Discovery kit with STM32U083MC MCU

Introduction

The STM32U083C-DK Discovery kit is a complete demonstration and development platform for the STM32U083MCT6 microcontroller. It is used as a reference design for the user application development before porting to the final product.

The full range of hardware features on the board helps the user to evaluate all the peripherals (USB FS device, segment LCD, touchkey, temperature sensor, and others) and to develop applications. The ARDUINO® Uno V3, mikroBUS™, and extension connectors easily connect to extension shields or daughterboards for specific applications.

The STM32U083C-DK Discovery kit does not require any separate probe as it integrates the STLINK-V2EC debugger/ programmer. It is operated by plugging it into a PC through a standard USB Type-A or USB Type-C® to USB Type-C® cable.
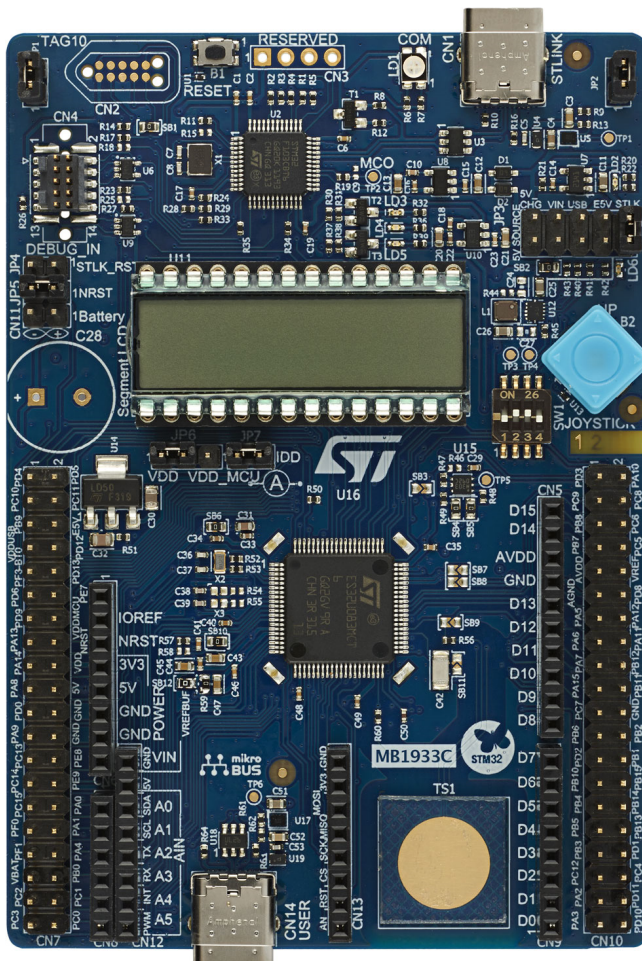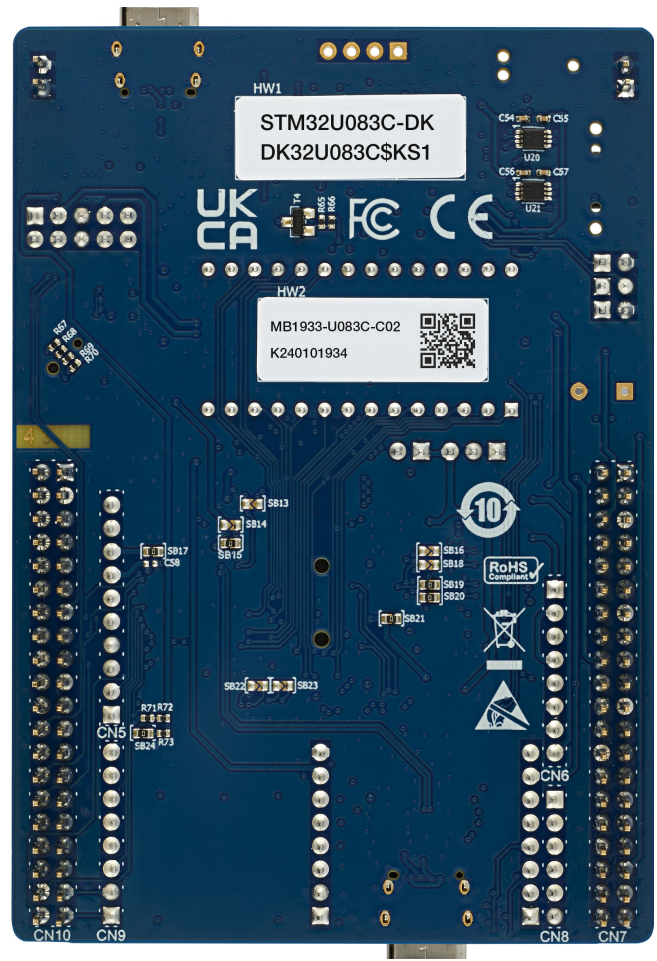
Figure 1. STM32U083C-DK top view

Figure 2. STM32U083C-DK bottom view

Pictures are not contractual.

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For further information contact your local STMicroelectronics sales office.

www.st.com

1 Features

- Ultra-low-power STM32U083MC microcontroller based on the Arm® Cortex®-M0+ core, featuring 256 Kbytes of flash memory and 40 Kbytes of SRAM in an LQFP80 package
- 4×24-segment LCD
- Three user LEDs
- Reset push-button
- User joystick
- Touchkey
- Temperature sensor
- Board connectors:
  - ST-LINK USB Type-C® connector
  - User USB Device with USB Type-C® connector
  - mikroBUS™ connectors
  - MIPI® debug in connector (Arm® Cortex® 10-pin 1.27 mm-pitch debug connector over STDC14 footprint)
  - Extension connectors for full access to all STM32 I/Os
  - VBAT dedicated connector provides the capability to power the board on a battery
- Flexible power-supply options: ST-LINK USB V_{BUS}, USB connector, or external sources
- VDD power supply selectable from 1.8 to 3.3 V in eight levels by step-down converter
- On-board STLINK-V2EC debugger/programmer with USB re-enumeration capability: mass storage, Virtual COM port, and debug port
- Comprehensive free software libraries and examples available with the STM32CubeU0 MCU Package
- Support of a wide choice of Integrated Development Environments (IDEs) including IAR Embedded Workbench®, MDK-ARM, and STM32CubeIDE

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

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2 Ordering information

To order the STM32U083C-DK Discovery kit, refer to Table 1. Additional information is available from the datasheet and reference manual of the target STM32.

Table 1. Ordering information

Order code	Board reference	Target STM32
STM32U083C-DK	• MB1933[1]	STM32U083MCT6

1. *Subsequently called main board in the rest of the documentation.*

2.1 Codification

The meaning of the codification is explained in Table 2.

Table 2. Codification explanation

STM32XXYYZ-DK	Description	Example: STM32U083C-DK
XX	MCU series in STM32 32-bit Arm Cortex MCUs	STM32U0 series
YY	MCU product line in the series	STM32U083 product line
Z	STM32 flash memory size: • C for 256 Kbytes	256 Kbytes
DK	Discovery kit	Discovery kit

3 Development environment

3.1 System requirements

- Multi-OS support: Windows® 10, Linux® 64-bit, or macOS®
- USB Type-A or USB Type-C® to USB Type-C® cable

Note: *macOS® is a trademark of Apple Inc., registered in the U.S. and other countries and regions.*

Linux® is a registered trademark of Linus Torvalds.

