# STM32 Nucleo-64 boards (MB1932)

## Introduction

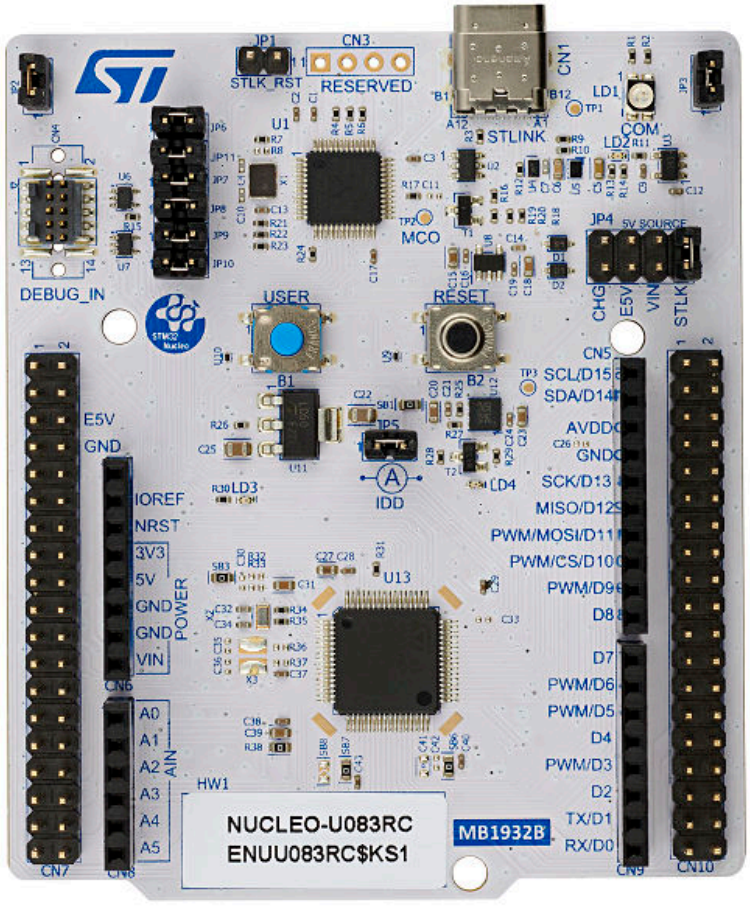
The STM32 Nucleo-64 boards, based on the MB1932 reference board (order codes NUCLEO-U083RC and NUCLEO-U031R8), provide an affordable and flexible way for users to test new concepts and build prototypes with the STM32 microcontroller with different combinations of performance, power consumption, and functionality.

The ARDUINO® Uno V3 connectivity support and the ST morpho headers provide an easy means of expanding the functionality of the STM32U0 Nucleo open development platform with a wide choice of specialized shields.

The STM32 Nucleo-64 board does not require any separate probe, as it integrates the STLINK-V2EC debugger/programmer.

The STM32 Nucleo-64 board comes with the comprehensive free STM32 software libraries and examples that are available with the STM32CubeU0 MCU Package.

**Figure 1. NUCLEO-U083RC board (Top view)**




*Picture is not contractual.*

# 1 Features

- STM32 microcontroller based on the Arm® Cortex®-M0+ core, in an LQFP64 package
- User LED shared with ARDUINO® Uno V3
- User and reset push-buttons
- 32.768 kHz crystal oscillator
- Board connectors:
  - ARDUINO® Uno V3 expansion connector
  - ST morpho extension pin headers for full access to all STM32U0 I/Os
  - USB Type-C® connector for the ST-LINK
  - Debug_IN connector 10-pin 1.27 mm-pitch debug connector over STDC14/MIPI10 footprint
- Flexible power-supply options: ST-LINK USB $V_{BUS}$ or external sources
- 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 STM32Cube 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.*

# 2 Ordering information

To order an STM32 Nucleo-64 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 reference | Target STM32 | Differentiating feature |
|---|---|---|---|
| NUCLEO-U083RC | MB1932(1) | STM32U083RCT6 | Cryptography |
| NUCLEO-U031R8 | | STM32U031R8T6 | - |

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 | Description | Example: NUCLEO-U083RC |
|---|---|---|
| XX | MCU series in STM32 32-bit Arm Cortex MCUs | STM32U0 series |
| YY | MCU product line in the series | STM32U083 product line |
| Z | STM32 package pin count:<br>• R for 64 pins | 64-pin package |
| T | STM32 flash memory size:<br>• C for 256 Kbytes<br>• 8 for 64 Kbytes | 256-Kbyte flash memory |

# 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*.

# 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 Quick start

The STM32 Nucleo-64 boards are low-cost and easy-to-use development kits, to evaluate and start development quickly with the STM32 Nucleo-64.

Before installing and using the product, accept the evaluation product license agreement from the *www.st.com/epla* webpage. For more information on the STM32 Nucleo-64 board and the software example, visit the *www.st.com/stm32nucleo* webpage.

## 5.1 Getting started

Follow the sequence below to configure the STM32 Nucleo-64 board and launch the demonstration application (refer to Figure 3 for component location):

1. Check jumper 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 the board.
3. To power the board, connect the STM32 Nucleo-64 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 (LD3) lights up and the COM LED (LD1) blinks.
4. Press the B1 blue user button.
5. Observe that the blinking frequency of the three green LEDs (LD4) changes, by clicking on the user button (B1).
6. Download the demonstration software and several software examples that help to use the STM32 Nucleo-64 features. These are available on the *www.st.com* website.
7. Develop your application using the available examples.

