



Adjustable LED blinking speed using STM8S-DISCOVERY touch sensing key

Application overview

This application note provides a short description of how to use the touch sensing key to change an LED blinking speed.

The Discover software demonstrates the touch sensing feature of the STM8S-DISCOVERY evaluation board. It may also be used as starter code for developers who need to manage this touch sensing key within applications that require a user interface. The STM8S-DISCOVERY is delivered with this code already programmed in the STM8S105C6T6 microcontroller Flash memory.

Once the STM8S105C6T6 is powered-up through a USB cable connected to the host PC, the LED LD1 starts blinking slowly, meaning that the programming has been completed successfully.

- Each time the TS1 key is pressed, LD1 blinking speed increases.
- The third time TS1 is pressed, LD1 is switched off.
- You can then restart a blinking cycle by pressing TS1 again.

The Discover demonstration software is available from the STM8S-DISCOVERY web pages at <http://www.st.com/mcu>.

Even though the STM8S-DISCOVERY is built around an STM8S105C6T6, it allows evaluation of the main features of all the STM8S MCUs.

Reference documents

- STM8S-DISCOVERY evaluation board use manual (UM0817).
- Developing and debugging your STM8S-DISCOVERY application code user manual (UM0834).
- RC acquisition principle for touch sensing applications (AN2927).

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1 Application description

1.1 Hardware required

The following STM8S-DISCOVERY on-board resources are used:

- LED, LD1
- Touch sensing key, TS1

No additional hardware is required to make this application software run on the STM8S-DISCOVERY.

1.2 Application schematics

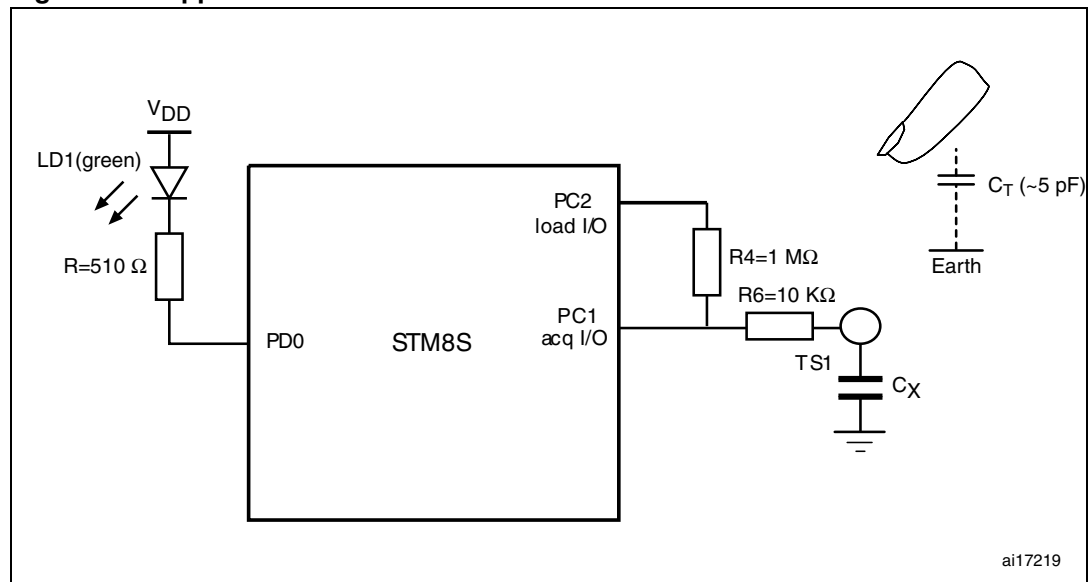
Figure 1 shows the touch sensing key implementation principle based on the RC acquisition method. For STM8S-DISCOVERY implementation details, refer to the board schematic provided in the STM8S-DISCOVERY user manual (UM0817).

Resistor R4 is the main resistor used to adjust the electrode touch sensitivity. Resistor R6 (10 K Ω) is optional. It is used to reduce noise sensitivity.

As soon as a finger touches electrode TS1, the STM8S microcontroller detects the small variation in the RC network capacitance (composed of R4, R6 and electrode capacitance C_X). This is done by monitoring C_X charge/discharge through PC1 (acquisition I/O).

For detailed information about RC acquisition principle for Touch Sensing applications, refer to AN2927.

Figure 1. Application schematics



1.3 Application principle

This application uses the timer TIM4 as a time-base generator to control the blinking speed of the LED LD1. Each time the STM8S microcontroller detects a touch event on TS1, TIM4 time base is reprogrammed to change the blinking speed.