Windows is a trademark of the Microsoft group of companies.

3.2 Development toolchains

- IAR Systems® - IAR Embedded Workbench®[1]
- Keil® - MDK-ARM[1]
- STMicroelectronics - STM32CubeIDE

1. *On Windows® only.*

3.3 Demonstration software

The demonstration software, included in the STM32Cube MCU Package corresponding to the on-board microcontroller, is preloaded in the STM32 flash memory for easy demonstration of the device peripherals in standalone mode. The latest versions of the demonstration source code and associated documentation can be downloaded from *www.st.com*.

3.4 CAD resources

All board design resources, including schematics, CAD databases, manufacturing files, and the bill of materials, are available from the STM32U083C-DK product page at *www.st.com*.

4 Conventions

Table 3 provides the conventions used for the ON and OFF settings in the present document.

Table 3. ON/OFF convention

Convention	Definition
Jumper JPx ON	Jumper fitted
Jumper JPx OFF	Jumper not fitted
Jumper JPx [1-2]	Jumper fitted between pin 1 and pin 2
Solder bridge SBx ON	SBx connections closed by 0 Ω resistor
Solder bridge SBx OFF	SBx connections left open
Resistor Rx ON	Resistor soldered
Resistor Rx OFF	Resistor not soldered
Capacitor Cx ON	Capacitor soldered
Capacitor Cx OFF	Capacitor not soldered

5 Safety recommendations

5.1 Targeted audience

This product targets users with at least basic electronics or embedded software development knowledge such as engineers, technicians, or students. This board is not a toy and is not suited for use by children.

5.2 Handling the board

This product contains a bare printed circuit board and like all products of this type, the user must be careful about the following points:

- The connection pins on the board might be sharp. Be careful when handling the board to avoid hurting yourself
- This board contains static-sensitive devices. To avoid damaging it, handle the board in an ESD-proof environment.
- While powered, do not touch the electric connections on the board with your fingers or anything conductive. The board operates at a voltage level that is not dangerous, but components might be damaged when shorted.
- Do not put any liquid on the board and avoid operating the board close to water or at a high humidity level.
- Do not operate the board if dirty or dusty.

6 Quick start

Before installing and using the product, accept the evaluation product license agreement from the *www.st.com/epla* webpage. For more information on the STM32U083C-DK Discovery kit and the demonstration software example, visit the STM32U083C-DK webpage.

6.1 Getting started

Follow the sequence below to configure the STM32U083C-DK Discovery kit and launch the demonstration application (refer to Section 7.1: STM32U083C-DK board layout for component locations):

1. Check jumper and switcher positions on board (refer to Table 4. Default jumper configuration),

2. For correct identification of all device interfaces from the host PC, install the STLINK-V2EC USB driver available on the *www.st.com/stm32nucleo* webpage, before connecting to the board,

3. To power the board, connect the STM32U083C-DK Discovery board to a PC with a USB Type-A or USB Type-C® to USB Type-C® cable through the USB connector (CN1). Once powered on, the PWR green LED (LD6) lights up and the COM LED (LD1) blinks,

4. Observe the LCD screen (U11) and push the joystick (B2) direction based on the display:

    – If the air quality sensor is connected to the board (if the user plugs it): The LCD informs of *air quality measurements* (CO_2 and TVOC),

    – If the air quality sensor is not connected to the board (not plugged), a menu to select three different demonstrations is displayed on the LCD:

    a. The *Temp Sensor demo* displays the temperature of the temperature sensor on the LCD,

    b. The *Touch Wakeup demo* uses *TSC1* to wake up from the Stop mode (*Stop/Wakeup* displayed on the LCD),

    c. The *LowPower Modes demo* selects one of the low-power modes to be used with a duty cycle from RTC to be in the Low-power or Running modes.

5. Download the demonstration software and several software examples that help to use the STM32U083C-DK Discovery kit features. These are available on the *www.st.com* website,

6. Develop your application using the available examples.

Table 4. Default jumper configuration

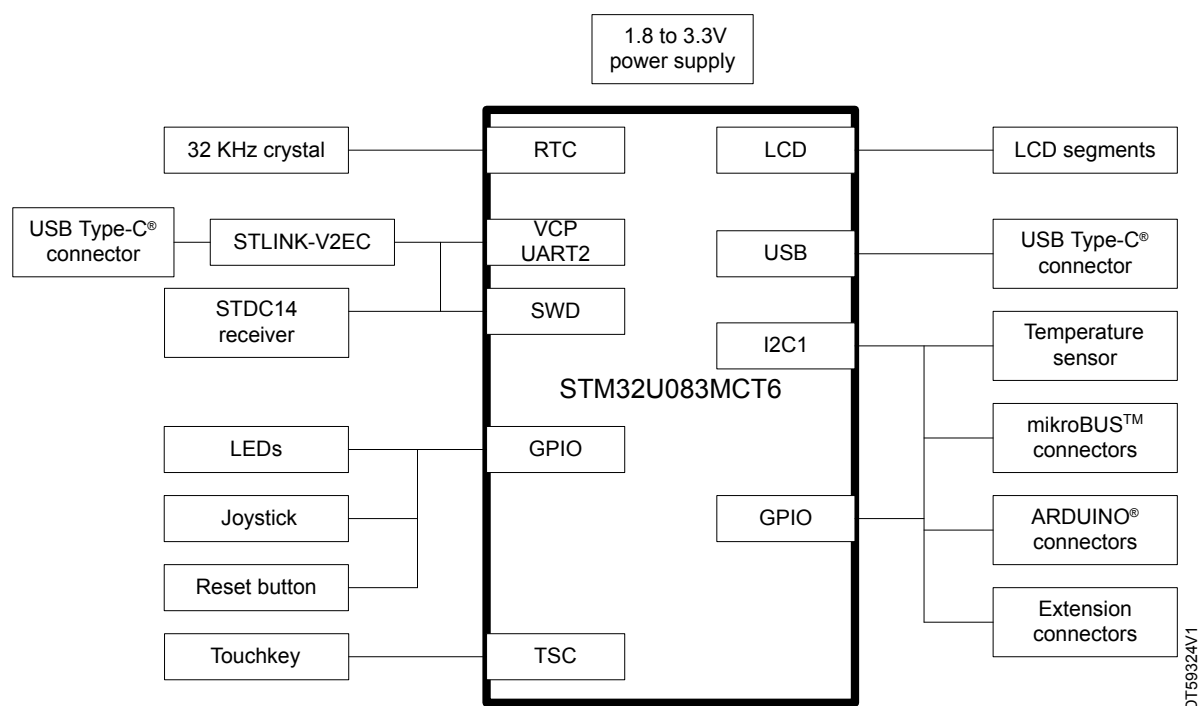| Jumper	Definition	Default position	Comment
JP7	IDD measurement	**ON**	STM32 VDD current measurement
JP3	5 V power selection	**[1-2]**	5 V power supply from ST-LINK USB
JP4	STLK reset	**OFF**	No STLK reset
JP5	NRST connection	**ON**	Reset signal from STLINK-V2EC to target MCU
JP6	Sensor power selection	**[1-2]**	VDD is the temperature sensor and mikroBUS™ connectors power supply
SW1	VDD output voltage configuration	**[1-8] OFF; [2-7], [3-6] ON**	Output voltage VDD is 3.3 V
	BOOT0 selection	**[4-5] OFF**	Main flash memory is selected as boot space

7 Hardware layout and configuration

The STM32U083C-DK Discovery kit is designed around the STM32U083MC microcontroller, in an LQFP80 package.

