STM32WL33 Nucleo-64 boards (MB1801 and MB2029)

Introduction

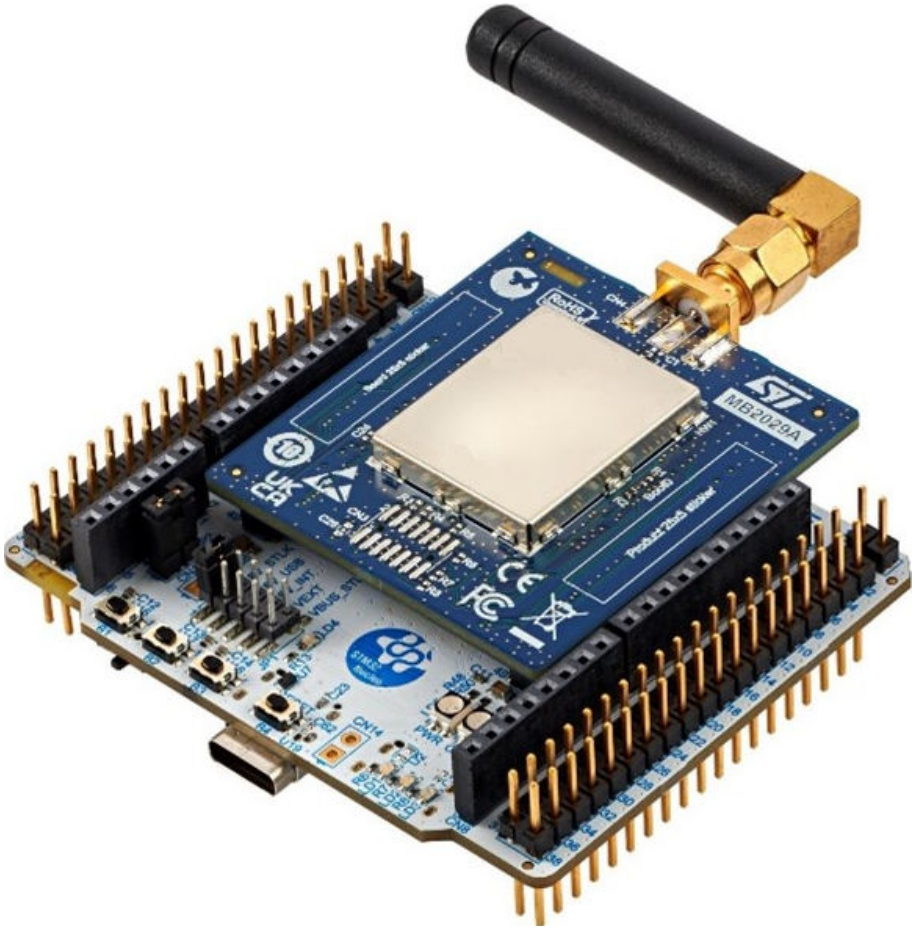
The STM32WL33 Nucleo-64 boards based on the MB1801 mezzanine board and MB2029 MCU RF board (NUCLEO-WL33CC1 and NUCLEO-WL33CC2 order codes) embed the STM32WL33CCV6 sub-GHz application processor. This high-performance and low-power application processor can operate in 433, 868, and 915 MHz bands.

The ARDUINO® Uno V3 connectivity support and the ST morpho headers provide an easy means of expanding the functionality of the STM32 Nucleo open development platform with a wide choice of specialized shields.

The STM32WL33 Nucleo-64 boards are supplied with a dedicated software package, HAL library, and various packaged software examples available with the STM32CubeWL3 MCU Package.

The boards are declined in two product variants with dedicated front ends tuned for specific frequency bands.

Figure 1. NUCLEO-WL33CCx global view



Picture is not contractual.

1 Features

- Ultra-low-power wireless STM32WL33CCV6 microcontroller based on the Arm® Cortex®-M0+ core, with 256 Kbytes of flash memory and 32 Kbytes of SRAM in a VFQFPN48 package featuring:
  - Ultra-low-power MCU
  - Sub-GHz transceiver with IPD front end optimized for 413-479 MHz or 826-958 MHz frequency bands, supporting OOK, ASK, 2(G)FSK, 4(G)FSK, D-BPSK, and DSSS modulations
  - Compatible with proprietary and standardized wireless protocols such as WM-Bus, Sigfox™, mioty, KNX-RF, and IEEE 802.15.4g
  - Low-power autonomous wake-up receiver
- Delivered with SMA antenna
- Three user LEDs
- Three user and one reset push-buttons
- Board connectors:
  - USB Type-C®
  - ARDUINO® Uno V3 expansion connector
  - ST morpho extension pin headers for full access to all MCU I/Os
- Flexible power-supply options: ST-LINK USB V_{BUS} 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 STM32CubeWL3 MCU Package
- Dedicated software tool to control and test radio transceiver
- Support of a wide choice of Integrated Development Environments (IDEs) including IAR Embedded Workbench®, MDK-ARM, and STM32CubeIDE

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2 Ordering information

To order the STM32WL33 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 references	Target STM32	Differentiating feature
NUCLEO-WL33CC1	• MB1801(1) • MB2029-Highband-Bxx(2)	STM32WL33CCV6	Front end optimized for 826-958 MHz high band at 16 dBm
NUCLEO-WL33CC2	• MB1801(1) • MB2029-Lowband-Bxx(2)		Front end optimized for 413-479 MHz high band at 16 dBm

1. *Mezzanine board*
2. *MCU RF board. Bxx stands for BOM revision.*

2.1 Codification

The meaning of the codification is explained in Table 2.

Table 2. Codification explanation

NUCLEO-XXYYZTN	Description	Example: NUCLEO-WL33CC1
XX	MCU series in STM32 32-bit Arm Cortex MCUs	STM32WL series
YY	MCU product line in the series	STM32WL3x product line
Z	STM32 package pin count: • C for 48 pins	48 pins
T	STM32 flash memory size: • C for 256 Kbytes	256 Kbytes
N	Frequency band: • 1: 826-958 MHz high-frequency band • 2: 413-479 MHz low-frequency band	High-frequency band

3 Development environment

3.1 System requirements

- Multi-OS support: Windows® 10 and 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 EDA resources

All board design resources, including schematics, EDA databases, manufacturing files, and the bill of materials, are available from the NUCLEO-WL33CC1 and NUCLEO-WL33CC2 product pages 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. Like all products of this type, the user must pay attention to the following points:

- The connection pins on the board might be sharp. Be careful when handling the board to avoid personal damage.
- 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 fingers or anything conductive. The board operates at voltage levels that are not dangerous, but components might be damaged when shorted.
- Do not put liquids on the board, and avoid using it near water or in high humidity.
- Do not operate the board if dirty or dusty.

6 Quick start

This section describes how to start development quickly using NUCLEO-WL33CCx.

To use the product, you must accept the evaluation product license agreement from the www.st.com/epla webpage.

Before the first use, make sure that no damage occurred to the board during shipment:

- All socket components must be firmly secured in their sockets.
- Nothing must be loose in the board blister.

The Nucleo board is an easy-to-use development kit to evaluate quickly and start development with an STM32 microcontroller in a VFQFPN48 package.

6.1 Getting started

Follow the sequence below to configure the NUCLEO-WL33CCx board and launch the demonstration application. The demonstration application is a command-line interface (CLI) to configure and start radio emission from the STM32CubeWiSE-RadioExplorer software (refer to Figure 3 and Figure 5 for component location):

1. Check jumper positions on board: JP2 ON, JP1 on 5V_STLK [1-2] on the MB1801 board.
2. Check that switch SW1 is on the 3V3 power supply (blue arrow - default switch on position [1-2]) on the MB1801 board. Refer to Section 7.1.5 for further details.
3. Download and install STM32CubeWiSE-RadioExplorer on a PC.
4. Connect the Nucleo to the PC using a USB Type-A or USB Type-C® to USB Type-C® cable. The green LD4 (5V) and LD5 (ST-LINK power status), and the red LD6 (COM) LEDs light up.
   For more information about ST-LINK PWR and COM LEDs, refer to the technical note *Overview of ST-LINK derivatives* (TN1235).
5. Use STM32CubeWiSE-RadioExplorer to configure radio parameters, and start radio emission or reception. For further details, refer to the dedicated user manual for STM32WL33 software tools *Getting started with STM32CubeWL3 software package for STM32WL3x microcontrollers* (UM3248).

7 Hardware layout and configuration

NUCLEO-WL33CCx is designed around the STM32WL33CCV6. The design includes a mezzanine board and an MCU RF board. The hardware block diagram in Figure 2 illustrates the connection between STM32WL33CCV6, peripherals (ARDUINO® Uno V3 connectors, ST morpho connector, and embedded ST-LINK), and RF front end. Figure 3 and Figure 5 help users locate these features on the board. The mechanical dimensions of the NUCLEO-WL33CCx product are shown in Figure 6.

