Description of STM32U0 HAL and low-layer drivers

Introduction

STM32Cube is an STMicroelectronics original initiative to significantly improve developer productivity by reducing development effort, time and cost. STM32Cube covers the STM32 portfolio.

STM32Cube includes:

- STM32CubeMX, a graphical software configuration tool that allows the generation of C initialization code using graphical wizards.
- A comprehensive embedded software platform, delivered per Series (such as STM32CubeU0 for STM32U0 Series)
  - The STM32Cube HAL, STM32 abstraction layer embedded software ensuring maximized portability across the STM32 portfolio. HAL APIs are available for all peripherals.
  - Low-layer APIs (LL) offering a fast light-weight expert-oriented layer which is closer to the hardware than the HAL. LL APIs are available only for a set of peripherals.
  - A consistent set of middleware components such as Azure® RTOS ThreadX , FileX and LevelX.
  - All embedded software utilities, delivered with a full set of examples.

The HAL driver layer provides a simple, generic multi-instance set of APIs (application programming interfaces) to interact with the upper layer (application, libraries and stacks). The HAL driver APIs are split into two categories: generic APIs, which provide common and generic functions for all the STM32 series and extension APIs, which include specific and customized functions for a given line or part number. The HAL drivers include a complete set of ready-to-use APIs that simplify the user application implementation. For example, the communication peripherals contain APIs to initialize and configure the peripheral, manage data transfers in polling mode, handle interrupts or DMA, and manage communication errors. The HAL drivers are feature-oriented instead of IP-oriented. For example, the timer APIs are split into several categories following the IP functions, such as basic timer, capture and pulse width modulation (PWM). The HAL driver layer implements run-time failure detection by checking the input values of all functions. Such dynamic checking enhances the firmware robustness. Run-time detection is also suitable for user application development and debugging.

The LL drivers offer hardware services based on the available features of the STM32 peripherals. These services reflect exactly the hardware capabilities, and provide atomic operations that must be called by following the programming model described in the product line reference manual. As a result, the LL services are not based on standalone processes and do not require any additional memory resources to save their states, counter or data pointers. All operations are performed by changing the content of the associated peripheral registers. Unlike the HAL, LL APIs are not provided for peripherals for which optimized access is not a key feature, or for those requiring heavy software configuration and/or a complex upper-level stack (such as USB).

The HAL and LL are complementary and cover a wide range of application requirements:

- The HAL offers high-level and feature-oriented APIs with a high-portability level. These hide the MCU and peripheral complexity from the end-user.
- The LL offers low-level APIs at register level, with better optimization but less portability. These require deep knowledge of the MCU and peripheral specifications.

The HAL- and LL-driver source code is developed in Strict ANSI-C, which makes it independent of the development tools. It is checked with the Coverity static analysis tool. It is fully documented.

The next release will be compliant with MISRA C®:2012 standard.

This user manual is structured as follows:

- Overview of HAL drivers
- Overview of low-layer drivers
- Cohabiting of HAL and LL drivers
- Detailed description of each peripheral driver: configuration structures, functions, and how to use the given API to build your application

1 General information

The STM32CubeU0 MCU Package runs on STM32U0 32-bit microcontrollers based on the Arm® Cortex®-M processor.

Note: Arm is a registered trademark of Arm Limited (or its subsidiaries) in the US and/or elsewhere.

2 Acronyms and definitions

Table 1. **Acronyms and definitions**

Acronym	Definition
ADC	Analog-to-digital converter
AES	Advanced encryption standard
ANSI	American national standards institute
API	Application programming interface
BSP	Board support package
CMSIS	Cortex microcontroller software interface standard
COMP	Comparator
CPU	Central processing unit
CRC	CRC calculation unit
CRYP	Cryptographic processor
DAC	Digital to analog converter
DMA	Direct memory access
EXTI	External interrupt/event controller
GPIO	General purpose I/Os
HAL	Hardware abstraction layer
HRTIM	High-resolution timer
I2C	Inter-integrated circuit
IRDA	Infrared data association
IWDG	Independent watchdog
LCD	Liquid crystal display controller
LPTIM	Low-power timer
LPUART	Low-power universal asynchronous receiver/transmitter
MCO	Microcontroller clock output
MPU	Memory protection unit
MSP	MCU specific package
NOR	NOR Flash memory
NVIC	Nested vectored interrupt controller
OPAMP	Operational amplifier
PCD	USB peripheral controller driver
PPP	STM32 peripheral or block
PWR	Power controller
RCC	Reset and clock controller
RNG	Random number generator
RTC	Real-time clock
SMARTCARD	Smartcard IC
SPI	Serial peripheral interface
SRAM	SRAM external memory
SWPMI	Serial wire protocol master interface

Acronym	Definition
SysTick	System tick timer
TIM	Advanced-control, general-purpose or basic timer
TSC	Touch sensing controller
UART	Universal asynchronous receiver/transmitter
USART	Universal synchronous receiver/transmitter
WWDG	Window watchdog
USB	Universal serial bus

3 Overview of HAL drivers

The HAL drivers are designed to offer a rich set of APIs and to interact easily with the application upper layers.

Each driver consists of a set of functions covering the most common peripheral features. The development of each driver is driven by a common API which standardizes the driver structure, the functions and the parameter names.

The HAL drivers include a set of driver modules, each module being linked to a standalone peripheral. However, in some cases, the module is linked to a peripheral functional mode. As an example, several modules exist for the USART peripheral: UART driver module, USART driver module, SMARTCARD driver module and IRDA driver module.

The HAL main features are the following:

- Cross-family portable set of APIs covering the common peripheral features as well as extension APIs in case of specific peripheral features.
- Three API programming models: polling, interrupt and DMA.
- APIs are RTOS compliant:
  - Fully reentrant APIs
  - Systematic usage of timeouts in polling mode
- Support of peripheral multi-instance allowing concurrent API calls for multiple instances of a given peripheral (such as USART1 or USART2)
- All HAL APIs implement user-callback functions mechanism:
  - Peripheral Init/DeInit HAL APIs can call user-callback functions to perform peripheral system level Initialization/De-Initialization (clock, GPIOs, interrupt, DMA)
  - Peripherals interrupt events
  - Error events
- Object locking mechanism: safe hardware access to prevent multiple spurious accesses to shared resources.
- Timeout used for all blocking processes: the timeout can be a simple counter or a timebase.

3.1 HAL and user-application files

3.1.1 HAL driver files

HAL drivers are composed of the following set of files:

Table 2. HAL driver files

File	Description
stm32u0xx_hal_ppp.c	Main peripheral/module driver file It includes the APIs that are common to all STM32 devices. *Example: stm32u0xx_hal_adc.c, stm32u0xx_hal_irda.c.*
stm32u0xx_hal_ppp.h	Header file of the main driver C file It includes common data, handle and enumeration structures, define statements and macros, as well as the exported generic APIs. *Example:stm32u0xx_hal_adc.h,stm32u0xx_hal_irda.h.*
stm32u0xx_hal_ppp_ex.c	Extension file of a peripheral/module driver. It includes the specific APIs for a given part number or family, as well as the newly defined APIs that overwrite the default generic APIs if the internal process is implemented in different way. *Example:stm32u0xx_hal_adc_ex.c,stm32u0xx_hal_flash_ex.c.*
stm32u0xx_hal_ppp_ex.h	Header file of the extension C file It includes the specific data and enumeration structures, define statements and macros, as well as the exported device part number specific APIs *Example: stm32u0xx_hal_adc_ex.h,stm32u0xx_hal_flash_ex.h.*
stm32u0xx_hal.c	This file is used for HAL initialization and contains DBGMCU, Remap and Time Delay based on SysTick APIs.
stm32u0xx_hal.h	stm32u0xx_hal.c header file
stm32u0xx_hal_msp_template.c	Template file to be copied to the user application folder It contains the MSP initialization and de-initialization (main routine and callbacks) of the peripheral used in the user application.
stm32u0xx_hal_conf_template.h	Template file allowing to customize the drivers for a given application
stm32u0xx_hal_def.h	Common HAL resources such as common define statements, enumerations, structures and macros

3.1.2 User-application files

The minimum files required to build an application using the HAL are listed in the table below:

Table 3. User-application files

File	Description
system_stm32u0xx.c	This file contains SystemInit() that is called at startup just after reset and before branching to the main program. It does not configure the system clock at startup (contrary to the standard library). This is to be done using the HAL APIs in the user files. It allows relocating the vector table in internal SRAM.
startup_stm32u0xx.s	Toolchain specific file that contains reset handler and exception vectors. For some toolchains, it allows adapting the stack/heap size to fit the application requirements.
stm32u0xx_flash.icf (optional)	Linker file for EWARM toolchain allowing mainly adapting the stack/heap size to fit the application requirements.
stm32u0xx_hal_msp.c	This file contains the MSP initialization and de-initialization (main routine and callbacks) of the peripheral used in the user application.
stm32u0xx_hal_conf.h	This file allows the user to customize the HAL drivers for a specific application.

File	Description
	It is not mandatory to modify this configuration. The application can use the default configuration without any modification.
stm32u0xx_it.c/.h	This file contains the exceptions handler and peripherals interrupt service routine, and calls HAL_IncTick() at regular time intervals to increment a local variable (declared in *stm32u0x*x_hal.c) used as HAL timebase. By default, this function is called each 1ms in Systick ISR. The PPP_IRQHandler() routine must call HAL_PPP_IRQHandler() if an interrupt based process is used within the application.
main.c/.h	This file contains the main program routine, mainly: • Call to HAL_Init() • assert_failed() implementation • system clock configuration • peripheral HAL initialization and user application code.

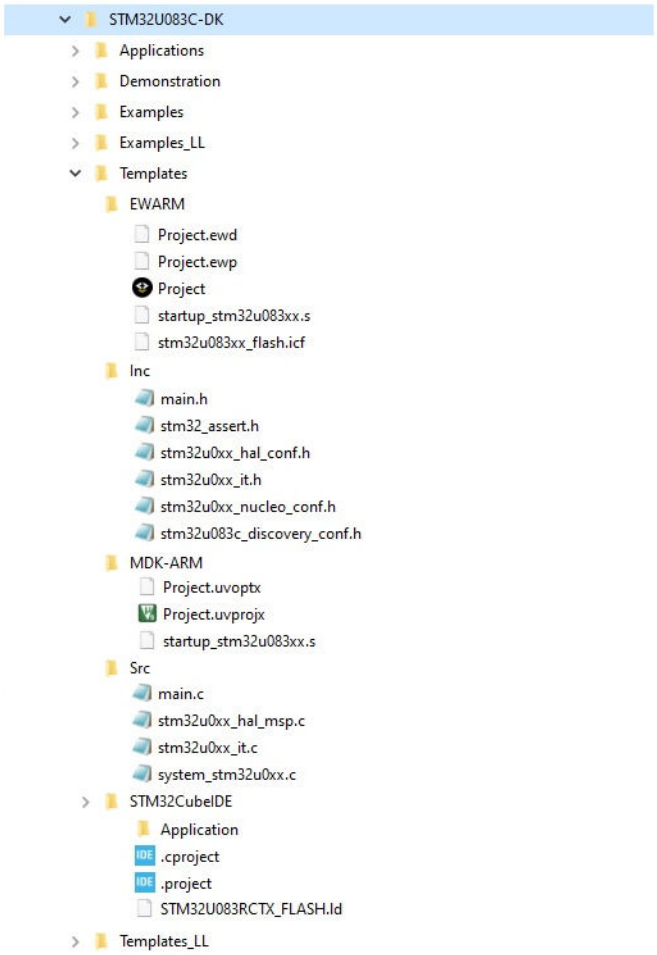
The STM32Cube package comes with ready-to-use project templates, one for each supported board. Each project contains the files listed above and a preconfigured project for the supported toolchains.

Each project template provides empty main loop function and can be used as a starting point to get familiar with project settings for STM32Cube. Its features are the following:

- It contains the sources of HAL, CMSIS and BSP drivers which are the minimal components to develop a code on a given board.
- It contains the include paths for all the firmware components.
- It defines the STM32 device supported, and allows configuring the CMSIS and HAL drivers accordingly.
- It provides ready to use user files preconfigured as defined below:
  - HAL is initialized
  - SysTick ISR implemented for HAL_GetTick()
  - System clock configured with the selected device frequency.

Note: If an existing project is copied to another location, then include paths must be updated.

Figure 1. Example of project template



3.2 HAL data structures

Each HAL driver can contain the following data structures:

- Peripheral handle structures
- Initialization and configuration structures
- Specific process structures.

3.2.1 Peripheral handle structures

The APIs have a modular generic multi-instance architecture that enables working with several IP instances simultaneously.

PPP_HandleTypeDef *handle is the main structure that is implemented in the HAL drivers. It handles the peripheral/module configuration and registers and embeds all the structures and variables needed to follow the peripheral device flow.

The peripheral handle is used for the following purposes:

- Multi-instance support: each peripheral/module instance has its own handle. As a result instance resources are independent.
- Peripheral process intercommunication: the handle is used to manage shared data resources between the process routines.
  Example: global pointers, DMA handles, state machine.
- Storage : this handle is used also to manage global variables within a given HAL driver.

An example of peripheral structure is shown below:

```
typedef struct
{
USART_TypeDef *Instance; /* USART registers base address */
USART_InitTypeDef Init; /* Usart communication parameters */
uint8_t *pTxBuffPtr;/* Pointer to Usart Tx transfer Buffer */
uint16_t TxXferSize; /* Usart Tx Transfer size */
__IO uint16_t TxXferCount;/* Usart Tx Transfer Counter */
uint8_t *pRxBuffPtr;/* Pointer to Usart Rx transfer Buffer */
uint16_t RxXferSize; /* Usart Rx Transfer size */
__IO uint16_t RxXferCount; /* Usart Rx Transfer Counter */
DMA_HandleTypeDef *hdmatx; /* Usart Tx DMA Handle parameters */
DMA_HandleTypeDef *hdmarx; /* Usart Rx DMA Handle parameters */
HAL_LockTypeDef Lock; /* Locking object */
__IO HAL_USART_StateTypeDef State; /* Usart communication state */
__IO HAL_USART_ErrorTypeDef ErrorCode;/* USART Error code */
}USART_HandleTypeDef;
```

Note:

1. *The multi-instance feature implies that all the APIs used in the application are reentrant and avoid using global variables because subroutines can fail to be reentrant if they rely on a global variable to remain unchanged but that variable is modified when the subroutine is recursively invoked. For this reason, the following rules are respected:*
   - *Reentrant code does not hold any static (or global) non-constant data: reentrant functions can work with global data. For example, a reentrant interrupt service routine can grab a piece of hardware status to work with (for example serial port read buffer) which is not only global, but volatile. Still, typical use of static variables and global data is not advised, in the sense that only atomic read-modify-write instructions should be used in these variables. It should not be possible for an interrupt or signal to occur during the execution of such an instruction.*
   - *Reentrant code does not modify its own code.*
2. *When a peripheral can manage several processes simultaneously using the DMA (full duplex case), the DMA interface handle for each process is added in the PPP_HandleTypeDef.*
3. *For the shared and system peripherals, no handle or instance object is used. The peripherals concerned by this exception are the following:*
   - *GPIO*
   - *SYSTICK*
   - *NVIC*
   - *PWR*
   - *RCC*
   - *FLASH*

3.2.2 Initialization and configuration structure

These structures are defined in the generic driver header file when it is common to all part numbers. When they can change from one part number to another, the structures are defined in the extension header file for each part number.

```
typedef struct
{
uint32_t BaudRate; /*!< This member configures the UART communication baudrate.*/
uint32_t WordLength; /*!< Specifies the number of data bits transmitted or received in a fram
e.*/
uint32_t StopBits; /*!< Specifies the number of stop bits transmitted.*/
uint32_t Parity; /*!< Specifies the parity mode. */
uint32_t Mode; /*!< Specifies wether the Receive or Transmit mode is enabled or disabled.*/
uint32_t HwFlowCtl; /*!< Specifies wether the hardware flow control mode is enabled or disabl
ed.*/
uint32_t OverSampling; /*!< Specifies wether the Over sampling 8 is enabled or disabled,
to achieve higher speed (up to fPCLK/8).*/
}UART_InitTypeDef;
```

Note: The config structure is used to initialize the sub-modules or sub-instances. See below example:

```
HAL_ADC_ConfigChannel (ADC_HandleTypeDef* hadc, ADC_ChannelConfTypeDef* sConfig)
```

3.2.3 Specific process structures

The specific process structures are used for specific process (common APIs). They are defined in the generic driver header file.

Example:

```
HAL_PPP_Process (PPP_HandleTypeDef* hadc,PPP_ProcessConfig* sConfig)
```

3.3 API classification

The HAL APIs are classified into the following categories:

- **Generic APIs:** common generic APIs applying to all STM32 devices. These APIs are consequently present in the generic HAL driver files of all STM32 microcontrollers.

```
HAL_StatusTypeDef HAL_ADC_Init(ADC_HandleTypeDef* hadc);
HAL_StatusTypeDef HAL_ADC_DeInit(ADC_HandleTypeDef *hadc);
HAL_StatusTypeDef HAL_ADC_Start(ADC_HandleTypeDef* hadc);
HAL_StatusTypeDef HAL_ADC_Stop(ADC_HandleTypeDef* hadc);
HAL_StatusTypeDef HAL_ADC_Start_IT(ADC_HandleTypeDef* hadc);
HAL_StatusTypeDef HAL_ADC_Stop_IT(ADC_HandleTypeDef* hadc);
void HAL_ADC_IRQHandler(ADC_HandleTypeDef* hadc);
```

- **Extension APIs:**
  This set of API is divided into two sub-categories :
  - **Family specific APIs:** APIs applying to a given family. They are located in the extension HAL driver file (see example below related to the ADC).

```
HAL_StatusTypeDef HAL_ADCEx_Calibration_Start(ADC_HandleTypeDef* hadc,uint32_t Sin
gleDiff);
uint32_t HAL_ADCEx_Calibration_GetValue(ADC_HandleTypeDef* hadc, uint32_t SingleDi
ff);
```

  - **Feature/Device specific APIs**: these APIs are implemented in the extension file and delimited by specific define statements relative to CMSIS bits or features and depending on device part number.

```
#if defined(PWR_SHDW_SUPPORT)
void HAL_PWREx_EnterSHUTDOWNMode(void);
#endif
```

Note: The data structure related to the specific APIs is delimited by the device part number define statement. It is located in the corresponding extension header C file.

The following table summarizes the location of the different categories of HAL APIs in the driver files.

Table 4. API classification

	Generic file	Extension file
Common APIs	X	X
Family specific APIs	-	X
Device specific APIs	-	X

Note: Family specific APIs are only related to a given family. This means that if a specific API is implemented in another family, and the arguments of this latter family are different, additional structures and arguments might need to be added.

The IRQ handlers are used for common and family specific processes.

3.4 Devices supported by HAL drivers

Table 5. List of devices supported by HAL/LL drivers

IP/modules	STM32U083xx	STM32U073xx	STM32U031xx
stm32u0xx_hal.c	Yes	Yes	Yes
stm32u0xx_hal_adc.c	Yes	Yes	Yes
stm32u0xx_hal_adc_ex.c	Yes	Yes	Yes
stm32u0xx_hal_comp.c	Yes	Yes	Yes
stm32u0xx_hal_cortex.c	Yes	Yes	Yes
stm32u0xx_hal_crc.c	Yes	Yes	Yes
stm32u0xx_hal_crc_ex.c	Yes	Yes	Yes
stm32u0xx_hal_cryp.c	Yes	No	No
stm32u0xx_hal_cryp_ex.c	Yes	No	No
stm32u0xx_hal_dac.c	Yes	Yes	Yes
stm32u0xx_hal_dac_ex.c	Yes	Yes	Yes
stm32u0xx_hal_dma.c	Yes	Yes	Yes
stm32u0xx_hal_dma_ex.c	Yes	Yes	Yes
stm32u0xx_hal_exti.c	Yes	Yes	Yes
stm32u0xx_hal_flash.c	Yes	Yes	Yes
stm32u0xx_hal_flash_ex.c	Yes	Yes	Yes
stm32u0xx_hal_gpio.c	Yes	Yes	Yes
stm32u0xx_hal_i2c.c	Yes	Yes	Yes
stm32u0xx_hal_i2c_ex.c	Yes	Yes	Yes
stm32u0xx_hal_irda.c	Yes	Yes	Yes
stm32u0xx_hal_iwdg.c	Yes	Yes	Yes
stm32u0xx_hal_lcd.c	Yes	Yes	No
stm32u0xx_hal_lptim.c	Yes	Yes	Yes
stm32u0xx_hal_msp_template.c	Yes	Yes	Yes
stm32u0xx_hal_opamp.c	Yes	Yes	Yes
stm32u0xx_hal_opamp_ex.c	Yes	Yes	Yes
stm32u0xx_hal_pcd.c	Yes	Yes	No
stm32u0xx_hal_pcd_ex.c	Yes	Yes	No
stm32u0xx_hal_pwr.c	Yes	Yes	Yes
stm32u0xx_hal_pwr_ex.c	Yes	Yes	Yes
stm32u0xx_hal_rcc.c	Yes	Yes	Yes
stm32u0xx_hal_rcc_ex.c	Yes	Yes	Yes
stm32u0xx_hal_rng.c	Yes	Yes	Yes
stm32u0xx_hal_rng_ex.c	Yes	Yes	Yes
stm32u0xx_hal_rtc.c	Yes	Yes	Yes
stm32u0xx_hal_rtc_ex.c	Yes	Yes	Yes
stm32u0xx_hal_smartcard.c	Yes	Yes	Yes
stm32u0xx_hal_smartcard_ex.c	Yes	Yes	Yes

IP/modules	STM32U083xx	STM32U073xx	STM32U031xx
stm32u0xx_hal_spi.c	Yes	Yes	Yes
stm32u0xx_hal_spi_ex.c	Yes	Yes	Yes
stm32u0xx_hal_tim.c	Yes	Yes	Yes
stm32u0xx_hal_tim_ex.c	Yes	Yes	Yes
stm32u0xx_hal_timebase_rtc_alarm_template.c	Yes	Yes	Yes
stm32u0xx_hal_timebase_rtc_wakeup_template.c	Yes	Yes	Yes
stm32u0xx_hal_timebase_tim_template.c	Yes	Yes	Yes
stm32u0xx_hal_tsc.c	Yes	Yes	Yes
stm32u0xx_hal_uart.c	Yes	Yes	Yes
stm32u0xx_hal_uart_ex.c	Yes	Yes	Yes
stm32u0xx_hal_usart.c	Yes	Yes	Yes
stm32u0xx_hal_usart_ex.c	Yes	Yes	Yes
stm32u0xx_hal_wwdg.c	Yes	Yes	Yes

3.5 HAL driver rules

3.5.1 HAL API naming rules

The following naming rules are used in HAL drivers:

Table 6. HAL API naming rules

	Generic	Family specific APIs	Device specific APIs
File names	*stm32u0xx_hal_ppp (c/h)*	*stm32u0xx_hal_ppp_ex (c/h)*	*stm32u0xx_ hal_ppp_ex (c/h)*
Module name	*HAL_PPP_ MODULE*		
Function name	*HAL_PPP_Function* *HAL_PPP_FeatureFunction_MODE*	*HAL_PPPEx_Function* *HAL_PPPEx_FeatureFunction_MODE*	*HAL_PPPEx_Function* *HAL_PPPEx_FeatureFunction_MODE*
Handle name	*PPP_HandleTypedef*	*NA*	*NA*
Init structure name	*PPP_InitTypeDef*	*NA*	*PPP_InitTypeDef*
Enum name	*HAL_PPP_StructnameTypeDef*	*NA*	*NA*

- The **PPP** prefix refers to the peripheral functional mode and not to the peripheral itself. For example, if the USART, PPP can be USART, IRDA, UART or SMARTCARD depending on the peripheral mode.
- The constants used in one file are defined within this file. A constant used in several files is defined in a header file. All constants are written in uppercase, except for peripheral driver function parameters.
- typedef variable names should be suffixed with _TypeDef.
- Registers are considered as constants. In most cases, their name is in uppercase and uses the same acronyms as in the STM32U0 reference manuals.
- Peripheral registers are declared in the PPP_TypeDef structure (for example ADC_TypeDef) in stm32u0xxx.h header file:
stm32u0xxx.h corresponds to stm32u083xx.h, stm32u073xx.h and stm32u031xx.h.
- Peripheral function names are prefixed by HAL_, then the corresponding peripheral acronym in uppercase followed by an underscore. The first letter of each word is in uppercase (for example HAL_UART_Transmit()). Only one underscore is allowed in a function name to separate the peripheral acronym from the rest of the function name.
- The structure containing the PPP peripheral initialization parameters are named PPP_InitTypeDef (for example ADC_InitTypeDef).
- The structure containing the Specific configuration parameters for the PPP peripheral are named PPP_xxxxConfTypeDef (for example ADC_ChannelConfTypeDef).
- Peripheral handle structures are named PPP_HandleTypedef (e.g DMA_HandleTypeDef)
- The functions used to initialize the PPP peripheral according to parameters specified in PPP_InitTypeDef are named HAL_PPP_Init (for example HAL_TIM_Init()).
- The functions used to reset the PPP peripheral registers to their default values are named HAL_PPP_DeInit (for example HAL_TIM_DeInit()).
- The **MODE** suffix refers to the process mode, which can be polling, interrupt or DMA. As an example, when the DMA is used in addition to the native resources, the function should be called:
HAL_PPP_Function_DMA().
- The **Feature** prefix should refer to the new feature.
Example: *HAL_ADCEx_InjectedStart()*() refers to the injection mode.

3.5.2 HAL general naming rules

- For the shared and system peripherals, no handle or instance object is used. This rule applies to the following peripherals:
  - GPIO
  - SYSTICK
  - NVIC
  - RCC
  - FLASH

Example: The *HAL_GPIO_Init()* requires only the GPIO address and its configuration parameters.

```
HAL_StatusTypeDef HAL_GPIO_Init (GPIO_TypeDef* GPIOx, GPIO_InitTypeDef *Init)
{
/*GPIO Initialization body */
}
```

- The macros that handle interrupts and specific clock configurations are defined in each peripheral/module driver. These macros are exported in the peripheral driver header files so that they can be used by the extension file. The list of these macros is defined below:

Note: This list is not exhaustive and other macros related to peripheral features can be added, so that they can be used in the user application.

Table 7. Macros handling interrupts and specific clock configurations

Macros	Description
__HAL_PPP_ENABLE_IT(__HANDLE__, __INTERRUPT__)	Enables a specific peripheral interrupt
__HAL_PPP_DISABLE_IT(__HANDLE__, __INTERRUPT__)	Disables a specific peripheral interrupt
__HAL_PPP_GET_IT (__HANDLE__, __ INTERRUPT __)	Gets a specific peripheral interrupt status
__HAL_PPP_CLEAR_IT (__HANDLE__, __ INTERRUPT __)	Clears a specific peripheral interrupt status
__HAL_PPP_GET_FLAG (__HANDLE__, __FLAG__)	Gets a specific peripheral flag status
__HAL_PPP_CLEAR_FLAG (__HANDLE__, __FLAG__)	Clears a specific peripheral flag status
__HAL_PPP_ENABLE(__HANDLE__)	Enables a peripheral
__HAL_PPP_DISABLE(__HANDLE__)	Disables a peripheral
__HAL_PPP_XXXX (__HANDLE__, __PARAM__)	Specific PPP HAL driver macro
__HAL_PPP_GET_ IT_SOURCE (__HANDLE__, __ INTERRUPT __)	Checks the source of specified interrupt

- NVIC and SYSTICK are two Arm® Cortex® core features. The APIs related to these features are located in the stm32u0xx_hal_cortex.c file.
- The PPP handles are valid before using the HAL_PPP_Init() API. The init function performs a check before modifying the handle fields.

```
 HAL_PPP_Init(PPP_HandleTypeDef)
if(hppp == NULL)
 {
 return HAL_ERROR;
 }
```

- The macros defined below are used:
  - Conditional macro:

```
#define ABS(x) (((x) > 0) ? (x) : -(x))
```

  - Pseudo-code macro (multiple instructions macro):

```
#define __HAL_LINKDMA(__HANDLE__, __PPP_DMA_FIELD_, __DMA_HANDLE_) \
do{ \
(__HANDLE__)->__PPP_DMA_FIELD_ = &(__DMA_HANDLE_); \
(__DMA_HANDLE_).Parent = (__HANDLE__); \
} while(0)
```

3.5.3 HAL interrupt handler and callback functions

Besides the APIs, HAL peripheral drivers include:

- HAL_PPP_IRQHandler() peripheral interrupt handler that should be called from stm32u0xx_it.c
- User callback functions.

The user callback functions are defined as empty functions with “weak” attribute. They have to be defined in the user code.

There are three types of user callbacks functions:

- Peripheral system level initialization/ de-Initialization callbacks: HAL_PPP_MspInit() and HAL_PPP_MspDeInit
- Process complete callbacks : HAL_PPP_ProcessCpltCallback
- Error callback: HAL_PPP_ErrorCallback.

Table 8. Callback functions

Callback functions	Example
HAL_PPP_MspInit() / _DeInit()	Example: HAL_USART_MspInit() Called from HAL_PPP_Init() API function to perform peripheral system level initialization (GPIOs, clock, DMA, interrupt)
HAL_PPP_ProcessCpltCallback	Example: HAL_USART_TxCpltCallback Called by peripheral or DMA interrupt handler when the process completes
HAL_PPP_ErrorCallback	Example: HAL_USART_ErrorCallback Called by peripheral or DMA interrupt handler when an error occurs

3.6 HAL generic APIs

The generic APIs provide common generic functions applying to all STM32 devices. They are composed of four APIs groups:

- **Initialization and de-initialization functions:**HAL_PPP_Init(), HAL_PPP_DeInit()
- **IO operation functions**: HAL_PPP_Read(), HAL_PPP_Write(),HAL_PPP_Transmit(), HAL_PPP_Receive()
- **Control functions**: HAL_PPP_Set (), HAL_PPP_Get ().
- **State and Errors functions**: HAL_PPP_GetState (), HAL_PPP_GetError ().

For some peripheral/module drivers, these groups are modified depending on the peripheral/module implementation.

Example: in the timer driver, the API grouping is based on timer features (such as PWM, OC and IC).

The initialization and de-initialization functions allow initializing a peripheral and configuring the low-level resources, mainly clocks, GPIO, alternate functions (AF) and possibly DMA and interrupts. The *HAL_DeInit()* function restores the peripheral default state, frees the low-level resources and removes any direct dependency with the hardware.

The IO operation functions perform a row access to the peripheral payload data in write and read modes.

The control functions are used to change dynamically the peripheral configuration and set another operating mode.

The peripheral state and errors functions allow retrieving in run time the peripheral and data flow states, and identifying the type of errors that occurred. The example below is based on the ADC peripheral. The list of generic APIs is not exhaustive. It is only given as an example.

Table 9. HAL generic APIs

Function group	Common API name	Description
Initialization group	*HAL_ADC_Init()*	This function initializes the peripheral and configures the low -level resources (clocks, GPIO, AF..)
	HAL_ADC_DeInit()	This function restores the peripheral default state, frees the low-level resources and removes any direct dependency with the hardware.
IO operation group	*HAL_ADC_Start ()*	This function starts ADC conversions when the polling method is used
	HAL_ADC_Stop ()	This function stops ADC conversions when the polling method is used
	HAL_ADC_PollForConversion()	This function allows waiting for the end of conversions when the polling method is used. In this case, a timout value is specified by the user according to the application.
	HAL_ADC_Start_IT()	This function starts ADC conversions when the interrupt method is used
	HAL_ADC_Stop_IT()	This function stops ADC conversions when the interrupt method is used
	HAL_ADC_IRQHandler()	This function handles ADC interrupt requests
	HAL_ADC_ConvCpltCallback()	Callback function called in the IT subroutine to indicate the end of the current process or when a DMA transfer has completed
	HAL_ADC_ErrorCallback()	Callback function called in the IT subroutine if a peripheral error or a DMA transfer error occurred
Control group	*HAL_ADC_ConfigChannel()*	This function configures the selected ADC regular channel, the corresponding rank in the sequencer and the sample time
	HAL_ADC_AnalogWDGConfig	This function configures the analog watchdog for the selected ADC
State and Errors group	*HAL_ADC_GetState()*	This function allows getting in run time the peripheral and the data flow states.
	HAL_ADC_GetError()	This fuction allows getting in run time the error that occurred during IT routine

3.7 HAL extension APIs

3.7.1 HAL extension model overview

The extension APIs provide specific functions or overwrite modified APIs for a specific family (series) or specific part number within the same family.

The extension model consists of an additional file, stm32u0xx_hal_ppp_ex.c, that includes all the specific functions and define statements (stm32u0xx_hal_ppp_ex.h) for a given part number.

Below an example based on the ADC peripheral:

Table 10. HAL extension APIs

Function group	Common API name
HAL_ADCEx_CalibrationStart()	This function is used to start the automatic ADC calibration
HAL_ADCEx_Calibration_GetValue()	This function is used to get the ADC calibration factor

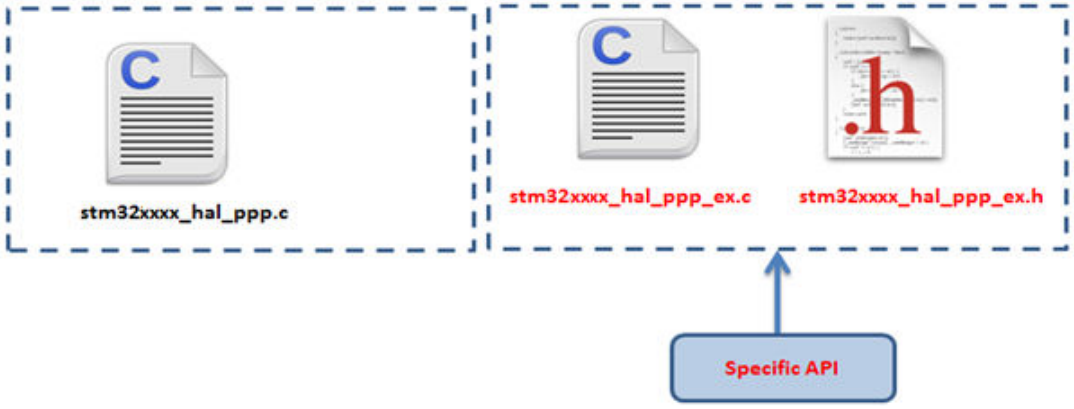
3.7.2 HAL extension model cases

The specific peripheral features can be handled by the HAL drivers in five different ways. They are described below.

Adding a part number-specific function

When a new feature specific to a given device is required, the new APIs are added in the stm32u0xx_hal_ppp_ex.c extension file. They are named HAL_PPPEx_Function().

Figure 2. Adding device-specific functions



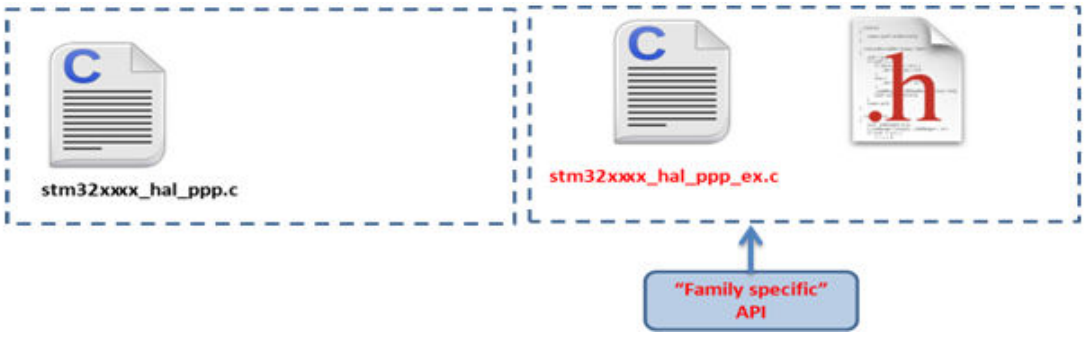
Example: stm32u0xx_hal_pwr_ex.c/h

```
#if defined(PWR_SHDW_SUPPORT)
void HAL_PWREx_EnterSHUTDOWNMode(void);
#endif
```

Adding a family-specific function

In this case, the API is added in the extension driver C file and named HAL_PPPEx_Function ().

Figure 3. Adding family-specific functions

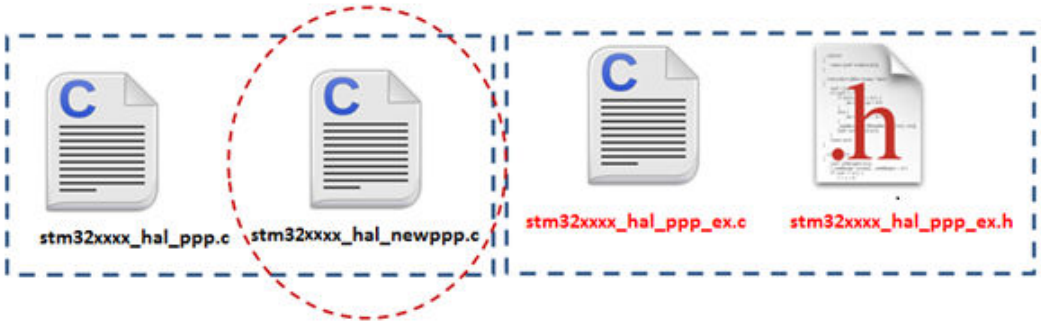


Adding a new peripheral (specific to a device belonging to a given family)

When a peripheral which is available only in a specific device is required, the APIs corresponding to this new peripheral/module (newPPP) are added in a new stm32u0xx_hal_newppp.c. However the inclusion of this file is selected in the stm32u0xx_hal_conf.h using the macro:

```
#define HAL_NEWPPP_MODULE_ENABLED
```

Figure 4. **Adding new peripherals**

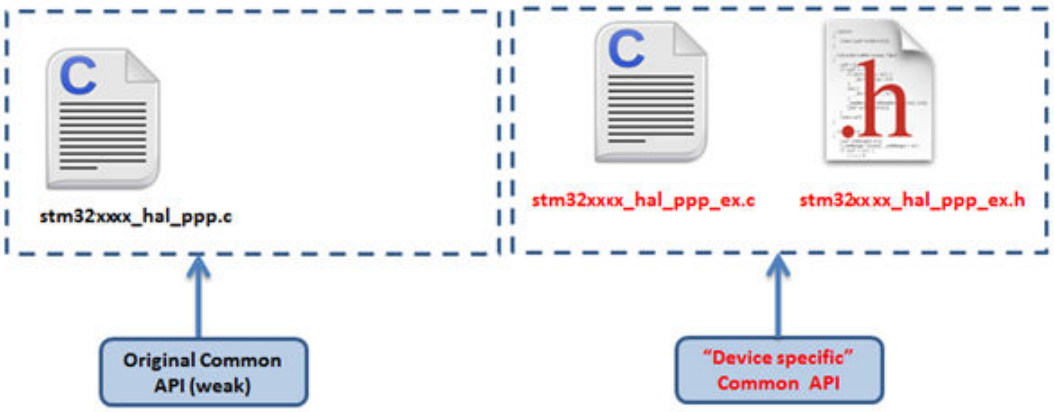


Example: stm32u0xx_hal_adc.c/h

Updating existing common APIs

In this case, the routines are defined with the same names in the stm32u0xx_hal_ppp_ex.c extension file, while the generic API is defined as *weak*, so that the compiler overwrites the original routine by the new defined function.

Figure 5. **Updating existing APIs**



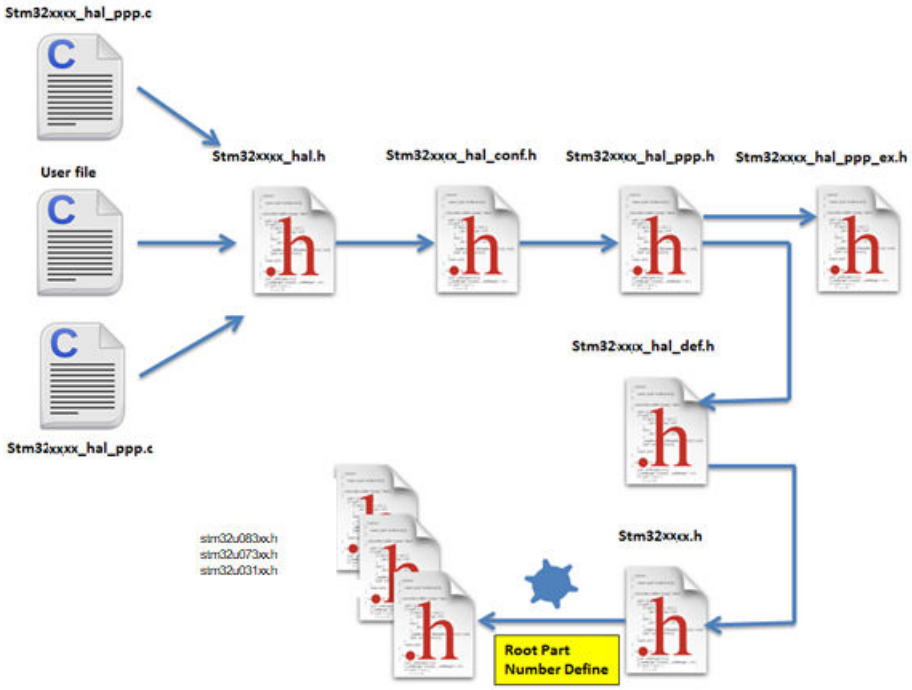
Updating existing data structures

The data structure for a specific device part number (for example PPP_InitTypeDef) can have different fields. In this case, the data structure is defined in the extension header file and delimited by the specific part number define statement.

3.8 File inclusion model

The header of the common HAL driver file (stm32u0xx_hal.h) includes the common configurations for the whole HAL library. It is the only header file that is included in the user sources and the HAL C sources files to be able to use the HAL resources.

Figure 6. File inclusion model



A PPP driver is a standalone module which is used in a project. The user must enable the corresponding USE_HAL_PPP_MODULE define statement in the configuration file.

```
/**********************************************************************
* @file stm32u0xx_hal_conf.h
* @author MCD Application Team
* @version VX.Y.Z * @date dd-mm-yyyy
* @brief This file contains the modules to be used
**********************************************************************
(…)
#define HAL_USART_MODULE_ENABLED
#define HAL_IRDA_MODULE_ENABLED
#define HAL_DMA_MODULE_ENABLED
#define HAL_RCC_MODULE_ENABLED
(…)
```

3.9 HAL common resources

The common HAL resources, such as common define enumerations, structures and macros, are defined in *stm32u0xx_hal_def.h*.The main common define enumeration is *HAL_StatusTypeDef*.

- **HAL Status**
  The HAL status is used by almost all HAL APIs, except for boolean functions and IRQ handler. It returns the status of the current API operations. It has four possible values as described below:

```
Typedef enum
{
HAL_OK = 0x00,
HAL_ERROR = 0x01,
HAL_BUSY = 0x02,
HAL_TIMEOUT = 0x03
} HAL_StatusTypeDef;
```

- **HAL Locked**
  The HAL lock is used by all HAL APIs to prevent accessing by accident shared resources.

```
typedef enum
{
HAL_UNLOCKED = 0x00, /*!<Resources unlocked */
HAL_LOCKED = 0x01 /*!< Resources locked */
} HAL_LockTypeDef;
```

  In addition to common resources, the stm32u0xx_hal_def.h file calls the stm32u0xx.h file in CMSIS library to get the data structures and the address mapping for all peripherals:
  - Declarations of peripheral registers and bits definition.
  - Macros to access peripheral registers hardware (such as Write register or Read register).
- **Common macros**
  - Macro defining HAL_MAX_DELAY

```
#define HAL_MAX_DELAY 0xFFFFFFFF
```

  - Macro linking a PPP peripheral to a DMA structure pointer:

```
#define __HAL_LINKDMA(__HANDLE__, __PPP_DMA_FIELD_, __DMA_HANDLE_) \
do{ \
  (__HANDLE__)->__PPP_DMA_FIELD_ = &(__DMA_HANDLE_); \
  (__DMA_HANDLE_).Parent = (__HANDLE__); \
} while(0)
```

3.10 HAL configuration

The configuration file, stm32u0xx_hal_conf.h, allows customizing the drivers for the user application. Modifying this configuration is not mandatory: the application can use the default configuration without any modification.

To configure these parameters, the user should enable, disable or modify some options by uncommenting, commenting or modifying the values of the related define statements as described in the table below:

Table 11. Define statements used for HAL configuration

Configuration item	Description	Default Value
HSE_VALUE	Defines the value of the external oscillator (HSE) expressed in Hz. The user must adjust this define statement when using a different crystal value.	32 000 000 Hz
HSE_STARTUP_TIMEOUT	Timeout for HSE start-up, expressed in ms	100 ms
HSI_VALUE	Defines the value of the internal oscillator (HSI) expressed in Hz.	16 000 000 Hz
HSI48_VALUE	Defines the value of the Internal High Speed oscillator for USB expressed in Hz. The real value may vary depending on the variations in voltage and temperature.	48 000 000 Hz
LSI_VALUE	Defines the default value of the Low-speed internal oscillator (LSI) expressed in Hz.	32000 Hz

Configuration item	Description	Default Value
LSE_VALUE	Defines the value of the external oscillator (LSE) expressed in Hz. The user must adjust this define statement when using a different crystal value.	32768 Hz
LSE_STARTUP_TIMEOUT	Timeout for LSE start-up, expressed in ms	5000 ms
VDD_VALUE	VDD value	3300 mV
USE_RTOS	Enables the use of RTOS	FALSE (for future use)
PREFETCH_ENABLE	Enables prefetch feature	FALSE

Note: The stm32u0xx_hal_conf_template.h file is located in the HAL drivers Inc folder. It should be copied to the user folder, renamed and modified as described above.

By default, the values defined in the stm32u0xx_hal_conf_template.h file are the same as the ones used for the examples and demonstrations. All HAL include files are enabled so that they can be used in the user code without modifications.

3.11 HAL system peripheral handling

This section gives an overview of how the system peripherals are handled by the HAL drivers. The full API list is provided within each peripheral driver description section.

3.11.1 Clocks

Two main functions can be used to configure the system clock:

- HAL_RCC_OscConfig (RCC_OscInitTypeDef *RCC_OscInitStruct). This function configures/enables multiple clock sources (HSE, HSI, LSE, LSI, PLL).
- HAL_RCC_ClockConfig (RCC_ClkInitTypeDef *RCC_ClkInitStruct, uint32_t FLatency). This function
  - selects the system clock source
  - configures AHB, APB1, and APB2 clock dividers
  - configures the number of Flash memory wait states
  - updates the SysTick configuration when HCLK clock changes.

Some peripheral clocks are not derived from the system clock (such as RTC, USB). In this case, the clock configuration is performed by an extended API defined in stm32u0xx_hal_rcc_ex.c: *HAL_RCCEx_PeriphCLKConfig(RCC_PeriphCLKInitTypeDef *PeriphClkInit)*.

Additional RCC HAL driver functions are available:

- HAL_RCC_DeInit() Clock de-initialization function that returns clock configuration to reset state
- Get clock functions that allow retreiving various clock configurations (such as system clock, HCLK, PCLK1 or PCLK2)
- MCO and CSS configuration functions

A set of macros are defined in stm32u0xx_hal_rcc.h and stm32u0xx_hal_rcc_ex.h. They allow executing elementary operations on RCC block registers, such as peripherals clock gating/reset control:

- __HAL_PPP_CLK_ENABLE/__HAL_PPP_CLK_DISABLE to enable/disable the peripheral clock.
- __HAL_PPP_FORCE_RESET/__HAL_PPP_RELEASE_RESET to force/release peripheral reset
- __HAL_PPP_CLK_SLEEP_ENABLE/__HAL_PPP_CLK_SLEEP_DISABLE to enable/disable the peripheral clock during Sleep mode.
- __HAL_PPP_IS_CLK_ENABLED/__HAL_PPP_IS_CLK_DISABLED to query about the enabled/disabled status of the peripheral clock.
- __HAL_PPP_IS_CLK_SLEEP_ENABLED/__HAL_PPP_IS_CLK_SLEEP_DISABLED to query about the enabled/disabled status of the peripheral clock during Sleep mode.

3.11.2 GPIOs

GPIO HAL APIs are the following:

- HAL_GPIO_Init() / HAL_GPIO_DeInit()
- HAL_GPIO_ReadPin() / HAL_GPIO_WritePin()

- HAL_GPIO_TogglePin ().

In addition to standard GPIO modes (input, output, analog), the pin mode can be configured as EXTI with interrupt or event generation.

When selecting EXTI mode with interrupt generation, the user must call HAL_GPIO_EXTI_IRQHandler() from stm32u0xx_it.c and implement HAL_GPIO_EXTI_Callback()

The table below describes the GPIO_InitTypeDef structure field.

Table 12. Description of GPIO_InitTypeDef structure

Structure field	Description
Pin	Specifies the GPIO pins to be configured. Possible values: GPIO_PIN_x or GPIO_PIN_All, where x[0..15]
Mode	Specifies the operating mode for the selected pins: GPIO mode or EXTI mode. Possible values are: • GPIO mode – GPIO_MODE_INPUT : Input floating – GPIO_MODE_OUTPUT_PP : Output push-pull – GPIO_MODE_OUTPUT_OD : Output open drain – GPIO_MODE_AF_PP : Alternate function push-pull – GPIO_MODE_AF_OD : Alternate function open drain – GPIO_MODE_ANALOG : Analog mode – GPIO_MODE_ANALOG_ADC_CONTROL: ADC analog mode • External Interrupt mode – GPIO_MODE_IT_RISING : Rising edge trigger detection – GPIO_MODE_IT_FALLING : Falling edge trigger detection – GPIO_MODE_IT_RISING_FALLING : Rising/Falling edge trigger detection • External Event mode – GPIO_MODE_EVT_RISING : Rising edge trigger detection – GPIO_MODE_EVT_FALLING : Falling edge trigger detection – GPIO_MODE_EVT_RISING_FALLING: Rising/Falling edge trigger detection
Pull	Specifies the Pull-up or Pull-down activation for the selected pins. Possible values are: GPIO_NOPULL GPIO_PULLUP GPIO_PULLDOWN
Speed	Specifies the speed for the selected pins Possible values are: GPIO_SPEED_FREQ_LOW GPIO_SPEED_FREQ_MEDIUM GPIO_SPEED_FREQ_HIGH GPIO_SPEED_FREQ_VERY_HIGH

Please find below typical GPIO configuration examples:

- Configuring GPIOs as output push-pull to drive external LEDs:

```
GPIO_InitStruct.Pin = GPIO_PIN_12 | GPIO_PIN_13 | GPIO_PIN_14 | GPIO_PIN_15;
GPIO_InitStruct.Mode = GPIO_MODE_OUTPUT_PP;
GPIO_InitStruct.Pull = GPIO_PULLUP;
GPIO_InitStruct.Speed = GPIO_SPEED_FREQ_MEDIUM;
HAL_GPIO_Init(GPIOD, &GPIO_InitStruct);
```

- Configuring PA0 as external interrupt with falling edge sensitivity:

```
GPIO_InitStructure.Mode = GPIO_MODE_IT_FALLING;
GPIO_InitStructure.Pull = GPIO_NOPULL;
GPIO_InitStructure.Pin = GPIO_PIN_0;
HAL_GPIO_Init(GPIOA, &GPIO_InitStructure);
```

3.11.3 Cortex® NVIC and SysTick timer

The Cortex® HAL driver, stm32u0xx_hal_cortex.c, provides APIs to handle NVIC and SysTick. The supported APIs include:

- HAL_NVIC_SetPriority()/ HAL_NVIC_SetPriorityGrouping()
- HAL_NVIC_GetPriority() / HAL_NVIC_GetPriorityGrouping()
- HAL_NVIC_EnableIRQ()/HAL_NVIC_DisableIRQ()
- HAL_NVIC_SystemReset()
- HAL_SYSTICK_IRQHandler()
- HAL_NVIC_GetPendingIRQ() / HAL_NVIC_SetPendingIRQ () / HAL_NVIC_ClearPendingIRQ()
- HAL_NVIC_GetActive(IRQn)
- HAL_SYSTICK_Config()
- HAL_SYSTICK_CLKSourceConfig()
- HAL_SYSTICK_Callback()

3.11.4 PWR

The PWR HAL driver handles power management. The features shared between all STM32 Series are listed below:

- PVD configuration, enabling/disabling and interrupt handling
  - HAL_PWR_ConfigPVD() (kept for compatibility with other Series but identical to HAL_PWREx_ConfigPVD())
  - HAL_PWR_EnablePVD() / HAL_PWR_DisablePVD() (kept for compatibility with other Series but identical to HAL_PWREx_EnablePVD() / HAL_PWREx_DisablePVD())
  - HAL_PWR_PVD_IRQHandler() (kept for compatibility with other Series but identical to HAL_PWREx_PVD_IRQHandler() and HAL_PWREx_PVD_PVM_IRQHandler() depending on the device used)
- Wakeup pin configuration
  - HAL_PWR_EnableWakeUpPin() / HAL_PWR_DisableWakeUpPin()
- Low-power mode entry
  - HAL_PWR_EnterSLEEPMode()
  - HAL_PWR_EnterSTOPMode()
  - HAL_PWR_EnterSTANDBYMode()
- STM32U0 low-power management features:
  - HAL_PWREx_EnableLowPowerRunMode()
  - HAL_PWREx_DisableLowPowerRunMode()
  - HAL_PWREx_PVD_Rising_Callback() (identical to HAL_PWREx_PVD_PVM_Rising_Callback())
  - HAL_PWREx_PVD_Falling_Callback() (identical to HAL_PWREx_PVD_PVM_Falling_Callback())
  - HAL_PWREx_EnterSHUTDOWNMode()

3.11.5 EXTI

The EXTI is not considered as a standalone peripheral but rather as a service used by other peripheral, that are handled through EXTI HAL APIs. In addition, each peripheral HAL driver implements the associated EXTI configuration and function as macros in its header file.

The first 16 EXTI lines connected to the GPIOs, are managed within the GPIO driver. The GPIO_InitTypeDef structure allows configuring an I/O as external interrupt or external event.

The EXTI lines connected internally to the PVD, RTC, USB, and Ethernet, are configured within the HAL drivers of these peripheral through the macros given in the table below.

The EXTI internal connections depend on the targeted STM32 microcontroller (refer to the product datasheet for more details):

Table 13. Description of EXTI configuration macros

Macros	Description
__HAL_PPP_{SUBLOCK}__EXTI_ENABLE_IT()	Enables a given EXTI line interrupt Example: __HAL_PWR_PVD_EXTI_ENABLE_IT()
__HAL_PPP_{SUBLOCK}__EXTI_DISABLE_IT()	Disables a given EXTI line. Example: __HAL_PWR_PVD_EXTI_DISABLE_IT()
__HAL_ PPP_{SUBLOCK}__EXTI_GET_FLAG()	Gets a given EXTI line interrupt flag pending bit status. Example: __HAL_PWR_PVD_EXTI_GET_FLAG()
__HAL_ PPP_{SUBLOCK}_EXTI_CLEAR_FLAG()	Clears a given EXTI line interrupt flag pending bit. Example; __HAL_PWR_PVD_EXTI_CLEAR_FLAG()
__HAL_ PPP_{SUBLOCK}_EXTI_GENERATE_SWIT()	Generates a software interrupt for a given EXTI line. Example: __HAL_PWR_PVD_EXTI_ GENERATE_SWIT ()
__HAL_PPP_SUBBLOCK_EXTI_ENABLE_EVENT()	Enable a given EXTI line event Example: __HAL_RTC_WAKEUP_EXTI_ENABLE_EVENT()
__HAL_PPP_SUBBLOCK_EXTI_DISABLE_EVENT()	Disable a given EXTI line event Example: __HAL_RTC_WAKEUP_EXTI_DISABLE_EVENT()
__HAL_ PPP_SUBBLOCK_EXTI_ENABLE_RISING_EDGE()	Configure an EXTI Interrupt or Event on rising edge
__HAL_ PPP_SUBBLOCK_EXTI_ENABLE_FALLING_EDGE()	Enable an EXTI Interrupt or Event on Falling edge
__HAL_ PPP_SUBBLOCK_EXTI_DISABLE_RISING_EDGE()	Disable an EXTI Interrupt or Event on rising edge
__HAL_ PPP_SUBBLOCK_EXTI_DISABLE_FALLING_EDGE()	Disable an EXTI Interrupt or Event on Falling edge
__HAL_ PPP_SUBBLOCK_EXTI_ENABLE_RISING_FALLING_EDGE()	Enable an EXTI Interrupt or Event on Rising/Falling edge
__HAL_ PPP_SUBBLOCK_EXTI_DISABLE_RISING_FALLING_EDGE()	Disable an EXTI Interrupt or Event on Rising/Falling edge

If the EXTI interrupt mode is selected, the user application must call HAL_PPP_FUNCTION_IRQHandler() (for example HAL_PWR_PVD_IRQHandler()), from stm32u0xx_it.c file, and implement HAL_PPP_FUNCTIONCallback() callback function (for example HAL_PWR_PVDCallback().

3.11.6 DMA

The DMA HAL driver allows enabling and configuring the peripheral to be connected to the DMA Channels (except for internal SRAM/FLASH memory which do not require any initialization). Refer to the product reference manual for details on the DMA request corresponding to each peripheral.

For a given channel, HAL_DMA_Init() API allows programming the required configuration through the following parameters:

- Transfer direction
- Source and destination data formats
- Circular, Normal control mode

- Channel priority level
- Source and destination Increment mode
- Hardware request connected to the peripheral

Two operating modes are available:

- Polling mode I/O operation
  1. Use HAL_DMA_Start() to start DMA transfer when the source and destination addresses and the Length of data to be transferred have been configured.
  2. Use HAL_DMA_PollForTransfer() to poll for the end of current transfer. In this case a fixed timeout can be configured depending on the user application.
- Interrupt mode I/O operation
  1. Configure the DMA interrupt priority using HAL_NVIC_SetPriority().
  2. Enable the DMA IRQ handler using HAL_NVIC_EnableIRQ().
  3. Use HAL_DMA_Start_IT() to start DMA transfer when the source and destination addresses and the length of data to be transferred have been configured. In this case the DMA interrupt is configured.
  4. Use HAL_DMA_IRQHandler() called under DMA_IRQHandler() Interrupt subroutine.
  5. When data transfer is complete, HAL_DMA_IRQHandler() function is executed and a user function can be called by customizing XferCpltCallback and XferErrorCallback function pointer (that is a member of DMA handle structure).

Additional functions and macros are available to ensure efficient DMA management:

- Use HAL_DMA_GetState() function to return the DMA state and HAL_DMA_GetError() in case of error detection.
- Use HAL_DMA_Abort() function to abort the current transfer.

The most used DMA HAL driver macros are the following:

- __HAL_DMA_ENABLE: enables the specified DMA channel
- __HAL_DMA_DISABLE: disables the specified DMA channel
- __HAL_DMA_GET_FLAG: gets the DMA channel pending flags
- __HAL_DMA_CLEAR_FLAG: clears the DMA channel pending flags
- __HAL_DMA_ENABLE_IT: enables the specified DMA channel interrupts
- __HAL_DMA_DISABLE_IT: disables the specified DMA channel interrupts
- __HAL_DMA_GET_IT_SOURCE: checks whether the specified DMA channel interrupt has been enabled or not

Note: When a peripheral is used in DMA mode, the DMA initialization must be done in the HAL_PPP_MspInit() callback. In addition, the user application must associate the DMA handle to the PPP handle (refer to section "HAL IO operation functions").

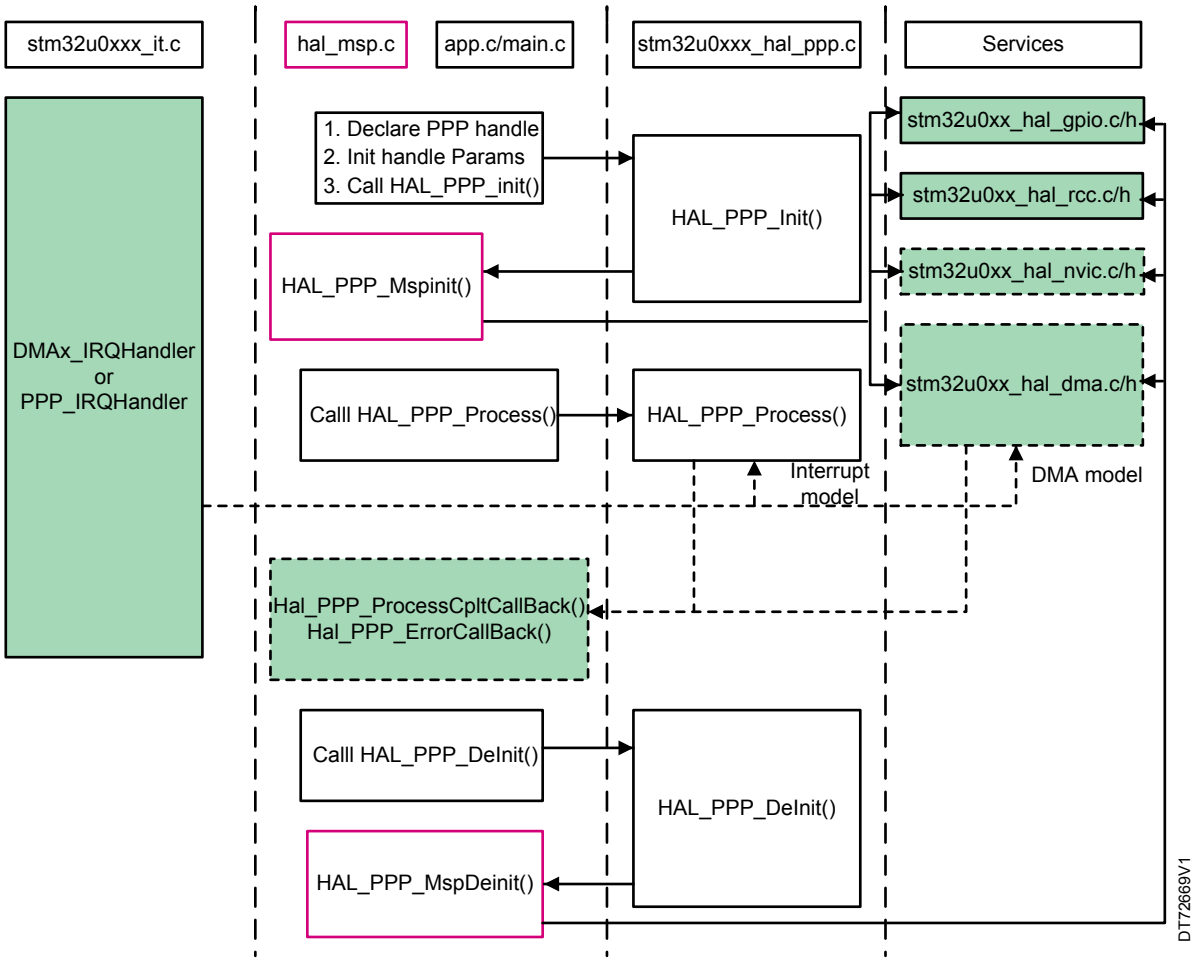
Note: DMA channel callbacks need to be initialized by the user application only in case of memory-to-memory transfer. However when peripheral-to-memory transfers are used, these callbacks are automatically initialized by calling a process API function that uses the DMA.

3.12 How to use HAL drivers

3.12.1 HAL usage models

The following figure shows the typical use of the HAL driver and the interaction between the application user, the HAL driver and the interrupts.

Figure 7. **HAL driver model**



Note: The functions implemented in the HAL driver are shown in green, the functions called from interrupt handlers in dotted lines, and the msp functions implemented in the user application in red. Non-dotted lines represent the interactions between the user application functions.

Basically, the HAL driver APIs are called from user files and optionally from interrupt handlers file when the APIs based on the DMA or the PPP peripheral dedicated interrupts are used.

When DMA or PPP peripheral interrupts are used, the PPP process complete callbacks are called to inform the user about the process completion in real-time event mode (interrupts). Note that the same process completion callbacks are used for DMA in interrupt mode.

3.12.2 HAL initialization

3.12.2.1 HAL global initialization

In addition to the peripheral initialization and de-initialization functions, a set of APIs are provided to initialize the HAL core implemented in file stm32u0xx_hal.c.

- HAL_Init(): this function must be called at application startup to
  - initialize data/instruction cache and pre-fetch queue
  - set SysTick timer to generate an interrupt each 1ms (based on HSI clock) with the lowest priority
  - call HAL_MspInit() user callback function to perform system level initializations (Clock, GPIOs, DMA, interrupts). HAL_MspInit() is defined as “weak” empty function in the HAL drivers.
- HAL_DeInit()
  - resets all peripherals
  - calls function HAL_MspDeInit() which is a user callback function to do system level De-Initializations.

- HAL_GetTick(): this function gets current SysTick counter value (incremented in SysTick interrupt) used by peripherals drivers to handle timeouts.
- HAL_Delay(). this function implements a delay (expressed in milliseconds) using the SysTick timer. Care must be taken when using HAL_Delay() since this function provides an accurate delay (expressed in milliseconds) based on a variable incremented in SysTick ISR. This means that if HAL_Delay() is called from a peripheral ISR, then the SysTick interrupt must have highest priority (numerically lower) than the peripheral interrupt, otherwise the caller ISR is blocked.

3.12.2.2 *System clock initialization*

The clock configuration is done at the beginning of the user code. However the user can change the configuration of the clock in his own code.

Below the typical clock configuration sequence to reach the maximum clock frequency of 64 MHz based on the HSE clock.

```
/**
  * @brief  Configure system clock frequency to 48MHz (MSI range 11).
  * @param  None.
  * @retval System Status.
  */
static System_StatusTypeDef SystemClock(void)
{
  RCC_ClkInitTypeDef RCC_ClkInitStruct;
  RCC_OscInitTypeDef RCC_OscInitStruct;
  if (HAL_PWREx_ControlVoltageScaling(PWR_REGULATOR_VOLTAGE_SCALE2) != HAL_OK)
  {
    return SYSTEM_ERROR;
  }

  RCC_OscInitStruct.OscillatorType      = RCC_OSCILLATORTYPE_MSI;
  RCC_OscInitStruct.HSEState            = RCC_HSE_OFF;
  RCC_OscInitStruct.MSIState            = RCC_MSI_ON;
  RCC_OscInitStruct.HSIState            = RCC_HSI_OFF;
  RCC_OscInitStruct.PLL.PLLState        = RCC_PLL_OFF;
  RCC_OscInitStruct.HSICalibrationValue = RCC_HSICALIBRATION_DEFAULT;
  RCC_OscInitStruct.MSICalibrationValue = USER_MSI_CALIBRATION;
  RCC_OscInitStruct.MSIClockRange       = RCC_MSIRANGE_11;
  RCC_OscInitStruct.PLL.PLLState        = RCC_PLL_OFF;
  RCC_OscInitStruct.PLL.PLLSource       = RCC_PLLSOURCE_NONE ;
  RCC_OscInitStruct.PLL.PLLM            = RCC_PLLM_DIV8;
  RCC_OscInitStruct.PLL.PLLN            = 8;
  RCC_OscInitStruct.PLL.PLLP            = RCC_PLLP_DIV2; /* 24MHz */
  RCC_OscInitStruct.PLL.PLLQ            = RCC_PLLQ_DIV2; /* 24MHz */
  RCC_OscInitStruct.PLL.PLLR            = RCC_PLLR_DIV2; /* 24MHz */
  if (HAL_RCC_OscConfig(&RCC_OscInitStruct) != HAL_OK)
  {
    return SYSTEM_ERROR;
  }

  /* Select PLL as system clock source and configure the HCLK, PCLK1 clocks dividers */
  RCC_ClkInitStruct.ClockType = (RCC_CLOCKTYPE_SYSCLK | RCC_CLOCKTYPE_HCLK | RCC_CLOCKTYPE_PC
LK1);
  RCC_ClkInitStruct.SYSCLKSource = RCC_SYSCLKSOURCE_MSI;
  RCC_ClkInitStruct.AHBCLKDivider = RCC_SYSCLK_DIV1;
  RCC_ClkInitStruct.APB1CLKDivider = RCC_HCLK_DIV1;

  if (HAL_RCC_ClockConfig(&RCC_ClkInitStruct, FLASH_LATENCY_2))
  {
    /* HAL RCC configuration error */
    return SYSTEM_ERROR;
  }

  return SYSTEM_OK;
}
```

3.12.2.3 *HAL MSP initialization process*

The peripheral initialization is done through *HAL_PPP_Init()* while the hardware resources initialization used by a peripheral (PPP) is performed during this initialization by calling MSP callback function *HAL_PPP_MspInit()*.

The MspInit callback performs the low level initialization related to the different additional hardware resources: RCC, GPIO, NVIC and DMA.

All the HAL drivers with handles include two MSP callbacks for initialization and de-initialization:

```
/**
* @brief Initializes the PPP MSP.
* @param hppp: PPP handle
* @retval None */
void __weak HAL_PPP_MspInit(PPP_HandleTypeDef *hppp) {
/* NOTE : This function Should not be modified, when the callback is needed,
the HAL_PPP_MspInit could be implemented in the user file */
}
/**
* @brief DeInitializes PPP MSP.
* @param hppp: PPP handle
* @retval None */
void __weak HAL_PPP_MspDeInit(PPP_HandleTypeDef *hppp) {
/* NOTE : This function Should not be modified, when the callback is needed,
the HAL_PPP_MspDeInit could be implemented in the user file */
}
```

The MSP callbacks are declared empty as weak functions in each peripheral driver. The user can use them to set the low level initialization code or omit them and use his own initialization routine.

The HAL MSP callback is implemented inside the *stm32u0xx_hal_msp.c* file in the user folders. An *stm32u0xx_hal_msp.c* file template is located in the HAL folder and should be copied to the user folder. It can be generated automatically by STM32CubeMX tool and further modified. Note that all the routines are declared as weak functions and could be overwritten or removed to use user low level initialization code.

stm32u0xx_hal_msp.c file contains the following functions:

Table 14. MSP functions

Routine	Description
void HAL_MspInit()	Global MSP initialization routine
void HAL_MspDeInit()	Global MSP de-initialization routine
void HAL_PPP_MspInit()	PPP MSP initialization routine
void HAL_PPP_MspDeInit()	PPP MSP de-initialization routine

By default, if no peripheral needs to be de-initialized during the program execution, the whole MSP initialization is done in *Hal_MspInit()* and MSP De-Initialization in the *Hal_MspDeInit()*. In this case the *HAL_PPP_MspInit()* and *HAL_PPP_MspDeInit()* are not implemented.

When one or more peripherals needs to be de-initialized in run time and the low level resources of a given peripheral need to be released and used by another peripheral, HAL_PPP_MspDeInit() and *HAL_PPP_MspInit()* are implemented for the concerned peripheral and other peripherals initialization and de-Initialization are kept in the global *HAL_MspInit()* and the *HAL_MspDeInit()*.

If there is nothing to be initialized by the global *HAL_MspInit()* and *HAL_MspDeInit()*, the two routines can simply be omitted.

3.12.3 HAL I/O operation process

The HAL functions with internal data processing like transmit, receive, write and read are generally provided with three data processing modes as follows:

- Polling mode
- Interrupt mode
- DMA mode

3.12.3.1 Polling mode

In Polling mode, the HAL functions return the process status when the data processing in blocking mode is complete. The operation is considered complete when the function returns the HAL_OK status, otherwise an error status is returned. The user can get more information through the *HAL_PPP_GetState()* function. The data processing is handled internally in a loop. A timeout (expressed in ms) is used to prevent process hanging.

The example below shows the typical Polling mode processing sequence :

```
HAL_StatusTypeDef HAL_PPP_Transmit ( PPP_HandleTypeDef * phandle, uint8_t pData,
int16_tSize,uint32_tTimeout)
{
if((pData == NULL ) || (Size == 0))
{
return HAL_ERROR;
}
(…) while (data processing is running)
{
if( timeout reached )
{
return HAL_TIMEOUT;
}
}
(…)
return HAL_OK; }
```

3.12.3.2 Interrupt mode

In Interrupt mode, the HAL function returns the process status after starting the data processing and enabling the appropriate interruption. The end of the operation is indicated by a callback declared as a weak function. It can be customized by the user to be informed in real-time about the process completion. The user can also get the process status through the *HAL_PPP_GetState()* function.

In Interrupt mode, four functions are declared in the driver:

- *HAL_PPP_Process_IT()*: launches the process
- *HAL_PPP_IRQHandler()*: global PPP peripheral interruption
- *__weak HAL_PPP_ProcessCpltCallback ()*: callback relative to the process completion.
- *__weak HAL_PPP_ProcessErrorCallback()*: callback relative to the process Error.

To use a process in Interrupt mode, *HAL_PPP_Process_IT()* is called in the user file and HAL_PPP_IRQHandler in *stm32u0xx_it.c.*

The *HAL_PPP_ProcessCpltCallback()* function is declared as weak function in the driver. This means that the user can declare it again in the application. The function in the driver is not modified.

An example of use is illustrated below:

main.c file:

```
UART_HandleTypeDef UartHandle;
int main(void)
{
/* Set User Parameters */
UartHandle.Init.BaudRate = 9600;
UartHandle.Init.WordLength = UART_DATABITS_8;
UartHandle.Init.StopBits = UART_STOPBITS_1;
UartHandle.Init.Parity = UART_PARITY_NONE;
UartHandle.Init.HwFlowCtl = UART_HWCONTROL_NONE;
UartHandle.Init.Mode = UART_MODE_TX_RX;
UartHandle.Init.Instance = USART1;
HAL_UART_Init(&UartHandle);
HAL_UART_SendIT(&UartHandle, TxBuffer, sizeof(TxBuffer));
while (1);
}
void HAL_UART_TxCpltCallback(UART_HandleTypeDef *huart)
{
}
void HAL_UART_ErrorCallback(UART_HandleTypeDef *huart)
{
}
```

*stm32u0xx_it.c*file:

```
extern UART_HandleTypeDef UartHandle;
void USART1_IRQHandler(void)
{
HAL_UART_IRQHandler(&UartHandle);
}
```

3.12.3.3 DMA mode

In DMA mode, the HAL function returns the process status after starting the data processing through the DMA and after enabling the appropriate DMA interruption. The end of the operation is indicated by a callback declared as a weak function and can be customized by the user to be informed in real-time about the process completion. The user can also get the process status through the *HAL_PPP_GetState()* function. For the DMA mode, three functions are declared in the driver:

- *HAL_PPP_Process_DMA()*: launch the process
- *HAL_PPP_DMA_IRQHandler()*: the DMA interruption used by the PPP peripheral
- *__weak HAL_PPP_ProcessCpltCallback()*: the callback relative to the process completion.
- *__weak HAL_PPP_ErrorCpltCallback()*: the callback relative to the process Error.

To use a process in DMA mode, *HAL_PPP_Process_DMA()* is called in the user file and the *HAL_PPP_DMA_IRQHandler()* is placed in the *stm32u0xx_it.c*. When DMA mode is used, the DMA initialization is done in the *HAL_PPP_MspInit()* callback. The user should also associate the DMA handle to the PPP handle. For this purpose, the handles of all the peripheral drivers that use the DMA must be declared as follows:

```
typedef struct
{
PPP_TypeDef *Instance; /* Register base address */
PPP_InitTypeDef Init; /* PPP communication parameters */
HAL_StateTypeDef State; /* PPP communication state */
(…)
DMA_HandleTypeDef *hdma; /* associated DMA handle */
} PPP_HandleTypeDef;
```

The initialization is done as follows (UART example):

```
int main(void)
{
/* Set User Parameters */
UartHandle.Init.BaudRate = 9600;
UartHandle.Init.WordLength = UART_DATABITS_8;
UartHandle.Init.StopBits = UART_STOPBITS_1;
UartHandle.Init.Parity = UART_PARITY_NONE;
UartHandle.Init.HwFlowCtl = UART_HWCONTROL_NONE;
UartHandle.Init.Mode = UART_MODE_TX_RX;
UartHandle.Init.Instance = UART1;
HAL_UART_Init(&UartHandle);
(..)
}
void HAL_USART_MspInit (UART_HandleTypeDef * huart)
{
static DMA_HandleTypeDef hdma_tx;
static DMA_HandleTypeDef hdma_rx;
(…)
__HAL_LINKDMA(UartHandle, DMA_Handle_tx, hdma_tx);
__HAL_LINKDMA(UartHandle, DMA_Handle_rx, hdma_rx);
(…)
}
```

The *HAL_PPP_ProcessCpltCallback()* function is declared as weak function in the driver that means, the user can declare it again in the application code. The function in the driver should not be modified.

An example of use is illustrated below:

main.c file:

```
UART_HandleTypeDef UartHandle;
int main(void)
{
/* Set User Paramaters */
UartHandle.Init.BaudRate = 9600;
UartHandle.Init.WordLength = UART_DATABITS_8;
UartHandle.Init.StopBits = UART_STOPBITS_1;
UartHandle.Init.Parity = UART_PARITY_NONE;
UartHandle.Init.HwFlowCtl = UART_HWCONTROL_NONE;
UartHandle.Init.Mode = UART_MODE_TX_RX; UartHandle.Init.Instance = USART1;
HAL_UART_Init(&UartHandle);
HAL_UART_Send_DMA(&UartHandle, TxBuffer, sizeof(TxBuffer));
while (1);
}
void HAL_UART_TxCpltCallback(UART_HandleTypeDef *phuart)
{
}
void HAL_UART_TxErrorCallback(UART_HandleTypeDef *phuart)
{
}
```

stm32u0xx_it.c file:

```
extern UART_HandleTypeDef UartHandle;
void DMAx_IRQHandler(void)
{
HAL_DMA_IRQHandler(&UartHandle.DMA_Handle_tx);
}
```

HAL_USART_TxCpltCallback() and *HAL_USART_ErrorCallback()* should be linked in the *HAL_PPP_Process_DMA()* function to the DMA transfer complete callback and the DMA transfer Error callback by using the following statement:

```
HAL_PPP_Process_DMA (PPP_HandleTypeDef *hppp, Params….)
{
(…)
hppp->DMA_Handle->XferCpltCallback = HAL_UART_TxCpltCallback ;
hppp->DMA_Handle->XferErrorCallback = HAL_UART_ErrorCallback ;
(…)
}
```

3.12.4 Timeout and error management

3.12.4.1 Timeout management

The timeout is often used for the APIs that operate in Polling mode. It defines the delay during which a blocking process should wait till an error is returned. An example is provided below:

```
HAL_StatusTypeDef HAL_DMA_PollForTransfer(DMA_HandleTypeDef *hdma, uint32_t CompleteLevel, ui
nt32_t Timeout)
```

The timeout possible values are the following:

Table 15. Timeout values

Timeout value	Description
0	No poll : Immediate process check and exit
1 ... (HAL_MAX_DELAY -1) (1)	Timeout in ms
HAL_MAX_DELAY	Infinite poll till process is successful

1. *HAL_MAX_DELAY is defined in the stm32u0xx_hal_def.h as 0xFFFFFFFF*

However, in some cases, a fixed timeout is used for system peripherals or internal HAL driver processes. In these cases, the timeout has the same meaning and is used in the same way, except when it is defined locally in the drivers and cannot be modified or introduced as an argument in the user application.

Example of fixed timeout:

```
#define LOCAL_PROCESS_TIMEOUT 100
HAL_StatusTypeDef HAL_PPP_Process(PPP_HandleTypeDef *hppp)
{
  (…)
  tickstart = HAL_GetTick();
  (…)
 while (ProcessOngoing)
  {
    (…)
   if ((HAL_GetTick() - tickstart) > LOCAL_PROCESS_TIMEOUT)
    {
      hppp->ErrorCode |= HAL_PPP_ERROR_TIMEOUT;
      hppp->State= HAL_PPP_STATE_READY;
      return HAL_ERROR;
    }
  }
  (…)
}
```

The following example shows how to use the timeout inside the polling functions:

```
HAL_StatusTypeDef HAL_PPP_Poll(PPP_HandleTypeDef *hppp, uint32_t Timeout)
{
  (…)
  tickstart = HAL_GetTick();
  (…)
 while (ProcessOngoing)
  {
    (…)
   if (((HAL_GetTick() - tickstart) > Timeout) || (Timeout == 0))
    {
      hppp->ErrorCode |= HAL_PPP_ERROR_TIMEOUT;
      hppp->State= HAL_PPP_STATE_READY;
      return HAL_ERROR;
    }
  }
  (…)
}
```

3.12.4.2 *Error management*

The HAL drivers implement a check on the following items:

- Valid parameters: for some process the used parameters should be valid and already defined, otherwise the system may crash or go into an undefined state. These critical parameters are checked before being used (see example below).

```
HAL_StatusTypeDef HAL_PPP_Process(PPP_HandleTypeDef* hppp, uint32_t *pdata, uint32 Size
)
{
if ((pData == NULL ) || (Size == 0))
{
return HAL_ERROR;
}
}
```

- Valid handle: the PPP peripheral handle is the most important argument since it keeps the PPP driver vital parameters. It is always checked in the beginning of the *HAL_PPP_Init()* function.

```
HAL_StatusTypeDef HAL_PPP_Init(PPP_HandleTypeDef* hppp)
{
if (hppp == NULL) //the handle should be already allocated
{
return HAL_ERROR;
}
}
```

- Timeout error: the following statement is used when a timeout error occurs:

```
while (Process ongoing)
{
timeout = HAL_GetTick() + Timeout; while (data processing is running)
{
if(timeout) { return HAL_TIMEOUT;
}
}
```

When an error occurs during a peripheral process, *HAL_PPP_Process ()* returns with a *HAL_ERROR* status. The HAL PPP driver implements the *HAL_PPP_GetError ()* to allow retrieving the origin of the error.

```
HAL_PPP_ErrorTypeDef HAL_PPP_GetError (PPP_HandleTypeDef *hppp);
```

In all peripheral handles, a *HAL_PPP_ErrorTypeDef* is defined and used to store the last error code.

```
typedef struct
{
PPP_TypeDef * Instance; /* PPP registers base address */
PPP_InitTypeDef Init; /* PPP initialization parameters */
HAL_LockTypeDef Lock; /* PPP locking object */
__IO HAL_PPP_StateTypeDef State; /* PPP state */
__IO HAL_PPP_ErrorTypeDef ErrorCode; /* PPP Error code */
(…)
/* PPP specific parameters */
}
PPP_HandleTypeDef;
```

The error state and the peripheral global state are always updated before returning an error:

```
PPP->State = HAL_PPP_READY;  /* Set the peripheral ready */
PP->ErrorCode = HAL_ERRORCODE ; /* Set the error code */
_HAL_UNLOCK(PPP) ; /* Unlock the PPP resources */
return HAL_ERROR;  /*return with HAL error */
```

HAL_PPP_GetError () must be used in interrupt mode in the error callback:

```
void HAL_PPP_ProcessCpltCallback(PPP_HandleTypeDef *hspi)
{
ErrorCode = HAL_PPP_GetError (hppp); /* retreive error code */
}
```

3.12.4.3 *Run-time checking*

The HAL implements run-time failure detection by checking the input values of all HAL driver functions. The run-time checking is achieved by using an *assert_param* macro. This macro is used in all the HAL driver functions which have an input parameter. It allows verifying that the input value lies within the parameter allowed values.

To enable the run-time checking, use the *assert_param* macro, and leave the define ***USE_FULL_ASSERT*** uncommented in *stm32u0xx_hal_conf.h* file.

```
void HAL_UART_Init(UART_HandleTypeDef *huart)
{
(..) /* Check the parameters */
assert_param(IS_UART_INSTANCE(huart->Instance));
assert_param(IS_UART_BAUDRATE(huart->Init.BaudRate));
assert_param(IS_UART_WORD_LENGTH(huart->Init.WordLength));
assert_param(IS_UART_STOPBITS(huart->Init.StopBits));
assert_param(IS_UART_PARITY(huart->Init.Parity));
assert_param(IS_UART_MODE(huart->Init.Mode));
assert_param(IS_UART_HARDWARE_FLOW_CONTROL(huart->Init.HwFlowCtl));
(..)
```

```
/** @defgroup UART_Word_Length *
@{
*/
#define UART_WORDLENGTH_8B ((uint32_t)0x00000000)
#define UART_WORDLENGTH_9B ((uint32_t)USART_CR1_M)
#define IS_UART_WORD_LENGTH(LENGTH) (((LENGTH) == UART_WORDLENGTH_8B) ||
\ ((LENGTH) == UART_WORDLENGTH_9B))
```

If the expression passed to the assert_param macro is false, the*assert_failed* function is called and returns the name of the source file and the source line number of the call that failed. If the expression is true, no value is returned.

The *assert_param* macro is implemented in stm32u0xx_hal_conf.h:

```
/* Exported macro ------------------------------------------------------------*/
#ifdef USE_FULL_ASSERT
/**
* @brief The assert_param macro is used for function's parameters check.
* @param expr: If expr is false, it calls assert_failed function
* which reports the name of the source file and the source
* line number of the call that failed.
* If expr is true, it returns no value.
* @retval None */
#define assert_param(expr) ((expr)?(void)0:assert_failed((uint8_t *)__FILE__, __LINE__))
/* Exported functions ---------------------------------------*/
void assert_failed(uint8_t* file, uint32_t line);
#else
#define assert_param(expr)((void)0)
#endif /* USE_FULL_ASSERT */
```

The *assert_failed* function is implemented in the main.c file or in any other user C file:

```
#ifdef USE_FULL_ASSERT /**
* @brief Reports the name of the source file and the source line number
* where the assert_param error has occurred.
* @param file: pointer to the source file name
* @param line: assert_param error line source number
* @retval None */
void assert_failed(uint8_t* file, uint32_t line)
{
/* User can add his own implementation to report the file name and line number,
ex: printf("Wrong parameters value: file %s on line %d\r\n", file, line) */
/* Infinite loop */
while (1)
{
}
}
```

Attention: ***Because of the overhead run-time checking introduces, it is recommended to use it during application code development and debugging, and to remove it from the final application to improve code size and speed.***

4 Overview of low-layer drivers

The low-layer (LL) drivers are designed to offer a fast light-weight expert-oriented layer which is closer to the hardware than the HAL. Contrary to the HAL, LL APIs are not provided for peripherals where optimized access is not a key feature, or those requiring heavy software configuration and/or complex upper-level stack (such as USB).

The LL drivers feature:

- A set of functions to initialize peripheral main features according to the parameters specified in data structures
- A set of functions used to fill initialization data structures with the reset values of each field
- Functions to perform peripheral de-initialization (peripheral registers restored to their default values)
- A set of inline functions for direct and atomic register access
- Full independence from HAL since LL drivers can be used either in standalone mode (without HAL drivers) or in mixed mode (with HAL drivers)
- Full coverage of the supported peripheral features

The low-layer drivers provide hardware services based on the available features of the STM32 peripherals. These services reflect exactly the hardware capabilities and provide one-shot operations that must be called following the programming model described in the microcontroller line reference manual. As a result, the LL services do not implement any processing and do not require any additional memory resources to save their states, counter or data pointers: all the operations are performed by changing the associated peripheral registers content.

4.1 Low-layer files

The low-layer drivers are built around header/C files (one per each supported peripheral) plus five header files for some System and Cortex related features.

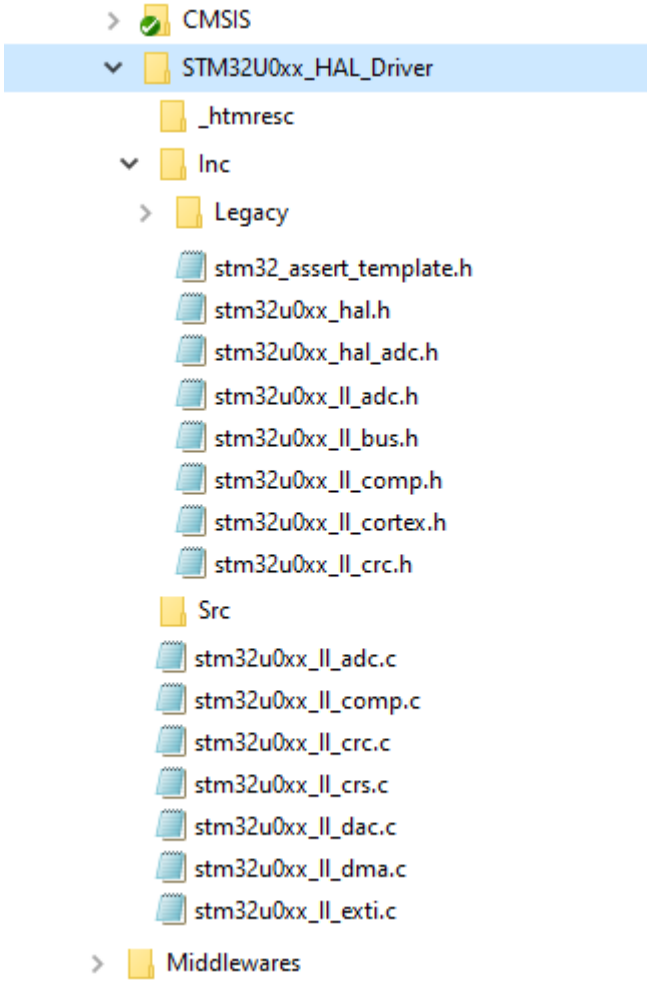
Table 16. LL driver files

File	Description
stm32u0xx_ll_bus.h	This is the h-source file for core bus control and peripheral clock activation and deactivation *Example: LL_AHB2_GRP1_EnableClock*
stm32u0xx_ll_ppp.h/.c	stm32u0xx_ll_ppp.c provides peripheral initialization functions such as LL_PPP_Init(), LL_PPP_StructInit(), LL_PPP_DeInit(). All the other APIs are definined within stm32u0xx_ll_ppp.h file. The low-layer PPP driver is a standalone module. To use it, the application must include it in the stm32u0xx_ll_ppp.h file.
stm32u0xx_ll_cortex.h	Cortex-M related register operation APIs including the Systick, Low power (such as LL_SYSTICK_xxxxx and LL_LPM_xxxxx "Low Power Mode")
stm32u0xx_ll_utils.h/.c	This file covers the generic APIs: • Read of device unique ID and electronic signature • Timebase and delay management • System clock configuration.
stm32u0xx_ll_system.h	System related operations. Example: LL_SYSCFG_xxx, LL_DBGMCU_xxx, LL_FLASH_xxx, and LL_VREFBUF_xxx
stm32_assert_template.h	Template file allowing to define the assert_param macro, that is used when run-time checking is enabled. This file is required only when the LL drivers are used in standalone mode (without calling the HAL APIs). It should be copied to the application folder and renamed to stm32_assert.h.

Note: There is no configuration file for the LL drivers.

The low-layer files are located in the same HAL driver folder.

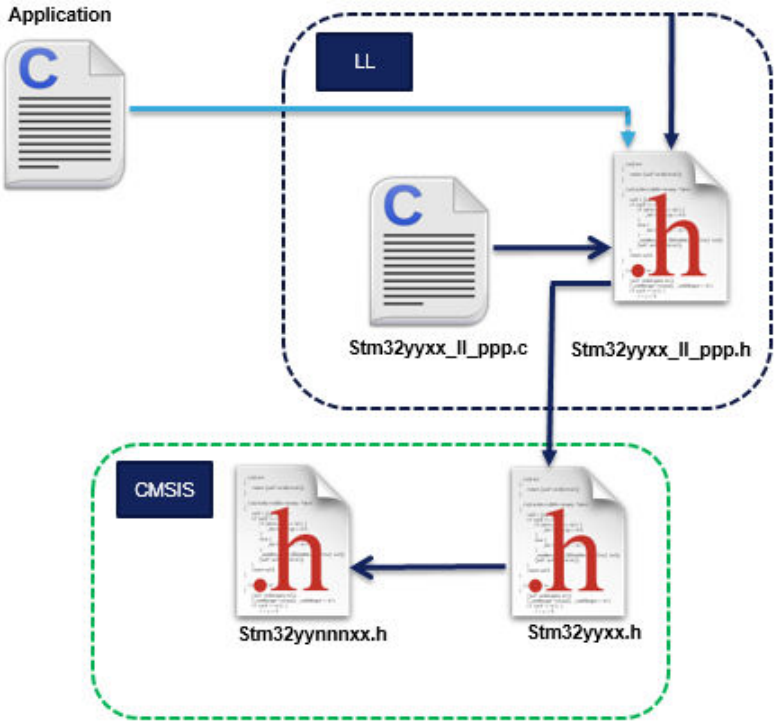
Figure 8. **Low-layer driver folders**



In general, low-layer drivers include only the STM32 CMSIS device file.

```
#include "stm32yyxx.h"
```

Figure 9. **Low-layer driver CMSIS files**



Application files have to include only the used low-layer driver header files.

4.2 Overview of low-layer APIs and naming rules

4.2.1 Peripheral initialization functions

The LL drivers offer three sets of initialization functions. They are defined in stm32u0xx_ll_ppp.c file:

- Functions to initialize peripheral main features according to the parameters specified in data structures
- A set of functions used to fill initialization data structures with the reset values of each field
- Function for peripheral de-initialization (peripheral registers restored to their default values)

The definition of these LL initialization functions and associated resources (structure, literals and prototypes) is conditioned by a compilation switch: *USE_FULL_LL_DRIVER*. To use these functions, this switch must be added in the toolchain compiler preprocessor or to any generic header file which is processed before the LL drivers.

The below table shows the list of the common functions provided for all the supported peripherals:

Table 17. Common peripheral initialization functions

Functions	Return Type	Parameters	Description
LL_PPP_Init	*ErrorStatus*	• *PPP_TypeDef* PPPx* • *LL_PPP_InitTypeDef* PPP_InitStruct*	Initializes the peripheral main features according to the parameters specified in PPP_InitStruct. Example: LL_USART_Init(USART_TypeDef *USARTx, LL_USART_InitTypeDef *USART_InitStruct)
LL_PPP_StructInit	*void*	• *LL_PPP_InitTypeDef* PPP_InitStruct*	Fills each PPP_InitStruct member with its default value. Example. LL_USART_StructInit(LL_USART_InitTypeDef *USART_InitStruct)
LL_PPP_DeInit	*ErrorStatus*	• *PPP_TypeDef* PPPx*	De-initializes the peripheral registers, that is restore them to their default reset values. Example. LL_USART_DeInit(USART_TypeDef *USARTx)

Additional functions are available for some peripherals (refer to Table 18. Optional peripheral initialization functions).

Table 18. Optional peripheral initialization functions

Functions	Return Type	Parameters	Examples
LL_PPP{_CATEGORY}_Init	*ErrorStatus*	• *PPP_TypeDef* PPPx* • *LL_PPP{_CATEGORY}_InitTypeDef* PPP{_CATEGORY}_InitStruct*	Initializes peripheral features according to the parameters specified in PPP_InitStruct. Example: LL_ADC_INJ_Init(ADC_TypeDef *ADCx, LL_ADC_INJ_InitTypeDef *ADC_INJ_InitStruct) LL_RTC_TIME_Init(RTC_TypeDef *RTCx, uint32_t RTC_Format, LL_RTC_TimeTypeDef *RTC_TimeStruct) LL_RTC_DATE_Init(RTC_TypeDef *RTCx, uint32_t RTC_Format, LL_RTC_DateTypeDef *RTC_DateStruct) LL_TIM_IC_Init(TIM_TypeDef* TIMx, uint32_t Channel, LL_TIM_IC_InitTypeDef* TIM_IC_InitStruct) LL_TIM_ENCODER_Init(TIM_TypeDef* TIMx, LL_TIM_ENCODER_InitTypeDef* TIM_EncoderInitStruct)
LL_PPP{_CATEGORY}_StructInit	*void*	*LL_PPP{_CATEGORY}_InitTypeDef* PPP{_CATEGORY}_InitStruct*	Fills each *PPP{_CATEGORY}_InitStruct* member with its default value. Example: LL_ADC_INJ_StructInit(LL_ADC_INJ_InitTypeDef *ADC_INJ_InitStruct)
LL_PPP_CommonInit	*ErrorStatus*	• *PPP_TypeDef* PPPx* • *LL_PPP_CommonInitTypeDef* PPP_CommonInitStruct*	Initializes the common features shared between different instances of the same peripheral. Example: LL_ADC_CommonInit(ADC_Common_TypeDef *ADCxy_COMMON, LL_ADC_CommonInitTypeDef *ADC_CommonInitStruct)
LL_PPP_CommonStructInit	*void*	*LL_PPP_CommonInitTypeDef* PPP_CommonInitStruct*	Fills each *PPP_CommonInitStruct* member with its default value Example: LL_ADC_CommonStructInit(LL_ADC_CommonInitTypeDef *ADC_CommonInitStruct)
LL_PPP_ClockInit	*ErrorStatus*	• *PPP_TypeDef* PPPx* • *LL_PPP_ClockInitTypeDef* PPP_ClockInitStruct*	Initializes the peripheral clock configuration in synchronous mode. Example: LL_USART_ClockInit(USART_TypeDef *USARTx, LL_USART_ClockInitTypeDef *USART_ClockInitStruct)

Functions	Return Type	Parameters	Examples
LL_PPP_ClockStructInit	*void*	*LL_PPP_ClockInitTypeDef* PPP_ClockInitStruct*	Fills each *PPP_ClockInitStruct* member with its default value Example: LL_USART_ClockStructInit(LL_USART_ClockInitTypeDef *USART_ClockInitStruct)

4.2.1.1 *Run-time checking*

Like HAL drivers, LL initialization functions implement run-time failure detection by checking the input values of all LL driver functions. For more details, refer to Section 3.12.4.3: Run-time checking.

When using the LL drivers in standalone mode (without calling HAL functions), the following actions are required to use run-time checking:

1. Copy stm32_assert_template.h to the application folder and rename it to stm32_assert.h. This file defines the assert_param macro which is used when run-time checking is enabled.
2. Include stm32_assert.h file within the application main header file.
3. Add the USE_FULL_ASSERT compilation switch in the toolchain compiler preprocessor or in any generic header file which is processed before the stm32_assert.h driver.

Note: Run-time checking is not available for LL inline functions.

4.2.2 Peripheral register-level configuration functions

On top of the peripheral initialization functions, the LL drivers offer a set of inline functions for direct atomic register access. Their format is as follows:

```
__STATIC_INLINE return_type LL_PPP_Function (PPPx_TypeDef *PPPx, args)
```

The “Function” naming is defined depending to the action category:

- **Specific Interrupt, DMA request and status flags management**: Set/Get/Clear/Enable/Disable flags on interrupt and status registers

Table 19. Specific Interrupt, DMA request and status flags management

Name	Examples
LL_PPP_{_CATEGORY}_ActionItem_BITNAME *LL_PPP{_CATEGORY}_IsItem_BITNAME_Action*	• LL_RCC_IsActiveFlag_LSIRDY • LL_RCC_IsActiveFlag_FWRST() • LL_ADC_ClearFlag_EOC(ADC1) • LL_DMA_ClearFlag_TCx(DMA_TypeDef* DMAx)

Table 20. Available function formats

Item	Action	Format
Flag	Get	*LL_PPP_IsActiveFlag_BITNAME*
	Clear	*LL_PPP_ClearFlag_BITNAME*
Interrupts	Enable	*LL_PPP_EnableIT_BITNAME*
	Disable	*LL_PPP_DisableIT_BITNAME*
	Get	*LL_PPP_IsEnabledIT_BITNAME*
DMA	Enable	*LL_PPP_EnableDMAReq_BITNAME*
	Disable	*LL_PPP_DisableDMAReq_BITNAME*
	Get	*LL_PPP_IsEnabledDMAReq_BITNAME*

Note: BITNAME refers to the peripheral register bit name as described in the product line reference manual.

- **Peripheral clock activation/deactivation management**: Enable/Disable/Reset a peripheral clock

Table 21. Peripheral clock activation/deactivation management

Name	Examples
LL_BUS_GRPx_ActionClock{Mode}	• *LL_AHB2_GRP1_EnableClock (LL_AHB2_GRP1_PERIPH_GPIOA| LL_AHB2_GRP1_PERIPH_GPIOB)* • *LL_APB1_GRP1_EnableClockSleep (LL_APB1_GRP1_PERIPH_DAC1)*

Note: 'x' corresponds to the group index and refers to the index of the modified register on a given bus. 'bus' corresponds to the bus name.

- ***Peripheral activation/deactivation management*** : Enable/disable a peripheral or activate/deactivate specific peripheral features

Table 22. Peripheral activation/deactivation management

Name	Examples
LL_PPP{_CATEGORY}_Action{Item} *LL_PPP{_CATEGORY}_IsItemAction*	• *LL_ADC_Enable ()* • *LL_ADC_StartCalibration();* • *LL_ADC_IsCalibrationOnGoing;* • *LL_RCC_HSI_Enable ()* • *LL_RCC_HSI_IsReady()*

- ***Peripheral configuration management*** : Set/get a peripheral configuration settings

Table 23. Peripheral configuration management

Name	Examples
LL_PPP{_CATEGORY}_Set{ or Get}ConfigItem	*LL_USART_SetBaudRate (USART2, Clock, LL_USART_BAUDRATE_9600)*

- ***Peripheral register management*** : Write/read the content of a register/retrun DMA relative register address

Table 24. Peripheral register management

Name
LL_PPP_WriteReg(__INSTANCE__, __REG__, __VALUE__)
LL_PPP_ReadReg(__INSTANCE__, __REG__)
*LL_PPP_DMA_GetRegAddr (PPP_TypeDef *PPPx,{Sub Instance if any ex: Channel} , {uint32_t Propriety})*

Note: The Propriety is a variable used to identify the DMA transfer direction or the data register type.

5 Cohabiting of HAL and LL

The low-ayer APIs are designed to be used in standalone mode or combined with the HAL. They cannot be automatically used with the HAL for the same peripheral instance. If you use the LL APIs for a specific instance, you can still use the HAL APIs for other instances. Be careful that the low-layer APIs might overwrite some registers which content is mirrored in the HAL handles.

5.1 Low-layer driver used in Standalone mode

The low-layer APIs can be used without calling the HAL driver services. This is done by simply including stm32u0xx_ll_ppp.h in the application files. The LL APIs for a given peripheral are called by executing the same sequence as the one recommended by the programming model in the corresponding product line reference manual. In this case the HAL drivers associated to the used peripheral can be removed from the workspace. However the STM32CubeU0 framework should be used in the same way as in the HAL drivers case which means that System file, startup file and CMSIS should always be used.

Note: When the BSP drivers are included, the used HAL drivers associated with the BSP functions drivers should be included in the workspace, even if they are not used by the application layer.

5.2 Mixed use of low-layer APIs and HAL drivers

In this case the low-layer APIs are used in conjunction with the HAL drivers to achieve direct and register level based operations.

Mixed use is allowed, however some consideration should be taken into account:

- It is recommended to avoid using simultaneously the HAL APIs and the combination of low-layer APIs for a given peripheral instance. If this is the case, one or more private fields in the HAL PPP handle structure should be updated accordingly.
- For operations and processes that do not alter the handle fields including the initialization structure, the HAL driver APIs and the low-layer services can be used together for the same peripheral instance.
- The low-layer drivers can be used without any restriction with all the HAL drivers that are not based on handle objects (RCC, common HAL, Flash and GPIO).

Several examples showing how to use HAL and LL in the same application are provided within stm32u0 firmware package (refer to Examples_MIX projects).

Note:

1. *When the HAL Init/DeInit APIs are not used and are replaced by the low-layer macros, the InitMsp() functions are not called and the MSP initialization should be done in the user application.*
2. *When process APIs are not used and the corresponding function is performed through the low-layer APIs, the callbacks are not called and post processing or error management should be done by the user application.*
3. *When the LL APIs is used for process operations, the IRQ handler HAL APIs cannot be called and the IRQ should be implemented by the user application. Each LL driver implements the macros needed to read and clear the associated interrupt flags.*

6 HAL System Driver

6.1 HAL Firmware driver API description

The following section lists the various functions of the HAL library.

6.1.1 How to use this driver

The common HAL driver contains a set of generic and common APIs that can be used by the PPP peripheral drivers and the user to start using the HAL.

The HAL contains two APIs categories:

- Common HAL APIs
- Services HAL APIs

6.1.2 HAL Initialization and Configuration functions

This section provides functions allowing to:

- Initialize the Flash interface the NVIC allocation and initial time base clock configuration.
- De-initialize common part of the HAL.
- Configure the time base source to have 1ms time base with a dedicated Tick interrupt priority.
  - SysTick timer is used by default as source of time base, but user can eventually implement his proper time base source (a general purpose timer for example or other time source), keeping in mind that Time base duration should be kept 1ms since PPP_TIMEOUT_VALUEs are defined and handled in milliseconds basis.
  - Time base configuration function (HAL_InitTick ()) is called automatically at the beginning of the program after reset by HAL_Init() or at any time when clock is configured, by HAL_RCC_ClockConfig().
  - Source of time base is configured to generate interrupts at regular time intervals. Care must be taken if HAL_Delay() is called from a peripheral ISR process, the Tick interrupt line must have higher priority (numerically lower) than the peripheral interrupt. Otherwise the caller ISR process will be blocked.
  - functions affecting time base configurations are declared as __weak to make override possible in case of other implementations in user file.

This section contains the following APIs:

- ***HAL_Init()***
- ***HAL_DeInit()***
- ***HAL_MspInit()***
- ***HAL_MspDeInit()***
- ***HAL_InitTick()***

6.1.3 HAL Control functions

This section provides functions allowing to:

- Provide a tick value in millisecond
- Provide a blocking delay in millisecond
- Suspend the time base source interrupt
- Resume the time base source interrupt
- Get the HAL API driver version
- Get the device identifier
- Get the device revision identifier

This section contains the following APIs:

- ***HAL_IncTick()***
- ***HAL_GetTick()***

- *HAL_GetTickPrio()*
- *HAL_SetTickFreq()*
- *HAL_GetTickFreq()*
- *HAL_Delay()*
- *HAL_SuspendTick()*
- *HAL_ResumeTick()*
- *HAL_GetHalVersion()*
- *HAL_GetREVID()*
- *HAL_GetDEVID()*
- *HAL_GetUIDw0()*
- *HAL_GetUIDw1()*
- *HAL_GetUIDw2()*

6.1.4 HAL Debug functions

This section provides functions allowing to:

- Enable/Disable Debug module during STOP mode
- Enable/Disable Debug module during STANDBY mode

This section contains the following APIs:

- *HAL_DBGMCU_EnableDBGStopMode()*
- *HAL_DBGMCU_DisableDBGStopMode()*
- *HAL_DBGMCU_EnableDBGStandbyMode()*
- *HAL_DBGMCU_DisableDBGStandbyMode()*

6.1.5 HAL SYSCFG configuration functions

This section provides functions allowing to:

- Enable/Disable Pin remap
- Configure the Voltage reference buffer
- Enable/Disable the Voltage reference buffer
- Enable/Disable the I/O analog switch voltage booster
- Enable/Disable dead battery behavior(*)
- Configure Clamping Diode on specific pins(*) (*) Feature not available on all devices

This section contains the following APIs:

- *HAL_SYSCFG_VREFBUF_VoltageScalingConfig()*
- *HAL_SYSCFG_VREFBUF_HighImpedanceConfig()*
- *HAL_SYSCFG_VREFBUF_TrimmingConfig()*
- *HAL_SYSCFG_EnableVREFBUF()*
- *HAL_SYSCFG_DisableVREFBUF()*
- *HAL_SYSCFG_EnableIOAnalogSwitchBooster()*
- *HAL_SYSCFG_DisableIOAnalogSwitchBooster()*
- *HAL_SYSCFG_EnableRemap()*
- *HAL_SYSCFG_DisableRemap()*
- *HAL_SYSCFG_EnableTSCComparatorMode()*
- *HAL_SYSCFG_DisableTSCComparatorMode()*
- *HAL_SYSCFG_SetTSCComparatorModeIO()*
- *HAL_SYSCFG_GetTSCComparatorModeIO()*
- *HAL_SYSCFG_ClearTSCComparatorModeIO()*
- *HAL_SYSCFG_LockSRAM2()*
- *HAL_SYSCFG_UnlockSRAM2()*
- *HAL_SYSCFG_EraseSRAM2()*

6.1.6 Detailed description of functions

HAL_Init

Function name

HAL_StatusTypeDef HAL_Init (void)

Function description

Configure the Flash prefetch and the Instruction cache, the time base source, NVIC and any required global low level hardware by calling the HAL_MspInit() callback function to be optionally defined in user file stm32u0xx_hal_msp.c.

Return values

- **HAL:** status

Notes

- HAL_Init() function is called at the beginning of program after reset and before the clock configuration.
- In the default implementation the System Timer (Systick) is used as source of time base. The Systick configuration is based on HSI clock, as HSI is the clock used after a system Reset. Once done, time base tick starts incrementing: the tick variable counter is incremented each 1ms in the SysTick_Handler() interrupt handler.

HAL_DeInit

Function name

HAL_StatusTypeDef HAL_DeInit (void)

Function description

This function de-Initializes common part of the HAL and stops the source of time base.

Return values

- **HAL:** status

Notes

- This function is optional.

HAL_MspInit

Function name

void HAL_MspInit (void)

Function description

Initialize the MSP.

Return values

- **None:**

HAL_MspDeInit

Function name

void HAL_MspDeInit (void)

Function description

DeInitializes the MSP.

Return values

- **None:**

HAL_InitTick

Function name

HAL_StatusTypeDef HAL_InitTick (uint32_t TickPriority)

Function description

This function configures the source of the time base: The time source is configured to have 1ms time base with a dedicated Tick interrupt priority.

Parameters

- **TickPriority:** Tick interrupt priority.

Return values

- **HAL:** status

Notes

- This function is called automatically at the beginning of program after reset by HAL_Init() or at any time when clock is reconfigured by HAL_RCC_ClockConfig().
- In the default implementation, SysTick timer is the source of time base. It is used to generate interrupts at regular time intervals. Care must be taken if HAL_Delay() is called from a peripheral ISR process, The SysTick interrupt must have higher priority (numerically lower) than the peripheral interrupt. Otherwise the caller ISR process will be blocked. The function is declared as __weak to be overwritten in case of other implementation in user file.

HAL_IncTick

Function name

void HAL_IncTick (void)

Function description

This function is called to increment a global variable "uwTick" used as application time base.

Return values

- **None:**

Notes

- In the default implementation, this variable is incremented each 1ms in SysTick ISR.
- This function is declared as __weak to be overwritten in case of other implementations in user file.

HAL_Delay

Function name

void HAL_Delay (uint32_t Delay)

Function description

This function provides minimum delay (in milliseconds) based on variable incremented.

Parameters

- **Delay:** specifies the delay time length, in milliseconds.

Return values

- **None:**

Notes

- In the default implementation , SysTick timer is the source of time base. It is used to generate interrupts at regular time intervals where uwTick is incremented.
- This function is declared as __weak to be overwritten in case of other implementations in user file.

HAL_GetTick

Function name

uint32_t HAL_GetTick (void)

Function description

Provides a tick value in millisecond.

Return values

- **tick:** value

Notes

- This function is declared as __weak to be overwritten in case of other implementations in user file.

HAL_GetTickPrio

Function name

uint32_t HAL_GetTickPrio (void)

Function description

This function returns a tick priority.

Return values

- **tick:** priority

HAL_SetTickFreq

Function name

HAL_StatusTypeDef HAL_SetTickFreq (uint32_t Freq)

Function description

Set new tick Freq.

Return values

- **Status:**

HAL_GetTickFreq

Function name

uint32_t HAL_GetTickFreq (void)

Function description

return tick frequency.

Return values

- **tick:** period in Hz

HAL_SuspendTick

Function name

void HAL_SuspendTick (void)

Function description

Suspend Tick increment.

Return values

- **None:**

Notes

- In the default implementation , SysTick timer is the source of time base. It is used to generate interrupts at regular time intervals. Once HAL_SuspendTick() is called, the SysTick interrupt will be disabled and so Tick increment is suspended.
- This function is declared as __weak to be overwritten in case of other implementations in user file.

HAL_ResumeTick

Function name

void HAL_ResumeTick (void)

Function description

Resume Tick increment.

Return values

- **None:**

Notes

- In the default implementation , SysTick timer is the source of time base. It is used to generate interrupts at regular time intervals. Once HAL_ResumeTick() is called, the SysTick interrupt will be enabled and so Tick increment is resumed.
- This function is declared as __weak to be overwritten in case of other implementations in user file.

HAL_GetHalVersion

Function name

uint32_t HAL_GetHalVersion (void)

Function description

Returns the HAL revision.

Return values

- **version:** : 0xXYZR (8bits for each decimal, R for RC)

HAL_GetREVID

Function name

uint32_t HAL_GetREVID (void)

Function description

Returns the device revision identifier.

Return values

- **Device:** revision identifier

HAL_GetDEVID

Function name

uint32_t HAL_GetDEVID (void)

Function description

Returns the device identifier.

Return values

- **Device:** identifier

HAL_GetUIDw0

Function name

uint32_t HAL_GetUIDw0 (void)

Function description

Return the first word of the unique device identifier (UID based on 96 bits)

Return values

- **Device:** identifier

HAL_GetUIDw1

Function name

uint32_t HAL_GetUIDw1 (void)

Function description

Return the second word of the unique device identifier (UID based on 96 bits)

Return values

- **Device:** identifier

HAL_GetUIDw2

Function name

uint32_t HAL_GetUIDw2 (void)

Function description

Return the third word of the unique device identifier (UID based on 96 bits)

Return values

- **Device:** identifier

HAL_DBGMCU_EnableDBGStopMode

Function name

void HAL_DBGMCU_EnableDBGStopMode (void)

Function description

Enable the Debug Module during STOP mode.

Return values

- **None:**

HAL_DBGMCU_DisableDBGStopMode

Function name

void HAL_DBGMCU_DisableDBGStopMode (void)

Function description

Disable the Debug Module during STOP mode.

Return values

- **None:**

HAL_DBGMCU_EnableDBGStandbyMode

Function name

void HAL_DBGMCU_EnableDBGStandbyMode (void)

Function description

Enable the Debug Module during STANDBY mode.

Return values

- **None:**

HAL_DBGMCU_DisableDBGStandbyMode

Function name

void HAL_DBGMCU_DisableDBGStandbyMode (void)

Function description

Disable the Debug Module during STANDBY mode.

Return values

- **None:**

HAL_SYSCFG_VREFBUF_VoltageScalingConfig

Function name

void HAL_SYSCFG_VREFBUF_VoltageScalingConfig (uint32_t VoltageScaling)

Function description

Configure the internal voltage reference buffer voltage scale.

Parameters

- **VoltageScaling:** specifies the output voltage to achieve This parameter can be one of the following values:
  - VREFBUF Voltage Scale

Return values

- **None:**

HAL_SYSCFG_VREFBUF_HighImpedanceConfig

Function name

void HAL_SYSCFG_VREFBUF_HighImpedanceConfig (uint32_t Mode)

Function description

Configure the internal voltage reference buffer high impedance mode.

Parameters

- **Mode:** specifies the high impedance mode This parameter can be one of the following values:
  - VREFBUF High Impedance

Return values

- **None:**

HAL_SYSCFG_VREFBUF_TrimmingConfig

Function name

void HAL_SYSCFG_VREFBUF_TrimmingConfig (uint32_t TrimmingValue)

Function description

Tune the Internal Voltage Reference buffer (VREFBUF).

Return values

- **None:**

HAL_SYSCFG_EnableVREFBUF

Function name

HAL_StatusTypeDef HAL_SYSCFG_EnableVREFBUF (void)

Function description

Enable the Internal Voltage Reference buffer (VREFBUF).

Return values

- **HAL_OK/HAL_TIMEOUT:**

HAL_SYSCFG_DisableVREFBUF

Function name

void HAL_SYSCFG_DisableVREFBUF (void)

Function description

Disable the Internal Voltage Reference buffer (VREFBUF).

Return values

- **None:**

HAL_SYSCFG_EnableIOAnalogSwitchBooster

Function name

void HAL_SYSCFG_EnableIOAnalogSwitchBooster (void)

Function description

Enable the I/O analog switch voltage booster.

Return values

- **None:**

HAL_SYSCFG_DisableIOAnalogSwitchBooster

Function name

void HAL_SYSCFG_DisableIOAnalogSwitchBooster (void)

Function description

Disable the I/O analog switch voltage booster.

Return values

- **None:**

HAL_SYSCFG_EnableRemap

Function name

void HAL_SYSCFG_EnableRemap (uint32_t PinRemap)

Function description

Enable the remap on PA11_PA12.

Parameters

- **PinRemap:** specifies which pins have to be remapped This parameter can be any combination of the following values:
  - SYSCFG_REMAP_PA11
  - SYSCFG_REMAP_PA12

Return values

- **None:**

HAL_SYSCFG_DisableRemap

Function name

void HAL_SYSCFG_DisableRemap (uint32_t PinRemap)

Function description

Disable the remap on PA11_PA12.

Parameters

- **PinRemap:** specifies which pins will behave normally This parameter can be any combination of the following values:
  - SYSCFG_REMAP_PA11
  - SYSCFG_REMAP_PA12

Return values

- **None:**

HAL_SYSCFG_EnableTSCComparatorMode

Function name

void HAL_SYSCFG_EnableTSCComparatorMode (void)

Function description

Enable TSC Comparator Mode.

Return values

- **None:**

HAL_SYSCFG_DisableTSCComparatorMode

Function name

void HAL_SYSCFG_DisableTSCComparatorMode (void)

Function description

Disable TSC Comparator Mode.

Return values

- **None:**

HAL_SYSCFG_SetTSCComparatorModeIO

Function name

void HAL_SYSCFG_SetTSCComparatorModeIO (uint32_t CompModeIOGRP)

Function description

Set configuration of TSC comparator mode.

Parameters

- **CompModeIOGRP:** specifies which comparator mode group IO will be configured. This parameter can be any combination of the following values:
  - SYSCFG TSC IO COMP MODE

Return values

- **None:**

HAL_SYSCFG_GetTSCComparatorModeIO

Function name

uint32_t HAL_SYSCFG_GetTSCComparatorModeIO (uint32_t CompModeIOGRP)

Function description

Get the configuration of TSC comparator mode.

Parameters

- **CompModeIOGRP:** specifies which comparator mode group IO will be configured. This parameter can be any combination of the following values:
  - SYSCFG TSC IO COMP MODE

Return values

- **State:** of bit (1 or 0).

HAL_SYSCFG_ClearTSCComparatorModeIO

Function name

void HAL_SYSCFG_ClearTSCComparatorModeIO (uint32_t CompModeIOGRP)

Function description

Clear configuration of TSC comparator mode.

Parameters

- **CompModeIOGRP:** specifies which group will This parameter can be any combination of the following values:
  - SYSCFG TSC IO COMP MODE

Return values

- **None:**

HAL_SYSCFG_LockSRAM2

Function name

void HAL_SYSCFG_LockSRAM2 (void)

Function description

SRAM2 page write protection lock prior to erase.

Return values

- **None:**

HAL_SYSCFG_UnlockSRAM2

Function name

void HAL_SYSCFG_UnlockSRAM2 (void)

Function description

SRAM2 page write protection unlock prior to erase.

Return values

- **None:**

HAL_SYSCFG_EraseSRAM2

Function name

void HAL_SYSCFG_EraseSRAM2 (void)

Function description

Start a hardware SRAM2 erase operation.

Return values

- **None:**

Notes

- As long as SRAM2 is not erased the SRAM2ER bit will be set. This bit is automatically reset at the end of the SRAM2 erase operation.

6.2 HAL Firmware driver defines

The following section lists the various define and macros of the module.

6.2.1 HAL

HAL

IR Modulation Envelope signal selection

HAL_SYSCFG_IRDA_ENV_SEL_TIM16

00: Timer16 is selected as IR Modulation envelope source

HAL_SYSCFG_IRDA_ENV_SEL_USART1

01: USART1 is selected as IR Modulation envelope source

HAL_SYSCFG_IRDA_ENV_SEL_USART2

10: USART2 is selected as IR Modulation envelope source

IR output polarity selection

HAL_SYSCFG_IRDA_POLARITY_NOT_INVERTED

0: IR output polarity not inverted

HAL_SYSCFG_IRDA_POLARITY_INVERTED

1: IR output polarity inverted

HAL ISR Wrapper

HAL_SYSCFG_ITLINE0

Internal define for macro handling

HAL_SYSCFG_ITLINE1

Internal define for macro handling

HAL_SYSCFG_ITLINE2

Internal define for macro handling

HAL_SYSCFG_ITLINE3

Internal define for macro handling

HAL_SYSCFG_ITLINE4

Internal define for macro handling

HAL_SYSCFG_ITLINE5

Internal define for macro handling

HAL_SYSCFG_ITLINE6

Internal define for macro handling

HAL_SYSCFG_ITLINE7

Internal define for macro handling

HAL_SYSCFG_ITLINE8

Internal define for macro handling

HAL_SYSCFG_ITLINE9

Internal define for macro handling

HAL_SYSCFG_ITLINE10

Internal define for macro handling

HAL_SYSCFG_ITLINE11

Internal define for macro handling

HAL_SYSCFG_ITLINE12

Internal define for macro handling

HAL_SYSCFG_ITLINE13

Internal define for macro handling

HAL_SYSCFG_ITLINE14

Internal define for macro handling

HAL_SYSCFG_ITLINE15

Internal define for macro handling

HAL_SYSCFG_ITLINE16

Internal define for macro handling

HAL_SYSCFG_ITLINE17

Internal define for macro handling

HAL_SYSCFG_ITLINE18

Internal define for macro handling

HAL_SYSCFG_ITLINE19

Internal define for macro handling

HAL_SYSCFG_ITLINE20

Internal define for macro handling

HAL_SYSCFG_ITLINE21

Internal define for macro handling

HAL_SYSCFG_ITLINE22

Internal define for macro handling

HAL_SYSCFG_ITLINE23

Internal define for macro handling

HAL_SYSCFG_ITLINE24

Internal define for macro handling

HAL_SYSCFG_ITLINE25

Internal define for macro handling

HAL_SYSCFG_ITLINE26

Internal define for macro handling

HAL_SYSCFG_ITLINE27

Internal define for macro handling

HAL_SYSCFG_ITLINE28

Internal define for macro handling

HAL_SYSCFG_ITLINE29

Internal define for macro handling

HAL_SYSCFG_ITLINE30

Internal define for macro handling

HAL_SYSCFG_ITLINE31

Internal define for macro handling

HAL_ITLINE_WWDG

WWDG has expired ....

HAL_ITLINE_PVDOUT

Power voltage detection Interrupt ....

HAL_ITLINE_RTC

RTC -> exti[28] Interrupt

HAL_ITLINE_TAMPER

TAMPER -> exti[29] interrupt ....

HAL_ITLINE_FLASH_ECC

Flash ECC Interrupt

HAL_ITLINE_FLASH_ITF

Flash ITF Interrupt

HAL_ITLINE_RCC

RCC Interrupt

HAL_ITLINE_CRS

RCC Interrupt

HAL_ITLINE_EXTI0

External Interrupt 0

HAL_ITLINE_EXTI1

External Interrupt 1

HAL_ITLINE_EXTI2

External Interrupt 2

HAL_ITLINE_EXTI3

External Interrupt 3

HAL_ITLINE_EXTI4

EXTI4 Interrupt

HAL_ITLINE_EXTI5

EXTI5 Interrupt

HAL_ITLINE_EXTI6

EXTI6 Interrupt

HAL_ITLINE_EXTI7

EXTI7 Interrupt

HAL_ITLINE_EXTI8

EXTI8 Interrupt

HAL_ITLINE_EXTI9

EXTI9 Interrupt

HAL_ITLINE_EXTI10

EXTI10 Interrupt

HAL_ITLINE_EXTI11

EXTI11 Interrupt

HAL_ITLINE_EXTI12

EXTI12 Interrupt

HAL_ITLINE_EXTI13

EXTI13 Interrupt

HAL_ITLINE_EXTI14

EXTI14 Interrupt

HAL_ITLINE_EXTI15

EXTI15 Interrupt

HAL_ITLINE_USBFS

USBFS Interrupt

HAL_ITLINE_DMA1_CH1

DMA1 Channel 1 Interrupt

HAL_ITLINE_DMA1_CH2

DMA1 Channel 2 Interrupt

HAL_ITLINE_DMA1_CH3

DMA1 Channel 3 Interrupt

HAL_ITLINE_DMAMUX

DMAMUX Interrupt

HAL_ITLINE_DMA1_CH4

DMA1 Channel 4 Interrupt

HAL_ITLINE_DMA1_CH5

DMA1 Channel 5 Interrupt

HAL_ITLINE_DMA1_CH6

DMA1 Channel 6 Interrupt

HAL_ITLINE_DMA1_CH7

DMA1 Channel 7 Interrupt

HAL_ITLINE_DMA1_CH8

DMA1 Channel 8 Interrupt

HAL_ITLINE_DMA1_CH9

DMA1 Channel 9 Interrupt

HAL_ITLINE_DMA1_CH10

DMA1 Channel 10 Interrupt

HAL_ITLINE_DMA1_CH11

DMA1 Channel 11 Interrupt

HAL_ITLINE_DMA1_CH12

DMA1 Channel 12 Interrupt

HAL_ITLINE_ADC

ADC Interrupt

HAL_ITLINE_COMP1

COMP1 Interrupt -> exti[17]

HAL_ITLINE_COMP2

COMP2 Interrupt -> exti[18]

HAL_ITLINE_TIM1_BRK

TIM1 BRK Interrupt

HAL_ITLINE_TIM1_UPD

TIM1 UPD Interrupt

HAL_ITLINE_TIM1_TRG

TIM1 TRG Interrupt

HAL_ITLINE_TIM1_CCU

TIM1 CCU Interrupt

HAL_ITLINE_TIM1_CC1

TIM1 CC1 Interrupt

HAL_ITLINE_TIM1_CC2

TIM1 CC2 Interrupt

HAL_ITLINE_TIM1_CC3

TIM1 CC3 Interrupt

HAL_ITLINE_TIM1_CC4

TIM1 CC4 Interrupt

HAL_ITLINE_TIM2

TIM2 Interrupt

HAL_ITLINE_TIM3

TIM3 Interrupt

HAL_ITLINE_TIM6

TIM6 Interrupt

HAL_ITLINE_LPTIM1

LPTIM1 Interrupt -> exti[24]

HAL_ITLINE_TIM7

TIM7 Interrupt

HAL_ITLINE_LPTIM2

LPTIM2 Interrupt -> exti[25]

HAL_ITLINE_TIM14

TIM14 Interrupt

HAL_ITLINE_TIM15

TIM15 Interrupt

HAL_ITLINE_TIM16

TIM16 Interrupt

HAL_ITLINE_LPTIM3

LPTIM3 Interrupt -> exti[26]

HAL_ITLINE_TSC_MCE

TSC MCE Interrupt

HAL_ITLINE_TSC_EOA

TSC EOA Interrupt

HAL_ITLINE_LCD

LCD Interrupt

HAL_ITLINE_I2C1

I2C1 Interrupt -> exti[33]

HAL_ITLINE_I2C2

I2C2 Interrupt

HAL_ITLINE_I2C4

I2C4 Interrupt

HAL_ITLINE_I2C3

I2C3 Interrupt

HAL_ITLINE_SPI1

SPI1 Interrupt

HAL_ITLINE_SPI2

SPI2 Interrupt

HAL_ITLINE_USART1

USART1 GLB Interrupt -> exti[25]

HAL_ITLINE_USART2

USART2 GLB Interrupt -> exti[26]

HAL_ITLINE_LPUART2

LPUART2 GLB Interrupt -> exti[31]

HAL_ITLINE_USART3

USART3 Interrupt ....

HAL_ITLINE_LPUART1

LPUART1 Interrupt -> exti[28]

HAL_ITLINE_USART4

USART4 Interrupt ....

HAL_ITLINE_LPUART3

LPUART3 Interrupt -> exti[32]

HAL_ITLINE_RNG

RNG Interrupt

HAL_ITLINE_AES

AES Interrupt

Pin remapping

SYSCFG_REMAP_PA11

PA11 pad behaves digitally as PA9 GPIO pin

SYSCFG_REMAP_PA12

PA12 pad behaves digitally as PA10 GPIO pin

Tick Frequency

HAL_TICK_FREQ_10HZ

HAL_TICK_FREQ_100HZ

HAL_TICK_FREQ_1KHZ

HAL_TICK_FREQ_DEFAULT

Boot Mode

SYSCFG_BOOT_MAINFLASH

Main Flash memory mapped at 0x0000 0000

SYSCFG_BOOT_SYSTEMFLASH

System Flash memory mapped at 0x0000 0000

SYSCFG_BOOT_SRAM

Embedded SRAM mapped at 0x0000 0000

Break

SYSCFG_BREAK_SP

Enables and locks the SRAM Parity error signal with Break Input of TIM1/15/16

SYSCFG_BREAK_PVD

Enables and locks the PVD connection with TIM1/15/16 Break Input and also the PVDE and PLS bits of the Power Control Interface

SYSCFG_BREAK_LOCKUP

Enables and locks the LOCKUP output of CortexM0+ with Break Input of TIM1/15/16

SYSCFG_BREAK_ECC

Enables and locks the ECC of CortexM0+ with Break Input of TIM1/15/16

SYSCFG TSC IO COMP MODE

SYSCFG_COMP_MODE_GRP2_IO1

Enable comparator mode for group 2 on I/O 1

SYSCFG_COMP_MODE_GRP2_IO3

Enable comparator mode for group 2 on I/O 3

SYSCFG_COMP_MODE_GRP4_IO1

Enable comparator mode for group 4 on I/O 1

SYSCFG_COMP_MODE_GRP6_IO1

Enable comparator mode for group 6 on I/O 1

SYSCFG_COMP_MODE_GRP7_IO2

Enable comparator mode for group 7 on I/O 2

SYSCFG Exported Macros

__HAL_SYSCFG_REMAPMEMORY_FLASH

__HAL_SYSCFG_REMAPMEMORY_SYSTEMFLASH

__HAL_SYSCFG_REMAPMEMORY_SRAM

__HAL_SYSCFG_GET_BOOT_MODE

Description:

- Return the boot mode as configured by user.

Return value:

- The: boot mode as configured by user. The returned value can be one of the following values

__HAL_SYSCFG_BREAK_ECC_LOCK

Notes:

- The selected configuration is locked and can be unlocked only by system reset.

Enable and lock the connection of Flash ECC error connection to TIM1 Break input.

__HAL_SYSCFG_BREAK_LOCKUP_LOCK

Notes:

- The selected configuration is locked and can be unlocked only by system reset.

Enables and locks the connection of Cortex-M0+ LOCKUP (Hardfault) output to TIM1/15/16/17 Break input

__HAL_SYSCFG_BREAK_PVD_LOCK

Notes:

- The selected configuration is locked and can be unlocked only by system reset

Enables and locks the PVD connection with Timer1/15/16/17 Break input, as well as the PVDE and PLS[2:0] in the PWR_CR register

__HAL_SYSCFG_BREAK_SRAMPARITY_LOCK

Notes:

- The selected configuration is locked and can only be unlocked by system reset

__HAL_SYSCFG_GET_FLAG

Description:

- Check SYSCFG flag is set or not.

Parameters:

- __FLAG__: specifies the flag to check. This parameter can be one of the following values:
  - SYSCFG_FLAG_SRAM1_PE SRAM1 Parity Error Flag
  - SYSCFG_FLAG_SRAM2_PE SRAM2 Parity Error Flag
  - SYSCFG_FLAG_SRAM2_BUSY SRAM2 Erase Ongoing

Return value:

- The: new state of __FLAG__ (TRUE or FALSE).

__HAL_SYSCFG_CLEAR_FLAG

Description:

- Set the PEF bit to clear the SRAM Parity Error Flag.

Parameters:

- __FLAG__: specifies the flag to clear. This parameter can be one of the following values:
  - SYSCFG_FLAG_SRAM1_PE SRAM1 Parity Error Flag
  - SYSCFG_FLAG_SRAM2_PE SRAM2 Parity Error Flag

__HAL_SYSCFG_FASTMODEPLUS_ENABLE

Description:

- Fast-mode Plus driving capability enable/disable macros.

Parameters:

- __FASTMODEPLUS__: This parameter can be a value of

__HAL_SYSCFG_FASTMODEPLUS_DISABLE

__HAL_SYSCFG_GET_PENDING_IT

Notes:

- Allow to determine interrupt source per line.

__HAL_SYSCFG_IRDA_ENV_SELECTION

Description:

- selection of the modulation envelope signal macro, using bits [7:6] of SYSCFG_CFGR1 register

Parameters:

- __SOURCE__: This parameter can be a value of

__HAL_SYSCFG_GET_IRDA_ENV_SELECTION

__HAL_SYSCFG_IRDA_OUT_POLARITY_SELECTION

Description:

- IROut Polarity Selection, using bit[5] of SYSCFG_CFGR1 register.

Parameters:

- __SEL__: This parameter can be a value of

__HAL_SYSCFG_GET_POLARITY

Description:

- Return the IROut Polarity mode as configured by user.

Return value:

- The: IROut polarity as configured by user. The returned value can be one of

__HAL_SYSCFG_BREAK_ENABLE

Description:

- Break input to TIM1/15/16 capability enable/disable macros.

Parameters:

- __BREAK__: This parameter can be a value of

__HAL_SYSCFG_BREAK_DISABLE

Fast mode Plus on GPIO

SYSCFG_FASTMODEPLUS_PB6

Enable Fast mode Plus on PB6

SYSCFG_FASTMODEPLUS_PB7

Enable Fast mode Plus on PB7

SYSCFG_FASTMODEPLUS_PB8

Enable Fast mode Plus on PB8

SYSCFG_FASTMODEPLUS_PB9

Enable Fast mode Plus on PB9

SYSCFG_FASTMODEPLUS_PA9

Enable Fast mode Plus on PA9

SYSCFG_FASTMODEPLUS_PA10

Enable Fast mode Plus on PA10

Flags

SYSCFG_FLAG_SRAM1_PE

SRAM1 parity error

SYSCFG_FLAG_SRAM2_PE

SRAM2 parity error

SYSCFG_FLAG_SRAM2_BUSY

SRAM2 busy by erase operation

VREFBUF High Impedance

SYSCFG_VREFBUF_HIGH_IMPEDANCE_DISABLE

VREF_plus pin is internally connected to Voltage reference buffer output

SYSCFG_VREFBUF_HIGH_IMPEDANCE_ENABLE

VREF_plus pin is high impedance

VREFBUF Voltage Scale

SYSCFG_VREFBUF_VOLTAGE_SCALE0

Voltage reference scale 0: VREF_OUT1 around 2.048 V. This requires VDDA equal to or higher than 2.4 V.

SYSCFG_VREFBUF_VOLTAGE_SCALE1

Voltage reference scale 1: VREF_OUT1 around 2.5 V. This requires VDDA equal to or higher than 2.8 V.

7 HAL ADC Generic Driver

7.1 ADC Firmware driver registers structures

7.1.1 ADC_OversamplingTypeDef

ADC_OversamplingTypeDef is defined in the stm32u0xx_hal_adc.h

Data Fields

- ***uint32_t Ratio***
- ***uint32_t RightBitShift***
- ***uint32_t TriggeredMode***

Field Documentation

- ***uint32_t ADC_OversamplingTypeDef::Ratio***
  Configures the oversampling ratio. This parameter can be a value of ***ADC_HAL_EC_OVS_RATIO***
- ***uint32_t ADC_OversamplingTypeDef::RightBitShift***
  Configures the division coefficient for the Oversampler. This parameter can be a value of ***ADC_HAL_EC_OVS_SHIFT***
- ***uint32_t ADC_OversamplingTypeDef::TriggeredMode***
  Selects the regular triggered oversampling mode. This parameter can be a value of ***ADC_HAL_EC_OVS_DISCONT_MODE***

7.1.2 ADC_InitTypeDef

ADC_InitTypeDef is defined in the stm32u0xx_hal_adc.h

Data Fields

- ***uint32_t ClockPrescaler***
- ***uint32_t Resolution***
- ***uint32_t DataAlign***
- ***uint32_t ScanConvMode***
- ***uint32_t EOCSelection***
- ***FunctionalState LowPowerAutoWait***
- ***FunctionalState LowPowerAutoPowerOff***
- ***FunctionalState ContinuousConvMode***
- ***uint32_t NbrOfConversion***
- ***FunctionalState DiscontinuousConvMode***
- ***uint32_t ExternalTrigConv***
- ***uint32_t ExternalTrigConvEdge***
- ***FunctionalState DMAContinuousRequests***
- ***uint32_t Overrun***
- ***uint32_t SamplingTimeCommon1***
- ***uint32_t SamplingTimeCommon2***
- ***FunctionalState OversamplingMode***
- ***ADC_OversamplingTypeDef Oversampling***
- ***uint32_t TriggerFrequencyMode***

Field Documentation

- ***uint32_t ADC_InitTypeDef::ClockPrescaler***
  Select ADC clock source (synchronous clock derived from APB clock or asynchronous clock derived from system clock or PLL (Refer to reference manual for list of clocks available)) and clock prescaler. This parameter can be a value of ***ADC_HAL_EC_COMMON_CLOCK_SOURCE***. Note: The ADC clock configuration is common to all ADC instances. Note: In case of synchronous clock mode based on HCLK/1, the configuration must be enabled only if the system clock has a 50% duty clock cycle (APB prescaler configured inside RCC must be bypassed and PCLK clock must have 50% duty cycle). Refer to reference manual for details. Note: In case of usage of asynchronous clock, the selected clock must be preliminarily enabled at RCC top level. Note: This parameter can be modified only if all ADC instances are disabled.
- ***uint32_t ADC_InitTypeDef::Resolution***
  Configure the ADC resolution. This parameter can be a value of ***ADC_HAL_EC_RESOLUTION***
- ***uint32_t ADC_InitTypeDef::DataAlign***
  Specify ADC data alignment in conversion data register (right or left). Refer to reference manual for alignments formats versus resolutions. This parameter can be a value of ***ADC_HAL_EC_DATA_ALIGN***
- ***uint32_t ADC_InitTypeDef::ScanConvMode***
  Configure the sequencer of ADC group regular. On this STM32 series, ADC group regular sequencer both modes "fully configurable" or "not fully configurable" are available:
  - sequencer configured to fully configurable: sequencer length and each rank affectation to a channel are configurable.
    - Sequence length: Set number of ranks in the scan sequence.
    - Sequence direction: Unless specified in parameters, sequencer scan direction is forward (from rank 1 to rank n).
  - sequencer configured to not fully configurable: sequencer length and each rank affectation to a channel are fixed by channel HW number.
    - Sequence length: Number of ranks in the scan sequence is defined by number of channels set in the sequence, rank of each channel is fixed by channel HW number. (channel 0 fixed on rank 0, channel 1 fixed on rank1, ...).
    - Sequence direction: Unless specified in parameters, sequencer scan direction is forward (from lowest channel number to highest channel number). This parameter can be associated to parameter 'DiscontinuousConvMode' to have main sequence subdivided in successive parts. Sequencer is automatically enabled if several channels are set (sequencer cannot be disabled, as it can be the case on other STM32 devices): If only 1 channel is set: Conversion is performed in single mode. If several channels are set: Conversions are performed in sequence mode. This parameter can be a value of ***ADC_Scan_mode***
- ***uint32_t ADC_InitTypeDef::EOCSelection***
  Specify which EOC (End Of Conversion) flag is used for conversion by polling and interruption: end of unitary conversion or end of sequence conversions. This parameter can be a value of ***ADC_EOCSelection***.
- ***FunctionalState ADC_InitTypeDef::LowPowerAutoWait***
  Select the dynamic low power Auto Delay: new conversion start only when the previous conversion (for ADC group regular) has been retrieved by user software, using function **HAL_ADC_GetValue()**. This feature automatically adapts the frequency of ADC conversions triggers to the speed of the system that reads the data. Moreover, this avoids risk of overrun for low frequency applications. This parameter can be set to ENABLE or DISABLE. Note: It is not recommended to use with interruption or DMA (**HAL_ADC_Start_IT()**, **HAL_ADC_Start_DMA()**) since these modes have to clear immediately the EOC flag (by CPU to free the IRQ pending event or by DMA). Auto wait will work but fort a very short time, discarding its intended benefit (except specific case of high load of CPU or DMA transfers which can justify usage of auto wait). Do use with polling: 1. Start conversion with **HAL_ADC_Start()**, 2. Later on, when ADC conversion data is needed: use **HAL_ADC_PollForConversion()** to ensure that conversion is completed and **HAL_ADC_GetValue()** to retrieve conversion result and trig another conversion start.
- ***FunctionalState ADC_InitTypeDef::LowPowerAutoPowerOff***
  Select the auto-off mode: the ADC automatically powers-off after a conversion and automatically wakes-up when a new conversion is triggered (with startup time between trigger and start of sampling). This feature can be combined with automatic wait mode (parameter 'LowPowerAutoWait'). This parameter can be set to ENABLE or DISABLE.
- ***FunctionalState ADC_InitTypeDef::ContinuousConvMode***
  Specify whether the conversion is performed in single mode (one conversion) or continuous mode for ADC group regular, after the first ADC conversion start trigger occurred (software start or external trigger). This parameter can be set to ENABLE or DISABLE.

- ***uint32_t ADC_InitTypeDef::NbrOfConversion***
  Specify the number of ranks that will be converted within the regular group sequencer. This parameter is dependent on ScanConvMode:
  - sequencer configured to fully configurable: Number of ranks in the scan sequence is configurable using this parameter. Note: After the first call of '**HAL_ADC_Init()**', each rank corresponding to parameter "NbrOfConversion" must be set using '**HAL_ADC_ConfigChannel()**'. Afterwards, when all needed sequencer ranks are set, parameter 'NbrOfConversion' can be updated without modifying configuration of sequencer ranks (sequencer ranks above 'NbrOfConversion' are discarded).
  - sequencer configured to not fully configurable: Number of ranks in the scan sequence is defined by number of channels set in the sequence. This parameter is discarded. This parameter must be a number between Min_Data = 1 and Max_Data = 8. Note: This parameter must be modified when no conversion is on going on regular group (ADC disabled, or ADC enabled without continuous mode or external trigger that could launch a conversion).
- ***FunctionalState ADC_InitTypeDef::DiscontinuousConvMode***
  Specify whether the conversions sequence of ADC group regular is performed in Complete-sequence/ Discontinuous-sequence (main sequence subdivided in successive parts). Discontinuous mode is used only if sequencer is enabled (parameter 'ScanConvMode'). If sequencer is disabled, this parameter is discarded. Discontinuous mode can be enabled only if continuous mode is disabled. If continuous mode is enabled, this parameter setting is discarded. This parameter can be set to ENABLE or DISABLE. Note: On this STM32 series, ADC group regular number of discontinuous ranks increment is fixed to one-by-one.
- ***uint32_t ADC_InitTypeDef::ExternalTrigConv***
  Select the external event source used to trigger ADC group regular conversion start. If set to ADC_SOFTWARE_START, external triggers are disabled and software trigger is used instead. This parameter can be a value of ***ADC_regular_external_trigger_source***. Caution: external trigger source is common to all ADC instances.
- ***uint32_t ADC_InitTypeDef::ExternalTrigConvEdge***
  Select the external event edge used to trigger ADC group regular conversion start If trigger source is set to ADC_SOFTWARE_START, this parameter is discarded. This parameter can be a value of ***ADC_regular_external_trigger_edge***
- ***FunctionalState ADC_InitTypeDef::DMAContinuousRequests***
  Specify whether the DMA requests are performed in one shot mode (DMA transfer stops when number of conversions is reached) or in continuous mode (DMA transfer unlimited, whatever number of conversions). This parameter can be set to ENABLE or DISABLE. Note: In continuous mode, DMA must be configured in circular mode. Otherwise an overrun will be triggered when DMA buffer maximum pointer is reached.
- ***uint32_t ADC_InitTypeDef::Overrun***
  Select the behavior in case of overrun: data overwritten or preserved (default). This parameter can be a value of ***ADC_HAL_EC_REG_OVR_DATA_BEHAVIOR***. Note: In case of overrun set to data preserved and usage with programming model with interruption (HAL_Start_IT()): ADC IRQ handler has to clear end of conversion flags, this induces the release of the preserved data. If needed, this data can be saved in function **HAL_ADC_ConvCpltCallback()**, placed in user program code (called before end of conversion flags clear) Note: Error reporting with respect to the conversion mode:
  - Usage with ADC conversion by polling for event or interruption: Error is reported only if overrun is set to data preserved. If overrun is set to data overwritten, user can willingly not read all the converted data, this is not considered as an erroneous case.
  - Usage with ADC conversion by DMA: Error is reported whatever overrun setting (DMA is expected to process all data from data register).
- ***uint32_t ADC_InitTypeDef::SamplingTimeCommon1***
  Set sampling time common to a group of channels. Unit: ADC clock cycles Conversion time is the addition of sampling time and processing time (12.5 ADC clock cycles at ADC resolution 12 bits, 10.5 cycles at 10 bits, 8.5 cycles at 8 bits, 6.5 cycles at 6 bits). Note: On this STM32 family, two different sampling time settings are available, each channel can use one of these two settings. On some other STM32 devices this parameter in channel wise and is located into ADC channel initialization structure. This parameter can be a value of ***ADC_HAL_EC_CHANNEL_SAMPLINGTIME*** Note: In case of usage of internal measurement channels (VrefInt/Vbat/TempSensor) sampling time constraints must be respected (sampling time can be adjusted in function of ADC clock frequency and sampling time setting) Refer to device datasheet for timings values, parameters TS_vrefint, TS_vbat, TS_temp (values rough order: few tens of microseconds).

- ***uint32_t ADC_InitTypeDef::SamplingTimeCommon2***
  Set sampling time common to a group of channels, second common setting possible. Unit: ADC clock cycles Conversion time is the addition of sampling time and processing time (12.5 ADC clock cycles at ADC resolution 12 bits, 10.5 cycles at 10 bits, 8.5 cycles at 8 bits, 6.5 cycles at 6 bits). Note: On this STM32 family, two different sampling time settings are available, each channel can use one of these two settings. On some other STM32 devices this parameter in channel wise and is located into ADC channel initialization structure. This parameter can be a value of ***ADC_HAL_EC_CHANNEL_SAMPLINGTIME***
  Note: In case of usage of internal measurement channels (VrefInt/Vbat/TempSensor) sampling time constraints must be respected (sampling time can be adjusted in function of ADC clock frequency and sampling time setting) Refer to device datasheet for timings values, parameters TS_vrefint, TS_vbat, TS_temp (values rough order: few tens of microseconds).
- ***FunctionalState ADC_InitTypeDef::OversamplingMode***
  Specify whether the oversampling feature is enabled or disabled. This parameter can be set to ENABLE or DISABLE. Note: This parameter can be modified only if there is no conversion is ongoing on ADC group regular.
- ***ADC_OversamplingTypeDef ADC_InitTypeDef::Oversampling***
  Specify the Oversampling parameters. Caution: this setting overwrites the previous oversampling configuration if oversampling is already enabled.
- ***uint32_t ADC_InitTypeDef::TriggerFrequencyMode***
  Set ADC trigger frequency mode. This parameter can be a value of ***ADC_HAL_EC_REG_TRIGGER_FREQ***. Note: ADC trigger frequency mode must be set to low frequency when a duration is exceeded before ADC conversion start trigger event (between ADC enable and ADC conversion start trigger event or between two ADC conversion start trigger event). Duration value: Refer to device datasheet, parameter "tIdle". Note: When ADC trigger frequency mode is set to low frequency, some rearm cycles are inserted before performing ADC conversion start, inducing a delay of 2 ADC clock cycles.

7.1.3 ADC_ChannelConfTypeDef

ADC_ChannelConfTypeDef is defined in the stm32u0xx_hal_adc.h

Data Fields

- ***uint32_t Channel***
- ***uint32_t Rank***
- ***uint32_t SamplingTime***

Field Documentation

- ***uint32_t ADC_ChannelConfTypeDef::Channel***
  Specify the channel to configure into ADC regular group. This parameter can be a value of ***ADC_HAL_EC_CHANNEL*** Note: Depending on devices and ADC instances, some channels may not be available on device package pins. Refer to device datasheet for channels availability.
- ***uint32_t ADC_ChannelConfTypeDef::Rank***
  Add or remove the channel from ADC regular group sequencer and specify its conversion rank. This parameter is dependent on ScanConvMode:
  - sequencer configured to fully configurable: Channels ordering into each rank of scan sequence: whatever channel can be placed into whatever rank.
  - sequencer configured to not fully configurable: rank of each channel is fixed by channel HW number. (channel 0 fixed on rank 0, channel 1 fixed on rank1, ...). Despite the channel rank is fixed, this parameter allow an additional possibility: to remove the selected rank (selected channel) from sequencer. This parameter can be a value of ***ADC_HAL_EC_REG_SEQ_RANKS***
- ***uint32_t ADC_ChannelConfTypeDef::SamplingTime***
  Sampling time value to be set for the selected channel. Unit: ADC clock cycles Conversion time is the addition of sampling time and processing time (12.5 ADC clock cycles at ADC resolution 12 bits, 10.5 cycles at 10 bits, 8.5 cycles at 8 bits, 6.5 cycles at 6 bits). This parameter can be a value of ***ADC_HAL_EC_SAMPLINGTIME_COMMON*** Note: On this STM32 family, two different sampling time settings are available (refer to parameters "SamplingTimeCommon1" and "SamplingTimeCommon2"), each channel can use one of these two settings.Note: In case of usage of internal measurement channels (VrefInt/Vbat/ TempSensor), sampling time constraints must be respected (sampling time can be adjusted in function of ADC clock frequency and sampling time setting) Refer to device datasheet for timings values.

7.1.4 ADC_AnalogWDGConfTypeDef

ADC_AnalogWDGConfTypeDef is defined in the stm32u0xx_hal_adc.h

Data Fields

- ***uint32_t WatchdogNumber***
- ***uint32_t WatchdogMode***
- ***uint32_t Channel***
- ***FunctionalState ITMode***
- ***uint32_t HighThreshold***
- ***uint32_t LowThreshold***

Field Documentation

- ***uint32_t ADC_AnalogWDGConfTypeDef::WatchdogNumber***
  Select which ADC analog watchdog is monitoring the selected channel. For Analog Watchdog 1: Only 1 channel can be monitored (or overall group of channels by setting parameter 'WatchdogMode') For Analog Watchdog 2 and 3: Several channels can be monitored (by successive calls of '**HAL_ADC_AnalogWDGConfig()**' for each channel) This parameter can be a value of ***ADC_HAL_EC_AWD_NUMBER***.
- ***uint32_t ADC_AnalogWDGConfTypeDef::WatchdogMode***
  Configure the ADC analog watchdog mode: single/all/none channels. For Analog Watchdog 1: Configure the ADC analog watchdog mode: single channel or all channels, ADC group regular. For Analog Watchdog 2 and 3: Several channels can be monitored by applying successively the AWD init structure. This parameter can be a value of ***ADC_analog_watchdog_mode***.
- ***uint32_t ADC_AnalogWDGConfTypeDef::Channel***
  Select which ADC channel to monitor by analog watchdog. For Analog Watchdog 1: this parameter has an effect only if parameter 'WatchdogMode' is configured on single channel (only 1 channel can be monitored). For Analog Watchdog 2 and 3: Several channels can be monitored. To use this feature, call successively the function **HAL_ADC_AnalogWDGConfig()** for each channel to be added (or removed with value 'ADC_ANALOGWATCHDOG_NONE'). This parameter can be a value of ***ADC_HAL_EC_CHANNEL***.
- ***FunctionalState ADC_AnalogWDGConfTypeDef::ITMode***
  Specify whether the analog watchdog is configured in interrupt or polling mode. This parameter can be set to ENABLE or DISABLE
- ***uint32_t ADC_AnalogWDGConfTypeDef::HighThreshold***
  Configure the ADC analog watchdog High threshold value. Depending of ADC resolution selected (12, 10, 8 or 6 bits), this parameter must be a number between Min_Data = 0x000 and Max_Data = 0xFFF, 0x3FF, 0xFF or 0x3F respectively. Note: Analog watchdog 2 and 3 are limited to a resolution of 8 bits: if ADC resolution is 12 bits the 4 LSB are ignored, if ADC resolution is 10 bits the 2 LSB are ignored. Note: If ADC oversampling is enabled, ADC analog watchdog thresholds are impacted: the comparison of analog watchdog thresholds is done on oversampling final computation (after ratio and shift application): ADC data register bitfield [15:4] (12 most significant bits).
- ***uint32_t ADC_AnalogWDGConfTypeDef::LowThreshold***
  Configures the ADC analog watchdog Low threshold value. Depending of ADC resolution selected (12, 10, 8 or 6 bits), this parameter must be a number between Min_Data = 0x000 and Max_Data = 0xFFF, 0x3FF, 0xFF or 0x3F respectively. Note: Analog watchdog 2 and 3 are limited to a resolution of 8 bits: if ADC resolution is 12 bits the 4 LSB are ignored, if ADC resolution is 10 bits the 2 LSB are ignored. Note: If ADC oversampling is enabled, ADC analog watchdog thresholds are impacted: the comparison of analog watchdog thresholds is done on oversampling final computation (after ratio and shift application): ADC data register bitfield [15:4] (12 most significant bits).

7.1.5 __ADC_HandleTypeDef

__ADC_HandleTypeDef is defined in the stm32u0xx_hal_adc.h

Data Fields

- ***ADC_TypeDef * Instance***
- ***ADC_InitTypeDef Init***
- ***DMA_HandleTypeDef * DMA_Handle***
- ***HAL_LockTypeDef Lock***
- ***__IO uint32_t State***
- ***__IO uint32_t ErrorCode***

- ***uint32_t ADCGroupRegularSequencerRanks***
- ***void(* ConvCpltCallback***
- ***void(* ConvHalfCpltCallback***
- ***void(* LevelOutOfWindowCallback***
- ***void(* ErrorCallback***
- ***void(* LevelOutOfWindow2Callback***
- ***void(* LevelOutOfWindow3Callback***
- ***void(* EndOfSamplingCallback***
- ***void(* CalibrationCpltCallback***
- ***void(* ADCReadyCallback***
- ***void(* ChannelConfigReadyCallback***
- ***void(* MspInitCallback***
- ***void(* MspDeInitCallback***

Field Documentation

- ***ADC_TypeDef* __ADC_HandleTypeDef::Instance***
  Register base address
- ***ADC_InitTypeDef __ADC_HandleTypeDef::Init***
  ADC initialization parameters and regular conversions setting
- ***DMA_HandleTypeDef* __ADC_HandleTypeDef::DMA_Handle***
  Pointer DMA Handler
- ***HAL_LockTypeDef __ADC_HandleTypeDef::Lock***
  ADC locking object
- ***__IO uint32_t __ADC_HandleTypeDef::State***
  ADC communication state (bitmap of ADC states)
- ***__IO uint32_t __ADC_HandleTypeDef::ErrorCode***
  ADC Error code
- ***uint32_t __ADC_HandleTypeDef::ADCGroupRegularSequencerRanks***
  ADC group regular sequencer memorization of ranks setting, used in mode "fully configurable" (refer to parameter 'ScanConvMode')
- ***void(* __ADC_HandleTypeDef::ConvCpltCallback)(struct __ADC_HandleTypeDef *hadc)***
  ADC conversion complete callback
- ***void(* __ADC_HandleTypeDef::ConvHalfCpltCallback)(struct __ADC_HandleTypeDef *hadc)***
  ADC conversion DMA half-transfer callback
- ***void(* __ADC_HandleTypeDef::LevelOutOfWindowCallback)(struct __ADC_HandleTypeDef *hadc)***
  ADC analog watchdog 1 callback
- ***void(* __ADC_HandleTypeDef::ErrorCallback)(struct __ADC_HandleTypeDef *hadc)***
  ADC error callback
- ***void(* __ADC_HandleTypeDef::LevelOutOfWindow2Callback)(struct __ADC_HandleTypeDef *hadc)***
  ADC analog watchdog 2 callback
- ***void(* __ADC_HandleTypeDef::LevelOutOfWindow3Callback)(struct __ADC_HandleTypeDef *hadc)***
  ADC analog watchdog 3 callback
- ***void(* __ADC_HandleTypeDef::EndOfSamplingCallback)(struct __ADC_HandleTypeDef *hadc)***
  ADC end of sampling callback
- ***void(* __ADC_HandleTypeDef::CalibrationCpltCallback)(struct __ADC_HandleTypeDef *hadc)***
  ADC end of calibration callback
- ***void(* __ADC_HandleTypeDef::ADCReadyCallback)(struct __ADC_HandleTypeDef *hadc)***
  ADC Ready callback
- ***void(* __ADC_HandleTypeDef::ChannelConfigReadyCallback)(struct __ADC_HandleTypeDef *hadc)***
  ADC Channel Configuration Ready callback
- ***void(* __ADC_HandleTypeDef::MspInitCallback)(struct __ADC_HandleTypeDef *hadc)***
  ADC Msp Init callback
- ***void(* __ADC_HandleTypeDef::MspDeInitCallback)(struct __ADC_HandleTypeDef *hadc)***
  ADC Msp DeInit callback

7.2 ADC Firmware driver API description

The following section lists the various functions of the ADC library.

7.2.1 ADC peripheral features

- 12-bit, 10-bit, 8-bit or 6-bit configurable resolution.
- Interrupt generation at the end of regular conversion and in case of analog watchdog or overrun events.
- Single and continuous conversion modes.
- Scan mode for conversion of several channels sequentially.
- Data alignment with in-built data coherency.
- Programmable sampling time (common to group of channels)
- External trigger (timer or EXTI) with configurable polarity
- DMA request generation for transfer of conversions data of regular group.
- ADC calibration
- ADC conversion of regular group.
- ADC supply requirements: 1.62 V to 3.6 V.
- ADC input range: from Vref- (connected to Vssa) to Vref+ (connected to Vdda or to an external voltage reference).

7.2.2 How to use this driver

Configuration of top level parameters related to ADC

1. Enable the ADC interface
   - As prerequisite, ADC clock must be configured at RCC top level. Caution: On this series, ADC clock frequency max is 35MHz (refer to device datasheet). Therefore, ADC clock source from RCC and ADC clock prescaler must be configured to remain below this maximum frequency.
   - Two clock settings are mandatory:
     - ADC clock (core clock, also possibly conversion clock).
     - ADC clock (conversions clock). Four possible clock sources: synchronous clock from APB clock (same as ADC core clock) or asynchronous clock from RCC level: SYSCLK, HSI16, PLLPCLK.
     - Example: Into HAL_ADC_MspInit() (recommended code location) or with other device clock parameters configuration:
     - __HAL_RCC_ADC_CLK_ENABLE(); (mandatory: core clock)
     - __HAL_RCC_ADC_CLK_ENABLE(); (mandatory)
   - ADC clock source and clock prescaler are configured at ADC level with parameter "ClockPrescaler" using function HAL_ADC_Init().
2. ADC pins configuration
   - Enable the clock for the ADC GPIOs using macro __HAL_RCC_GPIOx_CLK_ENABLE()
   - Configure these ADC pins in analog mode using function HAL_GPIO_Init()
3. Optionally, in case of usage of ADC with interruptions:
   - Configure the NVIC for ADC using function HAL_NVIC_EnableIRQ(ADCx_IRQn)
   - Insert the ADC interruption handler function HAL_ADC_IRQHandler() into the function of corresponding ADC interruption vector ADCx_IRQHandler().
4. Optionally, in case of usage of DMA:
   - Configure the DMA (DMA channel, mode normal or circular, ...) using function HAL_DMA_Init().
   - Configure the NVIC for DMA using function HAL_NVIC_EnableIRQ(DMAx_Channelx_IRQn)
   - Insert the ADC interruption handler function HAL_ADC_IRQHandler() into the function of corresponding DMA interruption vector DMAx_Channelx_IRQHandler().

Configuration of ADC, group regular, channels parameters

1. Configure the ADC parameters (resolution, data alignment, ...) and regular group parameters (conversion trigger, sequencer, ...) using function HAL_ADC_Init().

2. Configure the channels for regular group parameters (channel number, channel rank into sequencer, ..., into regular group) using function HAL_ADC_ConfigChannel().
3. Optionally, configure the analog watchdog parameters (channels monitored, thresholds, ...) using function HAL_ADC_AnalogWDGConfig().

Execution of ADC conversions

1. Optionally, perform an automatic ADC calibration to improve the conversion accuracy using function HAL_ADCEx_Calibration_Start().
2. ADC driver can be used among three modes: polling, interruption, transfer by DMA.
   - ADC conversion by polling:
     - Activate the ADC peripheral and start conversions using function HAL_ADC_Start()
     - Wait for ADC conversion completion using function HAL_ADC_PollForConversion()
     - Retrieve conversion results using function HAL_ADC_GetValue()
     - Stop conversion and disable the ADC peripheral using function HAL_ADC_Stop()
   - ADC conversion by interruption:
     - Activate the ADC peripheral and start conversions using function HAL_ADC_Start_IT()
     - Wait for ADC conversion completion by call of function HAL_ADC_ConvCpltCallback() (this function must be implemented in user program)
     - Retrieve conversion results using function HAL_ADC_GetValue()
     - Stop conversion and disable the ADC peripheral using function HAL_ADC_Stop_IT()
   - ADC conversion with transfer by DMA:
     - Activate the ADC peripheral and start conversions using function HAL_ADC_Start_DMA()
     - Wait for ADC conversion completion by call of function HAL_ADC_ConvCpltCallback() or HAL_ADC_ConvHalfCpltCallback() (these functions must be implemented in user program)
     - Conversion results are automatically transferred by DMA into destination variable address.
     - Stop conversion and disable the ADC peripheral using function HAL_ADC_Stop_DMA()

Note: Callback functions must be implemented in user program:

- *HAL_ADC_ErrorCallback()*
- *HAL_ADC_LevelOutOfWindowCallback() (callback of analog watchdog)*
- *HAL_ADC_ConvCpltCallback()*
- *HAL_ADC_ConvHalfCpltCallback*

Deinitialization of ADC

1. Disable the ADC interface
   - ADC clock can be hard reset and disabled at RCC top level.
   - Hard reset of ADC peripherals using macro __ADCx_FORCE_RESET(), __ADCx_RELEASE_RESET().
   - ADC clock disable using the equivalent macro/functions as configuration step.
     - Example: Into HAL_ADC_MspDeInit() (recommended code location) or with other device clock parameters configuration:
     - RCC_OscInitStructure.OscillatorType = RCC_OSCILLATORTYPE_HSI14;
     - RCC_OscInitStructure.HSI14State = RCC_HSI14_OFF; (if not used for system clock)
     - HAL_RCC_OscConfig(&RCC_OscInitStructure);
2. ADC pins configuration
   - Disable the clock for the ADC GPIOs using macro __HAL_RCC_GPIOx_CLK_DISABLE()
3. Optionally, in case of usage of ADC with interruptions:
   - Disable the NVIC for ADC using function HAL_NVIC_EnableIRQ(ADCx_IRQn)
4. Optionally, in case of usage of DMA:
   - Deinitialize the DMA using function HAL_DMA_Init().
   - Disable the NVIC for DMA using function HAL_NVIC_EnableIRQ(DMAx_Channelx_IRQn)

Callback registration

The compilation flag USE_HAL_ADC_REGISTER_CALLBACKS, when set to 1, allows the user to configure dynamically the driver callbacks. Use Functions HAL_ADC_RegisterCallback() to register an interrupt callback.

Function HAL_ADC_RegisterCallback() allows to register following callbacks:

- ConvCpltCallback : ADC conversion complete callback
- ConvHalfCpltCallback : ADC conversion DMA half-transfer callback
- LevelOutOfWindowCallback : ADC analog watchdog 1 callback
- ErrorCallback : ADC error callback
- LevelOutOfWindow2Callback : ADC analog watchdog 2 callback
- LevelOutOfWindow3Callback : ADC analog watchdog 3 callback
- EndOfSamplingCallback : ADC end of sampling callback
- MspInitCallback : ADC Msp Init callback
- MspDeInitCallback : ADC Msp DeInit callback This function takes as parameters the HAL peripheral handle, the Callback ID and a pointer to the user callback function.

Use function HAL_ADC_UnRegisterCallback to reset a callback to the default weak function.

HAL_ADC_UnRegisterCallback takes as parameters the HAL peripheral handle, and the Callback ID. This function allows to reset following callbacks:

- ConvCpltCallback : ADC conversion complete callback
- ConvHalfCpltCallback : ADC conversion DMA half-transfer callback
- LevelOutOfWindowCallback : ADC analog watchdog 1 callback
- ErrorCallback : ADC error callback
- LevelOutOfWindow2Callback : ADC analog watchdog 2 callback
- LevelOutOfWindow3Callback : ADC analog watchdog 3 callback
- EndOfSamplingCallback : ADC end of sampling callback
- MspInitCallback : ADC Msp Init callback
- MspDeInitCallback : ADC Msp DeInit callback

By default, after the HAL_ADC_Init() and when the state is HAL_ADC_STATE_RESET all callbacks are set to the corresponding weak functions: examples HAL_ADC_ConvCpltCallback(), HAL_ADC_ErrorCallback(). Exception done for MspInit and MspDeInit functions that are reset to the legacy weak functions in the HAL_ADC_Init()/ HAL_ADC_DeInit() only when these callbacks are null (not registered beforehand).

If MspInit or MspDeInit are not null, the HAL_ADC_Init()/ HAL_ADC_DeInit() keep and use the user MspInit/ MspDeInit callbacks (registered beforehand) whatever the state.

Callbacks can be registered/unregistered in HAL_ADC_STATE_READY state only. Exception done MspInit/ MspDeInit functions that can be registered/unregistered in HAL_ADC_STATE_READY or HAL_ADC_STATE_RESET state, thus registered (user) MspInit/DeInit callbacks can be used during the Init/ DeInit.

Then, the user first registers the MspInit/MspDeInit user callbacks using HAL_ADC_RegisterCallback() before calling HAL_ADC_DeInit() or HAL_ADC_Init() function.

When the compilation flag USE_HAL_ADC_REGISTER_CALLBACKS is set to 0 or not defined, the callback registration feature is not available and all callbacks are set to the corresponding weak functions.

7.2.3 Peripheral Control functions

This section provides functions allowing to:

- Configure channels on regular group
- Configure the analog watchdog

This section contains the following APIs:

- ***HAL_ADC_ConfigChannel()***
- ***HAL_ADC_AnalogWDGConfig()***

7.2.4 Peripheral state and errors functions

This subsection provides functions to get in run-time the status of the peripheral.

- Check the ADC state
- Check the ADC error code

This section contains the following APIs:

- ***HAL_ADC_GetState()***
- ***HAL_ADC_GetError()***

7.2.5 Detailed description of functions

HAL_ADC_Init

Function name

HAL_StatusTypeDef HAL_ADC_Init (ADC_HandleTypeDef * hadc)

Function description

Initialize the ADC peripheral and regular group according to parameters specified in structure "ADC_InitTypeDef".

Parameters

- **hadc:** ADC handle

Return values

- **HAL:** status

Notes

- As prerequisite, ADC clock must be configured at RCC top level (refer to description of RCC configuration for ADC in header of this file).
- Possibility to update parameters on the fly: This function initializes the ADC MSP (HAL_ADC_MspInit()) only when coming from ADC state reset. Following calls to this function can be used to reconfigure some parameters of ADC_InitTypeDef structure on the fly, without modifying MSP configuration. If ADC MSP has to be modified again, HAL_ADC_DeInit() must be called before HAL_ADC_Init(). The setting of these parameters is conditioned to ADC state. For parameters constraints, see comments of structure "ADC_InitTypeDef".
- This function configures the ADC within 2 scopes: scope of entire ADC and scope of regular group. For parameters details, see comments of structure "ADC_InitTypeDef".

HAL_ADC_DeInit

Function name

HAL_StatusTypeDef HAL_ADC_DeInit (ADC_HandleTypeDef * hadc)

Function description

Deinitialize the ADC peripheral registers to their default reset values, with deinitialization of the ADC MSP.

Parameters

- **hadc:** ADC handle

Return values

- **HAL:** status

Notes

- For devices with several ADCs: reset of ADC common registers is done only if all ADCs sharing the same common group are disabled. (function "HAL_ADC_MspDeInit()" is also called under the same conditions: all ADC instances use the same core clock at RCC level, disabling the core clock reset all ADC instances). If this is not the case, reset of these common parameters reset is bypassed without error reporting: it can be the intended behavior in case of reset of a single ADC while the other ADCs sharing the same common group is still running.

HAL_ADC_MspInit

Function name

void HAL_ADC_MspInit (ADC_HandleTypeDef * hadc)

Function description

Initialize the ADC MSP.

Parameters

- **hadc:** ADC handle

Return values

- **None:**

HAL_ADC_MspDeInit

Function name

void HAL_ADC_MspDeInit (ADC_HandleTypeDef * hadc)

Function description

DeInitialize the ADC MSP.

Parameters

- **hadc:** ADC handle

Return values

- **None:**

Notes

- All ADC instances use the same core clock at RCC level, disabling the core clock reset all ADC instances).

HAL_ADC_RegisterCallback

Function name

HAL_StatusTypeDef HAL_ADC_RegisterCallback (ADC_HandleTypeDef * hadc, HAL_ADC_CallbackIDTypeDef CallbackID, pADC_CallbackTypeDef pCallback)

Function description

Register a User ADC Callback To be used instead of the weak predefined callback.

Parameters

- **hadc:** Pointer to a ADC_HandleTypeDef structure that contains the configuration information for the specified ADC.
- **CallbackID:** ID of the callback to be registered This parameter can be one of the following values:
  - HAL_ADC_CONVERSION_COMPLETE_CB_ID ADC conversion complete callback ID
  - HAL_ADC_CONVERSION_HALF_CB_ID ADC conversion DMA half-transfer callback ID
  - HAL_ADC_LEVEL_OUT_OF_WINDOW_1_CB_ID ADC analog watchdog 1 callback ID
  - HAL_ADC_ERROR_CB_ID ADC error callback ID
  - HAL_ADC_LEVEL_OUT_OF_WINDOW_2_CB_ID ADC analog watchdog 2 callback ID
  - HAL_ADC_LEVEL_OUT_OF_WINDOW_3_CB_ID ADC analog watchdog 3 callback ID
  - HAL_ADC_END_OF_SAMPLING_CB_ID ADC end of sampling callback ID
  - HAL_ADC_MSPINIT_CB_ID ADC Msp Init callback ID
  - HAL_ADC_MSPDEINIT_CB_ID ADC Msp DeInit callback ID
  - HAL_ADC_END_OF_CALIBRATION_CB_ID ADC end of calibration callback ID
  - HAL_ADC_ADC_READY_CB_ID ADC Ready callback ID
  - HAL_ADC_CONFIG_CHANNEL_ID ADC config channel callback ID
  - HAL_ADC_MSPINIT_CB_ID MspInit callback ID
  - HAL_ADC_MSPDEINIT_CB_ID MspDeInit callback ID
- **pCallback:** pointer to the Callback function

Return values

- **HAL:** status

HAL_ADC_UnRegisterCallback

Function name

HAL_StatusTypeDef HAL_ADC_UnRegisterCallback (ADC_HandleTypeDef * hadc, HAL_ADC_CallbackIDTypeDef CallbackID)

Function description

Unregister a ADC Callback ADC callback is redirected to the weak predefined callback.

Parameters

- **hadc:** Pointer to a ADC_HandleTypeDef structure that contains the configuration information for the specified ADC.
- **CallbackID:** ID of the callback to be unregistered This parameter can be one of the following values:
  - HAL_ADC_CONVERSION_COMPLETE_CB_ID ADC conversion complete callback ID
  - HAL_ADC_CONVERSION_HALF_CB_ID ADC conversion DMA half-transfer callback ID
  - HAL_ADC_LEVEL_OUT_OF_WINDOW_1_CB_ID ADC analog watchdog 1 callback ID
  - HAL_ADC_ERROR_CB_ID ADC error callback ID
  - HAL_ADC_LEVEL_OUT_OF_WINDOW_2_CB_ID ADC analog watchdog 2 callback ID
  - HAL_ADC_LEVEL_OUT_OF_WINDOW_3_CB_ID ADC analog watchdog 3 callback ID
  - HAL_ADC_END_OF_SAMPLING_CB_ID ADC end of sampling callback ID
  - HAL_ADC_MSPINIT_CB_ID ADC Msp Init callback ID
  - HAL_ADC_MSPDEINIT_CB_ID ADC Msp DeInit callback ID
  - HAL_ADC_END_OF_CALIBRATION_CB_ID ADC end of calibration callback ID
  - HAL_ADC_ADC_READY_CB_ID ADC Ready callback ID
  - HAL_ADC_CONFIG_CHANNEL_ID ADC config channel callback ID
  - HAL_ADC_MSPINIT_CB_ID MspInit callback ID
  - HAL_ADC_MSPDEINIT_CB_ID MspDeInit callback ID

Return values

- **HAL:** status

HAL_ADC_Start

Function name

HAL_StatusTypeDef HAL_ADC_Start (ADC_HandleTypeDef * hadc)

Function description

Enable ADC, start conversion of regular group.

Parameters

- **hadc:** ADC handle

Return values

- **HAL:** status

Notes

- Interruptions enabled in this function: None.

HAL_ADC_Stop

Function name

HAL_StatusTypeDef HAL_ADC_Stop (ADC_HandleTypeDef * hadc)

Function description

Stop ADC conversion of regular group (and injected channels in case of auto_injection mode), disable ADC peripheral.

Parameters

- **hadc:** ADC handle

Return values

- **HAL:** status.

Notes

- : ADC peripheral disable is forcing stop of potential conversion on injected group. If injected group is under use, it should be preliminarily stopped using HAL_ADCEx_InjectedStop function.

HAL_ADC_PollForConversion

Function name

HAL_StatusTypeDef HAL_ADC_PollForConversion (ADC_HandleTypeDef * hadc, uint32_t Timeout)

Function description

Wait for regular group conversion to be completed.

Parameters

- **hadc:** ADC handle
- **Timeout:** Timeout value in millisecond.

Return values

- **HAL:** status

Notes

- ADC conversion flags EOS (end of sequence) and EOC (end of conversion) are cleared by this function, with an exception: if low power feature "LowPowerAutoWait" is enabled, flags are not cleared to not interfere with this feature until data register is read using function HAL_ADC_GetValue().
- This function cannot be used in a particular setup: ADC configured in DMA mode and polling for end of each conversion (ADC init parameter "EOCSelection" set to ADC_EOC_SINGLE_CONV). In this case, DMA resets the flag EOC and polling cannot be performed on each conversion. Nevertheless, polling can still be performed on the complete sequence (ADC init parameter "EOCSelection" set to ADC_EOC_SEQ_CONV).

HAL_ADC_PollForEvent

Function name

HAL_StatusTypeDef HAL_ADC_PollForEvent (ADC_HandleTypeDef * hadc, uint32_t EventType, uint32_t Timeout)

Function description

Poll for ADC event.

Parameters

- **hadc:** ADC handle
- **EventType:** the ADC event type. This parameter can be one of the following values:
  - ADC_EOSMP_EVENT ADC End of Sampling event
  - ADC_AWD1_EVENT ADC Analog watchdog 1 event (main analog watchdog, present on all STM32 series)
  - ADC_AWD2_EVENT ADC Analog watchdog 2 event (additional analog watchdog, not present on all STM32 series)
  - ADC_AWD3_EVENT ADC Analog watchdog 3 event (additional analog watchdog, not present on all STM32 series)
  - ADC_OVR_EVENT ADC Overrun event
- **Timeout:** Timeout value in millisecond.

Return values

- **HAL:** status

Notes

- The relevant flag is cleared if found to be set, except for ADC_FLAG_OVR. Indeed, the latter is reset only if hadc->Init.Overrun field is set to ADC_OVR_DATA_OVERWRITTEN. Otherwise, data register may be potentially overwritten by a new converted data as soon as OVR is cleared. To reset OVR flag once the preserved data is retrieved, the user can resort to macro __HAL_ADC_CLEAR_FLAG(hadc, ADC_FLAG_OVR);

HAL_ADC_Start_IT

Function name

HAL_StatusTypeDef HAL_ADC_Start_IT (ADC_HandleTypeDef * hadc)

Function description

Enable ADC, start conversion of regular group with interruption.

Parameters

- **hadc:** ADC handle

Return values

- **HAL:** status

Notes

- Interruptions enabled in this function according to initialization setting : EOC (end of conversion), EOS (end of sequence), OVR overrun. Each of these interruptions has its dedicated callback function.
- To guarantee a proper reset of all interruptions once all the needed conversions are obtained, HAL_ADC_Stop_IT() must be called to ensure a correct stop of the IT-based conversions.
- By default, HAL_ADC_Start_IT() does not enable the End Of Sampling interruption. If required (e.g. in case of oversampling with trigger mode), the user must: 1. first clear the EOSMP flag if set with macro __HAL_ADC_CLEAR_FLAG(hadc, ADC_FLAG_EOSMP) 2. then enable the EOSMP interrupt with macro __HAL_ADC_ENABLE_IT(hadc, ADC_IT_EOSMP) before calling HAL_ADC_Start_IT().

HAL_ADC_Stop_IT

Function name

HAL_StatusTypeDef HAL_ADC_Stop_IT (ADC_HandleTypeDef * hadc)

Function description

Stop ADC conversion of regular group (and injected group in case of auto_injection mode), disable interrution of end-of-conversion, disable ADC peripheral.

Parameters

- **hadc:** ADC handle

Return values

- **HAL:** status.

HAL_ADC_Start_DMA

Function name

HAL_StatusTypeDef HAL_ADC_Start_DMA (ADC_HandleTypeDef * hadc, uint32_t * pData, uint32_t Length)

Function description

Enable ADC, start conversion of regular group and transfer result through DMA.

Parameters

- **hadc:** ADC handle
- **pData:** Destination Buffer address.
- **Length:** Number of data to be transferred from ADC peripheral to memory

Return values

- **HAL:** status.

Notes

- Interruptions enabled in this function: overrun (if applicable), DMA half transfer, DMA transfer complete. Each of these interruptions has its dedicated callback function.

HAL_ADC_Stop_DMA

Function name

HAL_StatusTypeDef HAL_ADC_Stop_DMA (ADC_HandleTypeDef * hadc)

Function description

Stop ADC conversion of regular group (and injected group in case of auto_injection mode), disable ADC DMA transfer, disable ADC peripheral.

Parameters

- **hadc:** ADC handle

Return values

- **HAL:** status.

HAL_ADC_GetValue

Function name

uint32_t HAL_ADC_GetValue (const ADC_HandleTypeDef * hadc)

Function description

Get ADC regular group conversion result.

Parameters

- **hadc:** ADC handle

Return values

- **ADC:** group regular conversion data

Notes

- Reading register DR automatically clears ADC flag EOC (ADC group regular end of unitary conversion).
- This function does not clear ADC flag EOS (ADC group regular end of sequence conversion). Occurrence of flag EOS rising: If sequencer is composed of 1 rank, flag EOS is equivalent to flag EOC.If sequencer is composed of several ranks, during the scan sequence flag EOC only is raised, at the end of the scan sequence both flags EOC and EOS are raised. To clear this flag, either use function: in programming model IT: HAL_ADC_IRQHandler(), in programming model polling: HAL_ADC_PollForConversion() or __HAL_ADC_CLEAR_FLAG(&hadc, ADC_FLAG_EOS).

HAL_ADC_IRQHandler

Function name

void HAL_ADC_IRQHandler (ADC_HandleTypeDef * hadc)

Function description

Handle ADC interrupt request.

Parameters

- **hadc:** ADC handle

Return values

- **None:**

HAL_ADC_ConvCpltCallback

Function name

void HAL_ADC_ConvCpltCallback (ADC_HandleTypeDef * hadc)

Function description

Conversion complete callback in non-blocking mode.

Parameters

- **hadc:** ADC handle

Return values

- **None:**

HAL_ADC_ConvHalfCpltCallback

Function name

void HAL_ADC_ConvHalfCpltCallback (ADC_HandleTypeDef * hadc)

Function description

Conversion DMA half-transfer callback in non-blocking mode.

Parameters

- **hadc:** ADC handle

Return values

- **None:**

HAL_ADC_LevelOutOfWindowCallback

Function name

void HAL_ADC_LevelOutOfWindowCallback (ADC_HandleTypeDef * hadc)

Function description

Analog watchdog 1 callback in non-blocking mode.

Parameters

- **hadc:** ADC handle

Return values

- **None:**

HAL_ADC_ErrorCallback

Function name

void HAL_ADC_ErrorCallback (ADC_HandleTypeDef * hadc)

Function description

ADC error callback in non-blocking mode (ADC conversion with interruption or transfer by DMA).

Parameters

- **hadc:** ADC handle

Return values

- **None:**

Notes

- In case of error due to overrun when using ADC with DMA transfer (HAL ADC handle parameter "ErrorCode" to state "HAL_ADC_ERROR_OVR"): Reinitialize the DMA using function "HAL_ADC_Stop_DMA()".If needed, restart a new ADC conversion using function "HAL_ADC_Start_DMA()" (this function is also clearing overrun flag)

HAL_ADC_CalibrationCpltCallback

Function name

void HAL_ADC_CalibrationCpltCallback (ADC_HandleTypeDef * hadc)

Function description

Calibration complete callback in non-blocking mode.

Parameters

- **hadc:** ADC handle

Return values

- **None:**

HAL_ADC_ADCReadyCallback

Function name

void HAL_ADC_ADCReadyCallback (ADC_HandleTypeDef * hadc)

Function description

ADC Ready callback in non-blocking mode.

Parameters

- **hadc:** ADC handle

Return values

- **None:**

HAL_ADC_ConfigChannel

Function name

HAL_StatusTypeDef HAL_ADC_ConfigChannel (ADC_HandleTypeDef * hadc, const ADC_ChannelConfTypeDef * pConfig)

Function description

Configure a channel to be assigned to ADC group regular.

Parameters

- **hadc:** ADC handle
- **pConfig:** Structure of ADC channel assigned to ADC group regular.

Return values

- **HAL:** status

Notes

- In case of usage of internal measurement channels: Vbat/VrefInt/TempSensor. These internal paths can be disabled using function HAL_ADC_DeInit().
- Possibility to update parameters on the fly: This function initializes channel into ADC group regular, following calls to this function can be used to reconfigure some parameters of structure "ADC_ChannelConfTypeDef" on the fly, without resetting the ADC. The setting of these parameters is conditioned to ADC state: Refer to comments of structure "ADC_ChannelConfTypeDef".

HAL_ADC_AnalogWDGConfig

Function name

HAL_StatusTypeDef HAL_ADC_AnalogWDGConfig (ADC_HandleTypeDef * hadc, const ADC_AnalogWDGConfTypeDef * pAnalogWDGConfig)

Function description

Configure the analog watchdog.

Parameters

- **hadc:** ADC handle
- **pAnalogWDGConfig:** Structure of ADC analog watchdog configuration

Return values

- **HAL:** status

Notes

- Possibility to update parameters on the fly: This function initializes the selected analog watchdog, successive calls to this function can be used to reconfigure some parameters of structure "ADC_AnalogWDGConfTypeDef" on the fly, without resetting the ADC. The setting of these parameters is conditioned to ADC state. For parameters constraints, see comments of structure "ADC_AnalogWDGConfTypeDef".
- On this STM32 series, analog watchdog thresholds can be modified while ADC conversion is on going. In this case, some constraints must be taken into account: the programmed threshold values are effective from the next ADC EOC (end of unitary conversion). Considering that registers write delay may happen due to bus activity, this might cause an uncertainty on the effective timing of the new programmed threshold values.

HAL_ADC_GetState

Function name

uint32_t HAL_ADC_GetState (const ADC_HandleTypeDef * hadc)

Function description

Return the ADC handle state.

Parameters

- **hadc:** ADC handle

Return values

- **ADC:** handle state (bitfield on 32 bits)

Notes

- ADC state machine is managed by bitfields, ADC status must be compared with states bits. For example: " if ((HAL_ADC_GetState(hadc1) & HAL_ADC_STATE_REG_BUSY) != 0UL) " " if ((HAL_ADC_GetState(hadc1) & HAL_ADC_STATE_AWD1) != 0UL) "

HAL_ADC_GetError

Function name

uint32_t HAL_ADC_GetError (const ADC_HandleTypeDef * hadc)

Function description

Return the ADC error code.

Parameters

- **hadc:** ADC handle

Return values

- **ADC:** error code (bitfield on 32 bits)

ADC_ConversionStop

Function name

HAL_StatusTypeDef ADC_ConversionStop (ADC_HandleTypeDef * hadc)

Function description

Stop ADC conversion.

Parameters

- **hadc:** ADC handle

Return values

- **HAL:** status.

Notes

- Prerequisite condition to use this function: ADC conversions must be stopped to disable the ADC.

ADC_Enable

Function name

HAL_StatusTypeDef ADC_Enable (ADC_HandleTypeDef * hadc)

Function description

Enable the selected ADC.

Parameters

- **hadc:** ADC handle

Return values

- **HAL:** status.

Notes

- Prerequisite condition to use this function: ADC must be disabled and voltage regulator must be enabled (done into HAL_ADC_Init()).

ADC_Disable

Function name

HAL_StatusTypeDef ADC_Disable (ADC_HandleTypeDef * hadc)

Function description

Disable the selected ADC.

Parameters

- **hadc:** ADC handle

Return values

- **HAL:** status.

Notes

- Prerequisite condition to use this function: ADC conversions must be stopped.

7.3 ADC Firmware driver defines

The following section lists the various define and macros of the module.

7.3.1 ADC

ADC

ADC analog watchdog (AWD) mode

ADC_ANALOGWATCHDOG_NONE

ADC AWD not selected

ADC_ANALOGWATCHDOG_SINGLE_REG

ADC AWD applied to a regular group single channel

ADC_ANALOGWATCHDOG_ALL_REG

ADC AWD applied to regular group all channels

ADC sequencer end of unitary conversion or sequence conversions

ADC_EOC_SINGLE_CONV

End of unitary conversion flag

ADC_EOC_SEQ_CONV

End of sequence conversions flag

ADC Error Code

HAL_ADC_ERROR_NONE

No error

HAL_ADC_ERROR_INTERNAL

ADC peripheral internal error (problem of clocking, enable/disable, erroneous state, ...)

HAL_ADC_ERROR_OVR

Overrun error

HAL_ADC_ERROR_DMA

DMA transfer error

HAL_ADC_ERROR_INVALID_CALLBACK

Invalid Callback error

ADC Event type

ADC_EOSMP_EVENT

Notes:

- Analog watchdog 1 is available on all stm32 series Analog watchdog 2 and 3 are not available on all series ADC End of Sampling event

ADC_AWD1_EVENT

ADC Analog watchdog 1 event (main analog watchdog)

ADC_AWD2_EVENT

ADC Analog watchdog 2 event (additional analog watchdog)

ADC_AWD3_EVENT

ADC Analog watchdog 3 event (additional analog watchdog)

ADC_OVR_EVENT

ADC overrun event

ADC Exported Constants

ADC_AWD_EVENT

ADC Analog watchdog 1 event: Naming for compatibility with other STM32 devices having only one analog watchdog

ADC flags definition

ADC_FLAG_RDY

ADC Ready flag

ADC_FLAG_CCRDY

ADC channel configuration ready flag

ADC_FLAG_EOSMP

ADC End of Sampling flag

ADC_FLAG_EOC

ADC End of Regular Conversion flag

ADC_FLAG_EOS

ADC End of Regular sequence of Conversions flag

ADC_FLAG_OVR

ADC overrun flag

ADC_FLAG_AWD1

ADC Analog watchdog 1 flag (main analog watchdog)

ADC_FLAG_AWD2

ADC Analog watchdog 2 flag (additional analog watchdog)

ADC_FLAG_AWD3

ADC Analog watchdog 3 flag (additional analog watchdog)

ADC_FLAG_EOCAL

ADC End of Calibration interrupt flag

Analog watchdog - ADC analog watchdog (AWD) number

ADC_ANALOGWATCHDOG_1

ADC analog watchdog number 1

ADC_ANALOGWATCHDOG_2

ADC analog watchdog number 2

ADC_ANALOGWATCHDOG_3

ADC analog watchdog number 3

ADC instance - Channel number

ADC_CHANNEL_0

External channel (GPIO pin) ADCx_IN0

ADC_CHANNEL_1

External channel (GPIO pin) ADCx_IN1

ADC_CHANNEL_2

External channel (GPIO pin) ADCx_IN2

ADC_CHANNEL_3

External channel (GPIO pin) ADCx_IN3

ADC_CHANNEL_4

External channel (GPIO pin) ADCx_IN4

ADC_CHANNEL_5

External channel (GPIO pin) ADCx_IN5

ADC_CHANNEL_6

External channel (GPIO pin) ADCx_IN6

ADC_CHANNEL_7

External channel (GPIO pin) ADCx_IN7

ADC_CHANNEL_8

External channel (GPIO pin) ADCx_IN8

ADC_CHANNEL_9

External channel (GPIO pin) ADCx_IN9

ADC_CHANNEL_10

External channel (GPIO pin) ADCx_IN10

ADC_CHANNEL_11

External channel (GPIO pin) ADCx_IN11

ADC_CHANNEL_12

External channel (GPIO pin) ADCx_IN12

ADC_CHANNEL_13

External channel (GPIO pin) ADCx_IN13

ADC_CHANNEL_14

External channel (GPIO pin) ADCx_IN14

ADC_CHANNEL_15

External channel (GPIO pin) ADCx_IN15

ADC_CHANNEL_16

External channel (GPIO pin) ADCx_IN16

ADC_CHANNEL_17

External channel (GPIO pin) ADCx_IN17

ADC_CHANNEL_18

External channel (GPIO pin) ADCx_IN18

ADC_CHANNEL_19

External channel (GPIO pin) ADCx_IN19

ADC_CHANNEL_TEMPSENSOR

Internal channel Temperature sensor.

ADC_CHANNEL_VREFINT

Internal channel VrefInt: Internal voltage reference.

ADC_CHANNEL_VBAT

Internal channel Vbat/3: Vbat voltage through a divider ladder of factor 1/3 to have channel voltage always below Vdda.

ADC_CHANNEL_DACCH1

Internal channel DAC channel 1.

Channel - Sampling time

ADC_SAMPLETIME_1CYCLE_5

Sampling time 1.5 ADC clock cycle

ADC_SAMPLETIME_3CYCLES_5

Sampling time 3.5 ADC clock cycles

ADC_SAMPLETIME_7CYCLES_5

Sampling time 7.5 ADC clock cycles

ADC_SAMPLETIME_12CYCLES_5

Sampling time 12.5 ADC clock cycles

ADC_SAMPLETIME_19CYCLES_5

Sampling time 19.5 ADC clock cycles

ADC_SAMPLETIME_39CYCLES_5

Sampling time 39.5 ADC clock cycles

ADC_SAMPLETIME_79CYCLES_5

Sampling time 79.5 ADC clock cycles

ADC_SAMPLETIME_160CYCLES_5

Sampling time 160.5 ADC clock cycles

ADC common - Clock source

ADC_CLOCK_SYNC_PCLK_DIV1

ADC synchronous clock from AHB clock without prescaler. This configuration must be enabled only if PCLK has a 50% duty clock cycle (APB prescaler configured inside the RCC must be bypassed and the system clock must by 50% duty cycle)

ADC_CLOCK_SYNC_PCLK_DIV2

ADC synchronous clock from AHB clock with prescaler division by 2

ADC_CLOCK_SYNC_PCLK_DIV4

ADC synchronous clock from AHB clock with prescaler division by 4

ADC_CLOCK_ASYNC_DIV1

ADC asynchronous clock without prescaler

ADC_CLOCK_ASYNC_DIV2

ADC asynchronous clock with prescaler division by 2

ADC_CLOCK_ASYNC_DIV4

ADC asynchronous clock with prescaler division by 4

ADC_CLOCK_ASYNC_DIV6

ADC asynchronous clock with prescaler division by 6

ADC_CLOCK_ASYNC_DIV8

ADC asynchronous clock with prescaler division by 8

ADC_CLOCK_ASYNC_DIV10

ADC asynchronous clock with prescaler division by 10

ADC_CLOCK_ASYNC_DIV12

ADC asynchronous clock with prescaler division by 12

ADC_CLOCK_ASYNC_DIV16

ADC asynchronous clock with prescaler division by 16

ADC_CLOCK_ASYNC_DIV32

ADC asynchronous clock with prescaler division by 32

ADC_CLOCK_ASYNC_DIV64

ADC asynchronous clock with prescaler division by 64

ADC_CLOCK_ASYNC_DIV128

ADC asynchronous clock with prescaler division by 128

ADC_CLOCK_ASYNC_DIV256

ADC asynchronous clock with prescaler division by 256

ADC conversion data alignment

ADC_DATAALIGN_RIGHT

ADC conversion data alignment: right aligned (alignment on data register LSB bit 0)

ADC_DATAALIGN_LEFT

ADC conversion data alignment: left aligned (alignment on data register MSB bit 15)

ADC instance - Groups

ADC_REGULAR_GROUP

ADC group regular (available on all STM32 devices)

Oversampling - Discontinuous mode

ADC_TRIGGEREDMODE_SINGLE_TRIGGER

ADC oversampling discontinuous mode: continuous mode (all conversions of OVS ratio are done from 1 trigger)

ADC_TRIGGEREDMODE_MULTI_TRIGGER

ADC oversampling discontinuous mode: discontinuous mode (each conversion of OVS ratio needs a trigger)

Oversampling - Ratio

ADC_OVERSAMPLING_RATIO_2

Notes:

- The oversampling ratio is the number of ADC conversions performed, sum of these conversions data is computed to result as the ADC oversampling conversion data (before potential shift) ADC oversampling ratio 2

ADC_OVERSAMPLING_RATIO_4

ADC oversampling ratio 4

ADC_OVERSAMPLING_RATIO_8

ADC oversampling ratio 8

ADC_OVERSAMPLING_RATIO_16

ADC oversampling ratio 16

ADC_OVERSAMPLING_RATIO_32

ADC oversampling ratio 32

ADC_OVERSAMPLING_RATIO_64

ADC oversampling ratio 64

ADC_OVERSAMPLING_RATIO_128

ADC oversampling ratio 128

ADC_OVERSAMPLING_RATIO_256

ADC oversampling ratio 256

Oversampling - Data shift

ADC_RIGHTBITSHIFT_NONE

Notes:

- The sum of the ADC conversions data is divided by "Rightbitshift" number to result as the ADC oversampling conversion data) ADC oversampling no shift

ADC_RIGHTBITSHIFT_1

ADC oversampling right shift of 1 ranks

ADC_RIGHTBITSHIFT_2

ADC oversampling right shift of 2 ranks

ADC_RIGHTBITSHIFT_3

ADC oversampling right shift of 3 ranks

ADC_RIGHTBITSHIFT_4

ADC oversampling right shift of 4 ranks

ADC_RIGHTBITSHIFT_5

ADC oversampling right shift of 5 ranks

ADC_RIGHTBITSHIFT_6

ADC oversampling right shift of 6 ranks

ADC_RIGHTBITSHIFT_7

ADC oversampling right shift of 7 ranks

ADC_RIGHTBITSHIFT_8

ADC oversampling right shift of 8 ranks

ADC group regular - Overrun behavior on conversion data

ADC_OVR_DATA_PRESERVED

ADC group regular behavior in case of overrun: data preserved

ADC_OVR_DATA_OVERWRITTEN

ADC group regular behavior in case of overrun: data overwritten

ADC group regular - Sequencer ranks

ADC_RANK_CHANNEL_NUMBER

Enable the rank of the selected channels. Number of ranks in the sequence is defined by number of channels enabled, rank of each channel is defined by channel number (channel 0 fixed on rank 0, channel 1 fixed on rank1, ...). Setting relevant if parameter "ScanConvMode" is set to sequencer not fully configurable.

ADC_RANK_NONE

Disable the selected rank (selected channel) from sequencer. Setting relevant if parameter "ScanConvMode" is set to sequencer not fully configurable.

ADC_REGULAR_RANK_1

ADC group regular sequencer rank 1

ADC_REGULAR_RANK_2

ADC group regular sequencer rank 2

ADC_REGULAR_RANK_3

ADC group regular sequencer rank 3

ADC_REGULAR_RANK_4

ADC group regular sequencer rank 4

ADC_REGULAR_RANK_5

ADC group regular sequencer rank 5

ADC_REGULAR_RANK_6

ADC group regular sequencer rank 6

ADC_REGULAR_RANK_7

ADC group regular sequencer rank 7

ADC_REGULAR_RANK_8

ADC group regular sequencer rank 8

ADC group regular - Trigger frequency mode

ADC_TRIGGER_FREQ_HIGH

Notes:

- ADC trigger frequency mode must be set to low frequency when a duration is exceeded before ADC conversion start trigger event (between ADC enable and ADC conversion start trigger event or between two ADC conversion start trigger event). Duration value: Refer to device datasheet, parameter "tIdle". Trigger frequency mode set to high frequency.

ADC_TRIGGER_FREQ_LOW

Trigger frequency mode set to low frequency.

ADC instance - Resolution

ADC_RESOLUTION_12B

ADC resolution 12 bits

ADC_RESOLUTION_10B

ADC resolution 10 bits

ADC_RESOLUTION_8B

ADC resolution 8 bits

ADC_RESOLUTION_6B

ADC resolution 6 bits

ADC instance - Sampling time common to a group of channels

ADC_SAMPLINGTIME_COMMON_1

Set sampling time common to a group of channels: sampling time nb 1

ADC_SAMPLINGTIME_COMMON_2

Set sampling time common to a group of channels: sampling time nb 2

HAL ADC macro to manage HAL ADC handle, IT and flags.

__HAL_ADC_RESET_HANDLE_STATE

Description:

- Reset ADC handle state.

Parameters:

- __HANDLE__: ADC handle

Return value:

- None

__HAL_ADC_ENABLE_IT

Description:

- Enable ADC interrupt.

Parameters:

- __HANDLE__: ADC handle
- __INTERRUPT__: ADC Interrupt This parameter can be one of the following values:
  - ADC_IT_RDY ADC Ready interrupt source
  - ADC_IT_CCRDY ADC channel configuration ready interrupt source
  - ADC_IT_EOSMP ADC End of Sampling interrupt source
  - ADC_IT_EOC ADC End of Regular Conversion interrupt source
  - ADC_IT_EOS ADC End of Regular sequence of Conversions interrupt source
  - ADC_IT_OVR ADC overrun interrupt source
  - ADC_IT_AWD1 ADC Analog watchdog 1 interrupt source (main analog watchdog)
  - ADC_IT_AWD2 ADC Analog watchdog 2 interrupt source (additional analog watchdog)
  - ADC_IT_AWD3 ADC Analog watchdog 3 interrupt source (additional analog watchdog)

Return value:

- None

__HAL_ADC_DISABLE_IT

Description:

- Disable ADC interrupt.

Parameters:

- __HANDLE__: ADC handle
- __INTERRUPT__: ADC Interrupt This parameter can be one of the following values:
  - ADC_IT_RDY ADC Ready interrupt source
  - ADC_IT_CCRDY ADC channel configuration ready interrupt source
  - ADC_IT_EOSMP ADC End of Sampling interrupt source
  - ADC_IT_EOC ADC End of Regular Conversion interrupt source
  - ADC_IT_EOS ADC End of Regular sequence of Conversions interrupt source
  - ADC_IT_OVR ADC overrun interrupt source
  - ADC_IT_AWD1 ADC Analog watchdog 1 interrupt source (main analog watchdog)
  - ADC_IT_AWD2 ADC Analog watchdog 2 interrupt source (additional analog watchdog)
  - ADC_IT_AWD3 ADC Analog watchdog 3 interrupt source (additional analog watchdog)

Return value:

- None

__HAL_ADC_GET_IT_SOURCE

Description:

- Checks if the specified ADC interrupt source is enabled or disabled.

Parameters:

- __HANDLE__: ADC handle
- __INTERRUPT__: ADC interrupt source to check This parameter can be one of the following values:
  - ADC_IT_RDY ADC Ready interrupt source
  - ADC_IT_CCRDY ADC channel configuration ready interrupt source
  - ADC_IT_EOSMP ADC End of Sampling interrupt source
  - ADC_IT_EOC ADC End of Regular Conversion interrupt source
  - ADC_IT_EOS ADC End of Regular sequence of Conversions interrupt source
  - ADC_IT_OVR ADC overrun interrupt source
  - ADC_IT_AWD1 ADC Analog watchdog 1 interrupt source (main analog watchdog)
  - ADC_IT_AWD2 ADC Analog watchdog 2 interrupt source (additional analog watchdog)
  - ADC_IT_AWD3 ADC Analog watchdog 3 interrupt source (additional analog watchdog)

Return value:

- State: of interruption (SET or RESET)

__HAL_ADC_GET_FLAG

Description:

- Check whether the specified ADC flag is set or not.

Parameters:

- __HANDLE__: ADC handle
- __FLAG__: ADC flag This parameter can be one of the following values:
  - ADC_FLAG_RDY ADC Ready flag
  - ADC_FLAG_CCRDY ADC channel configuration ready flag
  - ADC_FLAG_EOSMP ADC End of Sampling flag
  - ADC_FLAG_EOC ADC End of Regular Conversion flag
  - ADC_FLAG_EOS ADC End of Regular sequence of Conversions flag
  - ADC_FLAG_OVR ADC overrun flag
  - ADC_FLAG_AWD1 ADC Analog watchdog 1 flag (main analog watchdog)
  - ADC_FLAG_AWD2 ADC Analog watchdog 2 flag (additional analog watchdog)
  - ADC_FLAG_AWD3 ADC Analog watchdog 3 flag (additional analog watchdog)

Return value:

- State: of flag (TRUE or FALSE).

__HAL_ADC_CLEAR_FLAG

Description:

- Clear the specified ADC flag.

Parameters:

- __HANDLE__: ADC handle
- __FLAG__: ADC flag This parameter can be one of the following values:
  - ADC_FLAG_RDY ADC Ready flag
  - ADC_FLAG_CCRDY ADC channel configuration ready flag
  - ADC_FLAG_EOSMP ADC End of Sampling flag
  - ADC_FLAG_EOC ADC End of Regular Conversion flag
  - ADC_FLAG_EOS ADC End of Regular sequence of Conversions flag
  - ADC_FLAG_OVR ADC overrun flag
  - ADC_FLAG_AWD1 ADC Analog watchdog 1 flag (main analog watchdog)
  - ADC_FLAG_AWD2 ADC Analog watchdog 2 flag (additional analog watchdog)
  - ADC_FLAG_AWD3 ADC Analog watchdog 3 flag (additional analog watchdog)

Return value:

- None

HAL ADC helper macro

__HAL_ADC_CHANNEL_TO_DECIMAL_NB

Description:

- Helper macro to get ADC channel number in decimal format from literals ADC_CHANNEL_x.

Parameters:

- __CHANNEL__: This parameter can be one of the following values:
  - ADC_CHANNEL_0
  - ADC_CHANNEL_1
  - ADC_CHANNEL_2
  - ADC_CHANNEL_3
  - ADC_CHANNEL_4
  - ADC_CHANNEL_5
  - ADC_CHANNEL_6
  - ADC_CHANNEL_7
  - ADC_CHANNEL_8
  - ADC_CHANNEL_9
  - ADC_CHANNEL_10
  - ADC_CHANNEL_11
  - ADC_CHANNEL_12
  - ADC_CHANNEL_13
  - ADC_CHANNEL_14
  - ADC_CHANNEL_15
  - ADC_CHANNEL_16
  - ADC_CHANNEL_17
  - ADC_CHANNEL_18
  - ADC_CHANNEL_19
  - ADC_CHANNEL_VREFINT
  - ADC_CHANNEL_TEMPSENSOR
  - ADC_CHANNEL_VBAT
  - ADC_CHANNEL_DACCH1

Return value:

- Value: between Min_Data=0 and Max_Data=18

Notes:

- Example: __HAL_ADC_CHANNEL_TO_DECIMAL_NB(ADC_CHANNEL_4) will return decimal number "4". The input can be a value from functions where a channel number is returned, either defined with number or with bitfield (only one bit must be set).

__HAL_ADC_DECIMAL_NB_TO_CHANNEL

Description:

- Helper macro to get ADC channel in literal format ADC_CHANNEL_x from number in decimal format.

Parameters:

- __DECIMAL_NB__: Value between Min_Data=0 and Max_Data=18

Return value:

- Returned: value can be one of the following values:
  - ADC_CHANNEL_0
  - ADC_CHANNEL_1
  - ADC_CHANNEL_2
  - ADC_CHANNEL_3
  - ADC_CHANNEL_4
  - ADC_CHANNEL_5
  - ADC_CHANNEL_6
  - ADC_CHANNEL_7
  - ADC_CHANNEL_8
  - ADC_CHANNEL_9
  - ADC_CHANNEL_10
  - ADC_CHANNEL_11
  - ADC_CHANNEL_12
  - ADC_CHANNEL_13
  - ADC_CHANNEL_14
  - ADC_CHANNEL_15
  - ADC_CHANNEL_16
  - ADC_CHANNEL_17
  - ADC_CHANNEL_18
  - ADC_CHANNEL_19
  - ADC_CHANNEL_VREFINT
  - ADC_CHANNEL_TEMPSENSOR
  - ADC_CHANNEL_VBAT
  - ADC_CHANNEL_DACCH1

Notes:

- Example: __HAL_ADC_DECIMAL_NB_TO_CHANNEL(4) will return a data equivalent to "ADC_CHANNEL_4".

__HAL_ADC_IS_CHANNEL_INTERNAL

Description:

- Helper macro to determine whether the selected channel corresponds to literal definitions of driver.

Parameters:

- __CHANNEL__: This parameter can be one of the following values:
  - ADC_CHANNEL_0
  - ADC_CHANNEL_1
  - ADC_CHANNEL_2
  - ADC_CHANNEL_3
  - ADC_CHANNEL_4
  - ADC_CHANNEL_5
  - ADC_CHANNEL_6
  - ADC_CHANNEL_7
  - ADC_CHANNEL_8
  - ADC_CHANNEL_9
  - ADC_CHANNEL_10
  - ADC_CHANNEL_11
  - ADC_CHANNEL_12
  - ADC_CHANNEL_13
  - ADC_CHANNEL_14
  - ADC_CHANNEL_15
  - ADC_CHANNEL_16
  - ADC_CHANNEL_17
  - ADC_CHANNEL_18
  - ADC_CHANNEL_19
  - ADC_CHANNEL_VREFINT
  - ADC_CHANNEL_TEMPSENSOR
  - ADC_CHANNEL_VBAT
  - ADC_CHANNEL_DACCH1

Return value:

- Value: "0" if the channel corresponds to a parameter definition of a ADC external channel (channel connected to a GPIO pin). Value "1" if the channel corresponds to a parameter definition of a ADC internal channel.

Notes:

- The different literal definitions of ADC channels are: ADC internal channel: ADC_CHANNEL_VREFINT, ADC_CHANNEL_TEMPSENSOR, ...ADC external channel (channel connected to a GPIO pin): ADC_CHANNEL_1, ADC_CHANNEL_2, ... The channel parameter must be a value defined from literal definition of a ADC internal channel (ADC_CHANNEL_VREFINT, ADC_CHANNEL_TEMPSENSOR, ...), ADC external channel (ADC_CHANNEL_1, ADC_CHANNEL_2, ...), must not be a value from functions where a channel number is returned from ADC registers, because internal and external channels share the same channel number in ADC registers. The differentiation is made only with parameters definitions of driver.

__HAL_ADC_CHANNEL_INTERNAL_TO_EXTERNAL

Description:

- Helper macro to convert a channel defined from parameter definition of a ADC internal channel (ADC_CHANNEL_VREFINT, ADC_CHANNEL_TEMPSENSOR, ...), to its equivalent parameter definition of a ADC external channel (ADC_CHANNEL_1, ADC_CHANNEL_2, ...).

Parameters:

- __CHANNEL__: This parameter can be one of the following values:
  - ADC_CHANNEL_0
  - ADC_CHANNEL_1
  - ADC_CHANNEL_2
  - ADC_CHANNEL_3
  - ADC_CHANNEL_4
  - ADC_CHANNEL_5
  - ADC_CHANNEL_6
  - ADC_CHANNEL_7
  - ADC_CHANNEL_8
  - ADC_CHANNEL_9
  - ADC_CHANNEL_10
  - ADC_CHANNEL_11
  - ADC_CHANNEL_12
  - ADC_CHANNEL_13
  - ADC_CHANNEL_14
  - ADC_CHANNEL_15
  - ADC_CHANNEL_16
  - ADC_CHANNEL_17
  - ADC_CHANNEL_18
  - ADC_CHANNEL_19
  - ADC_CHANNEL_VREFINT
  - ADC_CHANNEL_TEMPSENSOR
  - ADC_CHANNEL_VBAT
  - ADC_CHANNEL_DACCH1

Return value:

- Returned: value can be one of the following values:
  - ADC_CHANNEL_0
  - ADC_CHANNEL_1
  - ADC_CHANNEL_2
  - ADC_CHANNEL_3
  - ADC_CHANNEL_4
  - ADC_CHANNEL_5
  - ADC_CHANNEL_6
  - ADC_CHANNEL_7
  - ADC_CHANNEL_8
  - ADC_CHANNEL_9
  - ADC_CHANNEL_10
  - ADC_CHANNEL_11
  - ADC_CHANNEL_12
  - ADC_CHANNEL_13
  - ADC_CHANNEL_14
  - ADC_CHANNEL_15
  - ADC_CHANNEL_16
  - ADC_CHANNEL_17
  - ADC_CHANNEL_18
  - ADC_CHANNEL_19

Notes:

- The channel parameter can be, additionally to a value defined from parameter definition of a ADC internal channel (ADC_CHANNEL_VREFINT, ADC_CHANNEL_TEMPSENSOR, ...), a value defined from parameter definition of ADC external channel (ADC_CHANNEL_1, ADC_CHANNEL_2, ...) or a value from functions where a channel number is returned from ADC registers.

__HAL_ADC_IS_CHANNEL_INTERNAL_AVAILABLE

Description:

- Helper macro to determine whether the internal channel selected is available on the ADC instance selected.

Parameters:

- __ADC_INSTANCE__: ADC instance
- __CHANNEL__: This parameter can be one of the following values:
  - ADC_CHANNEL_VREFINT
  - ADC_CHANNEL_TEMPSENSOR
  - ADC_CHANNEL_VBAT
  - ADC_CHANNEL_DACCH1

Return value:

- Value: "0" if the internal channel selected is not available on the ADC instance selected. Value "1" if the internal channel selected is available on the ADC instance selected.

Notes:

- The channel parameter must be a value defined from parameter definition of a ADC internal channel (ADC_CHANNEL_VREFINT, ADC_CHANNEL_TEMPSENSOR, ...), must not be a value defined from parameter definition of ADC external channel (ADC_CHANNEL_1, ADC_CHANNEL_2, ...) or a value from functions where a channel number is returned from ADC registers, because internal and external channels share the same channel number in ADC registers. The differentiation is made only with parameters definitions of driver.

__HAL_ADC_COMMON_INSTANCE

Description:

- Helper macro to select the ADC common instance to which is belonging the selected ADC instance.

Parameters:

- __ADCx__: ADC instance

Return value:

- ADC: common register instance

Notes:

- ADC common register instance can be used for: Set parameters common to several ADC instancesMultimode (for devices with several ADC instances) Refer to functions having argument "ADCxy_COMMON" as parameter.

__HAL_ADC_IS_ENABLED_ALL_COMMON_INSTANCE

Description:

- Helper macro to check if all ADC instances sharing the same ADC common instance are disabled.

Parameters:

- __ADCXY_COMMON__: ADC common instance (can be set directly from CMSIS definition or by using helper macro

Return value:

- Value: "0" if all ADC instances sharing the same ADC common instance are disabled. Value "1" if at least one ADC instance sharing the same ADC common instance is enabled.

Notes:

- This check is required by functions with setting conditioned to ADC state: All ADC instances of the ADC common group must be disabled. Refer to functions having argument "ADCxy_COMMON" as parameter. On devices with only 1 ADC common instance, parameter of this macro is useless and can be ignored (parameter kept for compatibility with devices featuring several ADC common instances).

__HAL_ADC_DIGITAL_SCALE

Description:

- Helper macro to define the ADC conversion data full-scale digital value corresponding to the selected ADC resolution.

Parameters:

- __ADC_RESOLUTION__: This parameter can be one of the following values:
  - ADC_RESOLUTION_12B
  - ADC_RESOLUTION_10B
  - ADC_RESOLUTION_8B
  - ADC_RESOLUTION_6B

Return value:

- ADC: conversion data full-scale digital value

Notes:

- ADC conversion data full-scale corresponds to voltage range determined by analog voltage references Vref+ and Vref- (refer to reference manual).

__HAL_ADC_CONVERT_DATA_RESOLUTION

Description:

- Helper macro to convert the ADC conversion data from a resolution to another resolution.

Parameters:

- __DATA__: ADC conversion data to be converted
- __ADC_RESOLUTION_CURRENT__: Resolution of to the data to be converted This parameter can be one of the following values:
  - ADC_RESOLUTION_12B
  - ADC_RESOLUTION_10B
  - ADC_RESOLUTION_8B
  - ADC_RESOLUTION_6B
- __ADC_RESOLUTION_TARGET__: Resolution of the data after conversion This parameter can be one of the following values:
  - ADC_RESOLUTION_12B
  - ADC_RESOLUTION_10B
  - ADC_RESOLUTION_8B
  - ADC_RESOLUTION_6B

Return value:

- ADC: conversion data to the requested resolution

__HAL_ADC_CALC_DATA_TO_VOLTAGE

Description:

- Helper macro to calculate the voltage (unit: mVolt) corresponding to a ADC conversion data (unit: digital value).

Parameters:

- __VREFANALOG_VOLTAGE__: Analog reference voltage (unit: mV)
- __ADC_DATA__: ADC conversion data (resolution 12 bits) (unit: digital value).
- __ADC_RESOLUTION__: This parameter can be one of the following values:
  - ADC_RESOLUTION_12B
  - ADC_RESOLUTION_10B
  - ADC_RESOLUTION_8B
  - ADC_RESOLUTION_6B

Return value:

- ADC: conversion data equivalent voltage value (unit: mVolt)

Notes:

- Analog reference voltage (Vref+) must be either known from user board environment or can be calculated using ADC measurement and ADC helper macro __LL_ADC_CALC_VREFANALOG_VOLTAGE().

__HAL_ADC_CALC_VREFANALOG_VOLTAGE

Description:

- Helper macro to calculate analog reference voltage (Vref+) (unit: mVolt) from ADC conversion data of internal voltage reference VrefInt.

Parameters:

- __VREFINT_ADC_DATA__: ADC conversion data (resolution 12 bits) of internal voltage reference VrefInt (unit: digital value).
- __ADC_RESOLUTION__: This parameter can be one of the following values:
  - ADC_RESOLUTION_12B
  - ADC_RESOLUTION_10B
  - ADC_RESOLUTION_8B
  - ADC_RESOLUTION_6B

Return value:

- Analog: reference voltage (unit: mV)

Notes:

- Computation is using VrefInt calibration value stored in system memory for each device during production. This voltage depends on user board environment: voltage level connected to pin Vref+. On devices with small package, the pin Vref+ is not present and internally bonded to pin Vdda. On this STM32 series, calibration data of internal voltage reference VrefInt corresponds to a resolution of 12 bits, this is the recommended ADC resolution to convert voltage of internal voltage reference VrefInt. Otherwise, this macro performs the processing to scale ADC conversion data to 12 bits.

__HAL_ADC_CALC_TEMPERATURE

Description:

- Helper macro to calculate the temperature (unit: degree Celsius) from ADC conversion data of internal temperature sensor.

Parameters:

- __VREFANALOG_VOLTAGE__: Analog reference voltage (unit: mV)
- __TEMPSENSOR_ADC_DATA__: ADC conversion data of internal temperature sensor (unit: digital value).
- __ADC_RESOLUTION__: ADC resolution at which internal temperature sensor voltage has been measured. This parameter can be one of the following values:
  - ADC_RESOLUTION_12B
  - ADC_RESOLUTION_10B
  - ADC_RESOLUTION_8B
  - ADC_RESOLUTION_6B

Return value:

- Temperature: (unit: degree Celsius)

Notes:

- Computation is using temperature sensor calibration values stored in system memory for each device during production. Calculation formula: Temperature = ((TS_ADC_DATA - TS_CAL1) * (TS_CAL2_TEMP - TS_CAL1_TEMP)) / (TS_CAL2 - TS_CAL1) + TS_CAL1_TEMP with TS_ADC_DATA = temperature sensor raw data measured by ADC Avg_Slope = (TS_CAL2 - TS_CAL1) / (TS_CAL2_TEMP - TS_CAL1_TEMP) TS_CAL1 = equivalent TS_ADC_DATA at temperature TEMP_DEGC_CAL1 (calibrated in factory) TS_CAL2 = equivalent TS_ADC_DATA at temperature TEMP_DEGC_CAL2 (calibrated in factory) Caution: Calculation relevancy under reserve that calibration parameters are correct (address and data). To calculate temperature using temperature sensor datasheet typical values (generic values less, therefore less accurate than calibrated values), use helper macro __LL_ADC_CALC_TEMPERATURE_TYP_PARAMS(). As calculation input, the analog reference voltage (Vref+) must be defined as it impacts the ADC LSB equivalent voltage. Analog reference voltage (Vref+) must be either known from user board environment or can be calculated using ADC measurement and ADC helper macro __LL_ADC_CALC_VREFANALOG_VOLTAGE(). On this STM32 series, calibration data of temperature sensor corresponds to a resolution of 12 bits, this is the recommended ADC resolution to convert voltage of temperature sensor. Otherwise, this macro performs the processing to scale ADC conversion data to 12 bits.

__HAL_ADC_CALC_TEMPERATURE_TYP_PARAMS

Description:

- Helper macro to calculate the temperature (unit: degree Celsius) from ADC conversion data of internal temperature sensor.

Parameters:

- __TEMPSENSOR_TYP_AVGSLOPE__: Device datasheet data: Temperature sensor slope typical value (unit: uV/DegCelsius). On this STM32 series, refer to device datasheet parameter "Avg_Slope".
- __TEMPSENSOR_TYP_CALX_V__: Device datasheet data: Temperature sensor voltage typical value (at temperature and Vref+ defined in parameters below) (unit: mV). On this STM32 series, refer to device datasheet parameter "V30" (corresponding to TS_CAL1).
- __TEMPSENSOR_CALX_TEMP__: Device datasheet data: Temperature at which temperature sensor voltage (see parameter above) is corresponding (unit: mV)
- __VREFANALOG_VOLTAGE__: Analog voltage reference (Vref+) voltage (unit: mV)
- __TEMPSENSOR_ADC_DATA__: ADC conversion data of internal temperature sensor (unit: digital value).
- __ADC_RESOLUTION__: ADC resolution at which internal temperature sensor voltage has been measured. This parameter can be one of the following values:
  - ADC_RESOLUTION_12B
  - ADC_RESOLUTION_10B
  - ADC_RESOLUTION_8B
  - ADC_RESOLUTION_6B

Return value:

- Temperature: (unit: degree Celsius)

Notes:

- Computation is using temperature sensor typical values (refer to device datasheet). Calculation formula: Temperature = (TS_TYP_CALx_VOLT(uV) - TS_ADC_DATA * Conversion_uV) / Avg_Slope + CALx_TEMP with TS_ADC_DATA = temperature sensor raw data measured by ADC (unit: digital value) Avg_Slope = temperature sensor slope (unit: uV/Degree Celsius) TS_TYP_CALx_VOLT = temperature sensor digital value at temperature CALx_TEMP (unit: mV) Caution: Calculation relevancy under reserve the temperature sensor of the current device has characteristics in line with datasheet typical values. If temperature sensor calibration values are available on on this device (presence of macro __LL_ADC_CALC_TEMPERATURE()), temperature calculation will be more accurate using helper macro __LL_ADC_CALC_TEMPERATURE(). As calculation input, the analog reference voltage (Vref+) must be defined as it impacts the ADC LSB equivalent voltage. Analog reference voltage (Vref+) must be either known from user board environment or can be calculated using ADC measurement and ADC helper macro __LL_ADC_CALC_VREFANALOG_VOLTAGE(). ADC measurement data must correspond to a resolution of 12bits (full scale digital value 4095). If not the case, the data must be preliminarily rescaled to an equivalent resolution of 12 bits.

ADC interrupts definition

ADC_IT_RDY

ADC Ready interrupt source

ADC_IT_CCRDY

ADC channel configuration ready interrupt source

ADC_IT_EOSMP

ADC End of sampling interrupt source

ADC_IT_EOC

ADC End of regular conversion interrupt source

ADC_IT_EOS

ADC End of regular sequence of conversions interrupt source

ADC_IT_OVR

ADC overrun interrupt source

ADC_IT_AWD1

ADC Analog watchdog 1 interrupt source (main analog watchdog)

ADC_IT_AWD2

ADC Analog watchdog 2 interrupt source (additional analog watchdog)

ADC_IT_AWD3

ADC Analog watchdog 3 interrupt source (additional analog watchdog)

ADC_IT_EOCAL

ADC End of Calibration interrupt source

ADC group regular trigger edge (when external trigger is selected)

ADC_EXTERNALTRIGCONVEDGE_NONE

ADC group regular trigger disabled (SW start)

ADC_EXTERNALTRIGCONVEDGE_RISING

ADC group regular conversion trigger polarity set to rising edge

ADC_EXTERNALTRIGCONVEDGE_FALLING

ADC group regular conversion trigger polarity set to falling edge

ADC_EXTERNALTRIGCONVEDGE_RISINGFALLING

ADC group regular conversion trigger polarity set to both rising and falling edges

ADC group regular trigger source

ADC_SOFTWARE_START

ADC group regular conversion trigger software start

ADC_EXTERNALTRIG_T1_TRGO2

ADC group regular conversion trigger from external peripheral: TIM1 TRGO.

ADC_EXTERNALTRIG_T1_CC4

ADC group regular conversion trigger from external peripheral: TIM1 channel 4 event (capture compare).

ADC_EXTERNALTRIG_T2_TRGO

ADC group regular conversion trigger from external peripheral: TIM2 TRGO.

ADC_EXTERNALTRIG_T3_TRGO

ADC group regular conversion trigger from external peripheral: TIM3 TRGO.

ADC_EXTERNALTRIG_T15_TRGO

ADC group regular conversion trigger from external peripheral: TIM15 TRGO.

ADC_EXTERNALTRIG_T6_TRGO

ADC group regular conversion trigger from external peripheral: TIM6 TRGO.

ADC_EXTERNALTRIG_EXT_IT11

ADC group regular conversion trigger from external peripheral: external interrupt line 11.

ADC Regular Conversion Number Verification

IS_ADC_REGULAR_NB_CONV

ADC sequencer scan mode

ADC_SCAN_DISABLE

Sequencer set to fully configurable: only the rank 1 is enabled (no scan sequence on several ranks)

ADC_SCAN_ENABLE

Sequencer set to fully configurable: sequencer length and each rank affectation to a channel are configurable.

ADC_SCAN_SEQ_FIXED

Sequencer set to not fully configurable: sequencer length and each rank affectation to a channel are fixed by channel HW number (channel 0 fixed on rank 0, channel 1 fixed on rank1, ...). Scan direction forward: from channel 0 to channel 18

ADC_SCAN_SEQ_FIXED_BACKWARD

Sequencer set to not fully configurable: sequencer length and each rank affectation to a channel are fixed by channel HW number (channel 0 fixed on rank 0, channel 1 fixed on rank1, ...). Scan direction backward: from channel 18 to channel 0

ADC_SCAN_DIRECTION_FORWARD

ADC_SCAN_DIRECTION_BACKWARD

ADC States

HAL_ADC_STATE_RESET

Notes:

- ADC state machine is managed by bitfields, state must be compared with bit by bit. For example: " if ((HAL_ADC_GetState(hadc1) & HAL_ADC_STATE_REG_BUSY) != 0UL) " " if ((HAL_ADC_GetState(hadc1) & HAL_ADC_STATE_AWD1) != 0UL) " ADC not yet initialized or disabled

HAL_ADC_STATE_READY

ADC peripheral ready for use

HAL_ADC_STATE_BUSY_INTERNAL

ADC is busy from internal process (ex : calibration, ...)

HAL_ADC_STATE_TIMEOUT

TimeOut occurrence

HAL_ADC_STATE_ERROR_INTERNAL

Internal error occurrence

HAL_ADC_STATE_ERROR_CONFIG

Configuration error occurrence

HAL_ADC_STATE_ERROR_DMA

DMA error occurrence

HAL_ADC_STATE_REG_BUSY

A conversion on ADC group regular is ongoing or can occur (either by continuous mode, external trigger, low power auto power-on (if feature available), multimode ADC master control (if feature available))

HAL_ADC_STATE_REG_EOC

Conversion data available on group regular

HAL_ADC_STATE_REG_OVR

Overrun occurrence

HAL_ADC_STATE_REG_EOSMP

Not available on this STM32 series: End Of Sampling flag raised

HAL_ADC_STATE_INJ_BUSY

Not available on this STM32 series: A conversion on group injected is ongoing or can occur (either by auto-injection mode, external trigger, low power auto power-on (if feature available), multimode ADC master control (if feature available))

HAL_ADC_STATE_INJ_EOC

Not available on this STM32 series: Conversion data available on group injected

HAL_ADC_STATE_INJ_JQOVF

Not available on this STM32 series: Injected queue overflow occurrence

HAL_ADC_STATE_AWD1

Out-of-window occurrence of ADC analog watchdog 1

HAL_ADC_STATE_AWD2

Out-of-window occurrence of ADC analog watchdog 2

HAL_ADC_STATE_AWD3

Out-of-window occurrence of ADC analog watchdog 3

HAL_ADC_STATE_MULTIMODE_SLAVE

Not available on this STM32 series: ADC in multimode slave state, controlled by another ADC master (when feature available)

8 HAL ADC Extension Driver

8.1 ADCEx Firmware driver API description

The following section lists the various functions of the ADCEx library.

8.1.1 IO operation functions

This section provides functions allowing to:

- Perform the ADC self-calibration.
- Get calibration factors.
- Set calibration factors.

This section contains the following APIs:

- ***HAL_ADCEx_Calibration_Start()***
- ***HAL_ADCEx_Calibration_GetValue()***
- ***HAL_ADCEx_Calibration_SetValue()***
- ***HAL_ADCEx_LevelOutOfWindow2Callback()***
- ***HAL_ADCEx_LevelOutOfWindow3Callback()***
- ***HAL_ADCEx_EndOfSamplingCallback()***
- ***HAL_ADCEx_ChannelConfigReadyCallback()***

8.1.2 Detailed description of functions

HAL_ADCEx_Calibration_Start

Function name

HAL_StatusTypeDef HAL_ADCEx_Calibration_Start (ADC_HandleTypeDef * hadc)

Function description

Perform an ADC automatic self-calibration Calibration prerequisite: ADC must be disabled (execute this function before HAL_ADC_Start() or after HAL_ADC_Stop()).

Parameters

- **hadc:** ADC handle

Return values

- **HAL:** status

Notes

- Calibration factor can be read after calibration, using function HAL_ADC_GetValue() (value on 7 bits: from DR[6;0]).

HAL_ADCEx_Calibration_GetValue

Function name

uint32_t HAL_ADCEx_Calibration_GetValue (const ADC_HandleTypeDef * hadc)

Function description

Get the calibration factor.

Parameters

- **hadc:** ADC handle.

Return values

- **Calibration:** value.

HAL_ADCEx_Calibration_SetValue

Function name

HAL_StatusTypeDef HAL_ADCEx_Calibration_SetValue (ADC_HandleTypeDef * hadc, uint32_t CalibrationFactor)

Function description

Set the calibration factor to overwrite automatic conversion result.

Parameters

- **hadc:** ADC handle
- **CalibrationFactor:** Calibration factor (coded on 7 bits maximum)

Return values

- **HAL:** state

HAL_ADCEx_LevelOutOfWindow2Callback

Function name

void HAL_ADCEx_LevelOutOfWindow2Callback (ADC_HandleTypeDef * hadc)

Function description

Analog watchdog 2 callback in non-blocking mode.

Parameters

- **hadc:** ADC handle

Return values

- **None:**

HAL_ADCEx_LevelOutOfWindow3Callback

Function name

void HAL_ADCEx_LevelOutOfWindow3Callback (ADC_HandleTypeDef * hadc)

Function description

Analog watchdog 3 callback in non-blocking mode.

Parameters

- **hadc:** ADC handle

Return values

- **None:**

HAL_ADCEx_EndOfSamplingCallback

Function name

void HAL_ADCEx_EndOfSamplingCallback (ADC_HandleTypeDef * hadc)

Function description

End Of Sampling callback in non-blocking mode.

Parameters

- **hadc:** ADC handle

Return values

- **None:**

HAL_ADCEx_ChannelConfigReadyCallback

Function name

void HAL_ADCEx_ChannelConfigReadyCallback (ADC_HandleTypeDef * hadc)

Function description

ADC channel configuration ready callback in non-blocking mode.

Parameters

- **hadc:** ADC handle

Return values

- **None:**

HAL_ADCEx_DisableVoltageRegulator

Function name

HAL_StatusTypeDef HAL_ADCEx_DisableVoltageRegulator (ADC_HandleTypeDef * hadc)

Function description

Disable ADC voltage regulator.

Parameters

- **hadc:** ADC handle

Return values

- **HAL:** status

Notes

- Disabling voltage regulator allows to save power. This operation can be carried out only when ADC is disabled.
- To enable again the voltage regulator, the user is expected to resort to HAL_ADC_Init() API.

8.2 ADCEx Firmware driver defines

The following section lists the various define and macros of the module.

8.2.1 ADCEx

ADCEx

9 HAL COMP Generic Driver

9.1 COMP Firmware driver registers structures

9.1.1 COMP_InitTypeDef

COMP_InitTypeDef is defined in the stm32u0xx_hal_comp.h

Data Fields

- ***uint32_t WindowMode***
- ***uint32_t WindowOutput***
- ***uint32_t Mode***
- ***uint32_t InputPlus***
- ***uint32_t InputMinus***
- ***uint32_t Hysteresis***
- ***uint32_t OutputPol***
- ***uint32_t BlankingSrce***
- ***uint32_t TriggerMode***

Field Documentation

- ***uint32_t COMP_InitTypeDef::WindowMode***
  Set window mode of a pair of comparators instances (2 consecutive instances odd and even COMP<x> and COMP<x+1>). Note: HAL COMP driver allows to set window mode from any COMP instance of the pair of COMP instances composing window mode. This parameter can be a value of ***COMP_WindowMode***
- ***uint32_t COMP_InitTypeDef::WindowOutput***
  Set window mode output. This parameter can be a value of ***COMP_WindowOutput***
- ***uint32_t COMP_InitTypeDef::Mode***
  Set comparator operating mode to adjust power and speed. Note: For the characteristics of comparator power modes (propagation delay and power consumption), refer to device datasheet. This parameter can be a value of ***COMP_PowerMode***
- ***uint32_t COMP_InitTypeDef::InputPlus***
  Set comparator input plus (non-inverting input). This parameter can be a value of ***COMP_InputPlus***
- ***uint32_t COMP_InitTypeDef::InputMinus***
  Set comparator input minus (inverting input). This parameter can be a value of ***COMP_InputMinus***
- ***uint32_t COMP_InitTypeDef::Hysteresis***
  Set comparator hysteresis mode of the input minus. This parameter can be a value of ***COMP_Hysteresis***
- ***uint32_t COMP_InitTypeDef::OutputPol***
  Set comparator output polarity. This parameter can be a value of ***COMP_OutputPolarity***
- ***uint32_t COMP_InitTypeDef::BlankingSrce***
  Set comparator blanking source. This parameter can be a value of ***COMP_BlankingSrce***
- ***uint32_t COMP_InitTypeDef::TriggerMode***
  Set the comparator output triggering External Interrupt Line (EXTI). This parameter can be a value of ***COMP_EXTI_TriggerMode***

9.1.2 COMP_HandleTypeDef

COMP_HandleTypeDef is defined in the stm32u0xx_hal_comp.h

Data Fields

- ***COMP_TypeDef * Instance***
- ***COMP_InitTypeDef Init***
- ***HAL_LockTypeDef Lock***
- ***__IO HAL_COMP_StateTypeDef State***
- ***__IO uint32_t ErrorCode***

Field Documentation

- ***COMP_TypeDef* COMP_HandleTypeDef::Instance***
  Register base address
- ***COMP_InitTypeDef COMP_HandleTypeDef::Init***
  COMP required parameters
- ***HAL_LockTypeDef COMP_HandleTypeDef::Lock***
  Locking object
- ***__IO HAL_COMP_StateTypeDef COMP_HandleTypeDef::State***
  COMP communication state
- ***__IO uint32_t COMP_HandleTypeDef::ErrorCode***
  COMP error code

9.2 COMP Firmware driver API description

The following section lists the various functions of the COMP library.

9.2.1 COMP Peripheral features

The STM32U0xx device family integrates two analog comparators instances: COMP1, COMP2 except for the products featuring only one instance: COMP1 (in this case, all comments related to pair of comparators are not applicable)

1. Comparators input minus (inverting input) and input plus (non inverting input) can be set to internal references or to GPIO pins (refer to GPIO list in reference manual).
2. Comparators output level is available using HAL_COMP_GetOutputLevel() and can be redirected to other peripherals: GPIO pins (in mode alternate functions for comparator), timers. (refer to GPIO list in reference manual).
3. The comparators have interrupt capability through the EXTI controller with wake-up from sleep and stop modes.
4. Pairs of comparators instances can be combined in window mode (2 consecutive instances odd and even COMP<x> and COMP<x+1>). From the corresponding IRQ handler, the right interrupt source can be retrieved using macro __HAL_COMP_COMPx_EXTI_GET_FLAG().

9.2.2 How to use this driver

This driver provides functions to configure and program the comparator instances of STM32U0xx devices. To use the comparator, perform the following steps:

1. Initialize the COMP low level resources by implementing the HAL_COMP_MspInit():
   – Configure the GPIO connected to comparator inputs plus and minus in analog mode using HAL_GPIO_Init().
   – If needed, configure the GPIO connected to comparator output in alternate function mode using HAL_GPIO_Init().
   – If required enable the COMP interrupt by configuring and enabling EXTI line in Interrupt mode and selecting the desired sensitivity level using HAL_GPIO_Init() function. After that enable the comparator interrupt vector using HAL_NVIC_EnableIRQ() function.
2. Configure the comparator using HAL_COMP_Init() function:
   – Select the input minus (inverting input)
   – Select the input plus (non-inverting input)
   – Select the hysteresis
   – Select the blanking source
   – Select the output polarity
   – Select the power mode
   – Select the window mode

Note: HAL_COMP_Init() calls internally __HAL_RCC_SYSCFG_CLK_ENABLE() to enable internal control clock of the comparators. However, this is a legacy strategy. In future STM32 families, COMP clock enable must be implemented by user in "HAL_COMP_MspInit()". Therefore, for compatibility anticipation, it is recommended to implement __HAL_RCC_SYSCFG_CLK_ENABLE() in "HAL_COMP_MspInit()".

3. Reconfiguration on-the-fly of comparator can be done by calling again function HAL_COMP_Init() with new input structure parameters values.
4. Enable the comparator using HAL_COMP_Start() function.
5. Use HAL_COMP_TriggerCallback() or HAL_COMP_GetOutputLevel() functions to manage comparator outputs (events and output level).
6. Disable the comparator using HAL_COMP_Stop() function.
7. De-initialize the comparator using HAL_COMP_DeInit() function.
8. For safety purpose, comparator configuration can be locked using HAL_COMP_Lock() function. The only way to unlock the comparator is a device hardware reset.

Callback registration

The compilation flag USE_HAL_COMP_REGISTER_CALLBACKS, when set to 1, allows the user to configure dynamically the driver callbacks. Use Functions HAL_COMP_RegisterCallback() to register an interrupt callback.

Function HAL_COMP_RegisterCallback() allows to register following callbacks:

- TriggerCallback : callback for COMP trigger.
- MspInitCallback : callback for Msp Init.
- MspDeInitCallback : callback for Msp DeInit. This function takes as parameters the HAL peripheral handle, the Callback ID and a pointer to the user callback function.

Use function HAL_COMP_UnRegisterCallback to reset a callback to the default weak function.

HAL_COMP_UnRegisterCallback takes as parameters the HAL peripheral handle, and the Callback ID. This function allows to reset following callbacks:

- TriggerCallback : callback for COMP trigger.
- MspInitCallback : callback for Msp Init.
- MspDeInitCallback : callback for Msp DeInit.

By default, after the HAL_COMP_Init() and when the state is HAL_COMP_STATE_RESET all callbacks are set to the corresponding weak functions: example HAL_COMP_TriggerCallback(). Exception done for MspInit and MspDeInit functions that are reset to the legacy weak functions in the HAL_COMP_Init()/ HAL_COMP_DeInit() only when these callbacks are null (not registered beforehand).

If MspInit or MspDeInit are not null, the HAL_COMP_Init()/ HAL_COMP_DeInit() keep and use the user MspInit/ MspDeInit callbacks (registered beforehand) whatever the state.

Callbacks can be registered/unregistered in HAL_COMP_STATE_READY state only. Exception done MspInit/ MspDeInit functions that can be registered/unregistered in HAL_COMP_STATE_READY or HAL_COMP_STATE_RESET state, thus registered (user) MspInit/DeInit callbacks can be used during the Init/ DeInit.

Then, the user first registers the MspInit/MspDeInit user callbacks using HAL_COMP_RegisterCallback() before calling HAL_COMP_DeInit() or HAL_COMP_Init() function.

When the compilation flag USE_HAL_COMP_REGISTER_CALLBACKS is set to 0 or not defined, the callback registration feature is not available and all callbacks are set to the corresponding weak functions.

9.2.3 Initialization and de-initialization functions

This section provides functions to initialize and de-initialize comparators

This section contains the following APIs:

- ***HAL_COMP_Init()***
- ***HAL_COMP_DeInit()***
- ***HAL_COMP_MspInit()***
- ***HAL_COMP_MspDeInit()***

9.2.4 IO operation functions

This section provides functions allowing to:

- Start a comparator instance.
- Stop a comparator instance.

This section contains the following APIs:

- *HAL_COMP_Start()*
- *HAL_COMP_Stop()*
- *HAL_COMP_IRQHandler()*

9.2.5 Peripheral Control functions

This subsection provides a set of functions allowing to control the comparators.

This section contains the following APIs:

- *HAL_COMP_Lock()*
- *HAL_COMP_GetOutputLevel()*
- *HAL_COMP_TriggerCallback()*

9.2.6 Peripheral State functions

This subsection permit to get in run-time the status of the peripheral.

This section contains the following APIs:

- *HAL_COMP_GetState()*
- *HAL_COMP_GetError()*

9.2.7 Detailed description of functions

HAL_COMP_Init

Function name

HAL_StatusTypeDef HAL_COMP_Init (COMP_HandleTypeDef * hcomp)

Function description

Initialize the COMP according to the specified parameters in the COMP_InitTypeDef and initialize the associated handle.

Parameters

- **hcomp:** COMP handle

Return values

- **HAL:** status

Notes

- If the selected comparator is locked, initialization can't be performed. To unlock the configuration, perform a system reset.

HAL_COMP_DeInit

Function name

HAL_StatusTypeDef HAL_COMP_DeInit (COMP_HandleTypeDef * hcomp)

Function description

DeInitialize the COMP peripheral.

Parameters

- **hcomp:** COMP handle

Return values

- **HAL:** status

Notes

- Deinitialization cannot be performed if the COMP configuration is locked. To unlock the configuration, perform a system reset.

HAL_COMP_MspInit

Function name

void HAL_COMP_MspInit (COMP_HandleTypeDef * hcomp)

Function description

Initialize the COMP MSP.

Parameters

- **hcomp:** COMP handle

Return values

- **None:**

HAL_COMP_MspDeInit

Function name

void HAL_COMP_MspDeInit (COMP_HandleTypeDef * hcomp)

Function description

DeInitialize the COMP MSP.

Parameters

- **hcomp:** COMP handle

Return values

- **None:**

HAL_COMP_Start

Function name

HAL_StatusTypeDef HAL_COMP_Start (COMP_HandleTypeDef * hcomp)

Function description

Start the comparator.

Parameters

- **hcomp:** COMP handle

Return values

- **HAL:** status

HAL_COMP_Stop

Function name

HAL_StatusTypeDef HAL_COMP_Stop (COMP_HandleTypeDef * hcomp)

Function description

Stop the comparator.

Parameters

- **hcomp:** COMP handle

Return values

- **HAL:** status

HAL_COMP_IRQHandler

Function name

void HAL_COMP_IRQHandler (COMP_HandleTypeDef * hcomp)

Function description

Comparator IRQ handler.

Parameters

- **hcomp:** COMP handle

Return values

- **None:**

HAL_COMP_Lock

Function name

HAL_StatusTypeDef HAL_COMP_Lock (COMP_HandleTypeDef * hcomp)

Function description

Lock the selected comparator configuration.

Parameters

- **hcomp:** COMP handle

Return values

- **HAL:** status

Notes

- A system reset is required to unlock the comparator configuration.
- Locking the comparator from reset state is possible if __HAL_RCC_SYSCFG_CLK_ENABLE() is being called before.

HAL_COMP_GetOutputLevel

Function name

uint32_t HAL_COMP_GetOutputLevel (const COMP_HandleTypeDef * hcomp)

Function description

Return the output level (high or low) of the selected comparator.

HAL_COMP_TriggerCallback

Function name

void HAL_COMP_TriggerCallback (COMP_HandleTypeDef * hcomp)

Function description

Comparator trigger callback.

Parameters

- **hcomp:** COMP handle

Return values

- **None:**

HAL_COMP_GetState

Function name

HAL_COMP_StateTypeDef HAL_COMP_GetState (const COMP_HandleTypeDef * hcomp)

Function description

Return the COMP handle state.

Parameters

- **hcomp:** COMP handle

Return values

- **HAL:** state

HAL_COMP_GetError

Function name

uint32_t HAL_COMP_GetError (const COMP_HandleTypeDef * hcomp)

Function description

Return the COMP error code.

Parameters

- **hcomp:** COMP handle

Return values

- **COMP:** error code

9.3 COMP Firmware driver defines

The following section lists the various define and macros of the module.

9.3.1 COMP

COMP

COMP blanking source

COMP_BLANKINGSRC_NONE

Comparator output without blanking

COMP_BLANKINGSRC_TIM1_OC4

Comparator output blanking source TIM1 OC4 (common to all COMP instances: COMP1, COMP2)

COMP_BLANKINGSRC_TIM1_OC5

Comparator output blanking source TIM1 OC5 (common to all COMP instances: COMP1, COMP2)

COMP_BLANKINGSRC_TIM2_OC3

Comparator output blanking source TIM2 OC3 (common to all COMP instances: COMP1, COMP2)

COMP_BLANKINGSRC_TIM3_OC3

Comparator output blanking source TIM3 OC3 (common to all COMP instances: COMP1, COMP2)

COMP_BLANKINGSRC_TIM15_OC2

Comparator output blanking source TIM15 OC2 (common to all COMP instances: COMP1, COMP2)

COMP Error Code

HAL_COMP_ERROR_NONE

No error

COMP Exported Types

COMP_STATE_BITFIELD_LOCK

COMP EXTI Lines

COMP_EXTI_LINE_COMP1

EXTI line 17 connected to COMP1 output

COMP_EXTI_LINE_COMP2

EXTI line 18 connected to COMP2 output

COMP_EXTI_IT

EXTI line event with interruption

COMP_EXTI_EVENT

EXTI line event only (without interruption)

COMP_EXTI_RISING

EXTI line event on rising edge

COMP_EXTI_FALLING

EXTI line event on falling edge

COMP external interrupt line management

__HAL_COMP_COMP1_EXTI_ENABLE_RISING_EDGE

Description:

- Enable the COMP1 EXTI line rising edge trigger.

Return value:

- None

__HAL_COMP_COMP1_EXTI_DISABLE_RISING_EDGE

Description:

- Disable the COMP1 EXTI line rising edge trigger.

Return value:

- None

__HAL_COMP_COMP1_EXTI_ENABLE_FALLING_EDGE

Description:

- Enable the COMP1 EXTI line falling edge trigger.

Return value:

- None

__HAL_COMP_COMP1_EXTI_DISABLE_FALLING_EDGE

Description:

- Disable the COMP1 EXTI line falling edge trigger.

Return value:

- None

__HAL_COMP_COMP1_EXTI_ENABLE_RISING_FALLING_EDGE

Description:

- Enable the COMP1 EXTI line rising & falling edge trigger.

Return value:

- None

__HAL_COMP_COMP1_EXTI_DISABLE_RISING_FALLING_EDGE

Description:

- Disable the COMP1 EXTI line rising & falling edge trigger.

Return value:

- None

__HAL_COMP_COMP1_EXTI_ENABLE_IT

Description:

- Enable the COMP1 EXTI line in interrupt mode.

Return value:

- None

__HAL_COMP_COMP1_EXTI_DISABLE_IT

Description:

- Disable the COMP1 EXTI line in interrupt mode.

Return value:

- None

__HAL_COMP_COMP1_EXTI_GENERATE_SWIT

Description:

- Generate a software interrupt on the COMP1 EXTI line.

Return value:

- None

__HAL_COMP_COMP1_EXTI_ENABLE_EVENT

Description:

- Enable the COMP1 EXTI line in event mode.

Return value:

- None

__HAL_COMP_COMP1_EXTI_DISABLE_EVENT

Description:

- Disable the COMP1 EXTI line in event mode.

Return value:

- None

__HAL_COMP_COMP1_EXTI_GET_RISING_FLAG

Description:

- Check whether the COMP1 EXTI line rising flag is set.

Return value:

- RESET: or SET

__HAL_COMP_COMP1_EXTI_CLEAR_RISING_FLAG

Description:

- Clear the COMP1 EXTI rising flag.

Return value:

- None

__HAL_COMP_COMP1_EXTI_GET_FALLING_FLAG

Description:

- Check whether the COMP1 EXTI line falling flag is set.

Return value:

- RESET: or SET

__HAL_COMP_COMP1_EXTI_CLEAR_FALLING_FLAG

Description:

- Clear the COMP1 EXTI falling flag.

Return value:

- None

__HAL_COMP_COMP2_EXTI_ENABLE_RISING_EDGE

Description:

- Enable the COMP2 EXTI line rising edge trigger.

Return value:

- None

__HAL_COMP_COMP2_EXTI_DISABLE_RISING_EDGE

Description:

- Disable the COMP2 EXTI line rising edge trigger.

Return value:

- None

__HAL_COMP_COMP2_EXTI_ENABLE_FALLING_EDGE

Description:

- Enable the COMP2 EXTI line falling edge trigger.

Return value:

- None

__HAL_COMP_COMP2_EXTI_DISABLE_FALLING_EDGE

Description:

- Disable the COMP2 EXTI line falling edge trigger.

Return value:

- None

__HAL_COMP_COMP2_EXTI_ENABLE_RISING_FALLING_EDGE

Description:

- Enable the COMP2 EXTI line rising & falling edge trigger.

Return value:

- None

__HAL_COMP_COMP2_EXTI_DISABLE_RISING_FALLING_EDGE

Description:

- Disable the COMP2 EXTI line rising & falling edge trigger.

Return value:

- None

__HAL_COMP_COMP2_EXTI_ENABLE_IT

Description:

- Enable the COMP2 EXTI line in interrupt mode.

Return value:

- None

__HAL_COMP_COMP2_EXTI_DISABLE_IT

Description:

- Disable the COMP2 EXTI line in interrupt mode.

Return value:

- None

__HAL_COMP_COMP2_EXTI_GENERATE_SWIT

Description:

- Generate a software interrupt on the COMP2 EXTI line.

Return value:

- None

__HAL_COMP_COMP2_EXTI_ENABLE_EVENT

Description:

- Enable the COMP2 EXTI line in event mode.

Return value:

- None

__HAL_COMP_COMP2_EXTI_DISABLE_EVENT

Description:

- Disable the COMP2 EXTI line in event mode.

Return value:

- None

__HAL_COMP_COMP2_EXTI_GET_RISING_FLAG

Description:

- Check whether the COMP2 EXTI line rising flag is set.

Return value:

- RESET: or SET

__HAL_COMP_COMP2_EXTI_CLEAR_RISING_FLAG

Description:

- Clear the COMP2 EXTI rising flag.

Return value:

- None

__HAL_COMP_COMP2_EXTI_GET_FALLING_FLAG

Description:

- Check whether the COMP2 EXTI line falling flag is set.

Return value:

- RESET: or SET

__HAL_COMP_COMP2_EXTI_CLEAR_FALLING_FLAG

Description:

- Clear the COMP2 EXTI falling flag.

Return value:

- None

COMP output to EXTI

COMP_TRIGGERMODE_NONE

Comparator output triggering no External Interrupt Line

COMP_TRIGGERMODE_IT_RISING

Comparator output triggering External Interrupt Line event with interruption, on rising edge

COMP_TRIGGERMODE_IT_FALLING

Comparator output triggering External Interrupt Line event with interruption, on falling edge

COMP_TRIGGERMODE_IT_RISING_FALLING

Comparator output triggering External Interrupt Line event with interruption, on both rising and falling edges

COMP_TRIGGERMODE_EVENT_RISING

Comparator output triggering External Interrupt Line event only (without interruption), on rising edge

COMP_TRIGGERMODE_EVENT_FALLING

Comparator output triggering External Interrupt Line event only (without interruption), on falling edge

COMP_TRIGGERMODE_EVENT_RISING_FALLING

Comparator output triggering External Interrupt Line event only (without interruption), on both rising and falling edges

COMP private macros to get EXTI line associated with comparators

COMP_GET_EXTI_LINE

Description:

- Get the specified EXTI line for a comparator instance.

Parameters:

- __INSTANCE__: specifies the COMP instance.

Return value:

- value: of

COMP Handle Management

__HAL_COMP_RESET_HANDLE_STATE

Description:

- Reset COMP handle state.

Parameters:

- __HANDLE__: COMP handle

Return value:

- None

COMP_CLEAR_ERRORCODE

Description:

- Clear COMP error code (set it to no error code "HAL_COMP_ERROR_NONE").

Parameters:

- __HANDLE__: COMP handle

Return value:

- None

__HAL_COMP_ENABLE

Description:

- Enable the specified comparator.

Parameters:

- __HANDLE__: COMP handle

Return value:

- None

__HAL_COMP_DISABLE

Description:

- Disable the specified comparator.

Parameters:

- __HANDLE__: COMP handle

Return value:

- None

__HAL_COMP_LOCK

Description:

- Lock the specified comparator configuration.

Parameters:

- __HANDLE__: COMP handle

Return value:

- None

Notes:

- Using this macro induce HAL COMP handle state machine being no more in line with COMP instance state. To keep HAL COMP handle state machine updated, it is recommended to use function "HAL_COMP_Lock')".

__HAL_COMP_IS_LOCKED

Description:

- Check whether the specified comparator is locked.

Parameters:

- __HANDLE__: COMP handle

Return value:

- Value: 0 if COMP instance is not locked, value 1 if COMP instance is locked

COMP hysteresis

COMP_HYSTERESIS_NONE

No hysteresis

COMP_HYSTERESIS_LOW

Hysteresis level low

COMP_HYSTERESIS_MEDIUM

Hysteresis level medium

COMP_HYSTERESIS_HIGH

Hysteresis level high

COMP input minus (inverting input)

COMP_INPUT_MINUS_1_4VREFINT

Comparator input minus connected to 1/4 VrefInt

COMP_INPUT_MINUS_1_2VREFINT

Comparator input minus connected to 1/2 VrefInt

COMP_INPUT_MINUS_3_4VREFINT

Comparator input minus connected to 3/4 VrefInt

COMP_INPUT_MINUS_VREFINT

Comparator input minus connected to VrefInt

COMP_INPUT_MINUS_DAC1_CH1

Comparator input minus connected to DAC1 channel 1 (DAC_OUT1)

COMP_INPUT_MINUS_IO1

Comparator input minus connected to IO1 (pin PC4 for COMP1, pin PB7 for COMP2)

COMP_INPUT_MINUS_IO2

Comparator input minus connected to IO2 (pin PB1 for COMP1, pin PB3 for COMP2)

COMP_INPUT_MINUS_IO3

Comparator input minus connected to IO3 (pin PA0 for COMP1, pin PA2 for COMP2)

COMP_INPUT_MINUS_IO4

Comparator input minus connected to IO4 (pin PA4 for COMP1, pin PA4 for COMP2)

COMP_INPUT_MINUS_IO5

Comparator input minus connected to IO5 (pin PA5 for COMP1, pin PA5 for COMP2)

COMP input plus (non-inverting input)

COMP_INPUT_PLUS_IO1

Comparator input plus connected to IO1 (pin PC5 for COMP1, pin PB4 for COMP2)

COMP_INPUT_PLUS_IO2

Comparator input plus connected to IO2 (pin PB2 for COMP1, pin PB6 for COMP2)

COMP_INPUT_PLUS_IO3

Comparator input plus connected to IO3 (pin PA1 for COMP1, pin PA3 for COMP2)

COMP_INPUT_PLUS_IO4

Comparator input plus connected to IO4 (pin PA9 for COMP1, pin PD10 for COMP2)

COMP_INPUT_PLUS_IO5

Comparator input plus connected to IO5 (pin PC6 for COMP1, not applicable for COMP2)

COMP Output Level

COMP_OUTPUT_LEVEL_LOW

COMP_OUTPUT_LEVEL_HIGH

COMP output Polarity

COMP_OUTPUTPOL_NONINVERTED

COMP output level is not inverted (comparator output is high when the input plus is at a higher voltage than the input minus)

COMP_OUTPUTPOL_INVERTED

COMP output level is inverted (comparator output is low when the input plus is at a higher voltage than the input minus)

COMP power mode

COMP_POWERMODE_HIGHSPEED

High Speed

COMP_POWERMODE_MEDIUMSPEED

Medium Speed

COMP_POWERMODE_ULTRALOWPOWER

Ultra-low power

COMP Window Mode

COMP_WINDOWMODE_DISABLE

Window mode disable: Comparators instances pair COMP1 and COMP2 are independent

COMP_WINDOWMODE_COMP1_INPUT_PLUS_COMMON

Window mode enable: Comparators instances pair COMP1 and COMP2 have their input plus connected together. The common input is COMP1 input plus (COMP2 input plus is no more accessible).

COMP_WINDOWMODE_COMP2_INPUT_PLUS_COMMON

Window mode enable: if used from COMP1 or COMP2 instance, comparators instances pair COMP1 and COMP2 have their input plus connected together, the common input is COMP2 input plus (COMP1 input plus is no more accessible).

COMP window mode instance differentiator

COMP_WINDOWMODE_COMP2

COMP window mode using common input of COMP instance: COMP2

COMP Window output

COMP_WINDOWOUTPUT_EACH_COMP

Window output default mode: Comparators output are indicating each their own state. To know window mode state: each comparator output must be read, if "((COMPx exclusive or COMPy) == 1)" then monitored signal is within comparators window.

COMP_WINDOWOUTPUT_COMP1

Window output synthesized on COMP1 output: COMP1 output is no more indicating its own state, but global window mode state (logical high means monitored signal is within comparators window). Note: impacts only comparator output signal level (COMPx_OUT propagated to GPIO, EXTI lines, timers, ...), does not impact output digital state of comparator (COMPx_VALUE) always reflecting each comparator output state.

COMP_WINDOWOUTPUT_COMP2

Window output synthesized on COMP2 output: COMP2 output is no more indicating its own state, but global window mode state (logical high means monitored signal is within comparators window). Note: impacts only comparator output signal level (COMPx_OUT propagated to GPIO, EXTI lines, timers, ...), does not impact output digital state of comparator (COMPx_VALUE) always reflecting each comparator output state.

COMP_WINDOWOUTPUT_BOTH

Window output synthesized on both comparators output of pair of comparator selected (COMP1 and COMP2: both comparators outputs are no more indicating their own state, but global window mode state (logical high means monitored signal is within comparators window). This is a specific configuration (technically possible but not relevant from application point of view: 2 comparators output used for the same signal level), standard configuration for window mode is one of the settings above.

10 HAL CORTEX Generic Driver

10.1 CORTEX Firmware driver registers structures

10.1.1 MPU_Region_InitTypeDef

MPU_Region_InitTypeDef is defined in the stm32u0xx_hal_cortex.h

Data Fields

- ***uint8_t Enable***
- ***uint8_t Number***
- ***uint32_t BaseAddress***
- ***uint8_t Size***
- ***uint8_t SubRegionDisable***
- ***uint8_t TypeExtField***
- ***uint8_t AccessPermission***
- ***uint8_t DisableExec***
- ***uint8_t IsShareable***
- ***uint8_t IsCacheable***
- ***uint8_t IsBufferable***

Field Documentation

- ***uint8_t MPU_Region_InitTypeDef::Enable***
  Specifies the status of the region. This parameter can be a value of ***CORTEX_MPU_Region_Enable***
- ***uint8_t MPU_Region_InitTypeDef::Number***
  Specifies the number of the region to protect. This parameter can be a value of ***CORTEX_MPU_Region_Number***
- ***uint32_t MPU_Region_InitTypeDef::BaseAddress***
  Specifies the base address of the region to protect.
- ***uint8_t MPU_Region_InitTypeDef::Size***
  Specifies the size of the region to protect. This parameter can be a value of ***CORTEX_MPU_Region_Size***
- ***uint8_t MPU_Region_InitTypeDef::SubRegionDisable***
  Specifies the number of the subregion protection to disable. This parameter must be a number between Min_Data = 0x00 and Max_Data = 0xFF
- ***uint8_t MPU_Region_InitTypeDef::TypeExtField***
  Specifies the TEX field level. This parameter can be a value of ***CORTEX_MPU_TEX_Levels***
- ***uint8_t MPU_Region_InitTypeDef::AccessPermission***
  Specifies the region access permission type. This parameter can be a value of ***CORTEX_MPU_Region_Permission_Attributes***
- ***uint8_t MPU_Region_InitTypeDef::DisableExec***
  Specifies the instruction access status. This parameter can be a value of ***CORTEX_MPU_Instruction_Access***
- ***uint8_t MPU_Region_InitTypeDef::IsShareable***
  Specifies the shareability status of the protected region. This parameter can be a value of ***CORTEX_MPU_Access_Shareable***
- ***uint8_t MPU_Region_InitTypeDef::IsCacheable***
  Specifies the cacheable status of the region protected. This parameter can be a value of ***CORTEX_MPU_Access_Cacheable***
- ***uint8_t MPU_Region_InitTypeDef::IsBufferable***
  Specifies the bufferable status of the protected region. This parameter can be a value of ***CORTEX_MPU_Access_Bufferable***

10.2 CORTEX Firmware driver API description

The following section lists the various functions of the CORTEX library.

10.2.1 How to use this driver

How to configure Interrupts using CORTEX HAL driver

This section provides functions allowing to configure the NVIC interrupts (IRQ). The Cortex M0+ exceptions are managed by CMSIS functions.

1. Enable and Configure the priority of the selected IRQ Channels. The priority can be 0..3.

Note: Lower priority values gives higher priority.

Note: Priority Order:

1. *Lowest priority.*
2. *Lowest hardware priority (IRQn position).*

2. Configure the priority of the selected IRQ Channels using HAL_NVIC_SetPriority()
3. Enable the selected IRQ Channels using HAL_NVIC_EnableIRQ()

Note: Negative value of IRQn_Type are not allowed.

How to configure Systick using CORTEX HAL driver

Setup SysTick Timer for time base.

- The HAL_SYSTICK_Config()function calls the SysTick_Config() function which is a CMSIS function that:
  - Configures the SysTick Reload register with value passed as function parameter.
  - Configures the SysTick IRQ priority to the lowest value (0x03).
  - Resets the SysTick Counter register.
  - Configures the SysTick Counter clock source to be Core Clock Source (HCLK).
  - Enables the SysTick Interrupt.
  - Starts the SysTick Counter.
- You can change the SysTick Clock source to be HCLK_Div8 by calling the macro __HAL_CORTEX_SYSTICKCLK_CONFIG(SYSTICK_CLKSOURCE_HCLK_DIV8) just after the HAL_SYSTICK_Config() function call. The __HAL_CORTEX_SYSTICKCLK_CONFIG() macro is defined inside the stm32u0xx_hal_cortex.h file.
- You can change the SysTick IRQ priority by calling the HAL_NVIC_SetPriority(SysTick_IRQn,...) function just after the HAL_SYSTICK_Config() function call. The HAL_NVIC_SetPriority() call the NVIC_SetPriority() function which is a CMSIS function.
- To adjust the SysTick time base, use the following formula: Reload Value = SysTick Counter Clock (Hz) x Desired Time base (s)
  - Reload Value is the parameter to be passed for HAL_SYSTICK_Config() function
  - Reload Value should not exceed 0xFFFFFF

10.2.2 Initialization and Configuration functions

This section provides the CORTEX HAL driver functions allowing to configure Interrupts Systick functionalities

This section contains the following APIs:

- ***HAL_NVIC_SetPriority()***
- ***HAL_NVIC_EnableIRQ()***
- ***HAL_NVIC_DisableIRQ()***
- ***HAL_NVIC_SystemReset()***
- ***HAL_SYSTICK_Config()***

10.2.3 Peripheral Control functions

This subsection provides a set of functions allowing to control the CORTEX (NVIC, SYSTICK, MPU) functionalities.

This section contains the following APIs:

- ***HAL_NVIC_GetPriority()***
- ***HAL_NVIC_SetPendingIRQ()***

- *HAL_NVIC_GetPendingIRQ()*
- *HAL_NVIC_ClearPendingIRQ()*
- *HAL_SYSTICK_CLKSourceConfig()*
- *HAL_SYSTICK_IRQHandler()*
- *HAL_SYSTICK_Callback()*
- *HAL_MPU_Enable()*
- *HAL_MPU_Disable()*
- *HAL_MPU_EnableRegion()*
- *HAL_MPU_DisableRegion()*
- *HAL_MPU_ConfigRegion()*

10.2.4 Detailed description of functions

HAL_NVIC_SetPriority

Function name

void HAL_NVIC_SetPriority (IRQn_Type IRQn, uint32_t PreemptPriority, uint32_t SubPriority)

Function description

Sets the priority of an interrupt.

Parameters

- **IRQn:** External interrupt number . This parameter can be an enumerator of IRQn_Type enumeration (For the complete STM32 Devices IRQ Channels list, please refer to stm32u0xx.h file)
- **PreemptPriority:** The preemption priority for the IRQn channel. This parameter can be a value between 0 and 3. A lower priority value indicates a higher priority
- **SubPriority:** the subpriority level for the IRQ channel. with stm32u0xx devices, this parameter is a dummy value and it is ignored, because no subpriority supported in Cortex M0+ based products.

Return values

- **None:**

HAL_NVIC_EnableIRQ

Function name

void HAL_NVIC_EnableIRQ (IRQn_Type IRQn)

Function description

Enable a device specific interrupt in the NVIC interrupt controller.

Parameters

- **IRQn:** External interrupt number. This parameter can be an enumerator of IRQn_Type enumeration (For the complete STM32 Devices IRQ Channels list, please refer to the appropriate CMSIS device file (stm32u0xxxx.h))

Return values

- **None:**

HAL_NVIC_DisableIRQ

Function name

void HAL_NVIC_DisableIRQ (IRQn_Type IRQn)

Function description

Disable a device specific interrupt in the NVIC interrupt controller.

Parameters

- **IRQn:** External interrupt number. This parameter can be an enumerator of IRQn_Type enumeration (For the complete STM32 Devices IRQ Channels list, please refer to the appropriate CMSIS device file (stm32u0xxxx.h))

Return values

- **None:**

HAL_NVIC_SystemReset

Function name

void HAL_NVIC_SystemReset (void)

Function description

Initiate a system reset request to reset the MCU.

Return values

- **None:**

HAL_SYSTICK_Config

Function name

uint32_t HAL_SYSTICK_Config (uint32_t TicksNumb)

Function description

Initialize the System Timer with interrupt enabled and start the System Tick Timer (SysTick): Counter is in free running mode to generate periodic interrupts.

Parameters

- **TicksNumb:** Specifies the ticks Number of ticks between two interrupts.

Return values

- **status:** - 0 Function succeeded.
  - 1 Function failed.

HAL_NVIC_GetPriority

Function name

uint32_t HAL_NVIC_GetPriority (IRQn_Type IRQn)

Function description

Get the priority of an interrupt.

Parameters

- **IRQn:** External interrupt number. This parameter can be an enumerator of IRQn_Type enumeration (For the complete STM32 Devices IRQ Channels list, please refer to the appropriate CMSIS device file (stm32u0xxxx.h))

Return values

- **None:**

HAL_NVIC_GetPendingIRQ

Function name

uint32_t HAL_NVIC_GetPendingIRQ (IRQn_Type IRQn)

Function description

Get Pending Interrupt (read the pending register in the NVIC and return the pending bit for the specified interrupt).

Parameters

- **IRQn:** External interrupt number. This parameter can be an enumerator of IRQn_Type enumeration (For the complete STM32 Devices IRQ Channels list, please refer to the appropriate CMSIS device file (stm32u0xxxx.h))

Return values

- **status:** - 0 Interrupt status is not pending.
  - 1 Interrupt status is pending.

HAL_NVIC_SetPendingIRQ

Function name

void HAL_NVIC_SetPendingIRQ (IRQn_Type IRQn)

Function description

Set Pending bit of an external interrupt.

Parameters

- **IRQn:** External interrupt number This parameter can be an enumerator of IRQn_Type enumeration (For the complete STM32 Devices IRQ Channels list, please refer to the appropriate CMSIS device file (stm32u0xxxx.h))

Return values

- **None:**

HAL_NVIC_ClearPendingIRQ

Function name

void HAL_NVIC_ClearPendingIRQ (IRQn_Type IRQn)

Function description

Clear the pending bit of an external interrupt.

Parameters

- **IRQn:** External interrupt number. This parameter can be an enumerator of IRQn_Type enumeration (For the complete STM32 Devices IRQ Channels list, please refer to the appropriate CMSIS device file (stm32u0xxxx.h))

Return values

- **None:**

HAL_SYSTICK_CLKSourceConfig

Function name

void HAL_SYSTICK_CLKSourceConfig (uint32_t CLKSource)

Function description

Configure the SysTick clock source.

Parameters

- **CLKSource:** specifies the SysTick clock source. This parameter can be one of the following values:
  - SYSTICK_CLKSOURCE_HCLK_DIV8: AHB clock divided by 8 selected as SysTick clock source.
  - SYSTICK_CLKSOURCE_HCLK: AHB clock selected as SysTick clock source.

Return values

- **None:**

HAL_SYSTICK_IRQHandler

Function name

void HAL_SYSTICK_IRQHandler (void)

Function description

Handle SYSTICK interrupt request.

Return values

- **None:**

HAL_SYSTICK_Callback

Function name

void HAL_SYSTICK_Callback (void)

Function description

SYSTICK callback.

Return values

- **None:**

HAL_MPU_Enable

Function name

void HAL_MPU_Enable (uint32_t MPU_Control)

Function description

Enable the MPU.

Parameters

- **MPU_Control:** Specifies the control mode of the MPU during hard fault, NMI, FAULTMASK and privileged access to the default memory This parameter can be one of the following values:
  - MPU_HFNMI_PRIVDEF_NONE
  - MPU_HARDFAULT_NMI
  - MPU_PRIVILEGED_DEFAULT
  - MPU_HFNMI_PRIVDEF

Return values

- **None:**

HAL_MPU_Disable

Function name

void HAL_MPU_Disable (void)

Function description

Disable the MPU.

Return values

- **None:**

HAL_MPU_EnableRegion

Function name

void HAL_MPU_EnableRegion (uint32_t RegionNumber)

Function description

Enable the MPU Region.

Return values

- **None:**

HAL_MPU_DisableRegion

Function name

void HAL_MPU_DisableRegion (uint32_t RegionNumber)

Function description

Disable the MPU Region.

Return values

- **None:**

HAL_MPU_ConfigRegion

Function name

void HAL_MPU_ConfigRegion (MPU_Region_InitTypeDef * MPU_Init)

Function description

Initialize and configure the Region and the memory to be protected.

Parameters

- **MPU_Init:** Pointer to a MPU_Region_InitTypeDef structure that contains the initialization and configuration information.

Return values

- **None:**

10.3 CORTEX Firmware driver defines

The following section lists the various define and macros of the module.

10.3.1 CORTEX

CORTEX

CORTEX MPU Instruction Access Bufferable

MPU_ACCESS_BUFFERABLE

MPU_ACCESS_NOT_BUFFERABLE

CORTEX MPU Instruction Access Cacheable

MPU_ACCESS_CACHEABLE

MPU_ACCESS_NOT_CACHEABLE

CORTEX MPU Instruction Access Shareable

MPU_ACCESS_SHAREABLE

MPU_ACCESS_NOT_SHAREABLE

CORTEX MPU HFNMI and PRIVILEGED Access control

MPU_HFNMI_PRIVDEF_NONE

MPU_HARDFAULT_NMI

MPU_PRIVILEGED_DEFAULT

MPU_HFNMI_PRIVDEF

CORTEX MPU Instruction Access

MPU_INSTRUCTION_ACCESS_ENABLE

MPU_INSTRUCTION_ACCESS_DISABLE

CORTEX MPU Region Enable

MPU_REGION_ENABLE

MPU_REGION_DISABLE

CORTEX MPU Region Number

MPU_REGION_NUMBER0

MPU_REGION_NUMBER1

MPU_REGION_NUMBER2

MPU_REGION_NUMBER3

MPU_REGION_NUMBER4

MPU_REGION_NUMBER5

MPU_REGION_NUMBER6

MPU_REGION_NUMBER7

CORTEX MPU Region Permission Attributes

MPU_REGION_NO_ACCESS

MPU_REGION_PRIV_RW

MPU_REGION_PRIV_RW_URO

MPU_REGION_FULL_ACCESS

MPU_REGION_PRIV_RO

MPU_REGION_PRIV_RO_URO

CORTEX MPU Region Size

MPU_REGION_SIZE_256B

MPU_REGION_SIZE_512B

MPU_REGION_SIZE_1KB

MPU_REGION_SIZE_2KB

MPU_REGION_SIZE_4KB

MPU_REGION_SIZE_8KB

MPU_REGION_SIZE_16KB

MPU_REGION_SIZE_32KB

MPU_REGION_SIZE_64KB

MPU_REGION_SIZE_128KB

MPU_REGION_SIZE_256KB

MPU_REGION_SIZE_512KB

MPU_REGION_SIZE_1MB

MPU_REGION_SIZE_2MB

MPU_REGION_SIZE_4MB

MPU_REGION_SIZE_8MB

MPU_REGION_SIZE_16MB

MPU_REGION_SIZE_32MB

MPU_REGION_SIZE_64MB

MPU_REGION_SIZE_128MB

MPU_REGION_SIZE_256MB

MPU_REGION_SIZE_512MB

MPU_REGION_SIZE_1GB

MPU_REGION_SIZE_2GB

MPU_REGION_SIZE_4GB

CORTEX MPU TEX Levels

MPU_TEX_LEVEL0

MPU_TEX_LEVEL1

MPU_TEX_LEVEL2

CORTEX SysTick clock source

SYSTICK_CLKSOURCE_HCLK_DIV8

SYSTICK_CLKSOURCE_HCLK

11 HAL CRC Generic Driver

11.1 CRC Firmware driver registers structures

11.1.1 CRC_InitTypeDef

CRC_InitTypeDef is defined in the stm32u0xx_hal_crc.h

Data Fields

- ***uint8_t DefaultPolynomialUse***
- ***uint8_t DefaultInitValueUse***
- ***uint32_t GeneratingPolynomial***
- ***uint32_t CRCLength***
- ***uint32_t InitValue***
- ***uint32_t InputDataInversionMode***
- ***uint32_t OutputDataInversionMode***

Field Documentation

- ***uint8_t CRC_InitTypeDef::DefaultPolynomialUse***
  This parameter is a value of ***CRC_Default_Polynomial*** and indicates if default polynomial is used. If set to DEFAULT_POLYNOMIAL_ENABLE, resort to default X^32 + X^26 + X^23 + X^22 + X^16 + X^12 + X^11 + X^10 +X^8 + X^7 + X^5 + X^4 + X^2+ X +1. In that case, there is no need to set GeneratingPolynomial field. If otherwise set to DEFAULT_POLYNOMIAL_DISABLE, GeneratingPolynomial and CRCLength fields must be set.
- ***uint8_t CRC_InitTypeDef::DefaultInitValueUse***
  This parameter is a value of ***CRC_Default_InitValue_Use*** and indicates if default init value is used. If set to DEFAULT_INIT_VALUE_ENABLE, resort to default 0xFFFFFFFF value. In that case, there is no need to set InitValue field. If otherwise set to DEFAULT_INIT_VALUE_DISABLE, InitValue field must be set.
- ***uint32_t CRC_InitTypeDef::GeneratingPolynomial***
  Set CRC generating polynomial as a 7, 8, 16 or 32-bit long value for a polynomial degree respectively equal to 7, 8, 16 or 32. This field is written in normal, representation e.g., for a polynomial of degree 7, X^7 + X^6 + X^5 + X^2 + 1 is written 0x65. No need to specify it if DefaultPolynomialUse is set to DEFAULT_POLYNOMIAL_ENABLE.
- ***uint32_t CRC_InitTypeDef::CRCLength***
  This parameter is a value of ***CRC_Polynomial_Sizes*** and indicates CRC length. Value can be either one of
  - **CRC_POLYLENGTH_32B** (32-bit CRC),
  - **CRC_POLYLENGTH_16B** (16-bit CRC),
  - **CRC_POLYLENGTH_8B** (8-bit CRC),
  - **CRC_POLYLENGTH_7B** (7-bit CRC).
- ***uint32_t CRC_InitTypeDef::InitValue***
  Init value to initiate CRC computation. No need to specify it if DefaultInitValueUse is set to DEFAULT_INIT_VALUE_ENABLE.
- ***uint32_t CRC_InitTypeDef::InputDataInversionMode***
  This parameter is a value of ***CRCEx_Input_Data_Inversion*** and specifies input data inversion mode. Can be either one of the following values
  - **CRC_INPUTDATA_INVERSION_NONE** no input data inversion
  - **CRC_INPUTDATA_INVERSION_BYTE** byte-wise inversion, 0x1A2B3C4D becomes 0x58D43CB2
  - **CRC_INPUTDATA_INVERSION_HALFWORD** halfword-wise inversion, 0x1A2B3C4D becomes 0xD458B23C
  - **CRC_INPUTDATA_INVERSION_WORD** word-wise inversion, 0x1A2B3C4D becomes 0xB23CD458

- ***uint32_t CRC_InitTypeDef::OutputDataInversionMode***
  This parameter is a value of ***CRCEx_Output_Data_Inversion*** and specifies output data (i.e. CRC) inversion mode. Can be either
  - **CRC_OUTPUTDATA_INVERSION_DISABLE** no CRC inversion,
  - **CRC_OUTPUTDATA_INVERSION_ENABLE** CRC 0x11223344 is converted into 0x22CC4488

11.1.2 CRC_HandleTypeDef

CRC_HandleTypeDef is defined in the stm32u0xx_hal_crc.h

Data Fields

- ***CRC_TypeDef * Instance***
- ***CRC_InitTypeDef Init***
- ***HAL_LockTypeDef Lock***
- ***__IO HAL_CRC_StateTypeDef State***
- ***uint32_t InputDataFormat***

Field Documentation

- ***CRC_TypeDef* CRC_HandleTypeDef::Instance***
  Register base address
- ***CRC_InitTypeDef CRC_HandleTypeDef::Init***
  CRC configuration parameters
- ***HAL_LockTypeDef CRC_HandleTypeDef::Lock***
  CRC Locking object
- ***__IO HAL_CRC_StateTypeDef CRC_HandleTypeDef::State***
  CRC communication state
- ***uint32_t CRC_HandleTypeDef::InputDataFormat***
  This parameter is a value of ***CRC_Input_Buffer_Format*** and specifies input data format. Can be either
  - **CRC_INPUTDATA_FORMAT_BYTES** input data is a stream of bytes (8-bit data)
  - **CRC_INPUTDATA_FORMAT_HALFWORDS** input data is a stream of half-words (16-bit data)
  - **CRC_INPUTDATA_FORMAT_WORDS** input data is a stream of words (32-bit data)

  Note that constant CRC_INPUT_FORMAT_UNDEFINED is defined but an initialization error must occur if InputBufferFormat is not one of the three values listed above

11.2 CRC Firmware driver API description

The following section lists the various functions of the CRC library.

11.2.1 How to use this driver

- Enable CRC AHB clock using __HAL_RCC_CRC_CLK_ENABLE();
- Initialize CRC calculator
  - specify generating polynomial (peripheral default or non-default one)
  - specify initialization value (peripheral default or non-default one)
  - specify input data format
  - specify input or output data inversion mode if any
- Use HAL_CRC_Accumulate() function to compute the CRC value of the input data buffer starting with the previously computed CRC as initialization value
- Use HAL_CRC_Calculate() function to compute the CRC value of the input data buffer starting with the defined initialization value (default or non-default) to initiate CRC calculation

11.2.2 Initialization and de-initialization functions

This section provides functions allowing to:

- Initialize the CRC according to the specified parameters in the CRC_InitTypeDef and create the associated handle
- DeInitialize the CRC peripheral

- Initialize the CRC MSP (MCU Specific Package)
- DeInitialize the CRC MSP

This section contains the following APIs:

- ***HAL_CRC_Init()***
- ***HAL_CRC_DeInit()***
- ***HAL_CRC_MspInit()***
- ***HAL_CRC_MspDeInit()***

11.2.3 Peripheral Control functions

This section provides functions allowing to:

- compute the 7, 8, 16 or 32-bit CRC value of an 8, 16 or 32-bit data buffer using combination of the previous CRC value and the new one.

or

- compute the 7, 8, 16 or 32-bit CRC value of an 8, 16 or 32-bit data buffer independently of the previous CRC value.

This section contains the following APIs:

- ***HAL_CRC_Accumulate()***
- ***HAL_CRC_Calculate()***

11.2.4 Peripheral State functions

This subsection permits to get in run-time the status of the peripheral.

This section contains the following APIs:

- ***HAL_CRC_GetState()***

11.2.5 Detailed description of functions

HAL_CRC_Init

Function name

HAL_StatusTypeDef HAL_CRC_Init (CRC_HandleTypeDef * hcrc)

Function description

Initialize the CRC according to the specified parameters in the CRC_InitTypeDef and create the associated handle.

Parameters

- **hcrc:** CRC handle

Return values

- **HAL:** status

HAL_CRC_DeInit

Function name

HAL_StatusTypeDef HAL_CRC_DeInit (CRC_HandleTypeDef * hcrc)

Function description

DeInitialize the CRC peripheral.

Parameters

- **hcrc:** CRC handle

Return values

- **HAL:** status

HAL_CRC_MspInit

Function name

void HAL_CRC_MspInit (CRC_HandleTypeDef * hcrc)

Function description

Initializes the CRC MSP.

Parameters

- **hcrc:** CRC handle

Return values

- **None:**

HAL_CRC_MspDeInit

Function name

void HAL_CRC_MspDeInit (CRC_HandleTypeDef * hcrc)

Function description

DeInitialize the CRC MSP.

Parameters

- **hcrc:** CRC handle

Return values

- **None:**

HAL_CRC_Accumulate

Function name

uint32_t HAL_CRC_Accumulate (CRC_HandleTypeDef * hcrc, uint32_t pBuffer, uint32_t BufferLength)

Function description

Compute the 7, 8, 16 or 32-bit CRC value of an 8, 16 or 32-bit data buffer starting with the previously computed CRC as initialization value.

Parameters

- **hcrc:** CRC handle
- **pBuffer:** pointer to the input data buffer, exact input data format is provided by hcrc->InputDataFormat.
- **BufferLength:** input data buffer length (number of bytes if pBuffer type is * uint8_t, number of half-words if pBuffer type is * uint16_t, number of words if pBuffer type is * uint32_t).

Return values

- **uint32_t:** CRC (returned value LSBs for CRC shorter than 32 bits)

Notes

- By default, the API expects a uint32_t pointer as input buffer parameter. Input buffer pointers with other types simply need to be cast in uint32_t and the API will internally adjust its input data processing based on the handle field hcrc->InputDataFormat.

HAL_CRC_Calculate

Function name

uint32_t HAL_CRC_Calculate (CRC_HandleTypeDef * hcrc, uint32_t pBuffer, uint32_t BufferLength)

Function description

Compute the 7, 8, 16 or 32-bit CRC value of an 8, 16 or 32-bit data buffer starting with hcrc->Instance->INIT as initialization value.

Parameters

- **hcrc:** CRC handle
- **pBuffer:** pointer to the input data buffer, exact input data format is provided by hcrc->InputDataFormat.
- **BufferLength:** input data buffer length (number of bytes if pBuffer type is * uint8_t, number of half-words if pBuffer type is * uint16_t, number of words if pBuffer type is * uint32_t).

Return values

- **uint32_t:** CRC (returned value LSBs for CRC shorter than 32 bits)

Notes

- By default, the API expects a uint32_t pointer as input buffer parameter. Input buffer pointers with other types simply need to be cast in uint32_t and the API will internally adjust its input data processing based on the handle field hcrc->InputDataFormat.

HAL_CRC_GetState

Function name

HAL_CRC_StateTypeDef HAL_CRC_GetState (const CRC_HandleTypeDef * hcrc)

Function description

Return the CRC handle state.

Parameters

- **hcrc:** CRC handle

Return values

- **HAL:** state

11.3 CRC Firmware driver defines

The following section lists the various define and macros of the module.

11.3.1 CRC

CRC

Default CRC computation initialization value

DEFAULT_CRC_INITVALUE

Initial CRC default value

Indicates whether or not default init value is used

DEFAULT_INIT_VALUE_ENABLE

Enable initial CRC default value

DEFAULT_INIT_VALUE_DISABLE

Disable initial CRC default value

Indicates whether or not default polynomial is used

DEFAULT_POLYNOMIAL_ENABLE

Enable default generating polynomial 0x04C11DB7

DEFAULT_POLYNOMIAL_DISABLE

Disable default generating polynomial 0x04C11DB7

Default CRC generating polynomial

DEFAULT_CRC32_POLY

X^32 + X^26 + X^23 + X^22 + X^16 + X^12 + X^11 + X^10 +X^8 + X^7 + X^5 + X^4 + X^2+ X +1

CRC Exported Macros

__HAL_CRC_RESET_HANDLE_STATE

Description:

- Reset CRC handle state.

Parameters:

- __HANDLE__: CRC handle.

Return value:

- None

__HAL_CRC_DR_RESET

Description:

- Reset CRC Data Register.

Parameters:

- __HANDLE__: CRC handle

Return value:

- None

__HAL_CRC_INITIALCRCVALUE_CONFIG

Description:

- Set CRC INIT non-default value.

Parameters:

- __HANDLE__: CRC handle
- __INIT__: 32-bit initial value

Return value:

- None

__HAL_CRC_SET_IDR

Description:

- Store data in the Independent Data (ID) register.

Parameters:

- __HANDLE__: CRC handle
- __VALUE__: Value to be stored in the ID register

Return value:

- None

Notes:

- Refer to the Reference Manual to get the authorized __VALUE__ length in bits

__HAL_CRC_GET_IDR

Description:

- Return the data stored in the Independent Data (ID) register.

Parameters:

- __HANDLE__: CRC handle

Return value:

- Value: of the ID register

Notes:

- Refer to the Reference Manual to get the authorized __VALUE__ length in bits

Input Buffer Format

CRC_INPUTDATA_FORMAT_UNDEFINED

Undefined input data format

CRC_INPUTDATA_FORMAT_BYTES

Input data in byte format

CRC_INPUTDATA_FORMAT_HALFWORDS

Input data in half-word format

CRC_INPUTDATA_FORMAT_WORDS

Input data in word format

Polynomial sizes to configure the peripheral

CRC_POLYLENGTH_32B

Resort to a 32-bit long generating polynomial

CRC_POLYLENGTH_16B

Resort to a 16-bit long generating polynomial

CRC_POLYLENGTH_8B

Resort to a 8-bit long generating polynomial

CRC_POLYLENGTH_7B

Resort to a 7-bit long generating polynomial

CRC polynomial possible sizes actual definitions

HAL_CRC_LENGTH_32B

32-bit long CRC

HAL_CRC_LENGTH_16B

16-bit long CRC

HAL_CRC_LENGTH_8B

8-bit long CRC

HAL_CRC_LENGTH_7B

7-bit long CRC

12 HAL CRC Extension Driver

12.1 CRCEx Firmware driver API description

The following section lists the various functions of the CRCEx library.

12.1.1 How to use this driver

- Set user-defined generating polynomial through HAL_CRCEx_Polynomial_Set()
- Configure Input or Output data inversion

12.1.2 Extended configuration functions

This section provides functions allowing to:

- Configure the generating polynomial
- Configure the input data inversion
- Configure the output data inversion

This section contains the following APIs:

- ***HAL_CRCEx_Polynomial_Set()***
- ***HAL_CRCEx_Input_Data_Reverse()***
- ***HAL_CRCEx_Output_Data_Reverse()***

12.1.3 Detailed description of functions

HAL_CRCEx_Polynomial_Set

Function name

HAL_StatusTypeDef HAL_CRCEx_Polynomial_Set (CRC_HandleTypeDef * hcrc, uint32_t Pol, uint32_t PolyLength)

Function description

Initialize the CRC polynomial if different from default one.

Parameters

- **hcrc:** CRC handle
- **Pol:** CRC generating polynomial (7, 8, 16 or 32-bit long). This parameter is written in normal representation, e.g.
  - for a polynomial of degree 7, X^7 + X^6 + X^5 + X^2 + 1 is written 0x65
  - for a polynomial of degree 16, X^16 + X^12 + X^5 + 1 is written 0x1021
- **PolyLength:** CRC polynomial length. This parameter can be one of the following values:
  - CRC_POLYLENGTH_7B 7-bit long CRC (generating polynomial of degree 7)
  - CRC_POLYLENGTH_8B 8-bit long CRC (generating polynomial of degree 8)
  - CRC_POLYLENGTH_16B 16-bit long CRC (generating polynomial of degree 16)
  - CRC_POLYLENGTH_32B 32-bit long CRC (generating polynomial of degree 32)

Return values

- **HAL:** status

HAL_CRCEx_Input_Data_Reverse

Function name

HAL_StatusTypeDef HAL_CRCEx_Input_Data_Reverse (CRC_HandleTypeDef * hcrc, uint32_t InputReverseMode)

Function description

Set the Reverse Input data mode.

Parameters

- **hcrc:** CRC handle
- **InputReverseMode:** Input Data inversion mode. This parameter can be one of the following values:
  - CRC_INPUTDATA_INVERSION_NONE no change in bit order (default value)
  - CRC_INPUTDATA_INVERSION_BYTE Byte-wise bit reversal
  - CRC_INPUTDATA_INVERSION_HALFWORD HalfWord-wise bit reversal
  - CRC_INPUTDATA_INVERSION_WORD Word-wise bit reversal

Return values

- **HAL:** status

HAL_CRCEx_Output_Data_Reverse

Function name

HAL_StatusTypeDef HAL_CRCEx_Output_Data_Reverse (CRC_HandleTypeDef * hcrc, uint32_t OutputReverseMode)

Function description

Set the Reverse Output data mode.

Parameters

- **hcrc:** CRC handle
- **OutputReverseMode:** Output Data inversion mode. This parameter can be one of the following values:
  - CRC_OUTPUTDATA_INVERSION_DISABLE no CRC inversion (default value)
  - CRC_OUTPUTDATA_INVERSION_ENABLE bit-level inversion (e.g. for a 8-bit CRC: 0xB5 becomes 0xAD)

Return values

- **HAL:** status

12.2 CRCEx Firmware driver defines

The following section lists the various define and macros of the module.

12.2.1 CRCEx

CRCEx

CRC Extended Exported Macros

__HAL_CRC_OUTPUTREVERSAL_BIT_ENABLE

Description:

- Set CRC output bit-reversal.

Parameters:

- __HANDLE__: CRC handle

Return value:

- None

__HAL_CRC_OUTPUTREVERSAL_HALFWORD_ENABLE

Description:

- Set CRC output halfword-reversal.

Parameters:

- __HANDLE__: CRC handle

Return value:

- None

__HAL_CRC_OUTPUTREVERSAL_BYTE_ENABLE

Description:

- Set CRC output byte-reversal.

Parameters:

- __HANDLE__: CRC handle

Return value:

- None

__HAL_CRC_OUTPUTREVERSAL_ENABLE

__HAL_CRC_OUTPUTREVERSAL_DISABLE

Description:

- Unset CRC output reversal.

Parameters:

- __HANDLE__: CRC handle

Return value:

- None

__HAL_CRC_POLYNOMIAL_CONFIG

Description:

- Set CRC non-default polynomial.

Parameters:

- __HANDLE__: CRC handle
- __POLYNOMIAL__: 7, 8, 16 or 32-bit polynomial

Return value:

- None

Input Data Inversion Modes

CRC_INPUTDATA_INVERSION_NONE

No input data inversion

CRC_INPUTDATA_INVERSION_HALFWORD_BYWORD

Input data half-word-reversal done by word

CRC_INPUTDATA_INVERSION_BYTE_BYWORD

Input data byte-reversal done by word

CRC_INPUTDATA_INVERSION_BIT_BYBYTE

Input data bit-reversal done by byte

CRC_INPUTDATA_INVERSION_BIT_BYHALFWORD

Input data bit-reversal done by half-word

CRC_INPUTDATA_INVERSION_BIT_BYWORD

Input data bit-reversal done by word

CRC_INPUTDATA_INVERSION_BYTE

Definition for compatibility with legacy code

CRC_INPUTDATA_INVERSION_HALFWORD

Definition for compatibility with legacy code

CRC_INPUTDATA_INVERSION_WORD

Definition for compatibility with legacy code

Output Data Inversion Modes

CRC_OUTPUTDATA_INVERSION_DISABLE

No output data inversion

CRC_OUTPUTDATA_INVERSION_BIT

Output data bit-reversal

CRC_OUTPUTDATA_INVERSION_HALFWORD

Output data half-word-reversal done by word

CRC_OUTPUTDATA_INVERSION_BYTE

Output data byte-reversal done by word

CRC_OUTPUTDATA_INVERSION_ENABLE

Definition for compatibility with legacy code

13 HAL CRYP Generic Driver

13.1 CRYP Firmware driver registers structures

13.1.1 CRYP_ConfigTypeDef

CRYP_ConfigTypeDef is defined in the stm32u0xx_hal_cryp.h

Data Fields

- ***uint32_t DataType***
- ***uint32_t KeySize***
- ***uint32_t * pKey***
- ***uint32_t * pInitVect***
- ***uint32_t Algorithm***
- ***uint32_t * Header***
- ***uint32_t HeaderSize***
- ***uint32_t * B0***
- ***uint32_t DataWidthUnit***
- ***uint32_t HeaderWidthUnit***
- ***uint32_t KeyIVConfigSkip***

Field Documentation

- ***uint32_t CRYP_ConfigTypeDef::DataType***
  32-bit data, 16-bit data, 8-bit data or 1-bit string. This parameter can be a value of ***CRYP_Data_Type***
- ***uint32_t CRYP_ConfigTypeDef::KeySize***
  Used only in AES mode : 128, 192 or 256 bit key length in CRYP1. 128 or 256 bit key length in TinyAES This parameter can be a value of ***CRYP_Key_Size***
- ***uint32_t* CRYP_ConfigTypeDef::pKey***
  The key used for encryption/decryption
- ***uint32_t* CRYP_ConfigTypeDef::pInitVect***
  The initialization vector used also as initialization counter in CTR mode
- ***uint32_t CRYP_ConfigTypeDef::Algorithm***
  DES/ TDES Algorithm ECB/CBC AES Algorithm ECB/CBC/CTR/GCM or CCM This parameter can be a value of ***CRYP_Algorithm_Mode***
- ***uint32_t* CRYP_ConfigTypeDef::Header***
  used only in AES GCM and CCM Algorithm for authentication, GCM : also known as Additional Authentication Data CCM : named B1 composed of the associated data length and Associated Data.
- ***uint32_t CRYP_ConfigTypeDef::HeaderSize***
  The size of header buffer
- ***uint32_t* CRYP_ConfigTypeDef::B0***
  B0 is first authentication block used only in AES CCM mode
- ***uint32_t CRYP_ConfigTypeDef::DataWidthUnit***
  Payload Data Width Unit, this parameter can be value of ***CRYP_Data_Width_Unit***
- ***uint32_t CRYP_ConfigTypeDef::HeaderWidthUnit***
  Header Width Unit, this parameter can be value of ***CRYP_Header_Width_Unit***
- ***uint32_t CRYP_ConfigTypeDef::KeyIVConfigSkip***
  CRYP peripheral Key and IV configuration skip, to config Key and Initialization Vector only once and to skip configuration for consecutive processings. This parameter can be a value of ***CRYP_Configuration_Skip***

13.1.2 __CRYP_HandleTypeDef

__CRYP_HandleTypeDef is defined in the stm32u0xx_hal_cryp.h

Data Fields

- ***AES_TypeDef * Instance***
- ***CRYP_ConfigTypeDef Init***

- ***FunctionalState AutoKeyDerivation***
- ***uint32_t * pCrypInBuffPtr***
- ***uint32_t * pCrypOutBuffPtr***
- ***__IO uint16_t CrypHeaderCount***
- ***__IO uint16_t CrypInCount***
- ***__IO uint16_t CrypOutCount***
- ***uint16_t Size***
- ***uint32_t Phase***
- ***DMA_HandleTypeDef * hdmain***
- ***DMA_HandleTypeDef * hdmaout***
- ***HAL_LockTypeDef Lock***
- ***__IO HAL_CRYP_STATETypeDef State***
- ***__IO uint32_t ErrorCode***
- ***uint32_t KeyIVConfig***
- ***uint32_t SizesSum***
- ***void(* InCpltCallback***
- ***void(* OutCpltCallback***
- ***void(* ErrorCallback***
- ***void(* MspInitCallback***
- ***void(* MspDeInitCallback***

Field Documentation

- ***AES_TypeDef* __CRYP_HandleTypeDef::Instance***
  AES Register base address
- ***CRYP_ConfigTypeDef __CRYP_HandleTypeDef::Init***
  CRYP required parameters
- ***FunctionalState __CRYP_HandleTypeDef::AutoKeyDerivation***
  Used only in TinyAES to allow to bypass or not key write-up before decryption. This parameter can be a value of ENABLE/DISABLE
- ***uint32_t* __CRYP_HandleTypeDef::pCrypInBuffPtr***
  Pointer to CRYP processing (encryption, decryption,...) buffer
- ***uint32_t* __CRYP_HandleTypeDef::pCrypOutBuffPtr***
  Pointer to CRYP processing (encryption, decryption,...) buffer
- ***__IO uint16_t __CRYP_HandleTypeDef::CrypHeaderCount***
  Counter of header data in words
- ***__IO uint16_t __CRYP_HandleTypeDef::CrypInCount***
  Counter of input data in words
- ***__IO uint16_t __CRYP_HandleTypeDef::CrypOutCount***
  Counter of output data in words
- ***uint16_t __CRYP_HandleTypeDef::Size***
  Length of input data
- ***uint32_t __CRYP_HandleTypeDef::Phase***
  CRYP peripheral phase
- ***DMA_HandleTypeDef* __CRYP_HandleTypeDef::hdmain***
  CRYP In DMA handle parameters
- ***DMA_HandleTypeDef* __CRYP_HandleTypeDef::hdmaout***
  CRYP Out DMA handle parameters
- ***HAL_LockTypeDef __CRYP_HandleTypeDef::Lock***
  CRYP locking object
- ***__IO HAL_CRYP_STATETypeDef __CRYP_HandleTypeDef::State***
  CRYP peripheral state
- ***__IO uint32_t __CRYP_HandleTypeDef::ErrorCode***
  CRYP peripheral error code

- ***uint32_t __CRYP_HandleTypeDef::KeyIVConfig***
  CRYP peripheral Key and IV configuration flag, used when configuration can be skipped
- ***uint32_t __CRYP_HandleTypeDef::SizesSum***
  Sum of successive payloads lengths (in bytes), stored for a single signature computation after several messages processing
- ***void(* __CRYP_HandleTypeDef::InCpltCallback)(struct __CRYP_HandleTypeDef *hcryp)***
  CRYP Input FIFO transfer completed callback
- ***void(* __CRYP_HandleTypeDef::OutCpltCallback)(struct __CRYP_HandleTypeDef *hcryp)***
  CRYP Output FIFO transfer completed callback
- ***void(* __CRYP_HandleTypeDef::ErrorCallback)(struct __CRYP_HandleTypeDef *hcryp)***
  CRYP Error callback
- ***void(* __CRYP_HandleTypeDef::MspInitCallback)(struct __CRYP_HandleTypeDef *hcryp)***
  CRYP Msp Init callback
- ***void(* __CRYP_HandleTypeDef::MspDeInitCallback)(struct __CRYP_HandleTypeDef *hcryp)***
  CRYP Msp DeInit callback

13.2 CRYP Firmware driver API description

The following section lists the various functions of the CRYP library.

13.2.1 How to use this driver

The CRYP HAL driver can be used in CRYP or TinyAES peripheral as follows:

1. Initialize the CRYP low level resources by implementing the HAL_CRYP_MspInit():
   a. Enable the CRYP interface clock using __HAL_RCC_CRYP_CLK_ENABLE() or __HAL_RCC_AES_CLK_ENABLE for TinyAES peripheral
   b. In case of using interrupts (e.g. HAL_CRYP_Encrypt_IT())
      - Configure the CRYP interrupt priority using HAL_NVIC_SetPriority()
      - Enable the CRYP IRQ handler using HAL_NVIC_EnableIRQ()
      - In CRYP IRQ handler, call HAL_CRYP_IRQHandler()
   c. In case of using DMA to control data transfer (e.g. HAL_CRYP_Encrypt_DMA())
      - Enable the DMAx interface clock using __RCC_DMAx_CLK_ENABLE()
      - Configure and enable two DMA streams one for managing data transfer from memory to peripheral (input stream) and another stream for managing data transfer from peripheral to memory (output stream)
      - Associate the initialized DMA handle to the CRYP DMA handle using __HAL_LINKDMA()
      - Configure the priority and enable the NVIC for the transfer complete interrupt on the two DMA channels. The output channel should have higher priority than the input channel HAL_NVIC_SetPriority() and HAL_NVIC_EnableIRQ().

2. Initialize the CRYP according to the specified parameters :
   a. The data type: 1-bit, 8-bit, 16-bit or 32-bit.
   b. The key size: 128, 192 or 256.
   c. The AlgoMode DES/ TDES Algorithm ECB/CBC or AES Algorithm ECB/CBC/CTR/GCM or CCM.
   d. The initialization vector (counter). It is not used in ECB mode.
   e. The key buffer used for encryption/decryption.
      - In some specific configurations, the key is written by the application code out of the HAL scope. In that case, user can still resort to the HAL APIs as usual but must make sure that pKey pointer is set to NULL.
   f. The DataWidthUnit field. It specifies whether the data length (or the payload length for authentication algorithms) is in words or bytes.
   g. The Header used only in AES GCM and CCM Algorithm for authentication.
   h. The HeaderSize providing the size of the header buffer in words or bytes, depending upon HeaderWidthUnit field.
   i. The HeaderWidthUnit field. It specifies whether the header length (for authentication algorithms) is in words or bytes.
   j. The B0 block is the first authentication block used only in AES CCM mode.
   k. The KeyIVConfigSkip used to process several messages in a row (please see more information below).
3. Three processing (encryption/decryption) functions are available:
   a. Polling mode: encryption and decryption APIs are blocking functions i.e. they process the data and wait till the processing is finished, e.g. HAL_CRYP_Encrypt & HAL_CRYP_Decrypt
   b. Interrupt mode: encryption and decryption APIs are not blocking functions i.e. they process the data under interrupt, e.g. HAL_CRYP_Encrypt_IT & HAL_CRYP_Decrypt_IT
   c. DMA mode: encryption and decryption APIs are not blocking functions i.e. the data transfer is ensured by DMA, e.g. HAL_CRYP_Encrypt_DMA & HAL_CRYP_Decrypt_DMA
4. When the processing function is called at first time after HAL_CRYP_Init() the CRYP peripheral is configured and processes the buffer in input. At second call, no need to Initialize the CRYP, user have to get current configuration via HAL_CRYP_GetConfig() API, then only HAL_CRYP_SetConfig() is requested to set new parameters, finally user can start encryption/decryption.
5. Call HAL_CRYP_DeInit() to deinitialize the CRYP peripheral.
6. To process a single message with consecutive calls to HAL_CRYP_Encrypt() or HAL_CRYP_Decrypt() without having to configure again the Key or the Initialization Vector between each API call, the field KeyIVConfigSkip of the initialization structure must be set to CRYP_KEYIVCONFIG_ONCE. Same is true for consecutive calls of HAL_CRYP_Encrypt_IT(), HAL_CRYP_Decrypt_IT(), HAL_CRYP_Encrypt_DMA() or HAL_CRYP_Decrypt_DMA().

The cryptographic processor supports following standards:

1. The data encryption standard (DES) and Triple-DES (TDES) supported only by CRYP1 peripheral:
   a. 64-bit data block processing
   b. chaining modes supported :
      - Electronic Code Book(ECB)
      - Cipher Block Chaining (CBC)
   c. keys length supported :64-bit, 128-bit and 192-bit.
2. The advanced encryption standard (AES) supported by CRYP1 & TinyAES peripheral:
   a. 128-bit data block processing
   b. chaining modes supported :
      - Electronic Code Book(ECB)
      - Cipher Block Chaining (CBC)
      - Counter mode (CTR)
      - Galois/counter mode (GCM/GMAC)
      - Counter with Cipher Block Chaining-Message(CCM)
   c. keys length Supported :
      - for CRYP1 peripheral: 128-bit, 192-bit and 256-bit.
      - for TinyAES peripheral: 128-bit and 256-bit

Note: Specific care must be taken to format the key and the Initialization Vector IV!

If the key is defined as a 128-bit long array key[127..0] = {b127 ... b0} where b127 is the MSB and b0 the LSB, the key must be stored in MCU memory

- as a sequence of words where the MSB word comes first (occupies the lowest memory address)
  - address n+0 : 0b b127 .. b120 b119 .. b112 b111 .. b104 b103 .. b96
  - address n+4 : 0b b95 .. b88 b87 .. b80 b79 .. b72 b71 .. b64
  - address n+8 : 0b b63 .. b56 b55 .. b48 b47 .. b40 b39 .. b32
  - address n+C : 0b b31 .. b24 b23 .. b16 b15 .. b8 b7 .. b0

Hereafter, another illustration when considering a 128-bit long key made of 16 bytes {B15..B0}. The 4 32-bit words that make the key must be stored as follows in MCU memory:

- address n+0 : 0x B15 B14 B13 B12
- address n+4 : 0x B11 B10 B9 B8
- address n+8 : 0x B7 B6 B5 B4
- address n+C : 0x B3 B2 B1 B0

which leads to the expected setting

- AES_KEYR3 = 0x B15 B14 B13 B12
- AES_KEYR2 = 0x B11 B10 B9 B8
- AES_KEYR1 = 0x B7 B6 B5 B4
- AES_KEYR0 = 0x B3 B2 B1 B0

Same format must be applied for a 256-bit long key made of 32 bytes {B31..B0}. The 8 32-bit words that make the key must be stored as follows in MCU memory:

- address n+00 : 0x B31 B30 B29 B28
- address n+04 : 0x B27 B26 B25 B24
- address n+08 : 0x B23 B22 B21 B20
- address n+0C : 0x B19 B18 B17 B16
- address n+10 : 0x B15 B14 B13 B12
- address n+14 : 0x B11 B10 B9 B8
- address n+18 : 0x B7 B6 B5 B4
- address n+1C : 0x B3 B2 B1 B0

which leads to the expected setting

- AES_KEYR7 = 0x B31 B30 B29 B28
- AES_KEYR6 = 0x B27 B26 B25 B24
- AES_KEYR5 = 0x B23 B22 B21 B20
- AES_KEYR4 = 0x B19 B18 B17 B16
- AES_KEYR3 = 0x B15 B14 B13 B12
- AES_KEYR2 = 0x B11 B10 B9 B8
- AES_KEYR1 = 0x B7 B6 B5 B4
- AES_KEYR0 = 0x B3 B2 B1 B0

Initialization Vector IV (4 32-bit words) format must follow the same as that of a 128-bit long key.

Note that key and IV registers are not sensitive to swap mode selection.

This section describes the AES Galois/counter mode (GCM) supported by both CRYP1 and TinyAES peripherals:

1. Algorithm supported :
   a. Galois/counter mode (GCM)
   b. Galois message authentication code (GMAC) :is exactly the same as GCM algorithm composed only by an header.

2. Four phases are performed in GCM :
   a. Init phase: peripheral prepares the GCM hash subkey (H) and do the IV processing
   b. Header phase: peripheral processes the Additional Authenticated Data (AAD), with hash computation only.
   c. Payload phase: peripheral processes the plaintext (P) with hash computation + keystream encryption + data XORing. It works in a similar way for ciphertext (C).
   d. Final phase: peripheral generates the authenticated tag (T) using the last block of data.
3. structure of message construction in GCM is defined as below :
   a. 16 bytes Initial Counter Block (ICB)composed of IV and counter
   b. The authenticated header A (also knows as Additional Authentication Data AAD) this part of the message is only authenticated, not encrypted.
   c. The plaintext message P is both authenticated and encrypted as ciphertext. GCM standard specifies that ciphertext has same bit length as the plaintext.
   d. The last block is composed of the length of A (on 64 bits) and the length of ciphertext (on 64 bits)

A more detailed description of the GCM message structure is available below.

This section describe The AES Counter with Cipher Block Chaining-Message Authentication Code (CCM) supported by both CRYP1 and TinyAES peripheral:

1. Specific parameters for CCM :
   a. B0 block : follows NIST Special Publication 800-38C,
   b. B1 block (header)
   c. CTRx block : control blocks

A detailed description of the CCM message structure is available below.

1. Four phases are performed in CCM for CRYP1 peripheral:
   a. Init phase: peripheral prepares the GCM hash subkey (H) and do the IV processing
   b. Header phase: peripheral processes the Additional Authenticated Data (AAD), with hash computation only.
   c. Payload phase: peripheral processes the plaintext (P) with hash computation + keystream encryption + data XORing. It works in a similar way for ciphertext (C).
   d. Final phase: peripheral generates the authenticated tag (T) using the last block of data.
2. CCM in TinyAES peripheral:
   a. To perform message payload encryption or decryption AES is configured in CTR mode.
   b. For authentication two phases are performed : - Header phase: peripheral processes the Additional Authenticated Data (AAD) first, then the cleartext message only cleartext payload (not the ciphertext payload) is used and no output.
   c. Final phase: peripheral generates the authenticated tag (T) using the last block of data.

Callback registration

The compilation define USE_HAL_CRYP_REGISTER_CALLBACKS when set to 1 allows the user to configure dynamically the driver callbacks. Use Functions HAL_CRYP_RegisterCallback() or HAL_CRYP_RegisterXXXCallback() to register an interrupt callback.

Function HAL_CRYP_RegisterCallback() allows to register following callbacks:

- InCpltCallback : Input FIFO transfer completed callback.
- OutCpltCallback : Output FIFO transfer completed callback.
- ErrorCallback : callback for error detection.
- MspInitCallback : CRYP MspInit.
- MspDeInitCallback : CRYP MspDeInit. This function takes as parameters the HAL peripheral handle, the Callback ID and a pointer to the user callback function.

Use function HAL_CRYP_UnRegisterCallback() to reset a callback to the default weak function. HAL_CRYP_UnRegisterCallback() takes as parameters the HAL peripheral handle, and the Callback ID. This function allows to reset following callbacks:

- InCpltCallback : Input FIFO transfer completed callback.
- OutCpltCallback : Output FIFO transfer completed callback.
- ErrorCallback : callback for error detection.
- MspInitCallback : CRYP MspInit.

- MspDeInitCallback : CRYP MspDeInit.

By default, after the HAL_CRYP_Init() and when the state is HAL_CRYP_STATE_RESET all callbacks are set to the corresponding weak functions : examples HAL_CRYP_InCpltCallback() , HAL_CRYP_OutCpltCallback(). Exception done for MspInit and MspDeInit functions that are reset to the legacy weak function in the HAL_CRYP_Init()/ HAL_CRYP_DeInit() only when these callbacks are null (not registered beforehand). if not, MspInit or MspDeInit are not null, the HAL_CRYP_Init() / HAL_CRYP_DeInit() keep and use the user MspInit/ MspDeInit functions (registered beforehand)

Callbacks can be registered/unregistered in HAL_CRYP_STATE_READY state only. Exception done MspInit/ MspDeInit callbacks that can be registered/unregistered in HAL_CRYP_STATE_READY or HAL_CRYP_STATE_RESET state, thus registered (user) MspInit/DeInit callbacks can be used during the Init/ DeInit. In that case first register the MspInit/MspDeInit user callbacks using HAL_CRYP_RegisterCallback() before calling HAL_CRYP_DeInit() or HAL_CRYP_Init() function.

When The compilation define USE_HAL_CRYP_REGISTER_CALLBACKS is set to 0 or not defined, the callback registration feature is not available and all callbacks are set to the corresponding weak functions.

Suspend/Resume feature

The compilation define USE_HAL_CRYP_SUSPEND_RESUME when set to 1 allows the user to resort to the suspend/resume feature. A low priority block processing can be suspended to process a high priority block instead. When the high priority block processing is over, the low priority block processing can be resumed, restarting from the point where it was suspended. This feature is applicable only in non-blocking interrupt mode.

User must resort to HAL_CRYP_Suspend() to suspend the low priority block processing. This API manages the hardware block processing suspension and saves all the internal data that will be needed to restart later on. Upon HAL_CRYP_Suspend() completion, the user can launch the processing of any other block (high priority block processing).

When the high priority block processing is over, user must invoke HAL_CRYP_Resume() to resume the low priority block processing. Ciphering (or deciphering) restarts from the suspension point and ends as usual.

HAL_CRYP_Suspend() reports an error when the suspension request is sent too late (i.e when the low priority block processing is about to end). There is no use to suspend the tag generation processing for authentication algorithms.

Note: If the key is written out of HAL scope (case pKey pointer set to NULL by the user), the block processing suspension/resumption mechanism is NOT applicable.

Note: If the Key and Initialization Vector are configured only once and configuration is skipped for consecutive processings (case KeyIVConfigSkip set to CRYP_KEYIVCONFIG_ONCE), the block processing suspension/ resumption mechanism is NOT applicable.

13.2.2 Initialization, de-initialization and Set and Get configuration functions

This section provides functions allowing to:

- Initialize the CRYP
- DeInitialize the CRYP
- Initialize the CRYP MSP
- DeInitialize the CRYP MSP
- configure CRYP (HAL_CRYP_SetConfig) with the specified parameters in the CRYP_ConfigTypeDef Parameters which are configured in This section are :
  - Key size
  - Data Type : 32,16, 8 or 1bit
  - AlgoMode :
    - for CRYP1 peripheral : ECB and CBC in DES/TDES Standard ECB,CBC,CTR,GCM/GMAC and CCM in AES Standard.
    - for TinyAES2 peripheral, only ECB,CBC,CTR,GCM/GMAC and CCM in AES Standard are supported.
- Get CRYP configuration (HAL_CRYP_GetConfig) from the specified parameters in the CRYP_HandleTypeDef

This section contains the following APIs:

- ***HAL_CRYP_Init()***

- *HAL_CRYP_DeInit()*
- *HAL_CRYP_SetConfig()*
- *HAL_CRYP_GetConfig()*
- *HAL_CRYP_MspInit()*
- *HAL_CRYP_MspDeInit()*
- *HAL_CRYP_RegisterCallback()*
- *HAL_CRYP_UnRegisterCallback()*

13.2.3 Encrypt Decrypt functions

This section provides API allowing to Encrypt/Decrypt Data following Standard DES/TDES or AES, and Algorithm configured by the user:

- Standard DES/TDES only supported by CRYP1 peripheral, below list of Algorithm supported : - Electronic Code Book(ECB) - Cipher Block Chaining (CBC)
- Standard AES supported by CRYP1 peripheral & TinyAES, list of Algorithm supported: - Electronic Code Book(ECB) - Cipher Block Chaining (CBC) - Counter mode (CTR) - Cipher Block Chaining (CBC) - Counter mode (CTR) - Galois/counter mode (GCM) - Counter with Cipher Block Chaining-Message(CCM)

Three processing functions are available:

- Polling mode : HAL_CRYP_Encrypt & HAL_CRYP_Decrypt
- Interrupt mode : HAL_CRYP_Encrypt_IT & HAL_CRYP_Decrypt_IT
- DMA mode : HAL_CRYP_Encrypt_DMA & HAL_CRYP_Decrypt_DMA

This section contains the following APIs:

- *HAL_CRYP_Encrypt()*
- *HAL_CRYP_Decrypt()*
- *HAL_CRYP_Encrypt_IT()*
- *HAL_CRYP_Decrypt_IT()*
- *HAL_CRYP_Encrypt_DMA()*
- *HAL_CRYP_Decrypt_DMA()*

13.2.4 CRYP IRQ handler management

This section provides CRYP IRQ handler and callback functions.

- HAL_CRYP_IRQHandler CRYP interrupt request
- HAL_CRYP_InCpltCallback input data transfer complete callback
- HAL_CRYP_OutCpltCallback output data transfer complete callback
- HAL_CRYP_ErrorCallback CRYP error callback
- HAL_CRYP_GetState return the CRYP state
- HAL_CRYP_GetError return the CRYP error code

This section contains the following APIs:

- *HAL_CRYP_IRQHandler()*
- *HAL_CRYP_GetError()*
- *HAL_CRYP_GetState()*
- *HAL_CRYP_InCpltCallback()*
- *HAL_CRYP_OutCpltCallback()*
- *HAL_CRYP_ErrorCallback()*

13.2.5 Detailed description of functions

HAL_CRYP_Init

Function name

HAL_StatusTypeDef HAL_CRYP_Init (CRYP_HandleTypeDef * hcryp)

Function description

Initializes the CRYP according to the specified parameters in the CRYP_ConfigTypeDef and creates the associated handle.

Parameters

- **hcryp:** pointer to a CRYP_HandleTypeDef structure that contains the configuration information for CRYP module

Return values

- **HAL:** status

HAL_CRYP_DeInit

Function name

HAL_StatusTypeDef HAL_CRYP_DeInit (CRYP_HandleTypeDef * hcryp)

Function description

De-Initializes the CRYP peripheral.

Parameters

- **hcryp:** pointer to a CRYP_HandleTypeDef structure that contains the configuration information for CRYP module

Return values

- **HAL:** status

HAL_CRYP_MspInit

Function name

void HAL_CRYP_MspInit (CRYP_HandleTypeDef * hcryp)

Function description

Initializes the CRYP MSP.

Parameters

- **hcryp:** pointer to a CRYP_HandleTypeDef structure that contains the configuration information for CRYP module

Return values

- **None:**

HAL_CRYP_MspDeInit

Function name

void HAL_CRYP_MspDeInit (CRYP_HandleTypeDef * hcryp)

Function description

DeInitializes CRYP MSP.

Parameters

- **hcryp:** pointer to a CRYP_HandleTypeDef structure that contains the configuration information for CRYP module

Return values

- **None:**

HAL_CRYP_SetConfig

Function name

HAL_StatusTypeDef HAL_CRYP_SetConfig (CRYP_HandleTypeDef * hcryp, CRYP_ConfigTypeDef * pConf)

Function description

Configure the CRYP according to the specified parameters in the CRYP_ConfigTypeDef.

Parameters

- **hcryp:** pointer to a CRYP_HandleTypeDef structure
- **pConf:** pointer to a CRYP_ConfigTypeDef structure that contains the configuration information for CRYP module

Return values

- **HAL:** status

HAL_CRYP_GetConfig

Function name

HAL_StatusTypeDef HAL_CRYP_GetConfig (CRYP_HandleTypeDef * hcryp, CRYP_ConfigTypeDef * pConf)

Function description

Get CRYP Configuration parameters in associated handle.

Parameters

- **pConf:** pointer to a CRYP_ConfigTypeDef structure
- **hcryp:** pointer to a CRYP_HandleTypeDef structure that contains the configuration information for CRYP module

Return values

- **HAL:** status

HAL_CRYP_RegisterCallback

Function name

HAL_StatusTypeDef HAL_CRYP_RegisterCallback (CRYP_HandleTypeDef * hcryp, HAL_CRYP_CallbackIDTypeDef CallbackID, pCRYP_CallbackTypeDef pCallback)

Function description

Register a User CRYP Callback To be used instead of the weak predefined callback.

Parameters

- **hcryp:** cryp handle
- **CallbackID:** ID of the callback to be registered This parameter can be one of the following values:
  - HAL_CRYP_INPUT_COMPLETE_CB_ID Input FIFO transfer completed callback ID
  - HAL_CRYP_OUTPUT_COMPLETE_CB_ID Output FIFO transfer completed callback ID
  - HAL_CRYP_ERROR_CB_ID Error callback ID
  - HAL_CRYP_MSPINIT_CB_ID MspInit callback ID
  - HAL_CRYP_MSPDEINIT_CB_ID MspDeInit callback ID
- **pCallback:** pointer to the Callback function

Return values

- **status:**

HAL_CRYP_UnRegisterCallback

Function name

HAL_StatusTypeDef HAL_CRYP_UnRegisterCallback (CRYP_HandleTypeDef * hcryp, HAL_CRYP_CallbackIDTypeDef CallbackID)

Function description

Unregister an CRYP Callback CRYP callback is redirected to the weak predefined callback.

Parameters

- **hcryp:** cryp handle
- **CallbackID:** ID of the callback to be unregistered This parameter can be one of the following values:
  - HAL_CRYP_INPUT_COMPLETE_CB_ID Input FIFO transfer completed callback ID
  - HAL_CRYP_OUTPUT_COMPLETE_CB_ID Output FIFO transfer completed callback ID
  - HAL_CRYP_ERROR_CB_ID Error callback ID
  - HAL_CRYP_MSPINIT_CB_ID MspInit callback ID
  - HAL_CRYP_MSPDEINIT_CB_ID MspDeInit callback ID

Return values

- **status:**

HAL_CRYP_Encrypt

Function name

HAL_StatusTypeDef HAL_CRYP_Encrypt (CRYP_HandleTypeDef * hcryp, uint32_t * Input, uint16_t Size, uint32_t * Output, uint32_t Timeout)

Function description

Encryption mode.

Parameters

- **hcryp:** pointer to a CRYP_HandleTypeDef structure that contains the configuration information for CRYP module
- **Input:** Pointer to the input buffer (plaintext)
- **Size:** Length of the plaintext buffer in bytes or words (depending upon DataWidthUnit field)
- **Output:** Pointer to the output buffer(ciphertext)
- **Timeout:** Specify Timeout value

Return values

- **HAL:** status

HAL_CRYP_Decrypt

Function name

HAL_StatusTypeDef HAL_CRYP_Decrypt (CRYP_HandleTypeDef * hcryp, uint32_t * Input, uint16_t Size, uint32_t * Output, uint32_t Timeout)

Function description

Decryption mode.

Parameters

- **hcryp:** pointer to a CRYP_HandleTypeDef structure that contains the configuration information for CRYP module
- **Input:** Pointer to the input buffer (ciphertext)
- **Size:** Length of the plaintext buffer in bytes or words (depending upon DataWidthUnit field)
- **Output:** Pointer to the output buffer(plaintext)
- **Timeout:** Specify Timeout value

Return values

- **HAL:** status

HAL_CRYP_Encrypt_IT

Function name

HAL_StatusTypeDef HAL_CRYP_Encrypt_IT (CRYP_HandleTypeDef * hcryp, uint32_t * Input, uint16_t Size, uint32_t * Output)

Function description

Encryption in interrupt mode.

Parameters

- **hcryp:** pointer to a CRYP_HandleTypeDef structure that contains the configuration information for CRYP module
- **Input:** Pointer to the input buffer (plaintext)
- **Size:** Length of the plaintext buffer in bytes or words (depending upon DataWidthUnit field)
- **Output:** Pointer to the output buffer(ciphertext)

Return values

- **HAL:** status

HAL_CRYP_Decrypt_IT

Function name

HAL_StatusTypeDef HAL_CRYP_Decrypt_IT (CRYP_HandleTypeDef * hcryp, uint32_t * Input, uint16_t Size, uint32_t * Output)

Function description

Decryption in interrupt mode.

Parameters

- **hcryp:** pointer to a CRYP_HandleTypeDef structure that contains the configuration information for CRYP module
- **Input:** Pointer to the input buffer (ciphertext)
- **Size:** Length of the plaintext buffer in bytes or words (depending upon DataWidthUnit field)
- **Output:** Pointer to the output buffer(plaintext)

Return values

- **HAL:** status

HAL_CRYP_Encrypt_DMA

Function name

HAL_StatusTypeDef HAL_CRYP_Encrypt_DMA (CRYP_HandleTypeDef * hcryp, uint32_t * Input, uint16_t Size, uint32_t * Output)

Function description

Encryption in DMA mode.

Parameters

- **hcryp:** pointer to a CRYP_HandleTypeDef structure that contains the configuration information for CRYP module
- **Input:** Pointer to the input buffer (plaintext)
- **Size:** Length of the plaintext buffer in bytes or words (depending upon DataWidthUnit field)
- **Output:** Pointer to the output buffer(ciphertext)

Return values

- **HAL:** status

HAL_CRYP_Decrypt_DMA

Function name

HAL_StatusTypeDef HAL_CRYP_Decrypt_DMA (CRYP_HandleTypeDef * hcryp, uint32_t * Input, uint16_t Size, uint32_t * Output)

Function description

Decryption in DMA mode.

Parameters

- **hcryp:** pointer to a CRYP_HandleTypeDef structure that contains the configuration information for CRYP module
- **Input:** Pointer to the input buffer (ciphertext)
- **Size:** Length of the plaintext buffer in bytes or words (depending upon DataWidthUnit field)
- **Output:** Pointer to the output buffer(plaintext)

Return values

- **HAL:** status

HAL_CRYP_IRQHandler

Function name

void HAL_CRYP_IRQHandler (CRYP_HandleTypeDef * hcryp)

Function description

This function handles cryptographic interrupt request.

Parameters

- **hcryp:** pointer to a CRYP_HandleTypeDef structure that contains the configuration information for CRYP module

Return values

- **None:**

HAL_CRYP_GetState

Function name

HAL_CRYP_STATETypeDef HAL_CRYP_GetState (CRYP_HandleTypeDef * hcryp)

Function description

Returns the CRYP state.

Parameters

- **hcryp:** pointer to a CRYP_HandleTypeDef structure that contains the configuration information for CRYP module.

Return values

- **HAL:** state

HAL_CRYP_InCpltCallback

Function name

void HAL_CRYP_InCpltCallback (CRYP_HandleTypeDef * hcryp)

Function description

Input FIFO transfer completed callback.

Parameters

- **hcryp:** pointer to a CRYP_HandleTypeDef structure that contains the configuration information for CRYP module.

Return values

- **None:**

HAL_CRYP_OutCpltCallback

Function name

void HAL_CRYP_OutCpltCallback (CRYP_HandleTypeDef * hcryp)

Function description

Output FIFO transfer completed callback.

Parameters

- **hcryp:** pointer to a CRYP_HandleTypeDef structure that contains the configuration information for CRYP module.

Return values

- **None:**

HAL_CRYP_ErrorCallback

Function name

void HAL_CRYP_ErrorCallback (CRYP_HandleTypeDef * hcryp)

Function description

CRYP error callback.

Parameters

- **hcryp:** pointer to a CRYP_HandleTypeDef structure that contains the configuration information for CRYP module.

Return values

- **None:**

HAL_CRYP_GetError

Function name

uint32_t HAL_CRYP_GetError (CRYP_HandleTypeDef * hcryp)

Function description

Return the CRYP error code.

Parameters

- **hcryp:** pointer to a CRYP_HandleTypeDef structure that contains the configuration information for the CRYP peripheral

Return values

- **CRYP:** error code

13.3 CRYP Firmware driver defines

The following section lists the various define and macros of the module.

13.3.1 CRYP

CRYP

CRYP Algorithm Mode

CRYP_AES_ECB

Electronic codebook chaining algorithm

CRYP_AES_CBC

Cipher block chaining algorithm

CRYP_AES_CTR

Counter mode chaining algorithm

CRYP_AES_GCM_GMAC

Galois counter mode - Galois message authentication code

CRYP_AES_CCM

Counter with Cipher Mode

CRYP Key and IV Configuration Skip Mode

CRYP_KEYIVCONFIG_ALWAYS

Peripheral Key and IV configuration to do systematically

CRYP_KEYIVCONFIG_ONCE

Peripheral Key and IV configuration to do only once

CRYP Data Type

CRYP_DATATYPE_32B

32-bit data type (no swapping)

CRYP_DATATYPE_16B

16-bit data type (half-word swapping)

CRYP_DATATYPE_8B

8-bit data type (byte swapping)

CRYP_DATATYPE_1B

1-bit data type (bit swapping)

CRYP Data Width Unit

CRYP_DATAWIDTHUNIT_WORD

By default, size unit is word

CRYP_DATAWIDTHUNIT_BYTE

By default, size unit is byte

CRYP Error Definition

HAL_CRYP_ERROR_NONE

No error

HAL_CRYP_ERROR_WRITE

Write error

HAL_CRYP_ERROR_READ

Read error

HAL_CRYP_ERROR_DMA

DMA error

HAL_CRYP_ERROR_BUSY

Busy flag error

HAL_CRYP_ERROR_TIMEOUT

Timeout error

HAL_CRYP_ERROR_NOT_SUPPORTED

Not supported mode

HAL_CRYP_ERROR_AUTH_TAG_SEQUENCE

Sequence are not respected only for GCM or CCM

HAL_CRYP_ERROR_INVALID_CALLBACK

Invalid Callback error

CRYP Exported Macros

__HAL_CRYP_RESET_HANDLE_STATE

Description:

- Reset CRYP handle state.

Parameters:

- __HANDLE__: specifies the CRYP handle.

Return value:

- None

__HAL_CRYP_ENABLE

Description:

- Enable/Disable the CRYP peripheral.

Parameters:

- __HANDLE__: specifies the CRYP handle.

Return value:

- None

__HAL_CRYP_DISABLE

CRYP_FLAG_MASK

Description:

- Check whether the specified CRYP status flag is set or not.

Parameters:

- __HANDLE__: specifies the CRYP handle.
- __FLAG__: specifies the flag to check. This parameter can be one of the following values for TinyAES:
  - CRYP_FLAG_BUSY GCM process suspension forbidden
  - CRYP_IT_WRERR Write Error
  - CRYP_IT_RDERR Read Error
  - CRYP_IT_CCF Computation Complete This parameter can be one of the following values for CRYP:
  - CRYP_FLAG_BUSY: The CRYP core is currently processing a block of data or a key preparation (for AES decryption).
  - CRYP_FLAG_IFEM: Input FIFO is empty
  - CRYP_FLAG_IFNF: Input FIFO is not full
  - CRYP_FLAG_INRIS: Input FIFO service raw interrupt is pending
  - CRYP_FLAG_OFNE: Output FIFO is not empty
  - CRYP_FLAG_OFFU: Output FIFO is full
  - CRYP_FLAG_OUTRIS: Input FIFO service raw interrupt is pending

Return value:

- The: state of __FLAG__ (TRUE or FALSE).

__HAL_CRYP_GET_FLAG

__HAL_CRYP_CLEAR_FLAG

Description:

- Clear the CRYP pending status flag.

Parameters:

- __HANDLE__: specifies the CRYP handle.
- __FLAG__: specifies the flag to clear. This parameter can be one of the following values:
  - CRYP_ERR_CLEAR Read (RDERR) or Write Error (WRERR) Flag Clear
  - CRYP_CCF_CLEAR Computation Complete Flag (CCF) Clear

Return value:

- None

__HAL_CRYP_GET_IT_SOURCE

Description:

- Check whether the specified CRYP interrupt source is enabled or not.

Parameters:

- __HANDLE__: specifies the CRYP handle.
- __INTERRUPT__: CRYP interrupt source to check This parameter can be one of the following values for TinyAES:
  - CRYP_IT_ERRIE Error interrupt (used for RDERR and WRERR)
  - CRYP_IT_CCFIE Computation Complete interrupt

Return value:

- State: of interruption (TRUE or FALSE).

__HAL_CRYP_GET_IT

Description:

- Check whether the specified CRYP interrupt is set or not.

Parameters:

- __HANDLE__: specifies the CRYP handle.
- __INTERRUPT__: specifies the interrupt to check. This parameter can be one of the following values for TinyAES:
  - CRYP_IT_WRERR Write Error
  - CRYP_IT_RDERR Read Error
  - CRYP_IT_CCF Computation Complete This parameter can be one of the following values for CRYP:
  - CRYP_IT_INI: Input FIFO service masked interrupt status
  - CRYP_IT_OUTI: Output FIFO service masked interrupt status

Return value:

- The: state of __INTERRUPT__ (TRUE or FALSE).

__HAL_CRYP_ENABLE_IT

Description:

- Enable the CRYP interrupt.

Parameters:

- __HANDLE__: specifies the CRYP handle.
- __INTERRUPT__: CRYP Interrupt. This parameter can be one of the following values for TinyAES:
  - CRYP_IT_ERRIE Error interrupt (used for RDERR and WRERR)
  - CRYP_IT_CCFIE Computation Complete interrupt This parameter can be one of the following values for CRYP: @ CRYP_IT_INI : Input FIFO service interrupt mask. @ CRYP_IT_OUTI : Output FIFO service interrupt mask.CRYP interrupt.

Return value:

- None

__HAL_CRYP_DISABLE_IT

Description:

- Disable the CRYP interrupt.

Parameters:

- __HANDLE__: specifies the CRYP handle.
- __INTERRUPT__: CRYP Interrupt. This parameter can be one of the following values for TinyAES:
  - CRYP_IT_ERRIE Error interrupt (used for RDERR and WRERR)
  - CRYP_IT_CCFIE Computation Complete interrupt This parameter can be one of the following values for CRYP: @ CRYP_IT_INI : Input FIFO service interrupt mask. @ CRYP_IT_OUTI : Output FIFO service interrupt mask.CRYP interrupt.

Return value:

- None

CRYP Flags

CRYP_FLAG_BUSY

GCM process suspension forbidden

CRYP_FLAG_WRERR

Write Error

CRYP_FLAG_RDERR

Read error

CRYP_FLAG_CCF

Computation completed

CRYP_CCF_CLEAR

Computation Complete Flag Clear

CRYP_ERR_CLEAR

Error Flag Clear

CRYP Header Width Unit

CRYP_HEADERWIDTHUNIT_WORD

By default, header size unit is word

CRYP_HEADERWIDTHUNIT_BYTE

By default, header size unit is byte

CRYP Interrupt

CRYP_IT_CCFIE

Computation Complete interrupt enable

CRYP_IT_ERRIE

Error interrupt enable

CRYP_IT_WRERR

Write Error

CRYP_IT_RDERR

Read Error

CRYP_IT_CCF

Computation completed

CRYP Private macros to check input parameters

IS_CRYP_ALGORITHM

IS_CRYP_KEYSIZE

IS_CRYP_DATATYPE

IS_CRYP_INIT

IS_CRYP_BUFFERSIZE

CRYP Key Size

CRYP_KEYSIZE_128B

128-bit long key

CRYP_KEYSIZE_256B

256-bit long key

14 HAL CRYP Extension Driver

14.1 CRYPEx Firmware driver API description

The following section lists the various functions of the CRYPEx library.

14.1.1 Extended AES processing functions

This section provides functions allowing to generate the authentication TAG in Polling mode

1. HAL_CRYPEx_AESGCM_GenerateAuthTAG
2. HAL_CRYPEx_AESCCM_GenerateAuthTAG they should be used after Encrypt/Decrypt operation.

This section contains the following APIs:

- ***HAL_CRYPEx_AESGCM_GenerateAuthTAG()***
- ***HAL_CRYPEx_AESCCM_GenerateAuthTAG()***

14.1.2 Key Derivation functions

This section provides functions allowing to Enable or Disable the the AutoKeyDerivation parameter in CRYP_HandleTypeDef structure These function are allowed only in TinyAES peripheral.

This section contains the following APIs:

- ***HAL_CRYPEx_EnableAutoKeyDerivation()***
- ***HAL_CRYPEx_DisableAutoKeyDerivation()***

14.1.3 Detailed description of functions

HAL_CRYPEx_AESGCM_GenerateAuthTAG

Function name

HAL_StatusTypeDef HAL_CRYPEx_AESGCM_GenerateAuthTAG (CRYP_HandleTypeDef * hcryp, uint32_t * AuthTag, uint32_t Timeout)

Function description

generate the GCM authentication TAG.

Parameters

- **hcryp:** pointer to a CRYP_HandleTypeDef structure that contains the configuration information for CRYP module
- **AuthTag:** Pointer to the authentication buffer
- **Timeout:** Timeout duration

Return values

- **HAL:** status

HAL_CRYPEx_AESCCM_GenerateAuthTAG

Function name

HAL_StatusTypeDef HAL_CRYPEx_AESCCM_GenerateAuthTAG (CRYP_HandleTypeDef * hcryp, uint32_t * AuthTag, uint32_t Timeout)

Function description

AES CCM Authentication TAG generation.

Parameters

- **hcryp:** pointer to a CRYP_HandleTypeDef structure that contains the configuration information for CRYP module
- **AuthTag:** Pointer to the authentication buffer
- **Timeout:** Timeout duration

Return values

- **HAL:** status

HAL_CRYPEx_EnableAutoKeyDerivation

Function name

void HAL_CRYPEx_EnableAutoKeyDerivation (CRYP_HandleTypeDef * hcryp)

Function description

AES enable key derivation functions.

Parameters

- **hcryp:** pointer to a CRYP_HandleTypeDef structure.

HAL_CRYPEx_DisableAutoKeyDerivation

Function name

void HAL_CRYPEx_DisableAutoKeyDerivation (CRYP_HandleTypeDef * hcryp)

Function description

AES disable key derivation functions.

Parameters

- **hcryp:** pointer to a CRYP_HandleTypeDef structure.

15 HAL DAC Generic Driver

15.1 DAC Firmware driver registers structures

15.1.1 __DAC_HandleTypeDef

__DAC_HandleTypeDef is defined in the stm32u0xx_hal_dac.h

Data Fields

- ***DAC_TypeDef * Instance***
- ***__IO HAL_DAC_StateTypeDef State***
- ***HAL_LockTypeDef Lock***
- ***DMA_HandleTypeDef * DMA_Handle1***
- ***DMA_HandleTypeDef * DMA_Handle2***
- ***__IO uint32_t ErrorCode***
- ***void(* ConvCpltCallbackCh1***
- ***void(* ConvHalfCpltCallbackCh1***
- ***void(* ErrorCallbackCh1***
- ***void(* DMAUnderrunCallbackCh1***
- ***void(* MspInitCallback***
- ***void(* MspDeInitCallback***

Field Documentation

- ***DAC_TypeDef* __DAC_HandleTypeDef::Instance***
  Register base address
- ***__IO HAL_DAC_StateTypeDef __DAC_HandleTypeDef::State***
  DAC communication state
- ***HAL_LockTypeDef __DAC_HandleTypeDef::Lock***
  DAC locking object
- ***DMA_HandleTypeDef* __DAC_HandleTypeDef::DMA_Handle1***
  Pointer DMA handler for channel 1
- ***DMA_HandleTypeDef* __DAC_HandleTypeDef::DMA_Handle2***
  Pointer DMA handler for channel 2
- ***__IO uint32_t __DAC_HandleTypeDef::ErrorCode***
  DAC Error code
- ***void(* __DAC_HandleTypeDef::ConvCpltCallbackCh1)(struct __DAC_HandleTypeDef *hdac)***
- ***void(* __DAC_HandleTypeDef::ConvHalfCpltCallbackCh1)(struct __DAC_HandleTypeDef *hdac)***
- ***void(* __DAC_HandleTypeDef::ErrorCallbackCh1)(struct __DAC_HandleTypeDef *hdac)***
- ***void(* __DAC_HandleTypeDef::DMAUnderrunCallbackCh1)(struct __DAC_HandleTypeDef *hdac)***
- ***void(* __DAC_HandleTypeDef::MspInitCallback)(struct __DAC_HandleTypeDef *hdac)***
- ***void(* __DAC_HandleTypeDef::MspDeInitCallback)(struct __DAC_HandleTypeDef *hdac)***

15.1.2 DAC_SampleAndHoldConfTypeDef

DAC_SampleAndHoldConfTypeDef is defined in the stm32u0xx_hal_dac.h

Data Fields

- ***uint32_t DAC_SampleTime***
- ***uint32_t DAC_HoldTime***
- ***uint32_t DAC_RefreshTime***

Field Documentation

- ***uint32_t DAC_SampleAndHoldConfTypeDef::DAC_SampleTime***
  Specifies the Sample time for the selected channel. This parameter applies when DAC_SampleAndHold is DAC_SAMPLEANDHOLD_ENABLE. This parameter must be a number between Min_Data = 0 and Max_Data = 1023

- ***uint32_t DAC_SampleAndHoldConfTypeDef::DAC_HoldTime***
  Specifies the hold time for the selected channel This parameter applies when DAC_SampleAndHold is DAC_SAMPLEANDHOLD_ENABLE. This parameter must be a number between Min_Data = 0 and Max_Data = 1023
- ***uint32_t DAC_SampleAndHoldConfTypeDef::DAC_RefreshTime***
  Specifies the refresh time for the selected channel This parameter applies when DAC_SampleAndHold is DAC_SAMPLEANDHOLD_ENABLE. This parameter must be a number between Min_Data = 0 and Max_Data = 255

15.1.3 DAC_ChannelConfTypeDef

DAC_ChannelConfTypeDef is defined in the stm32u0xx_hal_dac.h

Data Fields

- ***uint32_t DAC_SampleAndHold***
- ***uint32_t DAC_Trigger***
- ***uint32_t DAC_OutputBuffer***
- ***uint32_t DAC_ConnectOnChipPeripheral***
- ***uint32_t DAC_UserTrimming***
- ***uint32_t DAC_TrimmingValue***
- ***DAC_SampleAndHoldConfTypeDef DAC_SampleAndHoldConfig***

Field Documentation

- ***uint32_t DAC_ChannelConfTypeDef::DAC_SampleAndHold***
  Specifies whether the DAC mode. This parameter can be a value of ***DAC_SampleAndHold***
- ***uint32_t DAC_ChannelConfTypeDef::DAC_Trigger***
  Specifies the external trigger for the selected DAC channel. This parameter can be a value of ***DAC_trigger_selection***
- ***uint32_t DAC_ChannelConfTypeDef::DAC_OutputBuffer***
  Specifies whether the DAC channel output buffer is enabled or disabled. This parameter can be a value of ***DAC_output_buffer***
- ***uint32_t DAC_ChannelConfTypeDef::DAC_ConnectOnChipPeripheral***
  Specifies whether the DAC output is connected or not to on chip peripheral. This parameter can be a value of ***DAC_ConnectOnChipPeripheral***
- ***uint32_t DAC_ChannelConfTypeDef::DAC_UserTrimming***
  Specifies the trimming mode This parameter must be a value of ***DAC_UserTrimming*** DAC_UserTrimming is either factory or user trimming
- ***uint32_t DAC_ChannelConfTypeDef::DAC_TrimmingValue***
  Specifies the offset trimming value i.e. when DAC_SampleAndHold is DAC_TRIMMING_USER. This parameter must be a number between Min_Data = 1 and Max_Data = 31
- ***DAC_SampleAndHoldConfTypeDef DAC_ChannelConfTypeDef::DAC_SampleAndHoldConfig***
  Sample and Hold settings

15.2 DAC Firmware driver API description

The following section lists the various functions of the DAC library.

15.2.1 DAC Peripheral features

DAC Channels

#error "Please implement comment here for your STM32 series"

DAC Buffer mode feature

Each DAC channel integrates an output buffer that can be used to reduce the output impedance, and to drive external loads directly without having to add an external operational amplifier. To enable, the output buffer use sConfig.DAC_OutputBuffer = DAC_OUTPUTBUFFER_ENABLE;

Note: Refer to the device datasheet for more details about output impedance value with and without output buffer.

GPIO configurations guidelines

When a DAC channel is used (ex channel1 on PA4) and the other is not (ex channel2 on PA5 is configured in Analog and disabled). Channel1 may disturb channel2 as coupling effect. Note that there is no coupling on channel2 as soon as channel2 is turned on. Coupling on adjacent channel could be avoided as follows: when unused PA5 is configured as INPUT PULL-UP or DOWN. PA5 is configured in ANALOG just before it is turned on.

DAC Sample and Hold feature

For each converter, 2 modes are supported: normal mode and "sample and hold" mode (i.e. low power mode). In the sample and hold mode, the DAC core converts data, then holds the converted voltage on a capacitor. When not converting, the DAC cores and buffer are completely turned off between samples and the DAC output is tri-stated, therefore reducing the overall power consumption. A new stabilization period is needed before each new conversion. The sample and hold allow setting internal or external voltage @ low power consumption cost (output value can be at any given rate either by CPU or DMA). The Sample and hold block and registers uses either LSI & run in several power modes: run mode, sleep mode, low power run, low power sleep mode & stop1 mode. Low power stop1 mode allows only static conversion. To enable Sample and Hold mode Enable LSI using HAL_RCC_OscConfig with RCC_OSCILLATORTYPE_LSI & RCC_LSI_ON parameters. Use DAC_InitStructure.DAC_SampleAndHold = DAC_SAMPLEANDHOLD_ENABLE; & DAC_ChannelConfTypeDef.DAC_SampleAndHoldConfig.DAC_SampleTime, DAC_HoldTime & DAC_RefreshTime;

DAC calibration feature

1. The 2 converters (channel1 & channel2) provide calibration capabilities.
   - Calibration aims at correcting some offset of output buffer.
   - The DAC uses either factory calibration settings OR user defined calibration (trimming) settings (i.e. trimming mode).
   - The user defined settings can be figured out using self calibration handled by HAL_DACEx_SelfCalibrate.
   - HAL_DACEx_SelfCalibrate:
     - Runs automatically the calibration.
     - Enables the user trimming mode
     - Updates a structure with trimming values with fresh calibration results. The user may store the calibration results for larger (ex monitoring the trimming as a function of temperature for instance)

DAC wave generation feature

Both DAC channels can be used to generate

1. Noise wave
2. Triangle wave

DAC data format

The DAC data format can be:

1. 8-bit right alignment using DAC_ALIGN_8B_R
2. 12-bit left alignment using DAC_ALIGN_12B_L
3. 12-bit right alignment using DAC_ALIGN_12B_R

DAC data value to voltage correspondence

The analog output voltage on each DAC channel pin is determined by the following equation:

DAC_OUTx = VREF+ * DOR / 4095

- with DOR is the Data Output Register

VREF+ is the input voltage reference (refer to the device datasheet)

e.g. To set DAC_OUT1 to 0.7V, use

- Assuming that VREF+ = 3.3V, DAC_OUT1 = (3.3 * 868) / 4095 = 0.7V

DMA requests

#error "Please implement comment here for your STM32 series"

Note: For Dual mode and specific signal (Triangle and noise) generation please refer to Extended Features Driver description

15.2.2 How to use this driver

- DAC APB clock must be enabled to get write access to DAC registers using HAL_DAC_Init() #error "Please implement comment here for your STM32 series"
- Configure the DAC channel using HAL_DAC_ConfigChannel() function.
- Enable the DAC channel using HAL_DAC_Start() or HAL_DAC_Start_DMA() functions.

Calibration mode IO operation

- Retrieve the factory trimming (calibration settings) using HAL_DACEx_GetTrimOffset()
- Run the calibration using HAL_DACEx_SelfCalibrate()
- Update the trimming while DAC running using HAL_DACEx_SetUserTrimming()

Polling mode IO operation

- Start the DAC peripheral using HAL_DAC_Start()
- To read the DAC last data output value, use the HAL_DAC_GetValue() function.
- Stop the DAC peripheral using HAL_DAC_Stop()

DMA mode IO operation

- Start the DAC peripheral using HAL_DAC_Start_DMA(), at this stage the user specify the length of data to be transferred at each end of conversion First issued trigger will start the conversion of the value previously set by HAL_DAC_SetValue().
- At the middle of data transfer HAL_DAC_ConvHalfCpltCallbackCh1() function is executed and user can add his own code by customization of function pointer HAL_DAC_ConvHalfCpltCallbackCh1()
- At The end of data transfer HAL_DAC_ConvCpltCallbackCh1() function is executed and user can add his own code by customization of function pointer HAL_DAC_ConvCpltCallbackCh1()
- In case of transfer Error, HAL_DAC_ErrorCallbackCh1() function is executed and user can add his own code by customization of function pointer HAL_DAC_ErrorCallbackCh1 #error "Please implement comment here for your STM32 series"
- Stop the DAC peripheral using HAL_DAC_Stop_DMA()

Callback registration

The compilation define USE_HAL_DAC_REGISTER_CALLBACKS when set to 1 allows the user to configure dynamically the driver callbacks. Use Functions HAL_DAC_RegisterCallback() to register a user callback, it allows to register following callbacks:

- ConvCpltCallbackCh1 : callback when a half transfer is completed on Ch1.
- ConvHalfCpltCallbackCh1 : callback when a transfer is completed on Ch1.
- ErrorCallbackCh1 : callback when an error occurs on Ch1.
- DMAUnderrunCallbackCh1 : callback when an underrun error occurs on Ch1.
- MspInitCallback : DAC MspInit.
- MspDeInitCallback : DAC MspdeInit. This function takes as parameters the HAL peripheral handle, the Callback ID and a pointer to the user callback function. Use function HAL_DAC_UnRegisterCallback() to reset a callback to the default weak (overridden) function. It allows to reset following callbacks:
- ConvCpltCallbackCh1 : callback when a half transfer is completed on Ch1.
- ConvHalfCpltCallbackCh1 : callback when a transfer is completed on Ch1.
- ErrorCallbackCh1 : callback when an error occurs on Ch1.
- DMAUnderrunCallbackCh1 : callback when an underrun error occurs on Ch1.
- MspInitCallback : DAC MspInit.

- MspDeInitCallback : DAC MspdeInit.
- All Callbacks This function) takes as parameters the HAL peripheral handle and the Callback ID. By default, after the HAL_DAC_Init and if the state is HAL_DAC_STATE_RESET all callbacks are reset to the corresponding legacy weak (overridden) functions. Exception done for MspInit and MspDeInit callbacks that are respectively reset to the legacy weak (overridden) functions in the HAL_DAC_Init and HAL_DAC_DeInit only when these callbacks are null (not registered beforehand). If not, MspInit or MspDeInit are not null, the HAL_DAC_Init and HAL_DAC_DeInit keep and use the user MspInit/MspDeInit callbacks (registered beforehand) Callbacks can be registered/unregistered in READY state only. Exception done for MspInit/MspDeInit callbacks that can be registered/unregistered in READY or RESET state, thus registered (user) MspInit/DeInit callbacks can be used during the Init/DeInit. In that case first register the MspInit/MspDeInit user callbacks using HAL_DAC_RegisterCallback before calling HAL_DAC_DeInit or HAL_DAC_Init function. When The compilation define USE_HAL_DAC_REGISTER_CALLBACKS is set to 0 or not defined, the callback registering feature is not available and weak (overridden) callbacks are used.

DAC HAL driver macros list

Below the list of most used macros in DAC HAL driver.

- __HAL_DAC_ENABLE : Enable the DAC peripheral
- __HAL_DAC_DISABLE : Disable the DAC peripheral
- __HAL_DAC_CLEAR_FLAG: Clear the DAC's pending flags
- __HAL_DAC_GET_FLAG: Get the selected DAC's flag status

Note: You can refer to the DAC HAL driver header file for more useful macros

15.2.3 Initialization and de-initialization functions

This section provides functions allowing to:

- Initialize and configure the DAC.
- De-initialize the DAC.

This section contains the following APIs:

- ***HAL_DAC_Init()***
- ***HAL_DAC_DeInit()***
- ***HAL_DAC_MspInit()***
- ***HAL_DAC_MspDeInit()***
- ***HAL_DAC_RegisterCallback()***
- ***HAL_DAC_UnRegisterCallback()***

15.2.4 IO operation functions

This section provides functions allowing to:

- Start conversion.
- Stop conversion.
- Start conversion and enable DMA transfer.
- Stop conversion and disable DMA transfer.
- Get result of conversion.

This section contains the following APIs:

- ***HAL_DAC_Start()***
- ***HAL_DAC_Stop()***
- ***HAL_DAC_Start_DMA()***
- ***HAL_DAC_Stop_DMA()***
- ***HAL_DAC_IRQHandler()***
- ***HAL_DAC_SetValue()***
- ***HAL_DAC_ConvCpltCallbackCh1()***
- ***HAL_DAC_ConvHalfCpltCallbackCh1()***
- ***HAL_DAC_ErrorCallbackCh1()***

- *HAL_DAC_DMAUnderrunCallbackCh1()*
- *HAL_DAC_RegisterCallback()*
- *HAL_DAC_UnRegisterCallback()*

15.2.5 Peripheral Control functions

This section provides functions allowing to:

- Configure channels.
- Set the specified data holding register value for DAC channel.

This section contains the following APIs:

- *HAL_DAC_GetValue()*
- *HAL_DAC_ConfigChannel()*

15.2.6 Peripheral State and Errors functions

This subsection provides functions allowing to

- Check the DAC state.
- Check the DAC Errors.

This section contains the following APIs:

- *HAL_DAC_GetState()*
- *HAL_DAC_GetError()*

15.2.7 Detailed description of functions

HAL_DAC_Init

Function name

HAL_StatusTypeDef HAL_DAC_Init (DAC_HandleTypeDef * hdac)

Function description

Initialize the DAC peripheral according to the specified parameters in the DAC_InitStruct and initialize the associated handle.

Parameters

- **hdac:** pointer to a DAC_HandleTypeDef structure that contains the configuration information for the specified DAC.

Return values

- **HAL:** status

HAL_DAC_DeInit

Function name

HAL_StatusTypeDef HAL_DAC_DeInit (DAC_HandleTypeDef * hdac)

Function description

Deinitialize the DAC peripheral registers to their default reset values.

Parameters

- **hdac:** pointer to a DAC_HandleTypeDef structure that contains the configuration information for the specified DAC.

Return values

- **HAL:** status

HAL_DAC_MspInit

Function name

void HAL_DAC_MspInit (DAC_HandleTypeDef * hdac)

Function description

Initialize the DAC MSP.

Parameters

- **hdac:** pointer to a DAC_HandleTypeDef structure that contains the configuration information for the specified DAC.

Return values

- **None:**

HAL_DAC_MspDeInit

Function name

void HAL_DAC_MspDeInit (DAC_HandleTypeDef * hdac)

Function description

DeInitialize the DAC MSP.

Parameters

- **hdac:** pointer to a DAC_HandleTypeDef structure that contains the configuration information for the specified DAC.

Return values

- **None:**

HAL_DAC_Start

Function name

HAL_StatusTypeDef HAL_DAC_Start (DAC_HandleTypeDef * hdac, uint32_t Channel)

Function description

Enables DAC and starts conversion of channel.

Parameters

- **hdac:** pointer to a DAC_HandleTypeDef structure that contains the configuration information for the specified DAC.
- **Channel:** The selected DAC channel. This parameter can be one of the following values:
  - DAC_CHANNEL_1: DAC Channel1 selected

Return values

- **HAL:** status

HAL_DAC_Stop

Function name

HAL_StatusTypeDef HAL_DAC_Stop (DAC_HandleTypeDef * hdac, uint32_t Channel)

Function description

Disables DAC and stop conversion of channel.

Parameters

- **hdac:** pointer to a DAC_HandleTypeDef structure that contains the configuration information for the specified DAC.
- **Channel:** The selected DAC channel. This parameter can be one of the following values:
  - DAC_CHANNEL_1: DAC Channel1 selected

Return values

- **HAL:** status

HAL_DAC_Start_DMA

Function name

HAL_StatusTypeDef HAL_DAC_Start_DMA (DAC_HandleTypeDef * hdac, uint32_t Channel, const uint32_t * pData, uint32_t Length, uint32_t Alignment)

Function description

Enables DAC and starts conversion of channel.

Parameters

- **hdac:** pointer to a DAC_HandleTypeDef structure that contains the configuration information for the specified DAC.
- **Channel:** The selected DAC channel. This parameter can be one of the following values:
  - DAC_CHANNEL_1: DAC Channel1 selected
- **pData:** The source Buffer address.
- **Length:** The length of data to be transferred from memory to DAC peripheral
- **Alignment:** Specifies the data alignment for DAC channel. This parameter can be one of the following values:
  - DAC_ALIGN_8B_R: 8bit right data alignment selected
  - DAC_ALIGN_12B_L: 12bit left data alignment selected
  - DAC_ALIGN_12B_R: 12bit right data alignment selected

Return values

- **HAL:** status

HAL_DAC_Stop_DMA

Function name

HAL_StatusTypeDef HAL_DAC_Stop_DMA (DAC_HandleTypeDef * hdac, uint32_t Channel)

Function description

Disables DAC and stop conversion of channel.

Parameters

- **hdac:** pointer to a DAC_HandleTypeDef structure that contains the configuration information for the specified DAC.
- **Channel:** The selected DAC channel. This parameter can be one of the following values:
  - DAC_CHANNEL_1: DAC Channel1 selected

Return values

- **HAL:** status

HAL_DAC_IRQHandler

Function name

void HAL_DAC_IRQHandler (DAC_HandleTypeDef * hdac)

Function description

Handles DAC interrupt request This function uses the interruption of DMA underrun.

Parameters

- **hdac:** pointer to a DAC_HandleTypeDef structure that contains the configuration information for the specified DAC.

Return values

- **None:**

HAL_DAC_SetValue

Function name

HAL_StatusTypeDef HAL_DAC_SetValue (DAC_HandleTypeDef * hdac, uint32_t Channel, uint32_t Alignment, uint32_t Data)

Function description

Set the specified data holding register value for DAC channel.

Parameters

- **hdac:** pointer to a DAC_HandleTypeDef structure that contains the configuration information for the specified DAC.
- **Channel:** The selected DAC channel. This parameter can be one of the following values:
  - DAC_CHANNEL_1: DAC Channel1 selected
- **Alignment:** Specifies the data alignment. This parameter can be one of the following values:
  - DAC_ALIGN_8B_R: 8bit right data alignment selected
  - DAC_ALIGN_12B_L: 12bit left data alignment selected
  - DAC_ALIGN_12B_R: 12bit right data alignment selected
- **Data:** Data to be loaded in the selected data holding register.

Return values

- **HAL:** status

HAL_DAC_ConvCpltCallbackCh1

Function name

void HAL_DAC_ConvCpltCallbackCh1 (DAC_HandleTypeDef * hdac)

Function description

Conversion complete callback in non-blocking mode for Channel1.

Parameters

- **hdac:** pointer to a DAC_HandleTypeDef structure that contains the configuration information for the specified DAC.

Return values

- **None:**

HAL_DAC_ConvHalfCpltCallbackCh1

Function name

void HAL_DAC_ConvHalfCpltCallbackCh1 (DAC_HandleTypeDef * hdac)

Function description

Conversion half DMA transfer callback in non-blocking mode for Channel1.

Parameters

- **hdac:** pointer to a DAC_HandleTypeDef structure that contains the configuration information for the specified DAC.

Return values

- **None:**

HAL_DAC_ErrorCallbackCh1

Function name

void HAL_DAC_ErrorCallbackCh1 (DAC_HandleTypeDef * hdac)

Function description

Error DAC callback for Channel1.

Parameters

- **hdac:** pointer to a DAC_HandleTypeDef structure that contains the configuration information for the specified DAC.

Return values

- **None:**

HAL_DAC_DMAUnderrunCallbackCh1

Function name

void HAL_DAC_DMAUnderrunCallbackCh1 (DAC_HandleTypeDef * hdac)

Function description

DMA underrun DAC callback for channel1.

Parameters

- **hdac:** pointer to a DAC_HandleTypeDef structure that contains the configuration information for the specified DAC.

Return values

- **None:**

HAL_DAC_RegisterCallback

Function name

HAL_StatusTypeDef HAL_DAC_RegisterCallback (DAC_HandleTypeDef * hdac, HAL_DAC_CallbackIDTypeDef CallbackID, pDAC_CallbackTypeDef pCallback)

Function description

Register a User DAC Callback To be used instead of the weak (overridden) predefined callback.

Parameters

- **hdac:** DAC handle
- **CallbackID:** ID of the callback to be registered This parameter can be one of the following values:
  - HAL_DAC_ERROR_INVALID_CALLBACK DAC Error Callback ID
  - HAL_DAC_CH1_COMPLETE_CB_ID DAC CH1 Complete Callback ID
  - HAL_DAC_CH1_HALF_COMPLETE_CB_ID DAC CH1 Half Complete Callback ID
  - HAL_DAC_CH1_ERROR_ID DAC CH1 Error Callback ID
  - HAL_DAC_CH1_UNDERRUN_CB_ID DAC CH1 UnderRun Callback ID
  - HAL_DAC_MSPINIT_CB_ID DAC MSP Init Callback ID
  - HAL_DAC_MSPDEINIT_CB_ID DAC MSP DeInit Callback ID
- **pCallback:** pointer to the Callback function

Return values

- **status:**

Notes

- The HAL_DAC_RegisterCallback() may be called before HAL_DAC_Init() in HAL_DAC_STATE_RESET to register callbacks for HAL_DAC_MSPINIT_CB_ID and HAL_DAC_MSPDEINIT_CB_ID

HAL_DAC_UnRegisterCallback

Function name

HAL_StatusTypeDef HAL_DAC_UnRegisterCallback (DAC_HandleTypeDef * hdac, HAL_DAC_CallbackIDTypeDef CallbackID)

Function description

Unregister a User DAC Callback DAC Callback is redirected to the weak (overridden) predefined callback.

Parameters

- **hdac:** DAC handle
- **CallbackID:** ID of the callback to be unregistered This parameter can be one of the following values:
  - HAL_DAC_CH1_COMPLETE_CB_ID DAC CH1 transfer Complete Callback ID
  - HAL_DAC_CH1_HALF_COMPLETE_CB_ID DAC CH1 Half Complete Callback ID
  - HAL_DAC_CH1_ERROR_ID DAC CH1 Error Callback ID
  - HAL_DAC_CH1_UNDERRUN_CB_ID DAC CH1 UnderRun Callback ID
  - HAL_DAC_MSPINIT_CB_ID DAC MSP Init Callback ID
  - HAL_DAC_MSPDEINIT_CB_ID DAC MSP DeInit Callback ID
  - HAL_DAC_ALL_CB_ID DAC All callbacks

Return values

- **status:**

Notes

- The HAL_DAC_UnRegisterCallback() may be called before HAL_DAC_Init() in HAL_DAC_STATE_RESET to un-register callbacks for HAL_DAC_MSPINIT_CB_ID and HAL_DAC_MSPDEINIT_CB_ID

HAL_DAC_GetValue

Function name

uint32_t HAL_DAC_GetValue (const DAC_HandleTypeDef * hdac, uint32_t Channel)

Function description

Returns the last data output value of the selected DAC channel.

Parameters

- **hdac:** pointer to a DAC_HandleTypeDef structure that contains the configuration information for the specified DAC.
- **Channel:** The selected DAC channel. This parameter can be one of the following values:
  - DAC_CHANNEL_1: DAC Channel1 selected

Return values

- **The:** selected DAC channel data output value.

HAL_DAC_ConfigChannel

Function name

HAL_StatusTypeDef HAL_DAC_ConfigChannel (DAC_HandleTypeDef * hdac, const DAC_ChannelConfTypeDef * sConfig, uint32_t Channel)

Function description

Configures the selected DAC channel.

Parameters

- **hdac:** pointer to a DAC_HandleTypeDef structure that contains the configuration information for the specified DAC.
- **sConfig:** DAC configuration structure.
- **Channel:** The selected DAC channel. This parameter can be one of the following values:
  - DAC_CHANNEL_1: DAC Channel1 selected

Return values

- **HAL:** status

HAL_DAC_GetState

Function name

HAL_DAC_StateTypeDef HAL_DAC_GetState (const DAC_HandleTypeDef * hdac)

Function description

return the DAC handle state

Parameters

- **hdac:** pointer to a DAC_HandleTypeDef structure that contains the configuration information for the specified DAC.

Return values

- **HAL:** state

HAL_DAC_GetError

Function name

uint32_t HAL_DAC_GetError (const DAC_HandleTypeDef * hdac)

Function description

Return the DAC error code.

Parameters

- **hdac:** pointer to a DAC_HandleTypeDef structure that contains the configuration information for the specified DAC.

Return values

- **DAC:** Error Code

DAC_DMAConvCpltCh1

Function name

void DAC_DMAConvCpltCh1 (DMA_HandleTypeDef * hdma)

Function description

DMA conversion complete callback.

Parameters

- **hdma:** pointer to a DMA_HandleTypeDef structure that contains the configuration information for the specified DMA module.

Return values

- **None:**

DAC_DMAErrorCh1

Function name

void DAC_DMAErrorCh1 (DMA_HandleTypeDef * hdma)

Function description

DMA error callback.

Parameters

- **hdma:** pointer to a DMA_HandleTypeDef structure that contains the configuration information for the specified DMA module.

Return values

- **None:**

DAC_DMAHalfConvCpltCh1

Function name

void DAC_DMAHalfConvCpltCh1 (DMA_HandleTypeDef * hdma)

Function description

DMA half transfer complete callback.

Parameters

- **hdma:** pointer to a DMA_HandleTypeDef structure that contains the configuration information for the specified DMA module.

Return values

- **None:**

15.3 DAC Firmware driver defines

The following section lists the various define and macros of the module.

15.3.1 DAC

DAC

DAC Channel selection

DAC_CHANNEL_1

DAC ConnectOnChipPeripheral

DAC_CHIPCONNECT_EXTERNAL

DAC_CHIPCONNECT_INTERNAL

DAC_CHIPCONNECT_BOTH

DAC data alignment

DAC_ALIGN_12B_R

DAC_ALIGN_12B_L

DAC_ALIGN_8B_R

DAC Error Code

HAL_DAC_ERROR_NONE

No error

HAL_DAC_ERROR_DMAUNDERRUNCH1

DAC channel1 DMA underrun error

HAL_DAC_ERROR_DMA

DMA error

HAL_DAC_ERROR_TIMEOUT

Timeout error

HAL_DAC_ERROR_INVALID_CALLBACK

Invalid callback error

DAC Exported Macros

__HAL_DAC_RESET_HANDLE_STATE

Description:

- Reset DAC handle state.

Parameters:

- __HANDLE__: specifies the DAC handle.

Return value:

- None

__HAL_DAC_ENABLE

Description:

- Enable the DAC channel.

Parameters:

- __HANDLE__: specifies the DAC handle.
- __DAC_Channel__: specifies the DAC channel

Return value:

- None

__HAL_DAC_DISABLE

Description:

- Disable the DAC channel.

Parameters:

- __HANDLE__: specifies the DAC handle
- __DAC_Channel__: specifies the DAC channel.

Return value:

- None

DAC_DHR12R1_ALIGNMENT

Description:

- Set DHR12R1 alignment.

Parameters:

- __ALIGNMENT__: specifies the DAC alignment

Return value:

- None

DAC_DHR12RD_ALIGNMENT

Description:

- Set DHR12RD alignment.

Parameters:

- __ALIGNMENT__: specifies the DAC alignment

Return value:

- None

__HAL_DAC_ENABLE_IT

Description:

- Enable the DAC interrupt.

Parameters:

- __HANDLE__: specifies the DAC handle
- __INTERRUPT__: specifies the DAC interrupt. This parameter can be any combination of the following values:
  - DAC_IT_DMAUDR1 DAC channel 1 DMA underrun interrupt

Return value:

- None

__HAL_DAC_DISABLE_IT

Description:

- Disable the DAC interrupt.

Parameters:

- __HANDLE__: specifies the DAC handle
- __INTERRUPT__: specifies the DAC interrupt. This parameter can be any combination of the following values:
  - DAC_IT_DMAUDR1 DAC channel 1 DMA underrun interrupt

Return value:

- None

__HAL_DAC_GET_IT_SOURCE

Description:

- Check whether the specified DAC interrupt source is enabled or not.

Parameters:

- __HANDLE__: DAC handle
- __INTERRUPT__: DAC interrupt source to check This parameter can be any combination of the following values:
  - DAC_IT_DMAUDR1 DAC channel 1 DMA underrun interrupt

Return value:

- State: of interruption (SET or RESET)

__HAL_DAC_GET_FLAG

Description:

- Get the selected DAC's flag status.

Parameters:

- __HANDLE__: specifies the DAC handle.
- __FLAG__: specifies the DAC flag to get. This parameter can be any combination of the following values:
  - DAC_FLAG_DMAUDR1 DAC channel 1 DMA underrun flag

Return value:

- None

__HAL_DAC_CLEAR_FLAG

Description:

- Clear the DAC's flag.

Parameters:

- __HANDLE__: specifies the DAC handle.
- __FLAG__: specifies the DAC flag to clear. This parameter can be any combination of the following values:
  - DAC_FLAG_DMAUDR1 DAC channel 1 DMA underrun flag

Return value:

- None

DAC flags definition

DAC_FLAG_DMAUDR1

DAC IT definition

DAC_IT_DMAUDR1

DAC output buffer

DAC_OUTPUTBUFFER_ENABLE

DAC_OUTPUTBUFFER_DISABLE

DAC power mode

DAC_SAMPLEANDHOLD_DISABLE

DAC_SAMPLEANDHOLD_ENABLE

DAC trigger selection

DAC_TRIGGER_NONE

Conversion is automatic once the DAC_DHRxxxx register has been loaded, and not by external trigger

DAC_TRIGGER_SOFTWARE

Conversion started by software trigger for DAC channel

DAC_TRIGGER_T1_TRGO

TIM1 TRGO selected as external conversion trigger for DAC channel

DAC_TRIGGER_T2_TRGO

TIM2 TRGO selected as external conversion trigger for DAC channel

DAC_TRIGGER_T3_TRGO

TIM3 TRGO selected as external conversion trigger for DAC channel

DAC_TRIGGER_T6_TRGO

TIM6 TRGO selected as external conversion trigger for DAC channel

DAC_TRIGGER_T7_TRGO

TIM7 TRGO selected as external conversion trigger for DAC channel

DAC_TRIGGER_T15_TRGO

TIM15 TRGO selected as external conversion trigger for DAC channel

DAC_TRIGGER_LPTIM1_OUT

LPTIM1_OUT selected as external conversion trigger for DAC channel

DAC_TRIGGER_LPTIM2_OUT

LPTIM2_OUT selected as external conversion trigger for DAC channel

DAC_TRIGGER_EXT_IT9

EXTI Line9 event selected as external conversion trigger for DAC channel

DAC User Trimming

DAC_TRIMMING_FACTORY

Factory trimming

DAC_TRIMMING_USER

User trimming

16 HAL DAC Extension Driver

16.1 DACEx Firmware driver API description

The following section lists the various functions of the DACEx library.

16.1.1 How to use this driver

Signal generation operation

- Use HAL_DACEx_TriangleWaveGenerate() to generate Triangle signal.
- Use HAL_DACEx_NoiseWaveGenerate() to generate Noise signal.
- HAL_DACEx_SelfCalibrate to calibrate one DAC channel.
- HAL_DACEx_SetUserTrimming to set user trimming value.
- HAL_DACEx_GetTrimOffset to retrieve trimming value (factory setting after reset, user setting if HAL_DACEx_SetUserTrimming have been used at least one time after reset).

16.1.2 Extended features functions

This section provides functions allowing to:

- Start conversion.
- Stop conversion.
- Start conversion and enable DMA transfer.
- Stop conversion and disable DMA transfer.
- Get result of conversion.
- Get result of dual mode conversion.

This section contains the following APIs:

- ***HAL_DACEx_TriangleWaveGenerate()***
- ***HAL_DACEx_NoiseWaveGenerate()***
- ***HAL_DACEx_SelfCalibrate()***
- ***HAL_DACEx_SetUserTrimming()***
- ***HAL_DACEx_GetTrimOffset()***

16.1.3 Detailed description of functions

HAL_DACEx_TriangleWaveGenerate

Function name

HAL_StatusTypeDef HAL_DACEx_TriangleWaveGenerate (DAC_HandleTypeDef * hdac, uint32_t Channel, uint32_t Amplitude)

Function description

Enable or disable the selected DAC channel wave generation.

Parameters

- **hdac:** pointer to a DAC_HandleTypeDef structure that contains the configuration information for the specified DAC.
- **Channel:** The selected DAC channel. This parameter can be one of the following values:
  - DAC_CHANNEL_1: DAC Channel1 selected
- **Amplitude:** Select max triangle amplitude. This parameter can be one of the following values:
  - DAC_TRIANGLEAMPLITUDE_1: Select max triangle amplitude of 1
  - DAC_TRIANGLEAMPLITUDE_3: Select max triangle amplitude of 3
  - DAC_TRIANGLEAMPLITUDE_7: Select max triangle amplitude of 7
  - DAC_TRIANGLEAMPLITUDE_15: Select max triangle amplitude of 15
  - DAC_TRIANGLEAMPLITUDE_31: Select max triangle amplitude of 31
  - DAC_TRIANGLEAMPLITUDE_63: Select max triangle amplitude of 63
  - DAC_TRIANGLEAMPLITUDE_127: Select max triangle amplitude of 127
  - DAC_TRIANGLEAMPLITUDE_255: Select max triangle amplitude of 255
  - DAC_TRIANGLEAMPLITUDE_511: Select max triangle amplitude of 511
  - DAC_TRIANGLEAMPLITUDE_1023: Select max triangle amplitude of 1023
  - DAC_TRIANGLEAMPLITUDE_2047: Select max triangle amplitude of 2047
  - DAC_TRIANGLEAMPLITUDE_4095: Select max triangle amplitude of 4095

Return values

- **HAL:** status

HAL_DACEx_NoiseWaveGenerate

Function name

HAL_StatusTypeDef HAL_DACEx_NoiseWaveGenerate (DAC_HandleTypeDef * hdac, uint32_t Channel, uint32_t Amplitude)

Function description

Enable or disable the selected DAC channel wave generation.

Parameters

- **hdac:** pointer to a DAC_HandleTypeDef structure that contains the configuration information for the specified DAC.
- **Channel:** The selected DAC channel. This parameter can be one of the following values:
  - DAC_CHANNEL_1: DAC Channel1 selected
- **Amplitude:** Unmask DAC channel LFSR for noise wave generation. This parameter can be one of the following values:
  - DAC_LFSRUNMASK_BIT0: Unmask DAC channel LFSR bit0 for noise wave generation
  - DAC_LFSRUNMASK_BITS1_0: Unmask DAC channel LFSR bit[1:0] for noise wave generation
  - DAC_LFSRUNMASK_BITS2_0: Unmask DAC channel LFSR bit[2:0] for noise wave generation
  - DAC_LFSRUNMASK_BITS3_0: Unmask DAC channel LFSR bit[3:0] for noise wave generation
  - DAC_LFSRUNMASK_BITS4_0: Unmask DAC channel LFSR bit[4:0] for noise wave generation
  - DAC_LFSRUNMASK_BITS5_0: Unmask DAC channel LFSR bit[5:0] for noise wave generation
  - DAC_LFSRUNMASK_BITS6_0: Unmask DAC channel LFSR bit[6:0] for noise wave generation
  - DAC_LFSRUNMASK_BITS7_0: Unmask DAC channel LFSR bit[7:0] for noise wave generation
  - DAC_LFSRUNMASK_BITS8_0: Unmask DAC channel LFSR bit[8:0] for noise wave generation
  - DAC_LFSRUNMASK_BITS9_0: Unmask DAC channel LFSR bit[9:0] for noise wave generation
  - DAC_LFSRUNMASK_BITS10_0: Unmask DAC channel LFSR bit[10:0] for noise wave generation
  - DAC_LFSRUNMASK_BITS11_0: Unmask DAC channel LFSR bit[11:0] for noise wave generation

Return values

- **HAL:** status

HAL_DACEx_SelfCalibrate

Function name

HAL_StatusTypeDef HAL_DACEx_SelfCalibrate (DAC_HandleTypeDef * hdac, DAC_ChannelConfTypeDef * sConfig, uint32_t Channel)

Function description

Run the self calibration of one DAC channel.

Parameters

- **hdac:** pointer to a DAC_HandleTypeDef structure that contains the configuration information for the specified DAC.
- **sConfig:** DAC channel configuration structure.
- **Channel:** The selected DAC channel. This parameter can be one of the following values:
  - DAC_CHANNEL_1: DAC Channel1 selected

Return values

- **Updates:** DAC_TrimmingValue. , DAC_UserTrimming set to DAC_UserTrimming
- **HAL:** status

Notes

- Calibration runs about 7 ms.

HAL_DACEx_SetUserTrimming

Function name

HAL_StatusTypeDef HAL_DACEx_SetUserTrimming (DAC_HandleTypeDef * hdac, DAC_ChannelConfTypeDef * sConfig, uint32_t Channel, uint32_t NewTrimmingValue)

Function description

Set the trimming mode and trimming value (user trimming mode applied).

Parameters

- **hdac:** pointer to a DAC_HandleTypeDef structure that contains the configuration information for the specified DAC.
- **sConfig:** DAC configuration structure updated with new DAC trimming value.
- **Channel:** The selected DAC channel. This parameter can be one of the following values:
  - DAC_CHANNEL_1: DAC Channel1 selected
- **NewTrimmingValue:** DAC new trimming value

Return values

- **HAL:** status

HAL_DACEx_GetTrimOffset

Function name

uint32_t HAL_DACEx_GetTrimOffset (const DAC_HandleTypeDef * hdac, uint32_t Channel)

Function description

Return the DAC trimming value.

Parameters

- **hdac:** DAC handle
- **Channel:** The selected DAC channel. This parameter can be one of the following values:
  - DAC_CHANNEL_1: DAC Channel1 selected

Return values

- **Trimming:** value : range: 0->31

16.2 DACEx Firmware driver defines

The following section lists the various define and macros of the module.

16.2.1 DACEx

DACEx

DACEx lfsrunmask triangle amplitude

DAC_LFSRUNMASK_BIT0

Unmask DAC channel LFSR bit0 for noise wave generation

DAC_LFSRUNMASK_BITS1_0

Unmask DAC channel LFSR bit[1:0] for noise wave generation

DAC_LFSRUNMASK_BITS2_0

Unmask DAC channel LFSR bit[2:0] for noise wave generation

DAC_LFSRUNMASK_BITS3_0

Unmask DAC channel LFSR bit[3:0] for noise wave generation

DAC_LFSRUNMASK_BITS4_0

Unmask DAC channel LFSR bit[4:0] for noise wave generation

DAC_LFSRUNMASK_BITS5_0

Unmask DAC channel LFSR bit[5:0] for noise wave generation

DAC_LFSRUNMASK_BITS6_0

Unmask DAC channel LFSR bit[6:0] for noise wave generation

DAC_LFSRUNMASK_BITS7_0

Unmask DAC channel LFSR bit[7:0] for noise wave generation

DAC_LFSRUNMASK_BITS8_0

Unmask DAC channel LFSR bit[8:0] for noise wave generation

DAC_LFSRUNMASK_BITS9_0

Unmask DAC channel LFSR bit[9:0] for noise wave generation

DAC_LFSRUNMASK_BITS10_0

Unmask DAC channel LFSR bit[10:0] for noise wave generation

DAC_LFSRUNMASK_BITS11_0

Unmask DAC channel LFSR bit[11:0] for noise wave generation

DAC_TRIANGLEAMPLITUDE_1

Select max triangle amplitude of 1

DAC_TRIANGLEAMPLITUDE_3

Select max triangle amplitude of 3

DAC_TRIANGLEAMPLITUDE_7

Select max triangle amplitude of 7

DAC_TRIANGLEAMPLITUDE_15

Select max triangle amplitude of 15

DAC_TRIANGLEAMPLITUDE_31

Select max triangle amplitude of 31

DAC_TRIANGLEAMPLITUDE_63

Select max triangle amplitude of 63

DAC_TRIANGLEAMPLITUDE_127

Select max triangle amplitude of 127

DAC_TRIANGLEAMPLITUDE_255

Select max triangle amplitude of 255

DAC_TRIANGLEAMPLITUDE_511

Select max triangle amplitude of 511

DAC_TRIANGLEAMPLITUDE_1023

Select max triangle amplitude of 1023

DAC_TRIANGLEAMPLITUDE_2047

Select max triangle amplitude of 2047

DAC_TRIANGLEAMPLITUDE_4095

Select max triangle amplitude of 4095

17 HAL DMA Generic Driver

17.1 DMA Firmware driver registers structures

17.1.1 DMA_InitTypeDef

DMA_InitTypeDef is defined in the stm32u0xx_hal_dma.h

Data Fields

- ***uint32_t Request***
- ***uint32_t Direction***
- ***uint32_t PeriphInc***
- ***uint32_t MemInc***
- ***uint32_t PeriphDataAlignment***
- ***uint32_t MemDataAlignment***
- ***uint32_t Mode***
- ***uint32_t Priority***

Field Documentation

- ***uint32_t DMA_InitTypeDef::Request***
  Specifies the request selected for the specified channel. This parameter can be a value of ***DMA_request***
- ***uint32_t DMA_InitTypeDef::Direction***
  Specifies if the data will be transferred from memory to peripheral, from memory to memory or from peripheral to memory. This parameter can be a value of ***DMA_Data_transfer_direction***
- ***uint32_t DMA_InitTypeDef::PeriphInc***
  Specifies whether the Peripheral address register should be incremented or not. This parameter can be a value of ***DMA_Peripheral_incremented_mode***
- ***uint32_t DMA_InitTypeDef::MemInc***
  Specifies whether the memory address register should be incremented or not. This parameter can be a value of ***DMA_Memory_incremented_mode***
- ***uint32_t DMA_InitTypeDef::PeriphDataAlignment***
  Specifies the Peripheral data width. This parameter can be a value of ***DMA_Peripheral_data_size***
- ***uint32_t DMA_InitTypeDef::MemDataAlignment***
  Specifies the Memory data width. This parameter can be a value of ***DMA_Memory_data_size***
- ***uint32_t DMA_InitTypeDef::Mode***
  Specifies the operation mode of the DMAy Channelx. This parameter can be a value of ***DMA_mode***
  Note:
  – The circular buffer mode cannot be used if the memory-to-memory data transfer is configured on the selected Channel
- ***uint32_t DMA_InitTypeDef::Priority***
  Specifies the software priority for the DMAy Channelx. This parameter can be a value of ***DMA_Priority_level***

17.1.2 __DMA_HandleTypeDef

__DMA_HandleTypeDef is defined in the stm32u0xx_hal_dma.h

Data Fields

- ***DMA_Channel_TypeDef * Instance***
- ***DMA_InitTypeDef Init***
- ***HAL_LockTypeDef Lock***
- ***__IO HAL_DMA_StateTypeDef State***
- ***void * Parent***
- ***void(* XferCpltCallback***
- ***void(* XferHalfCpltCallback***
- ***void(* XferErrorCallback***

- ***void(* XferAbortCallback***
- ***__IO uint32_t ErrorCode***
- ***DMA_TypeDef * DmaBaseAddress***
- ***uint32_t ChannelIndex***
- ***DMAMUX_Channel_TypeDef * DMAmuxChannel***
- ***DMAMUX_ChannelStatus_TypeDef * DMAmuxChannelStatus***
- ***uint32_t DMAmuxChannelStatusMask***
- ***DMAMUX_RequestGen_TypeDef * DMAmuxRequestGen***
- ***DMAMUX_RequestGenStatus_TypeDef * DMAmuxRequestGenStatus***
- ***uint32_t DMAmuxRequestGenStatusMask***

Field Documentation

- ***DMA_Channel_TypeDef* __DMA_HandleTypeDef::Instance***
  Register base address
- ***DMA_InitTypeDef __DMA_HandleTypeDef::Init***
  DMA communication parameters
- ***HAL_LockTypeDef __DMA_HandleTypeDef::Lock***
  DMA locking object
- ***__IO HAL_DMA_StateTypeDef __DMA_HandleTypeDef::State***
  DMA transfer state
- ***void* __DMA_HandleTypeDef::Parent***
  Parent object state
- ***void(* __DMA_HandleTypeDef::XferCpltCallback)(struct __DMA_HandleTypeDef *hdma)***
  DMA transfer complete callback
- ***void(* __DMA_HandleTypeDef::XferHalfCpltCallback)(struct __DMA_HandleTypeDef *hdma)***
  DMA Half transfer complete callback
- ***void(* __DMA_HandleTypeDef::XferErrorCallback)(struct __DMA_HandleTypeDef *hdma)***
  DMA transfer error callback
- ***void(* __DMA_HandleTypeDef::XferAbortCallback)(struct __DMA_HandleTypeDef *hdma)***
  DMA transfer abort callback
- ***__IO uint32_t __DMA_HandleTypeDef::ErrorCode***
  DMA Error code
- ***DMA_TypeDef* __DMA_HandleTypeDef::DmaBaseAddress***
  DMA Channel Base Address
- ***uint32_t __DMA_HandleTypeDef::ChannelIndex***
  DMA Channel Index
- ***DMAMUX_Channel_TypeDef* __DMA_HandleTypeDef::DMAmuxChannel***
  Register base address
- ***DMAMUX_ChannelStatus_TypeDef* __DMA_HandleTypeDef::DMAmuxChannelStatus***
  DMAMUX Channels Status Base Address
- ***uint32_t __DMA_HandleTypeDef::DMAmuxChannelStatusMask***
  DMAMUX Channel Status Mask
- ***DMAMUX_RequestGen_TypeDef* __DMA_HandleTypeDef::DMAmuxRequestGen***
  DMAMUX request generator Base Address
- ***DMAMUX_RequestGenStatus_TypeDef* __DMA_HandleTypeDef::DMAmuxRequestGenStatus***
  DMAMUX request generator Address
- ***uint32_t __DMA_HandleTypeDef::DMAmuxRequestGenStatusMask***
  DMAMUX request generator Status mask

17.2 DMA Firmware driver API description

The following section lists the various functions of the DMA library.

17.2.1 How to use this driver

1. Enable and configure the peripheral to be connected to the DMA Channel (except for internal SRAM / FLASH memories: no initialization is necessary). Please refer to the Reference manual for connection between peripherals and DMA requests.
2. For a given Channel, program the required configuration through the following parameters: Channel request, Transfer Direction, Source and Destination data formats, Circular or Normal mode, Channel Priority level, Source and Destination Increment mode using HAL_DMA_Init() function. Prior to HAL_DMA_Init the peripheral clock shall be enabled for both DMA & DMAMUX thanks to:
   a. DMA1 or DMA2: __HAL_RCC_DMA1_CLK_ENABLE() or __HAL_RCC_DMA2_CLK_ENABLE();
3. Use HAL_DMA_GetState() function to return the DMA state and HAL_DMA_GetError() in case of error detection.
4. Use HAL_DMA_Abort() function to abort the current transfer

Note: In Memory-to-Memory transfer mode, Circular mode is not allowed.

Polling mode IO operation

- Use HAL_DMA_Start() to start DMA transfer after the configuration of Source address and destination address and the Length of data to be transferred
- Use HAL_DMA_PollForTransfer() to poll for the end of current transfer, in this case a fixed Timeout can be configured by User depending from his application.

Interrupt mode IO operation

- Configure the DMA interrupt priority using HAL_NVIC_SetPriority()
- Enable the DMA IRQ handler using HAL_NVIC_EnableIRQ()
- Use HAL_DMA_Start_IT() to start DMA transfer after the configuration of Source address and destination address and the Length of data to be transferred. In this case the DMA interrupt is configured
- Use HAL_DMA_IRQHandler() called under DMA_IRQHandler() Interrupt subroutine
- At the end of data transfer HAL_DMA_IRQHandler() function is executed and user can add his own function to register callbacks with HAL_DMA_RegisterCallback().

DMA HAL driver macros list

Below the list of macros in DMA HAL driver.

- __HAL_DMA_ENABLE: Enable the specified DMA Channel.
- __HAL_DMA_DISABLE: Disable the specified DMA Channel.
- __HAL_DMA_GET_FLAG: Get the DMA Channel pending flags.
- __HAL_DMA_CLEAR_FLAG: Clear the DMA Channel pending flags.
- __HAL_DMA_ENABLE_IT: Enable the specified DMA Channel interrupts.
- __HAL_DMA_DISABLE_IT: Disable the specified DMA Channel interrupts.
- __HAL_DMA_GET_IT_SOURCE: Check whether the specified DMA Channel interrupt is enabled or not.

Note: You can refer to the DMA HAL driver header file for more useful macros

17.2.2 Initialization and de-initialization functions

This section provides functions allowing to initialize the DMA Channel source and destination addresses, incrementation and data sizes, transfer direction, circular/normal mode selection, memory-to-memory mode selection and Channel priority value.

The HAL_DMA_Init() function follows the DMA configuration procedures as described in reference manual.

This section contains the following APIs:

- ***HAL_DMA_Init()***
- ***HAL_DMA_DeInit()***

17.2.3 IO operation functions

This section provides functions allowing to:

- Configure the source, destination address and data length and Start DMA transfer
- Configure the source, destination address and data length and Start DMA transfer with interrupt

- Abort DMA transfer
- Poll for transfer complete
- Handle DMA interrupt request
- Register and Unregister DMA callbacks

This section contains the following APIs:

- *HAL_DMA_Start()*
- *HAL_DMA_Start_IT()*
- *HAL_DMA_Abort()*
- *HAL_DMA_Abort_IT()*
- *HAL_DMA_PollForTransfer()*
- *HAL_DMA_IRQHandler()*
- *HAL_DMA_RegisterCallback()*
- *HAL_DMA_UnRegisterCallback()*

17.2.4 Peripheral State and Errors functions

This subsection provides functions allowing to

- Check the DMA state
- Get error code

This section contains the following APIs:

- *HAL_DMA_GetState()*
- *HAL_DMA_GetError()*

17.2.5 Detailed description of functions

HAL_DMA_Init

Function name

HAL_StatusTypeDef HAL_DMA_Init (DMA_HandleTypeDef * hdma)

Function description

Initialize the DMA according to the specified parameters in the DMA_InitTypeDef and initialize the associated handle.

Parameters

- **hdma:** Pointer to a DMA_HandleTypeDef structure that contains the configuration information for the specified DMA Channel.

Return values

- **HAL:** status

HAL_DMA_DeInit

Function name

HAL_StatusTypeDef HAL_DMA_DeInit (DMA_HandleTypeDef * hdma)

Function description

DeInitialize the DMA peripheral.

Parameters

- **hdma:** Pointer to a DMA_HandleTypeDef structure that contains the configuration information for the specified DMA Channel.

Return values

- **HAL:** status

HAL_DMA_Start

Function name

HAL_StatusTypeDef HAL_DMA_Start (DMA_HandleTypeDef * hdma, uint32_t SrcAddress, uint32_t DstAddress, uint32_t DataLength)

Function description

Start the DMA Transfer.

Parameters

- **hdma:** Pointer to a DMA_HandleTypeDef structure that contains the configuration information for the specified DMA Channel.
- **SrcAddress:** The source memory Buffer address
- **DstAddress:** The destination memory Buffer address
- **DataLength:** The length of data to be transferred from source to destination

Return values

- **HAL:** status

HAL_DMA_Start_IT

Function name

HAL_StatusTypeDef HAL_DMA_Start_IT (DMA_HandleTypeDef * hdma, uint32_t SrcAddress, uint32_t DstAddress, uint32_t DataLength)

Function description

Start the DMA Transfer with interrupt enabled.

Parameters

- **hdma:** Pointer to a DMA_HandleTypeDef structure that contains the configuration information for the specified DMA Channel.
- **SrcAddress:** The source memory Buffer address
- **DstAddress:** The destination memory Buffer address
- **DataLength:** The length of data to be transferred from source to destination

Return values

- **HAL:** status

HAL_DMA_Abort

Function name

HAL_StatusTypeDef HAL_DMA_Abort (DMA_HandleTypeDef * hdma)

Function description

Abort the DMA Transfer.

Parameters

- **hdma:** Pointer to a DMA_HandleTypeDef structure that contains the configuration information for the specified DMA Channel.

Return values

- **HAL:** status

HAL_DMA_Abort_IT

Function name

HAL_StatusTypeDef HAL_DMA_Abort_IT (DMA_HandleTypeDef * hdma)

Function description

Aborts the DMA Transfer in Interrupt mode.

Parameters

- **hdma:** Pointer to a DMA_HandleTypeDef structure that contains the configuration information for the specified DMA Channel.

Return values

- **HAL:** status

HAL_DMA_PollForTransfer

Function name

HAL_StatusTypeDef HAL_DMA_PollForTransfer (DMA_HandleTypeDef * hdma, HAL_DMA_LevelCompleteTypeDef CompleteLevel, uint32_t Timeout)

Function description

Polling for transfer complete.

Parameters

- **hdma:** Pointer to a DMA_HandleTypeDef structure that contains the configuration information for the specified DMA Channel.
- **CompleteLevel:** Specifies the DMA level complete.
- **Timeout:** Timeout duration.

Return values

- **HAL:** status

HAL_DMA_IRQHandler

Function name

void HAL_DMA_IRQHandler (DMA_HandleTypeDef * hdma)

Function description

Handle DMA interrupt request.

Parameters

- **hdma:** Pointer to a DMA_HandleTypeDef structure that contains the configuration information for the specified DMA Channel.

Return values

- **None:**

HAL_DMA_RegisterCallback

Function name

HAL_StatusTypeDef HAL_DMA_RegisterCallback (DMA_HandleTypeDef * hdma, HAL_DMA_CallbackIDTypeDef CallbackID, void(*)(DMA_HandleTypeDef *_hdma) pCallback)

Function description

Register callbacks.

Parameters

- **hdma:** Pointer to a DMA_HandleTypeDef structure that contains the configuration information for the specified DMA Channel.
- **CallbackID:** User Callback identifier a HAL_DMA_CallbackIDTypeDef ENUM as parameter.
- **pCallback:** Pointer to private callback function which has pointer to a DMA_HandleTypeDef structure as parameter.

Return values

- **HAL:** status

HAL_DMA_UnRegisterCallback

Function name

HAL_StatusTypeDef HAL_DMA_UnRegisterCallback (DMA_HandleTypeDef * hdma, HAL_DMA_CallbackIDTypeDef CallbackID)

Function description

UnRegister callbacks.

Parameters

- **hdma:** Pointer to a DMA_HandleTypeDef structure that contains the configuration information for the specified DMA Channel.
- **CallbackID:** User Callback identifier a HAL_DMA_CallbackIDTypeDef ENUM as parameter.

Return values

- **HAL:** status

HAL_DMA_GetState

Function name

HAL_DMA_StateTypeDef HAL_DMA_GetState (DMA_HandleTypeDef * hdma)

Function description

Return the DMA handle state.

Parameters

- **hdma:** Pointer to a DMA_HandleTypeDef structure that contains the configuration information for the specified DMA Channel.

Return values

- **HAL:** state

HAL_DMA_GetError

Function name

uint32_t HAL_DMA_GetError (DMA_HandleTypeDef * hdma)

Function description

Return the DMA error code.

Parameters

- **hdma:** Pointer to a DMA_HandleTypeDef structure that contains the configuration information for the specified DMA Channel.

Return values

- **DMA:** Error Code

17.3 DMA Firmware driver defines

The following section lists the various define and macros of the module.

17.3.1 DMA

DMA

DMA Data transfer direction

DMA_PERIPH_TO_MEMORY

Peripheral to memory direction

DMA_MEMORY_TO_PERIPH

Memory to peripheral direction

DMA_MEMORY_TO_MEMORY

Memory to memory direction

DMA Error Code

HAL_DMA_ERROR_NONE

No error

HAL_DMA_ERROR_TE

Transfer error

HAL_DMA_ERROR_NO_XFER

Abort requested with no Xfer ongoing

HAL_DMA_ERROR_TIMEOUT

Timeout error

HAL_DMA_ERROR_PARAM

Parameter error

HAL_DMA_ERROR_BUSY

DMA Busy error

HAL_DMA_ERROR_NOT_SUPPORTED

Not supported mode

HAL_DMA_ERROR_SYNC

DMAMUX sync overrun error

HAL_DMA_ERROR_REQGEN

DMAMUX request generator overrun error

DMA Exported Macros

__HAL_DMA_RESET_HANDLE_STATE

Description:

- Reset DMA handle state.

Parameters:

- __HANDLE__: DMA handle

Return value:

- None

__HAL_DMA_ENABLE

Description:

- Enable the specified DMA Channel.

Parameters:

- __HANDLE__: DMA handle

Return value:

- None

__HAL_DMA_DISABLE

Description:

- Disable the specified DMA Channel.

Parameters:

- __HANDLE__: DMA handle

Return value:

- None

__HAL_DMA_GET_TC_FLAG_INDEX

Description:

- Return the current DMA Channel transfer complete flag.

Parameters:

- __HANDLE__: DMA handle

Return value:

- The: specified transfer complete flag index.

__HAL_DMA_GET_HT_FLAG_INDEX

Description:

- Return the current DMA Channel half transfer complete flag.

Parameters:

- __HANDLE__: DMA handle

Return value:

- The: specified half transfer complete flag index.

__HAL_DMA_GET_TE_FLAG_INDEX

Description:

- Return the current DMA Channel transfer error flag.

Parameters:

- __HANDLE__: DMA handle

Return value:

- The: specified transfer error flag index.

__HAL_DMA_GET_GI_FLAG_INDEX

Description:

- Return the current DMA Channel Global interrupt flag.

Parameters:

- __HANDLE__: DMA handle

Return value:

- The: specified transfer error flag index.

__HAL_DMA_GET_FLAG

Description:

- Get the DMA Channel pending flags.

Parameters:

- __HANDLE__: DMA handle
- __FLAG__: Get the specified flag. This parameter can be any combination of the following values:
  - DMA_FLAG_TCx: Transfer complete flag
  - DMA_FLAG_HTx: Half transfer complete flag
  - DMA_FLAG_TEx: Transfer error flag
  - DMA_FLAG_GIx: Global interrupt flag Where x can be 1 to max Channel supported by the product to select the DMA Channel flag.

Return value:

- The: state of FLAG (SET or RESET).

__HAL_DMA_CLEAR_FLAG

Description:

- Clear the DMA Channel pending flags.

Parameters:

- __HANDLE__: DMA handle
- __FLAG__: specifies the flag to clear. This parameter can be any combination of the following values:
  - DMA_FLAG_TCx: Transfer complete flag
  - DMA_FLAG_HTx: Half transfer complete flag
  - DMA_FLAG_TEx: Transfer error flag
  - DMA_FLAG_GIx: Global interrupt flag Where x can be 1 to max Channel supported by the product to select the DMA Channel flag.

Return value:

- None

__HAL_DMA_ENABLE_IT

Description:

- Enable the specified DMA Channel interrupts.

Parameters:

- __HANDLE__: DMA handle
- __INTERRUPT__: specifies the DMA interrupt sources to be enabled or disabled. This parameter can be any combination of the following values:
  - DMA_IT_TC: Transfer complete interrupt mask
  - DMA_IT_HT: Half transfer complete interrupt mask
  - DMA_IT_TE: Transfer error interrupt mask

Return value:

- None

__HAL_DMA_DISABLE_IT

Description:

- Disable the specified DMA Channel interrupts.

Parameters:

- __HANDLE__: DMA handle
- __INTERRUPT__: specifies the DMA interrupt sources to be enabled or disabled. This parameter can be any combination of the following values:
  - DMA_IT_TC: Transfer complete interrupt mask
  - DMA_IT_HT: Half transfer complete interrupt mask
  - DMA_IT_TE: Transfer error interrupt mask

Return value:

- None

__HAL_DMA_GET_IT_SOURCE

Description:

- Check whether the specified DMA Channel interrupt is enabled or disabled.

Parameters:

- __HANDLE__: DMA handle
- __INTERRUPT__: specifies the DMA interrupt source to check. This parameter can be one of the following values:
  - DMA_IT_TC: Transfer complete interrupt mask
  - DMA_IT_HT: Half transfer complete interrupt mask
  - DMA_IT_TE: Transfer error interrupt mask

Return value:

- The: state of DMA_IT (SET or RESET).

__HAL_DMA_GET_COUNTER

Description:

- Returns the number of remaining data units in the current DMA Channel transfer.

Parameters:

- __HANDLE__: DMA handle

Return value:

- The: number of remaining data units in the current DMA Channel transfer.

DMA flag definitions

DMA_FLAG_GI1

Global Interrupt flag for Channel 1

DMA_FLAG_TC1

Transfer Complete flag for Channel 1

DMA_FLAG_HT1

Half Transfer flag for Channel 1

DMA_FLAG_TE1

Transfer Error flag for Channel 1

DMA_FLAG_GI2

Global Interrupt flag for Channel 2

DMA_FLAG_TC2

Transfer Complete flag for Channel 2

DMA_FLAG_HT2

Half Transfer flag for Channel 2

DMA_FLAG_TE2

Transfer Error flag for Channel 2

DMA_FLAG_GI3

Global Interrupt flag for Channel 3

DMA_FLAG_TC3

Transfer Complete flag for Channel 3

DMA_FLAG_HT3

Half Transfer flag for Channel 3

DMA_FLAG_TE3

Transfer Error flag for Channel 3

DMA_FLAG_GI4

Global Interrupt flag for Channel 4

DMA_FLAG_TC4

Transfer Complete flag for Channel 4

DMA_FLAG_HT4

Half Transfer flag for Channel 4

DMA_FLAG_TE4

Transfer Error flag for Channel 4

DMA_FLAG_GI5

Global Interrupt flag for Channel 5

DMA_FLAG_TC5

Transfer Complete flag for Channel 5

DMA_FLAG_HT5

Half Transfer flag for Channel 5

DMA_FLAG_TE5

Transfer Error for Channel 5

DMA_FLAG_GI6

Global Interrupt flag for Channel 6

DMA_FLAG_TC6

Transfer Complete flag for Channel 6

DMA_FLAG_HT6

Half Transfer flag for Channel 6

DMA_FLAG_TE6

Transfer Error flag for Channel 6

DMA_FLAG_GI7

Global Interrupt flag for Channel 7

DMA_FLAG_TC7

Transfer Complete flag for Channel 7

DMA_FLAG_HT7

Half Transfer flag for Channel 7

DMA_FLAG_TE7

Transfer Error flag for Channel 7

TIM DMA Handle Index

TIM_DMA_ID_UPDATE

Index of the DMA handle used for Update DMA requests

TIM_DMA_ID_CC1

Index of the DMA handle used for Capture/Compare 1 DMA requests

TIM_DMA_ID_CC2

Index of the DMA handle used for Capture/Compare 2 DMA requests

TIM_DMA_ID_CC3

Index of the DMA handle used for Capture/Compare 3 DMA requests

TIM_DMA_ID_CC4

Index of the DMA handle used for Capture/Compare 4 DMA requests

TIM_DMA_ID_COMMUTATION

Index of the DMA handle used for Commutation DMA requests

TIM_DMA_ID_TRIGGER

Index of the DMA handle used for Trigger DMA requests

DMA interrupt enable definitions

DMA_IT_TC

Transfer Complete interrupt

DMA_IT_HT

Half Transfer Complete interrupt

DMA_IT_TE

Transfer Error interrupt

DMA Memory data size

DMA_MDATAALIGN_BYTE

Memory data alignment : Byte

DMA_MDATAALIGN_HALFWORD

Memory data alignment : HalfWord

DMA_MDATAALIGN_WORD

Memory data alignment : Word

DMA Memory incremented mode

DMA_MINC_ENABLE

Memory increment mode Enable

DMA_MINC_DISABLE

Memory increment mode Disable

DMA mode

DMA_NORMAL

Normal mode

DMA_CIRCULAR

Circular mode

DMA Peripheral data size

DMA_PDATAALIGN_BYTE

Peripheral data alignment : Byte

DMA_PDATAALIGN_HALFWORD

Peripheral data alignment : HalfWord

DMA_PDATAALIGN_WORD

Peripheral data alignment : Word

DMA Peripheral incremented mode

DMA_PINC_ENABLE

Peripheral increment mode Enable

DMA_PINC_DISABLE

Peripheral increment mode Disable

DMA Priority level

DMA_PRIORITY_LOW

Priority level : Low

DMA_PRIORITY_MEDIUM

Priority level : Medium

DMA_PRIORITY_HIGH

Priority level : High

DMA_PRIORITY_VERY_HIGH

Priority level : Very_High

DMA request

DMA_REQUEST_MEM2MEM

memory to memory transfer

DMA_REQUEST_GENERATOR0

DMAMUX request generator 0

DMA_REQUEST_GENERATOR1

DMAMUX request generator 1

DMA_REQUEST_GENERATOR2

DMAMUX request generator 2

DMA_REQUEST_GENERATOR3

DMAMUX request generator 3

DMA_REQUEST_ADC

DMAMUX ADC1 request

DMA_REQUEST_AES_IN

DMAMUX AES_IN request

DMA_REQUEST_AES_OUT

DMAMUX AES_OUT request

DMA_REQUEST_DAC_CH1

DMAMUX DAC_CH1 request

DMA_REQUEST_I2C1_RX

DMAMUX I2C1 RX request

DMA_REQUEST_I2C1_TX

DMAMUX I2C1 TX request

DMA_REQUEST_I2C2_RX

DMAMUX I2C2 RX request

DMA_REQUEST_I2C2_TX

DMAMUX I2C2 TX request

DMA_REQUEST_I2C3_RX

DMAMUX I2C3 RX request

DMA_REQUEST_I2C3_TX

DMAMUX I2C3 TX request

DMA_REQUEST_I2C4_RX

DMAMUX I2C4 RX request

DMA_REQUEST_I2C4_TX

DMAMUX I2C4 TX request

DMA_REQUEST_LPTIM1_IC1

DMAMUX LPTIM1 IC1 request

DMA_REQUEST_LPTIM1_IC2

DMAMUX LPTIM1 IC2 request

DMA_REQUEST_LPTIM1_IC3

DMAMUX LPTIM1 IC3 request

DMA_REQUEST_LPTIM1_IC4

DMAMUX LPTIM1 IC4 request

DMA_REQUEST_LPTIM1_UE

DMAMUX LPTIM1 UE request

DMA_REQUEST_LPTIM2_IC1

DMAMUX LPTIM2 IC1 request

DMA_REQUEST_LPTIM2_IC2

DMAMUX LPTIM2 IC2 request

DMA_REQUEST_LPTIM2_UE

DMAMUX LPTIM2 UE request

DMA_REQUEST_LPTIM3_IC1

DMAMUX LPTIM3 IC1 request

DMA_REQUEST_LPTIM3_IC2

DMAMUX LPTIM3 IC2 request

DMA_REQUEST_LPTIM3_IC3

DMAMUX LPTIM3 IC3 request

DMA_REQUEST_LPTIM3_IC4

DMAMUX LPTIM3 IC4 request

DMA_REQUEST_LPTIM3_UE

DMAMUX LPTIM3 UE request

DMA_REQUEST_LPUART1_RX

DMAMUX LPUART1 RX request

DMA_REQUEST_LPUART1_TX

DMAMUX LPUART1 TX request

DMA_REQUEST_LPUART2_RX

DMAMUX LPUART2 RX request

DMA_REQUEST_LPUART2_TX

DMAMUX LPUART2 TX request

DMA_REQUEST_LPUART3_RX

DMAMUX LPUART3 RX request

DMA_REQUEST_LPUART3_TX

DMAMUX LPUART3 TX request

DMA_REQUEST_SPI1_RX

DMAMUX SPI1 RX request

DMA_REQUEST_SPI1_TX

DMAMUX SPI1 TX request

DMA_REQUEST_SPI2_RX

DMAMUX SPI2 RX request

DMA_REQUEST_SPI2_TX

DMAMUX SPI2 TX request

DMA_REQUEST_SPI3_RX

DMAMUX SPI3 RX request

DMA_REQUEST_SPI3_TX

DMAMUX SPI3 TX request

DMA_REQUEST_TIM1_CH1

DMAMUX TIM1 CH1 request

DMA_REQUEST_TIM1_CH2

DMAMUX TIM1 CH2 request

DMA_REQUEST_TIM1_CH3

DMAMUX TIM1 CH3 request

DMA_REQUEST_TIM1_CH4

DMAMUX TIM1 CH4 request

DMA_REQUEST_TIM1_TRIG_COM

DMAMUX TIM1 TRIG COM request

DMA_REQUEST_TIM1_UP

DMAMUX TIM1 UP request

DMA_REQUEST_TIM2_CH1

DMAMUX TIM2 CH1 request

DMA_REQUEST_TIM2_CH2

DMAMUX TIM2 CH2 request

DMA_REQUEST_TIM2_CH3

DMAMUX TIM2 CH3 request

DMA_REQUEST_TIM2_CH4

DMAMUX TIM2 CH4 request

DMA_REQUEST_TIM2_TRIG

DMAMUX TIM2 TRIG request

DMA_REQUEST_TIM2_UP

DMAMUX TIM2 UP request

DMA_REQUEST_TIM3_CH1

DMAMUX TIM3 CH1 request

DMA_REQUEST_TIM3_CH2

DMAMUX TIM3 CH2 request

DMA_REQUEST_TIM3_CH3

DMAMUX TIM3 CH3 request

DMA_REQUEST_TIM3_CH4

DMAMUX TIM3 CH4 request

DMA_REQUEST_TIM3_TRIG

DMAMUX TIM3 TRIG request

DMA_REQUEST_TIM3_UP

DMAMUX TIM3 UP request

DMA_REQUEST_TIM6_UP

DMAMUX TIM6 UP request

DMA_REQUEST_TIM7_UP

DMAMUX TIM7 UP request

DMA_REQUEST_TIM15_CH1

DMAMUX TIM15 CH1 request

DMA_REQUEST_TIM15_CH2

DMAMUX TIM15 CH2 request

DMA_REQUEST_TIM15_TRIG_COM

DMAMUX TIM15 TRIG COM request

DMA_REQUEST_TIM15_UP

DMAMUX TIM15 UP request

DMA_REQUEST_TIM16_CH1

DMAMUX TIM16 CH1 request

DMA_REQUEST_TIM16_COM

DMAMUX TIM16 COM request

DMA_REQUEST_TIM16_UP

DMAMUX TIM16 UP request

DMA_REQUEST_USART1_RX

DMAMUX USART1 RX request

DMA_REQUEST_USART1_TX

DMAMUX USART1 TX request

DMA_REQUEST_USART2_RX

DMAMUX USART2 RX request

DMA_REQUEST_USART2_TX

DMAMUX USART2 TX request

DMA_REQUEST_USART3_RX

DMAMUX USART3 RX request

DMA_REQUEST_USART3_TX

DMAMUX USART3 TX request

DMA_REQUEST_USART4_RX

DMAMUX USART4 RX request

DMA_REQUEST_USART4_TX

DMAMUX USART4 TX request

DMA_MAX_REQUEST

18 HAL DMA Extension Driver

18.1 DMAEx Firmware driver registers structures

18.1.1 HAL_DMA_MuxSyncConfigTypeDef

HAL_DMA_MuxSyncConfigTypeDef is defined in the stm32u0xx_hal_dma_ex.h

Data Fields

- ***uint32_t SyncSignalID***
- ***uint32_t SyncPolarity***
- ***FunctionalState SyncEnable***
- ***FunctionalState EventEnable***
- ***uint32_t RequestNumber***

Field Documentation

- ***uint32_t HAL_DMA_MuxSyncConfigTypeDef::SyncSignalID***
  Specifies the synchronization signal gating the DMA request in periodic mode. This parameter can be a value of ***DMAEx_DMAMUX_SyncSignalID_selection***
- ***uint32_t HAL_DMA_MuxSyncConfigTypeDef::SyncPolarity***
  Specifies the polarity of the signal on which the DMA request is synchronized. This parameter can be a value of ***DMAEx_DMAMUX_SyncPolarity_selection***
- ***FunctionalState HAL_DMA_MuxSyncConfigTypeDef::SyncEnable***
  Specifies if the synchronization shall be enabled or disabled This parameter can take the value ENABLE or DISABLE
- ***FunctionalState HAL_DMA_MuxSyncConfigTypeDef::EventEnable***
  Specifies if an event shall be generated once the RequestNumber is reached. This parameter can take the value ENABLE or DISABLE
- ***uint32_t HAL_DMA_MuxSyncConfigTypeDef::RequestNumber***
  Specifies the number of DMA request that will be authorized after a sync event This parameter must be a number between Min_Data = 1 and Max_Data = 32

18.1.2 HAL_DMA_MuxRequestGeneratorConfigTypeDef

HAL_DMA_MuxRequestGeneratorConfigTypeDef is defined in the stm32u0xx_hal_dma_ex.h

Data Fields

- ***uint32_t SignalID***
- ***uint32_t Polarity***
- ***uint32_t RequestNumber***

Field Documentation

- ***uint32_t HAL_DMA_MuxRequestGeneratorConfigTypeDef::SignalID***
  Specifies the ID of the signal used for DMAMUX request generator This parameter can be a value of ***DMAEx_DMAMUX_SignalGeneratorID_selection***
- ***uint32_t HAL_DMA_MuxRequestGeneratorConfigTypeDef::Polarity***
  Specifies the polarity of the signal on which the request is generated. This parameter can be a value of ***DMAEx_DMAMUX_RequestGeneneratorPolarity_selection***
- ***uint32_t HAL_DMA_MuxRequestGeneratorConfigTypeDef::RequestNumber***
  Specifies the number of DMA request that will be generated after a signal event This parameter must be a number between Min_Data = 1 and Max_Data = 32

18.2 DMAEx Firmware driver API description

The following section lists the various functions of the DMAEx library.

18.2.1 How to use this driver

The DMA Extension HAL driver can be used as follows:

- Configure the DMAMUX Synchronization Block using HAL_DMAEx_ConfigMuxSync function.
- Configure the DMAMUX Request Generator Block using HAL_DMAEx_ConfigMuxRequestGenerator function. Functions HAL_DMAEx_EnableMuxRequestGenerator and HAL_DMAEx_DisableMuxRequestGenerator can then be used to respectively enable/disable the request generator.
- To handle the DMAMUX Interrupts, the function HAL_DMAEx_MUX_IRQHandler should be called from the DMAMUX IRQ handler i.e DMAMUX1_OVR_IRQHandler. As only one interrupt line is available for all DMAMUX channels and request generators , HAL_DMAEx_MUX_IRQHandler should be called with, as parameter, the appropriate DMA handle as many as used DMAs in the user project (exception done if a given DMA is not using the DMAMUX SYNC block neither a request generator)

18.2.2 Extended features functions

This section provides functions allowing to:

- Configure the DMAMUX Synchronization Block using HAL_DMAEx_ConfigMuxSync function.
- Configure the DMAMUX Request Generator Block using HAL_DMAEx_ConfigMuxRequestGenerator function. Functions HAL_DMAEx_EnableMuxRequestGenerator and HAL_DMAEx_DisableMuxRequestGenerator can then be used to respectively enable/disable the request generator.
- Handle DMAMUX interrupts using HAL_DMAEx_MUX_IRQHandler : should be called from the DMAMUX IRQ handler

This section contains the following APIs:

- ***HAL_DMAEx_ConfigMuxSync()***
- ***HAL_DMAEx_ConfigMuxRequestGenerator()***
- ***HAL_DMAEx_EnableMuxRequestGenerator()***
- ***HAL_DMAEx_DisableMuxRequestGenerator()***
- ***HAL_DMAEx_MUX_IRQHandler()***

18.2.3 Detailed description of functions

HAL_DMAEx_ConfigMuxRequestGenerator

Function name

HAL_StatusTypeDef HAL_DMAEx_ConfigMuxRequestGenerator (DMA_HandleTypeDef * hdma, HAL_DMA_MuxRequestGeneratorConfigTypeDef * pRequestGeneratorConfig)

Function description

Configure the DMAMUX request generator block used by the given DMA channel (instance).

Parameters

- **hdma:** Pointer to a DMA_HandleTypeDef structure that contains the configuration information for the specified DMA channel.
- **pRequestGeneratorConfig:** Pointer to HAL_DMA_MuxRequestGeneratorConfigTypeDef contains the request generator parameters.

Return values

- **HAL:** status

HAL_DMAEx_EnableMuxRequestGenerator

Function name

HAL_StatusTypeDef HAL_DMAEx_EnableMuxRequestGenerator (DMA_HandleTypeDef * hdma)

Function description

Enable the DMAMUX request generator block used by the given DMA channel (instance).

Parameters

- **hdma:** Pointer to a DMA_HandleTypeDef structure that contains the configuration information for the specified DMA channel.

Return values

- **HAL:** status

HAL_DMAEx_DisableMuxRequestGenerator

Function name

HAL_StatusTypeDef HAL_DMAEx_DisableMuxRequestGenerator (DMA_HandleTypeDef * hdma)

Function description

Disable the DMAMUX request generator block used by the given DMA channel (instance).

Parameters

- **hdma:** Pointer to a DMA_HandleTypeDef structure that contains the configuration information for the specified DMA channel.

Return values

- **HAL:** status

HAL_DMAEx_ConfigMuxSync

Function name

HAL_StatusTypeDef HAL_DMAEx_ConfigMuxSync (DMA_HandleTypeDef * hdma, HAL_DMA_MuxSyncConfigTypeDef * pSyncConfig)

Function description

Configure the DMAMUX synchronization parameters for a given DMA channel (instance).

Parameters

- **hdma:** Pointer to a DMA_HandleTypeDef structure that contains the configuration information for the specified DMA channel.
- **pSyncConfig:** Pointer to HAL_DMA_MuxSyncConfigTypeDef contains the DMAMUX synchronization parameters

Return values

- **HAL:** status

HAL_DMAEx_MUX_IRQHandler

Function name

void HAL_DMAEx_MUX_IRQHandler (DMA_HandleTypeDef * hdma)

Function description

Handles DMAMUX interrupt request.

Parameters

- **hdma:** Pointer to a DMA_HandleTypeDef structure that contains the configuration information for the specified DMA channel.

Return values

- **None:**

18.3 DMAEx Firmware driver defines

The following section lists the various define and macros of the module.

18.3.1 DMAEx

DMAEx

DMAMUX RequestGeneneratorPolarity selection

HAL_DMAMUX_REQ_GEN_NO_EVENT

block request generator events

HAL_DMAMUX_REQ_GEN_RISING

generate request on rising edge events

HAL_DMAMUX_REQ_GEN_FALLING

generate request on falling edge events

HAL_DMAMUX_REQ_GEN_RISING_FALLING

generate request on rising and falling edge events

DMAMUX SignalGeneratorID selection

HAL_DMAMUX1_REQ_GEN_EXTI0

Request signal generation from EXTI Line0

HAL_DMAMUX1_REQ_GEN_EXTI1

Request signal generation from EXTI Line1

HAL_DMAMUX1_REQ_GEN_EXTI2

Request signal generation from EXTI Line2

HAL_DMAMUX1_REQ_GEN_EXTI3

Request signal generation from EXTI Line3

HAL_DMAMUX1_REQ_GEN_EXTI4

Request signal generation from EXTI Line4

HAL_DMAMUX1_REQ_GEN_EXTI5

Request signal generation from EXTI Line5

HAL_DMAMUX1_REQ_GEN_EXTI6

Request signal generation from EXTI Line6

HAL_DMAMUX1_REQ_GEN_EXTI7

Request signal generation from EXTI Line7

HAL_DMAMUX1_REQ_GEN_EXTI8

Request signal generation from EXTI Line8

HAL_DMAMUX1_REQ_GEN_EXTI9

Request signal generation from EXTI Line9

HAL_DMAMUX1_REQ_GEN_EXTI10

Request signal generation from EXTI Line10

HAL_DMAMUX1_REQ_GEN_EXTI11

Request signal generation from EXTI Line11

HAL_DMAMUX1_REQ_GEN_EXTI12

Request signal generation from EXTI Line12

HAL_DMAMUX1_REQ_GEN_EXTI13

Request signal generation from EXTI Line13

HAL_DMAMUX1_REQ_GEN_EXTI14

Request signal generation from EXTI Line14

HAL_DMAMUX1_REQ_GEN_EXTI15

Request signal generation from EXTI Line15

HAL_DMAMUX1_REQ_GEN_DMAMUX1_CH0_EVT

Request signal generation from DMAMUX channel0 Event

HAL_DMAMUX1_REQ_GEN_DMAMUX1_CH1_EVT

Request signal generation from DMAMUX channel1 Event

HAL_DMAMUX1_REQ_GEN_DMAMUX1_CH2_EVT

Request signal generation from DMAMUX channel2 Event

HAL_DMAMUX1_REQ_GEN_DMAMUX1_CH3_EVT

Request signal generation from DMAMUX channel3 Event

HAL_DMAMUX1_REQ_GEN_LPTIM1_OUT

Request signal generation from LPTIM1 Output

HAL_DMAMUX1_REQ_GEN_LPTIM2_OUT

Request signal generation from LPTIM2 Output

HAL_DMAMUX1_REQ_GEN_LPTIM3_OUT

Request signal generation from LPTIM3 Output

HAL_DMAMUX1_MAX_REQ_GEN

DMAMUX SyncPolarity selection

HAL_DMAMUX_SYNC_NO_EVENT

block synchronization events

HAL_DMAMUX_SYNC_RISING

synchronize with rising edge events

HAL_DMAMUX_SYNC_FALLING

synchronize with falling edge events

HAL_DMAMUX_SYNC_RISING_FALLING

synchronize with rising and falling edge events

DMAMUX SyncSignalID selection

HAL_DMAMUX1_SYNC_EXTI0

Synchronization signal from EXTI Line0

HAL_DMAMUX1_SYNC_EXTI1

Synchronization signal from EXTI Line1

HAL_DMAMUX1_SYNC_EXTI2

Synchronization signal from EXTI Line2

HAL_DMAMUX1_SYNC_EXTI3

Synchronization signal from EXTI Line3

HAL_DMAMUX1_SYNC_EXTI4

Synchronization signal from EXTI Line4

HAL_DMAMUX1_SYNC_EXTI5

Synchronization signal from EXTI Line5

HAL_DMAMUX1_SYNC_EXTI6

Synchronization signal from EXTI Line6

HAL_DMAMUX1_SYNC_EXTI7

Synchronization signal from EXTI Line7

HAL_DMAMUX1_SYNC_EXTI8

Synchronization signal from EXTI Line8

HAL_DMAMUX1_SYNC_EXTI9

Synchronization signal from EXTI Line9

HAL_DMAMUX1_SYNC_EXTI10

Synchronization signal from EXTI Line10

HAL_DMAMUX1_SYNC_EXTI11

Synchronization signal from EXTI Line11

HAL_DMAMUX1_SYNC_EXTI12

Synchronization signal from EXTI Line12

HAL_DMAMUX1_SYNC_EXTI13

Synchronization signal from EXTI Line1 3

HAL_DMAMUX1_SYNC_EXTI14

Synchronization signal from EXTI Line1 4

HAL_DMAMUX1_SYNC_EXTI15

Synchronization signal from EXTI Line1 5

HAL_DMAMUX1_SYNC_DMAMUX1_CH0_EVT

Synchronization signal from DMAMUX channel0 Event

HAL_DMAMUX1_SYNC_DMAMUX1_CH1_EVT

Synchronization signal from DMAMUX channel1 Event

HAL_DMAMUX1_SYNC_DMAMUX1_CH2_EVT

Synchronization signal from DMAMUX channel2 Event

HAL_DMAMUX1_SYNC_DMAMUX1_CH3_EVT

Synchronization signal from DMAMUX channel3 Event

HAL_DMAMUX1_SYNC_LPTIM1_OUT

Synchronization signal from LPTIM1 Output

HAL_DMAMUX1_SYNC_LPTIM2_OUT

Synchronization signal from LPTIM2 Output

HAL_DMAMUX1_SYNC_LPTIM3_OUT

Synchronization signal from LPTIM3 Output

HAL_DMAMUX1_MAX_SYNC

19 HAL EXTI Generic Driver

19.1 EXTI Firmware driver registers structures

19.1.1 EXTI_HandleTypeDef

EXTI_HandleTypeDef is defined in the stm32u0xx_hal_exti.h

Data Fields

- ***uint32_t Line***
- ***void(* RisingCallback***
- ***void(* FallingCallback***

Field Documentation

- ***uint32_t EXTI_HandleTypeDef::Line***
  Exti line number
- ***void(* EXTI_HandleTypeDef::RisingCallback)(void)***
  Exti rising callback
- ***void(* EXTI_HandleTypeDef::FallingCallback)(void)***
  Exti falling callback

19.1.2 EXTI_ConfigTypeDef

EXTI_ConfigTypeDef is defined in the stm32u0xx_hal_exti.h

Data Fields

- ***uint32_t Line***
- ***uint32_t Mode***
- ***uint32_t Trigger***
- ***uint32_t GPIOSel***

Field Documentation

- ***uint32_t EXTI_ConfigTypeDef::Line***
  The Exti line to be configured. This parameter can be a value of ***EXTI_Line***
- ***uint32_t EXTI_ConfigTypeDef::Mode***
  The Exit Mode to be configured for a core. This parameter can be a combination of ***EXTI_Mode***
- ***uint32_t EXTI_ConfigTypeDef::Trigger***
  The Exti Trigger to be configured. This parameter can be a value of ***EXTI_Trigger***
- ***uint32_t EXTI_ConfigTypeDef::GPIOSel***
  The Exti GPIO multiplexer selection to be configured. This parameter is only possible for line 0 to 15. It can be a value of ***EXTI_GPIOSel***

19.2 EXTI Firmware driver API description

The following section lists the various functions of the EXTI library.

19.2.1 EXTI Peripheral features

- Each Exti line can be configured within this driver.
- Exti line can be configured in 3 different modes
  - Interrupt
  - Event
  - Both of them
- Configurable Exti lines can be configured with 3 different triggers
  - Rising
  - Falling
  - Both of them

- When set in interrupt mode, configurable Exti lines have two diffenrents interrupt pending registers which allow to distinguish which transition occurs:
  - Rising edge pending interrupt
  - Falling
- Exti lines 0 to 15 are linked to gpio pin number 0 to 15. Gpio port can be selected through multiplexer.

19.2.2 How to use this driver

1. Configure the EXTI line using HAL_EXTI_SetConfigLine().
   - Choose the interrupt line number by setting "Line" member from EXTI_ConfigTypeDef structure.
   - Configure the interrupt and/or event mode using "Mode" member from EXTI_ConfigTypeDef structure.
   - For configurable lines, configure rising and/or falling trigger "Trigger" member from EXTI_ConfigTypeDef structure.
   - For Exti lines linked to gpio, choose gpio port using "GPIOSel" member from GPIO_InitTypeDef structure.
2. Get current Exti configuration of a dedicated line using HAL_EXTI_GetConfigLine().
   - Provide exiting handle as parameter.
   - Provide pointer on EXTI_ConfigTypeDef structure as second parameter.
3. Clear Exti configuration of a dedicated line using HAL_EXTI_GetConfigLine().
   - Provide exiting handle as parameter.
4. Register callback to treat Exti interrupts using HAL_EXTI_RegisterCallback().
   - Provide exiting handle as first parameter.
   - Provide which callback will be registered using one value from EXTI_CallbackIDTypeDef.
   - Provide callback function pointer.
5. Get interrupt pending bit using HAL_EXTI_GetPending().
6. Clear interrupt pending bit using HAL_EXTI_GetPending().
7. Generate software interrupt using HAL_EXTI_GenerateSWI().

19.2.3 Configuration functions

This section contains the following APIs:

- ***HAL_EXTI_SetConfigLine()***
- ***HAL_EXTI_GetConfigLine()***
- ***HAL_EXTI_ClearConfigLine()***
- ***HAL_EXTI_RegisterCallback()***
- ***HAL_EXTI_GetHandle()***

19.2.4 Detailed description of functions

HAL_EXTI_SetConfigLine

Function name

HAL_StatusTypeDef HAL_EXTI_SetConfigLine (EXTI_HandleTypeDef * hexti, EXTI_ConfigTypeDef * pExtiConfig)

Function description

Set configuration of a dedicated Exti line.