At application start-up, the timer time base is configured to 1 second and LD1 toggles slowly (every second). This configuration allows to check visually that the STM8S Flash memory was successfully programmed.

Each time a touch event is detected on the TS1 key, LD1 blinking speed is increased according to the timer time-base settings described in [Table 1](#). At the third touch, the LED is switched off. You can then restart the blinking cycle.

Table 1. LED LD1 configuration

TS1 state	LD1 state	Timer time base
At start-up	LD1 toggles	1 s
1st TS1 touch	LD1 toggles	200 ms
2nd TS1 touch	LD1 toggles	100 ms
3rd TS1 touch	LD1 is switched off	N/A

2 Software description

The application software uses both STM8 standard and touch sensing firmware libraries to control general purpose functions, plus touch sensing peripherals.

These functions and peripherals are the following:

- Clock (CLK)
The clock control enables and delivers the correct clock frequency to the CPU and peripherals. It configures the HSI prescaler division factor to 1.
- GPIOs
They drive the MCU I/Os to interface with external hardware. They configure port PD0 as output push-pull low to drive the LED LD1.
- TIM3
TIM3 is a 16-bit timer with an 8-bit prescaler. The touch sensing firmware library uses TIM3 for touch sensing acquisition (TIMACQ). See [Table 2](#) for the corresponding define statement in the STM8S touch sensing library.
- TIM4
TIM4 is a basic 8-bit timer used as a generic time base (TIMTICK). This time base is used by the touch sensing firmware library to control the charge/discharge cycles of the RC network (resistor R4 plus TS1 electrode). TIM4 is also used by the application to control LD1 blinking speed.
It is distinct from the acquisition timer TIM3. See [Table 2](#) for the corresponding define statement in the STM8S touch sensing library.

2.1 Touch sensing library configuration

The *STM8_TSL_RC_Configuration.h* file configures the touch sensing library.

[Table 2](#) describes the main define statements required to configure the library for the STM8S-DISCOVERY to control TS1 touch sensing key. The other define statements should keep their default values. Refer to the STM8S touch sensing library online help for details concerning these define statements.

Table 2. Touch Sensing library configuration

Function	#define statement	Value	Comment
MCU selection	STM8S	1	-
Acquisition timer	TIMACQ TIMACQ_CNTR_ADD	TIM3 0x5328	TIM3 base address
Time-base timer	TIMTICK	TIM4	-
Load I/O	LOADREF_PORT_ADDR LOADREF_BIT	GPIOC_BaseAddress 0x04	Port PC4 selected

Table 2. Touch Sensing library configuration (continued)

Function	#define statement	Value	Comment
Single channel key	SCKEY_P1_KEY_COUNT	1	Number of keys = 1 Port PC selected Pin 1 selected as acquisition input Pin 3 for active shield Pin 3 for active shield Key port P2 not used Key port P3 not used
	SCKEY_P1_PORT_ADDR	GPIOC_BaseAddress	
	SCKEY_P1_A	0x02	
	SCKEY_P1_DRIVEN_SHIELD_MASK	0x08	
	SCKEY_P2_COUNT	0	
	SCKEY_P3_COUNT	0	
Multichannel key	NUMBER_OF_MULTI_CHANNEL_KEYS	0	Multichannel key feature disabled
Electrode mask	GPIOA_ELECTRODES_MASK	0x00 0x00 0x0A 0x00 0x00 0x00 0x00 0x00	Defines the electrode mask for each GPIO used. Mask must be set to 0x00 for unused GPIOs.
	GPIOB_ELECTRODES_MASK		
	GPIOC_ELECTRODES_MASK		
	GPIOD_ELECTRODES_MASK		
	GPIOE_ELECTRODES_MASK		
	GPIOF_ELECTRODES_MASK		
	GPIOG_ELECTRODES_MASK		
	GPIOH_ELECTRODES_MASK		
GPIOI_ELECTRODES_MASK			

2.2 Standard STM8S standard firmware library configuration

The *stm8s_conf.h* file of the STM8S standard firmware library is used to configure the library by enabling the peripheral functions used by the application.