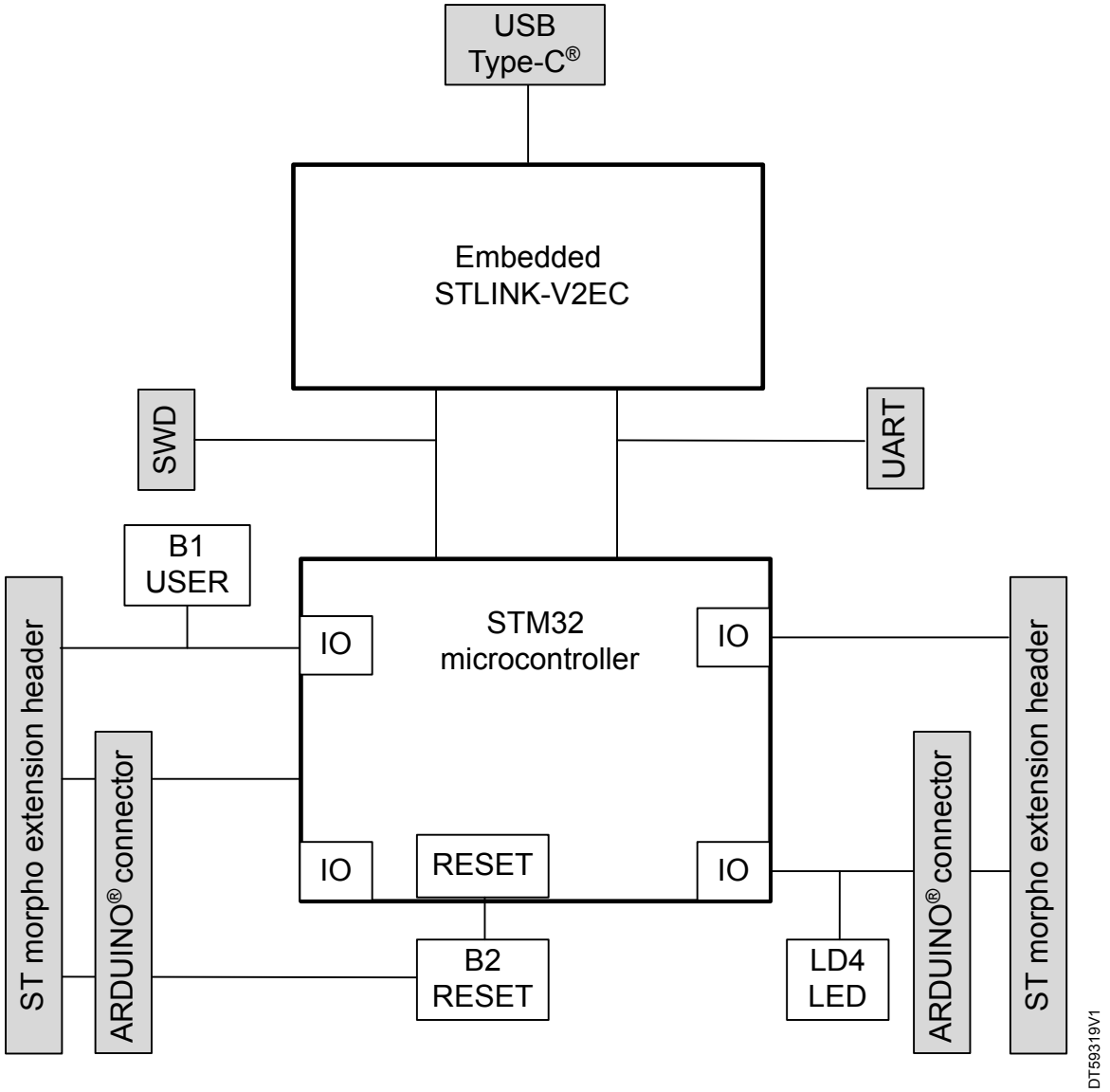
**Table 4. Default jumper configuration**

| Jumper | Definition | Default position | Comment |
|---|---|---|---|
| JP5 | IDD measurement | **ON** | STM32 VDD current measurement |
| JP4 | 5 V power selection | **[1-2]** | 5 V power supply from ST-LINK USB |
| JP1 | STLK reset | **OFF** | No STLK reset |
| JP6 to JP10 | SWD interface | **ON** | On-board STLINK-V2EC debugger |

