

STM32WL Nucleo-64 board (MB1389)

Introduction

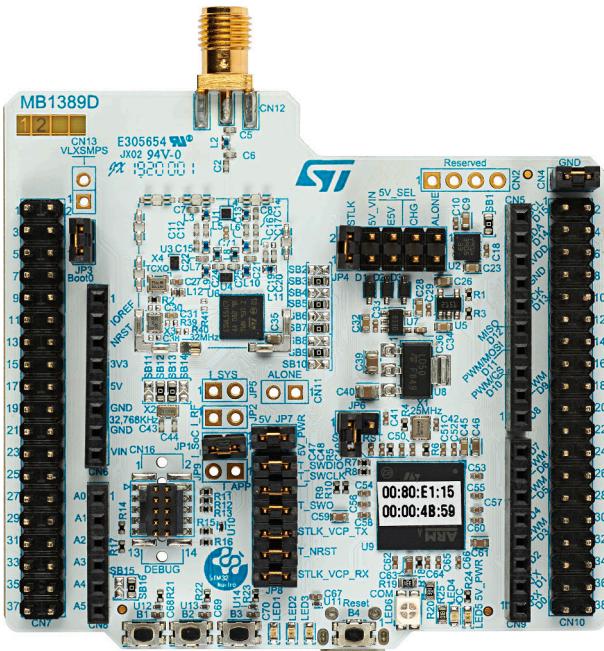
The **NUCLEO-WL55JC** STM32WL Nucleo-64 board, based on the MB1389 reference board (**NUCLEO-WL55JC1** and **NUCLEO-WL55JC2** order codes), provides an affordable and flexible way for users to try out new concepts and build prototypes with the STM32WL series microcontroller, choosing from the various combinations of performance, power consumption, and features.

The ARDUINO® Uno V3 connectivity support and the ST morpho headers provide an easy means of expanding the functionality of the STM32WL Nucleo open development platform with a wide choice of specialized shields.

The STM32WL Nucleo-64 board does not require any separate probe as it integrates the STLINK-V3E debugger and programmer.

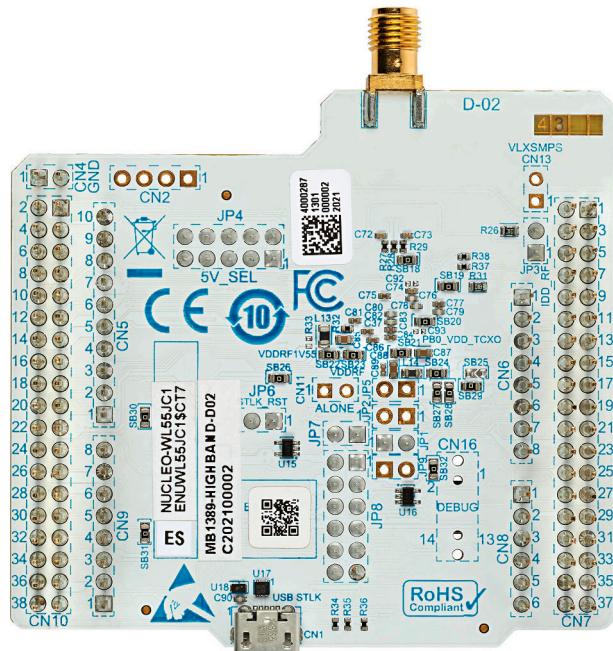
The STM32WL Nucleo-64 board is supplied with the STM32WL comprehensive software HAL library and various packaged software examples available with the STM32CubeWL MCU Package.

Figure 1. NUCLEO-WL55JC top view



Pictures are not contractual.

Figure 2. NUCLEO-WL55JC bottom view



1 Features

- STM32WL55JC microcontroller multiprotocol LPWAN dual-core 32-bit (Arm® Cortex®-M4/M0+ at 48 MHz) in UFBGA73 package featuring:
 - Ultra-low-power MCU
 - RF transceiver (150 to 960 MHz frequency range) supporting LoRa®, (G)FSK, (G)MSK, and BPSK modulations
 - 256-Kbyte flash memory and 64-Kbyte SRAM
- Three user LEDs
- Three user and one reset push-buttons
- 32.768 kHz LSE crystal oscillator
- 32 MHz HSE on-board oscillator
- Board connectors:
 - USB with Micro-B
 - MIPI® debug connector
 - ARDUINO® Uno V3 expansion connector
 - ST morpho extension pin headers for full access to all STM32WL I/Os
- Delivered with SMA antenna
- Flexible power-supply options: ST-LINK USB V_{BUS}, USB connector, or external sources
- On-board STLINK-V3 debugger/programmer with USB re-enumeration capability: mass storage, Virtual COM port, and debug port
- Comprehensive free software libraries and examples available with the [STM32CubeWL](#) MCU Package
- Support of a wide choice of Integrated Development Environments (IDEs) including IAR Embedded Workbench®, MDK-ARM, and STM32CubelDE
- Suitable for rapid prototyping of end nodes based on LoRaWAN®, Sigfox™, wM-Bus, and many other proprietary protocols
- Fully open hardware platform

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

arm

2 Ordering information

To order an STM32WL Nucleo-64 board, refer to [Table 1](#). Additional information is available from the datasheet and reference manual of the target STM32.

Table 1. List of available products

Order code	Board reference	Target STM32	Differentiating feature
NUCLEO-WL55JC1	MB1389 ⁽¹⁾	STM32WL55JCI7	High-frequency band. The RF frequency range is 865 to 928 MHz.
NUCLEO-WL55JC2			Low-frequency band. The RF frequency range is 433 to 510 MHz.

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-XXYYZTN		Description	Example: NUCLEO-WL55JC1
XX		MCU series in STM32 32-bit Arm Cortex MCUs	STM32WL series
YY		MCU product line in the series	STM32WL55: Dual-core with LoRa®, (G)FSK, (G)MSK, and BPSK modulations
Z		STM32 package pin count: • J for 73 pins	73 pins
T		STM32 flash memory size: • C for 256 Kbytes	256-Kbyte flash memory
N		Frequency band: • 1: high-frequency band • 2: low-frequency band	High-frequency band

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 Micro-B 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-WL55JC** 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 Quick start

The STM32WL Nucleo-64 board is an easy-to-use and low-cost development kit used to evaluate and start development quickly with an STM32WL series microcontroller in the UFBGA73 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 STM32WL Nucleo-64 and demonstration software, visit the www.st.com/stm32nucleo webpage.

5.1 Getting started

Follow the sequence below to configure the STM32WL Nucleo-64 board and launch the demonstration application (refer to [Figure 4](#) for component location):

1. Check the jumper positions on board, I_SoC (JP1) ON, BOOT0 (JP3) ON, power source (JP4) on 5V_USB_STLK, 5V_PWR (JP7) ON, and all six jumpers (JP8) ON.
The jumper position on the board is explained in [Table 4](#).
2. Connect the STM32WL Nucleo-64 board to a PC with a standard USB cable through the USB connector (CN1) to power the board. Then the PWR green (LED5) and COM (LED6) LEDs light up, while the three LEDs (LED1, LED2, and LED3) blink.
3. On the PC, connect a UART terminal to the board using the following settings:
 - UART terminal: new line received = auto; new line transmit = LF (line feed)
 - Serial port setting: select COM port number, 9600 baud rate, 8-bit data, parity none, one stop bit, and no flow control
4. Press on the B4 reset button of the STM32WL Nucleo-64 board.
 - The STM32WL Nucleo-64 board remains silent until it gets a command from the connected PC to send a beacon on one of the beacon frequencies.
 - The frequency is selected depending on the region.
 - After the version check, the first three commands to send to the PC must set region, subregion, and start the beacon (AT+REGION=x and AT_BEACON_ON). The first two commands select the format of the transmission beacon. The third command starts sending the beacon.
 - For a list of available regions run AT_LIST_REGIONS.
5. Then the concentrator (a second NUCLEO-WL55JC) starts flashing a green LED on each time slot of the network.
6. To get the demonstration fully up and running, up to 14 Nucleo demonstration sensors can be flashed and placed against a Nucleo demonstration concentrator.
7. This demo application software is available on the www.st.com website.

Table 4. Jumper configuration

Jumper	Definition	Position ⁽¹⁾	Comment ⁽¹⁾
JP1	I_SoC	ON	For STM32WL current measurements
JP2	I_RF	OFF (SB28 ON)	For STM32WL current measurements (RF part)
JP3	BOOT0	ON	It allows the PH3/BOOT0 pull-down resistor to be disconnected and used as an I/O if the software BOOT0 is used, thanks to the option bytes.
JP4	5 V power-source selection	[1-2] (Default)	5V_USB_STLK (from ST-LINK)
		[3-4] (optional)	5V_VIN
		[5-6] (optional)	E5V
		[7-8] (optional)	5V_USB_CHGR
		[9-10] (optional)	STD_ALONE_5V

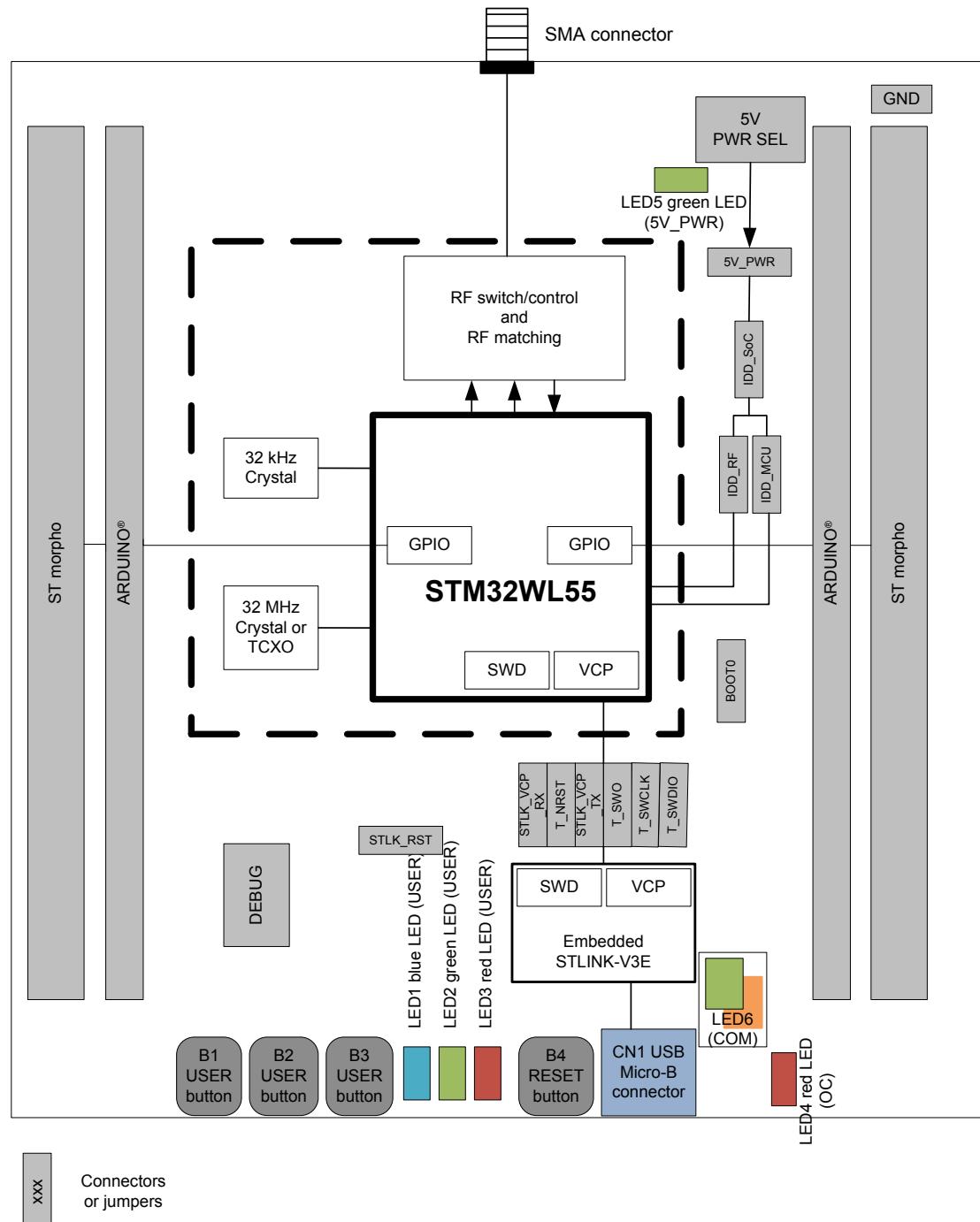
Jumper	Definition	Position ⁽¹⁾	Comment ⁽¹⁾
JP5	I_SYS	OFF (SB27 ON)	For STM32WL current measurements (digital part)
JP6	STLK-RST	OFF	STLINK-V3E reset
JP7	5V_PWR	ON	5 V power-source selection
JP8	Signals between STLINK-V3E and MCU target	[1-2]	T_SWDIO connected to ST-LINK
		[3-4]	T_SWCLK connected to ST-LINK
		[5-6]	T_SWO connected to ST-LINK
		[7-8]	STLK_VCP_TX connected to ST-LINK
		[9-10]	T_NRST connected to ST-LINK
		[11-12]	STLK_VCP_TX connected to ST-LINK
JP9	I_APP	OFF (SB32 ON)	Needed for U3 and U4 DC switches current measurement

1. The default jumper state is shown in bold.

6 Hardware layout and configuration

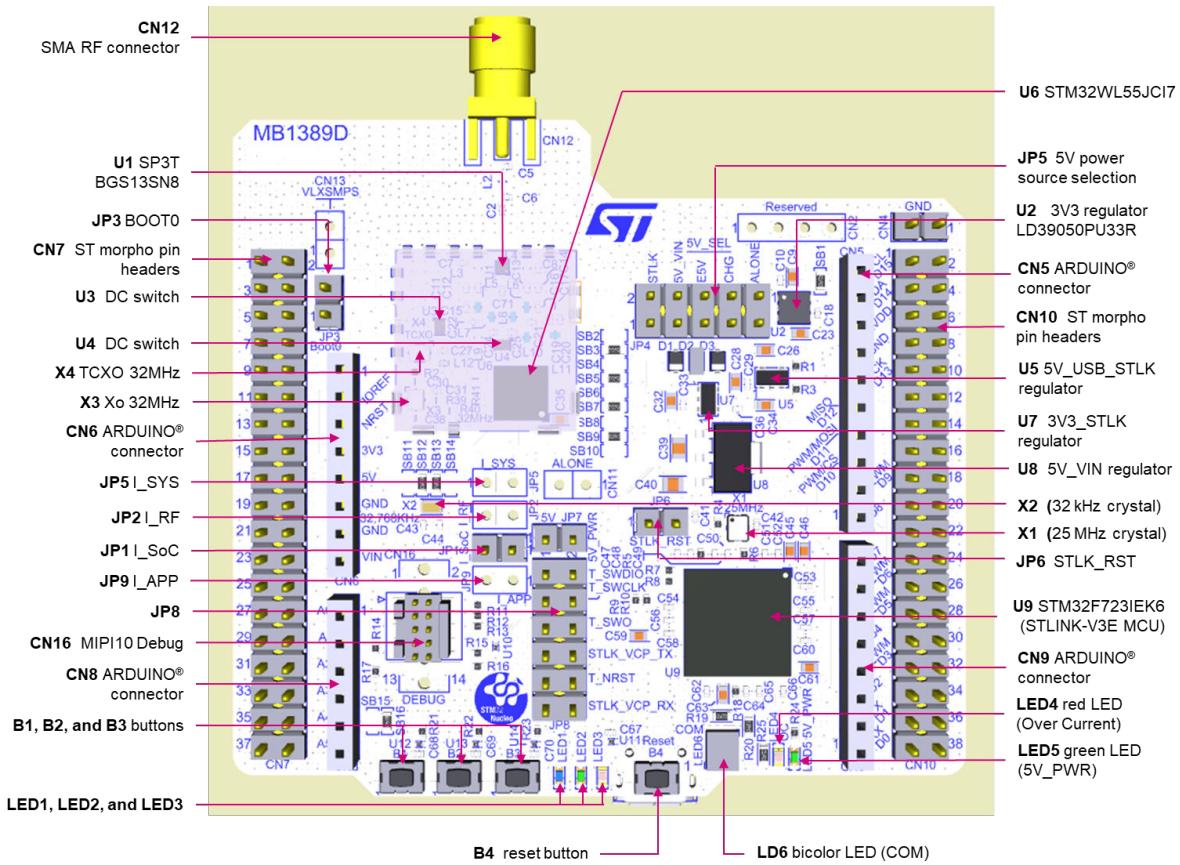
The STM32WL Nucleo-64 board is designed around the STM32 microcontrollers in a 73-pin UFBGA package. Figure 3 shows the connections between the STM32 and its peripherals (STLINK-V3E, push-buttons, LEDs, USB, ARDUINO® Uno, and ST morpho headers). Figure 4 and Figure 6 show the location of these features on the STM32WL Nucleo-64 board. The mechanical dimensions of the board are shown in Figure 7.