Parameters

- **hexti:** Exti handle.
- **pExtiConfig:** Pointer on EXTI configuration to be set.

Return values

- **HAL:** Status.

HAL_EXTI_GetConfigLine

Function name

HAL_StatusTypeDef HAL_EXTI_GetConfigLine (EXTI_HandleTypeDef * hexti, EXTI_ConfigTypeDef * pExtiConfig)

Function description

Get configuration of a dedicated Exti line.

Parameters

- **hexti:** Exti handle.
- **pExtiConfig:** Pointer on structure to store Exti configuration.

Return values

- **HAL:** Status.

HAL_EXTI_ClearConfigLine

Function name

HAL_StatusTypeDef HAL_EXTI_ClearConfigLine (EXTI_HandleTypeDef * hexti)

Function description

Clear whole configuration of a dedicated Exti line.

Parameters

- **hexti:** Exti handle.

Return values

- **HAL:** Status.

HAL_EXTI_RegisterCallback

Function name

HAL_StatusTypeDef HAL_EXTI_RegisterCallback (EXTI_HandleTypeDef * hexti, EXTI_CallbackIDTypeDef CallbackID, void(*)(void) pPendingCbfn)

Function description

Register callback for a dedicaated Exti line.

Parameters

- **hexti:** Exti handle.
- **CallbackID:** User callback identifier. This parameter can be one of
  - EXTI_CallbackIDTypeDef values.
- **pPendingCbfn:** function pointer to be stored as callback.

Return values

- **HAL:** Status.

HAL_EXTI_GetHandle

Function name

HAL_StatusTypeDef HAL_EXTI_GetHandle (EXTI_HandleTypeDef * hexti, uint32_t ExtiLine)

Function description

Store line number as handle private field.

Parameters

- **hexti:** Exti handle.
- **ExtiLine:** Exti line number. This parameter can be from 0 to EXTI_LINE_NB.

Return values

- **HAL:** Status.

HAL_EXTI_IRQHandler

Function name

void HAL_EXTI_IRQHandler (EXTI_HandleTypeDef * hexti)

Function description

Handle EXTI interrupt request.

Parameters

- **hexti:** Exti handle.

Return values

- **none.:**

HAL_EXTI_GetPending

Function name

uint32_t HAL_EXTI_GetPending (EXTI_HandleTypeDef * hexti, uint32_t Edge)

Function description

Get interrupt pending bit of a dedicated line.

Parameters

- **hexti:** Exti handle.
- **Edge:** Specify which pending edge as to be checked. This parameter can be one of the following values:
  - EXTI_TRIGGER_RISING
  - EXTI_TRIGGER_FALLING

Return values

- **1:** if interrupt is pending else 0.

HAL_EXTI_ClearPending

Function name

void HAL_EXTI_ClearPending (EXTI_HandleTypeDef * hexti, uint32_t Edge)

Function description

Clear interrupt pending bit of a dedicated line.

Parameters

- **hexti:** Exti handle.
- **Edge:** Specify which pending edge as to be clear. This parameter can be one of the following values:
  - EXTI_TRIGGER_RISING
  - EXTI_TRIGGER_FALLING

Return values

- **None.:**

HAL_EXTI_GenerateSWI

Function name

void HAL_EXTI_GenerateSWI (EXTI_HandleTypeDef * hexti)

Function description

Generate a software interrupt for a dedicated line.

Parameters

- **hexti:** Exti handle.

Return values

- **None.:**

19.3 EXTI Firmware driver defines

The following section lists the various define and macros of the module.

19.3.1 EXTI

EXTI

EXTI GPIOSel

EXTI_GPIOA

EXTI_GPIOB

EXTI_GPIOC

EXTI_GPIOD

EXTI_GPIOE

EXTI_GPIOF

EXTI Line

EXTI_LINE_0

EXTI_LINE_1

EXTI_LINE_2

EXTI_LINE_3

EXTI_LINE_4

EXTI_LINE_5

EXTI_LINE_6

EXTI_LINE_7

EXTI_LINE_8

EXTI_LINE_9

EXTI_LINE_10

EXTI_LINE_11

EXTI_LINE_12

EXTI_LINE_13

EXTI_LINE_14

EXTI_LINE_15

EXTI_LINE_16

EXTI_LINE_17

EXTI_LINE_18

EXTI_LINE_19

EXTI_LINE_20

EXTI_LINE_21

EXTI_LINE_22

EXTI_LINE_23

EXTI_LINE_24

EXTI_LINE_25

EXTI_LINE_26

EXTI_LINE_27

EXTI_LINE_28

EXTI_LINE_29

EXTI_LINE_30

EXTI_LINE_31

EXTI_LINE_32

EXTI_LINE_33

EXTI_LINE_34

EXTI_LINE_35

EXTI_LINE_36

EXTI_LINE_37

EXTI Mode

EXTI_MODE_NONE

EXTI_MODE_INTERRUPT

EXTI_MODE_EVENT

EXTI Trigger

EXTI_TRIGGER_NONE

EXTI_TRIGGER_RISING

EXTI_TRIGGER_FALLING

EXTI_TRIGGER_RISING_FALLING

20 HAL FLASH Generic Driver

20.1 FLASH Firmware driver registers structures

20.1.1 FLASH_EraseInitTypeDef

FLASH_EraseInitTypeDef is defined in the stm32u0xx_hal_flash.h

Data Fields

- ***uint32_t TypeErase***
- ***uint32_t Banks***
- ***uint32_t Page***
- ***uint32_t NbPages***

Field Documentation

- ***uint32_t FLASH_EraseInitTypeDef::TypeErase***
  Mass erase or page erase. This parameter can be a value of ***FLASH_Type_Erase***
- ***uint32_t FLASH_EraseInitTypeDef::Banks***
  Select bank to erase. This parameter must be a value of ***FLASH_Banks*** (FLASH_BANK_BOTH should be used only for mass erase)
- ***uint32_t FLASH_EraseInitTypeDef::Page***
  Initial Flash page to erase when page erase is enabled This parameter must be a value between 0 and (FLASH_PAGE_NB - 1)
- ***uint32_t FLASH_EraseInitTypeDef::NbPages***
  Number of pages to be erased. This parameter must be a value between 1 and (FLASH_PAGE_NB - value of initial page)

20.1.2 FLASH_OBProgramInitTypeDef

FLASH_OBProgramInitTypeDef is defined in the stm32u0xx_hal_flash.h

Data Fields

- ***uint32_t OptionType***
- ***uint32_t WRPArea***
- ***uint32_t WRPStartOffset***
- ***uint32_t WRPEndOffset***
- ***uint32_t RDPLevel***
- ***uint32_t USERType***
- ***uint32_t USERConfig***
- ***uint32_t RDPKeyType***
- ***uint32_t RDPKey1***
- ***uint32_t RDPKey2***
- ***uint32_t RDPKey3***
- ***uint32_t RDPKey4***
- ***uint32_t BootLock***
- ***uint32_t HDPEndPage***
- ***uint32_t HDPState***

Field Documentation

- ***uint32_t FLASH_OBProgramInitTypeDef::OptionType***
  Option byte to be configured. This parameter can be a combination of the values of ***FLASH_OB_Type***
- ***uint32_t FLASH_OBProgramInitTypeDef::WRPArea***
  Write protection area to be programmed (used for OPTIONBYTE_WRP). Only one WRP area could be programmed at the same time. This parameter can be value of ***FLASH_OB_WRP_Area***

- ***uint32_t FLASH_OBProgramInitTypeDef::WRPStartOffset***
  Write protection start offset (used for OPTIONBYTE_WRP). This parameter must be a value between 0 and [FLASH_PAGE_NB - 1]
- ***uint32_t FLASH_OBProgramInitTypeDef::WRPEndOffset***
  Write protection end offset (used for OPTIONBYTE_WRP). This parameter must be a value between WRPStartOffset and [FLASH_PAGE_NB - 1]
- ***uint32_t FLASH_OBProgramInitTypeDef::RDPLevel***
  Set the read protection level (used for OPTIONBYTE_RDP). This parameter can be a value of ***FLASH_OB_Read_Protection***
- ***uint32_t FLASH_OBProgramInitTypeDef::USERType***
  User option byte(s) to be configured (used for OPTIONBYTE_USER). This parameter can be a combination of ***FLASH_OB_USER_Type***
- ***uint32_t FLASH_OBProgramInitTypeDef::USERConfig***
  Value of the user option byte (used for OPTIONBYTE_USER). This parameter can be a combination of ***FLASH_OB_USER_BOR_ENABLE***, ***FLASH_OB_USER_BOR_LEVEL***, ***FLASH_OB_USER_RESET_CONFIG***, ***FLASH_OB_USER_NRST_STOP***, ***FLASH_OB_USER_NRST_STANDBY***, ***FLASH_OB_USER_NRST_SHUTDOWN***, ***FLASH_OB_USER_IWDG_SW***, ***FLASH_OB_USER_IWDG_STOP***, ***FLASH_OB_USER_IWDG_STANDBY***, ***FLASH_OB_USER_WWDG_SW***, ***FLASH_OB_USER_SRAM_PARITY***, ***FLASH_OB_USER_NBOOT_SEL***, ***FLASH_OB_USER_NBOOT1***, ***FLASH_OB_USER_NBOOT0***, ***FLASH_OB_USER_INPUT_RESET_HOLDER***
- ***uint32_t FLASH_OBProgramInitTypeDef::RDPKeyType***
  Configuration of the RDP OEM keys (used for OPTIONBYTE_RDPKEY). This parameter can be a value of ***FLASH_OB_RDP_Key_Type***
- ***uint32_t FLASH_OBProgramInitTypeDef::RDPKey1***
  Value of the RDP OEM key 1 (used for OPTIONBYTE_RDPKEY)
- ***uint32_t FLASH_OBProgramInitTypeDef::RDPKey2***
  Value of the RDP OEM key 1 (used for OPTIONBYTE_RDPKEY)
- ***uint32_t FLASH_OBProgramInitTypeDef::RDPKey3***
  Value of the RDP OEM key 1 (used for OPTIONBYTE_RDPKEY)
- ***uint32_t FLASH_OBProgramInitTypeDef::RDPKey4***
  Value of the RDP OEM key 1 (used for OPTIONBYTE_RDPKEY)
- ***uint32_t FLASH_OBProgramInitTypeDef::BootLock***
  Allow to force a unique boot entry point to Flash or system Flash
- ***uint32_t FLASH_OBProgramInitTypeDef::HDPEndPage***
  This parameter defines Hide protection area end page
- ***uint32_t FLASH_OBProgramInitTypeDef::HDPState***
  Hide protection area enable

20.1.3 FLASH_ProcessTypeDef

FLASH_ProcessTypeDef is defined in the stm32u0xx_hal_flash.h

Data Fields

- ***HAL_LockTypeDef Lock***
- ***uint32_t ErrorCode***
- ***uint32_t ProcedureOnGoing***
- ***uint32_t Address***
- ***uint32_t Banks***
- ***uint32_t Page***
- ***uint32_t NbPagesToErase***

Field Documentation

- ***HAL_LockTypeDef FLASH_ProcessTypeDef::Lock***
- ***uint32_t FLASH_ProcessTypeDef::ErrorCode***
- ***uint32_t FLASH_ProcessTypeDef::ProcedureOnGoing***
- ***uint32_t FLASH_ProcessTypeDef::Address***
- ***uint32_t FLASH_ProcessTypeDef::Banks***

- ***uint32_t FLASH_ProcessTypeDef::Page***
- ***uint32_t FLASH_ProcessTypeDef::NbPagesToErase***

20.1.4 FLASH_HDPExtensionTypeDef

FLASH_HDPExtensionTypeDef is defined in the stm32u0xx_hal_flash.h

Data Fields

- ***uint32_t Status***
- ***uint32_t NbPages***

Field Documentation

- ***uint32_t FLASH_HDPExtensionTypeDef::Status***
  State of the HDP Extension area ***FLASHEx_HDPEXT_Access***
- ***uint32_t FLASH_HDPExtensionTypeDef::NbPages***
  Number of pages to be HDP extended. This parameter can be a value between 1 and max number of pages in the flash

20.2 FLASH Firmware driver API description

The following section lists the various functions of the FLASH library.

20.2.1 FLASH peripheral features

The Flash memory interface manages CPU AHB I-Code and D-Code accesses to the Flash memory. It implements the erase and program Flash memory operations and the read and write protection mechanisms.

The Flash memory interface accelerates code execution with a system of instruction prefetch and cache lines.

The FLASH main features are:

- Flash memory read operations
- Flash memory program/erase operations
- Read / write protections
- Option bytes programming
- Prefetch on I-Code
- 32 cache lines of 4*64 bits on I-Code
- Error code correction (ECC) : Data in flash are 72-bits word (8 bits added per double word)

20.2.2 How to use this driver

This driver provides functions and macros to configure and program the FLASH memory of all STM32U0xx devices.

1. Flash Memory IO Programming functions:
   - Lock and Unlock the FLASH interface using HAL_FLASH_Unlock() and HAL_FLASH_Lock() functions
   - Program functions: double word and fast program (full row programming)
   - There are two modes of programming:
     - Polling mode using HAL_FLASH_Program() function
     - Interrupt mode using HAL_FLASH_Program_IT() function
2. Interrupts and flags management functions:
   - Handle FLASH interrupts by calling HAL_FLASH_IRQHandler()
   - Callback functions are called when the flash operations are finished : HAL_FLASH_EndOfOperationCallback() when everything is ok, otherwise HAL_FLASH_OperationErrorCallback()
   - Get error flag status by calling HAL_GetError()
3. Option bytes management functions :
   - Lock and Unlock the option bytes using HAL_FLASH_OB_Unlock() and HAL_FLASH_OB_Lock() functions
   - Launch the reload of the option bytes using HAL_FLASH_OB_Launch() function. In this case, a reset is generated

In addition to these functions, this driver includes a set of macros allowing to handle the following operations:

- Set the latency
- Enable/Disable the prefetch buffer
- Enable/Disable the Instruction cache
- Reset the Instruction cache
- Enable/Disable the Flash power-down during low-power run and sleep modes
- Enable/Disable the Flash interrupts
- Monitor the Flash flags status

20.2.3 Programming operation functions

This subsection provides a set of functions allowing to manage the FLASH program operations.

This section contains the following APIs:

- ***HAL_FLASH_Program()***
- ***HAL_FLASH_Program_IT()***
- ***HAL_FLASH_IRQHandler()***
- ***HAL_FLASH_EndOfOperationCallback()***
- ***HAL_FLASH_OperationErrorCallback()***

20.2.4 Peripheral Control functions

This subsection provides a set of functions allowing to control the FLASH memory operations.

This section contains the following APIs:

- ***HAL_FLASH_Unlock()***
- ***HAL_FLASH_Lock()***
- ***HAL_FLASH_OB_Unlock()***
- ***HAL_FLASH_OB_Lock()***
- ***HAL_FLASH_OB_Launch()***

20.2.5 Peripheral Errors functions

This subsection permits to get in run-time Errors of the FLASH peripheral.

This section contains the following APIs:

- ***HAL_FLASH_GetError()***

20.2.6 Detailed description of functions

HAL_FLASH_Program

Function name

HAL_StatusTypeDef HAL_FLASH_Program (uint32_t TypeProgram, uint32_t Address, uint64_t Data)

Function description

Program double word or fast program of a row at a specified address.

Parameters

- **TypeProgram:** Indicate the way to program at a specified address. This parameter can be a value of FLASH Program Type
- **Address:** Specifies the address to be programmed.
- **Data:** Specifies the data to be programmed This parameter is the data for the double word program and the address where are stored the data for the row fast program depending on the TypeProgram: TypeProgram = FLASH_TYPEPROGRAM_DOUBLEWORD (64-bit) TypeProgram = FLASH_TYPEPROGRAM_FAST (32-bit).

Return values

- **HAL_StatusTypeDef:** HAL Status

HAL_FLASH_Program_IT

Function name

HAL_StatusTypeDef HAL_FLASH_Program_IT (uint32_t TypeProgram, uint32_t Address, uint64_t Data)

Function description

Program double word or fast program of a row at a specified address with interrupt enabled.

Parameters

- **TypeProgram:** Indicate the way to program at a specified address. This parameter can be a value of FLASH Program Type
- **Address:** Specifies the address to be programmed.
- **Data:** Specifies the data to be programmed This parameter is the data for the double word program and the address where are stored the data for the row fast program depending on the TypeProgram: TypeProgram = FLASH_TYPEPROGRAM_DOUBLEWORD (64-bit) TypeProgram = FLASH_TYPEPROGRAM_FAST (32-bit).

Return values

- **HAL:** Status

HAL_FLASH_IRQHandler

Function name

void HAL_FLASH_IRQHandler (void)

Function description

Handle FLASH interrupt request.

Return values

- **None:**

HAL_FLASH_EndOfOperationCallback

Function name

void HAL_FLASH_EndOfOperationCallback (uint32_t ReturnValue)

Function description

FLASH end of operation interrupt callback.

Parameters

- **ReturnValue:** The value saved in this parameter depends on the ongoing procedure Mass Erase: 0 Page Erase: Page which has been erased Program: Address which was selected for data program

Return values

- **None:**

HAL_FLASH_OperationErrorCallback

Function name

void HAL_FLASH_OperationErrorCallback (uint32_t ReturnValue)

Function description

FLASH operation error interrupt callback.

Parameters

- **ReturnValue:** The value saved in this parameter depends on the ongoing procedure Mass Erase: 0 Page Erase: Page number which returned an error Program: Address which was selected for data program

Return values

- **None:**

HAL_FLASH_Unlock

Function name

HAL_StatusTypeDef HAL_FLASH_Unlock (void)

Function description

Unlock the FLASH control register access.

Return values

- **HAL:** Status

HAL_FLASH_Lock

Function name

HAL_StatusTypeDef HAL_FLASH_Lock (void)

Function description

Lock the FLASH control register access.

Return values

- **HAL:** Status

HAL_FLASH_OB_Unlock

Function name

HAL_StatusTypeDef HAL_FLASH_OB_Unlock (void)

Function description

Unlock the FLASH Option Bytes Registers access.

Return values

- **HAL:** Status

HAL_FLASH_OB_Lock

Function name

HAL_StatusTypeDef HAL_FLASH_OB_Lock (void)

Function description

Lock the FLASH Option Bytes Registers access.

Return values

- **HAL:** Status

HAL_FLASH_OB_Launch

Function name

HAL_StatusTypeDef HAL_FLASH_OB_Launch (void)

Function description

Launch the option byte loading.

Return values

- **HAL:** Status

HAL_FLASH_GetError

Function name

uint32_t HAL_FLASH_GetError (void)

Function description

Get the specific FLASH error flag.

Return values

- **FLASH_ErrorCode:** The returned value can be
  - HAL_FLASH_ERROR_NONE No error set
  - HAL_FLASH_ERROR_OP Operation error
  - HAL_FLASH_ERROR_PROG Programming error
  - HAL_FLASH_ERROR_WRP Write protection error
  - HAL_FLASH_ERROR_PGA Programming alignment error
  - HAL_FLASH_ERROR_SIZ Size error
  - HAL_FLASH_ERROR_PGS Programming sequence error
  - HAL_FLASH_ERROR_MIS Fast programming data miss error
  - HAL_FLASH_ERROR_FAST Fast programming error
  - HAL_FLASH_ERROR_OPTV Option validity error
  - HAL_FLASH_ERROR_ECCD two ECC errors have been detected

FLASH_WaitForLastOperation

Function name

HAL_StatusTypeDef FLASH_WaitForLastOperation (uint32_t Timeout)

Function description

Wait for a FLASH operation to complete.

Parameters

- **Timeout:** maximum flash operation timeout

Return values

- **HAL_StatusTypeDef:** HAL Status

20.3 FLASH Firmware driver defines

The following section lists the various define and macros of the module.

20.3.1 FLASH

FLASH

FLASH Banks

FLASH_BANK_1

Bank 1

FLASH Error

HAL_FLASH_ERROR_NONE

HAL_FLASH_ERROR_OP

HAL_FLASH_ERROR_PROG

HAL_FLASH_ERROR_WRP

HAL_FLASH_ERROR_PGA

HAL_FLASH_ERROR_SIZ

HAL_FLASH_ERROR_PGS

HAL_FLASH_ERROR_MIS

HAL_FLASH_ERROR_FAST

HAL_FLASH_ERROR_HDPOPT

HAL_FLASH_ERROR_OEMOPT

HAL_FLASH_ERROR_OPTV

HAL_FLASH_ERROR_ECCD

FLASH Exported Macros

__HAL_FLASH_SET_LATENCY

Description:

- Set the FLASH Latency.

Parameters:

- __LATENCY__: FLASH Latency This parameter can be one of the following values :
  - FLASH_LATENCY_0 FLASH Zero wait state
  - FLASH_LATENCY_1 FLASH One wait state
  - FLASH_LATENCY_2 FLASH Two wait states

Return value:

- None

__HAL_FLASH_GET_LATENCY

Description:

- Get the FLASH Latency.

Return value:

- FLASH: Latency Returned value can be one of the following values :
  - FLASH_LATENCY_0 FLASH Zero wait state
  - FLASH_LATENCY_1 FLASH One wait state
  - FLASH_LATENCY_2 FLASH Two wait states

__HAL_FLASH_PREFETCH_BUFFER_ENABLE

Description:

- Enable the FLASH prefetch buffer.

Return value:

- None

__HAL_FLASH_PREFETCH_BUFFER_DISABLE

Description:

- Disable the FLASH prefetch buffer.

Return value:

- None

__HAL_FLASH_INSTRUCTION_CACHE_ENABLE

Description:

- Enable the FLASH instruction cache.

Return value:

- none

__HAL_FLASH_INSTRUCTION_CACHE_DISABLE

Description:

- Disable the FLASH instruction cache.

Return value:

- none

__HAL_FLASH_INSTRUCTION_CACHE_RESET

Description:

- Reset the FLASH instruction Cache.

Return value:

- None

Notes:

- This function must be used only when the Instruction Cache is disabled.

FLASH Flags Definition

FLASH_FLAG_EOP

FLASH End of operation flag

FLASH_FLAG_OPERR

FLASH Operation error flag

FLASH_FLAG_PROGERR

FLASH Programming error flag

FLASH_FLAG_WRPERR

FLASH Write protection error flag

FLASH_FLAG_PGAERR

FLASH Programming alignment error flag

FLASH_FLAG_SIZERR

FLASH Size error flag

FLASH_FLAG_PGSERR

FLASH Programming sequence error flag

FLASH_FLAG_MISERR

FLASH Fast programming data miss error flag

FLASH_FLAG_FASTERR

FLASH Fast programming error flag

FLASH_FLAG_OPTVERR

FLASH Option validity error flag

FLASH_FLAG_BSY1

FLASH Operation Busy flag for Bank 1

FLASH_FLAG_BSY

FLASH Operation Busy flag - legacy name for single bank

FLASH_FLAG_CFGBSY

FLASH Configuration Busy flag

FLASH_FLAG_ECCC1

FLASH ECC correction on bank 1

FLASH_FLAG_ECCD1

FLASH ECC detection on bank 1

FLASH_FLAG_ECCC

FLASH ECC correction - legacy name for single bank

FLASH_FLAG_ECCD

FLASH ECC detection - legacy name for single bank

FLASH Interrupts Macros

__HAL_FLASH_ENABLE_IT

Description:

- Enable the specified FLASH interrupt.

Parameters:

- __INTERRUPT__: FLASH interrupt This parameter can be one of the following values :
  - FLASH_IT_EOP End of FLASH Operation Interrupt
  - FLASH_IT_OPERR Error Interrupt
  - FLASH_IT_ECCC1 ECC Correction Interrupt on bank 1
  - FLASH_IT_ECCC ECC Correction Interrupt - legacy name for single bank

Return value:

- none

__HAL_FLASH_DISABLE_IT

Description:

- Disable the specified FLASH interrupt.

Parameters:

- __INTERRUPT__: FLASH interrupt This parameter can be one of the following values :
  - FLASH_IT_EOP End of FLASH Operation Interrupt
  - FLASH_IT_OPERR Error Interrupt
  - FLASH_IT_ECCC1 ECC Correction Interrupt on bank 1
  - FLASH_IT_ECCC ECC Correction Interrupt - legacy name for single bank

Return value:

- none

__HAL_FLASH_GET_FLAG

Description:

- Check whether the specified FLASH flag is set or not.

Parameters:

- __FLAG__: specifies the FLASH flag to check. This parameter can be one of the following values :
  - FLASH_FLAG_EOP FLASH End of Operation flag
  - FLASH_FLAG_OPERR FLASH Operation error flag
  - FLASH_FLAG_PROGERR FLASH Programming error flag
  - FLASH_FLAG_WRPERR FLASH Write protection error flag
  - FLASH_FLAG_PGAERR FLASH Programming alignment error flag
  - FLASH_FLAG_SIZERR FLASH Size error flag
  - FLASH_FLAG_PGSERR FLASH Programming sequence error flag
  - FLASH_FLAG_MISERR FLASH Fast programming data miss error flag
  - FLASH_FLAG_FASTERR FLASH Fast programming error flag
  - FLASH_FLAG_OPTVERR FLASH Option validity error flag
  - FLASH_FLAG_BSY1 FLASH bank 1 write/erase operations in progress flag
  - FLASH_FLAG_BSY FLASH write/erase operations in progress flag - legacy name for single bank
  - FLASH_FLAG_CFGBSY FLASH configuration is busy : program or erase setting are used.
  - FLASH_FLAG_ECCC1 FLASH one ECC error has been detected and corrected
  - FLASH_FLAG_ECCD1 FLASH two ECC errors have been detected on bank 1
  - FLASH_FLAG_ECCC FLASH one ECC error has been detected and corrected - legacy name for single bank
  - FLASH_FLAG_ECCD FLASH two ECC errors have been detected - legacy name for single bank

Return value:

- The: state of FLASH_FLAG (SET or RESET).

__HAL_FLASH_CLEAR_FLAG

Description:

- Clear the FLASH pending flags.

Parameters:

- __FLAG__: specifies the FLASH flags to clear. This parameter can be one of the following values :
  - FLASH_FLAG_EOP FLASH End of Operation flag
  - FLASH_FLAG_OPERR FLASH Operation error flag
  - FLASH_FLAG_PROGERR FLASH Programming error flag
  - FLASH_FLAG_WRPERR FLASH Write protection error flag
  - FLASH_FLAG_PGAERR FLASH Programming alignment error flag
  - FLASH_FLAG_SIZERR FLASH Size error flag
  - FLASH_FLAG_PGSERR FLASH Programming sequence error flag
  - FLASH_FLAG_MISERR FLASH Fast programming data miss error flag
  - FLASH_FLAG_FASTERR FLASH Fast programming error flag
  - FLASH_FLAG_OPTVERR FLASH Option validity error flag
  - FLASH_FLAG_ECCC1 FLASH one ECC error has been detected and corrected
  - FLASH_FLAG_ECCD1 FLASH two ECC errors have been detected on bank 1
  - FLASH_FLAG_ECCC FLASH one ECC error has been detected and corrected - legacy name for single bank
  - FLASH_FLAG_ECCD FLASH two ECC errors have been detected - legacy name for single bank

Return value:

- None

FLASH Interrupts Definition

FLASH_IT_EOP

End of FLASH Operation Interrupt source

FLASH_IT_OPERR

Error Interrupt source

FLASH_IT_ECCC1

ECC Correction on Bank 1 Interrupt source

FLASH_IT_ECCC

ECC Correction - legacy name for single bank

FLASH Keys

FLASH_KEY1

Flash key1

FLASH_KEY2

Flash key2: used with FLASH_KEY1 \ to unlock the FLASH registers access

FLASH_OPTKEY1

Flash option byte key1

FLASH_OPTKEY2

Flash option byte key2: used with FLASH_OPTKEY1 \ to allow option bytes operations

FLASH Latency

FLASH_LATENCY_0

FLASH Zero wait state

FLASH_LATENCY_1

FLASH One wait state

FLASH_LATENCY_2

FLASH Two wait states

FLASH Option Bytes Read Protection Key Type

OB_RDP_KEY_OEM1

OEM1 key

OB_RDP_KEY_OEM2

OEM2 key

FLASH Option Bytes Read Protection

OB_RDP_LEVEL_0

OB_RDP_LEVEL_1

OB_RDP_LEVEL_2

Warning: When enabling read protection level 2 \ it is no more possible to go back to level 1 or 0

FLASH Option Bytes Secure boot lock

OB_BOOT_LOCK_DISABLE

Boot Lock is free

OB_BOOT_LOCK_ENABLE

Boot Lock is forced to Flash or System Flash

FLASH Option Bytes Type

OPTIONBYTE_WRP

WRP option byte configuration

OPTIONBYTE_RDP

RDP option byte configuration

OPTIONBYTE_USER

USER option byte configuration

OPTIONBYTE_HDP

HDP option byte configuration

OPTIONBYTE_RDPKEY

RDP OEM KEYs option byte configuration

OPTIONBYTE_ALL

All option byte configuration

FLASH Option Bytes User BOR enable

OB_BOR_DISABLE

BOR Reset set to default

OB_BOR_ENABLE

Use option byte to define BOR thresholds

FLASH Option Bytes User BOR Level

OB_BOR_LEVEL_FALLING_0

BOR falling level 1 with threshold around 2.0V

OB_BOR_LEVEL_FALLING_1

BOR falling level 2 with threshold around 2.2V

OB_BOR_LEVEL_FALLING_2

BOR falling level 3 with threshold around 2.5V

OB_BOR_LEVEL_FALLING_3

BOR falling level 4 with threshold around 2.8V

OB_BOR_LEVEL_RISING_0

BOR rising level 1 with threshold around 2.1V

OB_BOR_LEVEL_RISING_1

BOR rising level 2 with threshold around 2.3V

OB_BOR_LEVEL_RISING_2

BOR rising level 3 with threshold around 2.6V

OB_BOR_LEVEL_RISING_3

BOR rising level 4 with threshold around 2.9V

FLASH Option Bytes User input reset holder bit

OB_IRH_ENABLE

Internal Reset handler enable

OB_IRH_DISABLE

Internal Reset handler disable

FLASH Option Bytes User IWDG Mode On Standby

OB_IWDG_STDBY_FREEZE

Independent watchdog counter is frozen in Standby mode

OB_IWDG_STDBY_RUN

Independent watchdog counter is running in Standby mode

FLASH Option Bytes User IWDG Mode On Stop

OB_IWDG_STOP_FREEZE

Independent watchdog counter is frozen in Stop mode

OB_IWDG_STOP_RUN

Independent watchdog counter is running in Stop mode

FLASH Option Bytes User IWDG Type

OB_IWDG_HW

Hardware independent watchdog

OB_IWDG_SW

Software independent watchdog

FLASH Option Bytes User nBOOT0 option bit

OB_NBOOT0_RESET

nBOOT0 = 0

OB_NBOOT0_SET

nBOOT0 = 1

FLASH Option Bytes User BOOT1 Type

OB_BOOT1_SRAM

Embedded SRAM is selected as boot space (if nBOOT0=0 or BOOT0_pin=1)

OB_BOOT1_SYSTEM

System memory is selected as boot space (if nBOOT0=0 or BOOT0_pin=1)

FLASH Option Bytes User Boot0 Selection

OB_BOOT0_FROM_PIN

BOOT0 signal is defined by PA14/BOOT0 pin value

OB_BOOT0_FROM_OB

BOOT0 signal is defined by nBOOT0 option bit

FLASH Option Bytes User Reset On Shutdown

OB_SHUTDOWN_RST

Reset generated when entering the shutdown mode

OB_SHUTDOWN_NORST

No reset generated when entering the shutdown mode

FLASH Option Bytes User Reset On Standby

OB_STANDBY_RST

Reset generated when entering the standby mode

OB_STANDBY_NORST

No reset generated when entering the standby mode

FLASH Option Bytes User Reset On Stop

OB_STOP_RST

Reset generated when entering the stop mode

OB_STOP_NORST

No reset generated when entering the stop mode

FLASH Option Bytes User reset config bit

OB_RESET_MODE_INPUT_ONLY

Reset pin is in Reset input mode only

OB_RESET_MODE_GPIO

Reset pin is in GPIO mode mode only

OB_RESET_MODE_INPUT_OUTPUT

Reset pin is in reset input and output mode

FLASH Option Bytes User SRAM parity

OB_SRAM_PARITY_ENABLE

Sram parity enable

OB_SRAM_PARITY_DISABLE

Sram parity disable

FLASH Option Bytes User Type

OB_USER_BOR_EN

BOR reset enable

OB_USER_BOR_LEV

BOR reset Level

OB_USER_NRST_STOP

Reset generated when entering the stop mode

OB_USER_NRST_STDBY

Reset generated when entering the standby mode

OB_USER_NRST_SHDW

Reset generated when entering the shutdown mode

OB_USER_IWDG_SW

Independent watchdog selection

OB_USER_IWDG_STOP

Independent watchdog counter freeze in stop mode

OB_USER_IWDG_STDBY

Independent watchdog counter freeze in standby mode

OB_USER_WWDG_SW

Window watchdog selection

OB_USER_RAM_PARITY_CHECK

Sram parity check control

OB_USER_NBOOT_SEL

Boot Selection

OB_USER_NBOOT1

nBoot1 configuration

OB_USER_NBOOT0

nBoot0 configuration

OB_USER_NRST_MODE

Reset pin configuration

OB_USER_INPUT_RESET_HOLDER

Internal reset holder enable

OB_USER_ALL

all option bits

FLASH Option Bytes User WWDG Type

OB_WWDG_HW

Hardware window watchdog

OB_WWDG_SW

Software window watchdog

FLASH WRP Area

OB_WRPAREA_ZONE_A

Flash Zone A

OB_WRPAREA_ZONE_B

Flash Zone B

FLASH Erase Type

FLASH_TYPEERASE_PAGES

Pages erase only

FLASH_TYPEERASE_MASS

Flash mass erase activation

FLASH Program Type

FLASH_TYPEPROGRAM_DOUBLEWORD

Program a double-word (64-bit) at a specified address

FLASH_TYPEPROGRAM_FAST

Fast program a 32 row double-word (64-bit) at a specified address

21 HAL FLASH Extension Driver

21.1 FLASHEx Firmware driver API description

The following section lists the various functions of the FLASHEx library.

21.1.1 Flash Extended features

Comparing to other previous devices, the FLASH interface for STM32U0xx devices contains the following additional features

- Capacity up to 128 Kbytes with single bank architecture supporting read-while-write capability (RWW)
- Write protection
- Single bank memory organization
- Hide Protection areas

21.1.2 How to use this driver

This driver provides functions to configure and program the FLASH memory of all STM32U0xx devices. It includes

1. Flash Memory Erase functions:
   - Lock and Unlock the FLASH interface using HAL_FLASH_Unlock() and HAL_FLASH_Lock() functions
   - Erase function: Erase page, erase all sectors
   - There are two modes of erase :
     - Polling Mode using HAL_FLASHEx_Erase()
     - Interrupt Mode using HAL_FLASHEx_Erase_IT()
2. Option Bytes Programming function: Use HAL_FLASHEx_OBProgram() to :
   - Set/Reset the write protection
   - Set the Read protection Level
   - Program the user Option Bytes
   - Set boot lock
   - Configure the Hide protection areas
3. Get Option Bytes Configuration function: Use HAL_FLASHEx_OBGetConfig() to :
   - Get the value of a write protection area
   - Know if the read protection is activated
   - Get the value of the user Option Bytes
   - Get the boot lock information
   - Get the configuration of Hide protection areas
4. Enable or disable debugger usage using HAL_FLASHEx_EnableDebugger and HAL_FLASHEx_DisableDebugger.
5. Check is flash content is empty or not using HAL_FLASHEx_FlashEmptyCheck. and modify this setting (for flash loader purpose e.g.) using HAL_FLASHEx_ForceFlashEmpty.
6. Enable HDP area protection using HAL_FLASHEx_EnableHDPProtection

21.1.3 Extended programming operation functions

This subsection provides a set of functions allowing to manage the Extended FLASH programming operations Operations.

This section contains the following APIs:

- ***HAL_FLASHEx_Erase()***
- ***HAL_FLASHEx_Erase_IT()***
- ***HAL_FLASHEx_OBProgram()***
- ***HAL_FLASHEx_OBGetConfig()***
- ***HAL_FLASHEx_EnableDebugger()***

- *HAL_FLASHEx_DisableDebugger()*
- *HAL_FLASHEx_FlashEmptyCheck()*
- *HAL_FLASHEx_ForceFlashEmpty()*
- *HAL_FLASHEx_EnableHDPProtection()*
- *HAL_FLASHEx_IsEnabledHDPProtection()*
- *HAL_FLASHEx_ConfigHDPExtension()*
- *HAL_FLASHEx_GetHDPExtensionConfig()*
- *HAL_FLASH_OB_GetOEMKeyCRC()*

21.1.4 Detailed description of functions

HAL_FLASHEx_Erase

Function name

HAL_StatusTypeDef HAL_FLASHEx_Erase (FLASH_EraseInitTypeDef * pEraseInit, uint32_t * PageError)

Function description

Perform a mass erase or erase the specified FLASH memory pages.

Parameters

- **pEraseInit:** Pointer to an FLASH_EraseInitTypeDef structure that contains the configuration information for the erasing.
- **PageError:** Pointer to variable that contains the configuration information on faulty page in case of error (0xFFFFFFFF means that all the pages have been correctly erased)

Return values

- **HAL:** Status

HAL_FLASHEx_Erase_IT

Function name

HAL_StatusTypeDef HAL_FLASHEx_Erase_IT (FLASH_EraseInitTypeDef * pEraseInit)

Function description

Perform a mass erase or erase the specified FLASH memory pages with interrupt enabled.

Parameters

- **pEraseInit:** Pointer to an FLASH_EraseInitTypeDef structure that contains the configuration information for the erasing.

Return values

- **HAL:** Status

HAL_FLASHEx_EnableDebugger

Function name

void HAL_FLASHEx_EnableDebugger (void)

Function description

Enable Debugger.

Return values

- **None:**

Notes

- After calling this API, flash interface allow debugger intrusion.

HAL_FLASHEx_DisableDebugger

Function name

void HAL_FLASHEx_DisableDebugger (void)

Function description

Disable Debugger.

Return values

- **None:**

Notes

- After calling this API, Debugger is disabled: it is no more possible to break, see CPU register, etc...

HAL_FLASHEx_FlashEmptyCheck

Function name

uint32_t HAL_FLASHEx_FlashEmptyCheck (void)

Function description

Flash Empty check.

Return values

- **0:** if 1st location is not programmed else

Notes

- This API checks if first location in Flash is programmed or not. This check is done once by Option Byte Loader.

HAL_FLASHEx_ForceFlashEmpty

Function name

void HAL_FLASHEx_ForceFlashEmpty (uint32_t FlashEmpty)

Function description

Force Empty check value.

Parameters

- **FlashEmpty:** this parameter can be a value of FLASHEx Empty Check

Return values

- **None:**

Notes

- Allows to modify program empty check value in order to force this infrmation in Flash Interface, for all next reset that do not launch Option Byte Loader.

HAL_FLASHEx_OBProgram

Function name

HAL_StatusTypeDef HAL_FLASHEx_OBProgram (FLASH_OBProgramInitTypeDef * pOBInit)

Function description

Program Option bytes.

Parameters

- **pOBInit:** Pointer to an FLASH_OBProgramInitTypeDef structure that contains the configuration information for the programming.

Return values

- **HAL:** Status

Notes

- To configure any option bytes, the option lock bit OPTLOCK must be cleared with the call of HAL_FLASH_OB_Unlock() function.
- New option bytes configuration will be taken into account only after an option bytes launch through the call of HAL_FLASH_OB_Launch()a Power On Resetan exit from Standby or Shutdown mode.

HAL_FLASHEx_OBGetConfig

Function name

void HAL_FLASHEx_OBGetConfig (FLASH_OBProgramInitTypeDef * pOBInit)

Function description

Get the Option bytes configuration.

Parameters

- **pOBInit:** Pointer to an FLASH_OBProgramInitTypeDef structure that contains the configuration information. The fields pOBInit->WRPArea should indicate which area is requested for the WRP.

Return values

- **None:**

Notes

- warning: this API only read flash register, it does not reflect any change that would have been programmed between previous Option byte loading and current call.

HAL_FLASHEx_EnableHDPProtection

Function name

void HAL_FLASHEx_EnableHDPProtection (uint32_t Banks)

Function description

Enable the HDP Protection area .

Parameters

- **Banks:** specifies the bank number this parameter can be:
  - FLASH_BANK_1

Return values

- **None:**

HAL_FLASHEx_IsEnabledHDPProtection

Function name

uint32_t HAL_FLASHEx_IsEnabledHDPProtection (void)

Function description

Check if the HDP area protection enabled.

Return values

- **returns:** 1 if the Protection is enabled 0 if the protection is disabled

HAL_FLASHEx_ConfigHDPExtension

Function name

void HAL_FLASHEx_ConfigHDPExtension (FLASH_HDPExtensionTypeDef * pHDPExtension)

Function description

HDP extension area configuration.

Parameters

- **pHDPExtension:** pointer to an FLASH_HDPExtentionTypeDef structure that contains the configuration information.

Return values

- **None:**

HAL_FLASHEx_GetHDPExtensionConfig

Function name

void HAL_FLASHEx_GetHDPExtensionConfig (FLASH_HDPExtensionTypeDef * pHDPExtension)

Function description

Get HDP extension configuration.

Parameters

- **pHDPExtension:** pointer to an FLASH_HDPExtentionTypeDef structure that contains the configuration information.

Return values

- **None:**

HAL_FLASH_OB_GetOEMKeyCRC

Function name

void HAL_FLASH_OB_GetOEMKeyCRC (uint32_t RDPKeyType, uint32_t * OEMKeyCRC)

Function description

Get the OEM1/2 keys CRC.

Parameters

- **RDPKeyType:** specifies the read protection key type. This parameter can be one of the following values:
  - OB_RDP_KEY_OEM1: OEM1 key
  - OB_RDP_KEY_OEM2: OEM2 key
- **OEMKeyCRC:** specifies the OEM keys CRC.

Return values

- **None:**

FLASH_PageErase

Function name

void FLASH_PageErase (uint32_t Page)

Function description

Erase the specified FLASH memory page.

Parameters

- **Page:** FLASH page to erase This parameter must be a value between 0 and (max number of pages in Flash - 1)

Return values

- **None:**

FLASH_FlushCaches

Function name

void FLASH_FlushCaches (void)

Function description

Flush the instruction cache.

Return values

- **None:**

21.2 FLASHEx Firmware driver defines

The following section lists the various define and macros of the module.

21.2.1 FLASHEx

FLASHEx

FLASHEx Empty Check

FLASH_NOT_EMPTY

1st location in Flash is programmed

FLASH_EMPTY

1st location in Flash is empty

FLASHEx HDPEXT access

FLASH_HDPEXT_ACCESS_GRANTED

Access to HDP extension area granted

FLASH_HDPEXT_ACCESS_DENIED

Access to HDP extension area denied but HDP_EXT size increment allowed at any time

FLASH_HDPEXT_ACCESS_LOCKED

Access to HDP extension area denied and HDP_EXT size update not possible

22 HAL GPIO Generic Driver

22.1 GPIO Firmware driver registers structures

22.1.1 GPIO_InitTypeDef

GPIO_InitTypeDef is defined in the stm32u0xx_hal_gpio.h

Data Fields

- ***uint32_t Pin***
- ***uint32_t Mode***
- ***uint32_t Pull***
- ***uint32_t Speed***
- ***uint32_t Alternate***

Field Documentation

- ***uint32_t GPIO_InitTypeDef::Pin***
  Specifies the GPIO pins to be configured. This parameter can be any value of ***GPIO_pins***
- ***uint32_t GPIO_InitTypeDef::Mode***
  Specifies the operating mode for the selected pins. This parameter can be a value of ***GPIO_mode***
- ***uint32_t GPIO_InitTypeDef::Pull***
  Specifies the Pull-up or Pull-Down activation for the selected pins. This parameter can be a value of ***GPIO_pull***
- ***uint32_t GPIO_InitTypeDef::Speed***
  Specifies the speed for the selected pins. This parameter can be a value of ***GPIO_speed***
- ***uint32_t GPIO_InitTypeDef::Alternate***
  Peripheral to be connected to the selected pins This parameter can be a value of ***GPIOEx_Alternate_function_selection***

22.2 GPIO Firmware driver API description

The following section lists the various functions of the GPIO library.

22.2.1 GPIO Peripheral features

- Each port bit of the general-purpose I/O (GPIO) ports can be individually configured by software in several modes:
  - Input mode
  - Analog mode
  - Output mode
  - Alternate function mode
  - External interrupt/event lines
- During and just after reset, the alternate functions and external interrupt lines are not active and the I/O ports are configured in input floating mode.
- All GPIO pins have weak internal pull-up and pull-down resistors, which can be activated or not.
- In Output or Alternate mode, each IO can be configured on open-drain or push-pull type and the IO speed can be selected depending on the VDD value.
- The microcontroller IO pins are connected to onboard peripherals/modules through a multiplexer that allows only one peripheral alternate function (AF) connected to an IO pin at a time. In this way, there can be no conflict between peripherals sharing the same IO pin.
- All ports have external interrupt/event capability. To use external interrupt lines, the port must be configured in input mode. All available GPIO pins are connected to the 16 external interrupt/event lines from EXTI0 to EXTI15.

- The external interrupt/event controller consists of up to 28 edge detectors (16 lines are connected to GPIO) for generating event/interrupt requests (each input line can be independently configured to select the type (interrupt or event) and the corresponding trigger event (rising or falling or both). Each line can also be masked independently.

22.2.2 How to use this driver

1. Enable the GPIO AHB clock using the following function: __HAL_RCC_GPIOx_CLK_ENABLE().
2. Configure the GPIO pin(s) using HAL_GPIO_Init().
   - Configure the IO mode using "Mode" member from GPIO_InitTypeDef structure
   - Activate Pull-up, Pull-down resistor using "Pull" member from GPIO_InitTypeDef structure.
   - In case of Output or alternate function mode selection: the speed is configured through "Speed" member from GPIO_InitTypeDef structure.
   - In alternate mode is selection, the alternate function connected to the IO is configured through "Alternate" member from GPIO_InitTypeDef structure.
   - Analog mode is required when a pin is to be used as ADC channel or DAC output.
   - In case of external interrupt/event selection the "Mode" member from GPIO_InitTypeDef structure select the type (interrupt or event) and the corresponding trigger event (rising or falling or both).
3. In case of external interrupt/event mode selection, configure NVIC IRQ priority mapped to the EXTI line using HAL_NVIC_SetPriority() and enable it using HAL_NVIC_EnableIRQ().
4. To get the level of a pin configured in input mode use HAL_GPIO_ReadPin().
5. To set/reset the level of a pin configured in output mode use HAL_GPIO_WritePin()/HAL_GPIO_TogglePin().
6. To lock pin configuration until next reset use HAL_GPIO_LockPin().
7. During and just after reset, the alternate functions are not active and the GPIO pins are configured in input floating mode (except JTAG pins).
8. The LSE oscillator pins OSC32_IN and OSC32_OUT can be used as general purpose (PC14 and PC15, respectively) when the LSE oscillator is off. The LSE has priority over the GPIO function.
9. The HSE oscillator pins OSC_IN/OSC_OUT can be used as general purpose PF0 and PF1, respectively, when the HSE oscillator is off. The HSE has priority over the GPIO function.

22.2.3 Initialization and de-initialization functions

This section contains the following APIs:

- ***HAL_GPIO_Init()***
- ***HAL_GPIO_DeInit()***

22.2.4 Detailed description of functions

HAL_GPIO_Init

Function name

void HAL_GPIO_Init (GPIO_TypeDef * GPIOx, GPIO_InitTypeDef * GPIO_Init)

Function description

Initialize the GPIOx peripheral according to the specified parameters in the GPIO_Init.

Parameters

- **GPIOx:** where x can be (A..F) to select the GPIO peripheral for STM32U0xx family
- **GPIO_Init:** pointer to a GPIO_InitTypeDef structure that contains the configuration information for the specified GPIO peripheral.

Return values

- **None:**

HAL_GPIO_DeInit

Function name

void HAL_GPIO_DeInit (GPIO_TypeDef * GPIOx, uint32_t GPIO_Pin)

Function description

De-initialize the GPIOx peripheral registers to their default reset values.

Parameters

- **GPIOx:** where x can be (A..F) to select the GPIO peripheral for STM32U0xx family
- **GPIO_Pin:** specifies the port bit to be written. This parameter can be any combination of GPIO_Pin_x where x can be (0..15).

Return values

- **None:**

HAL_GPIO_ReadPin

Function name

GPIO_PinState HAL_GPIO_ReadPin (GPIO_TypeDef * GPIOx, uint16_t GPIO_Pin)

Function description

Read the specified input port pin.

Parameters

- **GPIOx:** where x can be (A..F) to select the GPIO peripheral for STM32U0xx family
- **GPIO_Pin:** specifies the port bit to read. This parameter can be any combination of GPIO_Pin_x where x can be (0..15).

Return values

- **The:** input port pin value.

HAL_GPIO_WritePin

Function name

void HAL_GPIO_WritePin (GPIO_TypeDef * GPIOx, uint16_t GPIO_Pin, GPIO_PinState PinState)

Function description

Set or clear the selected data port bit.

Parameters

- **GPIOx:** where x can be (A..F) to select the GPIO peripheral for STM32U0xx family
- **GPIO_Pin:** specifies the port bit to be written. This parameter can be any combination of GPIO_Pin_x where x can be (0..15).
- **PinState:** specifies the value to be written to the selected bit. This parameter can be one of the GPIO_PinState enum values:
  - GPIO_PIN_RESET: to clear the port pin
  - GPIO_PIN_SET: to set the port pin

Return values

- **None:**

Notes

- This function uses GPIOx_BSRR and GPIOx_BRR registers to allow atomic read/modify accesses. In this way, there is no risk of an IRQ occurring between the read and the modify access.

HAL_GPIO_TogglePin

Function name

void HAL_GPIO_TogglePin (GPIO_TypeDef * GPIOx, uint16_t GPIO_Pin)

Function description

Toggle the specified GPIO pin.

Parameters

- **GPIOx:** where x can be (A..F) to select the GPIO peripheral for STM32U0xx family
- **GPIO_Pin:** specifies the pin to be toggled. This parameter can be any combination of GPIO_Pin_x where x can be (0..15).

Return values

- **None:**

HAL_GPIO_LockPin

Function name

HAL_StatusTypeDef HAL_GPIO_LockPin (GPIO_TypeDef * GPIOx, uint16_t GPIO_Pin)

Function description

Lock GPIO Pins configuration registers.

Parameters

- **GPIOx:** where x can be (A..F) to select the GPIO peripheral for STM32U0xx family
- **GPIO_Pin:** specifies the port bits to be locked. This parameter can be any combination of GPIO_Pin_x where x can be (0..15).

Return values

- **None:**

Notes

- The locked registers are GPIOx_MODER, GPIOx_OTYPER, GPIOx_OSPEEDR, GPIOx_PUPDR, GPIOx_AFRL and GPIOx_AFRH.
- The configuration of the locked GPIO pins can no longer be modified until the next reset.

HAL_GPIO_EXTI_IRQHandler

Function name

void HAL_GPIO_EXTI_IRQHandler (uint16_t GPIO_Pin)

Function description

Handle EXTI interrupt request.

Parameters

- **GPIO_Pin:** Specifies the port pin connected to corresponding EXTI line.

Return values

- **None:**

HAL_GPIO_EXTI_Rising_Callback

Function name

void HAL_GPIO_EXTI_Rising_Callback (uint16_t GPIO_Pin)

Function description

EXTI line detection callback.

Parameters

- **GPIO_Pin:** Specifies the port pin connected to corresponding EXTI line.

Return values

- **None:**

HAL_GPIO_EXTI_Falling_Callback

Function name

void HAL_GPIO_EXTI_Falling_Callback (uint16_t GPIO_Pin)

Function description

EXTI line detection callback.

Parameters

- **GPIO_Pin:** Specifies the port pin connected to corresponding EXTI line.

Return values

- **None:**

22.3 GPIO Firmware driver defines

The following section lists the various define and macros of the module.

22.3.1 GPIO

GPIO

GPIO Exported Macros

__HAL_GPIO_EXTI_GET_RISING_IT

Description:

- Check whether the specified EXTI line is rising edge asserted or not.

Parameters:

- __EXTI_LINE__: specifies the EXTI line to check. This parameter can be GPIO_PIN_x where x can be(0..15)

Return value:

- The: new state of __EXTI_LINE__ (SET or RESET).

__HAL_GPIO_EXTI_CLEAR_RISING_IT

Description:

- Clear the EXTI line rising pending bits.

Parameters:

- __EXTI_LINE__: specifies the EXTI lines to clear. This parameter can be any combination of GPIO_PIN_x where x can be (0..15)

Return value:

- None

__HAL_GPIO_EXTI_GET_FALLING_IT

Description:

- Check whether the specified EXTI line is falling edge asserted or not.

Parameters:

- __EXTI_LINE__: specifies the EXTI line to check. This parameter can be GPIO_PIN_x where x can be(0..15)

Return value:

- The: new state of __EXTI_LINE__ (SET or RESET).

__HAL_GPIO_EXTI_CLEAR_FALLING_IT

Description:

- Clear the EXTI line falling pending bits.

Parameters:

- __EXTI_LINE__: specifies the EXTI lines to clear. This parameter can be any combination of GPIO_PIN_x where x can be (0..15)

Return value:

- None

__HAL_GPIO_EXTI_GET_IT

Description:

- Check whether the specified EXTI line is asserted or not.

Parameters:

- __EXTI_LINE__: specifies the EXTI line to check. This parameter can be GPIO_PIN_x where x can be(0..15)

Return value:

- The: new state of __EXTI_LINE__ (SET or RESET).

__HAL_GPIO_EXTI_CLEAR_IT

Description:

- Clear the EXTI's line pending bits.

Parameters:

- __EXTI_LINE__: specifies the EXTI lines to clear. This parameter can be any combination of GPIO_PIN_x where x can be (0..15)

Return value:

- None

__HAL_GPIO_EXTI_GENERATE_SWIT

Description:

- Generate a Software interrupt on selected EXTI line.

Parameters:

- __EXTI_LINE__: specifies the EXTI line to check. This parameter can be GPIO_PIN_x where x can be(0..15)

Return value:

- None

__HAL_GPIO_EXTI_GET_FLAG

Description:

- Check whether the specified EXTI line flag is set or not.

Parameters:

- __EXTI_LINE__: specifies the EXTI line flag to check. This parameter can be GPIO_PIN_x where x can be(0..15)

Return value:

- The: new state of __EXTI_LINE__ (SET or RESET).

__HAL_GPIO_EXTI_CLEAR_FLAG

Description:

- Clear the EXTI line pending flags.

Parameters:

- __EXTI_LINE__: specifies the EXTI lines flags to clear. This parameter can be any combination of GPIO_PIN_x where x can be (0..15)

Return value:

- None

GPIO mode

GPIO_MODE_INPUT

Input Floating Mode

GPIO_MODE_OUTPUT_PP

Output Push Pull Mode

GPIO_MODE_OUTPUT_OD

Output Open Drain Mode

GPIO_MODE_AF_PP

Alternate Function Push Pull Mode

GPIO_MODE_AF_OD

Alternate Function Open Drain Mode

GPIO_MODE_ANALOG

Analog Mode

GPIO_MODE_IT_RISING

External Interrupt Mode with Rising edge trigger detection

GPIO_MODE_IT_FALLING

External Interrupt Mode with Falling edge trigger detection

GPIO_MODE_IT_RISING_FALLING

External Interrupt Mode with Rising/Falling edge trigger detection

GPIO_MODE_EVT_RISING

External Event Mode with Rising edge trigger detection

GPIO_MODE_EVT_FALLING

External Event Mode with Falling edge trigger detection

GPIO_MODE_EVT_RISING_FALLING

External Event Mode with Rising/Falling edge trigger detection

GPIO pins

GPIO_PIN_0

GPIO_PIN_1

GPIO_PIN_2

GPIO_PIN_3

GPIO_PIN_4

GPIO_PIN_5

GPIO_PIN_6

GPIO_PIN_7

GPIO_PIN_8

GPIO_PIN_9

GPIO_PIN_10

GPIO_PIN_11

GPIO_PIN_12

GPIO_PIN_13

GPIO_PIN_14

GPIO_PIN_15

GPIO_PIN_ALL

GPIO_PIN_MASK

GPIO pull

GPIO_NOPULL
: No Pull-up or Pull-down activation

GPIO_PULLUP
: Pull-up activation

GPIO_PULLDOWN
: Pull-down activation

GPIO speed

GPIO_SPEED_FREQ_LOW
: Low speed

GPIO_SPEED_FREQ_MEDIUM
: Medium speed

GPIO_SPEED_FREQ_HIGH

High speed

GPIO_SPEED_FREQ_VERY_HIGH

Very high speed

23 HAL GPIO Extension Driver

23.1 GPIOEx Firmware driver defines

The following section lists the various define and macros of the module.

23.1.1 GPIOEx

GPIOEx

GPIOEx Alternate function selection

GPIO_AF0_MCO

MCO (MCO1) Alternate Function mapping

GPIO_AF0_OSC_EN

OSC (By pass and Enable) Alternate Function mapping

GPIO_AF0_OSC32_EN

OSC32 (By pass and Enable) Alternate Function mapping

GPIO_AF0_SWD

SWD (SWDIO/SWDCLK) Alternate Function mapping

GPIO_AF0_MCO2

MCO (MCO2) Alternate Function mapping

GPIO_AF0_RTC

RTC (OUT2/REFIN) Alternate Function mapping

GPIO_AF1_IR

IR Alternate Function mapping

GPIO_AF1_TIM1

TIM1 Alternate Function mapping

GPIO_AF1_TIM2

TIM2 Alternate Function mapping

GPIO_AF1_LPTIM1

LPTIM1 Alternate Function mapping

GPIO_AF1_OSC_EN

OSC (By pass and Enable) Alternate Function mapping

GPIO_AF2_LPTIM1

LPTIM1 Alternate Function mapping

GPIO_AF2_LPTIM3

LPTIM3 Alternate Function mapping

GPIO_AF2_I2C4

I2C4 Alternate Function mapping

GPIO_AF2_TIM2

TIM2 Alternate Function mapping

GPIO_AF2_TIM3

TIM3 Alternate Function mapping

GPIO_AF2_TIM1

TIM3 Alternate Function mapping

GPIO_AF3_I2C2

I2C2 Alternate Function mapping

GPIO_AF3_MCO2

MCO (MCO2) Alternate Function mapping

GPIO_AF3_USART2

USART2 Alternate Function mapping

GPIO_AF3_I2C4

I2C4 Alternate Function mapping

GPIO_AF4_I2C3

I2C3 Alternate Function mapping

GPIO_AF4_I2C1

I2C1 Alternate Function mapping

GPIO_AF4_LPTIM3

LPTIM3 Alternate Function mapping

GPIO_AF4_I2C2

I2C2 Alternate Function mapping

GPIO_AF4_I2C4

I2C4 Alternate Function mapping

GPIO_AF5_SPI1

SPI1 Alternate Function mapping

GPIO_AF5_I2C2

I2C2 Alternate Function mapping

GPIO_AF5_SPI2

SPI2 Alternate Function mapping

GPIO_AF6_SPI2

SPI2 Alternate Function mapping

GPIO_AF6_SPI3

SPI3 Alternate Function mapping

GPIO_AF6_COMP1

COMP1 Alternate Function mapping

GPIO_AF6_LPUART3

LPUART3 Alternate Function mapping

GPIO_AF7_USART1

USART1 Alternate Function mapping

GPIO_AF7_USART2

USART2 Alternate Function mapping

GPIO_AF7_USART3

USART3 Alternate Function mapping

GPIO_AF8_USART4

USART4 Alternate Function mapping

GPIO_AF8_LPUART1

LPUART1 Alternate Function mapping

GPIO_AF8_LPUART2

LPUART2 Alternate Function mapping

GPIO_AF8_LPUART3

LPUART3 Alternate Function mapping

GPIO_AF9_TSC

TSC Alternate Function mapping

GPIO_AF10_LPUART2

LPUART2 Alternate Function mapping

GPIO_AF10_USB

USB Alternate Function mapping

GPIO_AF10_CRS

CRS Alternate Function mapping

GPIO_AF11_LCD

LCD Alternate Function mapping

GPIO_AF12_COMP1

COMP1 Alternate Function mapping

GPIO_AF12_COMP2

COMP2 Alternate Function mapping

GPIO_AF12_LCD

LCD Alternate Function mapping

GPIO_AF14_LPTIM1

AF 14 selection LPTIM1 Alternate Function mapping

GPIO_AF14_LPTIM2

LPTIM2 Alternate Function mapping

GPIO_AF14_LPTIM3

LPTIM3 Alternate Function mapping

GPIO_AF14_TIM2

TIM2 Alternate Function mapping

GPIO_AF14_TIM15

TIM15 Alternate Function mapping

GPIO_AF14_TIM16

TIM16 Alternate Function mapping

GPIO_AF15_EVENTOUT

EVENTOUT Alternate Function mapping

GPIOEx Exported Macros

IS_GPIO_AF

GPIOEx Get Port Index

GPIO_GET_INDEX

24 HAL I2C Generic Driver

24.1 I2C Firmware driver registers structures

24.1.1 I2C_InitTypeDef

I2C_InitTypeDef is defined in the stm32u0xx_hal_i2c.h

Data Fields

- ***uint32_t Timing***
- ***uint32_t OwnAddress1***
- ***uint32_t AddressingMode***
- ***uint32_t DualAddressMode***
- ***uint32_t OwnAddress2***
- ***uint32_t OwnAddress2Masks***
- ***uint32_t GeneralCallMode***
- ***uint32_t NoStretchMode***

Field Documentation

- ***uint32_t I2C_InitTypeDef::Timing***
  Specifies the I2C_TIMINGR_register value. This parameter calculated by referring to I2C initialization section in Reference manual
- ***uint32_t I2C_InitTypeDef::OwnAddress1***
  Specifies the first device own address. This parameter can be a 7-bit or 10-bit address.
- ***uint32_t I2C_InitTypeDef::AddressingMode***
  Specifies if 7-bit or 10-bit addressing mode is selected. This parameter can be a value of ***I2C_ADDRESSING_MODE***
- ***uint32_t I2C_InitTypeDef::DualAddressMode***
  Specifies if dual addressing mode is selected. This parameter can be a value of ***I2C_DUAL_ADDRESSING_MODE***
- ***uint32_t I2C_InitTypeDef::OwnAddress2***
  Specifies the second device own address if dual addressing mode is selected This parameter can be a 7-bit address.
- ***uint32_t I2C_InitTypeDef::OwnAddress2Masks***
  Specifies the acknowledge mask address second device own address if dual addressing mode is selected. This parameter can be a value of ***I2C_OWN_ADDRESS2_MASKS***
- ***uint32_t I2C_InitTypeDef::GeneralCallMode***
  Specifies if general call mode is selected. This parameter can be a value of ***I2C_GENERAL_CALL_ADDRESSING_MODE***
- ***uint32_t I2C_InitTypeDef::NoStretchMode***
  Specifies if nostretch mode is selected. This parameter can be a value of ***I2C_NOSTRETCH_MODE***

24.1.2 __I2C_HandleTypeDef

__I2C_HandleTypeDef is defined in the stm32u0xx_hal_i2c.h

Data Fields

- ***I2C_TypeDef * Instance***
- ***I2C_InitTypeDef Init***
- ***uint8_t * pBuffPtr***
- ***uint16_t XferSize***
- ***__IO uint16_t XferCount***
- ***__IO uint32_t XferOptions***
- ***__IO uint32_t PreviousState***
- ***HAL_StatusTypeDef(* XferISR***
- ***DMA_HandleTypeDef * hdmatx***

- ***DMA_HandleTypeDef * hdmarx***
- ***HAL_LockTypeDef Lock***
- ***__IO HAL_I2C_StateTypeDef State***
- ***__IO HAL_I2C_ModeTypeDef Mode***
- ***__IO uint32_t ErrorCode***
- ***__IO uint32_t AddrEventCount***
- ***__IO uint32_t Devaddress***
- ***__IO uint32_t Memaddress***
- ***void(* MasterTxCpltCallback***
- ***void(* MasterRxCpltCallback***
- ***void(* SlaveTxCpltCallback***
- ***void(* SlaveRxCpltCallback***
- ***void(* ListenCpltCallback***
- ***void(* MemTxCpltCallback***
- ***void(* MemRxCpltCallback***
- ***void(* ErrorCallback***
- ***void(* AbortCpltCallback***
- ***void(* AddrCallback***
- ***void(* MspInitCallback***
- ***void(* MspDeInitCallback***

Field Documentation

- ***I2C_TypeDef* __I2C_HandleTypeDef::Instance***
  I2C registers base address
- ***I2C_InitTypeDef __I2C_HandleTypeDef::Init***
  I2C communication parameters
- ***uint8_t* __I2C_HandleTypeDef::pBuffPtr***
  Pointer to I2C transfer buffer
- ***uint16_t __I2C_HandleTypeDef::XferSize***
  I2C transfer size
- ***__IO uint16_t __I2C_HandleTypeDef::XferCount***
  I2C transfer counter
- ***__IO uint32_t __I2C_HandleTypeDef::XferOptions***
  I2C sequantial transfer options, this parameter can be a value of ***I2C_XFEROPTIONS***
- ***__IO uint32_t __I2C_HandleTypeDef::PreviousState***
  I2C communication Previous state
- ***HAL_StatusTypeDef(* __I2C_HandleTypeDef::XferISR)(struct __I2C_HandleTypeDef *hi2c, uint32_t ITFlags, uint32_t ITSources)***
  I2C transfer IRQ handler function pointer
- ***DMA_HandleTypeDef* __I2C_HandleTypeDef::hdmatx***
  I2C Tx DMA handle parameters
- ***DMA_HandleTypeDef* __I2C_HandleTypeDef::hdmarx***
  I2C Rx DMA handle parameters
- ***HAL_LockTypeDef __I2C_HandleTypeDef::Lock***
  I2C locking object
- ***__IO HAL_I2C_StateTypeDef __I2C_HandleTypeDef::State***
  I2C communication state
- ***__IO HAL_I2C_ModeTypeDef __I2C_HandleTypeDef::Mode***
  I2C communication mode
- ***__IO uint32_t __I2C_HandleTypeDef::ErrorCode***
  I2C Error code
- ***__IO uint32_t __I2C_HandleTypeDef::AddrEventCount***
  I2C Address Event counter

- ***__IO uint32_t __I2C_HandleTypeDef::Devaddress***
  I2C Target device address
- ***__IO uint32_t __I2C_HandleTypeDef::Memaddress***
  I2C Target memory address
- ***void(* __I2C_HandleTypeDef::MasterTxCpltCallback)(struct __I2C_HandleTypeDef *hi2c)***
  I2C Master Tx Transfer completed callback
- ***void(* __I2C_HandleTypeDef::MasterRxCpltCallback)(struct __I2C_HandleTypeDef *hi2c)***
  I2C Master Rx Transfer completed callback
- ***void(* __I2C_HandleTypeDef::SlaveTxCpltCallback)(struct __I2C_HandleTypeDef *hi2c)***
  I2C Slave Tx Transfer completed callback
- ***void(* __I2C_HandleTypeDef::SlaveRxCpltCallback)(struct __I2C_HandleTypeDef *hi2c)***
  I2C Slave Rx Transfer completed callback
- ***void(* __I2C_HandleTypeDef::ListenCpltCallback)(struct __I2C_HandleTypeDef *hi2c)***
  I2C Listen Complete callback
- ***void(* __I2C_HandleTypeDef::MemTxCpltCallback)(struct __I2C_HandleTypeDef *hi2c)***
  I2C Memory Tx Transfer completed callback
- ***void(* __I2C_HandleTypeDef::MemRxCpltCallback)(struct __I2C_HandleTypeDef *hi2c)***
  I2C Memory Rx Transfer completed callback
- ***void(* __I2C_HandleTypeDef::ErrorCallback)(struct __I2C_HandleTypeDef *hi2c)***
  I2C Error callback
- ***void(* __I2C_HandleTypeDef::AbortCpltCallback)(struct __I2C_HandleTypeDef *hi2c)***
  I2C Abort callback
- ***void(* __I2C_HandleTypeDef::AddrCallback)(struct __I2C_HandleTypeDef *hi2c, uint8_t TransferDirection, uint16_t AddrMatchCode)***
  I2C Slave Address Match callback
- ***void(* __I2C_HandleTypeDef::MspInitCallback)(struct __I2C_HandleTypeDef *hi2c)***
  I2C Msp Init callback
- ***void(* __I2C_HandleTypeDef::MspDeInitCallback)(struct __I2C_HandleTypeDef *hi2c)***
  I2C Msp DeInit callback

24.2 I2C Firmware driver API description

The following section lists the various functions of the I2C library.

24.2.1 How to use this driver

The I2C HAL driver can be used as follows:

1. Declare a I2C_HandleTypeDef handle structure, for example: I2C_HandleTypeDef hi2c;
2. Initialize the I2C low level resources by implementing the HAL_I2C_MspInit() API:
   a. Enable the I2Cx interface clock
   b. I2C pins configuration
      - Enable the clock for the I2C GPIOs
      - Configure I2C pins as alternate function open-drain
   c. NVIC configuration if you need to use interrupt process
      - Configure the I2Cx interrupt priority
      - Enable the NVIC I2C IRQ Channel
   d. DMA Configuration if you need to use DMA process
      - Declare a DMA_HandleTypeDef handle structure for the transmit or receive channel
      - Enable the DMAx interface clock using
      - Configure the DMA handle parameters
      - Configure the DMA Tx or Rx channel
      - Associate the initialized DMA handle to the hi2c DMA Tx or Rx handle
      - Configure the priority and enable the NVIC for the transfer complete interrupt on the DMA Tx or Rx channel

3. Configure the Communication Clock Timing, Own Address1, Master Addressing mode, Dual Addressing mode, Own Address2, Own Address2 Mask, General call and Nostretch mode in the hi2c Init structure.
4. Initialize the I2C registers by calling the HAL_I2C_Init(), configures also the low level Hardware (GPIO, CLOCK, NVIC...etc) by calling the customized HAL_I2C_MspInit(&hi2c) API.
5. To check if target device is ready for communication, use the function HAL_I2C_IsDeviceReady()
6. For I2C IO and IO MEM operations, three operation modes are available within this driver :

Polling mode IO operation

- Transmit in master mode an amount of data in blocking mode using HAL_I2C_Master_Transmit()
- Receive in master mode an amount of data in blocking mode using HAL_I2C_Master_Receive()
- Transmit in slave mode an amount of data in blocking mode using HAL_I2C_Slave_Transmit()
- Receive in slave mode an amount of data in blocking mode using HAL_I2C_Slave_Receive()

Polling mode IO MEM operation

- Write an amount of data in blocking mode to a specific memory address using HAL_I2C_Mem_Write()
- Read an amount of data in blocking mode from a specific memory address using HAL_I2C_Mem_Read()

Interrupt mode IO operation

- Transmit in master mode an amount of data in non-blocking mode using HAL_I2C_Master_Transmit_IT()
- At transmission end of transfer, HAL_I2C_MasterTxCpltCallback() is executed and users can add their own code by customization of function pointer HAL_I2C_MasterTxCpltCallback()
- Receive in master mode an amount of data in non-blocking mode using HAL_I2C_Master_Receive_IT()
- At reception end of transfer, HAL_I2C_MasterRxCpltCallback() is executed and users can add their own code by customization of function pointer HAL_I2C_MasterRxCpltCallback()
- Transmit in slave mode an amount of data in non-blocking mode using HAL_I2C_Slave_Transmit_IT()
- At transmission end of transfer, HAL_I2C_SlaveTxCpltCallback() is executed and users can add their own code by customization of function pointer HAL_I2C_SlaveTxCpltCallback()
- Receive in slave mode an amount of data in non-blocking mode using HAL_I2C_Slave_Receive_IT()
- At reception end of transfer, HAL_I2C_SlaveRxCpltCallback() is executed and users can add their own code by customization of function pointer HAL_I2C_SlaveRxCpltCallback()
- In case of transfer Error, HAL_I2C_ErrorCallback() function is executed and users can add their own code by customization of function pointer HAL_I2C_ErrorCallback()
- Abort a master or memory I2C process communication with Interrupt using HAL_I2C_Master_Abort_IT()
- End of abort process, HAL_I2C_AbortCpltCallback() is executed and users can add their own code by customization of function pointer HAL_I2C_AbortCpltCallback()
- Discard a slave I2C process communication using __HAL_I2C_GENERATE_NACK() macro. This action will inform Master to generate a Stop condition to discard the communication.

Interrupt mode or DMA mode IO sequential operation

Note: These interfaces allow to manage a sequential transfer with a repeated start condition when a direction change during transfer

- A specific option field manage the different steps of a sequential transfer

- Option field values are defined through I2C_XFEROPTIONS and are listed below:
  - I2C_FIRST_AND_LAST_FRAME: No sequential usage, functional is same as associated interfaces in no sequential mode
  - I2C_FIRST_FRAME: Sequential usage, this option allow to manage a sequence with start condition, address and data to transfer without a final stop condition
  - I2C_FIRST_AND_NEXT_FRAME: Sequential usage (Master only), this option allow to manage a sequence with start condition, address and data to transfer without a final stop condition, an then permit a call the same master sequential interface several times (like HAL_I2C_Master_Seq_Transmit_IT() then HAL_I2C_Master_Seq_Transmit_IT() or HAL_I2C_Master_Seq_Transmit_DMA() then HAL_I2C_Master_Seq_Transmit_DMA())
  - I2C_NEXT_FRAME: Sequential usage, this option allow to manage a sequence with a restart condition, address and with new data to transfer if the direction change or manage only the new data to transfer if no direction change and without a final stop condition in both cases
  - I2C_LAST_FRAME: Sequential usage, this option allow to manage a sequance with a restart condition, address and with new data to transfer if the direction change or manage only the new data to transfer if no direction change and with a final stop condition in both cases
  - I2C_LAST_FRAME_NO_STOP: Sequential usage (Master only), this option allow to manage a restart condition after several call of the same master sequential interface several times (link with option I2C_FIRST_AND_NEXT_FRAME). Usage can, transfer several bytes one by one using HAL_I2C_Master_Seq_Transmit_IT or HAL_I2C_Master_Seq_Receive_IT or HAL_I2C_Master_Seq_Transmit_DMA or HAL_I2C_Master_Seq_Receive_DMA with option I2C_FIRST_AND_NEXT_FRAME then I2C_NEXT_FRAME. Then usage of this option I2C_LAST_FRAME_NO_STOP at the last Transmit or Receive sequence permit to call the opposite interface Receive or Transmit without stopping the communication and so generate a restart condition.
  - I2C_OTHER_FRAME: Sequential usage (Master only), this option allow to manage a restart condition after each call of the same master sequential interface. Usage can, transfer several bytes one by one with a restart with slave address between each bytes using HAL_I2C_Master_Seq_Transmit_IT or HAL_I2C_Master_Seq_Receive_IT or HAL_I2C_Master_Seq_Transmit_DMA or HAL_I2C_Master_Seq_Receive_DMA with option I2C_FIRST_FRAME then I2C_OTHER_FRAME. Then usage of this option I2C_OTHER_AND_LAST_FRAME at the last frame to help automatic generation of STOP condition.

- Different sequential I2C interfaces are listed below:
  - Sequential transmit in master I2C mode an amount of data in non-blocking mode using HAL_I2C_Master_Seq_Transmit_IT() or using HAL_I2C_Master_Seq_Transmit_DMA()
    - At transmission end of current frame transfer, HAL_I2C_MasterTxCpltCallback() is executed and users can add their own code by customization of function pointer HAL_I2C_MasterTxCpltCallback()
  - Sequential receive in master I2C mode an amount of data in non-blocking mode using HAL_I2C_Master_Seq_Receive_IT() or using HAL_I2C_Master_Seq_Receive_DMA()
    - At reception end of current frame transfer, HAL_I2C_MasterRxCpltCallback() is executed and users can add their own code by customization of function pointer HAL_I2C_MasterRxCpltCallback()
  - Abort a master or memory IT or DMA I2C process communication with Interrupt using HAL_I2C_Master_Abort_IT()
    - End of abort process, HAL_I2C_AbortCpltCallback() is executed and users can add their own code by customization of function pointer HAL_I2C_AbortCpltCallback()
  - Enable/disable the Address listen mode in slave I2C mode using HAL_I2C_EnableListen_IT() HAL_I2C_DisableListen_IT()
    - When address slave I2C match, HAL_I2C_AddrCallback() is executed and users can add their own code to check the Address Match Code and the transmission direction request by master (Write/Read).
    - At Listen mode end HAL_I2C_ListenCpltCallback() is executed and users can add their own code by customization of function pointer HAL_I2C_ListenCpltCallback()
  - Sequential transmit in slave I2C mode an amount of data in non-blocking mode using HAL_I2C_Slave_Seq_Transmit_IT() or using HAL_I2C_Slave_Seq_Transmit_DMA()
    - At transmission end of current frame transfer, HAL_I2C_SlaveTxCpltCallback() is executed and users can add their own code by customization of function pointer HAL_I2C_SlaveTxCpltCallback()
  - Sequential receive in slave I2C mode an amount of data in non-blocking mode using HAL_I2C_Slave_Seq_Receive_IT() or using HAL_I2C_Slave_Seq_Receive_DMA()
    - At reception end of current frame transfer, HAL_I2C_SlaveRxCpltCallback() is executed and users can add their own code by customization of function pointer HAL_I2C_SlaveRxCpltCallback()
  - In case of transfer Error, HAL_I2C_ErrorCallback() function is executed and users can add their own code by customization of function pointer HAL_I2C_ErrorCallback()
  - Discard a slave I2C process communication using __HAL_I2C_GENERATE_NACK() macro. This action will inform Master to generate a Stop condition to discard the communication.

Interrupt mode IO MEM operation

- Write an amount of data in non-blocking mode with Interrupt to a specific memory address using HAL_I2C_Mem_Write_IT()
- At Memory end of write transfer, HAL_I2C_MemTxCpltCallback() is executed and users can add their own code by customization of function pointer HAL_I2C_MemTxCpltCallback()
- Read an amount of data in non-blocking mode with Interrupt from a specific memory address using HAL_I2C_Mem_Read_IT()
- At Memory end of read transfer, HAL_I2C_MemRxCpltCallback() is executed and users can add their own code by customization of function pointer HAL_I2C_MemRxCpltCallback()
- In case of transfer Error, HAL_I2C_ErrorCallback() function is executed and users can add their own code by customization of function pointer HAL_I2C_ErrorCallback()

DMA mode IO operation

- Transmit in master mode an amount of data in non-blocking mode (DMA) using HAL_I2C_Master_Transmit_DMA()
- At transmission end of transfer, HAL_I2C_MasterTxCpltCallback() is executed and users can add their own code by customization of function pointer HAL_I2C_MasterTxCpltCallback()

- Receive in master mode an amount of data in non-blocking mode (DMA) using HAL_I2C_Master_Receive_DMA()
- At reception end of transfer, HAL_I2C_MasterRxCpltCallback() is executed and users can add their own code by customization of function pointer HAL_I2C_MasterRxCpltCallback()
- Transmit in slave mode an amount of data in non-blocking mode (DMA) using HAL_I2C_Slave_Transmit_DMA()
- At transmission end of transfer, HAL_I2C_SlaveTxCpltCallback() is executed and users can add their own code by customization of function pointer HAL_I2C_SlaveTxCpltCallback()
- Receive in slave mode an amount of data in non-blocking mode (DMA) using HAL_I2C_Slave_Receive_DMA()
- At reception end of transfer, HAL_I2C_SlaveRxCpltCallback() is executed and users can add their own code by customization of function pointer HAL_I2C_SlaveRxCpltCallback()
- In case of transfer Error, HAL_I2C_ErrorCallback() function is executed and users can add their own code by customization of function pointer HAL_I2C_ErrorCallback()
- Abort a master or memory I2C process communication with Interrupt using HAL_I2C_Master_Abort_IT()
- End of abort process, HAL_I2C_AbortCpltCallback() is executed and users can add their own code by customization of function pointer HAL_I2C_AbortCpltCallback()
- Discard a slave I2C process communication using __HAL_I2C_GENERATE_NACK() macro. This action will inform Master to generate a Stop condition to discard the communication.

DMA mode IO MEM operation

- Write an amount of data in non-blocking mode with DMA to a specific memory address using HAL_I2C_Mem_Write_DMA()
- At Memory end of write transfer, HAL_I2C_MemTxCpltCallback() is executed and users can add their own code by customization of function pointer HAL_I2C_MemTxCpltCallback()
- Read an amount of data in non-blocking mode with DMA from a specific memory address using HAL_I2C_Mem_Read_DMA()
- At Memory end of read transfer, HAL_I2C_MemRxCpltCallback() is executed and users can add their own code by customization of function pointer HAL_I2C_MemRxCpltCallback()
- In case of transfer Error, HAL_I2C_ErrorCallback() function is executed and users can add their own code by customization of function pointer HAL_I2C_ErrorCallback()

I2C HAL driver macros list

Below the list of most used macros in I2C HAL driver.

- __HAL_I2C_ENABLE: Enable the I2C peripheral
- __HAL_I2C_DISABLE: Disable the I2C peripheral
- __HAL_I2C_GENERATE_NACK: Generate a Non-Acknowledge I2C peripheral in Slave mode
- __HAL_I2C_GET_FLAG: Check whether the specified I2C flag is set or not
- __HAL_I2C_CLEAR_FLAG: Clear the specified I2C pending flag
- __HAL_I2C_ENABLE_IT: Enable the specified I2C interrupt
- __HAL_I2C_DISABLE_IT: Disable the specified I2C interrupt

Callback registration

The compilation flag USE_HAL_I2C_REGISTER_CALLBACKS when set to 1 allows the user to configure dynamically the driver callbacks. Use Functions HAL_I2C_RegisterCallback() or HAL_I2C_RegisterAddrCallback() to register an interrupt callback.

Function HAL_I2C_RegisterCallback() allows to register following callbacks:

- MasterTxCpltCallback : callback for Master transmission end of transfer.
- MasterRxCpltCallback : callback for Master reception end of transfer.
- SlaveTxCpltCallback : callback for Slave transmission end of transfer.
- SlaveRxCpltCallback : callback for Slave reception end of transfer.
- ListenCpltCallback : callback for end of listen mode.
- MemTxCpltCallback : callback for Memory transmission end of transfer.

- MemRxCpltCallback : callback for Memory reception end of transfer.
- ErrorCallback : callback for error detection.
- AbortCpltCallback : callback for abort completion process.
- MspInitCallback : callback for Msp Init.
- MspDeInitCallback : callback for Msp DeInit. This function takes as parameters the HAL peripheral handle, the Callback ID and a pointer to the user callback function.

For specific callback AddrCallback use dedicated register callbacks : HAL_I2C_RegisterAddrCallback().

Use function HAL_I2C_UnRegisterCallback to reset a callback to the default weak function. HAL_I2C_UnRegisterCallback takes as parameters the HAL peripheral handle, and the Callback ID. This function allows to reset following callbacks:

- MasterTxCpltCallback : callback for Master transmission end of transfer.
- MasterRxCpltCallback : callback for Master reception end of transfer.
- SlaveTxCpltCallback : callback for Slave transmission end of transfer.
- SlaveRxCpltCallback : callback for Slave reception end of transfer.
- ListenCpltCallback : callback for end of listen mode.
- MemTxCpltCallback : callback for Memory transmission end of transfer.
- MemRxCpltCallback : callback for Memory reception end of transfer.
- ErrorCallback : callback for error detection.
- AbortCpltCallback : callback for abort completion process.
- MspInitCallback : callback for Msp Init.
- MspDeInitCallback : callback for Msp DeInit.

For callback AddrCallback use dedicated register callbacks : HAL_I2C_UnRegisterAddrCallback().

By default, after the HAL_I2C_Init() and when the state is HAL_I2C_STATE_RESET all callbacks are set to the corresponding weak functions: examples HAL_I2C_MasterTxCpltCallback(), HAL_I2C_MasterRxCpltCallback(). Exception done for MspInit and MspDeInit functions that are reset to the legacy weak functions in the HAL_I2C_Init()/ HAL_I2C_DeInit() only when these callbacks are null (not registered beforehand). If MspInit or MspDeInit are not null, the HAL_I2C_Init()/ HAL_I2C_DeInit() keep and use the user MspInit/MspDeInit callbacks (registered beforehand) whatever the state.

Callbacks can be registered/unregistered in HAL_I2C_STATE_READY state only. Exception done MspInit/ MspDeInit functions that can be registered/unregistered in HAL_I2C_STATE_READY or HAL_I2C_STATE_RESET state, thus registered (user) MspInit/DeInit callbacks can be used during the Init/DeInit. Then, the user first registers the MspInit/MspDeInit user callbacks using HAL_I2C_RegisterCallback() before calling HAL_I2C_DeInit() or HAL_I2C_Init() function.

When the compilation flag USE_HAL_I2C_REGISTER_CALLBACKS is set to 0 or not defined, the callback registration feature is not available and all callbacks are set to the corresponding weak functions.

Note: You can refer to the I2C HAL driver header file for more useful macros

24.2.2 Initialization and de-initialization functions

This subsection provides a set of functions allowing to initialize and deinitialize the I2Cx peripheral:

- User must Implement HAL_I2C_MspInit() function in which he configures all related peripherals resources (CLOCK, GPIO, DMA, IT and NVIC).
- Call the function HAL_I2C_Init() to configure the selected device with the selected configuration:
  - Clock Timing
  - Own Address 1
  - Addressing mode (Master, Slave)
  - Dual Addressing mode
  - Own Address 2
  - Own Address 2 Mask
  - General call mode
  - Nostretch mode
- Call the function HAL_I2C_DeInit() to restore the default configuration of the selected I2Cx peripheral.

This section contains the following APIs:

- *HAL_I2C_Init()*
- *HAL_I2C_DeInit()*
- *HAL_I2C_MspInit()*
- *HAL_I2C_MspDeInit()*
- *HAL_I2C_RegisterCallback()*
- *HAL_I2C_UnRegisterCallback()*
- *HAL_I2C_RegisterAddrCallback()*
- *HAL_I2C_UnRegisterAddrCallback()*

24.2.3 IO operation functions

This subsection provides a set of functions allowing to manage the I2C data transfers.

1. There are two modes of transfer:
   - Blocking mode : The communication is performed in the polling mode. The status of all data processing is returned by the same function after finishing transfer.
   - No-Blocking mode : The communication is performed using Interrupts or DMA. These functions return the status of the transfer startup. The end of the data processing will be indicated through the dedicated I2C IRQ when using Interrupt mode or the DMA IRQ when using DMA mode.
2. Blocking mode functions are :
   - HAL_I2C_Master_Transmit()
   - HAL_I2C_Master_Receive()
   - HAL_I2C_Slave_Transmit()
   - HAL_I2C_Slave_Receive()
   - HAL_I2C_Mem_Write()
   - HAL_I2C_Mem_Read()
   - HAL_I2C_IsDeviceReady()
3. No-Blocking mode functions with Interrupt are :
   - HAL_I2C_Master_Transmit_IT()
   - HAL_I2C_Master_Receive_IT()
   - HAL_I2C_Slave_Transmit_IT()
   - HAL_I2C_Slave_Receive_IT()
   - HAL_I2C_Mem_Write_IT()
   - HAL_I2C_Mem_Read_IT()
   - HAL_I2C_Master_Seq_Transmit_IT()
   - HAL_I2C_Master_Seq_Receive_IT()
   - HAL_I2C_Slave_Seq_Transmit_IT()
   - HAL_I2C_Slave_Seq_Receive_IT()
   - HAL_I2C_EnableListen_IT()
   - HAL_I2C_DisableListen_IT()
   - HAL_I2C_Master_Abort_IT()
4. No-Blocking mode functions with DMA are :
   - HAL_I2C_Master_Transmit_DMA()
   - HAL_I2C_Master_Receive_DMA()
   - HAL_I2C_Slave_Transmit_DMA()
   - HAL_I2C_Slave_Receive_DMA()
   - HAL_I2C_Mem_Write_DMA()
   - HAL_I2C_Mem_Read_DMA()
   - HAL_I2C_Master_Seq_Transmit_DMA()
   - HAL_I2C_Master_Seq_Receive_DMA()
   - HAL_I2C_Slave_Seq_Transmit_DMA()
   - HAL_I2C_Slave_Seq_Receive_DMA()

5. A set of Transfer Complete Callbacks are provided in non Blocking mode:
   - HAL_I2C_MasterTxCpltCallback()
   - HAL_I2C_MasterRxCpltCallback()
   - HAL_I2C_SlaveTxCpltCallback()
   - HAL_I2C_SlaveRxCpltCallback()
   - HAL_I2C_MemTxCpltCallback()
   - HAL_I2C_MemRxCpltCallback()
   - HAL_I2C_AddrCallback()
   - HAL_I2C_ListenCpltCallback()
   - HAL_I2C_ErrorCallback()
   - HAL_I2C_AbortCpltCallback()

This section contains the following APIs:

- ***HAL_I2C_Master_Transmit()***
- ***HAL_I2C_Master_Receive()***
- ***HAL_I2C_Slave_Transmit()***
- ***HAL_I2C_Slave_Receive()***
- ***HAL_I2C_Master_Transmit_IT()***
- ***HAL_I2C_Master_Receive_IT()***
- ***HAL_I2C_Slave_Transmit_IT()***
- ***HAL_I2C_Slave_Receive_IT()***
- ***HAL_I2C_Master_Transmit_DMA()***
- ***HAL_I2C_Master_Receive_DMA()***
- ***HAL_I2C_Slave_Transmit_DMA()***
- ***HAL_I2C_Slave_Receive_DMA()***
- ***HAL_I2C_Mem_Write()***
- ***HAL_I2C_Mem_Read()***
- ***HAL_I2C_Mem_Write_IT()***
- ***HAL_I2C_Mem_Read_IT()***
- ***HAL_I2C_Mem_Write_DMA()***
- ***HAL_I2C_Mem_Read_DMA()***
- ***HAL_I2C_IsDeviceReady()***
- ***HAL_I2C_Master_Seq_Transmit_IT()***
- ***HAL_I2C_Master_Seq_Transmit_DMA()***
- ***HAL_I2C_Master_Seq_Receive_IT()***
- ***HAL_I2C_Master_Seq_Receive_DMA()***
- ***HAL_I2C_Slave_Seq_Transmit_IT()***
- ***HAL_I2C_Slave_Seq_Transmit_DMA()***
- ***HAL_I2C_Slave_Seq_Receive_IT()***
- ***HAL_I2C_Slave_Seq_Receive_DMA()***
- ***HAL_I2C_EnableListen_IT()***
- ***HAL_I2C_DisableListen_IT()***
- ***HAL_I2C_Master_Abort_IT()***

24.2.4 Peripheral State, Mode and Error functions

This subsection permit to get in run-time the status of the peripheral and the data flow.

This section contains the following APIs:

- ***HAL_I2C_GetState()***
- ***HAL_I2C_GetMode()***
- ***HAL_I2C_GetError()***

24.2.5 Detailed description of functions

HAL_I2C_Init

Function name

HAL_StatusTypeDef HAL_I2C_Init (I2C_HandleTypeDef * hi2c)

Function description

Initializes the I2C according to the specified parameters in the I2C_InitTypeDef and initialize the associated handle.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.

Return values

- **HAL:** status

HAL_I2C_DeInit

Function name

HAL_StatusTypeDef HAL_I2C_DeInit (I2C_HandleTypeDef * hi2c)

Function description

DeInitialize the I2C peripheral.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.

Return values

- **HAL:** status

HAL_I2C_MspInit

Function name

void HAL_I2C_MspInit (I2C_HandleTypeDef * hi2c)

Function description

Initialize the I2C MSP.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.

Return values

- **None:**

HAL_I2C_MspDeInit

Function name

void HAL_I2C_MspDeInit (I2C_HandleTypeDef * hi2c)

Function description

DeInitialize the I2C MSP.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.

Return values

- **None:**

HAL_I2C_RegisterCallback

Function name

HAL_StatusTypeDef HAL_I2C_RegisterCallback (I2C_HandleTypeDef * hi2c, HAL_I2C_CallbackIDTypeDef CallbackID, pI2C_CallbackTypeDef pCallback)

Function description

Register a User I2C Callback To be used instead of the weak predefined callback.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.
- **CallbackID:** ID of the callback to be registered This parameter can be one of the following values:
  - HAL_I2C_MASTER_TX_COMPLETE_CB_ID Master Tx Transfer completed callback ID
  - HAL_I2C_MASTER_RX_COMPLETE_CB_ID Master Rx Transfer completed callback ID
  - HAL_I2C_SLAVE_TX_COMPLETE_CB_ID Slave Tx Transfer completed callback ID
  - HAL_I2C_SLAVE_RX_COMPLETE_CB_ID Slave Rx Transfer completed callback ID
  - HAL_I2C_LISTEN_COMPLETE_CB_ID Listen Complete callback ID
  - HAL_I2C_MEM_TX_COMPLETE_CB_ID Memory Tx Transfer callback ID
  - HAL_I2C_MEM_RX_COMPLETE_CB_ID Memory Rx Transfer completed callback ID
  - HAL_I2C_ERROR_CB_ID Error callback ID
  - HAL_I2C_ABORT_CB_ID Abort callback ID
  - HAL_I2C_MSPINIT_CB_ID MspInit callback ID
  - HAL_I2C_MSPDEINIT_CB_ID MspDeInit callback ID
- **pCallback:** pointer to the Callback function

Return values

- **HAL:** status

Notes

- The HAL_I2C_RegisterCallback() may be called before HAL_I2C_Init() in HAL_I2C_STATE_RESET to register callbacks for HAL_I2C_MSPINIT_CB_ID and HAL_I2C_MSPDEINIT_CB_ID.

HAL_I2C_UnRegisterCallback

Function name

HAL_StatusTypeDef HAL_I2C_UnRegisterCallback (I2C_HandleTypeDef * hi2c, HAL_I2C_CallbackIDTypeDef CallbackID)

Function description

Unregister an I2C Callback I2C callback is redirected to the weak predefined callback.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.
- **CallbackID:** ID of the callback to be unregistered This parameter can be one of the following values: This parameter can be one of the following values:
  - HAL_I2C_MASTER_TX_COMPLETE_CB_ID Master Tx Transfer completed callback ID
  - HAL_I2C_MASTER_RX_COMPLETE_CB_ID Master Rx Transfer completed callback ID
  - HAL_I2C_SLAVE_TX_COMPLETE_CB_ID Slave Tx Transfer completed callback ID
  - HAL_I2C_SLAVE_RX_COMPLETE_CB_ID Slave Rx Transfer completed callback ID
  - HAL_I2C_LISTEN_COMPLETE_CB_ID Listen Complete callback ID
  - HAL_I2C_MEM_TX_COMPLETE_CB_ID Memory Tx Transfer callback ID
  - HAL_I2C_MEM_RX_COMPLETE_CB_ID Memory Rx Transfer completed callback ID
  - HAL_I2C_ERROR_CB_ID Error callback ID
  - HAL_I2C_ABORT_CB_ID Abort callback ID
  - HAL_I2C_MSPINIT_CB_ID MspInit callback ID
  - HAL_I2C_MSPDEINIT_CB_ID MspDeInit callback ID

Return values

- **HAL:** status

Notes

- The HAL_I2C_UnRegisterCallback() may be called before HAL_I2C_Init() in HAL_I2C_STATE_RESET to un-register callbacks for HAL_I2C_MSPINIT_CB_ID and HAL_I2C_MSPDEINIT_CB_ID.

HAL_I2C_RegisterAddrCallback

Function name

HAL_StatusTypeDef HAL_I2C_RegisterAddrCallback (I2C_HandleTypeDef * hi2c, pI2C_AddrCallbackTypeDef pCallback)

Function description

Register the Slave Address Match I2C Callback To be used instead of the weak HAL_I2C_AddrCallback() predefined callback.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.
- **pCallback:** pointer to the Address Match Callback function

Return values

- **HAL:** status

HAL_I2C_UnRegisterAddrCallback

Function name

HAL_StatusTypeDef HAL_I2C_UnRegisterAddrCallback (I2C_HandleTypeDef * hi2c)

Function description

UnRegister the Slave Address Match I2C Callback Info Ready I2C Callback is redirected to the weak HAL_I2C_AddrCallback() predefined callback.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.

Return values

- **HAL:** status

HAL_I2C_Master_Transmit

Function name

HAL_StatusTypeDef HAL_I2C_Master_Transmit (I2C_HandleTypeDef * hi2c, uint16_t DevAddress, uint8_t * pData, uint16_t Size, uint32_t Timeout)

Function description

Transmits in master mode an amount of data in blocking mode.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.
- **DevAddress:** Target device address: The device 7 bits address value in datasheet must be shifted to the left before calling the interface
- **pData:** Pointer to data buffer
- **Size:** Amount of data to be sent
- **Timeout:** Timeout duration

Return values

- **HAL:** status

HAL_I2C_Master_Receive

Function name

HAL_StatusTypeDef HAL_I2C_Master_Receive (I2C_HandleTypeDef * hi2c, uint16_t DevAddress, uint8_t * pData, uint16_t Size, uint32_t Timeout)

Function description

Receives in master mode an amount of data in blocking mode.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.
- **DevAddress:** Target device address: The device 7 bits address value in datasheet must be shifted to the left before calling the interface
- **pData:** Pointer to data buffer
- **Size:** Amount of data to be sent
- **Timeout:** Timeout duration

Return values

- **HAL:** status

HAL_I2C_Slave_Transmit

Function name

HAL_StatusTypeDef HAL_I2C_Slave_Transmit (I2C_HandleTypeDef * hi2c, uint8_t * pData, uint16_t Size, uint32_t Timeout)

Function description

Transmits in slave mode an amount of data in blocking mode.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.
- **pData:** Pointer to data buffer
- **Size:** Amount of data to be sent
- **Timeout:** Timeout duration

Return values

- **HAL:** status

HAL_I2C_Slave_Receive

Function name

HAL_StatusTypeDef HAL_I2C_Slave_Receive (I2C_HandleTypeDef * hi2c, uint8_t * pData, uint16_t Size, uint32_t Timeout)

Function description

Receive in slave mode an amount of data in blocking mode.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.
- **pData:** Pointer to data buffer
- **Size:** Amount of data to be sent
- **Timeout:** Timeout duration

Return values

- **HAL:** status

HAL_I2C_Mem_Write

Function name

HAL_StatusTypeDef HAL_I2C_Mem_Write (I2C_HandleTypeDef * hi2c, uint16_t DevAddress, uint16_t MemAddress, uint16_t MemAddSize, uint8_t * pData, uint16_t Size, uint32_t Timeout)

Function description

Write an amount of data in blocking mode to a specific memory address.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.
- **DevAddress:** Target device address: The device 7 bits address value in datasheet must be shifted to the left before calling the interface
- **MemAddress:** Internal memory address
- **MemAddSize:** Size of internal memory address
- **pData:** Pointer to data buffer
- **Size:** Amount of data to be sent
- **Timeout:** Timeout duration

Return values

- **HAL:** status

HAL_I2C_Mem_Read

Function name

HAL_StatusTypeDef HAL_I2C_Mem_Read (I2C_HandleTypeDef * hi2c, uint16_t DevAddress, uint16_t MemAddress, uint16_t MemAddSize, uint8_t * pData, uint16_t Size, uint32_t Timeout)

Function description

Read an amount of data in blocking mode from a specific memory address.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.
- **DevAddress:** Target device address: The device 7 bits address value in datasheet must be shifted to the left before calling the interface
- **MemAddress:** Internal memory address
- **MemAddSize:** Size of internal memory address
- **pData:** Pointer to data buffer
- **Size:** Amount of data to be sent
- **Timeout:** Timeout duration

Return values

- **HAL:** status

HAL_I2C_IsDeviceReady

Function name

HAL_StatusTypeDef HAL_I2C_IsDeviceReady (I2C_HandleTypeDef * hi2c, uint16_t DevAddress, uint32_t Trials, uint32_t Timeout)

Function description

Checks if target device is ready for communication.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.
- **DevAddress:** Target device address: The device 7 bits address value in datasheet must be shifted to the left before calling the interface
- **Trials:** Number of trials
- **Timeout:** Timeout duration

Return values

- **HAL:** status

Notes

- This function is used with Memory devices

HAL_I2C_Master_Transmit_IT

Function name

HAL_StatusTypeDef HAL_I2C_Master_Transmit_IT (I2C_HandleTypeDef * hi2c, uint16_t DevAddress, uint8_t * pData, uint16_t Size)

Function description

Transmit in master mode an amount of data in non-blocking mode with Interrupt.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.
- **DevAddress:** Target device address: The device 7 bits address value in datasheet must be shifted to the left before calling the interface
- **pData:** Pointer to data buffer
- **Size:** Amount of data to be sent

Return values

- **HAL:** status

HAL_I2C_Master_Receive_IT

Function name

HAL_StatusTypeDef HAL_I2C_Master_Receive_IT (I2C_HandleTypeDef * hi2c, uint16_t DevAddress, uint8_t * pData, uint16_t Size)

Function description

Receive in master mode an amount of data in non-blocking mode with Interrupt.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.
- **DevAddress:** Target device address: The device 7 bits address value in datasheet must be shifted to the left before calling the interface
- **pData:** Pointer to data buffer
- **Size:** Amount of data to be sent

Return values

- **HAL:** status

HAL_I2C_Slave_Transmit_IT

Function name

HAL_StatusTypeDef HAL_I2C_Slave_Transmit_IT (I2C_HandleTypeDef * hi2c, uint8_t * pData, uint16_t Size)

Function description

Transmit in slave mode an amount of data in non-blocking mode with Interrupt.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.
- **pData:** Pointer to data buffer
- **Size:** Amount of data to be sent

Return values

- **HAL:** status

HAL_I2C_Slave_Receive_IT

Function name

HAL_StatusTypeDef HAL_I2C_Slave_Receive_IT (I2C_HandleTypeDef * hi2c, uint8_t * pData, uint16_t Size)

Function description

Receive in slave mode an amount of data in non-blocking mode with Interrupt.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.
- **pData:** Pointer to data buffer
- **Size:** Amount of data to be sent

Return values

- **HAL:** status

HAL_I2C_Mem_Write_IT

Function name

HAL_StatusTypeDef HAL_I2C_Mem_Write_IT (I2C_HandleTypeDef * hi2c, uint16_t DevAddress, uint16_t MemAddress, uint16_t MemAddSize, uint8_t * pData, uint16_t Size)

Function description

Write an amount of data in non-blocking mode with Interrupt to a specific memory address.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.
- **DevAddress:** Target device address: The device 7 bits address value in datasheet must be shifted to the left before calling the interface
- **MemAddress:** Internal memory address
- **MemAddSize:** Size of internal memory address
- **pData:** Pointer to data buffer
- **Size:** Amount of data to be sent

Return values

- **HAL:** status

HAL_I2C_Mem_Read_IT

Function name

HAL_StatusTypeDef HAL_I2C_Mem_Read_IT (I2C_HandleTypeDef * hi2c, uint16_t DevAddress, uint16_t MemAddress, uint16_t MemAddSize, uint8_t * pData, uint16_t Size)

Function description

Read an amount of data in non-blocking mode with Interrupt from a specific memory address.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.
- **DevAddress:** Target device address: The device 7 bits address value in datasheet must be shifted to the left before calling the interface
- **MemAddress:** Internal memory address
- **MemAddSize:** Size of internal memory address
- **pData:** Pointer to data buffer
- **Size:** Amount of data to be sent

Return values

- **HAL:** status

HAL_I2C_Master_Seq_Transmit_IT

Function name

HAL_StatusTypeDef HAL_I2C_Master_Seq_Transmit_IT (I2C_HandleTypeDef * hi2c, uint16_t DevAddress, uint8_t * pData, uint16_t Size, uint32_t XferOptions)

Function description

Sequential transmit in master I2C mode an amount of data in non-blocking mode with Interrupt.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.
- **DevAddress:** Target device address: The device 7 bits address value in datasheet must be shifted to the left before calling the interface
- **pData:** Pointer to data buffer
- **Size:** Amount of data to be sent
- **XferOptions:** Options of Transfer, value of I2C Sequential Transfer Options

Return values

- **HAL:** status

Notes

- This interface allow to manage repeated start condition when a direction change during transfer

HAL_I2C_Master_Seq_Receive_IT

Function name

HAL_StatusTypeDef HAL_I2C_Master_Seq_Receive_IT (I2C_HandleTypeDef * hi2c, uint16_t DevAddress, uint8_t * pData, uint16_t Size, uint32_t XferOptions)

Function description

Sequential receive in master I2C mode an amount of data in non-blocking mode with Interrupt.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.
- **DevAddress:** Target device address: The device 7 bits address value in datasheet must be shifted to the left before calling the interface
- **pData:** Pointer to data buffer
- **Size:** Amount of data to be sent
- **XferOptions:** Options of Transfer, value of I2C Sequential Transfer Options

Return values

- **HAL:** status

Notes

- This interface allow to manage repeated start condition when a direction change during transfer

HAL_I2C_Slave_Seq_Transmit_IT

Function name

HAL_StatusTypeDef HAL_I2C_Slave_Seq_Transmit_IT (I2C_HandleTypeDef * hi2c, uint8_t * pData, uint16_t Size, uint32_t XferOptions)

Function description

Sequential transmit in slave/device I2C mode an amount of data in non-blocking mode with Interrupt.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.
- **pData:** Pointer to data buffer
- **Size:** Amount of data to be sent
- **XferOptions:** Options of Transfer, value of I2C Sequential Transfer Options

Return values

- **HAL:** status

Notes

- This interface allow to manage repeated start condition when a direction change during transfer

HAL_I2C_Slave_Seq_Receive_IT

Function name

HAL_StatusTypeDef HAL_I2C_Slave_Seq_Receive_IT (I2C_HandleTypeDef * hi2c, uint8_t * pData, uint16_t Size, uint32_t XferOptions)

Function description

Sequential receive in slave/device I2C mode an amount of data in non-blocking mode with Interrupt.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.
- **pData:** Pointer to data buffer
- **Size:** Amount of data to be sent
- **XferOptions:** Options of Transfer, value of I2C Sequential Transfer Options

Return values

- **HAL:** status

Notes

- This interface allow to manage repeated start condition when a direction change during transfer

HAL_I2C_EnableListen_IT

Function name

HAL_StatusTypeDef HAL_I2C_EnableListen_IT (I2C_HandleTypeDef * hi2c)

Function description

Enable the Address listen mode with Interrupt.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.

Return values

- **HAL:** status

HAL_I2C_DisableListen_IT

Function name

HAL_StatusTypeDef HAL_I2C_DisableListen_IT (I2C_HandleTypeDef * hi2c)

Function description

Disable the Address listen mode with Interrupt.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C

Return values

- **HAL:** status

HAL_I2C_Master_Abort_IT

Function name

HAL_StatusTypeDef HAL_I2C_Master_Abort_IT (I2C_HandleTypeDef * hi2c, uint16_t DevAddress)

Function description

Abort a master or memory I2C IT or DMA process communication with Interrupt.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.
- **DevAddress:** Target device address: The device 7 bits address value in datasheet must be shifted to the left before calling the interface

Return values

- **HAL:** status

HAL_I2C_Master_Transmit_DMA

Function name

HAL_StatusTypeDef HAL_I2C_Master_Transmit_DMA (I2C_HandleTypeDef * hi2c, uint16_t DevAddress, uint8_t * pData, uint16_t Size)

Function description

Transmit in master mode an amount of data in non-blocking mode with DMA.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.
- **DevAddress:** Target device address: The device 7 bits address value in datasheet must be shifted to the left before calling the interface
- **pData:** Pointer to data buffer
- **Size:** Amount of data to be sent

Return values

- **HAL:** status

HAL_I2C_Master_Receive_DMA

Function name

HAL_StatusTypeDef HAL_I2C_Master_Receive_DMA (I2C_HandleTypeDef * hi2c, uint16_t DevAddress, uint8_t * pData, uint16_t Size)

Function description

Receive in master mode an amount of data in non-blocking mode with DMA.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.
- **DevAddress:** Target device address: The device 7 bits address value in datasheet must be shifted to the left before calling the interface
- **pData:** Pointer to data buffer
- **Size:** Amount of data to be sent

Return values

- **HAL:** status

HAL_I2C_Slave_Transmit_DMA

Function name

HAL_StatusTypeDef HAL_I2C_Slave_Transmit_DMA (I2C_HandleTypeDef * hi2c, uint8_t * pData, uint16_t Size)

Function description

Transmit in slave mode an amount of data in non-blocking mode with DMA.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.
- **pData:** Pointer to data buffer
- **Size:** Amount of data to be sent

Return values

- **HAL:** status

HAL_I2C_Slave_Receive_DMA

Function name

HAL_StatusTypeDef HAL_I2C_Slave_Receive_DMA (I2C_HandleTypeDef * hi2c, uint8_t * pData, uint16_t Size)

Function description

Receive in slave mode an amount of data in non-blocking mode with DMA.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.
- **pData:** Pointer to data buffer
- **Size:** Amount of data to be sent

Return values

- **HAL:** status

HAL_I2C_Mem_Write_DMA

Function name

HAL_StatusTypeDef HAL_I2C_Mem_Write_DMA (I2C_HandleTypeDef * hi2c, uint16_t DevAddress, uint16_t MemAddress, uint16_t MemAddSize, uint8_t * pData, uint16_t Size)

Function description

Write an amount of data in non-blocking mode with DMA to a specific memory address.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.
- **DevAddress:** Target device address: The device 7 bits address value in datasheet must be shifted to the left before calling the interface
- **MemAddress:** Internal memory address
- **MemAddSize:** Size of internal memory address
- **pData:** Pointer to data buffer
- **Size:** Amount of data to be sent

Return values

- **HAL:** status

HAL_I2C_Mem_Read_DMA

Function name

HAL_StatusTypeDef HAL_I2C_Mem_Read_DMA (I2C_HandleTypeDef * hi2c, uint16_t DevAddress, uint16_t MemAddress, uint16_t MemAddSize, uint8_t * pData, uint16_t Size)

Function description

Reads an amount of data in non-blocking mode with DMA from a specific memory address.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.
- **DevAddress:** Target device address: The device 7 bits address value in datasheet must be shifted to the left before calling the interface
- **MemAddress:** Internal memory address
- **MemAddSize:** Size of internal memory address
- **pData:** Pointer to data buffer
- **Size:** Amount of data to be read

Return values

- **HAL:** status

HAL_I2C_Master_Seq_Transmit_DMA

Function name

HAL_StatusTypeDef HAL_I2C_Master_Seq_Transmit_DMA (I2C_HandleTypeDef * hi2c, uint16_t DevAddress, uint8_t * pData, uint16_t Size, uint32_t XferOptions)

Function description

Sequential transmit in master I2C mode an amount of data in non-blocking mode with DMA.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.
- **DevAddress:** Target device address: The device 7 bits address value in datasheet must be shifted to the left before calling the interface
- **pData:** Pointer to data buffer
- **Size:** Amount of data to be sent
- **XferOptions:** Options of Transfer, value of I2C Sequential Transfer Options

Return values

- **HAL:** status

Notes

- This interface allow to manage repeated start condition when a direction change during transfer

HAL_I2C_Master_Seq_Receive_DMA

Function name

HAL_StatusTypeDef HAL_I2C_Master_Seq_Receive_DMA (I2C_HandleTypeDef * hi2c, uint16_t DevAddress, uint8_t * pData, uint16_t Size, uint32_t XferOptions)

Function description

Sequential receive in master I2C mode an amount of data in non-blocking mode with DMA.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.
- **DevAddress:** Target device address: The device 7 bits address value in datasheet must be shifted to the left before calling the interface
- **pData:** Pointer to data buffer
- **Size:** Amount of data to be sent
- **XferOptions:** Options of Transfer, value of I2C Sequential Transfer Options

Return values

- **HAL:** status

Notes

- This interface allow to manage repeated start condition when a direction change during transfer

HAL_I2C_Slave_Seq_Transmit_DMA

Function name

HAL_StatusTypeDef HAL_I2C_Slave_Seq_Transmit_DMA (I2C_HandleTypeDef * hi2c, uint8_t * pData, uint16_t Size, uint32_t XferOptions)

Function description

Sequential transmit in slave/device I2C mode an amount of data in non-blocking mode with DMA.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.
- **pData:** Pointer to data buffer
- **Size:** Amount of data to be sent
- **XferOptions:** Options of Transfer, value of I2C Sequential Transfer Options

Return values

- **HAL:** status

Notes

- This interface allow to manage repeated start condition when a direction change during transfer

HAL_I2C_Slave_Seq_Receive_DMA

Function name

HAL_StatusTypeDef HAL_I2C_Slave_Seq_Receive_DMA (I2C_HandleTypeDef * hi2c, uint8_t * pData, uint16_t Size, uint32_t XferOptions)

Function description

Sequential receive in slave/device I2C mode an amount of data in non-blocking mode with DMA.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.
- **pData:** Pointer to data buffer
- **Size:** Amount of data to be sent
- **XferOptions:** Options of Transfer, value of I2C Sequential Transfer Options

Return values

- **HAL:** status

Notes

- This interface allow to manage repeated start condition when a direction change during transfer

HAL_I2C_EV_IRQHandler

Function name

void HAL_I2C_EV_IRQHandler (I2C_HandleTypeDef * hi2c)

Function description

This function handles I2C event interrupt request.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.

Return values

- **None:**

HAL_I2C_ER_IRQHandler

Function name

void HAL_I2C_ER_IRQHandler (I2C_HandleTypeDef * hi2c)

Function description

This function handles I2C error interrupt request.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.

Return values

- **None:**

HAL_I2C_MasterTxCpltCallback

Function name

void HAL_I2C_MasterTxCpltCallback (I2C_HandleTypeDef * hi2c)

Function description

Master Tx Transfer completed callback.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.

Return values

- **None:**

HAL_I2C_MasterRxCpltCallback

Function name

void HAL_I2C_MasterRxCpltCallback (I2C_HandleTypeDef * hi2c)

Function description

Master Rx Transfer completed callback.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.

Return values

- **None:**

HAL_I2C_SlaveTxCpltCallback

Function name

void HAL_I2C_SlaveTxCpltCallback (I2C_HandleTypeDef * hi2c)

Function description

Slave Tx Transfer completed callback.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.

Return values

- **None:**

HAL_I2C_SlaveRxCpltCallback

Function name

void HAL_I2C_SlaveRxCpltCallback (I2C_HandleTypeDef * hi2c)

Function description

Slave Rx Transfer completed callback.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.

Return values

- **None:**

HAL_I2C_AddrCallback

Function name

void HAL_I2C_AddrCallback (I2C_HandleTypeDef * hi2c, uint8_t TransferDirection, uint16_t AddrMatchCode)

Function description

Slave Address Match callback.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.
- **TransferDirection:** Master request Transfer Direction (Write/Read), value of I2C Transfer Direction Master Point of View
- **AddrMatchCode:** Address Match Code

Return values

- **None:**

HAL_I2C_ListenCpltCallback

Function name

void HAL_I2C_ListenCpltCallback (I2C_HandleTypeDef * hi2c)

Function description

Listen Complete callback.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.

Return values

- **None:**

HAL_I2C_MemTxCpltCallback

Function name

void HAL_I2C_MemTxCpltCallback (I2C_HandleTypeDef * hi2c)

Function description

Memory Tx Transfer completed callback.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.

Return values

- **None:**

HAL_I2C_MemRxCpltCallback

Function name

void HAL_I2C_MemRxCpltCallback (I2C_HandleTypeDef * hi2c)

Function description

Memory Rx Transfer completed callback.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.

Return values

- **None:**

HAL_I2C_ErrorCallback

Function name

void HAL_I2C_ErrorCallback (I2C_HandleTypeDef * hi2c)

Function description

I2C error callback.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.

Return values

- **None:**

HAL_I2C_AbortCpltCallback

Function name

void HAL_I2C_AbortCpltCallback (I2C_HandleTypeDef * hi2c)

Function description

I2C abort callback.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.

Return values

- **None:**

HAL_I2C_GetState

Function name

HAL_I2C_StateTypeDef HAL_I2C_GetState (const I2C_HandleTypeDef * hi2c)

Function description

Return the I2C handle state.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.

Return values

- **HAL:** state

HAL_I2C_GetMode

Function name

HAL_I2C_ModeTypeDef HAL_I2C_GetMode (const I2C_HandleTypeDef * hi2c)

Function description

Returns the I2C Master, Slave, Memory or no mode.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for I2C module

Return values

- **HAL:** mode

HAL_I2C_GetError

Function name

uint32_t HAL_I2C_GetError (const I2C_HandleTypeDef * hi2c)

Function description

Return the I2C error code.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2C.

Return values

- **I2C:** Error Code

24.3 I2C Firmware driver defines

The following section lists the various define and macros of the module.

24.3.1 I2C

I2C

I2C Addressing Mode

I2C_ADDRESSINGMODE_7BIT

I2C_ADDRESSINGMODE_10BIT

I2C Dual Addressing Mode

I2C_DUALADDRESS_DISABLE

I2C_DUALADDRESS_ENABLE

I2C Error Code definition

HAL_I2C_ERROR_NONE

No error

HAL_I2C_ERROR_BERR

BERR error

HAL_I2C_ERROR_ARLO

ARLO error

HAL_I2C_ERROR_AF

ACKF error

HAL_I2C_ERROR_OVR

OVR error

HAL_I2C_ERROR_DMA

DMA transfer error

HAL_I2C_ERROR_TIMEOUT

Timeout error

HAL_I2C_ERROR_SIZE

Size Management error

HAL_I2C_ERROR_DMA_PARAM

DMA Parameter Error

HAL_I2C_ERROR_INVALID_CALLBACK

Invalid Callback error

HAL_I2C_ERROR_INVALID_PARAM

Invalid Parameters error

I2C Exported Macros

__HAL_I2C_RESET_HANDLE_STATE

Description:

- Reset I2C handle state.

Parameters:

- __HANDLE__: specifies the I2C Handle.

Return value:

- None

__HAL_I2C_ENABLE_IT

Description:

- Enable the specified I2C interrupt.

Parameters:

- __HANDLE__: specifies the I2C Handle.
- __INTERRUPT__: specifies the interrupt source to enable. This parameter can be one of the following values:
  - I2C_IT_ERRI Errors interrupt enable
  - I2C_IT_TCI Transfer complete interrupt enable
  - I2C_IT_STOPI STOP detection interrupt enable
  - I2C_IT_NACKI NACK received interrupt enable
  - I2C_IT_ADDRI Address match interrupt enable
  - I2C_IT_RXI RX interrupt enable
  - I2C_IT_TXI TX interrupt enable

Return value:

- None

__HAL_I2C_DISABLE_IT

Description:

- Disable the specified I2C interrupt.

Parameters:

- __HANDLE__: specifies the I2C Handle.
- __INTERRUPT__: specifies the interrupt source to disable. This parameter can be one of the following values:
  - I2C_IT_ERRI Errors interrupt enable
  - I2C_IT_TCI Transfer complete interrupt enable
  - I2C_IT_STOPI STOP detection interrupt enable
  - I2C_IT_NACKI NACK received interrupt enable
  - I2C_IT_ADDRI Address match interrupt enable
  - I2C_IT_RXI RX interrupt enable
  - I2C_IT_TXI TX interrupt enable

Return value:

- None

__HAL_I2C_GET_IT_SOURCE

Description:

- Check whether the specified I2C interrupt source is enabled or not.

Parameters:

- __HANDLE__: specifies the I2C Handle.
- __INTERRUPT__: specifies the I2C interrupt source to check. This parameter can be one of the following values:
  - I2C_IT_ERRI Errors interrupt enable
  - I2C_IT_TCI Transfer complete interrupt enable
  - I2C_IT_STOPI STOP detection interrupt enable
  - I2C_IT_NACKI NACK received interrupt enable
  - I2C_IT_ADDRI Address match interrupt enable
  - I2C_IT_RXI RX interrupt enable
  - I2C_IT_TXI TX interrupt enable

Return value:

- The: new state of __INTERRUPT__ (SET or RESET).

I2C_FLAG_MASK

Description:

- Check whether the specified I2C flag is set or not.

Parameters:

- __HANDLE__: specifies the I2C Handle.
- __FLAG__: specifies the flag to check. This parameter can be one of the following values:
  - I2C_FLAG_TXE Transmit data register empty
  - I2C_FLAG_TXIS Transmit interrupt status
  - I2C_FLAG_RXNE Receive data register not empty
  - I2C_FLAG_ADDR Address matched (slave mode)
  - I2C_FLAG_AF Acknowledge failure received flag
  - I2C_FLAG_STOPF STOP detection flag
  - I2C_FLAG_TC Transfer complete (master mode)
  - I2C_FLAG_TCR Transfer complete reload
  - I2C_FLAG_BERR Bus error
  - I2C_FLAG_ARLO Arbitration lost
  - I2C_FLAG_OVR Overrun/Underrun
  - I2C_FLAG_PECERR PEC error in reception
  - I2C_FLAG_TIMEOUT Timeout or Tlow detection flag
  - I2C_FLAG_ALERT SMBus alert
  - I2C_FLAG_BUSY Bus busy
  - I2C_FLAG_DIR Transfer direction (slave mode)

Return value:

- The: new state of __FLAG__ (SET or RESET).

__HAL_I2C_GET_FLAG

__HAL_I2C_CLEAR_FLAG

Description:

- Clear the I2C pending flags which are cleared by writing 1 in a specific bit.

Parameters:

- __HANDLE__: specifies the I2C Handle.
- __FLAG__: specifies the flag to clear. This parameter can be any combination of the following values:
  - I2C_FLAG_TXE Transmit data register empty
  - I2C_FLAG_ADDR Address matched (slave mode)
  - I2C_FLAG_AF Acknowledge failure received flag
  - I2C_FLAG_STOPF STOP detection flag
  - I2C_FLAG_BERR Bus error
  - I2C_FLAG_ARLO Arbitration lost
  - I2C_FLAG_OVR Overrun/Underrun
  - I2C_FLAG_PECERR PEC error in reception
  - I2C_FLAG_TIMEOUT Timeout or Tlow detection flag
  - I2C_FLAG_ALERT SMBus alert

Return value:

- None

__HAL_I2C_ENABLE

Description:

- Enable the specified I2C peripheral.

Parameters:

- __HANDLE__: specifies the I2C Handle.

Return value:

- None

__HAL_I2C_DISABLE

Description:

- Disable the specified I2C peripheral.

Parameters:

- __HANDLE__: specifies the I2C Handle.

Return value:

- None

__HAL_I2C_GENERATE_NACK

Description:

- Generate a Non-Acknowledge I2C peripheral in Slave mode.

Parameters:

- __HANDLE__: specifies the I2C Handle.

Return value:

- None

I2C Flag definition

I2C_FLAG_TXE

I2C_FLAG_TXIS

I2C_FLAG_RXNE

I2C_FLAG_ADDR

I2C_FLAG_AF

I2C_FLAG_STOPF

I2C_FLAG_TC

I2C_FLAG_TCR

I2C_FLAG_BERR

I2C_FLAG_ARLO

I2C_FLAG_OVR

I2C_FLAG_PECERR

I2C_FLAG_TIMEOUT

I2C_FLAG_ALERT

I2C_FLAG_BUSY

I2C_FLAG_DIR

I2C General Call Addressing Mode

I2C_GENERALCALL_DISABLE

I2C_GENERALCALL_ENABLE

I2C Interrupt configuration definition

I2C_IT_ERRI

I2C_IT_TCI

I2C_IT_STOPI

I2C_IT_NACKI

I2C_IT_ADDRI

I2C_IT_RXI

I2C_IT_TXI

I2C Memory Address Size

I2C_MEMADD_SIZE_8BIT

I2C_MEMADD_SIZE_16BIT

I2C No-Stretch Mode

I2C_NOSTRETCH_DISABLE

I2C_NOSTRETCH_ENABLE

I2C Own Address2 Masks

I2C_OA2_NOMASK

I2C_OA2_MASK01

I2C_OA2_MASK02

I2C_OA2_MASK03

I2C_OA2_MASK04

I2C_OA2_MASK05

I2C_OA2_MASK06

I2C_OA2_MASK07

I2C Reload End Mode

I2C_RELOAD_MODE

I2C_AUTOEND_MODE

I2C_SOFTEND_MODE

I2C Start or Stop Mode

I2C_NO_STARTSTOP

I2C_GENERATE_STOP

I2C_GENERATE_START_READ

I2C_GENERATE_START_WRITE

I2C Transfer Direction Master Point of View

I2C_DIRECTION_TRANSMIT

I2C_DIRECTION_RECEIVE

I2C Sequential Transfer Options

I2C_FIRST_FRAME

I2C_FIRST_AND_NEXT_FRAME

I2C_NEXT_FRAME

I2C_FIRST_AND_LAST_FRAME

I2C_LAST_FRAME

I2C_LAST_FRAME_NO_STOP

I2C_OTHER_FRAME

I2C_OTHER_AND_LAST_FRAME

25 HAL I2C Extension Driver

25.1 I2CEx Firmware driver API description

The following section lists the various functions of the I2CEx library.

25.1.1 I2C peripheral Extended features

Comparing to other previous devices, the I2C interface for STM32U0xx devices contains the following additional features

- Possibility to disable or enable Analog Noise Filter
- Use of a configured Digital Noise Filter
- Disable or enable wakeup from Stop mode(s)
- Disable or enable Fast Mode Plus

25.1.2 How to use this driver

This driver provides functions to configure Noise Filter and Wake Up Feature

1. Configure I2C Analog noise filter using the function HAL_I2CEx_ConfigAnalogFilter()
2. Configure I2C Digital noise filter using the function HAL_I2CEx_ConfigDigitalFilter()
3. Configure the enable or disable of I2C Wake Up Mode using the functions :
   - HAL_I2CEx_EnableWakeUp()
   - HAL_I2CEx_DisableWakeUp()
4. Configure the enable or disable of fast mode plus driving capability using the functions :
   - HAL_I2CEx_ConfigFastModePlus()

25.1.3 Filter Mode Functions

This section provides functions allowing to:

- Configure Noise Filters

This section contains the following APIs:

- ***HAL_I2CEx_ConfigAnalogFilter()***
- ***HAL_I2CEx_ConfigDigitalFilter()***

25.1.4 WakeUp Mode Functions

This section provides functions allowing to:

- Configure Wake Up Feature

This section contains the following APIs:

- ***HAL_I2CEx_EnableWakeUp()***
- ***HAL_I2CEx_DisableWakeUp()***

25.1.5 Fast Mode Plus Functions

This section provides functions allowing to:

- Configure Fast Mode Plus

This section contains the following APIs:

- ***HAL_I2CEx_ConfigFastModePlus()***

25.1.6 Detailed description of functions

HAL_I2CEx_ConfigAnalogFilter

Function name

HAL_StatusTypeDef HAL_I2CEx_ConfigAnalogFilter (I2C_HandleTypeDef * hi2c, uint32_t AnalogFilter)

Function description

Configure I2C Analog noise filter.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2Cx peripheral.
- **AnalogFilter:** New state of the Analog filter.

Return values

- **HAL:** status

HAL_I2CEx_ConfigDigitalFilter

Function name

HAL_StatusTypeDef HAL_I2CEx_ConfigDigitalFilter (I2C_HandleTypeDef * hi2c, uint32_t DigitalFilter)

Function description

Configure I2C Digital noise filter.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2Cx peripheral.
- **DigitalFilter:** Coefficient of digital noise filter between Min_Data=0x00 and Max_Data=0x0F.

Return values

- **HAL:** status

HAL_I2CEx_EnableWakeUp

Function name

HAL_StatusTypeDef HAL_I2CEx_EnableWakeUp (I2C_HandleTypeDef * hi2c)

Function description

Enable I2C wakeup from Stop mode(s).

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2Cx peripheral.

Return values

- **HAL:** status

HAL_I2CEx_DisableWakeUp

Function name

HAL_StatusTypeDef HAL_I2CEx_DisableWakeUp (I2C_HandleTypeDef * hi2c)

Function description

Disable I2C wakeup from Stop mode(s).

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2Cx peripheral.

Return values

- **HAL:** status

HAL_I2CEx_ConfigFastModePlus

Function name

HAL_StatusTypeDef HAL_I2CEx_ConfigFastModePlus (I2C_HandleTypeDef * hi2c, uint32_t FastModePlus)

Function description

Configure I2C Fast Mode Plus.

Parameters

- **hi2c:** Pointer to a I2C_HandleTypeDef structure that contains the configuration information for the specified I2Cx peripheral.
- **FastModePlus:** New state of the Fast Mode Plus.

Return values

- **HAL:** status

25.2 I2CEx Firmware driver defines

The following section lists the various define and macros of the module.

25.2.1 I2CEx

I2CEx

I2C Extended Analog Filter

I2C_ANALOGFILTER_ENABLE

I2C_ANALOGFILTER_DISABLE

I2C Extended Fast Mode Plus

I2C_FASTMODEPLUS_ENABLE

Enable Fast Mode Plus

I2C_FASTMODEPLUS_DISABLE

Disable Fast Mode Plus

26 HAL IRDA Generic Driver

26.1 IRDA Firmware driver registers structures

26.1.1 IRDA_InitTypeDef

IRDA_InitTypeDef is defined in the stm32u0xx_hal_irda.h

Data Fields

- ***uint32_t BaudRate***
- ***uint32_t WordLength***
- ***uint32_t Parity***
- ***uint32_t Mode***
- ***uint8_t Prescaler***
- ***uint16_t PowerMode***
- ***uint32_t ClockPrescaler***

Field Documentation

- ***uint32_t IRDA_InitTypeDef::BaudRate***
  This member configures the IRDA communication baud rate. The baud rate register is computed using the following formula: Baud Rate Register = ((usart_ker_ckpres) / ((hirda->Init.BaudRate))) where usart_ker_ckpres is the IRDA input clock divided by a prescaler
- ***uint32_t IRDA_InitTypeDef::WordLength***
  Specifies the number of data bits transmitted or received in a frame. This parameter can be a value of ***IRDAEx_Word_Length***
- ***uint32_t IRDA_InitTypeDef::Parity***
  Specifies the parity mode. This parameter can be a value of ***IRDA_Parity***
  Note:
  – When parity is enabled, the computed parity is inserted at the MSB position of the transmitted data (9th bit when the word length is set to 9 data bits; 8th bit when the word length is set to 8 data bits).
- ***uint32_t IRDA_InitTypeDef::Mode***
  Specifies whether the Receive or Transmit mode is enabled or disabled. This parameter can be a value of ***IRDA_Transfer_Mode***
- ***uint8_t IRDA_InitTypeDef::Prescaler***
  Specifies the Prescaler value for dividing the UART/USART source clock to achieve low-power frequency.
  Note:
  – Prescaler value 0 is forbidden
- ***uint16_t IRDA_InitTypeDef::PowerMode***
  Specifies the IRDA power mode. This parameter can be a value of ***IRDA_Low_Power***
- ***uint32_t IRDA_InitTypeDef::ClockPrescaler***
  Specifies the prescaler value used to divide the IRDA clock source. This parameter can be a value of ***IRDA_ClockPrescaler***.

26.1.2 __IRDA_HandleTypeDef

__IRDA_HandleTypeDef is defined in the stm32u0xx_hal_irda.h

Data Fields

- ***USART_TypeDef * Instance***
- ***IRDA_InitTypeDef Init***
- ***const uint8_t * pTxBuffPtr***
- ***uint16_t TxXferSize***
- ***__IO uint16_t TxXferCount***
- ***uint8_t * pRxBuffPtr***
- ***uint16_t RxXferSize***
- ***__IO uint16_t RxXferCount***

- ***uint16_t Mask***
- ***DMA_HandleTypeDef * hdmatx***
- ***DMA_HandleTypeDef * hdmarx***
- ***HAL_LockTypeDef Lock***
- ***__IO HAL_IRDA_StateTypeDef gState***
- ***__IO HAL_IRDA_StateTypeDef RxState***
- ***__IO uint32_t ErrorCode***
- ***void(* TxHalfCpltCallback***
- ***void(* TxCpltCallback***
- ***void(* RxHalfCpltCallback***
- ***void(* RxCpltCallback***
- ***void(* ErrorCallback***
- ***void(* AbortCpltCallback***
- ***void(* AbortTransmitCpltCallback***
- ***void(* AbortReceiveCpltCallback***
- ***void(* MspInitCallback***
- ***void(* MspDeInitCallback***

Field Documentation

- ***USART_TypeDef* __IRDA_HandleTypeDef::Instance***
  USART registers base address
- ***IRDA_InitTypeDef __IRDA_HandleTypeDef::Init***
  IRDA communication parameters
- ***const uint8_t* __IRDA_HandleTypeDef::pTxBuffPtr***
  Pointer to IRDA Tx transfer Buffer
- ***uint16_t __IRDA_HandleTypeDef::TxXferSize***
  IRDA Tx Transfer size
- ***__IO uint16_t __IRDA_HandleTypeDef::TxXferCount***
  IRDA Tx Transfer Counter
- ***uint8_t* __IRDA_HandleTypeDef::pRxBuffPtr***
  Pointer to IRDA Rx transfer Buffer
- ***uint16_t __IRDA_HandleTypeDef::RxXferSize***
  IRDA Rx Transfer size
- ***__IO uint16_t __IRDA_HandleTypeDef::RxXferCount***
  IRDA Rx Transfer Counter
- ***uint16_t __IRDA_HandleTypeDef::Mask***
  USART RX RDR register mask
- ***DMA_HandleTypeDef* __IRDA_HandleTypeDef::hdmatx***
  IRDA Tx DMA Handle parameters
- ***DMA_HandleTypeDef* __IRDA_HandleTypeDef::hdmarx***
  IRDA Rx DMA Handle parameters
- ***HAL_LockTypeDef __IRDA_HandleTypeDef::Lock***
  Locking object
- ***__IO HAL_IRDA_StateTypeDef __IRDA_HandleTypeDef::gState***
  IRDA state information related to global Handle management and also related to Tx operations. This parameter can be a value of **HAL_IRDA_StateTypeDef**
- ***__IO HAL_IRDA_StateTypeDef __IRDA_HandleTypeDef::RxState***
  IRDA state information related to Rx operations. This parameter can be a value of **HAL_IRDA_StateTypeDef**
- ***__IO uint32_t __IRDA_HandleTypeDef::ErrorCode***
  IRDA Error code
- ***void(* __IRDA_HandleTypeDef::TxHalfCpltCallback)(struct __IRDA_HandleTypeDef *hirda)***
  IRDA Tx Half Complete Callback
- ***void(* __IRDA_HandleTypeDef::TxCpltCallback)(struct __IRDA_HandleTypeDef *hirda)***
  IRDA Tx Complete Callback

- ***void(* __IRDA_HandleTypeDef::RxHalfCpltCallback)(struct __IRDA_HandleTypeDef *hirda)***
  IRDA Rx Half Complete Callback
- ***void(* __IRDA_HandleTypeDef::RxCpltCallback)(struct __IRDA_HandleTypeDef *hirda)***
  IRDA Rx Complete Callback
- ***void(* __IRDA_HandleTypeDef::ErrorCallback)(struct __IRDA_HandleTypeDef *hirda)***
  IRDA Error Callback
- ***void(* __IRDA_HandleTypeDef::AbortCpltCallback)(struct __IRDA_HandleTypeDef *hirda)***
  IRDA Abort Complete Callback
- ***void(* __IRDA_HandleTypeDef::AbortTransmitCpltCallback)(struct __IRDA_HandleTypeDef *hirda)***
  IRDA Abort Transmit Complete Callback
- ***void(* __IRDA_HandleTypeDef::AbortReceiveCpltCallback)(struct __IRDA_HandleTypeDef *hirda)***
  IRDA Abort Receive Complete Callback
- ***void(* __IRDA_HandleTypeDef::MspInitCallback)(struct __IRDA_HandleTypeDef *hirda)***
  IRDA Msp Init callback
- ***void(* __IRDA_HandleTypeDef::MspDeInitCallback)(struct __IRDA_HandleTypeDef *hirda)***
  IRDA Msp DeInit callback

26.2 IRDA Firmware driver API description

The following section lists the various functions of the IRDA library.

26.2.1 How to use this driver

The IRDA HAL driver can be used as follows:

1. Declare a IRDA_HandleTypeDef handle structure (eg. IRDA_HandleTypeDef hirda).
2. Initialize the IRDA low level resources by implementing the HAL_IRDA_MspInit() API in setting the associated USART or UART in IRDA mode:
   - Enable the USARTx/UARTx interface clock.
   - USARTx/UARTx pins configuration:
     - Enable the clock for the USARTx/UARTx GPIOs.
     - Configure these USARTx/UARTx pins (TX as alternate function pull-up, RX as alternate function Input).
   - NVIC configuration if you need to use interrupt process (HAL_IRDA_Transmit_IT() and HAL_IRDA_Receive_IT() APIs):
     - Configure the USARTx/UARTx interrupt priority.
     - Enable the NVIC USARTx/UARTx IRQ handle.
     - The specific IRDA interrupts (Transmission complete interrupt, RXNE interrupt and Error Interrupts) will be managed using the macros __HAL_IRDA_ENABLE_IT() and __HAL_IRDA_DISABLE_IT() inside the transmit and receive process.
   - DMA Configuration if you need to use DMA process (HAL_IRDA_Transmit_DMA() and HAL_IRDA_Receive_DMA() APIs):
     - Declare a DMA handle structure for the Tx/Rx channel.
     - Enable the DMAx interface clock.
     - Configure the declared DMA handle structure with the required Tx/Rx parameters.
     - Configure the DMA Tx/Rx channel.
     - Associate the initialized DMA handle to the IRDA DMA Tx/Rx handle.
     - Configure the priority and enable the NVIC for the transfer complete interrupt on the DMA Tx/Rx channel.
3. Program the Baud Rate, Word Length and Parity and Mode(Receiver/Transmitter), the normal or low power mode and the clock prescaler in the hirda handle Init structure.

4. Initialize the IRDA registers by calling the HAL_IRDA_Init() API:
   – This API configures also the low level Hardware GPIO, CLOCK, CORTEX...etc) by calling the customized HAL_IRDA_MspInit() API.

Note: The specific IRDA interrupts (Transmission complete interrupt, RXNE interrupt and Error Interrupts) will be managed using the macros __HAL_IRDA_ENABLE_IT() and __HAL_IRDA_DISABLE_IT() inside the transmit and receive process.

5. Three operation modes are available within this driver :

Polling mode IO operation

- Send an amount of data in blocking mode using HAL_IRDA_Transmit()
- Receive an amount of data in blocking mode using HAL_IRDA_Receive()

Interrupt mode IO operation

- Send an amount of data in non-blocking mode using HAL_IRDA_Transmit_IT()
- At transmission end of transfer HAL_IRDA_TxCpltCallback() is executed and user can add his own code by customization of function pointer HAL_IRDA_TxCpltCallback()
- Receive an amount of data in non-blocking mode using HAL_IRDA_Receive_IT()
- At reception end of transfer HAL_IRDA_RxCpltCallback() is executed and user can add his own code by customization of function pointer HAL_IRDA_RxCpltCallback()
- In case of transfer Error, HAL_IRDA_ErrorCallback() function is executed and user can add his own code by customization of function pointer HAL_IRDA_ErrorCallback()

DMA mode IO operation

- Send an amount of data in non-blocking mode (DMA) using HAL_IRDA_Transmit_DMA()
- At transmission half of transfer HAL_IRDA_TxHalfCpltCallback() is executed and user can add his own code by customization of function pointer HAL_IRDA_TxHalfCpltCallback()
- At transmission end of transfer HAL_IRDA_TxCpltCallback() is executed and user can add his own code by customization of function pointer HAL_IRDA_TxCpltCallback()
- Receive an amount of data in non-blocking mode (DMA) using HAL_IRDA_Receive_DMA()
- At reception half of transfer HAL_IRDA_RxHalfCpltCallback() is executed and user can add his own code by customization of function pointer HAL_IRDA_RxHalfCpltCallback()
- At reception end of transfer HAL_IRDA_RxCpltCallback() is executed and user can add his own code by customization of function pointer HAL_IRDA_RxCpltCallback()
- In case of transfer Error, HAL_IRDA_ErrorCallback() function is executed and user can add his own code by customization of function pointer HAL_IRDA_ErrorCallback()

IRDA HAL driver macros list

Below the list of most used macros in IRDA HAL driver.

- __HAL_IRDA_ENABLE: Enable the IRDA peripheral
- __HAL_IRDA_DISABLE: Disable the IRDA peripheral
- __HAL_IRDA_GET_FLAG : Check whether the specified IRDA flag is set or not
- __HAL_IRDA_CLEAR_FLAG : Clear the specified IRDA pending flag
- __HAL_IRDA_ENABLE_IT: Enable the specified IRDA interrupt
- __HAL_IRDA_DISABLE_IT: Disable the specified IRDA interrupt
- __HAL_IRDA_GET_IT_SOURCE: Check whether or not the specified IRDA interrupt is enabled

Note: You can refer to the IRDA HAL driver header file for more useful macros

26.2.2 Callback registration

The compilation define USE_HAL_IRDA_REGISTER_CALLBACKS when set to 1 allows the user to configure dynamically the driver callbacks.

Use Function HAL_IRDA_RegisterCallback() to register a user callback. Function HAL_IRDA_RegisterCallback() allows to register following callbacks:

- TxHalfCpltCallback : Tx Half Complete Callback.
- TxCpltCallback : Tx Complete Callback.
- RxHalfCpltCallback : Rx Half Complete Callback.
- RxCpltCallback : Rx Complete Callback.
- ErrorCallback : Error Callback.
- AbortCpltCallback : Abort Complete Callback.
- AbortTransmitCpltCallback : Abort Transmit Complete Callback.
- AbortReceiveCpltCallback : Abort Receive Complete Callback.
- MspInitCallback : IRDA MspInit.
- MspDeInitCallback : IRDA MspDeInit. This function takes as parameters the HAL peripheral handle, the Callback ID and a pointer to the user callback function.

Use function HAL_IRDA_UnRegisterCallback() to reset a callback to the default weak function. HAL_IRDA_UnRegisterCallback() takes as parameters the HAL peripheral handle, and the Callback ID. This function allows to reset following callbacks:

- TxHalfCpltCallback : Tx Half Complete Callback.
- TxCpltCallback : Tx Complete Callback.
- RxHalfCpltCallback : Rx Half Complete Callback.
- RxCpltCallback : Rx Complete Callback.
- ErrorCallback : Error Callback.
- AbortCpltCallback : Abort Complete Callback.
- AbortTransmitCpltCallback : Abort Transmit Complete Callback.
- AbortReceiveCpltCallback : Abort Receive Complete Callback.
- MspInitCallback : IRDA MspInit.
- MspDeInitCallback : IRDA MspDeInit.

By default, after the HAL_IRDA_Init() and when the state is HAL_IRDA_STATE_RESET all callbacks are set to the corresponding weak functions: examples HAL_IRDA_TxCpltCallback(), HAL_IRDA_RxHalfCpltCallback(). Exception done for MspInit and MspDeInit functions that are respectively reset to the legacy weak functions in the HAL_IRDA_Init() and HAL_IRDA_DeInit() only when these callbacks are null (not registered beforehand). If not, MspInit or MspDeInit are not null, the HAL_IRDA_Init() and HAL_IRDA_DeInit() keep and use the user MspInit/ MspDeInit callbacks (registered beforehand).

Callbacks can be registered/unregistered in HAL_IRDA_STATE_READY state only. Exception done MspInit/ MspDeInit that can be registered/unregistered in HAL_IRDA_STATE_READY or HAL_IRDA_STATE_RESET state, thus registered (user) MspInit/DeInit callbacks can be used during the Init/DeInit. In that case first register the MspInit/MspDeInit user callbacks using HAL_IRDA_RegisterCallback() before calling HAL_IRDA_DeInit() or HAL_IRDA_Init() function.

When The compilation define USE_HAL_IRDA_REGISTER_CALLBACKS is set to 0 or not defined, the callback registration feature is not available and weak callbacks are used.

26.2.3 Initialization and Configuration functions

This subsection provides a set of functions allowing to initialize the USARTx in asynchronous IRDA mode.

- For the asynchronous mode only these parameters can be configured:
  - Baud Rate
  - Word Length
  - Parity: If the parity is enabled, then the MSB bit of the data written in the data register is transmitted but is changed by the parity bit.
  - Power mode
  - Prescaler setting
  - Receiver/transmitter modes

The HAL_IRDA_Init() API follows the USART asynchronous configuration procedures (details for the procedures are available in reference manual).

This section contains the following APIs:

- ***HAL_IRDA_Init()***

- *HAL_IRDA_DeInit()*
- *HAL_IRDA_MspInit()*
- *HAL_IRDA_MspDeInit()*
- *HAL_IRDA_RegisterCallback()*
- *HAL_IRDA_UnRegisterCallback()*

26.2.4 IO operation functions

This subsection provides a set of functions allowing to manage the IRDA data transfers.

IrDA is a half duplex communication protocol. If the Transmitter is busy, any data on the IrDA receive line will be ignored by the IrDA decoder and if the Receiver is busy, data on the TX from the USART to IrDA will not be encoded by IrDA. While receiving data, transmission should be avoided as the data to be transmitted could be corrupted.

1. There are two modes of transfer:
   - Blocking mode: the communication is performed in polling mode. The HAL status of all data processing is returned by the same function after finishing transfer.
   - Non-Blocking mode: the communication is performed using Interrupts or DMA, these API's return the HAL status. The end of the data processing will be indicated through the dedicated IRDA IRQ when using Interrupt mode or the DMA IRQ when using DMA mode. The HAL_IRDA_TxCpltCallback(), HAL_IRDA_RxCpltCallback() user callbacks will be executed respectively at the end of the Transmit or Receive process The HAL_IRDA_ErrorCallback() user callback will be executed when a communication error is detected
2. Blocking mode APIs are :
   - HAL_IRDA_Transmit()
   - HAL_IRDA_Receive()
3. Non Blocking mode APIs with Interrupt are :
   - HAL_IRDA_Transmit_IT()
   - HAL_IRDA_Receive_IT()
   - HAL_IRDA_IRQHandler()
4. Non Blocking mode functions with DMA are :
   - HAL_IRDA_Transmit_DMA()
   - HAL_IRDA_Receive_DMA()
   - HAL_IRDA_DMAPause()
   - HAL_IRDA_DMAResume()
   - HAL_IRDA_DMAStop()
5. A set of Transfer Complete Callbacks are provided in Non Blocking mode:
   - HAL_IRDA_TxHalfCpltCallback()
   - HAL_IRDA_TxCpltCallback()
   - HAL_IRDA_RxHalfCpltCallback()
   - HAL_IRDA_RxCpltCallback()
   - HAL_IRDA_ErrorCallback()
6. Non-Blocking mode transfers could be aborted using Abort API's :
   - HAL_IRDA_Abort()
   - HAL_IRDA_AbortTransmit()
   - HAL_IRDA_AbortReceive()
   - HAL_IRDA_Abort_IT()
   - HAL_IRDA_AbortTransmit_IT()
   - HAL_IRDA_AbortReceive_IT()
7. For Abort services based on interrupts (HAL_IRDA_Abortxxx_IT), a set of Abort Complete Callbacks are provided:
   - HAL_IRDA_AbortCpltCallback()
   - HAL_IRDA_AbortTransmitCpltCallback()
   - HAL_IRDA_AbortReceiveCpltCallback()

8. In Non-Blocking mode transfers, possible errors are split into 2 categories. Errors are handled as follows :
   – Error is considered as Recoverable and non blocking : Transfer could go till end, but error severity is to be evaluated by user : this concerns Frame Error, Parity Error or Noise Error in Interrupt mode reception . Received character is then retrieved and stored in Rx buffer, Error code is set to allow user to identify error type, and HAL_IRDA_ErrorCallback() user callback is executed. Transfer is kept ongoing on IRDA side. If user wants to abort it, Abort services should be called by user.
   – Error is considered as Blocking : Transfer could not be completed properly and is aborted. This concerns Overrun Error In Interrupt mode reception and all errors in DMA mode. Error code is set to allow user to identify error type, and HAL_IRDA_ErrorCallback() user callback is executed.

This section contains the following APIs:

- *HAL_IRDA_Transmit()*
- *HAL_IRDA_Receive()*
- *HAL_IRDA_Transmit_IT()*
- *HAL_IRDA_Receive_IT()*
- *HAL_IRDA_Transmit_DMA()*
- *HAL_IRDA_Receive_DMA()*
- *HAL_IRDA_DMAPause()*
- *HAL_IRDA_DMAResume()*
- *HAL_IRDA_DMAStop()*
- *HAL_IRDA_Abort()*
- *HAL_IRDA_AbortTransmit()*
- *HAL_IRDA_AbortReceive()*
- *HAL_IRDA_Abort_IT()*
- *HAL_IRDA_AbortTransmit_IT()*
- *HAL_IRDA_AbortReceive_IT()*
- *HAL_IRDA_IRQHandler()*
- *HAL_IRDA_TxCpltCallback()*
- *HAL_IRDA_TxHalfCpltCallback()*
- *HAL_IRDA_RxCpltCallback()*
- *HAL_IRDA_RxHalfCpltCallback()*
- *HAL_IRDA_ErrorCallback()*
- *HAL_IRDA_AbortCpltCallback()*
- *HAL_IRDA_AbortTransmitCpltCallback()*
- *HAL_IRDA_AbortReceiveCpltCallback()*

26.2.5 Peripheral State and Error functions

This subsection provides a set of functions allowing to return the State of IrDA communication process and also return Peripheral Errors occurred during communication process

- HAL_IRDA_GetState() API can be helpful to check in run-time the state of the IRDA peripheral handle.
- HAL_IRDA_GetError() checks in run-time errors that could occur during communication.

This section contains the following APIs:

- *HAL_IRDA_GetState()*
- *HAL_IRDA_GetError()*

26.2.6 Detailed description of functions

HAL_IRDA_Init

Function name

HAL_StatusTypeDef HAL_IRDA_Init (IRDA_HandleTypeDef * hirda)

Function description

Initialize the IRDA mode according to the specified parameters in the IRDA_InitTypeDef and initialize the associated handle.

Parameters

- **hirda:** Pointer to a IRDA_HandleTypeDef structure that contains the configuration information for the specified IRDA module.

Return values

- **HAL:** status

HAL_IRDA_DeInit

Function name

HAL_StatusTypeDef HAL_IRDA_DeInit (IRDA_HandleTypeDef * hirda)

Function description

DeInitialize the IRDA peripheral.

Parameters

- **hirda:** Pointer to a IRDA_HandleTypeDef structure that contains the configuration information for the specified IRDA module.

Return values

- **HAL:** status

HAL_IRDA_MspInit

Function name

void HAL_IRDA_MspInit (IRDA_HandleTypeDef * hirda)

Function description

Initialize the IRDA MSP.

Parameters

- **hirda:** Pointer to a IRDA_HandleTypeDef structure that contains the configuration information for the specified IRDA module.

Return values

- **None:**

HAL_IRDA_MspDeInit

Function name

void HAL_IRDA_MspDeInit (IRDA_HandleTypeDef * hirda)

Function description

DeInitialize the IRDA MSP.

Parameters

- **hirda:** Pointer to a IRDA_HandleTypeDef structure that contains the configuration information for the specified IRDA module.

Return values

- **None:**

HAL_IRDA_RegisterCallback

Function name

HAL_StatusTypeDef HAL_IRDA_RegisterCallback (IRDA_HandleTypeDef * hirda, HAL_IRDA_CallbackIDTypeDef CallbackID, pIRDA_CallbackTypeDef pCallback)

Function description

Register a User IRDA Callback To be used to override the weak predefined callback.

Parameters

- **hirda:** irda handle
- **CallbackID:** ID of the callback to be registered This parameter can be one of the following values:
  - HAL_IRDA_TX_HALFCOMPLETE_CB_ID Tx Half Complete Callback ID
  - HAL_IRDA_TX_COMPLETE_CB_ID Tx Complete Callback ID
  - HAL_IRDA_RX_HALFCOMPLETE_CB_ID Rx Half Complete Callback ID
  - HAL_IRDA_RX_COMPLETE_CB_ID Rx Complete Callback ID
  - HAL_IRDA_ERROR_CB_ID Error Callback ID
  - HAL_IRDA_ABORT_COMPLETE_CB_ID Abort Complete Callback ID
  - HAL_IRDA_ABORT_TRANSMIT_COMPLETE_CB_ID Abort Transmit Complete Callback ID
  - HAL_IRDA_ABORT_RECEIVE_COMPLETE_CB_ID Abort Receive Complete Callback ID
  - HAL_IRDA_MSPINIT_CB_ID MspInit Callback ID
  - HAL_IRDA_MSPDEINIT_CB_ID MspDeInit Callback ID
- **pCallback:** pointer to the Callback function

Return values

- **HAL:** status

Notes

- The HAL_IRDA_RegisterCallback() may be called before HAL_IRDA_Init() in HAL_IRDA_STATE_RESET to register callbacks for HAL_IRDA_MSPINIT_CB_ID and HAL_IRDA_MSPDEINIT_CB_ID

HAL_IRDA_UnRegisterCallback

Function name

HAL_StatusTypeDef HAL_IRDA_UnRegisterCallback (IRDA_HandleTypeDef * hirda, HAL_IRDA_CallbackIDTypeDef CallbackID)

Function description

Unregister an IRDA callback IRDA callback is redirected to the weak predefined callback.

Parameters

- **hirda:** irda handle
- **CallbackID:** ID of the callback to be unregistered This parameter can be one of the following values:
  - HAL_IRDA_TX_HALFCOMPLETE_CB_ID Tx Half Complete Callback ID
  - HAL_IRDA_TX_COMPLETE_CB_ID Tx Complete Callback ID
  - HAL_IRDA_RX_HALFCOMPLETE_CB_ID Rx Half Complete Callback ID
  - HAL_IRDA_RX_COMPLETE_CB_ID Rx Complete Callback ID
  - HAL_IRDA_ERROR_CB_ID Error Callback ID
  - HAL_IRDA_ABORT_COMPLETE_CB_ID Abort Complete Callback ID
  - HAL_IRDA_ABORT_TRANSMIT_COMPLETE_CB_ID Abort Transmit Complete Callback ID
  - HAL_IRDA_ABORT_RECEIVE_COMPLETE_CB_ID Abort Receive Complete Callback ID
  - HAL_IRDA_MSPINIT_CB_ID MspInit Callback ID
  - HAL_IRDA_MSPDEINIT_CB_ID MspDeInit Callback ID

Return values

- **HAL:** status

Notes

- The HAL_IRDA_UnRegisterCallback() may be called before HAL_IRDA_Init() in HAL_IRDA_STATE_RESET to un-register callbacks for HAL_IRDA_MSPINIT_CB_ID and HAL_IRDA_MSPDEINIT_CB_ID

HAL_IRDA_Transmit

Function name

HAL_StatusTypeDef HAL_IRDA_Transmit (IRDA_HandleTypeDef * hirda, const uint8_t * pData, uint16_t Size, uint32_t Timeout)

Function description

Send an amount of data in blocking mode.

Parameters

- **hirda:** Pointer to a IRDA_HandleTypeDef structure that contains the configuration information for the specified IRDA module.
- **pData:** Pointer to data buffer (u8 or u16 data elements).
- **Size:** Amount of data elements (u8 or u16) to be sent.
- **Timeout:** Specify timeout value.

Return values

- **HAL:** status

Notes

- When UART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), the sent data is handled as a set of u16. In this case, Size must reflect the number of u16 available through pData.
- When IRDA parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), address of user data buffer containing data to be sent, should be aligned on a half word frontier (16 bits) (as sent data will be handled using u16 pointer cast). Depending on compilation chain, use of specific alignment compilation directives or pragmas might be required to ensure proper alignment for pData.

HAL_IRDA_Receive

Function name

HAL_StatusTypeDef HAL_IRDA_Receive (IRDA_HandleTypeDef * hirda, uint8_t * pData, uint16_t Size, uint32_t Timeout)

Function description

Receive an amount of data in blocking mode.

Parameters

- **hirda:** Pointer to a IRDA_HandleTypeDef structure that contains the configuration information for the specified IRDA module.
- **pData:** Pointer to data buffer (u8 or u16 data elements).
- **Size:** Amount of data elements (u8 or u16) to be received.
- **Timeout:** Specify timeout value.

Return values

- **HAL:** status

Notes

- When UART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), the received data is handled as a set of u16. In this case, Size must reflect the number of u16 available through pData.
- When IRDA parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), address of user data buffer for storing data to be received, should be aligned on a half word frontier (16 bits) (as received data will be handled using u16 pointer cast). Depending on compilation chain, use of specific alignment compilation directives or pragmas might be required to ensure proper alignment for pData.

HAL_IRDA_Transmit_IT

Function name

HAL_StatusTypeDef HAL_IRDA_Transmit_IT (IRDA_HandleTypeDef * hirda, const uint8_t * pData, uint16_t Size)

Function description

Send an amount of data in interrupt mode.

Parameters

- **hirda:** Pointer to a IRDA_HandleTypeDef structure that contains the configuration information for the specified IRDA module.
- **pData:** Pointer to data buffer (u8 or u16 data elements).
- **Size:** Amount of data elements (u8 or u16) to be sent.

Return values

- **HAL:** status

Notes

- When UART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), the sent data is handled as a set of u16. In this case, Size must reflect the number of u16 available through pData.
- When IRDA parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), address of user data buffer containing data to be sent, should be aligned on a half word frontier (16 bits) (as sent data will be handled using u16 pointer cast). Depending on compilation chain, use of specific alignment compilation directives or pragmas might be required to ensure proper alignment for pData.

HAL_IRDA_Receive_IT

Function name

HAL_StatusTypeDef HAL_IRDA_Receive_IT (IRDA_HandleTypeDef * hirda, uint8_t * pData, uint16_t Size)

Function description

Receive an amount of data in interrupt mode.

Parameters

- **hirda:** Pointer to a IRDA_HandleTypeDef structure that contains the configuration information for the specified IRDA module.
- **pData:** Pointer to data buffer (u8 or u16 data elements).
- **Size:** Amount of data elements (u8 or u16) to be received.

Return values

- **HAL:** status

Notes

- When UART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), the received data is handled as a set of u16. In this case, Size must reflect the number of u16 available through pData.
- When IRDA parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), address of user data buffer for storing data to be received, should be aligned on a half word frontier (16 bits) (as received data will be handled using u16 pointer cast). Depending on compilation chain, use of specific alignment compilation directives or pragmas might be required to ensure proper alignment for pData.

HAL_IRDA_Transmit_DMA

Function name

HAL_StatusTypeDef HAL_IRDA_Transmit_DMA (IRDA_HandleTypeDef * hirda, const uint8_t * pData, uint16_t Size)

Function description

Send an amount of data in DMA mode.

Parameters

- **hirda:** Pointer to a IRDA_HandleTypeDef structure that contains the configuration information for the specified IRDA module.
- **pData:** pointer to data buffer (u8 or u16 data elements).
- **Size:** Amount of data elements (u8 or u16) to be sent.

Return values

- **HAL:** status

Notes

- When UART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), the sent data is handled as a set of u16. In this case, Size must reflect the number of u16 available through pData.
- When IRDA parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), address of user data buffer containing data to be sent, should be aligned on a half word frontier (16 bits) (as sent data will be handled by DMA from halfword frontier). Depending on compilation chain, use of specific alignment compilation directives or pragmas might be required to ensure proper alignment for pData.

HAL_IRDA_Receive_DMA

Function name

HAL_StatusTypeDef HAL_IRDA_Receive_DMA (IRDA_HandleTypeDef * hirda, uint8_t * pData, uint16_t Size)

Function description

Receive an amount of data in DMA mode.

Parameters

- **hirda:** Pointer to a IRDA_HandleTypeDef structure that contains the configuration information for the specified IRDA module.
- **pData:** Pointer to data buffer (u8 or u16 data elements).
- **Size:** Amount of data elements (u8 or u16) to be received.

Return values

- **HAL:** status

Notes

- When UART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), the received data is handled as a set of u16. In this case, Size must reflect the number of u16 available through pData.
- When the IRDA parity is enabled (PCE = 1), the received data contains the parity bit (MSB position).
- When IRDA parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), address of user data buffer for storing data to be received, should be aligned on a half word frontier (16 bits) (as received data will be handled by DMA from halfword frontier). Depending on compilation chain, use of specific alignment compilation directives or pragmas might be required to ensure proper alignment for pData.

HAL_IRDA_DMAPause

Function name

HAL_StatusTypeDef HAL_IRDA_DMAPause (IRDA_HandleTypeDef * hirda)

Function description

Pause the DMA Transfer.

Parameters

- **hirda:** Pointer to a IRDA_HandleTypeDef structure that contains the configuration information for the specified IRDA module.

Return values

- **HAL:** status

HAL_IRDA_DMAResume

Function name

HAL_StatusTypeDef HAL_IRDA_DMAResume (IRDA_HandleTypeDef * hirda)

Function description

Resume the DMA Transfer.

Parameters

- **hirda:** Pointer to a IRDA_HandleTypeDef structure that contains the configuration information for the specified UART module.

Return values

- **HAL:** status

HAL_IRDA_DMAStop

Function name

HAL_StatusTypeDef HAL_IRDA_DMAStop (IRDA_HandleTypeDef * hirda)

Function description

Stop the DMA Transfer.

Parameters

- **hirda:** Pointer to a IRDA_HandleTypeDef structure that contains the configuration information for the specified UART module.

Return values

- **HAL:** status

HAL_IRDA_Abort

Function name

HAL_StatusTypeDef HAL_IRDA_Abort (IRDA_HandleTypeDef * hirda)

Function description

Abort ongoing transfers (blocking mode).

Parameters

- **hirda:** Pointer to a IRDA_HandleTypeDef structure that contains the configuration information for the specified UART module.

Return values

- **HAL:** status

Notes

- This procedure could be used for aborting any ongoing transfer started in Interrupt or DMA mode. This procedure performs following operations : Disable IRDA Interrupts (Tx and Rx)Disable the DMA transfer in the peripheral register (if enabled)Abort DMA transfer by calling HAL_DMA_Abort (in case of transfer in DMA mode)Set handle State to READY
- This procedure is executed in blocking mode : when exiting function, Abort is considered as completed.

HAL_IRDA_AbortTransmit

Function name

HAL_StatusTypeDef HAL_IRDA_AbortTransmit (IRDA_HandleTypeDef * hirda)

Function description

Abort ongoing Transmit transfer (blocking mode).

Parameters

- **hirda:** Pointer to a IRDA_HandleTypeDef structure that contains the configuration information for the specified UART module.

Return values

- **HAL:** status

Notes

- This procedure could be used for aborting any ongoing Tx transfer started in Interrupt or DMA mode. This procedure performs following operations : Disable IRDA Interrupts (Tx)Disable the DMA transfer in the peripheral register (if enabled)Abort DMA transfer by calling HAL_DMA_Abort (in case of transfer in DMA mode)Set handle State to READY
- This procedure is executed in blocking mode : when exiting function, Abort is considered as completed.

HAL_IRDA_AbortReceive

Function name

HAL_StatusTypeDef HAL_IRDA_AbortReceive (IRDA_HandleTypeDef * hirda)

Function description

Abort ongoing Receive transfer (blocking mode).

Parameters

- **hirda:** Pointer to a IRDA_HandleTypeDef structure that contains the configuration information for the specified UART module.

Return values

- **HAL:** status

Notes

- This procedure could be used for aborting any ongoing Rx transfer started in Interrupt or DMA mode. This procedure performs following operations : Disable IRDA Interrupts (Rx)Disable the DMA transfer in the peripheral register (if enabled)Abort DMA transfer by calling HAL_DMA_Abort (in case of transfer in DMA mode)Set handle State to READY
- This procedure is executed in blocking mode : when exiting function, Abort is considered as completed.

HAL_IRDA_Abort_IT

Function name

HAL_StatusTypeDef HAL_IRDA_Abort_IT (IRDA_HandleTypeDef * hirda)

Function description

Abort ongoing transfers (Interrupt mode).

Parameters

- **hirda:** Pointer to a IRDA_HandleTypeDef structure that contains the configuration information for the specified UART module.

Return values

- **HAL:** status

Notes

- This procedure could be used for aborting any ongoing transfer started in Interrupt or DMA mode. This procedure performs following operations : Disable IRDA Interrupts (Tx and Rx)Disable the DMA transfer in the peripheral register (if enabled)Abort DMA transfer by calling HAL_DMA_Abort_IT (in case of transfer in DMA mode)Set handle State to READYAt abort completion, call user abort complete callback
- This procedure is executed in Interrupt mode, meaning that abort procedure could be considered as completed only when user abort complete callback is executed (not when exiting function).

HAL_IRDA_AbortTransmit_IT

Function name

HAL_StatusTypeDef HAL_IRDA_AbortTransmit_IT (IRDA_HandleTypeDef * hirda)

Function description

Abort ongoing Transmit transfer (Interrupt mode).

Parameters

- **hirda:** Pointer to a IRDA_HandleTypeDef structure that contains the configuration information for the specified UART module.

Return values

- **HAL:** status

Notes

- This procedure could be used for aborting any ongoing Tx transfer started in Interrupt or DMA mode. This procedure performs following operations : Disable IRDA Interrupts (Tx)Disable the DMA transfer in the peripheral register (if enabled)Abort DMA transfer by calling HAL_DMA_Abort_IT (in case of transfer in DMA mode)Set handle State to READYAt abort completion, call user abort complete callback
- This procedure is executed in Interrupt mode, meaning that abort procedure could be considered as completed only when user abort complete callback is executed (not when exiting function).

HAL_IRDA_AbortReceive_IT

Function name

HAL_StatusTypeDef HAL_IRDA_AbortReceive_IT (IRDA_HandleTypeDef * hirda)

Function description

Abort ongoing Receive transfer (Interrupt mode).

Parameters

- **hirda:** Pointer to a IRDA_HandleTypeDef structure that contains the configuration information for the specified UART module.

Return values

- **HAL:** status

Notes

- This procedure could be used for aborting any ongoing Rx transfer started in Interrupt or DMA mode. This procedure performs following operations : Disable IRDA Interrupts (Rx)Disable the DMA transfer in the peripheral register (if enabled)Abort DMA transfer by calling HAL_DMA_Abort_IT (in case of transfer in DMA mode)Set handle State to READYAt abort completion, call user abort complete callback
- This procedure is executed in Interrupt mode, meaning that abort procedure could be considered as completed only when user abort complete callback is executed (not when exiting function).

HAL_IRDA_IRQHandler

Function name

void HAL_IRDA_IRQHandler (IRDA_HandleTypeDef * hirda)

Function description

Handle IRDA interrupt request.

Parameters

- **hirda:** Pointer to a IRDA_HandleTypeDef structure that contains the configuration information for the specified IRDA module.

Return values

- **None:**

HAL_IRDA_TxCpltCallback

Function name

void HAL_IRDA_TxCpltCallback (IRDA_HandleTypeDef * hirda)

Function description

Tx Transfer completed callback.

Parameters

- **hirda:** Pointer to a IRDA_HandleTypeDef structure that contains the configuration information for the specified IRDA module.

Return values

- **None:**

HAL_IRDA_RxCpltCallback

Function name

void HAL_IRDA_RxCpltCallback (IRDA_HandleTypeDef * hirda)

Function description

Rx Transfer completed callback.

Parameters

- **hirda:** Pointer to a IRDA_HandleTypeDef structure that contains the configuration information for the specified IRDA module.

Return values

- **None:**

HAL_IRDA_TxHalfCpltCallback

Function name

void HAL_IRDA_TxHalfCpltCallback (IRDA_HandleTypeDef * hirda)

Function description

Tx Half Transfer completed callback.

Parameters

- **hirda:** Pointer to a IRDA_HandleTypeDef structure that contains the configuration information for the specified USART module.

Return values

- **None:**

HAL_IRDA_RxHalfCpltCallback

Function name

void HAL_IRDA_RxHalfCpltCallback (IRDA_HandleTypeDef * hirda)

Function description

Rx Half Transfer complete callback.

Parameters

- **hirda:** Pointer to a IRDA_HandleTypeDef structure that contains the configuration information for the specified IRDA module.

Return values

- **None:**

HAL_IRDA_ErrorCallback

Function name

void HAL_IRDA_ErrorCallback (IRDA_HandleTypeDef * hirda)

Function description

IRDA error callback.

Parameters

- **hirda:** Pointer to a IRDA_HandleTypeDef structure that contains the configuration information for the specified IRDA module.

Return values

- **None:**

HAL_IRDA_AbortCpltCallback

Function name

void HAL_IRDA_AbortCpltCallback (IRDA_HandleTypeDef * hirda)

Function description

IRDA Abort Complete callback.

Parameters

- **hirda:** Pointer to a IRDA_HandleTypeDef structure that contains the configuration information for the specified IRDA module.

Return values

- **None:**

HAL_IRDA_AbortTransmitCpltCallback

Function name

void HAL_IRDA_AbortTransmitCpltCallback (IRDA_HandleTypeDef * hirda)

Function description

IRDA Abort Complete callback.

Parameters

- **hirda:** Pointer to a IRDA_HandleTypeDef structure that contains the configuration information for the specified IRDA module.

Return values

- **None:**

HAL_IRDA_AbortReceiveCpltCallback

Function name

void HAL_IRDA_AbortReceiveCpltCallback (IRDA_HandleTypeDef * hirda)

Function description

IRDA Abort Receive Complete callback.

Parameters

- **hirda:** Pointer to a IRDA_HandleTypeDef structure that contains the configuration information for the specified IRDA module.

Return values

- **None:**

HAL_IRDA_GetState

Function name

HAL_IRDA_StateTypeDef HAL_IRDA_GetState (const IRDA_HandleTypeDef * hirda)

Function description

Return the IRDA handle state.

Parameters

- **hirda:** Pointer to a IRDA_HandleTypeDef structure that contains the configuration information for the specified IRDA module.

Return values

- **HAL:** state

HAL_IRDA_GetError

Function name

uint32_t HAL_IRDA_GetError (const IRDA_HandleTypeDef * hirda)

Function description

Return the IRDA handle error code.

Parameters

- **hirda:** Pointer to a IRDA_HandleTypeDef structure that contains the configuration information for the specified IRDA module.

Return values

- **IRDA:** Error Code

26.3 IRDA Firmware driver defines

The following section lists the various define and macros of the module.

26.3.1 IRDA

IRDA

IRDA Clock Prescaler

IRDA_PRESCALER_DIV1

fclk_pres = fclk

IRDA_PRESCALER_DIV2

fclk_pres = fclk/2

IRDA_PRESCALER_DIV4

fclk_pres = fclk/4

IRDA_PRESCALER_DIV6

fclk_pres = fclk/6

IRDA_PRESCALER_DIV8

fclk_pres = fclk/8

IRDA_PRESCALER_DIV10

fclk_pres = fclk/10

IRDA_PRESCALER_DIV12

fclk_pres = fclk/12

IRDA_PRESCALER_DIV16

fclk_pres = fclk/16

IRDA_PRESCALER_DIV32

fclk_pres = fclk/32

IRDA_PRESCALER_DIV64

fclk_pres = fclk/64

IRDA_PRESCALER_DIV128

fclk_pres = fclk/128

IRDA_PRESCALER_DIV256

fclk_pres = fclk/256

IRDA DMA Rx

IRDA_DMA_RX_DISABLE

IRDA DMA RX disabled

IRDA_DMA_RX_ENABLE

IRDA DMA RX enabled

IRDA DMA Tx

IRDA_DMA_TX_DISABLE

IRDA DMA TX disabled

IRDA_DMA_TX_ENABLE

IRDA DMA TX enabled

IRDA Error Code Definition

HAL_IRDA_ERROR_NONE

No error

HAL_IRDA_ERROR_PE

Parity error

HAL_IRDA_ERROR_NE

Noise error

HAL_IRDA_ERROR_FE

frame error

HAL_IRDA_ERROR_ORE

Overrun error

HAL_IRDA_ERROR_DMA

DMA transfer error

HAL_IRDA_ERROR_BUSY

Busy Error

HAL_IRDA_ERROR_INVALID_CALLBACK

Invalid Callback error

IRDA Exported Macros

__HAL_IRDA_RESET_HANDLE_STATE

Description:

- Reset IRDA handle state.

Parameters:

- __HANDLE__: IRDA handle.

Return value:

- None

__HAL_IRDA_FLUSH_DRREGISTER

Description:

- Flush the IRDA DR register.

Parameters:

- __HANDLE__: specifies the IRDA Handle.

Return value:

- None

__HAL_IRDA_CLEAR_FLAG

Description:

- Clear the specified IRDA pending flag.

Parameters:

- __HANDLE__: specifies the IRDA Handle.
- __FLAG__: specifies the flag to check. This parameter can be any combination of the following values:
  - IRDA_CLEAR_PEF
  - IRDA_CLEAR_FEF
  - IRDA_CLEAR_NEF
  - IRDA_CLEAR_OREF
  - IRDA_CLEAR_TCF
  - IRDA_CLEAR_IDLEF

Return value:

- None

__HAL_IRDA_CLEAR_PEFLAG

Description:

- Clear the IRDA PE pending flag.

Parameters:

- __HANDLE__: specifies the IRDA Handle.

Return value:

- None

__HAL_IRDA_CLEAR_FEFLAG

Description:

- Clear the IRDA FE pending flag.

Parameters:

- __HANDLE__: specifies the IRDA Handle.

Return value:

- None

__HAL_IRDA_CLEAR_NEFLAG

Description:

- Clear the IRDA NE pending flag.

Parameters:

- __HANDLE__: specifies the IRDA Handle.

Return value:

- None

__HAL_IRDA_CLEAR_OREFLAG

Description:

- Clear the IRDA ORE pending flag.

Parameters:

- __HANDLE__: specifies the IRDA Handle.

Return value:

- None

__HAL_IRDA_CLEAR_IDLEFLAG

Description:

- Clear the IRDA IDLE pending flag.

Parameters:

- __HANDLE__: specifies the IRDA Handle.

Return value:

- None

__HAL_IRDA_GET_FLAG

Description:

- Check whether the specified IRDA flag is set or not.

Parameters:

- __HANDLE__: specifies the IRDA Handle.
- __FLAG__: specifies the flag to check. This parameter can be one of the following values:
  - IRDA_FLAG_REACK Receive enable acknowledge flag
  - IRDA_FLAG_TEACK Transmit enable acknowledge flag
  - IRDA_FLAG_BUSY Busy flag
  - IRDA_FLAG_ABRF Auto Baud rate detection flag
  - IRDA_FLAG_ABRE Auto Baud rate detection error flag
  - IRDA_FLAG_TXE Transmit data register empty flag
  - IRDA_FLAG_TC Transmission Complete flag
  - IRDA_FLAG_RXNE Receive data register not empty flag
  - IRDA_FLAG_ORE OverRun Error flag
  - IRDA_FLAG_NE Noise Error flag
  - IRDA_FLAG_FE Framing Error flag
  - IRDA_FLAG_PE Parity Error flag

Return value:

- The: new state of __FLAG__ (TRUE or FALSE).

__HAL_IRDA_ENABLE_IT

Description:

- Enable the specified IRDA interrupt.

Parameters:

- __HANDLE__: specifies the IRDA Handle.
- __INTERRUPT__: specifies the IRDA interrupt source to enable. This parameter can be one of the following values:
  - IRDA_IT_TXE Transmit Data Register empty interrupt
  - IRDA_IT_TC Transmission complete interrupt
  - IRDA_IT_RXNE Receive Data register not empty interrupt
  - IRDA_IT_IDLE Idle line detection interrupt
  - IRDA_IT_PE Parity Error interrupt
  - IRDA_IT_ERR Error interrupt(Frame error, noise error, overrun error)

Return value:

- None

__HAL_IRDA_DISABLE_IT

Description:

- Disable the specified IRDA interrupt.

Parameters:

- __HANDLE__: specifies the IRDA Handle.
- __INTERRUPT__: specifies the IRDA interrupt source to disable. This parameter can be one of the following values:
  - IRDA_IT_TXE Transmit Data Register empty interrupt
  - IRDA_IT_TC Transmission complete interrupt
  - IRDA_IT_RXNE Receive Data register not empty interrupt
  - IRDA_IT_IDLE Idle line detection interrupt
  - IRDA_IT_PE Parity Error interrupt
  - IRDA_IT_ERR Error interrupt(Frame error, noise error, overrun error)

Return value:

- None

__HAL_IRDA_GET_IT

Description:

- Check whether the specified IRDA interrupt has occurred or not.

Parameters:

- __HANDLE__: specifies the IRDA Handle.
- __INTERRUPT__: specifies the IRDA interrupt source to check. This parameter can be one of the following values:
  - IRDA_IT_TXE Transmit Data Register empty interrupt
  - IRDA_IT_TC Transmission complete interrupt
  - IRDA_IT_RXNE Receive Data register not empty interrupt
  - IRDA_IT_IDLE Idle line detection interrupt
  - IRDA_IT_ORE OverRun Error interrupt
  - IRDA_IT_NE Noise Error interrupt
  - IRDA_IT_FE Framing Error interrupt
  - IRDA_IT_PE Parity Error interrupt

Return value:

- The: new state of __IT__ (SET or RESET).

__HAL_IRDA_GET_IT_SOURCE

Description:

- Check whether the specified IRDA interrupt source is enabled or not.

Parameters:

- __HANDLE__: specifies the IRDA Handle.
- __INTERRUPT__: specifies the IRDA interrupt source to check. This parameter can be one of the following values:
  - IRDA_IT_TXE Transmit Data Register empty interrupt
  - IRDA_IT_TC Transmission complete interrupt
  - IRDA_IT_RXNE Receive Data register not empty interrupt
  - IRDA_IT_IDLE Idle line detection interrupt
  - IRDA_IT_ERR Framing, overrun or noise error interrupt
  - IRDA_IT_PE Parity Error interrupt

Return value:

- The: new state of __IT__ (SET or RESET).

__HAL_IRDA_CLEAR_IT

Description:

- Clear the specified IRDA ISR flag, in setting the proper ICR register flag.

Parameters:

- __HANDLE__: specifies the IRDA Handle.
- __IT_CLEAR__: specifies the interrupt clear register flag that needs to be set to clear the corresponding interrupt This parameter can be one of the following values:
  - IRDA_CLEAR_PEF Parity Error Clear Flag
  - IRDA_CLEAR_FEF Framing Error Clear Flag
  - IRDA_CLEAR_NEF Noise detected Clear Flag
  - IRDA_CLEAR_OREF OverRun Error Clear Flag
  - IRDA_CLEAR_TCF Transmission Complete Clear Flag

Return value:

- None

__HAL_IRDA_SEND_REQ

Description:

- Set a specific IRDA request flag.

Parameters:

- __HANDLE__: specifies the IRDA Handle.
- __REQ__: specifies the request flag to set This parameter can be one of the following values:
  - IRDA_AUTOBAUD_REQUEST Auto-Baud Rate Request
  - IRDA_RXDATA_FLUSH_REQUEST Receive Data flush Request
  - IRDA_TXDATA_FLUSH_REQUEST Transmit data flush Request

Return value:

- None

__HAL_IRDA_ONE_BIT_SAMPLE_ENABLE

Description:

- Enable the IRDA one bit sample method.

Parameters:

- __HANDLE__: specifies the IRDA Handle.

Return value:

- None

__HAL_IRDA_ONE_BIT_SAMPLE_DISABLE

Description:

- Disable the IRDA one bit sample method.

Parameters:

- __HANDLE__: specifies the IRDA Handle.

Return value:

- None

__HAL_IRDA_ENABLE

Description:

- Enable UART/USART associated to IRDA Handle.

Parameters:

- __HANDLE__: specifies the IRDA Handle.

Return value:

- None

__HAL_IRDA_DISABLE

Description:

- Disable UART/USART associated to IRDA Handle.

Parameters:

- __HANDLE__: specifies the IRDA Handle.

Return value:

- None

IRDA Flags

IRDA_FLAG_REACK

IRDA receive enable acknowledge flag

IRDA_FLAG_TEACK

IRDA transmit enable acknowledge flag

IRDA_FLAG_BUSY

IRDA busy flag

IRDA_FLAG_ABRF

IRDA auto Baud rate flag

IRDA_FLAG_ABRE

IRDA auto Baud rate error

IRDA_FLAG_TXE

IRDA transmit data register empty

IRDA_FLAG_TC

IRDA transmission complete

IRDA_FLAG_RXNE

IRDA read data register not empty

IRDA_FLAG_ORE

IRDA overrun error

IRDA_FLAG_NE

IRDA noise error

IRDA_FLAG_FE

IRDA frame error

IRDA_FLAG_PE

IRDA parity error

IRDA interruptions flags mask

IRDA_IT_MASK

IRDA Interruptions flags mask

IRDA_CR_MASK

IRDA control register mask

IRDA_CR_POS

IRDA control register position

IRDA_ISR_MASK

IRDA ISR register mask

IRDA_ISR_POS

IRDA ISR register position

IRDA Interrupts Definition

IRDA_IT_PE

IRDA Parity error interruption

IRDA_IT_TXE

IRDA Transmit data register empty interruption

IRDA_IT_TC

IRDA Transmission complete interruption

IRDA_IT_RXNE

IRDA Read data register not empty interruption

IRDA_IT_IDLE

IRDA Idle interruption

IRDA_IT_ERR

IRDA Error interruption

IRDA_IT_ORE

IRDA Overrun error interruption

IRDA_IT_NE

IRDA Noise error interruption

IRDA_IT_FE

IRDA Frame error interruption

IRDA Interruption Clear Flags

IRDA_CLEAR_PEF

Parity Error Clear Flag

IRDA_CLEAR_FEF

Framing Error Clear Flag

IRDA_CLEAR_NEF

Noise Error detected Clear Flag

IRDA_CLEAR_OREF

OverRun Error Clear Flag

IRDA_CLEAR_IDLEF

IDLE line detected Clear Flag

IRDA_CLEAR_TCF

Transmission Complete Clear Flag

IRDA Low Power

IRDA_POWERMODE_NORMAL

IRDA normal power mode

IRDA_POWERMODE_LOWPOWER

IRDA low power mode

IRDA Mode

IRDA_MODE_DISABLE

Associated UART disabled in IRDA mode

IRDA_MODE_ENABLE

Associated UART enabled in IRDA mode

IRDA One Bit Sampling

IRDA_ONE_BIT_SAMPLE_DISABLE

One-bit sampling disabled

IRDA_ONE_BIT_SAMPLE_ENABLE

One-bit sampling enabled

IRDA Parity

IRDA_PARITY_NONE

No parity

IRDA_PARITY_EVEN

Even parity

IRDA_PARITY_ODD

Odd parity

IRDA Request Parameters

IRDA_AUTOBAUD_REQUEST

Auto-Baud Rate Request

IRDA_RXDATA_FLUSH_REQUEST

Receive Data flush Request

IRDA_TXDATA_FLUSH_REQUEST

Transmit data flush Request

IRDA State

IRDA_STATE_DISABLE

IRDA disabled

IRDA_STATE_ENABLE

IRDA enabled

IRDA State Code Definition

HAL_IRDA_STATE_RESET

Peripheral is not initialized Value is allowed for gState and RxState

HAL_IRDA_STATE_READY

Peripheral Initialized and ready for use Value is allowed for gState and RxState

HAL_IRDA_STATE_BUSY

An internal process is ongoing Value is allowed for gState only

HAL_IRDA_STATE_BUSY_TX

Data Transmission process is ongoing Value is allowed for gState only

HAL_IRDA_STATE_BUSY_RX

Data Reception process is ongoing Value is allowed for RxState only

HAL_IRDA_STATE_BUSY_TX_RX

Data Transmission and Reception process is ongoing Not to be used for neither gState nor RxState. Value is result of combination (Or) between gState and RxState values

HAL_IRDA_STATE_TIMEOUT

Timeout state Value is allowed for gState only

HAL_IRDA_STATE_ERROR

Error Value is allowed for gState only

IRDA Transfer Mode

IRDA_MODE_RX

RX mode

IRDA_MODE_TX

TX mode

IRDA_MODE_TX_RX

RX and TX mode

27 HAL IRDA Extension Driver

27.1 IRDAEx Firmware driver defines

The following section lists the various define and macros of the module.

27.1.1 IRDAEx

IRDAEx

IRDAEx Word Length

IRDA_WORDLENGTH_7B

7-bit long frame

IRDA_WORDLENGTH_8B

8-bit long frame

IRDA_WORDLENGTH_9B

9-bit long frame

28 HAL IWDG Generic Driver

28.1 IWDG Firmware driver registers structures

28.1.1 IWDG_InitTypeDef

IWDG_InitTypeDef is defined in the stm32u0xx_hal_iwdg.h

Data Fields

- ***uint32_t Prescaler***
- ***uint32_t Reload***
- ***uint32_t Window***
- ***uint32_t EWI***

Field Documentation

- ***uint32_t IWDG_InitTypeDef::Prescaler***
  Select the prescaler of the IWDG. This parameter can be a value of ***IWDG_Prescaler***
- ***uint32_t IWDG_InitTypeDef::Reload***
  Specifies the IWDG down-counter reload value. This parameter must be a number between Min_Data = 0 and Max_Data = 0x0FFF
- ***uint32_t IWDG_InitTypeDef::Window***
  Specifies the window value to be compared to the down-counter. This parameter must be a number between Min_Data = 0 and Max_Data = 0x0FFF
- ***uint32_t IWDG_InitTypeDef::EWI***
  Specifies if IWDG Early Wakeup Interrupt is enable or not and the comparator value. This parameter must be a number between Min_Data = 0 and Max_Data = 0x0FFF value 0 means that EWI is disabled

28.1.2 __IWDG_HandleTypeDef

__IWDG_HandleTypeDef is defined in the stm32u0xx_hal_iwdg.h

Data Fields

- ***IWDG_TypeDef * Instance***
- ***IWDG_InitTypeDef Init***
- ***void(* EwiCallback***
- ***void(* MspInitCallback***

Field Documentation

- ***IWDG_TypeDef* __IWDG_HandleTypeDef::Instance***
  Register base address
- ***IWDG_InitTypeDef __IWDG_HandleTypeDef::Init***
  IWDG required parameters
- ***void(* __IWDG_HandleTypeDef::EwiCallback)(struct __IWDG_HandleTypeDef *hiwdg)***
  IWDG Early WakeUp Interrupt callback
- ***void(* __IWDG_HandleTypeDef::MspInitCallback)(struct __IWDG_HandleTypeDef *hiwdg)***
  IWDG Msp Init callback

28.2 IWDG Firmware driver API description

The following section lists the various functions of the IWDG library.

28.2.1 IWDG Generic features

- The IWDG can be started by either software or hardware (configurable through option byte).
- The IWDG is clocked by the Low-Speed Internal clock (LSI) and thus stays active even if the main clock fails.

- Once the IWDG is started, the LSI is forced ON and both cannot be disabled. The counter starts counting down from the reset value (0xFFF). When it reaches the end of count value (0x000) a reset signal is generated (IWDG reset).
- Whenever the key value 0x0000 AAAA is written in the IWDG_KR register, the IWDG_RLR value is reloaded into the counter and the watchdog reset is prevented.
- The IWDG is implemented in the VDD voltage domain that is still functional in STOP and STANDBY mode (IWDG reset can wake up the CPU from STANDBY). IWDGRST flag in RCC_CSR register can be used to inform when an IWDG reset occurs.
- Debug mode: When the microcontroller enters debug mode (core halted), the IWDG counter either continues to work normally or stops, depending on DBG_IWDG_STOP configuration bit in DBG module, accessible through __HAL_DBGMCU_FREEZE_IWDG() and __HAL_DBGMCU_UNFREEZE_IWDG() macros.

Min-max timeout value @32KHz (LSI): ~125us / ~131.04s The IWDG timeout may vary due to LSI clock frequency dispersion. STM32U0xx devices provide the capability to measure the LSI clock frequency (LSI clock is internally connected to TIM16 CH1 input capture). The measured value can be used to have an IWDG timeout with an acceptable accuracy.

Default timeout value (necessary for IWDG_SR status register update): Constant LSI_VALUE is defined based on the nominal LSI clock frequency. This frequency being subject to variations as mentioned above, the default timeout value (defined through constant HAL_IWDG_DEFAULT_TIMEOUT below) may become too short or too long. In such cases, this default timeout value can be tuned by redefining the constant LSI_VALUE at user-application level (based, for instance, on the measured LSI clock frequency as explained above).

28.2.2 How to use this driver

1. Register callback to treat Iwdg interrupt and MspInit using HAL_IWDG_RegisterCallback().
   - Provide exiting handle as first parameter.
   - Provide which callback will be registered using one value from HAL_IWDG_CallbackIDTypeDef.
   - Provide callback function pointer.
2. Use IWDG using HAL_IWDG_Init() function to :
   - Enable instance by writing Start keyword in IWDG_KEY register. LSI clock is forced ON and IWDG counter starts counting down.
   - Enable write access to configuration registers: IWDG_PR, IWDG_RLR, IWDG_WINR and EWCR.
   - Configure the IWDG prescaler and counter reload value. This reload value will be loaded in the IWDG counter each time the watchdog is reloaded, then the IWDG will start counting down from this value.
   - Depending on window parameter:
     - If Window Init parameter is same as Window register value, nothing more is done but reload counter value in order to exit function with exact time base.
     - Else modify Window register. This will automatically reload watchdog counter.
   - Depending on Early Wakeup Interrupt parameter:
     - If EWI is set to disable, comparator is set to 0, interrupt is disable & flag is clear.
     - Else modify EWCR register, setting comparator value, enable interrupt & clear flag.
   - Wait for status flags to be reset.
3. Then the application program must refresh the IWDG counter at regular intervals during normal operation to prevent an MCU reset, using HAL_IWDG_Refresh() function.

IWDG HAL driver macros list

Below the list of most used macros in IWDG HAL driver:

- __HAL_IWDG_START: Enable the IWDG peripheral
- __HAL_IWDG_RELOAD_COUNTER: Reloads IWDG counter with value defined in the reload register

28.2.3 Initialization and Start functions

This section provides functions allowing to:

- Initialize the IWDG according to the specified parameters in the IWDG_InitTypeDef of associated handle.
- Manage Window option.

- Once initialization is performed in HAL_IWDG_Init function, Watchdog is reloaded in order to exit function with correct time base.

This section contains the following APIs:

- *HAL_IWDG_Init()*
- *HAL_IWDG_MspInit()*
- *HAL_IWDG_RegisterCallback()*
- *HAL_IWDG_UnRegisterCallback()*

28.2.4 IO operation functions

This section provides functions allowing to:

- Refresh the IWDG.

This section contains the following APIs:

- *HAL_IWDG_Refresh()*
- *HAL_IWDG_GetActiveStatus()*
- *HAL_IWDG_IRQHandler()*
- *HAL_IWDG_EarlyWakeupCallback()*

28.2.5 Detailed description of functions

HAL_IWDG_Init

Function name

HAL_StatusTypeDef HAL_IWDG_Init (IWDG_HandleTypeDef * hiwdg)

Function description

Initialize the IWDG according to the specified parameters in the IWDG_InitTypeDef and start watchdog.

Parameters

- **hiwdg:** pointer to a IWDG_HandleTypeDef structure that contains the configuration information for the specified IWDG module.

Return values

- **HAL:** status

HAL_IWDG_MspInit

Function name

void HAL_IWDG_MspInit (IWDG_HandleTypeDef * hiwdg)

Function description

Initialize the IWDG MSP.

Parameters

- **hiwdg:** pointer to a IWDG_HandleTypeDef structure that contains the configuration information for the specified IWDG module.

Return values

- **None:**

Notes

- When rewriting this function in user file, mechanism may be added to avoid multiple initialize when HAL_IWDG_Init function is called again to change parameters.

HAL_IWDG_RegisterCallback

Function name

HAL_StatusTypeDef HAL_IWDG_RegisterCallback (IWDG_HandleTypeDef * hiwdg, HAL_IWDG_CallbackIDTypeDef CallbackID, pIWDG_CallbackTypeDef pCallback)

Function description

Register a User IWDG Callback To be used instead of the weak (surcharged) predefined callback.

Parameters

- **hiwdg:** IWDG handle
- **CallbackID:** ID of the callback to be registered This parameter can be one of the following values:
  - HAL_IWDG_EWI_CB_ID Early WakeUp Interrupt Callback ID
  - HAL_IWDG_MSPINIT_CB_ID MspInit callback ID
- **pCallback:** pointer to the Callback function

Return values

- **status:**

HAL_IWDG_UnRegisterCallback

Function name

HAL_StatusTypeDef HAL_IWDG_UnRegisterCallback (IWDG_HandleTypeDef * hiwdg, HAL_IWDG_CallbackIDTypeDef CallbackID)

Function description

Unregister a IWDG Callback IWDG Callback is redirected to the weak (surcharged) predefined callback.

Parameters

- **hiwdg:** IWDG handle
- **CallbackID:** ID of the callback to be registered This parameter can be one of the following values:
  - HAL_IWDG_EWI_CB_ID Early WakeUp Interrupt Callback ID
  - HAL_IWDG_MSPINIT_CB_ID MspInit callback ID

Return values

- **status:**

HAL_IWDG_Refresh

Function name

HAL_StatusTypeDef HAL_IWDG_Refresh (IWDG_HandleTypeDef * hiwdg)

Function description

Refresh the IWDG.

Parameters

- **hiwdg:** pointer to a IWDG_HandleTypeDef structure that contains the configuration information for the specified IWDG module.

Return values

- **HAL:** status

HAL_IWDG_GetActiveStatus

Function name

uint32_t HAL_IWDG_GetActiveStatus (const IWDG_HandleTypeDef * hiwdg)

Function description

Get back IWDG running status.

Parameters

- **hiwdg:** pointer to a IWDG_HandleTypeDef structure that contains the configuration information for the specified IWDG module.

Return values

- **can:** be one of following value :
  - IWDG_STATUS_DISABLE
  - IWDG_STATUS_ENABLE

Notes

- This API allows to know if IWDG has been started by other master, thread or by hardware.

HAL_IWDG_IRQHandler

Function name

void HAL_IWDG_IRQHandler (IWDG_HandleTypeDef * hiwdg)

Function description

Handle IWDG interrupt request.

Parameters

- **hiwdg:** pointer to a IWDG_HandleTypeDef structure that contains the configuration information for the specified IWDG module.

Return values

- **None:**

Notes

- The Early Wakeup Interrupt (EWI) can be used if specific safety operations or data logging must be performed before the actual reset is generated. The EWI interrupt is enabled by calling HAL_IWDG_Init function with EWIMode set to IWDG_EWI_ENABLE. When the downcounter reaches the value 0x40, and EWI interrupt is generated and the corresponding Interrupt Service Routine (ISR) can be used to trigger specific actions (such as communications or data logging), before resetting the device.

HAL_IWDG_EarlyWakeupCallback

Function name

void HAL_IWDG_EarlyWakeupCallback (IWDG_HandleTypeDef * hiwdg)

Function description

IWDG Early Wakeup callback.

Parameters

- **hiwdg:** pointer to a IWDG_HandleTypeDef structure that contains the configuration information for the specified IWDG module.

Return values

- **None:**

28.3 IWDG Firmware driver defines

The following section lists the various define and macros of the module.

28.3.1 IWDG

IWDG

IWDG Active Status

IWDG_STATUS_DISABLE

IWDG_STATUS_ENABLE

IWDG Early Wakeup Interrupt Mode

IWDG_EWI_DISABLE

EWI Disable

IWDG Exported Macros

__HAL_IWDG_START

Description:

- Enable the IWDG peripheral.

Parameters:

- __HANDLE__: IWDG handle

Return value:

- None

__HAL_IWDG_RELOAD_COUNTER

Description:

- Reload IWDG counter with value defined in the reload register (write access to IWDG_PR, IWDG_RLR, IWDG_WINR and EWCR registers disabled).

Parameters:

- __HANDLE__: IWDG handle

Return value:

- None

IWDG Prescaler

IWDG_PRESCALER_4

IWDG prescaler set to 4

IWDG_PRESCALER_8

IWDG prescaler set to 8

IWDG_PRESCALER_16

IWDG prescaler set to 16

IWDG_PRESCALER_32

IWDG prescaler set to 32

IWDG_PRESCALER_64

IWDG prescaler set to 64

IWDG_PRESCALER_128

IWDG prescaler set to 128

IWDG_PRESCALER_256

IWDG prescaler set to 256

IWDG_PRESCALER_512

IWDG prescaler set to 512

IWDG_PRESCALER_1024

IWDG prescaler set to 1024

IWDG Window option

IWDG_WINDOW_DISABLE

29 HAL LCD Generic Driver

29.1 LCD Firmware driver registers structures

29.1.1 LCD_InitTypeDef

LCD_InitTypeDef is defined in the stm32u0xx_hal_lcd.h

Data Fields

- ***uint32_t Prescaler***
- ***uint32_t Divider***
- ***uint32_t Duty***
- ***uint32_t Bias***
- ***uint32_t VoltageSource***
- ***uint32_t Contrast***
- ***uint32_t DeadTime***
- ***uint32_t PulseOnDuration***
- ***uint32_t HighDrive***
- ***uint32_t BlinkMode***
- ***uint32_t BlinkFrequency***
- ***uint32_t MuxSegment***

Field Documentation

- ***uint32_t LCD_InitTypeDef::Prescaler***
  Configures the LCD Prescaler. This parameter can be one value of ***LCD_Prescaler***
- ***uint32_t LCD_InitTypeDef::Divider***
  Configures the LCD Divider. This parameter can be one value of ***LCD_Divider***
- ***uint32_t LCD_InitTypeDef::Duty***
  Configures the LCD Duty. This parameter can be one value of ***LCD_Duty***
- ***uint32_t LCD_InitTypeDef::Bias***
  Configures the LCD Bias. This parameter can be one value of ***LCD_Bias***
- ***uint32_t LCD_InitTypeDef::VoltageSource***
  Selects the LCD Voltage source. This parameter can be one value of ***LCD_Voltage_Source***
- ***uint32_t LCD_InitTypeDef::Contrast***
  Configures the LCD Contrast. This parameter can be one value of ***LCD_Contrast***
- ***uint32_t LCD_InitTypeDef::DeadTime***
  Configures the LCD Dead Time. This parameter can be one value of ***LCD_DeadTime***
- ***uint32_t LCD_InitTypeDef::PulseOnDuration***
  Configures the LCD Pulse On Duration. This parameter can be one value of ***LCD_PulseOnDuration***
- ***uint32_t LCD_InitTypeDef::HighDrive***
  Enable or disable the low resistance divider. This parameter can be one value of ***LCD_HighDrive***
- ***uint32_t LCD_InitTypeDef::BlinkMode***
  Configures the LCD Blink Mode. This parameter can be one value of ***LCD_BlinkMode***
- ***uint32_t LCD_InitTypeDef::BlinkFrequency***
  Configures the LCD Blink frequency. This parameter can be one value of ***LCD_BlinkFrequency***
- ***uint32_t LCD_InitTypeDef::MuxSegment***
  Enable or disable mux segment. This parameter can be one value of ***LCD_MuxSegment***

29.1.2 LCD_HandleTypeDef

LCD_HandleTypeDef is defined in the stm32u0xx_hal_lcd.h

Data Fields

- ***LCD_TypeDef * Instance***
- ***LCD_InitTypeDef Init***
- ***HAL_LockTypeDef Lock***

- ***__IO HAL_LCD_StateTypeDef State***
- ***__IO uint32_t ErrorCode***

Field Documentation

- ***LCD_TypeDef* LCD_HandleTypeDef::Instance***
- ***LCD_InitTypeDef LCD_HandleTypeDef::Init***
- ***HAL_LockTypeDef LCD_HandleTypeDef::Lock***
- ***__IO HAL_LCD_StateTypeDef LCD_HandleTypeDef::State***
- ***__IO uint32_t LCD_HandleTypeDef::ErrorCode***

29.2 LCD Firmware driver API description

The following section lists the various functions of the LCD library.

29.2.1 How to use this driver

The LCD HAL driver can be used as follows:

1. Declare a LCD_HandleTypeDef handle structure.

Note: The frequency generator allows you to achieve various LCD frame rates starting from an LCD input clock frequency (LCDCLK) which can vary from 32 kHz up to 1 MHz.

2. Initialize the LCD low level resources by implementing the HAL_LCD_MspInit() API:
   - Enable the LCDCLK (same as RTCCLK): to configure the RTCCLK/LCDCLK, proceed as follows:
     - Use RCC function HAL_RCCEx_PeriphCLKConfig in indicating RCC_PERIPHCLK_LCD and selected clock source (HSE, LSI or LSE)
   - LCD pins configuration:
     - Enable the clock for the LCD GPIOs.
     - Configure these LCD pins as alternate function no-pull.
   - Enable the LCD interface clock.
3. Program the Prescaler, Divider, Blink mode, Blink Frequency Duty, Bias, Voltage Source, Dead Time, Pulse On Duration, Contrast, High drive and Multiplexer Segment in the Init structure of the LCD handle.
4. Initialize the LCD registers by calling the HAL_LCD_Init() API.

Note: The HAL_LCD_Init() API configures also the low level Hardware GPIO, CLOCK, ...etc) by calling the customized HAL_LCD_MspInit() API.

Note: After calling the HAL_LCD_Init() the LCD RAM memory is cleared

5. Optionally you can update the LCD configuration using these macros:
   - LCD High Drive using the __HAL_LCD_HIGHDRIVER_ENABLE() and __HAL_LCD_HIGHDRIVER_DISABLE() macros
   - Voltage output buffer using __HAL_LCD_VOLTAGE_BUFFER_ENABLE() and __HAL_LCD_VOLTAGE_BUFFER_DISABLE() macros
   - LCD Pulse ON Duration using the __HAL_LCD_PULSEONDURATION_CONFIG() macro
   - LCD Dead Time using the __HAL_LCD_DEADTIME_CONFIG() macro
   - The LCD Blink mode and frequency using the __HAL_LCD_BLINK_CONFIG() macro
   - The LCD Contrast using the __HAL_LCD_CONTRAST_CONFIG() macro
6. Write to the LCD RAM memory using the HAL_LCD_Write() API, this API can be called more time to update the different LCD RAM registers before calling HAL_LCD_UpdateDisplayRequest() API.
7. The HAL_LCD_Clear() API can be used to clear the LCD RAM memory.
8. When LCD RAM memory is updated enable the update display request using the HAL_LCD_UpdateDisplayRequest() API.

LCD and low power modes:

1. The LCD remain active during Sleep, Low Power run, Low Power Sleep and STOP modes.

29.2.2 Initialization and Configuration functions

This section contains the following APIs:

- *HAL_LCD_Init()*
- *HAL_LCD_DeInit()*
- *HAL_LCD_MspDeInit()*
- *HAL_LCD_MspInit()*

29.2.3 IO operation functions

Using its double buffer memory the LCD controller ensures the coherency of the displayed information without having to use interrupts to control LCD_RAM modification.

The application software can access the first buffer level (LCD_RAM) through the APB interface. Once it has modified the LCD_RAM using the HAL_LCD_Write() API, it sets the UDR flag in the LCD_SR register using the HAL_LCD_UpdateDisplayRequest() API.

This UDR flag (update display request) requests the updated information to be moved into the second buffer level (LCD_DISPLAY).

This operation is done synchronously with the frame (at the beginning of the next frame), until the update is completed, the LCD_RAM is write protected and the UDR flag stays high.

Once the update is completed another flag (UDD - Update Display Done) is set and generates an interrupt if the UDDIE bit in the LCD_FCR register is set. The time it takes to update LCD_DISPLAY is, in the worst case, one odd and one even frame.

The update will not occur (UDR = 1 and UDD = 0) until the display is enabled (LCDEN = 1).

This section contains the following APIs:

- *HAL_LCD_Write()*
- *HAL_LCD_Clear()*
- *HAL_LCD_UpdateDisplayRequest()*

29.2.4 Peripheral State functions

This subsection provides a set of functions allowing to control the LCD:

- HAL_LCD_GetState() API can be helpful to check in run-time the state of the LCD peripheral State.
- HAL_LCD_GetError() API to return the LCD error code.

This section contains the following APIs:

- *HAL_LCD_GetState()*
- *HAL_LCD_GetError()*

29.2.5 Detailed description of functions

HAL_LCD_DeInit

Function name

HAL_StatusTypeDef HAL_LCD_DeInit (LCD_HandleTypeDef * hlcd)

Function description

DeInitialize the LCD peripheral.

Parameters

- **hlcd:** LCD handle

Return values

- **HAL:** status

HAL_LCD_Init

Function name

HAL_StatusTypeDef HAL_LCD_Init (LCD_HandleTypeDef * hlcd)

Function description

Initialize the LCD peripheral according to the specified parameters in the LCD_InitStruct and initialize the associated handle.

Parameters

- **hlcd:** LCD handle

Return values

- **None:**

Notes

- This function can be used only when the LCD is disabled.

HAL_LCD_MspInit

Function name

void HAL_LCD_MspInit (LCD_HandleTypeDef * hlcd)

Function description

Initialize the LCD MSP.

Parameters

- **hlcd:** LCD handle

Return values

- **None:**

HAL_LCD_MspDeInit

Function name

void HAL_LCD_MspDeInit (LCD_HandleTypeDef * hlcd)

Function description

DeInitialize the LCD MSP.

Parameters

- **hlcd:** LCD handle

Return values

- **None:**

HAL_LCD_Write

Function name

HAL_StatusTypeDef HAL_LCD_Write (LCD_HandleTypeDef * hlcd, uint32_t RAMRegisterIndex, uint32_t RAMRegisterMask, uint32_t Data)

Function description

Write a word in the specific LCD RAM.

Parameters

- **hlcd:** LCD handle
- **RAMRegisterIndex:** specifies the LCD RAM Register. This parameter can be one of the following values:
  - LCD_RAM_REGISTER0: LCD RAM Register 0
  - LCD_RAM_REGISTER1: LCD RAM Register 1
  - LCD_RAM_REGISTER2: LCD RAM Register 2
  - LCD_RAM_REGISTER3: LCD RAM Register 3
  - LCD_RAM_REGISTER4: LCD RAM Register 4
  - LCD_RAM_REGISTER5: LCD RAM Register 5
  - LCD_RAM_REGISTER6: LCD RAM Register 6
  - LCD_RAM_REGISTER7: LCD RAM Register 7
  - LCD_RAM_REGISTER8: LCD RAM Register 8
  - LCD_RAM_REGISTER9: LCD RAM Register 9
  - LCD_RAM_REGISTER10: LCD RAM Register 10
  - LCD_RAM_REGISTER11: LCD RAM Register 11
  - LCD_RAM_REGISTER12: LCD RAM Register 12
  - LCD_RAM_REGISTER13: LCD RAM Register 13
  - LCD_RAM_REGISTER14: LCD RAM Register 14
  - LCD_RAM_REGISTER15: LCD RAM Register 15
- **RAMRegisterMask:** specifies the LCD RAM Register Data Mask.
- **Data:** specifies LCD Data Value to be written.

Return values

- **None:**

HAL_LCD_Clear

Function name

HAL_StatusTypeDef HAL_LCD_Clear (LCD_HandleTypeDef * hlcd)

Function description

Clear the LCD RAM registers.

Parameters

- **hlcd:** LCD handle

Return values

- **None:**

HAL_LCD_UpdateDisplayRequest

Function name

HAL_StatusTypeDef HAL_LCD_UpdateDisplayRequest (LCD_HandleTypeDef * hlcd)

Function description

Enable the Update Display Request.

Parameters

- **hlcd:** LCD handle

Return values

- **None:**

Notes

- Each time software modifies the LCD_RAM it must set the UDR bit to transfer the updated data to the second level buffer. The UDR bit stays set until the end of the update and during this time the LCD_RAM is write protected.
- When the display is disabled, the update is performed for all LCD_DISPLAY locations. When the display is enabled, the update is performed only for locations for which commons are active (depending on DUTY). For example if DUTY = 1/2, only the LCD_DISPLAY of COM0 and COM1 will be updated.

HAL_LCD_GetState

Function name

HAL_LCD_StateTypeDef HAL_LCD_GetState (LCD_HandleTypeDef * hlcd)

Function description

Return the LCD handle state.

Parameters

- **hlcd:** LCD handle

Return values

- **HAL:** state

HAL_LCD_GetError

Function name

uint32_t HAL_LCD_GetError (LCD_HandleTypeDef * hlcd)

Function description

Return the LCD error code.

Parameters

- **hlcd:** LCD handle

Return values

- **LCD:** Error Code

LCD_WaitForSynchro

Function name

HAL_StatusTypeDef LCD_WaitForSynchro (LCD_HandleTypeDef * hlcd)

Function description

Wait until the LCD FCR register is synchronized in the LCDCLK domain.

Return values

- **None:**

29.3 LCD Firmware driver defines

The following section lists the various define and macros of the module.

29.3.1 LCD

LCD

LCD Bias

LCD_BIAS_1_4

1/4 Bias

LCD_BIAS_1_2

1/2 Bias

LCD_BIAS_1_3

1/3 Bias

LCD Blink Frequency

LCD_BLINKFREQUENCY_DIV8

The Blink frequency = fLCD/8

LCD_BLINKFREQUENCY_DIV16

The Blink frequency = fLCD/16

LCD_BLINKFREQUENCY_DIV32

The Blink frequency = fLCD/32

LCD_BLINKFREQUENCY_DIV64

The Blink frequency = fLCD/64

LCD_BLINKFREQUENCY_DIV128

The Blink frequency = fLCD/128

LCD_BLINKFREQUENCY_DIV256

The Blink frequency = fLCD/256

LCD_BLINKFREQUENCY_DIV512

The Blink frequency = fLCD/512

LCD_BLINKFREQUENCY_DIV1024

The Blink frequency = fLCD/1024

LCD Blink Mode

LCD_BLINKMODE_OFF

Blink disabled

LCD_BLINKMODE_SEG0_COM0

Blink enabled on SEG[0], COM[0] (1 pixel)

LCD_BLINKMODE_SEG0_ALLCOM

Blink enabled on SEG[0], all COM (up to 8 pixels according to the programmed duty)

LCD_BLINKMODE_ALLSEG_ALLCOM

Blink enabled on all SEG and all COM (all pixels)

LCD Contrast

LCD_CONTRASTLEVEL_0

Maximum Voltage = 2.60V

LCD_CONTRASTLEVEL_1

Maximum Voltage = 2.73V

LCD_CONTRASTLEVEL_2

Maximum Voltage = 2.86V

LCD_CONTRASTLEVEL_3

Maximum Voltage = 2.99V

LCD_CONTRASTLEVEL_4

Maximum Voltage = 3.12V

LCD_CONTRASTLEVEL_5

Maximum Voltage = 3.26V

LCD_CONTRASTLEVEL_6

Maximum Voltage = 3.40V

LCD_CONTRASTLEVEL_7

Maximum Voltage = 3.55V

LCD Dead Time

LCD_DEADTIME_0

No dead Time

LCD_DEADTIME_1

One Phase between different couple of Frame

LCD_DEADTIME_2

Two Phase between different couple of Frame

LCD_DEADTIME_3

Three Phase between different couple of Frame

LCD_DEADTIME_4

Four Phase between different couple of Frame

LCD_DEADTIME_5

Five Phase between different couple of Frame

LCD_DEADTIME_6

Six Phase between different couple of Frame

LCD_DEADTIME_7

Seven Phase between different couple of Frame

LCD Divider

LCD_DIVIDER_16

LCD frequency = CLKPS/16

LCD_DIVIDER_17

LCD frequency = CLKPS/17

LCD_DIVIDER_18

LCD frequency = CLKPS/18

LCD_DIVIDER_19

LCD frequency = CLKPS/19

LCD_DIVIDER_20

LCD frequency = CLKPS/20

LCD_DIVIDER_21

LCD frequency = CLKPS/21

LCD_DIVIDER_22

LCD frequency = CLKPS/22

LCD_DIVIDER_23

LCD frequency = CLKPS/23

LCD_DIVIDER_24

LCD frequency = CLKPS/24

LCD_DIVIDER_25

LCD frequency = CLKPS/25

LCD_DIVIDER_26

LCD frequency = CLKPS/26

LCD_DIVIDER_27

LCD frequency = CLKPS/27

LCD_DIVIDER_28

LCD frequency = CLKPS/28

LCD_DIVIDER_29

LCD frequency = CLKPS/29

LCD_DIVIDER_30

LCD frequency = CLKPS/30

LCD_DIVIDER_31

LCD frequency = CLKPS/31

LCD Duty

LCD_DUTY_STATIC

Static duty

LCD_DUTY_1_2

1/2 duty

LCD_DUTY_1_3

1/3 duty

LCD_DUTY_1_4

1/4 duty

LCD_DUTY_1_8

1/8 duty

LCD Error Code

HAL_LCD_ERROR_NONE

No error

HAL_LCD_ERROR_FCRSF

Synchro flag timeout error

HAL_LCD_ERROR_UDR

Update display request flag timeout error

HAL_LCD_ERROR_UDD

Update display done flag timeout error

HAL_LCD_ERROR_ENS

LCD enabled status flag timeout error

HAL_LCD_ERROR_RDY

LCD Booster ready timeout error

LCD Exported Macros

__HAL_LCD_RESET_HANDLE_STATE

Description:

- Reset LCD handle state.

Parameters:

- __HANDLE__: specifies the LCD Handle.

Return value:

- None

__HAL_LCD_ENABLE

Description:

- Enable the LCD peripheral.

Parameters:

- __HANDLE__: specifies the LCD Handle.

Return value:

- None

__HAL_LCD_DISABLE

Description:

- Disable the LCD peripheral.

Parameters:

- __HANDLE__: specifies the LCD Handle.

Return value:

- None

__HAL_LCD_HIGHDRIVER_ENABLE

Description:

- Enable the low resistance divider.

Parameters:

- __HANDLE__: specifies the LCD Handle.

Return value:

- None

Notes:

- Displays with high internal resistance may need a longer drive time to achieve satisfactory contrast. This function is useful in this case if some additional power consumption can be tolerated. When this mode is enabled, the PulseOn Duration (PON) have to be programmed to 1/CK_PS (LCD_PULSEONDURATION_1).

__HAL_LCD_HIGHDRIVER_DISABLE

Description:

- Disable the low resistance divider.

Parameters:

- __HANDLE__: specifies the LCD Handle.

Return value:

- None

__HAL_LCD_VOLTAGE_BUFFER_ENABLE

Description:

- Enable the voltage output buffer for higher driving capability.

Parameters:

- __HANDLE__: specifies the LCD Handle.

Return value:

- None

__HAL_LCD_VOLTAGE_BUFFER_DISABLE

Description:

- Disable the voltage output buffer for higher driving capability.

Parameters:

- __HANDLE__: specifies the LCD Handle.

Return value:

- None

__HAL_LCD_PULSEONDURATION_CONFIG

Description:

- Configure the LCD pulse on duration.

Parameters:

- __HANDLE__: specifies the LCD Handle.
- __DURATION__: specifies the LCD pulse on duration in terms of CK_PS (prescaled LCD clock period) pulses. This parameter can be one of the following values:
  - LCD_PULSEONDURATION_0: 0 pulse
  - LCD_PULSEONDURATION_1: Pulse ON duration = 1/CK_PS
  - LCD_PULSEONDURATION_2: Pulse ON duration = 2/CK_PS
  - LCD_PULSEONDURATION_3: Pulse ON duration = 3/CK_PS
  - LCD_PULSEONDURATION_4: Pulse ON duration = 4/CK_PS
  - LCD_PULSEONDURATION_5: Pulse ON duration = 5/CK_PS
  - LCD_PULSEONDURATION_6: Pulse ON duration = 6/CK_PS
  - LCD_PULSEONDURATION_7: Pulse ON duration = 7/CK_PS

Return value:

- None

__HAL_LCD_DEADTIME_CONFIG

Description:

- Configure the LCD dead time.

Parameters:

- __HANDLE__: specifies the LCD Handle.
- __DEADTIME__: specifies the LCD dead time. This parameter can be one of the following values:
  - LCD_DEADTIME_0: No dead Time
  - LCD_DEADTIME_1: One Phase between different couple of Frame
  - LCD_DEADTIME_2: Two Phase between different couple of Frame
  - LCD_DEADTIME_3: Three Phase between different couple of Frame
  - LCD_DEADTIME_4: Four Phase between different couple of Frame
  - LCD_DEADTIME_5: Five Phase between different couple of Frame
  - LCD_DEADTIME_6: Six Phase between different couple of Frame
  - LCD_DEADTIME_7: Seven Phase between different couple of Frame

Return value:

- None

__HAL_LCD_CONTRAST_CONFIG

Description:

- Configure the LCD contrast.

Parameters:

- __HANDLE__: specifies the LCD Handle.
- __CONTRAST__: specifies the LCD Contrast. This parameter can be one of the following values:
  - LCD_CONTRASTLEVEL_0: Maximum Voltage = 2.60V
  - LCD_CONTRASTLEVEL_1: Maximum Voltage = 2.73V
  - LCD_CONTRASTLEVEL_2: Maximum Voltage = 2.86V
  - LCD_CONTRASTLEVEL_3: Maximum Voltage = 2.99V
  - LCD_CONTRASTLEVEL_4: Maximum Voltage = 3.12V
  - LCD_CONTRASTLEVEL_5: Maximum Voltage = 3.25V
  - LCD_CONTRASTLEVEL_6: Maximum Voltage = 3.38V
  - LCD_CONTRASTLEVEL_7: Maximum Voltage = 3.51V

Return value:

- None

__HAL_LCD_BLINK_CONFIG

Description:

- Configure the LCD Blink mode and Blink frequency.

Parameters:

- __HANDLE__: specifies the LCD Handle.
- __BLINKMODE__: specifies the LCD blink mode. This parameter can be one of the following values:
  - LCD_BLINKMODE_OFF: Blink disabled
  - LCD_BLINKMODE_SEG0_COM0: Blink enabled on SEG[0], COM[0] (1 pixel)
  - LCD_BLINKMODE_SEG0_ALLCOM: Blink enabled on SEG[0], all COM (up to 8 pixels according to the programmed duty)
  - LCD_BLINKMODE_ALLSEG_ALLCOM: Blink enabled on all SEG and all COM (all pixels)
- __BLINKFREQUENCY__: specifies the LCD blink frequency.
  - LCD_BLINKFREQUENCY_DIV8: The Blink frequency = fLcd/8
  - LCD_BLINKFREQUENCY_DIV16: The Blink frequency = fLcd/16
  - LCD_BLINKFREQUENCY_DIV32: The Blink frequency = fLcd/32
  - LCD_BLINKFREQUENCY_DIV64: The Blink frequency = fLcd/64
  - LCD_BLINKFREQUENCY_DIV128: The Blink frequency = fLcd/128
  - LCD_BLINKFREQUENCY_DIV256: The Blink frequency = fLcd/256
  - LCD_BLINKFREQUENCY_DIV512: The Blink frequency = fLcd/512
  - LCD_BLINKFREQUENCY_DIV1024: The Blink frequency = fLcd/1024

Return value:

- None

__HAL_LCD_ENABLE_IT

Description:

- Enable the specified LCD interrupt.

Parameters:

- __HANDLE__: specifies the LCD Handle.
- __INTERRUPT__: specifies the LCD interrupt source to be enabled. This parameter can be one of the following values:
  - LCD_IT_SOF: Start of Frame Interrupt
  - LCD_IT_UDD: Update Display Done Interrupt

Return value:

- None

__HAL_LCD_DISABLE_IT

Description:

- Disable the specified LCD interrupt.

Parameters:

- __HANDLE__: specifies the LCD Handle.
- __INTERRUPT__: specifies the LCD interrupt source to be disabled. This parameter can be one of the following values:
  - LCD_IT_SOF: Start of Frame Interrupt
  - LCD_IT_UDD: Update Display Done Interrupt

Return value:

- None

__HAL_LCD_GET_IT_SOURCE

Description:

- Check whether the specified LCD interrupt source is enabled or not.

Parameters:

- __HANDLE__: specifies the LCD Handle.
- __IT__: specifies the LCD interrupt source to check. This parameter can be one of the following values:
  - LCD_IT_SOF: Start of Frame Interrupt
  - LCD_IT_UDD: Update Display Done Interrupt.

Return value:

- The: state of __IT__ (TRUE or FALSE).

Notes:

- If the device is in STOP mode (PCLK not provided) UDD will not generate an interrupt even if UDDIE = 1. If the display is not enabled the UDD interrupt will never occur.

__HAL_LCD_GET_FLAG

Description:

- Check whether the specified LCD flag is set or not.

Parameters:

- __HANDLE__: specifies the LCD Handle.
- __FLAG__: specifies the flag to check. This parameter can be one of the following values:
  - LCD_FLAG_ENS: LCD Enabled flag. It indicates the LCD controller status.
  - LCD_FLAG_SOF: Start of Frame flag. This flag is set by hardware at the beginning of a new frame, at the same time as the display data is updated.
  - LCD_FLAG_UDR: Update Display Request flag.
  - LCD_FLAG_UDD: Update Display Done flag.
  - LCD_FLAG_RDY: Step_up converter Ready flag. It indicates the status of the step-up converter.
  - LCD_FLAG_FCRSF: LCD Frame Control Register Synchronization Flag. This flag is set by hardware each time the LCD_FCR register is updated in the LCDCLK domain.

Return value:

- The: new state of __FLAG__ (TRUE or FALSE).

Notes:

- The ENS bit is set immediately when the LCDEN bit in the LCD_CR goes from 0 to 1. On deactivation it reflects the real status of LCD so it becomes 0 at the end of the last displayed frame.

__HAL_LCD_CLEAR_FLAG

Description:

- Clear the specified LCD pending flag.

Parameters:

- __HANDLE__: specifies the LCD Handle.
- __FLAG__: specifies the flag to clear. This parameter can be any combination of the following values:
  - LCD_FLAG_SOF: Start of Frame Interrupt
  - LCD_FLAG_UDD: Update Display Done Interrupt

Return value:

- None

LCD Flags Definition

LCD_FLAG_ENS

LCD enabled status

LCD_FLAG_SOF

Start of frame flag

LCD_FLAG_UDR

Update display request

LCD_FLAG_UDD

Update display done

LCD_FLAG_RDY

Ready flag

LCD_FLAG_FCRSF

LCD Frame Control Register Synchronization flag

LCD High Drive

LCD_HIGHDRIVE_DISABLE

High drive disabled

LCD_HIGHDRIVE_ENABLE

High drive enabled

LCD Interrupts

LCD_IT_SOF

LCD_IT_UDD

LCD Mux Segment

LCD_MUXSEGMENT_DISABLE

SEG pin multiplexing disabled

LCD_MUXSEGMENT_ENABLE

SEG[31:28] are multiplexed with SEG[43:40]

LCD Prescaler

LCD_PRESCALER_1

CLKPS = LCDCLK

LCD_PRESCALER_2

CLKPS = LCDCLK/2

LCD_PRESCALER_4

CLKPS = LCDCLK/4

LCD_PRESCALER_8

CLKPS = LCDCLK/8

LCD_PRESCALER_16

CLKPS = LCDCLK/16

LCD_PRESCALER_32

CLKPS = LCDCLK/32

LCD_PRESCALER_64

CLKPS = LCDCLK/64

LCD_PRESCALER_128

CLKPS = LCDCLK/128

LCD_PRESCALER_256

CLKPS = LCDCLK/256

LCD_PRESCALER_512

CLKPS = LCDCLK/512

LCD_PRESCALER_1024

CLKPS = LCDCLK/1024

LCD_PRESCALER_2048

CLKPS = LCDCLK/2048

LCD_PRESCALER_4096

CLKPS = LCDCLK/4096

LCD_PRESCALER_8192

CLKPS = LCDCLK/8192

LCD_PRESCALER_16384

CLKPS = LCDCLK/16384

LCD_PRESCALER_32768

CLKPS = LCDCLK/32768

LCD Pulse On Duration

LCD_PULSEONDURATION_0

Pulse ON duration = 0 pulse

LCD_PULSEONDURATION_1

Pulse ON duration = 1/CK_PS

LCD_PULSEONDURATION_2

Pulse ON duration = 2/CK_PS

LCD_PULSEONDURATION_3

Pulse ON duration = 3/CK_PS

LCD_PULSEONDURATION_4

Pulse ON duration = 4/CK_PS

LCD_PULSEONDURATION_5

Pulse ON duration = 5/CK_PS

LCD_PULSEONDURATION_6

Pulse ON duration = 6/CK_PS

LCD_PULSEONDURATION_7

Pulse ON duration = 7/CK_PS

LCD RAMRegister

LCD_RAM_REGISTER0

LCD RAM Register 0

LCD_RAM_REGISTER1

LCD RAM Register 1

LCD_RAM_REGISTER2

LCD RAM Register 2

LCD_RAM_REGISTER3

LCD RAM Register 3

LCD_RAM_REGISTER4

LCD RAM Register 4

LCD_RAM_REGISTER5

LCD RAM Register 5

LCD_RAM_REGISTER6

LCD RAM Register 6

LCD_RAM_REGISTER7

LCD RAM Register 7

LCD_RAM_REGISTER8

LCD RAM Register 8

LCD_RAM_REGISTER9

LCD RAM Register 9

LCD_RAM_REGISTER10

LCD RAM Register 10

LCD_RAM_REGISTER11

LCD RAM Register 11

LCD_RAM_REGISTER12

LCD RAM Register 12

LCD_RAM_REGISTER13

LCD RAM Register 13

LCD_RAM_REGISTER14

LCD RAM Register 14

LCD_RAM_REGISTER15

LCD RAM Register 15

LCD Voltage Source

LCD_VOLTAGESOURCE_INTERNAL

Internal voltage source for the LCD

LCD_VOLTAGESOURCE_EXTERNAL

External voltage source for the LCD

30 HAL LPTIM Generic Driver

30.1 LPTIM Firmware driver registers structures

30.1.1 LPTIM_ClockConfigTypeDef

LPTIM_ClockConfigTypeDef is defined in the stm32u0xx_hal_lptim.h

Data Fields

- ***uint32_t Source***
- ***uint32_t Prescaler***

Field Documentation

- ***uint32_t LPTIM_ClockConfigTypeDef::Source***
  Selects the clock source. This parameter can be a value of ***LPTIM_Clock_Source***
- ***uint32_t LPTIM_ClockConfigTypeDef::Prescaler***
  Specifies the counter clock Prescaler. This parameter can be a value of ***LPTIM_Clock_Prescaler***

30.1.2 LPTIM_ULPClockConfigTypeDef

LPTIM_ULPClockConfigTypeDef is defined in the stm32u0xx_hal_lptim.h

Data Fields

- ***uint32_t Polarity***
- ***uint32_t SampleTime***

Field Documentation

- ***uint32_t LPTIM_ULPClockConfigTypeDef::Polarity***
  Selects the polarity of the active edge for the counter unit if the ULPTIM input is selected. Note: This parameter is used only when Ultra low power clock source is used. Note: If the polarity is configured on 'both edges', an auxiliary clock (one of the Low power oscillator) must be active. This parameter can be a value of ***LPTIM_Clock_Polarity***
- ***uint32_t LPTIM_ULPClockConfigTypeDef::SampleTime***
  Selects the clock sampling time to configure the clock glitch filter. Note: This parameter is used only when Ultra low power clock source is used. This parameter can be a value of ***LPTIM_Clock_Sample_Time***

30.1.3 LPTIM_TriggerConfigTypeDef

LPTIM_TriggerConfigTypeDef is defined in the stm32u0xx_hal_lptim.h

Data Fields

- ***uint32_t Source***
- ***uint32_t ActiveEdge***
- ***uint32_t SampleTime***

Field Documentation

- ***uint32_t LPTIM_TriggerConfigTypeDef::Source***
  Selects the Trigger source. This parameter can be a value of ***LPTIM_Trigger_Source***
- ***uint32_t LPTIM_TriggerConfigTypeDef::ActiveEdge***
  Selects the Trigger active edge. Note: This parameter is used only when an external trigger is used. This parameter can be a value of ***LPTIM_External_Trigger_Polarity***
- ***uint32_t LPTIM_TriggerConfigTypeDef::SampleTime***
  Selects the trigger sampling time to configure the clock glitch filter. Note: This parameter is used only when an external trigger is used. This parameter can be a value of ***LPTIM_Trigger_Sample_Time***

30.1.4 LPTIM_InitTypeDef

LPTIM_InitTypeDef is defined in the stm32u0xx_hal_lptim.h

Data Fields

- ***LPTIM_ClockConfigTypeDef Clock***
- ***LPTIM_ULPClockConfigTypeDef UltraLowPowerClock***

- ***LPTIM_TriggerConfigTypeDef Trigger***
- ***uint32_t Period***
- ***uint32_t UpdateMode***
- ***uint32_t CounterSource***
- ***uint32_t Input1Source***
- ***uint32_t Input2Source***
- ***uint32_t RepetitionCounter***

Field Documentation

- ***LPTIM_ClockConfigTypeDef LPTIM_InitTypeDef::Clock***
  Specifies the clock parameters
- ***LPTIM_ULPClockConfigTypeDef LPTIM_InitTypeDef::UltraLowPowerClock***
  Specifies the Ultra Low Power clock parameters
- ***LPTIM_TriggerConfigTypeDef LPTIM_InitTypeDef::Trigger***
  Specifies the Trigger parameters
- ***uint32_t LPTIM_InitTypeDef::Period***
  Specifies the period value to be loaded into the active Auto-Reload Register at the next update event. This parameter can be a number between Min_Data = 0x0001 and Max_Data = 0xFFFF.
- ***uint32_t LPTIM_InitTypeDef::UpdateMode***
  Specifies whether the update of the autoreload and the compare values is done immediately or after the end of current period. This parameter can be a value of ***LPTIM_Updating_Mode***
- ***uint32_t LPTIM_InitTypeDef::CounterSource***
  Specifies whether the counter is incremented each internal event or each external event. This parameter can be a value of ***LPTIM_Counter_Source***
- ***uint32_t LPTIM_InitTypeDef::Input1Source***
  Specifies source selected for input1 (GPIO or comparator output). This parameter can be a value of ***LPTIM_Input1_Source***
- ***uint32_t LPTIM_InitTypeDef::Input2Source***
  Specifies source selected for input2 (GPIO or comparator output). Note: This parameter is used only for encoder feature so is used only for LPTIM1 instance. This parameter can be a value of ***LPTIM_Input2_Source***
- ***uint32_t LPTIM_InitTypeDef::RepetitionCounter***
  Specifies the repetition counter value. Each time the RCR downcounter reaches zero, an update event is generated and counting restarts from the RCR value (N). Note: When using repetition counter the UpdateMode field must be set to LPTIM_UPDATE_ENDOFPERIOD otherwise unpredictable behavior may occur. This parameter must be a number between Min_Data = 0x00 and Max_Data = 0xFF.

30.1.5 LPTIM_OC_ConfigTypeDef

LPTIM_OC_ConfigTypeDef is defined in the stm32u0xx_hal_lptim.h

Data Fields

- ***uint32_t Pulse***
- ***uint32_t OCPolarity***

Field Documentation

- ***uint32_t LPTIM_OC_ConfigTypeDef::Pulse***
  Specifies the pulse value to be loaded into the Capture Compare Register. This parameter can be a number between Min_Data = 0x0000 and Max_Data = 0xFFFF
- ***uint32_t LPTIM_OC_ConfigTypeDef::OCPolarity***
  Specifies the output polarity. This parameter can be a value of ***LPTIM_Output_Compare_Polarity***

30.1.6 LPTIM_IC_ConfigTypeDef

LPTIM_IC_ConfigTypeDef is defined in the stm32u0xx_hal_lptim.h

Data Fields

- ***uint32_t ICInputSource***
- ***uint32_t ICPrescaler***
- ***uint32_t ICPolarity***

- ***uint32_t ICFilter***

Field Documentation

- ***uint32_t LPTIM_IC_ConfigTypeDef::ICInputSource***
  Specifies source selected for IC channel. This parameter can be a value of ***LPTIM_Input_Capture_Source***
- ***uint32_t LPTIM_IC_ConfigTypeDef::ICPrescaler***
  Specifies the Input Capture Prescaler. This parameter can be a value of ***LPTIM_Input_Capture_Prescaler***
- ***uint32_t LPTIM_IC_ConfigTypeDef::ICPolarity***
  Specifies the active edge of the input signal. This parameter can be a value of ***LPTIM_Input_Capture_Polarity***
- ***uint32_t LPTIM_IC_ConfigTypeDef::ICFilter***
  Specifies the input capture filter. This parameter can be a value of ***LPTIM_Input_Capture_Filter***

30.1.7 __LPTIM_HandleTypeDef

__LPTIM_HandleTypeDef is defined in the stm32u0xx_hal_lptim.h

Data Fields

- ***LPTIM_TypeDef * Instance***
- ***LPTIM_InitTypeDef Init***
- ***HAL_LPTIM_ActiveChannel Channel***
- ***DMA_HandleTypeDef * hdma***
- ***HAL_StatusTypeDef Status***
- ***HAL_LockTypeDef Lock***
- ***__IO HAL_LPTIM_StateTypeDef State***
- ***__IO HAL_LPTIM_ChannelStateTypeDef ChannelState***
- ***void(* MspInitCallback***
- ***void(* MspDeInitCallback***
- ***void(* CompareMatchCallback***
- ***void(* AutoReloadMatchCallback***
- ***void(* TriggerCallback***
- ***void(* CompareWriteCallback***
- ***void(* AutoReloadWriteCallback***
- ***void(* DirectionUpCallback***
- ***void(* DirectionDownCallback***
- ***void(* UpdateEventCallback***
- ***void(* RepCounterWriteCallback***
- ***void(* UpdateEventHalfCpltCallback***
- ***void(* ErrorCallback***
- ***void(* IC_CaptureCallback***
- ***void(* IC_CaptureHalfCpltCallback***
- ***void(* IC_OverCaptureCallback***

Field Documentation

- ***LPTIM_TypeDef* __LPTIM_HandleTypeDef::Instance***
  Register base address
- ***LPTIM_InitTypeDef __LPTIM_HandleTypeDef::Init***
  LPTIM required parameters
- ***HAL_LPTIM_ActiveChannel __LPTIM_HandleTypeDef::Channel***
  Active channel
- ***DMA_HandleTypeDef* __LPTIM_HandleTypeDef::hdma[5]***
  DMA Handlers array, This array is accessed by a ***LPTIM_DMA_Handle_index***
- ***HAL_StatusTypeDef __LPTIM_HandleTypeDef::Status***
  LPTIM peripheral status

- ***HAL_LockTypeDef __LPTIM_HandleTypeDef::Lock***
  LPTIM locking object
- ***__IO HAL_LPTIM_StateTypeDef __LPTIM_HandleTypeDef::State***
  LPTIM peripheral state
- ***__IO HAL_LPTIM_ChannelStateTypeDef __LPTIM_HandleTypeDef::ChannelState[4]***
  LPTIM channel operation state
- ***void(* __LPTIM_HandleTypeDef::MspInitCallback)(struct __LPTIM_HandleTypeDef *hlptim)***
  LPTIM Base Msp Init Callback
- ***void(* __LPTIM_HandleTypeDef::MspDeInitCallback)(struct __LPTIM_HandleTypeDef *hlptim)***
  LPTIM Base Msp DeInit Callback
- ***void(* __LPTIM_HandleTypeDef::CompareMatchCallback)(struct __LPTIM_HandleTypeDef *hlptim)***
  Compare match Callback
- ***void(* __LPTIM_HandleTypeDef::AutoReloadMatchCallback)(struct __LPTIM_HandleTypeDef *hlptim)***
  Auto-reload match Callback
- ***void(* __LPTIM_HandleTypeDef::TriggerCallback)(struct __LPTIM_HandleTypeDef *hlptim)***
  External trigger event detection Callback
- ***void(* __LPTIM_HandleTypeDef::CompareWriteCallback)(struct __LPTIM_HandleTypeDef *hlptim)***
  Compare register write complete Callback
- ***void(* __LPTIM_HandleTypeDef::AutoReloadWriteCallback)(struct __LPTIM_HandleTypeDef *hlptim)***
  Auto-reload register write complete Callback
- ***void(* __LPTIM_HandleTypeDef::DirectionUpCallback)(struct __LPTIM_HandleTypeDef *hlptim)***
  Up-counting direction change Callback
- ***void(* __LPTIM_HandleTypeDef::DirectionDownCallback)(struct __LPTIM_HandleTypeDef *hlptim)***
  Down-counting direction change Callback
- ***void(* __LPTIM_HandleTypeDef::UpdateEventCallback)(struct __LPTIM_HandleTypeDef *hlptim)***
  Update event detection Callback
- ***void(* __LPTIM_HandleTypeDef::RepCounterWriteCallback)(struct __LPTIM_HandleTypeDef *hlptim)***
  Repetition counter register write complete Callback
- ***void(* __LPTIM_HandleTypeDef::UpdateEventHalfCpltCallback)(struct __LPTIM_HandleTypeDef *hlptim)***
  Update event half complete detection Callback
- ***void(* __LPTIM_HandleTypeDef::ErrorCallback)(struct __LPTIM_HandleTypeDef *hlptim)***
  LPTIM Error Callback
- ***void(* __LPTIM_HandleTypeDef::IC_CaptureCallback)(struct __LPTIM_HandleTypeDef *hlptim)***
  Input capture Callback
- ***void(* __LPTIM_HandleTypeDef::IC_CaptureHalfCpltCallback)(struct __LPTIM_HandleTypeDef *htim)***
  Input Capture half complete Callback
- ***void(* __LPTIM_HandleTypeDef::IC_OverCaptureCallback)(struct __LPTIM_HandleTypeDef *hlptim)***
  Over capture Callback

30.2 LPTIM Firmware driver API description

The following section lists the various functions of the LPTIM library.

30.2.1 How to use this driver

The LPTIM HAL driver can be used as follows:

1. Initialize the LPTIM low level resources by implementing the HAL_LPTIM_MspInit():
   - Enable the LPTIM interface clock using __HAL_RCC_LPTIMx_CLK_ENABLE().
   - In case of using interrupts (e.g. HAL_LPTIM_PWM_Start_IT()):
     - Configure the LPTIM interrupt priority using HAL_NVIC_SetPriority().
     - Enable the LPTIM IRQ handler using HAL_NVIC_EnableIRQ().
     - In LPTIM IRQ handler, call HAL_LPTIM_IRQHandler().
2. Initialize the LPTIM HAL using HAL_LPTIM_Init(). This function configures mainly:
   - The instance: LPTIM1, LPTIM2, LPTIM3 or LPTIM4.
   - Clock: the counter clock.
     - Source : it can be either the ULPTIM input (IN1) or one of the internal clock; (APB, LSE, LSI or MSI).
     - Prescaler: select the clock divider.
   - UltraLowPowerClock : To be used only if the ULPTIM is selected as counter clock source.
     - Polarity: polarity of the active edge for the counter unit if the ULPTIM input is selected.
     - SampleTime: clock sampling time to configure the clock glitch filter.
   - Trigger: How the counter start.
     - Source: trigger can be software or one of the hardware triggers.
     - ActiveEdge : only for hardware trigger.
     - SampleTime : trigger sampling time to configure the trigger glitch filter.
   - OutputPolarity : 2 opposite polarities are possible.
   - UpdateMode: specifies whether the update of the autoreload and the compare values is done immediately or after the end of current period.
   - Input1Source: Source selected for input1 (GPIO or comparator output).
   - Input2Source: Source selected for input2 (GPIO or comparator output). Input2 is used only for encoder feature so is used only for LPTIM1 instance.
3. Six modes are available:
   - PWM Mode: To generate a PWM signal with specified period and pulse, call HAL_LPTIM_PWM_Start() or HAL_LPTIM_PWM_Start_IT() for interruption mode.
   - One Pulse Mode: To generate pulse with specified width in response to a stimulus, call HAL_LPTIM_OnePulse_Start() or HAL_LPTIM_OnePulse_Start_IT() for interruption mode.
   - Set once Mode: In this mode, the output changes the level (from low level to high level if the output polarity is configured high, else the opposite) when a compare match occurs. To start this mode, call HAL_LPTIM_SetOnce_Start() or HAL_LPTIM_SetOnce_Start_IT() for interruption mode.
   - Encoder Mode: To use the encoder interface call HAL_LPTIM_Encoder_Start() or HAL_LPTIM_Encoder_Start_IT() for interruption mode. Only available for LPTIM1 instance.
   - Time out Mode: an active edge on one selected trigger input rests the counter. The first trigger event will start the timer, any successive trigger event will reset the counter and the timer will restart. To start this mode call HAL_LPTIM_TimeOut_Start_IT() or HAL_LPTIM_TimeOut_Start_IT() for interruption mode.
   - Counter Mode: counter can be used to count external events on the LPTIM Input1 or it can be used to count internal clock cycles. To start this mode, call HAL_LPTIM_Counter_Start() or HAL_LPTIM_Counter_Start_IT() for interruption mode.
4. User can stop any process by calling the corresponding API: HAL_LPTIM_Xxx_Stop() or HAL_LPTIM_Xxx_Stop_IT() if the process is already started in interruption mode.
5. De-initialize the LPTIM peripheral using HAL_LPTIM_DeInit().

Callback registration

The compilation define USE_HAL_LPTIM_REGISTER_CALLBACKS when set to 1 allows the user to configure dynamically the driver callbacks.

Use Function HAL_LPTIM_RegisterCallback() to register a callback. HAL_LPTIM_RegisterCallback() takes as parameters the HAL peripheral handle, the Callback ID and a pointer to the user callback function.

Use function HAL_LPTIM_UnRegisterCallback() to reset a callback to the default weak function. HAL_LPTIM_UnRegisterCallback takes as parameters the HAL peripheral handle, and the Callback ID.

These functions allow to register/unregister following callbacks:

- MspInitCallback : LPTIM Base Msp Init Callback.
- MspDeInitCallback : LPTIM Base Msp DeInit Callback.
- CompareMatchCallback : Compare match Callback.
- AutoReloadMatchCallback : Auto-reload match Callback.
- TriggerCallback : External trigger event detection Callback.
- CompareWriteCallback : Compare register write complete Callback.
- AutoReloadWriteCallback : Auto-reload register write complete Callback.
- DirectionUpCallback : Up-counting direction change Callback.
- DirectionDownCallback : Down-counting direction change Callback.
- UpdateEventCallback : Update event detection Callback.
- RepCounterWriteCallback : Repetition counter register write complete Callback.

By default, after the Init and when the state is HAL_LPTIM_STATE_RESET all interrupt callbacks are set to the corresponding weak functions: examples HAL_LPTIM_TriggerCallback(), HAL_LPTIM_CompareMatchCallback().

Exception done for MspInit and MspDeInit functions that are reset to the legacy weak functionalities in the Init/DeInit only when these callbacks are null (not registered beforehand). If not, MspInit or MspDeInit are not null, the Init/DeInit keep and use the user MspInit/MspDeInit callbacks (registered beforehand)

Callbacks can be registered/unregistered in HAL_LPTIM_STATE_READY state only. Exception done MspInit/MspDeInit that can be registered/unregistered in HAL_LPTIM_STATE_READY or HAL_LPTIM_STATE_RESET state, thus registered (user) MspInit/DeInit callbacks can be used during the Init/DeInit. In that case first register the MspInit/MspDeInit user callbacks using HAL_LPTIM_RegisterCallback() before calling DeInit or Init function.

When The compilation define USE_HAL_LPTIM_REGISTER_CALLBACKS is set to 0 or not defined, the callback registration feature is not available and all callbacks are set to the corresponding weak functions.

30.2.2 Initialization and de-initialization functions

This section provides functions allowing to:

- Initialize the LPTIM according to the specified parameters in the LPTIM_InitTypeDef and initialize the associated handle.
- DeInitialize the LPTIM peripheral.
- Initialize the LPTIM MSP.
- DeInitialize the LPTIM MSP.

This section contains the following APIs:

- ***HAL_LPTIM_Init()***
- ***HAL_LPTIM_DeInit()***
- ***HAL_LPTIM_MspInit()***
- ***HAL_LPTIM_MspDeInit()***

30.2.3 LPTIM Start Stop operation functions

This section provides functions allowing to:

- Start the PWM mode.
- Stop the PWM mode.
- Start the One pulse mode.
- Stop the One pulse mode.
- Start the Set once mode.
- Stop the Set once mode.
- Start the Encoder mode.
- Stop the Encoder mode.
- Start the Timeout mode.
- Stop the Timeout mode.
- Start the Counter mode.
- Stop the Counter mode.

This section contains the following APIs:

- *HAL_LPTIM_PWM_Start()*
- *HAL_LPTIM_PWM_Stop()*
- *HAL_LPTIM_PWM_Start_IT()*
- *HAL_LPTIM_PWM_Stop_IT()*
- *HAL_LPTIM_PWM_Start_DMA()*
- *HAL_LPTIM_PWM_Stop_DMA()*
- *HAL_LPTIM_OnePulse_Start()*
- *HAL_LPTIM_OnePulse_Stop()*
- *HAL_LPTIM_OnePulse_Start_IT()*
- *HAL_LPTIM_OnePulse_Stop_IT()*
- *HAL_LPTIM_SetOnce_Start()*
- *HAL_LPTIM_SetOnce_Stop()*
- *HAL_LPTIM_SetOnce_Start_IT()*
- *HAL_LPTIM_SetOnce_Stop_IT()*
- *HAL_LPTIM_Encoder_Start()*
- *HAL_LPTIM_Encoder_Stop()*
- *HAL_LPTIM_Encoder_Start_IT()*
- *HAL_LPTIM_Encoder_Stop_IT()*
- *HAL_LPTIM_TimeOut_Start()*
- *HAL_LPTIM_TimeOut_Stop()*
- *HAL_LPTIM_TimeOut_Start_IT()*
- *HAL_LPTIM_TimeOut_Stop_IT()*
- *HAL_LPTIM_Counter_Start()*
- *HAL_LPTIM_Counter_Stop()*
- *HAL_LPTIM_Counter_Start_IT()*
- *HAL_LPTIM_Counter_Stop_IT()*
- *HAL_LPTIM_IC_Start()*
- *HAL_LPTIM_IC_Stop()*
- *HAL_LPTIM_IC_Start_IT()*
- *HAL_LPTIM_IC_Stop_IT()*
- *HAL_LPTIM_IC_Start_DMA()*
- *HAL_LPTIM_IC_Stop_DMA()*
- *HAL_LPTIM_OC_ConfigChannel()*
- *HAL_LPTIM_IC_ConfigChannel()*

30.2.4 LPTIM Read operation functions

This section provides LPTIM Reading functions.

- Read the counter value.
- Read the period (Auto-reload) value.
- Read the pulse (Compare)value.

This section contains the following APIs:

- *HAL_LPTIM_ReadCounter()*
- *HAL_LPTIM_ReadAutoReload()*
- *HAL_LPTIM_ReadCapturedValue()*
- *HAL_LPTIM_IC_GetOffset()*

30.2.5 LPTIM Config function

This section provides LPTIM Config function.

- Configure channel: Output Compare mode, Period, Polarity.

This section contains the following APIs:

- *HAL_LPTIM_OC_ConfigChannel()*
- *HAL_LPTIM_IC_ConfigChannel()*

30.2.6 Peripheral State functions

This subsection permits to get in run-time the status of the peripheral.

This section contains the following APIs:

- *HAL_LPTIM_GetState()*

30.2.7 Detailed description of functions

HAL_LPTIM_Init

Function name

HAL_StatusTypeDef HAL_LPTIM_Init (LPTIM_HandleTypeDef * hlptim)

Function description

Initialize the LPTIM according to the specified parameters in the LPTIM_InitTypeDef and initialize the associated handle.

Parameters

- **hlptim:** LPTIM handle

Return values

- **HAL:** status

HAL_LPTIM_DeInit

Function name

HAL_StatusTypeDef HAL_LPTIM_DeInit (LPTIM_HandleTypeDef * hlptim)

Function description

DeInitialize the LPTIM peripheral.

Parameters

- **hlptim:** LPTIM handle

Return values

- **HAL:** status

HAL_LPTIM_MspInit

Function name

void HAL_LPTIM_MspInit (LPTIM_HandleTypeDef * hlptim)

Function description

Initialize the LPTIM MSP.

Parameters

- **hlptim:** LPTIM handle

Return values

- **None:**

HAL_LPTIM_MspDeInit

Function name

void HAL_LPTIM_MspDeInit (LPTIM_HandleTypeDef * hlptim)

Function description

DeInitialize LPTIM MSP.

Parameters

- **hlptim:** LPTIM handle

Return values

- **None:**

HAL_LPTIM_OC_ConfigChannel

Function name

HAL_StatusTypeDef HAL_LPTIM_OC_ConfigChannel (LPTIM_HandleTypeDef * hlptim, const LPTIM_OC_ConfigTypeDef * sConfig, uint32_t Channel)

Function description

Parameters

- **hlptim:** LPTIM handle
- **sConfig:** The output configuration structure
- **Channel:** LPTIM Channel to be configured This parameter can be one of the following values:
  - LPTIM_CHANNEL_1: LPTIM Channel 1 selected
  - LPTIM_CHANNEL_2: LPTIM Channel 2 selected
  - LPTIM_CHANNEL_3: LPTIM Channel 3 selected
  - LPTIM_CHANNEL_4: LPTIM Channel 4 selected

Return values

- **HAL:** status

Notes

- Successive calls to HAL_LPTIM_OC_ConfigChannel can only be performed after a delay that must be greater or equal than the value of (PRESC x 3) kernel clock cycles, PRESC[2:0] being the clock decimal division factor (1, 2, 4, ..., 128). Any successive call violating this delay, leads to unpredictable results.

HAL_LPTIM_PWM_Start

Function name

HAL_StatusTypeDef HAL_LPTIM_PWM_Start (LPTIM_HandleTypeDef * hlptim, uint32_t Channel)

Function description

Start the LPTIM PWM generation.

Parameters

- **hlptim:** LPTIM handle
- **Channel:** LPTIM Channel to be enabled This parameter can be one of the following values:
  - LPTIM_CHANNEL_1: LPTIM Channel 1 selected
  - LPTIM_CHANNEL_2: LPTIM Channel 2 selected
  - LPTIM_CHANNEL_3: LPTIM Channel 3 selected
  - LPTIM_CHANNEL_4: LPTIM Channel 4 selected

Return values

- **HAL:** status

HAL_LPTIM_PWM_Stop

Function name

HAL_StatusTypeDef HAL_LPTIM_PWM_Stop (LPTIM_HandleTypeDef * hlptim, uint32_t Channel)

Function description

Stop the LPTIM PWM generation.

Parameters

- **hlptim:** LPTIM handle
- **Channel:** LPTIM Channel to be disabled This parameter can be one of the following values:
  - LPTIM_CHANNEL_1: LPTIM Channel 1 selected
  - LPTIM_CHANNEL_2: LPTIM Channel 2 selected
  - LPTIM_CHANNEL_3: LPTIM Channel 3 selected
  - LPTIM_CHANNEL_4: LPTIM Channel 4 selected

Return values

- **HAL:** status

HAL_LPTIM_PWM_Start_IT

Function name

HAL_StatusTypeDef HAL_LPTIM_PWM_Start_IT (LPTIM_HandleTypeDef * hlptim, uint32_t Channel)

Function description

Start the LPTIM PWM generation in interrupt mode.

Parameters

- **hlptim:** LPTIM handle
- **Channel:** LPTIM Channel to be enabled This parameter can be one of the following values:
  - LPTIM_CHANNEL_1: LPTIM Channel 1 selected
  - LPTIM_CHANNEL_2: LPTIM Channel 2 selected
  - LPTIM_CHANNEL_3: LPTIM Channel 3 selected
  - LPTIM_CHANNEL_4: LPTIM Channel 4 selected

Return values

- **HAL:** status

HAL_LPTIM_PWM_Stop_IT

Function name

HAL_StatusTypeDef HAL_LPTIM_PWM_Stop_IT (LPTIM_HandleTypeDef * hlptim, uint32_t Channel)

Function description

Stop the LPTIM PWM generation in interrupt mode.

Parameters

- **hlptim:** LPTIM handle
- **Channel:** LPTIM Channel to be disabled This parameter can be one of the following values:
  - LPTIM_CHANNEL_1: LPTIM Channel 1 selected
  - LPTIM_CHANNEL_2: LPTIM Channel 2 selected
  - LPTIM_CHANNEL_3: LPTIM Channel 3 selected
  - LPTIM_CHANNEL_4: LPTIM Channel 4 selected

Return values

- **HAL:** status

HAL_LPTIM_PWM_Start_DMA

Function name

HAL_StatusTypeDef HAL_LPTIM_PWM_Start_DMA (LPTIM_HandleTypeDef * hlptim, uint32_t Channel, const uint32_t * pData, uint32_t Length)

Function description

Start the LPTIM PWM generation in DMA mode.

Parameters

- **hlptim:** LPTIM handle
- **Channel:** LPTIM Channel to be enabled This parameter can be one of the following values:
  - LPTIM_CHANNEL_1: LPTIM Channel 1 selected
  - LPTIM_CHANNEL_2: LPTIM Channel 2 selected
  - LPTIM_CHANNEL_3: LPTIM Channel 3 selected
  - LPTIM_CHANNEL_4: LPTIM Channel 4 selected
- **pData:** The destination Buffer address
- **Length:** The length of data to be transferred from LPTIM peripheral to memory

Return values

- **HAL:** status

HAL_LPTIM_PWM_Stop_DMA

Function name

HAL_StatusTypeDef HAL_LPTIM_PWM_Stop_DMA (LPTIM_HandleTypeDef * hlptim, uint32_t Channel)

Function description

Stop the LPTIM PWM generation in DMA mode.

Parameters

- **hlptim:** LPTIM handle
- **Channel:** LPTIM Channel to be disabled This parameter can be one of the following values:
  - LPTIM_CHANNEL_1: LPTIM Channel 1 selected
  - LPTIM_CHANNEL_2: LPTIM Channel 2 selected
  - LPTIM_CHANNEL_3: LPTIM Channel 3 selected
  - LPTIM_CHANNEL_4: LPTIM Channel 4 selected

Return values

- **HAL:** status

HAL_LPTIM_OnePulse_Start

Function name

HAL_StatusTypeDef HAL_LPTIM_OnePulse_Start (LPTIM_HandleTypeDef * hlptim, uint32_t Channel)

Function description

Start the LPTIM One pulse generation.

Parameters

- **hlptim:** LPTIM handle
- **Channel:** LPTIM Channel to be enabled This parameter can be one of the following values:
  - LPTIM_CHANNEL_1: LPTIM Channel 1 selected
  - LPTIM_CHANNEL_2: LPTIM Channel 2 selected
  - LPTIM_CHANNEL_3: LPTIM Channel 3 selected
  - LPTIM_CHANNEL_4: LPTIM Channel 4 selected

Return values

- **HAL:** status

HAL_LPTIM_OnePulse_Stop

Function name

HAL_StatusTypeDef HAL_LPTIM_OnePulse_Stop (LPTIM_HandleTypeDef * hlptim, uint32_t Channel)

Function description

Stop the LPTIM One pulse generation.

Parameters

- **hlptim:** LPTIM handle
- **Channel:** LPTIM Channel to be disabled This parameter can be one of the following values:
  - LPTIM_CHANNEL_1: LPTIM Channel 1 selected
  - LPTIM_CHANNEL_2: LPTIM Channel 2 selected
  - LPTIM_CHANNEL_3: LPTIM Channel 3 selected
  - LPTIM_CHANNEL_4: LPTIM Channel 4 selected

Return values

- **HAL:** status

HAL_LPTIM_OnePulse_Start_IT

Function name

HAL_StatusTypeDef HAL_LPTIM_OnePulse_Start_IT (LPTIM_HandleTypeDef * hlptim, uint32_t Channel)

Function description

Start the LPTIM One pulse generation in interrupt mode.

Parameters

- **hlptim:** LPTIM handle
- **Channel:** LPTIM Channel to be enabled This parameter can be one of the following values:
  - LPTIM_CHANNEL_1: LPTIM Channel 1 selected
  - LPTIM_CHANNEL_2: LPTIM Channel 2 selected
  - LPTIM_CHANNEL_3: LPTIM Channel 3 selected
  - LPTIM_CHANNEL_4: LPTIM Channel 4 selected

Return values

- **HAL:** status

HAL_LPTIM_OnePulse_Stop_IT

Function name

HAL_StatusTypeDef HAL_LPTIM_OnePulse_Stop_IT (LPTIM_HandleTypeDef * hlptim, uint32_t Channel)

Function description

Stop the LPTIM One pulse generation in interrupt mode.

Parameters

- **hlptim:** LPTIM handle
- **Channel:** LPTIM Channel to be disabled This parameter can be one of the following values:
  - LPTIM_CHANNEL_1: LPTIM Channel 1 selected
  - LPTIM_CHANNEL_2: LPTIM Channel 2 selected
  - LPTIM_CHANNEL_3: LPTIM Channel 3 selected
  - LPTIM_CHANNEL_4: LPTIM Channel 4 selected

Return values

- **HAL:** status

HAL_LPTIM_SetOnce_Start

Function name

HAL_StatusTypeDef HAL_LPTIM_SetOnce_Start (LPTIM_HandleTypeDef * hlptim, uint32_t Channel)

Function description

Start the LPTIM in Set once mode.

Parameters

- **hlptim:** LPTIM handle
- **Channel:** LPTIM Channel to be enabled This parameter can be one of the following values:
  - LPTIM_CHANNEL_1: LPTIM Channel 1 selected
  - LPTIM_CHANNEL_2: LPTIM Channel 2 selected
  - LPTIM_CHANNEL_3: LPTIM Channel 3 selected
  - LPTIM_CHANNEL_4: LPTIM Channel 4 selected

Return values

- **HAL:** status

HAL_LPTIM_SetOnce_Stop

Function name

HAL_StatusTypeDef HAL_LPTIM_SetOnce_Stop (LPTIM_HandleTypeDef * hlptim, uint32_t Channel)

Function description

Stop the LPTIM Set once mode.

Parameters

- **hlptim:** LPTIM handle
- **Channel:** LPTIM Channel to be disabled This parameter can be one of the following values:
  - LPTIM_CHANNEL_1: LPTIM Channel 1 selected
  - LPTIM_CHANNEL_2: LPTIM Channel 2 selected
  - LPTIM_CHANNEL_3: LPTIM Channel 3 selected
  - LPTIM_CHANNEL_4: LPTIM Channel 4 selected

Return values

- **HAL:** status

HAL_LPTIM_SetOnce_Start_IT

Function name

HAL_StatusTypeDef HAL_LPTIM_SetOnce_Start_IT (LPTIM_HandleTypeDef * hlptim, uint32_t Channel)

Function description

Start the LPTIM Set once mode in interrupt mode.

Parameters

- **hlptim:** LPTIM handle
- **Channel:** LPTIM Channel to be enabled This parameter can be one of the following values:
  - LPTIM_CHANNEL_1: LPTIM Channel 1 selected
  - LPTIM_CHANNEL_2: LPTIM Channel 2 selected
  - LPTIM_CHANNEL_3: LPTIM Channel 3 selected
  - LPTIM_CHANNEL_4: LPTIM Channel 4 selected

Return values

- **HAL:** status

HAL_LPTIM_SetOnce_Stop_IT

Function name

HAL_StatusTypeDef HAL_LPTIM_SetOnce_Stop_IT (LPTIM_HandleTypeDef * hlptim, uint32_t Channel)

Function description

Stop the LPTIM Set once mode in interrupt mode.

Parameters

- **hlptim:** LPTIM handle
- **Channel:** LPTIM Channel to be disabled This parameter can be one of the following values:
  - LPTIM_CHANNEL_1: LPTIM Channel 1 selected
  - LPTIM_CHANNEL_2: LPTIM Channel 2 selected
  - LPTIM_CHANNEL_3: LPTIM Channel 3 selected
  - LPTIM_CHANNEL_4: LPTIM Channel 4 selected

Return values

- **HAL:** status

HAL_LPTIM_Encoder_Start

Function name

HAL_StatusTypeDef HAL_LPTIM_Encoder_Start (LPTIM_HandleTypeDef * hlptim)

Function description

Start the Encoder interface.

Parameters

- **hlptim:** LPTIM handle

Return values

- **HAL:** status

HAL_LPTIM_Encoder_Stop

Function name

HAL_StatusTypeDef HAL_LPTIM_Encoder_Stop (LPTIM_HandleTypeDef * hlptim)

Function description

Stop the Encoder interface.

Parameters

- **hlptim:** LPTIM handle

Return values

- **HAL:** status

HAL_LPTIM_Encoder_Start_IT

Function name

HAL_StatusTypeDef HAL_LPTIM_Encoder_Start_IT (LPTIM_HandleTypeDef * hlptim)

Function description

Start the Encoder interface in interrupt mode.

Parameters

- **hlptim:** LPTIM handle

Return values

- **HAL:** status

HAL_LPTIM_Encoder_Stop_IT

Function name

HAL_StatusTypeDef HAL_LPTIM_Encoder_Stop_IT (LPTIM_HandleTypeDef * hlptim)

Function description

Stop the Encoder interface in interrupt mode.

Parameters

- **hlptim:** LPTIM handle

Return values

- **HAL:** status

HAL_LPTIM_TimeOut_Start

Function name

HAL_StatusTypeDef HAL_LPTIM_TimeOut_Start (LPTIM_HandleTypeDef * hlptim, uint32_t Timeout)

Function description

Start the Timeout function.

Parameters

- **hlptim:** LPTIM handle
- **Timeout:** Specifies the TimeOut value to reset the counter. This parameter must be a value between 0x0000 and 0xFFFF.

Return values

- **HAL:** status

Notes

- The first trigger event will start the timer, any successive trigger event will reset the counter and the timer restarts.

HAL_LPTIM_TimeOut_Stop

Function name

HAL_StatusTypeDef HAL_LPTIM_TimeOut_Stop (LPTIM_HandleTypeDef * hlptim)

Function description

Stop the Timeout function.

Parameters

- **hlptim:** LPTIM handle

Return values

- **HAL:** status

HAL_LPTIM_TimeOut_Start_IT

Function name

HAL_StatusTypeDef HAL_LPTIM_TimeOut_Start_IT (LPTIM_HandleTypeDef * hlptim, uint32_t Timeout)

Function description

Start the Timeout function in interrupt mode.

Parameters

- **hlptim:** LPTIM handle
- **Timeout:** Specifies the TimeOut value to reset the counter. This parameter must be a value between 0x0000 and 0xFFFF.

Return values

- **HAL:** status

Notes

- The first trigger event will start the timer, any successive trigger event will reset the counter and the timer restarts.

HAL_LPTIM_TimeOut_Stop_IT

Function name

HAL_StatusTypeDef HAL_LPTIM_TimeOut_Stop_IT (LPTIM_HandleTypeDef * hlptim)

Function description

Stop the Timeout function in interrupt mode.

Parameters

- **hlptim:** LPTIM handle

Return values

- **HAL:** status

HAL_LPTIM_Counter_Start

Function name

HAL_StatusTypeDef HAL_LPTIM_Counter_Start (LPTIM_HandleTypeDef * hlptim)

Function description

Start the Counter mode.

Parameters

- **hlptim:** LPTIM handle

Return values

- **HAL:** status

HAL_LPTIM_Counter_Stop

Function name

HAL_StatusTypeDef HAL_LPTIM_Counter_Stop (LPTIM_HandleTypeDef * hlptim)

Function description

Stop the Counter mode.

Parameters

- **hlptim:** LPTIM handle

Return values

- **HAL:** status

HAL_LPTIM_Counter_Start_IT

Function name

HAL_StatusTypeDef HAL_LPTIM_Counter_Start_IT (LPTIM_HandleTypeDef * hlptim)

Function description

Start the Counter mode in interrupt mode.

Parameters

- **hlptim:** LPTIM handle

Return values

- **HAL:** status

HAL_LPTIM_Counter_Stop_IT

Function name

HAL_StatusTypeDef HAL_LPTIM_Counter_Stop_IT (LPTIM_HandleTypeDef * hlptim)

Function description

Stop the Counter mode in interrupt mode.

Parameters

- **hlptim:** LPTIM handle

Return values

- **HAL:** status

HAL_LPTIM_IC_ConfigChannel

Function name

HAL_StatusTypeDef HAL_LPTIM_IC_ConfigChannel (LPTIM_HandleTypeDef * hlptim, const LPTIM_IC_ConfigTypeDef * sConfig, uint32_t Channel)

Function description

Parameters

- **hlptim:** LPTIM handle
- **sConfig:** The input configuration structure
- **Channel:** LPTIM Channel to be configured This parameter can be one of the following values:
  - LPTIM_CHANNEL_1: LPTIM Channel 1 selected
  - LPTIM_CHANNEL_2: LPTIM Channel 2 selected
  - LPTIM_CHANNEL_3: LPTIM Channel 3 selected
  - LPTIM_CHANNEL_4: LPTIM Channel 4 selected

Return values

- **HAL:** status

Notes

- Successive calls to HAL_LPTIM_IC_ConfigChannel can only be performed after a delay that must be greater or equal than the value of (PRESC x 3) kernel clock cycles, PRESC[2:0] being the clock decimal division factor (1, 2, 4, ..., 128). Any successive call violating this delay, leads to unpredictable results.

HAL_LPTIM_IC_Start

Function name

HAL_StatusTypeDef HAL_LPTIM_IC_Start (LPTIM_HandleTypeDef * hlptim, uint32_t Channel)

Function description

Starts the LPTIM Input Capture measurement.

Parameters

- **hlptim:** LPTIM Input Capture handle
- **Channel:** LPTIM Channels to be enabled This parameter can be one of the following values:
  - LPTIM_CHANNEL_1: TIM Channel 1 selected
  - LPTIM_CHANNEL_2: TIM Channel 2 selected
  - LPTIM_CHANNEL_3: TIM Channel 3 selected
  - LPTIM_CHANNEL_4: TIM Channel 4 selected

Return values

- **HAL:** status

HAL_LPTIM_IC_Stop

Function name

HAL_StatusTypeDef HAL_LPTIM_IC_Stop (LPTIM_HandleTypeDef * hlptim, uint32_t Channel)

Function description

Stops the LPTIM Input Capture measurement.

Parameters

- **hlptim:** LPTIM Input Capture handle
- **Channel:** LPTIM Channels to be disabled This parameter can be one of the following values:
  - LPTIM_CHANNEL_1: TIM Channel 1 selected
  - LPTIM_CHANNEL_2: TIM Channel 2 selected
  - LPTIM_CHANNEL_3: TIM Channel 3 selected
  - LPTIM_CHANNEL_4: TIM Channel 4 selected

Return values

- **HAL:** status

HAL_LPTIM_IC_Start_IT

Function name

HAL_StatusTypeDef HAL_LPTIM_IC_Start_IT (LPTIM_HandleTypeDef * hlptim, uint32_t Channel)

Function description

Starts the LPTIM Input Capture measurement in interrupt mode.

Parameters

- **hlptim:** LPTIM Input Capture handle
- **Channel:** LPTIM Channels to be enabled This parameter can be one of the following values:
  - LPTIM_CHANNEL_1: TIM Channel 1 selected
  - LPTIM_CHANNEL_2: TIM Channel 2 selected
  - LPTIM_CHANNEL_3: TIM Channel 3 selected
  - LPTIM_CHANNEL_4: TIM Channel 4 selected

Return values

- **HAL:** status

HAL_LPTIM_IC_Stop_IT

Function name

HAL_StatusTypeDef HAL_LPTIM_IC_Stop_IT (LPTIM_HandleTypeDef * hlptim, uint32_t Channel)

Function description

Stops the LPTIM Input Capture measurement in interrupt mode.

Parameters

- **hlptim:** LPTIM Input Capture handle
- **Channel:** LPTIM Channels to be disabled This parameter can be one of the following values:
  - LPTIM_CHANNEL_1: TIM Channel 1 selected
  - LPTIM_CHANNEL_2: TIM Channel 2 selected
  - LPTIM_CHANNEL_3: TIM Channel 3 selected
  - LPTIM_CHANNEL_4: TIM Channel 4 selected

Return values

- **HAL:** status

HAL_LPTIM_IC_Start_DMA

Function name

HAL_StatusTypeDef HAL_LPTIM_IC_Start_DMA (LPTIM_HandleTypeDef * hlptim, uint32_t Channel, uint32_t * pData, uint32_t Length)

Function description

Starts the LPTIM Input Capture measurement in DMA mode.

Parameters

- **hlptim:** LPTIM Input Capture handle
- **Channel:** LPTIM Channels to be enabled This parameter can be one of the following values:
  - LPTIM_CHANNEL_1: TIM Channel 1 selected
  - LPTIM_CHANNEL_2: TIM Channel 2 selected
  - LPTIM_CHANNEL_3: TIM Channel 3 selected
  - LPTIM_CHANNEL_4: TIM Channel 4 selected
- **pData:** The destination Buffer address
- **Length:** The length of data to be transferred from LPTIM peripheral to memory

Return values

- **HAL:** status

HAL_LPTIM_IC_Stop_DMA

Function name

HAL_StatusTypeDef HAL_LPTIM_IC_Stop_DMA (LPTIM_HandleTypeDef * hlptim, uint32_t Channel)

Function description

Stops the LPTIM Input Capture measurement in DMA mode.

Parameters

- **hlptim:** LPTIM Input Capture handle
- **Channel:** LPTIM Channels to be disabled This parameter can be one of the following values:
  - LPTIM_CHANNEL_1: TIM Channel 1 selected
  - LPTIM_CHANNEL_2: TIM Channel 2 selected
  - LPTIM_CHANNEL_3: TIM Channel 3 selected
  - LPTIM_CHANNEL_4: TIM Channel 4 selected

Return values

- **HAL:** status

HAL_LPTIM_ReadCounter

Function name

uint32_t HAL_LPTIM_ReadCounter (const LPTIM_HandleTypeDef * hlptim)

Function description

Return the current counter value.

Parameters

- **hlptim:** LPTIM handle

Return values

- **Counter:** value.

HAL_LPTIM_ReadAutoReload

Function name

uint32_t HAL_LPTIM_ReadAutoReload (const LPTIM_HandleTypeDef * hlptim)

Function description

Return the current Autoreload (Period) value.

Parameters

- **hlptim:** LPTIM handle

Return values

- **Autoreload:** value.

HAL_LPTIM_ReadCapturedValue

Function name

uint32_t HAL_LPTIM_ReadCapturedValue (const LPTIM_HandleTypeDef * hlptim, uint32_t Channel)

Function description

Return the current Compare (Pulse) value.

Parameters

- **hlptim:** LPTIM handle
- **Channel:** LPTIM Channel to be selected This parameter can be one of the following values:
  - LPTIM_CHANNEL_1: LPTIM Channel 1 selected
  - LPTIM_CHANNEL_2: LPTIM Channel 2 selected
  - LPTIM_CHANNEL_3: LPTIM Channel 3 selected
  - LPTIM_CHANNEL_4: LPTIM Channel 4 selected

Return values

- **Compare:** value.

HAL_LPTIM_IC_GetOffset

Function name

uint8_t HAL_LPTIM_IC_GetOffset (const LPTIM_HandleTypeDef * hlptim, uint32_t Channel)

Function description

LPTimer Input Capture Get Offset(in counter step unit)

Parameters

- **hlptim:** pointer to a LPTIM_HandleTypeDef structure that contains the configuration information for LPTIM module.
- **Channel:** This parameter can be one of the following values:
  - LPTIM_CHANNEL_1: LPTIM Channel 1 selected
  - LPTIM_CHANNEL_2: LPTIM Channel 2 selected
  - LPTIM_CHANNEL_3: LPTIM Channel 3 selected
  - LPTIM_CHANNEL_4: LPTIM Channel 4 selected

Return values

- **The:** offset value

Notes

- The real capture value corresponding to the input capture trigger can be calculated using the formula hereafter : Real capture value = captured(LPTIM_CCRx) - offset The Offset value is depending on the glitch filter value for the channel and the value of the prescaler for the kernel clock. Please check Errata Sheet V1_8 for more details under "variable latency on input capture channel" section.

HAL_LPTIM_IRQHandler

Function name

void HAL_LPTIM_IRQHandler (LPTIM_HandleTypeDef * hlptim)

Function description

Handle LPTIM interrupt request.

Parameters

- **hlptim:** LPTIM handle

Return values

- **None:**

HAL_LPTIM_CompareMatchCallback

Function name

void HAL_LPTIM_CompareMatchCallback (LPTIM_HandleTypeDef * hlptim)

Function description

Compare match callback in non-blocking mode.

Parameters

- **hlptim:** LPTIM handle

Return values

- **None:**

HAL_LPTIM_AutoReloadMatchCallback

Function name

void HAL_LPTIM_AutoReloadMatchCallback (LPTIM_HandleTypeDef * hlptim)

Function description

Autoreload match callback in non-blocking mode.

Parameters

- **hlptim:** LPTIM handle

Return values

- **None:**

HAL_LPTIM_TriggerCallback

Function name

void HAL_LPTIM_TriggerCallback (LPTIM_HandleTypeDef * hlptim)

Function description

Trigger detected callback in non-blocking mode.

Parameters

- **hlptim:** LPTIM handle

Return values

- **None:**

HAL_LPTIM_CompareWriteCallback

Function name

void HAL_LPTIM_CompareWriteCallback (LPTIM_HandleTypeDef * hlptim)

Function description

Compare write callback in non-blocking mode.

Parameters

- **hlptim:** LPTIM handle

Return values

- **None:**

HAL_LPTIM_AutoReloadWriteCallback

Function name

void HAL_LPTIM_AutoReloadWriteCallback (LPTIM_HandleTypeDef * hlptim)

Function description

Autoreload write callback in non-blocking mode.

Parameters

- **hlptim:** LPTIM handle

Return values

- **None:**

HAL_LPTIM_DirectionUpCallback

Function name

void HAL_LPTIM_DirectionUpCallback (LPTIM_HandleTypeDef * hlptim)

Function description

Direction counter changed from Down to Up callback in non-blocking mode.

Parameters

- **hlptim:** LPTIM handle

Return values

- **None:**

HAL_LPTIM_DirectionDownCallback

Function name

void HAL_LPTIM_DirectionDownCallback (LPTIM_HandleTypeDef * hlptim)

Function description

Direction counter changed from Up to Down callback in non-blocking mode.

Parameters

- **hlptim:** LPTIM handle

Return values

- **None:**

HAL_LPTIM_ErrorCallback

Function name

void HAL_LPTIM_ErrorCallback (LPTIM_HandleTypeDef * hlptim)

Function description

Error callback in non-blocking mode.

Parameters

- **hlptim:** LPTIM handle

Return values

- **None:**

HAL_LPTIM_UpdateEventCallback

Function name

void HAL_LPTIM_UpdateEventCallback (LPTIM_HandleTypeDef * hlptim)

Function description

Repetition counter underflowed (or contains zero) and LPTIM counter overflowed callback in non-blocking mode.

Parameters

- **hlptim:** LPTIM handle

Return values

- **None:**

HAL_LPTIM_UpdateEventHalfCpltCallback

Function name

void HAL_LPTIM_UpdateEventHalfCpltCallback (LPTIM_HandleTypeDef * hlptim)

Function description

Update event half complete callback in non-blocking mode.

Parameters

- **hlptim:** LPTIM handle

Return values

- **None:**

HAL_LPTIM_RepCounterWriteCallback

Function name

void HAL_LPTIM_RepCounterWriteCallback (LPTIM_HandleTypeDef * hlptim)

Function description

Successful APB bus write to repetition counter register callback in non-blocking mode.

Parameters

- **hlptim:** LPTIM handle

Return values

- **None:**

HAL_LPTIM_IC_CaptureCallback

Function name

void HAL_LPTIM_IC_CaptureCallback (LPTIM_HandleTypeDef * hlptim)

Function description

Input Capture callback in non-blocking mode.

Parameters

- **hlptim:** LPTIM handle

Return values

- **None:**

HAL_LPTIM_IC_CaptureHalfCpltCallback

Function name

void HAL_LPTIM_IC_CaptureHalfCpltCallback (LPTIM_HandleTypeDef * hlptim)

Function description

Input Capture half complete callback in non-blocking mode.

Parameters

- **hlptim:** LPTIM IC handle

Return values

- **None:**

HAL_LPTIM_IC_OverCaptureCallback

Function name

void HAL_LPTIM_IC_OverCaptureCallback (LPTIM_HandleTypeDef * hlptim)

Function description

Over Capture callback in non-blocking mode.

Parameters

- **hlptim:** LPTIM handle

Return values

- **None:**

HAL_LPTIM_RegisterCallback

Function name

HAL_StatusTypeDef HAL_LPTIM_RegisterCallback (LPTIM_HandleTypeDef * hlptim, HAL_LPTIM_CallbackIDTypeDef CallbackID, pLPTIM_CallbackTypeDef pCallback)

Function description

Register a User LPTIM callback to be used instead of the weak predefined callback.

Parameters

- **hlptim:** LPTIM handle
- **CallbackID:** ID of the callback to be registered This parameter can be one of the following values:
  - HAL_LPTIM_MSPINIT_CB_ID LPTIM Base Msp Init Callback ID
  - HAL_LPTIM_MSPDEINIT_CB_ID LPTIM Base Msp DeInit Callback ID
  - HAL_LPTIM_COMPARE_MATCH_CB_ID Compare match Callback ID
  - HAL_LPTIM_AUTORELOAD_MATCH_CB_ID Auto-reload match Callback ID
  - HAL_LPTIM_TRIGGER_CB_ID External trigger event detection Callback ID
  - HAL_LPTIM_COMPARE_WRITE_CB_ID Compare register write complete Callback ID
  - HAL_LPTIM_AUTORELOAD_WRITE_CB_ID Auto-reload register write complete Callback ID
  - HAL_LPTIM_DIRECTION_UP_CB_ID Up-counting direction change Callback ID
  - HAL_LPTIM_DIRECTION_DOWN_CB_ID Down-counting direction change Callback ID
  - HAL_LPTIM_UPDATE_EVENT_CB_ID Update event detection Callback ID
  - HAL_LPTIM_REP_COUNTER_WRITE_CB_ID Repetition counter register write complete Callback ID
  - HAL_LPTIM_UPDATE_EVENT_HALF_CB_ID Update event Half detection Callback ID
  - HAL_LPTIM_ERROR_CB_ID Error Callback ID
  - HAL_LPTIM_IC_CAPTURE_CB_ID Input Capture Callback ID
  - HAL_LPTIM_IC_CAPTURE_HALF_CB_ID Input Capture half complete Callback ID
  - HAL_LPTIM_OVER_CAPTURE_CB_ID Over Capture Callback ID
- **pCallback:** pointer to the callback function

Return values

- **status:**

HAL_LPTIM_UnRegisterCallback

Function name

HAL_StatusTypeDef HAL_LPTIM_UnRegisterCallback (LPTIM_HandleTypeDef * hlptim, HAL_LPTIM_CallbackIDTypeDef CallbackID)

Function description

Unregister a LPTIM callback LLPTIM callback is redirected to the weak predefined callback.

Parameters

- **hlptim:** LPTIM handle
- **CallbackID:** ID of the callback to be unregistered This parameter can be one of the following values:
  - HAL_LPTIM_MSPINIT_CB_ID LPTIM Base Msp Init Callback ID
  - HAL_LPTIM_MSPDEINIT_CB_ID LPTIM Base Msp DeInit Callback ID
  - HAL_LPTIM_COMPARE_MATCH_CB_ID Compare match Callback ID
  - HAL_LPTIM_AUTORELOAD_MATCH_CB_ID Auto-reload match Callback ID
  - HAL_LPTIM_TRIGGER_CB_ID External trigger event detection Callback ID
  - HAL_LPTIM_COMPARE_WRITE_CB_ID Compare register write complete Callback ID
  - HAL_LPTIM_AUTORELOAD_WRITE_CB_ID Auto-reload register write complete Callback ID
  - HAL_LPTIM_DIRECTION_UP_CB_ID Up-counting direction change Callback ID
  - HAL_LPTIM_DIRECTION_DOWN_CB_ID Down-counting direction change Callback ID
  - HAL_LPTIM_UPDATE_EVENT_CB_ID Update event detection Callback ID
  - HAL_LPTIM_REP_COUNTER_WRITE_CB_ID Repetition counter register write complete Callback ID
  - HAL_LPTIM_UPDATE_EVENT_HALF_CB_ID Update event Half detection Callback ID
  - HAL_LPTIM_ERROR_CB_ID Error Callback ID
  - HAL_LPTIM_IC_CAPTURE_CB_ID Input Capture Callback ID
  - HAL_LPTIM_IC_CAPTURE_HALF_CB_ID Input Capture half complete Callback ID
  - HAL_LPTIM_OVER_CAPTURE_CB_ID Over Capture Callback ID

Return values

- **status:**

HAL_LPTIM_GetState

Function name

HAL_LPTIM_StateTypeDef HAL_LPTIM_GetState (const LPTIM_HandleTypeDef * hlptim)

Function description

Return the LPTIM handle state.

Parameters

- **hlptim:** LPTIM handle

Return values

- **HAL:** state

30.3 LPTIM Firmware driver defines

The following section lists the various define and macros of the module.

30.3.1 LPTIM

LPTIM

LPTIM Channel

LPTIM_CHANNEL_1

Capture/compare channel 1 identifier

LPTIM_CHANNEL_2

Capture/compare channel 2 identifier

LPTIM_CHANNEL_3

Capture/compare channel 1 identifier

LPTIM_CHANNEL_4

Capture/compare channel 2 identifier

LPTIM Clock Polarity

LPTIM_CLOCKPOLARITY_RISING

LPTIM_CLOCKPOLARITY_FALLING

LPTIM_CLOCKPOLARITY_RISING_FALLING

LPTIM Clock Prescaler

LPTIM_PRESCALER_DIV1

LPTIM_PRESCALER_DIV2

LPTIM_PRESCALER_DIV4

LPTIM_PRESCALER_DIV8

LPTIM_PRESCALER_DIV16

LPTIM_PRESCALER_DIV32

LPTIM_PRESCALER_DIV64

LPTIM_PRESCALER_DIV128

LPTIM Clock Sample Time

LPTIM_CLOCKSAMPLETIME_DIRECTTRANSITION

LPTIM_CLOCKSAMPLETIME_2TRANSITIONS

LPTIM_CLOCKSAMPLETIME_4TRANSITIONS

LPTIM_CLOCKSAMPLETIME_8TRANSITIONS

LPTIM Clock Source

LPTIM_CLOCKSOURCE_APBCLOCK_LPOSC

LPTIM_CLOCKSOURCE_ULPTIM

LPTIM Counter Source

LPTIM_COUNTERSOURCE_INTERNAL

LPTIM_COUNTERSOURCE_EXTERNAL

LPTIM DMA Handle Index

LPTIM_DMA_ID_UPDATE

Index of the DMA handle used for Update DMA requests

LPTIM_DMA_ID_CC1

Index of the DMA handle used for Capture/Update event 1 DMA request

LPTIM_DMA_ID_CC2

Index of the DMA handle used for Capture/Update event 2 DMA request

LPTIM_DMA_ID_CC3

Index of the DMA handle used for Capture/Update event 3 DMA request

LPTIM_DMA_ID_CC4

Index of the DMA handle used for Capture/Update event 4 DMA request

LPTIM DMA Sources

LPTIM_DMA_UPDATE

DMA request is triggered by the update event

LPTIM_DMA_CC1

DMA request is triggered by the capture 1 event

LPTIM_DMA_CC2

DMA request is triggered by the capture 2 event

LPTIM_DMA_CC3

DMA request is triggered by the capture 3 event

LPTIM_DMA_CC4

DMA request is triggered by the capture 4 event

LPTIM Exported Macros

__HAL_LPTIM_RESET_HANDLE_STATE

Description:

- Reset LPTIM handle state.

Parameters:

- __HANDLE__: LPTIM handle

Return value:

- None

__HAL_LPTIM_ENABLE

Description:

- Enable the LPTIM peripheral.

Parameters:

- __HANDLE__: LPTIM handle

Return value:

- None

__HAL_LPTIM_DISABLE

Description:

- Disable the LPTIM peripheral.

Parameters:

- __HANDLE__: LPTIM handle

Return value:

- None

__HAL_LPTIM_START_CONTINUOUS

Description:

- Start the LPTIM peripheral in Continuous mode.

Parameters:

- __HANDLE__: LPTIM handle

Return value:

- None

__HAL_LPTIM_START_SINGLE

Description:

- Start the LPTIM peripheral in single mode.

Parameters:

- __HANDLE__: LPTIM handle

Return value:

- None

__HAL_LPTIM_RESET_COUNTER

Description:

- Reset the LPTIM Counter register in synchronous mode.

Parameters:

- __HANDLE__: LPTIM handle

Return value:

- None

__HAL_LPTIM_RESET_COUNTER_AFTERREAD

Description:

- Reset after read of the LPTIM Counter register in asynchronous mode.

Parameters:

- __HANDLE__: LPTIM handle

Return value:

- None

__HAL_LPTIM_AUTORELOAD_SET

Description:

- Write the passed parameter in the Autoreload register.

Parameters:

- __HANDLE__: LPTIM handle
- __VALUE__: Autoreload value

Return value:

- None

Notes:

- The ARR register can only be modified when the LPTIM instance is enabled.

__HAL_LPTIM_COMPARE_SET

Description:

- Write the passed parameter in the Compare register.

Parameters:

- __HANDLE__: LPTIM handle
- __VALUE__: Compare value
- __CHANNEL__: TIM Channel to be configured

Return value:

- None

Notes:

- The CCRx registers can only be modified when the LPTIM instance is enabled.

__HAL_LPTIM_REPETITIONCOUNTER_SET

Description:

- Write the passed parameter in the Repetition register.

Parameters:

- __HANDLE__: LPTIM handle
- __VALUE__: Repetition value

Return value:

- None

__HAL_LPTIM_REPETITIONCOUNTER_GET

Description:

- Return the current Repetition value.

Parameters:

- __HANDLE__: LPTIM handle

Return value:

- Repetition: register value

Notes:

- The RCR register can only be modified when the LPTIM instance is enabled.

__HAL_LPTIM_CAPTURE_COMPARE_ENABLE

Description:

- Enable the LPTIM signal input/output on the corresponding pin.

Parameters:

- __HANDLE__: LPTIM handle
- __CHANNEL__: LPTIM Channels to be enabled. This parameter can be one of the following values:
  - LPTIM_CHANNEL_1: LPTIM Channel 1 selected
  - LPTIM_CHANNEL_2: LPTIM Channel 2 selected
  - LPTIM_CHANNEL_3: LPTIM Channel 3 selected
  - LPTIM_CHANNEL_4: LPTIM Channel 4 selected

Return value:

- None

__HAL_LPTIM_CAPTURE_COMPARE_DISABLE

Description:

- Disable the LPTIM signal input/output on the corresponding pin.

Parameters:

- __HANDLE__: LPTIM handle
- __CHANNEL__: LPTIM Channels to be disabled. This parameter can be one of the following values:
  - LPTIM_CHANNEL_1: LPTIM Channel 1 selected
  - LPTIM_CHANNEL_2: LPTIM Channel 2 selected
  - LPTIM_CHANNEL_3: LPTIM Channel 3 selected
  - LPTIM_CHANNEL_4: LPTIM Channel 4 selected

Return value:

- None

__HAL_LPTIM_GET_FLAG

Description:

- Check whether the specified LPTIM flag is set or not.

Parameters:

- __HANDLE__: LPTIM handle
- __FLAG__: LPTIM flag to check This parameter can be a value of:
  - LPTIM_FLAG_REPOK : Repetition register update OK Flag.
  - LPTIM_FLAG_UPDATE : Update event Flag.
  - LPTIM_FLAG_DOWN : Counter direction change up Flag.
  - LPTIM_FLAG_UP : Counter direction change down to up Flag.
  - LPTIM_FLAG_ARROK : Autoreload register update OK Flag.
  - LPTIM_FLAG_CMP1OK : Compare register 1 update OK Flag.
  - LPTIM_FLAG_CMP2OK : Compare register 2 update OK Flag.
  - LPTIM_FLAG_CMP3OK : Compare register 3 update OK Flag.
  - LPTIM_FLAG_CMP4OK : Compare register 4 update OK Flag.
  - LPTIM_FLAG_EXTTRIG : External trigger edge event Flag.
  - LPTIM_FLAG_ARRM : Autoreload match Flag.
  - LPTIM_FLAG_CC1 : Capture/Compare 1 interrupt flag.
  - LPTIM_FLAG_CC2 : Capture/Compare 2 interrupt flag.
  - LPTIM_FLAG_CC3 : Capture/Compare 3 interrupt flag.
  - LPTIM_FLAG_CC4 : Capture/Compare 4 interrupt flag.
  - LPTIM_FLAG_CC1O : Capture/Compare 1 over-capture flag.
  - LPTIM_FLAG_CC2O : Capture/Compare 2 over-capture flag.
  - LPTIM_FLAG_CC3O : Capture/Compare 3 over-capture flag.
  - LPTIM_FLAG_CC4O : Capture/Compare 4 over-capture flag.
  - LPTIM_FLAG_DIEROK : DMA & interrupt enable update OK flag.

Return value:

- The: state of the specified flag (SET or RESET).

__HAL_LPTIM_CLEAR_FLAG

Description:

- Clear the specified LPTIM flag.

Parameters:

- __HANDLE__: LPTIM handle.
- __FLAG__: LPTIM flag to clear. This parameter can be a value of:
  - LPTIM_FLAG_REPOK : Repetition register update OK Flag.
  - LPTIM_FLAG_UPDATE : Update event Flag.
  - LPTIM_FLAG_DOWN : Counter direction change up Flag.
  - LPTIM_FLAG_UP : Counter direction change down to up Flag.
  - LPTIM_FLAG_ARROK : Autoreload register update OK Flag.
  - LPTIM_FLAG_CMP1OK : Compare register 1 update OK Flag.
  - LPTIM_FLAG_CMP2OK : Compare register 2 update OK Flag.
  - LPTIM_FLAG_CMP3OK : Compare register 3 update OK Flag.
  - LPTIM_FLAG_CMP4OK : Compare register 4 update OK Flag.
  - LPTIM_FLAG_EXTTRIG : External trigger edge event Flag.
  - LPTIM_FLAG_ARRM : Autoreload match Flag.
  - LPTIM_FLAG_CC1 : Capture/Compare 1 interrupt flag.
  - LPTIM_FLAG_CC2 : Capture/Compare 2 interrupt flag.
  - LPTIM_FLAG_CC3 : Capture/Compare 3 interrupt flag.
  - LPTIM_FLAG_CC4 : Capture/Compare 4 interrupt flag.
  - LPTIM_FLAG_CC1O : Capture/Compare 1 over-capture flag.
  - LPTIM_FLAG_CC2O : Capture/Compare 2 over-capture flag.
  - LPTIM_FLAG_CC3O : Capture/Compare 3 over-capture flag.
  - LPTIM_FLAG_CC4O : Capture/Compare 4 over-capture flag.
  - LPTIM_FLAG_DIEROK : DMA & interrupt enable update OK flag.

Return value:

- None.

__HAL_LPTIM_ENABLE_IT

Description:

- Enable the specified LPTIM interrupt.

Parameters:

- __HANDLE__: LPTIM handle.
- __INTERRUPT__: LPTIM interrupt to set. This parameter can be a value of:
  - LPTIM_IT_REPOK : Repetition register update OK Interrupt.
  - LPTIM_IT_UPDATE : Update event register Interrupt.
  - LPTIM_IT_DOWN : Counter direction change up Interrupt.
  - LPTIM_IT_UP : Counter direction change down to up Interrupt.
  - LPTIM_IT_ARROK : Autoreload register update OK Interrupt.
  - LPTIM_IT_CMP1OK : Compare register 1 update OK Interrupt.
  - LPTIM_IT_CMP2OK : Compare register 2 update OK Interrupt.
  - LPTIM_IT_CMP3OK : Compare register 3 update OK Interrupt.
  - LPTIM_IT_CMP4OK : Compare register 4 update OK Interrupt.
  - LPTIM_IT_EXTTRIG : External trigger edge event Interrupt.
  - LPTIM_IT_ARRM : Autoreload match Interrupt.
  - LPTIM_IT_CC1 : Capture/Compare 1 interrupt Interrupt.
  - LPTIM_IT_CC2 : Capture/Compare 2 interrupt Interrupt.
  - LPTIM_IT_CC3 : Capture/Compare 3 interrupt Interrupt.
  - LPTIM_IT_CC4 : Capture/Compare 4 interrupt Interrupt.
  - LPTIM_IT_CC1O : Capture/Compare 1 over-capture Interrupt.
  - LPTIM_IT_CC2O : Capture/Compare 2 over-capture Interrupt.
  - LPTIM_IT_CC3O : Capture/Compare 3 over-capture Interrupt.
  - LPTIM_IT_CC4O : Capture/Compare 4 over-capture Interrupt.

Return value:

- None.

Notes:

- The LPTIM interrupts can only be enabled when the LPTIM instance is enabled.

__HAL_LPTIM_DISABLE_IT

Description:

- Disable the specified LPTIM interrupt.

Parameters:

- __HANDLE__: LPTIM handle.
- __INTERRUPT__: LPTIM interrupt to set. This parameter can be a value of:
  - LPTIM_IT_REPOK : Repetition register update OK Interrupt.
  - LPTIM_IT_UPDATE : Update event register Interrupt.
  - LPTIM_IT_DOWN : Counter direction change up Interrupt.
  - LPTIM_IT_UP : Counter direction change down to up Interrupt.
  - LPTIM_IT_ARROK : Autoreload register update OK Interrupt.
  - LPTIM_IT_CMP1OK : Compare register 1 update OK Interrupt.
  - LPTIM_IT_CMP2OK : Compare register 2 update OK Interrupt.
  - LPTIM_IT_CMP3OK : Compare register 3 update OK Interrupt.
  - LPTIM_IT_CMP4OK : Compare register 4 update OK Interrupt.
  - LPTIM_IT_EXTTRIG : External trigger edge event Interrupt.
  - LPTIM_IT_ARRM : Autoreload match Interrupt.
  - LPTIM_IT_CC1 : Capture/Compare 1 interrupt Interrupt.
  - LPTIM_IT_CC2 : Capture/Compare 2 interrupt Interrupt.
  - LPTIM_IT_CC3 : Capture/Compare 3 interrupt Interrupt.
  - LPTIM_IT_CC4 : Capture/Compare 4 interrupt Interrupt.
  - LPTIM_IT_CC1O : Capture/Compare 1 over-capture Interrupt.
  - LPTIM_IT_CC2O : Capture/Compare 2 over-capture Interrupt.
  - LPTIM_IT_CC3O : Capture/Compare 3 over-capture Interrupt.
  - LPTIM_IT_CC4O : Capture/Compare 4 over-capture Interrupt.

Return value:

- None.

Notes:

- The LPTIM interrupts can only be disabled when the LPTIM instance is enabled.

__HAL_LPTIM_ENABLE_DMA

Description:

- Enable the specified DMA request.

Parameters:

- __HANDLE__: specifies the TIM Handle.
- __DMA__: specifies the LPTIM DMA request to enable. This parameter can be one of the following values:
  - LPTIM_DMA_UPDATE: Update DMA request
  - LPTIM_DMA_CC1: Capture/Compare 1 DMA request
  - LPTIM_DMA_CC2: Capture/Compare 2 DMA request
  - LPTIM_DMA_CC3: Capture/Compare 3 DMA request
  - LPTIM_DMA_CC4: Capture/Compare 4 DMA request

Return value:

- None

__HAL_LPTIM_DISABLE_DMA

Description:

- Disable the specified DMA request.

Parameters:

- __HANDLE__: specifies the LPTIM Handle.
- __DMA__: specifies the LPTIM DMA request to disable. This parameter can be one of the following values:
  - LPTIM_DMA_UPDATE: Update DMA request
  - LPTIM_DMA_CC1: Capture/Compare 1 DMA request
  - LPTIM_DMA_CC2: Capture/Compare 2 DMA request
  - LPTIM_DMA_CC3: Capture/Compare 3 DMA request
  - LPTIM_DMA_CC4: Capture/Compare 4 DMA request

Return value:

- None

__HAL_LPTIM_GET_IT_SOURCE

Description:

- Check whether the specified LPTIM interrupt source is enabled or not.

Parameters:

- __HANDLE__: LPTIM handle.
- __INTERRUPT__: LPTIM interrupt to check. This parameter can be a value of:
  - LPTIM_IT_REPOK : Repetition register update OK Interrupt.
  - LPTIM_IT_UPDATE : Update event register Interrupt.
  - LPTIM_IT_DOWN : Counter direction change up Interrupt.
  - LPTIM_IT_UP : Counter direction change down to up Interrupt.
  - LPTIM_IT_ARROK : Autoreload register update OK Interrupt.
  - LPTIM_IT_CMP1OK : Compare register 1 update OK Interrupt.
  - LPTIM_IT_CMP2OK : Compare register 2 update OK Interrupt.
  - LPTIM_IT_CMP3OK : Compare register 3 update OK Interrupt.
  - LPTIM_IT_CMP4OK : Compare register 4 update OK Interrupt.
  - LPTIM_IT_EXTTRIG : External trigger edge event Interrupt.
  - LPTIM_IT_ARRM : Autoreload match Interrupt.
  - LPTIM_IT_CC1 : Capture/Compare 1 interrupt Interrupt.
  - LPTIM_IT_CC2 : Capture/Compare 2 interrupt Interrupt.
  - LPTIM_IT_CC3 : Capture/Compare 3 interrupt Interrupt.
  - LPTIM_IT_CC4 : Capture/Compare 4 interrupt Interrupt.
  - LPTIM_IT_CC1O : Capture/Compare 1 over-capture Interrupt.
  - LPTIM_IT_CC2O : Capture/Compare 2 over-capture Interrupt.
  - LPTIM_IT_CC3O : Capture/Compare 3 over-capture Interrupt.
  - LPTIM_IT_CC4O : Capture/Compare 4 over-capture Interrupt.

Return value:

- Interrupt: status.

LPTIM External Trigger Polarity

LPTIM_ACTIVEEDGE_RISING

LPTIM_ACTIVEEDGE_FALLING

LPTIM_ACTIVEEDGE_RISING_FALLING

LPTIM Flags Definition

LPTIM_FLAG_CC1O

LPTIM_FLAG_CC2O

LPTIM_FLAG_CC3O

LPTIM_FLAG_CC4O

LPTIM_FLAG_CC1

LPTIM_FLAG_CC2

LPTIM_FLAG_CC3

LPTIM_FLAG_CC4

LPTIM_FLAG_CMP1OK

LPTIM_FLAG_CMP2OK

LPTIM_FLAG_CMP3OK

LPTIM_FLAG_CMP4OK

LPTIM_FLAG_DIEROK

LPTIM_FLAG_REPOK

LPTIM_FLAG_UPDATE

LPTIM_FLAG_DOWN

LPTIM_FLAG_UP

LPTIM_FLAG_ARROK

LPTIM_FLAG_EXTTRIG

LPTIM_FLAG_ARRM

LPTIM Input1 Source

LPTIM_INPUT1SOURCE_GPIO

For LPTIM1, LPTIM2 and LPTIM3

LPTIM_INPUT1SOURCE_COMP1

For LPTIM1, LPTIM2 and LPTIM3

LPTIM_INPUT1SOURCE_COMP2

For LPTIM2

LPTIM_INPUT1SOURCE_COMP1_COMP2

For LPTIM2

LPTIM Input2 Source

LPTIM_INPUT2SOURCE_GPIO

For LPTIM1 and LPTIM3

LPTIM_INPUT2SOURCE_COMP2

For LPTIM1 and LPTIM3

LPTIM Input Capture Filter

LPTIM_ICFLT_CLOCK_DIV1

any external input capture signal level change is considered as a valid transition

LPTIM_ICFLT_CLOCK_DIV2

external input capture signal level change must be stable for at least 2 clock periods before it is considered as valid transition

LPTIM_ICFLT_CLOCK_DIV4

external input capture signal level change must be stable for at least 4 clock periods before it is considered as valid transition

LPTIM_ICFLT_CLOCK_DIV8

external input capture signal level change must be stable for at least 8 clock periods before it is considered as valid transition

LPTIM Input Capture Polarity

LPTIM_ICPOLARITY_RISING

Capture/Compare input rising polarity

LPTIM_ICPOLARITY_FALLING

Capture/Compare input falling polarity

LPTIM_ICPOLARITY_RISING_FALLING

Capture/Compare input rising and falling polarities

LPTIM Input Capture Prescaler

LPTIM_ICPSC_DIV1

Capture performed each time an edge is detected on the capture input

LPTIM_ICPSC_DIV2

Capture performed once every 2 events

LPTIM_ICPSC_DIV4

Capture performed once every 4 events

LPTIM_ICPSC_DIV8

Capture performed once every 8 events

LPTIM Input Capture Source

LPTIM_IC1SOURCE_GPIO

For LPTIM1, LPTIM2 and LPTIM3

LPTIM_IC1SOURCE_COMP1

For LPTIM1, LPTIM2 and LPTIM3

LPTIM_IC1SOURCE_COMP2

For LPTIM1, LPTIM2 and LPTIM3

LPTIM_IC2SOURCE_GPIO

For LPTIM1, LPTIM2 and LPTIM3

LPTIM_IC2SOURCE_MCO1

For LPTIM1, LPTIM2 and LPTIM3

LPTIM_IC2SOURCE_MCO2

For LPTIM1, LPTIM2 and LPTIM3

LPTIM_IC3SOURCE_GPIO

For LPTIM1 and LPTIM3

LPTIM_IC3SOURCE_COMP1

For LPTIM1 and LPTIM3

LPTIM_IC3SOURCE_COMP2

For LPTIM1 and LPTIM3

LPTIM_IC4SOURCE_GPIO

For LPTIM1 and LPTIM3

LPTIM_IC4SOURCE_COMP1

For LPTIM1 and LPTIM3

LPTIM_IC4SOURCE_COMP2

For LPTIM1 and LPTIM3

LPTIM Interrupts Definition

LPTIM_IT_CC1O

LPTIM_IT_CC2O

LPTIM_IT_CC3O

LPTIM_IT_CC4O

LPTIM_IT_CC1

LPTIM_IT_CC2

LPTIM_IT_CC3

LPTIM_IT_CC4

LPTIM_IT_CMP1OK

LPTIM_IT_CMP2OK

LPTIM_IT_CMP3OK

LPTIM_IT_CMP4OK

LPTIM_IT_REPOK

LPTIM_IT_UPDATE

LPTIM_IT_DOWN

LPTIM_IT_UP

LPTIM_IT_ARROK

LPTIM_IT_EXTTRIG

LPTIM_IT_ARRM

LPTIM Output Compare Polarity

LPTIM_OCPOLARITY_HIGH

Capture/Compare output polarity

LPTIM_OCPOLARITY_LOW

Capture/Compare output polarity

LPTIM Trigger Sample Time

LPTIM_TRIGSAMPLETIME_DIRECTTRANSITION

LPTIM_TRIGSAMPLETIME_2TRANSITIONS

LPTIM_TRIGSAMPLETIME_4TRANSITIONS

LPTIM_TRIGSAMPLETIME_8TRANSITIONS

LPTIM Trigger Source

LPTIM_TRIGSOURCE_SOFTWARE

LPTIM_TRIGSOURCE_0

LPTIM_TRIGSOURCE_1

LPTIM_TRIGSOURCE_2

LPTIM_TRIGSOURCE_3

LPTIM_TRIGSOURCE_4

LPTIM_TRIGSOURCE_5

LPTIM_TRIGSOURCE_6

LPTIM_TRIGSOURCE_7

LPTIM Updating Mode

LPTIM_UPDATE_IMMEDIATE

LPTIM_UPDATE_ENDOFPERIOD

31 HAL OPAMP Generic Driver

31.1 OPAMP Firmware driver registers structures

31.1.1 OPAMP_InitTypeDef

OPAMP_InitTypeDef is defined in the stm32u0xx_hal_opamp.h

Data Fields

- ***uint32_t PowerSupplyRange***
- ***uint32_t PowerMode***
- ***uint32_t Mode***
- ***uint32_t InvertingInput***
- ***uint32_t NonInvertingInput***
- ***uint32_t PgaGain***
- ***uint32_t UserTrimming***
- ***uint32_t TrimmingValueP***
- ***uint32_t TrimmingValueN***
- ***uint32_t TrimmingValuePLowPower***
- ***uint32_t TrimmingValueNLowPower***

Field Documentation

- ***uint32_t OPAMP_InitTypeDef::PowerSupplyRange***
  Specifies the power supply range: above or under 2.4V. This parameter is not used, but kept for compatibility with other families. Caution: Whatever this parameter, the effective PowerSupplyRange is forced to OPAMP_POWERSUPPLY_HIGH in HAL_OPAMP_Init. This parameter applies to the both OPAMP instances.
- ***uint32_t OPAMP_InitTypeDef::PowerMode***
  Specifies the power mode Normal or Low-Power and the speed mode Normal or High. This parameter must be a value of ***OPAMP_PowerMode***
- ***uint32_t OPAMP_InitTypeDef::Mode***
  Specifies the OPAMP mode (Standalone, Follower or PGA) This parameter must be a value of ***OPAMP_Mode***
- ***uint32_t OPAMP_InitTypeDef::InvertingInput***
  Specifies the inverting input in Standalone & PGA modes. In Follower mode this parameter is Not Applicable. This parameter must be a value of ***OPAMP_InvertingInput***
- ***uint32_t OPAMP_InitTypeDef::NonInvertingInput***
  Specifies the non inverting input of the opamp. This parameter must be a value of ***OPAMP_NonInvertingInput***
- ***uint32_t OPAMP_InitTypeDef::PgaGain***
  Specifies the gain (2, 4, 8 or 16) in PGA mode i.e. when mode is OPAMP_PGA_MODE. This parameter must be a value of ***OPAMP_PgaGain***
- ***uint32_t OPAMP_InitTypeDef::UserTrimming***
  Specifies the trimming mode is either factory or user trimming This parameter must be a value of ***OPAMP_UserTrimming***.
- ***uint32_t OPAMP_InitTypeDef::TrimmingValueP***
  Specifies the offset trimming value (PMOS) i.e. when UserTrimming is OPAMP_TRIMMING_USER. This parameter must be a number between Min_Data = 0 and Max_Data = 31 16 is typical default value
- ***uint32_t OPAMP_InitTypeDef::TrimmingValueN***
  Specifies the offset trimming value (NMOS) i.e. when UserTrimming is OPAMP_TRIMMING_USER. This parameter must be a number between Min_Data = 0 and Max_Data = 31 16 is typical default value
- ***uint32_t OPAMP_InitTypeDef::TrimmingValuePLowPower***
  Specifies the offset trimming value (PMOS) in lowpower mode i.e. when UserTrimming is OPAMP_TRIMMING_USER. This parameter must be a number between Min_Data = 0 and Max_Data = 31 16 is typical default value

- ***uint32_t OPAMP_InitTypeDef::TrimmingValueNLowPower***
  Specifies the offset trimming value (NMOS) in lowpower mode i.e. when UserTrimming is OPAMP_TRIMMING_USER. This parameter must be a number between Min_Data = 0 and Max_Data = 31
  16 is typical default value

31.1.2 __OPAMP_HandleTypeDef

__OPAMP_HandleTypeDef is defined in the stm32u0xx_hal_opamp.h

Data Fields

- ***OPAMP_TypeDef * Instance***
- ***OPAMP_InitTypeDef Init***
- ***HAL_StatusTypeDef Status***
- ***HAL_LockTypeDef Lock***
- ***__IO HAL_OPAMP_StateTypeDef State***
- ***void(* MspInitCallback***
- ***void(* MspDeInitCallback***

Field Documentation

- ***OPAMP_TypeDef* __OPAMP_HandleTypeDef::Instance***
  OPAMP instance's registers base address
- ***OPAMP_InitTypeDef __OPAMP_HandleTypeDef::Init***
  OPAMP required parameters
- ***HAL_StatusTypeDef __OPAMP_HandleTypeDef::Status***
  OPAMP peripheral status
- ***HAL_LockTypeDef __OPAMP_HandleTypeDef::Lock***
  Locking object
- ***__IO HAL_OPAMP_StateTypeDef __OPAMP_HandleTypeDef::State***
  OPAMP communication state
- ***void(* __OPAMP_HandleTypeDef::MspInitCallback)(struct __OPAMP_HandleTypeDef *hopamp)***
- ***void(* __OPAMP_HandleTypeDef::MspDeInitCallback)(struct __OPAMP_HandleTypeDef *hopamp)***

31.2 OPAMP Firmware driver API description

The following section lists the various functions of the OPAMP library.

31.2.1 OPAMP Peripheral Features

The device integrates 1 or 2 operational amplifiers OPAMP1 & OPAMP2

1. The OPAMP(s) provide(s) several exclusive running modes.
   – Standalone mode
   – Programmable Gain Amplifier (PGA) mode (Resistor feedback output)
   – Follower mode
2. Each OPAMP(s) can be configured in normal and low power mode with different speeds.
3. The OPAMP(s) provide(s) calibration capabilities.
   – Calibration aims at correcting some offset for running mode.
   – The OPAMP uses either factory calibration settings OR user defined calibration (trimming) settings (i.e. trimming mode).
   – The user defined settings can be figured out using self calibration handled by HAL_OPAMP_SelfCalibrate, HAL_OPAMPEx_SelfCalibrateAll
   – HAL_OPAMP_SelfCalibrate:
     ◦ Runs automatically the calibration.
     ◦ Enables the user trimming mode
     ◦ Updates the init structure with trimming values with fresh calibration results. The user may store the calibration results for larger (ex monitoring the trimming as a function of temperature for instance)
     ◦ HAL_OPAMPEx_SelfCalibrateAll runs calibration of all OPAMPs in parallel to save search time.

4. Running mode: Standalone mode
   – Gain is set externally (gain depends on external loads).
   – Follower mode also possible externally by connecting the inverting input to the output.
5. Running mode: Follower mode
   – No Inverting Input is connected.
6. Running mode: Programmable Gain Amplifier (PGA) mode (Resistor feedback output)
   – The OPAMP(s) output(s) can be internally connected to resistor feedback output.
   – OPAMP gain is either 2, 4, 8 or 16.
7. The OPAMPs inverting input can be selected according to the Reference Manual "OPAMP function description" chapter.
8. The OPAMPs non inverting input can be selected according to the Reference Manual "OPAMP function description" chapter.

31.2.2 How to use this driver

Speed & power mode

To run in low power mode with different speed:

1. Configure the OPAMP using HAL_OPAMP_Init() function:
   – Select OPAMP_POWERMODE_LOWPOWER_NORMALSPEED
   – Select OPAMP_POWERMODE_LOWPOWER_HIGHSPEED
   – Select OPAMP_POWERMODE_NORMALPOWER_NORMALSPEED
   – Select OPAMP_POWERMODE_NORMALPOWER_HIGHSPEED

Calibration

To run the OPAMP calibration self calibration:

1. Start calibration using HAL_OPAMP_SelfCalibrate. Store the calibration results.

Running mode

To use the OPAMP, perform the following steps:

1. Fill in the HAL_OPAMP_MspInit() to
   – Enable the OPAMP Peripheral clock using macro __HAL_RCC_OPAMP_CLK_ENABLE()
   – Configure the OPAMP input and output in analog mode using HAL_GPIO_Init() to map the OPAMP output to the GPIO pin.
2. Registrate Callbacks
   – The compilation define USE_HAL_OPAMP_REGISTER_CALLBACKS when set to 1 allows the user to configure dynamically the driver callbacks.
   – Use Functions @ref HAL_OPAMP_RegisterCallback() to register a user callback, it allows to register following callbacks:
     ◦ MspInitCallback : OPAMP MspInit.
     ◦ MspDeInitCallback : OPAMP MspFeInit. This function takes as parameters the HAL peripheral handle, the Callback ID and a pointer to the user callback function.
   – Use function @ref HAL_OPAMP_UnRegisterCallback() to reset a callback to the default weak (overridden) function. It allows to reset following callbacks:
     ◦ MspInitCallback : OPAMP MspInit.
     ◦ MspDeInitCallback : OPAMP MspdeInit.
     ◦ All Callbacks

3. Configure the OPAMP using HAL_OPAMP_Init() function:
   – Select the mode
   – Select the inverting input
   – Select the non-inverting input
   – If PGA mode is enabled, Select if inverting input is connected.
   – Select either factory or user defined trimming mode.
   – If the user-defined trimming mode is enabled, select PMOS & NMOS trimming values (typically values set by HAL_OPAMP_SelfCalibrate function).
4. Enable the OPAMP using HAL_OPAMP_Start() function.
5. Disable the OPAMP using HAL_OPAMP_Stop() function.
6. Lock the OPAMP in running mode using HAL_OPAMP_Lock() function. Caution: On STM32U0, HAL OPAMP lock is software lock only (not hardware lock as on some other STM32 devices)
7. If needed, unlock the OPAMP using HAL_OPAMPEx_Unlock() function.

Running mode: change of configuration during OPAMP ON

To Re-configure OPAMP when OPAMP is ON (change on the fly)

1. If needed, fill in the HAL_OPAMP_MspInit()
   – This is the case for instance if you wish to use new OPAMP I/O
2. Configure the OPAMP using HAL_OPAMP_Init() function:
   – As in configure case, select first the parameters you wish to modify.
3. Change from low power mode to normal power mode (& vice versa) requires first HAL_OPAMP_DeInit() (force OPAMP OFF) and then HAL_OPAMP_Init(). In other words, of OPAMP is ON, HAL_OPAMP_Init can NOT change power mode alone.

31.2.3 Initialization and de-initialization functions

This section contains the following APIs:

- ***HAL_OPAMP_Init()***
- ***HAL_OPAMP_DeInit()***
- ***HAL_OPAMP_MspInit()***
- ***HAL_OPAMP_MspDeInit()***

31.2.4 IO operation functions

This subsection provides a set of functions allowing to manage the OPAMP start, stop and calibration actions.

This section contains the following APIs:

- ***HAL_OPAMP_Start()***
- ***HAL_OPAMP_Stop()***
- ***HAL_OPAMP_SelfCalibrate()***

31.2.5 Peripheral Control functions

This subsection provides a set of functions allowing to control the OPAMP data transfers.

This section contains the following APIs:

- ***HAL_OPAMP_Lock()***
- ***HAL_OPAMP_GetTrimOffset()***

31.2.6 Peripheral State functions

This subsection permits to get in run-time the status of the peripheral.

This section contains the following APIs:

- ***HAL_OPAMP_GetState()***

31.2.7 Peripheral Callback functions

This subsection permits to get in run-time the status of the peripheral.

This section contains the following APIs:

- *HAL_OPAMP_RegisterCallback()*
- *HAL_OPAMP_UnRegisterCallback()*

31.2.8 Detailed description of functions

HAL_OPAMP_Init

Function name

HAL_StatusTypeDef HAL_OPAMP_Init (OPAMP_HandleTypeDef * hopamp)

Function description

Initializes the OPAMP according to the specified parameters in the OPAMP_InitTypeDef and initialize the associated handle.

Parameters

- **hopamp:** OPAMP handle

Return values

- **HAL:** status

Notes

- If the selected opamp is locked, initialization can't be performed. To unlock the configuration, perform a system reset.

HAL_OPAMP_DeInit

Function name

HAL_StatusTypeDef HAL_OPAMP_DeInit (OPAMP_HandleTypeDef * hopamp)

Function description

DeInitialize the OPAMP peripheral.

Parameters

- **hopamp:** OPAMP handle

Return values

- **HAL:** status

HAL_OPAMP_MspInit

Function name

void HAL_OPAMP_MspInit (OPAMP_HandleTypeDef * hopamp)

Function description

Initialize the OPAMP MSP.

Parameters

- **hopamp:** OPAMP handle

Return values

- **None:**

HAL_OPAMP_MspDeInit

Function name

void HAL_OPAMP_MspDeInit (OPAMP_HandleTypeDef * hopamp)

Function description

DeInitialize OPAMP MSP.

Parameters

- **hopamp:** OPAMP handle

Return values

- **None:**

HAL_OPAMP_Start

Function name

HAL_StatusTypeDef HAL_OPAMP_Start (OPAMP_HandleTypeDef * hopamp)

Function description

Start the OPAMP.

Parameters

- **hopamp:** OPAMP handle

Return values

- **HAL:** status

HAL_OPAMP_Stop

Function name

HAL_StatusTypeDef HAL_OPAMP_Stop (OPAMP_HandleTypeDef * hopamp)

Function description

Stop the OPAMP.

Parameters

- **hopamp:** OPAMP handle

Return values

- **HAL:** status

HAL_OPAMP_SelfCalibrate

Function name

HAL_StatusTypeDef HAL_OPAMP_SelfCalibrate (OPAMP_HandleTypeDef * hopamp)

Function description

Run the self calibration of one OPAMP.

Parameters

- **hopamp:** handle

Return values

- **Updated:** offset trimming values (PMOS & NMOS), user trimming is enabled
- **HAL:** status

Notes

- Calibration is performed in the mode specified in OPAMP init structure (mode normal or low-power). To perform calibration for both modes, repeat this function twice after OPAMP init structure accordingly updated.
- Calibration runs about 10 ms.

HAL_OPAMP_Lock

Function name

HAL_StatusTypeDef HAL_OPAMP_Lock (OPAMP_HandleTypeDef * hopamp)

Function description

Lock the selected OPAMP configuration.

Parameters

- **hopamp:** OPAMP handle

Return values

- **HAL:** status

HAL_OPAMP_GetTrimOffset

Function name

HAL_OPAMP_TrimmingValueTypeDef HAL_OPAMP_GetTrimOffset (const OPAMP_HandleTypeDef * hopamp, uint32_t trimmingoffset)

Function description

Return the OPAMP factory trimming value.

Parameters

- **hopamp:** : OPAMP handle
- **trimmingoffset:** : Trimming offset (P or N) This parameter must be a value of OPAMP Factory Trimming

Return values

- **Trimming:** value (P or N): range: 0->31 or OPAMP_FACTORYTRIMMING_DUMMY if trimming value is not available

Notes

- Calibration parameter retrieved is corresponding to the mode specified in OPAMP init structure (mode normal or low-power). To retrieve calibration parameters for both modes, repeat this function after OPAMP init structure accordingly updated.

HAL_OPAMP_GetState

Function name

HAL_OPAMP_StateTypeDef HAL_OPAMP_GetState (const OPAMP_HandleTypeDef * hopamp)

Function description

Return the OPAMP handle state.

Parameters

- **hopamp:** : OPAMP handle

Return values

- **HAL:** state

HAL_OPAMP_RegisterCallback

Function name

HAL_StatusTypeDef HAL_OPAMP_RegisterCallback (OPAMP_HandleTypeDef * hopamp, HAL_OPAMP_CallbackIDTypeDef CallbackID, pOPAMP_CallbackTypeDef pCallback)

Function description

Register a User OPAMP Callback To be used instead of the weak (overridden) predefined callback.

Parameters

- **hopamp:** : OPAMP handle
- **CallbackID:** : ID of the callback to be registered This parameter can be one of the following values:
  - HAL_OPAMP_MSP_INIT_CB_ID OPAMP MspInit callback ID
  - HAL_OPAMP_MSP_DEINIT_CB_ID OPAMP MspDeInit callback ID
- **pCallback:** : pointer to the Callback function

Return values

- **status:**

HAL_OPAMP_UnRegisterCallback

Function name

HAL_StatusTypeDef HAL_OPAMP_UnRegisterCallback (OPAMP_HandleTypeDef * hopamp, HAL_OPAMP_CallbackIDTypeDef CallbackID)

Function description

Unregister a User OPAMP Callback OPAMP Callback is redirected to the weak (overridden) predefined callback.

Parameters

- **hopamp:** : OPAMP handle
- **CallbackID:** : ID of the callback to be unregistered This parameter can be one of the following values:
  - HAL_OPAMP_MSP_INIT_CB_ID OPAMP MSP Init Callback ID
  - HAL_OPAMP_MSP_DEINIT_CB_ID OPAMP MSP DeInit Callback ID
  - HAL_OPAMP_ALL_CB_ID OPAMP All Callbacks

Return values

- **status:**

31.3 OPAMP Firmware driver defines

The following section lists the various define and macros of the module.

31.3.1 OPAMP

OPAMP

OPAMP Exported Macros

__HAL_OPAMP_RESET_HANDLE_STATE

Description:

- Reset OPAMP handle state.

Parameters:

- __HANDLE__: OPAMP handle.

Return value:

- None

OPAMP Factory Trimming

OPAMP_FACTORYTRIMMING_DUMMY

Dummy value if trimming value could not be retrieved

OPAMP_FACTORYTRIMMING_N

Offset trimming N

OPAMP_FACTORYTRIMMING_P

Offset trimming P

OPAMP Inverting Input

OPAMP_INVERTINGINPUT_IO0

OPAMP inverting input connected to dedicated IO pin low-leakage

OPAMP_INVERTINGINPUT_CONNECT_NO

OPAMP inverting input not connected externally (PGA mode only)

OPAMP Mode

OPAMP_STANDALONE_MODE

standalone mode

OPAMP_PGA_MODE

PGA mode

OPAMP_FOLLOWER_MODE

follower mode

OPAMP Non Inverting Input

OPAMP_NONINVERTINGINPUT_IO0

OPAMP non-inverting input connected to dedicated IO pin

OPAMP_NONINVERTINGINPUT_DAC_CH

OPAMP non-inverting input connected internally to DAC channel

OPAMP Pga Gain

OPAMP_PGA_GAIN_2

PGA gain = 2

OPAMP_PGA_GAIN_4

PGA gain = 4

OPAMP_PGA_GAIN_8

PGA gain = 8

OPAMP_PGA_GAIN_16

PGA gain = 16

OPAMP PowerMode

OPAMP_POWERMODE_NORMALPOWER_NORMALSPEED

OPAMP power mode normal speed normal

OPAMP_POWERMODE_LOWPOWER_NORMALSPEED

OPAMP power mode low-power speed normal

OPAMP PowerSupplyRange

OPAMP_POWERSUPPLY_LOW

Power supply range low (VDDA lower than 2.4V)

OPAMP_POWERSUPPLY_HIGH

Power supply range high (VDDA higher than 2.4V)

OPAMP User Trimming

OPAMP_TRIMMING_FACTORY

Factory trimming

OPAMP_TRIMMING_USER

User trimming

32 HAL OPAMP Extension Driver

32.1 OPAMPEx Firmware driver API description

The following section lists the various functions of the OPAMPEx library.

32.1.1 Initialization and de-initialization functions

This section contains the following APIs:

- *Section 32.1.6: HAL_OPAMP_Init()*
- *Section 32.1.6: HAL_OPAMP_DeInit()*
- *Section 32.1.6: HAL_OPAMP_MspInit()*
- *Section 32.1.6: HAL_OPAMP_MspDeInit()*

32.1.2 IO operation functions

This subsection provides a set of functions allowing to manage the OPAMP start, stop and calibration actions.
This section contains the following APIs:

- *Section 32.1.6: HAL_OPAMP_Start()*
- *Section 32.1.6: HAL_OPAMP_Stop()*
- *Section 32.1.6: HAL_OPAMP_SelfCalibrate()*

32.1.3 Peripheral Control functions

This subsection provides a set of functions allowing to control the OPAMP data transfers.
This section contains the following APIs:

- *Section 32.1.6: HAL_OPAMP_Lock()*
- *Section 32.1.6: HAL_OPAMP_GetTrimOffset()*

32.1.4 Peripheral State functions

This subsection permits to get in run-time the status of the peripheral.
This section contains the following APIs:

- *Section 32.1.6: HAL_OPAMP_GetState()*

32.1.5 Peripheral Callback functions

This subsection permits to get in run-time the status of the peripheral.
This section contains the following APIs:

- *Section 32.1.6: HAL_OPAMP_RegisterCallback()*
- *Section 32.1.6: HAL_OPAMP_UnRegisterCallback()*

32.1.6 Detailed description of functions

HAL_OPAMPEx_Unlock

Function name

HAL_StatusTypeDef HAL_OPAMPEx_Unlock (OPAMP_HandleTypeDef * hopamp)

Function description

Unlock the selected OPAMP configuration.

Parameters

- **hopamp:** OPAMP handle

Return values

- **HAL:** status

Notes

- This function must be called only when OPAMP is in state "locked".

33 HAL PCD Generic Driver

33.1 PCD Firmware driver registers structures

33.1.1 __PCD_HandleTypeDef

__PCD_HandleTypeDef is defined in the stm32u0xx_hal_pcd.h

Data Fields

- ***PCD_TypeDef * Instance***
- ***PCD_InitTypeDef Init***
- ***__IO uint8_t USB_Address***
- ***PCD_EPTypeDef IN_ep***
- ***PCD_EPTypeDef OUT_ep***
- ***HAL_LockTypeDef Lock***
- ***__IO PCD_StateTypeDef State***
- ***__IO uint32_t ErrorCode***
- ***uint32_t Setup***
- ***PCD_LPM_StateTypeDef LPM_State***
- ***uint32_t BESL***
- ***uint32_t lpm_active***
- ***uint32_t battery_charging_active***
- ***void * pData***
- ***void(* SOFCallback***
- ***void(* SetupStageCallback***
- ***void(* ResetCallback***
- ***void(* SuspendCallback***
- ***void(* ResumeCallback***
- ***void(* ConnectCallback***
- ***void(* DisconnectCallback***
- ***void(* DataOutStageCallback***
- ***void(* DataInStageCallback***
- ***void(* ISOOUTIncompleteCallback***
- ***void(* ISOINIncompleteCallback***
- ***void(* BCDCallback***
- ***void(* LPMCallback***
- ***void(* MspInitCallback***
- ***void(* MspDeInitCallback***

Field Documentation

- ***PCD_TypeDef* __PCD_HandleTypeDef::Instance***
  Register base address
- ***PCD_InitTypeDef __PCD_HandleTypeDef::Init***
  PCD required parameters
- ***__IO uint8_t __PCD_HandleTypeDef::USB_Address***
  USB Address
- ***PCD_EPTypeDef __PCD_HandleTypeDef::IN_ep[8]***
  IN endpoint parameters
- ***PCD_EPTypeDef __PCD_HandleTypeDef::OUT_ep[8]***
  OUT endpoint parameters
- ***HAL_LockTypeDef __PCD_HandleTypeDef::Lock***
  PCD peripheral status

- ***__IO PCD_StateTypeDef __PCD_HandleTypeDef::State***
  PCD communication state
- ***__IO uint32_t __PCD_HandleTypeDef::ErrorCode***
  PCD Error code
- ***uint32_t __PCD_HandleTypeDef::Setup[12]***
  Setup packet buffer
- ***PCD_LPM_StateTypeDef __PCD_HandleTypeDef::LPM_State***
  LPM State
- ***uint32_t __PCD_HandleTypeDef::BESL***
- ***uint32_t __PCD_HandleTypeDef::lpm_active***
  Enable or disable the Link Power Management . This parameter can be set to ENABLE or DISABLE
- ***uint32_t __PCD_HandleTypeDef::battery_charging_active***
  Enable or disable Battery charging. This parameter can be set to ENABLE or DISABLE
- ***void* __PCD_HandleTypeDef::pData***
  Pointer to upper stack Handler
- ***void(* __PCD_HandleTypeDef::SOFCallback)(struct __PCD_HandleTypeDef *hpcd)***
  USB OTG PCD SOF callback
- ***void(* __PCD_HandleTypeDef::SetupStageCallback)(struct __PCD_HandleTypeDef *hpcd)***
  USB OTG PCD Setup Stage callback
- ***void(* __PCD_HandleTypeDef::ResetCallback)(struct __PCD_HandleTypeDef *hpcd)***
  USB OTG PCD Reset callback
- ***void(* __PCD_HandleTypeDef::SuspendCallback)(struct __PCD_HandleTypeDef *hpcd)***
  USB OTG PCD Suspend callback
- ***void(* __PCD_HandleTypeDef::ResumeCallback)(struct __PCD_HandleTypeDef *hpcd)***
  USB OTG PCD Resume callback
- ***void(* __PCD_HandleTypeDef::ConnectCallback)(struct __PCD_HandleTypeDef *hpcd)***
  USB OTG PCD Connect callback
- ***void(* __PCD_HandleTypeDef::DisconnectCallback)(struct __PCD_HandleTypeDef *hpcd)***
  USB OTG PCD Disconnect callback
- ***void(* __PCD_HandleTypeDef::DataOutStageCallback)(struct __PCD_HandleTypeDef *hpcd, uint8_t epnum)***
  USB OTG PCD Data OUT Stage callback
- ***void(* __PCD_HandleTypeDef::DataInStageCallback)(struct __PCD_HandleTypeDef *hpcd, uint8_t epnum)***
  USB OTG PCD Data IN Stage callback
- ***void(* __PCD_HandleTypeDef::ISOOUTIncompleteCallback)(struct __PCD_HandleTypeDef *hpcd, uint8_t epnum)***
  USB OTG PCD ISO OUT Incomplete callback
- ***void(* __PCD_HandleTypeDef::ISOINIncompleteCallback)(struct __PCD_HandleTypeDef *hpcd, uint8_t epnum)***
  USB OTG PCD ISO IN Incomplete callback
- ***void(* __PCD_HandleTypeDef::BCDCallback)(struct __PCD_HandleTypeDef *hpcd, PCD_BCD_MsgTypeDef msg)***
  USB OTG PCD BCD callback
- ***void(* __PCD_HandleTypeDef::LPMCallback)(struct __PCD_HandleTypeDef *hpcd, PCD_LPM_MsgTypeDef msg)***
  USB OTG PCD LPM callback
- ***void(* __PCD_HandleTypeDef::MspInitCallback)(struct __PCD_HandleTypeDef *hpcd)***
  USB OTG PCD Msp Init callback
- ***void(* __PCD_HandleTypeDef::MspDeInitCallback)(struct __PCD_HandleTypeDef *hpcd)***
  USB OTG PCD Msp DeInit callback

33.2 PCD Firmware driver API description

The following section lists the various functions of the PCD library.

33.2.1 How to use this driver

The PCD HAL driver can be used as follows:

1. Declare a PCD_HandleTypeDef handle structure, for example: PCD_HandleTypeDef hpcd;
2. Fill parameters of Init structure in HCD handle
3. Call HAL_PCD_Init() API to initialize the PCD peripheral (Core, Device core, ...)
4. Initialize the PCD low level resources through the HAL_PCD_MspInit() API:
   a. Enable the PCD/USB Low Level interface clock using
      ◦ __HAL_RCC_USB_CLK_ENABLE(); For USB Device FS peripheral
   b. Initialize the related GPIO clocks
   c. Configure PCD pin-out
   d. Configure PCD NVIC interrupt
5. Associate the Upper USB device stack to the HAL PCD Driver:
   a. hpcd.pData = pdev;
6. Enable PCD transmission and reception:
   a. HAL_PCD_Start();

33.2.2 Initialization and de-initialization functions

This section provides functions allowing to:

This section contains the following APIs:

- ***HAL_PCD_Init()***
- ***HAL_PCD_DeInit()***
- ***HAL_PCD_MspInit()***
- ***HAL_PCD_MspDeInit()***
- ***HAL_PCD_RegisterCallback()***
- ***HAL_PCD_UnRegisterCallback()***
- ***HAL_PCD_RegisterDataOutStageCallback()***
- ***HAL_PCD_UnRegisterDataOutStageCallback()***
- ***HAL_PCD_RegisterDataInStageCallback()***
- ***HAL_PCD_UnRegisterDataInStageCallback()***
- ***HAL_PCD_RegisterIsoOutIncpltCallback()***
- ***HAL_PCD_UnRegisterIsoOutIncpltCallback()***
- ***HAL_PCD_RegisterIsoInIncpltCallback()***
- ***HAL_PCD_UnRegisterIsoInIncpltCallback()***
- ***HAL_PCD_RegisterBcdCallback()***
- ***HAL_PCD_UnRegisterBcdCallback()***
- ***HAL_PCD_RegisterLpmCallback()***
- ***HAL_PCD_UnRegisterLpmCallback()***

33.2.3 IO operation functions

This subsection provides a set of functions allowing to manage the PCD data transfers.

This section contains the following APIs:

- ***HAL_PCD_Start()***
- ***HAL_PCD_Stop()***
- ***HAL_PCD_IRQHandler()***
- ***HAL_PCD_DataOutStageCallback()***
- ***HAL_PCD_DataInStageCallback()***
- ***HAL_PCD_SetupStageCallback()***
- ***HAL_PCD_SOFCallback()***
- ***HAL_PCD_ResetCallback()***

- *HAL_PCD_SuspendCallback()*
- *HAL_PCD_ResumeCallback()*
- *HAL_PCD_ISOOUTIncompleteCallback()*
- *HAL_PCD_ISOINIncompleteCallback()*
- *HAL_PCD_ConnectCallback()*
- *HAL_PCD_DisconnectCallback()*

33.2.4 Peripheral Control functions

This subsection provides a set of functions allowing to control the PCD data transfers.

This section contains the following APIs:

- *HAL_PCD_DevConnect()*
- *HAL_PCD_DevDisconnect()*
- *HAL_PCD_SetAddress()*
- *HAL_PCD_EP_Open()*
- *HAL_PCD_EP_Close()*
- *HAL_PCD_EP_Receive()*
- *HAL_PCD_EP_GetRxCount()*
- *HAL_PCD_EP_Transmit()*
- *HAL_PCD_EP_SetStall()*
- *HAL_PCD_EP_ClrStall()*
- *HAL_PCD_EP_Abort()*
- *HAL_PCD_EP_Flush()*
- *HAL_PCD_ActivateRemoteWakeup()*
- *HAL_PCD_DeActivateRemoteWakeup()*

33.2.5 Peripheral State functions

This subsection permits to get in run-time the status of the peripheral and the data flow.

This section contains the following APIs:

- *HAL_PCD_GetState()*

33.2.6 Detailed description of functions

HAL_PCD_Init

Function name

HAL_StatusTypeDef HAL_PCD_Init (PCD_HandleTypeDef * hpcd)

Function description

Initializes the PCD according to the specified parameters in the PCD_InitTypeDef and initialize the associated handle.

Parameters

- **hpcd:** PCD handle

Return values

- **HAL:** status

HAL_PCD_DeInit

Function name

HAL_StatusTypeDef HAL_PCD_DeInit (PCD_HandleTypeDef * hpcd)

Function description

DeInitializes the PCD peripheral.

Parameters

- **hpcd:** PCD handle

Return values

- **HAL:** status

HAL_PCD_MspInit

Function name

void HAL_PCD_MspInit (PCD_HandleTypeDef * hpcd)

Function description

Initializes the PCD MSP.

Parameters

- **hpcd:** PCD handle

Return values

- **None:**

HAL_PCD_MspDeInit

Function name

void HAL_PCD_MspDeInit (PCD_HandleTypeDef * hpcd)

Function description

DeInitializes PCD MSP.

Parameters

- **hpcd:** PCD handle

Return values

- **None:**

HAL_PCD_RegisterCallback

Function name

HAL_StatusTypeDef HAL_PCD_RegisterCallback (PCD_HandleTypeDef * hpcd, HAL_PCD_CallbackIDTypeDef CallbackID, pPCD_CallbackTypeDef pCallback)

Function description

Register a User USB PCD Callback To be used instead of the weak predefined callback.

Parameters

- **hpcd:** USB PCD handle
- **CallbackID:** ID of the callback to be registered This parameter can be one of the following values:
  - HAL_PCD_SOF_CB_ID USB PCD SOF callback ID
  - HAL_PCD_SETUPSTAGE_CB_ID USB PCD Setup callback ID
  - HAL_PCD_RESET_CB_ID USB PCD Reset callback ID
  - HAL_PCD_SUSPEND_CB_ID USB PCD Suspend callback ID
  - HAL_PCD_RESUME_CB_ID USB PCD Resume callback ID
  - HAL_PCD_CONNECT_CB_ID USB PCD Connect callback ID
  - HAL_PCD_DISCONNECT_CB_ID USB PCD Disconnect callback ID
  - HAL_PCD_MSPINIT_CB_ID MspDeInit callback ID
  - HAL_PCD_MSPDEINIT_CB_ID MspDeInit callback ID
- **pCallback:** pointer to the Callback function

Return values

- **HAL:** status

HAL_PCD_UnRegisterCallback

Function name

HAL_StatusTypeDef HAL_PCD_UnRegisterCallback (PCD_HandleTypeDef * hpcd, HAL_PCD_CallbackIDTypeDef CallbackID)

Function description

Unregister an USB PCD Callback USB PCD callback is redirected to the weak predefined callback.

Parameters

- **hpcd:** USB PCD handle
- **CallbackID:** ID of the callback to be unregistered This parameter can be one of the following values:
  - HAL_PCD_SOF_CB_ID USB PCD SOF callback ID
  - HAL_PCD_SETUPSTAGE_CB_ID USB PCD Setup callback ID
  - HAL_PCD_RESET_CB_ID USB PCD Reset callback ID
  - HAL_PCD_SUSPEND_CB_ID USB PCD Suspend callback ID
  - HAL_PCD_RESUME_CB_ID USB PCD Resume callback ID
  - HAL_PCD_CONNECT_CB_ID USB PCD Connect callback ID
  - HAL_PCD_DISCONNECT_CB_ID USB PCD Disconnect callback ID
  - HAL_PCD_MSPINIT_CB_ID MspDeInit callback ID
  - HAL_PCD_MSPDEINIT_CB_ID MspDeInit callback ID

Return values

- **HAL:** status

HAL_PCD_RegisterDataOutStageCallback

Function name

HAL_StatusTypeDef HAL_PCD_RegisterDataOutStageCallback (PCD_HandleTypeDef * hpcd, pPCD_DataOutStageCallbackTypeDef pCallback)

Function description

Register USB PCD Data OUT Stage Callback To be used instead of the weak HAL_PCD_DataOutStageCallback() predefined callback.

Parameters

- **hpcd:** PCD handle
- **pCallback:** pointer to the USB PCD Data OUT Stage Callback function

Return values

- **HAL:** status

HAL_PCD_UnRegisterDataOutStageCallback

Function name

HAL_StatusTypeDef HAL_PCD_UnRegisterDataOutStageCallback (PCD_HandleTypeDef * hpcd)

Function description

Unregister the USB PCD Data OUT Stage Callback USB PCD Data OUT Stage Callback is redirected to the weak HAL_PCD_DataOutStageCallback() predefined callback.

Parameters

- **hpcd:** PCD handle

Return values

- **HAL:** status

HAL_PCD_RegisterDataInStageCallback

Function name

HAL_StatusTypeDef HAL_PCD_RegisterDataInStageCallback (PCD_HandleTypeDef * hpcd, pPCD_DataInStageCallbackTypeDef pCallback)

Function description

Register USB PCD Data IN Stage Callback To be used instead of the weak HAL_PCD_DataInStageCallback() predefined callback.

Parameters

- **hpcd:** PCD handle
- **pCallback:** pointer to the USB PCD Data IN Stage Callback function

Return values

- **HAL:** status

HAL_PCD_UnRegisterDataInStageCallback

Function name

HAL_StatusTypeDef HAL_PCD_UnRegisterDataInStageCallback (PCD_HandleTypeDef * hpcd)

Function description

Unregister the USB PCD Data IN Stage Callback USB PCD Data OUT Stage Callback is redirected to the weak HAL_PCD_DataInStageCallback() predefined callback.

Parameters

- **hpcd:** PCD handle

Return values

- **HAL:** status

HAL_PCD_RegisterIsoOutIncpltCallback

Function name

HAL_StatusTypeDef HAL_PCD_RegisterIsoOutIncpltCallback (PCD_HandleTypeDef * hpcd, pPCD_IsoOutIncpltCallbackTypeDef pCallback)

Function description

Register USB PCD Iso OUT incomplete Callback To be used instead of the weak HAL_PCD_ISOOUTIncompleteCallback() predefined callback.

Parameters

- **hpcd:** PCD handle
- **pCallback:** pointer to the USB PCD Iso OUT incomplete Callback function

Return values

- **HAL:** status

HAL_PCD_UnRegisterIsoOutIncpltCallback

Function name

HAL_StatusTypeDef HAL_PCD_UnRegisterIsoOutIncpltCallback (PCD_HandleTypeDef * hpcd)

Function description

Unregister the USB PCD Iso OUT incomplete Callback USB PCD Iso OUT incomplete Callback is redirected to the weak HAL_PCD_ISOOUTIncompleteCallback() predefined callback.

Parameters

- **hpcd:** PCD handle

Return values

- **HAL:** status

HAL_PCD_RegisterIsoInIncpltCallback

Function name

HAL_StatusTypeDef HAL_PCD_RegisterIsoInIncpltCallback (PCD_HandleTypeDef * hpcd, pPCD_IsoInIncpltCallbackTypeDef pCallback)

Function description

Register USB PCD Iso IN incomplete Callback To be used instead of the weak HAL_PCD_ISOINIncompleteCallback() predefined callback.

Parameters

- **hpcd:** PCD handle
- **pCallback:** pointer to the USB PCD Iso IN incomplete Callback function

Return values

- **HAL:** status

HAL_PCD_UnRegisterIsoInIncpltCallback

Function name

HAL_StatusTypeDef HAL_PCD_UnRegisterIsoInIncpltCallback (PCD_HandleTypeDef * hpcd)

Function description

Unregister the USB PCD Iso IN incomplete Callback USB PCD Iso IN incomplete Callback is redirected to the weak HAL_PCD_ISOINIncompleteCallback() predefined callback.

Parameters

- **hpcd:** PCD handle

Return values

- **HAL:** status

HAL_PCD_RegisterBcdCallback

Function name

HAL_StatusTypeDef HAL_PCD_RegisterBcdCallback (PCD_HandleTypeDef * hpcd, pPCD_BcdCallbackTypeDef pCallback)

Function description

Register USB PCD BCD Callback To be used instead of the weak HAL_PCDEx_BCD_Callback() predefined callback.

Parameters

- **hpcd:** PCD handle
- **pCallback:** pointer to the USB PCD BCD Callback function

Return values

- **HAL:** status

HAL_PCD_UnRegisterBcdCallback

Function name

HAL_StatusTypeDef HAL_PCD_UnRegisterBcdCallback (PCD_HandleTypeDef * hpcd)

Function description

Unregister the USB PCD BCD Callback USB BCD Callback is redirected to the weak HAL_PCDEx_BCD_Callback() predefined callback.

Parameters

- **hpcd:** PCD handle

Return values

- **HAL:** status

HAL_PCD_RegisterLpmCallback

Function name

HAL_StatusTypeDef HAL_PCD_RegisterLpmCallback (PCD_HandleTypeDef * hpcd, pPCD_LpmCallbackTypeDef pCallback)

Function description

Register USB PCD LPM Callback To be used instead of the weak HAL_PCDEx_LPM_Callback() predefined callback.

Parameters

- **hpcd:** PCD handle
- **pCallback:** pointer to the USB PCD LPM Callback function

Return values

- **HAL:** status

HAL_PCD_UnRegisterLpmCallback

Function name

HAL_StatusTypeDef HAL_PCD_UnRegisterLpmCallback (PCD_HandleTypeDef * hpcd)

Function description

Unregister the USB PCD LPM Callback USB LPM Callback is redirected to the weak HAL_PCDEx_LPM_Callback() predefined callback.

Parameters

- **hpcd:** PCD handle

Return values

- **HAL:** status

HAL_PCD_Start

Function name

HAL_StatusTypeDef HAL_PCD_Start (PCD_HandleTypeDef * hpcd)

Function description

Start the USB device.

Parameters

- **hpcd:** PCD handle

Return values

- **HAL:** status

HAL_PCD_Stop

Function name

HAL_StatusTypeDef HAL_PCD_Stop (PCD_HandleTypeDef * hpcd)

Function description

Stop the USB device.

Parameters

- **hpcd:** PCD handle

Return values

- **HAL:** status

HAL_PCD_IRQHandler

Function name

void HAL_PCD_IRQHandler (PCD_HandleTypeDef * hpcd)

Function description

This function handles PCD interrupt request.

Parameters

- **hpcd:** PCD handle

Return values

- **HAL:** status

HAL_PCD_SOFCallback

Function name

void HAL_PCD_SOFCallback (PCD_HandleTypeDef * hpcd)

Function description

USB Start Of Frame callback.

Parameters

- **hpcd:** PCD handle

Return values

- **None:**

HAL_PCD_SetupStageCallback

Function name

void HAL_PCD_SetupStageCallback (PCD_HandleTypeDef * hpcd)

Function description

Setup stage callback.

Parameters

- **hpcd:** PCD handle

Return values

- **None:**

HAL_PCD_ResetCallback

Function name

void HAL_PCD_ResetCallback (PCD_HandleTypeDef * hpcd)

Function description

USB Reset callback.

Parameters

- **hpcd:** PCD handle

Return values

- **None:**

HAL_PCD_SuspendCallback

Function name

void HAL_PCD_SuspendCallback (PCD_HandleTypeDef * hpcd)

Function description

Suspend event callback.

Parameters

- **hpcd:** PCD handle

Return values

- **None:**

HAL_PCD_ResumeCallback

Function name

void HAL_PCD_ResumeCallback (PCD_HandleTypeDef * hpcd)

Function description

Resume event callback.

Parameters

- **hpcd:** PCD handle

Return values

- **None:**

HAL_PCD_ConnectCallback

Function name

void HAL_PCD_ConnectCallback (PCD_HandleTypeDef * hpcd)

Function description

Connection event callback.

Parameters

- **hpcd:** PCD handle

Return values

- **None:**

HAL_PCD_DisconnectCallback

Function name

void HAL_PCD_DisconnectCallback (PCD_HandleTypeDef * hpcd)

Function description

Disconnection event callback.

Parameters

- **hpcd:** PCD handle

Return values

- **None:**

HAL_PCD_DataOutStageCallback

Function name

void HAL_PCD_DataOutStageCallback (PCD_HandleTypeDef * hpcd, uint8_t epnum)

Function description

Data OUT stage callback.

Parameters

- **hpcd:** PCD handle
- **epnum:** endpoint number

Return values

- **None:**

HAL_PCD_DataInStageCallback

Function name

void HAL_PCD_DataInStageCallback (PCD_HandleTypeDef * hpcd, uint8_t epnum)

Function description

Data IN stage callback.

Parameters

- **hpcd:** PCD handle
- **epnum:** endpoint number

Return values

- **None:**

HAL_PCD_ISOOUTIncompleteCallback

Function name

void HAL_PCD_ISOOUTIncompleteCallback (PCD_HandleTypeDef * hpcd, uint8_t epnum)

Function description

Incomplete ISO OUT callback.

Parameters

- **hpcd:** PCD handle
- **epnum:** endpoint number

Return values

- **None:**

HAL_PCD_ISOINIncompleteCallback

Function name

void HAL_PCD_ISOINIncompleteCallback (PCD_HandleTypeDef * hpcd, uint8_t epnum)

Function description

Incomplete ISO IN callback.

Parameters

- **hpcd:** PCD handle
- **epnum:** endpoint number

Return values

- **None:**

HAL_PCD_DevConnect

Function name

HAL_StatusTypeDef HAL_PCD_DevConnect (PCD_HandleTypeDef * hpcd)

Function description

Connect the USB device.

Parameters

- **hpcd:** PCD handle

Return values

- **HAL:** status

HAL_PCD_DevDisconnect

Function name

HAL_StatusTypeDef HAL_PCD_DevDisconnect (PCD_HandleTypeDef * hpcd)

Function description

Disconnect the USB device.

Parameters

- **hpcd:** PCD handle

Return values

- **HAL:** status

HAL_PCD_SetAddress

Function name

HAL_StatusTypeDef HAL_PCD_SetAddress (PCD_HandleTypeDef * hpcd, uint8_t address)

Function description

Set the USB Device address.

Parameters

- **hpcd:** PCD handle
- **address:** new device address

Return values

- **HAL:** status

HAL_PCD_EP_Open

Function name

HAL_StatusTypeDef HAL_PCD_EP_Open (PCD_HandleTypeDef * hpcd, uint8_t ep_addr, uint16_t ep_mps, uint8_t ep_type)

Function description

Open and configure an endpoint.

Parameters

- **hpcd:** PCD handle
- **ep_addr:** endpoint address
- **ep_mps:** endpoint max packet size
- **ep_type:** endpoint type

Return values

- **HAL:** status

HAL_PCD_EP_Close

Function name

HAL_StatusTypeDef HAL_PCD_EP_Close (PCD_HandleTypeDef * hpcd, uint8_t ep_addr)

Function description

Deactivate an endpoint.

Parameters

- **hpcd:** PCD handle
- **ep_addr:** endpoint address

Return values

- **HAL:** status

HAL_PCD_EP_Receive

Function name

HAL_StatusTypeDef HAL_PCD_EP_Receive (PCD_HandleTypeDef * hpcd, uint8_t ep_addr, uint8_t * pBuf, uint32_t len)

Function description

Receive an amount of data.

Parameters

- **hpcd:** PCD handle
- **ep_addr:** endpoint address
- **pBuf:** pointer to the reception buffer
- **len:** amount of data to be received

Return values

- **HAL:** status

HAL_PCD_EP_Transmit

Function name

HAL_StatusTypeDef HAL_PCD_EP_Transmit (PCD_HandleTypeDef * hpcd, uint8_t ep_addr, uint8_t * pBuf, uint32_t len)

Function description

Send an amount of data.

Parameters

- **hpcd:** PCD handle
- **ep_addr:** endpoint address
- **pBuf:** pointer to the transmission buffer
- **len:** amount of data to be sent

Return values

- **HAL:** status

HAL_PCD_EP_SetStall

Function name

HAL_StatusTypeDef HAL_PCD_EP_SetStall (PCD_HandleTypeDef * hpcd, uint8_t ep_addr)

Function description

Set a STALL condition over an endpoint.

Parameters

- **hpcd:** PCD handle
- **ep_addr:** endpoint address

Return values

- **HAL:** status

HAL_PCD_EP_ClrStall

Function name

HAL_StatusTypeDef HAL_PCD_EP_ClrStall (PCD_HandleTypeDef * hpcd, uint8_t ep_addr)

Function description

Clear a STALL condition over in an endpoint.

Parameters

- **hpcd:** PCD handle
- **ep_addr:** endpoint address

Return values

- **HAL:** status

HAL_PCD_EP_Flush

Function name

HAL_StatusTypeDef HAL_PCD_EP_Flush (PCD_HandleTypeDef * hpcd, uint8_t ep_addr)

Function description

Flush an endpoint.

Parameters

- **hpcd:** PCD handle
- **ep_addr:** endpoint address

Return values

- **HAL:** status

HAL_PCD_EP_Abort

Function name

HAL_StatusTypeDef HAL_PCD_EP_Abort (PCD_HandleTypeDef * hpcd, uint8_t ep_addr)

Function description

Abort an USB EP transaction.

Parameters

- **hpcd:** PCD handle
- **ep_addr:** endpoint address

Return values

- **HAL:** status

HAL_PCD_ActivateRemoteWakeup

Function name

HAL_StatusTypeDef HAL_PCD_ActivateRemoteWakeup (PCD_HandleTypeDef * hpcd)

Function description

Activate remote wakeup signalling.

Parameters

- **hpcd:** PCD handle

Return values

- **HAL:** status

HAL_PCD_DeActivateRemoteWakeup

Function name

HAL_StatusTypeDef HAL_PCD_DeActivateRemoteWakeup (PCD_HandleTypeDef * hpcd)

Function description

De-activate remote wakeup signalling.

Parameters

- **hpcd:** PCD handle

Return values

- **HAL:** status

HAL_PCD_EP_GetRxCount

Function name

uint32_t HAL_PCD_EP_GetRxCount (PCD_HandleTypeDef const * hpcd, uint8_t ep_addr)

Function description

Get Received Data Size.

Parameters

- **hpcd:** PCD handle
- **ep_addr:** endpoint address

Return values

- **Data:** Size

HAL_PCD_GetState

Function name

PCD_StateTypeDef HAL_PCD_GetState (PCD_HandleTypeDef const * hpcd)

Function description

Return the PCD handle state.

Parameters

- **hpcd:** PCD handle

Return values

- **HAL:** state

PCD_GET_EP_RX_CNT

Function name

__STATIC_INLINE uint16_t PCD_GET_EP_RX_CNT (const PCD_TypeDef * Instance, uint16_t bEpNum)

Function description

gets counter of the rx buffer.

Parameters

- **Instance:** USB peripheral instance register address.
- **bEpNum:** channel Number.

Return values

- **Counter:** value

PCD_GET_EP_DBUF0_CNT

Function name

__STATIC_INLINE uint16_t PCD_GET_EP_DBUF0_CNT (const PCD_TypeDef * Instance, uint16_t bEpNum)

Function description

gets counter of the rx buffer0.

Parameters

- **Instance:** USB peripheral instance register address.
- **bEpNum:** channel Number.

Return values

- **Counter:** value

PCD_GET_EP_DBUF1_CNT

Function name

__STATIC_INLINE uint16_t PCD_GET_EP_DBUF1_CNT (const PCD_TypeDef * Instance, uint16_t bEpNum)

Function description

gets counter of the rx buffer1.

Parameters

- **Instance:** USB peripheral instance register address.
- **bEpNum:** channel Number.

Return values

- **Counter:** value

33.3 PCD Firmware driver defines

The following section lists the various define and macros of the module.

33.3.1 PCD

PCD

PCD ENDP

PCD_ENDP0

PCD_ENDP1

PCD_ENDP2

PCD_ENDP3

PCD_ENDP4

PCD_ENDP5

PCD_ENDP6

PCD_ENDP7

PCD Endpoint Kind

PCD_SNG_BUF

PCD_DBL_BUF

PCD EP0 MPS

PCD_EP0MPS_64

PCD_EP0MPS_32

PCD_EP0MPS_16

PCD_EP0MPS_08

PCD Error Code definition

HAL_PCD_ERROR_INVALID_CALLBACK

Invalid Callback error

PCD Exported Macros

__HAL_PCD_ENABLE

__HAL_PCD_DISABLE

__HAL_PCD_GET_FLAG

__HAL_PCD_CLEAR_FLAG

__HAL_USB_WAKEUP_EXTI_ENABLE_IT

__HAL_USB_WAKEUP_EXTI_DISABLE_IT

PCD PHY Module

PCD_PHY_ULPI

PCD_PHY_EMBEDDED

PCD_PHY_UTMI

PCD Speed

PCD_SPEED_FULL

34 HAL PCD Extension Driver

34.1 PCDEx Firmware driver API description

The following section lists the various functions of the PCDEx library.

34.1.1 Extended features functions

This section provides functions allowing to:

- Update FIFO configuration

This section contains the following APIs:

- *HAL_PCDEx_PMAConfig()*
- *HAL_PCDEx_ActivateBCD()*
- *HAL_PCDEx_DeActivateBCD()*
- *HAL_PCDEx_BCD_VBUSDetect()*
- *HAL_PCDEx_ActivateLPM()*
- *HAL_PCDEx_DeActivateLPM()*
- *HAL_PCDEx_LPM_Callback()*
- *HAL_PCDEx_BCD_Callback()*

34.1.2 Detailed description of functions

HAL_PCDEx_PMAConfig

Function name

HAL_StatusTypeDef HAL_PCDEx_PMAConfig (PCD_HandleTypeDef * hpcd, uint16_t ep_addr, uint16_t ep_kind, uint32_t pmaadress)

Function description

Configure PMA for EP.

Parameters

- **hpcd:** Device instance
- **ep_addr:** endpoint address
- **ep_kind:** endpoint Kind USB_SNG_BUF: Single Buffer used USB_DBL_BUF: Double Buffer used
- **pmaadress:** EP address in The PMA: In case of single buffer endpoint this parameter is 16-bit value providing the address in PMA allocated to endpoint. In case of double buffer endpoint this parameter is a 32-bit value providing the endpoint buffer 0 address in the LSB part of 32-bit value and endpoint buffer 1 address in the MSB part of 32-bit value.

Return values

- **HAL:** status

HAL_PCDEx_ActivateLPM

Function name

HAL_StatusTypeDef HAL_PCDEx_ActivateLPM (PCD_HandleTypeDef * hpcd)

Function description

Activate LPM feature.

Parameters

- **hpcd:** PCD handle

Return values

- **HAL:** status

HAL_PCDEx_DeActivateLPM

Function name

HAL_StatusTypeDef HAL_PCDEx_DeActivateLPM (PCD_HandleTypeDef * hpcd)

Function description

Deactivate LPM feature.

Parameters

- **hpcd:** PCD handle

Return values

- **HAL:** status

HAL_PCDEx_ActivateBCD

Function name

HAL_StatusTypeDef HAL_PCDEx_ActivateBCD (PCD_HandleTypeDef * hpcd)

Function description

Activate BatteryCharging feature.

Parameters

- **hpcd:** PCD handle

Return values

- **HAL:** status

HAL_PCDEx_DeActivateBCD

Function name

HAL_StatusTypeDef HAL_PCDEx_DeActivateBCD (PCD_HandleTypeDef * hpcd)

Function description

Deactivate BatteryCharging feature.

Parameters

- **hpcd:** PCD handle

Return values

- **HAL:** status

HAL_PCDEx_BCD_VBUSDetect

Function name

void HAL_PCDEx_BCD_VBUSDetect (PCD_HandleTypeDef * hpcd)

Function description

Handle BatteryCharging Process.

Parameters

- **hpcd:** PCD handle

Return values

- **HAL:** status

HAL_PCDEx_LPM_Callback

Function name

void HAL_PCDEx_LPM_Callback (PCD_HandleTypeDef * hpcd, PCD_LPM_MsgTypeDef msg)

Function description

Send LPM message to user layer callback.

Parameters

- **hpcd:** PCD handle
- **msg:** LPM message

Return values

- **HAL:** status

HAL_PCDEx_BCD_Callback

Function name

void HAL_PCDEx_BCD_Callback (PCD_HandleTypeDef * hpcd, PCD_BCD_MsgTypeDef msg)

Function description

Send BatteryCharging message to user layer callback.

Parameters

- **hpcd:** PCD handle
- **msg:** LPM message

Return values

- **HAL:** status

35 HAL PWR Generic Driver

35.1 PWR Firmware driver registers structures

35.1.1 PWR_PVDTypeDef

PWR_PVDTypeDef is defined in the stm32u0xx_hal_pwr.h

Data Fields

- ***uint32_t PVDLevel***
- ***uint32_t Mode***

Field Documentation

- ***uint32_t PWR_PVDTypeDef::PVDLevel***
  PVDLevel: Specifies the PVD detection level. This parameter can be a value of ***PWR_PVD_detection_level***.
- ***uint32_t PWR_PVDTypeDef::Mode***
  Mode: Specifies the operating mode for the selected pins. This parameter can be a value of ***PWR_PVD_Mode***.

35.2 PWR Firmware driver API description

The following section lists the various functions of the PWR library.

35.2.1 Initialization and de-initialization functions

This section contains the following APIs:

- ***HAL_PWR_DeInit()***
- ***HAL_PWR_EnableBkUpAccess()***
- ***HAL_PWR_DisableBkUpAccess()***

35.2.2 Peripheral Control functions

PVD configuration

- The PVD is used to monitor the VDD power supply by comparing it to a threshold selected by the PVD Level (PLS[2:0] bits in PWR_CR2 register).
- PVDO flag is available to indicate if VDD/VDDA is higher or lower than the PVD threshold. This event is internally connected to the EXTI line16 and can generate an interrupt if enabled. This is done through __HAL_PVD_EXTI_ENABLE_IT() macro.
- The PVD is stopped in Standby mode.

WakeUp pin configuration

- WakeUp pins are used to wakeup the system from Standby mode or Shutdown mode. The polarity of these pins can be set to configure event detection on high level (rising edge) or low level (falling edge).

Low Power modes configuration

The devices feature 8 low-power modes:

- Low-power Run mode: core and peripherals are running, main regulator off, low power regulator on.
- Sleep mode: Cortex-M4 core stopped, peripherals kept running, main and low power regulators on.
- Low-power Sleep mode: Cortex-M4 core stopped, peripherals kept running, main regulator off, low power regulator on.
- Stop 0 mode: all clocks are stopped except LSI and LSE, main and low power regulators on.
- Stop 1 mode: all clocks are stopped except LSI and LSE, main regulator off, low power regulator on.

- Stop 2 mode: all clocks are stopped except LSI and LSE, main regulator off, low power regulator on, reduced set of waking up IPs compared to Stop 1 mode.
- Standby mode with SRAM2: all clocks are stopped except LSI and LSE, SRAM2 content preserved, main regulator off, low power regulator on.
- Standby mode without SRAM2: all clocks are stopped except LSI and LSE, main and low power regulators off.
- Shutdown mode: all clocks are stopped except LSE, main and low power regulators off.

Low-power run mode

- Entry: (from main run mode)
  - set LPR bit with HAL_PWREx_EnableLowPowerRunMode() API after having decreased the system clock below 2 MHz.
- Exit:
  - clear LPR bit then wait for REGLP bit to be reset with HAL_PWREx_DisableLowPowerRunMode() API. Only then can the system clock frequency be increased above 2 MHz.

Sleep mode / Low-power sleep mode

- Entry: The Sleep mode / Low-power Sleep mode is entered through HAL_PWR_EnterSLEEPMode() API in specifying whether or not the regulator is forced to low-power mode and if exit is interrupt or event-triggered.
  - PWR_MAINREGULATOR_ON: Sleep mode (regulator in main mode).
  - PWR_LOWPOWERREGULATOR_ON: Low-power sleep (regulator in low power mode). In the latter case, the system clock frequency must have been decreased below 2 MHz beforehand.
  - PWR_SLEEPENTRY_WFI: enter SLEEP mode with WFI instruction
  - PWR_SLEEPENTRY_WFE: enter SLEEP mode with WFE instruction
- WFI Exit:
  - Any peripheral interrupt acknowledged by the nested vectored interrupt controller (NVIC) or any wake-up event.
- WFE Exit:
  - Any wake-up event such as an EXTI line configured in event mode.

When exiting the Low-power sleep mode by issuing an interrupt or a wakeup event, the MCU is in Low-power Run mode.

Stop 0, Stop 1 and Stop 2 modes

- Entry: The Stop 0, Stop 1 or Stop 2 modes are entered through the following API's:
  - HAL_PWREx_EnterSTOP0Mode() for mode 0 or HAL_PWREx_EnterSTOP1Mode() for mode 1 or for porting reasons HAL_PWR_EnterSTOPMode().
  - HAL_PWREx_EnterSTOP2Mode() for mode 2.
- Regulator setting (applicable to HAL_PWR_EnterSTOPMode() only):
  - PWR_MAINREGULATOR_ON
  - PWR_LOWPOWERREGULATOR_ON
- Exit (interrupt or event-triggered, specified when entering STOP mode):
  - PWR_STOPENTRY_WFI: enter Stop mode with WFI instruction
  - PWR_STOPENTRY_WFE: enter Stop mode with WFE instruction
- WFI Exit:
  - Any EXTI Line (Internal or External) configured in Interrupt mode.
  - Some specific communication peripherals (USART, LPUART, I2C) interrupts when programmed in wakeup mode.
- WFE Exit:
  - Any EXTI Line (Internal or External) configured in Event mode.

When exiting Stop 0 and Stop 1 modes, the MCU is either in Run mode or in Low-power Run mode depending on the LPR bit setting. When exiting Stop 2 mode, the MCU is in Run mode.

Standby mode

The Standby mode offers two options:

- option a) all clocks off except LSI and LSE, RRS bit set (keeps voltage regulator in low power mode). SRAM and registers contents are lost except for the SRAM2 content, the RTC registers, RTC backup registers and Standby circuitry.
- option b) all clocks off except LSI and LSE, RRS bit cleared (voltage regulator then disabled). SRAM and register contents are lost except for the RTC registers, RTC backup registers and Standby circuitry.
  - Entry:
    - The Standby mode is entered through HAL_PWR_EnterSTANDBYMode() API. SRAM1 and register contents are lost except for registers in the Backup domain and Standby circuitry. SRAM2 content can be preserved if the bit RRS is set in PWR_CR3 register. To enable this feature, the user can resort to HAL_PWREx_EnableSRAM2ContentRetention() API to set RRS bit.
  - Exit:
    - WKUP pin rising edge, RTC alarm or wakeup, tamper event, time-stamp event, external reset in NRST pin, IWDG reset.

After waking up from Standby mode, program execution restarts in the same way as after a Reset.

Shutdown mode

In Shutdown mode, voltage regulator is disabled, all clocks are off except LSE, RRS bit is cleared. SRAM and registers contents are lost except for backup domain registers.

- Entry: The Shutdown mode is entered through HAL_PWREx_EnterSHUTDOWNMode() API.
- Exit:
  - WKUP pin rising edge, RTC alarm or wakeup, tamper event, time-stamp event, external reset in NRST pin.

After waking up from Shutdown mode, program execution restarts in the same way as after a Reset.

Auto-wakeup (AWU) from low-power mode

The MCU can be woken up from low-power mode by an RTC Alarm event, an RTC Wakeup event, a tamper event or a time-stamp event, without depending on an external interrupt (Auto-wakeup mode).

- RTC auto-wakeup (AWU) from the Stop, Standby and Shutdown modes
  - To wake up from the Stop mode with an RTC alarm event, it is necessary to configure the RTC to generate the RTC alarm using the HAL_RTC_SetAlarm_IT() function.
  - To wake up from the Stop mode with an RTC Tamper or time stamp event, it is necessary to configure the RTC to detect the tamper or time stamp event using the HAL_RTCEx_SetTimeStamp_IT() or HAL_RTCEx_SetTamper_IT() functions.
  - To wake up from the Stop mode with an RTC WakeUp event, it is necessary to configure the RTC to generate the RTC WakeUp event using the HAL_RTCEx_SetWakeUpTimer_IT() function.

This section contains the following APIs:

- ***HAL_PWR_ConfigPVD()***
- ***HAL_PWR_EnablePVD()***
- ***HAL_PWR_DisablePVD()***
- ***HAL_PWR_EnableWakeUpPin()***
- ***HAL_PWR_DisableWakeUpPin()***
- ***HAL_PWR_EnterSLEEPMode()***
- ***HAL_PWR_EnterSTOPMode()***
- ***HAL_PWR_EnterSTANDBYMode()***
- ***HAL_PWR_EnterSHUTDOWNMode()***
- ***HAL_PWR_EnableSleepOnExit()***
- ***HAL_PWR_DisableSleepOnExit()***
- ***HAL_PWR_EnableSEVOnPend()***

- *HAL_PWR_DisableSEVOnPend()*
- *HAL_PWR_PVDCallback()*

35.2.3 Detailed description of functions

HAL_PWR_DeInit

Function name

void HAL_PWR_DeInit (void)

Function description

Deinitialize the HAL PWR peripheral registers to their default reset values.

Return values

- **None:**

HAL_PWR_EnableBkUpAccess

Function name

void HAL_PWR_EnableBkUpAccess (void)

Function description

Enable access to the backup domain (RTC registers, RTC backup data registers).

Return values

- **None:**

Notes

- After reset, the backup domain is protected against possible unwanted write accesses.
- RTCSEL that sets the RTC clock source selection is in the RTC back-up domain. In order to set or modify the RTC clock, the backup domain access must be disabled.
- LSEON bit that switches on and off the LSE crystal belongs as well to the back-up domain.

HAL_PWR_DisableBkUpAccess

Function name

void HAL_PWR_DisableBkUpAccess (void)

Function description

Disable access to the backup domain (RTC registers, RTC backup data registers).

Return values

- **None:**

HAL_PWR_ConfigPVD

Function name

HAL_StatusTypeDef HAL_PWR_ConfigPVD (PWR_PVDTypeDef * sConfigPVD)

Function description

Configure the voltage threshold detected by the Power Voltage Detector (PVD).

Parameters

- **sConfigPVD:** pointer to a PWR_PVDTypeDef structure that contains the PVD configuration information.

Return values

- **None:**

Notes

- Refer to the electrical characteristics of your device datasheet for more details about the voltage thresholds corresponding to each detection level.

HAL_PWR_EnablePVD

Function name

void HAL_PWR_EnablePVD (void)

Function description

Enable the Power Voltage Detector (PVD).

Return values

- **None:**

HAL_PWR_DisablePVD

Function name

void HAL_PWR_DisablePVD (void)

Function description

Disable the Power Voltage Detector (PVD).

Return values

- **None:**

HAL_PWR_EnableWakeUpPin

Function name

void HAL_PWR_EnableWakeUpPin (uint32_t WakeUpPinPolarity)

Function description

Enable the WakeUp PINx functionality.

Parameters

- **WakeUpPinPolarity:** Specifies which Wake-Up pin to enable. This parameter can be one of the following legacy values which set the default polarity i.e. detection on high level (rising edge):
  - PWR_WAKEUP_PIN1, PWR_WAKEUP_PIN2, PWR_WAKEUP_PIN3, PWR_WAKEUP_PIN4, PWR_WAKEUP_PIN5

  or one of the following value where the user can explicitly specify the enabled pin and the chosen polarity:
  - PWR_WAKEUP_PIN1_HIGH or PWR_WAKEUP_PIN1_LOW
  - PWR_WAKEUP_PIN2_HIGH or PWR_WAKEUP_PIN2_LOW
  - PWR_WAKEUP_PIN3_HIGH or PWR_WAKEUP_PIN3_LOW
  - PWR_WAKEUP_PIN4_HIGH or PWR_WAKEUP_PIN4_LOW
  - PWR_WAKEUP_PIN5_HIGH or PWR_WAKEUP_PIN5_LOW

Return values

- **None:**

Notes

- PWR_WAKEUP_PINx and PWR_WAKEUP_PINx_HIGH are equivalent.

HAL_PWR_DisableWakeUpPin

Function name

void HAL_PWR_DisableWakeUpPin (uint32_t WakeUpPinx)

Function description

Disable the WakeUp PINx functionality.

Parameters

- **WakeUpPinx:** Specifies the Power Wake-Up pin to disable. This parameter can be one of the following values:
  - PWR_WAKEUP_PIN1, PWR_WAKEUP_PIN2, PWR_WAKEUP_PIN3, PWR_WAKEUP_PIN4, PWR_WAKEUP_PIN5

Return values

- **None:**

HAL_PWR_EnterSLEEPMode

Function name

void HAL_PWR_EnterSLEEPMode (uint32_t Regulator, uint8_t SLEEPEntry)

Function description

Enter Sleep or Low-power Sleep mode.

Parameters

- **Regulator:** Specifies the regulator state in Sleep/Low-power Sleep mode. This parameter can be one of the following values:
  - PWR_MAINREGULATOR_ON Sleep mode (regulator in main mode)
  - PWR_LOWPOWERREGULATOR_ON Low-power Sleep mode (regulator in low-power mode)
- **SLEEPEntry:** Specifies if Sleep mode is entered with WFI or WFE instruction. This parameter can be one of the following values:
  - PWR_SLEEPENTRY_WFI enter Sleep or Low-power Sleep mode with WFI instruction
  - PWR_SLEEPENTRY_WFE enter Sleep or Low-power Sleep mode with WFE instruction

Return values

- **None:**

Notes

- In Sleep/Low-power Sleep mode, all I/O pins keep the same state as in Run mode.
- Low-power Sleep mode is entered from Low-power Run mode. Therefore, if not yet in Low-power Run mode before calling HAL_PWR_EnterSLEEPMode() with Regulator set to PWR_LOWPOWERREGULATOR_ON, the user can optionally configure the Flash in power-down monde in setting the SLEEP_PD bit in FLASH_ACR register. Additionally, the clock frequency must be reduced below 2 MHz. Setting SLEEP_PD in FLASH_ACR then appropriately reducing the clock frequency must be done before calling HAL_PWR_EnterSLEEPMode() API.
- When exiting Low-power Sleep mode, the MCU is in Low-power Run mode. To move in Run mode, the user must resort to HAL_PWREx_DisableLowPowerRunMode() API.
- When WFI entry is used, tick interrupt have to be disabled if not desired as the interrupt wake up source.

HAL_PWR_EnterSTOPMode

Function name

void HAL_PWR_EnterSTOPMode (uint32_t Regulator, uint8_t STOPEntry)

Function description

Enter Stop 0 mode.

Parameters

- **Regulator:** Specifies the regulator state in Stop mode. This parameter can be one of the following values:
  - PWR_MAINREGULATOR_ON Stop 0 mode (main regulator ON)
  - PWR_LOWPOWERREGULATOR_ON Stop 1 mode (low power regulator ON)
- **STOPEntry:** Specifies Stop 0 or Stop 1 mode is entered with WFI or WFE instruction. This parameter can be one of the following values:
  - PWR_STOPENTRY_WFI Enter Stop 0 or Stop 1 mode with WFI instruction.
  - PWR_STOPENTRY_WFE Enter Stop 0 or Stop 1 mode with WFE instruction.

Return values

- **None:**

Notes

- This API is named HAL_PWR_EnterSTOPMode to ensure compatibility with legacy code running on devices where only "Stop mode" is mentioned with main or low power regulator ON.
- In Stop mode, all I/O pins keep the same state as in Run mode.
- All clocks in the VCORE domain are stopped; the PLL, the MSI, the HSI and the HSE oscillators are disabled. Some peripherals with the wakeup capability (I2Cx, USARTx and LPUART) can switch on the HSI to receive a frame, and switch off the HSI after receiving the frame if it is not a wakeup frame. In this case, the HSI clock is propagated only to the peripheral requesting it. SRAM1, SRAM2 and register contents are preserved. The BOR is available. The voltage regulator can be configured either in normal (Stop 0) or low-power mode (Stop 1).
- When exiting Stop 0 or Stop 1 mode by issuing an interrupt or a wakeup event, the HSI RC oscillator is selected as system clock if STOPWUCK bit in RCC_CFGR register is set; the MSI oscillator is selected if STOPWUCK is cleared.
- When the voltage regulator operates in low power mode (Stop 1), an additional startup delay is incurred when waking up. By keeping the internal regulator ON during Stop mode (Stop 0), the consumption is higher although the startup time is reduced.

HAL_PWR_EnterSTANDBYMode

Function name

void HAL_PWR_EnterSTANDBYMode (void)

Function description

Enter Standby mode.

Return values

- **None:**

Notes

- In Standby mode, the PLL, the HSI, the MSI and the HSE oscillators are switched off. The voltage regulator is disabled, except when SRAM2 content is preserved in which case the regulator is in low-power mode. SRAM1 and register contents are lost except for registers in the Backup domain and Standby circuitry. SRAM2 content can be preserved if the bit RRS is set in PWR_CR3 register. To enable this feature, the user can resort to HAL_PWREx_EnableSRAM2ContentRetention() API to set RRS bit. The BOR is available.
- The I/Os can be configured either with a pull-up or pull-down or can be kept in analog state. HAL_PWREx_EnableGPIOPullUp() and HAL_PWREx_EnableGPIOPullDown() respectively enable Pull Up and Pull Down state, HAL_PWREx_DisableGPIOPullUp() and HAL_PWREx_DisableGPIOPullDown() disable the same. These states are effective in Standby mode only if APC bit is set through HAL_PWREx_EnablePullUpPullDownConfig() API.

HAL_PWR_EnterSHUTDOWNMode

Function name

void HAL_PWR_EnterSHUTDOWNMode (void)

Function description

Enter Shutdown mode.

Return values

- **None:**

Notes

- In Shutdown mode, the PLL, the HSI, the MSI, the LSI and the HSE oscillators are switched off. The voltage regulator is disabled and Vcore domain is powered off. SRAM1, SRAM2 and registers contents are lost except for registers in the Backup domain. The BOR is not available.
- The I/Os can be configured either with a pull-up or pull-down or can be kept in analog state.

HAL_PWR_EnableSleepOnExit

Function name

void HAL_PWR_EnableSleepOnExit (void)

Function description

Indicate Sleep-On-Exit when returning from Handler mode to Thread mode.

Return values

- **None:**

Notes

- Set SLEEPONEXIT bit of SCR register. When this bit is set, the processor re-enters SLEEP mode when an interruption handling is over. Setting this bit is useful when the processor is expected to run only on interruptions handling.

HAL_PWR_DisableSleepOnExit

Function name

void HAL_PWR_DisableSleepOnExit (void)

Function description

Disable Sleep-On-Exit feature when returning from Handler mode to Thread mode.

Return values

- **None:**

Notes

- Clear SLEEPONEXIT bit of SCR register. When this bit is set, the processor re-enters SLEEP mode when an interruption handling is over.

HAL_PWR_EnableSEVOnPend

Function name

void HAL_PWR_EnableSEVOnPend (void)

Function description

Enable CORTEX M4 SEVONPEND bit.

Return values

- **None:**

Notes

- Set SEVONPEND bit of SCR register. When this bit is set, this causes WFE to wake up when an interrupt moves from inactive to pended.

HAL_PWR_DisableSEVOnPend

Function name

void HAL_PWR_DisableSEVOnPend (void)

Function description

Disable CORTEX M4 SEVONPEND bit.

Return values

- **None:**

Notes

- Clear SEVONPEND bit of SCR register. When this bit is set, this causes WFE to wake up when an interrupt moves from inactive to pended.

HAL_PWR_PVDCallback

Function name

void HAL_PWR_PVDCallback (void)

Function description

PWR PVD interrupt callback.

Return values

- **None:**

35.3 PWR Firmware driver defines

The following section lists the various define and macros of the module.

35.3.1 PWR

PWR

PWR EWUP All Pins

PWR_EWUP_Msk

Mask for all wake-up pins

PWR Exported Macros

__HAL_PWR_GET_FLAG

Description:

- Check whether or not a specific PWR flag is set.

Parameters:

- __FLAG__: specifies the flag to check. This parameter can be one of the following values:
  - PWR_FLAG_WUF1 Wake Up Flag 1. Indicates that a wakeup event was received from the WKUP pin 1.
  - PWR_FLAG_WUF2 Wake Up Flag 2. Indicates that a wakeup event was received from the WKUP pin 2.
  - PWR_FLAG_WUF3 Wake Up Flag 3. Indicates that a wakeup event was received from the WKUP pin 3.
  - PWR_FLAG_WUF4 Wake Up Flag 4. Indicates that a wakeup event was received from the WKUP pin 4.
  - PWR_FLAG_WUF5 Wake Up Flag 5. Indicates that a wakeup event was received from the WKUP pin 5.
  - PWR_FLAG_WUF7 Wake Up Flag 7. Indicates that a wakeup event was received from the WKUP pin 7.
  - PWR_FLAG_SB StandBy Flag. Indicates that the system entered StandBy mode.
  - PWR_FLAG_STOP0 Stop Flag. Indicates that the system entered Stop mode 0.
  - PWR_FLAG_STOP1 Stop Flag. Indicates that the system entered Stop mode 1.
  - PWR_FLAG_STOP2 Stop Flag. Indicates that the system entered Stop mode 2.
  - PWR_FLAG_WUFI Wake-Up Flag Internal. Set when a wakeup is detected on the internal wakeup line.
  - PWR_FLAG_REGLPS Low Power Regulator Started. Indicates whether or not the low-power regulator is ready.
  - PWR_FLAG_REGLPF Low Power Regulator Flag. Indicates whether the regulator is ready in main mode or is in low-power mode.
  - PWR_FLAG_VOSF Voltage Scaling Flag. Indicates whether the regulator is ready in the selected voltage range or is still changing to the required voltage level.
  - PWR_FLAG_PVDO Power Voltage Detector Output. Indicates whether VDD voltage is below or above the selected PVD threshold.
  - PWR_FLAG_PVMO_USB Peripheral Voltage Monitoring Output 1. Indicates whether VDDUSB voltage is below or above PVM1 threshold.
  - PWR_FLAG_PVMO_ADC Peripheral Voltage Monitoring Output 3. Indicates whether VDDA voltage is below or above PVM3 threshold.
  - PWR_FLAG_PVMO_DAC Peripheral Voltage Monitoring Output 4. Indicates whether VDDA voltage is below or above PVM4 threshold.

Return value:

- The: new state of __FLAG__ (TRUE or FALSE).

__HAL_PWR_CLEAR_FLAG

Description:

- Clear a specific PWR flag.

Parameters:

- __FLAG__: specifies the flag to clear. This parameter can be one of the following values:
  - PWR_FLAG_WUF1 Wake Up Flag 1. Indicates that a wakeup event was received from the WKUP pin 1.
  - PWR_FLAG_WUF2 Wake Up Flag 2. Indicates that a wakeup event was received from the WKUP pin 2.
  - PWR_FLAG_WUF3 Wake Up Flag 3. Indicates that a wakeup event was received from the WKUP pin 3.
  - PWR_FLAG_WUF4 Wake Up Flag 4. Indicates that a wakeup event was received from the WKUP pin 4.
  - PWR_FLAG_WUF5 Wake Up Flag 5. Indicates that a wakeup event was received from the WKUP pin 5.
  - PWR_FLAG_WUF7 Wake Up Flag 7. Indicates that a wakeup event was received from the WKUP pin 7.
  - PWR_FLAG_WU Encompasses all five Wake Up Flags.
  - PWR_FLAG_SB Standby Flag. Indicates that the system entered Standby mode.

Return value:

- None

__HAL_PWR_PVD_EXTI_ENABLE_IT

Description:

- Enable the PVD Extended Interrupt Line.

Return value:

- None

__HAL_PWR_PVD_EXTI_DISABLE_IT

Description:

- Disable the PVD Extended Interrupt Line.

Return value:

- None

__HAL_PWR_PVD_EXTI_ENABLE_EVENT

Description:

- Enable the PVD Event Line.

Return value:

- None

__HAL_PWR_PVD_EXTI_DISABLE_EVENT

Description:

- Disable the PVD Event Line.

Return value:

- None

__HAL_PWR_PVD_EXTI_ENABLE_RISING_EDGE

Description:

- Enable the PVD Extended Interrupt Rising Trigger.

Return value:

- None

__HAL_PWR_PVD_EXTI_DISABLE_RISING_EDGE

Description:

- Disable the PVD Extended Interrupt Rising Trigger.

Return value:

- None

__HAL_PWR_PVD_EXTI_ENABLE_FALLING_EDGE

Description:

- Enable the PVD Extended Interrupt Falling Trigger.

Return value:

- None

__HAL_PWR_PVD_EXTI_DISABLE_FALLING_EDGE

Description:

- Disable the PVD Extended Interrupt Falling Trigger.

Return value:

- None

__HAL_PWR_PVD_EXTI_ENABLE_RISING_FALLING_EDGE

Description:

- Enable the PVD Extended Interrupt Rising & Falling Trigger.

Return value:

- None

__HAL_PWR_PVD_EXTI_DISABLE_RISING_FALLING_EDGE

Description:

- Disable the PVD Extended Interrupt Rising & Falling Trigger.

Return value:

- None

__HAL_PWR_PVD_EXTI_GENERATE_SWIT

Description:

- Generate a Software interrupt on selected EXTI line.

Return value:

- None

__HAL_PWR_PVD_EXTI_GET_RISING_FLAG

Description:

- Check whether the specified PVD EXTI Rising interrupt flag is set or not.

Return value:

- EXTI: PVD Line Status.

__HAL_PWR_PVD_EXTI_GET_FALLING_FLAG

Description:

- Check whether the specified PVD EXTI Falling interrupt flag is set or not.

Return value:

- EXTI: PVD Line Status.

__HAL_PWR_PVD_EXTI_CLEAR_FLAG

Description:

- Clear the PVD EXTI Interrupt flag.

Return value:

- None.

Programmable Voltage Detection levels

PWR_PVDLEVEL_0

PVD threshold around 2.0 V

PWR_PVDLEVEL_1

PVD threshold around 2.2 V

PWR_PVDLEVEL_2

PVD threshold around 2.4 V

PWR_PVDLEVEL_3

PVD threshold around 2.5 V

PWR_PVDLEVEL_4

PVD threshold around 2.6 V

PWR_PVDLEVEL_5

PVD threshold around 2.8 V

PWR_PVDLEVEL_6

PVD threshold around 2.9 V

PWR_PVDLEVEL_7

External input analog voltage (compared internally to VREFINT)

PWR PVD event line

PWR_EVENT_LINE_PVD

Event line 16 Connected to the PVD Event Line

PWR PVD external interrupt line

PWR_EXTI_LINE_PVD

External interrupt line 16 Connected to the PVD EXTI Line

PWR PVD interrupt and event mode

PWR_PVD_MODE_NORMAL

Basic mode is used

PWR_PVD_MODE_IT_RISING

External Interrupt Mode with Rising edge trigger detection

PWR_PVD_MODE_IT_FALLING

External Interrupt Mode with Falling edge trigger detection

PWR_PVD_MODE_IT_RISING_FALLING

External Interrupt Mode with Rising/Falling edge trigger detection

PWR_PVD_MODE_EVENT_RISING

Event Mode with Rising edge trigger detection

PWR_PVD_MODE_EVENT_FALLING

Event Mode with Falling edge trigger detection

PWR_PVD_MODE_EVENT_RISING_FALLING

Event Mode with Rising/Falling edge trigger detection

PWR PVD Mode Mask

PVD_MODE_IT

Mask for interruption yielded by PVD threshold crossing

PVD_MODE_EVT

Mask for event yielded by PVD threshold crossing

PVD_RISING_EDGE

Mask for rising edge set as PVD trigger

PVD_FALLING_EDGE

Mask for falling edge set as PVD trigger

PWR regulator mode

PWR_MAINREGULATOR_ON

Regulator in main mode

PWR_LOWPOWERREGULATOR_ON

Regulator in low-power mode

PWR SLEEP mode entry

PWR_SLEEPENTRY_WFI

Wait For Interruption instruction to enter Sleep mode

PWR_SLEEPENTRY_WFE

Wait For Event instruction to enter Sleep mode

PWR STOP mode entry

PWR_STOPENTRY_WFI

Wait For Interruption instruction to enter Stop mode

PWR_STOPENTRY_WFE

Wait For Event instruction to enter Stop mode

36 HAL PWR Extension Driver

36.1 PWREx Firmware driver registers structures

36.1.1 PWR_PVMTypeDef

PWR_PVMTypeDef is defined in the stm32u0xx_hal_pwr_ex.h

Data Fields

- ***uint32_t PVMType***
- ***uint32_t Mode***

Field Documentation

- ***uint32_t PWR_PVMTypeDef::PVMType***
  PVMType: Specifies which voltage is monitored and against which threshold. This parameter can be a value of ***PWREx_PVM_Type***.
  - **PWR_PVM_1** Peripheral Voltage Monitoring USB enable: VDDUSB versus 1.2 V (applicable when USB feature is supported).
  - **PWR_PVM_3** Peripheral Voltage Monitoring ADC enable: VDDA versus 1.62 V.
  - **PWR_PVM_4** Peripheral Voltage Monitoring DAC enable: VDDA versus 2.2 V.
- ***uint32_t PWR_PVMTypeDef::Mode***
  Mode: Specifies the operating mode for the selected pins. This parameter can be a value of ***PWREx_PVM_Mode***.

36.2 PWREx Firmware driver API description

The following section lists the various functions of the PWREx library.

36.2.1 How to use this driver

1. Call HAL_PWREx_ControlVoltageScaling() and HAL_PWREx_GetVoltageRange() to set / get the voltage scaling range. (+) Voltage scaling can be one of the following values :
   - voltage output scale 1 : 1V2 => Used when system clock frequency is up to 160 MHz
   - voltage output scale 2 : 1V1 => Used when system clock frequency is up to 100 MHz
2. Call HAL_PWREx_EnterSTOP1Mode() function to enter the whole system to Stop 1 mode. Wake-up from Stop 1 mode could be following to an event or an interrupt according to low power mode intrinsic request called (__WFI() or __WFE()). (Regulator state on U0 devices is managed internally but regulator parameter is kept for product compatibility).
3. Call HAL_PWREx_EnterSTOP2Mode() function to enter the whole system to Stop 2 mode. Wake-up from Stop 2 mode could be following to an event or an interrupt according to low power mode intrinsic request called (__WFI() or __WFE()). (Regulator state on U0 devices is managed internally but regulator parameter is kept for product compatibility).
4. Call HAL_PWREx_EnableBatteryCharging() and HAL_PWREx_DisableBatteryCharging() to enable / disable the battery charging capability when VDD alimentation is available.
5. Call HAL_PWREx_ConfigPVM() after setting parameters to be configured (event mode and PVD type) in order to set up the Peripheral Voltage use HAL_PWREx_EnablePVM1(),HAL_PWREx_EnablePVM3() and HAL_PWREx_EnablePVM4() functions and use HAL_PWREx_DisablePVM1(),HAL_PWREx_EnablePVM3() and HAL_PWREx_EnablePVM4() to stop the PVM VDDx monitoring. (+) PVM monitored voltages are :
   - VDDUSB versus 1V2
   - VDDADC versus 1V62
   - VDDDAC versus 2V2
6. Call HAL_PWREx_PVD_PVM_IRQHandler() function to handle the PWR PVD and PVM interrupt request.
7. Call HAL_PWREx_EnablePullUpPullDownConfig() and HAL_PWREx_DisablePullUpPullDownConfig() to I/O enable / disable pull-up and pull-down configuration.

8. Call HAL_PWREx_EnableGPIOPullUp() and HAL_PWREx_EnableGPIOPullDown() to apply respectively pull-up and pull-down to selected I/O. Call HAL_PWREx_DisableGPIOPullUp() and HAL_PWREx_DisableGPIOPullDown() to disable applied respectively pull-up and pull-down to selected I/O.

(#) Call HAL_PWREx_ControlVoltageScaling() and HAL_PWREx_GetVoltageRange() to set / get the voltage scaling range.

- Voltage scaling can be one of the following values :
  - voltage output scale 1 : 1V2 => Used when system clock frequency is up to 160 MHz
  - voltage output scale 2 : 1V1 => Used when system clock frequency is up to 100 MHz (#) Call HAL_PWREx_EnterSTOP1Mode() function to enter the whole system to Stop 1 mode. Wake-up from Stop 1 mode could be following to an event or an interrupt according to low power mode intrinsic request called (__WFI() or __WFE()). (Regulator state on U0 devices is managed internally but regulator parameter is kept for product compatibility). (#) Call HAL_PWREx_EnterSTOP2Mode() function to enter the whole system to Stop 2 mode. Wake-up from Stop 2 mode could be following to an event or an interrupt according to low power mode intrinsic request called (__WFI() or __WFE()). (Regulator state on U0 devices is managed internally but regulator parameter is kept for product compatibility). (#) Call HAL_PWREx_EnableBatteryCharging() and HAL_PWREx_DisableBatteryCharging() to enable / disable the battery charging capability when VDD alimentation is available. (#) Call HAL_PWREx_ConfigPVM() after setting parameters to be configured (event mode and PVD type) in order to set up the Peripheral Voltage use HAL_PWREx_EnablePVM1(),HAL_PWREx_EnablePVM3() and HAL_PWREx_EnablePVM4() functions and use HAL_PWREx_DisablePVM1(),HAL_PWREx_EnablePVM3() and HAL_PWREx_EnablePVM4() to stop the PVM VDDx monitoring.
- PVM monitored voltages are :
  - VDDUSB versus 1V2
  - VDDADC versus 1V62
  - VDDDAC versus 2V2 (#) Call HAL_PWREx_PVD_PVM_IRQHandler() function to handle the PWR PVD and PVM interrupt request. (#) Call HAL_PWREx_EnablePullUpPullDownConfig() and HAL_PWREx_DisablePullUpPullDownConfig() to I/O enable / disable pull-up and pull-down configuration. (#) Call HAL_PWREx_EnableGPIOPullUp() and HAL_PWREx_EnableGPIOPullDown() to apply respectively pull-up and pull-down to selected I/O. Call HAL_PWREx_DisableGPIOPullUp() and HAL_PWREx_DisableGPIOPullDown() to disable applied respectively pull-up and pull-down to selected I/O.

36.2.2 Power supply control functions

This section provides functions allowing to control power supply.

- When exiting the Stop or Standby modes, the regulator is the same than when entering low power modes. The voltage range is the Range 2.
- Both regulators can provide four different voltages (voltage scaling) and can operate in Stop modes. Voltage scaling ranges can be one of the following values :
  - voltage output scale 1 : 1V2 => Used when system clock frequency is up to 160 MHz
  - voltage output scale 2 : 1V1 => Used when system clock frequency is up to 100 MHz

This section contains the following APIs:

- ***HAL_PWREx_ControlVoltageScaling()***
- ***HAL_PWREx_GetVoltageRange()***

36.2.3 Low power control functions

This section provides functions allowing to control low power modes.

Low Power modes configuration

This section presents 3 principles low power modes :

- Stop 1 mode : Cortex-M4 is stopped, clocks are stopped and the regulator is in low power mode. Only autonomous peripherals can operate in this mode.
- Stop 2 mode : Cortex-M4 is stopped, clocks are stopped and the regulator is in low power mode. No peripheral can operate in this mode. Only RAMs content is preserved.

- Shutdown mode : All PWR domains enter Shutdown mode and the VCORE supply regulator is powered off. The SRAMs and register contents are lost except for registers in the Backup domain.

Stop 1 mode

The Stop 1 mode is based on the Cortex-M4 Deepsleep mode combined with peripheral clock gating. In Stop 1 mode, all clocks in the VCORE domain are stopped. The PLL, MSIS, MSIK, HSI16 and HSE oscillators are disabled. Some peripherals with the LPBAM capability can switch on HSI16 or MSIS or MSIK for transferring data. All SRAMs and register contents are preserved, but the SRAMs can be totally or partially switched off to further reduce consumption. The BOR is always available in Stop 1 mode.

- Entry: The Stop 1 mode is entered by using the HAL_PWREx_EnterSTOP1Mode() function.
  - PWR_STOPENTRY_WFI: enter Stop 1 mode with WFI instruction.
  - PWR_STOPENTRY_WFE: enter Stop 1 mode with WFE instruction.
- Exit: Any EXTI line configured in interrupt mode (the corresponding EXTI interrupt vector must be enabled in the NVIC). The interrupt source can be external interrupts or peripherals with wakeup capability. Any peripheral interrupt occurring when the AHB/APB clocks are present due to an autonomous peripheral clock request (the peripheral vector must be enabled in the NVIC) Any EXTI line configured in event mode.

Stop 2 mode

The Stop 2 mode is based on the Cortex-M4 Deepsleep mode combined with peripheral clock gating. In Stop 2 mode, all clocks in the VCORE domain are stopped. The PLL, MSIS, MSIK, HSI16 and HSE oscillators are disabled. All SRAMs and register contents are preserved, but the SRAMs can be totally or partially switched off to further reduce consumption. The BOR is always available in Stop 2 mode.

- Entry: The Stop 2 mode is entered by using the HAL_PWREx_EnterSTOP2Mode() function.
  - PWR_STOPENTRY_WFI: enter Stop 2 mode with WFI instruction.
  - PWR_STOPENTRY_WFE: enter Stop 23 mode with WFE instruction.
- Exit: WKUPx pin edge, RTC or TAMP event, external Reset in NRST pin, IWDG Reset, BOR reset.

Shutdown mode

The lowest power consumption is reached in Shutdown mode. It is based on the Deepsleep mode with the voltage regulator disabled. The VCORE domain is consequently powered off. The PLL, HSI16, MSIS, MSIK and HSE oscillators are also switched off. The SRAMs and register contents are lost except for registers in the Backup domain. The BOR is not available in Shutdown mode. No power voltage monitoring is possible in this mode, therefore the switch to Backup domain is not supported.

- Entry: The Shutdown mode is entered by using the HAL_PWREx_EnterSHUTDOWNMode() function.
- Exit: WKUPx pin edge, RTC/TAMP event, external Reset in NRST pin.

This section contains the following APIs:

- ***HAL_PWREx_EnableLowPowerRunMode()***
- ***HAL_PWREx_DisableLowPowerRunMode()***
- ***HAL_PWREx_EnterSTOP1Mode()***
- ***HAL_PWREx_EnterSTOP2Mode()***

36.2.4 Voltage Monitoring Functions

This section provides functions allowing voltage monitoring.

PVM configuration

- The supplies (VDDADC, VDDDAC and VDDUSB) can be independent from VDD and can be monitored with three peripheral voltage monitoring (PVM).
- Each PVM output is connected to an EXTI line and can generate an interrupt if enabled through the EXTI registers. The PVMx output interrupt is generated when the independent power supply drops below the PVM threshold and/or when it rises above the PVM threshold, depending on EXTI line rising/falling edge configuration.
- Each PVM can remain active in Stop 0, Stop 1, Stop 2 modes, and the PVM interrupt can wake up from the Stop mode.

VBAT charging

When VDD is present, it is possible to charge the external battery on VBAT through an internal resistance. The VBAT charging is done either through a 5 kOhm resistor or through a 1.5 kOhm resistor depending on the VBRS bit value in the PWR_BDCR2 register. The battery charging is enabled by setting VBE bit in the PWR_BDCR2 register. It is automatically disabled in VBAT mode.

Backup domain monitoring

When the Backup domain voltage and temperature monitoring is enabled (MONEN = 1 in the PWR_BDCR1 register), the Backup domain voltage and the temperature are monitored. If the Backup domain voltage monitoring internal tamper is enabled in the TAMP peripheral (ITAMP1E = 1 in the TAMP_CR1 register), a tamper event is generated when the Backup domain voltage is above the functional range. In case the Backup domain voltage is below the functional range, a Brownout reset is generated, erasing all device including Backup domain.

Backup domain battery

- To retain the content of the backup registers and supply the RTC function when VDD is turned off, the VBAT pin can be connected to an optional backup voltage supplied by a battery or by another source. The VBAT pin powers the RTC unit, the LSE oscillator and the PC13 to PC15 I/Os, allowing the RTC to operate even when the main power supply is turned off. The backup SRAM is optionally powered by VBAT pin when the BREN bit is set in the PWR Backup domain control register 1 (PWR_BDCR1). The switch to the VBAT supply is controlled by the power down reset embedded in the Reset block.

This section contains the following APIs:

- ***HAL_PWREx_EnablePVM1()***
- ***HAL_PWREx_DisablePVM1()***
- ***HAL_PWREx_EnablePVM3()***
- ***HAL_PWREx_DisablePVM3()***
- ***HAL_PWREx_EnablePVM4()***
- ***HAL_PWREx_DisablePVM4()***
- ***HAL_PWREx_ConfigPVM()***
- ***HAL_PWREx_EnableVddUSB()***
- ***HAL_PWREx_DisableVddUSB()***
- ***HAL_PWREx_EnableBatteryCharging()***
- ***HAL_PWREx_DisableBatteryCharging()***
- ***HAL_PWREx_PVD_PVM_IRQHandler()***
- ***HAL_PWREx_PVM1_Callback()***
- ***HAL_PWREx_PVM3_Callback()***
- ***HAL_PWREx_PVM4_Callback()***
- ***HAL_PWREx_EnableInternalWakeUpLine()***
- ***HAL_PWREx_DisableInternalWakeUpLine()***

36.2.5 Memories Retention Functions

Several STM32U0 devices RAM are configurable to keep / lose RAMs content during Stop mode (Stop 0/1/2).

- Retained content RAM in Stop modes are :
  - SRAM

This section contains the following APIs:

- ***HAL_PWREx_EnableSRAMContentRetention()***
- ***HAL_PWREx_DisableSRAMContentRetention()***
- ***HAL_PWREx_EnableFlashPowerDown()***
- ***HAL_PWREx_DisableFlashPowerDown()***
- ***HAL_PWREx_EnableUltraLowPowerMode()***
- ***HAL_PWREx_DisableUltraLowPowerMode()***

36.2.6 Pull-Up Pull-Down Configuration Functions

In Standby and Shutdown mode, pull up and pull down can be configured to maintain an I/O in the selected state. If the APC bit in the PWR_APCR register is set, the I/Os can be configured either with a pull-up through PWR_PUCRx registers (x=A,B,C,D,E,F), or with a pull-down through PWR_PDCRx registers (x=A,B,C,D,E,F), or can be kept in analog state if none of the PWR_PUCRx or PWR_PDCRx register is set.

The pull-down configuration has highest priority over pull-up configuration in case both PWR_PUCRx and PWR_PDCRx are set for the same I/O. This configuration is lost when exiting the Shutdown but not from Standby mode.

This section contains the following APIs:

- *HAL_PWREx_EnablePullUpPullDownConfig()*
- *HAL_PWREx_DisablePullUpPullDownConfig()*
- *HAL_PWREx_EnableGPIOPullUp()*
- *HAL_PWREx_DisableGPIOPullUp()*
- *HAL_PWREx_EnableGPIOPullDown()*
- *HAL_PWREx_DisableGPIOPullDown()*

36.2.7 Detailed description of functions

HAL_PWREx_ControlVoltageScaling

Function name

HAL_StatusTypeDef HAL_PWREx_ControlVoltageScaling (uint32_t VoltageScaling)

Function description

Configure the main internal regulator output voltage.

Parameters

- **VoltageScaling:** specifies the regulator output voltage to achieve a tradeoff between performance and power consumption. This parameter can be one of the following values:

HAL_PWREx_GetVoltageRange

Function name

uint32_t HAL_PWREx_GetVoltageRange (void)

Function description

Return Voltage Scaling Range.

Return values

- **VOS:** bit field (PWR_REGULATOR_VOLTAGE_SCALE1 or PWR_REGULATOR_VOLTAGE_SCALE2)

HAL_PWREx_EnableLowPowerRunMode

Function name

void HAL_PWREx_EnableLowPowerRunMode (void)

Function description

Enter Low-power Run mode.

Return values

- **None:**

Notes

- In Low-power Run mode, all I/O pins keep the same state as in Run mode.
- When Regulator is set to PWR_LOWPOWERREGULATOR_ON, the user can optionally configure the Flash in power-down monde in setting the RUN_PD bit in FLASH_ACR register. Additionally, the clock frequency must be reduced below 2 MHz. Setting RUN_PD in FLASH_ACR then appropriately reducing the clock frequency must be done before calling HAL_PWREx_EnableLowPowerRunMode() API.

HAL_PWREx_DisableLowPowerRunMode

Function name

HAL_StatusTypeDef HAL_PWREx_DisableLowPowerRunMode (void)

Function description

Exit Low-power Run mode.

Return values

- **HAL:** Status

Notes

- Before HAL_PWREx_DisableLowPowerRunMode() completion, the function checks that REGLPF has been properly reset (otherwise, HAL_PWREx_DisableLowPowerRunMode returns HAL_TIMEOUT status). The system clock frequency can then be increased above 2 MHz.

HAL_PWREx_EnterSTOP1Mode

Function name

void HAL_PWREx_EnterSTOP1Mode (uint8_t STOPEntry)

Function description

Enter Stop 1 mode.

Parameters

- **STOPEntry:** specifies if Stop mode in entered with WFI or WFE instruction. This parameter can be one of the following values:
  - PWR_STOPENTRY_WFI Enter Stop mode with WFI instruction
  - PWR_STOPENTRY_WFE Enter Stop mode with WFE instruction

Return values

- **None:**

Notes

- In Stop 1 mode, only low power voltage regulator is ON.
- In Stop 1 mode, all I/O pins keep the same state as in Run mode.
- All clocks in the VCORE domain are stopped; the PLL, the MSI, the HSI and the HSE oscillators are disabled. Some peripherals with the wakeup capability (I2Cx, USARTx and LPUART) can switch on the HSI to receive a frame, and switch off the HSI after receiving the frame if it is not a wakeup frame. In this case, the HSI clock is propagated only to the peripheral requesting it. SRAM and register contents are preserved. The BOR is available.
- When exiting Stop 1 mode by issuing an interrupt or a wakeup event, the HSI RC oscillator is selected as system clock if STOPWUCK bit in RCC_CFGR register is set; the MSI oscillator is selected if STOPWUCK is cleared.
- Due to low power mode, an additional startup delay is incurred when waking up from Stop 1 mode.

HAL_PWREx_EnterSTOP2Mode

Function name

void HAL_PWREx_EnterSTOP2Mode (uint8_t STOPEntry)

Function description

Enter Stop 2 mode.

Parameters

- **STOPEntry:** specifies if Stop mode in entered with WFI or WFE instruction. This parameter can be one of the following values:
  - PWR_STOPENTRY_WFI Enter Stop mode with WFI instruction
  - PWR_STOPENTRY_WFE Enter Stop mode with WFE instruction

Return values

- **None:**

Notes

- In Stop 2 mode, only low power voltage regulator is ON.
- In Stop 2 mode, all I/O pins keep the same state as in Run mode.
- All clocks in the VCORE domain are stopped, the PLL, the MSI, the HSI and the HSE oscillators are disabled. Some peripherals with wakeup capability (LCD, LPTIM1, I2C3 and LPUART) can switch on the HSI to receive a frame, and switch off the HSI after receiving the frame if it is not a wakeup frame. In this case the HSI clock is propagated only to the peripheral requesting it. SRAM and register contents are preserved. The BOR is available. The voltage regulator is set in low-power mode but LPR bit must be cleared to enter stop 2 mode. Otherwise, Stop 1 mode is entered.
- When exiting Stop 2 mode by issuing an interrupt or a wakeup event, the HSI RC oscillator is selected as system clock if STOPWUCK bit in RCC_CFGR register is set; the MSI oscillator is selected if STOPWUCK is cleared.

HAL_PWREx_EnableBatteryCharging

Function name

void HAL_PWREx_EnableBatteryCharging (uint32_t ResistorSelection)

Function description

Enable battery charging.

Parameters

- **ResistorSelection:** specifies the resistor impedance. This parameter can be one of the following values:
  - PWR_BATTERY_CHARGING_RESISTOR_5 5 kOhms resistor
  - PWR_BATTERY_CHARGING_RESISTOR_1_5 1.5 kOhms resistor

Return values

- **None:**

HAL_PWREx_DisableBatteryCharging

Function name

void HAL_PWREx_DisableBatteryCharging (void)

Function description

Disable battery charging.

Return values

- **None:**

HAL_PWREx_EnablePVM1

Function name

void HAL_PWREx_EnablePVM1 (void)

Function description

Enable the Power Voltage Monitoring 1: VDDUSB versus 1.2V.

Return values

- **None:**

HAL_PWREx_DisablePVM1

Function name

void HAL_PWREx_DisablePVM1 (void)

Function description

Disable the Power Voltage Monitoring 1: VDDUSB versus 1.2V.

Return values

- **None:**

HAL_PWREx_EnablePVM3

Function name

void HAL_PWREx_EnablePVM3 (void)

Function description

Enable the Power Voltage Monitoring 2: VDDA versus 1.62V.

Return values

- **None:**

HAL_PWREx_DisablePVM3

Function name

void HAL_PWREx_DisablePVM3 (void)

Function description

Disable the Power Voltage Monitoring 2: VDDA versus 1.62V.

Return values

- **None:**

HAL_PWREx_EnablePVM4

Function name

void HAL_PWREx_EnablePVM4 (void)

Function description

Enable the Power Voltage Monitoring 3: VDDA versus 2.2V.

Return values

- **None:**

HAL_PWREx_DisablePVM4

Function name

void HAL_PWREx_DisablePVM4 (void)

Function description

Disable the Power Voltage Monitoring 3: VDDA versus 2.2V.

Return values

- **None:**

HAL_PWREx_ConfigPVM

Function name

HAL_StatusTypeDef HAL_PWREx_ConfigPVM (PWR_PVMTypeDef * sConfigPVM)

Function description

Configure the Peripheral Voltage Monitoring (PVM).

Parameters

- **sConfigPVM:** pointer to a PWR_PVMTypeDef structure that contains the PVM configuration information.

Return values

- **HAL:** status

Notes

- The API configures a single PVM according to the information contained in the input structure. To configure several PVMs, the API must be singly called for each PVM used.
- Refer to the electrical characteristics of your device datasheet for more details about the voltage thresholds corresponding to each detection level and to each monitored supply.

HAL_PWREx_EnableVddUSB

Function name

void HAL_PWREx_EnableVddUSB (void)

Function description

Enable VDDUSB supply.

Return values

- **None:**

Notes

- Remove VDDUSB electrical and logical isolation, once VDDUSB supply is present.

HAL_PWREx_DisableVddUSB

Function name

void HAL_PWREx_DisableVddUSB (void)

Function description

Disable VDDUSB supply.

Return values

- **None:**

HAL_PWREx_PVD_PVM_IRQHandler

Function name

void HAL_PWREx_PVD_PVM_IRQHandler (void)

Function description

This function handles the PWR PVD/PVMx interrupt request.

Return values

- **None:**

Notes

- This API should be called under the PVD_PVM_IRQHandler().

HAL_PWREx_PVM1_Callback

Function name

void HAL_PWREx_PVM1_Callback (void)

Function description

PWR PVM USB interrupt callback.

Return values

- **None:**

HAL_PWREx_PVM3_Callback

Function name

void HAL_PWREx_PVM3_Callback (void)

Function description

PWR PVM ADC interrupt callback.

Return values

- **None:**

HAL_PWREx_PVM4_Callback

Function name

void HAL_PWREx_PVM4_Callback (void)

Function description

PWR PVM DAC interrupt callback.

Return values

- **None:**

HAL_PWREx_EnableInternalWakeUpLine

Function name

void HAL_PWREx_EnableInternalWakeUpLine (void)

Function description

Enable Internal Wake-up Line.

Return values

- **None:**

HAL_PWREx_DisableInternalWakeUpLine

Function name

void HAL_PWREx_DisableInternalWakeUpLine (void)

Function description

Disable Internal Wake-up Line.

Return values

- **None:**

HAL_PWREx_EnableSRAMContentRetention

Function name

void HAL_PWREx_EnableSRAMContentRetention (void)

Function description

Enable Full SRAM content retention in Standby mode.

Return values

- **None:**

HAL_PWREx_DisableSRAMContentRetention

Function name

void HAL_PWREx_DisableSRAMContentRetention (void)

Function description

Disable SRAM content retention in Standby mode.

Return values

- **None:**

HAL_PWREx_EnableFlashPowerDown

Function name

void HAL_PWREx_EnableFlashPowerDown (uint32_t PowerMode)

Function description

Enable Flash Power Down.

Parameters

- **PowerMode:** this can be a combination of following values:
  - PWR_FLASHPD_LPRUN
  - PWR_FLASHPD_LPSLEEP
  - PWR_FLASHPD_STOP

Return values

- **None:**

Notes

- This API allows to enable flash power down capabilities in low power run, low power sleep and stop modes.

HAL_PWREx_DisableFlashPowerDown

Function name

void HAL_PWREx_DisableFlashPowerDown (uint32_t PowerMode)

Function description

Disable Flash Power Down.

Parameters

- **PowerMode:** this can be a combination of following values:
  - PWR_FLASHPD_LPRUN
  - PWR_FLASHPD_LPSLEEP
  - PWR_FLASHPD_STOP

Return values

- **None:**

Notes

- This API allows to disable flash power down capabilities in low power run, low power sleep and stop modes.

HAL_PWREx_EnableUltraLowPowerMode

Function name

void HAL_PWREx_EnableUltraLowPowerMode (void)

Function description

Enable Ultra Low Power BORL, BORH and PVD for STOP2 and Standby modes.

Return values

- **None:**

Notes

- All the other modes are not affected by this bit.

HAL_PWREx_DisableUltraLowPowerMode

Function name

void HAL_PWREx_DisableUltraLowPowerMode (void)

Function description

Disable Ultra Low Power BORL, BORH and PVD for STOP2 and Standby modes.

Return values

- **None:**

Notes

- All the other modes are not affected by this bit

HAL_PWREx_EnableGPIOPullUp

Function name

HAL_StatusTypeDef HAL_PWREx_EnableGPIOPullUp (uint32_t GPIO, uint32_t GPIONumber)

Function description

Enable GPIO pull-up state in Standby and Shutdown modes.

Parameters

- **GPIO_Port:** Specify the IO port. This parameter can be PWR_GPIO_A, ..., PWR_GPIO_H (or PWR_GPIO_I depending on the devices) to select the GPIO peripheral.
- **GPIO_Pin:** Specify the I/O pins numbers. This parameter can be one of the following values: PWR_GPIO_BIT_0, ..., PWR_GPIO_BIT_15 (except for the port where less I/O pins are available) or the logical OR of several of them to set several bits for a given port in a single API call.

Return values

- **HAL:** Status

Notes

- Set the relevant PUy bits of PWR_PUCRx register to configure the I/O in pull-up state in Standby and Shutdown modes.
- This state is effective in Standby and Shutdown modes only if APC bit is set through HAL_PWREx_EnablePullUpPullDownConfig() API.
- The configuration is lost when exiting the Shutdown mode due to the power-on reset, maintained when exiting the Standby mode.
- To avoid any conflict at Standby and Shutdown modes exits, the corresponding PDy bit of PWR_PDCRx register is cleared unless it is reserved.
- Even if a PUy bit to set is reserved, the other PUy bits entered as input parameter at the same time are set.

HAL_PWREx_DisableGPIOPullUp

Function name

HAL_StatusTypeDef HAL_PWREx_DisableGPIOPullUp (uint32_t GPIO, uint32_t GPIONumber)

Function description

Disable GPIO pull-up state in Standby mode and Shutdown modes.

Parameters

- **GPIO_Port:** Specifies the IO port. This parameter can be PWR_GPIO_A, ..., PWR_GPIO_H (or PWR_GPIO_I depending on the devices) to select the GPIO peripheral.
- **GPIO_Pin:** Specify the I/O pins numbers. This parameter can be one of the following values: PWR_GPIO_BIT_0, ..., PWR_GPIO_BIT_15 (except for the port where less I/O pins are available) or the logical OR of several of them to reset several bits for a given port in a single API call.

Return values

- **HAL:** Status

Notes

- Reset the relevant PUy bits of PWR_PUCRx register used to configure the I/O in pull-up state in Standby and Shutdown modes.
- Even if a PUy bit to reset is reserved, the other PUy bits entered as input parameter at the same time are reset.

HAL_PWREx_EnableGPIOPullDown

Function name

HAL_StatusTypeDef HAL_PWREx_EnableGPIOPullDown (uint32_t GPIO, uint32_t GPIONumber)

Function description

Enable GPIO pull-down state in Standby and Shutdown modes.

Parameters

- **GPIO_Port:** Specify the IO port. This parameter can be PWR_GPIO_A..PWR_GPIO_H (or PWR_GPIO_I depending on the devices) to select the GPIO peripheral.
- **GPIO_Pin:** Specify the I/O pins numbers. This parameter can be one of the following values: PWR_GPIO_BIT_0, ..., PWR_GPIO_BIT_15 (except for the port where less I/O pins are available) or the logical OR of several of them to set several bits for a given port in a single API call.

Return values

- **HAL:** Status

Notes

- Set the relevant PDy bits of PWR_PDCRx register to configure the I/O in pull-down state in Standby and Shutdown modes.
- This state is effective in Standby and Shutdown modes only if APC bit is set through HAL_PWREx_EnablePullUpPullDownConfig() API.
- The configuration is lost when exiting the Shutdown mode due to the power-on reset, maintained when exiting the Standby mode.
- To avoid any conflict at Standby and Shutdown modes exits, the corresponding PUy bit of PWR_PUCRx register is cleared unless it is reserved.
- Even if a PDy bit to set is reserved, the other PDy bits entered as input parameter at the same time are set.

HAL_PWREx_DisableGPIOPullDown

Function name

HAL_StatusTypeDef HAL_PWREx_DisableGPIOPullDown (uint32_t GPIO, uint32_t GPIONumber)

Function description

Disable GPIO pull-down state in Standby and Shutdown modes.

Parameters

- **GPIO_Port:** Specifies the IO port. This parameter can be PWR_GPIO_A..PWR_GPIO_H (or PWR_GPIO_I depending on the devices) to select the GPIO peripheral.
- **GPIO_Pin:** Specify the I/O pins numbers. This parameter can be one of the following values: PWR_GPIO_BIT_0, ..., PWR_GPIO_BIT_15 (except for the port where less I/O pins are available) or the logical OR of several of them to reset several bits for a given port in a single API call.

Return values

- **HAL:** Status

Notes

- Reset the relevant PDy bits of PWR_PDCRx register used to configure the I/O in pull-down state in Standby and Shutdown modes.
- Even if a PDy bit to reset is reserved, the other PDy bits entered as input parameter at the same time are reset.

HAL_PWREx_EnablePullUpPullDownConfig

Function name

void HAL_PWREx_EnablePullUpPullDownConfig (void)

Function description

Enable pull-up and pull-down configuration.

Return values

- **None:**

Notes

- When APC bit is set, the I/O pull-up and pull-down configurations defined in PWR_PUCRx and PWR_PDCRx registers are applied in Standby and Shutdown modes.
- Pull-up set by PUy bit of PWR_PUCRx register is not activated if the corresponding PDy bit of PWR_PDCRx register is also set (pull-down configuration priority is higher). HAL_PWREx_EnableGPIOPullUp() and HAL_PWREx_EnableGPIOPullDown() API's ensure there is no conflict when setting PUy or PDy bit.

HAL_PWREx_DisablePullUpPullDownConfig

Function name

void HAL_PWREx_DisablePullUpPullDownConfig (void)

Function description

Disable pull-up and pull-down configuration.

Return values

- **None:**

Notes

- When APC bit is cleared, the I/O pull-up and pull-down configurations defined in PWR_PUCRx and PWR_PDCRx registers are not applied in Standby and Shutdown modes.

36.3 PWREx Firmware driver defines

The following section lists the various define and macros of the module.

36.3.1 PWREx

PWREx

PWR Extended Exported Macros

__HAL_PWR_PVM1_EXTI_ENABLE_IT

Description:

- Enable the PVM USB Extended Interrupt Line.

Return value:

- None

__HAL_PWR_PVM1_EXTI_DISABLE_IT

Description:

- Disable the PVM USB Extended Interrupt Line.

Return value:

- None

__HAL_PWR_PVM1_EXTI_ENABLE_EVENT

Description:

- Enable the PVM USB Event Line.

Return value:

- None

__HAL_PWR_PVM1_EXTI_DISABLE_EVENT

Description:

- Disable the PVM USB Event Line.

Return value:

- None

__HAL_PWR_PVM1_EXTI_ENABLE_RISING_EDGE

Description:

- Enable the PVM1 USB Extended Interrupt Rising Trigger.

Return value:

- None

__HAL_PWR_PVM1_EXTI_DISABLE_RISING_EDGE

Description:

- Disable the PVM USB Extended Interrupt Rising Trigger.

Return value:

- None

__HAL_PWR_PVM1_EXTI_ENABLE_FALLING_EDGE

Description:

- Enable the PVM USB Extended Interrupt Falling Trigger.

Return value:

- None

__HAL_PWR_PVM1_EXTI_DISABLE_FALLING_EDGE

Description:

- Disable the PVM USB Extended Interrupt Falling Trigger.

Return value:

- None

__HAL_PWR_PVM1_EXTI_ENABLE_RISING_FALLING_EDGE

Description:

- PVM USB EXTI line configuration: set rising & falling edge trigger.

Return value:

- None

__HAL_PWR_PVM1_EXTI_DISABLE_RISING_FALLING_EDGE

Description:

- Disable the PVM USB Extended Interrupt Rising & Falling Trigger.

Return value:

- None

__HAL_PWR_PVM1_EXTI_GENERATE_SWIT

Description:

- Generate a Software interrupt on selected EXTI line.

Return value:

- None

__HAL_PWR_PVM1_EXTI_GET_RISING_FLAG

Description:

- Check whether the specified PVM USB EXTI Rising interrupt flag is set or not.

Return value:

- EXTI: PVM_USB Line Status.

__HAL_PWR_PVM1_EXTI_GET_FALLING_FLAG

Description:

- Check whether the specified PVM USB Falling EXTI interrupt flag is set or not.

Return value:

- EXTI: PVM USB Line Status.

__HAL_PWR_PVM1_EXTI_CLEAR_FLAG

Description:

- Clear the PVM USB EXTI flag.

Return value:

- None

__HAL_PWR_PVM3_EXTI_ENABLE_IT

Description:

- Enable the PVM ADC Extended Interrupt Line.

Return value:

- None

__HAL_PWR_PVM3_EXTI_DISABLE_IT

Description:

- Disable the PVM ADC Extended Interrupt Line.

Return value:

- None

__HAL_PWR_PVM3_EXTI_ENABLE_EVENT

Description:

- Enable the PVM ADC Event Line.

Return value:

- None

__HAL_PWR_PVM3_EXTI_DISABLE_EVENT

Description:

- Disable the PVM ADC Event Line.

Return value:

- None

__HAL_PWR_PVM3_EXTI_ENABLE_RISING_EDGE

Description:

- Enable the PVM ADC Extended Interrupt Rising Trigger.

Return value:

- None

__HAL_PWR_PVM3_EXTI_DISABLE_RISING_EDGE

Description:

- Disable the PVM ADC Extended Interrupt Rising Trigger.

Return value:

- None

__HAL_PWR_PVM3_EXTI_ENABLE_FALLING_EDGE

Description:

- Enable the PVM ADC Extended Interrupt Falling Trigger.

Return value:

- None

__HAL_PWR_PVM3_EXTI_DISABLE_FALLING_EDGE

Description:

- Disable the PVM ADC Extended Interrupt Falling Trigger.

Return value:

- None

__HAL_PWR_PVM3_EXTI_ENABLE_RISING_FALLING_EDGE

Description:

- PVM ADC EXTI line configuration: set rising & falling edge trigger.

Return value:

- None

__HAL_PWR_PVM3_EXTI_DISABLE_RISING_FALLING_EDGE

Description:

- Disable the PVM ADC Extended Interrupt Rising & Falling Trigger.

Return value:

- None

__HAL_PWR_PVM3_EXTI_GENERATE_SWIT

Description:

- Generate a Software interrupt on selected EXTI line.

Return value:

- None

__HAL_PWR_PVM3_EXTI_GET_RISING_FLAG

Description:

- Check whether the specified PVM ADC EXTI Rising interrupt flag is set or not.

Return value:

- EXTI: PVM ADC Line Status.

__HAL_PWR_PVM3_EXTI_GET_FALLING_FLAG

Description:

- Check whether the specified PVM ADC EXTI Falling interrupt flag is set or not.

Return value:

- EXTI: PVM ADC Line Status.

__HAL_PWR_PVM3_EXTI_CLEAR_FLAG

Description:

- Clear the PVM_ADC EXTI flag.

Return value:

- None

__HAL_PWR_PVM4_EXTI_ENABLE_IT

Description:

- Enable the PVM DAC Extended Interrupt Line.

Return value:

- None

__HAL_PWR_PVM4_EXTI_DISABLE_IT

Description:

- Disable the PVM DAC Extended Interrupt Line.

Return value:

- None

__HAL_PWR_PVM4_EXTI_ENABLE_EVENT

Description:

- Enable the PVM DAC Event Line.

Return value:

- None

__HAL_PWR_PVM4_EXTI_DISABLE_EVENT

Description:

- Disable the PVM DAC Event Line.

Return value:

- None

__HAL_PWR_PVM4_EXTI_ENABLE_RISING_EDGE

Description:

- Enable the PVM DAC Extended Interrupt Rising Trigger.

Return value:

- None

__HAL_PWR_PVM4_EXTI_DISABLE_RISING_EDGE

Description:

- Disable the PVM DAC Extended Interrupt Rising Trigger.

Return value:

- None

__HAL_PWR_PVM4_EXTI_ENABLE_FALLING_EDGE

Description:

- Enable the PVM DAC Extended Interrupt Falling Trigger.

Return value:

- None

__HAL_PWR_PVM4_EXTI_DISABLE_FALLING_EDGE

Description:

- Disable the PVM DAC Extended Interrupt Falling Trigger.

Return value:

- None

__HAL_PWR_PVM4_EXTI_ENABLE_RISING_FALLING_EDGE

Description:

- PVM3 EXTI line configuration: set rising & falling edge trigger.

Return value:

- None

__HAL_PWR_PVM4_EXTI_DISABLE_RISING_FALLING_EDGE

Description:

- Disable the PVM_DAC Extended Interrupt Rising & Falling Trigger.

Return value:

- None

__HAL_PWR_PVM4_EXTI_GENERATE_SWIT

Description:

- Generate a Software interrupt on selected EXTI line.

Return value:

- None

__HAL_PWR_PVM4_EXTI_GET_RISING_FLAG

Description:

- Check whether the specified PVM DAC EXTI Rising interrupt flag is set or not.

Return value:

- EXTI: PVM DAC Line Status.

__HAL_PWR_PVM4_EXTI_GET_FALLING_FLAG

Description:

- Check whether the specified PVM DAC EXTI Falling interrupt flag is set or not.