# 6 Hardware layout and configuration

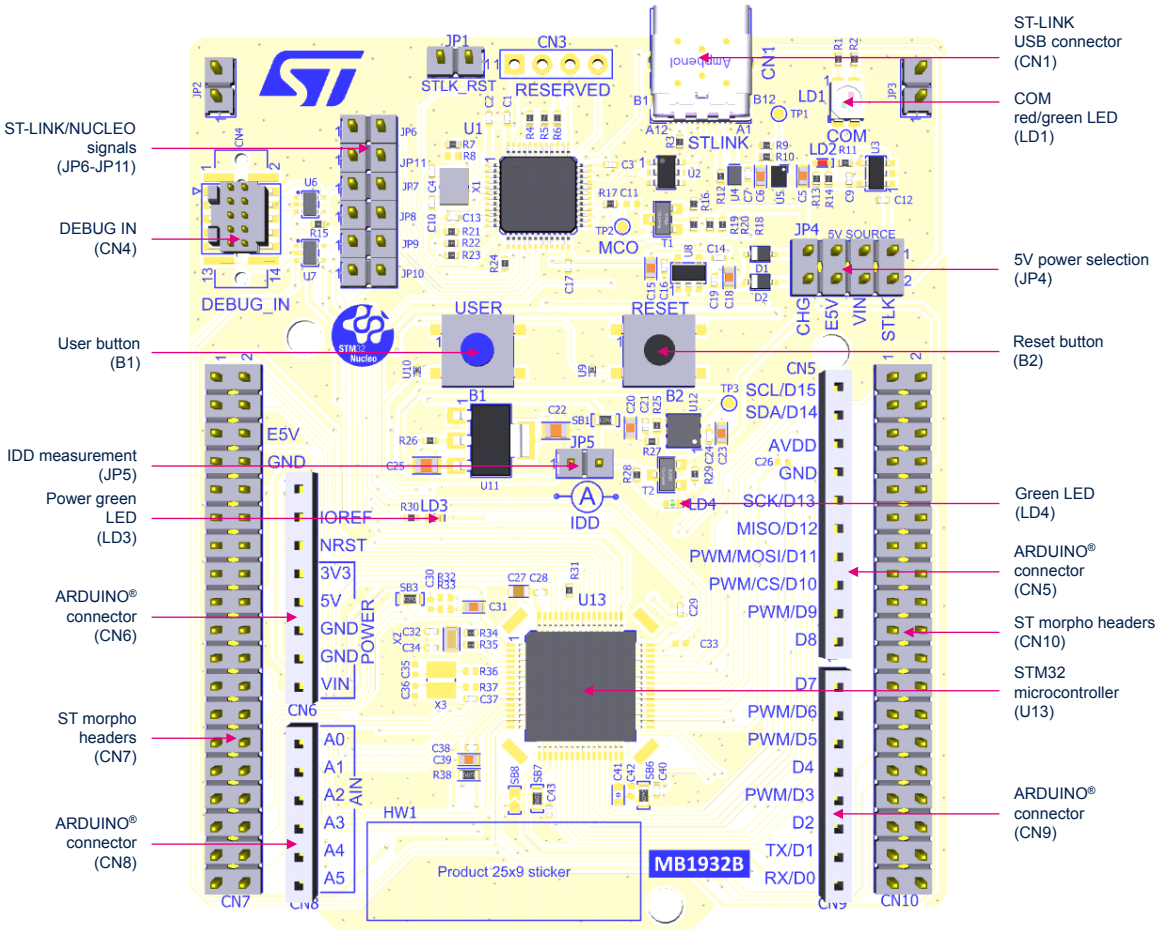
The STM32 Nucleo-64 boards are designed around the STM32 microcontrollers in an LQFP64 package.
Figure 2 illustrates the connections between the STM32 and its peripherals, such as STLINK-V2EC, push-buttons, LEDs, ARDUINO® Uno V3 connectors, and ST morpho headers.
Figure 3 shows the location of the STM32 Nucleo-64 features.
The mechanical dimensions of the board are shown in Figure 4.