Figure 2. Hardware block diagram

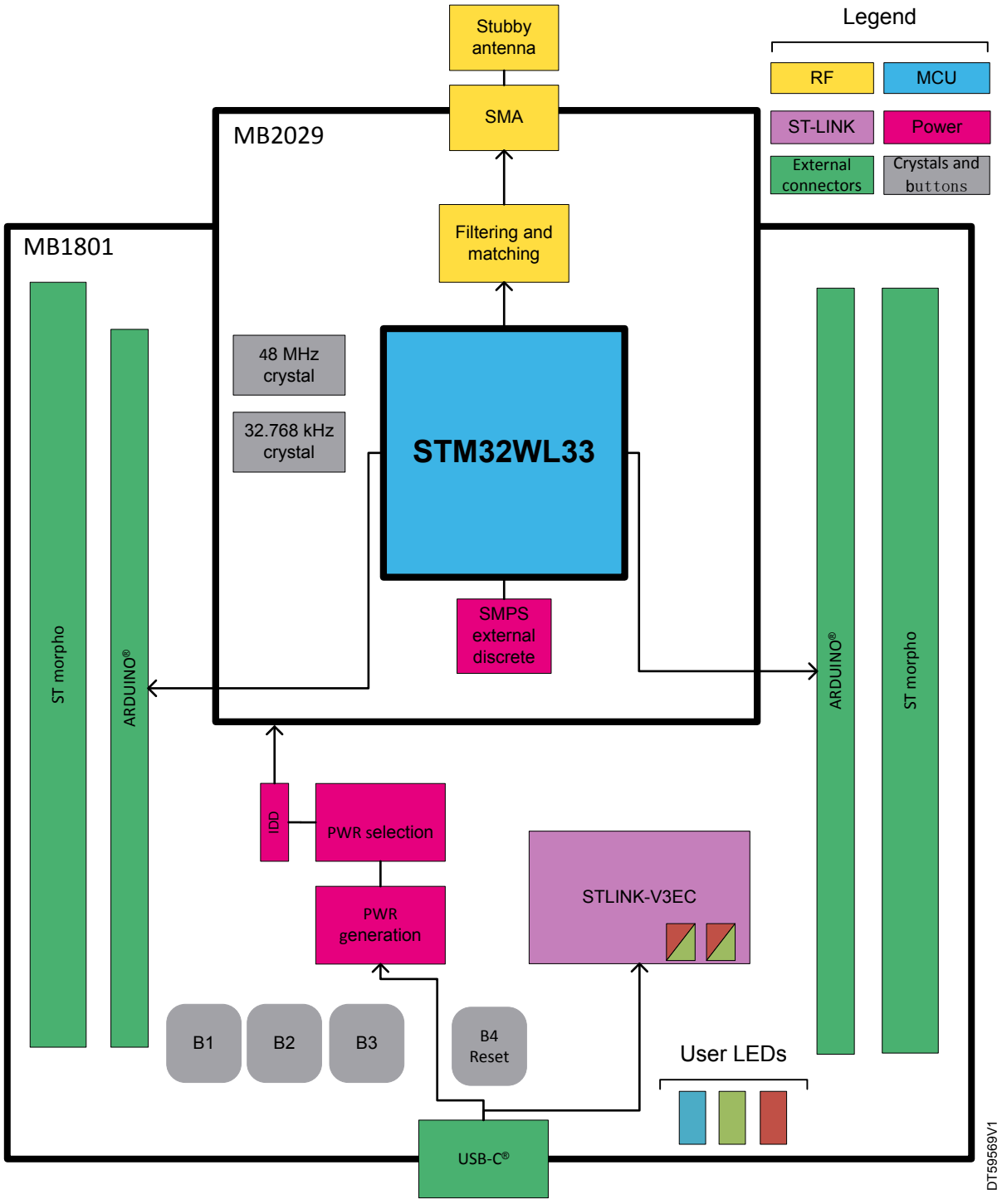


Figure 3. NUCLEO-WL33CCx top view

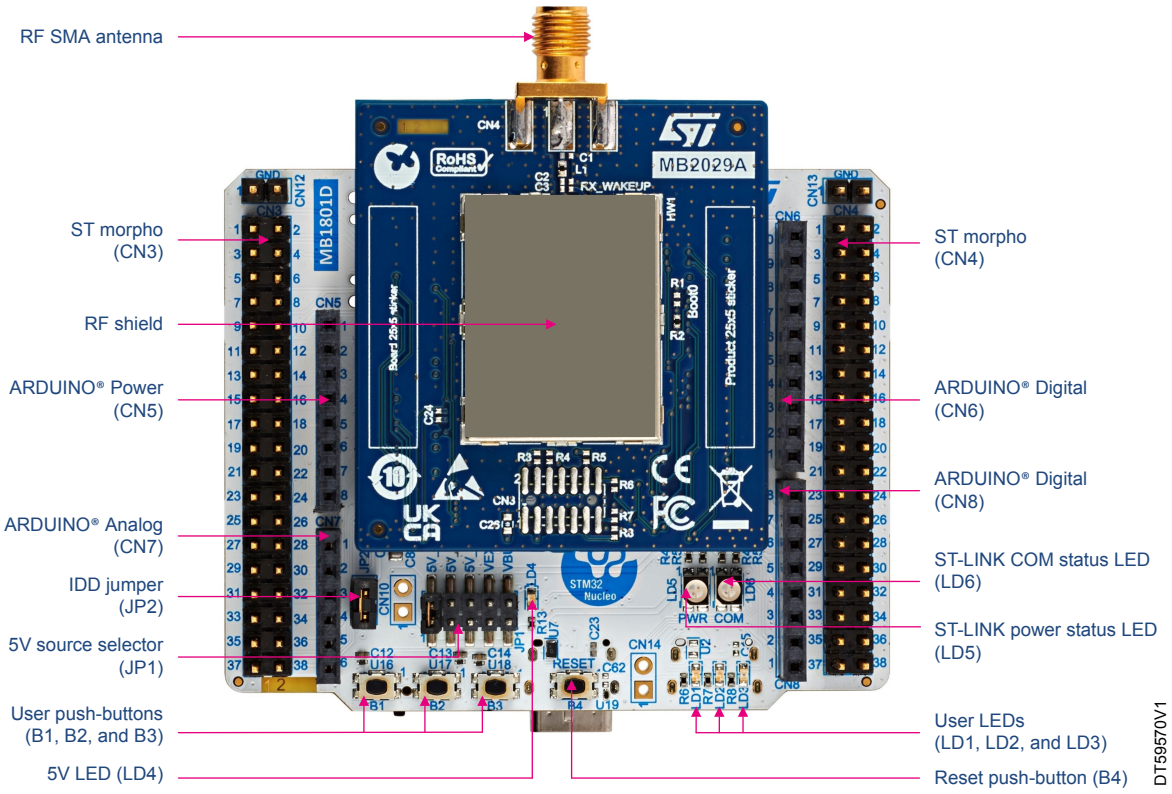


Figure 4. NUCLEO-WL33CCx PCB details of the MCU RF board

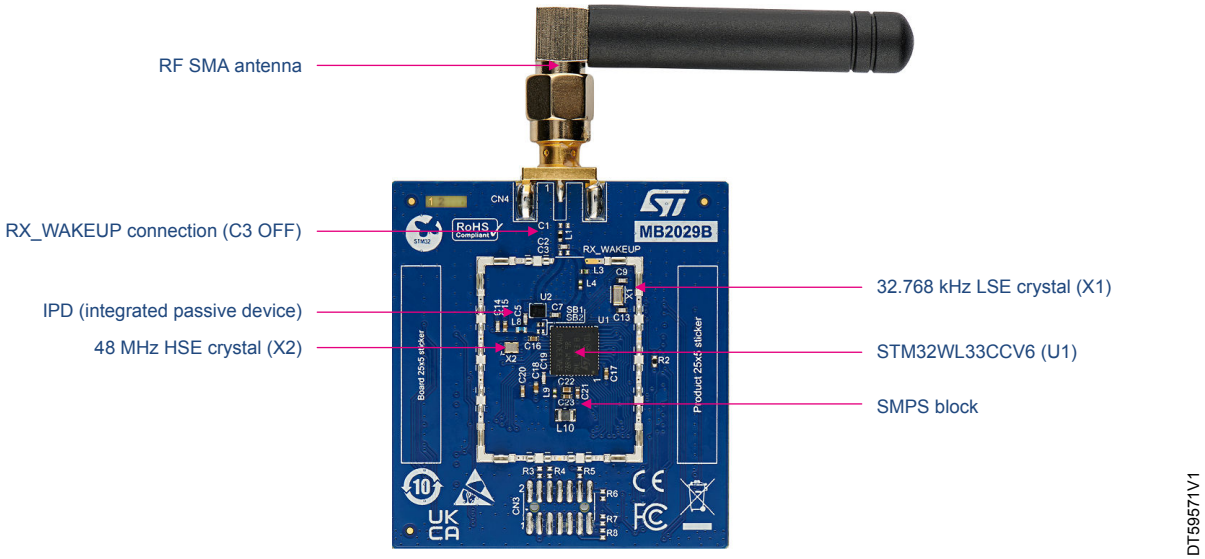


Figure 5. NUCLEO-WL33CCx bottom view

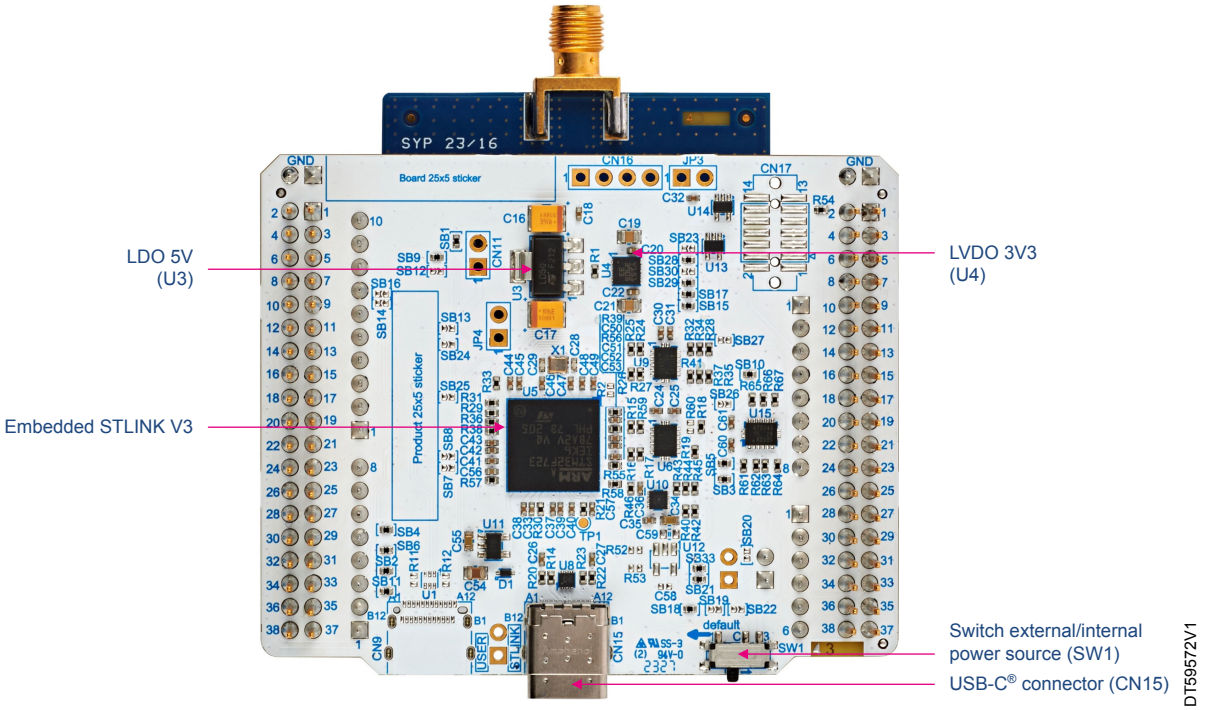
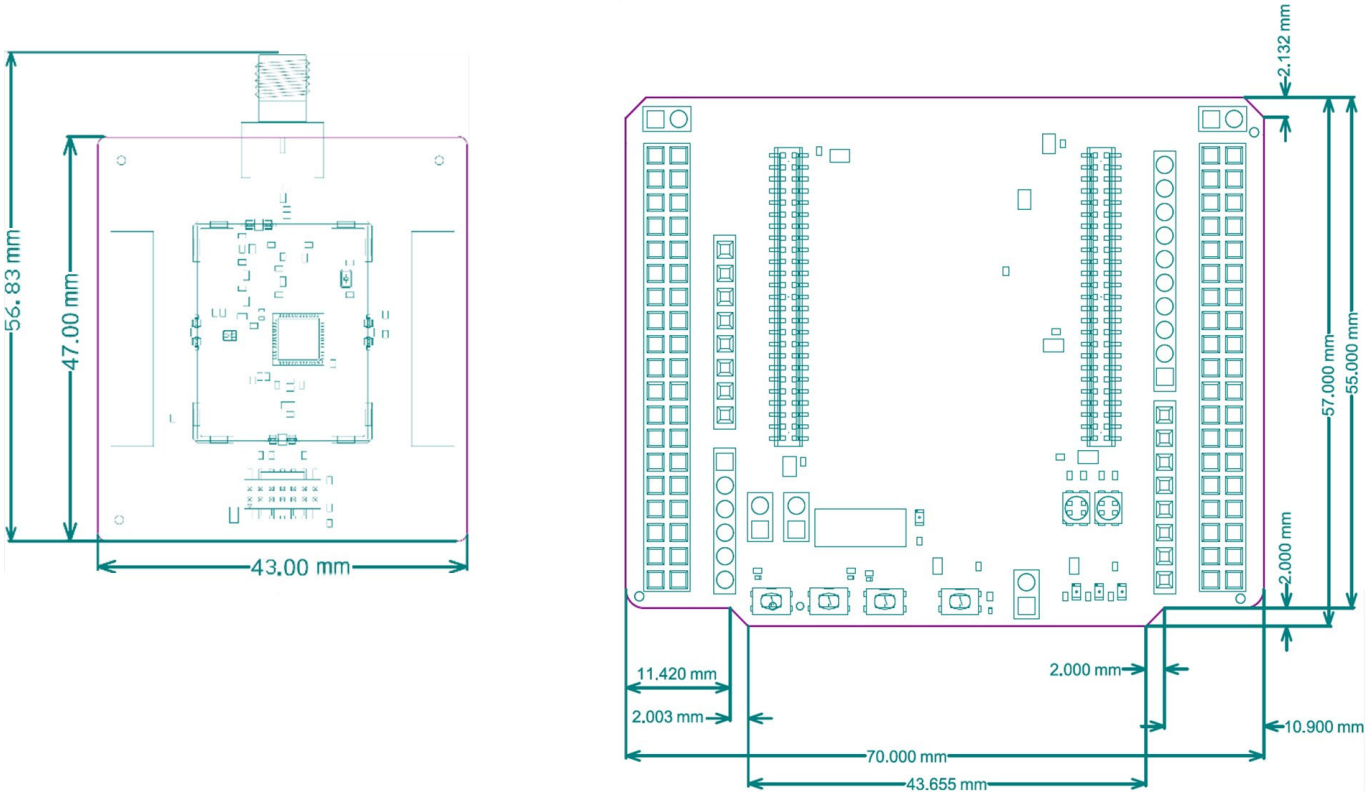


Figure 6. NUCLEO-WL33CCx mechanical dimensions (in millimeters)

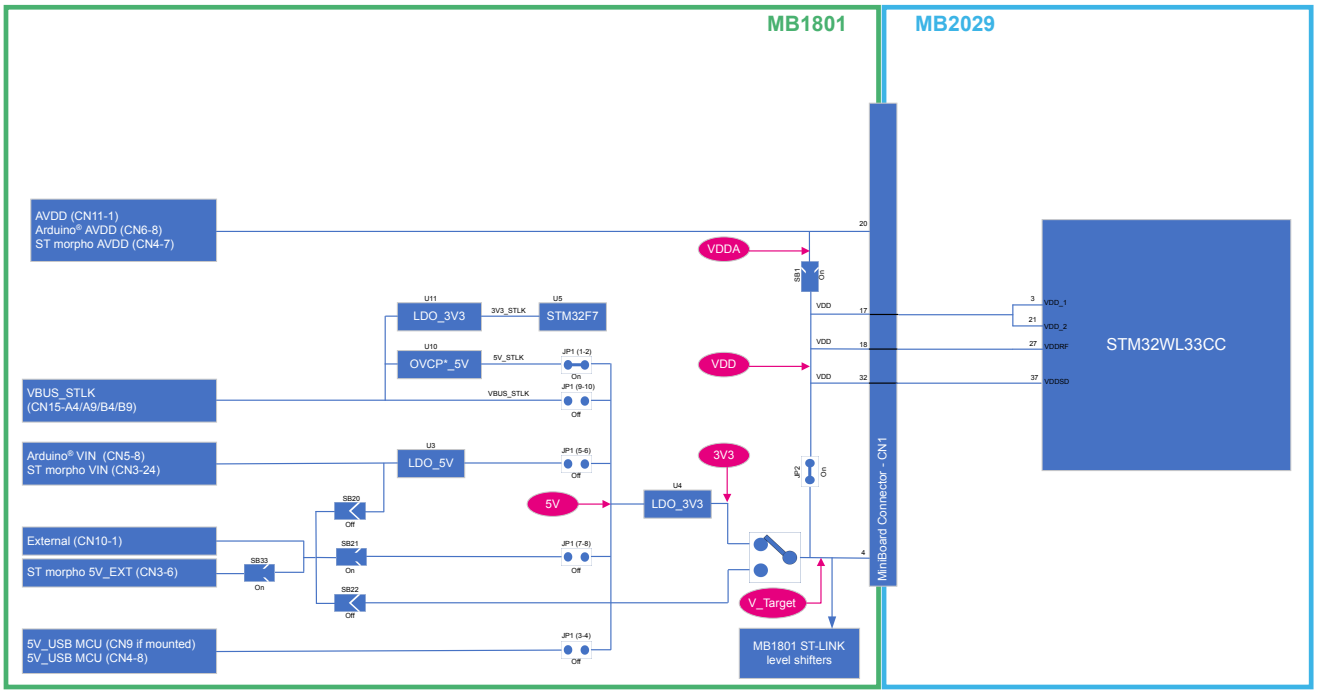


7.1 Power supply

7.1.1 General description

By default, the STM32WL33CC embedded on this Nucleo board is supplied by 3V3 but the board proposes many possibilities to supply the module. In fact, at first, the 3V3 can come from ST-LINK USB, ARDUINO®, or ST morpho connectors. Moreover, STM32WL33CC can be supplied by an external source (between 1.7 and 3.6 V). Thanks to level shifters, debugging by embedded ST-LINK is always possible even if the supply voltage of the target is different than 3V3 (ST-LINK supply). Figure 7 shows the power tree. Moreover, this figure also shows the default state of the jumpers and the solder bridges.

Figure 7. NUCLEO-WL33CCx power tree



Warning: *V_Target is a power domain supplying parts of the MB1801 circuitry, LEDs, ST-LINK level shifters, and target side pull-up.*

Note: A power supply unit or auxiliary equipment complying with the EN 62368-1:2014+A11:2017 standard and safety extralow voltage (SELV/ES1) with limited power capability (LPS/PS2) must power the NUCLEO-WL33CCx board.

7.1.2 7 to 12 V power supply

A 7 to 12 V DC power source can power NUCLEO-WL33CCx. There are three connectors available for this configuration:

- Pin VIN of the ARDUINO® connector (CN5-8). It is possible to apply up to +12 V on this pin or use an ARDUINO® shield, which can deliver this type of voltage.
- Pin VIN of the ST morpho connector (CN3-24). It is possible to apply up to +12 V on this pin like for the ARDUINO® connection.