Return value:

- EXTI: PVM DAC Line Status.

__HAL_PWR_PVM4_EXTI_CLEAR_FLAG

Description:

- Clear the PVM DAC EXTI flag.

Return value:

- None.

__HAL_PWR_VOLTAGESCALING_CONFIG

Description:

- Configure the main internal regulator output voltage.

Parameters:

- __REGULATOR__: specifies the regulator output voltage to achieve a tradeoff between performance and power consumption. This parameter can be one of the following values:
  - PWR_REGULATOR_VOLTAGE_SCALE1 Regulator voltage output range 1 mode, typical output voltage at 1.2 V, system frequency up to 80 MHz.
  - PWR_REGULATOR_VOLTAGE_SCALE2 Regulator voltage output range 2 mode, typical output voltage at 1.0 V, system frequency up to 26 MHz.

Return value:

- None

Notes:

- This macro is similar to HAL_PWREx_ControlVoltageScaling() API but doesn't check whether or not VOSF flag is cleared when moving from range 2 to range 1. User may resort to __HAL_PWR_GET_FLAG() macro to check VOSF bit resetting.

PWR Status Flags

PWR_FLAG_WUF1

Wakeup event on wakeup pin 1

PWR_FLAG_WUF2

Wakeup event on wakeup pin 2

PWR_FLAG_WUF3

Wakeup event on wakeup pin 3

PWR_FLAG_WUF4

Wakeup event on wakeup pin 4

PWR_FLAG_WUF5

Wakeup event on wakeup pin 5

PWR_FLAG_WUF7

Wakeup event on wakeup pin 7

PWR_FLAG_WU

Encompass wakeup event on all wakeup pins

PWR_FLAG_SB

Standby flag

PWR_FLAG_STOP0

Stop0 flag

PWR_FLAG_STOP1

Stop1 flag

PWR_FLAG_STOP2

Stop2 flag

PWR_FLAG_WUFI

Wakeup on internal wakeup line

PWR_FLAG_FLASHRDY

flash ready flag

PWR_FLAG_REGLPS

Low-power regulator start flag

PWR_FLAG_REGLPF

Low-power regulator flag

PWR_FLAG_VOSF

Voltage scaling flag

PWR_FLAG_PVDO

Power Voltage Detector output flag

PWR_FLAG_PVMO_USB

Power Voltage Monitoring 1 output flag

PWR_FLAG_PVMO_ADC

Power Voltage Monitoring 3 output flag

PWR_FLAG_PVMO_DAC

Power Voltage Monitoring 4 output flag

PWR_SCR_CWUF

Clear Wake-up Flags

Flash Power Down modes

PWR_FLASHPD_LPRUN

Enable Flash power down in low power run mode

PWR_FLASHPD_LPSLEEP

Enable Flash power down in low power sleep mode

PWR_FLASHPD_STOP

Enable Flash power down in stop mode

GPIO port

PWR_GPIO_A

GPIO port A

PWR_GPIO_B

GPIO port B

PWR_GPIO_C

GPIO port C

PWR_GPIO_D

GPIO port D

PWR_GPIO_E

GPIO port E

PWR_GPIO_F

GPIO port F

GPIO bit number for I/O setting in standby/shutdown mode

PWR_GPIO_BIT_0

GPIO port I/O pin 0

PWR_GPIO_BIT_1

GPIO port I/O pin 1

PWR_GPIO_BIT_2

GPIO port I/O pin 2

PWR_GPIO_BIT_3

GPIO port I/O pin 3

PWR_GPIO_BIT_4

GPIO port I/O pin 4

PWR_GPIO_BIT_5

GPIO port I/O pin 5

PWR_GPIO_BIT_6

GPIO port I/O pin 6

PWR_GPIO_BIT_7

GPIO port I/O pin 7

PWR_GPIO_BIT_8

GPIO port I/O pin 8

PWR_GPIO_BIT_9

GPIO port I/O pin 9

PWR_GPIO_BIT_10

GPIO port I/O pin 10

PWR_GPIO_BIT_11

GPIO port I/O pin 11

PWR_GPIO_BIT_12

GPIO port I/O pin 12

PWR_GPIO_BIT_13

GPIO port I/O pin 13

PWR_GPIO_BIT_14

GPIO port I/O pin 14

PWR_GPIO_BIT_15

GPIO port I/O pin 15

PWR PVM event lines

PWR_EVENT_LINE_PVM1

Event line 19 Connected to the PVM USB EXTI Line

PWR_EVENT_LINE_PVM3

Event line 20 Connected to the PVM ADC EXTI Line

PWR_EVENT_LINE_PVM4

Event line 21 Connected to the PVM DAC EXTI Line

PWR PVM external interrupts lines

PWR_EXTI_LINE_PVM1

External interrupt line 19 Connected to the PVM USB EXTI Line

PWR_EXTI_LINE_PVM3

External interrupt line 20 Connected to the PVM ADC EXTI Line

PWR_EXTI_LINE_PVM4

External interrupt line 21 Connected to the PVM DAC EXTI Line

PWR PVM interrupt and event mode

PWR_PVM_MODE_NORMAL

basic mode is used

PWR_PVM_MODE_IT_RISING

External Interrupt Mode with Rising edge trigger detection

PWR_PVM_MODE_IT_FALLING

External Interrupt Mode with Falling edge trigger detection

PWR_PVM_MODE_IT_RISING_FALLING

External Interrupt Mode with Rising/Falling edge trigger detection

PWR_PVM_MODE_EVENT_RISING

Event Mode with Rising edge trigger detection

PWR_PVM_MODE_EVENT_FALLING

Event Mode with Falling edge trigger detection

PWR_PVM_MODE_EVENT_RISING_FALLING

Event Mode with Rising/Falling edge trigger detection

PWR PVM Mode Mask

PVM_MODE_IT

Mask for interruption yielded by PVM threshold crossing

PVM_MODE_EVT

Mask for event yielded by PVM threshold crossing

PVM_RISING_EDGE

Mask for rising edge set as PVM trigger

PVM_FALLING_EDGE

Mask for falling edge set as PVM trigger

Peripheral Voltage Monitoring type

PWR_PVM_1

Peripheral Voltage Monitoring 1 enable: VDDUSB versus 1.2 V (applicable when USB feature is supported)

PWR_PVM_3

Peripheral Voltage Monitoring 3 enable: VDDA versus 1.62 V

PWR_PVM_4

Peripheral Voltage Monitoring 4 enable: VDDA versus 2.2 V

PWR Regulator voltage scale

PWR_REGULATOR_VOLTAGE_SCALE1

Voltage scaling range 1 normal mode

PWR_REGULATOR_VOLTAGE_SCALE2

Voltage scaling range 2

PWR SRAM Retention in Standby mode

PWR_NO_SRAM_RETENTION

SRAM is powered off in Standby mode (SRAM content is lost)

PWR_FULL_SRAM_RETENTION

Full SRAM is powered by the low-power regulator in Standby mode

PWR Extended Flag Setting Time Out Value

PWR_FLAG_SETTING_DELAY_US

Time out value for REGLPF and VOSF flags setting

PWR battery charging

PWR_BATTERY_CHARGING_DISABLE

VBAT charging disable

PWR_BATTERY_CHARGING_ENABLE

VBAT charging enable

PWR battery charging resistor selection

PWR_BATTERY_CHARGING_RESISTOR_5

VBAT charging through a 5 kOhms resistor

PWR_BATTERY_CHARGING_RESISTOR_1_5

VBAT charging through a 1.5 kOhms resistor

PWR wake-up pins

PWR_WAKEUP_PIN1

Wakeup pin 1 (with high level polarity)

PWR_WAKEUP_PIN2

Wakeup pin 2 (with high level polarity)

PWR_WAKEUP_PIN3

Wakeup pin 3 (with high level polarity)

PWR_WAKEUP_PIN4

Wakeup pin 4 (with high level polarity)

PWR_WAKEUP_PIN5

Wakeup pin 5 (with high level polarity)

PWR_WAKEUP_PIN7

Wakeup pin 7 (with high level polarity)

PWR_WAKEUP_PIN1_HIGH

Wakeup pin 1 (with high level polarity)

PWR_WAKEUP_PIN2_HIGH

Wakeup pin 2 (with high level polarity)

PWR_WAKEUP_PIN3_HIGH

Wakeup pin 3 (with high level polarity)

PWR_WAKEUP_PIN4_HIGH

Wakeup pin 4 (with high level polarity)

PWR_WAKEUP_PIN5_HIGH

Wakeup pin 5 (with high level polarity)

PWR_WAKEUP_PIN7_HIGH

Wakeup pin 7 (with high level polarity)

PWR_WAKEUP_PIN1_LOW

Wakeup pin 1 (with low level polarity)

PWR_WAKEUP_PIN2_LOW

Wakeup pin 2 (with low level polarity)

PWR_WAKEUP_PIN3_LOW

Wakeup pin 3 (with low level polarity)

PWR_WAKEUP_PIN4_LOW

Wakeup pin 4 (with low level polarity)

PWR_WAKEUP_PIN5_LOW

Wakeup pin 5 (with low level polarity)

PWR_WAKEUP_PIN7_LOW

Wakeup pin 7 (with low level polarity)

Shift to apply to retrieve polarity information from PWR_WAKEUP_PINy_xxx constants

PWR_WUP_POLARITY_SHIFT

Internal constant used to retrieve wakeup pin polarity

37 HAL RCC Generic Driver

37.1 RCC Firmware driver registers structures

37.1.1 RCC_PLLInitTypeDef

RCC_PLLInitTypeDef is defined in the stm32u0xx_hal_rcc.h

Data Fields

- ***uint32_t PLLState***
- ***uint32_t PLLSource***
- ***uint32_t PLLM***
- ***uint32_t PLLN***
- ***uint32_t PLLP***
- ***uint32_t PLLQ***
- ***uint32_t PLLR***
- ***uint32_t PLLClockOut***

Field Documentation

- ***uint32_t RCC_PLLInitTypeDef::PLLState***
  The new state of the PLL. This parameter can be a value of ***RCC_PLL_Config***
- ***uint32_t RCC_PLLInitTypeDef::PLLSource***
  RCC_PLLSource: PLL entry clock source. This parameter must be a value of ***RCC_PLL_Clock_Source***
- ***uint32_t RCC_PLLInitTypeDef::PLLM***
  PLLM: Division factor for PLL VCO input clock. This parameter must be a number between Min_Data = 1 and Max_Data = 16
- ***uint32_t RCC_PLLInitTypeDef::PLLN***
  PLLN: Multiplication factor for PLL VCO output clock. This parameter must be a number between Min_Data = 4 and Max_Data = 512
- ***uint32_t RCC_PLLInitTypeDef::PLLP***
  PLLP: Division factor for system clock. This parameter must be a number between Min_Data = 1 and Max_Data = 128 odd division factors are not allowed
- ***uint32_t RCC_PLLInitTypeDef::PLLQ***
  PLLQ: Division factor for peripheral clocks. This parameter must be a number between Min_Data = 1 and Max_Data = 128
- ***uint32_t RCC_PLLInitTypeDef::PLLR***
  PLLR: Division factor for peripheral clocks. This parameter must be a number between Min_Data = 2 and Max_Data = 128
- ***uint32_t RCC_PLLInitTypeDef::PLLClockOut***
  PLLClockOut: specifies PLL output clock to be enabled. This parameter must be a value of ***RCC_PLL_Clock_Output***

37.1.2 RCC_OscInitTypeDef

RCC_OscInitTypeDef is defined in the stm32u0xx_hal_rcc.h

Data Fields

- ***uint32_t OscillatorType***
- ***uint32_t HSEState***
- ***uint32_t LSEState***
- ***uint32_t HSIState***
- ***uint32_t HSICalibrationValue***
- ***uint32_t LSIState***
- ***uint32_t LSIDiv***
- ***uint32_t MSIState***
- ***uint32_t MSICalibrationValue***

- ***uint32_t MSIClockRange***
- ***uint32_t HSI48State***
- ***RCC_PLLInitTypeDef PLL***

Field Documentation

- ***uint32_t RCC_OscInitTypeDef::OscillatorType***
  The oscillators to be configured. This parameter can be a value of ***RCC_Oscillator_Type***
- ***uint32_t RCC_OscInitTypeDef::HSEState***
  The new state of the HSE. This parameter can be a value of ***RCC_HSE_Config***
- ***uint32_t RCC_OscInitTypeDef::LSEState***
  The new state of the LSE. This parameter can be a value of ***RCC_LSE_Config***
- ***uint32_t RCC_OscInitTypeDef::HSIState***
  The new state of the HSI. This parameter can be a value of ***RCC_HSI_Config***
- ***uint32_t RCC_OscInitTypeDef::HSICalibrationValue***
  The calibration trimming value (default is RCC_HSICALIBRATION_DEFAULT). This parameter must be a number between Min_Data = 0x00 and Max_Data = 0x7F on the other devices
- ***uint32_t RCC_OscInitTypeDef::LSIState***
  The new state of the LSI. This parameter can be a value of ***RCC_LSI_Config***
- ***uint32_t RCC_OscInitTypeDef::LSIDiv***
  The division factor of the LSI. This parameter can be a value of ***RCC_LSI_Div***
- ***uint32_t RCC_OscInitTypeDef::MSIState***
  The new state of the MSI. This parameter can be a value of ***RCC_MSI_Config***
- ***uint32_t RCC_OscInitTypeDef::MSICalibrationValue***
  The calibration trimming value (default is RCC_MSICALIBRATION_DEFAULT). This parameter must be a number between Min_Data = 0x00 and Max_Data = 0xFF
- ***uint32_t RCC_OscInitTypeDef::MSIClockRange***
  The MSI frequency range. This parameter can be a value of ***RCC_MSI_Clock_Range***
- ***uint32_t RCC_OscInitTypeDef::HSI48State***
  The new state of the HSI48. This parameter can be a value of ***RCC_HSI48_Config***
- ***RCC_PLLInitTypeDef RCC_OscInitTypeDef::PLL***
  Main PLL structure parameters

37.1.3 RCC_ClkInitTypeDef

RCC_ClkInitTypeDef is defined in the stm32u0xx_hal_rcc.h

Data Fields

- ***uint32_t ClockType***
- ***uint32_t SYSCLKSource***
- ***uint32_t AHBCLKDivider***
- ***uint32_t APB1CLKDivider***

Field Documentation

- ***uint32_t RCC_ClkInitTypeDef::ClockType***
  The clock to be configured. This parameter can be a value of ***RCC_System_Clock_Type***
- ***uint32_t RCC_ClkInitTypeDef::SYSCLKSource***
  The clock source used as system clock (SYSCLK). This parameter can be a value of ***RCC_System_Clock_Source***
- ***uint32_t RCC_ClkInitTypeDef::AHBCLKDivider***
  The AHB clock (HCLK) divider. This clock is derived from the system clock (SYSCLK). This parameter can be a value of ***RCC_AHB_Clock_Source***
- ***uint32_t RCC_ClkInitTypeDef::APB1CLKDivider***
  The APB clock (PCLK1) divider. This clock is derived from the AHB clock (HCLK). This parameter can be a value of ***RCC_APB_Clock_Source***

37.2 RCC Firmware driver API description

The following section lists the various functions of the RCC library.

37.2.1 RCC specific features

After reset the device is running from Multiple Speed Internal oscillator (4 MHz) with Flash 0 wait state. Flash prefetch buffer, D-Cache and I-Cache are disabled, and all peripherals are off except internal SRAM, Flash and JTAG.

- There is no prescaler on High speed (AHBs) and Low speed (APBs) busses: all peripherals mapped on these busses are running at MSI speed.
- The clock for all peripherals is switched off, except the SRAM and FLASH.
- All GPIOs are in analog mode, except the JTAG pins which are assigned to be used for debug purpose.

Once the device started from reset, the user application has to:

- Configure the clock source to be used to drive the System clock (if the application needs higher frequency/ performance)
- Configure the System clock frequency and Flash settings
- Configure the AHB and APB busses prescalers
- Enable the clock for the peripheral(s) to be used
- Configure the clock source(s) for peripherals which clocks are not derived from the System clock (RTC, ADC, USB FS/RNG)

37.2.2 Initialization and de-initialization functions

This section provides functions allowing to configure the internal and external oscillators (HSE, HSI, LSE, MSI, LSI, PLL, CSS and MCO) and the System busses clocks (SYSCLK, AHB, APB).

Internal/external clock and PLL configuration

- HSI (high-speed internal): 16 MHz factory-trimmed RC used directly or through the PLL as System clock source.
- MSI (Multiple Speed Internal): Its frequency is software trimmable from 100KHZ to 48MHZ. It can be used to generate the clock for the USB OTG FS (48 MHz). The number of flash wait states is automatically adjusted when MSI range is updated with HAL_RCC_OscConfig() and the MSI is used as System clock source.
- LSI (low-speed internal): 32 KHz low consumption RC used as IWDG and/or RTC clock source.
- HSE (high-speed external): 4 to 48 MHz crystal oscillator used directly or through the PLL as System clock source. Can be used also optionally as RTC clock source.
- LSE (low-speed external): 32.768 KHz oscillator used optionally as RTC clock source.
- PLL (clocked by HSI, HSE or MSI) providing up to three independent output clocks:
  - The first output is used to generate the high speed system clock (up to 80MHz).
  - The second output is used to generate the clock for the USB OTG FS (48 MHz), the random analog generator (<=48 MHz) and the SDMMC1 (<= 48 MHz).
  - The third output is used to generate an accurate clock to achieve high-quality audio performance on SAI interface.
- CSS (Clock security system): once enabled, if a HSE clock failure occurs (HSE used directly or through PLL as System clock source), the System clock is automatically switched to HSI and an interrupt is generated if enabled. The interrupt is linked to the Cortex-M4 NMI (Non-Maskable Interrupt) exception vector.
- MCO (microcontroller clock output): used to output MSI, LSI, HSI, LSE, HSE or main PLL clock (through a configurable prescaler) on PA8 pin.

System, AHB and APB busses clocks configuration

- Several clock sources can be used to drive the System clock (SYSCLK): MSI, HSI, HSE and main PLL. The AHB clock (HCLK) is derived from System clock through configurable prescaler and used to clock the CPU, memory and peripherals mapped on AHB bus (DMA, GPIO...). APB (PCLK) clocks are derived from AHB clock through configurable prescalers and used to clock the peripherals mapped on these busses. You can use "HAL_RCC_GetSysClockFreq()" function to retrieve the frequencies of these clocks.

Note: *All the peripheral clocks are derived from the System clock (SYSCLK) except:*

- *RTC: the RTC clock can be derived either from the LSI, LSE or HSE clock divided by 2 to 31. You have to use __HAL_RCC_RTC_ENABLE() and HAL_RCCEx_PeriphCLKConfig() function to configure this clock.*
- *USB FS and RNG: USB FS requires a frequency equal to 48 MHz to work correctly, while the RNG peripherals require a frequency equal or lower than to 48 MHz. This clock is derived of the main PLL through PLLQ divider. You have to enable the peripheral clock and use HAL_RCCEx_PeriphCLKConfig() function to configure this clock.*
- *IWDG clock which is always the LSI clock.*

- The maximum frequency of the SYSCLK, HCLK, PCLK1 is 48 MHz. The clock source frequency should be adapted depending on the device voltage range as listed in the Reference Manual "Clock source frequency versus voltage scaling" chapter.

This section contains the following APIs:

- ***HAL_RCC_DeInit()***
- ***HAL_RCC_OscConfig()***
- ***HAL_RCC_ClockConfig()***

37.2.3 Peripheral Control functions

This subsection provides a set of functions allowing to:

- Output clock to MCO pin.
- Retrieve current clock frequencies.
- Enable the Clock Security System.

This section contains the following APIs:

- ***HAL_RCC_MCOConfig()***
- ***HAL_RCC_GetSysClockFreq()***
- ***HAL_RCC_GetHCLKFreq()***
- ***HAL_RCC_GetPCLK1Freq()***
- ***HAL_RCC_GetOscConfig()***
- ***HAL_RCC_GetClockConfig()***
- ***HAL_RCC_EnableCSS()***
- ***HAL_RCC_NMI_IRQHandler()***
- ***HAL_RCC_CSSCallback()***
- ***HAL_RCC_GetResetSource()***

37.2.4 Detailed description of functions

HAL_RCC_DeInit

Function name

HAL_StatusTypeDef HAL_RCC_DeInit (void)

Function description

Reset the RCC clock configuration to the default reset state.

Return values

- **None:**

Notes

- The default reset state of the clock configuration is given below: MSI ON and used as system clock sourceHSE, HSI and PLL OFFAHB, APB prescaler set to 1.CSS, MCO OFFAll interrupts disabled
- This function doesn't modify the configuration of the Peripheral clocksLSI, LSE and RTC clocks

HAL_RCC_OscConfig

Function name

HAL_StatusTypeDef HAL_RCC_OscConfig (RCC_OscInitTypeDef * RCC_OscInitStruct)

Function description

Initialize the RCC Oscillators according to the specified parameters in the RCC_OscInitTypeDef.

Parameters

- **RCC_OscInitStruct:** pointer to an RCC_OscInitTypeDef structure that contains the configuration information for the RCC Oscillators.

Return values

- **HAL:** status

Notes

- The PLL is not disabled when used as system clock.
- Transitions LSE Bypass to LSE On and LSE On to LSE Bypass are not supported by this macro. User should request a transition to LSE Off first and then LSE On or LSE Bypass.
- Transition HSE Bypass to HSE On and HSE On to HSE Bypass are not supported by this macro. User should request a transition to HSE Off first and then HSE On or HSE Bypass.

HAL_RCC_ClockConfig

Function name

HAL_StatusTypeDef HAL_RCC_ClockConfig (RCC_ClkInitTypeDef * RCC_ClkInitStruct, uint32_t FLatency)

Function description

HAL_RCC_MCOConfig

Function name

void HAL_RCC_MCOConfig (uint32_t RCC_MCOx, uint32_t RCC_MCOSource, uint32_t RCC_MCODiv)

Function description

Select the clock source to output on MCO pin(PA8).

Parameters

- **RCC_MCOx:** specifies the output direction for the clock source. For STM32U0xx family this parameter can have these values:
  - RCC_MCO1 Clock source to output on MCO1 pin(PA8).
  - RCC_MCO1 Clock source to output on MCO1 pin(PA9).
  - RCC_MCO1 Clock source to output on MCO1 pin(PF2).
  - RCC_MCO2 Clock source to output on MCO2 pin(PA10).
  - RCC_MCO2 Clock source to output on MCO2 pin(PC2).
  - RCC_MCO2 Clock source to output on MCO2 pin(PA8).
- **RCC_MCOSource:** specifies the clock source to output. This parameter can be one of the following values:
  - RCC_MCO1SOURCE_NOCLOCK MCO output disabled, no clock on MCO
  - RCC_MCO1SOURCE_SYSCLK system clock selected as MCO source
  - RCC_MCO1SOURCE_MSI MSI clock selected as MCO source
  - RCC_MCO1SOURCE_HSI HSI clock selected as MCO source
  - RCC_MCO1SOURCE_HSE HSE clock selected as MCO source
  - RCC_MCO1SOURCE_PLLR main PLL clock selected as MCO source
  - RCC_MCO1SOURCE_LSI LSI clock selected as MCO source
  - RCC_MCO1SOURCE_LSE LSE clock selected as MCO source
  - RCC_MCO1SOURCE_HSI48 HSI48 clock selected as MCO source
  - RCC_MCO2SOURCE_NOCLOCK MCO output disabled, no clock on MCO
  - RCC_MCO2SOURCE_SYSCLK system clock selected as MCO source
  - RCC_MCO2SOURCE_MSI MSI clock selected as MCO source
  - RCC_MCO2SOURCE_HSI HSI clock selected as MCO source
  - RCC_MCO2SOURCE_HSE HSE clock selected as MCO source
  - RCC_MCO2SOURCE_PLLR main PLL clock selected as MCO source
  - RCC_MCO2SOURCE_LSI LSI clock selected as MCO source
  - RCC_MCO2SOURCE_LSE LSE clock selected as MCO source
  - RCC_MCO2SOURCE_HSI48 HSI48 clock selected as MCO source

- **RCC_MCODiv:** specifies the MCO prescaler. This parameter can be one of the following values:
  - RCC_MCO1DIV_1 division by 1 applied to MCO clock
  - RCC_MCO1DIV_2 division by 2 applied to MCO clock
  - RCC_MCO1DIV_4 division by 4 applied to MCO clock
  - RCC_MCO1DIV_8 division by 8 applied to MCO clock
  - RCC_MCO1DIV_16 division by 16 applied to MCO clock
  - RCC_MCO1DIV_32 division by 32 applied to MCO clock
  - RCC_MCO1DIV_64 division by 64 applied to MCO clock
  - RCC_MCO1DIV_128 division by 128 applied to MCO clock
  - RCC_MCO1DIV_256 division by 256 applied to MCO clock
  - RCC_MCO1DIV_512 division by 512 applied to MCO clock
  - RCC_MCO1DIV_1024 division by 1024 applied to MCO clock
  - RCC_MCO2DIV_1 division by 1 applied to MCO clock
  - RCC_MCO2DIV_2 division by 2 applied to MCO clock
  - RCC_MCO2DIV_4 division by 4 applied to MCO clock
  - RCC_MCO2DIV_8 division by 8 applied to MCO clock
  - RCC_MCO2DIV_16 division by 16 applied to MCO clock
  - RCC_MCO2DIV_32 division by 32 applied to MCO clock
  - RCC_MCO2DIV_64 division by 64 applied to MCO clock
  - RCC_MCO2DIV_128 division by 128 applied to MCO clock
  - RCC_MCO2DIV_256 division by 256 applied to MCO clock
  - RCC_MCO2DIV_512 division by 512 applied to MCO clock
  - RCC_MCO2DIV_1024 division by 1024 applied to MCO clock

Return values

- **None:**

Notes

- PA8 should be configured in alternate function mode.

HAL_RCC_EnableCSS

Function name

void HAL_RCC_EnableCSS (void)

Function description

Enables the Clock Security System.

Return values

- **None:**

Notes

- If a failure is detected on the HSE oscillator clock, this oscillator is automatically disabled and an interrupt is generated to inform the software about the failure (Clock Security System Interrupt, CSSI), allowing the MCU to perform rescue operations. The CSSI is linked to the Cortex-M0+ NMI (Non-Maskable Interrupt) exception vector.

HAL_RCC_GetSysClockFreq

Function name

uint32_t HAL_RCC_GetSysClockFreq (void)

Function description

Return the SYSCLK frequency.

Return values

- **SYSCLK:** frequency

Notes

- The system frequency computed by this function is not the real frequency in the chip. It is calculated based on the predefined constant and the selected clock source:
- If SYSCLK source is MSI, function returns values based on MSI Value as defined by the MSI range.
- If SYSCLK source is HSI, function returns values based on HSI_VALUE(*)
- If SYSCLK source is HSE, function returns values based on HSE_VALUE(**)
- If SYSCLK source is PLL, function returns values based on HSE_VALUE(**), HSI_VALUE(*) or MSI Value multiplied/divided by the PLL factors.
- (*) HSI_VALUE is a constant defined in stm32u0xx_hal_conf.h file (default value 16 MHz) but the real value may vary depending on the variations in voltage and temperature.
- (**) HSE_VALUE is a constant defined in stm32u0xx_hal_conf.h file (default value 8 MHz), user has to ensure that HSE_VALUE is same as the real frequency of the crystal used. Otherwise, this function may have wrong result.
- The result of this function could be not correct when using fractional value for HSE crystal.
- This function can be used by the user application to compute the baudrate for the communication peripherals or configure other parameters.
- Each time SYSCLK changes, this function must be called to update the right SYSCLK value. Otherwise, any configuration based on this function will be incorrect.

HAL_RCC_GetHCLKFreq

Function name

uint32_t HAL_RCC_GetHCLKFreq (void)

Function description

Return the HCLK frequency.

Return values

- **HCLK:** frequency in Hz

Notes

- Each time HCLK changes, this function must be called to update the right HCLK value. Otherwise, any configuration based on this function will be incorrect.
- The SystemCoreClock CMSIS variable is used to store System Clock Frequency.

HAL_RCC_GetPCLK1Freq

Function name

uint32_t HAL_RCC_GetPCLK1Freq (void)

Function description

Return the PCLK frequency.

Return values

- **PCLK1:** frequency in Hz

Notes

- Each time PCLK changes, this function must be called to update the right PCLK1 value. Otherwise, any configuration based on this function will be incorrect.

HAL_RCC_GetOscConfig

Function name

void HAL_RCC_GetOscConfig (RCC_OscInitTypeDef * RCC_OscInitStruct)

Function description

Configure the RCC_OscInitStruct according to the internal RCC configuration registers.

Parameters

- **RCC_OscInitStruct:** pointer to an RCC_OscInitTypeDef structure that will be configured.

Return values

- **None:**

HAL_RCC_GetClockConfig

Function name

void HAL_RCC_GetClockConfig (RCC_ClkInitTypeDef * RCC_ClkInitStruct, uint32_t * pFLatency)

Function description

Configure the RCC_ClkInitStruct according to the internal RCC configuration registers.

Parameters

- **RCC_ClkInitStruct:** pointer to an RCC_ClkInitTypeDef structure that will be configured.
- **pFLatency:** Pointer on the Flash Latency.

Return values

- **None:**

HAL_RCC_GetResetSource

Function name

uint32_t HAL_RCC_GetResetSource (void)

Function description

Get and clear reset flags.

Return values

- **can:** be a combination of Reset Flag

Notes

- Once reset flags are retrieved, this API is clearing them in order to isolate next reset reason.

HAL_RCC_NMI_IRQHandler

Function name

void HAL_RCC_NMI_IRQHandler (void)

Function description

HAL_RCC_CSSCallback

Function name

void HAL_RCC_CSSCallback (void)

Function description

RCC Clock Security System interrupt callback.

Return values

- **none:**

37.3 RCC Firmware driver defines

The following section lists the various define and macros of the module.

37.3.1 RCC

RCC

AHB1_GRP1 Peripheral Clock Sleep Enable Disable

__HAL_RCC_DMA1_CLK_SLEEP_ENABLE

__HAL_RCC_DMA2_CLK_SLEEP_ENABLE

__HAL_RCC_FLASH_CLK_SLEEP_ENABLE

__HAL_RCC_SRAM1_CLK_SLEEP_ENABLE

__HAL_RCC_CRC_CLK_SLEEP_ENABLE

__HAL_RCC_AES_CLK_SLEEP_ENABLE

__HAL_RCC_RNG_CLK_SLEEP_ENABLE

__HAL_RCC_TSC_CLK_SLEEP_ENABLE

__HAL_RCC_DMA1_CLK_SLEEP_DISABLE

__HAL_RCC_DMA2_CLK_SLEEP_DISABLE

__HAL_RCC_FLASH_CLK_SLEEP_DISABLE

__HAL_RCC_SRAM1_CLK_SLEEP_DISABLE

__HAL_RCC_CRC_CLK_SLEEP_DISABLE

__HAL_RCC_AES_CLK_SLEEP_DISABLE

__HAL_RCC_RNG_CLK_SLEEP_DISABLE

__HAL_RCC_TSC_CLK_SLEEP_DISABLE

AHB Clock Source

RCC_SYSCLK_DIV1

SYSCLK not divided

RCC_SYSCLK_DIV2

SYSCLK divided by 2

RCC_SYSCLK_DIV4

SYSCLK divided by 4

RCC_SYSCLK_DIV8

SYSCLK divided by 8

RCC_SYSCLK_DIV16

SYSCLK divided by 16

RCC_SYSCLK_DIV64

SYSCLK divided by 64

RCC_SYSCLK_DIV128

SYSCLK divided by 128

RCC_SYSCLK_DIV256

SYSCLK divided by 256

RCC_SYSCLK_DIV512

SYSCLK divided by 512

AHB Peripheral Force Release Reset

__HAL_RCC_AHB_FORCE_RESET

__HAL_RCC_DMA1_FORCE_RESET

__HAL_RCC_DMA2_FORCE_RESET

__HAL_RCC_FLASH_FORCE_RESET

__HAL_RCC_CRC_FORCE_RESET

__HAL_RCC_AES_FORCE_RESET

__HAL_RCC_RNG_FORCE_RESET

__HAL_RCC_TSC_FORCE_RESET

__HAL_RCC_AHB_RELEASE_RESET

__HAL_RCC_DMA1_RELEASE_RESET

__HAL_RCC_DMA2_RELEASE_RESET

__HAL_RCC_FLASH_RELEASE_RESET

__HAL_RCC_CRC_RELEASE_RESET

__HAL_RCC_TSC_RELEASE_RESET

__HAL_RCC_RNG_RELEASE_RESET

__HAL_RCC_AES_RELEASE_RESET

AHB Peripheral Clock Enable Disable

__HAL_RCC_DMA1_CLK_ENABLE

__HAL_RCC_DMA2_CLK_ENABLE

__HAL_RCC_FLASH_CLK_ENABLE

__HAL_RCC_CRC_CLK_ENABLE

__HAL_RCC_TSC_CLK_ENABLE

__HAL_RCC_RNG_CLK_ENABLE

__HAL_RCC_AES_CLK_ENABLE

__HAL_RCC_DMA1_CLK_DISABLE

__HAL_RCC_DMA2_CLK_DISABLE

__HAL_RCC_FLASH_CLK_DISABLE

__HAL_RCC_CRC_CLK_DISABLE

__HAL_RCC_TSC_CLK_DISABLE

__HAL_RCC_RNG_CLK_DISABLE

__HAL_RCC_AES_CLK_DISABLE

AHB Peripheral Clock Enabled or Disabled Status

__HAL_RCC_DMA1_IS_CLK_ENABLED

__HAL_RCC_DMA2_IS_CLK_ENABLED

__HAL_RCC_FLASH_IS_CLK_ENABLED

__HAL_RCC_CRC_IS_CLK_ENABLED

__HAL_RCC_AES_IS_CLK_ENABLED

__HAL_RCC_RNG_IS_CLK_ENABLED

__HAL_RCC_TSC_IS_CLK_ENABLED

__HAL_RCC_DMA1_IS_CLK_DISABLED

__HAL_RCC_DMA2_IS_CLK_DISABLED

__HAL_RCC_FLASH_IS_CLK_DISABLED

__HAL_RCC_CRC_IS_CLK_DISABLED

__HAL_RCC_TSC_IS_CLK_DISABLED

__HAL_RCC_RNG_IS_CLK_DISABLED

__HAL_RCC_AES_IS_CLK_DISABLED

APB1 Peripheral Clock Enable Disable

__HAL_RCC_TIM2_CLK_ENABLE

__HAL_RCC_TIM3_CLK_ENABLE

__HAL_RCC_TIM6_CLK_ENABLE

__HAL_RCC_TIM7_CLK_ENABLE

__HAL_RCC_LPUART2_CLK_ENABLE

__HAL_RCC_LCD_CLK_ENABLE

__HAL_RCC_RTCAPB_CLK_ENABLE

__HAL_RCC_WWDG_CLK_ENABLE

__HAL_RCC_LPUART3_CLK_ENABLE

__HAL_RCC_USB_CLK_ENABLE

__HAL_RCC_SPI2_CLK_ENABLE

__HAL_RCC_SPI3_CLK_ENABLE

__HAL_RCC_CRS_CLK_ENABLE

__HAL_RCC_USART2_CLK_ENABLE

__HAL_RCC_USART3_CLK_ENABLE

__HAL_RCC_USART4_CLK_ENABLE

__HAL_RCC_LPUART1_CLK_ENABLE

__HAL_RCC_I2C1_CLK_ENABLE

__HAL_RCC_I2C2_CLK_ENABLE

__HAL_RCC_I2C3_CLK_ENABLE

__HAL_RCC_OPAMP_CLK_ENABLE

__HAL_RCC_I2C4_CLK_ENABLE

__HAL_RCC_LPTIM3_CLK_ENABLE

__HAL_RCC_PWR_CLK_ENABLE

__HAL_RCC_DAC1_CLK_ENABLE

__HAL_RCC_LPTIM2_CLK_ENABLE

__HAL_RCC_LPTIM1_CLK_ENABLE

__HAL_RCC_TIM2_CLK_DISABLE

__HAL_RCC_TIM3_CLK_DISABLE

__HAL_RCC_TIM6_CLK_DISABLE

__HAL_RCC_TIM7_CLK_DISABLE

__HAL_RCC_LPUART2_CLK_DISABLE

__HAL_RCC_LCD_CLK_DISABLE

__HAL_RCC_RTCAPB_CLK_DISABLE

__HAL_RCC_WWDG_CLK_DISABLE

__HAL_RCC_LPUART3_CLK_DISABLE

__HAL_RCC_USB_CLK_DISABLE

__HAL_RCC_SPI2_CLK_DISABLE

__HAL_RCC_SPI3_CLK_DISABLE

__HAL_RCC_CRS_CLK_DISABLE

__HAL_RCC_USART2_CLK_DISABLE

__HAL_RCC_USART3_CLK_DISABLE

__HAL_RCC_USART4_CLK_DISABLE

__HAL_RCC_LPUART1_CLK_DISABLE

__HAL_RCC_I2C1_CLK_DISABLE

__HAL_RCC_I2C2_CLK_DISABLE

__HAL_RCC_I2C3_CLK_DISABLE

__HAL_RCC_OPAMP_CLK_DISABLE

__HAL_RCC_I2C4_CLK_DISABLE

__HAL_RCC_LPTIM3_CLK_DISABLE

__HAL_RCC_PWR_CLK_DISABLE

__HAL_RCC_DAC1_CLK_DISABLE

__HAL_RCC_LPTIM2_CLK_DISABLE

__HAL_RCC_LPTIM1_CLK_DISABLE

APB1_GRP2 Peripheral Clock Sleep Enable Disable

__HAL_RCC_SYSCFG_CLK_SLEEP_ENABLE

__HAL_RCC_COMP_CLK_SLEEP_ENABLE

__HAL_RCC_VREFBUF_CLK_SLEEP_ENABLE

__HAL_RCC_TIM1_CLK_SLEEP_ENABLE

__HAL_RCC_SPI1_CLK_SLEEP_ENABLE

__HAL_RCC_USART1_CLK_SLEEP_ENABLE

__HAL_RCC_TIM15_CLK_SLEEP_ENABLE

__HAL_RCC_TIM16_CLK_SLEEP_ENABLE

__HAL_RCC_ADC_CLK_SLEEP_ENABLE

__HAL_RCC_SYSCFG_CLK_SLEEP_DISABLE

__HAL_RCC_COMP_CLK_SLEEP_DISABLE

__HAL_RCC_VREFBUF_CLK_SLEEP_DISABLE

__HAL_RCC_TIM1_CLK_SLEEP_DISABLE

__HAL_RCC_SPI1_CLK_SLEEP_DISABLE

__HAL_RCC_USART1_CLK_SLEEP_DISABLE

__HAL_RCC_TIM15_CLK_SLEEP_DISABLE

__HAL_RCC_TIM16_CLK_SLEEP_DISABLE

__HAL_RCC_ADC_CLK_SLEEP_DISABLE

APB_2 Peripheral Clock Enabled or Disabled Status

__HAL_RCC_SYSCFG_IS_CLK_ENABLED

__HAL_RCC_COMP_IS_CLK_DISABLED

__HAL_RCC_VREFBUF_IS_CLK_DISABLED

__HAL_RCC_TIM1_IS_CLK_ENABLED

__HAL_RCC_SPI1_IS_CLK_ENABLED

__HAL_RCC_USART1_IS_CLK_ENABLED

__HAL_RCC_TIM15_IS_CLK_ENABLED

__HAL_RCC_TIM16_IS_CLK_ENABLED

__HAL_RCC_ADC_IS_CLK_ENABLED

__HAL_RCC_COMP_IS_CLK_ENABLED

__HAL_RCC_VREFBUF_IS_CLK_ENABLED

__HAL_RCC_SYSCFG_IS_CLK_DISABLED

__HAL_RCC_TIM1_IS_CLK_DISABLED

__HAL_RCC_SPI1_IS_CLK_DISABLED

__HAL_RCC_USART1_IS_CLK_DISABLED

__HAL_RCC_TIM15_IS_CLK_DISABLED

__HAL_RCC_TIM16_IS_CLK_DISABLED

__HAL_RCC_ADC_IS_CLK_DISABLED

APB Peripheral Clock Sleep Enable Disable

__HAL_RCC_TIM2_CLK_SLEEP_ENABLE

__HAL_RCC_TIM3_CLK_SLEEP_ENABLE

__HAL_RCC_TIM6_CLK_SLEEP_ENABLE

__HAL_RCC_TIM7_CLK_SLEEP_ENABLE

__HAL_RCC_LPUART2_CLK_SLEEP_ENABLE

__HAL_RCC_LCD_CLK_SLEEP_ENABLE

__HAL_RCC_RTCAPB_CLK_SLEEP_ENABLE

__HAL_RCC_WWDG_CLK_SLEEP_ENABLE

__HAL_RCC_LPUART3_CLK_SLEEP_ENABLE

__HAL_RCC_USB_CLK_SLEEP_ENABLE

__HAL_RCC_SPI2_CLK_SLEEP_ENABLE

__HAL_RCC_SPI3_CLK_SLEEP_ENABLE

__HAL_RCC_CRS_CLK_SLEEP_ENABLE

__HAL_RCC_USART2_CLK_SLEEP_ENABLE

__HAL_RCC_USART3_CLK_SLEEP_ENABLE

__HAL_RCC_USART4_CLK_SLEEP_ENABLE

__HAL_RCC_LPUART1_CLK_SLEEP_ENABLE

__HAL_RCC_I2C1_CLK_SLEEP_ENABLE

__HAL_RCC_I2C2_CLK_SLEEP_ENABLE

__HAL_RCC_I2C3_CLK_SLEEP_ENABLE

__HAL_RCC_OPAMP_CLK_SLEEP_ENABLE

__HAL_RCC_I2C4_CLK_SLEEP_ENABLE

__HAL_RCC_LPTIM3_CLK_SLEEP_ENABLE

__HAL_RCC_PWR_CLK_SLEEP_ENABLE

__HAL_RCC_DAC1_CLK_SLEEP_ENABLE

__HAL_RCC_LPTIM2_CLK_SLEEP_ENABLE

__HAL_RCC_LPTIM1_CLK_SLEEP_ENABLE

__HAL_RCC_TIM2_CLK_SLEEP_DISABLE

__HAL_RCC_TIM3_CLK_SLEEP_DISABLE

__HAL_RCC_TIM6_CLK_SLEEP_DISABLE

__HAL_RCC_TIM7_CLK_SLEEP_DISABLE

__HAL_RCC_LPUART2_CLK_SLEEP_DISABLE

__HAL_RCC_LCD_CLK_SLEEP_DISABLE

__HAL_RCC_RTCAPB_CLK_SLEEP_DISABLE

__HAL_RCC_WWDG_CLK_SLEEP_DISABLE

__HAL_RCC_LPUART3_CLK_SLEEP_DISABLE

__HAL_RCC_USB_CLK_SLEEP_DISABLE

__HAL_RCC_SPI2_CLK_SLEEP_DISABLE

__HAL_RCC_SPI3_CLK_SLEEP_DISABLE

__HAL_RCC_CRS_CLK_SLEEP_DISABLE

__HAL_RCC_USART2_CLK_SLEEP_DISABLE

__HAL_RCC_USART3_CLK_SLEEP_DISABLE

__HAL_RCC_USART4_CLK_SLEEP_DISABLE

__HAL_RCC_LPUART1_CLK_SLEEP_DISABLE

__HAL_RCC_I2C1_CLK_SLEEP_DISABLE

__HAL_RCC_I2C2_CLK_SLEEP_DISABLE

__HAL_RCC_I2C3_CLK_SLEEP_DISABLE

__HAL_RCC_OPAMP_CLK_SLEEP_DISABLE

__HAL_RCC_I2C4_CLK_SLEEP_DISABLE

__HAL_RCC_LPTIM3_CLK_SLEEP_DISABLE

__HAL_RCC_PWR_CLK_SLEEP_DISABLE

__HAL_RCC_DAC1_CLK_SLEEP_DISABLE

__HAL_RCC_LPTIM2_CLK_SLEEP_DISABLE

__HAL_RCC_LPTIM1_CLK_SLEEP_DISABLE

APB Clock Source

RCC_HCLK_DIV1

HCLK not divided

RCC_HCLK_DIV2

HCLK divided by 2

RCC_HCLK_DIV4

HCLK divided by 4

RCC_HCLK_DIV8

HCLK divided by 8

RCC_HCLK_DIV16

HCLK divided by 16

APB1_GRP1 Peripheral Force Release Reset

__HAL_RCC_APB1_GRP1_FORCE_RESET

__HAL_RCC_TIM2_FORCE_RESET

__HAL_RCC_TIM3_FORCE_RESET

__HAL_RCC_TIM6_FORCE_RESET

__HAL_RCC_TIM7_FORCE_RESET

__HAL_RCC_LPUART2_FORCE_RESET

__HAL_RCC_LCD_FORCE_RESET

__HAL_RCC_LPUART3_FORCE_RESET

__HAL_RCC_USB_FORCE_RESET

__HAL_RCC_SPI2_FORCE_RESET

__HAL_RCC_SPI3_FORCE_RESET

__HAL_RCC_CRS_FORCE_RESET

__HAL_RCC_USART2_FORCE_RESET

__HAL_RCC_USART3_FORCE_RESET

__HAL_RCC_USART4_FORCE_RESET

__HAL_RCC_LPUART1_FORCE_RESET

__HAL_RCC_I2C1_FORCE_RESET

__HAL_RCC_I2C2_FORCE_RESET

__HAL_RCC_I2C3_FORCE_RESET

__HAL_RCC_OPAMP_FORCE_RESET

__HAL_RCC_I2C4_FORCE_RESET

__HAL_RCC_PWR_FORCE_RESET

__HAL_RCC_DAC1_FORCE_RESET

__HAL_RCC_LPTIM2_FORCE_RESET

__HAL_RCC_LPTIM1_FORCE_RESET

__HAL_RCC_LPTIM3_FORCE_RESET

__HAL_RCC_APB1_GRP1_RELEASE_RESET

__HAL_RCC_TIM2_RELEASE_RESET

__HAL_RCC_TIM3_RELEASE_RESET

__HAL_RCC_TIM6_RELEASE_RESET

__HAL_RCC_TIM7_RELEASE_RESET

__HAL_RCC_LPUART2_RELEASE_RESET

__HAL_RCC_LCD_RELEASE_RESET

__HAL_RCC_LPUART3_RELEASE_RESET

__HAL_RCC_USB_RELEASE_RESET

__HAL_RCC_SPI2_RELEASE_RESET

__HAL_RCC_SPI3_RELEASE_RESET

__HAL_RCC_CRS_RELEASE_RESET

__HAL_RCC_USART2_RELEASE_RESET

__HAL_RCC_USART3_RELEASE_RESET

__HAL_RCC_USART4_RELEASE_RESET

__HAL_RCC_LPUART1_RELEASE_RESET

__HAL_RCC_I2C1_RELEASE_RESET

__HAL_RCC_I2C2_RELEASE_RESET

__HAL_RCC_I2C3_RELEASE_RESET

__HAL_RCC_OPAMP_RELEASE_RESET

__HAL_RCC_I2C4_RELEASE_RESET

__HAL_RCC_PWR_RELEASE_RESET

__HAL_RCC_DAC1_RELEASE_RESET

__HAL_RCC_LPTIM2_RELEASE_RESET

__HAL_RCC_LPTIM1_RELEASE_RESET

__HAL_RCC_LPTIM3_RELEASE_RESET

APB1_GRP2 Peripheral Force Release Reset

__HAL_RCC_APB1_GRP2_FORCE_RESET

__HAL_RCC_SYSCFG_FORCE_RESET

__HAL_RCC_COMP_FORCE_RESET

__HAL_RCC_VREFBUF_FORCE_RESET

__HAL_RCC_TIM1_FORCE_RESET

__HAL_RCC_SPI1_FORCE_RESET

__HAL_RCC_USART1_FORCE_RESET

__HAL_RCC_TIM15_FORCE_RESET

__HAL_RCC_TIM16_FORCE_RESET

__HAL_RCC_ADC_FORCE_RESET

__HAL_RCC_APB1_GRP2_RELEASE_RESET

__HAL_RCC_SYSCFG_RELEASE_RESET

__HAL_RCC_COMP_RELEASE_RESET

__HAL_RCC_VREFBUF_RELEASE_RESET

__HAL_RCC_TIM1_RELEASE_RESET

__HAL_RCC_SPI1_RELEASE_RESET

__HAL_RCC_USART1_RELEASE_RESET

__HAL_RCC_TIM15_RELEASE_RESET

__HAL_RCC_TIM16_RELEASE_RESET

__HAL_RCC_ADC_RELEASE_RESET

APB Peripheral Clock Enable Disable

__HAL_RCC_SYSCFG_CLK_ENABLE

__HAL_RCC_COMP_CLK_ENABLE

__HAL_RCC_VREFBUF_CLK_ENABLE

__HAL_RCC_TIM1_CLK_ENABLE

__HAL_RCC_SPI1_CLK_ENABLE

__HAL_RCC_USART1_CLK_ENABLE

__HAL_RCC_TIM15_CLK_ENABLE

__HAL_RCC_TIM16_CLK_ENABLE

__HAL_RCC_ADC_CLK_ENABLE

__HAL_RCC_SYSCFG_CLK_DISABLE

__HAL_RCC_COMP_CLK_DISABLE

__HAL_RCC_VREFBUF_CLK_DISABLE

__HAL_RCC_TIM1_CLK_DISABLE

__HAL_RCC_SPI1_CLK_DISABLE

__HAL_RCC_USART1_CLK_DISABLE

__HAL_RCC_TIM15_CLK_DISABLE

__HAL_RCC_TIM16_CLK_DISABLE

__HAL_RCC_ADC_CLK_DISABLE

RCC Backup Domain Reset

__HAL_RCC_BACKUPRESET_FORCE

Description:

- Macros to force or release the Vswitch Backup domain reset.

Return value:

- None

Notes:

- This function resets the RTC peripheral (including the backup registers) and the RTC clock source selection in RCC_CSR register. The BKPSRAM is not affected by this reset.

__HAL_RCC_BACKUPRESET_RELEASE

Enable , Disable , Force_Reset and Release_Reset

__HAL_RCC_DBGMCU_CLK_ENABLE

__HAL_RCC_DBGMCU_IS_CLK_ENABLED

__HAL_RCC_DBGMCU_CLK_DISABLE

__HAL_RCC_DBGMCU_IS_CLK_DISABLED

__HAL_RCC_DBGMCU_FORCE_RESET

__HAL_RCC_DBGMCU_RELEASE_RESET

RCC Exported Macros

__HAL_RCC_HSI_ENABLE

Description:

- Macros to enable or disable the Internal High Speed 16MHz oscillator (HSI).

Return value:

- None

Notes:

- The HSI is stopped by hardware when entering STOP and STANDBY modes. It is used (enabled by hardware) as system clock source after startup from Reset, wakeup from STOP and STANDBY mode, or in case of failure of the HSE used directly or indirectly as system clock (if the Clock Security System CSS is enabled). HSI can not be stopped if it is used as system clock source. In this case, you have to select another source of the system clock then stop the HSI. After enabling the HSI, the application software should wait on HSIRDY flag to be set indicating that HSI clock is stable and can be used as system clock source. This parameter can be: ENABLE or DISABLE. When the HSI is stopped, HSIRDY flag goes low after 6 HSI oscillator clock cycles.

__HAL_RCC_HSI_DISABLE

__HAL_RCC_HSI_CALIBRATIONVALUE_ADJUST

Description:

- Macro to adjust the Internal High Speed 16MHz oscillator (HSI) calibration value.

Parameters:

- __HSICALIBRATIONVALUE__: specifies the calibration trimming value (default is RCC_HSICALIBRATION_DEFAULT). This parameter must be a number between 0 and 127.

Return value:

- None

Notes:

- The calibration is used to compensate for the variations in voltage and temperature that influence the frequency of the internal HSI RC.

__HAL_RCC_HSI_STOP_ENABLE

Description:

- Macros to enable or disable the force of the Internal High Speed oscillator (HSI) in STOP mode to be quickly available as kernel clock for USARTs and I2Cs.

Return value:

- None

Notes:

- Keeping the HSI ON in STOP mode allows to avoid slowing down the communication speed because of the HSI startup time. The enable of this function has not effect on the HSION bit. This parameter can be: ENABLE or DISABLE.

__HAL_RCC_HSI_STOP_DISABLE

__HAL_RCC_HSI_AUTOMATIC_START_ENABLE

Description:

- Macros to enable or disable the wakeup the Internal High Speed oscillator (HSI) in parallel to the Internal Multi Speed oscillator (MSI) used at system wakeup.

Return value:

- None

Notes:

- The enable of this function has not effect on the HSION bit. This parameter can be: ENABLE or DISABLE.

__HAL_RCC_HSI_AUTOMATIC_START_DISABLE

__HAL_RCC_MSI_ENABLE

Description:

- Macros to enable or disable the Internal Multi Speed oscillator (MSI).

Return value:

- None

Notes:

- The MSI is stopped by hardware when entering STOP and STANDBY modes. It is used (enabled by hardware) as system clock source after startup from Reset, wakeup from STOP and STANDBY mode, or in case of failure of the HSE used directly or indirectly as system clock (if the Clock Security System CSS is enabled). MSI can not be stopped if it is used as system clock source. In this case, you have to select another source of the system clock then stop the MSI. After enabling the MSI, the application software should wait on MSIRDY flag to be set indicating that MSI clock is stable and can be used as system clock source. When the MSI is stopped, MSIRDY flag goes low after 6 MSI oscillator clock cycles.

__HAL_RCC_MSI_DISABLE

__HAL_RCC_MSI_CALIBRATIONVALUE_ADJUST

Description:

- Macro Adjusts the Internal Multi Speed oscillator (MSI) calibration value.

Parameters:

- __MSICALIBRATIONVALUE__: specifies the calibration trimming value (default is RCC_MSICALIBRATION_DEFAULT). This parameter must be a number between 0 and 255.

Return value:

- None

Notes:

- The calibration is used to compensate for the variations in voltage and temperature that influence the frequency of the internal MSI RC. Refer to the Application Note AN3300 for more details on how to calibrate the MSI.

__HAL_RCC_MSI_RANGE_CONFIG

Description:

- Macro configures the Internal Multi Speed oscillator (MSI) clock range in run mode.

Parameters:

- __MSIRANGEVALUE__: specifies the MSI clock range. This parameter must be one of the following values:
  - RCC_MSIRANGE_0 MSI clock is around 48 MHz
  - RCC_MSIRANGE_1 MSI clock is around 24 MHz
  - RCC_MSIRANGE_2 MSI clock is around 16 MHz
  - RCC_MSIRANGE_3 MSI clock is around 12 MHz
  - RCC_MSIRANGE_4 MSI clock is around 4 MHz (default after Reset)
  - RCC_MSIRANGE_5 MSI clock is around 2 MHz
  - RCC_MSIRANGE_6 MSI clock is around 1.5 MHz
  - RCC_MSIRANGE_7 MSI clock is around 1 MHz
  - RCC_MSIRANGE_8 MSI clock is around 400 KHz
  - RCC_MSIRANGE_9 MSI clock is around 200 KHz
  - RCC_MSIRANGE_10 MSI clock is around 150 KHz
  - RCC_MSIRANGE_11 MSI clock is around 100 KHz

Return value:

- None

Notes:

- After restart from Reset , the MSI clock is around 4 MHz. After stop the startup clock can be MSI (at any of its possible frequencies, the one that was used before entering stop mode) or HSI. After Standby its frequency can be selected between 4 possible values (1, 2, 4 or 8 MHz). MSISRANGE can be modified when MSI is OFF (MSION=0) or when MSI is ready (MSIRDY=1). The MSI clock range after reset can be modified on the fly.

__HAL_RCC_MSI_STANDBY_RANGE_CONFIG

Description:

- Macro configures the Internal Multi Speed oscillator (MSI) clock range after Standby mode After Standby its frequency can be selected between 4 possible values (1, 2, 4 or 8 MHz).

Parameters:

- __MSISRANGEVALUE__: specifies the MSI clock range. This parameter must be one of the following values:
  - RCC_MSIRANGE_4 MSI clock is around 1 MHz
  - RCC_MSIRANGE_5 MSI clock is around 2 MHz
  - RCC_MSIRANGE_6 MSI clock is around 4 MHz (default after Reset)
  - RCC_MSIRANGE_7 MSI clock is around 8 MHz

Return value:

- None

__HAL_RCC_GET_MSI_RANGE

Description:

- Macro to get the Internal Multi Speed oscillator (MSI) clock range in run mode.

Return value:

- MSI: clock range. This parameter must be one of the following values:
  - RCC_MSIRANGE_0 MSI clock is around 100 KHz
  - RCC_MSIRANGE_1 MSI clock is around 200 KHz
  - RCC_MSIRANGE_2 MSI clock is around 400 KHz
  - RCC_MSIRANGE_3 MSI clock is around 800 KHz
  - RCC_MSIRANGE_4 MSI clock is around 1 MHz
  - RCC_MSIRANGE_5 MSI clock is around 2 MHz
  - RCC_MSIRANGE_6 MSI clock is around 4 MHz (default after Reset)
  - RCC_MSIRANGE_7 MSI clock is around 8 MHz
  - RCC_MSIRANGE_8 MSI clock is around 16 MHz
  - RCC_MSIRANGE_9 MSI clock is around 24 MHz
  - RCC_MSIRANGE_10 MSI clock is around 32 MHz
  - RCC_MSIRANGE_11 MSI clock is around 48 MHz

__HAL_RCC_LSI_ENABLE

Description:

- Macros to enable or disable the Internal Low Speed oscillator (LSI).

Return value:

- None

Notes:

- After enabling the LSI, the application software should wait on LSIRDY flag to be set indicating that LSI clock is stable and can be used to clock the IWDG and/or the RTC. LSI can not be disabled if the IWDG is running. When the LSI is stopped, LSIRDY flag goes low after 6 LSI oscillator clock cycles.

__HAL_RCC_LSI_DISABLE

__HAL_RCC_HSE_CONFIG

Description:

- Macro to configure the External High Speed oscillator (HSE).

Parameters:

- __STATE__: specifies the new state of the HSE. This parameter can be one of the following values:
  - RCC_HSE_OFF Turn OFF the HSE oscillator, HSERDY flag goes low after 6 HSE oscillator clock cycles.
  - RCC_HSE_ON Turn ON the HSE oscillator.
  - RCC_HSE_BYPASS HSE oscillator bypassed with external clock.

Return value:

- None

Notes:

- Transition HSE Bypass to HSE On and HSE On to HSE Bypass are not supported by this macro. User should request a transition to HSE Off first and then HSE On or HSE Bypass. After enabling the HSE (RCC_HSE_ON or RCC_HSE_Bypass), the application software should wait on HSERDY flag to be set indicating that HSE clock is stable and can be used to clock the PLL and/or system clock. HSE state can not be changed if it is used directly or through the PLL as system clock. In this case, you have to select another source of the system clock then change the HSE state (ex. disable it). The HSE is stopped by hardware when entering STOP and STANDBY modes. This function reset the CSSON bit, so if the clock security system(CSS) was previously enabled you have to enable it again after calling this function.

__HAL_RCC_LSE_CONFIG

Description:

- Macro to configure the External Low Speed oscillator (LSE).

Parameters:

- __STATE__: specifies the new state of the LSE. This parameter can be one of the following values:
  - RCC_LSE_OFF Turn OFF the LSE oscillator, LSERDY flag goes low after 6 LSE oscillator clock cycles.
  - RCC_LSE_ON_RTC_ONLY Turn ON the LSE oscillator to be used only for RTC.
  - RCC_LSE_ON Turn ON the LSE oscillator to be used by any peripheral.
  - RCC_LSE_BYPASS_RTC_ONLY LSE oscillator bypassed with external clock to be used only for RTC.
  - RCC_LSE_BYPASS LSE oscillator bypassed with external clock to be used by any peripheral.

Return value:

- None

Notes:

- Transitions LSE Bypass to LSE On and LSE On to LSE Bypass are not supported by this macro. User should request a transition to LSE Off first and then LSE On or LSE Bypass. As the LSE is in the Backup domain and write access is denied to this domain after reset, you have to enable write access using HAL_PWR_EnableBkUpAccess() function before to configure the LSE (to be done once after reset). After enabling the LSE (RCC_LSE_ON or RCC_LSE_BYPASS), the application software should wait on LSERDY flag to be set indicating that LSE clock is stable and can be used to clock the RTC.

__HAL_RCC_LSI_DIV_CONFIG

Description:

- Macro to set Low-speed clock (LSI) divider.

Parameters:

- __DIVIDER__: : specifies the divider value This parameter can be one of the following values
  - RCC_LSI_DIV1
  - RCC_LSI_DIV128

Return value:

- None

Notes:

- This bit can be written only when the LSI is disabled (LSION = 0 and LSIRDY = 0). The LSIPREDIV cannot be changed if the LSI is used by the IWDG or by the RTC.

__HAL_RCC_HSI48_ENABLE

Description:

- Macros to enable or disable the RC 48MHz oscillator (RC48).

Return value:

- None

Notes:

- The RC48 is stopped by hardware when entering STOP and STANDBY modes. After enabling the RC48, the application software should wait on HSI48RDY flag to be set indicating that RC48 clock is stable. This parameter can be: ENABLE or DISABLE.

__HAL_RCC_HSI48_DISABLE

__HAL_RCC_RTC_CONFIG

Description:

- Macros to configure the RTC clock (RTCCLK).

Parameters:

- __RTC_CLKSOURCE__: specifies the RTC clock source. This parameter can be one of the following values:
  - RCC_RTCCLKSOURCE_NONE No clock selected as RTC clock.
  - RCC_RTCCLKSOURCE_LSE LSE selected as RTC clock.
  - RCC_RTCCLKSOURCE_LSI LSI selected as RTC clock.
  - RCC_RTCCLKSOURCE_HSE_DIV32 HSE clock divided by 32 selected

Return value:

- None

Notes:

- As the RTC clock configuration bits are in the Backup domain and write access is denied to this domain after reset, you have to enable write access using the Power Backup Access macro before to configure the RTC clock source (to be done once after reset). Once the RTC clock is configured it cannot be changed unless the Backup domain is reset using __HAL_RCC_BACKUPRESET_FORCE() macro, or by a Power On Reset (POR).
- If the LSE or LSI is used as RTC clock source, the RTC continues to work in STOP and STANDBY modes, and can be used as wakeup source. However, when the HSE clock is used as RTC clock source, the RTC cannot be used in STOP and STANDBY modes. The maximum input clock frequency for RTC is 1MHz (when using HSE as RTC clock source).

__HAL_RCC_GET_RTC_SOURCE

Description:

- Macro to get the RTC clock source.

Return value:

- The: returned value can be one of the following:
  - RCC_RTCCLKSOURCE_NONE No clock selected as RTC clock.
  - RCC_RTCCLKSOURCE_LSE LSE selected as RTC clock.
  - RCC_RTCCLKSOURCE_LSI LSI selected as RTC clock.
  - RCC_RTCCLKSOURCE_HSE_DIV32 HSE clock divided by 32 selected

__HAL_RCC_PLL_ENABLE

Description:

- Macros to enable or disable the main PLL.

Return value:

- None

Notes:

- After enabling the main PLL, the application software should wait on PLLRDY flag to be set indicating that PLL clock is stable and can be used as system clock source. The main PLL can not be disabled if it is used as system clock source The main PLL is disabled by hardware when entering STOP and STANDBY modes.

__HAL_RCC_PLL_DISABLE

__HAL_RCC_PLL_PLLSOURCE_CONFIG

Description:

- Macro to configure the PLL clock source.

Parameters:

- __PLLSOURCE__: specifies the PLL entry clock source. This parameter can be one of the following values:
  - RCC_PLLSOURCE_NONE No clock selected as PLL clock entry
  - RCC_PLLSOURCE_MSI MSI oscillator clock selected as PLL clock entry
  - RCC_PLLSOURCE_HSI HSI oscillator clock selected as PLL clock entry
  - RCC_PLLSOURCE_HSE HSE oscillator clock selected as PLL clock entry
- __PLLSOURCE__: specifies the PLLs entry clock source. This parameter can be one of the following values:
  - RCC_PLLSOURCE_MSI: MSI oscillator clock selected as PLL clock entry
  - RCC_PLLSOURCE_HSI: HSI oscillator clock selected as PLL clock entry
  - RCC_PLLSOURCE_HSE: HSE oscillator clock selected as PLL clock entry

Return value:

- None

Notes:

- This function must be used only when the main PLL is disabled.
- This clock source is common for the main PLL and audio PLL (PLLSAI1 and PLLSAI2).
- This function must be used only when all PLLs are disabled.

__HAL_RCC_PLL_PLLSOURCE_CONFIG

Description:

- Macro to configure the PLL clock source.

Parameters:

- __PLLSOURCE__: specifies the PLL entry clock source. This parameter can be one of the following values:
  - RCC_PLLSOURCE_NONE No clock selected as PLL clock entry
  - RCC_PLLSOURCE_MSI MSI oscillator clock selected as PLL clock entry
  - RCC_PLLSOURCE_HSI HSI oscillator clock selected as PLL clock entry
  - RCC_PLLSOURCE_HSE HSE oscillator clock selected as PLL clock entry
- __PLLSOURCE__: specifies the PLLs entry clock source. This parameter can be one of the following values:
  - RCC_PLLSOURCE_MSI: MSI oscillator clock selected as PLL clock entry
  - RCC_PLLSOURCE_HSI: HSI oscillator clock selected as PLL clock entry
  - RCC_PLLSOURCE_HSE: HSE oscillator clock selected as PLL clock entry

Return value:

- None

Notes:

- This function must be used only when the main PLL is disabled.
- This clock source is common for the main PLL and audio PLL (PLLSAI1 and PLLSAI2).
- This function must be used only when all PLLs are disabled.

__HAL_RCC_PLL_PLLM_CONFIG

Description:

- Macro to configure the PLL source division factor M.

Parameters:

- __PLLM__: specifies the division factor for PLL VCO input clock This parameter must be a number between Min_Data = 1 and Max_Data = 8.

Return value:

- None

Notes:

- This function must be used only when the main PLL is disabled.
- You have to set the PLLM parameter correctly to ensure that the VCO input frequency ranges from 4 to 16 MHz. It is recommended to select a frequency of 16 MHz to limit PLL jitter.

__HAL_RCC_PLL_CONFIG

Description:

- Macro to configures the main PLL clock source, multiplication and division factors.

Parameters:

- __PLLSOURCE__: specifies the PLL entry clock source. This parameter can be one of the following values:
  - RCC_PLLSOURCE_MSI: MSI oscillator clock selected as PLL clock entry
  - RCC_PLLSOURCE_HSI: HSI oscillator clock selected as PLL clock entry
  - RCC_PLLSOURCE_HSE: HSE oscillator clock selected as PLL clock entry
- __PLLM__: specifies the division factor for PLL VCO input clock This parameter must be a number between 1 and 63.
- __PLLN__: specifies the multiplication factor for PLL VCO output clock This parameter must be a number between 4 and 127.
- __PLLP__: specifies the division factor for system clock. This parameter must be a number between 2 and 32
- __PLLQ__: specifies the division factor for peripheral kernel clocks This parameter must be a number between 2 and 8
- __PLLR__: specifies the division factor for peripheral kernel clocks This parameter must be a number between 2 and 8

Return value:

- None

Notes:

- This function must be used only when the main PLL is disabled.
- You have to set the PLLM parameter correctly to ensure that the VCO input frequency ranges from 1 to 16 MHz.
- You have to set the PLLN parameter correctly to ensure that the VCO output frequency is between 150 and 420 MHz (when in medium VCO range) or between 192 and 836 MHZ (when in wide VCO range)

__HAL_RCC_PLL_DIVM_CONFIG

Description:

- Macro to configure the PLL input clock division factor M.

Parameters:

- __PLLM__: specifies the division factor for PLL clock. This parameter must be a number between Min_Data = 1 and Max_Data = 16.

Return value:

- None

Notes:

- This function must be used only when the PLL is disabled. PLL clock source is common with the main PLL (configured through __HAL_RCC_PLL_CONFIG() macro)

__HAL_RCC_GET_PLL_OSCSOURCE

Description:

- Macro to get the oscillator used as PLL clock source.

Return value:

- The: oscillator used as PLL clock source. The returned value can be one of the following:
  - RCC_PLLSOURCE_NONE: No oscillator is used as PLL clock source.
  - RCC_PLLSOURCE_MSI: MSI oscillator is used as PLL clock source.
  - RCC_PLLSOURCE_HSI: HSI oscillator is used as PLL clock source.
  - RCC_PLLSOURCE_HSE: HSE oscillator is used as PLL clock source.

__HAL_RCC_PLLCLKOUT_ENABLE

Description:

- Enable each clock output (RCC_PLLRCLK, RCC_PLLQCLK, RCC_PLLPCLK)

Parameters:

- __PLLCLOCKOUT__: specifies the PLL clock to be output. This parameter can be one or a combination of the following values:
  - RCC_PLL_DIVP This clock is used to generate the clock for the ADC.
  - RCC_PLL_DIVQ This Clock is used to generate the clock for the High Speed Timers, and the random analog generator (<=48 MHz).
  - RCC_PLL_DIVR This Clock is used to generate the high speed system clock (up to 48MHz)

Return value:

- None

Notes:

- Enabling clock outputs RCC_PLLPCLK and RCC_PLLQCLK can be done at anytime without the need to stop the PLL in order to save power. But RCC_PLLRCLK cannot be stopped if used as System Clock. (*) RCC_PLLQCLK availability depends on devices

__HAL_RCC_PLLCLKOUT_DISABLE

Description:

- Disable each clock output (RCC_PLLRCLK, RCC_PLLQCLK, RCC_PLLPCLK)

Parameters:

- __PLLCLOCKOUT__: specifies the PLL clock to be output. This parameter can be one or a combination of the following values:
  - RCC_PLL_DIVP This clock may be used to generate the clock for the ADC, I2S1.
  - RCC_PLL_DIVQ This Clock may be used to generate the clock for the High Speed Timers, and RNG (<=48 MHz).
  - RCC_PLL_DIVR This Clock is used to generate the high speed system clock (up to 48MHz)

Return value:

- None

Notes:

- Disabling clock outputs RCC_PLLPCLK and RCC_PLLQCLK can be done at anytime without the need to stop the PLL in order to save power. But RCC_PLLRCLK cannot be stopped if used as System Clock. (*) RCC_PLLQCLK availability depends on devices

__HAL_RCC_GET_PLLCLKOUT_CONFIG

Description:

- Get clock output enable status (RCC_PLLRCLK, RCC_PLLQCLK, RCC_PLLPCLK)

Parameters:

- __PLLCLOCKOUT__: specifies the output PLL clock to be checked. This parameter can be one of the following values:
  - RCC_PLL_DIVP This clock may be used to generate the clock for the ADC, I2S1.
  - RCC_PLL_DIVQ This Clock may be used to generate the clock for the High Speed Timers, and RNG (<=48 MHz).
  - RCC_PLL_DIVR This Clock is used to generate the high speed system clock (up to 48MHz)

Return value:

- SET: / RESET
- SET: / RESET

Notes:

- (*) RCC_PLLQCLK availability depends on devices

__HAL_RCC_SYSCLK_CONFIG

Description:

- Macro to configure the system clock source.

Parameters:

- __SYSCLKSOURCE__: specifies the system clock source. This parameter can be one of the following values:
  - RCC_SYSCLKSOURCE_MSI: MSI oscillator is used as system clock source.
  - RCC_SYSCLKSOURCE_HSI: HSI oscillator is used as system clock source.
  - RCC_SYSCLKSOURCE_HSE: HSE oscillator is used as system clock source.
  - RCC_SYSCLKSOURCE_PLLCLK: PLL output is used as system clock source.
  - RCC_SYSCLKSOURCE_LSI: LSI oscillator is used as system clock source.
  - RCC_SYSCLKSOURCE_LSE: LSE oscillator is used as system clock source.

Return value:

- None

__HAL_RCC_GET_SYSCLK_SOURCE

Description:

- Macro to get the clock source used as system clock.

Return value:

- The: clock source used as system clock. The returned value can be one of the following:
  - RCC_SYSCLKSOURCE_MSI: MSI used as system clock.
  - RCC_SYSCLKSOURCE_HSI: HSI used as system clock.
  - RCC_SYSCLKSOURCE_HSE: HSE used as system clock.
  - RCC_SYSCLKSOURCE_PLLCLK: PLL used as system clock.
  - RCC_SYSCLKSOURCE_LSI: LSI used as system clock.
  - RCC_SYSCLKSOURCE_LSE: LSE used as system clock.

__HAL_RCC_LSEDRIVE_CONFIG

Description:

- Macro to configure the External Low Speed oscillator (LSE) drive capability.

Parameters:

- __LSEDRIVE__: specifies the new state of the LSE drive capability. This parameter can be one of the following values:
  - RCC_LSEDRIVE_LOW LSE oscillator low drive capability.
  - RCC_LSEDRIVE_MEDIUMLOW LSE oscillator medium low drive capability.
  - RCC_LSEDRIVE_MEDIUMHIGH LSE oscillator medium high drive capability.
  - RCC_LSEDRIVE_HIGH LSE oscillator high drive capability.

Return value:

- None

Notes:

- As the LSE is in the Backup domain and write access is denied to this domain after reset, you have to enable write access using HAL_PWR_EnableBkUpAccess() function before to configure the LSE (to be done once after reset).

__HAL_RCC_WAKEUPSTOP_CLK_CONFIG

Description:

- Macro to configure the wake up from stop clock.

Parameters:

- __STOPWUCLK__: specifies the clock source used after wake up from stop. This parameter can be one of the following values:
  - RCC_STOP_WAKEUPCLOCK_MSI MSI selected as system clock source
  - RCC_STOP_WAKEUPCLOCK_HSI HSI selected as system clock source

Return value:

- None

__HAL_RCC_MCO1_CONFIG

Description:

- Macro to configure the MCO clock.

Parameters:

- __MCOCLKSOURCE__: specifies the MCO clock source. This parameter can be one of the following values:
  - RCC_MCO1SOURCE_NOCLOCK MCO output disabled
  - RCC_MCO1SOURCE_SYSCLK System clock selected as MCO source
  - RCC_MCO1SOURCE_MSI MSI clock selected as MCO source
  - RCC_MCO1SOURCE_HSI HSI clock selected as MCO source
  - RCC_MCO1SOURCE_HSE HSE clock selected as MCO source
  - RCC_MCO1SOURCE_PLLR Main PLL clock selected as MCO source
  - RCC_MCO1SOURCE_LSI LSI clock selected as MCO source
  - RCC_MCO1SOURCE_LSE LSE clock selected as MCO source
  - RCC_MCO1SOURCE_HSI48 HSI48 clock selected as MCO source for devices with HSI48 (*)
- __MCODIV__: specifies the MCO clock prescaler. This parameter can be one of the following values:
  - RCC_MCO1DIV_1 MCO clock source is divided by 1
  - RCC_MCO1DIV_2 MCO clock source is divided by 2
  - RCC_MCO1DIV_4 MCO clock source is divided by 4
  - RCC_MCO1DIV_8 MCO clock source is divided by 8
  - RCC_MCO1DIV_16 MCO clock source is divided by 16
  - RCC_MCO1DIV_32 MCO clock source is divided by 32
  - RCC_MCO1DIV_64 MCO clock source is divided by 64
  - RCC_MCO1DIV_128 MCO clock source is divided by 128
  - RCC_MCO1DIV_256 MCO clock source is divided by 256
  - RCC_MCO1DIV_512 MCO clock source is divided by 512
  - RCC_MCO1DIV_1024 MCO clock source is divided by 1024

__HAL_RCC_MCO1_CONFIG

Description:

- Macro to configure the MCO clock.

Parameters:

- __MCOCLKSOURCE__: specifies the MCO clock source. This parameter can be one of the following values:
  - RCC_MCO1SOURCE_NOCLOCK MCO output disabled
  - RCC_MCO1SOURCE_SYSCLK System clock selected as MCO source
  - RCC_MCO1SOURCE_MSI MSI clock selected as MCO source
  - RCC_MCO1SOURCE_HSI HSI clock selected as MCO source
  - RCC_MCO1SOURCE_HSE HSE clock selected as MCO source
  - RCC_MCO1SOURCE_PLLR Main PLL clock selected as MCO source
  - RCC_MCO1SOURCE_LSI LSI clock selected as MCO source
  - RCC_MCO1SOURCE_LSE LSE clock selected as MCO source
  - RCC_MCO1SOURCE_HSI48 HSI48 clock selected as MCO source for devices with HSI48 (*)
- __MCODIV__: specifies the MCO clock prescaler. This parameter can be one of the following values:
  - RCC_MCO1DIV_1 MCO clock source is divided by 1
  - RCC_MCO1DIV_2 MCO clock source is divided by 2
  - RCC_MCO1DIV_4 MCO clock source is divided by 4
  - RCC_MCO1DIV_8 MCO clock source is divided by 8
  - RCC_MCO1DIV_16 MCO clock source is divided by 16
  - RCC_MCO1DIV_32 MCO clock source is divided by 32
  - RCC_MCO1DIV_64 MCO clock source is divided by 64
  - RCC_MCO1DIV_128 MCO clock source is divided by 128
  - RCC_MCO1DIV_256 MCO clock source is divided by 256
  - RCC_MCO1DIV_512 MCO clock source is divided by 512
  - RCC_MCO1DIV_1024 MCO clock source is divided by 1024

__HAL_RCC_MCO2_CONFIG

Description:

- Macro to configure the MCO clock.

Parameters:

- __MCOCLKSOURCE__: specifies the MCO clock source. This parameter can be one of the following values:
  - RCC_MCO2SOURCE_NOCLOCK MCO output disabled
  - RCC_MCO2SOURCE_SYSCLK System clock selected as MCO source
  - RCC_MCO2SOURCE_MSI MSI clock selected as MCO source
  - RCC_MCO2SOURCE_HSI HSI clock selected as MCO source
  - RCC_MCO2SOURCE_HSE HSE clock selected as MCO source
  - RCC_MCO2SOURCE_PLLR Main PLL clock selected as MCO source
  - RCC_MCO2SOURCE_LSI LSI clock selected as MCO source
  - RCC_MCO2SOURCE_LSE LSE clock selected as MCO source
  - RCC_MCO2SOURCE_HSI48 HSI48 clock selected as MCO source for devices with HSI48 (*)
- __MCODIV__: specifies the MCO clock prescaler. This parameter can be one of the following values:
  - RCC_MCO2DIV_1 MCO clock source is divided by 1
  - RCC_MCO2DIV_2 MCO clock source is divided by 2
  - RCC_MCO2DIV_4 MCO clock source is divided by 4
  - RCC_MCO2DIV_8 MCO clock source is divided by 8
  - RCC_MCO2DIV_16 MCO clock source is divided by 16
  - RCC_MCO2DIV_32 MCO clock source is divided by 32
  - RCC_MCO2DIV_64 MCO clock source is divided by 64
  - RCC_MCO2DIV_128 MCO clock source is divided by 128
  - RCC_MCO2DIV_256 MCO clock source is divided by 256
  - RCC_MCO2DIV_512 MCO clock source is divided by 512
  - RCC_MCO2DIV_1024 MCO clock source is divided by 1024

__HAL_RCC_MCO2_CONFIG

Description:

- Macro to configure the MCO clock.

Parameters:

- __MCOCLKSOURCE__: specifies the MCO clock source. This parameter can be one of the following values:
  - RCC_MCO2SOURCE_NOCLOCK MCO output disabled
  - RCC_MCO2SOURCE_SYSCLK System clock selected as MCO source
  - RCC_MCO2SOURCE_MSI MSI clock selected as MCO source
  - RCC_MCO2SOURCE_HSI HSI clock selected as MCO source
  - RCC_MCO2SOURCE_HSE HSE clock selected as MCO source
  - RCC_MCO2SOURCE_PLLR Main PLL clock selected as MCO source
  - RCC_MCO2SOURCE_LSI LSI clock selected as MCO source
  - RCC_MCO2SOURCE_LSE LSE clock selected as MCO source
  - RCC_MCO2SOURCE_HSI48 HSI48 clock selected as MCO source for devices with HSI48 (*)
- __MCODIV__: specifies the MCO clock prescaler. This parameter can be one of the following values:
  - RCC_MCO2DIV_1 MCO clock source is divided by 1
  - RCC_MCO2DIV_2 MCO clock source is divided by 2
  - RCC_MCO2DIV_4 MCO clock source is divided by 4
  - RCC_MCO2DIV_8 MCO clock source is divided by 8
  - RCC_MCO2DIV_16 MCO clock source is divided by 16
  - RCC_MCO2DIV_32 MCO clock source is divided by 32
  - RCC_MCO2DIV_64 MCO clock source is divided by 64
  - RCC_MCO2DIV_128 MCO clock source is divided by 128
  - RCC_MCO2DIV_256 MCO clock source is divided by 256
  - RCC_MCO2DIV_512 MCO clock source is divided by 512
  - RCC_MCO2DIV_1024 MCO clock source is divided by 1024

Flags

RCC_FLAG_MSIRDY

MSI Ready flag

RCC_FLAG_HSIRDY

HSI Ready flag

RCC_FLAG_HSERDY

HSE Ready flag

RCC_FLAG_PLLRDY

PLL Ready flag

RCC_FLAG_LSERDY

LSE Ready flag

RCC_FLAG_LSECSSD

LSE Clock Security System Interrupt flag

RCC_FLAG_LSESYSRDY

LSE clock ready to be used by the system

RCC_FLAG_LSIRDY

LSI Ready flag

RCC_FLAG_RMV

Remove reset flag

RCC_FLAG_OBLRST

Option byte loader reset flag

RCC_FLAG_PINRST

Pin reset flag

RCC_FLAG_PWRRST

PWR reset flag

RCC_FLAG_SFTRST

Software reset flag

RCC_FLAG_IWDGRST

Independent window Watchdog reset flag

RCC_FLAG_WWDGRST

Window watchdog reset flag

RCC_FLAG_LPWRRST

Low Power reset flag

RCC_FLAG_HSI48RDY

HSI48 Ready flag

Flags Interrupts Management

__HAL_RCC_ENABLE_IT

Description:

- Enable RCC interrupt (Perform access to RCC_CIER bits to enable the selected interrupts).

Parameters:

- __INTERRUPT__: specifies the RCC interrupt sources to be enabled. This parameter can be any combination of the following values:
  - RCC_IT_LSIRDY LSI ready interrupt
  - RCC_IT_LSERDY LSE ready interrupt
  - RCC_IT_MSIRDY MSI ready interrupt
  - RCC_IT_HSIRDY HSI ready interrupt
  - RCC_IT_HSERDY HSE ready interrupt
  - RCC_IT_PLLRDY PLL ready interrupt
  - RCC_IT_LSECSS LSE Clock security system interrupt
  - RCC_IT_HSI48RDY HSI48 ready interrupt (*)

Return value:

- None

__HAL_RCC_DISABLE_IT

Description:

- Disable RCC interrupt (Perform access to RCC_CIER bits to disable the selected interrupts).

Parameters:

- __INTERRUPT__: specifies the RCC interrupt sources to be disabled. This parameter can be any combination of the following values:
  - RCC_IT_LSIRDY LSI ready interrupt
  - RCC_IT_LSERDY LSE ready interrupt
  - RCC_IT_MSIRDY MSI ready interrupt
  - RCC_IT_HSIRDY HSI ready interrupt
  - RCC_IT_HSERDY HSE ready interrupt
  - RCC_IT_PLLRDY PLL ready interrupt
  - RCC_IT_LSECSS LSE Clock security system interrupt
  - RCC_IT_HSI48RDY HSI48 ready interrupt (*)

Return value:

- None

__HAL_RCC_CLEAR_IT

Description:

- Clear the RCC's interrupt pending bits (Perform access to RCC_CICR bits to clear the selected interrupt pending bits.

Parameters:

- __INTERRUPT__: specifies the interrupt pending bit to clear. This parameter can be any combination of the following values:
  - RCC_IT_LSIRDY LSI ready interrupt
  - RCC_IT_LSERDY LSE ready interrupt
  - RCC_IT_MSIRDY MSI ready interrupt
  - RCC_IT_HSIRDY HSI ready interrupt
  - RCC_IT_HSERDY HSE ready interrupt
  - RCC_IT_PLLRDY PLL ready interrupt
  - RCC_IT_LSECSS LSE Clock security system interrupt
  - RCC_IT_HSI48RDY HSI48 ready interrupt (*)

Return value:

- None

__HAL_RCC_GET_IT

Description:

- Check whether the RCC interrupt has occurred or not.

Parameters:

- __INTERRUPT__: specifies the RCC interrupt source to check. This parameter can be one of the following values:
  - RCC_IT_LSIRDY LSI ready interrupt
  - RCC_IT_LSERDY LSE ready interrupt
  - RCC_IT_MSIRDY MSI ready interrupt
  - RCC_IT_HSIRDY HSI ready interrupt
  - RCC_IT_HSERDY HSE ready interrupt
  - RCC_IT_PLLRDY PLL ready interrupt
  - RCC_IT_LSECSS LSE Clock security system interrupt
  - RCC_IT_HSI48RDY HSI48 ready interrupt (*)

Return value:

- The: new state of __INTERRUPT__ (TRUE or FALSE).

__HAL_RCC_CLEAR_RESET_FLAGS

Description:

- Set RMVF bit to clear the reset flags.

Return value:

- None

__HAL_RCC_GET_FLAG

Description:

- Check whether the selected RCC flag is set or not.

Parameters:

- __FLAG__: specifies the flag to check. This parameter can be one of the following values:
  - RCC_FLAG_MSIRDY MSI oscillator clock ready
  - RCC_FLAG_HSIRDY HSI oscillator clock ready
  - RCC_FLAG_HSERDY HSE oscillator clock ready
  - RCC_FLAG_PLLRDY PLL clock ready
  - RCC_FLAG_HSI48RDY HSI48 clock ready (*)
  - RCC_FLAG_LSERDY LSE oscillator clock ready
  - RCC_FLAG_LSECSSD Clock security system failure on LSE oscillator detection
  - RCC_FLAG_LSIRDY LSI oscillator clock ready
  - RCC_FLAG_PWRRST BOR reset
  - RCC_FLAG_OBLRST OBLRST reset
  - RCC_FLAG_PINRST Pin reset
  - RCC_FLAG_RMV Remove reset Flag
  - RCC_FLAG_SFTRST Software reset
  - RCC_FLAG_IWDGRST Independent Watchdog reset
  - RCC_FLAG_WWDGRST Window Watchdog reset
  - RCC_FLAG_LPWRRST Low Power reset

Return value:

- The: new state of __FLAG__ (TRUE or FALSE).

HSECSS Config

RCC_HSECSS_OFF

HSECSS clock deactivation

RCC_HSECSS_ON

HSECSS clock activation

HSE Config

RCC_HSE_OFF

HSE clock deactivation

RCC_HSE_ON

HSE clock activation

RCC_HSE_BYPASS

External clock source for HSE clock

HSI48 Config

RCC_HSI48_OFF

HSI48 clock deactivation

RCC_HSI48_ON

HSI48 clock activation

HSIASFS Config

RCC_HSIASFS_OFF

HSIASFS clock deactivation

RCC_HSIASFS_ON

HSIASFS clock activation

HSIK Config

RCC_HSIK_OFF

HSIK clock deactivation

RCC_HSIK_ON

HSIK clock activation

HSI Config

RCC_HSI_OFF

HSI clock deactivation

RCC_HSI_ON

HSI clock activation

RCC_HSICALIBRATION_DEFAULT

Interrupts

RCC_IT_LSIRDY

LSI Ready Interrupt flag

RCC_IT_LSERDY

LSE Ready Interrupt flag

RCC_IT_MSIRDY

MSI Ready Interrupt flag

RCC_IT_HSIRDY

HSI16 Ready Interrupt flag

RCC_IT_HSERDY

HSE Ready Interrupt flag

RCC_IT_PLLRDY

PLL Ready Interrupt flag

RCC_IT_CSS

HSE Clock Security System Interrupt flag

RCC_IT_LSECSS

LSE Clock Security System Interrupt flag

RCC_IT_HSI48RDY

HSI48 Ready Interrupt flag

IOPORT Clock Enable Disable

__HAL_RCC_GPIOA_CLK_ENABLE

__HAL_RCC_GPIOB_CLK_ENABLE

__HAL_RCC_GPIOC_CLK_ENABLE

__HAL_RCC_GPIOD_CLK_ENABLE

__HAL_RCC_GPIOE_CLK_ENABLE

__HAL_RCC_GPIOF_CLK_ENABLE

__HAL_RCC_GPIOA_CLK_DISABLE

__HAL_RCC_GPIOB_CLK_DISABLE

__HAL_RCC_GPIOC_CLK_DISABLE

__HAL_RCC_GPIOD_CLK_DISABLE

__HAL_RCC_GPIOE_CLK_DISABLE

__HAL_RCC_GPIOF_CLK_DISABLE

IOPORT Clock Sleep Enable Disable

__HAL_RCC_GPIOA_CLK_SLEEP_ENABLE

__HAL_RCC_GPIOB_CLK_SLEEP_ENABLE

__HAL_RCC_GPIOC_CLK_SLEEP_ENABLE

__HAL_RCC_GPIOD_CLK_SLEEP_ENABLE

__HAL_RCC_GPIOE_CLK_SLEEP_ENABLE

__HAL_RCC_GPIOF_CLK_SLEEP_ENABLE

__HAL_RCC_GPIOA_CLK_SLEEP_DISABLE

__HAL_RCC_GPIOB_CLK_SLEEP_DISABLE

__HAL_RCC_GPIOC_CLK_SLEEP_DISABLE

__HAL_RCC_GPIOD_CLK_SLEEP_DISABLE

__HAL_RCC_GPIOE_CLK_SLEEP_DISABLE

__HAL_RCC_GPIOF_CLK_SLEEP_DISABLE

IO Peripheral Force Release Reset

__HAL_RCC_IOP_FORCE_RESET

__HAL_RCC_GPIOA_FORCE_RESET

__HAL_RCC_GPIOB_FORCE_RESET

__HAL_RCC_GPIOC_FORCE_RESET

__HAL_RCC_GPIOD_FORCE_RESET

__HAL_RCC_GPIOE_FORCE_RESET

__HAL_RCC_GPIOF_FORCE_RESET

__HAL_RCC_IOP_RELEASE_RESET

__HAL_RCC_GPIOA_RELEASE_RESET

__HAL_RCC_GPIOB_RELEASE_RESET

__HAL_RCC_GPIOC_RELEASE_RESET

__HAL_RCC_GPIOD_RELEASE_RESET

__HAL_RCC_GPIOE_RELEASE_RESET

__HAL_RCC_GPIOF_RELEASE_RESET

LSE Drive Config

RCC_LSEDRIVE_LOW

LSE low drive capability

RCC_LSEDRIVE_MEDIUMLOW

LSE medium low drive capability

RCC_LSEDRIVE_MEDIUMHIGH

LSE medium high drive capability

RCC_LSEDRIVE_HIGH

LSE high drive capability

LSE Config

RCC_LSE_OFF

LSE clock deactivation

RCC_LSE_ON_RTC_ONLY

LSE clock activation for RTC only

RCC_LSE_ON

LSE clock activation for RCC and peripherals

RCC_LSE_BYPASS_RTC_ONLY

External clock source for LSE clock

RCC_LSE_BYPASS

External clock source for LSE clock

LSI Config

RCC_LSI_OFF

LSI clock deactivation

RCC_LSI_ON

LSI clock activation

LSI Div

RCC_LSI_DIV1

LSI clock is not divided

RCC_LSI_DIV128

LSI clock is divided by 128

MCO1 Clock Prescaler

RCC_MCO1DIV_1

MCO divided by 1

RCC_MCO1DIV_2

MCO divided by 2

RCC_MCO1DIV_4

MCO divided by 4

RCC_MCO1DIV_8

MCO divided by 8

RCC_MCO1DIV_16

MCO divided by 16

RCC_MCO1DIV_32

MCO divided by 32

RCC_MCO1DIV_64

MCO divided by 64

RCC_MCO1DIV_128

MCO divided by 128

RCC_MCO1DIV_256

MCO divided by 256

RCC_MCO1DIV_512

MCO divided by 512

RCC_MCO1DIV_1024

MCO divided by 1024

MCO1 Clock Source

RCC_MCO1SOURCE_NOCLOCK

MCO1 output disabled, no clock on MCO1

RCC_MCO1SOURCE_SYSCLK

SYSCLK selection as MCO1 source

RCC_MCO1SOURCE_MSI

MSI selection as MCO1 source

RCC_MCO1SOURCE_HSI

HSI selection as MCO1 source

RCC_MCO1SOURCE_HSE

HSE selection as MCO1 source

RCC_MCO1SOURCE_PLLR

PLLCLK selection as MCO1 source

RCC_MCO1SOURCE_LSI

LSI selection as MCO1 source

RCC_MCO1SOURCE_LSE

LSE selection as MCO1 source

RCC_MCO1SOURCE_HSI48

HSI48 selection as MCO1 source

RCC_MCO1SOURCE_RTC_ALT

RTC alternative clock selection as MCO1 source

RCC_MCO1SOURCE_RTC_WAKEUP

RTC wakeup interrupt signal selection as MCO1 source

MCO2 Clock Prescaler

RCC_MCO2DIV_1

MCO divided by 1

RCC_MCO2DIV_2

MCO divided by 2

RCC_MCO2DIV_4

MCO divided by 4

RCC_MCO2DIV_8

MCO divided by 8

RCC_MCO2DIV_16

MCO divided by 16

RCC_MCO2DIV_32

MCO divided by 32

RCC_MCO2DIV_64

MCO divided by 64

RCC_MCO2DIV_128

MCO divided by 128

RCC_MCO2DIV_256

MCO divided by 256

RCC_MCO2DIV_512

MCO divided by 512

RCC_MCO2DIV_1024

MCO divided by 1024

MCO2 Clock Source

RCC_MCO2SOURCE_NOCLOCK

MCO2 output disabled, no clock on MCO2

RCC_MCO2SOURCE_SYSCLK

SYSCLK selection as MCO2 source

RCC_MCO2SOURCE_MSI

MSI selection as MCO2 source

RCC_MCO2SOURCE_HSI

HSI selection as MCO2 source

RCC_MCO2SOURCE_HSE

HSE selection as MCO2 source

RCC_MCO2SOURCE_PLLR

PLLCLK selection as MCO2 source

RCC_MCO2SOURCE_LSI

LSI selection as MCO2 source

RCC_MCO2SOURCE_LSE

LSE selection as MCO2 source

RCC_MCO2SOURCE_HSI48

HSI48 selection as MCO2 source

RCC_MCO2SOURCE_RTC_ALT

RTC alternative clock selection as MCO2 source

RCC_MCO2SOURCE_RTC_WAKEUP

RTC wakeup interrupt signal selection as MCO2 source

MCO Index

RCC_MCO_GPIOPORT_POS

RCC_MCO_GPIOPORT_MASK

RCC_MCO_GPIOAF_POS

RCC_MCO_GPIOAF_MASK

RCC_MCO_INDEX_POS

RCC_MCO_INDEX_MASK

RCC_MCO1_INDEX

MCO1 index

RCC_MCO1_PA8

RCC_MCO1_PA9

RCC_MCO1_PF2

RCC_MCO1

RCC_MCO2_INDEX

MCO2 index

RCC_MCO2_PC2

RCC_MCO2_PA10

RCC_MCO2_PA8

RCC_MCO2

RCC_MCO

MCO1 to be compliant with other families with 2 MCOs

MSI Clock Range

RCC_MSIRANGE_0

MSI = 100 KHz

RCC_MSIRANGE_1

MSI = 200 KHz

RCC_MSIRANGE_2

MSI = 400 KHz

RCC_MSIRANGE_3

MSI = 800 KHz

RCC_MSIRANGE_4

MSI = 1 MHz

RCC_MSIRANGE_5

MSI = 2 MHz

RCC_MSIRANGE_6

MSI = 4 MHz

RCC_MSIRANGE_7

MSI = 8 MHz

RCC_MSIRANGE_8

MSI = 16 MHz

RCC_MSIRANGE_9

MSI = 24 MHz

RCC_MSIRANGE_10

MSI = 32 MHz

RCC_MSIRANGE_11

MSI = 48 MHz

MSI Config

RCC_MSI_OFF

MSI clock deactivation

RCC_MSI_ON

MSI clock activation

RCC_MSICALIBRATION_DEFAULT

Default MSI calibration trimming value

Oscillator Type

RCC_OSCILLATORTYPE_NONE

Oscillator configuration unchanged

RCC_OSCILLATORTYPE_HSE

HSE to configure

RCC_OSCILLATORTYPE_HSI

HSI to configure

RCC_OSCILLATORTYPE_LSE

LSE to configure

RCC_OSCILLATORTYPE_LSI

LSI to configure

RCC_OSCILLATORTYPE_MSI

MSI to configure

RCC_OSCILLATORTYPE_HSI48

HSI48 to configure

Peripheral Memory Mapping

RCC_MAP

PLLM Clock Divider

RCC_PLLM_DIV1

PLLM division factor = 8

RCC_PLLM_DIV2

PLLM division factor = 2

RCC_PLLM_DIV3

PLLM division factor = 3

RCC_PLLM_DIV4

PLLM division factor = 4

RCC_PLLM_DIV5

PLLM division factor = 5

RCC_PLLM_DIV6

PLLM division factor = 6

RCC_PLLM_DIV7

PLLM division factor = 7

RCC_PLLM_DIV8

PLLM division factor = 8

PLLP Clock Divider

RCC_PLLP_DIV2

PLLP division factor = 2

RCC_PLLP_DIV3

PLLP division factor = 3

RCC_PLLP_DIV4

PLLP division factor = 4

RCC_PLLP_DIV5

PLLP division factor = 5

RCC_PLLP_DIV6

PLLP division factor = 6

RCC_PLLP_DIV7

PLLP division factor = 7

RCC_PLLP_DIV8

PLLP division factor = 8

RCC_PLLP_DIV9

PLLP division factor = 9

RCC_PLLP_DIV10

PLLP division factor = 10

RCC_PLLP_DIV11

PLLP division factor = 11

RCC_PLLP_DIV12

PLLP division factor = 12

RCC_PLLP_DIV13

PLLP division factor = 13

RCC_PLLP_DIV14

PLLP division factor = 14

RCC_PLLP_DIV15

PLLP division factor = 15

RCC_PLLP_DIV16

PLLP division factor = 16

RCC_PLLP_DIV17

PLLP division factor = 17

RCC_PLLP_DIV18

PLLP division factor = 18

RCC_PLLP_DIV19

PLLP division factor = 19

RCC_PLLP_DIV20

PLLP division factor = 20

RCC_PLLP_DIV21

PLLP division factor = 21

RCC_PLLP_DIV22

PLLP division factor = 22

RCC_PLLP_DIV23

PLLP division factor = 23

RCC_PLLP_DIV24

PLLP division factor = 24

RCC_PLLP_DIV25

PLLP division factor = 25

RCC_PLLP_DIV26

PLLP division factor = 26

RCC_PLLP_DIV27

PLLP division factor = 27

RCC_PLLP_DIV28

PLLP division factor = 28

RCC_PLLP_DIV29

PLLP division factor = 29

RCC_PLLP_DIV30

PLLP division factor = 30

RCC_PLLP_DIV31

PLLP division factor = 31

RCC_PLLP_DIV32

PLLP division factor = 32

PLLQ Clock Divider

RCC_PLLQ_DIV2

PLLQ division factor = 2

RCC_PLLQ_DIV3

PLLQ division factor = 3

RCC_PLLQ_DIV4

PLLQ division factor = 4

RCC_PLLQ_DIV5

PLLQ division factor = 5

RCC_PLLQ_DIV6

PLLQ division factor = 6

RCC_PLLQ_DIV7
PLLQ division factor = 7

RCC_PLLQ_DIV8
PLLQ division factor = 8

PLLR Clock Divider

RCC_PLLR_DIV2
PLLR division factor = 2

RCC_PLLR_DIV3
PLLR division factor = 3

RCC_PLLR_DIV4
PLLR division factor = 4

RCC_PLLR_DIV5
PLLR division factor = 5

RCC_PLLR_DIV6
PLLR division factor = 6

RCC_PLLR_DIV7
PLLR division factor = 7

RCC_PLLR_DIV8
PLLR division factor = 8

RCC PLL Clock Output

RCC_PLL_DIVP

RCC_PLL_DIVQ

RCC_PLL_DIVR

RCC PLL Clock Source

RCC_PLLSOURCE_NONE

RCC_PLLSOURCE_MSI

RCC_PLLSOURCE_HSI

RCC_PLLSOURCE_HSE

RCC PLL Config

RCC_PLL_NONE

RCC_PLL_OFF

RCC_PLL_ON

Reset Flag

RCC_RESET_FLAG_PIN

PIN reset flag

RCC_RESET_FLAG_PWR

BOR or POR/PDR reset flag

RCC_RESET_FLAG_SW

Software Reset flag

RCC_RESET_FLAG_IWDG

Independent Watchdog reset flag

RCC_RESET_FLAG_WWDG

Window watchdog reset flag

RCC_RESET_FLAG_LPWR

Low power reset flag

RCC_RESET_FLAG_OBL

Option Byte Loader reset flag

RCC_RESET_FLAG_ALL

RCC RTC Clock Configuration

__HAL_RCC_RTC_ENABLE

Description:

- Macros to enable or disable the RTC clock.

Return value:

- None

Notes:

- As the RTC is in the Backup domain and write access is denied to this domain after reset, you have to enable write access using HAL_PWR_EnableBkUpAccess() function before to configure the RTC (to be done once after reset). These macros must be used after the RTC clock source was selected.

__HAL_RCC_RTC_DISABLE

RTC Clock Source

RCC_RTCCLKSOURCE_NONE

No clock used as RTC clock

RCC_RTCCLKSOURCE_LSE

LSE oscillator clock used as RTC clock

RCC_RTCCLKSOURCE_LSI

LSI oscillator clock used as RTC clock

RCC_RTCCLKSOURCE_HSE

HSE oscillator clock divided by 32 used as RTC clock

RCC_RTCCLKSOURCE_HSE_DIV32

Wake-Up from STOP Clock

RCC_STOP_WAKEUPCLOCK_MSI

MSI selection after wake-up from STOP

RCC_STOP_WAKEUPCLOCK_HSI

HSI selection after wake-up from STOP

System Clock Source

RCC_SYSCLKSOURCE_MSI

MSI selection as system clock

RCC_SYSCLKSOURCE_HSI

HSI selection as system clock

RCC_SYSCLKSOURCE_HSE

HSE selection as system clock

RCC_SYSCLKSOURCE_PLLCLK

PLL selection as system clock

RCC_SYSCLKSOURCE_LSI

LSI selection as system clock

RCC_SYSCLKSOURCE_LSE

LSE selection as system clock

System Clock Source Status

RCC_SYSCLKSOURCE_STATUS_MSI

MSI used as system clock

RCC_SYSCLKSOURCE_STATUS_HSI

HSI used as system clock

RCC_SYSCLKSOURCE_STATUS_HSE

HSE used as system clock

RCC_SYSCLKSOURCE_STATUS_PLLCLK

PLL used as system clock

RCC_SYSCLKSOURCE_STATUS_LSI

LSI used as system clock

RCC_SYSCLKSOURCE_STATUS_LSE

LSE used as system clock

System Clock Type

RCC_CLOCKTYPE_SYSCLK

SYSCLK to configure

RCC_CLOCKTYPE_HCLK

HCLK to configure

RCC_CLOCKTYPE_PCLK1

PCLK1 to configure

APB Peripheral Clock Enabled or Disabled Status

__HAL_RCC_TIM2_IS_CLK_ENABLED

__HAL_RCC_TIM3_IS_CLK_ENABLED

__HAL_RCC_TIM6_IS_CLK_ENABLED

__HAL_RCC_TIM7_IS_CLK_ENABLED

__HAL_RCC_LPUART2_IS_CLK_ENABLED

__HAL_RCC_LCD_IS_CLK_ENABLED

__HAL_RCC_RTCAPB_IS_CLK_ENABLED

__HAL_RCC_WWDG_IS_CLK_ENABLED

__HAL_RCC_LPUART3_IS_CLK_ENABLED

__HAL_RCC_USB_IS_CLK_ENABLED

__HAL_RCC_SPI2_IS_CLK_ENABLED

__HAL_RCC_SPI3_IS_CLK_ENABLED

__HAL_RCC_CRS_IS_CLK_ENABLED

__HAL_RCC_USART2_IS_CLK_ENABLED

__HAL_RCC_USART3_IS_CLK_ENABLED

__HAL_RCC_USART4_IS_CLK_ENABLED

__HAL_RCC_LPUART1_IS_CLK_ENABLED

__HAL_RCC_I2C1_IS_CLK_ENABLED

__HAL_RCC_I2C2_IS_CLK_ENABLED

__HAL_RCC_I2C3_IS_CLK_ENABLED

__HAL_RCC_OPAMP_IS_CLK_ENABLED

__HAL_RCC_I2C4_IS_CLK_ENABLED

__HAL_RCC_LPTIM3_IS_CLK_ENABLED

__HAL_RCC_PWR_IS_CLK_ENABLED

__HAL_RCC_DAC1_IS_CLK_ENABLED

__HAL_RCC_LPTIM2_IS_CLK_ENABLED

__HAL_RCC_LPTIM1_IS_CLK_ENABLED

__HAL_RCC_TIM2_IS_CLK_DISABLED

__HAL_RCC_TIM3_IS_CLK_DISABLED

__HAL_RCC_TIM6_IS_CLK_DISABLED

__HAL_RCC_TIM7_IS_CLK_DISABLED

__HAL_RCC_LPUART2_IS_CLK_DISABLED

__HAL_RCC_LCD_IS_CLK_DISABLED

__HAL_RCC_RTCAPB_IS_CLK_DISABLED

__HAL_RCC_WWDG_IS_CLK_DISABLED

__HAL_RCC_LPUART3_IS_CLK_DISABLED

__HAL_RCC_USB_IS_CLK_DISABLED

__HAL_RCC_SPI2_IS_CLK_DISABLED

__HAL_RCC_SPI3_IS_CLK_DISABLED

__HAL_RCC_CRS_IS_CLK_DISABLED

__HAL_RCC_USART2_IS_CLK_DISABLED

__HAL_RCC_USART3_IS_CLK_DISABLED

__HAL_RCC_USART4_IS_CLK_DISABLED

__HAL_RCC_LPUART1_IS_CLK_DISABLED

__HAL_RCC_I2C1_IS_CLK_DISABLED

__HAL_RCC_I2C2_IS_CLK_DISABLED

__HAL_RCC_I2C3_IS_CLK_DISABLED

__HAL_RCC_OPAMP_IS_CLK_DISABLED

__HAL_RCC_I2C4_IS_CLK_DISABLED

__HAL_RCC_LPTIM3_IS_CLK_DISABLED

__HAL_RCC_PWR_IS_CLK_DISABLED

__HAL_RCC_DAC1_IS_CLK_DISABLED

__HAL_RCC_LPTIM2_IS_CLK_DISABLED

__HAL_RCC_LPTIM1_IS_CLK_DISABLED

38 HAL RCC Extension Driver

38.1 RCCEx Firmware driver registers structures

38.1.1 PLL_ClocksTypeDef

PLL_ClocksTypeDef is defined in the stm32u0xx_hal_rcc_ex.h

Data Fields

- ***uint32_t PLL_P_Frequency***
- ***uint32_t PLL_Q_Frequency***
- ***uint32_t PLL_R_Frequency***

Field Documentation

- ***uint32_t PLL_ClocksTypeDef::PLL_P_Frequency***
- ***uint32_t PLL_ClocksTypeDef::PLL_Q_Frequency***
- ***uint32_t PLL_ClocksTypeDef::PLL_R_Frequency***

38.1.2 RCC_PeriphCLKInitTypeDef

RCC_PeriphCLKInitTypeDef is defined in the stm32u0xx_hal_rcc_ex.h

Data Fields

- ***uint32_t PeriphClockSelection***
- ***uint32_t Usart1ClockSelection***
- ***uint32_t Usart2ClockSelection***
- ***uint32_t Lpuart3ClockSelection***
- ***uint32_t Lpuart2ClockSelection***
- ***uint32_t Lpuart1ClockSelection***
- ***uint32_t I2c1ClockSelection***
- ***uint32_t I2c3ClockSelection***
- ***uint32_t Lptim1ClockSelection***
- ***uint32_t Lptim2ClockSelection***
- ***uint32_t Lptim3ClockSelection***
- ***uint32_t Tim1ClockSelection***
- ***uint32_t Tim15ClockSelection***
- ***uint32_t UsbClockSelection***
- ***uint32_t RngClockSelection***
- ***uint32_t AdcClockSelection***
- ***uint32_t RTCClockSelection***

Field Documentation

- ***uint32_t RCC_PeriphCLKInitTypeDef::PeriphClockSelection***
  The Extended Clock to be configured. This parameter can be a value of ***RCCEx_Periph_Clock_Selection***
- ***uint32_t RCC_PeriphCLKInitTypeDef::Usart1ClockSelection***
  Specifies USART1 clock source. This parameter can be a value of ***RCCEx_USART1_Clock_Source***
- ***uint32_t RCC_PeriphCLKInitTypeDef::Usart2ClockSelection***
  Specifies USART2 clock source. This parameter can be a value of ***RCCEx_USART2_Clock_Source***
- ***uint32_t RCC_PeriphCLKInitTypeDef::Lpuart3ClockSelection***
  Specifies LPUART1 clock source. This parameter can be a value of ***RCCEx_LPUART3_Clock_Source***
- ***uint32_t RCC_PeriphCLKInitTypeDef::Lpuart2ClockSelection***
  Specifies LPUART2 clock source. This parameter can be a value of ***RCCEx_LPUART2_Clock_Source***
- ***uint32_t RCC_PeriphCLKInitTypeDef::Lpuart1ClockSelection***
  Specifies LPUART3 clock source. This parameter can be a value of ***RCCEx_LPUART1_Clock_Source***

- ***uint32_t RCC_PeriphCLKInitTypeDef::I2c1ClockSelection***
  Specifies I2C1 clock source. This parameter can be a value of ***RCCEx_I2C1_Clock_Source***
- ***uint32_t RCC_PeriphCLKInitTypeDef::I2c3ClockSelection***
  Specifies I2C3 clock source. This parameter can be a value of ***RCCEx_I2C3_Clock_Source***
- ***uint32_t RCC_PeriphCLKInitTypeDef::Lptim1ClockSelection***
  Specifies LPTIM1 clock source. This parameter can be a value of ***RCCEx_LPTIM1_Clock_Source***
- ***uint32_t RCC_PeriphCLKInitTypeDef::Lptim2ClockSelection***
  Specifies LPTIM2 clock source. This parameter can be a value of ***RCCEx_LPTIM2_Clock_Source***
- ***uint32_t RCC_PeriphCLKInitTypeDef::Lptim3ClockSelection***
  Specifies LPTIM3 clock source. This parameter can be a value of ***RCCEx_LPTIM3_Clock_Source***
- ***uint32_t RCC_PeriphCLKInitTypeDef::Tim1ClockSelection***
  Specifies TIM1 clock source. This parameter can be a value of ***RCCEx_TIM1_Clock_Source***
- ***uint32_t RCC_PeriphCLKInitTypeDef::Tim15ClockSelection***
  Specifies TIM15 clock source. This parameter can be a value of ***RCCEx_TIM15_Clock_Source***
- ***uint32_t RCC_PeriphCLKInitTypeDef::UsbClockSelection***
  Specifies USB clock source. This parameter can be a value of ***RCCEx_USB_Clock_Source***
- ***uint32_t RCC_PeriphCLKInitTypeDef::RngClockSelection***
  Specifies RNG clock source. This parameter can be a value of ***RCCEx_RNG_Clock_Source***
- ***uint32_t RCC_PeriphCLKInitTypeDef::AdcClockSelection***
  Specifies ADC clock source. This parameter can be a value of ***RCCEx_ADC_Clock_Source***
- ***uint32_t RCC_PeriphCLKInitTypeDef::RTCClockSelection***
  Specifies RTC clock source. This parameter can be a value of ***RCC_RTC_Clock_Source***

38.1.3 RCC_CRSInitTypeDef

RCC_CRSInitTypeDef is defined in the stm32u0xx_hal_rcc_ex.h

Data Fields

- ***uint32_t Prescaler***
- ***uint32_t Source***
- ***uint32_t Polarity***
- ***uint32_t ReloadValue***
- ***uint32_t ErrorLimitValue***
- ***uint32_t HSI48CalibrationValue***

Field Documentation

- ***uint32_t RCC_CRSInitTypeDef::Prescaler***
  Specifies the division factor of the SYNC signal. This parameter can be a value of ***RCCEx_CRS_SynchroDivider***
- ***uint32_t RCC_CRSInitTypeDef::Source***
  Specifies the SYNC signal source. This parameter can be a value of ***RCCEx_CRS_SynchroSource***
- ***uint32_t RCC_CRSInitTypeDef::Polarity***
  Specifies the input polarity for the SYNC signal source. This parameter can be a value of ***RCCEx_CRS_SynchroPolarity***
- ***uint32_t RCC_CRSInitTypeDef::ReloadValue***
  Specifies the value to be loaded in the frequency error counter with each SYNC event. It can be calculated in using macro **__HAL_RCC_CRS_RELOADVALUE_CALCULATE(__FTARGET__, __FSYNC__)** This parameter must be a number between 0 and 0xFFFF or a value of ***RCCEx_CRS_ReloadValueDefault*** .
- ***uint32_t RCC_CRSInitTypeDef::ErrorLimitValue***
  Specifies the value to be used to evaluate the captured frequency error value. This parameter must be a number between 0 and 0xFF or a value of ***RCCEx_CRS_ErrorLimitDefault***
- ***uint32_t RCC_CRSInitTypeDef::HSI48CalibrationValue***
  Specifies a user-programmable trimming value to the HSI48 oscillator. This parameter must be a number between 0 and 0x3F or a value of ***RCCEx_CRS_HSI48CalibrationDefault***

38.1.4 RCC_CRSSynchroInfoTypeDef

RCC_CRSSynchroInfoTypeDef is defined in the stm32u0xx_hal_rcc_ex.h

Data Fields

- ***uint32_t ReloadValue***
- ***uint32_t HSI48CalibrationValue***
- ***uint32_t FreqErrorCapture***
- ***uint32_t FreqErrorDirection***

Field Documentation

- ***uint32_t RCC_CRSSynchroInfoTypeDef::ReloadValue***
  Specifies the value loaded in the Counter reload value. This parameter must be a number between 0 and 0xFFFF
- ***uint32_t RCC_CRSSynchroInfoTypeDef::HSI48CalibrationValue***
  Specifies value loaded in RC48 oscillator smooth trimming. This parameter must be a number between 0 and 0x3F
- ***uint32_t RCC_CRSSynchroInfoTypeDef::FreqErrorCapture***
  Specifies the value loaded in the .FECAP, the frequency error counter value latched in the time of the last SYNC event. This parameter must be a number between 0 and 0xFFFF
- ***uint32_t RCC_CRSSynchroInfoTypeDef::FreqErrorDirection***
  Specifies the value loaded in the .FEDIR, the counting direction of the frequency error counter latched in the time of the last SYNC event. It shows whether the actual frequency is below or above the target. This parameter must be a value of ***RCCEx_CRS_FreqErrorDirection***

38.2 RCCEx Firmware driver API description

The following section lists the various functions of the RCCEx library.

38.2.1 Extended Peripheral Control functions

This subsection provides a set of functions allowing to control the RCC Clocks frequencies.

Note: *Important note: Care must be taken when HAL_RCCEx_PeriphCLKConfig() is used to select the RTC clock source; in this case the Backup domain will be reset in order to modify the RTC Clock source, as consequence RTC registers (including the backup registers) are set to their reset values.*

This section contains the following APIs:

- ***HAL_RCCEx_PeriphCLKConfig()***
- ***HAL_RCCEx_GetPeriphCLKConfig()***
- ***HAL_RCCEx_GetPeriphCLKFreq()***
- ***HAL_RCCEx_GetPLLClockFreq()***
- ***HAL_RCCEx_EnablePLL()***
- ***HAL_RCCEx_DisablePLL()***
- ***HAL_RCCEx_WakeUpStopCLKConfig()***
- ***HAL_RCCEx_StandbyMSIRangeConfig()***
- ***HAL_RCCEx_EnableMSIPLLMode()***
- ***HAL_RCCEx_DisableMSIPLLMode()***
- ***HAL_RCCEx_EnableLSECSS()***
- ***HAL_RCCEx_DisableLSECSS()***
- ***HAL_RCCEx_EnableLSECSS_IT()***
- ***HAL_RCCEx_LSECSS_IRQHandler()***
- ***HAL_RCCEx_LSECSS_Callback()***
- ***HAL_RCCEx_EnableLSCO()***
- ***HAL_RCCEx_DisableLSCO()***

38.2.2 Extended Clock Recovery System Control functions

For devices with Clock Recovery System feature (CRS), RCC Extension HAL driver can be used as follows:

1. In System clock config, HSI48 needs to be enabled
2. Enable CRS clock in IP MSP init which will use CRS functions

3. Call CRS functions as follows:
   a. Prepare synchronization configuration necessary for HSI48 calibration
      - Default values can be set for frequency Error Measurement (reload and error limit) and also HSI48 oscillator smooth trimming.
      - Macro __HAL_RCC_CRS_RELOADVALUE_CALCULATE can be also used to calculate directly reload value with target and synchronization frequencies values
   b. Call function HAL_RCCEx_CRSConfig which
      - Resets CRS registers to their default values.
      - Configures CRS registers with synchronization configuration
      - Enables automatic calibration and frequency error counter feature Note: When using USB LPM (Link Power Management) and the device is in Sleep mode, the periodic USB SOF will not be generated by the host. No SYNC signal will therefore be provided to the CRS to calibrate the HSI48 on the run. To guarantee the required clock precision after waking up from Sleep mode, the LSE or reference clock on the GPIOs should be used as SYNC signal.
   c. A polling function is provided to wait for complete synchronization
      - Call function HAL_RCCEx_CRSWaitSynchronization()
      - According to CRS status, user can decide to adjust again the calibration or continue application if synchronization is OK
4. User can retrieve information related to synchronization in calling function HAL_RCCEx_CRSGetSynchronizationInfo()
5. Regarding synchronization status and synchronization information, user can try a new calibration in changing synchronization configuration and call again HAL_RCCEx_CRSConfig. Note: When the SYNC event is detected during the downcounting phase (before reaching the zero value), it means that the actual frequency is lower than the target (and so, that the TRIM value should be incremented), while when it is detected during the upcounting phase it means that the actual frequency is higher (and that the TRIM value should be decremented).
6. In interrupt mode, user can resort to the available macros (__HAL_RCC_CRS_XXX_IT). Interrupts will go through CRS Handler (CRS_IRQn/CRS_IRQHandler)
   – Call function HAL_RCCEx_CRSConfig()
   – Enable CRS_IRQn (thanks to NVIC functions)
   – Enable CRS interrupt (__HAL_RCC_CRS_ENABLE_IT)
   – Implement CRS status management in the following user callbacks called from HAL_RCCEx_CRS_IRQHandler():
      - HAL_RCCEx_CRS_SyncOkCallback()
      - HAL_RCCEx_CRS_SyncWarnCallback()
      - HAL_RCCEx_CRS_ExpectedSyncCallback()
      - HAL_RCCEx_CRS_ErrorCallback()
7. To force a SYNC EVENT, user can use the function HAL_RCCEx_CRSSoftwareSynchronizationGenerate(). This function can be called before calling HAL_RCCEx_CRSConfig (for instance in Systick handler)

This section contains the following APIs:

- ***HAL_RCCEx_CRSConfig()***
- ***HAL_RCCEx_CRSSoftwareSynchronizationGenerate()***
- ***HAL_RCCEx_CRSGetSynchronizationInfo()***
- ***HAL_RCCEx_CRSWaitSynchronization()***
- ***HAL_RCCEx_CRS_IRQHandler()***
- ***HAL_RCCEx_CRS_SyncOkCallback()***
- ***HAL_RCCEx_CRS_SyncWarnCallback()***
- ***HAL_RCCEx_CRS_ExpectedSyncCallback()***
- ***HAL_RCCEx_CRS_ErrorCallback()***

38.2.3 Detailed description of functions

HAL_RCCEx_PeriphCLKConfig

Function name

HAL_StatusTypeDef HAL_RCCEx_PeriphCLKConfig (RCC_PeriphCLKInitTypeDef * PeriphClkInit)

Function description

Initialize the RCC extended peripherals clocks according to the specified parameters in the RCC_PeriphCLKInitTypeDef.

Parameters

- **PeriphClkInit:** pointer to an RCC_PeriphCLKInitTypeDef structure that contains a field PeriphClockSelection which can be a combination of the following values:
  - RCC_PERIPHCLK_USART1 USART1 peripheral clock
  - RCC_PERIPHCLK_USART2 USART2 peripheral clock
  - RCC_PERIPHCLK_LPUART1 LPUART1 peripheral clock
  - RCC_PERIPHCLK_LPUART2 LPUART2 peripheral clock
  - RCC_PERIPHCLK_LPUART3 LPUART3 peripheral clock
  - RCC_PERIPHCLK_I2C1 I2C1 peripheral clock
  - RCC_PERIPHCLK_I2C3 I2C3 peripheral clock
  - RCC_PERIPHCLK_LPTIM1 LPTIM1 peripheral clock
  - RCC_PERIPHCLK_LPTIM2 LPTIM2 peripheral clock
  - RCC_PERIPHCLK_LPTIM3 LPTIM3 peripheral clock
  - RCC_PERIPHCLK_TIM1 TIM1 peripheral clock
  - RCC_PERIPHCLK_TIM15 TIM15 peripheral clock
  - RCC_PERIPHCLK_USB USB peripheral clock
  - RCC_PERIPHCLK_ADC ADC peripheral clock

Return values

- **HAL:** status

Notes

- Care must be taken when HAL_RCCEx_PeriphCLKConfig() is used to select the RTC clock source: in this case the access to Backup domain is enabled.

HAL_RCCEx_GetPeriphCLKConfig

Function name

void HAL_RCCEx_GetPeriphCLKConfig (RCC_PeriphCLKInitTypeDef * PeriphClkInit)

Function description

Get the RCC_ClkInitStruct according to the internal RCC configuration registers.

Parameters

- **PeriphClkInit:** pointer to an RCC_PeriphCLKInitTypeDef structure that returns the configuration information for the Extended Peripherals clocks(USART1, USART2, LPUART1, LPUART2, LPUART3, I2C1, I2C2, I2C3, I2C4, LPTIM1, LPTIM2, LPTIM3, USB, TIM1, LCD, SPI1, SPI2, SPI3, RTC, RNG, ADC, DAC, IWDG).

Return values

- **None:**

HAL_RCCEx_GetPeriphCLKFreq

Function name

uint32_t HAL_RCCEx_GetPeriphCLKFreq (uint32_t PeriphClk)

Function description

Return the peripheral clock frequency for peripherals with clock source from PLLSAIs.

Parameters

- **PeriphClk:** Peripheral clock identifier This parameter can be one of the following values:
  - RCC_PERIPHCLK_ADC ADC peripheral clock
  - RCC_PERIPHCLK_I2C1 I2C1 peripheral clock
  - RCC_PERIPHCLK_I2C3 I2C3 peripheral clock
  - RCC_PERIPHCLK_LPTIM1 LPTIM1 peripheral clock
  - RCC_PERIPHCLK_LPTIM2 LPTIM2 peripheral clock
  - RCC_PERIPHCLK_LPTIM3 LPTIM3 peripheral clock
  - RCC_PERIPHCLK_LPUART1 LPUART1 peripheral clock
  - RCC_PERIPHCLK_LPUART2 LPUART2 peripheral clock
  - RCC_PERIPHCLK_LPUART3 LPUART3 peripheral clock
  - RCC_PERIPHCLK_USART1 USART1 peripheral clock
  - RCC_PERIPHCLK_USART2 USART2 peripheral clock
  - RCC_PERIPHCLK_USART3 USART3 peripheral clock
  - RCC_PERIPHCLK_USART4 USART4 peripheral clock
  - RCC_PERIPHCLK_USB USB peripheral clock (only for devices with USB)
  - RCC_PERIPHCLK_RNG RNG peripheral clock (only for devices with RNG)
  - RCC_PERIPHCLK_TIM1 TIM1 peripheral clock (only for devices with TIM1)
  - RCC_PERIPHCLK_TIM15 TIM15 peripheral clock (only for devices with TIM15)

Return values

- **Frequency:** in Hz

Notes

- Return 0 if peripheral clock identifier not managed by this API

HAL_RCCEx_GetPLLClockFreq

Function name

void HAL_RCCEx_GetPLLClockFreq (PLL_ClocksTypeDef * PLL_Clocks)

Function description

Returns the PLL clock frequencies :PLL_P_Frequency,PLL_R_Frequency and PLL_Q_Frequency.

Parameters

- **PLL_Clocks:** structure.

Return values

- **None:**

Notes

- The PLL clock frequencies computed by this function is not the real frequency in the chip. It is calculated based on the predefined constant and the selected clock source:
- The function returns values based on HSE_VALUE, HSI_VALUE or MSI Value multiplied/divided by the PLL factors
- This function can be used by the user application to compute the baud-rate for the communication peripherals or configure other parameters.
- Each time PLLCLK changes, this function must be called to update the right PLLCLK value. Otherwise, any configuration based on this function will be incorrect.

HAL_RCCEx_EnablePLL

Function name

HAL_StatusTypeDef HAL_RCCEx_EnablePLL (RCC_PLLInitTypeDef * PLLInit)

Function description

Enable PLL.

Parameters

- **PLLInit:** pointer to an RCC_PLLInitTypeDef structure that contains the configuration information for the PLL

Return values

- **HAL:** status

HAL_RCCEx_DisablePLL

Function name

HAL_StatusTypeDef HAL_RCCEx_DisablePLL (void)

Function description

Disable PLL.

Return values

- **HAL:** status

HAL_RCCEx_WakeUpStopCLKConfig

Function name

void HAL_RCCEx_WakeUpStopCLKConfig (uint32_t WakeUpClk)

Function description

Configure the oscillator clock source for wakeup from Stop and CSS backup clock.

Parameters

- **WakeUpClk:** Wakeup clock This parameter can be one of the following values:
  - RCC_STOP_WAKEUPCLOCK_MSI MSI oscillator selection
  - RCC_STOP_WAKEUPCLOCK_HSI HSI oscillator selection

Return values

- **None:**

Notes

- This function shall not be called after the Clock Security System on HSE has been enabled.

HAL_RCCEx_StandbyMSIRangeConfig

Function name

void HAL_RCCEx_StandbyMSIRangeConfig (uint32_t MSIRange)

Function description

Configure the MSI range after standby mode.

Parameters

- **MSIRange:** MSI range This parameter can be one of the following values:
  - RCC_MSIRANGE_4 Range 4 around 4 MHz (reset value)
  - RCC_MSIRANGE_5 Range 5 around 2 MHz
  - RCC_MSIRANGE_6 Range 6 around 1.5 MHz
  - RCC_MSIRANGE_7 Range 7 around 1 MHz

Return values

- **None:**

Notes

- After Standby its frequency can be selected between 3 possible values (1, 3.072 or 4 MHz).

HAL_RCCEx_EnableLSECSS

Function name

void HAL_RCCEx_EnableLSECSS (void)

Function description

Enables the LSE Clock Security System.

Return values

- **None:**

HAL_RCCEx_DisableLSECSS

Function name

void HAL_RCCEx_DisableLSECSS (void)

Function description

Disables the LSE Clock Security System.

Return values

- **None:**

Notes

- Once enabled this bit cannot be disabled, except after an LSE failure detection (LSECSSD=1). In that case the software MUST disable the LSECSSON bit. Reset by power on reset and RTC software reset (RTCRST bit).

HAL_RCCEx_EnableLSECSS_IT

Function name

void HAL_RCCEx_EnableLSECSS_IT (void)

Function description

Enable the LSE Clock Security System IT & corresponding EXTI line.

Return values

- **None:**

Notes

- LSE Clock Security System IT is mapped on RTC EXTI line 27

HAL_RCCEx_LSECSS_IRQHandler

Function name

void HAL_RCCEx_LSECSS_IRQHandler (void)

Function description

Handle the RCC LSE Clock Security System interrupt request.

Return values

- **None:**

HAL_RCCEx_LSECSS_Callback

Function name

void HAL_RCCEx_LSECSS_Callback (void)

Function description

RCCEx LSE Clock Security System interrupt callback.

Return values

- **none:**

HAL_RCCEx_EnableLSCO

Function name

void HAL_RCCEx_EnableLSCO (uint32_t LSCOSource)

Function description

Select the Low Speed clock source to output on LSCO pin (PA2).

Parameters

- **LSCOSource:** specifies the Low Speed clock source to output. This parameter can be one of the following values:
  - RCC_LSCOSOURCE_LSI LSI clock selected as LSCO source
  - RCC_LSCOSOURCE_LSE LSE clock selected as LSCO source

Return values

- **None:**

HAL_RCCEx_DisableLSCO

Function name

void HAL_RCCEx_DisableLSCO (void)

Function description

Disable the Low Speed clock output.

Return values

- **None:**

HAL_RCCEx_EnableMSIPLLMode

Function name

void HAL_RCCEx_EnableMSIPLLMode (void)

Function description

Enable the PLL-mode of the MSI.

Return values

- **None:**

Notes

- Prior to enable the PLL-mode of the MSI for automatic hardware calibration LSE oscillator is to be enabled with HAL_RCC_OscConfig().

HAL_RCCEx_DisableMSIPLLMode

Function name

void HAL_RCCEx_DisableMSIPLLMode (void)

Function description

Disable the PLL-mode of the MSI.

Return values

- **None:**

Notes

- PLL-mode of the MSI is automatically reset when LSE oscillator is disabled.

HAL_RCCEx_CRSConfig

Function name

void HAL_RCCEx_CRSConfig (RCC_CRSInitTypeDef * pInit)

Function description

Start automatic synchronization for polling mode.

Parameters

- **pInit:** Pointer on RCC_CRSInitTypeDef structure

Return values

- **None:**

HAL_RCCEx_CRSSoftwareSynchronizationGenerate

Function name

void HAL_RCCEx_CRSSoftwareSynchronizationGenerate (void)

Function description

Generate the software synchronization event.

Return values

- **None:**

HAL_RCCEx_CRSGetSynchronizationInfo

Function name

void HAL_RCCEx_CRSGetSynchronizationInfo (RCC_CRSSynchroInfoTypeDef * pSynchroInfo)

Function description

Return synchronization info.

Parameters

- **pSynchroInfo:** Pointer on RCC_CRSSynchroInfoTypeDef structure

Return values

- **None:**

HAL_RCCEx_CRSWaitSynchronization

Function name

uint32_t HAL_RCCEx_CRSWaitSynchronization (uint32_t Timeout)

Function description

Wait for CRS Synchronization status.

Parameters

- **Timeout:** Duration of the timeout

Return values

- **Combination:** of Synchronization status This parameter can be a combination of the following values:
  - RCC_CRS_TIMEOUT
  - RCC_CRS_SYNCOK
  - RCC_CRS_SYNCWARN
  - RCC_CRS_SYNCERR
  - RCC_CRS_SYNCMISS
  - RCC_CRS_TRIMOVF

Notes

- Timeout is based on the maximum time to receive a SYNC event based on synchronization frequency.
- If Timeout set to HAL_MAX_DELAY, HAL_TIMEOUT will be never returned.

HAL_RCCEx_CRS_IRQHandler

Function name

void HAL_RCCEx_CRS_IRQHandler (void)

Function description

Handle the Clock Recovery System interrupt request.

Return values

- **None:**

HAL_RCCEx_CRS_SyncOkCallback

Function name

void HAL_RCCEx_CRS_SyncOkCallback (void)

Function description

RCCEx Clock Recovery System SYNCOK interrupt callback.

Return values

- **none:**

HAL_RCCEx_CRS_SyncWarnCallback

Function name

void HAL_RCCEx_CRS_SyncWarnCallback (void)

Function description

RCCEx Clock Recovery System SYNCWARN interrupt callback.

Return values

- **none:**

HAL_RCCEx_CRS_ExpectedSyncCallback

Function name

void HAL_RCCEx_CRS_ExpectedSyncCallback (void)

Function description

RCCEx Clock Recovery System Expected SYNC interrupt callback.

Return values

- **none:**

HAL_RCCEx_CRS_ErrorCallback

Function name

void HAL_RCCEx_CRS_ErrorCallback (uint32_t Error)

Function description

RCCEx Clock Recovery System Error interrupt callback.

Parameters

- **Error:** Combination of Error status. This parameter can be a combination of the following values:
  - RCC_CRS_SYNCERR
  - RCC_CRS_SYNCMISS
  - RCC_CRS_TRIMOVF

Return values

- **none:**

38.3 RCCEx Firmware driver defines

The following section lists the various define and macros of the module.

38.3.1 RCCEx

RCCEx

ADC1 Clock Source

RCC_ADCCLKSOURCE_SYSCLK

RCC_ADCCLKSOURCE_PLLP

RCC_ADCCLKSOURCE_HSI

RCCEx CRS ErrorLimitDefault

RCC_CRS_ERRORLIMIT_DEFAULT

Default Frequency error limit

RCCEx CRS Extended Features

__HAL_RCC_CRS_FREQ_ERROR_COUNTER_ENABLE

Description:

- Enable the oscillator clock for frequency error counter.

Return value:

- None

Notes:

- when the CEN bit is set the CRS_CFGR register becomes write-protected.

__HAL_RCC_CRS_FREQ_ERROR_COUNTER_DISABLE

Description:

- Disable the oscillator clock for frequency error counter.

Return value:

- None

__HAL_RCC_CRS_AUTOMATIC_CALIB_ENABLE

Description:

- Enable the automatic hardware adjustment of TRIM bits.

Return value:

- None

Notes:

- When the AUTOTRIMEN bit is set the CRS_CFGR register becomes write-protected.

__HAL_RCC_CRS_AUTOMATIC_CALIB_DISABLE

Description:

- Enable or disable the automatic hardware adjustment of TRIM bits.

Return value:

- None

__HAL_RCC_CRS_RELOADVALUE_CALCULATE

Description:

- Macro to calculate reload value to be set in CRS register according to target and sync frequencies.

Parameters:

- __FTARGET__: Target frequency (value in Hz)
- __FSYNC__: Synchronization signal frequency (value in Hz)

Return value:

- None

Notes:

- The RELOAD value should be selected according to the ratio between the target frequency and the frequency of the synchronization source after prescaling. It is then decreased by one in order to reach the expected synchronization on the zero value. The formula is the following: RELOAD = (fTARGET / fSYNC) -1

RCCEx CRS Flags

RCC_CRS_FLAG_SYNCOK

SYNC event OK flag

RCC_CRS_FLAG_SYNCWARN

SYNC warning flag

RCC_CRS_FLAG_ERR

Error flag

RCC_CRS_FLAG_ESYNC

Expected SYNC flag

RCC_CRS_FLAG_SYNCERR

SYNC error

RCC_CRS_FLAG_SYNCMISS

SYNC missed

RCC_CRS_FLAG_TRIMOVF

Trimming overflow or underflow

RCCEx CRS FreqErrorDirection

RCC_CRS_FREQERRORDIR_UP

Upcounting direction, the actual frequency is above the target

RCC_CRS_FREQERRORDIR_DOWN

Downcounting direction, the actual frequency is below the target

RCCEx CRS HSI48CalibrationDefault

RCC_CRS_HSI48CALIBRATION_DEFAULT

The default value is 64, which corresponds to the middle of the trimming interval. The trimming step is specified in the product datasheet. A higher TRIM value corresponds to a higher output frequency

RCCEx CRS Interrupt Sources

RCC_CRS_IT_SYNCOK

SYNC event OK

RCC_CRS_IT_SYNCWARN

SYNC warning

RCC_CRS_IT_ERR

Error

RCC_CRS_IT_ESYNC

Expected SYNC

RCC_CRS_IT_SYNCERR

SYNC error

RCC_CRS_IT_SYNCMISS

SYNC missed

RCC_CRS_IT_TRIMOVF

Trimming overflow or underflow

RCCEx CRS ReloadValueDefault

RCC_CRS_RELOADVALUE_DEFAULT

The reset value of the RELOAD field corresponds to a target frequency of 48 MHz and a synchronization signal frequency of 1 kHz (SOF signal from USB).

RCCEx CRS Status

RCC_CRS_NONE

RCC_CRS_TIMEOUT

RCC_CRS_SYNCOK

RCC_CRS_SYNCWARN

RCC_CRS_SYNCERR

RCC_CRS_SYNCMISS

RCC_CRS_TRIMOVF

RCCEx CRS SynchroDivider

RCC_CRS_SYNC_DIV1

Synchro Signal not divided (default)

RCC_CRS_SYNC_DIV2

Synchro Signal divided by 2

RCC_CRS_SYNC_DIV4

Synchro Signal divided by 4

RCC_CRS_SYNC_DIV8

Synchro Signal divided by 8

RCC_CRS_SYNC_DIV16

Synchro Signal divided by 16

RCC_CRS_SYNC_DIV32

Synchro Signal divided by 32

RCC_CRS_SYNC_DIV64

Synchro Signal divided by 64

RCC_CRS_SYNC_DIV128

Synchro Signal divided by 128

RCCEx CRS SynchroPolarity

RCC_CRS_SYNC_POLARITY_RISING

Synchro Active on rising edge (default)

RCC_CRS_SYNC_POLARITY_FALLING

Synchro Active on falling edge

RCCEx CRS SynchroSource

RCC_CRS_SYNC_SOURCE_GPIO

Synchro Signal source GPIO

RCC_CRS_SYNC_SOURCE_LSE

Synchro Signal source LSE

RCC_CRS_SYNC_SOURCE_USB

Synchro Signal source USB SOF (default)

RCCEx Exported Macros

__HAL_RCC_USART1_CONFIG

Description:

- Macro to configure the USART1 clock (USART1CLK).

Parameters:

- __USART1_CLKSOURCE__: specifies the USART1 clock source. This parameter can be one of the following values:
  - RCC_USART1CLKSOURCE_PCLK1 PCLK selected as USART1 clock
  - RCC_USART1CLKSOURCE_SYSCLK System Clock selected as USART1 clock
  - RCC_USART1CLKSOURCE_HSI HSI selected as USART1 clock
  - RCC_USART1CLKSOURCE_LSE SE selected as USART1 clock

Return value:

- None

__HAL_RCC_GET_USART1_SOURCE

Description:

- Macro to get the USART1 clock source.

Return value:

- The: clock source can be one of the following values:
  - RCC_USART1CLKSOURCE_PCLK1 PCLK selected as USART1 clock
  - RCC_USART1CLKSOURCE_SYSCLK System Clock selected as USART1 clock
  - RCC_USART1CLKSOURCE_HSI HSI selected as USART1 clock
  - RCC_USART1CLKSOURCE_LSE LSE selected as USART1 clock

__HAL_RCC_USART2_CONFIG

Description:

- Macro to configure the USART2 clock (USART2CLK).

Parameters:

- __USART2_CLKSOURCE__: specifies the USART2 clock source. This parameter can be one of the following values:
  - RCC_USART2CLKSOURCE_PCLK1 PCLK selected as USART2 clock
  - RCC_USART2CLKSOURCE_HSI HSI selected as USART2 clock
  - RCC_USART2CLKSOURCE_SYSCLK System Clock selected as USART2 clock
  - RCC_USART2CLKSOURCE_LSE LSE selected as USART2 clock

Return value:

- None

__HAL_RCC_GET_USART2_SOURCE

Description:

- Macro to get the USART2 clock source.

Return value:

- The: clock source can be one of the following values:
  - RCC_USART2CLKSOURCE_PCLK1 PCLK selected as USART2 clock
  - RCC_USART2CLKSOURCE_HSI HSI selected as USART2 clock
  - RCC_USART2CLKSOURCE_SYSCLK System Clock selected as USART2 clock
  - RCC_USART2CLKSOURCE_LSE LSE selected as USART2 clock

__HAL_RCC_LPUART1_CONFIG

Description:

- Macro to configure the LPUART1 clock (LPUART1CLK).

Parameters:

- __LPUART1_CLKSOURCE__: specifies the LPUART1 clock source. This parameter can be one of the following values:
  - RCC_LPUART1CLKSOURCE_PCLK1 PCLK selected as LPUART1 clock
  - RCC_LPUART1CLKSOURCE_HSI HSI selected as LPUART1 clock
  - RCC_LPUART1CLKSOURCE_SYSCLK System Clock selected as LPUART1 clock
  - RCC_LPUART1CLKSOURCE_LSE LSE selected as LPUART1 clock

Return value:

- None

__HAL_RCC_GET_LPUART1_SOURCE

Description:

- Macro to get the LPUART1 clock source.

Return value:

- The: clock source can be one of the following values:
  - RCC_LPUART1CLKSOURCE_PCLK1 PCLK selected as LPUART1 clock
  - RCC_LPUART1CLKSOURCE_HSI HSI selected as LPUART1 clock
  - RCC_LPUART1CLKSOURCE_SYSCLK System Clock selected as LPUART1 clock
  - RCC_LPUART1CLKSOURCE_LSE LSE selected as LPUART1 clock

__HAL_RCC_LPUART2_CONFIG

Description:

- Macro to configure the LPUART2 clock (LPUART2CLK).

Parameters:

- __LPUART2_CLKSOURCE__: specifies the LPUART2 clock source. This parameter can be one of the following values:
  - RCC_LPUART2CLKSOURCE_PCLK1 PCLK selected as LPUART2 clock
  - RCC_LPUART2CLKSOURCE_HSI HSI selected as LPUART2 clock
  - RCC_LPUART2CLKSOURCE_SYSCLK System Clock selected as LPUART2 clock
  - RCC_LPUART2CLKSOURCE_LSE LSE selected as LPUART2 clock

Return value:

- None

__HAL_RCC_GET_LPUART2_SOURCE

Description:

- Macro to get the LPUART2 clock source.

Return value:

- The: clock source can be one of the following values:
  - RCC_LPUART2CLKSOURCE_PCLK1 PCLK selected as LPUART2 clock
  - RCC_LPUART2CLKSOURCE_HSI HSI selected as LPUART2 clock
  - RCC_LPUART2CLKSOURCE_SYSCLK System Clock selected as LPUART2 clock
  - RCC_LPUART2CLKSOURCE_LSE LSE selected as LPUART2 clock

__HAL_RCC_LPUART3_CONFIG

Description:

- Macro to configure the LPUART3 clock (LPUART3CLK).

Parameters:

- __LPUART3_CLKSOURCE__: specifies the LPUART3 clock source. This parameter can be one of the following values:
  - RCC_LPUART3CLKSOURCE_PCLK1 PCLK selected as LPUART3 clock
  - RCC_LPUART3CLKSOURCE_HSI HSI selected as LPUART3 clock
  - RCC_LPUART3CLKSOURCE_SYSCLK System Clock selected as LPUART3 clock
  - RCC_LPUART3CLKSOURCE_LSE LSE selected as LPUART3 clock

Return value:

- None

__HAL_RCC_GET_LPUART3_SOURCE

Description:

- Macro to get the LPUART3 clock source.

Return value:

- The: clock source can be one of the following values:
  - RCC_LPUART3CLKSOURCE_PCLK1 PCLK selected as LPUART3 clock
  - RCC_LPUART3CLKSOURCE_HSI HSI selected as LPUART3 clock
  - RCC_LPUART3CLKSOURCE_SYSCLK System Clock selected as LPUART3 clock
  - RCC_LPUART3CLKSOURCE_LSE LSE selected as LPUART3 clock

__HAL_RCC_I2C1_CONFIG

Description:

- Macro to configure the I2C1 clock (I2C1CLK).

Parameters:

- __I2C1_CLKSOURCE__: specifies the I2C1 clock source. This parameter can be one of the following values:
  - RCC_I2C1CLKSOURCE_PCLK1 PCLK selected as I2C1 clock
  - RCC_I2C1CLKSOURCE_HSI HSI selected as I2C1 clock
  - RCC_I2C1CLKSOURCE_SYSCLK System Clock selected as I2C1 clock

Return value:

- None

__HAL_RCC_GET_I2C1_SOURCE

Description:

- Macro to get the I2C1 clock source.

Return value:

- The: clock source can be one of the following values:
  - RCC_I2C1CLKSOURCE_PCLK1 PCLK selected as I2C1 clock
  - RCC_I2C1CLKSOURCE_HSI HSI selected as I2C1 clock
  - RCC_I2C1CLKSOURCE_SYSCLK System Clock selected as I2C1 clock

__HAL_RCC_I2C3_CONFIG

Description:

- Macro to configure the I2C3 clock (I2C3CLK).

Parameters:

- __I2C3_CLKSOURCE__: specifies the I2C3 clock source. This parameter can be one of the following values:
  - RCC_I2C3CLKSOURCE_PCLK1 PCLK selected as I2C3 clock
  - RCC_I2C3CLKSOURCE_HSI HSI selected as I2C3 clock
  - RCC_I2C3CLKSOURCE_SYSCLK System Clock selected as I2C3 clock

Return value:

- None

__HAL_RCC_GET_I2C3_SOURCE

Description:

- Macro to get the I2C3 clock source.

Return value:

- The: clock source can be one of the following values:
  - RCC_I2C3CLKSOURCE_PCLK1 PCLK selected as I2C3 clock
  - RCC_I2C3CLKSOURCE_HSI HSI selected as I2C3 clock
  - RCC_I2C3CLKSOURCE_SYSCLK System Clock selected as I2C3 clock

__HAL_RCC_LPTIM1_CONFIG

Description:

- Macro to configure the LPTIM1 clock (LPTIM1CLK).

Parameters:

- __LPTIM1_CLKSOURCE__: specifies the LPTIM1 clock source. This parameter can be one of the following values:
  - RCC_LPTIM1CLKSOURCE_PCLK1 PCLK selected as LPTIM1 clock
  - RCC_LPTIM1CLKSOURCE_LSI LSI selected as LPTIM1 clock
  - RCC_LPTIM1CLKSOURCE_HSI HSI selected as LPTIM1 clock
  - RCC_LPTIM1CLKSOURCE_LSE LSE selected as LPTIM1 clock

Return value:

- None

__HAL_RCC_GET_LPTIM1_SOURCE

Description:

- Macro to get the LPTIM1 clock source.

Return value:

- The: clock source can be one of the following values:
  - RCC_LPTIM1CLKSOURCE_LSI LSI selected as LPTIM1 clock
  - RCC_LPTIM1CLKSOURCE_HSI HSI selected as LPTIM1 clock
  - RCC_LPTIM1CLKSOURCE_LSE LSE selected as LPTIM1 clock

__HAL_RCC_LPTIM2_CONFIG

Description:

- Macro to configure the LPTIM2 clock (LPTIM2CLK).

Parameters:

- __LPTIM2_CLKSOURCE__: specifies the LPTIM2 clock source. This parameter can be one of the following values:
  - RCC_LPTIM2CLKSOURCE_PCLK1 PCLK selected as LPTIM2 clock
  - RCC_LPTIM2CLKSOURCE_LSI LSI selected as LPTIM2 clock
  - RCC_LPTIM2CLKSOURCE_HSI HSI selected as LPTIM2 clock
  - RCC_LPTIM2CLKSOURCE_LSE LSE selected as LPTIM2 clock

Return value:

- None

__HAL_RCC_GET_LPTIM2_SOURCE

Description:

- Macro to get the LPTIM2 clock source.

Return value:

- The: clock source can be one of the following values:
  - RCC_LPTIM2CLKSOURCE_PCLK1 PCLK selected as LPTIM2 clock
  - RCC_LPTIM2CLKSOURCE_LSI HSI selected as LPTIM2 clock
  - RCC_LPTIM2CLKSOURCE_HSI HSI selected as LPTIM2 clock
  - RCC_LPTIM2CLKSOURCE_LSE LSE selected as LPTIM2 clock

__HAL_RCC_LPTIM3_CONFIG

Description:

- Macro to configure the LPTIM3 clock (LPTIM3CLK).

Parameters:

- __LPTIM3_CLKSOURCE__: specifies the LPTIM3 clock source. This parameter can be one of the following values:
  - RCC_LPTIM3CLKSOURCE_PCLK1 PCLK selected as LPTIM3 clock
  - RCC_LPTIM3CLKSOURCE_LSI LSI selected as LPTIM3 clock
  - RCC_LPTIM3CLKSOURCE_HSI HSI selected as LPTIM3 clock
  - RCC_LPTIM3CLKSOURCE_LSE LSE selected as LPTIM3 clock

Return value:

- None

__HAL_RCC_GET_LPTIM3_SOURCE

Description:

- Macro to get the LPTIM3 clock source.

Return value:

- The: clock source can be one of the following values:
  - RCC_LPTIM3CLKSOURCE_PCLK1 PCLK selected as LPTIM3 clock
  - RCC_LPTIM3CLKSOURCE_LSI LSI selected as LPTIM3 clock
  - RCC_LPTIM3CLKSOURCE_HSI HSI selected as LPTIM3 clock
  - RCC_LPTIM3CLKSOURCE_LSE LSE selected as LPTIM3 clock

__HAL_RCC_USB_CONFIG

Description:

- Macro to configure the CLK48 source (CLK48CLK).

Parameters:

- __USB_SOURCE__: specifies the CLK48 clock source. This parameter can be one of the following values:
  - RCC_USBCLKSOURCE_HSI48: HSI48 selected as USB source
  - RCC_USBCLKSOURCE_PLLQ : PLL selected as USB source
  - RCC_USBCLKSOURCE_MSIS : MSIS selected as USB source

__HAL_RCC_GET_USB_SOURCE

Description:

- macro to get the USB source.

Return value:

- The: clock source can be one of the following values:
  - RCC_USBCLKSOURCE_HSI48: HSI48 used as USB source
  - RCC_USBCLKSOURCE_PLLQ : PLL used as USB source
  - RCC_USBCLKSOURCE_MSIS : MSIS used as USB source

__HAL_RCC_RNG_CONFIG

Description:

- Macro to configure the RNG source (CLK48CLK).

Parameters:

- __RNG_SOURCE__: specifies the CLK48 clock source. This parameter can be one of the following values:
  - RCC_RNGCLKSOURCE_HSI48: HSI48 selected as USB source
  - RCC_RNGCLKSOURCE_PLLQ : PLL selected as USB source
  - RCC_RNGCLKSOURCE_MSIS : MSIS selected as USB source

__HAL_RCC_GET_RNG_SOURCE

Description:

- macro to get the RNG source.

Return value:

- The: clock source can be one of the following values:
  - RCC_RNGCLKSOURCE_HSI48: HSI48 used as USB source
  - RCC_RNGCLKSOURCE_PLLQ : PLL used as USB source
  - RCC_RNGCLKSOURCE_MSIS : MSIS used as USB source

__HAL_RCC_ADC_CONFIG

Description:

- macro to configure the ADC clock source.

Return value:

- The: clock source can be one of the following values:
  - RCC_ADCCLKSOURCE_SYSCLK : SYSCLK Clock selected as ADC1 clock
  - RCC_ADCCLKSOURCE_PLLP : PLLP Clock selected as ADC1 clock
  - RCC_ADCCLKSOURCE_HSI : HSI Clock selected as ADC1 clock

__HAL_RCC_GET_ADC_SOURCE

Description:

- macro to get the ADC clock source.

Return value:

- The: clock source can be one of the following values:
  - RCC_ADCCLKSOURCE_SYSCLK : SYSCLK Clock selected as ADC clock
  - RCC_ADCCLKSOURCE_PLLP : PLLP Clock selected as ADC clock
  - RCC_ADCCLKSOURCE_HSI : HSI Clock selected as ADC clock

__HAL_RCC_TIM1_CONFIG

Description:

- macro to configure the TIM1 clock source.

Return value:

- The: clock source can be one of the following values:
  - RCC_TIM1CLKSOURCE_PCLK : PCLK Clock used as TIM1 clock
  - RCC_TIM1CLKSOURCE_PLLQ : PLLQ clock used as TIM1 clock

__HAL_RCC_GET_TIM1_SOURCE

Description:

- macro to get the TIM1 clock source.

Return value:

- The: clock source can be one of the following values:
  - RCC_TIM1CLKSOURCE_PCLK1 : PCLK Clock used as TIM1 clock
  - RCC_TIM1CLKSOURCE_PLLQ : PLLQ clock used as TIM1 clock

__HAL_RCC_TIM15_CONFIG

Description:

- macro to configure the TIM15 clock source.

Return value:

- The: clock source can be one of the following values:
  - RCC_TIM15CLKSOURCE_PCLK1 : PCLK Clock used as TIM15 clock
  - RCC_TIM15CLKSOURCE_PLLQ : PLLQ clock used as TIM15 clock

__HAL_RCC_GET_TIM15_SOURCE

Description:

- macro to get the TIM15 clock source.

Return value:

- The: clock source can be one of the following values:
  - RCC_TIM15CLKSOURCE_PCLK1 : PCLK Clock used as TIM15 clock
  - RCC_TIM15CLKSOURCE_PLLQ : PLLQ clock used as TIM15 clock

RCC LSE CSS external interrupt line

RCC_EXTI_LINE_LSECSS

External interrupt line 27 connected to the LSE CSS EXTI Line

Flags Interrupts Management

__HAL_RCC_LSECSS_EXTI_ENABLE_IT

Description:

- Enable the RCC LSE CSS Extended Interrupt Line.

Return value:

- None

__HAL_RCC_LSECSS_EXTI_DISABLE_IT

Description:

- Disable the RCC LSE CSS Extended Interrupt Line.

Return value:

- None

__HAL_RCC_LSECSS_EXTI_ENABLE_EVENT

Description:

- Enable the RCC LSE CSS Event Line.

Return value:

- None.

__HAL_RCC_LSECSS_EXTI_DISABLE_EVENT

Description:

- Disable the RCC LSE CSS Event Line.

Return value:

- None.

__HAL_RCC_LSECSS_EXTI_ENABLE_FALLING_EDGE

Description:

- Enable the RCC LSE CSS Extended Interrupt Falling Trigger.

Return value:

- None.

__HAL_RCC_LSECSS_EXTI_DISABLE_FALLING_EDGE

Description:

- Disable the RCC LSE CSS Extended Interrupt Falling Trigger.

Return value:

- None.

__HAL_RCC_LSECSS_EXTI_ENABLE_RISING_EDGE

Description:

- Enable the RCC LSE CSS Extended Interrupt Rising Trigger.

Return value:

- None.

__HAL_RCC_LSECSS_EXTI_DISABLE_RISING_EDGE

Description:

- Disable the RCC LSE CSS Extended Interrupt Rising Trigger.

Return value:

- None.

__HAL_RCC_LSECSS_EXTI_ENABLE_RISING_FALLING_EDGE

Description:

- Enable the RCC LSE CSS Extended Interrupt Rising & Falling Trigger.

Return value:

- None.

__HAL_RCC_LSECSS_EXTI_DISABLE_RISING_FALLING_EDGE

Description:

- Disable the RCC LSE CSS Extended Interrupt Rising & Falling Trigger.

Return value:

- None.

__HAL_RCC_LSECSS_EXTI_GET_FLAG

Description:

- Check whether the specified RCC LSE CSS EXTI interrupt flag is set or not.

Return value:

- EXTI: RCC LSE CSS Line Status.

__HAL_RCC_LSECSS_EXTI_CLEAR_FLAG

Description:

- Clear the RCC LSE CSS EXTI flag.

Return value:

- None.

__HAL_RCC_LSECSS_EXTI_GENERATE_SWIT

Description:

- Generate a Software interrupt on the RCC LSE CSS EXTI line.

Return value:

- None.

__HAL_RCC_CRS_ENABLE_IT

Description:

- Enable the specified CRS interrupts.

Parameters:

- __INTERRUPT__: specifies the CRS interrupt sources to be enabled. This parameter can be any combination of the following values:
  - RCC_CRS_IT_SYNCOK SYNC event OK interrupt
  - RCC_CRS_IT_SYNCWARN SYNC warning interrupt
  - RCC_CRS_IT_ERR Synchronization or trimming error interrupt
  - RCC_CRS_IT_ESYNC Expected SYNC interrupt

Return value:

- None

__HAL_RCC_CRS_DISABLE_IT

Description:

- Disable the specified CRS interrupts.

Parameters:

- __INTERRUPT__: specifies the CRS interrupt sources to be disabled. This parameter can be any combination of the following values:
  - RCC_CRS_IT_SYNCOK SYNC event OK interrupt
  - RCC_CRS_IT_SYNCWARN SYNC warning interrupt
  - RCC_CRS_IT_ERR Synchronization or trimming error interrupt
  - RCC_CRS_IT_ESYNC Expected SYNC interrupt

Return value:

- None

__HAL_RCC_CRS_GET_IT_SOURCE

Description:

- Check whether the CRS interrupt has occurred or not.

Parameters:

- __INTERRUPT__: specifies the CRS interrupt source to check. This parameter can be one of the following values:
  - RCC_CRS_IT_SYNCOK SYNC event OK interrupt
  - RCC_CRS_IT_SYNCWARN SYNC warning interrupt
  - RCC_CRS_IT_ERR Synchronization or trimming error interrupt
  - RCC_CRS_IT_ESYNC Expected SYNC interrupt

Return value:

- The: new state of __INTERRUPT__ (SET or RESET).

RCC_CRS_IT_ERROR_MASK

Description:

- Clear the CRS interrupt pending bits.

Parameters:

- __INTERRUPT__: specifies the interrupt pending bit to clear. This parameter can be any combination of the following values:
  - RCC_CRS_IT_SYNCOK SYNC event OK interrupt
  - RCC_CRS_IT_SYNCWARN SYNC warning interrupt
  - RCC_CRS_IT_ERR Synchronization or trimming error interrupt
  - RCC_CRS_IT_ESYNC Expected SYNC interrupt
  - RCC_CRS_IT_TRIMOVF Trimming overflow or underflow interrupt
  - RCC_CRS_IT_SYNCERR SYNC error interrupt
  - RCC_CRS_IT_SYNCMISS SYNC missed interrupt

__HAL_RCC_CRS_CLEAR_IT

__HAL_RCC_CRS_GET_FLAG

Description:

- Check whether the specified CRS flag is set or not.

Parameters:

- __FLAG__: specifies the flag to check. This parameter can be one of the following values:
  - RCC_CRS_FLAG_SYNCOK SYNC event OK
  - RCC_CRS_FLAG_SYNCWARN SYNC warning
  - RCC_CRS_FLAG_ERR Error
  - RCC_CRS_FLAG_ESYNC Expected SYNC
  - RCC_CRS_FLAG_TRIMOVF Trimming overflow or underflow
  - RCC_CRS_FLAG_SYNCERR SYNC error
  - RCC_CRS_FLAG_SYNCMISS SYNC missed

Return value:

- The: new state of _FLAG_ (TRUE or FALSE).

RCC_CRS_FLAG_ERROR_MASK

Description:

- Clear the CRS specified FLAG.

Parameters:

- __FLAG__: specifies the flag to clear. This parameter can be one of the following values:
  - RCC_CRS_FLAG_SYNCOK SYNC event OK
  - RCC_CRS_FLAG_SYNCWARN SYNC warning
  - RCC_CRS_FLAG_ERR Error
  - RCC_CRS_FLAG_ESYNC Expected SYNC
  - RCC_CRS_FLAG_TRIMOVF Trimming overflow or underflow
  - RCC_CRS_FLAG_SYNCERR SYNC error
  - RCC_CRS_FLAG_SYNCMISS SYNC missed

Return value:

- None

Notes:

- RCC_CRS_FLAG_ERR clears RCC_CRS_FLAG_TRIMOVF, RCC_CRS_FLAG_SYNCERR, RCC_CRS_FLAG_SYNCMISS and consequently RCC_CRS_FLAG_ERR

__HAL_RCC_CRS_CLEAR_FLAG

I2C1 Clock Source

RCC_I2C1CLKSOURCE_PCLK1

RCC_I2C1CLKSOURCE_SYSCLK

RCC_I2C1CLKSOURCE_HSI

I2C3 Clock Source

RCC_I2C3CLKSOURCE_PCLK1

RCC_I2C3CLKSOURCE_SYSCLK

RCC_I2C3CLKSOURCE_HSI

LPTIM1 Clock Source

RCC_LPTIM1CLKSOURCE_PCLK1

RCC_LPTIM1CLKSOURCE_LSI

RCC_LPTIM1CLKSOURCE_HSI

RCC_LPTIM1CLKSOURCE_LSE

LPTIM2 Clock Source

RCC_LPTIM2CLKSOURCE_PCLK1

RCC_LPTIM2CLKSOURCE_LSI

RCC_LPTIM2CLKSOURCE_HSI

RCC_LPTIM2CLKSOURCE_LSE

LPTIM3 Clock Source

RCC_LPTIM3CLKSOURCE_PCLK1

RCC_LPTIM3CLKSOURCE_LSI

RCC_LPTIM3CLKSOURCE_HSI

RCC_LPTIM3CLKSOURCE_LSE

LPUART1 Clock Source

RCC_LPUART1CLKSOURCE_PCLK1

RCC_LPUART1CLKSOURCE_SYSCLK

RCC_LPUART1CLKSOURCE_HSI

RCC_LPUART1CLKSOURCE_LSE

LPUART2 Clock Source

RCC_LPUART2CLKSOURCE_PCLK1

RCC_LPUART2CLKSOURCE_SYSCLK

RCC_LPUART2CLKSOURCE_HSI

RCC_LPUART2CLKSOURCE_LSE

LPUART3 Clock Source

RCC_LPUART3CLKSOURCE_PCLK1

RCC_LPUART3CLKSOURCE_SYSCLK

RCC_LPUART3CLKSOURCE_HSI

RCC_LPUART3CLKSOURCE_LSE

Low Speed Clock Source

RCC_LSCOSOURCE_LSI

LSI selection for low speed clock output

RCC_LSCOSOURCE_LSE

LSE selection for low speed clock output

Periph Clock Selection

RCC_PERIPHCLK_USART1

RCC_PERIPHCLK_USART2

RCC_PERIPHCLK_LPUART3

RCC_PERIPHCLK_LPUART2

RCC_PERIPHCLK_LPUART1

RCC_PERIPHCLK_I2C1

RCC_PERIPHCLK_I2C3

RCC_PERIPHCLK_LPTIM1

RCC_PERIPHCLK_LPTIM2

RCC_PERIPHCLK_LPTIM3

RCC_PERIPHCLK_TIM1

RCC_PERIPHCLK_TIM15

RCC_PERIPHCLK_USB

RCC_PERIPHCLK_RNG

RCC_PERIPHCLK_ADC

RCC_PERIPHCLK_RTC

RCC_PERIPHCLK_USART3

RCC_PERIPHCLK_USART4

RNG Clock Source

RCC_RNGCLKSOURCE_NONE

RCC_RNGCLKSOURCE_MSI

RCC_RNGCLKSOURCE_PLLQ

RCC_RNGCLKSOURCE_HSI48

TIM15 Clock Source

RCC_TIM15CLKSOURCE_PCLK1

RCC_TIM15CLKSOURCE_PLLQ

TIM1 Clock Source

RCC_TIM1CLKSOURCE_PCLK1

RCC_TIM1CLKSOURCE_PLLQ

USART1 Clock Source

RCC_USART1CLKSOURCE_PCLK1

RCC_USART1CLKSOURCE_SYSCLK

RCC_USART1CLKSOURCE_HSI

RCC_USART1CLKSOURCE_LSE

USART2 Clock Source

RCC_USART2CLKSOURCE_PCLK1

RCC_USART2CLKSOURCE_SYSCLK

RCC_USART2CLKSOURCE_HSI

RCC_USART2CLKSOURCE_LSE

USB Clock Source

RCC_USBCLKSOURCE_NONE

RCC_USBCLKSOURCE_MSI

RCC_USBCLKSOURCE_PLLQ

RCC_USBCLKSOURCE_HSI48

39 HAL RNG Generic Driver

39.1 RNG Firmware driver registers structures

39.1.1 RNG_InitTypeDef

RNG_InitTypeDef is defined in the stm32u0xx_hal_rng.h

Data Fields

- ***uint32_t ClockErrorDetection***

Field Documentation

- ***uint32_t RNG_InitTypeDef::ClockErrorDetection***
  CED Clock error detection

39.1.2 __RNG_HandleTypeDef

__RNG_HandleTypeDef is defined in the stm32u0xx_hal_rng.h

Data Fields

- ***RNG_TypeDef * Instance***
- ***RNG_InitTypeDef Init***
- ***HAL_LockTypeDef Lock***
- ***__IO HAL_RNG_StateTypeDef State***
- ***__IO uint32_t ErrorCode***
- ***uint32_t RandomNumber***
- ***void(* ReadyDataCallback***
- ***void(* ErrorCallback***
- ***void(* MspInitCallback***
- ***void(* MspDeInitCallback***

Field Documentation

- ***RNG_TypeDef* __RNG_HandleTypeDef::Instance***
  Register base address
- ***RNG_InitTypeDef __RNG_HandleTypeDef::Init***
  RNG configuration parameters
- ***HAL_LockTypeDef __RNG_HandleTypeDef::Lock***
  RNG locking object
- ***__IO HAL_RNG_StateTypeDef __RNG_HandleTypeDef::State***
  RNG communication state
- ***__IO uint32_t __RNG_HandleTypeDef::ErrorCode***
  RNG Error code
- ***uint32_t __RNG_HandleTypeDef::RandomNumber***
  Last Generated RNG Data
- ***void(* __RNG_HandleTypeDef::ReadyDataCallback)(struct __RNG_HandleTypeDef *hrng, uint32_t random32bit)***
  RNG Data Ready Callback
- ***void(* __RNG_HandleTypeDef::ErrorCallback)(struct __RNG_HandleTypeDef *hrng)***
  RNG Error Callback
- ***void(* __RNG_HandleTypeDef::MspInitCallback)(struct __RNG_HandleTypeDef *hrng)***
  RNG Msp Init callback
- ***void(* __RNG_HandleTypeDef::MspDeInitCallback)(struct __RNG_HandleTypeDef *hrng)***
  RNG Msp DeInit callback

39.2 RNG Firmware driver API description

The following section lists the various functions of the RNG library.

39.2.1 How to use this driver

The RNG HAL driver can be used as follows:

1. Enable the RNG controller clock using __HAL_RCC_RNG_CLK_ENABLE() macro in HAL_RNG_MspInit().
2. Activate the RNG peripheral using HAL_RNG_Init() function.
3. Wait until the 32 bit Random Number Generator contains a valid random data using (polling/interrupt) mode.
4. Get the 32 bit random number using HAL_RNG_GenerateRandomNumber() function.

39.2.2 Callback registration

The compilation define USE_HAL_RNG_REGISTER_CALLBACKS when set to 1 allows the user to configure dynamically the driver callbacks.

Use Function HAL_RNG_RegisterCallback() to register a user callback. Function HAL_RNG_RegisterCallback() allows to register following callbacks:

- ErrorCallback : RNG Error Callback.
- MspInitCallback : RNG MspInit.
- MspDeInitCallback : RNG MspDeInit. This function takes as parameters the HAL peripheral handle, the Callback ID and a pointer to the user callback function.

Use function HAL_RNG_UnRegisterCallback() to reset a callback to the default weak (overridden) function. HAL_RNG_UnRegisterCallback() takes as parameters the HAL peripheral handle, and the Callback ID. This function allows to reset following callbacks:

- ErrorCallback : RNG Error Callback.
- MspInitCallback : RNG MspInit.
- MspDeInitCallback : RNG MspDeInit.

For specific callback ReadyDataCallback, use dedicated register callbacks: respectively HAL_RNG_RegisterReadyDataCallback() , HAL_RNG_UnRegisterReadyDataCallback().

By default, after the HAL_RNG_Init() and when the state is HAL_RNG_STATE_RESET all callbacks are set to the corresponding weak (overridden) functions: example HAL_RNG_ErrorCallback(). Exception done for MspInit and MspDeInit functions that are respectively reset to the legacy weak (overridden) functions in the HAL_RNG_Init() and HAL_RNG_DeInit() only when these callbacks are null (not registered beforehand). If not, MspInit or MspDeInit are not null, the HAL_RNG_Init() and HAL_RNG_DeInit() keep and use the user MspInit/MspDeInit callbacks (registered beforehand).

Callbacks can be registered/unregistered in HAL_RNG_STATE_READY state only. Exception done MspInit/ MspDeInit that can be registered/unregistered in HAL_RNG_STATE_READY or HAL_RNG_STATE_RESET state, thus registered (user) MspInit/DeInit callbacks can be used during the Init/DeInit. In that case first register the MspInit/MspDeInit user callbacks using HAL_RNG_RegisterCallback() before calling HAL_RNG_DeInit() or HAL_RNG_Init() function.

When The compilation define USE_HAL_RNG_REGISTER_CALLBACKS is set to 0 or not defined, the callback registration feature is not available and weak (overridden) callbacks are used.

39.2.3 Initialization and configuration functions

This section provides functions allowing to:

- Initialize the RNG according to the specified parameters in the RNG_InitTypeDef and create the associated handle
- DeInitialize the RNG peripheral
- Initialize the RNG MSP
- DeInitialize RNG MSP

This section contains the following APIs:

- ***HAL_RNG_Init()***
- ***HAL_RNG_DeInit()***
- ***HAL_RNG_MspInit()***
- ***HAL_RNG_MspDeInit()***
- ***HAL_RNG_RegisterCallback()***
- ***HAL_RNG_UnRegisterCallback()***

- *HAL_RNG_RegisterReadyDataCallback()*
- *HAL_RNG_UnRegisterReadyDataCallback()*

39.2.4 Peripheral Control functions

This section provides functions allowing to:

- Get the 32 bit Random number
- Get the 32 bit Random number with interrupt enabled
- Handle RNG interrupt request

This section contains the following APIs:

- *HAL_RNG_GenerateRandomNumber()*
- *HAL_RNG_GenerateRandomNumber_IT()*
- *HAL_RNG_IRQHandler()*
- *HAL_RNG_ReadLastRandomNumber()*
- *HAL_RNG_ReadyDataCallback()*
- *HAL_RNG_ErrorCallback()*

39.2.5 Peripheral State functions

This subsection permits to get in run-time the status of the peripheral and the data flow.

This section contains the following APIs:

- *HAL_RNG_GetState()*
- *HAL_RNG_GetError()*

39.2.6 Detailed description of functions

HAL_RNG_Init

Function name

HAL_StatusTypeDef HAL_RNG_Init (RNG_HandleTypeDef * hrng)

Function description

Initializes the RNG peripheral and creates the associated handle.

Parameters

- **hrng:** pointer to a RNG_HandleTypeDef structure that contains the configuration information for RNG.

Return values

- **HAL:** status

HAL_RNG_DeInit

Function name

HAL_StatusTypeDef HAL_RNG_DeInit (RNG_HandleTypeDef * hrng)

Function description

DeInitializes the RNG peripheral.

Parameters

- **hrng:** pointer to a RNG_HandleTypeDef structure that contains the configuration information for RNG.

Return values

- **HAL:** status

HAL_RNG_MspInit

Function name

void HAL_RNG_MspInit (RNG_HandleTypeDef * hrng)

Function description

Initializes the RNG MSP.

Parameters

- **hrng:** pointer to a RNG_HandleTypeDef structure that contains the configuration information for RNG.

Return values

- **None:**

HAL_RNG_MspDeInit

Function name

void HAL_RNG_MspDeInit (RNG_HandleTypeDef * hrng)

Function description

DeInitializes the RNG MSP.

Parameters

- **hrng:** pointer to a RNG_HandleTypeDef structure that contains the configuration information for RNG.

Return values

- **None:**

HAL_RNG_RegisterCallback

Function name

HAL_StatusTypeDef HAL_RNG_RegisterCallback (RNG_HandleTypeDef * hrng, HAL_RNG_CallbackIDTypeDef CallbackID, pRNG_CallbackTypeDef pCallback)

Function description

Register a User RNG Callback To be used instead of the weak predefined callback.

Parameters

- **hrng:** RNG handle
- **CallbackID:** ID of the callback to be registered This parameter can be one of the following values:
  - HAL_RNG_ERROR_CB_ID Error callback ID
  - HAL_RNG_MSPINIT_CB_ID MspInit callback ID
  - HAL_RNG_MSPDEINIT_CB_ID MspDeInit callback ID
- **pCallback:** pointer to the Callback function

Return values

- **HAL:** status

HAL_RNG_UnRegisterCallback

Function name

HAL_StatusTypeDef HAL_RNG_UnRegisterCallback (RNG_HandleTypeDef * hrng, HAL_RNG_CallbackIDTypeDef CallbackID)

Function description

Unregister an RNG Callback RNG callback is redirected to the weak predefined callback.

Parameters

- **hrng:** RNG handle
- **CallbackID:** ID of the callback to be unregistered This parameter can be one of the following values:
  - HAL_RNG_ERROR_CB_ID Error callback ID
  - HAL_RNG_MSPINIT_CB_ID MspInit callback ID
  - HAL_RNG_MSPDEINIT_CB_ID MspDeInit callback ID

Return values

- **HAL:** status

HAL_RNG_RegisterReadyDataCallback

Function name

HAL_StatusTypeDef HAL_RNG_RegisterReadyDataCallback (RNG_HandleTypeDef * hrng, pRNG_ReadyDataCallbackTypeDef pCallback)

Function description

Register Data Ready RNG Callback To be used instead of the weak HAL_RNG_ReadyDataCallback() predefined callback.

Parameters

- **hrng:** RNG handle
- **pCallback:** pointer to the Data Ready Callback function

Return values

- **HAL:** status

HAL_RNG_UnRegisterReadyDataCallback

Function name

HAL_StatusTypeDef HAL_RNG_UnRegisterReadyDataCallback (RNG_HandleTypeDef * hrng)

Function description

UnRegister the Data Ready RNG Callback Data Ready RNG Callback is redirected to the weak HAL_RNG_ReadyDataCallback() predefined callback.

Parameters

- **hrng:** RNG handle

Return values

- **HAL:** status

HAL_RNG_GenerateRandomNumber

Function name

HAL_StatusTypeDef HAL_RNG_GenerateRandomNumber (RNG_HandleTypeDef * hrng, uint32_t * random32bit)

Function description

Generates a 32-bit random number.

Parameters

- **hrng:** pointer to a RNG_HandleTypeDef structure that contains the configuration information for RNG.
- **random32bit:** pointer to generated random number variable if successful.

Return values

- **HAL:** status

Notes

- This function checks value of RNG_FLAG_DRDY flag to know if valid random number is available in the DR register (RNG_FLAG_DRDY flag set whenever a random number is available through the RNG_DR register). After transitioning from 0 to 1 (random number available), RNG_FLAG_DRDY flag remains high until output buffer becomes empty after reading four words from the RNG_DR register, i.e. further function calls will immediately return a new u32 random number (additional words are available and can be read by the application, till RNG_FLAG_DRDY flag remains high).
- When no more random number data is available in DR register, RNG_FLAG_DRDY flag is automatically cleared.

HAL_RNG_GenerateRandomNumber_IT

Function name

HAL_StatusTypeDef HAL_RNG_GenerateRandomNumber_IT (RNG_HandleTypeDef * hrng)

Function description

Generates a 32-bit random number in interrupt mode.

Parameters

- **hrng:** pointer to a RNG_HandleTypeDef structure that contains the configuration information for RNG.

Return values

- **HAL:** status

HAL_RNG_ReadLastRandomNumber

Function name

uint32_t HAL_RNG_ReadLastRandomNumber (const RNG_HandleTypeDef * hrng)

Function description

Read latest generated random number.

Parameters

- **hrng:** pointer to a RNG_HandleTypeDef structure that contains the configuration information for RNG.

Return values

- **random:** value

HAL_RNG_IRQHandler

Function name

void HAL_RNG_IRQHandler (RNG_HandleTypeDef * hrng)

Function description

Handles RNG interrupt request.

Parameters

- **hrng:** pointer to a RNG_HandleTypeDef structure that contains the configuration information for RNG.

Return values

- **None:**

Notes

- In the case of a clock error, the RNG is no more able to generate random numbers because the PLL48CLK clock is not correct. User has to check that the clock controller is correctly configured to provide the RNG clock and clear the CEIS bit using __HAL_RNG_CLEAR_IT(). The clock error has no impact on the previously generated random numbers, and the RNG_DR register contents can be used.
- In the case of a seed error, the generation of random numbers is interrupted as long as the SECS bit is '1'. If a number is available in the RNG_DR register, it must not be used because it may not have enough entropy. In this case, it is recommended to clear the SEIS bit using __HAL_RNG_CLEAR_IT(), then disable and enable the RNG peripheral to reinitialize and restart the RNG.
- User-written HAL_RNG_ErrorCallback() API is called once whether SEIS or CEIS are set.

HAL_RNG_ErrorCallback

Function name

void HAL_RNG_ErrorCallback (RNG_HandleTypeDef * hrng)

Function description

RNG error callbacks.

Parameters

- **hrng:** pointer to a RNG_HandleTypeDef structure that contains the configuration information for RNG.

Return values

- **None:**

HAL_RNG_ReadyDataCallback

Function name

void HAL_RNG_ReadyDataCallback (RNG_HandleTypeDef * hrng, uint32_t random32bit)

Function description

Data Ready callback in non-blocking mode.

Parameters

- **hrng:** pointer to a RNG_HandleTypeDef structure that contains the configuration information for RNG.
- **random32bit:** generated random number.

Return values

- **None:**

Notes

- When RNG_FLAG_DRDY flag value is set, first random number has been read from DR register in IRQ Handler and is provided as callback parameter. Depending on valid data available in the conditioning output buffer, additional words can be read by the application from DR register till DRDY bit remains high.

HAL_RNG_GetState

Function name

HAL_RNG_StateTypeDef HAL_RNG_GetState (const RNG_HandleTypeDef * hrng)

Function description

Returns the RNG state.

Parameters

- **hrng:** pointer to a RNG_HandleTypeDef structure that contains the configuration information for RNG.

Return values

- **HAL:** state

HAL_RNG_GetError

Function name

uint32_t HAL_RNG_GetError (const RNG_HandleTypeDef * hrng)

Function description

Return the RNG handle error code.

Parameters

- **hrng:** pointer to a RNG_HandleTypeDef structure.

Return values

- **RNG:** Error Code

RNG_RecoverSeedError

Function name

HAL_StatusTypeDef RNG_RecoverSeedError (RNG_HandleTypeDef * hrng)

Function description

RNG sequence to recover from a seed error.

Parameters

- **hrng:** pointer to a RNG_HandleTypeDef structure.

Return values

- **HAL:** status

39.3 RNG Firmware driver defines

The following section lists the various define and macros of the module.

39.3.1 RNG

RNG

RNG Error Definition

HAL_RNG_ERROR_NONE

No error

HAL_RNG_ERROR_INVALID_CALLBACK

Invalid Callback error

HAL_RNG_ERROR_TIMEOUT

Timeout error

HAL_RNG_ERROR_BUSY

Busy error

HAL_RNG_ERROR_SEED

Seed error

HAL_RNG_ERROR_CLOCK

Clock error

RNG Interrupt definition

RNG_IT_DRDY

Data Ready interrupt

RNG_IT_CEI

Clock error interrupt

RNG_IT_SEI

Seed error interrupt

RNG Flag definition

RNG_FLAG_DRDY

Data ready

RNG_FLAG_CECS

Clock error current status

RNG_FLAG_SECS

Seed error current status

RNG Clock Error Detection

RNG_CED_ENABLE

Clock error detection Enabled

RNG_CED_DISABLE

Clock error detection Disabled

RNG Exported Macros

__HAL_RNG_RESET_HANDLE_STATE

Description:

- Reset RNG handle state.

Parameters:

- __HANDLE__: RNG Handle

Return value:

- None

__HAL_RNG_ENABLE

Description:

- Enables the RNG peripheral.

Parameters:

- __HANDLE__: RNG Handle

Return value:

- None

__HAL_RNG_DISABLE

Description:

- Disables the RNG peripheral.

Parameters:

- __HANDLE__: RNG Handle

Return value:

- None

__HAL_RNG_GET_FLAG

Description:

- Check the selected RNG flag status.

Parameters:

- __HANDLE__: RNG Handle
- __FLAG__: RNG flag This parameter can be one of the following values:
  - RNG_FLAG_DRDY: Data ready
  - RNG_FLAG_CECS: Clock error current status
  - RNG_FLAG_SECS: Seed error current status

Return value:

- The: new state of __FLAG__ (SET or RESET).

__HAL_RNG_CLEAR_FLAG

Description:

- Clears the selected RNG flag status.

Parameters:

- __HANDLE__: RNG handle
- __FLAG__: RNG flag to clear

Return value:

- None

Notes:

- WARNING: This is a dummy macro for HAL code alignment, flags RNG_FLAG_DRDY, RNG_FLAG_CECS and RNG_FLAG_SECS are read-only.

__HAL_RNG_ENABLE_IT

Description:

- Enables the RNG interrupts.

Parameters:

- __HANDLE__: RNG Handle

Return value:

- None

__HAL_RNG_DISABLE_IT

Description:

- Disables the RNG interrupts.

Parameters:

- __HANDLE__: RNG Handle

Return value:

- None

__HAL_RNG_GET_IT

Description:

- Checks whether the specified RNG interrupt has occurred or not.

Parameters:

- __HANDLE__: RNG Handle
- __INTERRUPT__: specifies the RNG interrupt status flag to check. This parameter can be one of the following values:
  - RNG_IT_DRDY: Data ready interrupt
  - RNG_IT_CEI: Clock error interrupt
  - RNG_IT_SEI: Seed error interrupt

Return value:

- The: new state of __INTERRUPT__ (SET or RESET).

__HAL_RNG_CLEAR_IT

Description:

- Clear the RNG interrupt status flags.

Parameters:

- __HANDLE__: RNG Handle
- __INTERRUPT__: specifies the RNG interrupt status flag to clear. This parameter can be one of the following values:
  - RNG_IT_CEI: Clock error interrupt
  - RNG_IT_SEI: Seed error interrupt

Return value:

- None

Notes:

- RNG_IT_DRDY flag is read-only, reading RNG_DR register automatically clears RNG_IT_DRDY.

41 HAL RTC Generic Driver

41.1 RTC Firmware driver registers structures

41.1.1 RTC_InitTypeDef

RTC_InitTypeDef is defined in the stm32u0xx_hal_rtc.h

Data Fields

- ***uint32_t HourFormat***
- ***uint32_t AsynchPrediv***
- ***uint32_t SynchPrediv***
- ***uint32_t OutPut***
- ***uint32_t OutPutRemap***
- ***uint32_t OutPutPolarity***
- ***uint32_t OutPutType***
- ***uint32_t OutPutPullUp***
- ***uint32_t BinMode***
- ***uint32_t BinMixBcdU***

Field Documentation

- ***uint32_t RTC_InitTypeDef::HourFormat***
  Specifies the RTC Hour Format. This parameter can be a value of ***RTC_Hour_Formats***
- ***uint32_t RTC_InitTypeDef::AsynchPrediv***
  Specifies the RTC Asynchronous Predivider value. This parameter must be a number between Min_Data = 0x00 and Max_Data = 0x7F
- ***uint32_t RTC_InitTypeDef::SynchPrediv***
  Specifies the RTC Synchronous Predivider value. This parameter must be a number between Min_Data = 0x00 and Max_Data = 0x7FFF
- ***uint32_t RTC_InitTypeDef::OutPut***
  Specifies which signal will be routed to the RTC output. This parameter can be a value of ***RTCEx_Output_selection_Definitions***
- ***uint32_t RTC_InitTypeDef::OutPutRemap***
  Specifies the remap for RTC output. This parameter can be a value of ***RTC_Output_ALARM_OUT_Remap***
- ***uint32_t RTC_InitTypeDef::OutPutPolarity***
  Specifies the polarity of the output signal. This parameter can be a value of ***RTC_Output_Polarity_Definitions***
- ***uint32_t RTC_InitTypeDef::OutPutType***
  Specifies the RTC Output Pin mode. This parameter can be a value of ***RTC_Output_Type_ALARM_OUT***
- ***uint32_t RTC_InitTypeDef::OutPutPullUp***
  Specifies the RTC Output Pull-Up mode. This parameter can be a value of ***RTC_Output_PullUp_ALARM_OUT***
- ***uint32_t RTC_InitTypeDef::BinMode***
  Specifies the RTC binary mode. This parameter can be a value of ***RTCEx_Binary_Mode***
- ***uint32_t RTC_InitTypeDef::BinMixBcdU***
  Specifies the BCD calendar update if and only if BinMode = RTC_BINARY_MIX. This parameter can be a value of ***RTCEx_Binary_mix_BCDU***

41.1.2 RTC_TimeTypeDef

RTC_TimeTypeDef is defined in the stm32u0xx_hal_rtc.h

Data Fields

- ***uint8_t Hours***
- ***uint8_t Minutes***
- ***uint8_t Seconds***

- ***uint8_t TimeFormat***
- ***uint32_t SubSeconds***
- ***uint32_t SecondFraction***
- ***uint32_t DayLightSaving***
- ***uint32_t StoreOperation***

Field Documentation

- ***uint8_t RTC_TimeTypeDef::Hours***
  Specifies the RTC Time Hour. This parameter must be a number between Min_Data = 0 and Max_Data = 12 if the RTC_HourFormat_12 is selected. This parameter must be a number between Min_Data = 0 and Max_Data = 23 if the RTC_HourFormat_24 is selected
- ***uint8_t RTC_TimeTypeDef::Minutes***
  Specifies the RTC Time Minutes. This parameter must be a number between Min_Data = 0 and Max_Data = 59
- ***uint8_t RTC_TimeTypeDef::Seconds***
  Specifies the RTC Time Seconds. This parameter must be a number between Min_Data = 0 and Max_Data = 59
- ***uint8_t RTC_TimeTypeDef::TimeFormat***
  Specifies the RTC AM/PM Time. This parameter can be a value of ***RTC_AM_PM_Definitions***
- ***uint32_t RTC_TimeTypeDef::SubSeconds***
  Specifies the RTC_SSR RTC Sub Second register content. This field is not used by HAL_RTC_SetTime. If the free running 32 bit counter is not activated (mode binary none)
  - This parameter corresponds to a time unit range between [0-1] Second with [1 Sec / SecondFraction +1] granularity else
  - This parameter corresponds to the free running 32 bit counter.
- ***uint32_t RTC_TimeTypeDef::SecondFraction***
  Specifies the range or granularity of Sub Second register content corresponding to Synchronous pre-scaler factor value (PREDIV_S) This parameter corresponds to a time unit range between [0-1] Second with [1 Sec / SecondFraction +1] granularity. This field will be used only by HAL_RTC_GetTime function
- ***uint32_t RTC_TimeTypeDef::DayLightSaving***
  This interface is deprecated. To manage Daylight Saving Time, please use HAL_RTC_DST_xxx functions
- ***uint32_t RTC_TimeTypeDef::StoreOperation***
  This interface is deprecated. To manage Daylight Saving Time, please use HAL_RTC_DST_xxx functions

41.1.3 RTC_DateTypeDef

RTC_DateTypeDef is defined in the stm32u0xx_hal_rtc.h

Data Fields

- ***uint8_t WeekDay***
- ***uint8_t Month***
- ***uint8_t Date***
- ***uint8_t Year***

Field Documentation

- ***uint8_t RTC_DateTypeDef::WeekDay***
  Specifies the RTC Date WeekDay. This parameter can be a value of ***RTC_WeekDay_Definitions***
- ***uint8_t RTC_DateTypeDef::Month***
  Specifies the RTC Date Month (in BCD format). This parameter can be a value of ***RTC_Month_Date_Definitions***
- ***uint8_t RTC_DateTypeDef::Date***
  Specifies the RTC Date. This parameter must be a number between Min_Data = 1 and Max_Data = 31
- ***uint8_t RTC_DateTypeDef::Year***
  Specifies the RTC Date Year. This parameter must be a number between Min_Data = 0 and Max_Data = 99

41.1.4 RTC_AlarmTypeDef

RTC_AlarmTypeDef is defined in the stm32u0xx_hal_rtc.h

Data Fields

- ***RTC_TimeTypeDef AlarmTime***
- ***uint32_t AlarmMask***
- ***uint32_t AlarmSubSecondMask***
- ***uint32_t BinaryAutoClr***
- ***uint32_t AlarmDateWeekDaySel***
- ***uint8_t AlarmDateWeekDay***
- ***uint32_t FlagAutoClr***
- ***uint32_t Alarm***

Field Documentation

- ***RTC_TimeTypeDef RTC_AlarmTypeDef::AlarmTime***
  Specifies the RTC Alarm Time members
- ***uint32_t RTC_AlarmTypeDef::AlarmMask***
  Specifies the RTC Alarm Masks. This parameter can be a value of ***RTC_AlarmMask_Definitions***
- ***uint32_t RTC_AlarmTypeDef::AlarmSubSecondMask***
  Specifies the RTC Alarm SubSeconds Masks. if Binary mode is RTC_BINARY_ONLY or is RTC_BINARY_MIX This parameter can be a value of ***RTCEx_Alarm_Sub_Seconds_binary_Masks_Definitions*** else if Binary mode is RTC_BINARY_NONE This parameter can be a value of ***RTC_Alarm_Sub_Seconds_Masks_Definitions***
- ***uint32_t RTC_AlarmTypeDef::BinaryAutoClr***
  Clear synchronously counter (RTC_SSR) on binary alarm. RTC_ALARMSUBSECONDBIN_AUTOCLR_YES must only be used if Binary mode is RTC_BINARY_ONLY This parameter can be a value of ***RTCEx_Alarm_Sub_Seconds_binary_Clear_Definitions***
- ***uint32_t RTC_AlarmTypeDef::AlarmDateWeekDaySel***
  Specifies the RTC Alarm is on Date or WeekDay. This parameter can be a value of ***RTC_AlarmDateWeekDay_Definitions***
- ***uint8_t RTC_AlarmTypeDef::AlarmDateWeekDay***
  Specifies the RTC Alarm Date/WeekDay. If the Alarm Date is selected, this parameter must be set to a value in the 1-31 range. If the Alarm WeekDay is selected, this parameter can be a value of ***RTC_WeekDay_Definitions***
- ***uint32_t RTC_AlarmTypeDef::FlagAutoClr***
  Specifies the alarm trigger generation. This feature is meaningful to avoid any RTC software execution after configuration. When FlagAutoClr is set in interrupt mode, EXTI is configured as EVENT instead of interrupt to avoid useless IRQ handler execution. This parameter can be a value of ***RTC_ALARM_Flag_AutoClear_Definitions***
- ***uint32_t RTC_AlarmTypeDef::Alarm***
  Specifies the alarm . This parameter can be a value of ***RTC_Alarms_Definitions***

41.1.5 __RTC_HandleTypeDef

__RTC_HandleTypeDef is defined in the stm32u0xx_hal_rtc.h

Data Fields

- ***RTC_TypeDef * Instance***
- ***RTC_InitTypeDef Init***
- ***HAL_LockTypeDef Lock***
- ***__IO HAL_RTCStateTypeDef State***
- ***void(* AlarmAEventCallback***
- ***void(* AlarmBEventCallback***
- ***void(* TimeStampEventCallback***
- ***void(* WakeUpTimerEventCallback***
- ***void(* SSRUEventCallback***
- ***void(* Tamper1EventCallback***
- ***void(* Tamper2EventCallback***
- ***void(* Tamper3EventCallback***

- ***void(* Tamper4EventCallback***
- ***void(* Tamper5EventCallback***
- ***void(* InternalTamper3EventCallback***
- ***void(* InternalTamper4EventCallback***
- ***void(* InternalTamper5EventCallback***
- ***void(* InternalTamper6EventCallback***
- ***void(* MspInitCallback***
- ***void(* MspDeInitCallback***

Field Documentation

- ***RTC_TypeDef* __RTC_HandleTypeDef::Instance***
  Legacy register base address. Not used anymore, the driver directly uses cmsis base address
- ***RTC_InitTypeDef __RTC_HandleTypeDef::Init***
  RTC required parameters
- ***HAL_LockTypeDef __RTC_HandleTypeDef::Lock***
  RTC locking object
- ***__IO HAL_RTCStateTypeDef __RTC_HandleTypeDef::State***
  Time communication state
- ***void(* __RTC_HandleTypeDef::AlarmAEventCallback)(struct __RTC_HandleTypeDef *hrtc)***
  RTC Alarm A Event callback
- ***void(* __RTC_HandleTypeDef::AlarmBEventCallback)(struct __RTC_HandleTypeDef *hrtc)***
  RTC Alarm B Event callback
- ***void(* __RTC_HandleTypeDef::TimeStampEventCallback)(struct __RTC_HandleTypeDef *hrtc)***
  RTC TimeStamp Event callback
- ***void(* __RTC_HandleTypeDef::WakeUpTimerEventCallback)(struct __RTC_HandleTypeDef *hrtc)***
  RTC WakeUpTimer Event callback
- ***void(* __RTC_HandleTypeDef::SSRUEventCallback)(struct __RTC_HandleTypeDef *hrtc)***
  RTC SSRU Event callback
- ***void(* __RTC_HandleTypeDef::Tamper1EventCallback)(struct __RTC_HandleTypeDef *hrtc)***
  RTC Tamper 1 Event callback
- ***void(* __RTC_HandleTypeDef::Tamper2EventCallback)(struct __RTC_HandleTypeDef *hrtc)***
  RTC Tamper 2 Event callback
- ***void(* __RTC_HandleTypeDef::Tamper3EventCallback)(struct __RTC_HandleTypeDef *hrtc)***
  RTC Tamper 3 Event callback
- ***void(* __RTC_HandleTypeDef::Tamper4EventCallback)(struct __RTC_HandleTypeDef *hrtc)***
  RTC Tamper 4 Event callback
- ***void(* __RTC_HandleTypeDef::Tamper5EventCallback)(struct __RTC_HandleTypeDef *hrtc)***
  RTC Tamper 5 Event callback
- ***void(* __RTC_HandleTypeDef::InternalTamper3EventCallback)(struct __RTC_HandleTypeDef *hrtc)***
  RTC Internal Tamper 3 Event callback
- ***void(* __RTC_HandleTypeDef::InternalTamper4EventCallback)(struct __RTC_HandleTypeDef *hrtc)***
  RTC Internal Tamper 4 Event callback
- ***void(* __RTC_HandleTypeDef::InternalTamper5EventCallback)(struct __RTC_HandleTypeDef *hrtc)***
  RTC Internal Tamper 5 Event callback
- ***void(* __RTC_HandleTypeDef::InternalTamper6EventCallback)(struct __RTC_HandleTypeDef *hrtc)***
  RTC Internal Tamper 6 Event callback
- ***void(* __RTC_HandleTypeDef::MspInitCallback)(struct __RTC_HandleTypeDef *hrtc)***
  RTC Msp Init callback
- ***void(* __RTC_HandleTypeDef::MspDeInitCallback)(struct __RTC_HandleTypeDef *hrtc)***
  RTC Msp DeInit callback

41.2 RTC Firmware driver API description

The following section lists the various functions of the RTC library.

41.2.1 RTC Operating Condition

The real-time clock (RTC) and the RTC backup registers can be powered from the VBAT voltage when the main VDD supply is powered off. To retain the content of the RTC backup registers and supply the RTC when VDD is turned off, VBAT pin can be connected to an optional standby voltage supplied by a battery or by another source.

41.2.2 Backup Domain Reset

The backup domain reset sets all RTC registers and the RCC_BDCR register to their reset values. A backup domain reset is generated when one of the following events occurs:

1. Software reset, triggered by setting the BDRST bit in the RCC Backup domain control register (RCC_BDCR).
2. VDD or VBAT power on, if both supplies have previously been powered off.
3. Tamper detection event resets all data backup registers.

41.2.3 Backup Domain Access

After reset, the backup domain (RTC registers and RTC backup data registers) is protected against possible unwanted write accesses.

To enable access to the RTC Domain and RTC registers, proceed as follows:

- Enable the Power Controller (PWR) APB1 interface clock using the __HAL_RCC_PWR_CLK_ENABLE() function.
- Enable access to RTC domain using the HAL_PWR_EnableBkUpAccess() function.
- Select the RTC clock source using the __HAL_RCC_RTC_CONFIG() function.
- Enable RTC Clock using the __HAL_RCC_RTC_ENABLE() function.

To enable access to the RTC Domain and RTC registers, proceed as follows:

1. Call the function HAL_RCCEx_PeriphCLKConfig with RCC_PERIPHCLK_RTC for PeriphClockSelection and select RTCClockSelection (LSE, LSI or HSEdiv32)
2. Enable RTC Clock using the __HAL_RCC_RTC_ENABLE() macro.

41.2.4 How to use RTC Driver

- Enable the RTC domain access (see description in the section above).
- Configure the RTC Prescaler (Asynchronous and Synchronous) and RTC hour format using the HAL_RTC_Init() function.

Time and Date configuration

- To configure the RTC Calendar (Time and Date) use the HAL_RTC_SetTime() and HAL_RTC_SetDate() functions.
- To read the RTC Calendar, use the HAL_RTC_GetTime() and HAL_RTC_GetDate() functions.

Alarm configuration

- To configure the RTC Alarm use the HAL_RTC_SetAlarm() function. You can also configure the RTC Alarm with interrupt mode using the HAL_RTC_SetAlarm_IT() function.
- To read the RTC Alarm, use the HAL_RTC_GetAlarm() function.

41.2.5 RTC and low power modes

The MCU can be woken up from a low power mode by an RTC alternate function.

The RTC alternate functions are the RTC alarms (Alarm A and Alarm B), RTC wakeup, RTC tamper event detection and RTC time stamp event detection. These RTC alternate functions can wake up the system from the Stop and Standby low power modes.

The system can also wake up from low power modes without depending on an external interrupt (Auto-wakeup mode), by using the RTC alarm or the RTC wakeup events.

The RTC provides a programmable time base for waking up from the Stop or Standby mode at regular intervals. Wakeup from STOP and STANDBY modes is possible only when the RTC clock source is LSE or LSI.

Callback registration

41.2.6 Initialization and de-initialization functions

This section provides functions allowing to initialize and configure the RTC Prescaler (Synchronous and Asynchronous), RTC Hour format, disable RTC registers Write protection, enter and exit the RTC initialization mode, RTC registers synchronization check and reference clock detection enable.

1. The RTC Prescaler is programmed to generate the RTC 1Hz time base. It is split into 2 programmable prescalers to minimize power consumption.
   – A 7-bit asynchronous prescaler and a 15-bit synchronous prescaler.
   – When both prescalers are used, it is recommended to configure the asynchronous prescaler to a high value to minimize power consumption.
2. All RTC registers are Write protected. Writing to the RTC registers is enabled by writing a key into the Write Protection register, RTC_WPR.
3. To configure the RTC Calendar, user application should enter initialization mode. In this mode, the calendar counter is stopped and its value can be updated. When the initialization sequence is complete, the calendar restarts counting after 4 RTCCLK cycles.
4. To read the calendar through the shadow registers after Calendar initialization, calendar update or after wakeup from low power modes the software must first clear the RSF flag. The software must then wait until it is set again before reading the calendar, which means that the calendar registers have been correctly copied into the RTC_TR and RTC_DR shadow registers.The HAL_RTC_WaitForSynchro() function implements the above software sequence (RSF clear and RSF check).

This section contains the following APIs:

- ***HAL_RTC_Init()***
- ***HAL_RTC_DeInit()***
- ***HAL_RTC_RegisterCallback()***
- ***HAL_RTC_UnRegisterCallback()***
- ***HAL_RTC_MspInit()***
- ***HAL_RTC_MspDeInit()***

41.2.7 RTC Time and Date functions

This section provides functions allowing to configure Time and Date features

This section contains the following APIs:

- ***HAL_RTC_SetTime()***
- ***HAL_RTC_GetTime()***
- ***HAL_RTC_SetDate()***
- ***HAL_RTC_GetDate()***
- ***HAL_RTC_DST_Add1Hour()***
- ***HAL_RTC_DST_Sub1Hour()***
- ***HAL_RTC_DST_SetStoreOperation()***
- ***HAL_RTC_DST_ClearStoreOperation()***
- ***HAL_RTC_DST_ReadStoreOperation()***

41.2.8 RTC Alarm functions

This section provides functions allowing to configure Alarm feature

This section contains the following APIs:

- ***HAL_RTC_SetAlarm()***
- ***HAL_RTC_SetAlarm_IT()***
- ***HAL_RTC_DeactivateAlarm()***
- ***HAL_RTC_GetAlarm()***
- ***HAL_RTC_AlarmIRQHandler()***
- ***HAL_RTC_AlarmAEventCallback()***

- *HAL_RTC_PollForAlarmAEvent()*

41.2.9 Peripheral Control functions

This subsection provides functions allowing to

- Wait for RTC Time and Date Synchronization

This section contains the following APIs:

- *HAL_RTC_WaitForSynchro()*

41.2.10 Peripheral State functions

This subsection provides functions allowing to

- Get RTC state

This section contains the following APIs:

- *HAL_RTC_GetState()*

41.2.11 Detailed description of functions

HAL_RTC_Init

Function name

HAL_StatusTypeDef HAL_RTC_Init (RTC_HandleTypeDef * hrtc)

Function description

Initialize the RTC peripheral.

Parameters

- **hrtc:** RTC handle

Return values

- **HAL:** status

HAL_RTC_DeInit

Function name

HAL_StatusTypeDef HAL_RTC_DeInit (RTC_HandleTypeDef * hrtc)

Function description

DeInitialize the RTC peripheral.

Parameters

- **hrtc:** RTC handle

Return values

- **HAL:** status

Notes

- This function does not reset the RTC Backup Data registers.

HAL_RTC_MspInit

Function name

void HAL_RTC_MspInit (RTC_HandleTypeDef * hrtc)

Function description

Initialize the RTC MSP.

Parameters

- **hrtc:** RTC handle

Return values

- **None:**

HAL_RTC_MspDeInit

Function name

void HAL_RTC_MspDeInit (RTC_HandleTypeDef * hrtc)

Function description

DeInitialize the RTC MSP.

Parameters

- **hrtc:** RTC handle

Return values

- **None:**

HAL_RTC_RegisterCallback

Function name

HAL_StatusTypeDef HAL_RTC_RegisterCallback (RTC_HandleTypeDef * hrtc, HAL_RTC_CallbackIDTypeDef CallbackID, pRTC_CallbackTypeDef pCallback)

Function description

Register a User RTC Callback To be used instead of the weak predefined callback.

Parameters

- **hrtc:** RTC handle
- **CallbackID:** ID of the callback to be registered This parameter can be one of the following values:
  - HAL_RTC_ALARM_A_EVENT_CB_ID Alarm A Event Callback ID
  - HAL_RTC_ALARM_B_EVENT_CB_ID Alarm B Event Callback ID
  - HAL_RTC_TIMESTAMP_EVENT_CB_ID TimeStamp Event Callback ID
  - HAL_RTC_WAKEUPTIMER_EVENT_CB_ID WakeUp Timer Event Callback ID
  - HAL_RTC_SSRU_EVENT_CB_ID SSRU Event Callback ID
  - HAL_RTC_TAMPER1_EVENT_CB_ID Tamper 1 Callback ID
  - HAL_RTC_TAMPER2_EVENT_CB_ID Tamper 2 Callback ID
  - HAL_RTC_TAMPER3_EVENT_CB_ID Tamper 3 Callback ID
  - HAL_RTC_TAMPER4_EVENT_CB_ID Tamper 4 Callback ID
  - HAL_RTC_TAMPER5_EVENT_CB_ID Tamper 5 Callback ID
  - HAL_RTC_INTERNAL_TAMPER3_EVENT_CB_ID Internal Tamper 3 Callback ID
  - HAL_RTC_INTERNAL_TAMPER4_EVENT_CB_ID Internal Tamper 4 Callback ID
  - HAL_RTC_INTERNAL_TAMPER5_EVENT_CB_ID Internal Tamper 5 Callback ID
  - HAL_RTC_INTERNAL_TAMPER6_EVENT_CB_ID Internal Tamper 6 Callback ID
- **pCallback:** pointer to the Callback function

Return values

- **HAL:** status

HAL_RTC_UnRegisterCallback

Function name

HAL_StatusTypeDef HAL_RTC_UnRegisterCallback (RTC_HandleTypeDef * hrtc, HAL_RTC_CallbackIDTypeDef CallbackID)

Function description

Unregister an RTC Callback RTC callback is redirected to the weak predefined callback.

Parameters

- **hrtc:** RTC handle
- **CallbackID:** ID of the callback to be unregistered This parameter can be one of the following values: This parameter can be one of the following values:
  - HAL_RTC_ALARM_A_EVENT_CB_ID Alarm A Event Callback ID
  - HAL_RTC_ALARM_B_EVENT_CB_ID Alarm B Event Callback ID
  - HAL_RTC_TIMESTAMP_EVENT_CB_ID TimeStamp Event Callback ID
  - HAL_RTC_SSRU_EVENT_CB_ID SSRU Callback ID
  - HAL_RTC_WAKEUPTIMER_EVENT_CB_ID WakeUp Timer Event Callback ID
  - HAL_RTC_TAMPER1_EVENT_CB_ID Tamper 1 Callback ID
  - HAL_RTC_TAMPER2_EVENT_CB_ID Tamper 2 Callback ID
  - HAL_RTC_TAMPER3_EVENT_CB_ID Tamper 3 Callback ID
  - HAL_RTC_TAMPER4_EVENT_CB_ID Tamper 4 Callback ID
  - HAL_RTC_TAMPER5_EVENT_CB_ID Tamper 5 Callback ID
  - HAL_RTC_INTERNAL_TAMPER3_EVENT_CB_ID Internal Tamper 3 Callback ID
  - HAL_RTC_INTERNAL_TAMPER4_EVENT_CB_ID Internal Tamper 4 Callback ID
  - HAL_RTC_INTERNAL_TAMPER5_EVENT_CB_ID Internal Tamper 5 Callback ID
  - HAL_RTC_INTERNAL_TAMPER6_EVENT_CB_ID Internal Tamper 6 Callback ID
  - HAL_RTC_MSPINIT_CB_ID Msp Init callback ID
  - HAL_RTC_MSPDEINIT_CB_ID Msp DeInit callback ID

Return values

- **HAL:** status

HAL_RTC_SetTime

Function name

HAL_StatusTypeDef HAL_RTC_SetTime (RTC_HandleTypeDef * hrtc, RTC_TimeTypeDef * sTime, uint32_t Format)

Function description

Set RTC current time.

Parameters

- **hrtc:** RTC handle
- **sTime:** Pointer to Time structure if Binary mode is RTC_BINARY_ONLY, this parameter is not used and RTC_SSR will be automatically reset to 0xFFFFFFFF. else sTime->SubSeconds is not used and RTC_SSR will be automatically reset to the A 7-bit async prescaler (RTC_PRER_PREDIV_A)
- **Format:** Format of sTime->Hours, sTime->Minutes and sTime->Seconds. if Binary mode is RTC_BINARY_ONLY, this parameter is not used else this parameter can be one of the following values
  - RTC_FORMAT_BIN: Binary format
  - RTC_FORMAT_BCD: BCD format

Return values

- **HAL:** status

Notes

- DayLightSaving and StoreOperation interfaces are deprecated. To manage Daylight Saving Time, please use HAL_RTC_DST_xxx functions.

HAL_RTC_GetTime

Function name

HAL_StatusTypeDef HAL_RTC_GetTime (RTC_HandleTypeDef * hrtc, RTC_TimeTypeDef * sTime, uint32_t Format)

Function description

Get RTC current time.

Parameters

- **hrtc:** RTC handle
- **sTime:** if Binary mode is RTC_BINARY_ONLY, sTime->SubSeconds only is updated else Pointer to Time structure with Hours, Minutes and Seconds fields returned with input format (BIN or BCD), also SubSeconds field returning the RTC_SSR register content and SecondFraction field the Synchronous pre-scaler factor to be used for second fraction ratio computation.
- **Format:** Format of sTime->Hours, sTime->Minutes and sTime->Seconds. if Binary mode is RTC_BINARY_ONLY, this parameter is not used else this parameter can be one of the following values:
  - RTC_FORMAT_BIN: Binary format
  - RTC_FORMAT_BCD: BCD format

Return values

- **HAL:** status

Notes

- You can use SubSeconds and SecondFraction (sTime structure fields returned) to convert SubSeconds value in second fraction ratio with time unit following generic formula: Second fraction ratio * time_unit= [(SecondFraction-SubSeconds)/(SecondFraction+1)] * time_unit This conversion can be performed only if no shift operation is pending (ie. SHFP=0) when PREDIV_S >= SS
- You must call HAL_RTC_GetDate() after HAL_RTC_GetTime() to unlock the values in the higher-order calendar shadow registers to ensure consistency between the time and date values. Reading RTC current time locks the values in calendar shadow registers until Current date is read to ensure consistency between the time and date values.

HAL_RTC_SetDate

Function name

HAL_StatusTypeDef HAL_RTC_SetDate (RTC_HandleTypeDef * hrtc, RTC_DateTypeDef * sDate, uint32_t Format)

Function description

Set RTC current date.

Parameters

- **hrtc:** RTC handle
- **sDate:** Pointer to date structure
- **Format:** Format of sDate->Year, sDate->Month and sDate->Weekday. This parameter can be one of the following values:
  - RTC_FORMAT_BIN: Binary format
  - RTC_FORMAT_BCD: BCD format

Return values

- **HAL:** status

HAL_RTC_GetDate

Function name

HAL_StatusTypeDef HAL_RTC_GetDate (RTC_HandleTypeDef * hrtc, RTC_DateTypeDef * sDate, uint32_t Format)

Function description

Get RTC current date.

Parameters

- **hrtc:** RTC handle
- **sDate:** Pointer to Date structure
- **Format:** Format of sDate->Year, sDate->Month and sDate->Weekday. This parameter can be one of the following values:
  - RTC_FORMAT_BIN: Binary format
  - RTC_FORMAT_BCD: BCD format

Return values

- **HAL:** status

Notes

- You must call HAL_RTC_GetDate() after HAL_RTC_GetTime() to unlock the values in the higher-order calendar shadow registers to ensure consistency between the time and date values. Reading RTC current time locks the values in calendar shadow registers until Current date is read.

HAL_RTC_DST_Add1Hour

Function name

void HAL_RTC_DST_Add1Hour (RTC_HandleTypeDef * hrtc)

Function description

Daylight Saving Time, add one hour to the calendar in one single operation without going through the initialization procedure.

Parameters

- **hrtc:** pointer to a RTC_HandleTypeDef structure that contains the configuration information for RTC.

Return values

- **None:**

HAL_RTC_DST_Sub1Hour

Function name

void HAL_RTC_DST_Sub1Hour (RTC_HandleTypeDef * hrtc)

Function description

Daylight Saving Time, subtracts one hour from the calendar in one single operation without going through the initialization procedure.

Parameters

- **hrtc:** pointer to a RTC_HandleTypeDef structure that contains the configuration information for RTC.

Return values

- **None:**

HAL_RTC_DST_SetStoreOperation

Function name

void HAL_RTC_DST_SetStoreOperation (RTC_HandleTypeDef * hrtc)

Function description

Daylight Saving Time, sets the store operation bit.

Parameters

- **hrtc:** pointer to a RTC_HandleTypeDef structure that contains the configuration information for RTC.

Return values

- **None:**

Notes

- It can be used by the software in order to memorize the DST status.

HAL_RTC_DST_ClearStoreOperation

Function name

void HAL_RTC_DST_ClearStoreOperation (RTC_HandleTypeDef * hrtc)

Function description

Daylight Saving Time, clears the store operation bit.

Parameters

- **hrtc:** pointer to a RTC_HandleTypeDef structure that contains the configuration information for RTC.

Return values

- **None:**

HAL_RTC_DST_ReadStoreOperation

Function name

uint32_t HAL_RTC_DST_ReadStoreOperation (RTC_HandleTypeDef * hrtc)

Function description

Daylight Saving Time, reads the store operation bit.

Parameters

- **hrtc:** RTC handle

Return values

- **operation:** see RTC_StoreOperation_Definitions

HAL_RTC_SetAlarm

Function name

HAL_StatusTypeDef HAL_RTC_SetAlarm (RTC_HandleTypeDef * hrtc, RTC_AlarmTypeDef * sAlarm, uint32_t Format)

Function description

Set the specified RTC Alarm.

Parameters

- **hrtc:** RTC handle
- **sAlarm:** Pointer to Alarm structure if Binary mode is RTC_BINARY_ONLY, 3 fields only are used sAlarm->AlarmTime.SubSeconds sAlarm->AlarmSubSecondMask sAlarm->BinaryAutoClr
- **Format:** of the entered parameters. if Binary mode is RTC_BINARY_ONLY, this parameter is not used else this parameter can be one of the following values
  - RTC_FORMAT_BIN: Binary format
  - RTC_FORMAT_BCD: BCD format

Return values

- **HAL:** status

HAL_RTC_SetAlarm_IT

Function name

HAL_StatusTypeDef HAL_RTC_SetAlarm_IT (RTC_HandleTypeDef * hrtc, RTC_AlarmTypeDef * sAlarm, uint32_t Format)

Function description

Set the specified RTC Alarm with Interrupt.

Parameters

- **hrtc:** RTC handle
- **sAlarm:** Pointer to Alarm structure if Binary mode is RTC_BINARY_ONLY, 3 fields only are used sAlarm->AlarmTime.SubSeconds sAlarm->AlarmSubSecondMask sAlarm->BinaryAutoClr
- **Format:** Specifies the format of the entered parameters. if Binary mode is RTC_BINARY_ONLY, this parameter is not used else this parameter can be one of the following values
  - RTC_FORMAT_BIN: Binary format
  - RTC_FORMAT_BCD: BCD format

Return values

- **HAL:** status

HAL_RTC_DeactivateAlarm

Function name

HAL_StatusTypeDef HAL_RTC_DeactivateAlarm (RTC_HandleTypeDef * hrtc, uint32_t Alarm)

Function description

Deactivate the specified RTC Alarm.

Parameters

- **hrtc:** RTC handle
- **Alarm:** Specifies the Alarm. This parameter can be one of the following values:
  - RTC_ALARM_A: AlarmA
  - RTC_ALARM_B: AlarmB

Return values

- **HAL:** status

HAL_RTC_GetAlarm

Function name

HAL_StatusTypeDef HAL_RTC_GetAlarm (RTC_HandleTypeDef * hrtc, RTC_AlarmTypeDef * sAlarm, uint32_t Alarm, uint32_t Format)

Function description

Get the RTC Alarm value and masks.

Parameters

- **hrtc:** RTC handle
- **sAlarm:** Pointer to Date structure
- **Alarm:** Specifies the Alarm. This parameter can be one of the following values:
  - RTC_ALARM_A: AlarmA
  - RTC_ALARM_B: AlarmB
- **Format:** Specifies the format of the entered parameters. This parameter can be one of the following values:
  - RTC_FORMAT_BIN: Binary format
  - RTC_FORMAT_BCD: BCD format

Return values

- **HAL:** status

HAL_RTC_AlarmIRQHandler

Function name

void HAL_RTC_AlarmIRQHandler (RTC_HandleTypeDef * hrtc)

Function description

Handle Alarm interrupt request.

Parameters

- **hrtc:** RTC handle

Return values

- **None:**

HAL_RTC_PollForAlarmAEvent

Function name

HAL_StatusTypeDef HAL_RTC_PollForAlarmAEvent (RTC_HandleTypeDef * hrtc, uint32_t Timeout)

Function description

Handle AlarmA Polling request.

Parameters

- **hrtc:** RTC handle
- **Timeout:** Timeout duration

Return values

- **HAL:** status

HAL_RTC_AlarmAEventCallback

Function name

void HAL_RTC_AlarmAEventCallback (RTC_HandleTypeDef * hrtc)

Function description

Alarm A callback.

Parameters

- **hrtc:** RTC handle

Return values

- **None:**

HAL_RTC_WaitForSynchro

Function name

HAL_StatusTypeDef HAL_RTC_WaitForSynchro (RTC_HandleTypeDef * hrtc)

Function description

Wait until the RTC Time and Date registers (RTC_TR and RTC_DR) are synchronized with RTC APB clock.

Parameters

- **hrtc:** RTC handle

Return values

- **HAL:** status

Notes

- The RTC Resynchronization mode is write protected, use the __HAL_RTC_WRITEPROTECTION_DISABLE() before calling this function.
- To read the calendar through the shadow registers after Calendar initialization, calendar update or after wakeup from low power modes the software must first clear the RSF flag. The software must then wait until it is set again before reading the calendar, which means that the calendar registers have been correctly copied into the RTC_TR and RTC_DR shadow registers.

HAL_RTC_GetState

Function name

HAL_RTCStateTypeDef HAL_RTC_GetState (RTC_HandleTypeDef * hrtc)

Function description

Return the RTC handle state.

Parameters

- **hrtc:** RTC handle

Return values

- **HAL:** state

RTC_EnterInitMode

Function name

HAL_StatusTypeDef RTC_EnterInitMode (RTC_HandleTypeDef * hrtc)

Function description

Enter the RTC Initialization mode.

Parameters

- **hrtc:** RTC handle

Return values

- **HAL:** status

Notes

- The RTC Initialization mode is write protected, use the __HAL_RTC_WRITEPROTECTION_DISABLE() before calling this function.

RTC_ExitInitMode

Function name

HAL_StatusTypeDef RTC_ExitInitMode (RTC_HandleTypeDef * hrtc)

Function description

Exit the RTC Initialization mode.

Parameters

- **hrtc:** RTC handle

Return values

- **HAL:** status

RTC_ByteToBcd2

Function name

uint8_t RTC_ByteToBcd2 (uint8_t Value)

Function description

Convert a 2 digit decimal to BCD format.

Parameters

- **Value:** Byte to be converted

Return values

- **Converted:** byte

RTC_Bcd2ToByte

Function name

uint8_t RTC_Bcd2ToByte (uint8_t Value)

Function description

Convert from 2 digit BCD to Binary.

Parameters

- **Value:** BCD value to be converted

Return values

- **Converted:** word

41.3 RTC Firmware driver defines

The following section lists the various define and macros of the module.

41.3.1 RTC

RTC

RTC AlarmDateWeekDay Definitions

RTC_ALARMDATEWEEKDAYSEL_DATE

RTC_ALARMDATEWEEKDAYSEL_WEEKDAY

RTC AlarmMask Definitions

RTC_ALARMMASK_NONE

RTC_ALARMMASK_DATEWEEKDAY

RTC_ALARMMASK_HOURS

RTC_ALARMMASK_MINUTES

RTC_ALARMMASK_SECONDS

RTC_ALARMMASK_ALL

RTC Alarms Definitions

RTC_ALARM_A

RTC_ALARM_B

RTC Alarms Flag Auto Clear Definitions

ALARM_FLAG_AUTOCLR_ENABLE

ALARM_FLAG_AUTOCLR_DISABLE

RTC Alarm Sub Seconds Masks Definitions

RTC_ALARMSUBSECONDMASK_ALL

All Alarm SS fields are masked. There is no comparison on sub seconds for Alarm

RTC_ALARMSUBSECONDMASK_SS14_1

SS[14:1] not used in Alarm comparison. Only SS[0] is compared.

RTC_ALARMSUBSECONDMASK_SS14_2

SS[14:2] not used in Alarm comparison. Only SS[1:0] are compared

RTC_ALARMSUBSECONDMASK_SS14_3

SS[14:3] not used in Alarm comparison. Only SS[2:0] are compared

RTC_ALARMSUBSECONDMASK_SS14_4

SS[14:4] not used in Alarm comparison. Only SS[3:0] are compared

RTC_ALARMSUBSECONDMASK_SS14_5

SS[14:5] not used in Alarm comparison. Only SS[4:0] are compared

RTC_ALARMSUBSECONDMASK_SS14_6

SS[14:6] not used in Alarm comparison.Only SS[5:0] are compared

RTC_ALARMSUBSECONDMASK_SS14_7

SS[14:7] not used in Alarm comparison. Only SS[6:0] are compared

RTC_ALARMSUBSECONDMASK_SS14_8

SS[14:8] not used in Alarm comparison. Only SS[7:0] are compared

RTC_ALARMSUBSECONDMASK_SS14_9

SS[14:9] not used in Alarm comparison. Only SS[8:0] are compared

RTC_ALARMSUBSECONDMASK_SS14_10

SS[14:10] not used in Alarm comparison. Only SS[9:0] are compared

RTC_ALARMSUBSECONDMASK_SS14_11

SS[14:11] not used in Alarm comparison. Only SS[10:0] are compared

RTC_ALARMSUBSECONDMASK_SS14_12

SS[14:12] not used in Alarm comparison. Only SS[11:0] are compared

RTC_ALARMSUBSECONDMASK_SS14_13

SS[14:13] not used in Alarm comparison. Only SS[12:0] are compared

RTC_ALARMSUBSECONDMASK_SS14

SS[14] not used in Alarm comparison. Only SS[13:0] are compared

RTC_ALARMSUBSECONDMASK_NONE

SS[14:0] are compared and must match to activate alarm.

RTC AM PM Definitions

RTC_HOURFORMAT12_AM

RTC_HOURFORMAT12_PM

RTC Clear Flags Definitions

RTC_CLEAR_SSRUF

Clear SSR underflow flag

RTC_CLEAR_ITSF

Clear Internal Time-stamp flag

RTC_CLEAR_TSOVF

Clear Time-stamp overflow flag

RTC_CLEAR_TSF

Clear Time-stamp flag

RTC_CLEAR_WUTF

Clear Wakeup timer flag

RTC_CLEAR_ALRBF

Clear Alarm B flag

RTC_CLEAR_ALRAF

Clear Alarm A flag

RTC DayLightSaving Definitions

RTC_DAYLIGHTSAVING_SUB1H

RTC_DAYLIGHTSAVING_ADD1H

RTC_DAYLIGHTSAVING_NONE

RTC Exported Macros

__HAL_RTC_RESET_HANDLE_STATE

Description:

- Reset RTC handle state.

Parameters:

- __HANDLE__: RTC handle.

Return value:

- None

__HAL_RTC_WRITEPROTECTION_DISABLE

Description:

- Disable the write protection for RTC registers.

Parameters:

- __HANDLE__: specifies the RTC handle.

Return value:

- None

__HAL_RTC_WRITEPROTECTION_ENABLE

Description:

- Enable the write protection for RTC registers.

Parameters:

- __HANDLE__: specifies the RTC handle.

Return value:

- None

__HAL_RTC_DAYLIGHT_SAVING_TIME_ADD1H

Description:

- Add 1 hour (summer time change).

Parameters:

- __HANDLE__: specifies the RTC handle.
- __BKP__: Backup This parameter can be:
  - RTC_STOREOPERATION_RESET
  - RTC_STOREOPERATION_SET

Return value:

- None

__HAL_RTC_DAYLIGHT_SAVING_TIME_SUB1H

Description:

- Subtract 1 hour (winter time change).

Parameters:

- __HANDLE__: specifies the RTC handle.
- __BKP__: Backup This parameter can be:
  - RTC_STOREOPERATION_RESET
  - RTC_STOREOPERATION_SET

Return value:

- None

__HAL_RTC_ALARMA_ENABLE

Description:

- Enable the RTC ALARMA peripheral.

Parameters:

- __HANDLE__: specifies the RTC handle.

Return value:

- None

__HAL_RTC_ALARMA_DISABLE

Description:

- Disable the RTC ALARMA peripheral.

Parameters:

- __HANDLE__: specifies the RTC handle.

Return value:

- None

__HAL_RTC_ALARMB_ENABLE

Description:

- Enable the RTC ALARMB peripheral.

Parameters:

- __HANDLE__: specifies the RTC handle.

Return value:

- None

__HAL_RTC_ALARMB_DISABLE

Description:

- Disable the RTC ALARMB peripheral.

Parameters:

- __HANDLE__: specifies the RTC handle.

Return value:

- None

__HAL_RTC_ALARM_ENABLE_IT

Description:

- Enable the RTC Alarm interrupt.

Parameters:

- __HANDLE__: specifies the RTC handle.
- __INTERRUPT__: specifies the RTC Alarm interrupt sources to be enabled or disabled. This parameter can be any combination of the following values:
  - RTC_IT_ALRA Alarm A interrupt
  - RTC_IT_ALRB Alarm B interrupt

Return value:

- None

__HAL_RTC_ALARM_DISABLE_IT

Description:

- Disable the RTC Alarm interrupt.

Parameters:

- __HANDLE__: specifies the RTC handle.
- __INTERRUPT__: specifies the RTC Alarm interrupt sources to be enabled or disabled. This parameter can be any combination of the following values:
  - RTC_IT_ALRA Alarm A interrupt
  - RTC_IT_ALRB Alarm B interrupt

Return value:

- None

__HAL_RTC_ALARM_GET_IT

Description:

- Check whether the specified RTC Alarm interrupt has occurred or not.

Parameters:

- __HANDLE__: specifies the RTC handle.
- __INTERRUPT__: specifies the RTC Alarm interrupt sources to check. This parameter can be:
  - RTC_IT_ALRA Alarm A interrupt
  - RTC_IT_ALRB Alarm B interrupt

Return value:

- None

__HAL_RTC_ALARM_GET_IT_SOURCE

Description:

- Check whether the specified RTC Alarm interrupt has been enabled or not.

Parameters:

- __HANDLE__: specifies the RTC handle.
- __INTERRUPT__: specifies the RTC Alarm interrupt sources to check. This parameter can be:
  - RTC_IT_ALRA Alarm A interrupt
  - RTC_IT_ALRB Alarm B interrupt

Return value:

- None

__HAL_RTC_ALARM_GET_FLAG

Description:

- Get the selected RTC Alarms flag status.

Parameters:

- __HANDLE__: specifies the RTC handle.
- __FLAG__: specifies the RTC Alarm Flag sources to check. This parameter can be:
  - RTC_FLAG_ALRAF
  - RTC_FLAG_ALRBF

Return value:

- None

__HAL_RTC_ALARM_CLEAR_FLAG

Description:

- Clear the RTC Alarms pending flags.

Parameters:

- __HANDLE__: specifies the RTC handle.
- __FLAG__: specifies the RTC Alarm Flag sources to clear. This parameter can be:
  - RTC_FLAG_ALRAF
  - RTC_FLAG_ALRBF

Return value:

- None

__HAL_RTC_ALARM_EXTI_ENABLE_IT

Description:

- Enable interrupt on the RTC Alarm associated Exti line.

Return value:

- None

__HAL_RTC_ALARM_EXTI_DISABLE_IT

Description:

- Disable interrupt on the RTC Alarm associated Exti line.

Return value:

- None

__HAL_RTC_ALARM_EXTI_ENABLE_EVENT

Description:

- Enable event on the RTC Alarm associated Exti line.

Return value:

- None

__HAL_RTC_ALARM_EXTI_DISABLE_EVENT

Description:

- Disable event on the RTC Alarm associated Exti line.

Return value:

- None

RTC Flags Definitions

RTC_FLAG_RECALPF

Recalibration pending Flag

RTC_FLAG_INITF

Initialization flag

RTC_FLAG_RSF

Registers synchronization flag

RTC_FLAG_INITS

Initialization status flag

RTC_FLAG_SHPF

Shift operation pending flag

RTC_FLAG_WUTWF

Wakeup timer write flag

RTC_FLAG_SSRUF

SSR underflow flag

RTC_FLAG_ITSF

Internal Time-stamp flag

RTC_FLAG_TSOVF

Time-stamp overflow flag

RTC_FLAG_TSF

Time-stamp flag

RTC_FLAG_WUTF

Wakeup timer flag

RTC_FLAG_ALRBF

Alarm B flag

RTC_FLAG_ALRAF

Alarm A flag

RTC Hour Formats

RTC_HOURFORMAT_24

RTC_HOURFORMAT_12

RTC Input Parameter Format Definitions

RTC_FORMAT_BIN

RTC_FORMAT_BCD

RTC Interruptions Flag Mask

RTC_IT_MASK

RTC interruptions flags mask

RTC Interrupts Definitions

RTC_IT_TS

Enable Timestamp Interrupt

RTC_IT_WUT

Enable Wakeup timer Interrupt

RTC_IT_SSRU

Enable SSR Underflow Interrupt

RTC_IT_ALRA

Enable Alarm A Interrupt

RTC_IT_ALRB

Enable Alarm B Interrupt

RTC Private macros to check input parameters

IS_RTC_OUTPUT

IS_RTC_HOUR_FORMAT

IS_RTC_OUTPUT_POL

IS_RTC_OUTPUT_TYPE

IS_RTC_OUTPUT_PULLUP

IS_RTC_OUTPUT_REMAP

IS_RTC_HOURFORMAT12

IS_RTC_DAYLIGHT_SAVING

IS_RTC_STORE_OPERATION

IS_RTC_FORMAT

IS_RTC_YEAR

IS_RTC_MONTH

IS_RTC_DATE

IS_RTC_WEEKDAY

IS_RTC_ALARM_DATE_WEEKDAY_DATE

IS_RTC_ALARM_DATE_WEEKDAY_WEEKDAY

IS_RTC_ALARM_DATE_WEEKDAY_SEL

IS_RTC_ALARM_MASK

IS_RTC_ALARM

IS_RTC_ALARM_SUB_SECOND_VALUE

IS_RTC_ALARM_SUB_SECOND_MASK

IS_RTC_ASYNCH_PREDIV

IS_RTC_SYNCH_PREDIV

IS_RTC_HOUR12

IS_RTC_HOUR24

IS_RTC_MINUTES

IS_RTC_SECONDS

RTC Month Date Definitions

RTC_MONTH_JANUARY

RTC_MONTH_FEBRUARY

RTC_MONTH_MARCH

RTC_MONTH_APRIL

RTC_MONTH_MAY

RTC_MONTH_JUNE

RTC_MONTH_JULY

RTC_MONTH_AUGUST

RTC_MONTH_SEPTEMBER

RTC_MONTH_OCTOBER

RTC_MONTH_NOVEMBER

RTC_MONTH_DECEMBER

RTC Output ALARM OUT Remap

RTC_OUTPUT_REMAP_NONE

RTC_OUTPUT_REMAP_POS1

RTC Output Polarity Definitions

RTC_OUTPUT_POLARITY_HIGH

RTC_OUTPUT_POLARITY_LOW

RTC Output Pull-Up ALARM OUT

RTC_OUTPUT_PULLUP_NONE

RTC_OUTPUT_PULLUP_ON

RTC Output Type ALARM OUT

RTC_OUTPUT_TYPE_PUSHPULL

RTC_OUTPUT_TYPE_OPENDRAIN

RTC StoreOperation Definitions

RTC_STOREOPERATION_RESET

RTC_STOREOPERATION_SET

RTC WeekDay Definitions

RTC_WEEKDAY_MONDAY

RTC_WEEKDAY_TUESDAY

RTC_WEEKDAY_WEDNESDAY

RTC_WEEKDAY_THURSDAY

RTC_WEEKDAY_FRIDAY

RTC_WEEKDAY_SATURDAY

RTC_WEEKDAY_SUNDAY

42 HAL RTC Extension Driver

42.1 RTCEx Firmware driver registers structures

42.1.1 RTC_TamperTypeDef

RTC_TamperTypeDef is defined in the stm32u0xx_hal_rtc_ex.h

Data Fields

- ***uint32_t Tamper***
- ***uint32_t Trigger***
- ***uint32_t NoErase***
- ***uint32_t MaskFlag***
- ***uint32_t Filter***
- ***uint32_t SamplingFrequency***
- ***uint32_t PrechargeDuration***
- ***uint32_t TamperPullUp***
- ***uint32_t TimeStampOnTamperDetection***

Field Documentation

- ***uint32_t RTC_TamperTypeDef::Tamper***
  Specifies the Tamper Pin. This parameter can be a value of ***RTCEx_Tamper_Pins***
- ***uint32_t RTC_TamperTypeDef::Trigger***
  Specifies the Tamper Trigger. This parameter can be a value of ***RTCEx_Tamper_Trigger***
- ***uint32_t RTC_TamperTypeDef::NoErase***
  Specifies the Tamper no erase mode. This parameter can be a value of ***RTCEx_Tamper_EraseBackUp***
- ***uint32_t RTC_TamperTypeDef::MaskFlag***
  Specifies the Tamper Flag masking. This parameter can be a value of ***RTCEx_Tamper_MaskFlag***
- ***uint32_t RTC_TamperTypeDef::Filter***
  Specifies the TAMP Filter Tamper. This parameter can be a value of ***RTCEx_Tamper_Filter***
- ***uint32_t RTC_TamperTypeDef::SamplingFrequency***
  Specifies the sampling frequency. This parameter can be a value of ***RTCEx_Tamper_Sampling_Frequencies***
- ***uint32_t RTC_TamperTypeDef::PrechargeDuration***
  Specifies the Precharge Duration . This parameter can be a value of ***RTCEx_Tamper_Pin_Precharge_Duration***
- ***uint32_t RTC_TamperTypeDef::TamperPullUp***
  Specifies the Tamper PullUp . This parameter can be a value of ***RTCEx_Tamper_Pull_UP***
- ***uint32_t RTC_TamperTypeDef::TimeStampOnTamperDetection***
  Specifies the TimeStampOnTamperDetection. This parameter can be a value of ***RTCEx_Tamper_TimeStampOnTamperDetection***

42.1.2 RTC_InternalTamperTypeDef

RTC_InternalTamperTypeDef is defined in the stm32u0xx_hal_rtc_ex.h

Data Fields

- ***uint32_t IntTamper***
- ***uint32_t TimeStampOnTamperDetection***
- ***uint32_t NoErase***

Field Documentation

- ***uint32_t RTC_InternalTamperTypeDef::IntTamper***
  Specifies the Internal Tamper Pin. This parameter can be a value of ***RTCEx_Internal_Tamper_Pins***
- ***uint32_t RTC_InternalTamperTypeDef::TimeStampOnTamperDetection***
  Specifies the TimeStampOnTamperDetection. This parameter can be a value of ***RTCEx_Tamper_TimeStampOnTamperDetection***

- ***uint32_t RTC_InternalTamperTypeDef::NoErase***
  Specifies the internal Tamper no erase mode. This parameter can be a value of ***RTCEx_Tamper_EraseBackUp***

42.2 RTCEx Firmware driver API description

The following section lists the various functions of the RTCEx library.

42.2.1 How to use this driver

- Enable the RTC domain access.
- Configure the RTC Prescaler (Asynchronous and Synchronous) and RTC hour format using the HAL_RTC_Init() function.

RTC Wakeup configuration

- To configure the RTC Wakeup Clock source and Counter use the HAL_RTCEx_SetWakeUpTimer() function. You can also configure the RTC Wakeup timer with interrupt mode using the HAL_RTCEx_SetWakeUpTimer_IT() function.
- To read the RTC WakeUp Counter register, use the HAL_RTCEx_GetWakeUpTimer() function.

Outputs configuration

The RTC has 2 different outputs:

- RTC_ALARM: this output is used to manage the RTC Alarm A, Alarm B and WaKeUp signals. To output the selected RTC signal, use the HAL_RTC_Init() function.
- RTC_CALIB: this output is 512Hz signal or 1Hz. To enable the RTC_CALIB, use the HAL_RTCEx_SetCalibrationOutPut() function.
- Two pins can be used as RTC_ALARM or RTC_CALIB (PC13, PB2) managed on the RTC_OR register.
- When the RTC_CALIB or RTC_ALARM output is selected, the RTC_OUT pin is automatically configured in output alternate function.

Smooth digital Calibration configuration

- Configure the RTC Original Digital Calibration Value and the corresponding calibration cycle period (32s,16s and 8s) using the HAL_RTCEx_SetSmoothCalib() function.

TimeStamp configuration

- Enable the RTC TimeStamp using the HAL_RTCEx_SetTimeStamp() function. You can also configure the RTC TimeStamp with interrupt mode using the HAL_RTCEx_SetTimeStamp_IT() function.
- To read the RTC TimeStamp Time and Date register, use the HAL_RTCEx_GetTimeStamp() function.

Internal TimeStamp configuration

- Enable the RTC internal TimeStamp using the HAL_RTCEx_SetInternalTimeStamp() function. User has to check internal timestamp occurrence using __HAL_RTC_INTERNAL_TIMESTAMP_GET_FLAG.
- To read the RTC TimeStamp Time and Date register, use the HAL_RTCEx_GetTimeStamp() function.

Tamper configuration

- Enable the RTC Tamper and configure the Tamper filter count, trigger Edge or Level according to the Tamper filter (if equal to 0 Edge else Level) value, sampling frequency, NoErase, MaskFlag, precharge or discharge and Pull-UP using the HAL_RTCEx_SetTamper() function. You can configure RTC Tamper with interrupt mode using HAL_RTCEx_SetTamper_IT() function.
- The default configuration of the Tamper erases the backup registers. To avoid erase, enable the NoErase field on the RTC_TAMPCR register.
- With new RTC tamper configuration, you have to call HAL_RTC_Init() in order to perform TAMP base address offset calculation.
- If you do not intend to have tamper using RTC clock, you can bypass its initialization by setting ClockEnable inti field to RTC_CLOCK_DISABLE.

- Enable Internal tamper using HAL_RTCEx_SetInternalTamper. IT mode can be chosen using setting Interrupt field.

Backup Data Registers configuration

- To write to the RTC Backup Data registers, use the HAL_RTCEx_BKUPWrite() function.
- To read the RTC Backup Data registers, use the HAL_RTCEx_BKUPRead() function.
- Before calling these functions you have to call HAL_RTC_Init() in order to perform TAMP base address offset calculation.

42.2.2 RTC TimeStamp and Tamper functions

This section provides functions allowing to configure TimeStamp feature

This section contains the following APIs:

- ***HAL_RTCEx_SetTimeStamp()***
- ***HAL_RTCEx_SetTimeStamp_IT()***
- ***HAL_RTCEx_DeactivateTimeStamp()***
- ***HAL_RTCEx_SetInternalTimeStamp()***
- ***HAL_RTCEx_DeactivateInternalTimeStamp()***
- ***HAL_RTCEx_GetTimeStamp()***
- ***HAL_RTCEx_TimeStampIRQHandler()***
- ***HAL_RTCEx_TimeStampEventCallback()***
- ***HAL_RTCEx_PollForTimeStampEvent()***

42.2.3 RTC Wake-up functions

This section provides functions allowing to configure Wake-up feature

This section contains the following APIs:

- ***HAL_RTCEx_SetWakeUpTimer()***
- ***HAL_RTCEx_SetWakeUpTimer_IT()***
- ***HAL_RTCEx_DeactivateWakeUpTimer()***
- ***HAL_RTCEx_GetWakeUpTimer()***
- ***HAL_RTCEx_WakeUpTimerIRQHandler()***
- ***HAL_RTCEx_WakeUpTimerEventCallback()***
- ***HAL_RTCEx_PollForWakeUpTimerEvent()***

42.2.4 Extended Peripheral Control functions

This subsection provides functions allowing to

- Write a data in a specified RTC Backup data register
- Read a data in a specified RTC Backup data register
- Set the Coarse calibration parameters.
- Deactivate the Coarse calibration parameters
- Set the Smooth calibration parameters.
- Set Low Power calibration parameter.
- Configure the Synchronization Shift Control Settings.
- Configure the Calibration Pinout (RTC_CALIB) Selection (1Hz or 512Hz).
- Deactivate the Calibration Pinout (RTC_CALIB) Selection (1Hz or 512Hz).
- Enable the RTC reference clock detection.
- Disable the RTC reference clock detection.
- Enable the Bypass Shadow feature.
- Disable the Bypass Shadow feature.

This section contains the following APIs:

- ***HAL_RTCEx_SetSmoothCalib()***

- *HAL_RTCEx_SetLowPowerCalib()*
- *HAL_RTCEx_SetSynchroShift()*
- *HAL_RTCEx_SetCalibrationOutPut()*
- *HAL_RTCEx_DeactivateCalibrationOutPut()*
- *HAL_RTCEx_SetRefClock()*
- *HAL_RTCEx_DeactivateRefClock()*
- *HAL_RTCEx_EnableBypassShadow()*
- *HAL_RTCEx_DisableBypassShadow()*
- *HAL_RTCEx_SetSSRU_IT()*
- *HAL_RTCEx_DeactivateSSRU()*
- *HAL_RTCEx_SSRUIRQHandler()*
- *HAL_RTCEx_SSRUEventCallback()*

42.2.5 Extended features functions

This section provides functions allowing to:

- RTC Alarm B callback
- RTC Poll for Alarm B request

This section contains the following APIs:

- *HAL_RTCEx_AlarmBEventCallback()*
- *HAL_RTCEx_PollForAlarmBEvent()*

42.2.6 Tamper functions

- Before calling any tamper or internal tamper function, you have to call first HAL_RTC_Init() function.
- In that one you can select to output tamper event on RTC pin.
- Enable the Tamper and configure the Tamper filter count, trigger Edge or Level according to the Tamper filter (if equal to 0 Edge else Level) value, sampling frequency, NoErase, MaskFlag, precharge or discharge and Pull-UP, timestamp using the HAL_RTCEx_SetTamper() function. You can configure Tamper with interrupt mode using HAL_RTCEx_SetTamper_IT() function.
- The default configuration of the Tamper erases the backup registers. To avoid erase, enable the NoErase field on the TAMP_TAMPCR register.
- Enable Internal Tamper and configure it with interrupt, timestamp using the HAL_RTCEx_SetInternalTamper() function.

This section contains the following APIs:

- *HAL_RTCEx_SetTamper()*
- *HAL_RTCEx_SetTamper_IT()*
- *HAL_RTCEx_DeactivateTamper()*
- *HAL_RTCEx_PollForTamperEvent()*
- *HAL_RTCEx_SetInternalTamper()*
- *HAL_RTCEx_SetInternalTamper_IT()*
- *HAL_RTCEx_DeactivateInternalTamper()*
- *HAL_RTCEx_PollForInternalTamperEvent()*
- *HAL_RTCEx_TamperIRQHandler()*
- *HAL_RTCEx_Tamper1EventCallback()*
- *HAL_RTCEx_Tamper2EventCallback()*
- *HAL_RTCEx_Tamper3EventCallback()*
- *HAL_RTCEx_Tamper4EventCallback()*
- *HAL_RTCEx_Tamper5EventCallback()*
- *HAL_RTCEx_InternalTamper3EventCallback()*
- *HAL_RTCEx_InternalTamper4EventCallback()*
- *HAL_RTCEx_InternalTamper5EventCallback()*

- *HAL_RTCEx_InternalTamper6EventCallback()*

42.2.7 Extended RTC Backup register functions

- Before calling any tamper or internal tamper function, you have to call first HAL_RTC_Init() function.
- In that ine you can select to output tamper event on RTC pin.

This subsection provides functions allowing to

- Write a data in a specified RTC Backup data register
- Read a data in a specified RTC Backup data register

This section contains the following APIs:

- *HAL_RTCEx_BKUPWrite()*
- *HAL_RTCEx_BKUPRead()*
- *HAL_RTCEx_BKUPErase()*

42.2.8 Detailed description of functions

HAL_RTCEx_SetTimeStamp

Function name

HAL_StatusTypeDef HAL_RTCEx_SetTimeStamp (RTC_HandleTypeDef * hrtc, uint32_t TimeStampEdge, uint32_t RTC_TimeStampPin)

Function description

Set TimeStamp.

Parameters

- **hrtc:** RTC handle
- **TimeStampEdge:** Specifies the pin edge on which the TimeStamp is activated. This parameter can be one of the following values:
  - RTC_TIMESTAMPEDGE_RISING: the Time stamp event occurs on the rising edge of the related pin.
  - RTC_TIMESTAMPEDGE_FALLING: the Time stamp event occurs on the falling edge of the related pin.
- **RTC_TimeStampPin:** specifies the RTC TimeStamp Pin. This parameter can be one of the following values:
  - RTC_TIMESTAMPPIN_DEFAULT: PC13 is selected as RTC TimeStamp Pin. The RTC TimeStamp Pin is per default PC13, but for reasons of compatibility, this parameter is required.

Return values

- **HAL:** status

Notes

- This API must be called before enabling the TimeStamp feature.

HAL_RTCEx_SetTimeStamp_IT

Function name

HAL_StatusTypeDef HAL_RTCEx_SetTimeStamp_IT (RTC_HandleTypeDef * hrtc, uint32_t TimeStampEdge, uint32_t RTC_TimeStampPin)

Function description

Set TimeStamp with Interrupt.

Parameters

- **hrtc:** RTC handle
- **TimeStampEdge:** Specifies the pin edge on which the TimeStamp is activated. This parameter can be one of the following values:
  - RTC_TIMESTAMPEDGE_RISING: the Time stamp event occurs on the rising edge of the related pin.
  - RTC_TIMESTAMPEDGE_FALLING: the Time stamp event occurs on the falling edge of the related pin.
- **RTC_TimeStampPin:** Specifies the RTC TimeStamp Pin. This parameter can be one of the following values:
  - RTC_TIMESTAMPPIN_DEFAULT: PC13 is selected as RTC TimeStamp Pin. The RTC TimeStamp Pin is per default PC13, but for reasons of compatibility, this parameter is required.

Return values

- **HAL:** status

Notes

- This API must be called before enabling the TimeStamp feature.

HAL_RTCEx_DeactivateTimeStamp

Function name

HAL_StatusTypeDef HAL_RTCEx_DeactivateTimeStamp (RTC_HandleTypeDef * hrtc)

Function description

Deactivate TimeStamp.

Parameters

- **hrtc:** RTC handle

Return values

- **HAL:** status

HAL_RTCEx_SetInternalTimeStamp

Function name

HAL_StatusTypeDef HAL_RTCEx_SetInternalTimeStamp (RTC_HandleTypeDef * hrtc)

Function description

Set Internal TimeStamp.

Parameters

- **hrtc:** RTC handle

Return values

- **HAL:** status

Notes

- This API must be called before enabling the internal TimeStamp feature.

HAL_RTCEx_DeactivateInternalTimeStamp

Function name

HAL_StatusTypeDef HAL_RTCEx_DeactivateInternalTimeStamp (RTC_HandleTypeDef * hrtc)

Function description

Deactivate Internal TimeStamp.

Parameters

- **hrtc:** RTC handle

Return values

- **HAL:** status

HAL_RTCEx_GetTimeStamp

Function name

HAL_StatusTypeDef HAL_RTCEx_GetTimeStamp (RTC_HandleTypeDef * hrtc, RTC_TimeTypeDef * sTimeStamp, RTC_DateTypeDef * sTimeStampDate, uint32_t Format)

Function description

Get the RTC TimeStamp value.

Parameters

- **hrtc:** RTC handle
- **sTimeStamp:** Pointer to Time structure if BinMode = RTC_BINARY_ONLY, sTimeStamp->SubSeconds only is used
- **sTimeStampDate:** Pointer to Date structure if BinMode = RTC_BINARY_ONLY, this parameter is not used.
- **Format:** specifies the format of the entered parameters. if BinMode = RTC_BINARY_ONLY, this parameter is not used else this parameter can be one of the following values
  - RTC_FORMAT_BIN: Binary data format
  - RTC_FORMAT_BCD: BCD data format

Return values

- **HAL:** status

HAL_RTCEx_TimeStampIRQHandler

Function name

void HAL_RTCEx_TimeStampIRQHandler (RTC_HandleTypeDef * hrtc)

Function description

Handle TimeStamp interrupt request.

Parameters

- **hrtc:** RTC handle

Return values

- **None:**

HAL_RTCEx_PollForTimeStampEvent

Function name

HAL_StatusTypeDef HAL_RTCEx_PollForTimeStampEvent (RTC_HandleTypeDef * hrtc, uint32_t Timeout)

Function description

Handle TimeStamp polling request.

Parameters

- **hrtc:** RTC handle
- **Timeout:** Timeout duration

Return values

- **HAL:** status

HAL_RTCEx_TimeStampEventCallback

Function name

void HAL_RTCEx_TimeStampEventCallback (RTC_HandleTypeDef * hrtc)

Function description

TimeStamp callback.

Parameters

- **hrtc:** RTC handle

Return values

- **None:**

HAL_RTCEx_SetWakeUpTimer

Function name

HAL_StatusTypeDef HAL_RTCEx_SetWakeUpTimer (RTC_HandleTypeDef * hrtc, uint32_t WakeUpCounter, uint32_t WakeUpClock)

Function description

Set wake up timer.

Parameters

- **hrtc:** RTC handle
- **WakeUpCounter:** Wake up counter
- **WakeUpClock:** Wake up clock

Return values

- **HAL:** status

HAL_RTCEx_SetWakeUpTimer_IT

Function name

HAL_StatusTypeDef HAL_RTCEx_SetWakeUpTimer_IT (RTC_HandleTypeDef * hrtc, uint32_t WakeUpCounter, uint32_t WakeUpClock, uint32_t WakeUpAutoClr)

Function description

Set wake up timer with interrupt.

Parameters

- **hrtc:** RTC handle
- **WakeUpCounter:** Wake up counter
- **WakeUpClock:** Wake up clock
- **WakeUpAutoClr:** Wake up auto clear value (look at WUTOCLR in reference manual)
  - No effect if WakeUpAutoClr is set to zero
  - This feature is meaningful in case of Low power mode to avoid any RTC software execution after Wake Up. That is why when WakeUpAutoClr is set, EXTI is configured as EVENT instead of Interrupt to avoid useless IRQ handler execution.

Return values

- **HAL:** status

HAL_RTCEx_DeactivateWakeUpTimer

Function name

HAL_StatusTypeDef HAL_RTCEx_DeactivateWakeUpTimer (RTC_HandleTypeDef * hrtc)

Function description

Deactivate wake up timer counter.

Parameters

- **hrtc:** RTC handle

Return values

- **HAL:** status

HAL_RTCEx_GetWakeUpTimer

Function name

uint32_t HAL_RTCEx_GetWakeUpTimer (RTC_HandleTypeDef * hrtc)

Function description

Get wake up timer counter.

Parameters

- **hrtc:** RTC handle

Return values

- **Counter:** value

HAL_RTCEx_WakeUpTimerIRQHandler

Function name

void HAL_RTCEx_WakeUpTimerIRQHandler (RTC_HandleTypeDef * hrtc)

Function description

Handle Wake Up Timer interrupt request.

Parameters

- **hrtc:** RTC handle

Return values

- **None:**

HAL_RTCEx_WakeUpTimerEventCallback

Function name

void HAL_RTCEx_WakeUpTimerEventCallback (RTC_HandleTypeDef * hrtc)

Function description

Wake Up Timer callback.

Parameters

- **hrtc:** RTC handle

Return values

- **None:**

HAL_RTCEx_PollForWakeUpTimerEvent

Function name

HAL_StatusTypeDef HAL_RTCEx_PollForWakeUpTimerEvent (RTC_HandleTypeDef * hrtc, uint32_t Timeout)

Function description

Handle Wake Up Timer Polling.

Parameters

- **hrtc:** RTC handle
- **Timeout:** Timeout duration

Return values

- **HAL:** status

HAL_RTCEx_SetSmoothCalib

Function name

HAL_StatusTypeDef HAL_RTCEx_SetSmoothCalib (RTC_HandleTypeDef * hrtc, uint32_t SmoothCalibPeriod, uint32_t SmoothCalibPlusPulses, uint32_t SmoothCalibMinusPulsesValue)

Function description

Set the Smooth calibration parameters.

Parameters

- **hrtc:** RTC handle
- **SmoothCalibPeriod:** Select the Smooth Calibration Period. This parameter can be one of the following values :
  - RTC_SMOOTHCALIB_PERIOD_32SEC: The smooth calibration period is 32s.
  - RTC_SMOOTHCALIB_PERIOD_16SEC: The smooth calibration period is 16s.
  - RTC_SMOOTHCALIB_PERIOD_8SEC: The smooth calibration period is 8s.
- **SmoothCalibPlusPulses:** Select to Set or reset the CALP bit. This parameter can be one of the following values:
  - RTC_SMOOTHCALIB_PLUSPULSES_SET: Add one RTCCLK pulse every 2*11 pulses.
  - RTC_SMOOTHCALIB_PLUSPULSES_RESET: No RTCCLK pulses are added.
- **SmoothCalibMinusPulsesValue:** Select the value of CALM[8:0] bits. This parameter can be one any value from 0 to 0x000001FF.

Return values

- **HAL:** status

Notes

- To deactivate the smooth calibration, the field SmoothCalibPlusPulses must be equal to SMOOTHCALIB_PLUSPULSES_RESET and the field SmoothCalibMinusPulsesValue must be equal to 0.

HAL_RTCEx_SetLowPowerCalib

Function name

HAL_StatusTypeDef HAL_RTCEx_SetLowPowerCalib (RTC_HandleTypeDef * hrtc, uint32_t LowPowerCalib)

Function description

Select the low power Calibration mode.

Parameters

- **hrtc:** RTC handle
- **LowPowerCalib:** Low power Calibration mode. This parameter can be one of the following values :
  - RTC_LPCAL_SET: Low power mode.
  - RTC_LPCAL_RESET: High consumption mode.

Return values

- **HAL:** status

HAL_RTCEx_SetSynchroShift

Function name

HAL_StatusTypeDef HAL_RTCEx_SetSynchroShift (RTC_HandleTypeDef * hrtc, uint32_t ShiftAdd1S, uint32_t ShiftSubFS)

Function description

Configure the Synchronization Shift Control Settings.

Parameters

- **hrtc:** RTC handle
- **ShiftAdd1S:** Select to add or not 1 second to the time calendar. This parameter can be one of the following values:
  - RTC_SHIFTADD1S_SET: Add one second to the clock calendar.
  - RTC_SHIFTADD1S_RESET: No effect.
- **ShiftSubFS:** Select the number of Second Fractions to substitute. This parameter can be one any value from 0 to 0x7FFF.

Return values

- **HAL:** status

Notes

- When REFCKON is set, firmware must not write to Shift control register.

HAL_RTCEx_SetCalibrationOutPut

Function name

HAL_StatusTypeDef HAL_RTCEx_SetCalibrationOutPut (RTC_HandleTypeDef * hrtc, uint32_t CalibOutput)

Function description

Configure the Calibration Pinout (RTC_CALIB) Selection (1Hz or 512Hz).

Parameters

- **hrtc:** RTC handle
- **CalibOutput:** Select the Calibration output Selection . This parameter can be one of the following values:
  - RTC_CALIBOUTPUT_512HZ: A signal has a regular waveform at 512Hz.
  - RTC_CALIBOUTPUT_1HZ: A signal has a regular waveform at 1Hz.

Return values

- **HAL:** status

HAL_RTCEx_DeactivateCalibrationOutPut

Function name

HAL_StatusTypeDef HAL_RTCEx_DeactivateCalibrationOutPut (RTC_HandleTypeDef * hrtc)

Function description

Deactivate the Calibration Pinout (RTC_CALIB) Selection (1Hz or 512Hz).

Parameters

- **hrtc:** RTC handle

Return values

- **HAL:** status

HAL_RTCEx_SetRefClock

Function name

HAL_StatusTypeDef HAL_RTCEx_SetRefClock (RTC_HandleTypeDef * hrtc)

Function description

Enable the RTC reference clock detection.

Parameters

- **hrtc:** RTC handle

Return values

- **HAL:** status

HAL_RTCEx_DeactivateRefClock

Function name

HAL_StatusTypeDef HAL_RTCEx_DeactivateRefClock (RTC_HandleTypeDef * hrtc)

Function description

Disable the RTC reference clock detection.

Parameters

- **hrtc:** RTC handle

Return values

- **HAL:** status

HAL_RTCEx_EnableBypassShadow

Function name

HAL_StatusTypeDef HAL_RTCEx_EnableBypassShadow (RTC_HandleTypeDef * hrtc)

Function description

Enable the Bypass Shadow feature.

Parameters

- **hrtc:** RTC handle

Return values

- **HAL:** status

Notes

- When the Bypass Shadow is enabled the calendar value are taken directly from the Calendar counter.

HAL_RTCEx_DisableBypassShadow

Function name

HAL_StatusTypeDef HAL_RTCEx_DisableBypassShadow (RTC_HandleTypeDef * hrtc)

Function description

Disable the Bypass Shadow feature.

Parameters

- **hrtc:** RTC handle

Return values

- **HAL:** status

Notes

- When the Bypass Shadow is enabled the calendar value are taken directly from the Calendar counter.

HAL_RTCEx_SetSSRU_IT

Function name

HAL_StatusTypeDef HAL_RTCEx_SetSSRU_IT (RTC_HandleTypeDef * hrtc)

Function description

Set SSR Underflow detection with Interrupt.

Parameters

- **hrtc:** RTC handle

Return values

- **HAL:** status

HAL_RTCEx_DeactivateSSRU

Function name

HAL_StatusTypeDef HAL_RTCEx_DeactivateSSRU (RTC_HandleTypeDef * hrtc)

Function description

Deactivate SSR Underflow.

Parameters

- **hrtc:** RTC handle

Return values

- **HAL:** status

HAL_RTCEx_SSRUIRQHandler

Function name

void HAL_RTCEx_SSRUIRQHandler (RTC_HandleTypeDef * hrtc)

Function description

Handle SSR underflow interrupt request.

Parameters

- **hrtc:** RTC handle

Return values

- **None:**

HAL_RTCEx_SSRUEventCallback

Function name

void HAL_RTCEx_SSRUEventCallback (RTC_HandleTypeDef * hrtc)

Function description

SSR underflow callback.

Parameters

- **hrtc:** RTC handle

Return values

- **None:**

HAL_RTCEx_AlarmBEventCallback

Function name

void HAL_RTCEx_AlarmBEventCallback (RTC_HandleTypeDef * hrtc)

Function description

Alarm B callback.

Parameters

- **hrtc:** RTC handle

Return values

- **None:**

HAL_RTCEx_PollForAlarmBEvent

Function name

HAL_StatusTypeDef HAL_RTCEx_PollForAlarmBEvent (RTC_HandleTypeDef * hrtc, uint32_t Timeout)

Function description

Handle Alarm B Polling request.

Parameters

- **hrtc:** RTC handle
- **Timeout:** Timeout duration

Return values

- **HAL:** status

HAL_RTCEx_SetTamper

Function name

HAL_StatusTypeDef HAL_RTCEx_SetTamper (RTC_HandleTypeDef * hrtc, RTC_TamperTypeDef * sTamper)

Function description

Set Tamper.

Parameters

- **hrtc:** RTC handle
- **sTamper:** Pointer to Tamper Structure.

Return values

- **HAL:** status

HAL_RTCEx_SetTamper_IT

Function name

HAL_StatusTypeDef HAL_RTCEx_SetTamper_IT (RTC_HandleTypeDef * hrtc, RTC_TamperTypeDef * sTamper)

Function description

Set Tamper in IT mode.

Parameters

- **hrtc:** RTC handle
- **sTamper:** Pointer to Tamper Structure.

Return values

- **HAL:** status

HAL_RTCEx_DeactivateTamper

Function name

HAL_StatusTypeDef HAL_RTCEx_DeactivateTamper (RTC_HandleTypeDef * hrtc, uint32_t Tamper)

Function description

Deactivate Tamper.

Parameters

- **hrtc:** RTC handle
- **Tamper:** Selected tamper pin. This parameter can be a combination of the following values:
  - RTC_TAMPER_1
  - RTC_TAMPER_2
  - RTC_TAMPER_3
  - RTC_TAMPER_4
  - RTC_TAMPER_5

Return values

- **HAL:** status

HAL_RTCEx_PollForTamperEvent

Function name

HAL_StatusTypeDef HAL_RTCEx_PollForTamperEvent (RTC_HandleTypeDef * hrtc, uint32_t Tamper, uint32_t Timeout)

Function description

Tamper event polling.

Parameters

- **hrtc:** RTC handle
- **Tamper:** Selected tamper pin. This parameter can be a combination of the following values:
  - RTC_TAMPER_1
  - RTC_TAMPER_2
  - RTC_TAMPER_3
  - RTC_TAMPER_4
  - RTC_TAMPER_5
- **Timeout:** Timeout duration

Return values

- **HAL:** status

HAL_RTCEx_SetInternalTamper

Function name

HAL_StatusTypeDef HAL_RTCEx_SetInternalTamper (RTC_HandleTypeDef * hrtc, RTC_InternalTamperTypeDef * sIntTamper)

Function description

Set Internal Tamper.

Parameters

- **hrtc:** RTC handle
- **sIntTamper:** Pointer to Internal Tamper Structure.

Return values

- **HAL:** status

HAL_RTCEx_SetInternalTamper_IT

Function name

HAL_StatusTypeDef HAL_RTCEx_SetInternalTamper_IT (RTC_HandleTypeDef * hrtc, RTC_InternalTamperTypeDef * sIntTamper)

Function description

Set Internal Tamper in interrupt mode.

Parameters

- **hrtc:** RTC handle
- **sIntTamper:** Pointer to Internal Tamper Structure.

Return values

- **HAL:** status

HAL_RTCEx_DeactivateInternalTamper

Function name

HAL_StatusTypeDef HAL_RTCEx_DeactivateInternalTamper (RTC_HandleTypeDef * hrtc, uint32_t IntTamper)

Function description

Deactivate Internal Tamper.

Parameters

- **hrtc:** RTC handle
- **IntTamper:** Selected internal tamper event. This parameter can be any combination of existing internal tampers.

Return values

- **HAL:** status

HAL_RTCEx_PollForInternalTamperEvent

Function name

HAL_StatusTypeDef HAL_RTCEx_PollForInternalTamperEvent (RTC_HandleTypeDef * hrtc, uint32_t IntTamper, uint32_t Timeout)

Function description

Internal Tamper event polling.

Parameters

- **hrtc:** RTC handle
- **IntTamper:** selected tamper. This parameter can be any combination of existing internal tampers.
- **Timeout:** Timeout duration

Return values

- **HAL:** status

HAL_RTCEx_TamperIRQHandler

Function name

void HAL_RTCEx_TamperIRQHandler (RTC_HandleTypeDef * hrtc)

Function description

Handle Tamper interrupt request.

Parameters

- **hrtc:** RTC handle

Return values

- **None:**

HAL_RTCEx_Tamper1EventCallback

Function name

void HAL_RTCEx_Tamper1EventCallback (RTC_HandleTypeDef * hrtc)

Function description

Tamper 1 callback.

Parameters

- **hrtc:** RTC handle

Return values

- **None:**

HAL_RTCEx_Tamper2EventCallback

Function name

void HAL_RTCEx_Tamper2EventCallback (RTC_HandleTypeDef * hrtc)

Function description

Tamper 2 callback.

Parameters

- **hrtc:** RTC handle

Return values

- **None:**

HAL_RTCEx_Tamper3EventCallback

Function name

void HAL_RTCEx_Tamper3EventCallback (RTC_HandleTypeDef * hrtc)

Function description

Tamper 3 callback.

Parameters

- **hrtc:** RTC handle

Return values

- **None:**

HAL_RTCEx_Tamper4EventCallback

Function name

void HAL_RTCEx_Tamper4EventCallback (RTC_HandleTypeDef * hrtc)

Function description

Tamper 4 callback.

Parameters

- **hrtc:** RTC handle

Return values

- **None:**

HAL_RTCEx_Tamper5EventCallback

Function name

void HAL_RTCEx_Tamper5EventCallback (RTC_HandleTypeDef * hrtc)

Function description

Tamper 5 callback.

Parameters

- **hrtc:** RTC handle

Return values

- **None:**

HAL_RTCEx_InternalTamper3EventCallback

Function name

void HAL_RTCEx_InternalTamper3EventCallback (RTC_HandleTypeDef * hrtc)

Function description

Internal Tamper 3 callback.

Parameters

- **hrtc:** RTC handle

Return values

- **None:**

HAL_RTCEx_InternalTamper4EventCallback

Function name

void HAL_RTCEx_InternalTamper4EventCallback (RTC_HandleTypeDef * hrtc)

Function description

Internal Tamper 4 callback.

Parameters

- **hrtc:** RTC handle

Return values

- **None:**

HAL_RTCEx_InternalTamper5EventCallback

Function name

void HAL_RTCEx_InternalTamper5EventCallback (RTC_HandleTypeDef * hrtc)

Function description

Internal Tamper 5 callback.

Parameters

- **hrtc:** RTC handle

Return values

- **None:**

HAL_RTCEx_InternalTamper6EventCallback

Function name

void HAL_RTCEx_InternalTamper6EventCallback (RTC_HandleTypeDef * hrtc)

Function description

Internal Tamper 6 callback.

Parameters

- **hrtc:** RTC handle

Return values

- **None:**

HAL_RTCEx_BKUPWrite

Function name

void HAL_RTCEx_BKUPWrite (RTC_HandleTypeDef * hrtc, uint32_t BackupRegister, uint32_t Data)

Function description

Write a data in a specified RTC Backup data register.

Parameters

- **hrtc:** RTC handle
- **BackupRegister:** RTC Backup data Register number. This parameter can be RTC_BKP_DRx where x can be from 0 to RTC_BACKUP_NB
- **Data:** Data to be written in the specified Backup data register.

Return values

- **None:**

HAL_RTCEx_BKUPRead

Function name

uint32_t HAL_RTCEx_BKUPRead (RTC_HandleTypeDef * hrtc, uint32_t BackupRegister)

Function description

Reads data from the specified RTC Backup data Register.

Parameters

- **hrtc:** RTC handle
- **BackupRegister:** RTC Backup data Register number. This parameter can be RTC_BKP_DRx where x can be from 0 to RTC_BACKUP_NB

Return values

- **Read:** value

HAL_RTCEx_BKUPErase

Function name

void HAL_RTCEx_BKUPErase (RTC_HandleTypeDef * hrtc)

Function description

Reset the RTC Backup data Register and the device secrets.

Parameters

- **hrtc:** RTC handle

Return values

- **None:**

42.3 RTCEx Firmware driver defines

The following section lists the various define and macros of the module.

42.3.1 RTCEx

RTCEx

RTCEx Add 1 Second Parameter Definitions

RTC_SHIFTADD1S_RESET

RTC_SHIFTADD1S_SET

RTC Alarm Sub Seconds with binary mode auto clear

RTC_ALARMSUBSECONDBIN_AUTOCLR_NO

The synchronous Binary counter (SS[31:0] in RTC_SSR) is free-running.

RTC_ALARMSUBSECONDBIN_AUTOCLR_YES

The synchronous Binary counter (SS[31:0] in RTC_SSR) is running from 0xFFFFFFFF to RTC_ALRMABINR -> SS[31:0] value and is automatically reloaded with 0xFFFFFFFF whenreaching RTC_ALRMABINR -> SS[31:0].

RTC Alarm Sub Seconds with binary mode Masks Definitions

RTC_ALARMSUBSECONDBINMASK_ALL

All Alarm SS fields are masked. There is no comparison on sub seconds for Alarm

RTC_ALARMSUBSECONDBINMASK_SS31_1

SS[31:1] are don't care in Alarm comparison.Only SS[0] is compared

RTC_ALARMSUBSECONDBINMASK_SS31_2

SS[31:2] are don't care in Alarm comparison.Only SS[1:0] are compared

RTC_ALARMSUBSECONDBINMASK_SS31_3

SS[31:3] are don't care in Alarm comparison.Only SS[2:0] are compared

RTC_ALARMSUBSECONDBINMASK_SS31_4

SS[31:4] are don't care in Alarm comparison.Only SS[3:0] are compared

RTC_ALARMSUBSECONDBINMASK_SS31_5

SS[31:5] are don't care in Alarm comparison.Only SS[4:0] are compared

RTC_ALARMSUBSECONDBINMASK_SS31_6

SS[31:6] are don't care in Alarm comparison.Only SS[5:0] are compared

RTC_ALARMSUBSECONDBINMASK_SS31_7

SS[31:7] are don't care in Alarm comparison.Only SS[6:0] are compared

RTC_ALARMSUBSECONDBINMASK_SS31_8

SS[31:8] are don't care in Alarm comparison.Only SS[7:0] are compared

RTC_ALARMSUBSECONDBINMASK_SS31_9

SS[31:9] are don't care in Alarm comparison.Only SS[8:0] are compared

RTC_ALARMSUBSECONDBINMASK_SS31_10

SS[31:10] are don't care in Alarm comparison.Only SS[9:0] are compared

RTC_ALARMSUBSECONDBINMASK_SS31_11

SS[31:11] are don't care in Alarm comparison.Only SS[10:0] are compared

RTC_ALARMSUBSECONDBINMASK_SS31_12

SS[31:12] are don't care in Alarm comparison.Only SS[11:0] are compared

RTC_ALARMSUBSECONDBINMASK_SS31_13

SS[31:13] are don't care in Alarm comparison.Only SS[12:0] are compared

RTC_ALARMSUBSECONDBINMASK_SS31_14

SS[31:14] are don't care in Alarm comparison.Only SS[13:0] are compared

RTC_ALARMSUBSECONDBINMASK_SS31_15

SS[31:15] are don't care in Alarm comparison.Only SS[14:0] are compared

RTC_ALARMSUBSECONDBINMASK_SS31_16

SS[31:16] are don't care in Alarm comparison.Only SS[15:0] are compared

RTC_ALARMSUBSECONDBINMASK_SS31_17

SS[31:17] are don't care in Alarm comparison.Only SS[16:0] are compared

RTC_ALARMSUBSECONDBINMASK_SS31_18

SS[31:18] are don't care in Alarm comparison.Only SS[17:0] are compared

RTC_ALARMSUBSECONDBINMASK_SS31_19

SS[31:19] are don't care in Alarm comparison.Only SS[18:0] are compared

RTC_ALARMSUBSECONDBINMASK_SS31_20

SS[31:20] are don't care in Alarm comparison.Only SS[19:0] are compared

RTC_ALARMSUBSECONDBINMASK_SS31_21

SS[31:21] are don't care in Alarm comparison.Only SS[20:0] are compared

RTC_ALARMSUBSECONDBINMASK_SS31_22

SS[31:22] are don't care in Alarm comparison.Only SS[21:0] are compared

RTC_ALARMSUBSECONDBINMASK_SS31_23

SS[31:23] are don't care in Alarm comparison.Only SS[22:0] are compared

RTC_ALARMSUBSECONDBINMASK_SS31_24

SS[31:24] are don't care in Alarm comparison.Only SS[23:0] are compared

RTC_ALARMSUBSECONDBINMASK_SS31_25

SS[31:25] are don't care in Alarm comparison.Only SS[24:0] are compared

RTC_ALARMSUBSECONDBINMASK_SS31_26

SS[31:26] are don't care in Alarm comparison.Only SS[25:0] are compared

RTC_ALARMSUBSECONDBINMASK_SS31_27

SS[31:27] are don't care in Alarm comparison.Only SS[26:0] are compared

RTC_ALARMSUBSECONDBINMASK_SS31_28

SS[31:28] are don't care in Alarm comparison.Only SS[27:0] are compared

RTC_ALARMSUBSECONDBINMASK_SS31_29

SS[31:29] are don't care in Alarm comparison.Only SS[28:0] are compared

RTC_ALARMSUBSECONDBINMASK_SS31_30

SS[31:30] are don't care in Alarm comparison.Only SS[29:0] are compared

RTC_ALARMSUBSECONDBINMASK_SS31

SS[31] is don't care in Alarm comparison.Only SS[30:0] are compared

RTC_ALARMSUBSECONDBINMASK_NONE

SS[31:0] are compared and must match to activate alarm.

RTCEx Backup Registers Definition

RTC_BKP_NB

RTC_BKP_NUMBER

RTC_BKP_DR0

RTC_BKP_DR1

RTC_BKP_DR2

RTC_BKP_DR3

RTC_BKP_DR4

RTC_BKP_DR5

RTC_BKP_DR6

RTC_BKP_DR7

RTC_BKP_DR8

If Binary mode is RTC_BINARY_MIX, the BCD calendar second is incremented using the

RTC_BINARY_MIX_BCDU_0

The 1s BCD calendar increment is generated each time SS[7:0] = 0

RTC_BINARY_MIX_BCDU_1

The 1s BCD calendar increment is generated each time SS[8:0] = 0

RTC_BINARY_MIX_BCDU_2

The 1s BCD calendar increment is generated each time SS[9:0] = 0

RTC_BINARY_MIX_BCDU_3

The 1s BCD calendar increment is generated each time SS[10:0] = 0

RTC_BINARY_MIX_BCDU_4

The 1s BCD calendar increment is generated each time SS[11:0] = 0

RTC_BINARY_MIX_BCDU_5

The 1s BCD calendar increment is generated each time SS[12:0] = 0

RTC_BINARY_MIX_BCDU_6

The 1s BCD calendar increment is generated each time SS[13:0] = 0

RTC_BINARY_MIX_BCDU_7

The 1s BCD calendar increment is generated each time SS[14:0] = 0

RTC Binary Mode (32-bit free-running counter configuration).

RTC_BINARY_NONE

Free running BCD calendar mode (Binary mode disabled)

RTC_BINARY_ONLY

Free running Binary mode (BCD mode disabled)

RTC_BINARY_MIX

Free running BCD calendar and Binary modes

RTC Calibration

__HAL_RTC_CALIBRATION_OUTPUT_ENABLE

Description:

- Enable the RTC calibration output.

Parameters:

- __HANDLE__: specifies the RTC handle.

Return value:

- None

__HAL_RTC_CALIBRATION_OUTPUT_DISABLE

Description:

- Disable the calibration output.

Parameters:

- __HANDLE__: specifies the RTC handle.

Return value:

- None

__HAL_RTC_CLOCKREF_DETECTION_ENABLE

Description:

- Enable the clock reference detection.

Parameters:

- __HANDLE__: specifies the RTC handle.

Return value:

- None

__HAL_RTC_CLOCKREF_DETECTION_DISABLE

Description:

- Disable the clock reference detection.

Parameters:

- __HANDLE__: specifies the RTC handle.

Return value:

- None

__HAL_RTC_SHIFT_GET_FLAG

Description:

- Get the selected RTC shift operations flag status.

Parameters:

- __HANDLE__: specifies the RTC handle.
- __FLAG__: specifies the RTC shift operation Flag is pending or not. This parameter can be:
  - RTC_FLAG_SHPF

Return value:

- The: state of __FLAG__ (TRUE or FALSE).

RTCEx Calib Output selection Definitions

RTC_CALIBOUTPUT_512HZ

RTC_CALIBOUTPUT_1HZ

RTCEx Exported Macros

__HAL_RTC_CLEAR_FLAG

Description:

- Clear the specified RTC pending flag.

Parameters:

- __HANDLE__: specifies the RTC Handle.
- __FLAG__: specifies the flag to check. This parameter can be any combination of the following values:
  - RTC_CLEAR_ITSF Clear Internal Time-stamp flag
  - RTC_CLEAR_TSOVF Clear Time-stamp overflow flag
  - RTC_CLEAR_TSF Clear Time-stamp flag
  - RTC_CLEAR_WUTF Clear Wakeup timer flag
  - RTC_CLEAR_ALRBF Clear Alarm B flag
  - RTC_CLEAR_ALRAF Clear Alarm A flag
  - RTC_CLEAR_SSRUF Clear SSR underflow flag"

Return value:

- None

__HAL_RTC_GET_FLAG

Description:

- Check whether the specified RTC flag is set or not.

Parameters:

- __HANDLE__: specifies the RTC Handle.
- __FLAG__: specifies the flag to check. This parameter can be any combination of the following values:
  - RTC_FLAG_RECALPF Recalibration pending Flag
  - RTC_FLAG_INITF Initialization flag
  - RTC_FLAG_RSF Registers synchronization flag
  - RTC_FLAG_INITS Initialization status flag
  - RTC_FLAG_SHPF Shift operation pending flag
  - RTC_FLAG_WUTWF Wakeup timer write flag
  - RTC_FLAG_ITSF Internal Time-stamp flag
  - RTC_FLAG_TSOVF Time-stamp overflow flag
  - RTC_FLAG_TSF Time-stamp flag
  - RTC_FLAG_WUTF Wakeup timer flag
  - RTC_FLAG_ALRBF Alarm B flag
  - RTC_FLAG_ALRAF Alarm A flag

Return value:

- The: state of __FLAG__ (TRUE or FALSE).

RTCEx Flags

RTC_FLAG_TAMP_1

RTC_FLAG_TAMP_2

RTC_FLAG_TAMP_3

RTC_FLAG_TAMP_4

RTC_FLAG_TAMP_5

RTC_FLAG_TAMP_ALL

RTC_FLAG_INT_TAMP_3

RTC_FLAG_INT_TAMP_4

RTC_FLAG_INT_TAMP_5

RTC_FLAG_INT_TAMP_6

RTC_FLAG_INT_TAMP_ALL

RTCEx Internal Tamper Interrupt

RTC_IT_TAMP_1

Tamper 1 Interrupt

RTC_IT_TAMP_2

Tamper 2 Interrupt

RTC_IT_TAMP_3

Tamper 3 Interrupt

RTC_IT_TAMP_4

Tamper 4 Interrupt

RTC_IT_TAMP_5

Tamper 5 Interrupt

RTC_IT_TAMP_ALL

RTC_IT_INT_TAMP_3

Tamper 3 internal Interrupt

RTC_IT_INT_TAMP_4

Tamper 4 internal Interrupt

RTC_IT_INT_TAMP_5

Tamper 5 internal Interrupt

RTC_IT_INT_TAMP_6

Tamper 6 internal Interrupt

RTC_IT_INT_TAMP_ALL

RTCEx Internal Tamper Pins Definition

RTC_INT_TAMPER_3

RTC_INT_TAMPER_4

RTC_INT_TAMPER_5

RTC_INT_TAMPER_6

RTC_INT_TAMPER_ALL

Private macros to check input parameters

IS_TIMESTAMP_EDGE

IS_RTC_TIMESTAMP_PIN

IS_RTC_TIMESTAMPONTAMPER_DETECTION

IS_RTC_TAMPER_TAMPERDETECTIONOUTPUT

IS_RTC_WAKEUP_CLOCK

IS_RTC_WAKEUP_COUNTER

IS_RTC_SMOOTH_CALIB_PERIOD

IS_RTC_SMOOTH_CALIB_PLUS

IS_RTC_SMOOTH_CALIB_MINUS

IS_RTC_LOW_POWER_CALIB

IS_RTC_TAMPER

IS_RTC_INTERNAL_TAMPER

IS_RTC_TAMPER_TRIGGER

IS_RTC_TAMPER_ERASE_MODE

IS_RTC_TAMPER_MASKFLAG_STATE

IS_RTC_TAMPER_FILTER

IS_RTC_TAMPER_SAMPLING_FREQ

IS_RTC_TAMPER_PRECHARGE_DURATION

IS_RTC_TAMPER_PULLUP_STATE

IS_RTC_TAMPER_TIMESTAMPONTAMPER_DETECTION

IS_RTC_BKP

IS_RTC_SHIFT_ADD1S

IS_RTC_SHIFT_SUBFS

IS_RTC_CALIB_OUTPUT

IS_RTC_BINARY_MODE

IS_RTC_BINARY_MIX_BCDU

IS_RTC_ALARM_SUB_SECOND_BINARY_MASK

IS_RTC_ALARMSUBSECONDBIN_AUTOCLR

RTCEx Output Selection Definition

RTC_OUTPUT_DISABLE

RTC_OUTPUT_ALARMA

RTC_OUTPUT_ALARMB

RTC_OUTPUT_WAKEUP

RTC_OUTPUT_TAMPER

RTCEx Smooth calib Low Power Definitions

RTC_LPCAL_SET

Calibration window is 220 ck_apre, which is the required configuration for ultra-low consumption mode.

RTC_LPCAL_RESET

Calibration window is 220 RTCCLK, which is a high-consumption mode. This mode should be set only when less than 32s calibration window is required.

RTCEx Smooth calib period Definitions

RTC_SMOOTHCALIB_PERIOD_32SEC

If RTCCLK = 32768 Hz, Smooth calibration period is 32s, else 2exp20 RTCCLK pulses

RTC_SMOOTHCALIB_PERIOD_16SEC

If RTCCLK = 32768 Hz, Smooth calibration period is 16s, else 2exp19 RTCCLK pulses

RTC_SMOOTHCALIB_PERIOD_8SEC

If RTCCLK = 32768 Hz, Smooth calibration period is 8s, else 2exp18 RTCCLK pulses

RTCEx Smooth calib Plus pulses Definitions

RTC_SMOOTHCALIB_PLUSPULSES_SET

The number of RTCCLK pulses added during a X -second window = Y - CALM[8:0] with Y = 512, 256, 128 when X = 32, 16, 8

RTC_SMOOTHCALIB_PLUSPULSES_RESET

The number of RTCCLK pulses subbstited during a 32-second window = CALM[8:0]

RTC SSR Underflow

__HAL_RTC_SSRU_ENABLE_IT

Description:

- Enable the RTC SSRU interrupt.

Parameters:

- __HANDLE__: specifies the RTC handle.
- __INTERRUPT__: specifies the RTC SSRU interrupt sources to be enabled. This parameter can be:
  - RTC_IT_SSRU SSRU interrupt

Return value:

- None

__HAL_RTC_SSRU_DISABLE_IT

Description:

- Disable the RTC SSRU interrupt.

Parameters:

- __HANDLE__: specifies the RTC handle.
- __INTERRUPT__: specifies the RTC SSRU interrupt sources to be disabled. This parameter can be:
  - RTC_IT_SSRU SSRU interrupt

Return value:

- None

__HAL_RTC_SSRU_GET_IT

Description:

- Check whether the specified RTC SSRU interrupt has occurred or not.

Parameters:

- __HANDLE__: specifies the RTC handle.
- __INTERRUPT__: specifies the RTC SSRU interrupt to check. This parameter can be:
  - RTC_IT_SSRU SSRU interrupt

Return value:

- The: state of __FLAG__ (TRUE or FALSE).

__HAL_RTC_SSRU_GET_IT_SOURCE

Description:

- Check whether the specified RTC Wake Up timer interrupt has been enabled or not.

Parameters:

- __HANDLE__: specifies the RTC handle.
- __INTERRUPT__: specifies the RTC Wake Up timer interrupt sources to check. This parameter can be:
  - RTC_IT_SSRU SSRU interrupt

Return value:

- The: state of __FLAG__ (TRUE or FALSE).

__HAL_RTC_SSRU_GET_FLAG

Description:

- Get the selected RTC SSRU's flag status.

Parameters:

- __HANDLE__: specifies the RTC handle.
- __FLAG__: specifies the RTC SSRU Flag is pending or not. This parameter can be:
  - RTC_FLAG_SSRUF

Return value:

- The: state of __FLAG__ (TRUE or FALSE).

__HAL_RTC_SSRU_CLEAR_FLAG

Description:

- Clear the RTC Wake Up timer's pending flags.

Parameters:

- __HANDLE__: specifies the RTC handle.
- __FLAG__: specifies the RTC SSRU Flag to clear. This parameter can be:
  - RTC_FLAG_SSRUF

Return value:

- None

__HAL_RTC_SSRU_EXTI_ENABLE_IT

Description:

- Enable interrupt on the RTC SSR Underflow associated Exti line.

Return value:

- None

__HAL_RTC_SSRU_EXTI_DISABLE_IT

Description:

- Disable interrupt on the RTC SSR Underflow associated Exti line.

Return value:

- None

__HAL_RTC_SSRU_EXTI_ENABLE_EVENT

Description:

- Enable event on the RTC SSR Underflow associated Exti line.

Return value:

- None

__HAL_RTC_SSRU_EXTI_DISABLE_EVENT

Description:

- Disable event on the RTC SSR Underflow associated Exti line.

Return value:

- None

RTCEx tamper

__HAL_RTC_TAMPER_ENABLE

Description:

- Enable the TAMP Tamper input detection.

Parameters:

- __HANDLE__: specifies the RTC handle.
- __TAMPER__: specifies the RTC Tamper source to be enabled. This parameter can be any combination of the following values:
  - RTC_TAMPER_ALL: All tampers
  - RTC_TAMPER_1: Tamper1
  - RTC_TAMPER_2: Tamper2
  - RTC_TAMPER_3: Tamper3
  - RTC_TAMPER_4: Tamper4
  - RTC_TAMPER_5: Tamper5

Return value:

- None

__HAL_RTC_TAMPER_DISABLE

Description:

- Disable the TAMP Tamper input detection.

Parameters:

- __HANDLE__: specifies the RTC handle.
- __TAMPER__: specifies the RTC Tamper sources to be enabled. This parameter can be any combination of the following values:
  - RTC_TAMPER_ALL: All tampers
  - RTC_TAMPER_1: Tamper1
  - RTC_TAMPER_2: Tamper2
  - RTC_TAMPER_3: Tamper3
  - RTC_TAMPER_4: Tamper4
  - RTC_TAMPER_5: Tamper5

__HAL_RTC_TAMPER_ENABLE_IT

Description:

- Enable the TAMP Tamper interrupt.

Parameters:

- __HANDLE__: specifies the RTC handle.
- __INTERRUPT__: specifies the RTC Tamper interrupt sources to be enabled. This parameter can be any combination of the following values:
  - RTC_IT_TAMP_ALL: All tampers interrupts
  - RTC_IT_TAMP_1: Tamper1 interrupt
  - RTC_IT_TAMP_2: Tamper2 interrupt
  - RTC_IT_TAMP_3: Tamper3 interrupt
  - RTC_IT_TAMP_4: Tamper4 interrupt
  - RTC_IT_TAMP_5: Tamper5 interrupt

Return value:

- None

__HAL_RTC_TAMPER_DISABLE_IT

Description:

- Disable the TAMP Tamper interrupt.

Parameters:

- __HANDLE__: specifies the RTC handle.
- __INTERRUPT__: specifies the RTC Tamper interrupt sources to be disabled. This parameter can be any combination of the following values:
  - RTC_IT_TAMP_ALL: All tampers interrupts
  - RTC_IT_TAMP_1: Tamper1 interrupt
  - RTC_IT_TAMP_2: Tamper2 interrupt
  - RTC_IT_TAMP_3: Tamper3 interrupt
  - RTC_IT_TAMP_4: Tamper4 interrupt
  - RTC_IT_TAMP_5: Tamper5 interrupt

Return value:

- None

__HAL_RTC_TAMPER_GET_IT

Description:

- Check whether the specified RTC Tamper interrupt has occurred or not.

Parameters:

- __HANDLE__: specifies the RTC handle.
- __INTERRUPT__: specifies the RTC Tamper interrupt to check. This parameter can be:
  - RTC_IT_TAMP_ALL: All tampers interrupts
  - RTC_IT_TAMP_1: Tamper1 interrupt
  - RTC_IT_TAMP_2: Tamper2 interrupt
  - RTC_IT_TAMP_3: Tamper3 interrupt
  - RTC_IT_TAMP_4: Tamper4 interrupt
  - RTC_IT_TAMP_5: Tamper5 interrupt
  - RTC_IT_INT_TAMP_ALL: All Internal Tamper interrupts
  - RTC_IT_INT_TAMP_3: Internal Tamper3 interrupt
  - RTC_IT_INT_TAMP_4: Internal Tamper4 interrupt
  - RTC_IT_INT_TAMP_5: Internal Tamper5 interrupt
  - RTC_IT_INT_TAMP_6: Internal Tamper6 interrupt

Return value:

- The: state of __FLAG__ (TRUE or FALSE).

__HAL_RTC_TAMPER_GET_IT_SOURCE

Description:

- Check whether the specified RTC Tamper interrupt has been enabled or not.

Parameters:

- __HANDLE__: specifies the RTC handle.
- __INTERRUPT__: specifies the RTC Tamper interrupt source to check. This parameter can be:
  - RTC_IT_TAMP_ALL: All tampers interrupts
  - RTC_IT_TAMP_1: Tamper1 interrupt
  - RTC_IT_TAMP_2: Tamper2 interrupt
  - RTC_IT_TAMP_3: Tamper3 interrupt
  - RTC_IT_TAMP_4: Tamper4 interrupt
  - RTC_IT_TAMP_5: Tamper5 interrupt
  - RTC_IT_INT_TAMP_ALL: All internal tampers interrupts
  - RTC_IT_INT_TAMP_3: Internal Tamper3 interrupt
  - RTC_IT_INT_TAMP_4: Internal Tamper4 interrupt
  - RTC_IT_INT_TAMP_5: Internal Tamper5 interrupt
  - RTC_IT_INT_TAMP_6: Internal Tamper6 interrupt

Return value:

- The: state of __FLAG__ (TRUE or FALSE).

__HAL_RTC_TAMPER_GET_FLAG

Description:

- Get the selected RTC Tampers flag status.

Parameters:

- __HANDLE__: specifies the RTC handle.
- __FLAG__: specifies the RTC Tamper Flag is pending or not. This parameter can be:
  - RTC_FLAG_TAMP_ALL: All tampers flag
  - RTC_FLAG_TAMP_1: Tamper1 flag
  - RTC_FLAG_TAMP_2: Tamper2 flag
  - RTC_FLAG_TAMP_3: Tamper3 flag
  - RTC_FLAG_TAMP_4: Tamper4 flag
  - RTC_FLAG_TAMP_5: Tamper5 flag
  - RTC_FLAG_INT_TAMP_3: Internal Tamper3 flag
  - RTC_FLAG_INT_TAMP_4: Internal Tamper4 flag
  - RTC_FLAG_INT_TAMP_5: Internal Tamper5 flag
  - RTC_FLAG_INT_TAMP_6: Internal Tamper6 flag

Return value:

- The: state of __FLAG__ (TRUE or FALSE).

__HAL_RTC_TAMPER_CLEAR_FLAG

Description:

- Clear the RTC Tamper's pending flags.

Parameters:

- __HANDLE__: specifies the RTC handle.
- __FLAG__: specifies the RTC Tamper Flag to clear. This parameter can be:
  - RTC_FLAG_TAMP_ALL: All tampers flag
  - RTC_FLAG_TAMP_1: Tamper1 flag
  - RTC_FLAG_TAMP_2: Tamper2 flag
  - RTC_FLAG_TAMP_3: Tamper3 flag
  - RTC_FLAG_TAMP_4: Tamper4 flag
  - RTC_FLAG_TAMP_5: Tamper5 flag
  - RTC_FLAG_TAMP_6: Tamper6 flag
  - RTC_FLAG_TAMP_7: Tamper7 flag
  - RTC_FLAG_TAMP_8: Tamper8 flag
  - RTC_FLAG_INT_TAMP_ALL: All Internal Tamper flags
  - RTC_FLAG_INT_TAMP_1: Internal Tamper1 flag
  - RTC_FLAG_INT_TAMP_2: Internal Tamper2 flag
  - RTC_FLAG_INT_TAMP_3: Internal Tamper3 flag
  - RTC_FLAG_INT_TAMP_5: Internal Tamper5 flag
  - RTC_FLAG_INT_TAMP_6: Internal Tamper6 flag
  - RTC_FLAG_INT_TAMP_7: Internal Tamper7 flag
  - RTC_FLAG_INT_TAMP_8: Internal Tamper8 flag
  - RTC_FLAG_INT_TAMP_9: Internal Tamper9 flag
  - RTC_FLAG_INT_TAMP_11: Internal Tamper11 flag

Return value:

- None

__HAL_RTC_TAMPER_EXTI_ENABLE_IT

Description:

- Enable interrupt on the RTC tamper associated Exti line.

Return value:

- None

__HAL_RTC_TAMPER_EXTI_DISABLE_IT

Description:

- Disable interrupt on the RTC tamper associated Exti line.

Return value:

- None

__HAL_RTC_TAMPER_EXTI_ENABLE_EVENT

Description:

- Enable event on the RTC tamper associated Exti line.

Return value:

- None

__HAL_RTC_TAMPER_EXTI_DISABLE_EVENT

Description:

- Disable event on the RTC tamper associated Exti line.

Return value:

- None

RTCEx Tamper EraseBackUp

RTC_TAMPER_ERASE_BACKUP_ENABLE

RTC_TAMPER_ERASE_BACKUP_DISABLE

RTCEx Tamper Filter

RTC_TAMPERFILTER_DISABLE

Tamper filter is disabled

RTC_TAMPERFILTER_2SAMPLE

Tamper is activated after 2 consecutive samples at the active level

RTC_TAMPERFILTER_4SAMPLE

Tamper is activated after 4 consecutive samples at the active level

RTC_TAMPERFILTER_8SAMPLE

Tamper is activated after 8 consecutive samples at the active level

RTCEx Tamper MaskFlag

RTC_TAMPERMASK_FLAG_DISABLE

RTC_TAMPERMASK_FLAG_ENABLE

RTCEx Tamper Pins Definition

RTC_TAMPER_1

RTC_TAMPER_2

RTC_TAMPER_3

RTC_TAMPER_4

RTC_TAMPER_5

RTC_TAMPER_ALL

RTCEx Tamper Pin Precharge Duration

RTC_TAMPERPRECHARGEDURATION_1RTCCLK

Tamper pins are pre-charged before sampling during 1 RTCCLK cycle

RTC_TAMPERPRECHARGEDURATION_2RTCCLK

Tamper pins are pre-charged before sampling during 2 RTCCLK cycles

RTC_TAMPERPRECHARGEDURATION_4RTCCLK

Tamper pins are pre-charged before sampling during 4 RTCCLK cycles

RTC_TAMPERPRECHARGEDURATION_8RTCCLK

Tamper pins are pre-charged before sampling during 8 RTCCLK cycles

RTCEx Tamper Pull UP

RTC_TAMPER_PULLUP_ENABLE

Tamper pins are pre-charged before sampling

RTC_TAMPER_PULLUP_DISABLE

Tamper pins pre-charge is disabled

RTCEx Tamper Sampling Frequencies

RTC_TAMPERSAMPLINGFREQ_RTCCLK_DIV32768

Each of the tamper inputs are sampled with a frequency = RTCCLK / 32768

RTC_TAMPERSAMPLINGFREQ_RTCCLK_DIV16384

Each of the tamper inputs are sampled with a frequency = RTCCLK / 16384

RTC_TAMPERSAMPLINGFREQ_RTCCLK_DIV8192

Each of the tamper inputs are sampled with a frequency = RTCCLK / 8192

RTC_TAMPERSAMPLINGFREQ_RTCCLK_DIV4096

Each of the tamper inputs are sampled with a frequency = RTCCLK / 4096

RTC_TAMPERSAMPLINGFREQ_RTCCLK_DIV2048

Each of the tamper inputs are sampled with a frequency = RTCCLK / 2048

RTC_TAMPERSAMPLINGFREQ_RTCCLK_DIV1024

Each of the tamper inputs are sampled with a frequency = RTCCLK / 1024

RTC_TAMPERSAMPLINGFREQ_RTCCLK_DIV512

Each of the tamper inputs are sampled with a frequency = RTCCLK / 512

RTC_TAMPERSAMPLINGFREQ_RTCCLK_DIV256

Each of the tamper inputs are sampled with a frequency = RTCCLK / 256

RTCEx Tamper TimeStamp On Tamper Detection Definitions

RTC_TIMESTAMPONTAMPERDETECTION_DISABLE

TimeStamp on Tamper Detection event is not saved

RTC_TIMESTAMPONTAMPERDETECTION_ENABLE

TimeStamp on Tamper Detection event saved

RTCEx Tamper Trigger

RTC_TAMPERTRIGGER_RISINGEDGE

Warning : Filter must be RTC_TAMPERFILTER_DISABLE

RTC_TAMPERTRIGGER_FALLINGEDGE

Warning : Filter must be RTC_TAMPERFILTER_DISABLE

RTC_TAMPERTRIGGER_LOWLEVEL

Warning : Filter must not be RTC_TAMPERFILTER_DISABLE

RTC_TAMPERTRIGGER_HIGHLEVEL

Warning : Filter must not be RTC_TAMPERFILTER_DISABLE

RTC Timestamp

__HAL_RTC_TIMESTAMP_ENABLE

Description:

- Enable the RTC TimeStamp peripheral.

Parameters:

- __HANDLE__: specifies the RTC handle.

Return value:

- None

__HAL_RTC_TIMESTAMP_DISABLE

Description:

- Disable the RTC TimeStamp peripheral.

Parameters:

- __HANDLE__: specifies the RTC handle.

Return value:

- None

__HAL_RTC_TIMESTAMP_ENABLE_IT

Description:

- Enable the RTC TimeStamp interrupt.

Parameters:

- __HANDLE__: specifies the RTC handle.
- __INTERRUPT__: specifies the RTC TimeStamp interrupt source to be enabled. This parameter can be:
  - RTC_IT_TS TimeStamp interrupt

Return value:

- None

__HAL_RTC_TIMESTAMP_DISABLE_IT

Description:

- Disable the RTC TimeStamp interrupt.

Parameters:

- __HANDLE__: specifies the RTC handle.
- __INTERRUPT__: specifies the RTC TimeStamp interrupt source to be disabled. This parameter can be:
  - RTC_IT_TS TimeStamp interrupt

Return value:

- None

__HAL_RTC_TIMESTAMP_GET_IT

Description:

- Check whether the specified RTC TimeStamp interrupt has occurred or not.

Parameters:

- __HANDLE__: specifies the RTC handle.
- __INTERRUPT__: specifies the RTC TimeStamp interrupt to check. This parameter can be:
  - RTC_IT_TS TimeStamp interrupt

Return value:

- The: state of __FLAG__ (TRUE or FALSE).

__HAL_RTC_TIMESTAMP_GET_IT_SOURCE

Description:

- Check whether the specified RTC Time Stamp interrupt has been enabled or not.

Parameters:

- __HANDLE__: specifies the RTC handle.
- __INTERRUPT__: specifies the RTC Time Stamp interrupt source to check. This parameter can be:
  - RTC_IT_TS TimeStamp interrupt

Return value:

- The: state of __FLAG__ (TRUE or FALSE).

__HAL_RTC_TIMESTAMP_GET_FLAG

Description:

- Get the selected RTC TimeStamps flag status.

Parameters:

- __HANDLE__: specifies the RTC handle.
- __FLAG__: specifies the RTC TimeStamp Flag is pending or not. This parameter can be:
  - RTC_FLAG_TSF
  - RTC_FLAG_TSOVF

Return value:

- The: state of __FLAG__ (TRUE or FALSE).

__HAL_RTC_TIMESTAMP_CLEAR_FLAG

Description:

- Clear the RTC Time Stamps pending flags.

Parameters:

- __HANDLE__: specifies the RTC handle.
- __FLAG__: specifies the RTC TimeStamp Flag to clear. This parameter can be:
  - RTC_FLAG_TSF
  - RTC_FLAG_TSOVF

Return value:

- None

__HAL_RTC_TIMESTAMP_EXTI_ENABLE_IT

Description:

- Enable interrupt on the RTC Timestamp associated Exti line.

Return value:

- None

__HAL_RTC_TIMESTAMP_EXTI_DISABLE_IT

Description:

- Disable interrupt on the RTC Timestamp associated Exti line.

Return value:

- None

__HAL_RTC_TIMESTAMP_EXTI_ENABLE_EVENT

Description:

- Enable event on the RTC Timestamp associated Exti line.

Return value:

- None

__HAL_RTC_TIMESTAMP_EXTI_DISABLE_EVENT

Description:

- Disable event on the RTC Timestamp associated Exti line.

Return value:

- None

__HAL_RTC_INTERNAL_TIMESTAMP_ENABLE

Description:

- Enable the RTC internal TimeStamp peripheral.

Parameters:

- __HANDLE__: specifies the RTC handle.

Return value:

- None

__HAL_RTC_INTERNAL_TIMESTAMP_DISABLE

Description:

- Disable the RTC internal TimeStamp peripheral.

Parameters:

- __HANDLE__: specifies the RTC handle.

Return value:

- None

__HAL_RTC_INTERNAL_TIMESTAMP_GET_FLAG

Description:

- Get the selected RTC Internal Time Stamps flag status.

Parameters:

- __HANDLE__: specifies the RTC handle.
- __FLAG__: specifies the RTC Internal Time Stamp Flag is pending or not. This parameter can be:
  - RTC_FLAG_ITSF

Return value:

- None

__HAL_RTC_INTERNAL_TIMESTAMP_CLEAR_FLAG

Description:

- Clear the RTC Internal Time Stamps pending flags.

Parameters:

- __HANDLE__: specifies the RTC handle.
- __FLAG__: specifies the RTC Internal Time Stamp Flag source to clear. This parameter can be:
  - RTC_FLAG_ITSF

Return value:

- None

__HAL_RTC_TAMPTS_ENABLE

Description:

- Enable the RTC TimeStamp on Tamper detection.

Parameters:

- __HANDLE__: specifies the RTC handle.

Return value:

- None

__HAL_RTC_TAMPTS_DISABLE

Description:

- Disable the RTC TimeStamp on Tamper detection.

Parameters:

- __HANDLE__: specifies the RTC handle.

Return value:

- None

__HAL_RTC_TAMPOE_ENABLE

Description:

- Enable the RTC Tamper detection output.

Parameters:

- __HANDLE__: specifies the RTC handle.

Return value:

- None

__HAL_RTC_TAMPOE_DISABLE

Description:

- Disable the RTC Tamper detection output.

Parameters:

- __HANDLE__: specifies the RTC handle.

Return value:

- None

RTCEx TimeStamp Pin Selection

RTC_TIMESTAMPPIN_DEFAULT

RTCEx Time Stamp Edges definition

RTC_TIMESTAMPEDGE_RISING

RTC_TIMESTAMPEDGE_FALLING

RTC WakeUp Timer

__HAL_RTC_WAKEUPTIMER_ENABLE

Description:

- Enable the RTC WakeUp Timer peripheral.

Parameters:

- __HANDLE__: specifies the RTC handle.

Return value:

- None

__HAL_RTC_WAKEUPTIMER_DISABLE

Description:

- Disable the RTC WakeUp Timer peripheral.

Parameters:

- __HANDLE__: specifies the RTC handle.

Return value:

- None

__HAL_RTC_WAKEUPTIMER_ENABLE_IT

Description:

- Enable the RTC WakeUpTimer interrupt.

Parameters:

- __HANDLE__: specifies the RTC handle.
- __INTERRUPT__: specifies the RTC WakeUpTimer interrupt sources to be enabled. This parameter can be:
  - RTC_IT_WUT WakeUpTimer interrupt

Return value:

- None

__HAL_RTC_WAKEUPTIMER_DISABLE_IT

Description:

- Disable the RTC WakeUpTimer interrupt.

Parameters:

- __HANDLE__: specifies the RTC handle.
- __INTERRUPT__: specifies the RTC WakeUpTimer interrupt sources to be disabled. This parameter can be:
  - RTC_IT_WUT WakeUpTimer interrupt

Return value:

- None

__HAL_RTC_WAKEUPTIMER_GET_IT

Description:

- Check whether the specified RTC WakeUpTimer interrupt has occurred or not.

Parameters:

- __HANDLE__: specifies the RTC handle.
- __INTERRUPT__: specifies the RTC WakeUpTimer interrupt to check. This parameter can be:
  - RTC_IT_WUT WakeUpTimer interrupt

Return value:

- The: state of __FLAG__ (TRUE or FALSE).

__HAL_RTC_WAKEUPTIMER_GET_IT_SOURCE

Description:

- Check whether the specified RTC Wake Up timer interrupt has been enabled or not.

Parameters:

- __HANDLE__: specifies the RTC handle.
- __INTERRUPT__: specifies the RTC Wake Up timer interrupt sources to check. This parameter can be:
  - RTC_IT_WUT WakeUpTimer interrupt

Return value:

- The: state of __FLAG__ (TRUE or FALSE).

__HAL_RTC_WAKEUPTIMER_GET_FLAG

Description:

- Get the selected RTC WakeUpTimers flag status.

Parameters:

- __HANDLE__: specifies the RTC handle.
- __FLAG__: specifies the RTC WakeUpTimer Flag is pending or not. This parameter can be:
  - RTC_FLAG_WUTF
  - RTC_FLAG_WUTWF

Return value:

- The: state of __FLAG__ (TRUE or FALSE).

__HAL_RTC_WAKEUPTIMER_CLEAR_FLAG

Description:

- Clear the RTC Wake Up timers pending flags.

Parameters:

- __HANDLE__: specifies the RTC handle.
- __FLAG__: specifies the RTC WakeUpTimer Flag to clear. This parameter can be:
  - RTC_FLAG_WUTF

Return value:

- None

__HAL_RTC_WAKEUPTIMER_EXTI_ENABLE_IT

Description:

- Enable interrupt on the RTC WakeUp Timer associated Exti line.

Return value:

- None

__HAL_RTC_WAKEUPTIMER_EXTI_DISABLE_IT

Description:

- Disable interrupt on the RTC WakeUp Timer associated Exti line.

Return value:

- None

__HAL_RTC_WAKEUPTIMER_EXTI_ENABLE_EVENT

Description:

- Enable event on the RTC WakeUp Timer associated Exti line.

Return value:

- None

__HAL_RTC_WAKEUPTIMER_EXTI_DISABLE_EVENT

Description:

- Disable event on the RTC WakeUp Timer associated Exti line.

Return value:

- None

RTCEx Wakeup Timer Definitions

RTC_WAKEUPCLOCK_RTCCLK_DIV16

RTC_WAKEUPCLOCK_RTCCLK_DIV8

RTC_WAKEUPCLOCK_RTCCLK_DIV4

RTC_WAKEUPCLOCK_RTCCLK_DIV2

RTC_WAKEUPCLOCK_CK_SPRE_16BITS

RTC_WAKEUPCLOCK_CK_SPRE_17BITS

43 HAL SMARTCARD Generic Driver

43.1 SMARTCARD Firmware driver registers structures

43.1.1 SMARTCARD_InitTypeDef

SMARTCARD_InitTypeDef is defined in the stm32u0xx_hal_smartcard.h

Data Fields

- ***uint32_t BaudRate***
- ***uint32_t WordLength***
- ***uint32_t StopBits***
- ***uint16_t Parity***
- ***uint16_t Mode***
- ***uint16_t CLKPolarity***
- ***uint16_t CLKPhase***
- ***uint16_t CLKLastBit***
- ***uint16_t OneBitSampling***
- ***uint8_t Prescaler***
- ***uint8_t GuardTime***
- ***uint16_t NACKEnable***
- ***uint32_t TimeOutEnable***
- ***uint32_t TimeOutValue***
- ***uint8_t BlockLength***
- ***uint8_t AutoRetryCount***
- ***uint32_t ClockPrescaler***

Field Documentation

- ***uint32_t SMARTCARD_InitTypeDef::BaudRate***
  Configures the SmartCard communication baud rate. The baud rate register is computed using the following formula: Baud Rate Register = ((usart_ker_ckpres) / ((hsmartcard->Init.BaudRate))) where usart_ker_ckpres is the USART input clock divided by a prescaler
- ***uint32_t SMARTCARD_InitTypeDef::WordLength***
  Specifies the number of data bits transmitted or received in a frame. This parameter ***SMARTCARD_Word_Length*** can only be set to 9 (8 data + 1 parity bits).
- ***uint32_t SMARTCARD_InitTypeDef::StopBits***
  Specifies the number of stop bits. This parameter can be a value of ***SMARTCARD_Stop_Bits***.
- ***uint16_t SMARTCARD_InitTypeDef::Parity***
  Specifies the parity mode. This parameter can be a value of ***SMARTCARD_Parity***
  Note:
  – The parity is enabled by default (PCE is forced to 1). Since the WordLength is forced to 8 bits + parity, M is forced to 1 and the parity bit is the 9th bit.
- ***uint16_t SMARTCARD_InitTypeDef::Mode***
  Specifies whether the Receive or Transmit mode is enabled or disabled. This parameter can be a value of ***SMARTCARD_Mode***
- ***uint16_t SMARTCARD_InitTypeDef::CLKPolarity***
  Specifies the steady state of the serial clock. This parameter can be a value of ***SMARTCARD_Clock_Polarity***
- ***uint16_t SMARTCARD_InitTypeDef::CLKPhase***
  Specifies the clock transition on which the bit capture is made. This parameter can be a value of ***SMARTCARD_Clock_Phase***
- ***uint16_t SMARTCARD_InitTypeDef::CLKLastBit***
  Specifies whether the clock pulse corresponding to the last transmitted data bit (MSB) has to be output on the SCLK pin in synchronous mode. This parameter can be a value of ***SMARTCARD_Last_Bit***

- ***uint16_t SMARTCARD_InitTypeDef::OneBitSampling***
  Specifies whether a single sample or three samples' majority vote is selected. Selecting the single sample method increases the receiver tolerance to clock deviations. This parameter can be a value of ***SMARTCARD_OneBit_Sampling***.
- ***uint8_t SMARTCARD_InitTypeDef::Prescaler***
  Specifies the SmartCard Prescaler. This parameter can be any value from 0x01 to 0x1F. Prescaler value is multiplied by 2 to give the division factor of the source clock frequency
- ***uint8_t SMARTCARD_InitTypeDef::GuardTime***
  Specifies the SmartCard Guard Time applied after stop bits.
- ***uint16_t SMARTCARD_InitTypeDef::NACKEnable***
  Specifies whether the SmartCard NACK transmission is enabled in case of parity error. This parameter can be a value of ***SMARTCARD_NACK_Enable***
- ***uint32_t SMARTCARD_InitTypeDef::TimeOutEnable***
  Specifies whether the receiver timeout is enabled. This parameter can be a value of ***SMARTCARD_Timeout_Enable***
- ***uint32_t SMARTCARD_InitTypeDef::TimeOutValue***
  Specifies the receiver time out value in number of baud blocks: it is used to implement the Character Wait Time (CWT) and Block Wait Time (BWT). It is coded over 24 bits.
- ***uint8_t SMARTCARD_InitTypeDef::BlockLength***
  Specifies the SmartCard Block Length in T=1 Reception mode. This parameter can be any value from 0x0 to 0xFF
- ***uint8_t SMARTCARD_InitTypeDef::AutoRetryCount***
  Specifies the SmartCard auto-retry count (number of retries in receive and transmit mode). When set to 0, retransmission is disabled. Otherwise, its maximum value is 7 (before signalling an error)
- ***uint32_t SMARTCARD_InitTypeDef::ClockPrescaler***
  Specifies the prescaler value used to divide the USART clock source. This parameter can be a value of ***SMARTCARD_ClockPrescaler***.

43.1.2 SMARTCARD_AdvFeatureInitTypeDef

SMARTCARD_AdvFeatureInitTypeDef is defined in the stm32u0xx_hal_smartcard.h

Data Fields

- ***uint32_t AdvFeatureInit***
- ***uint32_t TxPinLevelInvert***
- ***uint32_t RxPinLevelInvert***
- ***uint32_t DataInvert***
- ***uint32_t Swap***
- ***uint32_t OverrunDisable***
- ***uint32_t DMADisableonRxError***
- ***uint32_t MSBFirst***
- ***uint16_t TxCompletionIndication***

Field Documentation

- ***uint32_t SMARTCARD_AdvFeatureInitTypeDef::AdvFeatureInit***
  Specifies which advanced SMARTCARD features is initialized. Several advanced features may be initialized at the same time. This parameter can be a value of ***SMARTCARDEx_Advanced_Features_Initialization_Type***
- ***uint32_t SMARTCARD_AdvFeatureInitTypeDef::TxPinLevelInvert***
  Specifies whether the TX pin active level is inverted. This parameter can be a value of ***SMARTCARD_Tx_Inv***
- ***uint32_t SMARTCARD_AdvFeatureInitTypeDef::RxPinLevelInvert***
  Specifies whether the RX pin active level is inverted. This parameter can be a value of ***SMARTCARD_Rx_Inv***
- ***uint32_t SMARTCARD_AdvFeatureInitTypeDef::DataInvert***
  Specifies whether data are inverted (positive/direct logic vs negative/inverted logic). This parameter can be a value of ***SMARTCARD_Data_Inv***

- ***uint32_t SMARTCARD_AdvFeatureInitTypeDef::Swap***
  Specifies whether TX and RX pins are swapped. This parameter can be a value of ***SMARTCARD_Rx_Tx_Swap***
- ***uint32_t SMARTCARD_AdvFeatureInitTypeDef::OverrunDisable***
  Specifies whether the reception overrun detection is disabled. This parameter can be a value of ***SMARTCARD_Overrun_Disable***
- ***uint32_t SMARTCARD_AdvFeatureInitTypeDef::DMADisableonRxError***
  Specifies whether the DMA is disabled in case of reception error. This parameter can be a value of ***SMARTCARD_DMA_Disable_on_Rx_Error***
- ***uint32_t SMARTCARD_AdvFeatureInitTypeDef::MSBFirst***
  Specifies whether MSB is sent first on UART line. This parameter can be a value of ***SMARTCARD_MSB_First***
- ***uint16_t SMARTCARD_AdvFeatureInitTypeDef::TxCompletionIndication***
  Specifies which transmission completion indication is used: before (when relevant flag is available) or once guard time period has elapsed. This parameter can be a value of ***SMARTCARDEx_Transmission_Completion_Indication***.

43.1.3 __SMARTCARD_HandleTypeDef

__SMARTCARD_HandleTypeDef is defined in the stm32u0xx_hal_smartcard.h

Data Fields

- ***USART_TypeDef * Instance***
- ***SMARTCARD_InitTypeDef Init***
- ***SMARTCARD_AdvFeatureInitTypeDef AdvancedInit***
- ***const uint8_t * pTxBuffPtr***
- ***uint16_t TxXferSize***
- ***__IO uint16_t TxXferCount***
- ***uint8_t * pRxBuffPtr***
- ***uint16_t RxXferSize***
- ***__IO uint16_t RxXferCount***
- ***uint16_t NbRxDataToProcess***
- ***uint16_t NbTxDataToProcess***
- ***uint32_t FifoMode***
- ***void(* RxISR***
- ***void(* TxISR***
- ***DMA_HandleTypeDef * hdmatx***
- ***DMA_HandleTypeDef * hdmarx***
- ***HAL_LockTypeDef Lock***
- ***__IO HAL_SMARTCARD_StateTypeDef gState***
- ***__IO HAL_SMARTCARD_StateTypeDef RxState***
- ***__IO uint32_t ErrorCode***
- ***void(* TxCpltCallback***
- ***void(* RxCpltCallback***
- ***void(* ErrorCallback***
- ***void(* AbortCpltCallback***
- ***void(* AbortTransmitCpltCallback***
- ***void(* AbortReceiveCpltCallback***
- ***void(* RxFifoFullCallback***
- ***void(* TxFifoEmptyCallback***
- ***void(* MspInitCallback***
- ***void(* MspDeInitCallback***

Field Documentation

- ***USART_TypeDef* __SMARTCARD_HandleTypeDef::Instance***
  USART registers base address
- ***SMARTCARD_InitTypeDef __SMARTCARD_HandleTypeDef::Init***
  SmartCard communication parameters
- ***SMARTCARD_AdvFeatureInitTypeDef __SMARTCARD_HandleTypeDef::AdvancedInit***
  SmartCard advanced features initialization parameters
- ***const uint8_t* __SMARTCARD_HandleTypeDef::pTxBuffPtr***
  Pointer to SmartCard Tx transfer Buffer
- ***uint16_t __SMARTCARD_HandleTypeDef::TxXferSize***
  SmartCard Tx Transfer size
- ***__IO uint16_t __SMARTCARD_HandleTypeDef::TxXferCount***
  SmartCard Tx Transfer Counter
- ***uint8_t* __SMARTCARD_HandleTypeDef::pRxBuffPtr***
  Pointer to SmartCard Rx transfer Buffer
- ***uint16_t __SMARTCARD_HandleTypeDef::RxXferSize***
  SmartCard Rx Transfer size
- ***__IO uint16_t __SMARTCARD_HandleTypeDef::RxXferCount***
  SmartCard Rx Transfer Counter
- ***uint16_t __SMARTCARD_HandleTypeDef::NbRxDataToProcess***
  Number of data to process during RX ISR execution
- ***uint16_t __SMARTCARD_HandleTypeDef::NbTxDataToProcess***
  Number of data to process during TX ISR execution
- ***uint32_t __SMARTCARD_HandleTypeDef::FifoMode***
  Specifies if the FIFO mode will be used. This parameter can be a value of ***SMARTCARDEx_FIFO_mode***.
- ***void(* __SMARTCARD_HandleTypeDef::RxISR)(struct __SMARTCARD_HandleTypeDef *huart)***
  Function pointer on Rx IRQ handler
- ***void(* __SMARTCARD_HandleTypeDef::TxISR)(struct __SMARTCARD_HandleTypeDef *huart)***
  Function pointer on Tx IRQ handler
- ***DMA_HandleTypeDef* __SMARTCARD_HandleTypeDef::hdmatx***
  SmartCard Tx DMA Handle parameters
- ***DMA_HandleTypeDef* __SMARTCARD_HandleTypeDef::hdmarx***
  SmartCard Rx DMA Handle parameters
- ***HAL_LockTypeDef __SMARTCARD_HandleTypeDef::Lock***
  Locking object
- ***__IO HAL_SMARTCARD_StateTypeDef __SMARTCARD_HandleTypeDef::gState***
  SmartCard state information related to global Handle management and also related to Tx operations. This parameter can be a value of **HAL_SMARTCARD_StateTypeDef**
- ***__IO HAL_SMARTCARD_StateTypeDef __SMARTCARD_HandleTypeDef::RxState***
  SmartCard state information related to Rx operations. This parameter can be a value of **HAL_SMARTCARD_StateTypeDef**
- ***__IO uint32_t __SMARTCARD_HandleTypeDef::ErrorCode***
  SmartCard Error code
- ***void(* __SMARTCARD_HandleTypeDef::TxCpltCallback)(struct __SMARTCARD_HandleTypeDef *hsmartcard)***
  SMARTCARD Tx Complete Callback
- ***void(* __SMARTCARD_HandleTypeDef::RxCpltCallback)(struct __SMARTCARD_HandleTypeDef *hsmartcard)***
  SMARTCARD Rx Complete Callback
- ***void(* __SMARTCARD_HandleTypeDef::ErrorCallback)(struct __SMARTCARD_HandleTypeDef *hsmartcard)***
  SMARTCARD Error Callback
- ***void(* __SMARTCARD_HandleTypeDef::AbortCpltCallback)(struct __SMARTCARD_HandleTypeDef *hsmartcard)***
  SMARTCARD Abort Complete Callback

- ***void(* __SMARTCARD_HandleTypeDef::AbortTransmitCpltCallback)(struct __SMARTCARD_HandleTypeDef *hsmartcard)***
  SMARTCARD Abort Transmit Complete Callback
- ***void(* __SMARTCARD_HandleTypeDef::AbortReceiveCpltCallback)(struct __SMARTCARD_HandleTypeDef *hsmartcard)***
  SMARTCARD Abort Receive Complete Callback
- ***void(* __SMARTCARD_HandleTypeDef::RxFifoFullCallback)(struct __SMARTCARD_HandleTypeDef *hsmartcard)***
  SMARTCARD Rx Fifo Full Callback
- ***void(* __SMARTCARD_HandleTypeDef::TxFifoEmptyCallback)(struct __SMARTCARD_HandleTypeDef *hsmartcard)***
  SMARTCARD Tx Fifo Empty Callback
- ***void(* __SMARTCARD_HandleTypeDef::MspInitCallback)(struct __SMARTCARD_HandleTypeDef *hsmartcard)***
  SMARTCARD Msp Init callback
- ***void(* __SMARTCARD_HandleTypeDef::MspDeInitCallback)(struct __SMARTCARD_HandleTypeDef *hsmartcard)***
  SMARTCARD Msp DeInit callback

43.2 SMARTCARD Firmware driver API description

The following section lists the various functions of the SMARTCARD library.

43.2.1 How to use this driver

The SMARTCARD HAL driver can be used as follows:

1. Declare a SMARTCARD_HandleTypeDef handle structure (eg. SMARTCARD_HandleTypeDef hsmartcard).
2. Associate a USART to the SMARTCARD handle hsmartcard.
3. Initialize the SMARTCARD low level resources by implementing the HAL_SMARTCARD_MspInit() API:
   - Enable the USARTx interface clock.
   - USART pins configuration:
     - Enable the clock for the USART GPIOs.
     - Configure the USART pins (TX as alternate function pull-up, RX as alternate function Input).
   - NVIC configuration if you need to use interrupt process (HAL_SMARTCARD_Transmit_IT() and HAL_SMARTCARD_Receive_IT() APIs):
     - Configure the USARTx interrupt priority.
     - Enable the NVIC USART IRQ handle.
   - DMA Configuration if you need to use DMA process (HAL_SMARTCARD_Transmit_DMA() and HAL_SMARTCARD_Receive_DMA() APIs):
     - Declare a DMA handle structure for the Tx/Rx channel.
     - Enable the DMAx interface clock.
     - Configure the declared DMA handle structure with the required Tx/Rx parameters.
     - Configure the DMA Tx/Rx channel.
     - Associate the initialized DMA handle to the SMARTCARD DMA Tx/Rx handle.
     - Configure the priority and enable the NVIC for the transfer complete interrupt on the DMA Tx/Rx channel.
4. Program the Baud Rate, Parity, Mode(Receiver/Transmitter), clock enabling/disabling and accordingly, the clock parameters (parity, phase, last bit), prescaler value, guard time and NACK on transmission error enabling or disabling in the hsmartcard handle Init structure.
5. If required, program SMARTCARD advanced features (TX/RX pins swap, TimeOut, auto-retry counter,...) in the hsmartcard handle AdvancedInit structure.
6. Initialize the SMARTCARD registers by calling the HAL_SMARTCARD_Init() API:
   - This API configures also the low level Hardware GPIO, CLOCK, CORTEX...etc) by calling the customized HAL_SMARTCARD_MspInit() API.

Note: The specific SMARTCARD interrupts (Transmission complete interrupt, RXNE interrupt and Error Interrupts) will be managed using the macros __HAL_SMARTCARD_ENABLE_IT() and __HAL_SMARTCARD_DISABLE_IT() inside the transmit and receive process.

Three operation modes are available within this driver :

Polling mode IO operation

- Send an amount of data in blocking mode using HAL_SMARTCARD_Transmit()
- Receive an amount of data in blocking mode using HAL_SMARTCARD_Receive()

Interrupt mode IO operation

- Send an amount of data in non-blocking mode using HAL_SMARTCARD_Transmit_IT()
- At transmission end of transfer HAL_SMARTCARD_TxCpltCallback() is executed and user can add his own code by customization of function pointer HAL_SMARTCARD_TxCpltCallback()
- Receive an amount of data in non-blocking mode using HAL_SMARTCARD_Receive_IT()
- At reception end of transfer HAL_SMARTCARD_RxCpltCallback() is executed and user can add his own code by customization of function pointer HAL_SMARTCARD_RxCpltCallback()
- In case of transfer Error, HAL_SMARTCARD_ErrorCallback() function is executed and user can add his own code by customization of function pointer HAL_SMARTCARD_ErrorCallback()

DMA mode IO operation

- Send an amount of data in non-blocking mode (DMA) using HAL_SMARTCARD_Transmit_DMA()
- At transmission end of transfer HAL_SMARTCARD_TxCpltCallback() is executed and user can add his own code by customization of function pointer HAL_SMARTCARD_TxCpltCallback()
- Receive an amount of data in non-blocking mode (DMA) using HAL_SMARTCARD_Receive_DMA()
- At reception end of transfer HAL_SMARTCARD_RxCpltCallback() is executed and user can add his own code by customization of function pointer HAL_SMARTCARD_RxCpltCallback()
- In case of transfer Error, HAL_SMARTCARD_ErrorCallback() function is executed and user can add his own code by customization of function pointer HAL_SMARTCARD_ErrorCallback()

SMARTCARD HAL driver macros list

Below the list of most used macros in SMARTCARD HAL driver.

- __HAL_SMARTCARD_GET_FLAG : Check whether or not the specified SMARTCARD flag is set
- __HAL_SMARTCARD_CLEAR_FLAG : Clear the specified SMARTCARD pending flag
- __HAL_SMARTCARD_ENABLE_IT: Enable the specified SMARTCARD interrupt
- __HAL_SMARTCARD_DISABLE_IT: Disable the specified SMARTCARD interrupt
- __HAL_SMARTCARD_GET_IT_SOURCE: Check whether or not the specified SMARTCARD interrupt is enabled

Note: You can refer to the SMARTCARD HAL driver header file for more useful macros

43.2.2 Callback registration

The compilation define USE_HAL_SMARTCARD_REGISTER_CALLBACKS when set to 1 allows the user to configure dynamically the driver callbacks.

Use Function HAL_SMARTCARD_RegisterCallback() to register a user callback. Function HAL_SMARTCARD_RegisterCallback() allows to register following callbacks:

- TxCpltCallback : Tx Complete Callback.
- RxCpltCallback : Rx Complete Callback.
- ErrorCallback : Error Callback.
- AbortCpltCallback : Abort Complete Callback.
- AbortTransmitCpltCallback : Abort Transmit Complete Callback.
- AbortReceiveCpltCallback : Abort Receive Complete Callback.
- RxFifoFullCallback : Rx Fifo Full Callback.
- TxFifoEmptyCallback : Tx Fifo Empty Callback.

- MspInitCallback : SMARTCARD MspInit.
- MspDeInitCallback : SMARTCARD MspDeInit. This function takes as parameters the HAL peripheral handle, the Callback ID and a pointer to the user callback function.

Use function HAL_SMARTCARD_UnRegisterCallback() to reset a callback to the default weak function. HAL_SMARTCARD_UnRegisterCallback() takes as parameters the HAL peripheral handle, and the Callback ID. This function allows to reset following callbacks:

- TxCpltCallback : Tx Complete Callback.
- RxCpltCallback : Rx Complete Callback.
- ErrorCallback : Error Callback.
- AbortCpltCallback : Abort Complete Callback.
- AbortTransmitCpltCallback : Abort Transmit Complete Callback.
- AbortReceiveCpltCallback : Abort Receive Complete Callback.
- RxFifoFullCallback : Rx Fifo Full Callback.
- TxFifoEmptyCallback : Tx Fifo Empty Callback.
- MspInitCallback : SMARTCARD MspInit.
- MspDeInitCallback : SMARTCARD MspDeInit.

By default, after the HAL_SMARTCARD_Init() and when the state is HAL_SMARTCARD_STATE_RESET all callbacks are set to the corresponding weak functions: examples HAL_SMARTCARD_TxCpltCallback(), HAL_SMARTCARD_RxCpltCallback(). Exception done for MspInit and MspDeInit functions that are respectively reset to the legacy weak functions in the HAL_SMARTCARD_Init() and HAL_SMARTCARD_DeInit() only when these callbacks are null (not registered beforehand). If not, MspInit or MspDeInit are not null, the HAL_SMARTCARD_Init() and HAL_SMARTCARD_DeInit() keep and use the user MspInit/MspDeInit callbacks (registered beforehand).

Callbacks can be registered/unregistered in HAL_SMARTCARD_STATE_READY state only. Exception done MspInit/MspDeInit that can be registered/unregistered in HAL_SMARTCARD_STATE_READY or HAL_SMARTCARD_STATE_RESET state, thus registered (user) MspInit/DeInit callbacks can be used during the Init/DeInit. In that case first register the MspInit/MspDeInit user callbacks using HAL_SMARTCARD_RegisterCallback() before calling HAL_SMARTCARD_DeInit() or HAL_SMARTCARD_Init() function.

When The compilation define USE_HAL_SMARTCARD_REGISTER_CALLBACKS is set to 0 or not defined, the callback registration feature is not available and weak callbacks are used.

43.2.3 Initialization and Configuration functions

This subsection provides a set of functions allowing to initialize the USARTx associated to the SmartCard.

- These parameters can be configured:
  - Baud Rate
  - Parity: parity should be enabled, frame Length is fixed to 8 bits plus parity
  - Receiver/transmitter modes
  - Synchronous mode (and if enabled, phase, polarity and last bit parameters)
  - Prescaler value
  - Guard bit time
  - NACK enabling or disabling on transmission error
- The following advanced features can be configured as well:
  - TX and/or RX pin level inversion
  - data logical level inversion
  - RX and TX pins swap
  - RX overrun detection disabling
  - DMA disabling on RX error
  - MSB first on communication line
  - Time out enabling (and if activated, timeout value)
  - Block length
  - Auto-retry counter

The HAL_SMARTCARD_Init() API follows the USART synchronous configuration procedures (details for the procedures are available in reference manual).

This section contains the following APIs:

- ***HAL_SMARTCARD_Init()***
- ***HAL_SMARTCARD_DeInit()***
- ***HAL_SMARTCARD_MspInit()***
- ***HAL_SMARTCARD_MspDeInit()***
- ***HAL_SMARTCARD_RegisterCallback()***
- ***HAL_SMARTCARD_UnRegisterCallback()***

43.2.4 IO operation functions

This subsection provides a set of functions allowing to manage the SMARTCARD data transfers.

Smartcard is a single wire half duplex communication protocol. The Smartcard interface is designed to support asynchronous protocol Smartcards as defined in the ISO 7816-3 standard. The USART should be configured as:

- 8 bits plus parity: where M=1 and PCE=1 in the USART_CR1 register
- 1.5 stop bits when transmitting and receiving: where STOP=11 in the USART_CR2 register.

1. There are two modes of transfer:
   a. Blocking mode: The communication is performed in polling mode. The HAL status of all data processing is returned by the same function after finishing transfer.
   b. Non-Blocking mode: The communication is performed using Interrupts or DMA, the relevant API's return the HAL status. The end of the data processing will be indicated through the dedicated SMARTCARD IRQ when using Interrupt mode or the DMA IRQ when using DMA mode.
   c. The HAL_SMARTCARD_TxCpltCallback(), HAL_SMARTCARD_RxCpltCallback() user callbacks will be executed respectively at the end of the Transmit or Receive process The HAL_SMARTCARD_ErrorCallback() user callback will be executed when a communication error is detected.
2. Blocking mode APIs are :
   a. HAL_SMARTCARD_Transmit()
   b. HAL_SMARTCARD_Receive()
3. Non Blocking mode APIs with Interrupt are :
   a. HAL_SMARTCARD_Transmit_IT()
   b. HAL_SMARTCARD_Receive_IT()
   c. HAL_SMARTCARD_IRQHandler()
4. Non Blocking mode functions with DMA are :
   a. HAL_SMARTCARD_Transmit_DMA()
   b. HAL_SMARTCARD_Receive_DMA()
5. A set of Transfer Complete Callbacks are provided in non Blocking mode:
   a. HAL_SMARTCARD_TxCpltCallback()
   b. HAL_SMARTCARD_RxCpltCallback()
   c. HAL_SMARTCARD_ErrorCallback()
1. Non-Blocking mode transfers could be aborted using Abort API's :
   a. HAL_SMARTCARD_Abort()
   b. HAL_SMARTCARD_AbortTransmit()
   c. HAL_SMARTCARD_AbortReceive()
   d. HAL_SMARTCARD_Abort_IT()
   e. HAL_SMARTCARD_AbortTransmit_IT()
   f. HAL_SMARTCARD_AbortReceive_IT()
2. For Abort services based on interrupts (HAL_SMARTCARD_Abortxxx_IT), a set of Abort Complete Callbacks are provided:
   a. HAL_SMARTCARD_AbortCpltCallback()
   b. HAL_SMARTCARD_AbortTransmitCpltCallback()
   c. HAL_SMARTCARD_AbortReceiveCpltCallback()

3. In Non-Blocking mode transfers, possible errors are split into 2 categories. Errors are handled as follows :
   a. Error is considered as Recoverable and non blocking : Transfer could go till end, but error severity is to be evaluated by user : this concerns Frame Error, Parity Error or Noise Error in Interrupt mode reception . Received character is then retrieved and stored in Rx buffer, Error code is set to allow user to identify error type, and HAL_SMARTCARD_ErrorCallback() user callback is executed. Transfer is kept ongoing on SMARTCARD side. If user wants to abort it, Abort services should be called by user.
   b. Error is considered as Blocking : Transfer could not be completed properly and is aborted. This concerns Frame Error in Interrupt mode transmission, Overrun Error in Interrupt mode reception and all errors in DMA mode. Error code is set to allow user to identify error type, and HAL_SMARTCARD_ErrorCallback() user callback is executed.

This section contains the following APIs:

- ***HAL_SMARTCARD_Transmit()***
- ***HAL_SMARTCARD_Receive()***
- ***HAL_SMARTCARD_Transmit_IT()***
- ***HAL_SMARTCARD_Receive_IT()***
- ***HAL_SMARTCARD_Transmit_DMA()***
- ***HAL_SMARTCARD_Receive_DMA()***
- ***HAL_SMARTCARD_Abort()***
- ***HAL_SMARTCARD_AbortTransmit()***
- ***HAL_SMARTCARD_AbortReceive()***
- ***HAL_SMARTCARD_Abort_IT()***
- ***HAL_SMARTCARD_AbortTransmit_IT()***
- ***HAL_SMARTCARD_AbortReceive_IT()***
- ***HAL_SMARTCARD_IRQHandler()***
- ***HAL_SMARTCARD_TxCpltCallback()***
- ***HAL_SMARTCARD_RxCpltCallback()***
- ***HAL_SMARTCARD_ErrorCallback()***
- ***HAL_SMARTCARD_AbortCpltCallback()***
- ***HAL_SMARTCARD_AbortTransmitCpltCallback()***
- ***HAL_SMARTCARD_AbortReceiveCpltCallback()***

43.2.5 Peripheral State and Errors functions

This subsection provides a set of functions allowing to return the State of SmartCard handle and also return Peripheral Errors occurred during communication process

- HAL_SMARTCARD_GetState() API can be helpful to check in run-time the state of the SMARTCARD peripheral.
- HAL_SMARTCARD_GetError() checks in run-time errors that could occur during communication.

This section contains the following APIs:

- ***HAL_SMARTCARD_GetState()***
- ***HAL_SMARTCARD_GetError()***

43.2.6 Detailed description of functions

HAL_SMARTCARD_Init

Function name

HAL_StatusTypeDef HAL_SMARTCARD_Init (SMARTCARD_HandleTypeDef * hsmartcard)

Function description

Initialize the SMARTCARD mode according to the specified parameters in the SMARTCARD_HandleTypeDef and initialize the associated handle.

Parameters

- **hsmartcard:** Pointer to a SMARTCARD_HandleTypeDef structure that contains the configuration information for the specified SMARTCARD module.

Return values

- **HAL:** status

HAL_SMARTCARD_DeInit

Function name

HAL_StatusTypeDef HAL_SMARTCARD_DeInit (SMARTCARD_HandleTypeDef * hsmartcard)

Function description

DeInitialize the SMARTCARD peripheral.

Parameters

- **hsmartcard:** Pointer to a SMARTCARD_HandleTypeDef structure that contains the configuration information for the specified SMARTCARD module.

Return values

- **HAL:** status

HAL_SMARTCARD_MspInit

Function name

void HAL_SMARTCARD_MspInit (SMARTCARD_HandleTypeDef * hsmartcard)

Function description

Initialize the SMARTCARD MSP.

Parameters

- **hsmartcard:** Pointer to a SMARTCARD_HandleTypeDef structure that contains the configuration information for the specified SMARTCARD module.

Return values

- **None:**

HAL_SMARTCARD_MspDeInit

Function name

void HAL_SMARTCARD_MspDeInit (SMARTCARD_HandleTypeDef * hsmartcard)

Function description

DeInitialize the SMARTCARD MSP.

Parameters

- **hsmartcard:** Pointer to a SMARTCARD_HandleTypeDef structure that contains the configuration information for the specified SMARTCARD module.

Return values

- **None:**

HAL_SMARTCARD_RegisterCallback

Function name

HAL_StatusTypeDef HAL_SMARTCARD_RegisterCallback (SMARTCARD_HandleTypeDef * hsmartcard, HAL_SMARTCARD_CallbackIDTypeDef CallbackID, pSMARTCARD_CallbackTypeDef pCallback)

Function description

Register a User SMARTCARD Callback To be used to override the weak predefined callback.

Parameters

- **hsmartcard:** smartcard handle
- **CallbackID:** ID of the callback to be registered This parameter can be one of the following values:
  - HAL_SMARTCARD_TX_COMPLETE_CB_ID Tx Complete Callback ID
  - HAL_SMARTCARD_RX_COMPLETE_CB_ID Rx Complete Callback ID
  - HAL_SMARTCARD_ERROR_CB_ID Error Callback ID
  - HAL_SMARTCARD_ABORT_COMPLETE_CB_ID Abort Complete Callback ID
  - HAL_SMARTCARD_ABORT_TRANSMIT_COMPLETE_CB_ID Abort Transmit Complete Callback ID
  - HAL_SMARTCARD_ABORT_RECEIVE_COMPLETE_CB_ID Abort Receive Complete Callback ID
  - HAL_SMARTCARD_RX_FIFO_FULL_CB_ID Rx Fifo Full Callback ID
  - HAL_SMARTCARD_TX_FIFO_EMPTY_CB_ID Tx Fifo Empty Callback ID
  - HAL_SMARTCARD_MSPINIT_CB_ID MspInit Callback ID
  - HAL_SMARTCARD_MSPDEINIT_CB_ID MspDeInit Callback ID
- **pCallback:** pointer to the Callback function

Return values

- **HAL:** status

Notes

- The HAL_SMARTCARD_RegisterCallback() may be called before HAL_SMARTCARD_Init() in HAL_SMARTCARD_STATE_RESET to register callbacks for HAL_SMARTCARD_MSPINIT_CB_ID and HAL_SMARTCARD_MSPDEINIT_CB_ID

HAL_SMARTCARD_UnRegisterCallback

Function name

HAL_StatusTypeDef HAL_SMARTCARD_UnRegisterCallback (SMARTCARD_HandleTypeDef * hsmartcard, HAL_SMARTCARD_CallbackIDTypeDef CallbackID)

Function description

Unregister an SMARTCARD callback SMARTCARD callback is redirected to the weak predefined callback.

Parameters

- **hsmartcard:** smartcard handle
- **CallbackID:** ID of the callback to be unregistered This parameter can be one of the following values:
  - HAL_SMARTCARD_TX_COMPLETE_CB_ID Tx Complete Callback ID
  - HAL_SMARTCARD_RX_COMPLETE_CB_ID Rx Complete Callback ID
  - HAL_SMARTCARD_ERROR_CB_ID Error Callback ID
  - HAL_SMARTCARD_ABORT_COMPLETE_CB_ID Abort Complete Callback ID
  - HAL_SMARTCARD_ABORT_TRANSMIT_COMPLETE_CB_ID Abort Transmit Complete Callback ID
  - HAL_SMARTCARD_ABORT_RECEIVE_COMPLETE_CB_ID Abort Receive Complete Callback ID
  - HAL_SMARTCARD_RX_FIFO_FULL_CB_ID Rx Fifo Full Callback ID
  - HAL_SMARTCARD_TX_FIFO_EMPTY_CB_ID Tx Fifo Empty Callback ID
  - HAL_SMARTCARD_MSPINIT_CB_ID MspInit Callback ID
  - HAL_SMARTCARD_MSPDEINIT_CB_ID MspDeInit Callback ID

Return values

- **HAL:** status

Notes

- The HAL_SMARTCARD_UnRegisterCallback() may be called before HAL_SMARTCARD_Init() in HAL_SMARTCARD_STATE_RESET to un-register callbacks for HAL_SMARTCARD_MSPINIT_CB_ID and HAL_SMARTCARD_MSPDEINIT_CB_ID

HAL_SMARTCARD_Transmit

Function name

HAL_StatusTypeDef HAL_SMARTCARD_Transmit (SMARTCARD_HandleTypeDef * hsmartcard, const uint8_t * pData, uint16_t Size, uint32_t Timeout)

Function description

Send an amount of data in blocking mode.

Parameters

- **hsmartcard:** Pointer to a SMARTCARD_HandleTypeDef structure that contains the configuration information for the specified SMARTCARD module.
- **pData:** pointer to data buffer.
- **Size:** amount of data to be sent.
- **Timeout:** Timeout duration.

Return values

- **HAL:** status

Notes

- When FIFO mode is enabled, writing a data in the TDR register adds one data to the TXFIFO. Write operations to the TDR register are performed when TXFNF flag is set. From hardware perspective, TXFNF flag and TXE are mapped on the same bit-field.

HAL_SMARTCARD_Receive

Function name

HAL_StatusTypeDef HAL_SMARTCARD_Receive (SMARTCARD_HandleTypeDef * hsmartcard, uint8_t * pData, uint16_t Size, uint32_t Timeout)

Function description

Receive an amount of data in blocking mode.

Parameters

- **hsmartcard:** Pointer to a SMARTCARD_HandleTypeDef structure that contains the configuration information for the specified SMARTCARD module.
- **pData:** pointer to data buffer.
- **Size:** amount of data to be received.
- **Timeout:** Timeout duration.

Return values

- **HAL:** status

Notes

- When FIFO mode is enabled, the RXFNE flag is set as long as the RXFIFO is not empty. Read operations from the RDR register are performed when RXFNE flag is set. From hardware perspective, RXFNE flag and RXNE are mapped on the same bit-field.

HAL_SMARTCARD_Transmit_IT

Function name

HAL_StatusTypeDef HAL_SMARTCARD_Transmit_IT (SMARTCARD_HandleTypeDef * hsmartcard, const uint8_t * pData, uint16_t Size)

Function description

Send an amount of data in interrupt mode.

Parameters

- **hsmartcard:** Pointer to a SMARTCARD_HandleTypeDef structure that contains the configuration information for the specified SMARTCARD module.
- **pData:** pointer to data buffer.
- **Size:** amount of data to be sent.

Return values

- **HAL:** status

Notes

- When FIFO mode is disabled, USART interrupt is generated whenever USART_TDR register is empty, i.e one interrupt per data to transmit.
- When FIFO mode is enabled, USART interrupt is generated whenever TXFIFO threshold reached. In that case the interrupt rate depends on TXFIFO threshold configuration.
- This function sets the hsmartcard->TxIsr function pointer according to the FIFO mode (data transmission processing depends on FIFO mode).

HAL_SMARTCARD_Receive_IT

Function name

HAL_StatusTypeDef HAL_SMARTCARD_Receive_IT (SMARTCARD_HandleTypeDef * hsmartcard, uint8_t * pData, uint16_t Size)

Function description

Receive an amount of data in interrupt mode.

Parameters

- **hsmartcard:** Pointer to a SMARTCARD_HandleTypeDef structure that contains the configuration information for the specified SMARTCARD module.
- **pData:** pointer to data buffer.
- **Size:** amount of data to be received.

Return values

- **HAL:** status

Notes

- When FIFO mode is disabled, USART interrupt is generated whenever USART_RDR register can be read, i.e one interrupt per data to receive.
- When FIFO mode is enabled, USART interrupt is generated whenever RXFIFO threshold reached. In that case the interrupt rate depends on RXFIFO threshold configuration.
- This function sets the hsmartcard->RxIsr function pointer according to the FIFO mode (data reception processing depends on FIFO mode).

HAL_SMARTCARD_Transmit_DMA

Function name

HAL_StatusTypeDef HAL_SMARTCARD_Transmit_DMA (SMARTCARD_HandleTypeDef * hsmartcard, const uint8_t * pData, uint16_t Size)

Function description

Send an amount of data in DMA mode.

Parameters

- **hsmartcard:** Pointer to a SMARTCARD_HandleTypeDef structure that contains the configuration information for the specified SMARTCARD module.
- **pData:** pointer to data buffer.
- **Size:** amount of data to be sent.

Return values

- **HAL:** status

HAL_SMARTCARD_Receive_DMA

Function name

HAL_StatusTypeDef HAL_SMARTCARD_Receive_DMA (SMARTCARD_HandleTypeDef * hsmartcard, uint8_t * pData, uint16_t Size)

Function description

Receive an amount of data in DMA mode.

Parameters

- **hsmartcard:** Pointer to a SMARTCARD_HandleTypeDef structure that contains the configuration information for the specified SMARTCARD module.
- **pData:** pointer to data buffer.
- **Size:** amount of data to be received.

Return values

- **HAL:** status

Notes

- The SMARTCARD-associated USART parity is enabled (PCE = 1), the received data contain the parity bit (MSB position).

HAL_SMARTCARD_Abort

Function name

HAL_StatusTypeDef HAL_SMARTCARD_Abort (SMARTCARD_HandleTypeDef * hsmartcard)

Function description

Abort ongoing transfers (blocking mode).

Parameters

- **hsmartcard:** Pointer to a SMARTCARD_HandleTypeDef structure that contains the configuration information for the specified SMARTCARD module.

Return values

- **HAL:** status

Notes

- This procedure could be used for aborting any ongoing transfer started in Interrupt or DMA mode. This procedure performs following operations : Disable SMARTCARD Interrupts (Tx and Rx)Disable the DMA transfer in the peripheral register (if enabled)Abort DMA transfer by calling HAL_DMA_Abort (in case of transfer in DMA mode)Set handle State to READY
- This procedure is executed in blocking mode : when exiting function, Abort is considered as completed.

HAL_SMARTCARD_AbortTransmit

Function name

HAL_StatusTypeDef HAL_SMARTCARD_AbortTransmit (SMARTCARD_HandleTypeDef * hsmartcard)

Function description

Abort ongoing Transmit transfer (blocking mode).

Parameters

- **hsmartcard:** Pointer to a SMARTCARD_HandleTypeDef structure that contains the configuration information for the specified SMARTCARD module.

Return values

- **HAL:** status

Notes

- This procedure could be used for aborting any ongoing Tx transfer started in Interrupt or DMA mode. This procedure performs following operations : Disable SMARTCARD Interrupts (Tx)Disable the DMA transfer in the peripheral register (if enabled)Abort DMA transfer by calling HAL_DMA_Abort (in case of transfer in DMA mode)Set handle State to READY
- This procedure is executed in blocking mode : when exiting function, Abort is considered as completed.

HAL_SMARTCARD_AbortReceive

Function name

HAL_StatusTypeDef HAL_SMARTCARD_AbortReceive (SMARTCARD_HandleTypeDef * hsmartcard)

Function description

Abort ongoing Receive transfer (blocking mode).

Parameters

- **hsmartcard:** Pointer to a SMARTCARD_HandleTypeDef structure that contains the configuration information for the specified SMARTCARD module.

Return values

- **HAL:** status

Notes

- This procedure could be used for aborting any ongoing Rx transfer started in Interrupt or DMA mode. This procedure performs following operations : Disable SMARTCARD Interrupts (Rx)Disable the DMA transfer in the peripheral register (if enabled)Abort DMA transfer by calling HAL_DMA_Abort (in case of transfer in DMA mode)Set handle State to READY
- This procedure is executed in blocking mode : when exiting function, Abort is considered as completed.

HAL_SMARTCARD_Abort_IT

Function name

HAL_StatusTypeDef HAL_SMARTCARD_Abort_IT (SMARTCARD_HandleTypeDef * hsmartcard)

Function description

Abort ongoing transfers (Interrupt mode).

Parameters

- **hsmartcard:** Pointer to a SMARTCARD_HandleTypeDef structure that contains the configuration information for the specified SMARTCARD module.

Return values

- **HAL:** status

Notes

- This procedure could be used for aborting any ongoing transfer started in Interrupt or DMA mode. This procedure performs following operations : Disable SMARTCARD Interrupts (Tx and Rx)Disable the DMA transfer in the peripheral register (if enabled)Abort DMA transfer by calling HAL_DMA_Abort_IT (in case of transfer in DMA mode)Set handle State to READYAt abort completion, call user abort complete callback
- This procedure is executed in Interrupt mode, meaning that abort procedure could be considered as completed only when user abort complete callback is executed (not when exiting function).

HAL_SMARTCARD_AbortTransmit_IT

Function name

HAL_StatusTypeDef HAL_SMARTCARD_AbortTransmit_IT (SMARTCARD_HandleTypeDef * hsmartcard)

Function description

Abort ongoing Transmit transfer (Interrupt mode).

Parameters

- **hsmartcard:** Pointer to a SMARTCARD_HandleTypeDef structure that contains the configuration information for the specified SMARTCARD module.

Return values

- **HAL:** status

Notes

- This procedure could be used for aborting any ongoing Tx transfer started in Interrupt or DMA mode. This procedure performs following operations : Disable SMARTCARD Interrupts (Tx)Disable the DMA transfer in the peripheral register (if enabled)Abort DMA transfer by calling HAL_DMA_Abort_IT (in case of transfer in DMA mode)Set handle State to READYAt abort completion, call user abort complete callback
- This procedure is executed in Interrupt mode, meaning that abort procedure could be considered as completed only when user abort complete callback is executed (not when exiting function).

HAL_SMARTCARD_AbortReceive_IT

Function name

HAL_StatusTypeDef HAL_SMARTCARD_AbortReceive_IT (SMARTCARD_HandleTypeDef * hsmartcard)

Function description

Abort ongoing Receive transfer (Interrupt mode).

Parameters

- **hsmartcard:** Pointer to a SMARTCARD_HandleTypeDef structure that contains the configuration information for the specified SMARTCARD module.

Return values

- **HAL:** status

Notes

- This procedure could be used for aborting any ongoing Rx transfer started in Interrupt or DMA mode. This procedure performs following operations : Disable SMARTCARD Interrupts (Rx)Disable the DMA transfer in the peripheral register (if enabled)Abort DMA transfer by calling HAL_DMA_Abort_IT (in case of transfer in DMA mode)Set handle State to READYAt abort completion, call user abort complete callback
- This procedure is executed in Interrupt mode, meaning that abort procedure could be considered as completed only when user abort complete callback is executed (not when exiting function).

HAL_SMARTCARD_IRQHandler

Function name

void HAL_SMARTCARD_IRQHandler (SMARTCARD_HandleTypeDef * hsmartcard)

Function description

Handle SMARTCARD interrupt requests.

Parameters

- **hsmartcard:** Pointer to a SMARTCARD_HandleTypeDef structure that contains the configuration information for the specified SMARTCARD module.

Return values

- **None:**

HAL_SMARTCARD_TxCpltCallback

Function name

void HAL_SMARTCARD_TxCpltCallback (SMARTCARD_HandleTypeDef * hsmartcard)

Function description

Tx Transfer completed callback.

Parameters

- **hsmartcard:** Pointer to a SMARTCARD_HandleTypeDef structure that contains the configuration information for the specified SMARTCARD module.

Return values

- **None:**

HAL_SMARTCARD_RxCpltCallback

Function name

void HAL_SMARTCARD_RxCpltCallback (SMARTCARD_HandleTypeDef * hsmartcard)

Function description

Rx Transfer completed callback.

Parameters

- **hsmartcard:** Pointer to a SMARTCARD_HandleTypeDef structure that contains the configuration information for the specified SMARTCARD module.

Return values

- **None:**

HAL_SMARTCARD_ErrorCallback

Function name

void HAL_SMARTCARD_ErrorCallback (SMARTCARD_HandleTypeDef * hsmartcard)

Function description

SMARTCARD error callback.

Parameters

- **hsmartcard:** Pointer to a SMARTCARD_HandleTypeDef structure that contains the configuration information for the specified SMARTCARD module.

Return values

- **None:**

HAL_SMARTCARD_AbortCpltCallback

Function name

void HAL_SMARTCARD_AbortCpltCallback (SMARTCARD_HandleTypeDef * hsmartcard)

Function description

SMARTCARD Abort Complete callback.

Parameters

- **hsmartcard:** Pointer to a SMARTCARD_HandleTypeDef structure that contains the configuration information for the specified SMARTCARD module.

Return values

- **None:**

HAL_SMARTCARD_AbortTransmitCpltCallback

Function name

void HAL_SMARTCARD_AbortTransmitCpltCallback (SMARTCARD_HandleTypeDef * hsmartcard)

Function description

SMARTCARD Abort Complete callback.

Parameters

- **hsmartcard:** Pointer to a SMARTCARD_HandleTypeDef structure that contains the configuration information for the specified SMARTCARD module.

Return values

- **None:**

HAL_SMARTCARD_AbortReceiveCpltCallback

Function name

void HAL_SMARTCARD_AbortReceiveCpltCallback (SMARTCARD_HandleTypeDef * hsmartcard)

Function description

SMARTCARD Abort Receive Complete callback.

Parameters

- **hsmartcard:** Pointer to a SMARTCARD_HandleTypeDef structure that contains the configuration information for the specified SMARTCARD module.

Return values

- **None:**

HAL_SMARTCARD_GetState

Function name

HAL_SMARTCARD_StateTypeDef HAL_SMARTCARD_GetState (const SMARTCARD_HandleTypeDef * hsmartcard)

Function description

Return the SMARTCARD handle state.

Parameters

- **hsmartcard:** Pointer to a SMARTCARD_HandleTypeDef structure that contains the configuration information for the specified SMARTCARD module.

Return values

- **SMARTCARD:** handle state

HAL_SMARTCARD_GetError

Function name

uint32_t HAL_SMARTCARD_GetError (const SMARTCARD_HandleTypeDef * hsmartcard)

Function description

Return the SMARTCARD handle error code.

Parameters

- **hsmartcard:** Pointer to a SMARTCARD_HandleTypeDef structure that contains the configuration information for the specified SMARTCARD module.

Return values

- **SMARTCARD:** handle Error Code

43.3 SMARTCARD Firmware driver defines

The following section lists the various define and macros of the module.

43.3.1 SMARTCARD

SMARTCARD

SMARTCARD Clock Prescaler

SMARTCARD_PRESCALER_DIV1

fclk_pres = fclk

SMARTCARD_PRESCALER_DIV2

fclk_pres = fclk/2

SMARTCARD_PRESCALER_DIV4

fclk_pres = fclk/4

SMARTCARD_PRESCALER_DIV6

fclk_pres = fclk/6

SMARTCARD_PRESCALER_DIV8

fclk_pres = fclk/8

SMARTCARD_PRESCALER_DIV10

fclk_pres = fclk/10

SMARTCARD_PRESCALER_DIV12

fclk_pres = fclk/12

SMARTCARD_PRESCALER_DIV16

fclk_pres = fclk/16

SMARTCARD_PRESCALER_DIV32

fclk_pres = fclk/32

SMARTCARD_PRESCALER_DIV64
: fclk_pres = fclk/64

SMARTCARD_PRESCALER_DIV128
: fclk_pres = fclk/128

SMARTCARD_PRESCALER_DIV256
: fclk_pres = fclk/256

SMARTCARD Clock Phase

SMARTCARD_PHASE_1EDGE
: SMARTCARD frame phase on first clock transition

SMARTCARD_PHASE_2EDGE
: SMARTCARD frame phase on second clock transition

SMARTCARD Clock Polarity

SMARTCARD_POLARITY_LOW
: SMARTCARD frame low polarity

SMARTCARD_POLARITY_HIGH
: SMARTCARD frame high polarity

SMARTCARD advanced feature Binary Data inversion

SMARTCARD_ADVFEATURE_DATAINV_DISABLE
: Binary data inversion disable

SMARTCARD_ADVFEATURE_DATAINV_ENABLE
: Binary data inversion enable

SMARTCARD advanced feature DMA Disable on Rx Error

SMARTCARD_ADVFEATURE_DMA_ENABLEONRXERROR
: DMA enable on Reception Error

SMARTCARD_ADVFEATURE_DMA_DISABLEONRXERROR
: DMA disable on Reception Error

SMARTCARD Error Code Definition

HAL_SMARTCARD_ERROR_NONE
: No error

HAL_SMARTCARD_ERROR_PE
: Parity error

HAL_SMARTCARD_ERROR_NE
: Noise error

HAL_SMARTCARD_ERROR_FE
: frame error

HAL_SMARTCARD_ERROR_ORE
: Overrun error

HAL_SMARTCARD_ERROR_DMA

DMA transfer error

HAL_SMARTCARD_ERROR_RTO

Receiver TimeOut error

HAL_SMARTCARD_ERROR_INVALID_CALLBACK

Invalid Callback error

SMARTCARD Exported Macros

__HAL_SMARTCARD_RESET_HANDLE_STATE

Description:

- Reset SMARTCARD handle states.

Parameters:

- __HANDLE__: SMARTCARD handle.

Return value:

- None

__HAL_SMARTCARD_FLUSH_DRREGISTER

Description:

- Flush the Smartcard Data registers.

Parameters:

- __HANDLE__: specifies the SMARTCARD Handle.

Return value:

- None

__HAL_SMARTCARD_CLEAR_FLAG

Description:

- Clear the specified SMARTCARD pending flag.

Parameters:

- __HANDLE__: specifies the SMARTCARD Handle.
- __FLAG__: specifies the flag to check. This parameter can be any combination of the following values:
  - SMARTCARD_CLEAR_PEF Parity error clear flag
  - SMARTCARD_CLEAR_FEF Framing error clear flag
  - SMARTCARD_CLEAR_NEF Noise detected clear flag
  - SMARTCARD_CLEAR_OREF OverRun error clear flag
  - SMARTCARD_CLEAR_IDLEF Idle line detected clear flag
  - SMARTCARD_CLEAR_TCF Transmission complete clear flag
  - SMARTCARD_CLEAR_TCBGTF Transmission complete before guard time clear flag
  - SMARTCARD_CLEAR_RTOF Receiver timeout clear flag
  - SMARTCARD_CLEAR_EOBF End of block clear flag
  - SMARTCARD_CLEAR_TXFECF TXFIFO empty Clear flag

Return value:

- None

__HAL_SMARTCARD_CLEAR_PEFLAG

Description:

- Clear the SMARTCARD PE pending flag.

Parameters:

- __HANDLE__: specifies the SMARTCARD Handle.

Return value:

- None

__HAL_SMARTCARD_CLEAR_FEFLAG

Description:

- Clear the SMARTCARD FE pending flag.

Parameters:

- __HANDLE__: specifies the SMARTCARD Handle.

Return value:

- None

__HAL_SMARTCARD_CLEAR_NEFLAG

Description:

- Clear the SMARTCARD NE pending flag.

Parameters:

- __HANDLE__: specifies the SMARTCARD Handle.

Return value:

- None

__HAL_SMARTCARD_CLEAR_OREFLAG

Description:

- Clear the SMARTCARD ORE pending flag.

Parameters:

- __HANDLE__: specifies the SMARTCARD Handle.

Return value:

- None

__HAL_SMARTCARD_CLEAR_IDLEFLAG

Description:

- Clear the SMARTCARD IDLE pending flag.

Parameters:

- __HANDLE__: specifies the SMARTCARD Handle.

Return value:

- None

__HAL_SMARTCARD_GET_FLAG

Description:

- Check whether the specified Smartcard flag is set or not.

Parameters:

- __HANDLE__: specifies the SMARTCARD Handle.
- __FLAG__: specifies the flag to check. This parameter can be one of the following values:
  - SMARTCARD_FLAG_TCBGT Transmission complete before guard time flag (when flag available)
  - SMARTCARD_FLAG_REACK Receive enable acknowledge flag
  - SMARTCARD_FLAG_TEACK Transmit enable acknowledge flag
  - SMARTCARD_FLAG_BUSY Busy flag
  - SMARTCARD_FLAG_EOBF End of block flag
  - SMARTCARD_FLAG_RTOF Receiver timeout flag
  - SMARTCARD_FLAG_TXE Transmit data register empty flag
  - SMARTCARD_FLAG_TC Transmission complete flag
  - SMARTCARD_FLAG_RXNE Receive data register not empty flag
  - SMARTCARD_FLAG_IDLE Idle line detection flag
  - SMARTCARD_FLAG_ORE Overrun error flag
  - SMARTCARD_FLAG_NE Noise error flag
  - SMARTCARD_FLAG_FE Framing error flag
  - SMARTCARD_FLAG_PE Parity error flag
  - SMARTCARD_FLAG_TXFNF TXFIFO not full flag
  - SMARTCARD_FLAG_RXFNE RXFIFO not empty flag
  - SMARTCARD_FLAG_TXFE TXFIFO Empty flag
  - SMARTCARD_FLAG_RXFF RXFIFO Full flag
  - SMARTCARD_FLAG_RXFT SMARTCARD RXFIFO threshold flag
  - SMARTCARD_FLAG_TXFT SMARTCARD TXFIFO threshold flag

Return value:

- The: new state of __FLAG__ (TRUE or FALSE).

__HAL_SMARTCARD_ENABLE_IT

Description:

- Enable the specified SmartCard interrupt.

Parameters:

- __HANDLE__: specifies the SMARTCARD Handle.
- __INTERRUPT__: specifies the SMARTCARD interrupt to enable. This parameter can be one of the following values:
  - SMARTCARD_IT_EOB End of block interrupt
  - SMARTCARD_IT_RTO Receive timeout interrupt
  - SMARTCARD_IT_TXE Transmit data register empty interrupt
  - SMARTCARD_IT_TC Transmission complete interrupt
  - SMARTCARD_IT_TCBGT Transmission complete before guard time interrupt (when interruption available)
  - SMARTCARD_IT_RXNE Receive data register not empty interrupt
  - SMARTCARD_IT_IDLE Idle line detection interrupt
  - SMARTCARD_IT_PE Parity error interrupt
  - SMARTCARD_IT_ERR Error interrupt(frame error, noise error, overrun error)
  - SMARTCARD_IT_TXFNF TX FIFO not full interruption
  - SMARTCARD_IT_RXFNE RXFIFO not empty interruption
  - SMARTCARD_IT_RXFF RXFIFO full interruption
  - SMARTCARD_IT_TXFE TXFIFO empty interruption
  - SMARTCARD_IT_RXFT RXFIFO threshold reached interruption
  - SMARTCARD_IT_TXFT TXFIFO threshold reached interruption

Return value:

- None

__HAL_SMARTCARD_DISABLE_IT

Description:

- Disable the specified SmartCard interrupt.

Parameters:

- __HANDLE__: specifies the SMARTCARD Handle.
- __INTERRUPT__: specifies the SMARTCARD interrupt to disable. This parameter can be one of the following values:
  - SMARTCARD_IT_EOB End of block interrupt
  - SMARTCARD_IT_RTO Receive timeout interrupt
  - SMARTCARD_IT_TXE Transmit data register empty interrupt
  - SMARTCARD_IT_TC Transmission complete interrupt
  - SMARTCARD_IT_TCBGT Transmission complete before guard time interrupt (when interruption available)
  - SMARTCARD_IT_RXNE Receive data register not empty interrupt
  - SMARTCARD_IT_IDLE Idle line detection interrupt
  - SMARTCARD_IT_PE Parity error interrupt
  - SMARTCARD_IT_ERR Error interrupt(frame error, noise error, overrun error)
  - SMARTCARD_IT_TXFNF TX FIFO not full interruption
  - SMARTCARD_IT_RXFNE RXFIFO not empty interruption
  - SMARTCARD_IT_RXFF RXFIFO full interruption
  - SMARTCARD_IT_TXFE TXFIFO empty interruption
  - SMARTCARD_IT_RXFT RXFIFO threshold reached interruption
  - SMARTCARD_IT_TXFT TXFIFO threshold reached interruption

Return value:

- None

__HAL_SMARTCARD_GET_IT

Description:

- Check whether the specified SmartCard interrupt has occurred or not.

Parameters:

- __HANDLE__: specifies the SMARTCARD Handle.
- __INTERRUPT__: specifies the SMARTCARD interrupt to check. This parameter can be one of the following values:
  - SMARTCARD_IT_EOB End of block interrupt
  - SMARTCARD_IT_RTO Receive timeout interrupt
  - SMARTCARD_IT_TXE Transmit data register empty interrupt
  - SMARTCARD_IT_TC Transmission complete interrupt
  - SMARTCARD_IT_TCBGT Transmission complete before guard time interrupt (when interruption available)
  - SMARTCARD_IT_RXNE Receive data register not empty interrupt
  - SMARTCARD_IT_IDLE Idle line detection interrupt
  - SMARTCARD_IT_PE Parity error interrupt
  - SMARTCARD_IT_ERR Error interrupt(frame error, noise error, overrun error)
  - SMARTCARD_IT_TXFNF TX FIFO not full interruption
  - SMARTCARD_IT_RXFNE RXFIFO not empty interruption
  - SMARTCARD_IT_RXFF RXFIFO full interruption
  - SMARTCARD_IT_TXFE TXFIFO empty interruption
  - SMARTCARD_IT_RXFT RXFIFO threshold reached interruption
  - SMARTCARD_IT_TXFT TXFIFO threshold reached interruption

Return value:

- The: new state of __INTERRUPT__ (SET or RESET).

__HAL_SMARTCARD_GET_IT_SOURCE

Description:

- Check whether the specified SmartCard interrupt source is enabled or not.

Parameters:

- __HANDLE__: specifies the SMARTCARD Handle.
- __INTERRUPT__: specifies the SMARTCARD interrupt source to check. This parameter can be one of the following values:
  - SMARTCARD_IT_EOB End of block interrupt
  - SMARTCARD_IT_RTO Receive timeout interrupt
  - SMARTCARD_IT_TXE Transmit data register empty interrupt
  - SMARTCARD_IT_TC Transmission complete interrupt
  - SMARTCARD_IT_TCBGT Transmission complete before guard time interrupt (when interruption available)
  - SMARTCARD_IT_RXNE Receive data register not empty interrupt
  - SMARTCARD_IT_IDLE Idle line detection interrupt
  - SMARTCARD_IT_PE Parity error interrupt
  - SMARTCARD_IT_ERR Error interrupt(frame error, noise error, overrun error)
  - SMARTCARD_IT_TXFNF TX FIFO not full interruption
  - SMARTCARD_IT_RXFNE RXFIFO not empty interruption
  - SMARTCARD_IT_RXFF RXFIFO full interruption
  - SMARTCARD_IT_TXFE TXFIFO empty interruption
  - SMARTCARD_IT_RXFT RXFIFO threshold reached interruption
  - SMARTCARD_IT_TXFT TXFIFO threshold reached interruption

Return value:

- The: new state of __INTERRUPT__ (SET or RESET).

__HAL_SMARTCARD_CLEAR_IT

Description:

- Clear the specified SMARTCARD ISR flag, in setting the proper ICR register flag.

Parameters:

- __HANDLE__: specifies the SMARTCARD Handle.
- __IT_CLEAR__: specifies the interrupt clear register flag that needs to be set to clear the corresponding interrupt. This parameter can be one of the following values:
  - SMARTCARD_CLEAR_PEF Parity error clear flag
  - SMARTCARD_CLEAR_FEF Framing error clear flag
  - SMARTCARD_CLEAR_NEF Noise detected clear flag
  - SMARTCARD_CLEAR_OREF OverRun error clear flag
  - SMARTCARD_CLEAR_IDLEF Idle line detection clear flag
  - SMARTCARD_CLEAR_TXFECF TXFIFO empty Clear Flag
  - SMARTCARD_CLEAR_TCF Transmission complete clear flag
  - SMARTCARD_CLEAR_TCBGTF Transmission complete before guard time clear flag (when flag available)
  - SMARTCARD_CLEAR_RTOF Receiver timeout clear flag
  - SMARTCARD_CLEAR_EOBF End of block clear flag

Return value:

- None

__HAL_SMARTCARD_SEND_REQ

Description:

- Set a specific SMARTCARD request flag.

Parameters:

- __HANDLE__: specifies the SMARTCARD Handle.
- __REQ__: specifies the request flag to set This parameter can be one of the following values:
  - SMARTCARD_RXDATA_FLUSH_REQUEST Receive data flush Request
  - SMARTCARD_TXDATA_FLUSH_REQUEST Transmit data flush Request

Return value:

- None

__HAL_SMARTCARD_ONE_BIT_SAMPLE_ENABLE

Description:

- Enable the SMARTCARD one bit sample method.

Parameters:

- __HANDLE__: specifies the SMARTCARD Handle.

Return value:

- None

__HAL_SMARTCARD_ONE_BIT_SAMPLE_DISABLE

Description:

- Disable the SMARTCARD one bit sample method.

Parameters:

- __HANDLE__: specifies the SMARTCARD Handle.

Return value:

- None

__HAL_SMARTCARD_ENABLE

Description:

- Enable the USART associated to the SMARTCARD Handle.

Parameters:

- __HANDLE__: specifies the SMARTCARD Handle.

Return value:

- None

__HAL_SMARTCARD_DISABLE

Description:

- Disable the USART associated to the SMARTCARD Handle.

Parameters:

- __HANDLE__: specifies the SMARTCARD Handle.

Return value:

- None

SMARTCARD interruptions flags mask

SMARTCARD_IT_MASK

SMARTCARD interruptions flags mask

SMARTCARD_CR_MASK

SMARTCARD control register mask

SMARTCARD_CR_POS

SMARTCARD control register position

SMARTCARD_ISR_MASK

SMARTCARD ISR register mask

SMARTCARD_ISR_POS

SMARTCARD ISR register position

SMARTCARD Last Bit

SMARTCARD_LASTBIT_DISABLE

SMARTCARD frame last data bit clock pulse not output to SCLK pin

SMARTCARD_LASTBIT_ENABLE

SMARTCARD frame last data bit clock pulse output to SCLK pin

SMARTCARD Transfer Mode

SMARTCARD_MODE_RX

SMARTCARD RX mode

SMARTCARD_MODE_TX

SMARTCARD TX mode

SMARTCARD_MODE_TX_RX

SMARTCARD RX and TX mode

SMARTCARD advanced feature MSB first

SMARTCARD_ADVFEATURE_MSBFIRST_DISABLE

Most significant bit sent/received first disable

SMARTCARD_ADVFEATURE_MSBFIRST_ENABLE

Most significant bit sent/received first enable

SMARTCARD NACK Enable

SMARTCARD_NACK_DISABLE

SMARTCARD NACK transmission disabled

SMARTCARD_NACK_ENABLE

SMARTCARD NACK transmission enabled

SMARTCARD One Bit Sampling Method

SMARTCARD_ONE_BIT_SAMPLE_DISABLE

SMARTCARD frame one-bit sample disabled

SMARTCARD_ONE_BIT_SAMPLE_ENABLE

SMARTCARD frame one-bit sample enabled

SMARTCARD advanced feature Overrun Disable

SMARTCARD_ADVFEATURE_OVERRUN_ENABLE

RX overrun enable

SMARTCARD_ADVFEATURE_OVERRUN_DISABLE

RX overrun disable

SMARTCARD Parity

SMARTCARD_PARITY_EVEN

SMARTCARD frame even parity

SMARTCARD_PARITY_ODD

SMARTCARD frame odd parity

SMARTCARD Request Parameters

SMARTCARD_RXDATA_FLUSH_REQUEST

Receive data flush request

SMARTCARD_TXDATA_FLUSH_REQUEST

Transmit data flush request

SMARTCARD advanced feature RX pin active level inversion

SMARTCARD_ADVFEATURE_RXINV_DISABLE

RX pin active level inversion disable

SMARTCARD_ADVFEATURE_RXINV_ENABLE

RX pin active level inversion enable

SMARTCARD advanced feature RX TX pins swap

SMARTCARD_ADVFEATURE_SWAP_DISABLE

TX/RX pins swap disable

SMARTCARD_ADVFEATURE_SWAP_ENABLE

TX/RX pins swap enable

SMARTCARD State Code Definition

HAL_SMARTCARD_STATE_RESET

Peripheral is not initialized. Value is allowed for gState and RxState

HAL_SMARTCARD_STATE_READY

Peripheral Initialized and ready for use. Value is allowed for gState and RxState

HAL_SMARTCARD_STATE_BUSY

an internal process is ongoing Value is allowed for gState only

HAL_SMARTCARD_STATE_BUSY_TX

Data Transmission process is ongoing Value is allowed for gState only

HAL_SMARTCARD_STATE_BUSY_RX

Data Reception process is ongoing Value is allowed for RxState only

HAL_SMARTCARD_STATE_BUSY_TX_RX

Data Transmission and Reception process is ongoing Not to be used for neither gState nor RxState. Value is result of combination (Or) between gState and RxState values

HAL_SMARTCARD_STATE_TIMEOUT

Timeout state Value is allowed for gState only

HAL_SMARTCARD_STATE_ERROR

Error Value is allowed for gState only

SMARTCARD Number of Stop Bits

SMARTCARD_STOPBITS_0_5

SMARTCARD frame with 0.5 stop bit

SMARTCARD_STOPBITS_1_5

SMARTCARD frame with 1.5 stop bits

SMARTCARD Timeout Enable

SMARTCARD_TIMEOUT_DISABLE

SMARTCARD receiver timeout disabled

SMARTCARD_TIMEOUT_ENABLE

SMARTCARD receiver timeout enabled

SMARTCARD advanced feature TX pin active level inversion

SMARTCARD_ADVFEATURE_TXINV_DISABLE

TX pin active level inversion disable

SMARTCARD_ADVFEATURE_TXINV_ENABLE

TX pin active level inversion enable

SMARTCARD Word Length

SMARTCARD_WORDLENGTH_9B

SMARTCARD frame length

44 HAL SMARTCARD Extension Driver

44.1 SMARTCARDEx Firmware driver API description

The following section lists the various functions of the SMARTCARDEx library.

44.1.1 SMARTCARD peripheral extended features

The Extended SMARTCARD HAL driver can be used as follows:

1. After having configured the SMARTCARD basic features with HAL_SMARTCARD_Init(), then program SMARTCARD advanced features if required (TX/RX pins swap, TimeOut, auto-retry counter,...) in the hsmartcard AdvancedInit structure.
2. FIFO mode enabling/disabling and RX/TX FIFO threshold programming.

Note: When SMARTCARD operates in FIFO mode, FIFO mode must be enabled prior starting RX/TX transfers. Also RX/TX FIFO thresholds must be configured prior starting RX/TX transfers.

44.1.2 Peripheral Control functions

This subsection provides a set of functions allowing to initialize the SMARTCARD.

- HAL_SMARTCARDEx_BlockLength_Config() API allows to configure the Block Length on the fly
- HAL_SMARTCARDEx_TimeOut_Config() API allows to configure the receiver timeout value on the fly
- HAL_SMARTCARDEx_EnableReceiverTimeOut() API enables the receiver timeout feature
- HAL_SMARTCARDEx_DisableReceiverTimeOut() API disables the receiver timeout feature

This section contains the following APIs:

- ***HAL_SMARTCARDEx_BlockLength_Config()***
- ***HAL_SMARTCARDEx_TimeOut_Config()***
- ***HAL_SMARTCARDEx_EnableReceiverTimeOut()***
- ***HAL_SMARTCARDEx_DisableReceiverTimeOut()***

44.1.3 IO operation functions

This subsection provides a set of FIFO mode related callback functions.

1. TX/RX Fifos Callbacks:
   - HAL_SMARTCARDEx_RxFifoFullCallback()
   - HAL_SMARTCARDEx_TxFifoEmptyCallback()

This section contains the following APIs:

- ***HAL_SMARTCARDEx_RxFifoFullCallback()***
- ***HAL_SMARTCARDEx_TxFifoEmptyCallback()***

44.1.4 Peripheral FIFO Control functions

This subsection provides a set of functions allowing to control the SMARTCARD FIFO feature.

- HAL_SMARTCARDEx_EnableFifoMode() API enables the FIFO mode
- HAL_SMARTCARDEx_DisableFifoMode() API disables the FIFO mode
- HAL_SMARTCARDEx_SetTxFifoThreshold() API sets the TX FIFO threshold
- HAL_SMARTCARDEx_SetRxFifoThreshold() API sets the RX FIFO threshold

This section contains the following APIs:

- ***HAL_SMARTCARDEx_EnableFifoMode()***
- ***HAL_SMARTCARDEx_DisableFifoMode()***
- ***HAL_SMARTCARDEx_SetTxFifoThreshold()***
- ***HAL_SMARTCARDEx_SetRxFifoThreshold()***

44.1.5 Detailed description of functions

HAL_SMARTCARDEx_BlockLength_Config

Function name

void HAL_SMARTCARDEx_BlockLength_Config (SMARTCARD_HandleTypeDef * hsmartcard, uint8_t BlockLength)

Function description

Update on the fly the SMARTCARD block length in RTOR register.

Parameters

- **hsmartcard:** Pointer to a SMARTCARD_HandleTypeDef structure that contains the configuration information for the specified SMARTCARD module.
- **BlockLength:** SMARTCARD block length (8-bit long at most)

Return values

- **None:**

HAL_SMARTCARDEx_TimeOut_Config

Function name

void HAL_SMARTCARDEx_TimeOut_Config (SMARTCARD_HandleTypeDef * hsmartcard, uint32_t TimeOutValue)

Function description

Update on the fly the receiver timeout value in RTOR register.

Parameters

- **hsmartcard:** Pointer to a SMARTCARD_HandleTypeDef structure that contains the configuration information for the specified SMARTCARD module.
- **TimeOutValue:** receiver timeout value in number of baud blocks. The timeout value must be less or equal to 0x0FFFFFFF.

Return values

- **None:**

HAL_SMARTCARDEx_EnableReceiverTimeOut

Function name

HAL_StatusTypeDef HAL_SMARTCARDEx_EnableReceiverTimeOut (SMARTCARD_HandleTypeDef * hsmartcard)

Function description

Enable the SMARTCARD receiver timeout feature.

Parameters

- **hsmartcard:** Pointer to a SMARTCARD_HandleTypeDef structure that contains the configuration information for the specified SMARTCARD module.

Return values

- **HAL:** status

HAL_SMARTCARDEx_DisableReceiverTimeOut

Function name

HAL_StatusTypeDef HAL_SMARTCARDEx_DisableReceiverTimeOut (SMARTCARD_HandleTypeDef * hsmartcard)

Function description

Disable the SMARTCARD receiver timeout feature.

Parameters

- **hsmartcard:** Pointer to a SMARTCARD_HandleTypeDef structure that contains the configuration information for the specified SMARTCARD module.

Return values

- **HAL:** status

HAL_SMARTCARDEx_RxFifoFullCallback

Function name

void HAL_SMARTCARDEx_RxFifoFullCallback (SMARTCARD_HandleTypeDef * hsmartcard)

Function description

SMARTCARD RX Fifo full callback.

Parameters

- **hsmartcard:** Pointer to a SMARTCARD_HandleTypeDef structure that contains the configuration information for the specified SMARTCARD module.

Return values

- **None:**

HAL_SMARTCARDEx_TxFifoEmptyCallback

Function name

void HAL_SMARTCARDEx_TxFifoEmptyCallback (SMARTCARD_HandleTypeDef * hsmartcard)

Function description

SMARTCARD TX Fifo empty callback.

Parameters

- **hsmartcard:** Pointer to a SMARTCARD_HandleTypeDef structure that contains the configuration information for the specified SMARTCARD module.

Return values

- **None:**

HAL_SMARTCARDEx_EnableFifoMode

Function name

HAL_StatusTypeDef HAL_SMARTCARDEx_EnableFifoMode (SMARTCARD_HandleTypeDef * hsmartcard)

Function description

Enable the FIFO mode.

Parameters

- **hsmartcard:** SMARTCARD handle.

Return values

- **HAL:** status

HAL_SMARTCARDEx_DisableFifoMode

Function name

HAL_StatusTypeDef HAL_SMARTCARDEx_DisableFifoMode (SMARTCARD_HandleTypeDef * hsmartcard)

Function description

Disable the FIFO mode.

Parameters

- **hsmartcard:** SMARTCARD handle.

Return values

- **HAL:** status

HAL_SMARTCARDEx_SetTxFifoThreshold

Function name

HAL_StatusTypeDef HAL_SMARTCARDEx_SetTxFifoThreshold (SMARTCARD_HandleTypeDef * hsmartcard, uint32_t Threshold)

Function description

Set the TXFIFO threshold.

Parameters

- **hsmartcard:** SMARTCARD handle.
- **Threshold:** TX FIFO threshold value This parameter can be one of the following values:
  - SMARTCARD_TXFIFO_THRESHOLD_1_8
  - SMARTCARD_TXFIFO_THRESHOLD_1_4
  - SMARTCARD_TXFIFO_THRESHOLD_1_2
  - SMARTCARD_TXFIFO_THRESHOLD_3_4
  - SMARTCARD_TXFIFO_THRESHOLD_7_8
  - SMARTCARD_TXFIFO_THRESHOLD_8_8

Return values

- **HAL:** status

HAL_SMARTCARDEx_SetRxFifoThreshold

Function name

HAL_StatusTypeDef HAL_SMARTCARDEx_SetRxFifoThreshold (SMARTCARD_HandleTypeDef * hsmartcard, uint32_t Threshold)

Function description

Set the RXFIFO threshold.

Parameters

- **hsmartcard:** SMARTCARD handle.
- **Threshold:** RX FIFO threshold value This parameter can be one of the following values:
  - SMARTCARD_RXFIFO_THRESHOLD_1_8
  - SMARTCARD_RXFIFO_THRESHOLD_1_4
  - SMARTCARD_RXFIFO_THRESHOLD_1_2
  - SMARTCARD_RXFIFO_THRESHOLD_3_4
  - SMARTCARD_RXFIFO_THRESHOLD_7_8
  - SMARTCARD_RXFIFO_THRESHOLD_8_8

Return values

- **HAL:** status

44.2 SMARTCARDEx Firmware driver defines

The following section lists the various define and macros of the module.

44.2.1 SMARTCARDEx

SMARTCARDEx

SMARTCARD advanced feature initialization type

SMARTCARD_ADVFEATURE_NO_INIT

No advanced feature initialization

SMARTCARD_ADVFEATURE_TXINVERT_INIT

TX pin active level inversion

SMARTCARD_ADVFEATURE_RXINVERT_INIT

RX pin active level inversion

SMARTCARD_ADVFEATURE_DATAINVERT_INIT

Binary data inversion

SMARTCARD_ADVFEATURE_SWAP_INIT

TX/RX pins swap

SMARTCARD_ADVFEATURE_RXOVERRUNDISABLE_INIT

RX overrun disable

SMARTCARD_ADVFEATURE_DMADISABLEONERROR_INIT

DMA disable on Reception Error

SMARTCARD_ADVFEATURE_MSBFIRST_INIT

Most significant bit sent/received first

SMARTCARD_ADVFEATURE_TXCOMPLETION

TX completion indication before of after guard time

SMARTCARD FIFO mode

SMARTCARD_FIFOMODE_DISABLE

FIFO mode disable

SMARTCARD_FIFOMODE_ENABLE

FIFO mode enable

SMARTCARD Flags

SMARTCARD_FLAG_TCBGT

SMARTCARD transmission complete before guard time completion

SMARTCARD_FLAG_REACK

SMARTCARD receive enable acknowledge flag

SMARTCARD_FLAG_TEACK

SMARTCARD transmit enable acknowledge flag

SMARTCARD_FLAG_BUSY

SMARTCARD busy flag

SMARTCARD_FLAG_EOBF

SMARTCARD end of block flag

SMARTCARD_FLAG_RTOF

SMARTCARD receiver timeout flag

SMARTCARD_FLAG_TXE

SMARTCARD transmit data register empty

SMARTCARD_FLAG_TXFNF

SMARTCARD TXFIFO not full

SMARTCARD_FLAG_TC

SMARTCARD transmission complete

SMARTCARD_FLAG_RXNE

SMARTCARD read data register not empty

SMARTCARD_FLAG_RXFNE

SMARTCARD RXFIFO not empty

SMARTCARD_FLAG_IDLE

SMARTCARD idle line detection

SMARTCARD_FLAG_ORE

SMARTCARD overrun error

SMARTCARD_FLAG_NE

SMARTCARD noise error

SMARTCARD_FLAG_FE

SMARTCARD frame error

SMARTCARD_FLAG_PE

SMARTCARD parity error

SMARTCARD_FLAG_TXFE

SMARTCARD TXFIFO Empty flag

SMARTCARD_FLAG_RXFF

SMARTCARD RXFIFO Full flag

SMARTCARD_FLAG_RXFT

SMARTCARD RXFIFO threshold flag

SMARTCARD_FLAG_TXFT

SMARTCARD TXFIFO threshold flag

SMARTCARD Interrupts Definition

SMARTCARD_IT_PE

SMARTCARD parity error interruption

SMARTCARD_IT_TXE

SMARTCARD transmit data register empty interruption

SMARTCARD_IT_TXFNF

SMARTCARD TX FIFO not full interruption

SMARTCARD_IT_TC

SMARTCARD transmission complete interruption

SMARTCARD_IT_RXNE

SMARTCARD read data register not empty interruption

SMARTCARD_IT_RXFNE

SMARTCARD RXFIFO not empty interruption

SMARTCARD_IT_IDLE

SMARTCARD idle line detection interruption

SMARTCARD_IT_ERR

SMARTCARD error interruption

SMARTCARD_IT_ORE

SMARTCARD overrun error interruption

SMARTCARD_IT_NE

SMARTCARD noise error interruption

SMARTCARD_IT_FE

SMARTCARD frame error interruption

SMARTCARD_IT_EOB

SMARTCARD end of block interruption

SMARTCARD_IT_RTO

SMARTCARD receiver timeout interruption

SMARTCARD_IT_TCBGT

SMARTCARD transmission complete before guard time completion interruption

SMARTCARD_IT_RXFF

SMARTCARD RXFIFO full interruption

SMARTCARD_IT_TXFE

SMARTCARD TXFIFO empty interruption

SMARTCARD_IT_RXFT

SMARTCARD RXFIFO threshold reached interruption

SMARTCARD_IT_TXFT

SMARTCARD TXFIFO threshold reached interruption

SMARTCARD Interruption Clear Flags

SMARTCARD_CLEAR_PEF

SMARTCARD parity error clear flag

SMARTCARD_CLEAR_FEF

SMARTCARD framing error clear flag

SMARTCARD_CLEAR_NEF

SMARTCARD noise error detected clear flag

SMARTCARD_CLEAR_OREF

SMARTCARD overrun error clear flag

SMARTCARD_CLEAR_IDLEF

SMARTCARD idle line detected clear flag

SMARTCARD_CLEAR_TXFECF

TXFIFO empty Clear Flag

SMARTCARD_CLEAR_TCF

SMARTCARD transmission complete clear flag

SMARTCARD_CLEAR_TCBGTF

SMARTCARD transmission complete before guard time completion clear flag

SMARTCARD_CLEAR_RTOF

SMARTCARD receiver time out clear flag

SMARTCARD_CLEAR_EOBF

SMARTCARD end of block clear flag

SMARTCARD RXFIFO threshold level

SMARTCARD_RXFIFO_THRESHOLD_1_8

RXFIFO FIFO reaches 1/8 of its depth

SMARTCARD_RXFIFO_THRESHOLD_1_4

RXFIFO FIFO reaches 1/4 of its depth

SMARTCARD_RXFIFO_THRESHOLD_1_2

RXFIFO FIFO reaches 1/2 of its depth

SMARTCARD_RXFIFO_THRESHOLD_3_4

RXFIFO FIFO reaches 3/4 of its depth

SMARTCARD_RXFIFO_THRESHOLD_7_8

RXFIFO FIFO reaches 7/8 of its depth

SMARTCARD_RXFIFO_THRESHOLD_8_8

RXFIFO FIFO becomes full

SMARTCARD Transmission Completion Indication

SMARTCARD_TCBGT

SMARTCARD transmission complete before guard time

SMARTCARD_TC

SMARTCARD transmission complete (flag raised when guard time has elapsed)

SMARTCARD TXFIFO threshold level

SMARTCARD_TXFIFO_THRESHOLD_1_8

TXFIFO reaches 1/8 of its depth

SMARTCARD_TXFIFO_THRESHOLD_1_4

TXFIFO reaches 1/4 of its depth

SMARTCARD_TXFIFO_THRESHOLD_1_2

TXFIFO reaches 1/2 of its depth

SMARTCARD_TXFIFO_THRESHOLD_3_4

TXFIFO reaches 3/4 of its depth

SMARTCARD_TXFIFO_THRESHOLD_7_8

TXFIFO reaches 7/8 of its depth

SMARTCARD_TXFIFO_THRESHOLD_8_8

TXFIFO becomes empty

45 HAL SPI Generic Driver

45.1 SPI Firmware driver registers structures

45.1.1 SPI_InitTypeDef

SPI_InitTypeDef is defined in the stm32u0xx_hal_spi.h

Data Fields

- ***uint32_t Mode***
- ***uint32_t Direction***
- ***uint32_t DataSize***
- ***uint32_t CLKPolarity***
- ***uint32_t CLKPhase***
- ***uint32_t NSS***
- ***uint32_t BaudRatePrescaler***
- ***uint32_t FirstBit***
- ***uint32_t TIMode***
- ***uint32_t CRCCalculation***
- ***uint32_t CRCPolynomial***
- ***uint32_t CRCLength***
- ***uint32_t NSSPMode***

Field Documentation

- ***uint32_t SPI_InitTypeDef::Mode***
  Specifies the SPI operating mode. This parameter can be a value of ***SPI_Mode***
- ***uint32_t SPI_InitTypeDef::Direction***
  Specifies the SPI bidirectional mode state. This parameter can be a value of ***SPI_Direction***
- ***uint32_t SPI_InitTypeDef::DataSize***
  Specifies the SPI data size. This parameter can be a value of ***SPI_Data_Size***
- ***uint32_t SPI_InitTypeDef::CLKPolarity***
  Specifies the serial clock steady state. This parameter can be a value of ***SPI_Clock_Polarity***
- ***uint32_t SPI_InitTypeDef::CLKPhase***
  Specifies the clock active edge for the bit capture. This parameter can be a value of ***SPI_Clock_Phase***
- ***uint32_t SPI_InitTypeDef::NSS***
  Specifies whether the NSS signal is managed by hardware (NSS pin) or by software using the SSI bit. This parameter can be a value of ***SPI_Slave_Select_management***
- ***uint32_t SPI_InitTypeDef::BaudRatePrescaler***
  Specifies the Baud Rate prescaler value which will be used to configure the transmit and receive SCK clock. This parameter can be a value of ***SPI_BaudRate_Prescaler***
  Note:
  – The communication clock is derived from the master clock. The slave clock does not need to be set.
- ***uint32_t SPI_InitTypeDef::FirstBit***
  Specifies whether data transfers start from MSB or LSB bit. This parameter can be a value of ***SPI_MSB_LSB_transmission***
- ***uint32_t SPI_InitTypeDef::TIMode***
  Specifies if the TI mode is enabled or not. This parameter can be a value of ***SPI_TI_mode***
- ***uint32_t SPI_InitTypeDef::CRCCalculation***
  Specifies if the CRC calculation is enabled or not. This parameter can be a value of ***SPI_CRC_Calculation***
- ***uint32_t SPI_InitTypeDef::CRCPolynomial***
  Specifies the polynomial used for the CRC calculation. This parameter must be an odd number between Min_Data = 1 and Max_Data = 65535
- ***uint32_t SPI_InitTypeDef::CRCLength***
  Specifies the CRC Length used for the CRC calculation. CRC Length is only used with Data8 and Data16, not other data size This parameter can be a value of ***SPI_CRC_length***

- ***uint32_t SPI_InitTypeDef::NSSPMode***
  Specifies whether the NSSP signal is enabled or not . This parameter can be a value of ***SPI_NSSP_Mode***
  This mode is activated by the NSSP bit in the SPIx_CR2 register and it takes effect only if the SPI interface is configured as Motorola SPI master (FRF=0) with capture on the first edge (SPIx_CR1 CPHA = 0, CPOL setting is ignored)..

45.1.2 __SPI_HandleTypeDef

__SPI_HandleTypeDef is defined in the stm32u0xx_hal_spi.h

Data Fields

- ***SPI_TypeDef * Instance***
- ***SPI_InitTypeDef Init***
- ***uint8_t * pTxBuffPtr***
- ***uint16_t TxXferSize***
- ***__IO uint16_t TxXferCount***
- ***uint8_t * pRxBuffPtr***
- ***uint16_t RxXferSize***
- ***__IO uint16_t RxXferCount***
- ***uint32_t CRCSize***
- ***void(* RxISR***
- ***void(* TxISR***
- ***DMA_HandleTypeDef * hdmatx***
- ***DMA_HandleTypeDef * hdmarx***
- ***HAL_LockTypeDef Lock***
- ***__IO HAL_SPI_StateTypeDef State***
- ***__IO uint32_t ErrorCode***
- ***void(* TxCpltCallback***
- ***void(* RxCpltCallback***
- ***void(* TxRxCpltCallback***
- ***void(* TxHalfCpltCallback***
- ***void(* RxHalfCpltCallback***
- ***void(* TxRxHalfCpltCallback***
- ***void(* ErrorCallback***
- ***void(* AbortCpltCallback***
- ***void(* MspInitCallback***
- ***void(* MspDeInitCallback***

Field Documentation

- ***SPI_TypeDef* __SPI_HandleTypeDef::Instance***
  SPI registers base address
- ***SPI_InitTypeDef __SPI_HandleTypeDef::Init***
  SPI communication parameters
- ***uint8_t* __SPI_HandleTypeDef::pTxBuffPtr***
  Pointer to SPI Tx transfer Buffer
- ***uint16_t __SPI_HandleTypeDef::TxXferSize***
  SPI Tx Transfer size
- ***__IO uint16_t __SPI_HandleTypeDef::TxXferCount***
  SPI Tx Transfer Counter
- ***uint8_t* __SPI_HandleTypeDef::pRxBuffPtr***
  Pointer to SPI Rx transfer Buffer
- ***uint16_t __SPI_HandleTypeDef::RxXferSize***
  SPI Rx Transfer size
- ***__IO uint16_t __SPI_HandleTypeDef::RxXferCount***
  SPI Rx Transfer Counter

- ***uint32_t __SPI_HandleTypeDef::CRCSize***
  SPI CRC size used for the transfer
- ***void(* __SPI_HandleTypeDef::RxISR)(struct __SPI_HandleTypeDef *hspi)***
  function pointer on Rx ISR
- ***void(* __SPI_HandleTypeDef::TxISR)(struct __SPI_HandleTypeDef *hspi)***
  function pointer on Tx ISR
- ***DMA_HandleTypeDef* __SPI_HandleTypeDef::hdmatx***
  SPI Tx DMA Handle parameters
- ***DMA_HandleTypeDef* __SPI_HandleTypeDef::hdmarx***
  SPI Rx DMA Handle parameters
- ***HAL_LockTypeDef __SPI_HandleTypeDef::Lock***
  Locking object
- ***__IO HAL_SPI_StateTypeDef __SPI_HandleTypeDef::State***
  SPI communication state
- ***__IO uint32_t __SPI_HandleTypeDef::ErrorCode***
  SPI Error code
- ***void(* __SPI_HandleTypeDef::TxCpltCallback)(struct __SPI_HandleTypeDef *hspi)***
  SPI Tx Completed callback
- ***void(* __SPI_HandleTypeDef::RxCpltCallback)(struct __SPI_HandleTypeDef *hspi)***
  SPI Rx Completed callback
- ***void(* __SPI_HandleTypeDef::TxRxCpltCallback)(struct __SPI_HandleTypeDef *hspi)***
  SPI TxRx Completed callback
- ***void(* __SPI_HandleTypeDef::TxHalfCpltCallback)(struct __SPI_HandleTypeDef *hspi)***
  SPI Tx Half Completed callback
- ***void(* __SPI_HandleTypeDef::RxHalfCpltCallback)(struct __SPI_HandleTypeDef *hspi)***
  SPI Rx Half Completed callback
- ***void(* __SPI_HandleTypeDef::TxRxHalfCpltCallback)(struct __SPI_HandleTypeDef *hspi)***
  SPI TxRx Half Completed callback
- ***void(* __SPI_HandleTypeDef::ErrorCallback)(struct __SPI_HandleTypeDef *hspi)***
  SPI Error callback
- ***void(* __SPI_HandleTypeDef::AbortCpltCallback)(struct __SPI_HandleTypeDef *hspi)***
  SPI Abort callback
- ***void(* __SPI_HandleTypeDef::MspInitCallback)(struct __SPI_HandleTypeDef *hspi)***
  SPI Msp Init callback
- ***void(* __SPI_HandleTypeDef::MspDeInitCallback)(struct __SPI_HandleTypeDef *hspi)***
  SPI Msp DeInit callback

45.2 SPI Firmware driver API description

The following section lists the various functions of the SPI library.

45.2.1 How to use this driver

The SPI HAL driver can be used as follows:

1. Declare a SPI_HandleTypeDef handle structure, for example: SPI_HandleTypeDef hspi;

2. Initialize the SPI low level resources by implementing the HAL_SPI_MspInit() API:
   a. Enable the SPIx interface clock
   b. SPI pins configuration
      - Enable the clock for the SPI GPIOs
      - Configure these SPI pins as alternate function push-pull
   c. NVIC configuration if you need to use interrupt process
      - Configure the SPIx interrupt priority
      - Enable the NVIC SPI IRQ handle
   d. DMA Configuration if you need to use DMA process
      - Declare a DMA_HandleTypeDef handle structure for the transmit or receive Stream/Channel
      - Enable the DMAx clock
      - Configure the DMA handle parameters
      - Configure the DMA Tx or Rx Stream/Channel
      - Associate the initialized hdma_tx(or _rx) handle to the hspi DMA Tx or Rx handle
      - Configure the priority and enable the NVIC for the transfer complete interrupt on the DMA Tx or Rx Stream/Channel
3. Program the Mode, BidirectionalMode , Data size, Baudrate Prescaler, NSS management, Clock polarity and phase, FirstBit and CRC configuration in the hspi Init structure.
4. Initialize the SPI registers by calling the HAL_SPI_Init() API:
   – This API configures also the low level Hardware GPIO, CLOCK, CORTEX...etc) by calling the customized HAL_SPI_MspInit() API.

Circular mode restriction:

1. The DMA circular mode cannot be used when the SPI is configured in these modes:
   a. Master 2Lines RxOnly
   b. Master 1Line Rx
2. The CRC feature is not managed when the DMA circular mode is enabled
3. When the SPI DMA Pause/Stop features are used, we must use the following APIs the HAL_SPI_DMAPause()/ HAL_SPI_DMAStop() only under the SPI callbacks

Master Receive mode restriction:

1. In Master unidirectional receive-only mode (MSTR =1, BIDIMODE=0, RXONLY=1) or bidirectional receive mode (MSTR=1, BIDIMODE=1, BIDIOE=0), to ensure that the SPI does not initiate a new transfer the following procedure has to be respected:
   a. HAL_SPI_DeInit()
   b. HAL_SPI_Init()

Callback registration:

1. The compilation flag USE_HAL_SPI_REGISTER_CALLBACKS when set to 1U allows the user to configure dynamically the driver callbacks. Use Functions HAL_SPI_RegisterCallback() to register an interrupt callback. Function HAL_SPI_RegisterCallback() allows to register following callbacks:
   – TxCpltCallback : SPI Tx Completed callback
   – RxCpltCallback : SPI Rx Completed callback
   – TxRxCpltCallback : SPI TxRx Completed callback
   – TxHalfCpltCallback : SPI Tx Half Completed callback
   – RxHalfCpltCallback : SPI Rx Half Completed callback
   – TxRxHalfCpltCallback : SPI TxRx Half Completed callback
   – ErrorCallback : SPI Error callback
   – AbortCpltCallback : SPI Abort callback
   – MspInitCallback : SPI Msp Init callback
   – MspDeInitCallback : SPI Msp DeInit callback This function takes as parameters the HAL peripheral handle, the Callback ID and a pointer to the user callback function.

2. Use function HAL_SPI_UnRegisterCallback to reset a callback to the default weak function. HAL_SPI_UnRegisterCallback takes as parameters the HAL peripheral handle, and the Callback ID. This function allows to reset following callbacks:
   - TxCpltCallback : SPI Tx Completed callback
   - RxCpltCallback : SPI Rx Completed callback
   - TxRxCpltCallback : SPI TxRx Completed callback
   - TxHalfCpltCallback : SPI Tx Half Completed callback
   - RxHalfCpltCallback : SPI Rx Half Completed callback
   - TxRxHalfCpltCallback : SPI TxRx Half Completed callback
   - ErrorCallback : SPI Error callback
   - AbortCpltCallback : SPI Abort callback
   - MspInitCallback : SPI Msp Init callback
   - MspDeInitCallback : SPI Msp DeInit callback

By default, after the HAL_SPI_Init() and when the state is HAL_SPI_STATE_RESET all callbacks are set to the corresponding weak functions: examples HAL_SPI_MasterTxCpltCallback(), HAL_SPI_MasterRxCpltCallback(). Exception done for MspInit and MspDeInit functions that are reset to the legacy weak functions in the HAL_SPI_Init()/ HAL_SPI_DeInit() only when these callbacks are null (not registered beforehand). If MspInit or MspDeInit are not null, the HAL_SPI_Init()/ HAL_SPI_DeInit() keep and use the user MspInit/MspDeInit callbacks (registered beforehand) whatever the state.

Callbacks can be registered/unregistered in HAL_SPI_STATE_READY state only. Exception done MspInit/ MspDeInit functions that can be registered/unregistered in HAL_SPI_STATE_READY or HAL_SPI_STATE_RESET state, thus registered (user) MspInit/DeInit callbacks can be used during the Init/DeInit. Then, the user first registers the MspInit/MspDeInit user callbacks using HAL_SPI_RegisterCallback() before calling HAL_SPI_DeInit() or HAL_SPI_Init() function.

When the compilation define USE_HAL_PPP_REGISTER_CALLBACKS is set to 0 or not defined, the callback registering feature is not available and weak (surcharged) callbacks are used.

Using the HAL it is not possible to reach all supported SPI frequency with the different SPI Modes, the following table resume the max SPI frequency reached with data size 8bits/16bits, according to frequency of the APBx Peripheral Clock (fPCLK) used by the SPI instance.

45.2.2 Initialization and de-initialization functions

This subsection provides a set of functions allowing to initialize and de-initialize the SPIx peripheral:

- User must implement HAL_SPI_MspInit() function in which he configures all related peripherals resources (CLOCK, GPIO, DMA, IT and NVIC).
- Call the function HAL_SPI_Init() to configure the selected device with the selected configuration:
  - Mode
  - Direction
  - Data Size
  - Clock Polarity and Phase
  - NSS Management
  - BaudRate Prescaler
  - FirstBit
  - TIMode
  - CRC Calculation
  - CRC Polynomial if CRC enabled
  - CRC Length, used only with Data8 and Data16
  - FIFO reception threshold
- Call the function HAL_SPI_DeInit() to restore the default configuration of the selected SPIx peripheral.

This section contains the following APIs:

- ***HAL_SPI_Init()***
- ***HAL_SPI_DeInit()***
- ***HAL_SPI_MspInit()***
- ***HAL_SPI_MspDeInit()***

- *HAL_SPI_RegisterCallback()*
- *HAL_SPI_UnRegisterCallback()*

45.2.3 IO operation functions

This subsection provides a set of functions allowing to manage the SPI data transfers.

The SPI supports master and slave mode :

1. There are two modes of transfer:
   - Blocking mode: The communication is performed in polling mode. The HAL status of all data processing is returned by the same function after finishing transfer.
   - No-Blocking mode: The communication is performed using Interrupts or DMA, These APIs return the HAL status. The end of the data processing will be indicated through the dedicated SPI IRQ when using Interrupt mode or the DMA IRQ when using DMA mode. The HAL_SPI_TxCpltCallback(), HAL_SPI_RxCpltCallback() and HAL_SPI_TxRxCpltCallback() user callbacks will be executed respectively at the end of the transmit or Receive process The HAL_SPI_ErrorCallback()user callback will be executed when a communication error is detected
2. APIs provided for these 2 transfer modes (Blocking mode or Non blocking mode using either Interrupt or DMA) exist for 1Line (simplex) and 2Lines (full duplex) modes.

This section contains the following APIs:

- *HAL_SPI_Transmit()*
- *HAL_SPI_Receive()*
- *HAL_SPI_TransmitReceive()*
- *HAL_SPI_Transmit_IT()*
- *HAL_SPI_Receive_IT()*
- *HAL_SPI_TransmitReceive_IT()*
- *HAL_SPI_Transmit_DMA()*
- *HAL_SPI_Receive_DMA()*
- *HAL_SPI_TransmitReceive_DMA()*
- *HAL_SPI_Abort()*
- *HAL_SPI_Abort_IT()*
- *HAL_SPI_DMAPause()*
- *HAL_SPI_DMAResume()*
- *HAL_SPI_DMAStop()*
- *HAL_SPI_IRQHandler()*
- *HAL_SPI_TxCpltCallback()*
- *HAL_SPI_RxCpltCallback()*
- *HAL_SPI_TxRxCpltCallback()*
- *HAL_SPI_TxHalfCpltCallback()*
- *HAL_SPI_RxHalfCpltCallback()*
- *HAL_SPI_TxRxHalfCpltCallback()*
- *HAL_SPI_ErrorCallback()*
- *HAL_SPI_AbortCpltCallback()*

45.2.4 Peripheral State and Errors functions

This subsection provides a set of functions allowing to control the SPI.

- HAL_SPI_GetState() API can be helpful to check in run-time the state of the SPI peripheral
- HAL_SPI_GetError() check in run-time Errors occurring during communication

This section contains the following APIs:

- *HAL_SPI_GetState()*
- *HAL_SPI_GetError()*

45.2.5 Detailed description of functions

HAL_SPI_Init

Function name

HAL_StatusTypeDef HAL_SPI_Init (SPI_HandleTypeDef * hspi)

Function description

Initialize the SPI according to the specified parameters in the SPI_InitTypeDef and initialize the associated handle.

Parameters

- **hspi:** pointer to a SPI_HandleTypeDef structure that contains the configuration information for SPI module.

Return values

- **HAL:** status

HAL_SPI_DeInit

Function name

HAL_StatusTypeDef HAL_SPI_DeInit (SPI_HandleTypeDef * hspi)

Function description

De-Initialize the SPI peripheral.

Parameters

- **hspi:** pointer to a SPI_HandleTypeDef structure that contains the configuration information for SPI module.

Return values

- **HAL:** status

HAL_SPI_MspInit

Function name

void HAL_SPI_MspInit (SPI_HandleTypeDef * hspi)

Function description

Initialize the SPI MSP.

Parameters

- **hspi:** pointer to a SPI_HandleTypeDef structure that contains the configuration information for SPI module.

Return values

- **None:**

HAL_SPI_MspDeInit

Function name

void HAL_SPI_MspDeInit (SPI_HandleTypeDef * hspi)

Function description

De-Initialize the SPI MSP.

Parameters

- **hspi:** pointer to a SPI_HandleTypeDef structure that contains the configuration information for SPI module.

Return values

- **None:**

HAL_SPI_RegisterCallback

Function name

HAL_StatusTypeDef HAL_SPI_RegisterCallback (SPI_HandleTypeDef * hspi, HAL_SPI_CallbackIDTypeDef CallbackID, pSPI_CallbackTypeDef pCallback)

Function description

Register a User SPI Callback To be used instead of the weak predefined callback.

Parameters

- **hspi:** Pointer to a SPI_HandleTypeDef structure that contains the configuration information for the specified SPI.
- **CallbackID:** ID of the callback to be registered
- **pCallback:** pointer to the Callback function

Return values

- **HAL:** status

HAL_SPI_UnRegisterCallback

Function name

HAL_StatusTypeDef HAL_SPI_UnRegisterCallback (SPI_HandleTypeDef * hspi, HAL_SPI_CallbackIDTypeDef CallbackID)

Function description

Unregister an SPI Callback SPI callback is redirected to the weak predefined callback.

Parameters

- **hspi:** Pointer to a SPI_HandleTypeDef structure that contains the configuration information for the specified SPI.
- **CallbackID:** ID of the callback to be unregistered

Return values

- **HAL:** status

HAL_SPI_Transmit

Function name

HAL_StatusTypeDef HAL_SPI_Transmit (SPI_HandleTypeDef * hspi, uint8_t * pData, uint16_t Size, uint32_t Timeout)

Function description

Transmit an amount of data in blocking mode.

Parameters

- **hspi:** pointer to a SPI_HandleTypeDef structure that contains the configuration information for SPI module.
- **pData:** pointer to data buffer
- **Size:** amount of data to be sent
- **Timeout:** Timeout duration

Return values

- **HAL:** status

HAL_SPI_Receive

Function name

HAL_StatusTypeDef HAL_SPI_Receive (SPI_HandleTypeDef * hspi, uint8_t * pData, uint16_t Size, uint32_t Timeout)

Function description

Receive an amount of data in blocking mode.

Parameters

- **hspi:** pointer to a SPI_HandleTypeDef structure that contains the configuration information for SPI module.
- **pData:** pointer to data buffer
- **Size:** amount of data to be received
- **Timeout:** Timeout duration

Return values

- **HAL:** status

HAL_SPI_TransmitReceive

Function name

HAL_StatusTypeDef HAL_SPI_TransmitReceive (SPI_HandleTypeDef * hspi, uint8_t * pTxData, uint8_t * pRxData, uint16_t Size, uint32_t Timeout)

Function description

Transmit and Receive an amount of data in blocking mode.

Parameters

- **hspi:** pointer to a SPI_HandleTypeDef structure that contains the configuration information for SPI module.
- **pTxData:** pointer to transmission data buffer
- **pRxData:** pointer to reception data buffer
- **Size:** amount of data to be sent and received
- **Timeout:** Timeout duration

Return values

- **HAL:** status

HAL_SPI_Transmit_IT

Function name

HAL_StatusTypeDef HAL_SPI_Transmit_IT (SPI_HandleTypeDef * hspi, uint8_t * pData, uint16_t Size)

Function description

Transmit an amount of data in non-blocking mode with Interrupt.

Parameters

- **hspi:** pointer to a SPI_HandleTypeDef structure that contains the configuration information for SPI module.
- **pData:** pointer to data buffer
- **Size:** amount of data to be sent

Return values

- **HAL:** status

HAL_SPI_Receive_IT

Function name

HAL_StatusTypeDef HAL_SPI_Receive_IT (SPI_HandleTypeDef * hspi, uint8_t * pData, uint16_t Size)

Function description

Receive an amount of data in non-blocking mode with Interrupt.

Parameters

- **hspi:** pointer to a SPI_HandleTypeDef structure that contains the configuration information for SPI module.
- **pData:** pointer to data buffer
- **Size:** amount of data to be sent

Return values

- **HAL:** status

HAL_SPI_TransmitReceive_IT

Function name

HAL_StatusTypeDef HAL_SPI_TransmitReceive_IT (SPI_HandleTypeDef * hspi, uint8_t * pTxData, uint8_t * pRxData, uint16_t Size)

Function description

Transmit and Receive an amount of data in non-blocking mode with Interrupt.

Parameters

- **hspi:** pointer to a SPI_HandleTypeDef structure that contains the configuration information for SPI module.
- **pTxData:** pointer to transmission data buffer
- **pRxData:** pointer to reception data buffer
- **Size:** amount of data to be sent and received

Return values

- **HAL:** status

HAL_SPI_Transmit_DMA

Function name

HAL_StatusTypeDef HAL_SPI_Transmit_DMA (SPI_HandleTypeDef * hspi, uint8_t * pData, uint16_t Size)

Function description

Transmit an amount of data in non-blocking mode with DMA.

Parameters

- **hspi:** pointer to a SPI_HandleTypeDef structure that contains the configuration information for SPI module.
- **pData:** pointer to data buffer
- **Size:** amount of data to be sent

Return values

- **HAL:** status

HAL_SPI_Receive_DMA

Function name

HAL_StatusTypeDef HAL_SPI_Receive_DMA (SPI_HandleTypeDef * hspi, uint8_t * pData, uint16_t Size)

Function description

Receive an amount of data in non-blocking mode with DMA.

Parameters

- **hspi:** pointer to a SPI_HandleTypeDef structure that contains the configuration information for SPI module.
- **pData:** pointer to data buffer
- **Size:** amount of data to be sent

Return values

- **HAL:** status

Notes

- In case of MASTER mode and SPI_DIRECTION_2LINES direction, hdmatx shall be defined.
- When the CRC feature is enabled the pData Length must be Size + 1.

HAL_SPI_TransmitReceive_DMA

Function name

HAL_StatusTypeDef HAL_SPI_TransmitReceive_DMA (SPI_HandleTypeDef * hspi, uint8_t * pTxData, uint8_t * pRxData, uint16_t Size)

Function description

Transmit and Receive an amount of data in non-blocking mode with DMA.

Parameters

- **hspi:** pointer to a SPI_HandleTypeDef structure that contains the configuration information for SPI module.
- **pTxData:** pointer to transmission data buffer
- **pRxData:** pointer to reception data buffer
- **Size:** amount of data to be sent

Return values

- **HAL:** status

Notes

- When the CRC feature is enabled the pRxData Length must be Size + 1

HAL_SPI_DMAPause

Function name

HAL_StatusTypeDef HAL_SPI_DMAPause (SPI_HandleTypeDef * hspi)

Function description

Pause the DMA Transfer.

Parameters

- **hspi:** pointer to a SPI_HandleTypeDef structure that contains the configuration information for the specified SPI module.

Return values

- **HAL:** status

HAL_SPI_DMAResume

Function name

HAL_StatusTypeDef HAL_SPI_DMAResume (SPI_HandleTypeDef * hspi)

Function description

Resume the DMA Transfer.

Parameters

- **hspi:** pointer to a SPI_HandleTypeDef structure that contains the configuration information for the specified SPI module.

Return values

- **HAL:** status

HAL_SPI_DMAStop

Function name

HAL_StatusTypeDef HAL_SPI_DMAStop (SPI_HandleTypeDef * hspi)

Function description

Stop the DMA Transfer.

Parameters

- **hspi:** pointer to a SPI_HandleTypeDef structure that contains the configuration information for the specified SPI module.

Return values

- **HAL:** status

HAL_SPI_Abort

Function name

HAL_StatusTypeDef HAL_SPI_Abort (SPI_HandleTypeDef * hspi)

Function description

Abort ongoing transfer (blocking mode).

Parameters

- **hspi:** SPI handle.

Return values

- **HAL:** status

Notes

- This procedure could be used for aborting any ongoing transfer (Tx and Rx), started in Interrupt or DMA mode. This procedure performs following operations : Disable SPI Interrupts (depending of transfer direction)Disable the DMA transfer in the peripheral register (if enabled)Abort DMA transfer by calling HAL_DMA_Abort (in case of transfer in DMA mode)Set handle State to READY
- This procedure is executed in blocking mode : when exiting function, Abort is considered as completed.

HAL_SPI_Abort_IT

Function name

HAL_StatusTypeDef HAL_SPI_Abort_IT (SPI_HandleTypeDef * hspi)

Function description

Abort ongoing transfer (Interrupt mode).

Parameters

- **hspi:** SPI handle.

Return values

- **HAL:** status

Notes

- This procedure could be used for aborting any ongoing transfer (Tx and Rx), started in Interrupt or DMA mode. This procedure performs following operations : Disable SPI Interrupts (depending of transfer direction)Disable the DMA transfer in the peripheral register (if enabled)Abort DMA transfer by calling HAL_DMA_Abort_IT (in case of transfer in DMA mode)Set handle State to READYAt abort completion, call user abort complete callback
- This procedure is executed in Interrupt mode, meaning that abort procedure could be considered as completed only when user abort complete callback is executed (not when exiting function).

HAL_SPI_IRQHandler

Function name

void HAL_SPI_IRQHandler (SPI_HandleTypeDef * hspi)

Function description

Handle SPI interrupt request.

Parameters

- **hspi:** pointer to a SPI_HandleTypeDef structure that contains the configuration information for the specified SPI module.

Return values

- **None:**

HAL_SPI_TxCpltCallback

Function name

void HAL_SPI_TxCpltCallback (SPI_HandleTypeDef * hspi)

Function description

Tx Transfer completed callback.

Parameters

- **hspi:** pointer to a SPI_HandleTypeDef structure that contains the configuration information for SPI module.

Return values

- **None:**

HAL_SPI_RxCpltCallback

Function name

void HAL_SPI_RxCpltCallback (SPI_HandleTypeDef * hspi)

Function description

Rx Transfer completed callback.

Parameters

- **hspi:** pointer to a SPI_HandleTypeDef structure that contains the configuration information for SPI module.

Return values

- **None:**

HAL_SPI_TxRxCpltCallback

Function name

void HAL_SPI_TxRxCpltCallback (SPI_HandleTypeDef * hspi)

Function description

Tx and Rx Transfer completed callback.

Parameters

- **hspi:** pointer to a SPI_HandleTypeDef structure that contains the configuration information for SPI module.

Return values

- **None:**

HAL_SPI_TxHalfCpltCallback

Function name

void HAL_SPI_TxHalfCpltCallback (SPI_HandleTypeDef * hspi)

Function description

Tx Half Transfer completed callback.

Parameters

- **hspi:** pointer to a SPI_HandleTypeDef structure that contains the configuration information for SPI module.

Return values

- **None:**

HAL_SPI_RxHalfCpltCallback

Function name

void HAL_SPI_RxHalfCpltCallback (SPI_HandleTypeDef * hspi)

Function description

Rx Half Transfer completed callback.

Parameters

- **hspi:** pointer to a SPI_HandleTypeDef structure that contains the configuration information for SPI module.

Return values

- **None:**

HAL_SPI_TxRxHalfCpltCallback

Function name

void HAL_SPI_TxRxHalfCpltCallback (SPI_HandleTypeDef * hspi)

Function description

Tx and Rx Half Transfer callback.

Parameters

- **hspi:** pointer to a SPI_HandleTypeDef structure that contains the configuration information for SPI module.

Return values

- **None:**

HAL_SPI_ErrorCallback

Function name

void HAL_SPI_ErrorCallback (SPI_HandleTypeDef * hspi)

Function description

SPI error callback.

Parameters

- **hspi:** pointer to a SPI_HandleTypeDef structure that contains the configuration information for SPI module.

Return values

- **None:**

HAL_SPI_AbortCpltCallback

Function name

void HAL_SPI_AbortCpltCallback (SPI_HandleTypeDef * hspi)

Function description

SPI Abort Complete callback.

Parameters

- **hspi:** SPI handle.

Return values

- **None:**

HAL_SPI_GetState

Function name

HAL_SPI_StateTypeDef HAL_SPI_GetState (SPI_HandleTypeDef * hspi)

Function description

Return the SPI handle state.

Parameters

- **hspi:** pointer to a SPI_HandleTypeDef structure that contains the configuration information for SPI module.

Return values

- **SPI:** state

HAL_SPI_GetError

Function name

uint32_t HAL_SPI_GetError (SPI_HandleTypeDef * hspi)

Function description

Return the SPI error code.

Parameters

- **hspi:** pointer to a SPI_HandleTypeDef structure that contains the configuration information for SPI module.

Return values

- **SPI:** error code in bitmap format

45.3 SPI Firmware driver defines

The following section lists the various define and macros of the module.

45.3.1 SPI

SPI

SPI BaudRate Prescaler

SPI_BAUDRATEPRESCALER_2

SPI_BAUDRATEPRESCALER_4

SPI_BAUDRATEPRESCALER_8

SPI_BAUDRATEPRESCALER_16

SPI_BAUDRATEPRESCALER_32

SPI_BAUDRATEPRESCALER_64

SPI_BAUDRATEPRESCALER_128

SPI_BAUDRATEPRESCALER_256

SPI Clock Phase

SPI_PHASE_1EDGE

SPI_PHASE_2EDGE

SPI Clock Polarity

SPI_POLARITY_LOW

SPI_POLARITY_HIGH

SPI CRC Calculation

SPI_CRCCALCULATION_DISABLE

SPI_CRCCALCULATION_ENABLE

SPI CRC Length

SPI_CRC_LENGTH_DATASIZE

SPI_CRC_LENGTH_8BIT

SPI_CRC_LENGTH_16BIT

SPI Data Size

SPI_DATASIZE_4BIT

SPI_DATASIZE_5BIT

SPI_DATASIZE_6BIT

SPI_DATASIZE_7BIT

SPI_DATASIZE_8BIT

SPI_DATASIZE_9BIT

SPI_DATASIZE_10BIT

SPI_DATASIZE_11BIT

SPI_DATASIZE_12BIT

SPI_DATASIZE_13BIT

SPI_DATASIZE_14BIT

SPI_DATASIZE_15BIT

SPI_DATASIZE_16BIT

SPI Direction Mode

SPI_DIRECTION_2LINES

SPI_DIRECTION_2LINES_RXONLY

SPI_DIRECTION_1LINE

SPI Error Code

HAL_SPI_ERROR_NONE
: No error

HAL_SPI_ERROR_MODF
: MODF error

HAL_SPI_ERROR_CRC
: CRC error

HAL_SPI_ERROR_OVR
: OVR error

HAL_SPI_ERROR_FRE
: FRE error

HAL_SPI_ERROR_DMA
: DMA transfer error

HAL_SPI_ERROR_FLAG

Error on RXNE/TXE/BSY/FTLVL/FRLVL Flag

HAL_SPI_ERROR_ABORT

Error during SPI Abort procedure

HAL_SPI_ERROR_INVALID_CALLBACK

Invalid Callback error

SPI Exported Macros

__HAL_SPI_RESET_HANDLE_STATE

Description:

- Reset SPI handle state.

Parameters:

- __HANDLE__: specifies the SPI Handle. This parameter can be SPI where x: 1, 2, or 3 to select the SPI peripheral.

Return value:

- None

__HAL_SPI_ENABLE_IT

Description:

- Enable the specified SPI interrupts.

Parameters:

- __HANDLE__: specifies the SPI Handle. This parameter can be SPI where x: 1, 2, or 3 to select the SPI peripheral.
- __INTERRUPT__: specifies the interrupt source to enable. This parameter can be one of the following values:
  - SPI_IT_TXE: Tx buffer empty interrupt enable
  - SPI_IT_RXNE: RX buffer not empty interrupt enable
  - SPI_IT_ERR: Error interrupt enable

Return value:

- None

__HAL_SPI_DISABLE_IT

Description:

- Disable the specified SPI interrupts.

Parameters:

- __HANDLE__: specifies the SPI handle. This parameter can be SPIx where x: 1, 2, or 3 to select the SPI peripheral.
- __INTERRUPT__: specifies the interrupt source to disable. This parameter can be one of the following values:
  - SPI_IT_TXE: Tx buffer empty interrupt enable
  - SPI_IT_RXNE: RX buffer not empty interrupt enable
  - SPI_IT_ERR: Error interrupt enable

Return value:

- None

__HAL_SPI_GET_IT_SOURCE

Description:

- Check whether the specified SPI interrupt source is enabled or not.

Parameters:

- __HANDLE__: specifies the SPI Handle. This parameter can be SPI where x: 1, 2, or 3 to select the SPI peripheral.
- __INTERRUPT__: specifies the SPI interrupt source to check. This parameter can be one of the following values:
  - SPI_IT_TXE: Tx buffer empty interrupt enable
  - SPI_IT_RXNE: RX buffer not empty interrupt enable
  - SPI_IT_ERR: Error interrupt enable

Return value:

- The: new state of __IT__ (TRUE or FALSE).

__HAL_SPI_GET_FLAG

Description:

- Check whether the specified SPI flag is set or not.

Parameters:

- __HANDLE__: specifies the SPI Handle. This parameter can be SPI where x: 1, 2, or 3 to select the SPI peripheral.
- __FLAG__: specifies the flag to check. This parameter can be one of the following values:
  - SPI_FLAG_RXNE: Receive buffer not empty flag
  - SPI_FLAG_TXE: Transmit buffer empty flag
  - SPI_FLAG_CRCERR: CRC error flag
  - SPI_FLAG_MODF: Mode fault flag
  - SPI_FLAG_OVR: Overrun flag
  - SPI_FLAG_BSY: Busy flag
  - SPI_FLAG_FRE: Frame format error flag
  - SPI_FLAG_FTLVL: SPI fifo transmission level
  - SPI_FLAG_FRLVL: SPI fifo reception level

Return value:

- The: new state of __FLAG__ (TRUE or FALSE).

__HAL_SPI_CLEAR_CRCERRFLAG

Description:

- Clear the SPI CRCERR pending flag.

Parameters:

- __HANDLE__: specifies the SPI Handle. This parameter can be SPI where x: 1, 2, or 3 to select the SPI peripheral.

Return value:

- None

__HAL_SPI_CLEAR_MODFFLAG

Description:

- Clear the SPI MODF pending flag.

Parameters:

- __HANDLE__: specifies the SPI Handle. This parameter can be SPI where x: 1, 2, or 3 to select the SPI peripheral.

Return value:

- None

__HAL_SPI_CLEAR_OVRFLAG

Description:

- Clear the SPI OVR pending flag.

Parameters:

- __HANDLE__: specifies the SPI Handle. This parameter can be SPI where x: 1, 2, or 3 to select the SPI peripheral.

Return value:

- None

__HAL_SPI_CLEAR_FREFLAG

Description:

- Clear the SPI FRE pending flag.

Parameters:

- __HANDLE__: specifies the SPI Handle. This parameter can be SPI where x: 1, 2, or 3 to select the SPI peripheral.

Return value:

- None

__HAL_SPI_ENABLE

Description:

- Enable the SPI peripheral.

Parameters:

- __HANDLE__: specifies the SPI Handle. This parameter can be SPI where x: 1, 2, or 3 to select the SPI peripheral.

Return value:

- None

__HAL_SPI_DISABLE

Description:

- Disable the SPI peripheral.