Figure 3 illustrates the connection between the STM32 and its peripherals: STLINK-V2EC, push-button, joystick, touchkey, LEDs, temperature sensor, LCD segments, user USB, mikroBUS™ connectors, ARDUINO® connectors, extension connectors, and configurable power supply.

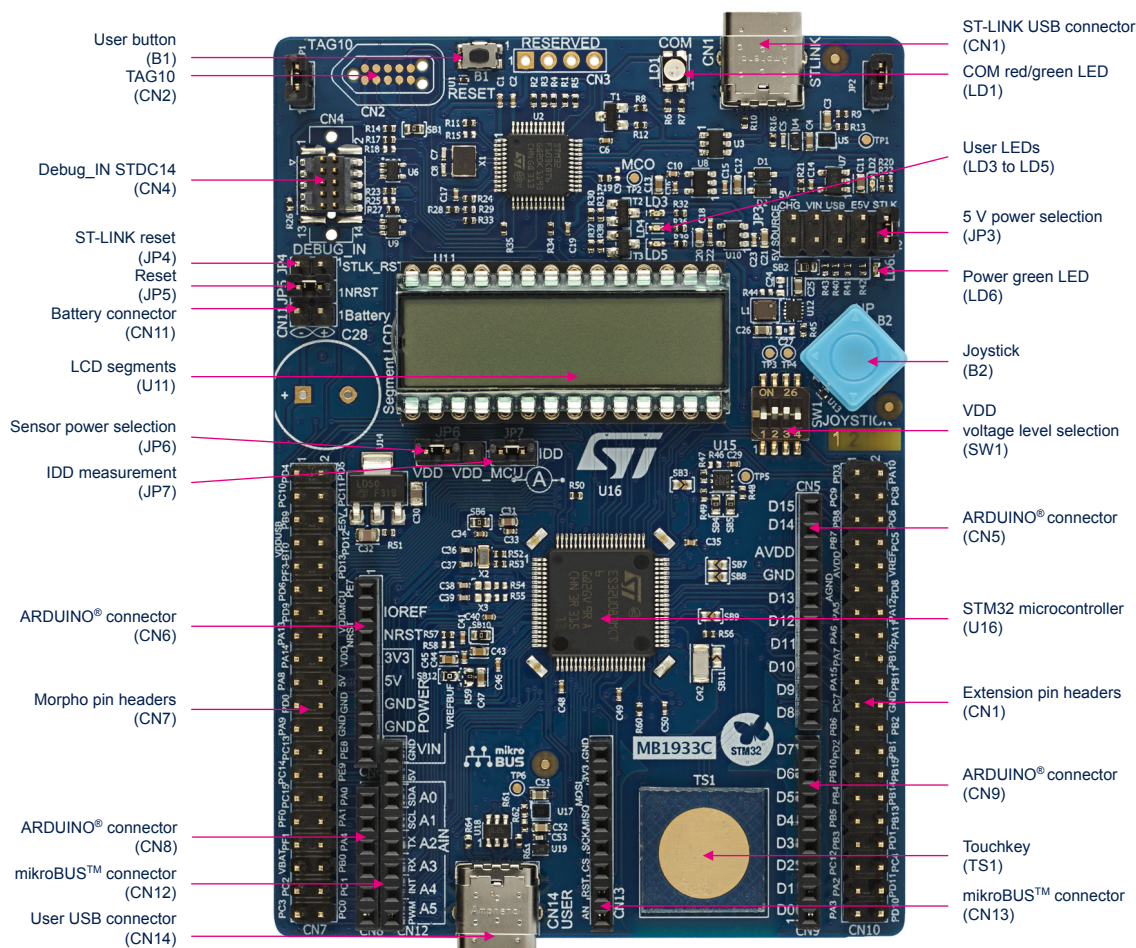Figure 4 shows the location of the STM32U083C-DK Discovery kit features.

The mechanical dimensions of the board are shown in Figure 5.

Figure 3. Hardware block diagram

7.1 STM32U083C-DK board layout

Figure 4. STM32U083C-DK layout top view

User button
(B1)
TAG10
(CN2)

Debug_IN STDC14
(CN4)

ST-LINK reset
(JP4)
Reset
(JP5)
Battery connector
(CN11)

LCD segments
(U11)

Sensor power selection
(JP6)
IDD measurement
(JP7)

ARDUINO® connector
(CN6)

Morpho pin headers
(CN7)

ARDUINO® connector
(CN8)
mikroBUS™ connector
(CN12)
User USB connector
(CN14)

ST-LINK USB connector
(CN1)
COM red/green LED
(LD1)

User LEDs
(LD3 to LD5)

5 V power selection
(JP3)

Power green LED
(LD6)

Joystick
(B2)

VDD
voltage level selection
(SW1)

ARDUINO® connector
(CN5)

STM32 microcontroller
(U16)

Extension pin headers
(CN1)

ARDUINO® connector
(CN9)

Touchkey
(TS1)

mikroBUS™ connector
(CN13)

DT59325V2

7.2 Mechanical drawing

Figure 5. STM32U083C-DK board mechanical drawing (in millimeters)
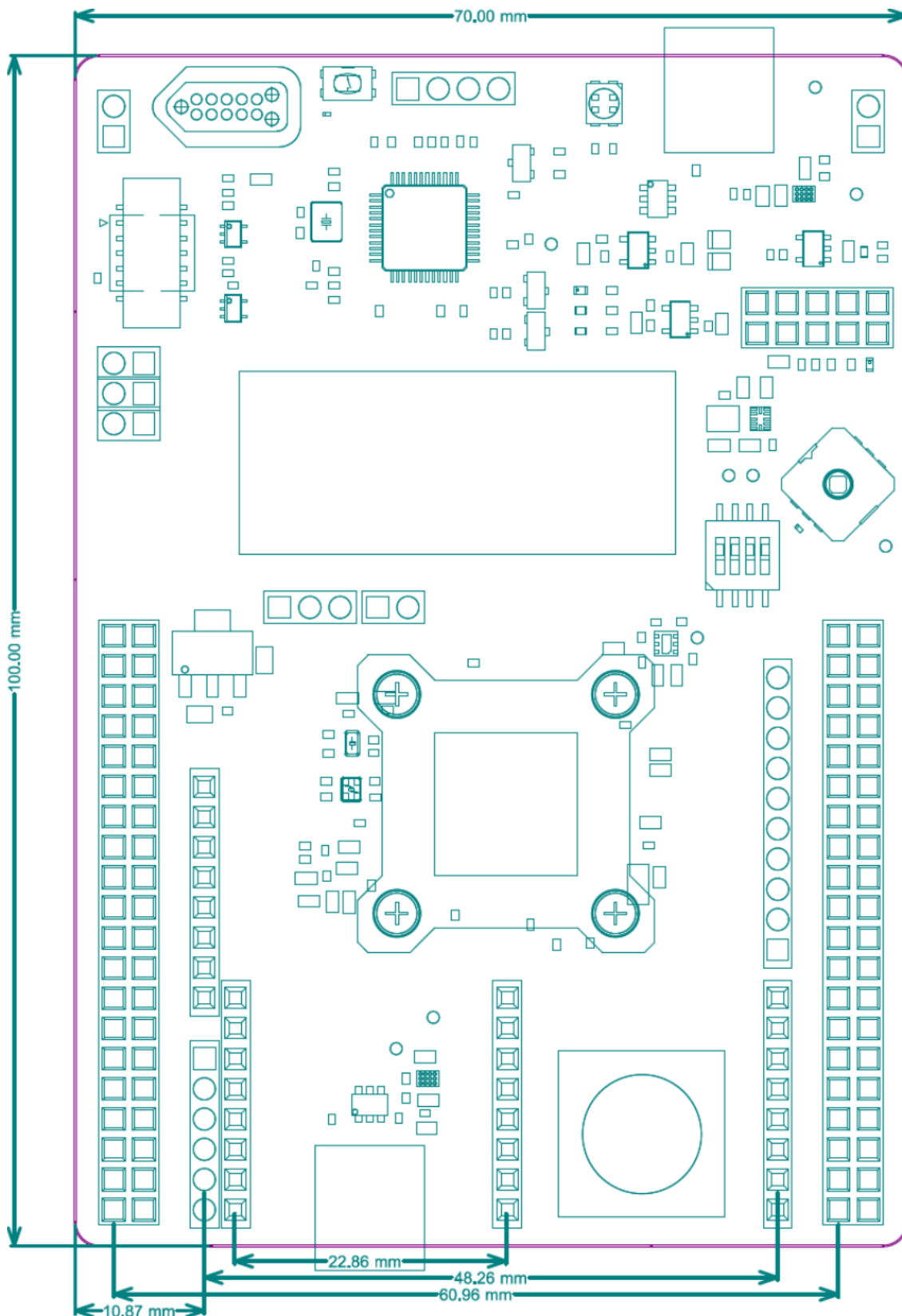
7.3 Embedded STLINK-V2EC