- External input (CN10). Be careful, in this case, the states of the jumpers and solder bridge are significant. Verify these states in Table 12. SB20 must be ON.

These sources are connected to a linear low-drop voltage regulator (U3). The output of this regulator is a potential source of the 5V signal. For further details, refer to the next section.

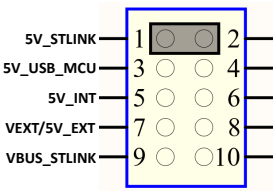
7.1.3 5 V power supply

Different 5 V DC power sources can power NUCLEO-WL33CCx. The 5 V can come from several connectors:

- 5V from USB-C® CN15 with or without overvoltage and current protection
- External source on CN10. Be careful, in this case, the states of the jumpers and solder bridge are critical. Refer to Table 12. SB21 must be ON.
- 5V_EXT from the ST morpho connector (CN3)
- 7-12 V input through the voltage regulator (U3), with the VIN ARDUINO® pin on CN5

The jumper (JP1) selects the 5V source. Table 4 shows the configuration to apply the selected source. Depending on the current needed on the devices connected to the USB port, and the board itself, power limitations can prevent the system from working as expected. The user must ensure that NUCLEO-WL33CCx is supplied with the correct power source depending on the current needed.

Table 4. Power supply selector (JP1) description

JP1 jumper	Setting[1]	Configuration
	**JP1 [1-2]**	**NUCLEO-WL33CCx is supplied through the ST-LINK USB Type-C® receptacle (CN15), with an overvoltage and an overcurrent protection device (U10).**
	JP1 [3-4]	Not available on NUCLEO-WL33CCx.
	JP1 [5-6]	NUCLEO-WL33CCx is supplied through the pin 8 of the ARDUINO® connector (CN5) or pin 24 of the ST morpho connector (CN3) or CN10 (setting SB20) Refer to the configuration details in the present Power supply section.
	JP1 [7-8]	NUCLEO-WL33CCx is supplied through CN10 or through pin 6 of the ST morpho connector (CN3). Refer to the configuration details in the present Power supply section.
	JP1 [9-10]	NUCLEO-WL33CCx is directly supplied by the USB Type-C® receptacle (CN15), without any overvoltage and overcurrent protection.

