STM32U3 Nucleo-144 board (MB2222)

Introduction

The STM32U3 Nucleo-144 board based on the MB2222 reference board (order code NUCLEO-U3C5ZI-Q) provides an affordable and flexible way for users to try out new concepts and build prototypes by choosing from the various combinations of performance and power-consumption features provided by the STM32U3 microcontroller.

The STM32 Nucleo-144 board offers an easy means to expand the functionality of the Nucleo open development platform with a wide choice of specialized shields through several expansion connectors:

- ARDUINO® Uno V3 connector
- ST morpho headers providing access to the MCU I/O pins

STM32U3 Nucleo-144 board contains an M.2 connector, which can be used to add serial memories.

The NUCLEO-U3C5ZI-Q board does not require any separate probes as it integrates the STLINK-V3EC debugger/programmer.

The STM32U3 Nucleo-144 board comes with the comprehensive free STM32 software libraries and examples available with the STM32CubeU3 MCU Package.

Figure 1. NUCLEO-U3C5ZI-Q top view

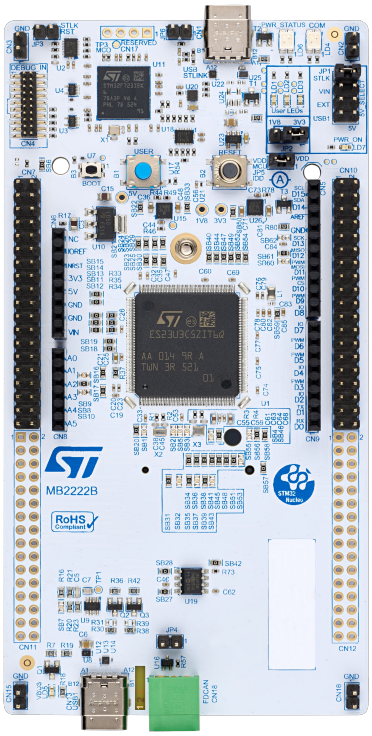
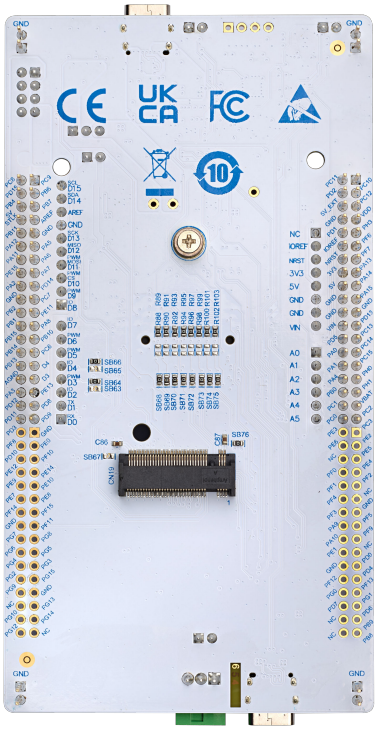


Figure 2. NUCLEO-U3C5ZI-Q bottom view



Pictures are not contractual.

1 Features

- Ultra-low-power STM32U3 series MCU, featuring a 32-bit Arm® Cortex®-M33 processor with Arm® TrustZone® and FPU, 144 DMIPS, 2 Mbytes of flash memory, 640 Kbytes of SRAM, SMPS, and crypto, in an LQFP144 package
- Internal SMPS to generate V_{CORE} logic supply
- USB Type-C® sink device FS
- Three user LEDs
- Reset, user, and boot mode push-buttons
- 32.768 kHz crystal oscillator
- Board connectors:
  - USB Type-C® connector
  - M.2 Key A serial memory connector
  - CAN FD header connector
  - MIPI20 compatible connector with trace signals
  - ARDUINO® Uno V3 connector
  - ST morpho extension pin headers for full access to most of the STM32 I/Os
- Flexible power-supply options: ST-LINK USB V_{BUS}, USB connector, or external sources
- On-board STLINK-V3EC debugger/programmer with USB re-enumeration capability: mass storage, Virtual COM port, and debug port
- Comprehensive free software libraries and examples available with the STM32CubeU3 MCU Package
- Support of a wide choice of Integrated Development Environments (IDEs) including IAR Embedded Workbench®, MDK-ARM, and STM32CubeIDE
- Handled by STM32CubeMonitor-UCPD (STM32CubeMonUCPD) software tool

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2 Ordering information

To order the NUCLEO-U3C5ZI-Q Nucleo-144 board, 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 references	Target STM32
NUCLEO-U3C5ZI-Q	MB2222[1]	STM32U3C5ZIT6Q

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

NUCLEO-XXYYZT-Q	Description	Example: NUCLEO-U3C5ZI-Q
XX	MCU series in STM32 32-bit Arm Cortex MCUs	STM32U3 series
YY	MCU product line in the series	STM32U3B5/3C5
Z	STM32 package pin count: • Z for 144 pins	144 pins
T	STM32 flash memory size: • I for 2 Mbytes	2 Mbytes
Q	STM32 has an internal SMPS function	Internal SMPS

3 Development environment

3.1 System requirements

- Multi-OS support: Windows® 10 or 11, 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 EDA resources

All board design resources, including schematics, EDA databases, manufacturing files, and the bill of materials, are available from the NUCLEO-U3C5ZI-Q 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 like 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 injury.
- 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 it close to water or at a high humidity level.
- Do not operate the board if it is dirty or dusty.
- The pins of the board are exposed and must not come into contact with a metal surface, as this can produce a short circuit and damage the board.

5.3 Delivery recommendations

Before the first use, inspect the board for any damage that may have occurred during shipment. Ensure that all socketed components are securely fixed in their sockets and that nothing is loose in the plastic bag.

5.4 Power supply

A power supply unit or auxiliary equipment complying with the EN 62368-1:2014+A11:2017 standard (or the one replacing it) and safety extralow voltage (SELV/ES1) with limited power capability (LPS/PS2) must power this equipment.

6 Quick start

The NUCLEO-U3C5ZI-Q board is a low-cost and easy-to-use development kit, to evaluate quickly and start development with an STM32U3C5ZIT6Q microcontroller in a LQFP144 package. Before installing and using the product, accept the evaluation product license agreement from the *www.st.com/epla* webpage. For more information on the NUCLEO-U3C5ZI-Q board and demonstration software, visit the *www.st.com/stm32nucleo* webpage.

6.1 Getting started

Follow the sequence below to configure the NUCLEO-U3C5ZI-Q board and launch the demonstration application (refer to Figure 5 for component locations):

1. Check the jumper position on the board (refer to Section 6.2 for the default board configuration).
2. To identify the device interfaces from the host PC, before connecting the board, install the STLINK-V3EC USB driver available on the *www.st.com* website.
3. Connect the NUCLEO-U3C5ZI-Q board to a PC with a USB cable (USB Type-A or USB Type-C® to USB Type-C®) through the USB connector (CN1) to power the board.
4. The 5V_PWR (LD7), COM (LD4), and PWR status (LD6) LEDs light up and the LD3 user LED starts blinking.
5. Each press of the blue user button (B1) takes the active LED through this sequence: LD3 (5 Hz) → LD2 (1 Hz) → LD1 (0.5 Hz).
6. Download the demonstration software and several software examples to use the STM32 Nucleo features, available from the *st.com* website.
7. Develop a custom application using the available examples.

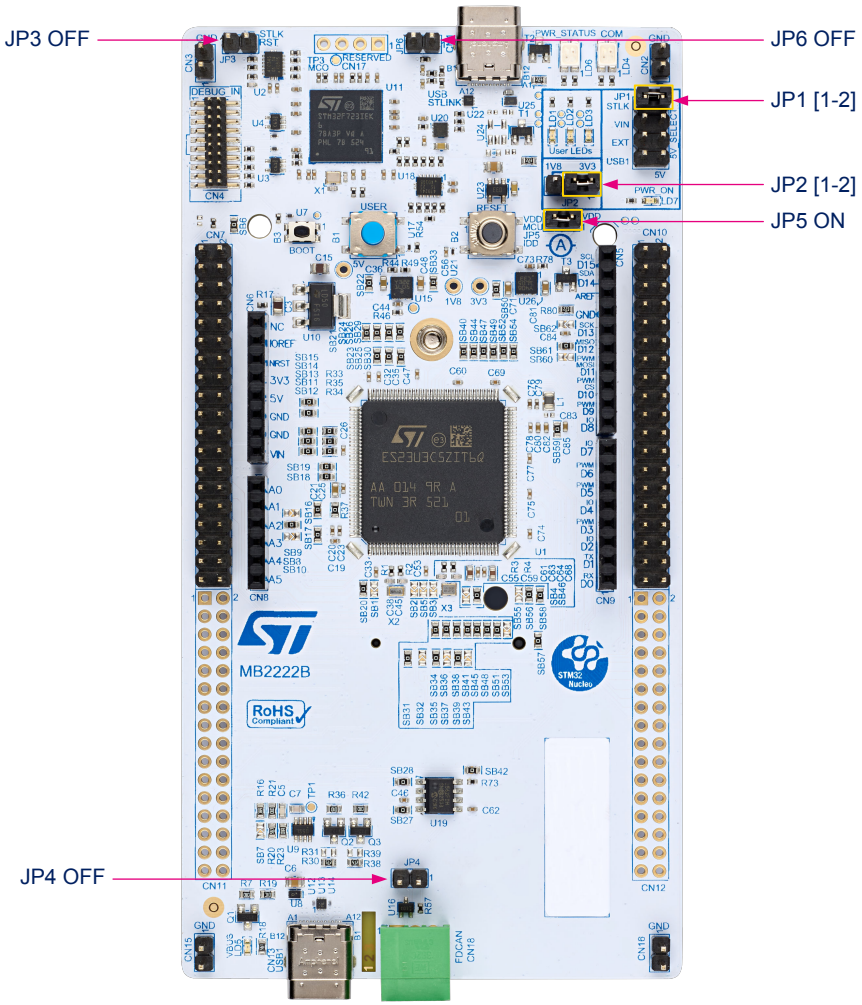
6.2 Default board configuration

By default, the NUCLEO-U3C5ZI-Q board is configured with ST-LINK power. The default jumper configuration and voltage setting are shown in Table 4.

Table 4. Default jumper configuration

Jumper	Definition	Default position	Comment
JP1	5 V power selection (user USB power source selection)	[1-2]	5 V from STLINK-V3EC
JP2	1.8 V/3.3 V selection	[1-2]	System power is 3.3 V by default
JP3	STLK_RST	OFF	-
JP4	CAN FD impedance matching	OFF	-
JP5	IDD measurement	ON	Used to give access to VDD MCU consumption
JP6	External debugger selection	OFF	“OFF” for debug with internal ST-LINK

Figure 3. Default board configuration



DT80211V1

7 Hardware layout and configuration

The NUCLEO-U3C5ZI-Q board is designed around the STM32U3C5ZIT6Q microcontroller in an LQFP144 package.

Figure 4 shows the connections between the STM32 and its peripherals (STLINK-V3EC, M.2 Key A serial memory connector, push-buttons, LEDs, USB, ST morpho headers, and FDCAN connector). Figure 5 shows the location of these features on the NUCLEO-U3C5ZI-Q board.

The mechanical dimensions of the board are shown in Figure 7.