**Figure 2. Hardware block diagram**



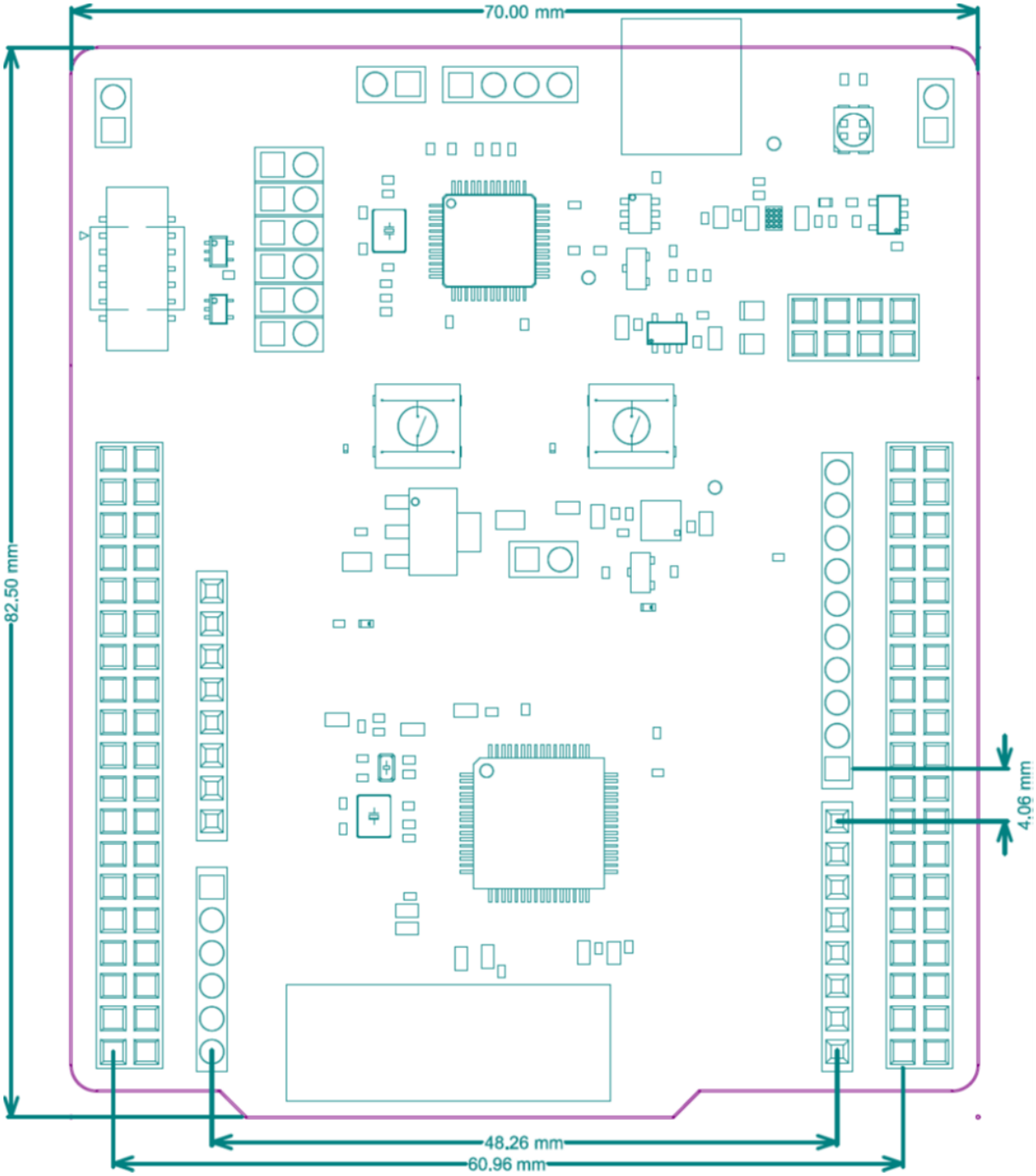
## 6.1 PCB layout

Figure 3. **Top layout**



## 6.2 Mechanical drawing

Figure 4. **Board mechanical dimensions (in millimeters)**



## 6.3 Embedded STLINK-V2EC

The STLINK-V2EC programming and debugging tool is integrated with the STM32 Nucleo-64 board.

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 8 to switch between STLINK-V2EC and the STDC14 configuration.

The STLINK-V2EC facility for debugging and flashing is integrated into the STM32 Nucleo-64.

Features supported in the STLINK-V2EC:

- USB software re-enumeration
- Mass storage interface on USB
- USB power management request for USB power above 100 mA

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.

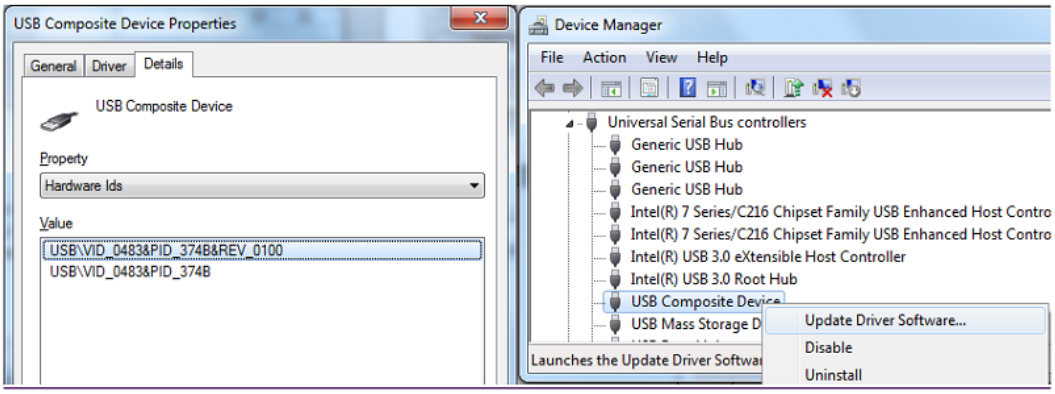
### 6.3.1 Drivers

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

In case the STM32 Nucleo-64 board is connected to the PC before the driver is installed, some STM32 Nucleo-64 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 5.

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

**Figure 5. USB composite device**




### 6.3.2 STLINK-V2EC firmware upgrade

STLINK-V2EC embeds a firmware mechanism for the in-place upgrade through the USB port. As the firmware might evolve during the lifetime of the STLINK-V2EC product (for example new functionalities, bug fixes, support for new microcontroller families), visiting the *www.st.com* website is recommended before starting to use the STM32 Nucleo-64 board, then periodically to stay up-to-date with the latest firmware version.

### 6.3.3 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), as shown in Figure 3. The Debug_IN connector is an Arm® Cortex® 10-pin 1.27 mm-pitch debug connector over STDC14/MIPI10 footprint according to Table 5. It supports STDC14 and MIPI10 standard connectors.

**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 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) |

## 6.4 Power supply and power selection

### 6.4.1 External power supply input

Several DC power sources can power the STM32 Nucleo-64 board. It is possible to supply the STM32 Nucleo-64 board with any of the following sources:

- STLK: 5 V from the STLINK-V2EC USB Type-C® connector
- VIN: 7 to 12 V from the ARDUINO® or ST morpho connector, with 5 V adaptation from LDO
- E5V: External 5 V power from the ST morpho connector
- CHG: 5 V from the STLINK-V2EC USB Type-C® connector without enumeration
- 3.3 V from the ARDUINO® or ST morpho connector

*Note: If the VIN, E5V, or 3V3 DC power source is used to power a Nucleo 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 6.

