P-NUCLEO-WB55 (MB1355 and MB1293)

Introduction

The P-NUCLEO-WB55 Nucleo pack, comprising a Nucleo-64 board and a USB dongle, provides an affordable and flexible way for users to try out new concepts and build prototypes using STM32WB microcontrollers with a 2.4-GHz radio interface.

This circuit block offers various combinations of performance, power consumption, and features. It supports a 2.4-GHz RF transceiver, handling Bluetooth® specification v5.4 and IEEE 802.15.4-2011 PHY and MAC.

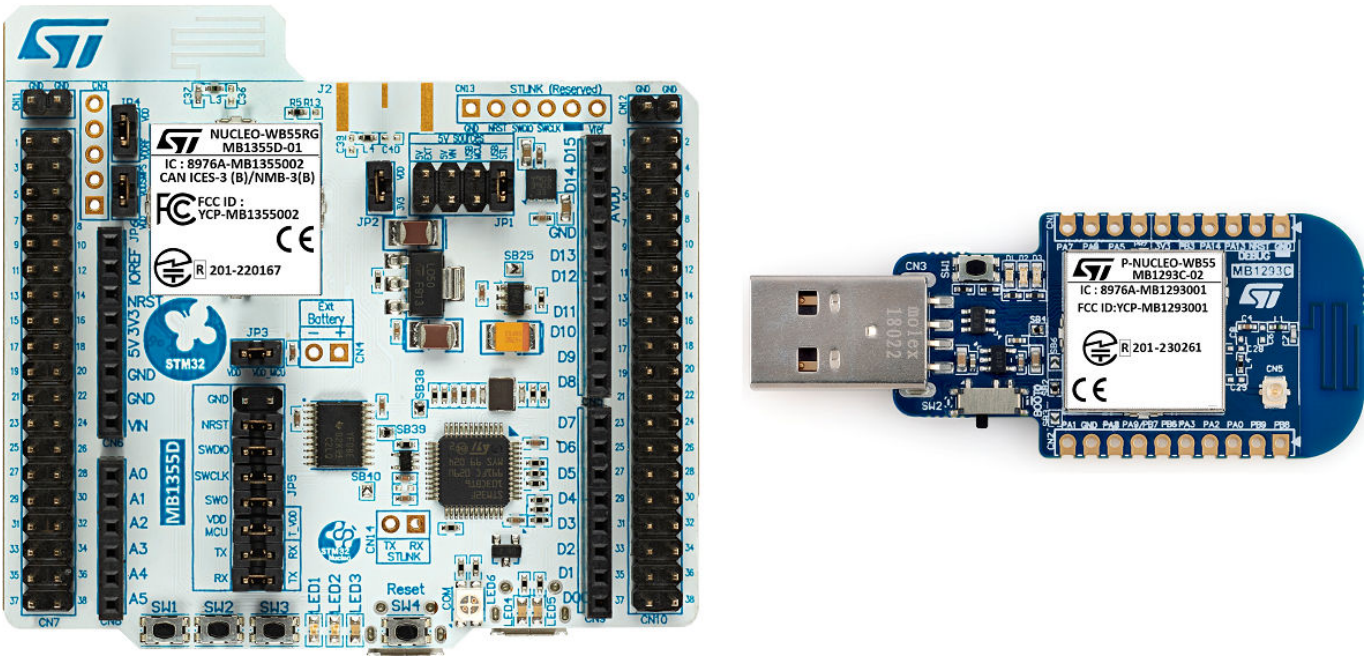
ARDUINO® Uno V3 connectivity and ST morpho headers allow users to extend the functionality of the Nucleo open-development platform with a wide choice of specialized shields.

The boards use a multiprotocol wireless 32-bit microcontroller, based on an Arm® Cortex®-M4 and M0+ core with FPU, featuring Bluetooth® LE and an 802.15.4 radio solution.

The STM32 Nucleo-64 board does not require any separate probes, as it integrates the ST-LINK/V2-1 debugger/programmer. The board comes with comprehensive free STM32 software libraries and examples in the STM32Cube package.

The USB dongle can be programmed through a USB bootloader or USB DFU. It is also possible to debug or program it using an external ST-LINK (not included) with the SWD interface shields.

Figure 1. P-NUCLEO-WB55 global view



Picture is not contractual.