1. *The default configuration is in bold.*

7.1.4 Current measurement

Given the low-power features of the device, it is pertinent to evaluate the STM32WL33CC current consumption. The board offers several possibilities for current measurement:

- The JP2 IDD jumper, for easy measurement. Set JP2 to OFF and insert an ammeter there. This measures only the STM32WL33CCV6 current consumption.
- An external power supply or DC Power Analyzer on JP2.
  1. Set the JP2 jumper to OFF.
  2. Insert the external supply on pin 2.
  3. Connect GND to CN12.

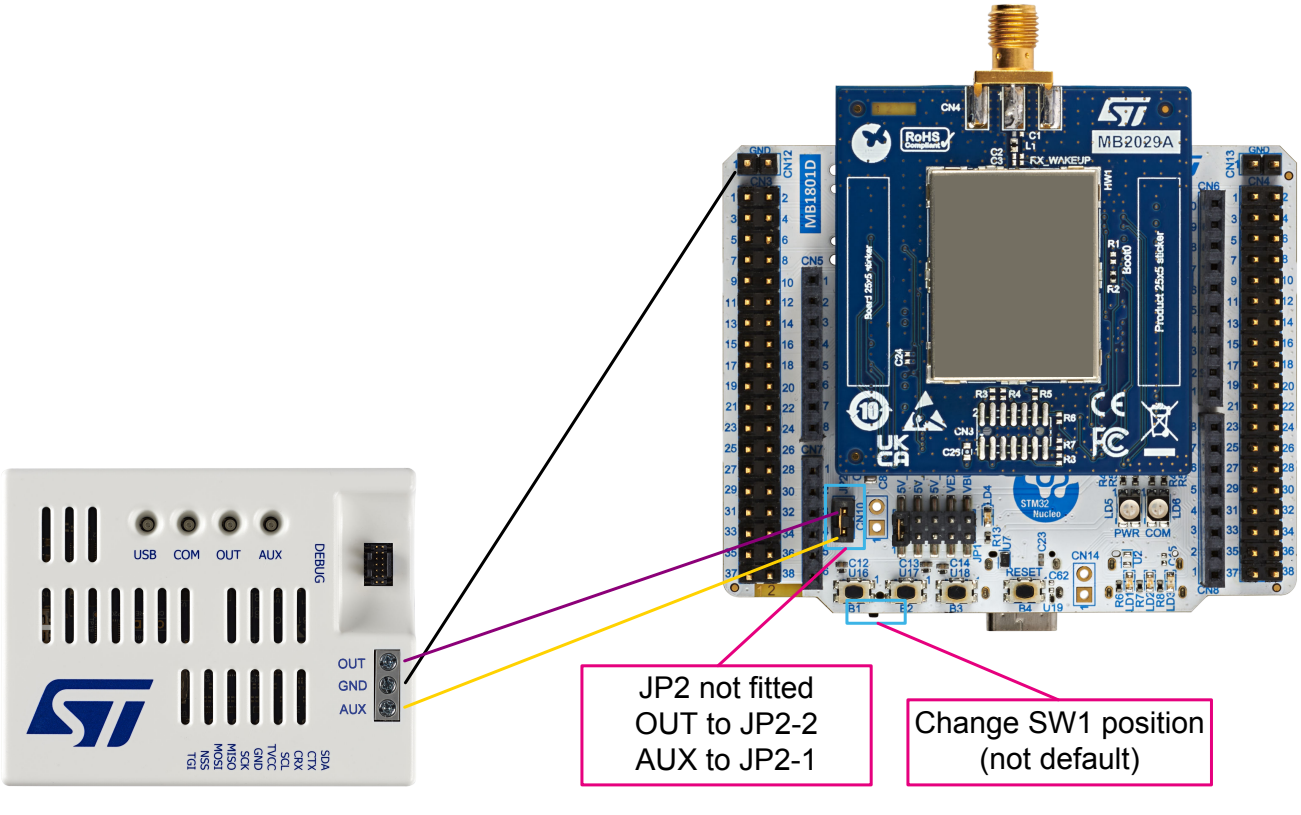
  This measures only the STM32WL33CCV6 current consumption, at the desired supply voltage and in the range of STM32WL33CCV6.

Note: Connecting an external supply to CN10 or CN3 for current measurement is not recommended, as it includes the V_Target domain consumption. Refer to the power tree in Figure 7.

- STLINK-V3PWR and STM32CubeMonitor-Power:
  1. Set the JP2 jumper to OFF.
  2. Connect VOUT of STLINK-V3PWR to JP2-2.
  3. Change the position of SW1 (not the default position).
  4. Use the STLINK-V3PWR AUX port to supply the V_Target power domain, using JP2-1.
  5. Connect GND to CN12.
  6. Configure the supply voltage and measure the current using STM32CubeMonitor-Power, at the desired supply voltage in the range of STM32WL33CCV6.

  Figure 8 shows the complete setup to connect STLINK-V3PWR to a STM32WL33CC board.
  In this configuration, VCP is accessible using the MB1801 ST-LINK V3EC connection and its level shifters.
  For more information on STLINK-V3PWR and STM32CubeMonitor-Power, refer to the dedicated pages and user manuals (*Source measurement unit (SMU) and debugger/programmer for STM32 microcontrollers* (UM3097) for STLINK-V3PWR and *STM32CubeMonitor-Power software tool for power and ultra-low-power measurements* (UM2202) for STM32CubeMonitor-Power, available from http://www.st.com.

Figure 8. **Connecting STLINK-V3PWR to STM32WL33CC**



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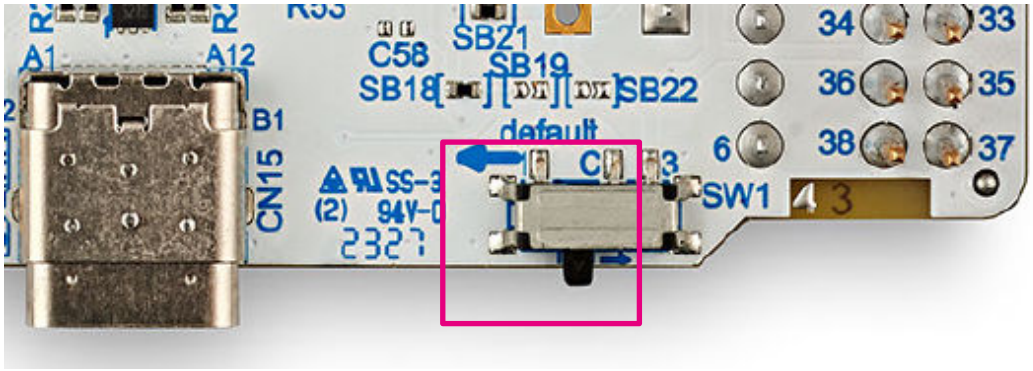
7.1.5 SW1 switch use

SW1 is a two-position switch used to select if the STM32WL33CC is supplied by onboard 3V3V LDO or an external power source.

1. Position [1-2]: It is the default position. The voltage source is the U4 LDO providing 3.3 V.

Figure 9. **SW1 default setting**



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2. Position [3-2]: The external sources might be applied on VEXT on CN10, ST morpho 5VEXT, or ARDUINO® VIN. The externally applied voltages must be in the range of STM32WL33CC supply: 1.7 to 3.6 V. Refer to solder bridge configurations of SB21, SB22, and SB23 given your use case.

7.2 Clock sources

7.2.1 HSE clock references

The high-speed clock (HSE) of the MCU RF board is a 48 MHz crystal unit. This crystal is the only clock source of the Sub-1GHz radio. The internal capacitor bank of STM32WL33CC can be used to trim this frequency.

Note: NUCLEO-WL33CCx boards are not systematically trimmed during production. The default value of the STM32WL33CC capacitor bank register is centered, and accuracy should be in the +/-10ppm range. The user can still establish a trimming procedure if necessary - for more details, refer to the application note How to calibrate the HSE clock for RF applications on STM32 wireless MCUs (AN5042), available from http://www.st.com.

7.2.2 LSE clock references

The low-speed clock (LSE) of the MCU RF board is a 32.768 kHz crystal unit.

7.3 Reset sources

The reset signal of NUCLEO-WL33CCx is active LOW. The internal PU forces the RST signal to a high level. The sources of reset are:

- The reset push-button (B4)
- The embedded STLINK-V3
- The ARDUINO® connector (CN5 pin 3)
- The ST morpho connector (CN3 pin 14)

7.4 Boot0

The NUCLEO-WL33CCx has a preprogrammed bootloader supporting the UART protocol with automatic baud rate detection. The main features of the embedded bootloader are:

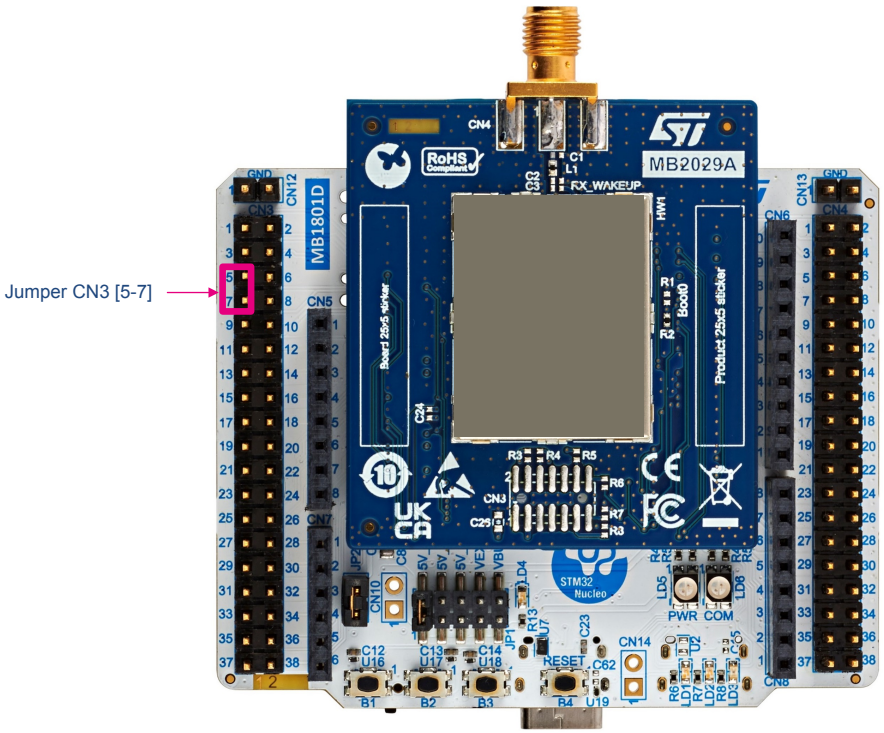
- Auto baud rate detection up to 1 Mbit/s
- Flash memory mass erase, section erase
- Flash memory programming
- Flash memory readout protections enable/disable

The preprogrammed bootloader is an application, which is stored in the internal ROM at manufacturing time by STMicroelectronics. This application allows upgrading the flash memory device with a user application using a serial communication channel (UART).