Figure 3. Hardware block diagram



6.1 PCB layout

Figure 4. Top layout



Two stickers are on the top of the MB1389 board: one RF certification sticker and one UID64 sticker.

1. The *RF certification* sticker is mandatory for any boards containing an RF module as this Nucleo MB1389, which contains a LoRa/SigFox RF transceiver. This sticker is placed on top of the RF-shielded box. This sticker must have a maximum size of 16 mm x 16 mm. This sticker displays at least the product CPN (NUCLEO-WL55JCx), the board reference (MB1389x-0x), the FCC ID number (YCP-MB1389000), the ISED ID (8976A-MB1389000) of the board, and the CE logo.
 2. The UID64 sticker. A 64-bit unique device identification (UID64) is stored in the flash memory and can be accessed by the CPUs, at the `0x1FFF7580` base address. The UID64 sticker (with a size of 10 mm x 5 mm) displays the UID information (16 digits as 64-bit codification in little-endian byte order) which is unique for each LoRa MCU, so unique for each MB1389 board.

Figure 5 shows both stickers:

Figure 5. RF certification and UID64 stickers

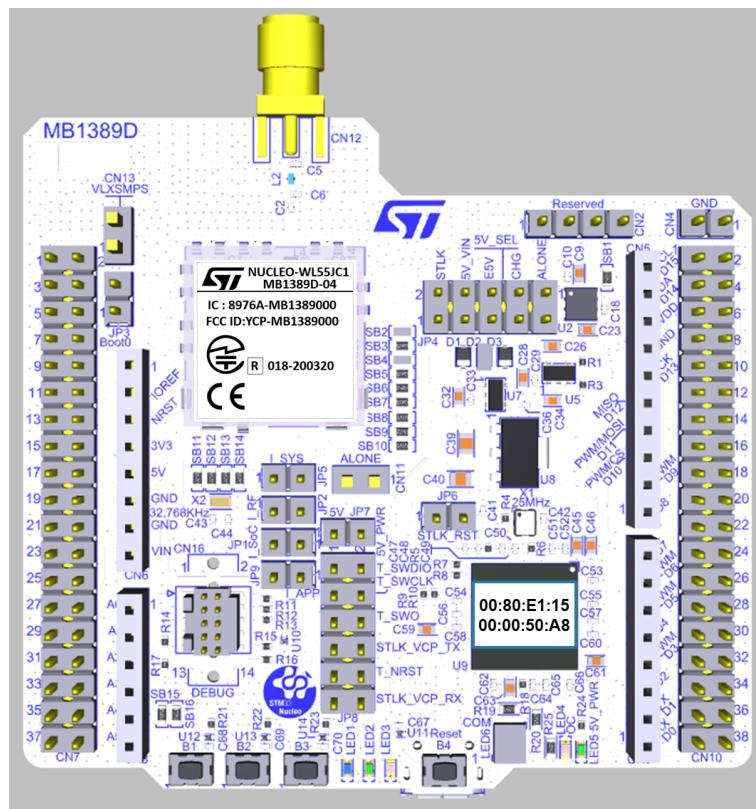
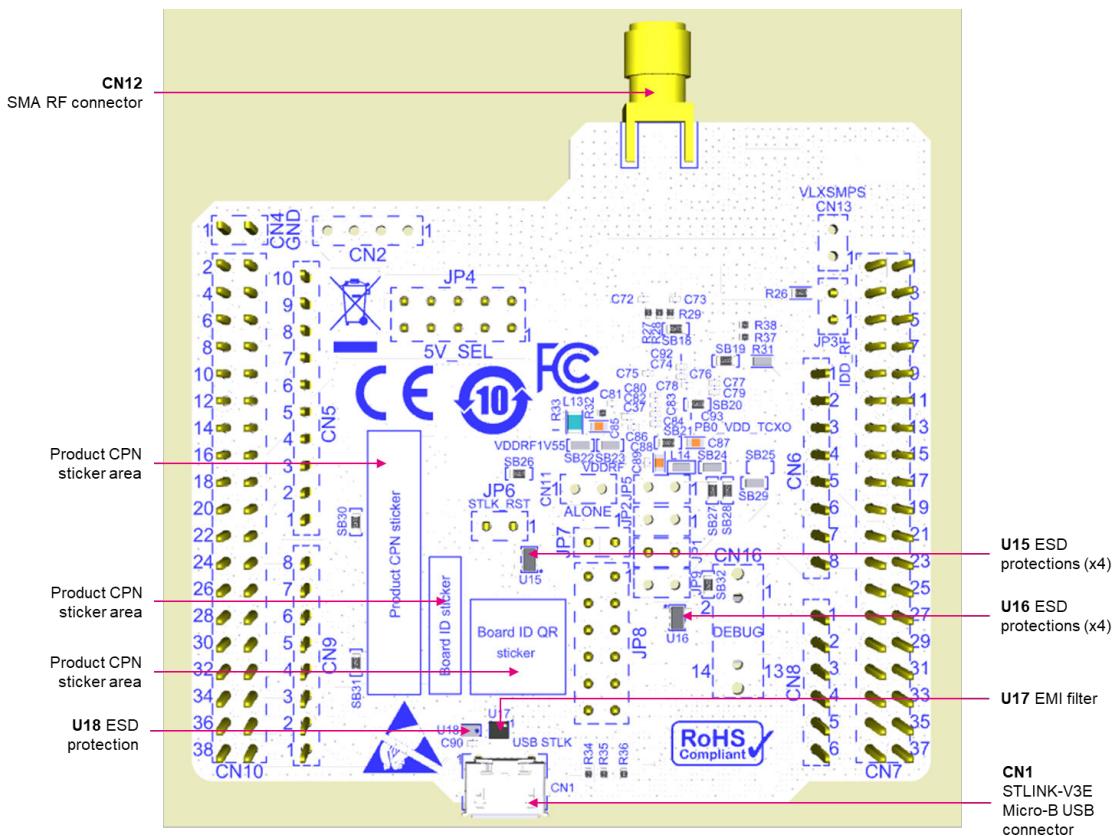
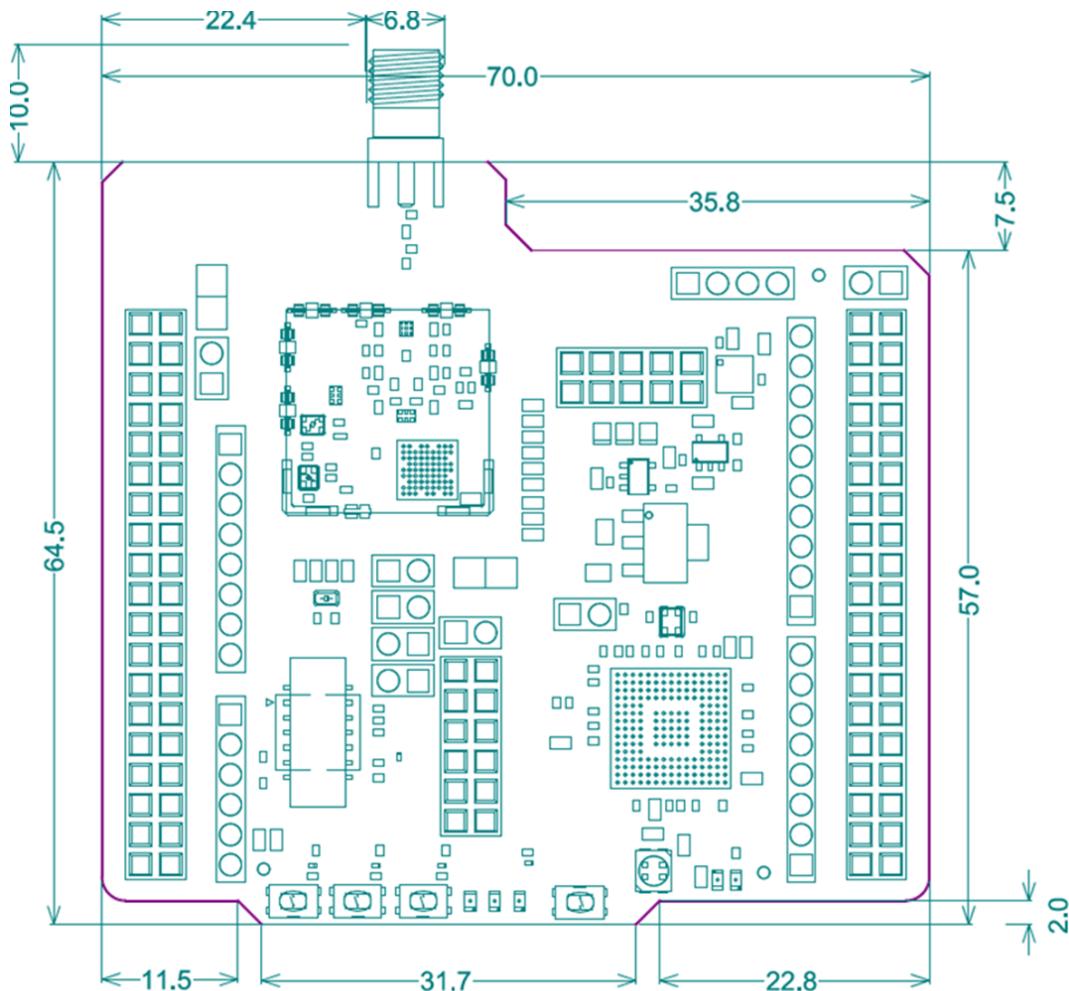


Figure 6. Bottom layout



6.2 Mechanical drawing

Figure 7. STM32WL Nucleo 73 board mechanical drawing (in millimeters)



6.3 Embedded STLINK-V3E

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

- Using the embedded STLINK-V3E
- Using an external debug tool connected to the MIPI10 connector (CN16).

The STLINK-V3E programming and debugging tool is integrated into the STM32WL Nucleo-64 board.

The embedded STLINK-V3E supports only SWD and VCP for STM32 devices. For information about the debugging and programming features of STLINK-V3, refer to the user manual *STLINK-V3SET debugger/programmer for STM8 and STM32* (UM2448), which describes in detail all the STLINK-V3 features.

Features supported on STLINK-V3E:

- 5 V power supplied by the USB connector (CN1)
- USB 2.0 high-speed-compatible interface
- SWD JTAG/Serial Wire Debug specific features:
 - 3 to 3.6 V application voltage on the JTAG/SWD interface and 5 V tolerant inputs
 - JTAG
 - Serial Wire Viewer communication
- MIPI10 connector (CN16)

- COM status LED (LED6) blinking during communication with the PC
- OC fault red LED (LED4) alerting on USB overcurrent request
- 5 V/300 mA output power supply (U4) capability with current limitation and LED
- 5V_PWR 5 V power green LED (LD4)

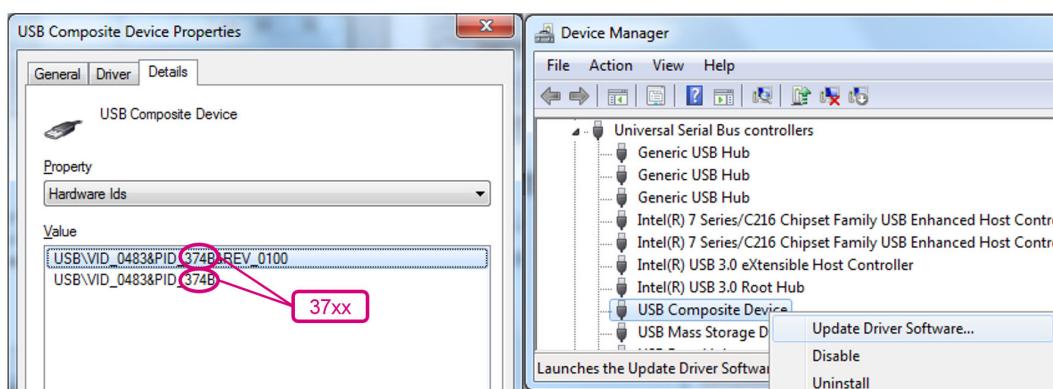
6.3.1 Drivers

Before connecting the STM32WL Nucleo-64 board to a Windows® PC via USB, a driver for the STLINK-V3E (STSW-LINK009) must be installed (not required for Windows 10® and above). It is available on the www.st.com website.

In case the STM32WL Nucleo-64 board is connected to the PC before the driver is installed, some STM32WL 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 8.

Note: Prefer using the *USB Composite Device* to handle a full recovery.

Figure 8. USB composite device



Note:

- 37xx:
- 374E for STLINK-V3E without bridge functions
 - 374F for STLINK-V3E with bridge functions

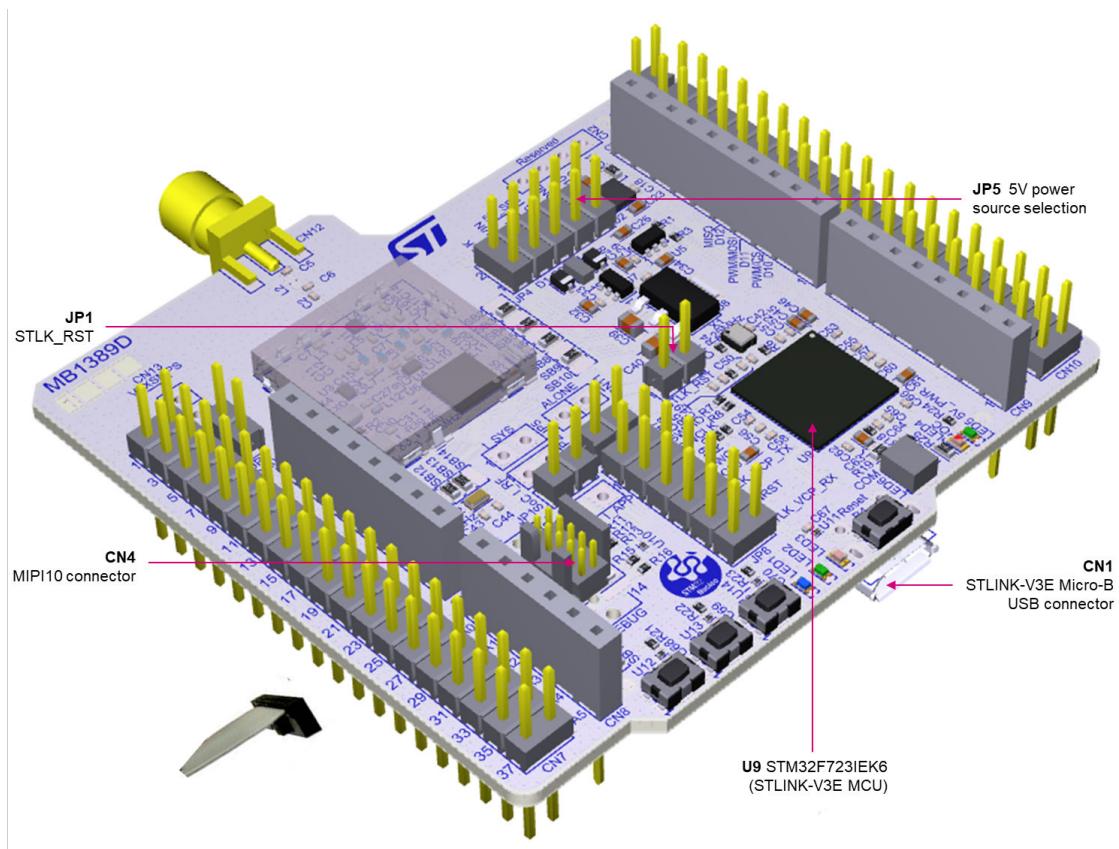
6.3.2 STLINK-V3E firmware upgrade

STLINK-V3E embeds a firmware upgrade mechanism for the in-place upgrade through the USB port. The firmware might evolve during the lifetime of the STLINK-V3E product (for example new functionalities, bug fixes, support for new microcontroller families). It is recommended to visit the www.st.com website before starting to use the STM32WL Nucleo-64 board and periodically, to stay up to date with the latest firmware version.