7.1 Hardware layout

Figure 4. NUCLEO-U3C5ZI-Q block diagram

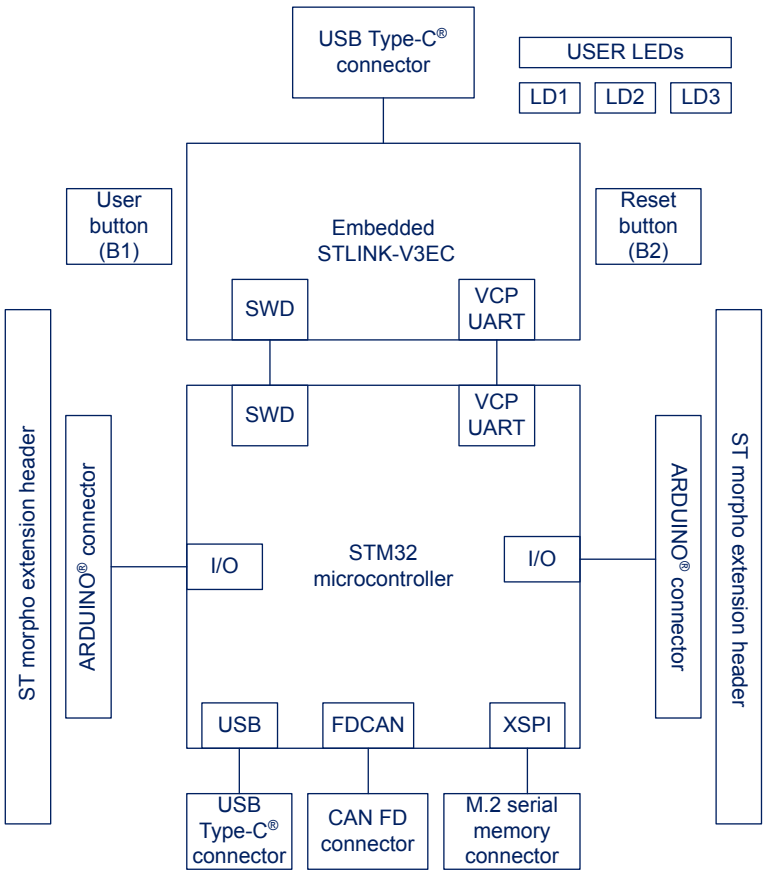


Figure 5. NUCLEO-U3C5ZI-Q top layout

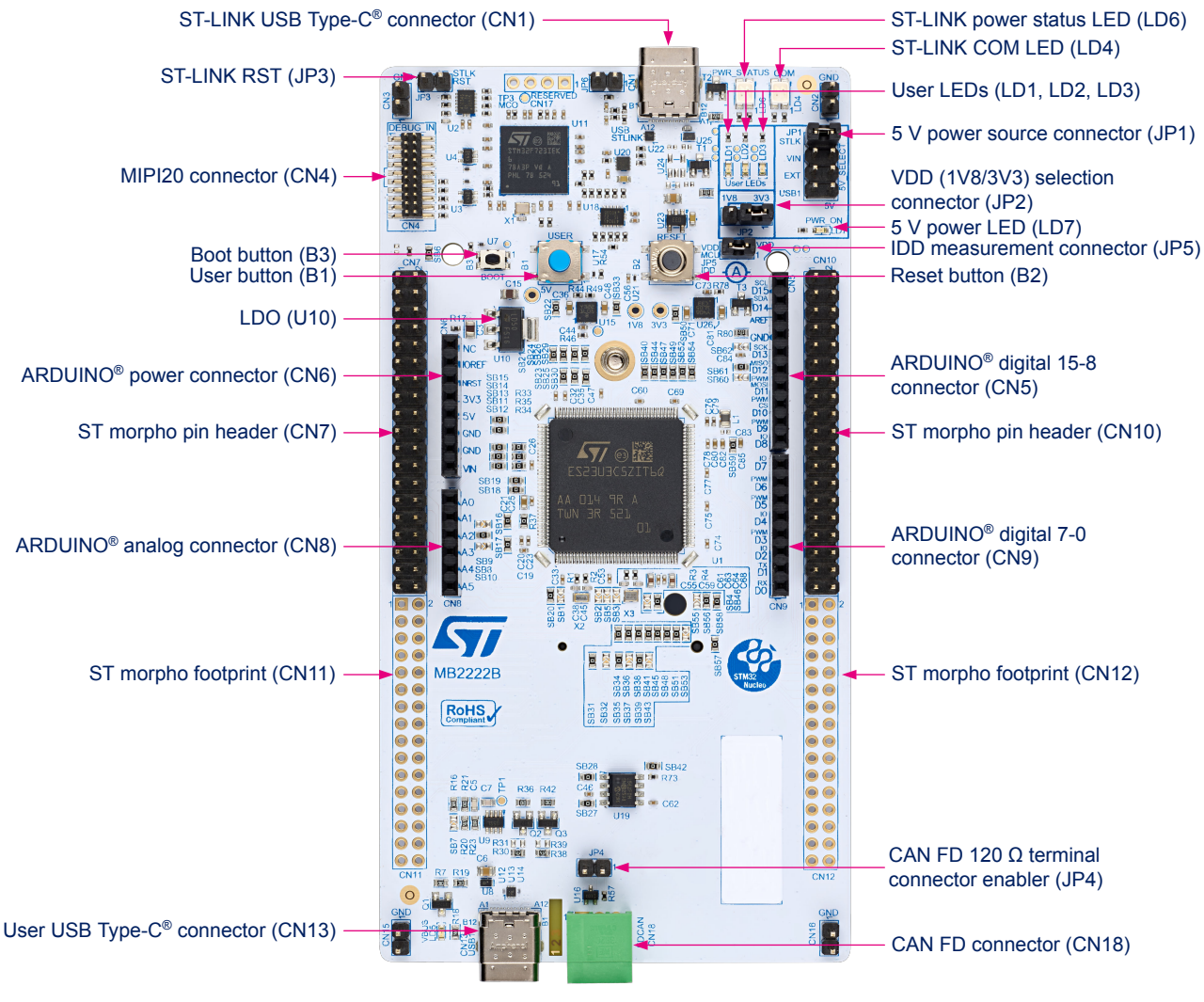
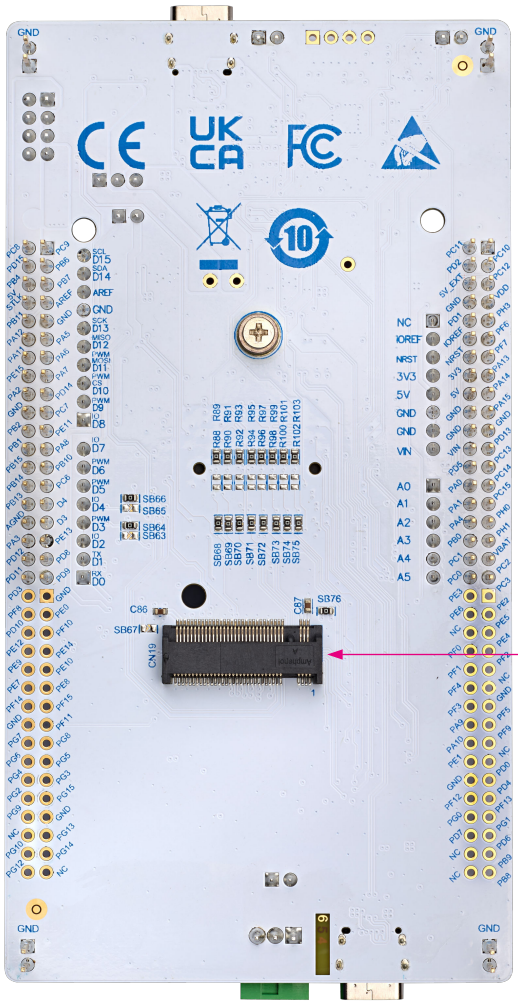
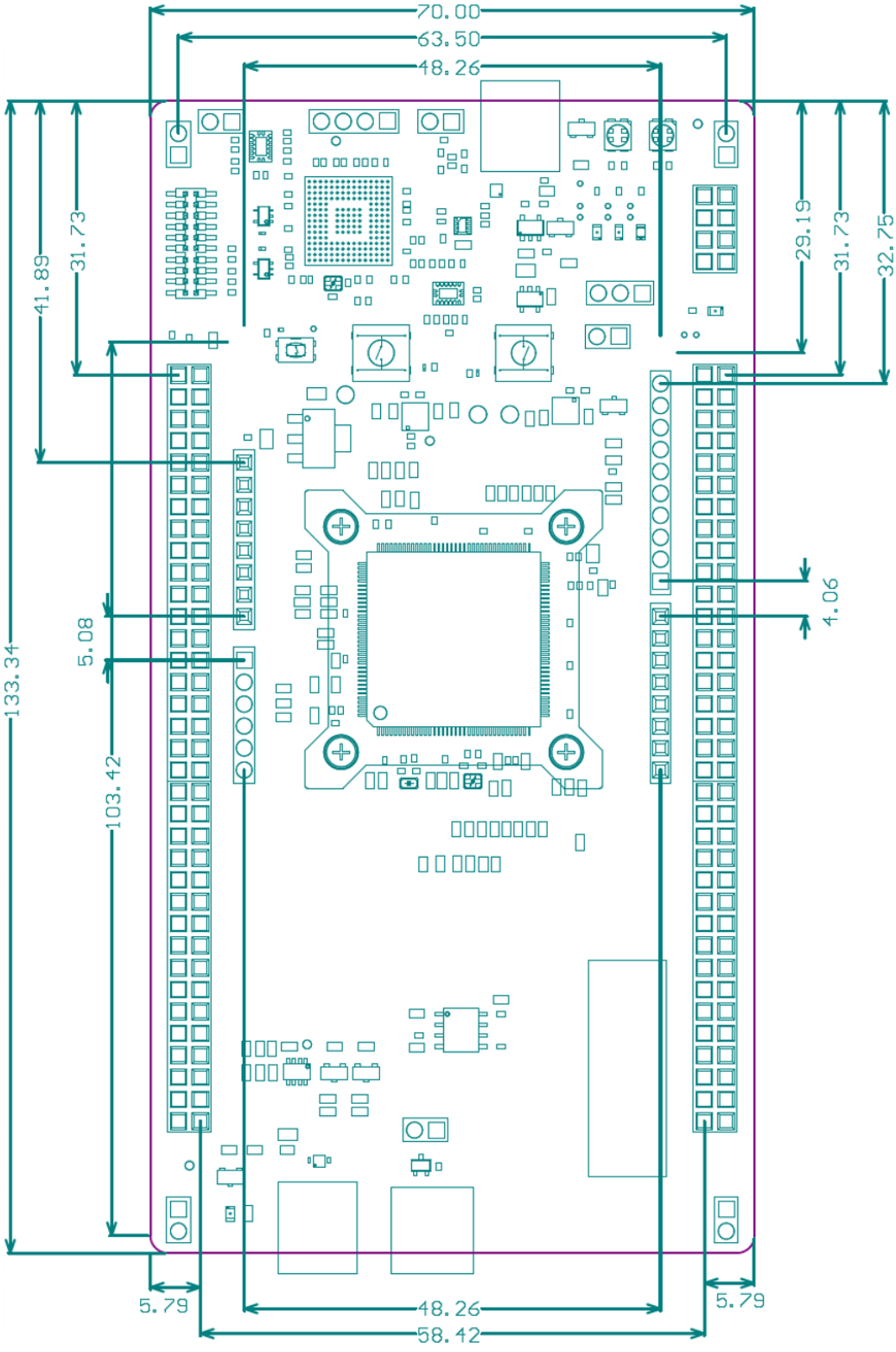


Figure 6. NUCLEO-U3C5ZI-Q bottom layout



7.2 Mechanical dimensions

Figure 7. **Board mechanical drawing (in millimeters)**



7.3 Embedded STLINK-V3EC

STLINK-V3EC is the embedded version of the STLINK-V3 included in the design of the NUCLEO-U3C5ZI-Q board. It allows access to the programming, debugging, and monitoring functions of the STM32 microcontroller through the USB STLK connector (CN1).