Parameters:

- __HANDLE__: specifies the SPI Handle. This parameter can be SPI where x: 1, 2, or 3 to select the SPI peripheral.

Return value:

- None

SPI FIFO Reception Threshold

SPI_RXFIFO_THRESHOLD

SPI_RXFIFO_THRESHOLD_QF

SPI_RXFIFO_THRESHOLD_HF

SPI Flags Definition

SPI_FLAG_RXNE

SPI_FLAG_TXE

SPI_FLAG_BSY

SPI_FLAG_CRCERR

SPI_FLAG_MODF

SPI_FLAG_OVR

SPI_FLAG_FRE

SPI_FLAG_FTLVL

SPI_FLAG_FRLVL

SPI_FLAG_MASK

SPI Interrupt Definition

SPI_IT_TXE

SPI_IT_RXNE

SPI_IT_ERR

SPI Mode

SPI_MODE_SLAVE

SPI_MODE_MASTER

SPI MSB LSB Transmission

SPI_FIRSTBIT_MSB

SPI_FIRSTBIT_LSB

SPI NSS Pulse Mode

SPI_NSS_PULSE_ENABLE

SPI_NSS_PULSE_DISABLE

SPI Reception FIFO Status Level

SPI_FRLVL_EMPTY

SPI_FRLVL_QUARTER_FULL

SPI_FRLVL_HALF_FULL

SPI_FRLVL_FULL

SPI Slave Select Management

SPI_NSS_SOFT

SPI_NSS_HARD_INPUT

SPI_NSS_HARD_OUTPUT

SPI TI Mode

SPI_TIMODE_DISABLE

SPI_TIMODE_ENABLE

SPI Transmission FIFO Status Level

SPI_FTLVL_EMPTY

SPI_FTLVL_QUARTER_FULL

SPI_FTLVL_HALF_FULL

SPI_FTLVL_FULL

46 HAL SPI Extension Driver

46.1 SPIEx Firmware driver API description

The following section lists the various functions of the SPIEx library.

46.1.1 IO operation functions

This subsection provides a set of extended functions to manage the SPI data transfers.

1. Rx data flush function:
   – HAL_SPIEx_FlushRxFifo()

This section contains the following APIs:

- ***HAL_SPIEx_FlushRxFifo()***

46.1.2 Detailed description of functions

HAL_SPIEx_FlushRxFifo

Function name

HAL_StatusTypeDef HAL_SPIEx_FlushRxFifo (const SPI_HandleTypeDef * hspi)

Function description

Flush the RX fifo.

Parameters

- **hspi:** pointer to a SPI_HandleTypeDef structure that contains the configuration information for the specified SPI module.

Return values

- **HAL:** status

47 HAL TIM Generic Driver

47.1 TIM Firmware driver registers structures

47.1.1 TIM_Base_InitTypeDef

TIM_Base_InitTypeDef is defined in the stm32u0xx_hal_tim.h

Data Fields

- ***uint32_t Prescaler***
- ***uint32_t CounterMode***
- ***uint32_t Period***
- ***uint32_t ClockDivision***
- ***uint32_t RepetitionCounter***
- ***uint32_t AutoReloadPreload***

Field Documentation

- ***uint32_t TIM_Base_InitTypeDef::Prescaler***
  Specifies the prescaler value used to divide the TIM clock. This parameter can be a number between Min_Data = 0x0000 and Max_Data = 0xFFFF
- ***uint32_t TIM_Base_InitTypeDef::CounterMode***
  Specifies the counter mode. This parameter can be a value of ***TIM_Counter_Mode***
- ***uint32_t TIM_Base_InitTypeDef::Period***
  Specifies the period value to be loaded into the active Auto-Reload Register at the next update event. This parameter can be a number between Min_Data = 0x0000 and Max_Data = 0xFFFF.
- ***uint32_t TIM_Base_InitTypeDef::ClockDivision***
  Specifies the clock division. This parameter can be a value of ***TIM_ClockDivision***
- ***uint32_t TIM_Base_InitTypeDef::RepetitionCounter***
  Specifies the repetition counter value. Each time the RCR downcounter reaches zero, an update event is generated and counting restarts from the RCR value (N). This means in PWM mode that (N+1) corresponds to:
  - the number of PWM periods in edge-aligned mode
  - the number of half PWM period in center-aligned mode GP timers: this parameter must be a number between Min_Data = 0x00 and Max_Data = 0xFF. Advanced timers: this parameter must be a number between Min_Data = 0x0000 and Max_Data = 0xFFFF.
- ***uint32_t TIM_Base_InitTypeDef::AutoReloadPreload***
  Specifies the auto-reload preload. This parameter can be a value of ***TIM_AutoReloadPreload***

47.1.2 TIM_OC_InitTypeDef

TIM_OC_InitTypeDef is defined in the stm32u0xx_hal_tim.h

Data Fields

- ***uint32_t OCMode***
- ***uint32_t Pulse***
- ***uint32_t OCPolarity***
- ***uint32_t OCNPolarity***
- ***uint32_t OCFastMode***
- ***uint32_t OCIdleState***
- ***uint32_t OCNIdleState***

Field Documentation

- ***uint32_t TIM_OC_InitTypeDef::OCMode***
  Specifies the TIM mode. This parameter can be a value of ***TIM_Output_Compare_and_PWM_modes***
- ***uint32_t TIM_OC_InitTypeDef::Pulse***
  Specifies the pulse value to be loaded into the Capture Compare Register. This parameter can be a number between Min_Data = 0x0000 and Max_Data = 0xFFFF

- ***uint32_t TIM_OC_InitTypeDef::OCPolarity***
  Specifies the output polarity. This parameter can be a value of ***TIM_Output_Compare_Polarity***
- ***uint32_t TIM_OC_InitTypeDef::OCNPolarity***
  Specifies the complementary output polarity. This parameter can be a value of ***TIM_Output_Compare_N_Polarity***
  Note:
  – This parameter is valid only for timer instances supporting break feature.
- ***uint32_t TIM_OC_InitTypeDef::OCFastMode***
  Specifies the Fast mode state. This parameter can be a value of ***TIM_Output_Fast_State***
  Note:
  – This parameter is valid only in PWM1 and PWM2 mode.
- ***uint32_t TIM_OC_InitTypeDef::OCIdleState***
  Specifies the TIM Output Compare pin state during Idle state. This parameter can be a value of ***TIM_Output_Compare_Idle_State***
  Note:
  – This parameter is valid only for timer instances supporting break feature.
- ***uint32_t TIM_OC_InitTypeDef::OCNIdleState***
  Specifies the TIM Output Compare pin state during Idle state. This parameter can be a value of ***TIM_Output_Compare_N_Idle_State***
  Note:
  – This parameter is valid only for timer instances supporting break feature.

47.1.3 TIM_OnePulse_InitTypeDef

TIM_OnePulse_InitTypeDef is defined in the stm32u0xx_hal_tim.h

Data Fields

- ***uint32_t OCMode***
- ***uint32_t Pulse***
- ***uint32_t OCPolarity***
- ***uint32_t OCNPolarity***
- ***uint32_t OCIdleState***
- ***uint32_t OCNIdleState***
- ***uint32_t ICPolarity***
- ***uint32_t ICSelection***
- ***uint32_t ICFilter***

Field Documentation

- ***uint32_t TIM_OnePulse_InitTypeDef::OCMode***
  Specifies the TIM mode. This parameter can be a value of ***TIM_Output_Compare_and_PWM_modes***
- ***uint32_t TIM_OnePulse_InitTypeDef::Pulse***
  Specifies the pulse value to be loaded into the Capture Compare Register. This parameter can be a number between Min_Data = 0x0000 and Max_Data = 0xFFFF
- ***uint32_t TIM_OnePulse_InitTypeDef::OCPolarity***
  Specifies the output polarity. This parameter can be a value of ***TIM_Output_Compare_Polarity***
- ***uint32_t TIM_OnePulse_InitTypeDef::OCNPolarity***
  Specifies the complementary output polarity. This parameter can be a value of ***TIM_Output_Compare_N_Polarity***
  Note:
  – This parameter is valid only for timer instances supporting break feature.
- ***uint32_t TIM_OnePulse_InitTypeDef::OCIdleState***
  Specifies the TIM Output Compare pin state during Idle state. This parameter can be a value of ***TIM_Output_Compare_Idle_State***
  Note:
  – This parameter is valid only for timer instances supporting break feature.

- ***uint32_t TIM_OnePulse_InitTypeDef::OCNIdleState***
  Specifies the TIM Output Compare pin state during Idle state. This parameter can be a value of *TIM_Output_Compare_N_Idle_State*
  Note:
  – This parameter is valid only for timer instances supporting break feature.
- ***uint32_t TIM_OnePulse_InitTypeDef::ICPolarity***
  Specifies the active edge of the input signal. This parameter can be a value of *TIM_Input_Capture_Polarity*
- ***uint32_t TIM_OnePulse_InitTypeDef::ICSelection***
  Specifies the input. This parameter can be a value of *TIM_Input_Capture_Selection*
- ***uint32_t TIM_OnePulse_InitTypeDef::ICFilter***
  Specifies the input capture filter. This parameter can be a number between Min_Data = 0x0 and Max_Data = 0xF

47.1.4 TIM_IC_InitTypeDef

TIM_IC_InitTypeDef is defined in the stm32u0xx_hal_tim.h

Data Fields

- ***uint32_t ICPolarity***
- ***uint32_t ICSelection***
- ***uint32_t ICPrescaler***
- ***uint32_t ICFilter***

Field Documentation

- ***uint32_t TIM_IC_InitTypeDef::ICPolarity***
  Specifies the active edge of the input signal. This parameter can be a value of *TIM_Input_Capture_Polarity*
- ***uint32_t TIM_IC_InitTypeDef::ICSelection***
  Specifies the input. This parameter can be a value of *TIM_Input_Capture_Selection*
- ***uint32_t TIM_IC_InitTypeDef::ICPrescaler***
  Specifies the Input Capture Prescaler. This parameter can be a value of *TIM_Input_Capture_Prescaler*
- ***uint32_t TIM_IC_InitTypeDef::ICFilter***
  Specifies the input capture filter. This parameter can be a number between Min_Data = 0x0 and Max_Data = 0xF

47.1.5 TIM_Encoder_InitTypeDef

TIM_Encoder_InitTypeDef is defined in the stm32u0xx_hal_tim.h

Data Fields

- ***uint32_t EncoderMode***
- ***uint32_t IC1Polarity***
- ***uint32_t IC1Selection***
- ***uint32_t IC1Prescaler***
- ***uint32_t IC1Filter***
- ***uint32_t IC2Polarity***
- ***uint32_t IC2Selection***
- ***uint32_t IC2Prescaler***
- ***uint32_t IC2Filter***

Field Documentation

- ***uint32_t TIM_Encoder_InitTypeDef::EncoderMode***
  Specifies the active edge of the input signal. This parameter can be a value of *TIM_Encoder_Mode*
- ***uint32_t TIM_Encoder_InitTypeDef::IC1Polarity***
  Specifies the active edge of the input signal. This parameter can be a value of *TIM_Encoder_Input_Polarity*
- ***uint32_t TIM_Encoder_InitTypeDef::IC1Selection***
  Specifies the input. This parameter can be a value of *TIM_Input_Capture_Selection*

- ***uint32_t TIM_Encoder_InitTypeDef::IC1Prescaler***
  Specifies the Input Capture Prescaler. This parameter can be a value of ***TIM_Input_Capture_Prescaler***
- ***uint32_t TIM_Encoder_InitTypeDef::IC1Filter***
  Specifies the input capture filter. This parameter can be a number between Min_Data = 0x0 and Max_Data = 0xF
- ***uint32_t TIM_Encoder_InitTypeDef::IC2Polarity***
  Specifies the active edge of the input signal. This parameter can be a value of ***TIM_Encoder_Input_Polarity***
- ***uint32_t TIM_Encoder_InitTypeDef::IC2Selection***
  Specifies the input. This parameter can be a value of ***TIM_Input_Capture_Selection***
- ***uint32_t TIM_Encoder_InitTypeDef::IC2Prescaler***
  Specifies the Input Capture Prescaler. This parameter can be a value of ***TIM_Input_Capture_Prescaler***
- ***uint32_t TIM_Encoder_InitTypeDef::IC2Filter***
  Specifies the input capture filter. This parameter can be a number between Min_Data = 0x0 and Max_Data = 0xF

47.1.6 TIM_ClockConfigTypeDef

TIM_ClockConfigTypeDef is defined in the stm32u0xx_hal_tim.h

Data Fields

- ***uint32_t ClockSource***
- ***uint32_t ClockPolarity***
- ***uint32_t ClockPrescaler***
- ***uint32_t ClockFilter***

Field Documentation

- ***uint32_t TIM_ClockConfigTypeDef::ClockSource***
  TIM clock sources This parameter can be a value of ***TIM_Clock_Source***
- ***uint32_t TIM_ClockConfigTypeDef::ClockPolarity***
  TIM clock polarity This parameter can be a value of ***TIM_Clock_Polarity***
- ***uint32_t TIM_ClockConfigTypeDef::ClockPrescaler***
  TIM clock prescaler This parameter can be a value of ***TIM_Clock_Prescaler***
- ***uint32_t TIM_ClockConfigTypeDef::ClockFilter***
  TIM clock filter This parameter can be a number between Min_Data = 0x0 and Max_Data = 0xF

47.1.7 TIM_ClearInputConfigTypeDef

TIM_ClearInputConfigTypeDef is defined in the stm32u0xx_hal_tim.h

Data Fields

- ***uint32_t ClearInputState***
- ***uint32_t ClearInputSource***
- ***uint32_t ClearInputPolarity***
- ***uint32_t ClearInputPrescaler***
- ***uint32_t ClearInputFilter***

Field Documentation

- ***uint32_t TIM_ClearInputConfigTypeDef::ClearInputState***
  TIM clear Input state This parameter can be ENABLE or DISABLE
- ***uint32_t TIM_ClearInputConfigTypeDef::ClearInputSource***
  TIM clear Input sources This parameter can be a value of ***TIM_ClearInput_Source***
- ***uint32_t TIM_ClearInputConfigTypeDef::ClearInputPolarity***
  TIM Clear Input polarity This parameter can be a value of ***TIM_ClearInput_Polarity***
- ***uint32_t TIM_ClearInputConfigTypeDef::ClearInputPrescaler***
  TIM Clear Input prescaler This parameter must be 0: When OCRef clear feature is used with ETR source, ETR prescaler must be off
- ***uint32_t TIM_ClearInputConfigTypeDef::ClearInputFilter***
  TIM Clear Input filter This parameter can be a number between Min_Data = 0x0 and Max_Data = 0xF

47.1.8 TIM_MasterConfigTypeDef

TIM_MasterConfigTypeDef is defined in the stm32u0xx_hal_tim.h

Data Fields

- ***uint32_t MasterOutputTrigger***
- ***uint32_t MasterOutputTrigger2***
- ***uint32_t MasterSlaveMode***

Field Documentation

- ***uint32_t TIM_MasterConfigTypeDef::MasterOutputTrigger***
  Trigger output (TRGO) selection This parameter can be a value of ***TIM_Master_Mode_Selection***
- ***uint32_t TIM_MasterConfigTypeDef::MasterOutputTrigger2***
  Trigger output2 (TRGO2) selection This parameter can be a value of ***TIM_Master_Mode_Selection_2***
- ***uint32_t TIM_MasterConfigTypeDef::MasterSlaveMode***
  Master/slave mode selection This parameter can be a value of ***TIM_Master_Slave_Mode***
  Note:
  – When the Master/slave mode is enabled, the effect of an event on the trigger input (TRGI) is delayed to allow a perfect synchronization between the current timer and its slaves (through TRGO). It is not mandatory in case of timer synchronization mode.

47.1.9 TIM_SlaveConfigTypeDef

TIM_SlaveConfigTypeDef is defined in the stm32u0xx_hal_tim.h

Data Fields

- ***uint32_t SlaveMode***
- ***uint32_t InputTrigger***
- ***uint32_t TriggerPolarity***
- ***uint32_t TriggerPrescaler***
- ***uint32_t TriggerFilter***

Field Documentation

- ***uint32_t TIM_SlaveConfigTypeDef::SlaveMode***
  Slave mode selection This parameter can be a value of ***TIM_Slave_Mode***
- ***uint32_t TIM_SlaveConfigTypeDef::InputTrigger***
  Input Trigger source This parameter can be a value of ***TIM_Trigger_Selection***
- ***uint32_t TIM_SlaveConfigTypeDef::TriggerPolarity***
  Input Trigger polarity This parameter can be a value of ***TIM_Trigger_Polarity***
- ***uint32_t TIM_SlaveConfigTypeDef::TriggerPrescaler***
  Input trigger prescaler This parameter can be a value of ***TIM_Trigger_Prescaler***
- ***uint32_t TIM_SlaveConfigTypeDef::TriggerFilter***
  Input trigger filter This parameter can be a number between Min_Data = 0x0 and Max_Data = 0xF

47.1.10 TIM_BreakDeadTimeConfigTypeDef

TIM_BreakDeadTimeConfigTypeDef is defined in the stm32u0xx_hal_tim.h

Data Fields

- ***uint32_t OffStateRunMode***
- ***uint32_t OffStateIDLEMode***
- ***uint32_t LockLevel***
- ***uint32_t DeadTime***
- ***uint32_t BreakState***
- ***uint32_t BreakPolarity***
- ***uint32_t BreakFilter***
- ***uint32_t BreakAFMode***
- ***uint32_t Break2State***
- ***uint32_t Break2Polarity***
- ***uint32_t Break2Filter***

- ***uint32_t Break2AFMode***
- ***uint32_t AutomaticOutput***

Field Documentation

- ***uint32_t TIM_BreakDeadTimeConfigTypeDef::OffStateRunMode***
  TIM off state in run mode, This parameter can be a value of ***TIM_OSSR_Off_State_Selection_for_Run_mode_state***
- ***uint32_t TIM_BreakDeadTimeConfigTypeDef::OffStateIDLEMode***
  TIM off state in IDLE mode, This parameter can be a value of ***TIM_OSSI_Off_State_Selection_for_Idle_mode_state***
- ***uint32_t TIM_BreakDeadTimeConfigTypeDef::LockLevel***
  TIM Lock level, This parameter can be a value of ***TIM_Lock_level***
- ***uint32_t TIM_BreakDeadTimeConfigTypeDef::DeadTime***
  TIM dead Time, This parameter can be a number between Min_Data = 0x00 and Max_Data = 0xFF
- ***uint32_t TIM_BreakDeadTimeConfigTypeDef::BreakState***
  TIM Break State, This parameter can be a value of ***TIM_Break_Input_enable_disable***
- ***uint32_t TIM_BreakDeadTimeConfigTypeDef::BreakPolarity***
  TIM Break input polarity, This parameter can be a value of ***TIM_Break_Polarity***
- ***uint32_t TIM_BreakDeadTimeConfigTypeDef::BreakFilter***
  Specifies the break input filter.This parameter can be a number between Min_Data = 0x0 and Max_Data = 0xF
- ***uint32_t TIM_BreakDeadTimeConfigTypeDef::BreakAFMode***
  Specifies the alternate function mode of the break input.This parameter can be a value of ***TIM_Break_Input_AF_Mode***
- ***uint32_t TIM_BreakDeadTimeConfigTypeDef::Break2State***
  TIM Break2 State, This parameter can be a value of ***TIM_Break2_Input_enable_disable***
- ***uint32_t TIM_BreakDeadTimeConfigTypeDef::Break2Polarity***
  TIM Break2 input polarity, This parameter can be a value of ***TIM_Break2_Polarity***
- ***uint32_t TIM_BreakDeadTimeConfigTypeDef::Break2Filter***
  TIM break2 input filter.This parameter can be a number between Min_Data = 0x0 and Max_Data = 0xF
- ***uint32_t TIM_BreakDeadTimeConfigTypeDef::Break2AFMode***
  Specifies the alternate function mode of the break2 input.This parameter can be a value of ***TIM_Break2_Input_AF_Mode***
- ***uint32_t TIM_BreakDeadTimeConfigTypeDef::AutomaticOutput***
  TIM Automatic Output Enable state, This parameter can be a value of ***TIM_AOE_Bit_Set_Reset***

47.1.11 __TIM_HandleTypeDef

__TIM_HandleTypeDef is defined in the stm32u0xx_hal_tim.h

Data Fields

- ***TIM_TypeDef * Instance***
- ***TIM_Base_InitTypeDef Init***
- ***HAL_TIM_ActiveChannel Channel***
- ***DMA_HandleTypeDef * hdma***
- ***HAL_LockTypeDef Lock***
- ***__IO HAL_TIM_StateTypeDef State***
- ***__IO HAL_TIM_ChannelStateTypeDef ChannelState***
- ***__IO HAL_TIM_ChannelStateTypeDef ChannelNState***
- ***__IO HAL_TIM_DMABurstStateTypeDef DMABurstState***
- ***void(* Base_MspInitCallback***
- ***void(* Base_MspDeInitCallback***
- ***void(* IC_MspInitCallback***
- ***void(* IC_MspDeInitCallback***
- ***void(* OC_MspInitCallback***
- ***void(* OC_MspDeInitCallback***
- ***void(* PWM_MspInitCallback***

- ***void(* PWM_MspDeInitCallback***
- ***void(* OnePulse_MspInitCallback***
- ***void(* OnePulse_MspDeInitCallback***
- ***void(* Encoder_MspInitCallback***
- ***void(* Encoder_MspDeInitCallback***
- ***void(* HallSensor_MspInitCallback***
- ***void(* HallSensor_MspDeInitCallback***
- ***void(* PeriodElapsedCallback***
- ***void(* PeriodElapsedHalfCpltCallback***
- ***void(* TriggerCallback***
- ***void(* TriggerHalfCpltCallback***
- ***void(* IC_CaptureCallback***
- ***void(* IC_CaptureHalfCpltCallback***
- ***void(* OC_DelayElapsedCallback***
- ***void(* PWM_PulseFinishedCallback***
- ***void(* PWM_PulseFinishedHalfCpltCallback***
- ***void(* ErrorCallback***
- ***void(* CommutationCallback***
- ***void(* CommutationHalfCpltCallback***
- ***void(* BreakCallback***
- ***void(* Break2Callback***

Field Documentation

- ***TIM_TypeDef* __TIM_HandleTypeDef::Instance***
  Register base address
- ***TIM_Base_InitTypeDef __TIM_HandleTypeDef::Init***
  TIM Time Base required parameters
- ***HAL_TIM_ActiveChannel __TIM_HandleTypeDef::Channel***
  Active channel
- ***DMA_HandleTypeDef* __TIM_HandleTypeDef::hdma[7]***
  DMA Handlers array This array is accessed by a ***DMA_Handle_index***
- ***HAL_LockTypeDef __TIM_HandleTypeDef::Lock***
  Locking object
- ***__IO HAL_TIM_StateTypeDef __TIM_HandleTypeDef::State***
  TIM operation state
- ***__IO HAL_TIM_ChannelStateTypeDef __TIM_HandleTypeDef::ChannelState[6]***
  TIM channel operation state
- ***__IO HAL_TIM_ChannelStateTypeDef __TIM_HandleTypeDef::ChannelNState[4]***
  TIM complementary channel operation state
- ***__IO HAL_TIM_DMABurstStateTypeDef __TIM_HandleTypeDef::DMABurstState***
  DMA burst operation state
- ***void(* __TIM_HandleTypeDef::Base_MspInitCallback)(struct __TIM_HandleTypeDef *htim)***
  TIM Base Msp Init Callback
- ***void(* __TIM_HandleTypeDef::Base_MspDeInitCallback)(struct __TIM_HandleTypeDef *htim)***
  TIM Base Msp DeInit Callback
- ***void(* __TIM_HandleTypeDef::IC_MspInitCallback)(struct __TIM_HandleTypeDef *htim)***
  TIM IC Msp Init Callback
- ***void(* __TIM_HandleTypeDef::IC_MspDeInitCallback)(struct __TIM_HandleTypeDef *htim)***
  TIM IC Msp DeInit Callback
- ***void(* __TIM_HandleTypeDef::OC_MspInitCallback)(struct __TIM_HandleTypeDef *htim)***
  TIM OC Msp Init Callback
- ***void(* __TIM_HandleTypeDef::OC_MspDeInitCallback)(struct __TIM_HandleTypeDef *htim)***
  TIM OC Msp DeInit Callback

- ***void(* __TIM_HandleTypeDef::PWM_MspInitCallback)(struct __TIM_HandleTypeDef *htim)***
  TIM PWM Msp Init Callback
- ***void(* __TIM_HandleTypeDef::PWM_MspDeInitCallback)(struct __TIM_HandleTypeDef *htim)***
  TIM PWM Msp DeInit Callback
- ***void(* __TIM_HandleTypeDef::OnePulse_MspInitCallback)(struct __TIM_HandleTypeDef *htim)***
  TIM One Pulse Msp Init Callback
- ***void(* __TIM_HandleTypeDef::OnePulse_MspDeInitCallback)(struct __TIM_HandleTypeDef *htim)***
  TIM One Pulse Msp DeInit Callback
- ***void(* __TIM_HandleTypeDef::Encoder_MspInitCallback)(struct __TIM_HandleTypeDef *htim)***
  TIM Encoder Msp Init Callback
- ***void(* __TIM_HandleTypeDef::Encoder_MspDeInitCallback)(struct __TIM_HandleTypeDef *htim)***
  TIM Encoder Msp DeInit Callback
- ***void(* __TIM_HandleTypeDef::HallSensor_MspInitCallback)(struct __TIM_HandleTypeDef *htim)***
  TIM Hall Sensor Msp Init Callback
- ***void(* __TIM_HandleTypeDef::HallSensor_MspDeInitCallback)(struct __TIM_HandleTypeDef *htim)***
  TIM Hall Sensor Msp DeInit Callback
- ***void(* __TIM_HandleTypeDef::PeriodElapsedCallback)(struct __TIM_HandleTypeDef *htim)***
  TIM Period Elapsed Callback
- ***void(* __TIM_HandleTypeDef::PeriodElapsedHalfCpltCallback)(struct __TIM_HandleTypeDef *htim)***
  TIM Period Elapsed half complete Callback
- ***void(* __TIM_HandleTypeDef::TriggerCallback)(struct __TIM_HandleTypeDef *htim)***
  TIM Trigger Callback
- ***void(* __TIM_HandleTypeDef::TriggerHalfCpltCallback)(struct __TIM_HandleTypeDef *htim)***
  TIM Trigger half complete Callback
- ***void(* __TIM_HandleTypeDef::IC_CaptureCallback)(struct __TIM_HandleTypeDef *htim)***
  TIM Input Capture Callback
- ***void(* __TIM_HandleTypeDef::IC_CaptureHalfCpltCallback)(struct __TIM_HandleTypeDef *htim)***
  TIM Input Capture half complete Callback
- ***void(* __TIM_HandleTypeDef::OC_DelayElapsedCallback)(struct __TIM_HandleTypeDef *htim)***
  TIM Output Compare Delay Elapsed Callback
- ***void(* __TIM_HandleTypeDef::PWM_PulseFinishedCallback)(struct __TIM_HandleTypeDef *htim)***
  TIM PWM Pulse Finished Callback
- ***void(* __TIM_HandleTypeDef::PWM_PulseFinishedHalfCpltCallback)(struct __TIM_HandleTypeDef *htim)***
  TIM PWM Pulse Finished half complete Callback
- ***void(* __TIM_HandleTypeDef::ErrorCallback)(struct __TIM_HandleTypeDef *htim)***
  TIM Error Callback
- ***void(* __TIM_HandleTypeDef::CommutationCallback)(struct __TIM_HandleTypeDef *htim)***
  TIM Commutation Callback
- ***void(* __TIM_HandleTypeDef::CommutationHalfCpltCallback)(struct __TIM_HandleTypeDef *htim)***
  TIM Commutation half complete Callback
- ***void(* __TIM_HandleTypeDef::BreakCallback)(struct __TIM_HandleTypeDef *htim)***
  TIM Break Callback
- ***void(* __TIM_HandleTypeDef::Break2Callback)(struct __TIM_HandleTypeDef *htim)***
  TIM Break2 Callback

47.2 TIM Firmware driver API description

The following section lists the various functions of the TIM library.

47.2.1 TIMER Generic features

The Timer features include:

1. 16-bit up, down, up/down auto-reload counter.
2. 16-bit programmable prescaler allowing dividing (also on the fly) the counter clock frequency either by any factor between 1 and 65536.

3. Up to 4 independent channels for:
   – Input Capture
   – Output Compare
   – PWM generation (Edge and Center-aligned Mode)
   – One-pulse mode output
4. Synchronization circuit to control the timer with external signals and to interconnect several timers together.
5. Supports incremental encoder for positioning purposes

47.2.2 How to use this driver

1. Initialize the TIM low level resources by implementing the following functions depending on the selected feature:
   – Time Base : HAL_TIM_Base_MspInit()
   – Input Capture : HAL_TIM_IC_MspInit()
   – Output Compare : HAL_TIM_OC_MspInit()
   – PWM generation : HAL_TIM_PWM_MspInit()
   – One-pulse mode output : HAL_TIM_OnePulse_MspInit()
   – Encoder mode output : HAL_TIM_Encoder_MspInit()
2. Initialize the TIM low level resources :
   a. Enable the TIM interface clock using __HAL_RCC_TIMx_CLK_ENABLE();
   b. TIM pins configuration
      ◦ Enable the clock for the TIM GPIOs using the following function: __HAL_RCC_GPIOx_CLK_ENABLE();
      ◦ Configure these TIM pins in Alternate function mode using HAL_GPIO_Init();
3. The external Clock can be configured, if needed (the default clock is the internal clock from the APBx), using the following function: HAL_TIM_ConfigClockSource, the clock configuration should be done before any start function.
4. Configure the TIM in the desired functioning mode using one of the Initialization function of this driver:
   – HAL_TIM_Base_Init: to use the Timer to generate a simple time base
   – HAL_TIM_OC_Init and HAL_TIM_OC_ConfigChannel: to use the Timer to generate an Output Compare signal.
   – HAL_TIM_PWM_Init and HAL_TIM_PWM_ConfigChannel: to use the Timer to generate a PWM signal.
   – HAL_TIM_IC_Init and HAL_TIM_IC_ConfigChannel: to use the Timer to measure an external signal.
   – HAL_TIM_OnePulse_Init and HAL_TIM_OnePulse_ConfigChannel: to use the Timer in One Pulse Mode.
   – HAL_TIM_Encoder_Init: to use the Timer Encoder Interface.
5. Activate the TIM peripheral using one of the start functions depending from the feature used:
   – Time Base : HAL_TIM_Base_Start(), HAL_TIM_Base_Start_DMA(), HAL_TIM_Base_Start_IT()
   – Input Capture : HAL_TIM_IC_Start(), HAL_TIM_IC_Start_DMA(), HAL_TIM_IC_Start_IT()
   – Output Compare : HAL_TIM_OC_Start(), HAL_TIM_OC_Start_DMA(), HAL_TIM_OC_Start_IT()
   – PWM generation : HAL_TIM_PWM_Start(), HAL_TIM_PWM_Start_DMA(), HAL_TIM_PWM_Start_IT()
   – One-pulse mode output : HAL_TIM_OnePulse_Start(), HAL_TIM_OnePulse_Start_IT()
   – Encoder mode output : HAL_TIM_Encoder_Start(), HAL_TIM_Encoder_Start_DMA(), HAL_TIM_Encoder_Start_IT().
6. The DMA Burst is managed with the two following functions: HAL_TIM_DMABurst_WriteStart() HAL_TIM_DMABurst_ReadStart()

Callback registration

The compilation define USE_HAL_TIM_REGISTER_CALLBACKS when set to 1 allows the user to configure dynamically the driver callbacks.

Use Function HAL_TIM_RegisterCallback() to register a callback. HAL_TIM_RegisterCallback() takes as parameters the HAL peripheral handle, the Callback ID and a pointer to the user callback function.

Use function HAL_TIM_UnRegisterCallback() to reset a callback to the default weak function. HAL_TIM_UnRegisterCallback takes as parameters the HAL peripheral handle, and the Callback ID.

These functions allow to register/unregister following callbacks:

- Base_MspInitCallback : TIM Base Msp Init Callback.
- Base_MspDeInitCallback : TIM Base Msp DeInit Callback.
- IC_MspInitCallback : TIM IC Msp Init Callback.
- IC_MspDeInitCallback : TIM IC Msp DeInit Callback.
- OC_MspInitCallback : TIM OC Msp Init Callback.
- OC_MspDeInitCallback : TIM OC Msp DeInit Callback.
- PWM_MspInitCallback : TIM PWM Msp Init Callback.
- PWM_MspDeInitCallback : TIM PWM Msp DeInit Callback.
- OnePulse_MspInitCallback : TIM One Pulse Msp Init Callback.
- OnePulse_MspDeInitCallback : TIM One Pulse Msp DeInit Callback.
- Encoder_MspInitCallback : TIM Encoder Msp Init Callback.
- Encoder_MspDeInitCallback : TIM Encoder Msp DeInit Callback.
- HallSensor_MspInitCallback : TIM Hall Sensor Msp Init Callback.
- HallSensor_MspDeInitCallback : TIM Hall Sensor Msp DeInit Callback.
- PeriodElapsedCallback : TIM Period Elapsed Callback.
- PeriodElapsedHalfCpltCallback : TIM Period Elapsed half complete Callback.
- TriggerCallback : TIM Trigger Callback.
- TriggerHalfCpltCallback : TIM Trigger half complete Callback.
- IC_CaptureCallback : TIM Input Capture Callback.
- IC_CaptureHalfCpltCallback : TIM Input Capture half complete Callback.
- OC_DelayElapsedCallback : TIM Output Compare Delay Elapsed Callback.
- PWM_PulseFinishedCallback : TIM PWM Pulse Finished Callback.
- PWM_PulseFinishedHalfCpltCallback : TIM PWM Pulse Finished half complete Callback.
- ErrorCallback : TIM Error Callback.
- CommutationCallback : TIM Commutation Callback.
- CommutationHalfCpltCallback : TIM Commutation half complete Callback.
- BreakCallback : TIM Break Callback.
- Break2Callback : TIM Break2 Callback.

By default, after the Init and when the state is HAL_TIM_STATE_RESET all interrupt callbacks are set to the corresponding weak functions: examples HAL_TIM_TriggerCallback(), HAL_TIM_ErrorCallback().

Exception done for MspInit and MspDeInit functions that are reset to the legacy weak functionalities in the Init / DeInit only when these callbacks are null (not registered beforehand). If not, MspInit or MspDeInit are not null, the Init / DeInit keep and use the user MspInit / MspDeInit callbacks(registered beforehand)

Callbacks can be registered / unregistered in HAL_TIM_STATE_READY state only. Exception done MspInit / MspDeInit that can be registered / unregistered in HAL_TIM_STATE_READY or HAL_TIM_STATE_RESET state, thus registered(user) MspInit / DeInit callbacks can be used during the Init / DeInit. In that case first register the MspInit/MspDeInit user callbacks using HAL_TIM_RegisterCallback() before calling DeInit or Init function.

When The compilation define USE_HAL_TIM_REGISTER_CALLBACKS is set to 0 or not defined, the callback registration feature is not available and all callbacks are set to the corresponding weak functions.

47.2.3 Time Base functions

This section provides functions allowing to:

- Initialize and configure the TIM base.
- De-initialize the TIM base.
- Start the Time Base.
- Stop the Time Base.
- Start the Time Base and enable interrupt.
- Stop the Time Base and disable interrupt.

- Start the Time Base and enable DMA transfer.
- Stop the Time Base and disable DMA transfer.

This section contains the following APIs:

- ***HAL_TIM_Base_Init()***
- ***HAL_TIM_Base_DeInit()***
- ***HAL_TIM_Base_MspInit()***
- ***HAL_TIM_Base_MspDeInit()***
- ***HAL_TIM_Base_Start()***
- ***HAL_TIM_Base_Stop()***
- ***HAL_TIM_Base_Start_IT()***
- ***HAL_TIM_Base_Stop_IT()***
- ***HAL_TIM_Base_Start_DMA()***
- ***HAL_TIM_Base_Stop_DMA()***

47.2.4 TIM Output Compare functions

This section provides functions allowing to:

- Initialize and configure the TIM Output Compare.
- De-initialize the TIM Output Compare.
- Start the TIM Output Compare.
- Stop the TIM Output Compare.
- Start the TIM Output Compare and enable interrupt.
- Stop the TIM Output Compare and disable interrupt.
- Start the TIM Output Compare and enable DMA transfer.
- Stop the TIM Output Compare and disable DMA transfer.

This section contains the following APIs:

- ***HAL_TIM_OC_Init()***
- ***HAL_TIM_OC_DeInit()***
- ***HAL_TIM_OC_MspInit()***
- ***HAL_TIM_OC_MspDeInit()***
- ***HAL_TIM_OC_Start()***
- ***HAL_TIM_OC_Stop()***
- ***HAL_TIM_OC_Start_IT()***
- ***HAL_TIM_OC_Stop_IT()***
- ***HAL_TIM_OC_Start_DMA()***
- ***HAL_TIM_OC_Stop_DMA()***

47.2.5 TIM PWM functions

This section provides functions allowing to:

- Initialize and configure the TIM PWM.
- De-initialize the TIM PWM.
- Start the TIM PWM.
- Stop the TIM PWM.
- Start the TIM PWM and enable interrupt.
- Stop the TIM PWM and disable interrupt.
- Start the TIM PWM and enable DMA transfer.
- Stop the TIM PWM and disable DMA transfer.

This section contains the following APIs:

- ***HAL_TIM_PWM_Init()***
- ***HAL_TIM_PWM_DeInit()***

- *HAL_TIM_PWM_MspInit()*
- *HAL_TIM_PWM_MspDeInit()*
- *HAL_TIM_PWM_Start()*
- *HAL_TIM_PWM_Stop()*
- *HAL_TIM_PWM_Start_IT()*
- *HAL_TIM_PWM_Stop_IT()*
- *HAL_TIM_PWM_Start_DMA()*
- *HAL_TIM_PWM_Stop_DMA()*

47.2.6 TIM Input Capture functions

This section provides functions allowing to:

- Initialize and configure the TIM Input Capture.
- De-initialize the TIM Input Capture.
- Start the TIM Input Capture.
- Stop the TIM Input Capture.
- Start the TIM Input Capture and enable interrupt.
- Stop the TIM Input Capture and disable interrupt.
- Start the TIM Input Capture and enable DMA transfer.
- Stop the TIM Input Capture and disable DMA transfer.

This section contains the following APIs:

- *HAL_TIM_IC_Init()*
- *HAL_TIM_IC_DeInit()*
- *HAL_TIM_IC_MspInit()*
- *HAL_TIM_IC_MspDeInit()*
- *HAL_TIM_IC_Start()*
- *HAL_TIM_IC_Stop()*
- *HAL_TIM_IC_Start_IT()*
- *HAL_TIM_IC_Stop_IT()*
- *HAL_TIM_IC_Start_DMA()*
- *HAL_TIM_IC_Stop_DMA()*

47.2.7 TIM One Pulse functions

This section provides functions allowing to:

- Initialize and configure the TIM One Pulse.
- De-initialize the TIM One Pulse.
- Start the TIM One Pulse.
- Stop the TIM One Pulse.
- Start the TIM One Pulse and enable interrupt.
- Stop the TIM One Pulse and disable interrupt.
- Start the TIM One Pulse and enable DMA transfer.
- Stop the TIM One Pulse and disable DMA transfer.

This section contains the following APIs:

- *HAL_TIM_OnePulse_Init()*
- *HAL_TIM_OnePulse_DeInit()*
- *HAL_TIM_OnePulse_MspInit()*
- *HAL_TIM_OnePulse_MspDeInit()*
- *HAL_TIM_OnePulse_Start()*
- *HAL_TIM_OnePulse_Stop()*
- *HAL_TIM_OnePulse_Start_IT()*

- *HAL_TIM_OnePulse_Stop_IT()*

47.2.8 TIM Encoder functions

This section provides functions allowing to:

- Initialize and configure the TIM Encoder.
- De-initialize the TIM Encoder.
- Start the TIM Encoder.
- Stop the TIM Encoder.
- Start the TIM Encoder and enable interrupt.
- Stop the TIM Encoder and disable interrupt.
- Start the TIM Encoder and enable DMA transfer.
- Stop the TIM Encoder and disable DMA transfer.

This section contains the following APIs:

- *HAL_TIM_Encoder_Init()*
- *HAL_TIM_Encoder_DeInit()*
- *HAL_TIM_Encoder_MspInit()*
- *HAL_TIM_Encoder_MspDeInit()*
- *HAL_TIM_Encoder_Start()*
- *HAL_TIM_Encoder_Stop()*
- *HAL_TIM_Encoder_Start_IT()*
- *HAL_TIM_Encoder_Stop_IT()*
- *HAL_TIM_Encoder_Start_DMA()*
- *HAL_TIM_Encoder_Stop_DMA()*

47.2.9 TIM Callbacks functions

This section provides TIM callback functions:

- TIM Period elapsed callback
- TIM Output Compare callback
- TIM Input capture callback
- TIM Trigger callback
- TIM Error callback

This section contains the following APIs:

- *HAL_TIM_PeriodElapsedCallback()*
- *HAL_TIM_PeriodElapsedHalfCpltCallback()*
- *HAL_TIM_OC_DelayElapsedCallback()*
- *HAL_TIM_IC_CaptureCallback()*
- *HAL_TIM_IC_CaptureHalfCpltCallback()*
- *HAL_TIM_PWM_PulseFinishedCallback()*
- *HAL_TIM_PWM_PulseFinishedHalfCpltCallback()*
- *HAL_TIM_TriggerCallback()*
- *HAL_TIM_TriggerHalfCpltCallback()*
- *HAL_TIM_ErrorCallback()*
- *HAL_TIM_RegisterCallback()*
- *HAL_TIM_UnRegisterCallback()*

47.2.10 Detailed description of functions

HAL_TIM_Base_Init

Function name

HAL_StatusTypeDef HAL_TIM_Base_Init (TIM_HandleTypeDef * htim)

Function description

Initializes the TIM Time base Unit according to the specified parameters in the TIM_HandleTypeDef and initialize the associated handle.

Parameters

- **htim:** TIM Base handle

Return values

- **HAL:** status

Notes

- Switching from Center Aligned counter mode to Edge counter mode (or reverse) requires a timer reset to avoid unexpected direction due to DIR bit readonly in center aligned mode. Ex: call HAL_TIM_Base_DeInit() before HAL_TIM_Base_Init()

HAL_TIM_Base_DeInit

Function name

HAL_StatusTypeDef HAL_TIM_Base_DeInit (TIM_HandleTypeDef * htim)

Function description

DeInitializes the TIM Base peripheral.

Parameters

- **htim:** TIM Base handle

Return values

- **HAL:** status

HAL_TIM_Base_MspInit

Function name

void HAL_TIM_Base_MspInit (TIM_HandleTypeDef * htim)

Function description

Initializes the TIM Base MSP.

Parameters

- **htim:** TIM Base handle

Return values

- **None:**

HAL_TIM_Base_MspDeInit

Function name

void HAL_TIM_Base_MspDeInit (TIM_HandleTypeDef * htim)

Function description

DeInitializes TIM Base MSP.

Parameters

- **htim:** TIM Base handle

Return values

- **None:**

HAL_TIM_Base_Start

Function name

HAL_StatusTypeDef HAL_TIM_Base_Start (TIM_HandleTypeDef * htim)

Function description

Starts the TIM Base generation.

Parameters

- **htim:** TIM Base handle

Return values

- **HAL:** status

HAL_TIM_Base_Stop

Function name

HAL_StatusTypeDef HAL_TIM_Base_Stop (TIM_HandleTypeDef * htim)

Function description

Stops the TIM Base generation.

Parameters

- **htim:** TIM Base handle

Return values

- **HAL:** status

HAL_TIM_Base_Start_IT

Function name

HAL_StatusTypeDef HAL_TIM_Base_Start_IT (TIM_HandleTypeDef * htim)

Function description

Starts the TIM Base generation in interrupt mode.

Parameters

- **htim:** TIM Base handle

Return values

- **HAL:** status

HAL_TIM_Base_Stop_IT

Function name

HAL_StatusTypeDef HAL_TIM_Base_Stop_IT (TIM_HandleTypeDef * htim)

Function description

Stops the TIM Base generation in interrupt mode.

Parameters

- **htim:** TIM Base handle

Return values

- **HAL:** status

HAL_TIM_Base_Start_DMA

Function name

HAL_StatusTypeDef HAL_TIM_Base_Start_DMA (TIM_HandleTypeDef * htim, const uint32_t * pData, uint16_t Length)

Function description

Starts the TIM Base generation in DMA mode.

Parameters

- **htim:** TIM Base handle
- **pData:** The source Buffer address.
- **Length:** The length of data to be transferred from memory to peripheral.

Return values

- **HAL:** status

HAL_TIM_Base_Stop_DMA

Function name

HAL_StatusTypeDef HAL_TIM_Base_Stop_DMA (TIM_HandleTypeDef * htim)

Function description

Stops the TIM Base generation in DMA mode.

Parameters

- **htim:** TIM Base handle

Return values

- **HAL:** status

HAL_TIM_OC_Init

Function name

HAL_StatusTypeDef HAL_TIM_OC_Init (TIM_HandleTypeDef * htim)

Function description

Initializes the TIM Output Compare according to the specified parameters in the TIM_HandleTypeDef and initializes the associated handle.

Parameters

- **htim:** TIM Output Compare handle

Return values

- **HAL:** status

Notes

- Switching from Center Aligned counter mode to Edge counter mode (or reverse) requires a timer reset to avoid unexpected direction due to DIR bit readonly in center aligned mode. Ex: call HAL_TIM_OC_DeInit() before HAL_TIM_OC_Init()

HAL_TIM_OC_DeInit

Function name

HAL_StatusTypeDef HAL_TIM_OC_DeInit (TIM_HandleTypeDef * htim)

Function description

DeInitializes the TIM peripheral.

Parameters

- **htim:** TIM Output Compare handle

Return values

- **HAL:** status

HAL_TIM_OC_MspInit

Function name

void HAL_TIM_OC_MspInit (TIM_HandleTypeDef * htim)

Function description

Initializes the TIM Output Compare MSP.

Parameters

- **htim:** TIM Output Compare handle

Return values

- **None:**

HAL_TIM_OC_MspDeInit

Function name

void HAL_TIM_OC_MspDeInit (TIM_HandleTypeDef * htim)

Function description

DeInitializes TIM Output Compare MSP.

Parameters

- **htim:** TIM Output Compare handle

Return values

- **None:**

HAL_TIM_OC_Start

Function name

HAL_StatusTypeDef HAL_TIM_OC_Start (TIM_HandleTypeDef * htim, uint32_t Channel)

Function description

Starts the TIM Output Compare signal generation.

Parameters

- **htim:** TIM Output Compare handle
- **Channel:** TIM Channel to be enabled This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected
  - TIM_CHANNEL_4: TIM Channel 4 selected
  - TIM_CHANNEL_5: TIM Channel 5 selected
  - TIM_CHANNEL_6: TIM Channel 6 selected

Return values

- **HAL:** status

HAL_TIM_OC_Stop

Function name

HAL_StatusTypeDef HAL_TIM_OC_Stop (TIM_HandleTypeDef * htim, uint32_t Channel)

Function description

Stops the TIM Output Compare signal generation.

Parameters

- **htim:** TIM Output Compare handle
- **Channel:** TIM Channel to be disabled This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected
  - TIM_CHANNEL_4: TIM Channel 4 selected
  - TIM_CHANNEL_5: TIM Channel 5 selected
  - TIM_CHANNEL_6: TIM Channel 6 selected

Return values

- **HAL:** status

HAL_TIM_OC_Start_IT

Function name

HAL_StatusTypeDef HAL_TIM_OC_Start_IT (TIM_HandleTypeDef * htim, uint32_t Channel)

Function description

Starts the TIM Output Compare signal generation in interrupt mode.

Parameters

- **htim:** TIM Output Compare handle
- **Channel:** TIM Channel to be enabled This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected
  - TIM_CHANNEL_4: TIM Channel 4 selected

Return values

- **HAL:** status

HAL_TIM_OC_Stop_IT

Function name

HAL_StatusTypeDef HAL_TIM_OC_Stop_IT (TIM_HandleTypeDef * htim, uint32_t Channel)

Function description

Stops the TIM Output Compare signal generation in interrupt mode.

Parameters

- **htim:** TIM Output Compare handle
- **Channel:** TIM Channel to be disabled This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected
  - TIM_CHANNEL_4: TIM Channel 4 selected

Return values

- **HAL:** status

HAL_TIM_OC_Start_DMA

Function name

HAL_StatusTypeDef HAL_TIM_OC_Start_DMA (TIM_HandleTypeDef * htim, uint32_t Channel, const uint32_t * pData, uint16_t Length)

Function description

Starts the TIM Output Compare signal generation in DMA mode.

Parameters

- **htim:** TIM Output Compare handle
- **Channel:** TIM Channel to be enabled This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected
  - TIM_CHANNEL_4: TIM Channel 4 selected
- **pData:** The source Buffer address.
- **Length:** The length of data to be transferred from memory to TIM peripheral

Return values

- **HAL:** status

HAL_TIM_OC_Stop_DMA

Function name

HAL_StatusTypeDef HAL_TIM_OC_Stop_DMA (TIM_HandleTypeDef * htim, uint32_t Channel)

Function description

Stops the TIM Output Compare signal generation in DMA mode.

Parameters

- **htim:** TIM Output Compare handle
- **Channel:** TIM Channel to be disabled This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected
  - TIM_CHANNEL_4: TIM Channel 4 selected

Return values

- **HAL:** status

HAL_TIM_PWM_Init

Function name

HAL_StatusTypeDef HAL_TIM_PWM_Init (TIM_HandleTypeDef * htim)

Function description

Initializes the TIM PWM Time Base according to the specified parameters in the TIM_HandleTypeDef and initializes the associated handle.

Parameters

- **htim:** TIM PWM handle

Return values

- **HAL:** status

Notes

- Switching from Center Aligned counter mode to Edge counter mode (or reverse) requires a timer reset to avoid unexpected direction due to DIR bit readonly in center aligned mode. Ex: call HAL_TIM_PWM_DeInit() before HAL_TIM_PWM_Init()

HAL_TIM_PWM_DeInit

Function name

HAL_StatusTypeDef HAL_TIM_PWM_DeInit (TIM_HandleTypeDef * htim)

Function description

DeInitializes the TIM peripheral.

Parameters

- **htim:** TIM PWM handle

Return values

- **HAL:** status

HAL_TIM_PWM_MspInit

Function name

void HAL_TIM_PWM_MspInit (TIM_HandleTypeDef * htim)

Function description

Initializes the TIM PWM MSP.

Parameters

- **htim:** TIM PWM handle

Return values

- **None:**

HAL_TIM_PWM_MspDeInit

Function name

void HAL_TIM_PWM_MspDeInit (TIM_HandleTypeDef * htim)

Function description

DeInitializes TIM PWM MSP.

Parameters

- **htim:** TIM PWM handle

Return values

- **None:**

HAL_TIM_PWM_Start

Function name

HAL_StatusTypeDef HAL_TIM_PWM_Start (TIM_HandleTypeDef * htim, uint32_t Channel)

Function description

Starts the PWM signal generation.

Parameters

- **htim:** TIM handle
- **Channel:** TIM Channels to be enabled This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected
  - TIM_CHANNEL_4: TIM Channel 4 selected
  - TIM_CHANNEL_5: TIM Channel 5 selected
  - TIM_CHANNEL_6: TIM Channel 6 selected

Return values

- **HAL:** status

HAL_TIM_PWM_Stop

Function name

HAL_StatusTypeDef HAL_TIM_PWM_Stop (TIM_HandleTypeDef * htim, uint32_t Channel)

Function description

Stops the PWM signal generation.

Parameters

- **htim:** TIM PWM handle
- **Channel:** TIM Channels to be disabled This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected
  - TIM_CHANNEL_4: TIM Channel 4 selected
  - TIM_CHANNEL_5: TIM Channel 5 selected
  - TIM_CHANNEL_6: TIM Channel 6 selected

Return values

- **HAL:** status

HAL_TIM_PWM_Start_IT

Function name

HAL_StatusTypeDef HAL_TIM_PWM_Start_IT (TIM_HandleTypeDef * htim, uint32_t Channel)

Function description

Starts the PWM signal generation in interrupt mode.

Parameters

- **htim:** TIM PWM handle
- **Channel:** TIM Channel to be enabled This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected
  - TIM_CHANNEL_4: TIM Channel 4 selected

Return values

- **HAL:** status

HAL_TIM_PWM_Stop_IT

Function name

HAL_StatusTypeDef HAL_TIM_PWM_Stop_IT (TIM_HandleTypeDef * htim, uint32_t Channel)

Function description

Stops the PWM signal generation in interrupt mode.

Parameters

- **htim:** TIM PWM handle
- **Channel:** TIM Channels to be disabled This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected
  - TIM_CHANNEL_4: TIM Channel 4 selected

Return values

- **HAL:** status

HAL_TIM_PWM_Start_DMA

Function name

HAL_StatusTypeDef HAL_TIM_PWM_Start_DMA (TIM_HandleTypeDef * htim, uint32_t Channel, const uint32_t * pData, uint16_t Length)

Function description

Starts the TIM PWM signal generation in DMA mode.

Parameters

- **htim:** TIM PWM handle
- **Channel:** TIM Channels to be enabled This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected
  - TIM_CHANNEL_4: TIM Channel 4 selected
- **pData:** The source Buffer address.
- **Length:** The length of data to be transferred from memory to TIM peripheral

Return values

- **HAL:** status

HAL_TIM_PWM_Stop_DMA

Function name

HAL_StatusTypeDef HAL_TIM_PWM_Stop_DMA (TIM_HandleTypeDef * htim, uint32_t Channel)

Function description

Stops the TIM PWM signal generation in DMA mode.

Parameters

- **htim:** TIM PWM handle
- **Channel:** TIM Channels to be disabled This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected
  - TIM_CHANNEL_4: TIM Channel 4 selected

Return values

- **HAL:** status

HAL_TIM_IC_Init

Function name

HAL_StatusTypeDef HAL_TIM_IC_Init (TIM_HandleTypeDef * htim)

Function description

Initializes the TIM Input Capture Time base according to the specified parameters in the TIM_HandleTypeDef and initializes the associated handle.

Parameters

- **htim:** TIM Input Capture handle

Return values

- **HAL:** status

Notes

- Switching from Center Aligned counter mode to Edge counter mode (or reverse) requires a timer reset to avoid unexpected direction due to DIR bit readonly in center aligned mode. Ex: call HAL_TIM_IC_DeInit() before HAL_TIM_IC_Init()

HAL_TIM_IC_DeInit

Function name

HAL_StatusTypeDef HAL_TIM_IC_DeInit (TIM_HandleTypeDef * htim)

Function description

DeInitializes the TIM peripheral.

Parameters

- **htim:** TIM Input Capture handle

Return values

- **HAL:** status

HAL_TIM_IC_MspInit

Function name

void HAL_TIM_IC_MspInit (TIM_HandleTypeDef * htim)

Function description

Initializes the TIM Input Capture MSP.

Parameters

- **htim:** TIM Input Capture handle

Return values

- **None:**

HAL_TIM_IC_MspDeInit

Function name

void HAL_TIM_IC_MspDeInit (TIM_HandleTypeDef * htim)

Function description

DeInitializes TIM Input Capture MSP.

Parameters

- **htim:** TIM handle

Return values

- **None:**

HAL_TIM_IC_Start

Function name

HAL_StatusTypeDef HAL_TIM_IC_Start (TIM_HandleTypeDef * htim, uint32_t Channel)

Function description

Starts the TIM Input Capture measurement.

Parameters

- **htim:** TIM Input Capture handle
- **Channel:** TIM Channels to be enabled This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected
  - TIM_CHANNEL_4: TIM Channel 4 selected

Return values

- **HAL:** status

HAL_TIM_IC_Stop

Function name

HAL_StatusTypeDef HAL_TIM_IC_Stop (TIM_HandleTypeDef * htim, uint32_t Channel)

Function description

Stops the TIM Input Capture measurement.

Parameters

- **htim:** TIM Input Capture handle
- **Channel:** TIM Channels to be disabled This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected
  - TIM_CHANNEL_4: TIM Channel 4 selected

Return values

- **HAL:** status

HAL_TIM_IC_Start_IT

Function name

HAL_StatusTypeDef HAL_TIM_IC_Start_IT (TIM_HandleTypeDef * htim, uint32_t Channel)

Function description

Starts the TIM Input Capture measurement in interrupt mode.

Parameters

- **htim:** TIM Input Capture handle
- **Channel:** TIM Channels to be enabled This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected
  - TIM_CHANNEL_4: TIM Channel 4 selected

Return values

- **HAL:** status

HAL_TIM_IC_Stop_IT

Function name

HAL_StatusTypeDef HAL_TIM_IC_Stop_IT (TIM_HandleTypeDef * htim, uint32_t Channel)

Function description

Stops the TIM Input Capture measurement in interrupt mode.

Parameters

- **htim:** TIM Input Capture handle
- **Channel:** TIM Channels to be disabled This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected
  - TIM_CHANNEL_4: TIM Channel 4 selected

Return values

- **HAL:** status

HAL_TIM_IC_Start_DMA

Function name

HAL_StatusTypeDef HAL_TIM_IC_Start_DMA (TIM_HandleTypeDef * htim, uint32_t Channel, uint32_t * pData, uint16_t Length)

Function description

Starts the TIM Input Capture measurement in DMA mode.

Parameters

- **htim:** TIM Input Capture handle
- **Channel:** TIM Channels to be enabled This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected
  - TIM_CHANNEL_4: TIM Channel 4 selected
- **pData:** The destination Buffer address.
- **Length:** The length of data to be transferred from TIM peripheral to memory.

Return values

- **HAL:** status

HAL_TIM_IC_Stop_DMA

Function name

HAL_StatusTypeDef HAL_TIM_IC_Stop_DMA (TIM_HandleTypeDef * htim, uint32_t Channel)

Function description

Stops the TIM Input Capture measurement in DMA mode.

Parameters

- **htim:** TIM Input Capture handle
- **Channel:** TIM Channels to be disabled This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected
  - TIM_CHANNEL_4: TIM Channel 4 selected

Return values

- **HAL:** status

HAL_TIM_OnePulse_Init

Function name

HAL_StatusTypeDef HAL_TIM_OnePulse_Init (TIM_HandleTypeDef * htim, uint32_t OnePulseMode)

Function description

Initializes the TIM One Pulse Time Base according to the specified parameters in the TIM_HandleTypeDef and initializes the associated handle.

Parameters

- **htim:** TIM One Pulse handle
- **OnePulseMode:** Select the One pulse mode. This parameter can be one of the following values:
  - TIM_OPMODE_SINGLE: Only one pulse will be generated.
  - TIM_OPMODE_REPETITIVE: Repetitive pulses will be generated.

Return values

- **HAL:** status

Notes

- Switching from Center Aligned counter mode to Edge counter mode (or reverse) requires a timer reset to avoid unexpected direction due to DIR bit readonly in center aligned mode. Ex: call HAL_TIM_OnePulse_DeInit() before HAL_TIM_OnePulse_Init()
- When the timer instance is initialized in One Pulse mode, timer channels 1 and channel 2 are reserved and cannot be used for other purpose.

HAL_TIM_OnePulse_DeInit

Function name

HAL_StatusTypeDef HAL_TIM_OnePulse_DeInit (TIM_HandleTypeDef * htim)

Function description

DeInitializes the TIM One Pulse.

Parameters

- **htim:** TIM One Pulse handle

Return values

- **HAL:** status

HAL_TIM_OnePulse_MspInit

Function name

void HAL_TIM_OnePulse_MspInit (TIM_HandleTypeDef * htim)

Function description

Initializes the TIM One Pulse MSP.

Parameters

- **htim:** TIM One Pulse handle

Return values

- **None:**

HAL_TIM_OnePulse_MspDeInit

Function name

void HAL_TIM_OnePulse_MspDeInit (TIM_HandleTypeDef * htim)

Function description

DeInitializes TIM One Pulse MSP.

Parameters

- **htim:** TIM One Pulse handle

Return values

- **None:**

HAL_TIM_OnePulse_Start

Function name

HAL_StatusTypeDef HAL_TIM_OnePulse_Start (TIM_HandleTypeDef * htim, uint32_t OutputChannel)

Function description

Starts the TIM One Pulse signal generation.

Parameters

- **htim:** TIM One Pulse handle
- **OutputChannel:** See note above

Return values

- **HAL:** status

Notes

- Though OutputChannel parameter is deprecated and ignored by the function it has been kept to avoid HAL_TIM API compatibility break.
- The pulse output channel is determined when calling HAL_TIM_OnePulse_ConfigChannel().

HAL_TIM_OnePulse_Stop

Function name

HAL_StatusTypeDef HAL_TIM_OnePulse_Stop (TIM_HandleTypeDef * htim, uint32_t OutputChannel)

Function description

Stops the TIM One Pulse signal generation.

Parameters

- **htim:** TIM One Pulse handle
- **OutputChannel:** See note above

Return values

- **HAL:** status

Notes

- Though OutputChannel parameter is deprecated and ignored by the function it has been kept to avoid HAL_TIM API compatibility break.
- The pulse output channel is determined when calling HAL_TIM_OnePulse_ConfigChannel().

HAL_TIM_OnePulse_Start_IT

Function name

HAL_StatusTypeDef HAL_TIM_OnePulse_Start_IT (TIM_HandleTypeDef * htim, uint32_t OutputChannel)

Function description

Starts the TIM One Pulse signal generation in interrupt mode.

Parameters

- **htim:** TIM One Pulse handle
- **OutputChannel:** See note above

Return values

- **HAL:** status

Notes

- Though OutputChannel parameter is deprecated and ignored by the function it has been kept to avoid HAL_TIM API compatibility break.
- The pulse output channel is determined when calling HAL_TIM_OnePulse_ConfigChannel().

HAL_TIM_OnePulse_Stop_IT

Function name

HAL_StatusTypeDef HAL_TIM_OnePulse_Stop_IT (TIM_HandleTypeDef * htim, uint32_t OutputChannel)

Function description

Stops the TIM One Pulse signal generation in interrupt mode.

Parameters

- **htim:** TIM One Pulse handle
- **OutputChannel:** See note above

Return values

- **HAL:** status

Notes

- Though OutputChannel parameter is deprecated and ignored by the function it has been kept to avoid HAL_TIM API compatibility break.
- The pulse output channel is determined when calling HAL_TIM_OnePulse_ConfigChannel().

HAL_TIM_Encoder_Init

Function name

HAL_StatusTypeDef HAL_TIM_Encoder_Init (TIM_HandleTypeDef * htim, const TIM_Encoder_InitTypeDef * sConfig)

Function description

Initializes the TIM Encoder Interface and initialize the associated handle.

Parameters

- **htim:** TIM Encoder Interface handle
- **sConfig:** TIM Encoder Interface configuration structure

Return values

- **HAL:** status

Notes

- Switching from Center Aligned counter mode to Edge counter mode (or reverse) requires a timer reset to avoid unexpected direction due to DIR bit readonly in center aligned mode. Ex: call HAL_TIM_Encoder_DeInit() before HAL_TIM_Encoder_Init()
- Encoder mode and External clock mode 2 are not compatible and must not be selected together Ex: A call for HAL_TIM_Encoder_Init will erase the settings of HAL_TIM_ConfigClockSource using TIM_CLOCKSOURCE_ETRMODE2 and vice versa
- When the timer instance is initialized in Encoder mode, timer channels 1 and channel 2 are reserved and cannot be used for other purpose.

HAL_TIM_Encoder_DeInit

Function name

HAL_StatusTypeDef HAL_TIM_Encoder_DeInit (TIM_HandleTypeDef * htim)

Function description

DeInitializes the TIM Encoder interface.

Parameters

- **htim:** TIM Encoder Interface handle

Return values

- **HAL:** status

HAL_TIM_Encoder_MspInit

Function name

void HAL_TIM_Encoder_MspInit (TIM_HandleTypeDef * htim)

Function description

Initializes the TIM Encoder Interface MSP.

Parameters

- **htim:** TIM Encoder Interface handle

Return values

- **None:**

HAL_TIM_Encoder_MspDeInit

Function name

void HAL_TIM_Encoder_MspDeInit (TIM_HandleTypeDef * htim)

Function description

DeInitializes TIM Encoder Interface MSP.

Parameters

- **htim:** TIM Encoder Interface handle

Return values

- **None:**

HAL_TIM_Encoder_Start

Function name

HAL_StatusTypeDef HAL_TIM_Encoder_Start (TIM_HandleTypeDef * htim, uint32_t Channel)

Function description

Starts the TIM Encoder Interface.

Parameters

- **htim:** TIM Encoder Interface handle
- **Channel:** TIM Channels to be enabled This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_ALL: TIM Channel 1 and TIM Channel 2 are selected

Return values

- **HAL:** status

HAL_TIM_Encoder_Stop

Function name

HAL_StatusTypeDef HAL_TIM_Encoder_Stop (TIM_HandleTypeDef * htim, uint32_t Channel)

Function description

Stops the TIM Encoder Interface.

Parameters

- **htim:** TIM Encoder Interface handle
- **Channel:** TIM Channels to be disabled This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_ALL: TIM Channel 1 and TIM Channel 2 are selected

Return values

- **HAL:** status

HAL_TIM_Encoder_Start_IT

Function name

HAL_StatusTypeDef HAL_TIM_Encoder_Start_IT (TIM_HandleTypeDef * htim, uint32_t Channel)

Function description

Starts the TIM Encoder Interface in interrupt mode.

Parameters

- **htim:** TIM Encoder Interface handle
- **Channel:** TIM Channels to be enabled This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_ALL: TIM Channel 1 and TIM Channel 2 are selected

Return values

- **HAL:** status

HAL_TIM_Encoder_Stop_IT

Function name

HAL_StatusTypeDef HAL_TIM_Encoder_Stop_IT (TIM_HandleTypeDef * htim, uint32_t Channel)

Function description

Stops the TIM Encoder Interface in interrupt mode.

Parameters

- **htim:** TIM Encoder Interface handle
- **Channel:** TIM Channels to be disabled This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_ALL: TIM Channel 1 and TIM Channel 2 are selected

Return values

- **HAL:** status

HAL_TIM_Encoder_Start_DMA

Function name

HAL_StatusTypeDef HAL_TIM_Encoder_Start_DMA (TIM_HandleTypeDef * htim, uint32_t Channel, uint32_t * pData1, uint32_t * pData2, uint16_t Length)

Function description

Starts the TIM Encoder Interface in DMA mode.

Parameters

- **htim:** TIM Encoder Interface handle
- **Channel:** TIM Channels to be enabled This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_ALL: TIM Channel 1 and TIM Channel 2 are selected
- **pData1:** The destination Buffer address for IC1.
- **pData2:** The destination Buffer address for IC2.
- **Length:** The length of data to be transferred from TIM peripheral to memory.

Return values

- **HAL:** status

HAL_TIM_Encoder_Stop_DMA

Function name

HAL_StatusTypeDef HAL_TIM_Encoder_Stop_DMA (TIM_HandleTypeDef * htim, uint32_t Channel)

Function description

Stops the TIM Encoder Interface in DMA mode.

Parameters

- **htim:** TIM Encoder Interface handle
- **Channel:** TIM Channels to be enabled This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_ALL: TIM Channel 1 and TIM Channel 2 are selected

Return values

- **HAL:** status

HAL_TIM_IRQHandler

Function name

void HAL_TIM_IRQHandler (TIM_HandleTypeDef * htim)

Function description

This function handles TIM interrupts requests.

Parameters

- **htim:** TIM handle

Return values

- **None:**

HAL_TIM_OC_ConfigChannel

Function name

HAL_StatusTypeDef HAL_TIM_OC_ConfigChannel (TIM_HandleTypeDef * htim, const TIM_OC_InitTypeDef * sConfig, uint32_t Channel)

Function description

Initializes the TIM Output Compare Channels according to the specified parameters in the TIM_OC_InitTypeDef.

Parameters

- **htim:** TIM Output Compare handle
- **sConfig:** TIM Output Compare configuration structure
- **Channel:** TIM Channels to configure This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected
  - TIM_CHANNEL_4: TIM Channel 4 selected
  - TIM_CHANNEL_5: TIM Channel 5 selected
  - TIM_CHANNEL_6: TIM Channel 6 selected

Return values

- **HAL:** status

HAL_TIM_PWM_ConfigChannel

Function name

HAL_StatusTypeDef HAL_TIM_PWM_ConfigChannel (TIM_HandleTypeDef * htim, const TIM_OC_InitTypeDef * sConfig, uint32_t Channel)

Function description

Initializes the TIM PWM channels according to the specified parameters in the TIM_OC_InitTypeDef.

Parameters

- **htim:** TIM PWM handle
- **sConfig:** TIM PWM configuration structure
- **Channel:** TIM Channels to be configured This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected
  - TIM_CHANNEL_4: TIM Channel 4 selected
  - TIM_CHANNEL_5: TIM Channel 5 selected
  - TIM_CHANNEL_6: TIM Channel 6 selected

Return values

- **HAL:** status

HAL_TIM_IC_ConfigChannel

Function name

HAL_StatusTypeDef HAL_TIM_IC_ConfigChannel (TIM_HandleTypeDef * htim, const TIM_IC_InitTypeDef * sConfig, uint32_t Channel)

Function description

Initializes the TIM Input Capture Channels according to the specified parameters in the TIM_IC_InitTypeDef.

Parameters

- **htim:** TIM IC handle
- **sConfig:** TIM Input Capture configuration structure
- **Channel:** TIM Channel to configure This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected
  - TIM_CHANNEL_4: TIM Channel 4 selected

Return values

- **HAL:** status

HAL_TIM_OnePulse_ConfigChannel

Function name

HAL_StatusTypeDef HAL_TIM_OnePulse_ConfigChannel (TIM_HandleTypeDef * htim, TIM_OnePulse_InitTypeDef * sConfig, uint32_t OutputChannel, uint32_t InputChannel)

Function description

Initializes the TIM One Pulse Channels according to the specified parameters in the TIM_OnePulse_InitTypeDef.

Parameters

- **htim:** TIM One Pulse handle
- **sConfig:** TIM One Pulse configuration structure
- **OutputChannel:** TIM output channel to configure This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
- **InputChannel:** TIM input Channel to configure This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected

Return values

- **HAL:** status

Notes

- To output a waveform with a minimum delay user can enable the fast mode by calling the __HAL_TIM_ENABLE_OCxFAST macro. Then CCx output is forced in response to the edge detection on TIx input, without taking in account the comparison.

HAL_TIM_ConfigOCrefClear

Function name

HAL_StatusTypeDef HAL_TIM_ConfigOCrefClear (TIM_HandleTypeDef * htim, const TIM_ClearInputConfigTypeDef * sClearInputConfig, uint32_t Channel)

Function description

Configures the OCRef clear feature.

Parameters

- **htim:** TIM handle
- **sClearInputConfig:** pointer to a TIM_ClearInputConfigTypeDef structure that contains the OCREF clear feature and parameters for the TIM peripheral.
- **Channel:** specifies the TIM Channel This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1
  - TIM_CHANNEL_2: TIM Channel 2
  - TIM_CHANNEL_3: TIM Channel 3
  - TIM_CHANNEL_4: TIM Channel 4
  - TIM_CHANNEL_5: TIM Channel 5
  - TIM_CHANNEL_6: TIM Channel 6

Return values

- **HAL:** status

HAL_TIM_ConfigClockSource

Function name

HAL_StatusTypeDef HAL_TIM_ConfigClockSource (TIM_HandleTypeDef * htim, const TIM_ClockConfigTypeDef * sClockSourceConfig)

Function description

Configures the clock source to be used.

Parameters

- **htim:** TIM handle
- **sClockSourceConfig:** pointer to a TIM_ClockConfigTypeDef structure that contains the clock source information for the TIM peripheral.

Return values

- **HAL:** status

HAL_TIM_ConfigTI1Input

Function name

HAL_StatusTypeDef HAL_TIM_ConfigTI1Input (TIM_HandleTypeDef * htim, uint32_t TI1_Selection)

Function description

Selects the signal connected to the TI1 input: direct from CH1_input or a XOR combination between CH1_input, CH2_input & CH3_input.

Parameters

- **htim:** TIM handle.
- **TI1_Selection:** Indicate whether or not channel 1 is connected to the output of a XOR gate. This parameter can be one of the following values:
  - TIM_TI1SELECTION_CH1: The TIMx_CH1 pin is connected to TI1 input
  - TIM_TI1SELECTION_XORCOMBINATION: The TIMx_CH1, CH2 and CH3 pins are connected to the TI1 input (XOR combination)

Return values

- **HAL:** status

HAL_TIM_SlaveConfigSynchro

Function name

HAL_StatusTypeDef HAL_TIM_SlaveConfigSynchro (TIM_HandleTypeDef * htim, const TIM_SlaveConfigTypeDef * sSlaveConfig)

Function description

Configures the TIM in Slave mode.

Parameters

- **htim:** TIM handle.
- **sSlaveConfig:** pointer to a TIM_SlaveConfigTypeDef structure that contains the selected trigger (internal trigger input, filtered timer input or external trigger input) and the Slave mode (Disable, Reset, Gated, Trigger, External clock mode 1).

Return values

- **HAL:** status

HAL_TIM_SlaveConfigSynchro_IT

Function name

HAL_StatusTypeDef HAL_TIM_SlaveConfigSynchro_IT (TIM_HandleTypeDef * htim, const TIM_SlaveConfigTypeDef * sSlaveConfig)

Function description

Configures the TIM in Slave mode in interrupt mode.

Parameters

- **htim:** TIM handle.
- **sSlaveConfig:** pointer to a TIM_SlaveConfigTypeDef structure that contains the selected trigger (internal trigger input, filtered timer input or external trigger input) and the Slave mode (Disable, Reset, Gated, Trigger, External clock mode 1).

Return values

- **HAL:** status

HAL_TIM_DMABurst_WriteStart

Function name

HAL_StatusTypeDef HAL_TIM_DMABurst_WriteStart (TIM_HandleTypeDef * htim, uint32_t BurstBaseAddress, uint32_t BurstRequestSrc, const uint32_t * BurstBuffer, uint32_t BurstLength)

Function description

Configure the DMA Burst to transfer Data from the memory to the TIM peripheral.

Parameters

- **htim:** TIM handle
- **BurstBaseAddress:** TIM Base address from where the DMA will start the Data write This parameter can be one of the following values:
  - TIM_DMABASE_CR1
  - TIM_DMABASE_CR2
  - TIM_DMABASE_SMCR
  - TIM_DMABASE_DIER
  - TIM_DMABASE_SR
  - TIM_DMABASE_EGR
  - TIM_DMABASE_CCMR1
  - TIM_DMABASE_CCMR2
  - TIM_DMABASE_CCER
  - TIM_DMABASE_CNT
  - TIM_DMABASE_PSC
  - TIM_DMABASE_ARR
  - TIM_DMABASE_RCR
  - TIM_DMABASE_CCR1
  - TIM_DMABASE_CCR2
  - TIM_DMABASE_CCR3
  - TIM_DMABASE_CCR4
  - TIM_DMABASE_BDTR
  - TIM_DMABASE_OR1
  - TIM_DMABASE_CCMR3
  - TIM_DMABASE_CCR5
  - TIM_DMABASE_CCR6
  - TIM_DMABASE_AF1
  - TIM_DMABASE_AF2
  - TIM_DMABASE_TISEL
- **BurstRequestSrc:** TIM DMA Request sources This parameter can be one of the following values:
  - TIM_DMA_UPDATE: TIM update Interrupt source
  - TIM_DMA_CC1: TIM Capture Compare 1 DMA source
  - TIM_DMA_CC2: TIM Capture Compare 2 DMA source
  - TIM_DMA_CC3: TIM Capture Compare 3 DMA source
  - TIM_DMA_CC4: TIM Capture Compare 4 DMA source
  - TIM_DMA_COM: TIM Commutation DMA source
  - TIM_DMA_TRIGGER: TIM Trigger DMA source
- **BurstBuffer:** The Buffer address.
- **BurstLength:** DMA Burst length. This parameter can be one value between: TIM_DMABURSTLENGTH_1TRANSFER and TIM_DMABURSTLENGTH_18TRANSFERS.

Return values

- **HAL:** status

Notes

- This function should be used only when BurstLength is equal to DMA data transfer length.

HAL_TIM_DMABurst_MultiWriteStart

Function name

HAL_StatusTypeDef HAL_TIM_DMABurst_MultiWriteStart (TIM_HandleTypeDef * htim, uint32_t BurstBaseAddress, uint32_t BurstRequestSrc, const uint32_t * BurstBuffer, uint32_t BurstLength, uint32_t DataLength)

Function description

Configure the DMA Burst to transfer multiple Data from the memory to the TIM peripheral.

Parameters

- **htim:** TIM handle
- **BurstBaseAddress:** TIM Base address from where the DMA will start the Data write This parameter can be one of the following values:
  - TIM_DMABASE_CR1
  - TIM_DMABASE_CR2
  - TIM_DMABASE_SMCR
  - TIM_DMABASE_DIER
  - TIM_DMABASE_SR
  - TIM_DMABASE_EGR
  - TIM_DMABASE_CCMR1
  - TIM_DMABASE_CCMR2
  - TIM_DMABASE_CCER
  - TIM_DMABASE_CNT
  - TIM_DMABASE_PSC
  - TIM_DMABASE_ARR
  - TIM_DMABASE_RCR
  - TIM_DMABASE_CCR1
  - TIM_DMABASE_CCR2
  - TIM_DMABASE_CCR3
  - TIM_DMABASE_CCR4
  - TIM_DMABASE_BDTR
  - TIM_DMABASE_OR1
  - TIM_DMABASE_CCMR3
  - TIM_DMABASE_CCR5
  - TIM_DMABASE_CCR6
  - TIM_DMABASE_AF1
  - TIM_DMABASE_AF2
  - TIM_DMABASE_TISEL
- **BurstRequestSrc:** TIM DMA Request sources This parameter can be one of the following values:
  - TIM_DMA_UPDATE: TIM update Interrupt source
  - TIM_DMA_CC1: TIM Capture Compare 1 DMA source
  - TIM_DMA_CC2: TIM Capture Compare 2 DMA source
  - TIM_DMA_CC3: TIM Capture Compare 3 DMA source
  - TIM_DMA_CC4: TIM Capture Compare 4 DMA source
  - TIM_DMA_COM: TIM Commutation DMA source
  - TIM_DMA_TRIGGER: TIM Trigger DMA source
- **BurstBuffer:** The Buffer address.
- **BurstLength:** DMA Burst length. This parameter can be one value between: TIM_DMABURSTLENGTH_1TRANSFER and TIM_DMABURSTLENGTH_18TRANSFERS.
- **DataLength:** Data length. This parameter can be one value between 1 and 0xFFFF.

Return values

- **HAL:** status

HAL_TIM_DMABurst_WriteStop

Function name

HAL_StatusTypeDef HAL_TIM_DMABurst_WriteStop (TIM_HandleTypeDef * htim, uint32_t BurstRequestSrc)

Function description

Stops the TIM DMA Burst mode.

Parameters

- **htim:** TIM handle
- **BurstRequestSrc:** TIM DMA Request sources to disable

Return values

- **HAL:** status

HAL_TIM_DMABurst_ReadStart

Function name

HAL_StatusTypeDef HAL_TIM_DMABurst_ReadStart (TIM_HandleTypeDef * htim, uint32_t BurstBaseAddress, uint32_t BurstRequestSrc, uint32_t * BurstBuffer, uint32_t BurstLength)

Function description

Configure the DMA Burst to transfer Data from the TIM peripheral to the memory.

Parameters

- **htim:** TIM handle
- **BurstBaseAddress:** TIM Base address from where the DMA will start the Data read This parameter can be one of the following values:
  - TIM_DMABASE_CR1
  - TIM_DMABASE_CR2
  - TIM_DMABASE_SMCR
  - TIM_DMABASE_DIER
  - TIM_DMABASE_SR
  - TIM_DMABASE_EGR
  - TIM_DMABASE_CCMR1
  - TIM_DMABASE_CCMR2
  - TIM_DMABASE_CCER
  - TIM_DMABASE_CNT
  - TIM_DMABASE_PSC
  - TIM_DMABASE_ARR
  - TIM_DMABASE_RCR
  - TIM_DMABASE_CCR1
  - TIM_DMABASE_CCR2
  - TIM_DMABASE_CCR3
  - TIM_DMABASE_CCR4
  - TIM_DMABASE_BDTR
  - TIM_DMABASE_OR1
  - TIM_DMABASE_CCMR3
  - TIM_DMABASE_CCR5
  - TIM_DMABASE_CCR6
  - TIM_DMABASE_AF1
  - TIM_DMABASE_AF2
  - TIM_DMABASE_TISEL
- **BurstRequestSrc:** TIM DMA Request sources This parameter can be one of the following values:
  - TIM_DMA_UPDATE: TIM update Interrupt source
  - TIM_DMA_CC1: TIM Capture Compare 1 DMA source
  - TIM_DMA_CC2: TIM Capture Compare 2 DMA source
  - TIM_DMA_CC3: TIM Capture Compare 3 DMA source
  - TIM_DMA_CC4: TIM Capture Compare 4 DMA source
  - TIM_DMA_COM: TIM Commutation DMA source
  - TIM_DMA_TRIGGER: TIM Trigger DMA source
- **BurstBuffer:** The Buffer address.
- **BurstLength:** DMA Burst length. This parameter can be one value between: TIM_DMABURSTLENGTH_1TRANSFER and TIM_DMABURSTLENGTH_18TRANSFERS.

Return values

- **HAL:** status

Notes

- This function should be used only when BurstLength is equal to DMA data transfer length.

HAL_TIM_DMABurst_MultiReadStart

Function name

HAL_StatusTypeDef HAL_TIM_DMABurst_MultiReadStart (TIM_HandleTypeDef * htim, uint32_t BurstBaseAddress, uint32_t BurstRequestSrc, uint32_t * BurstBuffer, uint32_t BurstLength, uint32_t DataLength)

Function description

Configure the DMA Burst to transfer Data from the TIM peripheral to the memory.

Parameters

- **htim:** TIM handle
- **BurstBaseAddress:** TIM Base address from where the DMA will start the Data read This parameter can be one of the following values:
  - TIM_DMABASE_CR1
  - TIM_DMABASE_CR2
  - TIM_DMABASE_SMCR
  - TIM_DMABASE_DIER
  - TIM_DMABASE_SR
  - TIM_DMABASE_EGR
  - TIM_DMABASE_CCMR1
  - TIM_DMABASE_CCMR2
  - TIM_DMABASE_CCER
  - TIM_DMABASE_CNT
  - TIM_DMABASE_PSC
  - TIM_DMABASE_ARR
  - TIM_DMABASE_RCR
  - TIM_DMABASE_CCR1
  - TIM_DMABASE_CCR2
  - TIM_DMABASE_CCR3
  - TIM_DMABASE_CCR4
  - TIM_DMABASE_BDTR
  - TIM_DMABASE_OR1
  - TIM_DMABASE_CCMR3
  - TIM_DMABASE_CCR5
  - TIM_DMABASE_CCR6
  - TIM_DMABASE_AF1
  - TIM_DMABASE_AF2
  - TIM_DMABASE_TISEL
- **BurstRequestSrc:** TIM DMA Request sources This parameter can be one of the following values:
  - TIM_DMA_UPDATE: TIM update Interrupt source
  - TIM_DMA_CC1: TIM Capture Compare 1 DMA source
  - TIM_DMA_CC2: TIM Capture Compare 2 DMA source
  - TIM_DMA_CC3: TIM Capture Compare 3 DMA source
  - TIM_DMA_CC4: TIM Capture Compare 4 DMA source
  - TIM_DMA_COM: TIM Commutation DMA source
  - TIM_DMA_TRIGGER: TIM Trigger DMA source
- **BurstBuffer:** The Buffer address.
- **BurstLength:** DMA Burst length. This parameter can be one value between: TIM_DMABURSTLENGTH_1TRANSFER and TIM_DMABURSTLENGTH_18TRANSFERS.
- **DataLength:** Data length. This parameter can be one value between 1 and 0xFFFF.

Return values

- **HAL:** status

HAL_TIM_DMABurst_ReadStop

Function name

HAL_StatusTypeDef HAL_TIM_DMABurst_ReadStop (TIM_HandleTypeDef * htim, uint32_t BurstRequestSrc)

Function description

Stop the DMA burst reading.

Parameters

- **htim:** TIM handle
- **BurstRequestSrc:** TIM DMA Request sources to disable.

Return values

- **HAL:** status

HAL_TIM_GenerateEvent

Function name

HAL_StatusTypeDef HAL_TIM_GenerateEvent (TIM_HandleTypeDef * htim, uint32_t EventSource)

Function description

Generate a software event.

Parameters

- **htim:** TIM handle
- **EventSource:** specifies the event source. This parameter can be one of the following values:
  - TIM_EVENTSOURCE_UPDATE: Timer update Event source
  - TIM_EVENTSOURCE_CC1: Timer Capture Compare 1 Event source
  - TIM_EVENTSOURCE_CC2: Timer Capture Compare 2 Event source
  - TIM_EVENTSOURCE_CC3: Timer Capture Compare 3 Event source
  - TIM_EVENTSOURCE_CC4: Timer Capture Compare 4 Event source
  - TIM_EVENTSOURCE_COM: Timer COM event source
  - TIM_EVENTSOURCE_TRIGGER: Timer Trigger Event source
  - TIM_EVENTSOURCE_BREAK: Timer Break event source
  - TIM_EVENTSOURCE_BREAK2: Timer Break2 event source

Return values

- **HAL:** status

Notes

- Basic timers can only generate an update event.
- TIM_EVENTSOURCE_COM is relevant only with advanced timer instances.
- TIM_EVENTSOURCE_BREAK and TIM_EVENTSOURCE_BREAK2 are relevant only for timer instances supporting break input(s).

HAL_TIM_ReadCapturedValue

Function name

uint32_t HAL_TIM_ReadCapturedValue (const TIM_HandleTypeDef * htim, uint32_t Channel)

Function description

Read the captured value from Capture Compare unit.

Parameters

- **htim:** TIM handle.
- **Channel:** TIM Channels to be enabled This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected
  - TIM_CHANNEL_4: TIM Channel 4 selected

Return values

- **Captured:** value

HAL_TIM_PeriodElapsedCallback

Function name

void HAL_TIM_PeriodElapsedCallback (TIM_HandleTypeDef * htim)

Function description

Period elapsed callback in non-blocking mode.

Parameters

- **htim:** TIM handle

Return values

- **None:**

HAL_TIM_PeriodElapsedHalfCpltCallback

Function name

void HAL_TIM_PeriodElapsedHalfCpltCallback (TIM_HandleTypeDef * htim)

Function description

Period elapsed half complete callback in non-blocking mode.

Parameters

- **htim:** TIM handle

Return values

- **None:**

HAL_TIM_OC_DelayElapsedCallback

Function name

void HAL_TIM_OC_DelayElapsedCallback (TIM_HandleTypeDef * htim)

Function description

Output Compare callback in non-blocking mode.

Parameters

- **htim:** TIM OC handle

Return values

- **None:**

HAL_TIM_IC_CaptureCallback

Function name

void HAL_TIM_IC_CaptureCallback (TIM_HandleTypeDef * htim)

Function description

Input Capture callback in non-blocking mode.

Parameters

- **htim:** TIM IC handle

Return values

- **None:**

HAL_TIM_IC_CaptureHalfCpltCallback

Function name

void HAL_TIM_IC_CaptureHalfCpltCallback (TIM_HandleTypeDef * htim)

Function description

Input Capture half complete callback in non-blocking mode.

Parameters

- **htim:** TIM IC handle

Return values

- **None:**

HAL_TIM_PWM_PulseFinishedCallback

Function name

void HAL_TIM_PWM_PulseFinishedCallback (TIM_HandleTypeDef * htim)

Function description

PWM Pulse finished callback in non-blocking mode.

Parameters

- **htim:** TIM handle

Return values

- **None:**

HAL_TIM_PWM_PulseFinishedHalfCpltCallback

Function name

void HAL_TIM_PWM_PulseFinishedHalfCpltCallback (TIM_HandleTypeDef * htim)

Function description

PWM Pulse finished half complete callback in non-blocking mode.

Parameters

- **htim:** TIM handle

Return values

- **None:**

HAL_TIM_TriggerCallback

Function name

void HAL_TIM_TriggerCallback (TIM_HandleTypeDef * htim)

Function description

Hall Trigger detection callback in non-blocking mode.

Parameters

- **htim:** TIM handle

Return values

- **None:**

HAL_TIM_TriggerHalfCpltCallback

Function name

void HAL_TIM_TriggerHalfCpltCallback (TIM_HandleTypeDef * htim)

Function description

Hall Trigger detection half complete callback in non-blocking mode.

Parameters

- **htim:** TIM handle

Return values

- **None:**

HAL_TIM_ErrorCallback

Function name

void HAL_TIM_ErrorCallback (TIM_HandleTypeDef * htim)

Function description

Timer error callback in non-blocking mode.

Parameters

- **htim:** TIM handle

Return values

- **None:**

HAL_TIM_RegisterCallback

Function name

HAL_StatusTypeDef HAL_TIM_RegisterCallback (TIM_HandleTypeDef * htim, HAL_TIM_CallbackIDTypeDef CallbackID, pTIM_CallbackTypeDef pCallback)

Function description

Register a User TIM callback to be used instead of the weak predefined callback.

Parameters

- **htim:** tim handle
- **CallbackID:** ID of the callback to be registered This parameter can be one of the following values:
  - HAL_TIM_BASE_MSPINIT_CB_ID Base MspInit Callback ID
  - HAL_TIM_BASE_MSPDEINIT_CB_ID Base MspDeInit Callback ID
  - HAL_TIM_IC_MSPINIT_CB_ID IC MspInit Callback ID
  - HAL_TIM_IC_MSPDEINIT_CB_ID IC MspDeInit Callback ID
  - HAL_TIM_OC_MSPINIT_CB_ID OC MspInit Callback ID
  - HAL_TIM_OC_MSPDEINIT_CB_ID OC MspDeInit Callback ID
  - HAL_TIM_PWM_MSPINIT_CB_ID PWM MspInit Callback ID
  - HAL_TIM_PWM_MSPDEINIT_CB_ID PWM MspDeInit Callback ID
  - HAL_TIM_ONE_PULSE_MSPINIT_CB_ID One Pulse MspInit Callback ID
  - HAL_TIM_ONE_PULSE_MSPDEINIT_CB_ID One Pulse MspDeInit Callback ID
  - HAL_TIM_ENCODER_MSPINIT_CB_ID Encoder MspInit Callback ID
  - HAL_TIM_ENCODER_MSPDEINIT_CB_ID Encoder MspDeInit Callback ID
  - HAL_TIM_HALL_SENSOR_MSPINIT_CB_ID Hall Sensor MspInit Callback ID
  - HAL_TIM_HALL_SENSOR_MSPDEINIT_CB_ID Hall Sensor MspDeInit Callback ID
  - HAL_TIM_PERIOD_ELAPSED_CB_ID Period Elapsed Callback ID
  - HAL_TIM_PERIOD_ELAPSED_HALF_CB_ID Period Elapsed half complete Callback ID
  - HAL_TIM_TRIGGER_CB_ID Trigger Callback ID
  - HAL_TIM_TRIGGER_HALF_CB_ID Trigger half complete Callback ID
  - HAL_TIM_IC_CAPTURE_CB_ID Input Capture Callback ID
  - HAL_TIM_IC_CAPTURE_HALF_CB_ID Input Capture half complete Callback ID
  - HAL_TIM_OC_DELAY_ELAPSED_CB_ID Output Compare Delay Elapsed Callback ID
  - HAL_TIM_PWM_PULSE_FINISHED_CB_ID PWM Pulse Finished Callback ID
  - HAL_TIM_PWM_PULSE_FINISHED_HALF_CB_ID PWM Pulse Finished half complete Callback ID
  - HAL_TIM_ERROR_CB_ID Error Callback ID
  - HAL_TIM_COMMUTATION_CB_ID Commutation Callback ID
  - HAL_TIM_COMMUTATION_HALF_CB_ID Commutation half complete Callback ID
  - HAL_TIM_BREAK_CB_ID Break Callback ID
  - HAL_TIM_BREAK2_CB_ID Break2 Callback ID
- **pCallback:** pointer to the callback function

Return values

- **status:**

HAL_TIM_UnRegisterCallback

Function name

HAL_StatusTypeDef HAL_TIM_UnRegisterCallback (TIM_HandleTypeDef * htim, HAL_TIM_CallbackIDTypeDef CallbackID)

Function description

Unregister a TIM callback TIM callback is redirected to the weak predefined callback.

Parameters

- **htim:** tim handle
- **CallbackID:** ID of the callback to be unregistered This parameter can be one of the following values:
  - HAL_TIM_BASE_MSPINIT_CB_ID Base MspInit Callback ID
  - HAL_TIM_BASE_MSPDEINIT_CB_ID Base MspDeInit Callback ID
  - HAL_TIM_IC_MSPINIT_CB_ID IC MspInit Callback ID
  - HAL_TIM_IC_MSPDEINIT_CB_ID IC MspDeInit Callback ID
  - HAL_TIM_OC_MSPINIT_CB_ID OC MspInit Callback ID
  - HAL_TIM_OC_MSPDEINIT_CB_ID OC MspDeInit Callback ID
  - HAL_TIM_PWM_MSPINIT_CB_ID PWM MspInit Callback ID
  - HAL_TIM_PWM_MSPDEINIT_CB_ID PWM MspDeInit Callback ID
  - HAL_TIM_ONE_PULSE_MSPINIT_CB_ID One Pulse MspInit Callback ID
  - HAL_TIM_ONE_PULSE_MSPDEINIT_CB_ID One Pulse MspDeInit Callback ID
  - HAL_TIM_ENCODER_MSPINIT_CB_ID Encoder MspInit Callback ID
  - HAL_TIM_ENCODER_MSPDEINIT_CB_ID Encoder MspDeInit Callback ID
  - HAL_TIM_HALL_SENSOR_MSPINIT_CB_ID Hall Sensor MspInit Callback ID
  - HAL_TIM_HALL_SENSOR_MSPDEINIT_CB_ID Hall Sensor MspDeInit Callback ID
  - HAL_TIM_PERIOD_ELAPSED_CB_ID Period Elapsed Callback ID
  - HAL_TIM_PERIOD_ELAPSED_HALF_CB_ID Period Elapsed half complete Callback ID
  - HAL_TIM_TRIGGER_CB_ID Trigger Callback ID
  - HAL_TIM_TRIGGER_HALF_CB_ID Trigger half complete Callback ID
  - HAL_TIM_IC_CAPTURE_CB_ID Input Capture Callback ID
  - HAL_TIM_IC_CAPTURE_HALF_CB_ID Input Capture half complete Callback ID
  - HAL_TIM_OC_DELAY_ELAPSED_CB_ID Output Compare Delay Elapsed Callback ID
  - HAL_TIM_PWM_PULSE_FINISHED_CB_ID PWM Pulse Finished Callback ID
  - HAL_TIM_PWM_PULSE_FINISHED_HALF_CB_ID PWM Pulse Finished half complete Callback ID
  - HAL_TIM_ERROR_CB_ID Error Callback ID
  - HAL_TIM_COMMUTATION_CB_ID Commutation Callback ID
  - HAL_TIM_COMMUTATION_HALF_CB_ID Commutation half complete Callback ID
  - HAL_TIM_BREAK_CB_ID Break Callback ID
  - HAL_TIM_BREAK2_CB_ID Break2 Callback ID

Return values

- **status:**

HAL_TIM_Base_GetState

Function name

HAL_TIM_StateTypeDef HAL_TIM_Base_GetState (const TIM_HandleTypeDef * htim)

Function description

Return the TIM Base handle state.

Parameters

- **htim:** TIM Base handle

Return values

- **HAL:** state

HAL_TIM_OC_GetState

Function name

HAL_TIM_StateTypeDef HAL_TIM_OC_GetState (const TIM_HandleTypeDef * htim)

Function description

Return the TIM OC handle state.

Parameters

- **htim:** TIM Output Compare handle

Return values

- **HAL:** state

HAL_TIM_PWM_GetState

Function name

HAL_TIM_StateTypeDef HAL_TIM_PWM_GetState (const TIM_HandleTypeDef * htim)

Function description

Return the TIM PWM handle state.

Parameters

- **htim:** TIM handle

Return values

- **HAL:** state

HAL_TIM_IC_GetState

Function name

HAL_TIM_StateTypeDef HAL_TIM_IC_GetState (const TIM_HandleTypeDef * htim)

Function description

Return the TIM Input Capture handle state.

Parameters

- **htim:** TIM IC handle

Return values

- **HAL:** state

HAL_TIM_OnePulse_GetState

Function name

HAL_TIM_StateTypeDef HAL_TIM_OnePulse_GetState (const TIM_HandleTypeDef * htim)

Function description

Return the TIM One Pulse Mode handle state.

Parameters

- **htim:** TIM OPM handle

Return values

- **HAL:** state

HAL_TIM_Encoder_GetState

Function name

HAL_TIM_StateTypeDef HAL_TIM_Encoder_GetState (const TIM_HandleTypeDef * htim)

Function description

Return the TIM Encoder Mode handle state.

Parameters

- **htim:** TIM Encoder Interface handle

Return values

- **HAL:** state

HAL_TIM_GetActiveChannel

Function name

HAL_TIM_ActiveChannel HAL_TIM_GetActiveChannel (const TIM_HandleTypeDef * htim)

Function description

Return the TIM Encoder Mode handle state.

Parameters

- **htim:** TIM handle

Return values

- **Active:** channel

HAL_TIM_GetChannelState

Function name

HAL_TIM_ChannelStateTypeDef HAL_TIM_GetChannelState (const TIM_HandleTypeDef * htim, uint32_t Channel)

Function description

Return actual state of the TIM channel.

Parameters

- **htim:** TIM handle
- **Channel:** TIM Channel This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1
  - TIM_CHANNEL_2: TIM Channel 2
  - TIM_CHANNEL_3: TIM Channel 3
  - TIM_CHANNEL_4: TIM Channel 4
  - TIM_CHANNEL_5: TIM Channel 5
  - TIM_CHANNEL_6: TIM Channel 6

Return values

- **TIM:** Channel state

HAL_TIM_DMABurstState

Function name

HAL_TIM_DMABurstStateTypeDef HAL_TIM_DMABurstState (const TIM_HandleTypeDef * htim)

Function description

Return actual state of a DMA burst operation.

Parameters

- **htim:** TIM handle

Return values

- **DMA:** burst state

TIM_Base_SetConfig

Function name

void TIM_Base_SetConfig (TIM_TypeDef * TIMx, const TIM_Base_InitTypeDef * Structure)

Function description

Time Base configuration.

Parameters

- **TIMx:** TIM peripheral
- **Structure:** TIM Base configuration structure

Return values

- **None:**

TIM_TI1_SetConfig

Function name

void TIM_TI1_SetConfig (TIM_TypeDef * TIMx, uint32_t TIM_ICPolarity, uint32_t TIM_ICSelection, uint32_t TIM_ICFilter)

Function description

Configure the TI1 as Input.

Parameters

- **TIMx:** to select the TIM peripheral.
- **TIM_ICPolarity:** The Input Polarity. This parameter can be one of the following values:
  - TIM_ICPOLARITY_RISING
  - TIM_ICPOLARITY_FALLING
  - TIM_ICPOLARITY_BOTHEDGE
- **TIM_ICSelection:** specifies the input to be used. This parameter can be one of the following values:
  - TIM_ICSELECTION_DIRECTTI: TIM Input 1 is selected to be connected to IC1.
  - TIM_ICSELECTION_INDIRECTTI: TIM Input 1 is selected to be connected to IC2.
  - TIM_ICSELECTION_TRC: TIM Input 1 is selected to be connected to TRC.
- **TIM_ICFilter:** Specifies the Input Capture Filter. This parameter must be a value between 0x00 and 0x0F.

Return values

- **None:**

Notes

- TIM_ICFilter and TIM_ICPolarity are not used in INDIRECT mode as TI2FP1 (on channel2 path) is used as the input signal. Therefore CCMR1 must be protected against un-initialized filter and polarity values.

TIM_OC2_SetConfig

Function name

void TIM_OC2_SetConfig (TIM_TypeDef * TIMx, const TIM_OC_InitTypeDef * OC_Config)

Function description

Timer Output Compare 2 configuration.

Parameters

- **TIMx:** to select the TIM peripheral
- **OC_Config:** The output configuration structure

Return values

- **None:**

TIM_ETR_SetConfig

Function name

void TIM_ETR_SetConfig (TIM_TypeDef * TIMx, uint32_t TIM_ExtTRGPrescaler, uint32_t TIM_ExtTRGPolarity, uint32_t ExtTRGFilter)

Function description

Configures the TIMx External Trigger (ETR).

Parameters

- **TIMx:** to select the TIM peripheral
- **TIM_ExtTRGPrescaler:** The external Trigger Prescaler. This parameter can be one of the following values:
  - TIM_ETRPRESCALER_DIV1: ETRP Prescaler OFF.
  - TIM_ETRPRESCALER_DIV2: ETRP frequency divided by 2.
  - TIM_ETRPRESCALER_DIV4: ETRP frequency divided by 4.
  - TIM_ETRPRESCALER_DIV8: ETRP frequency divided by 8.
- **TIM_ExtTRGPolarity:** The external Trigger Polarity. This parameter can be one of the following values:
  - TIM_ETRPOLARITY_INVERTED: active low or falling edge active.
  - TIM_ETRPOLARITY_NONINVERTED: active high or rising edge active.
- **ExtTRGFilter:** External Trigger Filter. This parameter must be a value between 0x00 and 0x0F

Return values

- **None:**

TIM_DMADelayPulseHalfCplt

Function name

void TIM_DMADelayPulseHalfCplt (DMA_HandleTypeDef * hdma)

Function description

TIM DMA Delay Pulse half complete callback.

Parameters

- **hdma:** pointer to DMA handle.

Return values

- **None:**

TIM_DMAError

Function name

void TIM_DMAError (DMA_HandleTypeDef * hdma)

Function description

TIM DMA error callback.

Parameters

- **hdma:** pointer to DMA handle.

Return values

- **None:**

TIM_DMACaptureCplt

Function name

void TIM_DMACaptureCplt (DMA_HandleTypeDef * hdma)

Function description

TIM DMA Capture complete callback.

Parameters

- **hdma:** pointer to DMA handle.

Return values

- **None:**

TIM_DMACaptureHalfCplt

Function name

void TIM_DMACaptureHalfCplt (DMA_HandleTypeDef * hdma)

Function description

TIM DMA Capture half complete callback.

Parameters

- **hdma:** pointer to DMA handle.

Return values

- **None:**

TIM_CCxChannelCmd

Function name

void TIM_CCxChannelCmd (TIM_TypeDef * TIMx, uint32_t Channel, uint32_t ChannelState)

Function description

Enables or disables the TIM Capture Compare Channel x.

Parameters

- **TIMx:** to select the TIM peripheral
- **Channel:** specifies the TIM Channel This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1
  - TIM_CHANNEL_2: TIM Channel 2
  - TIM_CHANNEL_3: TIM Channel 3
  - TIM_CHANNEL_4: TIM Channel 4
  - TIM_CHANNEL_5: TIM Channel 5 selected
  - TIM_CHANNEL_6: TIM Channel 6 selected
- **ChannelState:** specifies the TIM Channel CCxE bit new state. This parameter can be: TIM_CCx_ENABLE or TIM_CCx_DISABLE.

Return values

- **None:**

TIM_ResetCallback

Function name

void TIM_ResetCallback (TIM_HandleTypeDef * htim)

Function description

Reset interrupt callbacks to the legacy weak callbacks.

Parameters

- **htim:** pointer to a TIM_HandleTypeDef structure that contains the configuration information for TIM module.

Return values

- **None:**

47.3 TIM Firmware driver defines

The following section lists the various define and macros of the module.

47.3.1 TIM

TIM

TIM Automatic Output Enable

TIM_AUTOMATICOUTPUT_DISABLE

MOE can be set only by software

TIM_AUTOMATICOUTPUT_ENABLE

MOE can be set by software or automatically at the next update event (if none of the break inputs BRK and BRK2 is active)

TIM Auto-Reload Preload

TIM_AUTORELOAD_PRELOAD_DISABLE

TIMx_ARR register is not buffered

TIM_AUTORELOAD_PRELOAD_ENABLE

TIMx_ARR register is buffered

TIM Break2 Input Alternate Function Mode

TIM_BREAK2_AFMODE_INPUT

Break2 input BRK2 in input mode

TIM_BREAK2_AFMODE_BIDIRECTIONAL

Break2 input BRK2 in bidirectional mode

TIM Break input 2 Enable

TIM_BREAK2_DISABLE

Break input BRK2 is disabled

TIM_BREAK2_ENABLE

Break input BRK2 is enabled

TIM Break Input 2 Polarity

TIM_BREAK2POLARITY_LOW

Break input BRK2 is active low

TIM_BREAK2POLARITY_HIGH

Break input BRK2 is active high

TIM Break Input Alternate Function Mode

TIM_BREAK_AFMODE_INPUT

Break input BRK in input mode

TIM_BREAK_AFMODE_BIDIRECTIONAL

Break input BRK in bidirectional mode

TIM Break Input Enable

TIM_BREAK_ENABLE

Break input BRK is enabled

TIM_BREAK_DISABLE

Break input BRK is disabled

TIM Break Input Polarity

TIM_BREAKPOLARITY_LOW

Break input BRK is active low

TIM_BREAKPOLARITY_HIGH

Break input BRK is active high

TIM Break System

TIM_BREAK_SYSTEM_ECC

Enables and locks the ECC error signal with Break Input of TIM1/15/16

TIM_BREAK_SYSTEM_PVD

Enables and locks the PVD connection with TIM1/15/16 Break Input and also the PVDE and PLS bits of the Power Control Interface

TIM_BREAK_SYSTEM_SRAM_PARITY_ERROR

Enables and locks the SRAM_PARITY error signal with Break Input of TIM1/15/16

TIM_BREAK_SYSTEM_LOCKUP

Enables and locks the LOCKUP output of CortexM4 with Break Input of TIM1/15/16

CCx DMA request selection

TIM_CCDMAREQUEST_CC

CCx DMA request sent when capture or compare match event occurs

TIM_CCDMAREQUEST_UPDATE

CCx DMA requests sent when update event occurs

TIM Channel

TIM_CHANNEL_1

Capture/compare channel 1 identifier

TIM_CHANNEL_2

Capture/compare channel 2 identifier

TIM_CHANNEL_3

Capture/compare channel 3 identifier

TIM_CHANNEL_4

Capture/compare channel 4 identifier

TIM_CHANNEL_5

Compare channel 5 identifier

TIM_CHANNEL_6

Compare channel 6 identifier

TIM_CHANNEL_ALL

Global Capture/compare channel identifier

TIM Clear Input Polarity

TIM_CLEARINPUTPOLARITY_INVERTED

Polarity for ETRx pin

TIM_CLEARINPUTPOLARITY_NONINVERTED

Polarity for ETRx pin

TIM Clear Input Prescaler

TIM_CLEARINPUTPRESCALER_DIV1

No prescaler is used

TIM_CLEARINPUTPRESCALER_DIV2

Prescaler for External ETR pin: Capture performed once every 2 events.

TIM_CLEARINPUTPRESCALER_DIV4

Prescaler for External ETR pin: Capture performed once every 4 events.

TIM_CLEARINPUTPRESCALER_DIV8

Prescaler for External ETR pin: Capture performed once every 8 events.

TIM Clear Input Source

TIM_CLEARINPUTSOURCE_NONE

OCREF_CLR is disabled

TIM_CLEARINPUTSOURCE_ETR

OCREF_CLR is connected to ETRF input

TIM_CLEARINPUTSOURCE_COMP1

OCREF_CLR_INT is connected to COMP1 output

TIM_CLEARINPUTSOURCE_COMP2

OCREF_CLR_INT is connected to COMP2 output

TIM Clock Division

TIM_CLOCKDIVISION_DIV1

Clock division: tDTS=tCK_INT

TIM_CLOCKDIVISION_DIV2

Clock division: tDTS=2*tCK_INT

TIM_CLOCKDIVISION_DIV4

Clock division: tDTS=4*tCK_INT

TIM Clock Polarity

TIM_CLOCKPOLARITY_INVERTED

Polarity for ETRx clock sources

TIM_CLOCKPOLARITY_NONINVERTED

Polarity for ETRx clock sources

TIM_CLOCKPOLARITY_RISING

Polarity for TIx clock sources

TIM_CLOCKPOLARITY_FALLING

Polarity for TIx clock sources

TIM_CLOCKPOLARITY_BOTHEDGE

Polarity for TIx clock sources

TIM Clock Prescaler

TIM_CLOCKPRESCALER_DIV1

No prescaler is used

TIM_CLOCKPRESCALER_DIV2

Prescaler for External ETR Clock: Capture performed once every 2 events.

TIM_CLOCKPRESCALER_DIV4

Prescaler for External ETR Clock: Capture performed once every 4 events.

TIM_CLOCKPRESCALER_DIV8

Prescaler for External ETR Clock: Capture performed once every 8 events.

TIM Clock Source

TIM_CLOCKSOURCE_INTERNAL

Internal clock source

TIM_CLOCKSOURCE_ETRMODE1

External clock source mode 1 (ETRF)

TIM_CLOCKSOURCE_ETRMODE2

External clock source mode 2

TIM_CLOCKSOURCE_TI1ED

External clock source mode 1 (TTI1FP1 + edge detect.)

TIM_CLOCKSOURCE_TI1

External clock source mode 1 (TTI1FP1)

TIM_CLOCKSOURCE_TI2

External clock source mode 1 (TTI2FP2)

TIM_CLOCKSOURCE_ITR0

External clock source mode 1 (ITR0)

TIM_CLOCKSOURCE_ITR1

External clock source mode 1 (ITR1)

TIM_CLOCKSOURCE_ITR2

External clock source mode 1 (ITR2)

TIM_CLOCKSOURCE_ITR7

External clock source mode 1 (ITR7)

TIM Commutation Source

TIM_COMMUTATION_TRGI

When Capture/compare control bits are preloaded, they are updated by setting the COMG bit or when an rising edge occurs on trigger input

TIM_COMMUTATION_SOFTWARE

When Capture/compare control bits are preloaded, they are updated by setting the COMG bit

TIM Counter Mode

TIM_COUNTERMODE_UP

Counter used as up-counter

TIM_COUNTERMODE_DOWN

Counter used as down-counter

TIM_COUNTERMODE_CENTERALIGNED1

Center-aligned mode 1

TIM_COUNTERMODE_CENTERALIGNED2

Center-aligned mode 2

TIM_COUNTERMODE_CENTERALIGNED3

Center-aligned mode 3

TIM DMA Base Address

TIM_DMABASE_CR1

TIM_DMABASE_CR2

TIM_DMABASE_SMCR

TIM_DMABASE_DIER

TIM_DMABASE_SR

TIM_DMABASE_EGR

TIM_DMABASE_CCMR1

TIM_DMABASE_CCMR2

TIM_DMABASE_CCER

TIM_DMABASE_CNT

TIM_DMABASE_PSC

TIM_DMABASE_ARR

TIM_DMABASE_RCR

TIM_DMABASE_CCR1

TIM_DMABASE_CCR2

TIM_DMABASE_CCR3

TIM_DMABASE_CCR4

TIM_DMABASE_BDTR

TIM_DMABASE_DCR

TIM_DMABASE_DMAR

TIM_DMABASE_OR1

TIM_DMABASE_CCMR3

TIM_DMABASE_CCR5

TIM_DMABASE_CCR6

TIM_DMABASE_AF1

TIM_DMABASE_AF2

TIM_DMABASE_TISEL

TIM DMA Burst Length

TIM_DMABURSTLENGTH_1TRANSFER

The transfer is done to 1 register starting from TIMx_CR1 + TIMx_DCR.DBA

TIM_DMABURSTLENGTH_2TRANSFERS

The transfer is done to 2 registers starting from TIMx_CR1 + TIMx_DCR.DBA

TIM_DMABURSTLENGTH_3TRANSFERS

The transfer is done to 3 registers starting from TIMx_CR1 + TIMx_DCR.DBA

TIM_DMABURSTLENGTH_4TRANSFERS

The transfer is done to 4 registers starting from TIMx_CR1 + TIMx_DCR.DBA

TIM_DMABURSTLENGTH_5TRANSFERS

The transfer is done to 5 registers starting from TIMx_CR1 + TIMx_DCR.DBA

TIM_DMABURSTLENGTH_6TRANSFERS

The transfer is done to 6 registers starting from TIMx_CR1 + TIMx_DCR.DBA

TIM_DMABURSTLENGTH_7TRANSFERS

The transfer is done to 7 registers starting from TIMx_CR1 + TIMx_DCR.DBA

TIM_DMABURSTLENGTH_8TRANSFERS

The transfer is done to 8 registers starting from TIMx_CR1 + TIMx_DCR.DBA

TIM_DMABURSTLENGTH_9TRANSFERS

The transfer is done to 9 registers starting from TIMx_CR1 + TIMx_DCR.DBA

TIM_DMABURSTLENGTH_10TRANSFERS

The transfer is done to 10 registers starting from TIMx_CR1 + TIMx_DCR.DBA

TIM_DMABURSTLENGTH_11TRANSFERS

The transfer is done to 11 registers starting from TIMx_CR1 + TIMx_DCR.DBA

TIM_DMABURSTLENGTH_12TRANSFERS

The transfer is done to 12 registers starting from TIMx_CR1 + TIMx_DCR.DBA

TIM_DMABURSTLENGTH_13TRANSFERS

The transfer is done to 13 registers starting from TIMx_CR1 + TIMx_DCR.DBA

TIM_DMABURSTLENGTH_14TRANSFERS

The transfer is done to 14 registers starting from TIMx_CR1 + TIMx_DCR.DBA

TIM_DMABURSTLENGTH_15TRANSFERS

The transfer is done to 15 registers starting from TIMx_CR1 + TIMx_DCR.DBA

TIM_DMABURSTLENGTH_16TRANSFERS

The transfer is done to 16 registers starting from TIMx_CR1 + TIMx_DCR.DBA

TIM_DMABURSTLENGTH_17TRANSFERS

The transfer is done to 17 registers starting from TIMx_CR1 + TIMx_DCR.DBA

TIM_DMABURSTLENGTH_18TRANSFERS

The transfer is done to 18 registers starting from TIMx_CR1 + TIMx_DCR.DBA

TIM DMA Sources

TIM_DMA_UPDATE

DMA request is triggered by the update event

TIM_DMA_CC1

DMA request is triggered by the capture/compare macth 1 event

TIM_DMA_CC2

DMA request is triggered by the capture/compare macth 2 event event

TIM_DMA_CC3

DMA request is triggered by the capture/compare macth 3 event event

TIM_DMA_CC4

DMA request is triggered by the capture/compare macth 4 event event

TIM_DMA_COM

DMA request is triggered by the commutation event

TIM_DMA_TRIGGER

DMA request is triggered by the trigger event

TIM Encoder Input Polarity

TIM_ENCODERINPUTPOLARITY_RISING

Encoder input with rising edge polarity

TIM_ENCODERINPUTPOLARITY_FALLING

Encoder input with falling edge polarity

TIM Encoder Mode

TIM_ENCODERMODE_TI1

Quadrature encoder mode 1, x2 mode, counts up/down on TI1FP1 edge depending on TI2FP2 level

TIM_ENCODERMODE_TI2

Quadrature encoder mode 2, x2 mode, counts up/down on TI2FP2 edge depending on TI1FP1 level.

TIM_ENCODERMODE_TI12

Quadrature encoder mode 3, x4 mode, counts up/down on both TI1FP1 and TI2FP2 edges depending on the level of the other input.

TIM ETR Polarity

TIM_ETRPOLARITY_INVERTED

Polarity for ETR source

TIM_ETRPOLARITY_NONINVERTED

Polarity for ETR source

TIM ETR Prescaler

TIM_ETRPRESCALER_DIV1

No prescaler is used

TIM_ETRPRESCALER_DIV2

ETR input source is divided by 2

TIM_ETRPRESCALER_DIV4

ETR input source is divided by 4

TIM_ETRPRESCALER_DIV8

ETR input source is divided by 8

TIM Event Source

TIM_EVENTSOURCE_UPDATE

Reinitialize the counter and generates an update of the registers

TIM_EVENTSOURCE_CC1

A capture/compare event is generated on channel 1

TIM_EVENTSOURCE_CC2

A capture/compare event is generated on channel 2

TIM_EVENTSOURCE_CC3

A capture/compare event is generated on channel 3

TIM_EVENTSOURCE_CC4

A capture/compare event is generated on channel 4

TIM_EVENTSOURCE_COM

A commutation event is generated

TIM_EVENTSOURCE_TRIGGER

A trigger event is generated

TIM_EVENTSOURCE_BREAK

A break event is generated

TIM_EVENTSOURCE_BREAK2

A break 2 event is generated

TIM Exported Macros

__HAL_TIM_RESET_HANDLE_STATE

Description:

- Reset TIM handle state.

Parameters:

- __HANDLE__: TIM handle.

Return value:

- None

__HAL_TIM_ENABLE

Description:

- Enable the TIM peripheral.

Parameters:

- __HANDLE__: TIM handle

Return value:

- None

__HAL_TIM_MOE_ENABLE

Description:

- Enable the TIM main Output.

Parameters:

- __HANDLE__: TIM handle

Return value:

- None

__HAL_TIM_DISABLE

Description:

- Disable the TIM peripheral.

Parameters:

- __HANDLE__: TIM handle

Return value:

- None

__HAL_TIM_MOE_DISABLE

Description:

- Disable the TIM main Output.

Parameters:

- __HANDLE__: TIM handle

Return value:

- None

Notes:

- The Main Output Enable of a timer instance is disabled only if all the CCx and CCxN channels have been disabled

__HAL_TIM_MOE_DISABLE_UNCONDITIONALLY

Description:

- Disable the TIM main Output.

Parameters:

- __HANDLE__: TIM handle

Return value:

- None

Notes:

- The Main Output Enable of a timer instance is disabled unconditionally

__HAL_TIM_ENABLE_IT

Description:

- Enable the specified TIM interrupt.

Parameters:

- __HANDLE__: specifies the TIM Handle.
- __INTERRUPT__: specifies the TIM interrupt source to enable. This parameter can be one of the following values:
  - TIM_IT_UPDATE: Update interrupt
  - TIM_IT_CC1: Capture/Compare 1 interrupt
  - TIM_IT_CC2: Capture/Compare 2 interrupt
  - TIM_IT_CC3: Capture/Compare 3 interrupt
  - TIM_IT_CC4: Capture/Compare 4 interrupt
  - TIM_IT_COM: Commutation interrupt
  - TIM_IT_TRIGGER: Trigger interrupt
  - TIM_IT_BREAK: Break interrupt

Return value:

- None

__HAL_TIM_DISABLE_IT

Description:

- Disable the specified TIM interrupt.

Parameters:

- __HANDLE__: specifies the TIM Handle.
- __INTERRUPT__: specifies the TIM interrupt source to disable. This parameter can be one of the following values:
  - TIM_IT_UPDATE: Update interrupt
  - TIM_IT_CC1: Capture/Compare 1 interrupt
  - TIM_IT_CC2: Capture/Compare 2 interrupt
  - TIM_IT_CC3: Capture/Compare 3 interrupt
  - TIM_IT_CC4: Capture/Compare 4 interrupt
  - TIM_IT_COM: Commutation interrupt
  - TIM_IT_TRIGGER: Trigger interrupt
  - TIM_IT_BREAK: Break interrupt

Return value:

- None

__HAL_TIM_ENABLE_DMA

Description:

- Enable the specified DMA request.

Parameters:

- __HANDLE__: specifies the TIM Handle.
- __DMA__: specifies the TIM DMA request to enable. This parameter can be one of the following values:
  - TIM_DMA_UPDATE: Update DMA request
  - TIM_DMA_CC1: Capture/Compare 1 DMA request
  - TIM_DMA_CC2: Capture/Compare 2 DMA request
  - TIM_DMA_CC3: Capture/Compare 3 DMA request
  - TIM_DMA_CC4: Capture/Compare 4 DMA request
  - TIM_DMA_COM: Commutation DMA request
  - TIM_DMA_TRIGGER: Trigger DMA request

Return value:

- None

__HAL_TIM_DISABLE_DMA

Description:

- Disable the specified DMA request.

Parameters:

- __HANDLE__: specifies the TIM Handle.
- __DMA__: specifies the TIM DMA request to disable. This parameter can be one of the following values:
  - TIM_DMA_UPDATE: Update DMA request
  - TIM_DMA_CC1: Capture/Compare 1 DMA request
  - TIM_DMA_CC2: Capture/Compare 2 DMA request
  - TIM_DMA_CC3: Capture/Compare 3 DMA request
  - TIM_DMA_CC4: Capture/Compare 4 DMA request
  - TIM_DMA_COM: Commutation DMA request
  - TIM_DMA_TRIGGER: Trigger DMA request

Return value:

- None

__HAL_TIM_GET_FLAG

Description:

- Check whether the specified TIM interrupt flag is set or not.

Parameters:

- __HANDLE__: specifies the TIM Handle.
- __FLAG__: specifies the TIM interrupt flag to check. This parameter can be one of the following values:
  - TIM_FLAG_UPDATE: Update interrupt flag
  - TIM_FLAG_CC1: Capture/Compare 1 interrupt flag
  - TIM_FLAG_CC2: Capture/Compare 2 interrupt flag
  - TIM_FLAG_CC3: Capture/Compare 3 interrupt flag
  - TIM_FLAG_CC4: Capture/Compare 4 interrupt flag
  - TIM_FLAG_CC5: Compare 5 interrupt flag
  - TIM_FLAG_CC6: Compare 6 interrupt flag
  - TIM_FLAG_COM: Commutation interrupt flag
  - TIM_FLAG_TRIGGER: Trigger interrupt flag
  - TIM_FLAG_BREAK: Break interrupt flag
  - TIM_FLAG_BREAK2: Break 2 interrupt flag
  - TIM_FLAG_SYSTEM_BREAK: System Break interrupt flag
  - TIM_FLAG_CC1OF: Capture/Compare 1 overcapture flag
  - TIM_FLAG_CC2OF: Capture/Compare 2 overcapture flag
  - TIM_FLAG_CC3OF: Capture/Compare 3 overcapture flag
  - TIM_FLAG_CC4OF: Capture/Compare 4 overcapture flag

Return value:

- The: new state of __FLAG__ (TRUE or FALSE).

__HAL_TIM_CLEAR_FLAG

Description:

- Clear the specified TIM interrupt flag.

Parameters:

- __HANDLE__: specifies the TIM Handle.
- __FLAG__: specifies the TIM interrupt flag to clear. This parameter can be one of the following values:
  - TIM_FLAG_UPDATE: Update interrupt flag
  - TIM_FLAG_CC1: Capture/Compare 1 interrupt flag
  - TIM_FLAG_CC2: Capture/Compare 2 interrupt flag
  - TIM_FLAG_CC3: Capture/Compare 3 interrupt flag
  - TIM_FLAG_CC4: Capture/Compare 4 interrupt flag
  - TIM_FLAG_CC5: Compare 5 interrupt flag
  - TIM_FLAG_CC6: Compare 6 interrupt flag
  - TIM_FLAG_COM: Commutation interrupt flag
  - TIM_FLAG_TRIGGER: Trigger interrupt flag
  - TIM_FLAG_BREAK: Break interrupt flag
  - TIM_FLAG_BREAK2: Break 2 interrupt flag
  - TIM_FLAG_SYSTEM_BREAK: System Break interrupt flag
  - TIM_FLAG_CC1OF: Capture/Compare 1 overcapture flag
  - TIM_FLAG_CC2OF: Capture/Compare 2 overcapture flag
  - TIM_FLAG_CC3OF: Capture/Compare 3 overcapture flag
  - TIM_FLAG_CC4OF: Capture/Compare 4 overcapture flag

Return value:

- The: new state of __FLAG__ (TRUE or FALSE).

__HAL_TIM_GET_IT_SOURCE

Description:

- Check whether the specified TIM interrupt source is enabled or not.

Parameters:

- __HANDLE__: TIM handle
- __INTERRUPT__: specifies the TIM interrupt source to check. This parameter can be one of the following values:
  - TIM_IT_UPDATE: Update interrupt
  - TIM_IT_CC1: Capture/Compare 1 interrupt
  - TIM_IT_CC2: Capture/Compare 2 interrupt
  - TIM_IT_CC3: Capture/Compare 3 interrupt
  - TIM_IT_CC4: Capture/Compare 4 interrupt
  - TIM_IT_COM: Commutation interrupt
  - TIM_IT_TRIGGER: Trigger interrupt
  - TIM_IT_BREAK: Break interrupt

Return value:

- The: state of TIM_IT (SET or RESET).

__HAL_TIM_CLEAR_IT

Description:

- Clear the TIM interrupt pending bits.

Parameters:

- __HANDLE__: TIM handle
- __INTERRUPT__: specifies the interrupt pending bit to clear. This parameter can be one of the following values:
  - TIM_IT_UPDATE: Update interrupt
  - TIM_IT_CC1: Capture/Compare 1 interrupt
  - TIM_IT_CC2: Capture/Compare 2 interrupt
  - TIM_IT_CC3: Capture/Compare 3 interrupt
  - TIM_IT_CC4: Capture/Compare 4 interrupt
  - TIM_IT_COM: Commutation interrupt
  - TIM_IT_TRIGGER: Trigger interrupt
  - TIM_IT_BREAK: Break interrupt

Return value:

- None

__HAL_TIM_UIFREMAP_ENABLE

Description:

- Force a continuous copy of the update interrupt flag (UIF) into the timer counter register (bit 31).

Parameters:

- __HANDLE__: TIM handle.

Return value:

- None: mode.

Notes:

- This allows both the counter value and a potential roll-over condition signalled by the UIFCPY flag to be read in an atomic way.

__HAL_TIM_UIFREMAP_DISABLE

Description:

- Disable update interrupt flag (UIF) remapping.

Parameters:

- __HANDLE__: TIM handle.

Return value:

- None: mode.

__HAL_TIM_GET_UIFCPY

Description:

- Get update interrupt flag (UIF) copy status.

Parameters:

- __COUNTER__: Counter value.

Return value:

- The: state of UIFCPY (TRUE or FALSE). mode.

__HAL_TIM_IS_TIM_COUNTING_DOWN

Description:

- Indicates whether or not the TIM Counter is used as downcounter.

Parameters:

- __HANDLE__: TIM handle.

Return value:

- False: (Counter used as upcounter) or True (Counter used as downcounter)

Notes:

- This macro is particularly useful to get the counting mode when the timer operates in Center-aligned mode or Encoder mode.

__HAL_TIM_SET_PRESCALER

Description:

- Set the TIM Prescaler on runtime.

Parameters:

- __HANDLE__: TIM handle.
- __PRESC__: specifies the Prescaler new value.

Return value:

- None

__HAL_TIM_SET_COUNTER

Description:

- Set the TIM Counter Register value on runtime.

Parameters:

- __HANDLE__: TIM handle.
- __COUNTER__: specifies the Counter register new value.

Return value:

- None

__HAL_TIM_GET_COUNTER

Description:

- Get the TIM Counter Register value on runtime.

Parameters:

- __HANDLE__: TIM handle.

Return value:

- 16-bit: or 32-bit value of the timer counter register (TIMx_CNT)

__HAL_TIM_SET_AUTORELOAD

Description:

- Set the TIM Autoreload Register value on runtime without calling another time any Init function.

Parameters:

- __HANDLE__: TIM handle.
- __AUTORELOAD__: specifies the Counter register new value.

Return value:

- None

__HAL_TIM_GET_AUTORELOAD

Description:

- Get the TIM Autoreload Register value on runtime.

Parameters:

- __HANDLE__: TIM handle.

Return value:

- 16-bit: or 32-bit value of the timer auto-reload register(TIMx_ARR)

__HAL_TIM_SET_CLOCKDIVISION

Description:

- Set the TIM Clock Division value on runtime without calling another time any Init function.

Parameters:

- __HANDLE__: TIM handle.
- __CKD__: specifies the clock division value. This parameter can be one of the following value:
  - TIM_CLOCKDIVISION_DIV1: tDTS=tCK_INT
  - TIM_CLOCKDIVISION_DIV2: tDTS=2*tCK_INT
  - TIM_CLOCKDIVISION_DIV4: tDTS=4*tCK_INT

Return value:

- None

__HAL_TIM_GET_CLOCKDIVISION

Description:

- Get the TIM Clock Division value on runtime.

Parameters:

- __HANDLE__: TIM handle.

Return value:

- The: clock division can be one of the following values:
  - TIM_CLOCKDIVISION_DIV1: tDTS=tCK_INT
  - TIM_CLOCKDIVISION_DIV2: tDTS=2*tCK_INT
  - TIM_CLOCKDIVISION_DIV4: tDTS=4*tCK_INT

__HAL_TIM_SET_ICPRESCALER

Description:

- Set the TIM Input Capture prescaler on runtime without calling another time

Parameters:

- __HANDLE__: TIM handle.
- __CHANNEL__: TIM Channels to be configured. This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected
  - TIM_CHANNEL_4: TIM Channel 4 selected
- __ICPSC__: specifies the Input Capture4 prescaler new value. This parameter can be one of the following values:
  - TIM_ICPSC_DIV1: no prescaler
  - TIM_ICPSC_DIV2: capture is done once every 2 events
  - TIM_ICPSC_DIV4: capture is done once every 4 events
  - TIM_ICPSC_DIV8: capture is done once every 8 events

Return value:

- None

__HAL_TIM_GET_ICPRESCALER

Description:

- Get the TIM Input Capture prescaler on runtime.

Parameters:

- __HANDLE__: TIM handle.
- __CHANNEL__: TIM Channels to be configured. This parameter can be one of the following values:
  - TIM_CHANNEL_1: get input capture 1 prescaler value
  - TIM_CHANNEL_2: get input capture 2 prescaler value
  - TIM_CHANNEL_3: get input capture 3 prescaler value
  - TIM_CHANNEL_4: get input capture 4 prescaler value

Return value:

- The: input capture prescaler can be one of the following values:
  - TIM_ICPSC_DIV1: no prescaler
  - TIM_ICPSC_DIV2: capture is done once every 2 events
  - TIM_ICPSC_DIV4: capture is done once every 4 events
  - TIM_ICPSC_DIV8: capture is done once every 8 events

__HAL_TIM_SET_COMPARE

Description:

- Set the TIM Capture Compare Register value on runtime without calling another time ConfigChannel function.

Parameters:

- __HANDLE__: TIM handle.
- __CHANNEL__: TIM Channels to be configured. This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected
  - TIM_CHANNEL_4: TIM Channel 4 selected
  - TIM_CHANNEL_5: TIM Channel 5 selected
  - TIM_CHANNEL_6: TIM Channel 6 selected
- __COMPARE__: specifies the Capture Compare register new value.

Return value:

- None

__HAL_TIM_GET_COMPARE

Description:

- Get the TIM Capture Compare Register value on runtime.

Parameters:

- __HANDLE__: TIM handle.
- __CHANNEL__: TIM Channel associated with the capture compare register This parameter can be one of the following values:
  - TIM_CHANNEL_1: get capture/compare 1 register value
  - TIM_CHANNEL_2: get capture/compare 2 register value
  - TIM_CHANNEL_3: get capture/compare 3 register value
  - TIM_CHANNEL_4: get capture/compare 4 register value
  - TIM_CHANNEL_5: get capture/compare 5 register value
  - TIM_CHANNEL_6: get capture/compare 6 register value

Return value:

- 16-bit: or 32-bit value of the capture/compare register (TIMx_CCRy)

__HAL_TIM_ENABLE_OCxPRELOAD

Description:

- Set the TIM Output compare preload.

Parameters:

- __HANDLE__: TIM handle.
- __CHANNEL__: TIM Channels to be configured. This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected
  - TIM_CHANNEL_4: TIM Channel 4 selected
  - TIM_CHANNEL_5: TIM Channel 5 selected
  - TIM_CHANNEL_6: TIM Channel 6 selected

Return value:

- None

__HAL_TIM_DISABLE_OCxPRELOAD

Description:

- Reset the TIM Output compare preload.

Parameters:

- __HANDLE__: TIM handle.
- __CHANNEL__: TIM Channels to be configured. This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected
  - TIM_CHANNEL_4: TIM Channel 4 selected
  - TIM_CHANNEL_5: TIM Channel 5 selected
  - TIM_CHANNEL_6: TIM Channel 6 selected

Return value:

- None

__HAL_TIM_ENABLE_OCxFAST

Description:

- Enable fast mode for a given channel.

Parameters:

- __HANDLE__: TIM handle.
- __CHANNEL__: TIM Channels to be configured. This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected
  - TIM_CHANNEL_4: TIM Channel 4 selected
  - TIM_CHANNEL_5: TIM Channel 5 selected
  - TIM_CHANNEL_6: TIM Channel 6 selected

Return value:

- None

Notes:

- When fast mode is enabled an active edge on the trigger input acts like a compare match on CCx output. Delay to sample the trigger input and to activate CCx output is reduced to 3 clock cycles. Fast mode acts only if the channel is configured in PWM1 or PWM2 mode.

__HAL_TIM_DISABLE_OCxFAST

Description:

- Disable fast mode for a given channel.

Parameters:

- __HANDLE__: TIM handle.
- __CHANNEL__: TIM Channels to be configured. This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected
  - TIM_CHANNEL_4: TIM Channel 4 selected
  - TIM_CHANNEL_5: TIM Channel 5 selected
  - TIM_CHANNEL_6: TIM Channel 6 selected

Return value:

- None

Notes:

- When fast mode is disabled CCx output behaves normally depending on counter and CCRx values even when the trigger is ON. The minimum delay to activate CCx output when an active edge occurs on the trigger input is 5 clock cycles.

__HAL_TIM_URS_ENABLE

Description:

- Set the Update Request Source (URS) bit of the TIMx_CR1 register.

Parameters:

- __HANDLE__: TIM handle.

Return value:

- None

Notes:

- When the URS bit of the TIMx_CR1 register is set, only counter overflow/underflow generates an update interrupt or DMA request (if enabled)

__HAL_TIM_URS_DISABLE

Description:

- Reset the Update Request Source (URS) bit of the TIMx_CR1 register.

Parameters:

- __HANDLE__: TIM handle.

Return value:

- None

Notes:

- When the URS bit of the TIMx_CR1 register is reset, any of the following events generate an update interrupt or DMA request (if enabled): _ Counter overflow underflow _ Setting the UG bit _ Update generation through the slave mode controller

__HAL_TIM_SET_CAPTUREPOLARITY

Description:

- Set the TIM Capture x input polarity on runtime.

Parameters:

- __HANDLE__: TIM handle.
- __CHANNEL__: TIM Channels to be configured. This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected
  - TIM_CHANNEL_4: TIM Channel 4 selected
- __POLARITY__: Polarity for TIx source
  - TIM_INPUTCHANNELPOLARITY_RISING: Rising Edge
  - TIM_INPUTCHANNELPOLARITY_FALLING: Falling Edge
  - TIM_INPUTCHANNELPOLARITY_BOTHEDGE: Rising and Falling Edge

Return value:

- None

__HAL_TIM_SELECT_CCDMAREQUEST

Description:

- Select the Capture/compare DMA request source.

Parameters:

- __HANDLE__: specifies the TIM Handle.
- __CCDMA__: specifies Capture/compare DMA request source This parameter can be one of the following values:
  - TIM_CCDMAREQUEST_CC: CCx DMA request generated on Capture/Compare event
  - TIM_CCDMAREQUEST_UPDATE: CCx DMA request generated on Update event

Return value:

- None

TIM Flag Definition

TIM_FLAG_UPDATE

Update interrupt flag

TIM_FLAG_CC1

Capture/Compare 1 interrupt flag

TIM_FLAG_CC2

Capture/Compare 2 interrupt flag

TIM_FLAG_CC3

Capture/Compare 3 interrupt flag

TIM_FLAG_CC4

Capture/Compare 4 interrupt flag

TIM_FLAG_CC5

Capture/Compare 5 interrupt flag

TIM_FLAG_CC6

Capture/Compare 6 interrupt flag

TIM_FLAG_COM

Commutation interrupt flag

TIM_FLAG_TRIGGER

Trigger interrupt flag

TIM_FLAG_BREAK

Break interrupt flag

TIM_FLAG_BREAK2

Break 2 interrupt flag

TIM_FLAG_SYSTEM_BREAK

System Break interrupt flag

TIM_FLAG_CC1OF

Capture 1 overcapture flag

TIM_FLAG_CC2OF

Capture 2 overcapture flag

TIM_FLAG_CC3OF

Capture 3 overcapture flag

TIM_FLAG_CC4OF

Capture 4 overcapture flag

TIM Group Channel 5 and Channel 1, 2 or 3

TIM_GROUPCH5_NONE

No effect of OC5REF on OC1REFC, OC2REFC and OC3REFC

TIM_GROUPCH5_OC1REFC

OC1REFC is the logical AND of OC1REFC and OC5REF

TIM_GROUPCH5_OC2REFC

OC2REFC is the logical AND of OC2REFC and OC5REF

TIM_GROUPCH5_OC3REFC

OC3REFC is the logical AND of OC3REFC and OC5REF

TIM Input Capture Polarity

TIM_ICPOLARITY_RISING

Capture triggered by rising edge on timer input

TIM_ICPOLARITY_FALLING

Capture triggered by falling edge on timer input

TIM_ICPOLARITY_BOTHEDGE

Capture triggered by both rising and falling edges on timer input

TIM Input Capture Prescaler

TIM_ICPSC_DIV1

Capture performed each time an edge is detected on the capture input

TIM_ICPSC_DIV2

Capture performed once every 2 events

TIM_ICPSC_DIV4

Capture performed once every 4 events

TIM_ICPSC_DIV8

Capture performed once every 8 events

TIM Input Capture Selection

TIM_ICSELECTION_DIRECTTI

TIM Input 1, 2, 3 or 4 is selected to be connected to IC1, IC2, IC3 or IC4, respectively

TIM_ICSELECTION_INDIRECTTI

TIM Input 1, 2, 3 or 4 is selected to be connected to IC2, IC1, IC4 or IC3, respectively

TIM_ICSELECTION_TRC

TIM Input 1, 2, 3 or 4 is selected to be connected to TRC

TIM Input Channel polarity

TIM_INPUTCHANNELPOLARITY_RISING

Polarity for TIx source

TIM_INPUTCHANNELPOLARITY_FALLING

Polarity for TIx source

TIM_INPUTCHANNELPOLARITY_BOTHEDGE

Polarity for TIx source

TIM interrupt Definition

TIM_IT_UPDATE

Update interrupt

TIM_IT_CC1

Capture/Compare 1 interrupt

TIM_IT_CC2

Capture/Compare 2 interrupt

TIM_IT_CC3

Capture/Compare 3 interrupt

TIM_IT_CC4

Capture/Compare 4 interrupt

TIM_IT_COM

Commutation interrupt

TIM_IT_TRIGGER

Trigger interrupt

TIM_IT_BREAK

Break interrupt

TIM Lock level

TIM_LOCKLEVEL_OFF

LOCK OFF

TIM_LOCKLEVEL_1

LOCK Level 1

TIM_LOCKLEVEL_2

LOCK Level 2

TIM_LOCKLEVEL_3

LOCK Level 3

TIM Master Mode Selection

TIM_TRGO_RESET

TIMx_EGR.UG bit is used as trigger output (TRGO)

TIM_TRGO_ENABLE

TIMx_CR1.CEN bit is used as trigger output (TRGO)

TIM_TRGO_UPDATE

Update event is used as trigger output (TRGO)

TIM_TRGO_OC1

Capture or a compare match 1 is used as trigger output (TRGO)

TIM_TRGO_OC1REF

OC1REF signal is used as trigger output (TRGO)

TIM_TRGO_OC2REF

OC2REF signal is used as trigger output(TRGO)

TIM_TRGO_OC3REF

OC3REF signal is used as trigger output(TRGO)

TIM_TRGO_OC4REF

OC4REF signal is used as trigger output(TRGO)

TIM Master Mode Selection 2 (TRGO2)

TIM_TRGO2_RESET

TIMx_EGR.UG bit is used as trigger output (TRGO2)

TIM_TRGO2_ENABLE

TIMx_CR1.CEN bit is used as trigger output (TRGO2)

TIM_TRGO2_UPDATE

Update event is used as trigger output (TRGO2)

TIM_TRGO2_OC1

Capture or a compare match 1 is used as trigger output (TRGO2)

TIM_TRGO2_OC1REF

OC1REF signal is used as trigger output (TRGO2)

TIM_TRGO2_OC2REF

OC2REF signal is used as trigger output (TRGO2)

TIM_TRGO2_OC3REF

OC3REF signal is used as trigger output (TRGO2)

TIM_TRGO2_OC4REF

OC4REF signal is used as trigger output (TRGO2)

TIM_TRGO2_OC5REF

OC5REF signal is used as trigger output (TRGO2)

TIM_TRGO2_OC6REF

OC6REF signal is used as trigger output (TRGO2)

TIM_TRGO2_OC4REF_RISINGFALLING

OC4REF rising or falling edges generate pulses on TRGO2

TIM_TRGO2_OC6REF_RISINGFALLING

OC6REF rising or falling edges generate pulses on TRGO2

TIM_TRGO2_OC4REF_RISING_OC6REF_RISING

OC4REF or OC6REF rising edges generate pulses on TRGO2

TIM_TRGO2_OC4REF_RISING_OC6REF_FALLING

OC4REF rising or OC6REF falling edges generate pulses on TRGO2

TIM_TRGO2_OC5REF_RISING_OC6REF_RISING

OC5REF or OC6REF rising edges generate pulses on TRGO2

TIM_TRGO2_OC5REF_RISING_OC6REF_FALLING

OC5REF or OC6REF rising edges generate pulses on TRGO2

TIM Master/Slave Mode

TIM_MASTERSLAVEMODE_ENABLE

No action

TIM_MASTERSLAVEMODE_DISABLE

Master/slave mode is selected

TIM One Pulse Mode

TIM_OPMODE_SINGLE

Counter stops counting at the next update event

TIM_OPMODE_REPETITIVE

Counter is not stopped at update event

TIM OSSI OffState Selection for Idle mode state

TIM_OSSI_ENABLE

When inactive, OC/OCN outputs are enabled (still controlled by the timer)

TIM_OSSI_DISABLE

When inactive, OC/OCN outputs are disabled (not controlled any longer by the timer)

TIM OSSR OffState Selection for Run mode state

TIM_OSSR_ENABLE

When inactive, OC/OCN outputs are enabled (still controlled by the timer)

TIM_OSSR_DISABLE

When inactive, OC/OCN outputs are disabled (not controlled any longer by the timer)

TIM Output Compare and PWM Modes

TIM_OCMODE_TIMING

Frozen

TIM_OCMODE_ACTIVE

Set channel to active level on match

TIM_OCMODE_INACTIVE

Set channel to inactive level on match

TIM_OCMODE_TOGGLE

Toggle

TIM_OCMODE_PWM1

PWM mode 1

TIM_OCMODE_PWM2

PWM mode 2

TIM_OCMODE_FORCED_ACTIVE

Force active level

TIM_OCMODE_FORCED_INACTIVE

Force inactive level

TIM_OCMODE_RETRIGERRABLE_OPM1

Retrigerrable OPM mode 1

TIM_OCMODE_RETRIGERRABLE_OPM2

Retrigerrable OPM mode 2

TIM_OCMODE_COMBINED_PWM1

Combined PWM mode 1

TIM_OCMODE_COMBINED_PWM2

Combined PWM mode 2

TIM_OCMODE_ASYMMETRIC_PWM1

Asymmetric PWM mode 1

TIM_OCMODE_ASYMMETRIC_PWM2

Asymmetric PWM mode 2

TIM Output Compare Idle State

TIM_OCIDLESTATE_SET

Output Idle state: OCx=1 when MOE=0

TIM_OCIDLESTATE_RESET

Output Idle state: OCx=0 when MOE=0

TIM Complementary Output Compare Idle State

TIM_OCNIDLESTATE_SET

Complementary output Idle state: OCxN=1 when MOE=0

TIM_OCNIDLESTATE_RESET

Complementary output Idle state: OCxN=0 when MOE=0

TIM Complementary Output Compare Polarity

TIM_OCNPOLARITY_HIGH

Capture/Compare complementary output polarity

TIM_OCNPOLARITY_LOW

Capture/Compare complementary output polarity

TIM Complementary Output Compare State

TIM_OUTPUTNSTATE_DISABLE

OCxN is disabled

TIM_OUTPUTNSTATE_ENABLE

OCxN is enabled

TIM Output Compare Polarity

TIM_OCPOLARITY_HIGH

Capture/Compare output polarity

TIM_OCPOLARITY_LOW

Capture/Compare output polarity

TIM Output Compare State

TIM_OUTPUTSTATE_DISABLE

Capture/Compare 1 output disabled

TIM_OUTPUTSTATE_ENABLE

Capture/Compare 1 output enabled

TIM Output Fast State

TIM_OCFAST_DISABLE

Output Compare fast disable

TIM_OCFAST_ENABLE

Output Compare fast enable

TIM Slave mode

TIM_SLAVEMODE_DISABLE

Slave mode disabled

TIM_SLAVEMODE_RESET

Reset Mode

TIM_SLAVEMODE_GATED

Gated Mode

TIM_SLAVEMODE_TRIGGER

Trigger Mode

TIM_SLAVEMODE_EXTERNAL1

External Clock Mode 1

TIM_SLAVEMODE_COMBINED_RESETTRIGGER

Combined reset + trigger mode

TIM TI1 Input Selection

TIM_TI1SELECTION_CH1

The TIMx_CH1 pin is connected to TI1 input

TIM_TI1SELECTION_XORCOMBINATION

The TIMx_CH1, CH2 and CH3 pins are connected to the TI1 input (XOR combination)

TIM Trigger Polarity

TIM_TRIGGERPOLARITY_INVERTED

Polarity for ETRx trigger sources

TIM_TRIGGERPOLARITY_NONINVERTED

Polarity for ETRx trigger sources

TIM_TRIGGERPOLARITY_RISING

Polarity for TIxFPx or TI1_ED trigger sources

TIM_TRIGGERPOLARITY_FALLING

Polarity for TIxFPx or TI1_ED trigger sources

TIM_TRIGGERPOLARITY_BOTHEDGE

Polarity for TIxFPx or TI1_ED trigger sources

TIM Trigger Prescaler

TIM_TRIGGERPRESCALER_DIV1

No prescaler is used

TIM_TRIGGERPRESCALER_DIV2

Prescaler for External ETR Trigger: Capture performed once every 2 events.

TIM_TRIGGERPRESCALER_DIV4

Prescaler for External ETR Trigger: Capture performed once every 4 events.

TIM_TRIGGERPRESCALER_DIV8

Prescaler for External ETR Trigger: Capture performed once every 8 events.

TIM Trigger Selection

TIM_TS_ITR0

Internal Trigger 0 (ITR0)

TIM_TS_ITR1

Internal Trigger 1 (ITR1)

TIM_TS_ITR2

Internal Trigger 2 (ITR2)

TIM_TS_ITR7

Internal Trigger 7 (ITR7)

TIM_TS_TI1F_ED

TI1 Edge Detector (TI1F_ED)

TIM_TS_TI1FP1

Filtered Timer Input 1 (TI1FP1)

TIM_TS_TI2FP2

Filtered Timer Input 2 (TI2FP2)

TIM_TS_ETRF

Filtered External Trigger input (ETRF)

TIM_TS_NONE

No trigger selected

TIM Update Interrupt Flag Remap

TIM_UIFREMAP_DISABLE

Update interrupt flag remap disabled

TIM_UIFREMAP_ENABLE

Update interrupt flag remap enabled

48 HAL TIM Extension Driver

48.1 TIMEx Firmware driver registers structures

48.1.1 TIM_HallSensor_InitTypeDef

TIM_HallSensor_InitTypeDef is defined in the stm32u0xx_hal_tim_ex.h

Data Fields

- ***uint32_t IC1Polarity***
- ***uint32_t IC1Prescaler***
- ***uint32_t IC1Filter***
- ***uint32_t Commutation_Delay***

Field Documentation

- ***uint32_t TIM_HallSensor_InitTypeDef::IC1Polarity***
  Specifies the active edge of the input signal. This parameter can be a value of ***TIM_Input_Capture_Polarity***
- ***uint32_t TIM_HallSensor_InitTypeDef::IC1Prescaler***
  Specifies the Input Capture Prescaler. This parameter can be a value of ***TIM_Input_Capture_Prescaler***
- ***uint32_t TIM_HallSensor_InitTypeDef::IC1Filter***
  Specifies the input capture filter. This parameter can be a number between Min_Data = 0x0 and Max_Data = 0xF
- ***uint32_t TIM_HallSensor_InitTypeDef::Commutation_Delay***
  Specifies the pulse value to be loaded into the Capture Compare Register. This parameter can be a number between Min_Data = 0x0000 and Max_Data = 0xFFFF

48.1.2 TIMEx_BreakInputConfigTypeDef

TIMEx_BreakInputConfigTypeDef is defined in the stm32u0xx_hal_tim_ex.h

Data Fields

- ***uint32_t Source***
- ***uint32_t Enable***
- ***uint32_t Polarity***

Field Documentation

- ***uint32_t TIMEx_BreakInputConfigTypeDef::Source***
  Specifies the source of the timer break input. This parameter can be a value of ***TIMEx_Break_Input_Source***
- ***uint32_t TIMEx_BreakInputConfigTypeDef::Enable***
  Specifies whether or not the break input source is enabled. This parameter can be a value of ***TIMEx_Break_Input_Source_Enable***
- ***uint32_t TIMEx_BreakInputConfigTypeDef::Polarity***
  Specifies the break input source polarity. This parameter can be a value of ***TIMEx_Break_Input_Source_Polarity***

48.2 TIMEx Firmware driver API description

The following section lists the various functions of the TIMEx library.

48.2.1 TIMER Extended features

The Timer Extended features include:

1. Complementary outputs with programmable dead-time for :
   – Output Compare
   – PWM generation (Edge and Center-aligned Mode)
   – One-pulse mode output

2. Synchronization circuit to control the timer with external signals and to interconnect several timers together.
3. Break input to put the timer output signals in reset state or in a known state.
4. Supports incremental (quadrature) encoder and hall-sensor circuitry for positioning purposes

48.2.2 How to use this driver

1. Initialize the TIM low level resources by implementing the following functions depending on the selected feature:
   – Hall Sensor output : HAL_TIMEx_HallSensor_MspInit()
2. Initialize the TIM low level resources :
   a. Enable the TIM interface clock using __HAL_RCC_TIMx_CLK_ENABLE();
   b. TIM pins configuration
      ◦ Enable the clock for the TIM GPIOs using the following function: __HAL_RCC_GPIOx_CLK_ENABLE();
      ◦ Configure these TIM pins in Alternate function mode using HAL_GPIO_Init();
3. The external Clock can be configured, if needed (the default clock is the internal clock from the APBx), using the following function: HAL_TIM_ConfigClockSource, the clock configuration should be done before any start function.
4. Configure the TIM in the desired functioning mode using one of the initialization function of this driver:
   – HAL_TIMEx_HallSensor_Init() and HAL_TIMEx_ConfigCommutEvent(): to use the Timer Hall Sensor Interface and the commutation event with the corresponding Interrupt and DMA request if needed (Note that One Timer is used to interface with the Hall sensor Interface and another Timer should be used to use the commutation event).
5. Activate the TIM peripheral using one of the start functions:
   – Complementary Output Compare : HAL_TIMEx_OCN_Start(), HAL_TIMEx_OCN_Start_DMA(), HAL_TIMEx_OCN_Start_IT()
   – Complementary PWM generation : HAL_TIMEx_PWMN_Start(), HAL_TIMEx_PWMN_Start_DMA(), HAL_TIMEx_PWMN_Start_IT()
   – Complementary One-pulse mode output : HAL_TIMEx_OnePulseN_Start(), HAL_TIMEx_OnePulseN_Start_IT()
   – Hall Sensor output : HAL_TIMEx_HallSensor_Start(), HAL_TIMEx_HallSensor_Start_DMA(), HAL_TIMEx_HallSensor_Start_IT().

48.2.3 Timer Hall Sensor functions

This section provides functions allowing to:

- Initialize and configure TIM HAL Sensor.
- De-initialize TIM HAL Sensor.
- Start the Hall Sensor Interface.
- Stop the Hall Sensor Interface.
- Start the Hall Sensor Interface and enable interrupts.
- Stop the Hall Sensor Interface and disable interrupts.
- Start the Hall Sensor Interface and enable DMA transfers.
- Stop the Hall Sensor Interface and disable DMA transfers.

This section contains the following APIs:

- ***HAL_TIMEx_HallSensor_Init()***
- ***HAL_TIMEx_HallSensor_DeInit()***
- ***HAL_TIMEx_HallSensor_MspInit()***
- ***HAL_TIMEx_HallSensor_MspDeInit()***
- ***HAL_TIMEx_HallSensor_Start()***
- ***HAL_TIMEx_HallSensor_Stop()***
- ***HAL_TIMEx_HallSensor_Start_IT()***
- ***HAL_TIMEx_HallSensor_Stop_IT()***
- ***HAL_TIMEx_HallSensor_Start_DMA()***

- *HAL_TIMEx_HallSensor_Stop_DMA()*

48.2.4 Timer Complementary Output Compare functions

This section provides functions allowing to:

- Start the Complementary Output Compare/PWM.
- Stop the Complementary Output Compare/PWM.
- Start the Complementary Output Compare/PWM and enable interrupts.
- Stop the Complementary Output Compare/PWM and disable interrupts.
- Start the Complementary Output Compare/PWM and enable DMA transfers.
- Stop the Complementary Output Compare/PWM and disable DMA transfers.

This section contains the following APIs:

- *HAL_TIMEx_OCN_Start()*
- *HAL_TIMEx_OCN_Stop()*
- *HAL_TIMEx_OCN_Start_IT()*
- *HAL_TIMEx_OCN_Stop_IT()*
- *HAL_TIMEx_OCN_Start_DMA()*
- *HAL_TIMEx_OCN_Stop_DMA()*

48.2.5 Timer Complementary PWM functions

This section provides functions allowing to:

- Start the Complementary PWM.
- Stop the Complementary PWM.
- Start the Complementary PWM and enable interrupts.
- Stop the Complementary PWM and disable interrupts.
- Start the Complementary PWM and enable DMA transfers.
- Stop the Complementary PWM and disable DMA transfers.

This section contains the following APIs:

- *HAL_TIMEx_PWMN_Start()*
- *HAL_TIMEx_PWMN_Stop()*
- *HAL_TIMEx_PWMN_Start_IT()*
- *HAL_TIMEx_PWMN_Stop_IT()*
- *HAL_TIMEx_PWMN_Start_DMA()*
- *HAL_TIMEx_PWMN_Stop_DMA()*

48.2.6 Timer Complementary One Pulse functions

This section provides functions allowing to:

- Start the Complementary One Pulse generation.
- Stop the Complementary One Pulse.
- Start the Complementary One Pulse and enable interrupts.
- Stop the Complementary One Pulse and disable interrupts.

This section contains the following APIs:

- *HAL_TIMEx_OnePulseN_Start()*
- *HAL_TIMEx_OnePulseN_Stop()*
- *HAL_TIMEx_OnePulseN_Start_IT()*
- *HAL_TIMEx_OnePulseN_Stop_IT()*

48.2.7 Peripheral Control functions

This section provides functions allowing to:

- Configure the commutation event in case of use of the Hall sensor interface.

- Configure Output channels for OC and PWM mode.
- Configure Complementary channels, break features and dead time.
- Configure Master synchronization.
- Configure timer remapping capabilities.
- Select timer input source.
- Enable or disable channel grouping.

This section contains the following APIs:

- *HAL_TIMEx_ConfigCommutEvent()*
- *HAL_TIMEx_ConfigCommutEvent_IT()*
- *HAL_TIMEx_ConfigCommutEvent_DMA()*
- *HAL_TIMEx_MasterConfigSynchronization()*
- *HAL_TIMEx_ConfigBreakDeadTime()*
- *HAL_TIMEx_ConfigBreakInput()*
- *HAL_TIMEx_RemapConfig()*
- *HAL_TIMEx_TISelection()*
- *HAL_TIMEx_GroupChannel5()*
- *HAL_TIMEx_DisarmBreakInput()*
- *HAL_TIMEx_ReArmBreakInput()*

48.2.8 Extended Callbacks functions

This section provides Extended TIM callback functions:

- Timer Commutation callback
- Timer Break callback

This section contains the following APIs:

- *HAL_TIMEx_CommutCallback()*
- *HAL_TIMEx_CommutHalfCpltCallback()*
- *HAL_TIMEx_BreakCallback()*
- *HAL_TIMEx_Break2Callback()*

48.2.9 Extended Peripheral State functions

This subsection permits to get in run-time the status of the peripheral and the data flow.

This section contains the following APIs:

- *HAL_TIMEx_HallSensor_GetState()*
- *HAL_TIMEx_GetChannelNState()*

48.2.10 Detailed description of functions

HAL_TIMEx_HallSensor_Init

Function name

HAL_StatusTypeDef HAL_TIMEx_HallSensor_Init (TIM_HandleTypeDef * htim, const TIM_HallSensor_InitTypeDef * sConfig)

Function description

Initializes the TIM Hall Sensor Interface and initialize the associated handle.

Parameters

- **htim:** TIM Hall Sensor Interface handle
- **sConfig:** TIM Hall Sensor configuration structure

Return values

- **HAL:** status

Notes

- When the timer instance is initialized in Hall Sensor Interface mode, timer channels 1 and channel 2 are reserved and cannot be used for other purpose.

HAL_TIMEx_HallSensor_DeInit

Function name

HAL_StatusTypeDef HAL_TIMEx_HallSensor_DeInit (TIM_HandleTypeDef * htim)

Function description

DeInitializes the TIM Hall Sensor interface.

Parameters

- **htim:** TIM Hall Sensor Interface handle

Return values

- **HAL:** status

HAL_TIMEx_HallSensor_MspInit

Function name

void HAL_TIMEx_HallSensor_MspInit (TIM_HandleTypeDef * htim)

Function description

Initializes the TIM Hall Sensor MSP.

Parameters

- **htim:** TIM Hall Sensor Interface handle

Return values

- **None:**

HAL_TIMEx_HallSensor_MspDeInit

Function name

void HAL_TIMEx_HallSensor_MspDeInit (TIM_HandleTypeDef * htim)

Function description

DeInitializes TIM Hall Sensor MSP.

Parameters

- **htim:** TIM Hall Sensor Interface handle

Return values

- **None:**

HAL_TIMEx_HallSensor_Start

Function name

HAL_StatusTypeDef HAL_TIMEx_HallSensor_Start (TIM_HandleTypeDef * htim)

Function description

Starts the TIM Hall Sensor Interface.

Parameters

- **htim:** TIM Hall Sensor Interface handle

Return values

- **HAL:** status

HAL_TIMEx_HallSensor_Stop

Function name

HAL_StatusTypeDef HAL_TIMEx_HallSensor_Stop (TIM_HandleTypeDef * htim)

Function description

Stops the TIM Hall sensor Interface.

Parameters

- **htim:** TIM Hall Sensor Interface handle

Return values

- **HAL:** status

HAL_TIMEx_HallSensor_Start_IT

Function name

HAL_StatusTypeDef HAL_TIMEx_HallSensor_Start_IT (TIM_HandleTypeDef * htim)

Function description

Starts the TIM Hall Sensor Interface in interrupt mode.

Parameters

- **htim:** TIM Hall Sensor Interface handle

Return values

- **HAL:** status

HAL_TIMEx_HallSensor_Stop_IT

Function name

HAL_StatusTypeDef HAL_TIMEx_HallSensor_Stop_IT (TIM_HandleTypeDef * htim)

Function description

Stops the TIM Hall Sensor Interface in interrupt mode.

Parameters

- **htim:** TIM Hall Sensor Interface handle

Return values

- **HAL:** status

HAL_TIMEx_HallSensor_Start_DMA

Function name

HAL_StatusTypeDef HAL_TIMEx_HallSensor_Start_DMA (TIM_HandleTypeDef * htim, uint32_t * pData, uint16_t Length)

Function description

Starts the TIM Hall Sensor Interface in DMA mode.

Parameters

- **htim:** TIM Hall Sensor Interface handle
- **pData:** The destination Buffer address.
- **Length:** The length of data to be transferred from TIM peripheral to memory.

Return values

- **HAL:** status

HAL_TIMEx_HallSensor_Stop_DMA

Function name

HAL_StatusTypeDef HAL_TIMEx_HallSensor_Stop_DMA (TIM_HandleTypeDef * htim)

Function description

Stops the TIM Hall Sensor Interface in DMA mode.

Parameters

- **htim:** TIM Hall Sensor Interface handle

Return values

- **HAL:** status

HAL_TIMEx_OCN_Start

Function name

HAL_StatusTypeDef HAL_TIMEx_OCN_Start (TIM_HandleTypeDef * htim, uint32_t Channel)

Function description

Starts the TIM Output Compare signal generation on the complementary output.

Parameters

- **htim:** TIM Output Compare handle
- **Channel:** TIM Channel to be enabled This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected

Return values

- **HAL:** status

HAL_TIMEx_OCN_Stop

Function name

HAL_StatusTypeDef HAL_TIMEx_OCN_Stop (TIM_HandleTypeDef * htim, uint32_t Channel)

Function description

Stops the TIM Output Compare signal generation on the complementary output.

Parameters

- **htim:** TIM handle
- **Channel:** TIM Channel to be disabled This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected

Return values

- **HAL:** status

HAL_TIMEx_OCN_Start_IT

Function name

HAL_StatusTypeDef HAL_TIMEx_OCN_Start_IT (TIM_HandleTypeDef * htim, uint32_t Channel)

Function description

Starts the TIM Output Compare signal generation in interrupt mode on the complementary output.

Parameters

- **htim:** TIM OC handle
- **Channel:** TIM Channel to be enabled This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected

Return values

- **HAL:** status

HAL_TIMEx_OCN_Stop_IT

Function name

HAL_StatusTypeDef HAL_TIMEx_OCN_Stop_IT (TIM_HandleTypeDef * htim, uint32_t Channel)

Function description

Stops the TIM Output Compare signal generation in interrupt mode on the complementary output.

Parameters

- **htim:** TIM Output Compare handle
- **Channel:** TIM Channel to be disabled This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected

Return values

- **HAL:** status

HAL_TIMEx_OCN_Start_DMA

Function name

HAL_StatusTypeDef HAL_TIMEx_OCN_Start_DMA (TIM_HandleTypeDef * htim, uint32_t Channel, const uint32_t * pData, uint16_t Length)

Function description

Starts the TIM Output Compare signal generation in DMA mode on the complementary output.

Parameters

- **htim:** TIM Output Compare handle
- **Channel:** TIM Channel to be enabled This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected
- **pData:** The source Buffer address.
- **Length:** The length of data to be transferred from memory to TIM peripheral

Return values

- **HAL:** status

HAL_TIMEx_OCN_Stop_DMA

Function name

HAL_StatusTypeDef HAL_TIMEx_OCN_Stop_DMA (TIM_HandleTypeDef * htim, uint32_t Channel)

Function description

Stops the TIM Output Compare signal generation in DMA mode on the complementary output.

Parameters

- **htim:** TIM Output Compare handle
- **Channel:** TIM Channel to be disabled This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected

Return values

- **HAL:** status

HAL_TIMEx_PWMN_Start

Function name

HAL_StatusTypeDef HAL_TIMEx_PWMN_Start (TIM_HandleTypeDef * htim, uint32_t Channel)

Function description

Starts the PWM signal generation on the complementary output.

Parameters

- **htim:** TIM handle
- **Channel:** TIM Channel to be enabled This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected

Return values

- **HAL:** status

HAL_TIMEx_PWMN_Stop

Function name

HAL_StatusTypeDef HAL_TIMEx_PWMN_Stop (TIM_HandleTypeDef * htim, uint32_t Channel)

Function description

Stops the PWM signal generation on the complementary output.

Parameters

- **htim:** TIM handle
- **Channel:** TIM Channel to be disabled This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected

Return values

- **HAL:** status

HAL_TIMEx_PWMN_Start_IT

Function name

HAL_StatusTypeDef HAL_TIMEx_PWMN_Start_IT (TIM_HandleTypeDef * htim, uint32_t Channel)

Function description

Starts the PWM signal generation in interrupt mode on the complementary output.

Parameters

- **htim:** TIM handle
- **Channel:** TIM Channel to be disabled This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected

Return values

- **HAL:** status

HAL_TIMEx_PWMN_Stop_IT

Function name

HAL_StatusTypeDef HAL_TIMEx_PWMN_Stop_IT (TIM_HandleTypeDef * htim, uint32_t Channel)

Function description

Stops the PWM signal generation in interrupt mode on the complementary output.

Parameters

- **htim:** TIM handle
- **Channel:** TIM Channel to be disabled This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected

Return values

- **HAL:** status

HAL_TIMEx_PWMN_Start_DMA

Function name

HAL_StatusTypeDef HAL_TIMEx_PWMN_Start_DMA (TIM_HandleTypeDef * htim, uint32_t Channel, const uint32_t * pData, uint16_t Length)

Function description

Starts the TIM PWM signal generation in DMA mode on the complementary output.

Parameters

- **htim:** TIM handle
- **Channel:** TIM Channel to be enabled This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected
- **pData:** The source Buffer address.
- **Length:** The length of data to be transferred from memory to TIM peripheral

Return values

- **HAL:** status

HAL_TIMEx_PWMN_Stop_DMA

Function name

HAL_StatusTypeDef HAL_TIMEx_PWMN_Stop_DMA (TIM_HandleTypeDef * htim, uint32_t Channel)

Function description

Stops the TIM PWM signal generation in DMA mode on the complementary output.

Parameters

- **htim:** TIM handle
- **Channel:** TIM Channel to be disabled This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected
  - TIM_CHANNEL_3: TIM Channel 3 selected

Return values

- **HAL:** status

HAL_TIMEx_OnePulseN_Start

Function name

HAL_StatusTypeDef HAL_TIMEx_OnePulseN_Start (TIM_HandleTypeDef * htim, uint32_t OutputChannel)

Function description

Starts the TIM One Pulse signal generation on the complementary output.

Parameters

- **htim:** TIM One Pulse handle
- **OutputChannel:** pulse output channel to enable This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected

Return values

- **HAL:** status

Notes

- OutputChannel must match the pulse output channel chosen when calling HAL_TIM_OnePulse_ConfigChannel().

HAL_TIMEx_OnePulseN_Stop

Function name

HAL_StatusTypeDef HAL_TIMEx_OnePulseN_Stop (TIM_HandleTypeDef * htim, uint32_t OutputChannel)

Function description

Stops the TIM One Pulse signal generation on the complementary output.

Parameters

- **htim:** TIM One Pulse handle
- **OutputChannel:** pulse output channel to disable This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected

Return values

- **HAL:** status

Notes

- OutputChannel must match the pulse output channel chosen when calling HAL_TIM_OnePulse_ConfigChannel().

HAL_TIMEx_OnePulseN_Start_IT

Function name

HAL_StatusTypeDef HAL_TIMEx_OnePulseN_Start_IT (TIM_HandleTypeDef * htim, uint32_t OutputChannel)

Function description

Starts the TIM One Pulse signal generation in interrupt mode on the complementary channel.

Parameters

- **htim:** TIM One Pulse handle
- **OutputChannel:** pulse output channel to enable This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected

Return values

- **HAL:** status

Notes

- OutputChannel must match the pulse output channel chosen when calling HAL_TIM_OnePulse_ConfigChannel().

HAL_TIMEx_OnePulseN_Stop_IT

Function name

HAL_StatusTypeDef HAL_TIMEx_OnePulseN_Stop_IT (TIM_HandleTypeDef * htim, uint32_t OutputChannel)

Function description

Stops the TIM One Pulse signal generation in interrupt mode on the complementary channel.

Parameters

- **htim:** TIM One Pulse handle
- **OutputChannel:** pulse output channel to disable This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1 selected
  - TIM_CHANNEL_2: TIM Channel 2 selected

Return values

- **HAL:** status

Notes

- OutputChannel must match the pulse output channel chosen when calling HAL_TIM_OnePulse_ConfigChannel().

HAL_TIMEx_ConfigCommutEvent

Function name

HAL_StatusTypeDef HAL_TIMEx_ConfigCommutEvent (TIM_HandleTypeDef * htim, uint32_t InputTrigger, uint32_t CommutationSource)

Function description

Configure the TIM commutation event sequence.

Parameters

- **htim:** TIM handle
- **InputTrigger:** the Internal trigger corresponding to the Timer Interfacing with the Hall sensor This parameter can be one of the following values:
  - TIM_TS_ITR0: Internal trigger 0 selected
  - TIM_TS_ITR1: Internal trigger 1 selected
  - TIM_TS_ITR2: Internal trigger 2 selected
  - TIM_TS_ITR7: Internal trigger 7 selected
  - TIM_TS_NONE: No trigger is needed
- **CommutationSource:** the Commutation Event source This parameter can be one of the following values:
  - TIM_COMMUTATION_TRGI: Commutation source is the TRGI of the Interface Timer
  - TIM_COMMUTATION_SOFTWARE: Commutation source is set by software using the COMG bit

Return values

- **HAL:** status

Notes

- This function is mandatory to use the commutation event in order to update the configuration at each commutation detection on the TRGI input of the Timer, the typical use of this feature is with the use of another Timer(interface Timer) configured in Hall sensor interface, this interface Timer will generate the commutation at its TRGO output (connected to Timer used in this function) each time the TI1 of the Interface Timer detect a commutation at its input TI1.

HAL_TIMEx_ConfigCommutEvent_IT

Function name

HAL_StatusTypeDef HAL_TIMEx_ConfigCommutEvent_IT (TIM_HandleTypeDef * htim, uint32_t InputTrigger, uint32_t CommutationSource)

Function description

Configure the TIM commutation event sequence with interrupt.

Parameters

- **htim:** TIM handle
- **InputTrigger:** the Internal trigger corresponding to the Timer Interfacing with the Hall sensor This parameter can be one of the following values:
  - TIM_TS_ITR0: Internal trigger 0 selected
  - TIM_TS_ITR1: Internal trigger 1 selected
  - TIM_TS_ITR2: Internal trigger 2 selected
  - TIM_TS_ITR7: Internal trigger 7 selected
  - TIM_TS_NONE: No trigger is needed
- **CommutationSource:** the Commutation Event source This parameter can be one of the following values:
  - TIM_COMMUTATION_TRGI: Commutation source is the TRGI of the Interface Timer
  - TIM_COMMUTATION_SOFTWARE: Commutation source is set by software using the COMG bit

Return values

- **HAL:** status

Notes

- This function is mandatory to use the commutation event in order to update the configuration at each commutation detection on the TRGI input of the Timer, the typical use of this feature is with the use of another Timer(interface Timer) configured in Hall sensor interface, this interface Timer will generate the commutation at its TRGO output (connected to Timer used in this function) each time the TI1 of the Interface Timer detect a commutation at its input TI1.

HAL_TIMEx_ConfigCommutEvent_DMA

Function name

HAL_StatusTypeDef HAL_TIMEx_ConfigCommutEvent_DMA (TIM_HandleTypeDef * htim, uint32_t InputTrigger, uint32_t CommutationSource)

Function description

Configure the TIM commutation event sequence with DMA.

Parameters

- **htim:** TIM handle
- **InputTrigger:** the Internal trigger corresponding to the Timer Interfacing with the Hall sensor This parameter can be one of the following values:
  - TIM_TS_ITR0: Internal trigger 0 selected
  - TIM_TS_ITR1: Internal trigger 1 selected
  - TIM_TS_ITR2: Internal trigger 2 selected
  - TIM_TS_ITR7: Internal trigger 7 selected
  - TIM_TS_NONE: No trigger is needed
- **CommutationSource:** the Commutation Event source This parameter can be one of the following values:
  - TIM_COMMUTATION_TRGI: Commutation source is the TRGI of the Interface Timer
  - TIM_COMMUTATION_SOFTWARE: Commutation source is set by software using the COMG bit

Return values

- **HAL:** status

Notes

- This function is mandatory to use the commutation event in order to update the configuration at each commutation detection on the TRGI input of the Timer, the typical use of this feature is with the use of another Timer(interface Timer) configured in Hall sensor interface, this interface Timer will generate the commutation at its TRGO output (connected to Timer used in this function) each time the TI1 of the Interface Timer detect a commutation at its input TI1.
- The user should configure the DMA in his own software, in This function only the COMDE bit is set

HAL_TIMEx_MasterConfigSynchronization

Function name

HAL_StatusTypeDef HAL_TIMEx_MasterConfigSynchronization (TIM_HandleTypeDef * htim, const TIM_MasterConfigTypeDef * sMasterConfig)

Function description

Configures the TIM in master mode.

Parameters

- **htim:** TIM handle.
- **sMasterConfig:** pointer to a TIM_MasterConfigTypeDef structure that contains the selected trigger output (TRGO) and the Master/Slave mode.

Return values

- **HAL:** status

HAL_TIMEx_ConfigBreakDeadTime

Function name

HAL_StatusTypeDef HAL_TIMEx_ConfigBreakDeadTime (TIM_HandleTypeDef * htim, const TIM_BreakDeadTimeConfigTypeDef * sBreakDeadTimeConfig)

Function description

Configures the Break feature, dead time, Lock level, OSSI/OSSR State and the AOE(automatic output enable).

Parameters

- **htim:** TIM handle
- **sBreakDeadTimeConfig:** pointer to a TIM_ConfigBreakDeadConfigTypeDef structure that contains the BDTR Register configuration information for the TIM peripheral.

Return values

- **HAL:** status

Notes

- Interrupts can be generated when an active level is detected on the break input, the break 2 input or the system break input. Break interrupt can be enabled by calling the __HAL_TIM_ENABLE_IT macro.

HAL_TIMEx_ConfigBreakInput

Function name

HAL_StatusTypeDef HAL_TIMEx_ConfigBreakInput (TIM_HandleTypeDef * htim, uint32_t BreakInput, const TIMEx_BreakInputConfigTypeDef * sBreakInputConfig)

Function description

Configures the break input source.

Parameters

- **htim:** TIM handle.
- **BreakInput:** Break input to configure This parameter can be one of the following values:
  - TIM_BREAKINPUT_BRK: Timer break input
  - TIM_BREAKINPUT_BRK2: Timer break 2 input
- **sBreakInputConfig:** Break input source configuration

Return values

- **HAL:** status

HAL_TIMEx_GroupChannel5

Function name

HAL_StatusTypeDef HAL_TIMEx_GroupChannel5 (TIM_HandleTypeDef * htim, uint32_t Channels)

Function description

Group channel 5 and channel 1, 2 or 3.

Parameters

- **htim:** TIM handle.
- **Channels:** specifies the reference signal(s) the OC5REF is combined with. This parameter can be any combination of the following values: TIM_GROUPCH5_NONE: No effect of OC5REF on OC1REFC, OC2REFC and OC3REFC TIM_GROUPCH5_OC1REFC: OC1REFC is the logical AND of OC1REFC and OC5REF TIM_GROUPCH5_OC2REFC: OC2REFC is the logical AND of OC2REFC and OC5REF TIM_GROUPCH5_OC3REFC: OC3REFC is the logical AND of OC3REFC and OC5REF

Return values

- **HAL:** status

HAL_TIMEx_RemapConfig

Function name

HAL_StatusTypeDef HAL_TIMEx_RemapConfig (TIM_HandleTypeDef * htim, uint32_t Remap)

Function description

Configures the TIMx Remapping input capabilities.

Parameters

- **htim:** TIM handle.
- **Remap:** specifies the TIM remapping source. For TIM1, the parameter can take one of the following values:
  - TIM_TIM1_ETR_GPIO: TIM1 ETR is is connected to GPIO
  - TIM_TIM1_ETR_COMP1: TIM1 ETR is connected to COMP1 output
  - TIM_TIM1_ETR_COMP2: TIM1 ETR is connected to COMP2 output (*)
  - TIM_TIM1_ETR_ADC1_AWD1: TIM1 ETR is connected to ADC1 AWD1
  - TIM_TIM1_ETR_ADC1_AWD2: TIM1 ETR is connected to ADC1 AWD2
  - TIM_TIM1_ETR_ADC1_AWD3: TIM1 ETR is connected to ADC1 AWD3

  For TIM2, the parameter can take one of the following values:
  - TIM_TIM2_ETR_GPIO: TIM2_ETR is connected to GPIO
  - TIM_TIM2_ETR_COMP1: TIM2_ETR is connected to COMP1 output
  - TIM_TIM2_ETR_COMP2: TIM2_ETR is connected to COMP2 output (*)
  - TIM_TIM2_ETR_LSE: TIM2_ETR is connected to LSE
  - TIM_TIM2_ETR_MCO: TIM2_ETR is connected to MCO
  - TIM_TIM2_ETR_MCO2: TIM2_ETR is connected to MCO2

  For TIM3, the parameter can take one of the following values:
  - TIM_TIM3_ETR_GPIO TIM3_ETR is connected to GPIO
  - TIM_TIM3_ETR_COMP1 TIM3_ETR is connected to COMP1 output
  - TIM_TIM3_ETR_COMP2 TIM3_ETR is connected to COMP2 output (*)

  (*) Value not defined in all devices.

Return values

- **HAL:** status

HAL_TIMEx_TISelection

Function name

HAL_StatusTypeDef HAL_TIMEx_TISelection (TIM_HandleTypeDef * htim, uint32_t TISelection, uint32_t Channel)

Function description

Select the timer input source.

Parameters

- **htim:** TIM handle.
- **Channel:** specifies the TIM Channel This parameter can be one of the following values:
  - TIM_CHANNEL_1: TI1 input channel
  - TIM_CHANNEL_2: TI2 input channel
- **TISelection:** specifies the timer input source

Return values

- **HAL:** status

HAL_TIMEx_DisarmBreakInput

Function name

HAL_StatusTypeDef HAL_TIMEx_DisarmBreakInput (TIM_HandleTypeDef * htim, uint32_t BreakInput)

Function description

Disarm the designated break input (when it operates in bidirectional mode).

Parameters

- **htim:** TIM handle.
- **BreakInput:** Break input to disarm This parameter can be one of the following values:
  - TIM_BREAKINPUT_BRK: Timer break input
  - TIM_BREAKINPUT_BRK2: Timer break 2 input

Return values

- **HAL:** status

Notes

- The break input can be disarmed only when it is configured in bidirectional mode and when when MOE is reset.
- Purpose is to be able to have the input voltage back to high-state, whatever the time constant on the output .

HAL_TIMEx_ReArmBreakInput

Function name

HAL_StatusTypeDef HAL_TIMEx_ReArmBreakInput (const TIM_HandleTypeDef * htim, uint32_t BreakInput)

Function description

Arm the designated break input (when it operates in bidirectional mode).

Parameters

- **htim:** TIM handle.
- **BreakInput:** Break input to arm This parameter can be one of the following values:
  - TIM_BREAKINPUT_BRK: Timer break input
  - TIM_BREAKINPUT_BRK2: Timer break 2 input

Return values

- **HAL:** status

Notes

- Arming is possible at anytime, even if fault is present.
- Break input is automatically armed as soon as MOE bit is set.

HAL_TIMEx_CommutCallback

Function name

void HAL_TIMEx_CommutCallback (TIM_HandleTypeDef * htim)

Function description

Commutation callback in non-blocking mode.

Parameters

- **htim:** TIM handle

Return values

- **None:**

HAL_TIMEx_CommutHalfCpltCallback

Function name

void HAL_TIMEx_CommutHalfCpltCallback (TIM_HandleTypeDef * htim)

Function description

Commutation half complete callback in non-blocking mode.

Parameters

- **htim:** TIM handle

Return values

- **None:**

HAL_TIMEx_BreakCallback

Function name

void HAL_TIMEx_BreakCallback (TIM_HandleTypeDef * htim)

Function description

Break detection callback in non-blocking mode.

Parameters

- **htim:** TIM handle

Return values

- **None:**

HAL_TIMEx_Break2Callback

Function name

void HAL_TIMEx_Break2Callback (TIM_HandleTypeDef * htim)

Function description

Break2 detection callback in non blocking mode.

Parameters

- **htim:** TIM handle

Return values

- **None:**

HAL_TIMEx_HallSensor_GetState

Function name

HAL_TIM_StateTypeDef HAL_TIMEx_HallSensor_GetState (const TIM_HandleTypeDef * htim)

Function description

Return the TIM Hall Sensor interface handle state.

Parameters

- **htim:** TIM Hall Sensor handle

Return values

- **HAL:** state

HAL_TIMEx_GetChannelNState

Function name

HAL_TIM_ChannelStateTypeDef HAL_TIMEx_GetChannelNState (const TIM_HandleTypeDef * htim, uint32_t ChannelN)

Function description

Return actual state of the TIM complementary channel.

Parameters

- **htim:** TIM handle
- **ChannelN:** TIM Complementary channel This parameter can be one of the following values:
  - TIM_CHANNEL_1: TIM Channel 1
  - TIM_CHANNEL_2: TIM Channel 2
  - TIM_CHANNEL_3: TIM Channel 3

Return values

- **TIM:** Complementary channel state

TIMEx_DMACommutationCplt

Function name

void TIMEx_DMACommutationCplt (DMA_HandleTypeDef * hdma)

Function description

TIM DMA Commutation callback.

Parameters

- **hdma:** pointer to DMA handle.

Return values

- **None:**

TIMEx_DMACommutationHalfCplt

Function name

void TIMEx_DMACommutationHalfCplt (DMA_HandleTypeDef * hdma)

Function description

TIM DMA Commutation half complete callback.

Parameters

- **hdma:** pointer to DMA handle.

Return values

- **None:**

48.3 TIMEx Firmware driver defines

The following section lists the various define and macros of the module.

48.3.1 TIMEx

TIMEx

TIM Extended Break input

TIM_BREAKINPUT_BRK

Timer break input

TIM_BREAKINPUT_BRK2

Timer break2 input

TIM Extended Break input source

TIM_BREAKINPUTSOURCE_BKIN

An external source (GPIO) is connected to the BKIN pin

TIM_BREAKINPUTSOURCE_COMP1

The COMP1 output is connected to the break input

TIM_BREAKINPUTSOURCE_COMP2

The COMP2 output is connected to the break input

TIM Extended Break input source enabling

TIM_BREAKINPUTSOURCE_DISABLE

Break input source is disabled

TIM_BREAKINPUTSOURCE_ENABLE

Break input source is enabled

TIM Extended Break input polarity

TIM_BREAKINPUTSOURCE_POLARITY_LOW

Break input source is active low

TIM_BREAKINPUTSOURCE_POLARITY_HIGH

Break input source is active_high

TIM Extended Remapping

TIM_TIM1_ETR_GPIO

TIM1_ETR is connected to GPIO

TIM_TIM1_ETR_COMP1

TIM1_ETR is connected to COMP1 output

TIM_TIM1_ETR_COMP2

TIM1_ETR is connected to COMP2 output

TIM_TIM1_ETR_ADC1_AWD1

TIM1_ETR is connected to ADC1 AWD1

TIM_TIM1_ETR_ADC1_AWD2

TIM1_ETR is connected to ADC1 AWD2

TIM_TIM1_ETR_ADC1_AWD3

TIM1_ETR is connected to ADC1 AWD3

TIM_TIM2_ETR_GPIO

TIM2_ETR is connected to GPIO

TIM_TIM2_ETR_COMP1

TIM2_ETR is connected to COMP1 output

TIM_TIM2_ETR_COMP2

TIM2_ETR is connected to COMP2 output

TIM_TIM2_ETR_LSE

TIM2_ETR is connected to LSE

TIM_TIM2_ETR_MCO

TIM2_ETR is connected to MCO

TIM_TIM2_ETR_MCO2

TIM2_ETR is connected to MCO2

TIM_TIM3_ETR_GPIO

TIM3_ETR is connected to GPIO

TIM_TIM3_ETR_COMP1

TIM3_ETR is connected to COMP1 output

TIM_TIM3_ETR_COMP2

TIM3_ETR is connected to COMP2 output

TIM Extended Timer input selection

TIM_TIM1_TI1_GPIO

TIM1_TI1 is connected to GPIO

TIM_TIM1_TI1_COMP1

TIM1_TI1 is connected to COMP1 OUT

TIM_TIM1_TI2_GPIO

TIM1_TI2 is connected to GPIO

TIM_TIM1_TI2_COMP2

TIM1_TI2 is connected to COMP2 OUT

TIM_TIM2_TI1_GPIO

TIM2_TI1 is connected to GPIO

TIM_TIM2_TI1_COMP1

TIM2_TI1 is connected to COMP1 OUT

TIM_TIM2_TI2_GPIO

TIM2_TI2 is connected to GPIO

TIM_TIM2_TI2_COMP2

TIM2_TI2 is connected to COMP2 OUT

TIM_TIM3_TI1_GPIO

TIM3_TI1 is connected to GPIO

TIM_TIM3_TI1_COMP1

TIM3_TI1 is connected to COMP1 OUT

TIM_TIM3_TI2_GPIO

TIM3_TI2 is connected to GPIO

TIM_TIM3_TI2_COMP2

TIM3_TI2 is connected to COMP2 OUT

TIM_TIM15_TI1_GPIO

TIM15_TI1 is connected to GPIO

TIM_TIM15_TI1_TIM2_CH1

TIM15_TI1 is connected to TIM2 CH1

TIM_TIM15_TI1_TIM3_CH1

TIM15_TI1 is connected to TIM3 CH1

TIM_TIM15_TI2_GPIO

TIM15_TI2 is connected to GPIO

TIM_TIM15_TI2_TIM2_CH2

TIM15_TI2 is connected to TIM2 CH2

TIM_TIM15_TI2_TIM3_CH2

TIM15_TI2 is connected to TIM3 CH2

TIM_TIM16_TI1_GPIO

TIM16_TI1 is connected to GPIO

TIM_TIM16_TI1_LSI

TIM16_TI1 is connected to LSI

TIM_TIM16_TI1_LSE

TIM16_TI1 is connected to LSE

TIM_TIM16_TI1_RTC_WAKEUP

TIM16_TI1 is connected to TRC wakeup interrupt

TIM_TIM16_TI1_MCO2

TIM16_TI1 is connected to MCO2

49 HAL TSC Generic Driver

49.1 TSC Firmware driver registers structures

49.1.1 TSC_InitTypeDef

TSC_InitTypeDef is defined in the stm32u0xx_hal_tsc.h

Data Fields

- ***uint32_t CTPulseHighLength***
- ***uint32_t CTPulseLowLength***
- ***FunctionalState SpreadSpectrum***
- ***uint32_t SpreadSpectrumDeviation***
- ***uint32_t SpreadSpectrumPrescaler***
- ***uint32_t PulseGeneratorPrescaler***
- ***uint32_t MaxCountValue***
- ***uint32_t IODefaultMode***
- ***uint32_t SynchroPinPolarity***
- ***uint32_t AcquisitionMode***
- ***FunctionalState MaxCountInterrupt***
- ***uint32_t ChannelIOs***
- ***uint32_t ShieldIOs***
- ***uint32_t SamplingIOs***

Field Documentation

- ***uint32_t TSC_InitTypeDef::CTPulseHighLength***
  Charge-transfer high pulse length This parameter can be a value of ***TSC_CTPulseHL_Config***
- ***uint32_t TSC_InitTypeDef::CTPulseLowLength***
  Charge-transfer low pulse length This parameter can be a value of ***TSC_CTPulseLL_Config***
- ***FunctionalState TSC_InitTypeDef::SpreadSpectrum***
  Spread spectrum activation This parameter can be set to ENABLE or DISABLE.
- ***uint32_t TSC_InitTypeDef::SpreadSpectrumDeviation***
  Spread spectrum deviation This parameter must be a number between Min_Data = 0 and Max_Data = 127
- ***uint32_t TSC_InitTypeDef::SpreadSpectrumPrescaler***
  Spread spectrum prescaler This parameter can be a value of ***TSC_SpreadSpec_Prescaler***
- ***uint32_t TSC_InitTypeDef::PulseGeneratorPrescaler***
  Pulse generator prescaler This parameter can be a value of ***TSC_PulseGenerator_Prescaler***
- ***uint32_t TSC_InitTypeDef::MaxCountValue***
  Max count value This parameter can be a value of ***TSC_MaxCount_Value***
- ***uint32_t TSC_InitTypeDef::IODefaultMode***
  IO default mode This parameter can be a value of ***TSC_IO_Default_Mode***
- ***uint32_t TSC_InitTypeDef::SynchroPinPolarity***
  Synchro pin polarity This parameter can be a value of ***TSC_Synchro_Pin_Polarity***
- ***uint32_t TSC_InitTypeDef::AcquisitionMode***
  Acquisition mode This parameter can be a value of ***TSC_Acquisition_Mode***
- ***FunctionalState TSC_InitTypeDef::MaxCountInterrupt***
  Max count interrupt activation This parameter can be set to ENABLE or DISABLE.
- ***uint32_t TSC_InitTypeDef::ChannelIOs***
  Channel IOs mask
- ***uint32_t TSC_InitTypeDef::ShieldIOs***
  Shield IOs mask
- ***uint32_t TSC_InitTypeDef::SamplingIOs***
  Sampling IOs mask

49.1.2 TSC_IOConfigTypeDef

TSC_IOConfigTypeDef is defined in the stm32u0xx_hal_tsc.h

Data Fields

- ***uint32_t ChannelIOs***
- ***uint32_t ShieldIOs***
- ***uint32_t SamplingIOs***

Field Documentation

- ***uint32_t TSC_IOConfigTypeDef::ChannelIOs***
  Channel IOs mask
- ***uint32_t TSC_IOConfigTypeDef::ShieldIOs***
  Shield IOs mask
- ***uint32_t TSC_IOConfigTypeDef::SamplingIOs***
  Sampling IOs mask

49.1.3 TSC_HandleTypeDef

TSC_HandleTypeDef is defined in the stm32u0xx_hal_tsc.h

Data Fields

- ***TSC_TypeDef * Instance***
- ***TSC_InitTypeDef Init***
- ***__IO HAL_TSC_StateTypeDef State***
- ***HAL_LockTypeDef Lock***
- ***__IO uint32_t ErrorCode***

Field Documentation

- ***TSC_TypeDef* TSC_HandleTypeDef::Instance***
  Register base address
- ***TSC_InitTypeDef TSC_HandleTypeDef::Init***
  Initialization parameters
- ***__IO HAL_TSC_StateTypeDef TSC_HandleTypeDef::State***
  Peripheral state
- ***HAL_LockTypeDef TSC_HandleTypeDef::Lock***
  Lock feature
- ***__IO uint32_t TSC_HandleTypeDef::ErrorCode***
  TSC Error code

49.2 TSC Firmware driver API description

The following section lists the various functions of the TSC library.

49.2.1 TSC specific features

1. Proven and robust surface charge transfer acquisition principle
2. Supports up to 3 capacitive sensing channels per group
3. Capacitive sensing channels can be acquired in parallel offering a very good response time
4. Spread spectrum feature to improve system robustness in noisy environments
5. Full hardware management of the charge transfer acquisition sequence
6. Programmable charge transfer frequency
7. Programmable sampling capacitor I/O pin
8. Programmable channel I/O pin
9. Programmable max count value to avoid long acquisition when a channel is faulty
10. Dedicated end of acquisition and max count error flags with interrupt capability
11. One sampling capacitor for up to 3 capacitive sensing channels to reduce the system components
12. Compatible with proximity, touchkey, linear and rotary touch sensor implementation

49.2.2 How to use this driver

1. Enable the TSC interface clock using __HAL_RCC_TSC_CLK_ENABLE() macro.
2. GPIO pins configuration
   - Enable the clock for the TSC GPIOs using __HAL_RCC_GPIOx_CLK_ENABLE() macro.
   - Configure the TSC pins used as sampling IOs in alternate function output Open-Drain mode, and TSC pins used as channel/shield IOs in alternate function output Push-Pull mode using HAL_GPIO_Init() function.
3. Interrupts configuration
   - Configure the NVIC (if the interrupt model is used) using HAL_NVIC_SetPriority() and HAL_NVIC_EnableIRQ() and function.
4. TSC configuration
   - Configure all TSC parameters and used TSC IOs using HAL_TSC_Init() function.

TSC peripheral alternate functions are mapped on AF9.

Acquisition sequence

- Discharge all IOs using HAL_TSC_IODischarge() function.
- Wait a certain time allowing a good discharge of all capacitors. This delay depends of the sampling capacitor and electrodes design.
- Select the channel IOs to be acquired using HAL_TSC_IOConfig() function.
- Launch the acquisition using either HAL_TSC_Start() or HAL_TSC_Start_IT() function. If the synchronized mode is selected, the acquisition will start as soon as the signal is received on the synchro pin.
- Wait the end of acquisition using either HAL_TSC_PollForAcquisition() or HAL_TSC_GetState() function or using WFI instruction for example.
- Check the group acquisition status using HAL_TSC_GroupGetStatus() function.
- Read the acquisition value using HAL_TSC_GroupGetValue() function.

Callback registration

The compilation flag USE_HAL_TSC_REGISTER_CALLBACKS when set to 1 allows the user to configure dynamically the driver callbacks. Use Functions HAL_TSC_RegisterCallback() to register an interrupt callback.

Function HAL_TSC_RegisterCallback() allows to register following callbacks:

- ConvCpltCallback : callback for conversion complete process.
- ErrorCallback : callback for error detection.
- MspInitCallback : callback for Msp Init.
- MspDeInitCallback : callback for Msp DeInit.

This function takes as parameters the HAL peripheral handle, the Callback ID and a pointer to the user callback function.

Use function HAL_TSC_UnRegisterCallback to reset a callback to the default weak function. HAL_TSC_UnRegisterCallback takes as parameters the HAL peripheral handle, and the Callback ID.

This function allows to reset following callbacks:

- ConvCpltCallback : callback for conversion complete process.
- ErrorCallback : callback for error detection.
- MspInitCallback : callback for Msp Init.
- MspDeInitCallback : callback for Msp DeInit.

By default, after the HAL_TSC_Init() and when the state is HAL_TSC_STATE_RESET all callbacks are set to the corresponding weak functions: examples HAL_TSC_ConvCpltCallback(), HAL_TSC_ErrorCallback(). Exception done for MspInit and MspDeInit functions that are reset to the legacy weak functions in the HAL_TSC_Init()/ HAL_TSC_DeInit() only when these callbacks are null (not registered beforehand). If MspInit or MspDeInit are not null, the HAL_TSC_Init()/ HAL_TSC_DeInit() keep and use the user MspInit/MspDeInit callbacks (registered beforehand) whatever the state.

Callbacks can be registered/unregistered in HAL_TSC_STATE_READY state only. Exception done MspInit/MspDeInit functions that can be registered/unregistered in HAL_TSC_STATE_READY or HAL_TSC_STATE_RESET state, thus registered (user) MspInit/DeInit callbacks can be used during the Init/DeInit. Then, the user first registers the MspInit/MspDeInit user callbacks using HAL_TSC_RegisterCallback() before calling HAL_TSC_DeInit() or HAL_TSC_Init() function.

When the compilation flag USE_HAL_TSC_REGISTER_CALLBACKS is set to 0 or not defined, the callback registration feature is not available and all callbacks are set to the corresponding weak functions.

49.2.3 Initialization and de-initialization functions

This section provides functions allowing to:

- Initialize and configure the TSC.
- De-initialize the TSC.

This section contains the following APIs:

- ***HAL_TSC_Init()***
- ***HAL_TSC_DeInit()***
- ***HAL_TSC_MspInit()***
- ***HAL_TSC_MspDeInit()***

49.2.4 IO Operation functions

This section provides functions allowing to:

- Start acquisition in polling mode.
- Start acquisition in interrupt mode.
- Stop conversion in polling mode.
- Stop conversion in interrupt mode.
- Poll for acquisition completed.
- Get group acquisition status.
- Get group acquisition value.

This section contains the following APIs:

- ***HAL_TSC_Start()***
- ***HAL_TSC_Start_IT()***
- ***HAL_TSC_Stop()***
- ***HAL_TSC_Stop_IT()***
- ***HAL_TSC_PollForAcquisition()***
- ***HAL_TSC_GroupGetStatus()***
- ***HAL_TSC_GroupGetValue()***

49.2.5 Peripheral Control functions

This section provides functions allowing to:

- Configure TSC IOs
- Discharge TSC IOs

This section contains the following APIs:

- ***HAL_TSC_IOConfig()***
- ***HAL_TSC_IODischarge()***

49.2.6 State and Errors functions

This subsection provides functions allowing to

- Get TSC state.

This section contains the following APIs:

- ***HAL_TSC_GetState()***

49.2.7 Detailed description of functions

HAL_TSC_Init

Function name

HAL_StatusTypeDef HAL_TSC_Init (TSC_HandleTypeDef * htsc)

Function description

Initialize the TSC peripheral according to the specified parameters in the TSC_InitTypeDef structure and initialize the associated handle.

Parameters

- **htsc:** TSC handle

Return values

- **HAL:** status

HAL_TSC_DeInit

Function name

HAL_StatusTypeDef HAL_TSC_DeInit (TSC_HandleTypeDef * htsc)

Function description

Deinitialize the TSC peripheral registers to their default reset values.

Parameters

- **htsc:** TSC handle

Return values

- **HAL:** status

HAL_TSC_MspInit

Function name

void HAL_TSC_MspInit (TSC_HandleTypeDef * htsc)

Function description

Initialize the TSC MSP.

Parameters

- **htsc:** Pointer to a TSC_HandleTypeDef structure that contains the configuration information for the specified TSC.

Return values

- **None:**

HAL_TSC_MspDeInit

Function name

void HAL_TSC_MspDeInit (TSC_HandleTypeDef * htsc)

Function description

DeInitialize the TSC MSP.

Parameters

- **htsc:** Pointer to a TSC_HandleTypeDef structure that contains the configuration information for the specified TSC.

Return values

- **None:**

HAL_TSC_Start

Function name

HAL_StatusTypeDef HAL_TSC_Start (TSC_HandleTypeDef * htsc)

Function description

Start the acquisition.

Parameters

- **htsc:** Pointer to a TSC_HandleTypeDef structure that contains the configuration information for the specified TSC.

Return values

- **HAL:** status

HAL_TSC_Start_IT

Function name

HAL_StatusTypeDef HAL_TSC_Start_IT (TSC_HandleTypeDef * htsc)

Function description

Start the acquisition in interrupt mode.

Parameters

- **htsc:** Pointer to a TSC_HandleTypeDef structure that contains the configuration information for the specified TSC.

Return values

- **HAL:** status.

HAL_TSC_Stop

Function name

HAL_StatusTypeDef HAL_TSC_Stop (TSC_HandleTypeDef * htsc)

Function description

Stop the acquisition previously launched in polling mode.

Parameters

- **htsc:** Pointer to a TSC_HandleTypeDef structure that contains the configuration information for the specified TSC.

Return values

- **HAL:** status

HAL_TSC_Stop_IT

Function name

HAL_StatusTypeDef HAL_TSC_Stop_IT (TSC_HandleTypeDef * htsc)

Function description

Stop the acquisition previously launched in interrupt mode.

Parameters

- **htsc:** Pointer to a TSC_HandleTypeDef structure that contains the configuration information for the specified TSC.

Return values

- **HAL:** status

HAL_TSC_PollForAcquisition

Function name

HAL_StatusTypeDef HAL_TSC_PollForAcquisition (TSC_HandleTypeDef * htsc)

Function description

Start acquisition and wait until completion.

Parameters

- **htsc:** Pointer to a TSC_HandleTypeDef structure that contains the configuration information for the specified TSC.

Return values

- **HAL:** state

Notes

- There is no need of a timeout parameter as the max count error is already managed by the TSC peripheral.

HAL_TSC_GroupGetStatus

Function name

TSC_GroupStatusTypeDef HAL_TSC_GroupGetStatus (const TSC_HandleTypeDef * htsc, uint32_t gx_index)

Function description

Get the acquisition status for a group.

Parameters

- **htsc:** Pointer to a TSC_HandleTypeDef structure that contains the configuration information for the specified TSC.
- **gx_index:** Index of the group

Return values

- **Group:** status

HAL_TSC_GroupGetValue

Function name

uint32_t HAL_TSC_GroupGetValue (const TSC_HandleTypeDef * htsc, uint32_t gx_index)

Function description

Get the acquisition measure for a group.

Parameters

- **htsc:** Pointer to a TSC_HandleTypeDef structure that contains the configuration information for the specified TSC.
- **gx_index:** Index of the group

Return values

- **Acquisition:** measure

HAL_TSC_IOConfig

Function name

HAL_StatusTypeDef HAL_TSC_IOConfig (TSC_HandleTypeDef * htsc, const TSC_IOConfigTypeDef * config)

Function description

Configure TSC IOs.

Parameters

- **htsc:** Pointer to a TSC_HandleTypeDef structure that contains the configuration information for the specified TSC.
- **config:** Pointer to the configuration structure.

Return values

- **HAL:** status

HAL_TSC_IODischarge

Function name

HAL_StatusTypeDef HAL_TSC_IODischarge (TSC_HandleTypeDef * htsc, FunctionalState choice)

Function description

Discharge TSC IOs.

Parameters

- **htsc:** Pointer to a TSC_HandleTypeDef structure that contains the configuration information for the specified TSC.
- **choice:** This parameter can be set to ENABLE or DISABLE.

Return values

- **HAL:** status

HAL_TSC_GetState

Function name

HAL_TSC_StateTypeDef HAL_TSC_GetState (TSC_HandleTypeDef * htsc)

Function description

Return the TSC handle state.

Parameters

- **htsc:** Pointer to a TSC_HandleTypeDef structure that contains the configuration information for the specified TSC.

Return values

- **HAL:** state

HAL_TSC_IRQHandler

Function name

void HAL_TSC_IRQHandler (TSC_HandleTypeDef * htsc)

Function description

Handle TSC interrupt request.

Parameters

- **htsc:** Pointer to a TSC_HandleTypeDef structure that contains the configuration information for the specified TSC.

Return values

- **None:**

HAL_TSC_ConvCpltCallback

Function name

void HAL_TSC_ConvCpltCallback (TSC_HandleTypeDef * htsc)

Function description

Acquisition completed callback in non-blocking mode.

Parameters

- **htsc:** Pointer to a TSC_HandleTypeDef structure that contains the configuration information for the specified TSC.

Return values

- **None:**

HAL_TSC_ErrorCallback

Function name

void HAL_TSC_ErrorCallback (TSC_HandleTypeDef * htsc)

Function description

Error callback in non-blocking mode.

Parameters

- **htsc:** Pointer to a TSC_HandleTypeDef structure that contains the configuration information for the specified TSC.

Return values

- **None:**

49.3 TSC Firmware driver defines

The following section lists the various define and macros of the module.

49.3.1 TSC

TSC

Acquisition Mode

TSC_ACQ_MODE_NORMAL

Normal acquisition mode (acquisition starts as soon as START bit is set)

TSC_ACQ_MODE_SYNCHRO

Synchronized acquisition mode (acquisition starts if START bit is set and when the selected signal is detected on the SYNC input pin)

CTPulse High Length

TSC_CTPH_1CYCLE

Charge transfer pulse high during 1 cycle (PGCLK)

TSC_CTPH_2CYCLES

Charge transfer pulse high during 2 cycles (PGCLK)

TSC_CTPH_3CYCLES

Charge transfer pulse high during 3 cycles (PGCLK)

TSC_CTPH_4CYCLES

Charge transfer pulse high during 4 cycles (PGCLK)

TSC_CTPH_5CYCLES

Charge transfer pulse high during 5 cycles (PGCLK)

TSC_CTPH_6CYCLES

Charge transfer pulse high during 6 cycles (PGCLK)

TSC_CTPH_7CYCLES

Charge transfer pulse high during 7 cycles (PGCLK)

TSC_CTPH_8CYCLES

Charge transfer pulse high during 8 cycles (PGCLK)

TSC_CTPH_9CYCLES

Charge transfer pulse high during 9 cycles (PGCLK)

TSC_CTPH_10CYCLES

Charge transfer pulse high during 10 cycles (PGCLK)

TSC_CTPH_11CYCLES

Charge transfer pulse high during 11 cycles (PGCLK)

TSC_CTPH_12CYCLES

Charge transfer pulse high during 12 cycles (PGCLK)

TSC_CTPH_13CYCLES

Charge transfer pulse high during 13 cycles (PGCLK)

TSC_CTPH_14CYCLES

Charge transfer pulse high during 14 cycles (PGCLK)

TSC_CTPH_15CYCLES

Charge transfer pulse high during 15 cycles (PGCLK)

TSC_CTPH_16CYCLES

Charge transfer pulse high during 16 cycles (PGCLK)

CTPulse Low Length

TSC_CTPL_1CYCLE

Charge transfer pulse low during 1 cycle (PGCLK)

TSC_CTPL_2CYCLES

Charge transfer pulse low during 2 cycles (PGCLK)

TSC_CTPL_3CYCLES

Charge transfer pulse low during 3 cycles (PGCLK)

TSC_CTPL_4CYCLES

Charge transfer pulse low during 4 cycles (PGCLK)

TSC_CTPL_5CYCLES

Charge transfer pulse low during 5 cycles (PGCLK)

TSC_CTPL_6CYCLES

Charge transfer pulse low during 6 cycles (PGCLK)

TSC_CTPL_7CYCLES

Charge transfer pulse low during 7 cycles (PGCLK)

TSC_CTPL_8CYCLES

Charge transfer pulse low during 8 cycles (PGCLK)

TSC_CTPL_9CYCLES

Charge transfer pulse low during 9 cycles (PGCLK)

TSC_CTPL_10CYCLES

Charge transfer pulse low during 10 cycles (PGCLK)

TSC_CTPL_11CYCLES

Charge transfer pulse low during 11 cycles (PGCLK)

TSC_CTPL_12CYCLES

Charge transfer pulse low during 12 cycles (PGCLK)

TSC_CTPL_13CYCLES

Charge transfer pulse low during 13 cycles (PGCLK)

TSC_CTPL_14CYCLES

Charge transfer pulse low during 14 cycles (PGCLK)

TSC_CTPL_15CYCLES

Charge transfer pulse low during 15 cycles (PGCLK)

TSC_CTPL_16CYCLES

Charge transfer pulse low during 16 cycles (PGCLK)

TSC Error Code definition

HAL_TSC_ERROR_NONE

No error

TSC Exported Macros

__HAL_TSC_RESET_HANDLE_STATE

Description:

- Reset TSC handle state.

Parameters:

- __HANDLE__: TSC handle

Return value:

- None

__HAL_TSC_ENABLE

Description:

- Enable the TSC peripheral.

Parameters:

- __HANDLE__: TSC handle

Return value:

- None

__HAL_TSC_DISABLE

Description:

- Disable the TSC peripheral.

Parameters:

- __HANDLE__: TSC handle

Return value:

- None

__HAL_TSC_START_ACQ

Description:

- Start acquisition.

Parameters:

- __HANDLE__: TSC handle

Return value:

- None

__HAL_TSC_STOP_ACQ

Description:

- Stop acquisition.

Parameters:

- __HANDLE__: TSC handle

Return value:

- None

__HAL_TSC_SET_IODEF_OUTPPLOW

Description:

- Set IO default mode to output push-pull low.

Parameters:

- __HANDLE__: TSC handle

Return value:

- None

__HAL_TSC_SET_IODEF_INFLOAT

Description:

- Set IO default mode to input floating.

Parameters:

- __HANDLE__: TSC handle

Return value:

- None

__HAL_TSC_SET_SYNC_POL_FALL

Description:

- Set synchronization polarity to falling edge.

Parameters:

- __HANDLE__: TSC handle

Return value:

- None

__HAL_TSC_SET_SYNC_POL_RISE_HIGH

Description:

- Set synchronization polarity to rising edge and high level.

Parameters:

- __HANDLE__: TSC handle

Return value:

- None

__HAL_TSC_ENABLE_IT

Description:

- Enable TSC interrupt.

Parameters:

- __HANDLE__: TSC handle
- __INTERRUPT__: TSC interrupt

Return value:

- None

__HAL_TSC_DISABLE_IT

Description:

- Disable TSC interrupt.

Parameters:

- __HANDLE__: TSC handle
- __INTERRUPT__: TSC interrupt

Return value:

- None

__HAL_TSC_GET_IT_SOURCE

Description:

- Check whether the specified TSC interrupt source is enabled or not.

Parameters:

- __HANDLE__: TSC Handle
- __INTERRUPT__: TSC interrupt

Return value:

- SET: or RESET

__HAL_TSC_GET_FLAG

Description:

- Check whether the specified TSC flag is set or not.

Parameters:

- __HANDLE__: TSC handle
- __FLAG__: TSC flag

Return value:

- SET: or RESET

__HAL_TSC_CLEAR_FLAG

Description:

- Clear the TSC's pending flag.

Parameters:

- __HANDLE__: TSC handle
- __FLAG__: TSC flag

Return value:

- None

__HAL_TSC_ENABLE_HYSTERESIS

Description:

- Enable schmitt trigger hysteresis on a group of IOs.

Parameters:

- __HANDLE__: TSC handle
- __GX_IOY_MASK__: IOs mask

Return value:

- None

__HAL_TSC_DISABLE_HYSTERESIS

Description:

- Disable schmitt trigger hysteresis on a group of IOs.

Parameters:

- __HANDLE__: TSC handle
- __GX_IOY_MASK__: IOs mask

Return value:

- None

__HAL_TSC_OPEN_ANALOG_SWITCH

Description:

- Open analog switch on a group of IOs.

Parameters:

- __HANDLE__: TSC handle
- __GX_IOY_MASK__: IOs mask

Return value:

- None

__HAL_TSC_CLOSE_ANALOG_SWITCH

Description:

- Close analog switch on a group of IOs.

Parameters:

- __HANDLE__: TSC handle
- __GX_IOY_MASK__: IOs mask

Return value:

- None

__HAL_TSC_ENABLE_CHANNEL

Description:

- Enable a group of IOs in channel mode.

Parameters:

- __HANDLE__: TSC handle
- __GX_IOY_MASK__: IOs mask

Return value:

- None

__HAL_TSC_DISABLE_CHANNEL

Description:

- Disable a group of channel IOs.

Parameters:

- __HANDLE__: TSC handle
- __GX_IOY_MASK__: IOs mask

Return value:

- None

__HAL_TSC_ENABLE_SAMPLING

Description:

- Enable a group of IOs in sampling mode.

Parameters:

- __HANDLE__: TSC handle
- __GX_IOY_MASK__: IOs mask

Return value:

- None

__HAL_TSC_DISABLE_SAMPLING

Description:

- Disable a group of sampling IOs.

Parameters:

- __HANDLE__: TSC handle
- __GX_IOY_MASK__: IOs mask

Return value:

- None

__HAL_TSC_ENABLE_GROUP

Description:

- Enable acquisition groups.

Parameters:

- __HANDLE__: TSC handle
- __GX_MASK__: Groups mask

Return value:

- None

__HAL_TSC_DISABLE_GROUP

Description:

- Disable acquisition groups.

Parameters:

- __HANDLE__: TSC handle
- __GX_MASK__: Groups mask

Return value:

- None

__HAL_TSC_GET_GROUP_STATUS

Description:

- Gets acquisition group status.

Parameters:

- __HANDLE__: TSC Handle
- __GX_INDEX__: Group index

Return value:

- SET: or RESET

Flags definition

TSC_FLAG_EOA

End of acquisition flag

TSC_FLAG_MCE

Max count error flag

Group definition

TSC_GROUP1

TSC_GROUP2

TSC_GROUP3

TSC_GROUP4

TSC_GROUP5

TSC_GROUP6

TSC_GROUP7

TSC_GROUP1_IO1

TSC Group1 IO1

TSC_GROUP1_IO2

TSC Group1 IO2

TSC_GROUP1_IO3

TSC Group1 IO3

TSC_GROUP1_IO4

TSC Group1 IO4

TSC_GROUP2_IO1

TSC Group2 IO1

TSC_GROUP2_IO2

TSC Group2 IO2

TSC_GROUP2_IO3

TSC Group2 IO3

TSC_GROUP2_IO4

TSC Group2 IO4

TSC_GROUP3_IO1

TSC Group3 IO1

TSC_GROUP3_IO2

TSC Group3 IO2

TSC_GROUP3_IO3

TSC Group3 IO3

TSC_GROUP3_IO4

TSC Group3 IO4

TSC_GROUP4_IO1

TSC Group4 IO1

TSC_GROUP4_IO2

TSC Group4 IO2

TSC_GROUP4_IO3

TSC Group4 IO3

TSC_GROUP4_IO4

TSC Group4 IO4

TSC_GROUP5_IO1

TSC Group5 IO1

TSC_GROUP5_IO2

TSC Group5 IO2

TSC_GROUP5_IO3

TSC Group5 IO3

TSC_GROUP5_IO4

TSC Group5 IO4

TSC_GROUP6_IO1

TSC Group6 IO1

TSC_GROUP6_IO2

TSC Group6 IO2

TSC_GROUP6_IO3

TSC Group6 IO3

TSC_GROUP6_IO4

TSC Group6 IO4

TSC_GROUP7_IO1

TSC Group7 IO1

TSC_GROUP7_IO2

TSC Group7 IO2

TSC_GROUP7_IO3

TSC Group7 IO3

TSC_GROUP7_IO4

TSC Group7 IO4

Interrupts definition

TSC_IT_EOA

End of acquisition interrupt enable

TSC_IT_MCE

Max count error interrupt enable

IO Default Mode

TSC_IODEF_OUT_PP_LOW

I/Os are forced to output push-pull low

TSC_IODEF_IN_FLOAT

I/Os are in input floating

Max Count Value

TSC_MCV_255

255 maximum number of charge transfer pulses

TSC_MCV_511

511 maximum number of charge transfer pulses

TSC_MCV_1023

1023 maximum number of charge transfer pulses

TSC_MCV_2047

2047 maximum number of charge transfer pulses

TSC_MCV_4095

4095 maximum number of charge transfer pulses

TSC_MCV_8191

8191 maximum number of charge transfer pulses

TSC_MCV_16383

16383 maximum number of charge transfer pulses

Pulse Generator Prescaler

TSC_PG_PRESC_DIV1

Pulse Generator HCLK Div1

TSC_PG_PRESC_DIV2

Pulse Generator HCLK Div2

TSC_PG_PRESC_DIV4

Pulse Generator HCLK Div4

TSC_PG_PRESC_DIV8

Pulse Generator HCLK Div8

TSC_PG_PRESC_DIV16

Pulse Generator HCLK Div16

TSC_PG_PRESC_DIV32

Pulse Generator HCLK Div32

TSC_PG_PRESC_DIV64

Pulse Generator HCLK Div64

TSC_PG_PRESC_DIV128

Pulse Generator HCLK Div128

Spread Spectrum Prescaler

TSC_SS_PRESC_DIV1

Spread Spectrum Prescaler Div1

TSC_SS_PRESC_DIV2

Spread Spectrum Prescaler Div2

Synchro Pin Polarity

TSC_SYNC_POLARITY_FALLING

Falling edge only

TSC_SYNC_POLARITY_RISING

Rising edge and high level

50 HAL UART Generic Driver

50.1 UART Firmware driver registers structures

50.1.1 UART_InitTypeDef

UART_InitTypeDef is defined in the stm32u0xx_hal_uart.h

Data Fields

- ***uint32_t BaudRate***
- ***uint32_t WordLength***
- ***uint32_t StopBits***
- ***uint32_t Parity***
- ***uint32_t Mode***
- ***uint32_t HwFlowCtl***
- ***uint32_t OverSampling***
- ***uint32_t OneBitSampling***
- ***uint32_t ClockPrescaler***

Field Documentation

- ***uint32_t UART_InitTypeDef::BaudRate***
  This member configures the UART communication baud rate. The baud rate register is computed using the following formula: LPUART: ======= Baud Rate Register = ((256 * lpuart_ker_ckpres) / ((huart->Init.BaudRate))) where lpuart_ker_ck_pres is the UART input clock divided by a prescaler UART: =====
  - If oversampling is 16 or in LIN mode, Baud Rate Register = ((uart_ker_ckpres) / ((huart->Init.BaudRate)))
  - If oversampling is 8, Baud Rate Register[15:4] = ((2 * uart_ker_ckpres) / ((huart->Init.BaudRate))) [15:4] Baud Rate Register[3] = 0 Baud Rate Register[2:0] = (((2 * uart_ker_ckpres) / ((huart->Init.BaudRate)))[3:0]) >> 1 where uart_ker_ck_pres is the UART input clock divided by a prescaler
- ***uint32_t UART_InitTypeDef::WordLength***
  Specifies the number of data bits transmitted or received in a frame. This parameter can be a value of ***UARTEx_Word_Length***.
- ***uint32_t UART_InitTypeDef::StopBits***
  Specifies the number of stop bits transmitted. This parameter can be a value of ***UART_Stop_Bits***.
- ***uint32_t UART_InitTypeDef::Parity***
  Specifies the parity mode. This parameter can be a value of ***UART_Parity***
  Note:
  - When parity is enabled, the computed parity is inserted at the MSB position of the transmitted data (9th bit when the word length is set to 9 data bits; 8th bit when the word length is set to 8 data bits).
- ***uint32_t UART_InitTypeDef::Mode***
  Specifies whether the Receive or Transmit mode is enabled or disabled. This parameter can be a value of ***UART_Mode***.
- ***uint32_t UART_InitTypeDef::HwFlowCtl***
  Specifies whether the hardware flow control mode is enabled or disabled. This parameter can be a value of ***UART_Hardware_Flow_Control***.
- ***uint32_t UART_InitTypeDef::OverSampling***
  Specifies whether the Over sampling 8 is enabled or disabled, to achieve higher speed (up to f_PCLK/8). This parameter can be a value of ***UART_Over_Sampling***.
- ***uint32_t UART_InitTypeDef::OneBitSampling***
  Specifies whether a single sample or three samples' majority vote is selected. Selecting the single sample method increases the receiver tolerance to clock deviations. This parameter can be a value of ***UART_OneBit_Sampling***.
- ***uint32_t UART_InitTypeDef::ClockPrescaler***
  Specifies the prescaler value used to divide the UART clock source. This parameter can be a value of ***UART_ClockPrescaler***.

50.1.2 UART_AdvFeatureInitTypeDef

UART_AdvFeatureInitTypeDef is defined in the stm32u0xx_hal_uart.h

Data Fields

- ***uint32_t AdvFeatureInit***
- ***uint32_t TxPinLevelInvert***
- ***uint32_t RxPinLevelInvert***
- ***uint32_t DataInvert***
- ***uint32_t Swap***
- ***uint32_t OverrunDisable***
- ***uint32_t DMADisableonRxError***
- ***uint32_t AutoBaudRateEnable***
- ***uint32_t AutoBaudRateMode***
- ***uint32_t MSBFirst***

Field Documentation

- ***uint32_t UART_AdvFeatureInitTypeDef::AdvFeatureInit***
  Specifies which advanced UART features is initialized. Several Advanced Features may be initialized at the same time . This parameter can be a value of ***UART_Advanced_Features_Initialization_Type***.
- ***uint32_t UART_AdvFeatureInitTypeDef::TxPinLevelInvert***
  Specifies whether the TX pin active level is inverted. This parameter can be a value of ***UART_Tx_Inv***.
- ***uint32_t UART_AdvFeatureInitTypeDef::RxPinLevelInvert***
  Specifies whether the RX pin active level is inverted. This parameter can be a value of ***UART_Rx_Inv***.
- ***uint32_t UART_AdvFeatureInitTypeDef::DataInvert***
  Specifies whether data are inverted (positive/direct logic vs negative/inverted logic). This parameter can be a value of ***UART_Data_Inv***.
- ***uint32_t UART_AdvFeatureInitTypeDef::Swap***
  Specifies whether TX and RX pins are swapped. This parameter can be a value of ***UART_Rx_Tx_Swap***.
- ***uint32_t UART_AdvFeatureInitTypeDef::OverrunDisable***
  Specifies whether the reception overrun detection is disabled. This parameter can be a value of ***UART_Overrun_Disable***.
- ***uint32_t UART_AdvFeatureInitTypeDef::DMADisableonRxError***
  Specifies whether the DMA is disabled in case of reception error. This parameter can be a value of ***UART_DMA_Disable_on_Rx_Error***.
- ***uint32_t UART_AdvFeatureInitTypeDef::AutoBaudRateEnable***
  Specifies whether auto Baud rate detection is enabled. This parameter can be a value of ***UART_AutoBaudRate_Enable***.
- ***uint32_t UART_AdvFeatureInitTypeDef::AutoBaudRateMode***
  If auto Baud rate detection is enabled, specifies how the rate detection is carried out. This parameter can be a value of ***UART_AutoBaud_Rate_Mode***.
- ***uint32_t UART_AdvFeatureInitTypeDef::MSBFirst***
  Specifies whether MSB is sent first on UART line. This parameter can be a value of ***UART_MSB_First***.

50.1.3 __UART_HandleTypeDef

__UART_HandleTypeDef is defined in the stm32u0xx_hal_uart.h

Data Fields

- ***USART_TypeDef * Instance***
- ***UART_InitTypeDef Init***
- ***UART_AdvFeatureInitTypeDef AdvancedInit***
- ***const uint8_t * pTxBuffPtr***
- ***uint16_t TxXferSize***
- ***__IO uint16_t TxXferCount***
- ***uint8_t * pRxBuffPtr***
- ***uint16_t RxXferSize***
- ***__IO uint16_t RxXferCount***

- ***uint16_t Mask***
- ***uint32_t FifoMode***
- ***uint16_t NbRxDataToProcess***
- ***uint16_t NbTxDataToProcess***
- ***__IO HAL_UART_RxTypeTypeDef ReceptionType***
- ***__IO HAL_UART_RxEventTypeTypeDef RxEventType***
- ***void(* RxISR***
- ***void(* TxISR***
- ***DMA_HandleTypeDef * hdmatx***
- ***DMA_HandleTypeDef * hdmarx***
- ***HAL_LockTypeDef Lock***
- ***__IO HAL_UART_StateTypeDef gState***
- ***__IO HAL_UART_StateTypeDef RxState***
- ***__IO uint32_t ErrorCode***
- ***void(* TxHalfCpltCallback***
- ***void(* TxCpltCallback***
- ***void(* RxHalfCpltCallback***
- ***void(* RxCpltCallback***
- ***void(* ErrorCallback***
- ***void(* AbortCpltCallback***
- ***void(* AbortTransmitCpltCallback***
- ***void(* AbortReceiveCpltCallback***
- ***void(* WakeupCallback***
- ***void(* RxFifoFullCallback***
- ***void(* TxFifoEmptyCallback***
- ***void(* RxEventCallback***
- ***void(* MspInitCallback***
- ***void(* MspDeInitCallback***

Field Documentation

- ***USART_TypeDef* __UART_HandleTypeDef::Instance***
  UART registers base address
- ***UART_InitTypeDef __UART_HandleTypeDef::Init***
  UART communication parameters
- ***UART_AdvFeatureInitTypeDef __UART_HandleTypeDef::AdvancedInit***
  UART Advanced Features initialization parameters
- ***const uint8_t* __UART_HandleTypeDef::pTxBuffPtr***
  Pointer to UART Tx transfer Buffer
- ***uint16_t __UART_HandleTypeDef::TxXferSize***
  UART Tx Transfer size
- ***__IO uint16_t __UART_HandleTypeDef::TxXferCount***
  UART Tx Transfer Counter
- ***uint8_t* __UART_HandleTypeDef::pRxBuffPtr***
  Pointer to UART Rx transfer Buffer
- ***uint16_t __UART_HandleTypeDef::RxXferSize***
  UART Rx Transfer size
- ***__IO uint16_t __UART_HandleTypeDef::RxXferCount***
  UART Rx Transfer Counter
- ***uint16_t __UART_HandleTypeDef::Mask***
  UART Rx RDR register mask
- ***uint32_t __UART_HandleTypeDef::FifoMode***
  Specifies if the FIFO mode is being used. This parameter can be a value of ***UARTEx_FIFO_mode***.

- ***uint16_t __UART_HandleTypeDef::NbRxDataToProcess***
  Number of data to process during RX ISR execution
- ***uint16_t __UART_HandleTypeDef::NbTxDataToProcess***
  Number of data to process during TX ISR execution
- ***__IO HAL_UART_RxTypeTypeDef __UART_HandleTypeDef::ReceptionType***
  Type of ongoing reception
- ***__IO HAL_UART_RxEventTypeTypeDef __UART_HandleTypeDef::RxEventType***
  Type of Rx Event
- ***void(* __UART_HandleTypeDef::RxISR)(struct __UART_HandleTypeDef *huart)***
  Function pointer on Rx IRQ handler
- ***void(* __UART_HandleTypeDef::TxISR)(struct __UART_HandleTypeDef *huart)***
  Function pointer on Tx IRQ handler
- ***DMA_HandleTypeDef* __UART_HandleTypeDef::hdmatx***
  UART Tx DMA Handle parameters
- ***DMA_HandleTypeDef* __UART_HandleTypeDef::hdmarx***
  UART Rx DMA Handle parameters
- ***HAL_LockTypeDef __UART_HandleTypeDef::Lock***
  Locking object
- ***__IO HAL_UART_StateTypeDef __UART_HandleTypeDef::gState***
  UART state information related to global Handle management and also related to Tx operations. This parameter can be a value of **HAL_UART_StateTypeDef**
- ***__IO HAL_UART_StateTypeDef __UART_HandleTypeDef::RxState***
  UART state information related to Rx operations. This parameter can be a value of **HAL_UART_StateTypeDef**
- ***__IO uint32_t __UART_HandleTypeDef::ErrorCode***
  UART Error code
- ***void(* __UART_HandleTypeDef::TxHalfCpltCallback)(struct __UART_HandleTypeDef *huart)***
  UART Tx Half Complete Callback
- ***void(* __UART_HandleTypeDef::TxCpltCallback)(struct __UART_HandleTypeDef *huart)***
  UART Tx Complete Callback
- ***void(* __UART_HandleTypeDef::RxHalfCpltCallback)(struct __UART_HandleTypeDef *huart)***
  UART Rx Half Complete Callback
- ***void(* __UART_HandleTypeDef::RxCpltCallback)(struct __UART_HandleTypeDef *huart)***
  UART Rx Complete Callback
- ***void(* __UART_HandleTypeDef::ErrorCallback)(struct __UART_HandleTypeDef *huart)***
  UART Error Callback
- ***void(* __UART_HandleTypeDef::AbortCpltCallback)(struct __UART_HandleTypeDef *huart)***
  UART Abort Complete Callback
- ***void(* __UART_HandleTypeDef::AbortTransmitCpltCallback)(struct __UART_HandleTypeDef *huart)***
  UART Abort Transmit Complete Callback
- ***void(* __UART_HandleTypeDef::AbortReceiveCpltCallback)(struct __UART_HandleTypeDef *huart)***
  UART Abort Receive Complete Callback
- ***void(* __UART_HandleTypeDef::WakeupCallback)(struct __UART_HandleTypeDef *huart)***
  UART Wakeup Callback
- ***void(* __UART_HandleTypeDef::RxFifoFullCallback)(struct __UART_HandleTypeDef *huart)***
  UART Rx Fifo Full Callback
- ***void(* __UART_HandleTypeDef::TxFifoEmptyCallback)(struct __UART_HandleTypeDef *huart)***
  UART Tx Fifo Empty Callback
- ***void(* __UART_HandleTypeDef::RxEventCallback)(struct __UART_HandleTypeDef *huart, uint16_t Pos)***
  UART Reception Event Callback
- ***void(* __UART_HandleTypeDef::MspInitCallback)(struct __UART_HandleTypeDef *huart)***
  UART Msp Init callback
- ***void(* __UART_HandleTypeDef::MspDeInitCallback)(struct __UART_HandleTypeDef *huart)***
  UART Msp DeInit callback

50.2 UART Firmware driver API description

The following section lists the various functions of the UART library.

50.2.1 How to use this driver

The UART HAL driver can be used as follows:

1. Declare a UART_HandleTypeDef handle structure (eg. UART_HandleTypeDef huart).
2. Initialize the UART low level resources by implementing the HAL_UART_MspInit() API:
   - Enable the USARTx interface clock.
   - UART pins configuration:
     - Enable the clock for the UART GPIOs.
     - Configure these UART pins as alternate function pull-up.
   - NVIC configuration if you need to use interrupt process (HAL_UART_Transmit_IT() and HAL_UART_Receive_IT() APIs):
     - Configure the USARTx interrupt priority.
     - Enable the NVIC USART IRQ handle.
   - UART interrupts handling:

   Note: The specific UART interrupts (Transmission complete interrupt, RXNE interrupt, RX/TX FIFOs related interrupts and Error Interrupts) are managed using the macros __HAL_UART_ENABLE_IT() and __HAL_UART_DISABLE_IT() inside the transmit and receive processes.

   - DMA Configuration if you need to use DMA process (HAL_UART_Transmit_DMA() and HAL_UART_Receive_DMA() APIs):
     - Declare a DMA handle structure for the Tx/Rx channel.
     - Enable the DMAx interface clock.
     - Configure the declared DMA handle structure with the required Tx/Rx parameters.
     - Configure the DMA Tx/Rx channel.
     - Associate the initialized DMA handle to the UART DMA Tx/Rx handle.
     - Configure the priority and enable the NVIC for the transfer complete interrupt on the DMA Tx/Rx channel.
3. Program the Baud Rate, Word Length, Stop Bit, Parity, Prescaler value , Hardware flow control and Mode (Receiver/Transmitter) in the huart handle Init structure.
4. If required, program UART advanced features (TX/RX pins swap, auto Baud rate detection,...) in the huart handle AdvancedInit structure.
5. For the UART asynchronous mode, initialize the UART registers by calling the HAL_UART_Init() API.
6. For the UART Half duplex mode, initialize the UART registers by calling the HAL_HalfDuplex_Init() API.
7. For the UART LIN (Local Interconnection Network) mode, initialize the UART registers by calling the HAL_LIN_Init() API.
8. For the UART Multiprocessor mode, initialize the UART registers by calling the HAL_MultiProcessor_Init() API.
9. For the UART RS485 Driver Enabled mode, initialize the UART registers by calling the HAL_RS485Ex_Init() API.

Note: These API's (HAL_UART_Init(), HAL_HalfDuplex_Init(), HAL_LIN_Init(), HAL_MultiProcessor_Init(), also configure the low level Hardware GPIO, CLOCK, CORTEX...etc) by calling the customized HAL_UART_MspInit() API.

50.2.2 Callback registration

The compilation define USE_HAL_UART_REGISTER_CALLBACKS when set to 1 allows the user to configure dynamically the driver callbacks.

Use Function HAL_UART_RegisterCallback() to register a user callback. Function HAL_UART_RegisterCallback() allows to register following callbacks:

- TxHalfCpltCallback : Tx Half Complete Callback.
- TxCpltCallback : Tx Complete Callback.
- RxHalfCpltCallback : Rx Half Complete Callback.

- RxCpltCallback : Rx Complete Callback.
- ErrorCallback : Error Callback.
- AbortCpltCallback : Abort Complete Callback.
- AbortTransmitCpltCallback : Abort Transmit Complete Callback.
- AbortReceiveCpltCallback : Abort Receive Complete Callback.
- WakeupCallback : Wakeup Callback.
- RxFifoFullCallback : Rx Fifo Full Callback.
- TxFifoEmptyCallback : Tx Fifo Empty Callback.
- MspInitCallback : UART MspInit.
- MspDeInitCallback : UART MspDeInit. This function takes as parameters the HAL peripheral handle, the Callback ID and a pointer to the user callback function.

Use function HAL_UART_UnRegisterCallback() to reset a callback to the default weak function. HAL_UART_UnRegisterCallback() takes as parameters the HAL peripheral handle, and the Callback ID. This function allows to reset following callbacks:

- TxHalfCpltCallback : Tx Half Complete Callback.
- TxCpltCallback : Tx Complete Callback.
- RxHalfCpltCallback : Rx Half Complete Callback.
- RxCpltCallback : Rx Complete Callback.
- ErrorCallback : Error Callback.
- AbortCpltCallback : Abort Complete Callback.
- AbortTransmitCpltCallback : Abort Transmit Complete Callback.
- AbortReceiveCpltCallback : Abort Receive Complete Callback.
- WakeupCallback : Wakeup Callback.
- RxFifoFullCallback : Rx Fifo Full Callback.
- TxFifoEmptyCallback : Tx Fifo Empty Callback.
- MspInitCallback : UART MspInit.
- MspDeInitCallback : UART MspDeInit.

For specific callback RxEventCallback, use dedicated registration/reset functions: respectively HAL_UART_RegisterRxEventCallback() , HAL_UART_UnRegisterRxEventCallback().

By default, after the HAL_UART_Init() and when the state is HAL_UART_STATE_RESET all callbacks are set to the corresponding weak functions: examples HAL_UART_TxCpltCallback(), HAL_UART_RxHalfCpltCallback(). Exception done for MspInit and MspDeInit functions that are respectively reset to the legacy weak functions in the HAL_UART_Init() and HAL_UART_DeInit() only when these callbacks are null (not registered beforehand). If not, MspInit or MspDeInit are not null, the HAL_UART_Init() and HAL_UART_DeInit() keep and use the user MspInit/MspDeInit callbacks (registered beforehand).

Callbacks can be registered/unregistered in HAL_UART_STATE_READY state only. Exception done MspInit/MspDeInit that can be registered/unregistered in HAL_UART_STATE_READY or HAL_UART_STATE_RESET state, thus registered (user) MspInit/DeInit callbacks can be used during the Init/DeInit. In that case first register the MspInit/MspDeInit user callbacks using HAL_UART_RegisterCallback() before calling HAL_UART_DeInit() or HAL_UART_Init() function.

When The compilation define USE_HAL_UART_REGISTER_CALLBACKS is set to 0 or not defined, the callback registration feature is not available and weak callbacks are used.

50.2.3 Initialization and Configuration functions

This subsection provides a set of functions allowing to initialize the USARTx or the UARTy in asynchronous mode.

- For the asynchronous mode the parameters below can be configured:
  - Baud Rate
  - Word Length
  - Stop Bit
  - Parity: If the parity is enabled, then the MSB bit of the data written in the data register is transmitted but is changed by the parity bit.
  - Hardware flow control
  - Receiver/transmitter modes
  - Over Sampling Method
  - One-Bit Sampling Method
- For the asynchronous mode, the following advanced features can be configured as well:
  - TX and/or RX pin level inversion
  - data logical level inversion
  - RX and TX pins swap
  - RX overrun detection disabling
  - DMA disabling on RX error
  - MSB first on communication line
  - auto Baud rate detection

The HAL_UART_Init(), HAL_HalfDuplex_Init(), HAL_LIN_Init()and HAL_MultiProcessor_Init()API follow respectively the UART asynchronous, UART Half duplex, UART LIN mode and UART multiprocessor mode configuration procedures (details for the procedures are available in reference manual).

This section contains the following APIs:

- ***HAL_UART_Init()***
- ***HAL_HalfDuplex_Init()***
- ***HAL_LIN_Init()***
- ***HAL_MultiProcessor_Init()***
- ***HAL_UART_DeInit()***
- ***HAL_UART_MspInit()***
- ***HAL_UART_MspDeInit()***
- ***HAL_UART_RegisterCallback()***
- ***HAL_UART_UnRegisterCallback()***
- ***HAL_UART_RegisterRxEventCallback()***
- ***HAL_UART_UnRegisterRxEventCallback()***

50.2.4 IO operation functions

This section contains the following APIs:

- ***HAL_UART_Transmit()***
- ***HAL_UART_Receive()***
- ***HAL_UART_Transmit_IT()***
- ***HAL_UART_Receive_IT()***
- ***HAL_UART_Transmit_DMA()***
- ***HAL_UART_Receive_DMA()***
- ***HAL_UART_DMAPause()***
- ***HAL_UART_DMAResume()***
- ***HAL_UART_DMAStop()***
- ***HAL_UART_Abort()***
- ***HAL_UART_AbortTransmit()***
- ***HAL_UART_AbortReceive()***
- ***HAL_UART_Abort_IT()***
- ***HAL_UART_AbortTransmit_IT()***

- *HAL_UART_AbortReceive_IT()*
- *HAL_UART_IRQHandler()*
- *HAL_UART_TxCpltCallback()*
- *HAL_UART_TxHalfCpltCallback()*
- *HAL_UART_RxCpltCallback()*
- *HAL_UART_RxHalfCpltCallback()*
- *HAL_UART_ErrorCallback()*
- *HAL_UART_AbortCpltCallback()*
- *HAL_UART_AbortTransmitCpltCallback()*
- *HAL_UART_AbortReceiveCpltCallback()*
- *HAL_UARTEx_RxEventCallback()*

50.2.5 Peripheral Control functions

This subsection provides a set of functions allowing to control the UART.

- HAL_UART_ReceiverTimeout_Config() API allows to configure the receiver timeout value on the fly
- HAL_UART_EnableReceiverTimeout() API enables the receiver timeout feature
- HAL_UART_DisableReceiverTimeout() API disables the receiver timeout feature
- HAL_MultiProcessor_EnableMuteMode() API enables mute mode
- HAL_MultiProcessor_DisableMuteMode() API disables mute mode
- HAL_MultiProcessor_EnterMuteMode() API enters mute mode
- UART_SetConfig() API configures the UART peripheral
- UART_AdvFeatureConfig() API optionally configures the UART advanced features
- UART_CheckIdleState() API ensures that TEACK and/or REACK are set after initialization
- HAL_HalfDuplex_EnableTransmitter() API disables receiver and enables transmitter
- HAL_HalfDuplex_EnableReceiver() API disables transmitter and enables receiver
- HAL_LIN_SendBreak() API transmits the break characters

This section contains the following APIs:

- *HAL_UART_ReceiverTimeout_Config()*
- *HAL_UART_EnableReceiverTimeout()*
- *HAL_UART_DisableReceiverTimeout()*
- *HAL_MultiProcessor_EnableMuteMode()*
- *HAL_MultiProcessor_DisableMuteMode()*
- *HAL_MultiProcessor_EnterMuteMode()*
- *HAL_HalfDuplex_EnableTransmitter()*
- *HAL_HalfDuplex_EnableReceiver()*
- *HAL_LIN_SendBreak()*

50.2.6 Peripheral State and Error functions

This subsection provides functions allowing to :

- Return the UART handle state.
- Return the UART handle error code

This section contains the following APIs:

- *HAL_UART_GetState()*
- *HAL_UART_GetError()*

50.2.7 Detailed description of functions

HAL_UART_Init

Function name

HAL_StatusTypeDef HAL_UART_Init (UART_HandleTypeDef * huart)

Function description

Initialize the UART mode according to the specified parameters in the UART_InitTypeDef and initialize the associated handle.

Parameters

- **huart:** UART handle.

Return values

- **HAL:** status

HAL_HalfDuplex_Init

Function name

HAL_StatusTypeDef HAL_HalfDuplex_Init (UART_HandleTypeDef * huart)

Function description

Initialize the half-duplex mode according to the specified parameters in the UART_InitTypeDef and creates the associated handle.

Parameters

- **huart:** UART handle.

Return values

- **HAL:** status

HAL_LIN_Init

Function name

HAL_StatusTypeDef HAL_LIN_Init (UART_HandleTypeDef * huart, uint32_t BreakDetectLength)

Function description

Initialize the LIN mode according to the specified parameters in the UART_InitTypeDef and creates the associated handle.

Parameters

- **huart:** UART handle.
- **BreakDetectLength:** Specifies the LIN break detection length. This parameter can be one of the following values:
  - UART_LINBREAKDETECTLENGTH_10B 10-bit break detection
  - UART_LINBREAKDETECTLENGTH_11B 11-bit break detection

Return values

- **HAL:** status

HAL_MultiProcessor_Init

Function name

HAL_StatusTypeDef HAL_MultiProcessor_Init (UART_HandleTypeDef * huart, uint8_t Address, uint32_t WakeUpMethod)

Function description

Initialize the multiprocessor mode according to the specified parameters in the UART_InitTypeDef and initialize the associated handle.

Parameters

- **huart:** UART handle.
- **Address:** UART node address (4-, 6-, 7- or 8-bit long).
- **WakeUpMethod:** Specifies the UART wakeup method. This parameter can be one of the following values:
  - UART_WAKEUPMETHOD_IDLELINE WakeUp by an idle line detection
  - UART_WAKEUPMETHOD_ADDRESSMARK WakeUp by an address mark

Return values

- **HAL:** status

Notes

- If the user resorts to idle line detection wake up, the Address parameter is useless and ignored by the initialization function.
- If the user resorts to address mark wake up, the address length detection is configured by default to 4 bits only. For the UART to be able to manage 6-, 7- or 8-bit long addresses detection, the API HAL_MultiProcessorEx_AddressLength_Set() must be called after HAL_MultiProcessor_Init().

HAL_UART_DeInit

Function name

HAL_StatusTypeDef HAL_UART_DeInit (UART_HandleTypeDef * huart)

Function description

DeInitialize the UART peripheral.

Parameters

- **huart:** UART handle.

Return values

- **HAL:** status

HAL_UART_MspInit

Function name

void HAL_UART_MspInit (UART_HandleTypeDef * huart)

Function description

Initialize the UART MSP.

Parameters

- **huart:** UART handle.

Return values

- **None:**

HAL_UART_MspDeInit

Function name

void HAL_UART_MspDeInit (UART_HandleTypeDef * huart)

Function description

DeInitialize the UART MSP.

Parameters

- **huart:** UART handle.

Return values

- **None:**

HAL_UART_RegisterCallback

Function name

HAL_StatusTypeDef HAL_UART_RegisterCallback (UART_HandleTypeDef * huart, HAL_UART_CallbackIDTypeDef CallbackID, pUART_CallbackTypeDef pCallback)

Function description

Register a User UART Callback To be used to override the weak predefined callback.

Parameters

- **huart:** uart handle
- **CallbackID:** ID of the callback to be registered This parameter can be one of the following values:
  - HAL_UART_TX_HALFCOMPLETE_CB_ID Tx Half Complete Callback ID
  - HAL_UART_TX_COMPLETE_CB_ID Tx Complete Callback ID
  - HAL_UART_RX_HALFCOMPLETE_CB_ID Rx Half Complete Callback ID
  - HAL_UART_RX_COMPLETE_CB_ID Rx Complete Callback ID
  - HAL_UART_ERROR_CB_ID Error Callback ID
  - HAL_UART_ABORT_COMPLETE_CB_ID Abort Complete Callback ID
  - HAL_UART_ABORT_TRANSMIT_COMPLETE_CB_ID Abort Transmit Complete Callback ID
  - HAL_UART_ABORT_RECEIVE_COMPLETE_CB_ID Abort Receive Complete Callback ID
  - HAL_UART_WAKEUP_CB_ID Wakeup Callback ID
  - HAL_UART_RX_FIFO_FULL_CB_ID Rx Fifo Full Callback ID
  - HAL_UART_TX_FIFO_EMPTY_CB_ID Tx Fifo Empty Callback ID
  - HAL_UART_MSPINIT_CB_ID MspInit Callback ID
  - HAL_UART_MSPDEINIT_CB_ID MspDeInit Callback ID
- **pCallback:** pointer to the Callback function

Return values

- **HAL:** status

Notes

- The HAL_UART_RegisterCallback() may be called before HAL_UART_Init(), HAL_HalfDuplex_Init(), HAL_LIN_Init(), HAL_MultiProcessor_Init() or HAL_RS485Ex_Init() in HAL_UART_STATE_RESET to register callbacks for HAL_UART_MSPINIT_CB_ID and HAL_UART_MSPDEINIT_CB_ID

HAL_UART_UnRegisterCallback

Function name

HAL_StatusTypeDef HAL_UART_UnRegisterCallback (UART_HandleTypeDef * huart, HAL_UART_CallbackIDTypeDef CallbackID)

Function description

Unregister an UART Callback UART callaback is redirected to the weak predefined callback.

Parameters

- **huart:** uart handle
- **CallbackID:** ID of the callback to be unregistered This parameter can be one of the following values:
  - HAL_UART_TX_HALFCOMPLETE_CB_ID Tx Half Complete Callback ID
  - HAL_UART_TX_COMPLETE_CB_ID Tx Complete Callback ID
  - HAL_UART_RX_HALFCOMPLETE_CB_ID Rx Half Complete Callback ID
  - HAL_UART_RX_COMPLETE_CB_ID Rx Complete Callback ID
  - HAL_UART_ERROR_CB_ID Error Callback ID
  - HAL_UART_ABORT_COMPLETE_CB_ID Abort Complete Callback ID
  - HAL_UART_ABORT_TRANSMIT_COMPLETE_CB_ID Abort Transmit Complete Callback ID
  - HAL_UART_ABORT_RECEIVE_COMPLETE_CB_ID Abort Receive Complete Callback ID
  - HAL_UART_WAKEUP_CB_ID Wakeup Callback ID
  - HAL_UART_RX_FIFO_FULL_CB_ID Rx Fifo Full Callback ID
  - HAL_UART_TX_FIFO_EMPTY_CB_ID Tx Fifo Empty Callback ID
  - HAL_UART_MSPINIT_CB_ID MspInit Callback ID
  - HAL_UART_MSPDEINIT_CB_ID MspDeInit Callback ID

Return values

- **HAL:** status

Notes

- The HAL_UART_UnRegisterCallback() may be called before HAL_UART_Init(), HAL_HalfDuplex_Init(), HAL_LIN_Init(), HAL_MultiProcessor_Init() or HAL_RS485Ex_Init() in HAL_UART_STATE_RESET to un-register callbacks for HAL_UART_MSPINIT_CB_ID and HAL_UART_MSPDEINIT_CB_ID

HAL_UART_RegisterRxEventCallback

Function name

HAL_StatusTypeDef HAL_UART_RegisterRxEventCallback (UART_HandleTypeDef * huart, pUART_RxEventCallbackTypeDef pCallback)

Function description

Register a User UART Rx Event Callback To be used instead of the weak predefined callback.

Parameters

- **huart:** Uart handle
- **pCallback:** Pointer to the Rx Event Callback function

Return values

- **HAL:** status

HAL_UART_UnRegisterRxEventCallback

Function name

HAL_StatusTypeDef HAL_UART_UnRegisterRxEventCallback (UART_HandleTypeDef * huart)

Function description

UnRegister the UART Rx Event Callback UART Rx Event Callback is redirected to the weak HAL_UARTEx_RxEventCallback() predefined callback.

Parameters

- **huart:** Uart handle

Return values

- **HAL:** status

HAL_UART_Transmit

Function name

HAL_StatusTypeDef HAL_UART_Transmit (UART_HandleTypeDef * huart, const uint8_t * pData, uint16_t Size, uint32_t Timeout)

Function description

Send an amount of data in blocking mode.

Parameters

- **huart:** UART handle.
- **pData:** Pointer to data buffer (u8 or u16 data elements).
- **Size:** Amount of data elements (u8 or u16) to be sent.
- **Timeout:** Timeout duration.

Return values

- **HAL:** status

Notes

- When UART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), the sent data is handled as a set of u16. In this case, Size must indicate the number of u16 provided through pData.
- When FIFO mode is enabled, writing a data in the TDR register adds one data to the TXFIFO. Write operations to the TDR register are performed when TXFNF flag is set. From hardware perspective, TXFNF flag and TXE are mapped on the same bit-field.
- When UART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), address of user data buffer containing data to be sent, should be aligned on a half word frontier (16 bits) (as sent data will be handled using u16 pointer cast). Depending on compilation chain, use of specific alignment compilation directives or pragmas might be required to ensure proper alignment for pData.

HAL_UART_Receive

Function name

HAL_StatusTypeDef HAL_UART_Receive (UART_HandleTypeDef * huart, uint8_t * pData, uint16_t Size, uint32_t Timeout)

Function description

Receive an amount of data in blocking mode.

Parameters

- **huart:** UART handle.
- **pData:** Pointer to data buffer (u8 or u16 data elements).
- **Size:** Amount of data elements (u8 or u16) to be received.
- **Timeout:** Timeout duration.

Return values

- **HAL:** status

Notes

- When UART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), the received data is handled as a set of u16. In this case, Size must indicate the number of u16 available through pData.
- When FIFO mode is enabled, the RXFNE flag is set as long as the RXFIFO is not empty. Read operations from the RDR register are performed when RXFNE flag is set. From hardware perspective, RXFNE flag and RXNE are mapped on the same bit-field.
- When UART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), address of user data buffer for storing data to be received, should be aligned on a half word frontier (16 bits) (as received data will be handled using u16 pointer cast). Depending on compilation chain, use of specific alignment compilation directives or pragmas might be required to ensure proper alignment for pData.

HAL_UART_Transmit_IT

Function name

HAL_StatusTypeDef HAL_UART_Transmit_IT (UART_HandleTypeDef * huart, const uint8_t * pData, uint16_t Size)

Function description

Send an amount of data in interrupt mode.

Parameters

- **huart:** UART handle.
- **pData:** Pointer to data buffer (u8 or u16 data elements).
- **Size:** Amount of data elements (u8 or u16) to be sent.

Return values

- **HAL:** status

Notes

- When UART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), the sent data is handled as a set of u16. In this case, Size must indicate the number of u16 provided through pData.
- When UART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), address of user data buffer containing data to be sent, should be aligned on a half word frontier (16 bits) (as sent data will be handled using u16 pointer cast). Depending on compilation chain, use of specific alignment compilation directives or pragmas might be required to ensure proper alignment for pData.

HAL_UART_Receive_IT

Function name

HAL_StatusTypeDef HAL_UART_Receive_IT (UART_HandleTypeDef * huart, uint8_t * pData, uint16_t Size)

Function description

Receive an amount of data in interrupt mode.

Parameters

- **huart:** UART handle.
- **pData:** Pointer to data buffer (u8 or u16 data elements).
- **Size:** Amount of data elements (u8 or u16) to be received.

Return values

- **HAL:** status

Notes

- When UART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), the received data is handled as a set of u16. In this case, Size must indicate the number of u16 available through pData.
- When UART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), address of user data buffer for storing data to be received, should be aligned on a half word frontier (16 bits) (as received data will be handled using u16 pointer cast). Depending on compilation chain, use of specific alignment compilation directives or pragmas might be required to ensure proper alignment for pData.

HAL_UART_Transmit_DMA

Function name

HAL_StatusTypeDef HAL_UART_Transmit_DMA (UART_HandleTypeDef * huart, const uint8_t * pData, uint16_t Size)

Function description

Send an amount of data in DMA mode.

Parameters

- **huart:** UART handle.
- **pData:** Pointer to data buffer (u8 or u16 data elements).
- **Size:** Amount of data elements (u8 or u16) to be sent.

Return values

- **HAL:** status

Notes

- When UART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), the sent data is handled as a set of u16. In this case, Size must indicate the number of u16 provided through pData.
- When UART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), address of user data buffer containing data to be sent, should be aligned on a half word frontier (16 bits) (as sent data will be handled by DMA from halfword frontier). Depending on compilation chain, use of specific alignment compilation directives or pragmas might be required to ensure proper alignment for pData.

HAL_UART_Receive_DMA

Function name

HAL_StatusTypeDef HAL_UART_Receive_DMA (UART_HandleTypeDef * huart, uint8_t * pData, uint16_t Size)

Function description

Receive an amount of data in DMA mode.

Parameters

- **huart:** UART handle.
- **pData:** Pointer to data buffer (u8 or u16 data elements).
- **Size:** Amount of data elements (u8 or u16) to be received.

Return values

- **HAL:** status

Notes

- When the UART parity is enabled (PCE = 1), the received data contain the parity bit (MSB position).
- When UART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), the received data is handled as a set of u16. In this case, Size must indicate the number of u16 available through pData.
- When UART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), address of user data buffer for storing data to be received, should be aligned on a half word frontier (16 bits) (as received data will be handled by DMA from halfword frontier). Depending on compilation chain, use of specific alignment compilation directives or pragmas might be required to ensure proper alignment for pData.

HAL_UART_DMAPause

Function name

HAL_StatusTypeDef HAL_UART_DMAPause (UART_HandleTypeDef * huart)

Function description

Pause the DMA Transfer.

Parameters

- **huart:** UART handle.

Return values

- **HAL:** status

HAL_UART_DMAResume

Function name

HAL_StatusTypeDef HAL_UART_DMAResume (UART_HandleTypeDef * huart)

Function description

Resume the DMA Transfer.

Parameters

- **huart:** UART handle.

Return values

- **HAL:** status

HAL_UART_DMAStop

Function name

HAL_StatusTypeDef HAL_UART_DMAStop (UART_HandleTypeDef * huart)

Function description

Stop the DMA Transfer.

Parameters

- **huart:** UART handle.

Return values

- **HAL:** status

HAL_UART_Abort

Function name

HAL_StatusTypeDef HAL_UART_Abort (UART_HandleTypeDef * huart)

Function description

Abort ongoing transfers (blocking mode).

Parameters

- **huart:** UART handle.

Return values

- **HAL:** status

Notes

- This procedure could be used for aborting any ongoing transfer started in Interrupt or DMA mode. This procedure performs following operations : Disable UART Interrupts (Tx and Rx)Disable the DMA transfer in the peripheral register (if enabled)Abort DMA transfer by calling HAL_DMA_Abort (in case of transfer in DMA mode)Set handle State to READY
- This procedure is executed in blocking mode : when exiting function, Abort is considered as completed.

HAL_UART_AbortTransmit

Function name

HAL_StatusTypeDef HAL_UART_AbortTransmit (UART_HandleTypeDef * huart)

Function description

Abort ongoing Transmit transfer (blocking mode).

Parameters

- **huart:** UART handle.

Return values

- **HAL:** status

Notes

- This procedure could be used for aborting any ongoing Tx transfer started in Interrupt or DMA mode. This procedure performs following operations : Disable UART Interrupts (Tx)Disable the DMA transfer in the peripheral register (if enabled)Abort DMA transfer by calling HAL_DMA_Abort (in case of transfer in DMA mode)Set handle State to READY
- This procedure is executed in blocking mode : when exiting function, Abort is considered as completed.

HAL_UART_AbortReceive

Function name

HAL_StatusTypeDef HAL_UART_AbortReceive (UART_HandleTypeDef * huart)

Function description

Abort ongoing Receive transfer (blocking mode).

Parameters

- **huart:** UART handle.

Return values

- **HAL:** status

Notes

- This procedure could be used for aborting any ongoing Rx transfer started in Interrupt or DMA mode. This procedure performs following operations : Disable UART Interrupts (Rx)Disable the DMA transfer in the peripheral register (if enabled)Abort DMA transfer by calling HAL_DMA_Abort (in case of transfer in DMA mode)Set handle State to READY
- This procedure is executed in blocking mode : when exiting function, Abort is considered as completed.

HAL_UART_Abort_IT

Function name

HAL_StatusTypeDef HAL_UART_Abort_IT (UART_HandleTypeDef * huart)

Function description

Abort ongoing transfers (Interrupt mode).

Parameters

- **huart:** UART handle.

Return values

- **HAL:** status

Notes

- This procedure could be used for aborting any ongoing transfer started in Interrupt or DMA mode. This procedure performs following operations : Disable UART Interrupts (Tx and Rx)Disable the DMA transfer in the peripheral register (if enabled)Abort DMA transfer by calling HAL_DMA_Abort_IT (in case of transfer in DMA mode)Set handle State to READYAt abort completion, call user abort complete callback
- This procedure is executed in Interrupt mode, meaning that abort procedure could be considered as completed only when user abort complete callback is executed (not when exiting function).

HAL_UART_AbortTransmit_IT

Function name

HAL_StatusTypeDef HAL_UART_AbortTransmit_IT (UART_HandleTypeDef * huart)

Function description

Abort ongoing Transmit transfer (Interrupt mode).

Parameters

- **huart:** UART handle.

Return values

- **HAL:** status

Notes

- This procedure could be used for aborting any ongoing Tx transfer started in Interrupt or DMA mode. This procedure performs following operations : Disable UART Interrupts (Tx)Disable the DMA transfer in the peripheral register (if enabled)Abort DMA transfer by calling HAL_DMA_Abort_IT (in case of transfer in DMA mode)Set handle State to READYAt abort completion, call user abort complete callback
- This procedure is executed in Interrupt mode, meaning that abort procedure could be considered as completed only when user abort complete callback is executed (not when exiting function).

HAL_UART_AbortReceive_IT

Function name

HAL_StatusTypeDef HAL_UART_AbortReceive_IT (UART_HandleTypeDef * huart)

Function description

Abort ongoing Receive transfer (Interrupt mode).

Parameters

- **huart:** UART handle.

Return values

- **HAL:** status

Notes

- This procedure could be used for aborting any ongoing Rx transfer started in Interrupt or DMA mode. This procedure performs following operations : Disable UART Interrupts (Rx)Disable the DMA transfer in the peripheral register (if enabled)Abort DMA transfer by calling HAL_DMA_Abort_IT (in case of transfer in DMA mode)Set handle State to READYAt abort completion, call user abort complete callback
- This procedure is executed in Interrupt mode, meaning that abort procedure could be considered as completed only when user abort complete callback is executed (not when exiting function).

HAL_UART_IRQHandler

Function name

void HAL_UART_IRQHandler (UART_HandleTypeDef * huart)

Function description

Handle UART interrupt request.

Parameters

- **huart:** UART handle.

Return values

- **None:**

HAL_UART_TxHalfCpltCallback

Function name

void HAL_UART_TxHalfCpltCallback (UART_HandleTypeDef * huart)

Function description

Tx Half Transfer completed callback.

Parameters

- **huart:** UART handle.

Return values

- **None:**

HAL_UART_TxCpltCallback

Function name

void HAL_UART_TxCpltCallback (UART_HandleTypeDef * huart)

Function description

Tx Transfer completed callback.

Parameters

- **huart:** UART handle.

Return values

- **None:**

HAL_UART_RxHalfCpltCallback

Function name

void HAL_UART_RxHalfCpltCallback (UART_HandleTypeDef * huart)

Function description

Rx Half Transfer completed callback.

Parameters

- **huart:** UART handle.

Return values

- **None:**

HAL_UART_RxCpltCallback

Function name

void HAL_UART_RxCpltCallback (UART_HandleTypeDef * huart)

Function description

Rx Transfer completed callback.

Parameters

- **huart:** UART handle.

Return values

- **None:**

HAL_UART_ErrorCallback

Function name

void HAL_UART_ErrorCallback (UART_HandleTypeDef * huart)

Function description

UART error callback.

Parameters

- **huart:** UART handle.

Return values

- **None:**

HAL_UART_AbortCpltCallback

Function name

void HAL_UART_AbortCpltCallback (UART_HandleTypeDef * huart)

Function description

UART Abort Complete callback.

Parameters

- **huart:** UART handle.

Return values

- **None:**

HAL_UART_AbortTransmitCpltCallback

Function name

void HAL_UART_AbortTransmitCpltCallback (UART_HandleTypeDef * huart)

Function description

UART Abort Complete callback.

Parameters

- **huart:** UART handle.

Return values

- **None:**

HAL_UART_AbortReceiveCpltCallback

Function name

void HAL_UART_AbortReceiveCpltCallback (UART_HandleTypeDef * huart)

Function description

UART Abort Receive Complete callback.

Parameters

- **huart:** UART handle.

Return values

- **None:**

HAL_UARTEx_RxEventCallback

Function name

void HAL_UARTEx_RxEventCallback (UART_HandleTypeDef * huart, uint16_t Size)

Function description

Reception Event Callback (Rx event notification called after use of advanced reception service).

Parameters

- **huart:** UART handle
- **Size:** Number of data available in application reception buffer (indicates a position in reception buffer until which, data are available)

Return values

- **None:**

HAL_UART_ReceiverTimeout_Config

Function name

void HAL_UART_ReceiverTimeout_Config (UART_HandleTypeDef * huart, uint32_t TimeoutValue)

Function description

Update on the fly the receiver timeout value in RTOR register.

Parameters

- **huart:** Pointer to a UART_HandleTypeDef structure that contains the configuration information for the specified UART module.
- **TimeoutValue:** receiver timeout value in number of baud blocks. The timeout value must be less or equal to 0x0FFFFFFF.

Return values

- **None:**

HAL_UART_EnableReceiverTimeout

Function name

HAL_StatusTypeDef HAL_UART_EnableReceiverTimeout (UART_HandleTypeDef * huart)

Function description

Enable the UART receiver timeout feature.

Parameters

- **huart:** Pointer to a UART_HandleTypeDef structure that contains the configuration information for the specified UART module.

Return values

- **HAL:** status

HAL_UART_DisableReceiverTimeout

Function name

HAL_StatusTypeDef HAL_UART_DisableReceiverTimeout (UART_HandleTypeDef * huart)

Function description

Disable the UART receiver timeout feature.

Parameters

- **huart:** Pointer to a UART_HandleTypeDef structure that contains the configuration information for the specified UART module.

Return values

- **HAL:** status

HAL_LIN_SendBreak

Function name

HAL_StatusTypeDef HAL_LIN_SendBreak (UART_HandleTypeDef * huart)

Function description

Transmit break characters.

Parameters

- **huart:** UART handle.

Return values

- **HAL:** status

HAL_MultiProcessor_EnableMuteMode

Function name

HAL_StatusTypeDef HAL_MultiProcessor_EnableMuteMode (UART_HandleTypeDef * huart)

Function description

Enable UART in mute mode (does not mean UART enters mute mode; to enter mute mode, HAL_MultiProcessor_EnterMuteMode() API must be called).

Parameters

- **huart:** UART handle.

Return values

- **HAL:** status

HAL_MultiProcessor_DisableMuteMode

Function name

HAL_StatusTypeDef HAL_MultiProcessor_DisableMuteMode (UART_HandleTypeDef * huart)

Function description

Disable UART mute mode (does not mean the UART actually exits mute mode as it may not have been in mute mode at this very moment).

Parameters

- **huart:** UART handle.

Return values

- **HAL:** status

HAL_MultiProcessor_EnterMuteMode

Function name

void HAL_MultiProcessor_EnterMuteMode (UART_HandleTypeDef * huart)

Function description

Enter UART mute mode (means UART actually enters mute mode).

Parameters

- **huart:** UART handle.

Return values

- **None:**

Notes

- To exit from mute mode, HAL_MultiProcessor_DisableMuteMode() API must be called.

HAL_HalfDuplex_EnableTransmitter

Function name

HAL_StatusTypeDef HAL_HalfDuplex_EnableTransmitter (UART_HandleTypeDef * huart)

Function description

Enable the UART transmitter and disable the UART receiver.

Parameters

- **huart:** UART handle.

Return values

- **HAL:** status

HAL_HalfDuplex_EnableReceiver

Function name

HAL_StatusTypeDef HAL_HalfDuplex_EnableReceiver (UART_HandleTypeDef * huart)

Function description

Enable the UART receiver and disable the UART transmitter.

Parameters

- **huart:** UART handle.

Return values

- **HAL:** status.

HAL_UART_GetState

Function name

HAL_UART_StateTypeDef HAL_UART_GetState (const UART_HandleTypeDef * huart)

Function description

Return the UART handle state.

Parameters

- **huart:** Pointer to a UART_HandleTypeDef structure that contains the configuration information for the specified UART.

Return values

- **HAL:** state

HAL_UART_GetError

Function name

uint32_t HAL_UART_GetError (const UART_HandleTypeDef * huart)

Function description

Return the UART handle error code.

Parameters

- **huart:** Pointer to a UART_HandleTypeDef structure that contains the configuration information for the specified UART.

Return values

- **UART:** Error Code

UART_InitCallbacksToDefault

Function name

void UART_InitCallbacksToDefault (UART_HandleTypeDef * huart)

Function description

Initialize the callbacks to their default values.

Parameters

- **huart:** UART handle.

Return values

- **none:**

UART_SetConfig

Function name

HAL_StatusTypeDef UART_SetConfig (UART_HandleTypeDef * huart)

Function description

Configure the UART peripheral.

Parameters

- **huart:** UART handle.

Return values

- **HAL:** status

UART_CheckIdleState

Function name

HAL_StatusTypeDef UART_CheckIdleState (UART_HandleTypeDef * huart)

Function description

Check the UART Idle State.

Parameters

- **huart:** UART handle.

Return values

- **HAL:** status

UART_WaitOnFlagUntilTimeout

Function name

HAL_StatusTypeDef UART_WaitOnFlagUntilTimeout (UART_HandleTypeDef * huart, uint32_t Flag, FlagStatus Status, uint32_t Tickstart, uint32_t Timeout)

Function description

This function handles UART Communication Timeout.

Parameters

- **huart:** UART handle.
- **Flag:** Specifies the UART flag to check
- **Status:** The actual Flag status (SET or RESET)
- **Tickstart:** Tick start value
- **Timeout:** Timeout duration

Return values

- **HAL:** status

UART_AdvFeatureConfig

Function name

void UART_AdvFeatureConfig (UART_HandleTypeDef * huart)

Function description

Configure the UART peripheral advanced features.

Parameters

- **huart:** UART handle.

Return values

- **None:**

UART_Start_Receive_IT

Function name

HAL_StatusTypeDef UART_Start_Receive_IT (UART_HandleTypeDef * huart, uint8_t * pData, uint16_t Size)

Function description

Start Receive operation in interrupt mode.

Parameters

- **huart:** UART handle.
- **pData:** Pointer to data buffer (u8 or u16 data elements).
- **Size:** Amount of data elements (u8 or u16) to be received.

Return values

- **HAL:** status

Notes

- This function could be called by all HAL UART API providing reception in Interrupt mode.
- When calling this function, parameters validity is considered as already checked, i.e. Rx State, buffer address, ... UART Handle is assumed as Locked.

UART_Start_Receive_DMA

Function name

HAL_StatusTypeDef UART_Start_Receive_DMA (UART_HandleTypeDef * huart, uint8_t * pData, uint16_t Size)

Function description

Start Receive operation in DMA mode.

Parameters

- **huart:** UART handle.
- **pData:** Pointer to data buffer (u8 or u16 data elements).
- **Size:** Amount of data elements (u8 or u16) to be received.

Return values

- **HAL:** status

Notes

- This function could be called by all HAL UART API providing reception in DMA mode.
- When calling this function, parameters validity is considered as already checked, i.e. Rx State, buffer address, ... UART Handle is assumed as Locked.

50.3 UART Firmware driver defines

The following section lists the various define and macros of the module.

50.3.1 UART

UART

UART Advanced Feature Initialization Type

UART_ADVFEATURE_NO_INIT

No advanced feature initialization

UART_ADVFEATURE_TXINVERT_INIT

TX pin active level inversion

UART_ADVFEATURE_RXINVERT_INIT

RX pin active level inversion

UART_ADVFEATURE_DATAINVERT_INIT

Binary data inversion

UART_ADVFEATURE_SWAP_INIT

TX/RX pins swap

UART_ADVFEATURE_RXOVERRUNDISABLE_INIT

RX overrun disable

UART_ADVFEATURE_DMADISABLEONERROR_INIT

DMA disable on Reception Error

UART_ADVFEATURE_AUTOBAUDRATE_INIT

Auto Baud rate detection initialization

UART_ADVFEATURE_MSBFIRST_INIT

Most significant bit sent/received first

UART Advanced Feature Auto BaudRate Enable

UART_ADVFEATURE_AUTOBAUDRATE_DISABLE

RX Auto Baud rate detection enable

UART_ADVFEATURE_AUTOBAUDRATE_ENABLE

RX Auto Baud rate detection disable

UART Advanced Feature AutoBaud Rate Mode

UART_ADVFEATURE_AUTOBAUDRATE_ONSTARTBIT

Auto Baud rate detection on start bit

UART_ADVFEATURE_AUTOBAUDRATE_ONFALLINGEDGE

Auto Baud rate detection on falling edge

UART_ADVFEATURE_AUTOBAUDRATE_ON0X7FFRAME

Auto Baud rate detection on 0x7F frame detection

UART_ADVFEATURE_AUTOBAUDRATE_ON0X55FRAME

Auto Baud rate detection on 0x55 frame detection

UART Clock Prescaler

UART_PRESCALER_DIV1

fclk_pres = fclk

UART_PRESCALER_DIV2

fclk_pres = fclk/2

UART_PRESCALER_DIV4

fclk_pres = fclk/4

UART_PRESCALER_DIV6

fclk_pres = fclk/6

UART_PRESCALER_DIV8

fclk_pres = fclk/8

UART_PRESCALER_DIV10

fclk_pres = fclk/10

UART_PRESCALER_DIV12

fclk_pres = fclk/12

UART_PRESCALER_DIV16

fclk_pres = fclk/16

UART_PRESCALER_DIV32

fclk_pres = fclk/32

UART_PRESCALER_DIV64

fclk_pres = fclk/64

UART_PRESCALER_DIV128

fclk_pres = fclk/128

UART_PRESCALER_DIV256

fclk_pres = fclk/256

UART Driver Enable Assertion Time LSB Position In CR1 Register

UART_CR1_DEAT_ADDRESS_LSB_POS

UART Driver Enable assertion time LSB position in CR1 register

UART Driver Enable DeAssertion Time LSB Position In CR1 Register

UART_CR1_DEDT_ADDRESS_LSB_POS

UART Driver Enable de-assertion time LSB position in CR1 register

UART Address-matching LSB Position In CR2 Register

UART_CR2_ADDRESS_LSB_POS

UART address-matching LSB position in CR2 register

UART Advanced Feature Binary Data Inversion

UART_ADVFEATURE_DATAINV_DISABLE

Binary data inversion disable

UART_ADVFEATURE_DATAINV_ENABLE

Binary data inversion enable

UART Advanced Feature DMA Disable On Rx Error

UART_ADVFEATURE_DMA_ENABLEONRXERROR

DMA enable on Reception Error

UART_ADVFEATURE_DMA_DISABLEONRXERROR

DMA disable on Reception Error

UART DMA Rx

UART_DMA_RX_DISABLE

UART DMA RX disabled

UART_DMA_RX_ENABLE

UART DMA RX enabled

UART DMA Tx

UART_DMA_TX_DISABLE

UART DMA TX disabled

UART_DMA_TX_ENABLE

UART DMA TX enabled

UART DriverEnable Polarity

UART_DE_POLARITY_HIGH

Driver enable signal is active high

UART_DE_POLARITY_LOW

Driver enable signal is active low

UART Error Definition

HAL_UART_ERROR_NONE

No error

HAL_UART_ERROR_PE

Parity error

HAL_UART_ERROR_NE

Noise error

HAL_UART_ERROR_FE

Frame error

HAL_UART_ERROR_ORE

Overrun error

HAL_UART_ERROR_DMA

DMA transfer error

HAL_UART_ERROR_RTO

Receiver Timeout error

HAL_UART_ERROR_INVALID_CALLBACK

Invalid Callback error

UART Exported Macros

__HAL_UART_RESET_HANDLE_STATE

Description:

- Reset UART handle states.

Parameters:

- __HANDLE__: UART handle.

Return value:

- None

__HAL_UART_FLUSH_DRREGISTER

Description:

- Flush the UART Data registers.

Parameters:

- __HANDLE__: specifies the UART Handle.

Return value:

- None

__HAL_UART_CLEAR_FLAG

Description:

- Clear the specified UART pending flag.

Parameters:

- __HANDLE__: specifies the UART Handle.
- __FLAG__: specifies the flag to check. This parameter can be any combination of the following values:
  - UART_CLEAR_PEF Parity Error Clear Flag
  - UART_CLEAR_FEF Framing Error Clear Flag
  - UART_CLEAR_NEF Noise detected Clear Flag
  - UART_CLEAR_OREF Overrun Error Clear Flag
  - UART_CLEAR_IDLEF IDLE line detected Clear Flag
  - UART_CLEAR_TXFECF TXFIFO empty clear Flag
  - UART_CLEAR_TCF Transmission Complete Clear Flag
  - UART_CLEAR_RTOF Receiver Timeout clear flag
  - UART_CLEAR_LBDF LIN Break Detection Clear Flag
  - UART_CLEAR_CTSF CTS Interrupt Clear Flag
  - UART_CLEAR_CMF Character Match Clear Flag
  - UART_CLEAR_WUF Wake Up from stop mode Clear Flag

Return value:

- None

__HAL_UART_CLEAR_PEFLAG

Description:

- Clear the UART PE pending flag.

Parameters:

- __HANDLE__: specifies the UART Handle.

Return value:

- None

__HAL_UART_CLEAR_FEFLAG

Description:

- Clear the UART FE pending flag.

Parameters:

- __HANDLE__: specifies the UART Handle.

Return value:

- None

__HAL_UART_CLEAR_NEFLAG

Description:

- Clear the UART NE pending flag.

Parameters:

- __HANDLE__: specifies the UART Handle.

Return value:

- None

__HAL_UART_CLEAR_OREFLAG

Description:

- Clear the UART ORE pending flag.

Parameters:

- __HANDLE__: specifies the UART Handle.

Return value:

- None

__HAL_UART_CLEAR_IDLEFLAG

Description:

- Clear the UART IDLE pending flag.

Parameters:

- __HANDLE__: specifies the UART Handle.

Return value:

- None

__HAL_UART_CLEAR_TXFECF

Description:

- Clear the UART TX FIFO empty clear flag.

Parameters:

- __HANDLE__: specifies the UART Handle.

Return value:

- None

__HAL_UART_GET_FLAG

Description:

- Check whether the specified UART flag is set or not.

Parameters:

- __HANDLE__: specifies the UART Handle.
- __FLAG__: specifies the flag to check. This parameter can be one of the following values:
  - UART_FLAG_TXFT TXFIFO threshold flag
  - UART_FLAG_RXFT RXFIFO threshold flag
  - UART_FLAG_RXFF RXFIFO Full flag
  - UART_FLAG_TXFE TXFIFO Empty flag
  - UART_FLAG_REACK Receive enable acknowledge flag
  - UART_FLAG_TEACK Transmit enable acknowledge flag
  - UART_FLAG_WUF Wake up from stop mode flag
  - UART_FLAG_RWU Receiver wake up flag (if the UART in mute mode)
  - UART_FLAG_SBKF Send Break flag
  - UART_FLAG_CMF Character match flag
  - UART_FLAG_BUSY Busy flag
  - UART_FLAG_ABRF Auto Baud rate detection flag
  - UART_FLAG_ABRE Auto Baud rate detection error flag
  - UART_FLAG_CTS CTS Change flag
  - UART_FLAG_LBDF LIN Break detection flag
  - UART_FLAG_TXE Transmit data register empty flag
  - UART_FLAG_TXFNF UART TXFIFO not full flag
  - UART_FLAG_TC Transmission Complete flag
  - UART_FLAG_RXNE Receive data register not empty flag
  - UART_FLAG_RXFNE UART RXFIFO not empty flag
  - UART_FLAG_RTOF Receiver Timeout flag
  - UART_FLAG_IDLE Idle Line detection flag
  - UART_FLAG_ORE Overrun Error flag
  - UART_FLAG_NE Noise Error flag
  - UART_FLAG_FE Framing Error flag
  - UART_FLAG_PE Parity Error flag

Return value:

- The: new state of __FLAG__ (TRUE or FALSE).

__HAL_UART_ENABLE_IT

Description:

- Enable the specified UART interrupt.

Parameters:

- __HANDLE__: specifies the UART Handle.
- __INTERRUPT__: specifies the UART interrupt source to enable. This parameter can be one of the following values:
  - UART_IT_RXFF RXFIFO Full interrupt
  - UART_IT_TXFE TXFIFO Empty interrupt
  - UART_IT_RXFT RXFIFO threshold interrupt
  - UART_IT_TXFT TXFIFO threshold interrupt
  - UART_IT_WUF Wakeup from stop mode interrupt
  - UART_IT_CM Character match interrupt
  - UART_IT_CTS CTS change interrupt
  - UART_IT_LBD LIN Break detection interrupt
  - UART_IT_TXE Transmit Data Register empty interrupt
  - UART_IT_TXFNF TX FIFO not full interrupt
  - UART_IT_TC Transmission complete interrupt
  - UART_IT_RXNE Receive Data register not empty interrupt
  - UART_IT_RXFNE RXFIFO not empty interrupt
  - UART_IT_RTO Receive Timeout interrupt
  - UART_IT_IDLE Idle line detection interrupt
  - UART_IT_PE Parity Error interrupt
  - UART_IT_ERR Error interrupt (frame error, noise error, overrun error)

Return value:

- None

__HAL_UART_DISABLE_IT

Description:

- Disable the specified UART interrupt.

Parameters:

- __HANDLE__: specifies the UART Handle.
- __INTERRUPT__: specifies the UART interrupt source to disable. This parameter can be one of the following values:
  - UART_IT_RXFF RXFIFO Full interrupt
  - UART_IT_TXFE TXFIFO Empty interrupt
  - UART_IT_RXFT RXFIFO threshold interrupt
  - UART_IT_TXFT TXFIFO threshold interrupt
  - UART_IT_WUF Wakeup from stop mode interrupt
  - UART_IT_CM Character match interrupt
  - UART_IT_CTS CTS change interrupt
  - UART_IT_LBD LIN Break detection interrupt
  - UART_IT_TXE Transmit Data Register empty interrupt
  - UART_IT_TXFNF TX FIFO not full interrupt
  - UART_IT_TC Transmission complete interrupt
  - UART_IT_RXNE Receive Data register not empty interrupt
  - UART_IT_RXFNE RXFIFO not empty interrupt
  - UART_IT_RTO Receive Timeout interrupt
  - UART_IT_IDLE Idle line detection interrupt
  - UART_IT_PE Parity Error interrupt
  - UART_IT_ERR Error interrupt (Frame error, noise error, overrun error)

Return value:

- None

__HAL_UART_GET_IT

Description:

- Check whether the specified UART interrupt has occurred or not.

Parameters:

- __HANDLE__: specifies the UART Handle.
- __INTERRUPT__: specifies the UART interrupt to check. This parameter can be one of the following values:
  - UART_IT_RXFF RXFIFO Full interrupt
  - UART_IT_TXFE TXFIFO Empty interrupt
  - UART_IT_RXFT RXFIFO threshold interrupt
  - UART_IT_TXFT TXFIFO threshold interrupt
  - UART_IT_WUF Wakeup from stop mode interrupt
  - UART_IT_CM Character match interrupt
  - UART_IT_CTS CTS change interrupt
  - UART_IT_LBD LIN Break detection interrupt
  - UART_IT_TXE Transmit Data Register empty interrupt
  - UART_IT_TXFNF TX FIFO not full interrupt
  - UART_IT_TC Transmission complete interrupt
  - UART_IT_RXNE Receive Data register not empty interrupt
  - UART_IT_RXFNE RXFIFO not empty interrupt
  - UART_IT_RTO Receive Timeout interrupt
  - UART_IT_IDLE Idle line detection interrupt
  - UART_IT_PE Parity Error interrupt
  - UART_IT_ERR Error interrupt (Frame error, noise error, overrun error)

Return value:

- The: new state of __INTERRUPT__ (SET or RESET).

__HAL_UART_GET_IT_SOURCE

Description:

- Check whether the specified UART interrupt source is enabled or not.

Parameters:

- __HANDLE__: specifies the UART Handle.
- __INTERRUPT__: specifies the UART interrupt source to check. This parameter can be one of the following values:
  - UART_IT_RXFF RXFIFO Full interrupt
  - UART_IT_TXFE TXFIFO Empty interrupt
  - UART_IT_RXFT RXFIFO threshold interrupt
  - UART_IT_TXFT TXFIFO threshold interrupt
  - UART_IT_WUF Wakeup from stop mode interrupt
  - UART_IT_CM Character match interrupt
  - UART_IT_CTS CTS change interrupt
  - UART_IT_LBD LIN Break detection interrupt
  - UART_IT_TXE Transmit Data Register empty interrupt
  - UART_IT_TXFNF TX FIFO not full interrupt
  - UART_IT_TC Transmission complete interrupt
  - UART_IT_RXNE Receive Data register not empty interrupt
  - UART_IT_RXFNE RXFIFO not empty interrupt
  - UART_IT_RTO Receive Timeout interrupt
  - UART_IT_IDLE Idle line detection interrupt
  - UART_IT_PE Parity Error interrupt
  - UART_IT_ERR Error interrupt (Frame error, noise error, overrun error)

Return value:

- The: new state of __INTERRUPT__ (SET or RESET).

__HAL_UART_CLEAR_IT

Description:

- Clear the specified UART ISR flag, in setting the proper ICR register flag.

Parameters:

- __HANDLE__: specifies the UART Handle.
- __IT_CLEAR__: specifies the interrupt clear register flag that needs to be set to clear the corresponding interrupt This parameter can be one of the following values:
  - UART_CLEAR_PEF Parity Error Clear Flag
  - UART_CLEAR_FEF Framing Error Clear Flag
  - UART_CLEAR_NEF Noise detected Clear Flag
  - UART_CLEAR_OREF Overrun Error Clear Flag
  - UART_CLEAR_IDLEF IDLE line detected Clear Flag
  - UART_CLEAR_RTOF Receiver timeout clear flag
  - UART_CLEAR_TXFECF TXFIFO empty Clear Flag
  - UART_CLEAR_TCF Transmission Complete Clear Flag
  - UART_CLEAR_LBDF LIN Break Detection Clear Flag
  - UART_CLEAR_CTSF CTS Interrupt Clear Flag
  - UART_CLEAR_CMF Character Match Clear Flag
  - UART_CLEAR_WUF Wake Up from stop mode Clear Flag

Return value:

- None

__HAL_UART_SEND_REQ

Description:

- Set a specific UART request flag.

Parameters:

- __HANDLE__: specifies the UART Handle.
- __REQ__: specifies the request flag to set This parameter can be one of the following values:
  - UART_AUTOBAUD_REQUEST Auto-Baud Rate Request
  - UART_SENDBREAK_REQUEST Send Break Request
  - UART_MUTE_MODE_REQUEST Mute Mode Request
  - UART_RXDATA_FLUSH_REQUEST Receive Data flush Request
  - UART_TXDATA_FLUSH_REQUEST Transmit data flush Request

Return value:

- None

__HAL_UART_ONE_BIT_SAMPLE_ENABLE

Description:

- Enable the UART one bit sample method.

Parameters:

- __HANDLE__: specifies the UART Handle.

Return value:

- None

__HAL_UART_ONE_BIT_SAMPLE_DISABLE

Description:

- Disable the UART one bit sample method.

Parameters:

- __HANDLE__: specifies the UART Handle.

Return value:

- None

__HAL_UART_ENABLE

Description:

- Enable UART.

Parameters:

- __HANDLE__: specifies the UART Handle.

Return value:

- None

__HAL_UART_DISABLE

Description:

- Disable UART.

Parameters:

- __HANDLE__: specifies the UART Handle.

Return value:

- None

__HAL_UART_HWCONTROL_CTS_ENABLE

Description:

- Enable CTS flow control.

Parameters:

- __HANDLE__: specifies the UART Handle.

Return value:

- None

Notes:

- This macro allows to enable CTS hardware flow control for a given UART instance, without need to call HAL_UART_Init() function. As involving direct access to UART registers, usage of this macro should be fully endorsed by user. As macro is expected to be used for modifying CTS Hw flow control feature activation, without need for USART instance Deinit/Init, following conditions for macro call should be fulfilled : UART instance should have already been initialised (through call of HAL_UART_Init())macro could only be called when corresponding UART instance is disabled (i.e. __HAL_UART_DISABLE(__HANDLE__)) and should be followed by an Enable macro (i.e. __HAL_UART_ENABLE(__HANDLE__)).

__HAL_UART_HWCONTROL_CTS_DISABLE

Description:

- Disable CTS flow control.

Parameters:

- __HANDLE__: specifies the UART Handle.

Return value:

- None

Notes:

- This macro allows to disable CTS hardware flow control for a given UART instance, without need to call HAL_UART_Init() function. As involving direct access to UART registers, usage of this macro should be fully endorsed by user. As macro is expected to be used for modifying CTS Hw flow control feature activation, without need for USART instance Deinit/Init, following conditions for macro call should be fulfilled : UART instance should have already been initialised (through call of HAL_UART_Init())macro could only be called when corresponding UART instance is disabled (i.e. __HAL_UART_DISABLE(__HANDLE__)) and should be followed by an Enable macro (i.e. __HAL_UART_ENABLE(__HANDLE__)).

__HAL_UART_HWCONTROL_RTS_ENABLE

Description:

- Enable RTS flow control.

Parameters:

- __HANDLE__: specifies the UART Handle.

Return value:

- None

Notes:

- This macro allows to enable RTS hardware flow control for a given UART instance, without need to call HAL_UART_Init() function. As involving direct access to UART registers, usage of this macro should be fully endorsed by user. As macro is expected to be used for modifying RTS Hw flow control feature activation, without need for USART instance Deinit/Init, following conditions for macro call should be fulfilled : UART instance should have already been initialised (through call of HAL_UART_Init())macro could only be called when corresponding UART instance is disabled (i.e. __HAL_UART_DISABLE(__HANDLE__)) and should be followed by an Enable macro (i.e. __HAL_UART_ENABLE(__HANDLE__)).

__HAL_UART_HWCONTROL_RTS_DISABLE

Description:

- Disable RTS flow control.

Parameters:

- __HANDLE__: specifies the UART Handle.

Return value:

- None

Notes:

- This macro allows to disable RTS hardware flow control for a given UART instance, without need to call HAL_UART_Init() function. As involving direct access to UART registers, usage of this macro should be fully endorsed by user. As macro is expected to be used for modifying RTS Hw flow control feature activation, without need for USART instance Deinit/Init, following conditions for macro call should be fulfilled : UART instance should have already been initialised (through call of HAL_UART_Init())macro could only be called when corresponding UART instance is disabled (i.e. __HAL_UART_DISABLE(__HANDLE__)) and should be followed by an Enable macro (i.e. __HAL_UART_ENABLE(__HANDLE__)).

UART Status Flags

UART_FLAG_TXFT

UART TXFIFO threshold flag

UART_FLAG_RXFT

UART RXFIFO threshold flag

UART_FLAG_RXFF

UART RXFIFO Full flag

UART_FLAG_TXFE

UART TXFIFO Empty flag

UART_FLAG_REACK

UART receive enable acknowledge flag

UART_FLAG_TEACK

UART transmit enable acknowledge flag

UART_FLAG_WUF

UART wake-up from stop mode flag

UART_FLAG_RWU

UART receiver wake-up from mute mode flag

UART_FLAG_SBKF

UART send break flag

UART_FLAG_CMF

UART character match flag

UART_FLAG_BUSY

UART busy flag

UART_FLAG_ABRF

UART auto Baud rate flag

UART_FLAG_ABRE

UART auto Baud rate error

UART_FLAG_RTOF

UART receiver timeout flag

UART_FLAG_CTS

UART clear to send flag

UART_FLAG_CTSIF

UART clear to send interrupt flag

UART_FLAG_LBDF

UART LIN break detection flag

UART_FLAG_TXE

UART transmit data register empty

UART_FLAG_TXFNF

UART TXFIFO not full

UART_FLAG_TC

UART transmission complete

UART_FLAG_RXNE

UART read data register not empty

UART_FLAG_RXFNE

UART RXFIFO not empty

UART_FLAG_IDLE

UART idle flag

UART_FLAG_ORE

UART overrun error

UART_FLAG_NE

UART noise error

UART_FLAG_FE

UART frame error

UART_FLAG_PE

UART parity error

UART Half Duplex Selection

UART_HALF_DUPLEX_DISABLE

UART half-duplex disabled

UART_HALF_DUPLEX_ENABLE

UART half-duplex enabled

UART Hardware Flow Control

UART_HWCONTROL_NONE

No hardware control

UART_HWCONTROL_RTS

Request To Send

UART_HWCONTROL_CTS

Clear To Send

UART_HWCONTROL_RTS_CTS

Request and Clear To Send

UART Interruptions Flag Mask

UART_IT_MASK

UART interruptions flags mask

UART Interrupts Definition

UART_IT_PE

UART parity error interruption

UART_IT_TXE

UART transmit data register empty interruption

UART_IT_TXFNF

UART TX FIFO not full interruption

UART_IT_TC

UART transmission complete interruption

UART_IT_RXNE

UART read data register not empty interruption

UART_IT_RXFNE

UART RXFIFO not empty interruption

UART_IT_IDLE

UART idle interruption

UART_IT_LBD

UART LIN break detection interruption

UART_IT_CTS

UART CTS interruption

UART_IT_CM

UART character match interruption

UART_IT_WUF

UART wake-up from stop mode interruption

UART_IT_RXFF

UART RXFIFO full interruption

UART_IT_TXFE

UART TXFIFO empty interruption

UART_IT_RXFT

UART RXFIFO threshold reached interruption

UART_IT_TXFT

UART TXFIFO threshold reached interruption

UART_IT_RTO

UART receiver timeout interruption

UART_IT_ERR

UART error interruption

UART_IT_ORE

UART overrun error interruption

UART_IT_NE

UART noise error interruption

UART_IT_FE

UART frame error interruption

UART Interruption Clear Flags

UART_CLEAR_PEF

Parity Error Clear Flag

UART_CLEAR_FEF

Framing Error Clear Flag

UART_CLEAR_NEF

Noise Error detected Clear Flag

UART_CLEAR_OREF

Overrun Error Clear Flag

UART_CLEAR_IDLEF

IDLE line detected Clear Flag

UART_CLEAR_TXFECF

TXFIFO empty clear flag

UART_CLEAR_TCF

Transmission Complete Clear Flag

UART_CLEAR_LBDF

LIN Break Detection Clear Flag

UART_CLEAR_CTSF

CTS Interrupt Clear Flag

UART_CLEAR_CMF

Character Match Clear Flag

UART_CLEAR_WUF

Wake Up from stop mode Clear Flag

UART_CLEAR_RTOF

UART receiver timeout clear flag

UART Local Interconnection Network mode

UART_LIN_DISABLE

Local Interconnect Network disable

UART_LIN_ENABLE

Local Interconnect Network enable

UART LIN Break Detection

UART_LINBREAKDETECTLENGTH_10B

LIN 10-bit break detection length

UART_LINBREAKDETECTLENGTH_11B

LIN 11-bit break detection length

UART Transfer Mode

UART_MODE_RX

RX mode

UART_MODE_TX

TX mode

UART_MODE_TX_RX

RX and TX mode

UART Advanced Feature MSB First

UART_ADVFEATURE_MSBFIRST_DISABLE

Most significant bit sent/received first disable

UART_ADVFEATURE_MSBFIRST_ENABLE

Most significant bit sent/received first enable

UART Advanced Feature Mute Mode Enable

UART_ADVFEATURE_MUTEMODE_DISABLE

UART mute mode disable

UART_ADVFEATURE_MUTEMODE_ENABLE

UART mute mode enable

UART One Bit Sampling Method

UART_ONE_BIT_SAMPLE_DISABLE

One-bit sampling disable

UART_ONE_BIT_SAMPLE_ENABLE

One-bit sampling enable

UART Advanced Feature Overrun Disable

UART_ADVFEATURE_OVERRUN_ENABLE

RX overrun enable

UART_ADVFEATURE_OVERRUN_DISABLE

RX overrun disable

UART Over Sampling

UART_OVERSAMPLING_16

Oversampling by 16

UART_OVERSAMPLING_8

Oversampling by 8

UART Parity

UART_PARITY_NONE

No parity

UART_PARITY_EVEN

Even parity

UART_PARITY_ODD

Odd parity

UART Receiver Timeout

UART_RECEIVER_TIMEOUT_DISABLE

UART Receiver Timeout disable

UART_RECEIVER_TIMEOUT_ENABLE

UART Receiver Timeout enable

UART Reception type values

HAL_UART_RECEPTION_STANDARD

Standard reception

HAL_UART_RECEPTION_TOIDLE

Reception till completion or IDLE event

HAL_UART_RECEPTION_TORTO

Reception till completion or RTO event

HAL_UART_RECEPTION_TOCHARMATCH

Reception till completion or CM event

UART Request Parameters

UART_AUTOBAUD_REQUEST

Auto-Baud Rate Request

UART_SENDBREAK_REQUEST

Send Break Request

UART_MUTE_MODE_REQUEST

Mute Mode Request

UART_RXDATA_FLUSH_REQUEST

Receive Data flush Request

UART_TXDATA_FLUSH_REQUEST

Transmit data flush Request

UART RxEvent type values

HAL_UART_RXEVENT_TC

RxEvent linked to Transfer Complete event

HAL_UART_RXEVENT_HT

RxEvent linked to Half Transfer event

HAL_UART_RXEVENT_IDLE

RxEvent linked to IDLE event

UART Advanced Feature RX Pin Active Level Inversion

UART_ADVFEATURE_RXINV_DISABLE

RX pin active level inversion disable

UART_ADVFEATURE_RXINV_ENABLE

RX pin active level inversion enable

UART Advanced Feature RX TX Pins Swap

UART_ADVFEATURE_SWAP_DISABLE

TX/RX pins swap disable

UART_ADVFEATURE_SWAP_ENABLE

TX/RX pins swap enable

UART State

UART_STATE_DISABLE

UART disabled

UART_STATE_ENABLE

UART enabled

UART State Code Definition

HAL_UART_STATE_RESET

Peripheral is not initialized Value is allowed for gState and RxState

HAL_UART_STATE_READY

Peripheral Initialized and ready for use Value is allowed for gState and RxState

HAL_UART_STATE_BUSY

an internal process is ongoing Value is allowed for gState only

HAL_UART_STATE_BUSY_TX

Data Transmission process is ongoing Value is allowed for gState only

HAL_UART_STATE_BUSY_RX

Data Reception process is ongoing Value is allowed for RxState only

HAL_UART_STATE_BUSY_TX_RX

Data Transmission and Reception process is ongoing Not to be used for neither gState nor RxState.Value is result of combination (Or) between gState and RxState values

HAL_UART_STATE_TIMEOUT

Timeout state Value is allowed for gState only

HAL_UART_STATE_ERROR

Error Value is allowed for gState only

UART Number of Stop Bits

UART_STOPBITS_0_5

UART frame with 0.5 stop bit

UART_STOPBITS_1

UART frame with 1 stop bit

UART_STOPBITS_1_5

UART frame with 1.5 stop bits

UART_STOPBITS_2

UART frame with 2 stop bits

UART Advanced Feature Stop Mode Enable

UART_ADVFEATURE_STOPMODE_DISABLE

UART stop mode disable

UART_ADVFEATURE_STOPMODE_ENABLE

UART stop mode enable

UART polling-based communications time-out value

HAL_UART_TIMEOUT_VALUE

UART polling-based communications time-out value

UART Advanced Feature TX Pin Active Level Inversion

UART_ADVFEATURE_TXINV_DISABLE

TX pin active level inversion disable

UART_ADVFEATURE_TXINV_ENABLE

TX pin active level inversion enable

UART WakeUp From Stop Selection

UART_WAKEUP_ON_ADDRESS

UART wake-up on address

UART_WAKEUP_ON_STARTBIT

UART wake-up on start bit

UART_WAKEUP_ON_READDATA_NONEMPTY

UART wake-up on receive data register not empty or RXFIFO is not empty

UART WakeUp Methods

UART_WAKEUPMETHOD_IDLELINE

UART wake-up on idle line

UART_WAKEUPMETHOD_ADDRESSMARK

UART wake-up on address mark

51 HAL UART Extension Driver

51.1 UARTEx Firmware driver registers structures

51.1.1 UART_WakeUpTypeDef

UART_WakeUpTypeDef is defined in the stm32u0xx_hal_uart_ex.h

Data Fields

- ***uint32_t WakeUpEvent***
- ***uint16_t AddressLength***
- ***uint8_t Address***

Field Documentation

- ***uint32_t UART_WakeUpTypeDef::WakeUpEvent***
  Specifies which event will activate the Wakeup from Stop mode flag (WUF). This parameter can be a value of ***UART_WakeUp_from_Stop_Selection***. If set to UART_WAKEUP_ON_ADDRESS, the two other fields below must be filled up.
- ***uint16_t UART_WakeUpTypeDef::AddressLength***
  Specifies whether the address is 4 or 7-bit long. This parameter can be a value of ***UARTEx_WakeUp_Address_Length***.
- ***uint8_t UART_WakeUpTypeDef::Address***
  UART/USART node address (7-bit long max).

51.2 UARTEx Firmware driver API description

The following section lists the various functions of the UARTEx library.

51.2.1 UART peripheral extended features

51.2.2 Initialization and Configuration functions

This subsection provides a set of functions allowing to initialize the USARTx or the UARTy in asynchronous mode.

- For the asynchronous mode the parameters below can be configured:
  - Baud Rate
  - Word Length
  - Stop Bit
  - Parity: If the parity is enabled, then the MSB bit of the data written in the data register is transmitted but is changed by the parity bit.
  - Hardware flow control
  - Receiver/transmitter modes
  - Over Sampling Method
  - One-Bit Sampling Method
- For the asynchronous mode, the following advanced features can be configured as well:
  - TX and/or RX pin level inversion
  - data logical level inversion
  - RX and TX pins swap
  - RX overrun detection disabling
  - DMA disabling on RX error
  - MSB first on communication line
  - auto Baud rate detection

The HAL_RS485Ex_Init() API follows the UART RS485 mode configuration procedures (details for the procedures are available in reference manual).

This section contains the following APIs:

- *HAL_RS485Ex_Init()*

51.2.3 IO operation functions

This section contains the following APIs:

- *HAL_UARTEx_WakeupCallback()*
- *HAL_UARTEx_RxFifoFullCallback()*
- *HAL_UARTEx_TxFifoEmptyCallback()*

51.2.4 Peripheral Control functions

This section provides the following functions:

- HAL_MultiProcessorEx_AddressLength_Set() API optionally sets the UART node address detection length to more than 4 bits for multiprocessor address mark wake up.
- HAL_UARTEx_StopModeWakeUpSourceConfig() API defines the wake-up from stop mode trigger: address match, Start Bit detection or RXNE bit status.
- HAL_UARTEx_EnableStopMode() API enables the UART to wake up the MCU from stop mode
- HAL_UARTEx_DisableStopMode() API disables the above functionality
- HAL_UARTEx_EnableFifoMode() API enables the FIFO mode
- HAL_UARTEx_DisableFifoMode() API disables the FIFO mode
- HAL_UARTEx_SetTxFifoThreshold() API sets the TX FIFO threshold
- HAL_UARTEx_SetRxFifoThreshold() API sets the RX FIFO threshold

This subsection also provides a set of additional functions providing enhanced reception services to user. (For example, these functions allow application to handle use cases where number of data to be received is unknown).

1. Compared to standard reception services which only consider number of received data elements as reception completion criteria, these functions also consider additional events as triggers for updating reception status to caller : (+) Detection of inactivity period (RX line has not been active for a given period).
   – RX inactivity detected by IDLE event, i.e. RX line has been in idle state (normally high state) for 1 frame time, after last received byte.
   – RX inactivity detected by RTO, i.e. line has been in idle state for a programmable time, after last received byte. (+) Detection that a specific character has been received.
2. There are two mode of transfer: (+) Blocking mode: The reception is performed in polling mode, until either expected number of data is received, or till IDLE event occurs. Reception is handled only during function execution. When function exits, no data reception could occur. HAL status and number of actually received data elements, are returned by function after finishing transfer. (+) Non-Blocking mode: The reception is performed using Interrupts or DMA. These API's return the HAL status. The end of the data processing will be indicated through the dedicated UART IRQ when using Interrupt mode or the DMA IRQ when using DMA mode. The HAL_UARTEx_RxEventCallback() user callback will be executed during Receive process The HAL_UART_ErrorCallback()user callback will be executed when a reception error is detected.
3. Blocking mode API: (+) HAL_UARTEx_ReceiveToIdle()
4. Non-Blocking mode API with Interrupt: (+) HAL_UARTEx_ReceiveToIdle_IT()
5. Non-Blocking mode API with DMA: (+) HAL_UARTEx_ReceiveToIdle_DMA()

This subsection also provides a set of additional functions providing enhanced reception services to user. (For example, these functions allow application to handle use cases where number of data to be received is unknown). (#) Compared to standard reception services which only consider number of received data elements as reception completion criteria, these functions also consider additional events as triggers for updating reception status to caller :

- Detection of inactivity period (RX line has not been active for a given period).
  – RX inactivity detected by IDLE event, i.e. RX line has been in idle state (normally high state) for 1 frame time, after last received byte.
  – RX inactivity detected by RTO, i.e. line has been in idle state for a programmable time, after last received byte.
- Detection that a specific character has been received. (#) There are two mode of transfer:

- Blocking mode: The reception is performed in polling mode, until either expected number of data is received, or till IDLE event occurs. Reception is handled only during function execution. When function exits, no data reception could occur. HAL status and number of actually received data elements, are returned by function after finishing transfer.
- Non-Blocking mode: The reception is performed using Interrupts or DMA. These API's return the HAL status. The end of the data processing will be indicated through the dedicated UART IRQ when using Interrupt mode or the DMA IRQ when using DMA mode. The HAL_UARTEx_RxEventCallback() user callback will be executed during Receive process The HAL_UART_ErrorCallback()user callback will be executed when a reception error is detected. (#) Blocking mode API:
- HAL_UARTEx_ReceiveToIdle() (#) Non-Blocking mode API with Interrupt:
- HAL_UARTEx_ReceiveToIdle_IT() (#) Non-Blocking mode API with DMA:
- HAL_UARTEx_ReceiveToIdle_DMA()

This section contains the following APIs:

- ***HAL_MultiProcessorEx_AddressLength_Set()***
- ***HAL_UARTEx_StopModeWakeUpSourceConfig()***
- ***HAL_UARTEx_EnableStopMode()***
- ***HAL_UARTEx_DisableStopMode()***
- ***HAL_UARTEx_EnableFifoMode()***
- ***HAL_UARTEx_DisableFifoMode()***
- ***HAL_UARTEx_SetTxFifoThreshold()***
- ***HAL_UARTEx_SetRxFifoThreshold()***
- ***HAL_UARTEx_ReceiveToIdle()***
- ***HAL_UARTEx_ReceiveToIdle_IT()***
- ***HAL_UARTEx_ReceiveToIdle_DMA()***
- ***HAL_UARTEx_GetRxEventType()***

51.2.5 Detailed description of functions

HAL_RS485Ex_Init

Function name

HAL_StatusTypeDef HAL_RS485Ex_Init (UART_HandleTypeDef * huart, uint32_t Polarity, uint32_t AssertionTime, uint32_t DeassertionTime)

Function description

Initialize the RS485 Driver enable feature according to the specified parameters in the UART_InitTypeDef and creates the associated handle.

Parameters

- **huart:** UART handle.
- **Polarity:** Select the driver enable polarity. This parameter can be one of the following values:
  - UART_DE_POLARITY_HIGH DE signal is active high
  - UART_DE_POLARITY_LOW DE signal is active low
- **AssertionTime:** Driver Enable assertion time: 5-bit value defining the time between the activation of the DE (Driver Enable) signal and the beginning of the start bit. It is expressed in sample time units (1/8 or 1/16 bit time, depending on the oversampling rate)
- **DeassertionTime:** Driver Enable deassertion time: 5-bit value defining the time between the end of the last stop bit, in a transmitted message, and the de-activation of the DE (Driver Enable) signal. It is expressed in sample time units (1/8 or 1/16 bit time, depending on the oversampling rate).

Return values

- **HAL:** status

HAL_UARTEx_WakeupCallback

Function name

void HAL_UARTEx_WakeupCallback (UART_HandleTypeDef * huart)

Function description

UART wakeup from Stop mode callback.

Parameters

- **huart:** UART handle.

Return values

- **None:**

HAL_UARTEx_RxFifoFullCallback

Function name

void HAL_UARTEx_RxFifoFullCallback (UART_HandleTypeDef * huart)

Function description

UART RX Fifo full callback.

Parameters

- **huart:** UART handle.

Return values

- **None:**

HAL_UARTEx_TxFifoEmptyCallback

Function name

void HAL_UARTEx_TxFifoEmptyCallback (UART_HandleTypeDef * huart)

Function description

UART TX Fifo empty callback.

Parameters

- **huart:** UART handle.

Return values

- **None:**

HAL_UARTEx_StopModeWakeUpSourceConfig

Function name

HAL_StatusTypeDef HAL_UARTEx_StopModeWakeUpSourceConfig (UART_HandleTypeDef * huart, UART_WakeUpTypeDef WakeUpSelection)

Function description

Set Wakeup from Stop mode interrupt flag selection.

Parameters

- **huart:** UART handle.
- **WakeUpSelection:** Address match, Start Bit detection or RXNE/RXFNE bit status. This parameter can be one of the following values:
  - UART_WAKEUP_ON_ADDRESS
  - UART_WAKEUP_ON_STARTBIT
  - UART_WAKEUP_ON_READDATA_NONEMPTY

Return values

- **HAL:** status

Notes

- It is the application responsibility to enable the interrupt used as usart_wkup interrupt source before entering low-power mode.

HAL_UARTEx_EnableStopMode

Function name

HAL_StatusTypeDef HAL_UARTEx_EnableStopMode (UART_HandleTypeDef * huart)

Function description

Enable UART Stop Mode.

Parameters

- **huart:** UART handle.

Return values

- **HAL:** status

Notes

- The UART is able to wake up the MCU from Stop 1 mode as long as UART clock is HSI or LSE.

HAL_UARTEx_DisableStopMode

Function name

HAL_StatusTypeDef HAL_UARTEx_DisableStopMode (UART_HandleTypeDef * huart)

Function description

Disable UART Stop Mode.

Parameters

- **huart:** UART handle.

Return values

- **HAL:** status

HAL_MultiProcessorEx_AddressLength_Set

Function name

HAL_StatusTypeDef HAL_MultiProcessorEx_AddressLength_Set (UART_HandleTypeDef * huart, uint32_t AddressLength)

Function description

By default in multiprocessor mode, when the wake up method is set to address mark, the UART handles only 4-bit long addresses detection; this API allows to enable longer addresses detection (6-, 7- or 8-bit long).

Parameters

- **huart:** UART handle.
- **AddressLength:** This parameter can be one of the following values:
  - UART_ADDRESS_DETECT_4B 4-bit long address
  - UART_ADDRESS_DETECT_7B 6-, 7- or 8-bit long address

Return values

- **HAL:** status

Notes

- Addresses detection lengths are: 6-bit address detection in 7-bit data mode, 7-bit address detection in 8-bit data mode, 8-bit address detection in 9-bit data mode.

HAL_UARTEx_EnableFifoMode

Function name

HAL_StatusTypeDef HAL_UARTEx_EnableFifoMode (UART_HandleTypeDef * huart)

Function description

Enable the FIFO mode.

Parameters

- **huart:** UART handle.

Return values

- **HAL:** status

HAL_UARTEx_DisableFifoMode

Function name

HAL_StatusTypeDef HAL_UARTEx_DisableFifoMode (UART_HandleTypeDef * huart)

Function description

Disable the FIFO mode.

Parameters

- **huart:** UART handle.

Return values

- **HAL:** status

HAL_UARTEx_SetTxFifoThreshold

Function name

HAL_StatusTypeDef HAL_UARTEx_SetTxFifoThreshold (UART_HandleTypeDef * huart, uint32_t Threshold)

Function description

Set the TXFIFO threshold.

Parameters

- **huart:** UART handle.
- **Threshold:** TX FIFO threshold value This parameter can be one of the following values:
  - UART_TXFIFO_THRESHOLD_1_8
  - UART_TXFIFO_THRESHOLD_1_4
  - UART_TXFIFO_THRESHOLD_1_2
  - UART_TXFIFO_THRESHOLD_3_4
  - UART_TXFIFO_THRESHOLD_7_8
  - UART_TXFIFO_THRESHOLD_8_8

Return values

- **HAL:** status

HAL_UARTEx_SetRxFifoThreshold

Function name

HAL_StatusTypeDef HAL_UARTEx_SetRxFifoThreshold (UART_HandleTypeDef * huart, uint32_t Threshold)

Function description

Set the RXFIFO threshold.

Parameters

- **huart:** UART handle.
- **Threshold:** RX FIFO threshold value This parameter can be one of the following values:
  - UART_RXFIFO_THRESHOLD_1_8
  - UART_RXFIFO_THRESHOLD_1_4
  - UART_RXFIFO_THRESHOLD_1_2
  - UART_RXFIFO_THRESHOLD_3_4
  - UART_RXFIFO_THRESHOLD_7_8
  - UART_RXFIFO_THRESHOLD_8_8

Return values

- **HAL:** status

HAL_UARTEx_ReceiveToIdle

Function name

HAL_StatusTypeDef HAL_UARTEx_ReceiveToIdle (UART_HandleTypeDef * huart, uint8_t * pData, uint16_t Size, uint16_t * RxLen, uint32_t Timeout)

Function description

Receive an amount of data in blocking mode till either the expected number of data is received or an IDLE event occurs.

Parameters

- **huart:** UART handle.
- **pData:** Pointer to data buffer (uint8_t or uint16_t data elements).
- **Size:** Amount of data elements (uint8_t or uint16_t) to be received.
- **RxLen:** Number of data elements finally received (could be lower than Size, in case reception ends on IDLE event)
- **Timeout:** Timeout duration expressed in ms (covers the whole reception sequence).

Return values

- **HAL:** status

Notes

- HAL_OK is returned if reception is completed (expected number of data has been received) or if reception is stopped after IDLE event (less than the expected number of data has been received) In this case, RxLen output parameter indicates number of data available in reception buffer.
- When UART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), the received data is handled as a set of uint16_t. In this case, Size must indicate the number of uint16_t available through pData.
- When FIFO mode is enabled, the RXFNE flag is set as long as the RXFIFO is not empty. Read operations from the RDR register are performed when RXFNE flag is set. From hardware perspective, RXFNE flag and RXNE are mapped on the same bit-field.
- When UART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), address of user data buffer for storing data to be received, should be aligned on a half word frontier (16 bits) (as received data will be handled using uint16_t pointer cast). Depending on compilation chain, use of specific alignment compilation directives or pragmas might be required to ensure proper alignment for pData.

HAL_UARTEx_ReceiveToIdle_IT

Function name

HAL_StatusTypeDef HAL_UARTEx_ReceiveToIdle_IT (UART_HandleTypeDef * huart, uint8_t * pData, uint16_t Size)

Function description

Receive an amount of data in interrupt mode till either the expected number of data is received or an IDLE event occurs.

Parameters

- **huart:** UART handle.
- **pData:** Pointer to data buffer (uint8_t or uint16_t data elements).
- **Size:** Amount of data elements (uint8_t or uint16_t) to be received.

Return values

- **HAL:** status

Notes

- Reception is initiated by this function call. Further progress of reception is achieved thanks to UART interrupts raised by RXNE and IDLE events. Callback is called at end of reception indicating number of received data elements.
- When UART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), the received data is handled as a set of uint16_t. In this case, Size must indicate the number of uint16_t available through pData.
- When UART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), address of user data buffer for storing data to be received, should be aligned on a half word frontier (16 bits) (as received data will be handled using uint16_t pointer cast). Depending on compilation chain, use of specific alignment compilation directives or pragmas might be required to ensure proper alignment for pData.

HAL_UARTEx_ReceiveToIdle_DMA

Function name

HAL_StatusTypeDef HAL_UARTEx_ReceiveToIdle_DMA (UART_HandleTypeDef * huart, uint8_t * pData, uint16_t Size)

Function description

Receive an amount of data in DMA mode till either the expected number of data is received or an IDLE event occurs.

Parameters

- **huart:** UART handle.
- **pData:** Pointer to data buffer (uint8_t or uint16_t data elements).
- **Size:** Amount of data elements (uint8_t or uint16_t) to be received.

Return values

- **HAL:** status

Notes

- Reception is initiated by this function call. Further progress of reception is achieved thanks to DMA services, transferring automatically received data elements in user reception buffer and calling registered callbacks at half/end of reception. UART IDLE events are also used to consider reception phase as ended. In all cases, callback execution will indicate number of received data elements.
- When the UART parity is enabled (PCE = 1), the received data contain the parity bit (MSB position).
- When UART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), the received data is handled as a set of uint16_t. In this case, Size must indicate the number of uint16_t available through pData.
- When UART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), address of user data buffer for storing data to be received, should be aligned on a half word frontier (16 bits) (as received data will be handled by DMA from halfword frontier). Depending on compilation chain, use of specific alignment compilation directives or pragmas might be required to ensure proper alignment for pData.

HAL_UARTEx_GetRxEventType

Function name

HAL_UART_RxEventTypeTypeDef HAL_UARTEx_GetRxEventType (const UART_HandleTypeDef * huart)

Function description

Provide Rx Event type that has lead to RxEvent callback execution.

Parameters

- **huart:** UART handle.

Return values

- **Rx:** Event Type (return vale will be a value of UART RxEvent type values)

Notes

- When HAL_UARTEx_ReceiveToIdle_IT() or HAL_UARTEx_ReceiveToIdle_DMA() API are called, progress of reception process is provided to application through calls of Rx Event callback (either default one HAL_UARTEx_RxEventCallback() or user registered one). As several types of events could occur (IDLE event, Half Transfer, or Transfer Complete), this function allows to retrieve the Rx Event type that has lead to Rx Event callback execution.
- This function is expected to be called within the user implementation of Rx Event Callback, in order to provide the accurate value : In Interrupt Mode : HAL_UART_RXEVENT_TC : when Reception has been completed (expected nb of data has been received)HAL_UART_RXEVENT_IDLE : when Idle event occurred prior reception has been completed (nb of received data is lower than expected one) In DMA Mode :HAL_UART_RXEVENT_TC : when Reception has been completed (expected nb of data has been received)HAL_UART_RXEVENT_HT : when half of expected nb of data has been receivedHAL_UART_RXEVENT_IDLE : when Idle event occurred prior reception has been completed (nb of received data is lower than expected one). In DMA mode, RxEvent callback could be called several times; When DMA is configured in Normal Mode, HT event does not stop Reception process; When DMA is configured in Circular Mode, HT, TC or IDLE events don't stop Reception process;

51.3 UARTEx Firmware driver defines

The following section lists the various define and macros of the module.

51.3.1 UARTEx

UARTEx

UARTEx FIFO mode

UART_FIFOMODE_DISABLE

FIFO mode disable

UART_FIFOMODE_ENABLE

FIFO mode enable

UARTEx RXFIFO threshold level

UART_RXFIFO_THRESHOLD_1_8

RX FIFO reaches 1/8 of its depth

UART_RXFIFO_THRESHOLD_1_4

RX FIFO reaches 1/4 of its depth

UART_RXFIFO_THRESHOLD_1_2

RX FIFO reaches 1/2 of its depth

UART_RXFIFO_THRESHOLD_3_4

RX FIFO reaches 3/4 of its depth

UART_RXFIFO_THRESHOLD_7_8

RX FIFO reaches 7/8 of its depth

UART_RXFIFO_THRESHOLD_8_8

RX FIFO becomes full

UARTEx TXFIFO threshold level

UART_TXFIFO_THRESHOLD_1_8

TX FIFO reaches 1/8 of its depth

UART_TXFIFO_THRESHOLD_1_4

TX FIFO reaches 1/4 of its depth

UART_TXFIFO_THRESHOLD_1_2

TX FIFO reaches 1/2 of its depth

UART_TXFIFO_THRESHOLD_3_4

TX FIFO reaches 3/4 of its depth

UART_TXFIFO_THRESHOLD_7_8

TX FIFO reaches 7/8 of its depth

UART_TXFIFO_THRESHOLD_8_8

TX FIFO becomes empty

UARTEx WakeUp Address Length

UART_ADDRESS_DETECT_4B

4-bit long wake-up address

UART_ADDRESS_DETECT_7B

7-bit long wake-up address

UARTEx Word Length

UART_WORDLENGTH_7B

7-bit long UART frame

UART_WORDLENGTH_8B

8-bit long UART frame

UART_WORDLENGTH_9B

9-bit long UART frame

52 HAL USART Generic Driver

52.1 USART Firmware driver registers structures

52.1.1 USART_InitTypeDef

USART_InitTypeDef is defined in the stm32u0xx_hal_usart.h

Data Fields

- ***uint32_t BaudRate***
- ***uint32_t WordLength***
- ***uint32_t StopBits***
- ***uint32_t Parity***
- ***uint32_t Mode***
- ***uint32_t CLKPolarity***
- ***uint32_t CLKPhase***
- ***uint32_t CLKLastBit***
- ***uint32_t ClockPrescaler***

Field Documentation

- ***uint32_t USART_InitTypeDef::BaudRate***
  This member configures the Usart communication baud rate. The baud rate is computed using the following formula: Baud Rate Register[15:4] = ((2 * fclk_pres) / ((huart->Init.BaudRate)))[15:4] Baud Rate Register[3] = 0 Baud Rate Register[2:0] = (((2 * fclk_pres) / ((huart->Init.BaudRate)))[3:0]) >> 1 where fclk_pres is the USART input clock frequency (fclk) divided by a prescaler.
  Note:
  – Oversampling by 8 is systematically applied to achieve high baud rates.
- ***uint32_t USART_InitTypeDef::WordLength***
  Specifies the number of data bits transmitted or received in a frame. This parameter can be a value of ***USARTEx_Word_Length***.
- ***uint32_t USART_InitTypeDef::StopBits***
  Specifies the number of stop bits transmitted. This parameter can be a value of ***USART_Stop_Bits***.
- ***uint32_t USART_InitTypeDef::Parity***
  Specifies the parity mode. This parameter can be a value of ***USART_Parity***
  Note:
  – When parity is enabled, the computed parity is inserted at the MSB position of the transmitted data (9th bit when the word length is set to 9 data bits; 8th bit when the word length is set to 8 data bits).
- ***uint32_t USART_InitTypeDef::Mode***
  Specifies whether the Receive or Transmit mode is enabled or disabled. This parameter can be a value of ***USART_Mode***.
- ***uint32_t USART_InitTypeDef::CLKPolarity***
  Specifies the steady state of the serial clock. This parameter can be a value of ***USART_Clock_Polarity***.
- ***uint32_t USART_InitTypeDef::CLKPhase***
  Specifies the clock transition on which the bit capture is made. This parameter can be a value of ***USART_Clock_Phase***.
- ***uint32_t USART_InitTypeDef::CLKLastBit***
  Specifies whether the clock pulse corresponding to the last transmitted data bit (MSB) has to be output on the SCLK pin in synchronous mode. This parameter can be a value of ***USART_Last_Bit***.
- ***uint32_t USART_InitTypeDef::ClockPrescaler***
  Specifies the prescaler value used to divide the USART clock source. This parameter can be a value of ***USART_ClockPrescaler***.

52.1.2 __USART_HandleTypeDef

__USART_HandleTypeDef is defined in the stm32u0xx_hal_usart.h

Data Fields

- ***USART_TypeDef * Instance***
- ***USART_InitTypeDef Init***
- ***const uint8_t * pTxBuffPtr***
- ***uint16_t TxXferSize***
- ***__IO uint16_t TxXferCount***
- ***uint8_t * pRxBuffPtr***
- ***uint16_t RxXferSize***
- ***__IO uint16_t RxXferCount***
- ***uint16_t Mask***
- ***uint16_t NbRxDataToProcess***
- ***uint16_t NbTxDataToProcess***
- ***uint32_t SlaveMode***
- ***uint32_t FifoMode***
- ***void(* RxISR***
- ***void(* TxISR***
- ***DMA_HandleTypeDef * hdmatx***
- ***DMA_HandleTypeDef * hdmarx***
- ***HAL_LockTypeDef Lock***
- ***__IO HAL_USART_StateTypeDef State***
- ***__IO uint32_t ErrorCode***
- ***void(* TxHalfCpltCallback***
- ***void(* TxCpltCallback***
- ***void(* RxHalfCpltCallback***
- ***void(* RxCpltCallback***
- ***void(* TxRxCpltCallback***
- ***void(* ErrorCallback***
- ***void(* AbortCpltCallback***
- ***void(* RxFifoFullCallback***
- ***void(* TxFifoEmptyCallback***
- ***void(* MspInitCallback***
- ***void(* MspDeInitCallback***

Field Documentation

- ***USART_TypeDef* __USART_HandleTypeDef::Instance***
  USART registers base address
- ***USART_InitTypeDef __USART_HandleTypeDef::Init***
  USART communication parameters
- ***const uint8_t* __USART_HandleTypeDef::pTxBuffPtr***
  Pointer to USART Tx transfer Buffer
- ***uint16_t __USART_HandleTypeDef::TxXferSize***
  USART Tx Transfer size
- ***__IO uint16_t __USART_HandleTypeDef::TxXferCount***
  USART Tx Transfer Counter
- ***uint8_t* __USART_HandleTypeDef::pRxBuffPtr***
  Pointer to USART Rx transfer Buffer
- ***uint16_t __USART_HandleTypeDef::RxXferSize***
  USART Rx Transfer size
- ***__IO uint16_t __USART_HandleTypeDef::RxXferCount***
  USART Rx Transfer Counter
- ***uint16_t __USART_HandleTypeDef::Mask***
  USART Rx RDR register mask
- ***uint16_t __USART_HandleTypeDef::NbRxDataToProcess***
  Number of data to process during RX ISR execution

- ***uint16_t __USART_HandleTypeDef::NbTxDataToProcess***
  Number of data to process during TX ISR execution
- ***uint32_t __USART_HandleTypeDef::SlaveMode***
  Enable/Disable USART SPI Slave Mode. This parameter can be a value of ***USARTEx_Slave_Mode***
- ***uint32_t __USART_HandleTypeDef::FifoMode***
  Specifies if the FIFO mode will be used. This parameter can be a value of ***USARTEx_FIFO_mode***.
- ***void(* __USART_HandleTypeDef::RxISR)(struct __USART_HandleTypeDef *husart)***
  Function pointer on Rx IRQ handler
- ***void(* __USART_HandleTypeDef::TxISR)(struct __USART_HandleTypeDef *husart)***
  Function pointer on Tx IRQ handler
- ***DMA_HandleTypeDef* __USART_HandleTypeDef::hdmatx***
  USART Tx DMA Handle parameters
- ***DMA_HandleTypeDef* __USART_HandleTypeDef::hdmarx***
  USART Rx DMA Handle parameters
- ***HAL_LockTypeDef __USART_HandleTypeDef::Lock***
  Locking object
- ***__IO HAL_USART_StateTypeDef __USART_HandleTypeDef::State***
  USART communication state
- ***__IO uint32_t __USART_HandleTypeDef::ErrorCode***
  USART Error code
- ***void(* __USART_HandleTypeDef::TxHalfCpltCallback)(struct __USART_HandleTypeDef *husart)***
  USART Tx Half Complete Callback
- ***void(* __USART_HandleTypeDef::TxCpltCallback)(struct __USART_HandleTypeDef *husart)***
  USART Tx Complete Callback
- ***void(* __USART_HandleTypeDef::RxHalfCpltCallback)(struct __USART_HandleTypeDef *husart)***
  USART Rx Half Complete Callback
- ***void(* __USART_HandleTypeDef::RxCpltCallback)(struct __USART_HandleTypeDef *husart)***
  USART Rx Complete Callback
- ***void(* __USART_HandleTypeDef::TxRxCpltCallback)(struct __USART_HandleTypeDef *husart)***
  USART Tx Rx Complete Callback
- ***void(* __USART_HandleTypeDef::ErrorCallback)(struct __USART_HandleTypeDef *husart)***
  USART Error Callback
- ***void(* __USART_HandleTypeDef::AbortCpltCallback)(struct __USART_HandleTypeDef *husart)***
  USART Abort Complete Callback
- ***void(* __USART_HandleTypeDef::RxFifoFullCallback)(struct __USART_HandleTypeDef *husart)***
  USART Rx Fifo Full Callback
- ***void(* __USART_HandleTypeDef::TxFifoEmptyCallback)(struct __USART_HandleTypeDef *husart)***
  USART Tx Fifo Empty Callback
- ***void(* __USART_HandleTypeDef::MspInitCallback)(struct __USART_HandleTypeDef *husart)***
  USART Msp Init callback
- ***void(* __USART_HandleTypeDef::MspDeInitCallback)(struct __USART_HandleTypeDef *husart)***
  USART Msp DeInit callback

52.2 USART Firmware driver API description

The following section lists the various functions of the USART library.

52.2.1 How to use this driver

The USART HAL driver can be used as follows:

1. Declare a USART_HandleTypeDef handle structure (eg. USART_HandleTypeDef husart).

2. Initialize the USART low level resources by implementing the HAL_USART_MspInit() API:
   - Enable the USARTx interface clock.
   - USART pins configuration:
     - Enable the clock for the USART GPIOs.
     - Configure these USART pins as alternate function pull-up.
   - NVIC configuration if you need to use interrupt process (HAL_USART_Transmit_IT(), HAL_USART_Receive_IT() and HAL_USART_TransmitReceive_IT() APIs):
     - Configure the USARTx interrupt priority.
     - Enable the NVIC USART IRQ handle.
   - USART interrupts handling:

Note: The specific USART interrupts (Transmission complete interrupt, RXNE interrupt and Error Interrupts) will be managed using the macros __HAL_USART_ENABLE_IT() and __HAL_USART_DISABLE_IT() inside the transmit and receive process.

   - DMA Configuration if you need to use DMA process (HAL_USART_Transmit_DMA() HAL_USART_Receive_DMA() and HAL_USART_TransmitReceive_DMA() APIs):
     - Declare a DMA handle structure for the Tx/Rx channel.
     - Enable the DMAx interface clock.
     - Configure the declared DMA handle structure with the required Tx/Rx parameters.
     - Configure the DMA Tx/Rx channel.
     - Associate the initialized DMA handle to the USART DMA Tx/Rx handle.
     - Configure the priority and enable the NVIC for the transfer complete interrupt on the DMA Tx/Rx channel.
3. Program the Baud Rate, Word Length, Stop Bit, Parity, and Mode (Receiver/Transmitter) in the husart handle Init structure.
4. Initialize the USART registers by calling the HAL_USART_Init() API:
   - This API configures also the low level Hardware GPIO, CLOCK, CORTEX...etc) by calling the customized HAL_USART_MspInit(&husart) API.

Note: To configure and enable/disable the USART to wake up the MCU from stop mode, resort to UART API's HAL_UARTEx_StopModeWakeUpSourceConfig(), HAL_UARTEx_EnableStopMode() and HAL_UARTEx_DisableStopMode() in casting the USART handle to UART type UART_HandleTypeDef.

52.2.2 Callback registration

The compilation define USE_HAL_USART_REGISTER_CALLBACKS when set to 1 allows the user to configure dynamically the driver callbacks.

Use Function HAL_USART_RegisterCallback() to register a user callback. Function HAL_USART_RegisterCallback() allows to register following callbacks:

- TxHalfCpltCallback : Tx Half Complete Callback.
- TxCpltCallback : Tx Complete Callback.
- RxHalfCpltCallback : Rx Half Complete Callback.
- RxCpltCallback : Rx Complete Callback.
- TxRxCpltCallback : Tx Rx Complete Callback.
- ErrorCallback : Error Callback.
- AbortCpltCallback : Abort Complete Callback.
- RxFifoFullCallback : Rx Fifo Full Callback.
- TxFifoEmptyCallback : Tx Fifo Empty Callback.
- MspInitCallback : USART MspInit.
- MspDeInitCallback : USART MspDeInit. This function takes as parameters the HAL peripheral handle, the Callback ID and a pointer to the user callback function.

Use function HAL_USART_UnRegisterCallback() to reset a callback to the default weak function. HAL_USART_UnRegisterCallback() takes as parameters the HAL peripheral handle, and the Callback ID. This function allows to reset following callbacks:

- TxHalfCpltCallback : Tx Half Complete Callback.

- TxCpltCallback : Tx Complete Callback.
- RxHalfCpltCallback : Rx Half Complete Callback.
- RxCpltCallback : Rx Complete Callback.
- TxRxCpltCallback : Tx Rx Complete Callback.
- ErrorCallback : Error Callback.
- AbortCpltCallback : Abort Complete Callback.
- RxFifoFullCallback : Rx Fifo Full Callback.
- TxFifoEmptyCallback : Tx Fifo Empty Callback.
- MspInitCallback : USART MspInit.
- MspDeInitCallback : USART MspDeInit.

By default, after the HAL_USART_Init() and when the state is HAL_USART_STATE_RESET all callbacks are set to the corresponding weak functions: examples HAL_USART_TxCpltCallback(), HAL_USART_RxHalfCpltCallback(). Exception done for MspInit and MspDeInit functions that are respectively reset to the legacy weak functions in the HAL_USART_Init() and HAL_USART_DeInit() only when these callbacks are null (not registered beforehand). If not, MspInit or MspDeInit are not null, the HAL_USART_Init() and HAL_USART_DeInit() keep and use the user MspInit/MspDeInit callbacks (registered beforehand).

Callbacks can be registered/unregistered in HAL_USART_STATE_READY state only. Exception done MspInit/ MspDeInit that can be registered/unregistered in HAL_USART_STATE_READY or HAL_USART_STATE_RESET state, thus registered (user) MspInit/DeInit callbacks can be used during the Init/DeInit. In that case first register the MspInit/MspDeInit user callbacks using HAL_USART_RegisterCallback() before calling HAL_USART_DeInit() or HAL_USART_Init() function.

When The compilation define USE_HAL_USART_REGISTER_CALLBACKS is set to 0 or not defined, the callback registration feature is not available and weak callbacks are used.

52.2.3 Initialization and Configuration functions

This subsection provides a set of functions allowing to initialize the USART in asynchronous and in synchronous modes.

- For the asynchronous mode only these parameters can be configured:
  - Baud Rate
  - Word Length
  - Stop Bit
  - Parity: If the parity is enabled, then the MSB bit of the data written in the data register is transmitted but is changed by the parity bit.
  - USART polarity
  - USART phase
  - USART LastBit
  - Receiver/transmitter modes

The HAL_USART_Init() function follows the USART synchronous configuration procedure (details for the procedure are available in reference manual).

This section contains the following APIs:

- ***HAL_USART_Init()***
- ***HAL_USART_DeInit()***
- ***HAL_USART_MspInit()***
- ***HAL_USART_MspDeInit()***
- ***HAL_USART_RegisterCallback()***
- ***HAL_USART_UnRegisterCallback()***

52.2.4 IO operation functions

This subsection provides a set of functions allowing to manage the USART synchronous data transfers.

The USART supports master mode only: it cannot receive or send data related to an input clock (SCLK is always an output).

1. There are two modes of transfer:
   - Blocking mode: The communication is performed in polling mode. The HAL status of all data processing is returned by the same function after finishing transfer.
   - No-Blocking mode: The communication is performed using Interrupts or DMA, These API's return the HAL status. The end of the data processing will be indicated through the dedicated USART IRQ when using Interrupt mode or the DMA IRQ when using DMA mode. The HAL_USART_TxCpltCallback(), HAL_USART_RxCpltCallback() and HAL_USART_TxRxCpltCallback() user callbacks will be executed respectively at the end of the transmit or Receive process The HAL_USART_ErrorCallback()user callback will be executed when a communication error is detected
2. Blocking mode API's are :
   - HAL_USART_Transmit() in simplex mode
   - HAL_USART_Receive() in full duplex receive only
   - HAL_USART_TransmitReceive() in full duplex mode
3. Non-Blocking mode API's with Interrupt are :
   - HAL_USART_Transmit_IT() in simplex mode
   - HAL_USART_Receive_IT() in full duplex receive only
   - HAL_USART_TransmitReceive_IT() in full duplex mode
   - HAL_USART_IRQHandler()
4. No-Blocking mode API's with DMA are :
   - HAL_USART_Transmit_DMA() in simplex mode
   - HAL_USART_Receive_DMA() in full duplex receive only
   - HAL_USART_TransmitReceive_DMA() in full duplex mode
   - HAL_USART_DMAPause()
   - HAL_USART_DMAResume()
   - HAL_USART_DMAStop()
5. A set of Transfer Complete Callbacks are provided in Non_Blocking mode:
   - HAL_USART_TxCpltCallback()
   - HAL_USART_RxCpltCallback()
   - HAL_USART_TxHalfCpltCallback()
   - HAL_USART_RxHalfCpltCallback()
   - HAL_USART_ErrorCallback()
   - HAL_USART_TxRxCpltCallback()
6. Non-Blocking mode transfers could be aborted using Abort API's :
   - HAL_USART_Abort()
   - HAL_USART_Abort_IT()
7. For Abort services based on interrupts (HAL_USART_Abort_IT), a Abort Complete Callbacks is provided:
   - HAL_USART_AbortCpltCallback()
8. In Non-Blocking mode transfers, possible errors are split into 2 categories. Errors are handled as follows :
   - Error is considered as Recoverable and non blocking : Transfer could go till end, but error severity is to be evaluated by user : this concerns Frame Error, Parity Error or Noise Error in Interrupt mode reception . Received character is then retrieved and stored in Rx buffer, Error code is set to allow user to identify error type, and HAL_USART_ErrorCallback() user callback is executed. Transfer is kept ongoing on USART side. If user wants to abort it, Abort services should be called by user.
   - Error is considered as Blocking : Transfer could not be completed properly and is aborted. This concerns Overrun Error In Interrupt mode reception and all errors in DMA mode. Error code is set to allow user to identify error type, and HAL_USART_ErrorCallback() user callback is executed.

This section contains the following APIs:

- ***HAL_USART_Transmit()***
- ***HAL_USART_Receive()***
- ***HAL_USART_TransmitReceive()***
- ***HAL_USART_Transmit_IT()***
- ***HAL_USART_Receive_IT()***

- *HAL_USART_TransmitReceive_IT()*
- *HAL_USART_Transmit_DMA()*
- *HAL_USART_Receive_DMA()*
- *HAL_USART_TransmitReceive_DMA()*
- *HAL_USART_DMAPause()*
- *HAL_USART_DMAResume()*
- *HAL_USART_DMAStop()*
- *HAL_USART_Abort()*
- *HAL_USART_Abort_IT()*
- *HAL_USART_IRQHandler()*
- *HAL_USART_TxCpltCallback()*
- *HAL_USART_TxHalfCpltCallback()*
- *HAL_USART_RxCpltCallback()*
- *HAL_USART_RxHalfCpltCallback()*
- *HAL_USART_TxRxCpltCallback()*
- *HAL_USART_ErrorCallback()*
- *HAL_USART_AbortCpltCallback()*

52.2.5 Peripheral State and Error functions

This subsection provides functions allowing to :

- Return the USART handle state
- Return the USART handle error code

This section contains the following APIs:

- *HAL_USART_GetState()*
- *HAL_USART_GetError()*

52.2.6 Detailed description of functions

HAL_USART_Init

Function name

HAL_StatusTypeDef HAL_USART_Init (USART_HandleTypeDef * husart)

Function description

Initialize the USART mode according to the specified parameters in the USART_InitTypeDef and initialize the associated handle.

Parameters

- **husart:** USART handle.

Return values

- **HAL:** status

HAL_USART_DeInit

Function name

HAL_StatusTypeDef HAL_USART_DeInit (USART_HandleTypeDef * husart)

Function description

DeInitialize the USART peripheral.

Parameters

- **husart:** USART handle.

Return values

- **HAL:** status

HAL_USART_MspInit

Function name

void HAL_USART_MspInit (USART_HandleTypeDef * husart)

Function description

Initialize the USART MSP.

Parameters

- **husart:** USART handle.

Return values

- **None:**

HAL_USART_MspDeInit

Function name

void HAL_USART_MspDeInit (USART_HandleTypeDef * husart)

Function description

DeInitialize the USART MSP.

Parameters

- **husart:** USART handle.

Return values

- **None:**

HAL_USART_RegisterCallback

Function name

HAL_StatusTypeDef HAL_USART_RegisterCallback (USART_HandleTypeDef * husart, HAL_USART_CallbackIDTypeDef CallbackID, pUSART_CallbackTypeDef pCallback)

Function description

Register a User USART Callback To be used to override the weak predefined callback.

Parameters

- **husart:** usart handle
- **CallbackID:** ID of the callback to be registered This parameter can be one of the following values:
  - HAL_USART_TX_HALFCOMPLETE_CB_ID Tx Half Complete Callback ID
  - HAL_USART_TX_COMPLETE_CB_ID Tx Complete Callback ID
  - HAL_USART_RX_HALFCOMPLETE_CB_ID Rx Half Complete Callback ID
  - HAL_USART_RX_COMPLETE_CB_ID Rx Complete Callback ID
  - HAL_USART_TX_RX_COMPLETE_CB_ID Rx Complete Callback ID
  - HAL_USART_ERROR_CB_ID Error Callback ID
  - HAL_USART_ABORT_COMPLETE_CB_ID Abort Complete Callback ID
  - HAL_USART_RX_FIFO_FULL_CB_ID Rx Fifo Full Callback ID
  - HAL_USART_TX_FIFO_EMPTY_CB_ID Tx Fifo Empty Callback ID
  - HAL_USART_MSPINIT_CB_ID MspInit Callback ID
  - HAL_USART_MSPDEINIT_CB_ID MspDeInit Callback ID
- **pCallback:** pointer to the Callback function

Return values

- **HAL:** status +

Notes

- The HAL_USART_RegisterCallback() may be called before HAL_USART_Init() in HAL_USART_STATE_RESET to register callbacks for HAL_USART_MSPINIT_CB_ID and HAL_USART_MSPDEINIT_CB_ID

HAL_USART_UnRegisterCallback

Function name

HAL_StatusTypeDef HAL_USART_UnRegisterCallback (USART_HandleTypeDef * husart, HAL_USART_CallbackIDTypeDef CallbackID)

Function description

Unregister an USART Callback USART callaback is redirected to the weak predefined callback.

Parameters

- **husart:** usart handle
- **CallbackID:** ID of the callback to be unregistered This parameter can be one of the following values:
  - HAL_USART_TX_HALFCOMPLETE_CB_ID Tx Half Complete Callback ID
  - HAL_USART_TX_COMPLETE_CB_ID Tx Complete Callback ID
  - HAL_USART_RX_HALFCOMPLETE_CB_ID Rx Half Complete Callback ID
  - HAL_USART_RX_COMPLETE_CB_ID Rx Complete Callback ID
  - HAL_USART_TX_RX_COMPLETE_CB_ID Rx Complete Callback ID
  - HAL_USART_ERROR_CB_ID Error Callback ID
  - HAL_USART_ABORT_COMPLETE_CB_ID Abort Complete Callback ID
  - HAL_USART_RX_FIFO_FULL_CB_ID Rx Fifo Full Callback ID
  - HAL_USART_TX_FIFO_EMPTY_CB_ID Tx Fifo Empty Callback ID
  - HAL_USART_MSPINIT_CB_ID MspInit Callback ID
  - HAL_USART_MSPDEINIT_CB_ID MspDeInit Callback ID

Return values

- **HAL:** status

Notes

- The HAL_USART_UnRegisterCallback() may be called before HAL_USART_Init() in HAL_USART_STATE_RESET to un-register callbacks for HAL_USART_MSPINIT_CB_ID and HAL_USART_MSPDEINIT_CB_ID

HAL_USART_Transmit

Function name

HAL_StatusTypeDef HAL_USART_Transmit (USART_HandleTypeDef * husart, const uint8_t * pTxData, uint16_t Size, uint32_t Timeout)

Function description

Simplex send an amount of data in blocking mode.

Parameters

- **husart:** USART handle.
- **pTxData:** Pointer to data buffer (u8 or u16 data elements).
- **Size:** Amount of data elements (u8 or u16) to be sent.
- **Timeout:** Timeout duration.

Return values

- **HAL:** status

Notes

- When USART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), the sent data is handled as a set of u16. In this case, Size must indicate the number of u16 provided through pTxData.
- When USART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), address of user data buffer containing data to be sent, should be aligned on a half word frontier (16 bits) (as sent data will be handled using u16 pointer cast). Depending on compilation chain, use of specific alignment compilation directives or pragmas might be required to ensure proper alignment for pTxData.

HAL_USART_Receive

Function name

HAL_StatusTypeDef HAL_USART_Receive (USART_HandleTypeDef * husart, uint8_t * pRxData, uint16_t Size, uint32_t Timeout)

Function description

Receive an amount of data in blocking mode.

Parameters

- **husart:** USART handle.
- **pRxData:** Pointer to data buffer (u8 or u16 data elements).
- **Size:** Amount of data elements (u8 or u16) to be received.
- **Timeout:** Timeout duration.

Return values

- **HAL:** status

Notes

- To receive synchronous data, dummy data are simultaneously transmitted.
- When USART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), the received data is handled as a set of u16. In this case, Size must indicate the number of u16 available through pRxData.
- When USART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), address of user data buffer for storing data to be received, should be aligned on a half word frontier (16 bits) (as received data will be handled using u16 pointer cast). Depending on compilation chain, use of specific alignment compilation directives or pragmas might be required to ensure proper alignment for pRxData.

HAL_USART_TransmitReceive

Function name

HAL_StatusTypeDef HAL_USART_TransmitReceive (USART_HandleTypeDef * husart, const uint8_t * pTxData, uint8_t * pRxData, uint16_t Size, uint32_t Timeout)

Function description

Full-Duplex Send and Receive an amount of data in blocking mode.

Parameters

- **husart:** USART handle.
- **pTxData:** pointer to TX data buffer (u8 or u16 data elements).
- **pRxData:** pointer to RX data buffer (u8 or u16 data elements).
- **Size:** amount of data elements (u8 or u16) to be sent (same amount to be received).
- **Timeout:** Timeout duration.

Return values

- **HAL:** status

Notes

- When USART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), the sent data and the received data are handled as sets of u16. In this case, Size must indicate the number of u16 available through pTxData and through pRxData.
- When USART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), address of user data buffers containing data to be sent/received, should be aligned on a half word frontier (16 bits) (as sent/received data will be handled using u16 pointer cast). Depending on compilation chain, use of specific alignment compilation directives or pragmas might be required to ensure proper alignment for pTxData and pRxData.

HAL_USART_Transmit_IT

Function name

HAL_StatusTypeDef HAL_USART_Transmit_IT (USART_HandleTypeDef * husart, const uint8_t * pTxData, uint16_t Size)

Function description

Send an amount of data in interrupt mode.

Parameters

- **husart:** USART handle.
- **pTxData:** pointer to data buffer (u8 or u16 data elements).
- **Size:** amount of data elements (u8 or u16) to be sent.

Return values

- **HAL:** status

Notes

- When USART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), the sent data is handled as a set of u16. In this case, Size must indicate the number of u16 provided through pTxData.
- When USART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), address of user data buffer containing data to be sent, should be aligned on a half word frontier (16 bits) (as sent data will be handled using u16 pointer cast). Depending on compilation chain, use of specific alignment compilation directives or pragmas might be required to ensure proper alignment for pTxData.

HAL_USART_Receive_IT

Function name

HAL_StatusTypeDef HAL_USART_Receive_IT (USART_HandleTypeDef * husart, uint8_t * pRxData, uint16_t Size)

Function description

Receive an amount of data in interrupt mode.

Parameters

- **husart:** USART handle.
- **pRxData:** pointer to data buffer (u8 or u16 data elements).
- **Size:** amount of data elements (u8 or u16) to be received.

Return values

- **HAL:** status

Notes

- To receive synchronous data, dummy data are simultaneously transmitted.
- When USART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), the received data is handled as a set of u16. In this case, Size must indicate the number of u16 available through pRxData.
- When USART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), address of user data buffer for storing data to be received, should be aligned on a half word frontier (16 bits) (as received data will be handled using u16 pointer cast). Depending on compilation chain, use of specific alignment compilation directives or pragmas might be required to ensure proper alignment for pRxData.

HAL_USART_TransmitReceive_IT

Function name

HAL_StatusTypeDef HAL_USART_TransmitReceive_IT (USART_HandleTypeDef * husart, const uint8_t * pTxData, uint8_t * pRxData, uint16_t Size)

Function description

Full-Duplex Send and Receive an amount of data in interrupt mode.

Parameters

- **husart:** USART handle.
- **pTxData:** pointer to TX data buffer (u8 or u16 data elements).
- **pRxData:** pointer to RX data buffer (u8 or u16 data elements).
- **Size:** amount of data elements (u8 or u16) to be sent (same amount to be received).

Return values

- **HAL:** status

Notes

- When USART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), the sent data and the received data are handled as sets of u16. In this case, Size must indicate the number of u16 available through pTxData and through pRxData.
- When USART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), address of user data buffers containing data to be sent/received, should be aligned on a half word frontier (16 bits) (as sent/received data will be handled using u16 pointer cast). Depending on compilation chain, use of specific alignment compilation directives or pragmas might be required to ensure proper alignment for pTxData and pRxData.

HAL_USART_Transmit_DMA

Function name

HAL_StatusTypeDef HAL_USART_Transmit_DMA (USART_HandleTypeDef * husart, const uint8_t * pTxData, uint16_t Size)

Function description

Send an amount of data in DMA mode.

Parameters

- **husart:** USART handle.
- **pTxData:** pointer to data buffer (u8 or u16 data elements).
- **Size:** amount of data elements (u8 or u16) to be sent.

Return values

- **HAL:** status

Notes

- When USART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), the sent data is handled as a set of u16. In this case, Size must indicate the number of u16 provided through pTxData.
- When USART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), address of user data buffer containing data to be sent, should be aligned on a half word frontier (16 bits) (as sent data will be handled by DMA from halfword frontier). Depending on compilation chain, use of specific alignment compilation directives or pragmas might be required to ensure proper alignment for pTxData.

HAL_USART_Receive_DMA

Function name

HAL_StatusTypeDef HAL_USART_Receive_DMA (USART_HandleTypeDef * husart, uint8_t * pRxData, uint16_t Size)

Function description

Receive an amount of data in DMA mode.

Parameters

- **husart:** USART handle.
- **pRxData:** pointer to data buffer (u8 or u16 data elements).
- **Size:** amount of data elements (u8 or u16) to be received.

Return values

- **HAL:** status

Notes

- When the USART parity is enabled (PCE = 1), the received data contain the parity bit (MSB position).
- The USART DMA transmit channel must be configured in order to generate the clock for the slave.
- When USART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), the received data is handled as a set of u16. In this case, Size must indicate the number of u16 available through pRxData.
- When USART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), address of user data buffer for storing data to be received, should be aligned on a half word frontier (16 bits) (as received data will be handled by DMA from halfword frontier). Depending on compilation chain, use of specific alignment compilation directives or pragmas might be required to ensure proper alignment for pRxData.

HAL_USART_TransmitReceive_DMA

Function name

HAL_StatusTypeDef HAL_USART_TransmitReceive_DMA (USART_HandleTypeDef * husart, const uint8_t * pTxData, uint8_t * pRxData, uint16_t Size)

Function description

Full-Duplex Transmit Receive an amount of data in non-blocking mode.

Parameters

- **husart:** USART handle.
- **pTxData:** pointer to TX data buffer (u8 or u16 data elements).
- **pRxData:** pointer to RX data buffer (u8 or u16 data elements).
- **Size:** amount of data elements (u8 or u16) to be received/sent.

Return values

- **HAL:** status

Notes

- When the USART parity is enabled (PCE = 1) the data received contain the parity bit.
- When USART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), the sent data and the received data are handled as sets of u16. In this case, Size must indicate the number of u16 available through pTxData and through pRxData.
- When USART parity is not enabled (PCE = 0), and Word Length is configured to 9 bits (M1-M0 = 01), address of user data buffers containing data to be sent/received, should be aligned on a half word frontier (16 bits) (as sent/received data will be handled by DMA from halfword frontier). Depending on compilation chain, use of specific alignment compilation directives or pragmas might be required to ensure proper alignment for pTxData and pRxData.

HAL_USART_DMAPause

Function name

HAL_StatusTypeDef HAL_USART_DMAPause (USART_HandleTypeDef * husart)

Function description

Pause the DMA Transfer.

Parameters

- **husart:** USART handle.

Return values

- **HAL:** status

HAL_USART_DMAResume

Function name

HAL_StatusTypeDef HAL_USART_DMAResume (USART_HandleTypeDef * husart)

Function description

Resume the DMA Transfer.

Parameters

- **husart:** USART handle.

Return values

- **HAL:** status

HAL_USART_DMAStop

Function name

HAL_StatusTypeDef HAL_USART_DMAStop (USART_HandleTypeDef * husart)

Function description

Stop the DMA Transfer.

Parameters

- **husart:** USART handle.

Return values

- **HAL:** status

HAL_USART_Abort

Function name

HAL_StatusTypeDef HAL_USART_Abort (USART_HandleTypeDef * husart)

Function description

Abort ongoing transfers (blocking mode).

Parameters

- **husart:** USART handle.

Return values

- **HAL:** status

Notes

- This procedure could be used for aborting any ongoing transfer started in Interrupt or DMA mode. This procedure performs following operations : Disable USART Interrupts (Tx and Rx)Disable the DMA transfer in the peripheral register (if enabled)Abort DMA transfer by calling HAL_DMA_Abort (in case of transfer in DMA mode)Set handle State to READY
- This procedure is executed in blocking mode : when exiting function, Abort is considered as completed.

HAL_USART_Abort_IT

Function name

HAL_StatusTypeDef HAL_USART_Abort_IT (USART_HandleTypeDef * husart)

Function description

Abort ongoing transfers (Interrupt mode).

Parameters

- **husart:** USART handle.

Return values

- **HAL:** status

Notes

- This procedure could be used for aborting any ongoing transfer started in Interrupt or DMA mode. This procedure performs following operations : Disable USART Interrupts (Tx and Rx)Disable the DMA transfer in the peripheral register (if enabled)Abort DMA transfer by calling HAL_DMA_Abort_IT (in case of transfer in DMA mode)Set handle State to READYAt abort completion, call user abort complete callback
- This procedure is executed in Interrupt mode, meaning that abort procedure could be considered as completed only when user abort complete callback is executed (not when exiting function).

HAL_USART_IRQHandler

Function name

void HAL_USART_IRQHandler (USART_HandleTypeDef * husart)

Function description

Handle USART interrupt request.

Parameters

- **husart:** USART handle.

Return values

- **None:**

HAL_USART_TxHalfCpltCallback

Function name

void HAL_USART_TxHalfCpltCallback (USART_HandleTypeDef * husart)

Function description

Tx Half Transfer completed callback.

Parameters

- **husart:** USART handle.

Return values

- **None:**

HAL_USART_TxCpltCallback

Function name

void HAL_USART_TxCpltCallback (USART_HandleTypeDef * husart)

Function description

Tx Transfer completed callback.

Parameters

- **husart:** USART handle.

Return values

- **None:**

HAL_USART_RxCpltCallback

Function name

void HAL_USART_RxCpltCallback (USART_HandleTypeDef * husart)

Function description

Rx Transfer completed callback.

Parameters

- **husart:** USART handle.

Return values

- **None:**

HAL_USART_RxHalfCpltCallback

Function name

void HAL_USART_RxHalfCpltCallback (USART_HandleTypeDef * husart)

Function description

Rx Half Transfer completed callback.

Parameters

- **husart:** USART handle.

Return values

- **None:**

HAL_USART_TxRxCpltCallback

Function name

void HAL_USART_TxRxCpltCallback (USART_HandleTypeDef * husart)

Function description

Tx/Rx Transfers completed callback for the non-blocking process.

Parameters

- **husart:** USART handle.

Return values

- **None:**

HAL_USART_ErrorCallback

Function name

void HAL_USART_ErrorCallback (USART_HandleTypeDef * husart)

Function description

USART error callback.

Parameters

- **husart:** USART handle.

Return values

- **None:**

HAL_USART_AbortCpltCallback

Function name

void HAL_USART_AbortCpltCallback (USART_HandleTypeDef * husart)

Function description

USART Abort Complete callback.

Parameters

- **husart:** USART handle.

Return values

- **None:**

HAL_USART_GetState

Function name

HAL_USART_StateTypeDef HAL_USART_GetState (const USART_HandleTypeDef * husart)

Function description

Return the USART handle state.

Parameters

- **husart:** pointer to a USART_HandleTypeDef structure that contains the configuration information for the specified USART.

Return values

- **USART:** handle state

HAL_USART_GetError

Function name

uint32_t HAL_USART_GetError (const USART_HandleTypeDef * husart)

Function description

Return the USART error code.

Parameters

- **husart:** pointer to a USART_HandleTypeDef structure that contains the configuration information for the specified USART.

Return values

- **USART:** handle Error Code

52.3 USART Firmware driver defines

The following section lists the various define and macros of the module.

52.3.1 USART

USART

USART Clock

USART_CLOCK_DISABLE

USART clock disable

USART_CLOCK_ENABLE

USART clock enable

USART Clock Prescaler

USART_PRESCALER_DIV1

fclk_pres = fclk

USART_PRESCALER_DIV2

fclk_pres = fclk/2

USART_PRESCALER_DIV4

fclk_pres = fclk/4

USART_PRESCALER_DIV6

fclk_pres = fclk/6

USART_PRESCALER_DIV8

fclk_pres = fclk/8

USART_PRESCALER_DIV10

fclk_pres = fclk/10

USART_PRESCALER_DIV12

fclk_pres = fclk/12

USART_PRESCALER_DIV16

fclk_pres = fclk/16

USART_PRESCALER_DIV32

fclk_pres = fclk/32

USART_PRESCALER_DIV64

fclk_pres = fclk/64

USART_PRESCALER_DIV128

fclk_pres = fclk/128

USART_PRESCALER_DIV256

fclk_pres = fclk/256

USART Clock Phase

USART_PHASE_1EDGE

USART frame phase on first clock transition

USART_PHASE_2EDGE

USART frame phase on second clock transition

USART Clock Polarity

USART_POLARITY_LOW

Driver enable signal is active high

USART_POLARITY_HIGH

Driver enable signal is active low

USART Error Definition

HAL_USART_ERROR_NONE

No error

HAL_USART_ERROR_PE

Parity error

HAL_USART_ERROR_NE

Noise error

HAL_USART_ERROR_FE

Frame error

HAL_USART_ERROR_ORE

Overrun error

HAL_USART_ERROR_DMA

DMA transfer error

HAL_USART_ERROR_UDR

SPI slave underrun error

HAL_USART_ERROR_INVALID_CALLBACK

Invalid Callback error

HAL_USART_ERROR_RTO

Receiver Timeout error

USART Exported Macros

__HAL_USART_RESET_HANDLE_STATE

Description:

- Reset USART handle state.

Parameters:

- __HANDLE__: USART handle.

Return value:

- None

__HAL_USART_GET_FLAG

Description:

- Check whether the specified USART flag is set or not.

Parameters:

- __HANDLE__: specifies the USART Handle
- __FLAG__: specifies the flag to check. This parameter can be one of the following values:
  - USART_FLAG_TXFT TXFIFO threshold flag
  - USART_FLAG_RXFT RXFIFO threshold flag
  - USART_FLAG_RXFF RXFIFO Full flag
  - USART_FLAG_TXFE TXFIFO Empty flag
  - USART_FLAG_REACK Receive enable acknowledge flag
  - USART_FLAG_TEACK Transmit enable acknowledge flag
  - USART_FLAG_BUSY Busy flag
  - USART_FLAG_UDR SPI slave underrun error flag
  - USART_FLAG_TXE Transmit data register empty flag
  - USART_FLAG_TXFNF TXFIFO not full flag
  - USART_FLAG_TC Transmission Complete flag
  - USART_FLAG_RXNE Receive data register not empty flag
  - USART_FLAG_RXFNE RXFIFO not empty flag
  - USART_FLAG_RTOF Receiver Timeout flag
  - USART_FLAG_IDLE Idle Line detection flag
  - USART_FLAG_ORE OverRun Error flag
  - USART_FLAG_NE Noise Error flag
  - USART_FLAG_FE Framing Error flag
  - USART_FLAG_PE Parity Error flag

Return value:

- The: new state of __FLAG__ (TRUE or FALSE).

__HAL_USART_CLEAR_FLAG

Description:

- Clear the specified USART pending flag.

Parameters:

- __HANDLE__: specifies the USART Handle.
- __FLAG__: specifies the flag to check. This parameter can be any combination of the following values:
  - USART_CLEAR_PEF Parity Error Clear Flag
  - USART_CLEAR_FEF Framing Error Clear Flag
  - USART_CLEAR_NEF Noise detected Clear Flag
  - USART_CLEAR_OREF Overrun Error Clear Flag
  - USART_CLEAR_IDLEF IDLE line detected Clear Flag
  - USART_CLEAR_TXFECF TXFIFO empty clear Flag
  - USART_CLEAR_TCF Transmission Complete Clear Flag
  - USART_CLEAR_RTOF Receiver Timeout clear flag
  - USART_CLEAR_UDRF SPI slave underrun error Clear Flag

Return value:

- None

__HAL_USART_CLEAR_PEFLAG

Description:

- Clear the USART PE pending flag.

Parameters:

- __HANDLE__: specifies the USART Handle.

Return value:

- None

__HAL_USART_CLEAR_FEFLAG

Description:

- Clear the USART FE pending flag.

Parameters:

- __HANDLE__: specifies the USART Handle.

Return value:

- None

__HAL_USART_CLEAR_NEFLAG

Description:

- Clear the USART NE pending flag.

Parameters:

- __HANDLE__: specifies the USART Handle.

Return value:

- None

__HAL_USART_CLEAR_OREFLAG

Description:

- Clear the USART ORE pending flag.

Parameters:

- __HANDLE__: specifies the USART Handle.

Return value:

- None

__HAL_USART_CLEAR_IDLEFLAG

Description:

- Clear the USART IDLE pending flag.

Parameters:

- __HANDLE__: specifies the USART Handle.

Return value:

- None

__HAL_USART_CLEAR_TXFECF

Description:

- Clear the USART TX FIFO empty clear flag.

Parameters:

- __HANDLE__: specifies the USART Handle.

Return value:

- None

__HAL_USART_CLEAR_UDRFLAG

Description:

- Clear SPI slave underrun error flag.

Parameters:

- __HANDLE__: specifies the USART Handle.

Return value:

- None

__HAL_USART_ENABLE_IT

Description:

- Enable the specified USART interrupt.

Parameters:

- __HANDLE__: specifies the USART Handle.
- __INTERRUPT__: specifies the USART interrupt source to enable. This parameter can be one of the following values:
  - USART_IT_RXFF RXFIFO Full interrupt
  - USART_IT_TXFE TXFIFO Empty interrupt
  - USART_IT_RXFT RXFIFO threshold interrupt
  - USART_IT_TXFT TXFIFO threshold interrupt
  - USART_IT_TXE Transmit Data Register empty interrupt
  - USART_IT_TXFNF TX FIFO not full interrupt
  - USART_IT_TC Transmission complete interrupt
  - USART_IT_RXNE Receive Data register not empty interrupt
  - USART_IT_RXFNE RXFIFO not empty interrupt
  - USART_IT_IDLE Idle line detection interrupt
  - USART_IT_PE Parity Error interrupt
  - USART_IT_ERR Error interrupt(Frame error, noise error, overrun error)

Return value:

- None

__HAL_USART_DISABLE_IT

Description:

- Disable the specified USART interrupt.

Parameters:

- __HANDLE__: specifies the USART Handle.
- __INTERRUPT__: specifies the USART interrupt source to disable. This parameter can be one of the following values:
  - USART_IT_RXFF RXFIFO Full interrupt
  - USART_IT_TXFE TXFIFO Empty interrupt
  - USART_IT_RXFT RXFIFO threshold interrupt
  - USART_IT_TXFT TXFIFO threshold interrupt
  - USART_IT_TXE Transmit Data Register empty interrupt
  - USART_IT_TXFNF TX FIFO not full interrupt
  - USART_IT_TC Transmission complete interrupt
  - USART_IT_RXNE Receive Data register not empty interrupt
  - USART_IT_RXFNE RXFIFO not empty interrupt
  - USART_IT_IDLE Idle line detection interrupt
  - USART_IT_PE Parity Error interrupt
  - USART_IT_ERR Error interrupt(Frame error, noise error, overrun error)

Return value:

- None

__HAL_USART_GET_IT

Description:

- Check whether the specified USART interrupt has occurred or not.

Parameters:

- __HANDLE__: specifies the USART Handle.
- __INTERRUPT__: specifies the USART interrupt source to check. This parameter can be one of the following values:
  - USART_IT_RXFF RXFIFO Full interrupt
  - USART_IT_TXFE TXFIFO Empty interrupt
  - USART_IT_RXFT RXFIFO threshold interrupt
  - USART_IT_TXFT TXFIFO threshold interrupt
  - USART_IT_TXE Transmit Data Register empty interrupt
  - USART_IT_TXFNF TX FIFO not full interrupt
  - USART_IT_TC Transmission complete interrupt
  - USART_IT_RXNE Receive Data register not empty interrupt
  - USART_IT_RXFNE RXFIFO not empty interrupt
  - USART_IT_IDLE Idle line detection interrupt
  - USART_IT_ORE OverRun Error interrupt
  - USART_IT_NE Noise Error interrupt
  - USART_IT_FE Framing Error interrupt
  - USART_IT_PE Parity Error interrupt

Return value:

- The: new state of __INTERRUPT__ (SET or RESET).

__HAL_USART_GET_IT_SOURCE

Description:

- Check whether the specified USART interrupt source is enabled or not.

Parameters:

- __HANDLE__: specifies the USART Handle.
- __INTERRUPT__: specifies the USART interrupt source to check. This parameter can be one of the following values:
  - USART_IT_RXFF RXFIFO Full interrupt
  - USART_IT_TXFE TXFIFO Empty interrupt
  - USART_IT_RXFT RXFIFO threshold interrupt
  - USART_IT_TXFT TXFIFO threshold interrupt
  - USART_IT_TXE Transmit Data Register empty interrupt
  - USART_IT_TXFNF TX FIFO not full interrupt
  - USART_IT_TC Transmission complete interrupt
  - USART_IT_RXNE Receive Data register not empty interrupt
  - USART_IT_RXFNE RXFIFO not empty interrupt
  - USART_IT_IDLE Idle line detection interrupt
  - USART_IT_ORE OverRun Error interrupt
  - USART_IT_NE Noise Error interrupt
  - USART_IT_FE Framing Error interrupt
  - USART_IT_PE Parity Error interrupt

Return value:

- The: new state of __INTERRUPT__ (SET or RESET).

__HAL_USART_CLEAR_IT

Description:

- Clear the specified USART ISR flag, in setting the proper ICR register flag.

Parameters:

- __HANDLE__: specifies the USART Handle.
- __IT_CLEAR__: specifies the interrupt clear register flag that needs to be set to clear the corresponding interrupt. This parameter can be one of the following values:
  - USART_CLEAR_PEF Parity Error Clear Flag
  - USART_CLEAR_FEF Framing Error Clear Flag
  - USART_CLEAR_NEF Noise detected Clear Flag
  - USART_CLEAR_OREF Overrun Error Clear Flag
  - USART_CLEAR_IDLEF IDLE line detected Clear Flag
  - USART_CLEAR_RTOF Receiver timeout clear flag
  - USART_CLEAR_TXFECF TXFIFO empty clear Flag
  - USART_CLEAR_TCF Transmission Complete Clear Flag

Return value:

- None

__HAL_USART_SEND_REQ

Description:

- Set a specific USART request flag.

Parameters:

- __HANDLE__: specifies the USART Handle.
- __REQ__: specifies the request flag to set. This parameter can be one of the following values:
  - USART_RXDATA_FLUSH_REQUEST Receive Data flush Request
  - USART_TXDATA_FLUSH_REQUEST Transmit data flush Request

Return value:

- None

__HAL_USART_ONE_BIT_SAMPLE_ENABLE

Description:

- Enable the USART one bit sample method.

Parameters:

- __HANDLE__: specifies the USART Handle.

Return value:

- None

__HAL_USART_ONE_BIT_SAMPLE_DISABLE

Description:

- Disable the USART one bit sample method.

Parameters:

- __HANDLE__: specifies the USART Handle.

Return value:

- None

__HAL_USART_ENABLE

Description:

- Enable USART.

Parameters:

- __HANDLE__: specifies the USART Handle.

Return value:

- None

__HAL_USART_DISABLE

Description:

- Disable USART.

Parameters:

- __HANDLE__: specifies the USART Handle.

Return value:

- None

USART Flags

USART_FLAG_TXFT

USART TXFIFO threshold flag

USART_FLAG_RXFT

USART RXFIFO threshold flag

USART_FLAG_RXFF

USART RXFIFO Full flag

USART_FLAG_TXFE

USART TXFIFO Empty flag

USART_FLAG_REACK

USART receive enable acknowledge flag

USART_FLAG_TEACK

USART transmit enable acknowledge flag

USART_FLAG_BUSY

USART busy flag

USART_FLAG_UDR

SPI slave underrun error flag

USART_FLAG_TXE

USART transmit data register empty

USART_FLAG_TXFNF

USART TXFIFO not full

USART_FLAG_RTOF

USART receiver timeout flag

USART_FLAG_TC

USART transmission complete

USART_FLAG_RXNE

USART read data register not empty

USART_FLAG_RXFNE

USART RXFIFO not empty

USART_FLAG_IDLE

USART idle flag

USART_FLAG_ORE

USART overrun error

USART_FLAG_NE

USART noise error

USART_FLAG_FE

USART frame error

USART_FLAG_PE

USART parity error

USART Interruption Flags Mask

USART_IT_MASK

USART interruptions flags mask

USART_CR_MASK

USART control register mask

USART_CR_POS

USART control register position

USART_ISR_MASK

USART ISR register mask

USART_ISR_POS

USART ISR register position

USART Interrupts Definition

USART_IT_PE

USART parity error interruption

USART_IT_TXE

USART transmit data register empty interruption

USART_IT_TXFNF

USART TX FIFO not full interruption

USART_IT_TC

USART transmission complete interruption

USART_IT_RXNE

USART read data register not empty interruption

USART_IT_RXFNE

USART RXFIFO not empty interruption

USART_IT_IDLE

USART idle interruption

USART_IT_ERR

USART error interruption

USART_IT_ORE

USART overrun error interruption

USART_IT_NE

USART noise error interruption

USART_IT_FE

USART frame error interruption

USART_IT_RXFF

USART RXFIFO full interruption

USART_IT_TXFE

USART TXFIFO empty interruption

USART_IT_RXFT

USART RXFIFO threshold reached interruption

USART_IT_TXFT

USART TXFIFO threshold reached interruption

USART Interruption Clear Flags

USART_CLEAR_PEF

Parity Error Clear Flag

USART_CLEAR_FEF

Framing Error Clear Flag

USART_CLEAR_NEF

Noise Error detected Clear Flag

USART_CLEAR_OREF

OverRun Error Clear Flag

USART_CLEAR_IDLEF

IDLE line detected Clear Flag

USART_CLEAR_TCF

Transmission Complete Clear Flag

USART_CLEAR_UDRF

SPI slave underrun error Clear Flag

USART_CLEAR_TXFECF

TXFIFO Empty Clear Flag

USART_CLEAR_RTOF

USART receiver timeout clear flag

USART Last Bit

USART_LASTBIT_DISABLE

USART frame last data bit clock pulse not output to SCLK pin

USART_LASTBIT_ENABLE

USART frame last data bit clock pulse output to SCLK pin

USART Mode

USART_MODE_RX

RX mode

USART_MODE_TX

TX mode

USART_MODE_TX_RX

RX and TX mode

USART Parity

USART_PARITY_NONE

No parity

USART_PARITY_EVEN

Even parity

USART_PARITY_ODD

Odd parity

USART Request Parameters

USART_RXDATA_FLUSH_REQUEST

Receive Data flush Request

USART_TXDATA_FLUSH_REQUEST

Transmit data flush Request

USART Number of Stop Bits

USART_STOPBITS_0_5

USART frame with 0.5 stop bit

USART_STOPBITS_1

USART frame with 1 stop bit

USART_STOPBITS_1_5

USART frame with 1.5 stop bits

USART_STOPBITS_2

USART frame with 2 stop bits

53 HAL USART Extension Driver

53.1 USARTEx Firmware driver API description

The following section lists the various functions of the USARTEx library.

53.1.1 USART peripheral extended features

53.1.2 IO operation functions

This section contains the following APIs:

- *HAL_USARTEx_RxFifoFullCallback()*
- *HAL_USARTEx_TxFifoEmptyCallback()*

53.1.3 Peripheral Control functions

This section provides the following functions:

- HAL_USARTEx_EnableSPISlaveMode() API enables the SPI slave mode
- HAL_USARTEx_DisableSPISlaveMode() API disables the SPI slave mode
- HAL_USARTEx_ConfigNSS API configures the Slave Select input pin (NSS)
- HAL_USARTEx_EnableFifoMode() API enables the FIFO mode
- HAL_USARTEx_DisableFifoMode() API disables the FIFO mode
- HAL_USARTEx_SetTxFifoThreshold() API sets the TX FIFO threshold
- HAL_USARTEx_SetRxFifoThreshold() API sets the RX FIFO threshold

This section contains the following APIs:

- *HAL_USARTEx_EnableSlaveMode()*
- *HAL_USARTEx_DisableSlaveMode()*
- *HAL_USARTEx_ConfigNSS()*
- *HAL_USARTEx_EnableFifoMode()*
- *HAL_USARTEx_DisableFifoMode()*
- *HAL_USARTEx_SetTxFifoThreshold()*
- *HAL_USARTEx_SetRxFifoThreshold()*

53.1.4 Detailed description of functions

HAL_USARTEx_RxFifoFullCallback

Function name

void HAL_USARTEx_RxFifoFullCallback (USART_HandleTypeDef * husart)

Function description

USART RX Fifo full callback.

Parameters

- **husart:** USART handle.

Return values

- **None:**

HAL_USARTEx_TxFifoEmptyCallback

Function name

void HAL_USARTEx_TxFifoEmptyCallback (USART_HandleTypeDef * husart)

Function description

USART TX Fifo empty callback.

Parameters

- **husart:** USART handle.

Return values

- **None:**

HAL_USARTEx_EnableSlaveMode

Function name

HAL_StatusTypeDef HAL_USARTEx_EnableSlaveMode (USART_HandleTypeDef * husart)

Function description

Enable the SPI slave mode.

Parameters

- **husart:** USART handle.

Return values

- **HAL:** status

Notes

- When the USART operates in SPI slave mode, it handles data flow using the serial interface clock derived from the external SCLK signal provided by the external master SPI device.
- In SPI slave mode, the USART must be enabled before starting the master communications (or between frames while the clock is stable). Otherwise, if the USART slave is enabled while the master is in the middle of a frame, it will become desynchronized with the master.
- The data register of the slave needs to be ready before the first edge of the communication clock or before the end of the ongoing communication, otherwise the SPI slave will transmit zeros.

HAL_USARTEx_DisableSlaveMode

Function name

HAL_StatusTypeDef HAL_USARTEx_DisableSlaveMode (USART_HandleTypeDef * husart)

Function description

Disable the SPI slave mode.

Parameters

- **husart:** USART handle.

Return values

- **HAL:** status

HAL_USARTEx_ConfigNSS

Function name

HAL_StatusTypeDef HAL_USARTEx_ConfigNSS (USART_HandleTypeDef * husart, uint32_t NSSConfig)

Function description

Configure the Slave Select input pin (NSS).

Parameters

- **husart:** USART handle.
- **NSSConfig:** NSS configuration. This parameter can be one of the following values:
  - USART_NSS_HARD
  - USART_NSS_SOFT

Return values

- **HAL:** status

Notes

- Software NSS management: SPI slave will always be selected and NSS input pin will be ignored.
- Hardware NSS management: the SPI slave selection depends on NSS input pin. The slave is selected when NSS is low and deselected when NSS is high.

HAL_USARTEx_EnableFifoMode

Function name

HAL_StatusTypeDef HAL_USARTEx_EnableFifoMode (USART_HandleTypeDef * husart)

Function description

Enable the FIFO mode.

Parameters

- **husart:** USART handle.

Return values

- **HAL:** status

HAL_USARTEx_DisableFifoMode

Function name

HAL_StatusTypeDef HAL_USARTEx_DisableFifoMode (USART_HandleTypeDef * husart)

Function description

Disable the FIFO mode.

Parameters

- **husart:** USART handle.

Return values

- **HAL:** status

HAL_USARTEx_SetTxFifoThreshold

Function name

HAL_StatusTypeDef HAL_USARTEx_SetTxFifoThreshold (USART_HandleTypeDef * husart, uint32_t Threshold)

Function description

Set the TXFIFO threshold.

Parameters

- **husart:** USART handle.
- **Threshold:** TX FIFO threshold value This parameter can be one of the following values:
  - USART_TXFIFO_THRESHOLD_1_8
  - USART_TXFIFO_THRESHOLD_1_4
  - USART_TXFIFO_THRESHOLD_1_2
  - USART_TXFIFO_THRESHOLD_3_4
  - USART_TXFIFO_THRESHOLD_7_8
  - USART_TXFIFO_THRESHOLD_8_8

Return values

- **HAL:** status

HAL_USARTEx_SetRxFifoThreshold

Function name

HAL_StatusTypeDef HAL_USARTEx_SetRxFifoThreshold (USART_HandleTypeDef * husart, uint32_t Threshold)

Function description

Set the RXFIFO threshold.

Parameters

- **husart:** USART handle.
- **Threshold:** RX FIFO threshold value This parameter can be one of the following values:
  - USART_RXFIFO_THRESHOLD_1_8
  - USART_RXFIFO_THRESHOLD_1_4
  - USART_RXFIFO_THRESHOLD_1_2
  - USART_RXFIFO_THRESHOLD_3_4
  - USART_RXFIFO_THRESHOLD_7_8
  - USART_RXFIFO_THRESHOLD_8_8

Return values

- **HAL:** status

53.2 USARTEx Firmware driver defines

The following section lists the various define and macros of the module.

53.2.1 USARTEx

USARTEx

USARTEx FIFO mode

USART_FIFOMODE_DISABLE

FIFO mode disable

USART_FIFOMODE_ENABLE

FIFO mode enable

USARTEx RXFIFO threshold level

USART_RXFIFO_THRESHOLD_1_8

RXFIFO FIFO reaches 1/8 of its depth

USART_RXFIFO_THRESHOLD_1_4

RXFIFO FIFO reaches 1/4 of its depth

USART_RXFIFO_THRESHOLD_1_2

RXFIFO FIFO reaches 1/2 of its depth

USART_RXFIFO_THRESHOLD_3_4

RXFIFO FIFO reaches 3/4 of its depth

USART_RXFIFO_THRESHOLD_7_8

RXFIFO FIFO reaches 7/8 of its depth

USART_RXFIFO_THRESHOLD_8_8

RXFIFO FIFO becomes full

USARTEx Synchronous Slave mode enable

USART_SLAVEMODE_DISABLE

USART SPI Slave Mode Enable

USART_SLAVEMODE_ENABLE

USART SPI Slave Mode Disable

USARTEx Slave Select Management

USART_NSS_HARD

SPI slave selection depends on NSS input pin

USART_NSS_SOFT

SPI slave is always selected and NSS input pin is ignored

USARTEx TXFIFO threshold level

USART_TXFIFO_THRESHOLD_1_8

TXFIFO reaches 1/8 of its depth

USART_TXFIFO_THRESHOLD_1_4

TXFIFO reaches 1/4 of its depth

USART_TXFIFO_THRESHOLD_1_2

TXFIFO reaches 1/2 of its depth

USART_TXFIFO_THRESHOLD_3_4

TXFIFO reaches 3/4 of its depth

USART_TXFIFO_THRESHOLD_7_8

TXFIFO reaches 7/8 of its depth

USART_TXFIFO_THRESHOLD_8_8

TXFIFO becomes empty

USARTEx Word Length

USART_WORDLENGTH_7B

7-bit long USART frame

USART_WORDLENGTH_8B

8-bit long USART frame

USART_WORDLENGTH_9B

9-bit long USART frame

54 HAL WWDG Generic Driver

54.1 WWDG Firmware driver registers structures

54.1.1 WWDG_InitTypeDef

WWDG_InitTypeDef is defined in the stm32u0xx_hal_wwdg.h

Data Fields

- ***uint32_t Prescaler***
- ***uint32_t Window***
- ***uint32_t Counter***
- ***uint32_t EWIMode***

Field Documentation

- ***uint32_t WWDG_InitTypeDef::Prescaler***
  Specifies the prescaler value of the WWDG. This parameter can be a value of ***WWDG_Prescaler***
- ***uint32_t WWDG_InitTypeDef::Window***
  Specifies the WWDG window value to be compared to the downcounter. This parameter must be a number Min_Data = 0x40 and Max_Data = 0x7F
- ***uint32_t WWDG_InitTypeDef::Counter***
  Specifies the WWDG free-running downcounter value. This parameter must be a number between Min_Data = 0x40 and Max_Data = 0x7F
- ***uint32_t WWDG_InitTypeDef::EWIMode***
  Specifies if WWDG Early Wakeup Interrupt is enable or not. This parameter can be a value of ***WWDG_EWI_Mode***

54.1.2 __WWDG_HandleTypeDef

__WWDG_HandleTypeDef is defined in the stm32u0xx_hal_wwdg.h

Data Fields

- ***WWDG_TypeDef * Instance***
- ***WWDG_InitTypeDef Init***
- ***void(* EwiCallback***
- ***void(* MspInitCallback***

Field Documentation

- ***WWDG_TypeDef* __WWDG_HandleTypeDef::Instance***
  Register base address
- ***WWDG_InitTypeDef __WWDG_HandleTypeDef::Init***
  WWDG required parameters
- ***void(* __WWDG_HandleTypeDef::EwiCallback)(struct __WWDG_HandleTypeDef *hwwdg)***
  WWDG Early WakeUp Interrupt callback
- ***void(* __WWDG_HandleTypeDef::MspInitCallback)(struct __WWDG_HandleTypeDef *hwwdg)***
  WWDG Msp Init callback

54.2 WWDG Firmware driver API description

The following section lists the various functions of the WWDG library.

54.2.1 WWDG Specific features

Once enabled the WWDG generates a system reset on expiry of a programmed time period, unless the program refreshes the counter (T[6;0] downcounter) before reaching 0x3F value (i.e. a reset is generated when the counter value rolls down from 0x40 to 0x3F).

- An MCU reset is also generated if the counter value is refreshed before the counter has reached the refresh window value. This implies that the counter must be refreshed in a limited window.

- Once enabled the WWDG cannot be disabled except by a system reset.
- If required by application, an Early Wakeup Interrupt can be triggered in order to be warned before WWDG expiration. The Early Wakeup Interrupt (EWI) can be used if specific safety operations or data logging must be performed before the actual reset is generated. When the downcounter reaches 0x40, interrupt occurs. This mechanism requires WWDG interrupt line to be enabled in NVIC. Once enabled, EWI interrupt cannot be disabled except by a system reset.
- WWDGRST flag in RCC CSR register can be used to inform when a WWDG reset occurs.
- The WWDG counter input clock is derived from the APB clock divided by a programmable prescaler.
- WWDG clock (Hz) = PCLK1 / (4096 * Prescaler)
- WWDG timeout (mS) = 1000 * (T[5;0] + 1) / WWDG clock (Hz) where T[5;0] are the lowest 6 bits of Counter.
- WWDG Counter refresh is allowed between the following limits :
  - min time (mS) = 1000 * (Counter - Window) / WWDG clock
  - max time (mS) = 1000 * (Counter - 0x40) / WWDG clock
- Typical values:
  - Counter min (T[5;0] = 0x00) at 56MHz (PCLK1) with zero prescaler: max timeout before reset: approximately 73.14us
  - Counter max (T[5;0] = 0x3F) at 56MHz (PCLK1) with prescaler dividing by 128: max timeout before reset: approximately 599.18ms

54.2.2 How to use this driver

Common driver usage

- Enable WWDG APB1 clock using __HAL_RCC_WWDG_CLK_ENABLE().
- Configure the WWDG prescaler, refresh window value, counter value and early interrupt status using HAL_WWDG_Init() function. This will automatically enable WWDG and start its downcounter. Time reference can be taken from function exit. Care must be taken to provide a counter value greater than 0x40 to prevent generation of immediate reset.
- If the Early Wakeup Interrupt (EWI) feature is enabled, an interrupt is generated when the counter reaches 0x40. When HAL_WWDG_IRQHandler is triggered by the interrupt service routine, flag will be automatically cleared and HAL_WWDG_WakeupCallback user callback will be executed. User can add his own code by customization of callback HAL_WWDG_WakeupCallback.
- Then the application program must refresh the WWDG counter at regular intervals during normal operation to prevent an MCU reset, using HAL_WWDG_Refresh() function. This operation must occur only when the counter is lower than the refresh window value already programmed.

Callback registration

The compilation define USE_HAL_WWDG_REGISTER_CALLBACKS when set to 1 allows the user to configure dynamically the driver callbacks. Use Functions HAL_WWDG_RegisterCallback() to register a user callback.

- Function HAL_WWDG_RegisterCallback() allows to register following callbacks:
  - EwiCallback : callback for Early WakeUp Interrupt.
  - MspInitCallback : WWDG MspInit. This function takes as parameters the HAL peripheral handle, the Callback ID and a pointer to the user callback function.
- Use function HAL_WWDG_UnRegisterCallback() to reset a callback to the default weak (surcharged) function. HAL_WWDG_UnRegisterCallback() takes as parameters the HAL peripheral handle and the Callback ID. This function allows to reset following callbacks:
  - EwiCallback : callback for Early WakeUp Interrupt.
  - MspInitCallback : WWDG MspInit.

When calling HAL_WWDG_Init function, callbacks are reset to the corresponding legacy weak (surcharged) functions: HAL_WWDG_EarlyWakeupCallback() and HAL_WWDG_MspInit() only if they have not been registered before.

When compilation define USE_HAL_WWDG_REGISTER_CALLBACKS is set to 0 or not defined, the callback registering feature is not available and weak (surcharged) callbacks are used.

WWDG HAL driver macros list

Below the list of available macros in WWDG HAL driver.

- __HAL_WWDG_ENABLE: Enable the WWDG peripheral
- __HAL_WWDG_GET_FLAG: Get the selected WWDG's flag status
- __HAL_WWDG_CLEAR_FLAG: Clear the WWDG's pending flags
- __HAL_WWDG_ENABLE_IT: Enable the WWDG early wakeup interrupt

54.2.3 Initialization and Configuration functions

This section provides functions allowing to:

- Initialize and start the WWDG according to the specified parameters in the WWDG_InitTypeDef of associated handle.
- Initialize the WWDG MSP.

This section contains the following APIs:

- ***HAL_WWDG_Init()***
- ***HAL_WWDG_MspInit()***
- ***HAL_WWDG_RegisterCallback()***
- ***HAL_WWDG_UnRegisterCallback()***

54.2.4 IO operation functions

This section provides functions allowing to:

- Refresh the WWDG.
- Handle WWDG interrupt request and associated function callback.

This section contains the following APIs:

- ***HAL_WWDG_Refresh()***
- ***HAL_WWDG_IRQHandler()***
- ***HAL_WWDG_EarlyWakeupCallback()***

54.2.5 Detailed description of functions

HAL_WWDG_Init

Function name

HAL_StatusTypeDef HAL_WWDG_Init (WWDG_HandleTypeDef * hwwdg)

Function description

Initialize the WWDG according to the specified.

Parameters

- **hwwdg:** pointer to a WWDG_HandleTypeDef structure that contains the configuration information for the specified WWDG module.

Return values

- **HAL:** status

HAL_WWDG_MspInit

Function name

void HAL_WWDG_MspInit (WWDG_HandleTypeDef * hwwdg)

Function description

Initialize the WWDG MSP.

Parameters

- **hwwdg:** pointer to a WWDG_HandleTypeDef structure that contains the configuration information for the specified WWDG module.

Return values

- **None:**

Notes

- When rewriting this function in user file, mechanism may be added to avoid multiple initialize when HAL_WWDG_Init function is called again to change parameters.

HAL_WWDG_RegisterCallback

Function name

HAL_StatusTypeDef HAL_WWDG_RegisterCallback (WWDG_HandleTypeDef * hwwdg, HAL_WWDG_CallbackIDTypeDef CallbackID, pWWDG_CallbackTypeDef pCallback)

Function description

Register a User WWDG Callback To be used instead of the weak (surcharged) predefined callback.

Parameters

- **hwwdg:** WWDG handle
- **CallbackID:** ID of the callback to be registered This parameter can be one of the following values:
  - HAL_WWDG_EWI_CB_ID Early WakeUp Interrupt Callback ID
  - HAL_WWDG_MSPINIT_CB_ID MspInit callback ID
- **pCallback:** pointer to the Callback function

Return values

- **status:**

HAL_WWDG_UnRegisterCallback

Function name

HAL_StatusTypeDef HAL_WWDG_UnRegisterCallback (WWDG_HandleTypeDef * hwwdg, HAL_WWDG_CallbackIDTypeDef CallbackID)

Function description

Unregister a WWDG Callback WWDG Callback is redirected to the weak (surcharged) predefined callback.

Parameters

- **hwwdg:** WWDG handle
- **CallbackID:** ID of the callback to be registered This parameter can be one of the following values:
  - HAL_WWDG_EWI_CB_ID Early WakeUp Interrupt Callback ID
  - HAL_WWDG_MSPINIT_CB_ID MspInit callback ID

Return values

- **status:**

HAL_WWDG_Refresh

Function name

HAL_StatusTypeDef HAL_WWDG_Refresh (WWDG_HandleTypeDef * hwwdg)

Function description

Refresh the WWDG.

Parameters

- **hwwdg:** pointer to a WWDG_HandleTypeDef structure that contains the configuration information for the specified WWDG module.

Return values

- **HAL:** status

HAL_WWDG_IRQHandler

Function name

void HAL_WWDG_IRQHandler (WWDG_HandleTypeDef * hwwdg)

Function description

Handle WWDG interrupt request.

Parameters

- **hwwdg:** pointer to a WWDG_HandleTypeDef structure that contains the configuration information for the specified WWDG module.

Return values

- **None:**

Notes

- The Early Wakeup Interrupt (EWI) can be used if specific safety operations or data logging must be performed before the actual reset is generated. The EWI interrupt is enabled by calling HAL_WWDG_Init function with EWIMode set to WWDG_EWI_ENABLE. When the downcounter reaches the value 0x40, and EWI interrupt is generated and the corresponding Interrupt Service Routine (ISR) can be used to trigger specific actions (such as communications or data logging), before resetting the device.

HAL_WWDG_EarlyWakeupCallback

Function name

void HAL_WWDG_EarlyWakeupCallback (WWDG_HandleTypeDef * hwwdg)

Function description

WWDG Early Wakeup callback.

Parameters

- **hwwdg:** pointer to a WWDG_HandleTypeDef structure that contains the configuration information for the specified WWDG module.

Return values

- **None:**

54.3 WWDG Firmware driver defines

The following section lists the various define and macros of the module.

54.3.1 WWDG

WWDG

WWDG Early Wakeup Interrupt Mode

WWDG_EWI_DISABLE

EWI Disable

WWDG_EWI_ENABLE

EWI Enable

WWDG Exported Macros

__HAL_WWDG_ENABLE

Description:

- Enable the WWDG peripheral.

Parameters:

- __HANDLE__: WWDG handle

Return value:

- None

__HAL_WWDG_ENABLE_IT

Description:

- Enable the WWDG early wakeup interrupt.

Parameters:

- __HANDLE__: WWDG handle
- __INTERRUPT__: specifies the interrupt to enable. This parameter can be one of the following values:
  - WWDG_IT_EWI: Early wakeup interrupt

Return value:

- None

Notes:

- Once enabled this interrupt cannot be disabled except by a system reset.

__HAL_WWDG_GET_IT

Description:

- Check whether the selected WWDG interrupt has occurred or not.

Parameters:

- __HANDLE__: WWDG handle
- __INTERRUPT__: specifies the it to check. This parameter can be one of the following values:
  - WWDG_FLAG_EWIF: Early wakeup interrupt IT

Return value:

- The: new state of WWDG_FLAG (SET or RESET).

__HAL_WWDG_CLEAR_IT

Description:

- Clear the WWDG interrupt pending bits.

Parameters:

- __HANDLE__: WWDG handle
- __INTERRUPT__: specifies the interrupt pending bit to clear. This parameter can be one of the following values:
  - WWDG_FLAG_EWIF: Early wakeup interrupt flag

__HAL_WWDG_GET_FLAG

Description:

- Check whether the specified WWDG flag is set or not.

Parameters:

- __HANDLE__: WWDG handle
- __FLAG__: specifies the flag to check. This parameter can be one of the following values:
  - WWDG_FLAG_EWIF: Early wakeup interrupt flag

Return value:

- The: new state of WWDG_FLAG (SET or RESET).

__HAL_WWDG_CLEAR_FLAG

Description:

- Clear the WWDG's pending flags.

Parameters:

- __HANDLE__: WWDG handle
- __FLAG__: specifies the flag to clear. This parameter can be one of the following values:
  - WWDG_FLAG_EWIF: Early wakeup interrupt flag

Return value:

- None

__HAL_WWDG_GET_IT_SOURCE

Description:

- Check whether the specified WWDG interrupt source is enabled or not.

Parameters:

- __HANDLE__: WWDG Handle.
- __INTERRUPT__: specifies the WWDG interrupt source to check. This parameter can be one of the following values:
  - WWDG_IT_EWI: Early Wakeup Interrupt

Return value:

- state: of __INTERRUPT__ (TRUE or FALSE).

WWDG Flag definition

WWDG_FLAG_EWIF

Early wakeup interrupt flag

WWDG Interrupt definition

WWDG_IT_EWI

Early wakeup interrupt

WWDG Prescaler

WWDG_PRESCALER_1

WWDG counter clock = (PCLK1/4096)/1

WWDG_PRESCALER_2

WWDG counter clock = (PCLK1/4096)/2

WWDG_PRESCALER_4

WWDG counter clock = (PCLK1/4096)/4

WWDG_PRESCALER_8

WWDG counter clock = (PCLK1/4096)/8

WWDG_PRESCALER_16

WWDG counter clock = (PCLK1/4096)/16

WWDG_PRESCALER_32

WWDG counter clock = (PCLK1/4096)/32

WWDG_PRESCALER_64

WWDG counter clock = (PCLK1/4096)/64

WWDG_PRESCALER_128

WWDG counter clock = (PCLK1/4096)/128

55 LL ADC Generic Driver

55.1 ADC Firmware driver registers structures

55.1.1 LL_ADC_CommonInitTypeDef

LL_ADC_CommonInitTypeDef is defined in the stm32u0xx_ll_adc.h

Data Fields

- ***uint32_t CommonClock***

Field Documentation

- ***uint32_t LL_ADC_CommonInitTypeDef::CommonClock***
  Set parameter common to several ADC: Clock source and prescaler. This parameter can be a value of ***ADC_LL_EC_COMMON_CLOCK_SOURCE*** This feature can be modified afterwards using unitary function **LL_ADC_SetCommonClock()**.

55.1.2 LL_ADC_InitTypeDef

LL_ADC_InitTypeDef is defined in the stm32u0xx_ll_adc.h

Data Fields

- ***uint32_t Clock***
- ***uint32_t Resolution***
- ***uint32_t DataAlignment***
- ***uint32_t LowPowerMode***

Field Documentation

- ***uint32_t LL_ADC_InitTypeDef::Clock***
  Set ADC instance clock source and prescaler. This parameter can be a value of ***ADC_LL_EC_CLOCK_SOURCE***
  Note:
  - On this STM32 series, this parameter has some clock ratio constraints: ADC clock synchronous (from PCLK) with prescaler 1 must be enabled only if PCLK has a 50% duty clock cycle (APB prescaler configured inside the RCC must be bypassed and the system clock must by 50% duty cycle). This feature can be modified afterwards using unitary function **LL_ADC_SetClock()**. For more details, refer to description of this function.
- ***uint32_t LL_ADC_InitTypeDef::Resolution***
  Set ADC resolution. This parameter can be a value of ***ADC_LL_EC_RESOLUTION*** This feature can be modified afterwards using unitary function **LL_ADC_SetResolution()**.
- ***uint32_t LL_ADC_InitTypeDef::DataAlignment***
  Set ADC conversion data alignment. This parameter can be a value of ***ADC_LL_EC_DATA_ALIGN*** This feature can be modified afterwards using unitary function **LL_ADC_SetDataAlignment()**.
- ***uint32_t LL_ADC_InitTypeDef::LowPowerMode***
  Set ADC low power mode. This parameter can be a value of ***ADC_LL_EC_LP_MODE*** This feature can be modified afterwards using unitary function **LL_ADC_SetLowPowerMode()**.

55.1.3 LL_ADC_REG_InitTypeDef

LL_ADC_REG_InitTypeDef is defined in the stm32u0xx_ll_adc.h

Data Fields

- ***uint32_t TriggerSource***
- ***uint32_t SequencerLength***
- ***uint32_t SequencerDiscont***
- ***uint32_t ContinuousMode***
- ***uint32_t DMATransfer***
- ***uint32_t Overrun***

Field Documentation

- ***uint32_t LL_ADC_REG_InitTypeDef::TriggerSource***
  Set ADC group regular conversion trigger source: internal (SW start) or from external peripheral (timer event, external interrupt line). This parameter can be a value of ***ADC_LL_EC_REG_TRIGGER_SOURCE***
  Note:
  – On this STM32 series, setting trigger source to external trigger also set trigger polarity to rising edge(default setting for compatibility with some ADC on other STM32 series having this setting set by HW default value). In case of need to modify trigger edge, use function **LL_ADC_REG_SetTriggerEdge()**. This feature can be modified afterwards using unitary function **LL_ADC_REG_SetTriggerSource()**.
- ***uint32_t LL_ADC_REG_InitTypeDef::SequencerLength***
  Set ADC group regular sequencer length.
  Note:
  – This parameter has an effect only if group regular sequencer is set to mode "fully configurable". Refer to function **LL_ADC_REG_SetSequencerConfigurable()**. This parameter can be a value of ***ADC_LL_EC_REG_SEQ_SCAN_LENGTH*** This feature can be modified afterwards using unitary function **LL_ADC_REG_SetSequencerLength()**.
- ***uint32_t LL_ADC_REG_InitTypeDef::SequencerDiscont***
  Set ADC group regular sequencer discontinuous mode: sequence subdivided and scan conversions interrupted every selected number of ranks. This parameter can be a value of ***ADC_LL_EC_REG_SEQ_DISCONT_MODE***
  Note:
  – This parameter has an effect only if group regular sequencer is enabled (depending on the sequencer mode: scan length of 2 ranks or more, or several ADC channels enabled in group regular sequencer. Refer to function **LL_ADC_REG_SetSequencerConfigurable()**). This feature can be modified afterwards using unitary function **LL_ADC_REG_SetSequencerDiscont()**.
- ***uint32_t LL_ADC_REG_InitTypeDef::ContinuousMode***
  Set ADC continuous conversion mode on ADC group regular, whether ADC conversions are performed in single mode (one conversion per trigger) or in continuous mode (after the first trigger, following conversions launched successively automatically). This parameter can be a value of ***ADC_LL_EC_REG_CONTINUOUS_MODE*** Note: It is not possible to enable both ADC group regular continuous mode and discontinuous mode. This feature can be modified afterwards using unitary function **LL_ADC_REG_SetContinuousMode()**.
- ***uint32_t LL_ADC_REG_InitTypeDef::DMATransfer***
  Set ADC group regular conversion data transfer: no transfer or transfer by DMA, and DMA requests mode. This parameter can be a value of ***ADC_LL_EC_REG_DMA_TRANSFER*** This feature can be modified afterwards using unitary function **LL_ADC_REG_SetDMATransfer()**.
- ***uint32_t LL_ADC_REG_InitTypeDef::Overrun***
  Set ADC group regular behavior in case of overrun: data preserved or overwritten. This parameter can be a value of ***ADC_LL_EC_REG_OVR_DATA_BEHAVIOR*** This feature can be modified afterwards using unitary function **LL_ADC_REG_SetOverrun()**.

55.2 ADC Firmware driver API description

The following section lists the various functions of the ADC library.

55.2.1 Detailed description of functions

LL_ADC_DMA_GetRegAddr

Function name

__STATIC_INLINE uint32_t LL_ADC_DMA_GetRegAddr (const ADC_TypeDef * ADCx, uint32_t Register)

Function description

Function to help to configure DMA transfer from ADC: retrieve the ADC register address from ADC instance and a list of ADC registers intended to be used (most commonly) with DMA transfer.

Parameters

- **ADCx:** ADC instance
- **Register:** This parameter can be one of the following values:
  - LL_ADC_DMA_REG_REGULAR_DATA

Return values

- **ADC:** register address

Notes

- These ADC registers are data registers: when ADC conversion data is available in ADC data registers, ADC generates a DMA transfer request.
- This macro is intended to be used with LL DMA driver, refer to function "LL_DMA_ConfigAddresses()". Example: LL_DMA_ConfigAddresses(DMA1, LL_DMA_CHANNEL_1, LL_ADC_DMA_GetRegAddr(ADC1, LL_ADC_DMA_REG_REGULAR_DATA), (uint32_t)&< array or variable >, LL_DMA_DIRECTION_PERIPH_TO_MEMORY);
- For devices with several ADC: in multimode, some devices use a different data register outside of ADC instance scope (common data register). This macro manages this register difference, only ADC instance has to be set as parameter.

Reference Manual to LL API cross reference:

- DR DATA LL_ADC_DMA_GetRegAddr

LL_ADC_SetCommonClock

Function name

__STATIC_INLINE void LL_ADC_SetCommonClock (ADC_Common_TypeDef * ADCxy_COMMON, uint32_t CommonClock)

Function description

Set parameter common to several ADC: Clock source and prescaler.

Parameters

- **ADCxy_COMMON:** ADC common instance (can be set directly from CMSIS definition or by using helper macro __LL_ADC_COMMON_INSTANCE())
- **CommonClock:** This parameter can be one of the following values:
  - LL_ADC_CLOCK_ASYNC_DIV1 (1)
  - LL_ADC_CLOCK_ASYNC_DIV2 (1)
  - LL_ADC_CLOCK_ASYNC_DIV4 (1)
  - LL_ADC_CLOCK_ASYNC_DIV6 (1)
  - LL_ADC_CLOCK_ASYNC_DIV8 (1)
  - LL_ADC_CLOCK_ASYNC_DIV10 (1)
  - LL_ADC_CLOCK_ASYNC_DIV12 (1)
  - LL_ADC_CLOCK_ASYNC_DIV16 (1)
  - LL_ADC_CLOCK_ASYNC_DIV32 (1)
  - LL_ADC_CLOCK_ASYNC_DIV64 (1)
  - LL_ADC_CLOCK_ASYNC_DIV128 (1)
  - LL_ADC_CLOCK_ASYNC_DIV256 (1)

  (1) ADC common clock asynchronous prescaler is applied to each ADC instance if the corresponding ADC instance clock is set to clock source asynchronous. (refer to function LL_ADC_SetClock()).

Return values

- **None:**

Notes

- On this STM32 series, setting of this feature is conditioned to ADC state: All ADC instances of the ADC common group must be disabled. This check can be done with function LL_ADC_IsEnabled() for each ADC instance or by using helper macro helper macro __LL_ADC_IS_ENABLED_ALL_COMMON_INSTANCE().

Reference Manual to LL API cross reference:

- CCR PRESC LL_ADC_SetCommonClock

LL_ADC_GetCommonClock

Function name

__STATIC_INLINE uint32_t LL_ADC_GetCommonClock (const ADC_Common_TypeDef * ADCxy_COMMON)

Function description

Get parameter common to several ADC: Clock source and prescaler.

Parameters

- **ADCxy_COMMON:** ADC common instance (can be set directly from CMSIS definition or by using helper macro __LL_ADC_COMMON_INSTANCE())

Return values

- **Returned:** value can be one of the following values:
  - LL_ADC_CLOCK_ASYNC_DIV1 (1)
  - LL_ADC_CLOCK_ASYNC_DIV2 (1)
  - LL_ADC_CLOCK_ASYNC_DIV4 (1)
  - LL_ADC_CLOCK_ASYNC_DIV6 (1)
  - LL_ADC_CLOCK_ASYNC_DIV8 (1)
  - LL_ADC_CLOCK_ASYNC_DIV10 (1)
  - LL_ADC_CLOCK_ASYNC_DIV12 (1)
  - LL_ADC_CLOCK_ASYNC_DIV16 (1)
  - LL_ADC_CLOCK_ASYNC_DIV32 (1)
  - LL_ADC_CLOCK_ASYNC_DIV64 (1)
  - LL_ADC_CLOCK_ASYNC_DIV128 (1)
  - LL_ADC_CLOCK_ASYNC_DIV256 (1)

  (1) ADC common clock asynchronous prescaler is applied to each ADC instance if the corresponding ADC instance clock is set to clock source asynchronous. (refer to function LL_ADC_SetClock()).

Reference Manual to LL API cross reference:

- CCR PRESC LL_ADC_GetCommonClock

LL_ADC_SetCommonPathInternalCh

Function name

__STATIC_INLINE void LL_ADC_SetCommonPathInternalCh (ADC_Common_TypeDef * ADCxy_COMMON, uint32_t PathInternal)

Function description

Set parameter common to several ADC: measurement path to internal channels (VrefInt, temperature sensor, ...).

Parameters

- **ADCxy_COMMON:** ADC common instance (can be set directly from CMSIS definition or by using helper macro __LL_ADC_COMMON_INSTANCE())
- **PathInternal:** This parameter can be a combination of the following values:
  - LL_ADC_PATH_INTERNAL_NONE
  - LL_ADC_PATH_INTERNAL_VREFINT
  - LL_ADC_PATH_INTERNAL_TEMPSENSOR
  - LL_ADC_PATH_INTERNAL_VBAT

Return values

- **None:**

Notes

- One or several values can be selected. Example: (LL_ADC_PATH_INTERNAL_VREFINT | LL_ADC_PATH_INTERNAL_TEMPSENSOR) The values not selected are removed from configuration.
- Stabilization time of measurement path to internal channel: After enabling internal paths, before starting ADC conversion, a delay is required for internal voltage reference and temperature sensor stabilization time. Refer to device datasheet. Refer to literal LL_ADC_DELAY_VREFINT_STAB_US. Refer to literals LL_ADC_DELAY_TEMPSENSOR_STAB_US, LL_ADC_DELAY_TEMPSENSOR_BUFFER_STAB_US.
- ADC internal channel sampling time constraint: For ADC conversion of internal channels, a sampling time minimum value is required. Refer to device datasheet.
- On this STM32 series, setting of this feature is conditioned to ADC state: All ADC instances of the ADC common group must be disabled. This check can be done with function LL_ADC_IsEnabled() for each ADC instance or by using helper macro helper macro __LL_ADC_IS_ENABLED_ALL_COMMON_INSTANCE().

Reference Manual to LL API cross reference:

- CCR VREFEN LL_ADC_SetCommonPathInternalCh
- CCR TSEN LL_ADC_SetCommonPathInternalCh
- CCR VBATEN LL_ADC_SetCommonPathInternalCh

LL_ADC_SetCommonPathInternalChAdd

Function name

__STATIC_INLINE void LL_ADC_SetCommonPathInternalChAdd (ADC_Common_TypeDef * ADCxy_COMMON, uint32_t PathInternal)

Function description

Set parameter common to several ADC: measurement path to internal channels (VrefInt, temperature sensor, ...).

Parameters

- **ADCxy_COMMON:** ADC common instance (can be set directly from CMSIS definition or by using helper macro __LL_ADC_COMMON_INSTANCE())
- **PathInternal:** This parameter can be a combination of the following values:
  - LL_ADC_PATH_INTERNAL_NONE
  - LL_ADC_PATH_INTERNAL_VREFINT
  - LL_ADC_PATH_INTERNAL_TEMPSENSOR
  - LL_ADC_PATH_INTERNAL_VBAT

Return values

- **None:**

Notes

- One or several values can be selected. Example: (LL_ADC_PATH_INTERNAL_VREFINT | LL_ADC_PATH_INTERNAL_TEMPSENSOR)
- Stabilization time of measurement path to internal channel: After enabling internal paths, before starting ADC conversion, a delay is required for internal voltage reference and temperature sensor stabilization time. Refer to device datasheet. Refer to literal LL_ADC_DELAY_VREFINT_STAB_US. Refer to literals LL_ADC_DELAY_TEMPSENSOR_STAB_US, LL_ADC_DELAY_TEMPSENSOR_BUFFER_STAB_US.
- ADC internal channel sampling time constraint: For ADC conversion of internal channels, a sampling time minimum value is required. Refer to device datasheet.
- On this STM32 series, setting of this feature is conditioned to ADC state: All ADC instances of the ADC common group must be disabled. This check can be done with function LL_ADC_IsEnabled() for each ADC instance or by using helper macro helper macro __LL_ADC_IS_ENABLED_ALL_COMMON_INSTANCE().

Reference Manual to LL API cross reference:

- CCR VREFEN LL_ADC_SetCommonPathInternalChAdd
- CCR TSEN LL_ADC_SetCommonPathInternalChAdd
- CCR VBATEN LL_ADC_SetCommonPathInternalChAdd

LL_ADC_SetCommonPathInternalChRem

Function name

__STATIC_INLINE void LL_ADC_SetCommonPathInternalChRem (ADC_Common_TypeDef * ADCxy_COMMON, uint32_t PathInternal)

Function description

Set parameter common to several ADC: measurement path to internal channels (VrefInt, temperature sensor, ...).

Parameters

- **ADCxy_COMMON:** ADC common instance (can be set directly from CMSIS definition or by using helper macro __LL_ADC_COMMON_INSTANCE())
- **PathInternal:** This parameter can be a combination of the following values:
  - LL_ADC_PATH_INTERNAL_NONE
  - LL_ADC_PATH_INTERNAL_VREFINT
  - LL_ADC_PATH_INTERNAL_TEMPSENSOR
  - LL_ADC_PATH_INTERNAL_VBAT

Return values

- **None:**

Notes

- One or several values can be selected. Example: (LL_ADC_PATH_INTERNAL_VREFINT | LL_ADC_PATH_INTERNAL_TEMPSENSOR)
- On this STM32 series, setting of this feature is conditioned to ADC state: All ADC instances of the ADC common group must be disabled. This check can be done with function LL_ADC_IsEnabled() for each ADC instance or by using helper macro helper macro __LL_ADC_IS_ENABLED_ALL_COMMON_INSTANCE().

Reference Manual to LL API cross reference:

- CCR VREFEN LL_ADC_SetCommonPathInternalChRem
- CCR TSEN LL_ADC_SetCommonPathInternalChRem
- CCR VBATEN LL_ADC_SetCommonPathInternalChRem

LL_ADC_GetCommonPathInternalCh

Function name

__STATIC_INLINE uint32_t LL_ADC_GetCommonPathInternalCh (const ADC_Common_TypeDef * ADCxy_COMMON)

Function description

Get parameter common to several ADC: measurement path to internal channels (VrefInt, temperature sensor, ...).

Parameters

- **ADCxy_COMMON:** ADC common instance (can be set directly from CMSIS definition or by using helper macro __LL_ADC_COMMON_INSTANCE())

Return values

- **Returned:** value can be a combination of the following values:
  - LL_ADC_PATH_INTERNAL_NONE
  - LL_ADC_PATH_INTERNAL_VREFINT
  - LL_ADC_PATH_INTERNAL_TEMPSENSOR
  - LL_ADC_PATH_INTERNAL_VBAT

Notes

- One or several values can be selected. Example: (LL_ADC_PATH_INTERNAL_VREFINT | LL_ADC_PATH_INTERNAL_TEMPSENSOR)

Reference Manual to LL API cross reference:

- CCR VREFEN LL_ADC_GetCommonPathInternalCh
- CCR TSEN LL_ADC_GetCommonPathInternalCh
- CCR VBATEN LL_ADC_GetCommonPathInternalCh

LL_ADC_SetClock

Function name

__STATIC_INLINE void LL_ADC_SetClock (ADC_TypeDef * ADCx, uint32_t ClockSource)

Function description

Set ADC instance clock source and prescaler.

Parameters

- **ADCx:** ADC instance
- **ClockSource:** This parameter can be one of the following values:
  - LL_ADC_CLOCK_SYNC_PCLK_DIV4
  - LL_ADC_CLOCK_SYNC_PCLK_DIV2
  - LL_ADC_CLOCK_SYNC_PCLK_DIV1 (2)
  - LL_ADC_CLOCK_ASYNC (1)

  (1) Asynchronous clock prescaler can be configured using function LL_ADC_SetCommonClock().
- (2) Caution: This parameter has some clock ratio constraints: This configuration must be enabled only if PCLK has a 50% duty clock cycle (APB prescaler configured inside the RCC must be bypassed and the system clock must by 50% duty cycle). Refer to reference manual.

Return values

- **None:**

Notes

- On this STM32 series, setting of this feature is conditioned to ADC state: ADC must be disabled.

Reference Manual to LL API cross reference:

- CFGR2 CKMODE LL_ADC_SetClock

LL_ADC_GetClock

Function name

__STATIC_INLINE uint32_t LL_ADC_GetClock (const ADC_TypeDef * ADCx)

Function description

Get ADC instance clock source and prescaler.

Parameters

- **ADCx:** ADC instance

Return values

- **Returned:** value can be one of the following values:
  - LL_ADC_CLOCK_SYNC_PCLK_DIV4
  - LL_ADC_CLOCK_SYNC_PCLK_DIV2
  - LL_ADC_CLOCK_SYNC_PCLK_DIV1 (2)
  - LL_ADC_CLOCK_ASYNC (1)

  (1) Asynchronous clock prescaler can be retrieved using function LL_ADC_GetCommonClock().
- (2) Caution: This parameter has some clock ratio constraints: This configuration must be enabled only if PCLK has a 50% duty clock cycle (APB prescaler configured inside the RCC must be bypassed and the system clock must by 50% duty cycle). Refer to reference manual.

Reference Manual to LL API cross reference:

- CFGR2 CKMODE LL_ADC_GetClock

LL_ADC_SetCalibrationFactor

Function name

__STATIC_INLINE void LL_ADC_SetCalibrationFactor (ADC_TypeDef * ADCx, uint32_t CalibrationFactor)

Function description

Set ADC calibration factor in the mode single-ended or differential (for devices with differential mode available).

Parameters

- **ADCx:** ADC instance
- **CalibrationFactor:** Value between Min_Data=0x00 and Max_Data=0x7F

Return values

- **None:**

Notes

- This function is intended to set calibration parameters without having to perform a new calibration using LL_ADC_StartCalibration().
- On this STM32 series, setting of this feature is conditioned to ADC state: ADC must be enabled, without calibration on going, without conversion on going on group regular.

Reference Manual to LL API cross reference:

- CALFACT CALFACT LL_ADC_SetCalibrationFactor

LL_ADC_GetCalibrationFactor

Function name

__STATIC_INLINE uint32_t LL_ADC_GetCalibrationFactor (const ADC_TypeDef * ADCx)

Function description

Get ADC calibration factor in the mode single-ended or differential (for devices with differential mode available).

Parameters

- **ADCx:** ADC instance

Return values

- **Value:** between Min_Data=0x00 and Max_Data=0x7F

Notes

- Calibration factors are set by hardware after performing a calibration run using function LL_ADC_StartCalibration().

Reference Manual to LL API cross reference:

- CALFACT CALFACT LL_ADC_GetCalibrationFactor

LL_ADC_SetResolution

Function name

__STATIC_INLINE void LL_ADC_SetResolution (ADC_TypeDef * ADCx, uint32_t Resolution)

Function description

Set ADC resolution.

Parameters

- **ADCx:** ADC instance
- **Resolution:** This parameter can be one of the following values:
  - LL_ADC_RESOLUTION_12B
  - LL_ADC_RESOLUTION_10B
  - LL_ADC_RESOLUTION_8B
  - LL_ADC_RESOLUTION_6B

Return values

- **None:**

Notes

- On this STM32 series, setting of this feature is conditioned to ADC state: ADC must be disabled.

Reference Manual to LL API cross reference:

- CFGR1 RES LL_ADC_SetResolution

LL_ADC_GetResolution

Function name

__STATIC_INLINE uint32_t LL_ADC_GetResolution (const ADC_TypeDef * ADCx)

Function description

Get ADC resolution.

Parameters

- **ADCx:** ADC instance

Return values

- **Returned:** value can be one of the following values:
  - LL_ADC_RESOLUTION_12B
  - LL_ADC_RESOLUTION_10B
  - LL_ADC_RESOLUTION_8B
  - LL_ADC_RESOLUTION_6B

Reference Manual to LL API cross reference:

- CFGR1 RES LL_ADC_GetResolution

LL_ADC_SetDataAlignment

Function name

__STATIC_INLINE void LL_ADC_SetDataAlignment (ADC_TypeDef * ADCx, uint32_t DataAlignment)

Function description

Set ADC conversion data alignment.

Parameters

- **ADCx:** ADC instance
- **DataAlignment:** This parameter can be one of the following values:
  - LL_ADC_DATA_ALIGN_RIGHT
  - LL_ADC_DATA_ALIGN_LEFT

Return values

- **None:**

Notes

- Refer to reference manual for alignments formats dependencies to ADC resolutions.
- On this STM32 series, setting of this feature is conditioned to ADC state: ADC must be disabled.

Reference Manual to LL API cross reference:

- CFGR1 ALIGN LL_ADC_SetDataAlignment

LL_ADC_GetDataAlignment

Function name

__STATIC_INLINE uint32_t LL_ADC_GetDataAlignment (const ADC_TypeDef * ADCx)

Function description

Get ADC conversion data alignment.

Parameters

- **ADCx:** ADC instance

Return values

- **Returned:** value can be one of the following values:
  - LL_ADC_DATA_ALIGN_RIGHT
  - LL_ADC_DATA_ALIGN_LEFT

Notes

- Refer to reference manual for alignments formats dependencies to ADC resolutions.

Reference Manual to LL API cross reference:

- CFGR1 ALIGN LL_ADC_GetDataAlignment

LL_ADC_SetLowPowerMode

Function name

__STATIC_INLINE void LL_ADC_SetLowPowerMode (ADC_TypeDef * ADCx, uint32_t LowPowerMode)

Function description

Set ADC low power mode.

Parameters

- **ADCx:** ADC instance
- **LowPowerMode:** This parameter can be one of the following values:
  - LL_ADC_LP_MODE_NONE
  - LL_ADC_LP_AUTOWAIT
  - LL_ADC_LP_AUTOPOWEROFF
  - LL_ADC_LP_AUTOWAIT_AUTOPOWEROFF

Return values

- **None:**

Notes

- Description of ADC low power modes: ADC low power mode "auto wait": Dynamic low power mode, ADC conversions occurrences are limited to the minimum necessary in order to reduce power consumption. New ADC conversion starts only when the previous unitary conversion data (for ADC group regular) has been retrieved by user software. In the meantime, ADC remains idle: does not performs any other conversion. This mode allows to automatically adapt the ADC conversions triggers to the speed of the software that reads the data. Moreover, this avoids risk of overrun for low frequency applications. How to use this low power mode: It is not recommended to use with interruption or DMA since these modes have to clear immediately the EOC flag (by CPU to free the IRQ pending event or by DMA). Auto wait will work but fort a very short time, discarding its intended benefit (except specific case of high load of CPU or DMA transfers which can justify usage of auto wait).Do use with polling: 1. Start conversion, 2. Later on, when conversion data is needed: poll for end of conversion to ensure that conversion is completed and retrieve ADC conversion data. This will trig another ADC conversion start. ADC low power mode "auto power-off" (feature available on this device if parameter LL_ADC_LP_AUTOPOWEROFF is available): the ADC automatically powers-off after a conversion and automatically wakes up when a new conversion is triggered (with startup time between trigger and start of sampling). This feature can be combined with low power mode "auto wait".
- With ADC low power mode "auto wait", the ADC conversion data read is corresponding to previous ADC conversion start, independently of delay during which ADC was idle. Therefore, the ADC conversion data may be outdated: does not correspond to the current voltage level on the selected ADC channel.
- On this STM32 series, setting of this feature is conditioned to ADC state: ADC must be disabled.

Reference Manual to LL API cross reference:

- CFGR1 WAIT LL_ADC_SetLowPowerMode
- CFGR1 AUTOFF LL_ADC_SetLowPowerMode

LL_ADC_GetLowPowerMode

Function name

__STATIC_INLINE uint32_t LL_ADC_GetLowPowerMode (const ADC_TypeDef * ADCx)

Function description

Get ADC low power mode:

Parameters

- **ADCx:** ADC instance

Return values

- **Returned:** value can be one of the following values:
  - LL_ADC_LP_MODE_NONE
  - LL_ADC_LP_AUTOWAIT
  - LL_ADC_LP_AUTOPOWEROFF
  - LL_ADC_LP_AUTOWAIT_AUTOPOWEROFF

Notes

- Description of ADC low power modes: ADC low power mode "auto wait": Dynamic low power mode, ADC conversions occurrences are limited to the minimum necessary in order to reduce power consumption. New ADC conversion starts only when the previous unitary conversion data (for ADC group regular) has been retrieved by user software. In the meantime, ADC remains idle: does not performs any other conversion. This mode allows to automatically adapt the ADC conversions triggers to the speed of the software that reads the data. Moreover, this avoids risk of overrun for low frequency applications. How to use this low power mode: It is not recommended to use with interruption or DMA since these modes have to clear immediately the EOC flag (by CPU to free the IRQ pending event or by DMA). Auto wait will work but fort a very short time, discarding its intended benefit (except specific case of high load of CPU or DMA transfers which can justify usage of auto wait).Do use with polling: 1. Start conversion, 2. Later on, when conversion data is needed: poll for end of conversion to ensure that conversion is completed and retrieve ADC conversion data. This will trig another ADC conversion start. ADC low power mode "auto power-off" (feature available on this device if parameter LL_ADC_LP_AUTOPOWEROFF is available): the ADC automatically powers-off after a conversion and automatically wakes up when a new conversion is triggered (with startup time between trigger and start of sampling). This feature can be combined with low power mode "auto wait".
- With ADC low power mode "auto wait", the ADC conversion data read is corresponding to previous ADC conversion start, independently of delay during which ADC was idle. Therefore, the ADC conversion data may be outdated: does not correspond to the current voltage level on the selected ADC channel.

Reference Manual to LL API cross reference:

- CFGR1 WAIT LL_ADC_GetLowPowerMode
- CFGR1 AUTOFF LL_ADC_GetLowPowerMode

LL_ADC_SetTriggerFrequencyMode

Function name

__STATIC_INLINE void LL_ADC_SetTriggerFrequencyMode (ADC_TypeDef * ADCx, uint32_t TriggerFrequencyMode)

Function description

Set ADC trigger frequency mode.

Parameters

- **ADCx:** ADC instance
- **TriggerFrequencyMode:** This parameter can be one of the following values:
  - LL_ADC_TRIGGER_FREQ_HIGH
  - LL_ADC_TRIGGER_FREQ_LOW

Return values

- **None:**

Notes

- ADC trigger frequency mode must be set to low frequency when a duration is exceeded before ADC conversion start trigger event (between ADC enable and ADC conversion start trigger event or between two ADC conversion start trigger event). Duration value: Refer to device datasheet, parameter "tIdle".
- When ADC trigger frequency mode is set to low frequency, some rearm cycles are inserted before performing ADC conversion start, inducing a delay of 2 ADC clock cycles.
- Usage of ADC trigger frequency mode with ADC low power mode: Low power mode auto wait: Only the first ADC conversion start trigger inserts the rearm delay.Low power mode auto power-off: ADC trigger frequency mode is discarded.
- On this STM32 series, setting of this feature is conditioned to ADC state: ADC must be disabled.

Reference Manual to LL API cross reference:

- CFGR2 LFTRIG LL_ADC_SetTriggerFrequencyMode

LL_ADC_GetTriggerFrequencyMode

Function name

__STATIC_INLINE uint32_t LL_ADC_GetTriggerFrequencyMode (const ADC_TypeDef * ADCx)

Function description

Get ADC trigger frequency mode.

Parameters

- **ADCx:** ADC instance

Return values

- **Returned:** value can be one of the following values:
  - LL_ADC_TRIGGER_FREQ_HIGH
  - LL_ADC_TRIGGER_FREQ_LOW

Reference Manual to LL API cross reference:

- CFGR2 LFTRIG LL_ADC_GetTriggerFrequencyMode

LL_ADC_SetSamplingTimeCommonChannels

Function name

__STATIC_INLINE void LL_ADC_SetSamplingTimeCommonChannels (ADC_TypeDef * ADCx, uint32_t SamplingTimeY, uint32_t SamplingTime)

Function description

Set sampling time common to a group of channels.

Parameters

- **ADCx:** ADC instance
- **SamplingTimeY:** This parameter can be one of the following values:
  - LL_ADC_SAMPLINGTIME_COMMON_1
  - LL_ADC_SAMPLINGTIME_COMMON_2
- **SamplingTime:** This parameter can be one of the following values:
  - LL_ADC_SAMPLINGTIME_1CYCLE_5
  - LL_ADC_SAMPLINGTIME_3CYCLES_5
  - LL_ADC_SAMPLINGTIME_7CYCLES_5
  - LL_ADC_SAMPLINGTIME_12CYCLES_5
  - LL_ADC_SAMPLINGTIME_19CYCLES_5
  - LL_ADC_SAMPLINGTIME_39CYCLES_5
  - LL_ADC_SAMPLINGTIME_79CYCLES_5
  - LL_ADC_SAMPLINGTIME_160CYCLES_5

Return values

- **None:**

Notes

- Unit: ADC clock cycles.
- On this STM32 series, sampling time scope is on ADC instance: Sampling time common to all channels. (on some other STM32 series, sampling time is channel wise)
- In case of internal channel (VrefInt, TempSensor, ...) to be converted: sampling time constraints must be respected (sampling time can be adjusted in function of ADC clock frequency and sampling time setting). Refer to device datasheet for timings values (parameters TS_vrefint, TS_temp, ...).
- Conversion time is the addition of sampling time and processing time. On this STM32 series, ADC processing time is: 12.5 ADC clock cycles at ADC resolution 12 bits10.5 ADC clock cycles at ADC resolution 10 bits8.5 ADC clock cycles at ADC resolution 8 bits6.5 ADC clock cycles at ADC resolution 6 bits
- In case of ADC conversion of internal channel (VrefInt, temperature sensor, ...), a sampling time minimum value is required. Refer to device datasheet.
- On this STM32 series, setting of this feature is conditioned to ADC state: ADC must be disabled or enabled without conversion on going on group regular.

Reference Manual to LL API cross reference:

- SMPR SMP1 LL_ADC_SetSamplingTimeCommonChannels
-
- SMPR SMP2 LL_ADC_SetSamplingTimeCommonChannels

LL_ADC_GetSamplingTimeCommonChannels

Function name

__STATIC_INLINE uint32_t LL_ADC_GetSamplingTimeCommonChannels (const ADC_TypeDef * ADCx, uint32_t SamplingTimeY)

Function description

Get sampling time common to a group of channels.

Parameters

- **ADCx:** ADC instance
- **SamplingTimeY:** This parameter can be one of the following values:
  - LL_ADC_SAMPLINGTIME_COMMON_1
  - LL_ADC_SAMPLINGTIME_COMMON_2

Return values

- **Returned:** value can be one of the following values:
  - LL_ADC_SAMPLINGTIME_1CYCLE_5
  - LL_ADC_SAMPLINGTIME_3CYCLES_5
  - LL_ADC_SAMPLINGTIME_7CYCLES_5
  - LL_ADC_SAMPLINGTIME_12CYCLES_5
  - LL_ADC_SAMPLINGTIME_19CYCLES_5
  - LL_ADC_SAMPLINGTIME_39CYCLES_5
  - LL_ADC_SAMPLINGTIME_79CYCLES_5
  - LL_ADC_SAMPLINGTIME_160CYCLES_5

Notes

- Unit: ADC clock cycles.
- On this STM32 series, sampling time scope is on ADC instance: Sampling time common to all channels. (on some other STM32 series, sampling time is channel wise)
- Conversion time is the addition of sampling time and processing time. Refer to reference manual for ADC processing time of this STM32 series.

Reference Manual to LL API cross reference:

- SMPR SMP1 LL_ADC_GetSamplingTimeCommonChannels
-
- SMPR SMP2 LL_ADC_GetSamplingTimeCommonChannels

LL_ADC_REG_SetTriggerSource

Function name

__STATIC_INLINE void LL_ADC_REG_SetTriggerSource (ADC_TypeDef * ADCx, uint32_t TriggerSource)

Function description

Set ADC group regular conversion trigger source: internal (SW start) or from external peripheral (timer event, external interrupt line).