**Table 6. Power source capabilities**

| Input power | Connector pins | Voltage range | Maximum current | Limitation |
|---|---|---|---|---|
| STLK | CN1 JP4[1-2] | 4.75 to 5.5 V | 500 mA | The maximum current depends on the USB enumeration:<br>• 100 mA without enumeration<br>• 500 mA with good enumeration |
| VIN | CN6 pin 8<br>CN7 pin 24<br>JP4[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:<br>• 800 mA input current when VIN = 7 V<br>• 450 mA input current when 7 V < VIN < 9 V<br>• 250 mA input current when 9 V < VIN < 12 V |
| E5V | CN7 pin 6<br>JP4[5-6] | 4.75 to 5.5 V | 1 A | The maximum current depends on the power source. 1 A maximum is recommended for this Nucleo-64 board. |
| CHG | CN1<br>JP4[7-8] | 4.75 to 5.5 V | 500 mA | The maximum current depends on the USB Host used to power the Nucleo-64 board. No USB enumeration. |
| 3V3 | CN6 pin 4<br>CN7 pin 16 | 3.0 to 3.6 V | - | The maximum current depends on the 3V3 source. The 3V3 can be used when the STLINK-V2EC part of the PCB is not used. SB1 might be OFF to protect LDO (U12). |
| VDD | JP5 pin 1 | 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 1. In this case, only the MCU is powered. External functions like debug, LED, or expansion connector are not powered. This option can be used for the MCU power consumption measurement. |

**STLK** is a 5 V DC power with limitations from the STLINK-V2EC USB connector (CN1). In this case, the 5V jumper selection (JP5) must be on [1-2] to select the STLK power source on the JP4 silkscreen. 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 STM32 Nucleo-64 board and its shield can be powered via the USB STLINK-V2EC connector (CN1), but only the ST-LINK 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 STM32 Nucleo-64 board requires 500 mA of current from the host PC.

- 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 STM32 Nucleo-64 board and its shield requests 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 silkscreen (CN6 pin 8) or the ST morpho connector (CN7 pin 24). In this case, the JP5 jumper must be on [3-4] to select the VIN power source. In that case, the DC power comes from the ARDUINO® Uno V3 battery shield and is compatible with Adafruit® PowerBoost 500 shield.

An LDO (U11) is used to provide a fixed 5 V from VIN (7 to 12 V)

**E5V** 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 (JP4) must be on [5-6] to select the E5V power source.

**CHG** is used when a DC power charger is connected to the STLINK-V2EC USB connector (CN1). To select the CHG power source, the 5V jumper selection (JP4) must be on [7-8]. If an external USB charger powers the STM32 Nucleo-64 board, 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.

**External 3V3 power supply input**. In some situations, it is interesting to use an external 3.3 V source on the 3V3 input (CN6 pin 4, CN7 pin 16), for instance in case the 3.3 V is provided by an expansion board. When the Nucleo-64 is powered with only a 3.3 V source, STLINK-V2EC is not powered thus programming and debugging are unavailable. When using the 3V3 input, the STLINK-V2EC part is not supplied for this configuration. It is recommended to remove SB1 to avoid backward voltage to 5V through U12.

**VDD power supply input**. In some situations, it is interesting to use an external power source from 1.71 to 3.6 V to power only the MCU power supply pins (JP5 pin 1). In this configuration, external functions like debug, LED, or expansion connector are not powered. This option can be used to optimize MCU power consumption measurement.

### 6.4.2 Programing and debugging when the power supply is not from STLINK-V2EC (STLK)

In case the current consumption of the Nucleo-64 and the expansion boards exceeds the allowed current on the ST-LINK USB connector, the external power VIN, E5V, or USB-USER 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 JP4 jumper according to the 5 V selected external power source.
2. Connect the external power source according to JP4.
3. Power on the external power supply.
4. Check that the 5 V green LED (LD3) 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 be damaged or the current limited by the PC. 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 current. Consequently, the board is not power supplied (LED LD3 remains OFF).

### 6.4.3 Power supply output

**5V**: Whatever the power source is (STLK, VIN, E5V, or CHGR), the 5 V generated is present on CN6 pin 5 or CN7 pin 18 and can be used as an output power supply for an ARDUINO® shield or an expansion board. In this case, the maximum current of the power source specified in Table 6 needs to be respected.

• **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 U12 regulator (500 mA maximum concerning the STM32 Nucleo-64 board with shield consumption).

### 6.4.4 VDD IDD measurement

The IDD-labeled jumper (JP5) 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: STM32 microcontroller is powered (default configuration)
- Jumper OFF: To power and measure the consumption of the STM32 microcontroller, an ammeter, or an external 3.3 V power supply must be connected.

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

## 6.5 OSC clock sources

Three clock sources are available on the Nucleo-64 board:

- LSE is the 32.768 kHz crystal for the STM32 embedded RTC
- MCO is the 8 MHz clock from the STLINK-V2EC MCU for the STM32 microcontroller
- HSE is the 8 MHz oscillator for the STM32 microcontroller. This clock is available depending on the target STM32 series microcontroller used on the STM32 Nucleo-64.

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).

### 6.5.1 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 Nucleo-64 has the following characteristics: 32.768 kHz, 6 pF, and 20 ppm.