The STLINK-V3EC is integrated in the NUCLEO-U3C5ZI-Q board. It supports SWD and VCP/JTAG for STM32 devices.

STLINK-V3EC supports the following features:

- 5 V power supplied by the USB Type-C® connector (CN1)
- USB 2.0 high-speed-compatible interface
- JTAG and SWD protocols compatible with 1.7 to 3.6 V application voltage and 5 V tolerant input I/Os
- MIPI20 compatible connector (CN4)
- COM status LED (LD4), which blinks during communication with the PC
- Power status LED (LD6), which identifies the status of current output to the board

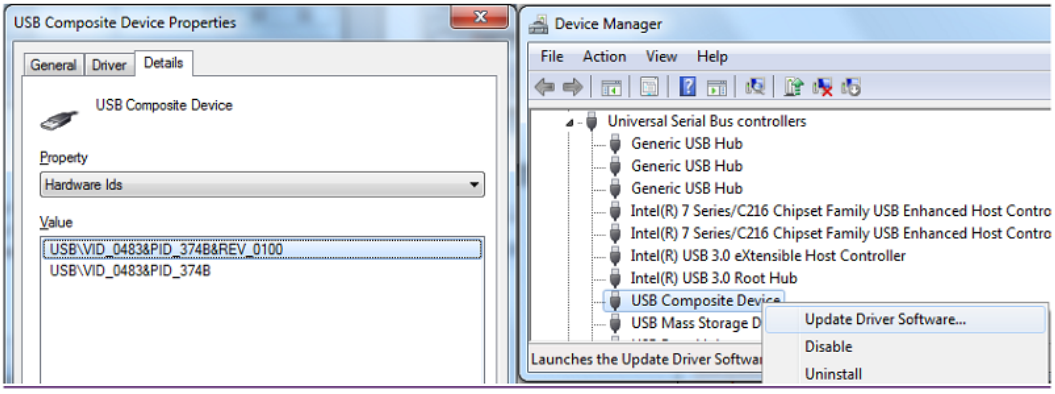
7.3.1 Drivers

Before connecting the NUCLEO-U3C5ZI-Q board to a Windows® PC through USB, the user must install a driver for STLINK-V3EC (not required for Windows® 10). It is available for download from the *st.com* website.

If the NUCLEO-U3C5ZI-Q board is connected to the PC before the driver is installed, some board 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 8.

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

Figure 8. USB Composite Device



Note: 37xx:

- *374E for STLINK-V3EC without bridge functions*
- *374F for STLINK-V3EC with bridge functions.*

7.3.2 Firmware upgrade

STLINK-V3EC embeds a firmware upgrade (STSW-LINK007) mechanism for in-place upgrades through the USB port. The firmware might evolve during the lifetime of the STLINK-V3EC product (for example, the addition of new functionalities, bug fixes, or support for new microcontroller families). It is recommended to visit the *st.com* website before using the NUCLEO-U3C5ZI-Q board and to stay up-to-date with the latest firmware version.

7.3.3 USB Type-C® connector

STLINK-V3EC supports the USB Type-C® connector.

7.3.4 Virtual COM port

The USART1 serial interface (PA9/PA10) is directly available as a Virtual COM port of the PC connected to the STLINK-V3EC USB connector (CN1). The VCP configuration is as follows:

- 8-bit data
- No parity
- One-stop bit
- No flow control

7.4 Power supply

7.4.1 External power supply input

The NUCLEO-U3C5ZI-Q Nucleo-144 board can take any of the following sources as its power supply:

- 5V_STLK: 5 V from the STLINK-V3EC USB Type-C® connector (CN1)
- 5V_VIN: 7 to 12 V from the ARDUINO®(CN6) or ST morpho (CN7) connector, with a 5 V adaptation using LDO (U10)
- 5V_EXT: external 5 V power from the ST morpho connector (CN7)
- 5V_USB_SINK: 5 V from the user USB Type-C® connector (CN13)
- 3V3 from the ARDUINO®(CN6) or ST morpho (CN7) connector

The power supply capabilities are summarized in Table 5.

Table 5. Power source capability

Input power name	Connector pins	Voltage range	Max. current	Limitation
5V_STLK	JP1 [1-2]	4.75 to 5.25 V	500 mA	ST-LINK manages the maximum current.
VIN (5V_VIN)	CN6 pin 8 CN7 pin 24 JP1 [3-4]	7 to 12 V	800 mA	From 7 to 12 V only and the input 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
5V_EXT	JP1 [5-6] CN7 pin 6	4.75 to 5.25 V	1.3 A	The maximum current depends on the power source. 1.3 A maximum is recommended for this Nucleo-144 board.
5V_USB_SINK(1)	JP1 [7-8]	4.75 to 5.25 V	500 mA	The maximum current depends on the USB Host used to power the Nucleo-144 board. 500 mA maximum is recommended for this board. In the default configuration, the board cannot be powered up this way(1).
3V3	CN6 pin 4 CN7 pin 16	3.0 to 3.6 V	-	The maximum current depends on the 3V3 source. The 3V3 source can be used when the STLINK-V3EC part of the PCB is not used. SB50 can be OFF to protect LDO (U26).
VDD_MCU	JP5 pin 2	1.71 to 3.6 V	-	It is possible to power only the MCU power supply pins by applying a voltage source on JP5 pin 2. In this case, only the MCU is powered. External functions like debugging, LED, or expansion connectors are not powered. This option can be used for MCU power consumption measurement.

1. *By default, in Self-Powered mode (R36 and R42 ON, Q1 and Q2 ON, and R31 and R39 OFF), the board cannot be powered up through the user USB. Set the board configuration to Bus-Powered mode (R36 and R42 OFF, Q1 and Q2 OFF, and R31 and R39 ON) so the board can be powered up through the user USB.*

5V_STLK

5V_STLK is a DC power with the limitation of the STLINK-V3EC USB Type-C® connector (CN1). In this case, the JP1 jumper must be on pin [1-2] to select the 5V_STLK power source.

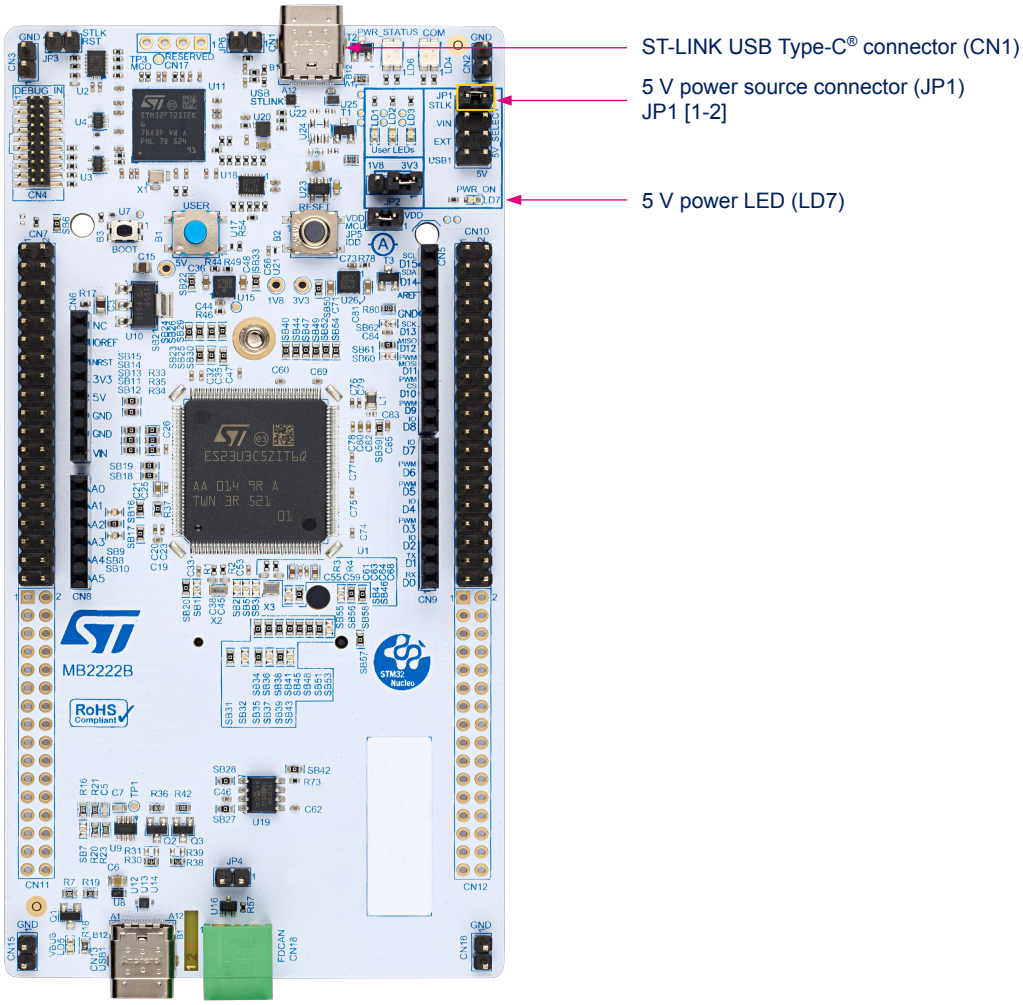
This is the default setting. If the USB enumeration succeeds, the 5V_STLK power is enabled by asserting the T_PWR_EN signal from the STLINK-V3EC MCU (U11). This pin is connected to the power eFuse (U20), which powers the board. This power eFuse also features a fast overvoltage current limitation, to protect the PC in case of an onboard short circuit. The STLINK-V3EC MCU (U11) determines the maximum current.

The NUCLEO-U3C5ZI-Q Nucleo-144 board and its shield can be powered by the STLINK-V3EC USB connector (CN1), but only the STLINK-V3EC circuit has power before USB enumeration, because the host PC only provides 100 mA to the board. During USB enumeration, the Nucleo board requires a 500+ mA current to the USB Host.

If the host can provide the required power, the enumeration finishes with a *SetConfiguration* command. Then, the power eFuse (U20) is switched on and the green LED (LD7) is turned on. The Nucleo board and its shield can now consume up to 500 mA.

For a 5V_STLK power supply, the JP1 jumper is set on [1-2], as shown in Figure 9.