The STLINK-V2EC programming and debugging tool is integrated with the STM32U083C-DK Discovery kit.

The embedded STLINK-V2EC supports only the SWD for STM32 devices.

For all general information concerning the debugging and programming features of STLINK-V2EC, refer to the user manual *ST-LINK/V2 in-circuit debugger/programmer for STM8 and STM32* (UM1075) and the technical note *Overview of ST-LINK derivatives* (TN1235).

There are two different ways to program and debug the onboard STM32 MCU:

- Using the embedded STLINK-V2EC
- Using an external debug tool connected to the STDC14/MIPI10 connector (CN4)

Refer to Table 11. Jumper configuration to switch between STLINK-V2EC and STDC14 configurations.

The STLINK-V2EC facility for debugging and flashing is integrated into the STM32 Discovery kit.

Features supported in STLINK-V2EC:

- USB software re-enumeration
- Mass storage interface on USB
- USB power management request for more than 100 mA power on the USB connector

Known limitations:

- Activating the readout protection on the STM32 target prevents the target application from running afterward. The target readout protection must be kept disabled on STLINK-V2EC boards.

7.3.1 Drivers

Until Windows® 10, STLINK-V2EC requires a dedicated USB driver, which is available from *www.st.com*.

In case the STM32U083C-DK Discovery kit is connected to the PC before the driver is installed, some STM32 Discovery kit interfaces might be declared as *Unknown* in the PC device manager. In this case, the user must install the dedicated driver files and update the driver of the connected device from the device manager, as shown in Figure 6.

Note: *It is preferable to use the USB Composite Device to handle a full recovery.*

Figure 6. USB composite device
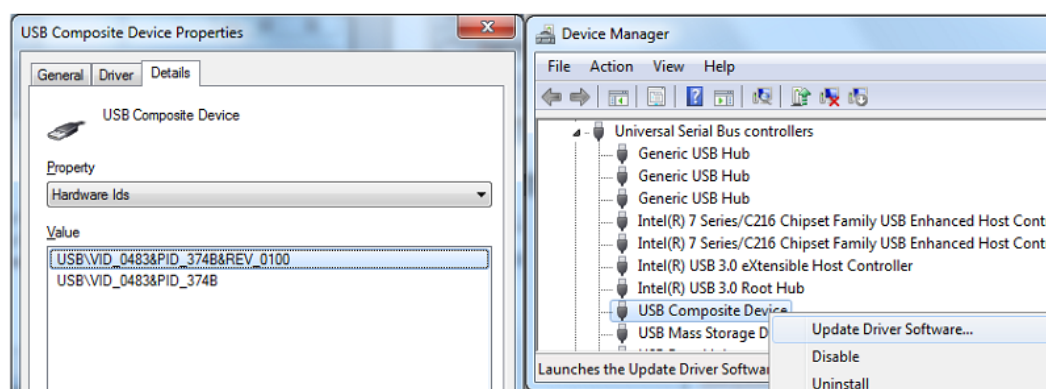
7.3.2 STLINK-V2EC firmware upgrade

STLINK-V2EC embeds a firmware mechanism for the in-place upgrade through the USB port. The firmware might evolve during the lifetime of the STLINK-V2EC product (for example new functionalities, bug fixes, support for new microcontroller families). Therefore, visiting the *www.st.com* website is recommended before starting to use the STM32U083C-DK Discovery kit, then periodically to stay up to date with the latest firmware version.

7.3.3 **Programming and debugging the on-board MCU using the Debug_IN connector**

To program the STM32 on board, plug in the Debug_IN connector (CN4) or TAG10 connector (CN2), as shown in Figure 4. The Debug_IN connector is an Arm® Cortex® 10-pin 1.27 mm-pitch debug connector over the STDC14/MIPI10 footprint according to Table 5. It supports the STDC14 or MIPI10 standard connectors. The TAG10 connector pinout is shown in Table 6.

Table 5. STDC14/MIPI10 connector (CN4) (SWD only)

MIPI10 pin	STDC14 pin	CN4	Designation
-	1	N/A	-
-	2	N/A	-
1	3	VDD	Target VDD from the application
2	4	SWDIO	SWD data input/output
3	5	GND	Ground
4	6	SWCLK	SWD clock
5	7	GND	Ground
6	8	SWO	Reserved
7	9	SWCLK	JRCLK
8	10	N/A	-
9	11	GNDDetect	-
10	12	NRST	RESET of the target MCU
-	13	VCP_RX	Target Rx used for VCP (with UART supporting bootloader)
-	14	VCP_TX	Target Tx used for VCP (with UART supporting bootloader)

Table 6. TAG10 connector (CN2) (SWD only)

TAG10 pin	CN2	Designation
1	VDD	Target VDD from the application
2	SWDIO	SWD data input/output
3	GND	Ground
4	SWCLK	SWD clock
5	GND	Ground (via SB1)
6	SWO	Reserved
7	N/A	-
8	N/A	-
9	N/A	-
10	NRST	Reset of target MCU

7.4 Power supply and power selection

7.4.1 External power supply input

Several DC power sources can power the STM32U083C-DK Discovery kit. It is possible to supply the STM32U083C-DK Discovery kit with any of the following sources:

- 5V_STLK: 5 V from the STLINK-V2EC USB Type-C® connector
- 5V_VIN: Regulated 5 V by LDO (U14) adaptation, powered by 7 to 12 V from the ARDUINO® or extension connectors
- E5V: External 5 V power from extension connectors
- VBUS_STLK: 5 V from the user USB Type-C® connector without enumeration
- 5V_USB: 5 V from the USB Type-C® connector

Note: *If the 5V_VIN or E5V DC power source is used to power a board, this power must comply with the EN-62368-1: 2014/A11:2017 standard and must be safety extralow voltage (SELV) with limited power capability.*

The power supply capabilities are shown in Table 7.