6.3.3 Using an external debug tool to program and debug the on-board STM32

There are two basic ways to support an external debug tool:

1. Keep the embedded STLINK-V3E running. Power on the STLINK-V3E at first until the COM LED turns red. Then connect the external debug tool through the STDC14/MIPI10 debug connector (CN16).
2. Set the embedded STLINK-V3E in a high-impedance state. When the STLK_RST jumper (JP6) is ON, the embedded STLINK-V3E is in the RESET state, and all GPIOs are in high impedance. Then, connect the external debug tool to the debug connector (CN16).

Figure 9. Connecting an external debug tool to program the on-board STM32WL**Table 5.** MIPI10/JTAGSTD14 debug connector (CN16)

MIPI10 pin	STD14 pin	CN16	Function
-	1	NC	Reserved
-	2	NC	Reserved
1	3	3V3	Target VCC
2	4	T_SWdio	T_JTMS target SWDIO using SWD protocol or target JTMS using JTAG protocol
3	5	GND	Ground
4	6	T_SWclk	T_JClk target SWCLK using SWD protocol or target JClk using JTAG protocol
5	7	GND	Ground
6	8	T_SWo	T_JTMS target SWO using SWD protocol or target JTDO using JTAG protocol
7	9	NC	Not connected
8	10	T_Jtdi	T_JTDI not used by SWD protocol, target JTDI using JTAG protocol, only for external tools
9	11	GndDetect	GND detection for plug indicator, used on SWD and JTAG neither
10	12	T_Nrst	T_JTMS target NRST using SWD protocol or target JTMS using JTAG protocol
-	13	T_Vcp_rx	Target Rx used for VCP, from UART dedicated to bootloader
-	14	T_Vcp_tx	Target Tx used for VCP, from UART dedicated to bootloader

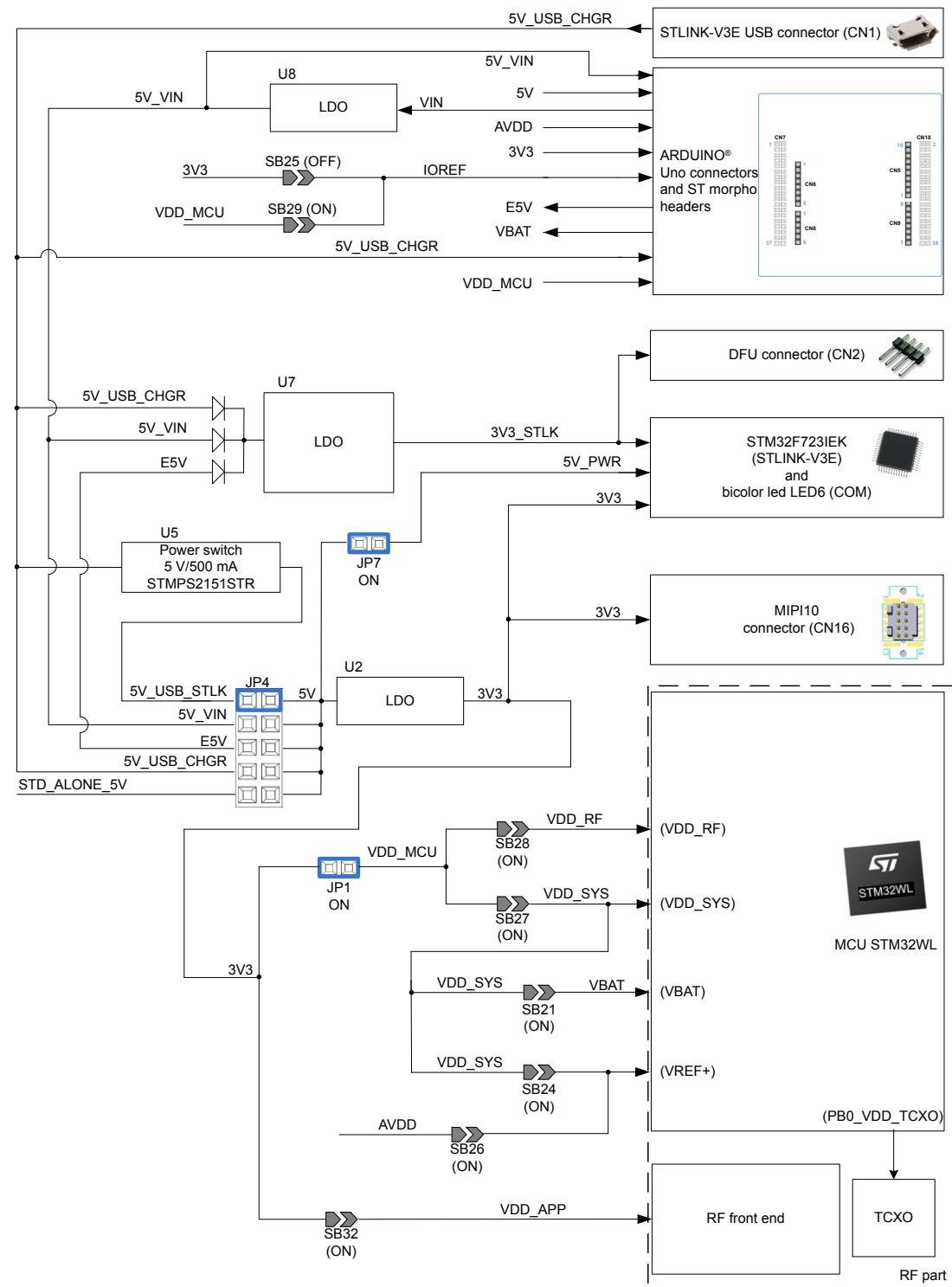
6.4

Power supply

Six different sources can provide the power supply:

- **A host PC connected to CN1 through a USB cable (default setting)**
- An external VIN from 7 to 12 V power supply connected to CN7 pin 24
- An external E5V 5 V power supply connected to CN7 pin 6
- An external 5V_USB_CHGR 5 V USB charger connected to CN1
- An external 3V3 3.3 V power supply connected to CN7 pin 16
- An external STD_ALONE_5V 5 V power supply to supply only the MCU part and not the STLINK-V3E part

Figure 10. STM32WL Nucleo-64 board power tree



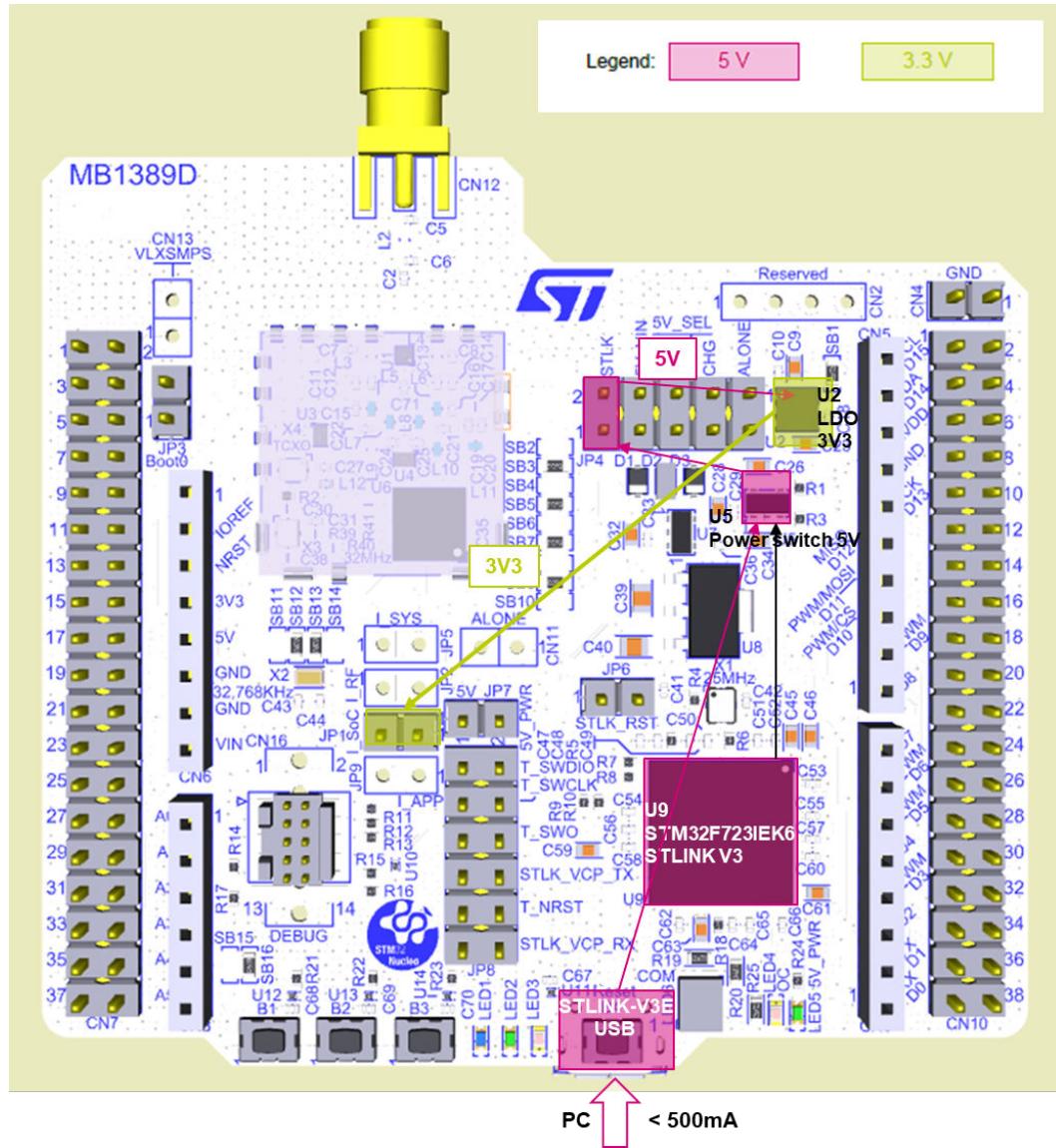
If 5V_VIN, E5V, 5V_USB_CHGR, 3V3, or STD_ALONE_5V is used to power the STM32WL Nucleo-64 board, this power source must comply with the EN-60950-1: 2006+A11/2009 standard and must be Safety Extra Low Voltage (SELV) with limited power capability.

If the power supply is 3V3 or STD_ALONE_5V, the ST-LINK is not powered and cannot be used.

Power supply input from STLINK-V3E USB connector (default setting)

The STM32WL Nucleo-64 board and shield can be powered from the 5 V STLINK-V3E connector (CN1) by setting 5V_SEL jumper on STLK (JP4 [1-2]), as illustrated in Figure 11. This is the default setting.

Figure 11. Power supply input from STLINK-V3E USB connector with PC (5 V, 500 mA maximum)



If the USB enumeration succeeds, the 5V_USB_STLK power is enabled, by asserting the T_PWR_EN signal from U9 STLINK-V3 STM32F723IEK6. This pin is connected to the U5 power switch, which powers the board. The U5 power switch also features a current limitation to protect the PC in case of a short circuit on board. If an overcurrent higher than 500 mA occurs on board, the red LED (LED4) is lit.

The Nucleo board and its shield can be powered from the ST-LINK USB connector (CN1), but only the ST-LINK circuit gets power before USB enumeration because the host PC only provides 100 mA to the board at that time.

During the USB enumeration, the Nucleo board requires 500 mA power from the host PC.

- If the host can provide the required power, the enumeration finishes with a *SetConfiguration* command. Then, the U5 power switch is switched ON and the 5V_PWR green LED (LED5) is turned ON, thus the Nucleo board with its shield can consume 500 mA at the maximum.
 - If the host is not able to provide the requested current, the enumeration fails. Therefore, the U5 power switch remains OFF and the MCU part including the extension board is not powered. As a consequence, the green LED (LED5) remains turned OFF. In this case, it is mandatory to use an external power supply.

Caution: If the maximum current consumption of the STM32WL Nucleo-64 board and its shield boards exceeds 300 mA, it is mandatory to check the root cause of the overconsumption. Consequently, if needed, power the STM32WL Nucleo-64 board with an external power supply connected to VIN, 5 V, or 3.3 V.

External power supply input from VIN (7 to 12 V, 800 mA maximum)

When VIN power supplies the STM32WL Nucleo-64 board (refer to [Table 6](#) and [Figure 12](#)), the jumper configuration must be on 5V_VIN (JP4 [3-4]).