The bootloader is activated by forcing PA10 high during hardware reset; otherwise, the application in flash memory is launched. Hardware reset is achieved by pressing the reset button (B4).

To force PA10 high on NUCLEO-WL33CCx, insert a jumper between pins 5-7 of the ST morpho connector CN3, as shown in Figure 10.

Figure 10. Boot0 jumper location on ST morpho connector (CN3)



Note: In deepstop mode, SWD connections and connections to STM32Tools are unavailable on STM32WL33. To program a new binary, enter bootloader mode by inserting a jumper between pins 5-7 of the ST morpho connector CN3 and resetting the board by pressing the reset button (B4).

7.5 Embedded STLINK-V3EC

The chapter below gives some information about the implementation of STLINK-V3EC.

For more details on STLINK-V3EC such as LED management, drivers, and firmware, refer to the technical note *Overview of ST-LINK derivatives* (TN1235).

For information about the debugging and programming features of STLINK-V3EC, refer to the user manual *STLINK-V3SET debugger/programmer for STM8 and STM32* (UM2448).

7.5.1 Description

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

- Using the embedded STLINK-V3EC programming and debugging tool on the NUCLEO-WL33CCx board
- Using an external debug tool connected to the MIPI10 connector (CN17) on the MB1801 board

The STLINK-V3EC facility for debugging and programming is integrated into the NUCLEO-WL33CC1 board.

Supported features in STLINK-V3EC:

- 5 V/500 mA power supply capability through the USB Type-C® connector (CN15)
- USB 2.0 high-speed-compatible interface
- JTAG and Serial Wire Debug (SWD) with Serial Wire Viewer (SWV)
- Virtual COM port (VCP)
- 1.7 to 3.6 V application voltage
- COM status LED that blinks during communication with the PC
- Power status LED that gives information about STLINK-V3EC target power
- Overvoltage protection with current limitation

Two tricolor LEDs (green, orange, and red) provide information about the STLINK-V3EC communication status (LD6) and STLINK-V3EC power status (LD5).

7.5.2 Drivers

Driver installation is not mandatory for Windows® 10 and above but assigns an ST-specific name to the ST-LINK COM port in the system device manager.

For detailed information on the ST-LINK USB drivers, refer to the technical note *Overview of ST-LINK derivatives* (TN1235).

7.5.3 STLINK-V3EC firmware upgrade

STLINK-V3EC embeds a firmware upgrade (STSW-LINK007) mechanism through the USB Type-C® port. The firmware might evolve during the lifetime of the STLINK-V3EC product (for example to add new functionalities, fix bugs, and support for new microcontroller families). Therefore, it is recommended to keep the STLINK-V3EC firmware up-to-date before starting to use the NUCLEO-WL33CCx board. The latest version of the ST-LINK firmware is available from the *www.st.com* website.

7.5.4 Using an external debug tool to program and debug STM32WL33CC

Before connecting any external debug tool to the STDC14 debug connector (CN17), the SWD and VCP signals from STLINK-V3EC must be isolated. For this, fit the jumper on JP4. It disables the U9 level shifter and isolates SWD and VCP signals from STLINK-V3EC. The configuration of the JP4 is explained in Table 5.

Once the jumper is fitted on JP4, an external debug tool can be connected to the STDC14 debug connector (CN17).

Table 5. JP4 configuration

Jumper	Definition	Setting	Comment
JP4	Debugger selection	ON [1-2]	An external debugger connected to the STDC14 connector (CN17) can be used. The level shifter (U9) is in high impedance (high-Z).
		OFF	The embedded STLINK-V3EC is selected (default configuration)

Note: The STDC14 connector supports 1V8 or 3V3 for the target reference voltage. When using the external debug connector (CN17), STLINK-V3EC can be used to supply the board through the USB Type-C® connector (CN15).

7.5.5 STLINK-V3EC USB connector (CN15)

The main function of this connector is the access to STLINK-V3EC embedded on NUCLEO-WL33CCx for the debugging as explained above. It can supply the board (refer to Power supply). The connector is a standard USB Type-C® connector.

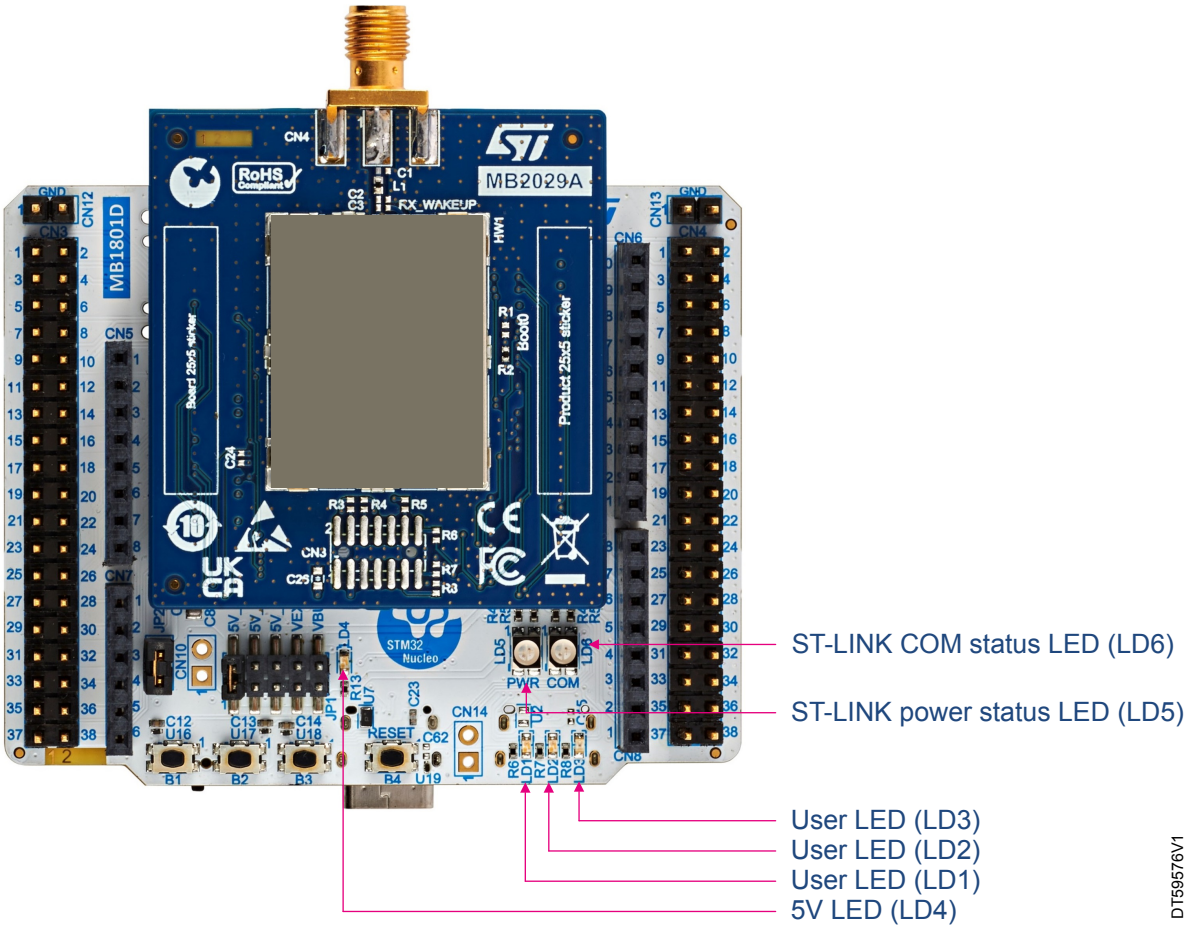
7.5.6 Level shifters

NUCLEO-WL33CCx features a system for supplying the STM32WL33CC with a voltage different from ST-LINK, always supplied by a 3V3 source with a dedicated LDO. Level shifters avoid conflict when using a different target voltage. Level shifters ensure the voltage conversion between ST-LINK and the SoC. It drives SWD and UART signals connected to ST-LINK.

7.6 LEDs

Six LEDs on the top side of the Nucleo board help the user during the application development.

Figure 11. LED locations



- LD1: This blue LED is available for user application. It is connected to PA14 of STM32WL33CC.
- LD2: This green LED is available for user application. It is connected to PB4 of STM32WL33CC.
- LD3: This red LED is available for user application. It is connected to PB5 of STM32WL33CC.
- LD4: This LED turns green when a 5V source is available (to select the 5V source, refer to Section 7.1.3: 5 V power supply).

LD5 and LD6 are ST-LINK power status and communication LEDs. For more information about ST-LINK PWR and COM LEDs, refer to the technical note *Overview of ST-LINK derivatives* (TN1235).