Figure 9. JP1 [1-2]: 5V_STLK power source

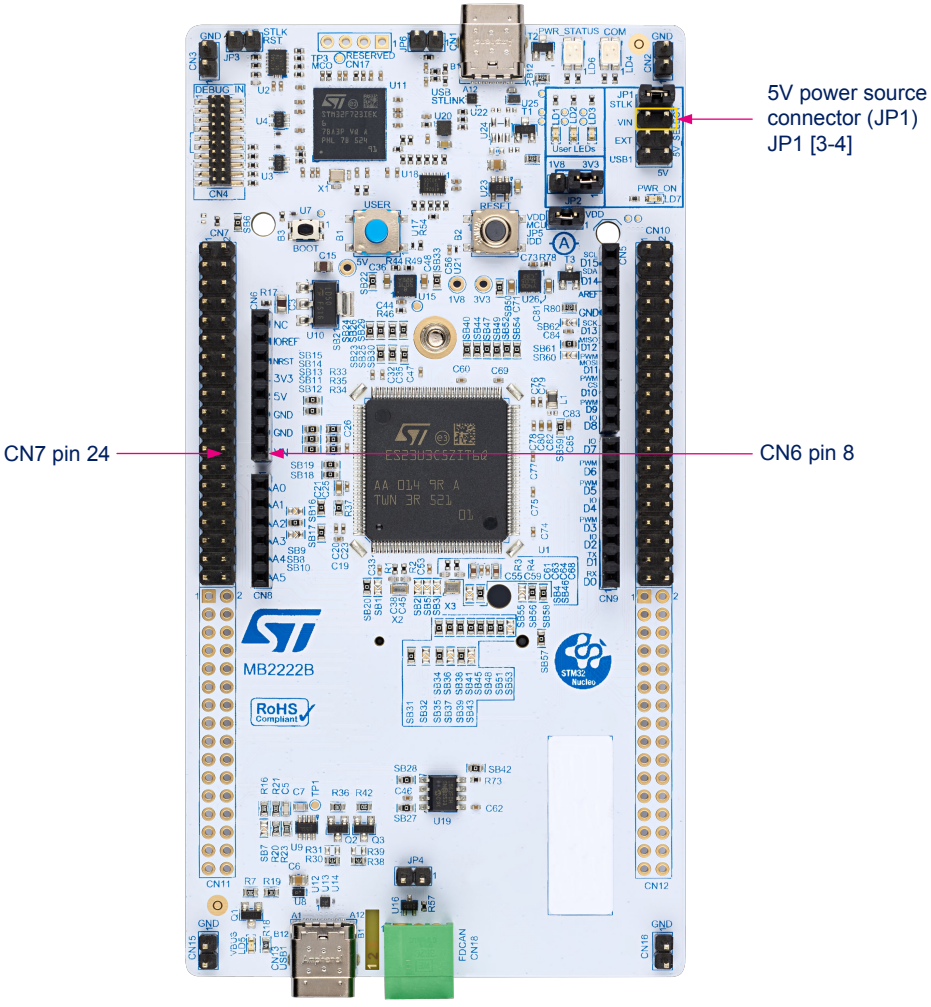


VIN (5V_VIN)

VIN (5V_VIN) is the 7 to 12 V DC power from the ARDUINO® connector (CN6) pin 8 named VIN on the connector silkscreen or from the ST morpho connector CN7 pin 24. In this case, the JP1 jumper must be on pin [3-4] to select the 5V_VIN power source. In this configuration, DC power comes from the power supply through the ARDUINO® Uno V3 battery shield (compatible with the Adafruit® PowerBoost 500 shield).

For a 5V_VIN power supply, the JP1 jumper is set on [3-4], as shown in Figure 10.

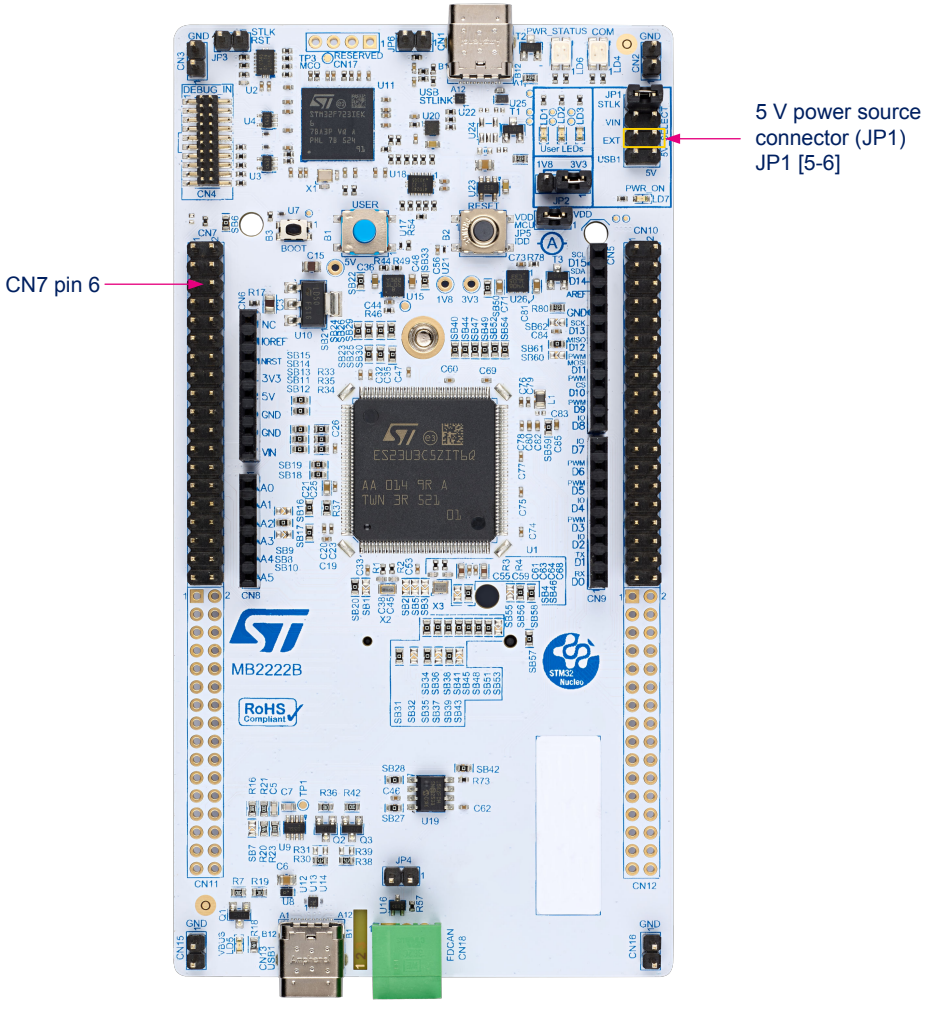
Figure 10. JP1 [3-4]: 5V_VIN power source



5V_EXT

5V_EXT is the DC power coming from an external 5 V DC power source from the ST morpho connector (CN7) pin 6. The 5V jumper selection (JP1) must be on pin [5-6] to select the E5V power source on the JP1 connector, and it must be configured as shown in Figure 11.

Figure 11. **JP1[5-6]: 5V_EXT power source**



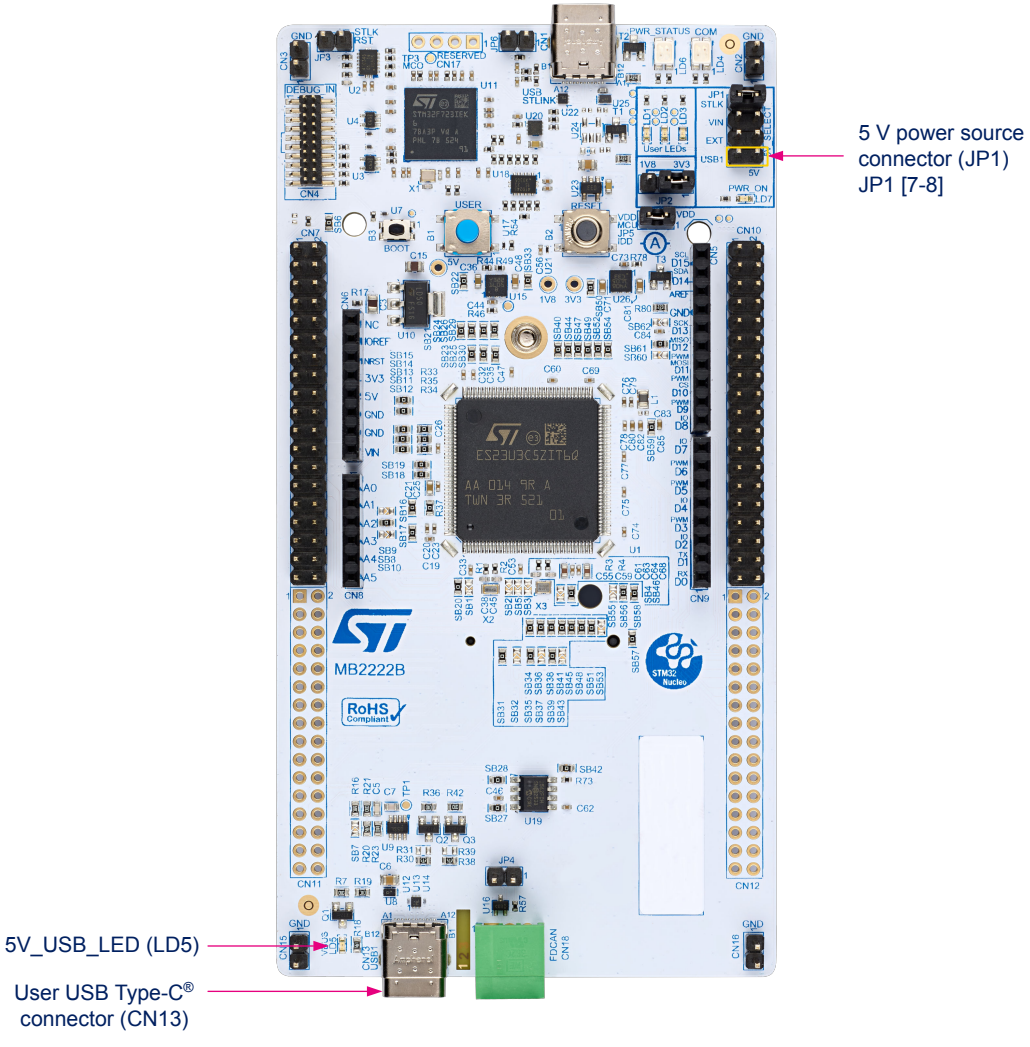
5V_USB_SINK

5V_USB_SINK is the DC power supply connected to the USB Type-C® user connector (CN13) when it is used as a sink port. In this case, the JP1 jumper must be [7-8] to select the USB PD power source. The green LED (LD5) is turned on.

5V_USB_SNK configuration: the JP1 jumper must be on [7-8] as shown in Figure 12.

By default, in Self-Powered mode (R36 and R42 ON, Q1 and Q2 ON, and R31 and R39 OFF), the board cannot be powered up through the user USB. Set the board configuration to Bus-Powered mode (R36 and R42 OFF, Q1 and Q2 OFF, and R31 and R39 ON) so the board can be powered up through the user USB.

Figure 12. JP1 [7-8]: 5V_USB_SNK power source



External 3V3

In certain scenarios, like when the 3.3 V supply is provided by an extension board, it can be interesting to use an external 3.3 V source on the 3V3 input (CN6 pin 4 and CN7 pin 16). When the NUCLEO-U3C5ZI-Q Nucleo-144 board is powered by a 3.3 V source only, STLINK-V3EC is not powered and programming and debugging are unavailable.

Warning: *When using the 3V3 input, the STLINK-V3EC part is not supplied. For this configuration, it is recommended to remove SB50 to avoid backward voltage to 5 V through U26.*

VDD_MCU

In certain scenarios, it can be interesting to use an external power source from 1.71 to 3.6 V, to power only the MCU power supply pins (JP5 pin 2). In this configuration, external functions like debug, LED, or the expansion connector are not powered. This option can be used to optimize MCU power consumption measurement.