Table 7. Power source capabilities

Input power	Connector pins	Voltage range	Maximum current	Limitation
5V_STLK	CN1 JP3[1-2]	4.75 to 5.5 V	500 mA	The maximum current depends on the USB enumeration: • 100 mA without enumeration • 500 mA with good enumeration
VIN	CN6 pin 8 JP3[7-8]	7 to 12 V	800 mA	From 7 to 12 V only and the maximum current capability is linked to the input voltage: • 800 mA input current when VIN = 7 V • 450 mA input current when 7 V < VIN < 9 V • 250 mA input current when 9 V < VIN < 12 V
E5V	CN7 pin 6 JP3[3-4]	4.75 to 5.5 V	1 A	The maximum current depends on the power source. 1 A maximum is recommended for this board.
VBUS_STLK	CN1 JP3[9-10]	4.75 to 5.5 V	500 mA	The maximum current depends on the USB Host used to power the board. No USB enumeration.
5V_USB	CN14 JP3[5-6]	4.75 to 5.5 V	500 mA	The maximum current depends on the presence or absence of the USB enumeration.

5V_STLK is a 5 V DC power with limitations from the STLINK-V2EC USB connector (CN1). In this case, the 5V jumper selection (JP3) must be on [1-2] to select the STLK power source on the JP3 connector. This is the default setting. If the USB enumeration succeeds, the STLK power is enabled, by asserting the T_PWR_EN signal coming from STLINK-V2EC. This pin is connected to a power switch, which powers the board. This power switch also features a current limitation to protect the PC in case of a short circuit on board, detected with a current higher than 750 mA.

The STM32U083C-DK Discovery kit and its shield can be powered from the STLINK-V2EC USB connector (CN1). Nevertheless, only the STLINK-V2EC circuit is powered before USB enumeration because the host PC only provides 100 mA to the board at that time. During the USB enumeration, the STM32U083C-DK Discovery kit with its shield requests no more than 500 mA current.

- If the host can provide the required power, the enumeration ends with a *SetConfiguration* command. Then, the power transistor is switched ON and the green LED (LD3) is turned ON. Thus, the STM32U083C-DK Discovery kit and its shield request no more than 500 mA current.
- If the host is not able to provide the required current, the enumeration fails. Therefore, the power switch stays OFF and the MCU part including the expansion board is not powered. As a consequence, the green LED (LD3) stays turned OFF. In this case, it is mandatory to use an external power supply.

VIN is the 7 to 12 V DC power from the ARDUINO® connector (CN6 pin 8). The 5V jumper selection (JP3) must be on [7-8] to select the VIN power source. In that case, the DC power can come from the ARDUINO® Uno V3 battery shield and is compatible with Adafruit® PowerBoost 500 shield.

An LDO (U14) is used to provide a fixed 5 V from VIN (7-12 V).

E5V is the DC power coming from an external 5 V DC power source from the extension connector (CN7 pin 6.) The 5V jumper selection (JP3) must be on [3-4] to select the E5V power source.

VBUS_STLK is when a DC power charger is connected to the STLINK-V2EC USB connector (CN1). To select the CHG power source, the 5V jumper selection (JP3) must be on [9-10]. If an external USB charger powers the STM32U083C-DK Discovery kit, then the debugging feature through CN1 is not available. If a host computer is connected instead of the charger, it is recommended to select the STLK power source.

5V_USB is a 5 V DC power with limitations from the USB Type-C® connector (CN14). In this case, the 5V jumper selection (JP3) must be on [5-6] to select the USB power source on the JP3 connector.

7.4.2 Programing/debugging when the power supply is not from STLINK-V2EC (STLK)

In case the current consumption of the Discovery kit with the expansion boards exceeds the allowed current on the ST-LINK USB connector, the external power VIN, E5V, or user USB can be used. In such a case, it is still possible to use the embedded ST-LINK for VCP programming and debugging. In this case, the following power sequence procedure must be respected:

1. Set the JP3 jumper according to the 5 V selected external power source.
2. Connect the external power source according to Table 7.
3. Power on the external power supply.
4. Check that the 5 V green LED (LD6) is turned ON.
5. Connect the PC to the USB connector (CN1) for programming/debugging.

If this sequence is not followed, the STLINK-V2EC V_{BUS} might first supply power to the board, and the following risks might be encountered:

- If the board needs more than 500 mA current, the PC might limit the current or be damaged. Therefore, the board is not powered correctly.
- 500 mA is requested at the enumeration: This request is rejectable and the enumeration does not succeed if the PC does not provide such a current. Consequently, the board is not power supplied (LED LD6 remains OFF).

7.4.3 STM32U083MC MCU IDD measurement

The IDD-labeled jumper (JP7) is used to measure the consumption of the STM32 microcontroller by removing the jumper and connecting an ammeter or any other current measurement tool:

- Jumper ON: The STM32 microcontroller is powered (default configuration).
- Jumper OFF: An ammeter or external 3.3 V power supply must be connected to power and measure the consumption of the STM32 microcontroller.

The IDD jumper can be used to measure the current consumption at several steps of the MCU voltages provided by the embedded step-down regulator.

7.4.4 Configurable step-down regulator

To evaluate the performance of STM32U083MC at various VDD levels, the STM32U083C-DK Discovery board embeds a step-down converter with eight different levels of output voltage provided to VDD. Selection is done through the configuration of the SW1 switch. The JP3 jumper selects the power source for this converter.

Refer to Table 8 to configure the level of output voltage.

Table 8. Output voltage level configuration via switch (SW1)

VDD	SW1.1	SW1.2	SW1.3
1.6 V	ON	OFF	OFF
1.8 V	ON	ON	ON
2.1 V	OFF	ON	OFF
2.5 V	OFF	OFF	OFF
2.7 V	OFF	OFF	ON
2.8 V	ON	OFF	ON
3.0 V	ON	ON	OFF
3.3 V[1]	**OFF**[1]	**ON**[1]	**ON**[1]

1. The default state is shown in bold.

Note: Take care of the board features voltage working conditions when configuring the different levels of output voltage.

7.5 OSC clock sources

Two clock sources are available on the Discovery kit:
- LSE is the 32.768 kHz crystal for the STM32 embedded RTC
- HSE is the 24 MHz oscillator for the STM32 microcontroller. Not fitted by default.

To help select the crystals and their associated capacitors, refer to the application note *Oscillator design guide for STM8AF/AL/S, STM32 MCUs and MPUs* (AN2867).

7.5.1 LSE: OSC 32 KHz clock supply

There are three ways to configure the pins corresponding to the low-speed clock (LSE):

LSE on-board oscillator X2 crystal (default configuration)

For example, the X2 crystal embedded in the Discovery kit has the following characteristics: 32.768 kHz, 6 pF, and 20 ppm.