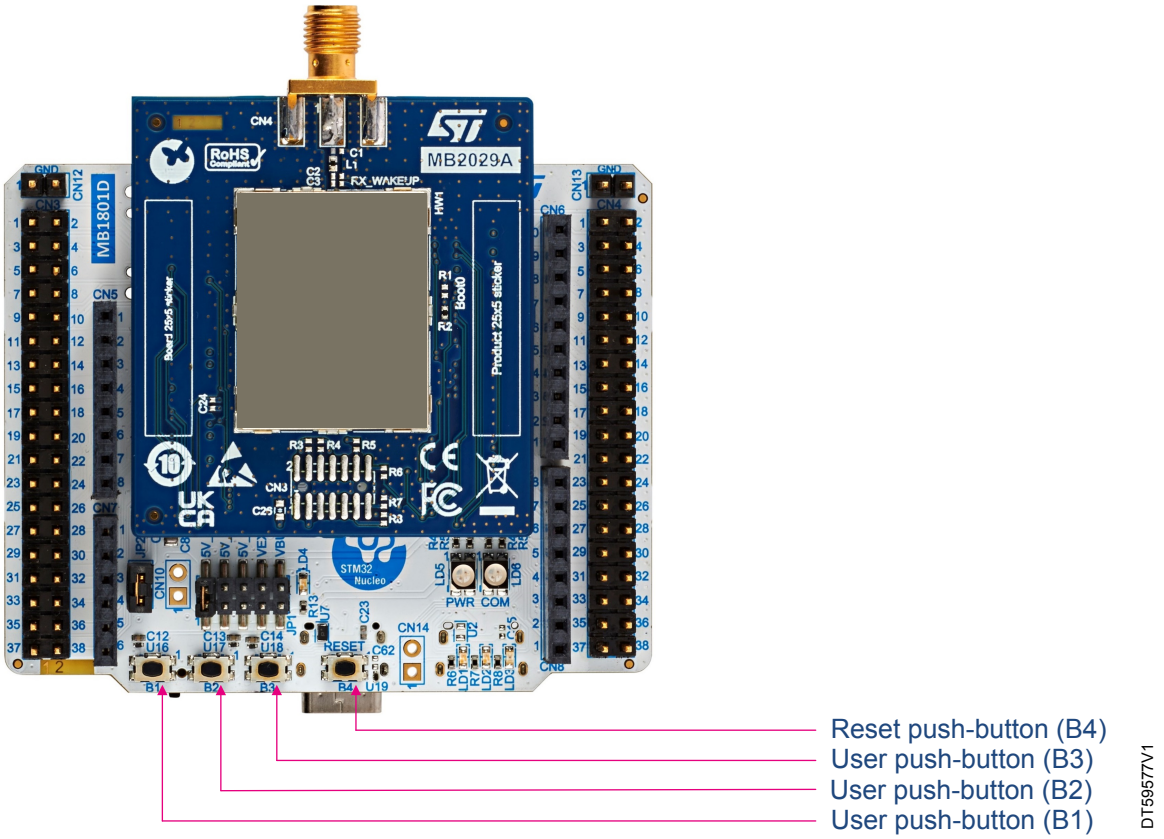
7.7 Push-buttons

7.7.1 Description

NUCLEO-WL33CCx provides four buttons:

- USER1 push-button (B1)
- USER2 push-button (B2)
- USER2 push-button (B3)
- Reset push-button (B4), used to reset the Nucleo board.

Figure 12. Push-button locations



7.7.2 Reset push-button

B4 is dedicated to the hardware reset of the Nucleo board.

7.7.3 User push-buttons

There are two push-buttons available for the user application. They are connected to PA0 and PA11. It is possible to use them for GPIO reading.

Note that PA0 is also connected to the ARDUINO® and ST morpho connectors as a GPIO, depending on the use case that can generate conflict. In this case, it is possible to remove the connection to push-buttons. Refer to MB1801 solder bridge configuration Table 12.

Table 6. I/O configuration for the user push-buttons

Name	I/O
USER1 push button (B1).	PA0
USER2 push button (B2)	PA11
USER3 push button (B3)	PB15

7.8 RF stage

The RF front end is designed to match and filter RF on three different paths: TX, RX, and RX_WAKEUP. NUCLEO-WL33CCx embeds an IPD (integrated passive device) that combines both TX and RX matching and filtering in a tiny package. Figure 13 gives a representation of external and internal RF blocks.

STM32WL33CC has two output power pins TX and TX_HP that are used in this way:

- TX pin alone is used for output power up to 10 dBm.
- TX_HP pin alone is used for output power up to 16 dBm.
- Above 16 dBm, both TX and TX_HP pins are used.

On NUCLEO-WL33CCx, only the TX_HP pin is connected for output power up to 16 dBm.

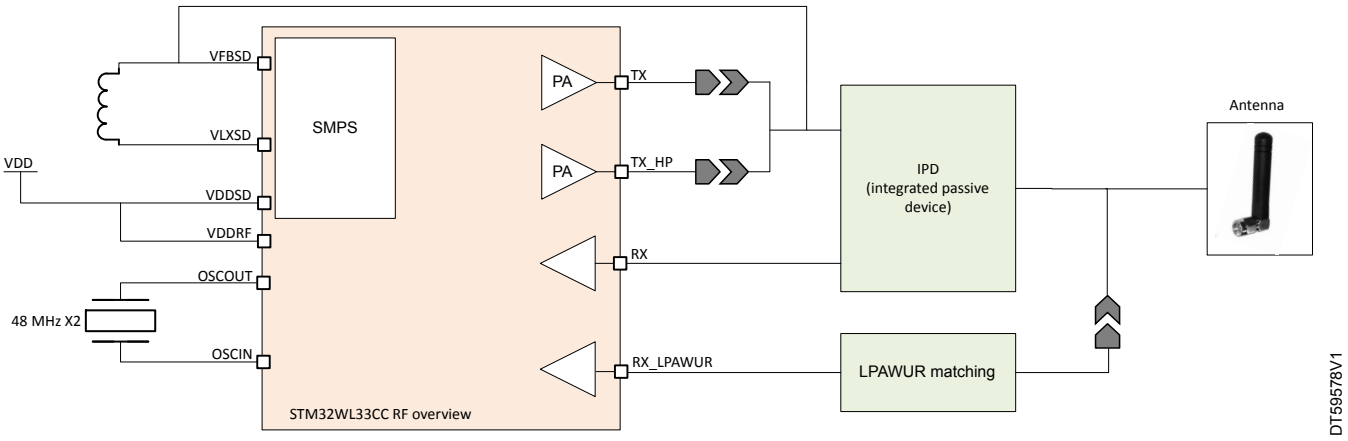
SMPS biases internal PA, SMPS being in the range of 1.2 to 2.4 V

The board comes with a shield can. This shield can must not be removed.

The antenna is glued to the SMA connector. A different reference antenna is used for lower and higher bands:

- NUCLEO-WL33CC1 is equipped with an LPRS SR-900 antenna.
- NUCLEO-WL33CC2 is equipped with an LPRS SR-433 antenna.

Figure 13. RF block diagram



NUCLEO-WL33CCx board variants embed a different IPD. Table 7 gives the part number and a description of IPD for each variant.

Table 7. IPD manufacturer part number used on NUCLEO-WL33CCx

NUCLEO-WL33CCx variant	Part number	Description
NUCLEO-WL33CC1	MLPF-WL-01D3	IPD for STM32WL3xxx, 826-958MHz, 16 dBm, on a 4-layer PCB
NUCLEO-WL33CC2	MLPF-WL-04D3	IPD for STM32WL3xxx, 413-479MHz, 16 dBm, on a 4-layer PCB

The antenna is stuck to the SMA connector because of FCC constraints. Indeed, it is mentioned in the FCC regulations. As soon as a product is considered *general public*, the FCC implies that the antenna must be stuck to the board connector with epoxy glue. Refer to the FCC documentation *BASIC EQUIPMENT AUTHORIZATION GUIDANCE FOR ANTENNAS USED WITH PART 15 INTENTIONAL RADIATORS* in the chapter *ANTENNA REQUIREMENTS—Section 15.203*.

7.8.1 RX_LPAWUR

STM32WL33CC features a low-power autonomous wake-up receiver (LPAWUR) meant to receive dedicated wake-up frames during a deep-sleep MCU state. The LPAWUR can work on three different frequency bands. By default, this feature is not connected to the antenna path. C3 is OFF.

BOM changes might be needed depending on the frequency band used, as shown in Table 8.

Table 8. LPAWUR path BOM given frequency bands

Frequency band	L4	L3	C3
A (860-928 MHz)	6.8 nH	5.6 nH	100 pF
B (2400-2483.5 MHz)	10 pF(1)	2.7 pF	1.8 pF
C (413-479 MHz)	47 nH	OFF	100 pF

1. *A capacitor of the indicated value replaces the inductor.*

NUCLEO-WL33CC1 is equipped with the RX LPAWUR BOM for frequency band A.

NUCLEO-WL33CC2 is equipped with the RX LPAWUR BOM for frequency band C.

7.9 ARDUINO® connectors

7.9.1 Description

On the bottom side of the board, there is an ARDUINO® Uno V3 connector. It is built around four standard connectors (CN5, CN6, CN7, and CN8). Most shields designed for ARDUINO® can fit with the Nucleo kits to offer flexibility in small form factor applications.

7.9.2 ARDUINO® interface and pinout

Figure 14 shows the position of the ARDUINO® shield when it is plugged into NUCLEO-WL33CCx with the pinout. The pinout shown in Figure 14 corresponds to standard ARDUINO® naming. To see the correspondence with the STM32, refer to Table 9.

Figure 14. ARDUINO® Uno connectors and shield location

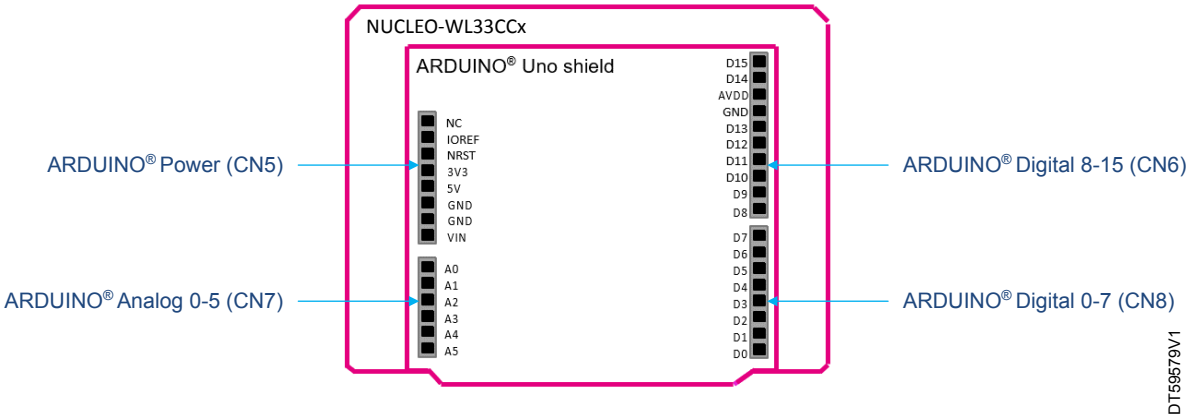


Table 9. ARDUINO® Uno V3 connectors pinout

Left connectors					Right connectors				
Connector	Pin number	Pin name	MCU pin	Function	Function	MCU pin	Pin name	Pin number	Connector
					I2C2_SCL	PA6	ARD_D15	10	CN6 Digital
					I2C2_SDA	PA7	ARD_D14	9	
					-	-	AVDD	8	
					GND	-	GND	7	
CN5 Power	1	NC	-	NC	SPI1_SCK	PB11	ARD_D13	6	
	2	3V3 (IOREF)	-	IOREF (V_TARGET)	SPI1_MISO	PB8	ARD_D12	5	
	3	NRST	NRST	NRST	SPI1_MOSI	PB9	ARD_D11	4	
	4	3V3	-	3V3 output	SPI1_NSS	PB10	ARD_D10	3	
	5	5V	-	5V	GPIO/LD1/LCB	PA14	ARD_D9	2	
	6	GND	-	GND	GPIO	PA5	ARD_D8	1	
	7	GND	-	GND					
	8	VIN	-	External supply input (7-12 V)	GPIO/LCB	PA4	ARD_D7	8	CN8 Digital
					GPIO	PA12	ARD_D6	7	
CN7 Analog	1	A0	PB0	ADC_VINM1	GPIO	PA13	ARD_D5	6	
	2	A1	PB1	ADC1_VINP1/LCA	**USART1_RX**/ LPUART1_RX	**PA8**/PB7[1]	ARD_D4	5	
	3	A2	PB2	ADC1_VINM0/LCT	GPIO/B1	PA0	ARD_D3	4	
	4	A3	PB3	ADC_VINP0	**USART1_TX**/ LPUART1_TX	**PA9**/PB6[1]	ARD_D2	3	
	5	A4	PB14	PVD_VIN	**LPUART1_TX**/ USART1_TX	**PB6**/PA9[1]	ARD_D1	2	
	6	A5	PB5	ADC_VINP3/LD3	**LPUART1_RX**/ USART1_RX	**PB7**/PA8[1]	ARD_D0	1	