7.4.2 Programing/debugging when the power supply is not from STLINK-V3EC (5V_STLK)

If the current consumption of the NUCLEO-U3C5ZI-Q and expansion boards exceeds the allowed current on the ST-LINK USB connector, the external power sources VIN, E5V, or USB-USER can be used. In this scenario, the embedded ST-LINK can still be used for Virtual COM port (VCP), programming, and debugging.

The following power sequence procedure must be followed:

1. Set the JP1 jumper according to the selected 5 V external power source.
2. Connect the external power source as per the JP1 configuration.
3. Turn on the external power supply.
4. Verify that the 5 V green LED (LD7) is illuminated.
5. Connect the PC to the USB connector (CN1) for programming and debugging.

7.4.3 Power supply output

5V

Regardless of the power source (5V_STLK, 5V_VIN, 5V_EXT, or 5V_USB_SINK), the 5 V generated is available on CN6 pin 5 or CN7 pin 18. It can be used as an output power supply for an ARDUINO® shield or an extension board. In this case, the maximum current of the power source specified in Table 5 must be adhered to.

3V3

The internal 3V3, on CN6 pin 4 or CN7 pin 16, can be used also as a power supply output. The current is limited by the maximum current capability of the U26 regulator.

7.4.4 Internal power supply

The NUCLEO-U3C5ZI-Q Nucleo-144 board is designed to support two specific voltage configurations:

- VDD at 3.3 V
- VDD at 1.8 V

3V3

Regardless of the 5 V power source, an LDO (U26) is used to deliver a fixed 3.3 V power voltage from a 5 V source. To select the 3.3 V voltage for the VDD, set the JP2 jumper to position [1-2]. A solder bridge (SB50) enables the option to disconnect the 3.3 V output:

- SB50 ON: the U26 LDO output provides a 3.3 V power supply (default configuration).
- SB50 OFF: the U26 LDO output does not provide a 3.3 Vpower supply.

1V8

An LDO (U15) is used to deliver a fixed 1.8 V power voltage from a 3.3 V source. Before using the 1.8 V voltage, ensure that all interfaces connected to the board are compatible with 1.8 V. To select 1.8 V for the VDD, connect the VDD jumper (JP2) to pin [2-3]. In this mode, some MCU voltage domains can remain at 3.3 V depending on the application use case. The MCU voltage selection is determined by the solder bridge configuration. Refer to Table 6 for the solder bridge configuration.

JP2 VDD voltage selection for 1V8/3V3 power sources

The JP2 jumper selects the VDD voltage:

- Set JP2 on [1-2] to configure VDD to 3.3 V.
- Set JP2 on [2-3] to configure VDD to 1.8 V.

The consumption on this jumper includes the MCU power pins connected to the VDD_MCU power line and other features supplied by VDD, such as:

- The level shifter power supply pins for STLINK-V3EC
- The user button
- The ARDUINO® shield on the IOREF pin
- The power supply pins on the ST morpho connector

MCU power supply

The default configuration of the MCU power pins is described in Table 6.

Table 6. MCU power configuration

Solder bridge configuration(1)	MCU power pins	MCU power supply
SB10	VDDIO2(2)	Power supply from M.2 serial daughter board (through CN19 pin6)
SB8		Power supply by VDD_MCU (1.8/3.3 V)
SB9		Power supply by fixed 3V3
SB56	VDDA	Power supply by VDD_MCU (1.8/3.3 V)
SB55		Power supply by fixed 3V3
SB58	VREFP	Power supply by VDD_MCU or fixed 3V3 (align with VDDA)
SB21	VDDUSB	Power supply by fixed 3V3
SB59	VDDSMPS	Power supply by VDD_MCU

1. *The default configuration is shown in bold.*
2. *VDDIO2 is a dedicated power domain for PG [2-15] and can be powered separately.*

Internal VCORE SMPS power supply

The power consumption in Run mode is significantly improved by generating the VCORE logic supply using the internal DC-DC converter. This feature is available only on boards with the "-Q" suffix.

For general information regarding design recommendations for STM32U3MCUs with an internal switched-mode power supply (SMPS) and the design guide for ultralow-power applications with performance, refer to the application note *Getting started with STM32U3 MCU hardware development* (AN6011), available from st.com.

VDD_MCU IDD measurement

The labeled IDD jumper (JP5) measures the consumption of the STM32 microcontroller. To measure the current consumption, remove the jumper and connect an ammeter or another current measurement tool.

- Jumper ON: the STM32 microcontroller is powered (default).
- Jumper OFF: connect an ammeter or an external 3.3 V power source to power the STM32 microcontroller and measure its consumption.

The IDD jumper can be used to measure the current consumption for both 3.3 V and 1.8 V MCU voltages.

7.5 Clock sources

Three clock sources are described below:

- LSE is the 32.768 kHz crystal for the STM32 embedded RTC.
- MCO is the 8 MHz clock from STLINK-V3EC for the STM32 microcontroller. It is not connected by default.
- HSE is the 16 MHz oscillator for the STM32 microcontroller. It is not mounted by default.

7.5.1 LSE clock references

There are three methods to set up the pins associated with the low-speed clock (LSE), which are detailed below.

LSE on-board oscillator X1 crystal (default configuration)

Refer to the application note *Guidelines for oscillator design on STM8AF/AL/S and STM32 MCUs/MPUs* (AN2867), with the following characteristics: 32.768 kHz, 1.5 pF, and 20 ppm. The following configuration is needed:

- R1 and R2 ON
- SB1 and SB2 OFF

External oscillator on PC14

The input clock comes from an external oscillator via the PC14 signal on the ST morpho connector (CN7 pin 25). The following configuration is needed:

- R1 and R2 OFF
- SB1 ON

LSE not used

PC14 and PC15 are used as GPIOs instead of low-speed clocks. The following configuration is needed:

- R1 and R2 OFF
- SB1 and SB2 ON

7.5.2 HSE clock references

There are four ways to configure the pins corresponding to the external high-speed clock (HSE), which are detailed below.

HSE on-board oscillator X3 crystal

For typical frequencies, capacitors, and resistors, refer to the STM32 microcontroller datasheet. Refer to the application note *Guidelines for oscillator design on STM8AF/AL/S and STM32 MCUs/MPUs* (AN2867). The X3 crystal has the following characteristics: 16 MHz, 6.2 pF, and 20 ppm. The following configuration applies:

- R3 and R4 ON
- SB5 (MCO) OFF
- SB3 and SB4 OFF

MCO from STLINK-V3EC

The MCO output of the STLINK-V3EC MCU is used as an input clock. This frequency cannot be changed. It is fixed at 8 MHz and connected to the PH0 OSC_IN pin of the STM32 microcontroller. The frequency might be changed during an ST-LINK firmware upgrade (refer to RN0093 for further details). The use of this clock source requires the following configuration:

- R3 and R4 OFF
- SB5 (MCO) ON
- SB3 and SB4 OFF

External oscillator on PH0

The input clock comes from an external oscillator through PH0, CN7 pin 29. The following configuration is required

- R3 and R4 OFF
- SB5 (MCO) OFF
- SB3 ON

HSE not used (default configuration)

PH0 and PH1 are used as GPIOs instead of clocks. This requires the following configuration:

- R3 and R4 OFF
- SB5 (MCO) OFF
- SB3 and SB4 ON

7.6 Boot modes

There is one BOOT (PH3-BOOT0) pin connected on this board to select the boot modes:

- **BOOT0 = 0: Boot from user flash memory (default configuration).**
- BOOT0 = 1: Boot from system memory (bootloader).

By default, BOOT0 is pulled down. To achieve a high voltage level, there are two options:

- Press the button (B3) to pull BOOT0 to a high voltage level. Note that once the button is released, BOOT0 returns to a low level.
- Use a jumper to short CN7 pin 5 and pin 7 (BOOT0 is shorted to VDD).

7.7 Reset sources

The reset signal of the NUCLEO-U3C5ZI-Q Nucleo-144 board is active LOW and the reset sources include:

- Reset button (B2)
- Embedded STLINK-V3EC (CN1)
- ARDUINO® connector (CN6 pin 3)
- ST morpho connector (CN7 pin 14)

7.8 LEDs

The NUCLEO-U3C5ZI-Q Nucleo-144 board contains seven LEDs:

- 5V_PWR LED (LD7). This green LED indicates that the STM32 part is powered by a 5 V source.
- User LEDs (LD1, LD2, LD3).
  - The green LED (LD1) is connected to PA5 (ARDUINO® D13) through SB61 by default. It can be connected to PE12 through SB60, which is not mounted by default.
  - The red LED (LD2) is connected to PE14.
  - The blue LED (LD3) is connected to PF8.
- USB Type-C® 5 V LED (LD5). This green LED shows the presence of V_{BUS} on CN13.
- STLINK-V3EC tricolor LEDs (LD4 and LD6). The tricolor (green, orange, and red) LEDs provide information about STLINK-V3EC communication status (LD4) and power status (LD6). For detailed information about these LEDs, refer to the technical note *Overview of STLINK derivatives* (TN1235).

7.9 Push-buttons

Two push-buttons are available on the NUCLEO-U3C5ZI-Q Nucleo-144 board:

- Reset button (B2). This 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.
- User button (B1). The blue button for user and wake-up functions is connected to PC13 to support the default tamper and wake-up functions of the STM32 microcontroller. When the button is pressed, the logic state is HIGH; otherwise, the logic state is LOW.

8 Board connectors

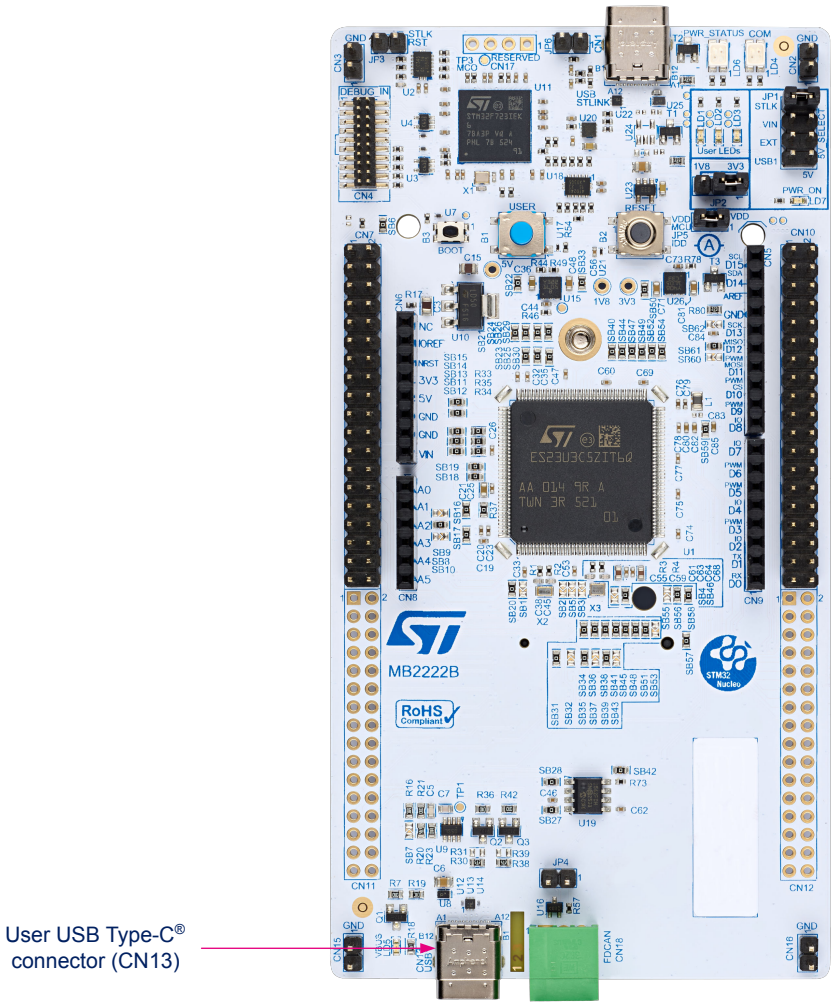
8.1 USB Type-C® (USB FS, sink only) (CN13)

The NUCLEO-U3C5ZI-Q Nucleo-144 board supports USB full-speed (USB FS) communication. The USB connector (CN13) is a USB Type-C® connector.