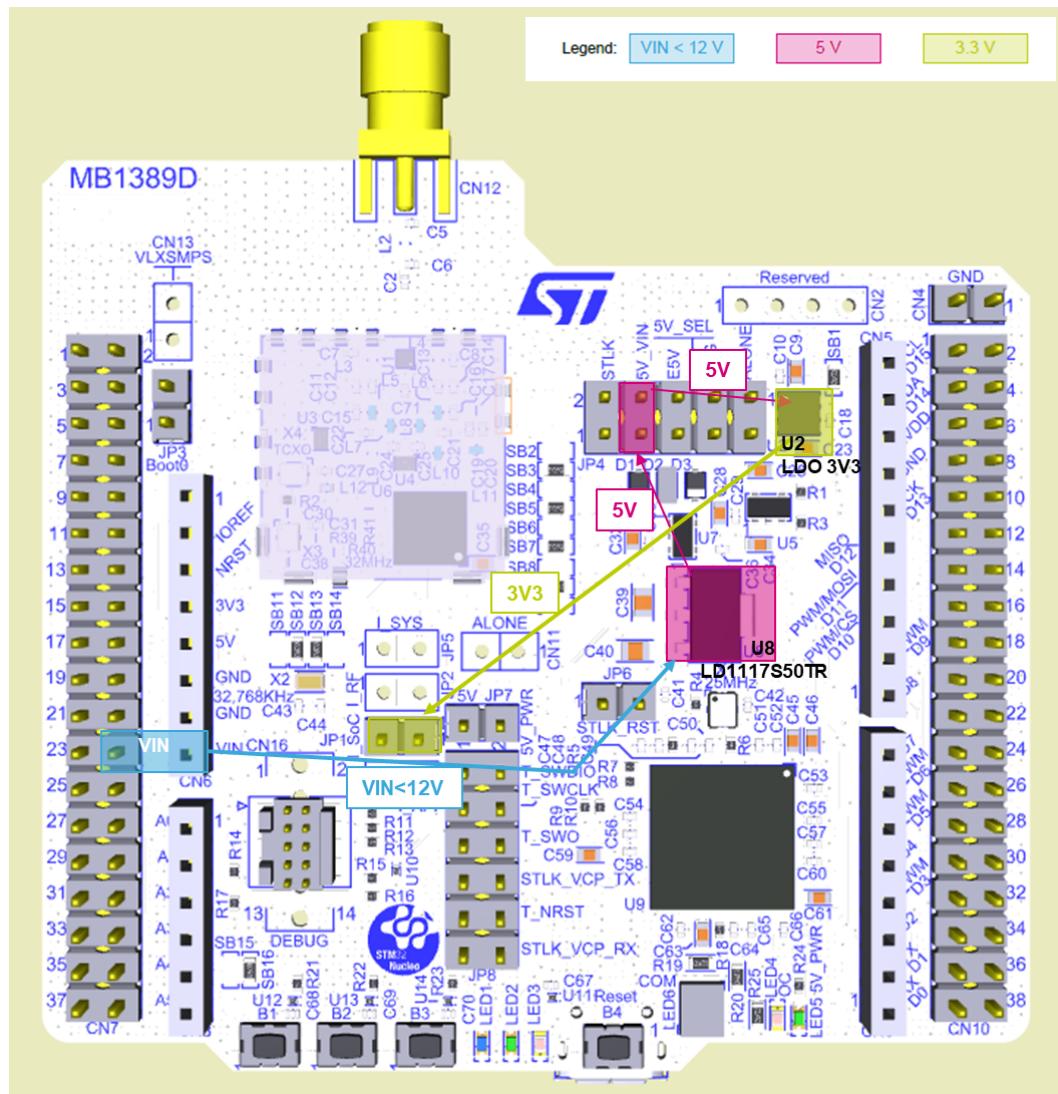
The STM32WL Nucleo-64 board and its shield boards can be powered in three different ways from an external power supply, depending on the voltage used. The three cases are summarized in [Table 6](#).

Table 6. External power sources: VIN (7 to 12 V)

Input power name	Connector pins	Voltage range	Maximum current	Limitation
VIN	CN6 pin 8 CN7 pin 24	7 to 12 V	800 mA	From 7 to 12 V only and input current capability is linked to input voltage: <ul style="list-style-type: none">• 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

Refer to [Section 6.4.1](#) for debugging when using an external power supply.

Figure 12. Power supply input from VIN (7 to 12 V, 800 mA maximum)



External power supply input from E5V (5 V, 500 mA maximum)

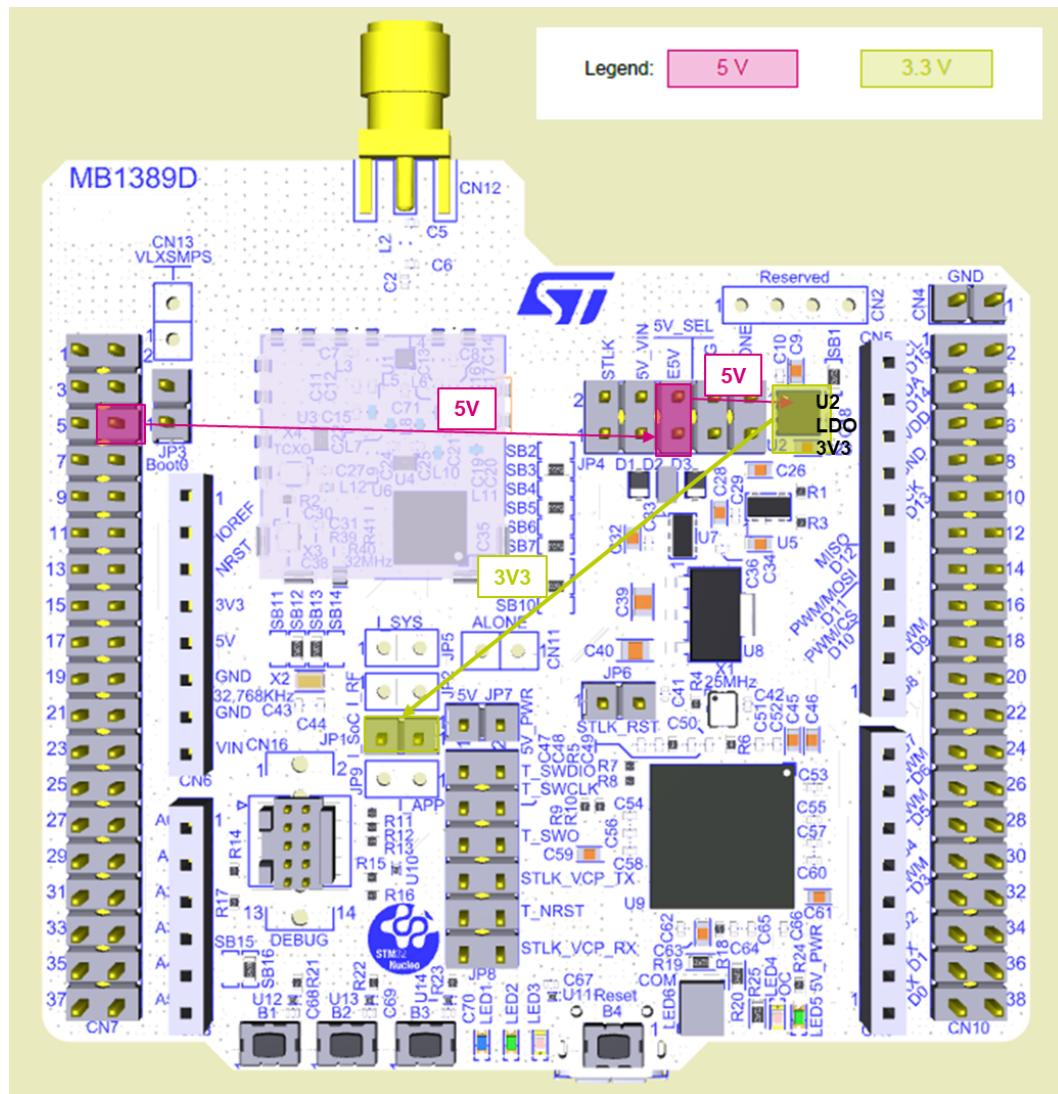
When E5V power supplies the STM32WL Nucleo-64 board (refer to [Table 7](#) and [Figure 13](#)), the jumper configuration must be on E5V (JP4 [5-6]).

Table 7. External power sources: E5V (5 V)

Input power name	Connector pins	Voltage range	Maximum current
E5V	CN7 pin 6	4.75 to 5.25 V	500 mA

Refer to Section 6.4.1 for debugging when using an external power supply.

Figure 13. Power supply input from 5V_EXT (5 V, 500 mA maximum)



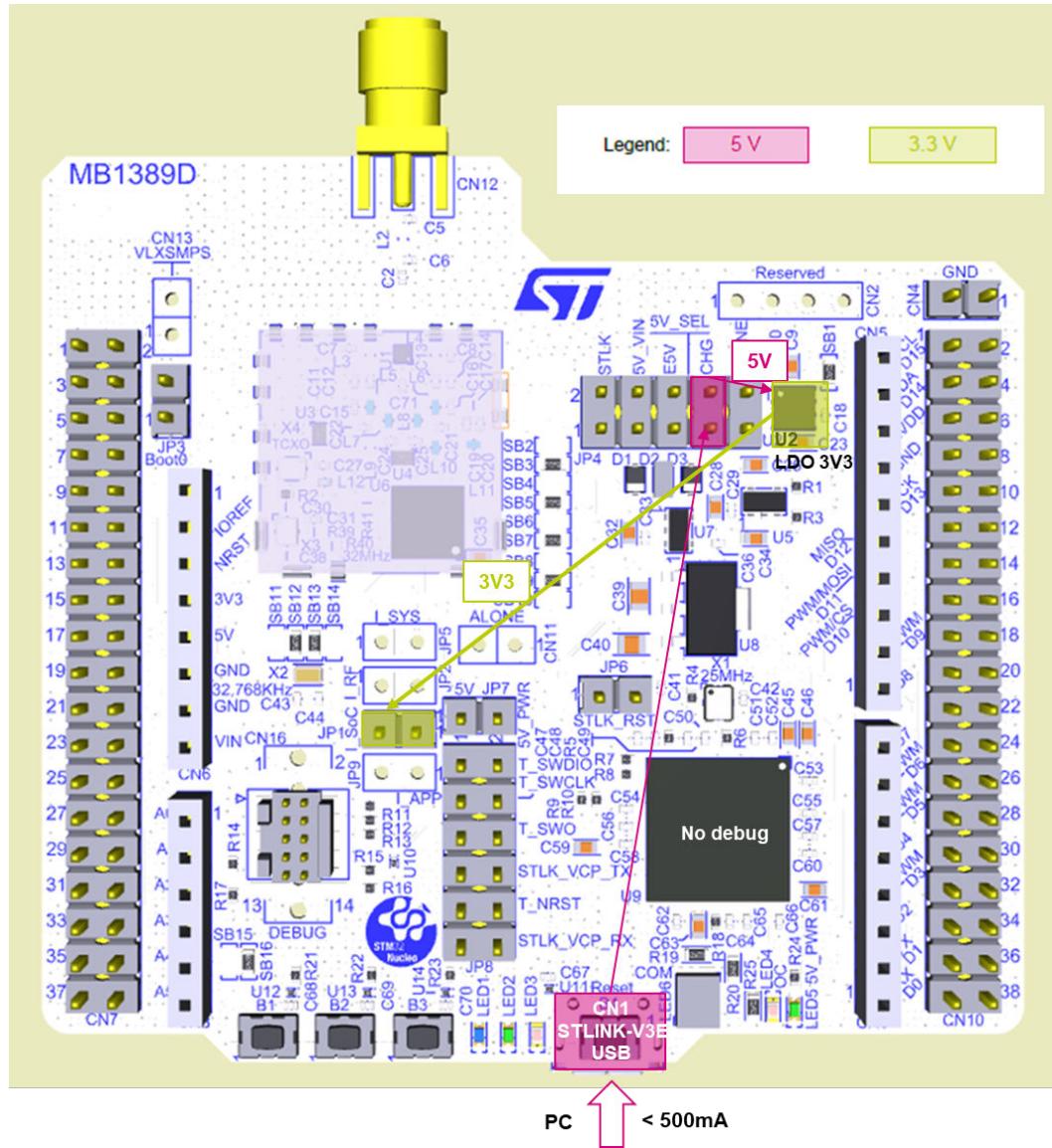
External power supply input from 5 V USB charger

When a USB charger on CN1 power supplies the STM32WL Nucleo-64 board (refer to Table 8 and Figure 14), the jumper configuration must be on 5V_CHGR (JP4 [7-8]).

Table 8. External power sources: 5V_CHGR (5 V)

Input power name	Connector pins	Voltage range	Maximum current
5V_CHGR	CN1	5 V	-

Figure 14. Power supply input from ST-LINK USB connector with 5 V USB charger



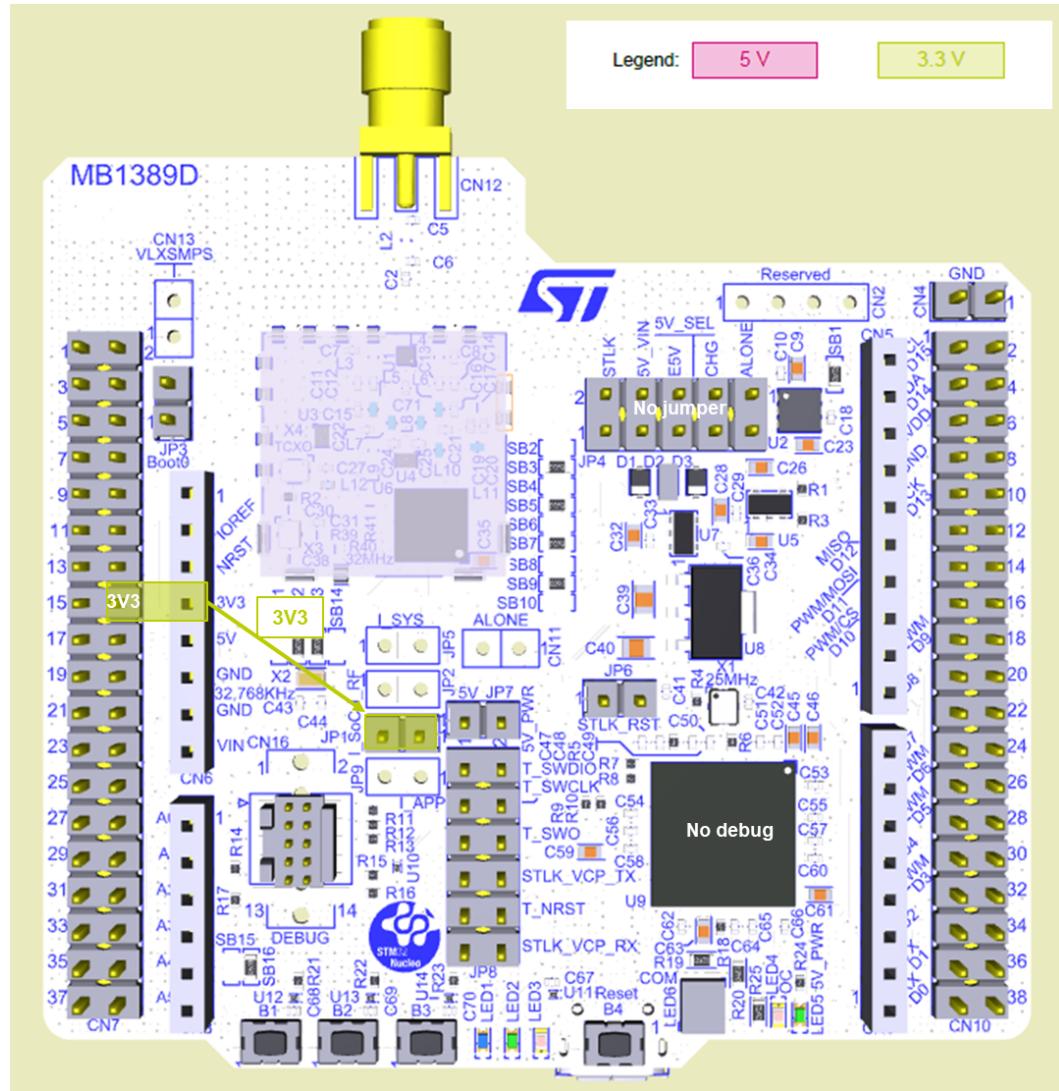
External power supply input from external 3.3 V

When a shield board provides the 3.3 V, it is interesting to use the 3.3 V (CN6 pin 4 or CN7 pin 16) directly as power input (refer to [Table 9](#) and [Figure 15](#)). In this case, the programming and debugging features are not available, since the ST-LINK is not powered.