The use of the embedded X2 crystal requests the following SB configuration:

- SB22 and SB24 OFF
- R34 and R35 ON

**External oscillator connected to PC14 input**

The use of the external oscillator through pin 25 of the ST morpho connector (CN7) requests the following configuration:

- SB22 ON
- R34 and R35 OFF

**LSE not used**

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

- SB22 and SB24 ON
- R34 and R35 OFF

### 6.5.2 HSE: OSC clock supply

There are four 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 Nucleo-64 has the following characteristics: 8 MHz, 8 pF, 20 ppm. The use of the embedded X3 crystal requests the following solder bridge configuration:

- SB28 and SB31 OFF
- R36 and R37 ON
- SB27 OFF

**MCO from STLINK-V2EC**

The MCO output of STLINK-V2EC is used as an input clock. This frequency cannot be changed. It is fixed at 8 MHz and connected to the PF0-OSC_IN of the STM32 microcontroller. The use of this clock source requests the following configuration:

- SB28 and SB31 OFF
- R36 and R37 OFF
- SB27 ON

**External oscillator to PF0 input**

The input clock comes from an external oscillator through PF0, CN17 pin 29. The following configuration is needed:

- SB28 ON
- R36 and R37 OFF
- SB27 OFF

**HSE not used (default configuration)**

PF0 and PF1 are used as GPIOs instead of clocks. The following configuration is needed:

- SB28 and SB31 ON
- R36 and R37 OFF
- SB27 OFF

## 6.6 Reset sources

The STM32 Nucleo-64 reset signal is active LOW and the reset sources include:

- The reset push-button (B2)
- The embedded STLINK-V2EC
- The ARDUINO® connector (CN6 pin 3)
- The ST morpho connector (CN7 pin 14)

## 6.7 Virtual COM port (VCP)

An STM32 serial interface is connected to the STLINK-V2EC debug interface. The user can choose the UART2 interface. Refer to Table 7 below to set the UART2 connection to the VCP interface.

**Table 7. VCP communication**

| Pin name | Function | Virtual COM port (default configuration | ST morpho connection |
|---|---|---|---|
| PA2 | UART2 TX | R24 ON | SB48 OFF |
| PA3 | UART2 RX | R23 ON | SB45 OFF |

## 6.8 LEDs

Four LEDs are available on the STM32 Nucleo-64 board. The four 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 USB_CHARGER mode.

**5V PWR LED (LD3)**

The green LED (LD3) indicates that the Nucleo-64 board is powered by a 5 V source, and this source is available on CN6 pin 5 and CN7 pin 18.

**User green LED (LD4)**

The user green LED (LD4) is connected to the STM32 I/O PA5 (SB12 ON, default configuration) also used for the ARDUINO® D13 function. A transistor is used to drive the LED whatever the MCU 1V8 or 3V3 voltage range.

## 6.9 Push-buttons

Two buttons are available on the Nucleo-64 board.

**USER button (B1)**

The blue button for the user and wake-up functions is connected to PC13 to support the default TAMPER function. When the button is pressed the logic state is LOW, otherwise, the logic state is HIGH. To connect the USER button to PC13, SB3 must be ON.

The USER button is implemented with a firmware debounce filter. This helps to reduce the BOM cost by removing the external hardware debounce filter R32, R33, and C30.

Warning: PC13 I/O used for the USER button must be set in INPUT, pull-up (PU) with debouncing. Never set the PC13 in OUTPUT level HIGH to avoid a shortcut when the USER button is pressed.

**RESET button (B2)**

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.

## 6.10 Jumper configuration

The default jumper positions are shown in Table 4. Table 8 describes the other available jumper settings

**Table 8. Jumper configuration**

| Jumper/CN | Function | State[1] | Comment |
|---|---|---|---|
| JP6-JP10 | SWD interface | **ON** | STLINK-V2EC enabled for on-board MCU debugger |
| | | OFF | STLINK-V2EC functions disabled and external debugger from the connector (CN4) |
| JP2, JP3, and JP11 | GND | **ON** | GND probe |
| JP4 | 5 V power selection | **[1-2]** | 5 V from ST-LINK |
| | | [3-4] | 5 V from VIN 7 to 12 V |
| | | [5-6] | 5 V from E5V |
| | | [7-8] | 5 V from USB_CHG |
| | | OFF | No 5 V power |
| JP1 | STLK reset | **OFF** | No STLK reset |
| | | ON | STLK reset |
| JP5 | IDD measurement | **ON** | VDD = 3.3 V |
| | | OFF | To connect the external source<br>(ULPBench probe as an example) |

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

## 6.11 Solder bridge configuration

Table 9 shows the solder bridge configurations and settings.