Parameters

- **ADCx:** ADC instance
- **TriggerSource:** This parameter can be one of the following values:
  - LL_ADC_REG_TRIG_SOFTWARE
  - LL_ADC_REG_TRIG_EXT_TIM1_TRGO2
  - LL_ADC_REG_TRIG_EXT_TIM1_CH4
  - LL_ADC_REG_TRIG_EXT_TIM2_TRGO
  - LL_ADC_REG_TRIG_EXT_TIM3_TRGO
  - LL_ADC_REG_TRIG_EXT_TIM15_TRGO
  - LL_ADC_REG_TRIG_EXT_TIM6_TRGO
  - LL_ADC_REG_TRIG_EXT_EXTI_LINE11

Return values

- **None:**

Notes

- On this STM32 series, setting trigger source to external trigger also set trigger polarity to rising edge (default setting for compatibility with some ADC on other STM32 series having this setting set by HW default value). In case of need to modify trigger edge, use function LL_ADC_REG_SetTriggerEdge().
- On this STM32 series, ADC trigger frequency mode must be set in function of frequency of ADC group regular conversion trigger. Refer to description of function LL_ADC_SetTriggerFrequencyMode().
- Availability of parameters of trigger sources from timer depends on timers availability on the selected device.
- On this STM32 series, setting of this feature is conditioned to ADC state: ADC must be disabled.

Reference Manual to LL API cross reference:

- CFGR1 EXTSEL LL_ADC_REG_SetTriggerSource
- CFGR1 EXTEN LL_ADC_REG_SetTriggerSource

LL_ADC_REG_GetTriggerSource

Function name

__STATIC_INLINE uint32_t LL_ADC_REG_GetTriggerSource (const ADC_TypeDef * ADCx)

Function description

Get ADC group regular conversion trigger source: internal (SW start) or from external peripheral (timer event, external interrupt line).

Parameters

- **ADCx:** ADC instance

Return values

- **Returned:** value can be one of the following values:
  - LL_ADC_REG_TRIG_SOFTWARE
  - LL_ADC_REG_TRIG_EXT_TIM1_TRGO2
  - LL_ADC_REG_TRIG_EXT_TIM1_CH4
  - LL_ADC_REG_TRIG_EXT_TIM2_TRGO
  - LL_ADC_REG_TRIG_EXT_TIM3_TRGO
  - LL_ADC_REG_TRIG_EXT_TIM15_TRGO
  - LL_ADC_REG_TRIG_EXT_TIM6_TRGO
  - LL_ADC_REG_TRIG_EXT_EXTI_LINE11

Notes

- To determine whether group regular trigger source is internal (SW start) or external, without detail of which peripheral is selected as external trigger, (equivalent to "if(LL_ADC_REG_GetTriggerSource(ADC1) == LL_ADC_REG_TRIG_SOFTWARE)") use function LL_ADC_REG_IsTriggerSourceSWStart.
- Availability of parameters of trigger sources from timer depends on timers availability on the selected device.

Reference Manual to LL API cross reference:

- CFGR1 EXTSEL LL_ADC_REG_GetTriggerSource
- CFGR1 EXTEN LL_ADC_REG_GetTriggerSource

LL_ADC_REG_IsTriggerSourceSWStart

Function name

__STATIC_INLINE uint32_t LL_ADC_REG_IsTriggerSourceSWStart (const ADC_TypeDef * ADCx)

Function description

Get ADC group regular conversion trigger source internal (SW start) or external.

Parameters

- **ADCx:** ADC instance

Return values

- **Value:** "0" if trigger source external trigger Value "1" if trigger source SW start.

Notes

- In case of group regular trigger source set to external trigger, to determine which peripheral is selected as external trigger, use function LL_ADC_REG_GetTriggerSource().

Reference Manual to LL API cross reference:

- CFGR1 EXTEN LL_ADC_REG_IsTriggerSourceSWStart

LL_ADC_REG_SetTriggerEdge

Function name

__STATIC_INLINE void LL_ADC_REG_SetTriggerEdge (ADC_TypeDef * ADCx, uint32_t ExternalTriggerEdge)

Function description

Set ADC group regular conversion trigger polarity.

Parameters

- **ADCx:** ADC instance
- **ExternalTriggerEdge:** This parameter can be one of the following values:
  - LL_ADC_REG_TRIG_EXT_RISING
  - LL_ADC_REG_TRIG_EXT_FALLING
  - LL_ADC_REG_TRIG_EXT_RISINGFALLING

Return values

- **None:**

Notes

- Applicable only for trigger source set to external trigger.
- On this STM32 series, setting of this feature is conditioned to ADC state: ADC must be disabled.

Reference Manual to LL API cross reference:

- CFGR1 EXTEN LL_ADC_REG_SetTriggerEdge

LL_ADC_REG_GetTriggerEdge

Function name

__STATIC_INLINE uint32_t LL_ADC_REG_GetTriggerEdge (const ADC_TypeDef * ADCx)

Function description

Get ADC group regular conversion trigger polarity.

Parameters

- **ADCx:** ADC instance

Return values

- **Returned:** value can be one of the following values:
  - LL_ADC_REG_TRIG_EXT_RISING
  - LL_ADC_REG_TRIG_EXT_FALLING
  - LL_ADC_REG_TRIG_EXT_RISINGFALLING

Notes

- Applicable only for trigger source set to external trigger.

Reference Manual to LL API cross reference:

- CFGR1 EXTEN LL_ADC_REG_GetTriggerEdge

LL_ADC_REG_SetSequencerConfigurable

Function name

__STATIC_INLINE void LL_ADC_REG_SetSequencerConfigurable (ADC_TypeDef * ADCx, uint32_t Configurability)

Function description

Set ADC group regular sequencer configuration flexibility.

Parameters

- **ADCx:** ADC instance
- **Configurability:** This parameter can be one of the following values:
  - LL_ADC_REG_SEQ_FIXED
  - LL_ADC_REG_SEQ_CONFIGURABLE

Return values

- **None:**

Notes

- On this STM32 series, ADC group regular sequencer both modes "fully configurable" or "not fully configurable" are available: sequencer configured to fully configurable: sequencer length and each rank affectation to a channel are configurable. Refer to description of function LL_ADC_REG_SetSequencerLength().sequencer configured to not fully configurable: sequencer length and each rank affectation to a channel are fixed by channel HW number. Refer to description of function LL_ADC_REG_SetSequencerChannels().
- On this STM32 series, after modifying sequencer (functions LL_ADC_REG_SetSequencerLength() LL_ADC_REG_SetSequencerRanks(), ...) it is mandatory to wait for the assertion of CCRDY flag Otherwise, some actions may be ignored. Refer to description of LL_ADC_IsActiveFlag_CCRDY for more details.
- On this STM32 series, setting of this feature is conditioned to ADC state: ADC must be disabled.

Reference Manual to LL API cross reference:

- CFGR CHSELRMOD LL_ADC_REG_SetSequencerConfigurable

LL_ADC_REG_GetSequencerConfigurable

Function name

__STATIC_INLINE uint32_t LL_ADC_REG_GetSequencerConfigurable (const ADC_TypeDef * ADCx)

Function description

Get ADC group regular sequencer configuration flexibility.

Parameters

- **ADCx:** ADC instance

Return values

- **Returned:** value can be one of the following values:
  - LL_ADC_REG_SEQ_FIXED
  - LL_ADC_REG_SEQ_CONFIGURABLE

Notes

- On this STM32 series, ADC group regular sequencer both modes "fully configurable" or "not fully configurable" are available: sequencer configured to fully configurable: sequencer length and each rank affectation to a channel are configurable. Refer to description of function LL_ADC_REG_SetSequencerLength().sequencer configured to not fully configurable: sequencer length and each rank affectation to a channel are fixed by channel HW number. Refer to description of function LL_ADC_REG_SetSequencerChannels().

Reference Manual to LL API cross reference:

- CFGR CHSELRMOD LL_ADC_REG_SetSequencerConfigurable

LL_ADC_REG_SetSequencerLength

Function name

__STATIC_INLINE void LL_ADC_REG_SetSequencerLength (ADC_TypeDef * ADCx, uint32_t SequencerNbRanks)

Function description

Set ADC group regular sequencer length and scan direction.

Parameters

- **ADCx:** ADC instance
- **SequencerNbRanks:** This parameter can be one of the following values:
  - LL_ADC_REG_SEQ_SCAN_DISABLE
  - LL_ADC_REG_SEQ_SCAN_ENABLE_2RANKS
  - LL_ADC_REG_SEQ_SCAN_ENABLE_3RANKS
  - LL_ADC_REG_SEQ_SCAN_ENABLE_4RANKS
  - LL_ADC_REG_SEQ_SCAN_ENABLE_5RANKS
  - LL_ADC_REG_SEQ_SCAN_ENABLE_6RANKS
  - LL_ADC_REG_SEQ_SCAN_ENABLE_7RANKS
  - LL_ADC_REG_SEQ_SCAN_ENABLE_8RANKS

Return values

- **None:**

Notes

- Description of ADC group regular sequencer features: For devices with sequencer fully configurable (function "LL_ADC_REG_SetSequencerRanks()" available): sequencer length and each rank affectation to a channel are configurable. This function performs configuration of: Sequence length: Number of ranks in the scan sequence.Sequence direction: Unless specified in parameters, sequencer scan direction is forward (from rank 1 to rank n). Sequencer ranks are selected using function "LL_ADC_REG_SetSequencerRanks()". For devices with sequencer not fully configurable (function "LL_ADC_REG_SetSequencerChannels()" available): sequencer length and each rank affectation to a channel are defined by channel number. This function performs configuration of: Sequence length: Number of ranks in the scan sequence is defined by number of channels set in the sequence, rank of each channel is fixed by channel HW number. (channel 0 fixed on rank 0, channel 1 fixed on rank1, ...).Sequence direction: Unless specified in parameters, sequencer scan direction is forward (from lowest channel number to highest channel number). Sequencer ranks are selected using function "LL_ADC_REG_SetSequencerChannels()". To set scan direction differently, refer to function LL_ADC_REG_SetSequencerScanDirection().
- On this STM32 series, ADC group regular sequencer both modes "fully configurable" or "not fully configurable" are available, they can be chosen using function LL_ADC_REG_SetSequencerConfigurable().
- On this STM32 series, after modifying sequencer (functions LL_ADC_REG_SetSequencerLength() LL_ADC_REG_SetSequencerRanks(), ...) it is mandatory to wait for the assertion of CCRDY flag using LL_ADC_IsActiveFlag_CCRDY(). Otherwise, some actions may be ignored. Refer to description of LL_ADC_IsActiveFlag_CCRDY for more details.
- Sequencer disabled is equivalent to sequencer of 1 rank: ADC conversion on only 1 channel.
- On this STM32 series, setting of this feature is conditioned to ADC state: ADC must be disabled or enabled without conversion on going on group regular.

Reference Manual to LL API cross reference:

- CHSELR SQ1 LL_ADC_REG_SetSequencerLength
- CHSELR SQ2 LL_ADC_REG_SetSequencerLength
- CHSELR SQ3 LL_ADC_REG_SetSequencerLength
- CHSELR SQ4 LL_ADC_REG_SetSequencerLength
- CHSELR SQ5 LL_ADC_REG_SetSequencerLength
- CHSELR SQ6 LL_ADC_REG_SetSequencerLength
- CHSELR SQ7 LL_ADC_REG_SetSequencerLength
- CHSELR SQ8 LL_ADC_REG_SetSequencerLength

LL_ADC_REG_GetSequencerLength

Function name

__STATIC_INLINE uint32_t LL_ADC_REG_GetSequencerLength (const ADC_TypeDef * ADCx)

Function description

Get ADC group regular sequencer length and scan direction.

Parameters

- **ADCx:** ADC instance

Return values

- **Returned:** value can be one of the following values:
  - LL_ADC_REG_SEQ_SCAN_DISABLE
  - LL_ADC_REG_SEQ_SCAN_ENABLE_2RANKS
  - LL_ADC_REG_SEQ_SCAN_ENABLE_3RANKS
  - LL_ADC_REG_SEQ_SCAN_ENABLE_4RANKS
  - LL_ADC_REG_SEQ_SCAN_ENABLE_5RANKS
  - LL_ADC_REG_SEQ_SCAN_ENABLE_6RANKS
  - LL_ADC_REG_SEQ_SCAN_ENABLE_7RANKS
  - LL_ADC_REG_SEQ_SCAN_ENABLE_8RANKS

Notes

- Description of ADC group regular sequencer features: For devices with sequencer fully configurable (function "LL_ADC_REG_SetSequencerRanks()" available): sequencer length and each rank affectation to a channel are configurable. This function retrieves: Sequence length: Number of ranks in the scan sequence.Sequence direction: Unless specified in parameters, sequencer scan direction is forward (from rank 1 to rank n). Sequencer ranks are selected using function "LL_ADC_REG_SetSequencerRanks()". For devices with sequencer not fully configurable (function "LL_ADC_REG_SetSequencerChannels()" available): sequencer length and each rank affectation to a channel are defined by channel number. This function retrieves: Sequence length: Number of ranks in the scan sequence is defined by number of channels set in the sequence, rank of each channel is fixed by channel HW number. (channel 0 fixed on rank 0, channel 1 fixed on rank1, ...).Sequence direction: Unless specified in parameters, sequencer scan direction is forward (from lowest channel number to highest channel number). Sequencer ranks are selected using function "LL_ADC_REG_SetSequencerChannels()". To set scan direction differently, refer to function LL_ADC_REG_SetSequencerScanDirection().
- On this STM32 series, ADC group regular sequencer both modes "fully configurable" or "not fully configurable" are available, they can be chosen using function LL_ADC_REG_SetSequencerConfigurable().
- Sequencer disabled is equivalent to sequencer of 1 rank: ADC conversion on only 1 channel.

Reference Manual to LL API cross reference:

- CHSELR SQ1 LL_ADC_REG_GetSequencerLength
- CHSELR SQ2 LL_ADC_REG_GetSequencerLength
- CHSELR SQ3 LL_ADC_REG_GetSequencerLength
- CHSELR SQ4 LL_ADC_REG_GetSequencerLength
- CHSELR SQ5 LL_ADC_REG_GetSequencerLength
- CHSELR SQ6 LL_ADC_REG_GetSequencerLength
- CHSELR SQ7 LL_ADC_REG_GetSequencerLength
- CHSELR SQ8 LL_ADC_REG_GetSequencerLength

LL_ADC_REG_SetSequencerScanDirection

Function name

__STATIC_INLINE void LL_ADC_REG_SetSequencerScanDirection (ADC_TypeDef * ADCx, uint32_t ScanDirection)

Function description

Set ADC group regular sequencer scan direction.

Parameters

- **ADCx:** ADC instance
- **ScanDirection:** This parameter can be one of the following values:
  - LL_ADC_REG_SEQ_SCAN_DIR_FORWARD
  - LL_ADC_REG_SEQ_SCAN_DIR_BACKWARD

Return values

- **None:**

Notes

- On this STM32 series, parameter relevant only is sequencer is set to mode not fully configurable, refer to function LL_ADC_REG_SetSequencerConfigurable().
- On some other STM32 series, this setting is not available and the default scan direction is forward.
- On this STM32 series, after modifying sequencer (functions LL_ADC_REG_SetSequencerLength() LL_ADC_REG_SetSequencerRanks(), ...) it is mandatory to wait for the assertion of CCRDY flag using LL_ADC_IsActiveFlag_CCRDY(). Otherwise, some actions may be ignored. Refer to description of LL_ADC_IsActiveFlag_CCRDY for more details.
- On this STM32 series, setting of this feature is conditioned to ADC state: ADC must be disabled.

Reference Manual to LL API cross reference:

- CFGR1 SCANDIR LL_ADC_REG_SetSequencerScanDirection

LL_ADC_REG_GetSequencerScanDirection

Function name

__STATIC_INLINE uint32_t LL_ADC_REG_GetSequencerScanDirection (const ADC_TypeDef * ADCx)

Function description

Get ADC group regular sequencer scan direction.

Parameters

- **ADCx:** ADC instance

Return values

- **Returned:** value can be one of the following values:
  - LL_ADC_REG_SEQ_SCAN_DIR_FORWARD
  - LL_ADC_REG_SEQ_SCAN_DIR_BACKWARD

Notes

- On this STM32 series, parameter relevant only is sequencer is set to mode not fully configurable, refer to function LL_ADC_REG_SetSequencerConfigurable().
- On some other STM32 series, this setting is not available and the default scan direction is forward.

Reference Manual to LL API cross reference:

- CFGR1 SCANDIR LL_ADC_REG_GetSequencerScanDirection

LL_ADC_REG_SetSequencerDiscont

Function name

__STATIC_INLINE void LL_ADC_REG_SetSequencerDiscont (ADC_TypeDef * ADCx, uint32_t SeqDiscont)

Function description

Set ADC group regular sequencer discontinuous mode: sequence subdivided and scan conversions interrupted every selected number of ranks.

Parameters

- **ADCx:** ADC instance
- **SeqDiscont:** This parameter can be one of the following values:
  - LL_ADC_REG_SEQ_DISCONT_DISABLE
  - LL_ADC_REG_SEQ_DISCONT_1RANK

Return values

- **None:**

Notes

- It is not possible to enable both ADC group regular continuous mode and sequencer discontinuous mode.
- On this STM32 series, setting of this feature is conditioned to ADC state: ADC must be disabled.

Reference Manual to LL API cross reference:

- CFGR1 DISCEN LL_ADC_REG_SetSequencerDiscont
-

LL_ADC_REG_GetSequencerDiscont

Function name

__STATIC_INLINE uint32_t LL_ADC_REG_GetSequencerDiscont (const ADC_TypeDef * ADCx)

Function description

Get ADC group regular sequencer discontinuous mode: sequence subdivided and scan conversions interrupted every selected number of ranks.

Parameters

- **ADCx:** ADC instance

Return values

- **Returned:** value can be one of the following values:
  - LL_ADC_REG_SEQ_DISCONT_DISABLE
  - LL_ADC_REG_SEQ_DISCONT_1RANK

Reference Manual to LL API cross reference:

- CFGR1 DISCEN LL_ADC_REG_GetSequencerDiscont
-

LL_ADC_REG_SetSequencerRanks

Function name

__STATIC_INLINE void LL_ADC_REG_SetSequencerRanks (ADC_TypeDef * ADCx, uint32_t Rank, uint32_t Channel)

Function description

Set ADC group regular sequence: channel on the selected scan sequence rank.

Parameters

- **ADCx:** ADC instance
- **Rank:** This parameter can be one of the following values:
  - LL_ADC_REG_RANK_1
  - LL_ADC_REG_RANK_2
  - LL_ADC_REG_RANK_3
  - LL_ADC_REG_RANK_4
  - LL_ADC_REG_RANK_5
  - LL_ADC_REG_RANK_6
  - LL_ADC_REG_RANK_7
  - LL_ADC_REG_RANK_8
- **Channel:** This parameter can be one of the following values:
  - LL_ADC_CHANNEL_0
  - LL_ADC_CHANNEL_1
  - LL_ADC_CHANNEL_2
  - LL_ADC_CHANNEL_3
  - LL_ADC_CHANNEL_4
  - LL_ADC_CHANNEL_5
  - LL_ADC_CHANNEL_6
  - LL_ADC_CHANNEL_7
  - LL_ADC_CHANNEL_8
  - LL_ADC_CHANNEL_9
  - LL_ADC_CHANNEL_10
  - LL_ADC_CHANNEL_11
  - LL_ADC_CHANNEL_12
  - LL_ADC_CHANNEL_13
  - LL_ADC_CHANNEL_14
  - LL_ADC_CHANNEL_15
  - LL_ADC_CHANNEL_16
  - LL_ADC_CHANNEL_17
  - LL_ADC_CHANNEL_18
  - LL_ADC_CHANNEL_19
  - LL_ADC_CHANNEL_TEMPSENSOR
  - LL_ADC_CHANNEL_VREFINT
  - LL_ADC_CHANNEL_VBAT
  - LL_ADC_CHANNEL_DACCH1

Return values

- **None:**

Notes

- This function performs configuration of: Channels ordering into each rank of scan sequence: whatever channel can be placed into whatever rank.
- On this STM32 series, ADC group regular sequencer is fully configurable: sequencer length and each rank affectation to a channel are configurable. Refer to description of function LL_ADC_REG_SetSequencerLength().
- Depending on devices and packages, some channels may not be available. Refer to device datasheet for channels availability.
- On this STM32 series, to measure internal channels (VrefInt, TempSensor, ...), measurement paths to internal channels must be enabled separately. This can be done using function LL_ADC_SetCommonPathInternalCh().
- On this STM32 series, after modifying sequencer (functions LL_ADC_REG_SetSequencerLength() LL_ADC_REG_SetSequencerRanks(), ...) it is mandatory to wait for the assertion of CCRDY flag using LL_ADC_IsActiveFlag_CCRDY(). Otherwise, some actions may be ignored. Refer to description of LL_ADC_IsActiveFlag_CCRDY for more details.
- On this STM32 series, setting of this feature is conditioned to ADC state: ADC must be disabled or enabled without conversion on going on group regular.

Reference Manual to LL API cross reference:

- CHSELR SQ1 LL_ADC_REG_SetSequencerRanks
- CHSELR SQ2 LL_ADC_REG_SetSequencerRanks
- CHSELR SQ3 LL_ADC_REG_SetSequencerRanks
- CHSELR SQ4 LL_ADC_REG_SetSequencerRanks
- CHSELR SQ5 LL_ADC_REG_SetSequencerRanks
- CHSELR SQ6 LL_ADC_REG_SetSequencerRanks
- CHSELR SQ7 LL_ADC_REG_SetSequencerRanks
- CHSELR SQ8 LL_ADC_REG_SetSequencerRanks

LL_ADC_REG_GetSequencerRanks

Function name

__STATIC_INLINE uint32_t LL_ADC_REG_GetSequencerRanks (const ADC_TypeDef * ADCx, uint32_t Rank)

Function description

Get ADC group regular sequence: channel on the selected scan sequence rank.

Parameters

- **ADCx:** ADC instance
- **Rank:** This parameter can be one of the following values:
  - LL_ADC_REG_RANK_1
  - LL_ADC_REG_RANK_2
  - LL_ADC_REG_RANK_3
  - LL_ADC_REG_RANK_4
  - LL_ADC_REG_RANK_5
  - LL_ADC_REG_RANK_6
  - LL_ADC_REG_RANK_7
  - LL_ADC_REG_RANK_8

Return values

- **Returned:** value can be one of the following values:
  - LL_ADC_CHANNEL_0
  - LL_ADC_CHANNEL_1
  - LL_ADC_CHANNEL_2
  - LL_ADC_CHANNEL_3
  - LL_ADC_CHANNEL_4
  - LL_ADC_CHANNEL_5
  - LL_ADC_CHANNEL_6
  - LL_ADC_CHANNEL_7
  - LL_ADC_CHANNEL_8
  - LL_ADC_CHANNEL_9
  - LL_ADC_CHANNEL_10
  - LL_ADC_CHANNEL_11
  - LL_ADC_CHANNEL_12
  - LL_ADC_CHANNEL_13
  - LL_ADC_CHANNEL_14
  - LL_ADC_CHANNEL_15
  - LL_ADC_CHANNEL_16
  - LL_ADC_CHANNEL_17
  - LL_ADC_CHANNEL_18
  - LL_ADC_CHANNEL_19
  - LL_ADC_CHANNEL_TEMPSENSOR
  - LL_ADC_CHANNEL_VREFINT
  - LL_ADC_CHANNEL_VBAT
  - LL_ADC_CHANNEL_DACCH1

Notes

- On this STM32 series, ADC group regular sequencer is fully configurable: sequencer length and each rank affectation to a channel are configurable. Refer to description of function LL_ADC_REG_SetSequencerLength().
- Depending on devices and packages, some channels may not be available. Refer to device datasheet for channels availability.
- Usage of the returned channel number: To reinject this channel into another function LL_ADC_xxx: the returned channel number is only partly formatted on definition of literals LL_ADC_CHANNEL_x. Therefore, it has to be compared with parts of literals LL_ADC_CHANNEL_x or using helper macro __LL_ADC_CHANNEL_TO_DECIMAL_NB(). Then the selected literal LL_ADC_CHANNEL_x can be used as parameter for another function.To get the channel number in decimal format: process the returned value with the helper macro __LL_ADC_CHANNEL_TO_DECIMAL_NB().

Reference Manual to LL API cross reference:

- CHSELR SQ1 LL_ADC_REG_GetSequencerRanks
- CHSELR SQ2 LL_ADC_REG_GetSequencerRanks
- CHSELR SQ3 LL_ADC_REG_GetSequencerRanks
- CHSELR SQ4 LL_ADC_REG_GetSequencerRanks
- CHSELR SQ5 LL_ADC_REG_GetSequencerRanks
- CHSELR SQ6 LL_ADC_REG_GetSequencerRanks
- CHSELR SQ7 LL_ADC_REG_GetSequencerRanks
- CHSELR SQ8 LL_ADC_REG_GetSequencerRanks

LL_ADC_REG_SetSequencerChannels

Function name

__STATIC_INLINE void LL_ADC_REG_SetSequencerChannels (ADC_TypeDef * ADCx, uint32_t Channel)

Function description

Set ADC group regular sequence: channel on rank corresponding to channel number.

Parameters

- **ADCx:** ADC instance
- **Channel:** This parameter can be a combination of the following values:
  - LL_ADC_CHANNEL_0
  - LL_ADC_CHANNEL_1
  - LL_ADC_CHANNEL_2
  - LL_ADC_CHANNEL_3
  - LL_ADC_CHANNEL_4
  - LL_ADC_CHANNEL_5
  - LL_ADC_CHANNEL_6
  - LL_ADC_CHANNEL_7
  - LL_ADC_CHANNEL_8
  - LL_ADC_CHANNEL_9
  - LL_ADC_CHANNEL_10
  - LL_ADC_CHANNEL_11
  - LL_ADC_CHANNEL_12
  - LL_ADC_CHANNEL_13
  - LL_ADC_CHANNEL_14
  - LL_ADC_CHANNEL_15
  - LL_ADC_CHANNEL_16
  - LL_ADC_CHANNEL_17
  - LL_ADC_CHANNEL_18
  - LL_ADC_CHANNEL_19
  - LL_ADC_CHANNEL_TEMPSENSOR
  - LL_ADC_CHANNEL_VREFINT
  - LL_ADC_CHANNEL_VBAT
  - LL_ADC_CHANNEL_DACCH1

Return values

- **None:**

Notes

- This function performs: Channels ordering into each rank of scan sequence: rank of each channel is fixed by channel HW number (channel 0 fixed on rank 0, channel 1 fixed on rank1, ...).Set channels selected by overwriting the current sequencer configuration.
- On this STM32 series, ADC group regular sequencer both modes "fully configurable" or "not fully configurable" are available, they can be chosen using function LL_ADC_REG_SetSequencerConfigurable(). This function can be used with setting "not fully configurable". Refer to description of functions LL_ADC_REG_SetSequencerConfigurable() and LL_ADC_REG_SetSequencerLength().
- On this STM32 series, after modifying sequencer (functions LL_ADC_REG_SetSequencerLength() LL_ADC_REG_SetSequencerRanks(), ...) it is mandatory to wait for the assertion of CCRDY flag using LL_ADC_IsActiveFlag_CCRDY(). Otherwise, some actions may be ignored. Refer to description of LL_ADC_IsActiveFlag_CCRDY for more details.
- Depending on devices and packages, some channels may not be available. Refer to device datasheet for channels availability.
- On this STM32 series, to measure internal channels (VrefInt, TempSensor, ...), measurement paths to internal channels must be enabled separately. This can be done using function LL_ADC_SetCommonPathInternalCh().
- On this STM32 series, setting of this feature is conditioned to ADC state: ADC must be disabled or enabled without conversion on going on group regular.
- One or several values can be selected. Example: (LL_ADC_CHANNEL_4 | LL_ADC_CHANNEL_12 | ...)

Reference Manual to LL API cross reference:

- CHSELR CHSEL0 LL_ADC_REG_SetSequencerChannels
- CHSELR CHSEL1 LL_ADC_REG_SetSequencerChannels
- CHSELR CHSEL2 LL_ADC_REG_SetSequencerChannels
- CHSELR CHSEL3 LL_ADC_REG_SetSequencerChannels
- CHSELR CHSEL4 LL_ADC_REG_SetSequencerChannels
- CHSELR CHSEL5 LL_ADC_REG_SetSequencerChannels
- CHSELR CHSEL6 LL_ADC_REG_SetSequencerChannels
- CHSELR CHSEL7 LL_ADC_REG_SetSequencerChannels
- CHSELR CHSEL8 LL_ADC_REG_SetSequencerChannels
- CHSELR CHSEL9 LL_ADC_REG_SetSequencerChannels
- CHSELR CHSEL10 LL_ADC_REG_SetSequencerChannels
- CHSELR CHSEL11 LL_ADC_REG_SetSequencerChannels
- CHSELR CHSEL12 LL_ADC_REG_SetSequencerChannels
- CHSELR CHSEL13 LL_ADC_REG_SetSequencerChannels
- CHSELR CHSEL14 LL_ADC_REG_SetSequencerChannels
- CHSELR CHSEL15 LL_ADC_REG_SetSequencerChannels
- CHSELR CHSEL16 LL_ADC_REG_SetSequencerChannels
- CHSELR CHSEL17 LL_ADC_REG_SetSequencerChannels
- CHSELR CHSEL18 LL_ADC_REG_SetSequencerChannels

LL_ADC_REG_SetSequencerChAdd

Function name

__STATIC_INLINE void LL_ADC_REG_SetSequencerChAdd (ADC_TypeDef * ADCx, uint32_t Channel)

Function description

Add channel to ADC group regular sequence: channel on rank corresponding to channel number.

Parameters

- **ADCx:** ADC instance
- **Channel:** This parameter can be a combination of the following values:
  - LL_ADC_CHANNEL_0
  - LL_ADC_CHANNEL_1
  - LL_ADC_CHANNEL_2
  - LL_ADC_CHANNEL_3
  - LL_ADC_CHANNEL_4
  - LL_ADC_CHANNEL_5
  - LL_ADC_CHANNEL_6
  - LL_ADC_CHANNEL_7
  - LL_ADC_CHANNEL_8
  - LL_ADC_CHANNEL_9
  - LL_ADC_CHANNEL_10
  - LL_ADC_CHANNEL_11
  - LL_ADC_CHANNEL_12
  - LL_ADC_CHANNEL_13
  - LL_ADC_CHANNEL_14
  - LL_ADC_CHANNEL_15
  - LL_ADC_CHANNEL_16
  - LL_ADC_CHANNEL_17
  - LL_ADC_CHANNEL_18
  - LL_ADC_CHANNEL_19
  - LL_ADC_CHANNEL_TEMPSENSOR
  - LL_ADC_CHANNEL_VREFINT
  - LL_ADC_CHANNEL_VBAT
  - LL_ADC_CHANNEL_DACCH1

Return values

- **None:**

Notes

- This function performs: Channels ordering into each rank of scan sequence: rank of each channel is fixed by channel HW number (channel 0 fixed on rank 0, channel 1 fixed on rank1, ...).Set channels selected by adding them to the current sequencer configuration.
- On this STM32 series, ADC group regular sequencer both modes "fully configurable" or "not fully configurable" are available, they can be chosen using function LL_ADC_REG_SetSequencerConfigurable(). This function can be used with setting "not fully configurable". Refer to description of functions LL_ADC_REG_SetSequencerConfigurable() and LL_ADC_REG_SetSequencerLength().
- On this STM32 series, after modifying sequencer (functions LL_ADC_REG_SetSequencerLength() LL_ADC_REG_SetSequencerRanks(), ...) it is mandatory to wait for the assertion of CCRDY flag using LL_ADC_IsActiveFlag_CCRDY(). Otherwise, some actions may be ignored. Refer to description of LL_ADC_IsActiveFlag_CCRDY for more details.
- Depending on devices and packages, some channels may not be available. Refer to device datasheet for channels availability.
- On this STM32 series, to measure internal channels (VrefInt, TempSensor, ...), measurement paths to internal channels must be enabled separately. This can be done using function LL_ADC_SetCommonPathInternalCh().
- On this STM32 series, setting of this feature is conditioned to ADC state: ADC must be disabled or enabled without conversion on going on group regular.
- One or several values can be selected. Example: (LL_ADC_CHANNEL_4 | LL_ADC_CHANNEL_12 | ...)

Reference Manual to LL API cross reference:

- CHSELR CHSEL0 LL_ADC_REG_SetSequencerChAdd
- CHSELR CHSEL1 LL_ADC_REG_SetSequencerChAdd
- CHSELR CHSEL2 LL_ADC_REG_SetSequencerChAdd
- CHSELR CHSEL3 LL_ADC_REG_SetSequencerChAdd
- CHSELR CHSEL4 LL_ADC_REG_SetSequencerChAdd
- CHSELR CHSEL5 LL_ADC_REG_SetSequencerChAdd
- CHSELR CHSEL6 LL_ADC_REG_SetSequencerChAdd
- CHSELR CHSEL7 LL_ADC_REG_SetSequencerChAdd
- CHSELR CHSEL8 LL_ADC_REG_SetSequencerChAdd
- CHSELR CHSEL9 LL_ADC_REG_SetSequencerChAdd
- CHSELR CHSEL10 LL_ADC_REG_SetSequencerChAdd
- CHSELR CHSEL11 LL_ADC_REG_SetSequencerChAdd
- CHSELR CHSEL12 LL_ADC_REG_SetSequencerChAdd
- CHSELR CHSEL13 LL_ADC_REG_SetSequencerChAdd
- CHSELR CHSEL14 LL_ADC_REG_SetSequencerChAdd
- CHSELR CHSEL15 LL_ADC_REG_SetSequencerChAdd
- CHSELR CHSEL16 LL_ADC_REG_SetSequencerChAdd
- CHSELR CHSEL17 LL_ADC_REG_SetSequencerChAdd
- CHSELR CHSEL18 LL_ADC_REG_SetSequencerChAdd

LL_ADC_REG_SetSequencerChRem

Function name

__STATIC_INLINE void LL_ADC_REG_SetSequencerChRem (ADC_TypeDef * ADCx, uint32_t Channel)

Function description

Remove channel to ADC group regular sequence: channel on rank corresponding to channel number.

Parameters

- **ADCx:** ADC instance
- **Channel:** This parameter can be a combination of the following values:
  - LL_ADC_CHANNEL_0
  - LL_ADC_CHANNEL_1
  - LL_ADC_CHANNEL_2
  - LL_ADC_CHANNEL_3
  - LL_ADC_CHANNEL_4
  - LL_ADC_CHANNEL_5
  - LL_ADC_CHANNEL_6
  - LL_ADC_CHANNEL_7
  - LL_ADC_CHANNEL_8
  - LL_ADC_CHANNEL_9
  - LL_ADC_CHANNEL_10
  - LL_ADC_CHANNEL_11
  - LL_ADC_CHANNEL_12
  - LL_ADC_CHANNEL_13
  - LL_ADC_CHANNEL_14
  - LL_ADC_CHANNEL_15
  - LL_ADC_CHANNEL_16
  - LL_ADC_CHANNEL_17
  - LL_ADC_CHANNEL_18
  - LL_ADC_CHANNEL_19
  - LL_ADC_CHANNEL_TEMPSENSOR
  - LL_ADC_CHANNEL_VREFINT
  - LL_ADC_CHANNEL_VBAT
  - LL_ADC_CHANNEL_DACCH1

Return values

- **None:**

Notes

- This function performs: Channels ordering into each rank of scan sequence: rank of each channel is fixed by channel HW number (channel 0 fixed on rank 0, channel 1 fixed on rank1, ...).Set channels selected by removing them to the current sequencer configuration.
- On this STM32 series, ADC group regular sequencer both modes "fully configurable" or "not fully configurable" are available, they can be chosen using function LL_ADC_REG_SetSequencerConfigurable(). This function can be used with setting "not fully configurable". Refer to description of functions LL_ADC_REG_SetSequencerConfigurable() and LL_ADC_REG_SetSequencerLength().
- On this STM32 series, after modifying sequencer (functions LL_ADC_REG_SetSequencerLength() LL_ADC_REG_SetSequencerRanks(), ...) it is mandatory to wait for the assertion of CCRDY flag using LL_ADC_IsActiveFlag_CCRDY(). Otherwise, some actions may be ignored. Refer to description of LL_ADC_IsActiveFlag_CCRDY for more details.
- Depending on devices and packages, some channels may not be available. Refer to device datasheet for channels availability.
- On this STM32 series, to measure internal channels (VrefInt, TempSensor, ...), measurement paths to internal channels must be enabled separately. This can be done using function LL_ADC_SetCommonPathInternalCh().
- On this STM32 series, setting of this feature is conditioned to ADC state: ADC must be disabled or enabled without conversion on going on group regular.
- One or several values can be selected. Example: (LL_ADC_CHANNEL_4 | LL_ADC_CHANNEL_12 | ...)

Reference Manual to LL API cross reference:

- CHSELR CHSEL0 LL_ADC_REG_SetSequencerChRem
- CHSELR CHSEL1 LL_ADC_REG_SetSequencerChRem
- CHSELR CHSEL2 LL_ADC_REG_SetSequencerChRem
- CHSELR CHSEL3 LL_ADC_REG_SetSequencerChRem
- CHSELR CHSEL4 LL_ADC_REG_SetSequencerChRem
- CHSELR CHSEL5 LL_ADC_REG_SetSequencerChRem
- CHSELR CHSEL6 LL_ADC_REG_SetSequencerChRem
- CHSELR CHSEL7 LL_ADC_REG_SetSequencerChRem
- CHSELR CHSEL8 LL_ADC_REG_SetSequencerChRem
- CHSELR CHSEL9 LL_ADC_REG_SetSequencerChRem
- CHSELR CHSEL10 LL_ADC_REG_SetSequencerChRem
- CHSELR CHSEL11 LL_ADC_REG_SetSequencerChRem
- CHSELR CHSEL12 LL_ADC_REG_SetSequencerChRem
- CHSELR CHSEL13 LL_ADC_REG_SetSequencerChRem
- CHSELR CHSEL14 LL_ADC_REG_SetSequencerChRem
- CHSELR CHSEL15 LL_ADC_REG_SetSequencerChRem
- CHSELR CHSEL16 LL_ADC_REG_SetSequencerChRem
- CHSELR CHSEL17 LL_ADC_REG_SetSequencerChRem
- CHSELR CHSEL18 LL_ADC_REG_SetSequencerChRem

LL_ADC_REG_GetSequencerChannels

Function name

__STATIC_INLINE uint32_t LL_ADC_REG_GetSequencerChannels (const ADC_TypeDef * ADCx)

Function description

Get ADC group regular sequence: channel on rank corresponding to channel number.

Parameters

- **ADCx:** ADC instance

Return values

- **Returned:** value can be a combination of the following values:
  - LL_ADC_CHANNEL_0
  - LL_ADC_CHANNEL_1
  - LL_ADC_CHANNEL_2
  - LL_ADC_CHANNEL_3
  - LL_ADC_CHANNEL_4
  - LL_ADC_CHANNEL_5
  - LL_ADC_CHANNEL_6
  - LL_ADC_CHANNEL_7
  - LL_ADC_CHANNEL_8
  - LL_ADC_CHANNEL_9
  - LL_ADC_CHANNEL_10
  - LL_ADC_CHANNEL_11
  - LL_ADC_CHANNEL_12
  - LL_ADC_CHANNEL_13
  - LL_ADC_CHANNEL_14
  - LL_ADC_CHANNEL_15
  - LL_ADC_CHANNEL_16
  - LL_ADC_CHANNEL_17
  - LL_ADC_CHANNEL_18
  - LL_ADC_CHANNEL_19
  - LL_ADC_CHANNEL_TEMPSENSOR
  - LL_ADC_CHANNEL_VREFINT
  - LL_ADC_CHANNEL_VBAT
  - LL_ADC_CHANNEL_DACCH1

Notes

- This function performs: Channels order reading into each rank of scan sequence: rank of each channel is fixed by channel HW number (channel 0 fixed on rank 0, channel 1 fixed on rank1, ...).
- On this STM32 series, ADC group regular sequencer both modes "fully configurable" or "not fully configurable" are available, they can be chosen using function LL_ADC_REG_SetSequencerConfigurable(). This function can be used with setting "not fully configurable". Refer to description of functions LL_ADC_REG_SetSequencerConfigurable() and LL_ADC_REG_SetSequencerLength().
- Depending on devices and packages, some channels may not be available. Refer to device datasheet for channels availability.
- On this STM32 series, to measure internal channels (VrefInt, TempSensor, ...), measurement paths to internal channels must be enabled separately. This can be done using function LL_ADC_SetCommonPathInternalCh().
- On this STM32 series, setting of this feature is conditioned to ADC state: ADC must be disabled or enabled without conversion on going on group regular.
- One or several values can be retrieved. Example: (LL_ADC_CHANNEL_4 | LL_ADC_CHANNEL_12 | ...)

Reference Manual to LL API cross reference:

- CHSELR CHSEL0 LL_ADC_REG_GetSequencerChannels
- CHSELR CHSEL1 LL_ADC_REG_GetSequencerChannels
- CHSELR CHSEL2 LL_ADC_REG_GetSequencerChannels
- CHSELR CHSEL3 LL_ADC_REG_GetSequencerChannels
- CHSELR CHSEL4 LL_ADC_REG_GetSequencerChannels
- CHSELR CHSEL5 LL_ADC_REG_GetSequencerChannels
- CHSELR CHSEL6 LL_ADC_REG_GetSequencerChannels
- CHSELR CHSEL7 LL_ADC_REG_GetSequencerChannels
- CHSELR CHSEL8 LL_ADC_REG_GetSequencerChannels
- CHSELR CHSEL9 LL_ADC_REG_GetSequencerChannels
- CHSELR CHSEL10 LL_ADC_REG_GetSequencerChannels
- CHSELR CHSEL11 LL_ADC_REG_GetSequencerChannels
- CHSELR CHSEL12 LL_ADC_REG_GetSequencerChannels
- CHSELR CHSEL13 LL_ADC_REG_GetSequencerChannels
- CHSELR CHSEL14 LL_ADC_REG_GetSequencerChannels
- CHSELR CHSEL15 LL_ADC_REG_GetSequencerChannels
- CHSELR CHSEL16 LL_ADC_REG_GetSequencerChannels
- CHSELR CHSEL17 LL_ADC_REG_GetSequencerChannels
- CHSELR CHSEL18 LL_ADC_REG_GetSequencerChannels

LL_ADC_REG_SetContinuousMode

Function name

__STATIC_INLINE void LL_ADC_REG_SetContinuousMode (ADC_TypeDef * ADCx, uint32_t Continuous)

Function description

Set ADC continuous conversion mode on ADC group regular.

Parameters

- **ADCx:** ADC instance
- **Continuous:** This parameter can be one of the following values:
  - LL_ADC_REG_CONV_SINGLE
  - LL_ADC_REG_CONV_CONTINUOUS

Return values

- **None:**

Notes

- Description of ADC continuous conversion mode: single mode: one conversion per triggercontinuous mode: after the first trigger, following conversions launched successively automatically.
- It is not possible to enable both ADC group regular continuous mode and sequencer discontinuous mode.
- On this STM32 series, setting of this feature is conditioned to ADC state: ADC must be disabled.

Reference Manual to LL API cross reference:

- CFGR1 CONT LL_ADC_REG_SetContinuousMode

LL_ADC_REG_GetContinuousMode

Function name

__STATIC_INLINE uint32_t LL_ADC_REG_GetContinuousMode (const ADC_TypeDef * ADCx)

Function description

Get ADC continuous conversion mode on ADC group regular.

Parameters

- **ADCx:** ADC instance

Return values

- **Returned:** value can be one of the following values:
  - LL_ADC_REG_CONV_SINGLE
  - LL_ADC_REG_CONV_CONTINUOUS

Notes

- Description of ADC continuous conversion mode: single mode: one conversion per triggercontinuous mode: after the first trigger, following conversions launched successively automatically.

Reference Manual to LL API cross reference:

- CFGR1 CONT LL_ADC_REG_GetContinuousMode

LL_ADC_REG_SetDMATransfer

Function name

__STATIC_INLINE void LL_ADC_REG_SetDMATransfer (ADC_TypeDef * ADCx, uint32_t DMATransfer)

Function description

Set ADC group regular conversion data transfer: no transfer or transfer by DMA, and DMA requests mode.

Parameters

- **ADCx:** ADC instance
- **DMATransfer:** This parameter can be one of the following values:
  - LL_ADC_REG_DMA_TRANSFER_NONE
  - LL_ADC_REG_DMA_TRANSFER_LIMITED
  - LL_ADC_REG_DMA_TRANSFER_UNLIMITED

Return values

- **None:**

Notes

- If transfer by DMA selected, specifies the DMA requests mode: Limited mode (One shot mode): DMA transfer requests are stopped when number of DMA data transfers (number of ADC conversions) is reached. This ADC mode is intended to be used with DMA mode non-circular.Unlimited mode: DMA transfer requests are unlimited, whatever number of DMA data transfers (number of ADC conversions). This ADC mode is intended to be used with DMA mode circular.
- If ADC DMA requests mode is set to unlimited and DMA is set to mode non-circular: when DMA transfers size will be reached, DMA will stop transfers of ADC conversions data ADC will raise an overrun error (overrun flag and interruption if enabled).
- To configure DMA source address (peripheral address), use function LL_ADC_DMA_GetRegAddr().
- On this STM32 series, setting of this feature is conditioned to ADC state: ADC must be disabled.

Reference Manual to LL API cross reference:

- CFGR1 DMAEN LL_ADC_REG_SetDMATransfer
- CFGR1 DMACFG LL_ADC_REG_SetDMATransfer

LL_ADC_REG_GetDMATransfer

Function name

__STATIC_INLINE uint32_t LL_ADC_REG_GetDMATransfer (const ADC_TypeDef * ADCx)

Function description

Get ADC group regular conversion data transfer: no transfer or transfer by DMA, and DMA requests mode.

Parameters

- **ADCx:** ADC instance

Return values

- **Returned:** value can be one of the following values:
  - LL_ADC_REG_DMA_TRANSFER_NONE
  - LL_ADC_REG_DMA_TRANSFER_LIMITED
  - LL_ADC_REG_DMA_TRANSFER_UNLIMITED

Notes

- If transfer by DMA selected, specifies the DMA requests mode: Limited mode (One shot mode): DMA transfer requests are stopped when number of DMA data transfers (number of ADC conversions) is reached. This ADC mode is intended to be used with DMA mode non-circular.Unlimited mode: DMA transfer requests are unlimited, whatever number of DMA data transfers (number of ADC conversions). This ADC mode is intended to be used with DMA mode circular.
- If ADC DMA requests mode is set to unlimited and DMA is set to mode non-circular: when DMA transfers size will be reached, DMA will stop transfers of ADC conversions data ADC will raise an overrun error (overrun flag and interruption if enabled).
- To configure DMA source address (peripheral address), use function LL_ADC_DMA_GetRegAddr().

Reference Manual to LL API cross reference:

- CFGR1 DMAEN LL_ADC_REG_GetDMATransfer
- CFGR1 DMACFG LL_ADC_REG_GetDMATransfer

LL_ADC_REG_SetOverrun

Function name

__STATIC_INLINE void LL_ADC_REG_SetOverrun (ADC_TypeDef * ADCx, uint32_t Overrun)

Function description

Set ADC group regular behavior in case of overrun: data preserved or overwritten.

Parameters

- **ADCx:** ADC instance
- **Overrun:** This parameter can be one of the following values:
  - LL_ADC_REG_OVR_DATA_PRESERVED
  - LL_ADC_REG_OVR_DATA_OVERWRITTEN

Return values

- **None:**

Notes

- Compatibility with devices without feature overrun: other devices without this feature have a behavior equivalent to data overwritten. The default setting of overrun is data preserved. Therefore, for compatibility with all devices, parameter overrun should be set to data overwritten.
- On this STM32 series, setting of this feature is conditioned to ADC state: ADC must be disabled.

Reference Manual to LL API cross reference:

- CFGR1 OVRMOD LL_ADC_REG_SetOverrun

LL_ADC_REG_GetOverrun

Function name

__STATIC_INLINE uint32_t LL_ADC_REG_GetOverrun (const ADC_TypeDef * ADCx)

Function description

Get ADC group regular behavior in case of overrun: data preserved or overwritten.

Parameters

- **ADCx:** ADC instance

Return values

- **Returned:** value can be one of the following values:
  - LL_ADC_REG_OVR_DATA_PRESERVED
  - LL_ADC_REG_OVR_DATA_OVERWRITTEN

Reference Manual to LL API cross reference:

- CFGR1 OVRMOD LL_ADC_REG_GetOverrun

LL_ADC_SetChannelSamplingTime

Function name

__STATIC_INLINE void LL_ADC_SetChannelSamplingTime (ADC_TypeDef * ADCx, uint32_t Channel, uint32_t SamplingTimeY)

Function description

Set sampling time of the selected ADC channel Unit: ADC clock cycles.

Parameters

- **ADCx:** ADC instance
- **Channel:** This parameter can be a combination of the following values:
  - LL_ADC_CHANNEL_0
  - LL_ADC_CHANNEL_1
  - LL_ADC_CHANNEL_2
  - LL_ADC_CHANNEL_3
  - LL_ADC_CHANNEL_4
  - LL_ADC_CHANNEL_5
  - LL_ADC_CHANNEL_6
  - LL_ADC_CHANNEL_7
  - LL_ADC_CHANNEL_8
  - LL_ADC_CHANNEL_9
  - LL_ADC_CHANNEL_10
  - LL_ADC_CHANNEL_11
  - LL_ADC_CHANNEL_12
  - LL_ADC_CHANNEL_13
  - LL_ADC_CHANNEL_14
  - LL_ADC_CHANNEL_15
  - LL_ADC_CHANNEL_16
  - LL_ADC_CHANNEL_17
  - LL_ADC_CHANNEL_18
  - LL_ADC_CHANNEL_19
  - LL_ADC_CHANNEL_TEMPSENSOR
  - LL_ADC_CHANNEL_VREFINT
  - LL_ADC_CHANNEL_VBAT
  - LL_ADC_CHANNEL_DACCH1
- **SamplingTimeY:** This parameter can be one of the following values:
  - LL_ADC_SAMPLINGTIME_COMMON_1
  - LL_ADC_SAMPLINGTIME_COMMON_2

Return values

- **None:**

Notes

- On this device, sampling time is on channel scope: independently of channel mapped on ADC group regular or injected.
- In case of internal channel (VrefInt, TempSensor, ...) to be converted: sampling time constraints must be respected (sampling time can be adjusted in function of ADC clock frequency and sampling time setting). Refer to device datasheet for timings values (parameters TS_vrefint, TS_temp, ...).
- Conversion time is the addition of sampling time and processing time. Refer to reference manual for ADC processing time of this STM32 series.
- In case of ADC conversion of internal channel (VrefInt, temperature sensor, ...), a sampling time minimum value is required. Refer to device datasheet.
- On this STM32 series, setting of this feature is conditioned to ADC state: ADC must be disabled or enabled without conversion on going on group regular.

Reference Manual to LL API cross reference:

- SMPR SMPSEL0 LL_ADC_SetChannelSamplingTime
- SMPR SMPSEL1 LL_ADC_SetChannelSamplingTime
- SMPR SMPSEL2 LL_ADC_SetChannelSamplingTime
- SMPR SMPSEL3 LL_ADC_SetChannelSamplingTime
- SMPR SMPSEL4 LL_ADC_SetChannelSamplingTime
- SMPR SMPSEL5 LL_ADC_SetChannelSamplingTime
- SMPR SMPSEL6 LL_ADC_SetChannelSamplingTime
- SMPR SMPSEL7 LL_ADC_SetChannelSamplingTime
- SMPR SMPSEL8 LL_ADC_SetChannelSamplingTime
- SMPR SMPSEL9 LL_ADC_SetChannelSamplingTime
- SMPR SMPSEL10 LL_ADC_SetChannelSamplingTime
- SMPR SMPSEL11 LL_ADC_SetChannelSamplingTime
- SMPR SMPSEL12 LL_ADC_SetChannelSamplingTime
- SMPR SMPSEL13 LL_ADC_SetChannelSamplingTime
- SMPR SMPSEL14 LL_ADC_SetChannelSamplingTime
- SMPR SMPSEL15 LL_ADC_SetChannelSamplingTime
- SMPR SMPSEL16 LL_ADC_SetChannelSamplingTime
- SMPR SMPSEL17 LL_ADC_SetChannelSamplingTime
- SMPR SMPSEL18 LL_ADC_SetChannelSamplingTime

LL_ADC_GetChannelSamplingTime

Function name

__STATIC_INLINE uint32_t LL_ADC_GetChannelSamplingTime (const ADC_TypeDef * ADCx, uint32_t Channel)

Function description

Get sampling time of the selected ADC channel Unit: ADC clock cycles.

Parameters

- **ADCx:** ADC instance
- **Channel:** This parameter can be one of the following values:
  - LL_ADC_CHANNEL_0
  - LL_ADC_CHANNEL_1
  - LL_ADC_CHANNEL_2
  - LL_ADC_CHANNEL_3
  - LL_ADC_CHANNEL_4
  - LL_ADC_CHANNEL_5
  - LL_ADC_CHANNEL_6
  - LL_ADC_CHANNEL_7
  - LL_ADC_CHANNEL_8
  - LL_ADC_CHANNEL_9
  - LL_ADC_CHANNEL_10
  - LL_ADC_CHANNEL_11
  - LL_ADC_CHANNEL_12
  - LL_ADC_CHANNEL_13
  - LL_ADC_CHANNEL_14
  - LL_ADC_CHANNEL_15
  - LL_ADC_CHANNEL_16
  - LL_ADC_CHANNEL_17
  - LL_ADC_CHANNEL_18
  - LL_ADC_CHANNEL_19
  - LL_ADC_CHANNEL_TEMPSENSOR
  - LL_ADC_CHANNEL_VREFINT
  - LL_ADC_CHANNEL_VBAT
  - LL_ADC_CHANNEL_DACCH1

Return values

- **Returned:** value can be one of the following values:
  - LL_ADC_SAMPLINGTIME_COMMON_1
  - LL_ADC_SAMPLINGTIME_COMMON_2

Notes

- On this device, sampling time is on channel scope: independently of channel mapped on ADC group regular or injected.
- Conversion time is the addition of sampling time and processing time. Refer to reference manual for ADC processing time of this STM32 series.

Reference Manual to LL API cross reference:

- SMPR SMPSEL0 LL_ADC_GetChannelSamplingTime
- SMPR SMPSEL1 LL_ADC_GetChannelSamplingTime
- SMPR SMPSEL2 LL_ADC_GetChannelSamplingTime
- SMPR SMPSEL3 LL_ADC_GetChannelSamplingTime
- SMPR SMPSEL4 LL_ADC_GetChannelSamplingTime
- SMPR SMPSEL5 LL_ADC_GetChannelSamplingTime
- SMPR SMPSEL6 LL_ADC_GetChannelSamplingTime
- SMPR SMPSEL7 LL_ADC_GetChannelSamplingTime
- SMPR SMPSEL8 LL_ADC_GetChannelSamplingTime
- SMPR SMPSEL9 LL_ADC_GetChannelSamplingTime
- SMPR SMPSEL10 LL_ADC_GetChannelSamplingTime
- SMPR SMPSEL11 LL_ADC_GetChannelSamplingTime
- SMPR SMPSEL12 LL_ADC_GetChannelSamplingTime
- SMPR SMPSEL13 LL_ADC_GetChannelSamplingTime
- SMPR SMPSEL14 LL_ADC_GetChannelSamplingTime
- SMPR SMPSEL15 LL_ADC_GetChannelSamplingTime
- SMPR SMPSEL16 LL_ADC_GetChannelSamplingTime
- SMPR SMPSEL17 LL_ADC_GetChannelSamplingTime
- SMPR SMPSEL18 LL_ADC_GetChannelSamplingTime

LL_ADC_SetAnalogWDMonitChannels

Function name

__STATIC_INLINE void LL_ADC_SetAnalogWDMonitChannels (ADC_TypeDef * ADCx, uint32_t AWDy, uint32_t AWDChannelGroup)

Function description

Set ADC analog watchdog monitored channels: a single channel, multiple channels or all channels, on ADC group regular.

Parameters

- **ADCx:** ADC instance
- **AWDy:** This parameter can be one of the following values:
  - LL_ADC_AWD1
  - LL_ADC_AWD2
  - LL_ADC_AWD3
- **AWDChannelGroup:** This parameter can be one of the following values:
  - LL_ADC_AWD_DISABLE
  - LL_ADC_AWD_ALL_CHANNELS_REG
  - LL_ADC_AWD_CHANNEL_0_REG
  - LL_ADC_AWD_CHANNEL_1_REG
  - LL_ADC_AWD_CHANNEL_2_REG
  - LL_ADC_AWD_CHANNEL_3_REG
  - LL_ADC_AWD_CHANNEL_4_REG
  - LL_ADC_AWD_CHANNEL_5_REG
  - LL_ADC_AWD_CHANNEL_6_REG
  - LL_ADC_AWD_CHANNEL_7_REG
  - LL_ADC_AWD_CHANNEL_8_REG
  - LL_ADC_AWD_CHANNEL_9_REG
  - LL_ADC_AWD_CHANNEL_10_REG
  - LL_ADC_AWD_CHANNEL_11_REG
  - LL_ADC_AWD_CHANNEL_12_REG
  - LL_ADC_AWD_CHANNEL_13_REG
  - LL_ADC_AWD_CHANNEL_14_REG
  - LL_ADC_AWD_CHANNEL_15_REG
  - LL_ADC_AWD_CHANNEL_16_REG
  - LL_ADC_AWD_CHANNEL_17_REG
  - LL_ADC_AWD_CHANNEL_18_REG
  - LL_ADC_AWD_CHANNEL_19_REG
  - LL_ADC_AWD_CH_TEMPSENSOR_REG
  - LL_ADC_AWD_CH_VREFINT_REG
  - LL_ADC_AWD_CH_VBAT_REG
  - LL_ADC_AWD_CH_DACCH1_REG

Return values

- **None:**

Notes

- Once monitored channels are selected, analog watchdog is enabled.
- In case of need to define a single channel to monitor with analog watchdog from sequencer channel definition, use helper macro __LL_ADC_ANALOGWD_CHANNEL_GROUP().
- On this STM32 series, there are 2 kinds of analog watchdog instance: AWD standard (instance AWD1): channels monitored: can monitor 1 channel or all channels.groups monitored: ADC group regular.resolution: resolution is not limited (corresponds to ADC resolution configured). AWD flexible (instances AWD2, AWD3): channels monitored: flexible on channels monitored, selection is channel wise, from from 1 to all channels. Specificity of this analog watchdog: Multiple channels can be selected. For example: (LL_ADC_AWD_CHANNEL4_REG_INJ | LL_ADC_AWD_CHANNEL5_REG_INJ | ...)groups monitored: not selection possible (monitoring on both groups regular and injected). Channels selected are monitored on groups regular and injected: LL_ADC_AWD_CHANNELxx_REG_INJ (do not use parameters LL_ADC_AWD_CHANNELxx_REG and LL_ADC_AWD_CHANNELxx_INJ)resolution: resolution is not limited (corresponds to ADC resolution configured).
- On this STM32 series, setting of this feature is conditioned to ADC state: ADC must be disabled.

Reference Manual to LL API cross reference:

- CFGR1 AWD1CH LL_ADC_SetAnalogWDMonitChannels
- CFGR1 AWD1SGL LL_ADC_SetAnalogWDMonitChannels
- CFGR1 AWD1EN LL_ADC_SetAnalogWDMonitChannels
- AWD2CR AWD2CH LL_ADC_SetAnalogWDMonitChannels
- AWD3CR AWD3CH LL_ADC_SetAnalogWDMonitChannels

LL_ADC_GetAnalogWDMonitChannels

Function name

__STATIC_INLINE uint32_t LL_ADC_GetAnalogWDMonitChannels (const ADC_TypeDef * ADCx, uint32_t AWDy)

Function description

Get ADC analog watchdog monitored channel.

Parameters

- **ADCx:** ADC instance
- **AWDy:** This parameter can be one of the following values:
  - LL_ADC_AWD1
  - LL_ADC_AWD2 (1)
  - LL_ADC_AWD3 (1)

  (1) On this AWD number, monitored channel can be retrieved if only 1 channel is programmed (or none or all channels). This function cannot retrieve monitored channel if multiple channels are programmed simultaneously by bitfield.

Return values

- **Returned:** value can be one of the following values:
  - LL_ADC_AWD_DISABLE
  - LL_ADC_AWD_ALL_CHANNELS_REG
  - LL_ADC_AWD_CHANNEL_0_REG
  - LL_ADC_AWD_CHANNEL_1_REG
  - LL_ADC_AWD_CHANNEL_2_REG
  - LL_ADC_AWD_CHANNEL_3_REG
  - LL_ADC_AWD_CHANNEL_4_REG
  - LL_ADC_AWD_CHANNEL_5_REG
  - LL_ADC_AWD_CHANNEL_6_REG
  - LL_ADC_AWD_CHANNEL_7_REG
  - LL_ADC_AWD_CHANNEL_8_REG
  - LL_ADC_AWD_CHANNEL_9_REG
  - LL_ADC_AWD_CHANNEL_10_REG
  - LL_ADC_AWD_CHANNEL_11_REG
  - LL_ADC_AWD_CHANNEL_12_REG
  - LL_ADC_AWD_CHANNEL_13_REG
  - LL_ADC_AWD_CHANNEL_14_REG
  - LL_ADC_AWD_CHANNEL_15_REG
  - LL_ADC_AWD_CHANNEL_16_REG
  - LL_ADC_AWD_CHANNEL_17_REG
  - LL_ADC_AWD_CHANNEL_18_REG
  - LL_ADC_AWD_CHANNEL_19_REG

Notes

- Usage of the returned channel number: To reinject this channel into another function LL_ADC_xxx: the returned channel number is only partly formatted on definition of literals LL_ADC_CHANNEL_x. Therefore, it has to be compared with parts of literals LL_ADC_CHANNEL_x or using helper macro __LL_ADC_CHANNEL_TO_DECIMAL_NB(). Then the selected literal LL_ADC_CHANNEL_x can be used as parameter for another function.To get the channel number in decimal format: process the returned value with the helper macro __LL_ADC_CHANNEL_TO_DECIMAL_NB(). Applicable only when the analog watchdog is set to monitor one channel.
- On this STM32 series, there are 2 kinds of analog watchdog instance: AWD standard (instance AWD1): channels monitored: can monitor 1 channel or all channels.groups monitored: ADC group regular.resolution: resolution is not limited (corresponds to ADC resolution configured). AWD flexible (instances AWD2, AWD3): channels monitored: flexible on channels monitored, selection is channel wise, from from 1 to all channels. Specificity of this analog watchdog: Multiple channels can be selected. For example: (LL_ADC_AWD_CHANNEL4_REG_INJ | LL_ADC_AWD_CHANNEL5_REG_INJ | ...)groups monitored: not selection possible (monitoring on both groups regular and injected). Channels selected are monitored on groups regular and injected: LL_ADC_AWD_CHANNELxx_REG_INJ (do not use parameters LL_ADC_AWD_CHANNELxx_REG and LL_ADC_AWD_CHANNELxx_INJ)resolution: resolution is not limited (corresponds to ADC resolution configured).
- On this STM32 series, setting of this feature is conditioned to ADC state: ADC must be disabled or enabled without conversion on going on group regular.

Reference Manual to LL API cross reference:

- CFGR1 AWD1CH LL_ADC_GetAnalogWDMonitChannels
- CFGR1 AWD1SGL LL_ADC_GetAnalogWDMonitChannels
- CFGR1 AWD1EN LL_ADC_GetAnalogWDMonitChannels
- AWD2CR AWD2CH LL_ADC_GetAnalogWDMonitChannels
- AWD3CR AWD3CH LL_ADC_GetAnalogWDMonitChannels

LL_ADC_ConfigAnalogWDThresholds

Function name

__STATIC_INLINE void LL_ADC_ConfigAnalogWDThresholds (ADC_TypeDef * ADCx, uint32_t AWDy, uint32_t AWDThresholdHighValue, uint32_t AWDThresholdLowValue)

Function description

Set ADC analog watchdog thresholds value of both thresholds high and low.

Parameters

- **ADCx:** ADC instance
- **AWDy:** This parameter can be one of the following values:
  - LL_ADC_AWD1
  - LL_ADC_AWD2
  - LL_ADC_AWD3
- **AWDThresholdHighValue:** Value between Min_Data=0x000 and Max_Data=0xFFF
- **AWDThresholdLowValue:** Value between Min_Data=0x000 and Max_Data=0xFFF

Return values

- **None:**

Notes

- If value of only one threshold high or low must be set, use function LL_ADC_SetAnalogWDThresholds().
- In case of ADC resolution different of 12 bits, analog watchdog thresholds data require a specific shift. Use helper macro __LL_ADC_ANALOGWD_SET_THRESHOLD_RESOLUTION().
- On this STM32 series, there are 2 kinds of analog watchdog instance: AWD standard (instance AWD1): channels monitored: can monitor 1 channel or all channels.groups monitored: ADC group regular.resolution: resolution is not limited (corresponds to ADC resolution configured). AWD flexible (instances AWD2, AWD3): channels monitored: flexible on channels monitored, selection is channel wise, from from 1 to all channels. Specificity of this analog watchdog: Multiple channels can be selected. For example: (LL_ADC_AWD_CHANNEL4_REG_INJ | LL_ADC_AWD_CHANNEL5_REG_INJ | ...)groups monitored: not selection possible (monitoring on both groups regular and injected). Channels selected are monitored on groups regular and injected: LL_ADC_AWD_CHANNELxx_REG_INJ (do not use parameters LL_ADC_AWD_CHANNELxx_REG and LL_ADC_AWD_CHANNELxx_INJ)resolution: resolution is not limited (corresponds to ADC resolution configured).
- If ADC oversampling is enabled, ADC analog watchdog thresholds are impacted: the comparison of analog watchdog thresholds is done on oversampling final computation (after ratio and shift application): ADC data register bitfield [15:4] (12 most significant bits). Examples: Oversampling ratio and shift selected to have ADC conversion data on 12 bits (ratio 16 and shift 4, or ratio 32 and shift 5, ...): ADC analog watchdog thresholds must be divided by 16.Oversampling ratio and shift selected to have ADC conversion data on 14 bits (ratio 16 and shift 2, or ratio 32 and shift 3, ...): ADC analog watchdog thresholds must be divided by 4.Oversampling ratio and shift selected to have ADC conversion data on 16 bits (ratio 16 and shift none, or ratio 32 and shift 1, ...): ADC analog watchdog thresholds match directly to ADC data register.
- On this STM32 series, setting of this feature is conditioned to ADC state: ADC must be disabled or enabled without conversion on going on group regular.

Reference Manual to LL API cross reference:

- AWD1TR HT1 LL_ADC_ConfigAnalogWDThresholds
- AWD2TR HT2 LL_ADC_ConfigAnalogWDThresholds
- AWD3TR HT3 LL_ADC_ConfigAnalogWDThresholds
- AWD1TR LT1 LL_ADC_ConfigAnalogWDThresholds
- AWD2TR LT2 LL_ADC_ConfigAnalogWDThresholds
- AWD3TR LT3 LL_ADC_ConfigAnalogWDThresholds

LL_ADC_SetAnalogWDThresholds

Function name

__STATIC_INLINE void LL_ADC_SetAnalogWDThresholds (ADC_TypeDef * ADCx, uint32_t AWDy, uint32_t AWDThresholdsHighLow, uint32_t AWDThresholdValue)

Function description

Set ADC analog watchdog threshold value of threshold high or low.

Parameters

- **ADCx:** ADC instance
- **AWDy:** This parameter can be one of the following values:
  - LL_ADC_AWD1
  - LL_ADC_AWD2
  - LL_ADC_AWD3
- **AWDThresholdsHighLow:** This parameter can be one of the following values:
  - LL_ADC_AWD_THRESHOLD_HIGH
  - LL_ADC_AWD_THRESHOLD_LOW
- **AWDThresholdValue:** Value between Min_Data=0x000 and Max_Data=0xFFF

Return values

- **None:**

Notes

- If values of both thresholds high or low must be set, use function LL_ADC_ConfigAnalogWDThresholds().
- In case of ADC resolution different of 12 bits, analog watchdog thresholds data require a specific shift. Use helper macro __LL_ADC_ANALOGWD_SET_THRESHOLD_RESOLUTION().
- On this STM32 series, there are 2 kinds of analog watchdog instance: AWD standard (instance AWD1): channels monitored: can monitor 1 channel or all channels.groups monitored: ADC group regular.resolution: resolution is not limited (corresponds to ADC resolution configured). AWD flexible (instances AWD2, AWD3): channels monitored: flexible on channels monitored, selection is channel wise, from from 1 to all channels. Specificity of this analog watchdog: Multiple channels can be selected. For example: (LL_ADC_AWD_CHANNEL4_REG_INJ | LL_ADC_AWD_CHANNEL5_REG_INJ | ...)groups monitored: not selection possible (monitoring on both groups regular and injected). Channels selected are monitored on groups regular and injected: LL_ADC_AWD_CHANNELxx_REG_INJ (do not use parameters LL_ADC_AWD_CHANNELxx_REG and LL_ADC_AWD_CHANNELxx_INJ)resolution: resolution is not limited (corresponds to ADC resolution configured).
- If ADC oversampling is enabled, ADC analog watchdog thresholds are impacted: the comparison of analog watchdog thresholds is done on oversampling final computation (after ratio and shift application): ADC data register bitfield [15:4] (12 most significant bits). Examples: Oversampling ratio and shift selected to have ADC conversion data on 12 bits (ratio 16 and shift 4, or ratio 32 and shift 5, ...): ADC analog watchdog thresholds must be divided by 16.Oversampling ratio and shift selected to have ADC conversion data on 14 bits (ratio 16 and shift 2, or ratio 32 and shift 3, ...): ADC analog watchdog thresholds must be divided by 4.Oversampling ratio and shift selected to have ADC conversion data on 16 bits (ratio 16 and shift none, or ratio 32 and shift 1, ...): ADC analog watchdog thresholds match directly to ADC data register.
- On this STM32 series, setting of this feature is not conditioned to ADC state: ADC can be disabled, enabled with or without conversion on going on ADC group regular.

Reference Manual to LL API cross reference:

- AWD1TR HT1 LL_ADC_SetAnalogWDThresholds
- AWD2TR HT2 LL_ADC_SetAnalogWDThresholds
- AWD3TR HT3 LL_ADC_SetAnalogWDThresholds
- AWD1TR LT1 LL_ADC_SetAnalogWDThresholds
- AWD2TR LT2 LL_ADC_SetAnalogWDThresholds
- AWD3TR LT3 LL_ADC_SetAnalogWDThresholds

LL_ADC_GetAnalogWDThresholds

Function name

__STATIC_INLINE uint32_t LL_ADC_GetAnalogWDThresholds (const ADC_TypeDef * ADCx, uint32_t AWDy, uint32_t AWDThresholdsHighLow)

Function description

Get ADC analog watchdog threshold value of threshold high, threshold low or raw data with ADC thresholds high and low concatenated.

Parameters

- **ADCx:** ADC instance
- **AWDy:** This parameter can be one of the following values:
  - LL_ADC_AWD1
  - LL_ADC_AWD2
  - LL_ADC_AWD3
- **AWDThresholdsHighLow:** This parameter can be one of the following values:
  - LL_ADC_AWD_THRESHOLD_HIGH
  - LL_ADC_AWD_THRESHOLD_LOW
  - LL_ADC_AWD_THRESHOLDS_HIGH_LOW

Return values

- **Value:** between Min_Data=0x000 and Max_Data=0xFFF

Notes

- If raw data with ADC thresholds high and low is retrieved, the data of each threshold high or low can be isolated using helper macro: __LL_ADC_ANALOGWD_THRESHOLDS_HIGH_LOW().
- In case of ADC resolution different of 12 bits, analog watchdog thresholds data require a specific shift. Use helper macro __LL_ADC_ANALOGWD_GET_THRESHOLD_RESOLUTION().

Reference Manual to LL API cross reference:

- AWD1TR HT1 LL_ADC_GetAnalogWDThresholds
- AWD2TR HT2 LL_ADC_GetAnalogWDThresholds
- AWD3TR HT3 LL_ADC_GetAnalogWDThresholds
- AWD1TR LT1 LL_ADC_GetAnalogWDThresholds
- AWD2TR LT2 LL_ADC_GetAnalogWDThresholds
- AWD3TR LT3 LL_ADC_GetAnalogWDThresholds

LL_ADC_SetOverSamplingScope

Function name

__STATIC_INLINE void LL_ADC_SetOverSamplingScope (ADC_TypeDef * ADCx, uint32_t OvsScope)

Function description

Set ADC oversampling scope.

Parameters

- **ADCx:** ADC instance
- **OvsScope:** This parameter can be one of the following values:
  - LL_ADC_OVS_DISABLE
  - LL_ADC_OVS_GRP_REGULAR_CONTINUED

Return values

- **None:**

Notes

- On this STM32 series, setting of this feature is conditioned to ADC state: ADC must be disabled.

Reference Manual to LL API cross reference:

- CFGR2 OVSE LL_ADC_SetOverSamplingScope

LL_ADC_GetOverSamplingScope

Function name

__STATIC_INLINE uint32_t LL_ADC_GetOverSamplingScope (const ADC_TypeDef * ADCx)

Function description

Get ADC oversampling scope.

Parameters

- **ADCx:** ADC instance

Return values

- **Returned:** value can be one of the following values:
  - LL_ADC_OVS_DISABLE
  - LL_ADC_OVS_GRP_REGULAR_CONTINUED

Reference Manual to LL API cross reference:

- CFGR2 OVSE LL_ADC_GetOverSamplingScope

LL_ADC_SetOverSamplingDiscont

Function name

__STATIC_INLINE void LL_ADC_SetOverSamplingDiscont (ADC_TypeDef * ADCx, uint32_t OverSamplingDiscont)

Function description

Set ADC oversampling discontinuous mode (triggered mode) on the selected ADC group.

Parameters

- **ADCx:** ADC instance
- **OverSamplingDiscont:** This parameter can be one of the following values:
  - LL_ADC_OVS_REG_CONT
  - LL_ADC_OVS_REG_DISCONT

Return values

- **None:**

Notes

- Number of oversampled conversions are done either in: continuous mode (all conversions of oversampling ratio are done from 1 trigger)discontinuous mode (each conversion of oversampling ratio needs a trigger)
- On this STM32 series, setting of this feature is conditioned to ADC state: ADC must be disabled.

Reference Manual to LL API cross reference:

- CFGR2 TOVS LL_ADC_SetOverSamplingDiscont

LL_ADC_GetOverSamplingDiscont

Function name

__STATIC_INLINE uint32_t LL_ADC_GetOverSamplingDiscont (const ADC_TypeDef * ADCx)

Function description

Get ADC oversampling discontinuous mode (triggered mode) on the selected ADC group.

Parameters

- **ADCx:** ADC instance

Return values

- **Returned:** value can be one of the following values:
  - LL_ADC_OVS_REG_CONT
  - LL_ADC_OVS_REG_DISCONT

Notes

- Number of oversampled conversions are done either in: continuous mode (all conversions of oversampling ratio are done from 1 trigger)discontinuous mode (each conversion of oversampling ratio needs a trigger)

Reference Manual to LL API cross reference:

- CFGR2 TOVS LL_ADC_GetOverSamplingDiscont

LL_ADC_ConfigOverSamplingRatioShift

Function name

__STATIC_INLINE void LL_ADC_ConfigOverSamplingRatioShift (ADC_TypeDef * ADCx, uint32_t Ratio, uint32_t Shift)

Function description

Set ADC oversampling.

Parameters

- **ADCx:** ADC instance
- **Ratio:** This parameter can be one of the following values:
  - LL_ADC_OVS_RATIO_2
  - LL_ADC_OVS_RATIO_4
  - LL_ADC_OVS_RATIO_8
  - LL_ADC_OVS_RATIO_16
  - LL_ADC_OVS_RATIO_32
  - LL_ADC_OVS_RATIO_64
  - LL_ADC_OVS_RATIO_128
  - LL_ADC_OVS_RATIO_256
- **Shift:** This parameter can be one of the following values:
  - LL_ADC_OVS_SHIFT_NONE
  - LL_ADC_OVS_SHIFT_RIGHT_1
  - LL_ADC_OVS_SHIFT_RIGHT_2
  - LL_ADC_OVS_SHIFT_RIGHT_3
  - LL_ADC_OVS_SHIFT_RIGHT_4
  - LL_ADC_OVS_SHIFT_RIGHT_5
  - LL_ADC_OVS_SHIFT_RIGHT_6
  - LL_ADC_OVS_SHIFT_RIGHT_7
  - LL_ADC_OVS_SHIFT_RIGHT_8

Return values

- **None:**

Notes

- This function set the 2 items of oversampling configuration: ratioshift
- On this STM32 series, setting of this feature is conditioned to ADC state: ADC must be disabled.

Reference Manual to LL API cross reference:

- CFGR2 OVSS LL_ADC_ConfigOverSamplingRatioShift
- CFGR2 OVSR LL_ADC_ConfigOverSamplingRatioShift

LL_ADC_GetOverSamplingRatio

Function name

__STATIC_INLINE uint32_t LL_ADC_GetOverSamplingRatio (const ADC_TypeDef * ADCx)

Function description

Get ADC oversampling ratio.

Parameters

- **ADCx:** ADC instance

Return values

- **Ratio:** This parameter can be one of the following values:
  - LL_ADC_OVS_RATIO_2
  - LL_ADC_OVS_RATIO_4
  - LL_ADC_OVS_RATIO_8
  - LL_ADC_OVS_RATIO_16
  - LL_ADC_OVS_RATIO_32
  - LL_ADC_OVS_RATIO_64
  - LL_ADC_OVS_RATIO_128
  - LL_ADC_OVS_RATIO_256

Reference Manual to LL API cross reference:

- CFGR2 OVSR LL_ADC_GetOverSamplingRatio

LL_ADC_GetOverSamplingShift

Function name

__STATIC_INLINE uint32_t LL_ADC_GetOverSamplingShift (const ADC_TypeDef * ADCx)

Function description

Get ADC oversampling shift.

Parameters

- **ADCx:** ADC instance

Return values

- **Shift:** This parameter can be one of the following values:
  - LL_ADC_OVS_SHIFT_NONE
  - LL_ADC_OVS_SHIFT_RIGHT_1
  - LL_ADC_OVS_SHIFT_RIGHT_2
  - LL_ADC_OVS_SHIFT_RIGHT_3
  - LL_ADC_OVS_SHIFT_RIGHT_4
  - LL_ADC_OVS_SHIFT_RIGHT_5
  - LL_ADC_OVS_SHIFT_RIGHT_6
  - LL_ADC_OVS_SHIFT_RIGHT_7
  - LL_ADC_OVS_SHIFT_RIGHT_8

Reference Manual to LL API cross reference:

- CFGR2 OVSS LL_ADC_GetOverSamplingShift

LL_ADC_EnableInternalRegulator

Function name

__STATIC_INLINE void LL_ADC_EnableInternalRegulator (ADC_TypeDef * ADCx)

Function description

Enable ADC instance internal voltage regulator.

Parameters

- **ADCx:** ADC instance

Return values

- **None:**

Notes

- On this STM32 series, there are three possibilities to enable the voltage regulator: by enabling it manually using function LL_ADC_EnableInternalRegulator().by launching a calibration using function LL_ADC_StartCalibration().by enabling the ADC using function LL_ADC_Enable().
- On this STM32 series, after ADC internal voltage regulator enable, a delay for ADC internal voltage regulator stabilization is required before performing a ADC calibration or ADC enable. Refer to device datasheet, parameter "tADCVREG_STUP". Refer to literal LL_ADC_DELAY_INTERNAL_REGUL_STAB_US.
- On this STM32 series, setting of this feature is conditioned to ADC state: ADC must be ADC disabled.

Reference Manual to LL API cross reference:

- CR ADVREGEN LL_ADC_EnableInternalRegulator

LL_ADC_DisableInternalRegulator

Function name

__STATIC_INLINE void LL_ADC_DisableInternalRegulator (ADC_TypeDef * ADCx)

Function description

Disable ADC internal voltage regulator.

Parameters

- **ADCx:** ADC instance

Return values

- **None:**

Notes

- On this STM32 series, setting of this feature is conditioned to ADC state: ADC must be ADC disabled.

Reference Manual to LL API cross reference:

- CR ADVREGEN LL_ADC_DisableInternalRegulator

LL_ADC_IsInternalRegulatorEnabled

Function name

__STATIC_INLINE uint32_t LL_ADC_IsInternalRegulatorEnabled (const ADC_TypeDef * ADCx)

Function description

Get the selected ADC instance internal voltage regulator state.

Parameters

- **ADCx:** ADC instance

Return values

- **0:** internal regulator is disabled, 1: internal regulator is enabled.

Reference Manual to LL API cross reference:

- CR ADVREGEN LL_ADC_IsInternalRegulatorEnabled

LL_ADC_Enable

Function name

__STATIC_INLINE void LL_ADC_Enable (ADC_TypeDef * ADCx)

Function description

Enable the selected ADC instance.

Parameters

- **ADCx:** ADC instance

Return values

- **None:**

Notes

- On this STM32 series, after ADC enable, a delay for ADC internal analog stabilization is required before performing a ADC conversion start. Refer to device datasheet, parameter tSTAB.
- On this STM32 series, flag LL_ADC_FLAG_ADRDY is raised when the ADC is enabled and when conversion clock is active. (not only core clock: this ADC has a dual clock domain)
- On this STM32 series, setting of this feature is conditioned to ADC state: ADC must be ADC disabled and ADC internal voltage regulator enabled.

Reference Manual to LL API cross reference:

- CR ADEN LL_ADC_Enable

LL_ADC_Disable

Function name

__STATIC_INLINE void LL_ADC_Disable (ADC_TypeDef * ADCx)

Function description

Disable the selected ADC instance.

Parameters

- **ADCx:** ADC instance

Return values

- **None:**

Notes

- On this STM32 series, setting of this feature is conditioned to ADC state: ADC must be not disabled. Must be enabled without conversion on going on group regular.

Reference Manual to LL API cross reference:

- CR ADDIS LL_ADC_Disable

LL_ADC_IsEnabled

Function name

__STATIC_INLINE uint32_t LL_ADC_IsEnabled (const ADC_TypeDef * ADCx)

Function description

Get the selected ADC instance enable state.

Parameters

- **ADCx:** ADC instance

Return values

- **0:** ADC is disabled, 1: ADC is enabled.

Notes

- On this STM32 series, flag LL_ADC_FLAG_ADRDY is raised when the ADC is enabled and when conversion clock is active. (not only core clock: this ADC has a dual clock domain)

Reference Manual to LL API cross reference:

- CR ADEN LL_ADC_IsEnabled

LL_ADC_IsDisableOngoing

Function name

__STATIC_INLINE uint32_t LL_ADC_IsDisableOngoing (const ADC_TypeDef * ADCx)

Function description

Get the selected ADC instance disable state.

Parameters

- **ADCx:** ADC instance

Return values

- **0:** no ADC disable command on going.

Reference Manual to LL API cross reference:

- CR ADDIS LL_ADC_IsDisableOngoing

LL_ADC_StartCalibration

Function name

__STATIC_INLINE void LL_ADC_StartCalibration (ADC_TypeDef * ADCx)

Function description

Start ADC calibration in the mode single-ended or differential (for devices with differential mode available).

Parameters

- **ADCx:** ADC instance

Return values

- **None:**

Notes

- On this STM32 series, a minimum number of ADC clock cycles are required between ADC end of calibration and ADC enable. Refer to literal LL_ADC_DELAY_CALIB_ENABLE_ADC_CYCLES.
- In case of usage of ADC with DMA transfer: On this STM32 series, ADC DMA transfer request should be disabled during calibration: Calibration factor is available in data register and also transferred by DMA. To not insert ADC calibration factor among ADC conversion data in array variable, DMA transfer must be disabled during calibration. (DMA transfer setting backup and disable before calibration, DMA transfer setting restore after calibration. Refer to functions LL_ADC_REG_GetDMATransfer(), LL_ADC_REG_SetDMATransfer()).
- In case of usage of feature auto power-off: This mode must be disabled during calibration Refer to function LL_ADC_SetLowPowerMode().
- On this STM32 series, setting of this feature is conditioned to ADC state: ADC must be ADC disabled.

Reference Manual to LL API cross reference:

- CR ADCAL LL_ADC_StartCalibration

LL_ADC_IsCalibrationOnGoing

Function name

__STATIC_INLINE uint32_t LL_ADC_IsCalibrationOnGoing (const ADC_TypeDef * ADCx)

Function description

Get ADC calibration state.

Parameters

- **ADCx:** ADC instance

Return values

- **0:** calibration complete, 1: calibration in progress.

Reference Manual to LL API cross reference:

- CR ADCAL LL_ADC_IsCalibrationOnGoing

LL_ADC_REG_StartConversion

Function name

__STATIC_INLINE void LL_ADC_REG_StartConversion (ADC_TypeDef * ADCx)

Function description

Start ADC group regular conversion.

Parameters

- **ADCx:** ADC instance

Return values

- **None:**

Notes

- On this STM32 series, this function is relevant for both internal trigger (SW start) and external trigger: If ADC trigger has been set to software start, ADC conversion starts immediately.If ADC trigger has been set to external trigger, ADC conversion will start at next trigger event (on the selected trigger edge) following the ADC start conversion command.
- On this STM32 series, setting of this feature is conditioned to ADC state: ADC must be enabled without conversion on going on group regular, without conversion stop command on going on group regular, without ADC disable command on going.

Reference Manual to LL API cross reference:

- CR ADSTART LL_ADC_REG_StartConversion

LL_ADC_REG_StopConversion

Function name

__STATIC_INLINE void LL_ADC_REG_StopConversion (ADC_TypeDef * ADCx)

Function description

Stop ADC group regular conversion.

Parameters

- **ADCx:** ADC instance

Return values

- **None:**

Notes

- On this STM32 series, setting of this feature is conditioned to ADC state: ADC must be enabled (potentially with conversion on going on group regular), without ADC disable command on going.

Reference Manual to LL API cross reference:

- CR ADSTP LL_ADC_REG_StopConversion

LL_ADC_REG_IsConversionOngoing

Function name

__STATIC_INLINE uint32_t LL_ADC_REG_IsConversionOngoing (const ADC_TypeDef * ADCx)

Function description

Get ADC group regular conversion state.

Parameters

- **ADCx:** ADC instance

Return values

- **0:** no conversion is on going on ADC group regular.

Reference Manual to LL API cross reference:

- CR ADSTART LL_ADC_REG_IsConversionOngoing

LL_ADC_REG_IsStopConversionOngoing

Function name

__STATIC_INLINE uint32_t LL_ADC_REG_IsStopConversionOngoing (const ADC_TypeDef * ADCx)

Function description

Get ADC group regular command of conversion stop state.

Parameters

- **ADCx:** ADC instance

Return values

- **0:** no command of conversion stop is on going on ADC group regular.

Reference Manual to LL API cross reference:

- CR ADSTP LL_ADC_REG_IsStopConversionOngoing

LL_ADC_REG_ReadConversionData32

Function name

__STATIC_INLINE uint32_t LL_ADC_REG_ReadConversionData32 (const ADC_TypeDef * ADCx)

Function description

Get ADC group regular conversion data, range fit for all ADC configurations: all ADC resolutions and all oversampling increased data width (for devices with feature oversampling).

Parameters

- **ADCx:** ADC instance

Return values

- **Value:** between Min_Data=0x00000000 and Max_Data=0xFFFFFFFF

Reference Manual to LL API cross reference:

- DR DATA LL_ADC_REG_ReadConversionData32

LL_ADC_REG_ReadConversionData12

Function name

__STATIC_INLINE uint16_t LL_ADC_REG_ReadConversionData12 (const ADC_TypeDef * ADCx)

Function description

Get ADC group regular conversion data, range fit for ADC resolution 12 bits.

Parameters

- **ADCx:** ADC instance

Return values

- **Value:** between Min_Data=0x000 and Max_Data=0xFFF

Notes

- For devices with feature oversampling: Oversampling can increase data width, function for extended range may be needed: LL_ADC_REG_ReadConversionData32.

Reference Manual to LL API cross reference:

- DR DATA LL_ADC_REG_ReadConversionData12

LL_ADC_REG_ReadConversionData10

Function name

__STATIC_INLINE uint16_t LL_ADC_REG_ReadConversionData10 (const ADC_TypeDef * ADCx)

Function description

Get ADC group regular conversion data, range fit for ADC resolution 10 bits.

Parameters

- **ADCx:** ADC instance

Return values

- **Value:** between Min_Data=0x000 and Max_Data=0x3FF

Notes

- For devices with feature oversampling: Oversampling can increase data width, function for extended range may be needed: LL_ADC_REG_ReadConversionData32.

Reference Manual to LL API cross reference:

- DR DATA LL_ADC_REG_ReadConversionData10

LL_ADC_REG_ReadConversionData8

Function name

__STATIC_INLINE uint8_t LL_ADC_REG_ReadConversionData8 (const ADC_TypeDef * ADCx)

Function description

Get ADC group regular conversion data, range fit for ADC resolution 8 bits.

Parameters

- **ADCx:** ADC instance

Return values

- **Value:** between Min_Data=0x00 and Max_Data=0xFF

Notes

- For devices with feature oversampling: Oversampling can increase data width, function for extended range may be needed: LL_ADC_REG_ReadConversionData32.

Reference Manual to LL API cross reference:

- DR DATA LL_ADC_REG_ReadConversionData8

LL_ADC_REG_ReadConversionData6

Function name

__STATIC_INLINE uint8_t LL_ADC_REG_ReadConversionData6 (const ADC_TypeDef * ADCx)

Function description

Get ADC group regular conversion data, range fit for ADC resolution 6 bits.

Parameters

- **ADCx:** ADC instance

Return values

- **Value:** between Min_Data=0x00 and Max_Data=0x3F

Notes

- For devices with feature oversampling: Oversampling can increase data width, function for extended range may be needed: LL_ADC_REG_ReadConversionData32.

Reference Manual to LL API cross reference:

- DR DATA LL_ADC_REG_ReadConversionData6

LL_ADC_IsActiveFlag_ADRDY

Function name

__STATIC_INLINE uint32_t LL_ADC_IsActiveFlag_ADRDY (const ADC_TypeDef * ADCx)

Function description

Get flag ADC ready.

Parameters

- **ADCx:** ADC instance

Return values

- **State:** of bit (1 or 0).

Notes

- On this STM32 series, flag LL_ADC_FLAG_ADRDY is raised when the ADC is enabled and when conversion clock is active. (not only core clock: this ADC has a dual clock domain)

Reference Manual to LL API cross reference:

- ISR ADRDY LL_ADC_IsActiveFlag_ADRDY

LL_ADC_IsActiveFlag_CCRDY

Function name

__STATIC_INLINE uint32_t LL_ADC_IsActiveFlag_CCRDY (const ADC_TypeDef * ADCx)

Function description

Get flag ADC channel configuration ready.

Parameters

- **ADCx:** ADC instance

Return values

- **State:** of bit (1 or 0).

Notes

- On this STM32 series, after modifying sequencer it is mandatory to wait for the assertion of CCRDY flag using LL_ADC_IsActiveFlag_CCRDY(). Otherwise, performing some actions (configuration update, ADC conversion start, ...) will be ignored. Functions requiring wait for CCRDY flag are: LL_ADC_REG_SetSequencerLength() LL_ADC_REG_SetSequencerRanks() LL_ADC_REG_SetSequencerChannels() LL_ADC_REG_SetSequencerChAdd() LL_ADC_REG_SetSequencerChRem() LL_ADC_REG_SetSequencerScanDirection() LL_ADC_REG_SetSequencerConfigurable()
- Duration of ADC channel configuration ready: CCRDY handshake requires 1APB + 2 ADC + 3 APB cycles after the channel configuration has been changed.

Reference Manual to LL API cross reference:

- ISR CCRDY LL_ADC_IsActiveFlag_CCRDY

LL_ADC_IsActiveFlag_EOC

Function name

__STATIC_INLINE uint32_t LL_ADC_IsActiveFlag_EOC (const ADC_TypeDef * ADCx)

Function description

Get flag ADC group regular end of unitary conversion.

Parameters

- **ADCx:** ADC instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR EOC LL_ADC_IsActiveFlag_EOC

LL_ADC_IsActiveFlag_EOS

Function name

__STATIC_INLINE uint32_t LL_ADC_IsActiveFlag_EOS (const ADC_TypeDef * ADCx)

Function description

Get flag ADC group regular end of sequence conversions.

Parameters

- **ADCx:** ADC instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR EOS LL_ADC_IsActiveFlag_EOS

LL_ADC_IsActiveFlag_OVR

Function name

__STATIC_INLINE uint32_t LL_ADC_IsActiveFlag_OVR (const ADC_TypeDef * ADCx)

Function description

Get flag ADC group regular overrun.

Parameters

- **ADCx:** ADC instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR OVR LL_ADC_IsActiveFlag_OVR

LL_ADC_IsActiveFlag_EOSMP

Function name

__STATIC_INLINE uint32_t LL_ADC_IsActiveFlag_EOSMP (const ADC_TypeDef * ADCx)

Function description

Get flag ADC group regular end of sampling phase.

Parameters

- **ADCx:** ADC instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR EOSMP LL_ADC_IsActiveFlag_EOSMP

LL_ADC_IsActiveFlag_AWD1

Function name

__STATIC_INLINE uint32_t LL_ADC_IsActiveFlag_AWD1 (const ADC_TypeDef * ADCx)

Function description

Get flag ADC analog watchdog 1 flag.

Parameters

- **ADCx:** ADC instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR AWD1 LL_ADC_IsActiveFlag_AWD1

LL_ADC_IsActiveFlag_AWD2

Function name

__STATIC_INLINE uint32_t LL_ADC_IsActiveFlag_AWD2 (const ADC_TypeDef * ADCx)

Function description

Get flag ADC analog watchdog 2.

Parameters

- **ADCx:** ADC instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR AWD2 LL_ADC_IsActiveFlag_AWD2

LL_ADC_IsActiveFlag_AWD3

Function name

__STATIC_INLINE uint32_t LL_ADC_IsActiveFlag_AWD3 (const ADC_TypeDef * ADCx)

Function description

Get flag ADC analog watchdog 3.

Parameters

- **ADCx:** ADC instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR AWD3 LL_ADC_IsActiveFlag_AWD3

LL_ADC_IsActiveFlag_EOCAL

Function name

__STATIC_INLINE uint32_t LL_ADC_IsActiveFlag_EOCAL (const ADC_TypeDef * ADCx)

Function description

Get flag ADC end of calibration.

Parameters

- **ADCx:** ADC instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR EOCAL LL_ADC_IsActiveFlag_EOCAL

LL_ADC_ClearFlag_ADRDY

Function name

__STATIC_INLINE void LL_ADC_ClearFlag_ADRDY (ADC_TypeDef * ADCx)

Function description

Clear flag ADC ready.

Parameters

- **ADCx:** ADC instance

Return values

- **None:**

Notes

- On this STM32 series, flag LL_ADC_FLAG_ADRDY is raised when the ADC is enabled and when conversion clock is active. (not only core clock: this ADC has a dual clock domain)

Reference Manual to LL API cross reference:

- ISR ADRDY LL_ADC_ClearFlag_ADRDY

LL_ADC_ClearFlag_CCRDY

Function name

__STATIC_INLINE void LL_ADC_ClearFlag_CCRDY (ADC_TypeDef * ADCx)

Function description

Clear flag ADC channel configuration ready.

Parameters

- **ADCx:** ADC instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR CCRDY LL_ADC_ClearFlag_CCRDY

LL_ADC_ClearFlag_EOC

Function name

__STATIC_INLINE void LL_ADC_ClearFlag_EOC (ADC_TypeDef * ADCx)

Function description

Clear flag ADC group regular end of unitary conversion.

Parameters

- **ADCx:** ADC instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ISR EOC LL_ADC_ClearFlag_EOC

LL_ADC_ClearFlag_EOS

Function name

__STATIC_INLINE void LL_ADC_ClearFlag_EOS (ADC_TypeDef * ADCx)

Function description

Clear flag ADC group regular end of sequence conversions.

Parameters

- **ADCx:** ADC instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ISR EOS LL_ADC_ClearFlag_EOS

LL_ADC_ClearFlag_OVR

Function name

__STATIC_INLINE void LL_ADC_ClearFlag_OVR (ADC_TypeDef * ADCx)

Function description

Clear flag ADC group regular overrun.

Parameters

- **ADCx:** ADC instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ISR OVR LL_ADC_ClearFlag_OVR

LL_ADC_ClearFlag_EOSMP

Function name

__STATIC_INLINE void LL_ADC_ClearFlag_EOSMP (ADC_TypeDef * ADCx)

Function description

Clear flag ADC group regular end of sampling phase.

Parameters

- **ADCx:** ADC instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ISR EOSMP LL_ADC_ClearFlag_EOSMP

LL_ADC_ClearFlag_AWD1

Function name

__STATIC_INLINE void LL_ADC_ClearFlag_AWD1 (ADC_TypeDef * ADCx)

Function description

Clear flag ADC analog watchdog 1.

Parameters

- **ADCx:** ADC instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ISR AWD1 LL_ADC_ClearFlag_AWD1

LL_ADC_ClearFlag_AWD2

Function name

__STATIC_INLINE void LL_ADC_ClearFlag_AWD2 (ADC_TypeDef * ADCx)

Function description

Clear flag ADC analog watchdog 2.

Parameters

- **ADCx:** ADC instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ISR AWD2 LL_ADC_ClearFlag_AWD2

LL_ADC_ClearFlag_AWD3

Function name

__STATIC_INLINE void LL_ADC_ClearFlag_AWD3 (ADC_TypeDef * ADCx)

Function description

Clear flag ADC analog watchdog 3.

Parameters

- **ADCx:** ADC instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ISR AWD3 LL_ADC_ClearFlag_AWD3

LL_ADC_ClearFlag_EOCAL

Function name

__STATIC_INLINE void LL_ADC_ClearFlag_EOCAL (ADC_TypeDef * ADCx)

Function description

Clear flag ADC end of calibration.

Parameters

- **ADCx:** ADC instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ISR EOCAL LL_ADC_ClearFlag_EOCAL

LL_ADC_EnableIT_ADRDY

Function name

__STATIC_INLINE void LL_ADC_EnableIT_ADRDY (ADC_TypeDef * ADCx)

Function description

Enable ADC ready.

Parameters

- **ADCx:** ADC instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IER ADRDYIE LL_ADC_EnableIT_ADRDY

LL_ADC_EnableIT_CCRDY

Function name

__STATIC_INLINE void LL_ADC_EnableIT_CCRDY (ADC_TypeDef * ADCx)

Function description

Enable interruption ADC channel configuration ready.

Parameters

- **ADCx:** ADC instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- IER CCRDYIE LL_ADC_EnableIT_CCRDY

LL_ADC_EnableIT_EOC

Function name

__STATIC_INLINE void LL_ADC_EnableIT_EOC (ADC_TypeDef * ADCx)

Function description

Enable interruption ADC group regular end of unitary conversion.

Parameters

- **ADCx:** ADC instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IER EOCIE LL_ADC_EnableIT_EOC

LL_ADC_EnableIT_EOS

Function name

__STATIC_INLINE void LL_ADC_EnableIT_EOS (ADC_TypeDef * ADCx)

Function description

Enable interruption ADC group regular end of sequence conversions.

Parameters

- **ADCx:** ADC instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IER EOSIE LL_ADC_EnableIT_EOS

LL_ADC_EnableIT_OVR

Function name

__STATIC_INLINE void LL_ADC_EnableIT_OVR (ADC_TypeDef * ADCx)

Function description

Enable ADC group regular interruption overrun.

Parameters

- **ADCx:** ADC instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IER OVRIE LL_ADC_EnableIT_OVR

LL_ADC_EnableIT_EOSMP

Function name

__STATIC_INLINE void LL_ADC_EnableIT_EOSMP (ADC_TypeDef * ADCx)

Function description

Enable interruption ADC group regular end of sampling.

Parameters

- **ADCx:** ADC instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IER EOSMPIE LL_ADC_EnableIT_EOSMP

LL_ADC_EnableIT_AWD1

Function name

__STATIC_INLINE void LL_ADC_EnableIT_AWD1 (ADC_TypeDef * ADCx)

Function description

Enable interruption ADC analog watchdog 1.

Parameters

- **ADCx:** ADC instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IER AWD1IE LL_ADC_EnableIT_AWD1

LL_ADC_EnableIT_AWD2

Function name

__STATIC_INLINE void LL_ADC_EnableIT_AWD2 (ADC_TypeDef * ADCx)

Function description

Enable interruption ADC analog watchdog 2.

Parameters

- **ADCx:** ADC instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IER AWD2IE LL_ADC_EnableIT_AWD2

LL_ADC_EnableIT_AWD3

Function name

__STATIC_INLINE void LL_ADC_EnableIT_AWD3 (ADC_TypeDef * ADCx)

Function description

Enable interruption ADC analog watchdog 3.

Parameters

- **ADCx:** ADC instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IER AWD3IE LL_ADC_EnableIT_AWD3

LL_ADC_EnableIT_EOCAL

Function name

__STATIC_INLINE void LL_ADC_EnableIT_EOCAL (ADC_TypeDef * ADCx)

Function description

Enable interruption ADC end of calibration.

Parameters

- **ADCx:** ADC instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IER EOCALIE LL_ADC_EnableIT_EOCAL

LL_ADC_DisableIT_ADRDY

Function name

__STATIC_INLINE void LL_ADC_DisableIT_ADRDY (ADC_TypeDef * ADCx)

Function description

Disable interruption ADC ready.

Parameters

- **ADCx:** ADC instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IER ADRDYIE LL_ADC_DisableIT_ADRDY

LL_ADC_DisableIT_CCRDY

Function name

__STATIC_INLINE void LL_ADC_DisableIT_CCRDY (ADC_TypeDef * ADCx)

Function description

Disable interruption ADC channel configuration ready.

Parameters

- **ADCx:** ADC instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- IER CCRDYIE LL_ADC_DisableIT_CCRDY

LL_ADC_DisableIT_EOC

Function name

__STATIC_INLINE void LL_ADC_DisableIT_EOC (ADC_TypeDef * ADCx)

Function description

Disable interruption ADC group regular end of unitary conversion.

Parameters

- **ADCx:** ADC instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IER EOCIE LL_ADC_DisableIT_EOC

LL_ADC_DisableIT_EOS

Function name

__STATIC_INLINE void LL_ADC_DisableIT_EOS (ADC_TypeDef * ADCx)

Function description

Disable interruption ADC group regular end of sequence conversions.

Parameters

- **ADCx:** ADC instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IER EOSIE LL_ADC_DisableIT_EOS

LL_ADC_DisableIT_OVR

Function name

__STATIC_INLINE void LL_ADC_DisableIT_OVR (ADC_TypeDef * ADCx)

Function description

Disable interruption ADC group regular overrun.

Parameters

- **ADCx:** ADC instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IER OVRIE LL_ADC_DisableIT_OVR

LL_ADC_DisableIT_EOSMP

Function name

__STATIC_INLINE void LL_ADC_DisableIT_EOSMP (ADC_TypeDef * ADCx)

Function description

Disable interruption ADC group regular end of sampling.

Parameters

- **ADCx:** ADC instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IER EOSMPIE LL_ADC_DisableIT_EOSMP

LL_ADC_DisableIT_AWD1

Function name

__STATIC_INLINE void LL_ADC_DisableIT_AWD1 (ADC_TypeDef * ADCx)

Function description

Disable interruption ADC analog watchdog 1.

Parameters

- **ADCx:** ADC instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IER AWD1IE LL_ADC_DisableIT_AWD1

LL_ADC_DisableIT_AWD2

Function name

__STATIC_INLINE void LL_ADC_DisableIT_AWD2 (ADC_TypeDef * ADCx)

Function description

Disable interruption ADC analog watchdog 2.

Parameters

- **ADCx:** ADC instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IER AWD2IE LL_ADC_DisableIT_AWD2

LL_ADC_DisableIT_AWD3

Function name

__STATIC_INLINE void LL_ADC_DisableIT_AWD3 (ADC_TypeDef * ADCx)

Function description

Disable interruption ADC analog watchdog 3.

Parameters

- **ADCx:** ADC instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IER AWD3IE LL_ADC_DisableIT_AWD3

LL_ADC_DisableIT_EOCAL

Function name

__STATIC_INLINE void LL_ADC_DisableIT_EOCAL (ADC_TypeDef * ADCx)

Function description

Disable interruption ADC end of calibration.

Parameters

- **ADCx:** ADC instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IER EOCALIE LL_ADC_DisableIT_EOCAL

LL_ADC_IsEnabledIT_ADRDY

Function name

__STATIC_INLINE uint32_t LL_ADC_IsEnabledIT_ADRDY (const ADC_TypeDef * ADCx)

Function description

Get state of interruption ADC ready (0: interrupt disabled, 1: interrupt enabled).

Parameters

- **ADCx:** ADC instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- IER ADRDYIE LL_ADC_IsEnabledIT_ADRDY

LL_ADC_IsEnabledIT_CCRDY

Function name

__STATIC_INLINE uint32_t LL_ADC_IsEnabledIT_CCRDY (const ADC_TypeDef * ADCx)

Function description

Get state of interruption ADC channel configuration ready.

Parameters

- **ADCx:** ADC instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- IER CCRDYIE LL_ADC_IsEnabledIT_CCRDY

LL_ADC_IsEnabledIT_EOC

Function name

__STATIC_INLINE uint32_t LL_ADC_IsEnabledIT_EOC (const ADC_TypeDef * ADCx)

Function description

Get state of interruption ADC group regular end of unitary conversion (0: interrupt disabled, 1: interrupt enabled).

Parameters

- **ADCx:** ADC instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- IER EOCIE LL_ADC_IsEnabledIT_EOC

LL_ADC_IsEnabledIT_EOS

Function name

__STATIC_INLINE uint32_t LL_ADC_IsEnabledIT_EOS (const ADC_TypeDef * ADCx)

Function description

Get state of interruption ADC group regular end of sequence conversions (0: interrupt disabled, 1: interrupt enabled).

Parameters

- **ADCx:** ADC instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- IER EOSIE LL_ADC_IsEnabledIT_EOS

LL_ADC_IsEnabledIT_OVR

Function name

__STATIC_INLINE uint32_t LL_ADC_IsEnabledIT_OVR (const ADC_TypeDef * ADCx)

Function description

Get state of interruption ADC group regular overrun (0: interrupt disabled, 1: interrupt enabled).

Parameters

- **ADCx:** ADC instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- IER OVRIE LL_ADC_IsEnabledIT_OVR

LL_ADC_IsEnabledIT_EOSMP

Function name

__STATIC_INLINE uint32_t LL_ADC_IsEnabledIT_EOSMP (const ADC_TypeDef * ADCx)

Function description

Get state of interruption ADC group regular end of sampling (0: interrupt disabled, 1: interrupt enabled).

Parameters

- **ADCx:** ADC instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- IER EOSMPIE LL_ADC_IsEnabledIT_EOSMP

LL_ADC_IsEnabledIT_AWD1

Function name

__STATIC_INLINE uint32_t LL_ADC_IsEnabledIT_AWD1 (const ADC_TypeDef * ADCx)

Function description

Get state of interruption ADC analog watchdog 1 (0: interrupt disabled, 1: interrupt enabled).

Parameters

- **ADCx:** ADC instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- IER AWD1IE LL_ADC_IsEnabledIT_AWD1

LL_ADC_IsEnabledIT_AWD2

Function name

__STATIC_INLINE uint32_t LL_ADC_IsEnabledIT_AWD2 (const ADC_TypeDef * ADCx)

Function description

Get state of interruption Get ADC analog watchdog 2 (0: interrupt disabled, 1: interrupt enabled).

Parameters

- **ADCx:** ADC instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- IER AWD2IE LL_ADC_IsEnabledIT_AWD2

LL_ADC_IsEnabledIT_AWD3

Function name

__STATIC_INLINE uint32_t LL_ADC_IsEnabledIT_AWD3 (const ADC_TypeDef * ADCx)

Function description

Get state of interruption Get ADC analog watchdog 3 (0: interrupt disabled, 1: interrupt enabled).

Parameters

- **ADCx:** ADC instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- IER AWD3IE LL_ADC_IsEnabledIT_AWD3

LL_ADC_IsEnabledIT_EOCAL

Function name

__STATIC_INLINE uint32_t LL_ADC_IsEnabledIT_EOCAL (const ADC_TypeDef * ADCx)

Function description

Get state of interruption ADC end of calibration (0: interrupt disabled, 1: interrupt enabled).

Parameters

- **ADCx:** ADC instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- IER EOCALIE LL_ADC_IsEnabledIT_EOCAL

LL_ADC_CommonDeInit

Function name

ErrorStatus LL_ADC_CommonDeInit (ADC_Common_TypeDef * ADCxy_COMMON)

Function description

De-initialize registers of all ADC instances belonging to the same ADC common instance to their default reset values.

Parameters

- **ADCxy_COMMON:** ADC common instance (can be set directly from CMSIS definition or by using helper macro __LL_ADC_COMMON_INSTANCE())

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: ADC common registers are de-initialized
  - ERROR: not applicable

Notes

- This function is performing a hard reset, using high level clock source RCC ADC reset.

LL_ADC_CommonInit

Function name

ErrorStatus LL_ADC_CommonInit (ADC_Common_TypeDef * ADCxy_COMMON, const LL_ADC_CommonInitTypeDef * pADC_CommonInitStruct)

Function description

Initialize some features of ADC common parameters (all ADC instances belonging to the same ADC common instance) and multimode (for devices with several ADC instances available).

Parameters

- **ADCxy_COMMON:** ADC common instance (can be set directly from CMSIS definition or by using helper macro __LL_ADC_COMMON_INSTANCE())
- **pADC_CommonInitStruct:** Pointer to a LL_ADC_CommonInitTypeDef structure

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: ADC common registers are initialized
  - ERROR: ADC common registers are not initialized

Notes

- The setting of ADC common parameters is conditioned to ADC instances state: All ADC instances belonging to the same ADC common instance must be disabled.

LL_ADC_CommonStructInit

Function name

void LL_ADC_CommonStructInit (LL_ADC_CommonInitTypeDef * pADC_CommonInitStruct)

Function description

Set each LL_ADC_CommonInitTypeDef field to default value.

Parameters

- **pADC_CommonInitStruct:** Pointer to a LL_ADC_CommonInitTypeDef structure whose fields will be set to default values.

Return values

- **None:**

LL_ADC_DeInit

Function name

ErrorStatus LL_ADC_DeInit (ADC_TypeDef * ADCx)

Function description

De-initialize registers of the selected ADC instance to their default reset values.

Parameters

- **ADCx:** ADC instance

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: ADC registers are de-initialized
  - ERROR: ADC registers are not de-initialized

Notes

- To reset all ADC instances quickly (perform a hard reset), use function LL_ADC_CommonDeInit().
- If this functions returns error status, it means that ADC instance is in an unknown state. In this case, perform a hard reset using high level clock source RCC ADC reset. Refer to function LL_ADC_CommonDeInit().

LL_ADC_Init

Function name

ErrorStatus LL_ADC_Init (ADC_TypeDef * ADCx, const LL_ADC_InitTypeDef * pADC_InitStruct)

Function description

Initialize some features of ADC instance.

Parameters

- **ADCx:** ADC instance
- **pADC_InitStruct:** Pointer to a LL_ADC_REG_InitTypeDef structure

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: ADC registers are initialized
  - ERROR: ADC registers are not initialized

Notes

- These parameters have an impact on ADC scope: ADC instance. Refer to corresponding unitary functions into Configuration of ADC hierarchical scope: ADC instance .
- The setting of these parameters by function LL_ADC_Init() is conditioned to ADC state: ADC instance must be disabled. This condition is applied to all ADC features, for efficiency and compatibility over all STM32 series. However, the different features can be set under different ADC state conditions (setting possible with ADC enabled without conversion on going, ADC enabled with conversion on going, ...) Each feature can be updated afterwards with a unitary function and potentially with ADC in a different state than disabled, refer to description of each function for setting conditioned to ADC state.
- After using this function, some other features must be configured using LL unitary functions. The minimum configuration remaining to be done is: Set ADC group regular sequencer: Depending on the sequencer mode (refer to function LL_ADC_REG_SetSequencerConfigurable()): map channel on the selected sequencer rank. Refer to function LL_ADC_REG_SetSequencerRanks();map channel on rank corresponding to channel number. Refer to function LL_ADC_REG_SetSequencerChannels(); Set ADC channel sampling time Refer to function LL_ADC_SetSamplingTimeCommonChannels(); Refer to function LL_ADC_SetChannelSamplingTime();

LL_ADC_StructInit

Function name

void LL_ADC_StructInit (LL_ADC_InitTypeDef * pADC_InitStruct)

Function description

Set each LL_ADC_InitTypeDef field to default value.

Parameters

- **pADC_InitStruct:** Pointer to a LL_ADC_InitTypeDef structure whose fields will be set to default values.

Return values

- **None:**

LL_ADC_REG_Init

Function name

ErrorStatus LL_ADC_REG_Init (ADC_TypeDef * ADCx, const LL_ADC_REG_InitTypeDef * pADC_RegInitStruct)

Function description

Initialize some features of ADC group regular.

Parameters

- **ADCx:** ADC instance
- **pADC_RegInitStruct:** Pointer to a LL_ADC_REG_InitTypeDef structure

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: ADC registers are initialized
  - ERROR: ADC registers are not initialized

Notes

- These parameters have an impact on ADC scope: ADC group regular. Refer to corresponding unitary functions into Configuration of ADC hierarchical scope: group regular (functions with prefix "REG").
- The setting of these parameters by function LL_ADC_Init() is conditioned to ADC state: ADC instance must be disabled. This condition is applied to all ADC features, for efficiency and compatibility over all STM32 series. However, the different features can be set under different ADC state conditions (setting possible with ADC enabled without conversion on going, ADC enabled with conversion on going, ...) Each feature can be updated afterwards with a unitary function and potentially with ADC in a different state than disabled, refer to description of each function for setting conditioned to ADC state.
- Before using this function, ADC group regular sequencer must be configured: refer to function LL_ADC_REG_SetSequencerConfigurable().
- After using this function, other features must be configured using LL unitary functions. The minimum configuration remaining to be done is: Set ADC group regular sequencer: Depending on the sequencer mode (refer to function LL_ADC_REG_SetSequencerConfigurable()): map channel on the selected sequencer rank. Refer to function LL_ADC_REG_SetSequencerRanks();map channel on rank corresponding to channel number. Refer to function LL_ADC_REG_SetSequencerChannels(); Set ADC channel sampling time Refer to function LL_ADC_SetSamplingTimeCommonChannels(); Refer to function LL_ADC_SetChannelSamplingTime();

LL_ADC_REG_StructInit

Function name

void LL_ADC_REG_StructInit (LL_ADC_REG_InitTypeDef * pADC_RegInitStruct)

Function description

Set each LL_ADC_REG_InitTypeDef field to default value.

Parameters

- **pADC_RegInitStruct:** Pointer to a LL_ADC_REG_InitTypeDef structure whose fields will be set to default values.

Return values

- **None:**

55.3 ADC Firmware driver defines

The following section lists the various define and macros of the module.

55.3.1 ADC

ADC

Analog watchdog - Monitored channels

LL_ADC_AWD_DISABLE

ADC analog watchdog monitoring disabled

LL_ADC_AWD_ALL_CHANNELS_REG

ADC analog watchdog monitoring of all channels, converted by group regular only

LL_ADC_AWD_CHANNEL_0_REG

ADC analog watchdog monitoring of ADC channel ADCx_IN0, converted by group regular only

LL_ADC_AWD_CHANNEL_1_REG

ADC analog watchdog monitoring of ADC channel ADCx_IN1, converted by group regular only

LL_ADC_AWD_CHANNEL_2_REG

ADC analog watchdog monitoring of ADC channel ADCx_IN2, converted by group regular only

LL_ADC_AWD_CHANNEL_3_REG

ADC analog watchdog monitoring of ADC channel ADCx_IN3, converted by group regular only

LL_ADC_AWD_CHANNEL_4_REG

ADC analog watchdog monitoring of ADC channel ADCx_IN4, converted by group regular only

LL_ADC_AWD_CHANNEL_5_REG

ADC analog watchdog monitoring of ADC channel ADCx_IN5, converted by group regular only

LL_ADC_AWD_CHANNEL_6_REG

ADC analog watchdog monitoring of ADC channel ADCx_IN6, converted by group regular only

LL_ADC_AWD_CHANNEL_7_REG

ADC analog watchdog monitoring of ADC channel ADCx_IN7, converted by group regular only

LL_ADC_AWD_CHANNEL_8_REG

ADC analog watchdog monitoring of ADC channel ADCx_IN8, converted by group regular only

LL_ADC_AWD_CHANNEL_9_REG

ADC analog watchdog monitoring of ADC channel ADCx_IN9, converted by group regular only

LL_ADC_AWD_CHANNEL_10_REG

ADC analog watchdog monitoring of ADC channel ADCx_IN10, converted by group regular only

LL_ADC_AWD_CHANNEL_11_REG

ADC analog watchdog monitoring of ADC channel ADCx_IN11, converted by group regular only

LL_ADC_AWD_CHANNEL_12_REG

ADC analog watchdog monitoring of ADC channel ADCx_IN12, converted by group regular only

LL_ADC_AWD_CHANNEL_13_REG

ADC analog watchdog monitoring of ADC channel ADCx_IN13, converted by group regular only

LL_ADC_AWD_CHANNEL_14_REG

ADC analog watchdog monitoring of ADC channel ADCx_IN14, converted by group regular only

LL_ADC_AWD_CHANNEL_15_REG

ADC analog watchdog monitoring of ADC channel ADCx_IN15, converted by group regular only

LL_ADC_AWD_CHANNEL_16_REG

ADC analog watchdog monitoring of ADC channel ADCx_IN16, converted by group regular only

LL_ADC_AWD_CHANNEL_17_REG

ADC analog watchdog monitoring of ADC channel ADCx_IN17, converted by group regular only

LL_ADC_AWD_CHANNEL_18_REG

ADC analog watchdog monitoring of ADC channel ADCx_IN18, converted by group regular only

LL_ADC_AWD_CHANNEL_19_REG

ADC analog watchdog monitoring of ADC channel ADCx_IN19, converted by group regular only

LL_ADC_AWD_CH_VREFINT_REG

ADC analog watchdog monitoring of ADC internal channel connected to VrefInt: Internal voltage reference, converted by group regular only

LL_ADC_AWD_CH_TEMPSENSOR_REG

ADC analog watchdog monitoring of ADC internal channel connected to internal temperature sensor, converted by group regular only

LL_ADC_AWD_CH_VBAT_REG

ADC analog watchdog monitoring of ADC internal channel connected to Vbat/3: Vbat voltage through a divider ladder of factor 1/3 to have channel voltage always below Vdda, converted by group regular only

LL_ADC_AWD_CH_DACCH1_REG

ADC analog watchdog monitoring of ADC internal channel connected to DAC channel 1, converted by group regular only

Analog watchdog - Analog watchdog number

LL_ADC_AWD1

ADC analog watchdog number 1

LL_ADC_AWD2

ADC analog watchdog number 2

LL_ADC_AWD3

ADC analog watchdog number 3

Analog watchdog - Thresholds

LL_ADC_AWD_THRESHOLD_HIGH

ADC analog watchdog threshold high

LL_ADC_AWD_THRESHOLD_LOW

ADC analog watchdog threshold low

LL_ADC_AWD_THRESHOLDS_HIGH_LOW

ADC analog watchdog both thresholds high and low concatenated into the same data

ADC instance - Channel number

LL_ADC_CHANNEL_0

ADC channel ADCx_IN0

LL_ADC_CHANNEL_1

ADC channel ADCx_IN1

LL_ADC_CHANNEL_2

ADC channel ADCx_IN2

LL_ADC_CHANNEL_3

ADC channel ADCx_IN3

LL_ADC_CHANNEL_4

ADC channel ADCx_IN4

LL_ADC_CHANNEL_5

ADC channel ADCx_IN5

LL_ADC_CHANNEL_6

ADC channel ADCx_IN6

LL_ADC_CHANNEL_7

ADC channel ADCx_IN7

LL_ADC_CHANNEL_8

ADC channel ADCx_IN8

LL_ADC_CHANNEL_9

ADC channel ADCx_IN9

LL_ADC_CHANNEL_10

ADC channel ADCx_IN10

LL_ADC_CHANNEL_11

ADC channel ADCx_IN11

LL_ADC_CHANNEL_12

ADC channel ADCx_IN12

LL_ADC_CHANNEL_13

ADC channel ADCx_IN13

LL_ADC_CHANNEL_14

ADC channel ADCx_IN14

LL_ADC_CHANNEL_15

ADC channel ADCx_IN15

LL_ADC_CHANNEL_16

ADC channel ADCx_IN16

LL_ADC_CHANNEL_17

ADC channel ADCx_IN17

LL_ADC_CHANNEL_18

ADC channel ADCx_IN18

LL_ADC_CHANNEL_19

ADC channel ADCx_IN19

LL_ADC_CHANNEL_TEMPSENSOR

ADC internal channel connected to internal temperature sensor.

LL_ADC_CHANNEL_VREFINT

ADC internal channel connected to VrefInt: Internal voltage reference.

LL_ADC_CHANNEL_VBAT

ADC internal channel connected to Vbat/3: Vbat voltage through a divider ladder of factor 1/3 to have channel voltage always below Vdda.

LL_ADC_CHANNEL_DACCH1

ADC internal channel connected to DAC channel 1.

Channel - Sampling time

LL_ADC_SAMPLINGTIME_1CYCLE_5

Sampling time 1.5 ADC clock cycle

LL_ADC_SAMPLINGTIME_3CYCLES_5

Sampling time 3.5 ADC clock cycles

LL_ADC_SAMPLINGTIME_7CYCLES_5

Sampling time 7.5 ADC clock cycles

LL_ADC_SAMPLINGTIME_12CYCLES_5

Sampling time 12.5 ADC clock cycles

LL_ADC_SAMPLINGTIME_19CYCLES_5

Sampling time 19.5 ADC clock cycles

LL_ADC_SAMPLINGTIME_39CYCLES_5

Sampling time 39.5 ADC clock cycles

LL_ADC_SAMPLINGTIME_79CYCLES_5

Sampling time 79.5 ADC clock cycles

LL_ADC_SAMPLINGTIME_160CYCLES_5

Sampling time 160.5 ADC clock cycles

ADC instance - Clock source

LL_ADC_CLOCK_SYNC_PCLK_DIV4

ADC synchronous clock derived from AHB clock divided by 4

LL_ADC_CLOCK_SYNC_PCLK_DIV2

ADC synchronous clock derived from AHB clock divided by 2

LL_ADC_CLOCK_SYNC_PCLK_DIV1

ADC synchronous clock derived from AHB clock not divided

LL_ADC_CLOCK_ASYNC

ADC asynchronous clock. Asynchronous clock prescaler can be configured using function

ADC common - Clock source

LL_ADC_CLOCK_ASYNC_DIV1

ADC asynchronous clock without prescaler

LL_ADC_CLOCK_ASYNC_DIV2

ADC asynchronous clock with prescaler division by 2. Setting common to ADC instances of ADC common group, applied ADC instance wise to each instance clock set to clock source asynchronous (refer to function

LL_ADC_CLOCK_ASYNC_DIV4

ADC asynchronous clock with prescaler division by 4. Setting common to ADC instances of ADC common group, applied ADC instance wise to each instance clock set to clock source asynchronous (refer to function

LL_ADC_CLOCK_ASYNC_DIV6

ADC asynchronous clock with prescaler division by 6. Setting common to ADC instances of ADC common group, applied ADC instance wise to each instance clock set to clock source asynchronous (refer to function

LL_ADC_CLOCK_ASYNC_DIV8

ADC asynchronous clock with prescaler division by 8. Setting common to ADC instances of ADC common group, applied ADC instance wise to each instance clock set to clock source asynchronous (refer to function

LL_ADC_CLOCK_ASYNC_DIV10

ADC asynchronous clock with prescaler division by 10. Setting common to ADC instances of ADC common group, applied ADC instance wise to each instance clock set to clock source asynchronous (refer to function

LL_ADC_CLOCK_ASYNC_DIV12

ADC asynchronous clock with prescaler division by 12. Setting common to ADC instances of ADC common group, applied ADC instance wise to each instance clock set to clock source asynchronous (refer to function

LL_ADC_CLOCK_ASYNC_DIV16

ADC asynchronous clock with prescaler division by 16. Setting common to ADC instances of ADC common group, applied ADC instance wise to each instance clock set to clock source asynchronous (refer to function

LL_ADC_CLOCK_ASYNC_DIV32

ADC asynchronous clock with prescaler division by 32. Setting common to ADC instances of ADC common group, applied ADC instance wise to each instance clock set to clock source asynchronous (refer to function

LL_ADC_CLOCK_ASYNC_DIV64

ADC asynchronous clock with prescaler division by 64. Setting common to ADC instances of ADC common group, applied ADC instance wise to each instance clock set to clock source asynchronous (refer to function

LL_ADC_CLOCK_ASYNC_DIV128

ADC asynchronous clock with prescaler division by 128. Setting common to ADC instances of ADC common group, applied ADC instance wise to each instance clock set to clock source asynchronous (refer to function

LL_ADC_CLOCK_ASYNC_DIV256

ADC asynchronous clock with prescaler division by 256. Setting common to ADC instances of ADC common group, applied ADC instance wise to each instance clock set to clock source asynchronous (refer to function

ADC common - Measurement path to internal channels

LL_ADC_PATH_INTERNAL_NONE

ADC measurement paths all disabled

LL_ADC_PATH_INTERNAL_VREFINT

ADC measurement path to internal channel VrefInt

LL_ADC_PATH_INTERNAL_TEMPSENSOR

ADC measurement path to internal channel temperature sensor

LL_ADC_PATH_INTERNAL_VBAT

ADC measurement path to internal channel Vbat

ADC instance - Data alignment

LL_ADC_DATA_ALIGN_RIGHT

ADC conversion data alignment: right aligned (alignment on data register LSB bit 0)

LL_ADC_DATA_ALIGN_LEFT

ADC conversion data alignment: left aligned (alignment on data register MSB bit 15)

ADC flags

LL_ADC_FLAG_ADRDY

ADC flag ADC instance ready

LL_ADC_FLAG_CCRDY

ADC flag ADC channel configuration ready

LL_ADC_FLAG_EOC

ADC flag ADC group regular end of unitary conversion

LL_ADC_FLAG_EOS

ADC flag ADC group regular end of sequence conversions

LL_ADC_FLAG_OVR

ADC flag ADC group regular overrun

LL_ADC_FLAG_EOSMP

ADC flag ADC group regular end of sampling phase

LL_ADC_FLAG_AWD1

ADC flag ADC analog watchdog 1

LL_ADC_FLAG_AWD2

ADC flag ADC analog watchdog 2

LL_ADC_FLAG_AWD3

ADC flag ADC analog watchdog 3

LL_ADC_FLAG_EOCAL

ADC flag end of calibration

ADC instance - Groups

LL_ADC_GROUP_REGULAR

ADC group regular (available on all STM32 devices)

Definitions of constants used by helper macro

LL_ADC_TEMPERATURE_CALC_ERROR

Definitions of ADC hardware constraints delays

LL_ADC_DELAY_INTERNAL_REGUL_STAB_US

Delay for ADC stabilization time (ADC voltage regulator start-up time)

LL_ADC_DELAY_VREFINT_STAB_US

Delay for internal voltage reference stabilization time

LL_ADC_DELAY_TEMPSENSOR_STAB_US

Delay for temperature sensor stabilization time (starting from temperature sensor enable, refer to

LL_ADC_DELAY_TEMPSENSOR_BUFFER_STAB_US

Delay for temperature sensor buffer stabilization time (starting from ADC enable, refer to

LL_ADC_DELAY_CALIB_ENABLE_ADC_CYCLES

Delay required between ADC end of calibration and ADC enable

ADC interruptions for configuration (interruption enable or disable)

LL_ADC_IT_ADRDY

ADC interruption ADC instance ready

LL_ADC_IT_CCRDY

ADC interruption channel configuration ready

LL_ADC_IT_EOC

ADC interruption ADC group regular end of unitary conversion

LL_ADC_IT_EOS

ADC interruption ADC group regular end of sequence conversions

LL_ADC_IT_OVR

ADC interruption ADC group regular overrun

LL_ADC_IT_EOSMP

ADC interruption ADC group regular end of sampling phase

LL_ADC_IT_AWD1

ADC interruption ADC analog watchdog 1

LL_ADC_IT_AWD2

ADC interruption ADC analog watchdog 2

LL_ADC_IT_AWD3

ADC interruption ADC analog watchdog 3

LL_ADC_IT_EOCAL

ADC interruption ADC end of calibration

ADC instance - Low power mode

LL_ADC_LP_MODE_NONE

No ADC low power mode activated

LL_ADC_LP_AUTOWAIT

ADC low power mode auto delay: Dynamic low power mode, ADC conversions are performed only when necessary (when previous ADC conversion data is read). See description with function

LL_ADC_LP_AUTOPOWEROFF

ADC low power mode auto power-off: the ADC automatically powers-off after a ADC conversion and automatically wakes up when a new ADC conversion is triggered (with startup time between trigger and start of sampling). See description with function

LL_ADC_LP_AUTOWAIT_AUTOPOWEROFF

ADC low power modes auto wait and auto power-off combined. See description with function

Oversampling - Discontinuous mode

LL_ADC_OVS_REG_CONT

ADC oversampling discontinuous mode: continuous mode (all conversions of oversampling ratio are done from 1 trigger)

LL_ADC_OVS_REG_DISCONT

ADC oversampling discontinuous mode: discontinuous mode (each conversion of oversampling ratio needs a trigger)

Oversampling - Ratio

LL_ADC_OVS_RATIO_2

ADC oversampling ratio of 2 (sum of conversions data computed to result as oversampling conversion data (before potential shift)

LL_ADC_OVS_RATIO_4

ADC oversampling ratio of 4 (sum of conversions data computed to result as oversampling conversion data (before potential shift)

LL_ADC_OVS_RATIO_8

ADC oversampling ratio of 8 (sum of conversions data computed to result as oversampling conversion data (before potential shift)

LL_ADC_OVS_RATIO_16

ADC oversampling ratio of 16 (sum of conversions data computed to result as oversampling conversion data (before potential shift)

LL_ADC_OVS_RATIO_32

ADC oversampling ratio of 32 (sum of conversions data computed to result as oversampling conversion data (before potential shift)

LL_ADC_OVS_RATIO_64

ADC oversampling ratio of 64 (sum of conversions data computed to result as oversampling conversion data (before potential shift)

LL_ADC_OVS_RATIO_128

ADC oversampling ratio of 128 (sum of conversions data computed to result as oversampling conversion data (before potential shift)

LL_ADC_OVS_RATIO_256

ADC oversampling ratio of 256 (sum of conversions data computed to result as oversampling conversion data (before potential shift)

Oversampling - Oversampling scope

LL_ADC_OVS_DISABLE

ADC oversampling disabled.

LL_ADC_OVS_GRP_REGULAR_CONTINUED

ADC oversampling on conversions of ADC group regular. Literal suffix "continued" is kept for compatibility with other STM32 devices featuring ADC group injected, in this case other oversampling scope parameters are available.

Oversampling - Data right shift

LL_ADC_OVS_SHIFT_NONE

ADC oversampling no shift (sum of the ADC conversions data is not divided to result as oversampling conversion data)

LL_ADC_OVS_SHIFT_RIGHT_1

ADC oversampling right shift of 1 (sum of the ADC conversions data (after OVS ratio) is divided by 2 to result as oversampling conversion data)

LL_ADC_OVS_SHIFT_RIGHT_2

ADC oversampling right shift of 2 (sum of the ADC conversions data (after OVS ratio) is divided by 4 to result as oversampling conversion data)

LL_ADC_OVS_SHIFT_RIGHT_3

ADC oversampling right shift of 3 (sum of the ADC conversions data (after OVS ratio) is divided by 8 to result as oversampling conversion data)

LL_ADC_OVS_SHIFT_RIGHT_4

ADC oversampling right shift of 4 (sum of the ADC conversions data (after OVS ratio) is divided by 16 to result as oversampling conversion data)

LL_ADC_OVS_SHIFT_RIGHT_5

ADC oversampling right shift of 5 (sum of the ADC conversions data (after OVS ratio) is divided by 32 to result as oversampling conversion data)

LL_ADC_OVS_SHIFT_RIGHT_6

ADC oversampling right shift of 6 (sum of the ADC conversions data (after OVS ratio) is divided by 64 to result as oversampling conversion data)

LL_ADC_OVS_SHIFT_RIGHT_7

ADC oversampling right shift of 7 (sum of the ADC conversions data (after OVS ratio) is divided by 128 to result as oversampling conversion data)

LL_ADC_OVS_SHIFT_RIGHT_8

ADC oversampling right shift of 8 (sum of the ADC conversions data (after OVS ratio) is divided by 256 to result as oversampling conversion data)

ADC registers compliant with specific purpose

LL_ADC_DMA_REG_REGULAR_DATA

ADC group regular - Continuous mode

LL_ADC_REG_CONV_SINGLE

ADC conversions performed in single mode: one conversion per trigger

LL_ADC_REG_CONV_CONTINUOUS

ADC conversions performed in continuous mode: after the first trigger, following conversions launched successively automatically

ADC group regular - DMA transfer of ADC conversion data

LL_ADC_REG_DMA_TRANSFER_NONE

ADC conversions are not transferred by DMA

LL_ADC_REG_DMA_TRANSFER_LIMITED

ADC conversion data are transferred by DMA, in limited mode (one shot mode): DMA transfer requests are stopped when number of DMA data transfers (number of ADC conversions) is reached. This ADC mode is intended to be used with DMA mode non-circular.

LL_ADC_REG_DMA_TRANSFER_UNLIMITED

ADC conversion data are transferred by DMA, in unlimited mode: DMA transfer requests are unlimited, whatever number of DMA data transferred (number of ADC conversions). This ADC mode is intended to be used with DMA mode circular.

ADC group regular - Overrun behavior on conversion data

LL_ADC_REG_OVR_DATA_PRESERVED

ADC group regular behavior in case of overrun: data preserved

LL_ADC_REG_OVR_DATA_OVERWRITTEN

ADC group regular behavior in case of overrun: data overwritten

ADC group regular - Sequencer discontinuous mode

LL_ADC_REG_SEQ_DISCONT_DISABLE

ADC group regular sequencer discontinuous mode disable

LL_ADC_REG_SEQ_DISCONT_1RANK

ADC group regular sequencer discontinuous mode enable with sequence interruption every rank

ADC group regular - Sequencer configuration flexibility

LL_ADC_REG_SEQ_FIXED

Sequencer configured to not fully configurable: sequencer length and each rank affectation to a channel are fixed by channel HW number. Refer to description of function

LL_ADC_REG_SEQ_CONFIGURABLE

Sequencer configured to fully configurable: sequencer length and each rank affectation to a channel are configurable. Refer to description of function

ADC group regular - Sequencer ranks

LL_ADC_REG_RANK_1

ADC group regular seq. rank 1

LL_ADC_REG_RANK_2

ADC group regular seq. rank 2

LL_ADC_REG_RANK_3

ADC group regular seq. rank 3

LL_ADC_REG_RANK_4

ADC group regular seq. rank 4

LL_ADC_REG_RANK_5

ADC group regular seq. rank 5

LL_ADC_REG_RANK_6

ADC group regular seq. rank 6

LL_ADC_REG_RANK_7

ADC group regular seq. rank 7

LL_ADC_REG_RANK_8

ADC group regular seq. rank 8

ADC group regular - Sequencer scan direction

LL_ADC_REG_SEQ_SCAN_DIR_FORWARD

On this STM32 series, parameter relevant only if sequencer set to mode not fully configurable, refer to function

LL_ADC_REG_SEQ_SCAN_DIR_BACKWARD

On this STM32 series, parameter relevant only if sequencer set to mode not fully configurable, refer to function

ADC group regular - Sequencer scan length

LL_ADC_REG_SEQ_SCAN_DISABLE

ADC group regular sequencer disable (equivalent to sequencer of 1 rank: ADC conversion on only 1 channel)

LL_ADC_REG_SEQ_SCAN_ENABLE_2RANKS

ADC group regular sequencer enable with 2 ranks in the sequence

LL_ADC_REG_SEQ_SCAN_ENABLE_3RANKS

ADC group regular sequencer enable with 3 ranks in the sequence

LL_ADC_REG_SEQ_SCAN_ENABLE_4RANKS

ADC group regular sequencer enable with 4 ranks in the sequence

LL_ADC_REG_SEQ_SCAN_ENABLE_5RANKS

ADC group regular sequencer enable with 5 ranks in the sequence

LL_ADC_REG_SEQ_SCAN_ENABLE_6RANKS

ADC group regular sequencer enable with 6 ranks in the sequence

LL_ADC_REG_SEQ_SCAN_ENABLE_7RANKS

ADC group regular sequencer enable with 7 ranks in the sequence

LL_ADC_REG_SEQ_SCAN_ENABLE_8RANKS

ADC group regular sequencer enable with 8 ranks in the sequence

ADC group regular - Trigger edge

LL_ADC_REG_TRIG_EXT_RISING

ADC group regular conversion trigger polarity set to rising edge

LL_ADC_REG_TRIG_EXT_FALLING

ADC group regular conversion trigger polarity set to falling edge

LL_ADC_REG_TRIG_EXT_RISINGFALLING

ADC group regular conversion trigger polarity set to both rising and falling edges

ADC group regular - Trigger frequency mode

LL_ADC_TRIGGER_FREQ_HIGH

ADC trigger frequency mode set to high frequency. Note: ADC trigger frequency mode must be set to low frequency when a duration is exceeded before ADC conversion start trigger event (between ADC enable and ADC conversion start trigger event or between two ADC conversion start trigger event). Duration value: Refer to device datasheet, parameter "tIdle".

LL_ADC_TRIGGER_FREQ_LOW

ADC trigger frequency mode set to low frequency. Note: ADC trigger frequency mode must be set to low frequency when a duration is exceeded before ADC conversion start trigger event (between ADC enable and ADC conversion start trigger event or between two ADC conversion start trigger event). Duration value: Refer to device datasheet, parameter "tIdle".

ADC group regular - Trigger source

LL_ADC_REG_TRIG_SOFTWARE

ADC group regular conversion trigger internal: SW start.

LL_ADC_REG_TRIG_EXT_TIM1_TRGO2

ADC group regular conversion trigger from external peripheral: TIM1 TRGO. Trigger edge set to rising edge (default setting).

LL_ADC_REG_TRIG_EXT_TIM1_CH4

ADC group regular conversion trigger from external peripheral: TIM1 channel 4 event (capture compare: input capture or output capture). Trigger edge set to rising edge (default setting).

LL_ADC_REG_TRIG_EXT_TIM2_TRGO

ADC group regular conversion trigger from external peripheral: TIM2 TRGO. Trigger edge set to rising edge (default setting).

LL_ADC_REG_TRIG_EXT_TIM3_TRGO

ADC group regular conversion trigger from external peripheral: TIM3 TRGO. Trigger edge set to rising edge (default setting).

LL_ADC_REG_TRIG_EXT_TIM15_TRGO

ADC group regular conversion trigger from external peripheral: TIM15 TRGO. Trigger edge set to rising edge (default setting).

LL_ADC_REG_TRIG_EXT_TIM6_TRGO

ADC group regular conversion trigger from external peripheral: TIM6 TRGO. Trigger edge set to rising edge (default setting).

LL_ADC_REG_TRIG_EXT_EXTI_LINE11

ADC group regular conversion trigger from external peripheral: external interrupt line 11. Trigger edge set to rising edge (default setting).

ADC instance - Resolution

LL_ADC_RESOLUTION_12B

ADC resolution 12 bits

LL_ADC_RESOLUTION_10B

ADC resolution 10 bits

LL_ADC_RESOLUTION_8B

ADC resolution 8 bits

LL_ADC_RESOLUTION_6B

ADC resolution 6 bits

ADC instance - Sampling time common to a group of channels

LL_ADC_SAMPLINGTIME_COMMON_1

Set sampling time common to a group of channels: sampling time nb 1

LL_ADC_SAMPLINGTIME_COMMON_2

Set sampling time common to a group of channels: sampling time nb 2

ADC helper macro

__LL_ADC_CHANNEL_TO_DECIMAL_NB

Description:

- Helper macro to get ADC channel number in decimal format from literals LL_ADC_CHANNEL_x.

Parameters:

- __CHANNEL__: This parameter can be one of the following values:
  - LL_ADC_CHANNEL_0
  - LL_ADC_CHANNEL_1
  - LL_ADC_CHANNEL_2
  - LL_ADC_CHANNEL_3
  - LL_ADC_CHANNEL_4
  - LL_ADC_CHANNEL_5
  - LL_ADC_CHANNEL_6
  - LL_ADC_CHANNEL_7
  - LL_ADC_CHANNEL_8
  - LL_ADC_CHANNEL_9
  - LL_ADC_CHANNEL_10
  - LL_ADC_CHANNEL_11
  - LL_ADC_CHANNEL_12
  - LL_ADC_CHANNEL_13
  - LL_ADC_CHANNEL_14
  - LL_ADC_CHANNEL_15
  - LL_ADC_CHANNEL_16
  - LL_ADC_CHANNEL_17
  - LL_ADC_CHANNEL_18
  - LL_ADC_CHANNEL_19
  - LL_ADC_CHANNEL_TEMPSENSOR
  - LL_ADC_CHANNEL_VREFINT
  - LL_ADC_CHANNEL_VBAT
  - LL_ADC_CHANNEL_DACCH1

Return value:

- Value: between Min_Data=0 and Max_Data=18

Notes:

- Example: __LL_ADC_CHANNEL_TO_DECIMAL_NB(LL_ADC_CHANNEL_4) will return decimal number "4". The input can be a value from functions where a channel number is returned, either defined with number or with bitfield (only one bit must be set).

__LL_ADC_DECIMAL_NB_TO_CHANNEL

Description:

- Helper macro to get ADC channel in literal format LL_ADC_CHANNEL_x from number in decimal format.

Parameters:

- __DECIMAL_NB__: Value between Min_Data=0 and Max_Data=18

Return value:

- Returned: value can be one of the following values:
  - LL_ADC_CHANNEL_0
  - LL_ADC_CHANNEL_1
  - LL_ADC_CHANNEL_2
  - LL_ADC_CHANNEL_3
  - LL_ADC_CHANNEL_4
  - LL_ADC_CHANNEL_5
  - LL_ADC_CHANNEL_6
  - LL_ADC_CHANNEL_7
  - LL_ADC_CHANNEL_8
  - LL_ADC_CHANNEL_9
  - LL_ADC_CHANNEL_10
  - LL_ADC_CHANNEL_11
  - LL_ADC_CHANNEL_12
  - LL_ADC_CHANNEL_13
  - LL_ADC_CHANNEL_14
  - LL_ADC_CHANNEL_15
  - LL_ADC_CHANNEL_16
  - LL_ADC_CHANNEL_17
  - LL_ADC_CHANNEL_18
  - LL_ADC_CHANNEL_19
  - LL_ADC_CHANNEL_TEMPSENSOR
  - LL_ADC_CHANNEL_VREFINT
  - LL_ADC_CHANNEL_VBAT
  - LL_ADC_CHANNEL_DACCH1

Notes:

- Example: __LL_ADC_DECIMAL_NB_TO_CHANNEL(4) will return a data equivalent to "LL_ADC_CHANNEL_4".

__LL_ADC_IS_CHANNEL_INTERNAL

Description:

- Helper macro to determine whether the selected channel corresponds to literal definitions of driver.

Parameters:

- __CHANNEL__: This parameter can be one of the following values:
  - LL_ADC_CHANNEL_0
  - LL_ADC_CHANNEL_1
  - LL_ADC_CHANNEL_2
  - LL_ADC_CHANNEL_3
  - LL_ADC_CHANNEL_4
  - LL_ADC_CHANNEL_5
  - LL_ADC_CHANNEL_6
  - LL_ADC_CHANNEL_7
  - LL_ADC_CHANNEL_8
  - LL_ADC_CHANNEL_9
  - LL_ADC_CHANNEL_10
  - LL_ADC_CHANNEL_11
  - LL_ADC_CHANNEL_12
  - LL_ADC_CHANNEL_13
  - LL_ADC_CHANNEL_14
  - LL_ADC_CHANNEL_15
  - LL_ADC_CHANNEL_16
  - LL_ADC_CHANNEL_17
  - LL_ADC_CHANNEL_18
  - LL_ADC_CHANNEL_19
  - LL_ADC_CHANNEL_TEMPSENSOR
  - LL_ADC_CHANNEL_VREFINT
  - LL_ADC_CHANNEL_VBAT
  - LL_ADC_CHANNEL_DACCH1

Return value:

- Value: "0" if the channel corresponds to a parameter definition of a ADC external channel (channel connected to a GPIO pin). Value "1" if the channel corresponds to a parameter definition of a ADC internal channel.

Notes:

- The different literal definitions of ADC channels are: ADC internal channel: LL_ADC_CHANNEL_VREFINT, LL_ADC_CHANNEL_TEMPSENSOR, ...ADC external channel (channel connected to a GPIO pin): LL_ADC_CHANNEL_1, LL_ADC_CHANNEL_2, ... The channel parameter must be a value defined from literal definition of a ADC internal channel (LL_ADC_CHANNEL_VREFINT, LL_ADC_CHANNEL_TEMPSENSOR, ...), ADC external channel (LL_ADC_CHANNEL_1, LL_ADC_CHANNEL_2, ...), must not be a value from functions where a channel number is returned from ADC registers, because internal and external channels share the same channel number in ADC registers. The differentiation is made only with parameters definitions of driver.

__LL_ADC_CHANNEL_INTERNAL_TO_EXTERNAL

Description:

- Helper macro to convert a channel defined from parameter definition of a ADC internal channel (LL_ADC_CHANNEL_VREFINT, LL_ADC_CHANNEL_TEMPSENSOR, ...), to its equivalent parameter definition of a ADC external channel (LL_ADC_CHANNEL_1, LL_ADC_CHANNEL_2, ...).

Parameters:

- __CHANNEL__: This parameter can be one of the following values:
  - LL_ADC_CHANNEL_0
  - LL_ADC_CHANNEL_1
  - LL_ADC_CHANNEL_2
  - LL_ADC_CHANNEL_3
  - LL_ADC_CHANNEL_4
  - LL_ADC_CHANNEL_5
  - LL_ADC_CHANNEL_6
  - LL_ADC_CHANNEL_7
  - LL_ADC_CHANNEL_8
  - LL_ADC_CHANNEL_9
  - LL_ADC_CHANNEL_10
  - LL_ADC_CHANNEL_11
  - LL_ADC_CHANNEL_12
  - LL_ADC_CHANNEL_13
  - LL_ADC_CHANNEL_14
  - LL_ADC_CHANNEL_15
  - LL_ADC_CHANNEL_16
  - LL_ADC_CHANNEL_17
  - LL_ADC_CHANNEL_18
  - LL_ADC_CHANNEL_19
  - LL_ADC_CHANNEL_TEMPSENSOR
  - LL_ADC_CHANNEL_VREFINT
  - LL_ADC_CHANNEL_VBAT
  - LL_ADC_CHANNEL_DACCH1

Return value:

- Returned: value can be one of the following values:
  - LL_ADC_CHANNEL_0
  - LL_ADC_CHANNEL_1
  - LL_ADC_CHANNEL_2
  - LL_ADC_CHANNEL_3
  - LL_ADC_CHANNEL_4
  - LL_ADC_CHANNEL_5
  - LL_ADC_CHANNEL_6
  - LL_ADC_CHANNEL_7
  - LL_ADC_CHANNEL_8
  - LL_ADC_CHANNEL_9
  - LL_ADC_CHANNEL_10
  - LL_ADC_CHANNEL_11
  - LL_ADC_CHANNEL_12
  - LL_ADC_CHANNEL_13
  - LL_ADC_CHANNEL_14
  - LL_ADC_CHANNEL_15
  - LL_ADC_CHANNEL_16
  - LL_ADC_CHANNEL_17
  - LL_ADC_CHANNEL_18
  - LL_ADC_CHANNEL_19

Notes:

- The channel parameter can be, additionally to a value defined from parameter definition of a ADC internal channel (LL_ADC_CHANNEL_VREFINT, LL_ADC_CHANNEL_TEMPSENSOR, ...), a value defined from parameter definition of ADC external channel (LL_ADC_CHANNEL_1, LL_ADC_CHANNEL_2, ...) or a value from functions where a channel number is returned from ADC registers.

__LL_ADC_IS_CHANNEL_INTERNAL_AVAILABLE

Description:

- Helper macro to determine whether the internal channel selected is available on the ADC instance selected.

Parameters:

- __ADC_INSTANCE__: ADC instance
- __CHANNEL__: This parameter can be one of the following values:
  - LL_ADC_CHANNEL_TEMPSENSOR
  - LL_ADC_CHANNEL_VREFINT
  - LL_ADC_CHANNEL_VBAT
  - LL_ADC_CHANNEL_DACCH1

Return value:

- Value: "0" if the internal channel selected is not available on the ADC instance selected. Value "1" if the internal channel selected is available on the ADC instance selected.

Notes:

- The channel parameter must be a value defined from parameter definition of a ADC internal channel (LL_ADC_CHANNEL_VREFINT, LL_ADC_CHANNEL_TEMPSENSOR, ...), must not be a value defined from parameter definition of ADC external channel (LL_ADC_CHANNEL_1, LL_ADC_CHANNEL_2, ...) or a value from functions where a channel number is returned from ADC registers, because internal and external channels share the same channel number in ADC registers. The differentiation is made only with parameters definitions of driver.

__LL_ADC_ANALOGWD_CHANNEL_GROUP

Description:

- Helper macro to define ADC analog watchdog parameter: define a single channel to monitor with analog watchdog from sequencer channel and groups definition.

Parameters:

- __CHANNEL__: This parameter can be one of the following values:
  - LL_ADC_CHANNEL_0
  - LL_ADC_CHANNEL_1
  - LL_ADC_CHANNEL_2
  - LL_ADC_CHANNEL_3
  - LL_ADC_CHANNEL_4
  - LL_ADC_CHANNEL_5
  - LL_ADC_CHANNEL_6
  - LL_ADC_CHANNEL_7
  - LL_ADC_CHANNEL_8
  - LL_ADC_CHANNEL_9
  - LL_ADC_CHANNEL_10
  - LL_ADC_CHANNEL_11
  - LL_ADC_CHANNEL_12
  - LL_ADC_CHANNEL_13
  - LL_ADC_CHANNEL_14
  - LL_ADC_CHANNEL_15
  - LL_ADC_CHANNEL_16
  - LL_ADC_CHANNEL_17
  - LL_ADC_CHANNEL_18
  - LL_ADC_CHANNEL_19
  - LL_ADC_CHANNEL_TEMPSENSOR
  - LL_ADC_CHANNEL_VREFINT
  - LL_ADC_CHANNEL_VBAT
  - LL_ADC_CHANNEL_DACCH1
- __GROUP__: This parameter can be one of the following values:
  - LL_ADC_GROUP_REGULAR

Return value:

- Returned: value can be one of the following values:
  - LL_ADC_AWD_DISABLE
  - LL_ADC_AWD_ALL_CHANNELS_REG
  - LL_ADC_AWD_CHANNEL_0_REG
  - LL_ADC_AWD_CHANNEL_1_REG
  - LL_ADC_AWD_CHANNEL_2_REG
  - LL_ADC_AWD_CHANNEL_3_REG
  - LL_ADC_AWD_CHANNEL_4_REG
  - LL_ADC_AWD_CHANNEL_5_REG
  - LL_ADC_AWD_CHANNEL_6_REG
  - LL_ADC_AWD_CHANNEL_7_REG
  - LL_ADC_AWD_CHANNEL_8_REG
  - LL_ADC_AWD_CHANNEL_9_REG
  - LL_ADC_AWD_CHANNEL_10_REG
  - LL_ADC_AWD_CHANNEL_11_REG
  - LL_ADC_AWD_CHANNEL_12_REG
  - LL_ADC_AWD_CHANNEL_13_REG
  - LL_ADC_AWD_CHANNEL_14_REG
  - LL_ADC_AWD_CHANNEL_15_REG
  - LL_ADC_AWD_CHANNEL_16_REG
  - LL_ADC_AWD_CHANNEL_17_REG
  - LL_ADC_AWD_CHANNEL_18_REG
  - LL_ADC_AWD_CHANNEL_19_REG
  - LL_ADC_AWD_CH_TEMPSENSOR_REG
  - LL_ADC_AWD_CH_VREFINT_REG
  - LL_ADC_AWD_CH_VBAT_REG
  - LL_ADC_AWD_CH_DACCH1_REG

Notes:

- To be used with function LL_ADC_SetAnalogWDMonitChannels(). Example:
  LL_ADC_SetAnalogWDMonitChannels(ADC1, LL_ADC_AWD1,
  __LL_ADC_ANALOGWD_CHANNEL_GROUP(LL_ADC_CHANNEL4, LL_ADC_GROUP_REGULAR))

__LL_ADC_ANALOGWD_SET_THRESHOLD_RESOLUTION

Description:

- Helper macro to set the value of ADC analog watchdog threshold high or low in function of ADC resolution, when ADC resolution is different of 12 bits.

Parameters:

- __ADC_RESOLUTION__: This parameter can be one of the following values:
  - LL_ADC_RESOLUTION_12B
  - LL_ADC_RESOLUTION_10B
  - LL_ADC_RESOLUTION_8B
  - LL_ADC_RESOLUTION_6B
- __AWD_THRESHOLD__: Value between Min_Data=0x000 and Max_Data=0xFFF

Return value:

- Value: between Min_Data=0x000 and Max_Data=0xFFF

Notes:

- To be used with function LL_ADC_ConfigAnalogWDThresholds() or LL_ADC_SetAnalogWDThresholds(). Example, with a ADC resolution of 8 bits, to set the value of analog watchdog threshold high (on 8 bits): LL_ADC_SetAnalogWDThresholds (< ADCx param >, __LL_ADC_ANALOGWD_SET_THRESHOLD_RESOLUTION(LL_ADC_RESOLUTION_8B, <threshold_value_8_bits>));

__LL_ADC_ANALOGWD_GET_THRESHOLD_RESOLUTION

Description:

- Helper macro to get the value of ADC analog watchdog threshold high or low in function of ADC resolution, when ADC resolution is different of 12 bits.

Parameters:

- __ADC_RESOLUTION__: This parameter can be one of the following values:
  - LL_ADC_RESOLUTION_12B
  - LL_ADC_RESOLUTION_10B
  - LL_ADC_RESOLUTION_8B
  - LL_ADC_RESOLUTION_6B
- __AWD_THRESHOLD_12_BITS__: Value between Min_Data=0x000 and Max_Data=0xFFF

Return value:

- Value: between Min_Data=0x000 and Max_Data=0xFFF

Notes:

- To be used with function LL_ADC_GetAnalogWDThresholds(). Example, with a ADC resolution of 8 bits, to get the value of analog watchdog threshold high (on 8 bits): < threshold_value_6_bits > = __LL_ADC_ANALOGWD_GET_THRESHOLD_RESOLUTION (LL_ADC_RESOLUTION_8B, LL_ADC_GetAnalogWDThresholds(<ADCx param>, LL_ADC_AWD_THRESHOLD_HIGH));

__LL_ADC_ANALOGWD_THRESHOLDS_HIGH_LOW

Description:

- Helper macro to get the ADC analog watchdog threshold high or low from raw value containing both thresholds concatenated.

Parameters:

- __AWD_THRESHOLD_TYPE__: This parameter can be one of the following values:
  - LL_ADC_AWD_THRESHOLD_HIGH
  - LL_ADC_AWD_THRESHOLD_LOW
- __AWD_THRESHOLDS__: Value between Min_Data=0x00000000 and Max_Data=0xFFFFFFFF

Return value:

- Value: between Min_Data=0x000 and Max_Data=0xFFF

Notes:

- To be used with function LL_ADC_GetAnalogWDThresholds(). Example, to get analog watchdog threshold high from the register raw value: __LL_ADC_ANALOGWD_THRESHOLDS_HIGH_LOW(LL_ADC_AWD_THRESHOLD_HIGH, <raw_value_with_both_thresholds>);

__LL_ADC_COMMON_INSTANCE

Description:

- Helper macro to select the ADC common instance to which is belonging the selected ADC instance.

Parameters:

- __ADCx__: ADC instance

Return value:

- ADC: common register instance

Notes:

- ADC common register instance can be used for: Set parameters common to several ADC instancesMultimode (for devices with several ADC instances) Refer to functions having argument "ADCxy_COMMON" as parameter.

__LL_ADC_IS_ENABLED_ALL_COMMON_INSTANCE

Description:

- Helper macro to check if all ADC instances sharing the same ADC common instance are disabled.

Parameters:

- __ADCXY_COMMON__: ADC common instance (can be set directly from CMSIS definition or by using helper macro

Return value:

- Value: "0" if all ADC instances sharing the same ADC common instance are disabled. Value "1" if at least one ADC instance sharing the same ADC common instance is enabled.

Notes:

- This check is required by functions with setting conditioned to ADC state: All ADC instances of the ADC common group must be disabled. Refer to functions having argument "ADCxy_COMMON" as parameter. On devices with only 1 ADC common instance, parameter of this macro is useless and can be ignored (parameter kept for compatibility with devices featuring several ADC common instances).

__LL_ADC_DIGITAL_SCALE

Description:

- Helper macro to define the ADC conversion data full-scale digital value corresponding to the selected ADC resolution.

Parameters:

- __ADC_RESOLUTION__: This parameter can be one of the following values:
  - LL_ADC_RESOLUTION_12B
  - LL_ADC_RESOLUTION_10B
  - LL_ADC_RESOLUTION_8B
  - LL_ADC_RESOLUTION_6B

Return value:

- ADC: conversion data full-scale digital value (unit: digital value of ADC conversion data)

Notes:

- ADC conversion data full-scale corresponds to voltage range determined by analog voltage references Vref+ and Vref- (refer to reference manual).

__LL_ADC_CONVERT_DATA_RESOLUTION

Description:

- Helper macro to convert the ADC conversion data from a resolution to another resolution.

Parameters:

- __DATA__: ADC conversion data to be converted
- __ADC_RESOLUTION_CURRENT__: Resolution of the data to be converted This parameter can be one of the following values:
  - LL_ADC_RESOLUTION_12B
  - LL_ADC_RESOLUTION_10B
  - LL_ADC_RESOLUTION_8B
  - LL_ADC_RESOLUTION_6B
- __ADC_RESOLUTION_TARGET__: Resolution of the data after conversion This parameter can be one of the following values:
  - LL_ADC_RESOLUTION_12B
  - LL_ADC_RESOLUTION_10B
  - LL_ADC_RESOLUTION_8B
  - LL_ADC_RESOLUTION_6B

Return value:

- ADC: conversion data to the requested resolution

__LL_ADC_CALC_DATA_TO_VOLTAGE

Description:

- Helper macro to calculate the voltage (unit: mVolt) corresponding to a ADC conversion data (unit: digital value).

Parameters:

- __VREFANALOG_VOLTAGE__: Analog reference voltage (unit: mV)
- __ADC_DATA__: ADC conversion data (resolution 12 bits) (unit: digital value).
- __ADC_RESOLUTION__: This parameter can be one of the following values:
  - LL_ADC_RESOLUTION_12B
  - LL_ADC_RESOLUTION_10B
  - LL_ADC_RESOLUTION_8B
  - LL_ADC_RESOLUTION_6B

Return value:

- ADC: conversion data equivalent voltage value (unit: mVolt)

Notes:

- Analog reference voltage (Vref+) must be either known from user board environment or can be calculated using ADC measurement and ADC helper macro __LL_ADC_CALC_VREFANALOG_VOLTAGE().

__LL_ADC_CALC_VREFANALOG_VOLTAGE

Description:

- Helper macro to calculate analog reference voltage (Vref+) (unit: mVolt) from ADC conversion data of internal voltage reference VrefInt.

Parameters:

- __VREFINT_ADC_DATA__: ADC conversion data (resolution 12 bits) of internal voltage reference VrefInt (unit: digital value).
- __ADC_RESOLUTION__: This parameter can be one of the following values:
  - LL_ADC_RESOLUTION_12B
  - LL_ADC_RESOLUTION_10B
  - LL_ADC_RESOLUTION_8B
  - LL_ADC_RESOLUTION_6B

Return value:

- Analog: reference voltage (unit: mV)

Notes:

- Computation is using VrefInt calibration value stored in system memory for each device during production. This voltage depends on user board environment: voltage level connected to pin Vref+. On devices with small package, the pin Vref+ is not present and internally bonded to pin Vdda. On this STM32 series, calibration data of internal voltage reference VrefInt corresponds to a resolution of 12 bits, this is the recommended ADC resolution to convert voltage of internal voltage reference VrefInt. Otherwise, this macro performs the processing to scale ADC conversion data to 12 bits.

__LL_ADC_CALC_TEMPERATURE

Description:

- Helper macro to calculate the temperature (unit: degree Celsius) from ADC conversion data of internal temperature sensor.

Parameters:

- __VREFANALOG_VOLTAGE__: Analog reference voltage (unit: mV)
- __TEMPSENSOR_ADC_DATA__: ADC conversion data of internal temperature sensor (unit: digital value).
- __ADC_RESOLUTION__: ADC resolution at which internal temperature sensor voltage has been measured. This parameter can be one of the following values:
  - LL_ADC_RESOLUTION_12B
  - LL_ADC_RESOLUTION_10B
  - LL_ADC_RESOLUTION_8B
  - LL_ADC_RESOLUTION_6B

Return value:

- Temperature: (unit: degree Celsius) In case or error, value LL_ADC_TEMPERATURE_CALC_ERROR is returned (inconsistent temperature value)

Notes:

- Computation is using temperature sensor calibration values stored in system memory for each device during production. Calculation formula: Temperature = ((TS_ADC_DATA - TS_CAL1) * (TS_CAL2_TEMP - TS_CAL1_TEMP)) / (TS_CAL2 - TS_CAL1) + TS_CAL1_TEMP with TS_ADC_DATA = temperature sensor raw data measured by ADC Avg_Slope = (TS_CAL2 - TS_CAL1) / (TS_CAL2_TEMP - TS_CAL1_TEMP) TS_CAL1 = equivalent TS_ADC_DATA at temperature TEMP_DEGC_CAL1 (calibrated in factory) TS_CAL2 = equivalent TS_ADC_DATA at temperature TEMP_DEGC_CAL2 (calibrated in factory) Caution: Calculation relevancy under reserve that calibration parameters are correct (address and data). To calculate temperature using temperature sensor datasheet typical values (generic values less, therefore less accurate than calibrated values), use helper macro __LL_ADC_CALC_TEMPERATURE_TYP_PARAMS(). As calculation input, the analog reference voltage (Vref+) must be defined as it impacts the ADC LSB equivalent voltage. Analog reference voltage (Vref+) must be either known from user board environment or can be calculated using ADC measurement and ADC helper macro __LL_ADC_CALC_VREFANALOG_VOLTAGE(). On this STM32 series, calibration data of temperature sensor corresponds to a resolution of 12 bits, this is the recommended ADC resolution to convert voltage of temperature sensor. Otherwise, this macro performs the processing to scale ADC conversion data to 12 bits.

__LL_ADC_CALC_TEMPERATURE_TYP_PARAMS

Description:

- Helper macro to calculate the temperature (unit: degree Celsius) from ADC conversion data of internal temperature sensor.

Parameters:

- __TEMPSENSOR_TYP_AVGSLOPE__: Device datasheet data: Temperature sensor slope typical value (unit: uV/DegCelsius). On this STM32 series, refer to device datasheet parameter "Avg_Slope".
- __TEMPSENSOR_TYP_CALX_V__: Device datasheet data: Temperature sensor voltage typical value (at temperature and Vref+ defined in parameters below) (unit: mV). On this STM32 series, refer to datasheet parameter "V30" (corresponding to TS_CAL1).
- __TEMPSENSOR_CALX_TEMP__: Device datasheet data: Temperature at which temperature sensor voltage (see parameter above) is corresponding (unit: mV)
- __VREFANALOG_VOLTAGE__: Analog voltage reference (Vref+) value (unit: mV)
- __TEMPSENSOR_ADC_DATA__: ADC conversion data of internal temperature sensor (unit: digital value).
- __ADC_RESOLUTION__: ADC resolution at which internal temperature sensor voltage has been measured. This parameter can be one of the following values:
  - LL_ADC_RESOLUTION_12B
  - LL_ADC_RESOLUTION_10B
  - LL_ADC_RESOLUTION_8B
  - LL_ADC_RESOLUTION_6B

Return value:

- Temperature: (unit: degree Celsius)

Notes:

- Computation is using temperature sensor typical values (refer to device datasheet). Calculation formula: Temperature = (TS_TYP_CALx_VOLT(uV) - TS_ADC_DATA * Conversion_uV) / Avg_Slope + CALx_TEMP with TS_ADC_DATA = temperature sensor raw data measured by ADC (unit: digital value) Avg_Slope = temperature sensor slope (unit: uV/Degree Celsius) TS_TYP_CALx_VOLT = temperature sensor digital value at temperature CALx_TEMP (unit: mV) Caution: Calculation relevancy under reserve the temperature sensor of the current device has characteristics in line with datasheet typical values. If temperature sensor calibration values are available on on this device (presence of macro __LL_ADC_CALC_TEMPERATURE()), temperature calculation will be more accurate using helper macro __LL_ADC_CALC_TEMPERATURE(). As calculation input, the analog reference voltage (Vref+) must be defined as it impacts the ADC LSB equivalent voltage. Analog reference voltage (Vref+) must be either known from user board environment or can be calculated using ADC measurement and ADC helper macro __LL_ADC_CALC_VREFANALOG_VOLTAGE(). ADC measurement data must correspond to a resolution of 12 bits (full scale digital value 4095). If not the case, the data must be preliminarily rescaled to an equivalent resolution of 12 bits.

Common write and read registers Macros

LL_ADC_WriteReg

Description:

- Write a value in ADC register.

Parameters:

- __INSTANCE__: ADC Instance
- __REG__: Register to be written
- __VALUE__: Value to be written in the register

Return value:

- None

LL_ADC_ReadReg

Description:

- Read a value in ADC register.

Parameters:

- __INSTANCE__: ADC Instance
- __REG__: Register to be read

Return value:

- Register: value

56 LL BUS Generic Driver

56.1 BUS Firmware driver API description

The following section lists the various functions of the BUS library.

56.1.1 Detailed description of functions

LL_AHB1_GRP1_EnableClock

Function name

__STATIC_INLINE void LL_AHB1_GRP1_EnableClock (uint32_t Periphs)

Function description

Enable AHB1 peripherals clock.

Parameters

- **Periphs:** This parameter can be a combination of the following values:
  - LL_AHB1_GRP1_PERIPH_DMA1
  - LL_AHB1_GRP1_PERIPH_DMA2
  - LL_AHB1_GRP1_PERIPH_FLASH
  - LL_AHB1_GRP1_PERIPH_CRC
  - LL_AHB1_GRP1_PERIPH_TSC
  - LL_AHB1_GRP1_PERIPH_AES
  - LL_AHB1_GRP1_PERIPH_RNG
  - LL_AHB1_GRP1_PERIPH_SRAM1

Return values

- **None:**

Reference Manual to LL API cross reference:

- AHBENR DMA1EN LL_AHB1_GRP1_EnableClock
- AHBENR DMA2EN LL_AHB1_GRP1_EnableClock
- AHBENR FLASHEN LL_AHB1_GRP1_EnableClock
- AHBENR CRCEN LL_AHB1_GRP1_EnableClock
- AHBENR TSCEN LL_AHB1_GRP1_EnableClock
- AHBENR AESEN LL_AHB1_GRP1_EnableClock
- AHBENR RNGEN LL_AHB1_GRP1_EnableClock
- AHBENR SRAM1EN LL_AHB1_GRP1_EnableClock

LL_AHB1_GRP1_IsEnabledClock

Function name

__STATIC_INLINE uint32_t LL_AHB1_GRP1_IsEnabledClock (uint32_t Periphs)

Function description

Check if AHB1 peripheral clock is enabled or not.

Parameters

- **Periphs:** This parameter can be a combination of the following values:
  - LL_AHB1_GRP1_PERIPH_DMA1
  - LL_AHB1_GRP1_PERIPH_DMA2
  - LL_AHB1_GRP1_PERIPH_FLASH
  - LL_AHB1_GRP1_PERIPH_CRC
  - LL_AHB1_GRP1_PERIPH_TSC
  - LL_AHB1_GRP1_PERIPH_AES
  - LL_AHB1_GRP1_PERIPH_RNG
  - LL_AHB1_GRP1_PERIPH_SRAM1

Return values

- **State:** of Periphs (1 or 0).

Reference Manual to LL API cross reference:

- AHBENR DMA1EN LL_AHB1_GRP1_IsEnabledClock
- AHBENR DMA2EN LL_AHB1_GRP1_IsEnabledClock
- AHBENR FLASHEN LL_AHB1_GRP1_IsEnabledClock
- AHBENR CRCEN LL_AHB1_GRP1_IsEnabledClock
- AHBENR TSCEN LL_AHB1_GRP1_IsEnabledClock
- AHBENR AESEN LL_AHB1_GRP1_IsEnabledClock
- AHBENR RNGEN LL_AHB1_GRP1_IsEnabledClock
- AHBENR SRAM1EN LL_AHB1_GRP1_IsEnabledClock

LL_AHB1_GRP1_DisableClock

Function name

__STATIC_INLINE void LL_AHB1_GRP1_DisableClock (uint32_t Periphs)

Function description

Disable AHB1 peripherals clock.

Parameters

- **Periphs:** This parameter can be a combination of the following values:
  - LL_AHB1_GRP1_PERIPH_DMA1
  - LL_AHB1_GRP1_PERIPH_DMA2
  - LL_AHB1_GRP1_PERIPH_FLASH
  - LL_AHB1_GRP1_PERIPH_CRC
  - LL_AHB1_GRP1_PERIPH_TSC
  - LL_AHB1_GRP1_PERIPH_AES
  - LL_AHB1_GRP1_PERIPH_RNG
  - LL_AHB1_GRP1_PERIPH_SRAM1

Return values

- **None:**

Reference Manual to LL API cross reference:

- AHBENR DMA1EN LL_AHB1_GRP1_DisableClock
- AHBENR DMA2EN LL_AHB1_GRP1_DisableClock
- AHBENR FLASHEN LL_AHB1_GRP1_DisableClock
- AHBENR CRCEN LL_AHB1_GRP1_DisableClock
- AHBENR TSCEN LL_AHB1_GRP1_DisableClock
- AHBENR AESEN LL_AHB1_GRP1_DisableClock
- AHBENR RNGEN LL_AHB1_GRP1_DisableClock
- AHBENR SRAM1EN LL_AHB1_GRP1_DisableClock

LL_AHB1_GRP1_ForceReset

Function name

__STATIC_INLINE void LL_AHB1_GRP1_ForceReset (uint32_t Periphs)

Function description

Force AHB1 peripherals reset.

Parameters

- **Periphs:** This parameter can be a combination of the following values:
  - LL_AHB1_GRP1_PERIPH_ALL
  - LL_AHB1_GRP1_PERIPH_DMA1
  - LL_AHB1_GRP1_PERIPH_DMA2
  - LL_AHB1_GRP1_PERIPH_FLASH
  - LL_AHB1_GRP1_PERIPH_CRC
  - LL_AHB1_GRP1_PERIPH_TSC
  - LL_AHB1_GRP1_PERIPH_AES
  - LL_AHB1_GRP1_PERIPH_RNG
  - LL_AHB1_GRP1_PERIPH_SRAM1

Return values

- **None:**

Reference Manual to LL API cross reference:

- AHBRSTR DMA1RST LL_AHB1_GRP1_ForceReset
- AHBRSTR DMA2RST LL_AHB1_GRP1_ForceReset
- AHBRSTR FLASHRST LL_AHB1_GRP1_ForceReset
- AHBRSTR CRCRST LL_AHB1_GRP1_ForceReset
- AHBRSTR TSCRST LL_AHB1_GRP1_ForceReset
- AHBRSTR AESRST LL_AHB1_GRP1_ForceReset
- AHBRSTR RNGRST LL_AHB1_GRP1_ForceReset
- AHBRSTR SRAM1RST LL_AHB1_GRP1_ForceReset

LL_AHB1_GRP1_ReleaseReset

Function name

__STATIC_INLINE void LL_AHB1_GRP1_ReleaseReset (uint32_t Periphs)

Function description

Release AHB1 peripherals reset.

Parameters

- **Periphs:** This parameter can be a combination of the following values:
  - LL_AHB1_GRP1_PERIPH_ALL
  - LL_AHB1_GRP1_PERIPH_DMA1
  - LL_AHB1_GRP1_PERIPH_DMA2
  - LL_AHB1_GRP1_PERIPH_FLASH
  - LL_AHB1_GRP1_PERIPH_CRC
  - LL_AHB1_GRP1_PERIPH_TSC
  - LL_AHB1_GRP1_PERIPH_AES
  - LL_AHB1_GRP1_PERIPH_RNG
  - LL_AHB1_GRP1_PERIPH_SRAM1

  (*) value not defined in all devices.

Return values

- **None:**

Reference Manual to LL API cross reference:

- AHBRSTR DMA1RST LL_AHB1_GRP1_ReleaseReset
- AHBRSTR DMA2RST LL_AHB1_GRP1_ReleaseReset
- AHBRSTR FLASHRST LL_AHB1_GRP1_ReleaseReset
- AHBRSTR CRCRST LL_AHB1_GRP1_ReleaseReset
- AHBRSTR TSCRST LL_AHB1_GRP1_ReleaseReset
- AHBRSTR AESRST LL_AHB1_GRP1_ReleaseReset
- AHBRSTR RNGRST LL_AHB1_GRP1_ReleaseReset
- AHBRSTR SRAM1RST LL_AHB1_GRP1_ReleaseReset

LL_AHB1_GRP1_EnableClockStopSleep

Function name

__STATIC_INLINE void LL_AHB1_GRP1_EnableClockStopSleep (uint32_t Periphs)

Function description

Enable AHB1 peripheral clocks in Sleep and Stop modes.

Parameters

- **Periphs:** This parameter can be a combination of the following values:
  - LL_AHB1_GRP1_PERIPH_DMA1
  - LL_AHB1_GRP1_PERIPH_DMA2
  - LL_AHB1_GRP1_PERIPH_FLASH
  - LL_AHB1_GRP1_PERIPH_CRC
  - LL_AHB1_GRP1_PERIPH_TSC
  - LL_AHB1_GRP1_PERIPH_AES
  - LL_AHB1_GRP1_PERIPH_RNG
  - LL_AHB1_GRP1_PERIPH_SRAM1

  (*) value not defined in all devices.

Return values

- **None:**

Reference Manual to LL API cross reference:

- AHBSMENR DMA1SMEN LL_AHB1_GRP1_EnableClockStopSleep
- AHBSMENR DMA2SMEN LL_AHB1_GRP1_EnableClockStopSleep
- AHBSMENR FLASHSMEN LL_AHB1_GRP1_EnableClockStopSleep
- AHBSMENR SRAM1SMEN LL_AHB1_GRP1_EnableClockStopSleep
- AHBSMENR CRCSMEN LL_AHB1_GRP1_EnableClockStopSleep
- AHBSMENR TSCSMEN LL_AHB1_GRP1_EnableClockStopSleep
- AHBSMENR AESSMEN LL_AHB1_GRP1_EnableClockStopSleep
- AHBSMENR RNGSMEN LL_AHB1_GRP1_EnableClockStopSleep
- AHBSMENR SRAM1SMEN LL_AHB1_GRP1_EnableClockStopSleep

LL_AHB1_GRP1_DisableClockStopSleep

Function name

__STATIC_INLINE void LL_AHB1_GRP1_DisableClockStopSleep (uint32_t Periphs)

Function description

Disable AHB1 peripheral clocks in Sleep and Stop modes.

Parameters

- **Periphs:** This parameter can be a combination of the following values:
  - LL_AHB1_GRP1_PERIPH_DMA1
  - LL_AHB1_GRP1_PERIPH_DMA2
  - LL_AHB1_GRP1_PERIPH_FLASH
  - LL_AHB1_GRP1_PERIPH_CRC
  - LL_AHB1_GRP1_PERIPH_TSC
  - LL_AHB1_GRP1_PERIPH_AES
  - LL_AHB1_GRP1_PERIPH_RNG
  - LL_AHB1_GRP1_PERIPH_SRAM1

  (*) value not defined in all devices.

Return values

- **None:**

Reference Manual to LL API cross reference:

- AHBSMENR DMA1SMEN LL_AHB1_GRP1_DisableClockStopSleep
- AHBSMENR DMA2SMEN LL_AHB1_GRP1_DisableClockStopSleep
- AHBSMENR FLASHSMEN LL_AHB1_GRP1_DisableClockStopSleep
- AHBSMENR SRAM1SMEN LL_AHB1_GRP1_DisableClockStopSleep
- AHBSMENR CRCSMEN LL_AHB1_GRP1_DisableClockStopSleep
- AHBSMENR TSCSMEN LL_AHB1_GRP1_DisableClockStopSleep
- AHBSMENR AESSMEN LL_AHB1_GRP1_DisableClockStopSleep
- AHBSMENR RNGSMEN LL_AHB1_GRP1_DisableClockStopSleep
- AHBSMENR SRAM1SMEN LL_AHB1_GRP1_DisableClockStopSleep

LL_APB1_GRP1_EnableClock

Function name

__STATIC_INLINE void LL_APB1_GRP1_EnableClock (uint32_t Periphs)

Function description

Enable APB1 GRP1 peripherals clock.

Parameters

- **Periphs:** This parameter can be a combination of the following values:
  - LL_APB1_GRP1_PERIPH_TIM2
  - LL_APB1_GRP1_PERIPH_TIM3
  - LL_APB1_GRP1_PERIPH_TIM6
  - LL_APB1_GRP1_PERIPH_TIM7
  - LL_APB1_GRP1_PERIPH_LPUART2
  - LL_APB1_GRP1_PERIPH_LCD
  - LL_APB1_GRP1_PERIPH_RTCAPB
  - LL_APB1_GRP1_PERIPH_WWDG
  - LL_APB1_GRP1_PERIPH_LPUART3
  - LL_APB1_GRP1_PERIPH_USB
  - LL_APB1_GRP1_PERIPH_SPI2
  - LL_APB1_GRP1_PERIPH_SPI3
  - LL_APB1_GRP1_PERIPH_CRS
  - LL_APB1_GRP1_PERIPH_USART2
  - LL_APB1_GRP1_PERIPH_USART3
  - LL_APB1_GRP1_PERIPH_USART4
  - LL_APB1_GRP1_PERIPH_LPUART1
  - LL_APB1_GRP1_PERIPH_I2C1
  - LL_APB1_GRP1_PERIPH_I2C2
  - LL_APB1_GRP1_PERIPH_I2C3
  - LL_APB1_GRP1_PERIPH_OPAMP
  - LL_APB1_GRP1_PERIPH_I2C4
  - LL_APB1_GRP1_PERIPH_LPTIM3
  - LL_APB1_GRP1_PERIPH_PWR
  - LL_APB1_GRP1_PERIPH_DAC1
  - LL_APB1_GRP1_PERIPH_LPTIM2
  - LL_APB1_GRP1_PERIPH_LPTIM1

Return values

- **None:**

Reference Manual to LL API cross reference:

- APBENR1 TIM2EN LL_APB1_GRP1_EnableClock
- APBENR1 TIM3EN LL_APB1_GRP1_EnableClock
- APBENR1 TIM6EN LL_APB1_GRP1_EnableClock
- APBENR1 TIM7EN LL_APB1_GRP1_EnableClock
- APBENR1 LPUART2EN LL_APB1_GRP1_EnableClock
- APBENR1 LCDEN LL_APB1_GRP1_EnableClock
- APBENR1 RTCAPBEN LL_APB1_GRP1_EnableClock
- APBENR1 WWDGEN LL_APB1_GRP1_EnableClock
- APBENR1 LPUART3EN LL_APB1_GRP1_EnableClock
- APBENR1 USBFSEN LL_APB1_GRP1_EnableClock
- APBENR1 SPI2EN LL_APB1_GRP1_EnableClock
- APBENR1 SPI3EN LL_APB1_GRP1_EnableClock
- APBENR1 CRSEN LL_APB1_GRP1_EnableClock
- APBENR1 USART2EN LL_APB1_GRP1_EnableClock
- APBENR1 USART3EN LL_APB1_GRP1_EnableClock
- APBENR1 USART4EN LL_APB1_GRP1_EnableClock
- APBENR1 LPUART1EN LL_APB1_GRP1_EnableClock
- APBENR1 I2C1EN LL_APB1_GRP1_EnableClock
- APBENR1 I2C2EN LL_APB1_GRP1_EnableClock
- APBENR1 I2C3EN LL_APB1_GRP1_EnableClock
- APBENR1 OPAMPEN LL_APB1_GRP1_EnableClock
- APBENR1 I2C4EN LL_APB1_GRP1_EnableClock
- APBENR1 LPTIM3EN LL_APB1_GRP1_EnableClock
- APBENR1 PWREN LL_APB1_GRP1_EnableClock
- APBENR1 DAC1EN LL_APB1_GRP1_EnableClock
- APBENR1 LPTIM2EN LL_APB1_GRP1_EnableClock APBENR1 LPTIM1EN LL_APB1_GRP1_EnableClock

LL_APB1_GRP1_IsEnabledClock

Function name

__STATIC_INLINE uint32_t LL_APB1_GRP1_IsEnabledClock (uint32_t Periphs)

Function description

Check if APB1 GRP1 peripheral clock is enabled or not.

Parameters

- **Periphs:** This parameter can be a combination of the following values:
  - LL_APB1_GRP1_PERIPH_TIM2
  - LL_APB1_GRP1_PERIPH_TIM3
  - LL_APB1_GRP1_PERIPH_TIM6
  - LL_APB1_GRP1_PERIPH_TIM7
  - LL_APB1_GRP1_PERIPH_LPUART2
  - LL_APB1_GRP1_PERIPH_LCD
  - LL_APB1_GRP1_PERIPH_RTCAPB
  - LL_APB1_GRP1_PERIPH_WWDG
  - LL_APB1_GRP1_PERIPH_LPUART3
  - LL_APB1_GRP1_PERIPH_USB
  - LL_APB1_GRP1_PERIPH_SPI2
  - LL_APB1_GRP1_PERIPH_SPI3
  - LL_APB1_GRP1_PERIPH_CRS
  - LL_APB1_GRP1_PERIPH_USART2
  - LL_APB1_GRP1_PERIPH_USART3
  - LL_APB1_GRP1_PERIPH_USART4
  - LL_APB1_GRP1_PERIPH_LPUART1
  - LL_APB1_GRP1_PERIPH_I2C1
  - LL_APB1_GRP1_PERIPH_I2C2
  - LL_APB1_GRP1_PERIPH_I2C3
  - LL_APB1_GRP1_PERIPH_OPAMP
  - LL_APB1_GRP1_PERIPH_I2C4
  - LL_APB1_GRP1_PERIPH_LPTIM3
  - LL_APB1_GRP1_PERIPH_PWR
  - LL_APB1_GRP1_PERIPH_DAC1
  - LL_APB1_GRP1_PERIPH_LPTIM2
  - LL_APB1_GRP1_PERIPH_LPTIM1

Return values

- **State:** of Periphs (1 or 0).

Reference Manual to LL API cross reference:

- APBENR1 TIM2EN LL_APB1_GRP1_IsEnabledClock
- APBENR1 TIM3EN LL_APB1_GRP1_IsEnabledClock
- APBENR1 TIM6EN LL_APB1_GRP1_IsEnabledClock
- APBENR1 TIM7EN LL_APB1_GRP1_IsEnabledClock
- APBENR1 LPUART2EN LL_APB1_GRP1_IsEnabledClock
- APBENR1 LCDEN LL_APB1_GRP1_IsEnabledClock
- APBENR1 RTCAPBEN LL_APB1_GRP1_IsEnabledClock
- APBENR1 WWDGEN LL_APB1_GRP1_IsEnabledClock
- APBENR1 LPUART3EN LL_APB1_GRP1_IsEnabledClock
- APBENR1 USBFSEN LL_APB1_GRP1_IsEnabledClock
- APBENR1 SPI2EN LL_APB1_GRP1_IsEnabledClock
- APBENR1 SPI3EN LL_APB1_GRP1_IsEnabledClock
- APBENR1 CRSEN LL_APB1_GRP1_IsEnabledClock
- APBENR1 USART2EN LL_APB1_GRP1_IsEnabledClock
- APBENR1 USART3EN LL_APB1_GRP1_IsEnabledClock
- APBENR1 USART4EN LL_APB1_GRP1_IsEnabledClock
- APBENR1 USART4EN LL_APB1_GRP1_IsEnabledClock
- APBENR1 LPUART1EN LL_APB1_GRP1_IsEnabledClock
- APBENR1 I2C1EN LL_APB1_GRP1_IsEnabledClock
- APBENR1 I2C2EN LL_APB1_GRP1_IsEnabledClock
- APBENR1 I2C3EN LL_APB1_GRP1_IsEnabledClock
- APBENR1 OPAMPEN LL_APB1_GRP1_IsEnabledClock
- APBENR1 I2C4EN LL_APB1_GRP1_IsEnabledClock
- APBENR1 LPTIM3EN LL_APB1_GRP1_IsEnabledClock
- APBENR1 PWREN LL_APB1_GRP1_IsEnabledClock
- APBENR1 DAC1EN LL_APB1_GRP1_IsEnabledClock
- APBENR1 LPTIM2EN LL_APB1_GRP1_IsEnabledClock
- APBENR1 LPTIM1EN LL_APB1_GRP1_IsEnabledClock

LL_APB1_GRP1_DisableClock

Function name

__STATIC_INLINE void LL_APB1_GRP1_DisableClock (uint32_t Periphs)

Function description

Disable APB1 GRP1 peripherals clock.

Parameters

- **Periphs:** This parameter can be a combination of the following values:
  - LL_APB1_GRP1_PERIPH_TIM2
  - LL_APB1_GRP1_PERIPH_TIM3
  - LL_APB1_GRP1_PERIPH_TIM6
  - LL_APB1_GRP1_PERIPH_TIM7
  - LL_APB1_GRP1_PERIPH_LPUART2
  - LL_APB1_GRP1_PERIPH_LCD
  - LL_APB1_GRP1_PERIPH_RTCAPB
  - LL_APB1_GRP1_PERIPH_WWDG
  - LL_APB1_GRP1_PERIPH_LPUART3
  - LL_APB1_GRP1_PERIPH_USB
  - LL_APB1_GRP1_PERIPH_SPI2
  - LL_APB1_GRP1_PERIPH_SPI3
  - LL_APB1_GRP1_PERIPH_CRS
  - LL_APB1_GRP1_PERIPH_USART2
  - LL_APB1_GRP1_PERIPH_USART3
  - LL_APB1_GRP1_PERIPH_USART4
  - LL_APB1_GRP1_PERIPH_LPUART1
  - LL_APB1_GRP1_PERIPH_I2C1
  - LL_APB1_GRP1_PERIPH_I2C2
  - LL_APB1_GRP1_PERIPH_I2C3
  - LL_APB1_GRP1_PERIPH_OPAMP
  - LL_APB1_GRP1_PERIPH_I2C4
  - LL_APB1_GRP1_PERIPH_LPTIM3
  - LL_APB1_GRP1_PERIPH_PWR
  - LL_APB1_GRP1_PERIPH_DAC1
  - LL_APB1_GRP1_PERIPH_LPTIM2
  - LL_APB1_GRP1_PERIPH_LPTIM1

Return values

- **None:**

Reference Manual to LL API cross reference:

- APBENR1 TIM2EN LL_APB1_GRP1_DisableClock
- APBENR1 TIM3EN LL_APB1_GRP1_DisableClock
- APBENR1 TIM6EN LL_APB1_GRP1_DisableClock
- APBENR1 TIM7EN LL_APB1_GRP1_DisableClock
- APBENR1 LPUART2EN LL_APB1_GRP1_DisableClock
- APBENR1 LCDEN LL_APB1_GRP1_DisableClock
- APBENR1 RTCAPBEN LL_APB1_GRP1_DisableClock
- APBENR1 WWDGEN LL_APB1_GRP1_DisableClock
- APBENR1 LPUART3EN LL_APB1_GRP1_DisableClock
- APBENR1 USBFSEN LL_APB1_GRP1_DisableClock
- APBENR1 SPI2EN LL_APB1_GRP1_DisableClock
- APBENR1 SPI3EN LL_APB1_GRP1_DisableClock
- APBENR1 CRSEN LL_APB1_GRP1_DisableClock
- APBENR1 USART2EN LL_APB1_GRP1_DisableClock
- APBENR1 USART3EN LL_APB1_GRP1_DisableClock
- APBENR1 USART4EN LL_APB1_GRP1_DisableClock
- APBENR1 LPUART1EN LL_APB1_GRP1_DisableClock
- APBENR1 I2C1EN LL_APB1_GRP1_DisableClock
- APBENR1 I2C2EN LL_APB1_GRP1_DisableClock
- APBENR1 I2C3EN LL_APB1_GRP1_DisableClock
- APBENR1 OPAMPEN LL_APB1_GRP1_DisableClock
- APBENR1 I2C4EN LL_APB1_GRP1_DisableClock
- APBENR1 LPTIM3EN LL_APB1_GRP1_DisableClock
- APBENR1 PWREN LL_APB1_GRP1_DisableClock
- APBENR1 DAC1EN LL_APB1_GRP1_DisableClock
- APBENR1 LPTIM2EN LL_APB1_GRP1_DisableClock
- APBENR1 LPTIM1EN LL_APB1_GRP1_DisableClock

LL_APB1_GRP1_ForceReset

Function name

__STATIC_INLINE void LL_APB1_GRP1_ForceReset (uint32_t Periphs)

Function description

Force APB1 GRP1 peripherals reset.

Parameters

- **Periphs:** This parameter can be a combination of the following values:
  - LL_APB1_GRP1_PERIPH_TIM2
  - LL_APB1_GRP1_PERIPH_TIM3
  - LL_APB1_GRP1_PERIPH_TIM6
  - LL_APB1_GRP1_PERIPH_TIM7
  - LL_APB1_GRP1_PERIPH_LPUART2
  - LL_APB1_GRP1_PERIPH_LCD
  - LL_APB1_GRP1_PERIPH_RTCAPB
  - LL_APB1_GRP1_PERIPH_WWDG
  - LL_APB1_GRP1_PERIPH_LPUART3
  - LL_APB1_GRP1_PERIPH_USB
  - LL_APB1_GRP1_PERIPH_SPI2
  - LL_APB1_GRP1_PERIPH_SPI3
  - LL_APB1_GRP1_PERIPH_CRS
  - LL_APB1_GRP1_PERIPH_USART2
  - LL_APB1_GRP1_PERIPH_USART3
  - LL_APB1_GRP1_PERIPH_USART4
  - LL_APB1_GRP1_PERIPH_LPUART1
  - LL_APB1_GRP1_PERIPH_I2C1
  - LL_APB1_GRP1_PERIPH_I2C2
  - LL_APB1_GRP1_PERIPH_I2C3
  - LL_APB1_GRP1_PERIPH_OPAMP
  - LL_APB1_GRP1_PERIPH_I2C4
  - LL_APB1_GRP1_PERIPH_LPTIM3
  - LL_APB1_GRP1_PERIPH_PWR
  - LL_APB1_GRP1_PERIPH_DAC1
  - LL_APB1_GRP1_PERIPH_LPTIM2
  - LL_APB1_GRP1_PERIPH_LPTIM1

Return values

- **None:**

Reference Manual to LL API cross reference:

- APBRSTR1 TIM2RST LL_APB1_GRP1_ForceReset
- APBRSTR1 TIM3RST LL_APB1_GRP1_ForceReset
- APBRSTR1 TIM6RST LL_APB1_GRP1_ForceReset
- APBRSTR1 TIM7RST LL_APB1_GRP1_ForceReset
- APBRSTR1 LPUART2RST LL_APB1_GRP1_ForceReset
- APBRSTR1 LCDRST LL_APB1_GRP1_ForceReset
- APBRSTR1 RTCAPBRST LL_APB1_GRP1_ForceReset
- APBRSTR1 WWDGRST LL_APB1_GRP1_ForceReset
- APBRSTR1 LPUART3RST LL_APB1_GRP1_ForceReset
- APBRSTR1 USBFSRST LL_APB1_GRP1_ForceReset
- APBRSTR1 SPI2RST LL_APB1_GRP1_ForceReset
- APBRSTR1 SPI3RST LL_APB1_GRP1_ForceReset
- APBRSTR1 CRSRST LL_APB1_GRP1_ForceReset
- APBRSTR1 USART2RST LL_APB1_GRP1_ForceReset
- APBRSTR1 USART3RST LL_APB1_GRP1_ForceReset
- APBRSTR1 USART4RST LL_APB1_GRP1_ForceReset
- APBRSTR1 LPUART1RST LL_APB1_GRP1_ForceReset
- APBRSTR1 I2C1RST LL_APB1_GRP1_ForceReset
- APBRSTR1 I2C2RST LL_APB1_GRP1_ForceReset
- APBRSTR1 I2C3RST LL_APB1_GRP1_ForceReset
- APBRSTR1 OPAMPRST LL_APB1_GRP1_ForceReset
- APBRSTR1 I2C4RST LL_APB1_GRP1_ForceReset
- APBRSTR1 LPTIM3RST LL_APB1_GRP1_ForceReset
- APBRSTR1 PWRRST LL_APB1_GRP1_ForceReset
- APBRSTR1 DAC1RST LL_APB1_GRP1_ForceReset
- APBRSTR1 LPTIM2RST LL_APB1_GRP1_ForceReset
- APBRSTR1 LPTIM1RST LL_APB1_GRP1_ForceReset

LL_APB1_GRP1_ReleaseReset

Function name

__STATIC_INLINE void LL_APB1_GRP1_ReleaseReset (uint32_t Periphs)

Function description

Release APB1 GRP1 peripherals reset.

Parameters

- **Periphs:** This parameter can be a combination of the following values:
  - LL_APB1_GRP1_PERIPH_TIM2
  - LL_APB1_GRP1_PERIPH_TIM3
  - LL_APB1_GRP1_PERIPH_TIM6
  - LL_APB1_GRP1_PERIPH_TIM7
  - LL_APB1_GRP1_PERIPH_LPUART2
  - LL_APB1_GRP1_PERIPH_LCD
  - LL_APB1_GRP1_PERIPH_RTCAPB
  - LL_APB1_GRP1_PERIPH_WWDG
  - LL_APB1_GRP1_PERIPH_LPUART3
  - LL_APB1_GRP1_PERIPH_USB
  - LL_APB1_GRP1_PERIPH_SPI2
  - LL_APB1_GRP1_PERIPH_SPI3
  - LL_APB1_GRP1_PERIPH_CRS
  - LL_APB1_GRP1_PERIPH_USART2
  - LL_APB1_GRP1_PERIPH_USART3
  - LL_APB1_GRP1_PERIPH_USART4
  - LL_APB1_GRP1_PERIPH_LPUART1
  - LL_APB1_GRP1_PERIPH_I2C1
  - LL_APB1_GRP1_PERIPH_I2C2
  - LL_APB1_GRP1_PERIPH_I2C3
  - LL_APB1_GRP1_PERIPH_OPAMP
  - LL_APB1_GRP1_PERIPH_I2C4
  - LL_APB1_GRP1_PERIPH_LPTIM3
  - LL_APB1_GRP1_PERIPH_PWR
  - LL_APB1_GRP1_PERIPH_DAC1
  - LL_APB1_GRP1_PERIPH_LPTIM2
  - LL_APB1_GRP1_PERIPH_LPTIM1

Return values

- **None:**

Reference Manual to LL API cross reference:

- APBRSTR1 TIM2RST LL_APB1_GRP1_ReleaseReset
- APBRSTR1 TIM3RST LL_APB1_GRP1_ReleaseReset
- APBRSTR1 TIM6RST LL_APB1_GRP1_ReleaseReset
- APBRSTR1 TIM7RST LL_APB1_GRP1_ReleaseReset
- APBRSTR1 LPUART2RST LL_APB1_GRP1_ReleaseReset
- APBRSTR1 LCDRST LL_APB1_GRP1_ReleaseReset
- APBRSTR1 RTCAPBRST LL_APB1_GRP1_ReleaseReset
- APBRSTR1 WWDGRST LL_APB1_GRP1_ReleaseReset
- APBRSTR1 LPUART3RST LL_APB1_GRP1_ReleaseReset
- APBRSTR1 USBFSRST LL_APB1_GRP1_ReleaseReset
- APBRSTR1 SPI2RST LL_APB1_GRP1_ReleaseReset
- APBRSTR1 SPI3RST LL_APB1_GRP1_ReleaseReset
- APBRSTR1 CRSRST LL_APB1_GRP1_ReleaseReset
- APBRSTR1 USART2RST LL_APB1_GRP1_ReleaseReset
- APBRSTR1 USART3RST LL_APB1_GRP1_ReleaseReset
- APBRSTR1 USART4RST LL_APB1_GRP1_ReleaseReset
- APBRSTR1 LPUART1RST LL_APB1_GRP1_ReleaseReset
- APBRSTR1 I2C1RST LL_APB1_GRP1_ReleaseReset
- APBRSTR1 I2C2RST LL_APB1_GRP1_ReleaseReset
- APBRSTR1 I2C3RST LL_APB1_GRP1_ReleaseReset
- APBRSTR1 OPAMPRST LL_APB1_GRP1_ReleaseReset
- APBRSTR1 I2C4RST LL_APB1_GRP1_ReleaseReset
- APBRSTR1 LPTIM3RST LL_APB1_GRP1_ReleaseReset
- APBRSTR1 PWRRST LL_APB1_GRP1_ReleaseReset
- APBRSTR1 DAC1RST LL_APB1_GRP1_ReleaseReset
- APBRSTR1 LPTIM2RST LL_APB1_GRP1_ReleaseReset
- APBRSTR1 LPTIM1RST LL_APB1_GRP1_ReleaseReset

LL_APB1_GRP1_EnableClockStopSleep

Function name

__STATIC_INLINE void LL_APB1_GRP1_EnableClockStopSleep (uint32_t Periphs)

Function description

Enable APB1 GRP1 peripheral clocks in Sleep and Stop modes.

Parameters

- **Periphs:** This parameter can be a combination of the following values:
  - LL_APB1_GRP1_PERIPH_TIM2
  - LL_APB1_GRP1_PERIPH_TIM3
  - LL_APB1_GRP1_PERIPH_TIM6
  - LL_APB1_GRP1_PERIPH_TIM7
  - LL_APB1_GRP1_PERIPH_LPUART2
  - LL_APB1_GRP1_PERIPH_LCD
  - LL_APB1_GRP1_PERIPH_RTCAPB
  - LL_APB1_GRP1_PERIPH_WWDG
  - LL_APB1_GRP1_PERIPH_LPUART3
  - LL_APB1_GRP1_PERIPH_USB
  - LL_APB1_GRP1_PERIPH_SPI2
  - LL_APB1_GRP1_PERIPH_SPI3
  - LL_APB1_GRP1_PERIPH_CRS
  - LL_APB1_GRP1_PERIPH_USART2
  - LL_APB1_GRP1_PERIPH_USART3
  - LL_APB1_GRP1_PERIPH_USART4
  - LL_APB1_GRP1_PERIPH_LPUART1
  - LL_APB1_GRP1_PERIPH_I2C1
  - LL_APB1_GRP1_PERIPH_I2C2
  - LL_APB1_GRP1_PERIPH_I2C3
  - LL_APB1_GRP1_PERIPH_OPAMP
  - LL_APB1_GRP1_PERIPH_I2C4
  - LL_APB1_GRP1_PERIPH_LPTIM3
  - LL_APB1_GRP1_PERIPH_PWR
  - LL_APB1_GRP1_PERIPH_DAC1
  - LL_APB1_GRP1_PERIPH_LPTIM2
  - LL_APB1_GRP1_PERIPH_LPTIM1

  (*) value not defined in all devices.

Return values

- **None:**

Reference Manual to LL API cross reference:

- APBSMENR1 TIM2SMEN LL_APB1_GRP1_EnableClockStopSleep
- APBSMENR1 TIM3SMEN LL_APB1_GRP1_EnableClockStopSleep
- APBSMENR1 TIM6SMEN LL_APB1_GRP1_EnableClockStopSleep
- APBSMENR1 TIM7SMEN LL_APB1_GRP1_EnableClockStopSleep
- APBSMENR1 LPUART2SMEN LL_APB1_GRP1_EnableClockStopSleep
- APBSMENR1 LCDSMEN LL_APB1_GRP1_EnableClockStopSleep
- APBSMENR1 RTCAPBSMEN LL_APB1_GRP1_EnableClockStopSleep
- APBSMENR1 WWDGSMEN LL_APB1_GRP1_EnableClockStopSleep
- APBSMENR1 LPUART3SMEN LL_APB1_GRP1_EnableClockStopSleep
- APBSMENR1 USBFSSMEN LL_APB1_GRP1_EnableClockStopSleep
- APBSMENR1 SPI2SMEN LL_APB1_GRP1_EnableClockStopSleep
- APBSMENR1 SPI3SMEN LL_APB1_GRP1_EnableClockStopSleep
- APBSMENR1 CRSSMEN LL_APB1_GRP1_EnableClockStopSleep
- APBSMENR1 USART2SMEN LL_APB1_GRP1_EnableClockStopSleep
- APBSMENR1 USART3SMEN LL_APB1_GRP1_EnableClockStopSleep
- APBSMENR1 USART4SMEN LL_APB1_GRP1_EnableClockStopSleep
- APBSMENR1 LPUART1SMEN LL_APB1_GRP1_EnableClockStopSleep
- APBSMENR1 I2C1SMEN LL_APB1_GRP1_EnableClockStopSleep
- APBSMENR1 I2C2SMEN LL_APB1_GRP1_EnableClockStopSleep
- APBSMENR1 I2C3SMEN LL_APB1_GRP1_EnableClockStopSleep
- APBSMENR1 OPAMPSMEN LL_APB1_GRP1_EnableClockStopSleep
- APBSMENR1 I2C4SMEN LL_APB1_GRP1_EnableClockStopSleep
- APBSMENR1 LPTIM3SMEN LL_APB1_GRP1_EnableClockStopSleep
- APBSMENR1 PWRSMEN LL_APB1_GRP1_EnableClockStopSleep
- APBSMENR1 DAC1SMEN LL_APB1_GRP1_EnableClockStopSleep
- APBSMENR1 LPTIM2SMEN LL_APB1_GRP1_EnableClockStopSleep
- APBSMENR1 LPTIM1SMEN LL_APB1_GRP1_EnableClockStopSleep

LL_APB1_GRP1_DisableClockStopSleep

Function name

__STATIC_INLINE void LL_APB1_GRP1_DisableClockStopSleep (uint32_t Periphs)

Function description

Disable APB_1 peripheral clocks in Sleep and Stop modes.

Parameters

- **Periphs:** This parameter can be a combination of the following values:
  - LL_APB1_GRP1_PERIPH_TIM2
  - LL_APB1_GRP1_PERIPH_TIM3
  - LL_APB1_GRP1_PERIPH_TIM6
  - LL_APB1_GRP1_PERIPH_TIM7
  - LL_APB1_GRP1_PERIPH_LPUART2
  - LL_APB1_GRP1_PERIPH_LCD
  - LL_APB1_GRP1_PERIPH_RTCAPB
  - LL_APB1_GRP1_PERIPH_WWDG
  - LL_APB1_GRP1_PERIPH_LPUART3
  - LL_APB1_GRP1_PERIPH_USB
  - LL_APB1_GRP1_PERIPH_SPI2
  - LL_APB1_GRP1_PERIPH_SPI3
  - LL_APB1_GRP1_PERIPH_CRS
  - LL_APB1_GRP1_PERIPH_USART2
  - LL_APB1_GRP1_PERIPH_USART3
  - LL_APB1_GRP1_PERIPH_USART4
  - LL_APB1_GRP1_PERIPH_LPUART1
  - LL_APB1_GRP1_PERIPH_I2C1
  - LL_APB1_GRP1_PERIPH_I2C2
  - LL_APB1_GRP1_PERIPH_I2C3
  - LL_APB1_GRP1_PERIPH_OPAMP
  - LL_APB1_GRP1_PERIPH_I2C4
  - LL_APB1_GRP1_PERIPH_LPTIM3
  - LL_APB1_GRP1_PERIPH_PWR
  - LL_APB1_GRP1_PERIPH_DAC1
  - LL_APB1_GRP1_PERIPH_LPTIM2
  - LL_APB1_GRP1_PERIPH_LPTIM1

Return values

- **None:**

Reference Manual to LL API cross reference:

- APBSMENR1 TIM2SMEN LL_APB1_GRP1_DisableClockStopSleep
- APBSMENR1 TIM3SMEN LL_APB1_GRP1_DisableClockStopSleep
- APBSMENR1 TIM6SMEN LL_APB1_GRP1_DisableClockStopSleep
- APBSMENR1 TIM7SMEN LL_APB1_GRP1_DisableClockStopSleep
- APBSMENR1 LPUART2SMEN LL_APB1_GRP1_DisableClockStopSleep
- APBSMENR1 LCDSMEN LL_APB1_GRP1_DisableClockStopSleep
- APBSMENR1 RTCAPBSMEN LL_APB1_GRP1_DisableClockStopSleep
- APBSMENR1 WWDGSMEN LL_APB1_GRP1_DisableClockStopSleep
- APBSMENR1 LPUART3SMEN LL_APB1_GRP1_DisableClockStopSleep
- APBSMENR1 USBFSSMEN LL_APB1_GRP1_DisableClockStopSleep
- APBSMENR1 SPI2SMEN LL_APB1_GRP1_DisableClockStopSleep
- APBSMENR1 SPI3SMEN LL_APB1_GRP1_DisableClockStopSleep
- APBSMENR1 CRSSMEN LL_APB1_GRP1_DisableClockStopSleep
- APBSMENR1 USART2SMEN LL_APB1_GRP1_DisableClockStopSleep
- APBSMENR1 USART3SMEN LL_APB1_GRP1_DisableClockStopSleep
- APBSMENR1 USART4SMEN LL_APB1_GRP1_DisableClockStopSleep
- APBSMENR1 LPUART1SMEN LL_APB1_GRP1_DisableClockStopSleep
- APBSMENR1 I2C1SMEN LL_APB1_GRP1_DisableClockStopSleep
- APBSMENR1 I2C2SMEN LL_APB1_GRP1_DisableClockStopSleep
- APBSMENR1 I2C3SMEN LL_APB1_GRP1_DisableClockStopSleep
- APBSMENR1 OPAMPSMEN LL_APB1_GRP1_DisableClockStopSleep
- APBSMENR1 I2C4SMEN LL_APB1_GRP1_DisableClockStopSleep
- APBSMENR1 LPTIM3SMEN LL_APB1_GRP1_DisableClockStopSleep
- APBSMENR1 PWRSMEN LL_APB1_GRP1_DisableClockStopSleep
- APBSMENR1 DAC1SMEN LL_APB1_GRP1_DisableClockStopSleep
- APBSMENR1 LPTIM2SMEN LL_APB1_GRP1_DisableClockStopSleep
- APBSMENR1 LPTIM1SMEN LL_APB1_GRP1_DisableClockStopSleep

LL_APB1_GRP2_EnableClock

Function name

__STATIC_INLINE void LL_APB1_GRP2_EnableClock (uint32_t Periphs)

Function description

Enable APB1 GRP2 peripherals clock.

Parameters

- **Periphs:** This parameter can be a combination of the following values:
  - LL_APB1_GRP2_PERIPH_SYSCFG
  - LL_APB1_GRP2_PERIPH_COMP
  - LL_APB1_GRP2_PERIPH_VREFBUF
  - LL_APB1_GRP2_PERIPH_TIM1
  - LL_APB1_GRP2_PERIPH_SPI1
  - LL_APB1_GRP2_PERIPH_USART1
  - LL_APB1_GRP2_PERIPH_TIM15
  - LL_APB1_GRP2_PERIPH_TIM16
  - LL_APB1_GRP2_PERIPH_ADC

Return values

- **None:**

Reference Manual to LL API cross reference:

- APBENR2 SYSCFGEN LL_APB1_GRP2_EnableClock
- APBENR2 TIM1EN LL_APB1_GRP2_EnableClock
- APBENR2 SPI1EN LL_APB1_GRP2_EnableClock
- APBENR2 USART1EN LL_APB1_GRP2_EnableClock
- APBENR2 TIM15EN LL_APB1_GRP2_EnableClock
- APBENR2 TIM16EN LL_APB1_GRP2_EnableClock
- APBENR2 ADCEN LL_APB1_GRP2_EnableClock

LL_APB1_GRP2_IsEnabledClock

Function name

__STATIC_INLINE uint32_t LL_APB1_GRP2_IsEnabledClock (uint32_t Periphs)

Function description

Check if APB1 GRP2 peripheral clock is enabled or not.

Parameters

- **Periphs:** This parameter can be a combination of the following values:
  - LL_APB1_GRP2_PERIPH_SYSCFG
  - LL_APB1_GRP2_PERIPH_COMP
  - LL_APB1_GRP2_PERIPH_VREFBUF
  - LL_APB1_GRP2_PERIPH_TIM1
  - LL_APB1_GRP2_PERIPH_SPI1
  - LL_APB1_GRP2_PERIPH_USART1
  - LL_APB1_GRP2_PERIPH_TIM15
  - LL_APB1_GRP2_PERIPH_TIM16
  - LL_APB1_GRP2_PERIPH_ADC

Return values

- **State:** of Periphs (1 or 0).

Notes

- (*) peripheral not available on all devices

Reference Manual to LL API cross reference:

- APBENR2 SYSCFGEN LL_APB1_GRP2_IsEnabledClock
- APBENR2 TIM1EN LL_APB1_GRP2_IsEnabledClock
- APBENR2 SPI1EN LL_APB1_GRP2_IsEnabledClock
- APBENR2 USART1EN LL_APB1_GRP2_IsEnabledClock
- APBENR2 TIM15EN LL_APB1_GRP2_IsEnabledClock
- APBENR2 TIM16EN LL_APB1_GRP2_IsEnabledClock
- APBENR2 ADCEN LL_APB1_GRP2_IsEnabledClock

LL_APB1_GRP2_DisableClock

Function name

__STATIC_INLINE void LL_APB1_GRP2_DisableClock (uint32_t Periphs)

Function description

Disable APB1 GRP2 peripherals clock.

Parameters

- **Periphs:** This parameter can be a combination of the following values:
  - LL_APB1_GRP2_PERIPH_SYSCFG
  - LL_APB1_GRP2_PERIPH_VREFBUF
  - LL_APB1_GRP2_PERIPH_COMP
  - LL_APB1_GRP2_PERIPH_TIM1
  - LL_APB1_GRP2_PERIPH_SPI1
  - LL_APB1_GRP2_PERIPH_USART1
  - LL_APB1_GRP2_PERIPH_TIM15
  - LL_APB1_GRP2_PERIPH_TIM16
  - LL_APB1_GRP2_PERIPH_ADC

Return values

- **None:**

Notes

- (*) peripheral not available on all devices

Reference Manual to LL API cross reference:

- APBENR2 SYSCFGEN LL_APB1_GRP2_DisableClock
- APBENR2 TIM1EN LL_APB1_GRP2_DisableClock
- APBENR2 SPI1EN LL_APB1_GRP2_DisableClock
- APBENR2 USART1EN LL_APB1_GRP2_DisableClock
- APBENR2 TIM15EN LL_APB1_GRP2_DisableClock
- APBENR2 TIM16EN LL_APB1_GRP2_DisableClock
- APBENR2 ADCEN LL_APB1_GRP2_DisableClock

LL_APB1_GRP2_ForceReset

Function name

__STATIC_INLINE void LL_APB1_GRP2_ForceReset (uint32_t Periphs)

Function description

Force APB1_GRP2 peripherals reset.

Parameters

- **Periphs:** This parameter can be a combination of the following values:
  - LL_APB1_GRP2_PERIPH_ALL
  - LL_APB1_GRP2_PERIPH_SYSCFG
  - LL_APB1_GRP2_PERIPH_VREFBUF
  - LL_APB1_GRP2_PERIPH_COMP
  - LL_APB1_GRP2_PERIPH_TIM1
  - LL_APB1_GRP2_PERIPH_SPI1
  - LL_APB1_GRP2_PERIPH_USART1
  - LL_APB1_GRP2_PERIPH_TIM15
  - LL_APB1_GRP2_PERIPH_TIM16
  - LL_APB1_GRP2_PERIPH_ADC

Return values

- **None:**

Notes

- (*) peripheral not available on all devices

Reference Manual to LL API cross reference:

- APBRSTR2 SYSCFGRST LL_APB1_GRP2_ForceReset
- APBRSTR2 TIM1RST LL_APB1_GRP2_ForceReset
- APBRSTR2 SPI1RST LL_APB1_GRP2_ForceReset
- APBRSTR2 USART1RST LL_APB1_GRP2_ForceReset
- APBRSTR2 TIM15RST LL_APB1_GRP2_ForceReset
- APBRSTR2 TIM16RST LL_APB1_GRP2_ForceReset
- APBRSTR2 ADCRST LL_APB1_GRP2_ForceReset

LL_APB1_GRP2_ReleaseReset

Function name

__STATIC_INLINE void LL_APB1_GRP2_ReleaseReset (uint32_t Periphs)

Function description

Release APB1_GRP2 peripherals reset.

Parameters

- **Periphs:** This parameter can be a combination of the following values:
  - LL_APB1_GRP2_PERIPH_ALL
  - LL_APB1_GRP2_PERIPH_SYSCFG
  - LL_APB1_GRP2_PERIPH_VREFBUF
  - LL_APB1_GRP2_PERIPH_COMP
  - LL_APB1_GRP2_PERIPH_TIM1
  - LL_APB1_GRP2_PERIPH_SPI1
  - LL_APB1_GRP2_PERIPH_USART1
  - LL_APB1_GRP2_PERIPH_TIM15
  - LL_APB1_GRP2_PERIPH_TIM16
  - LL_APB1_GRP2_PERIPH_ADC

Return values

- **None:**

Notes

- (*) peripheral not available on all devices

Reference Manual to LL API cross reference:

- APBRSTR2 SYSCFGRST LL_APB1_GRP2_ReleaseReset
- APBRSTR2 TIM1RST LL_APB1_GRP2_ReleaseReset
- APBRSTR2 SPI1RST LL_APB1_GRP2_ReleaseReset
- APBRSTR2 USART1RST LL_APB1_GRP2_ReleaseReset
- APBRSTR2 TIM15RST LL_APB1_GRP2_ReleaseReset
- APBRSTR2 TIM16RST LL_APB1_GRP2_ReleaseReset
- APBRSTR2 ADCRST LL_APB1_GRP2_ReleaseReset

LL_APB1_GRP2_EnableClockStopSleep

Function name

__STATIC_INLINE void LL_APB1_GRP2_EnableClockStopSleep (uint32_t Periphs)

Function description

Enable APB1_GRP2 peripheral clocks in Sleep and Stop modes.

Parameters

- **Periphs:** This parameter can be a combination of the following values:
  - LL_APB1_GRP2_PERIPH_ALL
  - LL_APB1_GRP2_PERIPH_SYSCFG
  - LL_APB1_GRP2_PERIPH_VREFBUF
  - LL_APB1_GRP2_PERIPH_COMP
  - LL_APB1_GRP2_PERIPH_TIM1
  - LL_APB1_GRP2_PERIPH_SPI1
  - LL_APB1_GRP2_PERIPH_USART1
  - LL_APB1_GRP2_PERIPH_TIM15
  - LL_APB1_GRP2_PERIPH_TIM16
  - LL_APB1_GRP2_PERIPH_ADC

Return values

- **None:**

Notes

- (*) peripheral not available on all devices

Reference Manual to LL API cross reference:

- APBSMENR2 SYSCFGSMEN LL_APB1_GRP2_EnableClockStopSleep
- APBSMENR2 TIM1SMEN LL_APB1_GRP2_EnableClockStopSleep
- APBSMENR2 SPI1SMEN LL_APB1_GRP2_EnableClockStopSleep
- APBSMENR2 USART1SMEN LL_APB1_GRP2_EnableClockStopSleep
- APBSMENR2 TIM15SMEN LL_APB1_GRP2_EnableClockStopSleep
- APBSMENR2 TIM16SMEN LL_APB1_GRP2_EnableClockStopSleep
- APBSMENR2 ADCSMEN LL_APB1_GRP2_EnableClockStopSleep

LL_APB1_GRP2_DisableClockStopSleep

Function name

__STATIC_INLINE void LL_APB1_GRP2_DisableClockStopSleep (uint32_t Periphs)

Function description

Disable APB1_GRP2 peripheral clocks in Sleep and Stop modes.

Parameters

- **Periphs:** This parameter can be a combination of the following values:
  - LL_APB1_GRP2_PERIPH_ALL
  - LL_APB1_GRP2_PERIPH_SYSCFG
  - LL_APB1_GRP2_PERIPH_VREFBUF
  - LL_APB1_GRP2_PERIPH_COMP
  - LL_APB1_GRP2_PERIPH_TIM1
  - LL_APB1_GRP2_PERIPH_SPI1
  - LL_APB1_GRP2_PERIPH_USART1
  - LL_APB1_GRP2_PERIPH_TIM15
  - LL_APB1_GRP2_PERIPH_TIM16
  - LL_APB1_GRP2_PERIPH_ADC

Return values

- **None:**

Notes

- (*) peripheral not available on all devices

Reference Manual to LL API cross reference:

- APBSMENR2 SYSCFGSMEN LL_APB1_GRP2_DisableClockStopSleep
- APBSMENR2 TIM1SMEN LL_APB1_GRP2_DisableClockStopSleep
- APBSMENR2 SPI1SMEN LL_APB1_GRP2_DisableClockStopSleep
- APBSMENR2 USART1SMEN LL_APB1_GRP2_DisableClockStopSleep
- APBSMENR2 TIM15SMEN LL_APB1_GRP2_DisableClockStopSleep
- APBSMENR2 TIM16SMEN LL_APB1_GRP2_DisableClockStopSleep
- APBSMENR2 ADCSMEN LL_APB1_GRP2_DisableClockStopSleep

LL_APB1_DBG_EnableClock

Function name

__STATIC_INLINE void LL_APB1_DBG_EnableClock (void)

Function description

Enable APB1 DBG clock.

Return values

- **None:**

Reference Manual to LL API cross reference:

- DBGCFGR DBGEN LL_APB1_DBG_EnableClock

LL_APB1_DBG_IsEnabledClock

Function name

__STATIC_INLINE uint32_t LL_APB1_DBG_IsEnabledClock (void)

Function description

Check if APB1 DBG clock is enabled or not.

Return values

- **State:** of Periphs (1 or 0).

Reference Manual to LL API cross reference:

- DBGCFGR DBGEN LL_APB1_DBG_IsEnabledClock

LL_APB1_DBG_DisableClock

Function name

__STATIC_INLINE void LL_APB1_DBG_DisableClock (void)

Function description

Disable APB1 DBG peripherals clock.

Return values

- **None:**

Reference Manual to LL API cross reference:

- DBGCFGR DBGEN LL_APB1_DBG_DisableClock

LL_APB1_DBG_ForceReset

Function name

__STATIC_INLINE void LL_APB1_DBG_ForceReset (void)

Function description

Force APB1_DBG peripherals reset.

Return values

- **None:**

Reference Manual to LL API cross reference:

- DBGCFGR DBGRST LL_APB1_DBG_ForceReset

LL_APB1_DBG_ReleaseReset

Function name

__STATIC_INLINE void LL_APB1_DBG_ReleaseReset (void)

Function description

Release APB1_DBG peripherals reset.

Return values

- **None:**

Reference Manual to LL API cross reference:

- DBGCFGR DBGRST LL_APB1_DBG_ReleaseReset

LL_IOP_GRP1_EnableClock

Function name

__STATIC_INLINE void LL_IOP_GRP1_EnableClock (uint32_t Periphs)

Function description

Enable IOP peripherals clock.

Parameters

- **Periphs:** This parameter can be a combination of the following values:
  - LL_IOP_GRP1_PERIPH_GPIOA
  - LL_IOP_GRP1_PERIPH_GPIOB
  - LL_IOP_GRP1_PERIPH_GPIOC
  - LL_IOP_GRP1_PERIPH_GPIOD
  - LL_IOP_GRP1_PERIPH_GPIOF

Return values

- **None:**

Reference Manual to LL API cross reference:

- IOPENR GPIOAEN LL_IOP_GRP1_EnableClock
- IOPENR GPIOBEN LL_IOP_GRP1_EnableClock
- IOPENR GPIOCEN LL_IOP_GRP1_EnableClock
- IOPENR GPIODEN LL_IOP_GRP1_EnableClock
- IOPENR GPIOFEN LL_IOP_GRP1_EnableClock

LL_IOP_GRP1_IsEnabledClock

Function name

__STATIC_INLINE uint32_t LL_IOP_GRP1_IsEnabledClock (uint32_t Periphs)

Function description

Check if IOP peripheral clock is enabled or not.

Parameters

- **Periphs:** This parameter can be a combination of the following values:
  - LL_IOP_GRP1_PERIPH_GPIOA
  - LL_IOP_GRP1_PERIPH_GPIOB
  - LL_IOP_GRP1_PERIPH_GPIOC
  - LL_IOP_GRP1_PERIPH_GPIOD
  - LL_IOP_GRP1_PERIPH_GPIOF

Return values

- **State:** of Periphs (1 or 0).

Reference Manual to LL API cross reference:

- IOPENR GPIOAEN LL_IOP_GRP1_IsEnabledClock
- IOPENR GPIOBEN LL_IOP_GRP1_IsEnabledClock
- IOPENR GPIOCEN LL_IOP_GRP1_IsEnabledClock
- IOPENR GPIODEN LL_IOP_GRP1_IsEnabledClock
- IOPENR GPIOFEN LL_IOP_GRP1_IsEnabledClock

LL_IOP_GRP1_DisableClock

Function name

__STATIC_INLINE void LL_IOP_GRP1_DisableClock (uint32_t Periphs)

Function description

Disable IOP peripherals clock.

Parameters

- **Periphs:** This parameter can be a combination of the following values:
  - LL_IOP_GRP1_PERIPH_GPIOA
  - LL_IOP_GRP1_PERIPH_GPIOB
  - LL_IOP_GRP1_PERIPH_GPIOC
  - LL_IOP_GRP1_PERIPH_GPIOD
  - LL_IOP_GRP1_PERIPH_GPIOF

Return values

- **None:**

Reference Manual to LL API cross reference:

- IOPENR GPIOAEN LL_IOP_GRP1_DisableClock
- IOPENR GPIOBEN LL_IOP_GRP1_DisableClock
- IOPENR GPIOCEN LL_IOP_GRP1_DisableClock
- IOPENR GPIODEN LL_IOP_GRP1_DisableClock
- IOPENR GPIOFEN LL_IOP_GRP1_DisableClock

LL_IOP_GRP1_ForceReset

Function name

__STATIC_INLINE void LL_IOP_GRP1_ForceReset (uint32_t Periphs)

Function description

Disable IOP peripherals clock.

Parameters

- **Periphs:** This parameter can be a combination of the following values:
  - LL_IOP_GRP1_PERIPH_ALL
  - LL_IOP_GRP1_PERIPH_GPIOA
  - LL_IOP_GRP1_PERIPH_GPIOB
  - LL_IOP_GRP1_PERIPH_GPIOC
  - LL_IOP_GRP1_PERIPH_GPIOD
  - LL_IOP_GRP1_PERIPH_GPIOF

Return values

- **None:**

Reference Manual to LL API cross reference:

- IOPRSTR GPIOARST LL_IOP_GRP1_ForceReset
- IOPRSTR GPIOBRST LL_IOP_GRP1_ForceReset
- IOPRSTR GPIOCRST LL_IOP_GRP1_ForceReset
- IOPRSTR GPIODRST LL_IOP_GRP1_ForceReset
- IOPRSTR GPIOFRST LL_IOP_GRP1_ForceReset

LL_IOP_GRP1_ReleaseReset

Function name

__STATIC_INLINE void LL_IOP_GRP1_ReleaseReset (uint32_t Periphs)

Function description

Release IOP peripherals reset.

Parameters

- **Periphs:** This parameter can be a combination of the following values:
  - LL_IOP_GRP1_PERIPH_ALL
  - LL_IOP_GRP1_PERIPH_GPIOA
  - LL_IOP_GRP1_PERIPH_GPIOB
  - LL_IOP_GRP1_PERIPH_GPIOC
  - LL_IOP_GRP1_PERIPH_GPIOD
  - LL_IOP_GRP1_PERIPH_GPIOF

Return values

- **None:**

Reference Manual to LL API cross reference:

- IOPRSTR GPIOARST LL_IOP_GRP1_ReleaseReset
- IOPRSTR GPIOBRST LL_IOP_GRP1_ReleaseReset
- IOPRSTR GPIOCRST LL_IOP_GRP1_ReleaseReset
- IOPRSTR GPIODRST LL_IOP_GRP1_ReleaseReset
- IOPRSTR GPIOFRST LL_IOP_GRP1_ReleaseReset

LL_IOP_GRP1_EnableClockStopSleep

Function name

__STATIC_INLINE void LL_IOP_GRP1_EnableClockStopSleep (uint32_t Periphs)

Function description

Enable IOP peripheral clocks in Sleep and Stop modes.

Parameters

- **Periphs:** This parameter can be a combination of the following values:
  - LL_IOP_GRP1_PERIPH_GPIOA
  - LL_IOP_GRP1_PERIPH_GPIOB
  - LL_IOP_GRP1_PERIPH_GPIOC
  - LL_IOP_GRP1_PERIPH_GPIOD
  - LL_IOP_GRP1_PERIPH_GPIOF

Return values

- **None:**

Reference Manual to LL API cross reference:

- IOPSMENR GPIOASMEN LL_IOP_GRP1_EnableClockStopSleep
- IOPSMENR GPIOBSMEN LL_IOP_GRP1_EnableClockStopSleep
- IOPSMENR GPIOCSMEN LL_IOP_GRP1_EnableClockStopSleep
- IOPSMENR GPIODSMEN LL_IOP_GRP1_EnableClockStopSleep
- IOPSMENR GPIOFSMEN LL_IOP_GRP1_EnableClockStopSleep

LL_IOP_GRP1_DisableClockStopSleep

Function name

__STATIC_INLINE void LL_IOP_GRP1_DisableClockStopSleep (uint32_t Periphs)

Function description

Disable IOP peripheral clocks in Sleep and Stop modes.

Parameters

- **Periphs:** This parameter can be a combination of the following values:
  - LL_IOP_GRP1_PERIPH_GPIOA
  - LL_IOP_GRP1_PERIPH_GPIOB
  - LL_IOP_GRP1_PERIPH_GPIOC
  - LL_IOP_GRP1_PERIPH_GPIOD
  - LL_IOP_GRP1_PERIPH_GPIOF

Return values

- **None:**

Reference Manual to LL API cross reference:

- IOPSMENR GPIOASMEN LL_IOP_GRP1_DisableClockStopSleep
- IOPSMENR GPIOBSMEN LL_IOP_GRP1_DisableClockStopSleep
- IOPSMENR GPIOCSMEN LL_IOP_GRP1_DisableClockStopSleep
- IOPSMENR GPIODSMEN LL_IOP_GRP1_DisableClockStopSleep
- IOPSMENR GPIOFSMEN LL_IOP_GRP1_DisableClockStopSleep

56.2 BUS Firmware driver defines

The following section lists the various define and macros of the module.

56.2.1 BUS

BUS

AHB GRP1 PERIPH

LL_AHB1_GRP1_PERIPH_ALL

LL_AHB1_GRP1_PERIPH_DMA1

LL_AHB1_GRP1_PERIPH_DMA2

LL_AHB1_GRP1_PERIPH_FLASH

LL_AHB1_GRP1_PERIPH_CRC

LL_AHB1_GRP1_PERIPH_TSC

LL_AHB1_GRP1_PERIPH_AES

LL_AHB1_GRP1_PERIPH_RNG

LL_AHB1_GRP1_PERIPH_SRAM1

APB1 GRP1 PERIPH

LL_APB1_GRP1_PERIPH_ALL

LL_APB1_GRP1_PERIPH_TIM2

LL_APB1_GRP1_PERIPH_TIM3

LL_APB1_GRP1_PERIPH_TIM6

LL_APB1_GRP1_PERIPH_TIM7

LL_APB1_GRP1_PERIPH_LPUART2

LL_APB1_GRP1_PERIPH_LCD

LL_APB1_GRP1_PERIPH_RTCAPB

LL_APB1_GRP1_PERIPH_WWDG

LL_APB1_GRP1_PERIPH_LPUART3

LL_APB1_GRP1_PERIPH_USB

LL_APB1_GRP1_PERIPH_SPI2

LL_APB1_GRP1_PERIPH_SPI3

LL_APB1_GRP1_PERIPH_CRS

LL_APB1_GRP1_PERIPH_USART2

LL_APB1_GRP1_PERIPH_USART3

LL_APB1_GRP1_PERIPH_USART4

LL_APB1_GRP1_PERIPH_LPUART1

LL_APB1_GRP1_PERIPH_I2C1

LL_APB1_GRP1_PERIPH_I2C2

LL_APB1_GRP1_PERIPH_I2C3

LL_APB1_GRP1_PERIPH_OPAMP

LL_APB1_GRP1_PERIPH_I2C4

LL_APB1_GRP1_PERIPH_LPTIM3

LL_APB1_GRP1_PERIPH_PWR

LL_APB1_GRP1_PERIPH_DAC1

LL_APB1_GRP1_PERIPH_LPTIM2

LL_APB1_GRP1_PERIPH_LPTIM1

APB1 GRP2 PERIPH

LL_APB1_GRP2_PERIPH_ALL

LL_APB1_GRP2_PERIPH_SYSCFG

LL_APB1_GRP2_PERIPH_COMP

LL_APB1_GRP2_PERIPH_VREFBUF

LL_APB1_GRP2_PERIPH_TIM1

LL_APB1_GRP2_PERIPH_SPI1

LL_APB1_GRP2_PERIPH_USART1

LL_APB1_GRP2_PERIPH_TIM15

LL_APB1_GRP2_PERIPH_TIM16

LL_APB1_GRP2_PERIPH_ADC

IOP GRP1 PERIPH

LL_IOP_GRP1_PERIPH_ALL

LL_IOP_GRP1_PERIPH_GPIOA

LL_IOP_GRP1_PERIPH_GPIOB

LL_IOP_GRP1_PERIPH_GPIOC

LL_IOP_GRP1_PERIPH_GPIOD

LL_IOP_GRP1_PERIPH_GPIOE

LL_IOP_GRP1_PERIPH_GPIOF

57 LL COMP Generic Driver

57.1 COMP Firmware driver registers structures

57.1.1 LL_COMP_InitTypeDef

LL_COMP_InitTypeDef is defined in the stm32u0xx_ll_comp.h

Data Fields

- ***uint32_t PowerMode***
- ***uint32_t InputPlus***
- ***uint32_t InputMinus***
- ***uint32_t InputHysteresis***
- ***uint32_t OutputPolarity***
- ***uint32_t OutputBlankingSource***

Field Documentation

- ***uint32_t LL_COMP_InitTypeDef::PowerMode***
  Set comparator operating mode to adjust power and speed. This parameter can be a value of ***COMP_LL_EC_POWERMODE*** This feature can be modified afterwards using unitary function **LL_COMP_SetPowerMode()**.
- ***uint32_t LL_COMP_InitTypeDef::InputPlus***
  Set comparator input plus (non-inverting input). This parameter can be a value of ***COMP_LL_EC_INPUT_PLUS*** This feature can be modified afterwards using unitary function **LL_COMP_SetInputPlus()**.
- ***uint32_t LL_COMP_InitTypeDef::InputMinus***
  Set comparator input minus (inverting input). This parameter can be a value of ***COMP_LL_EC_INPUT_MINUS*** This feature can be modified afterwards using unitary function **LL_COMP_SetInputMinus()**.
- ***uint32_t LL_COMP_InitTypeDef::InputHysteresis***
  Set comparator hysteresis mode of the input minus. This parameter can be a value of ***COMP_LL_EC_INPUT_HYSTERESIS*** This feature can be modified afterwards using unitary function **LL_COMP_SetInputHysteresis()**.
- ***uint32_t LL_COMP_InitTypeDef::OutputPolarity***
  Set comparator output polarity. This parameter can be a value of ***COMP_LL_EC_OUTPUT_POLARITY*** This feature can be modified afterwards using unitary function **LL_COMP_SetOutputPolarity()**.
- ***uint32_t LL_COMP_InitTypeDef::OutputBlankingSource***
  Set comparator blanking source. This parameter can be a value of ***COMP_LL_EC_OUTPUT_BLANKING_SOURCE*** This feature can be modified afterwards using unitary function **LL_COMP_SetOutputBlankingSource()**.

57.2 COMP Firmware driver API description

The following section lists the various functions of the COMP library.

57.2.1 Detailed description of functions

LL_COMP_SetCommonWindowMode

Function name

__STATIC_INLINE void LL_COMP_SetCommonWindowMode (COMP_Common_TypeDef * COMPxy_COMMON, uint32_t WindowMode)

Function description

Set window mode of a pair of comparators instances (2 consecutive COMP instances COMP<x> and COMP<x+1>).

Parameters

- **COMPxy_COMMON:** Comparator common instance (can be set directly from CMSIS definition or by using helper macro __LL_COMP_COMMON_INSTANCE())
- **WindowMode:** This parameter can be one of the following values:
  - LL_COMP_WINDOWMODE_DISABLE
  - LL_COMP_WINDOWMODE_COMP1_INPUT_PLUS_COMMON
  - LL_COMP_WINDOWMODE_COMP2_INPUT_PLUS_COMMON

Return values

- **None:**

Reference Manual to LL API cross reference:

- CSR WINMODE LL_COMP_SetCommonWindowMode

LL_COMP_GetCommonWindowMode

Function name

__STATIC_INLINE uint32_t LL_COMP_GetCommonWindowMode (const COMP_Common_TypeDef * COMPxy_COMMON)

Function description

Get window mode of a pair of comparators instances (2 consecutive COMP instances COMP<x> and COMP<x+1>).

Parameters

- **COMPxy_COMMON:** Comparator common instance (can be set directly from CMSIS definition or by using helper macro __LL_COMP_COMMON_INSTANCE())

Return values

- **Returned:** value can be one of the following values:
  - LL_COMP_WINDOWMODE_DISABLE
  - LL_COMP_WINDOWMODE_COMP1_INPUT_PLUS_COMMON
  - LL_COMP_WINDOWMODE_COMP2_INPUT_PLUS_COMMON

Reference Manual to LL API cross reference:

- CSR WINMODE LL_COMP_GetCommonWindowMode

LL_COMP_SetCommonWindowOutput

Function name

__STATIC_INLINE void LL_COMP_SetCommonWindowOutput (COMP_Common_TypeDef * COMPxy_COMMON, uint32_t WindowOutput)

Function description

Set window output of a pair of comparators instances (2 consecutive COMP instances COMP<x> and COMP<x+1>).

Parameters

- **COMPxy_COMMON:** Comparator common instance (can be set directly from CMSIS definition or by using helper macro __LL_COMP_COMMON_INSTANCE())
- **WindowOutput:** This parameter can be one of the following values:
  - LL_COMP_WINDOWOUTPUT_EACH_COMP
  - LL_COMP_WINDOWOUTPUT_COMP1
  - LL_COMP_WINDOWOUTPUT_COMP2

Return values

- **None:**

Reference Manual to LL API cross reference:

- CSR WINOUT LL_COMP_SetCommonWindowOutput

LL_COMP_GetCommonWindowOutput

Function name

__STATIC_INLINE uint32_t LL_COMP_GetCommonWindowOutput (const COMP_Common_TypeDef * COMPxy_COMMON)

Function description

Get window output of a pair of comparators instances (2 consecutive COMP instances COMP<x> and COMP<x+1>).

Parameters

- **COMPxy_COMMON:** Comparator common instance (can be set directly from CMSIS definition or by using helper macro __LL_COMP_COMMON_INSTANCE())

Return values

- **Returned:** value can be one of the following values:
  - LL_COMP_WINDOWOUTPUT_EACH_COMP
  - LL_COMP_WINDOWOUTPUT_COMP1
  - LL_COMP_WINDOWOUTPUT_COMP2

Reference Manual to LL API cross reference:

- CSR WINMODE LL_COMP_GetCommonWindowOutput

LL_COMP_SetPowerMode

Function name

__STATIC_INLINE void LL_COMP_SetPowerMode (COMP_TypeDef * COMPx, uint32_t PowerMode)

Function description

Set comparator instance operating mode to adjust power and speed.

Parameters

- **COMPx:** Comparator instance
- **PowerMode:** This parameter can be one of the following values:
  - LL_COMP_POWERMODE_HIGHSPEED
  - LL_COMP_POWERMODE_MEDIUMSPEED

Return values

- **None:**

Reference Manual to LL API cross reference:

- CSR PWRMODE LL_COMP_SetPowerMode

LL_COMP_GetPowerMode

Function name

__STATIC_INLINE uint32_t LL_COMP_GetPowerMode (const COMP_TypeDef * COMPx)

Function description

Get comparator instance operating mode to adjust power and speed.

Parameters

- **COMPx:** Comparator instance

Return values

- **Returned:** value can be one of the following values:
  - LL_COMP_POWERMODE_HIGHSPEED
  - LL_COMP_POWERMODE_MEDIUMSPEED

Reference Manual to LL API cross reference:

- CSR PWRMODE LL_COMP_GetPowerMode

LL_COMP_ConfigInputs

Function name

__STATIC_INLINE void LL_COMP_ConfigInputs (COMP_TypeDef * COMPx, uint32_t InputMinus, uint32_t InputPlus)

Function description

Set comparator inputs minus (inverting) and plus (non-inverting).

Parameters

- **COMPx:** Comparator instance
- **InputMinus:** This parameter can be one of the following values:
  - LL_COMP_INPUT_MINUS_1_4VREFINT
  - LL_COMP_INPUT_MINUS_1_2VREFINT
  - LL_COMP_INPUT_MINUS_3_4VREFINT
  - LL_COMP_INPUT_MINUS_VREFINT
  - LL_COMP_INPUT_MINUS_DAC1_CH1
  - LL_COMP_INPUT_MINUS_IO1
  - LL_COMP_INPUT_MINUS_IO2
  - LL_COMP_INPUT_MINUS_IO3
  - LL_COMP_INPUT_MINUS_IO4
  - LL_COMP_INPUT_MINUS_IO5
- **InputPlus:** This parameter can be one of the following values:
  - LL_COMP_INPUT_PLUS_IO1
  - LL_COMP_INPUT_PLUS_IO2
  - LL_COMP_INPUT_PLUS_IO3
  - LL_COMP_INPUT_PLUS_IO4
  - LL_COMP_INPUT_PLUS_IO5 (1)

  (1) Available only on COMP instance: COMP1.

Return values

- **None:**

Notes

- In case of comparator input selected to be connected to IO: GPIO pins are specific to each comparator instance. Refer to description of parameters or to reference manual.
- On this STM32 series, a voltage scaler is used when COMP input is based on VrefInt (VrefInt or subdivision of VrefInt): Voltage scaler requires a delay for voltage stabilization. Refer to device datasheet, parameter "tSTART_SCALER".

Reference Manual to LL API cross reference:

- CSR INMSEL LL_COMP_ConfigInputs
- CSR INPSEL LL_COMP_ConfigInputs
-

LL_COMP_SetInputPlus

Function name

__STATIC_INLINE void LL_COMP_SetInputPlus (COMP_TypeDef * COMPx, uint32_t InputPlus)

Function description

Set comparator input plus (non-inverting).

Parameters

- **COMPx:** Comparator instance
- **InputPlus:** This parameter can be one of the following values:
  - LL_COMP_INPUT_PLUS_IO1
  - LL_COMP_INPUT_PLUS_IO2
  - LL_COMP_INPUT_PLUS_IO3
  - LL_COMP_INPUT_PLUS_IO4
  - LL_COMP_INPUT_PLUS_IO5 (1)

  (1) Available only on COMP instance: COMP1.

Return values

- **None:**

Notes

- In case of comparator input selected to be connected to IO: GPIO pins are specific to each comparator instance. Refer to description of parameters or to reference manual.

Reference Manual to LL API cross reference:

- CSR INPSEL LL_COMP_SetInputPlus

LL_COMP_GetInputPlus

Function name

__STATIC_INLINE uint32_t LL_COMP_GetInputPlus (const COMP_TypeDef * COMPx)

Function description

Get comparator input plus (non-inverting).

Parameters

- **COMPx:** Comparator instance

Return values

- **Returned:** value can be one of the following values:
  - LL_COMP_INPUT_PLUS_IO1
  - LL_COMP_INPUT_PLUS_IO2
  - LL_COMP_INPUT_PLUS_IO3
  - LL_COMP_INPUT_PLUS_IO4
  - LL_COMP_INPUT_PLUS_IO5 (1)

  (1) Available only on COMP instance: COMP1.

Notes

- In case of comparator input selected to be connected to IO: GPIO pins are specific to each comparator instance. Refer to description of parameters or to reference manual.

Reference Manual to LL API cross reference:

- CSR INPSEL LL_COMP_GetInputPlus

LL_COMP_SetInputMinus

Function name

__STATIC_INLINE void LL_COMP_SetInputMinus (COMP_TypeDef * COMPx, uint32_t InputMinus)

Function description

Set comparator input minus (inverting).

Parameters

- **COMPx:** Comparator instance
- **InputMinus:** This parameter can be one of the following values:
  - LL_COMP_INPUT_MINUS_1_4VREFINT
  - LL_COMP_INPUT_MINUS_1_2VREFINT
  - LL_COMP_INPUT_MINUS_3_4VREFINT
  - LL_COMP_INPUT_MINUS_VREFINT
  - LL_COMP_INPUT_MINUS_DAC1_CH1
  - LL_COMP_INPUT_MINUS_IO1
  - LL_COMP_INPUT_MINUS_IO2
  - LL_COMP_INPUT_MINUS_IO3
  - LL_COMP_INPUT_MINUS_IO4
  - LL_COMP_INPUT_MINUS_IO5

Return values

- **None:**

Notes

- In case of comparator input selected to be connected to IO: GPIO pins are specific to each comparator instance. Refer to description of parameters or to reference manual.
- On this STM32 series, a voltage scaler is used when COMP input is based on VrefInt (VrefInt or subdivision of VrefInt): Voltage scaler requires a delay for voltage stabilization. Refer to device datasheet, parameter "tSTART_SCALER".

Reference Manual to LL API cross reference:

- CSR INMSEL LL_COMP_SetInputMinus

LL_COMP_GetInputMinus

Function name

__STATIC_INLINE uint32_t LL_COMP_GetInputMinus (const COMP_TypeDef * COMPx)

Function description

Get comparator input minus (inverting).

Parameters

- **COMPx:** Comparator instance

Return values

- **Returned:** value can be one of the following values:
  - LL_COMP_INPUT_MINUS_1_4VREFINT
  - LL_COMP_INPUT_MINUS_1_2VREFINT
  - LL_COMP_INPUT_MINUS_3_4VREFINT
  - LL_COMP_INPUT_MINUS_VREFINT
  - LL_COMP_INPUT_MINUS_DAC1_CH1
  - LL_COMP_INPUT_MINUS_IO4
  - LL_COMP_INPUT_MINUS_IO5

Notes

- In case of comparator input selected to be connected to IO: GPIO pins are specific to each comparator instance. Refer to description of parameters or to reference manual.

Reference Manual to LL API cross reference:

- CSR INMSEL LL_COMP_GetInputMinus

LL_COMP_SetInputHysteresis

Function name

__STATIC_INLINE void LL_COMP_SetInputHysteresis (COMP_TypeDef * COMPx, uint32_t InputHysteresis)

Function description

Set comparator instance hysteresis mode of the input minus (inverting input).

Parameters

- **COMPx:** Comparator instance
- **InputHysteresis:** This parameter can be one of the following values:
  - LL_COMP_HYSTERESIS_NONE
  - LL_COMP_HYSTERESIS_LOW
  - LL_COMP_HYSTERESIS_MEDIUM
  - LL_COMP_HYSTERESIS_HIGH

Return values

- **None:**

Reference Manual to LL API cross reference:

- CSR HYST LL_COMP_SetInputHysteresis

LL_COMP_GetInputHysteresis

Function name

__STATIC_INLINE uint32_t LL_COMP_GetInputHysteresis (const COMP_TypeDef * COMPx)

Function description

Get comparator instance hysteresis mode of the minus (inverting) input.

Parameters

- **COMPx:** Comparator instance

Return values

- **Returned:** value can be one of the following values:
  - LL_COMP_HYSTERESIS_NONE
  - LL_COMP_HYSTERESIS_LOW
  - LL_COMP_HYSTERESIS_MEDIUM
  - LL_COMP_HYSTERESIS_HIGH

Reference Manual to LL API cross reference:

- CSR HYST LL_COMP_GetInputHysteresis

LL_COMP_SetOutputPolarity

Function name

__STATIC_INLINE void LL_COMP_SetOutputPolarity (COMP_TypeDef * COMPx, uint32_t OutputPolarity)

Function description

Set comparator instance output polarity.

Parameters

- **COMPx:** Comparator instance
- **OutputPolarity:** This parameter can be one of the following values:
  - LL_COMP_OUTPUTPOL_NONINVERTED
  - LL_COMP_OUTPUTPOL_INVERTED

Return values

- **None:**

Reference Manual to LL API cross reference:

- CSR POLARITY LL_COMP_SetOutputPolarity

LL_COMP_GetOutputPolarity

Function name

__STATIC_INLINE uint32_t LL_COMP_GetOutputPolarity (const COMP_TypeDef * COMPx)

Function description

Get comparator instance output polarity.

Parameters

- **COMPx:** Comparator instance

Return values

- **Returned:** value can be one of the following values:
  - LL_COMP_OUTPUTPOL_NONINVERTED
  - LL_COMP_OUTPUTPOL_INVERTED

Reference Manual to LL API cross reference:

- CSR POLARITY LL_COMP_GetOutputPolarity

LL_COMP_SetOutputBlankingSource

Function name

__STATIC_INLINE void LL_COMP_SetOutputBlankingSource (COMP_TypeDef * COMPx, uint32_t BlankingSource)

Function description

Set comparator instance blanking source.

Parameters

- **COMPx:** Comparator instance
- **BlankingSource:** This parameter can be one of the following values:
  - LL_COMP_BLANKINGSRC_NONE
  - LL_COMP_BLANKINGSRC_TIM1_OC4 (1)
  - LL_COMP_BLANKINGSRC_TIM1_OC5 (1)
  - LL_COMP_BLANKINGSRC_TIM2_OC3 (1)
  - LL_COMP_BLANKINGSRC_TIM3_OC3 (1)
  - LL_COMP_BLANKINGSRC_TIM15_OC2 (1)

  (1) Parameter availability depending on timer availability on the selected device.

Return values

- **None:**

Notes

- Blanking source may be specific to each comparator instance. Refer to description of parameters or to reference manual.
- Availability of parameters of blanking source from timer depends on timers availability on the selected device.

Reference Manual to LL API cross reference:

- CSR BLANKING LL_COMP_SetOutputBlankingSource

LL_COMP_GetOutputBlankingSource

Function name

__STATIC_INLINE uint32_t LL_COMP_GetOutputBlankingSource (const COMP_TypeDef * COMPx)

Function description

Get comparator instance blanking source.

Parameters

- **COMPx:** Comparator instance

Return values

- **Returned:** value can be one of the following values:
  - LL_COMP_BLANKINGSRC_NONE
  - LL_COMP_BLANKINGSRC_TIM1_OC4 (1)
  - LL_COMP_BLANKINGSRC_TIM1_OC5 (1)
  - LL_COMP_BLANKINGSRC_TIM2_OC3 (1)
  - LL_COMP_BLANKINGSRC_TIM3_OC3 (1)
  - LL_COMP_BLANKINGSRC_TIM15_OC2 (1)

  (1) Parameter availability depending on timer availability on the selected device.

Notes

- Availability of parameters of blanking source from timer depends on timers availability on the selected device.
- Blanking source may be specific to each comparator instance. Refer to description of parameters or to reference manual.

Reference Manual to LL API cross reference:

- CSR BLANKING LL_COMP_GetOutputBlankingSource

LL_COMP_Enable

Function name

__STATIC_INLINE void LL_COMP_Enable (COMP_TypeDef * COMPx)

Function description

Enable comparator instance.

Parameters

- **COMPx:** Comparator instance

Return values

- **None:**

Notes

- After enable from off state, comparator requires a delay to reach reach propagation delay specification. Refer to device datasheet, parameter "tSTART".

Reference Manual to LL API cross reference:

- CSR EN LL_COMP_Enable

LL_COMP_Disable

Function name

__STATIC_INLINE void LL_COMP_Disable (COMP_TypeDef * COMPx)

Function description

Disable comparator instance.

Parameters

- **COMPx:** Comparator instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CSR EN LL_COMP_Disable

LL_COMP_IsEnabled

Function name

__STATIC_INLINE uint32_t LL_COMP_IsEnabled (const COMP_TypeDef * COMPx)

Function description

Get comparator enable state (0: COMP is disabled, 1: COMP is enabled)

Parameters

- **COMPx:** Comparator instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CSR EN LL_COMP_IsEnabled

LL_COMP_Lock

Function name

__STATIC_INLINE void LL_COMP_Lock (COMP_TypeDef * COMPx)

Function description

Lock comparator instance.

Parameters

- **COMPx:** Comparator instance

Return values

- **None:**

Notes

- Once locked, comparator configuration can be accessed in read-only.
- The only way to unlock the comparator is a device hardware reset.

Reference Manual to LL API cross reference:

- CSR LOCK LL_COMP_Lock

LL_COMP_IsLocked

Function name

__STATIC_INLINE uint32_t LL_COMP_IsLocked (const COMP_TypeDef * COMPx)

Function description

Get comparator lock state (0: COMP is unlocked, 1: COMP is locked).

Parameters

- **COMPx:** Comparator instance

Return values

- **State:** of bit (1 or 0).

Notes

- Once locked, comparator configuration can be accessed in read-only.
- The only way to unlock the comparator is a device hardware reset.

Reference Manual to LL API cross reference:

- CSR LOCK LL_COMP_IsLocked

LL_COMP_ReadOutputLevel

Function name

__STATIC_INLINE uint32_t LL_COMP_ReadOutputLevel (const COMP_TypeDef * COMPx)

Function description

Read comparator instance output level.

Parameters

- **COMPx:** Comparator instance

Return values

- **Returned:** value can be one of the following values:
  - LL_COMP_OUTPUT_LEVEL_LOW
  - LL_COMP_OUTPUT_LEVEL_HIGH

Notes

- The comparator output level depends on the selected polarity (Refer to function LL_COMP_SetOutputPolarity()). If the comparator polarity is not inverted: Comparator output is low when the input plus is at a lower voltage than the input minusComparator output is high when the input plus is at a higher voltage than the input minus If the comparator polarity is inverted:Comparator output is high when the input plus is at a lower voltage than the input minusComparator output is low when the input plus is at a higher voltage than the input minus

Reference Manual to LL API cross reference:

- CSR VALUE LL_COMP_ReadOutputLevel

LL_COMP_DeInit

Function name

ErrorStatus LL_COMP_DeInit (COMP_TypeDef * COMPx)

Function description

De-initialize registers of the selected COMP instance to their default reset values.

Parameters

- **COMPx:** COMP instance

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: COMP registers are de-initialized
  - ERROR: COMP registers are not de-initialized

Notes

- If comparator is locked, de-initialization by software is not possible. The only way to unlock the comparator is a device hardware reset.

LL_COMP_Init

Function name

ErrorStatus LL_COMP_Init (COMP_TypeDef * COMPx, const LL_COMP_InitTypeDef * COMP_InitStruct)

Function description

Initialize some features of COMP instance.

Parameters

- **COMPx:** COMP instance
- **COMP_InitStruct:** Pointer to a LL_COMP_InitTypeDef structure

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: COMP registers are initialized
  - ERROR: COMP registers are not initialized

Notes

- This function configures features of the selected COMP instance. Some features are also available at scope COMP common instance (common to several COMP instances). Refer to functions having argument "COMPxy_COMMON" as parameter.

LL_COMP_StructInit

Function name

void LL_COMP_StructInit (LL_COMP_InitTypeDef * COMP_InitStruct)

Function description

Set each LL_COMP_InitTypeDef field to default value.

Parameters

- **COMP_InitStruct:** Pointer to a LL_COMP_InitTypeDef structure whose fields will be set to default values.

Return values

- **None:**

57.3 COMP Firmware driver defines

The following section lists the various define and macros of the module.

57.3.1 COMP

COMP

Comparator common modes - Window mode

LL_COMP_WINDOWMODE_DISABLE

Window mode disable: Comparators 1 and 2 are independent

LL_COMP_WINDOWMODE_COMP1_INPUT_PLUS_COMMON

Window mode enable: Comparators instances pair COMP1 and COMP2 have their input plus connected together. The common input is COMP1 input plus (COMP2 input plus is no more accessible).

LL_COMP_WINDOWMODE_COMP2_INPUT_PLUS_COMMON

Window mode enable: if used from COMP1 or COMP2 instance, comparators instances pair COMP1 and COMP2 have their input plus connected together, the common input is COMP2 input plus (COMP1 input plus is no more accessible).

Comparator common modes - Window output

LL_COMP_WINDOWOUTPUT_EACH_COMP

Window output default mode: Comparators output are indicating each their own state. To know window mode state: each comparator output must be read, if "((COMPx exclusive or COMPy) == 1)" then monitored signal is within comparators window. The same way, if both comparators output are high, then monitored signal is below window.

LL_COMP_WINDOWOUTPUT_COMP1

Window output synthesized on COMP1 output: COMP1 output is no more indicating its own state, but global window mode state (logical high means monitored signal is within comparators window). Note: impacts only comparator output signal level (COMPx_OUT propagated to GPIO, EXTI lines, timers, ...), does not impact output digital state of comparator (COMPx_VALUE) always reflecting each comparator output state.

LL_COMP_WINDOWOUTPUT_COMP2

Window output synthesized on COMP2 output: COMP2 output is no more indicating its own state, but global window mode state (logical high means monitored signal is within comparators window). Note: impacts only comparator output signal level (COMPx_OUT propagated to GPIO, EXTI lines, timers, ...), does not impact output digital state of comparator (COMPx_VALUE) always reflecting each comparator output state.

LL_COMP_WINDOWOUTPUT_BOTH

Window output synthesized on both comparators output of pair of comparator selected (COMP1 and COMP2): both comparators outputs are no more indicating their own state, but global window mode state (logical high means monitored signal is within comparators window). This is a specific configuration (technically possible but not relevant from application point of view: 2 comparators output used for the same signal level), standard configuration for window mode is one of the settings above.

Definitions of COMP hardware constraints delays

LL_COMP_DELAY_STARTUP_US

Delay for COMP startup time

LL_COMP_DELAY_VOLTAGE_SCALER_STAB_US

Delay for COMP voltage scaler stabilization time

Comparator input - Hysteresis

LL_COMP_HYSTERESIS_NONE

No hysteresis

LL_COMP_HYSTERESIS_LOW

Hysteresis level low

LL_COMP_HYSTERESIS_MEDIUM

Hysteresis level medium

LL_COMP_HYSTERESIS_HIGH

Hysteresis level high

Comparator inputs - Input minus (input inverting) selection

LL_COMP_INPUT_MINUS_1_4VREFINT

Comparator input minus connected to 1/4 VrefInt

LL_COMP_INPUT_MINUS_1_2VREFINT

Comparator input minus connected to 1/2 VrefInt

LL_COMP_INPUT_MINUS_3_4VREFINT

Comparator input minus connected to 3/4 VrefInt

LL_COMP_INPUT_MINUS_VREFINT

Comparator input minus connected to VrefInt

LL_COMP_INPUT_MINUS_DAC1_CH1

Comparator input minus connected to DAC1 channel 1 (DAC_OUT1)

LL_COMP_INPUT_MINUS_IO1

Comparator input minus connected to IO1 (pin PC4 for COMP1, pin PB7 for COMP2)

LL_COMP_INPUT_MINUS_IO2

Comparator input minus connected to IO2 (pin PB1 for COMP1, pin PB3 for COMP2)

LL_COMP_INPUT_MINUS_IO3

Comparator input minus connected to IO3 (pin PA0 for COMP1, pin PA2 for COMP2)

LL_COMP_INPUT_MINUS_IO4

Comparator input minus connected to IO4 (pin PA4 for COMP1, pin PA4 for COMP2)

LL_COMP_INPUT_MINUS_IO5

Comparator input minus connected to IO5 (pin PA5 for COMP1, pin PA5 for COMP2)

Comparator inputs - Input plus (input non-inverting) selection

LL_COMP_INPUT_PLUS_IO1

Comparator input plus connected to IO1 (pin PC5 for COMP1, pin PB4 for COMP2)

LL_COMP_INPUT_PLUS_IO2

Comparator input plus connected to IO2 (pin PB2 for COMP1, pin PB6 for COMP2)

LL_COMP_INPUT_PLUS_IO3

Comparator input plus connected to IO3 (pin PA1 for COMP1, pin PA3 for COMP2)

LL_COMP_INPUT_PLUS_IO4

Comparator input plus connected to IO4 (pin PA9 for COMP1, pin PD10 for COMP2)

LL_COMP_INPUT_PLUS_IO5

Comparator input plus connected to IO5 (pin PC6 for COMP1)

Comparator output - Blanking source

LL_COMP_BLANKINGSRC_NONE

Comparator output without blanking

LL_COMP_BLANKINGSRC_TIM1_OC4

Comparator output blanking source TIM1 OC4 (common to all COMP instances: COMP1, COMP2)

LL_COMP_BLANKINGSRC_TIM1_OC5

Comparator output blanking source TIM1 OC5 (common to all COMP instances: COMP1, COMP2)

LL_COMP_BLANKINGSRC_TIM2_OC3

Comparator output blanking source TIM2 OC3 (common to all COMP instances: COMP1, COMP2)

LL_COMP_BLANKINGSRC_TIM3_OC3

Comparator output blanking source TIM3 OC3 (common to all COMP instances: COMP1, COMP2)

LL_COMP_BLANKINGSRC_TIM15_OC2

Comparator output blanking source TIM15 OC2 (common to all COMP instances: COMP1, COMP2)

Comparator output - Output level

LL_COMP_OUTPUT_LEVEL_LOW

Comparator output level low (if the polarity is not inverted, otherwise to be complemented)

LL_COMP_OUTPUT_LEVEL_HIGH

Comparator output level high (if the polarity is not inverted, otherwise to be complemented)

Comparator output - Output polarity

LL_COMP_OUTPUTPOL_NONINVERTED

COMP output polarity is not inverted: comparator output is high when the plus (non-inverting) input is at a higher voltage than the minus (inverting) input

LL_COMP_OUTPUTPOL_INVERTED

COMP output polarity is inverted: comparator output is low when the plus (non-inverting) input is at a lower voltage than the minus (inverting) input

Comparator modes - Power mode

LL_COMP_POWERMODE_HIGHSPEED

COMP power mode to high speed

LL_COMP_POWERMODE_MEDIUMSPEED

COMP power mode to medium speed

LL_COMP_POWERMODE_ULTRALOWPOWER

COMP power mode to ultra-low power

COMP helper macro

__LL_COMP_COMMON_INSTANCE

Description:

- Helper macro to select the COMP common instance to which is belonging the selected COMP instance.

Parameters:

- __COMPx__: COMP instance

Return value:

- COMP: common instance or value "0" if there is no COMP common instance.

Notes:

- COMP common register instance can be used to set parameters common to several COMP instances. Refer to functions having argument "COMPxy_COMMON" as parameter.

Common write and read registers macro

LL_COMP_WriteReg

Description:

- Write a value in COMP register.

Parameters:

- __INSTANCE__: comparator instance
- __REG__: Register to be written
- __VALUE__: Value to be written in the register

Return value:

- None

LL_COMP_ReadReg

Description:

- Read a value in COMP register.

Parameters:

- __INSTANCE__: comparator instance
- __REG__: Register to be read

Return value:

- Register: value

58 LL CORTEX Generic Driver

58.1 CORTEX Firmware driver API description

The following section lists the various functions of the CORTEX library.

58.1.1 Detailed description of functions

LL_SYSTICK_IsActiveCounterFlag

Function name

__STATIC_INLINE uint32_t LL_SYSTICK_IsActiveCounterFlag (void)

Function description

This function checks if the Systick counter flag is active or not.

Return values

- **State:** of bit (1 or 0).

Notes

- It can be used in timeout function on application side.

Reference Manual to LL API cross reference:

- STK_CTRL COUNTFLAG LL_SYSTICK_IsActiveCounterFlag

LL_SYSTICK_SetClkSource

Function name

__STATIC_INLINE void LL_SYSTICK_SetClkSource (uint32_t Source)

Function description

Configures the SysTick clock source.

Parameters

- **Source:** This parameter can be one of the following values:
  - LL_SYSTICK_CLKSOURCE_HCLK_DIV8
  - LL_SYSTICK_CLKSOURCE_HCLK

Return values

- **None:**

Reference Manual to LL API cross reference:

- STK_CTRL CLKSOURCE LL_SYSTICK_SetClkSource

LL_SYSTICK_GetClkSource

Function name

__STATIC_INLINE uint32_t LL_SYSTICK_GetClkSource (void)

Function description

Get the SysTick clock source.

Return values

- **Returned:** value can be one of the following values:
  - LL_SYSTICK_CLKSOURCE_HCLK_DIV8
  - LL_SYSTICK_CLKSOURCE_HCLK

Reference Manual to LL API cross reference:

- STK_CTRL CLKSOURCE LL_SYSTICK_GetClkSource

LL_SYSTICK_EnableIT

Function name

__STATIC_INLINE void LL_SYSTICK_EnableIT (void)

Function description

Enable SysTick exception request.

Return values

- **None:**

Reference Manual to LL API cross reference:

- STK_CTRL TICKINT LL_SYSTICK_EnableIT

LL_SYSTICK_DisableIT

Function name

__STATIC_INLINE void LL_SYSTICK_DisableIT (void)

Function description

Disable SysTick exception request.

Return values

- **None:**

Reference Manual to LL API cross reference:

- STK_CTRL TICKINT LL_SYSTICK_DisableIT

LL_SYSTICK_IsEnabledIT

Function name

__STATIC_INLINE uint32_t LL_SYSTICK_IsEnabledIT (void)

Function description

Checks if the SYSTICK interrupt is enabled or disabled.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- STK_CTRL TICKINT LL_SYSTICK_IsEnabledIT

LL_LPM_EnableSleep

Function name

__STATIC_INLINE void LL_LPM_EnableSleep (void)

Function description

Processor uses sleep as its low power mode.

Return values

- **None:**

Reference Manual to LL API cross reference:

- SCB_SCR SLEEPDEEP LL_LPM_EnableSleep

LL_LPM_EnableDeepSleep

Function name

__STATIC_INLINE void LL_LPM_EnableDeepSleep (void)

Function description

Processor uses deep sleep as its low power mode.

Return values

- **None:**

Reference Manual to LL API cross reference:

- SCB_SCR SLEEPDEEP LL_LPM_EnableDeepSleep

LL_LPM_EnableSleepOnExit

Function name

__STATIC_INLINE void LL_LPM_EnableSleepOnExit (void)

Function description

Configures sleep-on-exit when returning from Handler mode to Thread mode.

Return values

- **None:**

Notes

- Setting this bit to 1 enables an interrupt-driven application to avoid returning to an empty main application.

Reference Manual to LL API cross reference:

- SCB_SCR SLEEPONEXIT LL_LPM_EnableSleepOnExit

LL_LPM_DisableSleepOnExit

Function name

__STATIC_INLINE void LL_LPM_DisableSleepOnExit (void)

Function description

Do not sleep when returning to Thread mode.

Return values

- **None:**

Reference Manual to LL API cross reference:

- SCB_SCR SLEEPONEXIT LL_LPM_DisableSleepOnExit

LL_LPM_EnableEventOnPend

Function name

__STATIC_INLINE void LL_LPM_EnableEventOnPend (void)

Function description

Enabled events and all interrupts, including disabled interrupts, can wakeup the processor.

Return values

- **None:**

Reference Manual to LL API cross reference:

- SCB_SCR SEVEONPEND LL_LPM_EnableEventOnPend

LL_LPM_DisableEventOnPend

Function name

__STATIC_INLINE void LL_LPM_DisableEventOnPend (void)

Function description

Only enabled interrupts or events can wakeup the processor, disabled interrupts are excluded.

Return values

- **None:**

Reference Manual to LL API cross reference:

- SCB_SCR SEVEONPEND LL_LPM_DisableEventOnPend

LL_CPUID_GetImplementer

Function name

__STATIC_INLINE uint32_t LL_CPUID_GetImplementer (void)

Function description

Get Implementer code.

Return values

- **Value:** should be equal to 0x41 for ARM

Reference Manual to LL API cross reference:

- SCB_CPUID IMPLEMENTER LL_CPUID_GetImplementer

LL_CPUID_GetVariant

Function name

__STATIC_INLINE uint32_t LL_CPUID_GetVariant (void)

Function description

Get Variant number (The r value in the rnpn product revision identifier)

Return values

- **Value:** between 0 and 255 (0x0: revision 0)

Reference Manual to LL API cross reference:

- SCB_CPUID VARIANT LL_CPUID_GetVariant

LL_CPUID_GetArchitecture

Function name

__STATIC_INLINE uint32_t LL_CPUID_GetArchitecture (void)

Function description

Get Architecture number.

Return values

- **Value:** should be equal to 0xC for Cortex-M0+ devices

Reference Manual to LL API cross reference:

- SCB_CPUID ARCHITECTURE LL_CPUID_GetArchitecture

LL_CPUID_GetParNo

Function name

__STATIC_INLINE uint32_t LL_CPUID_GetParNo (void)

Function description

Get Part number.

Return values

- **Value:** should be equal to 0xC60 for Cortex-M0+

Reference Manual to LL API cross reference:

- SCB_CPUID PARTNO LL_CPUID_GetParNo

LL_CPUID_GetRevision

Function name

__STATIC_INLINE uint32_t LL_CPUID_GetRevision (void)

Function description

Get Revision number (The p value in the rnpn product revision identifier, indicates patch release)

Return values

- **Value:** between 0 and 255 (0x1: patch 1)

Reference Manual to LL API cross reference:

- SCB_CPUID REVISION LL_CPUID_GetRevision

LL_MPU_Enable

Function name

__STATIC_INLINE void LL_MPU_Enable (uint32_t Options)

Function description

Enable MPU with input options.

Parameters

- **Options:** This parameter can be one of the following values:
  - LL_MPU_CTRL_HFNMI_PRIVDEF_NONE
  - LL_MPU_CTRL_HARDFAULT_NMI
  - LL_MPU_CTRL_PRIVILEGED_DEFAULT
  - LL_MPU_CTRL_HFNMI_PRIVDEF

Return values

- **None:**

Reference Manual to LL API cross reference:

- MPU_CTRL ENABLE LL_MPU_Enable

LL_MPU_Disable

Function name

__STATIC_INLINE void LL_MPU_Disable (void)

Function description

Disable MPU.

Return values

- **None:**

Reference Manual to LL API cross reference:

- MPU_CTRL ENABLE LL_MPU_Disable

LL_MPU_IsEnabled

Function name

__STATIC_INLINE uint32_t LL_MPU_IsEnabled (void)

Function description

Check if MPU is enabled or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- MPU_CTRL ENABLE LL_MPU_IsEnabled

LL_MPU_EnableRegion

Function name

__STATIC_INLINE void LL_MPU_EnableRegion (uint32_t Region)

Function description

Enable a MPU region.

Parameters

- **Region:** This parameter can be one of the following values:
  - LL_MPU_REGION_NUMBER0
  - LL_MPU_REGION_NUMBER1
  - LL_MPU_REGION_NUMBER2
  - LL_MPU_REGION_NUMBER3
  - LL_MPU_REGION_NUMBER4
  - LL_MPU_REGION_NUMBER5
  - LL_MPU_REGION_NUMBER6
  - LL_MPU_REGION_NUMBER7

Return values

- **None:**

Reference Manual to LL API cross reference:

- MPU_RASR ENABLE LL_MPU_EnableRegion

LL_MPU_ConfigRegion

Function name

__STATIC_INLINE void LL_MPU_ConfigRegion (uint32_t Region, uint32_t SubRegionDisable, uint32_t Address, uint32_t Attributes)

Function description

Configure and enable a region.

Parameters

- **Region:** This parameter can be one of the following values:
  - LL_MPU_REGION_NUMBER0
  - LL_MPU_REGION_NUMBER1
  - LL_MPU_REGION_NUMBER2
  - LL_MPU_REGION_NUMBER3
  - LL_MPU_REGION_NUMBER4
  - LL_MPU_REGION_NUMBER5
  - LL_MPU_REGION_NUMBER6
  - LL_MPU_REGION_NUMBER7
- **Address:** Value of region base address
- **SubRegionDisable:** Sub-region disable value between Min_Data = 0x00 and Max_Data = 0xFF
- **Attributes:** This parameter can be a combination of the following values:
  - LL_MPU_REGION_SIZE_256B or LL_MPU_REGION_SIZE_512B or LL_MPU_REGION_SIZE_1KB or LL_MPU_REGION_SIZE_2KB or LL_MPU_REGION_SIZE_4KB or LL_MPU_REGION_SIZE_8KB or LL_MPU_REGION_SIZE_16KB or LL_MPU_REGION_SIZE_32KB or LL_MPU_REGION_SIZE_64KB or LL_MPU_REGION_SIZE_128KB or LL_MPU_REGION_SIZE_256KB or LL_MPU_REGION_SIZE_512KB or LL_MPU_REGION_SIZE_1MB or LL_MPU_REGION_SIZE_2MB or LL_MPU_REGION_SIZE_4MB or LL_MPU_REGION_SIZE_8MB or LL_MPU_REGION_SIZE_16MB or LL_MPU_REGION_SIZE_32MB or LL_MPU_REGION_SIZE_64MB or LL_MPU_REGION_SIZE_128MB or LL_MPU_REGION_SIZE_256MB or LL_MPU_REGION_SIZE_512MB or LL_MPU_REGION_SIZE_1GB or LL_MPU_REGION_SIZE_2GB or LL_MPU_REGION_SIZE_4GB
  - LL_MPU_REGION_NO_ACCESS or LL_MPU_REGION_PRIV_RW or LL_MPU_REGION_PRIV_RW_URO or LL_MPU_REGION_FULL_ACCESS or LL_MPU_REGION_PRIV_RO or LL_MPU_REGION_PRIV_RO_URO
  - LL_MPU_TEX_LEVEL0 or LL_MPU_TEX_LEVEL1 or LL_MPU_TEX_LEVEL2 or LL_MPU_TEX_LEVEL4
  - LL_MPU_INSTRUCTION_ACCESS_ENABLE or LL_MPU_INSTRUCTION_ACCESS_DISABLE
  - LL_MPU_ACCESS_SHAREABLE or LL_MPU_ACCESS_NOT_SHAREABLE
  - LL_MPU_ACCESS_CACHEABLE or LL_MPU_ACCESS_NOT_CACHEABLE
  - LL_MPU_ACCESS_BUFFERABLE or LL_MPU_ACCESS_NOT_BUFFERABLE

Return values

- **None:**

Reference Manual to LL API cross reference:

- MPU_RNR REGION LL_MPU_ConfigRegion
- MPU_RBAR REGION LL_MPU_ConfigRegion
- MPU_RBAR ADDR LL_MPU_ConfigRegion
- MPU_RASR XN LL_MPU_ConfigRegion
- MPU_RASR AP LL_MPU_ConfigRegion
- MPU_RASR S LL_MPU_ConfigRegion
- MPU_RASR C LL_MPU_ConfigRegion
- MPU_RASR B LL_MPU_ConfigRegion
- MPU_RASR SIZE LL_MPU_ConfigRegion

LL_MPU_DisableRegion

Function name

__STATIC_INLINE void LL_MPU_DisableRegion (uint32_t Region)

Function description

Disable a region.

Parameters

- **Region:** This parameter can be one of the following values:
  - LL_MPU_REGION_NUMBER0
  - LL_MPU_REGION_NUMBER1
  - LL_MPU_REGION_NUMBER2
  - LL_MPU_REGION_NUMBER3
  - LL_MPU_REGION_NUMBER4
  - LL_MPU_REGION_NUMBER5
  - LL_MPU_REGION_NUMBER6
  - LL_MPU_REGION_NUMBER7

Return values

- **None:**

Reference Manual to LL API cross reference:

- MPU_RNR REGION LL_MPU_DisableRegion
- MPU_RASR ENABLE LL_MPU_DisableRegion

58.2 CORTEX Firmware driver defines

The following section lists the various define and macros of the module.

58.2.1 CORTEX

CORTEX

MPU Bufferable Access

LL_MPU_ACCESS_BUFFERABLE

Bufferable memory attribute

LL_MPU_ACCESS_NOT_BUFFERABLE

Not Bufferable memory attribute

MPU Cacheable Access

LL_MPU_ACCESS_CACHEABLE

Cacheable memory attribute

LL_MPU_ACCESS_NOT_CACHEABLE

Not Cacheable memory attribute

SYSTICK Clock Source

LL_SYSTICK_CLKSOURCE_HCLK_DIV8

AHB clock divided by 8 selected as SysTick clock source.

LL_SYSTICK_CLKSOURCE_HCLK

AHB clock selected as SysTick clock source.

MPU Control

LL_MPU_CTRL_HFNMI_PRIVDEF_NONE

Disable NMI and privileged SW access

LL_MPU_CTRL_HARDFAULT_NMI

Enables the operation of MPU during hard fault, NMI, and FAULTMASK handlers

LL_MPU_CTRL_PRIVILEGED_DEFAULT

Enable privileged software access to default memory map

LL_MPU_CTRL_HFNMI_PRIVDEF

Enable NMI and privileged SW access

MPU Instruction Access

LL_MPU_INSTRUCTION_ACCESS_ENABLE

Instruction fetches enabled

LL_MPU_INSTRUCTION_ACCESS_DISABLE

Instruction fetches disabled

MPU Region Number

LL_MPU_REGION_NUMBER0

REGION Number 0

LL_MPU_REGION_NUMBER1

REGION Number 1

LL_MPU_REGION_NUMBER2

REGION Number 2

LL_MPU_REGION_NUMBER3

REGION Number 3

LL_MPU_REGION_NUMBER4

REGION Number 4

LL_MPU_REGION_NUMBER5

REGION Number 5

LL_MPU_REGION_NUMBER6

REGION Number 6

LL_MPU_REGION_NUMBER7

REGION Number 7

MPU Region Privileges

LL_MPU_REGION_NO_ACCESS

No access

LL_MPU_REGION_PRIV_RW

RW privileged (privileged access only)

LL_MPU_REGION_PRIV_RW_URO

RW privileged - RO user (Write in a user program generates a fault)

LL_MPU_REGION_FULL_ACCESS

RW privileged & user (Full access)

LL_MPU_REGION_PRIV_RO

RO privileged (privileged read only)

LL_MPU_REGION_PRIV_RO_URO

RO privileged & user (read only)

MPU Region Size

LL_MPU_REGION_SIZE_256B

256B Size of the MPU protection region

LL_MPU_REGION_SIZE_512B

512B Size of the MPU protection region

LL_MPU_REGION_SIZE_1KB

1KB Size of the MPU protection region

LL_MPU_REGION_SIZE_2KB

2KB Size of the MPU protection region

LL_MPU_REGION_SIZE_4KB

4KB Size of the MPU protection region

LL_MPU_REGION_SIZE_8KB

8KB Size of the MPU protection region

LL_MPU_REGION_SIZE_16KB

16KB Size of the MPU protection region

LL_MPU_REGION_SIZE_32KB

32KB Size of the MPU protection region

LL_MPU_REGION_SIZE_64KB

64KB Size of the MPU protection region

LL_MPU_REGION_SIZE_128KB

128KB Size of the MPU protection region

LL_MPU_REGION_SIZE_256KB

256KB Size of the MPU protection region

LL_MPU_REGION_SIZE_512KB

512KB Size of the MPU protection region

LL_MPU_REGION_SIZE_1MB

1MB Size of the MPU protection region

LL_MPU_REGION_SIZE_2MB

2MB Size of the MPU protection region

LL_MPU_REGION_SIZE_4MB

4MB Size of the MPU protection region

LL_MPU_REGION_SIZE_8MB

8MB Size of the MPU protection region

LL_MPU_REGION_SIZE_16MB

16MB Size of the MPU protection region

LL_MPU_REGION_SIZE_32MB

32MB Size of the MPU protection region

LL_MPU_REGION_SIZE_64MB

64MB Size of the MPU protection region

LL_MPU_REGION_SIZE_128MB

128MB Size of the MPU protection region

LL_MPU_REGION_SIZE_256MB

256MB Size of the MPU protection region

LL_MPU_REGION_SIZE_512MB

512MB Size of the MPU protection region

LL_MPU_REGION_SIZE_1GB

1GB Size of the MPU protection region

LL_MPU_REGION_SIZE_2GB

2GB Size of the MPU protection region

LL_MPU_REGION_SIZE_4GB

4GB Size of the MPU protection region

MPU Shareable Access

LL_MPU_ACCESS_SHAREABLE

Shareable memory attribute

LL_MPU_ACCESS_NOT_SHAREABLE

Not Shareable memory attribute

MPU TEX Level

LL_MPU_TEX_LEVEL0

b000 for TEX bits

LL_MPU_TEX_LEVEL1

b001 for TEX bits

LL_MPU_TEX_LEVEL2

b010 for TEX bits

LL_MPU_TEX_LEVEL4

b100 for TEX bits

59 LL CRC Generic Driver

59.1 CRC Firmware driver API description

The following section lists the various functions of the CRC library.

59.1.1 Detailed description of functions

LL_CRC_ResetCRCCalculationUnit

Function name

__STATIC_INLINE void LL_CRC_ResetCRCCalculationUnit (CRC_TypeDef * CRCx)

Function description

Reset the CRC calculation unit.

Parameters

- **CRCx:** CRC Instance

Return values

- **None:**

Notes

- If Programmable Initial CRC value feature is available, also set the Data Register to the value stored in the CRC_INIT register, otherwise, reset Data Register to its default value.

Reference Manual to LL API cross reference:

- CR RESET LL_CRC_ResetCRCCalculationUnit

LL_CRC_SetPolynomialSize

Function name

__STATIC_INLINE void LL_CRC_SetPolynomialSize (CRC_TypeDef * CRCx, uint32_t PolySize)

Function description

Configure size of the polynomial.

Parameters

- **CRCx:** CRC Instance
- **PolySize:** This parameter can be one of the following values:
  - LL_CRC_POLYLENGTH_32B
  - LL_CRC_POLYLENGTH_16B
  - LL_CRC_POLYLENGTH_8B
  - LL_CRC_POLYLENGTH_7B

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR POLYSIZE LL_CRC_SetPolynomialSize

LL_CRC_GetPolynomialSize

Function name

__STATIC_INLINE uint32_t LL_CRC_GetPolynomialSize (const CRC_TypeDef * CRCx)

Function description

Return size of the polynomial.

Parameters

- **CRCx:** CRC Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_CRC_POLYLENGTH_32B
  - LL_CRC_POLYLENGTH_16B
  - LL_CRC_POLYLENGTH_8B
  - LL_CRC_POLYLENGTH_7B

Reference Manual to LL API cross reference:

- CR POLYSIZE LL_CRC_GetPolynomialSize

LL_CRC_SetInputDataReverseType

Function name

__STATIC_INLINE void LL_CRC_SetInputDataReverseType (CRC_TypeDef * CRCx, uint32_t ReverseType)

Function description

Configure the reversal type of the input data.

Parameters

- **CRCx:** CRC Instance
- **ReverseType:** This parameter can be one of the following values:
  - LL_CRC_INDATA_REVERSETYPE_BIT
  - LL_CRC_INDATA_REVERSETYPE_BYTE_HALFWORD

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR RTYPE_IN LL_CRC_SetInputDataReverseType

LL_CRC_GetInputDataReverseType

Function name

__STATIC_INLINE uint32_t LL_CRC_GetInputDataReverseType (CRC_TypeDef * CRCx)

Function description

Return input data type of reversal.

Parameters

- **CRCx:** CRC Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_CRC_INDATA_REVERSETYPE_BIT
  - LL_CRC_INDATA_REVERSETYPE_BYTE_HALFWORD

Reference Manual to LL API cross reference:

- CR RTYPE_IN LL_CRC_GetInputDataReverseType

LL_CRC_SetOutputDataReverseType

Function name

__STATIC_INLINE void LL_CRC_SetOutputDataReverseType (CRC_TypeDef * CRCx, uint32_t ReverseType)

Function description

Configure the reversal type of the output data.

Parameters

- **CRCx:** CRC Instance
- **ReverseType:** This parameter can be one of the following values:
  - LL_CRC_OUTDATA_REVERSETYPE_BIT
  - LL_CRC_OUTDATA_REVERSETYPE_BYTE_HALFWORD

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR RTYPE_OUT LL_CRC_SetOutputDataReverseType

LL_CRC_GetOutputDataReverseType

Function name

__STATIC_INLINE uint32_t LL_CRC_GetOutputDataReverseType (CRC_TypeDef * CRCx)

Function description

Return output data type of reversal.

Parameters

- **CRCx:** CRC Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_CRC_OUTDATA_REVERSETYPE_BIT
  - LL_CRC_OUTDATA_REVERSETYPE_BYTE_HALFWORD

Reference Manual to LL API cross reference:

- CR RTYPE_OUT LL_CRC_GetOutputDataReverseType

LL_CRC_SetInputDataReverseMode

Function name

__STATIC_INLINE void LL_CRC_SetInputDataReverseMode (CRC_TypeDef * CRCx, uint32_t ReverseMode)

Function description

Configure the reversal of the bit order of the input data.

Parameters

- **CRCx:** CRC Instance
- **ReverseMode:** This parameter can be one of the following values:
  - LL_CRC_INDATA_REVERSE_NONE
  - LL_CRC_INDATA_REVERSE_BIT_BYBYTE
  - LL_CRC_INDATA_REVERSE_HALFWORD_BYWORD
  - LL_CRC_INDATA_REVERSE_BIT_BYHALFWORD
  - LL_CRC_INDATA_REVERSE_BYTE_BYWORD
  - LL_CRC_INDATA_REVERSE_BIT_BYWORD

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR REV_IN LL_CRC_SetInputDataReverseMode

LL_CRC_GetInputDataReverseMode

Function name

__STATIC_INLINE uint32_t LL_CRC_GetInputDataReverseMode (const CRC_TypeDef * CRCx)

Function description

Return mode of reversal for input data bit order.

Parameters

- **CRCx:** CRC Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_CRC_INDATA_REVERSE_NONE
  - LL_CRC_INDATA_REVERSE_BIT_BYBYTE
  - LL_CRC_INDATA_REVERSE_HALFWORD_BYWORD
  - LL_CRC_INDATA_REVERSE_BIT_BYHALFWORD
  - LL_CRC_INDATA_REVERSE_BYTE_BYWORD
  - LL_CRC_INDATA_REVERSE_BIT_BYWORD

Reference Manual to LL API cross reference:

- CR REV_IN LL_CRC_GetInputDataReverseMode

LL_CRC_SetOutputDataReverseMode

Function name

__STATIC_INLINE void LL_CRC_SetOutputDataReverseMode (CRC_TypeDef * CRCx, uint32_t ReverseMode)

Function description

Configure the reversal of the bit order of the Output data.

Parameters

- **CRCx:** CRC Instance
- **ReverseMode:** This parameter can be one of the following values:
  - LL_CRC_OUTDATA_REVERSE_NONE
  - LL_CRC_OUTDATA_REVERSE_BIT
  - LL_CRC_OUTDATA_REVERSE_HALFWORD
  - LL_CRC_OUTDATA_REVERSE_BYTE

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR REV_OUT LL_CRC_SetOutputDataReverseMode

LL_CRC_GetOutputDataReverseMode

Function name

__STATIC_INLINE uint32_t LL_CRC_GetOutputDataReverseMode (const CRC_TypeDef * CRCx)

Function description

Return mode of reversal of the bit order of the Output data.

Parameters

- **CRCx:** CRC Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_CRC_OUTDATA_REVERSE_NONE
  - LL_CRC_OUTDATA_REVERSE_BIT
  - LL_CRC_OUTDATA_REVERSE_HALFWORD
  - LL_CRC_OUTDATA_REVERSE_BYTE

Reference Manual to LL API cross reference:

- CR REV_OUT LL_CRC_GetOutputDataReverseMode

LL_CRC_SetInitialData

Function name

__STATIC_INLINE void LL_CRC_SetInitialData (CRC_TypeDef * CRCx, uint32_t InitCrc)

Function description

Initialize the Programmable initial CRC value.

Parameters

- **CRCx:** CRC Instance
- **InitCrc:** Value to be programmed in Programmable initial CRC value register

Return values

- **None:**

Notes

- If the CRC size is less than 32 bits, the least significant bits are used to write the correct value
- LL_CRC_DEFAULT_CRC_INITVALUE could be used as value for InitCrc parameter.

Reference Manual to LL API cross reference:

- INIT INIT LL_CRC_SetInitialData

LL_CRC_GetInitialData

Function name

__STATIC_INLINE uint32_t LL_CRC_GetInitialData (const CRC_TypeDef * CRCx)

Function description

Return current Initial CRC value.

Parameters

- **CRCx:** CRC Instance

Return values

- **Value:** programmed in Programmable initial CRC value register

Notes

- If the CRC size is less than 32 bits, the least significant bits are used to read the correct value

Reference Manual to LL API cross reference:

- INIT INIT LL_CRC_GetInitialData

LL_CRC_SetPolynomialCoef

Function name

__STATIC_INLINE void LL_CRC_SetPolynomialCoef (CRC_TypeDef * CRCx, uint32_t PolynomCoef)

Function description

Initialize the Programmable polynomial value (coefficients of the polynomial to be used for CRC calculation).

Parameters

- **CRCx:** CRC Instance
- **PolynomCoef:** Value to be programmed in Programmable Polynomial value register

Return values

- **None:**

Notes

- LL_CRC_DEFAULT_CRC32_POLY could be used as value for PolynomCoef parameter.
- Please check Reference Manual and existing Errata Sheets, regarding possible limitations for Polynomial values usage. For example, for a polynomial of degree 7, X^7 + X^6 + X^5 + X^2 + 1 is written 0x65

Reference Manual to LL API cross reference:

- POL POL LL_CRC_SetPolynomialCoef

LL_CRC_GetPolynomialCoef

Function name

__STATIC_INLINE uint32_t LL_CRC_GetPolynomialCoef (const CRC_TypeDef * CRCx)

Function description

Return current Programmable polynomial value.

Parameters

- **CRCx:** CRC Instance

Return values

- **Value:** programmed in Programmable Polynomial value register

Notes

- Please check Reference Manual and existing Errata Sheets, regarding possible limitations for Polynomial values usage. For example, for a polynomial of degree 7, X^7 + X^6 + X^5 + X^2 + 1 is written 0x65

Reference Manual to LL API cross reference:

- POL POL LL_CRC_GetPolynomialCoef

LL_CRC_FeedData32

Function name

__STATIC_INLINE void LL_CRC_FeedData32 (CRC_TypeDef * CRCx, uint32_t InData)

Function description

Write given 32-bit data to the CRC calculator.

Parameters

- **CRCx:** CRC Instance
- **InData:** value to be provided to CRC calculator between between Min_Data=0 and Max_Data=0xFFFFFFFF

Return values

- **None:**

Reference Manual to LL API cross reference:

- DR DR LL_CRC_FeedData32

LL_CRC_FeedData16

Function name

__STATIC_INLINE void LL_CRC_FeedData16 (CRC_TypeDef * CRCx, uint16_t InData)

Function description

Write given 16-bit data to the CRC calculator.

Parameters

- **CRCx:** CRC Instance
- **InData:** 16 bit value to be provided to CRC calculator between between Min_Data=0 and Max_Data=0xFFFF

Return values

- **None:**

Reference Manual to LL API cross reference:

- DR DR LL_CRC_FeedData16

LL_CRC_FeedData8

Function name

__STATIC_INLINE void LL_CRC_FeedData8 (CRC_TypeDef * CRCx, uint8_t InData)

Function description

Write given 8-bit data to the CRC calculator.

Parameters

- **CRCx:** CRC Instance
- **InData:** 8 bit value to be provided to CRC calculator between between Min_Data=0 and Max_Data=0xFF

Return values

- **None:**

Reference Manual to LL API cross reference:

- DR DR LL_CRC_FeedData8

LL_CRC_ReadData32

Function name

__STATIC_INLINE uint32_t LL_CRC_ReadData32 (const CRC_TypeDef * CRCx)

Function description

Return current CRC calculation result.

Parameters

- **CRCx:** CRC Instance

Return values

- **Current:** CRC calculation result as stored in CRC_DR register (32 bits).

Reference Manual to LL API cross reference:

- DR DR LL_CRC_ReadData32

LL_CRC_ReadData16

Function name

__STATIC_INLINE uint16_t LL_CRC_ReadData16 (const CRC_TypeDef * CRCx)

Function description

Return current CRC calculation result.

Parameters

- **CRCx:** CRC Instance

Return values

- **Current:** CRC calculation result as stored in CRC_DR register (16 bits).

Notes

- This function is expected to be used in a 16 bits CRC polynomial size context.

Reference Manual to LL API cross reference:

- DR DR LL_CRC_ReadData16

LL_CRC_ReadData8

Function name

__STATIC_INLINE uint8_t LL_CRC_ReadData8 (const CRC_TypeDef * CRCx)

Function description

Return current CRC calculation result.

Parameters

- **CRCx:** CRC Instance

Return values

- **Current:** CRC calculation result as stored in CRC_DR register (8 bits).

Notes

- This function is expected to be used in a 8 bits CRC polynomial size context.

Reference Manual to LL API cross reference:

- DR DR LL_CRC_ReadData8

LL_CRC_ReadData7

Function name

__STATIC_INLINE uint8_t LL_CRC_ReadData7 (const CRC_TypeDef * CRCx)

Function description

Return current CRC calculation result.

Parameters

- **CRCx:** CRC Instance

Return values

- **Current:** CRC calculation result as stored in CRC_DR register (7 bits).

Notes

- This function is expected to be used in a 7 bits CRC polynomial size context.

Reference Manual to LL API cross reference:

- DR DR LL_CRC_ReadData7

LL_CRC_Read_IDR

Function name

__STATIC_INLINE uint32_t LL_CRC_Read_IDR (const CRC_TypeDef * CRCx)

Function description

Return data stored in the Independent Data(IDR) register.

Parameters

- **CRCx:** CRC Instance

Return values

- **Value:** stored in CRC_IDR register (General-purpose 32-bit data register).

Notes

- This register can be used as a temporary storage location for one 32-bit long data.

Reference Manual to LL API cross reference:

- IDR IDR LL_CRC_Read_IDR

LL_CRC_Write_IDR

Function name

__STATIC_INLINE void LL_CRC_Write_IDR (CRC_TypeDef * CRCx, uint32_t InData)

Function description

Store data in the Independent Data(IDR) register.

Parameters

- **CRCx:** CRC Instance
- **InData:** value to be stored in CRC_IDR register (32-bit) between Min_Data=0 and Max_Data=0xFFFFFFFF

Return values

- **None:**

Notes

- This register can be used as a temporary storage location for one 32-bit long data.

Reference Manual to LL API cross reference:

- IDR IDR LL_CRC_Write_IDR

LL_CRC_DeInit

Function name

ErrorStatus LL_CRC_DeInit (const CRC_TypeDef * CRCx)

Function description

De-initialize CRC registers (Registers restored to their default values).

Parameters

- **CRCx:** CRC Instance

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: CRC registers are de-initialized
  - ERROR: CRC registers are not de-initialized

59.2 CRC Firmware driver defines

The following section lists the various define and macros of the module.

59.2.1 CRC

CRC

Default CRC computation initialization value

LL_CRC_DEFAULT_CRC_INITVALUE

Default CRC computation initialization value

Default CRC generating polynomial value

LL_CRC_DEFAULT_CRC32_POLY

Default CRC generating polynomial value

Input Data Reverse

LL_CRC_INDATA_REVERSE_NONE

Input Data bit order not affected

LL_CRC_INDATA_REVERSE_BIT_BYBYTE

Input Data bit reversal done by byte

LL_CRC_INDATA_REVERSE_BYTE

Definition for compatibility with legacy code

LL_CRC_INDATA_REVERSE_HALFWORD_BYWORD

Input Data half-word reversal done by word

LL_CRC_INDATA_REVERSE_BIT_BYHALFWORD

Input Data bit reversal done by half-word

LL_CRC_INDATA_REVERSE_HALFWORD

Definition for compatibility with legacy code

LL_CRC_INDATA_REVERSE_BYTE_BYWORD

Input Data byte reversal done by word

LL_CRC_INDATA_REVERSE_BIT_BYWORD

Input Data bit reversal done by word

LL_CRC_INDATA_REVERSE_WORD

Definition for compatibility with legacy code

Input Reverse Type

LL_CRC_INDATA_REVERSETYPE_BIT

Input Data reverse type at bit level granularity

LL_CRC_INDATA_REVERSETYPE_BYTE_HALFWORD

Input Data reverse type at byte or half-word level granularity

Output Data Reverse

LL_CRC_OUTDATA_REVERSE_NONE

Output Data bit order not affected

LL_CRC_OUTDATA_REVERSE_BIT

Output Data bit reversal done by bit

LL_CRC_OUTDATA_REVERSE_HALFWORD

Output Data half-word reversal done by word

LL_CRC_OUTDATA_REVERSE_BYTE

Output Data byte reversal done by word

Output Reverse Type

LL_CRC_OUTDATA_REVERSETYPE_BIT

Output Data reverse type at bit level granularity

LL_CRC_OUTDATA_REVERSETYPE_BYTE_HALFWORD

Output Data reverse type at byte or half-word level granularity

Polynomial length

LL_CRC_POLYLENGTH_32B

32 bits Polynomial size

LL_CRC_POLYLENGTH_16B

16 bits Polynomial size

LL_CRC_POLYLENGTH_8B

8 bits Polynomial size

LL_CRC_POLYLENGTH_7B

7 bits Polynomial size

Common Write and read registers Macros

LL_CRC_WriteReg

Description:

- Write a value in CRC register.

Parameters:

- __INSTANCE__: CRC Instance
- __REG__: Register to be written
- __VALUE__: Value to be written in the register

Return value:

- None

LL_CRC_ReadReg

Description:

- Read a value in CRC register.

Parameters:

- __INSTANCE__: CRC Instance
- __REG__: Register to be read

Return value:

- Register: value

60 LL CRS Generic Driver

60.1 CRS Firmware driver API description

The following section lists the various functions of the CRS library.

60.1.1 Detailed description of functions

LL_CRS_EnableFreqErrorCounter

Function name

__STATIC_INLINE void LL_CRS_EnableFreqErrorCounter (void)

Function description

Enable Frequency error counter.

Return values

- **None:**

Notes

- When this bit is set, the CRS_CFGR register is write-protected and cannot be modified

Reference Manual to LL API cross reference:

- CR CEN LL_CRS_EnableFreqErrorCounter

LL_CRS_DisableFreqErrorCounter

Function name

__STATIC_INLINE void LL_CRS_DisableFreqErrorCounter (void)

Function description

Disable Frequency error counter.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR CEN LL_CRS_DisableFreqErrorCounter

LL_CRS_IsEnabledFreqErrorCounter

Function name

__STATIC_INLINE uint32_t LL_CRS_IsEnabledFreqErrorCounter (void)

Function description

Check if Frequency error counter is enabled or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR CEN LL_CRS_IsEnabledFreqErrorCounter

LL_CRS_EnableAutoTrimming

Function name

__STATIC_INLINE void LL_CRS_EnableAutoTrimming (void)

Function description

Enable Automatic trimming counter.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR AUTOTRIMEN LL_CRS_EnableAutoTrimming

LL_CRS_DisableAutoTrimming

Function name

__STATIC_INLINE void LL_CRS_DisableAutoTrimming (void)

Function description

Disable Automatic trimming counter.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR AUTOTRIMEN LL_CRS_DisableAutoTrimming

LL_CRS_IsEnabledAutoTrimming

Function name

__STATIC_INLINE uint32_t LL_CRS_IsEnabledAutoTrimming (void)

Function description

Check if Automatic trimming is enabled or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR AUTOTRIMEN LL_CRS_IsEnabledAutoTrimming

LL_CRS_SetHSI48SmoothTrimming

Function name

__STATIC_INLINE void LL_CRS_SetHSI48SmoothTrimming (uint32_t Value)

Function description

Set HSI48 oscillator smooth trimming.

Parameters

- **Value:** a number between Min_Data = 0 and Max_Data = 63

Return values

- **None:**

Notes

- When the AUTOTRIMEN bit is set, this field is controlled by hardware and is read-only
- Default value can be set thanks to LL_CRS_HSI48CALIBRATION_DEFAULT

Reference Manual to LL API cross reference:

- CR TRIM LL_CRS_SetHSI48SmoothTrimming

LL_CRS_GetHSI48SmoothTrimming

Function name

__STATIC_INLINE uint32_t LL_CRS_GetHSI48SmoothTrimming (void)

Function description

Get HSI48 oscillator smooth trimming.

Return values

- **a:** number between Min_Data = 0 and Max_Data = 63

Reference Manual to LL API cross reference:

- CR TRIM LL_CRS_GetHSI48SmoothTrimming

LL_CRS_SetReloadCounter

Function name

__STATIC_INLINE void LL_CRS_SetReloadCounter (uint32_t Value)

Function description

Set counter reload value.

Parameters

- **Value:** a number between Min_Data = 0 and Max_Data = 0xFFFF

Return values

- **None:**

Notes

- Default value can be set thanks to LL_CRS_RELOADVALUE_DEFAULT Otherwise it can be calculated in using macro __LL_CRS_CALC_CALCULATE_RELOADVALUE (_FTARGET_, _FSYNC_)

Reference Manual to LL API cross reference:

- CFGR RELOAD LL_CRS_SetReloadCounter

LL_CRS_GetReloadCounter

Function name

__STATIC_INLINE uint32_t LL_CRS_GetReloadCounter (void)

Function description

Get counter reload value.

Return values

- **a:** number between Min_Data = 0 and Max_Data = 0xFFFF

Reference Manual to LL API cross reference:

- CFGR RELOAD LL_CRS_GetReloadCounter

LL_CRS_SetFreqErrorLimit

Function name

__STATIC_INLINE void LL_CRS_SetFreqErrorLimit (uint32_t Value)

Function description

Set frequency error limit.

Parameters

- **Value:** a number between Min_Data = 0 and Max_Data = 255

Return values

- **None:**

Notes

- Default value can be set thanks to LL_CRS_ERRORLIMIT_DEFAULT

Reference Manual to LL API cross reference:

- CFGR FELIM LL_CRS_SetFreqErrorLimit

LL_CRS_GetFreqErrorLimit

Function name

__STATIC_INLINE uint32_t LL_CRS_GetFreqErrorLimit (void)

Function description

Get frequency error limit.

Return values

- **A:** number between Min_Data = 0 and Max_Data = 255

Reference Manual to LL API cross reference:

- CFGR FELIM LL_CRS_GetFreqErrorLimit

LL_CRS_SetSyncDivider

Function name

__STATIC_INLINE void LL_CRS_SetSyncDivider (uint32_t Divider)

Function description

Set division factor for SYNC signal.

Parameters

- **Divider:** This parameter can be one of the following values:
  - LL_CRS_SYNC_DIV_1
  - LL_CRS_SYNC_DIV_2
  - LL_CRS_SYNC_DIV_4
  - LL_CRS_SYNC_DIV_8
  - LL_CRS_SYNC_DIV_16
  - LL_CRS_SYNC_DIV_32
  - LL_CRS_SYNC_DIV_64
  - LL_CRS_SYNC_DIV_128

Return values

- **None:**

Reference Manual to LL API cross reference:

- CFGR SYNCDIV LL_CRS_SetSyncDivider

LL_CRS_GetSyncDivider

Function name

__STATIC_INLINE uint32_t LL_CRS_GetSyncDivider (void)

Function description

Get division factor for SYNC signal.

Return values

- **Returned:** value can be one of the following values:
  - LL_CRS_SYNC_DIV_1
  - LL_CRS_SYNC_DIV_2
  - LL_CRS_SYNC_DIV_4
  - LL_CRS_SYNC_DIV_8
  - LL_CRS_SYNC_DIV_16
  - LL_CRS_SYNC_DIV_32
  - LL_CRS_SYNC_DIV_64
  - LL_CRS_SYNC_DIV_128

Reference Manual to LL API cross reference:

- CFGR SYNCDIV LL_CRS_GetSyncDivider

LL_CRS_SetSyncSignalSource

Function name

__STATIC_INLINE void LL_CRS_SetSyncSignalSource (uint32_t Source)

Function description

Set SYNC signal source.

Parameters

- **Source:** This parameter can be one of the following values:
  - LL_CRS_SYNC_SOURCE_GPIO
  - LL_CRS_SYNC_SOURCE_LSE
  - LL_CRS_SYNC_SOURCE_USB

Return values

- **None:**

Reference Manual to LL API cross reference:

- CFGR SYNCSRC LL_CRS_SetSyncSignalSource

LL_CRS_GetSyncSignalSource

Function name

__STATIC_INLINE uint32_t LL_CRS_GetSyncSignalSource (void)

Function description

Get SYNC signal source.

Return values

- **Returned:** value can be one of the following values:
  - LL_CRS_SYNC_SOURCE_GPIO
  - LL_CRS_SYNC_SOURCE_LSE
  - LL_CRS_SYNC_SOURCE_USB

Reference Manual to LL API cross reference:

- CFGR SYNCSRC LL_CRS_GetSyncSignalSource

LL_CRS_SetSyncPolarity

Function name

__STATIC_INLINE void LL_CRS_SetSyncPolarity (uint32_t Polarity)

Function description

Set input polarity for the SYNC signal source.

Parameters

- **Polarity:** This parameter can be one of the following values:
  - LL_CRS_SYNC_POLARITY_RISING
  - LL_CRS_SYNC_POLARITY_FALLING

Return values

- **None:**

Reference Manual to LL API cross reference:

- CFGR SYNCPOL LL_CRS_SetSyncPolarity

LL_CRS_GetSyncPolarity

Function name

__STATIC_INLINE uint32_t LL_CRS_GetSyncPolarity (void)

Function description

Get input polarity for the SYNC signal source.

Return values

- **Returned:** value can be one of the following values:
  - LL_CRS_SYNC_POLARITY_RISING
  - LL_CRS_SYNC_POLARITY_FALLING

Reference Manual to LL API cross reference:

- CFGR SYNCPOL LL_CRS_GetSyncPolarity

LL_CRS_ConfigSynchronization

Function name

__STATIC_INLINE void LL_CRS_ConfigSynchronization (uint32_t HSI48CalibrationValue, uint32_t ErrorLimitValue, uint32_t ReloadValue, uint32_t Settings)

Function description

Configure CRS for the synchronization.

Parameters

- **HSI48CalibrationValue:** a number between Min_Data = 0 and Max_Data = 63
- **ErrorLimitValue:** a number between Min_Data = 0 and Max_Data = 0xFFFF
- **ReloadValue:** a number between Min_Data = 0 and Max_Data = 255
- **Settings:** This parameter can be a combination of the following values:
  - LL_CRS_SYNC_DIV_1 or LL_CRS_SYNC_DIV_2 or LL_CRS_SYNC_DIV_4 or LL_CRS_SYNC_DIV_8 or LL_CRS_SYNC_DIV_16 or LL_CRS_SYNC_DIV_32 or LL_CRS_SYNC_DIV_64 or LL_CRS_SYNC_DIV_128
  - LL_CRS_SYNC_SOURCE_GPIO or LL_CRS_SYNC_SOURCE_LSE or LL_CRS_SYNC_SOURCE_USB
  - LL_CRS_SYNC_POLARITY_RISING or LL_CRS_SYNC_POLARITY_FALLING

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR TRIM LL_CRS_ConfigSynchronization
- CFGR RELOAD LL_CRS_ConfigSynchronization
- CFGR FELIM LL_CRS_ConfigSynchronization
- CFGR SYNCDIV LL_CRS_ConfigSynchronization
- CFGR SYNCSRC LL_CRS_ConfigSynchronization
- CFGR SYNCPOL LL_CRS_ConfigSynchronization

LL_CRS_GenerateEvent_SWSYNC

Function name

__STATIC_INLINE void LL_CRS_GenerateEvent_SWSYNC (void)

Function description

Generate software SYNC event.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR SWSYNC LL_CRS_GenerateEvent_SWSYNC

LL_CRS_GetFreqErrorDirection

Function name

__STATIC_INLINE uint32_t LL_CRS_GetFreqErrorDirection (void)

Function description

Get the frequency error direction latched in the time of the last SYNC event.

Return values

- **Returned:** value can be one of the following values:
  - LL_CRS_FREQ_ERROR_DIR_UP
  - LL_CRS_FREQ_ERROR_DIR_DOWN

Reference Manual to LL API cross reference:

- ISR FEDIR LL_CRS_GetFreqErrorDirection

LL_CRS_GetFreqErrorCapture

Function name

__STATIC_INLINE uint32_t LL_CRS_GetFreqErrorCapture (void)

Function description

Get the frequency error counter value latched in the time of the last SYNC event.

Return values

- **A:** number between Min_Data = 0x0000 and Max_Data = 0xFFFF

Reference Manual to LL API cross reference:

- ISR FECAP LL_CRS_GetFreqErrorCapture

LL_CRS_IsActiveFlag_SYNCOK

Function name

__STATIC_INLINE uint32_t LL_CRS_IsActiveFlag_SYNCOK (void)

Function description

Check if SYNC event OK signal occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR SYNCOKF LL_CRS_IsActiveFlag_SYNCOK

LL_CRS_IsActiveFlag_SYNCWARN

Function name

__STATIC_INLINE uint32_t LL_CRS_IsActiveFlag_SYNCWARN (void)

Function description

Check if SYNC warning signal occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR SYNCWARNF LL_CRS_IsActiveFlag_SYNCWARN

LL_CRS_IsActiveFlag_ERR

Function name

__STATIC_INLINE uint32_t LL_CRS_IsActiveFlag_ERR (void)

Function description

Check if Synchronization or trimming error signal occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR ERRF LL_CRS_IsActiveFlag_ERR

LL_CRS_IsActiveFlag_ESYNC

Function name

__STATIC_INLINE uint32_t LL_CRS_IsActiveFlag_ESYNC (void)

Function description

Check if Expected SYNC signal occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR ESYNCF LL_CRS_IsActiveFlag_ESYNC

LL_CRS_IsActiveFlag_SYNCERR

Function name

__STATIC_INLINE uint32_t LL_CRS_IsActiveFlag_SYNCERR (void)

Function description

Check if SYNC error signal occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR SYNCERR LL_CRS_IsActiveFlag_SYNCERR

LL_CRS_IsActiveFlag_SYNCMISS

Function name

__STATIC_INLINE uint32_t LL_CRS_IsActiveFlag_SYNCMISS (void)

Function description

Check if SYNC missed error signal occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR SYNCMISS LL_CRS_IsActiveFlag_SYNCMISS

LL_CRS_IsActiveFlag_TRIMOVF

Function name

__STATIC_INLINE uint32_t LL_CRS_IsActiveFlag_TRIMOVF (void)

Function description

Check if Trimming overflow or underflow occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR TRIMOVF LL_CRS_IsActiveFlag_TRIMOVF

LL_CRS_ClearFlag_SYNCOK

Function name

__STATIC_INLINE void LL_CRS_ClearFlag_SYNCOK (void)

Function description

Clear the SYNC event OK flag.

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR SYNCOKC LL_CRS_ClearFlag_SYNCOK

LL_CRS_ClearFlag_SYNCWARN

Function name

__STATIC_INLINE void LL_CRS_ClearFlag_SYNCWARN (void)

Function description

Clear the SYNC warning flag.

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR SYNCWARNC LL_CRS_ClearFlag_SYNCWARN

LL_CRS_ClearFlag_ERR

Function name

__STATIC_INLINE void LL_CRS_ClearFlag_ERR (void)

Function description

Clear TRIMOVF, SYNCMISS and SYNCERR bits and consequently also the ERR flag.

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR ERRC LL_CRS_ClearFlag_ERR

LL_CRS_ClearFlag_ESYNC

Function name

__STATIC_INLINE void LL_CRS_ClearFlag_ESYNC (void)

Function description

Clear Expected SYNC flag.

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR ESYNCC LL_CRS_ClearFlag_ESYNC

LL_CRS_EnableIT_SYNCOK

Function name

__STATIC_INLINE void LL_CRS_EnableIT_SYNCOK (void)

Function description

Enable SYNC event OK interrupt.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR SYNCOKIE LL_CRS_EnableIT_SYNCOK

LL_CRS_DisableIT_SYNCOK

Function name

__STATIC_INLINE void LL_CRS_DisableIT_SYNCOK (void)

Function description

Disable SYNC event OK interrupt.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR SYNCOKIE LL_CRS_DisableIT_SYNCOK

LL_CRS_IsEnabledIT_SYNCOK

Function name

__STATIC_INLINE uint32_t LL_CRS_IsEnabledIT_SYNCOK (void)

Function description

Check if SYNC event OK interrupt is enabled or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR SYNCOKIE LL_CRS_IsEnabledIT_SYNCOK

LL_CRS_EnableIT_SYNCWARN

Function name

__STATIC_INLINE void LL_CRS_EnableIT_SYNCWARN (void)

Function description

Enable SYNC warning interrupt.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR SYNCWARNIE LL_CRS_EnableIT_SYNCWARN

LL_CRS_DisableIT_SYNCWARN

Function name

__STATIC_INLINE void LL_CRS_DisableIT_SYNCWARN (void)

Function description

Disable SYNC warning interrupt.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR SYNCWARNIE LL_CRS_DisableIT_SYNCWARN

LL_CRS_IsEnabledIT_SYNCWARN

Function name

__STATIC_INLINE uint32_t LL_CRS_IsEnabledIT_SYNCWARN (void)

Function description

Check if SYNC warning interrupt is enabled or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR SYNCWARNIE LL_CRS_IsEnabledIT_SYNCWARN

LL_CRS_EnableIT_ERR

Function name

__STATIC_INLINE void LL_CRS_EnableIT_ERR (void)

Function description

Enable Synchronization or trimming error interrupt.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR ERRIE LL_CRS_EnableIT_ERR

LL_CRS_DisableIT_ERR

Function name

__STATIC_INLINE void LL_CRS_DisableIT_ERR (void)

Function description

Disable Synchronization or trimming error interrupt.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR ERRIE LL_CRS_DisableIT_ERR

LL_CRS_IsEnabledIT_ERR

Function name

__STATIC_INLINE uint32_t LL_CRS_IsEnabledIT_ERR (void)

Function description

Check if Synchronization or trimming error interrupt is enabled or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR ERRIE LL_CRS_IsEnabledIT_ERR

LL_CRS_EnableIT_ESYNC

Function name

__STATIC_INLINE void LL_CRS_EnableIT_ESYNC (void)

Function description

Enable Expected SYNC interrupt.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR ESYNCIE LL_CRS_EnableIT_ESYNC

LL_CRS_DisableIT_ESYNC

Function name

__STATIC_INLINE void LL_CRS_DisableIT_ESYNC (void)

Function description

Disable Expected SYNC interrupt.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR ESYNCIE LL_CRS_DisableIT_ESYNC

LL_CRS_IsEnabledIT_ESYNC

Function name

__STATIC_INLINE uint32_t LL_CRS_IsEnabledIT_ESYNC (void)

Function description

Check if Expected SYNC interrupt is enabled or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR ESYNCIE LL_CRS_IsEnabledIT_ESYNC

LL_CRS_DeInit

Function name

ErrorStatus LL_CRS_DeInit (void)

Function description

De-Initializes CRS peripheral registers to their default reset values.

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: CRS registers are de-initialized
  - ERROR: not applicable

60.2 CRS Firmware driver defines

The following section lists the various define and macros of the module.

60.2.1 CRS

CRS

Default Values

LL_CRS_RELOADVALUE_DEFAULT

Notes:

- The reset value of the RELOAD field corresponds to a target frequency of 48 MHz and a synchronization signal frequency of 1 kHz (SOF signal from USB)

LL_CRS_ERRORLIMIT_DEFAULT

LL_CRS_HSI48CALIBRATION_DEFAULT

Notes:

- The default value is 32, which corresponds to the middle of the trimming interval. The trimming step is around 67 kHz between two consecutive TRIM steps. A higher TRIM value corresponds to a higher output frequency

Frequency Error Direction

LL_CRS_FREQ_ERROR_DIR_UP

Upcounting direction, the actual frequency is above the target

LL_CRS_FREQ_ERROR_DIR_DOWN

Downcounting direction, the actual frequency is below the target

Get Flags Defines

LL_CRS_ISR_SYNCOKF

LL_CRS_ISR_SYNCWARNF

LL_CRS_ISR_ERRF

LL_CRS_ISR_ESYNCF

LL_CRS_ISR_SYNCERR

LL_CRS_ISR_SYNCMISS

LL_CRS_ISR_TRIMOVF

IT Defines

LL_CRS_CR_SYNCOKIE

LL_CRS_CR_SYNCWARNIE

LL_CRS_CR_ERRIE

LL_CRS_CR_ESYNCIE

Synchronization Signal Divider

LL_CRS_SYNC_DIV_1

Synchro Signal not divided (default)

LL_CRS_SYNC_DIV_2

Synchro Signal divided by 2

LL_CRS_SYNC_DIV_4

Synchro Signal divided by 4

LL_CRS_SYNC_DIV_8

Synchro Signal divided by 8

LL_CRS_SYNC_DIV_16

Synchro Signal divided by 16

LL_CRS_SYNC_DIV_32

Synchro Signal divided by 32

LL_CRS_SYNC_DIV_64

Synchro Signal divided by 64

LL_CRS_SYNC_DIV_128

Synchro Signal divided by 128

Synchronization Signal Polarity

LL_CRS_SYNC_POLARITY_RISING

Synchro Active on rising edge (default)

LL_CRS_SYNC_POLARITY_FALLING

Synchro Active on falling edge

Synchronization Signal Source

LL_CRS_SYNC_SOURCE_GPIO

Synchro Signal source GPIO

LL_CRS_SYNC_SOURCE_LSE

Synchro Signal source LSE

LL_CRS_SYNC_SOURCE_USB

Synchro Signal source USB SOF (default)

Exported_Macros_Calculate_Reload

__LL_CRS_CALC_CALCULATE_RELOADVALUE

Description:

- Macro to calculate reload value to be set in CRS register according to target and sync frequencies.

Parameters:

- __FTARGET__: Target frequency (value in Hz)
- __FSYNC__: Synchronization signal frequency (value in Hz)

Return value:

- Reload: value (in Hz)

Notes:

- The RELOAD value should be selected according to the ratio between the target frequency and the frequency of the synchronization source after prescaling. It is then decreased by one in order to reach the expected synchronization on the zero value. The formula is the following: RELOAD = (fTARGET / fSYNC) -1

Common Write and read registers Macros

LL_CRS_WriteReg

Description:

- Write a value in CRS register.

Parameters:

- __INSTANCE__: CRS Instance
- __REG__: Register to be written
- __VALUE__: Value to be written in the register

Return value:

- None

LL_CRS_ReadReg

Description:

- Read a value in CRS register.

Parameters:

- __INSTANCE__: CRS Instance
- __REG__: Register to be read

Return value:

- Register: value

61 LL DAC Generic Driver

61.1 DAC Firmware driver registers structures

61.1.1 LL_DAC_InitTypeDef

LL_DAC_InitTypeDef is defined in the stm32u0xx_ll_dac.h

Data Fields

- ***uint32_t TriggerSource***
- ***uint32_t WaveAutoGeneration***
- ***uint32_t WaveAutoGenerationConfig***
- ***uint32_t OutputBuffer***
- ***uint32_t OutputConnection***
- ***uint32_t OutputMode***

Field Documentation

- ***uint32_t LL_DAC_InitTypeDef::TriggerSource***
  Set the conversion trigger source for the selected DAC channel: internal (SW start) or from external peripheral (timer event, external interrupt line). This parameter can be a value of ***DAC_LL_EC_TRIGGER_SOURCE***This feature can be modified afterwards using unitary function **LL_DAC_SetTriggerSource()**.
- ***uint32_t LL_DAC_InitTypeDef::WaveAutoGeneration***
  Set the waveform automatic generation mode for the selected DAC channel. This parameter can be a value of ***DAC_LL_EC_WAVE_AUTO_GENERATION_MODE***This feature can be modified afterwards using unitary function **LL_DAC_SetWaveAutoGeneration()**.
- ***uint32_t LL_DAC_InitTypeDef::WaveAutoGenerationConfig***
  Set the waveform automatic generation mode for the selected DAC channel. If waveform automatic generation mode is set to noise, this parameter can be a value of ***DAC_LL_EC_WAVE_NOISE_LFSR_UNMASK_BITS*** If waveform automatic generation mode is set to triangle, this parameter can be a value of ***DAC_LL_EC_WAVE_TRIANGLE_AMPLITUDE***
  Note:
  – If waveform automatic generation mode is disabled, this parameter is discarded.

  This feature can be modified afterwards using unitary function **LL_DAC_SetWaveNoiseLFSR()**, **LL_DAC_SetWaveTriangleAmplitude()** depending on the wave automatic generation selected.
- ***uint32_t LL_DAC_InitTypeDef::OutputBuffer***
  Set the output buffer for the selected DAC channel. This parameter can be a value of ***DAC_LL_EC_OUTPUT_BUFFER***This feature can be modified afterwards using unitary function **LL_DAC_SetOutputBuffer()**.
- ***uint32_t LL_DAC_InitTypeDef::OutputConnection***
  Set the output connection for the selected DAC channel. This parameter can be a value of ***DAC_LL_EC_OUTPUT_CONNECTION***This feature can be modified afterwards using unitary function **LL_DAC_SetOutputConnection()**.
- ***uint32_t LL_DAC_InitTypeDef::OutputMode***
  Set the output mode normal or sample-and-hold for the selected DAC channel. This parameter can be a value of ***DAC_LL_EC_OUTPUT_MODE***This feature can be modified afterwards using unitary function **LL_DAC_SetOutputMode()**.

61.2 DAC Firmware driver API description

The following section lists the various functions of the DAC library.

61.2.1 Detailed description of functions

LL_DAC_SetMode

Function name

__STATIC_INLINE void LL_DAC_SetMode (DAC_TypeDef * DACx, uint32_t DAC_Channel, uint32_t ChannelMode)

Function description

Set the operating mode for the selected DAC channel: calibration or normal operating mode.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1
- **ChannelMode:** This parameter can be one of the following values:
  - LL_DAC_MODE_NORMAL_OPERATION
  - LL_DAC_MODE_CALIBRATION

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR CEN1 LL_DAC_SetMode

LL_DAC_GetMode

Function name

__STATIC_INLINE uint32_t LL_DAC_GetMode (const DAC_TypeDef * DACx, uint32_t DAC_Channel)

Function description

Get the operating mode for the selected DAC channel: calibration or normal operating mode.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1

Return values

- **Returned:** value can be one of the following values:
  - LL_DAC_MODE_NORMAL_OPERATION
  - LL_DAC_MODE_CALIBRATION

Reference Manual to LL API cross reference:

- CR CEN1 LL_DAC_GetMode

LL_DAC_SetTrimmingValue

Function name

__STATIC_INLINE void LL_DAC_SetTrimmingValue (DAC_TypeDef * DACx, uint32_t DAC_Channel, uint32_t TrimmingValue)

Function description

Set the offset trimming value for the selected DAC channel.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1
- **TrimmingValue:** Value between Min_Data=0x00 and Max_Data=0x1F

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCR OTRIM1 LL_DAC_SetTrimmingValue

LL_DAC_GetTrimmingValue

Function name

__STATIC_INLINE uint32_t LL_DAC_GetTrimmingValue (const DAC_TypeDef * DACx, uint32_t DAC_Channel)

Function description

Get the offset trimming value for the selected DAC channel.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1

Return values

- **TrimmingValue:** Value between Min_Data=0x00 and Max_Data=0x1F

Reference Manual to LL API cross reference:

- CCR OTRIM1 LL_DAC_GetTrimmingValue

LL_DAC_SetTriggerSource

Function name

__STATIC_INLINE void LL_DAC_SetTriggerSource (DAC_TypeDef * DACx, uint32_t DAC_Channel, uint32_t TriggerSource)

Function description

Set the conversion trigger source for the selected DAC channel.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1
- **TriggerSource:** This parameter can be one of the following values:
  - LL_DAC_TRIG_SOFTWARE
  - LL_DAC_TRIG_EXT_TIM1_TRGO
  - LL_DAC_TRIG_EXT_TIM2_TRGO
  - LL_DAC_TRIG_EXT_TIM3_TRGO
  - LL_DAC_TRIG_EXT_TIM6_TRGO
  - LL_DAC_TRIG_EXT_TIM7_TRGO
  - LL_DAC_TRIG_EXT_TIM15_TRGO
  - LL_DAC_TRIG_EXT_LPTIM1_OUT
  - LL_DAC_TRIG_EXT_LPTIM2_OUT
  - LL_DAC_TRIG_EXT_EXTI_LINE9

Return values

- **None:**

Notes

- For conversion trigger source to be effective, DAC trigger must be enabled using function LL_DAC_EnableTrigger().
- To set conversion trigger source, DAC channel must be disabled. Otherwise, the setting is discarded.
- Availability of parameters of trigger sources from timer depends on timers availability on the selected device.

Reference Manual to LL API cross reference:

- CR TSEL1 LL_DAC_SetTriggerSource

LL_DAC_GetTriggerSource

Function name

__STATIC_INLINE uint32_t LL_DAC_GetTriggerSource (const DAC_TypeDef * DACx, uint32_t DAC_Channel)

Function description

Get the conversion trigger source for the selected DAC channel.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1

Return values

- **Returned:** value can be one of the following values:
  - LL_DAC_TRIG_SOFTWARE
  - LL_DAC_TRIG_EXT_TIM1_TRGO
  - LL_DAC_TRIG_EXT_TIM2_TRGO
  - LL_DAC_TRIG_EXT_TIM3_TRGO
  - LL_DAC_TRIG_EXT_TIM6_TRGO
  - LL_DAC_TRIG_EXT_TIM7_TRGO
  - LL_DAC_TRIG_EXT_TIM15_TRGO
  - LL_DAC_TRIG_EXT_LPTIM1_OUT
  - LL_DAC_TRIG_EXT_LPTIM2_OUT
  - LL_DAC_TRIG_EXT_EXTI_LINE9

Notes

- For conversion trigger source to be effective, DAC trigger must be enabled using function LL_DAC_EnableTrigger().
- Availability of parameters of trigger sources from timer depends on timers availability on the selected device.

Reference Manual to LL API cross reference:

- CR TSEL1 LL_DAC_GetTriggerSource

LL_DAC_SetWaveAutoGeneration

Function name

__STATIC_INLINE void LL_DAC_SetWaveAutoGeneration (DAC_TypeDef * DACx, uint32_t DAC_Channel, uint32_t WaveAutoGeneration)

Function description

Set the waveform automatic generation mode for the selected DAC channel.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1
- **WaveAutoGeneration:** This parameter can be one of the following values:
  - LL_DAC_WAVE_AUTO_GENERATION_NONE
  - LL_DAC_WAVE_AUTO_GENERATION_NOISE
  - LL_DAC_WAVE_AUTO_GENERATION_TRIANGLE

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR WAVE1 LL_DAC_SetWaveAutoGeneration

LL_DAC_GetWaveAutoGeneration

Function name

__STATIC_INLINE uint32_t LL_DAC_GetWaveAutoGeneration (const DAC_TypeDef * DACx, uint32_t DAC_Channel)

Function description

Get the waveform automatic generation mode for the selected DAC channel.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1

Return values

- **Returned:** value can be one of the following values:
  - LL_DAC_WAVE_AUTO_GENERATION_NONE
  - LL_DAC_WAVE_AUTO_GENERATION_NOISE
  - LL_DAC_WAVE_AUTO_GENERATION_TRIANGLE

Reference Manual to LL API cross reference:

- CR WAVE1 LL_DAC_GetWaveAutoGeneration

LL_DAC_SetWaveNoiseLFSR

Function name

__STATIC_INLINE void LL_DAC_SetWaveNoiseLFSR (DAC_TypeDef * DACx, uint32_t DAC_Channel, uint32_t NoiseLFSRMask)

Function description

Set the noise waveform generation for the selected DAC channel: Noise mode and parameters LFSR (linear feedback shift register).

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1
- **NoiseLFSRMask:** This parameter can be one of the following values:
  - LL_DAC_NOISE_LFSR_UNMASK_BIT0
  - LL_DAC_NOISE_LFSR_UNMASK_BITS1_0
  - LL_DAC_NOISE_LFSR_UNMASK_BITS2_0
  - LL_DAC_NOISE_LFSR_UNMASK_BITS3_0
  - LL_DAC_NOISE_LFSR_UNMASK_BITS4_0
  - LL_DAC_NOISE_LFSR_UNMASK_BITS5_0
  - LL_DAC_NOISE_LFSR_UNMASK_BITS6_0
  - LL_DAC_NOISE_LFSR_UNMASK_BITS7_0
  - LL_DAC_NOISE_LFSR_UNMASK_BITS8_0
  - LL_DAC_NOISE_LFSR_UNMASK_BITS9_0
  - LL_DAC_NOISE_LFSR_UNMASK_BITS10_0
  - LL_DAC_NOISE_LFSR_UNMASK_BITS11_0

Return values

- **None:**

Notes

- For wave generation to be effective, DAC channel wave generation mode must be enabled using function LL_DAC_SetWaveAutoGeneration().
- This setting can be set when the selected DAC channel is disabled (otherwise, the setting operation is ignored).

Reference Manual to LL API cross reference:

- CR MAMP1 LL_DAC_SetWaveNoiseLFSR

LL_DAC_GetWaveNoiseLFSR

Function name

__STATIC_INLINE uint32_t LL_DAC_GetWaveNoiseLFSR (const DAC_TypeDef * DACx, uint32_t DAC_Channel)

Function description

Get the noise waveform generation for the selected DAC channel: Noise mode and parameters LFSR (linear feedback shift register).

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1

Return values

- **Returned:** value can be one of the following values:
  - LL_DAC_NOISE_LFSR_UNMASK_BIT0
  - LL_DAC_NOISE_LFSR_UNMASK_BITS1_0
  - LL_DAC_NOISE_LFSR_UNMASK_BITS2_0
  - LL_DAC_NOISE_LFSR_UNMASK_BITS3_0
  - LL_DAC_NOISE_LFSR_UNMASK_BITS4_0
  - LL_DAC_NOISE_LFSR_UNMASK_BITS5_0
  - LL_DAC_NOISE_LFSR_UNMASK_BITS6_0
  - LL_DAC_NOISE_LFSR_UNMASK_BITS7_0
  - LL_DAC_NOISE_LFSR_UNMASK_BITS8_0
  - LL_DAC_NOISE_LFSR_UNMASK_BITS9_0
  - LL_DAC_NOISE_LFSR_UNMASK_BITS10_0
  - LL_DAC_NOISE_LFSR_UNMASK_BITS11_0

Reference Manual to LL API cross reference:

- CR MAMP1 LL_DAC_GetWaveNoiseLFSR

LL_DAC_SetWaveTriangleAmplitude

Function name

__STATIC_INLINE void LL_DAC_SetWaveTriangleAmplitude (DAC_TypeDef * DACx, uint32_t DAC_Channel, uint32_t TriangleAmplitude)

Function description

Set the triangle waveform generation for the selected DAC channel: triangle mode and amplitude.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1
- **TriangleAmplitude:** This parameter can be one of the following values:
  - LL_DAC_TRIANGLE_AMPLITUDE_1
  - LL_DAC_TRIANGLE_AMPLITUDE_3
  - LL_DAC_TRIANGLE_AMPLITUDE_7
  - LL_DAC_TRIANGLE_AMPLITUDE_15
  - LL_DAC_TRIANGLE_AMPLITUDE_31
  - LL_DAC_TRIANGLE_AMPLITUDE_63
  - LL_DAC_TRIANGLE_AMPLITUDE_127
  - LL_DAC_TRIANGLE_AMPLITUDE_255
  - LL_DAC_TRIANGLE_AMPLITUDE_511
  - LL_DAC_TRIANGLE_AMPLITUDE_1023
  - LL_DAC_TRIANGLE_AMPLITUDE_2047
  - LL_DAC_TRIANGLE_AMPLITUDE_4095

Return values

- **None:**

Notes

- For wave generation to be effective, DAC channel wave generation mode must be enabled using function LL_DAC_SetWaveAutoGeneration().
- This setting can be set when the selected DAC channel is disabled (otherwise, the setting operation is ignored).

Reference Manual to LL API cross reference:

- CR MAMP1 LL_DAC_SetWaveTriangleAmplitude

LL_DAC_GetWaveTriangleAmplitude

Function name

__STATIC_INLINE uint32_t LL_DAC_GetWaveTriangleAmplitude (const DAC_TypeDef * DACx, uint32_t DAC_Channel)

Function description

Get the triangle waveform generation for the selected DAC channel: triangle mode and amplitude.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1

Return values

- **Returned:** value can be one of the following values:
  - LL_DAC_TRIANGLE_AMPLITUDE_1
  - LL_DAC_TRIANGLE_AMPLITUDE_3
  - LL_DAC_TRIANGLE_AMPLITUDE_7
  - LL_DAC_TRIANGLE_AMPLITUDE_15
  - LL_DAC_TRIANGLE_AMPLITUDE_31
  - LL_DAC_TRIANGLE_AMPLITUDE_63
  - LL_DAC_TRIANGLE_AMPLITUDE_127
  - LL_DAC_TRIANGLE_AMPLITUDE_255
  - LL_DAC_TRIANGLE_AMPLITUDE_511
  - LL_DAC_TRIANGLE_AMPLITUDE_1023
  - LL_DAC_TRIANGLE_AMPLITUDE_2047
  - LL_DAC_TRIANGLE_AMPLITUDE_4095

Reference Manual to LL API cross reference:

- CR MAMP1 LL_DAC_GetWaveTriangleAmplitude

LL_DAC_ConfigOutput

Function name

__STATIC_INLINE void LL_DAC_ConfigOutput (DAC_TypeDef * DACx, uint32_t DAC_Channel, uint32_t OutputMode, uint32_t OutputBuffer, uint32_t OutputConnection)

Function description

Set the output for the selected DAC channel.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1
- **OutputMode:** This parameter can be one of the following values:
  - LL_DAC_OUTPUT_MODE_NORMAL
  - LL_DAC_OUTPUT_MODE_SAMPLE_AND_HOLD
- **OutputBuffer:** This parameter can be one of the following values:
  - LL_DAC_OUTPUT_BUFFER_ENABLE
  - LL_DAC_OUTPUT_BUFFER_DISABLE
- **OutputConnection:** This parameter can be one of the following values:
  - LL_DAC_OUTPUT_CONNECT_GPIO
  - LL_DAC_OUTPUT_CONNECT_INTERNAL

Return values

- **None:**

Notes

- This function set several features: mode normal or sample-and-holdbufferconnection to GPIO or internal path. These features can also be set individually using dedicated functions:LL_DAC_SetOutputBuffer()LL_DAC_SetOutputMode()LL_DAC_SetOutputConnection()
- On this STM32 series, output connection depends on output mode (normal or sample and hold) and output buffer state. if output connection is set to internal path and output buffer is enabled (whatever output mode): output connection is also connected to GPIO pin (both connections to GPIO pin and internal path).if output connection is set to GPIO pin, output buffer is disabled, output mode set to sample and hold: output connection is also connected to internal path (both connections to GPIO pin and internal path).
- Mode sample-and-hold requires an external capacitor to be connected between DAC channel output and ground. Capacitor value depends on load on DAC channel output and sample-and-hold timings configured. As indication, capacitor typical value is 100nF (refer to device datasheet, parameter "CSH").

Reference Manual to LL API cross reference:

- CR MODE1 LL_DAC_ConfigOutput

LL_DAC_SetOutputMode

Function name

__STATIC_INLINE void LL_DAC_SetOutputMode (DAC_TypeDef * DACx, uint32_t DAC_Channel, uint32_t OutputMode)

Function description

Set the output mode normal or sample-and-hold for the selected DAC channel.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1
- **OutputMode:** This parameter can be one of the following values:
  - LL_DAC_OUTPUT_MODE_NORMAL
  - LL_DAC_OUTPUT_MODE_SAMPLE_AND_HOLD

Return values

- **None:**

Notes

- Mode sample-and-hold requires an external capacitor to be connected between DAC channel output and ground. Capacitor value depends on load on DAC channel output and sample-and-hold timings configured. As indication, capacitor typical value is 100nF (refer to device datasheet, parameter "CSH").

Reference Manual to LL API cross reference:

- CR MODE1 LL_DAC_SetOutputMode

LL_DAC_GetOutputMode

Function name

__STATIC_INLINE uint32_t LL_DAC_GetOutputMode (const DAC_TypeDef * DACx, uint32_t DAC_Channel)

Function description

Get the output mode normal or sample-and-hold for the selected DAC channel.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1

Return values

- **Returned:** value can be one of the following values:
  - LL_DAC_OUTPUT_MODE_NORMAL
  - LL_DAC_OUTPUT_MODE_SAMPLE_AND_HOLD

Reference Manual to LL API cross reference:

- CR MODE1 LL_DAC_GetOutputMode

LL_DAC_SetOutputBuffer

Function name

__STATIC_INLINE void LL_DAC_SetOutputBuffer (DAC_TypeDef * DACx, uint32_t DAC_Channel, uint32_t OutputBuffer)

Function description

Set the output buffer for the selected DAC channel.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1
- **OutputBuffer:** This parameter can be one of the following values:
  - LL_DAC_OUTPUT_BUFFER_ENABLE
  - LL_DAC_OUTPUT_BUFFER_DISABLE

Return values

- **None:**

Notes

- On this STM32 series, when buffer is enabled, its offset can be trimmed: factory calibration default values can be replaced by user trimming values, using function LL_DAC_SetTrimmingValue().

Reference Manual to LL API cross reference:

- CR MODE1 LL_DAC_SetOutputBuffer

LL_DAC_GetOutputBuffer

Function name

__STATIC_INLINE uint32_t LL_DAC_GetOutputBuffer (const DAC_TypeDef * DACx, uint32_t DAC_Channel)

Function description

Get the output buffer state for the selected DAC channel.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1

Return values

- **Returned:** value can be one of the following values:
  - LL_DAC_OUTPUT_BUFFER_ENABLE
  - LL_DAC_OUTPUT_BUFFER_DISABLE

Reference Manual to LL API cross reference:

- CR MODE1 LL_DAC_GetOutputBuffer

LL_DAC_SetOutputConnection

Function name

__STATIC_INLINE void LL_DAC_SetOutputConnection (DAC_TypeDef * DACx, uint32_t DAC_Channel, uint32_t OutputConnection)

Function description

Set the output connection for the selected DAC channel.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1
- **OutputConnection:** This parameter can be one of the following values:
  - LL_DAC_OUTPUT_CONNECT_GPIO
  - LL_DAC_OUTPUT_CONNECT_INTERNAL

Return values

- **None:**

Notes

- On this STM32 series, output connection depends on output mode (normal or sample and hold) and output buffer state. if output connection is set to internal path and output buffer is enabled (whatever output mode): output connection is also connected to GPIO pin (both connections to GPIO pin and internal path).if output connection is set to GPIO pin, output buffer is disabled, output mode set to sample and hold: output connection is also connected to internal path (both connections to GPIO pin and internal path).

Reference Manual to LL API cross reference:

- CR MODE1 LL_DAC_SetOutputConnection

LL_DAC_GetOutputConnection

Function name

__STATIC_INLINE uint32_t LL_DAC_GetOutputConnection (const DAC_TypeDef * DACx, uint32_t DAC_Channel)

Function description

Get the output connection for the selected DAC channel.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1

Return values

- **Returned:** value can be one of the following values:
  - LL_DAC_OUTPUT_CONNECT_GPIO
  - LL_DAC_OUTPUT_CONNECT_INTERNAL

Notes

- On this STM32 series, output connection depends on output mode (normal or sample and hold) and output buffer state. if output connection is set to internal path and output buffer is enabled (whatever output mode): output connection is also connected to GPIO pin (both connections to GPIO pin and internal path).if output connection is set to GPIO pin, output buffer is disabled, output mode set to sample and hold: output connection is also connected to internal path (both connections to GPIO pin and internal path).

Reference Manual to LL API cross reference:

- CR MODE1 LL_DAC_GetOutputConnection

LL_DAC_SetSampleAndHoldSampleTime

Function name

__STATIC_INLINE void LL_DAC_SetSampleAndHoldSampleTime (DAC_TypeDef * DACx, uint32_t DAC_Channel, uint32_t SampleTime)

Function description

Set the sample-and-hold timing for the selected DAC channel: sample time.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1
- **SampleTime:** Value between Min_Data=0x000 and Max_Data=0x3FF

Return values

- **None:**

Notes

- Sample time must be set when DAC channel is disabled or during DAC operation when DAC channel flag BWSTx is reset, otherwise the setting is ignored. Check BWSTx flag state using function "LL_DAC_IsActiveFlag_BWSTx()".

Reference Manual to LL API cross reference:

- SHSR1 TSAMPLE1 LL_DAC_SetSampleAndHoldSampleTime

LL_DAC_GetSampleAndHoldSampleTime

Function name

__STATIC_INLINE uint32_t LL_DAC_GetSampleAndHoldSampleTime (const DAC_TypeDef * DACx, uint32_t DAC_Channel)

Function description

Get the sample-and-hold timing for the selected DAC channel: sample time.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1

Return values

- **Value:** between Min_Data=0x000 and Max_Data=0x3FF

Reference Manual to LL API cross reference:

- SHSR1 TSAMPLE1 LL_DAC_GetSampleAndHoldSampleTime

LL_DAC_SetSampleAndHoldHoldTime

Function name

__STATIC_INLINE void LL_DAC_SetSampleAndHoldHoldTime (DAC_TypeDef * DACx, uint32_t DAC_Channel, uint32_t HoldTime)

Function description

Set the sample-and-hold timing for the selected DAC channel: hold time.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1
- **HoldTime:** Value between Min_Data=0x000 and Max_Data=0x3FF

Return values

- **None:**

Reference Manual to LL API cross reference:

- SHHR THOLD1 LL_DAC_SetSampleAndHoldHoldTime

LL_DAC_GetSampleAndHoldHoldTime

Function name

__STATIC_INLINE uint32_t LL_DAC_GetSampleAndHoldHoldTime (const DAC_TypeDef * DACx, uint32_t DAC_Channel)

Function description

Get the sample-and-hold timing for the selected DAC channel: hold time.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1

Return values

- **Value:** between Min_Data=0x000 and Max_Data=0x3FF

Reference Manual to LL API cross reference:

- SHHR THOLD1 LL_DAC_GetSampleAndHoldHoldTime

LL_DAC_SetSampleAndHoldRefreshTime

Function name

__STATIC_INLINE void LL_DAC_SetSampleAndHoldRefreshTime (DAC_TypeDef * DACx, uint32_t DAC_Channel, uint32_t RefreshTime)

Function description

Set the sample-and-hold timing for the selected DAC channel: refresh time.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1
- **RefreshTime:** Value between Min_Data=0x00 and Max_Data=0xFF

Return values

- **None:**

Reference Manual to LL API cross reference:

- SHRR TREFRESH1 LL_DAC_SetSampleAndHoldRefreshTime

LL_DAC_GetSampleAndHoldRefreshTime

Function name

__STATIC_INLINE uint32_t LL_DAC_GetSampleAndHoldRefreshTime (const DAC_TypeDef * DACx, uint32_t DAC_Channel)

Function description

Get the sample-and-hold timing for the selected DAC channel: refresh time.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1

Return values

- **Value:** between Min_Data=0x00 and Max_Data=0xFF

Reference Manual to LL API cross reference:

- SHRR TREFRESH1 LL_DAC_GetSampleAndHoldRefreshTime

LL_DAC_EnableDMAReq

Function name

__STATIC_INLINE void LL_DAC_EnableDMAReq (DAC_TypeDef * DACx, uint32_t DAC_Channel)

Function description

Enable DAC DMA transfer request of the selected channel.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1

Return values

- **None:**

Notes

- To configure DMA source address (peripheral address), use function LL_DAC_DMA_GetRegAddr().

Reference Manual to LL API cross reference:

- CR DMAEN1 LL_DAC_EnableDMAReq

LL_DAC_DisableDMAReq

Function name

__STATIC_INLINE void LL_DAC_DisableDMAReq (DAC_TypeDef * DACx, uint32_t DAC_Channel)

Function description

Disable DAC DMA transfer request of the selected channel.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1

Return values

- **None:**

Notes

- To configure DMA source address (peripheral address), use function LL_DAC_DMA_GetRegAddr().

Reference Manual to LL API cross reference:

- CR DMAEN1 LL_DAC_DisableDMAReq

LL_DAC_IsDMAReqEnabled

Function name

__STATIC_INLINE uint32_t LL_DAC_IsDMAReqEnabled (const DAC_TypeDef * DACx, uint32_t DAC_Channel)

Function description

Get DAC DMA transfer request state of the selected channel.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR DMAEN1 LL_DAC_IsDMAReqEnabled

LL_DAC_DMA_GetRegAddr

Function name

__STATIC_INLINE uint32_t LL_DAC_DMA_GetRegAddr (const DAC_TypeDef * DACx, uint32_t DAC_Channel, uint32_t Register)

Function description

Function to help to configure DMA transfer to DAC: retrieve the DAC register address from DAC instance and a list of DAC registers intended to be used (most commonly) with DMA transfer.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1
- **Register:** This parameter can be one of the following values:
  - LL_DAC_DMA_REG_DATA_12BITS_RIGHT_ALIGNED
  - LL_DAC_DMA_REG_DATA_12BITS_LEFT_ALIGNED
  - LL_DAC_DMA_REG_DATA_8BITS_RIGHT_ALIGNED

Return values

- **DAC:** register address

Notes

- These DAC registers are data holding registers: when DAC conversion is requested, DAC generates a DMA transfer request to have data available in DAC data holding registers.
- This macro is intended to be used with LL DMA driver, refer to function "LL_DMA_ConfigAddresses()". Example: LL_DMA_ConfigAddresses(DMA1, LL_DMA_CHANNEL_1, (uint32_t)&< array or variable >, LL_DAC_DMA_GetRegAddr(DAC1, LL_DAC_CHANNEL_1, LL_DAC_DMA_REG_DATA_12BITS_RIGHT_ALIGNED), LL_DMA_DIRECTION_MEMORY_TO_PERIPH);

Reference Manual to LL API cross reference:

- DHR12R1 DACC1DHR LL_DAC_DMA_GetRegAddr
- DHR12L1 DACC1DHR LL_DAC_DMA_GetRegAddr
- DHR8R1 DACC1DHR LL_DAC_DMA_GetRegAddr

LL_DAC_Enable

Function name

__STATIC_INLINE void LL_DAC_Enable (DAC_TypeDef * DACx, uint32_t DAC_Channel)

Function description

Enable DAC selected channel.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1

Return values

- **None:**

Notes

- After enable from off state, DAC channel requires a delay for output voltage to reach accuracy +/- 1 LSB. Refer to device datasheet, parameter "tWAKEUP".

Reference Manual to LL API cross reference:

- CR EN1 LL_DAC_Enable

LL_DAC_Disable

Function name

__STATIC_INLINE void LL_DAC_Disable (DAC_TypeDef * DACx, uint32_t DAC_Channel)

Function description

Disable DAC selected channel.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR EN1 LL_DAC_Disable

LL_DAC_IsEnabled

Function name

__STATIC_INLINE uint32_t LL_DAC_IsEnabled (const DAC_TypeDef * DACx, uint32_t DAC_Channel)

Function description

Get DAC enable state of the selected channel.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR EN1 LL_DAC_IsEnabled

LL_DAC_EnableTrigger

Function name

__STATIC_INLINE void LL_DAC_EnableTrigger (DAC_TypeDef * DACx, uint32_t DAC_Channel)

Function description

Enable DAC trigger of the selected channel.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1

Return values

- **None:**

Notes

- - If DAC trigger is disabled, DAC conversion is performed automatically once the data holding register is updated, using functions "LL_DAC_ConvertData{8; 12}{Right; Left} Aligned()": LL_DAC_ConvertData12RightAligned(), ... If DAC trigger is enabled, DAC conversion is performed only when a hardware of software trigger event is occurring. Select trigger source using function LL_DAC_SetTriggerSource().

Reference Manual to LL API cross reference:

- CR TEN1 LL_DAC_EnableTrigger

LL_DAC_DisableTrigger

Function name

__STATIC_INLINE void LL_DAC_DisableTrigger (DAC_TypeDef * DACx, uint32_t DAC_Channel)

Function description

Disable DAC trigger of the selected channel.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR TEN1 LL_DAC_DisableTrigger

LL_DAC_IsTriggerEnabled

Function name

__STATIC_INLINE uint32_t LL_DAC_IsTriggerEnabled (const DAC_TypeDef * DACx, uint32_t DAC_Channel)

Function description

Get DAC trigger state of the selected channel.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR TEN1 LL_DAC_IsTriggerEnabled

LL_DAC_TrigSWConversion

Function name

__STATIC_INLINE void LL_DAC_TrigSWConversion (DAC_TypeDef * DACx, uint32_t DAC_Channel)

Function description

Trig DAC conversion by software for the selected DAC channel.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can a combination of the following values:
  - LL_DAC_CHANNEL_1

Return values

- **None:**

Notes

- Preliminarily, DAC trigger must be set to software trigger using function LL_DAC_Init() LL_DAC_SetTriggerSource() with parameter "LL_DAC_TRIGGER_SOFTWARE". and DAC trigger must be enabled using function LL_DAC_EnableTrigger().
- For devices featuring DAC with 2 channels: this function can perform a SW start of both DAC channels simultaneously. Two channels can be selected as parameter. Example: (LL_DAC_CHANNEL_1 | LL_DAC_CHANNEL_2)

Reference Manual to LL API cross reference:

- SWTRIGR SWTRIG1 LL_DAC_TrigSWConversion

LL_DAC_ConvertData12RightAligned

Function name

__STATIC_INLINE void LL_DAC_ConvertData12RightAligned (DAC_TypeDef * DACx, uint32_t DAC_Channel, uint32_t Data)

Function description

Set the data to be loaded in the data holding register in format 12 bits left alignment (LSB aligned on bit 0), for the selected DAC channel.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1
- **Data:** Value between Min_Data=0x000 and Max_Data=0xFFF

Return values

- **None:**

Reference Manual to LL API cross reference:

- DHR12R1 DACC1DHR LL_DAC_ConvertData12RightAligned

LL_DAC_ConvertData12LeftAligned

Function name

__STATIC_INLINE void LL_DAC_ConvertData12LeftAligned (DAC_TypeDef * DACx, uint32_t DAC_Channel, uint32_t Data)

Function description

Set the data to be loaded in the data holding register in format 12 bits left alignment (MSB aligned on bit 15), for the selected DAC channel.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1
- **Data:** Value between Min_Data=0x000 and Max_Data=0xFFF

Return values

- **None:**

Reference Manual to LL API cross reference:

- DHR12L1 DACC1DHR LL_DAC_ConvertData12LeftAligned

LL_DAC_ConvertData8RightAligned

Function name

__STATIC_INLINE void LL_DAC_ConvertData8RightAligned (DAC_TypeDef * DACx, uint32_t DAC_Channel, uint32_t Data)

Function description

Set the data to be loaded in the data holding register in format 8 bits left alignment (LSB aligned on bit 0), for the selected DAC channel.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1
- **Data:** Value between Min_Data=0x00 and Max_Data=0xFF

Return values

- **None:**

Reference Manual to LL API cross reference:

- DHR8R1 DACC1DHR LL_DAC_ConvertData8RightAligned

LL_DAC_RetrieveOutputData

Function name

__STATIC_INLINE uint32_t LL_DAC_RetrieveOutputData (const DAC_TypeDef * DACx, uint32_t DAC_Channel)

Function description

Retrieve output data currently generated for the selected DAC channel.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1

Return values

- **Value:** between Min_Data=0x000 and Max_Data=0xFFF

Notes

- Whatever alignment and resolution settings (using functions "LL_DAC_ConvertData{8; 12}{Right; Left} Aligned()": LL_DAC_ConvertData12RightAligned(), ...), output data format is 12 bits right aligned (LSB aligned on bit 0).

Reference Manual to LL API cross reference:

- DOR1 DACC1DOR LL_DAC_RetrieveOutputData

LL_DAC_IsActiveFlag_CAL1

Function name

__STATIC_INLINE uint32_t LL_DAC_IsActiveFlag_CAL1 (const DAC_TypeDef * DACx)

Function description

Get DAC calibration offset flag for DAC channel 1.

Parameters

- **DACx:** DAC instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR CAL_FLAG1 LL_DAC_IsActiveFlag_CAL1

LL_DAC_IsActiveFlag_BWST1

Function name

__STATIC_INLINE uint32_t LL_DAC_IsActiveFlag_BWST1 (const DAC_TypeDef * DACx)

Function description

Get DAC busy writing sample time flag for DAC channel 1.

Parameters

- **DACx:** DAC instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR BWST1 LL_DAC_IsActiveFlag_BWST1

LL_DAC_IsActiveFlag_DMAUDR1

Function name

__STATIC_INLINE uint32_t LL_DAC_IsActiveFlag_DMAUDR1 (const DAC_TypeDef * DACx)

Function description

Get DAC underrun flag for DAC channel 1.

Parameters

- **DACx:** DAC instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR DMAUDR1 LL_DAC_IsActiveFlag_DMAUDR1

LL_DAC_ClearFlag_DMAUDR1

Function name

__STATIC_INLINE void LL_DAC_ClearFlag_DMAUDR1 (DAC_TypeDef * DACx)

Function description

Clear DAC underrun flag for DAC channel 1.

Parameters

- **DACx:** DAC instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- SR DMAUDR1 LL_DAC_ClearFlag_DMAUDR1

LL_DAC_EnableIT_DMAUDR1

Function name

__STATIC_INLINE void LL_DAC_EnableIT_DMAUDR1 (DAC_TypeDef * DACx)

Function description

Enable DMA underrun interrupt for DAC channel 1.

Parameters

- **DACx:** DAC instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR DMAUDRIE1 LL_DAC_EnableIT_DMAUDR1

LL_DAC_DisableIT_DMAUDR1

Function name

__STATIC_INLINE void LL_DAC_DisableIT_DMAUDR1 (DAC_TypeDef * DACx)

Function description

Disable DMA underrun interrupt for DAC channel 1.

Parameters

- **DACx:** DAC instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR DMAUDRIE1 LL_DAC_DisableIT_DMAUDR1

LL_DAC_IsEnabledIT_DMAUDR1

Function name

__STATIC_INLINE uint32_t LL_DAC_IsEnabledIT_DMAUDR1 (const DAC_TypeDef * DACx)

Function description

Get DMA underrun interrupt for DAC channel 1.

Parameters

- **DACx:** DAC instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR DMAUDRIE1 LL_DAC_IsEnabledIT_DMAUDR1

LL_DAC_DeInit

Function name

ErrorStatus LL_DAC_DeInit (const DAC_TypeDef * DACx)

Function description

De-initialize registers of the selected DAC instance to their default reset values.

Parameters

- **DACx:** DAC instance

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: DAC registers are de-initialized
  - ERROR: not applicable

LL_DAC_Init

Function name

ErrorStatus LL_DAC_Init (DAC_TypeDef * DACx, uint32_t DAC_Channel, const LL_DAC_InitTypeDef * DAC_InitStruct)

Function description

Initialize some features of DAC channel.

Parameters

- **DACx:** DAC instance
- **DAC_Channel:** This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1
- **DAC_InitStruct:** Pointer to a LL_DAC_InitTypeDef structure

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: DAC registers are initialized
  - ERROR: DAC registers are not initialized

Notes

- LL_DAC_Init() aims to ease basic configuration of a DAC channel. Leaving it ready to be enabled and output: a level by calling one of LL_DAC_ConvertData12RightAligned LL_DAC_ConvertData12LeftAligned LL_DAC_ConvertData8RightAligned or one of the supported autogenerated wave.
- This function allows configuration of: Output modeTriggerWave generation
- The setting of these parameters by function LL_DAC_Init() is conditioned to DAC state: DAC channel must be disabled.

LL_DAC_StructInit

Function name

void LL_DAC_StructInit (LL_DAC_InitTypeDef * DAC_InitStruct)

Function description

Set each LL_DAC_InitTypeDef field to default value.

Parameters

- **DAC_InitStruct:** pointer to a LL_DAC_InitTypeDef structure whose fields will be set to default values.

Return values

- **None:**

61.3 DAC Firmware driver defines

The following section lists the various define and macros of the module.

61.3.1 DAC

DAC

DAC channels

LL_DAC_CHANNEL_1

DAC channel 1

DAC flags

LL_DAC_FLAG_DMAUDR1

DAC channel 1 flag DMA underrun

LL_DAC_FLAG_CAL1

DAC channel 1 flag offset calibration status

LL_DAC_FLAG_BWST1

DAC channel 1 flag busy writing sample time

Definitions of DAC hardware constraints delays

LL_DAC_DELAY_STARTUP_VOLTAGE_SETTLING_US

Delay for DAC channel voltage settling time from DAC channel startup (transition from disable to enable)

LL_DAC_DELAY_VOLTAGE_SETTLING_US

Delay for DAC channel voltage settling time

DAC interruptions

LL_DAC_IT_DMAUDRIE1

DAC channel 1 interruption DMA underrun

DAC operating mode

LL_DAC_MODE_NORMAL_OPERATION

DAC channel in mode normal operation

LL_DAC_MODE_CALIBRATION

DAC channel in mode calibration

DAC channel output buffer

LL_DAC_OUTPUT_BUFFER_ENABLE

The selected DAC channel output is buffered: higher drive current capability, but also higher current consumption

LL_DAC_OUTPUT_BUFFER_DISABLE

The selected DAC channel output is not buffered: lower drive current capability, but also lower current consumption

DAC channel output connection

LL_DAC_OUTPUT_CONNECT_GPIO

The selected DAC channel output is connected to external pin

LL_DAC_OUTPUT_CONNECT_INTERNAL

The selected DAC channel output is connected to on-chip peripherals via internal paths. On this STM32 series, output connection depends on output mode (normal or sample and hold) and output buffer state. Refer to comments of function

DAC channel output mode

LL_DAC_OUTPUT_MODE_NORMAL

The selected DAC channel output is on mode normal.

LL_DAC_OUTPUT_MODE_SAMPLE_AND_HOLD

The selected DAC channel output is on mode sample-and-hold. Mode sample-and-hold requires an external capacitor, refer to description of function

DAC registers compliant with specific purpose

LL_DAC_DMA_REG_DATA_12BITS_RIGHT_ALIGNED

DAC channel data holding register 12 bits right aligned

LL_DAC_DMA_REG_DATA_12BITS_LEFT_ALIGNED

DAC channel data holding register 12 bits left aligned

LL_DAC_DMA_REG_DATA_8BITS_RIGHT_ALIGNED

DAC channel data holding register 8 bits right aligned

DAC channel output resolution

LL_DAC_RESOLUTION_12B

DAC channel resolution 12 bits

LL_DAC_RESOLUTION_8B

DAC channel resolution 8 bits

DAC trigger source

LL_DAC_TRIG_SOFTWARE

DAC channel conversion trigger internal (SW start)

LL_DAC_TRIG_EXT_TIM1_TRGO

DAC channel conversion trigger from external peripheral: TIM1 TRGO.

LL_DAC_TRIG_EXT_TIM2_TRGO

DAC channel conversion trigger from external peripheral: TIM2 TRGO.

LL_DAC_TRIG_EXT_TIM3_TRGO

DAC channel conversion trigger from external peripheral: TIM3 TRGO.

LL_DAC_TRIG_EXT_TIM6_TRGO

DAC channel conversion trigger from external peripheral: TIM6 TRGO.

LL_DAC_TRIG_EXT_TIM7_TRGO

DAC channel conversion trigger from external peripheral: TIM7 TRGO.

LL_DAC_TRIG_EXT_TIM15_TRGO

DAC channel conversion trigger from external peripheral: TIM15 TRGO.

LL_DAC_TRIG_EXT_LPTIM1_OUT

DAC channel conversion trigger from external peripheral: LPTIM1 TRGO.

LL_DAC_TRIG_EXT_LPTIM2_OUT

DAC channel conversion trigger from external peripheral: LPTIM2 TRGO.

LL_DAC_TRIG_EXT_EXTI_LINE9

DAC channel conversion trigger from external peripheral: external interrupt line 9.

DAC waveform automatic generation mode

LL_DAC_WAVE_AUTO_GENERATION_NONE

DAC channel wave auto generation mode disabled.

LL_DAC_WAVE_AUTO_GENERATION_NOISE

DAC channel wave auto generation mode enabled, set generated noise waveform.

LL_DAC_WAVE_AUTO_GENERATION_TRIANGLE

DAC channel wave auto generation mode enabled, set generated triangle waveform.

DAC wave generation - Noise LFSR unmask bits

LL_DAC_NOISE_LFSR_UNMASK_BIT0

Noise wave generation, unmask LFSR bit0, for the selected DAC channel

LL_DAC_NOISE_LFSR_UNMASK_BITS1_0

Noise wave generation, unmask LFSR bits[1:0], for the selected DAC channel

LL_DAC_NOISE_LFSR_UNMASK_BITS2_0

Noise wave generation, unmask LFSR bits[2:0], for the selected DAC channel

LL_DAC_NOISE_LFSR_UNMASK_BITS3_0

Noise wave generation, unmask LFSR bits[3:0], for the selected DAC channel

LL_DAC_NOISE_LFSR_UNMASK_BITS4_0

Noise wave generation, unmask LFSR bits[4:0], for the selected DAC channel

LL_DAC_NOISE_LFSR_UNMASK_BITS5_0

Noise wave generation, unmask LFSR bits[5:0], for the selected DAC channel

LL_DAC_NOISE_LFSR_UNMASK_BITS6_0

Noise wave generation, unmask LFSR bits[6:0], for the selected DAC channel

LL_DAC_NOISE_LFSR_UNMASK_BITS7_0

Noise wave generation, unmask LFSR bits[7:0], for the selected DAC channel

LL_DAC_NOISE_LFSR_UNMASK_BITS8_0

Noise wave generation, unmask LFSR bits[8:0], for the selected DAC channel

LL_DAC_NOISE_LFSR_UNMASK_BITS9_0

Noise wave generation, unmask LFSR bits[9:0], for the selected DAC channel

LL_DAC_NOISE_LFSR_UNMASK_BITS10_0

Noise wave generation, unmask LFSR bits[10:0], for the selected DAC channel

LL_DAC_NOISE_LFSR_UNMASK_BITS11_0

Noise wave generation, unmask LFSR bits[11:0], for the selected DAC channel

DAC wave generation - Triangle amplitude

LL_DAC_TRIANGLE_AMPLITUDE_1

Triangle wave generation, amplitude of 1 LSB of DAC output range, for the selected DAC channel

LL_DAC_TRIANGLE_AMPLITUDE_3

Triangle wave generation, amplitude of 3 LSB of DAC output range, for the selected DAC channel

LL_DAC_TRIANGLE_AMPLITUDE_7

Triangle wave generation, amplitude of 7 LSB of DAC output range, for the selected DAC channel

LL_DAC_TRIANGLE_AMPLITUDE_15

Triangle wave generation, amplitude of 15 LSB of DAC output range, for the selected DAC channel

LL_DAC_TRIANGLE_AMPLITUDE_31

Triangle wave generation, amplitude of 31 LSB of DAC output range, for the selected DAC channel

LL_DAC_TRIANGLE_AMPLITUDE_63

Triangle wave generation, amplitude of 63 LSB of DAC output range, for the selected DAC channel

LL_DAC_TRIANGLE_AMPLITUDE_127

Triangle wave generation, amplitude of 127 LSB of DAC output range, for the selected DAC channel

LL_DAC_TRIANGLE_AMPLITUDE_255

Triangle wave generation, amplitude of 255 LSB of DAC output range, for the selected DAC channel

LL_DAC_TRIANGLE_AMPLITUDE_511

Triangle wave generation, amplitude of 512 LSB of DAC output range, for the selected DAC channel

LL_DAC_TRIANGLE_AMPLITUDE_1023

Triangle wave generation, amplitude of 1023 LSB of DAC output range, for the selected DAC channel

LL_DAC_TRIANGLE_AMPLITUDE_2047

Triangle wave generation, amplitude of 2047 LSB of DAC output range, for the selected DAC channel

LL_DAC_TRIANGLE_AMPLITUDE_4095

Triangle wave generation, amplitude of 4095 LSB of DAC output range, for the selected DAC channel

DAC helper macro

__LL_DAC_CHANNEL_TO_DECIMAL_NB

Description:

- Helper macro to get DAC channel number in decimal format from literals LL_DAC_CHANNEL_x.

Parameters:

- __CHANNEL__: This parameter can be one of the following values:
  - LL_DAC_CHANNEL_1

Return value:

- 1

Notes:

- The input can be a value from functions where a channel number is returned.

__LL_DAC_DECIMAL_NB_TO_CHANNEL

Description:

- Helper macro to get DAC channel in literal format LL_DAC_CHANNEL_x from number in decimal format.

Parameters:

- __DECIMAL_NB__: 1...2

Return value:

- Returned: value can be one of the following values:
  - LL_DAC_CHANNEL_1

Notes:

- If the input parameter does not correspond to a DAC channel, this macro returns value '0'.

__LL_DAC_DIGITAL_SCALE

Description:

- Helper macro to define the DAC conversion data full-scale digital value corresponding to the selected DAC resolution.

Parameters:

- __DAC_RESOLUTION__: This parameter can be one of the following values:
  - LL_DAC_RESOLUTION_12B
  - LL_DAC_RESOLUTION_8B

Return value:

- ADC: conversion data equivalent voltage value (unit: mVolt)

Notes:

- DAC conversion data full-scale corresponds to voltage range determined by analog voltage references Vref+ and Vref- (refer to reference manual).

__LL_DAC_CALC_VOLTAGE_TO_DATA

Description:

- Helper macro to calculate the DAC conversion data (unit: digital value) corresponding to a voltage (unit: mVolt).

Parameters:

- __VREFANALOG_VOLTAGE__: Analog reference voltage (unit: mV)
- __DAC_VOLTAGE__: Voltage to be generated by DAC channel (unit: mVolt).
- __DAC_RESOLUTION__: This parameter can be one of the following values:
  - LL_DAC_RESOLUTION_12B
  - LL_DAC_RESOLUTION_8B

Return value:

- DAC: conversion data (unit: digital value)

Notes:

- This helper macro is intended to provide input data in voltage rather than digital value, to be used with LL DAC functions such as LL_DAC_ConvertData12RightAligned(). Analog reference voltage (Vref+) must be either known from user board environment or can be calculated using ADC measurement and ADC helper macro __LL_ADC_CALC_VREFANALOG_VOLTAGE().

Common write and read registers macros

LL_DAC_WriteReg

Description:

- Write a value in DAC register.

Parameters:

- __INSTANCE__: DAC Instance
- __REG__: Register to be written
- __VALUE__: Value to be written in the register

Return value:

- None

LL_DAC_ReadReg

Description:

- Read a value in DAC register.

Parameters:

- __INSTANCE__: DAC Instance
- __REG__: Register to be read

Return value:

- Register: value

62 LL DMAMUX Generic Driver

62.1 DMAMUX Firmware driver API description

The following section lists the various functions of the DMAMUX library.

62.1.1 Detailed description of functions

LL_DMAMUX_SetRequestID

Function name

__STATIC_INLINE void LL_DMAMUX_SetRequestID (DMAMUX_Channel_TypeDef * DMAMUXx, uint32_t Channel, uint32_t Request)

Function description

Set DMAMUX request ID for DMAMUX Channel x.

Parameters

- **DMAMUXx:** DMAMUXx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMAMUX_CHANNEL_0
  - LL_DMAMUX_CHANNEL_1
  - LL_DMAMUX_CHANNEL_2
  - LL_DMAMUX_CHANNEL_3
  - LL_DMAMUX_CHANNEL_4
  - LL_DMAMUX_CHANNEL_5
  - LL_DMAMUX_CHANNEL_6
  - All the next values are only available on chip which support DMA2:
  - LL_DMAMUX_CHANNEL_7
  - LL_DMAMUX_CHANNEL_8
  - LL_DMAMUX_CHANNEL_9
  - LL_DMAMUX_CHANNEL_10
  - LL_DMAMUX_CHANNEL_11

- **Request:** This parameter can be one of the following values:
  - LL_DMAMUX_REQ_MEM2MEM
  - LL_DMAMUX_REQ_GENERATOR0
  - LL_DMAMUX_REQ_GENERATOR1
  - LL_DMAMUX_REQ_GENERATOR2
  - LL_DMAMUX_REQ_GENERATOR3
  - LL_DMAMUX_REQ_ADC
  - LL_DMAMUX_REQ_AES_IN
  - LL_DMAMUX_REQ_AES_OUT
  - LL_DMAMUX_REQ_DAC_CH1
  - LL_DMAMUX_REQ_I2C1_RX
  - LL_DMAMUX_REQ_I2C1_TX
  - LL_DMAMUX_REQ_I2C2_RX
  - LL_DMAMUX_REQ_I2C2_TX
  - LL_DMAMUX_REQ_I2C3_RX
  - LL_DMAMUX_REQ_I2C3_TX
  - LL_DMAMUX_REQ_I2C4_RX
  - LL_DMAMUX_REQ_I2C4_TX
  - LL_DMAMUX_REQ_LPTIM1_IC1
  - LL_DMAMUX_REQ_LPTIM1_IC2
  - LL_DMAMUX_REQ_LPTIM1_IC3
  - LL_DMAMUX_REQ_LPTIM1_IC4
  - LL_DMAMUX_REQ_LPTIM1_UE
  - LL_DMAMUX_REQ_LPTIM2_IC1
  - LL_DMAMUX_REQ_LPTIM2_IC2
  - LL_DMAMUX_REQ_LPTIM2_UE
  - LL_DMAMUX_REQ_LPTIM3_IC1
  - LL_DMAMUX_REQ_LPTIM3_IC2
  - LL_DMAMUX_REQ_LPTIM3_IC3
  - LL_DMAMUX_REQ_LPTIM3_IC4
  - LL_DMAMUX_REQ_LPTIM3_UE
  - LL_DMAMUX_REQ_LPUART1_RX
  - LL_DMAMUX_REQ_LPUART1_TX
  - LL_DMAMUX_REQ_LPUART2_RX
  - LL_DMAMUX_REQ_LPUART2_TX
  - LL_DMAMUX_REQ_LPUART3_RX
  - LL_DMAMUX_REQ_LPUART3_TX
  - LL_DMAMUX_REQ_SPI1_RX
  - LL_DMAMUX_REQ_SPI1_TX
  - LL_DMAMUX_REQ_SPI2_RX
  - LL_DMAMUX_REQ_SPI2_TX
  - LL_DMAMUX_REQ_SPI3_RX
  - LL_DMAMUX_REQ_SPI3_TX
  - LL_DMAMUX_REQ_TIM1_CH1
  - LL_DMAMUX_REQ_TIM1_CH2
  - LL_DMAMUX_REQ_TIM1_CH3
  - LL_DMAMUX_REQ_TIM1_CH4
  - LL_DMAMUX_REQ_TIM1_TRIG_COM
  - LL_DMAMUX_REQ_TIM1_UP
  - LL_DMAMUX_REQ_TIM2_CH1

- LL_DMAMUX_REQ_TIM2_CH2
- LL_DMAMUX_REQ_TIM2_CH3
- LL_DMAMUX_REQ_TIM2_CH4
- LL_DMAMUX_REQ_TIM2_TRIG
- LL_DMAMUX_REQ_TIM2_UP
- LL_DMAMUX_REQ_TIM3_CH1
- LL_DMAMUX_REQ_TIM3_CH2
- LL_DMAMUX_REQ_TIM3_CH3
- LL_DMAMUX_REQ_TIM3_CH4
- LL_DMAMUX_REQ_TIM3_TRIG
- LL_DMAMUX_REQ_TIM3_UP
- LL_DMAMUX_REQ_TIM6_UP
- LL_DMAMUX_REQ_TIM7_UP
- LL_DMAMUX_REQ_TIM15_CH1
- LL_DMAMUX_REQ_TIM15_CH2
- LL_DMAMUX_REQ_TIM15_TRIG_COM
- LL_DMAMUX_REQ_TIM15_UP
- LL_DMAMUX_REQ_TIM16_CH1
- LL_DMAMUX_REQ_TIM16_COM
- LL_DMAMUX_REQ_TIM16_UP
- LL_DMAMUX_REQ_USART1_RX
- LL_DMAMUX_REQ_USART1_TX
- LL_DMAMUX_REQ_USART2_RX
- LL_DMAMUX_REQ_USART2_TX
- LL_DMAMUX_REQ_USART3_RX
- LL_DMAMUX_REQ_USART3_TX
- LL_DMAMUX_REQ_USART4_RX
- LL_DMAMUX_REQ_USART4_TX

Return values

- **None:**

Notes

- DMAMUX channel 0 to 6 are mapped to DMA1 channel 1 to 7. DMAMUX channel 7 to 11 are mapped to DMA2 channel 1 to 5 (** only available on chip which support DMA2 **).

Reference Manual to LL API cross reference:

- CxCR DMAREQ_ID LL_DMAMUX_SetRequestID

LL_DMAMUX_GetRequestID

Function name

__STATIC_INLINE uint32_t LL_DMAMUX_GetRequestID (DMAMUX_Channel_TypeDef * DMAMUXx, uint32_t Channel)

Function description

Get DMAMUX request ID for DMAMUX Channel x.

Parameters

- **DMAMUXx:** DMAMUXx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMAMUX_CHANNEL_0
  - LL_DMAMUX_CHANNEL_1
  - LL_DMAMUX_CHANNEL_2
  - LL_DMAMUX_CHANNEL_3
  - LL_DMAMUX_CHANNEL_4
  - LL_DMAMUX_CHANNEL_5
  - LL_DMAMUX_CHANNEL_6
  - All the next values are only available on chip which support DMA2:
  - LL_DMAMUX_CHANNEL_7
  - LL_DMAMUX_CHANNEL_8
  - LL_DMAMUX_CHANNEL_9
  - LL_DMAMUX_CHANNEL_10
  - LL_DMAMUX_CHANNEL_11

Return values

- **Returned:** value can be one of the following values:
  - LL_DMAMUX_REQ_MEM2MEM
  - LL_DMAMUX_REQ_GENERATOR0
  - LL_DMAMUX_REQ_GENERATOR1
  - LL_DMAMUX_REQ_GENERATOR2
  - LL_DMAMUX_REQ_GENERATOR3
  - LL_DMAMUX_REQ_ADC
  - LL_DMAMUX_REQ_AES_IN
  - LL_DMAMUX_REQ_AES_OUT
  - LL_DMAMUX_REQ_DAC_CH1
  - LL_DMAMUX_REQ_I2C1_RX
  - LL_DMAMUX_REQ_I2C1_TX
  - LL_DMAMUX_REQ_I2C2_RX
  - LL_DMAMUX_REQ_I2C2_TX
  - LL_DMAMUX_REQ_I2C3_RX
  - LL_DMAMUX_REQ_I2C3_TX
  - LL_DMAMUX_REQ_I2C4_RX
  - LL_DMAMUX_REQ_I2C4_TX
  - LL_DMAMUX_REQ_LPTIM1_IC1
  - LL_DMAMUX_REQ_LPTIM1_IC2
  - LL_DMAMUX_REQ_LPTIM1_IC3
  - LL_DMAMUX_REQ_LPTIM1_IC4
  - LL_DMAMUX_REQ_LPTIM1_UE
  - LL_DMAMUX_REQ_LPTIM2_IC1
  - LL_DMAMUX_REQ_LPTIM2_IC2
  - LL_DMAMUX_REQ_LPTIM2_UE
  - LL_DMAMUX_REQ_LPTIM3_IC1
  - LL_DMAMUX_REQ_LPTIM3_IC2
  - LL_DMAMUX_REQ_LPTIM3_IC3
  - LL_DMAMUX_REQ_LPTIM3_IC4
  - LL_DMAMUX_REQ_LPTIM3_UE
  - LL_DMAMUX_REQ_LPUART1_RX
  - LL_DMAMUX_REQ_LPUART1_TX
  - LL_DMAMUX_REQ_LPUART2_RX
  - LL_DMAMUX_REQ_LPUART2_TX
  - LL_DMAMUX_REQ_LPUART3_RX
  - LL_DMAMUX_REQ_LPUART3_TX
  - LL_DMAMUX_REQ_SPI1_RX
  - LL_DMAMUX_REQ_SPI1_TX
  - LL_DMAMUX_REQ_SPI2_RX
  - LL_DMAMUX_REQ_SPI2_TX
  - LL_DMAMUX_REQ_SPI3_RX
  - LL_DMAMUX_REQ_SPI3_TX
  - LL_DMAMUX_REQ_TIM1_CH1
  - LL_DMAMUX_REQ_TIM1_CH2
  - LL_DMAMUX_REQ_TIM1_CH3
  - LL_DMAMUX_REQ_TIM1_CH4
  - LL_DMAMUX_REQ_TIM1_TRIG_COM
  - LL_DMAMUX_REQ_TIM1_UP

- LL_DMAMUX_REQ_TIM2_CH1
- LL_DMAMUX_REQ_TIM2_CH2
- LL_DMAMUX_REQ_TIM2_CH3
- LL_DMAMUX_REQ_TIM2_CH4
- LL_DMAMUX_REQ_TIM2_TRIG
- LL_DMAMUX_REQ_TIM2_UP
- LL_DMAMUX_REQ_TIM3_CH1
- LL_DMAMUX_REQ_TIM3_CH2
- LL_DMAMUX_REQ_TIM3_CH3
- LL_DMAMUX_REQ_TIM3_CH4
- LL_DMAMUX_REQ_TIM3_TRIG
- LL_DMAMUX_REQ_TIM3_UP
- LL_DMAMUX_REQ_TIM6_UP
- LL_DMAMUX_REQ_TIM7_UP
- LL_DMAMUX_REQ_TIM15_CH1
- LL_DMAMUX_REQ_TIM15_CH2
- LL_DMAMUX_REQ_TIM15_TRIG_COM
- LL_DMAMUX_REQ_TIM15_UP
- LL_DMAMUX_REQ_TIM16_CH1
- LL_DMAMUX_REQ_TIM16_COM
- LL_DMAMUX_REQ_TIM16_UP
- LL_DMAMUX_REQ_USART1_RX
- LL_DMAMUX_REQ_USART1_TX
- LL_DMAMUX_REQ_USART2_RX
- LL_DMAMUX_REQ_USART2_TX
- LL_DMAMUX_REQ_USART3_RX
- LL_DMAMUX_REQ_USART3_TX
- LL_DMAMUX_REQ_USART4_RX
- LL_DMAMUX_REQ_USART4_TX

Notes

- DMAMUX channel 0 to 6 are mapped to DMA1 channel 1 to 7. DMAMUX channel 7 to 11 are mapped to DMA2 channel 1 to 5 (** only available on chip which support DMA2 **).

Reference Manual to LL API cross reference:

- CxCR DMAREQ_ID LL_DMAMUX_GetRequestID

LL_DMAMUX_SetSyncRequestNb

Function name

__STATIC_INLINE void LL_DMAMUX_SetSyncRequestNb (DMAMUX_Channel_TypeDef * DMAMUXx, uint32_t Channel, uint32_t RequestNb)

Function description

Set the number of DMA request that will be autorized after a synchronization event and/or the number of DMA request needed to generate an event.

Parameters

- **DMAMUXx:** DMAMUXx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMAMUX_CHANNEL_0
  - LL_DMAMUX_CHANNEL_1
  - LL_DMAMUX_CHANNEL_2
  - LL_DMAMUX_CHANNEL_3
  - LL_DMAMUX_CHANNEL_4
  - LL_DMAMUX_CHANNEL_5
  - LL_DMAMUX_CHANNEL_6
  - All the next values are only available on chip which support DMA2:
  - LL_DMAMUX_CHANNEL_7
  - LL_DMAMUX_CHANNEL_8
  - LL_DMAMUX_CHANNEL_9
  - LL_DMAMUX_CHANNEL_10
  - LL_DMAMUX_CHANNEL_11
- **RequestNb:** This parameter must be a value between Min_Data = 1 and Max_Data = 32.

Return values

- **None:**

Notes

- DMAMUX channel 0 to 6 are mapped to DMA1 channel 1 to 7. DMAMUX channel 7 to 11 are mapped to DMA2 channel 1 to 5 (** only available on chip which support DMA2 **).

Reference Manual to LL API cross reference:

- CxCR NBREQ LL_DMAMUX_SetSyncRequestNb

LL_DMAMUX_GetSyncRequestNb

Function name

__STATIC_INLINE uint32_t LL_DMAMUX_GetSyncRequestNb (DMAMUX_Channel_TypeDef * DMAMUXx, uint32_t Channel)

Function description

Get the number of DMA request that will be autorized after a synchronization event and/or the number of DMA request needed to generate an event.

Parameters

- **DMAMUXx:** DMAMUXx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMAMUX_CHANNEL_0
  - LL_DMAMUX_CHANNEL_1
  - LL_DMAMUX_CHANNEL_2
  - LL_DMAMUX_CHANNEL_3
  - LL_DMAMUX_CHANNEL_4
  - LL_DMAMUX_CHANNEL_5
  - LL_DMAMUX_CHANNEL_6
  - All the next values are only available on chip which support DMA2:
  - LL_DMAMUX_CHANNEL_7
  - LL_DMAMUX_CHANNEL_8
  - LL_DMAMUX_CHANNEL_9
  - LL_DMAMUX_CHANNEL_10
  - LL_DMAMUX_CHANNEL_11

Return values

- **Between:** Min_Data = 1 and Max_Data = 32

Notes

- DMAMUX channel 0 to 6 are mapped to DMA1 channel 1 to 7. DMAMUX channel 7 to 11 are mapped to DMA2 channel 1 to 5 (** only available on chip which support DMA2 **).

Reference Manual to LL API cross reference:

- CxCR NBREQ LL_DMAMUX_GetSyncRequestNb

LL_DMAMUX_SetSyncPolarity

Function name

__STATIC_INLINE void LL_DMAMUX_SetSyncPolarity (DMAMUX_Channel_TypeDef * DMAMUXx, uint32_t Channel, uint32_t Polarity)

Function description

Set the polarity of the signal on which the DMA request is synchronized.

Parameters

- **DMAMUXx:** DMAMUXx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMAMUX_CHANNEL_0
  - LL_DMAMUX_CHANNEL_1
  - LL_DMAMUX_CHANNEL_2
  - LL_DMAMUX_CHANNEL_3
  - LL_DMAMUX_CHANNEL_4
  - LL_DMAMUX_CHANNEL_5
  - LL_DMAMUX_CHANNEL_6
  - All the next values are only available on chip which support DMA2:
  - LL_DMAMUX_CHANNEL_7
  - LL_DMAMUX_CHANNEL_8
  - LL_DMAMUX_CHANNEL_9
  - LL_DMAMUX_CHANNEL_10
  - LL_DMAMUX_CHANNEL_11
- **Polarity:** This parameter can be one of the following values:
  - LL_DMAMUX_SYNC_NO_EVENT
  - LL_DMAMUX_SYNC_POL_RISING
  - LL_DMAMUX_SYNC_POL_FALLING
  - LL_DMAMUX_SYNC_POL_RISING_FALLING

Return values

- **None:**

Notes

- DMAMUX channel 0 to 6 are mapped to DMA1 channel 1 to 7. DMAMUX channel 7 to 11 are mapped to DMA2 channel 1 to 5 (** only available on chip which support DMA2 **).

Reference Manual to LL API cross reference:

- CxCR SPOL LL_DMAMUX_SetSyncPolarity

LL_DMAMUX_GetSyncPolarity

Function name

__STATIC_INLINE uint32_t LL_DMAMUX_GetSyncPolarity (DMAMUX_Channel_TypeDef * DMAMUXx, uint32_t Channel)

Function description

Get the polarity of the signal on which the DMA request is synchronized.

Parameters

- **DMAMUXx:** DMAMUXx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMAMUX_CHANNEL_0
  - LL_DMAMUX_CHANNEL_1
  - LL_DMAMUX_CHANNEL_2
  - LL_DMAMUX_CHANNEL_3
  - LL_DMAMUX_CHANNEL_4
  - LL_DMAMUX_CHANNEL_5
  - LL_DMAMUX_CHANNEL_6
  - All the next values are only available on chip which support DMA2:
  - LL_DMAMUX_CHANNEL_7
  - LL_DMAMUX_CHANNEL_8
  - LL_DMAMUX_CHANNEL_9
  - LL_DMAMUX_CHANNEL_10
  - LL_DMAMUX_CHANNEL_11

Return values

- **Returned:** value can be one of the following values:
  - LL_DMAMUX_SYNC_NO_EVENT
  - LL_DMAMUX_SYNC_POL_RISING
  - LL_DMAMUX_SYNC_POL_FALLING
  - LL_DMAMUX_SYNC_POL_RISING_FALLING

Notes

- DMAMUX channel 0 to 6 are mapped to DMA1 channel 1 to 7. DMAMUX channel 7 to 11 are mapped to DMA2 channel 1 to 5 (** only available on chip which support DMA2 **).

Reference Manual to LL API cross reference:

- CxCR SPOL LL_DMAMUX_GetSyncPolarity

LL_DMAMUX_EnableEventGeneration

Function name

__STATIC_INLINE void LL_DMAMUX_EnableEventGeneration (DMAMUX_Channel_TypeDef * DMAMUXx, uint32_t Channel)

Function description

Enable the Event Generation on DMAMUX channel x.

Parameters

- **DMAMUXx:** DMAMUXx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMAMUX_CHANNEL_0
  - LL_DMAMUX_CHANNEL_1
  - LL_DMAMUX_CHANNEL_2
  - LL_DMAMUX_CHANNEL_3
  - LL_DMAMUX_CHANNEL_4
  - LL_DMAMUX_CHANNEL_5
  - LL_DMAMUX_CHANNEL_6
  - All the next values are only available on chip which support DMA2:
  - LL_DMAMUX_CHANNEL_7
  - LL_DMAMUX_CHANNEL_8
  - LL_DMAMUX_CHANNEL_9
  - LL_DMAMUX_CHANNEL_10
  - LL_DMAMUX_CHANNEL_11

Return values

- **None:**

Notes

- DMAMUX channel 0 to 6 are mapped to DMA1 channel 1 to 7. DMAMUX channel 7 to 11 are mapped to DMA2 channel 1 to 5 (** only available on chip which support DMA2 **).

Reference Manual to LL API cross reference:

- CxCR EGE LL_DMAMUX_EnableEventGeneration

LL_DMAMUX_DisableEventGeneration

Function name

__STATIC_INLINE void LL_DMAMUX_DisableEventGeneration (DMAMUX_Channel_TypeDef * DMAMUXx, uint32_t Channel)

Function description

Disable the Event Generation on DMAMUX channel x.

Parameters

- **DMAMUXx:** DMAMUXx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMAMUX_CHANNEL_0
  - LL_DMAMUX_CHANNEL_1
  - LL_DMAMUX_CHANNEL_2
  - LL_DMAMUX_CHANNEL_3
  - LL_DMAMUX_CHANNEL_4
  - LL_DMAMUX_CHANNEL_5
  - LL_DMAMUX_CHANNEL_6
  - All the next values are only available on chip which support DMA2:
  - LL_DMAMUX_CHANNEL_7
  - LL_DMAMUX_CHANNEL_8
  - LL_DMAMUX_CHANNEL_9
  - LL_DMAMUX_CHANNEL_10
  - LL_DMAMUX_CHANNEL_11

Return values

- **None:**

Notes

- DMAMUX channel 0 to 6 are mapped to DMA1 channel 1 to 7. DMAMUX channel 7 to 11 are mapped to DMA2 channel 1 to 5 (** only available on chip which support DMA2 **).

Reference Manual to LL API cross reference:

- CxCR EGE LL_DMAMUX_DisableEventGeneration

LL_DMAMUX_IsEnabledEventGeneration

Function name

__STATIC_INLINE uint32_t LL_DMAMUX_IsEnabledEventGeneration (DMAMUX_Channel_TypeDef * DMAMUXx, uint32_t Channel)

Function description

Check if the Event Generation on DMAMUX channel x is enabled or disabled.

Parameters

- **DMAMUXx:** DMAMUXx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMAMUX_CHANNEL_0
  - LL_DMAMUX_CHANNEL_1
  - LL_DMAMUX_CHANNEL_2
  - LL_DMAMUX_CHANNEL_3
  - LL_DMAMUX_CHANNEL_4
  - LL_DMAMUX_CHANNEL_5
  - LL_DMAMUX_CHANNEL_6
  - All the next values are only available on chip which support DMA2:
  - LL_DMAMUX_CHANNEL_7
  - LL_DMAMUX_CHANNEL_8
  - LL_DMAMUX_CHANNEL_9
  - LL_DMAMUX_CHANNEL_10
  - LL_DMAMUX_CHANNEL_11

Return values

- **State:** of bit (1 or 0).

Notes

- DMAMUX channel 0 to 6 are mapped to DMA1 channel 1 to 7. DMAMUX channel 7 to 11 are mapped to DMA2 channel 1 to 5 (** only available on chip which support DMA2 **).

Reference Manual to LL API cross reference:

- CxCR EGE LL_DMAMUX_IsEnabledEventGeneration

LL_DMAMUX_EnableSync

Function name

__STATIC_INLINE void LL_DMAMUX_EnableSync (DMAMUX_Channel_TypeDef * DMAMUXx, uint32_t Channel)

Function description

Enable the synchronization mode.

Parameters

- **DMAMUXx:** DMAMUXx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMAMUX_CHANNEL_0
  - LL_DMAMUX_CHANNEL_1
  - LL_DMAMUX_CHANNEL_2
  - LL_DMAMUX_CHANNEL_3
  - LL_DMAMUX_CHANNEL_4
  - LL_DMAMUX_CHANNEL_5
  - LL_DMAMUX_CHANNEL_6
  - All the next values are only available on chip which support DMA2:
  - LL_DMAMUX_CHANNEL_7
  - LL_DMAMUX_CHANNEL_8
  - LL_DMAMUX_CHANNEL_9
  - LL_DMAMUX_CHANNEL_10
  - LL_DMAMUX_CHANNEL_11

Return values

- **None:**

Notes

- DMAMUX channel 0 to 6 are mapped to DMA1 channel 1 to 7. DMAMUX channel 7 to 11 are mapped to DMA2 channel 1 to 5 (** only available on chip which support DMA2 **).

Reference Manual to LL API cross reference:

- CxCR SE LL_DMAMUX_EnableSync

LL_DMAMUX_DisableSync

Function name

__STATIC_INLINE void LL_DMAMUX_DisableSync (DMAMUX_Channel_TypeDef * DMAMUXx, uint32_t Channel)

Function description

Disable the synchronization mode.

Parameters

- **DMAMUXx:** DMAMUXx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMAMUX_CHANNEL_0
  - LL_DMAMUX_CHANNEL_1
  - LL_DMAMUX_CHANNEL_2
  - LL_DMAMUX_CHANNEL_3
  - LL_DMAMUX_CHANNEL_4
  - LL_DMAMUX_CHANNEL_5
  - LL_DMAMUX_CHANNEL_6
  - All the next values are only available on chip which support DMA2:
  - LL_DMAMUX_CHANNEL_7
  - LL_DMAMUX_CHANNEL_8
  - LL_DMAMUX_CHANNEL_9
  - LL_DMAMUX_CHANNEL_10
  - LL_DMAMUX_CHANNEL_11

Return values

- **None:**

Notes

- DMAMUX channel 0 to 6 are mapped to DMA1 channel 1 to 7. DMAMUX channel 7 to 11 are mapped to DMA2 channel 1 to 5 (** only available on chip which support DMA2 **).

Reference Manual to LL API cross reference:

- CxCR SE LL_DMAMUX_DisableSync

LL_DMAMUX_IsEnabledSync

Function name

__STATIC_INLINE uint32_t LL_DMAMUX_IsEnabledSync (DMAMUX_Channel_TypeDef * DMAMUXx, uint32_t Channel)

Function description

Check if the synchronization mode is enabled or disabled.

Parameters

- **DMAMUXx:** DMAMUXx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMAMUX_CHANNEL_0
  - LL_DMAMUX_CHANNEL_1
  - LL_DMAMUX_CHANNEL_2
  - LL_DMAMUX_CHANNEL_3
  - LL_DMAMUX_CHANNEL_4
  - LL_DMAMUX_CHANNEL_5
  - LL_DMAMUX_CHANNEL_6
  - All the next values are only available on chip which support DMA2:
  - LL_DMAMUX_CHANNEL_7
  - LL_DMAMUX_CHANNEL_8
  - LL_DMAMUX_CHANNEL_9
  - LL_DMAMUX_CHANNEL_10
  - LL_DMAMUX_CHANNEL_11

Return values

- **State:** of bit (1 or 0).

Notes

- DMAMUX channel 0 to 6 are mapped to DMA1 channel 1 to 7. DMAMUX channel 7 to 11 are mapped to DMA2 channel 1 to 5 (** only available on chip which support DMA2 **).

Reference Manual to LL API cross reference:

- CxCR SE LL_DMAMUX_IsEnabledSync

LL_DMAMUX_SetSyncID

Function name

__STATIC_INLINE void LL_DMAMUX_SetSyncID (DMAMUX_Channel_TypeDef * DMAMUXx, uint32_t Channel, uint32_t SyncID)

Function description

Set DMAMUX synchronization ID on DMAMUX Channel x.

Parameters

- **DMAMUXx:** DMAMUXx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMAMUX_CHANNEL_0
  - LL_DMAMUX_CHANNEL_1
  - LL_DMAMUX_CHANNEL_2
  - LL_DMAMUX_CHANNEL_3
  - LL_DMAMUX_CHANNEL_4
  - LL_DMAMUX_CHANNEL_5
  - LL_DMAMUX_CHANNEL_6
  - All the next values are only available on chip which support DMA2:
  - LL_DMAMUX_CHANNEL_7
  - LL_DMAMUX_CHANNEL_8
  - LL_DMAMUX_CHANNEL_9
  - LL_DMAMUX_CHANNEL_10
  - LL_DMAMUX_CHANNEL_11
- **SyncID:** This parameter can be one of the following values:
  - LL_DMAMUX_SYNC_EXTI_LINE0
  - LL_DMAMUX_SYNC_EXTI_LINE1
  - LL_DMAMUX_SYNC_EXTI_LINE2
  - LL_DMAMUX_SYNC_EXTI_LINE3
  - LL_DMAMUX_SYNC_EXTI_LINE4
  - LL_DMAMUX_SYNC_EXTI_LINE5
  - LL_DMAMUX_SYNC_EXTI_LINE6
  - LL_DMAMUX_SYNC_EXTI_LINE7
  - LL_DMAMUX_SYNC_EXTI_LINE8
  - LL_DMAMUX_SYNC_EXTI_LINE9
  - LL_DMAMUX_SYNC_EXTI_LINE10
  - LL_DMAMUX_SYNC_EXTI_LINE11
  - LL_DMAMUX_SYNC_EXTI_LINE12
  - LL_DMAMUX_SYNC_EXTI_LINE13
  - LL_DMAMUX_SYNC_EXTI_LINE14
  - LL_DMAMUX_SYNC_EXTI_LINE15
  - LL_DMAMUX_SYNC_DMAMUX_CH0
  - LL_DMAMUX_SYNC_DMAMUX_CH1
  - LL_DMAMUX_SYNC_DMAMUX_CH2
  - LL_DMAMUX_SYNC_DMAMUX_CH3
  - LL_DMAMUX_SYNC_LPTIM1_OUT
  - LL_DMAMUX_SYNC_LPTIM2_OUT
  - LL_DMAMUX_SYNC_LPTIM3_OUT

Return values

- **None:**

Notes

- DMAMUX channel 0 to 6 are mapped to DMA1 channel 1 to 7. DMAMUX channel 7 to 11 are mapped to DMA2 channel 1 to 5 (** only available on chip which support DMA2 **).

Reference Manual to LL API cross reference:

- CxCR SYNC_ID LL_DMAMUX_SetSyncID

LL_DMAMUX_GetSyncID

Function name

__STATIC_INLINE uint32_t LL_DMAMUX_GetSyncID (DMAMUX_Channel_TypeDef * DMAMUXx, uint32_t Channel)

Function description

Get DMAMUX synchronization ID on DMAMUX Channel x.

Parameters

- **DMAMUXx:** DMAMUXx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMAMUX_CHANNEL_0
  - LL_DMAMUX_CHANNEL_1
  - LL_DMAMUX_CHANNEL_2
  - LL_DMAMUX_CHANNEL_3
  - LL_DMAMUX_CHANNEL_4
  - LL_DMAMUX_CHANNEL_5
  - LL_DMAMUX_CHANNEL_6
  - All the next values are only available on chip which support DMA2:
  - LL_DMAMUX_CHANNEL_7
  - LL_DMAMUX_CHANNEL_8
  - LL_DMAMUX_CHANNEL_9
  - LL_DMAMUX_CHANNEL_10
  - LL_DMAMUX_CHANNEL_11

Return values

- **Returned:** value can be one of the following values:
  - LL_DMAMUX_SYNC_EXTI_LINE0
  - LL_DMAMUX_SYNC_EXTI_LINE1
  - LL_DMAMUX_SYNC_EXTI_LINE2
  - LL_DMAMUX_SYNC_EXTI_LINE3
  - LL_DMAMUX_SYNC_EXTI_LINE4
  - LL_DMAMUX_SYNC_EXTI_LINE5
  - LL_DMAMUX_SYNC_EXTI_LINE6
  - LL_DMAMUX_SYNC_EXTI_LINE7
  - LL_DMAMUX_SYNC_EXTI_LINE8
  - LL_DMAMUX_SYNC_EXTI_LINE9
  - LL_DMAMUX_SYNC_EXTI_LINE10
  - LL_DMAMUX_SYNC_EXTI_LINE11
  - LL_DMAMUX_SYNC_EXTI_LINE12
  - LL_DMAMUX_SYNC_EXTI_LINE13
  - LL_DMAMUX_SYNC_EXTI_LINE14
  - LL_DMAMUX_SYNC_EXTI_LINE15
  - LL_DMAMUX_SYNC_DMAMUX_CH0
  - LL_DMAMUX_SYNC_DMAMUX_CH1
  - LL_DMAMUX_SYNC_DMAMUX_CH2
  - LL_DMAMUX_SYNC_DMAMUX_CH3
  - LL_DMAMUX_SYNC_LPTIM1_OUT
  - LL_DMAMUX_SYNC_LPTIM2_OUT
  - LL_DMAMUX_SYNC_LPTIM3_OUT

Notes

- DMAMUX channel 0 to 6 are mapped to DMA1 channel 1 to 7. DMAMUX channel 7 to 11 are mapped to DMA2 channel 1 to 5 (** only available on chip which support DMA2 **).

Reference Manual to LL API cross reference:

- CxCR SYNC_ID LL_DMAMUX_GetSyncID

LL_DMAMUX_EnableRequestGen

Function name

__STATIC_INLINE void LL_DMAMUX_EnableRequestGen (DMAMUX_Channel_TypeDef * DMAMUXx, uint32_t RequestGenChannel)

Function description

Enable the Request Generator.

Parameters

- **DMAMUXx:** DMAMUXx Instance
- **RequestGenChannel:** This parameter can be one of the following values:
  - LL_DMAMUX_REQ_GEN_0
  - LL_DMAMUX_REQ_GEN_1
  - LL_DMAMUX_REQ_GEN_2
  - LL_DMAMUX_REQ_GEN_3

Return values

- **None:**

Reference Manual to LL API cross reference:

- RGxCR GE LL_DMAMUX_EnableRequestGen

LL_DMAMUX_DisableRequestGen

Function name

__STATIC_INLINE void LL_DMAMUX_DisableRequestGen (DMAMUX_Channel_TypeDef * DMAMUXx, uint32_t RequestGenChannel)

Function description

Disable the Request Generator.

Parameters

- **DMAMUXx:** DMAMUXx Instance
- **RequestGenChannel:** This parameter can be one of the following values:
  - LL_DMAMUX_REQ_GEN_0
  - LL_DMAMUX_REQ_GEN_1
  - LL_DMAMUX_REQ_GEN_2
  - LL_DMAMUX_REQ_GEN_3

Return values

- **None:**

Reference Manual to LL API cross reference:

- RGxCR GE LL_DMAMUX_DisableRequestGen

LL_DMAMUX_IsEnabledRequestGen

Function name

__STATIC_INLINE uint32_t LL_DMAMUX_IsEnabledRequestGen (DMAMUX_Channel_TypeDef * DMAMUXx, uint32_t RequestGenChannel)

Function description

Check if the Request Generator is enabled or disabled.

Parameters

- **DMAMUXx:** DMAMUXx Instance
- **RequestGenChannel:** This parameter can be one of the following values:
  - LL_DMAMUX_REQ_GEN_0
  - LL_DMAMUX_REQ_GEN_1
  - LL_DMAMUX_REQ_GEN_2
  - LL_DMAMUX_REQ_GEN_3

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- RGxCR GE LL_DMAMUX_IsEnabledRequestGen

LL_DMAMUX_SetRequestGenPolarity

Function name

__STATIC_INLINE void LL_DMAMUX_SetRequestGenPolarity (DMAMUX_Channel_TypeDef * DMAMUXx, uint32_t RequestGenChannel, uint32_t Polarity)

Function description

Set the polarity of the signal on which the DMA request is generated.

Parameters

- **DMAMUXx:** DMAMUXx Instance
- **RequestGenChannel:** This parameter can be one of the following values:
  - LL_DMAMUX_REQ_GEN_0
  - LL_DMAMUX_REQ_GEN_1
  - LL_DMAMUX_REQ_GEN_2
  - LL_DMAMUX_REQ_GEN_3
- **Polarity:** This parameter can be one of the following values:
  - LL_DMAMUX_REQ_GEN_NO_EVENT
  - LL_DMAMUX_REQ_GEN_POL_RISING
  - LL_DMAMUX_REQ_GEN_POL_FALLING
  - LL_DMAMUX_REQ_GEN_POL_RISING_FALLING

Return values

- **None:**

Reference Manual to LL API cross reference:

- RGxCR GPOL LL_DMAMUX_SetRequestGenPolarity

LL_DMAMUX_GetRequestGenPolarity

Function name

__STATIC_INLINE uint32_t LL_DMAMUX_GetRequestGenPolarity (DMAMUX_Channel_TypeDef * DMAMUXx, uint32_t RequestGenChannel)

Function description

Get the polarity of the signal on which the DMA request is generated.

Parameters

- **DMAMUXx:** DMAMUXx Instance
- **RequestGenChannel:** This parameter can be one of the following values:
  - LL_DMAMUX_REQ_GEN_0
  - LL_DMAMUX_REQ_GEN_1
  - LL_DMAMUX_REQ_GEN_2
  - LL_DMAMUX_REQ_GEN_3

Return values

- **Returned:** value can be one of the following values:
  - LL_DMAMUX_REQ_GEN_NO_EVENT
  - LL_DMAMUX_REQ_GEN_POL_RISING
  - LL_DMAMUX_REQ_GEN_POL_FALLING
  - LL_DMAMUX_REQ_GEN_POL_RISING_FALLING

Reference Manual to LL API cross reference:

- RGxCR GPOL LL_DMAMUX_GetRequestGenPolarity

LL_DMAMUX_SetGenRequestNb

Function name

__STATIC_INLINE void LL_DMAMUX_SetGenRequestNb (DMAMUX_Channel_TypeDef * DMAMUXx, uint32_t RequestGenChannel, uint32_t RequestNb)

Function description

Set the number of DMA request that will be autorized after a generation event.

Parameters

- **DMAMUXx:** DMAMUXx Instance
- **RequestGenChannel:** This parameter can be one of the following values:
  - LL_DMAMUX_REQ_GEN_0
  - LL_DMAMUX_REQ_GEN_1
  - LL_DMAMUX_REQ_GEN_2
  - LL_DMAMUX_REQ_GEN_3
- **RequestNb:** This parameter must be a value between Min_Data = 1 and Max_Data = 32.

Return values

- **None:**

Notes

- This field can only be written when Generator is disabled.

Reference Manual to LL API cross reference:

- RGxCR GNBREQ LL_DMAMUX_SetGenRequestNb

LL_DMAMUX_GetGenRequestNb

Function name

__STATIC_INLINE uint32_t LL_DMAMUX_GetGenRequestNb (DMAMUX_Channel_TypeDef * DMAMUXx, uint32_t RequestGenChannel)

Function description

Get the number of DMA request that will be autorized after a generation event.

Parameters

- **DMAMUXx:** DMAMUXx Instance
- **RequestGenChannel:** This parameter can be one of the following values:
  - LL_DMAMUX_REQ_GEN_0
  - LL_DMAMUX_REQ_GEN_1
  - LL_DMAMUX_REQ_GEN_2
  - LL_DMAMUX_REQ_GEN_3

Return values

- **Between:** Min_Data = 1 and Max_Data = 32

Reference Manual to LL API cross reference:

- RGxCR GNBREQ LL_DMAMUX_GetGenRequestNb

LL_DMAMUX_SetRequestSignalID

Function name

__STATIC_INLINE void LL_DMAMUX_SetRequestSignalID (DMAMUX_Channel_TypeDef * DMAMUXx, uint32_t RequestGenChannel, uint32_t RequestSignalID)

Function description

Set DMAMUX external Request Signal ID on DMAMUX Request Generation Trigger Event Channel x.

Parameters

- **DMAMUXx:** DMAMUXx Instance
- **RequestGenChannel:** This parameter can be one of the following values:
  - LL_DMAMUX_REQ_GEN_0
  - LL_DMAMUX_REQ_GEN_1
  - LL_DMAMUX_REQ_GEN_2
  - LL_DMAMUX_REQ_GEN_3
- **RequestSignalID:** This parameter can be one of the following values:
  - LL_DMAMUX_REQ_GEN_EXTI_LINE0
  - LL_DMAMUX_REQ_GEN_EXTI_LINE1
  - LL_DMAMUX_REQ_GEN_EXTI_LINE2
  - LL_DMAMUX_REQ_GEN_EXTI_LINE3
  - LL_DMAMUX_REQ_GEN_EXTI_LINE4
  - LL_DMAMUX_REQ_GEN_EXTI_LINE5
  - LL_DMAMUX_REQ_GEN_EXTI_LINE6
  - LL_DMAMUX_REQ_GEN_EXTI_LINE7
  - LL_DMAMUX_REQ_GEN_EXTI_LINE8
  - LL_DMAMUX_REQ_GEN_EXTI_LINE9
  - LL_DMAMUX_REQ_GEN_EXTI_LINE10
  - LL_DMAMUX_REQ_GEN_EXTI_LINE11
  - LL_DMAMUX_REQ_GEN_EXTI_LINE12
  - LL_DMAMUX_REQ_GEN_EXTI_LINE13
  - LL_DMAMUX_REQ_GEN_EXTI_LINE14
  - LL_DMAMUX_REQ_GEN_EXTI_LINE15
  - LL_DMAMUX_REQ_GEN_DMAMUX_CH0
  - LL_DMAMUX_REQ_GEN_DMAMUX_CH1
  - LL_DMAMUX_REQ_GEN_DMAMUX_CH2
  - LL_DMAMUX_REQ_GEN_DMAMUX_CH3
  - LL_DMAMUX_REQ_GEN_LPTIM1_OUT
  - LL_DMAMUX_REQ_GEN_LPTIM2_OUT
  - LL_DMAMUX_REQ_GEN_LPTIM3_OUT

Return values

- **None:**

Reference Manual to LL API cross reference:

- RGxCR SIG_ID LL_DMAMUX_SetRequestSignalID

LL_DMAMUX_GetRequestSignalID

Function name

__STATIC_INLINE uint32_t LL_DMAMUX_GetRequestSignalID (DMAMUX_Channel_TypeDef * DMAMUXx, uint32_t RequestGenChannel)

Function description

Get DMAMUX external Request Signal ID set on DMAMUX Channel x.

Parameters

- **DMAMUXx:** DMAMUXx Instance
- **RequestGenChannel:** This parameter can be one of the following values:
  - LL_DMAMUX_REQ_GEN_0
  - LL_DMAMUX_REQ_GEN_1
  - LL_DMAMUX_REQ_GEN_2
  - LL_DMAMUX_REQ_GEN_3

Return values

- **Returned:** value can be one of the following values:
  - LL_DMAMUX_REQ_GEN_EXTI_LINE0
  - LL_DMAMUX_REQ_GEN_EXTI_LINE1
  - LL_DMAMUX_REQ_GEN_EXTI_LINE2
  - LL_DMAMUX_REQ_GEN_EXTI_LINE3
  - LL_DMAMUX_REQ_GEN_EXTI_LINE4
  - LL_DMAMUX_REQ_GEN_EXTI_LINE5
  - LL_DMAMUX_REQ_GEN_EXTI_LINE6
  - LL_DMAMUX_REQ_GEN_EXTI_LINE7
  - LL_DMAMUX_REQ_GEN_EXTI_LINE8
  - LL_DMAMUX_REQ_GEN_EXTI_LINE9
  - LL_DMAMUX_REQ_GEN_EXTI_LINE10
  - LL_DMAMUX_REQ_GEN_EXTI_LINE11
  - LL_DMAMUX_REQ_GEN_EXTI_LINE12
  - LL_DMAMUX_REQ_GEN_EXTI_LINE13
  - LL_DMAMUX_REQ_GEN_EXTI_LINE14
  - LL_DMAMUX_REQ_GEN_EXTI_LINE15
  - LL_DMAMUX_REQ_GEN_DMAMUX_CH0
  - LL_DMAMUX_REQ_GEN_DMAMUX_CH1
  - LL_DMAMUX_REQ_GEN_DMAMUX_CH2
  - LL_DMAMUX_REQ_GEN_DMAMUX_CH3
  - LL_DMAMUX_REQ_GEN_LPTIM1_OUT
  - LL_DMAMUX_REQ_GEN_LPTIM2_OUT
  - LL_DMAMUX_REQ_GEN_LPTIM3_OUT

Reference Manual to LL API cross reference:

- RGxCR SIG_ID LL_DMAMUX_GetRequestSignalID

LL_DMAMUX_IsActiveFlag_SO0

Function name

__STATIC_INLINE uint32_t LL_DMAMUX_IsActiveFlag_SO0 (DMAMUX_Channel_TypeDef * DMAMUXx)

Function description

Get Synchronization Event Overrun Flag Channel 0.

Parameters

- **DMAMUXx:** DMAMUXx DMAMUXx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CSR SOF0 LL_DMAMUX_IsActiveFlag_SO0

LL_DMAMUX_IsActiveFlag_SO1

Function name

__STATIC_INLINE uint32_t LL_DMAMUX_IsActiveFlag_SO1 (DMAMUX_Channel_TypeDef * DMAMUXx)

Function description

Get Synchronization Event Overrun Flag Channel 1.

Parameters

- **DMAMUXx:** DMAMUXx DMAMUXx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CSR SOF1 LL_DMAMUX_IsActiveFlag_SO1

LL_DMAMUX_IsActiveFlag_SO2

Function name

__STATIC_INLINE uint32_t LL_DMAMUX_IsActiveFlag_SO2 (DMAMUX_Channel_TypeDef * DMAMUXx)

Function description

Get Synchronization Event Overrun Flag Channel 2.

Parameters

- **DMAMUXx:** DMAMUXx DMAMUXx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CSR SOF2 LL_DMAMUX_IsActiveFlag_SO2

LL_DMAMUX_IsActiveFlag_SO3

Function name

__STATIC_INLINE uint32_t LL_DMAMUX_IsActiveFlag_SO3 (DMAMUX_Channel_TypeDef * DMAMUXx)

Function description

Get Synchronization Event Overrun Flag Channel 3.

Parameters

- **DMAMUXx:** DMAMUXx DMAMUXx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CSR SOF3 LL_DMAMUX_IsActiveFlag_SO3

LL_DMAMUX_IsActiveFlag_SO4

Function name

__STATIC_INLINE uint32_t LL_DMAMUX_IsActiveFlag_SO4 (DMAMUX_Channel_TypeDef * DMAMUXx)

Function description

Get Synchronization Event Overrun Flag Channel 4.

Parameters

- **DMAMUXx:** DMAMUXx DMAMUXx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CSR SOF4 LL_DMAMUX_IsActiveFlag_SO4

LL_DMAMUX_IsActiveFlag_SO5

Function name

__STATIC_INLINE uint32_t LL_DMAMUX_IsActiveFlag_SO5 (DMAMUX_Channel_TypeDef * DMAMUXx)

Function description

Get Synchronization Event Overrun Flag Channel 5.

Parameters

- **DMAMUXx:** DMAMUXx DMAMUXx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CSR SOF5 LL_DMAMUX_IsActiveFlag_SO5

LL_DMAMUX_IsActiveFlag_SO6

Function name

__STATIC_INLINE uint32_t LL_DMAMUX_IsActiveFlag_SO6 (DMAMUX_Channel_TypeDef * DMAMUXx)

Function description

Get Synchronization Event Overrun Flag Channel 6.

Parameters

- **DMAMUXx:** DMAMUXx DMAMUXx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CSR SOF6 LL_DMAMUX_IsActiveFlag_SO6

LL_DMAMUX_IsActiveFlag_SO7

Function name

__STATIC_INLINE uint32_t LL_DMAMUX_IsActiveFlag_SO7 (DMAMUX_Channel_TypeDef * DMAMUXx)

Function description

Get Synchronization Event Overrun Flag Channel 7.

Parameters

- **DMAMUXx:** DMAMUXx DMAMUXx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CSR SOF7 LL_DMAMUX_IsActiveFlag_SO7

LL_DMAMUX_IsActiveFlag_SO8

Function name

__STATIC_INLINE uint32_t LL_DMAMUX_IsActiveFlag_SO8 (DMAMUX_Channel_TypeDef * DMAMUXx)

Function description

Get Synchronization Event Overrun Flag Channel 8.

Parameters

- **DMAMUXx:** DMAMUXx DMAMUXx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CSR SOF8 LL_DMAMUX_IsActiveFlag_SO8

LL_DMAMUX_IsActiveFlag_SO9

Function name

__STATIC_INLINE uint32_t LL_DMAMUX_IsActiveFlag_SO9 (DMAMUX_Channel_TypeDef * DMAMUXx)

Function description

Get Synchronization Event Overrun Flag Channel 9.

Parameters

- **DMAMUXx:** DMAMUXx DMAMUXx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CSR SOF9 LL_DMAMUX_IsActiveFlag_SO9

LL_DMAMUX_IsActiveFlag_SO10

Function name

__STATIC_INLINE uint32_t LL_DMAMUX_IsActiveFlag_SO10 (DMAMUX_Channel_TypeDef * DMAMUXx)

Function description

Get Synchronization Event Overrun Flag Channel 10.

Parameters

- **DMAMUXx:** DMAMUXx DMAMUXx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CSR SOF10 LL_DMAMUX_IsActiveFlag_SO10

LL_DMAMUX_IsActiveFlag_SO11

Function name

__STATIC_INLINE uint32_t LL_DMAMUX_IsActiveFlag_SO11 (DMAMUX_Channel_TypeDef * DMAMUXx)

Function description

Get Synchronization Event Overrun Flag Channel 11.

Parameters

- **DMAMUXx:** DMAMUXx DMAMUXx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CSR SOF11 LL_DMAMUX_IsActiveFlag_SO11

LL_DMAMUX_IsActiveFlag_RGO0

Function name

__STATIC_INLINE uint32_t LL_DMAMUX_IsActiveFlag_RGO0 (DMAMUX_Channel_TypeDef * DMAMUXx)

Function description

Get Request Generator 0 Trigger Event Overrun Flag.

Parameters

- **DMAMUXx:** DMAMUXx DMAMUXx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- RGSR OF0 LL_DMAMUX_IsActiveFlag_RGO0

LL_DMAMUX_IsActiveFlag_RGO1

Function name

__STATIC_INLINE uint32_t LL_DMAMUX_IsActiveFlag_RGO1 (DMAMUX_Channel_TypeDef * DMAMUXx)

Function description

Get Request Generator 1 Trigger Event Overrun Flag.

Parameters

- **DMAMUXx:** DMAMUXx DMAMUXx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- RGSR OF1 LL_DMAMUX_IsActiveFlag_RGO1

LL_DMAMUX_IsActiveFlag_RGO2

Function name

__STATIC_INLINE uint32_t LL_DMAMUX_IsActiveFlag_RGO2 (DMAMUX_Channel_TypeDef * DMAMUXx)

Function description

Get Request Generator 2 Trigger Event Overrun Flag.

Parameters

- **DMAMUXx:** DMAMUXx DMAMUXx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- RGSR OF2 LL_DMAMUX_IsActiveFlag_RGO2

LL_DMAMUX_IsActiveFlag_RGO3

Function name

__STATIC_INLINE uint32_t LL_DMAMUX_IsActiveFlag_RGO3 (DMAMUX_Channel_TypeDef * DMAMUXx)

Function description

Get Request Generator 3 Trigger Event Overrun Flag.

Parameters

- **DMAMUXx:** DMAMUXx DMAMUXx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- RGSR OF3 LL_DMAMUX_IsActiveFlag_RGO3

LL_DMAMUX_ClearFlag_SO0

Function name

__STATIC_INLINE void LL_DMAMUX_ClearFlag_SO0 (DMAMUX_Channel_TypeDef * DMAMUXx)

Function description

Clear Synchronization Event Overrun Flag Channel 0.

Parameters

- **DMAMUXx:** DMAMUXx DMAMUXx Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CFR CSOF0 LL_DMAMUX_ClearFlag_SO0

LL_DMAMUX_ClearFlag_SO1

Function name

__STATIC_INLINE void LL_DMAMUX_ClearFlag_SO1 (DMAMUX_Channel_TypeDef * DMAMUXx)

Function description

Clear Synchronization Event Overrun Flag Channel 1.

Parameters

- **DMAMUXx:** DMAMUXx DMAMUXx Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CFR CSOF1 LL_DMAMUX_ClearFlag_SO1

LL_DMAMUX_ClearFlag_SO2

Function name

__STATIC_INLINE void LL_DMAMUX_ClearFlag_SO2 (DMAMUX_Channel_TypeDef * DMAMUXx)

Function description

Clear Synchronization Event Overrun Flag Channel 2.

Parameters

- **DMAMUXx:** DMAMUXx DMAMUXx Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CFR CSOF2 LL_DMAMUX_ClearFlag_SO2

LL_DMAMUX_ClearFlag_SO3

Function name

__STATIC_INLINE void LL_DMAMUX_ClearFlag_SO3 (DMAMUX_Channel_TypeDef * DMAMUXx)

Function description

Clear Synchronization Event Overrun Flag Channel 3.

Parameters

- **DMAMUXx:** DMAMUXx DMAMUXx Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CFR CSOF3 LL_DMAMUX_ClearFlag_SO3

LL_DMAMUX_ClearFlag_SO4

Function name

__STATIC_INLINE void LL_DMAMUX_ClearFlag_SO4 (DMAMUX_Channel_TypeDef * DMAMUXx)

Function description

Clear Synchronization Event Overrun Flag Channel 4.

Parameters

- **DMAMUXx:** DMAMUXx DMAMUXx Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CFR CSOF4 LL_DMAMUX_ClearFlag_SO4

LL_DMAMUX_ClearFlag_SO5

Function name

__STATIC_INLINE void LL_DMAMUX_ClearFlag_SO5 (DMAMUX_Channel_TypeDef * DMAMUXx)

Function description

Clear Synchronization Event Overrun Flag Channel 5.

Parameters

- **DMAMUXx:** DMAMUXx DMAMUXx Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CFR CSOF5 LL_DMAMUX_ClearFlag_SO5

LL_DMAMUX_ClearFlag_SO6

Function name

__STATIC_INLINE void LL_DMAMUX_ClearFlag_SO6 (DMAMUX_Channel_TypeDef * DMAMUXx)

Function description

Clear Synchronization Event Overrun Flag Channel 6.

Parameters

- **DMAMUXx:** DMAMUXx DMAMUXx Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CFR CSOF6 LL_DMAMUX_ClearFlag_SO6

LL_DMAMUX_ClearFlag_SO7

Function name

__STATIC_INLINE void LL_DMAMUX_ClearFlag_SO7 (DMAMUX_Channel_TypeDef * DMAMUXx)

Function description

Clear Synchronization Event Overrun Flag Channel 7.

Parameters

- **DMAMUXx:** DMAMUXx DMAMUXx Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CFR CSOF7 LL_DMAMUX_ClearFlag_SO7

LL_DMAMUX_ClearFlag_SO8

Function name

__STATIC_INLINE void LL_DMAMUX_ClearFlag_SO8 (DMAMUX_Channel_TypeDef * DMAMUXx)

Function description

Clear Synchronization Event Overrun Flag Channel 8.

Parameters

- **DMAMUXx:** DMAMUXx DMAMUXx Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CFR CSOF8 LL_DMAMUX_ClearFlag_SO8

LL_DMAMUX_ClearFlag_SO9

Function name

__STATIC_INLINE void LL_DMAMUX_ClearFlag_SO9 (DMAMUX_Channel_TypeDef * DMAMUXx)

Function description

Clear Synchronization Event Overrun Flag Channel 9.

Parameters

- **DMAMUXx:** DMAMUXx DMAMUXx Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CFR CSOF9 LL_DMAMUX_ClearFlag_SO9

LL_DMAMUX_ClearFlag_SO10

Function name

__STATIC_INLINE void LL_DMAMUX_ClearFlag_SO10 (DMAMUX_Channel_TypeDef * DMAMUXx)

Function description

Clear Synchronization Event Overrun Flag Channel 10.

Parameters

- **DMAMUXx:** DMAMUXx DMAMUXx Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CFR CSOF10 LL_DMAMUX_ClearFlag_SO10

LL_DMAMUX_ClearFlag_SO11

Function name

__STATIC_INLINE void LL_DMAMUX_ClearFlag_SO11 (DMAMUX_Channel_TypeDef * DMAMUXx)

Function description

Clear Synchronization Event Overrun Flag Channel 11.

Parameters

- **DMAMUXx:** DMAMUXx DMAMUXx Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CFR CSOF11 LL_DMAMUX_ClearFlag_SO11

LL_DMAMUX_ClearFlag_RGO0

Function name

__STATIC_INLINE void LL_DMAMUX_ClearFlag_RGO0 (DMAMUX_Channel_TypeDef * DMAMUXx)

Function description

Clear Request Generator 0 Trigger Event Overrun Flag.

Parameters

- **DMAMUXx:** DMAMUXx DMAMUXx Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- RGCFR COF0 LL_DMAMUX_ClearFlag_RGO0

LL_DMAMUX_ClearFlag_RGO1

Function name

__STATIC_INLINE void LL_DMAMUX_ClearFlag_RGO1 (DMAMUX_Channel_TypeDef * DMAMUXx)

Function description

Clear Request Generator 1 Trigger Event Overrun Flag.

Parameters

- **DMAMUXx:** DMAMUXx DMAMUXx Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- RGCFR COF1 LL_DMAMUX_ClearFlag_RGO1

LL_DMAMUX_ClearFlag_RGO2

Function name

__STATIC_INLINE void LL_DMAMUX_ClearFlag_RGO2 (DMAMUX_Channel_TypeDef * DMAMUXx)

Function description

Clear Request Generator 2 Trigger Event Overrun Flag.

Parameters

- **DMAMUXx:** DMAMUXx DMAMUXx Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- RGCFR COF2 LL_DMAMUX_ClearFlag_RGO2

LL_DMAMUX_ClearFlag_RGO3

Function name

__STATIC_INLINE void LL_DMAMUX_ClearFlag_RGO3 (DMAMUX_Channel_TypeDef * DMAMUXx)

Function description

Clear Request Generator 3 Trigger Event Overrun Flag.

Parameters

- **DMAMUXx:** DMAMUXx DMAMUXx Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- RGCFR COF3 LL_DMAMUX_ClearFlag_RGO3

LL_DMAMUX_EnableIT_SO

Function name

__STATIC_INLINE void LL_DMAMUX_EnableIT_SO (DMAMUX_Channel_TypeDef * DMAMUXx, uint32_t Channel)

Function description

Enable the Synchronization Event Overrun Interrupt on DMAMUX channel x.

Parameters

- **DMAMUXx:** DMAMUXx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMAMUX_CHANNEL_0
  - LL_DMAMUX_CHANNEL_1
  - LL_DMAMUX_CHANNEL_2
  - LL_DMAMUX_CHANNEL_3
  - LL_DMAMUX_CHANNEL_4
  - LL_DMAMUX_CHANNEL_5
  - LL_DMAMUX_CHANNEL_6
  - All the next values are only available on chip which support DMA2:
  - LL_DMAMUX_CHANNEL_7
  - LL_DMAMUX_CHANNEL_8
  - LL_DMAMUX_CHANNEL_9
  - LL_DMAMUX_CHANNEL_10
  - LL_DMAMUX_CHANNEL_11

Return values

- **None:**

Notes

- DMAMUX channel 0 to 6 are mapped to DMA1 channel 1 to 7. DMAMUX channel 7 to 11 are mapped to DMA2 channel 1 to 5 (** only available on chip which support DMA2 **).

Reference Manual to LL API cross reference:

- CxCR SOIE LL_DMAMUX_EnableIT_SO

LL_DMAMUX_DisableIT_SO

Function name

__STATIC_INLINE void LL_DMAMUX_DisableIT_SO (DMAMUX_Channel_TypeDef * DMAMUXx, uint32_t Channel)

Function description

Disable the Synchronization Event Overrun Interrupt on DMAMUX channel x.

Parameters

- **DMAMUXx:** DMAMUXx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMAMUX_CHANNEL_0
  - LL_DMAMUX_CHANNEL_1
  - LL_DMAMUX_CHANNEL_2
  - LL_DMAMUX_CHANNEL_3
  - LL_DMAMUX_CHANNEL_4
  - LL_DMAMUX_CHANNEL_5
  - LL_DMAMUX_CHANNEL_6
  - All the next values are only available on chip which support DMA2:
  - LL_DMAMUX_CHANNEL_7
  - LL_DMAMUX_CHANNEL_8
  - LL_DMAMUX_CHANNEL_9
  - LL_DMAMUX_CHANNEL_10
  - LL_DMAMUX_CHANNEL_11

Return values

- **None:**

Notes

- DMAMUX channel 0 to 6 are mapped to DMA1 channel 1 to 7. DMAMUX channel 7 to 11 are mapped to DMA2 channel 1 to 5 (** only available on chip which support DMA2 **).

Reference Manual to LL API cross reference:

- CxCR SOIE LL_DMAMUX_DisableIT_SO

LL_DMAMUX_IsEnabledIT_SO

Function name

__STATIC_INLINE uint32_t LL_DMAMUX_IsEnabledIT_SO (DMAMUX_Channel_TypeDef * DMAMUXx, uint32_t Channel)

Function description

Check if the Synchronization Event Overrun Interrupt on DMAMUX channel x is enabled or disabled.