Table 9. External power sources: 3V3

Input power name	Connector pins	Voltage range	Maximum current
3V3	CN6 pin 4 CN7 pin 16	3 to 3.6 V	1.3 A

Figure 15. Power supply input from external 3V3



External power supply input STD_ALONE_5V (5 V, 500 mA maximum)

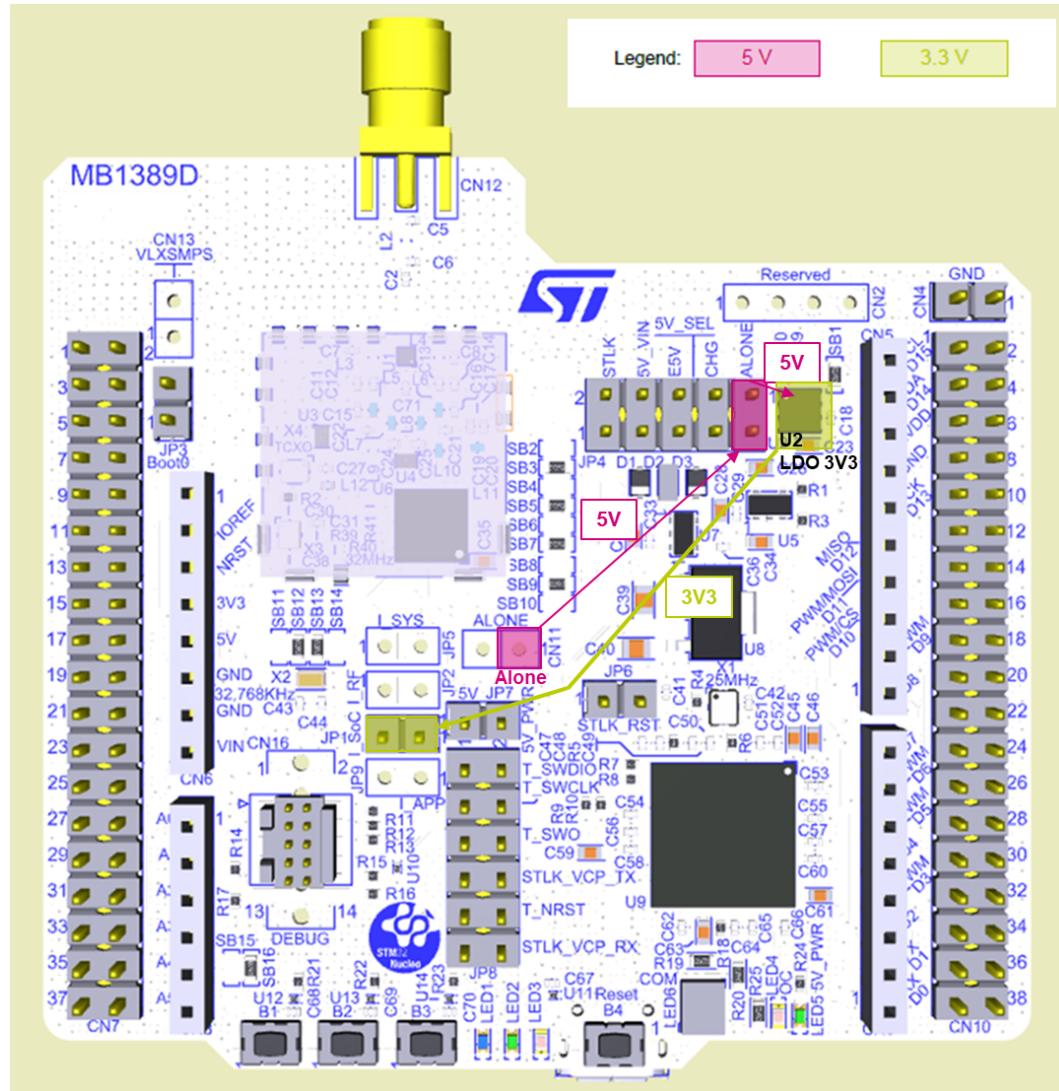
When STD_ALONE_5V power supplies the STM32WL Nucleo-64 board (refer to Table 10 and Figure 16), the jumper configuration must be on ALONE (JP4 [9-10]).

Table 10. External power sources: STD_ALONE_5V

Input power name	Connector pins	Voltage range	Maximum current
STD_ALONE_5V	CN11	4.75 to 5.25 V	500 mA

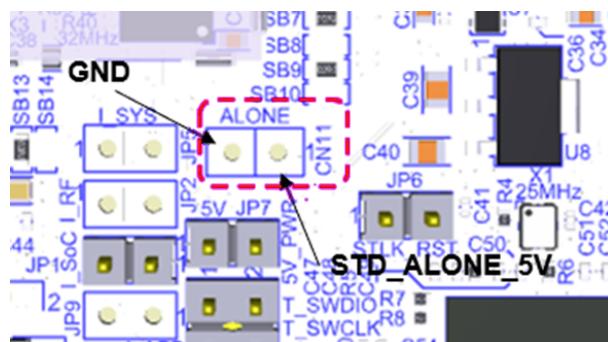
Refer to Section 6.4.1 for debugging when using an external power supply.

Figure 16. Power supply input from STD_ALONE_5V (5 V, 500 mA maximum)



When the board is supplied with STD_ALONE_5V (on connector 11), then the STLINK-V3E debugger is not supplied. Take care to supply correctly the board when using CN11. CN11 pin 1 is the STD_ALONE_5V supply and pin 2 is the GND, as shown in Figure 17.

Figure 17. STD_ALONE_5V and GND pins on CN11



To properly isolate the MCU STM32 WL from the STLINK-V3E debugger, it is recommended to remove the six jumpers (JP8) and JP7. In this case, there is no current leakage coming from the STLINK-V3E debugger in STM32WL current consumptions.

6.4.1 Debugging while using VIN or EXT as an external power supply

When VIN or E5V powers the board, it is still possible to use ST-LINK to program or debug, but it is mandatory to power the board first using VIN or EXT, then connect the USB cable to the PC. In this way, the enumeration succeeds, thanks to the external power source.

The following power-sequence procedure must be respected:

1. Set jumper JP4 [5-6] for E5V or JP4 [3-4] for VIN,
2. Connect the external power source to VIN or E5V,
3. Power on the external power supply $7\text{ V} < \text{VIN} < 12\text{ V}$ for VIN, or 5 V for E5V,
4. Check that the green LED (LED5) is turned ON,
5. Connect the PC to the USB connector (CN1).

If this order is not respected, USB might power the board first, then VIN or E5V as the following risks might be encountered:

1. If the board needs a current higher than 300 mA , the PC might be damaged or the PC can limit the supplied current. As a consequence, the board is not powered correctly.
2. Enumeration requests 300 mA . Thus, there is a risk that the request will be rejected. The enumeration does not succeed if the PC cannot provide such a current. Consequently, the board is not power-supplied, and the LED (LED5) remains OFF.

6.5 Clock sources

6.5.1 HSE clock (high-speed external clock)

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

- **HSE on-board oscillator from X3 crystal:** For typical frequencies, capacitors, and resistors, refer to the STM32 microcontroller datasheet and the application note *Guidelines for oscillator design on STM8AF/AL/S and STM32 MCUs/MPUs (AN2867)* for the oscillator design guide. The X3 crystal has the following characteristics: 32 MHz , 10 pF load capacitance, 10 ppm . It is recommended to use NDK_NX2016SA 32MHz EXS00A-CS06465 manufactured by NDK. The configuration must be:
 - X3 crystal (and X4 TCXO) soldered
 - No C30 and no C38 as those capacitors are integrated into the STM32WL MCU
 - SB20 OFF in order not to supply the TCXO
 - C31 OFF in order not to have a 32 MHz signal coming from the TCXO
 - R39 and R40 ON to connect the X3 crystal to the STM32WL MCU
- **HSE on-board oscillator from X4 TCXO (Default configuration):** The X4 TCXO has the following characteristics: 32 MHz , 10 pF load capacitance. It is recommended to use NT2016SF-32M-END5875A manufactured by NDK. The configuration must be:
 - X4 TCXO (and X3 crystal) soldered
 - SB20 ON to supply the TCXO
 - 10 pF C31 and 220Ω R2 ON to have a 32 MHz signal coming from the TCXO
 - R39 and R40 OFF to isolate the X3 crystal from the STM32WL MCU

Note:

Whatever the configuration is (X3 crystal or X4 TCXO), both X3 crystal and X4 TCXO are assembled on the board. This avoids soldering or desoldering either X3 or X4 to choose between X3 crystal and X4 TCXO configuration.

6.5.2 LSE clock (low-speed external clock) – 32.768 kHz

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

- **On-board oscillator (Default):** X2 crystal. Refer to the application note *Guidelines for oscillator design on STM8AF/AL/S and STM32 MCUs/MPUs (AN2867)* as the oscillator design guide for STM32 microcontrollers. It is recommended to use NX3215SA-32.768kHz-EXS00A-MU00527 (32.768 kHz, 6 pF load capacitance, 20 ppm) from NDK.
 - SB11 and SB14 OFF
 - SB12 and SB13 ON
- **Oscillator from external PC14:** From the external oscillator through the pin 25 of the CN7 connector, the configuration must be:
 - SB11 (and SB14 ON, but not necessary)
 - SB12 and SB13 OFF
- **LSE not used:** PC14 and PC15 are used as GPIOs instead of the low-speed clock. The configuration must be:
 - SB11 and SB14 ON (to get them on CN7)
 - SB12 and SB13 OFF

6.6 Board functions

6.6.1 LEDs

User LED (LED1)

This blue LED is a user LED connected to STM32WL I/O PB15. To light the LED1 LED, a HIGH logic state must be written in the corresponding GPIO PB15.

User LED (LED2)

This green user LED is connected to STM32WL I/O PB9. To light the LED2 LED, a HIGH logic state must be written in the corresponding GPIO PB9.

User LED (LED3)

This red LED is a user LED connected to STM32WL I/O PB11. To light the LED3 LED, a HIGH logic state must be written in the corresponding GPIO PB11.

USB power fault (OC, overcurrent) (LED4)

LED4 indicates that the board power consumption on the ST-LINK USB exceeds 500 mA. As a consequence, the user must check the root cause of the overconsumption or power of the board using an external power supply.

5V_PWR LED (LED5)

This green LED indicates that the STM32WL part is powered. +5 V power is available on CN6 pin 5 and CN7 pin 18 if the jumper JP7 is ON.

STLINK-V3 COM LED (LED6)

The bicolor (green, red) LED (LED6) provides information about STLINK-V3E communication status. LED6 indicates the communication progress between the PC and the STLINK-V3E, with the following setup:

- Blinking red: The first USB enumeration with the PC is taking place,
- Red LED ON: when the initialization between the PC and STLINK-V3E is complete,
- Blinking red or green: During the program and debug with the target,
- Green LED ON: Communication finished and successful,
- Orange ON: communication failure.

6.6.2 Push-buttons

B1 (USER)

The user button is connected to the STM32WL I/O PA0 by default (WKUP1, SB16 ON, and SB15 OFF) or PC13 (WKUP2, SB15 ON, and SB16 OFF) of the STM32WL microcontroller.

B2 (USER)

The user button is connected to the STM32WL I/O PA1 of the STM32WL microcontroller.

B3 (USER)

The user button is connected to the STM32WL I/O PC6 of the STM32WL microcontroller.

B4 (RESET)

This push-button is connected to NRST and is used to RESET the STM32WL microcontroller.

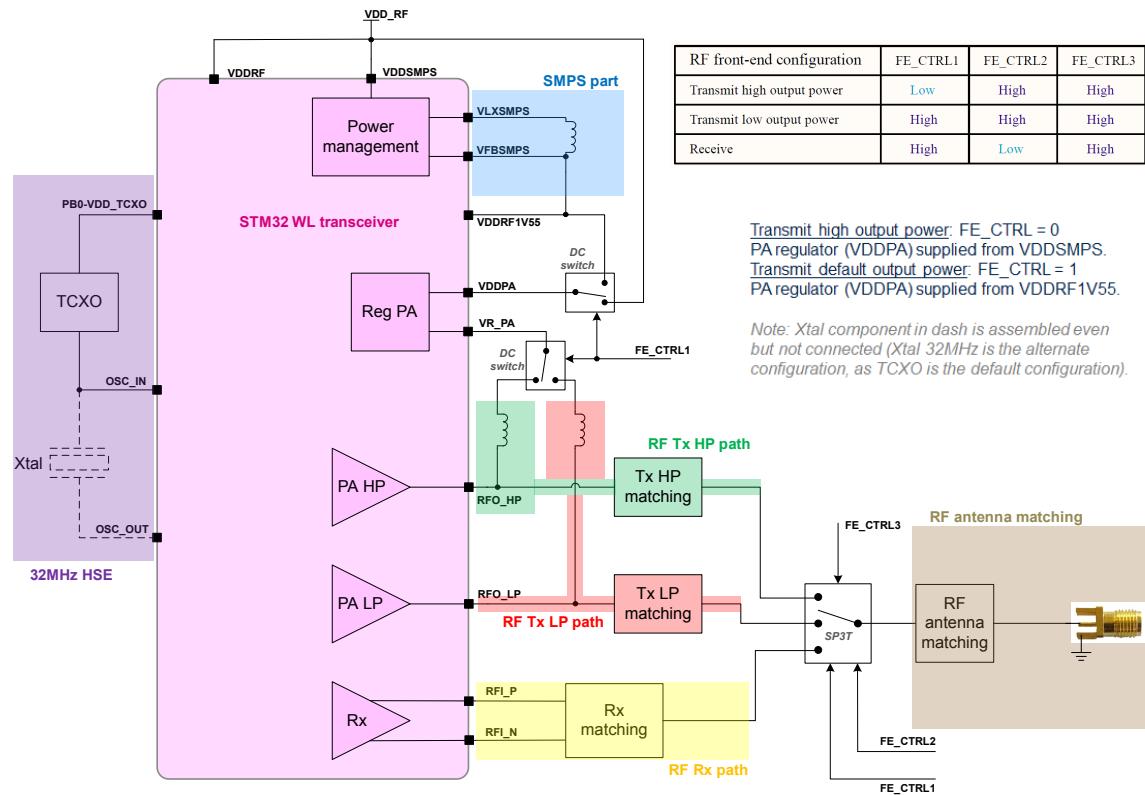
6.6.3 RF overview

The STM32WL Nucleo-64 board embeds an RF 3-port switch (SP3T) to address, with the same board the three modes: reception, high-power transmission, and low-power transmission. The choice between the two transmission modes can be done dynamically, thanks to two DC switches controlled by FE_CTRL1 (GPIO from STM32WL MCU):

- The high-output power transmission amplifier (PA HP) is supplied from the PA regulator (REG PA) up to 3.1 V. For this, the REG PA must be supplied directly from VDDSMPS.
- The default low-output power transmission amplifier (PA LP) can be supplied from the PA regulator (REG PA) up to 1.35 V. For this, the REG PA must be supplied from the regulated VFBSMPS supply at 1.55 V.

The RF block diagram is displayed in [Figure 18](#).