**Table 9. Solder bridge configuration and settings**

| Definition | Solder bridge | State[1] | Comment |
|---|---|---|---|
| 3.3 VLDO output | SB1 | **ON** | U12 LDO output provides 3.3 V |
| | | OFF | U12 LDO output does not provide 3.3 V |
| VBAT/VLCD | SB2 | **ON** | VBAT or VLCD on STM32 is connected to VDD. |
| | | OFF | VBAT or VLCD on STM32 is not connected to VDD. |
| USER button | SB3 | **ON** | The B1 push-button is connected to PC13. |
| | | OFF | The B1 push-button is not connected to the PC13. |
| AVDD | SB9 | **ON** | AVDD is connected to CN5 pin 8. |
| | | OFF | AVDD disconnected from CN5 pin 8. |
| AGND | SB36 | **ON** | AGND is connected to GND. |
| | | OFF | AGND is not connected to GND. |
| User LED | SB12 | **ON** | PA5 controls LD4. |
| | | OFF | LD4 is isolated. |
| SWD signals | SB15/SB17 | **OFF** | PA13/PA14 is not connected to the ST morpho connector. |
| | | ON | PA13/PA14 is connected to the ST morpho connector. |
| UART/VCP | SB23/SB44/ SB45/SB48 | **SB23/SB44 OFF SB45/SB48 OFF** | USART2 from PA2/PA3 as VCP |
| | | SB23/SB44 ON SB45/SB48 OFF | USART1 from PA9/PA10 as UART |
| | | SB23/SB44 OFF SB45/SB48 ON | USART2 from PA2/PA3 as UART |
| MCO | SB27 | **OFF** | MCO from STLK floating |
| | | ON | MCO from STLK provide 8 MHz CLK to MCU |
| HSE CLK selection | SB28/SB31 | **ON (R36/R37 OFF)** | PF0/PF1works as GPIOs |
| | | OFF | PF0/PF1works as HSE pins |
| LSE CLK selection | SB22/SB24 | **OFF** | PC14/PC15 works as LSE pins |
| | | ON (R34/R35 OFF) | PC14/PC15 works as GPIOs |
| ADC/IIC | SB46/SB47/ SB51/SB52 | **SB46/SB52 ON SB47/SB51 OFF** | CN8 pin 5/6 works as ADC |
| | | SB46/SB52 OFF SB47/SB51 ON | CN8 pin 5/6 works as IIC |

1. *The default solder bridge state is shown in bold.*

# 7 Connectors

Six expansion connectors are implemented on the STM32 Nucleo-64 board:

- The four ARDUINO® Uno V3 connectors (CN5, CN6, CN8, and CN9)
- The two ST morpho connectors (CN7 and CN10)

## 7.1 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 Nucleo-64 board.

Caution: Most of the STM32 microcontroller I/Os are 5 V tolerant, but a few of them are only 3.6 V compatible, while ARDUINO® Uno V3 is 5 V compatible. Refer to the STM32U0 series databrief and STM32xxxx product datasheets for their I/O structure.

The related pinout for the ARDUINO® connector is listed in Table 10.

**Table 10. ARDUINO® connectors on NUCLEO-U083RC and NUCLEO-U031R8**

| Left connectors | | | | |
|---|---|---|---|---|
| **Connector** | **Pin number** | **Pin name** | **MCU pin** | **Function** |
| CN6 | 1 | - | - | Reserved for test |
| | 2 | IOREF | - | I/O reference |
| | 3 | NRST | NRST | RESET |
| | 4 | 3V3 | - | 3.3 V input/ output |
| | 5 | 5V | - | 5 V output |
| | 6 | GND | - | GND |
| | 7 | GND | - | GND |
| | 8 | VIN | - | 7 to 12 V power input |
| CN8 | 1 | A0 | PA0 | ADC1_IN4 |
| | 2 | A1 | PA1 | ADC1_IN5 |
| | 3 | A2 | PA4 | ADC1_IN8 |
| | 4 | A3 | PB0 | ADC1_IN17 |
| | 5 | A4 | PC1 or PB9(1) | ADC1_IN1 or I2C1_SDA |
| | 6 | A5 | PC0 or PB8(1) | ADC1_IN0 or I2C1_SCL |

| Right connectors | | | | |
|---|---|---|---|---|
| **Function** | **MCU pin** | **Pin name** | **Pin number** | **Connector** |
| I2C1_SCL | PB8 | SCL/D15 | 10 | CN5 |
| I2C1_SDA | PB9 | SDA/D14 | 9 | |
| VREF+ | - | AVDD | 8 | |
| GND | - | GND | 7 | |
| SPI1_SCK | PA5 | SCK/D13 | 6 | |
| SPI1_MISO | PA6 | MISO/D12 | 5 | |
| SPI1_MOSI or TIM1_CH1N | PA7 | PWM/MOSI/D11 | 4 | |
| SPI_CS or TIM16_CH1N | PB6 | PWM/CS/D10 | 3 | |
| TIM3_CH2 | PC7 | PWM/D9 | 2 | |
| IO | PA9(2) | D8 | 1 | |
| IO | PA8 | D7 | 8 | CN9 |
| TIM2_CH3 | PB10 | PWM/D6 | 7 | |
| TIM3_CH1 | PB4 | PWM/D5 | 6 | |
| IO | PB5 | D4 | 5 | |
| TIM2_CH2 | PB3 | PWM/D3 | 4 | |
| IO | PA10(2) | D2 | 3 | |
| UART2_TX | PA2(2) | TX/D1 | 2 | |
| UART2_RX | PA3(2) | RX/D0 | 1 | |

1. *Refer to Table 9. Solder bridge configuration and settings*
2. *UART can select from PA2/PA3 as USART2 or PA9/PA10 as USART1. Refer to Table 9 for details.*

## 7.2 ST morpho connectors (CN7 and CN11)

The ST morpho connectors are two 2.54-pitch male pin headers (CN7 and CN11). They can be used to connect the STM32 Nucleo-64 board to an expansion or prototype/wrapping board placed on top of it. All signals and power pins of the STM32 are available on the two ST morpho connectors. An oscilloscope, a logic analyzer, or a voltmeter can also probe this connector.