Parameters

- **DMAMUXx:** DMAMUXx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMAMUX_CHANNEL_0
  - LL_DMAMUX_CHANNEL_1
  - LL_DMAMUX_CHANNEL_2
  - LL_DMAMUX_CHANNEL_3
  - LL_DMAMUX_CHANNEL_4
  - LL_DMAMUX_CHANNEL_5
  - LL_DMAMUX_CHANNEL_6
  - All the next values are only available on chip which support DMA2:
  - LL_DMAMUX_CHANNEL_7
  - LL_DMAMUX_CHANNEL_8
  - LL_DMAMUX_CHANNEL_9
  - LL_DMAMUX_CHANNEL_10
  - LL_DMAMUX_CHANNEL_11

Return values

- **State:** of bit (1 or 0).

Notes

- DMAMUX channel 0 to 6 are mapped to DMA1 channel 1 to 7. DMAMUX channel 7 to 11 are mapped to DMA2 channel 1 to 5 (** only available on chip which support DMA2 **).

Reference Manual to LL API cross reference:

- CxCR SOIE LL_DMAMUX_IsEnabledIT_SO

LL_DMAMUX_EnableIT_RGO

Function name

__STATIC_INLINE void LL_DMAMUX_EnableIT_RGO (DMAMUX_Channel_TypeDef * DMAMUXx, uint32_t RequestGenChannel)

Function description

Enable the Request Generation Trigger Event Overrun Interrupt on DMAMUX channel x.

Parameters

- **DMAMUXx:** DMAMUXx Instance
- **RequestGenChannel:** This parameter can be one of the following values:
  - LL_DMAMUX_REQ_GEN_0
  - LL_DMAMUX_REQ_GEN_1
  - LL_DMAMUX_REQ_GEN_2
  - LL_DMAMUX_REQ_GEN_3

Return values

- **None:**

Reference Manual to LL API cross reference:

- RGxCR OIE LL_DMAMUX_EnableIT_RGO

LL_DMAMUX_DisableIT_RGO

Function name

__STATIC_INLINE void LL_DMAMUX_DisableIT_RGO (DMAMUX_Channel_TypeDef * DMAMUXx, uint32_t RequestGenChannel)

Function description

Disable the Request Generation Trigger Event Overrun Interrupt on DMAMUX channel x.

Parameters

- **DMAMUXx:** DMAMUXx Instance
- **RequestGenChannel:** This parameter can be one of the following values:
  - LL_DMAMUX_REQ_GEN_0
  - LL_DMAMUX_REQ_GEN_1
  - LL_DMAMUX_REQ_GEN_2
  - LL_DMAMUX_REQ_GEN_3

Return values

- **None:**

Reference Manual to LL API cross reference:

- RGxCR OIE LL_DMAMUX_DisableIT_RGO

LL_DMAMUX_IsEnabledIT_RGO

Function name

__STATIC_INLINE uint32_t LL_DMAMUX_IsEnabledIT_RGO (DMAMUX_Channel_TypeDef * DMAMUXx, uint32_t RequestGenChannel)

Function description

Check if the Request Generation Trigger Event Overrun Interrupt on DMAMUX channel x is enabled or disabled.

Parameters

- **DMAMUXx:** DMAMUXx Instance
- **RequestGenChannel:** This parameter can be one of the following values:
  - LL_DMAMUX_REQ_GEN_0
  - LL_DMAMUX_REQ_GEN_1
  - LL_DMAMUX_REQ_GEN_2
  - LL_DMAMUX_REQ_GEN_3

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- RGxCR OIE LL_DMAMUX_IsEnabledIT_RGO

62.2 DMAMUX Firmware driver defines

The following section lists the various define and macros of the module.

62.2.1 DMAMUX

DMAMUX

DMAMUX Channel

LL_DMAMUX_CHANNEL_0

DMAMUX Channel 0 connected to DMA1 Channel 1

LL_DMAMUX_CHANNEL_1

DMAMUX Channel 1 connected to DMA1 Channel 2

LL_DMAMUX_CHANNEL_2

DMAMUX Channel 2 connected to DMA1 Channel 3

LL_DMAMUX_CHANNEL_3

DMAMUX Channel 3 connected to DMA1 Channel 4

LL_DMAMUX_CHANNEL_4

DMAMUX Channel 4 connected to DMA1 Channel 5

LL_DMAMUX_CHANNEL_5

DMAMUX Channel 5 connected to DMA1 Channel 6

LL_DMAMUX_CHANNEL_6

DMAMUX Channel 6 connected to DMA1 Channel 7

LL_DMAMUX_CHANNEL_7

DMAMUX Channel 7 connected to DMA2 Channel 1

LL_DMAMUX_CHANNEL_8

DMAMUX Channel 8 connected to DMA2 Channel 2

LL_DMAMUX_CHANNEL_9

DMAMUX Channel 9 connected to DMA2 Channel 3

LL_DMAMUX_CHANNEL_10

DMAMUX Channel 10 connected to DMA2 Channel 4

LL_DMAMUX_CHANNEL_11

DMAMUX Channel 11 connected to DMA2 Channel 5

Clear Flags Defines

LL_DMAMUX_CFR_CSOF0

Synchronization Event Overrun Flag Channel 0

LL_DMAMUX_CFR_CSOF1

Synchronization Event Overrun Flag Channel 1

LL_DMAMUX_CFR_CSOF2

Synchronization Event Overrun Flag Channel 2

LL_DMAMUX_CFR_CSOF3

Synchronization Event Overrun Flag Channel 3

LL_DMAMUX_CFR_CSOF4

Synchronization Event Overrun Flag Channel 4

LL_DMAMUX_CFR_CSOF5

Synchronization Event Overrun Flag Channel 5

LL_DMAMUX_CFR_CSOF6

Synchronization Event Overrun Flag Channel 6

LL_DMAMUX_CFR_CSOF7

Synchronization Event Overrun Flag Channel 7

LL_DMAMUX_CFR_CSOF8

Synchronization Event Overrun Flag Channel 8

LL_DMAMUX_CFR_CSOF9

Synchronization Event Overrun Flag Channel 9

LL_DMAMUX_CFR_CSOF10

Synchronization Event Overrun Flag Channel 10

LL_DMAMUX_CFR_CSOF11

Synchronization Event Overrun Flag Channel 11

LL_DMAMUX_RGCFR_RGCOF0

Request Generator 0 Trigger Event Overrun Flag

LL_DMAMUX_RGCFR_RGCOF1

Request Generator 1 Trigger Event Overrun Flag

LL_DMAMUX_RGCFR_RGCOF2

Request Generator 2 Trigger Event Overrun Flag

LL_DMAMUX_RGCFR_RGCOF3

Request Generator 3 Trigger Event Overrun Flag

Get Flags Defines

LL_DMAMUX_CSR_SOF0

Synchronization Event Overrun Flag Channel 0

LL_DMAMUX_CSR_SOF1

Synchronization Event Overrun Flag Channel 1

LL_DMAMUX_CSR_SOF2

Synchronization Event Overrun Flag Channel 2

LL_DMAMUX_CSR_SOF3

Synchronization Event Overrun Flag Channel 3

LL_DMAMUX_CSR_SOF4

Synchronization Event Overrun Flag Channel 4

LL_DMAMUX_CSR_SOF5

Synchronization Event Overrun Flag Channel 5

LL_DMAMUX_CSR_SOF6

Synchronization Event Overrun Flag Channel 6

LL_DMAMUX_CSR_SOF7

Synchronization Event Overrun Flag Channel 7

LL_DMAMUX_CSR_SOF8

Synchronization Event Overrun Flag Channel 8

LL_DMAMUX_CSR_SOF9

Synchronization Event Overrun Flag Channel 9

LL_DMAMUX_CSR_SOF10

Synchronization Event Overrun Flag Channel 10

LL_DMAMUX_CSR_SOF11

Synchronization Event Overrun Flag Channel 11

LL_DMAMUX_RGSR_RGOF0

Request Generator 0 Trigger Event Overrun Flag

LL_DMAMUX_RGSR_RGOF1

Request Generator 1 Trigger Event Overrun Flag

LL_DMAMUX_RGSR_RGOF2

Request Generator 2 Trigger Event Overrun Flag

LL_DMAMUX_RGSR_RGOF3

Request Generator 3 Trigger Event Overrun Flag

IT Defines

LL_DMAMUX_CCR_SOIE

Synchronization Event Overrun Interrupt

LL_DMAMUX_RGCR_RGOIE

Request Generation Trigger Event Overrun Interrupt

Transfer request

LL_DMAMUX_REQ_MEM2MEM

memory to memory transfer

LL_DMAMUX_REQ_GENERATOR0

DMAMUX request generator 0

LL_DMAMUX_REQ_GENERATOR1

DMAMUX request generator 1

LL_DMAMUX_REQ_GENERATOR2

DMAMUX request generator 2

LL_DMAMUX_REQ_GENERATOR3

DMAMUX request generator 3

LL_DMAMUX_REQ_ADC

DMAMUX ADC request

LL_DMAMUX_REQ_AES_IN

DMAMUX AES_IN request

LL_DMAMUX_REQ_AES_OUT

DMAMUX AES_OUT request

LL_DMAMUX_REQ_DAC_CH1

DMAMUX DAC_CH1 request

LL_DMAMUX_REQ_I2C1_RX

DMAMUX I2C1 RX request

LL_DMAMUX_REQ_I2C1_TX

DMAMUX I2C1 TX request

LL_DMAMUX_REQ_I2C2_RX

DMAMUX I2C2 RX request

LL_DMAMUX_REQ_I2C2_TX

DMAMUX I2C2 TX request

LL_DMAMUX_REQ_I2C3_RX

DMAMUX I2C3 RX request

LL_DMAMUX_REQ_I2C3_TX

DMAMUX I2C3 TX request

LL_DMAMUX_REQ_I2C4_RX

DMAMUX I2C4 RX request

LL_DMAMUX_REQ_I2C4_TX

DMAMUX I2C4 TX request

LL_DMAMUX_REQ_LPTIM1_IC1

DMAMUX LPTIM1 IC1 request

LL_DMAMUX_REQ_LPTIM1_IC2

DMAMUX LPTIM1 IC2 request

LL_DMAMUX_REQ_LPTIM1_IC3

DMAMUX LPTIM1 IC3 request

LL_DMAMUX_REQ_LPTIM1_IC4

DMAMUX LPTIM1 IC4 request

LL_DMAMUX_REQ_LPTIM1_UE

DMAMUX LPTIM1 UE request

LL_DMAMUX_REQ_LPTIM2_IC1

DMAMUX LPTIM2 IC1 request

LL_DMAMUX_REQ_LPTIM2_IC2

DMAMUX LPTIM2 IC2 request

LL_DMAMUX_REQ_LPTIM2_UE

DMAMUX LPTIM2 UE request

LL_DMAMUX_REQ_LPTIM3_IC1

DMAMUX LPTIM3 IC1 request

LL_DMAMUX_REQ_LPTIM3_IC2

DMAMUX LPTIM3 IC2 request

LL_DMAMUX_REQ_LPTIM3_IC3

DMAMUX LPTIM3 IC3 request

LL_DMAMUX_REQ_LPTIM3_IC4

DMAMUX LPTIM3 IC4 request

LL_DMAMUX_REQ_LPTIM3_UE

DMAMUX LPTIM3 UE request

LL_DMAMUX_REQ_LPUART1_RX

DMAMUX LPUART1 RX request

LL_DMAMUX_REQ_LPUART1_TX

DMAMUX LPUART1 TX request

LL_DMAMUX_REQ_LPUART2_RX

DMAMUX LPUART2 RX request

LL_DMAMUX_REQ_LPUART2_TX

DMAMUX LPUART2 TX request

LL_DMAMUX_REQ_LPUART3_RX

DMAMUX LPUART3 RX request

LL_DMAMUX_REQ_LPUART3_TX

DMAMUX LPUART3 TX request

LL_DMAMUX_REQ_SPI1_RX

DMAMUX SPI1 RX request

LL_DMAMUX_REQ_SPI1_TX

DMAMUX SPI1 TX request

LL_DMAMUX_REQ_SPI2_RX

DMAMUX SPI2 RX request

LL_DMAMUX_REQ_SPI2_TX

DMAMUX SPI2 TX request

LL_DMAMUX_REQ_SPI3_RX

DMAMUX SPI3 RX request

LL_DMAMUX_REQ_SPI3_TX

DMAMUX SPI3 TX request

LL_DMAMUX_REQ_TIM1_CH1

DMAMUX TIM1 CH1 request

LL_DMAMUX_REQ_TIM1_CH2

DMAMUX TIM1 CH2 request

LL_DMAMUX_REQ_TIM1_CH3

DMAMUX TIM1 CH3 request

LL_DMAMUX_REQ_TIM1_CH4

DMAMUX TIM1 CH4 request

LL_DMAMUX_REQ_TIM1_TRIG_COM

DMAMUX TIM1 TRIG COM request

LL_DMAMUX_REQ_TIM1_UP

DMAMUX TIM1 UP request

LL_DMAMUX_REQ_TIM2_CH1

DMAMUX TIM2 CH1 request

LL_DMAMUX_REQ_TIM2_CH2

DMAMUX TIM2 CH2 request

LL_DMAMUX_REQ_TIM2_CH3

DMAMUX TIM2 CH3 request

LL_DMAMUX_REQ_TIM2_CH4

DMAMUX TIM2 CH4 request

LL_DMAMUX_REQ_TIM2_TRIG

DMAMUX TIM2 TRIG request

LL_DMAMUX_REQ_TIM2_UP

DMAMUX TIM2 UP request

LL_DMAMUX_REQ_TIM3_CH1

DMAMUX TIM3 CH1 request

LL_DMAMUX_REQ_TIM3_CH2

DMAMUX TIM3 CH2 request

LL_DMAMUX_REQ_TIM3_CH3

DMAMUX TIM3 CH3 request

LL_DMAMUX_REQ_TIM3_CH4

DMAMUX TIM3 CH4 request

LL_DMAMUX_REQ_TIM3_TRIG

DMAMUX TIM3 TRIG request

LL_DMAMUX_REQ_TIM3_UP

DMAMUX TIM3 UP request

LL_DMAMUX_REQ_TIM6_UP

DMAMUX TIM6 UP request

LL_DMAMUX_REQ_TIM7_UP

DMAMUX TIM7 UP request

LL_DMAMUX_REQ_TIM15_CH1

DMAMUX TIM15 CH1 request

LL_DMAMUX_REQ_TIM15_CH2

DMAMUX TIM15 CH2 request

LL_DMAMUX_REQ_TIM15_TRIG_COM

DMAMUX TIM15 TRIG COMrequest

LL_DMAMUX_REQ_TIM15_UP

DMAMUX TIM15 UP request

LL_DMAMUX_REQ_TIM16_CH1

DMAMUX TIM16 CH1 request

LL_DMAMUX_REQ_TIM16_COM

DMAMUX TIM16 COM request

LL_DMAMUX_REQ_TIM16_UP

DMAMUX TIM16 UP request

LL_DMAMUX_REQ_USART1_RX

DMAMUX USART1 RX request

LL_DMAMUX_REQ_USART1_TX

DMAMUX USART1 TX request

LL_DMAMUX_REQ_USART2_RX

DMAMUX USART2 RX request

LL_DMAMUX_REQ_USART2_TX

DMAMUX USART2 TX request

LL_DMAMUX_REQ_USART3_RX

DMAMUX USART3 RX request

LL_DMAMUX_REQ_USART3_TX

DMAMUX USART3 TX request

LL_DMAMUX_REQ_USART4_RX

DMAMUX USART4 RX request

LL_DMAMUX_REQ_USART4_TX

DMAMUX USART4 TX request

LL_DMAMUX_MAX_REQ

External Request Signal Generation

LL_DMAMUX_REQ_GEN_EXTI_LINE0

Request signal generation from EXTI Line0

LL_DMAMUX_REQ_GEN_EXTI_LINE1

Request signal generation from EXTI Line1

LL_DMAMUX_REQ_GEN_EXTI_LINE2

Request signal generation from EXTI Line2

LL_DMAMUX_REQ_GEN_EXTI_LINE3

Request signal generation from EXTI Line3

LL_DMAMUX_REQ_GEN_EXTI_LINE4

Request signal generation from EXTI Line4

LL_DMAMUX_REQ_GEN_EXTI_LINE5

Request signal generation from EXTI Line5

LL_DMAMUX_REQ_GEN_EXTI_LINE6

Request signal generation from EXTI Line6

LL_DMAMUX_REQ_GEN_EXTI_LINE7

Request signal generation from EXTI Line7

LL_DMAMUX_REQ_GEN_EXTI_LINE8

Request signal generation from EXTI Line8

LL_DMAMUX_REQ_GEN_EXTI_LINE9

Request signal generation from EXTI Line9

LL_DMAMUX_REQ_GEN_EXTI_LINE10

Request signal generation from EXTI Line10

LL_DMAMUX_REQ_GEN_EXTI_LINE11

Request signal generation from EXTI Line11

LL_DMAMUX_REQ_GEN_EXTI_LINE12

Request signal generation from EXTI Line12

LL_DMAMUX_REQ_GEN_EXTI_LINE13

Request signal generation from EXTI Line13

LL_DMAMUX_REQ_GEN_EXTI_LINE14

Request signal generation from EXTI Line14

LL_DMAMUX_REQ_GEN_EXTI_LINE15

Request signal generation from EXTI Line15

LL_DMAMUX_REQ_GEN_DMAMUX_CH0

Request signal generation from DMAMUX channel0 Event

LL_DMAMUX_REQ_GEN_DMAMUX_CH1

Request signal generation from DMAMUX channel1 Event

LL_DMAMUX_REQ_GEN_DMAMUX_CH2

Request signal generation from DMAMUX channel2 Event

LL_DMAMUX_REQ_GEN_DMAMUX_CH3

Request signal generation from DMAMUX channel3 Event

LL_DMAMUX_REQ_GEN_LPTIM1_OUT

Request signal generation from LPTIM1 Output

LL_DMAMUX_REQ_GEN_LPTIM2_OUT

Request signal generation from LPTIM2 Output

LL_DMAMUX_REQ_GEN_LPTIM3_OUT

Request signal generation from LPTIM3 Output

Request Generator Channel

LL_DMAMUX_REQ_GEN_0

LL_DMAMUX_REQ_GEN_1

LL_DMAMUX_REQ_GEN_2

LL_DMAMUX_REQ_GEN_3

External Request Signal Generation Polarity

LL_DMAMUX_REQ_GEN_NO_EVENT

No external DMA request generation

LL_DMAMUX_REQ_GEN_POL_RISING

External DMA request generation on event on rising edge

LL_DMAMUX_REQ_GEN_POL_FALLING

External DMA request generation on event on falling edge

LL_DMAMUX_REQ_GEN_POL_RISING_FALLING

External DMA request generation on rising and falling edge

Synchronization Signal Event

LL_DMAMUX_SYNC_EXTI_LINE0

Synchronization signal from EXTI Line0

LL_DMAMUX_SYNC_EXTI_LINE1

Synchronization signal from EXTI Line1

LL_DMAMUX_SYNC_EXTI_LINE2

Synchronization signal from EXTI Line2

LL_DMAMUX_SYNC_EXTI_LINE3

Synchronization signal from EXTI Line3

LL_DMAMUX_SYNC_EXTI_LINE4

Synchronization signal from EXTI Line4

LL_DMAMUX_SYNC_EXTI_LINE5

Synchronization signal from EXTI Line5

LL_DMAMUX_SYNC_EXTI_LINE6

Synchronization signal from EXTI Line6

LL_DMAMUX_SYNC_EXTI_LINE7

Synchronization signal from EXTI Line7

LL_DMAMUX_SYNC_EXTI_LINE8

Synchronization signal from EXTI Line8

LL_DMAMUX_SYNC_EXTI_LINE9

Synchronization signal from EXTI Line9

LL_DMAMUX_SYNC_EXTI_LINE10

Synchronization signal from EXTI Line10

LL_DMAMUX_SYNC_EXTI_LINE11

Synchronization signal from EXTI Line11

LL_DMAMUX_SYNC_EXTI_LINE12

Synchronization signal from EXTI Line12

LL_DMAMUX_SYNC_EXTI_LINE13

Synchronization signal from EXTI Line1 3

LL_DMAMUX_SYNC_EXTI_LINE14

Synchronization signal from EXTI Line1 4

LL_DMAMUX_SYNC_EXTI_LINE15

Synchronization signal from EXTI Line1 5

LL_DMAMUX_SYNC_DMAMUX_CH0

Synchronization signal from DMAMUX channel0 Event

LL_DMAMUX_SYNC_DMAMUX_CH1

Synchronization signal from DMAMUX channel1 Event

LL_DMAMUX_SYNC_DMAMUX_CH2

Synchronization signal from DMAMUX channel2 Event

LL_DMAMUX_SYNC_DMAMUX_CH3

Synchronization signal from DMAMUX channel3 Event

LL_DMAMUX_SYNC_LPTIM1_OUT

Synchronization signal from LPTIM1 Output

LL_DMAMUX_SYNC_LPTIM2_OUT

Synchronization signal from LPTIM2 Output

LL_DMAMUX_SYNC_LPTIM3_OUT

Synchronization signal from LPTIM3 Output

Synchronization Signal Polarity

LL_DMAMUX_SYNC_NO_EVENT

All requests are blocked

LL_DMAMUX_SYNC_POL_RISING

Synchronization on event on rising edge

LL_DMAMUX_SYNC_POL_FALLING

Synchronization on event on falling edge

LL_DMAMUX_SYNC_POL_RISING_FALLING

Synchronization on event on rising and falling edge

Common Write and read registers macros

LL_DMAMUX_WriteReg

Description:

- Write a value in DMAMUX register.

Parameters:

- __INSTANCE__: DMAMUX Instance
- __REG__: Register to be written
- __VALUE__: Value to be written in the register

Return value:

- None

LL_DMAMUX_ReadReg

Description:

- Read a value in DMAMUX register.

Parameters:

- __INSTANCE__: DMAMUX Instance
- __REG__: Register to be read

Return value:

- Register: value

63 LL DMA Generic Driver

63.1 DMA Firmware driver registers structures

63.1.1 LL_DMA_InitTypeDef

LL_DMA_InitTypeDef is defined in the stm32u0xx_ll_dma.h

Data Fields

- ***uint32_t PeriphOrM2MSrcAddress***
- ***uint32_t MemoryOrM2MDstAddress***
- ***uint32_t Direction***
- ***uint32_t Mode***
- ***uint32_t PeriphOrM2MSrcIncMode***
- ***uint32_t MemoryOrM2MDstIncMode***
- ***uint32_t PeriphOrM2MSrcDataSize***
- ***uint32_t MemoryOrM2MDstDataSize***
- ***uint32_t NbData***
- ***uint32_t PeriphRequest***
- ***uint32_t Priority***

Field Documentation

- ***uint32_t LL_DMA_InitTypeDef::PeriphOrM2MSrcAddress***
  Specifies the peripheral base address for DMA transfer or as Source base address in case of memory to memory transfer direction.This parameter must be a value between Min_Data = 0 and Max_Data = 0xFFFFFFFF
- ***uint32_t LL_DMA_InitTypeDef::MemoryOrM2MDstAddress***
  Specifies the memory base address for DMA transfer or as Destination base address in case of memory to memory transfer direction.This parameter must be a value between Min_Data = 0 and Max_Data = 0xFFFFFFFF
- ***uint32_t LL_DMA_InitTypeDef::Direction***
  Specifies if the data will be transferred from memory to peripheral, from memory to memory or from peripheral to memory. This parameter can be a value of ***DMA_LL_EC_DIRECTION***This feature can be modified afterwards using unitary function **LL_DMA_SetDataTransferDirection()**.
- ***uint32_t LL_DMA_InitTypeDef::Mode***
  Specifies the normal or circular operation mode. This parameter can be a value of ***DMA_LL_EC_MODE***
  Note:
  – : The circular buffer mode cannot be used if the memory to memory data transfer direction is configured on the selected Channel

  This feature can be modified afterwards using unitary function **LL_DMA_SetMode()**.
- ***uint32_t LL_DMA_InitTypeDef::PeriphOrM2MSrcIncMode***
  Specifies whether the Peripheral address or Source address in case of memory to memory transfer direction is incremented or not. This parameter can be a value of ***DMA_LL_EC_PERIPH***This feature can be modified afterwards using unitary function **LL_DMA_SetPeriphIncMode()**.
- ***uint32_t LL_DMA_InitTypeDef::MemoryOrM2MDstIncMode***
  Specifies whether the Memory address or Destination address in case of memory to memory transfer direction is incremented or not. This parameter can be a value of ***DMA_LL_EC_MEMORY***This feature can be modified afterwards using unitary function **LL_DMA_SetMemoryIncMode()**.
- ***uint32_t LL_DMA_InitTypeDef::PeriphOrM2MSrcDataSize***
  Specifies the Peripheral data size alignment or Source data size alignment (byte, half word, word) in case of memory to memory transfer direction. This parameter can be a value of ***DMA_LL_EC_PDATAALIGN***This feature can be modified afterwards using unitary function **LL_DMA_SetPeriphSize()**.

- ***uint32_t LL_DMA_InitTypeDef::MemoryOrM2MDstDataSize***
  Specifies the Memory data size alignment or Destination data size alignment (byte, half word, word) in case of memory to memory transfer direction. This parameter can be a value of ***DMA_LL_EC_MDATAALIGN***This feature can be modified afterwards using unitary function **LL_DMA_SetMemorySize()**.
- ***uint32_t LL_DMA_InitTypeDef::NbData***
  Specifies the number of data to transfer, in data unit. The data unit is equal to the source buffer configuration set in PeripheralSize or MemorySize parameters depending in the transfer direction. This parameter must be a value between Min_Data = 0 and Max_Data = 0x0000FFFFThis feature can be modified afterwards using unitary function **LL_DMA_SetDataLength()**.
- ***uint32_t LL_DMA_InitTypeDef::PeriphRequest***
  Specifies the peripheral request. This parameter can be a value of ***DMAMUX_LL_EC_REQUEST***This feature can be modified afterwards using unitary function **LL_DMA_SetPeriphRequest()**.
- ***uint32_t LL_DMA_InitTypeDef::Priority***
  Specifies the channel priority level. This parameter can be a value of ***DMA_LL_EC_PRIORITY***This feature can be modified afterwards using unitary function **LL_DMA_SetChannelPriorityLevel()**.

63.2 DMA Firmware driver API description

The following section lists the various functions of the DMA library.

63.2.1 Detailed description of functions

LL_DMA_EnableChannel

Function name

__STATIC_INLINE void LL_DMA_EnableChannel (DMA_TypeDef * DMAx, uint32_t Channel)

Function description

Enable DMA channel.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCR EN LL_DMA_EnableChannel

LL_DMA_DisableChannel

Function name

__STATIC_INLINE void LL_DMA_DisableChannel (DMA_TypeDef * DMAx, uint32_t Channel)

Function description

Disable DMA channel.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCR EN LL_DMA_DisableChannel

LL_DMA_IsEnabledChannel

Function name

__STATIC_INLINE uint32_t LL_DMA_IsEnabledChannel (DMA_TypeDef * DMAx, uint32_t Channel)

Function description

Check if DMA channel is enabled or disabled.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CCR EN LL_DMA_IsEnabledChannel

LL_DMA_ConfigTransfer

Function name

__STATIC_INLINE void LL_DMA_ConfigTransfer (DMA_TypeDef * DMAx, uint32_t Channel, uint32_t Configuration)

Function description

Configure all parameters link to DMA transfer.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7
- **Configuration:** This parameter must be a combination of all the following values:
  - LL_DMA_DIRECTION_PERIPH_TO_MEMORY or LL_DMA_DIRECTION_MEMORY_TO_PERIPH or LL_DMA_DIRECTION_MEMORY_TO_MEMORY
  - LL_DMA_MODE_NORMAL or LL_DMA_MODE_CIRCULAR
  - LL_DMA_PERIPH_INCREMENT or LL_DMA_PERIPH_NOINCREMENT
  - LL_DMA_MEMORY_INCREMENT or LL_DMA_MEMORY_NOINCREMENT
  - LL_DMA_PDATAALIGN_BYTE or LL_DMA_PDATAALIGN_HALFWORD or LL_DMA_PDATAALIGN_WORD
  - LL_DMA_MDATAALIGN_BYTE or LL_DMA_MDATAALIGN_HALFWORD or LL_DMA_MDATAALIGN_WORD
  - LL_DMA_PRIORITY_LOW or LL_DMA_PRIORITY_MEDIUM or LL_DMA_PRIORITY_HIGH or LL_DMA_PRIORITY_VERYHIGH

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCR DIR LL_DMA_ConfigTransfer
- CCR MEM2MEM LL_DMA_ConfigTransfer
- CCR CIRC LL_DMA_ConfigTransfer
- CCR PINC LL_DMA_ConfigTransfer
- CCR MINC LL_DMA_ConfigTransfer
- CCR PSIZE LL_DMA_ConfigTransfer
- CCR MSIZE LL_DMA_ConfigTransfer
- CCR PL LL_DMA_ConfigTransfer

LL_DMA_SetDataTransferDirection

Function name

__STATIC_INLINE void LL_DMA_SetDataTransferDirection (DMA_TypeDef * DMAx, uint32_t Channel, uint32_t Direction)

Function description

Set Data transfer direction (read from peripheral or from memory).

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7
- **Direction:** This parameter can be one of the following values:
  - LL_DMA_DIRECTION_PERIPH_TO_MEMORY
  - LL_DMA_DIRECTION_MEMORY_TO_PERIPH
  - LL_DMA_DIRECTION_MEMORY_TO_MEMORY

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCR DIR LL_DMA_SetDataTransferDirection
- CCR MEM2MEM LL_DMA_SetDataTransferDirection

LL_DMA_GetDataTransferDirection

Function name

__STATIC_INLINE uint32_t LL_DMA_GetDataTransferDirection (DMA_TypeDef * DMAx, uint32_t Channel)

Function description

Get Data transfer direction (read from peripheral or from memory).

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7

Return values

- **Returned:** value can be one of the following values:
  - LL_DMA_DIRECTION_PERIPH_TO_MEMORY
  - LL_DMA_DIRECTION_MEMORY_TO_PERIPH
  - LL_DMA_DIRECTION_MEMORY_TO_MEMORY

Reference Manual to LL API cross reference:

- CCR DIR LL_DMA_GetDataTransferDirection
- CCR MEM2MEM LL_DMA_GetDataTransferDirection

LL_DMA_SetMode

Function name

__STATIC_INLINE void LL_DMA_SetMode (DMA_TypeDef * DMAx, uint32_t Channel, uint32_t Mode)

Function description

Set DMA mode circular or normal.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7
- **Mode:** This parameter can be one of the following values:
  - LL_DMA_MODE_NORMAL
  - LL_DMA_MODE_CIRCULAR

Return values

- **None:**

Notes

- The circular buffer mode cannot be used if the memory-to-memory data transfer is configured on the selected Channel.

Reference Manual to LL API cross reference:

- CCR CIRC LL_DMA_SetMode

LL_DMA_GetMode

Function name

__STATIC_INLINE uint32_t LL_DMA_GetMode (DMA_TypeDef * DMAx, uint32_t Channel)

Function description

Get DMA mode circular or normal.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7

Return values

- **Returned:** value can be one of the following values:
  - LL_DMA_MODE_NORMAL
  - LL_DMA_MODE_CIRCULAR

Reference Manual to LL API cross reference:

- CCR CIRC LL_DMA_GetMode

LL_DMA_SetPeriphIncMode

Function name

__STATIC_INLINE void LL_DMA_SetPeriphIncMode (DMA_TypeDef * DMAx, uint32_t Channel, uint32_t PeriphOrM2MSrcIncMode)

Function description

Set Peripheral increment mode.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7
- **PeriphOrM2MSrcIncMode:** This parameter can be one of the following values:
  - LL_DMA_PERIPH_INCREMENT
  - LL_DMA_PERIPH_NOINCREMENT

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCR PINC LL_DMA_SetPeriphIncMode

LL_DMA_GetPeriphIncMode

Function name

__STATIC_INLINE uint32_t LL_DMA_GetPeriphIncMode (DMA_TypeDef * DMAx, uint32_t Channel)

Function description

Get Peripheral increment mode.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7

Return values

- **Returned:** value can be one of the following values:
  - LL_DMA_PERIPH_INCREMENT
  - LL_DMA_PERIPH_NOINCREMENT

Reference Manual to LL API cross reference:

- CCR PINC LL_DMA_GetPeriphIncMode

LL_DMA_SetMemoryIncMode

Function name

__STATIC_INLINE void LL_DMA_SetMemoryIncMode (DMA_TypeDef * DMAx, uint32_t Channel, uint32_t MemoryOrM2MDstIncMode)

Function description

Set Memory increment mode.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7
- **MemoryOrM2MDstIncMode:** This parameter can be one of the following values:
  - LL_DMA_MEMORY_INCREMENT
  - LL_DMA_MEMORY_NOINCREMENT

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCR MINC LL_DMA_SetMemoryIncMode

LL_DMA_GetMemoryIncMode

Function name

__STATIC_INLINE uint32_t LL_DMA_GetMemoryIncMode (DMA_TypeDef * DMAx, uint32_t Channel)

Function description

Get Memory increment mode.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7

Return values

- **Returned:** value can be one of the following values:
  - LL_DMA_MEMORY_INCREMENT
  - LL_DMA_MEMORY_NOINCREMENT

Reference Manual to LL API cross reference:

- CCR MINC LL_DMA_GetMemoryIncMode

LL_DMA_SetPeriphSize

Function name

__STATIC_INLINE void LL_DMA_SetPeriphSize (DMA_TypeDef * DMAx, uint32_t Channel, uint32_t PeriphOrM2MSrcDataSize)

Function description

Set Peripheral size.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7
- **PeriphOrM2MSrcDataSize:** This parameter can be one of the following values:
  - LL_DMA_PDATAALIGN_BYTE
  - LL_DMA_PDATAALIGN_HALFWORD
  - LL_DMA_PDATAALIGN_WORD

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCR PSIZE LL_DMA_SetPeriphSize

LL_DMA_GetPeriphSize

Function name

__STATIC_INLINE uint32_t LL_DMA_GetPeriphSize (DMA_TypeDef * DMAx, uint32_t Channel)

Function description

Get Peripheral size.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7

Return values

- **Returned:** value can be one of the following values:
  - LL_DMA_PDATAALIGN_BYTE
  - LL_DMA_PDATAALIGN_HALFWORD
  - LL_DMA_PDATAALIGN_WORD

Reference Manual to LL API cross reference:

- CCR PSIZE LL_DMA_GetPeriphSize

LL_DMA_SetMemorySize

Function name

__STATIC_INLINE void LL_DMA_SetMemorySize (DMA_TypeDef * DMAx, uint32_t Channel, uint32_t MemoryOrM2MDstDataSize)

Function description

Set Memory size.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7
- **MemoryOrM2MDstDataSize:** This parameter can be one of the following values:
  - LL_DMA_MDATAALIGN_BYTE
  - LL_DMA_MDATAALIGN_HALFWORD
  - LL_DMA_MDATAALIGN_WORD

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCR MSIZE LL_DMA_SetMemorySize

LL_DMA_GetMemorySize

Function name

__STATIC_INLINE uint32_t LL_DMA_GetMemorySize (DMA_TypeDef * DMAx, uint32_t Channel)

Function description

Get Memory size.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7

Return values

- **Returned:** value can be one of the following values:
  - LL_DMA_MDATAALIGN_BYTE
  - LL_DMA_MDATAALIGN_HALFWORD
  - LL_DMA_MDATAALIGN_WORD

Reference Manual to LL API cross reference:

- CCR MSIZE LL_DMA_GetMemorySize

LL_DMA_SetChannelPriorityLevel

Function name

__STATIC_INLINE void LL_DMA_SetChannelPriorityLevel (DMA_TypeDef * DMAx, uint32_t Channel, uint32_t Priority)

Function description

Set Channel priority level.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7
- **Priority:** This parameter can be one of the following values:
  - LL_DMA_PRIORITY_LOW
  - LL_DMA_PRIORITY_MEDIUM
  - LL_DMA_PRIORITY_HIGH
  - LL_DMA_PRIORITY_VERYHIGH

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCR PL LL_DMA_SetChannelPriorityLevel

LL_DMA_GetChannelPriorityLevel

Function name

__STATIC_INLINE uint32_t LL_DMA_GetChannelPriorityLevel (DMA_TypeDef * DMAx, uint32_t Channel)

Function description

Get Channel priority level.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7

Return values

- **Returned:** value can be one of the following values:
  - LL_DMA_PRIORITY_LOW
  - LL_DMA_PRIORITY_MEDIUM
  - LL_DMA_PRIORITY_HIGH
  - LL_DMA_PRIORITY_VERYHIGH

Reference Manual to LL API cross reference:

- CCR PL LL_DMA_GetChannelPriorityLevel

LL_DMA_SetDataLength

Function name

__STATIC_INLINE void LL_DMA_SetDataLength (DMA_TypeDef * DMAx, uint32_t Channel, uint32_t NbData)

Function description

Set Number of data to transfer.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7
- **NbData:** Between Min_Data = 0 and Max_Data = 0x0000FFFF

Return values

- **None:**

Notes

- This action has no effect if channel is enabled.

Reference Manual to LL API cross reference:

- CNDTR NDT LL_DMA_SetDataLength

LL_DMA_GetDataLength

Function name

__STATIC_INLINE uint32_t LL_DMA_GetDataLength (DMA_TypeDef * DMAx, uint32_t Channel)

Function description

Get Number of data to transfer.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7

Return values

- **Between:** Min_Data = 0 and Max_Data = 0xFFFFFFFF

Notes

- Once the channel is enabled, the return value indicate the remaining bytes to be transmitted.

Reference Manual to LL API cross reference:

- CNDTR NDT LL_DMA_GetDataLength

LL_DMA_ConfigAddresses

Function name

__STATIC_INLINE void LL_DMA_ConfigAddresses (DMA_TypeDef * DMAx, uint32_t Channel, uint32_t SrcAddress, uint32_t DstAddress, uint32_t Direction)

Function description

Configure the Source and Destination addresses.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7
- **SrcAddress:** Between Min_Data = 0 and Max_Data = 0xFFFFFFFF
- **DstAddress:** Between Min_Data = 0 and Max_Data = 0xFFFFFFFF
- **Direction:** This parameter can be one of the following values:
  - LL_DMA_DIRECTION_PERIPH_TO_MEMORY
  - LL_DMA_DIRECTION_MEMORY_TO_PERIPH
  - LL_DMA_DIRECTION_MEMORY_TO_MEMORY

Return values

- **None:**

Notes

- This API must not be called when the DMA channel is enabled.
- Each peripheral using DMA provides an API to get directly the register address (LL_PPP_DMA_GetRegAddr).

Reference Manual to LL API cross reference:

- CPAR PA LL_DMA_ConfigAddresses
- CMAR MA LL_DMA_ConfigAddresses

LL_DMA_SetMemoryAddress

Function name

__STATIC_INLINE void LL_DMA_SetMemoryAddress (DMA_TypeDef * DMAx, uint32_t Channel, uint32_t MemoryAddress)

Function description

Set the Memory address.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7
- **MemoryAddress:** Between Min_Data = 0 and Max_Data = 0xFFFFFFFF

Return values

- **None:**

Notes

- Interface used for direction LL_DMA_DIRECTION_PERIPH_TO_MEMORY or LL_DMA_DIRECTION_MEMORY_TO_PERIPH only.
- This API must not be called when the DMA channel is enabled.

Reference Manual to LL API cross reference:

- CMAR MA LL_DMA_SetMemoryAddress

LL_DMA_SetPeriphAddress

Function name

__STATIC_INLINE void LL_DMA_SetPeriphAddress (DMA_TypeDef * DMAx, uint32_t Channel, uint32_t PeriphAddress)

Function description

Set the Peripheral address.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7
- **PeriphAddress:** Between Min_Data = 0 and Max_Data = 0xFFFFFFFF

Return values

- **None:**

Notes

- Interface used for direction LL_DMA_DIRECTION_PERIPH_TO_MEMORY or LL_DMA_DIRECTION_MEMORY_TO_PERIPH only.
- This API must not be called when the DMA channel is enabled.

Reference Manual to LL API cross reference:

- CPAR PA LL_DMA_SetPeriphAddress

LL_DMA_GetMemoryAddress

Function name

__STATIC_INLINE uint32_t LL_DMA_GetMemoryAddress (DMA_TypeDef * DMAx, uint32_t Channel)

Function description

Get Memory address.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7

Return values

- **Between:** Min_Data = 0 and Max_Data = 0xFFFFFFFF

Notes

- Interface used for direction LL_DMA_DIRECTION_PERIPH_TO_MEMORY or LL_DMA_DIRECTION_MEMORY_TO_PERIPH only.

Reference Manual to LL API cross reference:

- CMAR MA LL_DMA_GetMemoryAddress

LL_DMA_GetPeriphAddress

Function name

__STATIC_INLINE uint32_t LL_DMA_GetPeriphAddress (DMA_TypeDef * DMAx, uint32_t Channel)

Function description

Get Peripheral address.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7

Return values

- **Between:** Min_Data = 0 and Max_Data = 0xFFFFFFFF

Notes

- Interface used for direction LL_DMA_DIRECTION_PERIPH_TO_MEMORY or LL_DMA_DIRECTION_MEMORY_TO_PERIPH only.

Reference Manual to LL API cross reference:

- CPAR PA LL_DMA_GetPeriphAddress

LL_DMA_SetM2MSrcAddress

Function name

__STATIC_INLINE void LL_DMA_SetM2MSrcAddress (DMA_TypeDef * DMAx, uint32_t Channel, uint32_t MemoryAddress)

Function description

Set the Memory to Memory Source address.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7
- **MemoryAddress:** Between Min_Data = 0 and Max_Data = 0xFFFFFFFF

Return values

- **None:**

Notes

- Interface used for direction LL_DMA_DIRECTION_MEMORY_TO_MEMORY only.
- This API must not be called when the DMA channel is enabled.

Reference Manual to LL API cross reference:

- CPAR PA LL_DMA_SetM2MSrcAddress

LL_DMA_SetM2MDstAddress

Function name

__STATIC_INLINE void LL_DMA_SetM2MDstAddress (DMA_TypeDef * DMAx, uint32_t Channel, uint32_t MemoryAddress)

Function description

Set the Memory to Memory Destination address.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7
- **MemoryAddress:** Between Min_Data = 0 and Max_Data = 0xFFFFFFFF

Return values

- **None:**

Notes

- Interface used for direction LL_DMA_DIRECTION_MEMORY_TO_MEMORY only.
- This API must not be called when the DMA channel is enabled.

Reference Manual to LL API cross reference:

- CMAR MA LL_DMA_SetM2MDstAddress

LL_DMA_GetM2MSrcAddress

Function name

__STATIC_INLINE uint32_t LL_DMA_GetM2MSrcAddress (DMA_TypeDef * DMAx, uint32_t Channel)

Function description

Get the Memory to Memory Source address.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7

Return values

- **Between:** Min_Data = 0 and Max_Data = 0xFFFFFFFF

Notes

- Interface used for direction LL_DMA_DIRECTION_MEMORY_TO_MEMORY only.

Reference Manual to LL API cross reference:

- CPAR PA LL_DMA_GetM2MSrcAddress

LL_DMA_GetM2MDstAddress

Function name

__STATIC_INLINE uint32_t LL_DMA_GetM2MDstAddress (DMA_TypeDef * DMAx, uint32_t Channel)

Function description

Get the Memory to Memory Destination address.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7

Return values

- **Between:** Min_Data = 0 and Max_Data = 0xFFFFFFFF

Notes

- Interface used for direction LL_DMA_DIRECTION_MEMORY_TO_MEMORY only.

Reference Manual to LL API cross reference:

- CMAR MA LL_DMA_GetM2MDstAddress

LL_DMA_SetPeriphRequest

Function name

__STATIC_INLINE void LL_DMA_SetPeriphRequest (DMA_TypeDef * DMAx, uint32_t Channel, uint32_t Request)

Function description

Set DMA request for DMA Channels on DMAMUX Channel x.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7

- **Request:** This parameter can be one of the following values:
  - LL_DMAMUX_REQ_MEM2MEM
  - LL_DMAMUX_REQ_GENERATOR0
  - LL_DMAMUX_REQ_GENERATOR1
  - LL_DMAMUX_REQ_GENERATOR2
  - LL_DMAMUX_REQ_GENERATOR3
  - LL_DMAMUX_REQ_ADC
  - LL_DMAMUX_REQ_AES_IN
  - LL_DMAMUX_REQ_AES_OUT
  - LL_DMAMUX_REQ_DAC_CH1
  - LL_DMAMUX_REQ_I2C1_RX
  - LL_DMAMUX_REQ_I2C1_TX
  - LL_DMAMUX_REQ_I2C2_RX
  - LL_DMAMUX_REQ_I2C2_TX
  - LL_DMAMUX_REQ_I2C3_RX
  - LL_DMAMUX_REQ_I2C3_TX
  - LL_DMAMUX_REQ_I2C4_RX
  - LL_DMAMUX_REQ_I2C4_TX
  - LL_DMAMUX_REQ_LPTIM1_IC1
  - LL_DMAMUX_REQ_LPTIM1_IC2
  - LL_DMAMUX_REQ_LPTIM1_IC3
  - LL_DMAMUX_REQ_LPTIM1_IC4
  - LL_DMAMUX_REQ_LPTIM1_UE
  - LL_DMAMUX_REQ_LPTIM2_IC1
  - LL_DMAMUX_REQ_LPTIM2_IC2
  - LL_DMAMUX_REQ_LPTIM2_UE
  - LL_DMAMUX_REQ_LPTIM3_IC1
  - LL_DMAMUX_REQ_LPTIM3_IC2
  - LL_DMAMUX_REQ_LPTIM3_IC3
  - LL_DMAMUX_REQ_LPTIM3_IC4
  - LL_DMAMUX_REQ_LPTIM3_UE
  - LL_DMAMUX_REQ_LPUART1_RX
  - LL_DMAMUX_REQ_LPUART1_TX
  - LL_DMAMUX_REQ_LPUART2_RX
  - LL_DMAMUX_REQ_LPUART2_TX
  - LL_DMAMUX_REQ_LPUART3_RX
  - LL_DMAMUX_REQ_LPUART3_TX
  - LL_DMAMUX_REQ_SPI1_RX
  - LL_DMAMUX_REQ_SPI1_TX
  - LL_DMAMUX_REQ_SPI2_RX
  - LL_DMAMUX_REQ_SPI2_TX
  - LL_DMAMUX_REQ_SPI3_RX
  - LL_DMAMUX_REQ_SPI3_TX
  - LL_DMAMUX_REQ_TIM1_CH1
  - LL_DMAMUX_REQ_TIM1_CH2
  - LL_DMAMUX_REQ_TIM1_CH3
  - LL_DMAMUX_REQ_TIM1_CH4
  - LL_DMAMUX_REQ_TIM1_TRIG_COM
  - LL_DMAMUX_REQ_TIM1_UP
  - LL_DMAMUX_REQ_TIM2_CH1

- LL_DMAMUX_REQ_TIM2_CH2
- LL_DMAMUX_REQ_TIM2_CH3
- LL_DMAMUX_REQ_TIM2_CH4
- LL_DMAMUX_REQ_TIM2_TRIG
- LL_DMAMUX_REQ_TIM2_UP
- LL_DMAMUX_REQ_TIM3_CH1
- LL_DMAMUX_REQ_TIM3_CH2
- LL_DMAMUX_REQ_TIM3_CH3
- LL_DMAMUX_REQ_TIM3_CH4
- LL_DMAMUX_REQ_TIM3_TRIG
- LL_DMAMUX_REQ_TIM3_UP
- LL_DMAMUX_REQ_TIM6_UP
- LL_DMAMUX_REQ_TIM7_UP
- LL_DMAMUX_REQ_TIM15_CH1
- LL_DMAMUX_REQ_TIM15_CH2
- LL_DMAMUX_REQ_TIM15_TRIG_COM
- LL_DMAMUX_REQ_TIM15_UP
- LL_DMAMUX_REQ_TIM16_CH1
- LL_DMAMUX_REQ_TIM16_COM
- LL_DMAMUX_REQ_TIM16_UP
- LL_DMAMUX_REQ_USART1_RX
- LL_DMAMUX_REQ_USART1_TX
- LL_DMAMUX_REQ_USART2_RX
- LL_DMAMUX_REQ_USART2_TX
- LL_DMAMUX_REQ_USART3_RX
- LL_DMAMUX_REQ_USART3_TX
- LL_DMAMUX_REQ_USART4_RX
- LL_DMAMUX_REQ_USART4_TX

Return values

- **None:**

Notes

- DMAMUX channel 0 to 6 are mapped to DMA1 channel 1 to 7. DMAMUX channel 7 to 11 are mapped to DMA2 channel 1 to 5 (** only available on chip which support DMA2 **).

Reference Manual to LL API cross reference:

- CxCR DMAREQ_ID LL_DMA_SetPeriphRequest

LL_DMA_GetPeriphRequest

Function name

__STATIC_INLINE uint32_t LL_DMA_GetPeriphRequest (DMA_TypeDef * DMAx, uint32_t Channel)

Function description

Get DMA request for DMA Channels on DMAMUX Channel x.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7

Return values

- **Returned:** value can be one of the following values:
  - LL_DMAMUX_REQ_MEM2MEM
  - LL_DMAMUX_REQ_GENERATOR0
  - LL_DMAMUX_REQ_GENERATOR1
  - LL_DMAMUX_REQ_GENERATOR2
  - LL_DMAMUX_REQ_GENERATOR3
  - LL_DMAMUX_REQ_ADC
  - LL_DMAMUX_REQ_AES_IN
  - LL_DMAMUX_REQ_AES_OUT
  - LL_DMAMUX_REQ_DAC_CH1
  - LL_DMAMUX_REQ_I2C1_RX
  - LL_DMAMUX_REQ_I2C1_TX
  - LL_DMAMUX_REQ_I2C2_RX
  - LL_DMAMUX_REQ_I2C2_TX
  - LL_DMAMUX_REQ_I2C3_RX
  - LL_DMAMUX_REQ_I2C3_TX
  - LL_DMAMUX_REQ_I2C4_RX
  - LL_DMAMUX_REQ_I2C4_TX
  - LL_DMAMUX_REQ_LPTIM1_IC1
  - LL_DMAMUX_REQ_LPTIM1_IC2
  - LL_DMAMUX_REQ_LPTIM1_IC3
  - LL_DMAMUX_REQ_LPTIM1_IC4
  - LL_DMAMUX_REQ_LPTIM1_UE
  - LL_DMAMUX_REQ_LPTIM2_IC1
  - LL_DMAMUX_REQ_LPTIM2_IC2
  - LL_DMAMUX_REQ_LPTIM2_UE
  - LL_DMAMUX_REQ_LPTIM3_IC1
  - LL_DMAMUX_REQ_LPTIM3_IC2
  - LL_DMAMUX_REQ_LPTIM3_IC3
  - LL_DMAMUX_REQ_LPTIM3_IC4
  - LL_DMAMUX_REQ_LPTIM3_UE
  - LL_DMAMUX_REQ_LPUART1_RX
  - LL_DMAMUX_REQ_LPUART1_TX
  - LL_DMAMUX_REQ_LPUART2_RX
  - LL_DMAMUX_REQ_LPUART2_TX
  - LL_DMAMUX_REQ_LPUART3_RX
  - LL_DMAMUX_REQ_LPUART3_TX
  - LL_DMAMUX_REQ_SPI1_RX
  - LL_DMAMUX_REQ_SPI1_TX
  - LL_DMAMUX_REQ_SPI2_RX
  - LL_DMAMUX_REQ_SPI2_TX
  - LL_DMAMUX_REQ_SPI3_RX
  - LL_DMAMUX_REQ_SPI3_TX
  - LL_DMAMUX_REQ_TIM1_CH1
  - LL_DMAMUX_REQ_TIM1_CH2
  - LL_DMAMUX_REQ_TIM1_CH3
  - LL_DMAMUX_REQ_TIM1_CH4
  - LL_DMAMUX_REQ_TIM1_TRIG_COM
  - LL_DMAMUX_REQ_TIM1_UP

- LL_DMAMUX_REQ_TIM2_CH1
- LL_DMAMUX_REQ_TIM2_CH2
- LL_DMAMUX_REQ_TIM2_CH3
- LL_DMAMUX_REQ_TIM2_CH4
- LL_DMAMUX_REQ_TIM2_TRIG
- LL_DMAMUX_REQ_TIM2_UP
- LL_DMAMUX_REQ_TIM3_CH1
- LL_DMAMUX_REQ_TIM3_CH2
- LL_DMAMUX_REQ_TIM3_CH3
- LL_DMAMUX_REQ_TIM3_CH4
- LL_DMAMUX_REQ_TIM3_TRIG
- LL_DMAMUX_REQ_TIM3_UP
- LL_DMAMUX_REQ_TIM6_UP
- LL_DMAMUX_REQ_TIM7_UP
- LL_DMAMUX_REQ_TIM15_CH1
- LL_DMAMUX_REQ_TIM15_CH2
- LL_DMAMUX_REQ_TIM15_TRIG_COM
- LL_DMAMUX_REQ_TIM15_UP
- LL_DMAMUX_REQ_TIM16_CH1
- LL_DMAMUX_REQ_TIM16_COM
- LL_DMAMUX_REQ_TIM16_UP
- LL_DMAMUX_REQ_USART1_RX
- LL_DMAMUX_REQ_USART1_TX
- LL_DMAMUX_REQ_USART2_RX
- LL_DMAMUX_REQ_USART2_TX
- LL_DMAMUX_REQ_USART3_RX
- LL_DMAMUX_REQ_USART3_TX
- LL_DMAMUX_REQ_USART4_RX
- LL_DMAMUX_REQ_USART4_TX

Notes

- DMAMUX channel 0 to 6 are mapped to DMA1 channel 1 to 7. DMAMUX channel 7 to 11 are mapped to DMA2 channel 1 to 5 (** only available on chip which support DMA2 **).

Reference Manual to LL API cross reference:

- CxCR DMAREQ_ID LL_DMA_GetPeriphRequest

LL_DMA_IsActiveFlag_GI1

Function name

__STATIC_INLINE uint32_t LL_DMA_IsActiveFlag_GI1 (DMA_TypeDef * DMAx)

Function description

Get Channel 1 global interrupt flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR GIF1 LL_DMA_IsActiveFlag_GI1

LL_DMA_IsActiveFlag_GI2

Function name

__STATIC_INLINE uint32_t LL_DMA_IsActiveFlag_GI2 (DMA_TypeDef * DMAx)

Function description

Get Channel 2 global interrupt flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR GIF2 LL_DMA_IsActiveFlag_GI2

LL_DMA_IsActiveFlag_GI3

Function name

__STATIC_INLINE uint32_t LL_DMA_IsActiveFlag_GI3 (DMA_TypeDef * DMAx)

Function description

Get Channel 3 global interrupt flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR GIF3 LL_DMA_IsActiveFlag_GI3

LL_DMA_IsActiveFlag_GI4

Function name

__STATIC_INLINE uint32_t LL_DMA_IsActiveFlag_GI4 (DMA_TypeDef * DMAx)

Function description

Get Channel 4 global interrupt flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR GIF4 LL_DMA_IsActiveFlag_GI4

LL_DMA_IsActiveFlag_GI5

Function name

__STATIC_INLINE uint32_t LL_DMA_IsActiveFlag_GI5 (DMA_TypeDef * DMAx)

Function description

Get Channel 5 global interrupt flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR GIF5 LL_DMA_IsActiveFlag_GI5

LL_DMA_IsActiveFlag_GI6

Function name

__STATIC_INLINE uint32_t LL_DMA_IsActiveFlag_GI6 (DMA_TypeDef * DMAx)

Function description

Get Channel 6 global interrupt flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR GIF6 LL_DMA_IsActiveFlag_GI6

LL_DMA_IsActiveFlag_GI7

Function name

__STATIC_INLINE uint32_t LL_DMA_IsActiveFlag_GI7 (DMA_TypeDef * DMAx)

Function description

Get Channel 7 global interrupt flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR GIF7 LL_DMA_IsActiveFlag_GI7

LL_DMA_IsActiveFlag_TC1

Function name

__STATIC_INLINE uint32_t LL_DMA_IsActiveFlag_TC1 (DMA_TypeDef * DMAx)

Function description

Get Channel 1 transfer complete flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR TCIF1 LL_DMA_IsActiveFlag_TC1

LL_DMA_IsActiveFlag_TC2

Function name

__STATIC_INLINE uint32_t LL_DMA_IsActiveFlag_TC2 (DMA_TypeDef * DMAx)

Function description

Get Channel 2 transfer complete flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR TCIF2 LL_DMA_IsActiveFlag_TC2

LL_DMA_IsActiveFlag_TC3

Function name

__STATIC_INLINE uint32_t LL_DMA_IsActiveFlag_TC3 (DMA_TypeDef * DMAx)

Function description

Get Channel 3 transfer complete flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR TCIF3 LL_DMA_IsActiveFlag_TC3

LL_DMA_IsActiveFlag_TC4

Function name

__STATIC_INLINE uint32_t LL_DMA_IsActiveFlag_TC4 (DMA_TypeDef * DMAx)

Function description

Get Channel 4 transfer complete flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR TCIF4 LL_DMA_IsActiveFlag_TC4

LL_DMA_IsActiveFlag_TC5

Function name

__STATIC_INLINE uint32_t LL_DMA_IsActiveFlag_TC5 (DMA_TypeDef * DMAx)

Function description

Get Channel 5 transfer complete flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR TCIF5 LL_DMA_IsActiveFlag_TC5

LL_DMA_IsActiveFlag_TC6

Function name

__STATIC_INLINE uint32_t LL_DMA_IsActiveFlag_TC6 (DMA_TypeDef * DMAx)

Function description

Get Channel 6 transfer complete flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR TCIF6 LL_DMA_IsActiveFlag_TC6

LL_DMA_IsActiveFlag_TC7

Function name

__STATIC_INLINE uint32_t LL_DMA_IsActiveFlag_TC7 (DMA_TypeDef * DMAx)

Function description

Get Channel 7 transfer complete flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR TCIF7 LL_DMA_IsActiveFlag_TC7

LL_DMA_IsActiveFlag_HT1

Function name

__STATIC_INLINE uint32_t LL_DMA_IsActiveFlag_HT1 (DMA_TypeDef * DMAx)

Function description

Get Channel 1 half transfer flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR HTIF1 LL_DMA_IsActiveFlag_HT1

LL_DMA_IsActiveFlag_HT2

Function name

__STATIC_INLINE uint32_t LL_DMA_IsActiveFlag_HT2 (DMA_TypeDef * DMAx)

Function description

Get Channel 2 half transfer flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR HTIF2 LL_DMA_IsActiveFlag_HT2

LL_DMA_IsActiveFlag_HT3

Function name

__STATIC_INLINE uint32_t LL_DMA_IsActiveFlag_HT3 (DMA_TypeDef * DMAx)

Function description

Get Channel 3 half transfer flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR HTIF3 LL_DMA_IsActiveFlag_HT3

LL_DMA_IsActiveFlag_HT4

Function name

__STATIC_INLINE uint32_t LL_DMA_IsActiveFlag_HT4 (DMA_TypeDef * DMAx)

Function description

Get Channel 4 half transfer flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR HTIF4 LL_DMA_IsActiveFlag_HT4

LL_DMA_IsActiveFlag_HT5

Function name

__STATIC_INLINE uint32_t LL_DMA_IsActiveFlag_HT5 (DMA_TypeDef * DMAx)

Function description

Get Channel 5 half transfer flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR HTIF5 LL_DMA_IsActiveFlag_HT5

LL_DMA_IsActiveFlag_HT6

Function name

__STATIC_INLINE uint32_t LL_DMA_IsActiveFlag_HT6 (DMA_TypeDef * DMAx)

Function description

Get Channel 6 half transfer flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR HTIF6 LL_DMA_IsActiveFlag_HT6

LL_DMA_IsActiveFlag_HT7

Function name

__STATIC_INLINE uint32_t LL_DMA_IsActiveFlag_HT7 (DMA_TypeDef * DMAx)

Function description

Get Channel 7 half transfer flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR HTIF7 LL_DMA_IsActiveFlag_HT7

LL_DMA_IsActiveFlag_TE1

Function name

__STATIC_INLINE uint32_t LL_DMA_IsActiveFlag_TE1 (DMA_TypeDef * DMAx)

Function description

Get Channel 1 transfer error flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR TEIF1 LL_DMA_IsActiveFlag_TE1

LL_DMA_IsActiveFlag_TE2

Function name

__STATIC_INLINE uint32_t LL_DMA_IsActiveFlag_TE2 (DMA_TypeDef * DMAx)

Function description

Get Channel 2 transfer error flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR TEIF2 LL_DMA_IsActiveFlag_TE2

LL_DMA_IsActiveFlag_TE3

Function name

__STATIC_INLINE uint32_t LL_DMA_IsActiveFlag_TE3 (DMA_TypeDef * DMAx)

Function description

Get Channel 3 transfer error flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR TEIF3 LL_DMA_IsActiveFlag_TE3

LL_DMA_IsActiveFlag_TE4

Function name

__STATIC_INLINE uint32_t LL_DMA_IsActiveFlag_TE4 (DMA_TypeDef * DMAx)

Function description

Get Channel 4 transfer error flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR TEIF4 LL_DMA_IsActiveFlag_TE4

LL_DMA_IsActiveFlag_TE5

Function name

__STATIC_INLINE uint32_t LL_DMA_IsActiveFlag_TE5 (DMA_TypeDef * DMAx)

Function description

Get Channel 5 transfer error flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR TEIF5 LL_DMA_IsActiveFlag_TE5

LL_DMA_IsActiveFlag_TE6

Function name

__STATIC_INLINE uint32_t LL_DMA_IsActiveFlag_TE6 (DMA_TypeDef * DMAx)

Function description

Get Channel 6 transfer error flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR TEIF6 LL_DMA_IsActiveFlag_TE6

LL_DMA_IsActiveFlag_TE7

Function name

__STATIC_INLINE uint32_t LL_DMA_IsActiveFlag_TE7 (DMA_TypeDef * DMAx)

Function description

Get Channel 7 transfer error flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR TEIF7 LL_DMA_IsActiveFlag_TE7

LL_DMA_ClearFlag_GI1

Function name

__STATIC_INLINE void LL_DMA_ClearFlag_GI1 (DMA_TypeDef * DMAx)

Function description

Clear Channel 1 global interrupt flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **None:**

Notes

- Do not Clear Channel 1 global interrupt flag when the channel in ON. Instead clear specific flags transfer complete, half transfer & transfer error flag with LL_DMA_ClearFlag_TC1, LL_DMA_ClearFlag_HT1, LL_DMA_ClearFlag_TE1. bug id 2.4.1 in Product Errata Sheet.

Reference Manual to LL API cross reference:

- IFCR CGIF1 LL_DMA_ClearFlag_GI1

LL_DMA_ClearFlag_GI2

Function name

__STATIC_INLINE void LL_DMA_ClearFlag_GI2 (DMA_TypeDef * DMAx)

Function description

Clear Channel 2 global interrupt flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **None:**

Notes

- Do not Clear Channel 2 global interrupt flag when the channel in ON. Instead clear specific flags transfer complete, half transfer & transfer error flag with LL_DMA_ClearFlag_TC2, LL_DMA_ClearFlag_HT2, LL_DMA_ClearFlag_TE2. bug id 2.4.1 in Product Errata Sheet.

Reference Manual to LL API cross reference:

- IFCR CGIF2 LL_DMA_ClearFlag_GI2

LL_DMA_ClearFlag_GI3

Function name

__STATIC_INLINE void LL_DMA_ClearFlag_GI3 (DMA_TypeDef * DMAx)

Function description

Clear Channel 3 global interrupt flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **None:**

Notes

- Do not Clear Channel 3 global interrupt flag when the channel in ON. Instead clear specific flags transfer complete, half transfer & transfer error flag with LL_DMA_ClearFlag_TC3, LL_DMA_ClearFlag_HT3, LL_DMA_ClearFlag_TE3. bug id 2.4.1 in Product Errata Sheet.

Reference Manual to LL API cross reference:

- IFCR CGIF3 LL_DMA_ClearFlag_GI3

LL_DMA_ClearFlag_GI4

Function name

__STATIC_INLINE void LL_DMA_ClearFlag_GI4 (DMA_TypeDef * DMAx)

Function description

Clear Channel 4 global interrupt flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **None:**

Notes

- Do not Clear Channel 4 global interrupt flag when the channel in ON. Instead clear specific flags transfer complete, half transfer & transfer error flag with LL_DMA_ClearFlag_TC4, LL_DMA_ClearFlag_HT4, LL_DMA_ClearFlag_TE4. bug id 2.4.1 in Product Errata Sheet.

Reference Manual to LL API cross reference:

- IFCR CGIF4 LL_DMA_ClearFlag_GI4

LL_DMA_ClearFlag_GI5

Function name

__STATIC_INLINE void LL_DMA_ClearFlag_GI5 (DMA_TypeDef * DMAx)

Function description

Clear Channel 5 global interrupt flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **None:**

Notes

- Do not Clear Channel 5 global interrupt flag when the channel in ON. Instead clear specific flags transfer complete, half transfer & transfer error flag with LL_DMA_ClearFlag_TC5, LL_DMA_ClearFlag_HT5, LL_DMA_ClearFlag_TE5. bug id 2.4.1 in Product Errata Sheet.

Reference Manual to LL API cross reference:

- IFCR CGIF5 LL_DMA_ClearFlag_GI5

LL_DMA_ClearFlag_GI6

Function name

__STATIC_INLINE void LL_DMA_ClearFlag_GI6 (DMA_TypeDef * DMAx)

Function description

Clear Channel 6 global interrupt flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **None:**

Notes

- Do not Clear Channel 6 global interrupt flag when the channel in ON. Instead clear specific flags transfer complete, half transfer & transfer error flag with LL_DMA_ClearFlag_TC6, LL_DMA_ClearFlag_HT6, LL_DMA_ClearFlag_TE6. bug id 2.4.1 in Product Errata Sheet.

Reference Manual to LL API cross reference:

- IFCR CGIF6 LL_DMA_ClearFlag_GI6

LL_DMA_ClearFlag_GI7

Function name

__STATIC_INLINE void LL_DMA_ClearFlag_GI7 (DMA_TypeDef * DMAx)

Function description

Clear Channel 7 global interrupt flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **None:**

Notes

- Do not Clear Channel 7 global interrupt flag when the channel in ON. Instead clear specific flags transfer complete, half transfer & transfer error flag with LL_DMA_ClearFlag_TC7, LL_DMA_ClearFlag_HT7, LL_DMA_ClearFlag_TE7. bug id 2.4.1 in Product Errata Sheet.

Reference Manual to LL API cross reference:

- IFCR CGIF7 LL_DMA_ClearFlag_GI7

LL_DMA_ClearFlag_TC1

Function name

__STATIC_INLINE void LL_DMA_ClearFlag_TC1 (DMA_TypeDef * DMAx)

Function description

Clear Channel 1 transfer complete flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IFCR CTCIF1 LL_DMA_ClearFlag_TC1

LL_DMA_ClearFlag_TC2

Function name

__STATIC_INLINE void LL_DMA_ClearFlag_TC2 (DMA_TypeDef * DMAx)

Function description

Clear Channel 2 transfer complete flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IFCR CTCIF2 LL_DMA_ClearFlag_TC2

LL_DMA_ClearFlag_TC3

Function name

__STATIC_INLINE void LL_DMA_ClearFlag_TC3 (DMA_TypeDef * DMAx)

Function description

Clear Channel 3 transfer complete flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IFCR CTCIF3 LL_DMA_ClearFlag_TC3

LL_DMA_ClearFlag_TC4

Function name

__STATIC_INLINE void LL_DMA_ClearFlag_TC4 (DMA_TypeDef * DMAx)

Function description

Clear Channel 4 transfer complete flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IFCR CTCIF4 LL_DMA_ClearFlag_TC4

LL_DMA_ClearFlag_TC5

Function name

__STATIC_INLINE void LL_DMA_ClearFlag_TC5 (DMA_TypeDef * DMAx)

Function description

Clear Channel 5 transfer complete flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IFCR CTCIF5 LL_DMA_ClearFlag_TC5

LL_DMA_ClearFlag_TC6

Function name

__STATIC_INLINE void LL_DMA_ClearFlag_TC6 (DMA_TypeDef * DMAx)

Function description

Clear Channel 6 transfer complete flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IFCR CTCIF6 LL_DMA_ClearFlag_TC6

LL_DMA_ClearFlag_TC7

Function name

__STATIC_INLINE void LL_DMA_ClearFlag_TC7 (DMA_TypeDef * DMAx)

Function description

Clear Channel 7 transfer complete flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IFCR CTCIF7 LL_DMA_ClearFlag_TC7

LL_DMA_ClearFlag_HT1

Function name

__STATIC_INLINE void LL_DMA_ClearFlag_HT1 (DMA_TypeDef * DMAx)

Function description

Clear Channel 1 half transfer flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IFCR CHTIF1 LL_DMA_ClearFlag_HT1

LL_DMA_ClearFlag_HT2

Function name

__STATIC_INLINE void LL_DMA_ClearFlag_HT2 (DMA_TypeDef * DMAx)

Function description

Clear Channel 2 half transfer flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IFCR CHTIF2 LL_DMA_ClearFlag_HT2

LL_DMA_ClearFlag_HT3

Function name

__STATIC_INLINE void LL_DMA_ClearFlag_HT3 (DMA_TypeDef * DMAx)

Function description

Clear Channel 3 half transfer flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IFCR CHTIF3 LL_DMA_ClearFlag_HT3

LL_DMA_ClearFlag_HT4

Function name

__STATIC_INLINE void LL_DMA_ClearFlag_HT4 (DMA_TypeDef * DMAx)

Function description

Clear Channel 4 half transfer flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IFCR CHTIF4 LL_DMA_ClearFlag_HT4

LL_DMA_ClearFlag_HT5

Function name

__STATIC_INLINE void LL_DMA_ClearFlag_HT5 (DMA_TypeDef * DMAx)

Function description

Clear Channel 5 half transfer flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IFCR CHTIF5 LL_DMA_ClearFlag_HT5

LL_DMA_ClearFlag_HT6

Function name

__STATIC_INLINE void LL_DMA_ClearFlag_HT6 (DMA_TypeDef * DMAx)

Function description

Clear Channel 6 half transfer flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IFCR CHTIF6 LL_DMA_ClearFlag_HT6

LL_DMA_ClearFlag_HT7

Function name

__STATIC_INLINE void LL_DMA_ClearFlag_HT7 (DMA_TypeDef * DMAx)

Function description

Clear Channel 7 half transfer flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IFCR CHTIF7 LL_DMA_ClearFlag_HT7

LL_DMA_ClearFlag_TE1

Function name

__STATIC_INLINE void LL_DMA_ClearFlag_TE1 (DMA_TypeDef * DMAx)

Function description

Clear Channel 1 transfer error flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IFCR CTEIF1 LL_DMA_ClearFlag_TE1

LL_DMA_ClearFlag_TE2

Function name

__STATIC_INLINE void LL_DMA_ClearFlag_TE2 (DMA_TypeDef * DMAx)

Function description

Clear Channel 2 transfer error flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IFCR CTEIF2 LL_DMA_ClearFlag_TE2

LL_DMA_ClearFlag_TE3

Function name

__STATIC_INLINE void LL_DMA_ClearFlag_TE3 (DMA_TypeDef * DMAx)

Function description

Clear Channel 3 transfer error flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IFCR CTEIF3 LL_DMA_ClearFlag_TE3

LL_DMA_ClearFlag_TE4

Function name

__STATIC_INLINE void LL_DMA_ClearFlag_TE4 (DMA_TypeDef * DMAx)

Function description

Clear Channel 4 transfer error flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IFCR CTEIF4 LL_DMA_ClearFlag_TE4

LL_DMA_ClearFlag_TE5

Function name

__STATIC_INLINE void LL_DMA_ClearFlag_TE5 (DMA_TypeDef * DMAx)

Function description

Clear Channel 5 transfer error flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IFCR CTEIF5 LL_DMA_ClearFlag_TE5

LL_DMA_ClearFlag_TE6

Function name

__STATIC_INLINE void LL_DMA_ClearFlag_TE6 (DMA_TypeDef * DMAx)

Function description

Clear Channel 6 transfer error flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IFCR CTEIF6 LL_DMA_ClearFlag_TE6

LL_DMA_ClearFlag_TE7

Function name

__STATIC_INLINE void LL_DMA_ClearFlag_TE7 (DMA_TypeDef * DMAx)

Function description

Clear Channel 7 transfer error flag.

Parameters

- **DMAx:** DMAx Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IFCR CTEIF7 LL_DMA_ClearFlag_TE7

LL_DMA_EnableIT_TC

Function name

__STATIC_INLINE void LL_DMA_EnableIT_TC (DMA_TypeDef * DMAx, uint32_t Channel)

Function description

Enable Transfer complete interrupt.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCR TCIE LL_DMA_EnableIT_TC

LL_DMA_EnableIT_HT

Function name

__STATIC_INLINE void LL_DMA_EnableIT_HT (DMA_TypeDef * DMAx, uint32_t Channel)

Function description

Enable Half transfer interrupt.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCR HTIE LL_DMA_EnableIT_HT

LL_DMA_EnableIT_TE

Function name

__STATIC_INLINE void LL_DMA_EnableIT_TE (DMA_TypeDef * DMAx, uint32_t Channel)

Function description

Enable Transfer error interrupt.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCR TEIE LL_DMA_EnableIT_TE

LL_DMA_DisableIT_TC

Function name

__STATIC_INLINE void LL_DMA_DisableIT_TC (DMA_TypeDef * DMAx, uint32_t Channel)

Function description

Disable Transfer complete interrupt.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCR TCIE LL_DMA_DisableIT_TC

LL_DMA_DisableIT_HT

Function name

__STATIC_INLINE void LL_DMA_DisableIT_HT (DMA_TypeDef * DMAx, uint32_t Channel)

Function description

Disable Half transfer interrupt.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCR HTIE LL_DMA_DisableIT_HT

LL_DMA_DisableIT_TE

Function name

__STATIC_INLINE void LL_DMA_DisableIT_TE (DMA_TypeDef * DMAx, uint32_t Channel)

Function description

Disable Transfer error interrupt.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCR TEIE LL_DMA_DisableIT_TE

LL_DMA_IsEnabledIT_TC

Function name

__STATIC_INLINE uint32_t LL_DMA_IsEnabledIT_TC (DMA_TypeDef * DMAx, uint32_t Channel)

Function description

Check if Transfer complete Interrupt is enabled.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CCR TCIE LL_DMA_IsEnabledIT_TC

LL_DMA_IsEnabledIT_HT

Function name

__STATIC_INLINE uint32_t LL_DMA_IsEnabledIT_HT (DMA_TypeDef * DMAx, uint32_t Channel)

Function description

Check if Half transfer Interrupt is enabled.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CCR HTIE LL_DMA_IsEnabledIT_HT

LL_DMA_IsEnabledIT_TE

Function name

__STATIC_INLINE uint32_t LL_DMA_IsEnabledIT_TE (DMA_TypeDef * DMAx, uint32_t Channel)

Function description

Check if Transfer error Interrupt is enabled.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CCR TEIE LL_DMA_IsEnabledIT_TE

LL_DMA_Init

Function name

ErrorStatus LL_DMA_Init (DMA_TypeDef * DMAx, uint32_t Channel, LL_DMA_InitTypeDef * DMA_InitStruct)

Function description

Initialize the DMA registers according to the specified parameters in DMA_InitStruct.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7
- **DMA_InitStruct:** pointer to a LL_DMA_InitTypeDef structure.

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: DMA registers are initialized
  - ERROR: Not applicable

Notes

- To convert DMAx_Channely Instance to DMAx Instance and Channely, use helper macros : __LL_DMA_GET_INSTANCE __LL_DMA_GET_CHANNEL

LL_DMA_DeInit

Function name

ErrorStatus LL_DMA_DeInit (DMA_TypeDef * DMAx, uint32_t Channel)

Function description

De-initialize the DMA registers to their default reset values.

Parameters

- **DMAx:** DMAx Instance
- **Channel:** This parameter can be one of the following values:
  - LL_DMA_CHANNEL_1
  - LL_DMA_CHANNEL_2
  - LL_DMA_CHANNEL_3
  - LL_DMA_CHANNEL_4
  - LL_DMA_CHANNEL_5
  - LL_DMA_CHANNEL_6
  - LL_DMA_CHANNEL_7
  - LL_DMA_CHANNEL_ALL

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: DMA registers are de-initialized
  - ERROR: DMA registers are not de-initialized

LL_DMA_StructInit

Function name

void LL_DMA_StructInit (LL_DMA_InitTypeDef * DMA_InitStruct)

Function description

Set each LL_DMA_InitTypeDef field to default value.

Parameters

- **DMA_InitStruct:** Pointer to a LL_DMA_InitTypeDef structure.

Return values

- **None:**

63.3 DMA Firmware driver defines

The following section lists the various define and macros of the module.

63.3.1 DMA

DMA

CHANNEL

LL_DMA_CHANNEL_1

DMA Channel 1

LL_DMA_CHANNEL_2

DMA Channel 2

LL_DMA_CHANNEL_3

DMA Channel 3

LL_DMA_CHANNEL_4

DMA Channel 4

LL_DMA_CHANNEL_5

DMA Channel 5

LL_DMA_CHANNEL_6

DMA Channel 6

LL_DMA_CHANNEL_7

DMA Channel 7

LL_DMA_CHANNEL_ALL

DMA Channel all (used only for function

Clear Flags Defines

LL_DMA_IFCR_CGIF1

Channel 1 global flag

LL_DMA_IFCR_CTCIF1

Channel 1 transfer complete flag

LL_DMA_IFCR_CHTIF1

Channel 1 half transfer flag

LL_DMA_IFCR_CTEIF1

Channel 1 transfer error flag

LL_DMA_IFCR_CGIF2

Channel 2 global flag

LL_DMA_IFCR_CTCIF2

Channel 2 transfer complete flag

LL_DMA_IFCR_CHTIF2

Channel 2 half transfer flag

LL_DMA_IFCR_CTEIF2

Channel 2 transfer error flag

LL_DMA_IFCR_CGIF3

Channel 3 global flag

LL_DMA_IFCR_CTCIF3

Channel 3 transfer complete flag

LL_DMA_IFCR_CHTIF3

Channel 3 half transfer flag

LL_DMA_IFCR_CTEIF3

Channel 3 transfer error flag

LL_DMA_IFCR_CGIF4

Channel 4 global flag

LL_DMA_IFCR_CTCIF4

Channel 4 transfer complete flag

LL_DMA_IFCR_CHTIF4

Channel 4 half transfer flag

LL_DMA_IFCR_CTEIF4

Channel 4 transfer error flag

LL_DMA_IFCR_CGIF5

Channel 5 global flag

LL_DMA_IFCR_CTCIF5

Channel 5 transfer complete flag

LL_DMA_IFCR_CHTIF5

Channel 5 half transfer flag

LL_DMA_IFCR_CTEIF5

Channel 5 transfer error flag

LL_DMA_IFCR_CGIF6

Channel 6 global flag

LL_DMA_IFCR_CTCIF6

Channel 6 transfer complete flag

LL_DMA_IFCR_CHTIF6

Channel 6 half transfer flag

LL_DMA_IFCR_CTEIF6

Channel 6 transfer error flag

LL_DMA_IFCR_CGIF7

Channel 7 global flag

LL_DMA_IFCR_CTCIF7

Channel 7 transfer complete flag

LL_DMA_IFCR_CHTIF7

Channel 7 half transfer flag

LL_DMA_IFCR_CTEIF7

Channel 7 transfer error flag

Transfer Direction

LL_DMA_DIRECTION_PERIPH_TO_MEMORY

Peripheral to memory direction

LL_DMA_DIRECTION_MEMORY_TO_PERIPH

Memory to peripheral direction

LL_DMA_DIRECTION_MEMORY_TO_MEMORY

Memory to memory direction

Get Flags Defines

LL_DMA_ISR_GIF1

Channel 1 global flag

LL_DMA_ISR_TCIF1

Channel 1 transfer complete flag

LL_DMA_ISR_HTIF1

Channel 1 half transfer flag

LL_DMA_ISR_TEIF1

Channel 1 transfer error flag

LL_DMA_ISR_GIF2

Channel 2 global flag

LL_DMA_ISR_TCIF2

Channel 2 transfer complete flag

LL_DMA_ISR_HTIF2

Channel 2 half transfer flag

LL_DMA_ISR_TEIF2

Channel 2 transfer error flag

LL_DMA_ISR_GIF3

Channel 3 global flag

LL_DMA_ISR_TCIF3

Channel 3 transfer complete flag

LL_DMA_ISR_HTIF3

Channel 3 half transfer flag

LL_DMA_ISR_TEIF3

Channel 3 transfer error flag

LL_DMA_ISR_GIF4

Channel 4 global flag

LL_DMA_ISR_TCIF4

Channel 4 transfer complete flag

LL_DMA_ISR_HTIF4

Channel 4 half transfer flag

LL_DMA_ISR_TEIF4

Channel 4 transfer error flag

LL_DMA_ISR_GIF5

Channel 5 global flag

LL_DMA_ISR_TCIF5

Channel 5 transfer complete flag

LL_DMA_ISR_HTIF5

Channel 5 half transfer flag

LL_DMA_ISR_TEIF5

Channel 5 transfer error flag

LL_DMA_ISR_GIF6

Channel 6 global flag

LL_DMA_ISR_TCIF6

Channel 6 transfer complete flag

LL_DMA_ISR_HTIF6

Channel 6 half transfer flag

LL_DMA_ISR_TEIF6

Channel 6 transfer error flag

LL_DMA_ISR_GIF7

Channel 7 global flag

LL_DMA_ISR_TCIF7

Channel 7 transfer complete flag

LL_DMA_ISR_HTIF7

Channel 7 half transfer flag

LL_DMA_ISR_TEIF7

Channel 7 transfer error flag

IT Defines

LL_DMA_CCR_TCIE

Transfer complete interrupt

LL_DMA_CCR_HTIE

Half Transfer interrupt

LL_DMA_CCR_TEIE

Transfer error interrupt

Memory data alignment

LL_DMA_MDATAALIGN_BYTE

Memory data alignment : Byte

LL_DMA_MDATAALIGN_HALFWORD

Memory data alignment : HalfWord

LL_DMA_MDATAALIGN_WORD

Memory data alignment : Word

Memory increment mode

LL_DMA_MEMORY_INCREMENT

Memory increment mode Enable

LL_DMA_MEMORY_NOINCREMENT

Memory increment mode Disable

Transfer mode

LL_DMA_MODE_NORMAL

Normal Mode

LL_DMA_MODE_CIRCULAR

Circular Mode

Peripheral data alignment

LL_DMA_PDATAALIGN_BYTE

Peripheral data alignment : Byte

LL_DMA_PDATAALIGN_HALFWORD

Peripheral data alignment : HalfWord

LL_DMA_PDATAALIGN_WORD

Peripheral data alignment : Word

Peripheral increment mode

LL_DMA_PERIPH_INCREMENT

Peripheral increment mode Enable

LL_DMA_PERIPH_NOINCREMENT

Peripheral increment mode Disable

Transfer Priority level

LL_DMA_PRIORITY_LOW

Priority level : Low

LL_DMA_PRIORITY_MEDIUM

Priority level : Medium

LL_DMA_PRIORITY_HIGH

Priority level : High

LL_DMA_PRIORITY_VERYHIGH

Priority level : Very_High

Convert DMAxChannely

__LL_DMA_GET_INSTANCE

Description:

- Convert DMAx_Channely into DMAx.

Parameters:

- __CHANNEL_INSTANCE__: DMAx_Channely

Return value:

- DMAx

__LL_DMA_GET_CHANNEL

Description:

- Convert DMAx_Channely into LL_DMA_CHANNEL_y.

Parameters:

- __CHANNEL_INSTANCE__: DMAx_Channely

Return value:

- LL_DMA_CHANNEL_y

__LL_DMA_GET_CHANNEL_INSTANCE

Description:

- Convert DMA Instance DMAx and LL_DMA_CHANNEL_y into DMAx_Channely.

Parameters:

- __DMA_INSTANCE__: DMAx
- __CHANNEL__: LL_DMA_CHANNEL_y

Return value:

- DMAx_Channely

Common Write and read registers macros

LL_DMA_WriteReg

Description:

- Write a value in DMA register.

Parameters:

- __INSTANCE__: DMA Instance
- __REG__: Register to be written
- __VALUE__: Value to be written in the register

Return value:

- None

LL_DMA_ReadReg

Description:

- Read a value in DMA register.

Parameters:

- __INSTANCE__: DMA Instance
- __REG__: Register to be read

Return value:

- Register: value

64 LL EXTI Generic Driver

64.1 EXTI Firmware driver registers structures

64.1.1 LL_EXTI_InitTypeDef

LL_EXTI_InitTypeDef is defined in the stm32u0xx_ll_exti.h

Data Fields

- ***uint32_t Line_0_31***
- ***uint32_t Line_32_63***
- ***FunctionalState LineCommand***
- ***uint8_t Mode***
- ***uint8_t Trigger***

Field Documentation

- ***uint32_t LL_EXTI_InitTypeDef::Line_0_31***
  Specifies the EXTI lines to be enabled or disabled for Lines in range 0 to 31 This parameter can be any combination of ***EXTI_LL_EC_LINE***
- ***uint32_t LL_EXTI_InitTypeDef::Line_32_63***
  Specifies the EXTI lines to be enabled or disabled for Lines in range 32 to 63 This parameter can be any combination of ***EXTI_LL_EC_LINE***
- ***FunctionalState LL_EXTI_InitTypeDef::LineCommand***
  Specifies the new state of the selected EXTI lines. This parameter can be set either to ENABLE or DISABLE
- ***uint8_t LL_EXTI_InitTypeDef::Mode***
  Specifies the mode for the EXTI lines. This parameter can be a value of ***EXTI_LL_EC_MODE***.
- ***uint8_t LL_EXTI_InitTypeDef::Trigger***
  Specifies the trigger signal active edge for the EXTI lines. This parameter can be a value of ***EXTI_LL_EC_TRIGGER***.

64.2 EXTI Firmware driver API description

The following section lists the various functions of the EXTI library.

64.2.1 Detailed description of functions

LL_EXTI_EnableIT_0_31

Function name

__STATIC_INLINE void LL_EXTI_EnableIT_0_31 (uint32_t ExtiLine)

Function description

Enable ExtiLine Interrupt request for Lines in range 0 to 31.

Parameters

- **ExtiLine:** This parameter can be one of the following values:
  - LL_EXTI_LINE_0
  - LL_EXTI_LINE_1
  - LL_EXTI_LINE_2
  - LL_EXTI_LINE_3
  - LL_EXTI_LINE_4
  - LL_EXTI_LINE_5
  - LL_EXTI_LINE_6
  - LL_EXTI_LINE_7
  - LL_EXTI_LINE_8
  - LL_EXTI_LINE_9
  - LL_EXTI_LINE_10
  - LL_EXTI_LINE_11
  - LL_EXTI_LINE_12
  - LL_EXTI_LINE_13
  - LL_EXTI_LINE_14
  - LL_EXTI_LINE_15
  - LL_EXTI_LINE_16
  - LL_EXTI_LINE_17
  - LL_EXTI_LINE_18 (*)
  - LL_EXTI_LINE_19 (*)
  - LL_EXTI_LINE_20
  - LL_EXTI_LINE_21
  - LL_EXTI_LINE_22 (*)
  - LL_EXTI_LINE_23
  - LL_EXTI_LINE_24
  - LL_EXTI_LINE_25
  - LL_EXTI_LINE_26 (*)
  - LL_EXTI_LINE_27
  - LL_EXTI_LINE_28
  - LL_EXTI_LINE_29
  - LL_EXTI_LINE_30
  - LL_EXTI_LINE_31
  - LL_EXTI_LINE_ALL_0_31

  (*) value not defined in all devices.

Return values

- **None:**

Notes

- The reset value for the direct or internal lines (see RM) is set to 1 in order to enable the interrupt by default. Bits are set automatically at Power on.
- Please check each device line mapping for EXTI Line availability

Reference Manual to LL API cross reference:

- IMR1 IMx LL_EXTI_EnableIT_0_31

LL_EXTI_EnableIT_32_63

Function name

__STATIC_INLINE void LL_EXTI_EnableIT_32_63 (uint32_t ExtiLine)

Function description

Enable ExtiLine Interrupt request for Lines in range 32 to 63.

Parameters

- **ExtiLine:** This parameter can be one of the following values:
  - LL_EXTI_LINE_32 (*)
  - LL_EXTI_LINE_33
  - LL_EXTI_LINE_34
  - LL_EXTI_LINE_35
  - LL_EXTI_LINE_36 (*)
  - LL_EXTI_LINE_37
  - LL_EXTI_LINE_ALL_32_63

  (*) value not defined in all devices.

Return values

- **None:**

Notes

- The reset value for the direct lines (lines from 32 to 34, line 39) is set to 1 in order to enable the interrupt by default. Bits are set automatically at Power on.

Reference Manual to LL API cross reference:

- IMR2 IMx LL_EXTI_EnableIT_32_63

LL_EXTI_DisableIT_0_31

Function name

__STATIC_INLINE void LL_EXTI_DisableIT_0_31 (uint32_t ExtiLine)

Function description

Disable ExtiLine Interrupt request for Lines in range 0 to 31.

Parameters

- **ExtiLine:** This parameter can be one of the following values:
  - LL_EXTI_LINE_0
  - LL_EXTI_LINE_1
  - LL_EXTI_LINE_2
  - LL_EXTI_LINE_3
  - LL_EXTI_LINE_4
  - LL_EXTI_LINE_5
  - LL_EXTI_LINE_6
  - LL_EXTI_LINE_7
  - LL_EXTI_LINE_8
  - LL_EXTI_LINE_9
  - LL_EXTI_LINE_10
  - LL_EXTI_LINE_11
  - LL_EXTI_LINE_12
  - LL_EXTI_LINE_13
  - LL_EXTI_LINE_14
  - LL_EXTI_LINE_15
  - LL_EXTI_LINE_16
  - LL_EXTI_LINE_17
  - LL_EXTI_LINE_18 (*)
  - LL_EXTI_LINE_19 (*)
  - LL_EXTI_LINE_20
  - LL_EXTI_LINE_21
  - LL_EXTI_LINE_22 (*)
  - LL_EXTI_LINE_23
  - LL_EXTI_LINE_24
  - LL_EXTI_LINE_25
  - LL_EXTI_LINE_26 (*)
  - LL_EXTI_LINE_27
  - LL_EXTI_LINE_28
  - LL_EXTI_LINE_29
  - LL_EXTI_LINE_30
  - LL_EXTI_LINE_31
  - LL_EXTI_LINE_ALL_0_31

  (*) value not defined in all devices.

Return values

- **None:**

Notes

- The reset value for the direct or internal lines (see RM) is set to 1 in order to enable the interrupt by default. Bits are set automatically at Power on.
- Please check each device line mapping for EXTI Line availability

Reference Manual to LL API cross reference:

- IMR1 IMx LL_EXTI_DisableIT_0_31

LL_EXTI_DisableIT_32_63

Function name

__STATIC_INLINE void LL_EXTI_DisableIT_32_63 (uint32_t ExtiLine)

Function description

Disable ExtiLine Interrupt request for Lines in range 32 to 63.

Parameters

- **ExtiLine:** This parameter can be one of the following values:
  - LL_EXTI_LINE_32 (*)
  - LL_EXTI_LINE_33
  - LL_EXTI_LINE_34
  - LL_EXTI_LINE_35
  - LL_EXTI_LINE_36 (*)
  - LL_EXTI_LINE_37
  - LL_EXTI_LINE_ALL_32_63

  (*) value not defined in all devices.

Return values

- **None:**

Notes

- The reset value for the direct lines (lines from 32 to 34, line 39) is set to 1 in order to enable the interrupt by default. Bits are set automatically at Power on.

Reference Manual to LL API cross reference:

- IMR2 IMx LL_EXTI_DisableIT_32_63

LL_EXTI_IsEnabledIT_0_31

Function name

__STATIC_INLINE uint32_t LL_EXTI_IsEnabledIT_0_31 (uint32_t ExtiLine)

Function description

Indicate if ExtiLine Interrupt request is enabled for Lines in range 0 to 31.

Parameters

- **ExtiLine:** This parameter can be one of the following values:
  - LL_EXTI_LINE_0
  - LL_EXTI_LINE_1
  - LL_EXTI_LINE_2
  - LL_EXTI_LINE_3
  - LL_EXTI_LINE_4
  - LL_EXTI_LINE_5
  - LL_EXTI_LINE_6
  - LL_EXTI_LINE_7
  - LL_EXTI_LINE_8
  - LL_EXTI_LINE_9
  - LL_EXTI_LINE_10
  - LL_EXTI_LINE_11
  - LL_EXTI_LINE_12
  - LL_EXTI_LINE_13
  - LL_EXTI_LINE_14
  - LL_EXTI_LINE_15
  - LL_EXTI_LINE_16
  - LL_EXTI_LINE_17
  - LL_EXTI_LINE_18 (*)
  - LL_EXTI_LINE_19 (*)
  - LL_EXTI_LINE_20
  - LL_EXTI_LINE_21
  - LL_EXTI_LINE_22 (*)
  - LL_EXTI_LINE_23
  - LL_EXTI_LINE_24
  - LL_EXTI_LINE_25
  - LL_EXTI_LINE_26 (*)
  - LL_EXTI_LINE_27
  - LL_EXTI_LINE_28
  - LL_EXTI_LINE_29
  - LL_EXTI_LINE_30
  - LL_EXTI_LINE_31
  - LL_EXTI_LINE_ALL_0_31

  (*) value not defined in all devices.

Return values

- **State:** of bit (1 or 0).

Notes

- The reset value for the direct or internal lines (see RM) is set to 1 in order to enable the interrupt by default. Bits are set automatically at Power on.
- Please check each device line mapping for EXTI Line availability

Reference Manual to LL API cross reference:

- IMR1 IMx LL_EXTI_IsEnabledIT_0_31

LL_EXTI_IsEnabledIT_32_63

Function name

__STATIC_INLINE uint32_t LL_EXTI_IsEnabledIT_32_63 (uint32_t ExtiLine)

Function description

Indicate if ExtiLine Interrupt request is enabled for Lines in range 32 to 63.

Parameters

- **ExtiLine:** This parameter can be one of the following values:
  - LL_EXTI_LINE_32 (*)
  - LL_EXTI_LINE_33
  - LL_EXTI_LINE_34
  - LL_EXTI_LINE_35
  - LL_EXTI_LINE_36 (*)
  - LL_EXTI_LINE_37
  - LL_EXTI_LINE_ALL_32_63

  (*) value not defined in all devices.

Return values

- **State:** of bit (1 or 0).

Notes

- The reset value for the direct lines (lines from 32 to 34, line 39) is set to 1 in order to enable the interrupt by default. Bits are set automatically at Power on.

Reference Manual to LL API cross reference:

- IMR2 IMx LL_EXTI_IsEnabledIT_32_63

LL_EXTI_EnableEvent_0_31

Function name

__STATIC_INLINE void LL_EXTI_EnableEvent_0_31 (uint32_t ExtiLine)

Function description

Enable ExtiLine Event request for Lines in range 0 to 31.

Parameters

- **ExtiLine:** This parameter can be one of the following values:
  - LL_EXTI_LINE_0
  - LL_EXTI_LINE_1
  - LL_EXTI_LINE_2
  - LL_EXTI_LINE_3
  - LL_EXTI_LINE_4
  - LL_EXTI_LINE_5
  - LL_EXTI_LINE_6
  - LL_EXTI_LINE_7
  - LL_EXTI_LINE_8
  - LL_EXTI_LINE_9
  - LL_EXTI_LINE_10
  - LL_EXTI_LINE_11
  - LL_EXTI_LINE_12
  - LL_EXTI_LINE_13
  - LL_EXTI_LINE_14
  - LL_EXTI_LINE_15
  - LL_EXTI_LINE_16
  - LL_EXTI_LINE_17
  - LL_EXTI_LINE_18 (*)
  - LL_EXTI_LINE_19 (*)
  - LL_EXTI_LINE_20
  - LL_EXTI_LINE_21
  - LL_EXTI_LINE_22
  - LL_EXTI_LINE_23
  - LL_EXTI_LINE_24 (*)
  - LL_EXTI_LINE_25
  - LL_EXTI_LINE_26 (*)
  - LL_EXTI_LINE_27
  - LL_EXTI_LINE_28
  - LL_EXTI_LINE_29
  - LL_EXTI_LINE_30
  - LL_EXTI_LINE_31
  - LL_EXTI_LINE_ALL_0_31

  (*) value not defined in all devices.

Return values

- **None:**

Notes

- Please check each device line mapping for EXTI Line availability

Reference Manual to LL API cross reference:

- EMR1 EMx LL_EXTI_EnableEvent_0_31

LL_EXTI_EnableEvent_32_63

Function name

__STATIC_INLINE void LL_EXTI_EnableEvent_32_63 (uint32_t ExtiLine)

Function description

Enable ExtiLine Event request for Lines in range 32 to 63.

Parameters

- **ExtiLine:** This parameter can be a combination of the following values:
  - LL_EXTI_LINE_32 (*)
  - LL_EXTI_LINE_33
  - LL_EXTI_LINE_34
  - LL_EXTI_LINE_35
  - LL_EXTI_LINE_36 (*)
  - LL_EXTI_LINE_37
  - LL_EXTI_LINE_ALL_32_63

  (*) value not defined in all devices.

Return values

- **None:**

Reference Manual to LL API cross reference:

- EMR2 EMx LL_EXTI_EnableEvent_32_63

LL_EXTI_DisableEvent_0_31

Function name

__STATIC_INLINE void LL_EXTI_DisableEvent_0_31 (uint32_t ExtiLine)

Function description

Disable ExtiLine Event request for Lines in range 0 to 31.

Parameters

- **ExtiLine:** This parameter can be one of the following values:
  - LL_EXTI_LINE_0
  - LL_EXTI_LINE_1
  - LL_EXTI_LINE_2
  - LL_EXTI_LINE_3
  - LL_EXTI_LINE_4
  - LL_EXTI_LINE_5
  - LL_EXTI_LINE_6
  - LL_EXTI_LINE_7
  - LL_EXTI_LINE_8
  - LL_EXTI_LINE_9
  - LL_EXTI_LINE_10
  - LL_EXTI_LINE_11
  - LL_EXTI_LINE_12
  - LL_EXTI_LINE_13
  - LL_EXTI_LINE_14
  - LL_EXTI_LINE_15
  - LL_EXTI_LINE_16
  - LL_EXTI_LINE_17
  - LL_EXTI_LINE_18 (*)
  - LL_EXTI_LINE_19 (*)
  - LL_EXTI_LINE_20
  - LL_EXTI_LINE_21
  - LL_EXTI_LINE_22 (*)
  - LL_EXTI_LINE_23
  - LL_EXTI_LINE_24
  - LL_EXTI_LINE_25
  - LL_EXTI_LINE_26 (*)
  - LL_EXTI_LINE_27
  - LL_EXTI_LINE_28
  - LL_EXTI_LINE_29
  - LL_EXTI_LINE_30
  - LL_EXTI_LINE_31
  - LL_EXTI_LINE_ALL_0_31

  (*) value not defined in all devices.

Return values

- **None:**

Notes

- Please check each device line mapping for EXTI Line availability

Reference Manual to LL API cross reference:

- EMR1 EMx LL_EXTI_DisableEvent_0_31

LL_EXTI_DisableEvent_32_63

Function name

__STATIC_INLINE void LL_EXTI_DisableEvent_32_63 (uint32_t ExtiLine)

Function description

Disable ExtiLine Event request for Lines in range 32 to 63.

Parameters

- **ExtiLine:** This parameter can be a combination of the following values:
  - LL_EXTI_LINE_32 (*)
  - LL_EXTI_LINE_33
  - LL_EXTI_LINE_34
  - LL_EXTI_LINE_35
  - LL_EXTI_LINE_36 (*)
  - LL_EXTI_LINE_37
  - LL_EXTI_LINE_ALL_32_63

  (*) value not defined in all devices.

Return values

- **None:**

Reference Manual to LL API cross reference:

- EMR2 EMx LL_EXTI_DisableEvent_32_63

LL_EXTI_IsEnabledEvent_0_31

Function name

__STATIC_INLINE uint32_t LL_EXTI_IsEnabledEvent_0_31 (uint32_t ExtiLine)

Function description

Indicate if ExtiLine Event request is enabled for Lines in range 0 to 31.

Parameters

- **ExtiLine:** This parameter can be one of the following values:
  - LL_EXTI_LINE_0
  - LL_EXTI_LINE_1
  - LL_EXTI_LINE_2
  - LL_EXTI_LINE_3
  - LL_EXTI_LINE_4
  - LL_EXTI_LINE_5
  - LL_EXTI_LINE_6
  - LL_EXTI_LINE_7
  - LL_EXTI_LINE_8
  - LL_EXTI_LINE_9
  - LL_EXTI_LINE_10
  - LL_EXTI_LINE_11
  - LL_EXTI_LINE_12
  - LL_EXTI_LINE_13
  - LL_EXTI_LINE_14
  - LL_EXTI_LINE_15
  - LL_EXTI_LINE_16
  - LL_EXTI_LINE_17
  - LL_EXTI_LINE_18 (*)
  - LL_EXTI_LINE_19 (*)
  - LL_EXTI_LINE_20
  - LL_EXTI_LINE_21
  - LL_EXTI_LINE_22 (*)
  - LL_EXTI_LINE_23
  - LL_EXTI_LINE_24
  - LL_EXTI_LINE_25
  - LL_EXTI_LINE_26 (*)
  - LL_EXTI_LINE_27
  - LL_EXTI_LINE_28
  - LL_EXTI_LINE_29
  - LL_EXTI_LINE_30
  - LL_EXTI_LINE_31
  - LL_EXTI_LINE_ALL_0_31

  (*) value not defined in all devices.

Return values

- **State:** of bit (1 or 0).

Notes

- Please check each device line mapping for EXTI Line availability

Reference Manual to LL API cross reference:

- EMR1 EMx LL_EXTI_IsEnabledEvent_0_31

LL_EXTI_IsEnabledEvent_32_63

Function name

__STATIC_INLINE uint32_t LL_EXTI_IsEnabledEvent_32_63 (uint32_t ExtiLine)

Function description

Indicate if ExtiLine Event request is enabled for Lines in range 32 to 63.

Parameters

- **ExtiLine:** This parameter can be a combination of the following values:
  - LL_EXTI_LINE_32 (*)
  - LL_EXTI_LINE_33
  - LL_EXTI_LINE_34
  - LL_EXTI_LINE_35
  - LL_EXTI_LINE_36 (*)
  - LL_EXTI_LINE_37
  - LL_EXTI_LINE_ALL_32_63

  (*) value not defined in all devices.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- EMR2 EMx LL_EXTI_IsEnabledEvent_32_63

LL_EXTI_EnableRisingTrig_0_31

Function name

__STATIC_INLINE void LL_EXTI_EnableRisingTrig_0_31 (uint32_t ExtiLine)

Function description

Enable ExtiLine Rising Edge Trigger for Lines in range 0 to 31.

Parameters

- **ExtiLine:** This parameter can be a combination of the following values:
  - LL_EXTI_LINE_0
  - LL_EXTI_LINE_1
  - LL_EXTI_LINE_2
  - LL_EXTI_LINE_3
  - LL_EXTI_LINE_4
  - LL_EXTI_LINE_5
  - LL_EXTI_LINE_6
  - LL_EXTI_LINE_7
  - LL_EXTI_LINE_8
  - LL_EXTI_LINE_9
  - LL_EXTI_LINE_10
  - LL_EXTI_LINE_11
  - LL_EXTI_LINE_12
  - LL_EXTI_LINE_13
  - LL_EXTI_LINE_14
  - LL_EXTI_LINE_15
  - LL_EXTI_LINE_16
  - LL_EXTI_LINE_21

Return values

- **None:**

Notes

- The configurable wakeup lines are edge-triggered. No glitch must be generated on these lines. If a rising edge on a configurable interrupt line occurs during a write operation in the EXTI_RTSR register, the pending bit is not set. Rising and falling edge triggers can be set for the same interrupt line. In this case, both generate a trigger condition.
- Please check each device line mapping for EXTI Line availability

Reference Manual to LL API cross reference:

- RTSR1 RTx LL_EXTI_EnableRisingTrig_0_31

LL_EXTI_DisableRisingTrig_0_31

Function name

__STATIC_INLINE void LL_EXTI_DisableRisingTrig_0_31 (uint32_t ExtiLine)

Function description

Disable ExtiLine Rising Edge Trigger for Lines in range 0 to 31.

Parameters

- **ExtiLine:** This parameter can be a combination of the following values:
  - LL_EXTI_LINE_0
  - LL_EXTI_LINE_1
  - LL_EXTI_LINE_2
  - LL_EXTI_LINE_3
  - LL_EXTI_LINE_4
  - LL_EXTI_LINE_5
  - LL_EXTI_LINE_6
  - LL_EXTI_LINE_7
  - LL_EXTI_LINE_8
  - LL_EXTI_LINE_9
  - LL_EXTI_LINE_10
  - LL_EXTI_LINE_11
  - LL_EXTI_LINE_12
  - LL_EXTI_LINE_13
  - LL_EXTI_LINE_14
  - LL_EXTI_LINE_15
  - LL_EXTI_LINE_16
  - LL_EXTI_LINE_21

Return values

- **None:**

Notes

- The configurable wakeup lines are edge-triggered. No glitch must be generated on these lines. If a rising edge on a configurable interrupt line occurs during a write operation in the EXTI_RTSR register, the pending bit is not set. Rising and falling edge triggers can be set for the same interrupt line. In this case, both generate a trigger condition.
- Please check each device line mapping for EXTI Line availability

Reference Manual to LL API cross reference:

- RTSR1 RTx LL_EXTI_DisableRisingTrig_0_31

LL_EXTI_IsEnabledRisingTrig_0_31

Function name

__STATIC_INLINE uint32_t LL_EXTI_IsEnabledRisingTrig_0_31 (uint32_t ExtiLine)

Function description

Check if rising edge trigger is enabled for Lines in range 0 to 31.

Parameters

- **ExtiLine:** This parameter can be a combination of the following values:
  - LL_EXTI_LINE_0
  - LL_EXTI_LINE_1
  - LL_EXTI_LINE_2
  - LL_EXTI_LINE_3
  - LL_EXTI_LINE_4
  - LL_EXTI_LINE_5
  - LL_EXTI_LINE_6
  - LL_EXTI_LINE_7
  - LL_EXTI_LINE_8
  - LL_EXTI_LINE_9
  - LL_EXTI_LINE_10
  - LL_EXTI_LINE_11
  - LL_EXTI_LINE_12
  - LL_EXTI_LINE_13
  - LL_EXTI_LINE_14
  - LL_EXTI_LINE_15
  - LL_EXTI_LINE_16
  - LL_EXTI_LINE_21

Return values

- **State:** of bit (1 or 0).

Notes

- Please check each device line mapping for EXTI Line availability

Reference Manual to LL API cross reference:

- RTSR1 RTx LL_EXTI_IsEnabledRisingTrig_0_31

LL_EXTI_EnableFallingTrig_0_31

Function name

__STATIC_INLINE void LL_EXTI_EnableFallingTrig_0_31 (uint32_t ExtiLine)

Function description

Enable ExtiLine Falling Edge Trigger for Lines in range 0 to 31.

Parameters

- **ExtiLine:** This parameter can be a combination of the following values:
  - LL_EXTI_LINE_0
  - LL_EXTI_LINE_1
  - LL_EXTI_LINE_2
  - LL_EXTI_LINE_3
  - LL_EXTI_LINE_4
  - LL_EXTI_LINE_5
  - LL_EXTI_LINE_6
  - LL_EXTI_LINE_7
  - LL_EXTI_LINE_8
  - LL_EXTI_LINE_9
  - LL_EXTI_LINE_10
  - LL_EXTI_LINE_11
  - LL_EXTI_LINE_12
  - LL_EXTI_LINE_13
  - LL_EXTI_LINE_14
  - LL_EXTI_LINE_15
  - LL_EXTI_LINE_16
  - LL_EXTI_LINE_21

Return values

- **None:**

Notes

- The configurable wakeup lines are edge-triggered. No glitch must be generated on these lines. If a falling edge on a configurable interrupt line occurs during a write operation in the EXTI_FTSR register, the pending bit is not set. Rising and falling edge triggers can be set for the same interrupt line. In this case, both generate a trigger condition.
- Please check each device line mapping for EXTI Line availability

Reference Manual to LL API cross reference:

- FTSR1 FTx LL_EXTI_EnableFallingTrig_0_31

LL_EXTI_DisableFallingTrig_0_31

Function name

__STATIC_INLINE void LL_EXTI_DisableFallingTrig_0_31 (uint32_t ExtiLine)

Function description

Disable ExtiLine Falling Edge Trigger for Lines in range 0 to 31.

Parameters

- **ExtiLine:** This parameter can be a combination of the following values:
  - LL_EXTI_LINE_0
  - LL_EXTI_LINE_1
  - LL_EXTI_LINE_2
  - LL_EXTI_LINE_3
  - LL_EXTI_LINE_4
  - LL_EXTI_LINE_5
  - LL_EXTI_LINE_6
  - LL_EXTI_LINE_7
  - LL_EXTI_LINE_8
  - LL_EXTI_LINE_9
  - LL_EXTI_LINE_10
  - LL_EXTI_LINE_11
  - LL_EXTI_LINE_12
  - LL_EXTI_LINE_13
  - LL_EXTI_LINE_14
  - LL_EXTI_LINE_15
  - LL_EXTI_LINE_16
  - LL_EXTI_LINE_21

Return values

- **None:**

Notes

- The configurable wakeup lines are edge-triggered. No glitch must be generated on these lines. If a Falling edge on a configurable interrupt line occurs during a write operation in the EXTI_FTSR register, the pending bit is not set. Rising and falling edge triggers can be set for the same interrupt line. In this case, both generate a trigger condition.
- Please check each device line mapping for EXTI Line availability

Reference Manual to LL API cross reference:

- FTSR1 FTx LL_EXTI_DisableFallingTrig_0_31

LL_EXTI_IsEnabledFallingTrig_0_31

Function name

__STATIC_INLINE uint32_t LL_EXTI_IsEnabledFallingTrig_0_31 (uint32_t ExtiLine)

Function description

Check if falling edge trigger is enabled for Lines in range 0 to 31.

Parameters

- **ExtiLine:** This parameter can be a combination of the following values:
  - LL_EXTI_LINE_0
  - LL_EXTI_LINE_1
  - LL_EXTI_LINE_2
  - LL_EXTI_LINE_3
  - LL_EXTI_LINE_4
  - LL_EXTI_LINE_5
  - LL_EXTI_LINE_6
  - LL_EXTI_LINE_7
  - LL_EXTI_LINE_8
  - LL_EXTI_LINE_9
  - LL_EXTI_LINE_10
  - LL_EXTI_LINE_11
  - LL_EXTI_LINE_12
  - LL_EXTI_LINE_13
  - LL_EXTI_LINE_14
  - LL_EXTI_LINE_15
  - LL_EXTI_LINE_16
  - LL_EXTI_LINE_21

Return values

- **State:** of bit (1 or 0).

Notes

- Please check each device line mapping for EXTI Line availability

Reference Manual to LL API cross reference:

- FTSR1 FTx LL_EXTI_IsEnabledFallingTrig_0_31

LL_EXTI_GenerateSWI_0_31

Function name

__STATIC_INLINE void LL_EXTI_GenerateSWI_0_31 (uint32_t ExtiLine)

Function description

Generate a software Interrupt Event for Lines in range 0 to 31.

Parameters

- **ExtiLine:** This parameter can be a combination of the following values:
  - LL_EXTI_LINE_0
  - LL_EXTI_LINE_1
  - LL_EXTI_LINE_2
  - LL_EXTI_LINE_3
  - LL_EXTI_LINE_4
  - LL_EXTI_LINE_5
  - LL_EXTI_LINE_6
  - LL_EXTI_LINE_7
  - LL_EXTI_LINE_8
  - LL_EXTI_LINE_9
  - LL_EXTI_LINE_10
  - LL_EXTI_LINE_11
  - LL_EXTI_LINE_12
  - LL_EXTI_LINE_13
  - LL_EXTI_LINE_14
  - LL_EXTI_LINE_15
  - LL_EXTI_LINE_16
  - LL_EXTI_LINE_21

Return values

- **None:**

Notes

- If the interrupt is enabled on this line in the EXTI_IMR, writing a 1 to this bit when it is at '0' sets the corresponding pending bit in EXTI_PR resulting in an interrupt request generation. This bit is cleared by clearing the corresponding bit in the EXTI_PR register (by writing a 1 into the bit)
- Please check each device line mapping for EXTI Line availability

Reference Manual to LL API cross reference:

- SWIER1 SWIx LL_EXTI_GenerateSWI_0_31

LL_EXTI_IsActiveFallingFlag_0_31

Function name

__STATIC_INLINE uint32_t LL_EXTI_IsActiveFallingFlag_0_31 (uint32_t ExtiLine)

Function description

Check if the ExtLine Falling Flag is set or not for Lines in range 0 to 31.

Parameters

- **ExtiLine:** This parameter can be a combination of the following values:
  - LL_EXTI_LINE_0
  - LL_EXTI_LINE_1
  - LL_EXTI_LINE_2
  - LL_EXTI_LINE_3
  - LL_EXTI_LINE_4
  - LL_EXTI_LINE_5
  - LL_EXTI_LINE_6
  - LL_EXTI_LINE_7
  - LL_EXTI_LINE_8
  - LL_EXTI_LINE_9
  - LL_EXTI_LINE_10
  - LL_EXTI_LINE_11
  - LL_EXTI_LINE_12
  - LL_EXTI_LINE_13
  - LL_EXTI_LINE_14
  - LL_EXTI_LINE_15
  - LL_EXTI_LINE_16
  - LL_EXTI_LINE_21

Return values

- **State:** of bit (1 or 0).

Notes

- This bit is set when the falling edge event arrives on the interrupt line. This bit is cleared by writing a 1 to the bit.
- Please check each device line mapping for EXTI Line availability

Reference Manual to LL API cross reference:

- FPR1 FPIFx LL_EXTI_IsActiveFallingFlag_0_31

LL_EXTI_ReadFallingFlag_0_31

Function name

__STATIC_INLINE uint32_t LL_EXTI_ReadFallingFlag_0_31 (uint32_t ExtiLine)

Function description

Read ExtLine Combination Falling Flag for Lines in range 0 to 31.

Parameters

- **ExtiLine:** This parameter can be a combination of the following values:
  - LL_EXTI_LINE_0
  - LL_EXTI_LINE_1
  - LL_EXTI_LINE_2
  - LL_EXTI_LINE_3
  - LL_EXTI_LINE_4
  - LL_EXTI_LINE_5
  - LL_EXTI_LINE_6
  - LL_EXTI_LINE_7
  - LL_EXTI_LINE_8
  - LL_EXTI_LINE_9
  - LL_EXTI_LINE_10
  - LL_EXTI_LINE_11
  - LL_EXTI_LINE_12
  - LL_EXTI_LINE_13
  - LL_EXTI_LINE_14
  - LL_EXTI_LINE_15
  - LL_EXTI_LINE_16
  - LL_EXTI_LINE_21

Return values

- **@note:** This bit is set when the selected edge event arrives on the interrupt

Notes

- This bit is set when the falling edge event arrives on the interrupt line. This bit is cleared by writing a 1 to the bit.
- Please check each device line mapping for EXTI Line availability

Reference Manual to LL API cross reference:

- FPR1 FPIFx LL_EXTI_ReadFallingFlag_0_31

LL_EXTI_ClearFallingFlag_0_31

Function name

__STATIC_INLINE void LL_EXTI_ClearFallingFlag_0_31 (uint32_t ExtiLine)

Function description

Clear ExtLine Falling Flags for Lines in range 0 to 31.

Parameters

- **ExtiLine:** This parameter can be a combination of the following values:
  - LL_EXTI_LINE_0
  - LL_EXTI_LINE_1
  - LL_EXTI_LINE_2
  - LL_EXTI_LINE_3
  - LL_EXTI_LINE_4
  - LL_EXTI_LINE_5
  - LL_EXTI_LINE_6
  - LL_EXTI_LINE_7
  - LL_EXTI_LINE_8
  - LL_EXTI_LINE_9
  - LL_EXTI_LINE_10
  - LL_EXTI_LINE_11
  - LL_EXTI_LINE_12
  - LL_EXTI_LINE_13
  - LL_EXTI_LINE_14
  - LL_EXTI_LINE_15
  - LL_EXTI_LINE_16
  - LL_EXTI_LINE_21

Return values

- **None:**

Notes

- This bit is set when the falling edge event arrives on the interrupt line. This bit is cleared by writing a 1 to the bit.
- Please check each device line mapping for EXTI Line availability

Reference Manual to LL API cross reference:

- FPR1 FPIFx LL_EXTI_ClearFallingFlag_0_31

LL_EXTI_IsActiveRisingFlag_0_31

Function name

__STATIC_INLINE uint32_t LL_EXTI_IsActiveRisingFlag_0_31 (uint32_t ExtiLine)

Function description

Check if the ExtLine Rising Flag is set or not for Lines in range 0 to 31.

Parameters

- **ExtiLine:** This parameter can be a combination of the following values:
  - LL_EXTI_LINE_0
  - LL_EXTI_LINE_1
  - LL_EXTI_LINE_2
  - LL_EXTI_LINE_3
  - LL_EXTI_LINE_4
  - LL_EXTI_LINE_5
  - LL_EXTI_LINE_6
  - LL_EXTI_LINE_7
  - LL_EXTI_LINE_8
  - LL_EXTI_LINE_9
  - LL_EXTI_LINE_10
  - LL_EXTI_LINE_11
  - LL_EXTI_LINE_12
  - LL_EXTI_LINE_13
  - LL_EXTI_LINE_14
  - LL_EXTI_LINE_15
  - LL_EXTI_LINE_16
  - LL_EXTI_LINE_21

Return values

- **State:** of bit (1 or 0).

Notes

- This bit is set when the Rising edge event arrives on the interrupt line. This bit is cleared by writing a 1 to the bit.
- Please check each device line mapping for EXTI Line availability

Reference Manual to LL API cross reference:

- RPR1 RPIFx LL_EXTI_IsActiveRisingFlag_0_31

LL_EXTI_ReadRisingFlag_0_31

Function name

__STATIC_INLINE uint32_t LL_EXTI_ReadRisingFlag_0_31 (uint32_t ExtiLine)

Function description

Read ExtLine Combination Rising Flag for Lines in range 0 to 31.

Parameters

- **ExtiLine:** This parameter can be a combination of the following values:
  - LL_EXTI_LINE_0
  - LL_EXTI_LINE_1
  - LL_EXTI_LINE_2
  - LL_EXTI_LINE_3
  - LL_EXTI_LINE_4
  - LL_EXTI_LINE_5
  - LL_EXTI_LINE_6
  - LL_EXTI_LINE_7
  - LL_EXTI_LINE_8
  - LL_EXTI_LINE_9
  - LL_EXTI_LINE_10
  - LL_EXTI_LINE_11
  - LL_EXTI_LINE_12
  - LL_EXTI_LINE_13
  - LL_EXTI_LINE_14
  - LL_EXTI_LINE_15
  - LL_EXTI_LINE_16
  - LL_EXTI_LINE_21

Return values

- **@note:** This bit is set when the selected edge event arrives on the interrupt

Notes

- This bit is set when the Rising edge event arrives on the interrupt line. This bit is cleared by writing a 1 to the bit.
- Please check each device line mapping for EXTI Line availability

Reference Manual to LL API cross reference:

- RPR1 RPIFx LL_EXTI_ReadRisingFlag_0_31

LL_EXTI_ClearRisingFlag_0_31

Function name

__STATIC_INLINE void LL_EXTI_ClearRisingFlag_0_31 (uint32_t ExtiLine)

Function description

Clear ExtLine Rising Flags for Lines in range 0 to 31.

Parameters

- **ExtiLine:** This parameter can be a combination of the following values:
  - LL_EXTI_LINE_0
  - LL_EXTI_LINE_1
  - LL_EXTI_LINE_2
  - LL_EXTI_LINE_3
  - LL_EXTI_LINE_4
  - LL_EXTI_LINE_5
  - LL_EXTI_LINE_6
  - LL_EXTI_LINE_7
  - LL_EXTI_LINE_8
  - LL_EXTI_LINE_9
  - LL_EXTI_LINE_10
  - LL_EXTI_LINE_11
  - LL_EXTI_LINE_12
  - LL_EXTI_LINE_13
  - LL_EXTI_LINE_14
  - LL_EXTI_LINE_15
  - LL_EXTI_LINE_16
  - LL_EXTI_LINE_21

Return values

- **None:**

Notes

- This bit is set when the Rising edge event arrives on the interrupt line. This bit is cleared by writing a 1 to the bit.
- Please check each device line mapping for EXTI Line availability

Reference Manual to LL API cross reference:

- RPR1 RPIFx LL_EXTI_ClearRisingFlag_0_31

LL_EXTI_SetEXTISource

Function name

__STATIC_INLINE void LL_EXTI_SetEXTISource (uint32_t Port, uint32_t Line)

Function description

Configure source input for the EXTI external interrupt.

Parameters

- **Port:** This parameter can be one of the following values:
  - LL_EXTI_CONFIG_PORTA
  - LL_EXTI_CONFIG_PORTB
  - LL_EXTI_CONFIG_PORTC
  - LL_EXTI_CONFIG_PORTD
  - LL_EXTI_CONFIG_PORTE
  - LL_EXTI_CONFIG_PORTF

  (*) value not defined in all devices
- **Line:** This parameter can be one of the following values:
  - LL_EXTI_CONFIG_LINE0
  - LL_EXTI_CONFIG_LINE1
  - LL_EXTI_CONFIG_LINE2
  - LL_EXTI_CONFIG_LINE3
  - LL_EXTI_CONFIG_LINE4
  - LL_EXTI_CONFIG_LINE5
  - LL_EXTI_CONFIG_LINE6
  - LL_EXTI_CONFIG_LINE7
  - LL_EXTI_CONFIG_LINE8
  - LL_EXTI_CONFIG_LINE9
  - LL_EXTI_CONFIG_LINE10
  - LL_EXTI_CONFIG_LINE11
  - LL_EXTI_CONFIG_LINE12
  - LL_EXTI_CONFIG_LINE13
  - LL_EXTI_CONFIG_LINE14
  - LL_EXTI_CONFIG_LINE15

Return values

- **None:**

Reference Manual to LL API cross reference:

- EXTI_EXTICR1 EXTI0 LL_EXTI_SetEXTISource
- EXTI_EXTICR1 EXTI1 LL_EXTI_SetEXTISource
- EXTI_EXTICR1 EXTI2 LL_EXTI_SetEXTISource
- EXTI_EXTICR1 EXTI3 LL_EXTI_SetEXTISource
- EXTI_EXTICR2 EXTI4 LL_EXTI_SetEXTISource
- EXTI_EXTICR2 EXTI5 LL_EXTI_SetEXTISource
- EXTI_EXTICR2 EXTI6 LL_EXTI_SetEXTISource
- EXTI_EXTICR2 EXTI7 LL_EXTI_SetEXTISource
- EXTI_EXTICR3 EXTI8 LL_EXTI_SetEXTISource
- EXTI_EXTICR3 EXTI9 LL_EXTI_SetEXTISource
- EXTI_EXTICR3 EXTI10 LL_EXTI_SetEXTISource
- EXTI_EXTICR3 EXTI11 LL_EXTI_SetEXTISource
- EXTI_EXTICR4 EXTI12 LL_EXTI_SetEXTISource
- EXTI_EXTICR4 EXTI13 LL_EXTI_SetEXTISource
- EXTI_EXTICR4 EXTI14 LL_EXTI_SetEXTISource
- EXTI_EXTICR4 EXTI15 LL_EXTI_SetEXTISource

LL_EXTI_GetEXTISource

Function name

__STATIC_INLINE uint32_t LL_EXTI_GetEXTISource (uint32_t Line)

Function description

Get the configured defined for specific EXTI Line.

Parameters

- **Line:** This parameter can be one of the following values:
  - LL_EXTI_CONFIG_LINE0
  - LL_EXTI_CONFIG_LINE1
  - LL_EXTI_CONFIG_LINE2
  - LL_EXTI_CONFIG_LINE3
  - LL_EXTI_CONFIG_LINE4
  - LL_EXTI_CONFIG_LINE5
  - LL_EXTI_CONFIG_LINE6
  - LL_EXTI_CONFIG_LINE7
  - LL_EXTI_CONFIG_LINE8
  - LL_EXTI_CONFIG_LINE9
  - LL_EXTI_CONFIG_LINE10
  - LL_EXTI_CONFIG_LINE11
  - LL_EXTI_CONFIG_LINE12
  - LL_EXTI_CONFIG_LINE13
  - LL_EXTI_CONFIG_LINE14
  - LL_EXTI_CONFIG_LINE15

Return values

- **Returned:** value can be one of the following values:
  - LL_EXTI_CONFIG_PORTA
  - LL_EXTI_CONFIG_PORTB
  - LL_EXTI_CONFIG_PORTC
  - LL_EXTI_CONFIG_PORTD
  - LL_EXTI_CONFIG_PORTE
  - LL_EXTI_CONFIG_PORTF

Reference Manual to LL API cross reference:

- EXTI_EXTICR1 EXTI0 LL_EXTI_SetEXTISource
- EXTI_EXTICR1 EXTI1 LL_EXTI_SetEXTISource
- EXTI_EXTICR1 EXTI2 LL_EXTI_SetEXTISource
- EXTI_EXTICR1 EXTI3 LL_EXTI_SetEXTISource
- EXTI_EXTICR2 EXTI4 LL_EXTI_SetEXTISource
- EXTI_EXTICR2 EXTI5 LL_EXTI_SetEXTISource
- EXTI_EXTICR2 EXTI6 LL_EXTI_SetEXTISource
- EXTI_EXTICR2 EXTI7 LL_EXTI_SetEXTISource
- EXTI_EXTICR3 EXTI8 LL_EXTI_SetEXTISource
- EXTI_EXTICR3 EXTI9 LL_EXTI_SetEXTISource
- EXTI_EXTICR3 EXTI10 LL_EXTI_SetEXTISource
- EXTI_EXTICR3 EXTI11 LL_EXTI_SetEXTISource
- EXTI_EXTICR4 EXTI12 LL_EXTI_SetEXTISource
- EXTI_EXTICR4 EXTI13 LL_EXTI_SetEXTISource
- EXTI_EXTICR4 EXTI14 LL_EXTI_SetEXTISource
- EXTI_EXTICR4 EXTI15 LL_EXTI_SetEXTISource

LL_EXTI_Init

Function name

uint32_t LL_EXTI_Init (LL_EXTI_InitTypeDef * EXTI_InitStruct)

Function description

Initialize the EXTI registers according to the specified parameters in EXTI_InitStruct.

Parameters

- **EXTI_InitStruct:** pointer to a LL_EXTI_InitTypeDef structure.

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: EXTI registers are initialized
  - ERROR: not applicable

LL_EXTI_DeInit

Function name

uint32_t LL_EXTI_DeInit (void)

Function description

De-initialize the EXTI registers to their default reset values.

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: EXTI registers are de-initialized
  - ERROR: not applicable

LL_EXTI_StructInit

Function name

void LL_EXTI_StructInit (LL_EXTI_InitTypeDef * EXTI_InitStruct)

Function description

Set each LL_EXTI_InitTypeDef field to default value.

Parameters

- **EXTI_InitStruct:** Pointer to a LL_EXTI_InitTypeDef structure.

Return values

- **None:**

64.3 EXTI Firmware driver defines

The following section lists the various define and macros of the module.

64.3.1 EXTI

EXTI

LINE

LL_EXTI_LINE_0

Extended line 0

LL_EXTI_LINE_1

Extended line 1

LL_EXTI_LINE_2

Extended line 2

LL_EXTI_LINE_3

Extended line 3

LL_EXTI_LINE_4

Extended line 4

LL_EXTI_LINE_5

Extended line 5

LL_EXTI_LINE_6

Extended line 6

LL_EXTI_LINE_7

Extended line 7

LL_EXTI_LINE_8

Extended line 8

LL_EXTI_LINE_9

Extended line 9

LL_EXTI_LINE_10

Extended line 10

LL_EXTI_LINE_11

Extended line 11

LL_EXTI_LINE_12

Extended line 12

LL_EXTI_LINE_13

Extended line 13

LL_EXTI_LINE_14

Extended line 14

LL_EXTI_LINE_15

Extended line 15

LL_EXTI_LINE_16

Extended line 16

LL_EXTI_LINE_17

Extended line 17

LL_EXTI_LINE_18

Extended line 18

LL_EXTI_LINE_19

Extended line 19

LL_EXTI_LINE_20

Extended line 20

LL_EXTI_LINE_21

Extended line 21

LL_EXTI_LINE_22

Extended line 22

LL_EXTI_LINE_23

Extended line 23

LL_EXTI_LINE_24

Extended line 24

LL_EXTI_LINE_25

Extended line 25

LL_EXTI_LINE_26

Extended line 26

LL_EXTI_LINE_27

Extended line 27

LL_EXTI_LINE_28

Extended line 28

LL_EXTI_LINE_29

Extended line 29

LL_EXTI_LINE_30

Extended line 30

LL_EXTI_LINE_31

Extended line 31

LL_EXTI_LINE_ALL_0_31

All Extended line not reserved

LL_EXTI_LINE_32

Extended line 32

LL_EXTI_LINE_33

Extended line 33

LL_EXTI_LINE_34

Extended line 34

LL_EXTI_LINE_35

Extended line 35

LL_EXTI_LINE_36

Extended line 36

LL_EXTI_LINE_37

Extended line 37

LL_EXTI_LINE_ALL_32_63

All Extended line not reserved

LL_EXTI_LINE_ALL

All Extended line

LL_EXTI_LINE_NONE

None Extended line

Mode

LL_EXTI_MODE_IT

Interrupt Mode

LL_EXTI_MODE_EVENT

Event Mode

LL_EXTI_MODE_IT_EVENT

Interrupt & Event Mode

Edge Trigger

LL_EXTI_TRIGGER_NONE

No Trigger Mode

LL_EXTI_TRIGGER_RISING

Trigger Rising Mode

LL_EXTI_TRIGGER_FALLING

Trigger Falling Mode

LL_EXTI_TRIGGER_RISING_FALLING

Trigger Rising & Falling Mode

Common Write and read registers Macros

LL_EXTI_WriteReg

Description:

- Write a value in EXTI register.

Parameters:

- __REG__: Register to be written
- __VALUE__: Value to be written in the register

Return value:

- None

LL_EXTI_ReadReg

Description:

- Read a value in EXTI register.

Parameters:

- __REG__: Register to be read

Return value:

- Register: value

65 LL GPIO Generic Driver

65.1 GPIO Firmware driver registers structures

65.1.1 LL_GPIO_InitTypeDef

LL_GPIO_InitTypeDef is defined in the stm32u0xx_ll_gpio.h

Data Fields

- ***uint32_t Pin***
- ***uint32_t Mode***
- ***uint32_t Speed***
- ***uint32_t OutputType***
- ***uint32_t Pull***
- ***uint32_t Alternate***

Field Documentation

- ***uint32_t LL_GPIO_InitTypeDef::Pin***
  Specifies the GPIO pins to be configured. This parameter can be any value of ***GPIO_LL_EC_PIN***
- ***uint32_t LL_GPIO_InitTypeDef::Mode***
  Specifies the operating mode for the selected pins. This parameter can be a value of ***GPIO_LL_EC_MODE***.GPIO HW configuration can be modified afterwards using unitary function **LL_GPIO_SetPinMode()**.
- ***uint32_t LL_GPIO_InitTypeDef::Speed***
  Specifies the speed for the selected pins. This parameter can be a value of ***GPIO_LL_EC_SPEED***.GPIO HW configuration can be modified afterwards using unitary function **LL_GPIO_SetPinSpeed()**.
- ***uint32_t LL_GPIO_InitTypeDef::OutputType***
  Specifies the operating output type for the selected pins. This parameter can be a value of ***GPIO_LL_EC_OUTPUT***.GPIO HW configuration can be modified afterwards using unitary function **LL_GPIO_SetPinOutputType()**.
- ***uint32_t LL_GPIO_InitTypeDef::Pull***
  Specifies the operating Pull-up/Pull down for the selected pins. This parameter can be a value of ***GPIO_LL_EC_PULL***.GPIO HW configuration can be modified afterwards using unitary function **LL_GPIO_SetPinPull()**.
- ***uint32_t LL_GPIO_InitTypeDef::Alternate***
  Specifies the Peripheral to be connected to the selected pins. This parameter can be a value of ***GPIO_LL_EC_AF***.GPIO HW configuration can be modified afterwards using unitary function **LL_GPIO_SetAFPin_0_7()** and **LL_GPIO_SetAFPin_8_15()**.

65.2 GPIO Firmware driver API description

The following section lists the various functions of the GPIO library.

65.2.1 Detailed description of functions

LL_GPIO_SetPinMode

Function name

__STATIC_INLINE void LL_GPIO_SetPinMode (GPIO_TypeDef * GPIOx, uint32_t Pin, uint32_t Mode)

Function description

Configure gpio mode for a dedicated pin on dedicated port.

Parameters

- **GPIOx:** GPIO Port
- **Pin:** This parameter can be one of the following values:
  - LL_GPIO_PIN_0
  - LL_GPIO_PIN_1
  - LL_GPIO_PIN_2
  - LL_GPIO_PIN_3
  - LL_GPIO_PIN_4
  - LL_GPIO_PIN_5
  - LL_GPIO_PIN_6
  - LL_GPIO_PIN_7
  - LL_GPIO_PIN_8
  - LL_GPIO_PIN_9
  - LL_GPIO_PIN_10
  - LL_GPIO_PIN_11
  - LL_GPIO_PIN_12
  - LL_GPIO_PIN_13
  - LL_GPIO_PIN_14
  - LL_GPIO_PIN_15
- **Mode:** This parameter can be one of the following values:
  - LL_GPIO_MODE_INPUT
  - LL_GPIO_MODE_OUTPUT
  - LL_GPIO_MODE_ALTERNATE
  - LL_GPIO_MODE_ANALOG

Return values

- **None:**

Notes

- I/O mode can be Input mode, General purpose output, Alternate function mode or Analog.
- Warning: only one pin can be passed as parameter.

Reference Manual to LL API cross reference:

- MODER MODEy LL_GPIO_SetPinMode

LL_GPIO_GetPinMode

Function name

__STATIC_INLINE uint32_t LL_GPIO_GetPinMode (GPIO_TypeDef * GPIOx, uint32_t Pin)

Function description

Return gpio mode for a dedicated pin on dedicated port.

Parameters

- **GPIOx:** GPIO Port
- **Pin:** This parameter can be one of the following values:
  - LL_GPIO_PIN_0
  - LL_GPIO_PIN_1
  - LL_GPIO_PIN_2
  - LL_GPIO_PIN_3
  - LL_GPIO_PIN_4
  - LL_GPIO_PIN_5
  - LL_GPIO_PIN_6
  - LL_GPIO_PIN_7
  - LL_GPIO_PIN_8
  - LL_GPIO_PIN_9
  - LL_GPIO_PIN_10
  - LL_GPIO_PIN_11
  - LL_GPIO_PIN_12
  - LL_GPIO_PIN_13
  - LL_GPIO_PIN_14
  - LL_GPIO_PIN_15

Return values

- **Returned:** value can be one of the following values:
  - LL_GPIO_MODE_INPUT
  - LL_GPIO_MODE_OUTPUT
  - LL_GPIO_MODE_ALTERNATE
  - LL_GPIO_MODE_ANALOG

Notes

- I/O mode can be Input mode, General purpose output, Alternate function mode or Analog.
- Warning: only one pin can be passed as parameter.

Reference Manual to LL API cross reference:

- MODER MODEy LL_GPIO_GetPinMode

LL_GPIO_SetPinOutputType

Function name

__STATIC_INLINE void LL_GPIO_SetPinOutputType (GPIO_TypeDef * GPIOx, uint32_t PinMask, uint32_t OutputType)

Function description

Configure gpio output type for several pins on dedicated port.

Parameters

- **GPIOx:** GPIO Port
- **PinMask:** This parameter can be a combination of the following values:
  - LL_GPIO_PIN_0
  - LL_GPIO_PIN_1
  - LL_GPIO_PIN_2
  - LL_GPIO_PIN_3
  - LL_GPIO_PIN_4
  - LL_GPIO_PIN_5
  - LL_GPIO_PIN_6
  - LL_GPIO_PIN_7
  - LL_GPIO_PIN_8
  - LL_GPIO_PIN_9
  - LL_GPIO_PIN_10
  - LL_GPIO_PIN_11
  - LL_GPIO_PIN_12
  - LL_GPIO_PIN_13
  - LL_GPIO_PIN_14
  - LL_GPIO_PIN_15
  - LL_GPIO_PIN_ALL
- **OutputType:** This parameter can be one of the following values:
  - LL_GPIO_OUTPUT_PUSHPULL
  - LL_GPIO_OUTPUT_OPENDRAIN

Return values

- **None:**

Notes

- Output type as to be set when gpio pin is in output or alternate modes. Possible type are Push-pull or Open-drain.

Reference Manual to LL API cross reference:

- OTYPER OTy LL_GPIO_SetPinOutputType

LL_GPIO_GetPinOutputType

Function name

__STATIC_INLINE uint32_t LL_GPIO_GetPinOutputType (GPIO_TypeDef * GPIOx, uint32_t Pin)

Function description

Return gpio output type for several pins on dedicated port.

Parameters

- **GPIOx:** GPIO Port
- **Pin:** This parameter can be one of the following values:
  - LL_GPIO_PIN_0
  - LL_GPIO_PIN_1
  - LL_GPIO_PIN_2
  - LL_GPIO_PIN_3
  - LL_GPIO_PIN_4
  - LL_GPIO_PIN_5
  - LL_GPIO_PIN_6
  - LL_GPIO_PIN_7
  - LL_GPIO_PIN_8
  - LL_GPIO_PIN_9
  - LL_GPIO_PIN_10
  - LL_GPIO_PIN_11
  - LL_GPIO_PIN_12
  - LL_GPIO_PIN_13
  - LL_GPIO_PIN_14
  - LL_GPIO_PIN_15
  - LL_GPIO_PIN_ALL

Return values

- **Returned:** value can be one of the following values:
  - LL_GPIO_OUTPUT_PUSHPULL
  - LL_GPIO_OUTPUT_OPENDRAIN

Notes

- Output type as to be set when gpio pin is in output or alternate modes. Possible type are Push-pull or Open-drain.
- Warning: only one pin can be passed as parameter.

Reference Manual to LL API cross reference:

- OTYPER OTy LL_GPIO_GetPinOutputType

LL_GPIO_SetPinSpeed

Function name

__STATIC_INLINE void LL_GPIO_SetPinSpeed (GPIO_TypeDef * GPIOx, uint32_t Pin, uint32_t Speed)

Function description

Configure gpio speed for a dedicated pin on dedicated port.

Parameters

- **GPIOx:** GPIO Port
- **Pin:** This parameter can be one of the following values:
  - LL_GPIO_PIN_0
  - LL_GPIO_PIN_1
  - LL_GPIO_PIN_2
  - LL_GPIO_PIN_3
  - LL_GPIO_PIN_4
  - LL_GPIO_PIN_5
  - LL_GPIO_PIN_6
  - LL_GPIO_PIN_7
  - LL_GPIO_PIN_8
  - LL_GPIO_PIN_9
  - LL_GPIO_PIN_10
  - LL_GPIO_PIN_11
  - LL_GPIO_PIN_12
  - LL_GPIO_PIN_13
  - LL_GPIO_PIN_14
  - LL_GPIO_PIN_15
- **Speed:** This parameter can be one of the following values:
  - LL_GPIO_SPEED_FREQ_LOW
  - LL_GPIO_SPEED_FREQ_MEDIUM
  - LL_GPIO_SPEED_FREQ_HIGH
  - LL_GPIO_SPEED_FREQ_VERY_HIGH

Return values

- **None:**

Notes

- I/O speed can be Low, Medium, Fast or High speed.
- Warning: only one pin can be passed as parameter.
- Refer to datasheet for frequency specifications and the power supply and load conditions for each speed.

Reference Manual to LL API cross reference:

- OSPEEDR OSPEEDy LL_GPIO_SetPinSpeed

LL_GPIO_GetPinSpeed

Function name

__STATIC_INLINE uint32_t LL_GPIO_GetPinSpeed (GPIO_TypeDef * GPIOx, uint32_t Pin)

Function description

Return gpio speed for a dedicated pin on dedicated port.

Parameters

- **GPIOx:** GPIO Port
- **Pin:** This parameter can be one of the following values:
  - LL_GPIO_PIN_0
  - LL_GPIO_PIN_1
  - LL_GPIO_PIN_2
  - LL_GPIO_PIN_3
  - LL_GPIO_PIN_4
  - LL_GPIO_PIN_5
  - LL_GPIO_PIN_6
  - LL_GPIO_PIN_7
  - LL_GPIO_PIN_8
  - LL_GPIO_PIN_9
  - LL_GPIO_PIN_10
  - LL_GPIO_PIN_11
  - LL_GPIO_PIN_12
  - LL_GPIO_PIN_13
  - LL_GPIO_PIN_14
  - LL_GPIO_PIN_15

Return values

- **Returned:** value can be one of the following values:
  - LL_GPIO_SPEED_FREQ_LOW
  - LL_GPIO_SPEED_FREQ_MEDIUM
  - LL_GPIO_SPEED_FREQ_HIGH
  - LL_GPIO_SPEED_FREQ_VERY_HIGH

Notes

- I/O speed can be Low, Medium, Fast or High speed.
- Warning: only one pin can be passed as parameter.
- Refer to datasheet for frequency specifications and the power supply and load conditions for each speed.

Reference Manual to LL API cross reference:

- OSPEEDR OSPEEDy LL_GPIO_GetPinSpeed

LL_GPIO_SetPinPull

Function name

__STATIC_INLINE void LL_GPIO_SetPinPull (GPIO_TypeDef * GPIOx, uint32_t Pin, uint32_t Pull)

Function description

Configure gpio pull-up or pull-down for a dedicated pin on a dedicated port.

Parameters

- **GPIOx:** GPIO Port
- **Pin:** This parameter can be one of the following values:
  - LL_GPIO_PIN_0
  - LL_GPIO_PIN_1
  - LL_GPIO_PIN_2
  - LL_GPIO_PIN_3
  - LL_GPIO_PIN_4
  - LL_GPIO_PIN_5
  - LL_GPIO_PIN_6
  - LL_GPIO_PIN_7
  - LL_GPIO_PIN_8
  - LL_GPIO_PIN_9
  - LL_GPIO_PIN_10
  - LL_GPIO_PIN_11
  - LL_GPIO_PIN_12
  - LL_GPIO_PIN_13
  - LL_GPIO_PIN_14
  - LL_GPIO_PIN_15
- **Pull:** This parameter can be one of the following values:
  - LL_GPIO_PULL_NO
  - LL_GPIO_PULL_UP
  - LL_GPIO_PULL_DOWN

Return values

- **None:**

Notes

- Warning: only one pin can be passed as parameter.

Reference Manual to LL API cross reference:

- PUPDR PUPDy LL_GPIO_SetPinPull

LL_GPIO_GetPinPull

Function name

__STATIC_INLINE uint32_t LL_GPIO_GetPinPull (GPIO_TypeDef * GPIOx, uint32_t Pin)

Function description

Return gpio pull-up or pull-down for a dedicated pin on a dedicated port.

Parameters

- **GPIOx:** GPIO Port
- **Pin:** This parameter can be one of the following values:
  - LL_GPIO_PIN_0
  - LL_GPIO_PIN_1
  - LL_GPIO_PIN_2
  - LL_GPIO_PIN_3
  - LL_GPIO_PIN_4
  - LL_GPIO_PIN_5
  - LL_GPIO_PIN_6
  - LL_GPIO_PIN_7
  - LL_GPIO_PIN_8
  - LL_GPIO_PIN_9
  - LL_GPIO_PIN_10
  - LL_GPIO_PIN_11
  - LL_GPIO_PIN_12
  - LL_GPIO_PIN_13
  - LL_GPIO_PIN_14
  - LL_GPIO_PIN_15

Return values

- **Returned:** value can be one of the following values:
  - LL_GPIO_PULL_NO
  - LL_GPIO_PULL_UP
  - LL_GPIO_PULL_DOWN

Notes

- Warning: only one pin can be passed as parameter.

Reference Manual to LL API cross reference:

- PUPDR PUPDy LL_GPIO_GetPinPull

LL_GPIO_SetAFPin_0_7

Function name

__STATIC_INLINE void LL_GPIO_SetAFPin_0_7 (GPIO_TypeDef * GPIOx, uint32_t Pin, uint32_t Alternate)

Function description

Configure gpio alternate function of a dedicated pin from 0 to 7 for a dedicated port.

Parameters

- **GPIOx:** GPIO Port
- **Pin:** This parameter can be one of the following values:
  - LL_GPIO_PIN_0
  - LL_GPIO_PIN_1
  - LL_GPIO_PIN_2
  - LL_GPIO_PIN_3
  - LL_GPIO_PIN_4
  - LL_GPIO_PIN_5
  - LL_GPIO_PIN_6
  - LL_GPIO_PIN_7
- **Alternate:** This parameter can be one of the following values:
  - LL_GPIO_AF_0
  - LL_GPIO_AF_1
  - LL_GPIO_AF_2
  - LL_GPIO_AF_3
  - LL_GPIO_AF_4
  - LL_GPIO_AF_5
  - LL_GPIO_AF_6
  - LL_GPIO_AF_7
  - LL_GPIO_AF_8
  - LL_GPIO_AF_9
  - LL_GPIO_AF_10
  - LL_GPIO_AF_11
  - LL_GPIO_AF_12
  - LL_GPIO_AF_13
  - LL_GPIO_AF_14
  - LL_GPIO_AF_15

Return values

- **None:**

Notes

- Possible values are from AF0 to AF7 depending on target.
- Warning: only one pin can be passed as parameter.

Reference Manual to LL API cross reference:

- AFRL AFSELy LL_GPIO_SetAFPin_0_7

LL_GPIO_GetAFPin_0_7

Function name

__STATIC_INLINE uint32_t LL_GPIO_GetAFPin_0_7 (GPIO_TypeDef * GPIOx, uint32_t Pin)

Function description

Return gpio alternate function of a dedicated pin from 0 to 7 for a dedicated port.

Parameters

- **GPIOx:** GPIO Port
- **Pin:** This parameter can be one of the following values:
  - LL_GPIO_PIN_0
  - LL_GPIO_PIN_1
  - LL_GPIO_PIN_2
  - LL_GPIO_PIN_3
  - LL_GPIO_PIN_4
  - LL_GPIO_PIN_5
  - LL_GPIO_PIN_6
  - LL_GPIO_PIN_7

Return values

- **Returned:** value can be one of the following values:
  - LL_GPIO_AF_0
  - LL_GPIO_AF_1
  - LL_GPIO_AF_2
  - LL_GPIO_AF_3
  - LL_GPIO_AF_4
  - LL_GPIO_AF_5
  - LL_GPIO_AF_6
  - LL_GPIO_AF_7
  - LL_GPIO_AF_8
  - LL_GPIO_AF_9
  - LL_GPIO_AF_10
  - LL_GPIO_AF_11
  - LL_GPIO_AF_12
  - LL_GPIO_AF_13
  - LL_GPIO_AF_14
  - LL_GPIO_AF_15

Reference Manual to LL API cross reference:

- AFRL AFSELy LL_GPIO_GetAFPin_0_7

LL_GPIO_SetAFPin_8_15

Function name

__STATIC_INLINE void LL_GPIO_SetAFPin_8_15 (GPIO_TypeDef * GPIOx, uint32_t Pin, uint32_t Alternate)

Function description

Configure gpio alternate function of a dedicated pin from 8 to 15 for a dedicated port.

Parameters

- **GPIOx:** GPIO Port
- **Pin:** This parameter can be one of the following values:
  - LL_GPIO_PIN_8
  - LL_GPIO_PIN_9
  - LL_GPIO_PIN_10
  - LL_GPIO_PIN_11
  - LL_GPIO_PIN_12
  - LL_GPIO_PIN_13
  - LL_GPIO_PIN_14
  - LL_GPIO_PIN_15
- **Alternate:** This parameter can be one of the following values:
  - LL_GPIO_AF_0
  - LL_GPIO_AF_1
  - LL_GPIO_AF_2
  - LL_GPIO_AF_3
  - LL_GPIO_AF_4
  - LL_GPIO_AF_5
  - LL_GPIO_AF_6
  - LL_GPIO_AF_7
  - LL_GPIO_AF_8
  - LL_GPIO_AF_9
  - LL_GPIO_AF_10
  - LL_GPIO_AF_11
  - LL_GPIO_AF_12
  - LL_GPIO_AF_13
  - LL_GPIO_AF_14
  - LL_GPIO_AF_15

Return values

- **None:**

Notes

- Possible values are from AF0 to AF7 depending on target.
- Warning: only one pin can be passed as parameter.

Reference Manual to LL API cross reference:

- AFRH AFSELy LL_GPIO_SetAFPin_8_15

LL_GPIO_GetAFPin_8_15

Function name

__STATIC_INLINE uint32_t LL_GPIO_GetAFPin_8_15 (GPIO_TypeDef * GPIOx, uint32_t Pin)

Function description

Return gpio alternate function of a dedicated pin from 8 to 15 for a dedicated port.

Parameters

- **GPIOx:** GPIO Port
- **Pin:** This parameter can be one of the following values:
  - LL_GPIO_PIN_8
  - LL_GPIO_PIN_9
  - LL_GPIO_PIN_10
  - LL_GPIO_PIN_11
  - LL_GPIO_PIN_12
  - LL_GPIO_PIN_13
  - LL_GPIO_PIN_14
  - LL_GPIO_PIN_15

Return values

- **Returned:** value can be one of the following values:
  - LL_GPIO_AF_0
  - LL_GPIO_AF_1
  - LL_GPIO_AF_2
  - LL_GPIO_AF_3
  - LL_GPIO_AF_4
  - LL_GPIO_AF_5
  - LL_GPIO_AF_6
  - LL_GPIO_AF_7
  - LL_GPIO_AF_8
  - LL_GPIO_AF_9
  - LL_GPIO_AF_10
  - LL_GPIO_AF_11
  - LL_GPIO_AF_12
  - LL_GPIO_AF_13
  - LL_GPIO_AF_14
  - LL_GPIO_AF_15

Notes

- Possible values are from AF0 to AF7 depending on target.

Reference Manual to LL API cross reference:

- AFRH AFSELy LL_GPIO_GetAFPin_8_15

LL_GPIO_LockPin

Function name

__STATIC_INLINE void LL_GPIO_LockPin (GPIO_TypeDef * GPIOx, uint32_t PinMask)

Function description

Lock configuration of several pins for a dedicated port.

Parameters

- **GPIOx:** GPIO Port
- **PinMask:** This parameter can be a combination of the following values:
  - LL_GPIO_PIN_0
  - LL_GPIO_PIN_1
  - LL_GPIO_PIN_2
  - LL_GPIO_PIN_3
  - LL_GPIO_PIN_4
  - LL_GPIO_PIN_5
  - LL_GPIO_PIN_6
  - LL_GPIO_PIN_7
  - LL_GPIO_PIN_8
  - LL_GPIO_PIN_9
  - LL_GPIO_PIN_10
  - LL_GPIO_PIN_11
  - LL_GPIO_PIN_12
  - LL_GPIO_PIN_13
  - LL_GPIO_PIN_14
  - LL_GPIO_PIN_15
  - LL_GPIO_PIN_ALL

Return values

- **None:**

Notes

- When the lock sequence has been applied on a port bit, the value of this port bit can no longer be modified until the next reset.
- Each lock bit freezes a specific configuration register (control and alternate function registers).

Reference Manual to LL API cross reference:

- LCKR LCKK LL_GPIO_LockPin

LL_GPIO_IsPinLocked

Function name

__STATIC_INLINE uint32_t LL_GPIO_IsPinLocked (GPIO_TypeDef * GPIOx, uint32_t PinMask)

Function description

Return 1 if all pins passed as parameter, of a dedicated port, are locked.

Parameters

- **GPIOx:** GPIO Port
- **PinMask:** This parameter can be a combination of the following values:
  - LL_GPIO_PIN_0
  - LL_GPIO_PIN_1
  - LL_GPIO_PIN_2
  - LL_GPIO_PIN_3
  - LL_GPIO_PIN_4
  - LL_GPIO_PIN_5
  - LL_GPIO_PIN_6
  - LL_GPIO_PIN_7
  - LL_GPIO_PIN_8
  - LL_GPIO_PIN_9
  - LL_GPIO_PIN_10
  - LL_GPIO_PIN_11
  - LL_GPIO_PIN_12
  - LL_GPIO_PIN_13
  - LL_GPIO_PIN_14
  - LL_GPIO_PIN_15
  - LL_GPIO_PIN_ALL

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- LCKR LCKy LL_GPIO_IsPinLocked

LL_GPIO_IsAnyPinLocked

Function name

__STATIC_INLINE uint32_t LL_GPIO_IsAnyPinLocked (GPIO_TypeDef * GPIOx)

Function description

Return 1 if one of the pin of a dedicated port is locked.

Parameters

- **GPIOx:** GPIO Port

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- LCKR LCKK LL_GPIO_IsAnyPinLocked

LL_GPIO_ReadInputPort

Function name

__STATIC_INLINE uint32_t LL_GPIO_ReadInputPort (GPIO_TypeDef * GPIOx)

Function description

Return full input data register value for a dedicated port.

Parameters

- **GPIOx:** GPIO Port

Return values

- **Input:** data register value of port

Reference Manual to LL API cross reference:

- IDR IDy LL_GPIO_ReadInputPort

LL_GPIO_IsInputPinSet

Function name

__STATIC_INLINE uint32_t LL_GPIO_IsInputPinSet (GPIO_TypeDef * GPIOx, uint32_t PinMask)

Function description

Return if input data level for several pins of dedicated port is high or low.

Parameters

- **GPIOx:** GPIO Port
- **PinMask:** This parameter can be a combination of the following values:
  - LL_GPIO_PIN_0
  - LL_GPIO_PIN_1
  - LL_GPIO_PIN_2
  - LL_GPIO_PIN_3
  - LL_GPIO_PIN_4
  - LL_GPIO_PIN_5
  - LL_GPIO_PIN_6
  - LL_GPIO_PIN_7
  - LL_GPIO_PIN_8
  - LL_GPIO_PIN_9
  - LL_GPIO_PIN_10
  - LL_GPIO_PIN_11
  - LL_GPIO_PIN_12
  - LL_GPIO_PIN_13
  - LL_GPIO_PIN_14
  - LL_GPIO_PIN_15
  - LL_GPIO_PIN_ALL

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- IDR IDy LL_GPIO_IsInputPinSet

LL_GPIO_WriteOutputPort

Function name

__STATIC_INLINE void LL_GPIO_WriteOutputPort (GPIO_TypeDef * GPIOx, uint32_t PortValue)

Function description

Write output data register for the port.

Parameters

- **GPIOx:** GPIO Port
- **PortValue:** Level value for each pin of the port

Return values

- **None:**

Reference Manual to LL API cross reference:

- ODR ODy LL_GPIO_WriteOutputPort

LL_GPIO_ReadOutputPort

Function name

__STATIC_INLINE uint32_t LL_GPIO_ReadOutputPort (GPIO_TypeDef * GPIOx)

Function description

Return full output data register value for a dedicated port.

Parameters

- **GPIOx:** GPIO Port

Return values

- **Output:** data register value of port

Reference Manual to LL API cross reference:

- ODR ODy LL_GPIO_ReadOutputPort

LL_GPIO_IsOutputPinSet

Function name

__STATIC_INLINE uint32_t LL_GPIO_IsOutputPinSet (GPIO_TypeDef * GPIOx, uint32_t PinMask)

Function description

Return if input data level for several pins of dedicated port is high or low.

Parameters

- **GPIOx:** GPIO Port
- **PinMask:** This parameter can be a combination of the following values:
  - LL_GPIO_PIN_0
  - LL_GPIO_PIN_1
  - LL_GPIO_PIN_2
  - LL_GPIO_PIN_3
  - LL_GPIO_PIN_4
  - LL_GPIO_PIN_5
  - LL_GPIO_PIN_6
  - LL_GPIO_PIN_7
  - LL_GPIO_PIN_8
  - LL_GPIO_PIN_9
  - LL_GPIO_PIN_10
  - LL_GPIO_PIN_11
  - LL_GPIO_PIN_12
  - LL_GPIO_PIN_13
  - LL_GPIO_PIN_14
  - LL_GPIO_PIN_15
  - LL_GPIO_PIN_ALL

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ODR ODy LL_GPIO_IsOutputPinSet

LL_GPIO_SetOutputPin

Function name

__STATIC_INLINE void LL_GPIO_SetOutputPin (GPIO_TypeDef * GPIOx, uint32_t PinMask)

Function description

Set several pins to high level on dedicated gpio port.

Parameters

- **GPIOx:** GPIO Port
- **PinMask:** This parameter can be a combination of the following values:
  - LL_GPIO_PIN_0
  - LL_GPIO_PIN_1
  - LL_GPIO_PIN_2
  - LL_GPIO_PIN_3
  - LL_GPIO_PIN_4
  - LL_GPIO_PIN_5
  - LL_GPIO_PIN_6
  - LL_GPIO_PIN_7
  - LL_GPIO_PIN_8
  - LL_GPIO_PIN_9
  - LL_GPIO_PIN_10
  - LL_GPIO_PIN_11
  - LL_GPIO_PIN_12
  - LL_GPIO_PIN_13
  - LL_GPIO_PIN_14
  - LL_GPIO_PIN_15
  - LL_GPIO_PIN_ALL

Return values

- **None:**

Reference Manual to LL API cross reference:

- BSRR BSy LL_GPIO_SetOutputPin

LL_GPIO_ResetOutputPin

Function name

__STATIC_INLINE void LL_GPIO_ResetOutputPin (GPIO_TypeDef * GPIOx, uint32_t PinMask)

Function description

Set several pins to low level on dedicated gpio port.

Parameters

- **GPIOx:** GPIO Port
- **PinMask:** This parameter can be a combination of the following values:
  - LL_GPIO_PIN_0
  - LL_GPIO_PIN_1
  - LL_GPIO_PIN_2
  - LL_GPIO_PIN_3
  - LL_GPIO_PIN_4
  - LL_GPIO_PIN_5
  - LL_GPIO_PIN_6
  - LL_GPIO_PIN_7
  - LL_GPIO_PIN_8
  - LL_GPIO_PIN_9
  - LL_GPIO_PIN_10
  - LL_GPIO_PIN_11
  - LL_GPIO_PIN_12
  - LL_GPIO_PIN_13
  - LL_GPIO_PIN_14
  - LL_GPIO_PIN_15
  - LL_GPIO_PIN_ALL

Return values

- **None:**

Reference Manual to LL API cross reference:

- BRR BRy LL_GPIO_ResetOutputPin

LL_GPIO_TogglePin

Function name

__STATIC_INLINE void LL_GPIO_TogglePin (GPIO_TypeDef * GPIOx, uint32_t PinMask)

Function description

Toggle data value for several pin of dedicated port.

Parameters

- **GPIOx:** GPIO Port
- **PinMask:** This parameter can be a combination of the following values:
  - LL_GPIO_PIN_0
  - LL_GPIO_PIN_1
  - LL_GPIO_PIN_2
  - LL_GPIO_PIN_3
  - LL_GPIO_PIN_4
  - LL_GPIO_PIN_5
  - LL_GPIO_PIN_6
  - LL_GPIO_PIN_7
  - LL_GPIO_PIN_8
  - LL_GPIO_PIN_9
  - LL_GPIO_PIN_10
  - LL_GPIO_PIN_11
  - LL_GPIO_PIN_12
  - LL_GPIO_PIN_13
  - LL_GPIO_PIN_14
  - LL_GPIO_PIN_15
  - LL_GPIO_PIN_ALL

Return values

- **None:**

Reference Manual to LL API cross reference:

- ODR ODy LL_GPIO_TogglePin

LL_GPIO_DeInit

Function name

ErrorStatus LL_GPIO_DeInit (GPIO_TypeDef * GPIOx)

Function description

De-initialize GPIO registers (Registers restored to their default values).

Parameters

- **GPIOx:** GPIO Port

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: GPIO registers are de-initialized
  - ERROR: Wrong GPIO Port

LL_GPIO_Init

Function name

ErrorStatus LL_GPIO_Init (GPIO_TypeDef * GPIOx, LL_GPIO_InitTypeDef * GPIO_InitStruct)

Function description

Initialize GPIO registers according to the specified parameters in GPIO_InitStruct.

Parameters

- **GPIOx:** GPIO Port
- **GPIO_InitStruct:** pointer to a LL_GPIO_InitTypeDef structure that contains the configuration information for the specified GPIO peripheral.

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: GPIO registers are initialized according to GPIO_InitStruct content
  - ERROR: Not applicable

LL_GPIO_StructInit

Function name

void LL_GPIO_StructInit (LL_GPIO_InitTypeDef * GPIO_InitStruct)

Function description

Set each LL_GPIO_InitTypeDef field to default value.

Parameters

- **GPIO_InitStruct:** pointer to a LL_GPIO_InitTypeDef structure whose fields will be set to default values.

Return values

- **None:**

65.3 GPIO Firmware driver defines

The following section lists the various define and macros of the module.

65.3.1 GPIO

GPIO

Alternate Function

LL_GPIO_AF_0

Select alternate function 0

LL_GPIO_AF_1

Select alternate function 1

LL_GPIO_AF_2

Select alternate function 2

LL_GPIO_AF_3

Select alternate function 3

LL_GPIO_AF_4

Select alternate function 4

LL_GPIO_AF_5

Select alternate function 5

LL_GPIO_AF_6

Select alternate function 6

LL_GPIO_AF_7

Select alternate function 7

LL_GPIO_AF_8

Select alternate function 8

LL_GPIO_AF_9

Select alternate function 9

LL_GPIO_AF_10

Select alternate function 10

LL_GPIO_AF_11

Select alternate function 11

LL_GPIO_AF_12

Select alternate function 12

LL_GPIO_AF_13

Select alternate function 13

LL_GPIO_AF_14

Select alternate function 14

LL_GPIO_AF_15

Select alternate function 15

Mode

LL_GPIO_MODE_INPUT

Select input mode

LL_GPIO_MODE_OUTPUT

Select output mode

LL_GPIO_MODE_ALTERNATE

Select alternate function mode

LL_GPIO_MODE_ANALOG

Select analog mode

Output Type

LL_GPIO_OUTPUT_PUSHPULL

Select push-pull as output type

LL_GPIO_OUTPUT_OPENDRAIN

Select open-drain as output type

PIN

LL_GPIO_PIN_0

Select pin 0

LL_GPIO_PIN_1

Select pin 1

LL_GPIO_PIN_2

Select pin 2

LL_GPIO_PIN_3

Select pin 3

LL_GPIO_PIN_4

Select pin 4

LL_GPIO_PIN_5

Select pin 5

LL_GPIO_PIN_6

Select pin 6

LL_GPIO_PIN_7

Select pin 7

LL_GPIO_PIN_8

Select pin 8

LL_GPIO_PIN_9

Select pin 9

LL_GPIO_PIN_10

Select pin 10

LL_GPIO_PIN_11

Select pin 11

LL_GPIO_PIN_12

Select pin 12

LL_GPIO_PIN_13

Select pin 13

LL_GPIO_PIN_14

Select pin 14

LL_GPIO_PIN_15

Select pin 15

LL_GPIO_PIN_ALL

Select all pins

Pull Up Pull Down

LL_GPIO_PULL_NO

Select I/O no pull

LL_GPIO_PULL_UP

Select I/O pull up

LL_GPIO_PULL_DOWN

Select I/O pull down

Output Speed

LL_GPIO_SPEED_FREQ_LOW

Select I/O low output speed

LL_GPIO_SPEED_FREQ_MEDIUM

Select I/O medium output speed

LL_GPIO_SPEED_FREQ_HIGH

Select I/O fast output speed

LL_GPIO_SPEED_FREQ_VERY_HIGH

Select I/O high output speed

Common Write and read registers Macros

LL_GPIO_WriteReg

Description:

- Write a value in GPIO register.

Parameters:

- __INSTANCE__: GPIO Instance
- __REG__: Register to be written
- __VALUE__: Value to be written in the register

Return value:

- None

LL_GPIO_ReadReg

Description:

- Read a value in GPIO register.

Parameters:

- __INSTANCE__: GPIO Instance
- __REG__: Register to be read

Return value:

- Register: value

GPIO Exported Constants

LL_GPIO_SPEED_LOW

LL_GPIO_SPEED_MEDIUM

LL_GPIO_SPEED_FAST

LL_GPIO_SPEED_HIGH

66 LL I2C Generic Driver

66.1 I2C Firmware driver registers structures

66.1.1 LL_I2C_InitTypeDef

LL_I2C_InitTypeDef is defined in the stm32u0xx_ll_i2c.h

Data Fields

- ***uint32_t Timing***
- ***uint32_t AnalogFilter***
- ***uint32_t DigitalFilter***
- ***uint32_t OwnAddress1***
- ***uint32_t TypeAcknowledge***
- ***uint32_t OwnAddrSize***

Field Documentation

- ***uint32_t LL_I2C_InitTypeDef::Timing***
  Specifies the SDA setup, hold time and the SCL high, low period values. This parameter must be set by referring to the STM32CubeMX Tool and the helper macro **__LL_I2C_CONVERT_TIMINGS()**.This feature can be modified afterwards using unitary function **LL_I2C_SetTiming()**.
- ***uint32_t LL_I2C_InitTypeDef::AnalogFilter***
  Enables or disables analog noise filter. This parameter can be a value of ***I2C_LL_EC_ANALOGFILTER_SELECTION***.This feature can be modified afterwards using unitary functions **LL_I2C_EnableAnalogFilter()** or **LL_I2C_DisableAnalogFilter()**.
- ***uint32_t LL_I2C_InitTypeDef::DigitalFilter***
  Configures the digital noise filter. This parameter can be a number between Min_Data = 0x00 and Max_Data = 0x0F.This feature can be modified afterwards using unitary function **LL_I2C_SetDigitalFilter()**.
- ***uint32_t LL_I2C_InitTypeDef::OwnAddress1***
  Specifies the device own address 1. This parameter must be a value between Min_Data = 0x00 and Max_Data = 0x3FF.This feature can be modified afterwards using unitary function **LL_I2C_SetOwnAddress1()**.
- ***uint32_t LL_I2C_InitTypeDef::TypeAcknowledge***
  Specifies the ACKnowledge or Non ACKnowledge condition after the address receive match code or next received byte. This parameter can be a value of ***I2C_LL_EC_I2C_ACKNOWLEDGE***.This feature can be modified afterwards using unitary function **LL_I2C_AcknowledgeNextData()**.
- ***uint32_t LL_I2C_InitTypeDef::OwnAddrSize***
  Specifies the device own address 1 size (7-bit or 10-bit). This parameter can be a value of ***I2C_LL_EC_OWNADDRESS1***.This feature can be modified afterwards using unitary function **LL_I2C_SetOwnAddress1()**.

66.2 I2C Firmware driver API description

The following section lists the various functions of the I2C library.

66.2.1 Detailed description of functions

LL_I2C_Enable

Function name

__STATIC_INLINE void LL_I2C_Enable (I2C_TypeDef * I2Cx)

Function description

Enable I2C peripheral (PE = 1).

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 PE LL_I2C_Enable

LL_I2C_Disable

Function name

__STATIC_INLINE void LL_I2C_Disable (I2C_TypeDef * I2Cx)

Function description

Disable I2C peripheral (PE = 0).

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Notes

- When PE = 0, the I2C SCL and SDA lines are released. Internal state machines and status bits are put back to their reset value. When cleared, PE must be kept low for at least 3 APB clock cycles.

Reference Manual to LL API cross reference:

- CR1 PE LL_I2C_Disable

LL_I2C_IsEnabled

Function name

__STATIC_INLINE uint32_t LL_I2C_IsEnabled (const I2C_TypeDef * I2Cx)

Function description

Check if the I2C peripheral is enabled or disabled.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 PE LL_I2C_IsEnabled

LL_I2C_ConfigFilters

Function name

__STATIC_INLINE void LL_I2C_ConfigFilters (I2C_TypeDef * I2Cx, uint32_t AnalogFilter, uint32_t DigitalFilter)

Function description

Configure Noise Filters (Analog and Digital).

Parameters

- **I2Cx:** I2C Instance.
- **AnalogFilter:** This parameter can be one of the following values:
  - LL_I2C_ANALOGFILTER_ENABLE
  - LL_I2C_ANALOGFILTER_DISABLE
- **DigitalFilter:** This parameter must be a value between Min_Data=0x00 (Digital filter disabled) and Max_Data=0x0F (Digital filter enabled and filtering capability up to 15*ti2cclk). This parameter is used to configure the digital noise filter on SDA and SCL input. The digital filter will filter spikes with a length of up to DNF[3:0]*ti2cclk.

Return values

- **None:**

Notes

- If the analog filter is also enabled, the digital filter is added to analog filter. The filters can only be programmed when the I2C is disabled (PE = 0).

Reference Manual to LL API cross reference:

- CR1 ANFOFF LL_I2C_ConfigFilters
- CR1 DNF LL_I2C_ConfigFilters

LL_I2C_SetDigitalFilter

Function name

__STATIC_INLINE void LL_I2C_SetDigitalFilter (I2C_TypeDef * I2Cx, uint32_t DigitalFilter)

Function description

Configure Digital Noise Filter.

Parameters

- **I2Cx:** I2C Instance.
- **DigitalFilter:** This parameter must be a value between Min_Data=0x00 (Digital filter disabled) and Max_Data=0x0F (Digital filter enabled and filtering capability up to 15*ti2cclk). This parameter is used to configure the digital noise filter on SDA and SCL input. The digital filter will filter spikes with a length of up to DNF[3:0]*ti2cclk.

Return values

- **None:**

Notes

- If the analog filter is also enabled, the digital filter is added to analog filter. This filter can only be programmed when the I2C is disabled (PE = 0).

Reference Manual to LL API cross reference:

- CR1 DNF LL_I2C_SetDigitalFilter

LL_I2C_GetDigitalFilter

Function name

__STATIC_INLINE uint32_t LL_I2C_GetDigitalFilter (const I2C_TypeDef * I2Cx)

Function description

Get the current Digital Noise Filter configuration.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **Value:** between Min_Data=0x0 and Max_Data=0xF

Reference Manual to LL API cross reference:

- CR1 DNF LL_I2C_GetDigitalFilter

LL_I2C_EnableAnalogFilter

Function name

__STATIC_INLINE void LL_I2C_EnableAnalogFilter (I2C_TypeDef * I2Cx)

Function description

Enable Analog Noise Filter.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Notes

- This filter can only be programmed when the I2C is disabled (PE = 0).

Reference Manual to LL API cross reference:

- CR1 ANFOFF LL_I2C_EnableAnalogFilter

LL_I2C_DisableAnalogFilter

Function name

__STATIC_INLINE void LL_I2C_DisableAnalogFilter (I2C_TypeDef * I2Cx)

Function description

Disable Analog Noise Filter.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Notes

- This filter can only be programmed when the I2C is disabled (PE = 0).

Reference Manual to LL API cross reference:

- CR1 ANFOFF LL_I2C_DisableAnalogFilter

LL_I2C_IsEnabledAnalogFilter

Function name

__STATIC_INLINE uint32_t LL_I2C_IsEnabledAnalogFilter (const I2C_TypeDef * I2Cx)

Function description

Check if Analog Noise Filter is enabled or disabled.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 ANFOFF LL_I2C_IsEnabledAnalogFilter

LL_I2C_EnableDMAReq_TX

Function name

__STATIC_INLINE void LL_I2C_EnableDMAReq_TX (I2C_TypeDef * I2Cx)

Function description

Enable DMA transmission requests.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 TXDMAEN LL_I2C_EnableDMAReq_TX

LL_I2C_DisableDMAReq_TX

Function name

__STATIC_INLINE void LL_I2C_DisableDMAReq_TX (I2C_TypeDef * I2Cx)

Function description

Disable DMA transmission requests.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 TXDMAEN LL_I2C_DisableDMAReq_TX

LL_I2C_IsEnabledDMAReq_TX

Function name

__STATIC_INLINE uint32_t LL_I2C_IsEnabledDMAReq_TX (const I2C_TypeDef * I2Cx)

Function description

Check if DMA transmission requests are enabled or disabled.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 TXDMAEN LL_I2C_IsEnabledDMAReq_TX

LL_I2C_EnableDMAReq_RX

Function name

__STATIC_INLINE void LL_I2C_EnableDMAReq_RX (I2C_TypeDef * I2Cx)

Function description

Enable DMA reception requests.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 RXDMAEN LL_I2C_EnableDMAReq_RX

LL_I2C_DisableDMAReq_RX

Function name

__STATIC_INLINE void LL_I2C_DisableDMAReq_RX (I2C_TypeDef * I2Cx)

Function description

Disable DMA reception requests.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 RXDMAEN LL_I2C_DisableDMAReq_RX

LL_I2C_IsEnabledDMAReq_RX

Function name

__STATIC_INLINE uint32_t LL_I2C_IsEnabledDMAReq_RX (const I2C_TypeDef * I2Cx)

Function description

Check if DMA reception requests are enabled or disabled.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 RXDMAEN LL_I2C_IsEnabledDMAReq_RX

LL_I2C_DMA_GetRegAddr

Function name

__STATIC_INLINE uint32_t LL_I2C_DMA_GetRegAddr (const I2C_TypeDef * I2Cx, uint32_t Direction)

Function description

Get the data register address used for DMA transfer.

Parameters

- **I2Cx:** I2C Instance
- **Direction:** This parameter can be one of the following values:
  - LL_I2C_DMA_REG_DATA_TRANSMIT
  - LL_I2C_DMA_REG_DATA_RECEIVE

Return values

- **Address:** of data register

Reference Manual to LL API cross reference:

- TXDR TXDATA LL_I2C_DMA_GetRegAddr
- RXDR RXDATA LL_I2C_DMA_GetRegAddr

LL_I2C_EnableClockStretching

Function name

__STATIC_INLINE void LL_I2C_EnableClockStretching (I2C_TypeDef * I2Cx)

Function description

Enable Clock stretching.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Notes

- This bit can only be programmed when the I2C is disabled (PE = 0).

Reference Manual to LL API cross reference:

- CR1 NOSTRETCH LL_I2C_EnableClockStretching

LL_I2C_DisableClockStretching

Function name

__STATIC_INLINE void LL_I2C_DisableClockStretching (I2C_TypeDef * I2Cx)

Function description

Disable Clock stretching.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Notes

- This bit can only be programmed when the I2C is disabled (PE = 0).

Reference Manual to LL API cross reference:

- CR1 NOSTRETCH LL_I2C_DisableClockStretching

LL_I2C_IsEnabledClockStretching

Function name

__STATIC_INLINE uint32_t LL_I2C_IsEnabledClockStretching (const I2C_TypeDef * I2Cx)

Function description

Check if Clock stretching is enabled or disabled.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 NOSTRETCH LL_I2C_IsEnabledClockStretching

LL_I2C_EnableWakeUpFromStop

Function name

__STATIC_INLINE void LL_I2C_EnableWakeUpFromStop (I2C_TypeDef * I2Cx)

Function description

Enable Wakeup from STOP.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Notes

- The macro IS_I2C_WAKEUP_FROMSTOP_INSTANCE(I2Cx) can be used to check whether or not WakeUpFromStop feature is supported by the I2Cx Instance.
- This bit can only be programmed when Digital Filter is disabled.

Reference Manual to LL API cross reference:

- CR1 WUPEN LL_I2C_EnableWakeUpFromStop

LL_I2C_DisableWakeUpFromStop

Function name

__STATIC_INLINE void LL_I2C_DisableWakeUpFromStop (I2C_TypeDef * I2Cx)

Function description

Disable Wakeup from STOP.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Notes

- The macro IS_I2C_WAKEUP_FROMSTOP_INSTANCE(I2Cx) can be used to check whether or not WakeUpFromStop feature is supported by the I2Cx Instance.

Reference Manual to LL API cross reference:

- CR1 WUPEN LL_I2C_DisableWakeUpFromStop

LL_I2C_IsEnabledWakeUpFromStop

Function name

__STATIC_INLINE uint32_t LL_I2C_IsEnabledWakeUpFromStop (const I2C_TypeDef * I2Cx)

Function description

Check if Wakeup from STOP is enabled or disabled.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **State:** of bit (1 or 0).

Notes

- The macro IS_I2C_WAKEUP_FROMSTOP_INSTANCE(I2Cx) can be used to check whether or not WakeUpFromStop feature is supported by the I2Cx Instance.

Reference Manual to LL API cross reference:

- CR1 WUPEN LL_I2C_IsEnabledWakeUpFromStop

LL_I2C_EnableGeneralCall

Function name

__STATIC_INLINE void LL_I2C_EnableGeneralCall (I2C_TypeDef * I2Cx)

Function description

Enable General Call.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Notes

- When enabled the Address 0x00 is ACKed.

Reference Manual to LL API cross reference:

- CR1 GCEN LL_I2C_EnableGeneralCall

LL_I2C_DisableGeneralCall

Function name

__STATIC_INLINE void LL_I2C_DisableGeneralCall (I2C_TypeDef * I2Cx)

Function description

Disable General Call.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Notes

- When disabled the Address 0x00 is NACKed.

Reference Manual to LL API cross reference:

- CR1 GCEN LL_I2C_DisableGeneralCall

LL_I2C_IsEnabledGeneralCall

Function name

__STATIC_INLINE uint32_t LL_I2C_IsEnabledGeneralCall (const I2C_TypeDef * I2Cx)

Function description

Check if General Call is enabled or disabled.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 GCEN LL_I2C_IsEnabledGeneralCall

LL_I2C_EnableFastModePlus

Function name

__STATIC_INLINE void LL_I2C_EnableFastModePlus (I2C_TypeDef * I2Cx)

Function description

Enable I2C Fast Mode Plus (FMP = 1).

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Notes

- 20mA I/O drive enable

Reference Manual to LL API cross reference:

- CR1 FMP LL_I2C_EnableFastModePlus

LL_I2C_DisableFastModePlus

Function name

__STATIC_INLINE void LL_I2C_DisableFastModePlus (I2C_TypeDef * I2Cx)

Function description

Disable I2C Fast Mode Plus (FMP = 0).

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Notes

- 20mA I/O drive disable

Reference Manual to LL API cross reference:

- CR1 FMP LL_I2C_DisableFastModePlus

LL_I2C_IsEnabledFastModePlus

Function name

__STATIC_INLINE uint32_t LL_I2C_IsEnabledFastModePlus (const I2C_TypeDef * I2Cx)

Function description

Check if the I2C Fast Mode Plus is enabled or disabled.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 FMP LL_I2C_IsEnabledFastModePlus

LL_I2C_EnableAutoClearFlag_ADDR

Function name

__STATIC_INLINE void LL_I2C_EnableAutoClearFlag_ADDR (I2C_TypeDef * I2Cx)

Function description

Enable automatic clear of ADDR flag.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 ADDRACLR LL_I2C_EnableAutoClearFlag_ADDR

LL_I2C_DisableAutoClearFlag_ADDR

Function name

__STATIC_INLINE void LL_I2C_DisableAutoClearFlag_ADDR (I2C_TypeDef * I2Cx)

Function description

Disable automatic clear of ADDR flag.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 ADDRACLR LL_I2C_DisableAutoClearFlag_ADDR

LL_I2C_IsEnabledAutoClearFlag_ADDR

Function name

__STATIC_INLINE uint32_t LL_I2C_IsEnabledAutoClearFlag_ADDR (const I2C_TypeDef * I2Cx)

Function description

Check if the automatic clear of ADDR flag is enabled or disabled.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 ADDRACLR LL_I2C_IsEnabledAutoClearFlag_ADDR

LL_I2C_EnableAutoClearFlag_STOP

Function name

__STATIC_INLINE void LL_I2C_EnableAutoClearFlag_STOP (I2C_TypeDef * I2Cx)

Function description

Enable automatic clear of STOP flag.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 STOPFACLR LL_I2C_EnableAutoClearFlag_STOP

LL_I2C_DisableAutoClearFlag_STOP

Function name

__STATIC_INLINE void LL_I2C_DisableAutoClearFlag_STOP (I2C_TypeDef * I2Cx)

Function description

Disable automatic clear of STOP flag.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 STOPFACLR LL_I2C_DisableAutoClearFlag_STOP

LL_I2C_IsEnabledAutoClearFlag_STOP

Function name

__STATIC_INLINE uint32_t LL_I2C_IsEnabledAutoClearFlag_STOP (const I2C_TypeDef * I2Cx)

Function description

Check if the automatic clear of STOP flag is enabled or disabled.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 STOPFACLR LL_I2C_IsEnabledAutoClearFlag_STOP

LL_I2C_SetMasterAddressingMode

Function name

__STATIC_INLINE void LL_I2C_SetMasterAddressingMode (I2C_TypeDef * I2Cx, uint32_t AddressingMode)

Function description

Configure the Master to operate in 7-bit or 10-bit addressing mode.

Parameters

- **I2Cx:** I2C Instance.
- **AddressingMode:** This parameter can be one of the following values:
  - LL_I2C_ADDRESSING_MODE_7BIT
  - LL_I2C_ADDRESSING_MODE_10BIT

Return values

- **None:**

Notes

- Changing this bit is not allowed, when the START bit is set.

Reference Manual to LL API cross reference:

- CR2 ADD10 LL_I2C_SetMasterAddressingMode

LL_I2C_GetMasterAddressingMode

Function name

__STATIC_INLINE uint32_t LL_I2C_GetMasterAddressingMode (const I2C_TypeDef * I2Cx)

Function description

Get the Master addressing mode.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **Returned:** value can be one of the following values:
  - LL_I2C_ADDRESSING_MODE_7BIT
  - LL_I2C_ADDRESSING_MODE_10BIT

Reference Manual to LL API cross reference:

- CR2 ADD10 LL_I2C_GetMasterAddressingMode

LL_I2C_SetOwnAddress1

Function name

__STATIC_INLINE void LL_I2C_SetOwnAddress1 (I2C_TypeDef * I2Cx, uint32_t OwnAddress1, uint32_t OwnAddrSize)

Function description

Set the Own Address1.

Parameters

- **I2Cx:** I2C Instance.
- **OwnAddress1:** This parameter must be a value between Min_Data=0 and Max_Data=0x3FF.
- **OwnAddrSize:** This parameter can be one of the following values:
  - LL_I2C_OWNADDRESS1_7BIT
  - LL_I2C_OWNADDRESS1_10BIT

Return values

- **None:**

Reference Manual to LL API cross reference:

- OAR1 OA1 LL_I2C_SetOwnAddress1
- OAR1 OA1MODE LL_I2C_SetOwnAddress1

LL_I2C_EnableOwnAddress1

Function name

__STATIC_INLINE void LL_I2C_EnableOwnAddress1 (I2C_TypeDef * I2Cx)

Function description

Enable acknowledge on Own Address1 match address.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Reference Manual to LL API cross reference:

- OAR1 OA1EN LL_I2C_EnableOwnAddress1

LL_I2C_DisableOwnAddress1

Function name

__STATIC_INLINE void LL_I2C_DisableOwnAddress1 (I2C_TypeDef * I2Cx)

Function description

Disable acknowledge on Own Address1 match address.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Reference Manual to LL API cross reference:

- OAR1 OA1EN LL_I2C_DisableOwnAddress1

LL_I2C_IsEnabledOwnAddress1

Function name

__STATIC_INLINE uint32_t LL_I2C_IsEnabledOwnAddress1 (const I2C_TypeDef * I2Cx)

Function description

Check if Own Address1 acknowledge is enabled or disabled.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- OAR1 OA1EN LL_I2C_IsEnabledOwnAddress1

LL_I2C_SetOwnAddress2

Function name

__STATIC_INLINE void LL_I2C_SetOwnAddress2 (I2C_TypeDef * I2Cx, uint32_t OwnAddress2, uint32_t OwnAddrMask)

Function description

Set the 7bits Own Address2.

Parameters

- **I2Cx:** I2C Instance.
- **OwnAddress2:** Value between Min_Data=0 and Max_Data=0x7F.
- **OwnAddrMask:** This parameter can be one of the following values:
  - LL_I2C_OWNADDRESS2_NOMASK
  - LL_I2C_OWNADDRESS2_MASK01
  - LL_I2C_OWNADDRESS2_MASK02
  - LL_I2C_OWNADDRESS2_MASK03
  - LL_I2C_OWNADDRESS2_MASK04
  - LL_I2C_OWNADDRESS2_MASK05
  - LL_I2C_OWNADDRESS2_MASK06
  - LL_I2C_OWNADDRESS2_MASK07

Return values

- **None:**

Notes

- This action has no effect if own address2 is enabled.

Reference Manual to LL API cross reference:

- OAR2 OA2 LL_I2C_SetOwnAddress2
- OAR2 OA2MSK LL_I2C_SetOwnAddress2

LL_I2C_EnableOwnAddress2

Function name

__STATIC_INLINE void LL_I2C_EnableOwnAddress2 (I2C_TypeDef * I2Cx)

Function description

Enable acknowledge on Own Address2 match address.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Reference Manual to LL API cross reference:

- OAR2 OA2EN LL_I2C_EnableOwnAddress2

LL_I2C_DisableOwnAddress2

Function name

__STATIC_INLINE void LL_I2C_DisableOwnAddress2 (I2C_TypeDef * I2Cx)

Function description

Disable acknowledge on Own Address2 match address.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Reference Manual to LL API cross reference:

- OAR2 OA2EN LL_I2C_DisableOwnAddress2

LL_I2C_IsEnabledOwnAddress2

Function name

__STATIC_INLINE uint32_t LL_I2C_IsEnabledOwnAddress2 (const I2C_TypeDef * I2Cx)

Function description

Check if Own Address1 acknowledge is enabled or disabled.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- OAR2 OA2EN LL_I2C_IsEnabledOwnAddress2

LL_I2C_SetTiming

Function name

__STATIC_INLINE void LL_I2C_SetTiming (I2C_TypeDef * I2Cx, uint32_t Timing)

Function description

Configure the SDA setup, hold time and the SCL high, low period.

Parameters

- **I2Cx:** I2C Instance.
- **Timing:** This parameter must be a value between Min_Data=0 and Max_Data=0xFFFFFFFF.

Return values

- **None:**

Notes

- This bit can only be programmed when the I2C is disabled (PE = 0).
- This parameter is computed with the STM32CubeMX Tool.

Reference Manual to LL API cross reference:

- TIMINGR TIMINGR LL_I2C_SetTiming

LL_I2C_GetTimingPrescaler

Function name

__STATIC_INLINE uint32_t LL_I2C_GetTimingPrescaler (const I2C_TypeDef * I2Cx)

Function description

Get the Timing Prescaler setting.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **Value:** between Min_Data=0x0 and Max_Data=0xF

Reference Manual to LL API cross reference:

- TIMINGR PRESC LL_I2C_GetTimingPrescaler

LL_I2C_GetClockLowPeriod

Function name

__STATIC_INLINE uint32_t LL_I2C_GetClockLowPeriod (const I2C_TypeDef * I2Cx)

Function description

Get the SCL low period setting.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **Value:** between Min_Data=0x00 and Max_Data=0xFF

Reference Manual to LL API cross reference:

- TIMINGR SCLL LL_I2C_GetClockLowPeriod

LL_I2C_GetClockHighPeriod

Function name

__STATIC_INLINE uint32_t LL_I2C_GetClockHighPeriod (const I2C_TypeDef * I2Cx)

Function description

Get the SCL high period setting.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **Value:** between Min_Data=0x00 and Max_Data=0xFF

Reference Manual to LL API cross reference:

- TIMINGR SCLH LL_I2C_GetClockHighPeriod

LL_I2C_GetDataHoldTime

Function name

__STATIC_INLINE uint32_t LL_I2C_GetDataHoldTime (const I2C_TypeDef * I2Cx)

Function description

Get the SDA hold time.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **Value:** between Min_Data=0x0 and Max_Data=0xF

Reference Manual to LL API cross reference:

- TIMINGR SDADEL LL_I2C_GetDataHoldTime

LL_I2C_GetDataSetupTime

Function name

__STATIC_INLINE uint32_t LL_I2C_GetDataSetupTime (const I2C_TypeDef * I2Cx)

Function description

Get the SDA setup time.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **Value:** between Min_Data=0x0 and Max_Data=0xF

Reference Manual to LL API cross reference:

- TIMINGR SCLDEL LL_I2C_GetDataSetupTime

LL_I2C_EnableIT_TX

Function name

__STATIC_INLINE void LL_I2C_EnableIT_TX (I2C_TypeDef * I2Cx)

Function description

Enable TXIS interrupt.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 TXIE LL_I2C_EnableIT_TX

LL_I2C_DisableIT_TX

Function name

__STATIC_INLINE void LL_I2C_DisableIT_TX (I2C_TypeDef * I2Cx)

Function description

Disable TXIS interrupt.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 TXIE LL_I2C_DisableIT_TX

LL_I2C_IsEnabledIT_TX

Function name

__STATIC_INLINE uint32_t LL_I2C_IsEnabledIT_TX (const I2C_TypeDef * I2Cx)

Function description

Check if the TXIS Interrupt is enabled or disabled.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 TXIE LL_I2C_IsEnabledIT_TX

LL_I2C_EnableIT_RX

Function name

__STATIC_INLINE void LL_I2C_EnableIT_RX (I2C_TypeDef * I2Cx)

Function description

Enable RXNE interrupt.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 RXIE LL_I2C_EnableIT_RX

LL_I2C_DisableIT_RX

Function name

__STATIC_INLINE void LL_I2C_DisableIT_RX (I2C_TypeDef * I2Cx)

Function description

Disable RXNE interrupt.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 RXIE LL_I2C_DisableIT_RX

LL_I2C_IsEnabledIT_RX

Function name

__STATIC_INLINE uint32_t LL_I2C_IsEnabledIT_RX (const I2C_TypeDef * I2Cx)

Function description

Check if the RXNE Interrupt is enabled or disabled.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 RXIE LL_I2C_IsEnabledIT_RX

LL_I2C_EnableIT_ADDR

Function name

__STATIC_INLINE void LL_I2C_EnableIT_ADDR (I2C_TypeDef * I2Cx)

Function description

Enable Address match interrupt (slave mode only).

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 ADDRIE LL_I2C_EnableIT_ADDR

LL_I2C_DisableIT_ADDR

Function name

__STATIC_INLINE void LL_I2C_DisableIT_ADDR (I2C_TypeDef * I2Cx)

Function description

Disable Address match interrupt (slave mode only).

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 ADDRIE LL_I2C_DisableIT_ADDR

LL_I2C_IsEnabledIT_ADDR

Function name

__STATIC_INLINE uint32_t LL_I2C_IsEnabledIT_ADDR (const I2C_TypeDef * I2Cx)

Function description

Check if Address match interrupt is enabled or disabled.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 ADDRIE LL_I2C_IsEnabledIT_ADDR

LL_I2C_EnableIT_NACK

Function name

__STATIC_INLINE void LL_I2C_EnableIT_NACK (I2C_TypeDef * I2Cx)

Function description

Enable Not acknowledge received interrupt.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 NACKIE LL_I2C_EnableIT_NACK

LL_I2C_DisableIT_NACK

Function name

__STATIC_INLINE void LL_I2C_DisableIT_NACK (I2C_TypeDef * I2Cx)

Function description

Disable Not acknowledge received interrupt.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 NACKIE LL_I2C_DisableIT_NACK

LL_I2C_IsEnabledIT_NACK

Function name

__STATIC_INLINE uint32_t LL_I2C_IsEnabledIT_NACK (const I2C_TypeDef * I2Cx)

Function description

Check if Not acknowledge received interrupt is enabled or disabled.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 NACKIE LL_I2C_IsEnabledIT_NACK

LL_I2C_EnableIT_STOP

Function name

__STATIC_INLINE void LL_I2C_EnableIT_STOP (I2C_TypeDef * I2Cx)

Function description

Enable STOP detection interrupt.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 STOPIE LL_I2C_EnableIT_STOP

LL_I2C_DisableIT_STOP

Function name

__STATIC_INLINE void LL_I2C_DisableIT_STOP (I2C_TypeDef * I2Cx)

Function description

Disable STOP detection interrupt.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 STOPIE LL_I2C_DisableIT_STOP

LL_I2C_IsEnabledIT_STOP

Function name

__STATIC_INLINE uint32_t LL_I2C_IsEnabledIT_STOP (const I2C_TypeDef * I2Cx)

Function description

Check if STOP detection interrupt is enabled or disabled.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 STOPIE LL_I2C_IsEnabledIT_STOP

LL_I2C_EnableIT_TC

Function name

__STATIC_INLINE void LL_I2C_EnableIT_TC (I2C_TypeDef * I2Cx)

Function description

Enable Transfer Complete interrupt.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Notes

- Any of these events will generate interrupt : Transfer Complete (TC) Transfer Complete Reload (TCR)

Reference Manual to LL API cross reference:

- CR1 TCIE LL_I2C_EnableIT_TC

LL_I2C_DisableIT_TC

Function name

__STATIC_INLINE void LL_I2C_DisableIT_TC (I2C_TypeDef * I2Cx)

Function description

Disable Transfer Complete interrupt.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Notes

- Any of these events will generate interrupt : Transfer Complete (TC) Transfer Complete Reload (TCR)

Reference Manual to LL API cross reference:

- CR1 TCIE LL_I2C_DisableIT_TC

LL_I2C_IsEnabledIT_TC

Function name

__STATIC_INLINE uint32_t LL_I2C_IsEnabledIT_TC (const I2C_TypeDef * I2Cx)

Function description

Check if Transfer Complete interrupt is enabled or disabled.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 TCIE LL_I2C_IsEnabledIT_TC

LL_I2C_EnableIT_ERR

Function name

__STATIC_INLINE void LL_I2C_EnableIT_ERR (I2C_TypeDef * I2Cx)

Function description

Enable Error interrupts.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Notes

- Any of these errors will generate interrupt : Arbitration Loss (ARLO) Bus Error detection (BERR) Overrun/ Underrun (OVR)

Reference Manual to LL API cross reference:

- CR1 ERRIE LL_I2C_EnableIT_ERR

LL_I2C_DisableIT_ERR

Function name

__STATIC_INLINE void LL_I2C_DisableIT_ERR (I2C_TypeDef * I2Cx)

Function description

Disable Error interrupts.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Notes

- Any of these errors will generate interrupt : Arbitration Loss (ARLO) Bus Error detection (BERR) Overrun/ Underrun (OVR)

Reference Manual to LL API cross reference:

- CR1 ERRIE LL_I2C_DisableIT_ERR

LL_I2C_IsEnabledIT_ERR

Function name

__STATIC_INLINE uint32_t LL_I2C_IsEnabledIT_ERR (const I2C_TypeDef * I2Cx)

Function description

Check if Error interrupts are enabled or disabled.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 ERRIE LL_I2C_IsEnabledIT_ERR

LL_I2C_IsActiveFlag_TXE

Function name

__STATIC_INLINE uint32_t LL_I2C_IsActiveFlag_TXE (const I2C_TypeDef * I2Cx)

Function description

Indicate the status of Transmit data register empty flag.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **State:** of bit (1 or 0).

Notes

- RESET: When next data is written in Transmit data register. SET: When Transmit data register is empty.

Reference Manual to LL API cross reference:

- ISR TXE LL_I2C_IsActiveFlag_TXE

LL_I2C_IsActiveFlag_TXIS

Function name

__STATIC_INLINE uint32_t LL_I2C_IsActiveFlag_TXIS (const I2C_TypeDef * I2Cx)

Function description

Indicate the status of Transmit interrupt flag.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **State:** of bit (1 or 0).

Notes

- RESET: When next data is written in Transmit data register. SET: When Transmit data register is empty.

Reference Manual to LL API cross reference:

- ISR TXIS LL_I2C_IsActiveFlag_TXIS

LL_I2C_IsActiveFlag_RXNE

Function name

__STATIC_INLINE uint32_t LL_I2C_IsActiveFlag_RXNE (const I2C_TypeDef * I2Cx)

Function description

Indicate the status of Receive data register not empty flag.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **State:** of bit (1 or 0).

Notes

- RESET: When Receive data register is read. SET: When the received data is copied in Receive data register.

Reference Manual to LL API cross reference:

- ISR RXNE LL_I2C_IsActiveFlag_RXNE

LL_I2C_IsActiveFlag_ADDR

Function name

__STATIC_INLINE uint32_t LL_I2C_IsActiveFlag_ADDR (const I2C_TypeDef * I2Cx)

Function description

Indicate the status of Address matched flag (slave mode).

Parameters

- **I2Cx:** I2C Instance.

Return values

- **State:** of bit (1 or 0).

Notes

- RESET: Clear default value. SET: When the received slave address matched with one of the enabled slave address.

Reference Manual to LL API cross reference:

- ISR ADDR LL_I2C_IsActiveFlag_ADDR

LL_I2C_IsActiveFlag_NACK

Function name

__STATIC_INLINE uint32_t LL_I2C_IsActiveFlag_NACK (const I2C_TypeDef * I2Cx)

Function description

Indicate the status of Not Acknowledge received flag.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **State:** of bit (1 or 0).

Notes

- RESET: Clear default value. SET: When a NACK is received after a byte transmission.

Reference Manual to LL API cross reference:

- ISR NACKF LL_I2C_IsActiveFlag_NACK

LL_I2C_IsActiveFlag_STOP

Function name

__STATIC_INLINE uint32_t LL_I2C_IsActiveFlag_STOP (const I2C_TypeDef * I2Cx)

Function description

Indicate the status of Stop detection flag.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **State:** of bit (1 or 0).

Notes

- RESET: Clear default value. SET: When a Stop condition is detected.

Reference Manual to LL API cross reference:

- ISR STOPF LL_I2C_IsActiveFlag_STOP

LL_I2C_IsActiveFlag_TC

Function name

__STATIC_INLINE uint32_t LL_I2C_IsActiveFlag_TC (const I2C_TypeDef * I2Cx)

Function description

Indicate the status of Transfer complete flag (master mode).

Parameters

- **I2Cx:** I2C Instance.

Return values

- **State:** of bit (1 or 0).

Notes

- RESET: Clear default value. SET: When RELOAD=0, AUTOEND=0 and NBYTES date have been transferred.

Reference Manual to LL API cross reference:

- ISR TC LL_I2C_IsActiveFlag_TC

LL_I2C_IsActiveFlag_TCR

Function name

__STATIC_INLINE uint32_t LL_I2C_IsActiveFlag_TCR (const I2C_TypeDef * I2Cx)

Function description

Indicate the status of Transfer complete flag (master mode).

Parameters

- **I2Cx:** I2C Instance.

Return values

- **State:** of bit (1 or 0).

Notes

- RESET: Clear default value. SET: When RELOAD=1 and NBYTES date have been transferred.

Reference Manual to LL API cross reference:

- ISR TCR LL_I2C_IsActiveFlag_TCR

LL_I2C_IsActiveFlag_BERR

Function name

__STATIC_INLINE uint32_t LL_I2C_IsActiveFlag_BERR (const I2C_TypeDef * I2Cx)

Function description

Indicate the status of Bus error flag.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **State:** of bit (1 or 0).

Notes

- RESET: Clear default value. SET: When a misplaced Start or Stop condition is detected.

Reference Manual to LL API cross reference:

- ISR BERR LL_I2C_IsActiveFlag_BERR

LL_I2C_IsActiveFlag_ARLO

Function name

__STATIC_INLINE uint32_t LL_I2C_IsActiveFlag_ARLO (const I2C_TypeDef * I2Cx)

Function description

Indicate the status of Arbitration lost flag.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **State:** of bit (1 or 0).

Notes

- RESET: Clear default value. SET: When arbitration lost.

Reference Manual to LL API cross reference:

- ISR ARLO LL_I2C_IsActiveFlag_ARLO

LL_I2C_IsActiveFlag_OVR

Function name

__STATIC_INLINE uint32_t LL_I2C_IsActiveFlag_OVR (const I2C_TypeDef * I2Cx)

Function description

Indicate the status of Overrun/Underrun flag (slave mode).

Parameters

- **I2Cx:** I2C Instance.

Return values

- **State:** of bit (1 or 0).

Notes

- RESET: Clear default value. SET: When an overrun/underrun error occurs (Clock Stretching Disabled).

Reference Manual to LL API cross reference:

- ISR OVR LL_I2C_IsActiveFlag_OVR

LL_I2C_IsActiveFlag_BUSY

Function name

__STATIC_INLINE uint32_t LL_I2C_IsActiveFlag_BUSY (const I2C_TypeDef * I2Cx)

Function description

Indicate the status of Bus Busy flag.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **State:** of bit (1 or 0).

Notes

- RESET: Clear default value. SET: When a Start condition is detected.

Reference Manual to LL API cross reference:

- ISR BUSY LL_I2C_IsActiveFlag_BUSY

LL_I2C_ClearFlag_ADDR

Function name

__STATIC_INLINE void LL_I2C_ClearFlag_ADDR (I2C_TypeDef * I2Cx)

Function description

Clear Address Matched flag.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR ADDRCF LL_I2C_ClearFlag_ADDR

LL_I2C_ClearFlag_NACK

Function name

__STATIC_INLINE void LL_I2C_ClearFlag_NACK (I2C_TypeDef * I2Cx)

Function description

Clear Not Acknowledge flag.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR NACKCF LL_I2C_ClearFlag_NACK

LL_I2C_ClearFlag_STOP

Function name

__STATIC_INLINE void LL_I2C_ClearFlag_STOP (I2C_TypeDef * I2Cx)

Function description

Clear Stop detection flag.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR STOPCF LL_I2C_ClearFlag_STOP

LL_I2C_ClearFlag_TXE

Function name

__STATIC_INLINE void LL_I2C_ClearFlag_TXE (I2C_TypeDef * I2Cx)

Function description

Clear Transmit data register empty flag (TXE).

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Notes

- This bit can be clear by software in order to flush the transmit data register (TXDR).

Reference Manual to LL API cross reference:

- ISR TXE LL_I2C_ClearFlag_TXE

LL_I2C_ClearFlag_BERR

Function name

__STATIC_INLINE void LL_I2C_ClearFlag_BERR (I2C_TypeDef * I2Cx)

Function description

Clear Bus error flag.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR BERRCF LL_I2C_ClearFlag_BERR

LL_I2C_ClearFlag_ARLO

Function name

__STATIC_INLINE void LL_I2C_ClearFlag_ARLO (I2C_TypeDef * I2Cx)

Function description

Clear Arbitration lost flag.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR ARLOCF LL_I2C_ClearFlag_ARLO

LL_I2C_ClearFlag_OVR

Function name

__STATIC_INLINE void LL_I2C_ClearFlag_OVR (I2C_TypeDef * I2Cx)

Function description

Clear Overrun/Underrun flag.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR OVRCF LL_I2C_ClearFlag_OVR

LL_I2C_EnableAutoEndMode

Function name

__STATIC_INLINE void LL_I2C_EnableAutoEndMode (I2C_TypeDef * I2Cx)

Function description

Enable automatic STOP condition generation (master mode).

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Notes

- Automatic end mode : a STOP condition is automatically sent when NBYTES data are transferred. This bit has no effect in slave mode or when RELOAD bit is set.

Reference Manual to LL API cross reference:

- CR2 AUTOEND LL_I2C_EnableAutoEndMode

LL_I2C_DisableAutoEndMode

Function name

__STATIC_INLINE void LL_I2C_DisableAutoEndMode (I2C_TypeDef * I2Cx)

Function description

Disable automatic STOP condition generation (master mode).

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Notes

- Software end mode : TC flag is set when NBYTES data are transferre, stretching SCL low.

Reference Manual to LL API cross reference:

- CR2 AUTOEND LL_I2C_DisableAutoEndMode

LL_I2C_IsEnabledAutoEndMode

Function name

__STATIC_INLINE uint32_t LL_I2C_IsEnabledAutoEndMode (const I2C_TypeDef * I2Cx)

Function description

Check if automatic STOP condition is enabled or disabled.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR2 AUTOEND LL_I2C_IsEnabledAutoEndMode

LL_I2C_EnableReloadMode

Function name

__STATIC_INLINE void LL_I2C_EnableReloadMode (I2C_TypeDef * I2Cx)

Function description

Enable reload mode (master mode).

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Notes

- The transfer is not completed after the NBYTES data transfer, NBYTES will be reloaded when TCR flag is set.

Reference Manual to LL API cross reference:

- CR2 RELOAD LL_I2C_EnableReloadMode

LL_I2C_DisableReloadMode

Function name

__STATIC_INLINE void LL_I2C_DisableReloadMode (I2C_TypeDef * I2Cx)

Function description

Disable reload mode (master mode).

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Notes

- The transfer is completed after the NBYTES data transfer(STOP or RESTART will follow).

Reference Manual to LL API cross reference:

- CR2 RELOAD LL_I2C_DisableReloadMode

LL_I2C_IsEnabledReloadMode

Function name

__STATIC_INLINE uint32_t LL_I2C_IsEnabledReloadMode (const I2C_TypeDef * I2Cx)

Function description

Check if reload mode is enabled or disabled.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR2 RELOAD LL_I2C_IsEnabledReloadMode

LL_I2C_SetTransferSize

Function name

__STATIC_INLINE void LL_I2C_SetTransferSize (I2C_TypeDef * I2Cx, uint32_t TransferSize)

Function description

Configure the number of bytes for transfer.

Parameters

- **I2Cx:** I2C Instance.
- **TransferSize:** This parameter must be a value between Min_Data=0x00 and Max_Data=0xFF.

Return values

- **None:**

Notes

- Changing these bits when START bit is set is not allowed.

Reference Manual to LL API cross reference:

- CR2 NBYTES LL_I2C_SetTransferSize

LL_I2C_GetTransferSize

Function name

__STATIC_INLINE uint32_t LL_I2C_GetTransferSize (const I2C_TypeDef * I2Cx)

Function description

Get the number of bytes configured for transfer.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **Value:** between Min_Data=0x0 and Max_Data=0xFF

Reference Manual to LL API cross reference:

- CR2 NBYTES LL_I2C_GetTransferSize

LL_I2C_AcknowledgeNextData

Function name

__STATIC_INLINE void LL_I2C_AcknowledgeNextData (I2C_TypeDef * I2Cx, uint32_t TypeAcknowledge)

Function description

Prepare the generation of a ACKnowledge or Non ACKnowledge condition after the address receive match code or next received byte.

Parameters

- **I2Cx:** I2C Instance.
- **TypeAcknowledge:** This parameter can be one of the following values:
  - LL_I2C_ACK
  - LL_I2C_NACK

Return values

- **None:**

Notes

- Usage in Slave mode only.

Reference Manual to LL API cross reference:

- CR2 NACK LL_I2C_AcknowledgeNextData

LL_I2C_GenerateStartCondition

Function name

__STATIC_INLINE void LL_I2C_GenerateStartCondition (I2C_TypeDef * I2Cx)

Function description

Generate a START or RESTART condition.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Notes

- The START bit can be set even if bus is BUSY or I2C is in slave mode. This action has no effect when RELOAD is set.

Reference Manual to LL API cross reference:

- CR2 START LL_I2C_GenerateStartCondition

LL_I2C_GenerateStopCondition

Function name

__STATIC_INLINE void LL_I2C_GenerateStopCondition (I2C_TypeDef * I2Cx)

Function description

Generate a STOP condition after the current byte transfer (master mode).

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR2 STOP LL_I2C_GenerateStopCondition

LL_I2C_EnableAuto10BitRead

Function name

__STATIC_INLINE void LL_I2C_EnableAuto10BitRead (I2C_TypeDef * I2Cx)

Function description

Enable automatic RESTART Read request condition for 10bit address header (master mode).

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Notes

- The master sends the complete 10bit slave address read sequence : Start + 2 bytes 10bit address in Write direction + Restart + first 7 bits of 10bit address in Read direction.

Reference Manual to LL API cross reference:

- CR2 HEAD10R LL_I2C_EnableAuto10BitRead

LL_I2C_DisableAuto10BitRead

Function name

__STATIC_INLINE void LL_I2C_DisableAuto10BitRead (I2C_TypeDef * I2Cx)

Function description

Disable automatic RESTART Read request condition for 10bit address header (master mode).

Parameters

- **I2Cx:** I2C Instance.

Return values

- **None:**

Notes

- The master only sends the first 7 bits of 10bit address in Read direction.

Reference Manual to LL API cross reference:

- CR2 HEAD10R LL_I2C_DisableAuto10BitRead

LL_I2C_IsEnabledAuto10BitRead

Function name

__STATIC_INLINE uint32_t LL_I2C_IsEnabledAuto10BitRead (const I2C_TypeDef * I2Cx)

Function description

Check if automatic RESTART Read request condition for 10bit address header is enabled or disabled.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR2 HEAD10R LL_I2C_IsEnabledAuto10BitRead

LL_I2C_SetTransferRequest

Function name

__STATIC_INLINE void LL_I2C_SetTransferRequest (I2C_TypeDef * I2Cx, uint32_t TransferRequest)

Function description

Configure the transfer direction (master mode).

Parameters

- **I2Cx:** I2C Instance.
- **TransferRequest:** This parameter can be one of the following values:
  - LL_I2C_REQUEST_WRITE
  - LL_I2C_REQUEST_READ

Return values

- **None:**

Notes

- Changing these bits when START bit is set is not allowed.

Reference Manual to LL API cross reference:

- CR2 RD_WRN LL_I2C_SetTransferRequest

LL_I2C_GetTransferRequest

Function name

__STATIC_INLINE uint32_t LL_I2C_GetTransferRequest (const I2C_TypeDef * I2Cx)

Function description

Get the transfer direction requested (master mode).

Parameters

- **I2Cx:** I2C Instance.

Return values

- **Returned:** value can be one of the following values:
  - LL_I2C_REQUEST_WRITE
  - LL_I2C_REQUEST_READ

Reference Manual to LL API cross reference:

- CR2 RD_WRN LL_I2C_GetTransferRequest

LL_I2C_SetSlaveAddr

Function name

__STATIC_INLINE void LL_I2C_SetSlaveAddr (I2C_TypeDef * I2Cx, uint32_t SlaveAddr)

Function description

Configure the slave address for transfer (master mode).

Parameters

- **I2Cx:** I2C Instance.
- **SlaveAddr:** This parameter must be a value between Min_Data=0x00 and Max_Data=0x3F.

Return values

- **None:**

Notes

- Changing these bits when START bit is set is not allowed.

Reference Manual to LL API cross reference:

- CR2 SADD LL_I2C_SetSlaveAddr

LL_I2C_GetSlaveAddr

Function name

__STATIC_INLINE uint32_t LL_I2C_GetSlaveAddr (const I2C_TypeDef * I2Cx)

Function description

Get the slave address programmed for transfer.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **Value:** between Min_Data=0x0 and Max_Data=0x3F

Reference Manual to LL API cross reference:

- CR2 SADD LL_I2C_GetSlaveAddr

LL_I2C_HandleTransfer

Function name

__STATIC_INLINE void LL_I2C_HandleTransfer (I2C_TypeDef * I2Cx, uint32_t SlaveAddr, uint32_t SlaveAddrSize, uint32_t TransferSize, uint32_t EndMode, uint32_t Request)

Function description

Handles I2Cx communication when starting transfer or during transfer (TC or TCR flag are set).

Parameters

- **I2Cx:** I2C Instance.
- **SlaveAddr:** Specifies the slave address to be programmed.
- **SlaveAddrSize:** This parameter can be one of the following values:
  - LL_I2C_ADDRSLAVE_7BIT
  - LL_I2C_ADDRSLAVE_10BIT
- **TransferSize:** Specifies the number of bytes to be programmed. This parameter must be a value between Min_Data=0 and Max_Data=255.
- **EndMode:** This parameter can be one of the following values:
  - LL_I2C_MODE_RELOAD
  - LL_I2C_MODE_AUTOEND
  - LL_I2C_MODE_SOFTEND
- **Request:** This parameter can be one of the following values:
  - LL_I2C_GENERATE_NOSTARTSTOP
  - LL_I2C_GENERATE_STOP
  - LL_I2C_GENERATE_START_READ
  - LL_I2C_GENERATE_START_WRITE
  - LL_I2C_GENERATE_RESTART_7BIT_READ
  - LL_I2C_GENERATE_RESTART_7BIT_WRITE
  - LL_I2C_GENERATE_RESTART_10BIT_READ
  - LL_I2C_GENERATE_RESTART_10BIT_WRITE

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR2 SADD LL_I2C_HandleTransfer
- CR2 ADD10 LL_I2C_HandleTransfer
- CR2 RD_WRN LL_I2C_HandleTransfer
- CR2 START LL_I2C_HandleTransfer
- CR2 STOP LL_I2C_HandleTransfer
- CR2 RELOAD LL_I2C_HandleTransfer
- CR2 NBYTES LL_I2C_HandleTransfer
- CR2 AUTOEND LL_I2C_HandleTransfer
- CR2 HEAD10R LL_I2C_HandleTransfer

LL_I2C_GetTransferDirection

Function name

__STATIC_INLINE uint32_t LL_I2C_GetTransferDirection (const I2C_TypeDef * I2Cx)

Function description

Indicate the value of transfer direction (slave mode).

Parameters

- **I2Cx:** I2C Instance.

Return values

- **Returned:** value can be one of the following values:
  - LL_I2C_DIRECTION_WRITE
  - LL_I2C_DIRECTION_READ

Notes

- RESET: Write transfer, Slave enters in receiver mode. SET: Read transfer, Slave enters in transmitter mode.

Reference Manual to LL API cross reference:

- ISR DIR LL_I2C_GetTransferDirection

LL_I2C_GetAddressMatchCode

Function name

__STATIC_INLINE uint32_t LL_I2C_GetAddressMatchCode (const I2C_TypeDef * I2Cx)

Function description

Return the slave matched address.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **Value:** between Min_Data=0x00 and Max_Data=0x3F

Reference Manual to LL API cross reference:

- ISR ADDCODE LL_I2C_GetAddressMatchCode

LL_I2C_ReceiveData8

Function name

__STATIC_INLINE uint8_t LL_I2C_ReceiveData8 (const I2C_TypeDef * I2Cx)

Function description

Read Receive Data register.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **Value:** between Min_Data=0x00 and Max_Data=0xFF

Reference Manual to LL API cross reference:

- RXDR RXDATA LL_I2C_ReceiveData8

LL_I2C_TransmitData8

Function name

__STATIC_INLINE void LL_I2C_TransmitData8 (I2C_TypeDef * I2Cx, uint8_t Data)

Function description

Write in Transmit Data Register .

Parameters

- **I2Cx:** I2C Instance.
- **Data:** Value between Min_Data=0x00 and Max_Data=0xFF

Return values

- **None:**

Reference Manual to LL API cross reference:

- TXDR TXDATA LL_I2C_TransmitData8

LL_I2C_Init

Function name

ErrorStatus LL_I2C_Init (I2C_TypeDef * I2Cx, const LL_I2C_InitTypeDef * I2C_InitStruct)

Function description

Initialize the I2C registers according to the specified parameters in I2C_InitStruct.

Parameters

- **I2Cx:** I2C Instance.
- **I2C_InitStruct:** pointer to a LL_I2C_InitTypeDef structure.

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: I2C registers are initialized
  - ERROR: Not applicable

LL_I2C_DeInit

Function name

ErrorStatus LL_I2C_DeInit (const I2C_TypeDef * I2Cx)

Function description

De-initialize the I2C registers to their default reset values.

Parameters

- **I2Cx:** I2C Instance.

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: I2C registers are de-initialized
  - ERROR: I2C registers are not de-initialized

LL_I2C_StructInit

Function name

void LL_I2C_StructInit (LL_I2C_InitTypeDef * I2C_InitStruct)

Function description

Set each LL_I2C_InitTypeDef field to default value.

Parameters

- **I2C_InitStruct:** Pointer to a LL_I2C_InitTypeDef structure.

Return values

- **None:**

66.3 I2C Firmware driver defines

The following section lists the various define and macros of the module.

66.3.1 I2C

I2C

Master Addressing Mode

LL_I2C_ADDRESSING_MODE_7BIT

Master operates in 7-bit addressing mode.

LL_I2C_ADDRESSING_MODE_10BIT

Master operates in 10-bit addressing mode.

Slave Address Length

LL_I2C_ADDRSLAVE_7BIT

Slave Address in 7-bit.

LL_I2C_ADDRSLAVE_10BIT

Slave Address in 10-bit.

Analog Filter Selection

LL_I2C_ANALOGFILTER_ENABLE

Analog filter is enabled.

LL_I2C_ANALOGFILTER_DISABLE

Analog filter is disabled.

Clear Flags Defines

LL_I2C_ICR_ADDRCF

Address Matched flag

LL_I2C_ICR_NACKCF

Not Acknowledge flag

LL_I2C_ICR_STOPCF

Stop detection flag

LL_I2C_ICR_BERRCF

Bus error flag

LL_I2C_ICR_ARLOCF

Arbitration Lost flag

LL_I2C_ICR_OVRCF

Overrun/Underrun flag

Read Write Direction

LL_I2C_DIRECTION_WRITE

Write transfer request by master, slave enters receiver mode.

LL_I2C_DIRECTION_READ

Read transfer request by master, slave enters transmitter mode.

DMA Register Data

LL_I2C_DMA_REG_DATA_TRANSMIT

Get address of data register used for transmission

LL_I2C_DMA_REG_DATA_RECEIVE

Get address of data register used for reception

Start And Stop Generation

LL_I2C_GENERATE_NOSTARTSTOP

Don't Generate Stop and Start condition.

LL_I2C_GENERATE_STOP

Generate Stop condition (Size should be set to 0).

LL_I2C_GENERATE_START_READ

Generate Start for read request.

LL_I2C_GENERATE_START_WRITE

Generate Start for write request.

LL_I2C_GENERATE_RESTART_7BIT_READ

Generate Restart for read request, slave 7Bit address.

LL_I2C_GENERATE_RESTART_7BIT_WRITE

Generate Restart for write request, slave 7Bit address.

LL_I2C_GENERATE_RESTART_10BIT_READ

Generate Restart for read request, slave 10Bit address.

LL_I2C_GENERATE_RESTART_10BIT_WRITE

Generate Restart for write request, slave 10Bit address.

Get Flags Defines

LL_I2C_ISR_TXE

Transmit data register empty

LL_I2C_ISR_TXIS

Transmit interrupt status

LL_I2C_ISR_RXNE

Receive data register not empty

LL_I2C_ISR_ADDR

Address matched (slave mode)

LL_I2C_ISR_NACKF

Not Acknowledge received flag

LL_I2C_ISR_STOPF

Stop detection flag

LL_I2C_ISR_TC

Transfer Complete (master mode)

LL_I2C_ISR_TCR

Transfer Complete Reload

LL_I2C_ISR_BERR

Bus error

LL_I2C_ISR_ARLO

Arbitration lost

LL_I2C_ISR_OVR

Overrun/Underrun (slave mode)

LL_I2C_ISR_BUSY

Bus busy

Acknowledge Generation

LL_I2C_ACK

ACK is sent after current received byte.

LL_I2C_NACK

NACK is sent after current received byte.

IT Defines

LL_I2C_CR1_TXIE

TX Interrupt enable

LL_I2C_CR1_RXIE

RX Interrupt enable

LL_I2C_CR1_ADDRIE

Address match Interrupt enable (slave only)

LL_I2C_CR1_NACKIE

Not acknowledge received Interrupt enable

LL_I2C_CR1_STOPIE

STOP detection Interrupt enable

LL_I2C_CR1_TCIE

Transfer Complete interrupt enable

LL_I2C_CR1_ERRIE

Error interrupts enable

Transfer End Mode

LL_I2C_MODE_RELOAD

Enable I2C Reload mode.

LL_I2C_MODE_AUTOEND

Enable I2C Automatic end mode with no HW PEC comparison.

LL_I2C_MODE_SOFTEND

Enable I2C Software end mode with no HW PEC comparison.

Own Address 1 Length

LL_I2C_OWNADDRESS1_7BIT

Own address 1 is a 7-bit address.

LL_I2C_OWNADDRESS1_10BIT

Own address 1 is a 10-bit address.

Own Address 2 Masks

LL_I2C_OWNADDRESS2_NOMASK

Own Address2 No mask.

LL_I2C_OWNADDRESS2_MASK01

Only Address2 bits[7:2] are compared.

LL_I2C_OWNADDRESS2_MASK02

Only Address2 bits[7:3] are compared.

LL_I2C_OWNADDRESS2_MASK03

Only Address2 bits[7:4] are compared.

LL_I2C_OWNADDRESS2_MASK04

Only Address2 bits[7:5] are compared.

LL_I2C_OWNADDRESS2_MASK05

Only Address2 bits[7:6] are compared.

LL_I2C_OWNADDRESS2_MASK06

Only Address2 bits[7] are compared.

LL_I2C_OWNADDRESS2_MASK07

No comparison is done. All Address2 are acknowledged.

Transfer Request Direction

LL_I2C_REQUEST_WRITE

Master request a write transfer.

LL_I2C_REQUEST_READ

Master request a read transfer.

Convert SDA SCL timings

__LL_I2C_CONVERT_TIMINGS

Description:

- Configure the SDA setup, hold time and the SCL high, low period.

Parameters:

- __PRESCALER__: This parameter must be a value between Min_Data=0 and Max_Data=0xF.
- __SETUP_TIME__: This parameter must be a value between Min_Data=0 and Max_Data=0xF. (tscldel = (SCLDEL+1)xtpresc)
- __HOLD_TIME__: This parameter must be a value between Min_Data=0 and Max_Data=0xF. (tsdadel = SDADELxtpresc)
- __SCLH_PERIOD__: This parameter must be a value between Min_Data=0 and Max_Data=0xFF. (tsclh = (SCLH+1)xtpresc)
- __SCLL_PERIOD__: This parameter must be a value between Min_Data=0 and Max_Data=0xFF. (tscll = (SCLL+1)xtpresc)

Return value:

- Value: between Min_Data=0 and Max_Data=0xFFFFFFFF

Common Write and read registers Macros

LL_I2C_WriteReg

Description:

- Write a value in I2C register.

Parameters:

- __INSTANCE__: I2C Instance
- __REG__: Register to be written
- __VALUE__: Value to be written in the register

Return value:

- None

LL_I2C_ReadReg

Description:

- Read a value in I2C register.

Parameters:

- __INSTANCE__: I2C Instance
- __REG__: Register to be read

Return value:

- Register: value

67 LL IWDG Generic Driver

67.1 IWDG Firmware driver API description

The following section lists the various functions of the IWDG library.

67.1.1 Detailed description of functions

LL_IWDG_Enable

Function name

__STATIC_INLINE void LL_IWDG_Enable (IWDG_TypeDef * IWDGx)

Function description

Start the Independent Watchdog.

Parameters

- **IWDGx:** IWDG Instance

Return values

- **None:**

Notes

- Except if the hardware watchdog option is selected

Reference Manual to LL API cross reference:

- KR KEY LL_IWDG_Enable

LL_IWDG_ReloadCounter

Function name

__STATIC_INLINE void LL_IWDG_ReloadCounter (IWDG_TypeDef * IWDGx)

Function description

Reloads IWDG counter with value defined in the reload register.

Parameters

- **IWDGx:** IWDG Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- KR KEY LL_IWDG_ReloadCounter

LL_IWDG_EnableWriteAccess

Function name

__STATIC_INLINE void LL_IWDG_EnableWriteAccess (IWDG_TypeDef * IWDGx)

Function description

Enable write access to IWDG_PR, IWDG_RLR and IWDG_WINR registers.

Parameters

- **IWDGx:** IWDG Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- KR KEY LL_IWDG_EnableWriteAccess

LL_IWDG_DisableWriteAccess

Function name

__STATIC_INLINE void LL_IWDG_DisableWriteAccess (IWDG_TypeDef * IWDGx)

Function description

Disable write access to IWDG_PR, IWDG_RLR and IWDG_WINR registers.

Parameters

- **IWDGx:** IWDG Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- KR KEY LL_IWDG_DisableWriteAccess

LL_IWDG_SetPrescaler

Function name

__STATIC_INLINE void LL_IWDG_SetPrescaler (IWDG_TypeDef * IWDGx, uint32_t Prescaler)

Function description

Select the prescaler of the IWDG.

Parameters

- **IWDGx:** IWDG Instance
- **Prescaler:** This parameter can be one of the following values:
  - LL_IWDG_PRESCALER_4
  - LL_IWDG_PRESCALER_8
  - LL_IWDG_PRESCALER_16
  - LL_IWDG_PRESCALER_32
  - LL_IWDG_PRESCALER_64
  - LL_IWDG_PRESCALER_128
  - LL_IWDG_PRESCALER_256
  - LL_IWDG_PRESCALER_512
  - LL_IWDG_PRESCALER_1024

Return values

- **None:**

Reference Manual to LL API cross reference:

- PR PR LL_IWDG_SetPrescaler

LL_IWDG_GetPrescaler

Function name

__STATIC_INLINE uint32_t LL_IWDG_GetPrescaler (const IWDG_TypeDef * IWDGx)

Function description

Get the selected prescaler of the IWDG.

Parameters

- **IWDGx:** IWDG Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_IWDG_PRESCALER_4
  - LL_IWDG_PRESCALER_8
  - LL_IWDG_PRESCALER_16
  - LL_IWDG_PRESCALER_32
  - LL_IWDG_PRESCALER_64
  - LL_IWDG_PRESCALER_128
  - LL_IWDG_PRESCALER_256
  - LL_IWDG_PRESCALER_512
  - LL_IWDG_PRESCALER_1024

Reference Manual to LL API cross reference:

- PR PR LL_IWDG_GetPrescaler

LL_IWDG_SetReloadCounter

Function name

__STATIC_INLINE void LL_IWDG_SetReloadCounter (IWDG_TypeDef * IWDGx, uint32_t Counter)

Function description

Specify the IWDG down-counter reload value.

Parameters

- **IWDGx:** IWDG Instance
- **Counter:** Value between Min_Data=0 and Max_Data=0x0FFF

Return values

- **None:**

Reference Manual to LL API cross reference:

- RLR RL LL_IWDG_SetReloadCounter

LL_IWDG_GetReloadCounter

Function name

__STATIC_INLINE uint32_t LL_IWDG_GetReloadCounter (const IWDG_TypeDef * IWDGx)

Function description

Get the specified IWDG down-counter reload value.

Parameters

- **IWDGx:** IWDG Instance

Return values

- **Value:** between Min_Data=0 and Max_Data=0x0FFF

Reference Manual to LL API cross reference:

- RLR RL LL_IWDG_GetReloadCounter

LL_IWDG_SetWindow

Function name

__STATIC_INLINE void LL_IWDG_SetWindow (IWDG_TypeDef * IWDGx, uint32_t Window)

Function description

Specify high limit of the window value to be compared to the down-counter.

Parameters

- **IWDGx:** IWDG Instance
- **Window:** Value between Min_Data=0 and Max_Data=0x0FFF

Return values

- **None:**

Reference Manual to LL API cross reference:

- WINR WIN LL_IWDG_SetWindow

LL_IWDG_GetWindow

Function name

__STATIC_INLINE uint32_t LL_IWDG_GetWindow (const IWDG_TypeDef * IWDGx)

Function description

Get the high limit of the window value specified.

Parameters

- **IWDGx:** IWDG Instance

Return values

- **Value:** between Min_Data=0 and Max_Data=0x0FFF

Reference Manual to LL API cross reference:

- WINR WIN LL_IWDG_GetWindow

LL_IWDG_SetEwiTime

Function name

__STATIC_INLINE void LL_IWDG_SetEwiTime (IWDG_TypeDef * IWDGx, uint32_t Time)

Function description

Specify comparator value that will be used to trig Early Wakeup interrupt.

Parameters

- **IWDGx:** IWDG Instance
- **Time:** Value between Min_Data=0 and Max_Data=0x0FFF

Return values

- **None:**

Reference Manual to LL API cross reference:

- EWCR EWIT LL_IWDG_SetEwiTime

LL_IWDG_GetEwiTime

Function name

__STATIC_INLINE uint32_t LL_IWDG_GetEwiTime (const IWDG_TypeDef * IWDGx)

Function description

Get the Early Wakeup interrupt comparator value.

Parameters

- **IWDGx:** IWDG Instance

Return values

- **Value:** between Min_Data=0 and Max_Data=0x0FFF

Reference Manual to LL API cross reference:

- EWCR EWIT LL_IWDG_GetEwiTime

LL_IWDG_EnableIT_EWI

Function name

__STATIC_INLINE void LL_IWDG_EnableIT_EWI (IWDG_TypeDef * IWDGx)

Function description

Enable Early wakeup interrupt.

Parameters

- **IWDGx:** IWDG Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- EWCR EWIE LL_IWDG_EnableIT_EWI

LL_IWDG_DisableIT_EWI

Function name

__STATIC_INLINE void LL_IWDG_DisableIT_EWI (IWDG_TypeDef * IWDGx)

Function description

Disable Early wakeup interrupt.

Parameters

- **IWDGx:** IWDG Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- EWCR EWIE LL_IWDG_DisableIT_EWI

LL_IWDG_IsEnabledIT_EWI

Function name

__STATIC_INLINE uint32_t LL_IWDG_IsEnabledIT_EWI (const IWDG_TypeDef * IWDGx)

Function description

Indicates whether Early wakeup interrupt is enable.

Parameters

- **IWDGx:** IWDG Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- EWCR EWIE LL_IWDG_IsEnabledIT_EWI

LL_IWDG_IsActiveFlag_PVU

Function name

__STATIC_INLINE uint32_t LL_IWDG_IsActiveFlag_PVU (const IWDG_TypeDef * IWDGx)

Function description

Check if flag Prescaler Value Update is set or not.

Parameters

- **IWDGx:** IWDG Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR PVU LL_IWDG_IsActiveFlag_PVU

LL_IWDG_IsActiveFlag_RVU

Function name

__STATIC_INLINE uint32_t LL_IWDG_IsActiveFlag_RVU (const IWDG_TypeDef * IWDGx)

Function description

Check if flag Reload Value Update is set or not.

Parameters

- **IWDGx:** IWDG Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR RVU LL_IWDG_IsActiveFlag_RVU

LL_IWDG_IsActiveFlag_WVU

Function name

__STATIC_INLINE uint32_t LL_IWDG_IsActiveFlag_WVU (const IWDG_TypeDef * IWDGx)

Function description

Check if flag Window Value Update is set or not.

Parameters

- **IWDGx:** IWDG Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR WVU LL_IWDG_IsActiveFlag_WVU

LL_IWDG_IsActiveFlag_EWU

Function name

__STATIC_INLINE uint32_t LL_IWDG_IsActiveFlag_EWU (const IWDG_TypeDef * IWDGx)

Function description

Check if flag EWI Value Update is set or not.

Parameters

- **IWDGx:** IWDG Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR EVU LL_IWDG_IsActiveFlag_EWU

LL_IWDG_IsReady

Function name

__STATIC_INLINE uint32_t LL_IWDG_IsReady (const IWDG_TypeDef * IWDGx)

Function description

Check if all flags Prescaler, Reload, Window & Early Interrupt Value Update are reset or not.

Parameters

- **IWDGx:** IWDG Instance

Return values

- **State:** of bits (1 or 0).

Reference Manual to LL API cross reference:

- SR PVU LL_IWDG_IsReady
- SR RVU LL_IWDG_IsReady
- SR WVU LL_IWDG_IsReady
- SR EWU LL_IWDG_IsReady

LL_IWDG_IsActiveFlag_ONF

Function name

__STATIC_INLINE uint32_t LL_IWDG_IsActiveFlag_ONF (const IWDG_TypeDef * IWDGx)

Function description

Check if IWDG has been started or not.

Parameters

- **IWDGx:** IWDG Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR ONF LL_IWDG_IsActiveFlag_ONF

LL_IWDG_IsActiveFlag_EWIF

Function name

__STATIC_INLINE uint32_t LL_IWDG_IsActiveFlag_EWIF (const IWDG_TypeDef * IWDGx)

Function description

Check if Early Wakeup interrupt flag is set or not.

Parameters

- **IWDGx:** IWDG Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR EWIF LL_IWDG_IsActiveFlag_EWIF

LL_IWDG_ClearFlag_EWIF

Function name

__STATIC_INLINE void LL_IWDG_ClearFlag_EWIF (IWDG_TypeDef * IWDGx)

Function description

Clear the Early Wakeup interrupt flag.

Parameters

- **IWDGx:** IWDG Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- EWCR EWIC LL_IWDG_ClearFlag_EWIF

67.2 IWDG Firmware driver defines

The following section lists the various define and macros of the module.

67.2.1 IWDG

IWDG

Get Flags Defines

LL_IWDG_SR_PVU

Watchdog prescaler value update

LL_IWDG_SR_RVU

Watchdog counter reload value update

LL_IWDG_SR_WVU

Watchdog counter window value update

Prescaler Divider

LL_IWDG_PRESCALER_4

Divider by 4

LL_IWDG_PRESCALER_8

Divider by 8

LL_IWDG_PRESCALER_16

Divider by 16

LL_IWDG_PRESCALER_32

Divider by 32

LL_IWDG_PRESCALER_64

Divider by 64

LL_IWDG_PRESCALER_128

Divider by 128

LL_IWDG_PRESCALER_256

Divider by 256

LL_IWDG_PRESCALER_512

Divider by 512

LL_IWDG_PRESCALER_1024

Divider by 1024

Common Write and read registers Macros

LL_IWDG_WriteReg

Description:

- Write a value in IWDG register.

Parameters:

- __INSTANCE__: IWDG Instance
- __REG__: Register to be written
- __VALUE__: Value to be written in the register

Return value:

- None

LL_IWDG_ReadReg

Description:

- Read a value in IWDG register.

Parameters:

- __INSTANCE__: IWDG Instance
- __REG__: Register to be read

Return value:

- Register: value

68 LL LPTIM Generic Driver

68.1 LPTIM Firmware driver registers structures

68.1.1 LL_LPTIM_InitTypeDef

LL_LPTIM_InitTypeDef is defined in the stm32u0xx_ll_lptim.h

Data Fields

- ***uint32_t ClockSource***
- ***uint32_t Prescaler***
- ***uint32_t Waveform***

Field Documentation

- ***uint32_t LL_LPTIM_InitTypeDef::ClockSource***
  Specifies the source of the clock used by the LPTIM instance. This parameter can be a value of ***LPTIM_LL_EC_CLK_SOURCE***.This feature can be modified afterwards using unitary function **LL_LPTIM_SetClockSource()**.
- ***uint32_t LL_LPTIM_InitTypeDef::Prescaler***
  Specifies the prescaler division ratio. This parameter can be a value of ***LPTIM_LL_EC_PRESCALER***.This feature can be modified afterwards using using unitary function **LL_LPTIM_SetPrescaler()**.
- ***uint32_t LL_LPTIM_InitTypeDef::Waveform***
  Specifies the waveform shape. This parameter can be a value of ***LPTIM_LL_EC_OUTPUT_WAVEFORM***.This feature can be modified afterwards using unitary function **LL_LPTIM_SetWaveform()**.

68.2 LPTIM Firmware driver API description

The following section lists the various functions of the LPTIM library.

68.2.1 Detailed description of functions

LL_LPTIM_DeInit

Function name

ErrorStatus LL_LPTIM_DeInit (const LPTIM_TypeDef * LPTIMx)

Function description

Set LPTIMx registers to their reset values.

Parameters

- **LPTIMx:** LP Timer instance

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: LPTIMx registers are de-initialized
  - ERROR: invalid LPTIMx instance

LL_LPTIM_StructInit

Function name

void LL_LPTIM_StructInit (LL_LPTIM_InitTypeDef * LPTIM_InitStruct)

Function description

Set each fields of the LPTIM_InitStruct structure to its default value.

Parameters

- **LPTIM_InitStruct:** pointer to a LL_LPTIM_InitTypeDef structure

Return values

- **None:**

LL_LPTIM_Init

Function name

ErrorStatus LL_LPTIM_Init (LPTIM_TypeDef * LPTIMx, const LL_LPTIM_InitTypeDef * LPTIM_InitStruct)

Function description

Configure the LPTIMx peripheral according to the specified parameters.

Parameters

- **LPTIMx:** LP Timer Instance
- **LPTIM_InitStruct:** pointer to a LL_LPTIM_InitTypeDef structure

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: LPTIMx instance has been initialized
  - ERROR: LPTIMx instance hasn't been initialized

Notes

- LL_LPTIM_Init can only be called when the LPTIM instance is disabled.
- LPTIMx can be disabled using unitary function LL_LPTIM_Disable().

LL_LPTIM_Enable

Function name

__STATIC_INLINE void LL_LPTIM_Enable (LPTIM_TypeDef * LPTIMx)

Function description

Enable the LPTIM instance.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Notes

- After setting the ENABLE bit, a delay of two counter clock is needed before the LPTIM instance is actually enabled.

Reference Manual to LL API cross reference:

- CR ENABLE LL_LPTIM_Enable

LL_LPTIM_Disable

Function name

__STATIC_INLINE void LL_LPTIM_Disable (LPTIM_TypeDef * LPTIMx)

Function description

Disable the LPTIM instance.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR ENABLE LL_LPTIM_Disable

LL_LPTIM_IsEnabled

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsEnabled (const LPTIM_TypeDef * LPTIMx)

Function description

Indicates whether the LPTIM instance is enabled.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR ENABLE LL_LPTIM_IsEnabled

LL_LPTIM_StartCounter

Function name

__STATIC_INLINE void LL_LPTIM_StartCounter (LPTIM_TypeDef * LPTIMx, uint32_t OperatingMode)

Function description

Starts the LPTIM counter in the desired mode.

Parameters

- **LPTIMx:** Low-Power Timer instance
- **OperatingMode:** This parameter can be one of the following values:
  - LL_LPTIM_OPERATING_MODE_CONTINUOUS
  - LL_LPTIM_OPERATING_MODE_ONESHOT

Return values

- **None:**

Notes

- LPTIM instance must be enabled before starting the counter.
- It is possible to change on the fly from One Shot mode to Continuous mode.

Reference Manual to LL API cross reference:

- CR CNTSTRT LL_LPTIM_StartCounter
- CR SNGSTRT LL_LPTIM_StartCounter

LL_LPTIM_EnableResetAfterRead

Function name

__STATIC_INLINE void LL_LPTIM_EnableResetAfterRead (LPTIM_TypeDef * LPTIMx)

Function description

Enable reset after read.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Notes

- After calling this function any read access to LPTIM_CNT register will asynchronously reset the LPTIM_CNT register content.

Reference Manual to LL API cross reference:

- CR RSTARE LL_LPTIM_EnableResetAfterRead

LL_LPTIM_DisableResetAfterRead

Function name

__STATIC_INLINE void LL_LPTIM_DisableResetAfterRead (LPTIM_TypeDef * LPTIMx)

Function description

Disable reset after read.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR RSTARE LL_LPTIM_DisableResetAfterRead

LL_LPTIM_IsEnabledResetAfterRead

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsEnabledResetAfterRead (const LPTIM_TypeDef * LPTIMx)

Function description

Indicate whether the reset after read feature is enabled.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR RSTARE LL_LPTIM_IsEnabledResetAfterRead

LL_LPTIM_ResetCounter

Function name

__STATIC_INLINE void LL_LPTIM_ResetCounter (LPTIM_TypeDef * LPTIMx)

Function description

Reset of the LPTIM_CNT counter register (synchronous).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Notes

- Due to the synchronous nature of this reset, it only takes place after a synchronization delay of 3 LPTIM core clock cycles (LPTIM core clock may be different from APB clock).
- COUNTRST is automatically cleared by hardware

Reference Manual to LL API cross reference:

- CR COUNTRST LL_LPTIM_ResetCounter
-

LL_LPTIM_SetUpdateMode

Function name

__STATIC_INLINE void LL_LPTIM_SetUpdateMode (LPTIM_TypeDef * LPTIMx, uint32_t UpdateMode)

Function description

Set the LPTIM registers update mode (enable/disable register preload)

Parameters

- **LPTIMx:** Low-Power Timer instance
- **UpdateMode:** This parameter can be one of the following values:
  - LL_LPTIM_UPDATE_MODE_IMMEDIATE
  - LL_LPTIM_UPDATE_MODE_ENDOFPERIOD

Return values

- **None:**

Notes

- This function must be called when the LPTIM instance is disabled.

Reference Manual to LL API cross reference:

- CFGR PRELOAD LL_LPTIM_SetUpdateMode

LL_LPTIM_GetUpdateMode

Function name

__STATIC_INLINE uint32_t LL_LPTIM_GetUpdateMode (const LPTIM_TypeDef * LPTIMx)

Function description

Get the LPTIM registers update mode.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **Returned:** value can be one of the following values:
  - LL_LPTIM_UPDATE_MODE_IMMEDIATE
  - LL_LPTIM_UPDATE_MODE_ENDOFPERIOD

Reference Manual to LL API cross reference:

- CFGR PRELOAD LL_LPTIM_GetUpdateMode

LL_LPTIM_SetAutoReload

Function name

__STATIC_INLINE void LL_LPTIM_SetAutoReload (LPTIM_TypeDef * LPTIMx, uint32_t AutoReload)

Function description

Set the auto reload value.

Parameters

- **LPTIMx:** Low-Power Timer instance
- **AutoReload:** Value between Min_Data=0x0001 and Max_Data=0xFFFF

Return values

- **None:**

Notes

- The LPTIMx_ARR register content must only be modified when the LPTIM is enabled
- After a write to the LPTIMx_ARR register a new write operation to the same register can only be performed when the previous write operation is completed. Any successive write before the ARROK flag is set, will lead to unpredictable results.
- autoreload value be strictly greater than the compare value.

Reference Manual to LL API cross reference:

- ARR ARR LL_LPTIM_SetAutoReload

LL_LPTIM_GetAutoReload

Function name

__STATIC_INLINE uint32_t LL_LPTIM_GetAutoReload (const LPTIM_TypeDef * LPTIMx)

Function description

Get actual auto reload value.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **AutoReload:** Value between Min_Data=0x0001 and Max_Data=0xFFFF

Reference Manual to LL API cross reference:

- ARR ARR LL_LPTIM_GetAutoReload

LL_LPTIM_SetRepetition

Function name

__STATIC_INLINE void LL_LPTIM_SetRepetition (LPTIM_TypeDef * LPTIMx, uint32_t Repetition)

Function description

Set the repetition value.

Parameters

- **LPTIMx:** Low-Power Timer instance
- **Repetition:** Value between Min_Data=0x00 and Max_Data=0xFF

Return values

- **None:**

Notes

- The LPTIMx_RCR register content must only be modified when the LPTIM is enabled

Reference Manual to LL API cross reference:

- RCR REP LL_LPTIM_SetRepetition

LL_LPTIM_GetRepetition

Function name

__STATIC_INLINE uint32_t LL_LPTIM_GetRepetition (const LPTIM_TypeDef * LPTIMx)

Function description

Get the repetition value.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **Repetition:** Value between Min_Data=0x00 and Max_Data=0xFF

Reference Manual to LL API cross reference:

- RCR REP LL_LPTIM_GetRepetition

LL_LPTIM_CC_EnableChannel

Function name

__STATIC_INLINE void LL_LPTIM_CC_EnableChannel (LPTIM_TypeDef * LPTIMx, uint32_t Channel)

Function description

Enable capture/compare channel.

Parameters

- **LPTIMx:** LPTimer instance
- **Channel:** This parameter can be one of the following values:
  - LL_LPTIM_CHANNEL_CH1
  - LL_LPTIM_CHANNEL_CH2
  - LL_LPTIM_CHANNEL_CH3
  - LL_LPTIM_CHANNEL_CH4

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCMR1 CC1E LL_LPTIM_CC_EnableChannel
- CCMR1 CC2E LL_LPTIM_CC_EnableChannel
- CCMR2 CC3E LL_LPTIM_CC_EnableChannel
- CCMR2 CC4E LL_LPTIM_CC_EnableChannel

LL_LPTIM_CC_DisableChannel

Function name

__STATIC_INLINE void LL_LPTIM_CC_DisableChannel (LPTIM_TypeDef * LPTIMx, uint32_t Channel)

Function description

Disable capture/compare channel.

Parameters

- **LPTIMx:** LPTimer instance
- **Channel:** This parameter can be one of the following values:
  - LL_LPTIM_CHANNEL_CH1
  - LL_LPTIM_CHANNEL_CH2
  - LL_LPTIM_CHANNEL_CH3
  - LL_LPTIM_CHANNEL_CH4

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCMR1 CC1E LL_LPTIM_CC_DisableChannel
- CCMR1 CC2E LL_LPTIM_CC_DisableChannel
- CCMR2 CC3E LL_LPTIM_CC_DisableChannel
- CCMR2 CC4E LL_LPTIM_CC_DisableChannel

LL_LPTIM_CC_IsEnabledChannel

Function name

__STATIC_INLINE uint32_t LL_LPTIM_CC_IsEnabledChannel (const LPTIM_TypeDef * LPTIMx, uint32_t Channel)

Function description

Indicate whether channel is enabled.

Parameters

- **LPTIMx:** LPTimer instance
- **Channel:** This parameter can be one of the following values:
  - LL_LPTIM_CHANNEL_CH1
  - LL_LPTIM_CHANNEL_CH2
  - LL_LPTIM_CHANNEL_CH3
  - LL_LPTIM_CHANNEL_CH4

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CCMR1 CC1E LL_LPTIM_CC_IsEnabledChannel
- CCMR1 CC2E LL_LPTIM_CC_IsEnabledChannel
-
- CCMR2 CC3E LL_LPTIM_CC_IsEnabledChannel
- CCMR2 CC4E LL_LPTIM_CC_IsEnabledChannel

LL_LPTIM_OC_SetCompareCH1

Function name

__STATIC_INLINE void LL_LPTIM_OC_SetCompareCH1 (LPTIM_TypeDef * LPTIMx, uint32_t CompareValue)

Function description

Set the compare value.

Parameters

- **LPTIMx:** Low-Power Timer instance
- **CompareValue:** Value between Min_Data=0x00 and Max_Data=0xFFFF

Return values

- **None:**

Notes

- After a write to the LPTIMx_CCR1 register a new write operation to the same register can only be performed when the previous write operation is completed. Any successive write before the CMP1OK flag is set, will lead to unpredictable results.

Reference Manual to LL API cross reference:

- CCR1 CCR1 LL_LPTIM_OC_SetCompareCH1

LL_LPTIM_OC_GetCompareCH1

Function name

__STATIC_INLINE uint32_t LL_LPTIM_OC_GetCompareCH1 (const LPTIM_TypeDef * LPTIMx)

Function description

Get actual compare value.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **CompareValue:** Value between Min_Data=0x00 and Max_Data=0xFFFF

Reference Manual to LL API cross reference:

- CCR1 CCR1 LL_LPTIM_OC_GetCompareCH1

LL_LPTIM_OC_SetCompareCH2

Function name

__STATIC_INLINE void LL_LPTIM_OC_SetCompareCH2 (LPTIM_TypeDef * LPTIMx, uint32_t CompareValue)

Function description

Set the compare value.

Parameters

- **LPTIMx:** Low-Power Timer instance
- **CompareValue:** Value between Min_Data=0x00 and Max_Data=0xFFFF

Return values

- **None:**

Notes

- After a write to the LPTIMx_CCR2 register a new write operation to the same register can only be performed when the previous write operation is completed. Any successive write before the CMP2OK flag is set, will lead to unpredictable results.

Reference Manual to LL API cross reference:

- CCR2 CCR2 LL_LPTIM_OC_SetCompareCH2

LL_LPTIM_OC_GetCompareCH2

Function name

__STATIC_INLINE uint32_t LL_LPTIM_OC_GetCompareCH2 (const LPTIM_TypeDef * LPTIMx)

Function description

Get actual compare value.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **CompareValue:** Value between Min_Data=0x00 and Max_Data=0xFFFF

Reference Manual to LL API cross reference:

- CCR2 CCR2 LL_LPTIM_OC_GetCompareCH2

LL_LPTIM_OC_SetCompareCH3

Function name

__STATIC_INLINE void LL_LPTIM_OC_SetCompareCH3 (LPTIM_TypeDef * LPTIMx, uint32_t CompareValue)

Function description

Set the compare value.

Parameters

- **LPTIMx:** Low-Power Timer instance
- **CompareValue:** Value between Min_Data=0x00 and Max_Data=0xFFFF

Return values

- **None:**

Notes

- After a write to the LPTIMx_CCR3 register a new write operation to the same register can only be performed when the previous write operation is completed. Any successive write before the CMP3OK flag is set, will lead to unpredictable results.

Reference Manual to LL API cross reference:

- CCR3 CCR3 LL_LPTIM_OC_SetCompareCH3

LL_LPTIM_OC_GetCompareCH3

Function name

__STATIC_INLINE uint32_t LL_LPTIM_OC_GetCompareCH3 (LPTIM_TypeDef * LPTIMx)

Function description

Get actual compare value.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **CompareValue:** Value between Min_Data=0x00 and Max_Data=0xFFFF

Reference Manual to LL API cross reference:

- CCR3 CCR3 LL_LPTIM_OC_GetCompareCH3

LL_LPTIM_OC_SetCompareCH4

Function name

__STATIC_INLINE void LL_LPTIM_OC_SetCompareCH4 (LPTIM_TypeDef * LPTIMx, uint32_t CompareValue)

Function description

Set the compare value.

Parameters

- **LPTIMx:** Low-Power Timer instance
- **CompareValue:** Value between Min_Data=0x00 and Max_Data=0xFFFF

Return values

- **None:**

Notes

- After a write to the LPTIMx_CCR4 register a new write operation to the same register can only be performed when the previous write operation is completed. Any successive write before the CMP4OK flag is set, will lead to unpredictable results.

Reference Manual to LL API cross reference:

- CCR4 CCR4 LL_LPTIM_OC_SetCompareCH4

LL_LPTIM_OC_GetCompareCH4

Function name

__STATIC_INLINE uint32_t LL_LPTIM_OC_GetCompareCH4 (LPTIM_TypeDef * LPTIMx)

Function description

Get actual compare value.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **CompareValue:** Value between Min_Data=0x00 and Max_Data=0xFFFF

Reference Manual to LL API cross reference:

- CCR4 CCR4 LL_LPTIM_OC_GetCompareCH4

LL_LPTIM_GetCounter

Function name

__STATIC_INLINE uint32_t LL_LPTIM_GetCounter (const LPTIM_TypeDef * LPTIMx)

Function description

Get actual counter value.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **Counter:** value

Notes

- When the LPTIM instance is running with an asynchronous clock, reading the LPTIMx_CNT register may return unreliable values. So in this case it is necessary to perform two consecutive read accesses and verify that the two returned values are identical.

Reference Manual to LL API cross reference:

- CNT CNT LL_LPTIM_GetCounter

LL_LPTIM_SetCounterMode

Function name

__STATIC_INLINE void LL_LPTIM_SetCounterMode (LPTIM_TypeDef * LPTIMx, uint32_t CounterMode)

Function description

Set the counter mode (selection of the LPTIM counter clock source).

Parameters

- **LPTIMx:** Low-Power Timer instance
- **CounterMode:** This parameter can be one of the following values:
  - LL_LPTIM_COUNTER_MODE_INTERNAL
  - LL_LPTIM_COUNTER_MODE_EXTERNAL

Return values

- **None:**

Notes

- The counter mode can be set only when the LPTIM instance is disabled.

Reference Manual to LL API cross reference:

- CFGR COUNTMODE LL_LPTIM_SetCounterMode

LL_LPTIM_GetCounterMode

Function name

__STATIC_INLINE uint32_t LL_LPTIM_GetCounterMode (const LPTIM_TypeDef * LPTIMx)

Function description

Get the counter mode.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **Returned:** value can be one of the following values:
  - LL_LPTIM_COUNTER_MODE_INTERNAL
  - LL_LPTIM_COUNTER_MODE_EXTERNAL

Reference Manual to LL API cross reference:

- CFGR COUNTMODE LL_LPTIM_GetCounterMode

LL_LPTIM_SetWaveform

Function name

__STATIC_INLINE void LL_LPTIM_SetWaveform (LPTIM_TypeDef * LPTIMx, uint32_t Waveform)

Function description

Set waveform shape.

Parameters

- **LPTIMx:** Low-Power Timer instance
- **Waveform:** This parameter can be one of the following values:
  - LL_LPTIM_OUTPUT_WAVEFORM_PWM
  - LL_LPTIM_OUTPUT_WAVEFORM_SETONCE

Return values

- **None:**

Reference Manual to LL API cross reference:

- CFGR WAVE LL_LPTIM_SetWaveform

LL_LPTIM_GetWaveform

Function name

__STATIC_INLINE uint32_t LL_LPTIM_GetWaveform (const LPTIM_TypeDef * LPTIMx)

Function description

Get actual waveform shape.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **Returned:** value can be one of the following values:
  - LL_LPTIM_OUTPUT_WAVEFORM_PWM
  - LL_LPTIM_OUTPUT_WAVEFORM_SETONCE

Reference Manual to LL API cross reference:

- CFGR WAVE LL_LPTIM_GetWaveform

LL_LPTIM_OC_SetPolarity

Function name

__STATIC_INLINE void LL_LPTIM_OC_SetPolarity (LPTIM_TypeDef * LPTIMx, uint32_t Channel, uint32_t Polarity)

Function description

Set the polarity of an output channel.

Parameters

- **LPTIMx:** Low-Power Timer instance
- **Channel:** This parameter can be one of the following values:
  - LL_LPTIM_CHANNEL_CH1
  - LL_LPTIM_CHANNEL_CH2
  - LL_LPTIM_CHANNEL_CH3
  - LL_LPTIM_CHANNEL_CH4
- **Polarity:** This parameter can be one of the following values:
  - LL_LPTIM_OUTPUT_POLARITY_REGULAR
  - LL_LPTIM_OUTPUT_POLARITY_INVERSE

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCMR1 CC1P LL_LPTIM_OC_SetPolarity
-
- CCMR1 CC2P LL_LPTIM_OC_SetPolarity
-
- CCMR2 CC3P LL_LPTIM_OC_SetPolarity
-
- CCMR2 CC4P LL_LPTIM_OC_SetPolarity

LL_LPTIM_OC_GetPolarity

Function name

__STATIC_INLINE uint32_t LL_LPTIM_OC_GetPolarity (const LPTIM_TypeDef * LPTIMx, uint32_t Channel)

Function description

Get the polarity of an output channel.

Parameters

- **LPTIMx:** Low-Power Timer instance
- **Channel:** This parameter can be one of the following values:
  - LL_LPTIM_CHANNEL_CH1
  - LL_LPTIM_CHANNEL_CH2
  - LL_LPTIM_CHANNEL_CH3
  - LL_LPTIM_CHANNEL_CH4

Return values

- **Returned:** value can be one of the following values:
  - LL_LPTIM_OUTPUT_POLARITY_REGULAR
  - LL_LPTIM_OUTPUT_POLARITY_INVERSE

Reference Manual to LL API cross reference:

- CCMR1 CC1P LL_LPTIM_OC_GetPolarity
-
- CCMR1 CC2P LL_LPTIM_OC_GetPolarity
-
- CCMR2 CC3P LL_LPTIM_OC_GetPolarity
-
- CCMR2 CC4P LL_LPTIM_OC_GetPolarity

LL_LPTIM_SetPrescaler

Function name

__STATIC_INLINE void LL_LPTIM_SetPrescaler (LPTIM_TypeDef * LPTIMx, uint32_t Prescaler)

Function description

Set actual prescaler division ratio.

Parameters

- **LPTIMx:** Low-Power Timer instance
- **Prescaler:** This parameter can be one of the following values:
  - LL_LPTIM_PRESCALER_DIV1
  - LL_LPTIM_PRESCALER_DIV2
  - LL_LPTIM_PRESCALER_DIV4
  - LL_LPTIM_PRESCALER_DIV8
  - LL_LPTIM_PRESCALER_DIV16
  - LL_LPTIM_PRESCALER_DIV32
  - LL_LPTIM_PRESCALER_DIV64
  - LL_LPTIM_PRESCALER_DIV128

Return values

- **None:**

Notes

- This function must be called when the LPTIM instance is disabled.
- When the LPTIM is configured to be clocked by an internal clock source and the LPTIM counter is configured to be updated by active edges detected on the LPTIM external Input1, the internal clock provided to the LPTIM must be not be prescaled.

Reference Manual to LL API cross reference:

- CFGR PRESC LL_LPTIM_SetPrescaler

LL_LPTIM_GetPrescaler

Function name

__STATIC_INLINE uint32_t LL_LPTIM_GetPrescaler (const LPTIM_TypeDef * LPTIMx)

Function description

Get actual prescaler division ratio.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **Returned:** value can be one of the following values:
  - LL_LPTIM_PRESCALER_DIV1
  - LL_LPTIM_PRESCALER_DIV2
  - LL_LPTIM_PRESCALER_DIV4
  - LL_LPTIM_PRESCALER_DIV8
  - LL_LPTIM_PRESCALER_DIV16
  - LL_LPTIM_PRESCALER_DIV32
  - LL_LPTIM_PRESCALER_DIV64
  - LL_LPTIM_PRESCALER_DIV128

Reference Manual to LL API cross reference:

- CFGR PRESC LL_LPTIM_GetPrescaler

LL_LPTIM_SetInput1Src

Function name

__STATIC_INLINE void LL_LPTIM_SetInput1Src (LPTIM_TypeDef * LPTIMx, uint32_t Src)

Function description

Set LPTIM input 1 source (default GPIO).

Parameters

- **LPTIMx:** Low-Power Timer instance
- **Src:** This parameter can be one of the following values:
  - LL_LPTIM_INPUT1_SRC_GPIO
  - LL_LPTIM_INPUT1_SRC_COMP1
  - LL_LPTIM_INPUT1_SRC_COMP2 (*)
  - LL_LPTIM_INPUT1_SRC_COMP1_COMP2 (*) (*) Value not defined for all devices

Return values

- **None:**

Reference Manual to LL API cross reference:

- CFGR2 IN1SEL LL_LPTIM_SetInput1Src

LL_LPTIM_SetInput2Src

Function name

__STATIC_INLINE void LL_LPTIM_SetInput2Src (LPTIM_TypeDef * LPTIMx, uint32_t Src)

Function description

Set LPTIM input 2 source (default GPIO).

Parameters

- **LPTIMx:** Low-Power Timer instance
- **Src:** This parameter can be one of the following values:
  - LL_LPTIM_INPUT2_SRC_GPIO
  - LL_LPTIM_INPUT2_SRC_COMP2 (*) (*) Value not defined for all devices

Return values

- **None:**

Reference Manual to LL API cross reference:

- CFGR2 IN2SEL LL_LPTIM_SetInput2Src

LL_LPTIM_SetRemap

Function name

__STATIC_INLINE void LL_LPTIM_SetRemap (LPTIM_TypeDef * LPTIMx, uint32_t Src)

Function description

Set LPTIM input source (default GPIO).

Parameters

- **LPTIMx:** Low-Power Timer instance
- **Src:** This parameter can be one of the following values:
  - LL_LPTIM_LPTIM1_IC1_RMP_GPIO
  - LL_LPTIM_LPTIM1_IC1_RMP_COMP1
  - LL_LPTIM_LPTIM1_IC1_RMP_COMP2 (*)
  - LL_LPTIM_LPTIM1_IC2_RMP_GPIO
  - LL_LPTIM_LPTIM1_IC2_RMP_MCO1
  - LL_LPTIM_LPTIM1_IC2_RMP_MCO2
  - LL_LPTIM_LPTIM1_IC3_RMP_GPIO
  - LL_LPTIM_LPTIM1_IC3_RMP_COMP1
  - LL_LPTIM_LPTIM1_IC3_RMP_COMP2 (*)
  - LL_LPTIM_LPTIM1_IC4_RMP_GPIO
  - LL_LPTIM_LPTIM1_IC4_RMP_COMP1
  - LL_LPTIM_LPTIM1_IC4_RMP_COMP2 (*)
  - LL_LPTIM_LPTIM2_IC1_RMP_GPIO
  - LL_LPTIM_LPTIM2_IC1_RMP_COMP1
  - LL_LPTIM_LPTIM2_IC1_RMP_COMP2 (*)
  - LL_LPTIM_LPTIM2_IC2_RMP_GPIO
  - LL_LPTIM_LPTIM2_IC2_RMP_MCO1
  - LL_LPTIM_LPTIM2_IC2_RMP_MCO2
  - LL_LPTIM_LPTIM3_IC1_RMP_GPIO (*)
  - LL_LPTIM_LPTIM3_IC1_RMP_COMP1 (*)
  - LL_LPTIM_LPTIM3_IC1_RMP_COMP2 (*)
  - LL_LPTIM_LPTIM3_IC2_RMP_GPIO (*)
  - LL_LPTIM_LPTIM3_IC2_RMP_MCO1 (*)
  - LL_LPTIM_LPTIM3_IC2_RMP_MCO2 (*)
  - LL_LPTIM_LPTIM3_IC3_RMP_GPIO (*)
  - LL_LPTIM_LPTIM3_IC3_RMP_COMP1 (*)
  - LL_LPTIM_LPTIM3_IC3_RMP_COMP2 (*)
  - LL_LPTIM_LPTIM3_IC4_RMP_GPIO (*)
  - LL_LPTIM_LPTIM3_IC4_RMP_COMP1 (*)
  - LL_LPTIM_LPTIM3_IC4_RMP_COMP2 (*)

  (*) Value not defined in all devices.
-

Return values

- **None:**

Reference Manual to LL API cross reference:

- CFGR2 IC1SEL LL_LPTIM_SetRemap
-
- CFGR2 IC2SEL LL_LPTIM_SetRemap
-
- CFGR2 IC3SEL LL_LPTIM_SetRemap
-
- CFGR2 IC4SEL LL_LPTIM_SetRemap

LL_LPTIM_IC_SetPolarity

Function name

__STATIC_INLINE void LL_LPTIM_IC_SetPolarity (LPTIM_TypeDef * LPTIMx, uint32_t Channel, uint32_t Polarity)

Function description

Set the polarity of IC channel 1.

Parameters

- **LPTIMx:** Low-Power Timer instance
- **Channel:** This parameter can be one of the following values:
  - LL_LPTIM_CHANNEL_CH1
  - LL_LPTIM_CHANNEL_CH2
  - LL_LPTIM_CHANNEL_CH3
  - LL_LPTIM_CHANNEL_CH4
- **Polarity:** This parameter can be one of the following values:
  - LL_LPTIM_ICPOLARITY_RISING
  - LL_LPTIM_ICPOLARITY_FALLING
  - LL_LPTIM_ICPOLARITY_RISING_FALLING

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCMR1 CC1P LL_LPTIM_IC_SetPolarity
-
- CCMR1 CC2P LL_LPTIM_IC_SetPolarity
-
- CCMR2 CC3P LL_LPTIM_IC_SetPolarity
-
- CCMR2 CC4P LL_LPTIM_IC_SetPolarity

LL_LPTIM_IC_GetPolarity

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IC_GetPolarity (const LPTIM_TypeDef * LPTIMx, uint32_t Channel)

Function description

Get the polarity of IC channels.

Parameters

- **LPTIMx:** Low-Power Timer instance
- **Channel:** This parameter can be one of the following values:
  - LL_LPTIM_CHANNEL_CH1
  - LL_LPTIM_CHANNEL_CH2
  - LL_LPTIM_CHANNEL_CH3
  - LL_LPTIM_CHANNEL_CH4

Return values

- **Returned:** value can be one of the following values:
  - LL_LPTIM_ICPOLARITY_RISING
  - LL_LPTIM_ICPOLARITY_FALLING
  - LL_LPTIM_ICPOLARITY_RISING_FALLING

Reference Manual to LL API cross reference:

- CCMR1 CC1P LL_LPTIM_IC_GetPolarity
-
- CCMR1 CC2P LL_LPTIM_IC_GetPolarity
-
- CCMR2 CC3P LL_LPTIM_IC_GetPolarity
-
- CCMR2 CC4P LL_LPTIM_IC_GetPolarity

LL_LPTIM_IC_SetFilter

Function name

__STATIC_INLINE void LL_LPTIM_IC_SetFilter (LPTIM_TypeDef * LPTIMx, uint32_t Channel, uint32_t Filter)

Function description

Set the filter of IC channels.

Parameters

- **LPTIMx:** Low-Power Timer instance
- **Channel:** This parameter can be one of the following values:
  - LL_LPTIM_CHANNEL_CH1
  - LL_LPTIM_CHANNEL_CH2
  - LL_LPTIM_CHANNEL_CH3
  - LL_LPTIM_CHANNEL_CH4
- **Filter:** This parameter can be one of the following values:
  - LL_LPTIM_ICFLT_CLOCK_DIV1
  - LL_LPTIM_ICFLT_CLOCK_DIV2
  - LL_LPTIM_ICFLT_CLOCK_DIV4
  - LL_LPTIM_ICFLT_CLOCK_DIV8

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCMR1 IC1F LL_LPTIM_IC_SetFilter
-
- CCMR1 IC2F LL_LPTIM_IC_SetFilter
-
- CCMR2 IC3F LL_LPTIM_IC_SetFilter
-
- CCMR2 IC4F LL_LPTIM_IC_SetFilter

LL_LPTIM_IC_GetFilter

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IC_GetFilter (const LPTIM_TypeDef * LPTIMx, uint32_t Channel)

Function description

Get the filter of IC channels.

Parameters

- **LPTIMx:** Low-Power Timer instance
- **Channel:** This parameter can be one of the following values:
  - LL_LPTIM_CHANNEL_CH1
  - LL_LPTIM_CHANNEL_CH2
  - LL_LPTIM_CHANNEL_CH3
  - LL_LPTIM_CHANNEL_CH4

Return values

- **Returned:** value can be one of the following values:
  - LL_LPTIM_ICFLT_CLOCK_DIV1
  - LL_LPTIM_ICFLT_CLOCK_DIV2
  - LL_LPTIM_ICFLT_CLOCK_DIV4
  - LL_LPTIM_ICFLT_CLOCK_DIV8

Reference Manual to LL API cross reference:

- CCMR1 IC1F LL_LPTIM_IC_GetFilter
-
- CCMR1 IC2F LL_LPTIM_IC_GetFilter
-
- CCMR2 IC3F LL_LPTIM_IC_GetFilter
-
- CCMR2 IC4F LL_LPTIM_IC_GetFilter

LL_LPTIM_IC_SetPrescaler

Function name

__STATIC_INLINE void LL_LPTIM_IC_SetPrescaler (LPTIM_TypeDef * LPTIMx, uint32_t Channel, uint32_t Prescaler)

Function description

Set the prescaler of IC channels.

Parameters

- **LPTIMx:** Low-Power Timer instance
- **Channel:** This parameter can be one of the following values:
  - LL_LPTIM_CHANNEL_CH1
  - LL_LPTIM_CHANNEL_CH2
  - LL_LPTIM_CHANNEL_CH3
  - LL_LPTIM_CHANNEL_CH4
- **Prescaler:** This parameter can be one of the following values:
  - LL_LPTIM_ICPSC_DIV1
  - LL_LPTIM_ICPSC_DIV2
  - LL_LPTIM_ICPSC_DIV4
  - LL_LPTIM_ICPSC_DIV8

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCMR1 IC1PSC LL_LPTIM_IC_SetPrescaler
-
- CCMR1 IC2PSC LL_LPTIM_IC_SetPrescaler
-
- CCMR2 IC3PSC LL_LPTIM_IC_SetPrescaler
-
- CCMR2 IC4PSC LL_LPTIM_IC_SetPrescaler

LL_LPTIM_IC_GetPrescaler

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IC_GetPrescaler (const LPTIM_TypeDef * LPTIMx, uint32_t Channel)

Function description

Get the prescaler of IC channels.

Parameters

- **LPTIMx:** Low-Power Timer instance
- **Channel:** This parameter can be one of the following values:
  - LL_LPTIM_CHANNEL_CH1
  - LL_LPTIM_CHANNEL_CH2
  - LL_LPTIM_CHANNEL_CH3
  - LL_LPTIM_CHANNEL_CH4

Return values

- **Returned:** value can be one of the following values:
  - LL_LPTIM_ICPSC_DIV1
  - LL_LPTIM_ICPSC_DIV2
  - LL_LPTIM_ICPSC_DIV4
  - LL_LPTIM_ICPSC_DIV8

Reference Manual to LL API cross reference:

- CCMR1 IC1PSC LL_LPTIM_IC_GetPrescaler
-
- CCMR1 IC2PSC LL_LPTIM_IC_GetPrescaler
-
- CCMR2 IC3PSC LL_LPTIM_IC_GetPrescaler
-
- CCMR2 IC4PSC LL_LPTIM_IC_GetPrescaler

LL_LPTIM_CC_SetChannelMode

Function name

__STATIC_INLINE void LL_LPTIM_CC_SetChannelMode (LPTIM_TypeDef * LPTIMx, uint32_t Channel, uint32_t CCMode)

Function description

Set the Channel Mode.

Parameters

- **LPTIMx:** Low-Power Timer instance
- **Channel:** This parameter can be one of the following values:
  - LL_LPTIM_CHANNEL_CH1
  - LL_LPTIM_CHANNEL_CH2
  - LL_LPTIM_CHANNEL_CH3
  - LL_LPTIM_CHANNEL_CH4
- **CCMode:** This parameter can be one of the following values:
  - LL_LPTIM_CCMODE_OUTPUT_PWM
  - LL_LPTIM_CCMODE_INPUTCAPTURE

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCMR1 CC1SEL LL_LPTIM_CC_SetChannelMode
- CCMR1 CC2SEL LL_LPTIM_CC_SetChannelMode
- CCMR2 CC3SEL LL_LPTIM_CC_SetChannelMode
- CCMR2 CC4SEL LL_LPTIM_CC_SetChannelMode

LL_LPTIM_CC_GetChannelMode

Function name

__STATIC_INLINE uint32_t LL_LPTIM_CC_GetChannelMode (const LPTIM_TypeDef * LPTIMx, uint32_t Channel)

Function description

Get the Channel Mode.

Parameters

- **LPTIMx:** Low-Power Timer instance
- **Channel:** This parameter can be one of the following values:
  - LL_LPTIM_CHANNEL_CH1
  - LL_LPTIM_CHANNEL_CH2
  - LL_LPTIM_CHANNEL_CH3
  - LL_LPTIM_CHANNEL_CH4

Return values

- **Returned:** value can be one of the following values:
  - LL_LPTIM_CCMODE_OUTPUT_PWM
  - LL_LPTIM_CCMODE_INPUTCAPTURE

Reference Manual to LL API cross reference:

- CCMR1 CC1SEL LL_LPTIM_CC_GetChannelMode
- CCMR1 CC2SEL LL_LPTIM_CC_GetChannelMode
- CCMR2 CC3SEL LL_LPTIM_CC_GetChannelMode
- CCMR2 CC4SEL LL_LPTIM_CC_GetChannelMode

LL_LPTIM_IC_GetCaptureCH1

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IC_GetCaptureCH1 (const LPTIM_TypeDef * LPTIMx)

Function description

Get captured value for input channel 1.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **CapturedValue:** (between Min_Data=0 and Max_Data=65535)

Notes

- The real capture value corresponding to the input capture trigger can be calculated using the formula hereafter : Real capture value = captured(LPTIM_CCRx) - offset where offset can be retrieved by calling LL_LPTIM_IC_GET_OFFSET

Reference Manual to LL API cross reference:

- CCR1 CCR1 LL_LPTIM_IC_GetCaptureCH1

LL_LPTIM_IC_GetCaptureCH2

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IC_GetCaptureCH2 (const LPTIM_TypeDef * LPTIMx)

Function description

Get captured value for input channel 2.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **CapturedValue:** (between Min_Data=0 and Max_Data=65535)

Notes

- The real capture value corresponding to the input capture trigger can be calculated using the formula hereafter : Real capture value = captured(LPTIM_CCRx) - offset where offset can be retrieved by calling LL_LPTIM_IC_GET_OFFSET

Reference Manual to LL API cross reference:

- CCR2 CCR2 LL_LPTIM_IC_GetCaptureCH2

LL_LPTIM_IC_GetCaptureCH3

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IC_GetCaptureCH3 (LPTIM_TypeDef * LPTIMx)

Function description

Get captured value for input channel 3.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **CapturedValue:** (between Min_Data=0 and Max_Data=65535)

Notes

- The real capture value corresponding to the input capture trigger can be calculated using the formula hereafter : Real capture value = captured(LPTIM_CCRx) - offset where offset can be retrieved by calling LL_LPTIM_IC_GET_OFFSET

Reference Manual to LL API cross reference:

- CCR3 CCR3 LL_LPTIM_IC_GetCaptureCH3

LL_LPTIM_IC_GetCaptureCH4

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IC_GetCaptureCH4 (LPTIM_TypeDef * LPTIMx)

Function description

Get captured value for input channel 4.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **CapturedValue:** (between Min_Data=0 and Max_Data=65535)

Notes

- The real capture value corresponding to the input capture trigger can be calculated using the formula hereafter : Real capture value = captured(LPTIM_CCRx) - offset where offset can be retrieved by calling LL_LPTIM_IC_GET_OFFSET

Reference Manual to LL API cross reference:

- CCR4 CCR4 LL_LPTIM_IC_GetCaptureCH4

LL_LPTIM_EnableTimeout

Function name

__STATIC_INLINE void LL_LPTIM_EnableTimeout (LPTIM_TypeDef * LPTIMx)

Function description

Enable the timeout function.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Notes

- This function must be called when the LPTIM instance is disabled.
- The first trigger event will start the timer, any successive trigger event will reset the counter and the timer will restart.
- The timeout value corresponds to the compare value; if no trigger occurs within the expected time frame, the MCU is waked-up by the compare match event.

Reference Manual to LL API cross reference:

- CFGR TIMOUT LL_LPTIM_EnableTimeout

LL_LPTIM_DisableTimeout

Function name

__STATIC_INLINE void LL_LPTIM_DisableTimeout (LPTIM_TypeDef * LPTIMx)

Function description

Disable the timeout function.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Notes

- This function must be called when the LPTIM instance is disabled.
- A trigger event arriving when the timer is already started will be ignored.

Reference Manual to LL API cross reference:

- CFGR TIMOUT LL_LPTIM_DisableTimeout

LL_LPTIM_IsEnabledTimeout

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsEnabledTimeout (const LPTIM_TypeDef * LPTIMx)

Function description

Indicate whether the timeout function is enabled.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CFGR TIMOUT LL_LPTIM_IsEnabledTimeout

LL_LPTIM_TrigSw

Function name

__STATIC_INLINE void LL_LPTIM_TrigSw (LPTIM_TypeDef * LPTIMx)

Function description

Start the LPTIM counter.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Notes

- This function must be called when the LPTIM instance is disabled.

Reference Manual to LL API cross reference:

- CFGR TRIGEN LL_LPTIM_TrigSw

LL_LPTIM_ConfigTrigger

Function name

__STATIC_INLINE void LL_LPTIM_ConfigTrigger (LPTIM_TypeDef * LPTIMx, uint32_t Source, uint32_t Filter, uint32_t Polarity)

Function description

Configure the external trigger used as a trigger event for the LPTIM.

Parameters

- **LPTIMx:** Low-Power Timer instance
- **Source:** This parameter can be one of the following values:
  - LL_LPTIM_TRIG_SOURCE_GPIO
  - LL_LPTIM_TRIG_SOURCE_RTCALARMA
  - LL_LPTIM_TRIG_SOURCE_RTCALARMB
  - LL_LPTIM_TRIG_SOURCE_RTCTAMP1
  - LL_LPTIM_TRIG_SOURCE_RTCTAMP2
  - LL_LPTIM_TRIG_SOURCE_RTCTAMP3
  - LL_LPTIM_TRIG_SOURCE_COMP1
  - LL_LPTIM_TRIG_SOURCE_COMP2 (*)

  (*) Value not defined in all devices.
-
- **Filter:** This parameter can be one of the following values:
  - LL_LPTIM_TRIG_FILTER_NONE
  - LL_LPTIM_TRIG_FILTER_2
  - LL_LPTIM_TRIG_FILTER_4
  - LL_LPTIM_TRIG_FILTER_8
- **Polarity:** This parameter can be one of the following values:
  - LL_LPTIM_TRIG_POLARITY_RISING
  - LL_LPTIM_TRIG_POLARITY_FALLING
  - LL_LPTIM_TRIG_POLARITY_RISING_FALLING

Return values

- **None:**

Notes

- This function must be called when the LPTIM instance is disabled.
- An internal clock source must be present when a digital filter is required for the trigger.

Reference Manual to LL API cross reference:

- CFGR TRIGSEL LL_LPTIM_ConfigTrigger
- CFGR TRGFLT LL_LPTIM_ConfigTrigger
- CFGR TRIGEN LL_LPTIM_ConfigTrigger

LL_LPTIM_GetTriggerSource

Function name

__STATIC_INLINE uint32_t LL_LPTIM_GetTriggerSource (const LPTIM_TypeDef * LPTIMx)

Function description

Get actual external trigger source.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **Returned:** value can be one of the following values:
  - LL_LPTIM_TRIG_SOURCE_GPIO
  - LL_LPTIM_TRIG_SOURCE_RTCALARMA
  - LL_LPTIM_TRIG_SOURCE_RTCALARMB
  - LL_LPTIM_TRIG_SOURCE_RTCTAMP1
  - LL_LPTIM_TRIG_SOURCE_RTCTAMP2
  - LL_LPTIM_TRIG_SOURCE_RTCTAMP3
  - LL_LPTIM_TRIG_SOURCE_COMP1
  - LL_LPTIM_TRIG_SOURCE_COMP2 (*)

  (*) Value not defined in all devices.
-

Reference Manual to LL API cross reference:

- CFGR TRIGSEL LL_LPTIM_GetTriggerSource

LL_LPTIM_GetTriggerFilter

Function name

__STATIC_INLINE uint32_t LL_LPTIM_GetTriggerFilter (const LPTIM_TypeDef * LPTIMx)

Function description

Get actual external trigger filter.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **Returned:** value can be one of the following values:
  - LL_LPTIM_TRIG_FILTER_NONE
  - LL_LPTIM_TRIG_FILTER_2
  - LL_LPTIM_TRIG_FILTER_4
  - LL_LPTIM_TRIG_FILTER_8

Reference Manual to LL API cross reference:

- CFGR TRGFLT LL_LPTIM_GetTriggerFilter

LL_LPTIM_GetTriggerPolarity

Function name

__STATIC_INLINE uint32_t LL_LPTIM_GetTriggerPolarity (const LPTIM_TypeDef * LPTIMx)

Function description

Get actual external trigger polarity.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **Returned:** value can be one of the following values:
  - LL_LPTIM_TRIG_POLARITY_RISING
  - LL_LPTIM_TRIG_POLARITY_FALLING
  - LL_LPTIM_TRIG_POLARITY_RISING_FALLING

Reference Manual to LL API cross reference:

- CFGR TRIGEN LL_LPTIM_GetTriggerPolarity

LL_LPTIM_SetClockSource

Function name

__STATIC_INLINE void LL_LPTIM_SetClockSource (LPTIM_TypeDef * LPTIMx, uint32_t ClockSource)

Function description

Set the source of the clock used by the LPTIM instance.

Parameters

- **LPTIMx:** Low-Power Timer instance
- **ClockSource:** This parameter can be one of the following values:
  - LL_LPTIM_CLK_SOURCE_INTERNAL
  - LL_LPTIM_CLK_SOURCE_EXTERNAL

Return values

- **None:**

Notes

- This function must be called when the LPTIM instance is disabled.

Reference Manual to LL API cross reference:

- CFGR CKSEL LL_LPTIM_SetClockSource

LL_LPTIM_GetClockSource

Function name

__STATIC_INLINE uint32_t LL_LPTIM_GetClockSource (const LPTIM_TypeDef * LPTIMx)

Function description

Get actual LPTIM instance clock source.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **Returned:** value can be one of the following values:
  - LL_LPTIM_CLK_SOURCE_INTERNAL
  - LL_LPTIM_CLK_SOURCE_EXTERNAL

Reference Manual to LL API cross reference:

- CFGR CKSEL LL_LPTIM_GetClockSource

LL_LPTIM_ConfigClock

Function name

__STATIC_INLINE void LL_LPTIM_ConfigClock (LPTIM_TypeDef * LPTIMx, uint32_t ClockFilter, uint32_t ClockPolarity)

Function description

Configure the active edge or edges used by the counter when the LPTIM is clocked by an external clock source.

Parameters

- **LPTIMx:** Low-Power Timer instance
- **ClockFilter:** This parameter can be one of the following values:
  - LL_LPTIM_CLK_FILTER_NONE
  - LL_LPTIM_CLK_FILTER_2
  - LL_LPTIM_CLK_FILTER_4
  - LL_LPTIM_CLK_FILTER_8
- **ClockPolarity:** This parameter can be one of the following values:
  - LL_LPTIM_CLK_POLARITY_RISING
  - LL_LPTIM_CLK_POLARITY_FALLING
  - LL_LPTIM_CLK_POLARITY_RISING_FALLING

Return values

- **None:**

Notes

- This function must be called when the LPTIM instance is disabled.
- When both external clock signal edges are considered active ones, the LPTIM must also be clocked by an internal clock source with a frequency equal to at least four times the external clock frequency.
- An internal clock source must be present when a digital filter is required for external clock.

Reference Manual to LL API cross reference:

- CFGR CKFLT LL_LPTIM_ConfigClock
- CFGR CKPOL LL_LPTIM_ConfigClock

LL_LPTIM_GetClockPolarity

Function name

__STATIC_INLINE uint32_t LL_LPTIM_GetClockPolarity (const LPTIM_TypeDef * LPTIMx)

Function description

Get actual clock polarity.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **Returned:** value can be one of the following values:
  - LL_LPTIM_CLK_POLARITY_RISING
  - LL_LPTIM_CLK_POLARITY_FALLING
  - LL_LPTIM_CLK_POLARITY_RISING_FALLING

Reference Manual to LL API cross reference:

- CFGR CKPOL LL_LPTIM_GetClockPolarity

LL_LPTIM_GetClockFilter

Function name

__STATIC_INLINE uint32_t LL_LPTIM_GetClockFilter (const LPTIM_TypeDef * LPTIMx)

Function description

Get actual clock digital filter.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **Returned:** value can be one of the following values:
  - LL_LPTIM_CLK_FILTER_NONE
  - LL_LPTIM_CLK_FILTER_2
  - LL_LPTIM_CLK_FILTER_4
  - LL_LPTIM_CLK_FILTER_8

Reference Manual to LL API cross reference:

- CFGR CKFLT LL_LPTIM_GetClockFilter

LL_LPTIM_SetEncoderMode

Function name

__STATIC_INLINE void LL_LPTIM_SetEncoderMode (LPTIM_TypeDef * LPTIMx, uint32_t EncoderMode)

Function description

Configure the encoder mode.

Parameters

- **LPTIMx:** Low-Power Timer instance
- **EncoderMode:** This parameter can be one of the following values:
  - LL_LPTIM_ENCODER_MODE_RISING
  - LL_LPTIM_ENCODER_MODE_FALLING
  - LL_LPTIM_ENCODER_MODE_RISING_FALLING

Return values

- **None:**

Notes

- This function must be called when the LPTIM instance is disabled.

Reference Manual to LL API cross reference:

- CFGR CKPOL LL_LPTIM_SetEncoderMode

LL_LPTIM_GetEncoderMode

Function name

__STATIC_INLINE uint32_t LL_LPTIM_GetEncoderMode (const LPTIM_TypeDef * LPTIMx)

Function description

Get actual encoder mode.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **Returned:** value can be one of the following values:
  - LL_LPTIM_ENCODER_MODE_RISING
  - LL_LPTIM_ENCODER_MODE_FALLING
  - LL_LPTIM_ENCODER_MODE_RISING_FALLING

Reference Manual to LL API cross reference:

- CFGR CKPOL LL_LPTIM_GetEncoderMode

LL_LPTIM_EnableEncoderMode

Function name

__STATIC_INLINE void LL_LPTIM_EnableEncoderMode (LPTIM_TypeDef * LPTIMx)

Function description

Enable the encoder mode.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Notes

- This function must be called when the LPTIM instance is disabled.
- In this mode the LPTIM instance must be clocked by an internal clock source. Also, the prescaler division ratio must be equal to 1.
- LPTIM instance must be configured in continuous mode prior enabling the encoder mode.

Reference Manual to LL API cross reference:

- CFGR ENC LL_LPTIM_EnableEncoderMode

LL_LPTIM_DisableEncoderMode

Function name

__STATIC_INLINE void LL_LPTIM_DisableEncoderMode (LPTIM_TypeDef * LPTIMx)

Function description

Disable the encoder mode.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Notes

- This function must be called when the LPTIM instance is disabled.

Reference Manual to LL API cross reference:

- CFGR ENC LL_LPTIM_DisableEncoderMode

LL_LPTIM_IsEnabledEncoderMode

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsEnabledEncoderMode (const LPTIM_TypeDef * LPTIMx)

Function description

Indicates whether the LPTIM operates in encoder mode.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CFGR ENC LL_LPTIM_IsEnabledEncoderMode

LL_LPTIM_ClearFlag_CC1

Function name

__STATIC_INLINE void LL_LPTIM_ClearFlag_CC1 (LPTIM_TypeDef * LPTIMx)

Function description

Clear the compare match flag for channel 1 (CC1CF)

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR CC1CF LL_LPTIM_ClearFlag_CC1

LL_LPTIM_IsActiveFlag_CC1

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsActiveFlag_CC1 (const LPTIM_TypeDef * LPTIMx)

Function description

Inform application whether a capture/compare interrupt has occurred for channel 1.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR CC1IF LL_LPTIM_IsActiveFlag_CC1

LL_LPTIM_ClearFlag_CC2

Function name

__STATIC_INLINE void LL_LPTIM_ClearFlag_CC2 (LPTIM_TypeDef * LPTIMx)

Function description

Clear the compare match flag for channel 2 (CC2CF)

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR CC2CF LL_LPTIM_ClearFlag_CC2

LL_LPTIM_IsActiveFlag_CC2

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsActiveFlag_CC2 (const LPTIM_TypeDef * LPTIMx)

Function description

Inform application whether a capture/compare interrupt has occurred for channel 2.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR CC2IF LL_LPTIM_IsActiveFlag_CC2

LL_LPTIM_ClearFlag_CC3

Function name

__STATIC_INLINE void LL_LPTIM_ClearFlag_CC3 (LPTIM_TypeDef * LPTIMx)

Function description

Clear the capture/compare flag for channel 3 (CC3F)

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR CC3 LL_LPTIM_ClearFlag_CC3

LL_LPTIM_IsActiveFlag_CC3

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsActiveFlag_CC3 (LPTIM_TypeDef * LPTIMx)

Function description

Inform application whether a capture/compare interrupt has occurred for channel 3.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR CC3 LL_LPTIM_IsActiveFlag_CC3

LL_LPTIM_ClearFlag_CC4

Function name

__STATIC_INLINE void LL_LPTIM_ClearFlag_CC4 (LPTIM_TypeDef * LPTIMx)

Function description

Clear the capture/compare flag for channel 4 (CC4F)

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR CC4 LL_LPTIM_ClearFlag_CC4

LL_LPTIM_IsActiveFlag_CC4

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsActiveFlag_CC4 (LPTIM_TypeDef * LPTIMx)

Function description

Inform application whether a capture/compare interrupt has occurred for channel 4.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR CC4 LL_LPTIM_IsActiveFlag_CC4

LL_LPTIM_ClearFlag_CC1O

Function name

__STATIC_INLINE void LL_LPTIM_ClearFlag_CC1O (LPTIM_TypeDef * LPTIMx)

Function description

Clear the Capture/Compare 1 over-capture flag for channel 1 (CC1OCF)

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR CC1OCF LL_LPTIM_ClearFlag_CC1O

LL_LPTIM_IsActiveFlag_CC1O

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsActiveFlag_CC1O (const LPTIM_TypeDef * LPTIMx)

Function description

Inform application whether a Capture/Compare 1 over-capture has occurred for channel 1.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR CC1OF LL_LPTIM_IsActiveFlag_CC1O

LL_LPTIM_ClearFlag_CC2O

Function name

__STATIC_INLINE void LL_LPTIM_ClearFlag_CC2O (LPTIM_TypeDef * LPTIMx)

Function description

Clear the Capture/Compare 2 over-capture flag for channel 2 (CC2OCF)

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR CC2OCF LL_LPTIM_ClearFlag_CC2O

LL_LPTIM_IsActiveFlag_CC2O

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsActiveFlag_CC2O (const LPTIM_TypeDef * LPTIMx)

Function description

Inform application whether a Capture/Compare 2 over-capture has occurred for channel 2.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR CC2OF LL_LPTIM_IsActiveFlag_CC2O

LL_LPTIM_ClearFlag_CC3O

Function name

__STATIC_INLINE void LL_LPTIM_ClearFlag_CC3O (LPTIM_TypeDef * LPTIMx)

Function description

Clear the Capture/Compare 3 over-capture flag for channel 3 (CC3OCF)

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR CC3OCF LL_LPTIM_ClearFlag_CC3O

LL_LPTIM_IsActiveFlag_CC3O

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsActiveFlag_CC3O (const LPTIM_TypeDef * LPTIMx)

Function description

Inform application whether a Capture/Compare 3 over-capture has occurred for channel 3.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR CC3OF LL_LPTIM_IsActiveFlag_CC3O

LL_LPTIM_ClearFlag_CC4O

Function name

__STATIC_INLINE void LL_LPTIM_ClearFlag_CC4O (LPTIM_TypeDef * LPTIMx)

Function description

Clear the Capture/Compare 4 over-capture flag for channel 4 (CC4OCF)

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR CC4OCF LL_LPTIM_ClearFlag_CC4O

LL_LPTIM_IsActiveFlag_CC4O

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsActiveFlag_CC4O (const LPTIM_TypeDef * LPTIMx)

Function description

Inform application whether a Capture/Compare 4 over-capture has occurred for channel 4.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR CC4OF LL_LPTIM_IsActiveFlag_CC4O

LL_LPTIM_ClearFlag_ARRM

Function name

__STATIC_INLINE void LL_LPTIM_ClearFlag_ARRM (LPTIM_TypeDef * LPTIMx)

Function description

Clear the autoreload match flag (ARRMCF)

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR ARRMCF LL_LPTIM_ClearFlag_ARRM

LL_LPTIM_IsActiveFlag_ARRM

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsActiveFlag_ARRM (const LPTIM_TypeDef * LPTIMx)

Function description

Inform application whether a autoreload match interrupt has occurred.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR ARRM LL_LPTIM_IsActiveFlag_ARRM

LL_LPTIM_ClearFlag_EXTTRIG

Function name

__STATIC_INLINE void LL_LPTIM_ClearFlag_EXTTRIG (LPTIM_TypeDef * LPTIMx)

Function description

Clear the external trigger valid edge flag(EXTTRIGCF).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR EXTTRIGCF LL_LPTIM_ClearFlag_EXTTRIG

LL_LPTIM_IsActiveFlag_EXTTRIG

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsActiveFlag_EXTTRIG (const LPTIM_TypeDef * LPTIMx)

Function description

Inform application whether a valid edge on the selected external trigger input has occurred.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR EXTTRIG LL_LPTIM_IsActiveFlag_EXTTRIG

LL_LPTIM_ClearFlag_CMP1OK

Function name

__STATIC_INLINE void LL_LPTIM_ClearFlag_CMP1OK (LPTIM_TypeDef * LPTIMx)

Function description

Clear the compare register update interrupt flag (CMP1OKCF).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR CMP1OKCF LL_LPTIM_ClearFlag_CMP1OK

LL_LPTIM_IsActiveFlag_CMP1OK

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsActiveFlag_CMP1OK (const LPTIM_TypeDef * LPTIMx)

Function description

Informs application whether the APB bus write operation to the LPTIMx_CCR1 register has been successfully completed.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR CMP1OK LL_LPTIM_IsActiveFlag_CMP1OK

LL_LPTIM_ClearFlag_CMP2OK

Function name

__STATIC_INLINE void LL_LPTIM_ClearFlag_CMP2OK (LPTIM_TypeDef * LPTIMx)

Function description

Clear the compare register update interrupt flag (CMP2OKCF).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR CMP2OKCF LL_LPTIM_ClearFlag_CMP2OK

LL_LPTIM_IsActiveFlag_CMP2OK

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsActiveFlag_CMP2OK (const LPTIM_TypeDef * LPTIMx)

Function description

Informs application whether the APB bus write operation to the LPTIMx_CCR2 register has been successfully completed.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR CMP2OK LL_LPTIM_IsActiveFlag_CMP2OK

LL_LPTIM_ClearFlag_CMP3OK

Function name

__STATIC_INLINE void LL_LPTIM_ClearFlag_CMP3OK (LPTIM_TypeDef * LPTIMx)

Function description

Clear the compare register update interrupt flag (CMP3OKCF).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR CMP3OKCF LL_LPTIM_ClearFlag_CMP3OK

LL_LPTIM_IsActiveFlag_CMP3OK

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsActiveFlag_CMP3OK (LPTIM_TypeDef * LPTIMx)

Function description

Informs application whether the APB bus write operation to the LPTIMx_CCR3 register has been successfully completed.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR CMP3OK LL_LPTIM_IsActiveFlag_CMP3OK

LL_LPTIM_ClearFlag_CMP4OK

Function name

__STATIC_INLINE void LL_LPTIM_ClearFlag_CMP4OK (LPTIM_TypeDef * LPTIMx)

Function description

Clear the compare register update interrupt flag (CMP4OKCF).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR CMP4OKCF LL_LPTIM_ClearFlag_CMP4OK

LL_LPTIM_IsActiveFlag_CMP4OK

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsActiveFlag_CMP4OK (LPTIM_TypeDef * LPTIMx)

Function description

Informs application whether the APB bus write operation to the LPTIMx_CCR4 register has been successfully completed.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR CMP4OK LL_LPTIM_IsActiveFlag_CMP4OK

LL_LPTIM_ClearFlag_DIEROK

Function name

__STATIC_INLINE void LL_LPTIM_ClearFlag_DIEROK (LPTIM_TypeDef * LPTIMx)

Function description

Clear the interrupt register update interrupt flag (DIEROKCF).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR DIEROKCF LL_LPTIM_ClearFlag_DIEROK

LL_LPTIM_IsActiveFlag_DIEROK

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsActiveFlag_DIEROK (const LPTIM_TypeDef * LPTIMx)

Function description

Informs application whether the APB bus write operation to the LPTIMx_DIER register has been successfully completed.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR DIEROK LL_LPTIM_IsActiveFlag_DIEROK

LL_LPTIM_ClearFlag_ARROK

Function name

__STATIC_INLINE void LL_LPTIM_ClearFlag_ARROK (LPTIM_TypeDef * LPTIMx)

Function description

Clear the autoreload register update interrupt flag (ARROKCF).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR ARROKCF LL_LPTIM_ClearFlag_ARROK

LL_LPTIM_IsActiveFlag_ARROK

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsActiveFlag_ARROK (const LPTIM_TypeDef * LPTIMx)

Function description

Informs application whether the APB bus write operation to the LPTIMx_ARR register has been successfully completed.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR ARROK LL_LPTIM_IsActiveFlag_ARROK

LL_LPTIM_ClearFlag_UP

Function name

__STATIC_INLINE void LL_LPTIM_ClearFlag_UP (LPTIM_TypeDef * LPTIMx)

Function description

Clear the counter direction change to up interrupt flag (UPCF).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR UPCF LL_LPTIM_ClearFlag_UP

LL_LPTIM_IsActiveFlag_UP

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsActiveFlag_UP (const LPTIM_TypeDef * LPTIMx)

Function description

Informs the application whether the counter direction has changed from down to up (when the LPTIM instance operates in encoder mode).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR UP LL_LPTIM_IsActiveFlag_UP

LL_LPTIM_ClearFlag_DOWN

Function name

__STATIC_INLINE void LL_LPTIM_ClearFlag_DOWN (LPTIM_TypeDef * LPTIMx)

Function description

Clear the counter direction change to down interrupt flag (DOWNCF).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR DOWNCF LL_LPTIM_ClearFlag_DOWN

LL_LPTIM_IsActiveFlag_DOWN

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsActiveFlag_DOWN (const LPTIM_TypeDef * LPTIMx)

Function description

Informs the application whether the counter direction has changed from up to down (when the LPTIM instance operates in encoder mode).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR DOWN LL_LPTIM_IsActiveFlag_DOWN

LL_LPTIM_ClearFlag_REPOK

Function name

__STATIC_INLINE void LL_LPTIM_ClearFlag_REPOK (LPTIM_TypeDef * LPTIMx)

Function description

Clear the repetition register update interrupt flag (REPOKCF).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR REPOKCF LL_LPTIM_ClearFlag_REPOK

LL_LPTIM_IsActiveFlag_REPOK

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsActiveFlag_REPOK (const LPTIM_TypeDef * LPTIMx)

Function description

Informs application whether the APB bus write operation to the LPTIMx_RCR register has been successfully completed; If so, a new one can be initiated.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR REPOK LL_LPTIM_IsActiveFlag_REPOK

LL_LPTIM_ClearFlag_UE

Function name

__STATIC_INLINE void LL_LPTIM_ClearFlag_UE (LPTIM_TypeDef * LPTIMx)

Function description

Clear the update event flag (UECF).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR UECF LL_LPTIM_ClearFlag_UE

LL_LPTIM_IsActiveFlag_UE

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsActiveFlag_UE (const LPTIM_TypeDef * LPTIMx)

Function description

Informs application whether the LPTIMx update event has occurred.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR UE LL_LPTIM_IsActiveFlag_UE

LL_LPTIM_EnableIT_CC1

Function name

__STATIC_INLINE void LL_LPTIM_EnableIT_CC1 (LPTIM_TypeDef * LPTIMx)

Function description

Enable capture/compare 1 interrupt (CC1IE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC1IE LL_LPTIM_EnableIT_CC1

LL_LPTIM_DisableIT_CC1

Function name

__STATIC_INLINE void LL_LPTIM_DisableIT_CC1 (LPTIM_TypeDef * LPTIMx)

Function description

Disable capture/compare 1 interrupt (CC1IE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC1IE LL_LPTIM_DisableIT_CC1

LL_LPTIM_IsEnabledIT_CC1

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsEnabledIT_CC1 (const LPTIM_TypeDef * LPTIMx)

Function description

Indicates whether the capture/compare 1 interrupt (CC1IE) is enabled.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- DIER CC1IE LL_LPTIM_IsEnabledIT_CC1

LL_LPTIM_EnableIT_CC2

Function name

__STATIC_INLINE void LL_LPTIM_EnableIT_CC2 (LPTIM_TypeDef * LPTIMx)

Function description

Enable capture/compare 1 interrupt (CC2IE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC2IE LL_LPTIM_EnableIT_CC2

LL_LPTIM_DisableIT_CC2

Function name

__STATIC_INLINE void LL_LPTIM_DisableIT_CC2 (LPTIM_TypeDef * LPTIMx)

Function description

Disable capture/compare 2 interrupt (CC2IE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC2IE LL_LPTIM_DisableIT_CC2

LL_LPTIM_IsEnabledIT_CC2

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsEnabledIT_CC2 (const LPTIM_TypeDef * LPTIMx)

Function description

Indicates whether the capture/compare 2 interrupt (CC2IE) is enabled.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- DIER CC2IE LL_LPTIM_IsEnabledIT_CC2

LL_LPTIM_EnableIT_CC3

Function name

__STATIC_INLINE void LL_LPTIM_EnableIT_CC3 (LPTIM_TypeDef * LPTIMx)

Function description

Enable capture/compare 3 interrupt (CC3IE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC3IE LL_LPTIM_EnableIT_CC3

LL_LPTIM_DisableIT_CC3

Function name

__STATIC_INLINE void LL_LPTIM_DisableIT_CC3 (LPTIM_TypeDef * LPTIMx)

Function description

Disable capture/compare 3 interrupt (CC3IE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC3IE LL_LPTIM_DisableIT_CC3

LL_LPTIM_IsEnabledIT_CC3

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsEnabledIT_CC3 (LPTIM_TypeDef * LPTIMx)

Function description

Indicates whether the capture/compare 3 interrupt (CC3IE) is enabled.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- DIER CC3IE LL_LPTIM_IsEnabledIT_CC3

LL_LPTIM_EnableIT_CC4

Function name

__STATIC_INLINE void LL_LPTIM_EnableIT_CC4 (LPTIM_TypeDef * LPTIMx)

Function description

Enable capture/compare 4 interrupt (CC4IE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC4IE LL_LPTIM_EnableIT_CC4

LL_LPTIM_DisableIT_CC4

Function name

__STATIC_INLINE void LL_LPTIM_DisableIT_CC4 (LPTIM_TypeDef * LPTIMx)

Function description

Disable capture/compare 4 interrupt (CC4IE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC4IE LL_LPTIM_DisableIT_CC4

LL_LPTIM_IsEnabledIT_CC4

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsEnabledIT_CC4 (LPTIM_TypeDef * LPTIMx)

Function description

Indicates whether the capture/compare 4 interrupt (CC4IE) is enabled.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- DIER CC4IE LL_LPTIM_IsEnabledIT_CC4

LL_LPTIM_EnableIT_CC1O

Function name

__STATIC_INLINE void LL_LPTIM_EnableIT_CC1O (LPTIM_TypeDef * LPTIMx)

Function description

Enable capture/compare 1 over-capture interrupt (CC1OIE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC1OIE LL_LPTIM_EnableIT_CC1O

LL_LPTIM_DisableIT_CC1O

Function name

__STATIC_INLINE void LL_LPTIM_DisableIT_CC1O (LPTIM_TypeDef * LPTIMx)

Function description

Disable capture/compare 1 over-capture interrupt (CC1OIE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC1OIE LL_LPTIM_DisableIT_CC1O

LL_LPTIM_IsEnabledIT_CC1O

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsEnabledIT_CC1O (const LPTIM_TypeDef * LPTIMx)

Function description

Indicates whether the capture/compare 1 over-capture interrupt (CC1OIE) is enabled.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- DIER CC1OIE LL_LPTIM_IsEnabledIT_CC1O

LL_LPTIM_EnableIT_CC2O

Function name

__STATIC_INLINE void LL_LPTIM_EnableIT_CC2O (LPTIM_TypeDef * LPTIMx)

Function description

Enable capture/compare 1 over-capture interrupt (CC2OIE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC2OIE LL_LPTIM_EnableIT_CC2O

LL_LPTIM_DisableIT_CC2O

Function name

__STATIC_INLINE void LL_LPTIM_DisableIT_CC2O (LPTIM_TypeDef * LPTIMx)

Function description

Disable capture/compare 1 over-capture interrupt (CC2OIE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC2OIE LL_LPTIM_DisableIT_CC2O

LL_LPTIM_IsEnabledIT_CC2O

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsEnabledIT_CC2O (const LPTIM_TypeDef * LPTIMx)

Function description

Indicates whether the capture/compare 2 over-capture interrupt (CC2OIE) is enabled.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- DIER CC2OIE LL_LPTIM_IsEnabledIT_CC2O

LL_LPTIM_EnableIT_CC3O

Function name

__STATIC_INLINE void LL_LPTIM_EnableIT_CC3O (LPTIM_TypeDef * LPTIMx)

Function description

Enable capture/compare 3 over-capture interrupt (CC3OIE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC3OIE LL_LPTIM_EnableIT_CC3O

LL_LPTIM_DisableIT_CC3O

Function name

__STATIC_INLINE void LL_LPTIM_DisableIT_CC3O (LPTIM_TypeDef * LPTIMx)

Function description

Disable capture/compare 3 over-capture interrupt (CC3OIE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC3OIE LL_LPTIM_DisableIT_CC3O

LL_LPTIM_IsEnabledIT_CC3O

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsEnabledIT_CC3O (const LPTIM_TypeDef * LPTIMx)

Function description

Indicates whether the capture/compare 3 over-capture interrupt (CC3OIE) is enabled.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- DIER CC3OIE LL_LPTIM_IsEnabledIT_CC3O

LL_LPTIM_EnableIT_CC4O

Function name

__STATIC_INLINE void LL_LPTIM_EnableIT_CC4O (LPTIM_TypeDef * LPTIMx)

Function description

Enable capture/compare 4 over-capture interrupt (CC4OIE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC4OIE LL_LPTIM_EnableIT_CC4O

LL_LPTIM_DisableIT_CC4O

Function name

__STATIC_INLINE void LL_LPTIM_DisableIT_CC4O (LPTIM_TypeDef * LPTIMx)

Function description

Disable capture/compare 4 over-capture interrupt (CC4OIE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC4OIE LL_LPTIM_DisableIT_CC4O

LL_LPTIM_IsEnabledIT_CC4O

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsEnabledIT_CC4O (const LPTIM_TypeDef * LPTIMx)

Function description

Indicates whether the capture/compare 4 over-capture interrupt (CC4OIE) is enabled.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- DIER CC4OIE LL_LPTIM_IsEnabledIT_CC4O

LL_LPTIM_EnableIT_ARRM

Function name

__STATIC_INLINE void LL_LPTIM_EnableIT_ARRM (LPTIM_TypeDef * LPTIMx)

Function description

Enable autoreload match interrupt (ARRMIE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER ARRMIE LL_LPTIM_EnableIT_ARRM

LL_LPTIM_DisableIT_ARRM

Function name

__STATIC_INLINE void LL_LPTIM_DisableIT_ARRM (LPTIM_TypeDef * LPTIMx)

Function description

Disable autoreload match interrupt (ARRMIE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER ARRMIE LL_LPTIM_DisableIT_ARRM

LL_LPTIM_IsEnabledIT_ARRM

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsEnabledIT_ARRM (const LPTIM_TypeDef * LPTIMx)

Function description

Indicates whether the autoreload match interrupt (ARRMIE) is enabled.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- DIER ARRMIE LL_LPTIM_IsEnabledIT_ARRM

LL_LPTIM_EnableIT_EXTTRIG

Function name

__STATIC_INLINE void LL_LPTIM_EnableIT_EXTTRIG (LPTIM_TypeDef * LPTIMx)

Function description

Enable external trigger valid edge interrupt (EXTTRIGIE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER EXTTRIGIE LL_LPTIM_EnableIT_EXTTRIG

LL_LPTIM_DisableIT_EXTTRIG

Function name

__STATIC_INLINE void LL_LPTIM_DisableIT_EXTTRIG (LPTIM_TypeDef * LPTIMx)

Function description

Disable external trigger valid edge interrupt (EXTTRIGIE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER EXTTRIGIE LL_LPTIM_DisableIT_EXTTRIG

LL_LPTIM_IsEnabledIT_EXTTRIG

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsEnabledIT_EXTTRIG (const LPTIM_TypeDef * LPTIMx)

Function description

Indicates external trigger valid edge interrupt (EXTTRIGIE) is enabled.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- DIER EXTTRIGIE LL_LPTIM_IsEnabledIT_EXTTRIG

LL_LPTIM_EnableIT_CMP1OK

Function name

__STATIC_INLINE void LL_LPTIM_EnableIT_CMP1OK (LPTIM_TypeDef * LPTIMx)

Function description

Enable compare register write completed interrupt (CMP1OKIE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IER CMP1OKIE LL_LPTIM_EnableIT_CMP1OK

LL_LPTIM_DisableIT_CMP1OK

Function name

__STATIC_INLINE void LL_LPTIM_DisableIT_CMP1OK (LPTIM_TypeDef * LPTIMx)

Function description

Disable compare register write completed interrupt (CMP1OKIE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IER CMPO1KIE LL_LPTIM_DisableIT_CMP1OK

LL_LPTIM_IsEnabledIT_CMP1OK

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsEnabledIT_CMP1OK (const LPTIM_TypeDef * LPTIMx)

Function description

Indicates whether the compare register write completed interrupt (CMP1OKIE) is enabled.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- IER CMP1OKIE LL_LPTIM_IsEnabledIT_CMP1OK

LL_LPTIM_EnableIT_CMP2OK

Function name

__STATIC_INLINE void LL_LPTIM_EnableIT_CMP2OK (LPTIM_TypeDef * LPTIMx)

Function description

Enable compare register write completed interrupt (CMP2OKIE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IER CMP2OKIE LL_LPTIM_EnableIT_CMP2OK

LL_LPTIM_DisableIT_CMP2OK

Function name

__STATIC_INLINE void LL_LPTIM_DisableIT_CMP2OK (LPTIM_TypeDef * LPTIMx)

Function description

Disable compare register write completed interrupt (CMP2OKIE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IER CMP2OKIE LL_LPTIM_DisableIT_CMP2OK

LL_LPTIM_IsEnabledIT_CMP2OK

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsEnabledIT_CMP2OK (const LPTIM_TypeDef * LPTIMx)

Function description

Indicates whether the compare register write completed interrupt (CMP2OKIE) is enabled.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- IER CMP2OKIE LL_LPTIM_IsEnabledIT_CMP2OK

LL_LPTIM_EnableIT_CMP3OK

Function name

__STATIC_INLINE void LL_LPTIM_EnableIT_CMP3OK (LPTIM_TypeDef * LPTIMx)

Function description

Enable compare register write completed interrupt (CMP3OKIE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IER CMP3OKIE LL_LPTIM_EnableIT_CMP3OK

LL_LPTIM_DisableIT_CMP3OK

Function name

__STATIC_INLINE void LL_LPTIM_DisableIT_CMP3OK (LPTIM_TypeDef * LPTIMx)

Function description

Disable compare register write completed interrupt (CMP3OKIE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IER CMP3OKIE LL_LPTIM_DisableIT_CMP3OK

LL_LPTIM_IsEnabledIT_CMP3OK

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsEnabledIT_CMP3OK (LPTIM_TypeDef * LPTIMx)

Function description

Indicates whether the compare register write completed interrupt (CMP3OKIE) is enabled.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- IER CMP3OKIE LL_LPTIM_IsEnabledIT_CMP3OK

LL_LPTIM_EnableIT_CMP4OK

Function name

__STATIC_INLINE void LL_LPTIM_EnableIT_CMP4OK (LPTIM_TypeDef * LPTIMx)

Function description

Enable compare register write completed interrupt (CMP4OKIE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IER CMP4OKIE LL_LPTIM_EnableIT_CMP4OK

LL_LPTIM_DisableIT_CMP4OK

Function name

__STATIC_INLINE void LL_LPTIM_DisableIT_CMP4OK (LPTIM_TypeDef * LPTIMx)

Function description

Disable compare register write completed interrupt (CMP4OKIE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- IER CMP4OKIE LL_LPTIM_DisableIT_CMP4OK

LL_LPTIM_IsEnabledIT_CMP4OK

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsEnabledIT_CMP4OK (LPTIM_TypeDef * LPTIMx)

Function description

Indicates whether the compare register write completed interrupt (CMP4OKIE) is enabled.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- IER CMP4OKIE LL_LPTIM_IsEnabledIT_CMP4OK

LL_LPTIM_EnableIT_ARROK

Function name

__STATIC_INLINE void LL_LPTIM_EnableIT_ARROK (LPTIM_TypeDef * LPTIMx)

Function description

Enable autoreload register write completed interrupt (ARROKIE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER ARROKIE LL_LPTIM_EnableIT_ARROK

LL_LPTIM_DisableIT_ARROK

Function name

__STATIC_INLINE void LL_LPTIM_DisableIT_ARROK (LPTIM_TypeDef * LPTIMx)

Function description

Disable autoreload register write completed interrupt (ARROKIE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER ARROKIE LL_LPTIM_DisableIT_ARROK

LL_LPTIM_IsEnabledIT_ARROK

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsEnabledIT_ARROK (const LPTIM_TypeDef * LPTIMx)

Function description

Indicates whether the autoreload register write completed interrupt (ARROKIE) is enabled.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit(1 or 0).

Reference Manual to LL API cross reference:

- DIER ARROKIE LL_LPTIM_IsEnabledIT_ARROK

LL_LPTIM_EnableIT_UP

Function name

__STATIC_INLINE void LL_LPTIM_EnableIT_UP (LPTIM_TypeDef * LPTIMx)

Function description

Enable direction change to up interrupt (UPIE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER UPIE LL_LPTIM_EnableIT_UP

LL_LPTIM_DisableIT_UP

Function name

__STATIC_INLINE void LL_LPTIM_DisableIT_UP (LPTIM_TypeDef * LPTIMx)

Function description

Disable direction change to up interrupt (UPIE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER UPIE LL_LPTIM_DisableIT_UP

LL_LPTIM_IsEnabledIT_UP

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsEnabledIT_UP (const LPTIM_TypeDef * LPTIMx)

Function description

Indicates whether the direction change to up interrupt (UPIE) is enabled.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit(1 or 0).

Reference Manual to LL API cross reference:

- DIER UPIE LL_LPTIM_IsEnabledIT_UP

LL_LPTIM_EnableIT_DOWN

Function name

__STATIC_INLINE void LL_LPTIM_EnableIT_DOWN (LPTIM_TypeDef * LPTIMx)

Function description

Enable direction change to down interrupt (DOWNIE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER DOWNIE LL_LPTIM_EnableIT_DOWN

LL_LPTIM_DisableIT_DOWN

Function name

__STATIC_INLINE void LL_LPTIM_DisableIT_DOWN (LPTIM_TypeDef * LPTIMx)

Function description

Disable direction change to down interrupt (DOWNIE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER DOWNIE LL_LPTIM_DisableIT_DOWN

LL_LPTIM_IsEnabledIT_DOWN

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsEnabledIT_DOWN (const LPTIM_TypeDef * LPTIMx)

Function description

Indicates whether the direction change to down interrupt (DOWNIE) is enabled.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit(1 or 0).

Reference Manual to LL API cross reference:

- DIER DOWNIE LL_LPTIM_IsEnabledIT_DOWN

LL_LPTIM_EnableIT_REPOK

Function name

__STATIC_INLINE void LL_LPTIM_EnableIT_REPOK (LPTIM_TypeDef * LPTIMx)

Function description

Enable repetition register update successfully completed interrupt (REPOKIE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER REPOKIE LL_LPTIM_EnableIT_REPOK

LL_LPTIM_DisableIT_REPOK

Function name

__STATIC_INLINE void LL_LPTIM_DisableIT_REPOK (LPTIM_TypeDef * LPTIMx)

Function description

Disable repetition register update successfully completed interrupt (REPOKIE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER REPOKIE LL_LPTIM_DisableIT_REPOK

LL_LPTIM_IsEnabledIT_REPOK

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsEnabledIT_REPOK (const LPTIM_TypeDef * LPTIMx)

Function description

Indicates whether the repetition register update successfully completed interrupt (REPOKIE) is enabled.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit(1 or 0).

Reference Manual to LL API cross reference:

- DIER REPOKIE LL_LPTIM_IsEnabledIT_REPOK

LL_LPTIM_EnableIT_UE

Function name

__STATIC_INLINE void LL_LPTIM_EnableIT_UE (LPTIM_TypeDef * LPTIMx)

Function description

Enable update event interrupt (UEIE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER UEIE LL_LPTIM_EnableIT_UE

LL_LPTIM_DisableIT_UE

Function name

__STATIC_INLINE void LL_LPTIM_DisableIT_UE (LPTIM_TypeDef * LPTIMx)

Function description

Disable update event interrupt (UEIE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER UEIE LL_LPTIM_DisableIT_UE

LL_LPTIM_IsEnabledIT_UE

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsEnabledIT_UE (const LPTIM_TypeDef * LPTIMx)

Function description

Indicates whether the update event interrupt (UEIE) is enabled.

Parameters

- **LPTIMx:** Low-Power Timer instance @ retval State of bit(1 or 0).

Reference Manual to LL API cross reference:

- DIER UEIE LL_LPTIM_IsEnabledIT_UE

LL_LPTIM_EnableDMAReq_UPDATE

Function name

__STATIC_INLINE void LL_LPTIM_EnableDMAReq_UPDATE (LPTIM_TypeDef * LPTIMx)

Function description

Enable update DMA request.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER UEDE LL_LPTIM_EnableDMAReq_UPDATE

LL_LPTIM_DisableDMAReq_UPDATE

Function name

__STATIC_INLINE void LL_LPTIM_DisableDMAReq_UPDATE (LPTIM_TypeDef * LPTIMx)

Function description

Disable update DMA request.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER UEDE LL_LPTIM_DisableDMAReq_UPDATE

LL_LPTIM_IsEnabledDMAReq_UPDATE

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsEnabledDMAReq_UPDATE (const LPTIM_TypeDef * LPTIMx)

Function description

Indicates whether the update DMA request is enabled.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- DIER UEDE LL_LPTIM_IsEnabledDMAReq_UPDATE

LL_LPTIM_EnableDMAReq_CC1

Function name

__STATIC_INLINE void LL_LPTIM_EnableDMAReq_CC1 (LPTIM_TypeDef * LPTIMx)

Function description

Enable capture/compare 1 DMA request (CC1DE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC1DE LL_LPTIM_EnableDMAReq_CC1

LL_LPTIM_DisableDMAReq_CC1

Function name

__STATIC_INLINE void LL_LPTIM_DisableDMAReq_CC1 (LPTIM_TypeDef * LPTIMx)

Function description

Disable capture/compare 1 DMA request (CC1DE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC1DE LL_LPTIM_DisableDMAReq_CC1

LL_LPTIM_IsEnabledDMAReq_CC1

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsEnabledDMAReq_CC1 (const LPTIM_TypeDef * LPTIMx)

Function description

Indicates whether the capture/compare 1 DMA request (CC1DE) is enabled.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- DIER CC1DE LL_LPTIM_IsEnabledDMAReq_CC1

LL_LPTIM_EnableDMAReq_CC2

Function name

__STATIC_INLINE void LL_LPTIM_EnableDMAReq_CC2 (LPTIM_TypeDef * LPTIMx)

Function description

Enable capture/compare 2 DMA request (CC2DE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC2DE LL_LPTIM_EnableDMAReq_CC2

LL_LPTIM_DisableDMAReq_CC2

Function name

__STATIC_INLINE void LL_LPTIM_DisableDMAReq_CC2 (LPTIM_TypeDef * LPTIMx)

Function description

Disable capture/compare 2 DMA request (CC2DE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC2DE LL_LPTIM_DisableDMAReq_CC2

LL_LPTIM_IsEnabledDMAReq_CC2

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsEnabledDMAReq_CC2 (const LPTIM_TypeDef * LPTIMx)

Function description

Indicates whether the capture/compare 2 DMA request (CC2DE) is enabled.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- DIER CC2DE LL_LPTIM_IsEnabledDMAReq_CC2

LL_LPTIM_EnableDMAReq_CC3

Function name

__STATIC_INLINE void LL_LPTIM_EnableDMAReq_CC3 (LPTIM_TypeDef * LPTIMx)

Function description

Enable capture/compare 3 DMA request (CC3DE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC3DE LL_LPTIM_EnableDMAReq_CC3

LL_LPTIM_DisableDMAReq_CC3

Function name

__STATIC_INLINE void LL_LPTIM_DisableDMAReq_CC3 (LPTIM_TypeDef * LPTIMx)

Function description

Disable capture/compare 3 DMA request (CC3DE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC3DE LL_LPTIM_DisableDMAReq_CC3

LL_LPTIM_IsEnabledDMAReq_CC3

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsEnabledDMAReq_CC3 (const LPTIM_TypeDef * LPTIMx)

Function description

Indicates whether the capture/compare 3 DMA request (CC3DE) is enabled.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- DIER CC3DE LL_LPTIM_IsEnabledDMAReq_CC3

LL_LPTIM_EnableDMAReq_CC4

Function name

__STATIC_INLINE void LL_LPTIM_EnableDMAReq_CC4 (LPTIM_TypeDef * LPTIMx)

Function description

Enable capture/compare 4 DMA request (CC4DE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC4DE LL_LPTIM_EnableDMAReq_CC4

LL_LPTIM_DisableDMAReq_CC4

Function name

__STATIC_INLINE void LL_LPTIM_DisableDMAReq_CC4 (LPTIM_TypeDef * LPTIMx)

Function description

Disable capture/compare 4 DMA request (CC4DE).

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC4DE LL_LPTIM_DisableDMAReq_CC4

LL_LPTIM_IsEnabledDMAReq_CC4

Function name

__STATIC_INLINE uint32_t LL_LPTIM_IsEnabledDMAReq_CC4 (const LPTIM_TypeDef * LPTIMx)

Function description

Indicates whether the capture/compare 4 DMA request (CC4DE) is enabled.

Parameters

- **LPTIMx:** Low-Power Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- DIER CC4DE LL_LPTIM_IsEnabledDMAReq_CC4

68.3 LPTIM Firmware driver defines

The following section lists the various define and macros of the module.

68.3.1 LPTIM

LPTIM

Input1 Source

LL_LPTIM_INPUT1_SRC_GPIO

For LPTIM1, LPTIM2 and LPTIM3

LL_LPTIM_INPUT1_SRC_COMP1

For LPTIM1, LPTIM2 and LPTIM3

LL_LPTIM_INPUT1_SRC_COMP2

For LPTIM2

LL_LPTIM_INPUT1_SRC_COMP1_COMP2

For LPTIM2

Input2 Source

LL_LPTIM_INPUT2_SRC_GPIO

For LPTIM1 and LPTIM3

LL_LPTIM_INPUT2_SRC_COMP2

For LPTIM1 and LPTIM3

LPTIM1 Input Ch1 Remap

LL_LPTIM_LPTIM1_IC1_RMP_GPIO
IC1 connected to GPIO

LL_LPTIM_LPTIM1_IC1_RMP_COMP1
IC1 connected to COMP1

LL_LPTIM_LPTIM1_IC1_RMP_COMP2
IC1 connected to COMP2

LPTIM1 Input Ch2 Remap

LL_LPTIM_LPTIM1_IC2_RMP_GPIO
IC2 connected to GPIO

LL_LPTIM_LPTIM1_IC2_RMP_MCO1
IC2 connected to MCO1

LL_LPTIM_LPTIM1_IC2_RMP_MCO2
IC2 connected to MCO2

LPTIM1 Input Ch3 Remap

LL_LPTIM_LPTIM1_IC3_RMP_GPIO
IC3 connected to GPIO

LL_LPTIM_LPTIM1_IC3_RMP_COMP1
IC3 connected to COMP1

LL_LPTIM_LPTIM1_IC3_RMP_COMP2
IC3 connected to COMP2

LPTIM1 Input Ch4 Remap

LL_LPTIM_LPTIM1_IC4_RMP_GPIO
IC4 connected to GPIO

LL_LPTIM_LPTIM1_IC4_RMP_COMP1
IC4 connected to COMP1

LL_LPTIM_LPTIM1_IC4_RMP_COMP2
IC4 connected to COMP2

LPTIM2 Input Ch1 Remap

LL_LPTIM_LPTIM2_IC1_RMP_GPIO
IC1 connected to GPIO

LL_LPTIM_LPTIM2_IC1_RMP_COMP1
IC1 connected to COMP1

LL_LPTIM_LPTIM2_IC1_RMP_COMP2
IC1 connected to COMP2

LPTIM2 Input Ch2 Remap

LL_LPTIM_LPTIM2_IC2_RMP_GPIO
IC2 connected to GPIO

LL_LPTIM_LPTIM2_IC2_RMP_MCO1

IC2 connected to MCO1

LL_LPTIM_LPTIM2_IC2_RMP_MCO2

IC2 connected to MCO2

LPTIM3 Input Ch1 Remap

LL_LPTIM_LPTIM3_IC1_RMP_GPIO

IC1 connected to GPIO

LL_LPTIM_LPTIM3_IC1_RMP_COMP1

IC1 connected to COMP1

LL_LPTIM_LPTIM3_IC1_RMP_COMP2

IC1 connected to COMP2

LPTIM3 Input Ch2 Remap

LL_LPTIM_LPTIM3_IC2_RMP_GPIO

IC2 connected to GPIO

LL_LPTIM_LPTIM3_IC2_RMP_MCO1

IC2 connected to MCO1

LL_LPTIM_LPTIM3_IC2_RMP_MCO2

IC2 connected to MCO2

LPTIM3 Input Ch3 Remap

LL_LPTIM_LPTIM3_IC3_RMP_GPIO

IC3 connected to GPIO

LL_LPTIM_LPTIM3_IC3_RMP_COMP1

IC3 connected to COMP1

LL_LPTIM_LPTIM3_IC3_RMP_COMP2

IC3 connected to COMP2

LPTIM3 Input Ch4 Remap

LL_LPTIM_LPTIM3_IC4_RMP_GPIO

IC4 connected to GPIO

LL_LPTIM_LPTIM3_IC4_RMP_COMP1

IC4 connected to COMP1

LL_LPTIM_LPTIM3_IC4_RMP_COMP2

IC4 connected to COMP2

Clock Filter

LL_LPTIM_CLK_FILTER_NONE

Any external clock signal level change is considered as a valid transition

LL_LPTIM_CLK_FILTER_2

External clock signal level change must be stable for at least 2 clock periods before it is considered as valid transition

LL_LPTIM_CLK_FILTER_4

External clock signal level change must be stable for at least 4 clock periods before it is considered as valid transition

LL_LPTIM_CLK_FILTER_8

External clock signal level change must be stable for at least 8 clock periods before it is considered as valid transition

Clock Polarity

LL_LPTIM_CLK_POLARITY_RISING

The rising edge is the active edge used for counting

LL_LPTIM_CLK_POLARITY_FALLING

The falling edge is the active edge used for counting

LL_LPTIM_CLK_POLARITY_RISING_FALLING

Both edges are active edges

Clock Source

LL_LPTIM_CLK_SOURCE_INTERNAL

LPTIM is clocked by internal clock source (APB clock or any of the embedded oscillators)

LL_LPTIM_CLK_SOURCE_EXTERNAL

LPTIM is clocked by an external clock source through the LPTIM external Input1

Counter Mode

LL_LPTIM_COUNTER_MODE_INTERNAL

The counter is incremented following each internal clock pulse

LL_LPTIM_COUNTER_MODE_EXTERNAL

The counter is incremented following each valid clock pulse on the LPTIM external Input1

Encoder Mode

LL_LPTIM_ENCODER_MODE_RISING

The rising edge is the active edge used for counting

LL_LPTIM_ENCODER_MODE_FALLING

The falling edge is the active edge used for counting

LL_LPTIM_ENCODER_MODE_RISING_FALLING

Both edges are active edges

Get Flags Defines

LL_LPTIM_ISR_CMP1OK

Compare register 1 update OK

LL_LPTIM_ISR_CMP2OK

Compare register 2 update OK

LL_LPTIM_ISR_CMP3OK

Compare register 3 update OK

LL_LPTIM_ISR_CMP4OK

Compare register 4 update OK

LL_LPTIM_ISR_CC1IF

Capture/Compare 1 interrupt flag

LL_LPTIM_ISR_CC2IF

Capture/Compare 2 interrupt flag

LL_LPTIM_ISR_CC3IF

Capture/Compare 3 interrupt flag

LL_LPTIM_ISR_CC4IF

Capture/Compare 4 interrupt flag

LL_LPTIM_ISR_CC1OF

Capture/Compare 1 over-capture flag

LL_LPTIM_ISR_CC2OF

Capture/Compare 2 over-capture flag

LL_LPTIM_ISR_CC3OF

Capture/Compare 3 over-capture flag

LL_LPTIM_ISR_CC4OF

Capture/Compare 4 over-capture flag

LL_LPTIM_ISR_DIEROK

Interrupt enable register update OK

LL_LPTIM_ISR_ARRM

Autoreload match

LL_LPTIM_ISR_EXTTRIG

External trigger edge event

LL_LPTIM_ISR_ARROK

Autoreload register update OK

LL_LPTIM_ISR_UP

Counter direction change down to up

LL_LPTIM_ISR_DOWN

Counter direction change up to down

LL_LPTIM_ISR_UE

Update event

LL_LPTIM_ISR_REPOK

Repetition register update OK

IT Defines

LL_LPTIM_DIER_CMP1OKIE

Compare register 1 update OK

LL_LPTIM_DIER_CMP2OKIE

Compare register 2 update OK

LL_LPTIM_DIER_CMP3OKIE

Compare register 3 update OK

LL_LPTIM_DIER_CMP4OKIE

Compare register 4 update OK

LL_LPTIM_DIER_CC1IFIE

Capture/Compare 1 interrupt flag

LL_LPTIM_DIER_CC2IFIE

Capture/Compare 2 interrupt flag

LL_LPTIM_DIER_CC3IFIE

Capture/Compare 3 interrupt flag

LL_LPTIM_DIER_CC4IFIE

Capture/Compare 4 interrupt flag

LL_LPTIM_DIER_CC1OFIE

Capture/Compare 1 over-capture flag

LL_LPTIM_DIER_CC2OFIE

Capture/Compare 2 over-capture flag

LL_LPTIM_DIER_CC3OFIE

Capture/Compare 3 over-capture flag

LL_LPTIM_DIER_CC4OFIE

Capture/Compare 4 over-capture flag

LL_LPTIM_DIER_ARRMIE

Autoreload match

LL_LPTIM_DIER_EXTTRIGIE

External trigger edge event

LL_LPTIM_DIER_ARROKIE

Autoreload register update OK

LL_LPTIM_DIER_UPIE

Counter direction change down to up

LL_LPTIM_DIER_DOWNIE

Counter direction change up to down

LL_LPTIM_DIER_UEIE

Update event

LL_LPTIM_DIER_REPOKIE

Repetition register update OK

Input Capture Filter

LL_LPTIM_ICFLT_CLOCK_DIV1

any external input capture signal level change is considered as a valid transition

LL_LPTIM_ICFLT_CLOCK_DIV2

external input capture signal level change must be stable for at least 2 clock periods before it is considered as valid transition

LL_LPTIM_ICFLT_CLOCK_DIV4

external input capture signal level change must be stable for at least 4 clock periods before it is considered as valid transition

LL_LPTIM_ICFLT_CLOCK_DIV8

external input capture signal level change must be stable for at least 8 clock periods before it is considered as valid transition

Input Capture Polarity

LL_LPTIM_ICPOLARITY_RISING

Capture/Compare input rising polarity

LL_LPTIM_ICPOLARITY_FALLING

Capture/Compare input falling polarity

LL_LPTIM_ICPOLARITY_RISING_FALLING

Capture/Compare input rising and falling polarities

Input Capture Prescaler

LL_LPTIM_ICPSC_DIV1

Capture performed each time an edge is detected on the capture input

LL_LPTIM_ICPSC_DIV2

Capture performed once every 2 events

LL_LPTIM_ICPSC_DIV4

Capture performed once every 4 events

LL_LPTIM_ICPSC_DIV8

Capture performed once every 8 events

Input Capture selection

LL_LPTIM_CCMODE_OUTPUT_PWM

Select PWM mode

LL_LPTIM_CCMODE_INPUTCAPTURE

Select Input Capture mode

Operating Mode

LL_LPTIM_OPERATING_MODE_CONTINUOUS

LP Timer starts in continuous mode

LL_LPTIM_OPERATING_MODE_ONESHOT

LP Tilmer starts in single mode

Output Polarity

LL_LPTIM_OUTPUT_POLARITY_REGULAR

The LPTIM output reflects the compare results between LPTIMx_ARR and LPTIMx_CCRx registers

LL_LPTIM_OUTPUT_POLARITY_INVERSE

The LPTIM output reflects the inverse of the compare results between LPTIMx_ARR and LPTIMx_CCx registers

Output Waveform Type

LL_LPTIM_OUTPUT_WAVEFORM_PWM

LPTIM generates either a PWM waveform or a One pulse waveform depending on chosen operating mode CONTINUOUS or SINGLE

LL_LPTIM_OUTPUT_WAVEFORM_SETONCE

LPTIM generates a Set Once waveform

Prescaler Value

LL_LPTIM_PRESCALER_DIV1

Prescaler division factor is set to 1

LL_LPTIM_PRESCALER_DIV2

Prescaler division factor is set to 2

LL_LPTIM_PRESCALER_DIV4

Prescaler division factor is set to 4

LL_LPTIM_PRESCALER_DIV8

Prescaler division factor is set to 8

LL_LPTIM_PRESCALER_DIV16

Prescaler division factor is set to 16

LL_LPTIM_PRESCALER_DIV32

Prescaler division factor is set to 32

LL_LPTIM_PRESCALER_DIV64

Prescaler division factor is set to 64

LL_LPTIM_PRESCALER_DIV128

Prescaler division factor is set to 128

Trigger Filter

LL_LPTIM_TRIG_FILTER_NONE

Any trigger active level change is considered as a valid trigger

LL_LPTIM_TRIG_FILTER_2

Trigger active level change must be stable for at least 2 clock periods before it is considered as valid trigger

LL_LPTIM_TRIG_FILTER_4

Trigger active level change must be stable for at least 4 clock periods before it is considered as valid trigger

LL_LPTIM_TRIG_FILTER_8

Trigger active level change must be stable for at least 8 clock periods before it is considered as valid trigger

Trigger Polarity

LL_LPTIM_TRIG_POLARITY_RISING

LPTIM counter starts when a rising edge is detected

LL_LPTIM_TRIG_POLARITY_FALLING

LPTIM counter starts when a falling edge is detected

LL_LPTIM_TRIG_POLARITY_RISING_FALLING

LPTIM counter starts when a rising or a falling edge is detected

Trigger Source

LL_LPTIM_TRIG_SOURCE_GPIO

External input trigger is connected to TIMx_ETR input

LL_LPTIM_TRIG_SOURCE_RTCALARMA

External input trigger is connected to RTC Alarm A

LL_LPTIM_TRIG_SOURCE_RTCALARMB

External input trigger is connected to RTC Alarm B

LL_LPTIM_TRIG_SOURCE_RTCTAMP1

External input trigger is connected to RTC Tamper 1

LL_LPTIM_TRIG_SOURCE_RTCTAMP2

External input trigger is connected to RTC Tamper 2

LL_LPTIM_TRIG_SOURCE_RTCTAMP3

External input trigger is connected to RTC Tamper 3

LL_LPTIM_TRIG_SOURCE_COMP1

External input trigger is connected to COMP1 output

LL_LPTIM_TRIG_SOURCE_COMP2

External input trigger is connected to COMP2 output

Update Mode

LL_LPTIM_UPDATE_MODE_IMMEDIATE

Preload is disabled: registers are updated after each APB bus write access

LL_LPTIM_UPDATE_MODE_ENDOFPERIOD

preload is enabled: registers are updated at the end of the current LPTIM period

Common Write and read registers Macros

LL_LPTIM_WriteReg

Description:

- Write a value in LPTIM register.

Parameters:

- __INSTANCE__: LPTIM Instance
- __REG__: Register to be written
- __VALUE__: Value to be written in the register

Return value:

- None

LL_LPTIM_ReadReg

Description:

- Read a value in LPTIM register.

Parameters:

- __INSTANCE__: LPTIM Instance
- __REG__: Register to be read

Return value:

- Register: value

LL_LPTIM_IC_GET_OFFSET

Description:

- LPTimer Input Capture Get Offset(in counter step unit)

Parameters:

- __PSC__: This parameter can be one of the following values:
  - LL_LPTIM_PRESCALER_DIV1
  - LL_LPTIM_PRESCALER_DIV2
  - LL_LPTIM_PRESCALER_DIV4
  - LL_LPTIM_PRESCALER_DIV8
  - LL_LPTIM_PRESCALER_DIV16
  - LL_LPTIM_PRESCALER_DIV32
  - LL_LPTIM_PRESCALER_DIV64
  - LL_LPTIM_PRESCALER_DIV128
- __FLT__: This parameter can be one of the following values:
  - LL_LPTIM_ICFLT_CLOCK_DIV1
  - LL_LPTIM_ICFLT_CLOCK_DIV2
  - LL_LPTIM_ICFLT_CLOCK_DIV4
  - LL_LPTIM_ICFLT_CLOCK_DIV8

Return value:

- offset: value

Notes:

- The real capture value corresponding to the input capture trigger can be calculated using the formula hereafter : Real capture value = captured(LPTIM_CCRx) - offset The Offset value is depending on the glitch filter value for the channel and the value of the prescaler for the kernel clock. Please check Errata Sheet V1_8 for more details under "variable latency on input capture channel" section.

69 LL LPUART Generic Driver

69.1 LPUART Firmware driver registers structures

69.1.1 LL_LPUART_InitTypeDef

LL_LPUART_InitTypeDef is defined in the stm32u0xx_ll_lpuart.h

Data Fields

- ***uint32_t PrescalerValue***
- ***uint32_t BaudRate***
- ***uint32_t DataWidth***
- ***uint32_t StopBits***
- ***uint32_t Parity***
- ***uint32_t TransferDirection***
- ***uint32_t HardwareFlowControl***

Field Documentation

- ***uint32_t LL_LPUART_InitTypeDef::PrescalerValue***
  Specifies the Prescaler to compute the communication baud rate. This parameter can be a value of ***LPUART_LL_EC_PRESCALER***.This feature can be modified afterwards using unitary function **LL_LPUART_SetPrescaler()**.
- ***uint32_t LL_LPUART_InitTypeDef::BaudRate***
  This field defines expected LPUART communication baud rate.This feature can be modified afterwards using unitary function **LL_LPUART_SetBaudRate()**.
- ***uint32_t LL_LPUART_InitTypeDef::DataWidth***
  Specifies the number of data bits transmitted or received in a frame. This parameter can be a value of ***LPUART_LL_EC_DATAWIDTH***.This feature can be modified afterwards using unitary function **LL_LPUART_SetDataWidth()**.
- ***uint32_t LL_LPUART_InitTypeDef::StopBits***
  Specifies the number of stop bits transmitted. This parameter can be a value of ***LPUART_LL_EC_STOPBITS***.This feature can be modified afterwards using unitary function **LL_LPUART_SetStopBitsLength()**.
- ***uint32_t LL_LPUART_InitTypeDef::Parity***
  Specifies the parity mode. This parameter can be a value of ***LPUART_LL_EC_PARITY***.This feature can be modified afterwards using unitary function **LL_LPUART_SetParity()**.
- ***uint32_t LL_LPUART_InitTypeDef::TransferDirection***
  Specifies whether the Receive and/or Transmit mode is enabled or disabled. This parameter can be a value of ***LPUART_LL_EC_DIRECTION***.This feature can be modified afterwards using unitary function **LL_LPUART_SetTransferDirection()**.
- ***uint32_t LL_LPUART_InitTypeDef::HardwareFlowControl***
  Specifies whether the hardware flow control mode is enabled or disabled. This parameter can be a value of ***LPUART_LL_EC_HWCONTROL***.This feature can be modified afterwards using unitary function **LL_LPUART_SetHWFlowCtrl()**.

69.2 LPUART Firmware driver API description

The following section lists the various functions of the LPUART library.

69.2.1 Detailed description of functions

LL_LPUART_Enable

Function name

__STATIC_INLINE void LL_LPUART_Enable (USART_TypeDef * LPUARTx)

Function description

LPUART Enable.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 UE LL_LPUART_Enable

LL_LPUART_Disable

Function name

__STATIC_INLINE void LL_LPUART_Disable (USART_TypeDef * LPUARTx)

Function description

LPUART Disable.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Notes

- When LPUART is disabled, LPUART prescalers and outputs are stopped immediately, and current operations are discarded. The configuration of the LPUART is kept, but all the status flags, in the LPUARTx_ISR are set to their default values.
- In order to go into low-power mode without generating errors on the line, the TE bit must be reset before and the software must wait for the TC bit in the LPUART_ISR to be set before resetting the UE bit. The DMA requests are also reset when UE = 0 so the DMA channel must be disabled before resetting the UE bit.

Reference Manual to LL API cross reference:

- CR1 UE LL_LPUART_Disable

LL_LPUART_IsEnabled

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsEnabled (const USART_TypeDef * LPUARTx)

Function description

Indicate if LPUART is enabled.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 UE LL_LPUART_IsEnabled

LL_LPUART_EnableFIFO

Function name

__STATIC_INLINE void LL_LPUART_EnableFIFO (USART_TypeDef * LPUARTx)

Function description

FIFO Mode Enable.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 FIFOEN LL_LPUART_EnableFIFO

LL_LPUART_DisableFIFO

Function name

__STATIC_INLINE void LL_LPUART_DisableFIFO (USART_TypeDef * LPUARTx)

Function description

FIFO Mode Disable.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 FIFOEN LL_LPUART_DisableFIFO

LL_LPUART_IsEnabledFIFO

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsEnabledFIFO (const USART_TypeDef * LPUARTx)

Function description

Indicate if FIFO Mode is enabled.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 FIFOEN LL_LPUART_IsEnabledFIFO

LL_LPUART_SetTXFIFOThreshold

Function name

__STATIC_INLINE void LL_LPUART_SetTXFIFOThreshold (USART_TypeDef * LPUARTx, uint32_t Threshold)

Function description

Configure TX FIFO Threshold.

Parameters

- **LPUARTx:** LPUART Instance
- **Threshold:** This parameter can be one of the following values:
  - LL_LPUART_FIFOTHRESHOLD_1_8
  - LL_LPUART_FIFOTHRESHOLD_1_4
  - LL_LPUART_FIFOTHRESHOLD_1_2
  - LL_LPUART_FIFOTHRESHOLD_3_4
  - LL_LPUART_FIFOTHRESHOLD_7_8
  - LL_LPUART_FIFOTHRESHOLD_8_8

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 TXFTCFG LL_LPUART_SetTXFIFOThreshold

LL_LPUART_GetTXFIFOThreshold

Function name

__STATIC_INLINE uint32_t LL_LPUART_GetTXFIFOThreshold (const USART_TypeDef * LPUARTx)

Function description

Return TX FIFO Threshold Configuration.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_LPUART_FIFOTHRESHOLD_1_8
  - LL_LPUART_FIFOTHRESHOLD_1_4
  - LL_LPUART_FIFOTHRESHOLD_1_2
  - LL_LPUART_FIFOTHRESHOLD_3_4
  - LL_LPUART_FIFOTHRESHOLD_7_8
  - LL_LPUART_FIFOTHRESHOLD_8_8

Reference Manual to LL API cross reference:

- CR3 TXFTCFG LL_LPUART_GetTXFIFOThreshold

LL_LPUART_SetRXFIFOThreshold

Function name

__STATIC_INLINE void LL_LPUART_SetRXFIFOThreshold (USART_TypeDef * LPUARTx, uint32_t Threshold)

Function description

Configure RX FIFO Threshold.

Parameters

- **LPUARTx:** LPUART Instance
- **Threshold:** This parameter can be one of the following values:
  - LL_LPUART_FIFOTHRESHOLD_1_8
  - LL_LPUART_FIFOTHRESHOLD_1_4
  - LL_LPUART_FIFOTHRESHOLD_1_2
  - LL_LPUART_FIFOTHRESHOLD_3_4
  - LL_LPUART_FIFOTHRESHOLD_7_8
  - LL_LPUART_FIFOTHRESHOLD_8_8

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 RXFTCFG LL_LPUART_SetRXFIFOThreshold

LL_LPUART_GetRXFIFOThreshold

Function name

__STATIC_INLINE uint32_t LL_LPUART_GetRXFIFOThreshold (const USART_TypeDef * LPUARTx)

Function description

Return RX FIFO Threshold Configuration.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_LPUART_FIFOTHRESHOLD_1_8
  - LL_LPUART_FIFOTHRESHOLD_1_4
  - LL_LPUART_FIFOTHRESHOLD_1_2
  - LL_LPUART_FIFOTHRESHOLD_3_4
  - LL_LPUART_FIFOTHRESHOLD_7_8
  - LL_LPUART_FIFOTHRESHOLD_8_8

Reference Manual to LL API cross reference:

- CR3 RXFTCFG LL_LPUART_GetRXFIFOThreshold

LL_LPUART_ConfigFIFOsThreshold

Function name

__STATIC_INLINE void LL_LPUART_ConfigFIFOsThreshold (USART_TypeDef * LPUARTx, uint32_t TXThreshold, uint32_t RXThreshold)

Function description

Configure TX and RX FIFOs Threshold.

Parameters

- **LPUARTx:** LPUART Instance
- **TXThreshold:** This parameter can be one of the following values:
  - LL_LPUART_FIFOTHRESHOLD_1_8
  - LL_LPUART_FIFOTHRESHOLD_1_4
  - LL_LPUART_FIFOTHRESHOLD_1_2
  - LL_LPUART_FIFOTHRESHOLD_3_4
  - LL_LPUART_FIFOTHRESHOLD_7_8
  - LL_LPUART_FIFOTHRESHOLD_8_8
- **RXThreshold:** This parameter can be one of the following values:
  - LL_LPUART_FIFOTHRESHOLD_1_8
  - LL_LPUART_FIFOTHRESHOLD_1_4
  - LL_LPUART_FIFOTHRESHOLD_1_2
  - LL_LPUART_FIFOTHRESHOLD_3_4
  - LL_LPUART_FIFOTHRESHOLD_7_8
  - LL_LPUART_FIFOTHRESHOLD_8_8

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 TXFTCFG LL_LPUART_ConfigFIFOsThreshold
- CR3 RXFTCFG LL_LPUART_ConfigFIFOsThreshold

LL_LPUART_EnableInStopMode

Function name

__STATIC_INLINE void LL_LPUART_EnableInStopMode (USART_TypeDef * LPUARTx)

Function description

LPUART enabled in STOP Mode.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Notes

- When this function is enabled, LPUART is able to wake up the MCU from Stop mode, provided that LPUART clock selection is HSI or LSE in RCC.

Reference Manual to LL API cross reference:

- CR1 UESM LL_LPUART_EnableInStopMode

LL_LPUART_DisableInStopMode

Function name

__STATIC_INLINE void LL_LPUART_DisableInStopMode (USART_TypeDef * LPUARTx)

Function description

LPUART disabled in STOP Mode.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Notes

- When this function is disabled, LPUART is not able to wake up the MCU from Stop mode

Reference Manual to LL API cross reference:

- CR1 UESM LL_LPUART_DisableInStopMode

LL_LPUART_IsEnabledInStopMode

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsEnabledInStopMode (const USART_TypeDef * LPUARTx)

Function description

Indicate if LPUART is enabled in STOP Mode (able to wake up MCU from Stop mode or not)

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 UESM LL_LPUART_IsEnabledInStopMode

LL_LPUART_EnableDirectionRx

Function name

__STATIC_INLINE void LL_LPUART_EnableDirectionRx (USART_TypeDef * LPUARTx)

Function description

Receiver Enable (Receiver is enabled and begins searching for a start bit)

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 RE LL_LPUART_EnableDirectionRx

LL_LPUART_DisableDirectionRx

Function name

__STATIC_INLINE void LL_LPUART_DisableDirectionRx (USART_TypeDef * LPUARTx)

Function description

Receiver Disable.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 RE LL_LPUART_DisableDirectionRx

LL_LPUART_EnableDirectionTx

Function name

__STATIC_INLINE void LL_LPUART_EnableDirectionTx (USART_TypeDef * LPUARTx)

Function description

Transmitter Enable.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 TE LL_LPUART_EnableDirectionTx

LL_LPUART_DisableDirectionTx

Function name

__STATIC_INLINE void LL_LPUART_DisableDirectionTx (USART_TypeDef * LPUARTx)

Function description

Transmitter Disable.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 TE LL_LPUART_DisableDirectionTx

LL_LPUART_SetTransferDirection

Function name

__STATIC_INLINE void LL_LPUART_SetTransferDirection (USART_TypeDef * LPUARTx, uint32_t TransferDirection)

Function description

Configure simultaneously enabled/disabled states of Transmitter and Receiver.

Parameters

- **LPUARTx:** LPUART Instance
- **TransferDirection:** This parameter can be one of the following values:
  - LL_LPUART_DIRECTION_NONE
  - LL_LPUART_DIRECTION_RX
  - LL_LPUART_DIRECTION_TX
  - LL_LPUART_DIRECTION_TX_RX

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 RE LL_LPUART_SetTransferDirection
- CR1 TE LL_LPUART_SetTransferDirection

LL_LPUART_GetTransferDirection

Function name

__STATIC_INLINE uint32_t LL_LPUART_GetTransferDirection (const USART_TypeDef * LPUARTx)

Function description

Return enabled/disabled states of Transmitter and Receiver.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_LPUART_DIRECTION_NONE
  - LL_LPUART_DIRECTION_RX
  - LL_LPUART_DIRECTION_TX
  - LL_LPUART_DIRECTION_TX_RX

Reference Manual to LL API cross reference:

- CR1 RE LL_LPUART_GetTransferDirection
- CR1 TE LL_LPUART_GetTransferDirection

LL_LPUART_SetParity

Function name

__STATIC_INLINE void LL_LPUART_SetParity (USART_TypeDef * LPUARTx, uint32_t Parity)

Function description

Configure Parity (enabled/disabled and parity mode if enabled)

Parameters

- **LPUARTx:** LPUART Instance
- **Parity:** This parameter can be one of the following values:
  - LL_LPUART_PARITY_NONE
  - LL_LPUART_PARITY_EVEN
  - LL_LPUART_PARITY_ODD

Return values

- **None:**

Notes

- This function selects if hardware parity control (generation and detection) is enabled or disabled. When the parity control is enabled (Odd or Even), computed parity bit is inserted at the MSB position (depending on data width) and parity is checked on the received data.

Reference Manual to LL API cross reference:

- CR1 PS LL_LPUART_SetParity
- CR1 PCE LL_LPUART_SetParity

LL_LPUART_GetParity

Function name

__STATIC_INLINE uint32_t LL_LPUART_GetParity (const USART_TypeDef * LPUARTx)

Function description

Return Parity configuration (enabled/disabled and parity mode if enabled)

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_LPUART_PARITY_NONE
  - LL_LPUART_PARITY_EVEN
  - LL_LPUART_PARITY_ODD

Reference Manual to LL API cross reference:

- CR1 PS LL_LPUART_GetParity
- CR1 PCE LL_LPUART_GetParity

LL_LPUART_SetWakeUpMethod

Function name

__STATIC_INLINE void LL_LPUART_SetWakeUpMethod (USART_TypeDef * LPUARTx, uint32_t Method)

Function description

Set Receiver Wake Up method from Mute mode.

Parameters

- **LPUARTx:** LPUART Instance
- **Method:** This parameter can be one of the following values:
  - LL_LPUART_WAKEUP_IDLELINE
  - LL_LPUART_WAKEUP_ADDRESSMARK

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 WAKE LL_LPUART_SetWakeUpMethod

LL_LPUART_GetWakeUpMethod

Function name

__STATIC_INLINE uint32_t LL_LPUART_GetWakeUpMethod (const USART_TypeDef * LPUARTx)

Function description

Return Receiver Wake Up method from Mute mode.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_LPUART_WAKEUP_IDLELINE
  - LL_LPUART_WAKEUP_ADDRESSMARK

Reference Manual to LL API cross reference:

- CR1 WAKE LL_LPUART_GetWakeUpMethod

LL_LPUART_SetDataWidth

Function name

__STATIC_INLINE void LL_LPUART_SetDataWidth (USART_TypeDef * LPUARTx, uint32_t DataWidth)

Function description

Set Word length (nb of data bits, excluding start and stop bits)

Parameters

- **LPUARTx:** LPUART Instance
- **DataWidth:** This parameter can be one of the following values:
  - LL_LPUART_DATAWIDTH_7B
  - LL_LPUART_DATAWIDTH_8B
  - LL_LPUART_DATAWIDTH_9B

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 M LL_LPUART_SetDataWidth

LL_LPUART_GetDataWidth

Function name

__STATIC_INLINE uint32_t LL_LPUART_GetDataWidth (const USART_TypeDef * LPUARTx)

Function description

Return Word length (i.e.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_LPUART_DATAWIDTH_7B
  - LL_LPUART_DATAWIDTH_8B
  - LL_LPUART_DATAWIDTH_9B

Reference Manual to LL API cross reference:

- CR1 M LL_LPUART_GetDataWidth

LL_LPUART_EnableMuteMode

Function name

__STATIC_INLINE void LL_LPUART_EnableMuteMode (USART_TypeDef * LPUARTx)

Function description

Allow switch between Mute Mode and Active mode.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 MME LL_LPUART_EnableMuteMode

LL_LPUART_DisableMuteMode

Function name

__STATIC_INLINE void LL_LPUART_DisableMuteMode (USART_TypeDef * LPUARTx)

Function description

Prevent Mute Mode use.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 MME LL_LPUART_DisableMuteMode

LL_LPUART_IsEnabledMuteMode

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsEnabledMuteMode (const USART_TypeDef * LPUARTx)

Function description

Indicate if switch between Mute Mode and Active mode is allowed.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 MME LL_LPUART_IsEnabledMuteMode

LL_LPUART_SetPrescaler

Function name

__STATIC_INLINE void LL_LPUART_SetPrescaler (USART_TypeDef * LPUARTx, uint32_t PrescalerValue)

Function description

Configure Clock source prescaler for baudrate generator and oversampling.

Parameters

- **LPUARTx:** LPUART Instance
- **PrescalerValue:** This parameter can be one of the following values:
  - LL_LPUART_PRESCALER_DIV1
  - LL_LPUART_PRESCALER_DIV2
  - LL_LPUART_PRESCALER_DIV4
  - LL_LPUART_PRESCALER_DIV6
  - LL_LPUART_PRESCALER_DIV8
  - LL_LPUART_PRESCALER_DIV10
  - LL_LPUART_PRESCALER_DIV12
  - LL_LPUART_PRESCALER_DIV16
  - LL_LPUART_PRESCALER_DIV32
  - LL_LPUART_PRESCALER_DIV64
  - LL_LPUART_PRESCALER_DIV128
  - LL_LPUART_PRESCALER_DIV256

Return values

- **None:**

Reference Manual to LL API cross reference:

- PRESC PRESCALER LL_LPUART_SetPrescaler

LL_LPUART_GetPrescaler

Function name

__STATIC_INLINE uint32_t LL_LPUART_GetPrescaler (const USART_TypeDef * LPUARTx)

Function description

Retrieve the Clock source prescaler for baudrate generator and oversampling.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_LPUART_PRESCALER_DIV1
  - LL_LPUART_PRESCALER_DIV2
  - LL_LPUART_PRESCALER_DIV4
  - LL_LPUART_PRESCALER_DIV6
  - LL_LPUART_PRESCALER_DIV8
  - LL_LPUART_PRESCALER_DIV10
  - LL_LPUART_PRESCALER_DIV12
  - LL_LPUART_PRESCALER_DIV16
  - LL_LPUART_PRESCALER_DIV32
  - LL_LPUART_PRESCALER_DIV64
  - LL_LPUART_PRESCALER_DIV128
  - LL_LPUART_PRESCALER_DIV256

Reference Manual to LL API cross reference:

- PRESC PRESCALER LL_LPUART_GetPrescaler

LL_LPUART_SetStopBitsLength

Function name

__STATIC_INLINE void LL_LPUART_SetStopBitsLength (USART_TypeDef * LPUARTx, uint32_t StopBits)

Function description

Set the length of the stop bits.

Parameters

- **LPUARTx:** LPUART Instance
- **StopBits:** This parameter can be one of the following values:
  - LL_LPUART_STOPBITS_1
  - LL_LPUART_STOPBITS_2

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR2 STOP LL_LPUART_SetStopBitsLength

LL_LPUART_GetStopBitsLength

Function name

__STATIC_INLINE uint32_t LL_LPUART_GetStopBitsLength (const USART_TypeDef * LPUARTx)

Function description

Retrieve the length of the stop bits.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_LPUART_STOPBITS_1
  - LL_LPUART_STOPBITS_2

Reference Manual to LL API cross reference:

- CR2 STOP LL_LPUART_GetStopBitsLength

LL_LPUART_ConfigCharacter

Function name

__STATIC_INLINE void LL_LPUART_ConfigCharacter (USART_TypeDef * LPUARTx, uint32_t DataWidth, uint32_t Parity, uint32_t StopBits)

Function description

Configure Character frame format (Datawidth, Parity control, Stop Bits)

Parameters

- **LPUARTx:** LPUART Instance
- **DataWidth:** This parameter can be one of the following values:
  - LL_LPUART_DATAWIDTH_7B
  - LL_LPUART_DATAWIDTH_8B
  - LL_LPUART_DATAWIDTH_9B
- **Parity:** This parameter can be one of the following values:
  - LL_LPUART_PARITY_NONE
  - LL_LPUART_PARITY_EVEN
  - LL_LPUART_PARITY_ODD
- **StopBits:** This parameter can be one of the following values:
  - LL_LPUART_STOPBITS_1
  - LL_LPUART_STOPBITS_2

Return values

- **None:**

Notes

- Call of this function is equivalent to following function call sequence : Data Width configuration using LL_LPUART_SetDataWidth() functionParity Control and mode configuration using LL_LPUART_SetParity() functionStop bits configuration using LL_LPUART_SetStopBitsLength() function

Reference Manual to LL API cross reference:

- CR1 PS LL_LPUART_ConfigCharacter
- CR1 PCE LL_LPUART_ConfigCharacter
- CR1 M LL_LPUART_ConfigCharacter
- CR2 STOP LL_LPUART_ConfigCharacter

LL_LPUART_SetTXRXSwap

Function name

__STATIC_INLINE void LL_LPUART_SetTXRXSwap (USART_TypeDef * LPUARTx, uint32_t SwapConfig)

Function description

Configure TX/RX pins swapping setting.

Parameters

- **LPUARTx:** LPUART Instance
- **SwapConfig:** This parameter can be one of the following values:
  - LL_LPUART_TXRX_STANDARD
  - LL_LPUART_TXRX_SWAPPED

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR2 SWAP LL_LPUART_SetTXRXSwap

LL_LPUART_GetTXRXSwap

Function name

__STATIC_INLINE uint32_t LL_LPUART_GetTXRXSwap (const USART_TypeDef * LPUARTx)

Function description

Retrieve TX/RX pins swapping configuration.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_LPUART_TXRX_STANDARD
  - LL_LPUART_TXRX_SWAPPED

Reference Manual to LL API cross reference:

- CR2 SWAP LL_LPUART_GetTXRXSwap

LL_LPUART_SetRXPinLevel

Function name

__STATIC_INLINE void LL_LPUART_SetRXPinLevel (USART_TypeDef * LPUARTx, uint32_t PinInvMethod)

Function description

Configure RX pin active level logic.

Parameters

- **LPUARTx:** LPUART Instance
- **PinInvMethod:** This parameter can be one of the following values:
  - LL_LPUART_RXPIN_LEVEL_STANDARD
  - LL_LPUART_RXPIN_LEVEL_INVERTED

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR2 RXINV LL_LPUART_SetRXPinLevel

LL_LPUART_GetRXPinLevel

Function name

__STATIC_INLINE uint32_t LL_LPUART_GetRXPinLevel (const USART_TypeDef * LPUARTx)

Function description

Retrieve RX pin active level logic configuration.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_LPUART_RXPIN_LEVEL_STANDARD
  - LL_LPUART_RXPIN_LEVEL_INVERTED

Reference Manual to LL API cross reference:

- CR2 RXINV LL_LPUART_GetRXPinLevel

LL_LPUART_SetTXPinLevel

Function name

__STATIC_INLINE void LL_LPUART_SetTXPinLevel (USART_TypeDef * LPUARTx, uint32_t PinInvMethod)

Function description

Configure TX pin active level logic.

Parameters

- **LPUARTx:** LPUART Instance
- **PinInvMethod:** This parameter can be one of the following values:
  - LL_LPUART_TXPIN_LEVEL_STANDARD
  - LL_LPUART_TXPIN_LEVEL_INVERTED

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR2 TXINV LL_LPUART_SetTXPinLevel

LL_LPUART_GetTXPinLevel

Function name

__STATIC_INLINE uint32_t LL_LPUART_GetTXPinLevel (const USART_TypeDef * LPUARTx)

Function description

Retrieve TX pin active level logic configuration.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_LPUART_TXPIN_LEVEL_STANDARD
  - LL_LPUART_TXPIN_LEVEL_INVERTED

Reference Manual to LL API cross reference:

- CR2 TXINV LL_LPUART_GetTXPinLevel

LL_LPUART_SetBinaryDataLogic

Function name

__STATIC_INLINE void LL_LPUART_SetBinaryDataLogic (USART_TypeDef * LPUARTx, uint32_t DataLogic)

Function description

Configure Binary data logic.

Parameters

- **LPUARTx:** LPUART Instance
- **DataLogic:** This parameter can be one of the following values:
  - LL_LPUART_BINARY_LOGIC_POSITIVE
  - LL_LPUART_BINARY_LOGIC_NEGATIVE

Return values

- **None:**

Notes

- Allow to define how Logical data from the data register are send/received : either in positive/direct logic (1=H, 0=L) or in negative/inverse logic (1=L, 0=H)

Reference Manual to LL API cross reference:

- CR2 DATAINV LL_LPUART_SetBinaryDataLogic

LL_LPUART_GetBinaryDataLogic

Function name

__STATIC_INLINE uint32_t LL_LPUART_GetBinaryDataLogic (const USART_TypeDef * LPUARTx)

Function description

Retrieve Binary data configuration.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_LPUART_BINARY_LOGIC_POSITIVE
  - LL_LPUART_BINARY_LOGIC_NEGATIVE

Reference Manual to LL API cross reference:

- CR2 DATAINV LL_LPUART_GetBinaryDataLogic

LL_LPUART_SetTransferBitOrder

Function name

__STATIC_INLINE void LL_LPUART_SetTransferBitOrder (USART_TypeDef * LPUARTx, uint32_t BitOrder)

Function description

Configure transfer bit order (either Less or Most Significant Bit First)

Parameters

- **LPUARTx:** LPUART Instance
- **BitOrder:** This parameter can be one of the following values:
  - LL_LPUART_BITORDER_LSBFIRST
  - LL_LPUART_BITORDER_MSBFIRST

Return values

- **None:**

Notes

- MSB First means data is transmitted/received with the MSB first, following the start bit. LSB First means data is transmitted/received with data bit 0 first, following the start bit.

Reference Manual to LL API cross reference:

- CR2 MSBFIRST LL_LPUART_SetTransferBitOrder

LL_LPUART_GetTransferBitOrder

Function name

__STATIC_INLINE uint32_t LL_LPUART_GetTransferBitOrder (const USART_TypeDef * LPUARTx)

Function description

Return transfer bit order (either Less or Most Significant Bit First)

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_LPUART_BITORDER_LSBFIRST
  - LL_LPUART_BITORDER_MSBFIRST

Notes

- MSB First means data is transmitted/received with the MSB first, following the start bit. LSB First means data is transmitted/received with data bit 0 first, following the start bit.

Reference Manual to LL API cross reference:

- CR2 MSBFIRST LL_LPUART_GetTransferBitOrder

LL_LPUART_ConfigNodeAddress

Function name

__STATIC_INLINE void LL_LPUART_ConfigNodeAddress (USART_TypeDef * LPUARTx, uint32_t AddressLen, uint32_t NodeAddress)

Function description

Set Address of the LPUART node.

Parameters

- **LPUARTx:** LPUART Instance
- **AddressLen:** This parameter can be one of the following values:
  - LL_LPUART_ADDRESS_DETECT_4B
  - LL_LPUART_ADDRESS_DETECT_7B
- **NodeAddress:** 4 or 7 bit Address of the LPUART node.

Return values

- **None:**

Notes

- This is used in multiprocessor communication during Mute mode or Stop mode, for wake up with address mark detection.
- 4bits address node is used when 4-bit Address Detection is selected in ADDM7. (b7-b4 should be set to 0) 8bits address node is used when 7-bit Address Detection is selected in ADDM7. (This is used in multiprocessor communication during Mute mode or Stop mode, for wake up with 7-bit address mark detection. The MSB of the character sent by the transmitter should be equal to 1. It may also be used for character detection during normal reception, Mute mode inactive (for example, end of block detection in ModBus protocol). In this case, the whole received character (8-bit) is compared to the ADD[7:0] value and CMF flag is set on match)

Reference Manual to LL API cross reference:

- CR2 ADD LL_LPUART_ConfigNodeAddress
- CR2 ADDM7 LL_LPUART_ConfigNodeAddress

LL_LPUART_GetNodeAddress

Function name

__STATIC_INLINE uint32_t LL_LPUART_GetNodeAddress (const USART_TypeDef * LPUARTx)

Function description

Return 8 bit Address of the LPUART node as set in ADD field of CR2.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **Address:** of the LPUART node (Value between Min_Data=0 and Max_Data=255)

Notes

- If 4-bit Address Detection is selected in ADDM7, only 4bits (b3-b0) of returned value are relevant (b31-b4 are not relevant) If 7-bit Address Detection is selected in ADDM7, only 8bits (b7-b0) of returned value are relevant (b31-b8 are not relevant)

Reference Manual to LL API cross reference:

- CR2 ADD LL_LPUART_GetNodeAddress

LL_LPUART_GetNodeAddressLen

Function name

__STATIC_INLINE uint32_t LL_LPUART_GetNodeAddressLen (const USART_TypeDef * LPUARTx)

Function description

Return Length of Node Address used in Address Detection mode (7-bit or 4-bit)

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_LPUART_ADDRESS_DETECT_4B
  - LL_LPUART_ADDRESS_DETECT_7B

Reference Manual to LL API cross reference:

- CR2 ADDM7 LL_LPUART_GetNodeAddressLen

LL_LPUART_EnableRTSHWFlowCtrl

Function name

__STATIC_INLINE void LL_LPUART_EnableRTSHWFlowCtrl (USART_TypeDef * LPUARTx)

Function description

Enable RTS HW Flow Control.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 RTSE LL_LPUART_EnableRTSHWFlowCtrl

LL_LPUART_DisableRTSHWFlowCtrl

Function name

__STATIC_INLINE void LL_LPUART_DisableRTSHWFlowCtrl (USART_TypeDef * LPUARTx)

Function description

Disable RTS HW Flow Control.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 RTSE LL_LPUART_DisableRTSHWFlowCtrl

LL_LPUART_EnableCTSHWFlowCtrl

Function name

__STATIC_INLINE void LL_LPUART_EnableCTSHWFlowCtrl (USART_TypeDef * LPUARTx)

Function description

Enable CTS HW Flow Control.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 CTSE LL_LPUART_EnableCTSHWFlowCtrl

LL_LPUART_DisableCTSHWFlowCtrl

Function name

__STATIC_INLINE void LL_LPUART_DisableCTSHWFlowCtrl (USART_TypeDef * LPUARTx)

Function description

Disable CTS HW Flow Control.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 CTSE LL_LPUART_DisableCTSHWFlowCtrl

LL_LPUART_SetHWFlowCtrl

Function name

__STATIC_INLINE void LL_LPUART_SetHWFlowCtrl (USART_TypeDef * LPUARTx, uint32_t HardwareFlowControl)

Function description

Configure HW Flow Control mode (both CTS and RTS)

Parameters

- **LPUARTx:** LPUART Instance
- **HardwareFlowControl:** This parameter can be one of the following values:
  - LL_LPUART_HWCONTROL_NONE
  - LL_LPUART_HWCONTROL_RTS
  - LL_LPUART_HWCONTROL_CTS
  - LL_LPUART_HWCONTROL_RTS_CTS

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 RTSE LL_LPUART_SetHWFlowCtrl
- CR3 CTSE LL_LPUART_SetHWFlowCtrl

LL_LPUART_GetHWFlowCtrl

Function name

__STATIC_INLINE uint32_t LL_LPUART_GetHWFlowCtrl (const USART_TypeDef * LPUARTx)

Function description

Return HW Flow Control configuration (both CTS and RTS)

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_LPUART_HWCONTROL_NONE
  - LL_LPUART_HWCONTROL_RTS
  - LL_LPUART_HWCONTROL_CTS
  - LL_LPUART_HWCONTROL_RTS_CTS

Reference Manual to LL API cross reference:

- CR3 RTSE LL_LPUART_GetHWFlowCtrl
- CR3 CTSE LL_LPUART_GetHWFlowCtrl

LL_LPUART_EnableOverrunDetect

Function name

__STATIC_INLINE void LL_LPUART_EnableOverrunDetect (USART_TypeDef * LPUARTx)

Function description

Enable Overrun detection.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 OVRDIS LL_LPUART_EnableOverrunDetect

LL_LPUART_DisableOverrunDetect

Function name

__STATIC_INLINE void LL_LPUART_DisableOverrunDetect (USART_TypeDef * LPUARTx)

Function description

Disable Overrun detection.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 OVRDIS LL_LPUART_DisableOverrunDetect

LL_LPUART_IsEnabledOverrunDetect

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsEnabledOverrunDetect (const USART_TypeDef * LPUARTx)

Function description

Indicate if Overrun detection is enabled.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR3 OVRDIS LL_LPUART_IsEnabledOverrunDetect

LL_LPUART_SetWKUPType

Function name

__STATIC_INLINE void LL_LPUART_SetWKUPType (USART_TypeDef * LPUARTx, uint32_t Type)

Function description

Select event type for Wake UP Interrupt Flag (WUS[1:0] bits)

Parameters

- **LPUARTx:** LPUART Instance
- **Type:** This parameter can be one of the following values:
  - LL_LPUART_WAKEUP_ON_ADDRESS
  - LL_LPUART_WAKEUP_ON_STARTBIT
  - LL_LPUART_WAKEUP_ON_RXNE

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 WUS LL_LPUART_SetWKUPType

LL_LPUART_GetWKUPType

Function name

__STATIC_INLINE uint32_t LL_LPUART_GetWKUPType (const USART_TypeDef * LPUARTx)

Function description

Return event type for Wake UP Interrupt Flag (WUS[1:0] bits)

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_LPUART_WAKEUP_ON_ADDRESS
  - LL_LPUART_WAKEUP_ON_STARTBIT
  - LL_LPUART_WAKEUP_ON_RXNE

Reference Manual to LL API cross reference:

- CR3 WUS LL_LPUART_GetWKUPType

LL_LPUART_SetBaudRate

Function name

__STATIC_INLINE void LL_LPUART_SetBaudRate (USART_TypeDef * LPUARTx, uint32_t PeriphClk, uint32_t PrescalerValue, uint32_t BaudRate)

Function description

Configure LPUART BRR register for achieving expected Baud Rate value.

Parameters

- **LPUARTx:** LPUART Instance
- **PeriphClk:** Peripheral Clock
- **PrescalerValue:** This parameter can be one of the following values:
  - LL_LPUART_PRESCALER_DIV1
  - LL_LPUART_PRESCALER_DIV2
  - LL_LPUART_PRESCALER_DIV4
  - LL_LPUART_PRESCALER_DIV6
  - LL_LPUART_PRESCALER_DIV8
  - LL_LPUART_PRESCALER_DIV10
  - LL_LPUART_PRESCALER_DIV12
  - LL_LPUART_PRESCALER_DIV16
  - LL_LPUART_PRESCALER_DIV32
  - LL_LPUART_PRESCALER_DIV64
  - LL_LPUART_PRESCALER_DIV128
  - LL_LPUART_PRESCALER_DIV256
- **BaudRate:** Baud Rate

Return values

- **None:**

Notes

- Compute and set LPUARTDIV value in BRR Register (full BRR content) according to used Peripheral Clock and expected Baud Rate values
- Peripheral clock and Baud Rate values provided as function parameters should be valid (Baud rate value ! = 0).
- Provided that LPUARTx_BRR must be > = 0x300 and LPUART_BRR is 20-bit, a care should be taken when generating high baud rates using high PeriphClk values. PeriphClk must be in the range [3 x BaudRate, 4096 x BaudRate].

Reference Manual to LL API cross reference:

- BRR BRR LL_LPUART_SetBaudRate

LL_LPUART_GetBaudRate

Function name

__STATIC_INLINE uint32_t LL_LPUART_GetBaudRate (const USART_TypeDef * LPUARTx, uint32_t PeriphClk, uint32_t PrescalerValue)

Function description

Return current Baud Rate value, according to LPUARTDIV present in BRR register (full BRR content), and to used Peripheral Clock values.

Parameters

- **LPUARTx:** LPUART Instance
- **PeriphClk:** Peripheral Clock
- **PrescalerValue:** This parameter can be one of the following values:
  - LL_LPUART_PRESCALER_DIV1
  - LL_LPUART_PRESCALER_DIV2
  - LL_LPUART_PRESCALER_DIV4
  - LL_LPUART_PRESCALER_DIV6
  - LL_LPUART_PRESCALER_DIV8
  - LL_LPUART_PRESCALER_DIV10
  - LL_LPUART_PRESCALER_DIV12
  - LL_LPUART_PRESCALER_DIV16
  - LL_LPUART_PRESCALER_DIV32
  - LL_LPUART_PRESCALER_DIV64
  - LL_LPUART_PRESCALER_DIV128
  - LL_LPUART_PRESCALER_DIV256

Return values

- **Baud:** Rate

Notes

- In case of non-initialized or invalid value stored in BRR register, value 0 will be returned.

Reference Manual to LL API cross reference:

- BRR BRR LL_LPUART_GetBaudRate

LL_LPUART_EnableHalfDuplex

Function name

__STATIC_INLINE void LL_LPUART_EnableHalfDuplex (USART_TypeDef * LPUARTx)

Function description

Enable Single Wire Half-Duplex mode.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 HDSEL LL_LPUART_EnableHalfDuplex

LL_LPUART_DisableHalfDuplex

Function name

__STATIC_INLINE void LL_LPUART_DisableHalfDuplex (USART_TypeDef * LPUARTx)

Function description

Disable Single Wire Half-Duplex mode.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 HDSEL LL_LPUART_DisableHalfDuplex

LL_LPUART_IsEnabledHalfDuplex

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsEnabledHalfDuplex (const USART_TypeDef * LPUARTx)

Function description

Indicate if Single Wire Half-Duplex mode is enabled.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR3 HDSEL LL_LPUART_IsEnabledHalfDuplex

LL_LPUART_SetDEDeassertionTime

Function name

__STATIC_INLINE void LL_LPUART_SetDEDeassertionTime (USART_TypeDef * LPUARTx, uint32_t Time)

Function description

Set DEDT (Driver Enable De-Assertion Time), Time value expressed on 5 bits ([4:0] bits).

Parameters

- **LPUARTx:** LPUART Instance
- **Time:** Value between Min_Data=0 and Max_Data=31

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 DEDT LL_LPUART_SetDEDeassertionTime

LL_LPUART_GetDEDeassertionTime

Function name

__STATIC_INLINE uint32_t LL_LPUART_GetDEDeassertionTime (const USART_TypeDef * LPUARTx)

Function description

Return DEDT (Driver Enable De-Assertion Time)

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **Time:** value expressed on 5 bits ([4:0] bits) : c

Reference Manual to LL API cross reference:

- CR1 DEDT LL_LPUART_GetDEDeassertionTime

LL_LPUART_SetDEAssertionTime

Function name

__STATIC_INLINE void LL_LPUART_SetDEAssertionTime (USART_TypeDef * LPUARTx, uint32_t Time)

Function description

Set DEAT (Driver Enable Assertion Time), Time value expressed on 5 bits ([4:0] bits).

Parameters

- **LPUARTx:** LPUART Instance
- **Time:** Value between Min_Data=0 and Max_Data=31

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 DEAT LL_LPUART_SetDEAssertionTime

LL_LPUART_GetDEAssertionTime

Function name

__STATIC_INLINE uint32_t LL_LPUART_GetDEAssertionTime (const USART_TypeDef * LPUARTx)

Function description

Return DEAT (Driver Enable Assertion Time)

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **Time:** value expressed on 5 bits ([4:0] bits) : Time Value between Min_Data=0 and Max_Data=31

Reference Manual to LL API cross reference:

- CR1 DEAT LL_LPUART_GetDEAssertionTime

LL_LPUART_EnableDEMode

Function name

__STATIC_INLINE void LL_LPUART_EnableDEMode (USART_TypeDef * LPUARTx)

Function description

Enable Driver Enable (DE) Mode.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 DEM LL_LPUART_EnableDEMode

LL_LPUART_DisableDEMode

Function name

__STATIC_INLINE void LL_LPUART_DisableDEMode (USART_TypeDef * LPUARTx)

Function description

Disable Driver Enable (DE) Mode.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 DEM LL_LPUART_DisableDEMode

LL_LPUART_IsEnabledDEMode

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsEnabledDEMode (const USART_TypeDef * LPUARTx)

Function description

Indicate if Driver Enable (DE) Mode is enabled.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR3 DEM LL_LPUART_IsEnabledDEMode

LL_LPUART_SetDESignalPolarity

Function name

__STATIC_INLINE void LL_LPUART_SetDESignalPolarity (USART_TypeDef * LPUARTx, uint32_t Polarity)

Function description

Select Driver Enable Polarity.

Parameters

- **LPUARTx:** LPUART Instance
- **Polarity:** This parameter can be one of the following values:
  - LL_LPUART_DE_POLARITY_HIGH
  - LL_LPUART_DE_POLARITY_LOW

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 DEP LL_LPUART_SetDESignalPolarity

LL_LPUART_GetDESignalPolarity

Function name

__STATIC_INLINE uint32_t LL_LPUART_GetDESignalPolarity (const USART_TypeDef * LPUARTx)

Function description

Return Driver Enable Polarity.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_LPUART_DE_POLARITY_HIGH
  - LL_LPUART_DE_POLARITY_LOW

Reference Manual to LL API cross reference:

- CR3 DEP LL_LPUART_GetDESignalPolarity

LL_LPUART_IsActiveFlag_PE

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsActiveFlag_PE (const USART_TypeDef * LPUARTx)

Function description

Check if the LPUART Parity Error Flag is set or not.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR PE LL_LPUART_IsActiveFlag_PE

LL_LPUART_IsActiveFlag_FE

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsActiveFlag_FE (const USART_TypeDef * LPUARTx)

Function description

Check if the LPUART Framing Error Flag is set or not.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR FE LL_LPUART_IsActiveFlag_FE

LL_LPUART_IsActiveFlag_NE

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsActiveFlag_NE (const USART_TypeDef * LPUARTx)

Function description

Check if the LPUART Noise error detected Flag is set or not.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR NE LL_LPUART_IsActiveFlag_NE

LL_LPUART_IsActiveFlag_ORE

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsActiveFlag_ORE (const USART_TypeDef * LPUARTx)

Function description

Check if the LPUART OverRun Error Flag is set or not.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR ORE LL_LPUART_IsActiveFlag_ORE

LL_LPUART_IsActiveFlag_IDLE

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsActiveFlag_IDLE (const USART_TypeDef * LPUARTx)

Function description

Check if the LPUART IDLE line detected Flag is set or not.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR IDLE LL_LPUART_IsActiveFlag_IDLE

LL_LPUART_IsActiveFlag_RXNE_RXFNE

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsActiveFlag_RXNE_RXFNE (const USART_TypeDef * LPUARTx)

Function description

Check if the LPUART Read Data Register or LPUART RX FIFO Not Empty Flag is set or not.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR RXNE_RXFNE LL_LPUART_IsActiveFlag_RXNE_RXFNE

LL_LPUART_IsActiveFlag_TC

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsActiveFlag_TC (const USART_TypeDef * LPUARTx)

Function description

Check if the LPUART Transmission Complete Flag is set or not.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR TC LL_LPUART_IsActiveFlag_TC

LL_LPUART_IsActiveFlag_TXE_TXFNF

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsActiveFlag_TXE_TXFNF (const USART_TypeDef * LPUARTx)

Function description

Check if the LPUART Transmit Data Register Empty or LPUART TX FIFO Not Full Flag is set or not.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR TXE_TXFNF LL_LPUART_IsActiveFlag_TXE_TXFNF

LL_LPUART_IsActiveFlag_nCTS

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsActiveFlag_nCTS (const USART_TypeDef * LPUARTx)

Function description

Check if the LPUART CTS interrupt Flag is set or not.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR CTSIF LL_LPUART_IsActiveFlag_nCTS

LL_LPUART_IsActiveFlag_CTS

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsActiveFlag_CTS (const USART_TypeDef * LPUARTx)

Function description

Check if the LPUART CTS Flag is set or not.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR CTS LL_LPUART_IsActiveFlag_CTS

LL_LPUART_IsActiveFlag_BUSY

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsActiveFlag_BUSY (const USART_TypeDef * LPUARTx)

Function description

Check if the LPUART Busy Flag is set or not.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR BUSY LL_LPUART_IsActiveFlag_BUSY

LL_LPUART_IsActiveFlag_CM

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsActiveFlag_CM (const USART_TypeDef * LPUARTx)

Function description

Check if the LPUART Character Match Flag is set or not.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR CMF LL_LPUART_IsActiveFlag_CM

LL_LPUART_IsActiveFlag_SBK

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsActiveFlag_SBK (const USART_TypeDef * LPUARTx)

Function description

Check if the LPUART Send Break Flag is set or not.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR SBKF LL_LPUART_IsActiveFlag_SBK

LL_LPUART_IsActiveFlag_RWU

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsActiveFlag_RWU (const USART_TypeDef * LPUARTx)

Function description

Check if the LPUART Receive Wake Up from mute mode Flag is set or not.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR RWU LL_LPUART_IsActiveFlag_RWU

LL_LPUART_IsActiveFlag_WKUP

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsActiveFlag_WKUP (const USART_TypeDef * LPUARTx)

Function description

Check if the LPUART Wake Up from stop mode Flag is set or not.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR WUF LL_LPUART_IsActiveFlag_WKUP

LL_LPUART_IsActiveFlag_TEACK

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsActiveFlag_TEACK (const USART_TypeDef * LPUARTx)

Function description

Check if the LPUART Transmit Enable Acknowledge Flag is set or not.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR TEACK LL_LPUART_IsActiveFlag_TEACK

LL_LPUART_IsActiveFlag_REACK

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsActiveFlag_REACK (const USART_TypeDef * LPUARTx)

Function description

Check if the LPUART Receive Enable Acknowledge Flag is set or not.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR REACK LL_LPUART_IsActiveFlag_REACK

LL_LPUART_IsActiveFlag_TXFE

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsActiveFlag_TXFE (const USART_TypeDef * LPUARTx)

Function description

Check if the LPUART TX FIFO Empty Flag is set or not.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR TXFE LL_LPUART_IsActiveFlag_TXFE

LL_LPUART_IsActiveFlag_RXFF

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsActiveFlag_RXFF (const USART_TypeDef * LPUARTx)

Function description

Check if the LPUART RX FIFO Full Flag is set or not.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR RXFF LL_LPUART_IsActiveFlag_RXFF

LL_LPUART_IsActiveFlag_TXFT

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsActiveFlag_TXFT (const USART_TypeDef * LPUARTx)

Function description

Check if the LPUART TX FIFO Threshold Flag is set or not.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR TXFT LL_LPUART_IsActiveFlag_TXFT

LL_LPUART_IsActiveFlag_RXFT

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsActiveFlag_RXFT (const USART_TypeDef * LPUARTx)

Function description

Check if the LPUART RX FIFO Threshold Flag is set or not.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR RXFT LL_LPUART_IsActiveFlag_RXFT

LL_LPUART_ClearFlag_PE

Function name

__STATIC_INLINE void LL_LPUART_ClearFlag_PE (USART_TypeDef * LPUARTx)

Function description

Clear Parity Error Flag.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR PECF LL_LPUART_ClearFlag_PE

LL_LPUART_ClearFlag_FE

Function name

__STATIC_INLINE void LL_LPUART_ClearFlag_FE (USART_TypeDef * LPUARTx)

Function description

Clear Framing Error Flag.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR FECF LL_LPUART_ClearFlag_FE

LL_LPUART_ClearFlag_NE

Function name

__STATIC_INLINE void LL_LPUART_ClearFlag_NE (USART_TypeDef * LPUARTx)

Function description

Clear Noise detected Flag.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR NECF LL_LPUART_ClearFlag_NE

LL_LPUART_ClearFlag_ORE

Function name

__STATIC_INLINE void LL_LPUART_ClearFlag_ORE (USART_TypeDef * LPUARTx)

Function description

Clear OverRun Error Flag.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR ORECF LL_LPUART_ClearFlag_ORE

LL_LPUART_ClearFlag_IDLE

Function name

__STATIC_INLINE void LL_LPUART_ClearFlag_IDLE (USART_TypeDef * LPUARTx)

Function description

Clear IDLE line detected Flag.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR IDLECF LL_LPUART_ClearFlag_IDLE

LL_LPUART_ClearFlag_TC

Function name

__STATIC_INLINE void LL_LPUART_ClearFlag_TC (USART_TypeDef * LPUARTx)

Function description

Clear Transmission Complete Flag.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR TCCF LL_LPUART_ClearFlag_TC

LL_LPUART_ClearFlag_nCTS

Function name

__STATIC_INLINE void LL_LPUART_ClearFlag_nCTS (USART_TypeDef * LPUARTx)

Function description

Clear CTS Interrupt Flag.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR CTSCF LL_LPUART_ClearFlag_nCTS

LL_LPUART_ClearFlag_CM

Function name

__STATIC_INLINE void LL_LPUART_ClearFlag_CM (USART_TypeDef * LPUARTx)

Function description

Clear Character Match Flag.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR CMCF LL_LPUART_ClearFlag_CM

LL_LPUART_ClearFlag_WKUP

Function name

__STATIC_INLINE void LL_LPUART_ClearFlag_WKUP (USART_TypeDef * LPUARTx)

Function description

Clear Wake Up from stop mode Flag.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR WUCF LL_LPUART_ClearFlag_WKUP

LL_LPUART_EnableIT_IDLE

Function name

__STATIC_INLINE void LL_LPUART_EnableIT_IDLE (USART_TypeDef * LPUARTx)

Function description

Enable IDLE Interrupt.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 IDLEIE LL_LPUART_EnableIT_IDLE

LL_LPUART_EnableIT_RXNE_RXFNE

Function name

__STATIC_INLINE void LL_LPUART_EnableIT_RXNE_RXFNE (USART_TypeDef * LPUARTx)

Function description

Enable RX Not Empty and RX FIFO Not Empty Interrupt.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 RXNEIE_RXFNEIE LL_LPUART_EnableIT_RXNE_RXFNE

LL_LPUART_EnableIT_TC

Function name

__STATIC_INLINE void LL_LPUART_EnableIT_TC (USART_TypeDef * LPUARTx)

Function description

Enable Transmission Complete Interrupt.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 TCIE LL_LPUART_EnableIT_TC

LL_LPUART_EnableIT_TXE_TXFNF

Function name

__STATIC_INLINE void LL_LPUART_EnableIT_TXE_TXFNF (USART_TypeDef * LPUARTx)

Function description

Enable TX Empty and TX FIFO Not Full Interrupt.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 TXEIE_TXFNFIE LL_LPUART_EnableIT_TXE_TXFNF

LL_LPUART_EnableIT_PE

Function name

__STATIC_INLINE void LL_LPUART_EnableIT_PE (USART_TypeDef * LPUARTx)

Function description

Enable Parity Error Interrupt.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 PEIE LL_LPUART_EnableIT_PE

LL_LPUART_EnableIT_CM

Function name

__STATIC_INLINE void LL_LPUART_EnableIT_CM (USART_TypeDef * LPUARTx)

Function description

Enable Character Match Interrupt.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 CMIE LL_LPUART_EnableIT_CM

LL_LPUART_EnableIT_TXFE

Function name

__STATIC_INLINE void LL_LPUART_EnableIT_TXFE (USART_TypeDef * LPUARTx)

Function description

Enable TX FIFO Empty Interrupt.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 TXFEIE LL_LPUART_EnableIT_TXFE

LL_LPUART_EnableIT_RXFF

Function name

__STATIC_INLINE void LL_LPUART_EnableIT_RXFF (USART_TypeDef * LPUARTx)

Function description

Enable RX FIFO Full Interrupt.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 RXFFIE LL_LPUART_EnableIT_RXFF

LL_LPUART_EnableIT_ERROR

Function name

__STATIC_INLINE void LL_LPUART_EnableIT_ERROR (USART_TypeDef * LPUARTx)

Function description

Enable Error Interrupt.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Notes

- When set, Error Interrupt Enable Bit is enabling interrupt generation in case of a framing error, overrun error or noise flag (FE=1 or ORE=1 or NF=1 in the LPUARTx_ISR register). 0: Interrupt is inhibited1: An interrupt is generated when FE=1 or ORE=1 or NF=1 in the LPUARTx_ISR register.

Reference Manual to LL API cross reference:

- CR3 EIE LL_LPUART_EnableIT_ERROR

LL_LPUART_EnableIT_CTS

Function name

__STATIC_INLINE void LL_LPUART_EnableIT_CTS (USART_TypeDef * LPUARTx)

Function description

Enable CTS Interrupt.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 CTSIE LL_LPUART_EnableIT_CTS

LL_LPUART_EnableIT_WKUP

Function name

__STATIC_INLINE void LL_LPUART_EnableIT_WKUP (USART_TypeDef * LPUARTx)

Function description

Enable Wake Up from Stop Mode Interrupt.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 WUFIE LL_LPUART_EnableIT_WKUP

LL_LPUART_EnableIT_TXFT

Function name

__STATIC_INLINE void LL_LPUART_EnableIT_TXFT (USART_TypeDef * LPUARTx)

Function description

Enable TX FIFO Threshold Interrupt.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 TXFTIE LL_LPUART_EnableIT_TXFT

LL_LPUART_EnableIT_RXFT

Function name

__STATIC_INLINE void LL_LPUART_EnableIT_RXFT (USART_TypeDef * LPUARTx)

Function description

Enable RX FIFO Threshold Interrupt.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 RXFTIE LL_LPUART_EnableIT_RXFT

LL_LPUART_DisableIT_IDLE

Function name

__STATIC_INLINE void LL_LPUART_DisableIT_IDLE (USART_TypeDef * LPUARTx)

Function description

Disable IDLE Interrupt.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 IDLEIE LL_LPUART_DisableIT_IDLE

LL_LPUART_DisableIT_RXNE_RXFNE

Function name

__STATIC_INLINE void LL_LPUART_DisableIT_RXNE_RXFNE (USART_TypeDef * LPUARTx)

Function description

Disable RX Not Empty and RX FIFO Not Empty Interrupt.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 RXNEIE_RXFNEIE LL_LPUART_DisableIT_RXNE_RXFNE

LL_LPUART_DisableIT_TC

Function name

__STATIC_INLINE void LL_LPUART_DisableIT_TC (USART_TypeDef * LPUARTx)

Function description

Disable Transmission Complete Interrupt.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 TCIE LL_LPUART_DisableIT_TC

LL_LPUART_DisableIT_TXE_TXFNF

Function name

__STATIC_INLINE void LL_LPUART_DisableIT_TXE_TXFNF (USART_TypeDef * LPUARTx)

Function description

Disable TX Empty and TX FIFO Not Full Interrupt.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 TXEIE_TXFNFIE LL_LPUART_DisableIT_TXE_TXFNF

LL_LPUART_DisableIT_PE

Function name

__STATIC_INLINE void LL_LPUART_DisableIT_PE (USART_TypeDef * LPUARTx)

Function description

Disable Parity Error Interrupt.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 PEIE LL_LPUART_DisableIT_PE

LL_LPUART_DisableIT_CM

Function name

__STATIC_INLINE void LL_LPUART_DisableIT_CM (USART_TypeDef * LPUARTx)

Function description

Disable Character Match Interrupt.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 CMIE LL_LPUART_DisableIT_CM

LL_LPUART_DisableIT_TXFE

Function name

__STATIC_INLINE void LL_LPUART_DisableIT_TXFE (USART_TypeDef * LPUARTx)

Function description

Disable TX FIFO Empty Interrupt.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 TXFEIE LL_LPUART_DisableIT_TXFE

LL_LPUART_DisableIT_RXFF

Function name

__STATIC_INLINE void LL_LPUART_DisableIT_RXFF (USART_TypeDef * LPUARTx)

Function description

Disable RX FIFO Full Interrupt.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 RXFFIE LL_LPUART_DisableIT_RXFF

LL_LPUART_DisableIT_ERROR

Function name

__STATIC_INLINE void LL_LPUART_DisableIT_ERROR (USART_TypeDef * LPUARTx)

Function description

Disable Error Interrupt.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Notes

- When set, Error Interrupt Enable Bit is enabling interrupt generation in case of a framing error, overrun error or noise flag (FE=1 or ORE=1 or NF=1 in the LPUARTx_ISR register). 0: Interrupt is inhibited1: An interrupt is generated when FE=1 or ORE=1 or NF=1 in the LPUARTx_ISR register.

Reference Manual to LL API cross reference:

- CR3 EIE LL_LPUART_DisableIT_ERROR

LL_LPUART_DisableIT_CTS

Function name

__STATIC_INLINE void LL_LPUART_DisableIT_CTS (USART_TypeDef * LPUARTx)

Function description

Disable CTS Interrupt.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 CTSIE LL_LPUART_DisableIT_CTS

LL_LPUART_DisableIT_WKUP

Function name

__STATIC_INLINE void LL_LPUART_DisableIT_WKUP (USART_TypeDef * LPUARTx)

Function description

Disable Wake Up from Stop Mode Interrupt.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 WUFIE LL_LPUART_DisableIT_WKUP

LL_LPUART_DisableIT_TXFT

Function name

__STATIC_INLINE void LL_LPUART_DisableIT_TXFT (USART_TypeDef * LPUARTx)

Function description

Disable TX FIFO Threshold Interrupt.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 TXFTIE LL_LPUART_DisableIT_TXFT

LL_LPUART_DisableIT_RXFT

Function name

__STATIC_INLINE void LL_LPUART_DisableIT_RXFT (USART_TypeDef * LPUARTx)

Function description

Disable RX FIFO Threshold Interrupt.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 RXFTIE LL_LPUART_DisableIT_RXFT

LL_LPUART_IsEnabledIT_IDLE

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsEnabledIT_IDLE (const USART_TypeDef * LPUARTx)

Function description

Check if the LPUART IDLE Interrupt source is enabled or disabled.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 IDLEIE LL_LPUART_IsEnabledIT_IDLE

LL_LPUART_IsEnabledIT_RXNE_RXFNE

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsEnabledIT_RXNE_RXFNE (const USART_TypeDef * LPUARTx)

Function description

Check if the LPUART RX Not Empty and LPUART RX FIFO Not Empty Interrupt is enabled or disabled.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 RXNEIE_RXFNEIE LL_LPUART_IsEnabledIT_RXNE_RXFNE

LL_LPUART_IsEnabledIT_TC

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsEnabledIT_TC (const USART_TypeDef * LPUARTx)

Function description

Check if the LPUART Transmission Complete Interrupt is enabled or disabled.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 TCIE LL_LPUART_IsEnabledIT_TC

LL_LPUART_IsEnabledIT_TXE_TXFNF

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsEnabledIT_TXE_TXFNF (const USART_TypeDef * LPUARTx)

Function description

Check if the LPUART TX Empty and LPUART TX FIFO Not Full Interrupt is enabled or disabled.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 TXEIE_TXFNFIE LL_LPUART_IsEnabledIT_TXE_TXFNF

LL_LPUART_IsEnabledIT_PE

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsEnabledIT_PE (const USART_TypeDef * LPUARTx)

Function description

Check if the LPUART Parity Error Interrupt is enabled or disabled.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 PEIE LL_LPUART_IsEnabledIT_PE

LL_LPUART_IsEnabledIT_CM

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsEnabledIT_CM (const USART_TypeDef * LPUARTx)

Function description

Check if the LPUART Character Match Interrupt is enabled or disabled.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 CMIE LL_LPUART_IsEnabledIT_CM

LL_LPUART_IsEnabledIT_TXFE

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsEnabledIT_TXFE (const USART_TypeDef * LPUARTx)

Function description

Check if the LPUART TX FIFO Empty Interrupt is enabled or disabled.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 TXFEIE LL_LPUART_IsEnabledIT_TXFE

LL_LPUART_IsEnabledIT_RXFF

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsEnabledIT_RXFF (const USART_TypeDef * LPUARTx)

Function description

Check if the LPUART RX FIFO Full Interrupt is enabled or disabled.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 RXFFIE LL_LPUART_IsEnabledIT_RXFF

LL_LPUART_IsEnabledIT_ERROR

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsEnabledIT_ERROR (const USART_TypeDef * LPUARTx)

Function description

Check if the LPUART Error Interrupt is enabled or disabled.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR3 EIE LL_LPUART_IsEnabledIT_ERROR

LL_LPUART_IsEnabledIT_CTS

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsEnabledIT_CTS (const USART_TypeDef * LPUARTx)

Function description

Check if the LPUART CTS Interrupt is enabled or disabled.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR3 CTSIE LL_LPUART_IsEnabledIT_CTS

LL_LPUART_IsEnabledIT_WKUP

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsEnabledIT_WKUP (const USART_TypeDef * LPUARTx)

Function description

Check if the LPUART Wake Up from Stop Mode Interrupt is enabled or disabled.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR3 WUFIE LL_LPUART_IsEnabledIT_WKUP

LL_LPUART_IsEnabledIT_TXFT

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsEnabledIT_TXFT (const USART_TypeDef * LPUARTx)

Function description

Check if LPUART TX FIFO Threshold Interrupt is enabled or disabled.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR3 TXFTIE LL_LPUART_IsEnabledIT_TXFT

LL_LPUART_IsEnabledIT_RXFT

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsEnabledIT_RXFT (const USART_TypeDef * LPUARTx)

Function description

Check if LPUART RX FIFO Threshold Interrupt is enabled or disabled.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR3 RXFTIE LL_LPUART_IsEnabledIT_RXFT

LL_LPUART_EnableDMAReq_RX

Function name

__STATIC_INLINE void LL_LPUART_EnableDMAReq_RX (USART_TypeDef * LPUARTx)

Function description

Enable DMA Mode for reception.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 DMAR LL_LPUART_EnableDMAReq_RX

LL_LPUART_DisableDMAReq_RX

Function name

__STATIC_INLINE void LL_LPUART_DisableDMAReq_RX (USART_TypeDef * LPUARTx)

Function description

Disable DMA Mode for reception.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 DMAR LL_LPUART_DisableDMAReq_RX

LL_LPUART_IsEnabledDMAReq_RX

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsEnabledDMAReq_RX (const USART_TypeDef * LPUARTx)

Function description

Check if DMA Mode is enabled for reception.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR3 DMAR LL_LPUART_IsEnabledDMAReq_RX

LL_LPUART_EnableDMAReq_TX

Function name

__STATIC_INLINE void LL_LPUART_EnableDMAReq_TX (USART_TypeDef * LPUARTx)

Function description

Enable DMA Mode for transmission.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 DMAT LL_LPUART_EnableDMAReq_TX

LL_LPUART_DisableDMAReq_TX

Function name

__STATIC_INLINE void LL_LPUART_DisableDMAReq_TX (USART_TypeDef * LPUARTx)

Function description

Disable DMA Mode for transmission.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 DMAT LL_LPUART_DisableDMAReq_TX

LL_LPUART_IsEnabledDMAReq_TX

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsEnabledDMAReq_TX (const USART_TypeDef * LPUARTx)

Function description

Check if DMA Mode is enabled for transmission.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR3 DMAT LL_LPUART_IsEnabledDMAReq_TX

LL_LPUART_EnableDMADeactOnRxErr

Function name

__STATIC_INLINE void LL_LPUART_EnableDMADeactOnRxErr (USART_TypeDef * LPUARTx)

Function description

Enable DMA Disabling on Reception Error.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 DDRE LL_LPUART_EnableDMADeactOnRxErr

LL_LPUART_DisableDMADeactOnRxErr

Function name

__STATIC_INLINE void LL_LPUART_DisableDMADeactOnRxErr (USART_TypeDef * LPUARTx)

Function description

Disable DMA Disabling on Reception Error.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 DDRE LL_LPUART_DisableDMADeactOnRxErr

LL_LPUART_IsEnabledDMADeactOnRxErr

Function name

__STATIC_INLINE uint32_t LL_LPUART_IsEnabledDMADeactOnRxErr (const USART_TypeDef * LPUARTx)

Function description

Indicate if DMA Disabling on Reception Error is disabled.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR3 DDRE LL_LPUART_IsEnabledDMADeactOnRxErr

LL_LPUART_DMA_GetRegAddr

Function name

__STATIC_INLINE uint32_t LL_LPUART_DMA_GetRegAddr (const USART_TypeDef * LPUARTx, uint32_t Direction)

Function description

Get the LPUART data register address used for DMA transfer.

Parameters

- **LPUARTx:** LPUART Instance
- **Direction:** This parameter can be one of the following values:
  - LL_LPUART_DMA_REG_DATA_TRANSMIT
  - LL_LPUART_DMA_REG_DATA_RECEIVE

Return values

- **Address:** of data register

Reference Manual to LL API cross reference:

- RDR RDR LL_LPUART_DMA_GetRegAddr
-
- TDR TDR LL_LPUART_DMA_GetRegAddr

LL_LPUART_ReceiveData8

Function name

__STATIC_INLINE uint8_t LL_LPUART_ReceiveData8 (const USART_TypeDef * LPUARTx)

Function description

Read Receiver Data register (Receive Data value, 8 bits)

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **Time:** Value between Min_Data=0x00 and Max_Data=0xFF

Reference Manual to LL API cross reference:

- RDR RDR LL_LPUART_ReceiveData8

LL_LPUART_ReceiveData9

Function name

__STATIC_INLINE uint16_t LL_LPUART_ReceiveData9 (const USART_TypeDef * LPUARTx)

Function description

Read Receiver Data register (Receive Data value, 9 bits)

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **Time:** Value between Min_Data=0x00 and Max_Data=0x1FF

Reference Manual to LL API cross reference:

- RDR RDR LL_LPUART_ReceiveData9

LL_LPUART_TransmitData8

Function name

__STATIC_INLINE void LL_LPUART_TransmitData8 (USART_TypeDef * LPUARTx, uint8_t Value)

Function description

Write in Transmitter Data Register (Transmit Data value, 8 bits)

Parameters

- **LPUARTx:** LPUART Instance
- **Value:** between Min_Data=0x00 and Max_Data=0xFF

Return values

- **None:**

Reference Manual to LL API cross reference:

- TDR TDR LL_LPUART_TransmitData8

LL_LPUART_TransmitData9

Function name

__STATIC_INLINE void LL_LPUART_TransmitData9 (USART_TypeDef * LPUARTx, uint16_t Value)

Function description

Write in Transmitter Data Register (Transmit Data value, 9 bits)

Parameters

- **LPUARTx:** LPUART Instance
- **Value:** between Min_Data=0x00 and Max_Data=0x1FF

Return values

- **None:**

Reference Manual to LL API cross reference:

- TDR TDR LL_LPUART_TransmitData9

LL_LPUART_RequestBreakSending

Function name

__STATIC_INLINE void LL_LPUART_RequestBreakSending (USART_TypeDef * LPUARTx)

Function description

Request Break sending.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- RQR SBKRQ LL_LPUART_RequestBreakSending

LL_LPUART_RequestEnterMuteMode

Function name

__STATIC_INLINE void LL_LPUART_RequestEnterMuteMode (USART_TypeDef * LPUARTx)

Function description

Put LPUART in mute mode and set the RWU flag.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- RQR MMRQ LL_LPUART_RequestEnterMuteMode

LL_LPUART_RequestRxDataFlush

Function name

__STATIC_INLINE void LL_LPUART_RequestRxDataFlush (USART_TypeDef * LPUARTx)

Function description

Request a Receive Data and FIFO flush.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Notes

- Allows to discard the received data without reading them, and avoid an overrun condition.

Reference Manual to LL API cross reference:

- RQR RXFRQ LL_LPUART_RequestRxDataFlush

LL_LPUART_RequestTxDataFlush

Function name

__STATIC_INLINE void LL_LPUART_RequestTxDataFlush (USART_TypeDef * LPUARTx)

Function description

Request a Transmit data FIFO flush.

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **None:**

Notes

- TXFRQ bit is set to flush the whole FIFO when FIFO mode is enabled. This also sets the flag TXFE (TXFIFO empty bit in the LPUART_ISR register).
- Macro IS_UART_FIFO_INSTANCE(USARTx) can be used to check whether or not FIFO mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- RQR TXFRQ LL_LPUART_RequestTxDataFlush

LL_LPUART_DeInit

Function name

ErrorStatus LL_LPUART_DeInit (const USART_TypeDef * LPUARTx)

Function description

De-initialize LPUART registers (Registers restored to their default values).

Parameters

- **LPUARTx:** LPUART Instance

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: LPUART registers are de-initialized
  - ERROR: not applicable

LL_LPUART_Init

Function name

ErrorStatus LL_LPUART_Init (USART_TypeDef * LPUARTx, const LL_LPUART_InitTypeDef * LPUART_InitStruct)

Function description

Initialize LPUART registers according to the specified parameters in LPUART_InitStruct.

Parameters

- **LPUARTx:** LPUART Instance
- **LPUART_InitStruct:** pointer to a LL_LPUART_InitTypeDef structure that contains the configuration information for the specified LPUART peripheral.

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: LPUART registers are initialized according to LPUART_InitStruct content
  - ERROR: Problem occurred during LPUART Registers initialization

Notes

- As some bits in LPUART configuration registers can only be written when the LPUART is disabled (USART_CR1_UE bit =0), LPUART Peripheral should be in disabled state prior calling this function. Otherwise, ERROR result will be returned.
- Baud rate value stored in LPUART_InitStruct BaudRate field, should be valid (different from 0).

LL_LPUART_StructInit

Function name

void LL_LPUART_StructInit (LL_LPUART_InitTypeDef * LPUART_InitStruct)

Function description

Set each LL_LPUART_InitTypeDef field to default value.

Parameters

- **LPUART_InitStruct:** pointer to a LL_LPUART_InitTypeDef structure whose fields will be set to default values.

Return values

- **None:**

69.3 LPUART Firmware driver defines

The following section lists the various define and macros of the module.

69.3.1 LPUART

LPUART

Address Length Detection

LL_LPUART_ADDRESS_DETECT_4B

4-bit address detection method selected

LL_LPUART_ADDRESS_DETECT_7B

7-bit address detection (in 8-bit data mode) method selected

Binary Data Inversion

LL_LPUART_BINARY_LOGIC_POSITIVE

Logical data from the data register are send/received in positive/direct logic. (1=H, 0=L)

LL_LPUART_BINARY_LOGIC_NEGATIVE

Logical data from the data register are send/received in negative/inverse logic. (1=L, 0=H). The parity bit is also inverted.

Bit Order

LL_LPUART_BITORDER_LSBFIRST

data is transmitted/received with data bit 0 first, following the start bit

LL_LPUART_BITORDER_MSBFIRST

data is transmitted/received with the MSB first, following the start bit

Clear Flags Defines

LL_LPUART_ICR_PECF

Parity error clear flag

LL_LPUART_ICR_FECF

Framing error clear flag

LL_LPUART_ICR_NCF

Noise error detected clear flag

LL_LPUART_ICR_ORECF

Overrun error clear flag

LL_LPUART_ICR_IDLECF

Idle line detected clear flag

LL_LPUART_ICR_TCCF

Transmission complete clear flag

LL_LPUART_ICR_CTSCF

CTS clear flag

LL_LPUART_ICR_CMCF

Character match clear flag

LL_LPUART_ICR_WUCF

Wakeup from Stop mode clear flag

Datawidth

LL_LPUART_DATAWIDTH_7B

7 bits word length : Start bit, 7 data bits, n stop bits

LL_LPUART_DATAWIDTH_8B

8 bits word length : Start bit, 8 data bits, n stop bits

LL_LPUART_DATAWIDTH_9B

9 bits word length : Start bit, 9 data bits, n stop bits

Driver Enable Polarity

LL_LPUART_DE_POLARITY_HIGH

DE signal is active high

LL_LPUART_DE_POLARITY_LOW

DE signal is active low

Direction

LL_LPUART_DIRECTION_NONE

Transmitter and Receiver are disabled

LL_LPUART_DIRECTION_RX

Transmitter is disabled and Receiver is enabled

LL_LPUART_DIRECTION_TX

Transmitter is enabled and Receiver is disabled

LL_LPUART_DIRECTION_TX_RX

Transmitter and Receiver are enabled

DMA Register Data

LL_LPUART_DMA_REG_DATA_TRANSMIT

Get address of data register used for transmission

LL_LPUART_DMA_REG_DATA_RECEIVE

Get address of data register used for reception

FIFO Threshold

LL_LPUART_FIFOTHRESHOLD_1_8

FIFO reaches 1/8 of its depth

LL_LPUART_FIFOTHRESHOLD_1_4

FIFO reaches 1/4 of its depth

LL_LPUART_FIFOTHRESHOLD_1_2

FIFO reaches 1/2 of its depth

LL_LPUART_FIFOTHRESHOLD_3_4

FIFO reaches 3/4 of its depth

LL_LPUART_FIFOTHRESHOLD_7_8

FIFO reaches 7/8 of its depth

LL_LPUART_FIFOTHRESHOLD_8_8

FIFO becomes empty for TX and full for RX

Get Flags Defines

LL_LPUART_ISR_PE

Parity error flag

LL_LPUART_ISR_FE

Framing error flag

LL_LPUART_ISR_NE

Noise detected flag

LL_LPUART_ISR_ORE

Overrun error flag

LL_LPUART_ISR_IDLE

Idle line detected flag

LL_LPUART_ISR_RXNE_RXFNE

Read data register or RX FIFO not empty flag

LL_LPUART_ISR_TC

Transmission complete flag

LL_LPUART_ISR_TXE_TXFNF

Transmit data register empty or TX FIFO Not Full flag

LL_LPUART_ISR_CTSIF

CTS interrupt flag

LL_LPUART_ISR_CTS

CTS flag

LL_LPUART_ISR_BUSY

Busy flag

LL_LPUART_ISR_CMF

Character match flag

LL_LPUART_ISR_SBKF

Send break flag

LL_LPUART_ISR_RWU

Receiver wakeup from Mute mode flag

LL_LPUART_ISR_WUF

Wakeup from Stop mode flag

LL_LPUART_ISR_TEACK

Transmit enable acknowledge flag

LL_LPUART_ISR_REACK

Receive enable acknowledge flag

LL_LPUART_ISR_TXFE

TX FIFO empty flag

LL_LPUART_ISR_RXFF

RX FIFO full flag

LL_LPUART_ISR_RXFT

RX FIFO threshold flag

LL_LPUART_ISR_TXFT

TX FIFO threshold flag

Hardware Control

LL_LPUART_HWCONTROL_NONE

CTS and RTS hardware flow control disabled

LL_LPUART_HWCONTROL_RTS

RTS output enabled, data is only requested when there is space in the receive buffer

LL_LPUART_HWCONTROL_CTS

CTS mode enabled, data is only transmitted when the nCTS input is asserted (tied to 0)

LL_LPUART_HWCONTROL_RTS_CTS

CTS and RTS hardware flow control enabled

IT Defines

LL_LPUART_CR1_IDLEIE

IDLE interrupt enable

LL_LPUART_CR1_RXNEIE_RXFNEIE

Read data register and RXFIFO not empty interrupt enable

LL_LPUART_CR1_TCIE

Transmission complete interrupt enable

LL_LPUART_CR1_TXEIE_TXFNFIE

Transmit data register empty and TX FIFO not full interrupt enable

LL_LPUART_CR1_PEIE

Parity error

LL_LPUART_CR1_CMIE

Character match interrupt enable

LL_LPUART_CR1_TXFEIE

TX FIFO empty interrupt enable

LL_LPUART_CR1_RXFFIE

RX FIFO full interrupt enable

LL_LPUART_CR3_EIE

Error interrupt enable

LL_LPUART_CR3_CTSIE

CTS interrupt enable

LL_LPUART_CR3_WUFIE

Wakeup from Stop mode interrupt enable

LL_LPUART_CR3_TXFTIE

TX FIFO threshold interrupt enable

LL_LPUART_CR3_RXFTIE

RX FIFO threshold interrupt enable

Parity Control

LL_LPUART_PARITY_NONE

Parity control disabled

LL_LPUART_PARITY_EVEN

Parity control enabled and Even Parity is selected

LL_LPUART_PARITY_ODD

Parity control enabled and Odd Parity is selected

Clock Source Prescaler

LL_LPUART_PRESCALER_DIV1

Input clock not divided

LL_LPUART_PRESCALER_DIV2

Input clock divided by 2

LL_LPUART_PRESCALER_DIV4

Input clock divided by 4

LL_LPUART_PRESCALER_DIV6

Input clock divided by 6

LL_LPUART_PRESCALER_DIV8

Input clock divided by 8

LL_LPUART_PRESCALER_DIV10

Input clock divided by 10

LL_LPUART_PRESCALER_DIV12

Input clock divided by 12

LL_LPUART_PRESCALER_DIV16

Input clock divided by 16

LL_LPUART_PRESCALER_DIV32

Input clock divided by 32

LL_LPUART_PRESCALER_DIV64

Input clock divided by 64

LL_LPUART_PRESCALER_DIV128

Input clock divided by 128

LL_LPUART_PRESCALER_DIV256

Input clock divided by 256

RX Pin Active Level Inversion

LL_LPUART_RXPIN_LEVEL_STANDARD

RX pin signal works using the standard logic levels

LL_LPUART_RXPIN_LEVEL_INVERTED

RX pin signal values are inverted.

Stop Bits

LL_LPUART_STOPBITS_1

1 stop bit

LL_LPUART_STOPBITS_2

2 stop bits

TX Pin Active Level Inversion

LL_LPUART_TXPIN_LEVEL_STANDARD

TX pin signal works using the standard logic levels

LL_LPUART_TXPIN_LEVEL_INVERTED

TX pin signal values are inverted.

TX RX Pins Swap

LL_LPUART_TXRX_STANDARD

TX/RX pins are used as defined in standard pinout

LL_LPUART_TXRX_SWAPPED

TX and RX pins functions are swapped.

Wakeup

LL_LPUART_WAKEUP_IDLELINE

LPUART wake up from Mute mode on Idle Line

LL_LPUART_WAKEUP_ADDRESSMARK

LPUART wake up from Mute mode on Address Mark

Wakeup Activation

LL_LPUART_WAKEUP_ON_ADDRESS

Wake up active on address match

LL_LPUART_WAKEUP_ON_STARTBIT

Wake up active on Start bit detection

LL_LPUART_WAKEUP_ON_RXNE

Wake up active on RXNE

FLAG_Management

LL_LPUART_IsActiveFlag_RXNE

LL_LPUART_IsActiveFlag_TXE

IT_Management

LL_LPUART_EnableIT_RXNE

LL_LPUART_EnableIT_TXE

LL_LPUART_DisableIT_RXNE

LL_LPUART_DisableIT_TXE

LL_LPUART_IsEnabledIT_RXNE

LL_LPUART_IsEnabledIT_TXE

Helper Macros

__LL_LPUART_DIV

Description:

- Compute LPUARTDIV value according to Peripheral Clock and expected Baud Rate (20-bit value of LPUARTDIV is returned)

Parameters:

- __PERIPHCLK__: Peripheral Clock frequency used for LPUART Instance
- __PRESCALER__: This parameter can be one of the following values:
  - LL_LPUART_PRESCALER_DIV1
  - LL_LPUART_PRESCALER_DIV2
  - LL_LPUART_PRESCALER_DIV4
  - LL_LPUART_PRESCALER_DIV6
  - LL_LPUART_PRESCALER_DIV8
  - LL_LPUART_PRESCALER_DIV10
  - LL_LPUART_PRESCALER_DIV12
  - LL_LPUART_PRESCALER_DIV16
  - LL_LPUART_PRESCALER_DIV32
  - LL_LPUART_PRESCALER_DIV64
  - LL_LPUART_PRESCALER_DIV128
  - LL_LPUART_PRESCALER_DIV256
- __BAUDRATE__: Baud Rate value to achieve

Return value:

- LPUARTDIV: value to be used for BRR register filling

Common Write and read registers Macros

LL_LPUART_WriteReg

Description:

- Write a value in LPUART register.

Parameters:

- __INSTANCE__: LPUART Instance
- __REG__: Register to be written
- __VALUE__: Value to be written in the register

Return value:

- None

LL_LPUART_ReadReg

Description:

- Read a value in LPUART register.

Parameters:

- __INSTANCE__: LPUART Instance
- __REG__: Register to be read

Return value:

- Register: value

70 LL OPAMP Generic Driver

70.1 OPAMP Firmware driver registers structures

70.1.1 LL_OPAMP_InitTypeDef

LL_OPAMP_InitTypeDef is defined in the stm32u0xx_ll_opamp.h

Data Fields

- ***uint32_t PowerMode***
- ***uint32_t FunctionalMode***
- ***uint32_t InputNonInverting***
- ***uint32_t InputInverting***

Field Documentation

- ***uint32_t LL_OPAMP_InitTypeDef::PowerMode***
  Set the power mode Normal or Low-Power and the speed mode Normal or High. This parameter can be a value of ***OPAMP_LL_EC_POWERMODE*** This feature can be modified afterwards using unitary function **LL_OPAMP_SetPowerMode()**.
- ***uint32_t LL_OPAMP_InitTypeDef::FunctionalMode***
  Set OPAMP functional mode by setting internal connections: OPAMP operation in standalone, follower, ... This parameter can be a value of ***OPAMP_LL_EC_FUNCTIONAL_MODE***
  Note:
  – If OPAMP is configured in mode PGA, the gain can be configured using function **LL_OPAMP_SetPGAGain()**. This feature can be modified afterwards using unitary function **LL_OPAMP_SetFunctionalMode()**.
- ***uint32_t LL_OPAMP_InitTypeDef::InputNonInverting***
  Set OPAMP input non-inverting connection. This parameter can be a value of ***OPAMP_LL_EC_INPUT_NONINVERTING*** This feature can be modified afterwards using unitary function **LL_OPAMP_SetInputNonInverting()**.
- ***uint32_t LL_OPAMP_InitTypeDef::InputInverting***
  Set OPAMP inverting input connection. This parameter can be a value of ***OPAMP_LL_EC_INPUT_INVERTING***
  Note:
  – OPAMP inverting input is used with OPAMP in mode standalone or PGA with external capacitors for filtering circuit. Otherwise (OPAMP in mode follower), OPAMP inverting input is not used (not connected to GPIO pin), this parameter is discarded. This feature can be modified afterwards using unitary function **LL_OPAMP_SetInputInverting()**.

70.2 OPAMP Firmware driver API description

The following section lists the various functions of the OPAMP library.

70.2.1 Detailed description of functions

LL_OPAMP_SetCommonPowerRange

Function name

__STATIC_INLINE void LL_OPAMP_SetCommonPowerRange (OPAMP_Common_TypeDef * OPAMPxy_COMMON, uint32_t PowerRange)

Function description

Set OPAMP power range.

Parameters

- **OPAMPxy_COMMON:** OPAMP common instance
- **PowerRange:** This parameter can be one of the following values:
  - LL_OPAMP_POWERSUPPLY_RANGE_LOW
  - LL_OPAMP_POWERSUPPLY_RANGE_HIGH

Return values

- **None:**

Notes

- The OPAMP power range applies to several OPAMP instances (if several OPAMP instances available on the selected device). It is mandatory to set already the power range to high for performance purpose.
- On this STM32 series, setting of this feature is conditioned to OPAMP state: All OPAMP instances of the OPAMP common group must be disabled. This check can be done with function LL_OPAMP_IsEnabled() for each OPAMP instance.
- LL_OPAMP_POWERSUPPLY_RANGE_HIGH parameter is highly recommended for performance purpose.

Reference Manual to LL API cross reference:

- CSR OPARANGE LL_OPAMP_SetCommonPowerRange

LL_OPAMP_GetCommonPowerRange

Function name

__STATIC_INLINE uint32_t LL_OPAMP_GetCommonPowerRange (const OPAMP_Common_TypeDef * OPAMPxy_COMMON)

Function description

Get OPAMP power range.

Parameters

- **OPAMPxy_COMMON:** OPAMP common instance

Return values

- **Returned:** value can be one of the following values:
  - LL_OPAMP_POWERSUPPLY_RANGE_LOW
  - LL_OPAMP_POWERSUPPLY_RANGE_HIGH

Notes

- The OPAMP power range applies to several OPAMP instances (if several OPAMP instances available on the selected device).

Reference Manual to LL API cross reference:

- CSR OPARANGE LL_OPAMP_GetCommonPowerRange

LL_OPAMP_SetPowerMode

Function name

__STATIC_INLINE void LL_OPAMP_SetPowerMode (OPAMP_TypeDef * OPAMPx, uint32_t PowerMode)

Function description

Set OPAMP power mode.

Parameters

- **OPAMPx:** OPAMP instance
- **PowerMode:** This parameter can be one of the following values:
  - LL_OPAMP_POWERMODE_NORMALPOWER_NORMALSPEED
  - LL_OPAMP_POWERMODE_LOWPOWER_NORMALSPEED

Return values

- **None:**

Notes

- The OPAMP must be disabled to change this configuration.

Reference Manual to LL API cross reference:

- CSR OPALPM LL_OPAMP_SetPowerMode

LL_OPAMP_GetPowerMode

Function name

__STATIC_INLINE uint32_t LL_OPAMP_GetPowerMode (const OPAMP_TypeDef * OPAMPx)

Function description

Get OPAMP power mode.

Parameters

- **OPAMPx:** OPAMP instance

Return values

- **Returned:** value can be one of the following values:
  - LL_OPAMP_POWERMODE_NORMALPOWER_NORMALSPEED
  - LL_OPAMP_POWERMODE_LOWPOWER_NORMALSPEED

Reference Manual to LL API cross reference:

- CSR OPALPM & HSM LL_OPAMP_GetPowerMode

LL_OPAMP_SetMode

Function name

__STATIC_INLINE void LL_OPAMP_SetMode (OPAMP_TypeDef * OPAMPx, uint32_t Mode)

Function description

Set OPAMP mode calibration or functional.

Parameters

- **OPAMPx:** OPAMP instance
- **Mode:** This parameter can be one of the following values:
  - LL_OPAMP_MODE_FUNCTIONAL
  - LL_OPAMP_MODE_CALIBRATION

Return values

- **None:**

Notes

- OPAMP mode corresponds to functional or calibration mode: functional mode: OPAMP operation in standalone, follower, ... Set functional mode using function LL_OPAMP_SetFunctionalMode().calibration mode: offset calibration of the selected transistors differential pair NMOS or PMOS.
- On this STM32 series, during calibration, OPAMP functional mode must be set to standalone or follower mode (in order to open internal connections to resistors of PGA mode). Refer to function LL_OPAMP_SetFunctionalMode().

Reference Manual to LL API cross reference:

- CSR CALON LL_OPAMP_SetMode

LL_OPAMP_GetMode

Function name

__STATIC_INLINE uint32_t LL_OPAMP_GetMode (const OPAMP_TypeDef * OPAMPx)

Function description

Get OPAMP mode calibration or functional.

Parameters

- **OPAMPx:** OPAMP instance

Return values

- **Returned:** value can be one of the following values:
  - LL_OPAMP_MODE_FUNCTIONAL
  - LL_OPAMP_MODE_CALIBRATION

Notes

- OPAMP mode corresponds to functional or calibration mode: functional mode: OPAMP operation in standalone, follower, ... Set functional mode using function LL_OPAMP_SetFunctionalMode().calibration mode: offset calibration of the selected transistors differential pair NMOS or PMOS.

Reference Manual to LL API cross reference:

- CSR CALON LL_OPAMP_GetMode

LL_OPAMP_SetFunctionalMode

Function name

__STATIC_INLINE void LL_OPAMP_SetFunctionalMode (OPAMP_TypeDef * OPAMPx, uint32_t FunctionalMode)

Function description

Set OPAMP functional mode by setting internal connections.

Parameters

- **OPAMPx:** OPAMP instance
- **FunctionalMode:** This parameter can be one of the following values:
  - LL_OPAMP_MODE_STANDALONE
  - LL_OPAMP_MODE_FOLLOWER
  - LL_OPAMP_MODE_PGA

Return values

- **None:**

Notes

- This function reset bit of calibration mode to ensure to be in functional mode, in order to have OPAMP parameters (inputs selection, ...) set with the corresponding OPAMP mode to be effective.