1. *This is optional and needs to change the state of solder bridges. The default configuration is in bold.*

7.10 ST morpho connectors

7.10.1 ST morpho interface and pinout

The ST morpho connectors (CN3 and CN4) are male pin headers accessible on both sides of the board. All MCU signals are available on the ST morpho connectors. An oscilloscope, logical analyzer, or voltmeter can also probe these connectors.

Figure 15. ST morpho connector locations

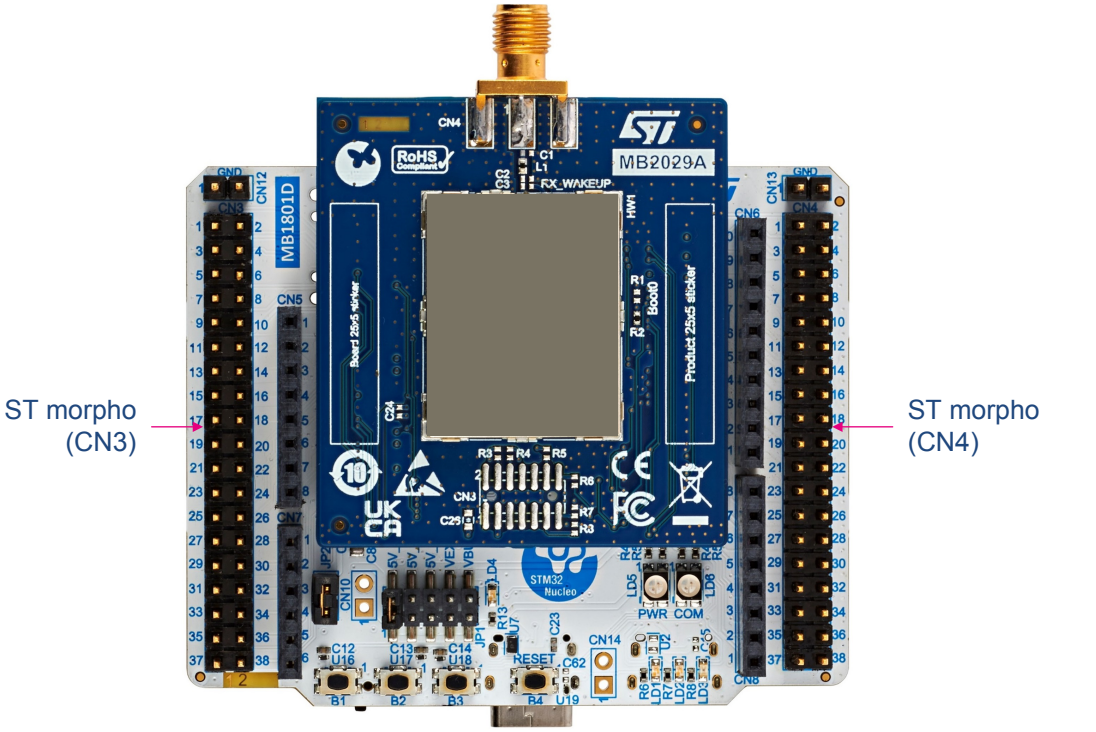


Table 10. Pinout of the ST morpho connector (CN3)

CN3					
Pin number	Main function	MCU pin	Pin number	Main function	MCU pin
1	-	-	2	-	-
3	-	-	4	-	-
5	VDD	-	6	5V_EXT	-
7	BOOT0	PA10	8	GND	-
9	SWDIO	PA2	10	5V_INT	-
11	SWCLK	PA3	12	IOREF	-
13	-	-	14	NRST	NRST
15	-	-	16	3V3	-
17	-	-	18	5V	-
19	GND	GND	20	GND	GND
21	-	-	22	GND	-
23	LD2	PB4	24	VIN	-
25	OSC_32_IN	PB13(1)	26	-	-

CN3					
Pin number	Main function	MCU pin	Pin number	Main function	MCU pin
27	OSC_32_OUT	PB12(1)	28	ADC_VINM1	PB0
29	-	-	30	ADC1_VINP1/LCA	PB1
31	-	-	32	ADC1_VINM0/LCT	PB2
33	VBAT	-	34	ADC_VINP0	PB4
35	VCP1_RX	PA15	36	PVD_VIN	PB14
37	VCP1_TX	PA1	38	ADC_VINP3/LD3	PB5

1. *This is optional and needs to change the state of solder bridges.*

Table 11. Pinout of the ST morpho connector (CN4)

CN4					
Pin number	Main function	MCU pin	Pin number	Main function	MCU pin
1	-	-	2	-	-
3	I2C2_SCL	PA6	4	-	-
5	I2C2_SDA	PA7	6	LD1	PA14
7	VDDA	-	8	5V_USB_MCU	-
9	GND	GND	10	-	-
11	SPI1_SCK	PB11	12	-	-
13	SPI1_MISO	PB8	14	-	-
15	SPI1_MOSI	PB9	16	-	-
17	SPI1_NSS	PB10	18	-	-
19	-	PA14	20	GND	GND
21	-	PA5	22	-	-
23	-	PA4	24	-	-
25	-	PA12	26	-	-
27	-	PA13	28	-	-
29	**USART1_RX**/LPUART1_RX	PA8/PB7(1)	30	B2	PA11
31	-	PA0	32	GND	GND
33	**USART1_TX**/LPUART1_TX	PA9/PB6(1)	34	B3	PB15
35	**LPUART1_TX**/USART1_TX	PB6/PA9(1)	36	B1	PA0
37	**LPUART1_RX**/USART1_RX	PB7/PA8(1)	38	LD3	PB5

1. *This is optional and needs to change the state of solder bridges. The default configuration is in bold.*

7.11 Solder bridge configuration and purpose

MB1801 has 33 solder bridges and MB2029 has 19 solder bridges. They allow an important number of configurations. Table 12 describes their purpose for MB1801 and Table 13 for MB2029. The default configuration is shown in bold.

7.11.1 MB1801 mezzanine board solder bridges

MB1801 solder bridges allow different configurations of power trees, user LEDs and buttons, and ST-LINK. Some of the configurations are not relevant for NUCLEO-WL33CCx. MB1801 solder bridges are all located on the bottom side.

Table 12. Solder bridges on the mezzanine board

Solder bridge control	Solder bridge (SB)	State(1)	Description(1)
AVDD(2)	SB1	**ON**	**The VDDA domain is connected to the VDD domain**
		OFF	The VDDA domain is separated from the VDD domain.
B1	SB2	**ON**	**The user button B1 is connected to PA0**
		OFF	The user button B1 is disconnected
VCP1_TX	SB3	**ON**	**VCP1 of ST-LINK is connected to target MCU(3) TX.**
		OFF	VCP1 is disconnected from target MCU(3) TX.
B2	SB4	**ON**	**The user button B2 is connected to PA11.**
		OFF	The user button B2 is disconnected.
VCP1_RX	SB5	**ON**	**VCP1 of ST-LINK is connected to target MCU(3) RX.**
		OFF	VCP1 is disconnected from the target MCU(3) RX.
B3	SB6	**ON**	**The user button B3 is connected to PB15.**
		OFF	The user button B3 is disconnected.
VCP2_RX(2)	SB7	ON	VCP2 of ST-LINK is connected to target MCU(3) RX.
		OFF	**VCP2 is disconnected from the target MCU(3) RX.**
VCP2_TX(2)	SB8	ON	VCP2 of ST-LINK is connected to target MCU(3) TX.
		OFF	**VCP2 is disconnected from target MCU(3) TX.**
LD1	SB9	**ON**	**The user LED LD1 is connected to PA14.**
		OFF	The user LED LD1 is disconnected.
LD2	SB10	**ON**	**The user LED LD2 is connected to PB4.**
		OFF	The user LED LD2 is disconnected.
LD3	SB11	**ON**	**The user LED LD3 is connected to PB5.**
		OFF	The user LED LD3 is disconnected.
JTDO(2)	SB12	ON	JTDO of the target MCU(3) is connected to ST-LINK.
		OFF	**JTDO of the target MCU(3) is disconnected from ST-LINK.**
JTDI(2)	SB13	ON	JTDI of the target MCU(3) is connected to ST-LINK
		OFF	**JTDI of the target MCU(3) is disconnected from ST-LINK.**
USB user P(2)	SB14	ON	USB user (CN9) positive bus is connected to the target MCU(3).
		OFF	**USB user (CN9) positive bus is disconnected**