Figure 18. RF block diagram



The screwed and glue-fixed antennas to connect to the SMA connector and provided in the blister are:

- ANT-SS900 from LPRS company for NUCLEO-WL55JC1 (high band frequency)
- ANT-SS450-510 from LPRS company for NUCLEO-WL55JC2 (low band frequency)

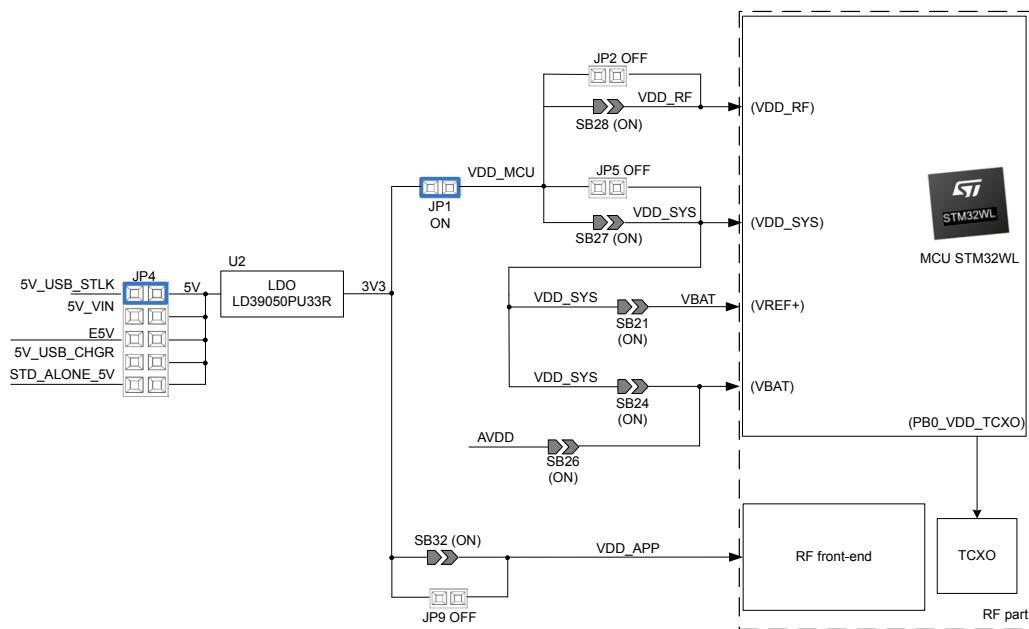
Those antennas have been used for the different FCC/ISED/CE certifications. It is then mandatory to use those referenced antennas (and only those) for radiated tests on the STM32WL Nucleo-64 boards.

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*. The purpose of *Section 15.203* is to prevent attaching any other antennas [other than the ones approved with the device] to a part 15 transmitter.

6.6.4 Current consumption measurement (I_SoC)

The labeled I_SoC jumper (JP1) is used to measure the STM32WL microcontroller consumption by removing the jumper and connecting an ammeter. Their location in the power structure is shown in Figure 19.

1. JP1 ON. STM32WL is powered with 3V3 voltage (default)
2. JP1 OFF. An ammeter must be connected to measure the STM32WL current. If there is no ammeter, the STM32 is not powered.

Figure 19. JP1 and JP4 settings for current consumption measurement**Note:**

I_{SoC} (on VDD_MCU) is the current consumption of all the STM32WL MCU.

I_{RF} (on VDD_RF) is the current consumption of the RF part of the STM32WL MCU.

I_{SYS} (on VDD_SYS) is the current consumption of the rest of the STM32WL MCU (except I-RF).

So, $I_{SoC} = I_{RF} + I_{SYS}$

The user can evaluate the current consumption of the RF part of the STM32WL MCU by connecting an ammeter on JP2. SB28 must be OFF in this case.

The user can also evaluate the current consumption of the rest of the STM32WL MCU (VDD_SYS) by connecting an ammeter on JP5. SB27 must be OFF in this case.

The user can also evaluate the current consumption of the RF front end (VDD_APP) by connecting an ammeter on JP9. SB32 must be OFF in this case. This current consumption only concerns both NX3L1T3157GM DC switches (U3 and U4).

6.6.5**Virtual COM port (VCP): LPUART and USART**

The STM32WL Nucleo-64 board offers the possibility to select which USART interface is connected to the STLINK-V3E, ARDUINO® Uno V3 connector (CN9 pins 2 and 1), or to the ST morpho connector (CN10 pins 35 and 37).

The selection is done by setting the related solder bridges as detailed in [Table 11](#) and [Table 12](#).

Table 11. USART1 connection

Solder bridge configuration ⁽¹⁾	Feature ⁽¹⁾
SB6, SB10: ON SB7, SB9, SB3, SB5: OFF	USART1 (PB6/PB7) connected to the STLINK-V3E Virtual COM port.
SB7, SB9: ON SB6, SB10, SB2, SB4: OFF	USART1 (PB6/PB7) connected to ARDUINO® (D1 and D0) and ST morpho connector (CN10 pin 35 and 37).

1. The default configuration is shown in bold

Table 12. LPUART1 connection

Solder bridge configuration ⁽¹⁾	Feature ⁽¹⁾
SB3, SB5: ON SB2, SB4, SB6, SB10: OFF	LPUART1 (PA2/PA3) connected to the STLINK-V3E Virtual COM port.
SB2, SB4: ON SB3, SB5, SB7, SB9: OFF	LPUART1 (PA2/PA3) connected to the ARDUINO® (D1 and D0) and ST morpho connector (CN10 pin 35 and 37).

1. The default configuration is shown in bold

By default:

- Communication between the target STM32WL and the STLINK-V3E MCU is enabled on LPUART1 to support the Virtual COM port.
- Communication between the target STM32WL, ARDUINO®, and ST morpho connectors is enabled on USART1.

6.7 Solder bridges

All 31 solder bridges are located on the STM32WL Nucleo-64 board.

All the solder bridges present on the STM32WL Nucleo-64 board are used to configure several I/Os and power supply pins for compatibility of features and pinout with the target STM32WL supported.

Table 13. Solder bridge configuration

Solder bridge control	Solder bridge (SB)	State ⁽¹⁾	Description ⁽¹⁾
3.3 V LDO output	SB1	ON	The U2 LDO output provides 3.3 V
		OFF	The U2 LDO output does NOT provide 3.3 V. The user must connect an external 3V3 source.
PA2 LPUART1 Tx	SB2	ON	ARD_D1_TX connected to LPUART1 Tx PA2
		OFF	ARD_D1_TX not connected to LPUART1 Tx PA2
	SB3	ON	STLINK_TX (T_VCP_TX) connected to LPUART1 Tx PA2
		OFF	STLINK_TX (T_VCP_TX) not connected to LPUART1 Tx PA2
PA3 LPUART1 Rx	SB4	ON	ARD_D0_RX connected to LPUART1 Rx PA3
		OFF	ARD_D0_RX not connected to LPUART1 Rx PA3
	SB5	ON	STLINK_RX (T_VCP_RX) connected to LPUART1 Rx PA3
		OFF	STLINK_RX (T_VCP_RX) not connected to LPUART1 Rx PA3
PB6 USART1 Tx	SB6	ON	STLINK_TX (T_VCP_TX) connected to USART1 Tx PB6
		OFF	STLINK_TX (T_VCP_TX) not connected to USART1 Tx PB6
	SB7	ON	ARD_D1_TX connected to USART1 Tx PB6
		OFF	ARD_D1_TX not connected to USART1 Tx PB6
T_SWO on PB3	SB8	ON	T_SWO connected to PB3
		OFF	T_SWO not connected to PB3 and isolated from ARD_D3
PB7 USART1 Rx	SB9	ON	ARD_D0_RX connected to USART1 Rx PB7
		OFF	ARD_D0_RX not connected to USART1 Rx PB7
	SB10	ON	STLINK_RX (T_VCP_RX) connected to USART1 Rx PB7
		OFF	STLINK_RX (T_VCP_RX) not connected to USART1 Rx PB7
LSE CLK selection	SB11	ON	PC14-OSC32_IN connected to ST morpho connector I/O usage (CN7 pin 25)
		OFF	PC14-OSC32_IN not connected to ST morpho connector
	SB12/SB13	ON	LSE provided by external LSE 32.768kHz CLK X2
		OFF	LSE not provided by external LSE 32.768kHz CLK X2
	SB14	ON	PC15-OSC32_OUT connected to ST morpho connector I/O usage (CN7 pin 27)
		OFF	PC15-OSC32_OUT not connected to ST morpho connector
B1 user button	SB15	ON	User button connected to PC13
		OFF	User button not connected to PC13
	SB16	ON	User button connected to PA0
		OFF	User button not connected to PA0
SP3T VDD supply	SB18	ON	VDD supplied with FE_CTRL3 (STM32WL I/O PC3)

Solder bridge control	Solder bridge (SB)	State ⁽¹⁾	Description ⁽¹⁾
SP3T VDD supply	SB18	OFF	VDD not connected to FE_CTRL3 (STM32WL I/O PC3)
BOOT0/PH3 on ST morpho connector	SB19	ON	BOOT0/PH3 connected to ST morpho connector CN7 pin 7
		OFF	BOOT0/PH3 not connected to ST morpho connector CN7 pin 7
32 MHz TCXO supply	SB20	ON	32 MHz TCXO supplied by PB0-VDD_TCXO (to STM32WL)
		OFF	32 MHz TCXO disconnected to PB0-VDD_TCXO (to STM32WL)
VBAT	SB21	ON	VBAT (pin A8 of STM32WL) powered by VDD_SYS
		OFF	VBAT (pin A8 of STM32WL) supplied separately (through VBAT on ST morpho connector CN7 pin 33)
VFBSMPS	SB22	ON	VFBSMPS (pin B2 of STM32WL) connected to VDDRF1V55 (pin F7 of STM32WL)
		OFF	VFBSMPS (pin B2 of STM32WL) disconnected from VDDRF1V55 (pin F7 of STM32WL) for current probing
VDDSMPS	SB23	ON	VDDSMPS (pin A2 of STM32WL) connected to VDDRF (pin E8 of STM32WL)
		OFF	VDDSMPS (pin A2 of STM32WL) disconnected from VDDRF (pin E8 of STM32WL) for current probing
VDDA/VREF+ supply	SB24	ON	STM32WL VDDA/VREF+ supplied by VDD_SYS through SMD ferrite bead L14. Be careful not to provide an external AVDD supply if SB26 is ON.
		OFF	STM32WL VDDA/VREF+ disconnected from VDD_SYS. STM32WL VDDA/VREF+ must be externally supplied by AVDD.
IOREF and 3V3 connection	SB25	ON	IOREF connected to the 3V3 power supply. Be careful to remove SB29 to avoid voltage supply conflict with VDD_MCU.
		OFF	IOREF not connected to 3V3 power supply
VDDA/VREF+ supply	SB26	ON	STM32WL VDDA/VREF+ externally supplied by AVDD. SB24 must be OFF to avoid supply conflict.
		OFF	STM32WL VDDA/VREF+ disconnected from AVDD. So, SB24 must be ON to supply properly STM32WL VDDA/VREF+ pins.
I_SYS current probing	SB27	ON	VDD_SYS generated from VDD_MCU
		OFF	For I_SYS current probing on JP5 jumper
I_RF current probing	SB28	ON	VDD_RF generated from VDD_MCU
		OFF	For I_RF current probing on JP2 jumper
IOREF and VDD_MCU connection	SB29	ON	IOREF connected to the VDD_MCU power supply. Be careful to remove SB25 to avoid voltage supply conflict with 3V3
		OFF	IOREF not connected to VDD_MCU power supply
PB0 on ST morpho connector	SB30	ON	PB0 connected to ST morpho connector (CN10 pin 22)
		OFF	PB0 not connected to ST morpho connector
PB3 on ST morpho	SB31	ON	PB3 connected to ARDUINO® D3
		OFF	PB3 not connected to ARDUINO® D3
I_APP current probing	SB32	ON	VDD_APP RF front-end supply generated from VDD_MCU
		OFF	For I_APP current probing on JP9 jumper

1. The default SB state is in bold.

7 Board connectors

Several connectors are implemented on the STM32WL Nucleo-64 board.

7.1

STLINK-V3E USB Micro-B connector (CN1)

The USB Micro-B connector (CN1) is used to connect the embedded STLINK-V3E to a PC for programming and debugging purposes.

Figure 20. USB Micro-B connector (CN23) front view

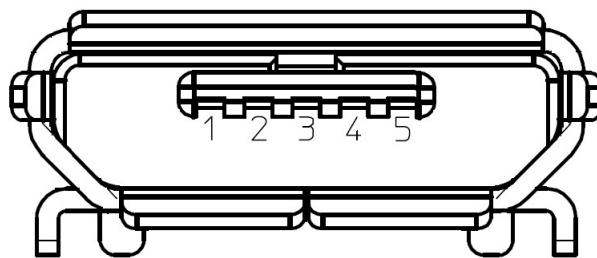


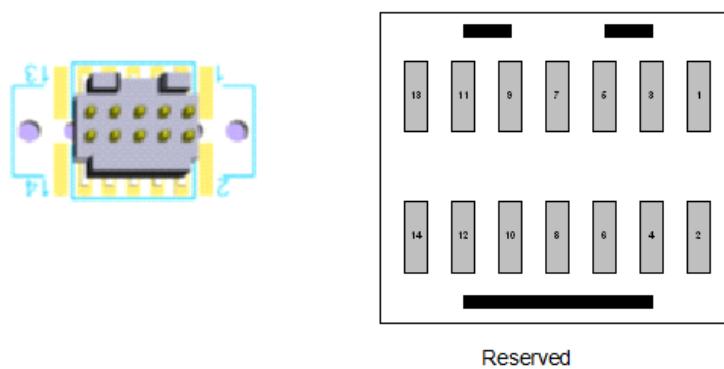
Table 14. USB Micro-B connector (CN23) front view

Connector	Pin number	Pin name	Signal name	STLINK-V3EMCU pin	Functions
CN1	1	VBUS	5V_USB_CHGR	-	5 V power
	2	DM	USB_DEV_HS_CN_N	R14	USB differential pair N
	3	DP	USB_DEV_HS_CN_P	R15	USB differential pair P
	4	ID	-	-	-
	5	GND	-	-	GND

7.2

MIPI10 connector (CN16)

Figure 21. MIPI10 debugging connector (CN16) top view



The MIPI10 connector is implemented with a footprint compatible with the STDC14 footprint. The related pinout for the MIPI10 connector is listed in [Table 15](#).

Table 15. MIPI10 connector (CN16) pinout (STDC14 pinout compatible)

Connector	Pin number	Description	Pin number	Description
CN16	1	-	2	-
	3	VDD (3V3)	4	T_SWDIO (PA13)
	5	GND	6	T_SWCLK (PA14)
	7	KEY (connected to GND)	8	T_SWO (PB3)
	9	-	10	T_JTDI (PA15)
	11	GNDDetect (connected to GND through a 100 Ω resistor)	12	T_NRST
	13	T_VCP_RX (PA3 by default or PB7)	14	T_VCP_TX (PA2 by default or PB6)

7.3

SMA connector (CN12)

A 50 Ω SMA connector (CN12) is available on the STM32WL Nucleo-64 board.

Figure 22. SMA connector (CN12)

By default, the output of the RF part is on the SMA connector (CN12).