The following define statements must be present:

- #define _CLK 1 enables the clock control CLK
- #define _GPIO 1 enables the GPIOs

2.3 Application software flowcharts

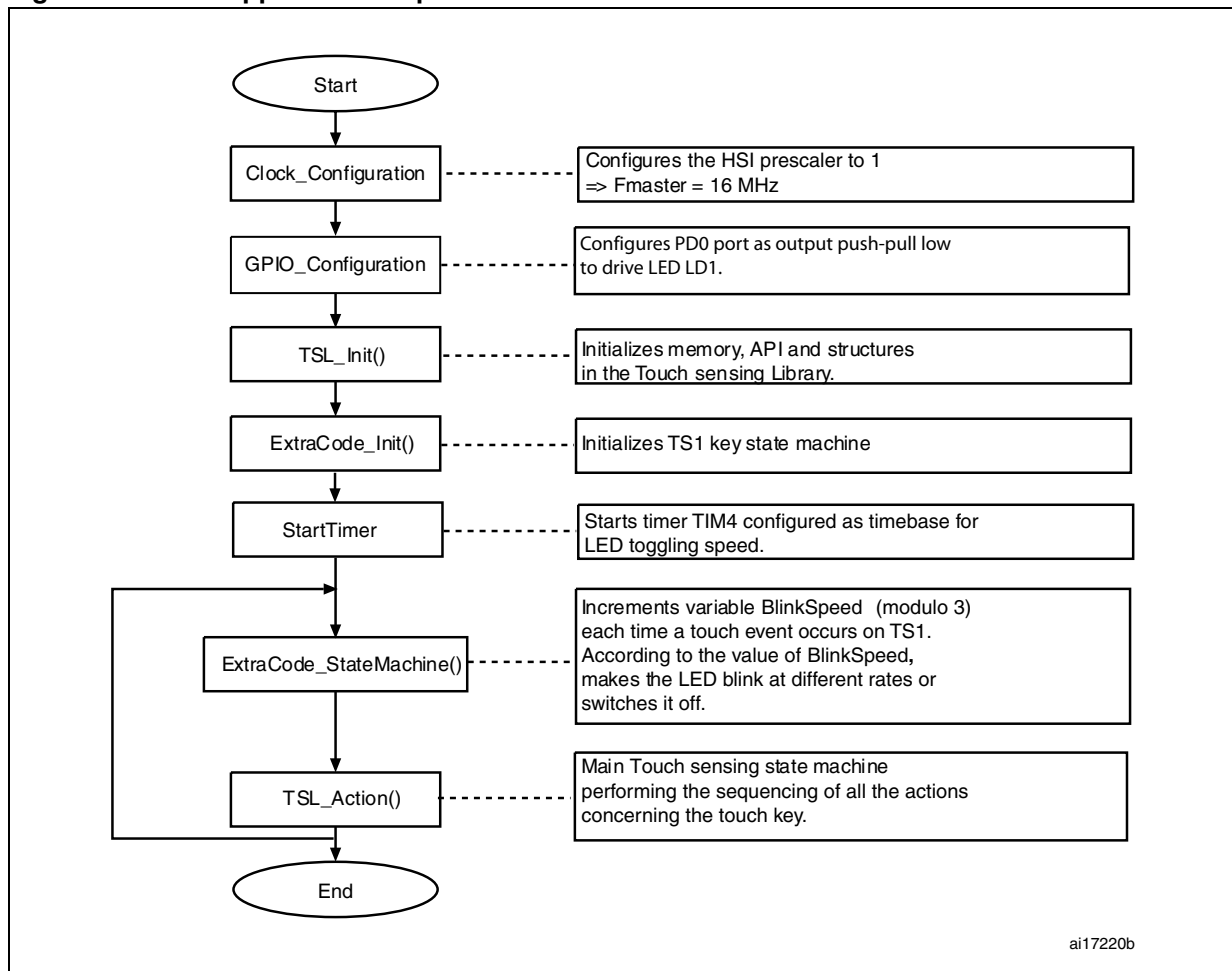
This section gives an overview of the application software main loop as well as of the function that controls LD1 blinking speed.

Detailed information can be found in the STM8S-DISCOVERY software user manual (UM0834).

2.3.1 Main loop flowchart

Figure 2 shows the flowchart of the application software main loop. Functions `TSL_Init()` and `TSL_Action()` in the API of the touch sensing library initialize the library and control the state machine that sequences the touch sensing management.