Reference Manual to LL API cross reference:

- CSR OPAMODE LL_OPAMP_SetFunctionalMode

LL_OPAMP_GetFunctionalMode

Function name

__STATIC_INLINE uint32_t LL_OPAMP_GetFunctionalMode (const OPAMP_TypeDef * OPAMPx)

Function description

Get OPAMP functional mode from setting of internal connections.

Parameters

- **OPAMPx:** OPAMP instance

Return values

- **Returned:** value can be one of the following values:
  - LL_OPAMP_MODE_STANDALONE
  - LL_OPAMP_MODE_FOLLOWER
  - LL_OPAMP_MODE_PGA

Reference Manual to LL API cross reference:

- CSR OPAMODE LL_OPAMP_GetFunctionalMode

LL_OPAMP_SetPGAGain

Function name

__STATIC_INLINE void LL_OPAMP_SetPGAGain (OPAMP_TypeDef * OPAMPx, uint32_t PGAGain)

Function description

Set OPAMP PGA gain.

Parameters

- **OPAMPx:** OPAMP instance
- **PGAGain:** This parameter can be one of the following values:
  - LL_OPAMP_PGA_GAIN_2
  - LL_OPAMP_PGA_GAIN_4
  - LL_OPAMP_PGA_GAIN_8
  - LL_OPAMP_PGA_GAIN_16

Return values

- **None:**

Notes

- Preliminarily, OPAMP must be set in mode PGA using function LL_OPAMP_SetFunctionalMode().

Reference Manual to LL API cross reference:

- CSR PGGAIN LL_OPAMP_SetPGAGain

LL_OPAMP_GetPGAGain

Function name

__STATIC_INLINE uint32_t LL_OPAMP_GetPGAGain (const OPAMP_TypeDef * OPAMPx)

Function description

Get OPAMP PGA gain.

Parameters

- **OPAMPx:** OPAMP instance

Return values

- **Returned:** value can be one of the following values:
  - LL_OPAMP_PGA_GAIN_2
  - LL_OPAMP_PGA_GAIN_4
  - LL_OPAMP_PGA_GAIN_8
  - LL_OPAMP_PGA_GAIN_16

Notes

- Preliminarily, OPAMP must be set in mode PGA using function LL_OPAMP_SetFunctionalMode().

Reference Manual to LL API cross reference:

- CSR PGGAIN LL_OPAMP_GetPGAGain

LL_OPAMP_SetInputNonInverting

Function name

__STATIC_INLINE void LL_OPAMP_SetInputNonInverting (OPAMP_TypeDef * OPAMPx, uint32_t InputNonInverting)

Function description

Set OPAMP non-inverting input connection.

Parameters

- **OPAMPx:** OPAMP instance
- **InputNonInverting:** This parameter can be one of the following values:
  - LL_OPAMP_INPUT_NONINVERT_IO0
  - LL_OPAMP_INPUT_NONINV_DAC1_CH1

Return values

- **None:**

Reference Manual to LL API cross reference:

- CSR VPSEL LL_OPAMP_SetInputNonInverting

LL_OPAMP_GetInputNonInverting

Function name

__STATIC_INLINE uint32_t LL_OPAMP_GetInputNonInverting (const OPAMP_TypeDef * OPAMPx)

Function description

Get OPAMP non-inverting input connection.

Parameters

- **OPAMPx:** OPAMP instance

Return values

- **Returned:** value can be one of the following values:
  - LL_OPAMP_INPUT_NONINVERT_IO0
  - LL_OPAMP_INPUT_NONINV_DAC1_CH1

Reference Manual to LL API cross reference:

- CSR VPSEL LL_OPAMP_GetInputNonInverting

LL_OPAMP_SetInputInverting

Function name

__STATIC_INLINE void LL_OPAMP_SetInputInverting (OPAMP_TypeDef * OPAMPx, uint32_t InputInverting)

Function description

Set OPAMP inverting input connection.

Parameters

- **OPAMPx:** OPAMP instance
- **InputInverting:** This parameter can be one of the following values:
  - LL_OPAMP_INPUT_INVERT_IO0
  - LL_OPAMP_INPUT_INVERT_CONNECT_NO

Return values

- **None:**

Notes

- OPAMP inverting input is used with OPAMP in mode standalone or PGA with external capacitors for filtering circuit. Otherwise (OPAMP in mode follower), OPAMP inverting input is not used (not connected to GPIO pin).

Reference Manual to LL API cross reference:

- CSR VMSEL LL_OPAMP_SetInputInverting

LL_OPAMP_GetInputInverting

Function name

__STATIC_INLINE uint32_t LL_OPAMP_GetInputInverting (const OPAMP_TypeDef * OPAMPx)

Function description

Get OPAMP inverting input connection.

Parameters

- **OPAMPx:** OPAMP instance

Return values

- **Returned:** value can be one of the following values:
  - LL_OPAMP_INPUT_INVERT_IO0
  - LL_OPAMP_INPUT_INVERT_CONNECT_NO

Reference Manual to LL API cross reference:

- CSR VMSEL LL_OPAMP_GetInputInverting

LL_OPAMP_SetNonInvertingInput

Function name

__STATIC_INLINE void LL_OPAMP_SetNonInvertingInput (OPAMP_TypeDef * OPAMPx, uint32_t NonInvertingInput)

Function description

LL_OPAMP_SetInvertingInput

Function name

__STATIC_INLINE void LL_OPAMP_SetInvertingInput (OPAMP_TypeDef * OPAMPx, uint32_t InvertingInput)

Function description

LL_OPAMP_SetTrimmingMode

Function name

__STATIC_INLINE void LL_OPAMP_SetTrimmingMode (OPAMP_TypeDef * OPAMPx, uint32_t TrimmingMode)

Function description

Set OPAMP trimming mode.

Parameters

- **OPAMPx:** OPAMP instance
- **TrimmingMode:** This parameter can be one of the following values:
  - LL_OPAMP_TRIMMING_FACTORY
  - LL_OPAMP_TRIMMING_USER

Return values

- **None:**

Reference Manual to LL API cross reference:

- CSR USERTRIM LL_OPAMP_SetTrimmingMode

LL_OPAMP_GetTrimmingMode

Function name

__STATIC_INLINE uint32_t LL_OPAMP_GetTrimmingMode (const OPAMP_TypeDef * OPAMPx)

Function description

Get OPAMP trimming mode.

Parameters

- **OPAMPx:** OPAMP instance

Return values

- **Returned:** value can be one of the following values:
  - LL_OPAMP_TRIMMING_FACTORY
  - LL_OPAMP_TRIMMING_USER

Reference Manual to LL API cross reference:

- CSR USERTRIM LL_OPAMP_GetTrimmingMode

LL_OPAMP_SetCalibrationSelection

Function name

__STATIC_INLINE void LL_OPAMP_SetCalibrationSelection (OPAMP_TypeDef * OPAMPx, uint32_t TransistorsDiffPair)

Function description

Set OPAMP offset to calibrate the selected transistors differential pair NMOS or PMOS.

Parameters

- **OPAMPx:** OPAMP instance
- **TransistorsDiffPair:** This parameter can be one of the following values:
  - LL_OPAMP_TRIMMING_NMOS
  - LL_OPAMP_TRIMMING_PMOS

Return values

- **None:**

Notes

- Preliminarily, OPAMP must be set in mode calibration using function LL_OPAMP_SetMode().

Reference Manual to LL API cross reference:

- CSR CALSEL LL_OPAMP_SetCalibrationSelection

LL_OPAMP_GetCalibrationSelection

Function name

__STATIC_INLINE uint32_t LL_OPAMP_GetCalibrationSelection (const OPAMP_TypeDef * OPAMPx)

Function description

Get OPAMP offset to calibrate the selected transistors differential pair NMOS or PMOS.

Parameters

- **OPAMPx:** OPAMP instance

Return values

- **Returned:** value can be one of the following values:
  - LL_OPAMP_TRIMMING_NMOS
  - LL_OPAMP_TRIMMING_PMOS

Notes

- Preliminarily, OPAMP must be set in mode calibration using function LL_OPAMP_SetMode().

Reference Manual to LL API cross reference:

- CSR CALSEL LL_OPAMP_GetCalibrationSelection

LL_OPAMP_IsCalibrationOutputSet

Function name

__STATIC_INLINE uint32_t LL_OPAMP_IsCalibrationOutputSet (const OPAMP_TypeDef * OPAMPx)

Function description

Get OPAMP calibration result of toggling output.

Parameters

- **OPAMPx:** OPAMP instance

Return values

- **State:** of bit (1 or 0).

Notes

- This functions returns: 0 if OPAMP calibration output is reset 1 if OPAMP calibration output is set

Reference Manual to LL API cross reference:

- CSR CALOUT LL_OPAMP_IsCalibrationOutputSet

LL_OPAMP_SetTrimmingValue

Function name

__STATIC_INLINE void LL_OPAMP_SetTrimmingValue (OPAMP_TypeDef * OPAMPx, uint32_t PowerMode, uint32_t TransistorsDiffPair, uint32_t TrimmingValue)

Function description

Set OPAMP trimming factor for the selected transistors differential pair NMOS or PMOS, corresponding to the selected power mode.

Parameters

- **OPAMPx:** OPAMP instance
- **PowerMode:** This parameter can be one of the following values:
  - LL_OPAMP_POWERMODE_NORMALPOWER_NORMALSPEED
  - LL_OPAMP_POWERMODE_LOWPOWER_NORMALSPEED
- **TransistorsDiffPair:** This parameter can be one of the following values:
  - LL_OPAMP_TRIMMING_NMOS
  - LL_OPAMP_TRIMMING_PMOS
- **TrimmingValue:** 0x00...0x1F

Return values

- **None:**

Reference Manual to LL API cross reference:

- OTR TRIMOFFSETN LL_OPAMP_SetTrimmingValue OTR TRIMOFFSETP LL_OPAMP_SetTrimmingValue LPOTR TRIMLPOFFSETN LL_OPAMP_SetTrimmingValue LPOTR TRIMLPOFFSETP LL_OPAMP_SetTrimmingValue

LL_OPAMP_GetTrimmingValue

Function name

__STATIC_INLINE uint32_t LL_OPAMP_GetTrimmingValue (const OPAMP_TypeDef * OPAMPx, uint32_t PowerMode, uint32_t TransistorsDiffPair)

Function description

Get OPAMP trimming factor for the selected transistors differential pair NMOS or PMOS, corresponding to the selected power mode.

Parameters

- **OPAMPx:** OPAMP instance
- **PowerMode:** This parameter can be one of the following values:
  - LL_OPAMP_POWERMODE_NORMALPOWER_NORMALSPEED
  - LL_OPAMP_POWERMODE_LOWPOWER_NORMALSPEED
- **TransistorsDiffPair:** This parameter can be one of the following values:
  - LL_OPAMP_TRIMMING_NMOS
  - LL_OPAMP_TRIMMING_PMOS

Return values

- **0x0...0x1F:**

Reference Manual to LL API cross reference:

- OTR TRIMOFFSETN LL_OPAMP_GetTrimmingValue OTR TRIMOFFSETP LL_OPAMP_GetTrimmingValue LPOTR TRIMLPOFFSETN LL_OPAMP_GetTrimmingValue LPOTR TRIMLPOFFSETP LL_OPAMP_GetTrimmingValue

LL_OPAMP_Enable

Function name

__STATIC_INLINE void LL_OPAMP_Enable (OPAMP_TypeDef * OPAMPx)

Function description

Enable OPAMP instance.

Parameters

- **OPAMPx:** OPAMP instance

Return values

- **None:**

Notes

- After enable from off state, OPAMP requires a delay to fulfill wake up time specification. Refer to device datasheet, parameter "tWAKEUP".

Reference Manual to LL API cross reference:

- CSR OPAMPXEN LL_OPAMP_Enable

LL_OPAMP_Disable

Function name

__STATIC_INLINE void LL_OPAMP_Disable (OPAMP_TypeDef * OPAMPx)

Function description

Disable OPAMP instance.

Parameters

- **OPAMPx:** OPAMP instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CSR OPAMPXEN LL_OPAMP_Disable

LL_OPAMP_IsEnabled

Function name

__STATIC_INLINE uint32_t LL_OPAMP_IsEnabled (const OPAMP_TypeDef * OPAMPx)

Function description

Get OPAMP instance enable state (0: OPAMP is disabled, 1: OPAMP is enabled)

Parameters

- **OPAMPx:** OPAMP instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CSR OPAMPXEN LL_OPAMP_IsEnabled

LL_OPAMP_DeInit

Function name

ErrorStatus LL_OPAMP_DeInit (OPAMP_TypeDef * OPAMPx)

Function description

De-initialize registers of the selected OPAMP instance to their default reset values.

Parameters

- **OPAMPx:** OPAMP instance

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: OPAMP registers are de-initialized
  - ERROR: OPAMP registers are not de-initialized

LL_OPAMP_Init

Function name

ErrorStatus LL_OPAMP_Init (OPAMP_TypeDef * OPAMPx, const LL_OPAMP_InitTypeDef * OPAMP_InitStruct)

Function description

Initialize some features of OPAMP instance.

Parameters

- **OPAMPx:** OPAMP instance
- **OPAMP_InitStruct:** Pointer to a LL_OPAMP_InitTypeDef structure

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: OPAMP registers are initialized
  - ERROR: OPAMP registers are not initialized

Notes

- This function reset bit of calibration mode to ensure to be in functional mode, in order to have OPAMP parameters (inputs selection, ...) set with the corresponding OPAMP mode to be effective.
- This function configures features of the selected OPAMP instance. Some features are also available at scope OPAMP common instance (common to several OPAMP instances).

LL_OPAMP_StructInit

Function name

void LL_OPAMP_StructInit (LL_OPAMP_InitTypeDef * OPAMP_InitStruct)

Function description

Set each LL_OPAMP_InitTypeDef field to default value.

Parameters

- **OPAMP_InitStruct:** pointer to a LL_OPAMP_InitTypeDef structure whose fields will be set to default values.

Return values

- **None:**

70.3 OPAMP Firmware driver defines

The following section lists the various define and macros of the module.

70.3.1 OPAMP

OPAMP

OPAMP functional mode

LL_OPAMP_MODE_STANDALONE

OPAMP functional mode, OPAMP operation in standalone

LL_OPAMP_MODE_FOLLOWER

OPAMP functional mode, OPAMP operation in follower

LL_OPAMP_MODE_PGA

OPAMP functional mode, OPAMP operation in PGA

Definitions of OPAMP hardware constraints delays

LL_OPAMP_DELAY_STARTUP_US

Delay for OPAMP startup time

OPAMP input inverting

LL_OPAMP_INPUT_INVERT_IO0

OPAMP inverting input connected to GPIO pin (valid also in PGA mode for filtering). Note: OPAMP inverting input is used with OPAMP in mode standalone or PGA with external capacitors for filtering circuit. Otherwise (OPAMP in mode follower), OPAMP inverting input is not used (not connected to GPIO pin).

LL_OPAMP_INPUT_INVERT_CONNECT_NO

OPAMP inverting input not externally connected (intended for OPAMP in mode follower or PGA without external capacitors for filtering)

OPAMP input non-inverting

LL_OPAMP_INPUT_NONINVERT_IO0

OPAMP non inverting input connected to GPIO pin (pin PA0 for OPAMP1)

LL_OPAMP_INPUT_NONINV_DAC1_CH1

OPAMP non inverting input connected to DAC1 channel output(channel1 for OPAMP1)

OPAMP mode calibration or functional.

LL_OPAMP_MODE_FUNCTIONAL

OPAMP functional mode

LL_OPAMP_MODE_CALIBRATION

OPAMP calibration mode

OPAMP PGA gain (relevant when OPAMP is in functional mode PGA)

LL_OPAMP_PGA_GAIN_2

OPAMP PGA gain 2

LL_OPAMP_PGA_GAIN_4

OPAMP PGA gain 4

LL_OPAMP_PGA_GAIN_8

OPAMP PGA gain 8

LL_OPAMP_PGA_GAIN_16

OPAMP PGA gain 16

OPAMP power mode

LL_OPAMP_POWERMODE_NORMALPOWER_NORMALSPEED

OPAMP power mode normal speed normal

LL_OPAMP_POWERMODE_LOWPOWER_NORMALSPEED

OPAMP power mode low-power speed normal

OPAMP power supply range

LL_OPAMP_POWERSUPPLY_RANGE_LOW

Power supply range low

LL_OPAMP_POWERSUPPLY_RANGE_HIGH

Power supply range high - recommended for performance purpose

OPAMP trimming mode

LL_OPAMP_TRIMMING_FACTORY

OPAMP trimming factors set to factory values

LL_OPAMP_TRIMMING_USER

OPAMP trimming factors set to user values

OPAMP trimming of transistors differential pair NMOS or PMOS

LL_OPAMP_TRIMMING_NMOS

OPAMP trimming of transistors differential pair NMOS

LL_OPAMP_TRIMMING_PMOS

OPAMP trimming of transistors differential pair PMOS

OPAMP helper macro

__LL_OPAMP_COMMON_INSTANCE

Description:

- Helper macro to select the OPAMP common instance to which is belonging the selected OPAMP instance.

Parameters:

- __OPAMPx__: OPAMP instance

Return value:

- OPAMP: common instance

Notes:

- OPAMP common register instance can be used to set parameters common to several OPAMP instances. Refer to functions having argument "OPAMPxy_COMMON" as parameter.

__LL_OPAMP_IS_ENABLED_ALL_COMMON_INSTANCE

Description:

- Helper macro to check if all OPAMP instances sharing the same OPAMP common instance are disabled.

Return value:

- 0: All OPAMP instances sharing the same OPAMP common instance are disabled. 1: At least one OPAMP instance sharing the same OPAMP common instance is enabled

Notes:

- This check is required by functions with setting conditioned to OPAMP state: All OPAMP instances of the OPAMP common group must be disabled. Refer to functions having argument "OPAMPxy_COMMON" as parameter.

Common write and read registers macro

LL_OPAMP_WriteReg

Description:

- Write a value in OPAMP register.

Parameters:

- __INSTANCE__: OPAMP Instance
- __REG__: Register to be written
- __VALUE__: Value to be written in the register

Return value:

- None

LL_OPAMP_ReadReg

Description:

- Read a value in OPAMP register.

Parameters:

- __INSTANCE__: OPAMP Instance
- __REG__: Register to be read

Return value:

- Register: value

71 LL PWR Generic Driver

71.1 PWR Firmware driver API description

The following section lists the various functions of the PWR library.

71.1.1 Detailed description of functions

LL_PWR_SetPowerMode

Function name

__STATIC_INLINE void LL_PWR_SetPowerMode (uint32_t LowPowerMode)

Function description

Set Low-Power mode.

Parameters

- **LowPowerMode:** This parameter can be one of the following values:
  - LL_PWR_MODE_STOP0
  - LL_PWR_MODE_STOP1
  - LL_PWR_MODE_STOP2
  - LL_PWR_MODE_STANDBY
  - LL_PWR_MODE_SHUTDOWN

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 LPMS LL_PWR_SetPowerMode

LL_PWR_GetPowerMode

Function name

__STATIC_INLINE uint32_t LL_PWR_GetPowerMode (void)

Function description

Get Low-Power mode.

Return values

- **Returned:** value can be one of the following values:
  - LL_PWR_MODE_STOP0
  - LL_PWR_MODE_STOP1
  - LL_PWR_MODE_STOP2
  - LL_PWR_MODE_STANDBY
  - LL_PWR_MODE_SHUTDOWN

Reference Manual to LL API cross reference:

- CR1 LPMS LL_PWR_GetPowerMode

LL_PWR_EnableFlashPWRDownModeDuringStop

Function name

__STATIC_INLINE void LL_PWR_EnableFlashPWRDownModeDuringStop (void)

Function description

Enable Flash Pwr Down Mode during Stop.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 FPD_STOP LL_PWR_EnableFlashPWRDownModeDuringStop

LL_PWR_DisableFlashPWRDownModeDuringStop

Function name

__STATIC_INLINE void LL_PWR_DisableFlashPWRDownModeDuringStop (void)

Function description

Disable Flash Pwr Down Mode during Stop.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 FPD_STOP LL_PWR_DisableFlashPWRDownModeDuringStop

LL_PWR_IsEnabledFlashPWRDownModeDuringSTOP

Function name

__STATIC_INLINE uint32_t LL_PWR_IsEnabledFlashPWRDownModeDuringSTOP (void)

Function description

Check if Flash Pwr Down Mode during Stop is enabled.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 FPD_STOP LL_PWR_IsEnabledFlashPWRDownModeDuringSTOP

LL_PWR_EnableFlashPWRDownModeDuringLPRun

Function name

__STATIC_INLINE void LL_PWR_EnableFlashPWRDownModeDuringLPRun (void)

Function description

Enable Flash Pwr Down Mode during LP run.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 FPD_LPRUN LL_PWR_EnableFlashPWRDownModeDuringLPRun

LL_PWR_DisableFlashPWRDownModeDuringLPRun

Function name

__STATIC_INLINE void LL_PWR_DisableFlashPWRDownModeDuringLPRun (void)

Function description

Disable Flash Pwr Down Mode during LP run.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 FPD_LPRUN LL_PWR_DisableFlashPWRDownModeDuringLPRun

LL_PWR_IsEnabledFlashPWRDownModeDuringLPRun

Function name

__STATIC_INLINE uint32_t LL_PWR_IsEnabledFlashPWRDownModeDuringLPRun (void)

Function description

Check if Flash Pwr Down Mode during LP run is enabled.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 FPD_LPRUN LL_PWR_IsEnabledFlashPWRDownModeDuringLPRun

LL_PWR_EnableFlashPWRDownModeDuringSleeep

Function name

__STATIC_INLINE void LL_PWR_EnableFlashPWRDownModeDuringSleeep (void)

Function description

Enable Flash Pwr Down Mode during LP Sleep.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 FPD_LPSLP LL_PWR_EnableFlashPWRDownModeDuringSleeep

LL_PWR_DisableFlashPWRDownModeDuringSleeep

Function name

__STATIC_INLINE void LL_PWR_DisableFlashPWRDownModeDuringSleeep (void)

Function description

Disable Flash Pwr Down Mode during LP Sleep.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 FPD_LPSLP LL_PWR_DisableFlashPWRDownModeDuringSleeep

LL_PWR_IsEnabledFlashPWRDownModeDuringSleeep

Function name

__STATIC_INLINE uint32_t LL_PWR_IsEnabledFlashPWRDownModeDuringSleeep (void)

Function description

Check if Flash Pwr Down Mode is enabled during Sleep.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 FPD_LPSLP LL_PWR_IsEnabledFlashPWRDownModeDuringSleeep

LL_PWR_EnableBkUpAccess

Function name

__STATIC_INLINE void LL_PWR_EnableBkUpAccess (void)

Function description

Enable access to the backup domain.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 DBP LL_PWR_EnableBkUpAccess

LL_PWR_DisableBkUpAccess

Function name

__STATIC_INLINE void LL_PWR_DisableBkUpAccess (void)

Function description

Disable access to the backup domain.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 DBP LL_PWR_DisableBkUpAccess

LL_PWR_IsEnabledBkUpAccess

Function name

__STATIC_INLINE uint32_t LL_PWR_IsEnabledBkUpAccess (void)

Function description

Check if the backup domain is enabled.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 DBP LL_PWR_IsEnabledBkUpAccess

LL_PWR_SetRegulVoltageScaling

Function name

__STATIC_INLINE void LL_PWR_SetRegulVoltageScaling (uint32_t VoltageScaling)

Function description

Set the main internal regulator output voltage.

Parameters

- **VoltageScaling:** This parameter can be one of the following values:
  - LL_PWR_REGU_VOLTAGE_SCALE1
  - LL_PWR_REGU_VOLTAGE_SCALE2

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 VOS LL_PWR_SetRegulVoltageScaling

LL_PWR_GetRegulVoltageScaling

Function name

__STATIC_INLINE uint32_t LL_PWR_GetRegulVoltageScaling (void)

Function description

Get the main internal regulator output voltage.

Return values

- **Returned:** value can be one of the following values:
  - LL_PWR_REGU_VOLTAGE_SCALE1
  - LL_PWR_REGU_VOLTAGE_SCALE2

Reference Manual to LL API cross reference:

- CR1 VOS LL_PWR_GetRegulVoltageScaling

LL_PWR_EnableLowPowerRunMode

Function name

__STATIC_INLINE void LL_PWR_EnableLowPowerRunMode (void)

Function description

Switch the regulator from main mode to low-power mode.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 LPR LL_PWR_EnableLowPowerRunMode

LL_PWR_DisableLowPowerRunMode

Function name

__STATIC_INLINE void LL_PWR_DisableLowPowerRunMode (void)

Function description

Switch the regulator from low-power mode to main mode.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 LPR LL_PWR_DisableLowPowerRunMode

LL_PWR_EnterLowPowerRunMode

Function name

__STATIC_INLINE void LL_PWR_EnterLowPowerRunMode (void)

Function description

*

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 LPR LL_PWR_EnterLowPowerRunMode

LL_PWR_ExitLowPowerRunMode

Function name

__STATIC_INLINE void LL_PWR_ExitLowPowerRunMode (void)

Function description

Switch from run main mode to low-power mode.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 LPR LL_PWR_ExitLowPowerRunMode

LL_PWR_IsEnabledLowPowerRunMode

Function name

__STATIC_INLINE uint32_t LL_PWR_IsEnabledLowPowerRunMode (void)

Function description

Check if the regulator is in low-power mode.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 LPR LL_PWR_IsEnabledLowPowerRunMode

LL_PWR_EnablePVD

Function name

__STATIC_INLINE void LL_PWR_EnablePVD (void)

Function description

Enable Power Voltage Detector.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR2 PVDE LL_PWR_EnablePVD

LL_PWR_DisablePVD

Function name

__STATIC_INLINE void LL_PWR_DisablePVD (void)

Function description

Disable Power Voltage Detector.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR2 PVDE LL_PWR_DisablePVD

LL_PWR_IsEnabledPVD

Function name

__STATIC_INLINE uint32_t LL_PWR_IsEnabledPVD (void)

Function description

Check if Power Voltage Detector is enabled.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR2 PVDE LL_PWR_IsEnabledPVD

LL_PWR_SetPVDLevel

Function name

__STATIC_INLINE void LL_PWR_SetPVDLevel (uint32_t PVDLevel)

Function description

Configure the voltage threshold detected by the Power Voltage Detector.

Parameters

- **PVDLevel:** This parameter can be one of the following values:
  - LL_PWR_PVDLEVEL_0
  - LL_PWR_PVDLEVEL_1
  - LL_PWR_PVDLEVEL_2
  - LL_PWR_PVDLEVEL_3
  - LL_PWR_PVDLEVEL_4
  - LL_PWR_PVDLEVEL_5
  - LL_PWR_PVDLEVEL_6
  - LL_PWR_PVDLEVEL_7

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR2 PLS LL_PWR_SetPVDLevel

LL_PWR_GetPVDLevel

Function name

__STATIC_INLINE uint32_t LL_PWR_GetPVDLevel (void)

Function description

Get the voltage threshold detection.

Return values

- **Returned:** value can be one of the following values:
  - LL_PWR_PVDLEVEL_0
  - LL_PWR_PVDLEVEL_1
  - LL_PWR_PVDLEVEL_2
  - LL_PWR_PVDLEVEL_3
  - LL_PWR_PVDLEVEL_4
  - LL_PWR_PVDLEVEL_5
  - LL_PWR_PVDLEVEL_6
  - LL_PWR_PVDLEVEL_7

Reference Manual to LL API cross reference:

- CR2 PLS LL_PWR_GetPVDLevel

LL_PWR_EnablePVM

Function name

__STATIC_INLINE void LL_PWR_EnablePVM (uint32_t PeriphVoltage)

Function description

Enable the Power Voltage Monitoring on a peripheral.

Parameters

- **PeriphVoltage:** This parameter can be one of the following values:
  - LL_PWR_PVM_VDDUSB_1_2V (*)
  - LL_PWR_PVM_VDDA_1_62V
  - LL_PWR_PVM_VDDA_2_2V

  (*) value not defined in all devices

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR2 PVME1 LL_PWR_EnablePVM
- CR2 PVME2 LL_PWR_EnablePVM
- CR2 PVME3 LL_PWR_EnablePVM
-

LL_PWR_DisablePVM

Function name

__STATIC_INLINE void LL_PWR_DisablePVM (uint32_t PeriphVoltage)

Function description

Disable the Power Voltage Monitoring on a peripheral.

Parameters

- **PeriphVoltage:** This parameter can be one of the following values:
  - LL_PWR_PVM_VDDUSB_1_2V (*)
  - LL_PWR_PVM_VDDA_1_62V
  - LL_PWR_PVM_VDDA_2_2V

  (*) value not defined in all devices

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR2 PVME1 LL_PWR_DisablePVM
- CR2 PVME2 LL_PWR_DisablePVM
- CR2 PVME3 LL_PWR_DisablePVM
-

LL_PWR_IsEnabledPVM

Function name

__STATIC_INLINE uint32_t LL_PWR_IsEnabledPVM (uint32_t PeriphVoltage)

Function description

Check if Power Voltage Monitoring is enabled on a peripheral.

Parameters

- **PeriphVoltage:** This parameter can be one of the following values:
  - LL_PWR_PVM_VDDUSB_1_2V (*)
  - LL_PWR_PVM_VDDA_1_62V
  - LL_PWR_PVM_VDDA_2_2V

  (*) value not defined in all devices

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR2 PVME1 LL_PWR_IsEnabledPVM
- CR2 PVME2 LL_PWR_IsEnabledPVM
- CR2 PVME3 LL_PWR_IsEnabledPVM
-

LL_PWR_EnableVddUSB

Function name

__STATIC_INLINE void LL_PWR_EnableVddUSB (void)

Function description

Enable VDDUSB supply.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR2 USV LL_PWR_EnableVddUSB

LL_PWR_DisableVddUSB

Function name

__STATIC_INLINE void LL_PWR_DisableVddUSB (void)

Function description

Disable VDDUSB supply.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR2 USV LL_PWR_DisableVddUSB

LL_PWR_IsEnabledVddUSB

Function name

__STATIC_INLINE uint32_t LL_PWR_IsEnabledVddUSB (void)

Function description

Check if VDDUSB supply is enabled.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR2 USV LL_PWR_IsEnabledVddUSB

LL_PWR_EnableWakeUpPin

Function name

__STATIC_INLINE void LL_PWR_EnableWakeUpPin (uint32_t WakeUpPin)

Function description

Enable the WakeUp PINx functionality.

Parameters

- **WakeUpPin:** This parameter can be one of the following values:
  - LL_PWR_WAKEUP_PIN1
  - LL_PWR_WAKEUP_PIN2
  - LL_PWR_WAKEUP_PIN3
  - LL_PWR_WAKEUP_PIN4
  - LL_PWR_WAKEUP_PIN5
  - LL_PWR_WAKEUP_PIN7

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 EWUP1 LL_PWR_EnableWakeUpPin
- CR3 EWUP2 LL_PWR_EnableWakeUpPin
- CR3 EWUP3 LL_PWR_EnableWakeUpPin
- CR3 EWUP4 LL_PWR_EnableWakeUpPin
- CR3 EWUP5 LL_PWR_EnableWakeUpPin
- CR3 EWUP7 LL_PWR_EnableWakeUpPin
-

LL_PWR_DisableWakeUpPin

Function name

__STATIC_INLINE void LL_PWR_DisableWakeUpPin (uint32_t WakeUpPin)

Function description

Disable the WakeUp PINx functionality.

Parameters

- **WakeUpPin:** This parameter can be one of the following values:
  - LL_PWR_WAKEUP_PIN1
  - LL_PWR_WAKEUP_PIN2
  - LL_PWR_WAKEUP_PIN3
  - LL_PWR_WAKEUP_PIN4
  - LL_PWR_WAKEUP_PIN5
  - LL_PWR_WAKEUP_PIN7

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 EWUP1 LL_PWR_DisableWakeUpPin
- CR3 EWUP2 LL_PWR_DisableWakeUpPin
- CR3 EWUP3 LL_PWR_DisableWakeUpPin
- CR3 EWUP4 LL_PWR_DisableWakeUpPin
- CR3 EWUP5 LL_PWR_DisableWakeUpPin
- CR3 EWUP7 LL_PWR_DisableWakeUpPin
-

LL_PWR_IsEnabledWakeUpPin

Function name

__STATIC_INLINE uint32_t LL_PWR_IsEnabledWakeUpPin (uint32_t WakeUpPin)

Function description

Check if the WakeUp PINx functionality is enabled.

Parameters

- **WakeUpPin:** This parameter can be one of the following values:
  - LL_PWR_WAKEUP_PIN1
  - LL_PWR_WAKEUP_PIN2
  - LL_PWR_WAKEUP_PIN3
  - LL_PWR_WAKEUP_PIN4
  - LL_PWR_WAKEUP_PIN5
  - LL_PWR_WAKEUP_PIN7

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR3 EWUP1 LL_PWR_IsEnabledWakeUpPin
- CR3 EWUP2 LL_PWR_IsEnabledWakeUpPin
- CR3 EWUP3 LL_PWR_IsEnabledWakeUpPin
- CR3 EWUP4 LL_PWR_IsEnabledWakeUpPin
- CR3 EWUP5 LL_PWR_IsEnabledWakeUpPin
- CR3 EWUP7 LL_PWR_IsEnabledWakeUpPin
-

LL_PWR_EnableSRAMRetention

Function name

__STATIC_INLINE void LL_PWR_EnableSRAMRetention (void)

Function description

Enable SRAM full content retention in Standby mode.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 RRS LL_PWR_EnableSRAMRetention

LL_PWR_DisableSRAMRetention

Function name

__STATIC_INLINE void LL_PWR_DisableSRAMRetention (void)

Function description

Disable SRAM content retention in Standby mode.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 RRS LL_PWR_DisableSRAMRetention

LL_PWR_IsEnabledSRAMRetention

Function name

__STATIC_INLINE uint32_t LL_PWR_IsEnabledSRAMRetention (void)

Function description

Check if SRAM full content retention in Standby mode is enabled.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR3 RRS LL_PWR_IsEnabledSRAMRetention

LL_PWR_SetSRAMContentRetention

Function name

__STATIC_INLINE void LL_PWR_SetSRAMContentRetention (uint32_t SRAMSize)

Function description

Set SRAM content retention in Standby mode.

Parameters

- **SRAMSize:** This parameter can be one of the following values:
  - LL_PWR_NO_SRAM_RETENTION
  - LL_PWR_FULL_SRAM_RETENTION

Return values

- **None:**

Notes

- Setting LL_PWR_NO_SRAM_RETENTION is same as calling LL_PWR_DisableSRAMRetention()
- Setting LL_PWR_FULL_SRAM_RETENTION is same as calling LL_PWR_EnableSRAMRetention()

Reference Manual to LL API cross reference:

- CR3 RRS LL_PWR_SetSRAMContentRetention

LL_PWR_GetSRAMContentRetention

Function name

__STATIC_INLINE uint32_t LL_PWR_GetSRAMContentRetention (void)

Function description

Get SRAM content retention in Standby mode.

Return values

- **Returned:** value can be one of the following values:
  - LL_PWR_NO_SRAM_RETENTION
  - LL_PWR_FULL_SRAM_RETENTION

Reference Manual to LL API cross reference:

- CR3 RRS LL_PWR_GetSRAMContentRetention

LL_PWR_EnableBORPVD_ULP

Function name

__STATIC_INLINE void LL_PWR_EnableBORPVD_ULP (void)

Function description

Enable Ultra Low Power BORL, BORH and PVD for STOP2 and Standby modes.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 ENULP LL_PWR_EnableBORPVD_ULP

LL_PWR_DisableBORPVD_ULP

Function name

__STATIC_INLINE void LL_PWR_DisableBORPVD_ULP (void)

Function description

Disable Ultra Low Power BORL, BORH and PVD for STOP2 and Standby modes.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 ENULP LL_PWR_DisableBORPVD_ULP

LL_PWR_IsEnabledBORPVD_ULP

Function name

__STATIC_INLINE uint32_t LL_PWR_IsEnabledBORPVD_ULP (void)

Function description

Check if Ultra Low Power BORL, BORH and PVD for STOP2 and Standby modes is enabled.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR3 ENULP LL_PWR_IsEnabledBORPVD_ULP

LL_PWR_EnablePUPDCfg

Function name

__STATIC_INLINE void LL_PWR_EnablePUPDCfg (void)

Function description

Enable pull-up and pull-down configuration.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 APC LL_PWR_EnablePUPDCfg

LL_PWR_DisablePUPDCfg

Function name

__STATIC_INLINE void LL_PWR_DisablePUPDCfg (void)

Function description

Disable pull-up and pull-down configuration.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 APC LL_PWR_DisablePUPDCfg

LL_PWR_IsEnabledPUPDCfg

Function name

__STATIC_INLINE uint32_t LL_PWR_IsEnabledPUPDCfg (void)

Function description

Check if pull-up and pull-down configuration is enabled.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR3 APC LL_PWR_IsEnabledPUPDCfg

LL_PWR_EnableInternWU

Function name

__STATIC_INLINE void LL_PWR_EnableInternWU (void)

Function description

Enable Internal Wake-up line.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 EIWUL LL_PWR_EnableInternWU

LL_PWR_DisableInternWU

Function name

__STATIC_INLINE void LL_PWR_DisableInternWU (void)

Function description

Disable Internal Wake-up line.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 EIWUL LL_PWR_DisableInternWU

LL_PWR_IsEnabledInternWU

Function name

__STATIC_INLINE uint32_t LL_PWR_IsEnabledInternWU (void)

Function description

Check if Internal Wake-up line is enabled.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR3 EIWUL LL_PWR_IsEnabledInternWU

LL_PWR_SetWakeUpPinPolarityLow

Function name

__STATIC_INLINE void LL_PWR_SetWakeUpPinPolarityLow (uint32_t WakeUpPin)

Function description

Set the Wake-Up pin polarity low for the event detection.

Parameters

- **WakeUpPin:** This parameter can be one of the following values:
  - LL_PWR_WAKEUP_PIN1
  - LL_PWR_WAKEUP_PIN2
  - LL_PWR_WAKEUP_PIN3
  - LL_PWR_WAKEUP_PIN4
  - LL_PWR_WAKEUP_PIN5
  - LL_PWR_WAKEUP_PIN7

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR4 WP1 LL_PWR_SetWakeUpPinPolarityLow
- CR4 WP2 LL_PWR_SetWakeUpPinPolarityLow
- CR4 WP3 LL_PWR_SetWakeUpPinPolarityLow
- CR4 WP4 LL_PWR_SetWakeUpPinPolarityLow
- CR4 WP5 LL_PWR_SetWakeUpPinPolarityLow
- CR4 WP7 LL_PWR_SetWakeUpPinPolarityLow

LL_PWR_SetWakeUpPinPolarityHigh

Function name

__STATIC_INLINE void LL_PWR_SetWakeUpPinPolarityHigh (uint32_t WakeUpPin)

Function description

Set the Wake-Up pin polarity high for the event detection.

Parameters

- **WakeUpPin:** This parameter can be one of the following values:
  - LL_PWR_WAKEUP_PIN1
  - LL_PWR_WAKEUP_PIN2
  - LL_PWR_WAKEUP_PIN3
  - LL_PWR_WAKEUP_PIN4
  - LL_PWR_WAKEUP_PIN5
  - LL_PWR_WAKEUP_PIN7

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR4 WP1 LL_PWR_SetWakeUpPinPolarityHigh
- CR4 WP2 LL_PWR_SetWakeUpPinPolarityHigh
- CR4 WP3 LL_PWR_SetWakeUpPinPolarityHigh
- CR4 WP4 LL_PWR_SetWakeUpPinPolarityHigh
- CR4 WP5 LL_PWR_SetWakeUpPinPolarityHigh
- CR4 WP7 LL_PWR_SetWakeUpPinPolarityHigh
-

LL_PWR_IsWakeUpPinPolarityLow

Function name

__STATIC_INLINE uint32_t LL_PWR_IsWakeUpPinPolarityLow (uint32_t WakeUpPin)

Function description

Get the Wake-Up pin polarity for the event detection.

Parameters

- **WakeUpPin:** This parameter can be one of the following values:
  - LL_PWR_WAKEUP_PIN1
  - LL_PWR_WAKEUP_PIN2
  - LL_PWR_WAKEUP_PIN3
  - LL_PWR_WAKEUP_PIN4
  - LL_PWR_WAKEUP_PIN5
  - LL_PWR_WAKEUP_PIN7

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR4 WP1 LL_PWR_IsWakeUpPinPolarityLow
- CR4 WP2 LL_PWR_IsWakeUpPinPolarityLow
- CR4 WP3 LL_PWR_IsWakeUpPinPolarityLow
- CR4 WP4 LL_PWR_IsWakeUpPinPolarityLow
- CR4 WP5 LL_PWR_IsWakeUpPinPolarityLow
- CR4 WP7 LL_PWR_IsWakeUpPinPolarityLow
-

LL_PWR_EnableBatteryCharging

Function name

__STATIC_INLINE void LL_PWR_EnableBatteryCharging (void)

Function description

Enable battery charging.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR4 VBE LL_PWR_EnableBatteryCharging

LL_PWR_DisableBatteryCharging

Function name

__STATIC_INLINE void LL_PWR_DisableBatteryCharging (void)

Function description

Disable battery charging.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR4 VBE LL_PWR_DisableBatteryCharging

LL_PWR_IsEnabledBatteryCharging

Function name

__STATIC_INLINE uint32_t LL_PWR_IsEnabledBatteryCharging (void)

Function description

Check if battery charging is enabled.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR4 VBE LL_PWR_IsEnabledBatteryCharging

LL_PWR_SetBattChargResistor

Function name

__STATIC_INLINE void LL_PWR_SetBattChargResistor (uint32_t Resistor)

Function description

Set the resistor impedance.

Parameters

- **Resistor:** This parameter can be one of the following values:
  - LL_PWR_BATT_CHARG_RESISTOR_5K
  - LL_PWR_BATT_CHARGRESISTOR_1_5K

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR4 VBRS LL_PWR_SetBattChargResistor

LL_PWR_GetBattChargResistor

Function name

__STATIC_INLINE uint32_t LL_PWR_GetBattChargResistor (void)

Function description

Get the resistor impedance.

Return values

- **Returned:** value can be one of the following values:
  - LL_PWR_BATT_CHARG_RESISTOR_5K
  - LL_PWR_BATT_CHARGRESISTOR_1_5K

Reference Manual to LL API cross reference:

- CR4 VBRS LL_PWR_GetBattChargResistor

LL_PWR_EnableGPIOPullUp

Function name

__STATIC_INLINE void LL_PWR_EnableGPIOPullUp (uint32_t GPIO, uint32_t GPIONumber)

Function description

Enable GPIO pull-up state in Standby and Shutdown modes.

Parameters

- **GPIO:** This parameter can be one of the following values:
  - LL_PWR_GPIO_A
  - LL_PWR_GPIO_B
  - LL_PWR_GPIO_C
  - LL_PWR_GPIO_D
  - LL_PWR_GPIO_E
  - LL_PWR_GPIO_F
- **GPIONumber:** This parameter can be one of the following values:
  - LL_PWR_GPIO_BIT_0
  - LL_PWR_GPIO_BIT_1
  - LL_PWR_GPIO_BIT_2
  - LL_PWR_GPIO_BIT_3
  - LL_PWR_GPIO_BIT_4
  - LL_PWR_GPIO_BIT_5
  - LL_PWR_GPIO_BIT_6
  - LL_PWR_GPIO_BIT_7
  - LL_PWR_GPIO_BIT_8
  - LL_PWR_GPIO_BIT_9
  - LL_PWR_GPIO_BIT_10
  - LL_PWR_GPIO_BIT_11
  - LL_PWR_GPIO_BIT_12
  - LL_PWR_GPIO_BIT_13
  - LL_PWR_GPIO_BIT_14
  - LL_PWR_GPIO_BIT_15

Return values

- **None:**

Reference Manual to LL API cross reference:

- PUCRA PU0-15 LL_PWR_EnableGPIOPullUp
- PUCRB PU0-15 LL_PWR_EnableGPIOPullUp
- PUCRC PU0-15 LL_PWR_EnableGPIOPullUp
- PUCRD PU0-13 LL_PWR_EnableGPIOPullUp
- PUCRE PU3,PU7-9 LL_PWR_EnableGPIOPullUp
- PUCRF PU0-3 LL_PWR_EnableGPIOPullUp
-

LL_PWR_DisableGPIOPullUp

Function name

__STATIC_INLINE void LL_PWR_DisableGPIOPullUp (uint32_t GPIO, uint32_t GPIONumber)

Function description

Disable GPIO pull-up state in Standby and Shutdown modes.

Parameters

- **GPIO:** This parameter can be one of the following values:
  - LL_PWR_GPIO_A
  - LL_PWR_GPIO_B
  - LL_PWR_GPIO_C
  - LL_PWR_GPIO_D
  - LL_PWR_GPIO_E
  - LL_PWR_GPIO_F
- **GPIONumber:** This parameter can be one of the following values:
  - LL_PWR_GPIO_BIT_0
  - LL_PWR_GPIO_BIT_1
  - LL_PWR_GPIO_BIT_2
  - LL_PWR_GPIO_BIT_3
  - LL_PWR_GPIO_BIT_4
  - LL_PWR_GPIO_BIT_5
  - LL_PWR_GPIO_BIT_6
  - LL_PWR_GPIO_BIT_7
  - LL_PWR_GPIO_BIT_8
  - LL_PWR_GPIO_BIT_9
  - LL_PWR_GPIO_BIT_10
  - LL_PWR_GPIO_BIT_11
  - LL_PWR_GPIO_BIT_12
  - LL_PWR_GPIO_BIT_13
  - LL_PWR_GPIO_BIT_14
  - LL_PWR_GPIO_BIT_15

Return values

- **None:**

Reference Manual to LL API cross reference:

- PUCRA PU0-15 LL_PWR_DisableGPIOPullUp
- PUCRB PU0-15 LL_PWR_EnableGPIOPullUp
- PUCRC PU0-15 LL_PWR_EnableGPIOPullUp
- PUCRD PU0-13 LL_PWR_EnableGPIOPullUp
- PUCRE PU3,PU7-9 LL_PWR_EnableGPIOPullUp
- PUCRF PU0-3 LL_PWR_EnableGPIOPullUp
-

LL_PWR_IsEnabledGPIOPullUp

Function name

__STATIC_INLINE uint32_t LL_PWR_IsEnabledGPIOPullUp (uint32_t GPIO, uint32_t GPIONumber)

Function description

Check if GPIO pull-up state is enabled.

Parameters

- **GPIO:** This parameter can be one of the following values:
  - LL_PWR_GPIO_A
  - LL_PWR_GPIO_B
  - LL_PWR_GPIO_C
  - LL_PWR_GPIO_D
  - LL_PWR_GPIO_E
  - LL_PWR_GPIO_F
- **GPIONumber:** This parameter can be one of the following values:
  - LL_PWR_GPIO_BIT_0
  - LL_PWR_GPIO_BIT_1
  - LL_PWR_GPIO_BIT_2
  - LL_PWR_GPIO_BIT_3
  - LL_PWR_GPIO_BIT_4
  - LL_PWR_GPIO_BIT_5
  - LL_PWR_GPIO_BIT_6
  - LL_PWR_GPIO_BIT_7
  - LL_PWR_GPIO_BIT_8
  - LL_PWR_GPIO_BIT_9
  - LL_PWR_GPIO_BIT_10
  - LL_PWR_GPIO_BIT_11
  - LL_PWR_GPIO_BIT_12
  - LL_PWR_GPIO_BIT_13
  - LL_PWR_GPIO_BIT_14
  - LL_PWR_GPIO_BIT_15

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- PUCRA PU0-15 LL_PWR_IsEnabledGPIOPullUp
- PUCRB PU0-15 LL_PWR_EnableGPIOPullUp
- PUCRC PU0-15 LL_PWR_EnableGPIOPullUp
- PUCRD PU0-13 LL_PWR_EnableGPIOPullUp
- PUCRE PU3,PU7-9 LL_PWR_EnableGPIOPullUp
- PUCRF PU0-3 LL_PWR_EnableGPIOPullUp
-

LL_PWR_EnableGPIOPullDown

Function name

__STATIC_INLINE void LL_PWR_EnableGPIOPullDown (uint32_t GPIO, uint32_t GPIONumber)

Function description

Enable GPIO pull-down state in Standby and Shutdown modes.

Parameters

- **GPIO:** This parameter can be one of the following values:
  - LL_PWR_GPIO_A
  - LL_PWR_GPIO_B
  - LL_PWR_GPIO_C
  - LL_PWR_GPIO_D
  - LL_PWR_GPIO_E
  - LL_PWR_GPIO_F
- **GPIONumber:** This parameter can be one of the following values:
  - LL_PWR_GPIO_BIT_0
  - LL_PWR_GPIO_BIT_1
  - LL_PWR_GPIO_BIT_2
  - LL_PWR_GPIO_BIT_3
  - LL_PWR_GPIO_BIT_4
  - LL_PWR_GPIO_BIT_5
  - LL_PWR_GPIO_BIT_6
  - LL_PWR_GPIO_BIT_7
  - LL_PWR_GPIO_BIT_8
  - LL_PWR_GPIO_BIT_9
  - LL_PWR_GPIO_BIT_10
  - LL_PWR_GPIO_BIT_11
  - LL_PWR_GPIO_BIT_12
  - LL_PWR_GPIO_BIT_13
  - LL_PWR_GPIO_BIT_14
  - LL_PWR_GPIO_BIT_15

Return values

- **None:**

Reference Manual to LL API cross reference:

- PDCRA PD0-15 LL_PWR_EnableGPIOPullDown
- PUCRB PU0-15 LL_PWR_EnableGPIOPullUp
- PUCRC PU0-15 LL_PWR_EnableGPIOPullUp
- PUCRD PU0-13 LL_PWR_EnableGPIOPullUp
- PUCRE PU3,PU7-9 LL_PWR_EnableGPIOPullUp
- PUCRF PU0-3 LL_PWR_EnableGPIOPullUp
-

LL_PWR_DisableGPIOPullDown

Function name

__STATIC_INLINE void LL_PWR_DisableGPIOPullDown (uint32_t GPIO, uint32_t GPIONumber)

Function description

Disable GPIO pull-down state in Standby and Shutdown modes.

Parameters

- **GPIO:** This parameter can be one of the following values:
  - LL_PWR_GPIO_A
  - LL_PWR_GPIO_B
  - LL_PWR_GPIO_C
  - LL_PWR_GPIO_D
  - LL_PWR_GPIO_E
  - LL_PWR_GPIO_F
- **GPIONumber:** This parameter can be one of the following values:
  - LL_PWR_GPIO_BIT_0
  - LL_PWR_GPIO_BIT_1
  - LL_PWR_GPIO_BIT_2
  - LL_PWR_GPIO_BIT_3
  - LL_PWR_GPIO_BIT_4
  - LL_PWR_GPIO_BIT_5
  - LL_PWR_GPIO_BIT_6
  - LL_PWR_GPIO_BIT_7
  - LL_PWR_GPIO_BIT_8
  - LL_PWR_GPIO_BIT_9
  - LL_PWR_GPIO_BIT_10
  - LL_PWR_GPIO_BIT_11
  - LL_PWR_GPIO_BIT_12
  - LL_PWR_GPIO_BIT_13
  - LL_PWR_GPIO_BIT_14
  - LL_PWR_GPIO_BIT_15

Return values

- **None:**

Reference Manual to LL API cross reference:

- PDCRA PD0-15 LL_PWR_DisableGPIOPullDown
- PUCRB PU0-15 LL_PWR_EnableGPIOPullUp
- PUCRC PU0-15 LL_PWR_EnableGPIOPullUp
- PUCRD PU0-13 LL_PWR_EnableGPIOPullUp
- PUCRE PU3,PU7-9 LL_PWR_EnableGPIOPullUp
- PUCRF PU0-3 LL_PWR_EnableGPIOPullUp
-

LL_PWR_IsEnabledGPIOPullDown

Function name

__STATIC_INLINE uint32_t LL_PWR_IsEnabledGPIOPullDown (uint32_t GPIO, uint32_t GPIONumber)

Function description

Check if GPIO pull-down state is enabled.

Parameters

- **GPIO:** This parameter can be one of the following values:
  - LL_PWR_GPIO_A
  - LL_PWR_GPIO_B
  - LL_PWR_GPIO_C
  - LL_PWR_GPIO_D
  - LL_PWR_GPIO_E
  - LL_PWR_GPIO_F
- **GPIONumber:** This parameter can be one of the following values:
  - LL_PWR_GPIO_BIT_0
  - LL_PWR_GPIO_BIT_1
  - LL_PWR_GPIO_BIT_2
  - LL_PWR_GPIO_BIT_3
  - LL_PWR_GPIO_BIT_4
  - LL_PWR_GPIO_BIT_5
  - LL_PWR_GPIO_BIT_6
  - LL_PWR_GPIO_BIT_7
  - LL_PWR_GPIO_BIT_8
  - LL_PWR_GPIO_BIT_9
  - LL_PWR_GPIO_BIT_10
  - LL_PWR_GPIO_BIT_11
  - LL_PWR_GPIO_BIT_12
  - LL_PWR_GPIO_BIT_13
  - LL_PWR_GPIO_BIT_14
  - LL_PWR_GPIO_BIT_15

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- PDCRA PD0-15 LL_PWR_IsEnabledGPIOPullDown
- PUCRB PU0-15 LL_PWR_EnableGPIOPullUp
- PUCRC PU0-15 LL_PWR_EnableGPIOPullUp
- PUCRD PU0-13 LL_PWR_EnableGPIOPullUp
- PUCRE PU3,PU7-9 LL_PWR_EnableGPIOPullUp
- PUCRF PU0-3 LL_PWR_EnableGPIOPullUp
-

LL_PWR_IsActiveFlag_WU1

Function name

__STATIC_INLINE uint32_t LL_PWR_IsActiveFlag_WU1 (void)

Function description

Get Wake-up Flag 1.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR1 WUF1 LL_PWR_IsActiveFlag_WU1

LL_PWR_IsActiveFlag_WU2

Function name

__STATIC_INLINE uint32_t LL_PWR_IsActiveFlag_WU2 (void)

Function description

Get Wake-up Flag 2.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR1 WUF2 LL_PWR_IsActiveFlag_WU2

LL_PWR_IsActiveFlag_WU3

Function name

__STATIC_INLINE uint32_t LL_PWR_IsActiveFlag_WU3 (void)

Function description

Get Wake-up Flag 3.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR1 WUF3 LL_PWR_IsActiveFlag_WU3

LL_PWR_IsActiveFlag_WU4

Function name

__STATIC_INLINE uint32_t LL_PWR_IsActiveFlag_WU4 (void)

Function description

Get Wake-up Flag 4.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR1 WUF4 LL_PWR_IsActiveFlag_WU4

LL_PWR_IsActiveFlag_WU5

Function name

__STATIC_INLINE uint32_t LL_PWR_IsActiveFlag_WU5 (void)

Function description

Get Wake-up Flag 5.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR1 WUF5 LL_PWR_IsActiveFlag_WU5

LL_PWR_IsActiveFlag_WU7

Function name

__STATIC_INLINE uint32_t LL_PWR_IsActiveFlag_WU7 (void)

Function description

Get Wake-up Flag 7.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR1 WUF7 LL_PWR_IsActiveFlag_WU7

LL_PWR_IsActiveFlag_SB

Function name

__STATIC_INLINE uint32_t LL_PWR_IsActiveFlag_SB (void)

Function description

Get Stand-By Flag.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR1 SBF LL_PWR_IsActiveFlag_SB

LL_PWR_IsActiveFlag_Stop0

Function name

__STATIC_INLINE uint32_t LL_PWR_IsActiveFlag_Stop0 (void)

Function description

Get Stop Flag.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR1 STOPF 0 LL_PWR_IsActiveFlag_Stop

LL_PWR_IsActiveFlag_Stop1

Function name

__STATIC_INLINE uint32_t LL_PWR_IsActiveFlag_Stop1 (void)

Function description

Get Stop Flag.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR1 STOPF 1 LL_PWR_IsActiveFlag_Stop

LL_PWR_IsActiveFlag_Stop2

Function name

__STATIC_INLINE uint32_t LL_PWR_IsActiveFlag_Stop2 (void)

Function description

Get Stop Flag.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR1 STOPF 2 LL_PWR_IsActiveFlag_Stop

LL_PWR_IsActiveFlag_InternWU

Function name

__STATIC_INLINE uint32_t LL_PWR_IsActiveFlag_InternWU (void)

Function description

Get Internal Wake-up line Flag.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR1 WUFI LL_PWR_IsActiveFlag_InternWU

LL_PWR_IsActiveFlag_FLASH_RDY

Function name

__STATIC_INLINE uint32_t LL_PWR_IsActiveFlag_FLASH_RDY (void)

Function description

Indicate whether or not the flash is ready.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR2 FLASH_RDY LL_PWR_IsActiveFlag_FLASH_RDY

LL_PWR_IsActiveFlag_REGLPS

Function name

__STATIC_INLINE uint32_t LL_PWR_IsActiveFlag_REGLPS (void)

Function description

Indicate whether or not the low-power regulator is ready.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR2 REGLPS LL_PWR_IsActiveFlag_REGLPS

LL_PWR_IsActiveFlag_REGLPF

Function name

__STATIC_INLINE uint32_t LL_PWR_IsActiveFlag_REGLPF (void)

Function description

Indicate whether the regulator is ready in main mode or is in low-power mode.

Return values

- **State:** of bit (1 or 0).

Notes

- Take care, return value "0" means the regulator is ready. Return value "1" means the output voltage range is still changing.

Reference Manual to LL API cross reference:

- SR2 REGLPF LL_PWR_IsActiveFlag_REGLPF

LL_PWR_IsActiveFlag_VOS

Function name

__STATIC_INLINE uint32_t LL_PWR_IsActiveFlag_VOS (void)

Function description

Indicate whether the regulator is ready in the selected voltage range or if its output voltage is still changing to the required voltage level.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR2 VOSF LL_PWR_IsActiveFlag_VOS

LL_PWR_IsActiveFlag_PVDO

Function name

__STATIC_INLINE uint32_t LL_PWR_IsActiveFlag_PVDO (void)

Function description

Indicate whether VDD voltage is below or above the selected PVD threshold.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR2 PVDO LL_PWR_IsActiveFlag_PVDO

LL_PWR_IsActiveFlag_PVMO_1

Function name

__STATIC_INLINE uint32_t LL_PWR_IsActiveFlag_PVMO_1 (void)

Function description

Indicate whether VDDUSB voltage is below or above PVMO1 threshold.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR2 PVMO1 LL_PWR_IsActiveFlag_PVMO_1

LL_PWR_IsActiveFlag_PVMO_3

Function name

__STATIC_INLINE uint32_t LL_PWR_IsActiveFlag_PVMO_3 (void)

Function description

Indicate whether VDDA ADC voltage is below or above PVMO3 threshold.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR2 PVMO3 LL_PWR_IsActiveFlag_PVMO_3

LL_PWR_IsActiveFlag_PVMO_4

Function name

__STATIC_INLINE uint32_t LL_PWR_IsActiveFlag_PVMO_4 (void)

Function description

Indicate whether VDDA voltage is below or above PVMO4 threshold.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR2 PVMO4 LL_PWR_IsActiveFlag_PVMO_4

LL_PWR_ClearFlag_WU1

Function name

__STATIC_INLINE void LL_PWR_ClearFlag_WU1 (void)

Function description

Clear Wake-up Flag 1.

Return values

- **None:**

Reference Manual to LL API cross reference:

- SCR CWUF1 LL_PWR_ClearFlag_WU1

LL_PWR_ClearFlag_WU2

Function name

__STATIC_INLINE void LL_PWR_ClearFlag_WU2 (void)

Function description

Clear Wake-up Flag 2.

Return values

- **None:**

Reference Manual to LL API cross reference:

- SCR CWUF2 LL_PWR_ClearFlag_WU2

LL_PWR_ClearFlag_WU3

Function name

__STATIC_INLINE void LL_PWR_ClearFlag_WU3 (void)

Function description

Clear Wake-up Flag 3.

Return values

- **None:**

Reference Manual to LL API cross reference:

- SCR CWUF3 LL_PWR_ClearFlag_WU3

LL_PWR_ClearFlag_WU4

Function name

__STATIC_INLINE void LL_PWR_ClearFlag_WU4 (void)

Function description

Clear Wake-up Flag 4.

Return values

- **None:**

Reference Manual to LL API cross reference:

- SCR CWUF4 LL_PWR_ClearFlag_WU4

LL_PWR_ClearFlag_WU5

Function name

__STATIC_INLINE void LL_PWR_ClearFlag_WU5 (void)

Function description

Clear Wake-up Flag 5.

Return values

- **None:**

Reference Manual to LL API cross reference:

- SCR CWUF5 LL_PWR_ClearFlag_WU5

LL_PWR_ClearFlag_WU7

Function name

__STATIC_INLINE void LL_PWR_ClearFlag_WU7 (void)

Function description

Clear Wake-up Flag 7.

Return values

- **None:**

Reference Manual to LL API cross reference:

- SCR CWUF7 LL_PWR_ClearFlag_WU7

LL_PWR_ClearFlag_CSB

Function name

__STATIC_INLINE void LL_PWR_ClearFlag_CSB (void)

Function description

Clear standby and stop Flags.

Return values

- **None:**

Reference Manual to LL API cross reference:

- SCR CSBF LL_PWR_ClearFlag_CSB

LL_PWR_DeInit

Function name

ErrorStatus LL_PWR_DeInit (void)

Function description

De-initialize the PWR registers to their default reset values.

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: PWR registers are de-initialized
  - ERROR: not applicable

71.2 PWR Firmware driver defines

The following section lists the various define and macros of the module.

71.2.1 PWR

PWR

BATT CHARG RESISTOR

LL_PWR_BATT_CHARG_RESISTOR_5K

LL_PWR_BATT_CHARGRESISTOR_1_5K

Clear Flags Defines

LL_PWR_SCR_CSBF

LL_PWR_SCR_CWUF7

LL_PWR_SCR_CWUF5

LL_PWR_SCR_CWUF4

LL_PWR_SCR_CWUF3

LL_PWR_SCR_CWUF2

LL_PWR_SCR_CWUF1

Get Flags Defines

LL_PWR_SR1_WUFI

LL_PWR_SR1_STOP2

LL_PWR_SR1_STOP1

LL_PWR_SR1_STOP0

LL_PWR_SR1_SBF

LL_PWR_SR1_WUF7

LL_PWR_SR1_WUF5

LL_PWR_SR1_WUF4

LL_PWR_SR1_WUF3

LL_PWR_SR1_WUF2

LL_PWR_SR1_WUF1

LL_PWR_SR2_PVMO4

LL_PWR_SR2_PVMO3

LL_PWR_SR2_PVMO1

LL_PWR_SR2_PVDO

LL_PWR_SR2_VOSF

LL_PWR_SR2_REGLPF

LL_PWR_SR2_REGLPS

LL_PWR_SR2_FLASHRDY

GPIO

LL_PWR_GPIO_A

LL_PWR_GPIO_B

LL_PWR_GPIO_C

LL_PWR_GPIO_D

LL_PWR_GPIO_E

LL_PWR_GPIO_F

GPIO BIT

LL_PWR_GPIO_BIT_0

LL_PWR_GPIO_BIT_1

LL_PWR_GPIO_BIT_2

LL_PWR_GPIO_BIT_3

LL_PWR_GPIO_BIT_4

LL_PWR_GPIO_BIT_5

LL_PWR_GPIO_BIT_6

LL_PWR_GPIO_BIT_7

LL_PWR_GPIO_BIT_8

LL_PWR_GPIO_BIT_9

LL_PWR_GPIO_BIT_10

LL_PWR_GPIO_BIT_11

LL_PWR_GPIO_BIT_12

LL_PWR_GPIO_BIT_13

LL_PWR_GPIO_BIT_14

LL_PWR_GPIO_BIT_15

MODE PWR

LL_PWR_MODE_STOP0

LL_PWR_MODE_STOP1

LL_PWR_MODE_STOP2

LL_PWR_MODE_STANDBY

LL_PWR_MODE_SHUTDOWN

PVDLEVEL

LL_PWR_PVDLEVEL_0

LL_PWR_PVDLEVEL_1

LL_PWR_PVDLEVEL_2

LL_PWR_PVDLEVEL_3

LL_PWR_PVDLEVEL_4

LL_PWR_PVDLEVEL_5

LL_PWR_PVDLEVEL_6

LL_PWR_PVDLEVEL_7

Peripheral voltage monitoring

LL_PWR_PVM_VDDUSB_1_2V

LL_PWR_PVM_VDDA_1_62V

LL_PWR_PVM_VDDA_2_2V

REGU VOLTAGE

LL_PWR_CR1_LPR

LL_PWR_REGU_VOLTAGE_SCALE1

LL_PWR_REGU_VOLTAGE_SCALE2

SRAM CONTENT RETENTION

LL_PWR_NO_SRAM_RETENTION

LL_PWR_FULL_SRAM_RETENTION

WAKEUP

LL_PWR_WAKEUP_PIN1

LL_PWR_WAKEUP_PIN2

LL_PWR_WAKEUP_PIN3

LL_PWR_WAKEUP_PIN4

LL_PWR_WAKEUP_PIN5

LL_PWR_WAKEUP_PIN7

Common Write and read registers Macros

LL_PWR_WriteReg

Description:

- Write a value in PWR register.

Parameters:

- __REG__: Register to be written
- __VALUE__: Value to be written in the register

Return value:

- None

LL_PWR_ReadReg

Description:

- Read a value in PWR register.

Parameters:

- __REG__: Register to be read

Return value:

- Register: value

PWR Exported Constants

LL_PWR_CR1_DBP

LL_PWR_CR1_FPD_LPSLP

LL_PWR_CR1_FPD_LPRUN

LL_PWR_CR1_FPD_STOP

72 LL RCC Generic Driver

72.1 RCC Firmware driver registers structures

72.1.1 LL_RCC_ClocksTypeDef

LL_RCC_ClocksTypeDef is defined in the stm32u0xx_ll_rcc.h

Data Fields

- ***uint32_t SYSCLK_Frequency***
- ***uint32_t HCLK_Frequency***
- ***uint32_t PCLK1_Frequency***

Field Documentation

- ***uint32_t LL_RCC_ClocksTypeDef::SYSCLK_Frequency***
  SYSCLK clock frequency
- ***uint32_t LL_RCC_ClocksTypeDef::HCLK_Frequency***
  HCLK clock frequency
- ***uint32_t LL_RCC_ClocksTypeDef::PCLK1_Frequency***
  PCLK1 clock frequency

72.2 RCC Firmware driver API description

The following section lists the various functions of the RCC library.

72.2.1 Detailed description of functions

LL_RCC_EnableCSS

Function name

__STATIC_INLINE void LL_RCC_EnableCSS (void)

Function description

Enable the Clock Security System.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR CSSON LL_RCC_EnableCSS

LL_RCC_DisableCSS

Function name

__STATIC_INLINE void LL_RCC_DisableCSS (void)

Function description

Disable the Clock Security System.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR CSSON LL_RCC_DisableCSS

LL_RCC_HSE_EnableBypass

Function name

__STATIC_INLINE void LL_RCC_HSE_EnableBypass (void)

Function description

Enable HSE external oscillator (HSE Bypass)

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR HSEBYP LL_RCC_HSE_EnableBypass

LL_RCC_HSE_DisableBypass

Function name

__STATIC_INLINE void LL_RCC_HSE_DisableBypass (void)

Function description

Disable HSE external oscillator (HSE Bypass)

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR HSEBYP LL_RCC_HSE_DisableBypass

LL_RCC_HSE_Enable

Function name

__STATIC_INLINE void LL_RCC_HSE_Enable (void)

Function description

Enable HSE crystal oscillator (HSE ON)

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR HSEON LL_RCC_HSE_Enable

LL_RCC_HSE_Disable

Function name

__STATIC_INLINE void LL_RCC_HSE_Disable (void)

Function description

Disable HSE crystal oscillator (HSE ON)

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR HSEON LL_RCC_HSE_Disable

LL_RCC_HSE_IsReady

Function name

__STATIC_INLINE uint32_t LL_RCC_HSE_IsReady (void)

Function description

Check if HSE oscillator Ready.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR HSERDY LL_RCC_HSE_IsReady

LL_RCC_HSI_EnableInStopMode

Function name

__STATIC_INLINE void LL_RCC_HSI_EnableInStopMode (void)

Function description

Enable HSI even in stop mode.

Return values

- **None:**

Notes

- HSI oscillator is forced ON even in Stop mode

Reference Manual to LL API cross reference:

- CR HSIKERON LL_RCC_HSI_EnableInStopMode

LL_RCC_HSI_DisableInStopMode

Function name

__STATIC_INLINE void LL_RCC_HSI_DisableInStopMode (void)

Function description

Disable HSI in stop mode.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR HSIKERON LL_RCC_HSI_DisableInStopMode

LL_RCC_HSI_IsEnabledInStopMode

Function name

__STATIC_INLINE uint32_t LL_RCC_HSI_IsEnabledInStopMode (void)

Function description

IsEnabled HSI in stop mode.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR HSIKERON LL_RCC_HSI_IsEnabledInStopMode

LL_RCC_HSI_Enable

Function name

__STATIC_INLINE void LL_RCC_HSI_Enable (void)

Function description

Enable HSI oscillator.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR HSION LL_RCC_HSI_Enable

LL_RCC_HSI_Disable

Function name

__STATIC_INLINE void LL_RCC_HSI_Disable (void)

Function description

Disable HSI oscillator.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR HSION LL_RCC_HSI_Disable

LL_RCC_HSI_IsReady

Function name

__STATIC_INLINE uint32_t LL_RCC_HSI_IsReady (void)

Function description

Check if HSI clock is ready.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR HSIRDY LL_RCC_HSI_IsReady

LL_RCC_HSI_EnableAutoFromStop

Function name

__STATIC_INLINE void LL_RCC_HSI_EnableAutoFromStop (void)

Function description

Enable HSI oscillator in auto start from stop mode.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR HSIASFS LL_RCC_HSI_EnableAutoFromStop

LL_RCC_HSI_DisableAutoFromStop

Function name

__STATIC_INLINE void LL_RCC_HSI_DisableAutoFromStop (void)

Function description

Disable HSI oscillator in auto start from stop mode.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR HSIASFS LL_RCC_HSI_DisableAutoFromStop

LL_RCC_HSI_IsEnabledInAutoFromStop

Function name

__STATIC_INLINE uint32_t LL_RCC_HSI_IsEnabledInAutoFromStop (void)

Function description

Check if HSI is enabled in auto start from stop mode.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR HSIASFS LL_RCC_HSI_IsEnabledInAutoFromStop

LL_RCC_HSI_GetCalibration

Function name

__STATIC_INLINE uint32_t LL_RCC_HSI_GetCalibration (void)

Function description

Get HSI Calibration value.

Return values

- **Between:** Min_Data = 0x00 and Max_Data = 0xFF

Notes

- When HSITRIM is written, HSICAL is updated with the sum of HSITRIM and the factory trim value

Reference Manual to LL API cross reference:

- ICSCR HSICAL LL_RCC_HSI_GetCalibration

LL_RCC_HSI_SetCalibTrimming

Function name

__STATIC_INLINE void LL_RCC_HSI_SetCalibTrimming (uint32_t Value)

Function description

Set HSI Calibration trimming.

Parameters

- **Value:** Between Min_Data = 0 and Max_Data = 31

Return values

- **None:**

Notes

- user-programmable trimming value that is added to the HSICAL
- Default value is 16, which, when added to the HSICAL value, should trim the HSI to 16 MHz +/- 1 %

Reference Manual to LL API cross reference:

- ICSCR HSITRIM LL_RCC_HSI_SetCalibTrimming

LL_RCC_HSI_GetCalibTrimming

Function name

__STATIC_INLINE uint32_t LL_RCC_HSI_GetCalibTrimming (void)

Function description

Get HSI Calibration trimming.

Return values

- **Between:** Min_Data = 0 and Max_Data = 31

Reference Manual to LL API cross reference:

- ICSCR HSITRIM LL_RCC_HSI_GetCalibTrimming

LL_RCC_LSE_Enable

Function name

__STATIC_INLINE void LL_RCC_LSE_Enable (void)

Function description

Enable Low Speed External (LSE) crystal.

Return values

- **None:**

Reference Manual to LL API cross reference:

- BDCR LSEON LL_RCC_LSE_Enable

LL_RCC_LSE_Disable

Function name

__STATIC_INLINE void LL_RCC_LSE_Disable (void)

Function description

Disable Low Speed External (LSE) crystal.

Return values

- **None:**

Reference Manual to LL API cross reference:

- BDCR LSEON LL_RCC_LSE_Disable

LL_RCC_LSE_EnablePropagation

Function name

__STATIC_INLINE void LL_RCC_LSE_EnablePropagation (void)

Function description

Enable LSE oscillator propagation for system clock.

Return values

- **None:**

Reference Manual to LL API cross reference:

- BDCR LSESYSEN LL_RCC_LSE_EnablePropagation

LL_RCC_LSE_DisablePropagation

Function name

__STATIC_INLINE void LL_RCC_LSE_DisablePropagation (void)

Function description

Disable LSE oscillator propagation for system clock.

Return values

- **None:**

Reference Manual to LL API cross reference:

- BDCR LSESYSEN LL_RCC_LSE_DisablePropagation

LL_RCC_LSE_EnableBypass

Function name

__STATIC_INLINE void LL_RCC_LSE_EnableBypass (void)

Function description

Enable external clock source (LSE bypass).

Return values

- **None:**

Reference Manual to LL API cross reference:

- BDCR LSEBYP LL_RCC_LSE_EnableBypass

LL_RCC_LSE_DisableBypass

Function name

__STATIC_INLINE void LL_RCC_LSE_DisableBypass (void)

Function description

Disable external clock source (LSE bypass).

Return values

- **None:**

Reference Manual to LL API cross reference:

- BDCR LSEBYP LL_RCC_LSE_DisableBypass

LL_RCC_LSE_SetDriveCapability

Function name

__STATIC_INLINE void LL_RCC_LSE_SetDriveCapability (uint32_t LSEDrive)

Function description

Set LSE oscillator drive capability.

Parameters

- **LSEDrive:** This parameter can be one of the following values:
  - LL_RCC_LSEDRIVE_LOW
  - LL_RCC_LSEDRIVE_MEDIUMLOW
  - LL_RCC_LSEDRIVE_MEDIUMHIGH
  - LL_RCC_LSEDRIVE_HIGH

Return values

- **None:**

Notes

- The oscillator is in Xtal mode when it is not in bypass mode.

Reference Manual to LL API cross reference:

- BDCR LSEDRV LL_RCC_LSE_SetDriveCapability

LL_RCC_LSE_GetDriveCapability

Function name

__STATIC_INLINE uint32_t LL_RCC_LSE_GetDriveCapability (void)

Function description

Get LSE oscillator drive capability.

Return values

- **Returned:** value can be one of the following values:
  - LL_RCC_LSEDRIVE_LOW
  - LL_RCC_LSEDRIVE_MEDIUMLOW
  - LL_RCC_LSEDRIVE_MEDIUMHIGH
  - LL_RCC_LSEDRIVE_HIGH

Reference Manual to LL API cross reference:

- BDCR LSEDRV LL_RCC_LSE_GetDriveCapability

LL_RCC_LSE_EnableCSS

Function name

__STATIC_INLINE void LL_RCC_LSE_EnableCSS (void)

Function description

Enable Clock security system on LSE.

Return values

- **None:**

Reference Manual to LL API cross reference:

- BDCR LSECSSON LL_RCC_LSE_EnableCSS

LL_RCC_LSE_DisableCSS

Function name

__STATIC_INLINE void LL_RCC_LSE_DisableCSS (void)

Function description

Disable Clock security system on LSE.

Return values

- **None:**

Notes

- Clock security system can be disabled only after a LSE failure detection. In that case it MUST be disabled by software.

Reference Manual to LL API cross reference:

- BDCR LSECSSON LL_RCC_LSE_DisableCSS

LL_RCC_LSE_IsReady

Function name

__STATIC_INLINE uint32_t LL_RCC_LSE_IsReady (void)

Function description

Check if LSE oscillator Ready.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- BDCR LSERDY LL_RCC_LSE_IsReady

LL_RCC_LSE_IsPropagationReady

Function name

__STATIC_INLINE uint32_t LL_RCC_LSE_IsPropagationReady (void)

Function description

Check if LSE oscillator propagation for system clock Ready.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- BDCR LSESYSRDY LL_RCC_LSE_IsPropagationReady

LL_RCC_LSE_IsCSSDetected

Function name

__STATIC_INLINE uint32_t LL_RCC_LSE_IsCSSDetected (void)

Function description

Check if CSS on LSE failure Detection.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- BDCR LSECSSD LL_RCC_LSE_IsCSSDetected

LL_RCC_LSI_Enable

Function name

__STATIC_INLINE void LL_RCC_LSI_Enable (void)

Function description

Enable LSI Oscillator.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CSR LSION LL_RCC_LSI_Enable

LL_RCC_LSI_Disable

Function name

__STATIC_INLINE void LL_RCC_LSI_Disable (void)

Function description

Disable LSI Oscillator.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CSR LSION LL_RCC_LSI_Disable

LL_RCC_LSI_IsReady

Function name

__STATIC_INLINE uint32_t LL_RCC_LSI_IsReady (void)

Function description

Check if LSI is Ready.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CSR LSIRDY LL_RCC_LSI_IsReady

LL_RCC_LSI_SetPrescaler

Function name

__STATIC_INLINE void LL_RCC_LSI_SetPrescaler (uint32_t LSIPrescaler)

Function description

Set LSI prescaler.

Parameters

- **LSIPrescaler:** This parameter can be one of the following values:
  - LL_RCC_LSI_DIV_1
  - LL_RCC_LSI_DIV_128

Return values

- **None:**

Reference Manual to LL API cross reference:

- CSR LSIPRE LL_RCC_LSI_SetPrescaler

LL_RCC_LSI_GetPrescaler

Function name

__STATIC_INLINE uint32_t LL_RCC_LSI_GetPrescaler (void)

Function description

Get LSI prescaler.

Return values

- **Returned:** value can be one of the following values:
  - LL_RCC_LSI_DIV_1
  - LL_RCC_LSI_DIV_128

Reference Manual to LL API cross reference:

- CSR LSIPRE LL_RCC_LSI_GetPrescaler

LL_RCC_MSI_Enable

Function name

__STATIC_INLINE void LL_RCC_MSI_Enable (void)

Function description

Enable MSI oscillator.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR MSION LL_RCC_MSI_Enable

LL_RCC_MSI_Disable

Function name

__STATIC_INLINE void LL_RCC_MSI_Disable (void)

Function description

Disable MSI oscillator.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR MSION LL_RCC_MSI_Disable

LL_RCC_MSI_IsReady

Function name

__STATIC_INLINE uint32_t LL_RCC_MSI_IsReady (void)

Function description

Check if MSI oscillator Ready.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR MSIRDY LL_RCC_MSI_IsReady

LL_RCC_MSI_EnablePLLMode

Function name

__STATIC_INLINE void LL_RCC_MSI_EnablePLLMode (void)

Function description

Enable MSI PLL-mode (Hardware auto calibration with LSE)

Return values

- **None:**

Notes

- MSIPLLEN must be enabled after LSE is enabled (LSEON enabled) and ready (LSERDY set by hardware)
- hardware protection to avoid enabling MSIPLLEN if LSE is not ready

Reference Manual to LL API cross reference:

- CR MSIPLLEN LL_RCC_MSI_EnablePLLMode

LL_RCC_MSI_DisablePLLMode

Function name

__STATIC_INLINE void LL_RCC_MSI_DisablePLLMode (void)

Function description

Disable MSI-PLL mode.

Return values

- **None:**

Notes

- cleared by hardware when LSE is disabled (LSEON = 0) or when the Clock Security System on LSE detects a LSE failure

Reference Manual to LL API cross reference:

- CR MSIPLLEN LL_RCC_MSI_DisablePLLMode

LL_RCC_MSI_EnableRangeSelection

Function name

__STATIC_INLINE void LL_RCC_MSI_EnableRangeSelection (void)

Function description

Enable MSI clock range selection with MSIRANGE register.

Return values

- **None:**

Notes

- Write 0 has no effect. After a standby or a reset MSIRGSEL is at 0 and the MSI range value is provided by MSISRANGE

Reference Manual to LL API cross reference:

- CR MSIRGSEL LL_RCC_MSI_EnableRangeSelection

LL_RCC_MSI_IsEnabledRangeSelect

Function name

__STATIC_INLINE uint32_t LL_RCC_MSI_IsEnabledRangeSelect (void)

Function description

Check if MSI clock range is selected with MSIRANGE register.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR MSIRGSEL LL_RCC_MSI_IsEnabledRangeSelect

LL_RCC_MSI_SetRange

Function name

__STATIC_INLINE void LL_RCC_MSI_SetRange (uint32_t Range)

Function description

Configure the Internal Multi Speed oscillator (MSI) clock range in run mode.

Parameters

- **Range:** This parameter can be one of the following values:
  - LL_RCC_MSIRANGE_0
  - LL_RCC_MSIRANGE_1
  - LL_RCC_MSIRANGE_2
  - LL_RCC_MSIRANGE_3
  - LL_RCC_MSIRANGE_4
  - LL_RCC_MSIRANGE_5
  - LL_RCC_MSIRANGE_6
  - LL_RCC_MSIRANGE_7
  - LL_RCC_MSIRANGE_8
  - LL_RCC_MSIRANGE_9
  - LL_RCC_MSIRANGE_10
  - LL_RCC_MSIRANGE_11

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR MSIRANGE LL_RCC_MSI_SetRange

LL_RCC_MSI_GetRange

Function name

__STATIC_INLINE uint32_t LL_RCC_MSI_GetRange (void)

Function description

Get the Internal Multi Speed oscillator (MSI) clock range in run mode.

Return values

- **Returned:** value can be one of the following values:
  - LL_RCC_MSIRANGE_0
  - LL_RCC_MSIRANGE_1
  - LL_RCC_MSIRANGE_2
  - LL_RCC_MSIRANGE_3
  - LL_RCC_MSIRANGE_4
  - LL_RCC_MSIRANGE_5
  - LL_RCC_MSIRANGE_6
  - LL_RCC_MSIRANGE_7
  - LL_RCC_MSIRANGE_8
  - LL_RCC_MSIRANGE_9
  - LL_RCC_MSIRANGE_10
  - LL_RCC_MSIRANGE_11

Reference Manual to LL API cross reference:

- CR MSIRANGE LL_RCC_MSI_GetRange

LL_RCC_MSI_SetRangeAfterStandby

Function name

__STATIC_INLINE void LL_RCC_MSI_SetRangeAfterStandby (uint32_t Range)

Function description

Configure MSI range used after standby.

Parameters

- **Range:** This parameter can be one of the following values:
  - LL_RCC_MSISRANGE_4
  - LL_RCC_MSISRANGE_5
  - LL_RCC_MSISRANGE_6
  - LL_RCC_MSISRANGE_7

Return values

- **None:**

Reference Manual to LL API cross reference:

- CSR MSISTBYRG LL_RCC_MSI_SetRangeAfterStandby

LL_RCC_MSI_GetRangeAfterStandby

Function name

__STATIC_INLINE uint32_t LL_RCC_MSI_GetRangeAfterStandby (void)

Function description

Get MSI range used after standby.

Return values

- **Returned:** value can be one of the following values:
  - LL_RCC_MSISRANGE_4
  - LL_RCC_MSISRANGE_5
  - LL_RCC_MSISRANGE_6
  - LL_RCC_MSISRANGE_7

Reference Manual to LL API cross reference:

- CSR MSISTBYRG LL_RCC_MSI_GetRangeAfterStandby

LL_RCC_MSI_GetCalibration

Function name

__STATIC_INLINE uint32_t LL_RCC_MSI_GetCalibration (void)

Function description

Get MSI Calibration value.

Return values

- **Between:** Min_Data = 0 and Max_Data = 255

Notes

- When MSITRIM is written, MSICAL is updated with the sum of MSITRIM and the factory trim value

Reference Manual to LL API cross reference:

- ICSCR MSICAL LL_RCC_MSI_GetCalibration

LL_RCC_MSI_SetCalibTrimming

Function name

__STATIC_INLINE void LL_RCC_MSI_SetCalibTrimming (uint32_t Value)

Function description

Set MSI Calibration trimming.

Parameters

- **Value:** Between Min_Data = 0 and Max_Data = 255

Return values

- **None:**

Notes

- user-programmable trimming value that is added to the MSICAL

Reference Manual to LL API cross reference:

- ICSCR MSITRIM LL_RCC_MSI_SetCalibTrimming

LL_RCC_MSI_GetCalibTrimming

Function name

__STATIC_INLINE uint32_t LL_RCC_MSI_GetCalibTrimming (void)

Function description

Get MSI Calibration trimming.

Return values

- **Between:** 0 and 255

Reference Manual to LL API cross reference:

- ICSCR MSITRIM LL_RCC_MSI_GetCalibTrimming

LL_RCC_LSCO_Enable

Function name

__STATIC_INLINE void LL_RCC_LSCO_Enable (void)

Function description

Enable Low speed clock.

Return values

- **None:**

Reference Manual to LL API cross reference:

- BDCR LSCOEN LL_RCC_LSCO_Enable

LL_RCC_LSCO_Disable

Function name

__STATIC_INLINE void LL_RCC_LSCO_Disable (void)

Function description

Disable Low speed clock.

Return values

- **None:**

Reference Manual to LL API cross reference:

- BDCR LSCOEN LL_RCC_LSCO_Disable

LL_RCC_LSCO_SetSource

Function name

__STATIC_INLINE void LL_RCC_LSCO_SetSource (uint32_t Source)

Function description

Configure Low speed clock selection.

Parameters

- **Source:** This parameter can be one of the following values:
  - LL_RCC_LSCO_CLKSOURCE_LSI
  - LL_RCC_LSCO_CLKSOURCE_LSE

Return values

- **None:**

Reference Manual to LL API cross reference:

- BDCR LSCOSEL LL_RCC_LSCO_SetSource

LL_RCC_LSCO_GetSource

Function name

__STATIC_INLINE uint32_t LL_RCC_LSCO_GetSource (void)

Function description

Get Low speed clock selection.

Return values

- **Returned:** value can be one of the following values:
  - LL_RCC_LSCO_CLKSOURCE_LSI
  - LL_RCC_LSCO_CLKSOURCE_LSE

Reference Manual to LL API cross reference:

- BDCR LSCOSEL LL_RCC_LSCO_GetSource

LL_RCC_SetSysClkSource

Function name

__STATIC_INLINE void LL_RCC_SetSysClkSource (uint32_t Source)

Function description

Configure the system clock source.

Parameters

- **Source:** This parameter can be one of the following values:
  - LL_RCC_SYS_CLKSOURCE_MSI
  - LL_RCC_SYS_CLKSOURCE_HSI
  - LL_RCC_SYS_CLKSOURCE_HSE
  - LL_RCC_SYS_CLKSOURCE_PLL
  - LL_RCC_SYS_CLKSOURCE_LSI
  - LL_RCC_SYS_CLKSOURCE_LSE

Return values

- **None:**

Reference Manual to LL API cross reference:

- CFGR SW LL_RCC_SetSysClkSource

LL_RCC_GetSysClkSource

Function name

__STATIC_INLINE uint32_t LL_RCC_GetSysClkSource (void)

Function description

Get the system clock source.

Return values

- **Returned:** value can be one of the following values:
  - LL_RCC_SYS_CLKSOURCE_STATUS_MSI
  - LL_RCC_SYS_CLKSOURCE_STATUS_HSI
  - LL_RCC_SYS_CLKSOURCE_STATUS_HSE
  - LL_RCC_SYS_CLKSOURCE_STATUS_PLL
  - LL_RCC_SYS_CLKSOURCE_STATUS_LSI
  - LL_RCC_SYS_CLKSOURCE_STATUS_LSE

Reference Manual to LL API cross reference:

- CFGR SWS LL_RCC_GetSysClkSource

LL_RCC_SetAHBPrescaler

Function name

__STATIC_INLINE void LL_RCC_SetAHBPrescaler (uint32_t Prescaler)

Function description

Set AHB prescaler.

Parameters

- **Prescaler:** This parameter can be one of the following values:
  - LL_RCC_SYSCLK_DIV_1
  - LL_RCC_SYSCLK_DIV_2
  - LL_RCC_SYSCLK_DIV_4
  - LL_RCC_SYSCLK_DIV_8
  - LL_RCC_SYSCLK_DIV_16
  - LL_RCC_SYSCLK_DIV_64
  - LL_RCC_SYSCLK_DIV_128
  - LL_RCC_SYSCLK_DIV_256
  - LL_RCC_SYSCLK_DIV_512

Return values

- **None:**

Reference Manual to LL API cross reference:

- CFGR HPRE LL_RCC_SetAHBPrescaler

LL_RCC_SetAPB1Prescaler

Function name

__STATIC_INLINE void LL_RCC_SetAPB1Prescaler (uint32_t Prescaler)

Function description

Set APB prescaler.

Parameters

- **Prescaler:** This parameter can be one of the following values:
  - LL_RCC_APB1_DIV_1
  - LL_RCC_APB1_DIV_2
  - LL_RCC_APB1_DIV_4
  - LL_RCC_APB1_DIV_8
  - LL_RCC_APB1_DIV_16

Return values

- **None:**

Reference Manual to LL API cross reference:

- CFGR PPRE LL_RCC_SetAPBPrescaler

LL_RCC_GetAHBPrescaler

Function name

__STATIC_INLINE uint32_t LL_RCC_GetAHBPrescaler (void)

Function description

Get AHB prescaler.

Return values

- **Returned:** value can be one of the following values:
  - LL_RCC_SYSCLK_DIV_1
  - LL_RCC_SYSCLK_DIV_2
  - LL_RCC_SYSCLK_DIV_4
  - LL_RCC_SYSCLK_DIV_8
  - LL_RCC_SYSCLK_DIV_16
  - LL_RCC_SYSCLK_DIV_64
  - LL_RCC_SYSCLK_DIV_128
  - LL_RCC_SYSCLK_DIV_256
  - LL_RCC_SYSCLK_DIV_512

Reference Manual to LL API cross reference:

- CFGR HPRE LL_RCC_GetAHBPrescaler

LL_RCC_GetAPB1Prescaler

Function name

__STATIC_INLINE uint32_t LL_RCC_GetAPB1Prescaler (void)

Function description

Get APB prescaler.

Return values

- **Returned:** value can be one of the following values:
  - LL_RCC_APB1_DIV_1
  - LL_RCC_APB1_DIV_2
  - LL_RCC_APB1_DIV_4
  - LL_RCC_APB1_DIV_8
  - LL_RCC_APB1_DIV_16

Reference Manual to LL API cross reference:

- CFGR PPRE LL_RCC_GetAPB1Prescaler

LL_RCC_SetClkAfterWakeFromStop

Function name

__STATIC_INLINE void LL_RCC_SetClkAfterWakeFromStop (uint32_t Clock)

Function description

Set Clock After Wake-Up From Stop mode.

Parameters

- **Clock:** This parameter can be one of the following values:
  - LL_RCC_STOP_WAKEUPCLOCK_MSI
  - LL_RCC_STOP_WAKEUPCLOCK_HSI

Return values

- **None:**

Reference Manual to LL API cross reference:

- CFGR STOPWUCK LL_RCC_SetClkAfterWakeFromStop

LL_RCC_GetClkAfterWakeFromStop

Function name

__STATIC_INLINE uint32_t LL_RCC_GetClkAfterWakeFromStop (void)

Function description

Get Clock After Wake-Up From Stop mode.

Return values

- **Returned:** value can be one of the following values:
  - LL_RCC_STOP_WAKEUPCLOCK_MSI
  - LL_RCC_STOP_WAKEUPCLOCK_HSI

Reference Manual to LL API cross reference:

- CFGR STOPWUCK LL_RCC_GetClkAfterWakeFromStop

LL_RCC_ConfigMCO

Function name

__STATIC_INLINE void LL_RCC_ConfigMCO (uint32_t MCOxSource, uint32_t MCOxPrescaler)

Function description

Configure MCOx.

Parameters

- **MCOxSource:** This parameter can be one of the following values:
  - LL_RCC_MCO1SOURCE_NOCLOCK
  - LL_RCC_MCO1SOURCE_SYSCLK
  - LL_RCC_MCO1SOURCE_MSI
  - LL_RCC_MCO1SOURCE_HSI16
  - LL_RCC_MCO1SOURCE_HSE
  - LL_RCC_MCO1SOURCE_PLLCLK
  - LL_RCC_MCO1SOURCE_LSI
  - LL_RCC_MCO1SOURCE_LSE
  - LL_RCC_MCO1SOURCE_HSI48
  - LL_RCC_MCO2SOURCE_NOCLOCK
  - LL_RCC_MCO2SOURCE_SYSCLK
  - LL_RCC_MCO2SOURCE_MSI
  - LL_RCC_MCO2SOURCE_HSI16
  - LL_RCC_MCO2SOURCE_HSE
  - LL_RCC_MCO2SOURCE_PLLCLK
  - LL_RCC_MCO2SOURCE_LSI
  - LL_RCC_MCO2SOURCE_LSE
  - LL_RCC_MCO2SOURCE_HSI48
- **MCOxPrescaler:** This parameter can be one of the following values:
  - LL_RCC_MCO1_DIV_1
  - LL_RCC_MCO1_DIV_2
  - LL_RCC_MCO1_DIV_4
  - LL_RCC_MCO1_DIV_8
  - LL_RCC_MCO1_DIV_16
  - LL_RCC_MCO1_DIV_32
  - LL_RCC_MCO1_DIV_64
  - LL_RCC_MCO1_DIV_128
  - LL_RCC_MCO1_DIV_256
  - LL_RCC_MCO1_DIV_512
  - LL_RCC_MCO2_DIV_1
  - LL_RCC_MCO2_DIV_2
  - LL_RCC_MCO2_DIV_4
  - LL_RCC_MCO2_DIV_8
  - LL_RCC_MCO2_DIV_16
  - LL_RCC_MCO2_DIV_32
  - LL_RCC_MCO2_DIV_64
  - LL_RCC_MCO2_DIV_128
  - LL_RCC_MCO2_DIV_256
  - LL_RCC_MCO2_DIV_512
  - LL_RCC_MCO2_DIV_1024

Return values

- **None:**

Reference Manual to LL API cross reference:

- CFGR MCO1 LL_RCC_ConfigMCO
- CFGR MCO1PRE LL_RCC_ConfigMCO
- CFGR MCO2 LL_RCC_ConfigMCO
- CFGR MCO2PRE LL_RCC_ConfigMCO

LL_RCC_SetUSARTClockSource

Function name

__STATIC_INLINE void LL_RCC_SetUSARTClockSource (uint32_t USARTxSource)

Function description

Configure USARTx clock source.

Parameters

- **USARTxSource:** This parameter can be one of the following values:
  - LL_RCC_USART1_CLKSOURCE_PCLK1
  - LL_RCC_USART1_CLKSOURCE_SYSCLK
  - LL_RCC_USART1_CLKSOURCE_HSI
  - LL_RCC_USART1_CLKSOURCE_LSE
  - LL_RCC_USART2_CLKSOURCE_PCLK1
  - LL_RCC_USART2_CLKSOURCE_SYSCLK
  - LL_RCC_USART2_CLKSOURCE_HSI
  - LL_RCC_USART2_CLKSOURCE_LSE

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCIPR USARTxSEL LL_RCC_SetUSARTClockSource

LL_RCC_SetLPUARTClockSource

Function name

__STATIC_INLINE void LL_RCC_SetLPUARTClockSource (uint32_t LPUARTxSource)

Function description

Configure LPUART1x clock source.

Parameters

- **LPUARTxSource:** This parameter can be one of the following values:
  - LL_RCC_LPUART1_CLKSOURCE_PCLK1
  - LL_RCC_LPUART1_CLKSOURCE_SYSCLK
  - LL_RCC_LPUART1_CLKSOURCE_HSI
  - LL_RCC_LPUART1_CLKSOURCE_LSE
  - LL_RCC_LPUART2_CLKSOURCE_PCLK1
  - LL_RCC_LPUART2_CLKSOURCE_SYSCLK
  - LL_RCC_LPUART2_CLKSOURCE_HSI
  - LL_RCC_LPUART2_CLKSOURCE_LSE
  - LL_RCC_LPUART3_CLKSOURCE_PCLK1 (*)
  - LL_RCC_LPUART3_CLKSOURCE_SYSCLK (*)
  - LL_RCC_LPUART3_CLKSOURCE_HSI (*)
  - LL_RCC_LPUART3_CLKSOURCE_LSE (*)

  (*) value not defined in all devices.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCIPR LPUART1SEL LL_RCC_SetLPUARTClockSource

LL_RCC_SetI2CClockSource

Function name

__STATIC_INLINE void LL_RCC_SetI2CClockSource (uint32_t I2CxSource)

Function description

Configure I2Cx clock source.

Parameters

- **I2CxSource:** This parameter can be one of the following values:
  - LL_RCC_I2C1_CLKSOURCE_PCLK1
  - LL_RCC_I2C1_CLKSOURCE_SYSCLK
  - LL_RCC_I2C1_CLKSOURCE_HSI
  - LL_RCC_I2C3_CLKSOURCE_PCLK1
  - LL_RCC_I2C3_CLKSOURCE_SYSCLK
  - LL_RCC_I2C3_CLKSOURCE_HSI

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCIPR I2CxSEL LL_RCC_SetI2CClockSource

LL_RCC_SetTIMClockSource

Function name

__STATIC_INLINE void LL_RCC_SetTIMClockSource (uint32_t TIMxSource)

Function description

Configure TIMx clock source.

Parameters

- **TIMxSource:** This parameter can be one of the following values:
  - LL_RCC_TIM1_CLKSOURCE_PLLQ
  - LL_RCC_TIM1_CLKSOURCE_PCLK1
  - LL_RCC_TIM15_CLKSOURCE_PLLQ
  - LL_RCC_TIM15_CLKSOURCE_PCLK1

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCIPR TIMxSEL LL_RCC_SetTIMClockSource

LL_RCC_SetLPTIMClockSource

Function name

__STATIC_INLINE void LL_RCC_SetLPTIMClockSource (uint32_t LPTIMxSource)

Function description

Configure LPTIMx clock source.

Parameters

- **LPTIMxSource:** This parameter can be one of the following values:
  - LL_RCC_LPTIM1_CLKSOURCE_PCLK1
  - LL_RCC_LPTIM1_CLKSOURCE_LSI
  - LL_RCC_LPTIM1_CLKSOURCE_HSI
  - LL_RCC_LPTIM1_CLKSOURCE_LSE
  - LL_RCC_LPTIM2_CLKSOURCE_PCLK1
  - LL_RCC_LPTIM2_CLKSOURCE_LSI
  - LL_RCC_LPTIM2_CLKSOURCE_HSI
  - LL_RCC_LPTIM2_CLKSOURCE_LSE
  - LL_RCC_LPTIM3_CLKSOURCE_PCLK1 (*)
  - LL_RCC_LPTIM3_CLKSOURCE_LSI (*)
  - LL_RCC_LPTIM3_CLKSOURCE_HSI (*)
  - LL_RCC_LPTIM3_CLKSOURCE_LSE (*)

  (*) value not defined in all devices.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCIPR LPTIMxSEL LL_RCC_SetLPTIMClockSource

LL_RCC_SetRNGClockSource

Function name

__STATIC_INLINE void LL_RCC_SetRNGClockSource (uint32_t RNGxSource)

Function description

Configure RNG clock source.

Parameters

- **RNGxSource:** This parameter can be one of the following values:
  - LL_RCC_RNG_CLKSOURCE_NONE
  - LL_RCC_RNG_CLKSOURCE_HSI48 (*)
  - LL_RCC_RNG_CLKSOURCE_PLLQ
  - LL_RCC_RNG_CLKSOURCE_MSI

  (*) value not defined in all devices.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCIPR CLK48MSEL LL_RCC_SetRNGClockSource

LL_RCC_SetUSBClockSource

Function name

__STATIC_INLINE void LL_RCC_SetUSBClockSource (uint32_t USBxSource)

Function description

Configure USB clock source.

Parameters

- **USBxSource:** This parameter can be one of the following values:
  - LL_RCC_USB_CLKSOURCE_NONE
  - LL_RCC_USB_CLKSOURCE_HSI48
  - LL_RCC_USB_CLKSOURCE_PLLQ
  - LL_RCC_USB_CLKSOURCE_MSI

  (*) value not defined in all devices.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCIPR USBSEL LL_RCC_SetUSBClockSource

LL_RCC_SetADCClockSource

Function name

__STATIC_INLINE void LL_RCC_SetADCClockSource (uint32_t ADCxSource)

Function description

Configure ADC clock source.

Parameters

- **ADCxSource:** This parameter can be one of the following values:
  - LL_RCC_ADC_CLKSOURCE_NONE
  - LL_RCC_ADC_CLKSOURCE_PLLP
  - LL_RCC_ADC_CLKSOURCE_HSI
  - LL_RCC_ADC_CLKSOURCE_SYSCLK

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCIPR ADCSEL LL_RCC_SetADCClockSource

LL_RCC_GetUSARTClockSource

Function name

__STATIC_INLINE uint32_t LL_RCC_GetUSARTClockSource (uint32_t USARTx)

Function description

Get USARTx clock source.

Parameters

- **USARTx:** This parameter can be one of the following values:
  - LL_RCC_USART1_CLKSOURCE
  - LL_RCC_USART2_CLKSOURCE

  (*) value not defined in all devices.

Return values

- **Returned:** value can be one of the following values:
  - LL_RCC_USART1_CLKSOURCE_PCLK1
  - LL_RCC_USART1_CLKSOURCE_SYSCLK
  - LL_RCC_USART1_CLKSOURCE_HSI
  - LL_RCC_USART1_CLKSOURCE_LSE
  - LL_RCC_USART2_CLKSOURCE_PCLK1
  - LL_RCC_USART2_CLKSOURCE_SYSCLK
  - LL_RCC_USART2_CLKSOURCE_HSI
  - LL_RCC_USART2_CLKSOURCE_LSE

Reference Manual to LL API cross reference:

- CCIPR USARTxSEL LL_RCC_GetUSARTClockSource

LL_RCC_GetLPUARTClockSource

Function name

__STATIC_INLINE uint32_t LL_RCC_GetLPUARTClockSource (uint32_t LPUARTx)

Function description

Get LPUARTx clock source.

Parameters

- **LPUARTx:** This parameter can be one of the following values:
  - LL_RCC_LPUART1_CLKSOURCE

Return values

- **Returned:** value can be one of the following values:
  - LL_RCC_LPUART1_CLKSOURCE_PCLK1
  - LL_RCC_LPUART1_CLKSOURCE_SYSCLK
  - LL_RCC_LPUART1_CLKSOURCE_HSI
  - LL_RCC_LPUART1_CLKSOURCE_LSE
  - LL_RCC_LPUART2_CLKSOURCE_PCLK1
  - LL_RCC_LPUART2_CLKSOURCE_SYSCLK
  - LL_RCC_LPUART2_CLKSOURCE_HSI
  - LL_RCC_LPUART2_CLKSOURCE_LSE
  - LL_RCC_LPUART3_CLKSOURCE_PCLK1 (*)
  - LL_RCC_LPUART3_CLKSOURCE_SYSCLK (*)
  - LL_RCC_LPUART3_CLKSOURCE_HSI (*)
  - LL_RCC_LPUART3_CLKSOURCE_LSE (*)

  (*) value not defined in all devices.

Reference Manual to LL API cross reference:

- CCIPR LPUART1SEL LL_RCC_GetLPUARTClockSource

LL_RCC_GetI2CClockSource

Function name

__STATIC_INLINE uint32_t LL_RCC_GetI2CClockSource (uint32_t I2Cx)

Function description

Get I2Cx clock source.

Parameters

- **I2Cx:** This parameter can be one of the following values:
  - LL_RCC_I2C1_CLKSOURCE
  - LL_RCC_I2C3_CLKSOURCE

  (*) value not defined in all devices.

Return values

- **Returned:** value can be one of the following values:
  - LL_RCC_I2C1_CLKSOURCE_PCLK1
  - LL_RCC_I2C1_CLKSOURCE_SYSCLK
  - LL_RCC_I2C1_CLKSOURCE_HSI
  - LL_RCC_I2C3_CLKSOURCE_PCLK1
  - LL_RCC_I2C3_CLKSOURCE_SYSCLK
  - LL_RCC_I2C3_CLKSOURCE_HSI

Reference Manual to LL API cross reference:

- CCIPR I2CxSEL LL_RCC_GetI2CClockSource

LL_RCC_GetTIMClockSource

Function name

__STATIC_INLINE uint32_t LL_RCC_GetTIMClockSource (uint32_t TIMx)

Function description

Get TIMx clock source.

Parameters

- **TIMx:** This parameter can be one of the following values:
  - LL_RCC_TIM1_CLKSOURCE
  - LL_RCC_TIM15_CLKSOURCE

Return values

- **Returned:** value can be one of the following values:
  - LL_RCC_TIM1_CLKSOURCE_PLLQ
  - LL_RCC_TIM1_CLKSOURCE_PCLK1
  - LL_RCC_TIM15_CLKSOURCE_PLLQ
  - LL_RCC_TIM15_CLKSOURCE_PCLK1

Reference Manual to LL API cross reference:

- CCIPR TIMxSEL LL_RCC_GetTIMClockSource

LL_RCC_GetLPTIMClockSource

Function name

__STATIC_INLINE uint32_t LL_RCC_GetLPTIMClockSource (uint32_t LPTIMx)

Function description

Get LPTIMx clock source.

Parameters

- **LPTIMx:** This parameter can be one of the following values:
  - LL_RCC_LPTIM1_CLKSOURCE
  - LL_RCC_LPTIM2_CLKSOURCE

Return values

- **Returned:** value can be one of the following values:
  - LL_RCC_LPTIM1_CLKSOURCE_PCLK1
  - LL_RCC_LPTIM1_CLKSOURCE_LSI
  - LL_RCC_LPTIM1_CLKSOURCE_HSI
  - LL_RCC_LPTIM1_CLKSOURCE_LSE
  - LL_RCC_LPTIM2_CLKSOURCE_PCLK1
  - LL_RCC_LPTIM2_CLKSOURCE_LSI
  - LL_RCC_LPTIM2_CLKSOURCE_HSI
  - LL_RCC_LPTIM2_CLKSOURCE_LSE
  - LL_RCC_LPTIM3_CLKSOURCE_PCLK1 (*)
  - LL_RCC_LPTIM3_CLKSOURCE_LSI (*)
  - LL_RCC_LPTIM3_CLKSOURCE_HSI (*)
  - LL_RCC_LPTIM3_CLKSOURCE_LSE (*)

  (*) value not defined in all devices.

Reference Manual to LL API cross reference:

- CCIPR LPTIM1SEL LL_RCC_GetLPTIMClockSource
- CCIPR LPTIM2SEL LL_RCC_GetLPTIMClockSource CCIPR LPTIM3SEL LL_RCC_GetLPTIMClockSource

LL_RCC_GetRNGClockSource

Function name

__STATIC_INLINE uint32_t LL_RCC_GetRNGClockSource (uint32_t RNGx)

Function description

Get RNGx clock source.

Parameters

- **RNGx:** This parameter can be one of the following values:
  - LL_RCC_RNG_CLKSOURCE

Return values

- **Returned:** value can be one of the following values:
  - LL_RCC_RNG_CLKSOURCE_NONE
  - LL_RCC_RNG_CLKSOURCE_HSI48
  - LL_RCC_RNG_CLKSOURCE_PLLQ
  - LL_RCC_RNG_CLKSOURCE_MSI

Reference Manual to LL API cross reference:

- CCIPR CLK48SEL LL_RCC_GetRNGClockSource

LL_RCC_GetUSBClockSource

Function name

__STATIC_INLINE uint32_t LL_RCC_GetUSBClockSource (uint32_t USBx)

Function description

Get USBx clock source.

Parameters

- **USBx:** This parameter can be one of the following values:
  - LL_RCC_USB_CLKSOURCE

Return values

- **Returned:** value can be one of the following values:
  - LL_RCC_USB_CLKSOURCE_NONE
  - LL_RCC_USB_CLKSOURCE_HSI48
  - LL_RCC_USB_CLKSOURCE_PLLQ
  - LL_RCC_USB_CLKSOURCE_MSI

Reference Manual to LL API cross reference:

- CCIPR CLK48SEL LL_RCC_GetUSBClockSource

LL_RCC_GetADCClockSource

Function name

__STATIC_INLINE uint32_t LL_RCC_GetADCClockSource (uint32_t ADCx)

Function description

Get ADCx clock source.

Parameters

- **ADCx:** This parameter can be one of the following values:
  - LL_RCC_ADC_CLKSOURCE

Return values

- **Returned:** value can be one of the following values:
  - LL_RCC_ADC_CLKSOURCE_NONE
  - LL_RCC_ADC_CLKSOURCE_PLLP
  - LL_RCC_ADC_CLKSOURCE_HSI
  - LL_RCC_ADC_CLKSOURCE_SYSCLK

Reference Manual to LL API cross reference:

- CCIPR ADCSEL LL_RCC_GetADCClockSource

LL_RCC_SetRTCClockSource

Function name

__STATIC_INLINE void LL_RCC_SetRTCClockSource (uint32_t Source)

Function description

Set RTC Clock Source.

Parameters

- **Source:** This parameter can be one of the following values:
  - LL_RCC_RTC_CLKSOURCE_NONE
  - LL_RCC_RTC_CLKSOURCE_LSE
  - LL_RCC_RTC_CLKSOURCE_LSI
  - LL_RCC_RTC_CLKSOURCE_HSE_DIV32

Return values

- **None:**

Notes

- Once the RTC clock source has been selected, it cannot be changed anymore unless the Backup domain is reset, or unless a failure is detected on LSE (LSECSSD is set). The BDRST bit can be used to reset them.

Reference Manual to LL API cross reference:

- BDCR RTCSEL LL_RCC_SetRTCClockSource

LL_RCC_GetRTCClockSource

Function name

__STATIC_INLINE uint32_t LL_RCC_GetRTCClockSource (void)

Function description

Get RTC Clock Source.

Return values

- **Returned:** value can be one of the following values:
  - LL_RCC_RTC_CLKSOURCE_NONE
  - LL_RCC_RTC_CLKSOURCE_LSE
  - LL_RCC_RTC_CLKSOURCE_LSI
  - LL_RCC_RTC_CLKSOURCE_HSE_DIV32

Reference Manual to LL API cross reference:

- BDCR RTCSEL LL_RCC_GetRTCClockSource

LL_RCC_EnableRTC

Function name

__STATIC_INLINE void LL_RCC_EnableRTC (void)

Function description

Enable RTC.

Return values

- **None:**

Reference Manual to LL API cross reference:

- BDCR RTCEN LL_RCC_EnableRTC

LL_RCC_DisableRTC

Function name

__STATIC_INLINE void LL_RCC_DisableRTC (void)

Function description

Disable RTC.

Return values

- **None:**

Reference Manual to LL API cross reference:

- BDCR RTCEN LL_RCC_DisableRTC

LL_RCC_IsEnabledRTC

Function name

__STATIC_INLINE uint32_t LL_RCC_IsEnabledRTC (void)

Function description

Check if RTC has been enabled or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- BDCR RTCEN LL_RCC_IsEnabledRTC

LL_RCC_ForceBackupDomainReset

Function name

__STATIC_INLINE void LL_RCC_ForceBackupDomainReset (void)

Function description

Force the Backup domain reset.

Return values

- **None:**

Reference Manual to LL API cross reference:

- BDCR BDRST LL_RCC_ForceBackupDomainReset

LL_RCC_ReleaseBackupDomainReset

Function name

__STATIC_INLINE void LL_RCC_ReleaseBackupDomainReset (void)

Function description

Release the Backup domain reset.

Return values

- **None:**

Reference Manual to LL API cross reference:

- BDCR BDRST LL_RCC_ReleaseBackupDomainReset

LL_RCC_PLL_Enable

Function name

__STATIC_INLINE void LL_RCC_PLL_Enable (void)

Function description

Enable PLL.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR PLLON LL_RCC_PLL_Enable

LL_RCC_PLL_Disable

Function name

__STATIC_INLINE void LL_RCC_PLL_Disable (void)

Function description

Disable PLL.

Return values

- **None:**

Notes

- Cannot be disabled if the PLL clock is used as the system clock

Reference Manual to LL API cross reference:

- CR PLLON LL_RCC_PLL_Disable

LL_RCC_PLL_IsReady

Function name

__STATIC_INLINE uint32_t LL_RCC_PLL_IsReady (void)

Function description

Check if PLL Ready.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR PLLRDY LL_RCC_PLL_IsReady

LL_RCC_HSI48_Enable

Function name

__STATIC_INLINE void LL_RCC_HSI48_Enable (void)

Function description

Enable HSI48.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CRRCR HSI48ON LL_RCC_HSI48_Enable

LL_RCC_HSI48_Disable

Function name

__STATIC_INLINE void LL_RCC_HSI48_Disable (void)

Function description

Disable HSI48.

Return values

- **None:**

Notes

- Cannot be disabled if the HSI48 clock is used as the system clock

Reference Manual to LL API cross reference:

- CRRCR HSI48ON LL_RCC_HSI48_Disable

LL_RCC_HSI48_IsReady

Function name

__STATIC_INLINE uint32_t LL_RCC_HSI48_IsReady (void)

Function description

Check if HSI48 Ready.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CRRCR HSI48RDY LL_RCC_HSI48_IsReady

LL_RCC_HSI48_GetCalibration

Function name

__STATIC_INLINE uint32_t LL_RCC_HSI48_GetCalibration (void)

Function description

Get HSI Calibration value.

Return values

- **Between:** Min_Data = 0x00 and Max_Data = 0xFF

Notes

- When HSITRIM is written, HSICAL is updated with the sum of HSITRIM and the factory trim value

Reference Manual to LL API cross reference:

- CRRCR HSICAL LL_RCC_HSI_GetCalibration

LL_RCC_HSI48_SetCalibration

Function name

__STATIC_INLINE void LL_RCC_HSI48_SetCalibration (uint32_t Value)

Function description

Set HSI Calibration trimming.

Parameters

- **Value:** Between Min_Data = 0 and Max_Data = 31

Return values

- **None:**

Notes

- user-programmable trimming value that is added to the HSICAL
- Default value is 16, which, when added to the HSICAL value, should trim the HSI to 16 MHz +/- 1 %

Reference Manual to LL API cross reference:

- CRRCR HSITRIM LL_RCC_HSI_SetCalibTrimming

LL_RCC_PLL_ConfigDomain_SYS

Function name

__STATIC_INLINE void LL_RCC_PLL_ConfigDomain_SYS (uint32_t Source, uint32_t PLLM, uint32_t PLLN, uint32_t PLLR)

Function description

Configure PLLR used for SYSCLK Domain.

Parameters

- **Source:** This parameter can be one of the following values:
  - LL_RCC_PLLSOURCE_NONE
  - LL_RCC_PLLSOURCE_MSI
  - LL_RCC_PLLSOURCE_HSI
  - LL_RCC_PLLSOURCE_HSE
- **PLLM:** This parameter can be one of the following values:
  - LL_RCC_PLLM_DIV_1
  - LL_RCC_PLLM_DIV_2
  - LL_RCC_PLLM_DIV_3
  - LL_RCC_PLLM_DIV_4
  - LL_RCC_PLLM_DIV_5
  - LL_RCC_PLLM_DIV_6
  - LL_RCC_PLLM_DIV_7
  - LL_RCC_PLLM_DIV_8
- **PLLN:** Between 4 and 127
- **PLLR:** This parameter can be one of the following values:
  - LL_RCC_PLLR_DIV_2
  - LL_RCC_PLLR_DIV_4
  - LL_RCC_PLLR_DIV_6
  - LL_RCC_PLLR_DIV_8

Return values

- **None:**

Notes

- PLL Source and PLLM Divider can be written only when PLL is disabled.
- PLLN/PLLR can be written only when PLL is disabled.

Reference Manual to LL API cross reference:

- PLLCFGR PLLSRC LL_RCC_PLL_ConfigDomain_SYS
- PLLCFGR PLLM LL_RCC_PLL_ConfigDomain_SYS
- PLLCFGR PLLN LL_RCC_PLL_ConfigDomain_SYS
- PLLCFGR PLLR LL_RCC_PLL_ConfigDomain_SYS

LL_RCC_PLL_ConfigDomain_PLLQ

Function name

__STATIC_INLINE void LL_RCC_PLL_ConfigDomain_PLLQ (uint32_t Source, uint32_t PLLM, uint32_t PLLN, uint32_t PLLQ)

Function description

Configure PLL used for Q domain clock.

Parameters

- **Source:** This parameter can be one of the following values:
  - LL_RCC_PLLSOURCE_NONE
  - LL_RCC_PLLSOURCE_MSI
  - LL_RCC_PLLSOURCE_HSI
  - LL_RCC_PLLSOURCE_HSE
- **PLLM:** This parameter can be one of the following values:
  - LL_RCC_PLLM_DIV_1
  - LL_RCC_PLLM_DIV_2
  - LL_RCC_PLLM_DIV_3
  - LL_RCC_PLLM_DIV_4
  - LL_RCC_PLLM_DIV_5
  - LL_RCC_PLLM_DIV_6
  - LL_RCC_PLLM_DIV_7
  - LL_RCC_PLLM_DIV_8
- **PLLN:** Between 4 and 127
- **PLLQ:** This parameter can be one of the following values:
  - LL_RCC_PLLQ_DIV_2
  - LL_RCC_PLLQ_DIV_4
  - LL_RCC_PLLQ_DIV_6
  - LL_RCC_PLLQ_DIV_8

Return values

- **None:**

Notes

- PLL Source and PLLM Divider can be written only when PLL.
- PLLN/PLLQ can be written only when PLL is disabled.
- This can be selected for USB, RNG

Reference Manual to LL API cross reference:

- PLLCFGR PLLSRC LL_RCC_PLL_ConfigDomain_PLLQ
- PLLCFGR PLLM LL_RCC_PLL_ConfigDomain_PLLQ
- PLLCFGR PLLN LL_RCC_PLL_ConfigDomain_PLLQ
- PLLCFGR PLLQ LL_RCC_PLL_ConfigDomain_PLLQ

LL_RCC_PLL_ConfigDomain_PLLP

Function name

__STATIC_INLINE void LL_RCC_PLL_ConfigDomain_PLLP (uint32_t Source, uint32_t PLLM, uint32_t PLLN, uint32_t PLLP)

Function description

Configure PLL used for P domain clock.

Parameters

- **Source:** This parameter can be one of the following values:
  - LL_RCC_PLLSOURCE_NONE
  - LL_RCC_PLLSOURCE_MSI
  - LL_RCC_PLLSOURCE_HSI
  - LL_RCC_PLLSOURCE_HSE
- **PLLM:** This parameter can be one of the following values:
  - LL_RCC_PLLM_DIV_1
  - LL_RCC_PLLM_DIV_2
  - LL_RCC_PLLM_DIV_3
  - LL_RCC_PLLM_DIV_4
  - LL_RCC_PLLM_DIV_5
  - LL_RCC_PLLM_DIV_6
  - LL_RCC_PLLM_DIV_7
  - LL_RCC_PLLM_DIV_8
- **PLLN:** Between 4 and 127
- **PLLP:** This parameter can be one of the following values:
  - LL_RCC_PLLP_DIV_2
  - LL_RCC_PLLP_DIV_3
  - LL_RCC_PLLP_DIV_4
  - LL_RCC_PLLP_DIV_5
  - LL_RCC_PLLP_DIV_6
  - LL_RCC_PLLP_DIV_7
  - LL_RCC_PLLP_DIV_8
  - LL_RCC_PLLP_DIV_9
  - LL_RCC_PLLP_DIV_10
  - LL_RCC_PLLP_DIV_11
  - LL_RCC_PLLP_DIV_12
  - LL_RCC_PLLP_DIV_13
  - LL_RCC_PLLP_DIV_14
  - LL_RCC_PLLP_DIV_15
  - LL_RCC_PLLP_DIV_16
  - LL_RCC_PLLP_DIV_17
  - LL_RCC_PLLP_DIV_18
  - LL_RCC_PLLP_DIV_19
  - LL_RCC_PLLP_DIV_20
  - LL_RCC_PLLP_DIV_21
  - LL_RCC_PLLP_DIV_22
  - LL_RCC_PLLP_DIV_23
  - LL_RCC_PLLP_DIV_24
  - LL_RCC_PLLP_DIV_25
  - LL_RCC_PLLP_DIV_26
  - LL_RCC_PLLP_DIV_27
  - LL_RCC_PLLP_DIV_28
  - LL_RCC_PLLP_DIV_29
  - LL_RCC_PLLP_DIV_30
  - LL_RCC_PLLP_DIV_31
  - LL_RCC_PLLP_DIV_32

Return values

- **None:**

Notes

- PLL Source and PLLM Divider can be written only when PLL.
- PLLN/PLLQ can be written only when PLL is disabled.
- This can be selected for ADC, TIM1 , TIM15

Reference Manual to LL API cross reference:

- PLLCFGR PLLSRC LL_RCC_PLL_ConfigDomain_PLLP
- PLLCFGR PLLM LL_RCC_PLL_ConfigDomain_PLLP
- PLLCFGR PLLN LL_RCC_PLL_ConfigDomain_PLLP
- PLLCFGR PLLP LL_RCC_PLL_ConfigDomain_PLLP

LL_RCC_PLL_GetN

Function name

__STATIC_INLINE uint32_t LL_RCC_PLL_GetN (void)

Function description

Get Main PLL multiplication factor for VCO.

Return values

- **Between:** 4 and 127

Reference Manual to LL API cross reference:

- PLLCFGR PLLN LL_RCC_PLL_GetN

LL_RCC_PLL_GetP

Function name

__STATIC_INLINE uint32_t LL_RCC_PLL_GetP (void)

Function description

Get Main PLL division factor for PLLP.

Return values

- **Returned:** value can be one of the following values:
  - LL_RCC_PLLP_DIV_2
  - LL_RCC_PLLP_DIV_3
  - LL_RCC_PLLP_DIV_4
  - LL_RCC_PLLP_DIV_5
  - LL_RCC_PLLP_DIV_6
  - LL_RCC_PLLP_DIV_7
  - LL_RCC_PLLP_DIV_8
  - LL_RCC_PLLP_DIV_9
  - LL_RCC_PLLP_DIV_10
  - LL_RCC_PLLP_DIV_11
  - LL_RCC_PLLP_DIV_12
  - LL_RCC_PLLP_DIV_13
  - LL_RCC_PLLP_DIV_14
  - LL_RCC_PLLP_DIV_15
  - LL_RCC_PLLP_DIV_16
  - LL_RCC_PLLP_DIV_17
  - LL_RCC_PLLP_DIV_18
  - LL_RCC_PLLP_DIV_19
  - LL_RCC_PLLP_DIV_20
  - LL_RCC_PLLP_DIV_21
  - LL_RCC_PLLP_DIV_22
  - LL_RCC_PLLP_DIV_23
  - LL_RCC_PLLP_DIV_24
  - LL_RCC_PLLP_DIV_25
  - LL_RCC_PLLP_DIV_26
  - LL_RCC_PLLP_DIV_27
  - LL_RCC_PLLP_DIV_28
  - LL_RCC_PLLP_DIV_29
  - LL_RCC_PLLP_DIV_30
  - LL_RCC_PLLP_DIV_31

Reference Manual to LL API cross reference:

- PLLCFGR PLLPDIV LL_RCC_PLL_GetP

LL_RCC_PLL_GetQ

Function name

__STATIC_INLINE uint32_t LL_RCC_PLL_GetQ (void)

Function description

Get Main PLL division factor for PLLQ.

Return values

- **Returned:** value can be one of the following values:
  - LL_RCC_PLLQ_DIV_2
  - LL_RCC_PLLQ_DIV_4
  - LL_RCC_PLLQ_DIV_6
  - LL_RCC_PLLQ_DIV_8

Notes

- Used for PLL48M1CLK selected for USB, RNG, SDMMC (48 MHz clock)

Reference Manual to LL API cross reference:

- PLLCFGR PLLQ LL_RCC_PLL_GetQ

LL_RCC_PLL_GetR

Function name

__STATIC_INLINE uint32_t LL_RCC_PLL_GetR (void)

Function description

Get Main PLL division factor for PLLR.

Return values

- **Returned:** value can be one of the following values:
  - LL_RCC_PLLR_DIV_2
  - LL_RCC_PLLR_DIV_4
  - LL_RCC_PLLR_DIV_6
  - LL_RCC_PLLR_DIV_8

Notes

- Used for PLLCLK (system clock)

Reference Manual to LL API cross reference:

- PLLCFGR PLLR LL_RCC_PLL_GetR

LL_RCC_PLL_GetMainSource

Function name

__STATIC_INLINE uint32_t LL_RCC_PLL_GetMainSource (void)

Function description

Get the oscillator used as PLL clock source.

Return values

- **Returned:** value can be one of the following values:
  - LL_RCC_PLLSOURCE_NONE
  - LL_RCC_PLLSOURCE_MSI
  - LL_RCC_PLLSOURCE_HSI
  - LL_RCC_PLLSOURCE_HSE

Reference Manual to LL API cross reference:

- PLLCFGR PLLSRC LL_RCC_PLL_GetMainSource

LL_RCC_PLL_GetM

Function name

__STATIC_INLINE uint32_t LL_RCC_PLL_GetM (void)

Function description

Get Division factor for the main PLL and other PLL.

Return values

- **Returned:** value can be one of the following values:
  - LL_RCC_PLLM_DIV_1
  - LL_RCC_PLLM_DIV_2
  - LL_RCC_PLLM_DIV_3
  - LL_RCC_PLLM_DIV_4
  - LL_RCC_PLLM_DIV_5
  - LL_RCC_PLLM_DIV_6
  - LL_RCC_PLLM_DIV_7
  - LL_RCC_PLLM_DIV_8

Reference Manual to LL API cross reference:

- PLLCFGR PLLM LL_RCC_PLL_GetM

LL_RCC_PLL_EnableDomain_PLLP

Function name

__STATIC_INLINE void LL_RCC_PLL_EnableDomain_PLLP (void)

Function description

Enable PLL output mapped on P domain clock.

Return values

- **None:**

Notes

- User shall check that PLL enable is not done through other functions (ex: I2S1)

Reference Manual to LL API cross reference:

- PLLCFGR PLLPEN LL_RCC_PLL_EnableDomain_PLLP

LL_RCC_PLL_DisableDomain_PLLP

Function name

__STATIC_INLINE void LL_RCC_PLL_DisableDomain_PLLP (void)

Function description

Disable PLL output mapped on P domain clock.

Return values

- **None:**

Notes

- Cannot be disabled if the PLL clock is used as the system clock
- User shall check that PLL is not used by any other peripheral (ex: I2S1)
- In order to save power, when the PLLCLK of the PLL is not used, should be 0

Reference Manual to LL API cross reference:

- PLLCFGR PLLPEN LL_RCC_PLL_DisableDomain_PLLP

LL_RCC_PLL_IsEnabledDomain_PLLP

Function name

__STATIC_INLINE uint32_t LL_RCC_PLL_IsEnabledDomain_PLLP (void)

Function description

Check if PLL output mapped on P domain clock is enabled.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- PLLCFGR PLLPEN LL_RCC_PLL_IsEnabledDomain_PLLP

LL_RCC_PLL_EnableDomain_PLLQ

Function name

__STATIC_INLINE void LL_RCC_PLL_EnableDomain_PLLQ (void)

Function description

Enable PLL output mapped on 48MHz domain clock.

Return values

- **None:**

Reference Manual to LL API cross reference:

- PLLCFGR PLLQEN LL_RCC_PLL_EnableDomain_PLLQ

LL_RCC_PLL_DisableDomain_PLLQ

Function name

__STATIC_INLINE void LL_RCC_PLL_DisableDomain_PLLQ (void)

Function description

Disable PLL output mapped on 48MHz domain clock.

Return values

- **None:**

Notes

- Cannot be disabled if the PLL clock is used as the system clock
- In order to save power, when the PLLCLK of the PLL is not used, should be 0

Reference Manual to LL API cross reference:

- PLLCFGR PLLQEN LL_RCC_PLL_DisableDomain_PLLQ

LL_RCC_PLL_IsEnabledDomain_PLLQ

Function name

__STATIC_INLINE uint32_t LL_RCC_PLL_IsEnabledDomain_PLLQ (void)

Function description

Check if PLL output mapped on Q domain clock is enabled.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- PLLCFGR PLLQEN LL_RCC_PLL_IsEnabledDomain_PLLQ

LL_RCC_PLL_EnableDomain_SYS

Function name

__STATIC_INLINE void LL_RCC_PLL_EnableDomain_SYS (void)

Function description

Enable PLL output mapped on SYSCLK domain.

Return values

- **None:**

Reference Manual to LL API cross reference:

- PLLCFGR PLLREN LL_RCC_PLL_EnableDomain_SYS

LL_RCC_PLL_DisableDomain_SYS

Function name

__STATIC_INLINE void LL_RCC_PLL_DisableDomain_SYS (void)

Function description

Disable PLL output mapped on SYSCLK domain.

Return values

- **None:**

Notes

- Cannot be disabled if the PLL clock is used as the system clock
- In order to save power, when the PLLCLK of the PLL is not used, Main PLL should be 0

Reference Manual to LL API cross reference:

- PLLCFGR PLLREN LL_RCC_PLL_DisableDomain_SYS

LL_RCC_PLL_IsEnabledDomain_SYS

Function name

__STATIC_INLINE uint32_t LL_RCC_PLL_IsEnabledDomain_SYS (void)

Function description

Check if PLL output mapped on tR(SYS) domain clock is enabled.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- PLLCFGR PLLREN LL_RCC_PLL_IsEnabledDomain_SYS

LL_RCC_ClearFlag_LSIRDY

Function name

__STATIC_INLINE void LL_RCC_ClearFlag_LSIRDY (void)

Function description

Clear LSI ready interrupt flag.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CICR LSIRDYC LL_RCC_ClearFlag_LSIRDY

LL_RCC_ClearFlag_LSERDY

Function name

__STATIC_INLINE void LL_RCC_ClearFlag_LSERDY (void)

Function description

Clear LSE ready interrupt flag.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CICR LSERDYC LL_RCC_ClearFlag_LSERDY

LL_RCC_ClearFlag_MSIRDY

Function name

__STATIC_INLINE void LL_RCC_ClearFlag_MSIRDY (void)

Function description

Clear MSI ready interrupt flag.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CICR MSIRDYC LL_RCC_ClearFlag_MSIRDY

LL_RCC_ClearFlag_HSIRDY

Function name

__STATIC_INLINE void LL_RCC_ClearFlag_HSIRDY (void)

Function description

Clear HSI ready interrupt flag.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CICR HSIRDYC LL_RCC_ClearFlag_HSIRDY

LL_RCC_ClearFlag_HSERDY

Function name

__STATIC_INLINE void LL_RCC_ClearFlag_HSERDY (void)

Function description

Clear HSE ready interrupt flag.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CICR HSERDYC LL_RCC_ClearFlag_HSERDY

LL_RCC_ClearFlag_PLLRDY

Function name

__STATIC_INLINE void LL_RCC_ClearFlag_PLLRDY (void)

Function description

Clear PLL ready interrupt flag.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CICR PLLRDYC LL_RCC_ClearFlag_PLLRDY

LL_RCC_ClearFlag_CSS

Function name

__STATIC_INLINE void LL_RCC_ClearFlag_CSS (void)

Function description

Clear Clock security system interrupt flag.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CICR CSSC LL_RCC_ClearFlag_HSECSS

LL_RCC_ClearFlag_LSECSS

Function name

__STATIC_INLINE void LL_RCC_ClearFlag_LSECSS (void)

Function description

Clear LSE Clock security system interrupt flag.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CICR LSECSSC LL_RCC_ClearFlag_LSECSS

LL_RCC_ClearFlag_HSI48RDY

Function name

__STATIC_INLINE void LL_RCC_ClearFlag_HSI48RDY (void)

Function description

Clear LSE Clock security system interrupt flag.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CICR HSI48RDYC LL_RCC_ClearFlag_HSI48RDY

LL_RCC_IsActiveFlag_LSIRDY

Function name

__STATIC_INLINE uint32_t LL_RCC_IsActiveFlag_LSIRDY (void)

Function description

Check if LSI ready interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CIFR LSIRDYF LL_RCC_IsActiveFlag_LSIRDY

LL_RCC_IsActiveFlag_LSERDY

Function name

__STATIC_INLINE uint32_t LL_RCC_IsActiveFlag_LSERDY (void)

Function description

Check if LSE ready interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CIFR LSERDYF LL_RCC_IsActiveFlag_LSERDY

LL_RCC_IsActiveFlag_MSIRDY

Function name

__STATIC_INLINE uint32_t LL_RCC_IsActiveFlag_MSIRDY (void)

Function description

Check if MSI ready interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CIFR MSIRDYF LL_RCC_IsActiveFlag_MSIRDY

LL_RCC_IsActiveFlag_HSIRDY

Function name

__STATIC_INLINE uint32_t LL_RCC_IsActiveFlag_HSIRDY (void)

Function description

Check if HSI ready interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CIFR HSIRDYF LL_RCC_IsActiveFlag_HSIRDY

LL_RCC_IsActiveFlag_HSERDY

Function name

__STATIC_INLINE uint32_t LL_RCC_IsActiveFlag_HSERDY (void)

Function description

Check if HSE ready interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CIFR HSERDYF LL_RCC_IsActiveFlag_HSERDY

LL_RCC_IsActiveFlag_PLLRDY

Function name

__STATIC_INLINE uint32_t LL_RCC_IsActiveFlag_PLLRDY (void)

Function description

Check if PLL ready interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CIFR PLLRDYF LL_RCC_IsActiveFlag_PLLRDY

LL_RCC_IsActiveFlag_HSI48RDY

Function name

__STATIC_INLINE uint32_t LL_RCC_IsActiveFlag_HSI48RDY (void)

Function description

Check if HSI48 ready interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CIR HSI48RDYF LL_RCC_IsActiveFlag_HSI48RDY

LL_RCC_IsActiveFlag_LSECSS

Function name

__STATIC_INLINE uint32_t LL_RCC_IsActiveFlag_LSECSS (void)

Function description

Check if Clock security system interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CIFR CSSF LL_RCC_IsActiveFlag_HSECSS

LL_RCC_IsActiveFlag_CSS

Function name

__STATIC_INLINE uint32_t LL_RCC_IsActiveFlag_CSS (void)

Function description

Check if LSE Clock security system interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CIFR LSECSSF LL_RCC_IsActiveFlag_LSECSS

LL_RCC_IsActiveFlag_IWDGRST

Function name

__STATIC_INLINE uint32_t LL_RCC_IsActiveFlag_IWDGRST (void)

Function description

Check if RCC flag Watchdog reset is set or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CSR IWDGRSTF LL_RCC_IsActiveFlag_IWDGRST

LL_RCC_IsActiveFlag_LPWRRST

Function name

__STATIC_INLINE uint32_t LL_RCC_IsActiveFlag_LPWRRST (void)

Function description

Check if RCC flag Low Power reset is set or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CSR LPWRRSTF LL_RCC_IsActiveFlag_LPWRRST

LL_RCC_IsActiveFlag_OBLRST

Function name

__STATIC_INLINE uint32_t LL_RCC_IsActiveFlag_OBLRST (void)

Function description

Check if RCC flag is set or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CSR OBLRSTF LL_RCC_IsActiveFlag_OBLRST

LL_RCC_IsActiveFlag_PINRST

Function name

__STATIC_INLINE uint32_t LL_RCC_IsActiveFlag_PINRST (void)

Function description

Check if RCC flag Pin reset is set or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CSR PINRSTF LL_RCC_IsActiveFlag_PINRST

LL_RCC_IsActiveFlag_SFTRST

Function name

__STATIC_INLINE uint32_t LL_RCC_IsActiveFlag_SFTRST (void)

Function description

Check if RCC flag Software reset is set or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CSR SFTRSTF LL_RCC_IsActiveFlag_SFTRST

LL_RCC_IsActiveFlag_WWDGRST

Function name

__STATIC_INLINE uint32_t LL_RCC_IsActiveFlag_WWDGRST (void)

Function description

Check if RCC flag Window Watchdog reset is set or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CSR WWDGRSTF LL_RCC_IsActiveFlag_WWDGRST

LL_RCC_IsActiveFlag_PWRRST

Function name

__STATIC_INLINE uint32_t LL_RCC_IsActiveFlag_PWRRST (void)

Function description

Check if RCC flag PWR reset is set or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CSR PWRRSTF LL_RCC_IsActiveFlag_PWRRST

LL_RCC_ClearResetFlags

Function name

__STATIC_INLINE void LL_RCC_ClearResetFlags (void)

Function description

Set RMVF bit to clear the reset flags.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CSR RMVF LL_RCC_ClearResetFlags

LL_RCC_EnableIT_LSIRDY

Function name

__STATIC_INLINE void LL_RCC_EnableIT_LSIRDY (void)

Function description

Enable LSI ready interrupt.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CIER LSIRDYIE LL_RCC_EnableIT_LSIRDY

LL_RCC_EnableIT_LSERDY

Function name

__STATIC_INLINE void LL_RCC_EnableIT_LSERDY (void)

Function description

Enable LSE ready interrupt.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CIER LSERDYIE LL_RCC_EnableIT_LSERDY

LL_RCC_EnableIT_MSIRDY

Function name

__STATIC_INLINE void LL_RCC_EnableIT_MSIRDY (void)

Function description

Enable MSI ready interrupt.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CIER MSIRDYIE LL_RCC_EnableIT_MSIRDY

LL_RCC_EnableIT_HSIRDY

Function name

__STATIC_INLINE void LL_RCC_EnableIT_HSIRDY (void)

Function description

Enable HSI ready interrupt.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CIER HSIRDYIE LL_RCC_EnableIT_HSIRDY

LL_RCC_EnableIT_HSERDY

Function name

__STATIC_INLINE void LL_RCC_EnableIT_HSERDY (void)

Function description

Enable HSE ready interrupt.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CIER HSERDYIE LL_RCC_EnableIT_HSERDY

LL_RCC_EnableIT_PLLRDY

Function name

__STATIC_INLINE void LL_RCC_EnableIT_PLLRDY (void)

Function description

Enable PLL ready interrupt.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CIER PLLRDYIE LL_RCC_EnableIT_PLLRDY

LL_RCC_EnableIT_HSI48RDY

Function name

__STATIC_INLINE void LL_RCC_EnableIT_HSI48RDY (void)

Function description

Enable HSI48 ready interrupt.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CIER HSI48RDYIE LL_RCC_EnableIT_HSI48RDY

LL_RCC_EnableIT_LSECSS

Function name

__STATIC_INLINE void LL_RCC_EnableIT_LSECSS (void)

Function description

Enable LSE clock security system interrupt.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CIER LSECSSIE LL_RCC_EnableIT_LSECSS

LL_RCC_DisableIT_LSIRDY

Function name

__STATIC_INLINE void LL_RCC_DisableIT_LSIRDY (void)

Function description

Disable LSI ready interrupt.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CIER LSIRDYIE LL_RCC_DisableIT_LSIRDY

LL_RCC_DisableIT_LSERDY

Function name

__STATIC_INLINE void LL_RCC_DisableIT_LSERDY (void)

Function description

Disable LSE ready interrupt.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CIER LSERDYIE LL_RCC_DisableIT_LSERDY

LL_RCC_DisableIT_MSIRDY

Function name

__STATIC_INLINE void LL_RCC_DisableIT_MSIRDY (void)

Function description

Disable MSI ready interrupt.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CIER MSIRDYIE LL_RCC_DisableIT_MSIRDY

LL_RCC_DisableIT_HSIRDY

Function name

__STATIC_INLINE void LL_RCC_DisableIT_HSIRDY (void)

Function description

Disable HSI ready interrupt.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CIER HSIRDYIE LL_RCC_DisableIT_HSIRDY

LL_RCC_DisableIT_HSERDY

Function name

__STATIC_INLINE void LL_RCC_DisableIT_HSERDY (void)

Function description

Disable HSE ready interrupt.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CIER HSERDYIE LL_RCC_DisableIT_HSERDY

LL_RCC_DisableIT_PLLRDY

Function name

__STATIC_INLINE void LL_RCC_DisableIT_PLLRDY (void)

Function description

Disable PLL ready interrupt.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CIER PLLRDYIE LL_RCC_DisableIT_PLLRDY

LL_RCC_DisableIT_HSI48RDY

Function name

__STATIC_INLINE void LL_RCC_DisableIT_HSI48RDY (void)

Function description

Disable HSI48 ready interrupt.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CIER HSI48RDYIE LL_RCC_DisableIT_HSI48RDY

LL_RCC_DisableIT_LSECSS

Function name

__STATIC_INLINE void LL_RCC_DisableIT_LSECSS (void)

Function description

Disable LSE clock security system interrupt.

Return values

- **None:**

Reference Manual to LL API cross reference:

- CIER LSECSSIE LL_RCC_DisableIT_LSECSS

LL_RCC_IsEnabledIT_LSIRDY

Function name

__STATIC_INLINE uint32_t LL_RCC_IsEnabledIT_LSIRDY (void)

Function description

Checks if LSI ready interrupt source is enabled or disabled.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CIER LSIRDYIE LL_RCC_IsEnabledIT_LSIRDY

LL_RCC_IsEnabledIT_LSERDY

Function name

__STATIC_INLINE uint32_t LL_RCC_IsEnabledIT_LSERDY (void)

Function description

Checks if LSE ready interrupt source is enabled or disabled.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CIER LSERDYIE LL_RCC_IsEnabledIT_LSERDY

LL_RCC_IsEnabledIT_MSIRDY

Function name

__STATIC_INLINE uint32_t LL_RCC_IsEnabledIT_MSIRDY (void)

Function description

Checks if MSI ready interrupt source is enabled or disabled.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CIER MSIRDYIE LL_RCC_IsEnabledIT_MSIRDY

LL_RCC_IsEnabledIT_HSIRDY

Function name

__STATIC_INLINE uint32_t LL_RCC_IsEnabledIT_HSIRDY (void)

Function description

Checks if HSI ready interrupt source is enabled or disabled.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CIER HSIRDYIE LL_RCC_IsEnabledIT_HSIRDY

LL_RCC_IsEnabledIT_HSERDY

Function name

__STATIC_INLINE uint32_t LL_RCC_IsEnabledIT_HSERDY (void)

Function description

Checks if HSE ready interrupt source is enabled or disabled.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CIER HSERDYIE LL_RCC_IsEnabledIT_HSERDY

LL_RCC_IsEnabledIT_PLLRDY

Function name

__STATIC_INLINE uint32_t LL_RCC_IsEnabledIT_PLLRDY (void)

Function description

Checks if PLL ready interrupt source is enabled or disabled.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CIER PLLRDYIE LL_RCC_IsEnabledIT_PLLRDY

LL_RCC_IsEnabledIT_HSI48RDY

Function name

__STATIC_INLINE uint32_t LL_RCC_IsEnabledIT_HSI48RDY (void)

Function description

Checks if HSI48 ready interrupt source is enabled or disabled.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CIER HSI48RDYIE LL_RCC_IsEnabledIT_HSI48RDY

LL_RCC_IsEnabledIT_LSECSS

Function name

__STATIC_INLINE uint32_t LL_RCC_IsEnabledIT_LSECSS (void)

Function description

Checks if LSECSS interrupt source is enabled or disabled.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CIER LSECSSIE LL_RCC_IsEnabledIT_LSECSS

LL_RCC_DeInit

Function name

ErrorStatus LL_RCC_DeInit (void)

Function description

Reset the RCC clock configuration to the default reset state.

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: RCC registers are de-initialized
  - ERROR: not applicable

Notes

- The default reset state of the clock configuration is given below: MSI ON and used as system clock sourceHSE, HSI, PLL and PLLSAIxSource OFFAHB, APB prescaler set to 1.CSS, MCO OFFAll interrupts disabled
- This function doesn't modify the configuration of the Peripheral clocksLSI, LSE and RTC clocks

LL_RCC_GetSystemClocksFreq

Function name

void LL_RCC_GetSystemClocksFreq (LL_RCC_ClocksTypeDef * RCC_Clocks)

Function description

Return the frequencies of different on chip clocks; System, AHB, APB buses clocks.

Parameters

- **RCC_Clocks:** pointer to a LL_RCC_ClocksTypeDef structure which will hold the clocks frequencies

Return values

- **None:**

Notes

- Each time SYSCLK, HCLK, PCLK1 and/or PCLK2 clock changes, this function must be called to update structure fields. Otherwise, any configuration based on this function will be incorrect.

LL_RCC_GetUSARTClockFreq

Function name

uint32_t LL_RCC_GetUSARTClockFreq (uint32_t USARTxSource)

Function description

Return USARTx clock frequency.

Parameters

- **USARTxSource:** This parameter can be one of the following values:
  - LL_RCC_USART1_CLKSOURCE
  - LL_RCC_USART2_CLKSOURCE
  - LL_RCC_USART3_CLKSOURCE
  - LL_RCC_USART4_CLKSOURCE

Return values

- **USART:** clock frequency (in Hz)
  - LL_RCC_PERIPH_FREQUENCY_NO indicates that oscillator (HSI or LSE) is not ready

LL_RCC_GetI2CClockFreq

Function name

uint32_t LL_RCC_GetI2CClockFreq (uint32_t I2CxSource)

Function description

Return I2Cx clock frequency.

Parameters

- **I2CxSource:** This parameter can be one of the following values:
  - LL_RCC_I2C1_CLKSOURCE
  - LL_RCC_I2C3_CLKSOURCE

  (*) value not defined in all devices.

Return values

- **I2C:** clock frequency (in Hz)
  - LL_RCC_PERIPH_FREQUENCY_NO indicates that HSI oscillator is not ready

LL_RCC_GetLPUARTClockFreq

Function name

uint32_t LL_RCC_GetLPUARTClockFreq (uint32_t LPUARTxSource)

Function description

Return LPUARTx clock frequency.

Parameters

- **LPUARTxSource:** This parameter can be one of the following values:
  - LL_RCC_LPUART1_CLKSOURCE

Return values

- **LPUART:** clock frequency (in Hz)
  - LL_RCC_PERIPH_FREQUENCY_NO indicates that oscillator (HSI or LSE) is not ready

LL_RCC_GetTIMClockFreq

Function name

uint32_t LL_RCC_GetTIMClockFreq (uint32_t TIMxSource)

Function description

Return TIMx clock frequency.

Parameters

- **TIMxSource:** This parameter can be one of the following values:
  - LL_RCC_TIM1_CLKSOURCE
  - LL_RCC_TIM15_CLKSOURCE

  (*) value not defined in all devices.

Return values

- **USART:** clock frequency (in Hz)
  - LL_RCC_PERIPH_FREQUENCY_NO indicates that oscillator (HSI or LSE) is not ready

LL_RCC_GetLPTIMClockFreq

Function name

uint32_t LL_RCC_GetLPTIMClockFreq (uint32_t LPTIMxSource)

Function description

Return LPTIMx clock frequency.

Parameters

- **LPTIMxSource:** This parameter can be one of the following values:
  - LL_RCC_LPTIM1_CLKSOURCE
  - LL_RCC_LPTIM2_CLKSOURCE
  - LL_RCC_LPTIM3_CLKSOURCE (*)

  (*) value not defined in all devices.

Return values

- **LPTIM:** clock frequency (in Hz)
  - LL_RCC_PERIPH_FREQUENCY_NO indicates that oscillator (HSI, LSI or LSE) is not ready

LL_RCC_GetRNGClockFreq

Function name

uint32_t LL_RCC_GetRNGClockFreq (uint32_t RNGxSource)

Function description

Return RNGx clock frequency.

Parameters

- **RNGxSource:** This parameter can be one of the following values:
  - LL_RCC_RNG_CLKSOURCE

Return values

- **RNG:** clock frequency (in Hz)
  - LL_RCC_PERIPH_FREQUENCY_NO indicates that oscillator (MSI) or PLL is not ready
  - LL_RCC_PERIPH_FREQUENCY_NA indicates that no clock source selected

LL_RCC_GetUSBClockFreq

Function name

uint32_t LL_RCC_GetUSBClockFreq (uint32_t USBxSource)

Function description

LL_RCC_GetRTCClockFreq

Function name

uint32_t LL_RCC_GetRTCClockFreq (void)

Function description

Return RTC clock frequency.

Return values

- **RTC:** clock frequency (in Hz)
  - LL_RCC_PERIPH_FREQUENCY_NO indicates that oscillators (LSI, LSE or HSE) are not ready
  - LL_RCC_PERIPH_FREQUENCY_NA indicates that no clock source selected

LL_RCC_GetADCClockFreq

Function name

uint32_t LL_RCC_GetADCClockFreq (uint32_t ADCxSource)

Function description

Return ADCx clock frequency.

Parameters

- **ADCxSource:** This parameter can be one of the following values:
  - LL_RCC_ADC_CLKSOURCE

Return values

- **ADC:** clock frequency (in Hz)
  - LL_RCC_PERIPH_FREQUENCY_NO indicates that oscillator (MSI) or PLL is not ready
  - LL_RCC_PERIPH_FREQUENCY_NA indicates that no clock source selected

72.3 RCC Firmware driver defines

The following section lists the various define and macros of the module.

72.3.1 RCC

RCC

Peripheral ADC get clock source

LL_RCC_ADC_CLKSOURCE

ADC Clock source selection

Peripheral ADC clock source selection

LL_RCC_ADC_CLKSOURCE_SYSCLK

SYSCLK clock used as ADC clock source

LL_RCC_ADC_CLKSOURCE_PLLP

PLL P clock used as ADC clock source

LL_RCC_ADC_CLKSOURCE_HSI

HSI clock used as ADC clock source

LL_RCC_ADC_CLKSOURCE_NONE

No clock used as ADC clock source

APB low-speed prescaler (APB1)

LL_RCC_APB1_DIV_1

APB not divided

LL_RCC_APB1_DIV_2

APB divided by 2

LL_RCC_APB1_DIV_4

APB divided by 4

LL_RCC_APB1_DIV_8

APB divided by 8

LL_RCC_APB1_DIV_16

APB divided by 16

Clear Flags Defines

LL_RCC_CICR_LSIRDYC

LSI Ready Interrupt Clear

LL_RCC_CICR_LSERDYC

LSE Ready Interrupt Clear

LL_RCC_CICR_MSIRDYC

MSI Ready Interrupt Clear

LL_RCC_CICR_HSIRDYC

HSI Ready Interrupt Clear

LL_RCC_CICR_HSERDYC

HSE Ready Interrupt Clear

LL_RCC_CICR_PLLRDYC

PLL Ready Interrupt Clear

LL_RCC_CICR_CSSC

Clock Security System Interrupt Clear

LL_RCC_CICR_LSECSSC

LSE Clock Security System Interrupt Clear

LL_RCC_CICR_HSI48RDYC

HSI48 Clock Security System Interrupt Clear

Get Flags Defines

LL_RCC_CIFR_LSIRDYF

LSI Ready Interrupt flag

LL_RCC_CIFR_LSERDYF

LSE Ready Interrupt flag

LL_RCC_CIFR_MSIRDYF

MSI Ready Interrupt flag

LL_RCC_CIFR_HSIRDYF

HSI Ready Interrupt flag

LL_RCC_CIFR_HSERDYF

HSE Ready Interrupt flag

LL_RCC_CIFR_PLLRDYF

PLL Ready Interrupt flag

LL_RCC_CIFR_CSSF

HSE Clock Security System Interrupt flag

LL_RCC_CIFR_LSECSSF

LSE Clock Security System Interrupt flag

LL_RCC_CIFR_HSI48RDYF

HSI48 Ready Interrupt flag

LL_RCC_CSR_RMVF

Low-Power reset flag

LL_RCC_CSR_OBLRSTF

OBL reset flag

LL_RCC_CSR_PINRSTF

PIN reset flag

LL_RCC_CSR_PWRRSTF

PWR reset flag

LL_RCC_CSR_SFTRSTF

Software Reset flag

LL_RCC_CSR_IWDGRSTF

Independent Watchdog reset flag

LL_RCC_CSR_WWDGRSTF

Window watchdog reset flag

LL_RCC_CSR_LPWRRSTF

Low-Power reset flag

Peripheral I2C get clock source

LL_RCC_I2C1_CLKSOURCE

I2C1 Clock source selection

LL_RCC_I2C3_CLKSOURCE

I2C3 Clock source selection

Peripheral I2C clock source selection

LL_RCC_I2C1_CLKSOURCE_PCLK1

PCLK1 clock used as I2C1 clock source

LL_RCC_I2C1_CLKSOURCE_SYSCLK

SYSCLK clock used as I2C1 clock source

LL_RCC_I2C1_CLKSOURCE_HSI

HSI clock used as I2C1 clock source

LL_RCC_I2C3_CLKSOURCE_PCLK1

PCLK1 clock used as I2C3 clock source

LL_RCC_I2C3_CLKSOURCE_SYSCLK

SYSCLK clock used as I2C3 clock source

LL_RCC_I2C3_CLKSOURCE_HSI

HSI clock used as I2C3 clock source

IT Defines

LL_RCC_CIER_LSIRDYIE

LSI Ready Interrupt Enable

LL_RCC_CIER_LSERDYIE

LSE Ready Interrupt Enable

LL_RCC_CIER_MSIRDYIE

MSI Ready Interrupt Enable

LL_RCC_CIER_HSIRDYIE

HSI Ready Interrupt Enable

LL_RCC_CIER_HSERDYIE

HSE Ready Interrupt Enable

LL_RCC_CIER_PLLRDYIE

PLL Ready Interrupt Enable

LL_RCC_CIER_LSECSSIE

LSE CSS Interrupt Enable

LL_RCC_CIER_HSI48RDYIE

HSI48 Ready Interrupt Enable

Peripheral LPTIM get clock source

LL_RCC_LPTIM1_CLKSOURCE

LPTIM2 Clock source selection

LL_RCC_LPTIM2_CLKSOURCE

LPTIM2 Clock source selection

LL_RCC_LPTIM3_CLKSOURCE

LPTIM2 Clock source selection

Peripheral LPTIM clock source selection

LL_RCC_LPTIM1_CLKSOURCE_PCLK1

PCLK selected as LPTIM1 clock

LL_RCC_LPTIM1_CLKSOURCE_LSI

LSI selected as LPTIM1 clock

LL_RCC_LPTIM1_CLKSOURCE_HSI

HSI selected as LPTIM1 clock

LL_RCC_LPTIM1_CLKSOURCE_LSE

LSE selected as LPTIM1 clock

LL_RCC_LPTIM2_CLKSOURCE_PCLK1

PCLK selected as LPTIM2 clock

LL_RCC_LPTIM2_CLKSOURCE_LSI

LSI selected as LPTIM2 clock

LL_RCC_LPTIM2_CLKSOURCE_HSI

HSI selected as LPTIM2 clock

LL_RCC_LPTIM2_CLKSOURCE_LSE

LSE selected as LPTIM2 clock

LL_RCC_LPTIM3_CLKSOURCE_PCLK1

PCLK selected as LPTIM3 clock

LL_RCC_LPTIM3_CLKSOURCE_LSI

LSI selected as LPTIM3 clock

LL_RCC_LPTIM3_CLKSOURCE_HSI

HSI selected as LPTIM3 clock

LL_RCC_LPTIM3_CLKSOURCE_LSE

LSE selected as LPTIM3 clock

Peripheral LPUART get clock source

LL_RCC_LPUART1_CLKSOURCE

LPUART1 Clock source selection

LL_RCC_LPUART2_CLKSOURCE

LPUART2 Clock source selection

LL_RCC_LPUART3_CLKSOURCE

LPUART3 Clock source selection

Peripheral LPUART clock source selection

LL_RCC_LPUART3_CLKSOURCE_PCLK1

PCLK clock used as LPUART3 clock source

LL_RCC_LPUART3_CLKSOURCE_SYSCLK

SYSCLK clock used as LPUART3 clock source

LL_RCC_LPUART3_CLKSOURCE_HSI

HSI clock used as LPUART3 clock source

LL_RCC_LPUART3_CLKSOURCE_LSE

LSE clock used as LPUART3 clock source

LL_RCC_LPUART2_CLKSOURCE_PCLK1

PCLK clock used as LPUART2 clock source

LL_RCC_LPUART2_CLKSOURCE_SYSCLK

SYSCLK clock used as LPUART2 clock source

LL_RCC_LPUART2_CLKSOURCE_HSI

HSI clock used as LPUART2 clock source

LL_RCC_LPUART2_CLKSOURCE_LSE

LSE clock used as LPUART2 clock source

LL_RCC_LPUART1_CLKSOURCE_PCLK1

PCLK clock used as LPUART1 clock source

LL_RCC_LPUART1_CLKSOURCE_SYSCLK

SYSCLK clock used as LPUART1 clock source

LL_RCC_LPUART1_CLKSOURCE_HSI

HSI clock used as LPUART1 clock source

LL_RCC_LPUART1_CLKSOURCE_LSE

LSE clock used as LPUART1 clock source

LSCO Selection

LL_RCC_LSCO_CLKSOURCE_LSI

LSI selection for low speed clock

LL_RCC_LSCO_CLKSOURCE_LSE

LSE selection for low speed clock

LSE oscillator drive capability

LL_RCC_LSEDRIVE_LOW

Xtal mode lower driving capability

LL_RCC_LSEDRIVE_MEDIUMLOW

Xtal mode medium low driving capability

LL_RCC_LSEDRIVE_MEDIUMHIGH

Xtal mode medium high driving capability

LL_RCC_LSEDRIVE_HIGH

Xtal mode higher driving capability

LSI prescaler

LL_RCC_LSI_DIV_1

LSI divided by 1

LL_RCC_LSI_DIV_128

LSI divided by 128

MCO1 SOURCE selection

LL_RCC_MCO1SOURCE_NOCLOCK

MCO output disabled, no clock on MCO

LL_RCC_MCO1SOURCE_SYSCLK

SYSCLK selection as MCO1 source

LL_RCC_MCO1SOURCE_MSI

MSI selection as MCO1 source

LL_RCC_MCO1SOURCE_HSI16

HSI16 selection as MCO1 source

LL_RCC_MCO1SOURCE_HSE

HSE selection as MCO1 source

LL_RCC_MCO1SOURCE_PLLCLK

Main PLL selection as MCO1 source

LL_RCC_MCO1SOURCE_LSI

LSI selection as MCO1 source

LL_RCC_MCO1SOURCE_LSE

LSE selection as MCO1 source

LL_RCC_MCO1SOURCE_HSI48

HSI48 selection as MCO1 source

LL_RCC_MCO1SOURCE_RTC

RTC alter clk selection as MCO1 source

LL_RCC_MCO1SOURCE_RTCWUPI

RTC wakeup interrupt signal selection as MCO1 source

MCO1 prescaler

LL_RCC_MCO1_DIV_1

MCO not divided

LL_RCC_MCO1_DIV_2

MCO divided by 2

LL_RCC_MCO1_DIV_4

MCO divided by 4

LL_RCC_MCO1_DIV_8

MCO divided by 8

LL_RCC_MCO1_DIV_16

MCO divided by 16

LL_RCC_MCO1_DIV_32

MCO divided by 32

LL_RCC_MCO1_DIV_64

MCO divided by 64

LL_RCC_MCO1_DIV_128

MCO divided by 128

LL_RCC_MCO1_DIV_256

MCO divided by 256

LL_RCC_MCO1_DIV_512

MCO divided by 512

LL_RCC_MCO1_DIV_1024

MCO divided by 1024

MCO2 SOURCE selection

LL_RCC_MCO2SOURCE_NOCLOCK

MCO output disabled, no clock on MCO2

LL_RCC_MCO2SOURCE_SYSCLK

SYSCLK selection as MCO2 source

LL_RCC_MCO2SOURCE_MSI

MSI selection as MCO2 source

LL_RCC_MCO2SOURCE_HSI16

HSI16 selection as MCO2 source

LL_RCC_MCO2SOURCE_HSE

HSE selection as MCO2 source

LL_RCC_MCO2SOURCE_PLLCLK

Main PLL selection as MCO2 source

LL_RCC_MCO2SOURCE_LSI

LSI selection as MCO2 source

LL_RCC_MCO2SOURCE_LSE

LSE selection as MCO2 source

LL_RCC_MCO2SOURCE_HSI48

HSI48 selection as MCO2 source

LL_RCC_MCO2SOURCE_RTC

RTC alter clk selection as MCO2 source

LL_RCC_MCO2SOURCE_RTCWUPI

RTC wakeup interrupt signal selection as MCO2 source

MCO2 prescaler

LL_RCC_MCO2_DIV_1

MCO not divided

LL_RCC_MCO2_DIV_2

MCO divided by 2

LL_RCC_MCO2_DIV_4

MCO divided by 4

LL_RCC_MCO2_DIV_8

MCO divided by 8

LL_RCC_MCO2_DIV_16

MCO divided by 16

LL_RCC_MCO2_DIV_32

MCO divided by 32

LL_RCC_MCO2_DIV_64

MCO divided by 64

LL_RCC_MCO2_DIV_128

MCO divided by 128

LL_RCC_MCO2_DIV_256

MCO divided by 256

LL_RCC_MCO2_DIV_512

MCO divided by 512

LL_RCC_MCO2_DIV_1024

MCO divided by 1024

MSI clock ranges

LL_RCC_MSIRANGE_0

MSI = 100 KHz

LL_RCC_MSIRANGE_1

MSI = 200 KHz

LL_RCC_MSIRANGE_2

MSI = 400 KHz

LL_RCC_MSIRANGE_3

MSI = 800 KHz

LL_RCC_MSIRANGE_4

MSI = 1 MHz

LL_RCC_MSIRANGE_5

MSI = 2 MHz

LL_RCC_MSIRANGE_6

MSI = 4 MHz

LL_RCC_MSIRANGE_7

MSI = 8 MHz

LL_RCC_MSIRANGE_8

MSI = 16 MHz

LL_RCC_MSIRANGE_9

MSI = 24 MHz

LL_RCC_MSIRANGE_10

MSI = 32 MHz

LL_RCC_MSIRANGE_11

MSI = 48 MHz

MSI clock range selection

LL_RCC_MSIRANGESEL_STANDBY

MSI Range is provided by MSISRANGE

LL_RCC_MSIRANGESEL_RUN

MSI Range is provided by MSIRANGE

MSI range after Standby mode

LL_RCC_MSISRANGE_4

MSI = 1 MHz

LL_RCC_MSISRANGE_5

MSI = 2 MHz

LL_RCC_MSISRANGE_6

MSI = 4 MHz

LL_RCC_MSISRANGE_7

MSI = 8 MHz

Peripheral clock frequency

LL_RCC_PERIPH_FREQUENCY_NO

No clock enabled for the peripheral

LL_RCC_PERIPH_FREQUENCY_NA

Frequency cannot be provided as external clock

PLL division factor

LL_RCC_PLLM_DIV_1

Main PLL division factor for PLLM input by 1

LL_RCC_PLLM_DIV_2

Main PLL division factor for PLLM input by 2

LL_RCC_PLLM_DIV_3

Main PLL division factor for PLLM input by 3

LL_RCC_PLLM_DIV_4

Main PLL division factor for PLLM input by 4

LL_RCC_PLLM_DIV_5

Main PLL division factor for PLLM input by 5

LL_RCC_PLLM_DIV_6

Main PLL division factor for PLLM input by 6

LL_RCC_PLLM_DIV_7

Main PLL division factor for PLLM input by 7

LL_RCC_PLLM_DIV_8

Main PLL division factor for PLLM input by 8

PLL division factor (PLLP)

LL_RCC_PLLP_DIV_2

Main PLL division factor for PLLP output by 2

LL_RCC_PLLP_DIV_3

Main PLL division factor for PLLP output by 3

LL_RCC_PLLP_DIV_4

Main PLL division factor for PLLP output by 4

LL_RCC_PLLP_DIV_5

Main PLL division factor for PLLP output by 5

LL_RCC_PLLP_DIV_6

Main PLL division factor for PLLP output by 6

LL_RCC_PLLP_DIV_7

Main PLL division factor for PLLP output by 7

LL_RCC_PLLP_DIV_8

Main PLL division factor for PLLP output by 8

LL_RCC_PLLP_DIV_9

Main PLL division factor for PLLP output by 9

LL_RCC_PLLP_DIV_10

Main PLL division factor for PLLP output by 10

LL_RCC_PLLP_DIV_11

Main PLL division factor for PLLP output by 11

LL_RCC_PLLP_DIV_12

Main PLL division factor for PLLP output by 12

LL_RCC_PLLP_DIV_13

Main PLL division factor for PLLP output by 13

LL_RCC_PLLP_DIV_14

Main PLL division factor for PLLP output by 14

LL_RCC_PLLP_DIV_15

Main PLL division factor for PLLP output by 15

LL_RCC_PLLP_DIV_16

Main PLL division factor for PLLP output by 16

LL_RCC_PLLP_DIV_17

Main PLL division factor for PLLP output by 17

LL_RCC_PLLP_DIV_18

Main PLL division factor for PLLP output by 18

LL_RCC_PLLP_DIV_19

Main PLL division factor for PLLP output by 19

LL_RCC_PLLP_DIV_20

Main PLL division factor for PLLP output by 20

LL_RCC_PLLP_DIV_21

Main PLL division factor for PLLP output by 21

LL_RCC_PLLP_DIV_22

Main PLL division factor for PLLP output by 22

LL_RCC_PLLP_DIV_23

Main PLL division factor for PLLP output by 23

LL_RCC_PLLP_DIV_24

Main PLL division factor for PLLP output by 24

LL_RCC_PLLP_DIV_25

Main PLL division factor for PLLP output by 25

LL_RCC_PLLP_DIV_26

Main PLL division factor for PLLP output by 26

LL_RCC_PLLP_DIV_27

Main PLL division factor for PLLP output by 27

LL_RCC_PLLP_DIV_28

Main PLL division factor for PLLP output by 28

LL_RCC_PLLP_DIV_29

Main PLL division factor for PLLP output by 29

LL_RCC_PLLP_DIV_30

Main PLL division factor for PLLP output by 30

LL_RCC_PLLP_DIV_31

Main PLL division factor for PLLP output by 31

LL_RCC_PLLP_DIV_32

Main PLL division factor for PLLP output by 32

PLL division factor (PLLQ)

LL_RCC_PLLQ_DIV_2

Main PLL division factor for PLLQ output by 2

LL_RCC_PLLQ_DIV_3

Main PLL division factor for PLLQ output by 3

LL_RCC_PLLQ_DIV_4

Main PLL division factor for PLLQ output by 4

LL_RCC_PLLQ_DIV_5

Main PLL division factor for PLLQ output by 5

LL_RCC_PLLQ_DIV_6

Main PLL division factor for PLLQ output by 6

LL_RCC_PLLQ_DIV_7

Main PLL division factor for PLLQ output by 7

LL_RCC_PLLQ_DIV_8

Main PLL division factor for PLLQ output by 8

PLL division factor (PLLR)

LL_RCC_PLLR_DIV_2

Main PLL division factor for PLLCLK (system clock) by 2

LL_RCC_PLLR_DIV_3

Main PLL division factor for PLLCLK (system clock) by 3

LL_RCC_PLLR_DIV_4

Main PLL division factor for PLLCLK (system clock) by 4

LL_RCC_PLLR_DIV_5

Main PLL division factor for PLLCLK (system clock) by 5

LL_RCC_PLLR_DIV_6

Main PLL division factor for PLLCLK (system clock) by 6

LL_RCC_PLLR_DIV_7

Main PLL division factor for PLLCLK (system clock) by 7

LL_RCC_PLLR_DIV_8

Main PLL division factor for PLLCLK (system clock) by 8

PLL entry clock source

LL_RCC_PLLSOURCE_NONE

No clock selected as main PLL entry clock source

LL_RCC_PLLSOURCE_MSI

MSI clock selected as main PLL entry clock source

LL_RCC_PLLSOURCE_HSI

HSI16 clock selected as main PLL entry clock source

LL_RCC_PLLSOURCE_HSE

HSE clock selected as main PLL entry clock source

Peripheral RNG get clock source

LL_RCC_RNG_CLKSOURCE

RNG Clock source selection

Peripheral RNG clock source selection

LL_RCC_RNG_CLKSOURCE_NONE

No clock used as RNG clock source

LL_RCC_RNG_CLKSOURCE_MSI

MSI clock used as RNG clock source

LL_RCC_RNG_CLKSOURCE_PLLQ

PLL clock used as RNG clock source

LL_RCC_RNG_CLKSOURCE_HSI48

HSI48 clock used as RNG clock source

RTC clock source selection

LL_RCC_RTC_CLKSOURCE_NONE

No clock used as RTC clock

LL_RCC_RTC_CLKSOURCE_LSE

LSE oscillator clock used as RTC clock

LL_RCC_RTC_CLKSOURCE_LSI

LSI oscillator clock used as RTC clock

LL_RCC_RTC_CLKSOURCE_HSE_DIV32

HSE oscillator clock divided by 32 used as RTC clock

Wakeup from Stop and CSS backup clock selection

LL_RCC_STOP_WAKEUPCLOCK_MSI

MSI selection after wake-up from STOP

LL_RCC_STOP_WAKEUPCLOCK_HSI

HSI selection after wake-up from STOP

AHB prescaler

LL_RCC_SYSCLK_DIV_1

SYSCLK not divided

LL_RCC_SYSCLK_DIV_2

SYSCLK divided by 2

LL_RCC_SYSCLK_DIV_4

SYSCLK divided by 4

LL_RCC_SYSCLK_DIV_8

SYSCLK divided by 8

LL_RCC_SYSCLK_DIV_16

SYSCLK divided by 16

LL_RCC_SYSCLK_DIV_64

SYSCLK divided by 64

LL_RCC_SYSCLK_DIV_128

SYSCLK divided by 128

LL_RCC_SYSCLK_DIV_256

SYSCLK divided by 256

LL_RCC_SYSCLK_DIV_512

SYSCLK divided by 512

System clock switch

LL_RCC_SYS_CLKSOURCE_MSI

MSI selection as system clock

LL_RCC_SYS_CLKSOURCE_HSI

HSI selection as system clock

LL_RCC_SYS_CLKSOURCE_HSE

HSE selection as system clock

LL_RCC_SYS_CLKSOURCE_PLL

PLL selection as system clock

LL_RCC_SYS_CLKSOURCE_LSI

LSI selection as system clock

LL_RCC_SYS_CLKSOURCE_LSE

LSE selection as system clock

System clock switch status

LL_RCC_SYS_CLKSOURCE_STATUS_MSI

MSI used as system clock

LL_RCC_SYS_CLKSOURCE_STATUS_HSI

HSI used as system clock

LL_RCC_SYS_CLKSOURCE_STATUS_HSE

HSE used as system clock

LL_RCC_SYS_CLKSOURCE_STATUS_PLL

PLL used as system clock

LL_RCC_SYS_CLKSOURCE_STATUS_LSI

LSI used as system clock

LL_RCC_SYS_CLKSOURCE_STATUS_LSE

LSE used as system clock

Peripheral TIMx get clock source

LL_RCC_TIM1_CLKSOURCE

TIM1 Clock source selection

LL_RCC_TIM15_CLKSOURCE

TIM15 Clock source selection

Peripheral TIM clock source selection

LL_RCC_TIM1_CLKSOURCE_PCLK1

PCLK clock used as TIM1 clock source

LL_RCC_TIM1_CLKSOURCE_PLLQ

PLL used as TIM1 clock source

LL_RCC_TIM15_CLKSOURCE_PCLK1

PCLK clock used as TIM15 clock source

LL_RCC_TIM15_CLKSOURCE_PLLQ

PLL used as TIM15 clock source

Peripheral USART get clock source

LL_RCC_USART1_CLKSOURCE

USART1 Clock source selection

LL_RCC_USART2_CLKSOURCE

USART2 Clock source selection

LL_RCC_USART3_CLKSOURCE

To be used for USART3 Clock frequency retrieval

LL_RCC_USART4_CLKSOURCE

To be used for USART4 Clock frequency retrieval

Peripheral USART clock source selection

LL_RCC_USART1_CLKSOURCE_PCLK1

PCLK clock used as USART1 clock source

LL_RCC_USART1_CLKSOURCE_SYSCLK

SYSCLK clock used as USART1 clock source

LL_RCC_USART1_CLKSOURCE_HSI

HSI clock used as USART1 clock source

LL_RCC_USART1_CLKSOURCE_LSE

LSE clock used as USART1 clock source

LL_RCC_USART2_CLKSOURCE_PCLK1

PCLK clock used as USART2 clock source

LL_RCC_USART2_CLKSOURCE_SYSCLK

SYSCLK clock used as USART2 clock source

LL_RCC_USART2_CLKSOURCE_HSI

HSI clock used as USART2 clock source

LL_RCC_USART2_CLKSOURCE_LSE

LSE clock used as USART2 clock source

Peripheral USB get clock source

LL_RCC_USB_CLKSOURCE

USB Clock source selection

Peripheral USB clock source selection

LL_RCC_USB_CLKSOURCE_NONE

No clock used as USB clock source

LL_RCC_USB_CLKSOURCE_MSI

MSI clock used as USB clock source

LL_RCC_USB_CLKSOURCE_PLLQ

PLL clock used as USB clock source

LL_RCC_USB_CLKSOURCE_HSI48

HSI48 clock used as USB clock source

Calculate frequencies

__LL_RCC_CALC_PLLCLK_R_FREQ

Description:

- Helper macro to calculate the PLLCLK frequency on system domain.

Parameters:

- __INPUTFREQ__: PLL Input frequency (based on MSI/HSE/HSI)
- __PLLM__: This parameter can be one of the following values:
  - LL_RCC_PLLM_DIV_1
  - LL_RCC_PLLM_DIV_2
  - LL_RCC_PLLM_DIV_3
  - LL_RCC_PLLM_DIV_4
  - LL_RCC_PLLM_DIV_5
  - LL_RCC_PLLM_DIV_6
  - LL_RCC_PLLM_DIV_7
  - LL_RCC_PLLM_DIV_8
- __PLLN__: Between 4 and 127
- __PLLR__: This parameter can be one of the following values:
  - LL_RCC_PLLR_DIV_2
  - LL_RCC_PLLR_DIV_3
  - LL_RCC_PLLR_DIV_4
  - LL_RCC_PLLR_DIV_5
  - LL_RCC_PLLR_DIV_6
  - LL_RCC_PLLR_DIV_7
  - LL_RCC_PLLR_DIV_8

Return value:

- PLL: clock frequency (in Hz)

Notes:

- ex: __LL_RCC_CALC_PLLCLK_R_FREQ (HSE_VALUE,LL_RCC_PLL_GetM (), LL_RCC_PLL_GetN (), LL_RCC_PLL_GetR ());

__LL_RCC_CALC_PLLCLK_Q_FREQ

Description:

- Helper macro to calculate the PLLCLK frequency used on 48M domain.

Parameters:

- __INPUTFREQ__: PLL Input frequency (based on MSI/HSE/HSI)
- __PLLM__: This parameter can be one of the following values:
  - LL_RCC_PLLM_DIV_1
  - LL_RCC_PLLM_DIV_2
  - LL_RCC_PLLM_DIV_3
  - LL_RCC_PLLM_DIV_4
  - LL_RCC_PLLM_DIV_5
  - LL_RCC_PLLM_DIV_6
  - LL_RCC_PLLM_DIV_7
  - LL_RCC_PLLM_DIV_8
- __PLLN__: Between 4 and 127
- __PLLQ__: This parameter can be one of the following values:
  - LL_RCC_PLLQ_DIV_2
  - LL_RCC_PLLR_DIV_3
  - LL_RCC_PLLQ_DIV_4
  - LL_RCC_PLLR_DIV_5
  - LL_RCC_PLLQ_DIV_6
  - LL_RCC_PLLR_DIV_7
  - LL_RCC_PLLQ_DIV_8

Return value:

- PLL: clock frequency (in Hz)

Notes:

- ex: __LL_RCC_CALC_PLLCLK_Q_FREQ (HSE_VALUE,LL_RCC_PLL_GetM (), LL_RCC_PLL_GetN (), LL_RCC_PLL_GetQ ());

__LL_RCC_CALC_HCLK_FREQ

Description:

- Helper macro to calculate the HCLK frequency.

Parameters:

- __SYSCLKFREQ__: SYSCLK frequency (based on MSI/HSE/HSI/PLLCLK)
- __AHBPRESCALER__: This parameter can be one of the following values:
  - LL_RCC_SYSCLK_DIV_1
  - LL_RCC_SYSCLK_DIV_2
  - LL_RCC_SYSCLK_DIV_4
  - LL_RCC_SYSCLK_DIV_8
  - LL_RCC_SYSCLK_DIV_16
  - LL_RCC_SYSCLK_DIV_64
  - LL_RCC_SYSCLK_DIV_128
  - LL_RCC_SYSCLK_DIV_256
  - LL_RCC_SYSCLK_DIV_512

Return value:

- HCLK: clock frequency (in Hz)

__LL_RCC_CALC_PCLK1_FREQ

Description:

- Helper macro to calculate the PCLK frequency (APB)

Parameters:

- __HCLKFREQ__: HCLK frequency
- __APBPRESCALER__: This parameter can be one of the following values:
  - LL_RCC_APB1_DIV_1
  - LL_RCC_APB1_DIV_2
  - LL_RCC_APB1_DIV_4
  - LL_RCC_APB1_DIV_8
  - LL_RCC_APB1_DIV_16

Return value:

- PCLK1: clock frequency (in Hz)

__LL_RCC_CALC_MSI_FREQ

Description:

- Helper macro to calculate the MSI frequency (in Hz)

Parameters:

- __MSISEL__: This parameter can be one of the following values:
  - LL_RCC_MSIRANGESEL_STANDBY
  - LL_RCC_MSIRANGESEL_RUN
- __MSIRANGE__: This parameter can be one of the following values:
  - LL_RCC_MSIRANGE_0
  - LL_RCC_MSIRANGE_1
  - LL_RCC_MSIRANGE_2
  - LL_RCC_MSIRANGE_3
  - LL_RCC_MSIRANGE_4
  - LL_RCC_MSIRANGE_5
  - LL_RCC_MSIRANGE_6
  - LL_RCC_MSIRANGE_7
  - LL_RCC_MSIRANGE_8
  - LL_RCC_MSIRANGE_9
  - LL_RCC_MSIRANGE_10
  - LL_RCC_MSIRANGE_11
  - LL_RCC_MSISRANGE_4
  - LL_RCC_MSISRANGE_5
  - LL_RCC_MSISRANGE_6
  - LL_RCC_MSISRANGE_7

Return value:

- MSI: clock frequency (in Hz)

Notes:

- __MSISEL__ can be retrieved thanks to function LL_RCC_MSI_IsEnabledRangeSelect() if __MSISEL__ is equal to LL_RCC_MSIRANGESEL_STANDBY, __MSIRANGE__can be retrieved by LL_RCC_MSI_GetRangeAfterStandby() else by LL_RCC_MSI_GetRange() ex: __LL_RCC_CALC_MSI_FREQ(LL_RCC_MSI_IsEnabledRangeSelect(), (LL_RCC_MSI_IsEnabledRangeSelect()? LL_RCC_MSI_GetRange(): LL_RCC_MSI_GetRangeAfterStandby()))

__LL_RCC_CALC_PLLCLK_P_FREQ

Description:

- Helper macro to calculate the PLLPCLK frequency used on P domain.

Parameters:

- __INPUTFREQ__: PLL Input frequency (based on HSE/HSI)
- __PLLM__: This parameter can be one of the following values:
  - LL_RCC_PLLM_DIV_1
  - LL_RCC_PLLM_DIV_2
  - LL_RCC_PLLM_DIV_3
  - LL_RCC_PLLM_DIV_4
  - LL_RCC_PLLM_DIV_5
  - LL_RCC_PLLM_DIV_6
  - LL_RCC_PLLM_DIV_7
  - LL_RCC_PLLM_DIV_8
- __PLLN__: Between Min_Data = 4 and Max_Data = 127
- __PLLP__: This parameter can be one of the following values:
  - LL_RCC_PLLP_DIV_2
  - LL_RCC_PLLP_DIV_3
  - LL_RCC_PLLP_DIV_4
  - LL_RCC_PLLP_DIV_5
  - LL_RCC_PLLP_DIV_6
  - LL_RCC_PLLP_DIV_7
  - LL_RCC_PLLP_DIV_8
  - LL_RCC_PLLP_DIV_9
  - LL_RCC_PLLP_DIV_10
  - LL_RCC_PLLP_DIV_11
  - LL_RCC_PLLP_DIV_12
  - LL_RCC_PLLP_DIV_13
  - LL_RCC_PLLP_DIV_14
  - LL_RCC_PLLP_DIV_15
  - LL_RCC_PLLP_DIV_16
  - LL_RCC_PLLP_DIV_17
  - LL_RCC_PLLP_DIV_18
  - LL_RCC_PLLP_DIV_19
  - LL_RCC_PLLP_DIV_20
  - LL_RCC_PLLP_DIV_21
  - LL_RCC_PLLP_DIV_22
  - LL_RCC_PLLP_DIV_23
  - LL_RCC_PLLP_DIV_24
  - LL_RCC_PLLP_DIV_25
  - LL_RCC_PLLP_DIV_26
  - LL_RCC_PLLP_DIV_27
  - LL_RCC_PLLP_DIV_28
  - LL_RCC_PLLP_DIV_29
  - LL_RCC_PLLP_DIV_30
  - LL_RCC_PLLP_DIV_31
  - LL_RCC_PLLP_DIV_32

Return value:

- PLL: clock frequency (in Hz)

Notes:

- ex: __LL_RCC_CALC_PLLCLK_P_FREQ (HSE_VALUE,LL_RCC_PLL_GetM (), LL_RCC_PLL_GetN (), LL_RCC_PLL_GetP ());

Common Write and read registers Macros

LL_RCC_WriteReg

Description:

- Write a value in RCC register.

Parameters:

- __REG__: Register to be written
- __VALUE__: Value to be written in the register

Return value:

- None

LL_RCC_ReadReg

Description:

- Read a value in RCC register.

Parameters:

- __REG__: Register to be read

Return value:

- Register: value

73 LL RNG Generic Driver

73.1 RNG Firmware driver registers structures

73.1.1 LL_RNG_InitTypeDef

LL_RNG_InitTypeDef is defined in the stm32u0xx_ll_rng.h

Data Fields

- ***uint32_t ClockErrorDetection***

Field Documentation

- ***uint32_t LL_RNG_InitTypeDef::ClockErrorDetection***
  Clock error detection. This parameter can be one value of ***RNG_LL_CED***. This parameter can be modified using unitary functions **LL_RNG_EnableClkErrorDetect()**.

73.2 RNG Firmware driver API description

The following section lists the various functions of the RNG library.

73.2.1 Detailed description of functions

LL_RNG_Enable

Function name

__STATIC_INLINE void LL_RNG_Enable (RNG_TypeDef * RNGx)

Function description

Enable Random Number Generation.

Parameters

- **RNGx:** RNG Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR RNGEN LL_RNG_Enable

LL_RNG_Disable

Function name

__STATIC_INLINE void LL_RNG_Disable (RNG_TypeDef * RNGx)

Function description

Disable Random Number Generation.

Parameters

- **RNGx:** RNG Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR RNGEN LL_RNG_Disable

LL_RNG_IsEnabled

Function name

__STATIC_INLINE uint32_t LL_RNG_IsEnabled (const RNG_TypeDef * RNGx)

Function description

Check if Random Number Generator is enabled.

Parameters

- **RNGx:** RNG Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR RNGEN LL_RNG_IsEnabled

LL_RNG_EnableClkErrorDetect

Function name

__STATIC_INLINE void LL_RNG_EnableClkErrorDetect (RNG_TypeDef * RNGx)

Function description

Enable Clock Error Detection.

Parameters

- **RNGx:** RNG Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR CED LL_RNG_EnableClkErrorDetect

LL_RNG_DisableClkErrorDetect

Function name

__STATIC_INLINE void LL_RNG_DisableClkErrorDetect (RNG_TypeDef * RNGx)

Function description

Disable RNG Clock Error Detection.

Parameters

- **RNGx:** RNG Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR CED LL_RNG_DisableClkErrorDetect

LL_RNG_IsEnabledClkErrorDetect

Function name

__STATIC_INLINE uint32_t LL_RNG_IsEnabledClkErrorDetect (const RNG_TypeDef * RNGx)

Function description

Check if RNG Clock Error Detection is enabled.

Parameters

- **RNGx:** RNG Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR CED LL_RNG_IsEnabledClkErrorDetect

LL_RNG_EnableCondReset

Function name

__STATIC_INLINE void LL_RNG_EnableCondReset (RNG_TypeDef * RNGx)

Function description

Set RNG Conditioning Soft Reset bit.

Parameters

- **RNGx:** RNG Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR CONDRST LL_RNG_EnableCondReset

LL_RNG_DisableCondReset

Function name

__STATIC_INLINE void LL_RNG_DisableCondReset (RNG_TypeDef * RNGx)

Function description

Reset RNG Conditioning Soft Reset bit.

Parameters

- **RNGx:** RNG Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR CONDRST LL_RNG_DisableCondReset

LL_RNG_IsEnabledCondReset

Function name

__STATIC_INLINE uint32_t LL_RNG_IsEnabledCondReset (const RNG_TypeDef * RNGx)

Function description

Check if RNG Conditioning Soft Reset bit is set.

Parameters

- **RNGx:** RNG Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR CONDRST LL_RNG_IsEnabledCondReset

LL_RNG_ConfigLock

Function name

__STATIC_INLINE void LL_RNG_ConfigLock (RNG_TypeDef * RNGx)

Function description

Enable RNG Config Lock.

Parameters

- **RNGx:** RNG Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR CONFIGLOCK LL_RNG_ConfigLock

LL_RNG_IsConfigLocked

Function name

__STATIC_INLINE uint32_t LL_RNG_IsConfigLocked (const RNG_TypeDef * RNGx)

Function description

Check if RNG Config Lock is enabled.

Parameters

- **RNGx:** RNG Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR CONFIGLOCK LL_RNG_IsConfigLocked

LL_RNG_EnableNistCompliance

Function name

__STATIC_INLINE void LL_RNG_EnableNistCompliance (RNG_TypeDef * RNGx)

Function description

Enable NIST Compliance.

Parameters

- **RNGx:** RNG Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR NISTC LL_RNG_EnableNistCompliance

LL_RNG_DisableNistCompliance

Function name

__STATIC_INLINE void LL_RNG_DisableNistCompliance (RNG_TypeDef * RNGx)

Function description

Disable NIST Compliance.

Parameters

- **RNGx:** RNG Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR NISTC LL_RNG_DisableNistCompliance

LL_RNG_IsEnabledNistCompliance

Function name

__STATIC_INLINE uint32_t LL_RNG_IsEnabledNistCompliance (const RNG_TypeDef * RNGx)

Function description

Check if NIST Compliance is enabled.

Parameters

- **RNGx:** RNG Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR NISTC LL_RNG_IsEnabledNistCompliance

LL_RNG_SetConfig1

Function name

__STATIC_INLINE void LL_RNG_SetConfig1 (RNG_TypeDef * RNGx, uint32_t Config1)

Function description

Set RNG Config1 Configuration field value.

Parameters

- **RNGx:** RNG Instance
- **Config1:** Value between 0 and 0x3F

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR RNG_CONFIG1 LL_RNG_SetConfig1

LL_RNG_GetConfig1

Function name

__STATIC_INLINE uint32_t LL_RNG_GetConfig1 (const RNG_TypeDef * RNGx)

Function description

Get RNG Config1 Configuration field value.

Parameters

- **RNGx:** RNG Instance

Return values

- **Returned:** Value expressed on 6 bits : Value between 0 and 0x3F

Reference Manual to LL API cross reference:

- CR RNG_CONFIG1 LL_RNG_GetConfig1

LL_RNG_SetConfig2

Function name

__STATIC_INLINE void LL_RNG_SetConfig2 (RNG_TypeDef * RNGx, uint32_t Config2)

Function description

Set RNG Config2 Configuration field value.

Parameters

- **RNGx:** RNG Instance
- **Config2:** Value between 0 and 0x7

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR RNG_CONFIG2 LL_RNG_SetConfig2

LL_RNG_GetConfig2

Function name

__STATIC_INLINE uint32_t LL_RNG_GetConfig2 (const RNG_TypeDef * RNGx)

Function description

Get RNG Config2 Configuration field value.

Parameters

- **RNGx:** RNG Instance

Return values

- **Returned:** Value expressed on 3 bits : Value between 0 and 0x7

Reference Manual to LL API cross reference:

- CR RNG_CONFIG2 LL_RNG_GetConfig2

LL_RNG_SetConfig3

Function name

__STATIC_INLINE void LL_RNG_SetConfig3 (RNG_TypeDef * RNGx, uint32_t Config3)

Function description

Set RNG Config3 Configuration field value.

Parameters

- **RNGx:** RNG Instance
- **Config3:** Value between 0 and 0xF

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR RNG_CONFIG3 LL_RNG_SetConfig3

LL_RNG_GetConfig3

Function name

__STATIC_INLINE uint32_t LL_RNG_GetConfig3 (const RNG_TypeDef * RNGx)

Function description

Get RNG Config3 Configuration field value.

Parameters

- **RNGx:** RNG Instance

Return values

- **Returned:** Value expressed on 4 bits : Value between 0 and 0xF

Reference Manual to LL API cross reference:

- CR RNG_CONFIG3 LL_RNG_GetConfig3

LL_RNG_SetClockDivider

Function name

__STATIC_INLINE void LL_RNG_SetClockDivider (RNG_TypeDef * RNGx, uint32_t Divider)

Function description

Set RNG Clock divider factor.

Parameters

- **RNGx:** RNG Instance
- **Divider:** can be one of the following values:
  - LL_RNG_CLKDIV_BY_1
  - LL_RNG_CLKDIV_BY_2
  - LL_RNG_CLKDIV_BY_4
  - LL_RNG_CLKDIV_BY_8
  - LL_RNG_CLKDIV_BY_16
  - LL_RNG_CLKDIV_BY_32
  - LL_RNG_CLKDIV_BY_64
  - LL_RNG_CLKDIV_BY_128
  - LL_RNG_CLKDIV_BY_256
  - LL_RNG_CLKDIV_BY_512
  - LL_RNG_CLKDIV_BY_1024
  - LL_RNG_CLKDIV_BY_2048
  - LL_RNG_CLKDIV_BY_4096
  - LL_RNG_CLKDIV_BY_8192
  - LL_RNG_CLKDIV_BY_16384
  - LL_RNG_CLKDIV_BY_32768

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR CLKDIV LL_RNG_SetClockDivider

LL_RNG_GetClockDivider

Function name

__STATIC_INLINE uint32_t LL_RNG_GetClockDivider (const RNG_TypeDef * RNGx)

Function description

Get RNG Clock divider factor.

Parameters

- **RNGx:** RNG Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_RNG_CLKDIV_BY_1
  - LL_RNG_CLKDIV_BY_2
  - LL_RNG_CLKDIV_BY_4
  - LL_RNG_CLKDIV_BY_8
  - LL_RNG_CLKDIV_BY_16
  - LL_RNG_CLKDIV_BY_32
  - LL_RNG_CLKDIV_BY_64
  - LL_RNG_CLKDIV_BY_128
  - LL_RNG_CLKDIV_BY_256
  - LL_RNG_CLKDIV_BY_512
  - LL_RNG_CLKDIV_BY_1024
  - LL_RNG_CLKDIV_BY_2048
  - LL_RNG_CLKDIV_BY_4096
  - LL_RNG_CLKDIV_BY_8192
  - LL_RNG_CLKDIV_BY_16384
  - LL_RNG_CLKDIV_BY_32768

Reference Manual to LL API cross reference:

- CR CLKDIV LL_RNG_GetClockDivider

LL_RNG_IsActiveFlag_DRDY

Function name

__STATIC_INLINE uint32_t LL_RNG_IsActiveFlag_DRDY (const RNG_TypeDef * RNGx)

Function description

Indicate if the RNG Data ready Flag is set or not.

Parameters

- **RNGx:** RNG Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR DRDY LL_RNG_IsActiveFlag_DRDY

LL_RNG_IsActiveFlag_CECS

Function name

__STATIC_INLINE uint32_t LL_RNG_IsActiveFlag_CECS (const RNG_TypeDef * RNGx)

Function description

Indicate if the Clock Error Current Status Flag is set or not.

Parameters

- **RNGx:** RNG Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR CECS LL_RNG_IsActiveFlag_CECS

LL_RNG_IsActiveFlag_SECS

Function name

__STATIC_INLINE uint32_t LL_RNG_IsActiveFlag_SECS (const RNG_TypeDef * RNGx)

Function description

Indicate if the Seed Error Current Status Flag is set or not.

Parameters

- **RNGx:** RNG Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR SECS LL_RNG_IsActiveFlag_SECS

LL_RNG_IsActiveFlag_CEIS

Function name

__STATIC_INLINE uint32_t LL_RNG_IsActiveFlag_CEIS (const RNG_TypeDef * RNGx)

Function description

Indicate if the Clock Error Interrupt Status Flag is set or not.

Parameters

- **RNGx:** RNG Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR CEIS LL_RNG_IsActiveFlag_CEIS

LL_RNG_IsActiveFlag_SEIS

Function name

__STATIC_INLINE uint32_t LL_RNG_IsActiveFlag_SEIS (const RNG_TypeDef * RNGx)

Function description

Indicate if the Seed Error Interrupt Status Flag is set or not.

Parameters

- **RNGx:** RNG Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR SEIS LL_RNG_IsActiveFlag_SEIS

LL_RNG_ClearFlag_CEIS

Function name

__STATIC_INLINE void LL_RNG_ClearFlag_CEIS (RNG_TypeDef * RNGx)

Function description

Clear Clock Error interrupt Status (CEIS) Flag.

Parameters

- **RNGx:** RNG Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- SR CEIS LL_RNG_ClearFlag_CEIS

LL_RNG_ClearFlag_SEIS

Function name

__STATIC_INLINE void LL_RNG_ClearFlag_SEIS (RNG_TypeDef * RNGx)

Function description

Clear Seed Error interrupt Status (SEIS) Flag.

Parameters

- **RNGx:** RNG Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- SR SEIS LL_RNG_ClearFlag_SEIS

LL_RNG_EnableIT

Function name

__STATIC_INLINE void LL_RNG_EnableIT (RNG_TypeDef * RNGx)

Function description

Enable Random Number Generator Interrupt (applies for either Seed error, Clock Error or Data ready interrupts)

Parameters

- **RNGx:** RNG Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR IE LL_RNG_EnableIT

LL_RNG_DisableIT

Function name

__STATIC_INLINE void LL_RNG_DisableIT (RNG_TypeDef * RNGx)

Function description

Disable Random Number Generator Interrupt (applies for either Seed error, Clock Error or Data ready interrupts)

Parameters

- **RNGx:** RNG Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR IE LL_RNG_DisableIT

LL_RNG_IsEnabledIT

Function name

__STATIC_INLINE uint32_t LL_RNG_IsEnabledIT (const RNG_TypeDef * RNGx)

Function description

Check if Random Number Generator Interrupt is enabled (applies for either Seed error, Clock Error or Data ready interrupts)

Parameters

- **RNGx:** RNG Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR IE LL_RNG_IsEnabledIT

LL_RNG_ReadRandData32

Function name

__STATIC_INLINE uint32_t LL_RNG_ReadRandData32 (const RNG_TypeDef * RNGx)

Function description

Return32-bit Random Number value.

Parameters

- **RNGx:** RNG Instance

Return values

- **Generated:** 32-bit random value

Reference Manual to LL API cross reference:

- DR RNDATA LL_RNG_ReadRandData32

LL_RNG_EnableArdis

Function name

__STATIC_INLINE void LL_RNG_EnableArdis (RNG_TypeDef * RNGx)

Function description

Enable Auto reset.

Parameters

- **RNGx:** RNG Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR ARDIS LL_RNG_EnableArdis

LL_RNG_DisableArdis

Function name

__STATIC_INLINE void LL_RNG_DisableArdis (RNG_TypeDef * RNGx)

Function description

Disable Auto reset.

Parameters

- **RNGx:** RNG Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR ARDIS LL_RNG_DisableArdis

LL_RNG_IsEnabledArdis

Function name

__STATIC_INLINE uint32_t LL_RNG_IsEnabledArdis (const RNG_TypeDef * RNGx)

Function description

Check if RNG Auto reset is enabled.

Parameters

- **RNGx:** RNG Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR ARDIS LL_RNG_IsEnabledArdis

LL_RNG_SetHealthConfig

Function name

__STATIC_INLINE void LL_RNG_SetHealthConfig (RNG_TypeDef * RNGx, uint32_t HTCFG)

Function description

Set RNG Health Test Control.

Parameters

- **RNGx:** RNG Instance
- **HTCFG:** can be values of 32 bits

Return values

- **None:**

Reference Manual to LL API cross reference:

- HTCR HTCFG LL_RNG_SetHealthConfig

LL_RNG_GetHealthConfig

Function name

__STATIC_INLINE uint32_t LL_RNG_GetHealthConfig (const RNG_TypeDef * RNGx)

Function description

Get RNG Health Test Control.

Parameters

- **RNGx:** RNG Instance

Return values

- **Return:** 32-bit RNG Health Test configuration

Reference Manual to LL API cross reference:

- HTCR HTCFG LL_RNG_GetHealthConfig

LL_RNG_Init

Function name

ErrorStatus LL_RNG_Init (RNG_TypeDef * RNGx, const LL_RNG_InitTypeDef * RNG_InitStruct)

Function description

Initialize RNG registers according to the specified parameters in RNG_InitStruct.

Parameters

- **RNGx:** RNG Instance
- **RNG_InitStruct:** pointer to a LL_RNG_InitTypeDef structure that contains the configuration information for the specified RNG peripheral.

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: RNG registers are initialized according to RNG_InitStruct content
  - ERROR: not applicable

LL_RNG_StructInit

Function name

void LL_RNG_StructInit (LL_RNG_InitTypeDef * RNG_InitStruct)

Function description

Set each LL_RNG_InitTypeDef field to default value.

Parameters

- **RNG_InitStruct:** pointer to a LL_RNG_InitTypeDef structure whose fields will be set to default values.

Return values

- **None:**

LL_RNG_DeInit

Function name

ErrorStatus LL_RNG_DeInit (const RNG_TypeDef * RNGx)

Function description

De-initialize RNG registers (Registers restored to their default values).

Parameters

- **RNGx:** RNG Instance

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: RNG registers are de-initialized
  - ERROR: not applicable

73.3 RNG Firmware driver defines

The following section lists the various define and macros of the module.

73.3.1 RNG

RNG

Auto reset disable

LL_RNG_ARDIS_ENABLE

ARDIS enabled automatic reset to clear SECS bit

LL_RNG_ARDIS_DISABLE

ARDIS disabled no automatic reset to clear SECS bit

Clock Error Detection

LL_RNG_CED_ENABLE

Clock error detection enabled

LL_RNG_CED_DISABLE

Clock error detection disabled

Value used to configure an internal

LL_RNG_CLKDIV_BY_1

No clock division

LL_RNG_CLKDIV_BY_2

2 RNG clock cycles per internal RNG clock

LL_RNG_CLKDIV_BY_4

4 RNG clock cycles per internal RNG clock

LL_RNG_CLKDIV_BY_8

8 RNG clock cycles per internal RNG clock

LL_RNG_CLKDIV_BY_16

16 RNG clock cycles per internal RNG clock

LL_RNG_CLKDIV_BY_32

32 RNG clock cycles per internal RNG clock

LL_RNG_CLKDIV_BY_64

64 RNG clock cycles per internal RNG clock

LL_RNG_CLKDIV_BY_128

128 RNG clock cycles per internal RNG clock

LL_RNG_CLKDIV_BY_256

256 RNG clock cycles per internal RNG clock

LL_RNG_CLKDIV_BY_512

512 RNG clock cycles per internal RNG clock

LL_RNG_CLKDIV_BY_1024

1024 RNG clock cycles per internal RNG clock

LL_RNG_CLKDIV_BY_2048

2048 RNG clock cycles per internal RNG clock

LL_RNG_CLKDIV_BY_4096

4096 RNG clock cycles per internal RNG clock

LL_RNG_CLKDIV_BY_8192

8192 RNG clock cycles per internal RNG clock

LL_RNG_CLKDIV_BY_16384

16384 RNG clock cycles per internal RNG clock

LL_RNG_CLKDIV_BY_32768

32768 RNG clock cycles per internal RNG clock

Get Flags Defines

LL_RNG_SR_DRDY

Register contains valid random data

LL_RNG_SR_CECS

Clock error current status

LL_RNG_SR_SECS

Seed error current status

LL_RNG_SR_CEIS

Clock error interrupt status

LL_RNG_SR_SEIS

Seed error interrupt status

IT Defines

LL_RNG_CR_IE

RNG Interrupt enable

Common Write and read registers Macros

LL_RNG_WriteReg

Description:

- Write a value in RNG register.

Parameters:

- __INSTANCE__: RNG Instance
- __REG__: Register to be written
- __VALUE__: Value to be written in the register

Return value:

- None

LL_RNG_ReadReg

Description:

- Read a value in RNG register.

Parameters:

- __INSTANCE__: RNG Instance
- __REG__: Register to be read

Return value:

- Register: value

NIST Compliance configuration

LL_RNG_NIST_COMPLIANT

Default NIST compliant configuration

LL_RNG_CUSTOM_NIST

Custom NIST configuration

74 LL RTC Generic Driver

74.1 RTC Firmware driver registers structures

74.1.1 LL_RTC_InitTypeDef

LL_RTC_InitTypeDef is defined in the stm32u0xx_ll_rtc.h

Data Fields

- ***uint32_t HourFormat***
- ***uint32_t AsynchPrescaler***
- ***uint32_t SynchPrescaler***

Field Documentation

- ***uint32_t LL_RTC_InitTypeDef::HourFormat***
  Specifies the RTC Hours Format. This parameter can be a value of ***RTC_LL_EC_HOURFORMAT***This feature can be modified afterwards using unitary function **LL_RTC_SetHourFormat()**.
- ***uint32_t LL_RTC_InitTypeDef::AsynchPrescaler***
  Specifies the RTC Asynchronous Predivider value. This parameter must be a number between Min_Data = 0x00 and Max_Data = 0x7FThis feature can be modified afterwards using unitary function **LL_RTC_SetAsynchPrescaler()**.
- ***uint32_t LL_RTC_InitTypeDef::SynchPrescaler***
  Specifies the RTC Synchronous Predivider value. This parameter must be a number between Min_Data = 0x00 and Max_Data = 0x7FFFThis feature can be modified afterwards using unitary function **LL_RTC_SetSynchPrescaler()**.

74.1.2 LL_RTC_TimeTypeDef

LL_RTC_TimeTypeDef is defined in the stm32u0xx_ll_rtc.h

Data Fields

- ***uint32_t TimeFormat***
- ***uint8_t Hours***
- ***uint8_t Minutes***
- ***uint8_t Seconds***

Field Documentation

- ***uint32_t LL_RTC_TimeTypeDef::TimeFormat***
  Specifies the RTC AM/PM Time. This parameter can be a value of ***RTC_LL_EC_TIME_FORMAT*** This feature can be modified afterwards using unitary function **LL_RTC_TIME_SetFormat()**
- ***uint8_t LL_RTC_TimeTypeDef::Hours***
  Specifies the RTC Time Hours. This parameter must be a number between Min_Data = 0 and Max_Data = 12 if the **LL_RTC_TIME_FORMAT_PM** is selected. This parameter must be a number between Min_Data = 0 and Max_Data = 23 if the **LL_RTC_TIME_FORMAT_AM_OR_24** is selected. This feature can be modified afterwards using unitary function **LL_RTC_TIME_SetHour()**
- ***uint8_t LL_RTC_TimeTypeDef::Minutes***
  Specifies the RTC Time Minutes. This parameter must be a number between Min_Data = 0 and Max_Data = 59 This feature can be modified afterwards using unitary function **LL_RTC_TIME_SetMinute()**
- ***uint8_t LL_RTC_TimeTypeDef::Seconds***
  Specifies the RTC Time Seconds. This parameter must be a number between Min_Data = 0 and Max_Data = 59 This feature can be modified afterwards using unitary function **LL_RTC_TIME_SetSecond()**

74.1.3 LL_RTC_DateTypeDef

LL_RTC_DateTypeDef is defined in the stm32u0xx_ll_rtc.h

Data Fields

- ***uint8_t WeekDay***
- ***uint8_t Month***
- ***uint8_t Day***

- ***uint8_t Year***

Field Documentation

- ***uint8_t LL_RTC_DateTypeDef::WeekDay***
  Specifies the RTC Date WeekDay. This parameter can be a value of ***RTC_LL_EC_WEEKDAY*** This feature can be modified afterwards using unitary function **LL_RTC_DATE_SetWeekDay()**.
- ***uint8_t LL_RTC_DateTypeDef::Month***
  Specifies the RTC Date Month. This parameter can be a value of ***RTC_LL_EC_MONTH*** This feature can be modified afterwards using unitary function **LL_RTC_DATE_SetMonth()**.
- ***uint8_t LL_RTC_DateTypeDef::Day***
  Specifies the RTC Date Day. This parameter must be a number between Min_Data = 1 and Max_Data = 31 This feature can be modified afterwards using unitary function **LL_RTC_DATE_SetDay()**.
- ***uint8_t LL_RTC_DateTypeDef::Year***
  Specifies the RTC Date Year. This parameter must be a number between Min_Data = 0 and Max_Data = 99 This feature can be modified afterwards using unitary function **LL_RTC_DATE_SetYear()**.

74.1.4 LL_RTC_AlarmTypeDef

LL_RTC_AlarmTypeDef is defined in the stm32u0xx_ll_rtc.h

Data Fields

- ***LL_RTC_TimeTypeDef AlarmTime***
- ***uint32_t AlarmMask***
- ***uint32_t AlarmDateWeekDaySel***
- ***uint8_t AlarmDateWeekDay***

Field Documentation

- ***LL_RTC_TimeTypeDef LL_RTC_AlarmTypeDef::AlarmTime***
  Specifies the RTC Alarm Time members.
- ***uint32_t LL_RTC_AlarmTypeDef::AlarmMask***
  Specifies the RTC Alarm Masks. This parameter can be a value of ***RTC_LL_EC_ALMA_MASK*** for ALARM A or ***RTC_LL_EC_ALMB_MASK*** for ALARM B. This feature can be modified afterwards using unitary function **LL_RTC_ALMA_SetMask()** for ALARM A or **LL_RTC_ALMB_SetMask()** for ALARM B
- ***uint32_t LL_RTC_AlarmTypeDef::AlarmDateWeekDaySel***
  Specifies the RTC Alarm is on day or WeekDay. This parameter can be a value of ***RTC_LL_EC_ALMA_WEEKDAY_SELECTION*** for ALARM A or ***RTC_LL_EC_ALMB_WEEKDAY_SELECTION*** for ALARM B This feature can be modified afterwards using unitary function **LL_RTC_ALMA_EnableWeekday()** or **for** ALARM A or **LL_RTC_ALMB_EnableWeekday()** or **LL_RTC_ALMB_DisableWeekday()** for ALARM B
- ***uint8_t LL_RTC_AlarmTypeDef::AlarmDateWeekDay***
  Specifies the RTC Alarm Day/WeekDay. If AlarmDateWeekDaySel set to day, this parameter must be a number between Min_Data = 1 and Max_Data = 31. This feature can be modified afterwards using unitary function **LL_RTC_ALMA_SetDay()** for ALARM A or **LL_RTC_ALMB_SetDay()** for ALARM B.If AlarmDateWeekDaySel set to Weekday, this parameter can be a value of ***RTC_LL_EC_WEEKDAY***. This feature can be modified afterwards using unitary function **LL_RTC_ALMA_SetWeekDay()** for ALARM A or **LL_RTC_ALMB_SetWeekDay()** for ALARM B.

74.2 RTC Firmware driver API description

The following section lists the various functions of the RTC library.

74.2.1 Detailed description of functions

LL_RTC_SetHourFormat

Function name

__STATIC_INLINE void LL_RTC_SetHourFormat (RTC_TypeDef * RTCx, uint32_t HourFormat)

Function description

Set Hours format (24 hour/day or AM/PM hour format)

Parameters

- **RTCx:** RTC Instance
- **HourFormat:** This parameter can be one of the following values:
  - LL_RTC_HOURFORMAT_24HOUR
  - LL_RTC_HOURFORMAT_AMPM

Return values

- **None:**

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.
- It can be written in initialization mode only (LL_RTC_EnableInitMode function)

Reference Manual to LL API cross reference:

- RTC_CR FMT LL_RTC_SetHourFormat

LL_RTC_GetHourFormat

Function name

__STATIC_INLINE uint32_t LL_RTC_GetHourFormat (RTC_TypeDef * RTCx)

Function description

Get Hours format (24 hour/day or AM/PM hour format)

Parameters

- **RTCx:** RTC Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_RTC_HOURFORMAT_24HOUR
  - LL_RTC_HOURFORMAT_AMPM

Reference Manual to LL API cross reference:

- RTC_CR FMT LL_RTC_GetHourFormat

LL_RTC_SetAlarmOutEvent

Function name

__STATIC_INLINE void LL_RTC_SetAlarmOutEvent (RTC_TypeDef * RTCx, uint32_t AlarmOutput)

Function description

Select the flag to be routed to RTC_ALARM output.

Parameters

- **RTCx:** RTC Instance
- **AlarmOutput:** This parameter can be one of the following values:
  - LL_RTC_ALARMOUT_DISABLE
  - LL_RTC_ALARMOUT_ALMA
  - LL_RTC_ALARMOUT_ALMB
  - LL_RTC_ALARMOUT_WAKEUP

Return values

- **None:**

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.

Reference Manual to LL API cross reference:

- RTC_CR OSEL LL_RTC_SetAlarmOutEvent

LL_RTC_GetAlarmOutEvent

Function name

__STATIC_INLINE uint32_t LL_RTC_GetAlarmOutEvent (RTC_TypeDef * RTCx)

Function description

Get the flag to be routed to RTC_ALARM output.

Parameters

- **RTCx:** RTC Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_RTC_ALARMOUT_DISABLE
  - LL_RTC_ALARMOUT_ALMA
  - LL_RTC_ALARMOUT_ALMB
  - LL_RTC_ALARMOUT_WAKEUP

Reference Manual to LL API cross reference:

- RTC_CR OSEL LL_RTC_GetAlarmOutEvent

LL_RTC_SetAlarmOutputType

Function name

__STATIC_INLINE void LL_RTC_SetAlarmOutputType (RTC_TypeDef * RTCx, uint32_t Output)

Function description

Set RTC_ALARM output type (ALARM in push-pull or open-drain output)

Parameters

- **RTCx:** RTC Instance
- **Output:** This parameter can be one of the following values:
  - LL_RTC_ALARM_OUTPUTTYPE_OPENDRAIN
  - LL_RTC_ALARM_OUTPUTTYPE_PUSHPULL

Return values

- **None:**

Reference Manual to LL API cross reference:

- RTC_CR TAMPALRM_TYPE LL_RTC_SetAlarmOutputType

LL_RTC_GetAlarmOutputType

Function name

__STATIC_INLINE uint32_t LL_RTC_GetAlarmOutputType (RTC_TypeDef * RTCx)

Function description

Get RTC_ALARM output type (ALARM in push-pull or open-drain output)

Parameters

- **RTCx:** RTC Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_RTC_ALARM_OUTPUTTYPE_OPENDRAIN
  - LL_RTC_ALARM_OUTPUTTYPE_PUSHPULL

Reference Manual to LL API cross reference:

- RTC_CR TAMPALRM_TYPE LL_RTC_GetAlarmOutputType

LL_RTC_EnableInitMode

Function name

__STATIC_INLINE void LL_RTC_EnableInitMode (RTC_TypeDef * RTCx)

Function description

Enable initialization mode.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Notes

- Initialization mode is used to program time and date register (RTC_TR and RTC_DR) and prescaler register (RTC_PRER). Counters are stopped and start counting from the new value when INIT is reset.

Reference Manual to LL API cross reference:

- RTC_ICSR INIT LL_RTC_EnableInitMode

LL_RTC_DisableInitMode

Function name

__STATIC_INLINE void LL_RTC_DisableInitMode (RTC_TypeDef * RTCx)

Function description

Disable initialization mode (Free running mode)

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- RTC_ICSR INIT LL_RTC_DisableInitMode

LL_RTC_SetOutputPolarity

Function name

__STATIC_INLINE void LL_RTC_SetOutputPolarity (RTC_TypeDef * RTCx, uint32_t Polarity)

Function description

Set Output polarity (pin is low when ALRAF/ALRBF/WUTF is asserted)

Parameters

- **RTCx:** RTC Instance
- **Polarity:** This parameter can be one of the following values:
  - LL_RTC_OUTPUTPOLARITY_PIN_HIGH
  - LL_RTC_OUTPUTPOLARITY_PIN_LOW

Return values

- **None:**

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.

Reference Manual to LL API cross reference:

- RTC_CR POL LL_RTC_SetOutputPolarity

LL_RTC_GetOutputPolarity

Function name

__STATIC_INLINE uint32_t LL_RTC_GetOutputPolarity (RTC_TypeDef * RTCx)

Function description

Get Output polarity.

Parameters

- **RTCx:** RTC Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_RTC_OUTPUTPOLARITY_PIN_HIGH
  - LL_RTC_OUTPUTPOLARITY_PIN_LOW

Reference Manual to LL API cross reference:

- RTC_CR POL LL_RTC_GetOutputPolarity

LL_RTC_EnableShadowRegBypass

Function name

__STATIC_INLINE void LL_RTC_EnableShadowRegBypass (RTC_TypeDef * RTCx)

Function description

Enable Bypass the shadow registers.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.

Reference Manual to LL API cross reference:

- RTC_CR BYPSHAD LL_RTC_EnableShadowRegBypass

LL_RTC_DisableShadowRegBypass

Function name

__STATIC_INLINE void LL_RTC_DisableShadowRegBypass (RTC_TypeDef * RTCx)

Function description

Disable Bypass the shadow registers.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- RTC_CR BYPSHAD LL_RTC_DisableShadowRegBypass

LL_RTC_IsShadowRegBypassEnabled

Function name

__STATIC_INLINE uint32_t LL_RTC_IsShadowRegBypassEnabled (RTC_TypeDef * RTCx)

Function description

Check if Shadow registers bypass is enabled or not.

Parameters

- **RTCx:** RTC Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- RTC_CR BYPSHAD LL_RTC_IsShadowRegBypassEnabled

LL_RTC_EnableRefClock

Function name

__STATIC_INLINE void LL_RTC_EnableRefClock (RTC_TypeDef * RTCx)

Function description

Enable RTC_REFIN reference clock detection (50 or 60 Hz)

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.
- It can be written in initialization mode only (LL_RTC_EnableInitMode function)

Reference Manual to LL API cross reference:

- RTC_CR REFCKON LL_RTC_EnableRefClock

LL_RTC_DisableRefClock

Function name

__STATIC_INLINE void LL_RTC_DisableRefClock (RTC_TypeDef * RTCx)

Function description

Disable RTC_REFIN reference clock detection (50 or 60 Hz)

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.
- It can be written in initialization mode only (LL_RTC_EnableInitMode function)

Reference Manual to LL API cross reference:

- RTC_CR REFCKON LL_RTC_DisableRefClock

LL_RTC_SetAsynchPrescaler

Function name

__STATIC_INLINE void LL_RTC_SetAsynchPrescaler (RTC_TypeDef * RTCx, uint32_t AsynchPrescaler)

Function description

Set Asynchronous prescaler factor.

Parameters

- **RTCx:** RTC Instance
- **AsynchPrescaler:** Value between Min_Data = 0 and Max_Data = 0x7F

Return values

- **None:**

Reference Manual to LL API cross reference:

- RTC_PRER PREDIV_A LL_RTC_SetAsynchPrescaler

LL_RTC_SetSynchPrescaler

Function name

__STATIC_INLINE void LL_RTC_SetSynchPrescaler (RTC_TypeDef * RTCx, uint32_t SynchPrescaler)

Function description

Set Synchronous prescaler factor.

Parameters

- **RTCx:** RTC Instance
- **SynchPrescaler:** Value between Min_Data = 0 and Max_Data = 0x7FFF

Return values

- **None:**

Reference Manual to LL API cross reference:

- RTC_PRER PREDIV_S LL_RTC_SetSynchPrescaler

LL_RTC_GetAsynchPrescaler

Function name

__STATIC_INLINE uint32_t LL_RTC_GetAsynchPrescaler (RTC_TypeDef * RTCx)

Function description

Get Asynchronous prescaler factor.

Parameters

- **RTCx:** RTC Instance

Return values

- **Value:** between Min_Data = 0 and Max_Data = 0x7F

Reference Manual to LL API cross reference:

- RTC_PRER PREDIV_A LL_RTC_GetAsynchPrescaler

LL_RTC_GetSynchPrescaler

Function name

__STATIC_INLINE uint32_t LL_RTC_GetSynchPrescaler (RTC_TypeDef * RTCx)

Function description

Get Synchronous prescaler factor.

Parameters

- **RTCx:** RTC Instance

Return values

- **Value:** between Min_Data = 0 and Max_Data = 0x7FFF

Reference Manual to LL API cross reference:

- RTC_PRER PREDIV_S LL_RTC_GetSynchPrescaler

LL_RTC_EnableWriteProtection

Function name

__STATIC_INLINE void LL_RTC_EnableWriteProtection (RTC_TypeDef * RTCx)

Function description

Enable the write protection for RTC registers.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- RTC_WPR KEY LL_RTC_EnableWriteProtection

LL_RTC_DisableWriteProtection

Function name

__STATIC_INLINE void LL_RTC_DisableWriteProtection (RTC_TypeDef * RTCx)

Function description

Disable the write protection for RTC registers.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- RTC_WPR KEY LL_RTC_DisableWriteProtection

LL_RTC_EnableTamperOutput

Function name

__STATIC_INLINE void LL_RTC_EnableTamperOutput (RTC_TypeDef * RTCx)

Function description

Enable tamper output.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Notes

- When the tamper output is enabled, all external and internal tamper flags are ORed and routed to the TAMPALRM output.

Reference Manual to LL API cross reference:

- RTC_CR TAMPOE LL_RTC_EnableTamperOutput

LL_RTC_DisableTamperOutput

Function name

__STATIC_INLINE void LL_RTC_DisableTamperOutput (RTC_TypeDef * RTCx)

Function description

Disable tamper output.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- RTC_CR TAMPOE LL_RTC_DisableTamperOutput

LL_RTC_IsTamperOutputEnabled

Function name

__STATIC_INLINE uint32_t LL_RTC_IsTamperOutputEnabled (RTC_TypeDef * RTCx)

Function description

Check if tamper output is enabled or not.

Parameters

- **RTCx:** RTC Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- RTC_CR TAMPOE LL_RTC_IsTamperOutputEnabled

LL_RTC_EnableAlarmPullUp

Function name

__STATIC_INLINE void LL_RTC_EnableAlarmPullUp (RTC_TypeDef * RTCx)

Function description

Enable internal pull-up in output mode.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- RTC_CR TAMPALRM_PU LL_RTC_EnableAlarmPullUp

LL_RTC_DisableAlarmPullUp

Function name

__STATIC_INLINE void LL_RTC_DisableAlarmPullUp (RTC_TypeDef * RTCx)

Function description

Disable internal pull-up in output mode.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- RTC_CR TAMPALRM_PU LL_RTC_EnableAlarmPullUp

LL_RTC_IsAlarmPullUpEnabled

Function name

__STATIC_INLINE uint32_t LL_RTC_IsAlarmPullUpEnabled (RTC_TypeDef * RTCx)

Function description

Check if internal pull-up in output mode is enabled or not.

Parameters

- **RTCx:** RTC Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- RTC_CR TAMPALRM_PU LL_RTC_IsAlarmPullUpEnabled

LL_RTC_EnableOutput2

Function name

__STATIC_INLINE void LL_RTC_EnableOutput2 (RTC_TypeDef * RTCx)

Function description

Enable RTC_OUT2 output.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Notes

- RTC_OUT2 mapping depends on both OSEL (LL_RTC_SetAlarmOutEvent) and COE (LL_RTC_CAL_SetOutputFreq) settings.
- RTC_OUT2 isn't available ins VBAT mode.

Reference Manual to LL API cross reference:

- RTC_CR OUT2EN LL_RTC_EnableOutput2

LL_RTC_DisableOutput2

Function name

__STATIC_INLINE void LL_RTC_DisableOutput2 (RTC_TypeDef * RTCx)

Function description

Disable RTC_OUT2 output.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- RTC_CR OUT2EN LL_RTC_DisableOutput2

LL_RTC_IsOutput2Enabled

Function name

__STATIC_INLINE uint32_t LL_RTC_IsOutput2Enabled (RTC_TypeDef * RTCx)

Function description

Check if RTC_OUT2 output is enabled or not.

Parameters

- **RTCx:** RTC Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- RTC_CR OUT2EN LL_RTC_IsOutput2Enabled

LL_RTC_TIME_SetFormat

Function name

__STATIC_INLINE void LL_RTC_TIME_SetFormat (RTC_TypeDef * RTCx, uint32_t TimeFormat)

Function description

Set time format (AM/24-hour or PM notation)

Parameters

- **RTCx:** RTC Instance
- **TimeFormat:** This parameter can be one of the following values:
  - LL_RTC_TIME_FORMAT_AM_OR_24
  - LL_RTC_TIME_FORMAT_PM

Return values

- **None:**

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.
- It can be written in initialization mode only (LL_RTC_EnableInitMode function)

Reference Manual to LL API cross reference:

- RTC_TR PM LL_RTC_TIME_SetFormat

LL_RTC_TIME_GetFormat

Function name

__STATIC_INLINE uint32_t LL_RTC_TIME_GetFormat (RTC_TypeDef * RTCx)

Function description

Get time format (AM or PM notation)

Parameters

- **RTCx:** RTC Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_RTC_TIME_FORMAT_AM_OR_24
  - LL_RTC_TIME_FORMAT_PM

Notes

- if RTC shadow registers are not bypassed (BYPSHAD=0), need to check if RSF flag is set before reading this bit
- Read either RTC_SSR or RTC_TR locks the values in the higher-order calendar shadow registers until RTC_DR is read (LL_RTC_ReadReg(RTC, DR)).

Reference Manual to LL API cross reference:

- RTC_TR PM LL_RTC_TIME_GetFormat

LL_RTC_TIME_SetHour

Function name

__STATIC_INLINE void LL_RTC_TIME_SetHour (RTC_TypeDef * RTCx, uint32_t Hours)

Function description

Set Hours in BCD format.

Parameters

- **RTCx:** RTC Instance
- **Hours:** Value between Min_Data=0x01 and Max_Data=0x12 or between Min_Data=0x00 and Max_Data=0x23

Return values

- **None:**

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.
- It can be written in initialization mode only (LL_RTC_EnableInitMode function)
- helper macro __LL_RTC_CONVERT_BIN2BCD is available to convert hour from binary to BCD format

Reference Manual to LL API cross reference:

- RTC_TR HT LL_RTC_TIME_SetHour
- RTC_TR HU LL_RTC_TIME_SetHour

LL_RTC_TIME_GetHour

Function name

__STATIC_INLINE uint32_t LL_RTC_TIME_GetHour (RTC_TypeDef * RTCx)

Function description

Get Hours in BCD format.

Parameters

- **RTCx:** RTC Instance

Return values

- **Value:** between Min_Data=0x01 and Max_Data=0x12 or between Min_Data=0x00 and Max_Data=0x23

Notes

- if RTC shadow registers are not bypassed (BYPSHAD=0), need to check if RSF flag is set before reading this bit
- Read either RTC_SSR or RTC_TR locks the values in the higher-order calendar shadow registers until RTC_DR is read (LL_RTC_ReadReg(RTC, DR)).
- helper macro __LL_RTC_CONVERT_BCD2BIN is available to convert hour from BCD to Binary format

Reference Manual to LL API cross reference:

- RTC_TR HT LL_RTC_TIME_GetHour
- RTC_TR HU LL_RTC_TIME_GetHour

LL_RTC_TIME_SetMinute

Function name

__STATIC_INLINE void LL_RTC_TIME_SetMinute (RTC_TypeDef * RTCx, uint32_t Minutes)

Function description

Set Minutes in BCD format.

Parameters

- **RTCx:** RTC Instance
- **Minutes:** Value between Min_Data=0x00 and Max_Data=0x59

Return values

- **None:**

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.
- It can be written in initialization mode only (LL_RTC_EnableInitMode function)
- helper macro __LL_RTC_CONVERT_BIN2BCD is available to convert Minutes from binary to BCD format

Reference Manual to LL API cross reference:

- RTC_TR MNT LL_RTC_TIME_SetMinute
- RTC_TR MNU LL_RTC_TIME_SetMinute

LL_RTC_TIME_GetMinute

Function name

__STATIC_INLINE uint32_t LL_RTC_TIME_GetMinute (RTC_TypeDef * RTCx)

Function description

Get Minutes in BCD format.

Parameters

- **RTCx:** RTC Instance

Return values

- **Value:** between Min_Data=0x00 and Max_Data=0x59

Notes

- if RTC shadow registers are not bypassed (BYPSHAD=0), need to check if RSF flag is set before reading this bit
- Read either RTC_SSR or RTC_TR locks the values in the higher-order calendar shadow registers until RTC_DR is read (LL_RTC_ReadReg(RTC, DR)).
- helper macro __LL_RTC_CONVERT_BCD2BIN is available to convert minute from BCD to Binary format

Reference Manual to LL API cross reference:

- RTC_TR MNT LL_RTC_TIME_GetMinute
- RTC_TR MNU LL_RTC_TIME_GetMinute

LL_RTC_TIME_SetSecond

Function name

__STATIC_INLINE void LL_RTC_TIME_SetSecond (RTC_TypeDef * RTCx, uint32_t Seconds)

Function description

Set Seconds in BCD format.

Parameters

- **RTCx:** RTC Instance
- **Seconds:** Value between Min_Data=0x00 and Max_Data=0x59

Return values

- **None:**

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.
- It can be written in initialization mode only (LL_RTC_EnableInitMode function)
- helper macro __LL_RTC_CONVERT_BIN2BCD is available to convert Seconds from binary to BCD format

Reference Manual to LL API cross reference:

- RTC_TR ST LL_RTC_TIME_SetSecond
- RTC_TR SU LL_RTC_TIME_SetSecond

LL_RTC_TIME_GetSecond

Function name

__STATIC_INLINE uint32_t LL_RTC_TIME_GetSecond (RTC_TypeDef * RTCx)

Function description

Get Seconds in BCD format.

Parameters

- **RTCx:** RTC Instance

Return values

- **Value:** between Min_Data=0x00 and Max_Data=0x59

Notes

- if RTC shadow registers are not bypassed (BYPSHAD=0), need to check if RSF flag is set before reading this bit
- Read either RTC_SSR or RTC_TR locks the values in the higher-order calendar shadow registers until RTC_DR is read (LL_RTC_ReadReg(RTC, DR)).
- helper macro __LL_RTC_CONVERT_BCD2BIN is available to convert Seconds from BCD to Binary format

Reference Manual to LL API cross reference:

- RTC_TR ST LL_RTC_TIME_GetSecond
- RTC_TR SU LL_RTC_TIME_GetSecond

LL_RTC_TIME_Config

Function name

__STATIC_INLINE void LL_RTC_TIME_Config (RTC_TypeDef * RTCx, uint32_t Format12_24, uint32_t Hours, uint32_t Minutes, uint32_t Seconds)

Function description

Set time (hour, minute and second) in BCD format.

Parameters

- **RTCx:** RTC Instance
- **Format12_24:** This parameter can be one of the following values:
  - LL_RTC_TIME_FORMAT_AM_OR_24
  - LL_RTC_TIME_FORMAT_PM
- **Hours:** Value between Min_Data=0x01 and Max_Data=0x12 or between Min_Data=0x00 and Max_Data=0x23
- **Minutes:** Value between Min_Data=0x00 and Max_Data=0x59
- **Seconds:** Value between Min_Data=0x00 and Max_Data=0x59

Return values

- **None:**

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.
- It can be written in initialization mode only (LL_RTC_EnableInitMode function)
- TimeFormat and Hours should follow the same format

Reference Manual to LL API cross reference:

- RTC_TR PM LL_RTC_TIME_Config
- RTC_TR HT LL_RTC_TIME_Config
- RTC_TR HU LL_RTC_TIME_Config
- RTC_TR MNT LL_RTC_TIME_Config
- RTC_TR MNU LL_RTC_TIME_Config
- RTC_TR ST LL_RTC_TIME_Config
- RTC_TR SU LL_RTC_TIME_Config

LL_RTC_TIME_Get

Function name

__STATIC_INLINE uint32_t LL_RTC_TIME_Get (RTC_TypeDef * RTCx)

Function description

Get time (hour, minute and second) in BCD format.

Parameters

- **RTCx:** RTC Instance

Return values

- **Combination:** of hours, minutes and seconds (Format: 0x00HHMMSS).

Notes

- if RTC shadow registers are not bypassed (BYPSHAD=0), need to check if RSF flag is set before reading this bit
- Read either RTC_SSR or RTC_TR locks the values in the higher-order calendar shadow registers until RTC_DR is read (LL_RTC_ReadReg(RTC, DR)).
- helper macros __LL_RTC_GET_HOUR, __LL_RTC_GET_MINUTE and __LL_RTC_GET_SECOND are available to get independently each parameter.

Reference Manual to LL API cross reference:

- RTC_TR HT LL_RTC_TIME_Get
- RTC_TR HU LL_RTC_TIME_Get
- RTC_TR MNT LL_RTC_TIME_Get
- RTC_TR MNU LL_RTC_TIME_Get
- RTC_TR ST LL_RTC_TIME_Get
- RTC_TR SU LL_RTC_TIME_Get

LL_RTC_TIME_EnableDayLightStore

Function name

__STATIC_INLINE void LL_RTC_TIME_EnableDayLightStore (RTC_TypeDef * RTCx)

Function description

Memorize whether the daylight saving time change has been performed.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.

Reference Manual to LL API cross reference:

- RTC_CR BKP LL_RTC_TIME_EnableDayLightStore

LL_RTC_TIME_DisableDayLightStore

Function name

__STATIC_INLINE void LL_RTC_TIME_DisableDayLightStore (RTC_TypeDef * RTCx)

Function description

Disable memorization whether the daylight saving time change has been performed.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.

Reference Manual to LL API cross reference:

- RTC_CR BKP LL_RTC_TIME_DisableDayLightStore

LL_RTC_TIME_IsDayLightStoreEnabled

Function name

__STATIC_INLINE uint32_t LL_RTC_TIME_IsDayLightStoreEnabled (RTC_TypeDef * RTCx)

Function description

Check if RTC Day Light Saving stored operation has been enabled or not.

Parameters

- **RTCx:** RTC Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- RTC_CR BKP LL_RTC_TIME_IsDayLightStoreEnabled

LL_RTC_TIME_DecHour

Function name

__STATIC_INLINE void LL_RTC_TIME_DecHour (RTC_TypeDef * RTCx)

Function description

Subtract 1 hour (winter time change)

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.

Reference Manual to LL API cross reference:

- RTC_CR SUB1H LL_RTC_TIME_DecHour

LL_RTC_TIME_IncHour

Function name

__STATIC_INLINE void LL_RTC_TIME_IncHour (RTC_TypeDef * RTCx)

Function description

Add 1 hour (summer time change)

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.

Reference Manual to LL API cross reference:

- RTC_CR ADD1H LL_RTC_TIME_IncHour

LL_RTC_TIME_GetSubSecond

Function name

__STATIC_INLINE uint32_t LL_RTC_TIME_GetSubSecond (RTC_TypeDef * RTCx)

Function description

Get Sub second value in the synchronous prescaler counter.

Parameters

- **RTCx:** RTC Instance

Return values

- **Sub:** second value (number between 0 and 65535)

Notes

- You can use both SubSeconds value and SecondFraction (PREDIV_S through LL_RTC_GetSynchPrescaler function) terms returned to convert Calendar SubSeconds value in second fraction ratio with time unit following generic formula: ==> Seconds fraction ratio * time_unit= [(SecondFraction-SubSeconds)/(SecondFraction+1)] * time_unit This conversion can be performed only if no shift operation is pending (ie. SHFP=0) when PREDIV_S >= SS.

Reference Manual to LL API cross reference:

- RTC_SSR SS LL_RTC_TIME_GetSubSecond

LL_RTC_TIME_Synchronize

Function name

__STATIC_INLINE void LL_RTC_TIME_Synchronize (RTC_TypeDef * RTCx, uint32_t ShiftSecond, uint32_t Fraction)

Function description

Synchronize to a remote clock with a high degree of precision.

Parameters

- **RTCx:** RTC Instance
- **ShiftSecond:** This parameter can be one of the following values:
  - LL_RTC_SHIFT_SECOND_DELAY
  - LL_RTC_SHIFT_SECOND_ADVANCE
- **Fraction:** Number of Seconds Fractions (any value from 0 to 0x7FFF)

Return values

- **None:**

Notes

- This operation effectively subtracts from (delays) or advance the clock of a fraction of a second.
- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.
- When REFCKON is set, firmware must not write to Shift control register.

Reference Manual to LL API cross reference:

- RTC_SHIFTR ADD1S LL_RTC_TIME_Synchronize
- RTC_SHIFTR SUBFS LL_RTC_TIME_Synchronize

LL_RTC_DATE_SetYear

Function name

__STATIC_INLINE void LL_RTC_DATE_SetYear (RTC_TypeDef * RTCx, uint32_t Year)

Function description

Set Year in BCD format.

Parameters

- **RTCx:** RTC Instance
- **Year:** Value between Min_Data=0x00 and Max_Data=0x99

Return values

- **None:**

Notes

- helper macro __LL_RTC_CONVERT_BIN2BCD is available to convert Year from binary to BCD format

Reference Manual to LL API cross reference:

- RTC_DR YT LL_RTC_DATE_SetYear
- RTC_DR YU LL_RTC_DATE_SetYear

LL_RTC_DATE_GetYear

Function name

__STATIC_INLINE uint32_t LL_RTC_DATE_GetYear (RTC_TypeDef * RTCx)

Function description

Get Year in BCD format.

Parameters

- **RTCx:** RTC Instance

Return values

- **Value:** between Min_Data=0x00 and Max_Data=0x99

Notes

- if RTC shadow registers are not bypassed (BYPSHAD=0), need to check if RSF flag is set before reading this bit
- helper macro __LL_RTC_CONVERT_BCD2BIN is available to convert Year from BCD to Binary format

Reference Manual to LL API cross reference:

- RTC_DR YT LL_RTC_DATE_GetYear
- RTC_DR YU LL_RTC_DATE_GetYear

LL_RTC_DATE_SetWeekDay

Function name

__STATIC_INLINE void LL_RTC_DATE_SetWeekDay (RTC_TypeDef * RTCx, uint32_t WeekDay)

Function description

Set Week day.

Parameters

- **RTCx:** RTC Instance
- **WeekDay:** This parameter can be one of the following values:
  - LL_RTC_WEEKDAY_MONDAY
  - LL_RTC_WEEKDAY_TUESDAY
  - LL_RTC_WEEKDAY_WEDNESDAY
  - LL_RTC_WEEKDAY_THURSDAY
  - LL_RTC_WEEKDAY_FRIDAY
  - LL_RTC_WEEKDAY_SATURDAY
  - LL_RTC_WEEKDAY_SUNDAY

Return values

- **None:**

Reference Manual to LL API cross reference:

- RTC_DR WDU LL_RTC_DATE_SetWeekDay

LL_RTC_DATE_GetWeekDay

Function name

__STATIC_INLINE uint32_t LL_RTC_DATE_GetWeekDay (RTC_TypeDef * RTCx)

Function description

Get Week day.

Parameters

- **RTCx:** RTC Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_RTC_WEEKDAY_MONDAY
  - LL_RTC_WEEKDAY_TUESDAY
  - LL_RTC_WEEKDAY_WEDNESDAY
  - LL_RTC_WEEKDAY_THURSDAY
  - LL_RTC_WEEKDAY_FRIDAY
  - LL_RTC_WEEKDAY_SATURDAY
  - LL_RTC_WEEKDAY_SUNDAY

Notes

- if RTC shadow registers are not bypassed (BYPSHAD=0), need to check if RSF flag is set before reading this bit

Reference Manual to LL API cross reference:

- RTC_DR WDU LL_RTC_DATE_GetWeekDay

LL_RTC_DATE_SetMonth

Function name

__STATIC_INLINE void LL_RTC_DATE_SetMonth (RTC_TypeDef * RTCx, uint32_t Month)

Function description

Set Month in BCD format.

Parameters

- **RTCx:** RTC Instance
- **Month:** This parameter can be one of the following values:
  - LL_RTC_MONTH_JANUARY
  - LL_RTC_MONTH_FEBRUARY
  - LL_RTC_MONTH_MARCH
  - LL_RTC_MONTH_APRIL
  - LL_RTC_MONTH_MAY
  - LL_RTC_MONTH_JUNE
  - LL_RTC_MONTH_JULY
  - LL_RTC_MONTH_AUGUST
  - LL_RTC_MONTH_SEPTEMBER
  - LL_RTC_MONTH_OCTOBER
  - LL_RTC_MONTH_NOVEMBER
  - LL_RTC_MONTH_DECEMBER

Return values

- **None:**

Notes

- helper macro __LL_RTC_CONVERT_BIN2BCD is available to convert Month from binary to BCD format

Reference Manual to LL API cross reference:

- RTC_DR MT LL_RTC_DATE_SetMonth
- RTC_DR MU LL_RTC_DATE_SetMonth

LL_RTC_DATE_GetMonth

Function name

__STATIC_INLINE uint32_t LL_RTC_DATE_GetMonth (RTC_TypeDef * RTCx)

Function description

Get Month in BCD format.

Parameters

- **RTCx:** RTC Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_RTC_MONTH_JANUARY
  - LL_RTC_MONTH_FEBRUARY
  - LL_RTC_MONTH_MARCH
  - LL_RTC_MONTH_APRIL
  - LL_RTC_MONTH_MAY
  - LL_RTC_MONTH_JUNE
  - LL_RTC_MONTH_JULY
  - LL_RTC_MONTH_AUGUST
  - LL_RTC_MONTH_SEPTEMBER
  - LL_RTC_MONTH_OCTOBER
  - LL_RTC_MONTH_NOVEMBER
  - LL_RTC_MONTH_DECEMBER

Notes

- if RTC shadow registers are not bypassed (BYPSHAD=0), need to check if RSF flag is set before reading this bit
- helper macro __LL_RTC_CONVERT_BCD2BIN is available to convert Month from BCD to Binary format

Reference Manual to LL API cross reference:

- RTC_DR MT LL_RTC_DATE_GetMonth
- RTC_DR MU LL_RTC_DATE_GetMonth

LL_RTC_DATE_SetDay

Function name

__STATIC_INLINE void LL_RTC_DATE_SetDay (RTC_TypeDef * RTCx, uint32_t Day)

Function description

Set Day in BCD format.

Parameters

- **RTCx:** RTC Instance
- **Day:** Value between Min_Data=0x01 and Max_Data=0x31

Return values

- **None:**

Notes

- helper macro __LL_RTC_CONVERT_BIN2BCD is available to convert Day from binary to BCD format

Reference Manual to LL API cross reference:

- RTC_DR DT LL_RTC_DATE_SetDay
- RTC_DR DU LL_RTC_DATE_SetDay

LL_RTC_DATE_GetDay

Function name

__STATIC_INLINE uint32_t LL_RTC_DATE_GetDay (RTC_TypeDef * RTCx)

Function description

Get Day in BCD format.

Parameters

- **RTCx:** RTC Instance

Return values

- **Value:** between Min_Data=0x01 and Max_Data=0x31

Notes

- if RTC shadow registers are not bypassed (BYPSHAD=0), need to check if RSF flag is set before reading this bit
- helper macro __LL_RTC_CONVERT_BCD2BIN is available to convert Day from BCD to Binary format

Reference Manual to LL API cross reference:

- RTC_DR DT LL_RTC_DATE_GetDay
- RTC_DR DU LL_RTC_DATE_GetDay

LL_RTC_DATE_Config

Function name

__STATIC_INLINE void LL_RTC_DATE_Config (RTC_TypeDef * RTCx, uint32_t WeekDay, uint32_t Day, uint32_t Month, uint32_t Year)

Function description

Set date (WeekDay, Day, Month and Year) in BCD format.

Parameters

- **RTCx:** RTC Instance
- **WeekDay:** This parameter can be one of the following values:
  - LL_RTC_WEEKDAY_MONDAY
  - LL_RTC_WEEKDAY_TUESDAY
  - LL_RTC_WEEKDAY_WEDNESDAY
  - LL_RTC_WEEKDAY_THURSDAY
  - LL_RTC_WEEKDAY_FRIDAY
  - LL_RTC_WEEKDAY_SATURDAY
  - LL_RTC_WEEKDAY_SUNDAY
- **Day:** Value between Min_Data=0x01 and Max_Data=0x31
- **Month:** This parameter can be one of the following values:
  - LL_RTC_MONTH_JANUARY
  - LL_RTC_MONTH_FEBRUARY
  - LL_RTC_MONTH_MARCH
  - LL_RTC_MONTH_APRIL
  - LL_RTC_MONTH_MAY
  - LL_RTC_MONTH_JUNE
  - LL_RTC_MONTH_JULY
  - LL_RTC_MONTH_AUGUST
  - LL_RTC_MONTH_SEPTEMBER
  - LL_RTC_MONTH_OCTOBER
  - LL_RTC_MONTH_NOVEMBER
  - LL_RTC_MONTH_DECEMBER
- **Year:** Value between Min_Data=0x00 and Max_Data=0x99

Return values

- **None:**

Reference Manual to LL API cross reference:

- RTC_DR WDU LL_RTC_DATE_Config
- RTC_DR MT LL_RTC_DATE_Config
- RTC_DR MU LL_RTC_DATE_Config
- RTC_DR DT LL_RTC_DATE_Config
- RTC_DR DU LL_RTC_DATE_Config
- RTC_DR YT LL_RTC_DATE_Config
- RTC_DR YU LL_RTC_DATE_Config

LL_RTC_DATE_Get

Function name

__STATIC_INLINE uint32_t LL_RTC_DATE_Get (RTC_TypeDef * RTCx)

Function description

Get date (WeekDay, Day, Month and Year) in BCD format.

Parameters

- **RTCx:** RTC Instance

Return values

- **Combination:** of WeekDay, Day, Month and Year (Format: 0xWWDDMMYY).

Notes

- if RTC shadow registers are not bypassed (BYPSHAD=0), need to check if RSF flag is set before reading this bit
- helper macros __LL_RTC_GET_WEEKDAY, __LL_RTC_GET_YEAR, __LL_RTC_GET_MONTH, and __LL_RTC_GET_DAY are available to get independently each parameter.

Reference Manual to LL API cross reference:

- RTC_DR WDU LL_RTC_DATE_Get
- RTC_DR MT LL_RTC_DATE_Get
- RTC_DR MU LL_RTC_DATE_Get
- RTC_DR DT LL_RTC_DATE_Get
- RTC_DR DU LL_RTC_DATE_Get
- RTC_DR YT LL_RTC_DATE_Get
- RTC_DR YU LL_RTC_DATE_Get

LL_RTC_ALMA_Enable

Function name

__STATIC_INLINE void LL_RTC_ALMA_Enable (RTC_TypeDef * RTCx)

Function description

Enable Alarm A.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.

Reference Manual to LL API cross reference:

- RTC_CR ALRAE LL_RTC_ALMA_Enable

LL_RTC_ALMA_Disable

Function name

__STATIC_INLINE void LL_RTC_ALMA_Disable (RTC_TypeDef * RTCx)

Function description

Disable Alarm A.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.

Reference Manual to LL API cross reference:

- RTC_CR ALRAE LL_RTC_ALMA_Disable

LL_RTC_ALMA_SetMask

Function name

__STATIC_INLINE void LL_RTC_ALMA_SetMask (RTC_TypeDef * RTCx, uint32_t Mask)

Function description

Specify the Alarm A masks.

Parameters

- **RTCx:** RTC Instance
- **Mask:** This parameter can be a combination of the following values:
  - LL_RTC_ALMA_MASK_NONE
  - LL_RTC_ALMA_MASK_DATEWEEKDAY
  - LL_RTC_ALMA_MASK_HOURS
  - LL_RTC_ALMA_MASK_MINUTES
  - LL_RTC_ALMA_MASK_SECONDS
  - LL_RTC_ALMA_MASK_ALL

Return values

- **None:**

Reference Manual to LL API cross reference:

- RTC_ALRMAR MSK4 LL_RTC_ALMA_SetMask
- RTC_ALRMAR MSK3 LL_RTC_ALMA_SetMask
- RTC_ALRMAR MSK2 LL_RTC_ALMA_SetMask
- RTC_ALRMAR MSK1 LL_RTC_ALMA_SetMask

LL_RTC_ALMA_GetMask

Function name

__STATIC_INLINE uint32_t LL_RTC_ALMA_GetMask (RTC_TypeDef * RTCx)

Function description

Get the Alarm A masks.

Parameters

- **RTCx:** RTC Instance

Return values

- **Returned:** value can be a combination of the following values:
  - LL_RTC_ALMA_MASK_NONE
  - LL_RTC_ALMA_MASK_DATEWEEKDAY
  - LL_RTC_ALMA_MASK_HOURS
  - LL_RTC_ALMA_MASK_MINUTES
  - LL_RTC_ALMA_MASK_SECONDS
  - LL_RTC_ALMA_MASK_ALL

Reference Manual to LL API cross reference:

- RTC_ALRMAR MSK4 LL_RTC_ALMA_GetMask
- RTC_ALRMAR MSK3 LL_RTC_ALMA_GetMask
- RTC_ALRMAR MSK2 LL_RTC_ALMA_GetMask
- RTC_ALRMAR MSK1 LL_RTC_ALMA_GetMask

LL_RTC_ALMA_EnableWeekday

Function name

__STATIC_INLINE void LL_RTC_ALMA_EnableWeekday (RTC_TypeDef * RTCx)

Function description

Enable AlarmA Week day selection (DU[3:0] represents the week day.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- RTC_ALRMAR WDSEL LL_RTC_ALMA_EnableWeekday

LL_RTC_ALMA_DisableWeekday

Function name

__STATIC_INLINE void LL_RTC_ALMA_DisableWeekday (RTC_TypeDef * RTCx)

Function description

Disable AlarmA Week day selection (DU[3:0] represents the date)

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- RTC_ALRMAR WDSEL LL_RTC_ALMA_DisableWeekday

LL_RTC_ALMA_SetDay

Function name

__STATIC_INLINE void LL_RTC_ALMA_SetDay (RTC_TypeDef * RTCx, uint32_t Day)

Function description

Set ALARM A Day in BCD format.

Parameters

- **RTCx:** RTC Instance
- **Day:** Value between Min_Data=0x01 and Max_Data=0x31

Return values

- **None:**

Notes

- helper macro __LL_RTC_CONVERT_BIN2BCD is available to convert Day from binary to BCD format

Reference Manual to LL API cross reference:

- RTC_ALRMAR DT LL_RTC_ALMA_SetDay
- RTC_ALRMAR DU LL_RTC_ALMA_SetDay

LL_RTC_ALMA_GetDay

Function name

__STATIC_INLINE uint32_t LL_RTC_ALMA_GetDay (RTC_TypeDef * RTCx)

Function description

Get ALARM A Day in BCD format.

Parameters

- **RTCx:** RTC Instance

Return values

- **Value:** between Min_Data=0x01 and Max_Data=0x31

Notes

- helper macro __LL_RTC_CONVERT_BCD2BIN is available to convert Day from BCD to Binary format

Reference Manual to LL API cross reference:

- RTC_ALRMAR DT LL_RTC_ALMA_GetDay
- RTC_ALRMAR DU LL_RTC_ALMA_GetDay

LL_RTC_ALMA_SetWeekDay

Function name

__STATIC_INLINE void LL_RTC_ALMA_SetWeekDay (RTC_TypeDef * RTCx, uint32_t WeekDay)

Function description

Set ALARM A Weekday.

Parameters

- **RTCx:** RTC Instance
- **WeekDay:** This parameter can be one of the following values:
  - LL_RTC_WEEKDAY_MONDAY
  - LL_RTC_WEEKDAY_TUESDAY
  - LL_RTC_WEEKDAY_WEDNESDAY
  - LL_RTC_WEEKDAY_THURSDAY
  - LL_RTC_WEEKDAY_FRIDAY
  - LL_RTC_WEEKDAY_SATURDAY
  - LL_RTC_WEEKDAY_SUNDAY

Return values

- **None:**

Reference Manual to LL API cross reference:

- RTC_ALRMAR DU LL_RTC_ALMA_SetWeekDay

LL_RTC_ALMA_GetWeekDay

Function name

__STATIC_INLINE uint32_t LL_RTC_ALMA_GetWeekDay (RTC_TypeDef * RTCx)

Function description

Get ALARM A Weekday.

Parameters

- **RTCx:** RTC Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_RTC_WEEKDAY_MONDAY
  - LL_RTC_WEEKDAY_TUESDAY
  - LL_RTC_WEEKDAY_WEDNESDAY
  - LL_RTC_WEEKDAY_THURSDAY
  - LL_RTC_WEEKDAY_FRIDAY
  - LL_RTC_WEEKDAY_SATURDAY
  - LL_RTC_WEEKDAY_SUNDAY

Reference Manual to LL API cross reference:

- RTC_ALRMAR DU LL_RTC_ALMA_GetWeekDay

LL_RTC_ALMA_SetTimeFormat

Function name

__STATIC_INLINE void LL_RTC_ALMA_SetTimeFormat (RTC_TypeDef * RTCx, uint32_t TimeFormat)

Function description

Set Alarm A time format (AM/24-hour or PM notation)

Parameters

- **RTCx:** RTC Instance
- **TimeFormat:** This parameter can be one of the following values:
  - LL_RTC_ALMA_TIME_FORMAT_AM
  - LL_RTC_ALMA_TIME_FORMAT_PM

Return values

- **None:**

Reference Manual to LL API cross reference:

- RTC_ALRMAR PM LL_RTC_ALMA_SetTimeFormat

LL_RTC_ALMA_GetTimeFormat

Function name

__STATIC_INLINE uint32_t LL_RTC_ALMA_GetTimeFormat (RTC_TypeDef * RTCx)

Function description

Get Alarm A time format (AM or PM notation)

Parameters

- **RTCx:** RTC Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_RTC_ALMA_TIME_FORMAT_AM
  - LL_RTC_ALMA_TIME_FORMAT_PM

Reference Manual to LL API cross reference:

- RTC_ALRMAR PM LL_RTC_ALMA_GetTimeFormat

LL_RTC_ALMA_SetHour

Function name

__STATIC_INLINE void LL_RTC_ALMA_SetHour (RTC_TypeDef * RTCx, uint32_t Hours)

Function description

Set ALARM A Hours in BCD format.

Parameters

- **RTCx:** RTC Instance
- **Hours:** Value between Min_Data=0x01 and Max_Data=0x12 or between Min_Data=0x00 and Max_Data=0x23

Return values

- **None:**

Notes

- helper macro __LL_RTC_CONVERT_BIN2BCD is available to convert Hours from binary to BCD format

Reference Manual to LL API cross reference:

- RTC_ALRMAR HT LL_RTC_ALMA_SetHour
- RTC_ALRMAR HU LL_RTC_ALMA_SetHour

LL_RTC_ALMA_GetHour

Function name

__STATIC_INLINE uint32_t LL_RTC_ALMA_GetHour (RTC_TypeDef * RTCx)

Function description

Get ALARM A Hours in BCD format.

Parameters

- **RTCx:** RTC Instance

Return values

- **Value:** between Min_Data=0x01 and Max_Data=0x12 or between Min_Data=0x00 and Max_Data=0x23

Notes

- helper macro __LL_RTC_CONVERT_BCD2BIN is available to convert Hours from BCD to Binary format

Reference Manual to LL API cross reference:

- RTC_ALRMAR HT LL_RTC_ALMA_GetHour
- RTC_ALRMAR HU LL_RTC_ALMA_GetHour

LL_RTC_ALMA_SetMinute

Function name

__STATIC_INLINE void LL_RTC_ALMA_SetMinute (RTC_TypeDef * RTCx, uint32_t Minutes)

Function description

Set ALARM A Minutes in BCD format.

Parameters

- **RTCx:** RTC Instance
- **Minutes:** Value between Min_Data=0x00 and Max_Data=0x59

Return values

- **None:**

Notes

- helper macro __LL_RTC_CONVERT_BIN2BCD is available to convert Minutes from binary to BCD format

Reference Manual to LL API cross reference:

- RTC_ALRMAR MNT LL_RTC_ALMA_SetMinute
- RTC_ALRMAR MNU LL_RTC_ALMA_SetMinute

LL_RTC_ALMA_GetMinute

Function name

__STATIC_INLINE uint32_t LL_RTC_ALMA_GetMinute (RTC_TypeDef * RTCx)

Function description

Get ALARM A Minutes in BCD format.

Parameters

- **RTCx:** RTC Instance

Return values

- **Value:** between Min_Data=0x00 and Max_Data=0x59

Notes

- helper macro __LL_RTC_CONVERT_BCD2BIN is available to convert Minutes from BCD to Binary format

Reference Manual to LL API cross reference:

- RTC_ALRMAR MNT LL_RTC_ALMA_GetMinute
- RTC_ALRMAR MNU LL_RTC_ALMA_GetMinute

LL_RTC_ALMA_SetSecond

Function name

__STATIC_INLINE void LL_RTC_ALMA_SetSecond (RTC_TypeDef * RTCx, uint32_t Seconds)

Function description

Set ALARM A Seconds in BCD format.

Parameters

- **RTCx:** RTC Instance
- **Seconds:** Value between Min_Data=0x00 and Max_Data=0x59

Return values

- **None:**

Notes

- helper macro __LL_RTC_CONVERT_BIN2BCD is available to convert Seconds from binary to BCD format

Reference Manual to LL API cross reference:

- RTC_ALRMAR ST LL_RTC_ALMA_SetSecond
- RTC_ALRMAR SU LL_RTC_ALMA_SetSecond

LL_RTC_ALMA_GetSecond

Function name

__STATIC_INLINE uint32_t LL_RTC_ALMA_GetSecond (RTC_TypeDef * RTCx)

Function description

Get ALARM A Seconds in BCD format.

Parameters

- **RTCx:** RTC Instance

Return values

- **Value:** between Min_Data=0x00 and Max_Data=0x59

Notes

- helper macro __LL_RTC_CONVERT_BCD2BIN is available to convert Seconds from BCD to Binary format

Reference Manual to LL API cross reference:

- RTC_ALRMAR ST LL_RTC_ALMA_GetSecond
- RTC_ALRMAR SU LL_RTC_ALMA_GetSecond

LL_RTC_ALMA_ConfigTime

Function name

__STATIC_INLINE void LL_RTC_ALMA_ConfigTime (RTC_TypeDef * RTCx, uint32_t Format12_24, uint32_t Hours, uint32_t Minutes, uint32_t Seconds)

Function description

Set Alarm A Time (hour, minute and second) in BCD format.

Parameters

- **RTCx:** RTC Instance
- **Format12_24:** This parameter can be one of the following values:
  - LL_RTC_ALMA_TIME_FORMAT_AM
  - LL_RTC_ALMA_TIME_FORMAT_PM
- **Hours:** Value between Min_Data=0x01 and Max_Data=0x12 or between Min_Data=0x00 and Max_Data=0x23
- **Minutes:** Value between Min_Data=0x00 and Max_Data=0x59
- **Seconds:** Value between Min_Data=0x00 and Max_Data=0x59

Return values

- **None:**

Reference Manual to LL API cross reference:

- RTC_ALRMAR PM LL_RTC_ALMA_ConfigTime
- RTC_ALRMAR HT LL_RTC_ALMA_ConfigTime
- RTC_ALRMAR HU LL_RTC_ALMA_ConfigTime
- RTC_ALRMAR MNT LL_RTC_ALMA_ConfigTime
- RTC_ALRMAR MNU LL_RTC_ALMA_ConfigTime
- RTC_ALRMAR ST LL_RTC_ALMA_ConfigTime
- RTC_ALRMAR SU LL_RTC_ALMA_ConfigTime

LL_RTC_ALMA_GetTime

Function name

__STATIC_INLINE uint32_t LL_RTC_ALMA_GetTime (RTC_TypeDef * RTCx)

Function description

Get Alarm B Time (hour, minute and second) in BCD format.

Parameters

- **RTCx:** RTC Instance

Return values

- **Combination:** of hours, minutes and seconds.

Notes

- helper macros __LL_RTC_GET_HOUR, __LL_RTC_GET_MINUTE and __LL_RTC_GET_SECOND are available to get independently each parameter.

Reference Manual to LL API cross reference:

- RTC_ALRMAR HT LL_RTC_ALMA_GetTime
- RTC_ALRMAR HU LL_RTC_ALMA_GetTime
- RTC_ALRMAR MNT LL_RTC_ALMA_GetTime
- RTC_ALRMAR MNU LL_RTC_ALMA_GetTime
- RTC_ALRMAR ST LL_RTC_ALMA_GetTime
- RTC_ALRMAR SU LL_RTC_ALMA_GetTime

LL_RTC_ALMA_SetSubSecondMask

Function name

__STATIC_INLINE void LL_RTC_ALMA_SetSubSecondMask (RTC_TypeDef * RTCx, uint32_t Mask)

Function description

Set Alarm A Mask the most-significant bits starting at this bit.

Parameters

- **RTCx:** RTC Instance
- **Mask:** Value between Min_Data=0x00 and Max_Data=0xF

Return values

- **None:**

Notes

- This register can be written only when ALRAE is reset in RTC_CR register, or in initialization mode.

Reference Manual to LL API cross reference:

- RTC_ALRMASSR MASKSS LL_RTC_ALMA_SetSubSecondMask

LL_RTC_ALMA_GetSubSecondMask

Function name

__STATIC_INLINE uint32_t LL_RTC_ALMA_GetSubSecondMask (RTC_TypeDef * RTCx)

Function description

Get Alarm A Mask the most-significant bits starting at this bit.

Parameters

- **RTCx:** RTC Instance

Return values

- **Value:** between Min_Data=0x00 and Max_Data=0xF

Reference Manual to LL API cross reference:

- RTC_ALRMASSR MASKSS LL_RTC_ALMA_GetSubSecondMask

LL_RTC_ALMA_SetBinAutoClr

Function name

__STATIC_INLINE void LL_RTC_ALMA_SetBinAutoClr (RTC_TypeDef * RTCx, uint32_t BinaryAutoClr)

Function description

Set Alarm A Binary mode auto clear.

Parameters

- **RTCx:** RTC Instance
- **BinaryAutoClr:** This parameter can be one of the following values:
  - LL_RTC_ALMA_SUBSECONDBIN_AUTOCLR_NO
  - LL_RTC_ALMA_SUBSECONDBIN_AUTOCLR_YES

Return values

- **None:**

Notes

- This register can be written only when ALRAE is reset in RTC_CR register, or in initialization mode.

Reference Manual to LL API cross reference:

- RTC_ALRABINR SSCLR LL_RTC_ALMA_SetBinAutoClr

LL_RTC_ALMA_GetBinAutoClr

Function name

__STATIC_INLINE uint32_t LL_RTC_ALMA_GetBinAutoClr (const RTC_TypeDef * RTCx)

Function description

Get Alarm A Binary mode auto clear.

Parameters

- **RTCx:** RTC Instance

Return values

- **It:** can be one of the following values:
  - LL_RTC_ALMA_SUBSECONDBIN_AUTOCLR_NO
  - LL_RTC_ALMA_SUBSECONDBIN_AUTOCLR_YES

Reference Manual to LL API cross reference:

- RTC_ALRABINR SSCLR LL_RTC_ALMA_GetBinAutoClr

LL_RTC_ALMA_SetSubSecond

Function name

__STATIC_INLINE void LL_RTC_ALMA_SetSubSecond (RTC_TypeDef * RTCx, uint32_t Subsecond)

Function description

Set Alarm A Sub seconds value.

Parameters

- **RTCx:** RTC Instance
- **Subsecond:** Value between Min_Data=0x00 and Max_Data=0x7FFF

Return values

- **None:**

Reference Manual to LL API cross reference:

- RCT_ALRMASSR SS LL_RTC_ALMA_SetSubSecond

LL_RTC_ALMA_GetSubSecond

Function name

__STATIC_INLINE uint32_t LL_RTC_ALMA_GetSubSecond (RTC_TypeDef * RTCx)

Function description

Get Alarm A Sub seconds value.

Parameters

- **RTCx:** RTC Instance

Return values

- **Value:** between Min_Data=0x00 and Max_Data=0x7FFF

Reference Manual to LL API cross reference:

- RCT_ALRMASSR SS LL_RTC_ALMA_GetSubSecond

LL_RTC_ALMB_Enable

Function name

__STATIC_INLINE void LL_RTC_ALMB_Enable (RTC_TypeDef * RTCx)

Function description

Enable Alarm B.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.

Reference Manual to LL API cross reference:

- RTC_CR ALRBE LL_RTC_ALMB_Enable

LL_RTC_ALMB_Disable

Function name

__STATIC_INLINE void LL_RTC_ALMB_Disable (RTC_TypeDef * RTCx)

Function description

Disable Alarm B.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.

Reference Manual to LL API cross reference:

- RTC_CR ALRBE LL_RTC_ALMB_Disable

LL_RTC_ALMB_SetMask

Function name

__STATIC_INLINE void LL_RTC_ALMB_SetMask (RTC_TypeDef * RTCx, uint32_t Mask)

Function description

Specify the Alarm B masks.

Parameters

- **RTCx:** RTC Instance
- **Mask:** This parameter can be a combination of the following values:
  - LL_RTC_ALMB_MASK_NONE
  - LL_RTC_ALMB_MASK_DATEWEEKDAY
  - LL_RTC_ALMB_MASK_HOURS
  - LL_RTC_ALMB_MASK_MINUTES
  - LL_RTC_ALMB_MASK_SECONDS
  - LL_RTC_ALMB_MASK_ALL

Return values

- **None:**

Reference Manual to LL API cross reference:

- RTC_ALRMBR MSK4 LL_RTC_ALMB_SetMask
- RTC_ALRMBR MSK3 LL_RTC_ALMB_SetMask
- RTC_ALRMBR MSK2 LL_RTC_ALMB_SetMask
- RTC_ALRMBR MSK1 LL_RTC_ALMB_SetMask

LL_RTC_ALMB_GetMask

Function name

__STATIC_INLINE uint32_t LL_RTC_ALMB_GetMask (RTC_TypeDef * RTCx)

Function description

Get the Alarm B masks.

Parameters

- **RTCx:** RTC Instance

Return values

- **Returned:** value can be a combination of the following values:
  - LL_RTC_ALMB_MASK_NONE
  - LL_RTC_ALMB_MASK_DATEWEEKDAY
  - LL_RTC_ALMB_MASK_HOURS
  - LL_RTC_ALMB_MASK_MINUTES
  - LL_RTC_ALMB_MASK_SECONDS
  - LL_RTC_ALMB_MASK_ALL

Reference Manual to LL API cross reference:

- RTC_ALRMBR MSK4 LL_RTC_ALMB_GetMask
- RTC_ALRMBR MSK3 LL_RTC_ALMB_GetMask
- RTC_ALRMBR MSK2 LL_RTC_ALMB_GetMask
- RTC_ALRMBR MSK1 LL_RTC_ALMB_GetMask

LL_RTC_ALMB_EnableWeekday

Function name

__STATIC_INLINE void LL_RTC_ALMB_EnableWeekday (RTC_TypeDef * RTCx)

Function description

Enable AlarmB Week day selection (DU[3:0] represents the week day.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- RTC_ALRMBR WDSEL LL_RTC_ALMB_EnableWeekday

LL_RTC_ALMB_DisableWeekday

Function name

__STATIC_INLINE void LL_RTC_ALMB_DisableWeekday (RTC_TypeDef * RTCx)

Function description

Disable AlarmB Week day selection (DU[3:0] represents the date)

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- RTC_ALRMBR WDSEL LL_RTC_ALMB_DisableWeekday

LL_RTC_ALMB_SetDay

Function name

__STATIC_INLINE void LL_RTC_ALMB_SetDay (RTC_TypeDef * RTCx, uint32_t Day)

Function description

Set ALARM B Day in BCD format.

Parameters

- **RTCx:** RTC Instance
- **Day:** Value between Min_Data=0x01 and Max_Data=0x31

Return values

- **None:**

Notes

- helper macro __LL_RTC_CONVERT_BIN2BCD is available to convert Day from binary to BCD format

Reference Manual to LL API cross reference:

- RTC_ALRMBR DT LL_RTC_ALMB_SetDay
- RTC_ALRMBR DU LL_RTC_ALMB_SetDay

LL_RTC_ALMB_GetDay

Function name

__STATIC_INLINE uint32_t LL_RTC_ALMB_GetDay (RTC_TypeDef * RTCx)

Function description

Get ALARM B Day in BCD format.

Parameters

- **RTCx:** RTC Instance

Return values

- **Value:** between Min_Data=0x01 and Max_Data=0x31

Notes

- helper macro __LL_RTC_CONVERT_BCD2BIN is available to convert Day from BCD to Binary format

Reference Manual to LL API cross reference:

- RTC_ALRMBR DT LL_RTC_ALMB_GetDay
- RTC_ALRMBR DU LL_RTC_ALMB_GetDay

LL_RTC_ALMB_SetWeekDay

Function name

__STATIC_INLINE void LL_RTC_ALMB_SetWeekDay (RTC_TypeDef * RTCx, uint32_t WeekDay)

Function description

Set ALARM B Weekday.

Parameters

- **RTCx:** RTC Instance
- **WeekDay:** This parameter can be one of the following values:
  - LL_RTC_WEEKDAY_MONDAY
  - LL_RTC_WEEKDAY_TUESDAY
  - LL_RTC_WEEKDAY_WEDNESDAY
  - LL_RTC_WEEKDAY_THURSDAY
  - LL_RTC_WEEKDAY_FRIDAY
  - LL_RTC_WEEKDAY_SATURDAY
  - LL_RTC_WEEKDAY_SUNDAY

Return values

- **None:**

Reference Manual to LL API cross reference:

- RTC_ALRMBR DU LL_RTC_ALMB_SetWeekDay

LL_RTC_ALMB_GetWeekDay

Function name

__STATIC_INLINE uint32_t LL_RTC_ALMB_GetWeekDay (RTC_TypeDef * RTCx)

Function description

Get ALARM B Weekday.

Parameters

- **RTCx:** RTC Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_RTC_WEEKDAY_MONDAY
  - LL_RTC_WEEKDAY_TUESDAY
  - LL_RTC_WEEKDAY_WEDNESDAY
  - LL_RTC_WEEKDAY_THURSDAY
  - LL_RTC_WEEKDAY_FRIDAY
  - LL_RTC_WEEKDAY_SATURDAY
  - LL_RTC_WEEKDAY_SUNDAY

Reference Manual to LL API cross reference:

- RTC_ALRMBR DU LL_RTC_ALMB_GetWeekDay

LL_RTC_ALMB_SetTimeFormat

Function name

__STATIC_INLINE void LL_RTC_ALMB_SetTimeFormat (RTC_TypeDef * RTCx, uint32_t TimeFormat)

Function description

Set ALARM B time format (AM/24-hour or PM notation)

Parameters

- **RTCx:** RTC Instance
- **TimeFormat:** This parameter can be one of the following values:
  - LL_RTC_ALMB_TIME_FORMAT_AM
  - LL_RTC_ALMB_TIME_FORMAT_PM

Return values

- **None:**

Reference Manual to LL API cross reference:

- RTC_ALRMBR PM LL_RTC_ALMB_SetTimeFormat

LL_RTC_ALMB_GetTimeFormat

Function name

__STATIC_INLINE uint32_t LL_RTC_ALMB_GetTimeFormat (RTC_TypeDef * RTCx)

Function description

Get ALARM B time format (AM or PM notation)

Parameters

- **RTCx:** RTC Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_RTC_ALMB_TIME_FORMAT_AM
  - LL_RTC_ALMB_TIME_FORMAT_PM

Reference Manual to LL API cross reference:

- RTC_ALRMBR PM LL_RTC_ALMB_GetTimeFormat

LL_RTC_ALMB_SetHour

Function name

__STATIC_INLINE void LL_RTC_ALMB_SetHour (RTC_TypeDef * RTCx, uint32_t Hours)

Function description

Set ALARM B Hours in BCD format.

Parameters

- **RTCx:** RTC Instance
- **Hours:** Value between Min_Data=0x01 and Max_Data=0x12 or between Min_Data=0x00 and Max_Data=0x23

Return values

- **None:**

Notes

- helper macro __LL_RTC_CONVERT_BIN2BCD is available to convert Hours from binary to BCD format

Reference Manual to LL API cross reference:

- RTC_ALRMBR HT LL_RTC_ALMB_SetHour
- RTC_ALRMBR HU LL_RTC_ALMB_SetHour

LL_RTC_ALMB_GetHour

Function name

__STATIC_INLINE uint32_t LL_RTC_ALMB_GetHour (RTC_TypeDef * RTCx)

Function description

Get ALARM B Hours in BCD format.

Parameters

- **RTCx:** RTC Instance

Return values

- **Value:** between Min_Data=0x01 and Max_Data=0x12 or between Min_Data=0x00 and Max_Data=0x23

Notes

- helper macro __LL_RTC_CONVERT_BCD2BIN is available to convert Hours from BCD to Binary format

Reference Manual to LL API cross reference:

- RTC_ALRMBR HT LL_RTC_ALMB_GetHour
- RTC_ALRMBR HU LL_RTC_ALMB_GetHour

LL_RTC_ALMB_SetMinute

Function name

__STATIC_INLINE void LL_RTC_ALMB_SetMinute (RTC_TypeDef * RTCx, uint32_t Minutes)

Function description

Set ALARM B Minutes in BCD format.

Parameters

- **RTCx:** RTC Instance
- **Minutes:** between Min_Data=0x00 and Max_Data=0x59

Return values

- **None:**

Notes

- helper macro __LL_RTC_CONVERT_BIN2BCD is available to convert Minutes from binary to BCD format

Reference Manual to LL API cross reference:

- RTC_ALRMBR MNT LL_RTC_ALMB_SetMinute
- RTC_ALRMBR MNU LL_RTC_ALMB_SetMinute

LL_RTC_ALMB_GetMinute

Function name

__STATIC_INLINE uint32_t LL_RTC_ALMB_GetMinute (RTC_TypeDef * RTCx)

Function description

Get ALARM B Minutes in BCD format.

Parameters

- **RTCx:** RTC Instance

Return values

- **Value:** between Min_Data=0x00 and Max_Data=0x59

Notes

- helper macro __LL_RTC_CONVERT_BCD2BIN is available to convert Minutes from BCD to Binary format

Reference Manual to LL API cross reference:

- RTC_ALRMBR MNT LL_RTC_ALMB_GetMinute
- RTC_ALRMBR MNU LL_RTC_ALMB_GetMinute

LL_RTC_ALMB_SetSecond

Function name

__STATIC_INLINE void LL_RTC_ALMB_SetSecond (RTC_TypeDef * RTCx, uint32_t Seconds)

Function description

Set ALARM B Seconds in BCD format.

Parameters

- **RTCx:** RTC Instance
- **Seconds:** Value between Min_Data=0x00 and Max_Data=0x59

Return values

- **None:**

Notes

- helper macro __LL_RTC_CONVERT_BIN2BCD is available to convert Seconds from binary to BCD format

Reference Manual to LL API cross reference:

- RTC_ALRMBR ST LL_RTC_ALMB_SetSecond
- RTC_ALRMBR SU LL_RTC_ALMB_SetSecond

LL_RTC_ALMB_GetSecond

Function name

__STATIC_INLINE uint32_t LL_RTC_ALMB_GetSecond (RTC_TypeDef * RTCx)

Function description

Get ALARM B Seconds in BCD format.

Parameters

- **RTCx:** RTC Instance

Return values

- **Value:** between Min_Data=0x00 and Max_Data=0x59

Notes

- helper macro __LL_RTC_CONVERT_BCD2BIN is available to convert Seconds from BCD to Binary format

Reference Manual to LL API cross reference:

- RTC_ALRMBR ST LL_RTC_ALMB_GetSecond
- RTC_ALRMBR SU LL_RTC_ALMB_GetSecond

LL_RTC_ALMB_ConfigTime

Function name

__STATIC_INLINE void LL_RTC_ALMB_ConfigTime (RTC_TypeDef * RTCx, uint32_t Format12_24, uint32_t Hours, uint32_t Minutes, uint32_t Seconds)

Function description

Set Alarm B Time (hour, minute and second) in BCD format.

Parameters

- **RTCx:** RTC Instance
- **Format12_24:** This parameter can be one of the following values:
  - LL_RTC_ALMB_TIME_FORMAT_AM
  - LL_RTC_ALMB_TIME_FORMAT_PM
- **Hours:** Value between Min_Data=0x01 and Max_Data=0x12 or between Min_Data=0x00 and Max_Data=0x23
- **Minutes:** Value between Min_Data=0x00 and Max_Data=0x59
- **Seconds:** Value between Min_Data=0x00 and Max_Data=0x59

Return values

- **None:**

Reference Manual to LL API cross reference:

- RTC_ALRMBR PM LL_RTC_ALMB_ConfigTime
- RTC_ALRMBR HT LL_RTC_ALMB_ConfigTime
- RTC_ALRMBR HU LL_RTC_ALMB_ConfigTime
- RTC_ALRMBR MNT LL_RTC_ALMB_ConfigTime
- RTC_ALRMBR MNU LL_RTC_ALMB_ConfigTime
- RTC_ALRMBR ST LL_RTC_ALMB_ConfigTime
- RTC_ALRMBR SU LL_RTC_ALMB_ConfigTime

LL_RTC_ALMB_GetTime

Function name

__STATIC_INLINE uint32_t LL_RTC_ALMB_GetTime (RTC_TypeDef * RTCx)

Function description

Get Alarm B Time (hour, minute and second) in BCD format.

Parameters

- **RTCx:** RTC Instance

Return values

- **Combination:** of hours, minutes and seconds.

Notes

- helper macros __LL_RTC_GET_HOUR, __LL_RTC_GET_MINUTE and __LL_RTC_GET_SECOND are available to get independently each parameter.

Reference Manual to LL API cross reference:

- RTC_ALRMBR HT LL_RTC_ALMB_GetTime
- RTC_ALRMBR HU LL_RTC_ALMB_GetTime
- RTC_ALRMBR MNT LL_RTC_ALMB_GetTime
- RTC_ALRMBR MNU LL_RTC_ALMB_GetTime
- RTC_ALRMBR ST LL_RTC_ALMB_GetTime
- RTC_ALRMBR SU LL_RTC_ALMB_GetTime

LL_RTC_ALMB_SetSubSecondMask

Function name

__STATIC_INLINE void LL_RTC_ALMB_SetSubSecondMask (RTC_TypeDef * RTCx, uint32_t Mask)

Function description

Set Alarm B Mask the most-significant bits starting at this bit.

Parameters

- **RTCx:** RTC Instance
- **Mask:** Value between Min_Data=0x00 and Max_Data=0xF

Return values

- **None:**

Notes

- This register can be written only when ALRBE is reset in RTC_CR register, or in initialization mode.

Reference Manual to LL API cross reference:

- RTC_ALRMBSSR MASKSS LL_RTC_ALMB_SetSubSecondMask

LL_RTC_ALMB_GetSubSecondMask

Function name

__STATIC_INLINE uint32_t LL_RTC_ALMB_GetSubSecondMask (RTC_TypeDef * RTCx)

Function description

Get Alarm B Mask the most-significant bits starting at this bit.

Parameters

- **RTCx:** RTC Instance

Return values

- **Value:** between Min_Data=0x00 and Max_Data=0xF

Reference Manual to LL API cross reference:

- RTC_ALRMBSSR MASKSS LL_RTC_ALMB_GetSubSecondMask

LL_RTC_ALMB_SetBinAutoClr

Function name

__STATIC_INLINE void LL_RTC_ALMB_SetBinAutoClr (RTC_TypeDef * RTCx, uint32_t BinaryAutoClr)

Function description

Set Alarm B Binary mode auto clear.

Parameters

- **RTCx:** RTC Instance
- **BinaryAutoClr:** This parameter can be one of the following values:
  - LL_RTC_ALMB_SUBSECONDBIN_AUTOCLR_NO
  - LL_RTC_ALMB_SUBSECONDBIN_AUTOCLR_YES

Return values

- **None:**

Notes

- This register can be written only when ALRBE is reset in RTC_CR register, or in initialization mode.

Reference Manual to LL API cross reference:

- RTC_ALRBBINR SSCLR LL_RTC_ALMB_SetBinAutoClr

LL_RTC_ALMB_GetBinAutoClr

Function name

__STATIC_INLINE uint32_t LL_RTC_ALMB_GetBinAutoClr (const RTC_TypeDef * RTCx)

Function description

Get Alarm B Binary mode auto clear.

Parameters

- **RTCx:** RTC Instance

Return values

- **It:** can be one of the following values:
  - LL_RTC_ALMB_SUBSECONDBIN_AUTOCLR_NO
  - LL_RTC_ALMB_SUBSECONDBIN_AUTOCLR_YES

Reference Manual to LL API cross reference:

- RTC_ALRBBINR SSCLR LL_RTC_ALMB_GetBinAutoClr

LL_RTC_ALMB_SetSubSecond

Function name

__STATIC_INLINE void LL_RTC_ALMB_SetSubSecond (RTC_TypeDef * RTCx, uint32_t Subsecond)

Function description

Set Alarm B Sub seconds value.

Parameters

- **RTCx:** RTC Instance
- **Subsecond:** Value between Min_Data=0x00 and Max_Data=0x7FFF

Return values

- **None:**

Reference Manual to LL API cross reference:

- RTC_ALRMBSSR SS LL_RTC_ALMB_SetSubSecond

LL_RTC_ALMB_GetSubSecond

Function name

__STATIC_INLINE uint32_t LL_RTC_ALMB_GetSubSecond (RTC_TypeDef * RTCx)

Function description

Get Alarm B Sub seconds value.

Parameters

- **RTCx:** RTC Instance

Return values

- **Value:** between Min_Data=0x00 and Max_Data=0x7FFF

Reference Manual to LL API cross reference:

- RTC_ALRMBSSR SS LL_RTC_ALMB_GetSubSecond

LL_RTC_TS_EnableInternalEvent

Function name

__STATIC_INLINE void LL_RTC_TS_EnableInternalEvent (RTC_TypeDef * RTCx)

Function description

Enable internal event timestamp.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.

Reference Manual to LL API cross reference:

- RTC_CR ITSE LL_RTC_TS_EnableInternalEvent

LL_RTC_TS_DisableInternalEvent

Function name

__STATIC_INLINE void LL_RTC_TS_DisableInternalEvent (RTC_TypeDef * RTCx)

Function description

Disable internal event timestamp.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.

Reference Manual to LL API cross reference:

- RTC_CR ITSE LL_RTC_TS_DisableInternalEvent

LL_RTC_TS_Enable

Function name

__STATIC_INLINE void LL_RTC_TS_Enable (RTC_TypeDef * RTCx)

Function description

Enable Timestamp.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.

Reference Manual to LL API cross reference:

- RTC_CR TSE LL_RTC_TS_Enable

LL_RTC_TS_Disable

Function name

__STATIC_INLINE void LL_RTC_TS_Disable (RTC_TypeDef * RTCx)

Function description

Disable Timestamp.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.

Reference Manual to LL API cross reference:

- RTC_CR TSE LL_RTC_TS_Disable

LL_RTC_TS_SetActiveEdge

Function name

__STATIC_INLINE void LL_RTC_TS_SetActiveEdge (RTC_TypeDef * RTCx, uint32_t Edge)

Function description

Set Time-stamp event active edge.

Parameters

- **RTCx:** RTC Instance
- **Edge:** This parameter can be one of the following values:
  - LL_RTC_TIMESTAMP_EDGE_RISING
  - LL_RTC_TIMESTAMP_EDGE_FALLING

Return values

- **None:**

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.
- TSE must be reset when TSEDGE is changed to avoid unwanted TSF setting

Reference Manual to LL API cross reference:

- RTC_CR TSEDGE LL_RTC_TS_SetActiveEdge

LL_RTC_TS_GetActiveEdge

Function name

__STATIC_INLINE uint32_t LL_RTC_TS_GetActiveEdge (RTC_TypeDef * RTCx)

Function description

Get Time-stamp event active edge.

Parameters

- **RTCx:** RTC Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_RTC_TIMESTAMP_EDGE_RISING
  - LL_RTC_TIMESTAMP_EDGE_FALLING

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.

Reference Manual to LL API cross reference:

- RTC_CR TSEDGE LL_RTC_TS_GetActiveEdge

LL_RTC_TS_GetTimeFormat

Function name

__STATIC_INLINE uint32_t LL_RTC_TS_GetTimeFormat (RTC_TypeDef * RTCx)

Function description

Get Timestamp AM/PM notation (AM or 24-hour format)

Parameters

- **RTCx:** RTC Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_RTC_TS_TIME_FORMAT_AM
  - LL_RTC_TS_TIME_FORMAT_PM

Reference Manual to LL API cross reference:

- RTC_TSTR PM LL_RTC_TS_GetTimeFormat

LL_RTC_TS_GetHour

Function name

__STATIC_INLINE uint32_t LL_RTC_TS_GetHour (RTC_TypeDef * RTCx)

Function description

Get Timestamp Hours in BCD format.

Parameters

- **RTCx:** RTC Instance

Return values

- **Value:** between Min_Data=0x01 and Max_Data=0x12 or between Min_Data=0x00 and Max_Data=0x23

Notes

- helper macro __LL_RTC_CONVERT_BCD2BIN is available to convert Hours from BCD to Binary format

Reference Manual to LL API cross reference:

- RTC_TSTR HT LL_RTC_TS_GetHour
- RTC_TSTR HU LL_RTC_TS_GetHour

LL_RTC_TS_GetMinute

Function name

__STATIC_INLINE uint32_t LL_RTC_TS_GetMinute (RTC_TypeDef * RTCx)

Function description

Get Timestamp Minutes in BCD format.

Parameters

- **RTCx:** RTC Instance

Return values

- **Value:** between Min_Data=0x00 and Max_Data=0x59

Notes

- helper macro __LL_RTC_CONVERT_BCD2BIN is available to convert Minutes from BCD to Binary format

Reference Manual to LL API cross reference:

- RTC_TSTR MNT LL_RTC_TS_GetMinute
- RTC_TSTR MNU LL_RTC_TS_GetMinute

LL_RTC_TS_GetSecond

Function name

__STATIC_INLINE uint32_t LL_RTC_TS_GetSecond (RTC_TypeDef * RTCx)

Function description

Get Timestamp Seconds in BCD format.

Parameters

- **RTCx:** RTC Instance

Return values

- **Value:** between Min_Data=0x00 and Max_Data=0x59

Notes

- helper macro __LL_RTC_CONVERT_BCD2BIN is available to convert Seconds from BCD to Binary format

Reference Manual to LL API cross reference:

- RTC_TSTR ST LL_RTC_TS_GetSecond
- RTC_TSTR SU LL_RTC_TS_GetSecond

LL_RTC_TS_GetTime

Function name

__STATIC_INLINE uint32_t LL_RTC_TS_GetTime (RTC_TypeDef * RTCx)

Function description

Get Timestamp time (hour, minute and second) in BCD format.

Parameters

- **RTCx:** RTC Instance

Return values

- **Combination:** of hours, minutes and seconds.

Notes

- helper macros __LL_RTC_GET_HOUR, __LL_RTC_GET_MINUTE and __LL_RTC_GET_SECOND are available to get independently each parameter.

Reference Manual to LL API cross reference:

- RTC_TSTR HT LL_RTC_TS_GetTime
- RTC_TSTR HU LL_RTC_TS_GetTime
- RTC_TSTR MNT LL_RTC_TS_GetTime
- RTC_TSTR MNU LL_RTC_TS_GetTime
- RTC_TSTR ST LL_RTC_TS_GetTime
- RTC_TSTR SU LL_RTC_TS_GetTime

LL_RTC_TS_GetWeekDay

Function name

__STATIC_INLINE uint32_t LL_RTC_TS_GetWeekDay (RTC_TypeDef * RTCx)

Function description

Get Timestamp Week day.

Parameters

- **RTCx:** RTC Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_RTC_WEEKDAY_MONDAY
  - LL_RTC_WEEKDAY_TUESDAY
  - LL_RTC_WEEKDAY_WEDNESDAY
  - LL_RTC_WEEKDAY_THURSDAY
  - LL_RTC_WEEKDAY_FRIDAY
  - LL_RTC_WEEKDAY_SATURDAY
  - LL_RTC_WEEKDAY_SUNDAY

Reference Manual to LL API cross reference:

- RTC_TSDR WDU LL_RTC_TS_GetWeekDay

LL_RTC_TS_GetMonth

Function name

__STATIC_INLINE uint32_t LL_RTC_TS_GetMonth (RTC_TypeDef * RTCx)

Function description

Get Timestamp Month in BCD format.

Parameters

- **RTCx:** RTC Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_RTC_MONTH_JANUARY
  - LL_RTC_MONTH_FEBRUARY
  - LL_RTC_MONTH_MARCH
  - LL_RTC_MONTH_APRIL
  - LL_RTC_MONTH_MAY
  - LL_RTC_MONTH_JUNE
  - LL_RTC_MONTH_JULY
  - LL_RTC_MONTH_AUGUST
  - LL_RTC_MONTH_SEPTEMBER
  - LL_RTC_MONTH_OCTOBER
  - LL_RTC_MONTH_NOVEMBER
  - LL_RTC_MONTH_DECEMBER

Notes

- helper macro __LL_RTC_CONVERT_BCD2BIN is available to convert Month from BCD to Binary format

Reference Manual to LL API cross reference:

- RTC_TSDR MT LL_RTC_TS_GetMonth
- RTC_TSDR MU LL_RTC_TS_GetMonth

LL_RTC_TS_GetDay

Function name

__STATIC_INLINE uint32_t LL_RTC_TS_GetDay (RTC_TypeDef * RTCx)

Function description

Get Timestamp Day in BCD format.

Parameters

- **RTCx:** RTC Instance

Return values

- **Value:** between Min_Data=0x01 and Max_Data=0x31

Notes

- helper macro __LL_RTC_CONVERT_BCD2BIN is available to convert Day from BCD to Binary format

Reference Manual to LL API cross reference:

- RTC_TSDR DT LL_RTC_TS_GetDay
- RTC_TSDR DU LL_RTC_TS_GetDay

LL_RTC_TS_GetDate

Function name

__STATIC_INLINE uint32_t LL_RTC_TS_GetDate (RTC_TypeDef * RTCx)

Function description

Get Timestamp date (WeekDay, Day and Month) in BCD format.

Parameters

- **RTCx:** RTC Instance

Return values

- **Combination:** of Weekday, Day and Month

Notes

- helper macros __LL_RTC_GET_WEEKDAY, __LL_RTC_GET_MONTH, and __LL_RTC_GET_DAY are available to get independently each parameter.

Reference Manual to LL API cross reference:

- RTC_TSDR WDU LL_RTC_TS_GetDate
- RTC_TSDR MT LL_RTC_TS_GetDate
- RTC_TSDR MU LL_RTC_TS_GetDate
- RTC_TSDR DT LL_RTC_TS_GetDate
- RTC_TSDR DU LL_RTC_TS_GetDate

LL_RTC_TS_GetSubSecond

Function name

__STATIC_INLINE uint32_t LL_RTC_TS_GetSubSecond (RTC_TypeDef * RTCx)

Function description

Get time-stamp sub second value.

Parameters

- **RTCx:** RTC Instance

Return values

- **Value:** between Min_Data=0x00 and Max_Data=0xFFFF

Reference Manual to LL API cross reference:

- RTC_TSDR SS LL_RTC_TS_GetSubSecond

LL_RTC_TS_EnableOnTamper

Function name

__STATIC_INLINE void LL_RTC_TS_EnableOnTamper (RTC_TypeDef * RTCx)

Function description

Activate timestamp on tamper detection event.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- RTC_CR TAMPTS LL_RTC_TS_EnableOnTamper

LL_RTC_TS_DisableOnTamper

Function name

__STATIC_INLINE void LL_RTC_TS_DisableOnTamper (RTC_TypeDef * RTCx)

Function description

Disable timestamp on tamper detection event.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- RTC_CR TAMPTS LL_RTC_TS_DisableOnTamper

LL_RTC_TAMPER_Enable

Function name

__STATIC_INLINE void LL_RTC_TAMPER_Enable (TAMP_TypeDef * TAMPx, uint32_t Tamper)

Function description

Enable TAMPx input detection.

Parameters

- **TAMPx:** TAMP Instance
- **Tamper:** This parameter can be a combination of the following values:
  - TAMPER

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_CR1 TAMP1E LL_RTC_TAMPER_Enable
- TAMP_CR1 TAMP2E LL_RTC_TAMPER_Enable
- TAMP_CR1 TAMP3E LL_RTC_TAMPER_Enable
- TAMP_CR1 TAMP4E LL_RTC_TAMPER_Enable
- TAMP_CR1 TAMP5E LL_RTC_TAMPER_Enable
-

LL_RTC_TAMPER_Disable

Function name

__STATIC_INLINE void LL_RTC_TAMPER_Disable (TAMP_TypeDef * TAMPx, uint32_t Tamper)

Function description

Clear TAMPx input detection.

Parameters

- **TAMPx:** TAMP Instance
- **Tamper:** This parameter can be a combination of the following values:
  - TAMPER

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_CR1 TAMP1E LL_RTC_TAMPER_Disable
- TAMP_CR1 TAMP2E LL_RTC_TAMPER_Disable
- TAMP_CR1 TAMP3E LL_RTC_TAMPER_Disable
- TAMP_CR1 TAMP4E LL_RTC_TAMPER_Disable
- TAMP_CR1 TAMP5E LL_RTC_TAMPER_Disable
-

LL_RTC_TAMPER_EnableMask

Function name

__STATIC_INLINE void LL_RTC_TAMPER_EnableMask (TAMP_TypeDef * TAMPx, uint32_t Mask)

Function description

Enable Tamper mask flag.

Parameters

- **TAMPx:** TAMP Instance
- **Mask:** This parameter can be a combination of the following values:
  - TAMPER MASK

Return values

- **None:**

Notes

- Associated Tamper IT must not enabled when tamper mask is set.

Reference Manual to LL API cross reference:

- TAMP_CR2 TAMP1MSK LL_RTC_TAMPER_EnableMask
- TAMP_CR2 TAMP2MSK LL_RTC_TAMPER_EnableMask
- TAMP_CR2 TAMP3MSK LL_RTC_TAMPER_EnableMask

LL_RTC_TAMPER_DisableMask

Function name

__STATIC_INLINE void LL_RTC_TAMPER_DisableMask (TAMP_TypeDef * TAMPx, uint32_t Mask)

Function description

Disable Tamper mask flag.

Parameters

- **TAMPx:** TAMP Instance
- **Mask:** This parameter can be a combination of the following values:
  - TAMPER MASK

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_CR2 TAMP1MF LL_RTC_TAMPER_DisableMask
- TAMP_CR2 TAMP2MF LL_RTC_TAMPER_DisableMask
- TAMP_CR2 TAMP3MF LL_RTC_TAMPER_DisableMask

LL_RTC_TAMPER_EnableEraseBKP

Function name

__STATIC_INLINE void LL_RTC_TAMPER_EnableEraseBKP (TAMP_TypeDef * TAMPx, uint32_t Tamper)

Function description

Enable backup register erase after Tamper event detection.

Parameters

- **TAMPx:** TAMP Instance
- **Tamper:** This parameter can be a combination of the following values:
  - TAMPER NO ERASE

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_CR2 TAMP1POM LL_RTC_TAMPER_EnableEraseBKP
- TAMP_CR2 TAMP2POM LL_RTC_TAMPER_EnableEraseBKP
- TAMP_CR2 TAMP3POM LL_RTC_TAMPER_EnableEraseBKP
- TAMP_CR2 TAMP4POM LL_RTC_TAMPER_EnableEraseBKP
- TAMP_CR2 TAMP5POM LL_RTC_TAMPER_EnableEraseBKP
-

LL_RTC_TAMPER_DisableEraseBKP

Function name

__STATIC_INLINE void LL_RTC_TAMPER_DisableEraseBKP (TAMP_TypeDef * TAMPx, uint32_t Tamper)

Function description

Disable backup register erase after Tamper event detection.

Parameters

- **TAMPx:** TAMP Instance
- **Tamper:** This parameter can be a combination of the following values:
  - TAMPER NO ERASE

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_CR2 TAMP1POM LL_RTC_TAMPER_EnableEraseBKP
- TAMP_CR2 TAMP2POM LL_RTC_TAMPER_EnableEraseBKP
- TAMP_CR2 TAMP3POM LL_RTC_TAMPER_EnableEraseBKP
- TAMP_CR2 TAMP4POM LL_RTC_TAMPER_EnableEraseBKP
- TAMP_CR2 TAMP5POM LL_RTC_TAMPER_EnableEraseBKP
-

LL_RTC_TAMPER_DisablePullUp

Function name

__STATIC_INLINE void LL_RTC_TAMPER_DisablePullUp (TAMP_TypeDef * TAMPx)

Function description

Disable RTC_TAMPx pull-up disable (Disable precharge of RTC_TAMPx pins)

Parameters

- **TAMPx:** TAMP Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_FLTCR TAMPPUDIS LL_RTC_TAMPER_DisablePullUp

LL_RTC_TAMPER_EnablePullUp

Function name

__STATIC_INLINE void LL_RTC_TAMPER_EnablePullUp (TAMP_TypeDef * TAMPx)

Function description

Enable RTC_TAMPx pull-up disable (Precharge RTC_TAMPx pins before sampling)

Parameters

- **TAMPx:** TAMP Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_FLTCR TAMPPUDIS LL_RTC_TAMPER_EnablePullUp

LL_RTC_TAMPER_SetPrecharge

Function name

__STATIC_INLINE void LL_RTC_TAMPER_SetPrecharge (TAMP_TypeDef * TAMPx, uint32_t Duration)

Function description

Set RTC_TAMPx precharge duration.

Parameters

- **TAMPx:** TAMP Instance
- **Duration:** This parameter can be one of the following values:
  - LL_RTC_TAMPER_DURATION_1RTCCLK
  - LL_RTC_TAMPER_DURATION_2RTCCLK
  - LL_RTC_TAMPER_DURATION_4RTCCLK
  - LL_RTC_TAMPER_DURATION_8RTCCLK

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_FLTCR TAMPPRCH LL_RTC_TAMPER_SetPrecharge

LL_RTC_TAMPER_GetPrecharge

Function name

__STATIC_INLINE uint32_t LL_RTC_TAMPER_GetPrecharge (TAMP_TypeDef * TAMPx)

Function description

Get RTC_TAMPx precharge duration.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_RTC_TAMPER_DURATION_1RTCCLK
  - LL_RTC_TAMPER_DURATION_2RTCCLK
  - LL_RTC_TAMPER_DURATION_4RTCCLK
  - LL_RTC_TAMPER_DURATION_8RTCCLK

Reference Manual to LL API cross reference:

- TAMP_FLTCR TAMPPRCH LL_RTC_TAMPER_GetPrecharge

LL_RTC_TAMPER_SetFilterCount

Function name

__STATIC_INLINE void LL_RTC_TAMPER_SetFilterCount (TAMP_TypeDef * TAMPx, uint32_t FilterCount)

Function description

Set RTC_TAMPx filter count.

Parameters

- **TAMPx:** TAMP Instance
- **FilterCount:** This parameter can be one of the following values:
  - LL_RTC_TAMPER_FILTER_DISABLE
  - LL_RTC_TAMPER_FILTER_2SAMPLE
  - LL_RTC_TAMPER_FILTER_4SAMPLE
  - LL_RTC_TAMPER_FILTER_8SAMPLE

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_FLTCR TAMPFLT LL_RTC_TAMPER_SetFilterCount

LL_RTC_TAMPER_GetFilterCount

Function name

__STATIC_INLINE uint32_t LL_RTC_TAMPER_GetFilterCount (TAMP_TypeDef * TAMPx)

Function description

Get RTC_TAMPx filter count.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_RTC_TAMPER_FILTER_DISABLE
  - LL_RTC_TAMPER_FILTER_2SAMPLE
  - LL_RTC_TAMPER_FILTER_4SAMPLE
  - LL_RTC_TAMPER_FILTER_8SAMPLE

Reference Manual to LL API cross reference:

- TAMP_FLTCR TAMPFLT LL_RTC_TAMPER_GetFilterCount

LL_RTC_TAMPER_SetSamplingFreq

Function name

__STATIC_INLINE void LL_RTC_TAMPER_SetSamplingFreq (TAMP_TypeDef * TAMPx, uint32_t SamplingFreq)

Function description

Set Tamper sampling frequency.

Parameters

- **TAMPx:** TAMP Instance
- **SamplingFreq:** This parameter can be one of the following values:
  - LL_RTC_TAMPER_SAMPLFREQDIV_32768
  - LL_RTC_TAMPER_SAMPLFREQDIV_16384
  - LL_RTC_TAMPER_SAMPLFREQDIV_8192
  - LL_RTC_TAMPER_SAMPLFREQDIV_4096
  - LL_RTC_TAMPER_SAMPLFREQDIV_2048
  - LL_RTC_TAMPER_SAMPLFREQDIV_1024
  - LL_RTC_TAMPER_SAMPLFREQDIV_512
  - LL_RTC_TAMPER_SAMPLFREQDIV_256

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_FLTCR TAMPFREQ LL_RTC_TAMPER_SetSamplingFreq

LL_RTC_TAMPER_GetSamplingFreq

Function name

__STATIC_INLINE uint32_t LL_RTC_TAMPER_GetSamplingFreq (TAMP_TypeDef * TAMPx)

Function description

Get Tamper sampling frequency.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_RTC_TAMPER_SAMPLFREQDIV_32768
  - LL_RTC_TAMPER_SAMPLFREQDIV_16384
  - LL_RTC_TAMPER_SAMPLFREQDIV_8192
  - LL_RTC_TAMPER_SAMPLFREQDIV_4096
  - LL_RTC_TAMPER_SAMPLFREQDIV_2048
  - LL_RTC_TAMPER_SAMPLFREQDIV_1024
  - LL_RTC_TAMPER_SAMPLFREQDIV_512
  - LL_RTC_TAMPER_SAMPLFREQDIV_256

Reference Manual to LL API cross reference:

- TAMP_FLTCR TAMPFREQ LL_RTC_TAMPER_GetSamplingFreq

LL_RTC_TAMPER_EnableActiveLevel

Function name

__STATIC_INLINE void LL_RTC_TAMPER_EnableActiveLevel (TAMP_TypeDef * TAMPx, uint32_t Tamper)

Function description

Enable Active level for Tamper input.

Parameters

- **TAMPx:** TAMP Instance
- **Tamper:** This parameter can be a combination of the following values:
  - TAMPER ACTIVE LEVEL

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_CR2 TAMP1TRG LL_RTC_TAMPER_EnableActiveLevel
- TAMP_CR2 TAMP2TRG LL_RTC_TAMPER_EnableActiveLevel
- TAMP_CR2 TAMP3TRG LL_RTC_TAMPER_EnableActiveLevel
- TAMP_CR2 TAMP4TRG LL_RTC_TAMPER_EnableActiveLevel
- TAMP_CR2 TAMP5TRG LL_RTC_TAMPER_EnableActiveLevel
-

LL_RTC_TAMPER_DisableActiveLevel

Function name

__STATIC_INLINE void LL_RTC_TAMPER_DisableActiveLevel (TAMP_TypeDef * TAMPx, uint32_t Tamper)

Function description

Disable Active level for Tamper input.

Parameters

- **TAMPx:** TAMP Instance
- **Tamper:** This parameter can be a combination of the following values:
  - TAMPER ACTIVE LEVEL

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_CR2 TAMP1TRG LL_RTC_TAMPER_DisableActiveLevel
- TAMP_CR2 TAMP2TRG LL_RTC_TAMPER_DisableActiveLevel
- TAMP_CR2 TAMP3TRG LL_RTC_TAMPER_DisableActiveLevel
- TAMP_CR2 TAMP4TRG LL_RTC_TAMPER_DisableActiveLevel
- TAMP_CR2 TAMP5TRG LL_RTC_TAMPER_DisableActiveLevel
-

LL_RTC_TAMPER_ITAMP_Enable

Function name

__STATIC_INLINE void LL_RTC_TAMPER_ITAMP_Enable (TAMP_TypeDef * TAMPx, uint32_t InternalTamper)

Function description

Enable internal tamper detection.

Parameters

- **TAMPx:** TAMP Instance
- **InternalTamper:** This parameter can be a combination of the following values:
  - INTERNAL TAMPER

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_CR1 ITAMP3E LL_RTC_TAMPER_ITAMP_Enable
- TAMP_CR1 ITAMP4E LL_RTC_TAMPER_ITAMP_Enable
- TAMP_CR1 ITAMP5E LL_RTC_TAMPER_ITAMP_Enable
- TAMP_CR1 ITAMP6E LL_RTC_TAMPER_ITAMP_Enable

LL_RTC_TAMPER_ITAMP_Disable

Function name

__STATIC_INLINE void LL_RTC_TAMPER_ITAMP_Disable (TAMP_TypeDef * TAMPx, uint32_t InternalTamper)

Function description

Disable internal tamper detection.

Parameters

- **TAMPx:** TAMP Instance
- **InternalTamper:** This parameter can be a combination of the following values:
  - INTERNAL TAMPER

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_CR1 ITAMP3E LL_RTC_TAMPER_ITAMP_Disable
- TAMP_CR1 ITAMP4E LL_RTC_TAMPER_ITAMP_Disable
- TAMP_CR1 ITAMP5E LL_RTC_TAMPER_ITAMP_Disable
- TAMP_CR1 ITAMP6E LL_RTC_TAMPER_ITAMP_Disable

LL_RTC_WAKEUP_Enable

Function name

__STATIC_INLINE void LL_RTC_WAKEUP_Enable (RTC_TypeDef * RTCx)

Function description

Enable Wakeup timer.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.

Reference Manual to LL API cross reference:

- RTC_CR WUTE LL_RTC_WAKEUP_Enable

LL_RTC_WAKEUP_Disable

Function name

__STATIC_INLINE void LL_RTC_WAKEUP_Disable (RTC_TypeDef * RTCx)

Function description

Disable Wakeup timer.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.

Reference Manual to LL API cross reference:

- RTC_CR WUTE LL_RTC_WAKEUP_Disable

LL_RTC_WAKEUP_IsEnabled

Function name

__STATIC_INLINE uint32_t LL_RTC_WAKEUP_IsEnabled (RTC_TypeDef * RTCx)

Function description

Check if Wakeup timer is enabled or not.

Parameters

- **RTCx:** RTC Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- RTC_CR WUTE LL_RTC_WAKEUP_IsEnabled

LL_RTC_WAKEUP_SetClock

Function name

__STATIC_INLINE void LL_RTC_WAKEUP_SetClock (RTC_TypeDef * RTCx, uint32_t WakeupClock)

Function description

Select Wakeup clock.

Parameters

- **RTCx:** RTC Instance
- **WakeupClock:** This parameter can be one of the following values:
  - LL_RTC_WAKEUPCLOCK_DIV_16
  - LL_RTC_WAKEUPCLOCK_DIV_8
  - LL_RTC_WAKEUPCLOCK_DIV_4
  - LL_RTC_WAKEUPCLOCK_DIV_2
  - LL_RTC_WAKEUPCLOCK_CKSPRE
  - LL_RTC_WAKEUPCLOCK_CKSPRE_WUT

Return values

- **None:**

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.
- Bit can be written only when RTC_CR WUTE bit = 0 and RTC_ICSR WUTWF bit = 1

Reference Manual to LL API cross reference:

- RTC_CR WUCKSEL LL_RTC_WAKEUP_SetClock

LL_RTC_WAKEUP_GetClock

Function name

__STATIC_INLINE uint32_t LL_RTC_WAKEUP_GetClock (RTC_TypeDef * RTCx)

Function description

Get Wakeup clock.

Parameters

- **RTCx:** RTC Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_RTC_WAKEUPCLOCK_DIV_16
  - LL_RTC_WAKEUPCLOCK_DIV_8
  - LL_RTC_WAKEUPCLOCK_DIV_4
  - LL_RTC_WAKEUPCLOCK_DIV_2
  - LL_RTC_WAKEUPCLOCK_CKSPRE
  - LL_RTC_WAKEUPCLOCK_CKSPRE_WUT

Reference Manual to LL API cross reference:

- RTC_CR WUCKSEL LL_RTC_WAKEUP_GetClock

LL_RTC_WAKEUP_SetAutoReload

Function name

__STATIC_INLINE void LL_RTC_WAKEUP_SetAutoReload (RTC_TypeDef * RTCx, uint32_t Value)

Function description

Set Wakeup auto-reload value.

Parameters

- **RTCx:** RTC Instance
- **Value:** Value between Min_Data=0x00 and Max_Data=0xFFFF

Return values

- **None:**

Notes

- Bit can be written only when WUTWF is set to 1 in RTC_ICSR

Reference Manual to LL API cross reference:

- RTC_WUTR WUT LL_RTC_WAKEUP_SetAutoReload

LL_RTC_WAKEUP_GetAutoReload

Function name

__STATIC_INLINE uint32_t LL_RTC_WAKEUP_GetAutoReload (RTC_TypeDef * RTCx)

Function description

Get Wakeup auto-reload value.

Parameters

- **RTCx:** RTC Instance

Return values

- **Value:** between Min_Data=0x00 and Max_Data=0xFFFF

Reference Manual to LL API cross reference:

- RTC_WUTR WUT LL_RTC_WAKEUP_GetAutoReload

LL_RTC_BKP_SetRegister

Function name

__STATIC_INLINE void LL_RTC_BKP_SetRegister (TAMP_TypeDef * TAMPx, uint32_t BackupRegister, uint32_t Data)

Function description

Writes a data in a specified Backup data register.

Parameters

- **TAMPx:** RTC Instance
- **BackupRegister:** This parameter can be one of the following values:
  - LL_RTC_BKP_DR0
  - LL_RTC_BKP_DR1
  - LL_RTC_BKP_DR2
  - LL_RTC_BKP_DR3
  - LL_RTC_BKP_DR4
  - LL_RTC_BKP_DR5
  - LL_RTC_BKP_DR6
  - LL_RTC_BKP_DR7
  - LL_RTC_BKP_DR8
- **Data:** Value between Min_Data=0x00 and Max_Data=0xFFFFFFFF

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_BKPxR BKP LL_RTC_BKP_SetRegister

LL_RTC_BKP_GetRegister

Function name

__STATIC_INLINE uint32_t LL_RTC_BKP_GetRegister (TAMP_TypeDef * TAMPx, uint32_t BackupRegister)

Function description

Reads data from the specified RTC Backup data Register.

Parameters

- **TAMPx:** RTC Instance
- **BackupRegister:** This parameter can be one of the following values:
  - LL_RTC_BKP_DR0
  - LL_RTC_BKP_DR1
  - LL_RTC_BKP_DR2
  - LL_RTC_BKP_DR3
  - LL_RTC_BKP_DR4
  - LL_RTC_BKP_DR5
  - LL_RTC_BKP_DR6
  - LL_RTC_BKP_DR7
  - LL_RTC_BKP_DR8

Return values

- **Value:** between Min_Data=0x00 and Max_Data=0xFFFFFFFF

Reference Manual to LL API cross reference:

- TAMP_BKPxR BKP LL_RTC_BKP_GetRegister

LL_RTC_CAL_SetOutputFreq

Function name

__STATIC_INLINE void LL_RTC_CAL_SetOutputFreq (RTC_TypeDef * RTCx, uint32_t Frequency)

Function description

Set Calibration output frequency (1 Hz or 512 Hz)

Parameters

- **RTCx:** RTC Instance
- **Frequency:** This parameter can be one of the following values:
  - LL_RTC_CALIB_OUTPUT_NONE
  - LL_RTC_CALIB_OUTPUT_1HZ
  - LL_RTC_CALIB_OUTPUT_512HZ

Return values

- **None:**

Notes

- Bits are write-protected. LL_RTC_DisableWriteProtection function should be called before.

Reference Manual to LL API cross reference:

- RTC_CR COE LL_RTC_CAL_SetOutputFreq
- RTC_CR COSEL LL_RTC_CAL_SetOutputFreq

LL_RTC_CAL_GetOutputFreq

Function name

__STATIC_INLINE uint32_t LL_RTC_CAL_GetOutputFreq (RTC_TypeDef * RTCx)

Function description

Get Calibration output frequency (1 Hz or 512 Hz)

Parameters

- **RTCx:** RTC Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_RTC_CALIB_OUTPUT_NONE
  - LL_RTC_CALIB_OUTPUT_1HZ
  - LL_RTC_CALIB_OUTPUT_512HZ

Reference Manual to LL API cross reference:

- RTC_CR COE LL_RTC_CAL_GetOutputFreq
- RTC_CR COSEL LL_RTC_CAL_GetOutputFreq

LL_RTC_CAL_SetPulse

Function name

__STATIC_INLINE void LL_RTC_CAL_SetPulse (RTC_TypeDef * RTCx, uint32_t Pulse)

Function description

Insert or not One RTCCLK pulse every 2exp11 pulses (frequency increased by 488.5 ppm)

Parameters

- **RTCx:** RTC Instance
- **Pulse:** This parameter can be one of the following values:
  - LL_RTC_CALIB_INSERTPULSE_NONE
  - LL_RTC_CALIB_INSERTPULSE_SET

Return values

- **None:**

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.
- Bit can be written only when RECALPF is set to 0 in RTC_ICSR

Reference Manual to LL API cross reference:

- RTC_CALR CALP LL_RTC_CAL_SetPulse

LL_RTC_CAL_IsPulseInserted

Function name

__STATIC_INLINE uint32_t LL_RTC_CAL_IsPulseInserted (RTC_TypeDef * RTCx)

Function description

Check if one RTCCLK has been inserted or not every 2exp11 pulses (frequency increased by 488.5 ppm)

Parameters

- **RTCx:** RTC Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- RTC_CALR CALP LL_RTC_CAL_IsPulseInserted

LL_RTC_CAL_SetPeriod

Function name

__STATIC_INLINE void LL_RTC_CAL_SetPeriod (RTC_TypeDef * RTCx, uint32_t Period)

Function description

Set the calibration cycle period.

Parameters

- **RTCx:** RTC Instance
- **Period:** This parameter can be one of the following values:
  - LL_RTC_CALIB_PERIOD_32SEC
  - LL_RTC_CALIB_PERIOD_16SEC
  - LL_RTC_CALIB_PERIOD_8SEC

Return values

- **None:**

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.
- Bit can be written only when RECALPF is set to 0 in RTC_ICSR

Reference Manual to LL API cross reference:

- RTC_CALR CALW8 LL_RTC_CAL_SetPeriod
- RTC_CALR CALW16 LL_RTC_CAL_SetPeriod

LL_RTC_CAL_GetPeriod

Function name

__STATIC_INLINE uint32_t LL_RTC_CAL_GetPeriod (RTC_TypeDef * RTCx)

Function description

Get the calibration cycle period.

Parameters

- **RTCx:** RTC Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_RTC_CALIB_PERIOD_32SEC
  - LL_RTC_CALIB_PERIOD_16SEC
  - LL_RTC_CALIB_PERIOD_8SEC

Reference Manual to LL API cross reference:

- RTC_CALR CALW8 LL_RTC_CAL_GetPeriod
- RTC_CALR CALW16 LL_RTC_CAL_GetPeriod

LL_RTC_CAL_SetMinus

Function name

__STATIC_INLINE void LL_RTC_CAL_SetMinus (RTC_TypeDef * RTCx, uint32_t CalibMinus)

Function description

Set Calibration minus.

Parameters

- **RTCx:** RTC Instance
- **CalibMinus:** Value between Min_Data=0x00 and Max_Data=0x1FF

Return values

- **None:**

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.
- Bit can be written only when RECALPF is set to 0 in RTC_ICSR

Reference Manual to LL API cross reference:

- RTC_CALR CALM LL_RTC_CAL_SetMinus

LL_RTC_CAL_GetMinus

Function name

__STATIC_INLINE uint32_t LL_RTC_CAL_GetMinus (RTC_TypeDef * RTCx)

Function description

Get Calibration minus.

Parameters

- **RTCx:** RTC Instance

Return values

- **Value:** between Min_Data=0x00 and Max_Data= 0x1FF

Reference Manual to LL API cross reference:

- RTC_CALR CALM LL_RTC_CAL_GetMinus

LL_RTC_IsActiveFlag_ITS

Function name

__STATIC_INLINE uint32_t LL_RTC_IsActiveFlag_ITS (RTC_TypeDef * RTCx)

Function description

Get Internal Time-stamp flag.

Parameters

- **RTCx:** RTC Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- RTC_SR ITSF LL_RTC_IsActiveFlag_ITS

LL_RTC_IsActiveFlag_RECALP

Function name

__STATIC_INLINE uint32_t LL_RTC_IsActiveFlag_RECALP (RTC_TypeDef * RTCx)

Function description

Get Recalibration pending Flag.

Parameters

- **RTCx:** RTC Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- RTC_ICSR RECALPF LL_RTC_IsActiveFlag_RECALP

LL_RTC_IsActiveFlag_TSOV

Function name

__STATIC_INLINE uint32_t LL_RTC_IsActiveFlag_TSOV (RTC_TypeDef * RTCx)

Function description

Get Time-stamp overflow flag.

Parameters

- **RTCx:** RTC Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- RTC_SR TSOVF LL_RTC_IsActiveFlag_TSOV

LL_RTC_IsActiveFlag_TS

Function name

__STATIC_INLINE uint32_t LL_RTC_IsActiveFlag_TS (RTC_TypeDef * RTCx)

Function description

Get Time-stamp flag.

Parameters

- **RTCx:** RTC Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- RTC_SR TSF LL_RTC_IsActiveFlag_TS

LL_RTC_IsActiveFlag_WUT

Function name

__STATIC_INLINE uint32_t LL_RTC_IsActiveFlag_WUT (RTC_TypeDef * RTCx)

Function description

Get Wakeup timer flag.

Parameters

- **RTCx:** RTC Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- RTC_SR WUTF LL_RTC_IsActiveFlag_WUT

LL_RTC_IsActiveFlag_ALRB

Function name

__STATIC_INLINE uint32_t LL_RTC_IsActiveFlag_ALRB (RTC_TypeDef * RTCx)

Function description

Get Alarm B flag.

Parameters

- **RTCx:** RTC Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- RTC_SR ALRBF LL_RTC_IsActiveFlag_ALRB

LL_RTC_IsActiveFlag_ALRA

Function name

__STATIC_INLINE uint32_t LL_RTC_IsActiveFlag_ALRA (RTC_TypeDef * RTCx)

Function description

Get Alarm A flag.

Parameters

- **RTCx:** RTC Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- RTC_SR ALRAF LL_RTC_IsActiveFlag_ALRA

LL_RTC_ClearFlag_SSRU

Function name

__STATIC_INLINE void LL_RTC_ClearFlag_SSRU (RTC_TypeDef * RTCx)

Function description

Clear SSR Underflow flag.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- RTC_SCR CSSRUF LL_RTC_ClearFlag_SSRU

LL_RTC_ClearFlag_ITS

Function name

__STATIC_INLINE void LL_RTC_ClearFlag_ITS (RTC_TypeDef * RTCx)

Function description

Clear Internal Time-stamp flag.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- RTC_SCR CITSF LL_RTC_ClearFlag_ITS

LL_RTC_ClearFlag_TSOV

Function name

__STATIC_INLINE void LL_RTC_ClearFlag_TSOV (RTC_TypeDef * RTCx)

Function description

Clear Time-stamp overflow flag.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- RTC_SCR CTSOVF LL_RTC_ClearFlag_TSOV

LL_RTC_ClearFlag_TS

Function name

__STATIC_INLINE void LL_RTC_ClearFlag_TS (RTC_TypeDef * RTCx)

Function description

Clear Time-stamp flag.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- RTC_SCR CTSF LL_RTC_ClearFlag_TS

LL_RTC_ClearFlag_WUT

Function name

__STATIC_INLINE void LL_RTC_ClearFlag_WUT (RTC_TypeDef * RTCx)

Function description

Clear Wakeup timer flag.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- RTC_SCR CWUTF LL_RTC_ClearFlag_WUT

LL_RTC_ClearFlag_ALRB

Function name

__STATIC_INLINE void LL_RTC_ClearFlag_ALRB (RTC_TypeDef * RTCx)

Function description

Clear Alarm B flag.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- RTC_SCR CALRBF LL_RTC_ClearFlag_ALRB

LL_RTC_ClearFlag_ALRA

Function name

__STATIC_INLINE void LL_RTC_ClearFlag_ALRA (RTC_TypeDef * RTCx)

Function description

Clear Alarm A flag.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- RTC_SCR CALRAF LL_RTC_ClearFlag_ALRA

LL_RTC_IsActiveFlag_INIT

Function name

__STATIC_INLINE uint32_t LL_RTC_IsActiveFlag_INIT (RTC_TypeDef * RTCx)

Function description

Get Initialization flag.

Parameters

- **RTCx:** RTC Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- RTC_ICSR INITF LL_RTC_IsActiveFlag_INIT

LL_RTC_IsActiveFlag_RS

Function name

__STATIC_INLINE uint32_t LL_RTC_IsActiveFlag_RS (RTC_TypeDef * RTCx)

Function description

Get Registers synchronization flag.

Parameters

- **RTCx:** RTC Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- RTC_ICSR RSF LL_RTC_IsActiveFlag_RS

LL_RTC_ClearFlag_RS

Function name

__STATIC_INLINE void LL_RTC_ClearFlag_RS (RTC_TypeDef * RTCx)

Function description

Clear Registers synchronization flag.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- RTC_ICSR RSF LL_RTC_ClearFlag_RS

LL_RTC_IsActiveFlag_INITS

Function name

__STATIC_INLINE uint32_t LL_RTC_IsActiveFlag_INITS (RTC_TypeDef * RTCx)

Function description

Get Initialization status flag.

Parameters

- **RTCx:** RTC Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- RTC_ICSR INITS LL_RTC_IsActiveFlag_INITS

LL_RTC_IsActiveFlag_SHP

Function name

__STATIC_INLINE uint32_t LL_RTC_IsActiveFlag_SHP (RTC_TypeDef * RTCx)

Function description

Get Shift operation pending flag.

Parameters

- **RTCx:** RTC Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- RTC_ICSR SHPF LL_RTC_IsActiveFlag_SHP

LL_RTC_IsActiveFlag_WUTW

Function name

__STATIC_INLINE uint32_t LL_RTC_IsActiveFlag_WUTW (RTC_TypeDef * RTCx)

Function description

Get Wakeup timer write flag.

Parameters

- **RTCx:** RTC Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- RTC_ICSR WUTWF LL_RTC_IsActiveFlag_WUTW

LL_RTC_IsActiveFlag_ALRAM

Function name

__STATIC_INLINE uint32_t LL_RTC_IsActiveFlag_ALRAM (RTC_TypeDef * RTCx)

Function description

Get Alarm A masked flag.

Parameters

- **RTCx:** RTC Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- RTC_MISR ALRAMF LL_RTC_IsActiveFlag_ALRAM

LL_RTC_IsActiveFlag_ALRBM

Function name

__STATIC_INLINE uint32_t LL_RTC_IsActiveFlag_ALRBM (RTC_TypeDef * RTCx)

Function description

Get Alarm B masked flag.

Parameters

- **RTCx:** RTC Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- RTC_MISR ALRBMF LL_RTC_IsActiveFlag_ALRBM

LL_RTC_IsActiveFlag_WUTM

Function name

__STATIC_INLINE uint32_t LL_RTC_IsActiveFlag_WUTM (RTC_TypeDef * RTCx)

Function description

Get Wakeup timer masked flag.

Parameters

- **RTCx:** RTC Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- RTC_MISR WUTMF LL_RTC_IsActiveFlag_WUTM

LL_RTC_IsActiveFlag_TSM

Function name

__STATIC_INLINE uint32_t LL_RTC_IsActiveFlag_TSM (RTC_TypeDef * RTCx)

Function description

Get Time-stamp masked flag.

Parameters

- **RTCx:** RTC Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- RTC_MISR TSMF LL_RTC_IsActiveFlag_TSM

LL_RTC_IsActiveFlag_TSOVM

Function name

__STATIC_INLINE uint32_t LL_RTC_IsActiveFlag_TSOVM (RTC_TypeDef * RTCx)

Function description

Get Time-stamp overflow masked flag.

Parameters

- **RTCx:** RTC Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- RTC_MISR TSOVMF LL_RTC_IsActiveFlag_TSOVM

LL_RTC_IsActiveFlag_ITSM

Function name

__STATIC_INLINE uint32_t LL_RTC_IsActiveFlag_ITSM (RTC_TypeDef * RTCx)

Function description

Get Internal Time-stamp masked flag.

Parameters

- **RTCx:** RTC Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- RTC_MISR ITSMF LL_RTC_IsActiveFlag_ITSM

LL_RTC_IsActiveFlag_TAMP1

Function name

__STATIC_INLINE uint32_t LL_RTC_IsActiveFlag_TAMP1 (TAMP_TypeDef * TAMPx)

Function description

Get tamper 1 detection flag.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- TAMP_SR TAMP1F LL_RTC_IsActiveFlag_TAMP1

LL_RTC_IsActiveFlag_TAMP2

Function name

__STATIC_INLINE uint32_t LL_RTC_IsActiveFlag_TAMP2 (TAMP_TypeDef * TAMPx)

Function description

Get tamper 2 detection flag.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- TAMP_SR TAMP2F LL_RTC_IsActiveFlag_TAMP2

LL_RTC_IsActiveFlag_TAMP3

Function name

__STATIC_INLINE uint32_t LL_RTC_IsActiveFlag_TAMP3 (TAMP_TypeDef * TAMPx)

Function description

Get tamper 3 detection flag.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- TAMP_SR TAMP3F LL_RTC_IsActiveFlag_TAMP3

LL_RTC_IsActiveFlag_TAMP4

Function name

__STATIC_INLINE uint32_t LL_RTC_IsActiveFlag_TAMP4 (TAMP_TypeDef * TAMPx)

Function description

Get tamper 4 detection flag.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- TAMP_SR TAMP4F LL_RTC_IsActiveFlag_TAMP4

LL_RTC_IsActiveFlag_TAMP5

Function name

__STATIC_INLINE uint32_t LL_RTC_IsActiveFlag_TAMP5 (TAMP_TypeDef * TAMPx)

Function description

Get tamper 5 detection flag.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- TAMP_SR TAMP5F LL_RTC_IsActiveFlag_TAMP5

LL_RTC_IsActiveFlag_ITAMP3

Function name

__STATIC_INLINE uint32_t LL_RTC_IsActiveFlag_ITAMP3 (TAMP_TypeDef * TAMPx)

Function description

Get internal tamper 3 detection flag.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- TAMP_SR ITAMP3F LL_RTC_IsActiveFlag_ITAMP3

LL_RTC_IsActiveFlag_ITAMP4

Function name

__STATIC_INLINE uint32_t LL_RTC_IsActiveFlag_ITAMP4 (TAMP_TypeDef * TAMPx)

Function description

Get internal tamper 4 detection flag.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- TAMP_SR ITAMPt4F LL_RTC_IsActiveFlag_ITAMP4

LL_RTC_IsActiveFlag_ITAMP5

Function name

__STATIC_INLINE uint32_t LL_RTC_IsActiveFlag_ITAMP5 (TAMP_TypeDef * TAMPx)

Function description

Get internal tamper 5 detection flag.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- TAMP_SR ITAMP5F LL_RTC_IsActiveFlag_ITAMP5

LL_RTC_IsActiveFlag_ITAMP6

Function name

__STATIC_INLINE uint32_t LL_RTC_IsActiveFlag_ITAMP6 (TAMP_TypeDef * TAMPx)

Function description

Get internal tamper 6 detection flag.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- TAMP_SR ITAMP6F LL_RTC_IsActiveFlag_ITAMP6

LL_RTC_IsActiveFlag_TAMP1M

Function name

__STATIC_INLINE uint32_t LL_RTC_IsActiveFlag_TAMP1M (TAMP_TypeDef * TAMPx)

Function description

Get tamper 1 interrupt masked flag.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- TAMP_MISR TAMP1MF LL_RTC_IsActiveFlag_TAMP1M

LL_RTC_IsActiveFlag_TAMP2M

Function name

__STATIC_INLINE uint32_t LL_RTC_IsActiveFlag_TAMP2M (TAMP_TypeDef * TAMPx)

Function description

Get tamper 2 interrupt masked flag.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- TAMP_MISR TAMP2MF LL_RTC_IsActiveFlag_TAMP2M

LL_RTC_IsActiveFlag_TAMP3M

Function name

__STATIC_INLINE uint32_t LL_RTC_IsActiveFlag_TAMP3M (TAMP_TypeDef * TAMPx)

Function description

Get tamper 3 interrupt masked flag.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- TAMP_MISR TAMP3MF LL_RTC_IsActiveFlag_TAMP3M

LL_RTC_IsActiveFlag_TAMP4M

Function name

__STATIC_INLINE uint32_t LL_RTC_IsActiveFlag_TAMP4M (TAMP_TypeDef * TAMPx)

Function description

Get tamper 4 interrupt masked flag.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- TAMP_MISR TAMP4MF LL_RTC_IsActiveFlag_TAMP4M

LL_RTC_IsActiveFlag_TAMP5M

Function name

__STATIC_INLINE uint32_t LL_RTC_IsActiveFlag_TAMP5M (TAMP_TypeDef * TAMPx)

Function description

Get tamper 5 interrupt masked flag.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- TAMP_MISR TAMP5MF LL_RTC_IsActiveFlag_TAMP5M

LL_RTC_IsActiveFlag_ITAMP3M

Function name

__STATIC_INLINE uint32_t LL_RTC_IsActiveFlag_ITAMP3M (TAMP_TypeDef * TAMPx)

Function description

Get internal tamper 3 interrupt masked flag.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- TAMP_MISR ITAMP3MF LL_RTC_IsActiveFlag_ITAMP3M

LL_RTC_IsActiveFlag_ITAMP4M

Function name

__STATIC_INLINE uint32_t LL_RTC_IsActiveFlag_ITAMP4M (TAMP_TypeDef * TAMPx)

Function description

Get internal tamper 4 interrupt masked flag.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- TAMP_MISR ITAMP4MF LL_RTC_IsActiveFlag_ITAMP4M

LL_RTC_IsActiveFlag_ITAMP5M

Function name

__STATIC_INLINE uint32_t LL_RTC_IsActiveFlag_ITAMP5M (TAMP_TypeDef * TAMPx)

Function description

Get internal tamper 5 interrupt masked flag.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- TAMP_MISR ITAMP5MF LL_RTC_IsActiveFlag_ITAMP5M

LL_RTC_IsActiveFlag_ITAMP6M

Function name

__STATIC_INLINE uint32_t LL_RTC_IsActiveFlag_ITAMP6M (TAMP_TypeDef * TAMPx)

Function description

Get internal tamper 6 interrupt masked flag.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- TAMP_MISR ITAMP6MF LL_RTC_IsActiveFlag_ITAMP6M

LL_RTC_ClearFlag_TAMP1

Function name

__STATIC_INLINE void LL_RTC_ClearFlag_TAMP1 (TAMP_TypeDef * TAMPx)

Function description

Clear tamper 1 detection flag.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_SCR CTAMP1F LL_RTC_ClearFlag_TAMP1

LL_RTC_ClearFlag_TAMP2

Function name

__STATIC_INLINE void LL_RTC_ClearFlag_TAMP2 (TAMP_TypeDef * TAMPx)

Function description

Clear tamper 2 detection flag.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_SCR CTAMP2F LL_RTC_ClearFlag_TAMP2

LL_RTC_ClearFlag_TAMP3

Function name

__STATIC_INLINE void LL_RTC_ClearFlag_TAMP3 (TAMP_TypeDef * TAMPx)

Function description

Clear tamper 3 detection flag.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_SCR CTAMP3F LL_RTC_ClearFlag_TAMP3

LL_RTC_ClearFlag_TAMP4

Function name

__STATIC_INLINE void LL_RTC_ClearFlag_TAMP4 (TAMP_TypeDef * TAMPx)

Function description

Clear tamper 4 detection flag.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_SCR CTAMP3F LL_RTC_ClearFlag_TAMP4

LL_RTC_ClearFlag_TAMP5

Function name

__STATIC_INLINE void LL_RTC_ClearFlag_TAMP5 (TAMP_TypeDef * TAMPx)

Function description

Clear tamper 5 detection flag.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_SCR CTAMP5F LL_RTC_ClearFlag_TAMP5

LL_RTC_ClearFlag_ITAMP3

Function name

__STATIC_INLINE void LL_RTC_ClearFlag_ITAMP3 (TAMP_TypeDef * TAMPx)

Function description

Clear internal tamper 3 detection flag.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_SCR CTAMP3F LL_RTC_ClearFlag_ITAMP3

LL_RTC_ClearFlag_ITAMP4

Function name

__STATIC_INLINE void LL_RTC_ClearFlag_ITAMP4 (TAMP_TypeDef * TAMPx)

Function description

Clear internal tamper 4 detection flag.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_SCR CTAMP4F LL_RTC_ClearFlag_ITAMP4

LL_RTC_ClearFlag_ITAMP5

Function name

__STATIC_INLINE void LL_RTC_ClearFlag_ITAMP5 (TAMP_TypeDef * TAMPx)

Function description

Clear internal tamper 5 detection flag.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_SCR CTAMP5F LL_RTC_ClearFlag_ITAMP5

LL_RTC_ClearFlag_ITAMP6

Function name

__STATIC_INLINE void LL_RTC_ClearFlag_ITAMP6 (TAMP_TypeDef * TAMPx)

Function description

Clear internal tamper 6 detection flag.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_SCR CTAMP6F LL_RTC_ClearFlag_ITAMP6

LL_RTC_EnableIT_TS

Function name

__STATIC_INLINE void LL_RTC_EnableIT_TS (RTC_TypeDef * RTCx)

Function description

Enable Time-stamp interrupt.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.

Reference Manual to LL API cross reference:

- RTC_CR TSIE LL_RTC_EnableIT_TS

LL_RTC_DisableIT_TS

Function name

__STATIC_INLINE void LL_RTC_DisableIT_TS (RTC_TypeDef * RTCx)

Function description

Disable Time-stamp interrupt.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.

Reference Manual to LL API cross reference:

- RTC_CR TSIE LL_RTC_DisableIT_TS

LL_RTC_EnableIT_WUT

Function name

__STATIC_INLINE void LL_RTC_EnableIT_WUT (RTC_TypeDef * RTCx)

Function description

Enable Wakeup timer interrupt.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.

Reference Manual to LL API cross reference:

- RTC_CR WUTIE LL_RTC_EnableIT_WUT

LL_RTC_DisableIT_WUT

Function name

__STATIC_INLINE void LL_RTC_DisableIT_WUT (RTC_TypeDef * RTCx)

Function description

Disable Wakeup timer interrupt.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.

Reference Manual to LL API cross reference:

- RTC_CR WUTIE LL_RTC_DisableIT_WUT

LL_RTC_EnableIT_ALRB

Function name

__STATIC_INLINE void LL_RTC_EnableIT_ALRB (RTC_TypeDef * RTCx)

Function description

Enable Alarm B interrupt.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.

Reference Manual to LL API cross reference:

- RTC_CR ALRBIE LL_RTC_EnableIT_ALRB

LL_RTC_DisableIT_ALRB

Function name

__STATIC_INLINE void LL_RTC_DisableIT_ALRB (RTC_TypeDef * RTCx)

Function description

Disable Alarm B interrupt.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.

Reference Manual to LL API cross reference:

- RTC_CR ALRBIE LL_RTC_DisableIT_ALRB

LL_RTC_EnableIT_ALRA

Function name

__STATIC_INLINE void LL_RTC_EnableIT_ALRA (RTC_TypeDef * RTCx)

Function description

Enable Alarm A interrupt.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.

Reference Manual to LL API cross reference:

- RTC_CR ALRAIE LL_RTC_EnableIT_ALRA

LL_RTC_DisableIT_ALRA

Function name

__STATIC_INLINE void LL_RTC_DisableIT_ALRA (RTC_TypeDef * RTCx)

Function description

Disable Alarm A interrupt.

Parameters

- **RTCx:** RTC Instance

Return values

- **None:**

Notes

- Bit is write-protected. LL_RTC_DisableWriteProtection function should be called before.

Reference Manual to LL API cross reference:

- RTC_CR ALRAIE LL_RTC_DisableIT_ALRA

LL_RTC_IsEnabledIT_TS

Function name

__STATIC_INLINE uint32_t LL_RTC_IsEnabledIT_TS (RTC_TypeDef * RTCx)

Function description

Check if Time-stamp interrupt is enabled or not.

Parameters

- **RTCx:** RTC Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- RTC_CR TSIE LL_RTC_IsEnabledIT_TS

LL_RTC_IsEnabledIT_WUT

Function name

__STATIC_INLINE uint32_t LL_RTC_IsEnabledIT_WUT (RTC_TypeDef * RTCx)

Function description

Check if Wakeup timer interrupt is enabled or not.

Parameters

- **RTCx:** RTC Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- RTC_CR WUTIE LL_RTC_IsEnabledIT_WUT

LL_RTC_IsEnabledIT_ALRB

Function name

__STATIC_INLINE uint32_t LL_RTC_IsEnabledIT_ALRB (RTC_TypeDef * RTCx)

Function description

Check if Alarm B interrupt is enabled or not.

Parameters

- **RTCx:** RTC Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- RTC_CR ALRBIE LL_RTC_IsEnabledIT_ALRB

LL_RTC_IsEnabledIT_ALRA

Function name

__STATIC_INLINE uint32_t LL_RTC_IsEnabledIT_ALRA (RTC_TypeDef * RTCx)

Function description

Check if Alarm A interrupt is enabled or not.

Parameters

- **RTCx:** RTC Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- RTC_CR ALRAIE LL_RTC_IsEnabledIT_ALRA

LL_RTC_EnableIT_TAMP1

Function name

__STATIC_INLINE void LL_RTC_EnableIT_TAMP1 (TAMP_TypeDef * TAMPx)

Function description

Enable tamper 1 interrupt.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_IER TAMP1IE LL_RTC_EnableIT_TAMP1

LL_RTC_DisableIT_TAMP1

Function name

__STATIC_INLINE void LL_RTC_DisableIT_TAMP1 (TAMP_TypeDef * TAMPx)

Function description

Disable tamper 1 interrupt.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_IER TAMP1IE LL_RTC_DisableIT_TAMP1

LL_RTC_EnableIT_TAMP2

Function name

__STATIC_INLINE void LL_RTC_EnableIT_TAMP2 (TAMP_TypeDef * TAMPx)

Function description

Enable tamper 2 interrupt.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_IER TAMP2IE LL_RTC_EnableIT_TAMP2

LL_RTC_DisableIT_TAMP2

Function name

__STATIC_INLINE void LL_RTC_DisableIT_TAMP2 (TAMP_TypeDef * TAMPx)

Function description

Disable tamper 2 interrupt.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_IER TAMP2IE LL_RTC_DisableIT_TAMP2

LL_RTC_EnableIT_TAMP3

Function name

__STATIC_INLINE void LL_RTC_EnableIT_TAMP3 (TAMP_TypeDef * TAMPx)

Function description

Enable tamper 3 interrupt.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_IER TAMP3IE LL_RTC_EnableIT_TAMP3

LL_RTC_DisableIT_TAMP3

Function name

__STATIC_INLINE void LL_RTC_DisableIT_TAMP3 (TAMP_TypeDef * TAMPx)

Function description

Disable tamper 3 interrupt.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_IER TAMP3IE LL_RTC_DisableIT_TAMP3

LL_RTC_EnableIT_TAMP4

Function name

__STATIC_INLINE void LL_RTC_EnableIT_TAMP4 (TAMP_TypeDef * TAMPx)

Function description

Enable tamper 4 interrupt.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_IER TAMP4IE LL_RTC_EnableIT_TAMP4

LL_RTC_DisableIT_TAMP4

Function name

__STATIC_INLINE void LL_RTC_DisableIT_TAMP4 (TAMP_TypeDef * TAMPx)

Function description

Disable tamper 4 interrupt.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_IER TAMP4IE LL_RTC_DisableIT_TAMP4

LL_RTC_EnableIT_TAMP5

Function name

__STATIC_INLINE void LL_RTC_EnableIT_TAMP5 (TAMP_TypeDef * TAMPx)

Function description

Enable tamper 5 interrupt.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_IER TAMP5IE LL_RTC_EnableIT_TAMP5

LL_RTC_DisableIT_TAMP5

Function name

__STATIC_INLINE void LL_RTC_DisableIT_TAMP5 (TAMP_TypeDef * TAMPx)

Function description

Disable tamper 5 interrupt.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_IER TAMP5IE LL_RTC_DisableIT_TAMP5

LL_RTC_EnableIT_ITAMP3

Function name

__STATIC_INLINE void LL_RTC_EnableIT_ITAMP3 (TAMP_TypeDef * TAMPx)

Function description

Enable internal tamper 3 interrupt.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_IER ITAMP3IE LL_RTC_EnableIT_ITAMP3

LL_RTC_DisableIT_ITAMP3

Function name

__STATIC_INLINE void LL_RTC_DisableIT_ITAMP3 (TAMP_TypeDef * TAMPx)

Function description

Disable internal tamper 3 interrupt.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_IER ITAMP3IE LL_RTC_DisableIT_ITAMP3

LL_RTC_EnableIT_ITAMP4

Function name

__STATIC_INLINE void LL_RTC_EnableIT_ITAMP4 (TAMP_TypeDef * TAMPx)

Function description

Enable internal tamper 4 interrupt.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_IER ITAMP4IE LL_RTC_EnableIT_ITAMP4

LL_RTC_DisableIT_ITAMP4

Function name

__STATIC_INLINE void LL_RTC_DisableIT_ITAMP4 (TAMP_TypeDef * TAMPx)

Function description

Disable internal tamper 4 interrupt.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_IER ITAMP4IE LL_RTC_DisableIT_ITAMP4

LL_RTC_EnableIT_ITAMP5

Function name

__STATIC_INLINE void LL_RTC_EnableIT_ITAMP5 (TAMP_TypeDef * TAMPx)

Function description

Enable internal tamper 5 interrupt.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_IER ITAMP5IE LL_RTC_EnableIT_ITAMP5

LL_RTC_DisableIT_ITAMP5

Function name

__STATIC_INLINE void LL_RTC_DisableIT_ITAMP5 (TAMP_TypeDef * TAMPx)

Function description

Disable internal tamper 5 interrupt.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_IER ITAMP5IE LL_RTC_DisableIT_ITAMP5

LL_RTC_EnableIT_ITAMP6

Function name

__STATIC_INLINE void LL_RTC_EnableIT_ITAMP6 (TAMP_TypeDef * TAMPx)

Function description

Enable internal tamper 6 interrupt.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_IER ITAMP5IE LL_RTC_EnableIT_ITAMP5

LL_RTC_DisableIT_ITAMP6

Function name

__STATIC_INLINE void LL_RTC_DisableIT_ITAMP6 (TAMP_TypeDef * TAMPx)

Function description

Disable internal tamper 6 interrupt.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- TAMP_IER ITAMP6IE LL_RTC_DisableIT_ITAMP6

LL_RTC_IsEnabledIT_TAMP1

Function name

__STATIC_INLINE uint32_t LL_RTC_IsEnabledIT_TAMP1 (TAMP_TypeDef * TAMPx)

Function description

Check if tamper 1 interrupt is enabled or not.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- TAMP_IER TAMP1IE LL_RTC_IsEnabledIT_TAMP1

LL_RTC_IsEnabledIT_TAMP2

Function name

__STATIC_INLINE uint32_t LL_RTC_IsEnabledIT_TAMP2 (TAMP_TypeDef * TAMPx)

Function description

Check if tamper 2 interrupt is enabled or not.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- TAMP_IER TAMP2IE LL_RTC_IsEnabledIT_TAMP2

LL_RTC_IsEnabledIT_TAMP3

Function name

__STATIC_INLINE uint32_t LL_RTC_IsEnabledIT_TAMP3 (TAMP_TypeDef * TAMPx)

Function description

Check if tamper 3 interrupt is enabled or not.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- TAMP_IER TAMP3IE LL_RTC_IsEnabledIT_TAMP3

LL_RTC_IsEnabledIT_TAMP4

Function name

__STATIC_INLINE uint32_t LL_RTC_IsEnabledIT_TAMP4 (TAMP_TypeDef * TAMPx)

Function description

Check if tamper 4 interrupt is enabled or not.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- TAMP_IER TAMP4IE LL_RTC_IsEnabledIT_TAMP4

LL_RTC_IsEnabledIT_TAMP5

Function name

__STATIC_INLINE uint32_t LL_RTC_IsEnabledIT_TAMP5 (TAMP_TypeDef * TAMPx)

Function description

Check if tamper 5 interrupt is enabled or not.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- TAMP_IER TAMP1IE LL_RTC_IsEnabledIT_TAMP5

LL_RTC_IsEnabledIT_ITAMP3

Function name

__STATIC_INLINE uint32_t LL_RTC_IsEnabledIT_ITAMP3 (TAMP_TypeDef * TAMPx)

Function description

Check if internal tamper 3 interrupt is enabled or not.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- TAMP_IER ITAMP3IE LL_RTC_IsEnabledIT_ITAMP3

LL_RTC_IsEnabledIT_ITAMP4

Function name

__STATIC_INLINE uint32_t LL_RTC_IsEnabledIT_ITAMP4 (TAMP_TypeDef * TAMPx)

Function description

Check if internal tamper 4 interrupt is enabled or not.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- TAMP_IER ITAMP4IE LL_RTC_IsEnabledIT_ITAMP4

LL_RTC_IsEnabledIT_ITAMP5

Function name

__STATIC_INLINE uint32_t LL_RTC_IsEnabledIT_ITAMP5 (TAMP_TypeDef * TAMPx)

Function description

Check if internal tamper 5 interrupt is enabled or not.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- TAMP_IER ITAMP5IE LL_RTC_IsEnabledIT_ITAMP5

LL_RTC_IsEnabledIT_ITAMP6

Function name

__STATIC_INLINE uint32_t LL_RTC_IsEnabledIT_ITAMP6 (TAMP_TypeDef * TAMPx)

Function description

Check if internal tamper 6 interrupt is enabled or not.

Parameters

- **TAMPx:** TAMP Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- TAMP_IER ITAMP6IE LL_RTC_IsEnabledIT_ITAMP6

LL_RTC_DeInit

Function name

ErrorStatus LL_RTC_DeInit (RTC_TypeDef * RTCx)

Function description

De-Initializes the RTC registers to their default reset values.

Parameters

- **RTCx:** RTC Instance

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: RTC registers are de-initialized
  - ERROR: RTC registers are not de-initialized

Notes

- This function doesn't reset the RTC Clock source and RTC Backup Data registers.

LL_RTC_Init

Function name

ErrorStatus LL_RTC_Init (RTC_TypeDef * RTCx, LL_RTC_InitTypeDef * RTC_InitStruct)

Function description

Initializes the RTC registers according to the specified parameters in RTC_InitStruct.

Parameters

- **RTCx:** RTC Instance
- **RTC_InitStruct:** pointer to a LL_RTC_InitTypeDef structure that contains the configuration information for the RTC peripheral.

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: RTC registers are initialized
  - ERROR: RTC registers are not initialized

Notes

- The RTC Prescaler register is write protected and can be written in initialization mode only.

LL_RTC_StructInit

Function name

void LL_RTC_StructInit (LL_RTC_InitTypeDef * RTC_InitStruct)

Function description

Set each LL_RTC_InitTypeDef field to default value.

Parameters

- **RTC_InitStruct:** pointer to a LL_RTC_InitTypeDef structure which will be initialized.

Return values

- **None:**

LL_RTC_TIME_Init

Function name

ErrorStatus LL_RTC_TIME_Init (RTC_TypeDef * RTCx, uint32_t RTC_Format, LL_RTC_TimeTypeDef * RTC_TimeStruct)

Function description

Set the RTC current time.

Parameters

- **RTCx:** RTC Instance
- **RTC_Format:** This parameter can be one of the following values:
  - LL_RTC_FORMAT_BIN
  - LL_RTC_FORMAT_BCD
- **RTC_TimeStruct:** pointer to a RTC_TimeTypeDef structure that contains the time configuration information for the RTC.

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: RTC Time register is configured
  - ERROR: RTC Time register is not configured

LL_RTC_TIME_StructInit

Function name

void LL_RTC_TIME_StructInit (LL_RTC_TimeTypeDef * RTC_TimeStruct)

Function description

Set each LL_RTC_TimeTypeDef field to default value (Time = 00h:00min:00sec).

Parameters

- **RTC_TimeStruct:** pointer to a LL_RTC_TimeTypeDef structure which will be initialized.

Return values

- **None:**

LL_RTC_DATE_Init

Function name

ErrorStatus LL_RTC_DATE_Init (RTC_TypeDef * RTCx, uint32_t RTC_Format, LL_RTC_DateTypeDef * RTC_DateStruct)

Function description

Set the RTC current date.

Parameters

- **RTCx:** RTC Instance
- **RTC_Format:** This parameter can be one of the following values:
  - LL_RTC_FORMAT_BIN
  - LL_RTC_FORMAT_BCD
- **RTC_DateStruct:** pointer to a RTC_DateTypeDef structure that contains the date configuration information for the RTC.

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: RTC Day register is configured
  - ERROR: RTC Day register is not configured

LL_RTC_DATE_StructInit

Function name

void LL_RTC_DATE_StructInit (LL_RTC_DateTypeDef * RTC_DateStruct)

Function description

Set each LL_RTC_DateTypeDef field to default value (date = Monday, January 01 xx00)

Parameters

- **RTC_DateStruct:** pointer to a LL_RTC_DateTypeDef structure which will be initialized.

Return values

- **None:**

LL_RTC_ALMA_Init

Function name

ErrorStatus LL_RTC_ALMA_Init (RTC_TypeDef * RTCx, uint32_t RTC_Format, LL_RTC_AlarmTypeDef * RTC_AlarmStruct)

Function description

Set the RTC Alarm A.

Parameters

- **RTCx:** RTC Instance
- **RTC_Format:** This parameter can be one of the following values:
  - LL_RTC_FORMAT_BIN
  - LL_RTC_FORMAT_BCD
- **RTC_AlarmStruct:** pointer to a LL_RTC_AlarmTypeDef structure that contains the alarm configuration parameters.

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: ALARMA registers are configured
  - ERROR: ALARMA registers are not configured

Notes

- The Alarm register can only be written when the corresponding Alarm is disabled (Use LL_RTC_ALMA_Disable function).

LL_RTC_ALMB_Init

Function name

ErrorStatus LL_RTC_ALMB_Init (RTC_TypeDef * RTCx, uint32_t RTC_Format, LL_RTC_AlarmTypeDef * RTC_AlarmStruct)

Function description

Set the RTC Alarm B.

Parameters

- **RTCx:** RTC Instance
- **RTC_Format:** This parameter can be one of the following values:
  - LL_RTC_FORMAT_BIN
  - LL_RTC_FORMAT_BCD
- **RTC_AlarmStruct:** pointer to a LL_RTC_AlarmTypeDef structure that contains the alarm configuration parameters.

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: ALARMB registers are configured
  - ERROR: ALARMB registers are not configured

Notes

- The Alarm register can only be written when the corresponding Alarm is disabled (LL_RTC_ALMB_Disable function).

LL_RTC_ALMA_StructInit

Function name

void LL_RTC_ALMA_StructInit (LL_RTC_AlarmTypeDef * RTC_AlarmStruct)

Function description

Set each LL_RTC_AlarmTypeDef of ALARMA field to default value (Time = 00h:00mn:00sec / Day = 1st day of the month/Mask = all fields are masked).

Parameters

- **RTC_AlarmStruct:** pointer to a LL_RTC_AlarmTypeDef structure which will be initialized.

Return values

- **None:**

LL_RTC_ALMB_StructInit

Function name

void LL_RTC_ALMB_StructInit (LL_RTC_AlarmTypeDef * RTC_AlarmStruct)

Function description

Set each LL_RTC_AlarmTypeDef of ALARMA field to default value (Time = 00h:00mn:00sec / Day = 1st day of the month/Mask = all fields are masked).

Parameters

- **RTC_AlarmStruct:** pointer to a LL_RTC_AlarmTypeDef structure which will be initialized.

Return values

- **None:**

LL_RTC_EnterInitMode

Function name

ErrorStatus LL_RTC_EnterInitMode (RTC_TypeDef * RTCx)

Function description

Enters the RTC Initialization mode.

Parameters

- **RTCx:** RTC Instance

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: RTC is in Init mode
  - ERROR: RTC is not in Init mode

Notes

- The RTC Initialization mode is write protected, use the LL_RTC_DisableWriteProtection before calling this function.

LL_RTC_ExitInitMode

Function name

ErrorStatus LL_RTC_ExitInitMode (RTC_TypeDef * RTCx)

Function description

Exit the RTC Initialization mode.

Parameters

- **RTCx:** RTC Instance

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: RTC exited from in Init mode
  - ERROR: Not applicable

Notes

- When the initialization sequence is complete, the calendar restarts counting after 4 RTCCLK cycles.
- The RTC Initialization mode is write protected, use the LL_RTC_DisableWriteProtection before calling this function.

LL_RTC_WaitForSynchro

Function name

ErrorStatus LL_RTC_WaitForSynchro (RTC_TypeDef * RTCx)

Function description

Waits until the RTC Time and Day registers (RTC_TR and RTC_DR) are synchronized with RTC APB clock.

Parameters

- **RTCx:** RTC Instance

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: RTC registers are synchronised
  - ERROR: RTC registers are not synchronised

Notes

- The RTC Resynchronization mode is write protected, use the LL_RTC_DisableWriteProtection before calling this function.
- To read the calendar through the shadow registers after Calendar initialization, calendar update or after wakeup from low power modes the software must first clear the RSF flag. The software must then wait until it is set again before reading the calendar, which means that the calendar registers have been correctly copied into the RTC_TR and RTC_DR shadow registers.

74.3 RTC Firmware driver defines

The following section lists the various define and macros of the module.

74.3.1 RTC

RTC

ALARM OUTPUT

LL_RTC_ALARMOUT_DISABLE

Output disabled

LL_RTC_ALARMOUT_ALMA

Alarm A output enabled

LL_RTC_ALARMOUT_ALMB

Alarm B output enabled

LL_RTC_ALARMOUT_WAKEUP

Wakeup output enabled

ALARM OUTPUT TYPE

LL_RTC_ALARM_OUTPUTTYPE_OPENDRAIN

RTC_ALARM is open-drain output

LL_RTC_ALARM_OUTPUTTYPE_PUSHPULL

RTC_ALARM is push-pull output

ALARMA MASK

LL_RTC_ALMA_MASK_NONE

No masks applied on Alarm A

LL_RTC_ALMA_MASK_DATEWEEKDAY

Date/day do not care in Alarm A comparison

LL_RTC_ALMA_MASK_HOURS

Hours do not care in Alarm A comparison

LL_RTC_ALMA_MASK_MINUTES

Minutes do not care in Alarm A comparison

LL_RTC_ALMA_MASK_SECONDS

Seconds do not care in Alarm A comparison

LL_RTC_ALMA_MASK_ALL

Masks all

RTC Alarm Sub Seconds with binary mode auto clear Definitions

LL_RTC_ALMA_SUBSECONDBIN_AUTOCLR_NO

The synchronous binary counter (SS[31:0] in RTC_SSR) is free-running.

LL_RTC_ALMA_SUBSECONDBIN_AUTOCLR_YES

The synchronous binary counter (SS[31:0] in RTC_SSR) is running from 0xFFFF FFFF to RTC_ALRMABINR -> SS[31:0] value and is automatically reloaded with 0xFFFF FFFF when reaching RTC_ALRMABINR -> SS[31:0].

ALARMA TIME FORMAT

LL_RTC_ALMA_TIME_FORMAT_AM

AM or 24-hour format

LL_RTC_ALMA_TIME_FORMAT_PM

PM

RTC Alarm A Date WeekDay

LL_RTC_ALMA_DATEWEEKDAYSEL_DATE

Alarm A Date is selected

LL_RTC_ALMA_DATEWEEKDAYSEL_WEEKDAY

Alarm A WeekDay is selected

ALARMB MASK

LL_RTC_ALMB_MASK_NONE

No masks applied on Alarm B

LL_RTC_ALMB_MASK_DATEWEEKDAY

Date/day do not care in Alarm B comparison

LL_RTC_ALMB_MASK_HOURS

Hours do not care in Alarm B comparison

LL_RTC_ALMB_MASK_MINUTES

Minutes do not care in Alarm B comparison

LL_RTC_ALMB_MASK_SECONDS

Seconds do not care in Alarm B comparison

LL_RTC_ALMB_MASK_ALL

Masks all

Alarm Sub Seconds with binary mode auto clear Definitions

LL_RTC_ALMB_SUBSECONDBIN_AUTOCLR_NO

The synchronous binary counter (SS[31:0] in RTC_SSR) is free-running.

LL_RTC_ALMB_SUBSECONDBIN_AUTOCLR_YES

The synchronous binary counter (SS[31:0] in RTC_SSR) is running from 0xFFFF FFFF to RTC_ALRMABINR -> SS[31:0] value and is automatically reloaded with 0xFFFF FFFF when reaching RTC_ALRMABINR -> SS[31:0].

ALARMB TIME FORMAT

LL_RTC_ALMB_TIME_FORMAT_AM

AM or 24-hour format

LL_RTC_ALMB_TIME_FORMAT_PM

PM

RTC Alarm B Date WeekDay

LL_RTC_ALMB_DATEWEEKDAYSEL_DATE

Alarm B Date is selected

LL_RTC_ALMB_DATEWEEKDAYSEL_WEEKDAY

Alarm B WeekDay is selected

BACKUP

LL_RTC_BKP_NUMBER

LL_RTC_BKP_DR0

LL_RTC_BKP_DR1

LL_RTC_BKP_DR2

LL_RTC_BKP_DR3

LL_RTC_BKP_DR4

LL_RTC_BKP_DR5

LL_RTC_BKP_DR6

LL_RTC_BKP_DR7

LL_RTC_BKP_DR8

Calibration pulse insertion

LL_RTC_CALIB_INSERTPULSE_NONE

No RTCCLK pulses are added

LL_RTC_CALIB_INSERTPULSE_SET

One RTCCLK pulse is effectively inserted every 2exp11 pulses (frequency increased by 488.5 ppm)

Calibration output

LL_RTC_CALIB_OUTPUT_NONE

Calibration output disabled

LL_RTC_CALIB_OUTPUT_1HZ

Calibration output is 1 Hz

LL_RTC_CALIB_OUTPUT_512HZ

Calibration output is 512 Hz

Calibration period

LL_RTC_CALIB_PERIOD_32SEC

Use a 32-second calibration cycle period

LL_RTC_CALIB_PERIOD_32SEC

Use a 32-second calibration cycle period

LL_RTC_CALIB_PERIOD_16SEC

Use a 16-second calibration cycle period

LL_RTC_CALIB_PERIOD_16SEC

Use a 16-second calibration cycle period

LL_RTC_CALIB_PERIOD_8SEC

Use a 8-second calibration cycle period

LL_RTC_CALIB_PERIOD_8SEC

Use a 8-second calibration cycle period

FORMAT

LL_RTC_FORMAT_BIN

Binary data format

LL_RTC_FORMAT_BCD

BCD data format

Get Flags Defines

LL_RTC_SCR_ITSF

LL_RTC_SCR_TSOVF

LL_RTC_SCR_TSF

LL_RTC_SCR_WUTF

LL_RTC_SCR_ALRBF

LL_RTC_SCR_ALRAF

LL_RTC_SCR_SSRUF

LL_RTC_ICSR_BCDU_2

LL_RTC_ICSR_BCDU_1

LL_RTC_ICSR_BCDU_0

LL_RTC_ICSR_BIN_1

LL_RTC_ICSR_BIN_0

LL_RTC_ICSR_RECALPF

LL_RTC_ICSR_INITF

LL_RTC_ICSR_RSF

LL_RTC_ICSR_INITS

LL_RTC_ICSR_SHPF

LL_RTC_ICSR_WUTWF

HOUR FORMAT

LL_RTC_HOURFORMAT_24HOUR

24 hour/day format

LL_RTC_HOURFORMAT_AMPM

AM/PM hour format

INTERNAL TAMPER

LL_RTC_TAMPER_ITAMP3

Internal tamper 3: LSE monitoring

LL_RTC_TAMPER_ITAMP4

Internal tamper 4: HSE monitoring

LL_RTC_TAMPER_ITAMP5

Internal tamper 5: RTC calendar overflow

LL_RTC_TAMPER_ITAMP6

Internal tamper 6: Test mode entry

IT Defines

LL_RTC_CR_TSIE

LL_RTC_CR_WUTIE

LL_RTC_CR_ALRBIE

LL_RTC_CR_ALRAIE

MONTH

LL_RTC_MONTH_JANUARY

January

LL_RTC_MONTH_FEBRUARY

February

LL_RTC_MONTH_MARCH

March

LL_RTC_MONTH_APRIL

April

LL_RTC_MONTH_MAY

May

LL_RTC_MONTH_JUNE

June

LL_RTC_MONTH_JULY

July

LL_RTC_MONTH_AUGUST

August

LL_RTC_MONTH_SEPTEMBER

September

LL_RTC_MONTH_OCTOBER

October

LL_RTC_MONTH_NOVEMBER

November

LL_RTC_MONTH_DECEMBER

December

OUTPUT POLARITY PIN

LL_RTC_OUTPUTPOLARITY_PIN_HIGH

Pin is high when ALRAF/ALRBF/WUTF is asserted (depending on OSEL)

LL_RTC_OUTPUTPOLARITY_PIN_LOW

Pin is low when ALRAF/ALRBF/WUTF is asserted (depending on OSEL)

SHIFT SECOND

LL_RTC_SHIFT_SECOND_DELAY

LL_RTC_SHIFT_SECOND_ADVANCE

TAMPER

LL_RTC_TAMPER_1

Tamper 1 input detection

LL_RTC_TAMPER_2

Tamper 2 input detection

LL_RTC_TAMPER_3

Tamper 3 input detection

LL_RTC_TAMPER_4

Tamper 4 input detection

LL_RTC_TAMPER_5

Tamper 5 input detection

TAMPER ACTIVE LEVEL

LL_RTC_TAMPER_ACTIVELEVEL_TAMP1

Tamper 1 input falling edge (if TAMPFLT = 00) or staying high (if TAMPFLT != 00) triggers a tamper detection event

LL_RTC_TAMPER_ACTIVELEVEL_TAMP2

Tamper 2 input falling edge (if TAMPFLT = 00) or staying high (if TAMPFLT != 00) triggers a tamper detection event

LL_RTC_TAMPER_ACTIVELEVEL_TAMP3

Tamper 3 input falling edge (if TAMPFLT = 00) or staying high (if TAMPFLT != 00) triggers a tamper detection event

LL_RTC_TAMPER_ACTIVELEVEL_TAMP4

Tamper 4 input falling edge (if TAMPFLT = 00) or staying high (if TAMPFLT != 00) triggers a tamper detection event

LL_RTC_TAMPER_ACTIVELEVEL_TAMP5

Tamper 5 input falling edge (if TAMPFLT = 00) or staying high (if TAMPFLT != 00) triggers a tamper detection event

TAMPER DURATION

LL_RTC_TAMPER_DURATION_1RTCCLK

Tamper pins are pre-charged before sampling during 1 RTCCLK cycle

LL_RTC_TAMPER_DURATION_2RTCCLK

Tamper pins are pre-charged before sampling during 2 RTCCLK cycles

LL_RTC_TAMPER_DURATION_4RTCCLK

Tamper pins are pre-charged before sampling during 4 RTCCLK cycles

LL_RTC_TAMPER_DURATION_8RTCCLK

Tamper pins are pre-charged before sampling during 8 RTCCLK cycles

TAMPER FILTER

LL_RTC_TAMPER_FILTER_DISABLE

Tamper filter is disabled

LL_RTC_TAMPER_FILTER_2SAMPLE

Tamper is activated after 2 consecutive samples at the active level

LL_RTC_TAMPER_FILTER_4SAMPLE

Tamper is activated after 4 consecutive samples at the active level

LL_RTC_TAMPER_FILTER_8SAMPLE

Tamper is activated after 8 consecutive samples at the active level.

TAMPER MASK

LL_RTC_TAMPER_MASK_TAMPER1

Tamper 1 event generates a trigger event. TAMP1F is masked and internally cleared by hardware.The backup registers are not erased

LL_RTC_TAMPER_MASK_TAMPER2

Tamper 2 event generates a trigger event. TAMP2F is masked and internally cleared by hardware. The backup registers are not erased.

LL_RTC_TAMPER_MASK_TAMPER3

Tamper 3 event generates a trigger event. TAMP3F is masked and internally cleared by hardware. The backup registers are not erased.

TAMPER NO ERASE

LL_RTC_TAMPER_NOERASE_TAMPER1

Tamper 1 event does not erase the backup registers.

LL_RTC_TAMPER_NOERASE_TAMPER2

Tamper 2 event does not erase the backup registers.

LL_RTC_TAMPER_NOERASE_TAMPER3

Tamper 3 event does not erase the backup registers.

LL_RTC_TAMPER_NOERASE_TAMPER4

Tamper 4 event does not erase the backup registers.

LL_RTC_TAMPER_NOERASE_TAMPER5

Tamper 5 event does not erase the backup registers.

TAMPER SAMPLING FREQUENCY DIVIDER

LL_RTC_TAMPER_SAMPLFREQDIV_32768

Each of the tamper inputs are sampled with a frequency = RTCCLK / 32768

LL_RTC_TAMPER_SAMPLFREQDIV_16384

Each of the tamper inputs are sampled with a frequency = RTCCLK / 16384

LL_RTC_TAMPER_SAMPLFREQDIV_8192

Each of the tamper inputs are sampled with a frequency = RTCCLK / 8192

LL_RTC_TAMPER_SAMPLFREQDIV_4096

Each of the tamper inputs are sampled with a frequency = RTCCLK / 4096

LL_RTC_TAMPER_SAMPLFREQDIV_2048

Each of the tamper inputs are sampled with a frequency = RTCCLK / 2048

LL_RTC_TAMPER_SAMPLFREQDIV_1024

Each of the tamper inputs are sampled with a frequency = RTCCLK / 1024

LL_RTC_TAMPER_SAMPLFREQDIV_512

Each of the tamper inputs are sampled with a frequency = RTCCLK / 512

LL_RTC_TAMPER_SAMPLFREQDIV_256

Each of the tamper inputs are sampled with a frequency = RTCCLK / 256

TIMESTAMP EDGE

LL_RTC_TIMESTAMP_EDGE_RISING

RTC_TS input rising edge generates a time-stamp event

LL_RTC_TIMESTAMP_EDGE_FALLING

RTC_TS input falling edge generates a time-stamp even

TIME FORMAT

LL_RTC_TIME_FORMAT_AM_OR_24

AM or 24-hour format

LL_RTC_TIME_FORMAT_PM

PM

TIMESTAMP TIME FORMAT

LL_RTC_TS_TIME_FORMAT_AM

AM or 24-hour format

LL_RTC_TS_TIME_FORMAT_PM

PM

WAKEUP CLOCK DIV

LL_RTC_WAKEUPCLOCK_DIV_16

RTC/16 clock is selected

LL_RTC_WAKEUPCLOCK_DIV_8

RTC/8 clock is selected

LL_RTC_WAKEUPCLOCK_DIV_4

RTC/4 clock is selected

LL_RTC_WAKEUPCLOCK_DIV_2

RTC/2 clock is selected

LL_RTC_WAKEUPCLOCK_CKSPRE

ck_spre (usually 1 Hz) clock is selected

LL_RTC_WAKEUPCLOCK_CKSPRE_WUT

ck_spre (usually 1 Hz) clock is selected and 2exp16 is added to the WUT counter value

WEEK DAY

LL_RTC_WEEKDAY_MONDAY

Monday

LL_RTC_WEEKDAY_TUESDAY

Tuesday

LL_RTC_WEEKDAY_WEDNESDAY

Wednesday

LL_RTC_WEEKDAY_THURSDAY

Thrusday

LL_RTC_WEEKDAY_FRIDAY

Friday

LL_RTC_WEEKDAY_SATURDAY

Saturday

LL_RTC_WEEKDAY_SUNDAY

Sunday

Convert helper Macros

__LL_RTC_CONVERT_BIN2BCD

Description:

- Helper macro to convert a value from 2 digit decimal format to BCD format.

Parameters:

- __VALUE__: Byte to be converted

Return value:

- Converted: byte

__LL_RTC_CONVERT_BCD2BIN

Description:

- Helper macro to convert a value from BCD format to 2 digit decimal format.

Parameters:

- __VALUE__: BCD value to be converted

Return value:

- Converted: byte

Date helper Macros

__LL_RTC_GET_WEEKDAY

Description:

- Helper macro to retrieve weekday.

Parameters:

- __RTC_DATE__: Date returned by

Return value:

- Returned: value can be one of the following values:
  - LL_RTC_WEEKDAY_MONDAY
  - LL_RTC_WEEKDAY_TUESDAY
  - LL_RTC_WEEKDAY_WEDNESDAY
  - LL_RTC_WEEKDAY_THURSDAY
  - LL_RTC_WEEKDAY_FRIDAY
  - LL_RTC_WEEKDAY_SATURDAY
  - LL_RTC_WEEKDAY_SUNDAY

__LL_RTC_GET_YEAR

Description:

- Helper macro to retrieve Year in BCD format.

Parameters:

- __RTC_DATE__: Value returned by

Return value:

- Year: in BCD format (0x00 . . . 0x99)

__LL_RTC_GET_MONTH

Description:

- Helper macro to retrieve Month in BCD format.

Parameters:

- __RTC_DATE__: Value returned by

Return value:

- Returned: value can be one of the following values:
  - LL_RTC_MONTH_JANUARY
  - LL_RTC_MONTH_FEBRUARY
  - LL_RTC_MONTH_MARCH
  - LL_RTC_MONTH_APRIL
  - LL_RTC_MONTH_MAY
  - LL_RTC_MONTH_JUNE
  - LL_RTC_MONTH_JULY
  - LL_RTC_MONTH_AUGUST
  - LL_RTC_MONTH_SEPTEMBER
  - LL_RTC_MONTH_OCTOBER
  - LL_RTC_MONTH_NOVEMBER
  - LL_RTC_MONTH_DECEMBER

__LL_RTC_GET_DAY

Description:

- Helper macro to retrieve Day in BCD format.

Parameters:

- __RTC_DATE__: Value returned by

Return value:

- Day: in BCD format (0x01 . . . 0x31)

Time helper Macros

__LL_RTC_GET_HOUR

Description:

- Helper macro to retrieve hour in BCD format.

Parameters:

- __RTC_TIME__: RTC time returned by

Return value:

- Hours: in BCD format (0x01. . .0x12 or between Min_Data=0x00 and Max_Data=0x23)

__LL_RTC_GET_MINUTE

Description:

- Helper macro to retrieve minute in BCD format.

Parameters:

- __RTC_TIME__: RTC time returned by

Return value:

- Minutes: in BCD format (0x00. . .0x59)

__LL_RTC_GET_SECOND

Description:

- Helper macro to retrieve second in BCD format.

Parameters:

- __RTC_TIME__: RTC time returned by

Return value:

- Seconds: in format (0x00. . .0x59)

Common Write and read registers Macros

LL_RTC_WriteReg

Description:

- Write a value in RTC register.

Parameters:

- __INSTANCE__: RTC Instance
- __REG__: Register to be written
- __VALUE__: Value to be written in the register

Return value:

- None

LL_RTC_ReadReg

Description:

- Read a value in RTC register.

Parameters:

- __INSTANCE__: RTC Instance
- __REG__: Register to be read

Return value:

- Register: value

75 LL SPI Generic Driver

75.1 SPI Firmware driver registers structures

75.1.1 LL_SPI_InitTypeDef

LL_SPI_InitTypeDef is defined in the stm32u0xx_ll_spi.h

Data Fields

- ***uint32_t TransferDirection***
- ***uint32_t Mode***
- ***uint32_t DataWidth***
- ***uint32_t ClockPolarity***
- ***uint32_t ClockPhase***
- ***uint32_t NSS***
- ***uint32_t BaudRate***
- ***uint32_t BitOrder***
- ***uint32_t CRCCalculation***
- ***uint32_t CRCPoly***

Field Documentation

- ***uint32_t LL_SPI_InitTypeDef::TransferDirection***
  Specifies the SPI unidirectional or bidirectional data mode. This parameter can be a value of ***SPI_LL_EC_TRANSFER_MODE***.This feature can be modified afterwards using unitary function **LL_SPI_SetTransferDirection()**.
- ***uint32_t LL_SPI_InitTypeDef::Mode***
  Specifies the SPI mode (Master/Slave). This parameter can be a value of ***SPI_LL_EC_MODE***.This feature can be modified afterwards using unitary function **LL_SPI_SetMode()**.
- ***uint32_t LL_SPI_InitTypeDef::DataWidth***
  Specifies the SPI data width. This parameter can be a value of ***SPI_LL_EC_DATAWIDTH***.This feature can be modified afterwards using unitary function **LL_SPI_SetDataWidth()**.
- ***uint32_t LL_SPI_InitTypeDef::ClockPolarity***
  Specifies the serial clock steady state. This parameter can be a value of ***SPI_LL_EC_POLARITY***.This feature can be modified afterwards using unitary function **LL_SPI_SetClockPolarity()**.
- ***uint32_t LL_SPI_InitTypeDef::ClockPhase***
  Specifies the clock active edge for the bit capture. This parameter can be a value of ***SPI_LL_EC_PHASE***.This feature can be modified afterwards using unitary function **LL_SPI_SetClockPhase()**.
- ***uint32_t LL_SPI_InitTypeDef::NSS***
  Specifies whether the NSS signal is managed by hardware (NSS pin) or by software using the SSI bit. This parameter can be a value of ***SPI_LL_EC_NSS_MODE***.This feature can be modified afterwards using unitary function **LL_SPI_SetNSSMode()**.
- ***uint32_t LL_SPI_InitTypeDef::BaudRate***
  Specifies the BaudRate prescaler value which will be used to configure the transmit and receive SCK clock. This parameter can be a value of ***SPI_LL_EC_BAUDRATEPRESCALER***.
  Note:
  – The communication clock is derived from the master clock. The slave clock does not need to be set.

  This feature can be modified afterwards using unitary function **LL_SPI_SetBaudRatePrescaler()**.
- ***uint32_t LL_SPI_InitTypeDef::BitOrder***
  Specifies whether data transfers start from MSB or LSB bit. This parameter can be a value of ***SPI_LL_EC_BIT_ORDER***.This feature can be modified afterwards using unitary function **LL_SPI_SetTransferBitOrder()**.
- ***uint32_t LL_SPI_InitTypeDef::CRCCalculation***
  Specifies if the CRC calculation is enabled or not. This parameter can be a value of ***SPI_LL_EC_CRC_CALCULATION***.This feature can be modified afterwards using unitary functions **LL_SPI_EnableCRC()** and **LL_SPI_DisableCRC()**.

- ***uint32_t LL_SPI_InitTypeDef::CRCPoly***
  Specifies the polynomial used for the CRC calculation. This parameter must be a number between Min_Data = 0x00 and Max_Data = 0xFFFF.This feature can be modified afterwards using unitary function **LL_SPI_SetCRCPolynomial()**.

75.2 SPI Firmware driver API description

The following section lists the various functions of the SPI library.

75.2.1 Detailed description of functions

LL_SPI_Enable

Function name

__STATIC_INLINE void LL_SPI_Enable (SPI_TypeDef * SPIx)

Function description

Enable SPI peripheral.

Parameters

- **SPIx:** SPI Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 SPE LL_SPI_Enable

LL_SPI_Disable

Function name

__STATIC_INLINE void LL_SPI_Disable (SPI_TypeDef * SPIx)

Function description

Disable SPI peripheral.

Parameters

- **SPIx:** SPI Instance

Return values

- **None:**

Notes

- When disabling the SPI, follow the procedure described in the Reference Manual.

Reference Manual to LL API cross reference:

- CR1 SPE LL_SPI_Disable

LL_SPI_IsEnabled

Function name

__STATIC_INLINE uint32_t LL_SPI_IsEnabled (SPI_TypeDef * SPIx)

Function description

Check if SPI peripheral is enabled.

Parameters

- **SPIx:** SPI Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 SPE LL_SPI_IsEnabled

LL_SPI_SetMode

Function name

__STATIC_INLINE void LL_SPI_SetMode (SPI_TypeDef * SPIx, uint32_t Mode)

Function description

Set SPI operation mode to Master or Slave.

Parameters

- **SPIx:** SPI Instance
- **Mode:** This parameter can be one of the following values:
  - LL_SPI_MODE_MASTER
  - LL_SPI_MODE_SLAVE

Return values

- **None:**

Notes

- This bit should not be changed when communication is ongoing.

Reference Manual to LL API cross reference:

- CR1 MSTR LL_SPI_SetMode
- CR1 SSI LL_SPI_SetMode

LL_SPI_GetMode

Function name

__STATIC_INLINE uint32_t LL_SPI_GetMode (SPI_TypeDef * SPIx)

Function description

Get SPI operation mode (Master or Slave)

Parameters

- **SPIx:** SPI Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_SPI_MODE_MASTER
  - LL_SPI_MODE_SLAVE

Reference Manual to LL API cross reference:

- CR1 MSTR LL_SPI_GetMode
- CR1 SSI LL_SPI_GetMode

LL_SPI_SetStandard

Function name

__STATIC_INLINE void LL_SPI_SetStandard (SPI_TypeDef * SPIx, uint32_t Standard)

Function description

Set serial protocol used.

Parameters

- **SPIx:** SPI Instance
- **Standard:** This parameter can be one of the following values:
  - LL_SPI_PROTOCOL_MOTOROLA
  - LL_SPI_PROTOCOL_TI

Return values

- **None:**

Notes

- This bit should be written only when SPI is disabled (SPE = 0) for correct operation.

Reference Manual to LL API cross reference:

- CR2 FRF LL_SPI_SetStandard

LL_SPI_GetStandard

Function name

__STATIC_INLINE uint32_t LL_SPI_GetStandard (SPI_TypeDef * SPIx)

Function description

Get serial protocol used.

Parameters

- **SPIx:** SPI Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_SPI_PROTOCOL_MOTOROLA
  - LL_SPI_PROTOCOL_TI

Reference Manual to LL API cross reference:

- CR2 FRF LL_SPI_GetStandard

LL_SPI_SetClockPhase

Function name

__STATIC_INLINE void LL_SPI_SetClockPhase (SPI_TypeDef * SPIx, uint32_t ClockPhase)

Function description

Set clock phase.

Parameters

- **SPIx:** SPI Instance
- **ClockPhase:** This parameter can be one of the following values:
  - LL_SPI_PHASE_1EDGE
  - LL_SPI_PHASE_2EDGE

Return values

- **None:**

Notes

- This bit should not be changed when communication is ongoing. This bit is not used in SPI TI mode.

Reference Manual to LL API cross reference:

- CR1 CPHA LL_SPI_SetClockPhase

LL_SPI_GetClockPhase

Function name

__STATIC_INLINE uint32_t LL_SPI_GetClockPhase (SPI_TypeDef * SPIx)

Function description

Get clock phase.

Parameters

- **SPIx:** SPI Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_SPI_PHASE_1EDGE
  - LL_SPI_PHASE_2EDGE

Reference Manual to LL API cross reference:

- CR1 CPHA LL_SPI_GetClockPhase

LL_SPI_SetClockPolarity

Function name

__STATIC_INLINE void LL_SPI_SetClockPolarity (SPI_TypeDef * SPIx, uint32_t ClockPolarity)

Function description

Set clock polarity.

Parameters

- **SPIx:** SPI Instance
- **ClockPolarity:** This parameter can be one of the following values:
  - LL_SPI_POLARITY_LOW
  - LL_SPI_POLARITY_HIGH

Return values

- **None:**

Notes

- This bit should not be changed when communication is ongoing. This bit is not used in SPI TI mode.

Reference Manual to LL API cross reference:

- CR1 CPOL LL_SPI_SetClockPolarity

LL_SPI_GetClockPolarity

Function name

__STATIC_INLINE uint32_t LL_SPI_GetClockPolarity (SPI_TypeDef * SPIx)

Function description

Get clock polarity.

Parameters

- **SPIx:** SPI Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_SPI_POLARITY_LOW
  - LL_SPI_POLARITY_HIGH

Reference Manual to LL API cross reference:

- CR1 CPOL LL_SPI_GetClockPolarity

LL_SPI_SetBaudRatePrescaler

Function name

__STATIC_INLINE void LL_SPI_SetBaudRatePrescaler (SPI_TypeDef * SPIx, uint32_t BaudRate)

Function description

Set baud rate prescaler.

Parameters

- **SPIx:** SPI Instance
- **BaudRate:** This parameter can be one of the following values:
  - LL_SPI_BAUDRATEPRESCALER_DIV2
  - LL_SPI_BAUDRATEPRESCALER_DIV4
  - LL_SPI_BAUDRATEPRESCALER_DIV8
  - LL_SPI_BAUDRATEPRESCALER_DIV16
  - LL_SPI_BAUDRATEPRESCALER_DIV32
  - LL_SPI_BAUDRATEPRESCALER_DIV64
  - LL_SPI_BAUDRATEPRESCALER_DIV128
  - LL_SPI_BAUDRATEPRESCALER_DIV256

Return values

- **None:**

Notes

- These bits should not be changed when communication is ongoing. SPI BaudRate = fPCLK/Prescaler.

Reference Manual to LL API cross reference:

- CR1 BR LL_SPI_SetBaudRatePrescaler

LL_SPI_GetBaudRatePrescaler

Function name

__STATIC_INLINE uint32_t LL_SPI_GetBaudRatePrescaler (SPI_TypeDef * SPIx)

Function description

Get baud rate prescaler.

Parameters

- **SPIx:** SPI Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_SPI_BAUDRATEPRESCALER_DIV2
  - LL_SPI_BAUDRATEPRESCALER_DIV4
  - LL_SPI_BAUDRATEPRESCALER_DIV8
  - LL_SPI_BAUDRATEPRESCALER_DIV16
  - LL_SPI_BAUDRATEPRESCALER_DIV32
  - LL_SPI_BAUDRATEPRESCALER_DIV64
  - LL_SPI_BAUDRATEPRESCALER_DIV128
  - LL_SPI_BAUDRATEPRESCALER_DIV256

Reference Manual to LL API cross reference:

- CR1 BR LL_SPI_GetBaudRatePrescaler

LL_SPI_SetTransferBitOrder

Function name

__STATIC_INLINE void LL_SPI_SetTransferBitOrder (SPI_TypeDef * SPIx, uint32_t BitOrder)

Function description

Set transfer bit order.

Parameters

- **SPIx:** SPI Instance
- **BitOrder:** This parameter can be one of the following values:
  - LL_SPI_LSB_FIRST
  - LL_SPI_MSB_FIRST

Return values

- **None:**

Notes

- This bit should not be changed when communication is ongoing. This bit is not used in SPI TI mode.

Reference Manual to LL API cross reference:

- CR1 LSBFIRST LL_SPI_SetTransferBitOrder

LL_SPI_GetTransferBitOrder

Function name

__STATIC_INLINE uint32_t LL_SPI_GetTransferBitOrder (SPI_TypeDef * SPIx)

Function description

Get transfer bit order.

Parameters

- **SPIx:** SPI Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_SPI_LSB_FIRST
  - LL_SPI_MSB_FIRST

Reference Manual to LL API cross reference:

- CR1 LSBFIRST LL_SPI_GetTransferBitOrder

LL_SPI_SetTransferDirection

Function name

__STATIC_INLINE void LL_SPI_SetTransferDirection (SPI_TypeDef * SPIx, uint32_t TransferDirection)

Function description

Set transfer direction mode.

Parameters

- **SPIx:** SPI Instance
- **TransferDirection:** This parameter can be one of the following values:
  - LL_SPI_FULL_DUPLEX
  - LL_SPI_SIMPLEX_RX
  - LL_SPI_HALF_DUPLEX_RX
  - LL_SPI_HALF_DUPLEX_TX

Return values

- **None:**

Notes

- For Half-Duplex mode, Rx Direction is set by default. In master mode, the MOSI pin is used and in slave mode, the MISO pin is used for Half-Duplex.

Reference Manual to LL API cross reference:

- CR1 RXONLY LL_SPI_SetTransferDirection
- CR1 BIDIMODE LL_SPI_SetTransferDirection
- CR1 BIDIOE LL_SPI_SetTransferDirection

LL_SPI_GetTransferDirection

Function name

__STATIC_INLINE uint32_t LL_SPI_GetTransferDirection (SPI_TypeDef * SPIx)

Function description

Get transfer direction mode.

Parameters

- **SPIx:** SPI Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_SPI_FULL_DUPLEX
  - LL_SPI_SIMPLEX_RX
  - LL_SPI_HALF_DUPLEX_RX
  - LL_SPI_HALF_DUPLEX_TX

Reference Manual to LL API cross reference:

- CR1 RXONLY LL_SPI_GetTransferDirection
- CR1 BIDIMODE LL_SPI_GetTransferDirection
- CR1 BIDIOE LL_SPI_GetTransferDirection

LL_SPI_SetDataWidth

Function name

__STATIC_INLINE void LL_SPI_SetDataWidth (SPI_TypeDef * SPIx, uint32_t DataWidth)

Function description

Set frame data width.

Parameters

- **SPIx:** SPI Instance
- **DataWidth:** This parameter can be one of the following values:
  - LL_SPI_DATAWIDTH_4BIT
  - LL_SPI_DATAWIDTH_5BIT
  - LL_SPI_DATAWIDTH_6BIT
  - LL_SPI_DATAWIDTH_7BIT
  - LL_SPI_DATAWIDTH_8BIT
  - LL_SPI_DATAWIDTH_9BIT
  - LL_SPI_DATAWIDTH_10BIT
  - LL_SPI_DATAWIDTH_11BIT
  - LL_SPI_DATAWIDTH_12BIT
  - LL_SPI_DATAWIDTH_13BIT
  - LL_SPI_DATAWIDTH_14BIT
  - LL_SPI_DATAWIDTH_15BIT
  - LL_SPI_DATAWIDTH_16BIT

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR2 DS LL_SPI_SetDataWidth

LL_SPI_GetDataWidth

Function name

__STATIC_INLINE uint32_t LL_SPI_GetDataWidth (SPI_TypeDef * SPIx)

Function description

Get frame data width.

Parameters

- **SPIx:** SPI Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_SPI_DATAWIDTH_4BIT
  - LL_SPI_DATAWIDTH_5BIT
  - LL_SPI_DATAWIDTH_6BIT
  - LL_SPI_DATAWIDTH_7BIT
  - LL_SPI_DATAWIDTH_8BIT
  - LL_SPI_DATAWIDTH_9BIT
  - LL_SPI_DATAWIDTH_10BIT
  - LL_SPI_DATAWIDTH_11BIT
  - LL_SPI_DATAWIDTH_12BIT
  - LL_SPI_DATAWIDTH_13BIT
  - LL_SPI_DATAWIDTH_14BIT
  - LL_SPI_DATAWIDTH_15BIT
  - LL_SPI_DATAWIDTH_16BIT

Reference Manual to LL API cross reference:

- CR2 DS LL_SPI_GetDataWidth

LL_SPI_SetRxFIFOThreshold

Function name

__STATIC_INLINE void LL_SPI_SetRxFIFOThreshold (SPI_TypeDef * SPIx, uint32_t Threshold)

Function description

Set threshold of RXFIFO that triggers an RXNE event.

Parameters

- **SPIx:** SPI Instance
- **Threshold:** This parameter can be one of the following values:
  - LL_SPI_RX_FIFO_TH_HALF
  - LL_SPI_RX_FIFO_TH_QUARTER

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR2 FRXTH LL_SPI_SetRxFIFOThreshold

LL_SPI_GetRxFIFOThreshold

Function name

__STATIC_INLINE uint32_t LL_SPI_GetRxFIFOThreshold (SPI_TypeDef * SPIx)

Function description

Get threshold of RXFIFO that triggers an RXNE event.

Parameters

- **SPIx:** SPI Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_SPI_RX_FIFO_TH_HALF
  - LL_SPI_RX_FIFO_TH_QUARTER

Reference Manual to LL API cross reference:

- CR2 FRXTH LL_SPI_GetRxFIFOThreshold

LL_SPI_EnableCRC

Function name

__STATIC_INLINE void LL_SPI_EnableCRC (SPI_TypeDef * SPIx)

Function description

Enable CRC.

Parameters

- **SPIx:** SPI Instance

Return values

- **None:**

Notes

- This bit should be written only when SPI is disabled (SPE = 0) for correct operation.

Reference Manual to LL API cross reference:

- CR1 CRCEN LL_SPI_EnableCRC

LL_SPI_DisableCRC

Function name

__STATIC_INLINE void LL_SPI_DisableCRC (SPI_TypeDef * SPIx)

Function description

Disable CRC.

Parameters

- **SPIx:** SPI Instance

Return values

- **None:**

Notes

- This bit should be written only when SPI is disabled (SPE = 0) for correct operation.

Reference Manual to LL API cross reference:

- CR1 CRCEN LL_SPI_DisableCRC

LL_SPI_IsEnabledCRC

Function name

__STATIC_INLINE uint32_t LL_SPI_IsEnabledCRC (SPI_TypeDef * SPIx)

Function description

Check if CRC is enabled.

Parameters

- **SPIx:** SPI Instance

Return values

- **State:** of bit (1 or 0).

Notes

- This bit should be written only when SPI is disabled (SPE = 0) for correct operation.

Reference Manual to LL API cross reference:

- CR1 CRCEN LL_SPI_IsEnabledCRC

LL_SPI_SetCRCWidth

Function name

__STATIC_INLINE void LL_SPI_SetCRCWidth (SPI_TypeDef * SPIx, uint32_t CRCLength)

Function description

Set CRC Length.

Parameters

- **SPIx:** SPI Instance
- **CRCLength:** This parameter can be one of the following values:
  - LL_SPI_CRC_8BIT
  - LL_SPI_CRC_16BIT

Return values

- **None:**

Notes

- This bit should be written only when SPI is disabled (SPE = 0) for correct operation.

Reference Manual to LL API cross reference:

- CR1 CRCL LL_SPI_SetCRCWidth

LL_SPI_GetCRCWidth

Function name

__STATIC_INLINE uint32_t LL_SPI_GetCRCWidth (SPI_TypeDef * SPIx)

Function description

Get CRC Length.

Parameters

- **SPIx:** SPI Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_SPI_CRC_8BIT
  - LL_SPI_CRC_16BIT

Reference Manual to LL API cross reference:

- CR1 CRCL LL_SPI_GetCRCWidth

LL_SPI_SetCRCNext

Function name

__STATIC_INLINE void LL_SPI_SetCRCNext (SPI_TypeDef * SPIx)

Function description

Set CRCNext to transfer CRC on the line.

Parameters

- **SPIx:** SPI Instance

Return values

- **None:**

Notes

- This bit has to be written as soon as the last data is written in the SPIx_DR register.

Reference Manual to LL API cross reference:

- CR1 CRCNEXT LL_SPI_SetCRCNext

LL_SPI_SetCRCPolynomial

Function name

__STATIC_INLINE void LL_SPI_SetCRCPolynomial (SPI_TypeDef * SPIx, uint32_t CRCPoly)

Function description

Set polynomial for CRC calculation.

Parameters

- **SPIx:** SPI Instance
- **CRCPoly:** This parameter must be a number between Min_Data = 0x00 and Max_Data = 0xFFFF

Return values

- **None:**

Reference Manual to LL API cross reference:

- CRCPR CRCPOLY LL_SPI_SetCRCPolynomial

LL_SPI_GetCRCPolynomial

Function name

__STATIC_INLINE uint32_t LL_SPI_GetCRCPolynomial (SPI_TypeDef * SPIx)

Function description

Get polynomial for CRC calculation.

Parameters

- **SPIx:** SPI Instance

Return values

- **Returned:** value is a number between Min_Data = 0x00 and Max_Data = 0xFFFF

Reference Manual to LL API cross reference:

- CRCPR CRCPOLY LL_SPI_GetCRCPolynomial

LL_SPI_GetRxCRC

Function name

__STATIC_INLINE uint32_t LL_SPI_GetRxCRC (SPI_TypeDef * SPIx)

Function description

Get Rx CRC.

Parameters

- **SPIx:** SPI Instance

Return values

- **Returned:** value is a number between Min_Data = 0x00 and Max_Data = 0xFFFF

Reference Manual to LL API cross reference:

- RXCRCR RXCRC LL_SPI_GetRxCRC

LL_SPI_GetTxCRC

Function name

__STATIC_INLINE uint32_t LL_SPI_GetTxCRC (SPI_TypeDef * SPIx)

Function description

Get Tx CRC.

Parameters

- **SPIx:** SPI Instance

Return values

- **Returned:** value is a number between Min_Data = 0x00 and Max_Data = 0xFFFF

Reference Manual to LL API cross reference:

- TXCRCR TXCRC LL_SPI_GetTxCRC

LL_SPI_SetNSSMode

Function name

__STATIC_INLINE void LL_SPI_SetNSSMode (SPI_TypeDef * SPIx, uint32_t NSS)

Function description

Set NSS mode.

Parameters

- **SPIx:** SPI Instance
- **NSS:** This parameter can be one of the following values:
  - LL_SPI_NSS_SOFT
  - LL_SPI_NSS_HARD_INPUT
  - LL_SPI_NSS_HARD_OUTPUT

Return values

- **None:**

Notes

- LL_SPI_NSS_SOFT Mode is not used in SPI TI mode.

Reference Manual to LL API cross reference:

- CR1 SSM LL_SPI_SetNSSMode
-
- CR2 SSOE LL_SPI_SetNSSMode

LL_SPI_GetNSSMode

Function name

__STATIC_INLINE uint32_t LL_SPI_GetNSSMode (SPI_TypeDef * SPIx)

Function description

Get NSS mode.

Parameters

- **SPIx:** SPI Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_SPI_NSS_SOFT
  - LL_SPI_NSS_HARD_INPUT
  - LL_SPI_NSS_HARD_OUTPUT

Reference Manual to LL API cross reference:

- CR1 SSM LL_SPI_GetNSSMode
-
- CR2 SSOE LL_SPI_GetNSSMode

LL_SPI_EnableNSSPulseMgt

Function name

__STATIC_INLINE void LL_SPI_EnableNSSPulseMgt (SPI_TypeDef * SPIx)

Function description

Enable NSS pulse management.

Parameters

- **SPIx:** SPI Instance

Return values

- **None:**

Notes

- This bit should not be changed when communication is ongoing. This bit is not used in SPI TI mode.

Reference Manual to LL API cross reference:

- CR2 NSSP LL_SPI_EnableNSSPulseMgt

LL_SPI_DisableNSSPulseMgt

Function name

__STATIC_INLINE void LL_SPI_DisableNSSPulseMgt (SPI_TypeDef * SPIx)

Function description

Disable NSS pulse management.

Parameters

- **SPIx:** SPI Instance

Return values

- **None:**

Notes

- This bit should not be changed when communication is ongoing. This bit is not used in SPI TI mode.

Reference Manual to LL API cross reference:

- CR2 NSSP LL_SPI_DisableNSSPulseMgt

LL_SPI_IsEnabledNSSPulse

Function name

__STATIC_INLINE uint32_t LL_SPI_IsEnabledNSSPulse (SPI_TypeDef * SPIx)

Function description

Check if NSS pulse is enabled.

Parameters

- **SPIx:** SPI Instance

Return values

- **State:** of bit (1 or 0).

Notes

- This bit should not be changed when communication is ongoing. This bit is not used in SPI TI mode.

Reference Manual to LL API cross reference:

- CR2 NSSP LL_SPI_IsEnabledNSSPulse

LL_SPI_IsActiveFlag_RXNE

Function name

__STATIC_INLINE uint32_t LL_SPI_IsActiveFlag_RXNE (SPI_TypeDef * SPIx)

Function description

Check if Rx buffer is not empty.

Parameters

- **SPIx:** SPI Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR RXNE LL_SPI_IsActiveFlag_RXNE

LL_SPI_IsActiveFlag_TXE

Function name

__STATIC_INLINE uint32_t LL_SPI_IsActiveFlag_TXE (SPI_TypeDef * SPIx)

Function description

Check if Tx buffer is empty.

Parameters

- **SPIx:** SPI Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR TXE LL_SPI_IsActiveFlag_TXE

LL_SPI_IsActiveFlag_CRCERR

Function name

__STATIC_INLINE uint32_t LL_SPI_IsActiveFlag_CRCERR (SPI_TypeDef * SPIx)

Function description

Get CRC error flag.

Parameters

- **SPIx:** SPI Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR CRCERR LL_SPI_IsActiveFlag_CRCERR

LL_SPI_IsActiveFlag_MODF

Function name

__STATIC_INLINE uint32_t LL_SPI_IsActiveFlag_MODF (SPI_TypeDef * SPIx)

Function description

Get mode fault error flag.

Parameters

- **SPIx:** SPI Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR MODF LL_SPI_IsActiveFlag_MODF

LL_SPI_IsActiveFlag_OVR

Function name

__STATIC_INLINE uint32_t LL_SPI_IsActiveFlag_OVR (SPI_TypeDef * SPIx)

Function description

Get overrun error flag.

Parameters

- **SPIx:** SPI Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR OVR LL_SPI_IsActiveFlag_OVR

LL_SPI_IsActiveFlag_BSY

Function name

__STATIC_INLINE uint32_t LL_SPI_IsActiveFlag_BSY (SPI_TypeDef * SPIx)

Function description

Get busy flag.

Parameters

- **SPIx:** SPI Instance

Return values

- **State:** of bit (1 or 0).

Notes

- The BSY flag is cleared under any one of the following conditions: -When the SPI is correctly disabled -When a fault is detected in Master mode (MODF bit set to 1) -In Master mode, when it finishes a data transmission and no new data is ready to be sent -In Slave mode, when the BSY flag is set to '0' for at least one SPI clock cycle between each data transfer.

Reference Manual to LL API cross reference:

- SR BSY LL_SPI_IsActiveFlag_BSY

LL_SPI_IsActiveFlag_FRE

Function name

__STATIC_INLINE uint32_t LL_SPI_IsActiveFlag_FRE (SPI_TypeDef * SPIx)

Function description

Get frame format error flag.

Parameters

- **SPIx:** SPI Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR FRE LL_SPI_IsActiveFlag_FRE

LL_SPI_GetRxFIFOLevel

Function name

__STATIC_INLINE uint32_t LL_SPI_GetRxFIFOLevel (SPI_TypeDef * SPIx)

Function description

Get FIFO reception Level.

Parameters

- **SPIx:** SPI Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_SPI_RX_FIFO_EMPTY
  - LL_SPI_RX_FIFO_QUARTER_FULL
  - LL_SPI_RX_FIFO_HALF_FULL
  - LL_SPI_RX_FIFO_FULL

Reference Manual to LL API cross reference:

- SR FRLVL LL_SPI_GetRxFIFOLevel

LL_SPI_GetTxFIFOLevel

Function name

__STATIC_INLINE uint32_t LL_SPI_GetTxFIFOLevel (SPI_TypeDef * SPIx)

Function description

Get FIFO Transmission Level.

Parameters

- **SPIx:** SPI Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_SPI_TX_FIFO_EMPTY
  - LL_SPI_TX_FIFO_QUARTER_FULL
  - LL_SPI_TX_FIFO_HALF_FULL
  - LL_SPI_TX_FIFO_FULL

Reference Manual to LL API cross reference:

- SR FTLVL LL_SPI_GetTxFIFOLevel

LL_SPI_ClearFlag_CRCERR

Function name

__STATIC_INLINE void LL_SPI_ClearFlag_CRCERR (SPI_TypeDef * SPIx)

Function description

Clear CRC error flag.

Parameters

- **SPIx:** SPI Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- SR CRCERR LL_SPI_ClearFlag_CRCERR

LL_SPI_ClearFlag_MODF

Function name

__STATIC_INLINE void LL_SPI_ClearFlag_MODF (SPI_TypeDef * SPIx)

Function description

Clear mode fault error flag.

Parameters

- **SPIx:** SPI Instance

Return values

- **None:**

Notes

- Clearing this flag is done by a read access to the SPIx_SR register followed by a write access to the SPIx_CR1 register

Reference Manual to LL API cross reference:

- SR MODF LL_SPI_ClearFlag_MODF

LL_SPI_ClearFlag_OVR

Function name

__STATIC_INLINE void LL_SPI_ClearFlag_OVR (SPI_TypeDef * SPIx)

Function description

Clear overrun error flag.

Parameters

- **SPIx:** SPI Instance

Return values

- **None:**

Notes

- Clearing this flag is done by a read access to the SPIx_DR register followed by a read access to the SPIx_SR register

Reference Manual to LL API cross reference:

- SR OVR LL_SPI_ClearFlag_OVR

LL_SPI_ClearFlag_FRE

Function name

__STATIC_INLINE void LL_SPI_ClearFlag_FRE (SPI_TypeDef * SPIx)

Function description

Clear frame format error flag.

Parameters

- **SPIx:** SPI Instance

Return values

- **None:**

Notes

- Clearing this flag is done by reading SPIx_SR register

Reference Manual to LL API cross reference:

- SR FRE LL_SPI_ClearFlag_FRE

LL_SPI_EnableIT_ERR

Function name

__STATIC_INLINE void LL_SPI_EnableIT_ERR (SPI_TypeDef * SPIx)

Function description

Enable error interrupt.

Parameters

- **SPIx:** SPI Instance

Return values

- **None:**

Notes

- This bit controls the generation of an interrupt when an error condition occurs (CRCERR, OVR, MODF in SPI mode, FRE at TI mode).

Reference Manual to LL API cross reference:

- CR2 ERRIE LL_SPI_EnableIT_ERR

LL_SPI_EnableIT_RXNE

Function name

__STATIC_INLINE void LL_SPI_EnableIT_RXNE (SPI_TypeDef * SPIx)

Function description

Enable Rx buffer not empty interrupt.

Parameters

- **SPIx:** SPI Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR2 RXNEIE LL_SPI_EnableIT_RXNE

LL_SPI_EnableIT_TXE

Function name

__STATIC_INLINE void LL_SPI_EnableIT_TXE (SPI_TypeDef * SPIx)

Function description

Enable Tx buffer empty interrupt.

Parameters

- **SPIx:** SPI Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR2 TXEIE LL_SPI_EnableIT_TXE

LL_SPI_DisableIT_ERR

Function name

__STATIC_INLINE void LL_SPI_DisableIT_ERR (SPI_TypeDef * SPIx)

Function description

Disable error interrupt.

Parameters

- **SPIx:** SPI Instance

Return values

- **None:**

Notes

- This bit controls the generation of an interrupt when an error condition occurs (CRCERR, OVR, MODF in SPI mode, FRE at TI mode).

Reference Manual to LL API cross reference:

- CR2 ERRIE LL_SPI_DisableIT_ERR

LL_SPI_DisableIT_RXNE

Function name

__STATIC_INLINE void LL_SPI_DisableIT_RXNE (SPI_TypeDef * SPIx)

Function description

Disable Rx buffer not empty interrupt.

Parameters

- **SPIx:** SPI Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR2 RXNEIE LL_SPI_DisableIT_RXNE

LL_SPI_DisableIT_TXE

Function name

__STATIC_INLINE void LL_SPI_DisableIT_TXE (SPI_TypeDef * SPIx)

Function description

Disable Tx buffer empty interrupt.

Parameters

- **SPIx:** SPI Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR2 TXEIE LL_SPI_DisableIT_TXE

LL_SPI_IsEnabledIT_ERR

Function name

__STATIC_INLINE uint32_t LL_SPI_IsEnabledIT_ERR (SPI_TypeDef * SPIx)

Function description

Check if error interrupt is enabled.

Parameters

- **SPIx:** SPI Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR2 ERRIE LL_SPI_IsEnabledIT_ERR

LL_SPI_IsEnabledIT_RXNE

Function name

__STATIC_INLINE uint32_t LL_SPI_IsEnabledIT_RXNE (SPI_TypeDef * SPIx)

Function description

Check if Rx buffer not empty interrupt is enabled.

Parameters

- **SPIx:** SPI Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR2 RXNEIE LL_SPI_IsEnabledIT_RXNE

LL_SPI_IsEnabledIT_TXE

Function name

__STATIC_INLINE uint32_t LL_SPI_IsEnabledIT_TXE (SPI_TypeDef * SPIx)

Function description

Check if Tx buffer empty interrupt.

Parameters

- **SPIx:** SPI Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR2 TXEIE LL_SPI_IsEnabledIT_TXE

LL_SPI_EnableDMAReq_RX

Function name

__STATIC_INLINE void LL_SPI_EnableDMAReq_RX (SPI_TypeDef * SPIx)

Function description

Enable DMA Rx.

Parameters

- **SPIx:** SPI Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR2 RXDMAEN LL_SPI_EnableDMAReq_RX

LL_SPI_DisableDMAReq_RX

Function name

__STATIC_INLINE void LL_SPI_DisableDMAReq_RX (SPI_TypeDef * SPIx)

Function description

Disable DMA Rx.

Parameters

- **SPIx:** SPI Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR2 RXDMAEN LL_SPI_DisableDMAReq_RX

LL_SPI_IsEnabledDMAReq_RX

Function name

__STATIC_INLINE uint32_t LL_SPI_IsEnabledDMAReq_RX (SPI_TypeDef * SPIx)

Function description

Check if DMA Rx is enabled.

Parameters

- **SPIx:** SPI Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR2 RXDMAEN LL_SPI_IsEnabledDMAReq_RX

LL_SPI_EnableDMAReq_TX

Function name

__STATIC_INLINE void LL_SPI_EnableDMAReq_TX (SPI_TypeDef * SPIx)

Function description

Enable DMA Tx.

Parameters

- **SPIx:** SPI Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR2 TXDMAEN LL_SPI_EnableDMAReq_TX

LL_SPI_DisableDMAReq_TX

Function name

__STATIC_INLINE void LL_SPI_DisableDMAReq_TX (SPI_TypeDef * SPIx)

Function description

Disable DMA Tx.

Parameters

- **SPIx:** SPI Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR2 TXDMAEN LL_SPI_DisableDMAReq_TX

LL_SPI_IsEnabledDMAReq_TX

Function name

__STATIC_INLINE uint32_t LL_SPI_IsEnabledDMAReq_TX (SPI_TypeDef * SPIx)

Function description

Check if DMA Tx is enabled.

Parameters

- **SPIx:** SPI Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR2 TXDMAEN LL_SPI_IsEnabledDMAReq_TX

LL_SPI_SetDMAParity_RX

Function name

__STATIC_INLINE void LL_SPI_SetDMAParity_RX (SPI_TypeDef * SPIx, uint32_t Parity)

Function description

Set parity of Last DMA reception.

Parameters

- **SPIx:** SPI Instance
- **Parity:** This parameter can be one of the following values:
  - LL_SPI_DMA_PARITY_ODD
  - LL_SPI_DMA_PARITY_EVEN

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR2 LDMARX LL_SPI_SetDMAParity_RX

LL_SPI_GetDMAParity_RX

Function name

__STATIC_INLINE uint32_t LL_SPI_GetDMAParity_RX (SPI_TypeDef * SPIx)

Function description

Get parity configuration for Last DMA reception.

Parameters

- **SPIx:** SPI Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_SPI_DMA_PARITY_ODD
  - LL_SPI_DMA_PARITY_EVEN

Reference Manual to LL API cross reference:

- CR2 LDMARX LL_SPI_GetDMAParity_RX

LL_SPI_SetDMAParity_TX

Function name

__STATIC_INLINE void LL_SPI_SetDMAParity_TX (SPI_TypeDef * SPIx, uint32_t Parity)

Function description

Set parity of Last DMA transmission.

Parameters

- **SPIx:** SPI Instance
- **Parity:** This parameter can be one of the following values:
  - LL_SPI_DMA_PARITY_ODD
  - LL_SPI_DMA_PARITY_EVEN

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR2 LDMATX LL_SPI_SetDMAParity_TX

LL_SPI_GetDMAParity_TX

Function name

__STATIC_INLINE uint32_t LL_SPI_GetDMAParity_TX (SPI_TypeDef * SPIx)

Function description

Get parity configuration for Last DMA transmission.

Parameters

- **SPIx:** SPI Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_SPI_DMA_PARITY_ODD
  - LL_SPI_DMA_PARITY_EVEN

Reference Manual to LL API cross reference:

- CR2 LDMATX LL_SPI_GetDMAParity_TX

LL_SPI_DMA_GetRegAddr

Function name

__STATIC_INLINE uint32_t LL_SPI_DMA_GetRegAddr (SPI_TypeDef * SPIx)

Function description

Get the data register address used for DMA transfer.

Parameters

- **SPIx:** SPI Instance

Return values

- **Address:** of data register

Reference Manual to LL API cross reference:

- DR DR LL_SPI_DMA_GetRegAddr

LL_SPI_ReceiveData8

Function name

__STATIC_INLINE uint8_t LL_SPI_ReceiveData8 (SPI_TypeDef * SPIx)

Function description

Read 8-Bits in the data register.

Parameters

- **SPIx:** SPI Instance

Return values

- **RxData:** Value between Min_Data=0x00 and Max_Data=0xFF

Reference Manual to LL API cross reference:

- DR DR LL_SPI_ReceiveData8

LL_SPI_ReceiveData16

Function name

__STATIC_INLINE uint16_t LL_SPI_ReceiveData16 (SPI_TypeDef * SPIx)

Function description

Read 16-Bits in the data register.

Parameters

- **SPIx:** SPI Instance

Return values

- **RxData:** Value between Min_Data=0x00 and Max_Data=0xFFFF

Reference Manual to LL API cross reference:

- DR DR LL_SPI_ReceiveData16

LL_SPI_TransmitData8

Function name

__STATIC_INLINE void LL_SPI_TransmitData8 (SPI_TypeDef * SPIx, uint8_t TxData)

Function description

Write 8-Bits in the data register.

Parameters

- **SPIx:** SPI Instance
- **TxData:** Value between Min_Data=0x00 and Max_Data=0xFF

Return values

- **None:**

Reference Manual to LL API cross reference:

- DR DR LL_SPI_TransmitData8

LL_SPI_TransmitData16

Function name

__STATIC_INLINE void LL_SPI_TransmitData16 (SPI_TypeDef * SPIx, uint16_t TxData)

Function description

Write 16-Bits in the data register.

Parameters

- **SPIx:** SPI Instance
- **TxData:** Value between Min_Data=0x00 and Max_Data=0xFFFF

Return values

- **None:**

Reference Manual to LL API cross reference:

- DR DR LL_SPI_TransmitData16

LL_SPI_DeInit

Function name

ErrorStatus LL_SPI_DeInit (SPI_TypeDef * SPIx)

Function description

De-initialize the SPI registers to their default reset values.

Parameters

- **SPIx:** SPI Instance

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: SPI registers are de-initialized
  - ERROR: SPI registers are not de-initialized

LL_SPI_Init

Function name

ErrorStatus LL_SPI_Init (SPI_TypeDef * SPIx, LL_SPI_InitTypeDef * SPI_InitStruct)

Function description

Initialize the SPI registers according to the specified parameters in SPI_InitStruct.

Parameters

- **SPIx:** SPI Instance
- **SPI_InitStruct:** pointer to a LL_SPI_InitTypeDef structure

Return values

- **An:** ErrorStatus enumeration value. (Return always SUCCESS)

Notes

- As some bits in SPI configuration registers can only be written when the SPI is disabled (SPI_CR1_SPE bit =0), SPI peripheral should be in disabled state prior calling this function. Otherwise, ERROR result will be returned.

LL_SPI_StructInit

Function name

void LL_SPI_StructInit (LL_SPI_InitTypeDef * SPI_InitStruct)

Function description

Set each LL_SPI_InitTypeDef field to default value.

Parameters

- **SPI_InitStruct:** pointer to a LL_SPI_InitTypeDef structure whose fields will be set to default values.

Return values

- **None:**

75.3 SPI Firmware driver defines

The following section lists the various define and macros of the module.

75.3.1 SPI

SPI

Baud Rate Prescaler

LL_SPI_BAUDRATEPRESCALER_DIV2

BaudRate control equal to fPCLK/2

LL_SPI_BAUDRATEPRESCALER_DIV4

BaudRate control equal to fPCLK/4

LL_SPI_BAUDRATEPRESCALER_DIV8

BaudRate control equal to fPCLK/8

LL_SPI_BAUDRATEPRESCALER_DIV16

BaudRate control equal to fPCLK/16

LL_SPI_BAUDRATEPRESCALER_DIV32

BaudRate control equal to fPCLK/32

LL_SPI_BAUDRATEPRESCALER_DIV64

BaudRate control equal to fPCLK/64

LL_SPI_BAUDRATEPRESCALER_DIV128

BaudRate control equal to fPCLK/128

LL_SPI_BAUDRATEPRESCALER_DIV256

BaudRate control equal to fPCLK/256

Transmission Bit Order

LL_SPI_LSB_FIRST

Data is transmitted/received with the LSB first

LL_SPI_MSB_FIRST

Data is transmitted/received with the MSB first

CRC Calculation

LL_SPI_CRCCALCULATION_DISABLE

CRC calculation disabled

LL_SPI_CRCCALCULATION_ENABLE

CRC calculation enabled

CRC Length

LL_SPI_CRC_8BIT

8-bit CRC length

LL_SPI_CRC_16BIT

16-bit CRC length

Datawidth

LL_SPI_DATAWIDTH_4BIT

Data length for SPI transfer: 4 bits

LL_SPI_DATAWIDTH_5BIT

Data length for SPI transfer: 5 bits

LL_SPI_DATAWIDTH_6BIT

Data length for SPI transfer: 6 bits

LL_SPI_DATAWIDTH_7BIT

Data length for SPI transfer: 7 bits

LL_SPI_DATAWIDTH_8BIT

Data length for SPI transfer: 8 bits

LL_SPI_DATAWIDTH_9BIT

Data length for SPI transfer: 9 bits

LL_SPI_DATAWIDTH_10BIT

Data length for SPI transfer: 10 bits

LL_SPI_DATAWIDTH_11BIT

Data length for SPI transfer: 11 bits

LL_SPI_DATAWIDTH_12BIT

Data length for SPI transfer: 12 bits

LL_SPI_DATAWIDTH_13BIT

Data length for SPI transfer: 13 bits

LL_SPI_DATAWIDTH_14BIT

Data length for SPI transfer: 14 bits

LL_SPI_DATAWIDTH_15BIT

Data length for SPI transfer: 15 bits

LL_SPI_DATAWIDTH_16BIT

Data length for SPI transfer: 16 bits

DMA Parity

LL_SPI_DMA_PARITY_EVEN

Select DMA parity Even

LL_SPI_DMA_PARITY_ODD

Select DMA parity Odd

Get Flags Defines

LL_SPI_SR_RXNE

Rx buffer not empty flag

LL_SPI_SR_TXE

Tx buffer empty flag

LL_SPI_SR_BSY

Busy flag

LL_SPI_SR_CRCERR

CRC error flag

LL_SPI_SR_MODF

Mode fault flag

LL_SPI_SR_OVR

Overrun flag

LL_SPI_SR_FRE

TI mode frame format error flag

IT Defines

LL_SPI_CR2_RXNEIE

Rx buffer not empty interrupt enable

LL_SPI_CR2_TXEIE

Tx buffer empty interrupt enable

LL_SPI_CR2_ERRIE

Error interrupt enable

Operation Mode

LL_SPI_MODE_MASTER

Master configuration

LL_SPI_MODE_SLAVE

Slave configuration

Slave Select Pin Mode

LL_SPI_NSS_SOFT

NSS managed internally. NSS pin not used and free

LL_SPI_NSS_HARD_INPUT

NSS pin used in Input. Only used in Master mode

LL_SPI_NSS_HARD_OUTPUT

NSS pin used in Output. Only used in Slave mode as chip select

Clock Phase

LL_SPI_PHASE_1EDGE

First clock transition is the first data capture edge

LL_SPI_PHASE_2EDGE

Second clock transition is the first data capture edge

Clock Polarity

LL_SPI_POLARITY_LOW

Clock to 0 when idle

LL_SPI_POLARITY_HIGH

Clock to 1 when idle

Serial Protocol

LL_SPI_PROTOCOL_MOTOROLA

Motorola mode. Used as default value

LL_SPI_PROTOCOL_TI

TI mode

RX FIFO Level

LL_SPI_RX_FIFO_EMPTY

FIFO reception empty

LL_SPI_RX_FIFO_QUARTER_FULL

FIFO reception 1/4

LL_SPI_RX_FIFO_HALF_FULL

FIFO reception 1/2

LL_SPI_RX_FIFO_FULL

FIFO reception full

RX FIFO Threshold

LL_SPI_RX_FIFO_TH_HALF

RXNE event is generated if FIFO level is greater than or equal to 1/2 (16-bit)

LL_SPI_RX_FIFO_TH_QUARTER

RXNE event is generated if FIFO level is greater than or equal to 1/4 (8-bit)

Transfer Mode

LL_SPI_FULL_DUPLEX

Full-Duplex mode. Rx and Tx transfer on 2 lines

LL_SPI_SIMPLEX_RX

Simplex Rx mode. Rx transfer only on 1 line

LL_SPI_HALF_DUPLEX_RX

Half-Duplex Rx mode. Rx transfer on 1 line

LL_SPI_HALF_DUPLEX_TX

Half-Duplex Tx mode. Tx transfer on 1 line

TX FIFO Level

LL_SPI_TX_FIFO_EMPTY

FIFO transmission empty

LL_SPI_TX_FIFO_QUARTER_FULL

FIFO transmission 1/4

LL_SPI_TX_FIFO_HALF_FULL

FIFO transmission 1/2

LL_SPI_TX_FIFO_FULL

FIFO transmission full

Common Write and read registers Macros

LL_SPI_WriteReg

Description:

- Write a value in SPI register.

Parameters:

- __INSTANCE__: SPI Instance
- __REG__: Register to be written
- __VALUE__: Value to be written in the register

Return value:

- None

LL_SPI_ReadReg

Description:

- Read a value in SPI register.

Parameters:

- __INSTANCE__: SPI Instance
- __REG__: Register to be read

Return value:

- Register: value

76 LL SYSTEM Generic Driver

76.1 SYSTEM Firmware driver API description

The following section lists the various functions of the SYSTEM library.

76.1.1 Detailed description of functions

LL_SYSCFG_SetRemapMemory

Function name

__STATIC_INLINE void LL_SYSCFG_SetRemapMemory (uint32_t Memory)

Function description

Set memory mapping at address 0x00000000.

Parameters

- **Memory:** This parameter can be one of the following values:
  - LL_SYSCFG_REMAP_FLASH
  - LL_SYSCFG_REMAP_SYSTEMFLASH
  - LL_SYSCFG_REMAP_SRAM

Return values

- **None:**

Reference Manual to LL API cross reference:

- SYSCFG_CFGR1 MEM_MODE LL_SYSCFG_SetRemapMemory

LL_SYSCFG_GetRemapMemory

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_GetRemapMemory (void)

Function description

Get memory mapping at address 0x00000000.

Return values

- **Returned:** value can be one of the following values:
  - LL_SYSCFG_REMAP_FLASH
  - LL_SYSCFG_REMAP_SYSTEMFLASH
  - LL_SYSCFG_REMAP_SRAM

Reference Manual to LL API cross reference:

- SYSCFG_CFGR1 MEM_MODE LL_SYSCFG_GetRemapMemory

LL_SYSCFG_EnablePinRemap

Function name

__STATIC_INLINE void LL_SYSCFG_EnablePinRemap (uint32_t PinRemap)

Function description

Enable remap of a pin on different pad.

Parameters

- **PinRemap:** This parameter can be a combination of the following values:
  - LL_SYSCFG_PIN_RMP_PA11
  - LL_SYSCFG_PIN_RMP_PA12

Return values

- **None:**

Reference Manual to LL API cross reference:

- SYSCFG_CFGR1 PA11_RMP LL_SYSCFG_EnablePinRemap
- SYSCFG_CFGR1 PA12_RMP LL_SYSCFG_EnablePinRemap
-

LL_SYSCFG_DisablePinRemap

Function name

__STATIC_INLINE void LL_SYSCFG_DisablePinRemap (uint32_t PinRemap)

Function description

Enable remap of a pin on different pad.

Parameters

- **PinRemap:** This parameter can be a combination of the following values:
  - LL_SYSCFG_PIN_RMP_PA11
  - LL_SYSCFG_PIN_RMP_PA12

Return values

- **None:**

Reference Manual to LL API cross reference:

- SYSCFG_CFGR1 PA11_RMP LL_SYSCFG_DisablePinRemap
- SYSCFG_CFGR1 PA12_RMP LL_SYSCFG_DisablePinRemap
-

LL_SYSCFG_SetIRModEnvelopeSignal

Function name

__STATIC_INLINE void LL_SYSCFG_SetIRModEnvelopeSignal (uint32_t Source)

Function description

Set IR Modulation Envelope signal source.

Parameters

- **Source:** This parameter can be one of the following values:
  - LL_SYSCFG_IR_MOD_TIM16
  - LL_SYSCFG_IR_MOD_USART1
  - LL_SYSCFG_IR_MOD_USART2

Return values

- **None:**

Reference Manual to LL API cross reference:

- SYSCFG_CFGR1 IR_MOD LL_SYSCFG_SetIRModEnvelopeSignal

LL_SYSCFG_GetIRModEnvelopeSignal

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_GetIRModEnvelopeSignal (void)

Function description

Get IR Modulation Envelope signal source.

Return values

- **Returned:** value can be one of the following values:
  - LL_SYSCFG_IR_MOD_TIM16
  - LL_SYSCFG_IR_MOD_USART1
  - LL_SYSCFG_IR_MOD_USART2

Reference Manual to LL API cross reference:

- SYSCFG_CFGR1 IR_MOD LL_SYSCFG_GetIRModEnvelopeSignal

LL_SYSCFG_SetIRPolarity

Function name

__STATIC_INLINE void LL_SYSCFG_SetIRPolarity (uint32_t Polarity)

Function description

Set IR Output polarity.

Parameters

- **Polarity:** This parameter can be one of the following values:
  - LL_SYSCFG_IR_POL_INVERTED
  - LL_SYSCFG_IR_POL_NOT_INVERTED

Return values

- **None:**

Reference Manual to LL API cross reference:

- SYSCFG_CFGR1 IR_POL LL_SYSCFG_SetIRPolarity

LL_SYSCFG_GetIRPolarity

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_GetIRPolarity (void)

Function description

Get IR Output polarity.

Return values

- **Returned:** value can be one of the following values:
  - LL_SYSCFG_IR_POL_INVERTED
  - LL_SYSCFG_IR_POL_NOT_INVERTED

Reference Manual to LL API cross reference:

- SYSCFG_CFGR1 IR_POL LL_SYSCFG_GetIRPolarity

LL_SYSCFG_EnableAnalogBooster

Function name

__STATIC_INLINE void LL_SYSCFG_EnableAnalogBooster (void)

Function description

Enable I/O analog switch voltage booster.

Return values

- **None:**

Notes

- When voltage booster is enabled, I/O analog switches are supplied by a dedicated voltage booster, from VDD power domain. This is the recommended configuration with low VDDA voltage operation.
- The I/O analog switch voltage booster is relevant for peripherals using I/O in analog input: ADC, COMP. However, COMP and OPAMP inputs have a high impedance and voltage booster do not impact performance significantly. Therefore, the voltage booster is mainly intended for usage with ADC.

Reference Manual to LL API cross reference:

- SYSCFG_CFGR1 BOOSTEN LL_SYSCFG_EnableAnalogBooster

LL_SYSCFG_DisableAnalogBooster

Function name

__STATIC_INLINE void LL_SYSCFG_DisableAnalogBooster (void)

Function description

Disable I/O analog switch voltage booster.

Return values

- **None:**

Notes

- When voltage booster is enabled, I/O analog switches are supplied by a dedicated voltage booster, from VDD power domain. This is the recommended configuration with low VDDA voltage operation.
- The I/O analog switch voltage booster is relevant for peripherals using I/O in analog input: ADC, COMP. However, COMP and OPAMP inputs have a high impedance and voltage booster do not impact performance significantly. Therefore, the voltage booster is mainly intended for usage with ADC.

Reference Manual to LL API cross reference:

- SYSCFG_CFGR1 BOOSTEN LL_SYSCFG_DisableAnalogBooster

LL_SYSCFG_EnableFastModePlus

Function name

__STATIC_INLINE void LL_SYSCFG_EnableFastModePlus (uint32_t ConfigFastModePlus)

Function description

Enable the I2C fast mode plus driving capability.

Parameters

- **ConfigFastModePlus:** This parameter can be a combination of the following values:
  - LL_SYSCFG_I2C_FASTMODEPLUS_PB6
  - LL_SYSCFG_I2C_FASTMODEPLUS_PB7
  - LL_SYSCFG_I2C_FASTMODEPLUS_PB8
  - LL_SYSCFG_I2C_FASTMODEPLUS_PB9
  - LL_SYSCFG_I2C_FASTMODEPLUS_PA9
  - LL_SYSCFG_I2C_FASTMODEPLUS_PA10
  - LL_SYSCFG_I2C_FASTMODEPLUS_I2C3

Return values

- **None:**

Reference Manual to LL API cross reference:

- SYSCFG_CFGR1 I2C_FMP_PB6 LL_SYSCFG_EnableFastModePlus
- SYSCFG_CFGR1 I2C_FMP_PB7 LL_SYSCFG_EnableFastModePlus
- SYSCFG_CFGR1 I2C_FMP_PB8 LL_SYSCFG_EnableFastModePlus
- SYSCFG_CFGR1 I2C_FMP_PB9 LL_SYSCFG_EnableFastModePlus
- SYSCFG_CFGR1 I2C_FMP_PA9 LL_SYSCFG_EnableFastModePlus
- SYSCFG_CFGR1 I2C_FMP_PA10 LL_SYSCFG_EnableFastModePlus
- SYSCFG_CFGR1 I2C_FMP_I2C3 LL_SYSCFG_EnableFastModePlus
-

LL_SYSCFG_DisableFastModePlus

Function name

__STATIC_INLINE void LL_SYSCFG_DisableFastModePlus (uint32_t ConfigFastModePlus)

Function description

Disable the I2C fast mode plus driving capability.

Parameters

- **ConfigFastModePlus:** This parameter can be a combination of the following values:
  - LL_SYSCFG_I2C_FASTMODEPLUS_PB6
  - LL_SYSCFG_I2C_FASTMODEPLUS_PB7
  - LL_SYSCFG_I2C_FASTMODEPLUS_PB8
  - LL_SYSCFG_I2C_FASTMODEPLUS_PB9
  - LL_SYSCFG_I2C_FASTMODEPLUS_PA9
  - LL_SYSCFG_I2C_FASTMODEPLUS_PA10
  - LL_SYSCFG_I2C_FASTMODEPLUS_I2C3

Return values

- **None:**

Reference Manual to LL API cross reference:

- SYSCFG_CFGR1 I2C_FMP_PB6 LL_SYSCFG_DisableFastModePlus
- SYSCFG_CFGR1 I2C_FMP_PB7 LL_SYSCFG_DisableFastModePlus
- SYSCFG_CFGR1 I2C_FMP_PB8 LL_SYSCFG_DisableFastModePlus
- SYSCFG_CFGR1 I2C_FMP_PB9 LL_SYSCFG_DisableFastModePlus
- SYSCFG_CFGR1 I2C_FMP_PA9 LL_SYSCFG_DisableFastModePlus
- SYSCFG_CFGR1 I2C_FMP_PA10 LL_SYSCFG_DisableFastModePlus
- SYSCFG_CFGR1 I2C_FMP_I2C3 LL_SYSCFG_DisableFastModePlus
-

LL_SYSCFG_IsActiveFlag_WWDG

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_WWDG (void)

Function description

Check if Window watchdog interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE0 SR_EWDG LL_SYSCFG_IsActiveFlag_WWDG

LL_SYSCFG_IsActiveFlag_PVDOUT

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_PVDOUT (void)

Function description

Check if PVD supply monitoring interrupt occurred or not (EXTI line 16).