The use of the embedded X2 crystal requests the following SB configuration:
- SB16 and SB18 OFF
- R52 and R53 ON

External oscillator connected to PC14 input

The use of the external oscillator through pin 27 of the extension connector (CN7) requests the following configuration:
- SB16 ON
- R52 and R53 OFF

LSE not used

PC14 and PC15 are used as GPIOs instead of low-speed clocks. The following configuration is needed:
- SB16 and SB18 ON
- R52 and R53 OFF

7.5.2 HSE: OSC clock supply

There are three ways to configure the pins corresponding to the external high-speed clock (HSE):

HSE on-board oscillator from X3 crystal

For example, the X3 crystal embedded in the Discovery kit has the following characteristics: 24 MHz, 8 pF, 20 ppm. The use of the embedded X3 crystal requests the following solder bridge configuration:
- SB19 and SB20 OFF
- R54 and R55 ON

External oscillator to PF0 input

The input clock comes from an external oscillator through PF0 (CN17 pin 31). The following configuration is needed:
- SB19 ON
- R54 and R55 OFF

HSE not used (default configuration)

PF0 and PF1 are used as GPIOs instead of clocks. The following configuration is needed:
- SB19 and SB20 ON
- R54 and R55 OFF

7.6 Reset sources

The Discovery kit reset signal is active LOW and the reset sources include:

- The reset push-button (B1)
- The embedded STLINK-V2EC
- The ARDUINO® connector (CN6 pin 3)
- The extension connector (CN7 pin 16)

7.7 Virtual COM port (VCP)

An STM32 serial interface is connected to the STLINK-V2EC debug interface. The user can choose the USART2 interface. Refer to Table 9 below to set the USART2 connection to the VCP interface.

Table 9. VCP communication

Pin name	Function	Virtual COM port (default configuration	Expansion connectors connection
PA2	USART2 Tx	U21 ON	U21 and R25 OFF
PA3	USART2 Rx	R33 ON	R33 OFF

7.8 LEDs

Six LEDs are available on the STM32U083C-DK Discovery kit. The six LEDs are located on the top side of the board:

STLINK-V2EC tricolor LED (LD1)

The tricolor (green, orange, and red) LED provides information about STLINK-V2EC communication status (LD1). For detailed information about the LED, refer to the technical note *Overview of ST-LINK derivatives* (TN1235).

VBUS_STLK over current LED (LD2)

The red LED is ON when overcurrent is detected on USB V_{BUS}. The LED gives the information that more than 500 mA is requested on V_{BUS}. In this case, it is recommended to supply the board with E5V, VIN, or in the USB charger mode.

5V PWR LED (LD6)

The green LED (LD6) indicates that the Discovery kit is powered by a 5 V source, and this source is available on CN6 pin 5 and CN7 pin 20.

User green LED (LD3), blue LED (LD4), and red LED (LD5)

The user green LED (LD3) is connected to the STM32 I/O PC13.
The user blue LED (LD4) is connected to the STM32 I/O PA5 (R66 ON, default configuration), also used for ARDUINO® D13 function.
The user red LED (LD5) is connected to the STM32 I/O PB2.
A transistor is used to drive the LED whatever the MCU 1V8 or 3V3 voltage range.

7.9 Push-buttons

Two buttons are available on the Discovery kit.

RESET button (B1)

The black button connected to NRST is used to reset the STM32 microcontroller. When the button is pressed the logic state is LOW, otherwise, the logic state is HIGH.

Joystick (B2)

This joystick is a 5-way rock switch using a single ADC input pin PC2. Push-in *Select* can be used as a digital user button and EXTI wake-up interrupt.

The joystick position for the ADC value refers to Table 10.

Table 10. Joystick position for the ADC value

Joystick position	Measurement ratio	ADC value (V)
Select	0	0
Left	0.20	0.67
Down	0.40	1.32
Up	0.61	2.01
Right	0.80	2.65
No key pressed	1.0	3.3

VREF is connected to the joystick resistor network as the power supply. So, the joystick can work whenever 3.3 or 1.8 V for the ADC measurement ratio.

7.10 Jumper configuration

The default jumper positions are shown in Table 4. Table 11 describes the other available jumper settings

Table 11. Jumper configuration

Jumper/CN	Function	State[1]	Comment
JP1, JP2	GND	**ON**	GND probe
JP3	5 V power selection	**[1-2]**	5 V from ST-LINK
		[3-4]	5 V from E5V
		[5-6]	5 V from user USB
		[7-8]	5 V from VIN 7 V to 12 V
		[9-10]	5 V from VBUS_STLK
		OFF	No 5 V power
JP4	STLK reset	**OFF**	No STLK reset
		ON	STLK reset
JP5	NRST connection	**ON**	Reset signal from STLINK-V2EC to target MCU
		OFF	STLINK-V2EC cannot reset target MCU
JP6	Sensor power selection	**[1-2]**	VDD is the temperature sensor and mikroBUS™ connectors power supply
		[2-3]	VDD_MCU is the temperature sensor and mikroBUS™ connectors power supply
JP7	IDD measurement	**ON**	VDD_MCU = VDD
		OFF	To connect the external source (ULPBench probe as an example)

1. *The default jumper state is shown in bold.*

7.11 Segment LCD

A 4×24-segment LCD, four commons, multiplexed 1/4 duty, 1/3 bias is mounted on the DIP28 connector (U11). Table 12 shows the remapped LCD pins to the STM32U083MC GPIO and segment LCD functions.

Table 12. LCD pinout

LCD pin	LCD name	MCU GPIO	LCD function
1	SEG0	PC4	LCD_SEG22
2	SEG1	PC5	LCD_SEG23
3	SEG2	PB1	LCD_SEG6
4	SEG3	PE7	LCD_SEG45
5	SEG4	PE8	LCD_SEG46
6	SEG5	PE9	LCD_SEG47
7	SEG6	PB11	LCD_SEG11
8	SEG7	PB14	LCD_SEG14
9	SEG8	PB15	LCD_SEG15
10	SEG9	PD8	LCD_SEG28
11	SEG10	PD9	LCD_SEG29
12	SEG11	PD12	LCD_SEG32
13	COM3	PB9	LCD_COM3
14	COM2	PA10	LCD_COM2
15	COM1	PA9	LCD_COM1
16	COM0	PA8	LCD_COM0
17	SEG12	PD13	LCD_SEG33
18	SEG13	PC6	LCD_SEG24
19	SEG14	PC8	LCD_SEG26
20	SEG15	PC9	LCD_SEG27
21	SEG16	PC10	LCD_SEG48
22	SEG17	PD0	LCD_SEG34
23	SEG18	PD1	LCD_SEG35
24	SEG19	PD3	LCD_SEG36
25	SEG20	PD4	LCD_SEG37
26	SEG21	PD5	LCD_SEG38
27	SEG22	PD6	LCD_SEG39
28	SEG23	PC11	LCD_SEG49

7.12 USB Type-C® port

The STM32U083C-DK Discovery kit supports USB full-speed (FS) communication through a USB Type-C® connector (CN14). The USB connector (CN14) can power the Discovery board at a 5 V DC voltage with a 500 mA current limitation using the V_{BUS} overvoltage protection (U17).

The STM32U083C-DK Discovery kit supports USB Type-C® sink only. When a USB Host connection to the USB Type-C® connector (CN14) of the STM32U083C-DK Discovery kit is detected, it starts behaving as a USB Device. Depending on the powering capability of the USB Host, the board can take power from the V_{BUS} terminal of CN14. In the board schematic diagrams, the corresponding power voltage line is called 5V_USB.