Figure 2. Main application loop flowchart



2.3.2 ExtraCode_StateMachine flowchart

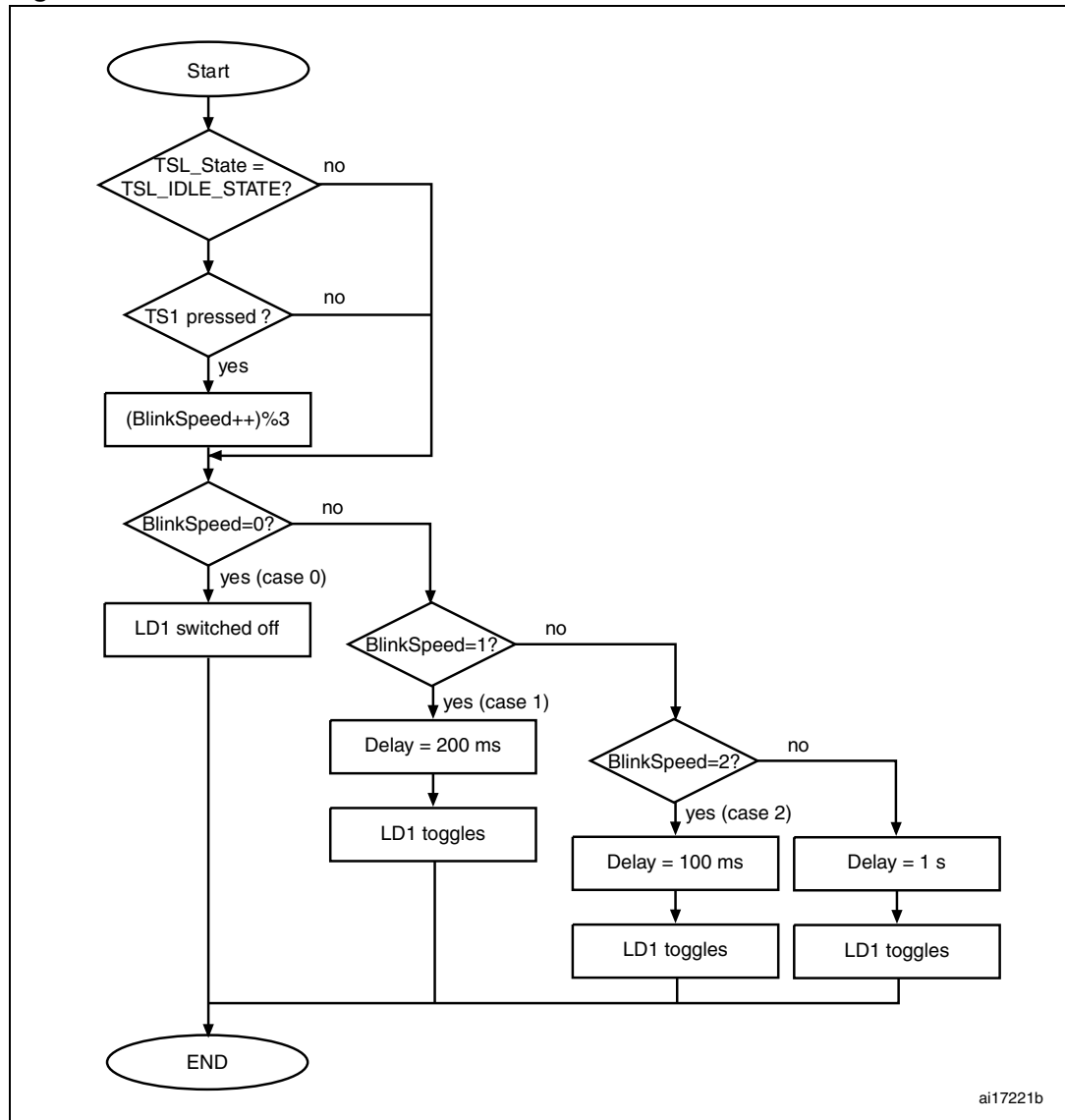
[Figure 3](#) shows the detailed flowchart of the `ExtraCode_StateMachine()` function.

The `ExtraCode_StateMachine()` function implements the algorithm that controls the LED blinking speed according to the number of times TS1 key is pressed.

LD1 blinking speed is controlled by the TIMTICK timer TIM4. This timer that is mainly used by the touch sensing firmware library to control the charge/discharge timing of the RC network, is already configured to generate a 100 ms time base. An interrupt is asserted every 100 ms. It sets a dedicated `User_flag_100ms` flag to warn the application when the counter has reached the preprogrammed value. The function `Delay` counts the number of times this flag has been set before making the LED toggle. As a result, the delay time can only be a multiple of 100 ms.

When a touch event is detected on TS1, the `BlinkSpeed` variable is incremented (modulo 3) by the main routine (see [Figure 3](#)) and the delay time is modified resulting in a change of the LED blinking frequency (refer to [Table 1](#)).

Figure 3. ExtraCode_StateMachine flowchart



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1. Refer to the STM8S firmware library for details on TSL_State and TSL_IDLE_STATE.

3 Revision history

Table 3. Document revision history

Date	Revision	Changes
08-Oct-2010	1	Initial release. UM0833 has been converted into this Application note. This document replaces UM0833.

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