Solder bridge control	Solder bridge (SB)	State[1]	Description[1]
SWCLK	SB15	**ON**	**SWCLK of the target MCU[3] is connected to ST-LINK.**
		OFF	SWCLK of the target MCU[3] is disconnected from ST-LINK
USB user N[2]	SB16	ON	USB user (CN9) negative bus is connected to the target MCU[3].
		OFF	**USB user (CN9) negative bus is disconnected**
SWDIO	SB17	**ON**	**SWDIO of the target MCU[3] is connected to ST-LINK.**
		OFF	SWDIO of the target MCU[3] is disconnected from ST-LINK
User LED supply	SB18	**ON**	**The user LEDs LD1, LD2, and LD3 are supplied by V_Target.**
		OFF	The user LEDs LD1, LD2, and LD3 are not supplied by V_Target
	SB19	ON	The user LEDs LD1, LD2, and LD3 are supplied by 3V3.
		OFF	**The user LEDs LD1, LD2, and LD3 are not supplied by 3V3.**
VEXT to U3	SB20	ON	The external supply on CN10 (VEXT) is connected to U3 LDO (5V_INT on JP1). This configuration is used if the applied voltage on CN10 is in the 7-12 V range.
		OFF	**VEXT and VIN domains are disconnected.**
VEXT to U4	SB21	**ON**	**The external supply on CN10 is connected to U4 LDO (VEXT on JP1). This configuration is used if the applied voltage on CN10 is in the 3.3-7 V range.**
		OFF	VEXT is disconnected from U4 LDO and JP1 (VEXT).
VEXT to target MCU[3]	SB22	ON	External supply VEXT on CN10 is connected directly to the target MCU[3] through SW1. This configuration is used if the applied voltage on CN10 is directly in range of the MCU power supply.
		OFF	**External supply VEXT is not connected directly to the MCU.**
VCP2_RTS[2]	SB23	ON	VCP2 of ST-LINK is connected to target MCU[3] RTS.
		OFF	**VCP2 is disconnected from target MCU[3] RTS.**
	SB26	ON	VCP2 of ST-LINK is connected to target MCU[3] RTS.
		OFF	**VCP2 is disconnected from target MCU[3] RTS.**
VCP2_CTS[2]	SB24	ON	VCP2 of ST-LINK is connected to target MCU[3] CTS.
		OFF	**VCP2 is disconnected from target MCU[3] CTS.**
	SB25	ON	VCP2 of ST-LINK is connected to target MCU[3] CTS.
		OFF	**VCP2 is disconnected from target MCU[3] CTS.**
	SB27	ON	VCP2 of ST-LINK is connected to target MCU[3] CTS.
		OFF	**VCP2 is disconnected from target MCU[3] CTS.**
BOOT0	SB28	**ON**	**ST-LINK I/O can control Boot0 of the target MCU[3].**
		OFF	Boot0 of the target MCU[3] is disconnected from ST-LINK
RESET	SB29	**ON**	**ST-LINK bridge I/O controls the target MCU[3] reset.**
		OFF	Target MCU[3] reset is disconnected.
	SB30	**ON**	**ST-LINK standard I/O controls the target MCU[3] reset.**
		OFF	Target MCU[3] reset is disconnected.

Solder bridge control	Solder bridge (SB)	State(1)	Description(1)
5VEXT	SB33	**ON**	**5V_EXT of ST morpho connector CN3 is connected to VEXT on JP1.**
		OFF	5V_EXT is disconnected from the power tree.

1. *The default configuration is in bold.*
2. *Those solder bridges have no impact on NUCLEO-WL33CCx. The function is not implemented or not available on STM32WL33CC.*
3. *For NUCLEO-WL33CCx, the target MCU is STM32WL33CC.*

7.11.2 MB2029 MCU RF board solder bridges

The MB2029 solder bridges allow different configurations of STM32WL33CC I/Os and alternate functions, crystal output on the mezzanine board, and TX power configurations. MB2029 solder bridges are located on the bottom side. To access these solder bridges, it is necessary to separate the mezzanine board and the MCU RF board. Be careful when doing this action and pay attention to the position on the CN1 and CN2 connectors.

Table 13. Solder bridges on the MCU RF board

Solder bridge control	Solder bridge (SB)	State[1]	Description[1]
TX_HP	SB1	**ON**	**TX_HP pin is connected to the RF TX path.**
		OFF	The TX_HP pin is disconnected from the RF TX path.
TX	SB2	ON	TX pin is connected to the RF TX path.
		OFF	**TX pin is disconnected from the RF TX path.**
X1-LSE	SB3	ON	OSC32_IN is output on the ST morpho connector CN3.
		OFF	**OSC32_IN is disconnected.**
	SB4	ON	OSC32_OUT is output on the ST morpho connector CN3.
		OFF	**OSC32_OUT is disconnected.**
LD1[2]	SB5	**ON**	**LD1 is connected to PA14.**
		OFF	LD1 is disconnected.
ARDUINO® D4	SB6	ON	ARDUINO® D4 is connected to PB7.
		OFF	**ARDUINO® D4 is disconnected from PB7.**
	SB7	**ON**	**ARDUINO® D4 is connected to PA8.**
		OFF	ARDUINO® D4 is disconnected from PA8.
ARDUINO® D3	SB8	**ON**	**ARDUINO® D3 is connected to PA0.**
		OFF	ARDUINO® D3 is disconnected from PA0.
ARDUINO® D2	SB9	ON	ARDUINO® D2 is connected to PB6.
		OFF	**ARDUINO® D2 is disconnected from PB6.**
	SB10	**ON**	**ARDUINO® D2 is connected to PA9.**
		OFF	ARDUINO® D2 is disconnected from PA9.
ARDUINO® D1 (TX)	SB11	ON	ARDUINO® D1 (TX) is connected to PA9 (USART1_TX).
		OFF	**ARDUINO® D1 is disconnected from PA9.**
	SB13	**ON**	**ARDUINO® D1 (TX) is connected to PB6 (LPUART1_TX).**
		OFF	ARDUINO® D1 is disconnected from PB6.
VCP1_RX[2]	SB14	**ON**	**VCP1_RX is connected to PA15 (USART1_RX).**
		OFF	VCP1_RX is disconnected from PA15.
ARDUINO® D0 (RX)	SB15	**ON**	**ARDUINO® D0 (RX) is connected to PB7 (LPUART1_RX).**
		OFF	ARDUINO® D0 is disconnected from PB7.
	SB17	ON	ARDUINO® D0 (RX) is connected to PA8 (USART1_RX).
		OFF	**ARDUINO® D0 is disconnected from PA8.**
VCP1_TX[2]	SB16	**ON**	**VCP1_TX is connected to PA1 (USART1_TX).**
		OFF	VCP1_TX is disconnected from PA1.
B1[2]	SB18	**ON**	**The user button B1 is connected to PA0.**
		OFF	The user button B1 is disconnected.
LD3[2]	SB19	**ON**	**The user LED LD3 is connected to PB5.**
		OFF	The user LED LD3 is disconnected.

1. *The default configuration is in bold.*
2. *Those solder bridges are redundant with MB1801 solder bridges. It is easier to change MB1801 solder bridges.*

8 NUCLEO-WL33CCx product information

8.1 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.

8.2 NUCLEO-WL33CCx product history

Table 14. Product history

Order code	Product identification	Product details	Product change description	Product limitations
NUCLEO-WL33CC1	NUWL33CC1$CR1	MCU: STM32WL33CCV6 silicon revision "Z" MCU errata sheet: *STM32WL33xx device errata* (ES0612) Boards: • MB1801-NoUSB-D03 (mezzanine board) • MB2029-Highband-B02 (MCU RF board)	Initial revision	No limitation
NUCLEO-WL33CC2	NUWL33CC2$CR1	MCU: STM32WL33CCV6 silicon revision "Z" MCU errata sheet: *STM32WL33xx device errata* (ES0612) Boards: • MB1801-NoUSB-D03 (mezzanine board) • MB2029-Lowband-B01 (MCU RF board)	Initial revision	No limitation

8.3 Board revision history

Table 15. Board revision history

Board reference	Board variant and revision	Board change description	Board limitations
MB1801 (mezzanine board)	NoUSB-D03	Initial revision	No limitation
MB2029 (MCU RF board)	Highband-B02	Initial revision	No limitation
	Lowband-B01	Initial revision	No limitation

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

9.1 FCC Compliance Statement

FCC Compliance Statement

Identification of products: NUCLEO-WL33CC1.
FCC ID: YCP-MB202900

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:

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

9.2 ISED Compliance Statement

ISED Compliance Statement

Identification of products: NUCLEO-WL33CC1.

IC: 8976A-MB202900

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).

10 UKCA Compliance Statement

SIMPLIFIED UK DECLARATION OF CONFORMITY

Hereby, the manufacturer STMicroelectronics, declares that the radio equipment type “NUCLEO-WL33CC1” is in compliance with the UK Radio Equipment Regulations 2017 (UK S.I. 2017 No. 1206). The full text of the UK Declaration of Conformity is available at the following internet address: *www.st.com*.

11 RED compliance statement

Simplified EC compliance statement:

Hereby, STMicroelectronics declares that the radio equipment type "Nucleo-WL33CC1" and "Nucleo-WL33CC2" are in compliance with Directive 2014/53/EU. The full text of the EU declaration of conformity is available at the following internet address: *www.st.com*.

Frequency range used in transmission and maximal radiated power in this range:

Nucleo-WL33CC1:

Frequency range: 869.4-869.65 MHz

Maximal power: 16 dBm e.r.p

Nucleo-WL33CC2:

Frequency range: 433.05 – 434.79 MHz

Maximal power: 10 dBm e.r.p.

Déclaration de conformité CE simplifiée :

Le soussigné, STMicroelectronics, déclare que l'équipement radioélectrique du type Nucleo-WL33CC1 et Nuceo-WL33CC2 sont conformes à la directive 2014/53/UE. Le texte complet de la déclaration UE de conformité est disponible à l'adresse internet suivante : *www.st.com*.

Bande de fréquence utilisée en transmission et puissance max rayonnés dans ces bandes :

Nucleo-WL33CC1 :

Bande de fréquence : 869.4-869.65 MHz

Puissance Max : 16 dBm e.r.p

Nucleo-WL33CC2 :

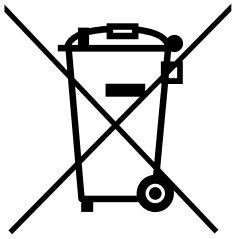
Bande de fréquence : 433.05 – 434.79 MHz

Puissance Max: 10 dBm e.r.p

12 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 16. **Document revision history**

Date	Revision	Changes
20-Nov-2024	1	Initial release.
02-Jun-2025	2	Updated: • Document title • Introduction • Section 2: Ordering information • Section 3.1: System requirements and Section 3.3: EDA resources • Section 7.1.1: General description • Section 7.1.4: Current measurement • Section 7.2.1: HSE clock references • Section 7.4: Boot0 • Table 9. ARDUINO® Uno V3 connectors pinout • Table 10. Pinout of the ST morpho connector (CN3) • Section 8.1: Product marking Added Section 10: UKCA Compliance Statement and Section 12: Product disposal

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