Section 7.4.1 provides information on how to use the powering option.

The PB6 pin is used for V_{BUS} sensing detection when the USB Device is bus-powered or self-powered. When VDD is 3.3 V, SB24 is ON. When VDD is 1.8 V, SB24 is OFF as the resistor divider value for V_{BUS} detection.

The hardware configuration for the USB FS interface is shown in Table 13.

Table 13. USB Type-C® GPIO configuration

GPIO	Hardware	Setting[1]	Configuration
PA11	SB8	**OFF**	PA11 is used as the USB_FS_N diff pair interface.
		ON	PA11 is connected in parallel to the extension connector (CN10). The USB interface can be disturbed.
PA12	SB7	**OFF**	PA12 is used as the USB_FS_P diff pair interface.
		ON	PA12 is connected in parallel to the extension connector (CN10). The USB interface can be disturbed.

1. The default configuration is shown in bold.

7.13 Touchkey button

The STM32U083C-DK Discovery kit supports a touchkey button based on either RC charging or charge-transfer technique. This one is enabled by default.

The touchkey button is connected to one of the TSC ports of STM32U083MC with the related charge capacitor. An active shield is designed in layer 2 of the main PCB, under the button footprint. It allows the reduction of disturbances from other circuits to prevent false touch detections.

The active shield is connected to another TSC interface of STM32U083MC through the R56 serial resistor. The related charge capacitor is connected to the same TSC interface.

The solder bridge and jumper configuration related to the touchkey function enables or disables its operation. However, most of them serve to optimize the touchkey performance, by isolating copper tracks to avoid disturbances due to their antenna effect.

For more information about the TSC interface and the tuning explanation for this interface, refer to the application note *Getting started with touch sensing control on STM32 microcontrollers* (AN5105) and the STM32U0 series product datasheets.

Table 14 describes the hardware configuration for the touchkey button interface.

Table 14. Hardware I/O configuration for the touchkey button interface

GPIO	Hardware	Setting[1]	Configuration
PD10	SB11	**OFF**	PD10 is directly connected to TKEY_CS.
		ON	PD10 can be used for extension I/O connectors. In this case, the touchkey layout is not optimized and the touchkey button may not be functional.
PD11	SB9	**OFF**	PD11 is directly connected to the touchkey button.
		ON	PD11 can be used for extension I/O connectors. In this case, the touchkey layout is not optimized and the touchkey button may not be functional.
PB12	SB23	**OFF**	PB12 is directly connected to the SHIELD touchkey button.
		ON	PB12 can be used for extension I/O connectors. In this case, the touchkey layout is not optimized and the touchkey button may not be functional.
PB13	SB22	**OFF**	PB13 is directly connected to SHIELD_CS.
		ON	PB13 can be used for extension I/O connectors. In this case, the touchkey layout is not optimized and the touchkey button may not be functional.

1. The default configuration is shown in bold.

7.14 Temperature sensor

The STM32U083C-DK Discovery kit embeds an ultra-low-power temperature sensor with 0.5°C accuracy and ALERT support. This sensor is managed with an I^{2}C shared with the ARDUINO® and mikroBUS™ connectors. The I^{2}C read/write address is `0x7F/0x7E`.

The temperature sensor is powered by VDD or VDD_MCU by jumper JP6. Refer to Section 7.10 for jumper configuration.

8 Connectors

8.1 ARDUINO® Uno V3

The CN5, CN6, CN8, and CN9 connectors are female connectors supporting the ARDUINO® Uno V3 standard. Most shields designed for ARDUINO® can fit the Discovery board.

Caution: *Most of the STM32 microcontroller I/Os are 5V‑tolerant, but a few of them are only 3.6V‑compatible, while ARDUINO® Uno V3 is 5V‑compatible. Refer to the STM32 series data brief and STM32xxxx product datasheets for their I/O structure.*

The related pinout for the ARDUINO® connector is listed in Table 15.

Table 15. ARDUINO® connectors on STM32U083C-DK

Left connectors					Right connectors				
Connector	Pin number	Pin name	MCU pin	Function	Function	MCU pin	Pin name	Pin number	Connector
					I2C1_SCL	PB8	SCL/D15	10	
					I2C1_SDA	PB7	SDA/D14	9	
					VREF+[1]	-	VREF	8	
					GND	-	GND	7	
CN6	1	NC	-	Reserved for test	SPI1_SCK	PA5	SCK/D13	6	CN5
	2	IOREF	-	I/O reference	SPI1_MISO	PA6	MISO/D12	5	
	3	NRST	NRST	RESET	SPI1_MOSI or TIM1_CH1N	PA7	PWM/MOSI/D11	4	
	4	3V3	-	3.3 V input/ output	SPI_CS or TIM16_CH1N	PA15	PWM/CS/D10	3	
	5	5V	-	5 V output	TIM3_CH2	PC7	PWM/D9	2	
	6	GND	-	GND	I/O	PB6	D8	1	
	7	GND	-	GND					
	8	VIN	-	7 to 12 V power input	I/O	PD2	D7	8	CN9
					TIM2_CH3	PB10	PWM/D6	7	
CN8	1	A0	PA0[2]	ADC1_IN4	TIM3_CH1	PB4	PWM/D5	6	
	2	A1	PA1[2]	ADC1_IN5	I/O	PB5	D4	5	
	3	A2	PA4[2]	ADC1_IN8	TIM2_CH2	PB3	PWM/D3	4	
	4	A3	PB0[2]	ADC1_IN17	I/O	PC12	D2	3	
	5	A4	PC1[2]	ADC1_IN1 or I2C1_SDA	USART2_TX	PA2	TX/D1	2	
	6	A5	PC0[2]	ADC1_IN0 or I2C1_SCL	USART2_RX	PA3	RX/D0	1	

1. *VREF is selected from the internal as default. VREF can be selected from external CN5 pin8 or CN10 pin 10 (SB17 ON and SB12 OFF).*

2. *The ADC input range is 0 <= VIN <= VREF.*

8.2 Extension connectors (CN7 and CN10)

The extension connectors are two 2x20 2.54-pitch male pin headers (CN7 and CN10). They can be used to connect the STM32U083C-DK Discovery kit to an expansion or prototype/wrapping board placed on top of it. All signals and power pins of the STM32 are available on the extension connectors. An oscilloscope, a logic analyzer, or a voltmeter can also probe this connector.

Table 16 describes the CN7 and CN10 connector pinout.