The NUCLEO-U3C5ZI-Q board supports the USB Type-C® sink power mode only.

The green USB power LED (LD5) lights up when V_{BUS} is powered by a USB Host and the board works as a USB Device.

Figure 13. USB Type-C® (CN13)



Operating mode

The USB Type-C® connector has two operating modes, each independently USB-certified based on hardware adaptation. Table 7 shows the different operating modes for the USB Type-C® connector. The default configuration is shown in bold.

Table 7. USB Type-C® operating modes

Operating mode	Configuration
Self-Powered mode	**R36 ON, R31 OFF, Q2 ON(1)**
Bus-Powered mode	R36 OFF, R31 ON, Q2 OFF

1. *In Self-Powered mode, U9, R23, and C7 are unnecessary and can be removed.*

Detection pin power level configuration

VBUS.DET is connected to the PF12 MCU pin for V_{BUS} insertion detection (with GPIO interrupt, not ADC sensing). Since there are two possible power levels (1.8V and 3.3V), the detection pin level must be adjusted as shown in Table 8. The default configuration is shown in bold.

Table 8. Detection pin power level configuration

VDDIO	Configuration
1.8V	SB7 ON
3.3V	**SB7 OFF**

8.2 M.2 Key A serial memory connector (CN19)

The bottom side of the NUCLEO-U3C5ZI-Q Nucleo-144 board contains an M.2 connector (CN19) to support memory extension with daughter boards.

An M.2 connector (CN19) has been implemented on the bottom side to support the extension of memory daughter boards. Depending on the design of the daughter board, the NUCLEO-U3C5ZI-Q board can operate with various types of memory through this connector. For example, the B-M2MEM-PACK1 M.2 serial memory pack includes a set of five different nonvolatile memory boards.

Table 9 provides the configuration of the M.2 Key A serial memory connector for this NUCLEO-U3C5ZI-Q board. Default configurations are shown in bold. For further details on the M.2 serial memory pack, refer to the technical note *M.2 serial memory pack interface specification* (TN1618).

Figure 14. **M.2 Key A serial memory connector (CN19)**

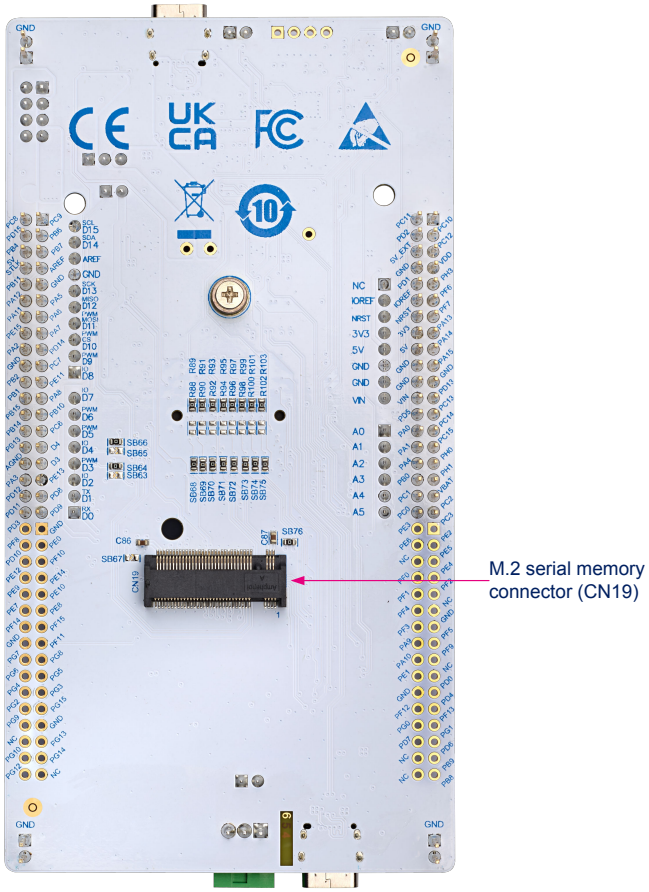


Table 9. **M.2 Key A serial memory connector (CN19) configuration**

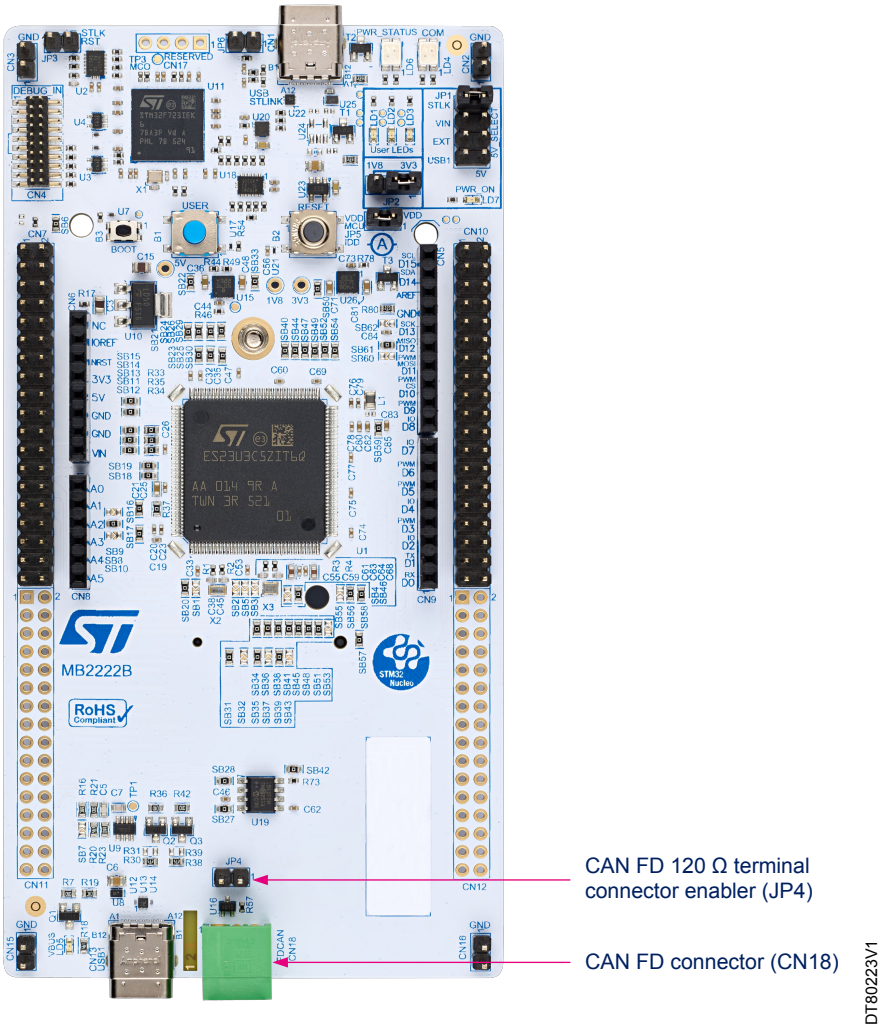
Pin number	Pin name	MCU pin	Function
2, 4, 72, 74	3V3	-	Power input for memory daughter board. For this Nucleo, it connects to fixed 3V3 when **SB76 ON, SB67 OFF**.
6	VDDIO1	-	Power output from memory daughter board. When using this power as input for the MCU VDDIO2 (SB10 ON, SB9 OFF, SB10 OFF), the PG [2-15] I/O power level is aligned with the corresponding signals from the daughter board.
68	VDDIO2	-	-
37	OSPI1_D0	PG4	Octo-SPI signals.
35	OSPI1_D1	PG5	
34	OSPI1_D2	PG8	
32	OSPI1_D3	PG2	
31	OSPI1_D4	PG3	
28	OSPI1_D5	PG6	
26	OSPI1_D6	PG9	
27	OSPI1_D7	PG10	
67	OSPI2_D0	PG4	Octo-SPI signals, multiplexed with Octo-SPI1.
65	OSPI2_D1	PG5	

Pin number	Pin name	MCU pin	Function
61	OSPI2_D2	PG8	Octo-SPI signals, multiplexed with Octo-SPI1.
59	OSPI2_D3	PG2	
55	OSPI2_D4	PG3	
53	OSPI2_D5	PG6	
49	OSPI2_D6	PG9	
47	OSPI2_D7	PG10	
22	OSPI1_NCS	PG12	**SB35 ON**; **SB32 OFF**; **SB37 OFF**; PG12 is used as Octo-SPI1 NCS.
20	-		SB35 OFF; SB32 ON; SB37 OFF; PG12 is reserved as Quad-SPI2 NCS.
54	OSPI2_NCS		SB35 OFF; SB32 OFF; SB37 ON; PG12 is reserved as Octo-SPI2 or Quad-SPI3 NCS.
52	-	-	-
25	OSPI1_DQS	PG15	**SB39 ON**; **SB43 OFF**; PG15 is used as Octo-SPI1 DQS
56	OSPI2_DQS		SB39 OFF; SB43 ON; PG15 is used as Octo-SPI2 DQS.
48	-	-	Reserved pins.
46	-	-	
41	OSPI1_CLK	PG13	Octo-SPI CLK.
43	OSPI1_NCLK	PG14	
71	OSPI2_CLK	PG13	Octo-SPI CLK, multiplexed with Octo-SPI1.
73	OSPI2_NCLK	PG14	
66	NRST	PG7/NRST	**SB51 ON**; **SB53 OFF**; PG7 is used as the reset input. SB51 OFF; SB53 ON; "NRST" system reset is used as the reset input.
64	VDDIO_SPI_I2C	-	Power of SPI, I^2C interface, connected to VDD.
60	I2C_SCL	PB6	I^2C signals, multiplexed with ARDUINO® I^2C.
58	I2C_SDA	PB7	
21	GPIO_SPI_NSS	PD6	SPI signals, multiplexed with ARDUINO® SPI.
16	GPIO_SPI_SCK	PA5	
19	GPIO_SPI_MISO	PA6	
17	GPIO_SPI_MOSI	PA7	
62	GPIO/ERR/INT_2	PF14	GPIO.
42	GPIO-LED1	PF10	GPIO.
38	GPIO-LED2	PF11	GPIO.
18	GPIO-LDO_EN	PD4	GPIO.
40	GPIO/ERR/INT_1	PF15	GPIO.
1, 7, 23, 24, 29, 30, 33, 36, 39, 44, 45, 50, 51, 57, 63, 69, 70, 75	GND	-	-

8.3 CAN FD header connector (CN18)

The NUCLEO-U3C5ZI-Q Nucleo-144 board supports the FDCAN feature. A CAN transceiver (U19) is implemented on the board to convert Tx (PB9) and Rx (PB8) signals into differential CAN-H (CAN_P) and CAN-L (CAN_N) signals. CAN_P and CAN_N are accessible through the FDCAN connector (CN18). A 120 Ω termination resistor (R57) is included on the board, and users can enable or disable this resistor through the JP4 jumper.