Table 16. SMA connector pinout

Connector	Pin number	Description
CN12	1	RF path
	2	GND
	3	GND
	4	GND
	5	GND

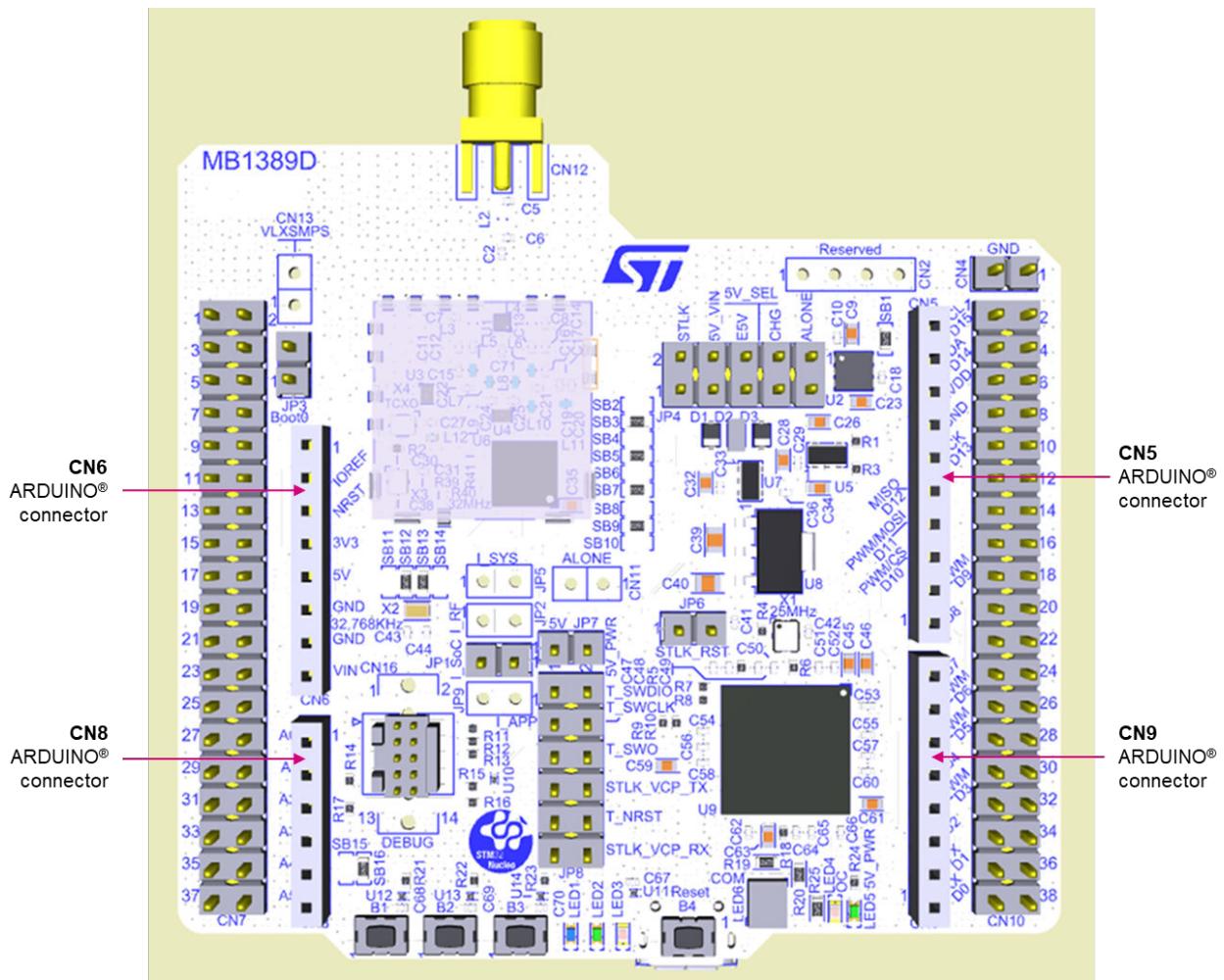
7.4

ARDUINO® Uno V3 connector (CN5, CN6, CN8, and CN9)

CN5, CN6, CN8, and CN9 are female connectors compatible with the ARDUINO® standard. Refer to Figure 23 for their location. Most shields designed for ARDUINO® can fit with the STM32WL Nucleo-64 board.

The ARDUINO® connector on the STM32WL Nucleo-64 board supports the ARDUINO® Uno V3.

Figure 23. ARDUINO® connector



The related pinout for the ARDUINO® connector is listed in Table 17.

Note:

ARDUINO® Uno V3 D0 and D1 signals are connected by default on USART1 (MCU I/O PB6 and PB7). Refer to Section 6.6.5 for details on how to modify the UART interface.

Table 17. ARDUINO® connector pinout

Connector	Pin number	Pin name	Signal name	STM32 pin ⁽¹⁾	Function ⁽¹⁾
CN6	1	NC	-	-	Reserved for test
	2	IOREF	-	-	I/O reference
	3	NRST	T_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 input power
CN8	1	A0	ADC	PB1	ADC1_IN5
	2	A1	ADC	PB2	ADC1_IN4
	3	A2	ADC	PA10	ADC1_IN6
	4	A3	ADC	PB4	ADC1_IN3
	5	A4	ADC	PB14	ADC1_IN1/I2C3_SDA
	6	A5	ADC	PB13	ADC1_IN0/I2C3_SCL
CN5	1	D8	ARD_D8	PC2	I/O
	2	PWM/D9	ARD_D9	PA9	TIM1_CH2
	3	PWM/CS/D10	ARD_D10	PA4	LPTIM1_OUT/SPI1_NSS
	4	PWM/MOSI/D11	ARD_D11	PA7	TIM17_CH1/SPI1_MOSI
	5	MISO/D12	ARD_D12	PA6	SPI1_MISO
	6	SCK/D13	ARD_D13	PA5	SPI1_SCK
	7	GND	-	-	GND
	8	AVDD	AVDD	AVDD/VREF+	Voltage reference
	9	SDA/D14	ARD_D14	PA11	I2C2_SDA
	10	SCL/D15	ARD_D15	PA12	I2C2_SCL
CN9	8	D7	ARD_D7	PC1	I/O
	7	PWM/D6	ARD_D6	PB10	TIM2_CH3
	6	PWM/D5	ARD_D5	PB8	TIM16_CH1
	5	D4	ARD_D4	PB5	I/O
	4	PWM/D3	ARD_D3	PB3	TIM2_CH2
	3	D2	ARD_D2	PB12	I/O
	2	TX/D1	ARD_D1	PA2/ PB6	LPUSART1_TX/ USART1_TX
	1	RX/D0	ARD_D0	PA3/ PB7	LPUSART1_RX/ USART1_RX

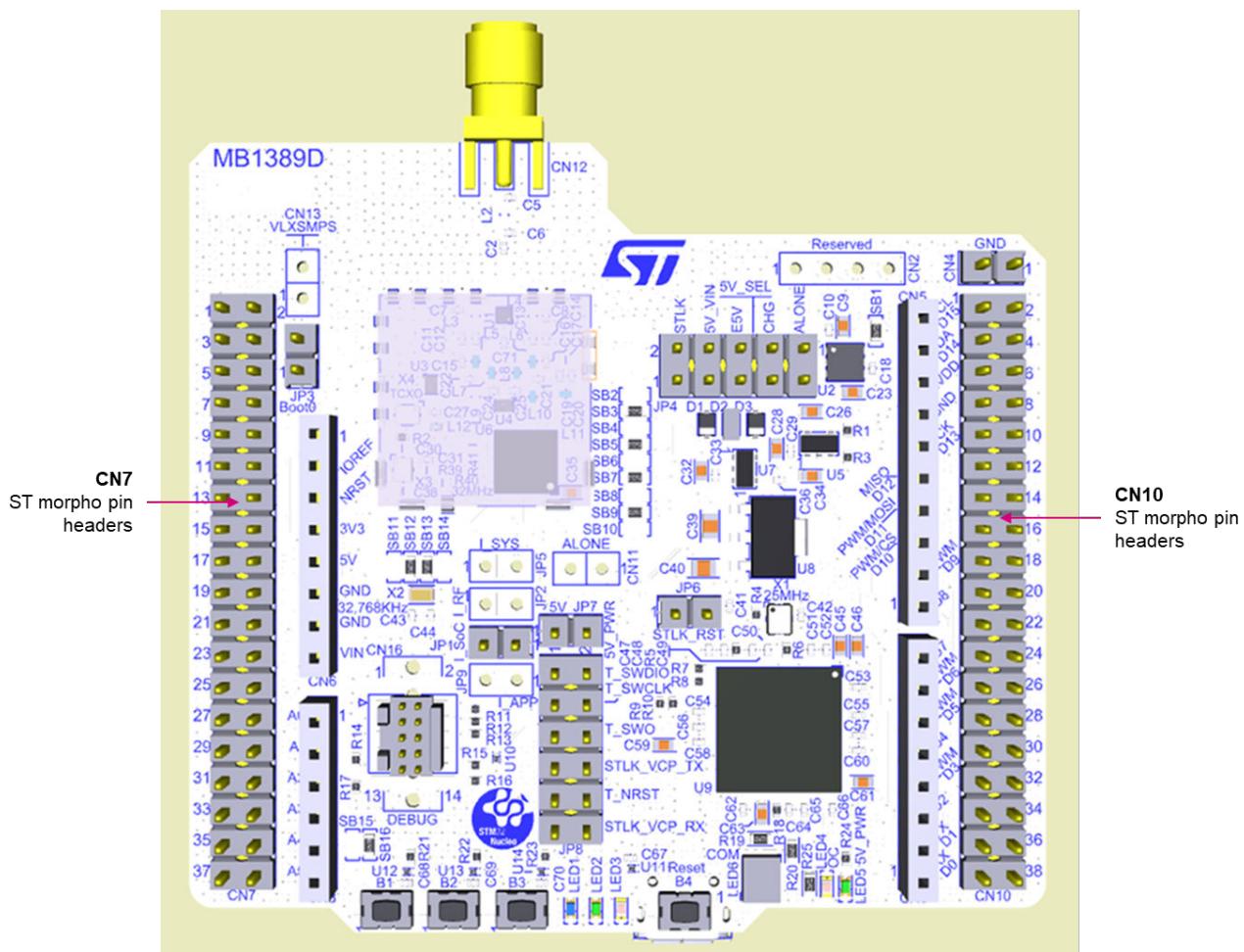
1. The default configuration is in bold.

7.5

ST morpho connectors (CN7 and CN10)

The ST morpho (CN7 and CN10) connectors are male pin headers accessible on both sides of the board. All signals and power pins of the STM32WL MCU are available on the ST morpho connectors. An oscilloscope, logical analyzer, or voltmeter can also probe these connectors.

Figure 24. ST morpho connectors



Note:

The D0 and D1 signals are connected by default to USART1 (MCU I/O PB6 and PB7). Refer to Section 6.6.5 for details about how to modify the UART interface.

Table 18 shows the pin assignment of each STM32WL I/O on the ST morpho connector.

Table 18. Pin assignment of the ST morpho connectors

CN7 odd pins		CN7 even pins		CN10 odd pins		CN10 even pins	
Pin number	Pin name	Pin number	Pin name ⁽¹⁾	Pin number	Pin name ⁽¹⁾	Pin number	Pin name
1	NC	2	NC	1	PA0	2	PC4
3	NC	4	NC	3	PA12	4	PC5
5	VDD_MCU	6	E5V	5	PA11	6	NC
7	BOOT0	8	GND	7	AVDD	8	5V_USB_CHGR ⁽²⁾
9	NC	10	NC	9	GND	10	NC
11	NC	12	IOREF	11	PA5	12	PC6

CN7 odd pins		CN7 even pins		CN10 odd pins		CN10 even pins	
Pin number	Pin name	Pin number	Pin name ⁽¹⁾	Pin number	Pin name ⁽¹⁾	Pin number	Pin name
13	PA13 ⁽³⁾	14	NRST	13	PA6	14	PC0
15	PA14 ⁽³⁾	16	3V3	15	PA7	16	PA8
17	PA15	18	5V	17	PA4	18	NC
19	GND	20	GND	19	PA9	20	GND
21	NC	22	GND	21	PC2	22	PB0
23	PC13	24	VIN	23	PC1	24	NC
25	PC14	26	NC	25	PB10	26	PB9
27	PC15	28	PB1	27	PB8	28	PB15
29	NC	30	PB2	29	PB5	30	PB11
31	NC	32	PA10	31	PB3	32	AGND
33	VBAT	34	PB4	33	PB12	34	NC
35	NC	36	PB14	35	PB6/PA2	36	PA1
37	NC	38	PB13	37	PB7/PA3	38	PC3

1. Default configuration in bold.
2. 5V_USB_CHGR is the 5 V power from the STLINK-V3E USB connector that rises first. It rises before the 5 V rising on the board.
3. PA13 and PA14 are shared with SWD signals connected to STLINK-V3E. It is not recommended to use them as I/O pins.

8 STM32WL Nucleo-64 I/O assignment

Table 19. STM32WL Nucleo-64 I/O assignment

Pin	Pin name	Signal or label	Main/optional feature/(SB) ⁽¹⁾
A1	VSSSMPS	VSSSMPS	GND of LDO/SMPs step-down converter
A2	VDDSMPS	VDDSMPS	External power supply of LDO/SMPs step-down converter
A4	PA14	T_SWCLK	T_SWCLK
A5	VDDA	VDDA	Analog voltage supply
A7	VDD	VDD	VDD voltage supply
A8	VBAT	VBAT	VBAT voltage supply
A9	PA12	PA12	ARD_D15 - I2C2_SCL
B1	VLXSMPS	VLXSMPS	VLXSMPS pin of SMPs step-down converter
B2	VFBSPMPS	VFBSPMPS	1.55 V provided by the SMPs step-down converter
B3	PA15	T_JTDI	T_JTDI
B4	PB15	PB15	LED1
B5	VREF+	VREF+	Input reference voltage for ADC
B6	PC14-OSC32_IN	OSC32_IN/PC14	LSE_CLK/GPIO PC14
B7	VSS	GND	GND
B8	PA13	T_SWDIO	T_SWDIO
B9	PA11	PA11	ARD_D14 - I2C2_SDA
C1	PB3	PB3	ARD_D3 - TIM2_CH2/T_SWO
C2	PB4	PB4	ARD_A3 - ADC1_IN3
C3	PB7	LPUART1_RX	ARD_D0/STLINK_RX (T_VCP_RX)
C4	PB9	PB9	LED2
C5	PC15-OSC32_OUT	OSC32_OUT/PC15	LSE_CLK/GPIO PC15
C6	PB14	PB14	ARD_A4 - ADC1_IN1/I2C3_SDA
C7	PC13	PC13	GPIO PC13/B1 user button
C8	PA10	PA10	ARD_A2 - ADC1_IN6
D2	PB5	PB5	ARD_D4 - I/O
D3	PB8	PB8	ARD_D5 - TIM16_CH1
D4	PC2	PC2	ARD_D8 - I/O
D5	PC3	PC3	FE_CTRL3
D6	PA0	PA0	B1 user button/GPIO PA0
D7	PB13	PB13	ARD_A5 - ADC1_IN0/I2C3_SCL
D8	PB2	PB2	ARD_A1 - ADC1_IN4
D9	VSS	GND	GND
E1	PB6	LPUART1_TX	ARD_D1/STLINK_TX (T_VCP_TX)
E2	VDD	VDD	VDD voltage supply
E3	VSS	GND	GND
E4	PC5	PC5	FE_CTRL2
E5	PA9	PA9	ARD_D9 - TIM1_CH2

Pin	Pin name	Signal or label	Main/optional feature/(SB) ⁽¹⁾
E6	PB12	PB12	ARD_D2 - I/O
E7	PB1	PB1	ARD_A0 - ADC1_IN5
E8	VDDRF	VDDRF	VDD supply for the RF part
E9	VDD	VDD	VDD voltage supply
F1	PC1	PC1	ARD_D7 - I/O
F2	PC0	PC0	I/O
F3	PC4	PC4	FE_CTRL1
F4	PA6	PA6	ARD_D12 - SPI1_MISO
F5	NRST	T_NRST	STM32WL RESET
F6	PB0-VDD_TCXO	PB0-VDD_TCXO	Supply voltage of TCXO/GPIO PB0
F7	VDDRF1V55	VDDRF1V55	External power supply for the radio
F8	OSC_OUT	OSC_OUT	HSE CLK
G2	PC6	PC6	B3 user button
G3	PA1	PA1	B2 user button
G4	PB11	PB11	LED3
G5	VSS	GND	GND
G6	VSSRF	VSSRF	GND for RF part
G7	VSSRF	VSSRF	GND for the RF part
G8	VSSRF	VSSRF	GND for the RF part
G9	OSC_IN	OSC_IN	HSE CLK
H1	PA3	LPUART_RX	STLINK_RX (T_VCP_RX)/ARD_D0
H2	PA2	LPUART_TX	STLINK_TX (T_VCP_TX)/ARD_D1
H3	PA7	PA7	ARD_D11 - TIM17_CH1/SPI1_MOSI
H4	PB10	PB10	ARD_D6 - TIM2_CH3
H5	VDD	VDD	VDD voltage supply
H6	VSSRF	VSSRF	GND for RF part
H7	RFI_N	RFI_N	RF receiver input (differential N path)
H8	VDDPA	VDDPA	Input supply for PA regulator
H9	VR_PA	VR_PA	Regulated PA supply output
J1	PA4	PA4	ARD_D10 - LPTIM1_OUT/SPI1_NSS
J2	PA5	PA5	ARD_D13 - SPI1_SCK
J3	PA8	PA8	I/O
J5	PH3	PH3	BOOT0
J6	RFI_P	RFI_P	RF receiver input (differential P path)
J8	RFO_LP	RFO_LP	Transmit default power PA output
J9	RFO_HP	RFO_HP	Transmit high-power PA output

1. The default configuration is shown in bold.

9 STM32WL Nucleo-64 board 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:



Dual-sticker example:



- Other boards if any: board reference with revision and serial number.