Table 16. Pin assignment for the STM32 on the extension connectors

CN7				CN10			
Pin name	Pin number	Pin number	Pin name	Pin name	Pin number	Pin number	Pin name
PD4	1	2	PD5	PD3	1	2	PA10
PC10	3	4	PC11	PC9	3	4	PC8
PB9	5	6	E5V	PB8	5	6	PC6
VDDUSB	7	8	PD12	PB7	7	8	PC5
PF3-BOOT0	9	10	PD13	AVDD	9	10	VREF[5]
PD6	11	12	PE7	AGND	11	12	PD8
PD9	13	14	VDD_MCU	PA5	13	14	PA12[3]
PA13[1]	15	16	NRST	PA6	15	16	PA11[3]
PA14[1]	17	18	VDD	PA7	17	18	PB12[4]
PA8	19	20	5V	PA15	19	20	PB11
PD0	21	22	GND	PC7	21	22	GND
PA9	23	24	GND	PB6	23	24	PB2
PC13	25	26	PE8	PD2	25	26	PB1
PC14[2]	27	28	PE9	PB10	27	28	PB15
PC15[2]	29	30	PA0	PB4	29	30	PB14
PF0[2]	31	32	PA1	PB5	31	32	PB13[4]
PF1[2]	33	34	PA4	PB3	33	34	PD1
VBAT	35	36	PB0	PC12	35	36	PC4
PC2	37	38	PC1	PA2	37	38	PD11[4]
PC3	39	40	PC0	PA3	39	40	PD10[4]

1. PA13 and PA14 are shared with SWD signals connected to STLINK-V2EC. It is not recommended to use them as I/O pins.
2. Refer to Section 7.5 for details.
3. Refer to Table 13 for details.
4. Refer to Table 14 for details.
5. The ADC input range is 0 <= VIN <= VREF.

8.3 mikroBUS™ compatible connectors (CN12 and CN13)

The mikroBUS™ compatible connectors CN12 and CN13 are a pair of 1×8-pin female connectors with a 2.54 mm pitch. The mikroBUS™ pinout assignment is available at the mikroe.com website.

Table 17 shows the definition of the pins.

Table 17. Description of the mikroBUS™ connector pins

Pin name	mikroBUS™ function	Pin number		Pin number	mikroBUS™ function	Pin name
PA0	AN	1		1	PWM	PB3
PB10	RST	2		2	INT	PB4
PA15	CS	3		3	Rx	PA3
PA5	SCK	4		4	Tx	PA2
PA6	MISO	5		5	SCL	PB8
PA7	MOSI	6		6	SDA	PB7
-	+3.3 V	7		7	+5 V	-
-	GND	8		8	GND	-

9 STM32U083C-DK product information

9.1 Product marking

The product and each board composing the product are identified with one or several stickers. The stickers, located on the top or bottom side of each PCB, provide product information:

- Main board featuring the target device: product order code, product identification, serial number, and board reference with revision.

  Single-sticker example:

Product order code Product identification syywwxxxxx MBxxxx-Variant-yzz

  Dual-sticker example:

Product order code Product identification	and	MBxxxx-Variant-yzz syywwxxxxx
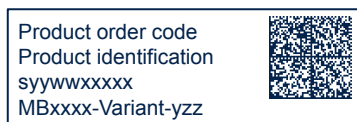
- Other boards if any: board reference with revision and serial number.

  Examples:

syywwxxxxx MBxxxx-Variant-yzz	or	MBxxxx-Variant-yzz syywwxxxxx	or		or	

On the main board sticker, the first line provides the product order code, and the second line the product identification.

On all board stickers, the line formatted as *"MBxxxx-Variant-yzz"* shows the board reference *"MBxxxx"*, the mounting variant *"Variant"* when several exist (optional), the PCB revision *"y"*, and the assembly revision *"zz"*, for example B01. The other line shows the board serial number used for traceability.

Products and parts labeled as *"ES"* or *"E"* are not yet qualified or feature devices that are not yet qualified. STMicroelectronics disclaims any responsibility for consequences arising from their use. Under no circumstances will STMicroelectronics be liable for the customer's use of these engineering samples. Before deciding to use these engineering samples for qualification activities, contact STMicroelectronics' quality department.

"ES" or *"E"* marking examples of location:

- On the targeted STM32 that is soldered on the board (for an illustration of STM32 marking, refer to the STM32 datasheet *Package information* paragraph at the *www.st.com* website).
- Next to the ordering part number of the evaluation tool that is stuck, or silk-screen printed on the board.

Some boards feature a specific STM32 device version, which allows the operation of any bundled commercial stack/library available. This STM32 device shows a *"U"* marking option at the end of the standard part number and is not available for sales.

To use the same commercial stack in their applications, the developers might need to purchase a part number specific to this stack/library. The price of those part numbers includes the stack/library royalties.

9.2 STM32U083C-DK product history

Table 18. Product history

Order code	Product identification	Product details	Product change description	Product limitations
STM32U083C-DK	DK32U083C$KS1	MCU: • STM32U083MCT6 silicon revision "A" MCU errata sheet: • *STM32U073xx and STM32U083xx device errata* (ES0602) Board: • MB1933-U083C-C02 (main board)	Initial revision	This product embeds a nonofficial demo binary with the following differences from the release 1.0.0: • The user button cannot be used to wake up from the Stop mode. • Air demo is accessible when pressing the DOWN key even if the sensor is not present.
	DK32U083C$KS2	MCU: • STM32U083MCT6 silicon revision "A" MCU errata sheet: • *STM32U073xx and STM32U083xx device errata* (ES0602) Board: • MB1933-U083C-C02 (main board)	The demonstration firmware binary is updated to v1.1.0.	No limitation

9.3 Board revision history

Table 19. Board revision history

Board reference	Board variant and revision	Board change description	Board limitations
MB1933 (main board)	MB1933-U083C-C02	Initial revision	No limitation

10 Federal Communications Commission (FCC) and ISED Canada Compliance Statements

10.1 FCC Compliance Statement

Part 15.19

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Part 15.21

Any changes or modifications to this equipment not expressly approved by STMicroelectronics may cause harmful interference and void the user's authority to operate this equipment.

Part 15.105

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception which can be determined by turning the equipment off and on, the user is encouraged to try to correct interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Note: *Use only shielded cables.*

To satisfy FCC RF exposure requirements, a separation distance of 20 cm or more should be maintained between the antenna of this device and persons during operation. To ensure compliance, operation at a closer distance than this is not recommended. This transmitter must not be collocated or operating in conjunction with any other antenna or transmitter.

Responsible Party – U.S. Contact Information:

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10.2 ISED Compliance Statement

ISED Canada ICES-003 Compliance Label: CAN ICES-3 (B) / NMB-3 (B).

Étiquette de conformité à la NMB-003 d'ISDE Canada : CAN ICES-3 (B) / NMB-3 (B).

11   Product disposal

Disposal of this product: WEEE (Waste Electrical and Electronic Equipment)

(Applicable in Europe)
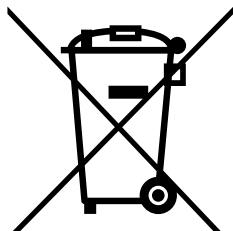
This symbol on the product, accessories, or accompanying documents indicates that the product and its electronic accessories should not be disposed of with household waste at the end of their working life.

To prevent possible harm to the environment and human health from uncontrolled waste disposal, please separate these items from other type of waste and recycle them responsibly to the designated collection point to promote the sustainable reuse of material resources.

Household users:

You should contact either the retailer where you buy the product or your local authority for further details of your nearest designated collection point.

Business users:

You should contact your dealer or supplier for further information.

Revision history

Table 20. Document revision history

Date	Revision	Changes
08-Feb-2024	1	Initial release.
07-Jan-2025	2	Added Safety recommendations, Section 7.4.4: Configurable step-down regulator, DK32U083C$KS2 product identification to Product history, and Product disposal. Updated Table 15. ARDUINO® connectors on STM32U083C-DK and Product marking.

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IMPORTANT NOTICE – READ CAREFULLY