Figure 15. FDCAN connector (CN18)



8.4 MIPI20 connector (CN4)

The NUCLEO-U3C5ZI-Q Nucleo-144 board supports an external debug tool through the CN4 connector for SWD/JTAG and trace debugging.

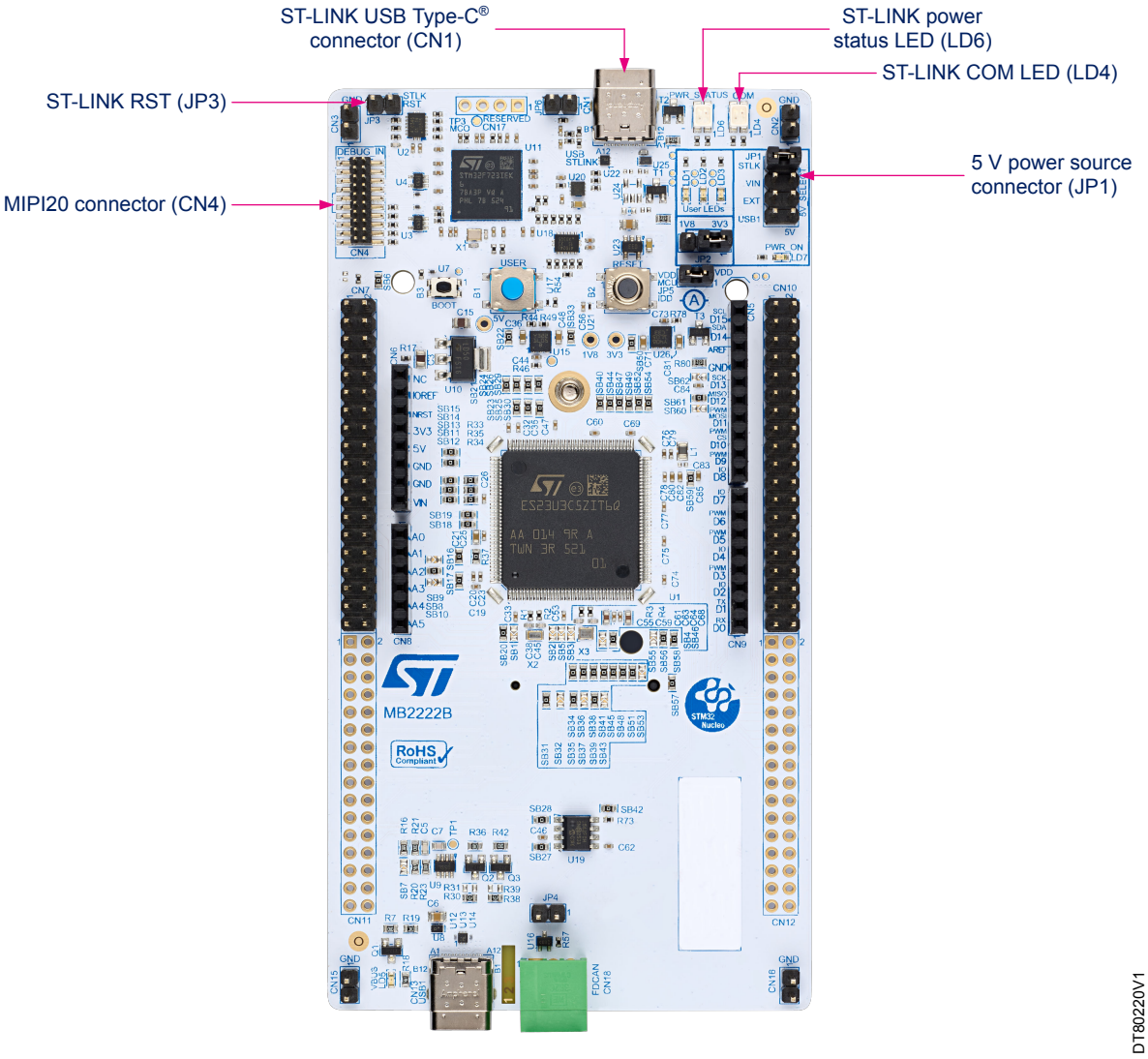
Power on the STLINK-V3EC until the COM LED (LD4) illuminates red and ensure the it remains operational. Connect the external debug tool using the MIPI20 debug connector (CN4).

Table 10 provides the MIPI20 connector pinout.

Table 10. MIPI20 debug connector (CN4) pinout

MIPI20 pin number	Signal name	STM32 pin	Function
1	3V3	-	Target power
2	DBGIN.SWDIO	PA13	Target SWDIO using SWD protocol or target JTMS (T_JTMS) using JTAG protocol
4	DBGIN.SWCLK	PA14	Target SWCLK using SWD protocol or target JTCK (T_JTCK) using JTAG protocol
6	DBGIN.SWO	PB3	Target SWO using SWD protocol or target JTDO (T_JTDO) using JTAG protocol
7	KEY	-	NC
8	DBGIN.JTDI	PA15	Not used by SWD protocol, target JTDI (T_JTDI) using JTAG protocol (SB22 ON)
10	NRST	NRST	Target NRST
12	TRACE.CLK	PE2	Trace clock signal
14	TRACE.D0	PE3	Trace data0 signal
16	TRACE.D1	PE4	Trace data1 signal
18	TRACE.D2	PE5	Trace data2 signal
20	TRACE.D3	PE6	Trace data3 signal
11 and 13	-	-	Through R5 to GND By default, R5 is OFF
3, 5, 9, 15, 17, and 19	GND	-	Ground

Figure 16. **MIPI20 connector (CN4)**



8.5 ARDUINO® Uno V3 connectors (CN5, CN6, CN8, CN9)

The ARDUINO® connectors (CN5, CN6, CN8, and CN9) are female connectors supporting the ARDUINO® Uno V3 standard.

Figure 17 indicates where the connectors are situated on the board and tables 11, 12, 13, and 14 provide their pinout configurations.

Figure 17. ARDUINO® Uno V3 connectors

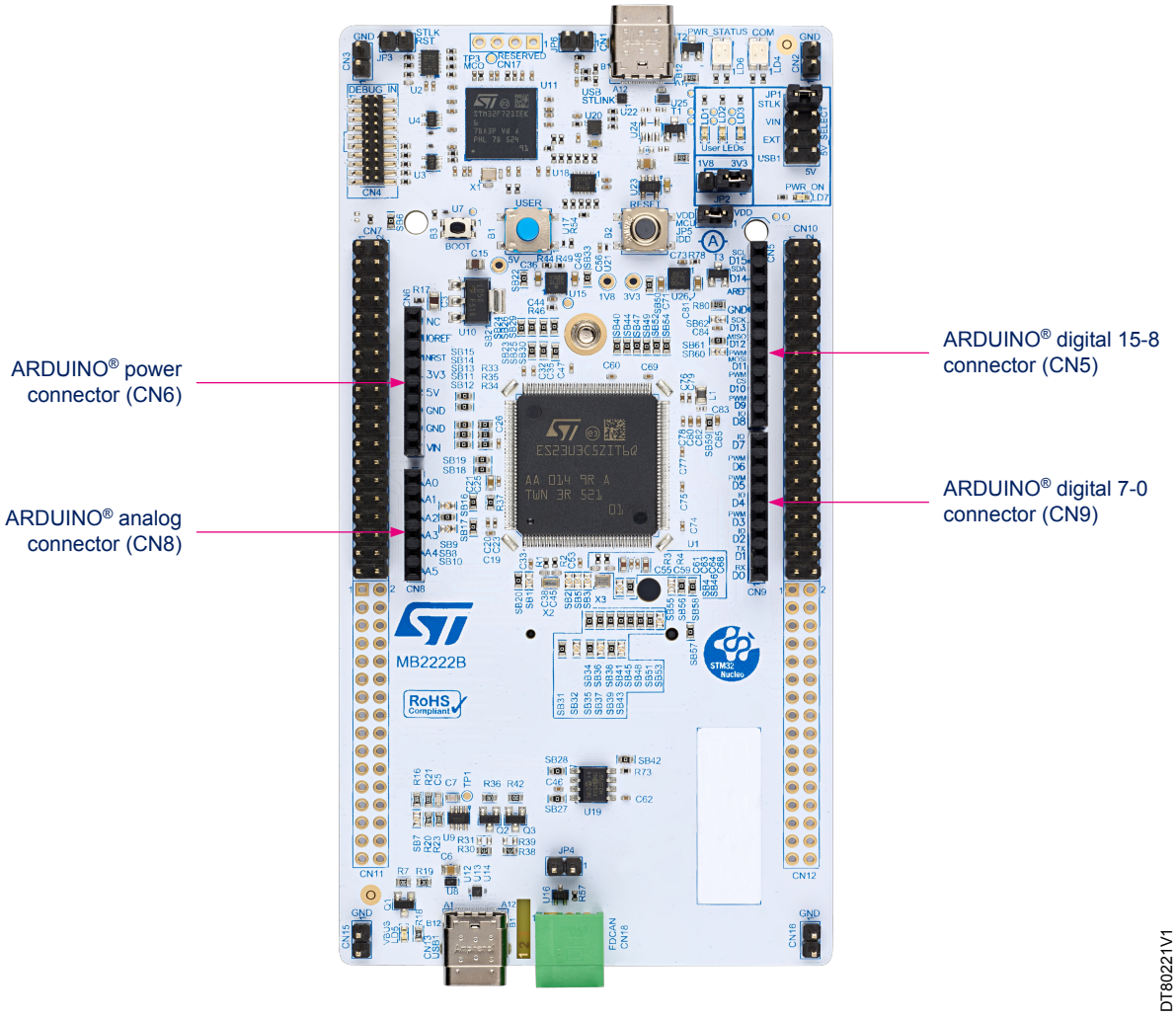


Table 11. ARDUINO® power connector (CN6) pinout

Pin number	Pin name	Signal name	STM32 pin	MCU function
1	NC	NC	-	RESERVED
2	IOREF	IOREF	-	I/O REF
3	NRST	NRST	NRST	RESET
4	3V3	3V3	-	3V3 power input for ARDUINO® daughter board
5	5V	5V	-	5 V power input for ARDUINO® daughter board
6	GND	GND	-	GND
7	GND	GND	-	GND
8	VIN	VIN	-	VIN (7-12 V) power for Nucleo board

Table 12. **ARDUINO® analog connector (CN8) pinout**

Pin number	Pin name	Signal name	STM32 pin	MCU function
1	A0	ADC	PA0	ADC1_IN3
2	A1	ADC	PA1	ADC1_IN4
3	A2	ADC	PA4	ADC1_IN7
4	A3	ADC	PB0	ADC1_IN13
5	A4	ADC	PC1	ADC1_IN2/I2C3_SDA/I3C2_SDA
6	A5	ADC	PC0	ADC1_IN1/I2C3_SCL/I3C2_SCL

Table 13. **ARDUINO® digital connector (CN9) pinout**

Pin number	Pin name	Signal name	STM32 pin	MCU function
8	D7	PA8	PA8	IO
7	D6	PB10	PB10	TIM2_CH3
6	D5	PC6	PC6	TIM3/8_CH1
5	D4	ARD_D4	PB5 **PE10**	IO
4	D3	ARD_D3	PB3 **PE9**	TIM2_CH2 (PB3) TIM1_CH1 (PE9)
3	D2	PE13	PE13	IO
2	D1	PD8	PD8	USART3_TX
1	D0	PD9	PD9	USART3_RX

Table 14. **ARDUINO® digital connector (CN5) pinout**

Pin number	Pin name	Signal name	STM32 pin	MCU function
10	SCL	PB6	PB6	I2C1/4_SCL/ I3C1/2_SCL
9	SDA	PB7	PB7	I2C1/4_SCL/ I3C1/2_SDA
8	AREF	-	-	Connected to VERFP though SB62(NC)
7	GND	GND	-	-
6	D13	PA5	PA5	SPI1_SCK
5	D12	PA6	PA6	SPI1_MISO
4	D11	PA7	PA7	SPI1_ MOSI TIM1_CH1N/TIM3_CH2 /TIM8_CH1N/ TIM17_CH1/LPTIM2_CH2
3	D10	PD14	PD14	IO TIM4_CH3/LPTIM3_CH1
2	D9	PC7	PC7	TIM3_CH2/TIM8_CH2/LPTIM2_CH2
1	D8	PE11	PE11	IO

8.6 ST morpho connectors (CN7, CN10)

The ST morpho connector consists of the CN7 and CN10 2.54-pitch male pin headers. They can be used to connect the NUCLEO-U3C5ZI-Q Nucleo-144 board to any of the following:

- Extension board
- Prototype/wrapping board
- Oscilloscope
- Logic analyzer
- Voltmeter

Note: The CN11 and CN12 connectors are not mounted on the NUCLEO-U3C5ZI-Q board.