**Table 11. Pin assignment for the STM32 on the ST morpho connectors**

| CN7 | | | |
|---|---|---|---|
| Pin name | Pin number | Pin number | Pin name |
| PC10 | 1 | 2 | PC11 |
| PC12 | 3 | 4 | PD2 |
| VDD | 5 | 6 | E5V |
| BOOT0(1) | 7 | 8 | GND |
| - | 9 | 10 | - |
| - | 11 | 12 | 3V3 |
| PA13(3) | 13 | 14 | NRST |
| PA14(3) | 15 | 16 | 3V3 |
| PA15 | 17 | 18 | 5V |
| GND | 19 | 20 | GND |
| PB7 | 21 | 22 | GND |
| PC13 | 23 | 24 | VIN |
| PC14 | 25 | 26 | - |
| PC15 | 27 | 28 | PA0 |
| PF0 | 29 | 30 | PA1 |
| PF1 | 31 | 32 | PA4 |
| VBAT | 33 | 34 | PB0 |
| PC2 | 35 | 36 | PC1/PB9(4) |
| PC3 | 37 | 38 | PC0/PB8(4) |

| CN11 | | | |
|---|---|---|---|
| Pin name | Pin number | Pin number | Pin name |
| PC9 | 1 | 2 | PC8 |
| PB8 | 3 | 4 | PC6 |
| PB9 | 5 | 6 | PC5 |
| AVDD | 7 | 8 | VBUS_STLK(2) |
| AGND | 9 | 10 | - |
| PA5 | 11 | 12 | PA12 |
| PA6 | 13 | 14 | PA11 |
| PA7 | 15 | 16 | PB12 |
| PB6 | 17 | 18 | PB11 |
| PC7 | 19 | 20 | GND |
| PA9 | 21 | 22 | PB2 |
| PA8 | 23 | 24 | PB1 |
| PB10 | 25 | 26 | PB15 |
| PB4 | 27 | 28 | PB14 |
| PB5 | 29 | 30 | PB13 |
| PB3 | 31 | 32 | AGND |
| PA10 | 33 | 34 | PC4 |
| PA2 | 35 | 36 | - |
| PA3 | 37 | 38 | - |

1. *The default state of BOOT0 is 0. It can be set to 1 when a jumper is plugged into the CN7 pins 5 (VDD) and 7 (BOOT0).*
2. *VBUS_STLK is a 5 V power signal, coming from the STLINK-V2EC USB connector. It rises before the 5V signals of the board.*
3. *PA13 and PA14 are shared with SWD signals connected to STLINK-V2EC. It is not recommended to use them as I/O pins.*
4. *Refer to Table 9. Solder bridge configuration and settings for details.*

# 8 STM32 Nucleo-64 board information

## 8.1 Product marking

The stickers located on the top or bottom side of all PCBs provide product information:

- First sticker: product order code and product identification, generally placed on the main board featuring the target device.
  Example:

  Product order code
  Product identification

- Second sticker: board reference with revision and serial number, available on each PCB.
  Example:

  MBxxxx-Variant-yzz
  syywwxxxxx

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

On the second sticker, the first line has the following format: *"MBxxxx-Variant-yzz"*, where *"MBxxxx"* is the board reference, *"Variant"* (optional) identifies the mounting variant when several exist, *"y"* is the PCB revision, and *"zz"* is the assembly revision, for example B01. The second line shows the board serial number used for traceability.

Parts marked as *"ES"* or *"E"* are not yet qualified and therefore not approved for use in production. ST is not responsible for any consequences resulting from such use. In no event will ST be liable for the customer using any of these engineering samples in production. ST's Quality department must be contacted prior to any decision to use these engineering samples to run a qualification activity.

*"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 evaluation tool ordering part number 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.

## 8.2 NUCLEO-U083RC and NUCLEO-U031R8 product history

**Table 12. Product history**

| Order code | Product identification | Product details | Product change description | Product limitations |
|---|---|---|---|---|
| NUCLEO-U083RC | NUU083RC$KS1 | MCU:<br>• STM32U083RCT6 silicon revision "A" | Initial revision | No limitation |
| | | MCU errata sheet:<br>• *STM32U073xx and STM32U083xx device errata* (ES0602) | | |
| | | Board:<br>• MB1932-U083RC-B01 (main board) | | |
| NUCLEO-U031R8 | NUU031R8$KS1 | MCU:<br>• STM32U031R8T6 silicon revision "A" | Initial revision | No limitation |
| | | MCU errata sheet:<br>• *STM32U031x4/6/8 device errata* (ES0603) | | |
| | | Board:<br>• MB1932-U031R8-B01 (main board) | | |

## 8.3 Board revision history

**Table 13. Board revision history**

| Board reference | Board variant and revision | Board change description | Board limitations |
|---|---|---|---|
| MB1932 (main board) | MB1932-U083RC-B01 | Initial revision | No limitation |
| | MB1932-U031R8-B01 | | |

# 9 Federal Communications Commission (FCC) and ISED Canada Compliance Statements

## 9.1 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 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.*

**Responsible party (in the USA)**

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200 Summit Drive | Suite 405 | Burlington, MA 01803
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Telephone: +1 781-472-9634

## 9.2 ISED Compliance Statement

This device complies with FCC and ISED Canada RF radiation exposure limits set forth for general population for mobile application (uncontrolled exposure). This device must not be collocated or operating in conjunction with any other antenna or transmitter.

### Compliance Statement

Notice: This device complies with ISED Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

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

### Déclaration de conformité

Avis: Le présent appareil est conforme aux CNR d'ISDE Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

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

# Revision history

Table 14. **Document revision history**

| Date | Revision | Changes |
|---|---|---|
| 19-Feb-2024 | 1 | Initial release. |

# Contents

# List of tables

# List of figures