Examples:



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 STM32WL Nucleo-64 board product history

Table 20. Product history

Order code	Product identification	Product details	Product change description	Product limitations
NUCLEO-WL55JC1	NUWL55JC1\$CT1	MCU: <ul style="list-style-type: none">STM32WL55JCI7 silicon revision "Z"	Initial revision	No limitation
		MCU errata sheet: <ul style="list-style-type: none">STM32WL55xx, STM32WL54xx device errata (ES0500)		
		Board: <ul style="list-style-type: none">MB1389-HIGHBAND-D04 (main board)		
NUCLEO-WL55JC1	NUWL55JC1\$CT2	MCU: <ul style="list-style-type: none">STM32WL55JCI7 silicon revision "Y"	<ul style="list-style-type: none">MCU silicon revision changedMain board revision changed	No limitation
		MCU errata sheet: <ul style="list-style-type: none">STM32WL55xx, STM32WL54xx device errata (ES0500)		
		Board: <ul style="list-style-type: none">MB1389-HIGHBAND-E02 (main board)		
NUCLEO-WL55JC2	NUWL55JC2\$CT3	MCU: <ul style="list-style-type: none">STM32WL55JCI7 silicon revision "Y"	Packaging: plastic blister replaced by a carton box	No limitation
		MCU errata sheet: <ul style="list-style-type: none">STM32WL55xx, STM32WL54xx device errata (ES0500)		
		Board: <ul style="list-style-type: none">MB1389-HIGHBAND-E02 (main board)		
NUCLEO-WL55JC2	NUWL55JC2\$CT1	MCU: <ul style="list-style-type: none">STM32WL55JCI7 silicon revision "Z"	Initial revision	No limitation
		MCU errata sheet: <ul style="list-style-type: none">STM32WL55xx, STM32WL54xx device errata (ES0500)		
		Board: <ul style="list-style-type: none">MB1389-LOWBAND-D04 (main board)		

Order code	Product identification	Product details	Product change description	Product limitations
NUCLEO-WL55JC2	NUWL55JC2\$CT2	MCU: <ul style="list-style-type: none">STM32WL55JC17 silicon revision "Y"	<ul style="list-style-type: none">MCU silicon revision changedMain board revision changed	No limitation
		MCU errata sheet: <ul style="list-style-type: none">STM32WL55xx, STM32WL54xx device errata (ES0500)		
	NUWL55JC2\$CT3	Board: <ul style="list-style-type: none">MB1389-LOWBAND-E02 (main board)	Packaging: plastic blister replaced by a carton box	No limitation
		MCU: <ul style="list-style-type: none">STM32WL55JC17 silicon revision "Y"		
		MCU errata sheet: <ul style="list-style-type: none">STM32WL55xx, STM32WL54xx device errata (ES0500)		
		Board: <ul style="list-style-type: none">MB1389-LOWBAND-E02 (main board)		

9.3 Board revision history

Table 21. Board revision history

Board reference	Board variant and revision	Board change description	Board limitations
MB1389 (main board)	LOWBAND-D04	Initial revision	<ul style="list-style-type: none">The maximum output power is limited to 19.7 dBm to fulfill FCC/IC/CE requirements.Output power higher than 19.7 dBm at the antenna is prohibited
	LOWBAND-E02	Eight decoupling capacitors added	
	HIGHBAND-D04	Initial revision	
	HIGHBAND-E02	Eight decoupling capacitors added	

10 Compliance statements and conformity declarations

10.1 Federal Communications Commission (FCC) compliance statement

Product identification

- Identification of the product: NUCLEO-WL55JC1
FCC ID: YCP-MB1389000
FCC ID: YCP-MB1389001

Part 15.19

These devices comply with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) these devices may not cause harmful interference, and (2) these devices 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 Class B digital devices, 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 instructions, 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 antennae of these devices and persons during operation. To ensure compliance, operation at a closer distance than this is not recommended. These transmitters 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

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

Product identification

- Identification of the product: NUCLEO-WL55JC1
IC: 8976A-MB1389000
IC: 8976A-MB1389001

Compliance statement

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

These devices comply with ISED Canada RF radiation exposure limits set forth for general population for mobile application (uncontrolled exposure).

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

These products comply with the ICES-003 standard class B of the ISED regulation.

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

Note: Use only shielded cables.

Identification des produits

- Identification du produit : NUCLEO-WL55JC1
IC : 8976A-MB1389000
IC : 8976A-MB1389001

Déclaration de conformité

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

Ces appareils sont conformes aux limites d'exposition aux rayonnements RF d'ISDE Canada établies pour la population générale pour les applications mobiles (exposition non contrôlée).

Pour satisfaire aux exigences d'ISDE en matière d'exposition aux RF, une distance de séparation de 20 cm ou plus doit être maintenue entre l'antenne de ces appareils et les personnes pendant son fonctionnement. Pour garantir la conformité, il n'est pas recommandé de les utiliser à une distance plus proche que celle-ci. Ces appareils ne doivent pas être placés à proximité ou fonctionner en conjonction avec une autre antenne ou un autre émetteur.

Ces produits sont conformes à la norme NMB-003 classe B de la ISDE.

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

Note: Utiliser uniquement des câbles blindés.

10.3 UKCA conformity

Simplified UK declaration of conformity

Hereby, the manufacturer STMicroelectronics, declares that the radio equipment types NUCLEO-WL55JC1 and NUCLEO-WL55JC2 are in compliance with the UK Radio Equipment Regulations 2017 (UK S.I. 2017 No. 1206) and with the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 (UK SI 2012 No. 3032).

The full text of the UK declaration of conformity is available at the following internet address: www.st.com.

Note: Use only shielded cables.

10.4 CE conformity

10.4.1 Simplified EU declaration of conformity

Hereby, STMicroelectronics declares that the radio equipment types NUCLEO-WL55JC1 and NUCLEO-WL55JC2 are in compliance with directives 2011/53/EU and 2015/863/EU (RoHS), and 2014/53/EU (RED).

Frequency range used in transmission and maximal radiated power in this range for NUCLEO-WL55JC1:

- Frequency range: 869.4-869.65 MHz (LoRa®, (G)FSK, (G)MSK, and BPSK)
- Maximal power: 25 mW EIRP

Frequency range used in transmission and maximal radiated power in this range for NUCLEO-WL55JC2:

- Frequency range: 433.05-434.79 MHz (LoRa®, (G)FSK, (G)MSK, and BPSK)
- Maximal power: 10 mW EIRP

The full text of the EU declaration of conformity is available on demand at the following internet address:
www.st.com.

- Note:*
- *RoHS: Restriction of hazardous substances*
 - *RED: Radio equipment directive*

Note: *Use only shielded cables.*

10.4.2 Déclaration de conformité UE simplifiée

STMicroelectronics déclare que les équipements radioélectriques des types NUCLEO-WL55JC1 et NUCLEO-WL55JC2 sont conformes aux directives 2011/53/UE et 2015/863/UE (LdSD), et à la directive 2014/53/UE (RED).

Plage de fréquences utilisée en transmission et puissance rayonnée maximale dans cette plage pour NUCLEO-WL55JC1 :

- Plage de fréquences : 869.4 - 869.65 MHz (LoRa®, (G)FSK, (G)MSK, et BPSK)
- Puissance maximale : 25 mW PIRE

Plage de fréquences utilisée en transmission et puissance rayonnée maximale dans cette plage pour NUCLEO-WL55JC2 :

- Plage de fréquences : 433.05 - 434.79 MHz (LoRa®, (G)FSK, (G)MSK, et BPSK)
- Puissance maximale : 10 mW PIRE

Le texte complet de la déclaration UE de conformité est disponible sur demande à l'adresse internet suivante :
www.st.com.

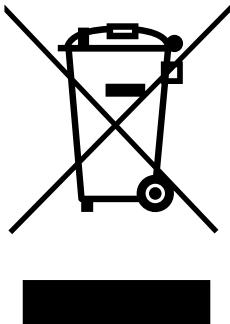
- Note:*
- *LdSD : directive sur la limitation de l'utilisation des substances dangereuses*
 - *RED : directive sur les équipements radio-électriques*

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 22. Document revision history

Date	Revision	Changes
17-Nov-2020	1	Initial release.
9-Jul-2021	2	<p>Added:</p> <ul style="list-style-type: none">Chapter on antenna stuck to SMA connector as FCC constraint in <i>Section 6.6.3</i> <p>Updated:</p> <ul style="list-style-type: none"><i>Table 17</i> in <i>Section 7.4: CN5, CN6, CN8, and CN9: ARDUINO® Uno V3 connector</i><i>NUCLEO-WL55JC product history</i><i>Board revision history</i>
27-Sep-2024	3	<p>Updated Section 9.1: Product marking.</p> <p>Added Product history and Board revision history tables.</p>
03-Nov-2025	4	<p>Updated:</p> <ul style="list-style-type: none">Section 3.1: System requirementsSection 6.6.4: Current consumption measurement (I_SoC)Table 18. Pin assignment of the ST morpho connectorsSection 9.1: Product markingSection 10: Compliance statements and conformity declarations <p>Added:</p> <ul style="list-style-type: none">Section 3.4: EDA resourcesSection 11: Product disposal

Contents

1	Features	2
2	Ordering information	3
2.1	Codification	3
3	Development environment	4
3.1	System requirements	4
3.2	Development toolchains	4
3.3	Demonstration software	4
3.4	EDA resources	4
4	Conventions	5
5	Quick start	6
5.1	Getting started	6
6	Hardware layout and configuration	8
6.1	PCB layout	9
6.2	Mechanical drawing	12
6.3	Embedded STLINK-V3E	12
6.3.1	Drivers	13
6.3.2	STLINK-V3E firmware upgrade	13
6.3.3	Using an external debug tool to program and debug the on-board STM32	13
6.4	Power supply	15
6.4.1	Debugging while using VIN or EXT as an external power supply	24
6.5	Clock sources	24
6.5.1	HSE clock (high-speed external clock)	24
6.5.2	LSE clock (low-speed external clock) – 32.768 kHz	25
6.6	Board functions	25
6.6.1	LEDs	25
6.6.2	Push-buttons	26
6.6.3	RF overview	26
6.6.4	Current consumption measurement (I_SoC)	27
6.6.5	Virtual COM port (VCP): LPUART and USART	28
6.7	Solder bridges	30
7	Board connectors	32
7.1	STLINK-V3E USB Micro-B connector (CN1)	32
7.2	MIP10 connector (CN16)	32
7.3	SMA connector (CN12)	33

7.4	ARDUINO® Uno V3 connector (CN5, CN6, CN8, and CN9)	34
7.5	ST morpho connectors (CN7 and CN10)	36
8	STM32WL Nucleo-64 I/O assignment	38
9	STM32WL Nucleo-64 board product information	40
9.1	Product marking	40
9.2	STM32WL Nucleo-64 board product history	41
9.3	Board revision history	42
10	Compliance statements and conformity declarations	43
10.1	Federal Communications Commission (FCC) compliance statement	43
10.2	Innovation, Science and Economic Development Canada (ISED) compliance statement .	43
10.3	UKCA conformity	44
10.4	CE conformity	44
10.4.1	Simplified EU declaration of conformity	44
10.4.2	Déclaration de conformité UE simplifiée	45
11	Product disposal	46
Revision history	47
List of tables	50
List of figures	51

List of tables

Table 1.	List of available products	3
Table 2.	Codification explanation	3
Table 3.	ON/OFF convention	5
Table 4.	Jumper configuration	6
Table 5.	MIPI10/JTAGSTDC14 debug connector (CN16)	14
Table 6.	External power sources: VIN (7 to 12 V)	18
Table 7.	External power sources: E5V (5 V)	19
Table 8.	External power sources: 5V_CHGR (5 V)	20
Table 9.	External power sources: 3V3	21
Table 10.	External power sources: STD_ALONE_5V	22
Table 11.	USART1 connection	28
Table 12.	LPUART1 connection	29
Table 13.	Solder bridge configuration	30
Table 14.	USB Micro-B connector (CN23) front view	32
Table 15.	MIPI10 connector (CN16) pinout (STDC14 pinout compatible)	33
Table 16.	SMA connector pinout	33
Table 17.	ARDUINO® connector pinout	35
Table 18.	Pin assignment of the ST morpho connectors	36
Table 19.	STM32WL Nucleo-64 I/O assignment	38
Table 20.	Product history	41
Table 21.	Board revision history	42
Table 22.	Document revision history	47

List of figures

Figure 1.	NUCLEO-WL55JC top view	1
Figure 2.	NUCLEO-WL55JC bottom view	1
Figure 3.	Hardware block diagram	8
Figure 4.	Top layout	9
Figure 5.	RF certification and UID64 stickers	10
Figure 6.	Bottom layout	11
Figure 7.	STM32WL Nucleo 73 board mechanical drawing (in millimeters)	12
Figure 8.	USB composite device.	13
Figure 9.	Connecting an external debug tool to program the on-board STM32WL	14
Figure 10.	STM32WL Nucleo-64 board power tree	16
Figure 11.	Power supply input from STLINK-V3E USB connector with PC (5 V, 500 mA maximum).	17
Figure 12.	Power supply input from VIN (7 to 12 V, 800 mA maximum)	19
Figure 13.	Power supply input from 5V_EXT (5 V, 500 mA maximum)	20
Figure 14.	Power supply input from ST-LINK USB connector with 5 V USB charger	21
Figure 15.	Power supply input from external 3V3	22
Figure 16.	Power supply input from STD_ALONE_5V (5 V, 500 mA maximum)	23
Figure 17.	STD_ALONE_5V and GND pins on CN11	23
Figure 18.	RF block diagram	27
Figure 19.	JP1 and JP4 settings for current consumption measurement	28
Figure 20.	USB Micro-B connector (CN23) front view	32
Figure 21.	MIP10 debugging connector (CN16) top view	32
Figure 22.	SMA connector (CN12)	33
Figure 23.	ARDUINO® connector	34
Figure 24.	ST morpho connectors	36

IMPORTANT NOTICE – READ CAREFULLY

STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice.

In the event of any conflict between the provisions of this document and the provisions of any contractual arrangement in force between the purchasers and ST, the provisions of such contractual arrangement shall prevail.

The purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST's terms and conditions of sale in place at the time of order acknowledgment.

The purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of the purchasers' products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

If the purchasers identify an ST product that meets their functional and performance requirements but that is not designated for the purchasers' market segment, the purchasers shall contact ST for more information.

ST and the ST logo are trademarks of ST. For additional information about ST trademarks, refer to www.st.com/trademarks. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2025 STMicroelectronics – All rights reserved