Figure 18. ST morpho connectors

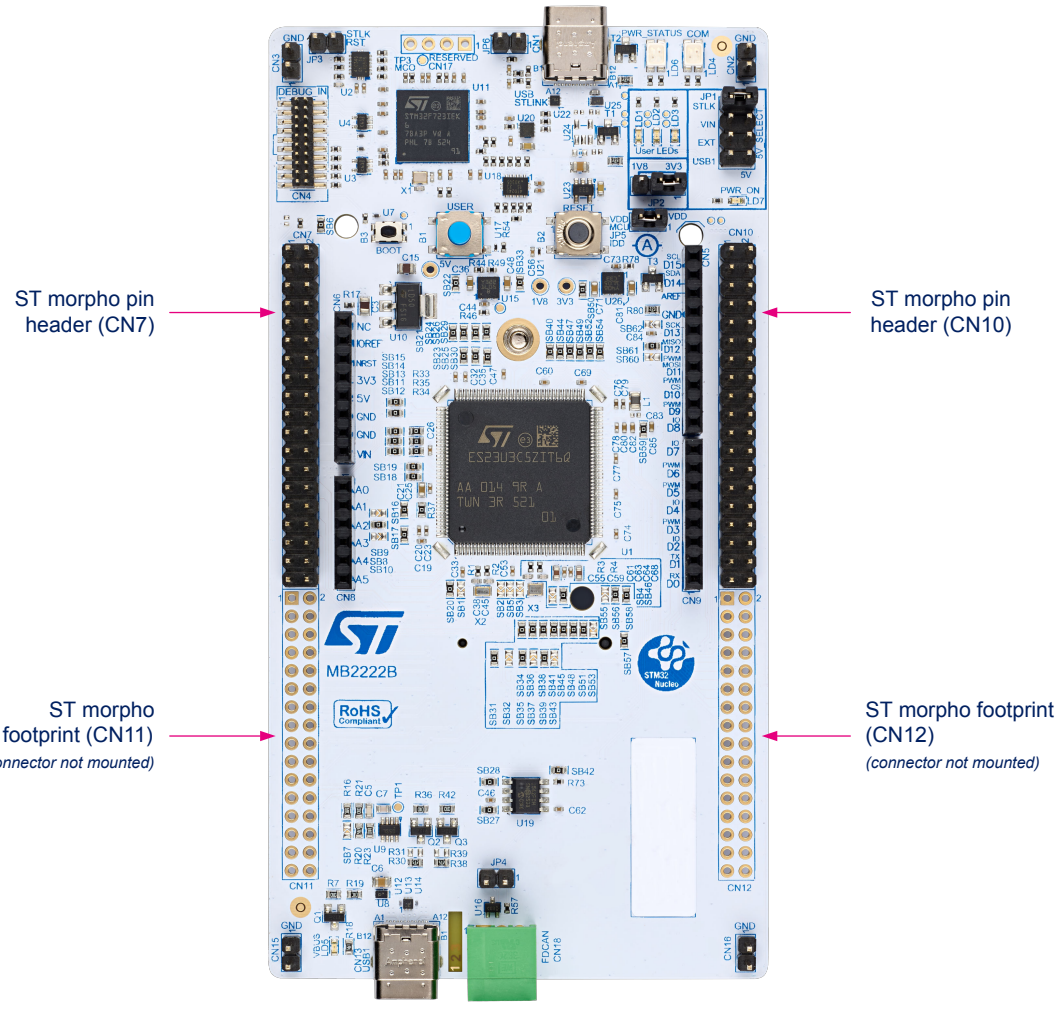


Table 15 and Table 16 show the pin assignments for the STM32 microcontroller on the ST morpho connector.

Table 15. ST morpho connector (CN7, CN10) pin assignment

CN7 odd pins		CN7 even pins		CN10 odd pins		CN10 even pins	
Pin number	Pin name	Pin number	Pin name	Pin number	Pin name	Pin number	Pin name
1	PC10	2	PC11	1	PC9	2	PC8
3	PC12	4	PD2	3	PB6	4	PD15

CN7 odd pins		CN7 even pins		CN10 odd pins		CN10 even pins	
Pin number	Pin name	Pin number	Pin name	Pin number	Pin name	Pin number	Pin name
5	VDD	6	5V_EXT	5	PB7	6	PB4
7	PH3-BOOT0	8	GND	7	-	8	5V_STLK
9	PF6	10	PD1	9	GND	10	PB11
11	PF7	12	IOREF	11	PA5	12	PA12
13	PA13	14	NRST	13	PA6	14	PA11
15	PA14	16	3V3	15	PA7	16	PE15
17	PA15	18	5V	17	PD14	18	PA2
19	GND	20	GND	19	PC7	20	GND
21	PD13	22	GND	21	PE11	22	PB2
23	PC13	24	VIN	23	PA8	24	PB1
25	PC14	26	PD5	25	PB10	26	PB15
27	PC15	28	PA0	27	PC6	28	PB14
29	PH0	30	PA1	29	ARD_D4	30	PB13
31	PH1	32	PA4	31	ARD_D3	32	AGND
33	VBAT	34	PB0	33	PE13	34	PA3
35	PC2	36	PC1	35	PD8	36	PD12
37	PC3	38	PC0	37	PD9	38	PD11

Table 16. ST morpho connector footprint (CN11, CN12) pin assignment

CN11 odd pins		CN11 even pins		CN12 odd pins		CN12 even pins	
Pin number	Pin name	Pin number	Pin name	Pin number	Pin name	Pin number	Pin name
1	PE2	2	PE3	1	GND	2	PD3
3	PE5	4	PE6	3	PE0	4	PF8
5	PE4	6	-	5	PF10	6	PD10
7	PF2	8	PF0	7	PE14	8	PE12
9	-	10	PF1	9	PE10	10	PE9
11	GND	12	PF4	11	PE8	12	PE7
13	PF5	14	PF3	13	PF15	14	PF14
15	PF9	16	PA9	15	PF11	16	GND
17	-	18	PA10	17	PG8	18	PG7
19	PD0	20	PE1	19	PG5	20	PG6
21	PD4	22	GND	21	PG3	22	PG4
23	PF13	24	PF12	23	PG15	24	PG2
25	PG1	26	PG0	25	GND	26	PG9
27	PD6	28	PD7	27	PG13	28	-
29	PB9	30	-	29	PG14	30	PG10
31	PB8	32	-	31	-	32	PG12

9 NUCLEO-U3C5ZI-Q 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 NUCLEO-U3C5ZI-Q product history

Table 17. Product history

Order code	Product identification	Product details	Product change description	Product limitations
NUCLEO-U3C5ZI-Q	NUU3C5ZIQ$KR1	MCU: STM32U3C5ZI silicon revision "A"	Initial revision	No limitation
		MCU errata sheet: *STM32U3B5xx and STM32U3C5xx device errata* (ES0659)		
		Board: MB2222-U3C5ZIQ-B03 (main board)		

9.3 Board revision history

Table 18. Board revision history

Board reference	Board variant and revision	Board change description	Board limitations
MB2222 (main board)	U3C5ZIQ-B03	Initial revision	No limitation

10 Compliance statements and conformity declarations

10.1 Federal Communications Commission (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 A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their own expense.

Note: Use only shielded cables.

Responsible Party - U.S. Contact Information:

Francesco Doddo
STMicroelectronics, Inc.
200 Summit Drive | Suite 405 | Burlington, MA 01803
USA
Telephone: +1 781-472-9634

10.2 Innovation, Science and Economic Development Canada (ISED) compliance statement

This product complies with the ICES-003 standard class A of the ISED regulation.

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

Note: Use only shielded cables.

Ce produit est conforme à la norme NMB-003 classe A de la ISDE.

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

Note: Utiliser uniquement des câbles blindés.

10.3 UKCA conformity

Simplified UK declaration of conformity

Hereby, the manufacturer STMicroelectronics, declares that the equipment type NUCLEO-U3C5ZI-Q is in compliance with the UK Electromagnetic Compatibility Regulations 2016 (UK SI 2016 No. 1091) and with the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 (UK SI 2012 No. 3032).

Note: Use only shielded cables.

10.4 CE conformity

10.4.1 Simplified EU declaration of conformity

Hereby, STMicroelectronics declares that the equipment type NUCLEO-U3C5ZI-Q is in compliance with directives 2011/53/EU and 2015/863/EU (RoHS), and 2014/30/EU (EMC).

Note:
- *RoHS: Restriction of hazardous substances*
- *EMC: Electromagnetic compatibility*

Warning

This device is compliant with Class A of EN55032/CISPR32. In a residential environment, this equipment may cause radio interference.

Note: Use only shielded cables.

10.4.2 Déclaration de conformité UE simplifiée

STMicroelectronics déclare que l'équipement électrique du type NUCLEO-U3C5ZI-Q est conforme aux directives 2011/53/UE et 2015/863/UE (LdSD), et à la directive 2014/30/UE (CEM).

Note:
- *LdSD : directive sur la limitation de l'utilisation des substances dangereuses*
- *CEM : compatibilité électromagnétique*

Avertissement

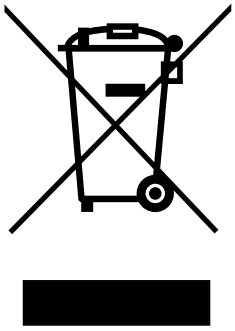
Cet équipement est conforme à la Classe A de la EN55032 / CISPR 32. Dans un environnement résidentiel, cet équipement peut créer des interférences radio.

Note: Utiliser uniquement des câbles blindés.

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 must 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, separate these items from other types of waste and recycle them responsibly at a designated collection point to promote the sustainable reuse of material resources.

Household users:

Contact the retailer that you purchased the product from or your local authority for details of your nearest designated collection point.

Business users:

Contact your dealer or supplier for further information.

Revision history

Table 19. **Document revision history**

Date	Revision	Changes
24-Feb-2026	1	Initial release.

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