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE1 SR_PVDOUT LL_SYSCFG_IsActiveFlag_PVDOUT

LL_SYSCFG_IsActiveFlag_PVMOUT1

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_PVMOUT1 (void)

Function description

Check if PVM supply monitoring interrupt occurred or not (EXTI line 19).

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE1 SR_PVMOUT1 LL_SYSCFG_IsActiveFlag_PVMOUT1

LL_SYSCFG_IsActiveFlag_PVMOUT3

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_PVMOUT3 (void)

Function description

Check if PVM supply monitoring interrupt occurred or not (EXTI line 20).

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE1 SR_PVMOUT3 LL_SYSCFG_IsActiveFlag_PVMOUT3

LL_SYSCFG_IsActiveFlag_PVMOUT4

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_PVMOUT4 (void)

Function description

Check if PVM supply monitoring interrupt occurred or not (EXTI line 21).

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE1 SR_PVMOUT4 LL_SYSCFG_IsActiveFlag_PVMOUT4

LL_SYSCFG_IsActiveFlag_RTC_WAKEUP

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_RTC_WAKEUP (void)

Function description

Check if RTC Wake Up interrupt occurred or not (EXTI line 19).

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE2 SR_RTC_WAKEUP LL_SYSCFG_IsActiveFlag_RTC_WAKEUP

LL_SYSCFG_IsActiveFlag_TAMPER

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_TAMPER (void)

Function description

Check if RTC Tamper and TimeStamp interrupt occurred or not (EXTI line 21).

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE2 SR_TAMPER LL_SYSCFG_IsActiveFlag_TAMPER

LL_SYSCFG_IsActiveFlag_FLASH_ITF

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_FLASH_ITF (void)

Function description

Check if Flash interface interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE3 SR_FLASH_ITF LL_SYSCFG_IsActiveFlag_FLASH_ITF

LL_SYSCFG_IsActiveFlag_FLASH_ECC

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_FLASH_ECC (void)

Function description

Check if Flash interface interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE3 SR_FLASH_ECC LL_SYSCFG_IsActiveFlag_FLASH_ECC

LL_SYSCFG_IsActiveFlag_CLK_CTRL

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_CLK_CTRL (void)

Function description

Check if Reset and clock control interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE4 SR_CLK_CTRL LL_SYSCFG_IsActiveFlag_CLK_CTRL

LL_SYSCFG_IsActiveFlag_CRS

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_CRS (void)

Function description

Check if Reset and clock control interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE4 SR_CRS LL_SYSCFG_IsActiveFlag_CRS

LL_SYSCFG_IsActiveFlag_EXTI0

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_EXTI0 (void)

Function description

Check if EXTI line 0 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE5 SR_EXTI0 LL_SYSCFG_IsActiveFlag_EXTI0

LL_SYSCFG_IsActiveFlag_EXTI1

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_EXTI1 (void)

Function description

Check if EXTI line 1 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE5 SR_EXTI1 LL_SYSCFG_IsActiveFlag_EXTI1

LL_SYSCFG_IsActiveFlag_EXTI2

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_EXTI2 (void)

Function description

Check if EXTI line 2 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE6 SR_EXTI2 LL_SYSCFG_IsActiveFlag_EXTI2

LL_SYSCFG_IsActiveFlag_EXTI3

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_EXTI3 (void)

Function description

Check if EXTI line 3 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE6 SR_EXTI3 LL_SYSCFG_IsActiveFlag_EXTI3

LL_SYSCFG_IsActiveFlag_EXTI4

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_EXTI4 (void)

Function description

Check if EXTI line 4 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE7 SR_EXTI4 LL_SYSCFG_IsActiveFlag_EXTI4

LL_SYSCFG_IsActiveFlag_EXTI5

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_EXTI5 (void)

Function description

Check if EXTI line 5 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE7 SR_EXTI5 LL_SYSCFG_IsActiveFlag_EXTI5

LL_SYSCFG_IsActiveFlag_EXTI6

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_EXTI6 (void)

Function description

Check if EXTI line 6 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE7 SR_EXTI6 LL_SYSCFG_IsActiveFlag_EXTI6

LL_SYSCFG_IsActiveFlag_EXTI7

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_EXTI7 (void)

Function description

Check if EXTI line 7 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE7 SR_EXTI7 LL_SYSCFG_IsActiveFlag_EXTI7

LL_SYSCFG_IsActiveFlag_EXTI8

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_EXTI8 (void)

Function description

Check if EXTI line 8 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE7 SR_EXTI8 LL_SYSCFG_IsActiveFlag_EXTI8

LL_SYSCFG_IsActiveFlag_EXTI9

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_EXTI9 (void)

Function description

Check if EXTI line 9 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE7 SR_EXTI9 LL_SYSCFG_IsActiveFlag_EXTI9

LL_SYSCFG_IsActiveFlag_EXTI10

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_EXTI10 (void)

Function description

Check if EXTI line 10 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE7 SR_EXTI10 LL_SYSCFG_IsActiveFlag_EXTI10

LL_SYSCFG_IsActiveFlag_EXTI11

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_EXTI11 (void)

Function description

Check if EXTI line 11 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE7 SR_EXTI11 LL_SYSCFG_IsActiveFlag_EXTI11

LL_SYSCFG_IsActiveFlag_EXTI12

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_EXTI12 (void)

Function description

Check if EXTI line 12 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE7 SR_EXTI12 LL_SYSCFG_IsActiveFlag_EXTI12

LL_SYSCFG_IsActiveFlag_EXTI13

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_EXTI13 (void)

Function description

Check if EXTI line 13 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE7 SR_EXTI13 LL_SYSCFG_IsActiveFlag_EXTI13

LL_SYSCFG_IsActiveFlag_EXTI14

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_EXTI14 (void)

Function description

Check if EXTI line 14 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE7 SR_EXTI14 LL_SYSCFG_IsActiveFlag_EXTI14

LL_SYSCFG_IsActiveFlag_EXTI15

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_EXTI15 (void)

Function description

Check if EXTI line 15 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE7 SR_EXTI15 LL_SYSCFG_IsActiveFlag_EXTI15

LL_SYSCFG_IsActiveFlag_USB

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_USB (void)

Function description

Check if EXTI USB interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE8 SR_USB LL_SYSCFG_IsActiveFlag_USB

LL_SYSCFG_IsActiveFlag_DMA1_CH1

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_DMA1_CH1 (void)

Function description

Check if DMA1 channel 1 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE9 SR_DMA1_CH1 LL_SYSCFG_IsActiveFlag_DMA1_CH1

LL_SYSCFG_IsActiveFlag_DMA1_CH2

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_DMA1_CH2 (void)

Function description

Check if DMA1 channel 2 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE10 SR_DMA1_CH2 LL_SYSCFG_IsActiveFlag_DMA1_CH2

LL_SYSCFG_IsActiveFlag_DMA1_CH3

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_DMA1_CH3 (void)

Function description

Check if DMA1 channel 3 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE10 SR_DMA1_CH3 LL_SYSCFG_IsActiveFlag_DMA1_CH3

LL_SYSCFG_IsActiveFlag_DMA1_CH4

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_DMA1_CH4 (void)

Function description

Check if DMA1 channel 4 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE11 SR_DMA1_CH4 LL_SYSCFG_IsActiveFlag_DMA1_CH4

LL_SYSCFG_IsActiveFlag_DMA1_CH5

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_DMA1_CH5 (void)

Function description

Check if DMA1 channel 5 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE11 SR_DMA1_CH5 LL_SYSCFG_IsActiveFlag_DMA1_CH5

LL_SYSCFG_IsActiveFlag_DMA1_CH6

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_DMA1_CH6 (void)

Function description

Check if DMA1 channel 6 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE11 SR_DMA1_CH6 LL_SYSCFG_IsActiveFlag_DMA1_CH6

LL_SYSCFG_IsActiveFlag_DMA1_CH7

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_DMA1_CH7 (void)

Function description

Check if DMA1 channel 7 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE11 SR_DMA1_CH7 LL_SYSCFG_IsActiveFlag_DMA1_CH7

LL_SYSCFG_IsActiveFlag_DMAMUX

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_DMAMUX (void)

Function description

Check if DMAMUX interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE11 SR_DMAMUX1 LL_SYSCFG_IsActiveFlag_DMAMUX

LL_SYSCFG_IsActiveFlag_DMA2_CH1

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_DMA2_CH1 (void)

Function description

Check if DMA2 channel 1 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE11 SR_DMA2_CH1 LL_SYSCFG_IsActiveFlag_DMA2_CH1

LL_SYSCFG_IsActiveFlag_DMA2_CH2

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_DMA2_CH2 (void)

Function description

Check if DMA2 channel 2 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE11 SR_DMA2_CH2 LL_SYSCFG_IsActiveFlag_DMA2_CH2

LL_SYSCFG_IsActiveFlag_DMA2_CH3

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_DMA2_CH3 (void)

Function description

Check if DMA2 channel 3 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE11 SR_DMA2_CH3 LL_SYSCFG_IsActiveFlag_DMA2_CH3

LL_SYSCFG_IsActiveFlag_DMA2_CH4

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_DMA2_CH4 (void)

Function description

Check if DMA2 channel 4 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE11 SR_DMA2_CH4 LL_SYSCFG_IsActiveFlag_DMA2_CH4

LL_SYSCFG_IsActiveFlag_DMA2_CH5

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_DMA2_CH5 (void)

Function description

Check if DMA2 channel 5 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE11 SR_DMA2_CH5 LL_SYSCFG_IsActiveFlag_DMA2_CH5

LL_SYSCFG_IsActiveFlag_ADC

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_ADC (void)

Function description

Check if ADC interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE12 SR_ADC LL_SYSCFG_IsActiveFlag_ADC

LL_SYSCFG_IsActiveFlag_COMP1

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_COMP1 (void)

Function description

Check if Comparator 1 interrupt occurred or not (EXTI line 17).

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE12 SR_COMP1 LL_SYSCFG_IsActiveFlag_COMP1

LL_SYSCFG_IsActiveFlag_COMP2

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_COMP2 (void)

Function description

Check if Comparator 2 interrupt occurred or not (EXTI line 18).

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE12 SR_COMP2 LL_SYSCFG_IsActiveFlag_COMP2

LL_SYSCFG_IsActiveFlag_TIM1_BRK

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_TIM1_BRK (void)

Function description

Check if Timer 1 break interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE13 SR_TIM1_BRK LL_SYSCFG_IsActiveFlag_TIM1_BRK

LL_SYSCFG_IsActiveFlag_TIM1_UPD

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_TIM1_UPD (void)

Function description

Check if Timer 1 update interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE13 SR_TIM1_UPD LL_SYSCFG_IsActiveFlag_TIM1_UPD

LL_SYSCFG_IsActiveFlag_TIM1_TRG

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_TIM1_TRG (void)

Function description

Check if Timer 1 trigger interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE13 SR_TIM1_TRG LL_SYSCFG_IsActiveFlag_TIM1_TRG

LL_SYSCFG_IsActiveFlag_TIM1_CCU

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_TIM1_CCU (void)

Function description

Check if Timer 1 commutation interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE13 SR_TIM1_CCU LL_SYSCFG_IsActiveFlag_TIM1_CCU

LL_SYSCFG_IsActiveFlag_TIM1_CC1

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_TIM1_CC1 (void)

Function description

Check if Timer 1 capture compare interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE14 SR_TIM1_CC LL_SYSCFG_IsActiveFlag_TIM1_CC

LL_SYSCFG_IsActiveFlag_TIM1_CC2

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_TIM1_CC2 (void)

Function description

Check if Timer 1 capture compare interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE14 SR_TIM1_CC2 LL_SYSCFG_IsActiveFlag_TIM1_CC2

LL_SYSCFG_IsActiveFlag_TIM1_CC3

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_TIM1_CC3 (void)

Function description

Check if Timer 1 capture compare interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE14 SR_TIM1_CC3 LL_SYSCFG_IsActiveFlag_TIM1_CC3

LL_SYSCFG_IsActiveFlag_TIM1_CC4

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_TIM1_CC4 (void)

Function description

Check if Timer 1 capture compare interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE14 SR_TIM1_CC4 LL_SYSCFG_IsActiveFlag_TIM1_CC4

LL_SYSCFG_IsActiveFlag_TIM2

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_TIM2 (void)

Function description

Check if Timer 2 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE15 SR_TIM2_GLB LL_SYSCFG_IsActiveFlag_TIM2

LL_SYSCFG_IsActiveFlag_TIM3

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_TIM3 (void)

Function description

Check if Timer 3 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE16 SR_TIM3_GLB LL_SYSCFG_IsActiveFlag_TIM3

LL_SYSCFG_IsActiveFlag_DAC

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_DAC (void)

Function description

Check if DAC underrun interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE17 SR_DAC LL_SYSCFG_IsActiveFlag_DAC

LL_SYSCFG_IsActiveFlag_TIM6

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_TIM6 (void)

Function description

Check if Timer 6 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE17 SR_TIM6_GLB LL_SYSCFG_IsActiveFlag_TIM6

LL_SYSCFG_IsActiveFlag_LPTIM1

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_LPTIM1 (void)

Function description

Check if LPTIM1 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE17 SR_LPTIM1_GLB LL_SYSCFG_IsActiveFlag_LPTIM1

LL_SYSCFG_IsActiveFlag_TIM7

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_TIM7 (void)

Function description

Check if Timer 7 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE18 SR_TIM7_GLB LL_SYSCFG_IsActiveFlag_TIM7

LL_SYSCFG_IsActiveFlag_LPTIM2

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_LPTIM2 (void)

Function description

Check if LPTIM2 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE18 SR_LPTIM2_GLB LL_SYSCFG_IsActiveFlag_LPTIM2

LL_SYSCFG_IsActiveFlag_TIM15

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_TIM15 (void)

Function description

Check if Timer 15 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE19 SR_TIM15_GLB LL_SYSCFG_IsActiveFlag_TIM15

LL_SYSCFG_IsActiveFlag_LPTIM3

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_LPTIM3 (void)

Function description

Check if LPTIM3 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE19 SR_LPTIM3_GLB LL_SYSCFG_IsActiveFlag_LPTIM3

LL_SYSCFG_IsActiveFlag_TIM16

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_TIM16 (void)

Function description

Check if Timer 16 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE20 SR_TIM15_GLB LL_SYSCFG_IsActiveFlag_TIM16

LL_SYSCFG_IsActiveFlag_TSC_MCE

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_TSC_MCE (void)

Function description

Check if TSC interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE21 SR_TSC_MCE LL_SYSCFG_IsActiveFlag_TSC_MCE

LL_SYSCFG_IsActiveFlag_TSC_EOA

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_TSC_EOA (void)

Function description

Check if TSC interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE21 SR_TSC_EOA LL_SYSCFG_IsActiveFlag_TSC_EOA

LL_SYSCFG_IsActiveFlag_LCD

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_LCD (void)

Function description

Check if TSC interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE22 SR_LCD LL_SYSCFG_IsActiveFlag_LCD

LL_SYSCFG_IsActiveFlag_I2C1

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_I2C1 (void)

Function description

Check if I2C1 interrupt occurred or not, combined with EXTI line 33.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE23 SR_I2C1_GLB LL_SYSCFG_IsActiveFlag_I2C1

LL_SYSCFG_IsActiveFlag_I2C2

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_I2C2 (void)

Function description

Check if I2C2 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE24 SR_I2C2_GLB LL_SYSCFG_IsActiveFlag_I2C2

LL_SYSCFG_IsActiveFlag_I2C3

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_I2C3 (void)

Function description

Check if I2C3 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE24 SR_I2C3_GLB LL_SYSCFG_IsActiveFlag_I2C3

LL_SYSCFG_IsActiveFlag_I2C4

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_I2C4 (void)

Function description

Check if I2C4 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE24 SR_I2C4_GLB LL_SYSCFG_IsActiveFlag_I2C4

LL_SYSCFG_IsActiveFlag_SPI1

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_SPI1 (void)

Function description

Check if SPI1 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE25 SR_SPI1 LL_SYSCFG_IsActiveFlag_SPI1

LL_SYSCFG_IsActiveFlag_SPI2

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_SPI2 (void)

Function description

Check if SPI2 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE26 SR_SPI2 LL_SYSCFG_IsActiveFlag_SPI2

LL_SYSCFG_IsActiveFlag_SPI3

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_SPI3 (void)

Function description

Check if SPI2 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE26 SR_SPI3 LL_SYSCFG_IsActiveFlag_SPI3

LL_SYSCFG_IsActiveFlag_USART1

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_USART1 (void)

Function description

Check if USART1 interrupt occurred or not, combined with EXTI line 25.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE27 SR_USART1_GLB LL_SYSCFG_IsActiveFlag_USART1

LL_SYSCFG_IsActiveFlag_USART2

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_USART2 (void)

Function description

Check if USART2 interrupt occurred or not, combined with EXTI line 35.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE28 SR_USART2 LL_SYSCFG_IsActiveFlag_USART2

LL_SYSCFG_IsActiveFlag_LPUART2

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_LPUART2 (void)

Function description

Check if LPUART2 interrupt occurred or not, combined with EXTI line 31.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE28 SR_LPUART2 LL_SYSCFG_IsActiveFlag_LPUART2

LL_SYSCFG_IsActiveFlag_USART3

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_USART3 (void)

Function description

Check if USART3 interrupt occurred or not, combined with EXTI line 29.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE29 SR_USART3_GLB LL_SYSCFG_IsActiveFlag_USART3

LL_SYSCFG_IsActiveFlag_LPUART1

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_LPUART1 (void)

Function description

Check if LPUART1 interrupt occurred or not, combined with EXTI line 30.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE29 SR_LPUART1_GLB LL_SYSCFG_IsActiveFlag_LPUART1

LL_SYSCFG_IsActiveFlag_USART4

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_USART4 (void)

Function description

Check if USART4 interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE29 SR_USART4 LL_SYSCFG_IsActiveFlag_USART4

LL_SYSCFG_IsActiveFlag_LPUART3

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_LPUART3 (void)

Function description

Check if LPUART1 interrupt occurred or not, combined with EXTI line 32.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE30 SR_LPUART3_GLB LL_SYSCFG_IsActiveFlag_LPUART3

LL_SYSCFG_IsActiveFlag_AES

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_AES (void)

Function description

Check if AES interrupt occurred or not.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE31 SR_AES LL_SYSCFG_IsActiveFlag_AES

LL_SYSCFG_IsActiveFlag_RNG

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_RNG (void)

Function description

Check if RNG interrupt occurred or not, combined with EXTI line 31.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_ITLINE31 SR_RNG LL_SYSCFG_IsActiveFlag_RNG

LL_SYSCFG_EnableSRAM2Erase

Function name

__STATIC_INLINE void LL_SYSCFG_EnableSRAM2Erase (void)

Function description

Enable SRAM2 Erase (starts a hardware SRAM2 erase operation.

Return values

- **None:**

Notes

- This bit is write-protected: setting this bit is possible only after the correct key sequence is written in the SYSCFG_SKR register as described in the Reference Manual.

Reference Manual to LL API cross reference:

- SYSCFG_SCSR SRAM2ER LL_SYSCFG_EnableSRAM2Erase

LL_SYSCFG_IsSRAM2EraseOngoing

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsSRAM2EraseOngoing (void)

Function description

Check if SRAM2 erase operation is on going.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_SCSR SRAM2BSY LL_SYSCFG_IsSRAM2EraseOngoing

LL_SYSCFG_SetTIMBreakInputs

Function name

__STATIC_INLINE void LL_SYSCFG_SetTIMBreakInputs (uint32_t Break)

Function description

Set connections to TIM1/15/16 Break inputs.

Parameters

- **Break:** This parameter can be a combination of the following values:
  - LL_SYSCFG_TIMBREAK_CCL
  - LL_SYSCFG_TIMBREAK_SPL
  - LL_SYSCFG_TIMBREAK_PVDL
  - LL_SYSCFG_TIMBREAK_ECCL
  - LL_SYSCFG_TIMBREAK_BKPL

Return values

- **None:**

Reference Manual to LL API cross reference:

- SYSCFG_CFGR2 CCL LL_SYSCFG_SetTIMBreakInputs
- SYSCFG_CFGR2 SPL LL_SYSCFG_SetTIMBreakInputs
- SYSCFG_CFGR2 PVDL LL_SYSCFG_SetTIMBreakInputs
- SYSCFG_CFGR2 ECCL LL_SYSCFG_SetTIMBreakInputs SYSCFG_CFGR2 BKPL LL_SYSCFG_SetTIMBreakInputs

LL_SYSCFG_GetTIMBreakInputs

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_GetTIMBreakInputs (void)

Function description

Set connections to TIM1/15/16 Break inputs.

Return values

- **None:**

Reference Manual to LL API cross reference:

- SYSCFG_CFGR2 CCL LL_SYSCFG_GetTIMBreakInputs
- SYSCFG_CFGR2 SPL LL_SYSCFG_GetTIMBreakInputs
- SYSCFG_CFGR2 PVDL LL_SYSCFG_GetTIMBreakInputs
- SYSCFG_CFGR2 ECCL LL_SYSCFG_GetTIMBreakInputs SYSCFG_CFGR2 BKPL LL_SYSCFG_GetTIMBreakInputs

LL_SYSCFG_IsActiveFlag_BKP

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_BKP (void)

Function description

Check if SRAM2 parity error detected.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_CFGR2 BKPF LL_SYSCFG_IsActiveFlag_BKP

LL_SYSCFG_ClearFlag_BKP

Function name

__STATIC_INLINE void LL_SYSCFG_ClearFlag_BKP (void)

Function description

Clear SRAM2 parity error flag.

Return values

- **None:**

Reference Manual to LL API cross reference:

- SYSCFG_CFGR2 BKPF LL_SYSCFG_ClearFlag_BKP

LL_SYSCFG_IsActiveFlag_SP

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_IsActiveFlag_SP (void)

Function description

Check if SRAM1 parity error detected.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SYSCFG_CFGR2 SPF LL_SYSCFG_IsActiveFlag_SP

LL_SYSCFG_ClearFlag_SP

Function name

__STATIC_INLINE void LL_SYSCFG_ClearFlag_SP (void)

Function description

Clear SRAM1 parity error flag.

Return values

- **None:**

Reference Manual to LL API cross reference:

- SYSCFG_CFGR2 SPF LL_SYSCFG_ClearFlag_SP

LL_SYSCFG_LockSRAM2WRP

Function name

__STATIC_INLINE void LL_SYSCFG_LockSRAM2WRP (void)

Function description

SRAM2 page write protection lock prior to erase.

Return values

- **None:**

Reference Manual to LL API cross reference:

- SYSCFG_SKR KEY LL_SYSCFG_LockSRAM2WRP

LL_SYSCFG_EnableTSCCmpMod_G2IO1

Function name

__STATIC_INLINE void LL_SYSCFG_EnableTSCCmpMod_G2IO1 (void)

Function description

Enable connection of PB4 to COMP2.

Return values

- **None:**

Reference Manual to LL API cross reference:

- SYSCFG_TSCCR G2_IO1 LL_SYSCFG_EnableTSCCmpMod_G2IO1

LL_SYSCFG_DisableTSCCmpMod_G2IO1

Function name

__STATIC_INLINE void LL_SYSCFG_DisableTSCCmpMod_G2IO1 (void)

Function description

Disable connection of PB4 to COMP2.

Return values

- **None:**

Reference Manual to LL API cross reference:

- SYSCFG_TSCCR G2_IO1 LL_SYSCFG_DisableTSCCmpMod_G2IO1

LL_SYSCFG_EnableTSCCmpMod_G2IO3

Function name

__STATIC_INLINE void LL_SYSCFG_EnableTSCCmpMod_G2IO3 (void)

Function description

Enable connection of PB6 to COMP2.

Return values

- **None:**

Reference Manual to LL API cross reference:

- SYSCFG_TSCCR G2_IO3 LL_SYSCFG_EnableTSCCmpMod_G2IO3

LL_SYSCFG_DisableTSCCmpMod_G2IO3

Function name

__STATIC_INLINE void LL_SYSCFG_DisableTSCCmpMod_G2IO3 (void)

Function description

Disable connection of PB6 to COMP2.

Return values

- **None:**

Reference Manual to LL API cross reference:

- SYSCFG_TSCCR G2_IO3 LL_SYSCFG_DisableTSCCmpMod_G2IO3

LL_SYSCFG_EnableTSCCmpMod_G4IO1

Function name

__STATIC_INLINE void LL_SYSCFG_EnableTSCCmpMod_G4IO1 (void)

Function description

Enable connection of PC6 to COMP1.

Return values

- **None:**

Reference Manual to LL API cross reference:

- SYSCFG_TSCCR G4_IO1 LL_SYSCFG_EnableTSCCmpMod_G4IO1

LL_SYSCFG_DisableTSCCmpMod_G4IO1

Function name

__STATIC_INLINE void LL_SYSCFG_DisableTSCCmpMod_G4IO1 (void)

Function description

Disable connection of PC6 to COMP1.

Return values

- **None:**

Reference Manual to LL API cross reference:

- SYSCFG_TSCCR G4_IO1 LL_SYSCFG_DisableTSCCmpMod_G4IO1

LL_SYSCFG_EnableTSCCmpMod_G6IO1

Function name

__STATIC_INLINE void LL_SYSCFG_EnableTSCCmpMod_G6IO1 (void)

Function description

Enable connection of PD10 to COMP2.

Return values

- **None:**

Reference Manual to LL API cross reference:

- SYSCFG_TSCCR G6_IO1 LL_SYSCFG_EnableTSCCmpMod_G6IO1

LL_SYSCFG_DisableTSCCmpMod_G6IO1

Function name

__STATIC_INLINE void LL_SYSCFG_DisableTSCCmpMod_G6IO1 (void)

Function description

Disable connection of PD10 to COMP2.

Return values

- **None:**

Reference Manual to LL API cross reference:

- SYSCFG_TSCCR G6_IO1 LL_SYSCFG_DisableTSCCmpMod_G6IO1

LL_SYSCFG_EnableTSCCmpMod_G7IO2

Function name

__STATIC_INLINE void LL_SYSCFG_EnableTSCCmpMod_G7IO2 (void)

Function description

Enable connection of PA9 to COMP1.

Return values

- **None:**

Reference Manual to LL API cross reference:

- SYSCFG_TSCCR G7_IO2 LL_SYSCFG_EnableTSCCmpMod_G7IO2

LL_SYSCFG_DisableTSCCmpMod_G7IO2

Function name

__STATIC_INLINE void LL_SYSCFG_DisableTSCCmpMod_G7IO2 (void)

Function description

Disable connection of PA9 to COMP1.

Return values

- **None:**

Reference Manual to LL API cross reference:

- SYSCFG_TSCCR G7_IO2 LL_SYSCFG_DisableTSCCmpMod_G7IO2

LL_SYSCFG_SetTSCIOControl

Function name

__STATIC_INLINE void LL_SYSCFG_SetTSCIOControl (uint32_t TSCIOControl)

Function description

I/O control in comparator mode.

Return values

- **None:**

Reference Manual to LL API cross reference:

- SYSCFG_TSCCR TSC_IOCTRL LL_SYSCFG_SetTSCIOControl
  - TSCIOControl This parameter can be a combination of the following values:
  - LL_SYSCFG_TSCIOCONTROL_REG
  - LL_SYSCFG_TSCIOCONTROL_ANALOG

LL_SYSCFG_GetTSCIOControl

Function name

__STATIC_INLINE uint32_t LL_SYSCFG_GetTSCIOControl (void)

Function description

I/O control in comparator mode.

Return values

- **Returned:** value can be one of the following values:
  - LL_SYSCFG_TSCIOCONTROL_REG
  - LL_SYSCFG_TSCIOCONTROL_ANALOG

Reference Manual to LL API cross reference:

- SYSCFG_TSCCR TSC_IOCTRL LL_SYSCFG_GetTSCIOControl

LL_SYSCFG_UnlockSRAM2WRP

Function name

__STATIC_INLINE void LL_SYSCFG_UnlockSRAM2WRP (void)

Function description

SRAM2 page write protection unlock prior to erase.

Return values

- **None:**

Reference Manual to LL API cross reference:

- SYSCFG_SKR KEY LL_SYSCFG_UnlockSRAM2WRP

LL_DBGMCU_GetDeviceID

Function name

__STATIC_INLINE uint32_t LL_DBGMCU_GetDeviceID (void)

Function description

Return the device identifier.

Return values

- **Values:** between Min_Data=0x00 and Max_Data=0xFFF

Notes

- For STM32U083xx devices, the device ID is 0x460

Reference Manual to LL API cross reference:

- DBG_IDCODE DEV_ID LL_DBGMCU_GetDeviceID

LL_DBGMCU_GetRevisionID

Function name

__STATIC_INLINE uint32_t LL_DBGMCU_GetRevisionID (void)

Function description

Return the device revision identifier.

Return values

- **Values:** between Min_Data=0x00 and Max_Data=0xFFFF

Notes

- This field indicates the revision of the device.

Reference Manual to LL API cross reference:

- DBG_IDCODE REV_ID LL_DBGMCU_GetRevisionID

LL_DBGMCU_EnableDBGStopMode

Function name

__STATIC_INLINE void LL_DBGMCU_EnableDBGStopMode (void)

Function description

Enable the Debug Module during STOP mode.

Return values

- **None:**

Reference Manual to LL API cross reference:

- DBG_CR DBG_STOP LL_DBGMCU_EnableDBGStopMode

LL_DBGMCU_DisableDBGStopMode

Function name

__STATIC_INLINE void LL_DBGMCU_DisableDBGStopMode (void)

Function description

Disable the Debug Module during STOP mode.

Return values

- **None:**

Reference Manual to LL API cross reference:

- DBG_CR DBG_STOP LL_DBGMCU_DisableDBGStopMode

LL_DBGMCU_EnableDBGStandbyMode

Function name

__STATIC_INLINE void LL_DBGMCU_EnableDBGStandbyMode (void)

Function description

Enable the Debug Module during STANDBY mode.

Return values

- **None:**

Reference Manual to LL API cross reference:

- DBG_CR DBG_STANDBY LL_DBGMCU_EnableDBGStandbyMode

LL_DBGMCU_DisableDBGStandbyMode

Function name

__STATIC_INLINE void LL_DBGMCU_DisableDBGStandbyMode (void)

Function description

Disable the Debug Module during STANDBY mode.

Return values

- **None:**

Reference Manual to LL API cross reference:

- DBG_CR DBG_STANDBY LL_DBGMCU_DisableDBGStandbyMode

LL_DBGMCU_APB1_GRP1_FreezePeriph

Function name

__STATIC_INLINE void LL_DBGMCU_APB1_GRP1_FreezePeriph (uint32_t Periphs)

Function description

Freeze APB1 peripherals (group1 peripherals)

Parameters

- **Periphs:** This parameter can be a combination of the following values:
  - LL_DBGMCU_APB1_GRP1_TIM2_STOP
  - LL_DBGMCU_APB1_GRP1_TIM3_STOP
  - LL_DBGMCU_APB1_GRP1_TIM4_STOP
  - LL_DBGMCU_APB1_GRP1_TIM6_STOP
  - LL_DBGMCU_APB1_GRP1_TIM7_STOP
  - LL_DBGMCU_APB1_GRP1_RTC_STOP
  - LL_DBGMCU_APB1_GRP1_WWDG_STOP
  - LL_DBGMCU_APB1_GRP1_IWDG_STOP
  - LL_DBGMCU_APB1_GRP1_I2C3_STOP
  - LL_DBGMCU_APB1_GRP1_I2C1_STOP
  - LL_DBGMCU_APB1_GRP1_LPTIM2_STOP
  - LL_DBGMCU_APB1_GRP1_LPTIM1_STOP

Return values

- **None:**

Reference Manual to LL API cross reference:

- DBG_APBFZ1 DBG_TIM2_STOP LL_DBGMCU_APB1_GRP1_FreezePeriph
- DBG_APBFZ1 DBG_TIM3_STOP LL_DBGMCU_APB1_GRP1_FreezePeriph
- DBG_APBFZ1 DBG_TIM4_STOP LL_DBGMCU_APB1_GRP1_FreezePeriph
- DBG_APBFZ1 DBG_TIM6_STOP LL_DBGMCU_APB1_GRP1_FreezePeriph
- DBG_APBFZ1 DBG_TIM7_STOP LL_DBGMCU_APB1_GRP1_FreezePeriph
- DBG_APBFZ1 DBG_RTC_STOP LL_DBGMCU_APB1_GRP1_FreezePeriph
- DBG_APBFZ1 DBG_WWDG_STOP LL_DBGMCU_APB1_GRP1_FreezePeriph
- DBG_APBFZ1 DBG_IWDG_STOP LL_DBGMCU_APB1_GRP1_FreezePeriph
- DBG_APBFZ1 DBG_I2C3_STOP LL_DBGMCU_APB1_GRP1_FreezePeriph
- DBG_APBFZ1 DBG_I2C1_STOP LL_DBGMCU_APB1_GRP1_FreezePeriph
- DBG_APBFZ1 DBG_LPTIM2_STOP LL_DBGMCU_APB1_GRP1_FreezePeriph
- DBG_APBFZ1 DBG_LPTIM1_STOP LL_DBGMCU_APB1_GRP1_FreezePeriph
-

LL_DBGMCU_APB1_GRP1_UnFreezePeriph

Function name

__STATIC_INLINE void LL_DBGMCU_APB1_GRP1_UnFreezePeriph (uint32_t Periphs)

Function description

Unfreeze APB1 peripherals (group1 peripherals)

Parameters

- **Periphs:** This parameter can be a combination of the following values:
  - LL_DBGMCU_APB1_GRP1_TIM2_STOP
  - LL_DBGMCU_APB1_GRP1_TIM3_STOP
  - LL_DBGMCU_APB1_GRP1_TIM4_STOP
  - LL_DBGMCU_APB1_GRP1_TIM6_STOP
  - LL_DBGMCU_APB1_GRP1_TIM7_STOP
  - LL_DBGMCU_APB1_GRP1_RTC_STOP
  - LL_DBGMCU_APB1_GRP1_WWDG_STOP
  - LL_DBGMCU_APB1_GRP1_IWDG_STOP
  - LL_DBGMCU_APB1_GRP1_I2C3_STOP
  - LL_DBGMCU_APB1_GRP1_I2C1_STOP
  - LL_DBGMCU_APB1_GRP1_LPTIM2_STOP
  - LL_DBGMCU_APB1_GRP1_LPTIM1_STOP

Return values

- **None:**

Reference Manual to LL API cross reference:

- DBG_APBFZ1 DBG_TIM2_STOP LL_DBGMCU_APB1_GRP1_UnFreezePeriph
- DBG_APBFZ1 DBG_TIM3_STOP LL_DBGMCU_APB1_GRP1_UnFreezePeriph
- DBG_APBFZ1 DBG_TIM4_STOP LL_DBGMCU_APB1_GRP1_UnFreezePeriph
- DBG_APBFZ1 DBG_TIM6_STOP LL_DBGMCU_APB1_GRP1_UnFreezePeriph
- DBG_APBFZ1 DBG_TIM7_STOP LL_DBGMCU_APB1_GRP1_UnFreezePeriph
- DBG_APBFZ1 DBG_RTC_STOP LL_DBGMCU_APB1_GRP1_UnFreezePeriph
- DBG_APBFZ1 DBG_WWDG_STOP LL_DBGMCU_APB1_GRP1_UnFreezePeriph
- DBG_APBFZ1 DBG_IWDG_STOP LL_DBGMCU_APB1_GRP1_UnFreezePeriph
- DBG_APBFZ1 DBG_I2C3_STOP LL_DBGMCU_APB1_GRP1_UnFreezePeriph
- DBG_APBFZ1 DBG_I2C1_STOP LL_DBGMCU_APB1_GRP1_UnFreezePeriph
- DBG_APBFZ1 DBG_LPTIM2_STOP LL_DBGMCU_APB1_GRP1_UnFreezePeriph
- DBG_APBFZ1 DBG_LPTIM1_STOP LL_DBGMCU_APB1_GRP1_UnFreezePeriph
-

LL_DBGMCU_APB1_GRP2_FreezePeriph

Function name

__STATIC_INLINE void LL_DBGMCU_APB1_GRP2_FreezePeriph (uint32_t Periphs)

Function description

Freeze APB2 peripherals.

Parameters

- **Periphs:** This parameter can be a combination of the following values:
  - LL_DBGMCU_APB1_GRP2_TIM1_STOP
  - LL_DBGMCU_APB1_GRP2_TIM14_STOP
  - LL_DBGMCU_APB1_GRP2_TIM15_STOP
  - LL_DBGMCU_APB1_GRP2_TIM16_STOP
  - LL_DBGMCU_APB1_GRP2_LPTIM3_STOP

Return values

- **None:**

Reference Manual to LL API cross reference:

- DBG_APBFZ2 DBG_TIM1_STOP LL_DBGMCU_APB1_GRP2_FreezePeriph
- DBG_APBFZ2 DBG_TIM14_STOP LL_DBGMCU_APB1_GRP2_FreezePeriph
- DBG_APBFZ2 DBG_TIM15_STOP LL_DBGMCU_APB1_GRP2_FreezePeriph
- DBG_APBFZ2 DBG_TIM16_STOP LL_DBGMCU_APB1_GRP2_FreezePeriph
- DBG_APBFZ2 DBG_LPTIM3_STOP LL_DBGMCU_APB1_GRP2_FreezePeriph
-

LL_DBGMCU_APB1_GRP2_UnFreezePeriph

Function name

__STATIC_INLINE void LL_DBGMCU_APB1_GRP2_UnFreezePeriph (uint32_t Periphs)

Function description

Unfreeze APB2 peripherals.

Parameters

- **Periphs:** This parameter can be a combination of the following values:
  - LL_DBGMCU_APB1_GRP2_TIM1_STOP
  - LL_DBGMCU_APB1_GRP2_TIM14_STOP
  - LL_DBGMCU_APB1_GRP2_TIM15_STOP
  - LL_DBGMCU_APB1_GRP2_TIM16_STOP
  - LL_DBGMCU_APB1_GRP2_LPTIM3_STOP

Return values

- **None:**

Reference Manual to LL API cross reference:

- DBG_APBFZ2 DBG_TIM1_STOP LL_DBGMCU_APB1_GRP2_UnFreezePeriph
- DBG_APBFZ2 DBG_TIM14_STOP LL_DBGMCU_APB1_GRP2_UnFreezePeriph
- DBG_APBFZ2 DBG_TIM15_STOP LL_DBGMCU_APB1_GRP2_UnFreezePeriph
- DBG_APBFZ2 DBG_TIM16_STOP LL_DBGMCU_APB1_GRP2_UnFreezePeriph
- DBG_APBFZ2 DBG_LPTIM3_STOP LL_DBGMCU_APB1_GRP2_UnFreezePeriph
-

LL_VREFBUF_Enable

Function name

__STATIC_INLINE void LL_VREFBUF_Enable (void)

Function description

Enable Internal voltage reference.

Return values

- **None:**

Reference Manual to LL API cross reference:

- VREFBUF_CSR VREFBUF_CSR_ENVR LL_VREFBUF_Enable

LL_VREFBUF_Disable

Function name

__STATIC_INLINE void LL_VREFBUF_Disable (void)

Function description

Disable Internal voltage reference.

Return values

- **None:**

Reference Manual to LL API cross reference:

- VREFBUF_CSR VREFBUF_CSR_ENVR LL_VREFBUF_Disable

LL_VREFBUF_EnableHIZ

Function name

__STATIC_INLINE void LL_VREFBUF_EnableHIZ (void)

Function description

Enable high impedance (VREF+pin is high impedance)

Return values

- **None:**

Reference Manual to LL API cross reference:

- VREFBUF_CSR VREFBUF_CSR_HIZ LL_VREFBUF_EnableHIZ

LL_VREFBUF_DisableHIZ

Function name

__STATIC_INLINE void LL_VREFBUF_DisableHIZ (void)

Function description

Disable high impedance (VREF+pin is internally connected to the voltage reference buffer output)

Return values

- **None:**

Reference Manual to LL API cross reference:

- VREFBUF_CSR VREFBUF_CSR_HIZ LL_VREFBUF_DisableHIZ

LL_VREFBUF_SetVoltageScaling

Function name

__STATIC_INLINE void LL_VREFBUF_SetVoltageScaling (uint32_t Scale)

Function description

Set the Voltage reference scale.

Parameters

- **Scale:** This parameter can be one of the following values:
  - LL_VREFBUF_VOLTAGE_SCALE0
  - LL_VREFBUF_VOLTAGE_SCALE1

Return values

- **None:**

Reference Manual to LL API cross reference:

- VREFBUF_CSR VREFBUF_CSR_VRS LL_VREFBUF_SetVoltageScaling

LL_VREFBUF_GetVoltageScaling

Function name

__STATIC_INLINE uint32_t LL_VREFBUF_GetVoltageScaling (void)

Function description

Get the Voltage reference scale.

Return values

- **Returned:** value can be one of the following values:
  - LL_VREFBUF_VOLTAGE_SCALE0
  - LL_VREFBUF_VOLTAGE_SCALE1

Reference Manual to LL API cross reference:

- VREFBUF_CSR VREFBUF_CSR_VRS LL_VREFBUF_GetVoltageScaling

LL_VREFBUF_IsVREFReady

Function name

__STATIC_INLINE uint32_t LL_VREFBUF_IsVREFReady (void)

Function description

Check if Voltage reference buffer is ready.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- VREFBUF_CSR VREFBUF_CSR_VRS LL_VREFBUF_IsVREFReady

LL_VREFBUF_GetTrimming

Function name

__STATIC_INLINE uint32_t LL_VREFBUF_GetTrimming (void)

Function description

Get the trimming code for VREFBUF calibration.

Return values

- **Between:** 0 and 0x3F

Reference Manual to LL API cross reference:

- VREFBUF_CCR VREFBUF_CCR_TRIM LL_VREFBUF_GetTrimming

LL_VREFBUF_SetTrimming

Function name

__STATIC_INLINE void LL_VREFBUF_SetTrimming (uint32_t Value)

Function description

Set the trimming code for VREFBUF calibration (Tune the internal reference buffer voltage)

Parameters

- **Value:** Between 0 and 0x3F

Return values

- **None:**

Reference Manual to LL API cross reference:

- VREFBUF_CCR VREFBUF_CCR_TRIM LL_VREFBUF_SetTrimming

LL_FLASH_SetLatency

Function name

__STATIC_INLINE void LL_FLASH_SetLatency (uint32_t Latency)

Function description

Set FLASH Latency.

Parameters

- **Latency:** This parameter can be one of the following values:
  - LL_FLASH_LATENCY_0
  - LL_FLASH_LATENCY_1
  - LL_FLASH_LATENCY_2

Return values

- **None:**

Reference Manual to LL API cross reference:

- FLASH_ACR FLASH_ACR_LATENCY LL_FLASH_SetLatency

LL_FLASH_GetLatency

Function name

__STATIC_INLINE uint32_t LL_FLASH_GetLatency (void)

Function description

Get FLASH Latency.

Return values

- **Returned:** value can be one of the following values:
  - LL_FLASH_LATENCY_0
  - LL_FLASH_LATENCY_1
  - LL_FLASH_LATENCY_2

Reference Manual to LL API cross reference:

- FLASH_ACR FLASH_ACR_LATENCY LL_FLASH_GetLatency

LL_FLASH_Unlock

Function name

__STATIC_INLINE void LL_FLASH_Unlock (void)

Function description

Unlock the Flash.

Return values

- **None:**

Reference Manual to LL API cross reference:

- FLASH_KEYR FLASH_KEYR_KEY LL_FLASH_Unlock

LL_FLASH_EnablePrefetch

Function name

__STATIC_INLINE void LL_FLASH_EnablePrefetch (void)

Function description

Enable Prefetch.

Return values

- **None:**

Reference Manual to LL API cross reference:

- FLASH_ACR FLASH_ACR_PRFTEN LL_FLASH_EnablePrefetch

LL_FLASH_DisablePrefetch

Function name

__STATIC_INLINE void LL_FLASH_DisablePrefetch (void)

Function description

Disable Prefetch.

Return values

- **None:**

Reference Manual to LL API cross reference:

- FLASH_ACR FLASH_ACR_PRFTEN LL_FLASH_DisablePrefetch

LL_FLASH_IsPrefetchEnabled

Function name

__STATIC_INLINE uint32_t LL_FLASH_IsPrefetchEnabled (void)

Function description

Check if Prefetch buffer is enabled.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- FLASH_ACR FLASH_ACR_PRFTEN LL_FLASH_IsPrefetchEnabled

LL_FLASH_EnableInstCache

Function name

__STATIC_INLINE void LL_FLASH_EnableInstCache (void)

Function description

Enable Instruction cache.

Return values

- **None:**

Reference Manual to LL API cross reference:

- FLASH_ACR FLASH_ACR_ICEN LL_FLASH_EnableInstCache

LL_FLASH_DisableInstCache

Function name

__STATIC_INLINE void LL_FLASH_DisableInstCache (void)

Function description

Disable Instruction cache.

Return values

- **None:**

Reference Manual to LL API cross reference:

- FLASH_ACR FLASH_ACR_ICEN LL_FLASH_DisableInstCache

LL_FLASH_EnableInstCacheReset

Function name

__STATIC_INLINE void LL_FLASH_EnableInstCacheReset (void)

Function description

Enable Instruction cache reset.

Return values

- **None:**

Notes

- bit can be written only when the instruction cache is disabled

Reference Manual to LL API cross reference:

- FLASH_ACR FLASH_ACR_ICRST LL_FLASH_EnableInstCacheReset

LL_FLASH_DisableInstCacheReset

Function name

__STATIC_INLINE void LL_FLASH_DisableInstCacheReset (void)

Function description

Disable Instruction cache reset.

Return values

- **None:**

Reference Manual to LL API cross reference:

- FLASH_ACR FLASH_ACR_ICRST LL_FLASH_DisableInstCacheReset

LL_FLASH_SetEmptyFlag

Function name

__STATIC_INLINE void LL_FLASH_SetEmptyFlag (void)

Function description

Set EMPTY flag information as Flash User area empty.

Return values

- **None:**

Reference Manual to LL API cross reference:

- FLASH_ACR FLASH_ACR_EMPTY LL_FLASH_SetEmptyFlag

LL_FLASH_ClearEmptyFlag

Function name

__STATIC_INLINE void LL_FLASH_ClearEmptyFlag (void)

Function description

Clear EMPTY flag information as Flash User area programmed.

Return values

- **None:**

Reference Manual to LL API cross reference:

- FLASH_ACR FLASH_ACR_EMPTY LL_FLASH_ClearEmptyFlag

LL_FLASH_IsEmptyFlag

Function name

__STATIC_INLINE uint32_t LL_FLASH_IsEmptyFlag (void)

Function description

Check if the EMPTY flag is set or reset.

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- FLASH_ACR EMPTY LL_FLASH_IsEmptyFlag

LL_FLASH_EnableDBGAccess

Function name

__STATIC_INLINE void LL_FLASH_EnableDBGAccess (void)

Function description

Set EMPTY flag information as Flash User area empty.

Return values

- **None:**

Reference Manual to LL API cross reference:

- FLASH_ACR FLASH_ACR_DBG_SWEN LL_FLASH_EnableDBGAccess

LL_FLASH_DisableDBGAccess

Function name

__STATIC_INLINE void LL_FLASH_DisableDBGAccess (void)

Function description

Clear EMPTY flag information as Flash User area programmed.

Return values

- **None:**

Reference Manual to LL API cross reference:

- FLASH_ACR FLASH_ACR_DBG_SWEN LL_FLASH_DisableDBGAccess

76.2 SYSTEM Firmware driver defines

The following section lists the various define and macros of the module.

76.2.1 SYSTEM

SYSTEM

DBGMCU APB1 STOP IP

LL_DBGMCU_APB1_GRP1_TIM2_STOP

TIM2 counter stopped when core is halted

LL_DBGMCU_APB1_GRP1_TIM3_STOP

TIM3 counter stopped when core is halted

LL_DBGMCU_APB1_GRP1_TIM4_STOP

TIM4 counter stopped when core is halted

LL_DBGMCU_APB1_GRP1_TIM6_STOP

TIM6 counter stopped when core is halted

LL_DBGMCU_APB1_GRP1_TIM7_STOP

TIM7 counter stopped when core is halted

LL_DBGMCU_APB1_GRP1_RTC_STOP

RTC Calendar frozen when core is halted

LL_DBGMCU_APB1_GRP1_WWDG_STOP

Debug Window Watchdog stopped when Core is halted

LL_DBGMCU_APB1_GRP1_IWDG_STOP

Debug Independent Watchdog stopped when Core is halted

LL_DBGMCU_APB1_GRP1_I2C3_STOP

I2C3 counter stopped when Core is halted

LL_DBGMCU_APB1_GRP1_I2C1_STOP

I2C1 counter stopped when Core is halted

LL_DBGMCU_APB1_GRP1_LPTIM2_STOP

LPTIM2 counter stopped when Core is halted

LL_DBGMCU_APB1_GRP1_LPTIM1_STOP

LPTIM1 counter stopped when Core is halted

LL_DBGMCU_APB1_GRP2_TIM1_STOP

TIM1 counter stopped when core is halted

LL_DBGMCU_APB1_GRP2_TIM14_STOP

TIM14 counter stopped when core is halted

LL_DBGMCU_APB1_GRP2_TIM15_STOP

TIM15 counter stopped when core is halted

LL_DBGMCU_APB1_GRP2_TIM16_STOP

TIM16 counter stopped when core is halted

LL_DBGMCU_APB1_GRP2_LPTIM3_STOP

LPTIM3 counter stopped when core is halted

EXTI CONFIG LINE

LL_EXTI_CONFIG_LINE0

EXTI_POSITION_0 | EXTICR[0]

LL_EXTI_CONFIG_LINE1

EXTI_POSITION_8 | EXTICR[0]

LL_EXTI_CONFIG_LINE2

EXTI_POSITION_16 | EXTICR[0]

LL_EXTI_CONFIG_LINE3

EXTI_POSITION_24 | EXTICR[0]

LL_EXTI_CONFIG_LINE4

EXTI_POSITION_0 | EXTICR[1]

LL_EXTI_CONFIG_LINE5

EXTI_POSITION_8 | EXTICR[1]

LL_EXTI_CONFIG_LINE6

EXTI_POSITION_16 | EXTICR[1]

LL_EXTI_CONFIG_LINE7

EXTI_POSITION_24 | EXTICR[1]

LL_EXTI_CONFIG_LINE8

EXTI_POSITION_0 | EXTICR[2]

LL_EXTI_CONFIG_LINE9

EXTI_POSITION_8 | EXTICR[2]

LL_EXTI_CONFIG_LINE10

EXTI_POSITION_16 | EXTICR[2]

LL_EXTI_CONFIG_LINE11

EXTI_POSITION_24 | EXTICR[2]

LL_EXTI_CONFIG_LINE12

EXTI_POSITION_0 | EXTICR[3]

LL_EXTI_CONFIG_LINE13

EXTI_POSITION_8 | EXTICR[3]

LL_EXTI_CONFIG_LINE14

EXTI_POSITION_16 | EXTICR[3]

LL_EXTI_CONFIG_LINE15

EXTI_POSITION_24 | EXTICR[3]

EXTI EXTI PORT

LL_EXTI_CONFIG_PORTA

EXTI PORT A

LL_EXTI_CONFIG_PORTB

EXTI PORT B

LL_EXTI_CONFIG_PORTC

EXTI PORT C

LL_EXTI_CONFIG_PORTD

EXTI PORT D

LL_EXTI_CONFIG_PORTE

EXTI PORT E

LL_EXTI_CONFIG_PORTF

EXTI PORT F

SYSCFG I2C FASTMODEPLUS

LL_SYSCFG_I2C_FASTMODEPLUS_PB6

I2C PB6 Fast mode plus

LL_SYSCFG_I2C_FASTMODEPLUS_PB7

I2C PB7 Fast mode plus

LL_SYSCFG_I2C_FASTMODEPLUS_PB8

I2C PB8 Fast mode plus

LL_SYSCFG_I2C_FASTMODEPLUS_PB9

I2C PB9 Fast mode plus

LL_SYSCFG_I2C_FASTMODEPLUS_PA9

Enable Fast Mode Plus on PA9

LL_SYSCFG_I2C_FASTMODEPLUS_PA10

Enable Fast Mode Plus on PA10

LL_SYSCFG_I2C_FASTMODEPLUS_I2C3

Enable Fast Mode Plus on I2C3

SYSCFG IR Modulation

LL_SYSCFG_IR_MOD_TIM16

00: Timer16 is selected as IRDA Modulation envelope source

LL_SYSCFG_IR_MOD_USART1

01: USART1 is selected as IRDA Modulation envelope source

LL_SYSCFG_IR_MOD_USART2

10: USART2 is selected as IRDA Modulation envelope source

SYSCFG IR Polarity

LL_SYSCFG_IR_POL_NOT_INVERTED

0: Output of IRDA (IROut) not inverted

LL_SYSCFG_IR_POL_INVERTED

1: Output of IRDA (IROut) inverted

FLASH KEY

FLASH_KEY1

Flash Unlock key1

FLASH_KEY2

Flash Unlock key2

FLASH LATENCY

LL_FLASH_LATENCY_0

FLASH Zero Latency cycle

LL_FLASH_LATENCY_1

FLASH One Latency cycle

LL_FLASH_LATENCY_2

FLASH Two wait states

SYSCFG PIN RMP

LL_SYSCFG_PIN_RMP_PA11

PA11 pin behaves as PA9 pin

LL_SYSCFG_PIN_RMP_PA12

PA12 pin behaves as PA10 pin

SYSCFG REMAP

LL_SYSCFG_REMAP_FLASH

Main Flash memory mapped at 0x00000000

LL_SYSCFG_REMAP_SYSTEMFLASH

System Flash memory mapped at 0x00000000

LL_SYSCFG_REMAP_SRAM

Embedded SRAM mapped at 0x00000000

SYSCFG TIMER BREAK

LL_SYSCFG_TIMBREAK_CCL

Enables and locks the connection of Cortex-M0+ LOCKUP(HardFault) output of TIM1/15/16 Break Input

LL_SYSCFG_TIMBREAK_SPL

Enables and locks the SRAM1 parity error signal connection to TIM1/15/16 Break input

LL_SYSCFG_TIMBREAK_PVDL

Enables and locks the PVD connection to TIM1/15/16 Break input, and also the PVDE and PLS bits of the Power Control Interface

LL_SYSCFG_TIMBREAK_ECCL

Enables and locks the flash ECC 2-bit error detection signal connection to TIM1/15/16 Break input

LL_SYSCFG_TIMBREAK_BKPL

Enables and locks the SRAM2 parity error signal connection

SYSCFG TSC IOCONTROL

LL_SYSCFG_TSCIOCONTROL_REG

I/O configured through the corresponding control register

LL_SYSCFG_TSCIOCONTROL_ANALOG

I/O configured as analog when TSC AF is activated

VREFBUF VOLTAGE

LL_VREFBUF_VOLTAGE_SCALE0

Voltage reference scale 0 (VREF_OUT1)

LL_VREFBUF_VOLTAGE_SCALE1

Voltage reference scale 1 (VREF_OUT2)

77 LL TIM Generic Driver

77.1 TIM Firmware driver registers structures

77.1.1 LL_TIM_InitTypeDef

LL_TIM_InitTypeDef is defined in the stm32u0xx_ll_tim.h

Data Fields

- ***uint16_t Prescaler***
- ***uint32_t CounterMode***
- ***uint32_t Autoreload***
- ***uint32_t ClockDivision***
- ***uint32_t RepetitionCounter***

Field Documentation

- ***uint16_t LL_TIM_InitTypeDef::Prescaler***
  Specifies the prescaler value used to divide the TIM clock. This parameter can be a number between Min_Data=0x0000 and Max_Data=0xFFFF.This feature can be modified afterwards using unitary function **LL_TIM_SetPrescaler()**.
- ***uint32_t LL_TIM_InitTypeDef::CounterMode***
  Specifies the counter mode. This parameter can be a value of ***TIM_LL_EC_COUNTERMODE***.This feature can be modified afterwards using unitary function **LL_TIM_SetCounterMode()**.
- ***uint32_t LL_TIM_InitTypeDef::Autoreload***
  Specifies the auto reload value to be loaded into the active Auto-Reload Register at the next update event. This parameter must be a number between Min_Data=0x0000 and Max_Data=0xFFFF. Some timer instances may support 32 bits counters. In that case this parameter must be a number between 0x0000 and 0xFFFFFFFF.This feature can be modified afterwards using unitary function **LL_TIM_SetAutoReload()**.
- ***uint32_t LL_TIM_InitTypeDef::ClockDivision***
  Specifies the clock division. This parameter can be a value of ***TIM_LL_EC_CLOCKDIVISION***.This feature can be modified afterwards using unitary function **LL_TIM_SetClockDivision()**.
- ***uint32_t LL_TIM_InitTypeDef::RepetitionCounter***
  Specifies the repetition counter value. Each time the RCR downcounter reaches zero, an update event is generated and counting restarts from the RCR value (N). This means in PWM mode that (N+1) corresponds to:
  - the number of PWM periods in edge-aligned mode
  - the number of half PWM period in center-aligned mode GP timers: this parameter must be a number between Min_Data = 0x00 and Max_Data = 0xFF. Advanced timers: this parameter must be a number between Min_Data = 0x0000 and Max_Data = 0xFFFF.

  This feature can be modified afterwards using unitary function **LL_TIM_SetRepetitionCounter()**.

77.1.2 LL_TIM_OC_InitTypeDef

LL_TIM_OC_InitTypeDef is defined in the stm32u0xx_ll_tim.h

Data Fields

- ***uint32_t OCMode***
- ***uint32_t OCState***
- ***uint32_t OCNState***
- ***uint32_t CompareValue***
- ***uint32_t OCPolarity***
- ***uint32_t OCNPolarity***
- ***uint32_t OCIdleState***
- ***uint32_t OCNIdleState***

Field Documentation

- ***uint32_t LL_TIM_OC_InitTypeDef::OCMode***
  Specifies the output mode. This parameter can be a value of ***TIM_LL_EC_OCMODE***.This feature can be modified afterwards using unitary function **LL_TIM_OC_SetMode()**.
- ***uint32_t LL_TIM_OC_InitTypeDef::OCState***
  Specifies the TIM Output Compare state. This parameter can be a value of ***TIM_LL_EC_OCSTATE***.This feature can be modified afterwards using unitary functions **LL_TIM_CC_EnableChannel()** or **LL_TIM_CC_DisableChannel()**.
- ***uint32_t LL_TIM_OC_InitTypeDef::OCNState***
  Specifies the TIM complementary Output Compare state. This parameter can be a value of ***TIM_LL_EC_OCSTATE***.This feature can be modified afterwards using unitary functions **LL_TIM_CC_EnableChannel()** or **LL_TIM_CC_DisableChannel()**.
- ***uint32_t LL_TIM_OC_InitTypeDef::CompareValue***
  Specifies the Compare value to be loaded into the Capture Compare Register. This parameter can be a number between Min_Data=0x0000 and Max_Data=0xFFFF.This feature can be modified afterwards using unitary function LL_TIM_OC_SetCompareCHx (x=1..6).
- ***uint32_t LL_TIM_OC_InitTypeDef::OCPolarity***
  Specifies the output polarity. This parameter can be a value of ***TIM_LL_EC_OCPOLARITY***.This feature can be modified afterwards using unitary function **LL_TIM_OC_SetPolarity()**.
- ***uint32_t LL_TIM_OC_InitTypeDef::OCNPolarity***
  Specifies the complementary output polarity. This parameter can be a value of ***TIM_LL_EC_OCPOLARITY***.This feature can be modified afterwards using unitary function **LL_TIM_OC_SetPolarity()**.
- ***uint32_t LL_TIM_OC_InitTypeDef::OCIdleState***
  Specifies the TIM Output Compare pin state during Idle state. This parameter can be a value of ***TIM_LL_EC_OCIDLESTATE***.This feature can be modified afterwards using unitary function **LL_TIM_OC_SetIdleState()**.
- ***uint32_t LL_TIM_OC_InitTypeDef::OCNIdleState***
  Specifies the TIM Output Compare pin state during Idle state. This parameter can be a value of ***TIM_LL_EC_OCIDLESTATE***.This feature can be modified afterwards using unitary function **LL_TIM_OC_SetIdleState()**.

77.1.3 LL_TIM_IC_InitTypeDef

LL_TIM_IC_InitTypeDef is defined in the stm32u0xx_ll_tim.h

Data Fields

- ***uint32_t ICPolarity***
- ***uint32_t ICActiveInput***
- ***uint32_t ICPrescaler***
- ***uint32_t ICFilter***

Field Documentation

- ***uint32_t LL_TIM_IC_InitTypeDef::ICPolarity***
  Specifies the active edge of the input signal. This parameter can be a value of ***TIM_LL_EC_IC_POLARITY***.This feature can be modified afterwards using unitary function **LL_TIM_IC_SetPolarity()**.
- ***uint32_t LL_TIM_IC_InitTypeDef::ICActiveInput***
  Specifies the input. This parameter can be a value of ***TIM_LL_EC_ACTIVEINPUT***.This feature can be modified afterwards using unitary function **LL_TIM_IC_SetActiveInput()**.
- ***uint32_t LL_TIM_IC_InitTypeDef::ICPrescaler***
  Specifies the Input Capture Prescaler. This parameter can be a value of ***TIM_LL_EC_ICPSC***.This feature can be modified afterwards using unitary function **LL_TIM_IC_SetPrescaler()**.
- ***uint32_t LL_TIM_IC_InitTypeDef::ICFilter***
  Specifies the input capture filter. This parameter can be a value of ***TIM_LL_EC_IC_FILTER***.This feature can be modified afterwards using unitary function **LL_TIM_IC_SetFilter()**.

77.1.4 LL_TIM_ENCODER_InitTypeDef

LL_TIM_ENCODER_InitTypeDef is defined in the stm32u0xx_ll_tim.h

Data Fields

- ***uint32_t EncoderMode***
- ***uint32_t IC1Polarity***
- ***uint32_t IC1ActiveInput***
- ***uint32_t IC1Prescaler***
- ***uint32_t IC1Filter***
- ***uint32_t IC2Polarity***
- ***uint32_t IC2ActiveInput***
- ***uint32_t IC2Prescaler***
- ***uint32_t IC2Filter***

Field Documentation

- ***uint32_t LL_TIM_ENCODER_InitTypeDef::EncoderMode***
  Specifies the encoder resolution (x2 or x4). This parameter can be a value of ***TIM_LL_EC_ENCODERMODE***.This feature can be modified afterwards using unitary function **LL_TIM_SetEncoderMode()**.
- ***uint32_t LL_TIM_ENCODER_InitTypeDef::IC1Polarity***
  Specifies the active edge of TI1 input. This parameter can be a value of ***TIM_LL_EC_IC_POLARITY***.This feature can be modified afterwards using unitary function **LL_TIM_IC_SetPolarity()**.
- ***uint32_t LL_TIM_ENCODER_InitTypeDef::IC1ActiveInput***
  Specifies the TI1 input source This parameter can be a value of ***TIM_LL_EC_ACTIVEINPUT***.This feature can be modified afterwards using unitary function **LL_TIM_IC_SetActiveInput()**.
- ***uint32_t LL_TIM_ENCODER_InitTypeDef::IC1Prescaler***
  Specifies the TI1 input prescaler value. This parameter can be a value of ***TIM_LL_EC_ICPSC***.This feature can be modified afterwards using unitary function **LL_TIM_IC_SetPrescaler()**.
- ***uint32_t LL_TIM_ENCODER_InitTypeDef::IC1Filter***
  Specifies the TI1 input filter. This parameter can be a value of ***TIM_LL_EC_IC_FILTER***.This feature can be modified afterwards using unitary function **LL_TIM_IC_SetFilter()**.
- ***uint32_t LL_TIM_ENCODER_InitTypeDef::IC2Polarity***
  Specifies the active edge of TI2 input. This parameter can be a value of ***TIM_LL_EC_IC_POLARITY***.This feature can be modified afterwards using unitary function **LL_TIM_IC_SetPolarity()**.
- ***uint32_t LL_TIM_ENCODER_InitTypeDef::IC2ActiveInput***
  Specifies the TI2 input source This parameter can be a value of ***TIM_LL_EC_ACTIVEINPUT***.This feature can be modified afterwards using unitary function **LL_TIM_IC_SetActiveInput()**.
- ***uint32_t LL_TIM_ENCODER_InitTypeDef::IC2Prescaler***
  Specifies the TI2 input prescaler value. This parameter can be a value of ***TIM_LL_EC_ICPSC***.This feature can be modified afterwards using unitary function **LL_TIM_IC_SetPrescaler()**.
- ***uint32_t LL_TIM_ENCODER_InitTypeDef::IC2Filter***
  Specifies the TI2 input filter. This parameter can be a value of ***TIM_LL_EC_IC_FILTER***.This feature can be modified afterwards using unitary function **LL_TIM_IC_SetFilter()**.

77.1.5 LL_TIM_HALLSENSOR_InitTypeDef

LL_TIM_HALLSENSOR_InitTypeDef is defined in the stm32u0xx_ll_tim.h

Data Fields

- ***uint32_t IC1Polarity***
- ***uint32_t IC1Prescaler***
- ***uint32_t IC1Filter***
- ***uint32_t CommutationDelay***

Field Documentation

- ***uint32_t LL_TIM_HALLSENSOR_InitTypeDef::IC1Polarity***
  Specifies the active edge of TI1 input. This parameter can be a value of ***TIM_LL_EC_IC_POLARITY***.This feature can be modified afterwards using unitary function **LL_TIM_IC_SetPolarity()**.
- ***uint32_t LL_TIM_HALLSENSOR_InitTypeDef::IC1Prescaler***
  Specifies the TI1 input prescaler value. Prescaler must be set to get a maximum counter period longer than the time interval between 2 consecutive changes on the Hall inputs. This parameter can be a value of ***TIM_LL_EC_ICPSC***.This feature can be modified afterwards using unitary function **LL_TIM_IC_SetPrescaler()**.

- ***uint32_t LL_TIM_HALLSENSOR_InitTypeDef::IC1Filter***
  Specifies the TI1 input filter. This parameter can be a value of ***TIM_LL_EC_IC_FILTER***.This feature can be modified afterwards using unitary function **LL_TIM_IC_SetFilter()**.
- ***uint32_t LL_TIM_HALLSENSOR_InitTypeDef::CommutationDelay***
  Specifies the compare value to be loaded into the Capture Compare Register. A positive pulse (TRGO event) is generated with a programmable delay every time a change occurs on the Hall inputs. This parameter can be a number between Min_Data = 0x0000 and Max_Data = 0xFFFF.This feature can be modified afterwards using unitary function **LL_TIM_OC_SetCompareCH2()**.

77.1.6 LL_TIM_BDTR_InitTypeDef

LL_TIM_BDTR_InitTypeDef is defined in the stm32u0xx_ll_tim.h

Data Fields

- ***uint32_t OSSRState***
- ***uint32_t OSSIState***
- ***uint32_t LockLevel***
- ***uint8_t DeadTime***
- ***uint16_t BreakState***
- ***uint32_t BreakPolarity***
- ***uint32_t BreakFilter***
- ***uint32_t BreakAFMode***
- ***uint32_t Break2State***
- ***uint32_t Break2Polarity***
- ***uint32_t Break2Filter***
- ***uint32_t Break2AFMode***
- ***uint32_t AutomaticOutput***

Field Documentation

- ***uint32_t LL_TIM_BDTR_InitTypeDef::OSSRState***
  Specifies the Off-State selection used in Run mode. This parameter can be a value of ***TIM_LL_EC_OSSR***This feature can be modified afterwards using unitary function **LL_TIM_SetOffStates()**
  Note:
  – This bit-field cannot be modified as long as LOCK level 2 has been programmed.
- ***uint32_t LL_TIM_BDTR_InitTypeDef::OSSIState***
  Specifies the Off-State used in Idle state. This parameter can be a value of ***TIM_LL_EC_OSSI***This feature can be modified afterwards using unitary function **LL_TIM_SetOffStates()**
  Note:
  – This bit-field cannot be modified as long as LOCK level 2 has been programmed.
- ***uint32_t LL_TIM_BDTR_InitTypeDef::LockLevel***
  Specifies the LOCK level parameters. This parameter can be a value of ***TIM_LL_EC_LOCKLEVEL***
  Note:
  – The LOCK bits can be written only once after the reset. Once the TIMx_BDTR register has been written, their content is frozen until the next reset.
- ***uint8_t LL_TIM_BDTR_InitTypeDef::DeadTime***
  Specifies the delay time between the switching-off and the switching-on of the outputs. This parameter can be a number between Min_Data = 0x00 and Max_Data = 0xFF.This feature can be modified afterwards using unitary function **LL_TIM_OC_SetDeadTime()**
  Note:
  – This bit-field can not be modified as long as LOCK level 1, 2 or 3 has been programmed.
- ***uint16_t LL_TIM_BDTR_InitTypeDef::BreakState***
  Specifies whether the TIM Break input is enabled or not. This parameter can be a value of ***TIM_LL_EC_BREAK_ENABLE***This feature can be modified afterwards using unitary functions **LL_TIM_EnableBRK()** or **LL_TIM_DisableBRK()**
  Note:
  – This bit-field can not be modified as long as LOCK level 1 has been programmed.

- ***uint32_t LL_TIM_BDTR_InitTypeDef::BreakPolarity***
  Specifies the TIM Break Input pin polarity. This parameter can be a value of ***TIM_LL_EC_BREAK_POLARITY***This feature can be modified afterwards using unitary function **LL_TIM_ConfigBRK()**
  Note:
  – This bit-field can not be modified as long as LOCK level 1 has been programmed.
- ***uint32_t LL_TIM_BDTR_InitTypeDef::BreakFilter***
  Specifies the TIM Break Filter. This parameter can be a value of ***TIM_LL_EC_BREAK_FILTER***This feature can be modified afterwards using unitary function **LL_TIM_ConfigBRK()**
  Note:
  – This bit-field can not be modified as long as LOCK level 1 has been programmed.
- ***uint32_t LL_TIM_BDTR_InitTypeDef::BreakAFMode***
  Specifies the alternate function mode of the break input. This parameter can be a value of ***TIM_LL_EC_BREAK_AFMODE***This feature can be modified afterwards using unitary functions **LL_TIM_ConfigBRK()**
  Note:
  – Bidirectional break input is only supported by advanced timers instances.
  – This bit-field can not be modified as long as LOCK level 1 has been programmed.
- ***uint32_t LL_TIM_BDTR_InitTypeDef::Break2State***
  Specifies whether the TIM Break2 input is enabled or not. This parameter can be a value of ***TIM_LL_EC_BREAK2_ENABLE***This feature can be modified afterwards using unitary functions **LL_TIM_EnableBRK2()** or **LL_TIM_DisableBRK2()**
  Note:
  – This bit-field can not be modified as long as LOCK level 1 has been programmed.
- ***uint32_t LL_TIM_BDTR_InitTypeDef::Break2Polarity***
  Specifies the TIM Break2 Input pin polarity. This parameter can be a value of ***TIM_LL_EC_BREAK2_POLARITY***This feature can be modified afterwards using unitary function **LL_TIM_ConfigBRK2()**
  Note:
  – This bit-field can not be modified as long as LOCK level 1 has been programmed.
- ***uint32_t LL_TIM_BDTR_InitTypeDef::Break2Filter***
  Specifies the TIM Break2 Filter. This parameter can be a value of ***TIM_LL_EC_BREAK2_FILTER***This feature can be modified afterwards using unitary function **LL_TIM_ConfigBRK2()**
  Note:
  – This bit-field can not be modified as long as LOCK level 1 has been programmed.
- ***uint32_t LL_TIM_BDTR_InitTypeDef::Break2AFMode***
  Specifies the alternate function mode of the break2 input. This parameter can be a value of ***TIM_LL_EC_BREAK2_AFMODE***This feature can be modified afterwards using unitary functions **LL_TIM_ConfigBRK2()**
  Note:
  – Bidirectional break input is only supported by advanced timers instances.
  – This bit-field can not be modified as long as LOCK level 1 has been programmed.
- ***uint32_t LL_TIM_BDTR_InitTypeDef::AutomaticOutput***
  Specifies whether the TIM Automatic Output feature is enabled or not. This parameter can be a value of ***TIM_LL_EC_AUTOMATICOUTPUT_ENABLE***This feature can be modified afterwards using unitary functions **LL_TIM_EnableAutomaticOutput()** or **LL_TIM_DisableAutomaticOutput()**
  Note:
  – This bit-field can not be modified as long as LOCK level 1 has been programmed.

77.2 TIM Firmware driver API description

The following section lists the various functions of the TIM library.

77.2.1 Detailed description of functions

LL_TIM_EnableCounter

Function name

__STATIC_INLINE void LL_TIM_EnableCounter (TIM_TypeDef * TIMx)

Function description

Enable timer counter.

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 CEN LL_TIM_EnableCounter

LL_TIM_DisableCounter

Function name

__STATIC_INLINE void LL_TIM_DisableCounter (TIM_TypeDef * TIMx)

Function description

Disable timer counter.

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 CEN LL_TIM_DisableCounter

LL_TIM_IsEnabledCounter

Function name

__STATIC_INLINE uint32_t LL_TIM_IsEnabledCounter (const TIM_TypeDef * TIMx)

Function description

Indicates whether the timer counter is enabled.

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 CEN LL_TIM_IsEnabledCounter

LL_TIM_EnableUpdateEvent

Function name

__STATIC_INLINE void LL_TIM_EnableUpdateEvent (TIM_TypeDef * TIMx)

Function description

Enable update event generation.

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 UDIS LL_TIM_EnableUpdateEvent

LL_TIM_DisableUpdateEvent

Function name

__STATIC_INLINE void LL_TIM_DisableUpdateEvent (TIM_TypeDef * TIMx)

Function description

Disable update event generation.

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 UDIS LL_TIM_DisableUpdateEvent

LL_TIM_IsEnabledUpdateEvent

Function name

__STATIC_INLINE uint32_t LL_TIM_IsEnabledUpdateEvent (const TIM_TypeDef * TIMx)

Function description

Indicates whether update event generation is enabled.

Parameters

- **TIMx:** Timer instance

Return values

- **Inverted:** state of bit (0 or 1).

Reference Manual to LL API cross reference:

- CR1 UDIS LL_TIM_IsEnabledUpdateEvent

LL_TIM_SetUpdateSource

Function name

__STATIC_INLINE void LL_TIM_SetUpdateSource (TIM_TypeDef * TIMx, uint32_t UpdateSource)

Function description

Set update event source.

Parameters

- **TIMx:** Timer instance
- **UpdateSource:** This parameter can be one of the following values:
  - LL_TIM_UPDATESOURCE_REGULAR
  - LL_TIM_UPDATESOURCE_COUNTER

Return values

- **None:**

Notes

- Update event source set to LL_TIM_UPDATESOURCE_REGULAR: any of the following events generate an update interrupt or DMA request if enabled: Counter overflow/underflowSetting the UG bitUpdate generation through the slave mode controller
- Update event source set to LL_TIM_UPDATESOURCE_COUNTER: only counter overflow/underflow generates an update interrupt or DMA request if enabled.

Reference Manual to LL API cross reference:

- CR1 URS LL_TIM_SetUpdateSource

LL_TIM_GetUpdateSource

Function name

__STATIC_INLINE uint32_t LL_TIM_GetUpdateSource (const TIM_TypeDef * TIMx)

Function description

Get actual event update source.

Parameters

- **TIMx:** Timer instance

Return values

- **Returned:** value can be one of the following values:
  - LL_TIM_UPDATESOURCE_REGULAR
  - LL_TIM_UPDATESOURCE_COUNTER

Reference Manual to LL API cross reference:

- CR1 URS LL_TIM_GetUpdateSource

LL_TIM_SetOnePulseMode

Function name

__STATIC_INLINE void LL_TIM_SetOnePulseMode (TIM_TypeDef * TIMx, uint32_t OnePulseMode)

Function description

Set one pulse mode (one shot v.s.

Parameters

- **TIMx:** Timer instance
- **OnePulseMode:** This parameter can be one of the following values:
  - LL_TIM_ONEPULSEMODE_SINGLE
  - LL_TIM_ONEPULSEMODE_REPETITIVE

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 OPM LL_TIM_SetOnePulseMode

LL_TIM_GetOnePulseMode

Function name

__STATIC_INLINE uint32_t LL_TIM_GetOnePulseMode (const TIM_TypeDef * TIMx)

Function description

Get actual one pulse mode.

Parameters

- **TIMx:** Timer instance

Return values

- **Returned:** value can be one of the following values:
  - LL_TIM_ONEPULSEMODE_SINGLE
  - LL_TIM_ONEPULSEMODE_REPETITIVE

Reference Manual to LL API cross reference:

- CR1 OPM LL_TIM_GetOnePulseMode

LL_TIM_SetCounterMode

Function name

__STATIC_INLINE void LL_TIM_SetCounterMode (TIM_TypeDef * TIMx, uint32_t CounterMode)

Function description

Set the timer counter counting mode.

Parameters

- **TIMx:** Timer instance
- **CounterMode:** This parameter can be one of the following values:
  - LL_TIM_COUNTERMODE_UP
  - LL_TIM_COUNTERMODE_DOWN
  - LL_TIM_COUNTERMODE_CENTER_UP
  - LL_TIM_COUNTERMODE_CENTER_DOWN
  - LL_TIM_COUNTERMODE_CENTER_UP_DOWN

Return values

- **None:**

Notes

- Macro IS_TIM_COUNTER_MODE_SELECT_INSTANCE(TIMx) can be used to check whether or not the counter mode selection feature is supported by a timer instance.
- Switching from Center Aligned counter mode to Edge counter mode (or reverse) requires a timer reset to avoid unexpected direction due to DIR bit readonly in center aligned mode.

Reference Manual to LL API cross reference:

- CR1 DIR LL_TIM_SetCounterMode
- CR1 CMS LL_TIM_SetCounterMode

LL_TIM_GetCounterMode

Function name

__STATIC_INLINE uint32_t LL_TIM_GetCounterMode (const TIM_TypeDef * TIMx)

Function description

Get actual counter mode.

Parameters

- **TIMx:** Timer instance

Return values

- **Returned:** value can be one of the following values:
  - LL_TIM_COUNTERMODE_UP
  - LL_TIM_COUNTERMODE_DOWN
  - LL_TIM_COUNTERMODE_CENTER_UP
  - LL_TIM_COUNTERMODE_CENTER_DOWN
  - LL_TIM_COUNTERMODE_CENTER_UP_DOWN

Notes

- Macro IS_TIM_COUNTER_MODE_SELECT_INSTANCE(TIMx) can be used to check whether or not the counter mode selection feature is supported by a timer instance.

Reference Manual to LL API cross reference:

- CR1 DIR LL_TIM_GetCounterMode
- CR1 CMS LL_TIM_GetCounterMode

LL_TIM_EnableARRPreload

Function name

__STATIC_INLINE void LL_TIM_EnableARRPreload (TIM_TypeDef * TIMx)

Function description

Enable auto-reload (ARR) preload.

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 ARPE LL_TIM_EnableARRPreload

LL_TIM_DisableARRPreload

Function name

__STATIC_INLINE void LL_TIM_DisableARRPreload (TIM_TypeDef * TIMx)

Function description

Disable auto-reload (ARR) preload.

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 ARPE LL_TIM_DisableARRPreload

LL_TIM_IsEnabledARRPreload

Function name

__STATIC_INLINE uint32_t LL_TIM_IsEnabledARRPreload (const TIM_TypeDef * TIMx)

Function description

Indicates whether auto-reload (ARR) preload is enabled.

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 ARPE LL_TIM_IsEnabledARRPreload

LL_TIM_SetClockDivision

Function name

__STATIC_INLINE void LL_TIM_SetClockDivision (TIM_TypeDef * TIMx, uint32_t ClockDivision)

Function description

Set the division ratio between the timer clock and the sampling clock used by the dead-time generators (when supported) and the digital filters.

Parameters

- **TIMx:** Timer instance
- **ClockDivision:** This parameter can be one of the following values:
  - LL_TIM_CLOCKDIVISION_DIV1
  - LL_TIM_CLOCKDIVISION_DIV2
  - LL_TIM_CLOCKDIVISION_DIV4

Return values

- **None:**

Notes

- Macro IS_TIM_CLOCK_DIVISION_INSTANCE(TIMx) can be used to check whether or not the clock division feature is supported by the timer instance.

Reference Manual to LL API cross reference:

- CR1 CKD LL_TIM_SetClockDivision

LL_TIM_GetClockDivision

Function name

__STATIC_INLINE uint32_t LL_TIM_GetClockDivision (const TIM_TypeDef * TIMx)

Function description

Get the actual division ratio between the timer clock and the sampling clock used by the dead-time generators (when supported) and the digital filters.

Parameters

- **TIMx:** Timer instance

Return values

- **Returned:** value can be one of the following values:
  - LL_TIM_CLOCKDIVISION_DIV1
  - LL_TIM_CLOCKDIVISION_DIV2
  - LL_TIM_CLOCKDIVISION_DIV4

Notes

- Macro IS_TIM_CLOCK_DIVISION_INSTANCE(TIMx) can be used to check whether or not the clock division feature is supported by the timer instance.

Reference Manual to LL API cross reference:

- CR1 CKD LL_TIM_GetClockDivision

LL_TIM_SetCounter

Function name

__STATIC_INLINE void LL_TIM_SetCounter (TIM_TypeDef * TIMx, uint32_t Counter)

Function description

Set the counter value.

Parameters

- **TIMx:** Timer instance
- **Counter:** Counter value (between Min_Data=0 and Max_Data=0xFFFF or 0xFFFFFFFF)

Return values

- **None:**

Notes

- Macro IS_TIM_32B_COUNTER_INSTANCE(TIMx) can be used to check whether or not a timer instance supports a 32 bits counter.

Reference Manual to LL API cross reference:

- CNT CNT LL_TIM_SetCounter

LL_TIM_GetCounter

Function name

__STATIC_INLINE uint32_t LL_TIM_GetCounter (const TIM_TypeDef * TIMx)

Function description

Get the counter value.

Parameters

- **TIMx:** Timer instance

Return values

- **Counter:** value (between Min_Data=0 and Max_Data=0xFFFF or 0xFFFFFFFF)

Notes

- Macro IS_TIM_32B_COUNTER_INSTANCE(TIMx) can be used to check whether or not a timer instance supports a 32 bits counter.

Reference Manual to LL API cross reference:

- CNT CNT LL_TIM_GetCounter

LL_TIM_GetDirection

Function name

__STATIC_INLINE uint32_t LL_TIM_GetDirection (const TIM_TypeDef * TIMx)

Function description

Get the current direction of the counter.

Parameters

- **TIMx:** Timer instance

Return values

- **Returned:** value can be one of the following values:
  - LL_TIM_COUNTERDIRECTION_UP
  - LL_TIM_COUNTERDIRECTION_DOWN

Reference Manual to LL API cross reference:

- CR1 DIR LL_TIM_GetDirection

LL_TIM_SetPrescaler

Function name

__STATIC_INLINE void LL_TIM_SetPrescaler (TIM_TypeDef * TIMx, uint32_t Prescaler)

Function description

Set the prescaler value.

Parameters

- **TIMx:** Timer instance
- **Prescaler:** between Min_Data=0 and Max_Data=65535

Return values

- **None:**

Notes

- The counter clock frequency CK_CNT is equal to fCK_PSC / (PSC[15:0] + 1).
- The prescaler can be changed on the fly as this control register is buffered. The new prescaler ratio is taken into account at the next update event.
- Helper macro __LL_TIM_CALC_PSC can be used to calculate the Prescaler parameter

Reference Manual to LL API cross reference:

- PSC PSC LL_TIM_SetPrescaler

LL_TIM_GetPrescaler

Function name

__STATIC_INLINE uint32_t LL_TIM_GetPrescaler (const TIM_TypeDef * TIMx)

Function description

Get the prescaler value.

Parameters

- **TIMx:** Timer instance

Return values

- **Prescaler:** value between Min_Data=0 and Max_Data=65535

Reference Manual to LL API cross reference:

- PSC PSC LL_TIM_GetPrescaler

LL_TIM_SetAutoReload

Function name

__STATIC_INLINE void LL_TIM_SetAutoReload (TIM_TypeDef * TIMx, uint32_t AutoReload)

Function description

Set the auto-reload value.

Parameters

- **TIMx:** Timer instance
- **AutoReload:** between Min_Data=0 and Max_Data=65535

Return values

- **None:**

Notes

- The counter is blocked while the auto-reload value is null.
- Macro IS_TIM_32B_COUNTER_INSTANCE(TIMx) can be used to check whether or not a timer instance supports a 32 bits counter.
- Helper macro __LL_TIM_CALC_ARR can be used to calculate the AutoReload parameter

Reference Manual to LL API cross reference:

- ARR ARR LL_TIM_SetAutoReload

LL_TIM_GetAutoReload

Function name

__STATIC_INLINE uint32_t LL_TIM_GetAutoReload (const TIM_TypeDef * TIMx)

Function description

Get the auto-reload value.

Parameters

- **TIMx:** Timer instance

Return values

- **Auto-reload:** value

Notes

- Macro IS_TIM_32B_COUNTER_INSTANCE(TIMx) can be used to check whether or not a timer instance supports a 32 bits counter.

Reference Manual to LL API cross reference:

- ARR ARR LL_TIM_GetAutoReload

LL_TIM_SetRepetitionCounter

Function name

__STATIC_INLINE void LL_TIM_SetRepetitionCounter (TIM_TypeDef * TIMx, uint32_t RepetitionCounter)

Function description

Set the repetition counter value.

Parameters

- **TIMx:** Timer instance
- **RepetitionCounter:** between Min_Data=0 and Max_Data=255 or 65535 for advanced timer.

Return values

- **None:**

Notes

- For advanced timer instances RepetitionCounter can be up to 65535.
- Macro IS_TIM_REPETITION_COUNTER_INSTANCE(TIMx) can be used to check whether or not a timer instance supports a repetition counter.

Reference Manual to LL API cross reference:

- RCR REP LL_TIM_SetRepetitionCounter

LL_TIM_GetRepetitionCounter

Function name

__STATIC_INLINE uint32_t LL_TIM_GetRepetitionCounter (const TIM_TypeDef * TIMx)

Function description

Get the repetition counter value.

Parameters

- **TIMx:** Timer instance

Return values

- **Repetition:** counter value

Notes

- Macro IS_TIM_REPETITION_COUNTER_INSTANCE(TIMx) can be used to check whether or not a timer instance supports a repetition counter.

Reference Manual to LL API cross reference:

- RCR REP LL_TIM_GetRepetitionCounter

LL_TIM_EnableUIFRemap

Function name

__STATIC_INLINE void LL_TIM_EnableUIFRemap (TIM_TypeDef * TIMx)

Function description

Force a continuous copy of the update interrupt flag (UIF) into the timer counter register (bit 31).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Notes

- This allows both the counter value and a potential roll-over condition signalled by the UIFCPY flag to be read in an atomic way.

Reference Manual to LL API cross reference:

- CR1 UIFREMAP LL_TIM_EnableUIFRemap

LL_TIM_DisableUIFRemap

Function name

__STATIC_INLINE void LL_TIM_DisableUIFRemap (TIM_TypeDef * TIMx)

Function description

Disable update interrupt flag (UIF) remapping.

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 UIFREMAP LL_TIM_DisableUIFRemap

LL_TIM_IsActiveUIFCPY

Function name

__STATIC_INLINE uint32_t LL_TIM_IsActiveUIFCPY (const uint32_t Counter)

Function description

Indicate whether update interrupt flag (UIF) copy is set.

Parameters

- **Counter:** Counter value

Return values

- **State:** of bit (1 or 0).

LL_TIM_CC_EnablePreload

Function name

__STATIC_INLINE void LL_TIM_CC_EnablePreload (TIM_TypeDef * TIMx)

Function description

Enable the capture/compare control bits (CCxE, CCxNE and OCxM) preload.

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Notes

- CCxE, CCxNE and OCxM bits are preloaded, after having been written, they are updated only when a commutation event (COM) occurs.
- Only on channels that have a complementary output.
- Macro IS_TIM_COMMUTATION_EVENT_INSTANCE(TIMx) can be used to check whether or not a timer instance is able to generate a commutation event.

Reference Manual to LL API cross reference:

- CR2 CCPC LL_TIM_CC_EnablePreload

LL_TIM_CC_DisablePreload

Function name

__STATIC_INLINE void LL_TIM_CC_DisablePreload (TIM_TypeDef * TIMx)

Function description

Disable the capture/compare control bits (CCxE, CCxNE and OCxM) preload.

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Notes

- Macro IS_TIM_COMMUTATION_EVENT_INSTANCE(TIMx) can be used to check whether or not a timer instance is able to generate a commutation event.

Reference Manual to LL API cross reference:

- CR2 CCPC LL_TIM_CC_DisablePreload

LL_TIM_CC_IsEnabledPreload

Function name

__STATIC_INLINE uint32_t LL_TIM_CC_IsEnabledPreload (const TIM_TypeDef * TIMx)

Function description

Indicates whether the capture/compare control bits (CCxE, CCxNE and OCxM) preload is enabled.

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR2 CCPC LL_TIM_CC_IsEnabledPreload

LL_TIM_CC_SetUpdate

Function name

__STATIC_INLINE void LL_TIM_CC_SetUpdate (TIM_TypeDef * TIMx, uint32_t CCUpdateSource)

Function description

Set the updated source of the capture/compare control bits (CCxE, CCxNE and OCxM).

Parameters

- **TIMx:** Timer instance
- **CCUpdateSource:** This parameter can be one of the following values:
  - LL_TIM_CCUPDATESOURCE_COMG_ONLY
  - LL_TIM_CCUPDATESOURCE_COMG_AND_TRGI

Return values

- **None:**

Notes

- Macro IS_TIM_COMMUTATION_EVENT_INSTANCE(TIMx) can be used to check whether or not a timer instance is able to generate a commutation event.

Reference Manual to LL API cross reference:

- CR2 CCUS LL_TIM_CC_SetUpdate

LL_TIM_CC_SetDMAReqTrigger

Function name

__STATIC_INLINE void LL_TIM_CC_SetDMAReqTrigger (TIM_TypeDef * TIMx, uint32_t DMAReqTrigger)

Function description

Set the trigger of the capture/compare DMA request.

Parameters

- **TIMx:** Timer instance
- **DMAReqTrigger:** This parameter can be one of the following values:
  - LL_TIM_CCDMAREQUEST_CC
  - LL_TIM_CCDMAREQUEST_UPDATE

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR2 CCDS LL_TIM_CC_SetDMAReqTrigger

LL_TIM_CC_GetDMAReqTrigger

Function name

__STATIC_INLINE uint32_t LL_TIM_CC_GetDMAReqTrigger (const TIM_TypeDef * TIMx)

Function description

Get actual trigger of the capture/compare DMA request.

Parameters

- **TIMx:** Timer instance

Return values

- **Returned:** value can be one of the following values:
  - LL_TIM_CCDMAREQUEST_CC
  - LL_TIM_CCDMAREQUEST_UPDATE

Reference Manual to LL API cross reference:

- CR2 CCDS LL_TIM_CC_GetDMAReqTrigger

LL_TIM_CC_SetLockLevel

Function name

__STATIC_INLINE void LL_TIM_CC_SetLockLevel (TIM_TypeDef * TIMx, uint32_t LockLevel)

Function description

Set the lock level to freeze the configuration of several capture/compare parameters.

Parameters

- **TIMx:** Timer instance
- **LockLevel:** This parameter can be one of the following values:
  - LL_TIM_LOCKLEVEL_OFF
  - LL_TIM_LOCKLEVEL_1
  - LL_TIM_LOCKLEVEL_2
  - LL_TIM_LOCKLEVEL_3

Return values

- **None:**

Notes

- Macro IS_TIM_BREAK_INSTANCE(TIMx) can be used to check whether or not the lock mechanism is supported by a timer instance.

Reference Manual to LL API cross reference:

- BDTR LOCK LL_TIM_CC_SetLockLevel

LL_TIM_CC_EnableChannel

Function name

__STATIC_INLINE void LL_TIM_CC_EnableChannel (TIM_TypeDef * TIMx, uint32_t Channels)

Function description

Enable capture/compare channels.

Parameters

- **TIMx:** Timer instance
- **Channels:** This parameter can be a combination of the following values:
  - LL_TIM_CHANNEL_CH1
  - LL_TIM_CHANNEL_CH1N
  - LL_TIM_CHANNEL_CH2
  - LL_TIM_CHANNEL_CH2N
  - LL_TIM_CHANNEL_CH3
  - LL_TIM_CHANNEL_CH3N
  - LL_TIM_CHANNEL_CH4
  - LL_TIM_CHANNEL_CH5
  - LL_TIM_CHANNEL_CH6

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCER CC1E LL_TIM_CC_EnableChannel
- CCER CC1NE LL_TIM_CC_EnableChannel
- CCER CC2E LL_TIM_CC_EnableChannel
- CCER CC2NE LL_TIM_CC_EnableChannel
- CCER CC3E LL_TIM_CC_EnableChannel
- CCER CC3NE LL_TIM_CC_EnableChannel
- CCER CC4E LL_TIM_CC_EnableChannel
- CCER CC5E LL_TIM_CC_EnableChannel
- CCER CC6E LL_TIM_CC_EnableChannel

LL_TIM_CC_DisableChannel

Function name

__STATIC_INLINE void LL_TIM_CC_DisableChannel (TIM_TypeDef * TIMx, uint32_t Channels)

Function description

Disable capture/compare channels.

Parameters

- **TIMx:** Timer instance
- **Channels:** This parameter can be a combination of the following values:
  - LL_TIM_CHANNEL_CH1
  - LL_TIM_CHANNEL_CH1N
  - LL_TIM_CHANNEL_CH2
  - LL_TIM_CHANNEL_CH2N
  - LL_TIM_CHANNEL_CH3
  - LL_TIM_CHANNEL_CH3N
  - LL_TIM_CHANNEL_CH4
  - LL_TIM_CHANNEL_CH5
  - LL_TIM_CHANNEL_CH6

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCER CC1E LL_TIM_CC_DisableChannel
- CCER CC1NE LL_TIM_CC_DisableChannel
- CCER CC2E LL_TIM_CC_DisableChannel
- CCER CC2NE LL_TIM_CC_DisableChannel
- CCER CC3E LL_TIM_CC_DisableChannel
- CCER CC3NE LL_TIM_CC_DisableChannel
- CCER CC4E LL_TIM_CC_DisableChannel
- CCER CC5E LL_TIM_CC_DisableChannel
- CCER CC6E LL_TIM_CC_DisableChannel

LL_TIM_CC_IsEnabledChannel

Function name

__STATIC_INLINE uint32_t LL_TIM_CC_IsEnabledChannel (const TIM_TypeDef * TIMx, uint32_t Channels)

Function description

Indicate whether channel(s) is(are) enabled.

Parameters

- **TIMx:** Timer instance
- **Channels:** This parameter can be a combination of the following values:
  - LL_TIM_CHANNEL_CH1
  - LL_TIM_CHANNEL_CH1N
  - LL_TIM_CHANNEL_CH2
  - LL_TIM_CHANNEL_CH2N
  - LL_TIM_CHANNEL_CH3
  - LL_TIM_CHANNEL_CH3N
  - LL_TIM_CHANNEL_CH4
  - LL_TIM_CHANNEL_CH5
  - LL_TIM_CHANNEL_CH6

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CCER CC1E LL_TIM_CC_IsEnabledChannel
- CCER CC1NE LL_TIM_CC_IsEnabledChannel
- CCER CC2E LL_TIM_CC_IsEnabledChannel
- CCER CC2NE LL_TIM_CC_IsEnabledChannel
- CCER CC3E LL_TIM_CC_IsEnabledChannel
- CCER CC3NE LL_TIM_CC_IsEnabledChannel
- CCER CC4E LL_TIM_CC_IsEnabledChannel
- CCER CC5E LL_TIM_CC_IsEnabledChannel
- CCER CC6E LL_TIM_CC_IsEnabledChannel

LL_TIM_OC_ConfigOutput

Function name

__STATIC_INLINE void LL_TIM_OC_ConfigOutput (TIM_TypeDef * TIMx, uint32_t Channel, uint32_t Configuration)

Function description

Configure an output channel.

Parameters

- **TIMx:** Timer instance
- **Channel:** This parameter can be one of the following values:
  - LL_TIM_CHANNEL_CH1
  - LL_TIM_CHANNEL_CH2
  - LL_TIM_CHANNEL_CH3
  - LL_TIM_CHANNEL_CH4
  - LL_TIM_CHANNEL_CH5
  - LL_TIM_CHANNEL_CH6
- **Configuration:** This parameter must be a combination of all the following values:
  - LL_TIM_OCPOLARITY_HIGH or LL_TIM_OCPOLARITY_LOW
  - LL_TIM_OCIDLESTATE_LOW or LL_TIM_OCIDLESTATE_HIGH

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCMR1 CC1S LL_TIM_OC_ConfigOutput
- CCMR1 CC2S LL_TIM_OC_ConfigOutput
- CCMR2 CC3S LL_TIM_OC_ConfigOutput
- CCMR2 CC4S LL_TIM_OC_ConfigOutput
- CCMR3 CC5S LL_TIM_OC_ConfigOutput
- CCMR3 CC6S LL_TIM_OC_ConfigOutput
- CCER CC1P LL_TIM_OC_ConfigOutput
- CCER CC2P LL_TIM_OC_ConfigOutput
- CCER CC3P LL_TIM_OC_ConfigOutput
- CCER CC4P LL_TIM_OC_ConfigOutput
- CCER CC5P LL_TIM_OC_ConfigOutput
- CCER CC6P LL_TIM_OC_ConfigOutput
- CR2 OIS1 LL_TIM_OC_ConfigOutput
- CR2 OIS2 LL_TIM_OC_ConfigOutput
- CR2 OIS3 LL_TIM_OC_ConfigOutput
- CR2 OIS4 LL_TIM_OC_ConfigOutput
- CR2 OIS5 LL_TIM_OC_ConfigOutput
- CR2 OIS6 LL_TIM_OC_ConfigOutput

LL_TIM_OC_SetMode

Function name

__STATIC_INLINE void LL_TIM_OC_SetMode (TIM_TypeDef * TIMx, uint32_t Channel, uint32_t Mode)

Function description

Define the behavior of the output reference signal OCxREF from which OCx and OCxN (when relevant) are derived.

Parameters

- **TIMx:** Timer instance
- **Channel:** This parameter can be one of the following values:
  - LL_TIM_CHANNEL_CH1
  - LL_TIM_CHANNEL_CH2
  - LL_TIM_CHANNEL_CH3
  - LL_TIM_CHANNEL_CH4
  - LL_TIM_CHANNEL_CH5
  - LL_TIM_CHANNEL_CH6
- **Mode:** This parameter can be one of the following values:
  - LL_TIM_OCMODE_FROZEN
  - LL_TIM_OCMODE_ACTIVE
  - LL_TIM_OCMODE_INACTIVE
  - LL_TIM_OCMODE_TOGGLE
  - LL_TIM_OCMODE_FORCED_INACTIVE
  - LL_TIM_OCMODE_FORCED_ACTIVE
  - LL_TIM_OCMODE_PWM1
  - LL_TIM_OCMODE_PWM2
  - LL_TIM_OCMODE_RETRIG_OPM1
  - LL_TIM_OCMODE_RETRIG_OPM2
  - LL_TIM_OCMODE_COMBINED_PWM1
  - LL_TIM_OCMODE_COMBINED_PWM2
  - LL_TIM_OCMODE_ASYMMETRIC_PWM1
  - LL_TIM_OCMODE_ASYMMETRIC_PWM2

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCMR1 OC1M LL_TIM_OC_SetMode
- CCMR1 OC2M LL_TIM_OC_SetMode
- CCMR2 OC3M LL_TIM_OC_SetMode
- CCMR2 OC4M LL_TIM_OC_SetMode
- CCMR3 OC5M LL_TIM_OC_SetMode
- CCMR3 OC6M LL_TIM_OC_SetMode

LL_TIM_OC_GetMode

Function name

__STATIC_INLINE uint32_t LL_TIM_OC_GetMode (const TIM_TypeDef * TIMx, uint32_t Channel)

Function description

Get the output compare mode of an output channel.

Parameters

- **TIMx:** Timer instance
- **Channel:** This parameter can be one of the following values:
  - LL_TIM_CHANNEL_CH1
  - LL_TIM_CHANNEL_CH2
  - LL_TIM_CHANNEL_CH3
  - LL_TIM_CHANNEL_CH4
  - LL_TIM_CHANNEL_CH5
  - LL_TIM_CHANNEL_CH6

Return values

- **Returned:** value can be one of the following values:
  - LL_TIM_OCMODE_FROZEN
  - LL_TIM_OCMODE_ACTIVE
  - LL_TIM_OCMODE_INACTIVE
  - LL_TIM_OCMODE_TOGGLE
  - LL_TIM_OCMODE_FORCED_INACTIVE
  - LL_TIM_OCMODE_FORCED_ACTIVE
  - LL_TIM_OCMODE_PWM1
  - LL_TIM_OCMODE_PWM2
  - LL_TIM_OCMODE_RETRIG_OPM1
  - LL_TIM_OCMODE_RETRIG_OPM2
  - LL_TIM_OCMODE_COMBINED_PWM1
  - LL_TIM_OCMODE_COMBINED_PWM2
  - LL_TIM_OCMODE_ASYMMETRIC_PWM1
  - LL_TIM_OCMODE_ASYMMETRIC_PWM2

Reference Manual to LL API cross reference:

- CCMR1 OC1M LL_TIM_OC_GetMode
- CCMR1 OC2M LL_TIM_OC_GetMode
- CCMR2 OC3M LL_TIM_OC_GetMode
- CCMR2 OC4M LL_TIM_OC_GetMode
- CCMR3 OC5M LL_TIM_OC_GetMode
- CCMR3 OC6M LL_TIM_OC_GetMode

LL_TIM_OC_SetPolarity

Function name

__STATIC_INLINE void LL_TIM_OC_SetPolarity (TIM_TypeDef * TIMx, uint32_t Channel, uint32_t Polarity)

Function description

Set the polarity of an output channel.

Parameters

- **TIMx:** Timer instance
- **Channel:** This parameter can be one of the following values:
  - LL_TIM_CHANNEL_CH1
  - LL_TIM_CHANNEL_CH1N
  - LL_TIM_CHANNEL_CH2
  - LL_TIM_CHANNEL_CH2N
  - LL_TIM_CHANNEL_CH3
  - LL_TIM_CHANNEL_CH3N
  - LL_TIM_CHANNEL_CH4
  - LL_TIM_CHANNEL_CH5
  - LL_TIM_CHANNEL_CH6
- **Polarity:** This parameter can be one of the following values:
  - LL_TIM_OCPOLARITY_HIGH
  - LL_TIM_OCPOLARITY_LOW

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCER CC1P LL_TIM_OC_SetPolarity
- CCER CC1NP LL_TIM_OC_SetPolarity
- CCER CC2P LL_TIM_OC_SetPolarity
- CCER CC2NP LL_TIM_OC_SetPolarity
- CCER CC3P LL_TIM_OC_SetPolarity
- CCER CC3NP LL_TIM_OC_SetPolarity
- CCER CC4P LL_TIM_OC_SetPolarity
- CCER CC5P LL_TIM_OC_SetPolarity
- CCER CC6P LL_TIM_OC_SetPolarity

LL_TIM_OC_GetPolarity

Function name

__STATIC_INLINE uint32_t LL_TIM_OC_GetPolarity (const TIM_TypeDef * TIMx, uint32_t Channel)

Function description

Get the polarity of an output channel.

Parameters

- **TIMx:** Timer instance
- **Channel:** This parameter can be one of the following values:
  - LL_TIM_CHANNEL_CH1
  - LL_TIM_CHANNEL_CH1N
  - LL_TIM_CHANNEL_CH2
  - LL_TIM_CHANNEL_CH2N
  - LL_TIM_CHANNEL_CH3
  - LL_TIM_CHANNEL_CH3N
  - LL_TIM_CHANNEL_CH4
  - LL_TIM_CHANNEL_CH5
  - LL_TIM_CHANNEL_CH6

Return values

- **Returned:** value can be one of the following values:
  - LL_TIM_OCPOLARITY_HIGH
  - LL_TIM_OCPOLARITY_LOW

Reference Manual to LL API cross reference:

- CCER CC1P LL_TIM_OC_GetPolarity
- CCER CC1NP LL_TIM_OC_GetPolarity
- CCER CC2P LL_TIM_OC_GetPolarity
- CCER CC2NP LL_TIM_OC_GetPolarity
- CCER CC3P LL_TIM_OC_GetPolarity
- CCER CC3NP LL_TIM_OC_GetPolarity
- CCER CC4P LL_TIM_OC_GetPolarity
- CCER CC5P LL_TIM_OC_GetPolarity
- CCER CC6P LL_TIM_OC_GetPolarity

LL_TIM_OC_SetIdleState

Function name

__STATIC_INLINE void LL_TIM_OC_SetIdleState (TIM_TypeDef * TIMx, uint32_t Channel, uint32_t IdleState)

Function description

Set the IDLE state of an output channel.

Parameters

- **TIMx:** Timer instance
- **Channel:** This parameter can be one of the following values:
  - LL_TIM_CHANNEL_CH1
  - LL_TIM_CHANNEL_CH1N
  - LL_TIM_CHANNEL_CH2
  - LL_TIM_CHANNEL_CH2N
  - LL_TIM_CHANNEL_CH3
  - LL_TIM_CHANNEL_CH3N
  - LL_TIM_CHANNEL_CH4
  - LL_TIM_CHANNEL_CH5
  - LL_TIM_CHANNEL_CH6
- **IdleState:** This parameter can be one of the following values:
  - LL_TIM_OCIDLESTATE_LOW
  - LL_TIM_OCIDLESTATE_HIGH

Return values

- **None:**

Notes

- This function is significant only for the timer instances supporting the break feature. Macro IS_TIM_BREAK_INSTANCE(TIMx) can be used to check whether or not a timer instance provides a break input.

Reference Manual to LL API cross reference:

- CR2 OIS1 LL_TIM_OC_SetIdleState
- CR2 OIS2N LL_TIM_OC_SetIdleState
- CR2 OIS2 LL_TIM_OC_SetIdleState
- CR2 OIS2N LL_TIM_OC_SetIdleState
- CR2 OIS3 LL_TIM_OC_SetIdleState
- CR2 OIS3N LL_TIM_OC_SetIdleState
- CR2 OIS4 LL_TIM_OC_SetIdleState
- CR2 OIS5 LL_TIM_OC_SetIdleState
- CR2 OIS6 LL_TIM_OC_SetIdleState

LL_TIM_OC_GetIdleState

Function name

__STATIC_INLINE uint32_t LL_TIM_OC_GetIdleState (const TIM_TypeDef * TIMx, uint32_t Channel)

Function description

Get the IDLE state of an output channel.

Parameters

- **TIMx:** Timer instance
- **Channel:** This parameter can be one of the following values:
  - LL_TIM_CHANNEL_CH1
  - LL_TIM_CHANNEL_CH1N
  - LL_TIM_CHANNEL_CH2
  - LL_TIM_CHANNEL_CH2N
  - LL_TIM_CHANNEL_CH3
  - LL_TIM_CHANNEL_CH3N
  - LL_TIM_CHANNEL_CH4
  - LL_TIM_CHANNEL_CH5
  - LL_TIM_CHANNEL_CH6

Return values

- **Returned:** value can be one of the following values:
  - LL_TIM_OCIDLESTATE_LOW
  - LL_TIM_OCIDLESTATE_HIGH

Reference Manual to LL API cross reference:

- CR2 OIS1 LL_TIM_OC_GetIdleState
- CR2 OIS2N LL_TIM_OC_GetIdleState
- CR2 OIS2 LL_TIM_OC_GetIdleState
- CR2 OIS2N LL_TIM_OC_GetIdleState
- CR2 OIS3 LL_TIM_OC_GetIdleState
- CR2 OIS3N LL_TIM_OC_GetIdleState
- CR2 OIS4 LL_TIM_OC_GetIdleState
- CR2 OIS5 LL_TIM_OC_GetIdleState
- CR2 OIS6 LL_TIM_OC_GetIdleState

LL_TIM_OC_EnableFast

Function name

__STATIC_INLINE void LL_TIM_OC_EnableFast (TIM_TypeDef * TIMx, uint32_t Channel)

Function description

Enable fast mode for the output channel.

Parameters

- **TIMx:** Timer instance
- **Channel:** This parameter can be one of the following values:
  - LL_TIM_CHANNEL_CH1
  - LL_TIM_CHANNEL_CH2
  - LL_TIM_CHANNEL_CH3
  - LL_TIM_CHANNEL_CH4
  - LL_TIM_CHANNEL_CH5
  - LL_TIM_CHANNEL_CH6

Return values

- **None:**

Notes

- Acts only if the channel is configured in PWM1 or PWM2 mode.

Reference Manual to LL API cross reference:

- CCMR1 OC1FE LL_TIM_OC_EnableFast
- CCMR1 OC2FE LL_TIM_OC_EnableFast
- CCMR2 OC3FE LL_TIM_OC_EnableFast
- CCMR2 OC4FE LL_TIM_OC_EnableFast
- CCMR3 OC5FE LL_TIM_OC_EnableFast
- CCMR3 OC6FE LL_TIM_OC_EnableFast

LL_TIM_OC_DisableFast

Function name

__STATIC_INLINE void LL_TIM_OC_DisableFast (TIM_TypeDef * TIMx, uint32_t Channel)

Function description

Disable fast mode for the output channel.

Parameters

- **TIMx:** Timer instance
- **Channel:** This parameter can be one of the following values:
  - LL_TIM_CHANNEL_CH1
  - LL_TIM_CHANNEL_CH2
  - LL_TIM_CHANNEL_CH3
  - LL_TIM_CHANNEL_CH4
  - LL_TIM_CHANNEL_CH5
  - LL_TIM_CHANNEL_CH6

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCMR1 OC1FE LL_TIM_OC_DisableFast
- CCMR1 OC2FE LL_TIM_OC_DisableFast
- CCMR2 OC3FE LL_TIM_OC_DisableFast
- CCMR2 OC4FE LL_TIM_OC_DisableFast
- CCMR3 OC5FE LL_TIM_OC_DisableFast
- CCMR3 OC6FE LL_TIM_OC_DisableFast

LL_TIM_OC_IsEnabledFast

Function name

__STATIC_INLINE uint32_t LL_TIM_OC_IsEnabledFast (const TIM_TypeDef * TIMx, uint32_t Channel)

Function description

Indicates whether fast mode is enabled for the output channel.

Parameters

- **TIMx:** Timer instance
- **Channel:** This parameter can be one of the following values:
  - LL_TIM_CHANNEL_CH1
  - LL_TIM_CHANNEL_CH2
  - LL_TIM_CHANNEL_CH3
  - LL_TIM_CHANNEL_CH4
  - LL_TIM_CHANNEL_CH5
  - LL_TIM_CHANNEL_CH6

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CCMR1 OC1FE LL_TIM_OC_IsEnabledFast
- CCMR1 OC2FE LL_TIM_OC_IsEnabledFast
- CCMR2 OC3FE LL_TIM_OC_IsEnabledFast
- CCMR2 OC4FE LL_TIM_OC_IsEnabledFast
- CCMR3 OC5FE LL_TIM_OC_IsEnabledFast
- CCMR3 OC6FE LL_TIM_OC_IsEnabledFast

LL_TIM_OC_EnablePreload

Function name

__STATIC_INLINE void LL_TIM_OC_EnablePreload (TIM_TypeDef * TIMx, uint32_t Channel)

Function description

Enable compare register (TIMx_CCRx) preload for the output channel.

Parameters

- **TIMx:** Timer instance
- **Channel:** This parameter can be one of the following values:
  - LL_TIM_CHANNEL_CH1
  - LL_TIM_CHANNEL_CH2
  - LL_TIM_CHANNEL_CH3
  - LL_TIM_CHANNEL_CH4
  - LL_TIM_CHANNEL_CH5
  - LL_TIM_CHANNEL_CH6

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCMR1 OC1PE LL_TIM_OC_EnablePreload
- CCMR1 OC2PE LL_TIM_OC_EnablePreload
- CCMR2 OC3PE LL_TIM_OC_EnablePreload
- CCMR2 OC4PE LL_TIM_OC_EnablePreload
- CCMR3 OC5PE LL_TIM_OC_EnablePreload
- CCMR3 OC6PE LL_TIM_OC_EnablePreload

LL_TIM_OC_DisablePreload

Function name

__STATIC_INLINE void LL_TIM_OC_DisablePreload (TIM_TypeDef * TIMx, uint32_t Channel)

Function description

Disable compare register (TIMx_CCRx) preload for the output channel.

Parameters

- **TIMx:** Timer instance
- **Channel:** This parameter can be one of the following values:
  - LL_TIM_CHANNEL_CH1
  - LL_TIM_CHANNEL_CH2
  - LL_TIM_CHANNEL_CH3
  - LL_TIM_CHANNEL_CH4
  - LL_TIM_CHANNEL_CH5
  - LL_TIM_CHANNEL_CH6

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCMR1 OC1PE LL_TIM_OC_DisablePreload
- CCMR1 OC2PE LL_TIM_OC_DisablePreload
- CCMR2 OC3PE LL_TIM_OC_DisablePreload
- CCMR2 OC4PE LL_TIM_OC_DisablePreload
- CCMR3 OC5PE LL_TIM_OC_DisablePreload
- CCMR3 OC6PE LL_TIM_OC_DisablePreload

LL_TIM_OC_IsEnabledPreload

Function name

__STATIC_INLINE uint32_t LL_TIM_OC_IsEnabledPreload (const TIM_TypeDef * TIMx, uint32_t Channel)

Function description

Indicates whether compare register (TIMx_CCRx) preload is enabled for the output channel.

Parameters

- **TIMx:** Timer instance
- **Channel:** This parameter can be one of the following values:
  - LL_TIM_CHANNEL_CH1
  - LL_TIM_CHANNEL_CH2
  - LL_TIM_CHANNEL_CH3
  - LL_TIM_CHANNEL_CH4
  - LL_TIM_CHANNEL_CH5
  - LL_TIM_CHANNEL_CH6

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CCMR1 OC1PE LL_TIM_OC_IsEnabledPreload
- CCMR1 OC2PE LL_TIM_OC_IsEnabledPreload
- CCMR2 OC3PE LL_TIM_OC_IsEnabledPreload
- CCMR2 OC4PE LL_TIM_OC_IsEnabledPreload
- CCMR3 OC5PE LL_TIM_OC_IsEnabledPreload
- CCMR3 OC6PE LL_TIM_OC_IsEnabledPreload

LL_TIM_OC_EnableClear

Function name

__STATIC_INLINE void LL_TIM_OC_EnableClear (TIM_TypeDef * TIMx, uint32_t Channel)

Function description

Enable clearing the output channel on an external event.

Parameters

- **TIMx:** Timer instance
- **Channel:** This parameter can be one of the following values:
  - LL_TIM_CHANNEL_CH1
  - LL_TIM_CHANNEL_CH2
  - LL_TIM_CHANNEL_CH3
  - LL_TIM_CHANNEL_CH4
  - LL_TIM_CHANNEL_CH5
  - LL_TIM_CHANNEL_CH6

Return values

- **None:**

Notes

- This function can only be used in Output compare and PWM modes. It does not work in Forced mode.
- Macro IS_TIM_OCXREF_CLEAR_INSTANCE(TIMx) can be used to check whether or not a timer instance can clear the OCxREF signal on an external event.

Reference Manual to LL API cross reference:

- CCMR1 OC1CE LL_TIM_OC_EnableClear
- CCMR1 OC2CE LL_TIM_OC_EnableClear
- CCMR2 OC3CE LL_TIM_OC_EnableClear
- CCMR2 OC4CE LL_TIM_OC_EnableClear
- CCMR3 OC5CE LL_TIM_OC_EnableClear
- CCMR3 OC6CE LL_TIM_OC_EnableClear

LL_TIM_OC_DisableClear

Function name

__STATIC_INLINE void LL_TIM_OC_DisableClear (TIM_TypeDef * TIMx, uint32_t Channel)

Function description

Disable clearing the output channel on an external event.

Parameters

- **TIMx:** Timer instance
- **Channel:** This parameter can be one of the following values:
  - LL_TIM_CHANNEL_CH1
  - LL_TIM_CHANNEL_CH2
  - LL_TIM_CHANNEL_CH3
  - LL_TIM_CHANNEL_CH4
  - LL_TIM_CHANNEL_CH5
  - LL_TIM_CHANNEL_CH6

Return values

- **None:**

Notes

- Macro IS_TIM_OCXREF_CLEAR_INSTANCE(TIMx) can be used to check whether or not a timer instance can clear the OCxREF signal on an external event.

Reference Manual to LL API cross reference:

- CCMR1 OC1CE LL_TIM_OC_DisableClear
- CCMR1 OC2CE LL_TIM_OC_DisableClear
- CCMR2 OC3CE LL_TIM_OC_DisableClear
- CCMR2 OC4CE LL_TIM_OC_DisableClear
- CCMR3 OC5CE LL_TIM_OC_DisableClear
- CCMR3 OC6CE LL_TIM_OC_DisableClear

LL_TIM_OC_IsEnabledClear

Function name

__STATIC_INLINE uint32_t LL_TIM_OC_IsEnabledClear (const TIM_TypeDef * TIMx, uint32_t Channel)

Function description

Indicates clearing the output channel on an external event is enabled for the output channel.

Parameters

- **TIMx:** Timer instance
- **Channel:** This parameter can be one of the following values:
  - LL_TIM_CHANNEL_CH1
  - LL_TIM_CHANNEL_CH2
  - LL_TIM_CHANNEL_CH3
  - LL_TIM_CHANNEL_CH4
  - LL_TIM_CHANNEL_CH5
  - LL_TIM_CHANNEL_CH6

Return values

- **State:** of bit (1 or 0).

Notes

- This function enables clearing the output channel on an external event.
- This function can only be used in Output compare and PWM modes. It does not work in Forced mode.
- Macro IS_TIM_OCXREF_CLEAR_INSTANCE(TIMx) can be used to check whether or not a timer instance can clear the OCxREF signal on an external event.

Reference Manual to LL API cross reference:

- CCMR1 OC1CE LL_TIM_OC_IsEnabledClear
- CCMR1 OC2CE LL_TIM_OC_IsEnabledClear
- CCMR2 OC3CE LL_TIM_OC_IsEnabledClear
- CCMR2 OC4CE LL_TIM_OC_IsEnabledClear
- CCMR3 OC5CE LL_TIM_OC_IsEnabledClear
- CCMR3 OC6CE LL_TIM_OC_IsEnabledClear

LL_TIM_OC_SetDeadTime

Function name

__STATIC_INLINE void LL_TIM_OC_SetDeadTime (TIM_TypeDef * TIMx, uint32_t DeadTime)

Function description

Set the dead-time delay (delay inserted between the rising edge of the OCxREF signal and the rising edge of the Ocx and OCxN signals).

Parameters

- **TIMx:** Timer instance
- **DeadTime:** between Min_Data=0 and Max_Data=255

Return values

- **None:**

Notes

- Macro IS_TIM_BREAK_INSTANCE(TIMx) can be used to check whether or not dead-time insertion feature is supported by a timer instance.
- Helper macro __LL_TIM_CALC_DEADTIME can be used to calculate the DeadTime parameter

Reference Manual to LL API cross reference:

- BDTR DTG LL_TIM_OC_SetDeadTime

LL_TIM_OC_SetCompareCH1

Function name

__STATIC_INLINE void LL_TIM_OC_SetCompareCH1 (TIM_TypeDef * TIMx, uint32_t CompareValue)

Function description

Set compare value for output channel 1 (TIMx_CCR1).

Parameters

- **TIMx:** Timer instance
- **CompareValue:** between Min_Data=0 and Max_Data=65535

Return values

- **None:**

Notes

- In 32-bit timer implementations compare value can be between 0x00000000 and 0xFFFFFFFF.
- Macro IS_TIM_32B_COUNTER_INSTANCE(TIMx) can be used to check whether or not a timer instance supports a 32 bits counter.
- Macro IS_TIM_CC1_INSTANCE(TIMx) can be used to check whether or not output channel 1 is supported by a timer instance.

Reference Manual to LL API cross reference:

- CCR1 CCR1 LL_TIM_OC_SetCompareCH1

LL_TIM_OC_SetCompareCH2

Function name

__STATIC_INLINE void LL_TIM_OC_SetCompareCH2 (TIM_TypeDef * TIMx, uint32_t CompareValue)

Function description

Set compare value for output channel 2 (TIMx_CCR2).

Parameters

- **TIMx:** Timer instance
- **CompareValue:** between Min_Data=0 and Max_Data=65535

Return values

- **None:**

Notes

- In 32-bit timer implementations compare value can be between 0x00000000 and 0xFFFFFFFF.
- Macro IS_TIM_32B_COUNTER_INSTANCE(TIMx) can be used to check whether or not a timer instance supports a 32 bits counter.
- Macro IS_TIM_CC2_INSTANCE(TIMx) can be used to check whether or not output channel 2 is supported by a timer instance.

Reference Manual to LL API cross reference:

- CCR2 CCR2 LL_TIM_OC_SetCompareCH2

LL_TIM_OC_SetCompareCH3

Function name

__STATIC_INLINE void LL_TIM_OC_SetCompareCH3 (TIM_TypeDef * TIMx, uint32_t CompareValue)

Function description

Set compare value for output channel 3 (TIMx_CCR3).

Parameters

- **TIMx:** Timer instance
- **CompareValue:** between Min_Data=0 and Max_Data=65535

Return values

- **None:**

Notes

- In 32-bit timer implementations compare value can be between 0x00000000 and 0xFFFFFFFF.
- Macro IS_TIM_32B_COUNTER_INSTANCE(TIMx) can be used to check whether or not a timer instance supports a 32 bits counter.
- Macro IS_TIM_CC3_INSTANCE(TIMx) can be used to check whether or not output channel is supported by a timer instance.

Reference Manual to LL API cross reference:

- CCR3 CCR3 LL_TIM_OC_SetCompareCH3

LL_TIM_OC_SetCompareCH4

Function name

__STATIC_INLINE void LL_TIM_OC_SetCompareCH4 (TIM_TypeDef * TIMx, uint32_t CompareValue)

Function description

Set compare value for output channel 4 (TIMx_CCR4).

Parameters

- **TIMx:** Timer instance
- **CompareValue:** between Min_Data=0 and Max_Data=65535

Return values

- **None:**

Notes

- In 32-bit timer implementations compare value can be between 0x00000000 and 0xFFFFFFFF.
- Macro IS_TIM_32B_COUNTER_INSTANCE(TIMx) can be used to check whether or not a timer instance supports a 32 bits counter.
- Macro IS_TIM_CC4_INSTANCE(TIMx) can be used to check whether or not output channel 4 is supported by a timer instance.

Reference Manual to LL API cross reference:

- CCR4 CCR4 LL_TIM_OC_SetCompareCH4

LL_TIM_OC_SetCompareCH5

Function name

__STATIC_INLINE void LL_TIM_OC_SetCompareCH5 (TIM_TypeDef * TIMx, uint32_t CompareValue)

Function description

Set compare value for output channel 5 (TIMx_CCR5).

Parameters

- **TIMx:** Timer instance
- **CompareValue:** between Min_Data=0 and Max_Data=65535

Return values

- **None:**

Notes

- Macro IS_TIM_CC5_INSTANCE(TIMx) can be used to check whether or not output channel 5 is supported by a timer instance.

Reference Manual to LL API cross reference:

- CCR5 CCR5 LL_TIM_OC_SetCompareCH5

LL_TIM_OC_SetCompareCH6

Function name

__STATIC_INLINE void LL_TIM_OC_SetCompareCH6 (TIM_TypeDef * TIMx, uint32_t CompareValue)

Function description

Set compare value for output channel 6 (TIMx_CCR6).

Parameters

- **TIMx:** Timer instance
- **CompareValue:** between Min_Data=0 and Max_Data=65535

Return values

- **None:**

Notes

- Macro IS_TIM_CC6_INSTANCE(TIMx) can be used to check whether or not output channel 6 is supported by a timer instance.

Reference Manual to LL API cross reference:

- CCR6 CCR6 LL_TIM_OC_SetCompareCH6

LL_TIM_OC_GetCompareCH1

Function name

__STATIC_INLINE uint32_t LL_TIM_OC_GetCompareCH1 (const TIM_TypeDef * TIMx)

Function description

Get compare value (TIMx_CCR1) set for output channel 1.

Parameters

- **TIMx:** Timer instance

Return values

- **CompareValue:** (between Min_Data=0 and Max_Data=65535)

Notes

- In 32-bit timer implementations returned compare value can be between 0x00000000 and 0xFFFFFFFF.
- Macro IS_TIM_32B_COUNTER_INSTANCE(TIMx) can be used to check whether or not a timer instance supports a 32 bits counter.
- Macro IS_TIM_CC1_INSTANCE(TIMx) can be used to check whether or not output channel 1 is supported by a timer instance.

Reference Manual to LL API cross reference:

- CCR1 CCR1 LL_TIM_OC_GetCompareCH1

LL_TIM_OC_GetCompareCH2

Function name

__STATIC_INLINE uint32_t LL_TIM_OC_GetCompareCH2 (const TIM_TypeDef * TIMx)

Function description

Get compare value (TIMx_CCR2) set for output channel 2.

Parameters

- **TIMx:** Timer instance

Return values

- **CompareValue:** (between Min_Data=0 and Max_Data=65535)

Notes

- In 32-bit timer implementations returned compare value can be between 0x00000000 and 0xFFFFFFFF.
- Macro IS_TIM_32B_COUNTER_INSTANCE(TIMx) can be used to check whether or not a timer instance supports a 32 bits counter.
- Macro IS_TIM_CC2_INSTANCE(TIMx) can be used to check whether or not output channel 2 is supported by a timer instance.

Reference Manual to LL API cross reference:

- CCR2 CCR2 LL_TIM_OC_GetCompareCH2

LL_TIM_OC_GetCompareCH3

Function name

__STATIC_INLINE uint32_t LL_TIM_OC_GetCompareCH3 (const TIM_TypeDef * TIMx)

Function description

Get compare value (TIMx_CCR3) set for output channel 3.

Parameters

- **TIMx:** Timer instance

Return values

- **CompareValue:** (between Min_Data=0 and Max_Data=65535)

Notes

- In 32-bit timer implementations returned compare value can be between 0x00000000 and 0xFFFFFFFF.
- Macro IS_TIM_32B_COUNTER_INSTANCE(TIMx) can be used to check whether or not a timer instance supports a 32 bits counter.
- Macro IS_TIM_CC3_INSTANCE(TIMx) can be used to check whether or not output channel 3 is supported by a timer instance.

Reference Manual to LL API cross reference:

- CCR3 CCR3 LL_TIM_OC_GetCompareCH3

LL_TIM_OC_GetCompareCH4

Function name

__STATIC_INLINE uint32_t LL_TIM_OC_GetCompareCH4 (const TIM_TypeDef * TIMx)

Function description

Get compare value (TIMx_CCR4) set for output channel 4.

Parameters

- **TIMx:** Timer instance

Return values

- **CompareValue:** (between Min_Data=0 and Max_Data=65535)

Notes

- In 32-bit timer implementations returned compare value can be between 0x00000000 and 0xFFFFFFFF.
- Macro IS_TIM_32B_COUNTER_INSTANCE(TIMx) can be used to check whether or not a timer instance supports a 32 bits counter.
- Macro IS_TIM_CC4_INSTANCE(TIMx) can be used to check whether or not output channel 4 is supported by a timer instance.

Reference Manual to LL API cross reference:

- CCR4 CCR4 LL_TIM_OC_GetCompareCH4

LL_TIM_OC_GetCompareCH5

Function name

__STATIC_INLINE uint32_t LL_TIM_OC_GetCompareCH5 (const TIM_TypeDef * TIMx)

Function description

Get compare value (TIMx_CCR5) set for output channel 5.

Parameters

- **TIMx:** Timer instance

Return values

- **CompareValue:** (between Min_Data=0 and Max_Data=65535)

Notes

- Macro IS_TIM_CC5_INSTANCE(TIMx) can be used to check whether or not output channel 5 is supported by a timer instance.

Reference Manual to LL API cross reference:

- CCR5 CCR5 LL_TIM_OC_GetCompareCH5

LL_TIM_OC_GetCompareCH6

Function name

__STATIC_INLINE uint32_t LL_TIM_OC_GetCompareCH6 (const TIM_TypeDef * TIMx)

Function description

Get compare value (TIMx_CCR6) set for output channel 6.

Parameters

- **TIMx:** Timer instance

Return values

- **CompareValue:** (between Min_Data=0 and Max_Data=65535)

Notes

- Macro IS_TIM_CC6_INSTANCE(TIMx) can be used to check whether or not output channel 6 is supported by a timer instance.

Reference Manual to LL API cross reference:

- CCR6 CCR6 LL_TIM_OC_GetCompareCH6

LL_TIM_SetCH5CombinedChannels

Function name

__STATIC_INLINE void LL_TIM_SetCH5CombinedChannels (TIM_TypeDef * TIMx, uint32_t GroupCH5)

Function description

Select on which reference signal the OC5REF is combined to.

Parameters

- **TIMx:** Timer instance
- **GroupCH5:** This parameter can be a combination of the following values:
  - LL_TIM_GROUPCH5_NONE
  - LL_TIM_GROUPCH5_OC1REFC
  - LL_TIM_GROUPCH5_OC2REFC
  - LL_TIM_GROUPCH5_OC3REFC

Return values

- **None:**

Notes

- Macro IS_TIM_COMBINED3PHASEPWM_INSTANCE(TIMx) can be used to check whether or not a timer instance supports the combined 3-phase PWM mode.

Reference Manual to LL API cross reference:

- CCR5 GC5C3 LL_TIM_SetCH5CombinedChannels
- CCR5 GC5C2 LL_TIM_SetCH5CombinedChannels
- CCR5 GC5C1 LL_TIM_SetCH5CombinedChannels

LL_TIM_IC_Config

Function name

__STATIC_INLINE void LL_TIM_IC_Config (TIM_TypeDef * TIMx, uint32_t Channel, uint32_t Configuration)

Function description

Configure input channel.

Parameters

- **TIMx:** Timer instance
- **Channel:** This parameter can be one of the following values:
  - LL_TIM_CHANNEL_CH1
  - LL_TIM_CHANNEL_CH2
  - LL_TIM_CHANNEL_CH3
  - LL_TIM_CHANNEL_CH4
- **Configuration:** This parameter must be a combination of all the following values:
  - LL_TIM_ACTIVEINPUT_DIRECTTI or LL_TIM_ACTIVEINPUT_INDIRECTTI or LL_TIM_ACTIVEINPUT_TRC
  - LL_TIM_ICPSC_DIV1 or ... or LL_TIM_ICPSC_DIV8
  - LL_TIM_IC_FILTER_FDIV1 or ... or LL_TIM_IC_FILTER_FDIV32_N8
  - LL_TIM_IC_POLARITY_RISING or LL_TIM_IC_POLARITY_FALLING or LL_TIM_IC_POLARITY_BOTHEDGE

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCMR1 CC1S LL_TIM_IC_Config
- CCMR1 IC1PSC LL_TIM_IC_Config
- CCMR1 IC1F LL_TIM_IC_Config
- CCMR1 CC2S LL_TIM_IC_Config
- CCMR1 IC2PSC LL_TIM_IC_Config
- CCMR1 IC2F LL_TIM_IC_Config
- CCMR2 CC3S LL_TIM_IC_Config
- CCMR2 IC3PSC LL_TIM_IC_Config
- CCMR2 IC3F LL_TIM_IC_Config
- CCMR2 CC4S LL_TIM_IC_Config
- CCMR2 IC4PSC LL_TIM_IC_Config
- CCMR2 IC4F LL_TIM_IC_Config
- CCER CC1P LL_TIM_IC_Config
- CCER CC1NP LL_TIM_IC_Config
- CCER CC2P LL_TIM_IC_Config
- CCER CC2NP LL_TIM_IC_Config
- CCER CC3P LL_TIM_IC_Config
- CCER CC3NP LL_TIM_IC_Config
- CCER CC4P LL_TIM_IC_Config
- CCER CC4NP LL_TIM_IC_Config

LL_TIM_IC_SetActiveInput

Function name

__STATIC_INLINE void LL_TIM_IC_SetActiveInput (TIM_TypeDef * TIMx, uint32_t Channel, uint32_t ICActiveInput)

Function description

Set the active input.

Parameters

- **TIMx:** Timer instance
- **Channel:** This parameter can be one of the following values:
  - LL_TIM_CHANNEL_CH1
  - LL_TIM_CHANNEL_CH2
  - LL_TIM_CHANNEL_CH3
  - LL_TIM_CHANNEL_CH4
- **ICActiveInput:** This parameter can be one of the following values:
  - LL_TIM_ACTIVEINPUT_DIRECTTI
  - LL_TIM_ACTIVEINPUT_INDIRECTTI
  - LL_TIM_ACTIVEINPUT_TRC

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCMR1 CC1S LL_TIM_IC_SetActiveInput
- CCMR1 CC2S LL_TIM_IC_SetActiveInput
- CCMR2 CC3S LL_TIM_IC_SetActiveInput
- CCMR2 CC4S LL_TIM_IC_SetActiveInput

LL_TIM_IC_GetActiveInput

Function name

__STATIC_INLINE uint32_t LL_TIM_IC_GetActiveInput (const TIM_TypeDef * TIMx, uint32_t Channel)

Function description

Get the current active input.

Parameters

- **TIMx:** Timer instance
- **Channel:** This parameter can be one of the following values:
  - LL_TIM_CHANNEL_CH1
  - LL_TIM_CHANNEL_CH2
  - LL_TIM_CHANNEL_CH3
  - LL_TIM_CHANNEL_CH4

Return values

- **Returned:** value can be one of the following values:
  - LL_TIM_ACTIVEINPUT_DIRECTTI
  - LL_TIM_ACTIVEINPUT_INDIRECTTI
  - LL_TIM_ACTIVEINPUT_TRC

Reference Manual to LL API cross reference:

- CCMR1 CC1S LL_TIM_IC_GetActiveInput
- CCMR1 CC2S LL_TIM_IC_GetActiveInput
- CCMR2 CC3S LL_TIM_IC_GetActiveInput
- CCMR2 CC4S LL_TIM_IC_GetActiveInput

LL_TIM_IC_SetPrescaler

Function name

__STATIC_INLINE void LL_TIM_IC_SetPrescaler (TIM_TypeDef * TIMx, uint32_t Channel, uint32_t ICPrescaler)

Function description

Set the prescaler of input channel.

Parameters

- **TIMx:** Timer instance
- **Channel:** This parameter can be one of the following values:
  - LL_TIM_CHANNEL_CH1
  - LL_TIM_CHANNEL_CH2
  - LL_TIM_CHANNEL_CH3
  - LL_TIM_CHANNEL_CH4
- **ICPrescaler:** This parameter can be one of the following values:
  - LL_TIM_ICPSC_DIV1
  - LL_TIM_ICPSC_DIV2
  - LL_TIM_ICPSC_DIV4
  - LL_TIM_ICPSC_DIV8

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCMR1 IC1PSC LL_TIM_IC_SetPrescaler
- CCMR1 IC2PSC LL_TIM_IC_SetPrescaler
- CCMR2 IC3PSC LL_TIM_IC_SetPrescaler
- CCMR2 IC4PSC LL_TIM_IC_SetPrescaler

LL_TIM_IC_GetPrescaler

Function name

__STATIC_INLINE uint32_t LL_TIM_IC_GetPrescaler (const TIM_TypeDef * TIMx, uint32_t Channel)

Function description

Get the current prescaler value acting on an input channel.

Parameters

- **TIMx:** Timer instance
- **Channel:** This parameter can be one of the following values:
  - LL_TIM_CHANNEL_CH1
  - LL_TIM_CHANNEL_CH2
  - LL_TIM_CHANNEL_CH3
  - LL_TIM_CHANNEL_CH4

Return values

- **Returned:** value can be one of the following values:
  - LL_TIM_ICPSC_DIV1
  - LL_TIM_ICPSC_DIV2
  - LL_TIM_ICPSC_DIV4
  - LL_TIM_ICPSC_DIV8

Reference Manual to LL API cross reference:

- CCMR1 IC1PSC LL_TIM_IC_GetPrescaler
- CCMR1 IC2PSC LL_TIM_IC_GetPrescaler
- CCMR2 IC3PSC LL_TIM_IC_GetPrescaler
- CCMR2 IC4PSC LL_TIM_IC_GetPrescaler

LL_TIM_IC_SetFilter

Function name

__STATIC_INLINE void LL_TIM_IC_SetFilter (TIM_TypeDef * TIMx, uint32_t Channel, uint32_t ICFilter)

Function description

Set the input filter duration.

Parameters

- **TIMx:** Timer instance
- **Channel:** This parameter can be one of the following values:
  - LL_TIM_CHANNEL_CH1
  - LL_TIM_CHANNEL_CH2
  - LL_TIM_CHANNEL_CH3
  - LL_TIM_CHANNEL_CH4
- **ICFilter:** This parameter can be one of the following values:
  - LL_TIM_IC_FILTER_FDIV1
  - LL_TIM_IC_FILTER_FDIV1_N2
  - LL_TIM_IC_FILTER_FDIV1_N4
  - LL_TIM_IC_FILTER_FDIV1_N8
  - LL_TIM_IC_FILTER_FDIV2_N6
  - LL_TIM_IC_FILTER_FDIV2_N8
  - LL_TIM_IC_FILTER_FDIV4_N6
  - LL_TIM_IC_FILTER_FDIV4_N8
  - LL_TIM_IC_FILTER_FDIV8_N6
  - LL_TIM_IC_FILTER_FDIV8_N8
  - LL_TIM_IC_FILTER_FDIV16_N5
  - LL_TIM_IC_FILTER_FDIV16_N6
  - LL_TIM_IC_FILTER_FDIV16_N8
  - LL_TIM_IC_FILTER_FDIV32_N5
  - LL_TIM_IC_FILTER_FDIV32_N6
  - LL_TIM_IC_FILTER_FDIV32_N8

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCMR1 IC1F LL_TIM_IC_SetFilter
- CCMR1 IC2F LL_TIM_IC_SetFilter
- CCMR2 IC3F LL_TIM_IC_SetFilter
- CCMR2 IC4F LL_TIM_IC_SetFilter

LL_TIM_IC_GetFilter

Function name

__STATIC_INLINE uint32_t LL_TIM_IC_GetFilter (const TIM_TypeDef * TIMx, uint32_t Channel)

Function description

Get the input filter duration.

Parameters

- **TIMx:** Timer instance
- **Channel:** This parameter can be one of the following values:
  - LL_TIM_CHANNEL_CH1
  - LL_TIM_CHANNEL_CH2
  - LL_TIM_CHANNEL_CH3
  - LL_TIM_CHANNEL_CH4

Return values

- **Returned:** value can be one of the following values:
  - LL_TIM_IC_FILTER_FDIV1
  - LL_TIM_IC_FILTER_FDIV1_N2
  - LL_TIM_IC_FILTER_FDIV1_N4
  - LL_TIM_IC_FILTER_FDIV1_N8
  - LL_TIM_IC_FILTER_FDIV2_N6
  - LL_TIM_IC_FILTER_FDIV2_N8
  - LL_TIM_IC_FILTER_FDIV4_N6
  - LL_TIM_IC_FILTER_FDIV4_N8
  - LL_TIM_IC_FILTER_FDIV8_N6
  - LL_TIM_IC_FILTER_FDIV8_N8
  - LL_TIM_IC_FILTER_FDIV16_N5
  - LL_TIM_IC_FILTER_FDIV16_N6
  - LL_TIM_IC_FILTER_FDIV16_N8
  - LL_TIM_IC_FILTER_FDIV32_N5
  - LL_TIM_IC_FILTER_FDIV32_N6
  - LL_TIM_IC_FILTER_FDIV32_N8

Reference Manual to LL API cross reference:

- CCMR1 IC1F LL_TIM_IC_GetFilter
- CCMR1 IC2F LL_TIM_IC_GetFilter
- CCMR2 IC3F LL_TIM_IC_GetFilter
- CCMR2 IC4F LL_TIM_IC_GetFilter

LL_TIM_IC_SetPolarity

Function name

__STATIC_INLINE void LL_TIM_IC_SetPolarity (TIM_TypeDef * TIMx, uint32_t Channel, uint32_t ICPolarity)

Function description

Set the input channel polarity.

Parameters

- **TIMx:** Timer instance
- **Channel:** This parameter can be one of the following values:
  - LL_TIM_CHANNEL_CH1
  - LL_TIM_CHANNEL_CH2
  - LL_TIM_CHANNEL_CH3
  - LL_TIM_CHANNEL_CH4
- **ICPolarity:** This parameter can be one of the following values:
  - LL_TIM_IC_POLARITY_RISING
  - LL_TIM_IC_POLARITY_FALLING
  - LL_TIM_IC_POLARITY_BOTHEDGE

Return values

- **None:**

Reference Manual to LL API cross reference:

- CCER CC1P LL_TIM_IC_SetPolarity
- CCER CC1NP LL_TIM_IC_SetPolarity
- CCER CC2P LL_TIM_IC_SetPolarity
- CCER CC2NP LL_TIM_IC_SetPolarity
- CCER CC3P LL_TIM_IC_SetPolarity
- CCER CC3NP LL_TIM_IC_SetPolarity
- CCER CC4P LL_TIM_IC_SetPolarity
- CCER CC4NP LL_TIM_IC_SetPolarity

LL_TIM_IC_GetPolarity

Function name

__STATIC_INLINE uint32_t LL_TIM_IC_GetPolarity (const TIM_TypeDef * TIMx, uint32_t Channel)

Function description

Get the current input channel polarity.

Parameters

- **TIMx:** Timer instance
- **Channel:** This parameter can be one of the following values:
  - LL_TIM_CHANNEL_CH1
  - LL_TIM_CHANNEL_CH2
  - LL_TIM_CHANNEL_CH3
  - LL_TIM_CHANNEL_CH4

Return values

- **Returned:** value can be one of the following values:
  - LL_TIM_IC_POLARITY_RISING
  - LL_TIM_IC_POLARITY_FALLING
  - LL_TIM_IC_POLARITY_BOTHEDGE

Reference Manual to LL API cross reference:

- CCER CC1P LL_TIM_IC_GetPolarity
- CCER CC1NP LL_TIM_IC_GetPolarity
- CCER CC2P LL_TIM_IC_GetPolarity
- CCER CC2NP LL_TIM_IC_GetPolarity
- CCER CC3P LL_TIM_IC_GetPolarity
- CCER CC3NP LL_TIM_IC_GetPolarity
- CCER CC4P LL_TIM_IC_GetPolarity
- CCER CC4NP LL_TIM_IC_GetPolarity

LL_TIM_IC_EnableXORCombination

Function name

__STATIC_INLINE void LL_TIM_IC_EnableXORCombination (TIM_TypeDef * TIMx)

Function description

Connect the TIMx_CH1, CH2 and CH3 pins to the TI1 input (XOR combination).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Notes

- Macro IS_TIM_XOR_INSTANCE(TIMx) can be used to check whether or not a timer instance provides an XOR input.

Reference Manual to LL API cross reference:

- CR2 TI1S LL_TIM_IC_EnableXORCombination

LL_TIM_IC_DisableXORCombination

Function name

__STATIC_INLINE void LL_TIM_IC_DisableXORCombination (TIM_TypeDef * TIMx)

Function description

Disconnect the TIMx_CH1, CH2 and CH3 pins from the TI1 input.

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Notes

- Macro IS_TIM_XOR_INSTANCE(TIMx) can be used to check whether or not a timer instance provides an XOR input.

Reference Manual to LL API cross reference:

- CR2 TI1S LL_TIM_IC_DisableXORCombination

LL_TIM_IC_IsEnabledXORCombination

Function name

__STATIC_INLINE uint32_t LL_TIM_IC_IsEnabledXORCombination (const TIM_TypeDef * TIMx)

Function description

Indicates whether the TIMx_CH1, CH2 and CH3 pins are connectected to the TI1 input.

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_TIM_XOR_INSTANCE(TIMx) can be used to check whether or not a timer instance provides an XOR input.

Reference Manual to LL API cross reference:

- CR2 TI1S LL_TIM_IC_IsEnabledXORCombination

LL_TIM_IC_GetCaptureCH1

Function name

__STATIC_INLINE uint32_t LL_TIM_IC_GetCaptureCH1 (const TIM_TypeDef * TIMx)

Function description

Get captured value for input channel 1.

Parameters

- **TIMx:** Timer instance

Return values

- **CapturedValue:** (between Min_Data=0 and Max_Data=65535)

Notes

- In 32-bit timer implementations returned captured value can be between 0x00000000 and 0xFFFFFFFF.
- Macro IS_TIM_32B_COUNTER_INSTANCE(TIMx) can be used to check whether or not a timer instance supports a 32 bits counter.
- Macro IS_TIM_CC1_INSTANCE(TIMx) can be used to check whether or not input channel 1 is supported by a timer instance.

Reference Manual to LL API cross reference:

- CCR1 CCR1 LL_TIM_IC_GetCaptureCH1

LL_TIM_IC_GetCaptureCH2

Function name

__STATIC_INLINE uint32_t LL_TIM_IC_GetCaptureCH2 (const TIM_TypeDef * TIMx)

Function description

Get captured value for input channel 2.

Parameters

- **TIMx:** Timer instance

Return values

- **CapturedValue:** (between Min_Data=0 and Max_Data=65535)

Notes

- In 32-bit timer implementations returned captured value can be between 0x00000000 and 0xFFFFFFFF.
- Macro IS_TIM_32B_COUNTER_INSTANCE(TIMx) can be used to check whether or not a timer instance supports a 32 bits counter.
- Macro IS_TIM_CC2_INSTANCE(TIMx) can be used to check whether or not input channel 2 is supported by a timer instance.

Reference Manual to LL API cross reference:

- CCR2 CCR2 LL_TIM_IC_GetCaptureCH2

LL_TIM_IC_GetCaptureCH3

Function name

__STATIC_INLINE uint32_t LL_TIM_IC_GetCaptureCH3 (const TIM_TypeDef * TIMx)

Function description

Get captured value for input channel 3.

Parameters

- **TIMx:** Timer instance

Return values

- **CapturedValue:** (between Min_Data=0 and Max_Data=65535)

Notes

- In 32-bit timer implementations returned captured value can be between 0x00000000 and 0xFFFFFFFF.
- Macro IS_TIM_32B_COUNTER_INSTANCE(TIMx) can be used to check whether or not a timer instance supports a 32 bits counter.
- Macro IS_TIM_CC3_INSTANCE(TIMx) can be used to check whether or not input channel 3 is supported by a timer instance.

Reference Manual to LL API cross reference:

- CCR3 CCR3 LL_TIM_IC_GetCaptureCH3

LL_TIM_IC_GetCaptureCH4

Function name

__STATIC_INLINE uint32_t LL_TIM_IC_GetCaptureCH4 (const TIM_TypeDef * TIMx)

Function description

Get captured value for input channel 4.

Parameters

- **TIMx:** Timer instance

Return values

- **CapturedValue:** (between Min_Data=0 and Max_Data=65535)

Notes

- In 32-bit timer implementations returned captured value can be between 0x00000000 and 0xFFFFFFFF.
- Macro IS_TIM_32B_COUNTER_INSTANCE(TIMx) can be used to check whether or not a timer instance supports a 32 bits counter.
- Macro IS_TIM_CC4_INSTANCE(TIMx) can be used to check whether or not input channel 4 is supported by a timer instance.

Reference Manual to LL API cross reference:

- CCR4 CCR4 LL_TIM_IC_GetCaptureCH4

LL_TIM_EnableExternalClock

Function name

__STATIC_INLINE void LL_TIM_EnableExternalClock (TIM_TypeDef * TIMx)

Function description

Enable external clock mode 2.

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Notes

- When external clock mode 2 is enabled the counter is clocked by any active edge on the ETRF signal.
- Macro IS_TIM_CLOCKSOURCE_ETRMODE2_INSTANCE(TIMx) can be used to check whether or not a timer instance supports external clock mode2.

Reference Manual to LL API cross reference:

- SMCR ECE LL_TIM_EnableExternalClock

LL_TIM_DisableExternalClock

Function name

__STATIC_INLINE void LL_TIM_DisableExternalClock (TIM_TypeDef * TIMx)

Function description

Disable external clock mode 2.

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Notes

- Macro IS_TIM_CLOCKSOURCE_ETRMODE2_INSTANCE(TIMx) can be used to check whether or not a timer instance supports external clock mode2.

Reference Manual to LL API cross reference:

- SMCR ECE LL_TIM_DisableExternalClock

LL_TIM_IsEnabledExternalClock

Function name

__STATIC_INLINE uint32_t LL_TIM_IsEnabledExternalClock (const TIM_TypeDef * TIMx)

Function description

Indicate whether external clock mode 2 is enabled.

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_TIM_CLOCKSOURCE_ETRMODE2_INSTANCE(TIMx) can be used to check whether or not a timer instance supports external clock mode2.

Reference Manual to LL API cross reference:

- SMCR ECE LL_TIM_IsEnabledExternalClock

LL_TIM_SetClockSource

Function name

__STATIC_INLINE void LL_TIM_SetClockSource (TIM_TypeDef * TIMx, uint32_t ClockSource)

Function description

Set the clock source of the counter clock.

Parameters

- **TIMx:** Timer instance
- **ClockSource:** This parameter can be one of the following values:
  - LL_TIM_CLOCKSOURCE_INTERNAL
  - LL_TIM_CLOCKSOURCE_EXT_MODE1
  - LL_TIM_CLOCKSOURCE_EXT_MODE2

Return values

- **None:**

Notes

- when selected clock source is external clock mode 1, the timer input the external clock is applied is selected by calling the LL_TIM_SetTriggerInput() function. This timer input must be configured by calling the LL_TIM_IC_Config() function.
- Macro IS_TIM_CLOCKSOURCE_ETRMODE1_INSTANCE(TIMx) can be used to check whether or not a timer instance supports external clock mode1.
- Macro IS_TIM_CLOCKSOURCE_ETRMODE2_INSTANCE(TIMx) can be used to check whether or not a timer instance supports external clock mode2.

Reference Manual to LL API cross reference:

- SMCR SMS LL_TIM_SetClockSource
- SMCR ECE LL_TIM_SetClockSource

LL_TIM_SetEncoderMode

Function name

__STATIC_INLINE void LL_TIM_SetEncoderMode (TIM_TypeDef * TIMx, uint32_t EncoderMode)

Function description

Set the encoder interface mode.

Parameters

- **TIMx:** Timer instance
- **EncoderMode:** This parameter can be one of the following values:
  - LL_TIM_ENCODERMODE_X2_TI1
  - LL_TIM_ENCODERMODE_X2_TI2
  - LL_TIM_ENCODERMODE_X4_TI12

Return values

- **None:**

Notes

- Macro IS_TIM_ENCODER_INTERFACE_INSTANCE(TIMx) can be used to check whether or not a timer instance supports the encoder mode.

Reference Manual to LL API cross reference:

- SMCR SMS LL_TIM_SetEncoderMode

LL_TIM_SetTriggerOutput

Function name

__STATIC_INLINE void LL_TIM_SetTriggerOutput (TIM_TypeDef * TIMx, uint32_t TimerSynchronization)

Function description

Set the trigger output (TRGO) used for timer synchronization .

Parameters

- **TIMx:** Timer instance
- **TimerSynchronization:** This parameter can be one of the following values:
  - LL_TIM_TRGO_RESET
  - LL_TIM_TRGO_ENABLE
  - LL_TIM_TRGO_UPDATE
  - LL_TIM_TRGO_CC1IF
  - LL_TIM_TRGO_OC1REF
  - LL_TIM_TRGO_OC2REF
  - LL_TIM_TRGO_OC3REF
  - LL_TIM_TRGO_OC4REF

Return values

- **None:**

Notes

- Macro IS_TIM_MASTER_INSTANCE(TIMx) can be used to check whether or not a timer instance can operate as a master timer.

Reference Manual to LL API cross reference:

- CR2 MMS LL_TIM_SetTriggerOutput

LL_TIM_SetTriggerOutput2

Function name

__STATIC_INLINE void LL_TIM_SetTriggerOutput2 (TIM_TypeDef * TIMx, uint32_t ADCSynchronization)

Function description

Set the trigger output 2 (TRGO2) used for ADC synchronization .

Parameters

- **TIMx:** Timer Instance
- **ADCSynchronization:** This parameter can be one of the following values:
  - LL_TIM_TRGO2_RESET
  - LL_TIM_TRGO2_ENABLE
  - LL_TIM_TRGO2_UPDATE
  - LL_TIM_TRGO2_CC1F
  - LL_TIM_TRGO2_OC1
  - LL_TIM_TRGO2_OC2
  - LL_TIM_TRGO2_OC3
  - LL_TIM_TRGO2_OC4
  - LL_TIM_TRGO2_OC5
  - LL_TIM_TRGO2_OC6
  - LL_TIM_TRGO2_OC4_RISINGFALLING
  - LL_TIM_TRGO2_OC6_RISINGFALLING
  - LL_TIM_TRGO2_OC4_RISING_OC6_RISING
  - LL_TIM_TRGO2_OC4_RISING_OC6_FALLING
  - LL_TIM_TRGO2_OC5_RISING_OC6_RISING
  - LL_TIM_TRGO2_OC5_RISING_OC6_FALLING

Return values

- **None:**

Notes

- Macro IS_TIM_TRGO2_INSTANCE(TIMx) can be used to check whether or not a timer instance can be used for ADC synchronization.

Reference Manual to LL API cross reference:

- CR2 MMS2 LL_TIM_SetTriggerOutput2

LL_TIM_SetSlaveMode

Function name

__STATIC_INLINE void LL_TIM_SetSlaveMode (TIM_TypeDef * TIMx, uint32_t SlaveMode)

Function description

Set the synchronization mode of a slave timer.

Parameters

- **TIMx:** Timer instance
- **SlaveMode:** This parameter can be one of the following values:
  - LL_TIM_SLAVEMODE_DISABLED
  - LL_TIM_SLAVEMODE_RESET
  - LL_TIM_SLAVEMODE_GATED
  - LL_TIM_SLAVEMODE_TRIGGER
  - LL_TIM_SLAVEMODE_COMBINED_RESETTRIGGER

Return values

- **None:**

Notes

- Macro IS_TIM_SLAVE_INSTANCE(TIMx) can be used to check whether or not a timer instance can operate as a slave timer.

Reference Manual to LL API cross reference:

- SMCR SMS LL_TIM_SetSlaveMode

LL_TIM_SetTriggerInput

Function name

__STATIC_INLINE void LL_TIM_SetTriggerInput (TIM_TypeDef * TIMx, uint32_t TriggerInput)

Function description

Set the selects the trigger input to be used to synchronize the counter.

Parameters

- **TIMx:** Timer instance
- **TriggerInput:** This parameter can be one of the following values:
  - LL_TIM_TS_ITR0
  - LL_TIM_TS_ITR1
  - LL_TIM_TS_ITR2
  - LL_TIM_TS_ITR7
  - LL_TIM_TS_TI1F_ED
  - LL_TIM_TS_TI1FP1
  - LL_TIM_TS_TI2FP2
  - LL_TIM_TS_ETRF

Return values

- **None:**

Notes

- Macro IS_TIM_SLAVE_INSTANCE(TIMx) can be used to check whether or not a timer instance can operate as a slave timer.

Reference Manual to LL API cross reference:

- SMCR TS LL_TIM_SetTriggerInput

LL_TIM_EnableMasterSlaveMode

Function name

__STATIC_INLINE void LL_TIM_EnableMasterSlaveMode (TIM_TypeDef * TIMx)

Function description

Enable the Master/Slave mode.

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Notes

- Macro IS_TIM_SLAVE_INSTANCE(TIMx) can be used to check whether or not a timer instance can operate as a slave timer.

Reference Manual to LL API cross reference:

- SMCR MSM LL_TIM_EnableMasterSlaveMode

LL_TIM_DisableMasterSlaveMode

Function name

__STATIC_INLINE void LL_TIM_DisableMasterSlaveMode (TIM_TypeDef * TIMx)

Function description

Disable the Master/Slave mode.

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Notes

- Macro IS_TIM_SLAVE_INSTANCE(TIMx) can be used to check whether or not a timer instance can operate as a slave timer.

Reference Manual to LL API cross reference:

- SMCR MSM LL_TIM_DisableMasterSlaveMode

LL_TIM_IsEnabledMasterSlaveMode

Function name

__STATIC_INLINE uint32_t LL_TIM_IsEnabledMasterSlaveMode (const TIM_TypeDef * TIMx)

Function description

Indicates whether the Master/Slave mode is enabled.

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_TIM_SLAVE_INSTANCE(TIMx) can be used to check whether or not a timer instance can operate as a slave timer.

Reference Manual to LL API cross reference:

- SMCR MSM LL_TIM_IsEnabledMasterSlaveMode

LL_TIM_ConfigETR

Function name

__STATIC_INLINE void LL_TIM_ConfigETR (TIM_TypeDef * TIMx, uint32_t ETRPolarity, uint32_t ETRPrescaler, uint32_t ETRFilter)

Function description

Configure the external trigger (ETR) input.

Parameters

- **TIMx:** Timer instance
- **ETRPolarity:** This parameter can be one of the following values:
  - LL_TIM_ETR_POLARITY_NONINVERTED
  - LL_TIM_ETR_POLARITY_INVERTED
- **ETRPrescaler:** This parameter can be one of the following values:
  - LL_TIM_ETR_PRESCALER_DIV1
  - LL_TIM_ETR_PRESCALER_DIV2
  - LL_TIM_ETR_PRESCALER_DIV4
  - LL_TIM_ETR_PRESCALER_DIV8
- **ETRFilter:** This parameter can be one of the following values:
  - LL_TIM_ETR_FILTER_FDIV1
  - LL_TIM_ETR_FILTER_FDIV1_N2
  - LL_TIM_ETR_FILTER_FDIV1_N4
  - LL_TIM_ETR_FILTER_FDIV1_N8
  - LL_TIM_ETR_FILTER_FDIV2_N6
  - LL_TIM_ETR_FILTER_FDIV2_N8
  - LL_TIM_ETR_FILTER_FDIV4_N6
  - LL_TIM_ETR_FILTER_FDIV4_N8
  - LL_TIM_ETR_FILTER_FDIV8_N6
  - LL_TIM_ETR_FILTER_FDIV8_N8
  - LL_TIM_ETR_FILTER_FDIV16_N5
  - LL_TIM_ETR_FILTER_FDIV16_N6
  - LL_TIM_ETR_FILTER_FDIV16_N8
  - LL_TIM_ETR_FILTER_FDIV32_N5
  - LL_TIM_ETR_FILTER_FDIV32_N6
  - LL_TIM_ETR_FILTER_FDIV32_N8

Return values

- **None:**

Notes

- Macro IS_TIM_ETR_INSTANCE(TIMx) can be used to check whether or not a timer instance provides an external trigger input.

Reference Manual to LL API cross reference:

- SMCR ETP LL_TIM_ConfigETR
- SMCR ETPS LL_TIM_ConfigETR
- SMCR ETF LL_TIM_ConfigETR

LL_TIM_SetETRSource

Function name

__STATIC_INLINE void LL_TIM_SetETRSource (TIM_TypeDef * TIMx, uint32_t ETRSource)

Function description

Select the external trigger (ETR) input source.

Parameters

- **TIMx:** Timer instance
- **ETRSource:** This parameter can be one of the following values:

Return values

- **None:**

Notes

- Macro IS_TIM_ETRSEL_INSTANCE(TIMx) can be used to check whether or not a timer instance supports ETR source selection.

Reference Manual to LL API cross reference:

- AF1 ETRSEL LL_TIM_SetETRSource

LL_TIM_EnableBRK

Function name

__STATIC_INLINE void LL_TIM_EnableBRK (TIM_TypeDef * TIMx)

Function description

Enable the break function.

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Notes

- Macro IS_TIM_BREAK_INSTANCE(TIMx) can be used to check whether or not a timer instance provides a break input.

Reference Manual to LL API cross reference:

- BDTR BKE LL_TIM_EnableBRK

LL_TIM_DisableBRK

Function name

__STATIC_INLINE void LL_TIM_DisableBRK (TIM_TypeDef * TIMx)

Function description

Disable the break function.

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Notes

- Macro IS_TIM_BREAK_INSTANCE(TIMx) can be used to check whether or not a timer instance provides a break input.

Reference Manual to LL API cross reference:

- BDTR BKE LL_TIM_DisableBRK

LL_TIM_ConfigBRK

Function name

__STATIC_INLINE void LL_TIM_ConfigBRK (TIM_TypeDef * TIMx, uint32_t BreakPolarity, uint32_t BreakFilter, uint32_t BreakAFMode)

Function description

Configure the break input.

Parameters

- **TIMx:** Timer instance
- **BreakPolarity:** This parameter can be one of the following values:
  - LL_TIM_BREAK_POLARITY_LOW
  - LL_TIM_BREAK_POLARITY_HIGH
- **BreakFilter:** This parameter can be one of the following values:
  - LL_TIM_BREAK_FILTER_FDIV1
  - LL_TIM_BREAK_FILTER_FDIV1_N2
  - LL_TIM_BREAK_FILTER_FDIV1_N4
  - LL_TIM_BREAK_FILTER_FDIV1_N8
  - LL_TIM_BREAK_FILTER_FDIV2_N6
  - LL_TIM_BREAK_FILTER_FDIV2_N8
  - LL_TIM_BREAK_FILTER_FDIV4_N6
  - LL_TIM_BREAK_FILTER_FDIV4_N8
  - LL_TIM_BREAK_FILTER_FDIV8_N6
  - LL_TIM_BREAK_FILTER_FDIV8_N8
  - LL_TIM_BREAK_FILTER_FDIV16_N5
  - LL_TIM_BREAK_FILTER_FDIV16_N6
  - LL_TIM_BREAK_FILTER_FDIV16_N8
  - LL_TIM_BREAK_FILTER_FDIV32_N5
  - LL_TIM_BREAK_FILTER_FDIV32_N6
  - LL_TIM_BREAK_FILTER_FDIV32_N8
- **BreakAFMode:** This parameter can be one of the following values:
  - LL_TIM_BREAK_AFMODE_INPUT
  - LL_TIM_BREAK_AFMODE_BIDIRECTIONAL

Return values

- **None:**

Notes

- Macro IS_TIM_BREAK_INSTANCE(TIMx) can be used to check whether or not a timer instance provides a break input.
- Bidirectional mode is only supported by advanced timer instances. Macro IS_TIM_ADVANCED_INSTANCE(TIMx) can be used to check whether or not a timer instance is an advanced-control timer.
- In bidirectional mode (BKBID bit set), the Break input is configured both in input mode and in open drain output mode. Any active Break event will assert a low logic level on the Break input to indicate an internal break event to external devices.
- When bidirectional mode isn't supported, BreakAFMode must be set to LL_TIM_BREAK_AFMODE_INPUT.

Reference Manual to LL API cross reference:

- BDTR BKP LL_TIM_ConfigBRK
- BDTR BKF LL_TIM_ConfigBRK
- BDTR BKBID LL_TIM_ConfigBRK

LL_TIM_DisarmBRK

Function name

__STATIC_INLINE void LL_TIM_DisarmBRK (TIM_TypeDef * TIMx)

Function description

Disarm the break input (when it operates in bidirectional mode).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Notes

- The break input can be disarmed only when it is configured in bidirectional mode and when when MOE is reset.
- Purpose is to be able to have the input voltage back to high-state, whatever the time constant on the output .

Reference Manual to LL API cross reference:

- BDTR BKDSRM LL_TIM_DisarmBRK

LL_TIM_EnableBRK2

Function name

__STATIC_INLINE void LL_TIM_EnableBRK2 (TIM_TypeDef * TIMx)

Function description

Enable the break 2 function.

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Notes

- Macro IS_TIM_BKIN2_INSTANCE(TIMx) can be used to check whether or not a timer instance provides a second break input.

Reference Manual to LL API cross reference:

- BDTR BK2E LL_TIM_EnableBRK2

LL_TIM_DisableBRK2

Function name

__STATIC_INLINE void LL_TIM_DisableBRK2 (TIM_TypeDef * TIMx)

Function description

Disable the break 2 function.

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Notes

- Macro IS_TIM_BKIN2_INSTANCE(TIMx) can be used to check whether or not a timer instance provides a second break input.

Reference Manual to LL API cross reference:

- BDTR BK2E LL_TIM_DisableBRK2

LL_TIM_ConfigBRK2

Function name

__STATIC_INLINE void LL_TIM_ConfigBRK2 (TIM_TypeDef * TIMx, uint32_t Break2Polarity, uint32_t Break2Filter, uint32_t Break2AFMode)

Function description

Configure the break 2 input.

Parameters

- **TIMx:** Timer instance
- **Break2Polarity:** This parameter can be one of the following values:
  - LL_TIM_BREAK2_POLARITY_LOW
  - LL_TIM_BREAK2_POLARITY_HIGH
- **Break2Filter:** This parameter can be one of the following values:
  - LL_TIM_BREAK2_FILTER_FDIV1
  - LL_TIM_BREAK2_FILTER_FDIV1_N2
  - LL_TIM_BREAK2_FILTER_FDIV1_N4
  - LL_TIM_BREAK2_FILTER_FDIV1_N8
  - LL_TIM_BREAK2_FILTER_FDIV2_N6
  - LL_TIM_BREAK2_FILTER_FDIV2_N8
  - LL_TIM_BREAK2_FILTER_FDIV4_N6
  - LL_TIM_BREAK2_FILTER_FDIV4_N8
  - LL_TIM_BREAK2_FILTER_FDIV8_N6
  - LL_TIM_BREAK2_FILTER_FDIV8_N8
  - LL_TIM_BREAK2_FILTER_FDIV16_N5
  - LL_TIM_BREAK2_FILTER_FDIV16_N6
  - LL_TIM_BREAK2_FILTER_FDIV16_N8
  - LL_TIM_BREAK2_FILTER_FDIV32_N5
  - LL_TIM_BREAK2_FILTER_FDIV32_N6
  - LL_TIM_BREAK2_FILTER_FDIV32_N8
- **Break2AFMode:** This parameter can be one of the following values:
  - LL_TIM_BREAK2_AFMODE_INPUT
  - LL_TIM_BREAK2_AFMODE_BIDIRECTIONAL

Return values

- **None:**

Notes

- Macro IS_TIM_BKIN2_INSTANCE(TIMx) can be used to check whether or not a timer instance provides a second break input.
- Bidirectional mode is only supported by advanced timer instances. Macro IS_TIM_ADVANCED_INSTANCE(TIMx) can be used to check whether or not a timer instance is an advanced-control timer.
- In bidirectional mode (BK2BID bit set), the Break 2 input is configured both in input mode and in open drain output mode. Any active Break event will assert a low logic level on the Break 2 input to indicate an internal break event to external devices.
- When bidirectional mode isn't supported, Break2AFMode must be set to LL_TIM_BREAK2_AFMODE_INPUT.

Reference Manual to LL API cross reference:

- BDTR BK2P LL_TIM_ConfigBRK2
- BDTR BK2F LL_TIM_ConfigBRK2
- BDTR BK2BID LL_TIM_ConfigBRK2

LL_TIM_DisarmBRK2

Function name

__STATIC_INLINE void LL_TIM_DisarmBRK2 (TIM_TypeDef * TIMx)

Function description

Disarm the break 2 input (when it operates in bidirectional mode).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Notes

- The break 2 input can be disarmed only when it is configured in bidirectional mode and when when MOE is reset.
- Purpose is to be able to have the input voltage back to high-state, whatever the time constant on the output.

Reference Manual to LL API cross reference:

- BDTR BK2DSRM LL_TIM_DisarmBRK2

LL_TIM_SetOffStates

Function name

__STATIC_INLINE void LL_TIM_SetOffStates (TIM_TypeDef * TIMx, uint32_t OffStateIdle, uint32_t OffStateRun)

Function description

Select the outputs off state (enabled v.s.

Parameters

- **TIMx:** Timer instance
- **OffStateIdle:** This parameter can be one of the following values:
  - LL_TIM_OSSI_DISABLE
  - LL_TIM_OSSI_ENABLE
- **OffStateRun:** This parameter can be one of the following values:
  - LL_TIM_OSSR_DISABLE
  - LL_TIM_OSSR_ENABLE

Return values

- **None:**

Notes

- Macro IS_TIM_BREAK_INSTANCE(TIMx) can be used to check whether or not a timer instance provides a break input.

Reference Manual to LL API cross reference:

- BDTR OSSI LL_TIM_SetOffStates
- BDTR OSSR LL_TIM_SetOffStates

LL_TIM_EnableAutomaticOutput

Function name

__STATIC_INLINE void LL_TIM_EnableAutomaticOutput (TIM_TypeDef * TIMx)

Function description

Enable automatic output (MOE can be set by software or automatically when a break input is active).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Notes

- Macro IS_TIM_BREAK_INSTANCE(TIMx) can be used to check whether or not a timer instance provides a break input.

Reference Manual to LL API cross reference:

- BDTR AOE LL_TIM_EnableAutomaticOutput

LL_TIM_DisableAutomaticOutput

Function name

__STATIC_INLINE void LL_TIM_DisableAutomaticOutput (TIM_TypeDef * TIMx)

Function description

Disable automatic output (MOE can be set only by software).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Notes

- Macro IS_TIM_BREAK_INSTANCE(TIMx) can be used to check whether or not a timer instance provides a break input.

Reference Manual to LL API cross reference:

- BDTR AOE LL_TIM_DisableAutomaticOutput

LL_TIM_IsEnabledAutomaticOutput

Function name

__STATIC_INLINE uint32_t LL_TIM_IsEnabledAutomaticOutput (const TIM_TypeDef * TIMx)

Function description

Indicate whether automatic output is enabled.

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_TIM_BREAK_INSTANCE(TIMx) can be used to check whether or not a timer instance provides a break input.

Reference Manual to LL API cross reference:

- BDTR AOE LL_TIM_IsEnabledAutomaticOutput

LL_TIM_EnableAllOutputs

Function name

__STATIC_INLINE void LL_TIM_EnableAllOutputs (TIM_TypeDef * TIMx)

Function description

Enable the outputs (set the MOE bit in TIMx_BDTR register).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Notes

- The MOE bit in TIMx_BDTR register allows to enable /disable the outputs by software and is reset in case of break or break2 event
- Macro IS_TIM_BREAK_INSTANCE(TIMx) can be used to check whether or not a timer instance provides a break input.

Reference Manual to LL API cross reference:

- BDTR MOE LL_TIM_EnableAllOutputs

LL_TIM_DisableAllOutputs

Function name

__STATIC_INLINE void LL_TIM_DisableAllOutputs (TIM_TypeDef * TIMx)

Function description

Disable the outputs (reset the MOE bit in TIMx_BDTR register).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Notes

- The MOE bit in TIMx_BDTR register allows to enable /disable the outputs by software and is reset in case of break or break2 event.
- Macro IS_TIM_BREAK_INSTANCE(TIMx) can be used to check whether or not a timer instance provides a break input.

Reference Manual to LL API cross reference:

- BDTR MOE LL_TIM_DisableAllOutputs

LL_TIM_IsEnabledAllOutputs

Function name

__STATIC_INLINE uint32_t LL_TIM_IsEnabledAllOutputs (const TIM_TypeDef * TIMx)

Function description

Indicates whether outputs are enabled.

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_TIM_BREAK_INSTANCE(TIMx) can be used to check whether or not a timer instance provides a break input.

Reference Manual to LL API cross reference:

- BDTR MOE LL_TIM_IsEnabledAllOutputs

LL_TIM_EnableBreakInputSource

Function name

__STATIC_INLINE void LL_TIM_EnableBreakInputSource (TIM_TypeDef * TIMx, uint32_t BreakInput, uint32_t Source)

Function description

Enable the signals connected to the designated timer break input.

Parameters

- **TIMx:** Timer instance
- **BreakInput:** This parameter can be one of the following values:
  - LL_TIM_BREAK_INPUT_BKIN
  - LL_TIM_BREAK_INPUT_BKIN2
- **Source:** This parameter can be one of the following values:
  - LL_TIM_BKIN_SOURCE_BKIN
  - LL_TIM_BKIN_SOURCE_BKCOMP1
  - LL_TIM_BKIN_SOURCE_BKCOMP2 (*)

  (*) Value not defined in all devices.

Return values

- **None:**

Notes

- Macro IS_TIM_BREAKSOURCE_INSTANCE(TIMx) can be used to check whether or not a timer instance allows for break input selection.

Reference Manual to LL API cross reference:

- AF1 BKINE LL_TIM_EnableBreakInputSource
- AF1 BKCMP1E LL_TIM_EnableBreakInputSource
- AF1 BKCMP2E LL_TIM_EnableBreakInputSource
- AF2 BK2INE LL_TIM_EnableBreakInputSource
- AF2 BK2CMP1E LL_TIM_EnableBreakInputSource
- AF2 BK2CMP2E LL_TIM_EnableBreakInputSource
-

LL_TIM_DisableBreakInputSource

Function name

__STATIC_INLINE void LL_TIM_DisableBreakInputSource (TIM_TypeDef * TIMx, uint32_t BreakInput, uint32_t Source)

Function description

Disable the signals connected to the designated timer break input.

Parameters

- **TIMx:** Timer instance
- **BreakInput:** This parameter can be one of the following values:
  - LL_TIM_BREAK_INPUT_BKIN
  - LL_TIM_BREAK_INPUT_BKIN2
- **Source:** This parameter can be one of the following values:
  - LL_TIM_BKIN_SOURCE_BKIN
  - LL_TIM_BKIN_SOURCE_BKCOMP1
  - LL_TIM_BKIN_SOURCE_BKCOMP2 (*)

  (*) Value not defined in all devices.

Return values

- **None:**

Notes

- Macro IS_TIM_BREAKSOURCE_INSTANCE(TIMx) can be used to check whether or not a timer instance allows for break input selection.

Reference Manual to LL API cross reference:

- AF1 BKINE LL_TIM_DisableBreakInputSource
- AF1 BKCMP1E LL_TIM_DisableBreakInputSource
- AF1 BKCMP2E LL_TIM_DisableBreakInputSource
- AF2 BK2INE LL_TIM_DisableBreakInputSource
- AF2 BK2CMP1E LL_TIM_DisableBreakInputSource
- AF2 BK2CMP2E LL_TIM_DisableBreakInputSource
-

LL_TIM_SetBreakInputSourcePolarity

Function name

__STATIC_INLINE void LL_TIM_SetBreakInputSourcePolarity (TIM_TypeDef * TIMx, uint32_t BreakInput, uint32_t Source, uint32_t Polarity)

Function description

Set the polarity of the break signal for the timer break input.

Parameters

- **TIMx:** Timer instance
- **BreakInput:** This parameter can be one of the following values:
  - LL_TIM_BREAK_INPUT_BKIN
  - LL_TIM_BREAK_INPUT_BKIN2
- **Source:** This parameter can be one of the following values:
  - LL_TIM_BKIN_SOURCE_BKIN
  - LL_TIM_BKIN_SOURCE_BKCOMP1
  - LL_TIM_BKIN_SOURCE_BKCOMP2 (*)
- **Polarity:** This parameter can be one of the following values:
  - LL_TIM_BKIN_POLARITY_LOW
  - LL_TIM_BKIN_POLARITY_HIGH

(*) Value not defined in all devices.

Return values

- **None:**

Notes

- Macro IS_TIM_BREAKSOURCE_INSTANCE(TIMx) can be used to check whether or not a timer instance allows for break input selection.

Reference Manual to LL API cross reference:

- AF1 BKINP LL_TIM_SetBreakInputSourcePolarity
- AF1 BKCMP1P LL_TIM_SetBreakInputSourcePolarity
- AF1 BKCMP2P LL_TIM_SetBreakInputSourcePolarity
- AF2 BK2INP LL_TIM_SetBreakInputSourcePolarity
- AF2 BK2CMP1P LL_TIM_SetBreakInputSourcePolarity
- AF2 BK2CMP2P LL_TIM_SetBreakInputSourcePolarity

LL_TIM_ConfigDMABurst

Function name

__STATIC_INLINE void LL_TIM_ConfigDMABurst (TIM_TypeDef * TIMx, uint32_t DMABurstBaseAddress, uint32_t DMABurstLength)

Function description

Configures the timer DMA burst feature.

Parameters

- **TIMx:** Timer instance
- **DMABurstBaseAddress:** This parameter can be one of the following values:
  - LL_TIM_DMABURST_BASEADDR_CR1
  - LL_TIM_DMABURST_BASEADDR_CR2
  - LL_TIM_DMABURST_BASEADDR_SMCR
  - LL_TIM_DMABURST_BASEADDR_DIER
  - LL_TIM_DMABURST_BASEADDR_SR
  - LL_TIM_DMABURST_BASEADDR_EGR
  - LL_TIM_DMABURST_BASEADDR_CCMR1
  - LL_TIM_DMABURST_BASEADDR_CCMR2
  - LL_TIM_DMABURST_BASEADDR_CCER
  - LL_TIM_DMABURST_BASEADDR_CNT
  - LL_TIM_DMABURST_BASEADDR_PSC
  - LL_TIM_DMABURST_BASEADDR_ARR
  - LL_TIM_DMABURST_BASEADDR_RCR
  - LL_TIM_DMABURST_BASEADDR_CCR1
  - LL_TIM_DMABURST_BASEADDR_CCR2
  - LL_TIM_DMABURST_BASEADDR_CCR3
  - LL_TIM_DMABURST_BASEADDR_CCR4
  - LL_TIM_DMABURST_BASEADDR_BDTR
  - LL_TIM_DMABURST_BASEADDR_OR1
  - LL_TIM_DMABURST_BASEADDR_CCMR3
  - LL_TIM_DMABURST_BASEADDR_CCR5
  - LL_TIM_DMABURST_BASEADDR_CCR6
  - LL_TIM_DMABURST_BASEADDR_AF1
  - LL_TIM_DMABURST_BASEADDR_AF2
  - LL_TIM_DMABURST_BASEADDR_TISEL
- **DMABurstLength:** This parameter can be one of the following values:
  - LL_TIM_DMABURST_LENGTH_1TRANSFER
  - LL_TIM_DMABURST_LENGTH_2TRANSFERS
  - LL_TIM_DMABURST_LENGTH_3TRANSFERS
  - LL_TIM_DMABURST_LENGTH_4TRANSFERS
  - LL_TIM_DMABURST_LENGTH_5TRANSFERS
  - LL_TIM_DMABURST_LENGTH_6TRANSFERS
  - LL_TIM_DMABURST_LENGTH_7TRANSFERS
  - LL_TIM_DMABURST_LENGTH_8TRANSFERS
  - LL_TIM_DMABURST_LENGTH_9TRANSFERS
  - LL_TIM_DMABURST_LENGTH_10TRANSFERS
  - LL_TIM_DMABURST_LENGTH_11TRANSFERS
  - LL_TIM_DMABURST_LENGTH_12TRANSFERS
  - LL_TIM_DMABURST_LENGTH_13TRANSFERS
  - LL_TIM_DMABURST_LENGTH_14TRANSFERS
  - LL_TIM_DMABURST_LENGTH_15TRANSFERS
  - LL_TIM_DMABURST_LENGTH_16TRANSFERS
  - LL_TIM_DMABURST_LENGTH_17TRANSFERS
  - LL_TIM_DMABURST_LENGTH_18TRANSFERS

Return values

- **None:**

Notes

- Macro IS_TIM_DMABURST_INSTANCE(TIMx) can be used to check whether or not a timer instance supports the DMA burst mode.

Reference Manual to LL API cross reference:

- DCR DBL LL_TIM_ConfigDMABurst
- DCR DBA LL_TIM_ConfigDMABurst

LL_TIM_SetRemap

Function name

__STATIC_INLINE void LL_TIM_SetRemap (TIM_TypeDef * TIMx, uint32_t Remap)

Function description

Remap TIM inputs (input channel, internal/external triggers).

Parameters

- **TIMx:** Timer instance
- **Remap:** Remap param depends on the TIMx. Description available only in CHM version of the User Manual (not in .pdf). Otherwise see Reference Manual description of TISEL registers.

Return values

- **None:**

Notes

- Macro IS_TIM_REMAP_INSTANCE(TIMx) can be used to check whether or not a some timer inputs can be remapped.

Reference Manual to LL API cross reference:

- TIM1_TISEL TI1SEL LL_TIM_SetRemap
- TIM1_TISEL TI2SEL LL_TIM_SetRemap
- TIM2_TISEL TI1SEL LL_TIM_SetRemap
- TIM2_TISEL TI2SEL LL_TIM_SetRemap
- TIM3_TISEL TI1SEL LL_TIM_SetRemap
- TIM3_TISEL TI2SEL LL_TIM_SetRemap
- TIM15_TISEL TI1SEL LL_TIM_SetRemap
- TIM15_TISEL TI2SEL LL_TIM_SetRemap
- TIM16_TISEL TI1SEL LL_TIM_SetRemap
-

LL_TIM_SetOCRefClearInputSource

Function name

__STATIC_INLINE void LL_TIM_SetOCRefClearInputSource (TIM_TypeDef * TIMx, uint32_t OCRefClearInputSource)

Function description

Set the OCREF clear input source.

Parameters

- **TIMx:** Timer instance
- **OCRefClearInputSource:** This parameter can be one of the following values:
  - LL_TIM_OCREF_CLR_INT_ETR
  - LL_TIM_OCREF_CLR_INT_COMP1
  - LL_TIM_OCREF_CLR_INT_COMP2 (*)

  (*) Value not defined in all devices.
-

Return values

- **None:**

Notes

- The OCxREF signal of a given channel can be cleared when a high level is applied on the OCREF_CLR_INPUT
- This function can only be used in Output compare and PWM modes.

Reference Manual to LL API cross reference:

- SMCR OCCS LL_TIM_SetOCRefClearInputSource
- OR1 OCREF_CLR LL_TIM_SetOCRefClearInputSource

LL_TIM_ClearFlag_UPDATE

Function name

__STATIC_INLINE void LL_TIM_ClearFlag_UPDATE (TIM_TypeDef * TIMx)

Function description

Clear the update interrupt flag (UIF).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- SR UIF LL_TIM_ClearFlag_UPDATE

LL_TIM_IsActiveFlag_UPDATE

Function name

__STATIC_INLINE uint32_t LL_TIM_IsActiveFlag_UPDATE (const TIM_TypeDef * TIMx)

Function description

Indicate whether update interrupt flag (UIF) is set (update interrupt is pending).

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR UIF LL_TIM_IsActiveFlag_UPDATE

LL_TIM_ClearFlag_CC1

Function name

__STATIC_INLINE void LL_TIM_ClearFlag_CC1 (TIM_TypeDef * TIMx)

Function description

Clear the Capture/Compare 1 interrupt flag (CC1F).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- SR CC1IF LL_TIM_ClearFlag_CC1

LL_TIM_IsActiveFlag_CC1

Function name

__STATIC_INLINE uint32_t LL_TIM_IsActiveFlag_CC1 (const TIM_TypeDef * TIMx)

Function description

Indicate whether Capture/Compare 1 interrupt flag (CC1F) is set (Capture/Compare 1 interrupt is pending).

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR CC1IF LL_TIM_IsActiveFlag_CC1

LL_TIM_ClearFlag_CC2

Function name

__STATIC_INLINE void LL_TIM_ClearFlag_CC2 (TIM_TypeDef * TIMx)

Function description

Clear the Capture/Compare 2 interrupt flag (CC2F).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- SR CC2IF LL_TIM_ClearFlag_CC2

LL_TIM_IsActiveFlag_CC2

Function name

__STATIC_INLINE uint32_t LL_TIM_IsActiveFlag_CC2 (const TIM_TypeDef * TIMx)

Function description

Indicate whether Capture/Compare 2 interrupt flag (CC2F) is set (Capture/Compare 2 interrupt is pending).

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR CC2IF LL_TIM_IsActiveFlag_CC2

LL_TIM_ClearFlag_CC3

Function name

__STATIC_INLINE void LL_TIM_ClearFlag_CC3 (TIM_TypeDef * TIMx)

Function description

Clear the Capture/Compare 3 interrupt flag (CC3F).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- SR CC3IF LL_TIM_ClearFlag_CC3

LL_TIM_IsActiveFlag_CC3

Function name

__STATIC_INLINE uint32_t LL_TIM_IsActiveFlag_CC3 (const TIM_TypeDef * TIMx)

Function description

Indicate whether Capture/Compare 3 interrupt flag (CC3F) is set (Capture/Compare 3 interrupt is pending).

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR CC3IF LL_TIM_IsActiveFlag_CC3

LL_TIM_ClearFlag_CC4

Function name

__STATIC_INLINE void LL_TIM_ClearFlag_CC4 (TIM_TypeDef * TIMx)

Function description

Clear the Capture/Compare 4 interrupt flag (CC4F).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- SR CC4IF LL_TIM_ClearFlag_CC4

LL_TIM_IsActiveFlag_CC4

Function name

__STATIC_INLINE uint32_t LL_TIM_IsActiveFlag_CC4 (const TIM_TypeDef * TIMx)

Function description

Indicate whether Capture/Compare 4 interrupt flag (CC4F) is set (Capture/Compare 4 interrupt is pending).

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR CC4IF LL_TIM_IsActiveFlag_CC4

LL_TIM_ClearFlag_CC5

Function name

__STATIC_INLINE void LL_TIM_ClearFlag_CC5 (TIM_TypeDef * TIMx)

Function description

Clear the Capture/Compare 5 interrupt flag (CC5F).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- SR CC5IF LL_TIM_ClearFlag_CC5

LL_TIM_IsActiveFlag_CC5

Function name

__STATIC_INLINE uint32_t LL_TIM_IsActiveFlag_CC5 (const TIM_TypeDef * TIMx)

Function description

Indicate whether Capture/Compare 5 interrupt flag (CC5F) is set (Capture/Compare 5 interrupt is pending).

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR CC5IF LL_TIM_IsActiveFlag_CC5

LL_TIM_ClearFlag_CC6

Function name

__STATIC_INLINE void LL_TIM_ClearFlag_CC6 (TIM_TypeDef * TIMx)

Function description

Clear the Capture/Compare 6 interrupt flag (CC6F).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- SR CC6IF LL_TIM_ClearFlag_CC6

LL_TIM_IsActiveFlag_CC6

Function name

__STATIC_INLINE uint32_t LL_TIM_IsActiveFlag_CC6 (const TIM_TypeDef * TIMx)

Function description

Indicate whether Capture/Compare 6 interrupt flag (CC6F) is set (Capture/Compare 6 interrupt is pending).

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR CC6IF LL_TIM_IsActiveFlag_CC6

LL_TIM_ClearFlag_COM

Function name

__STATIC_INLINE void LL_TIM_ClearFlag_COM (TIM_TypeDef * TIMx)

Function description

Clear the commutation interrupt flag (COMIF).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- SR COMIF LL_TIM_ClearFlag_COM

LL_TIM_IsActiveFlag_COM

Function name

__STATIC_INLINE uint32_t LL_TIM_IsActiveFlag_COM (const TIM_TypeDef * TIMx)

Function description

Indicate whether commutation interrupt flag (COMIF) is set (commutation interrupt is pending).

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR COMIF LL_TIM_IsActiveFlag_COM

LL_TIM_ClearFlag_TRIG

Function name

__STATIC_INLINE void LL_TIM_ClearFlag_TRIG (TIM_TypeDef * TIMx)

Function description

Clear the trigger interrupt flag (TIF).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- SR TIF LL_TIM_ClearFlag_TRIG

LL_TIM_IsActiveFlag_TRIG

Function name

__STATIC_INLINE uint32_t LL_TIM_IsActiveFlag_TRIG (const TIM_TypeDef * TIMx)

Function description

Indicate whether trigger interrupt flag (TIF) is set (trigger interrupt is pending).

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR TIF LL_TIM_IsActiveFlag_TRIG

LL_TIM_ClearFlag_BRK

Function name

__STATIC_INLINE void LL_TIM_ClearFlag_BRK (TIM_TypeDef * TIMx)

Function description

Clear the break interrupt flag (BIF).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- SR BIF LL_TIM_ClearFlag_BRK

LL_TIM_IsActiveFlag_BRK

Function name

__STATIC_INLINE uint32_t LL_TIM_IsActiveFlag_BRK (const TIM_TypeDef * TIMx)

Function description

Indicate whether break interrupt flag (BIF) is set (break interrupt is pending).

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR BIF LL_TIM_IsActiveFlag_BRK

LL_TIM_ClearFlag_BRK2

Function name

__STATIC_INLINE void LL_TIM_ClearFlag_BRK2 (TIM_TypeDef * TIMx)

Function description

Clear the break 2 interrupt flag (B2IF).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- SR B2IF LL_TIM_ClearFlag_BRK2

LL_TIM_IsActiveFlag_BRK2

Function name

__STATIC_INLINE uint32_t LL_TIM_IsActiveFlag_BRK2 (const TIM_TypeDef * TIMx)

Function description

Indicate whether break 2 interrupt flag (B2IF) is set (break 2 interrupt is pending).

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR B2IF LL_TIM_IsActiveFlag_BRK2

LL_TIM_ClearFlag_CC1OVR

Function name

__STATIC_INLINE void LL_TIM_ClearFlag_CC1OVR (TIM_TypeDef * TIMx)

Function description

Clear the Capture/Compare 1 over-capture interrupt flag (CC1OF).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- SR CC1OF LL_TIM_ClearFlag_CC1OVR

LL_TIM_IsActiveFlag_CC1OVR

Function name

__STATIC_INLINE uint32_t LL_TIM_IsActiveFlag_CC1OVR (const TIM_TypeDef * TIMx)

Function description

Indicate whether Capture/Compare 1 over-capture interrupt flag (CC1OF) is set (Capture/Compare 1 interrupt is pending).

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR CC1OF LL_TIM_IsActiveFlag_CC1OVR

LL_TIM_ClearFlag_CC2OVR

Function name

__STATIC_INLINE void LL_TIM_ClearFlag_CC2OVR (TIM_TypeDef * TIMx)

Function description

Clear the Capture/Compare 2 over-capture interrupt flag (CC2OF).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- SR CC2OF LL_TIM_ClearFlag_CC2OVR

LL_TIM_IsActiveFlag_CC2OVR

Function name

__STATIC_INLINE uint32_t LL_TIM_IsActiveFlag_CC2OVR (const TIM_TypeDef * TIMx)

Function description

Indicate whether Capture/Compare 2 over-capture interrupt flag (CC2OF) is set (Capture/Compare 2 over-capture interrupt is pending).

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR CC2OF LL_TIM_IsActiveFlag_CC2OVR

LL_TIM_ClearFlag_CC3OVR

Function name

__STATIC_INLINE void LL_TIM_ClearFlag_CC3OVR (TIM_TypeDef * TIMx)

Function description

Clear the Capture/Compare 3 over-capture interrupt flag (CC3OF).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- SR CC3OF LL_TIM_ClearFlag_CC3OVR

LL_TIM_IsActiveFlag_CC3OVR

Function name

__STATIC_INLINE uint32_t LL_TIM_IsActiveFlag_CC3OVR (const TIM_TypeDef * TIMx)

Function description

Indicate whether Capture/Compare 3 over-capture interrupt flag (CC3OF) is set (Capture/Compare 3 over-capture interrupt is pending).

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR CC3OF LL_TIM_IsActiveFlag_CC3OVR

LL_TIM_ClearFlag_CC4OVR

Function name

__STATIC_INLINE void LL_TIM_ClearFlag_CC4OVR (TIM_TypeDef * TIMx)

Function description

Clear the Capture/Compare 4 over-capture interrupt flag (CC4OF).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- SR CC4OF LL_TIM_ClearFlag_CC4OVR

LL_TIM_IsActiveFlag_CC4OVR

Function name

__STATIC_INLINE uint32_t LL_TIM_IsActiveFlag_CC4OVR (const TIM_TypeDef * TIMx)

Function description

Indicate whether Capture/Compare 4 over-capture interrupt flag (CC4OF) is set (Capture/Compare 4 over-capture interrupt is pending).

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR CC4OF LL_TIM_IsActiveFlag_CC4OVR

LL_TIM_ClearFlag_SYSBRK

Function name

__STATIC_INLINE void LL_TIM_ClearFlag_SYSBRK (TIM_TypeDef * TIMx)

Function description

Clear the system break interrupt flag (SBIF).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- SR SBIF LL_TIM_ClearFlag_SYSBRK

LL_TIM_IsActiveFlag_SYSBRK

Function name

__STATIC_INLINE uint32_t LL_TIM_IsActiveFlag_SYSBRK (const TIM_TypeDef * TIMx)

Function description

Indicate whether system break interrupt flag (SBIF) is set (system break interrupt is pending).

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- SR SBIF LL_TIM_IsActiveFlag_SYSBRK

LL_TIM_EnableIT_UPDATE

Function name

__STATIC_INLINE void LL_TIM_EnableIT_UPDATE (TIM_TypeDef * TIMx)

Function description

Enable update interrupt (UIE).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER UIE LL_TIM_EnableIT_UPDATE

LL_TIM_DisableIT_UPDATE

Function name

__STATIC_INLINE void LL_TIM_DisableIT_UPDATE (TIM_TypeDef * TIMx)

Function description

Disable update interrupt (UIE).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER UIE LL_TIM_DisableIT_UPDATE

LL_TIM_IsEnabledIT_UPDATE

Function name

__STATIC_INLINE uint32_t LL_TIM_IsEnabledIT_UPDATE (const TIM_TypeDef * TIMx)

Function description

Indicates whether the update interrupt (UIE) is enabled.

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- DIER UIE LL_TIM_IsEnabledIT_UPDATE

LL_TIM_EnableIT_CC1

Function name

__STATIC_INLINE void LL_TIM_EnableIT_CC1 (TIM_TypeDef * TIMx)

Function description

Enable capture/compare 1 interrupt (CC1IE).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC1IE LL_TIM_EnableIT_CC1

LL_TIM_DisableIT_CC1

Function name

__STATIC_INLINE void LL_TIM_DisableIT_CC1 (TIM_TypeDef * TIMx)

Function description

Disable capture/compare 1 interrupt (CC1IE).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC1IE LL_TIM_DisableIT_CC1

LL_TIM_IsEnabledIT_CC1

Function name

__STATIC_INLINE uint32_t LL_TIM_IsEnabledIT_CC1 (const TIM_TypeDef * TIMx)

Function description

Indicates whether the capture/compare 1 interrupt (CC1IE) is enabled.

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- DIER CC1IE LL_TIM_IsEnabledIT_CC1

LL_TIM_EnableIT_CC2

Function name

__STATIC_INLINE void LL_TIM_EnableIT_CC2 (TIM_TypeDef * TIMx)

Function description

Enable capture/compare 2 interrupt (CC2IE).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC2IE LL_TIM_EnableIT_CC2

LL_TIM_DisableIT_CC2

Function name

__STATIC_INLINE void LL_TIM_DisableIT_CC2 (TIM_TypeDef * TIMx)

Function description

Disable capture/compare 2 interrupt (CC2IE).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC2IE LL_TIM_DisableIT_CC2

LL_TIM_IsEnabledIT_CC2

Function name

__STATIC_INLINE uint32_t LL_TIM_IsEnabledIT_CC2 (const TIM_TypeDef * TIMx)

Function description

Indicates whether the capture/compare 2 interrupt (CC2IE) is enabled.

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- DIER CC2IE LL_TIM_IsEnabledIT_CC2

LL_TIM_EnableIT_CC3

Function name

__STATIC_INLINE void LL_TIM_EnableIT_CC3 (TIM_TypeDef * TIMx)

Function description

Enable capture/compare 3 interrupt (CC3IE).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC3IE LL_TIM_EnableIT_CC3

LL_TIM_DisableIT_CC3

Function name

__STATIC_INLINE void LL_TIM_DisableIT_CC3 (TIM_TypeDef * TIMx)

Function description

Disable capture/compare 3 interrupt (CC3IE).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC3IE LL_TIM_DisableIT_CC3

LL_TIM_IsEnabledIT_CC3

Function name

__STATIC_INLINE uint32_t LL_TIM_IsEnabledIT_CC3 (const TIM_TypeDef * TIMx)

Function description

Indicates whether the capture/compare 3 interrupt (CC3IE) is enabled.

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- DIER CC3IE LL_TIM_IsEnabledIT_CC3

LL_TIM_EnableIT_CC4

Function name

__STATIC_INLINE void LL_TIM_EnableIT_CC4 (TIM_TypeDef * TIMx)

Function description

Enable capture/compare 4 interrupt (CC4IE).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC4IE LL_TIM_EnableIT_CC4

LL_TIM_DisableIT_CC4

Function name

__STATIC_INLINE void LL_TIM_DisableIT_CC4 (TIM_TypeDef * TIMx)

Function description

Disable capture/compare 4 interrupt (CC4IE).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC4IE LL_TIM_DisableIT_CC4

LL_TIM_IsEnabledIT_CC4

Function name

__STATIC_INLINE uint32_t LL_TIM_IsEnabledIT_CC4 (const TIM_TypeDef * TIMx)

Function description

Indicates whether the capture/compare 4 interrupt (CC4IE) is enabled.

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- DIER CC4IE LL_TIM_IsEnabledIT_CC4

LL_TIM_EnableIT_COM

Function name

__STATIC_INLINE void LL_TIM_EnableIT_COM (TIM_TypeDef * TIMx)

Function description

Enable commutation interrupt (COMIE).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER COMIE LL_TIM_EnableIT_COM

LL_TIM_DisableIT_COM

Function name

__STATIC_INLINE void LL_TIM_DisableIT_COM (TIM_TypeDef * TIMx)

Function description

Disable commutation interrupt (COMIE).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER COMIE LL_TIM_DisableIT_COM

LL_TIM_IsEnabledIT_COM

Function name

__STATIC_INLINE uint32_t LL_TIM_IsEnabledIT_COM (const TIM_TypeDef * TIMx)

Function description

Indicates whether the commutation interrupt (COMIE) is enabled.

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- DIER COMIE LL_TIM_IsEnabledIT_COM

LL_TIM_EnableIT_TRIG

Function name

__STATIC_INLINE void LL_TIM_EnableIT_TRIG (TIM_TypeDef * TIMx)

Function description

Enable trigger interrupt (TIE).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER TIE LL_TIM_EnableIT_TRIG

LL_TIM_DisableIT_TRIG

Function name

__STATIC_INLINE void LL_TIM_DisableIT_TRIG (TIM_TypeDef * TIMx)

Function description

Disable trigger interrupt (TIE).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER TIE LL_TIM_DisableIT_TRIG

LL_TIM_IsEnabledIT_TRIG

Function name

__STATIC_INLINE uint32_t LL_TIM_IsEnabledIT_TRIG (const TIM_TypeDef * TIMx)

Function description

Indicates whether the trigger interrupt (TIE) is enabled.

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- DIER TIE LL_TIM_IsEnabledIT_TRIG

LL_TIM_EnableIT_BRK

Function name

__STATIC_INLINE void LL_TIM_EnableIT_BRK (TIM_TypeDef * TIMx)

Function description

Enable break interrupt (BIE).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER BIE LL_TIM_EnableIT_BRK

LL_TIM_DisableIT_BRK

Function name

__STATIC_INLINE void LL_TIM_DisableIT_BRK (TIM_TypeDef * TIMx)

Function description

Disable break interrupt (BIE).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER BIE LL_TIM_DisableIT_BRK

LL_TIM_IsEnabledIT_BRK

Function name

__STATIC_INLINE uint32_t LL_TIM_IsEnabledIT_BRK (const TIM_TypeDef * TIMx)

Function description

Indicates whether the break interrupt (BIE) is enabled.

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- DIER BIE LL_TIM_IsEnabledIT_BRK

LL_TIM_EnableDMAReq_UPDATE

Function name

__STATIC_INLINE void LL_TIM_EnableDMAReq_UPDATE (TIM_TypeDef * TIMx)

Function description

Enable update DMA request (UDE).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER UDE LL_TIM_EnableDMAReq_UPDATE

LL_TIM_DisableDMAReq_UPDATE

Function name

__STATIC_INLINE void LL_TIM_DisableDMAReq_UPDATE (TIM_TypeDef * TIMx)

Function description

Disable update DMA request (UDE).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER UDE LL_TIM_DisableDMAReq_UPDATE

LL_TIM_IsEnabledDMAReq_UPDATE

Function name

__STATIC_INLINE uint32_t LL_TIM_IsEnabledDMAReq_UPDATE (const TIM_TypeDef * TIMx)

Function description

Indicates whether the update DMA request (UDE) is enabled.

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- DIER UDE LL_TIM_IsEnabledDMAReq_UPDATE

LL_TIM_EnableDMAReq_CC1

Function name

__STATIC_INLINE void LL_TIM_EnableDMAReq_CC1 (TIM_TypeDef * TIMx)

Function description

Enable capture/compare 1 DMA request (CC1DE).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC1DE LL_TIM_EnableDMAReq_CC1

LL_TIM_DisableDMAReq_CC1

Function name

__STATIC_INLINE void LL_TIM_DisableDMAReq_CC1 (TIM_TypeDef * TIMx)

Function description

Disable capture/compare 1 DMA request (CC1DE).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC1DE LL_TIM_DisableDMAReq_CC1

LL_TIM_IsEnabledDMAReq_CC1

Function name

__STATIC_INLINE uint32_t LL_TIM_IsEnabledDMAReq_CC1 (const TIM_TypeDef * TIMx)

Function description

Indicates whether the capture/compare 1 DMA request (CC1DE) is enabled.

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- DIER CC1DE LL_TIM_IsEnabledDMAReq_CC1

LL_TIM_EnableDMAReq_CC2

Function name

__STATIC_INLINE void LL_TIM_EnableDMAReq_CC2 (TIM_TypeDef * TIMx)

Function description

Enable capture/compare 2 DMA request (CC2DE).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC2DE LL_TIM_EnableDMAReq_CC2

LL_TIM_DisableDMAReq_CC2

Function name

__STATIC_INLINE void LL_TIM_DisableDMAReq_CC2 (TIM_TypeDef * TIMx)

Function description

Disable capture/compare 2 DMA request (CC2DE).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC2DE LL_TIM_DisableDMAReq_CC2

LL_TIM_IsEnabledDMAReq_CC2

Function name

__STATIC_INLINE uint32_t LL_TIM_IsEnabledDMAReq_CC2 (const TIM_TypeDef * TIMx)

Function description

Indicates whether the capture/compare 2 DMA request (CC2DE) is enabled.

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- DIER CC2DE LL_TIM_IsEnabledDMAReq_CC2

LL_TIM_EnableDMAReq_CC3

Function name

__STATIC_INLINE void LL_TIM_EnableDMAReq_CC3 (TIM_TypeDef * TIMx)

Function description

Enable capture/compare 3 DMA request (CC3DE).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC3DE LL_TIM_EnableDMAReq_CC3

LL_TIM_DisableDMAReq_CC3

Function name

__STATIC_INLINE void LL_TIM_DisableDMAReq_CC3 (TIM_TypeDef * TIMx)

Function description

Disable capture/compare 3 DMA request (CC3DE).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC3DE LL_TIM_DisableDMAReq_CC3

LL_TIM_IsEnabledDMAReq_CC3

Function name

__STATIC_INLINE uint32_t LL_TIM_IsEnabledDMAReq_CC3 (const TIM_TypeDef * TIMx)

Function description

Indicates whether the capture/compare 3 DMA request (CC3DE) is enabled.

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- DIER CC3DE LL_TIM_IsEnabledDMAReq_CC3

LL_TIM_EnableDMAReq_CC4

Function name

__STATIC_INLINE void LL_TIM_EnableDMAReq_CC4 (TIM_TypeDef * TIMx)

Function description

Enable capture/compare 4 DMA request (CC4DE).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC4DE LL_TIM_EnableDMAReq_CC4

LL_TIM_DisableDMAReq_CC4

Function name

__STATIC_INLINE void LL_TIM_DisableDMAReq_CC4 (TIM_TypeDef * TIMx)

Function description

Disable capture/compare 4 DMA request (CC4DE).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER CC4DE LL_TIM_DisableDMAReq_CC4

LL_TIM_IsEnabledDMAReq_CC4

Function name

__STATIC_INLINE uint32_t LL_TIM_IsEnabledDMAReq_CC4 (const TIM_TypeDef * TIMx)

Function description

Indicates whether the capture/compare 4 DMA request (CC4DE) is enabled.

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- DIER CC4DE LL_TIM_IsEnabledDMAReq_CC4

LL_TIM_EnableDMAReq_COM

Function name

__STATIC_INLINE void LL_TIM_EnableDMAReq_COM (TIM_TypeDef * TIMx)

Function description

Enable commutation DMA request (COMDE).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER COMDE LL_TIM_EnableDMAReq_COM

LL_TIM_DisableDMAReq_COM

Function name

__STATIC_INLINE void LL_TIM_DisableDMAReq_COM (TIM_TypeDef * TIMx)

Function description

Disable commutation DMA request (COMDE).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER COMDE LL_TIM_DisableDMAReq_COM

LL_TIM_IsEnabledDMAReq_COM

Function name

__STATIC_INLINE uint32_t LL_TIM_IsEnabledDMAReq_COM (const TIM_TypeDef * TIMx)

Function description

Indicates whether the commutation DMA request (COMDE) is enabled.

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- DIER COMDE LL_TIM_IsEnabledDMAReq_COM

LL_TIM_EnableDMAReq_TRIG

Function name

__STATIC_INLINE void LL_TIM_EnableDMAReq_TRIG (TIM_TypeDef * TIMx)

Function description

Enable trigger interrupt (TDE).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER TDE LL_TIM_EnableDMAReq_TRIG

LL_TIM_DisableDMAReq_TRIG

Function name

__STATIC_INLINE void LL_TIM_DisableDMAReq_TRIG (TIM_TypeDef * TIMx)

Function description

Disable trigger interrupt (TDE).

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- DIER TDE LL_TIM_DisableDMAReq_TRIG

LL_TIM_IsEnabledDMAReq_TRIG

Function name

__STATIC_INLINE uint32_t LL_TIM_IsEnabledDMAReq_TRIG (const TIM_TypeDef * TIMx)

Function description

Indicates whether the trigger interrupt (TDE) is enabled.

Parameters

- **TIMx:** Timer instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- DIER TDE LL_TIM_IsEnabledDMAReq_TRIG

LL_TIM_GenerateEvent_UPDATE

Function name

__STATIC_INLINE void LL_TIM_GenerateEvent_UPDATE (TIM_TypeDef * TIMx)

Function description

Generate an update event.

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- EGR UG LL_TIM_GenerateEvent_UPDATE

LL_TIM_GenerateEvent_CC1

Function name

__STATIC_INLINE void LL_TIM_GenerateEvent_CC1 (TIM_TypeDef * TIMx)

Function description

Generate Capture/Compare 1 event.

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- EGR CC1G LL_TIM_GenerateEvent_CC1

LL_TIM_GenerateEvent_CC2

Function name

__STATIC_INLINE void LL_TIM_GenerateEvent_CC2 (TIM_TypeDef * TIMx)

Function description

Generate Capture/Compare 2 event.

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- EGR CC2G LL_TIM_GenerateEvent_CC2

LL_TIM_GenerateEvent_CC3

Function name

__STATIC_INLINE void LL_TIM_GenerateEvent_CC3 (TIM_TypeDef * TIMx)

Function description

Generate Capture/Compare 3 event.

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- EGR CC3G LL_TIM_GenerateEvent_CC3

LL_TIM_GenerateEvent_CC4

Function name

__STATIC_INLINE void LL_TIM_GenerateEvent_CC4 (TIM_TypeDef * TIMx)

Function description

Generate Capture/Compare 4 event.

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- EGR CC4G LL_TIM_GenerateEvent_CC4

LL_TIM_GenerateEvent_COM

Function name

__STATIC_INLINE void LL_TIM_GenerateEvent_COM (TIM_TypeDef * TIMx)

Function description

Generate commutation event.

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- EGR COMG LL_TIM_GenerateEvent_COM

LL_TIM_GenerateEvent_TRIG

Function name

__STATIC_INLINE void LL_TIM_GenerateEvent_TRIG (TIM_TypeDef * TIMx)

Function description

Generate trigger event.

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- EGR TG LL_TIM_GenerateEvent_TRIG

LL_TIM_GenerateEvent_BRK

Function name

__STATIC_INLINE void LL_TIM_GenerateEvent_BRK (TIM_TypeDef * TIMx)

Function description

Generate break event.

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- EGR BG LL_TIM_GenerateEvent_BRK

LL_TIM_GenerateEvent_BRK2

Function name

__STATIC_INLINE void LL_TIM_GenerateEvent_BRK2 (TIM_TypeDef * TIMx)

Function description

Generate break 2 event.

Parameters

- **TIMx:** Timer instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- EGR B2G LL_TIM_GenerateEvent_BRK2

LL_TIM_DeInit

Function name

ErrorStatus LL_TIM_DeInit (const TIM_TypeDef * TIMx)

Function description

Set TIMx registers to their reset values.

Parameters

- **TIMx:** Timer instance

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: TIMx registers are de-initialized
  - ERROR: invalid TIMx instance

LL_TIM_StructInit

Function name

void LL_TIM_StructInit (LL_TIM_InitTypeDef * TIM_InitStruct)

Function description

Set the fields of the time base unit configuration data structure to their default values.

Parameters

- **TIM_InitStruct:** pointer to a LL_TIM_InitTypeDef structure (time base unit configuration data structure)

Return values

- **None:**

LL_TIM_Init

Function name

ErrorStatus LL_TIM_Init (TIM_TypeDef * TIMx, const LL_TIM_InitTypeDef * TIM_InitStruct)

Function description

Configure the TIMx time base unit.

Parameters

- **TIMx:** Timer Instance
- **TIM_InitStruct:** pointer to a LL_TIM_InitTypeDef structure (TIMx time base unit configuration data structure)

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: TIMx registers are de-initialized
  - ERROR: not applicable

LL_TIM_OC_StructInit

Function name

void LL_TIM_OC_StructInit (LL_TIM_OC_InitTypeDef * TIM_OC_InitStruct)

Function description

Set the fields of the TIMx output channel configuration data structure to their default values.

Parameters

- **TIM_OC_InitStruct:** pointer to a LL_TIM_OC_InitTypeDef structure (the output channel configuration data structure)

Return values

- **None:**

LL_TIM_OC_Init

Function name

ErrorStatus LL_TIM_OC_Init (TIM_TypeDef * TIMx, uint32_t Channel, const LL_TIM_OC_InitTypeDef * TIM_OC_InitStruct)

Function description

Configure the TIMx output channel.

Parameters

- **TIMx:** Timer Instance
- **Channel:** This parameter can be one of the following values:
  - LL_TIM_CHANNEL_CH1
  - LL_TIM_CHANNEL_CH2
  - LL_TIM_CHANNEL_CH3
  - LL_TIM_CHANNEL_CH4
  - LL_TIM_CHANNEL_CH5
  - LL_TIM_CHANNEL_CH6
- **TIM_OC_InitStruct:** pointer to a LL_TIM_OC_InitTypeDef structure (TIMx output channel configuration data structure)

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: TIMx output channel is initialized
  - ERROR: TIMx output channel is not initialized

LL_TIM_IC_StructInit

Function name

void LL_TIM_IC_StructInit (LL_TIM_IC_InitTypeDef * TIM_ICInitStruct)

Function description

Set the fields of the TIMx input channel configuration data structure to their default values.

Parameters

- **TIM_ICInitStruct:** pointer to a LL_TIM_IC_InitTypeDef structure (the input channel configuration data structure)

Return values

- **None:**

LL_TIM_IC_Init

Function name

ErrorStatus LL_TIM_IC_Init (TIM_TypeDef * TIMx, uint32_t Channel, const LL_TIM_IC_InitTypeDef * TIM_IC_InitStruct)

Function description

Configure the TIMx input channel.

Parameters

- **TIMx:** Timer Instance
- **Channel:** This parameter can be one of the following values:
  - LL_TIM_CHANNEL_CH1
  - LL_TIM_CHANNEL_CH2
  - LL_TIM_CHANNEL_CH3
  - LL_TIM_CHANNEL_CH4
- **TIM_IC_InitStruct:** pointer to a LL_TIM_IC_InitTypeDef structure (TIMx input channel configuration data structure)

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: TIMx output channel is initialized
  - ERROR: TIMx output channel is not initialized

LL_TIM_ENCODER_StructInit

Function name

void LL_TIM_ENCODER_StructInit (LL_TIM_ENCODER_InitTypeDef * TIM_EncoderInitStruct)

Function description

Fills each TIM_EncoderInitStruct field with its default value.

Parameters

- **TIM_EncoderInitStruct:** pointer to a LL_TIM_ENCODER_InitTypeDef structure (encoder interface configuration data structure)

Return values

- **None:**

LL_TIM_ENCODER_Init

Function name

ErrorStatus LL_TIM_ENCODER_Init (TIM_TypeDef * TIMx, const LL_TIM_ENCODER_InitTypeDef * TIM_EncoderInitStruct)

Function description

Configure the encoder interface of the timer instance.

Parameters

- **TIMx:** Timer Instance
- **TIM_EncoderInitStruct:** pointer to a LL_TIM_ENCODER_InitTypeDef structure (TIMx encoder interface configuration data structure)

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: TIMx registers are de-initialized
  - ERROR: not applicable

LL_TIM_HALLSENSOR_StructInit

Function name

void LL_TIM_HALLSENSOR_StructInit (LL_TIM_HALLSENSOR_InitTypeDef * TIM_HallSensorInitStruct)

Function description

Set the fields of the TIMx Hall sensor interface configuration data structure to their default values.

Parameters

- **TIM_HallSensorInitStruct:** pointer to a LL_TIM_HALLSENSOR_InitTypeDef structure (HALL sensor interface configuration data structure)

Return values

- **None:**

LL_TIM_HALLSENSOR_Init

Function name

ErrorStatus LL_TIM_HALLSENSOR_Init (TIM_TypeDef * TIMx, const LL_TIM_HALLSENSOR_InitTypeDef * TIM_HallSensorInitStruct)

Function description

Configure the Hall sensor interface of the timer instance.

Parameters

- **TIMx:** Timer Instance
- **TIM_HallSensorInitStruct:** pointer to a LL_TIM_HALLSENSOR_InitTypeDef structure (TIMx HALL sensor interface configuration data structure)

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: TIMx registers are de-initialized
  - ERROR: not applicable

Notes

- TIMx CH1, CH2 and CH3 inputs connected through a XOR to the TI1 input channel
- TIMx slave mode controller is configured in reset mode. Selected internal trigger is TI1F_ED.
- Channel 1 is configured as input, IC1 is mapped on TRC.
- Captured value stored in TIMx_CCR1 correspond to the time elapsed between 2 changes on the inputs. It gives information about motor speed.
- Channel 2 is configured in output PWM 2 mode.
- Compare value stored in TIMx_CCR2 corresponds to the commutation delay.
- OC2REF is selected as trigger output on TRGO.
- LL_TIM_IC_POLARITY_BOTHEDGE must not be used for TI1 when it is used when TIMx operates in Hall sensor interface mode.

LL_TIM_BDTR_StructInit

Function name

void LL_TIM_BDTR_StructInit (LL_TIM_BDTR_InitTypeDef * TIM_BDTRInitStruct)

Function description

Set the fields of the Break and Dead Time configuration data structure to their default values.

Parameters

- **TIM_BDTRInitStruct:** pointer to a LL_TIM_BDTR_InitTypeDef structure (Break and Dead Time configuration data structure)

Return values

- **None:**

LL_TIM_BDTR_Init

Function name

ErrorStatus LL_TIM_BDTR_Init (TIM_TypeDef * TIMx, const LL_TIM_BDTR_InitTypeDef * TIM_BDTRInitStruct)

Function description

Configure the Break and Dead Time feature of the timer instance.

Parameters

- **TIMx:** Timer Instance
- **TIM_BDTRInitStruct:** pointer to a LL_TIM_BDTR_InitTypeDef structure (Break and Dead Time configuration data structure)

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: Break and Dead Time is initialized
  - ERROR: not applicable

Notes

- As the bits BK2P, BK2E, BK2F[3:0], BKF[3:0], AOE, BKP, BKE, OSSI, OSSR and DTG[7:0] can be write-locked depending on the LOCK configuration, it can be necessary to configure all of them during the first write access to the TIMx_BDTR register.
- Macro IS_TIM_BREAK_INSTANCE(TIMx) can be used to check whether or not a timer instance provides a break input.
- Macro IS_TIM_BKIN2_INSTANCE(TIMx) can be used to check whether or not a timer instance provides a second break input.

77.3 TIM Firmware driver defines

The following section lists the various define and macros of the module.

77.3.1 TIM

TIM

Active Input Selection

LL_TIM_ACTIVEINPUT_DIRECTTI

ICx is mapped on TIx

LL_TIM_ACTIVEINPUT_INDIRECTTI

ICx is mapped on TIy

LL_TIM_ACTIVEINPUT_TRC

ICx is mapped on TRC

Automatic output enable

LL_TIM_AUTOMATICOUTPUT_DISABLE

MOE can be set only by software

LL_TIM_AUTOMATICOUTPUT_ENABLE

MOE can be set by software or automatically at the next update event

BKIN POLARITY

LL_TIM_BKIN_POLARITY_LOW

BRK BKIN input is active low

LL_TIM_BKIN_POLARITY_HIGH

BRK BKIN input is active high

BKIN SOURCE

LL_TIM_BKIN_SOURCE_BKIN

BKIN input from AF controller

LL_TIM_BKIN_SOURCE_BKCOMP1

internal signal: COMP1 output

LL_TIM_BKIN_SOURCE_BKCOMP2

internal signal: COMP2 output

BREAK2 AF MODE

LL_TIM_BREAK2_AFMODE_INPUT

Break2 input BRK2 in input mode

LL_TIM_BREAK2_AFMODE_BIDIRECTIONAL

Break2 input BRK2 in bidirectional mode

Break2 Enable

LL_TIM_BREAK2_DISABLE

Break2 function disabled

LL_TIM_BREAK2_ENABLE

Break2 function enabled

BREAK2 FILTER

LL_TIM_BREAK2_FILTER_FDIV1

No filter, BRK acts asynchronously

LL_TIM_BREAK2_FILTER_FDIV1_N2

fSAMPLING=fCK_INT, N=2

LL_TIM_BREAK2_FILTER_FDIV1_N4

fSAMPLING=fCK_INT, N=4

LL_TIM_BREAK2_FILTER_FDIV1_N8
fSAMPLING=fCK_INT, N=8

LL_TIM_BREAK2_FILTER_FDIV2_N6
fSAMPLING=fDTS/2, N=6

LL_TIM_BREAK2_FILTER_FDIV2_N8
fSAMPLING=fDTS/2, N=8

LL_TIM_BREAK2_FILTER_FDIV4_N6
fSAMPLING=fDTS/4, N=6

LL_TIM_BREAK2_FILTER_FDIV4_N8
fSAMPLING=fDTS/4, N=8

LL_TIM_BREAK2_FILTER_FDIV8_N6
fSAMPLING=fDTS/8, N=6

LL_TIM_BREAK2_FILTER_FDIV8_N8
fSAMPLING=fDTS/8, N=8

LL_TIM_BREAK2_FILTER_FDIV16_N5
fSAMPLING=fDTS/16, N=5

LL_TIM_BREAK2_FILTER_FDIV16_N6
fSAMPLING=fDTS/16, N=6

LL_TIM_BREAK2_FILTER_FDIV16_N8
fSAMPLING=fDTS/16, N=8

LL_TIM_BREAK2_FILTER_FDIV32_N5
fSAMPLING=fDTS/32, N=5

LL_TIM_BREAK2_FILTER_FDIV32_N6
fSAMPLING=fDTS/32, N=6

LL_TIM_BREAK2_FILTER_FDIV32_N8
fSAMPLING=fDTS/32, N=8

BREAK2 POLARITY

LL_TIM_BREAK2_POLARITY_LOW
Break input BRK2 is active low

LL_TIM_BREAK2_POLARITY_HIGH
Break input BRK2 is active high

BREAK AF MODE

LL_TIM_BREAK_AFMODE_INPUT
Break input BRK in input mode

LL_TIM_BREAK_AFMODE_BIDIRECTIONAL
Break input BRK in bidirectional mode

Break Enable

LL_TIM_BREAK_DISABLE

Break function disabled

LL_TIM_BREAK_ENABLE

Break function enabled

break filter

LL_TIM_BREAK_FILTER_FDIV1

No filter, BRK acts asynchronously

LL_TIM_BREAK_FILTER_FDIV1_N2

fSAMPLING=fCK_INT, N=2

LL_TIM_BREAK_FILTER_FDIV1_N4

fSAMPLING=fCK_INT, N=4

LL_TIM_BREAK_FILTER_FDIV1_N8

fSAMPLING=fCK_INT, N=8

LL_TIM_BREAK_FILTER_FDIV2_N6

fSAMPLING=fDTS/2, N=6

LL_TIM_BREAK_FILTER_FDIV2_N8

fSAMPLING=fDTS/2, N=8

LL_TIM_BREAK_FILTER_FDIV4_N6

fSAMPLING=fDTS/4, N=6

LL_TIM_BREAK_FILTER_FDIV4_N8

fSAMPLING=fDTS/4, N=8

LL_TIM_BREAK_FILTER_FDIV8_N6

fSAMPLING=fDTS/8, N=6

LL_TIM_BREAK_FILTER_FDIV8_N8

fSAMPLING=fDTS/8, N=8

LL_TIM_BREAK_FILTER_FDIV16_N5

fSAMPLING=fDTS/16, N=5

LL_TIM_BREAK_FILTER_FDIV16_N6

fSAMPLING=fDTS/16, N=6

LL_TIM_BREAK_FILTER_FDIV16_N8

fSAMPLING=fDTS/16, N=8

LL_TIM_BREAK_FILTER_FDIV32_N5

fSAMPLING=fDTS/32, N=5

LL_TIM_BREAK_FILTER_FDIV32_N6

fSAMPLING=fDTS/32, N=6

LL_TIM_BREAK_FILTER_FDIV32_N8

fSAMPLING=fDTS/32, N=8

BREAK INPUT

LL_TIM_BREAK_INPUT_BKIN

TIMx_BKIN input

LL_TIM_BREAK_INPUT_BKIN2

TIMx_BKIN2 input

break polarity

LL_TIM_BREAK_POLARITY_LOW

Break input BRK is active low

LL_TIM_BREAK_POLARITY_HIGH

Break input BRK is active high

Capture Compare DMA Request

LL_TIM_CCDMAREQUEST_CC

CCx DMA request sent when CCx event occurs

LL_TIM_CCDMAREQUEST_UPDATE

CCx DMA requests sent when update event occurs

Capture Compare Update Source

LL_TIM_CCUPDATESOURCE_COMG_ONLY

Capture/compare control bits are updated by setting the COMG bit only

LL_TIM_CCUPDATESOURCE_COMG_AND_TRGI

Capture/compare control bits are updated by setting the COMG bit or when a rising edge occurs on trigger input (TRGI)

Channel

LL_LPTIM_CHANNEL_CH1

LPTIM input/output channel 1

LL_LPTIM_CHANNEL_CH2

LPTIM input/output channel 2

LL_LPTIM_CHANNEL_CH3

LPTIM input/output channel 3

LL_LPTIM_CHANNEL_CH4

LPTIM input/output channel 4

LL_TIM_CHANNEL_CH1

Timer input/output channel 1

LL_TIM_CHANNEL_CH1N

Timer complementary output channel 1

LL_TIM_CHANNEL_CH2

Timer input/output channel 2

LL_TIM_CHANNEL_CH2N

Timer complementary output channel 2

LL_TIM_CHANNEL_CH3

Timer input/output channel 3

LL_TIM_CHANNEL_CH3N

Timer complementary output channel 3

LL_TIM_CHANNEL_CH4

Timer input/output channel 4

LL_TIM_CHANNEL_CH5

Timer output channel 5

LL_TIM_CHANNEL_CH6

Timer output channel 6

Clock Division

LL_TIM_CLOCKDIVISION_DIV1

tDTS=tCK_INT

LL_TIM_CLOCKDIVISION_DIV2

tDTS=2*tCK_INT

LL_TIM_CLOCKDIVISION_DIV4

tDTS=4*tCK_INT

Clock Source

LL_TIM_CLOCKSOURCE_INTERNAL

The timer is clocked by the internal clock provided from the RCC

LL_TIM_CLOCKSOURCE_EXT_MODE1

Counter counts at each rising or falling edge on a selected input

LL_TIM_CLOCKSOURCE_EXT_MODE2

Counter counts at each rising or falling edge on the external trigger input ETR

Counter Direction

LL_TIM_COUNTERDIRECTION_UP

Timer counter counts up

LL_TIM_COUNTERDIRECTION_DOWN

Timer counter counts down

Counter Mode

LL_TIM_COUNTERMODE_UP

Counter used as upcounter

LL_TIM_COUNTERMODE_DOWN

Counter used as downcounter

LL_TIM_COUNTERMODE_CENTER_DOWN

The counter counts up and down alternatively. Output compare interrupt flags of output channels are set only when the counter is counting down.

LL_TIM_COUNTERMODE_CENTER_UP

The counter counts up and down alternatively. Output compare interrupt flags of output channels are set only when the counter is counting up

LL_TIM_COUNTERMODE_CENTER_UP_DOWN

The counter counts up and down alternatively. Output compare interrupt flags of output channels are set only when the counter is counting up or down.

DMA Burst Base Address

LL_TIM_DMABURST_BASEADDR_CR1

TIMx_CR1 register is the DMA base address for DMA burst

LL_TIM_DMABURST_BASEADDR_CR2

TIMx_CR2 register is the DMA base address for DMA burst

LL_TIM_DMABURST_BASEADDR_SMCR

TIMx_SMCR register is the DMA base address for DMA burst

LL_TIM_DMABURST_BASEADDR_DIER

TIMx_DIER register is the DMA base address for DMA burst

LL_TIM_DMABURST_BASEADDR_SR

TIMx_SR register is the DMA base address for DMA burst

LL_TIM_DMABURST_BASEADDR_EGR

TIMx_EGR register is the DMA base address for DMA burst

LL_TIM_DMABURST_BASEADDR_CCMR1

TIMx_CCMR1 register is the DMA base address for DMA burst

LL_TIM_DMABURST_BASEADDR_CCMR2

TIMx_CCMR2 register is the DMA base address for DMA burst

LL_TIM_DMABURST_BASEADDR_CCER

TIMx_CCER register is the DMA base address for DMA burst

LL_TIM_DMABURST_BASEADDR_CNT

TIMx_CNT register is the DMA base address for DMA burst

LL_TIM_DMABURST_BASEADDR_PSC

TIMx_PSC register is the DMA base address for DMA burst

LL_TIM_DMABURST_BASEADDR_ARR

TIMx_ARR register is the DMA base address for DMA burst

LL_TIM_DMABURST_BASEADDR_RCR

TIMx_RCR register is the DMA base address for DMA burst

LL_TIM_DMABURST_BASEADDR_CCR1

TIMx_CCR1 register is the DMA base address for DMA burst

LL_TIM_DMABURST_BASEADDR_CCR2

TIMx_CCR2 register is the DMA base address for DMA burst

LL_TIM_DMABURST_BASEADDR_CCR3

TIMx_CCR3 register is the DMA base address for DMA burst

LL_TIM_DMABURST_BASEADDR_CCR4

TIMx_CCR4 register is the DMA base address for DMA burst

LL_TIM_DMABURST_BASEADDR_BDTR

TIMx_BDTR register is the DMA base address for DMA burst

LL_TIM_DMABURST_BASEADDR_OR1

TIMx_OR1 register is the DMA base address for DMA burst

LL_TIM_DMABURST_BASEADDR_CCMR3

TIMx_CCMR3 register is the DMA base address for DMA burst

LL_TIM_DMABURST_BASEADDR_CCR5

TIMx_CCR5 register is the DMA base address for DMA burst

LL_TIM_DMABURST_BASEADDR_CCR6

TIMx_CCR6 register is the DMA base address for DMA burst

LL_TIM_DMABURST_BASEADDR_AF1

TIMx_AF1 register is the DMA base address for DMA burst

LL_TIM_DMABURST_BASEADDR_AF2

TIMx_AF2 register is the DMA base address for DMA burst

LL_TIM_DMABURST_BASEADDR_TISEL

TIMx_TISEL register is the DMA base address for DMA burst

DMA Burst Length

LL_TIM_DMABURST_LENGTH_1TRANSFER

Transfer is done to 1 register starting from the DMA burst base address

LL_TIM_DMABURST_LENGTH_2TRANSFERS

Transfer is done to 2 registers starting from the DMA burst base address

LL_TIM_DMABURST_LENGTH_3TRANSFERS

Transfer is done to 3 registers starting from the DMA burst base address

LL_TIM_DMABURST_LENGTH_4TRANSFERS

Transfer is done to 4 registers starting from the DMA burst base address

LL_TIM_DMABURST_LENGTH_5TRANSFERS

Transfer is done to 5 registers starting from the DMA burst base address

LL_TIM_DMABURST_LENGTH_6TRANSFERS

Transfer is done to 6 registers starting from the DMA burst base address

LL_TIM_DMABURST_LENGTH_7TRANSFERS

Transfer is done to 7 registers starting from the DMA burst base address

LL_TIM_DMABURST_LENGTH_8TRANSFERS

Transfer is done to 1 registers starting from the DMA burst base address

LL_TIM_DMABURST_LENGTH_9TRANSFERS

Transfer is done to 9 registers starting from the DMA burst base address

LL_TIM_DMABURST_LENGTH_10TRANSFERS

Transfer is done to 10 registers starting from the DMA burst base address

LL_TIM_DMABURST_LENGTH_11TRANSFERS

Transfer is done to 11 registers starting from the DMA burst base address

LL_TIM_DMABURST_LENGTH_12TRANSFERS

Transfer is done to 12 registers starting from the DMA burst base address

LL_TIM_DMABURST_LENGTH_13TRANSFERS

Transfer is done to 13 registers starting from the DMA burst base address

LL_TIM_DMABURST_LENGTH_14TRANSFERS

Transfer is done to 14 registers starting from the DMA burst base address

LL_TIM_DMABURST_LENGTH_15TRANSFERS

Transfer is done to 15 registers starting from the DMA burst base address

LL_TIM_DMABURST_LENGTH_16TRANSFERS

Transfer is done to 16 registers starting from the DMA burst base address

LL_TIM_DMABURST_LENGTH_17TRANSFERS

Transfer is done to 17 registers starting from the DMA burst base address

LL_TIM_DMABURST_LENGTH_18TRANSFERS

Transfer is done to 18 registers starting from the DMA burst base address

Encoder Mode

LL_TIM_ENCODERMODE_X2_TI1

Quadrature encoder mode 1, x2 mode - Counter counts up/down on TI1FP1 edge depending on TI2FP2 level

LL_TIM_ENCODERMODE_X2_TI2

Quadrature encoder mode 2, x2 mode - Counter counts up/down on TI2FP2 edge depending on TI1FP1 level

LL_TIM_ENCODERMODE_X4_TI12

Quadrature encoder mode 3, x4 mode - Counter counts up/down on both TI1FP1 and TI2FP2 edges depending on the level of the other input

External Trigger Source

LL_TIM_ETRSOURCE_GPIO

ETR input is connected to GPIO

LL_TIM_ETRSOURCE_COMP1

ETR input is connected to COMP1_OUT

LL_TIM_ETRSOURCE_COMP2

ETR input is connected to COMP2_OUT

LL_TIM_ETRSOURCE_ADC1_AWD1

ETR input is connected to ADC1 analog watchdog 1

LL_TIM_ETRSOURCE_ADC1_AWD2

ETR input is connected to ADC1 analog watchdog 2

LL_TIM_ETRSOURCE_ADC1_AWD3

ETR input is connected to ADC1 analog watchdog 3

LL_TIM_ETRSOURCE_LSE

ETR input is connected to LSE

LL_TIM_ETRSOURCE_MCO

ETR input is connected to MCO

LL_TIM_ETRSOURCE_MCO2

ETR input is connected to MCO2

External Trigger Filter

LL_TIM_ETR_FILTER_FDIV1

No filter, sampling is done at fDTS

LL_TIM_ETR_FILTER_FDIV1_N2

fSAMPLING=fCK_INT, N=2

LL_TIM_ETR_FILTER_FDIV1_N4

fSAMPLING=fCK_INT, N=4

LL_TIM_ETR_FILTER_FDIV1_N8

fSAMPLING=fCK_INT, N=8

LL_TIM_ETR_FILTER_FDIV2_N6

fSAMPLING=fDTS/2, N=6

LL_TIM_ETR_FILTER_FDIV2_N8

fSAMPLING=fDTS/2, N=8

LL_TIM_ETR_FILTER_FDIV4_N6

fSAMPLING=fDTS/4, N=6

LL_TIM_ETR_FILTER_FDIV4_N8

fSAMPLING=fDTS/4, N=8

LL_TIM_ETR_FILTER_FDIV8_N6

fSAMPLING=fDTS/8, N=6

LL_TIM_ETR_FILTER_FDIV8_N8

fSAMPLING=fDTS/16, N=8

LL_TIM_ETR_FILTER_FDIV16_N5

fSAMPLING=fDTS/16, N=5

LL_TIM_ETR_FILTER_FDIV16_N6

fSAMPLING=fDTS/16, N=6

LL_TIM_ETR_FILTER_FDIV16_N8

fSAMPLING=fDTS/16, N=8

LL_TIM_ETR_FILTER_FDIV32_N5

fSAMPLING=fDTS/32, N=5

LL_TIM_ETR_FILTER_FDIV32_N6

fSAMPLING=fDTS/32, N=6

LL_TIM_ETR_FILTER_FDIV32_N8

fSAMPLING=fDTS/32, N=8

External Trigger Polarity

LL_TIM_ETR_POLARITY_NONINVERTED

ETR is non-inverted, active at high level or rising edge

LL_TIM_ETR_POLARITY_INVERTED

ETR is inverted, active at low level or falling edge

External Trigger Prescaler

LL_TIM_ETR_PRESCALER_DIV1

ETR prescaler OFF

LL_TIM_ETR_PRESCALER_DIV2

ETR frequency is divided by 2

LL_TIM_ETR_PRESCALER_DIV4

ETR frequency is divided by 4

LL_TIM_ETR_PRESCALER_DIV8

ETR frequency is divided by 8

Get Flags Defines

LL_TIM_SR_UIF

Update interrupt flag

LL_TIM_SR_CC1IF

Capture/compare 1 interrupt flag

LL_TIM_SR_CC2IF

Capture/compare 2 interrupt flag

LL_TIM_SR_CC3IF

Capture/compare 3 interrupt flag

LL_TIM_SR_CC4IF

Capture/compare 4 interrupt flag

LL_TIM_SR_CC5IF

Capture/compare 5 interrupt flag

LL_TIM_SR_CC6IF

Capture/compare 6 interrupt flag

LL_TIM_SR_COMIF

COM interrupt flag

LL_TIM_SR_TIF

Trigger interrupt flag

LL_TIM_SR_BIF

Break interrupt flag

LL_TIM_SR_B2IF

Second break interrupt flag

LL_TIM_SR_CC1OF

Capture/Compare 1 overcapture flag

LL_TIM_SR_CC2OF

Capture/Compare 2 overcapture flag

LL_TIM_SR_CC3OF

Capture/Compare 3 overcapture flag

LL_TIM_SR_CC4OF

Capture/Compare 4 overcapture flag

LL_TIM_SR_SBIF

System Break interrupt flag

GROUPCH5

LL_TIM_GROUPCH5_NONE

No effect of OC5REF on OC1REFC, OC2REFC and OC3REFC

LL_TIM_GROUPCH5_OC1REFC

OC1REFC is the logical AND of OC1REFC and OC5REF

LL_TIM_GROUPCH5_OC2REFC

OC2REFC is the logical AND of OC2REFC and OC5REF

LL_TIM_GROUPCH5_OC3REFC

OC3REFC is the logical AND of OC3REFC and OC5REF

Input Configuration Prescaler

LL_TIM_ICPSC_DIV1

No prescaler, capture is done each time an edge is detected on the capture input

LL_TIM_ICPSC_DIV2

Capture is done once every 2 events

LL_TIM_ICPSC_DIV4

Capture is done once every 4 events

LL_TIM_ICPSC_DIV8

Capture is done once every 8 events

Input Configuration Filter

LL_TIM_IC_FILTER_FDIV1

No filter, sampling is done at fDTS

LL_TIM_IC_FILTER_FDIV1_N2

fSAMPLING=fCK_INT, N=2

LL_TIM_IC_FILTER_FDIV1_N4

fSAMPLING=fCK_INT, N=4

LL_TIM_IC_FILTER_FDIV1_N8

fSAMPLING=fCK_INT, N=8

LL_TIM_IC_FILTER_FDIV2_N6

fSAMPLING=fDTS/2, N=6

LL_TIM_IC_FILTER_FDIV2_N8

fSAMPLING=fDTS/2, N=8

LL_TIM_IC_FILTER_FDIV4_N6

fSAMPLING=fDTS/4, N=6

LL_TIM_IC_FILTER_FDIV4_N8

fSAMPLING=fDTS/4, N=8

LL_TIM_IC_FILTER_FDIV8_N6

fSAMPLING=fDTS/8, N=6

LL_TIM_IC_FILTER_FDIV8_N8

fSAMPLING=fDTS/8, N=8

LL_TIM_IC_FILTER_FDIV16_N5

fSAMPLING=fDTS/16, N=5

LL_TIM_IC_FILTER_FDIV16_N6

fSAMPLING=fDTS/16, N=6

LL_TIM_IC_FILTER_FDIV16_N8

fSAMPLING=fDTS/16, N=8

LL_TIM_IC_FILTER_FDIV32_N5

fSAMPLING=fDTS/32, N=5

LL_TIM_IC_FILTER_FDIV32_N6

fSAMPLING=fDTS/32, N=6

LL_TIM_IC_FILTER_FDIV32_N8

fSAMPLING=fDTS/32, N=8

Input Configuration Polarity

LL_TIM_IC_POLARITY_RISING

The circuit is sensitive to TIxFP1 rising edge, TIxFP1 is not inverted

LL_TIM_IC_POLARITY_FALLING

The circuit is sensitive to TIxFP1 falling edge, TIxFP1 is inverted

LL_TIM_IC_POLARITY_BOTHEDGE

The circuit is sensitive to both TIxFP1 rising and falling edges, TIxFP1 is not inverted

IT Defines

LL_TIM_DIER_UIE

Update interrupt enable

LL_TIM_DIER_CC1IE

Capture/compare 1 interrupt enable

LL_TIM_DIER_CC2IE

Capture/compare 2 interrupt enable

LL_TIM_DIER_CC3IE

Capture/compare 3 interrupt enable

LL_TIM_DIER_CC4IE

Capture/compare 4 interrupt enable

LL_TIM_DIER_COMIE

COM interrupt enable

LL_TIM_DIER_TIE

Trigger interrupt enable

LL_TIM_DIER_BIE

Break interrupt enable

Lock Level

LL_TIM_LOCKLEVEL_OFF

LOCK OFF - No bit is write protected

LL_TIM_LOCKLEVEL_1

LOCK Level 1

LL_TIM_LOCKLEVEL_2

LOCK Level 2

LL_TIM_LOCKLEVEL_3

LOCK Level 3

Output Configuration Idle State

LL_TIM_OCIDLESTATE_LOW

OCx=0 (after a dead-time if OC is implemented) when MOE=0

LL_TIM_OCIDLESTATE_HIGH

OCx=1 (after a dead-time if OC is implemented) when MOE=0

Output Configuration Mode

LL_TIM_OCMODE_FROZEN

The comparison between the output compare register TIMx_CCRy and the counter TIMx_CNT has no effect on the output channel level

LL_TIM_OCMODE_ACTIVE

OCyREF is forced high on compare match

LL_TIM_OCMODE_INACTIVE

OCyREF is forced low on compare match

LL_TIM_OCMODE_TOGGLE

OCyREF toggles on compare match

LL_TIM_OCMODE_FORCED_INACTIVE

OCyREF is forced low

LL_TIM_OCMODE_FORCED_ACTIVE

OCyREF is forced high

LL_TIM_OCMODE_PWM1

In upcounting, channel y is active as long as TIMx_CNT<TIMx_CCRy else inactive. In downcounting, channel y is inactive as long as TIMx_CNT>TIMx_CCRy else active.

LL_TIM_OCMODE_PWM2

In upcounting, channel y is inactive as long as TIMx_CNT<TIMx_CCRy else active. In downcounting, channel y is active as long as TIMx_CNT>TIMx_CCRy else inactive

LL_TIM_OCMODE_RETRIG_OPM1

Retrigerrable OPM mode 1

LL_TIM_OCMODE_RETRIG_OPM2

Retrigerrable OPM mode 2

LL_TIM_OCMODE_COMBINED_PWM1

Combined PWM mode 1

LL_TIM_OCMODE_COMBINED_PWM2

Combined PWM mode 2

LL_TIM_OCMODE_ASYMMETRIC_PWM1

Asymmetric PWM mode 1

LL_TIM_OCMODE_ASYMMETRIC_PWM2

Asymmetric PWM mode 2

Output Configuration Polarity

LL_TIM_OCPOLARITY_HIGH

OCxactive high

LL_TIM_OCPOLARITY_LOW

OCxactive low

OCREF clear input selection

LL_TIM_OCREF_CLR_INT_ETR

OCREF_CLR_INT is connected to ETRF

LL_TIM_OCREF_CLR_INT_COMP1

OCREF clear input is connected to COMP1_OUT

LL_TIM_OCREF_CLR_INT_COMP2

OCREF clear input is connected to COMP2_OUT

Output Configuration State

LL_TIM_OCSTATE_DISABLE

OCx is not active

LL_TIM_OCSTATE_ENABLE

OCx signal is output on the corresponding output pin

One Pulse Mode

LL_TIM_ONEPULSEMODE_SINGLE

Counter stops counting at the next update event

LL_TIM_ONEPULSEMODE_REPETITIVE

Counter is not stopped at update event

OSSI

LL_TIM_OSSI_DISABLE

When inactive, OCx/OCxN outputs are disabled

LL_TIM_OSSI_ENABLE

When inactive, OxC/OCxN outputs are first forced with their inactive level then forced to their idle level after the deadtime

OSSR

LL_TIM_OSSR_DISABLE

When inactive, OCx/OCxN outputs are disabled

LL_TIM_OSSR_ENABLE

When inactive, OC/OCN outputs are enabled with their inactive level as soon as CCxE=1 or CCxNE=1

Slave Mode

LL_TIM_SLAVEMODE_DISABLED

Slave mode disabled

LL_TIM_SLAVEMODE_RESET

Reset Mode - Rising edge of the selected trigger input (TRGI) reinitializes the counter

LL_TIM_SLAVEMODE_GATED

Gated Mode - The counter clock is enabled when the trigger input (TRGI) is high

LL_TIM_SLAVEMODE_TRIGGER

Trigger Mode - The counter starts at a rising edge of the trigger TRGI

LL_TIM_SLAVEMODE_COMBINED_RESETTRIGGER

Combined reset + trigger mode - Rising edge of the selected trigger input (TRGI) reinitializes the counter, generates an update of the registers and starts the counter

TIM15 Timer Input Ch1 Remap

LL_TIM_TIM15_TI1_RMP_GPIO

TIM15 input 1 is connected to GPIO

LL_TIM_TIM15_TI1_RMP_TIM2_IC1

TIM15 input 1 is connected to TIM2 input 1

LL_TIM_TIM15_TI1_RMP_TIM3_IC1

TIM15 input 1 is connected to TIM3 input 1

TIM15 Timer Input Ch2 Remap

LL_TIM_TIM15_TI2_RMP_GPIO

TIM15 input 2 is connected to GPIO

LL_TIM_TIM15_TI2_RMP_TIM2_IC2

TIM15 input 2 is connected to TIM2 input 2

LL_TIM_TIM15_TI2_RMP_TIM3_IC2

TIM15 input 2 is connected to TIM3 input 2

TIM16 Timer Input Ch1 Remap

LL_TIM_TIM16_TI1_RMP_GPIO

TIM16 input 1 is connected to GPIO

LL_TIM_TIM16_TI1_RMP_LSI

TIM16 input 1 is connected to LSI

LL_TIM_TIM16_TI1_RMP_LSE

TIM16 input 1 is connected to LSE

LL_TIM_TIM16_TI1_RMP_RTC_WK

TIM16 input 1 is connected to RTC_WAKEUP

LL_TIM_TIM16_TI1_RMP_MCO2

TIM16 input 1 is connected to MCO2

TIM1 Timer Input Ch1 Remap

LL_TIM_TIM1_TI1_RMP_GPIO

TIM1 input 1 is connected to GPIO

LL_TIM_TIM1_TI1_RMP_COMP1

TIM1 input 1 is connected to COMP1_OUT

TIM1 Timer Input Ch2 Remap

LL_TIM_TIM1_TI2_RMP_GPIO

TIM1 input 2 is connected to GPIO

LL_TIM_TIM1_TI2_RMP_COMP2

TIM1 input 2 is connected to COMP2_OUT

TIM2 Timer Input Ch1 Remap

LL_TIM_TIM2_TI1_RMP_GPIO

TIM2 input 1 is connected to GPIO

LL_TIM_TIM2_TI1_RMP_COMP1

TIM2 input 1 is connected to COMP1_OUT

TIM2 Timer Input Ch2 Remap

LL_TIM_TIM2_TI2_RMP_GPIO

TIM2 input 2 is connected to GPIO

LL_TIM_TIM2_TI2_RMP_COMP2

TIM2 input 2 is connected to COMP2_OUT

TIM3 Timer Input Ch1 Remap

LL_TIM_TIM3_TI1_RMP_GPIO

TIM3 input 1 is connected to GPIO

LL_TIM_TIM3_TI1_RMP_COMP1

TIM3 input 1 is connected to COMP1_OUT

TIM3 Timer Input Ch2 Remap

LL_TIM_TIM3_TI2_RMP_GPIO

TIM3 input 2 is connected to GPIO

LL_TIM_TIM3_TI2_RMP_COMP2

TIM3 input 2 is connected to COMP2_OUT

Trigger Output

LL_TIM_TRGO_RESET

UG bit from the TIMx_EGR register is used as trigger output

LL_TIM_TRGO_ENABLE

Counter Enable signal (CNT_EN) is used as trigger output

LL_TIM_TRGO_UPDATE

Update event is used as trigger output

LL_TIM_TRGO_CC1IF

CC1 capture or a compare match is used as trigger output

LL_TIM_TRGO_OC1REF

OC1REF signal is used as trigger output

LL_TIM_TRGO_OC2REF

OC2REF signal is used as trigger output

LL_TIM_TRGO_OC3REF

OC3REF signal is used as trigger output

LL_TIM_TRGO_OC4REF

OC4REF signal is used as trigger output

Trigger Output 2

LL_TIM_TRGO2_RESET

UG bit from the TIMx_EGR register is used as trigger output 2

LL_TIM_TRGO2_ENABLE

Counter Enable signal (CNT_EN) is used as trigger output 2

LL_TIM_TRGO2_UPDATE

Update event is used as trigger output 2

LL_TIM_TRGO2_CC1F

CC1 capture or a compare match is used as trigger output 2

LL_TIM_TRGO2_OC1

OC1REF signal is used as trigger output 2

LL_TIM_TRGO2_OC2

OC2REF signal is used as trigger output 2

LL_TIM_TRGO2_OC3

OC3REF signal is used as trigger output 2

LL_TIM_TRGO2_OC4

OC4REF signal is used as trigger output 2

LL_TIM_TRGO2_OC5

OC5REF signal is used as trigger output 2

LL_TIM_TRGO2_OC6

OC6REF signal is used as trigger output 2

LL_TIM_TRGO2_OC4_RISINGFALLING

OC4REF rising or falling edges are used as trigger output 2

LL_TIM_TRGO2_OC6_RISINGFALLING

OC6REF rising or falling edges are used as trigger output 2

LL_TIM_TRGO2_OC4_RISING_OC6_RISING

OC4REF or OC6REF rising edges are used as trigger output 2

LL_TIM_TRGO2_OC4_RISING_OC6_FALLING

OC4REF rising or OC6REF falling edges are used as trigger output 2

LL_TIM_TRGO2_OC5_RISING_OC6_RISING

OC5REF or OC6REF rising edges are used as trigger output 2

LL_TIM_TRGO2_OC5_RISING_OC6_FALLING

OC5REF rising or OC6REF falling edges are used as trigger output 2

Trigger Selection

LL_TIM_TS_ITR0

Internal Trigger 0 (ITR0) is used as trigger input

LL_TIM_TS_ITR1

Internal Trigger 1 (ITR1) is used as trigger input

LL_TIM_TS_ITR2

Internal Trigger 2 (ITR2) is used as trigger input

LL_TIM_TS_ITR7

Internal Trigger 7 (ITR7) is used as trigger input

LL_TIM_TS_TI1F_ED

TI1 Edge Detector (TI1F_ED) is used as trigger input

LL_TIM_TS_TI1FP1

Filtered Timer Input 1 (TI1FP1) is used as trigger input

LL_TIM_TS_TI2FP2

Filtered Timer Input 2 (TI12P2) is used as trigger input

LL_TIM_TS_ETRF

Filtered external Trigger (ETRF) is used as trigger input

Update Source

LL_TIM_UPDATESOURCE_REGULAR

Counter overflow/underflow, Setting the UG bit or Update generation through the slave mode controller generates an update request

LL_TIM_UPDATESOURCE_COUNTER

Only counter overflow/underflow generates an update request

Common Write and read registers Macros

LL_TIM_WriteReg

Description:

- Write a value in TIM register.

Parameters:

- __INSTANCE__: TIM Instance
- __REG__: Register to be written
- __VALUE__: Value to be written in the register

Return value:

- None

LL_TIM_ReadReg

Description:

- Read a value in TIM register.

Parameters:

- __INSTANCE__: TIM Instance
- __REG__: Register to be read

Return value:

- Register: value

TIM Exported Macros

__LL_TIM_GETFLAG_UIFCPY

Description:

- HELPER macro retrieving the UIFCPY flag from the counter value.

Parameters:

- __CNT__: Counter value

Return value:

- UIF: status bit

Notes:

- ex: __LL_TIM_GETFLAG_UIFCPY (LL_TIM_GetCounter ()); Relevant only if UIF flag remapping has been enabled (UIF status bit is copied to TIMx_CNT register bit 31)

__LL_TIM_CALC_DEADTIME

Description:

- HELPER macro calculating DTG[0:7] in the TIMx_BDTR register to achieve the requested dead time duration.

Parameters:

- __TIMCLK__: timer input clock frequency (in Hz)
- __CKD__: This parameter can be one of the following values:
  - LL_TIM_CLOCKDIVISION_DIV1
  - LL_TIM_CLOCKDIVISION_DIV2
  - LL_TIM_CLOCKDIVISION_DIV4
- __DT__: deadtime duration (in ns)

Return value:

- DTG[0:7]

Notes:

- ex: __LL_TIM_CALC_DEADTIME (80000000, LL_TIM_GetClockDivision (), 120);

__LL_TIM_CALC_PSC

Description:

- HELPER macro calculating the prescaler value to achieve the required counter clock frequency.

Parameters:

- __TIMCLK__: timer input clock frequency (in Hz)
- __CNTCLK__: counter clock frequency (in Hz)

Return value:

- Prescaler: value (between Min_Data=0 and Max_Data=65535)

Notes:

- ex: __LL_TIM_CALC_PSC (80000000, 1000000);

__LL_TIM_CALC_ARR

Description:

- HELPER macro calculating the auto-reload value to achieve the required output signal frequency.

Parameters:

- __TIMCLK__: timer input clock frequency (in Hz)
- __PSC__: prescaler
- __FREQ__: output signal frequency (in Hz)

Return value:

- Auto-reload: value (between Min_Data=0 and Max_Data=65535)

Notes:

- ex: __LL_TIM_CALC_ARR (1000000, LL_TIM_GetPrescaler (), 10000);

__LL_TIM_CALC_DELAY

Description:

- HELPER macro calculating the compare value required to achieve the required timer output compare active/inactive delay.

Parameters:

- __TIMCLK__: timer input clock frequency (in Hz)
- __PSC__: prescaler
- __DELAY__: timer output compare active/inactive delay (in us)

Return value:

- Compare: value (between Min_Data=0 and Max_Data=65535)

Notes:

- ex: __LL_TIM_CALC_DELAY (1000000, LL_TIM_GetPrescaler (), 10);

__LL_TIM_CALC_PULSE

Description:

- HELPER macro calculating the auto-reload value to achieve the required pulse duration (when the timer operates in one pulse mode).

Parameters:

- __TIMCLK__: timer input clock frequency (in Hz)
- __PSC__: prescaler
- __DELAY__: timer output compare active/inactive delay (in us)
- __PULSE__: pulse duration (in us)

Return value:

- Auto-reload: value (between Min_Data=0 and Max_Data=65535)

Notes:

- ex: __LL_TIM_CALC_PULSE (1000000, LL_TIM_GetPrescaler (), 10, 20);

__LL_TIM_GET_ICPSC_RATIO

Description:

- HELPER macro retrieving the ratio of the input capture prescaler.

Parameters:

- __ICPSC__: This parameter can be one of the following values:
  - LL_TIM_ICPSC_DIV1
  - LL_TIM_ICPSC_DIV2
  - LL_TIM_ICPSC_DIV4
  - LL_TIM_ICPSC_DIV8

Return value:

- Input: capture prescaler ratio (1, 2, 4 or 8)

Notes:

- ex: __LL_TIM_GET_ICPSC_RATIO (LL_TIM_IC_GetPrescaler ());

78 LL USART Generic Driver

78.1 USART Firmware driver registers structures

78.1.1 LL_USART_InitTypeDef

LL_USART_InitTypeDef is defined in the stm32u0xx_ll_usart.h

Data Fields

- ***uint32_t PrescalerValue***
- ***uint32_t BaudRate***
- ***uint32_t DataWidth***
- ***uint32_t StopBits***
- ***uint32_t Parity***
- ***uint32_t TransferDirection***
- ***uint32_t HardwareFlowControl***
- ***uint32_t OverSampling***

Field Documentation

- ***uint32_t LL_USART_InitTypeDef::PrescalerValue***
  Specifies the Prescaler to compute the communication baud rate. This parameter can be a value of ***USART_LL_EC_PRESCALER***.This feature can be modified afterwards using unitary function **LL_USART_SetPrescaler()**.
- ***uint32_t LL_USART_InitTypeDef::BaudRate***
  This field defines expected Usart communication baud rate.This feature can be modified afterwards using unitary function **LL_USART_SetBaudRate()**.
- ***uint32_t LL_USART_InitTypeDef::DataWidth***
  Specifies the number of data bits transmitted or received in a frame. This parameter can be a value of ***USART_LL_EC_DATAWIDTH***.This feature can be modified afterwards using unitary function **LL_USART_SetDataWidth()**.
- ***uint32_t LL_USART_InitTypeDef::StopBits***
  Specifies the number of stop bits transmitted. This parameter can be a value of ***USART_LL_EC_STOPBITS***.This feature can be modified afterwards using unitary function **LL_USART_SetStopBitsLength()**.
- ***uint32_t LL_USART_InitTypeDef::Parity***
  Specifies the parity mode. This parameter can be a value of ***USART_LL_EC_PARITY***.This feature can be modified afterwards using unitary function **LL_USART_SetParity()**.
- ***uint32_t LL_USART_InitTypeDef::TransferDirection***
  Specifies whether the Receive and/or Transmit mode is enabled or disabled. This parameter can be a value of ***USART_LL_EC_DIRECTION***.This feature can be modified afterwards using unitary function **LL_USART_SetTransferDirection()**.
- ***uint32_t LL_USART_InitTypeDef::HardwareFlowControl***
  Specifies whether the hardware flow control mode is enabled or disabled. This parameter can be a value of ***USART_LL_EC_HWCONTROL***.This feature can be modified afterwards using unitary function **LL_USART_SetHWFlowCtrl()**.
- ***uint32_t LL_USART_InitTypeDef::OverSampling***
  Specifies whether USART oversampling mode is 16 or 8. This parameter can be a value of ***USART_LL_EC_OVERSAMPLING***.This feature can be modified afterwards using unitary function **LL_USART_SetOverSampling()**.

78.1.2 LL_USART_ClockInitTypeDef

LL_USART_ClockInitTypeDef is defined in the stm32u0xx_ll_usart.h

Data Fields

- ***uint32_t ClockOutput***
- ***uint32_t ClockPolarity***
- ***uint32_t ClockPhase***

- ***uint32_t LastBitClockPulse***

Field Documentation

- ***uint32_t LL_USART_ClockInitTypeDef::ClockOutput***
  Specifies whether the USART clock is enabled or disabled. This parameter can be a value of ***USART_LL_EC_CLOCK***.USART HW configuration can be modified afterwards using unitary functions **LL_USART_EnableSCLKOutput()** or **LL_USART_DisableSCLKOutput()**. For more details, refer to description of this function.
- ***uint32_t LL_USART_ClockInitTypeDef::ClockPolarity***
  Specifies the steady state of the serial clock. This parameter can be a value of ***USART_LL_EC_POLARITY***.USART HW configuration can be modified afterwards using unitary functions **LL_USART_SetClockPolarity()**. For more details, refer to description of this function.
- ***uint32_t LL_USART_ClockInitTypeDef::ClockPhase***
  Specifies the clock transition on which the bit capture is made. This parameter can be a value of ***USART_LL_EC_PHASE***.USART HW configuration can be modified afterwards using unitary functions **LL_USART_SetClockPhase()**. For more details, refer to description of this function.
- ***uint32_t LL_USART_ClockInitTypeDef::LastBitClockPulse***
  Specifies whether the clock pulse corresponding to the last transmitted data bit (MSB) has to be output on the SCLK pin in synchronous mode. This parameter can be a value of ***USART_LL_EC_LASTCLKPULSE***.USART HW configuration can be modified afterwards using unitary functions **LL_USART_SetLastClkPulseOutput()**. For more details, refer to description of this function.

78.2 USART Firmware driver API description

The following section lists the various functions of the USART library.

78.2.1 Detailed description of functions

LL_USART_Enable

Function name

__STATIC_INLINE void LL_USART_Enable (USART_TypeDef * USARTx)

Function description

USART Enable.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 UE LL_USART_Enable

LL_USART_Disable

Function name

__STATIC_INLINE void LL_USART_Disable (USART_TypeDef * USARTx)

Function description

USART Disable (all USART prescalers and outputs are disabled)

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- When USART is disabled, USART prescalers and outputs are stopped immediately, and current operations are discarded. The configuration of the USART is kept, but all the status flags, in the USARTx_ISR are set to their default values.

Reference Manual to LL API cross reference:

- CR1 UE LL_USART_Disable

LL_USART_IsEnabled

Function name

__STATIC_INLINE uint32_t LL_USART_IsEnabled (const USART_TypeDef * USARTx)

Function description

Indicate if USART is enabled.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 UE LL_USART_IsEnabled

LL_USART_EnableFIFO

Function name

__STATIC_INLINE void LL_USART_EnableFIFO (USART_TypeDef * USARTx)

Function description

FIFO Mode Enable.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_FIFO_INSTANCE(USARTx) can be used to check whether or not FIFO mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR1 FIFOEN LL_USART_EnableFIFO

LL_USART_DisableFIFO

Function name

__STATIC_INLINE void LL_USART_DisableFIFO (USART_TypeDef * USARTx)

Function description

FIFO Mode Disable.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_FIFO_INSTANCE(USARTx) can be used to check whether or not FIFO mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR1 FIFOEN LL_USART_DisableFIFO

LL_USART_IsEnabledFIFO

Function name

__STATIC_INLINE uint32_t LL_USART_IsEnabledFIFO (const USART_TypeDef * USARTx)

Function description

Indicate if FIFO Mode is enabled.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_UART_FIFO_INSTANCE(USARTx) can be used to check whether or not FIFO mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR1 FIFOEN LL_USART_IsEnabledFIFO

LL_USART_SetTXFIFOThreshold

Function name

__STATIC_INLINE void LL_USART_SetTXFIFOThreshold (USART_TypeDef * USARTx, uint32_t Threshold)

Function description

Configure TX FIFO Threshold.

Parameters

- **USARTx:** USART Instance
- **Threshold:** This parameter can be one of the following values:
  - LL_USART_FIFOTHRESHOLD_1_8
  - LL_USART_FIFOTHRESHOLD_1_4
  - LL_USART_FIFOTHRESHOLD_1_2
  - LL_USART_FIFOTHRESHOLD_3_4
  - LL_USART_FIFOTHRESHOLD_7_8
  - LL_USART_FIFOTHRESHOLD_8_8

Return values

- **None:**

Notes

- Macro IS_UART_FIFO_INSTANCE(USARTx) can be used to check whether or not FIFO mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 TXFTCFG LL_USART_SetTXFIFOThreshold

LL_USART_GetTXFIFOThreshold

Function name

__STATIC_INLINE uint32_t LL_USART_GetTXFIFOThreshold (const USART_TypeDef * USARTx)

Function description

Return TX FIFO Threshold Configuration.

Parameters

- **USARTx:** USART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_USART_FIFOTHRESHOLD_1_8
  - LL_USART_FIFOTHRESHOLD_1_4
  - LL_USART_FIFOTHRESHOLD_1_2
  - LL_USART_FIFOTHRESHOLD_3_4
  - LL_USART_FIFOTHRESHOLD_7_8
  - LL_USART_FIFOTHRESHOLD_8_8

Notes

- Macro IS_UART_FIFO_INSTANCE(USARTx) can be used to check whether or not FIFO mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 TXFTCFG LL_USART_GetTXFIFOThreshold

LL_USART_SetRXFIFOThreshold

Function name

__STATIC_INLINE void LL_USART_SetRXFIFOThreshold (USART_TypeDef * USARTx, uint32_t Threshold)

Function description

Configure RX FIFO Threshold.

Parameters

- **USARTx:** USART Instance
- **Threshold:** This parameter can be one of the following values:
  - LL_USART_FIFOTHRESHOLD_1_8
  - LL_USART_FIFOTHRESHOLD_1_4
  - LL_USART_FIFOTHRESHOLD_1_2
  - LL_USART_FIFOTHRESHOLD_3_4
  - LL_USART_FIFOTHRESHOLD_7_8
  - LL_USART_FIFOTHRESHOLD_8_8

Return values

- **None:**

Notes

- Macro IS_UART_FIFO_INSTANCE(USARTx) can be used to check whether or not FIFO mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 RXFTCFG LL_USART_SetRXFIFOThreshold

LL_USART_GetRXFIFOThreshold

Function name

__STATIC_INLINE uint32_t LL_USART_GetRXFIFOThreshold (const USART_TypeDef * USARTx)

Function description

Return RX FIFO Threshold Configuration.

Parameters

- **USARTx:** USART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_USART_FIFOTHRESHOLD_1_8
  - LL_USART_FIFOTHRESHOLD_1_4
  - LL_USART_FIFOTHRESHOLD_1_2
  - LL_USART_FIFOTHRESHOLD_3_4
  - LL_USART_FIFOTHRESHOLD_7_8
  - LL_USART_FIFOTHRESHOLD_8_8

Notes

- Macro IS_UART_FIFO_INSTANCE(USARTx) can be used to check whether or not FIFO mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 RXFTCFG LL_USART_GetRXFIFOThreshold

LL_USART_ConfigFIFOsThreshold

Function name

__STATIC_INLINE void LL_USART_ConfigFIFOsThreshold (USART_TypeDef * USARTx, uint32_t TXThreshold, uint32_t RXThreshold)

Function description

Configure TX and RX FIFOs Threshold.

Parameters

- **USARTx:** USART Instance
- **TXThreshold:** This parameter can be one of the following values:
  - LL_USART_FIFOTHRESHOLD_1_8
  - LL_USART_FIFOTHRESHOLD_1_4
  - LL_USART_FIFOTHRESHOLD_1_2
  - LL_USART_FIFOTHRESHOLD_3_4
  - LL_USART_FIFOTHRESHOLD_7_8
  - LL_USART_FIFOTHRESHOLD_8_8
- **RXThreshold:** This parameter can be one of the following values:
  - LL_USART_FIFOTHRESHOLD_1_8
  - LL_USART_FIFOTHRESHOLD_1_4
  - LL_USART_FIFOTHRESHOLD_1_2
  - LL_USART_FIFOTHRESHOLD_3_4
  - LL_USART_FIFOTHRESHOLD_7_8
  - LL_USART_FIFOTHRESHOLD_8_8

Return values

- **None:**

Notes

- Macro IS_UART_FIFO_INSTANCE(USARTx) can be used to check whether or not FIFO mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 TXFTCFG LL_USART_ConfigFIFOsThreshold
- CR3 RXFTCFG LL_USART_ConfigFIFOsThreshold

LL_USART_EnableInStopMode

Function name

__STATIC_INLINE void LL_USART_EnableInStopMode (USART_TypeDef * USARTx)

Function description

USART enabled in STOP Mode.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- When this function is enabled, USART is able to wake up the MCU from Stop mode, provided that USART clock selection is HSI or LSE in RCC.
- Macro IS_UART_WAKEUP_FROMSTOP_INSTANCE(USARTx) can be used to check whether or not Wake-up from Stop mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR1 UESM LL_USART_EnableInStopMode

LL_USART_DisableInStopMode

Function name

__STATIC_INLINE void LL_USART_DisableInStopMode (USART_TypeDef * USARTx)

Function description

USART disabled in STOP Mode.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- When this function is disabled, USART is not able to wake up the MCU from Stop mode
- Macro IS_UART_WAKEUP_FROMSTOP_INSTANCE(USARTx) can be used to check whether or not Wake-up from Stop mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR1 UESM LL_USART_DisableInStopMode

LL_USART_IsEnabledInStopMode

Function name

__STATIC_INLINE uint32_t LL_USART_IsEnabledInStopMode (const USART_TypeDef * USARTx)

Function description

Indicate if USART is enabled in STOP Mode (able to wake up MCU from Stop mode or not)

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_UART_WAKEUP_FROMSTOP_INSTANCE(USARTx) can be used to check whether or not Wake-up from Stop mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR1 UESM LL_USART_IsEnabledInStopMode

LL_USART_EnableDirectionRx

Function name

__STATIC_INLINE void LL_USART_EnableDirectionRx (USART_TypeDef * USARTx)

Function description

Receiver Enable (Receiver is enabled and begins searching for a start bit)

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 RE LL_USART_EnableDirectionRx

LL_USART_DisableDirectionRx

Function name

__STATIC_INLINE void LL_USART_DisableDirectionRx (USART_TypeDef * USARTx)

Function description

Receiver Disable.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 RE LL_USART_DisableDirectionRx

LL_USART_EnableDirectionTx

Function name

__STATIC_INLINE void LL_USART_EnableDirectionTx (USART_TypeDef * USARTx)

Function description

Transmitter Enable.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 TE LL_USART_EnableDirectionTx

LL_USART_DisableDirectionTx

Function name

__STATIC_INLINE void LL_USART_DisableDirectionTx (USART_TypeDef * USARTx)

Function description

Transmitter Disable.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 TE LL_USART_DisableDirectionTx

LL_USART_SetTransferDirection

Function name

__STATIC_INLINE void LL_USART_SetTransferDirection (USART_TypeDef * USARTx, uint32_t TransferDirection)

Function description

Configure simultaneously enabled/disabled states of Transmitter and Receiver.

Parameters

- **USARTx:** USART Instance
- **TransferDirection:** This parameter can be one of the following values:
  - LL_USART_DIRECTION_NONE
  - LL_USART_DIRECTION_RX
  - LL_USART_DIRECTION_TX
  - LL_USART_DIRECTION_TX_RX

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 RE LL_USART_SetTransferDirection
- CR1 TE LL_USART_SetTransferDirection

LL_USART_GetTransferDirection

Function name

__STATIC_INLINE uint32_t LL_USART_GetTransferDirection (const USART_TypeDef * USARTx)

Function description

Return enabled/disabled states of Transmitter and Receiver.

Parameters

- **USARTx:** USART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_USART_DIRECTION_NONE
  - LL_USART_DIRECTION_RX
  - LL_USART_DIRECTION_TX
  - LL_USART_DIRECTION_TX_RX

Reference Manual to LL API cross reference:

- CR1 RE LL_USART_GetTransferDirection
- CR1 TE LL_USART_GetTransferDirection

LL_USART_SetParity

Function name

__STATIC_INLINE void LL_USART_SetParity (USART_TypeDef * USARTx, uint32_t Parity)

Function description

Configure Parity (enabled/disabled and parity mode if enabled).

Parameters

- **USARTx:** USART Instance
- **Parity:** This parameter can be one of the following values:
  - LL_USART_PARITY_NONE
  - LL_USART_PARITY_EVEN
  - LL_USART_PARITY_ODD

Return values

- **None:**

Notes

- This function selects if hardware parity control (generation and detection) is enabled or disabled. When the parity control is enabled (Odd or Even), computed parity bit is inserted at the MSB position (9th or 8th bit depending on data width) and parity is checked on the received data.

Reference Manual to LL API cross reference:

- CR1 PS LL_USART_SetParity
- CR1 PCE LL_USART_SetParity

LL_USART_GetParity

Function name

__STATIC_INLINE uint32_t LL_USART_GetParity (const USART_TypeDef * USARTx)

Function description

Return Parity configuration (enabled/disabled and parity mode if enabled)

Parameters

- **USARTx:** USART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_USART_PARITY_NONE
  - LL_USART_PARITY_EVEN
  - LL_USART_PARITY_ODD

Reference Manual to LL API cross reference:

- CR1 PS LL_USART_GetParity
- CR1 PCE LL_USART_GetParity

LL_USART_SetWakeUpMethod

Function name

__STATIC_INLINE void LL_USART_SetWakeUpMethod (USART_TypeDef * USARTx, uint32_t Method)

Function description

Set Receiver Wake Up method from Mute mode.

Parameters

- **USARTx:** USART Instance
- **Method:** This parameter can be one of the following values:
  - LL_USART_WAKEUP_IDLELINE
  - LL_USART_WAKEUP_ADDRESSMARK

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 WAKE LL_USART_SetWakeUpMethod

LL_USART_GetWakeUpMethod

Function name

__STATIC_INLINE uint32_t LL_USART_GetWakeUpMethod (const USART_TypeDef * USARTx)

Function description

Return Receiver Wake Up method from Mute mode.

Parameters

- **USARTx:** USART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_USART_WAKEUP_IDLELINE
  - LL_USART_WAKEUP_ADDRESSMARK

Reference Manual to LL API cross reference:

- CR1 WAKE LL_USART_GetWakeUpMethod

LL_USART_SetDataWidth

Function name

__STATIC_INLINE void LL_USART_SetDataWidth (USART_TypeDef * USARTx, uint32_t DataWidth)

Function description

Set Word length (i.e.

Parameters

- **USARTx:** USART Instance
- **DataWidth:** This parameter can be one of the following values:
  - LL_USART_DATAWIDTH_7B
  - LL_USART_DATAWIDTH_8B
  - LL_USART_DATAWIDTH_9B

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 M0 LL_USART_SetDataWidth
- CR1 M1 LL_USART_SetDataWidth

LL_USART_GetDataWidth

Function name

__STATIC_INLINE uint32_t LL_USART_GetDataWidth (const USART_TypeDef * USARTx)

Function description

Return Word length (i.e.

Parameters

- **USARTx:** USART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_USART_DATAWIDTH_7B
  - LL_USART_DATAWIDTH_8B
  - LL_USART_DATAWIDTH_9B

Reference Manual to LL API cross reference:

- CR1 M0 LL_USART_GetDataWidth
- CR1 M1 LL_USART_GetDataWidth

LL_USART_EnableMuteMode

Function name

__STATIC_INLINE void LL_USART_EnableMuteMode (USART_TypeDef * USARTx)

Function description

Allow switch between Mute Mode and Active mode.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 MME LL_USART_EnableMuteMode

LL_USART_DisableMuteMode

Function name

__STATIC_INLINE void LL_USART_DisableMuteMode (USART_TypeDef * USARTx)

Function description

Prevent Mute Mode use.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 MME LL_USART_DisableMuteMode

LL_USART_IsEnabledMuteMode

Function name

__STATIC_INLINE uint32_t LL_USART_IsEnabledMuteMode (const USART_TypeDef * USARTx)

Function description

Indicate if switch between Mute Mode and Active mode is allowed.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 MME LL_USART_IsEnabledMuteMode

LL_USART_SetOverSampling

Function name

__STATIC_INLINE void LL_USART_SetOverSampling (USART_TypeDef * USARTx, uint32_t OverSampling)

Function description

Set Oversampling to 8-bit or 16-bit mode.

Parameters

- **USARTx:** USART Instance
- **OverSampling:** This parameter can be one of the following values:
  - LL_USART_OVERSAMPLING_16
  - LL_USART_OVERSAMPLING_8

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 OVER8 LL_USART_SetOverSampling

LL_USART_GetOverSampling

Function name

__STATIC_INLINE uint32_t LL_USART_GetOverSampling (const USART_TypeDef * USARTx)

Function description

Return Oversampling mode.

Parameters

- **USARTx:** USART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_USART_OVERSAMPLING_16
  - LL_USART_OVERSAMPLING_8

Reference Manual to LL API cross reference:

- CR1 OVER8 LL_USART_GetOverSampling

LL_USART_SetLastClkPulseOutput

Function name

__STATIC_INLINE void LL_USART_SetLastClkPulseOutput (USART_TypeDef * USARTx, uint32_t LastBitClockPulse)

Function description

Configure if Clock pulse of the last data bit is output to the SCLK pin or not.

Parameters

- **USARTx:** USART Instance
- **LastBitClockPulse:** This parameter can be one of the following values:
  - LL_USART_LASTCLKPULSE_NO_OUTPUT
  - LL_USART_LASTCLKPULSE_OUTPUT

Return values

- **None:**

Notes

- Macro IS_USART_INSTANCE(USARTx) can be used to check whether or not Synchronous mode is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR2 LBCL LL_USART_SetLastClkPulseOutput

LL_USART_GetLastClkPulseOutput

Function name

__STATIC_INLINE uint32_t LL_USART_GetLastClkPulseOutput (const USART_TypeDef * USARTx)

Function description

Retrieve Clock pulse of the last data bit output configuration (Last bit Clock pulse output to the SCLK pin or not)

Parameters

- **USARTx:** USART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_USART_LASTCLKPULSE_NO_OUTPUT
  - LL_USART_LASTCLKPULSE_OUTPUT

Notes

- Macro IS_USART_INSTANCE(USARTx) can be used to check whether or not Synchronous mode is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR2 LBCL LL_USART_GetLastClkPulseOutput

LL_USART_SetClockPhase

Function name

__STATIC_INLINE void LL_USART_SetClockPhase (USART_TypeDef * USARTx, uint32_t ClockPhase)

Function description

Select the phase of the clock output on the SCLK pin in synchronous mode.

Parameters

- **USARTx:** USART Instance
- **ClockPhase:** This parameter can be one of the following values:
  - LL_USART_PHASE_1EDGE
  - LL_USART_PHASE_2EDGE

Return values

- **None:**

Notes

- Macro IS_USART_INSTANCE(USARTx) can be used to check whether or not Synchronous mode is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR2 CPHA LL_USART_SetClockPhase

LL_USART_GetClockPhase

Function name

__STATIC_INLINE uint32_t LL_USART_GetClockPhase (const USART_TypeDef * USARTx)

Function description

Return phase of the clock output on the SCLK pin in synchronous mode.

Parameters

- **USARTx:** USART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_USART_PHASE_1EDGE
  - LL_USART_PHASE_2EDGE

Notes

- Macro IS_USART_INSTANCE(USARTx) can be used to check whether or not Synchronous mode is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR2 CPHA LL_USART_GetClockPhase

LL_USART_SetClockPolarity

Function name

__STATIC_INLINE void LL_USART_SetClockPolarity (USART_TypeDef * USARTx, uint32_t ClockPolarity)

Function description

Select the polarity of the clock output on the SCLK pin in synchronous mode.

Parameters

- **USARTx:** USART Instance
- **ClockPolarity:** This parameter can be one of the following values:
  - LL_USART_POLARITY_LOW
  - LL_USART_POLARITY_HIGH

Return values

- **None:**

Notes

- Macro IS_USART_INSTANCE(USARTx) can be used to check whether or not Synchronous mode is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR2 CPOL LL_USART_SetClockPolarity

LL_USART_GetClockPolarity

Function name

__STATIC_INLINE uint32_t LL_USART_GetClockPolarity (const USART_TypeDef * USARTx)

Function description

Return polarity of the clock output on the SCLK pin in synchronous mode.

Parameters

- **USARTx:** USART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_USART_POLARITY_LOW
  - LL_USART_POLARITY_HIGH

Notes

- Macro IS_USART_INSTANCE(USARTx) can be used to check whether or not Synchronous mode is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR2 CPOL LL_USART_GetClockPolarity

LL_USART_ConfigClock

Function name

__STATIC_INLINE void LL_USART_ConfigClock (USART_TypeDef * USARTx, uint32_t Phase, uint32_t Polarity, uint32_t LBCPOutput)

Function description

Configure Clock signal format (Phase Polarity and choice about output of last bit clock pulse)

Parameters

- **USARTx:** USART Instance
- **Phase:** This parameter can be one of the following values:
  - LL_USART_PHASE_1EDGE
  - LL_USART_PHASE_2EDGE
- **Polarity:** This parameter can be one of the following values:
  - LL_USART_POLARITY_LOW
  - LL_USART_POLARITY_HIGH
- **LBCPOutput:** This parameter can be one of the following values:
  - LL_USART_LASTCLKPULSE_NO_OUTPUT
  - LL_USART_LASTCLKPULSE_OUTPUT

Return values

- **None:**

Notes

- Macro IS_USART_INSTANCE(USARTx) can be used to check whether or not Synchronous mode is supported by the USARTx instance.
- Call of this function is equivalent to following function call sequence : Clock Phase configuration using LL_USART_SetClockPhase() functionClock Polarity configuration using LL_USART_SetClockPolarity() functionOutput of Last bit Clock pulse configuration using LL_USART_SetLastClkPulseOutput() function

Reference Manual to LL API cross reference:

- CR2 CPHA LL_USART_ConfigClock
- CR2 CPOL LL_USART_ConfigClock
- CR2 LBCL LL_USART_ConfigClock

LL_USART_SetPrescaler

Function name

__STATIC_INLINE void LL_USART_SetPrescaler (USART_TypeDef * USARTx, uint32_t PrescalerValue)

Function description

Configure Clock source prescaler for baudrate generator and oversampling.

Parameters

- **USARTx:** USART Instance
- **PrescalerValue:** This parameter can be one of the following values:
  - LL_USART_PRESCALER_DIV1
  - LL_USART_PRESCALER_DIV2
  - LL_USART_PRESCALER_DIV4
  - LL_USART_PRESCALER_DIV6
  - LL_USART_PRESCALER_DIV8
  - LL_USART_PRESCALER_DIV10
  - LL_USART_PRESCALER_DIV12
  - LL_USART_PRESCALER_DIV16
  - LL_USART_PRESCALER_DIV32
  - LL_USART_PRESCALER_DIV64
  - LL_USART_PRESCALER_DIV128
  - LL_USART_PRESCALER_DIV256

Return values

- **None:**

Notes

- Macro IS_UART_FIFO_INSTANCE(USARTx) can be used to check whether or not FIFO mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- PRESC PRESCALER LL_USART_SetPrescaler

LL_USART_GetPrescaler

Function name

__STATIC_INLINE uint32_t LL_USART_GetPrescaler (const USART_TypeDef * USARTx)

Function description

Retrieve the Clock source prescaler for baudrate generator and oversampling.

Parameters

- **USARTx:** USART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_USART_PRESCALER_DIV1
  - LL_USART_PRESCALER_DIV2
  - LL_USART_PRESCALER_DIV4
  - LL_USART_PRESCALER_DIV6
  - LL_USART_PRESCALER_DIV8
  - LL_USART_PRESCALER_DIV10
  - LL_USART_PRESCALER_DIV12
  - LL_USART_PRESCALER_DIV16
  - LL_USART_PRESCALER_DIV32
  - LL_USART_PRESCALER_DIV64
  - LL_USART_PRESCALER_DIV128
  - LL_USART_PRESCALER_DIV256

Notes

- Macro IS_UART_FIFO_INSTANCE(USARTx) can be used to check whether or not FIFO mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- PRESC PRESCALER LL_USART_GetPrescaler

LL_USART_EnableSCLKOutput

Function name

__STATIC_INLINE void LL_USART_EnableSCLKOutput (USART_TypeDef * USARTx)

Function description

Enable Clock output on SCLK pin.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_USART_INSTANCE(USARTx) can be used to check whether or not Synchronous mode is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR2 CLKEN LL_USART_EnableSCLKOutput

LL_USART_DisableSCLKOutput

Function name

__STATIC_INLINE void LL_USART_DisableSCLKOutput (USART_TypeDef * USARTx)

Function description

Disable Clock output on SCLK pin.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_USART_INSTANCE(USARTx) can be used to check whether or not Synchronous mode is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR2 CLKEN LL_USART_DisableSCLKOutput

LL_USART_IsEnabledSCLKOutput

Function name

__STATIC_INLINE uint32_t LL_USART_IsEnabledSCLKOutput (const USART_TypeDef * USARTx)

Function description

Indicate if Clock output on SCLK pin is enabled.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_USART_INSTANCE(USARTx) can be used to check whether or not Synchronous mode is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR2 CLKEN LL_USART_IsEnabledSCLKOutput

LL_USART_SetStopBitsLength

Function name

__STATIC_INLINE void LL_USART_SetStopBitsLength (USART_TypeDef * USARTx, uint32_t StopBits)

Function description

Set the length of the stop bits.

Parameters

- **USARTx:** USART Instance
- **StopBits:** This parameter can be one of the following values:
  - LL_USART_STOPBITS_0_5
  - LL_USART_STOPBITS_1
  - LL_USART_STOPBITS_1_5
  - LL_USART_STOPBITS_2

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR2 STOP LL_USART_SetStopBitsLength

LL_USART_GetStopBitsLength

Function name

__STATIC_INLINE uint32_t LL_USART_GetStopBitsLength (const USART_TypeDef * USARTx)

Function description

Retrieve the length of the stop bits.

Parameters

- **USARTx:** USART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_USART_STOPBITS_0_5
  - LL_USART_STOPBITS_1
  - LL_USART_STOPBITS_1_5
  - LL_USART_STOPBITS_2

Reference Manual to LL API cross reference:

- CR2 STOP LL_USART_GetStopBitsLength

LL_USART_ConfigCharacter

Function name

__STATIC_INLINE void LL_USART_ConfigCharacter (USART_TypeDef * USARTx, uint32_t DataWidth, uint32_t Parity, uint32_t StopBits)

Function description

Configure Character frame format (Datawidth, Parity control, Stop Bits)

Parameters

- **USARTx:** USART Instance
- **DataWidth:** This parameter can be one of the following values:
  - LL_USART_DATAWIDTH_7B
  - LL_USART_DATAWIDTH_8B
  - LL_USART_DATAWIDTH_9B
- **Parity:** This parameter can be one of the following values:
  - LL_USART_PARITY_NONE
  - LL_USART_PARITY_EVEN
  - LL_USART_PARITY_ODD
- **StopBits:** This parameter can be one of the following values:
  - LL_USART_STOPBITS_0_5
  - LL_USART_STOPBITS_1
  - LL_USART_STOPBITS_1_5
  - LL_USART_STOPBITS_2

Return values

- **None:**

Notes

- Call of this function is equivalent to following function call sequence : Data Width configuration using LL_USART_SetDataWidth() functionParity Control and mode configuration using LL_USART_SetParity() functionStop bits configuration using LL_USART_SetStopBitsLength() function

Reference Manual to LL API cross reference:

- CR1 PS LL_USART_ConfigCharacter
- CR1 PCE LL_USART_ConfigCharacter
- CR1 M0 LL_USART_ConfigCharacter
- CR1 M1 LL_USART_ConfigCharacter
- CR2 STOP LL_USART_ConfigCharacter

LL_USART_SetTXRXSwap

Function name

__STATIC_INLINE void LL_USART_SetTXRXSwap (USART_TypeDef * USARTx, uint32_t SwapConfig)

Function description

Configure TX/RX pins swapping setting.

Parameters

- **USARTx:** USART Instance
- **SwapConfig:** This parameter can be one of the following values:
  - LL_USART_TXRX_STANDARD
  - LL_USART_TXRX_SWAPPED

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR2 SWAP LL_USART_SetTXRXSwap

LL_USART_GetTXRXSwap

Function name

__STATIC_INLINE uint32_t LL_USART_GetTXRXSwap (const USART_TypeDef * USARTx)

Function description

Retrieve TX/RX pins swapping configuration.

Parameters

- **USARTx:** USART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_USART_TXRX_STANDARD
  - LL_USART_TXRX_SWAPPED

Reference Manual to LL API cross reference:

- CR2 SWAP LL_USART_GetTXRXSwap

LL_USART_SetRXPinLevel

Function name

__STATIC_INLINE void LL_USART_SetRXPinLevel (USART_TypeDef * USARTx, uint32_t PinInvMethod)

Function description

Configure RX pin active level logic.

Parameters

- **USARTx:** USART Instance
- **PinInvMethod:** This parameter can be one of the following values:
  - LL_USART_RXPIN_LEVEL_STANDARD
  - LL_USART_RXPIN_LEVEL_INVERTED

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR2 RXINV LL_USART_SetRXPinLevel

LL_USART_GetRXPinLevel

Function name

__STATIC_INLINE uint32_t LL_USART_GetRXPinLevel (const USART_TypeDef * USARTx)

Function description

Retrieve RX pin active level logic configuration.

Parameters

- **USARTx:** USART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_USART_RXPIN_LEVEL_STANDARD
  - LL_USART_RXPIN_LEVEL_INVERTED

Reference Manual to LL API cross reference:

- CR2 RXINV LL_USART_GetRXPinLevel

LL_USART_SetTXPinLevel

Function name

__STATIC_INLINE void LL_USART_SetTXPinLevel (USART_TypeDef * USARTx, uint32_t PinInvMethod)

Function description

Configure TX pin active level logic.

Parameters

- **USARTx:** USART Instance
- **PinInvMethod:** This parameter can be one of the following values:
  - LL_USART_TXPIN_LEVEL_STANDARD
  - LL_USART_TXPIN_LEVEL_INVERTED

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR2 TXINV LL_USART_SetTXPinLevel

LL_USART_GetTXPinLevel

Function name

__STATIC_INLINE uint32_t LL_USART_GetTXPinLevel (const USART_TypeDef * USARTx)

Function description

Retrieve TX pin active level logic configuration.

Parameters

- **USARTx:** USART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_USART_TXPIN_LEVEL_STANDARD
  - LL_USART_TXPIN_LEVEL_INVERTED

Reference Manual to LL API cross reference:

- CR2 TXINV LL_USART_GetTXPinLevel

LL_USART_SetBinaryDataLogic

Function name

__STATIC_INLINE void LL_USART_SetBinaryDataLogic (USART_TypeDef * USARTx, uint32_t DataLogic)

Function description

Configure Binary data logic.

Parameters

- **USARTx:** USART Instance
- **DataLogic:** This parameter can be one of the following values:
  - LL_USART_BINARY_LOGIC_POSITIVE
  - LL_USART_BINARY_LOGIC_NEGATIVE

Return values

- **None:**

Notes

- Allow to define how Logical data from the data register are send/received : either in positive/direct logic (1=H, 0=L) or in negative/inverse logic (1=L, 0=H)

Reference Manual to LL API cross reference:

- CR2 DATAINV LL_USART_SetBinaryDataLogic

LL_USART_GetBinaryDataLogic

Function name

__STATIC_INLINE uint32_t LL_USART_GetBinaryDataLogic (const USART_TypeDef * USARTx)

Function description

Retrieve Binary data configuration.

Parameters

- **USARTx:** USART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_USART_BINARY_LOGIC_POSITIVE
  - LL_USART_BINARY_LOGIC_NEGATIVE

Reference Manual to LL API cross reference:

- CR2 DATAINV LL_USART_GetBinaryDataLogic

LL_USART_SetTransferBitOrder

Function name

__STATIC_INLINE void LL_USART_SetTransferBitOrder (USART_TypeDef * USARTx, uint32_t BitOrder)

Function description

Configure transfer bit order (either Less or Most Significant Bit First)

Parameters

- **USARTx:** USART Instance
- **BitOrder:** This parameter can be one of the following values:
  - LL_USART_BITORDER_LSBFIRST
  - LL_USART_BITORDER_MSBFIRST

Return values

- **None:**

Notes

- MSB First means data is transmitted/received with the MSB first, following the start bit. LSB First means data is transmitted/received with data bit 0 first, following the start bit.

Reference Manual to LL API cross reference:

- CR2 MSBFIRST LL_USART_SetTransferBitOrder

LL_USART_GetTransferBitOrder

Function name

__STATIC_INLINE uint32_t LL_USART_GetTransferBitOrder (const USART_TypeDef * USARTx)

Function description

Return transfer bit order (either Less or Most Significant Bit First)

Parameters

- **USARTx:** USART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_USART_BITORDER_LSBFIRST
  - LL_USART_BITORDER_MSBFIRST

Notes

- MSB First means data is transmitted/received with the MSB first, following the start bit. LSB First means data is transmitted/received with data bit 0 first, following the start bit.

Reference Manual to LL API cross reference:

- CR2 MSBFIRST LL_USART_GetTransferBitOrder

LL_USART_EnableAutoBaudRate

Function name

__STATIC_INLINE void LL_USART_EnableAutoBaudRate (USART_TypeDef * USARTx)

Function description

Enable Auto Baud-Rate Detection.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_USART_AUTOBAUDRATE_DETECTION_INSTANCE(USARTx) can be used to check whether or not Auto Baud Rate detection feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR2 ABREN LL_USART_EnableAutoBaudRate

LL_USART_DisableAutoBaudRate

Function name

__STATIC_INLINE void LL_USART_DisableAutoBaudRate (USART_TypeDef * USARTx)

Function description

Disable Auto Baud-Rate Detection.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_USART_AUTOBAUDRATE_DETECTION_INSTANCE(USARTx) can be used to check whether or not Auto Baud Rate detection feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR2 ABREN LL_USART_DisableAutoBaudRate

LL_USART_IsEnabledAutoBaud

Function name

__STATIC_INLINE uint32_t LL_USART_IsEnabledAutoBaud (const USART_TypeDef * USARTx)

Function description

Indicate if Auto Baud-Rate Detection mechanism is enabled.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_USART_AUTOBAUDRATE_DETECTION_INSTANCE(USARTx) can be used to check whether or not Auto Baud Rate detection feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR2 ABREN LL_USART_IsEnabledAutoBaud

LL_USART_SetAutoBaudRateMode

Function name

__STATIC_INLINE void LL_USART_SetAutoBaudRateMode (USART_TypeDef * USARTx, uint32_t AutoBaudRateMode)

Function description

Set Auto Baud-Rate mode bits.

Parameters

- **USARTx:** USART Instance
- **AutoBaudRateMode:** This parameter can be one of the following values:
  - LL_USART_AUTOBAUD_DETECT_ON_STARTBIT
  - LL_USART_AUTOBAUD_DETECT_ON_FALLINGEDGE
  - LL_USART_AUTOBAUD_DETECT_ON_7F_FRAME
  - LL_USART_AUTOBAUD_DETECT_ON_55_FRAME

Return values

- **None:**

Notes

- Macro IS_USART_AUTOBAUDRATE_DETECTION_INSTANCE(USARTx) can be used to check whether or not Auto Baud Rate detection feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR2 ABRMODE LL_USART_SetAutoBaudRateMode

LL_USART_GetAutoBaudRateMode

Function name

__STATIC_INLINE uint32_t LL_USART_GetAutoBaudRateMode (const USART_TypeDef * USARTx)

Function description

Return Auto Baud-Rate mode.

Parameters

- **USARTx:** USART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_USART_AUTOBAUD_DETECT_ON_STARTBIT
  - LL_USART_AUTOBAUD_DETECT_ON_FALLINGEDGE
  - LL_USART_AUTOBAUD_DETECT_ON_7F_FRAME
  - LL_USART_AUTOBAUD_DETECT_ON_55_FRAME

Notes

- Macro IS_USART_AUTOBAUDRATE_DETECTION_INSTANCE(USARTx) can be used to check whether or not Auto Baud Rate detection feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR2 ABRMODE LL_USART_GetAutoBaudRateMode

LL_USART_EnableRxTimeout

Function name

__STATIC_INLINE void LL_USART_EnableRxTimeout (USART_TypeDef * USARTx)

Function description

Enable Receiver Timeout.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR2 RTOEN LL_USART_EnableRxTimeout

LL_USART_DisableRxTimeout

Function name

__STATIC_INLINE void LL_USART_DisableRxTimeout (USART_TypeDef * USARTx)

Function description

Disable Receiver Timeout.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR2 RTOEN LL_USART_DisableRxTimeout

LL_USART_IsEnabledRxTimeout

Function name

__STATIC_INLINE uint32_t LL_USART_IsEnabledRxTimeout (const USART_TypeDef * USARTx)

Function description

Indicate if Receiver Timeout feature is enabled.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR2 RTOEN LL_USART_IsEnabledRxTimeout

LL_USART_ConfigNodeAddress

Function name

__STATIC_INLINE void LL_USART_ConfigNodeAddress (USART_TypeDef * USARTx, uint32_t AddressLen, uint32_t NodeAddress)

Function description

Set Address of the USART node.

Parameters

- **USARTx:** USART Instance
- **AddressLen:** This parameter can be one of the following values:
  - LL_USART_ADDRESS_DETECT_4B
  - LL_USART_ADDRESS_DETECT_7B
- **NodeAddress:** 4 or 7 bit Address of the USART node.

Return values

- **None:**

Notes

- This is used in multiprocessor communication during Mute mode or Stop mode, for wake up with address mark detection.
- 4bits address node is used when 4-bit Address Detection is selected in ADDM7. (b7-b4 should be set to 0) 8bits address node is used when 7-bit Address Detection is selected in ADDM7. (This is used in multiprocessor communication during Mute mode or Stop mode, for wake up with 7-bit address mark detection. The MSB of the character sent by the transmitter should be equal to 1. It may also be used for character detection during normal reception, Mute mode inactive (for example, end of block detection in ModBus protocol). In this case, the whole received character (8-bit) is compared to the ADD[7:0] value and CMF flag is set on match)

Reference Manual to LL API cross reference:

- CR2 ADD LL_USART_ConfigNodeAddress
- CR2 ADDM7 LL_USART_ConfigNodeAddress

LL_USART_GetNodeAddress

Function name

__STATIC_INLINE uint32_t LL_USART_GetNodeAddress (const USART_TypeDef * USARTx)

Function description

Return 8 bit Address of the USART node as set in ADD field of CR2.

Parameters

- **USARTx:** USART Instance

Return values

- **Address:** of the USART node (Value between Min_Data=0 and Max_Data=255)

Notes

- If 4-bit Address Detection is selected in ADDM7, only 4bits (b3-b0) of returned value are relevant (b31-b4 are not relevant) If 7-bit Address Detection is selected in ADDM7, only 8bits (b7-b0) of returned value are relevant (b31-b8 are not relevant)

Reference Manual to LL API cross reference:

- CR2 ADD LL_USART_GetNodeAddress

LL_USART_GetNodeAddressLen

Function name

__STATIC_INLINE uint32_t LL_USART_GetNodeAddressLen (const USART_TypeDef * USARTx)

Function description

Return Length of Node Address used in Address Detection mode (7-bit or 4-bit)

Parameters

- **USARTx:** USART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_USART_ADDRESS_DETECT_4B
  - LL_USART_ADDRESS_DETECT_7B

Reference Manual to LL API cross reference:

- CR2 ADDM7 LL_USART_GetNodeAddressLen

LL_USART_EnableRTSHWFlowCtrl

Function name

__STATIC_INLINE void LL_USART_EnableRTSHWFlowCtrl (USART_TypeDef * USARTx)

Function description

Enable RTS HW Flow Control.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_HWFLOW_INSTANCE(USARTx) can be used to check whether or not Hardware Flow control feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 RTSE LL_USART_EnableRTSHWFlowCtrl

LL_USART_DisableRTSHWFlowCtrl

Function name

__STATIC_INLINE void LL_USART_DisableRTSHWFlowCtrl (USART_TypeDef * USARTx)

Function description

Disable RTS HW Flow Control.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_HWFLOW_INSTANCE(USARTx) can be used to check whether or not Hardware Flow control feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 RTSE LL_USART_DisableRTSHWFlowCtrl

LL_USART_EnableCTSHWFlowCtrl

Function name

__STATIC_INLINE void LL_USART_EnableCTSHWFlowCtrl (USART_TypeDef * USARTx)

Function description

Enable CTS HW Flow Control.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_HWFLOW_INSTANCE(USARTx) can be used to check whether or not Hardware Flow control feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 CTSE LL_USART_EnableCTSHWFlowCtrl

LL_USART_DisableCTSHWFlowCtrl

Function name

__STATIC_INLINE void LL_USART_DisableCTSHWFlowCtrl (USART_TypeDef * USARTx)

Function description

Disable CTS HW Flow Control.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_HWFLOW_INSTANCE(USARTx) can be used to check whether or not Hardware Flow control feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 CTSE LL_USART_DisableCTSHWFlowCtrl

LL_USART_SetHWFlowCtrl

Function name

__STATIC_INLINE void LL_USART_SetHWFlowCtrl (USART_TypeDef * USARTx, uint32_t HardwareFlowControl)

Function description

Configure HW Flow Control mode (both CTS and RTS)

Parameters

- **USARTx:** USART Instance
- **HardwareFlowControl:** This parameter can be one of the following values:
  - LL_USART_HWCONTROL_NONE
  - LL_USART_HWCONTROL_RTS
  - LL_USART_HWCONTROL_CTS
  - LL_USART_HWCONTROL_RTS_CTS

Return values

- **None:**

Notes

- Macro IS_UART_HWFLOW_INSTANCE(USARTx) can be used to check whether or not Hardware Flow control feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 RTSE LL_USART_SetHWFlowCtrl
- CR3 CTSE LL_USART_SetHWFlowCtrl

LL_USART_GetHWFlowCtrl

Function name

__STATIC_INLINE uint32_t LL_USART_GetHWFlowCtrl (const USART_TypeDef * USARTx)

Function description

Return HW Flow Control configuration (both CTS and RTS)

Parameters

- **USARTx:** USART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_USART_HWCONTROL_NONE
  - LL_USART_HWCONTROL_RTS
  - LL_USART_HWCONTROL_CTS
  - LL_USART_HWCONTROL_RTS_CTS

Notes

- Macro IS_UART_HWFLOW_INSTANCE(USARTx) can be used to check whether or not Hardware Flow control feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 RTSE LL_USART_GetHWFlowCtrl
- CR3 CTSE LL_USART_GetHWFlowCtrl

LL_USART_EnableOneBitSamp

Function name

__STATIC_INLINE void LL_USART_EnableOneBitSamp (USART_TypeDef * USARTx)

Function description

Enable One bit sampling method.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 ONEBIT LL_USART_EnableOneBitSamp

LL_USART_DisableOneBitSamp

Function name

__STATIC_INLINE void LL_USART_DisableOneBitSamp (USART_TypeDef * USARTx)

Function description

Disable One bit sampling method.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 ONEBIT LL_USART_DisableOneBitSamp

LL_USART_IsEnabledOneBitSamp

Function name

__STATIC_INLINE uint32_t LL_USART_IsEnabledOneBitSamp (const USART_TypeDef * USARTx)

Function description

Indicate if One bit sampling method is enabled.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR3 ONEBIT LL_USART_IsEnabledOneBitSamp

LL_USART_EnableOverrunDetect

Function name

__STATIC_INLINE void LL_USART_EnableOverrunDetect (USART_TypeDef * USARTx)

Function description

Enable Overrun detection.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 OVRDIS LL_USART_EnableOverrunDetect

LL_USART_DisableOverrunDetect

Function name

__STATIC_INLINE void LL_USART_DisableOverrunDetect (USART_TypeDef * USARTx)

Function description

Disable Overrun detection.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 OVRDIS LL_USART_DisableOverrunDetect

LL_USART_IsEnabledOverrunDetect

Function name

__STATIC_INLINE uint32_t LL_USART_IsEnabledOverrunDetect (const USART_TypeDef * USARTx)

Function description

Indicate if Overrun detection is enabled.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR3 OVRDIS LL_USART_IsEnabledOverrunDetect

LL_USART_SetWKUPType

Function name

__STATIC_INLINE void LL_USART_SetWKUPType (USART_TypeDef * USARTx, uint32_t Type)

Function description

Select event type for Wake UP Interrupt Flag (WUS[1:0] bits)

Parameters

- **USARTx:** USART Instance
- **Type:** This parameter can be one of the following values:
  - LL_USART_WAKEUP_ON_ADDRESS
  - LL_USART_WAKEUP_ON_STARTBIT
  - LL_USART_WAKEUP_ON_RXNE

Return values

- **None:**

Notes

- Macro IS_UART_WAKEUP_FROMSTOP_INSTANCE(USARTx) can be used to check whether or not Wake-up from Stop mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 WUS LL_USART_SetWKUPType

LL_USART_GetWKUPType

Function name

__STATIC_INLINE uint32_t LL_USART_GetWKUPType (const USART_TypeDef * USARTx)

Function description

Return event type for Wake UP Interrupt Flag (WUS[1:0] bits)

Parameters

- **USARTx:** USART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_USART_WAKEUP_ON_ADDRESS
  - LL_USART_WAKEUP_ON_STARTBIT
  - LL_USART_WAKEUP_ON_RXNE

Notes

- Macro IS_UART_WAKEUP_FROMSTOP_INSTANCE(USARTx) can be used to check whether or not Wake-up from Stop mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 WUS LL_USART_GetWKUPType

LL_USART_SetBaudRate

Function name

__STATIC_INLINE void LL_USART_SetBaudRate (USART_TypeDef * USARTx, uint32_t PeriphClk, uint32_t PrescalerValue, uint32_t OverSampling, uint32_t BaudRate)

Function description

Configure USART BRR register for achieving expected Baud Rate value.

Parameters

- **USARTx:** USART Instance
- **PeriphClk:** Peripheral Clock
- **PrescalerValue:** This parameter can be one of the following values:
  - LL_USART_PRESCALER_DIV1
  - LL_USART_PRESCALER_DIV2
  - LL_USART_PRESCALER_DIV4
  - LL_USART_PRESCALER_DIV6
  - LL_USART_PRESCALER_DIV8
  - LL_USART_PRESCALER_DIV10
  - LL_USART_PRESCALER_DIV12
  - LL_USART_PRESCALER_DIV16
  - LL_USART_PRESCALER_DIV32
  - LL_USART_PRESCALER_DIV64
  - LL_USART_PRESCALER_DIV128
  - LL_USART_PRESCALER_DIV256
- **OverSampling:** This parameter can be one of the following values:
  - LL_USART_OVERSAMPLING_16
  - LL_USART_OVERSAMPLING_8
- **BaudRate:** Baud Rate

Return values

- **None:**

Notes

- Compute and set USARTDIV value in BRR Register (full BRR content) according to used Peripheral Clock, Oversampling mode, and expected Baud Rate values
- Peripheral clock and Baud rate values provided as function parameters should be valid (Baud rate value != 0)
- In case of oversampling by 16 and 8, BRR content must be greater than or equal to 16d.

Reference Manual to LL API cross reference:

- BRR BRR LL_USART_SetBaudRate

LL_USART_GetBaudRate

Function name

__STATIC_INLINE uint32_t LL_USART_GetBaudRate (const USART_TypeDef * USARTx, uint32_t PeriphClk, uint32_t PrescalerValue, uint32_t OverSampling)

Function description

Return current Baud Rate value, according to USARTDIV present in BRR register (full BRR content), and to used Peripheral Clock and Oversampling mode values.

Parameters

- **USARTx:** USART Instance
- **PeriphClk:** Peripheral Clock
- **PrescalerValue:** This parameter can be one of the following values:
  - LL_USART_PRESCALER_DIV1
  - LL_USART_PRESCALER_DIV2
  - LL_USART_PRESCALER_DIV4
  - LL_USART_PRESCALER_DIV6
  - LL_USART_PRESCALER_DIV8
  - LL_USART_PRESCALER_DIV10
  - LL_USART_PRESCALER_DIV12
  - LL_USART_PRESCALER_DIV16
  - LL_USART_PRESCALER_DIV32
  - LL_USART_PRESCALER_DIV64
  - LL_USART_PRESCALER_DIV128
  - LL_USART_PRESCALER_DIV256
- **OverSampling:** This parameter can be one of the following values:
  - LL_USART_OVERSAMPLING_16
  - LL_USART_OVERSAMPLING_8

Return values

- **Baud:** Rate

Notes

- In case of non-initialized or invalid value stored in BRR register, value 0 will be returned.
- In case of oversampling by 16 and 8, BRR content must be greater than or equal to 16d.

Reference Manual to LL API cross reference:

- BRR BRR LL_USART_GetBaudRate

LL_USART_SetRxTimeout

Function name

__STATIC_INLINE void LL_USART_SetRxTimeout (USART_TypeDef * USARTx, uint32_t Timeout)

Function description

Set Receiver Time Out Value (expressed in nb of bits duration)

Parameters

- **USARTx:** USART Instance
- **Timeout:** Value between Min_Data=0x00 and Max_Data=0x00FFFFFF

Return values

- **None:**

Reference Manual to LL API cross reference:

- RTOR RTO LL_USART_SetRxTimeout

LL_USART_GetRxTimeout

Function name

__STATIC_INLINE uint32_t LL_USART_GetRxTimeout (const USART_TypeDef * USARTx)

Function description

Get Receiver Time Out Value (expressed in nb of bits duration)

Parameters

- **USARTx:** USART Instance

Return values

- **Value:** between Min_Data=0x00 and Max_Data=0x00FFFFFF

Reference Manual to LL API cross reference:

- RTOR RTO LL_USART_GetRxTimeout

LL_USART_SetBlockLength

Function name

__STATIC_INLINE void LL_USART_SetBlockLength (USART_TypeDef * USARTx, uint32_t BlockLength)

Function description

Set Block Length value in reception.

Parameters

- **USARTx:** USART Instance
- **BlockLength:** Value between Min_Data=0x00 and Max_Data=0xFF

Return values

- **None:**

Reference Manual to LL API cross reference:

- RTOR BLEN LL_USART_SetBlockLength

LL_USART_GetBlockLength

Function name

__STATIC_INLINE uint32_t LL_USART_GetBlockLength (const USART_TypeDef * USARTx)

Function description

Get Block Length value in reception.

Parameters

- **USARTx:** USART Instance

Return values

- **Value:** between Min_Data=0x00 and Max_Data=0xFF

Reference Manual to LL API cross reference:

- RTOR BLEN LL_USART_GetBlockLength

LL_USART_EnableIrda

Function name

__STATIC_INLINE void LL_USART_EnableIrda (USART_TypeDef * USARTx)

Function description

Enable IrDA mode.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_IRDA_INSTANCE(USARTx) can be used to check whether or not IrDA feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 IREN LL_USART_EnableIrda

LL_USART_DisableIrda

Function name

__STATIC_INLINE void LL_USART_DisableIrda (USART_TypeDef * USARTx)

Function description

Disable IrDA mode.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_IRDA_INSTANCE(USARTx) can be used to check whether or not IrDA feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 IREN LL_USART_DisableIrda

LL_USART_IsEnabledIrda

Function name

__STATIC_INLINE uint32_t LL_USART_IsEnabledIrda (const USART_TypeDef * USARTx)

Function description

Indicate if IrDA mode is enabled.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_IRDA_INSTANCE(USARTx) can be used to check whether or not IrDA feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 IREN LL_USART_IsEnabledIrda

LL_USART_SetIrdaPowerMode

Function name

__STATIC_INLINE void LL_USART_SetIrdaPowerMode (USART_TypeDef * USARTx, uint32_t PowerMode)

Function description

Configure IrDA Power Mode (Normal or Low Power)

Parameters

- **USARTx:** USART Instance
- **PowerMode:** This parameter can be one of the following values:
  - LL_USART_IRDA_POWER_NORMAL
  - LL_USART_IRDA_POWER_LOW

Return values

- **None:**

Notes

- Macro IS_IRDA_INSTANCE(USARTx) can be used to check whether or not IrDA feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 IRLP LL_USART_SetIrdaPowerMode

LL_USART_GetIrdaPowerMode

Function name

__STATIC_INLINE uint32_t LL_USART_GetIrdaPowerMode (const USART_TypeDef * USARTx)

Function description

Retrieve IrDA Power Mode configuration (Normal or Low Power)

Parameters

- **USARTx:** USART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_USART_IRDA_POWER_NORMAL
  - LL_USART_PHASE_2EDGE

Notes

- Macro IS_IRDA_INSTANCE(USARTx) can be used to check whether or not IrDA feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 IRLP LL_USART_GetIrdaPowerMode

LL_USART_SetIrdaPrescaler

Function name

__STATIC_INLINE void LL_USART_SetIrdaPrescaler (USART_TypeDef * USARTx, uint32_t PrescalerValue)

Function description

Set Irda prescaler value, used for dividing the USART clock source to achieve the Irda Low Power frequency (8 bits value)

Parameters

- **USARTx:** USART Instance
- **PrescalerValue:** Value between Min_Data=0x00 and Max_Data=0xFF

Return values

- **None:**

Notes

- Macro IS_IRDA_INSTANCE(USARTx) can be used to check whether or not IrDA feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- GTPR PSC LL_USART_SetIrdaPrescaler

LL_USART_GetIrdaPrescaler

Function name

__STATIC_INLINE uint32_t LL_USART_GetIrdaPrescaler (const USART_TypeDef * USARTx)

Function description

Return Irda prescaler value, used for dividing the USART clock source to achieve the Irda Low Power frequency (8 bits value)

Parameters

- **USARTx:** USART Instance

Return values

- **Irda:** prescaler value (Value between Min_Data=0x00 and Max_Data=0xFF)

Notes

- Macro IS_IRDA_INSTANCE(USARTx) can be used to check whether or not IrDA feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- GTPR PSC LL_USART_GetIrdaPrescaler

LL_USART_EnableSmartcardNACK

Function name

__STATIC_INLINE void LL_USART_EnableSmartcardNACK (USART_TypeDef * USARTx)

Function description

Enable Smartcard NACK transmission.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_SMARTCARD_INSTANCE(USARTx) can be used to check whether or not Smartcard feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 NACK LL_USART_EnableSmartcardNACK

LL_USART_DisableSmartcardNACK

Function name

__STATIC_INLINE void LL_USART_DisableSmartcardNACK (USART_TypeDef * USARTx)

Function description

Disable Smartcard NACK transmission.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_SMARTCARD_INSTANCE(USARTx) can be used to check whether or not Smartcard feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 NACK LL_USART_DisableSmartcardNACK

LL_USART_IsEnabledSmartcardNACK

Function name

__STATIC_INLINE uint32_t LL_USART_IsEnabledSmartcardNACK (const USART_TypeDef * USARTx)

Function description

Indicate if Smartcard NACK transmission is enabled.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_SMARTCARD_INSTANCE(USARTx) can be used to check whether or not Smartcard feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 NACK LL_USART_IsEnabledSmartcardNACK

LL_USART_EnableSmartcard

Function name

__STATIC_INLINE void LL_USART_EnableSmartcard (USART_TypeDef * USARTx)

Function description

Enable Smartcard mode.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_SMARTCARD_INSTANCE(USARTx) can be used to check whether or not Smartcard feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 SCEN LL_USART_EnableSmartcard

LL_USART_DisableSmartcard

Function name

__STATIC_INLINE void LL_USART_DisableSmartcard (USART_TypeDef * USARTx)

Function description

Disable Smartcard mode.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_SMARTCARD_INSTANCE(USARTx) can be used to check whether or not Smartcard feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 SCEN LL_USART_DisableSmartcard

LL_USART_IsEnabledSmartcard

Function name

__STATIC_INLINE uint32_t LL_USART_IsEnabledSmartcard (const USART_TypeDef * USARTx)

Function description

Indicate if Smartcard mode is enabled.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_SMARTCARD_INSTANCE(USARTx) can be used to check whether or not Smartcard feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 SCEN LL_USART_IsEnabledSmartcard

LL_USART_SetSmartcardAutoRetryCount

Function name

__STATIC_INLINE void LL_USART_SetSmartcardAutoRetryCount (USART_TypeDef * USARTx, uint32_t AutoRetryCount)

Function description

Set Smartcard Auto-Retry Count value (SCARCNT[2:0] bits)

Parameters

- **USARTx:** USART Instance
- **AutoRetryCount:** Value between Min_Data=0 and Max_Data=7

Return values

- **None:**

Notes

- Macro IS_SMARTCARD_INSTANCE(USARTx) can be used to check whether or not Smartcard feature is supported by the USARTx instance.
- This bit-field specifies the number of retries in transmit and receive, in Smartcard mode. In transmission mode, it specifies the number of automatic retransmission retries, before generating a transmission error (FE bit set). In reception mode, it specifies the number or erroneous reception trials, before generating a reception error (RXNE and PE bits set)

Reference Manual to LL API cross reference:

- CR3 SCARCNT LL_USART_SetSmartcardAutoRetryCount

LL_USART_GetSmartcardAutoRetryCount

Function name

__STATIC_INLINE uint32_t LL_USART_GetSmartcardAutoRetryCount (const USART_TypeDef * USARTx)

Function description

Return Smartcard Auto-Retry Count value (SCARCNT[2:0] bits)

Parameters

- **USARTx:** USART Instance

Return values

- **Smartcard:** Auto-Retry Count value (Value between Min_Data=0 and Max_Data=7)

Notes

- Macro IS_SMARTCARD_INSTANCE(USARTx) can be used to check whether or not Smartcard feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 SCARCNT LL_USART_GetSmartcardAutoRetryCount

LL_USART_SetSmartcardPrescaler

Function name

__STATIC_INLINE void LL_USART_SetSmartcardPrescaler (USART_TypeDef * USARTx, uint32_t PrescalerValue)

Function description

Set Smartcard prescaler value, used for dividing the USART clock source to provide the SMARTCARD Clock (5 bits value)

Parameters

- **USARTx:** USART Instance
- **PrescalerValue:** Value between Min_Data=0 and Max_Data=31

Return values

- **None:**

Notes

- Macro IS_SMARTCARD_INSTANCE(USARTx) can be used to check whether or not Smartcard feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- GTPR PSC LL_USART_SetSmartcardPrescaler

LL_USART_GetSmartcardPrescaler

Function name

__STATIC_INLINE uint32_t LL_USART_GetSmartcardPrescaler (const USART_TypeDef * USARTx)

Function description

Return Smartcard prescaler value, used for dividing the USART clock source to provide the SMARTCARD Clock (5 bits value)

Parameters

- **USARTx:** USART Instance

Return values

- **Smartcard:** prescaler value (Value between Min_Data=0 and Max_Data=31)

Notes

- Macro IS_SMARTCARD_INSTANCE(USARTx) can be used to check whether or not Smartcard feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- GTPR PSC LL_USART_GetSmartcardPrescaler

LL_USART_SetSmartcardGuardTime

Function name

__STATIC_INLINE void LL_USART_SetSmartcardGuardTime (USART_TypeDef * USARTx, uint32_t GuardTime)

Function description

Set Smartcard Guard time value, expressed in nb of baud clocks periods (GT[7:0] bits : Guard time value)

Parameters

- **USARTx:** USART Instance
- **GuardTime:** Value between Min_Data=0x00 and Max_Data=0xFF

Return values

- **None:**

Notes

- Macro IS_SMARTCARD_INSTANCE(USARTx) can be used to check whether or not Smartcard feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- GTPR GT LL_USART_SetSmartcardGuardTime

LL_USART_GetSmartcardGuardTime

Function name

__STATIC_INLINE uint32_t LL_USART_GetSmartcardGuardTime (const USART_TypeDef * USARTx)

Function description

Return Smartcard Guard time value, expressed in nb of baud clocks periods (GT[7:0] bits : Guard time value)

Parameters

- **USARTx:** USART Instance

Return values

- **Smartcard:** Guard time value (Value between Min_Data=0x00 and Max_Data=0xFF)

Notes

- Macro IS_SMARTCARD_INSTANCE(USARTx) can be used to check whether or not Smartcard feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- GTPR GT LL_USART_GetSmartcardGuardTime

LL_USART_EnableHalfDuplex

Function name

__STATIC_INLINE void LL_USART_EnableHalfDuplex (USART_TypeDef * USARTx)

Function description

Enable Single Wire Half-Duplex mode.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_HALFDUPLEX_INSTANCE(USARTx) can be used to check whether or not Half-Duplex mode is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 HDSEL LL_USART_EnableHalfDuplex

LL_USART_DisableHalfDuplex

Function name

__STATIC_INLINE void LL_USART_DisableHalfDuplex (USART_TypeDef * USARTx)

Function description

Disable Single Wire Half-Duplex mode.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_HALFDUPLEX_INSTANCE(USARTx) can be used to check whether or not Half-Duplex mode is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 HDSEL LL_USART_DisableHalfDuplex

LL_USART_IsEnabledHalfDuplex

Function name

__STATIC_INLINE uint32_t LL_USART_IsEnabledHalfDuplex (const USART_TypeDef * USARTx)

Function description

Indicate if Single Wire Half-Duplex mode is enabled.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_UART_HALFDUPLEX_INSTANCE(USARTx) can be used to check whether or not Half-Duplex mode is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 HDSEL LL_USART_IsEnabledHalfDuplex

LL_USART_EnableSPISlave

Function name

__STATIC_INLINE void LL_USART_EnableSPISlave (USART_TypeDef * USARTx)

Function description

Enable SPI Synchronous Slave mode.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_SPI_SLAVE_INSTANCE(USARTx) can be used to check whether or not SPI Slave mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR2 SLVEN LL_USART_EnableSPISlave

LL_USART_DisableSPISlave

Function name

__STATIC_INLINE void LL_USART_DisableSPISlave (USART_TypeDef * USARTx)

Function description

Disable SPI Synchronous Slave mode.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_SPI_SLAVE_INSTANCE(USARTx) can be used to check whether or not SPI Slave mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR2 SLVEN LL_USART_DisableSPISlave

LL_USART_IsEnabledSPISlave

Function name

__STATIC_INLINE uint32_t LL_USART_IsEnabledSPISlave (const USART_TypeDef * USARTx)

Function description

Indicate if SPI Synchronous Slave mode is enabled.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_UART_SPI_SLAVE_INSTANCE(USARTx) can be used to check whether or not SPI Slave mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR2 SLVEN LL_USART_IsEnabledSPISlave

LL_USART_EnableSPISlaveSelect

Function name

__STATIC_INLINE void LL_USART_EnableSPISlaveSelect (USART_TypeDef * USARTx)

Function description

Enable SPI Slave Selection using NSS input pin.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_SPI_SLAVE_INSTANCE(USARTx) can be used to check whether or not SPI Slave mode feature is supported by the USARTx instance.
- SPI Slave Selection depends on NSS input pin (The slave is selected when NSS is low and deselected when NSS is high).

Reference Manual to LL API cross reference:

- CR2 DIS_NSS LL_USART_EnableSPISlaveSelect

LL_USART_DisableSPISlaveSelect

Function name

__STATIC_INLINE void LL_USART_DisableSPISlaveSelect (USART_TypeDef * USARTx)

Function description

Disable SPI Slave Selection using NSS input pin.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_SPI_SLAVE_INSTANCE(USARTx) can be used to check whether or not SPI Slave mode feature is supported by the USARTx instance.
- SPI Slave will be always selected and NSS input pin will be ignored.

Reference Manual to LL API cross reference:

- CR2 DIS_NSS LL_USART_DisableSPISlaveSelect

LL_USART_IsEnabledSPISlaveSelect

Function name

__STATIC_INLINE uint32_t LL_USART_IsEnabledSPISlaveSelect (const USART_TypeDef * USARTx)

Function description

Indicate if SPI Slave Selection depends on NSS input pin.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_UART_SPI_SLAVE_INSTANCE(USARTx) can be used to check whether or not SPI Slave mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR2 DIS_NSS LL_USART_IsEnabledSPISlaveSelect

LL_USART_SetLINBrkDetectionLen

Function name

__STATIC_INLINE void LL_USART_SetLINBrkDetectionLen (USART_TypeDef * USARTx, uint32_t LINBDLength)

Function description

Set LIN Break Detection Length.

Parameters

- **USARTx:** USART Instance
- **LINBDLength:** This parameter can be one of the following values:
  - LL_USART_LINBREAK_DETECT_10B
  - LL_USART_LINBREAK_DETECT_11B

Return values

- **None:**

Notes

- Macro IS_UART_LIN_INSTANCE(USARTx) can be used to check whether or not LIN feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR2 LBDL LL_USART_SetLINBrkDetectionLen

LL_USART_GetLINBrkDetectionLen

Function name

__STATIC_INLINE uint32_t LL_USART_GetLINBrkDetectionLen (const USART_TypeDef * USARTx)

Function description

Return LIN Break Detection Length.

Parameters

- **USARTx:** USART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_USART_LINBREAK_DETECT_10B
  - LL_USART_LINBREAK_DETECT_11B

Notes

- Macro IS_UART_LIN_INSTANCE(USARTx) can be used to check whether or not LIN feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR2 LBDL LL_USART_GetLINBrkDetectionLen

LL_USART_EnableLIN

Function name

__STATIC_INLINE void LL_USART_EnableLIN (USART_TypeDef * USARTx)

Function description

Enable LIN mode.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_LIN_INSTANCE(USARTx) can be used to check whether or not LIN feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR2 LINEN LL_USART_EnableLIN

LL_USART_DisableLIN

Function name

__STATIC_INLINE void LL_USART_DisableLIN (USART_TypeDef * USARTx)

Function description

Disable LIN mode.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_LIN_INSTANCE(USARTx) can be used to check whether or not LIN feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR2 LINEN LL_USART_DisableLIN

LL_USART_IsEnabledLIN

Function name

__STATIC_INLINE uint32_t LL_USART_IsEnabledLIN (const USART_TypeDef * USARTx)

Function description

Indicate if LIN mode is enabled.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_UART_LIN_INSTANCE(USARTx) can be used to check whether or not LIN feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR2 LINEN LL_USART_IsEnabledLIN

LL_USART_SetDEDeassertionTime

Function name

__STATIC_INLINE void LL_USART_SetDEDeassertionTime (USART_TypeDef * USARTx, uint32_t Time)

Function description

Set DEDT (Driver Enable De-Assertion Time), Time value expressed on 5 bits ([4:0] bits).

Parameters

- **USARTx:** USART Instance
- **Time:** Value between Min_Data=0 and Max_Data=31

Return values

- **None:**

Notes

- Macro IS_UART_DRIVER_ENABLE_INSTANCE(USARTx) can be used to check whether or not Driver Enable feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR1 DEDT LL_USART_SetDEDeassertionTime

LL_USART_GetDEDeassertionTime

Function name

__STATIC_INLINE uint32_t LL_USART_GetDEDeassertionTime (const USART_TypeDef * USARTx)

Function description

Return DEDT (Driver Enable De-Assertion Time)

Parameters

- **USARTx:** USART Instance

Return values

- **Time:** value expressed on 5 bits ([4:0] bits) : Value between Min_Data=0 and Max_Data=31

Notes

- Macro IS_UART_DRIVER_ENABLE_INSTANCE(USARTx) can be used to check whether or not Driver Enable feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR1 DEDT LL_USART_GetDEDeassertionTime

LL_USART_SetDEAssertionTime

Function name

__STATIC_INLINE void LL_USART_SetDEAssertionTime (USART_TypeDef * USARTx, uint32_t Time)

Function description

Set DEAT (Driver Enable Assertion Time), Time value expressed on 5 bits ([4:0] bits).

Parameters

- **USARTx:** USART Instance
- **Time:** Value between Min_Data=0 and Max_Data=31

Return values

- **None:**

Notes

- Macro IS_UART_DRIVER_ENABLE_INSTANCE(USARTx) can be used to check whether or not Driver Enable feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR1 DEAT LL_USART_SetDEAssertionTime

LL_USART_GetDEAssertionTime

Function name

__STATIC_INLINE uint32_t LL_USART_GetDEAssertionTime (const USART_TypeDef * USARTx)

Function description

Return DEAT (Driver Enable Assertion Time)

Parameters

- **USARTx:** USART Instance

Return values

- **Time:** value expressed on 5 bits ([4:0] bits) : Value between Min_Data=0 and Max_Data=31

Notes

- Macro IS_UART_DRIVER_ENABLE_INSTANCE(USARTx) can be used to check whether or not Driver Enable feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR1 DEAT LL_USART_GetDEAssertionTime

LL_USART_EnableDEMode

Function name

__STATIC_INLINE void LL_USART_EnableDEMode (USART_TypeDef * USARTx)

Function description

Enable Driver Enable (DE) Mode.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_DRIVER_ENABLE_INSTANCE(USARTx) can be used to check whether or not Driver Enable feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 DEM LL_USART_EnableDEMode

LL_USART_DisableDEMode

Function name

__STATIC_INLINE void LL_USART_DisableDEMode (USART_TypeDef * USARTx)

Function description

Disable Driver Enable (DE) Mode.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_DRIVER_ENABLE_INSTANCE(USARTx) can be used to check whether or not Driver Enable feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 DEM LL_USART_DisableDEMode

LL_USART_IsEnabledDEMode

Function name

__STATIC_INLINE uint32_t LL_USART_IsEnabledDEMode (const USART_TypeDef * USARTx)

Function description

Indicate if Driver Enable (DE) Mode is enabled.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_UART_DRIVER_ENABLE_INSTANCE(USARTx) can be used to check whether or not Driver Enable feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 DEM LL_USART_IsEnabledDEMode

LL_USART_SetDESignalPolarity

Function name

__STATIC_INLINE void LL_USART_SetDESignalPolarity (USART_TypeDef * USARTx, uint32_t Polarity)

Function description

Select Driver Enable Polarity.

Parameters

- **USARTx:** USART Instance
- **Polarity:** This parameter can be one of the following values:
  - LL_USART_DE_POLARITY_HIGH
  - LL_USART_DE_POLARITY_LOW

Return values

- **None:**

Notes

- Macro IS_UART_DRIVER_ENABLE_INSTANCE(USARTx) can be used to check whether or not Driver Enable feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 DEP LL_USART_SetDESignalPolarity

LL_USART_GetDESignalPolarity

Function name

__STATIC_INLINE uint32_t LL_USART_GetDESignalPolarity (const USART_TypeDef * USARTx)

Function description

Return Driver Enable Polarity.

Parameters

- **USARTx:** USART Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_USART_DE_POLARITY_HIGH
  - LL_USART_DE_POLARITY_LOW

Notes

- Macro IS_UART_DRIVER_ENABLE_INSTANCE(USARTx) can be used to check whether or not Driver Enable feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 DEP LL_USART_GetDESignalPolarity

LL_USART_ConfigAsyncMode

Function name

__STATIC_INLINE void LL_USART_ConfigAsyncMode (USART_TypeDef * USARTx)

Function description

Perform basic configuration of USART for enabling use in Asynchronous Mode (UART)

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- In UART mode, the following bits must be kept cleared: LINEN bit in the USART_CR2 register,CLKEN bit in the USART_CR2 register,SCEN bit in the USART_CR3 register,IREN bit in the USART_CR3 register,HDSEL bit in the USART_CR3 register.
- Call of this function is equivalent to following function call sequence : Clear LINEN in CR2 using LL_USART_DisableLIN() functionClear CLKEN in CR2 using LL_USART_DisableSCLKOutput() functionClear SCEN in CR3 using LL_USART_DisableSmartcard() functionClear IREN in CR3 using LL_USART_DisableIrda() functionClear HDSEL in CR3 using LL_USART_DisableHalfDuplex() function
- Other remaining configurations items related to Asynchronous Mode (as Baud Rate, Word length, Parity, ...) should be set using dedicated functions

Reference Manual to LL API cross reference:

- CR2 LINEN LL_USART_ConfigAsyncMode
- CR2 CLKEN LL_USART_ConfigAsyncMode
- CR3 SCEN LL_USART_ConfigAsyncMode
- CR3 IREN LL_USART_ConfigAsyncMode
- CR3 HDSEL LL_USART_ConfigAsyncMode

LL_USART_ConfigSyncMode

Function name

__STATIC_INLINE void LL_USART_ConfigSyncMode (USART_TypeDef * USARTx)

Function description

Perform basic configuration of USART for enabling use in Synchronous Mode.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- In Synchronous mode, the following bits must be kept cleared: LINEN bit in the USART_CR2 register,SCEN bit in the USART_CR3 register,IREN bit in the USART_CR3 register,HDSEL bit in the USART_CR3 register. This function also sets the USART in Synchronous mode.
- Macro IS_USART_INSTANCE(USARTx) can be used to check whether or not Synchronous mode is supported by the USARTx instance.
- Call of this function is equivalent to following function call sequence : Clear LINEN in CR2 using LL_USART_DisableLIN() functionClear IREN in CR3 using LL_USART_DisableIrda() functionClear SCEN in CR3 using LL_USART_DisableSmartcard() functionClear HDSEL in CR3 using LL_USART_DisableHalfDuplex() functionSet CLKEN in CR2 using LL_USART_EnableSCLKOutput() function
- Other remaining configurations items related to Synchronous Mode (as Baud Rate, Word length, Parity, Clock Polarity, ...) should be set using dedicated functions

Reference Manual to LL API cross reference:

- CR2 LINEN LL_USART_ConfigSyncMode
- CR2 CLKEN LL_USART_ConfigSyncMode
- CR3 SCEN LL_USART_ConfigSyncMode
- CR3 IREN LL_USART_ConfigSyncMode
- CR3 HDSEL LL_USART_ConfigSyncMode

LL_USART_ConfigLINMode

Function name

__STATIC_INLINE void LL_USART_ConfigLINMode (USART_TypeDef * USARTx)

Function description

Perform basic configuration of USART for enabling use in LIN Mode.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- In LIN mode, the following bits must be kept cleared: STOP and CLKEN bits in the USART_CR2 register,SCEN bit in the USART_CR3 register,IREN bit in the USART_CR3 register,HDSEL bit in the USART_CR3 register. This function also set the UART/USART in LIN mode.
- Macro IS_UART_LIN_INSTANCE(USARTx) can be used to check whether or not LIN feature is supported by the USARTx instance.
- Call of this function is equivalent to following function call sequence : Clear CLKEN in CR2 using LL_USART_DisableSCLKOutput() functionClear STOP in CR2 using LL_USART_SetStopBitsLength() functionClear SCEN in CR3 using LL_USART_DisableSmartcard() functionClear IREN in CR3 using LL_USART_DisableIrda() functionClear HDSEL in CR3 using LL_USART_DisableHalfDuplex() functionSet LINEN in CR2 using LL_USART_EnableLIN() function
- Other remaining configurations items related to LIN Mode (as Baud Rate, Word length, LIN Break Detection Length, ...) should be set using dedicated functions

Reference Manual to LL API cross reference:

- CR2 CLKEN LL_USART_ConfigLINMode
- CR2 STOP LL_USART_ConfigLINMode
- CR2 LINEN LL_USART_ConfigLINMode
- CR3 IREN LL_USART_ConfigLINMode
- CR3 SCEN LL_USART_ConfigLINMode
- CR3 HDSEL LL_USART_ConfigLINMode

LL_USART_ConfigHalfDuplexMode

Function name

__STATIC_INLINE void LL_USART_ConfigHalfDuplexMode (USART_TypeDef * USARTx)

Function description

Perform basic configuration of USART for enabling use in Half Duplex Mode.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- In Half Duplex mode, the following bits must be kept cleared: LINEN bit in the USART_CR2 register,CLKEN bit in the USART_CR2 register,SCEN bit in the USART_CR3 register,IREN bit in the USART_CR3 register, This function also sets the UART/USART in Half Duplex mode.
- Macro IS_UART_HALFDUPLEX_INSTANCE(USARTx) can be used to check whether or not Half-Duplex mode is supported by the USARTx instance.
- Call of this function is equivalent to following function call sequence : Clear LINEN in CR2 using LL_USART_DisableLIN() functionClear CLKEN in CR2 using LL_USART_DisableSCLKOutput() functionClear SCEN in CR3 using LL_USART_DisableSmartcard() functionClear IREN in CR3 using LL_USART_DisableIrda() functionSet HDSEL in CR3 using LL_USART_EnableHalfDuplex() function
- Other remaining configurations items related to Half Duplex Mode (as Baud Rate, Word length, Parity, ...) should be set using dedicated functions

Reference Manual to LL API cross reference:

- CR2 LINEN LL_USART_ConfigHalfDuplexMode
- CR2 CLKEN LL_USART_ConfigHalfDuplexMode
- CR3 HDSEL LL_USART_ConfigHalfDuplexMode
- CR3 SCEN LL_USART_ConfigHalfDuplexMode
- CR3 IREN LL_USART_ConfigHalfDuplexMode

LL_USART_ConfigSmartcardMode

Function name

__STATIC_INLINE void LL_USART_ConfigSmartcardMode (USART_TypeDef * USARTx)

Function description

Perform basic configuration of USART for enabling use in Smartcard Mode.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- In Smartcard mode, the following bits must be kept cleared: LINEN bit in the USART_CR2 register,IREN bit in the USART_CR3 register,HDSEL bit in the USART_CR3 register. This function also configures Stop bits to 1.5 bits and sets the USART in Smartcard mode (SCEN bit). Clock Output is also enabled (CLKEN).
- Macro IS_SMARTCARD_INSTANCE(USARTx) can be used to check whether or not Smartcard feature is supported by the USARTx instance.
- Call of this function is equivalent to following function call sequence : Clear LINEN in CR2 using LL_USART_DisableLIN() functionClear IREN in CR3 using LL_USART_DisableIrda() functionClear HDSEL in CR3 using LL_USART_DisableHalfDuplex() functionConfigure STOP in CR2 using LL_USART_SetStopBitsLength() functionSet CLKEN in CR2 using LL_USART_EnableSCLKOutput() functionSet SCEN in CR3 using LL_USART_EnableSmartcard() function
- Other remaining configurations items related to Smartcard Mode (as Baud Rate, Word length, Parity, ...) should be set using dedicated functions

Reference Manual to LL API cross reference:

- CR2 LINEN LL_USART_ConfigSmartcardMode
- CR2 STOP LL_USART_ConfigSmartcardMode
- CR2 CLKEN LL_USART_ConfigSmartcardMode
- CR3 HDSEL LL_USART_ConfigSmartcardMode
- CR3 SCEN LL_USART_ConfigSmartcardMode

LL_USART_ConfigIrdaMode

Function name

__STATIC_INLINE void LL_USART_ConfigIrdaMode (USART_TypeDef * USARTx)

Function description

Perform basic configuration of USART for enabling use in Irda Mode.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- In IRDA mode, the following bits must be kept cleared: LINEN bit in the USART_CR2 register,STOP and CLKEN bits in the USART_CR2 register,SCEN bit in the USART_CR3 register,HDSEL bit in the USART_CR3 register. This function also sets the UART/USART in IRDA mode (IREN bit).
- Macro IS_IRDA_INSTANCE(USARTx) can be used to check whether or not IrDA feature is supported by the USARTx instance.
- Call of this function is equivalent to following function call sequence : Clear LINEN in CR2 using LL_USART_DisableLIN() functionClear CLKEN in CR2 using LL_USART_DisableSCLKOutput() functionClear SCEN in CR3 using LL_USART_DisableSmartcard() functionClear HDSEL in CR3 using LL_USART_DisableHalfDuplex() functionConfigure STOP in CR2 using LL_USART_SetStopBitsLength() functionSet IREN in CR3 using LL_USART_EnableIrda() function
- Other remaining configurations items related to Irda Mode (as Baud Rate, Word length, Power mode, ...) should be set using dedicated functions

Reference Manual to LL API cross reference:

- CR2 LINEN LL_USART_ConfigIrdaMode
- CR2 CLKEN LL_USART_ConfigIrdaMode
- CR2 STOP LL_USART_ConfigIrdaMode
- CR3 SCEN LL_USART_ConfigIrdaMode
- CR3 HDSEL LL_USART_ConfigIrdaMode
- CR3 IREN LL_USART_ConfigIrdaMode

LL_USART_ConfigMultiProcessMode

Function name

__STATIC_INLINE void LL_USART_ConfigMultiProcessMode (USART_TypeDef * USARTx)

Function description

Perform basic configuration of USART for enabling use in Multi processor Mode (several USARTs connected in a network, one of the USARTs can be the master, its TX output connected to the RX inputs of the other slaves USARTs).

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- In MultiProcessor mode, the following bits must be kept cleared: LINEN bit in the USART_CR2 register,CLKEN bit in the USART_CR2 register,SCEN bit in the USART_CR3 register,IREN bit in the USART_CR3 register,HDSEL bit in the USART_CR3 register.
- Call of this function is equivalent to following function call sequence : Clear LINEN in CR2 using LL_USART_DisableLIN() functionClear CLKEN in CR2 using LL_USART_DisableSCLKOutput() functionClear SCEN in CR3 using LL_USART_DisableSmartcard() functionClear IREN in CR3 using LL_USART_DisableIrda() functionClear HDSEL in CR3 using LL_USART_DisableHalfDuplex() function
- Other remaining configurations items related to Multi processor Mode (as Baud Rate, Wake Up Method, Node address, ...) should be set using dedicated functions

Reference Manual to LL API cross reference:

- CR2 LINEN LL_USART_ConfigMultiProcessMode
- CR2 CLKEN LL_USART_ConfigMultiProcessMode
- CR3 SCEN LL_USART_ConfigMultiProcessMode
- CR3 HDSEL LL_USART_ConfigMultiProcessMode
- CR3 IREN LL_USART_ConfigMultiProcessMode

LL_USART_IsActiveFlag_PE

Function name

__STATIC_INLINE uint32_t LL_USART_IsActiveFlag_PE (const USART_TypeDef * USARTx)

Function description

Check if the USART Parity Error Flag is set or not.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR PE LL_USART_IsActiveFlag_PE

LL_USART_IsActiveFlag_FE

Function name

__STATIC_INLINE uint32_t LL_USART_IsActiveFlag_FE (const USART_TypeDef * USARTx)

Function description

Check if the USART Framing Error Flag is set or not.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR FE LL_USART_IsActiveFlag_FE

LL_USART_IsActiveFlag_NE

Function name

__STATIC_INLINE uint32_t LL_USART_IsActiveFlag_NE (const USART_TypeDef * USARTx)

Function description

Check if the USART Noise error detected Flag is set or not.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR NE LL_USART_IsActiveFlag_NE

LL_USART_IsActiveFlag_ORE

Function name

__STATIC_INLINE uint32_t LL_USART_IsActiveFlag_ORE (const USART_TypeDef * USARTx)

Function description

Check if the USART OverRun Error Flag is set or not.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR ORE LL_USART_IsActiveFlag_ORE

LL_USART_IsActiveFlag_IDLE

Function name

__STATIC_INLINE uint32_t LL_USART_IsActiveFlag_IDLE (const USART_TypeDef * USARTx)

Function description

Check if the USART IDLE line detected Flag is set or not.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR IDLE LL_USART_IsActiveFlag_IDLE

LL_USART_IsActiveFlag_RXNE_RXFNE

Function name

__STATIC_INLINE uint32_t LL_USART_IsActiveFlag_RXNE_RXFNE (const USART_TypeDef * USARTx)

Function description

Check if the USART Read Data Register or USART RX FIFO Not Empty Flag is set or not.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_UART_FIFO_INSTANCE(USARTx) can be used to check whether or not FIFO mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- ISR RXNE_RXFNE LL_USART_IsActiveFlag_RXNE_RXFNE

LL_USART_IsActiveFlag_TC

Function name

__STATIC_INLINE uint32_t LL_USART_IsActiveFlag_TC (const USART_TypeDef * USARTx)

Function description

Check if the USART Transmission Complete Flag is set or not.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR TC LL_USART_IsActiveFlag_TC

LL_USART_IsActiveFlag_TXE_TXFNF

Function name

__STATIC_INLINE uint32_t LL_USART_IsActiveFlag_TXE_TXFNF (const USART_TypeDef * USARTx)

Function description

Check if the USART Transmit Data Register Empty or USART TX FIFO Not Full Flag is set or not.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_UART_FIFO_INSTANCE(USARTx) can be used to check whether or not FIFO mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- ISR TXE_TXFNF LL_USART_IsActiveFlag_TXE_TXFNF

LL_USART_IsActiveFlag_LBD

Function name

__STATIC_INLINE uint32_t LL_USART_IsActiveFlag_LBD (const USART_TypeDef * USARTx)

Function description

Check if the USART LIN Break Detection Flag is set or not.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_UART_LIN_INSTANCE(USARTx) can be used to check whether or not LIN feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- ISR LBDF LL_USART_IsActiveFlag_LBD

LL_USART_IsActiveFlag_nCTS

Function name

__STATIC_INLINE uint32_t LL_USART_IsActiveFlag_nCTS (const USART_TypeDef * USARTx)

Function description

Check if the USART CTS interrupt Flag is set or not.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_UART_HWFLOW_INSTANCE(USARTx) can be used to check whether or not Hardware Flow control feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- ISR CTSIF LL_USART_IsActiveFlag_nCTS

LL_USART_IsActiveFlag_CTS

Function name

__STATIC_INLINE uint32_t LL_USART_IsActiveFlag_CTS (const USART_TypeDef * USARTx)

Function description

Check if the USART CTS Flag is set or not.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_UART_HWFLOW_INSTANCE(USARTx) can be used to check whether or not Hardware Flow control feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- ISR CTS LL_USART_IsActiveFlag_CTS

LL_USART_IsActiveFlag_RTO

Function name

__STATIC_INLINE uint32_t LL_USART_IsActiveFlag_RTO (const USART_TypeDef * USARTx)

Function description

Check if the USART Receiver Time Out Flag is set or not.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR RTOF LL_USART_IsActiveFlag_RTO

LL_USART_IsActiveFlag_EOB

Function name

__STATIC_INLINE uint32_t LL_USART_IsActiveFlag_EOB (const USART_TypeDef * USARTx)

Function description

Check if the USART End Of Block Flag is set or not.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_SMARTCARD_INSTANCE(USARTx) can be used to check whether or not Smartcard feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- ISR EOBF LL_USART_IsActiveFlag_EOB

LL_USART_IsActiveFlag_UDR

Function name

__STATIC_INLINE uint32_t LL_USART_IsActiveFlag_UDR (const USART_TypeDef * USARTx)

Function description

Check if the SPI Slave Underrun error flag is set or not.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_UART_SPI_SLAVE_INSTANCE(USARTx) can be used to check whether or not SPI Slave mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- ISR UDR LL_USART_IsActiveFlag_UDR

LL_USART_IsActiveFlag_ABRE

Function name

__STATIC_INLINE uint32_t LL_USART_IsActiveFlag_ABRE (const USART_TypeDef * USARTx)

Function description

Check if the USART Auto-Baud Rate Error Flag is set or not.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_USART_AUTOBAUDRATE_DETECTION_INSTANCE(USARTx) can be used to check whether or not Auto Baud Rate detection feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- ISR ABRE LL_USART_IsActiveFlag_ABRE

LL_USART_IsActiveFlag_ABR

Function name

__STATIC_INLINE uint32_t LL_USART_IsActiveFlag_ABR (const USART_TypeDef * USARTx)

Function description

Check if the USART Auto-Baud Rate Flag is set or not.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_USART_AUTOBAUDRATE_DETECTION_INSTANCE(USARTx) can be used to check whether or not Auto Baud Rate detection feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- ISR ABRF LL_USART_IsActiveFlag_ABR

LL_USART_IsActiveFlag_BUSY

Function name

__STATIC_INLINE uint32_t LL_USART_IsActiveFlag_BUSY (const USART_TypeDef * USARTx)

Function description

Check if the USART Busy Flag is set or not.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR BUSY LL_USART_IsActiveFlag_BUSY

LL_USART_IsActiveFlag_CM

Function name

__STATIC_INLINE uint32_t LL_USART_IsActiveFlag_CM (const USART_TypeDef * USARTx)

Function description

Check if the USART Character Match Flag is set or not.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR CMF LL_USART_IsActiveFlag_CM

LL_USART_IsActiveFlag_SBK

Function name

__STATIC_INLINE uint32_t LL_USART_IsActiveFlag_SBK (const USART_TypeDef * USARTx)

Function description

Check if the USART Send Break Flag is set or not.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR SBKF LL_USART_IsActiveFlag_SBK

LL_USART_IsActiveFlag_RWU

Function name

__STATIC_INLINE uint32_t LL_USART_IsActiveFlag_RWU (const USART_TypeDef * USARTx)

Function description

Check if the USART Receive Wake Up from mute mode Flag is set or not.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR RWU LL_USART_IsActiveFlag_RWU

LL_USART_IsActiveFlag_WKUP

Function name

__STATIC_INLINE uint32_t LL_USART_IsActiveFlag_WKUP (const USART_TypeDef * USARTx)

Function description

Check if the USART Wake Up from stop mode Flag is set or not.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_UART_WAKEUP_FROMSTOP_INSTANCE(USARTx) can be used to check whether or not Wake-up from Stop mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- ISR WUF LL_USART_IsActiveFlag_WKUP

LL_USART_IsActiveFlag_TEACK

Function name

__STATIC_INLINE uint32_t LL_USART_IsActiveFlag_TEACK (const USART_TypeDef * USARTx)

Function description

Check if the USART Transmit Enable Acknowledge Flag is set or not.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR TEACK LL_USART_IsActiveFlag_TEACK

LL_USART_IsActiveFlag_REACK

Function name

__STATIC_INLINE uint32_t LL_USART_IsActiveFlag_REACK (const USART_TypeDef * USARTx)

Function description

Check if the USART Receive Enable Acknowledge Flag is set or not.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR REACK LL_USART_IsActiveFlag_REACK

LL_USART_IsActiveFlag_TXFE

Function name

__STATIC_INLINE uint32_t LL_USART_IsActiveFlag_TXFE (const USART_TypeDef * USARTx)

Function description

Check if the USART TX FIFO Empty Flag is set or not.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_UART_FIFO_INSTANCE(USARTx) can be used to check whether or not FIFO mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- ISR TXFE LL_USART_IsActiveFlag_TXFE

LL_USART_IsActiveFlag_RXFF

Function name

__STATIC_INLINE uint32_t LL_USART_IsActiveFlag_RXFF (const USART_TypeDef * USARTx)

Function description

Check if the USART RX FIFO Full Flag is set or not.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_UART_FIFO_INSTANCE(USARTx) can be used to check whether or not FIFO mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- ISR RXFF LL_USART_IsActiveFlag_RXFF

LL_USART_IsActiveFlag_TCBGT

Function name

__STATIC_INLINE uint32_t LL_USART_IsActiveFlag_TCBGT (const USART_TypeDef * USARTx)

Function description

Check if the Smartcard Transmission Complete Before Guard Time Flag is set or not.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- ISR TCBGT LL_USART_IsActiveFlag_TCBGT

LL_USART_IsActiveFlag_TXFT

Function name

__STATIC_INLINE uint32_t LL_USART_IsActiveFlag_TXFT (const USART_TypeDef * USARTx)

Function description

Check if the USART TX FIFO Threshold Flag is set or not.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_UART_FIFO_INSTANCE(USARTx) can be used to check whether or not FIFO mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- ISR TXFT LL_USART_IsActiveFlag_TXFT

LL_USART_IsActiveFlag_RXFT

Function name

__STATIC_INLINE uint32_t LL_USART_IsActiveFlag_RXFT (const USART_TypeDef * USARTx)

Function description

Check if the USART RX FIFO Threshold Flag is set or not.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_UART_FIFO_INSTANCE(USARTx) can be used to check whether or not FIFO mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- ISR RXFT LL_USART_IsActiveFlag_RXFT

LL_USART_ClearFlag_PE

Function name

__STATIC_INLINE void LL_USART_ClearFlag_PE (USART_TypeDef * USARTx)

Function description

Clear Parity Error Flag.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR PECF LL_USART_ClearFlag_PE

LL_USART_ClearFlag_FE

Function name

__STATIC_INLINE void LL_USART_ClearFlag_FE (USART_TypeDef * USARTx)

Function description

Clear Framing Error Flag.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR FECF LL_USART_ClearFlag_FE

LL_USART_ClearFlag_NE

Function name

__STATIC_INLINE void LL_USART_ClearFlag_NE (USART_TypeDef * USARTx)

Function description

Clear Noise Error detected Flag.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR NECF LL_USART_ClearFlag_NE

LL_USART_ClearFlag_ORE

Function name

__STATIC_INLINE void LL_USART_ClearFlag_ORE (USART_TypeDef * USARTx)

Function description

Clear OverRun Error Flag.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR ORECF LL_USART_ClearFlag_ORE

LL_USART_ClearFlag_IDLE

Function name

__STATIC_INLINE void LL_USART_ClearFlag_IDLE (USART_TypeDef * USARTx)

Function description

Clear IDLE line detected Flag.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR IDLECF LL_USART_ClearFlag_IDLE

LL_USART_ClearFlag_TXFE

Function name

__STATIC_INLINE void LL_USART_ClearFlag_TXFE (USART_TypeDef * USARTx)

Function description

Clear TX FIFO Empty Flag.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_FIFO_INSTANCE(USARTx) can be used to check whether or not FIFO mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- ICR TXFECF LL_USART_ClearFlag_TXFE

LL_USART_ClearFlag_TC

Function name

__STATIC_INLINE void LL_USART_ClearFlag_TC (USART_TypeDef * USARTx)

Function description

Clear Transmission Complete Flag.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR TCCF LL_USART_ClearFlag_TC

LL_USART_ClearFlag_TCBGT

Function name

__STATIC_INLINE void LL_USART_ClearFlag_TCBGT (USART_TypeDef * USARTx)

Function description

Clear Smartcard Transmission Complete Before Guard Time Flag.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR TCBGTCF LL_USART_ClearFlag_TCBGT

LL_USART_ClearFlag_LBD

Function name

__STATIC_INLINE void LL_USART_ClearFlag_LBD (USART_TypeDef * USARTx)

Function description

Clear LIN Break Detection Flag.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_LIN_INSTANCE(USARTx) can be used to check whether or not LIN feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- ICR LBDCF LL_USART_ClearFlag_LBD

LL_USART_ClearFlag_nCTS

Function name

__STATIC_INLINE void LL_USART_ClearFlag_nCTS (USART_TypeDef * USARTx)

Function description

Clear CTS Interrupt Flag.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_HWFLOW_INSTANCE(USARTx) can be used to check whether or not Hardware Flow control feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- ICR CTSCF LL_USART_ClearFlag_nCTS

LL_USART_ClearFlag_RTO

Function name

__STATIC_INLINE void LL_USART_ClearFlag_RTO (USART_TypeDef * USARTx)

Function description

Clear Receiver Time Out Flag.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR RTOCF LL_USART_ClearFlag_RTO

LL_USART_ClearFlag_EOB

Function name

__STATIC_INLINE void LL_USART_ClearFlag_EOB (USART_TypeDef * USARTx)

Function description

Clear End Of Block Flag.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_SMARTCARD_INSTANCE(USARTx) can be used to check whether or not Smartcard feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- ICR EOBCF LL_USART_ClearFlag_EOB

LL_USART_ClearFlag_UDR

Function name

__STATIC_INLINE void LL_USART_ClearFlag_UDR (USART_TypeDef * USARTx)

Function description

Clear SPI Slave Underrun Flag.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_SPI_SLAVE_INSTANCE(USARTx) can be used to check whether or not SPI Slave mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- ICR UDRCF LL_USART_ClearFlag_UDR

LL_USART_ClearFlag_CM

Function name

__STATIC_INLINE void LL_USART_ClearFlag_CM (USART_TypeDef * USARTx)

Function description

Clear Character Match Flag.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- ICR CMCF LL_USART_ClearFlag_CM

LL_USART_ClearFlag_WKUP

Function name

__STATIC_INLINE void LL_USART_ClearFlag_WKUP (USART_TypeDef * USARTx)

Function description

Clear Wake Up from stop mode Flag.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_WAKEUP_FROMSTOP_INSTANCE(USARTx) can be used to check whether or not Wake-up from Stop mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- ICR WUCF LL_USART_ClearFlag_WKUP

LL_USART_EnableIT_IDLE

Function name

__STATIC_INLINE void LL_USART_EnableIT_IDLE (USART_TypeDef * USARTx)

Function description

Enable IDLE Interrupt.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 IDLEIE LL_USART_EnableIT_IDLE

LL_USART_EnableIT_RXNE_RXFNE

Function name

__STATIC_INLINE void LL_USART_EnableIT_RXNE_RXFNE (USART_TypeDef * USARTx)

Function description

Enable RX Not Empty and RX FIFO Not Empty Interrupt.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_FIFO_INSTANCE(USARTx) can be used to check whether or not FIFO mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR1 RXNEIE_RXFNEIE LL_USART_EnableIT_RXNE_RXFNE

LL_USART_EnableIT_TC

Function name

__STATIC_INLINE void LL_USART_EnableIT_TC (USART_TypeDef * USARTx)

Function description

Enable Transmission Complete Interrupt.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 TCIE LL_USART_EnableIT_TC

LL_USART_EnableIT_TXE_TXFNF

Function name

__STATIC_INLINE void LL_USART_EnableIT_TXE_TXFNF (USART_TypeDef * USARTx)

Function description

Enable TX Empty and TX FIFO Not Full Interrupt.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_FIFO_INSTANCE(USARTx) can be used to check whether or not FIFO mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR1 TXEIE_TXFNFIE LL_USART_EnableIT_TXE_TXFNF

LL_USART_EnableIT_PE

Function name

__STATIC_INLINE void LL_USART_EnableIT_PE (USART_TypeDef * USARTx)

Function description

Enable Parity Error Interrupt.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 PEIE LL_USART_EnableIT_PE

LL_USART_EnableIT_CM

Function name

__STATIC_INLINE void LL_USART_EnableIT_CM (USART_TypeDef * USARTx)

Function description

Enable Character Match Interrupt.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 CMIE LL_USART_EnableIT_CM

LL_USART_EnableIT_RTO

Function name

__STATIC_INLINE void LL_USART_EnableIT_RTO (USART_TypeDef * USARTx)

Function description

Enable Receiver Timeout Interrupt.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 RTOIE LL_USART_EnableIT_RTO

LL_USART_EnableIT_EOB

Function name

__STATIC_INLINE void LL_USART_EnableIT_EOB (USART_TypeDef * USARTx)

Function description

Enable End Of Block Interrupt.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_SMARTCARD_INSTANCE(USARTx) can be used to check whether or not Smartcard feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR1 EOBIE LL_USART_EnableIT_EOB

LL_USART_EnableIT_TXFE

Function name

__STATIC_INLINE void LL_USART_EnableIT_TXFE (USART_TypeDef * USARTx)

Function description

Enable TX FIFO Empty Interrupt.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_FIFO_INSTANCE(USARTx) can be used to check whether or not FIFO mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR1 TXFEIE LL_USART_EnableIT_TXFE

LL_USART_EnableIT_RXFF

Function name

__STATIC_INLINE void LL_USART_EnableIT_RXFF (USART_TypeDef * USARTx)

Function description

Enable RX FIFO Full Interrupt.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 RXFFIE LL_USART_EnableIT_RXFF

LL_USART_EnableIT_LBD

Function name

__STATIC_INLINE void LL_USART_EnableIT_LBD (USART_TypeDef * USARTx)

Function description

Enable LIN Break Detection Interrupt.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_LIN_INSTANCE(USARTx) can be used to check whether or not LIN feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR2 LBDIE LL_USART_EnableIT_LBD

LL_USART_EnableIT_ERROR

Function name

__STATIC_INLINE void LL_USART_EnableIT_ERROR (USART_TypeDef * USARTx)

Function description

Enable Error Interrupt.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- When set, Error Interrupt Enable Bit is enabling interrupt generation in case of a framing error, overrun error or noise flag (FE=1 or ORE=1 or NF=1 in the USARTx_ISR register). 0: Interrupt is inhibited 1: An interrupt is generated when FE=1 or ORE=1 or NF=1 in the USARTx_ISR register.

Reference Manual to LL API cross reference:

- CR3 EIE LL_USART_EnableIT_ERROR

LL_USART_EnableIT_CTS

Function name

__STATIC_INLINE void LL_USART_EnableIT_CTS (USART_TypeDef * USARTx)

Function description

Enable CTS Interrupt.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_HWFLOW_INSTANCE(USARTx) can be used to check whether or not Hardware Flow control feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 CTSIE LL_USART_EnableIT_CTS

LL_USART_EnableIT_WKUP

Function name

__STATIC_INLINE void LL_USART_EnableIT_WKUP (USART_TypeDef * USARTx)

Function description

Enable Wake Up from Stop Mode Interrupt.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_WAKEUP_FROMSTOP_INSTANCE(USARTx) can be used to check whether or not Wake-up from Stop mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 WUFIE LL_USART_EnableIT_WKUP

LL_USART_EnableIT_TXFT

Function name

__STATIC_INLINE void LL_USART_EnableIT_TXFT (USART_TypeDef * USARTx)

Function description

Enable TX FIFO Threshold Interrupt.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_FIFO_INSTANCE(USARTx) can be used to check whether or not FIFO mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 TXFTIE LL_USART_EnableIT_TXFT

LL_USART_EnableIT_TCBGT

Function name

__STATIC_INLINE void LL_USART_EnableIT_TCBGT (USART_TypeDef * USARTx)

Function description

Enable Smartcard Transmission Complete Before Guard Time Interrupt.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_SMARTCARD_INSTANCE(USARTx) can be used to check whether or not Smartcard feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 TCBGTIE LL_USART_EnableIT_TCBGT

LL_USART_EnableIT_RXFT

Function name

__STATIC_INLINE void LL_USART_EnableIT_RXFT (USART_TypeDef * USARTx)

Function description

Enable RX FIFO Threshold Interrupt.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_FIFO_INSTANCE(USARTx) can be used to check whether or not FIFO mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 RXFTIE LL_USART_EnableIT_RXFT

LL_USART_DisableIT_IDLE

Function name

__STATIC_INLINE void LL_USART_DisableIT_IDLE (USART_TypeDef * USARTx)

Function description

Disable IDLE Interrupt.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 IDLEIE LL_USART_DisableIT_IDLE

LL_USART_DisableIT_RXNE_RXFNE

Function name

__STATIC_INLINE void LL_USART_DisableIT_RXNE_RXFNE (USART_TypeDef * USARTx)

Function description

Disable RX Not Empty and RX FIFO Not Empty Interrupt.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_FIFO_INSTANCE(USARTx) can be used to check whether or not FIFO mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR1 RXNEIE_RXFNEIE LL_USART_DisableIT_RXNE_RXFNE

LL_USART_DisableIT_TC

Function name

__STATIC_INLINE void LL_USART_DisableIT_TC (USART_TypeDef * USARTx)

Function description

Disable Transmission Complete Interrupt.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 TCIE LL_USART_DisableIT_TC

LL_USART_DisableIT_TXE_TXFNF

Function name

__STATIC_INLINE void LL_USART_DisableIT_TXE_TXFNF (USART_TypeDef * USARTx)

Function description

Disable TX Empty and TX FIFO Not Full Interrupt.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_FIFO_INSTANCE(USARTx) can be used to check whether or not FIFO mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR1 TXEIE_TXFNFIE LL_USART_DisableIT_TXE_TXFNF

LL_USART_DisableIT_PE

Function name

__STATIC_INLINE void LL_USART_DisableIT_PE (USART_TypeDef * USARTx)

Function description

Disable Parity Error Interrupt.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 PEIE LL_USART_DisableIT_PE

LL_USART_DisableIT_CM

Function name

__STATIC_INLINE void LL_USART_DisableIT_CM (USART_TypeDef * USARTx)

Function description

Disable Character Match Interrupt.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 CMIE LL_USART_DisableIT_CM

LL_USART_DisableIT_RTO

Function name

__STATIC_INLINE void LL_USART_DisableIT_RTO (USART_TypeDef * USARTx)

Function description

Disable Receiver Timeout Interrupt.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR1 RTOIE LL_USART_DisableIT_RTO

LL_USART_DisableIT_EOB

Function name

__STATIC_INLINE void LL_USART_DisableIT_EOB (USART_TypeDef * USARTx)

Function description

Disable End Of Block Interrupt.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_SMARTCARD_INSTANCE(USARTx) can be used to check whether or not Smartcard feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR1 EOBIE LL_USART_DisableIT_EOB

LL_USART_DisableIT_TXFE

Function name

__STATIC_INLINE void LL_USART_DisableIT_TXFE (USART_TypeDef * USARTx)

Function description

Disable TX FIFO Empty Interrupt.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_FIFO_INSTANCE(USARTx) can be used to check whether or not FIFO mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR1 TXFEIE LL_USART_DisableIT_TXFE

LL_USART_DisableIT_RXFF

Function name

__STATIC_INLINE void LL_USART_DisableIT_RXFF (USART_TypeDef * USARTx)

Function description

Disable RX FIFO Full Interrupt.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_FIFO_INSTANCE(USARTx) can be used to check whether or not FIFO mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR1 RXFFIE LL_USART_DisableIT_RXFF

LL_USART_DisableIT_LBD

Function name

__STATIC_INLINE void LL_USART_DisableIT_LBD (USART_TypeDef * USARTx)

Function description

Disable LIN Break Detection Interrupt.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_LIN_INSTANCE(USARTx) can be used to check whether or not LIN feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR2 LBDIE LL_USART_DisableIT_LBD

LL_USART_DisableIT_ERROR

Function name

__STATIC_INLINE void LL_USART_DisableIT_ERROR (USART_TypeDef * USARTx)

Function description

Disable Error Interrupt.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- When set, Error Interrupt Enable Bit is enabling interrupt generation in case of a framing error, overrun error or noise flag (FE=1 or ORE=1 or NF=1 in the USARTx_ISR register). 0: Interrupt is inhibited 1: An interrupt is generated when FE=1 or ORE=1 or NF=1 in the USARTx_ISR register.

Reference Manual to LL API cross reference:

- CR3 EIE LL_USART_DisableIT_ERROR

LL_USART_DisableIT_CTS

Function name

__STATIC_INLINE void LL_USART_DisableIT_CTS (USART_TypeDef * USARTx)

Function description

Disable CTS Interrupt.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_HWFLOW_INSTANCE(USARTx) can be used to check whether or not Hardware Flow control feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 CTSIE LL_USART_DisableIT_CTS

LL_USART_DisableIT_WKUP

Function name

__STATIC_INLINE void LL_USART_DisableIT_WKUP (USART_TypeDef * USARTx)

Function description

Disable Wake Up from Stop Mode Interrupt.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_WAKEUP_FROMSTOP_INSTANCE(USARTx) can be used to check whether or not Wake-up from Stop mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 WUFIE LL_USART_DisableIT_WKUP

LL_USART_DisableIT_TXFT

Function name

__STATIC_INLINE void LL_USART_DisableIT_TXFT (USART_TypeDef * USARTx)

Function description

Disable TX FIFO Threshold Interrupt.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_FIFO_INSTANCE(USARTx) can be used to check whether or not FIFO mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 TXFTIE LL_USART_DisableIT_TXFT

LL_USART_DisableIT_TCBGT

Function name

__STATIC_INLINE void LL_USART_DisableIT_TCBGT (USART_TypeDef * USARTx)

Function description

Disable Smartcard Transmission Complete Before Guard Time Interrupt.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_SMARTCARD_INSTANCE(USARTx) can be used to check whether or not Smartcard feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 TCBGTIE LL_USART_DisableIT_TCBGT

LL_USART_DisableIT_RXFT

Function name

__STATIC_INLINE void LL_USART_DisableIT_RXFT (USART_TypeDef * USARTx)

Function description

Disable RX FIFO Threshold Interrupt.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_FIFO_INSTANCE(USARTx) can be used to check whether or not FIFO mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 RXFTIE LL_USART_DisableIT_RXFT

LL_USART_IsEnabledIT_IDLE

Function name

__STATIC_INLINE uint32_t LL_USART_IsEnabledIT_IDLE (const USART_TypeDef * USARTx)

Function description

Check if the USART IDLE Interrupt source is enabled or disabled.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 IDLEIE LL_USART_IsEnabledIT_IDLE

LL_USART_IsEnabledIT_RXNE_RXFNE

Function name

__STATIC_INLINE uint32_t LL_USART_IsEnabledIT_RXNE_RXFNE (const USART_TypeDef * USARTx)

Function description

Check if the USART RX Not Empty and USART RX FIFO Not Empty Interrupt is enabled or disabled.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_UART_FIFO_INSTANCE(USARTx) can be used to check whether or not FIFO mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR1 RXNEIE_RXFNEIE LL_USART_IsEnabledIT_RXNE_RXFNE

LL_USART_IsEnabledIT_TC

Function name

__STATIC_INLINE uint32_t LL_USART_IsEnabledIT_TC (const USART_TypeDef * USARTx)

Function description

Check if the USART Transmission Complete Interrupt is enabled or disabled.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 TCIE LL_USART_IsEnabledIT_TC

LL_USART_IsEnabledIT_TXE_TXFNF

Function name

__STATIC_INLINE uint32_t LL_USART_IsEnabledIT_TXE_TXFNF (const USART_TypeDef * USARTx)

Function description

Check if the USART TX Empty and USART TX FIFO Not Full Interrupt is enabled or disabled.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_UART_FIFO_INSTANCE(USARTx) can be used to check whether or not FIFO mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR1 TXEIE_TXFNFIE LL_USART_IsEnabledIT_TXE_TXFNF

LL_USART_IsEnabledIT_PE

Function name

__STATIC_INLINE uint32_t LL_USART_IsEnabledIT_PE (const USART_TypeDef * USARTx)

Function description

Check if the USART Parity Error Interrupt is enabled or disabled.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 PEIE LL_USART_IsEnabledIT_PE

LL_USART_IsEnabledIT_CM

Function name

__STATIC_INLINE uint32_t LL_USART_IsEnabledIT_CM (const USART_TypeDef * USARTx)

Function description

Check if the USART Character Match Interrupt is enabled or disabled.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 CMIE LL_USART_IsEnabledIT_CM

LL_USART_IsEnabledIT_RTO

Function name

__STATIC_INLINE uint32_t LL_USART_IsEnabledIT_RTO (const USART_TypeDef * USARTx)

Function description

Check if the USART Receiver Timeout Interrupt is enabled or disabled.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR1 RTOIE LL_USART_IsEnabledIT_RTO

LL_USART_IsEnabledIT_EOB

Function name

__STATIC_INLINE uint32_t LL_USART_IsEnabledIT_EOB (const USART_TypeDef * USARTx)

Function description

Check if the USART End Of Block Interrupt is enabled or disabled.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_SMARTCARD_INSTANCE(USARTx) can be used to check whether or not Smartcard feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR1 EOBIE LL_USART_IsEnabledIT_EOB

LL_USART_IsEnabledIT_TXFE

Function name

__STATIC_INLINE uint32_t LL_USART_IsEnabledIT_TXFE (const USART_TypeDef * USARTx)

Function description

Check if the USART TX FIFO Empty Interrupt is enabled or disabled.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_UART_FIFO_INSTANCE(USARTx) can be used to check whether or not FIFO mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR1 TXFEIE LL_USART_IsEnabledIT_TXFE

LL_USART_IsEnabledIT_RXFF

Function name

__STATIC_INLINE uint32_t LL_USART_IsEnabledIT_RXFF (const USART_TypeDef * USARTx)

Function description

Check if the USART RX FIFO Full Interrupt is enabled or disabled.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_UART_FIFO_INSTANCE(USARTx) can be used to check whether or not FIFO mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR1 RXFFIE LL_USART_IsEnabledIT_RXFF

LL_USART_IsEnabledIT_LBD

Function name

__STATIC_INLINE uint32_t LL_USART_IsEnabledIT_LBD (const USART_TypeDef * USARTx)

Function description

Check if the USART LIN Break Detection Interrupt is enabled or disabled.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_UART_LIN_INSTANCE(USARTx) can be used to check whether or not LIN feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR2 LBDIE LL_USART_IsEnabledIT_LBD

LL_USART_IsEnabledIT_ERROR

Function name

__STATIC_INLINE uint32_t LL_USART_IsEnabledIT_ERROR (const USART_TypeDef * USARTx)

Function description

Check if the USART Error Interrupt is enabled or disabled.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR3 EIE LL_USART_IsEnabledIT_ERROR

LL_USART_IsEnabledIT_CTS

Function name

__STATIC_INLINE uint32_t LL_USART_IsEnabledIT_CTS (const USART_TypeDef * USARTx)

Function description

Check if the USART CTS Interrupt is enabled or disabled.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_UART_HWFLOW_INSTANCE(USARTx) can be used to check whether or not Hardware Flow control feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 CTSIE LL_USART_IsEnabledIT_CTS

LL_USART_IsEnabledIT_WKUP

Function name

__STATIC_INLINE uint32_t LL_USART_IsEnabledIT_WKUP (const USART_TypeDef * USARTx)

Function description

Check if the USART Wake Up from Stop Mode Interrupt is enabled or disabled.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_UART_WAKEUP_FROMSTOP_INSTANCE(USARTx) can be used to check whether or not Wake-up from Stop mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 WUFIE LL_USART_IsEnabledIT_WKUP

LL_USART_IsEnabledIT_TXFT

Function name

__STATIC_INLINE uint32_t LL_USART_IsEnabledIT_TXFT (const USART_TypeDef * USARTx)

Function description

Check if USART TX FIFO Threshold Interrupt is enabled or disabled.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_UART_FIFO_INSTANCE(USARTx) can be used to check whether or not FIFO mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 TXFTIE LL_USART_IsEnabledIT_TXFT

LL_USART_IsEnabledIT_TCBGT

Function name

__STATIC_INLINE uint32_t LL_USART_IsEnabledIT_TCBGT (const USART_TypeDef * USARTx)

Function description

Check if the Smartcard Transmission Complete Before Guard Time Interrupt is enabled or disabled.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_SMARTCARD_INSTANCE(USARTx) can be used to check whether or not Smartcard feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 TCBGTIE LL_USART_IsEnabledIT_TCBGT

LL_USART_IsEnabledIT_RXFT

Function name

__STATIC_INLINE uint32_t LL_USART_IsEnabledIT_RXFT (const USART_TypeDef * USARTx)

Function description

Check if USART RX FIFO Threshold Interrupt is enabled or disabled.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Notes

- Macro IS_UART_FIFO_INSTANCE(USARTx) can be used to check whether or not FIFO mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- CR3 RXFTIE LL_USART_IsEnabledIT_RXFT

LL_USART_EnableDMAReq_RX

Function name

__STATIC_INLINE void LL_USART_EnableDMAReq_RX (USART_TypeDef * USARTx)

Function description

Enable DMA Mode for reception.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 DMAR LL_USART_EnableDMAReq_RX

LL_USART_DisableDMAReq_RX

Function name

__STATIC_INLINE void LL_USART_DisableDMAReq_RX (USART_TypeDef * USARTx)

Function description

Disable DMA Mode for reception.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 DMAR LL_USART_DisableDMAReq_RX

LL_USART_IsEnabledDMAReq_RX

Function name

__STATIC_INLINE uint32_t LL_USART_IsEnabledDMAReq_RX (const USART_TypeDef * USARTx)

Function description

Check if DMA Mode is enabled for reception.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR3 DMAR LL_USART_IsEnabledDMAReq_RX

LL_USART_EnableDMAReq_TX

Function name

__STATIC_INLINE void LL_USART_EnableDMAReq_TX (USART_TypeDef * USARTx)

Function description

Enable DMA Mode for transmission.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 DMAT LL_USART_EnableDMAReq_TX

LL_USART_DisableDMAReq_TX

Function name

__STATIC_INLINE void LL_USART_DisableDMAReq_TX (USART_TypeDef * USARTx)

Function description

Disable DMA Mode for transmission.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 DMAT LL_USART_DisableDMAReq_TX

LL_USART_IsEnabledDMAReq_TX

Function name

__STATIC_INLINE uint32_t LL_USART_IsEnabledDMAReq_TX (const USART_TypeDef * USARTx)

Function description

Check if DMA Mode is enabled for transmission.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR3 DMAT LL_USART_IsEnabledDMAReq_TX

LL_USART_EnableDMADeactOnRxErr

Function name

__STATIC_INLINE void LL_USART_EnableDMADeactOnRxErr (USART_TypeDef * USARTx)

Function description

Enable DMA Disabling on Reception Error.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 DDRE LL_USART_EnableDMADeactOnRxErr

LL_USART_DisableDMADeactOnRxErr

Function name

__STATIC_INLINE void LL_USART_DisableDMADeactOnRxErr (USART_TypeDef * USARTx)

Function description

Disable DMA Disabling on Reception Error.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- CR3 DDRE LL_USART_DisableDMADeactOnRxErr

LL_USART_IsEnabledDMADeactOnRxErr

Function name

__STATIC_INLINE uint32_t LL_USART_IsEnabledDMADeactOnRxErr (const USART_TypeDef * USARTx)

Function description

Indicate if DMA Disabling on Reception Error is disabled.

Parameters

- **USARTx:** USART Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR3 DDRE LL_USART_IsEnabledDMADeactOnRxErr

LL_USART_DMA_GetRegAddr

Function name

__STATIC_INLINE uint32_t LL_USART_DMA_GetRegAddr (const USART_TypeDef * USARTx, uint32_t Direction)

Function description

Get the data register address used for DMA transfer.

Parameters

- **USARTx:** USART Instance
- **Direction:** This parameter can be one of the following values:
  - LL_USART_DMA_REG_DATA_TRANSMIT
  - LL_USART_DMA_REG_DATA_RECEIVE

Return values

- **Address:** of data register

Reference Manual to LL API cross reference:

- RDR RDR LL_USART_DMA_GetRegAddr
-
- TDR TDR LL_USART_DMA_GetRegAddr

LL_USART_ReceiveData8

Function name

__STATIC_INLINE uint8_t LL_USART_ReceiveData8 (const USART_TypeDef * USARTx)

Function description

Read Receiver Data register (Receive Data value, 8 bits)

Parameters

- **USARTx:** USART Instance

Return values

- **Value:** between Min_Data=0x00 and Max_Data=0xFF

Reference Manual to LL API cross reference:

- RDR RDR LL_USART_ReceiveData8

LL_USART_ReceiveData9

Function name

__STATIC_INLINE uint16_t LL_USART_ReceiveData9 (const USART_TypeDef * USARTx)

Function description

Read Receiver Data register (Receive Data value, 9 bits)

Parameters

- **USARTx:** USART Instance

Return values

- **Value:** between Min_Data=0x00 and Max_Data=0x1FF

Reference Manual to LL API cross reference:

- RDR RDR LL_USART_ReceiveData9

LL_USART_TransmitData8

Function name

__STATIC_INLINE void LL_USART_TransmitData8 (USART_TypeDef * USARTx, uint8_t Value)

Function description

Write in Transmitter Data Register (Transmit Data value, 8 bits)

Parameters

- **USARTx:** USART Instance
- **Value:** between Min_Data=0x00 and Max_Data=0xFF

Return values

- **None:**

Reference Manual to LL API cross reference:

- TDR TDR LL_USART_TransmitData8

LL_USART_TransmitData9

Function name

__STATIC_INLINE void LL_USART_TransmitData9 (USART_TypeDef * USARTx, uint16_t Value)

Function description

Write in Transmitter Data Register (Transmit Data value, 9 bits)

Parameters

- **USARTx:** USART Instance
- **Value:** between Min_Data=0x00 and Max_Data=0x1FF

Return values

- **None:**

Reference Manual to LL API cross reference:

- TDR TDR LL_USART_TransmitData9

LL_USART_RequestAutoBaudRate

Function name

__STATIC_INLINE void LL_USART_RequestAutoBaudRate (USART_TypeDef * USARTx)

Function description

Request an Automatic Baud Rate measurement on next received data frame.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_USART_AUTOBAUDRATE_DETECTION_INSTANCE(USARTx) can be used to check whether or not Auto Baud Rate detection feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- RQR ABRRQ LL_USART_RequestAutoBaudRate

LL_USART_RequestBreakSending

Function name

__STATIC_INLINE void LL_USART_RequestBreakSending (USART_TypeDef * USARTx)

Function description

Request Break sending.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- RQR SBKRQ LL_USART_RequestBreakSending

LL_USART_RequestEnterMuteMode

Function name

__STATIC_INLINE void LL_USART_RequestEnterMuteMode (USART_TypeDef * USARTx)

Function description

Put USART in mute mode and set the RWU flag.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- RQR MMRQ LL_USART_RequestEnterMuteMode

LL_USART_RequestRxDataFlush

Function name

__STATIC_INLINE void LL_USART_RequestRxDataFlush (USART_TypeDef * USARTx)

Function description

Request a Receive Data and FIFO flush.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_FIFO_INSTANCE(USARTx) can be used to check whether or not FIFO mode feature is supported by the USARTx instance.
- Allows to discard the received data without reading them, and avoid an overrun condition.

Reference Manual to LL API cross reference:

- RQR RXFRQ LL_USART_RequestRxDataFlush

LL_USART_RequestTxDataFlush

Function name

__STATIC_INLINE void LL_USART_RequestTxDataFlush (USART_TypeDef * USARTx)

Function description

Request a Transmit data and FIFO flush.

Parameters

- **USARTx:** USART Instance

Return values

- **None:**

Notes

- Macro IS_UART_FIFO_INSTANCE(USARTx) can be used to check whether or not FIFO mode feature is supported by the USARTx instance.

Reference Manual to LL API cross reference:

- RQR TXFRQ LL_USART_RequestTxDataFlush

LL_USART_DeInit

Function name

ErrorStatus LL_USART_DeInit (const USART_TypeDef * USARTx)

Function description

De-initialize USART registers (Registers restored to their default values).

Parameters

- **USARTx:** USART Instance

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: USART registers are de-initialized
  - ERROR: USART registers are not de-initialized

LL_USART_Init

Function name

ErrorStatus LL_USART_Init (USART_TypeDef * USARTx, const LL_USART_InitTypeDef * USART_InitStruct)

Function description

Initialize USART registers according to the specified parameters in USART_InitStruct.

Parameters

- **USARTx:** USART Instance
- **USART_InitStruct:** pointer to a LL_USART_InitTypeDef structure that contains the configuration information for the specified USART peripheral.

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: USART registers are initialized according to USART_InitStruct content
  - ERROR: Problem occurred during USART Registers initialization

Notes

- As some bits in USART configuration registers can only be written when the USART is disabled (USART_CR1_UE bit =0), USART Peripheral should be in disabled state prior calling this function. Otherwise, ERROR result will be returned.
- Baud rate value stored in USART_InitStruct BaudRate field, should be valid (different from 0).

LL_USART_StructInit

Function name

void LL_USART_StructInit (LL_USART_InitTypeDef * USART_InitStruct)

Function description

Set each LL_USART_InitTypeDef field to default value.

Parameters

- **USART_InitStruct:** pointer to a LL_USART_InitTypeDef structure whose fields will be set to default values.

Return values

- **None:**

LL_USART_ClockInit

Function name

ErrorStatus LL_USART_ClockInit (USART_TypeDef * USARTx, const LL_USART_ClockInitTypeDef * USART_ClockInitStruct)

Function description

Initialize USART Clock related settings according to the specified parameters in the USART_ClockInitStruct.

Parameters

- **USARTx:** USART Instance
- **USART_ClockInitStruct:** pointer to a LL_USART_ClockInitTypeDef structure that contains the Clock configuration information for the specified USART peripheral.

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: USART registers related to Clock settings are initialized according to USART_ClockInitStruct content
  - ERROR: Problem occurred during USART Registers initialization

Notes

- As some bits in USART configuration registers can only be written when the USART is disabled (USART_CR1_UE bit =0), USART Peripheral should be in disabled state prior calling this function. Otherwise, ERROR result will be returned.

LL_USART_ClockStructInit

Function name

void LL_USART_ClockStructInit (LL_USART_ClockInitTypeDef * USART_ClockInitStruct)

Function description

Set each field of a LL_USART_ClockInitTypeDef type structure to default value.

Parameters

- **USART_ClockInitStruct:** pointer to a LL_USART_ClockInitTypeDef structure whose fields will be set to default values.

Return values

- **None:**

78.3 USART Firmware driver defines

The following section lists the various define and macros of the module.

78.3.1 USART

USART

Address Length Detection

LL_USART_ADDRESS_DETECT_4B

4-bit address detection method selected

LL_USART_ADDRESS_DETECT_7B

7-bit address detection (in 8-bit data mode) method selected

Autobaud Detection

LL_USART_AUTOBAUD_DETECT_ON_STARTBIT

Measurement of the start bit is used to detect the baud rate

LL_USART_AUTOBAUD_DETECT_ON_FALLINGEDGE

Falling edge to falling edge measurement. Received frame must start with a single bit = 1 -> Frame = Start10xxxxxx

LL_USART_AUTOBAUD_DETECT_ON_7F_FRAME

0x7F frame detection

LL_USART_AUTOBAUD_DETECT_ON_55_FRAME

0x55 frame detection

Binary Data Inversion

LL_USART_BINARY_LOGIC_POSITIVE

Logical data from the data register are send/received in positive/direct logic. (1=H, 0=L)

LL_USART_BINARY_LOGIC_NEGATIVE

Logical data from the data register are send/received in negative/inverse logic. (1=L, 0=H). The parity bit is also inverted.

Bit Order

LL_USART_BITORDER_LSBFIRST

data is transmitted/received with data bit 0 first, following the start bit

LL_USART_BITORDER_MSBFIRST

data is transmitted/received with the MSB first, following the start bit

Clear Flags Defines

LL_USART_ICR_PECF

Parity error clear flag

LL_USART_ICR_FECF

Framing error clear flag

LL_USART_ICR_NECF

Noise error detected clear flag

LL_USART_ICR_ORECF

Overrun error clear flag

LL_USART_ICR_IDLECF

Idle line detected clear flag

LL_USART_ICR_TXFECF

TX FIFO Empty clear flag

LL_USART_ICR_TCCF

Transmission complete clear flag

LL_USART_ICR_TCBGTCF

Transmission completed before guard time clear flag

LL_USART_ICR_LBDCF

LIN break detection clear flag

LL_USART_ICR_CTSCF

CTS clear flag

LL_USART_ICR_RTOCF

Receiver timeout clear flag

LL_USART_ICR_EOBCF

End of block clear flag

LL_USART_ICR_UDRCF

SPI Slave Underrun clear flag

LL_USART_ICR_CMCF

Character match clear flag

LL_USART_ICR_WUCF

Wakeup from Stop mode clear flag

Clock Signal

LL_USART_CLOCK_DISABLE

Clock signal not provided

LL_USART_CLOCK_ENABLE

Clock signal provided

Datawidth

LL_USART_DATAWIDTH_7B

7 bits word length : Start bit, 7 data bits, n stop bits

LL_USART_DATAWIDTH_8B

8 bits word length : Start bit, 8 data bits, n stop bits

LL_USART_DATAWIDTH_9B

9 bits word length : Start bit, 9 data bits, n stop bits

Driver Enable Polarity

LL_USART_DE_POLARITY_HIGH

DE signal is active high

LL_USART_DE_POLARITY_LOW

DE signal is active low

Communication Direction

LL_USART_DIRECTION_NONE

Transmitter and Receiver are disabled

LL_USART_DIRECTION_RX

Transmitter is disabled and Receiver is enabled

LL_USART_DIRECTION_TX

Transmitter is enabled and Receiver is disabled

LL_USART_DIRECTION_TX_RX

Transmitter and Receiver are enabled

DMA Register Data

LL_USART_DMA_REG_DATA_TRANSMIT

Get address of data register used for transmission

LL_USART_DMA_REG_DATA_RECEIVE

Get address of data register used for reception

FIFO Threshold

LL_USART_FIFOTHRESHOLD_1_8

FIFO reaches 1/8 of its depth

LL_USART_FIFOTHRESHOLD_1_4

FIFO reaches 1/4 of its depth

LL_USART_FIFOTHRESHOLD_1_2

FIFO reaches 1/2 of its depth

LL_USART_FIFOTHRESHOLD_3_4

FIFO reaches 3/4 of its depth

LL_USART_FIFOTHRESHOLD_7_8

FIFO reaches 7/8 of its depth

LL_USART_FIFOTHRESHOLD_8_8

FIFO becomes empty for TX and full for RX

Get Flags Defines

LL_USART_ISR_PE

Parity error flag

LL_USART_ISR_FE

Framing error flag

LL_USART_ISR_NE

Noise detected flag

LL_USART_ISR_ORE

Overrun error flag

LL_USART_ISR_IDLE

Idle line detected flag

LL_USART_ISR_RXNE_RXFNE

Read data register or RX FIFO not empty flag

LL_USART_ISR_TC

Transmission complete flag

LL_USART_ISR_TXE_TXFNF

Transmit data register empty or TX FIFO Not Full flag

LL_USART_ISR_LBDF

LIN break detection flag

LL_USART_ISR_CTSIF

CTS interrupt flag

LL_USART_ISR_CTS

CTS flag

LL_USART_ISR_RTOF

Receiver timeout flag

LL_USART_ISR_EOBF

End of block flag

LL_USART_ISR_UDR

SPI Slave underrun error flag

LL_USART_ISR_ABRE

Auto baud rate error flag

LL_USART_ISR_ABRF

Auto baud rate flag

LL_USART_ISR_BUSY

Busy flag

LL_USART_ISR_CMF

Character match flag

LL_USART_ISR_SBKF

Send break flag

LL_USART_ISR_RWU

Receiver wakeup from Mute mode flag

LL_USART_ISR_WUF

Wakeup from Stop mode flag

LL_USART_ISR_TEACK

Transmit enable acknowledge flag

LL_USART_ISR_REACK

Receive enable acknowledge flag

LL_USART_ISR_TXFE

TX FIFO empty flag

LL_USART_ISR_RXFF

RX FIFO full flag

LL_USART_ISR_TCBGT

Transmission complete before guard time completion flag

LL_USART_ISR_RXFT

RX FIFO threshold flag

LL_USART_ISR_TXFT

TX FIFO threshold flag

Hardware Control

LL_USART_HWCONTROL_NONE

CTS and RTS hardware flow control disabled

LL_USART_HWCONTROL_RTS

RTS output enabled, data is only requested when there is space in the receive buffer

LL_USART_HWCONTROL_CTS

CTS mode enabled, data is only transmitted when the nCTS input is asserted (tied to 0)

LL_USART_HWCONTROL_RTS_CTS

CTS and RTS hardware flow control enabled

IrDA Power

LL_USART_IRDA_POWER_NORMAL

IrDA normal power mode

LL_USART_IRDA_POWER_LOW

IrDA low power mode

IT Defines

LL_USART_CR1_IDLEIE

IDLE interrupt enable

LL_USART_CR1_RXNEIE_RXFNEIE

Read data register and RXFIFO not empty interrupt enable

LL_USART_CR1_TCIE

Transmission complete interrupt enable

LL_USART_CR1_TXEIE_TXFNFIE

Transmit data register empty and TX FIFO not full interrupt enable

LL_USART_CR1_PEIE

Parity error

LL_USART_CR1_CMIE

Character match interrupt enable

LL_USART_CR1_RTOIE

Receiver timeout interrupt enable

LL_USART_CR1_EOBIE

End of Block interrupt enable

LL_USART_CR1_TXFEIE

TX FIFO empty interrupt enable

LL_USART_CR1_RXFFIE

RX FIFO full interrupt enable

LL_USART_CR2_LBDIE

LIN break detection interrupt enable

LL_USART_CR3_EIE

Error interrupt enable

LL_USART_CR3_CTSIE

CTS interrupt enable

LL_USART_CR3_WUFIE

Wakeup from Stop mode interrupt enable

LL_USART_CR3_TXFTIE

TX FIFO threshold interrupt enable

LL_USART_CR3_TCBGTIE

Transmission complete before guard time interrupt enable

LL_USART_CR3_RXFTIE

RX FIFO threshold interrupt enable

Last Clock Pulse

LL_USART_LASTCLKPULSE_NO_OUTPUT

The clock pulse of the last data bit is not output to the SCLK pin

LL_USART_LASTCLKPULSE_OUTPUT

The clock pulse of the last data bit is output to the SCLK pin

LIN Break Detection Length

LL_USART_LINBREAK_DETECT_10B

10-bit break detection method selected

LL_USART_LINBREAK_DETECT_11B

11-bit break detection method selected

Oversampling

LL_USART_OVERSAMPLING_16

Oversampling by 16

LL_USART_OVERSAMPLING_8

Oversampling by 8

Parity Control

LL_USART_PARITY_NONE

Parity control disabled

LL_USART_PARITY_EVEN

Parity control enabled and Even Parity is selected

LL_USART_PARITY_ODD

Parity control enabled and Odd Parity is selected

Clock Phase

LL_USART_PHASE_1EDGE

The first clock transition is the first data capture edge

LL_USART_PHASE_2EDGE

The second clock transition is the first data capture edge

Clock Polarity

LL_USART_POLARITY_LOW

Steady low value on SCLK pin outside transmission window

LL_USART_POLARITY_HIGH

Steady high value on SCLK pin outside transmission window

Clock Source Prescaler

LL_USART_PRESCALER_DIV1

Input clock not divided

LL_USART_PRESCALER_DIV2

Input clock divided by 2

LL_USART_PRESCALER_DIV4

Input clock divided by 4

LL_USART_PRESCALER_DIV6

Input clock divided by 6

LL_USART_PRESCALER_DIV8

Input clock divided by 8

LL_USART_PRESCALER_DIV10

Input clock divided by 10

LL_USART_PRESCALER_DIV12

Input clock divided by 12

LL_USART_PRESCALER_DIV16

Input clock divided by 16

LL_USART_PRESCALER_DIV32

Input clock divided by 32

LL_USART_PRESCALER_DIV64

Input clock divided by 64

LL_USART_PRESCALER_DIV128

Input clock divided by 128

LL_USART_PRESCALER_DIV256

Input clock divided by 256

RX Pin Active Level Inversion

LL_USART_RXPIN_LEVEL_STANDARD

RX pin signal works using the standard logic levels

LL_USART_RXPIN_LEVEL_INVERTED

RX pin signal values are inverted.

Stop Bits

LL_USART_STOPBITS_0_5

0.5 stop bit

LL_USART_STOPBITS_1

1 stop bit

LL_USART_STOPBITS_1_5

1.5 stop bits

LL_USART_STOPBITS_2

2 stop bits

TX Pin Active Level Inversion

LL_USART_TXPIN_LEVEL_STANDARD

TX pin signal works using the standard logic levels

LL_USART_TXPIN_LEVEL_INVERTED

TX pin signal values are inverted.

TX RX Pins Swap

LL_USART_TXRX_STANDARD

TX/RX pins are used as defined in standard pinout

LL_USART_TXRX_SWAPPED

TX and RX pins functions are swapped.

Wakeup

LL_USART_WAKEUP_IDLELINE

USART wake up from Mute mode on Idle Line

LL_USART_WAKEUP_ADDRESSMARK

USART wake up from Mute mode on Address Mark

Wakeup Activation

LL_USART_WAKEUP_ON_ADDRESS

Wake up active on address match

LL_USART_WAKEUP_ON_STARTBIT

Wake up active on Start bit detection

LL_USART_WAKEUP_ON_RXNE

Wake up active on RXNE

FLAG_Management

LL_USART_IsActiveFlag_RXNE

LL_USART_IsActiveFlag_TXE

IT_Management

LL_USART_EnableIT_RXNE

LL_USART_EnableIT_TXE

LL_USART_DisableIT_RXNE

LL_USART_DisableIT_TXE

LL_USART_IsEnabledIT_RXNE

LL_USART_IsEnabledIT_TXE

Exported_Macros_Helper

__LL_USART_DIV_SAMPLING8

Description:

- Compute USARTDIV value according to Peripheral Clock and expected Baud Rate in 8 bits sampling mode (32 bits value of USARTDIV is returned)

Parameters:

- __PERIPHCLK__: Peripheral Clock frequency used for USART instance
- __PRESCALER__: This parameter can be one of the following values:
  - LL_USART_PRESCALER_DIV1
  - LL_USART_PRESCALER_DIV2
  - LL_USART_PRESCALER_DIV4
  - LL_USART_PRESCALER_DIV6
  - LL_USART_PRESCALER_DIV8
  - LL_USART_PRESCALER_DIV10
  - LL_USART_PRESCALER_DIV12
  - LL_USART_PRESCALER_DIV16
  - LL_USART_PRESCALER_DIV32
  - LL_USART_PRESCALER_DIV64
  - LL_USART_PRESCALER_DIV128
  - LL_USART_PRESCALER_DIV256
- __BAUDRATE__: Baud rate value to achieve

Return value:

- USARTDIV: value to be used for BRR register filling in OverSampling_8 case

__LL_USART_DIV_SAMPLING16

Description:

- Compute USARTDIV value according to Peripheral Clock and expected Baud Rate in 16 bits sampling mode (32 bits value of USARTDIV is returned)

Parameters:

- __PERIPHCLK__: Peripheral Clock frequency used for USART instance
- __PRESCALER__: This parameter can be one of the following values:
  - LL_USART_PRESCALER_DIV1
  - LL_USART_PRESCALER_DIV2
  - LL_USART_PRESCALER_DIV4
  - LL_USART_PRESCALER_DIV6
  - LL_USART_PRESCALER_DIV8
  - LL_USART_PRESCALER_DIV10
  - LL_USART_PRESCALER_DIV12
  - LL_USART_PRESCALER_DIV16
  - LL_USART_PRESCALER_DIV32
  - LL_USART_PRESCALER_DIV64
  - LL_USART_PRESCALER_DIV128
  - LL_USART_PRESCALER_DIV256
- __BAUDRATE__: Baud rate value to achieve

Return value:

- USARTDIV: value to be used for BRR register filling in OverSampling_16 case

Common Write and read registers Macros

LL_USART_WriteReg

Description:

- Write a value in USART register.

Parameters:

- __INSTANCE__: USART Instance
- __REG__: Register to be written
- __VALUE__: Value to be written in the register

Return value:

- None

LL_USART_ReadReg

Description:

- Read a value in USART register.

Parameters:

- __INSTANCE__: USART Instance
- __REG__: Register to be read

Return value:

- Register: value

79 LL UTILS Generic Driver

79.1 UTILS Firmware driver registers structures

79.1.1 LL_UTILS_PLLInitTypeDef

LL_UTILS_PLLInitTypeDef is defined in the stm32u0xx_ll_utils.h

Data Fields

- ***uint32_t PLLM***
- ***uint32_t PLLN***
- ***uint32_t PLLR***

Field Documentation

- ***uint32_t LL_UTILS_PLLInitTypeDef::PLLM***
  Division factor for PLL VCO input clock. This parameter can be a value of ***RCC_LL_EC_PLLM_DIV***This feature can be modified afterwards using unitary function **LL_RCC_PLL_ConfigDomain_SYS()**.
- ***uint32_t LL_UTILS_PLLInitTypeDef::PLLN***
  Multiplication factor for PLL VCO output clock. This parameter must be a number between Min_Data = 8 and Max_Data = 86This feature can be modified afterwards using unitary function **LL_RCC_PLL_ConfigDomain_SYS()**.
- ***uint32_t LL_UTILS_PLLInitTypeDef::PLLR***
  Division for the main system clock. This parameter can be a value of ***RCC_LL_EC_PLLR_DIV***This feature can be modified afterwards using unitary function **LL_RCC_PLL_ConfigDomain_SYS()**.

79.1.2 LL_UTILS_ClkInitTypeDef

LL_UTILS_ClkInitTypeDef is defined in the stm32u0xx_ll_utils.h

Data Fields

- ***uint32_t AHBCLKDivider***
- ***uint32_t APB1CLKDivider***

Field Documentation

- ***uint32_t LL_UTILS_ClkInitTypeDef::AHBCLKDivider***
  The AHBS clock (HCLKS) divider. This clock is derived from the system clock (SYSCLK). This parameter can be a value of ***RCC_LL_EC_SYSCLK_DIV***This feature can be modified afterwards using unitary function **LL_RCC_SetAHBPrescaler()**.
- ***uint32_t LL_UTILS_ClkInitTypeDef::APB1CLKDivider***
  The APB1 clock (PCLK1) divider. This clock is derived from the AHB clock (HCLK). This parameter can be a value of ***RCC_LL_EC_APB1_DIV***This feature can be modified afterwards using unitary function **LL_RCC_SetAPB1Prescaler()**.

79.2 UTILS Firmware driver API description

The following section lists the various functions of the UTILS library.

79.2.1 System Configuration functions

System, HCLK, AHB, and APB buses clocks configuration

- The maximum frequency of the SYSCLK, HCLK, and PCLK is 640000000 Hz.

This section contains the following APIs:

- ***LL_SetSystemCoreClock()***
- ***LL_PLL_ConfigSystemClock_MSI()***
- ***LL_PLL_ConfigSystemClock_HSI()***
- ***LL_PLL_ConfigSystemClock_HSE()***

79.2.2 Detailed description of functions

LL_GetUID_Word0

Function name

__STATIC_INLINE uint32_t LL_GetUID_Word0 (void)

Function description

Get Word0 of the unique device identifier (UID based on 96 bits)

Return values

- **UID[31:0]:** X and Y coordinates on the wafer expressed in BCD format

LL_GetUID_Word1

Function name

__STATIC_INLINE uint32_t LL_GetUID_Word1 (void)

Function description

Get Word1 of the unique device identifier (UID based on 96 bits)

Return values

- **UID[63:32]:** Wafer number (UID[39:32]) & LOT_NUM[23:0] (UID[63:40])

LL_GetUID_Word2

Function name

__STATIC_INLINE uint32_t LL_GetUID_Word2 (void)

Function description

Get Word2 of the unique device identifier (UID based on 96 bits)

Return values

- **UID[95:64]:** Lot number (ASCII encoded) - LOT_NUM[55:24]

LL_GetFlashSize

Function name

__STATIC_INLINE uint32_t LL_GetFlashSize (void)

Function description

Get Flash memory size.

Return values

- **FLASH_SIZE[15:0]:** Flash memory size

Notes

- This bitfield indicates the size of the device Flash memory expressed in Kbytes. As an example, 0x040 corresponds to 64 Kbytes.

LL_GetPackageType

Function name

__STATIC_INLINE uint32_t LL_GetPackageType (void)

Function description

Get Package type.

Return values

- **Returned:** value can be one of the following values:
  - LL_UTILS_PACKAGETYPE_UFQFPN32
  - LL_UTILS_PACKAGETYPE_UFQFPN48
  - LL_UTILS_PACKAGETYPE_LQFP48
  - LL_UTILS_PACKAGETYPE_LQFP64
  - LL_UTILS_PACKAGETYPE_BGA64
  - LL_UTILS_PACKAGETYPE_TSSOP20 (*)
  - LL_UTILS_PACKAGETYPE_WLCSP29 (*)
  - LL_UTILS_PACKAGETYPE_LQFP32 (*)
  - LL_UTILS_PACKAGETYPE_WLCS42 (*)
  - LL_UTILS_PACKAGETYPE_LQFP80 (*)
  - LL_UTILS_PACKAGETYPE_BGA80 (*)

Notes

- (*) Availability depends on devices.

LL_InitTick

Function name

__STATIC_INLINE void LL_InitTick (uint32_t HCLKFrequency, uint32_t Ticks)

Function description

This function configures the Cortex-M SysTick source of the time base.

Parameters

- **HCLKFrequency:** HCLK frequency in Hz (can be calculated thanks to RCC helper macro)
- **Ticks:** Number of ticks

Return values

- **None:**

Notes

- When a RTOS is used, it is recommended to avoid changing the SysTick configuration by calling this function, for a delay use rather osDelay RTOS service.

LL_Init1msTick

Function name

void LL_Init1msTick (uint32_t HCLKFrequency)

Function description

This function configures the Cortex-M SysTick source to have 1ms time base.

Parameters

- **HCLKFrequency:** HCLK frequency in Hz

Return values

- **None:**

Notes

- When a RTOS is used, it is recommended to avoid changing the Systick configuration by calling this function, for a delay use rather osDelay RTOS service.
- HCLK frequency can be calculated thanks to RCC helper macro or function LL_RCC_GetSystemClocksFreq (HCLK_Frequency field)

LL_mDelay

Function name

void LL_mDelay (uint32_t Delay)

Function description

This function provides accurate delay (in milliseconds) based on SysTick counter flag.

Parameters

- **Delay:** specifies the delay time length, in milliseconds.

Return values

- **None:**

Notes

- When a RTOS is used, it is recommended to avoid using blocking delay and use rather osDelay service.
- To respect 1ms timebase, user should call LL_Init1msTick function which will configure Systick to 1ms

LL_SetSystemCoreClock

Function name

void LL_SetSystemCoreClock (uint32_t HCLKFrequency)

Function description

This function sets directly SystemCoreClock CMSIS variable.

Parameters

- **HCLKFrequency:** HCLK frequency in Hz (can be calculated thanks to RCC helper macro)

Return values

- **None:**

Notes

- Variable can be calculated also through SystemCoreClockUpdate function.

LL_PLL_ConfigSystemClock_MSI

Function name

ErrorStatus LL_PLL_ConfigSystemClock_MSI (LL_UTILS_PLLInitTypeDef * UTILS_PLLInitStruct, LL_UTILS_ClkInitTypeDef * UTILS_ClkInitStruct)

Function description

This function configures system clock with MSI as clock source of the PLL.

Parameters

- **UTILS_PLLInitStruct:** pointer to a LL_UTILS_PLLInitTypeDef structure that contains the configuration information for the PLL.
- **UTILS_ClkInitStruct:** pointer to a LL_UTILS_ClkInitTypeDef structure that contains the configuration information for the BUS prescalers.

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: Max frequency configuration done
  - ERROR: Max frequency configuration not done

Notes

- The application needs to ensure that PLL is disabled
- The application needs to ensure that PLL configuration is valid
- The application needs to ensure that MSI range is valid.
- The application needs to ensure that BUS prescalers are valid
- Function is based on the following formula: PLL output frequency = (((MSI frequency / PLLM) * PLLN) / PLLR)PLLM:ensure that the VCO input frequency ranges from 4 to 16 MHz (PLLVCO_input = MSI frequency / PLLM)PLLN:ensure that the VCO output frequency is between 96 and 344 MHz (PLLVCO_output = PLLVCO_input * PLLN)PLLR:ensure that max frequency at 122000000 Hz is reached (PLLVCO_output / PLLR)

LL_PLL_ConfigSystemClock_HSI

Function name

ErrorStatus LL_PLL_ConfigSystemClock_HSI (LL_UTILS_PLLInitTypeDef * UTILS_PLLInitStruct, LL_UTILS_ClkInitTypeDef * UTILS_ClkInitStruct)

Function description

This function configures system clock at maximum frequency with HSI as clock source of the PLL.

Parameters

- **UTILS_PLLInitStruct:** pointer to a LL_UTILS_PLLInitTypeDef structure that contains the configuration information for the PLL.
- **UTILS_ClkInitStruct:** pointer to a LL_UTILS_ClkInitTypeDef structure that contains the configuration information for the BUS prescalers.

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: Max frequency configuration done
  - ERROR: Max frequency configuration not done

Notes

- The application need to ensure that PLL is disabled
- The application needs to ensure that PLL configuration is valid
- The application needs to ensure that BUS prescalers are valid
- Function is based on the following formula: PLL output frequency = (((HSI frequency / PLLM) * PLLN) / PLLR)PLLM:ensure that the VCO input frequency ranges from 4 to 16 MHz (PLLVCO_input = HSI frequency / PLLM)PLLN:ensure that the VCO output frequency is between 96 and 344 MHz (PLLVCO_output = PLLVCO_input * PLLN)PLLR:ensure that max frequency at 122000000 Hz is reach (PLLVCO_output / PLLR)

LL_PLL_ConfigSystemClock_HSE

Function name

ErrorStatus LL_PLL_ConfigSystemClock_HSE (uint32_t HSEBypass, LL_UTILS_PLLInitTypeDef * UTILS_PLLInitStruct, LL_UTILS_ClkInitTypeDef * UTILS_ClkInitStruct)

Function description

This function configures system clock with HSE as clock source of the PLL.

Parameters

- **HSEBypass:** This parameter can be one of the following values:
  - LL_UTILS_HSEBYPASS_ON
  - LL_UTILS_HSEBYPASS_OFF
- **UTILS_PLLInitStruct:** pointer to a LL_UTILS_PLLInitTypeDef structure that contains the configuration information for the PLL.
- **UTILS_ClkInitStruct:** pointer to a LL_UTILS_ClkInitTypeDef structure that contains the configuration information for the BUS prescalers.

Return values

- **An:** ErrorStatus enumeration value:
  - SUCCESS: Max frequency configuration done
  - ERROR: Max frequency configuration not done

Notes

- The application need to ensure that PLL, PLLSAI1 and/or PLLSAI2 are disabled.
- The application needs to ensure that PLL configuration is valid
- The application needs to ensure that BUS prescalers are valid
- Function is based on the following formula: PLL output frequency = (((HSE frequency / PLLM) * PLLN) / PLLR)PLLM: ensure that the VCO input frequency ranges from 4 to 16 MHz (PLLVCO_input = HSE frequency / PLLM)PLLN: ensure that the VCO output frequency is between 96 and 344 MHz (PLLVCO_output = PLLVCO_input * PLLN)PLLR: ensure that max frequency at 122000000 Hz is reached (PLLVCO_output / PLLR)

79.3 UTILS Firmware driver defines

The following section lists the various define and macros of the module.

79.3.1 UTILS

UTILS

HSE Bypass activation

LL_UTILS_HSEBYPASS_OFF

HSE Bypass is not enabled

LL_UTILS_HSEBYPASS_ON

HSE Bypass is enabled

PACKAGE TYPE

LL_UTILS_PACKAGETYPE_UFQFPN32

PACKAGETYPE_UFQFPN32

LL_UTILS_PACKAGETYPE_WLCS42

PACKAGETYPE_WLCS42

LL_UTILS_PACKAGETYPE_UFQFPN48

PACKAGETYPE_UFQFPN48

LL_UTILS_PACKAGETYPE_LQFP48

PACKAGETYPE_LQFP48

LL_UTILS_PACKAGETYPE_LQFP64

PACKAGETYPE_LQFP64

LL_UTILS_PACKAGETYPE_BGA64

PACKAGETYPE_BGA64

LL_UTILS_PACKAGETYPE_LQFP80

PACKAGETYPE_LQFP80

LL_UTILS_PACKAGETYPE_BGA80

PACKAGETYPE_BGA80

80 LL WWDG Generic Driver

80.1 WWDG Firmware driver API description

The following section lists the various functions of the WWDG library.

80.1.1 Detailed description of functions

LL_WWDG_Enable

Function name

__STATIC_INLINE void LL_WWDG_Enable (WWDG_TypeDef * WWDGx)

Function description

Enable Window Watchdog.

Parameters

- **WWDGx:** WWDG Instance

Return values

- **None:**

Notes

- It is enabled by setting the WDGA bit in the WWDG_CR register, then it cannot be disabled again except by a reset. This bit is set by software and only cleared by hardware after a reset. When WDGA = 1, the watchdog can generate a reset.

Reference Manual to LL API cross reference:

- CR WDGA LL_WWDG_Enable

LL_WWDG_IsEnabled

Function name

__STATIC_INLINE uint32_t LL_WWDG_IsEnabled (const WWDG_TypeDef * WWDGx)

Function description

Checks if Window Watchdog is enabled.

Parameters

- **WWDGx:** WWDG Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CR WDGA LL_WWDG_IsEnabled

LL_WWDG_SetCounter

Function name

__STATIC_INLINE void LL_WWDG_SetCounter (WWDG_TypeDef * WWDGx, uint32_t Counter)

Function description

Set the Watchdog counter value to provided value (7-bits T[6:0])

Parameters

- **WWDGx:** WWDG Instance
- **Counter:** 0..0x7F (7 bit counter value)

Return values

- **None:**

Notes

- When writing to the WWDG_CR register, always write 1 in the MSB b6 to avoid generating an immediate reset This counter is decremented every (4096 x 2expWDGTB) PCLK cycles A reset is produced when it rolls over from 0x40 to 0x3F (bit T6 becomes cleared) Setting the counter lower then 0x40 causes an immediate reset (if WWDG enabled)

Reference Manual to LL API cross reference:

- CR T LL_WWDG_SetCounter

LL_WWDG_GetCounter

Function name

__STATIC_INLINE uint32_t LL_WWDG_GetCounter (const WWDG_TypeDef * WWDGx)

Function description

Return current Watchdog Counter Value (7 bits counter value)

Parameters

- **WWDGx:** WWDG Instance

Return values

- **7:** bit Watchdog Counter value

Reference Manual to LL API cross reference:

- CR T LL_WWDG_GetCounter

LL_WWDG_SetPrescaler

Function name

__STATIC_INLINE void LL_WWDG_SetPrescaler (WWDG_TypeDef * WWDGx, uint32_t Prescaler)

Function description

Set the time base of the prescaler (WDGTB).

Parameters

- **WWDGx:** WWDG Instance
- **Prescaler:** This parameter can be one of the following values:
  - LL_WWDG_PRESCALER_1
  - LL_WWDG_PRESCALER_2
  - LL_WWDG_PRESCALER_4
  - LL_WWDG_PRESCALER_8
  - LL_WWDG_PRESCALER_16
  - LL_WWDG_PRESCALER_32
  - LL_WWDG_PRESCALER_64
  - LL_WWDG_PRESCALER_128

Return values

- **None:**

Notes

- Prescaler is used to apply ratio on PCLK clock, so that Watchdog counter is decremented every (4096 x 2expWDGTB) PCLK cycles

Reference Manual to LL API cross reference:

- CFR WDGTB LL_WWDG_SetPrescaler

LL_WWDG_GetPrescaler

Function name

__STATIC_INLINE uint32_t LL_WWDG_GetPrescaler (const WWDG_TypeDef * WWDGx)

Function description

Return current Watchdog Prescaler Value.

Parameters

- **WWDGx:** WWDG Instance

Return values

- **Returned:** value can be one of the following values:
  - LL_WWDG_PRESCALER_1
  - LL_WWDG_PRESCALER_2
  - LL_WWDG_PRESCALER_4
  - LL_WWDG_PRESCALER_8
  - LL_WWDG_PRESCALER_16
  - LL_WWDG_PRESCALER_32
  - LL_WWDG_PRESCALER_64
  - LL_WWDG_PRESCALER_128

Reference Manual to LL API cross reference:

- CFR WDGTB LL_WWDG_GetPrescaler

LL_WWDG_SetWindow

Function name

__STATIC_INLINE void LL_WWDG_SetWindow (WWDG_TypeDef * WWDGx, uint32_t Window)

Function description

Set the Watchdog Window value to be compared to the downcounter (7-bits W[6:0]).

Parameters

- **WWDGx:** WWDG Instance
- **Window:** 0x00..0x7F (7 bit Window value)

Return values

- **None:**

Notes

- This window value defines when write in the WWDG_CR register to program Watchdog counter is allowed. Watchdog counter value update must occur only when the counter value is lower than the Watchdog window register value. Otherwise, a MCU reset is generated if the 7-bit Watchdog counter value (in the control register) is refreshed before the downcounter has reached the watchdog window register value. Physically is possible to set the Window lower then 0x40 but it is not recommended. To generate an immediate reset, it is possible to set the Counter lower than 0x40.

Reference Manual to LL API cross reference:

- CFR W LL_WWDG_SetWindow

LL_WWDG_GetWindow

Function name

__STATIC_INLINE uint32_t LL_WWDG_GetWindow (const WWDG_TypeDef * WWDGx)

Function description

Return current Watchdog Window Value (7 bits value)

Parameters

- **WWDGx:** WWDG Instance

Return values

- **7:** bit Watchdog Window value

Reference Manual to LL API cross reference:

- CFR W LL_WWDG_GetWindow

LL_WWDG_IsActiveFlag_EWKUP

Function name

__STATIC_INLINE uint32_t LL_WWDG_IsActiveFlag_EWKUP (const WWDG_TypeDef * WWDGx)

Function description

Indicates if the WWDG Early Wakeup Interrupt Flag is set or not.

Parameters

- **WWDGx:** WWDG Instance

Return values

- **State:** of bit (1 or 0).

Notes

- This bit is set by hardware when the counter has reached the value 0x40. It must be cleared by software by writing 0. A write of 1 has no effect. This bit is also set if the interrupt is not enabled.

Reference Manual to LL API cross reference:

- SR EWIF LL_WWDG_IsActiveFlag_EWKUP

LL_WWDG_ClearFlag_EWKUP

Function name

__STATIC_INLINE void LL_WWDG_ClearFlag_EWKUP (WWDG_TypeDef * WWDGx)

Function description

Clear WWDG Early Wakeup Interrupt Flag (EWIF)

Parameters

- **WWDGx:** WWDG Instance

Return values

- **None:**

Reference Manual to LL API cross reference:

- SR EWIF LL_WWDG_ClearFlag_EWKUP

LL_WWDG_EnableIT_EWKUP

Function name

__STATIC_INLINE void LL_WWDG_EnableIT_EWKUP (WWDG_TypeDef * WWDGx)

Function description

Enable the Early Wakeup Interrupt.

Parameters

- **WWDGx:** WWDG Instance

Return values

- **None:**

Notes

- When set, an interrupt occurs whenever the counter reaches value 0x40. This interrupt is only cleared by hardware after a reset

Reference Manual to LL API cross reference:

- CFR EWI LL_WWDG_EnableIT_EWKUP

LL_WWDG_IsEnabledIT_EWKUP

Function name

__STATIC_INLINE uint32_t LL_WWDG_IsEnabledIT_EWKUP (const WWDG_TypeDef * WWDGx)

Function description

Check if Early Wakeup Interrupt is enabled.

Parameters

- **WWDGx:** WWDG Instance

Return values

- **State:** of bit (1 or 0).

Reference Manual to LL API cross reference:

- CFR EWI LL_WWDG_IsEnabledIT_EWKUP

80.2 WWDG Firmware driver defines

The following section lists the various define and macros of the module.

80.2.1 WWDG

WWDG

IT Defines

LL_WWDG_CFR_EWI

PRESCALER

LL_WWDG_PRESCALER_1

WWDG counter clock = (PCLK1/4096)/1

LL_WWDG_PRESCALER_2

WWDG counter clock = (PCLK1/4096)/2

LL_WWDG_PRESCALER_4

WWDG counter clock = (PCLK1/4096)/4

LL_WWDG_PRESCALER_8

WWDG counter clock = (PCLK1/4096)/8

LL_WWDG_PRESCALER_16

WWDG counter clock = (PCLK1/4096)/16

LL_WWDG_PRESCALER_32

WWDG counter clock = (PCLK1/4096)/32

LL_WWDG_PRESCALER_64

WWDG counter clock = (PCLK1/4096)/64

LL_WWDG_PRESCALER_128

WWDG counter clock = (PCLK1/4096)/128

Common Write and read registers macros

LL_WWDG_WriteReg

Description:

- Write a value in WWDG register.

Parameters:

- __INSTANCE__: WWDG Instance
- __REG__: Register to be written
- __VALUE__: Value to be written in the register

Return value:

- None

LL_WWDG_ReadReg

Description:

- Read a value in WWDG register.

Parameters:

- __INSTANCE__: WWDG Instance
- __REG__: Register to be read

Return value:

- Register: value

81 FAQs

General subjects

Why should I use the HAL drivers?

There are many advantages in using the HAL drivers:

- Ease of use: you can use the HAL drivers to configure and control any peripheral embedded within your STM32 MCU without prior in-depth knowledge of the product.
- HAL drivers provide intuitive and ready-to-use APIs to configure the peripherals and support polling, interrupt and DMA programming model to accommodate all application requirements, thus allowing the end-user to build a complete application by calling a few APIs.
- Higher level of abstraction than a standard peripheral library allowing to transparently manage:
  - Data transfers and processing using blocking mode (polling) or non-blocking mode (interrupt or DMA)
  - Error management through peripheral error detection and timeout mechanism.
- Generic architecture speeding up initialization and porting, thus allowing customers to focus on innovation.
- Generic set of APIs with full compatibility across the STM32 Series/lines, to ease the porting task between STM32 MCUs.
- The APIs provided within the HAL drivers are feature-oriented and do not require in-depth knowledge of peripheral operation.
- The APIs provided are modular. They include initialization, IO operation and control functions. The end-user has to call init function, then start the process by calling one IO operation functions (write, read, transmit, receive, …). Most of the peripherals have the same architecture.
- The number of functions required to build a complete and useful application is very reduced. As an example, to build a UART communication process, the user only has to call HAL_UART_Init() then HAL_UART_Transmit() or HAL_UART_Receive().

Which devices are supported by the HAL drivers?

The HAL drivers are developed to support all STM32U0 devices. To ensure compatibility between all devices and portability with others Series and lines, the API is split into the generic and the extension APIs . For more details, please refer to *section* ***Devices supported by the HAL drivers***.

What is the cost of using HAL drivers in term of code size and performance?

Like generic architecture drivers, the HAL drivers may induce firmware overhead.

This is due to the high abstraction level and ready-to-use APIs which allow data transfers, errors management and offloads the user application from implementation details.

Architecture

How many files should I modify to configure the HAL drivers?

Only one file needs to be modified: stm32u0xx_hal_conf.h. You can modify this file by disabling unused modules, or adjusting some parameters (i.e. HSE value, System configuration…)

A template is provided in the HAL drivers folders (stm32u0xx_hal_conf_template.c).

Which header files should I include in my application to use the HAL drivers?

Only stm32u0xx_hal.h file has to be included.

What is the difference between xx_hal_ppp.c/.h and xx_hal_ppp_ *ex* .c/.h?

The HAL driver architecture supports common features across STM32 Series/lines. To support specific features, the drivers are split into two groups.

- The generic APIs (stm32u0xx_hal_ppp.c): It includes the common set of APIs across all the STM32 product lines
- The extension APIs (stm32u0xx_hal_ppp_ex.c): It includes the specific APIs for specific device part number or family.

Initialization and I/O operation functions

How do I configure the system clock?

Unlike the standard library, the system clock configuration is not performed in CMSIS drivers file (system_stm32u0xx.c) but in the main user application by calling the two main functions, HAL_RCC_OscConfig() and HAL_RCC_ClockConfig(). It can be modified in any user application section.

What is the purpose of the *PPP_HandleTypeDef *pHandle* structure located in each driver in addition to the Initialization structure

PPP_HandleTypeDef *pHandle is the main structure implemented in the HAL drivers. It handles the peripheral configuration and registers, and embeds all the structures and variables required to follow the peripheral device flow (pointer to buffer, Error code, State,...)

However, this structure is not required to service peripherals such as GPIO, SYSTICK, PWR, and RCC.

What is the purpose of HAL_PPP_MspInit() and HAL_PPP_MspDeInit() functions?

These function are called within HAL_PPP_Init() and HAL_PPP_DeInit(), respectively. They are used to perform the low level Initialization/de-initialization related to the additional hardware resources (RCC, GPIO, NVIC and DMA).

These functions are declared in stm32u0xx_hal_msp.c. A template is provided in the HAL driver folders (stm32u0xx_hal_msp_template.c).

When and how should I use callbacks functions (functions declared with the attribute *__weak*)?

Use callback functions for the I/O operations used in DMA or interrupt mode. The PPP process complete callbacks are called to inform the user about process completion in real-time event mode (interrupts).

The Errors callbacks are called when a processing error occurs in DMA or interrupt mode. These callbacks are customized by the user to add user proprietary code. They can be declared in the application. Note that the same process completion callbacks are used for DMA and interrupt mode.

Is it mandatory to use HAL_Init() function at the beginning of the user application?

It is mandatory to use HAL_Init() function to enable the system configuration (Prefetch, Data instruction cache,…), configure the systTick and the NVIC priority grouping and the hardware low level initialization.

The SysTick configuration shall be adjusted by calling ***HAL_RCC_ClockConfig()*** function, to obtain 1 ms whatever the system clock.

Why do I need to configure the SysTick timer to use the HAL drivers?

The SysTick timer is configured to be used to generate variable increments by calling *HAL_IncTick()* function in SysTick ISR and retrieve the value of this variable by calling *HAL_GetTick()* function.

The call HAL_GetTick() function is mandatory when using HAL drivers with Polling Process or when using HAL_Delay().

Why is the SysTick timer configured to have 1 ms?

This is mandatory to ensure correct IO operation in particular for polling mode operation where the 1 ms is required as timebase.

Could HAL_Delay() function block my application under certain conditions?

Care must be taken when using HAL_Delay() since this function provides accurate delay based on a variable incremented in SysTick ISR. This implies that if HAL_Delay() is called from a peripheral ISR process, then the SysTick interrupt must have higher priority (numerically lower) than the peripheral interrupt, otherwise the caller ISR process will be blocked. Use HAL_NVIC_SetPriority() function to change the SysTick interrupt priority.

What programming model sequence should I follow to use HAL drivers ?

Follow the sequence below to use the APIs provided in the HAL drivers:

1. Call HAL_Init() function to initialize the system (data cache, NVIC priority,…).

2. Initialize the system clock by calling HAL_RCC_OscConfig() followed by HAL_RCC_ClockConfig().
3. Add HAL_IncTick() function under SysTick_Handler() ISR function to enable polling process when using HAL_Delay() function
4. Start initializing your peripheral by calling HAL_PPP_Init().
5. Implement the hardware low level initialization (Peripheral clock, GPIO, DMA,..) by calling HAL_PPP_MspInit() in stm32u0xx_hal_msp.c
6. Start your process operation by calling IO operation functions.

What is the purpose of HAL_PPP_IRQHandler() function and when should I use it?

HAL_PPP_IRQHandler() is used to handle interrupt process. It is called under PPP_IRQHandler() function in stm32u0xx_it.c. In this case, the end-user has to implement only the callbacks functions (prefixed by __weak) to perform the appropriate action when an interrupt is detected. Advanced users can implement their own code in PPP_IRQHandler() without calling HAL_PPP_IRQHandler().

Can I use directly the macros defined in xx_hal_ppp.h ?

Yes, you can: a set of macros is provided with the APIs. They allow accessing directly some specific features using peripheral flags.

Where must PPP_HandleTypedef structure peripheral handler be declared?

PPP_HandleTypedef structure peripheral handler must be declared as a global variable, so that all the structure fields are set to 0 by default. In this way, the peripheral handler default state are set to HAL_PPP_STATE_RESET, which is the default state for each peripheral after a system reset.

When should I use HAL versus LL drivers?

HAL drivers offer high-level and function-oriented APIs, with a high level of portability. Product/IPs complexity is hidden for end users. LL drivers offer low-level APIs at registers level, with a better optimization but less portability. They require a deep knowledge of product/IPs specifications.

How can I include LL drivers in my environment? Is there any LL configuration file as for HAL?

There is no configuration file. Source code shall directly include the necessary stm32u0xx_ll_ppp.h file(s).

Can I use HAL and LL drivers together? If yes, what are the constraints?

It is possible to use both HAL and LL drivers. One can handle the IP initialization phase with HAL and then manage the I/O operations with LL drivers. The major difference between HAL and LL is that HAL drivers require to create and use handles for operation management while LL drivers operates directly on peripheral registers. Mixing HAL and LL is illustrated in Examples_MIX example.

Is there any LL APIs which are not available with HAL?

Yes, there are. A few Cortex® APIs have been added in stm32u0xx_ll_cortex.h e.g. for accessing SCB or SysTick registers.

Why are SysTick interrupts not enabled on LL drivers?

When using LL drivers in standalone mode, you do not need to enable SysTick interrupts because they are not used in LL APIs, while HAL functions requires SysTick interrupts to manage timeouts.

Revision history

Table 25. **Document revision history**

Date	Version	Change
11-Mar-2024	1	Initial release.

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