1 Features

Nucleo-64 board

- STM32WB microcontroller in VFQFPN68 package
- 2.4 GHz RF transceiver supporting Bluetooth® specification v5.4 and IEEE 802.15.4-2011 PHY and MAC
- Dedicated 32-bit Arm® Cortex®-M0+ CPU for real-time radio layer
- SMPS significantly reduces power consumption in Run mode.
- Three user LEDs shared with ARDUINO®
- Four push-buttons
- 32.768 kHz LSE crystal oscillator
- 32 MHz crystal oscillator with integrated trimming capacitors
- Board connectors:
  - ARDUINO® Uno V3
  - ST morpho extension pin headers
- Flexible power-supply options: ST-LINK USB V_{BUS} or external sources
- On-board ST-LINK/V2-1 debugger/programmer with USB re-enumeration capability: mass storage, Virtual COM port, and debug port
- Comprehensive free software libraries and examples available with the STM32CubeWB MCU Package
- Support of a wide choice of Integrated Development Environments (IDEs) including IAR Embedded Workbench®, MDK-ARM, and STM32CubeIDE

USB dongle

- Dedicated 32-bit Arm® Cortex®-M0+ CPU for real-time radio layer
- SMPS significantly reduces power consumption in Run mode.
- 32.768 kHz LSE crystal oscillator
- 32 MHz crystal oscillator with integrated trimming capacitors
- Full Bluetooth® solution with integrated PCB antenna for fast connection
- Switch for boot management.
- User push-button
- Three user LEDs

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

2 Ordering information

To order the P-NUCLEO-WB55 Nucleo pack, refer to Table 1. Additional information is available from the datasheet and reference manual of the target STM32.

Table 1. Ordering information

Order code	Board reference	Target STM32
P-NUCLEO-WB55	• MB1355(1)	STM32WB55RGU6
	• MB1293(2)	STM32WB55CGU6

1. *Main board*
2. *USB dongle*

2.1 Codification

The meaning of the codification is explained in Table 2.

Table 2. Codification explanation

P-NUCLEO-XXYY	Description	Example: P-NUCLEO-WB55
P-NUCLEO	Nucleo pack	Nucleo pack
XX	MCU series in STM32 32-bit Arm Cortex MCUs	STM32WB series
YY	MCU product line in the series	STM32WBx5 product line

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 P-NUCLEO-WB55 product page at *www.st.com*.

4 Conventions

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

Table 3. ON/OFF convention

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

5 Safety recommendations

5.1 Targeted audience

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

5.2 Handling the board

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

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

5.3 Power supply

This product is not delivered with a power supply.

The equipment must be powered by a power supply unit or an auxiliary equipment complying with the standard EN 62368-1 (2014+A11/2017), which must be Safety Extra Low Voltage (SELV/ES1) with limited power capability (LPS/PS2).

6 Quick start

The Nucleo pack is a low-cost and easy-to-use development kit to evaluate quickly and start a project based on an STM32WB microcontroller featuring a 2.4 GHz RF transceiver supporting Bluetooth® specification v5.4 and IEEE 802.15.4-2011 PHY and MAC in a VFQFPN68 or UFQFPN48 package.

1. Before installing and using the product, accept the evaluation product license agreement from *www.st.com/epla*.
2. To identify all the device interfaces from the host PC, install the Nucleo USB driver available at *www.st.com/stm32nucleo* before connecting the board.
3. Set the JP1 jumper: [7-8] on USB STL.
4. Plug the Nucleo USB ST-LINK connector (P2P server) and USB dongle (P2P client) into power sources. On the P2P server, you see a blinking LED for approximately 1 minute.
5. Once the P2P client is powered, push the SW1 button to start scanning (it automatically connects to the P2P server).
6. Once connected, the green LED blinks for each connection interval. The P2P client searches for the P2P service, the LED and button characteristics, and enables notification.
7. Pushing the SW1 button toggles the blue LED on the remote device.
8. Pushing the SW2 button on the Nucleo board changes the connection interval (50 ms, 1 s). The effect is visible directly on the green LED of the Nucleo board.
9. The demonstration software and several software examples that make it possible to use the STM32 Nucleo board and USB dongle features are available at *www.st.com/stm32nucleo*.
10. Develop your application using the available examples.

7 MB1355 hardware layout and configuration

This section presents the architecture and available functions of the MB1355 board.

7.1 MB1355 description

MB1355 is designed around the STM32WB55RG microcontroller. The hardware block diagram in Figure 2 illustrates the connection between STM32WB55RG and its peripherals (LEDs, push-buttons, ARDUINO® Uno V3 connectors, ST morpho connectors, and embedded ST-LINK).

Figure 3 to Figure 6 help the user locate these features on the MB1355 board. The mechanical dimensions are shown in Figure 7.

Figure 2. MB1355 hardware block diagram

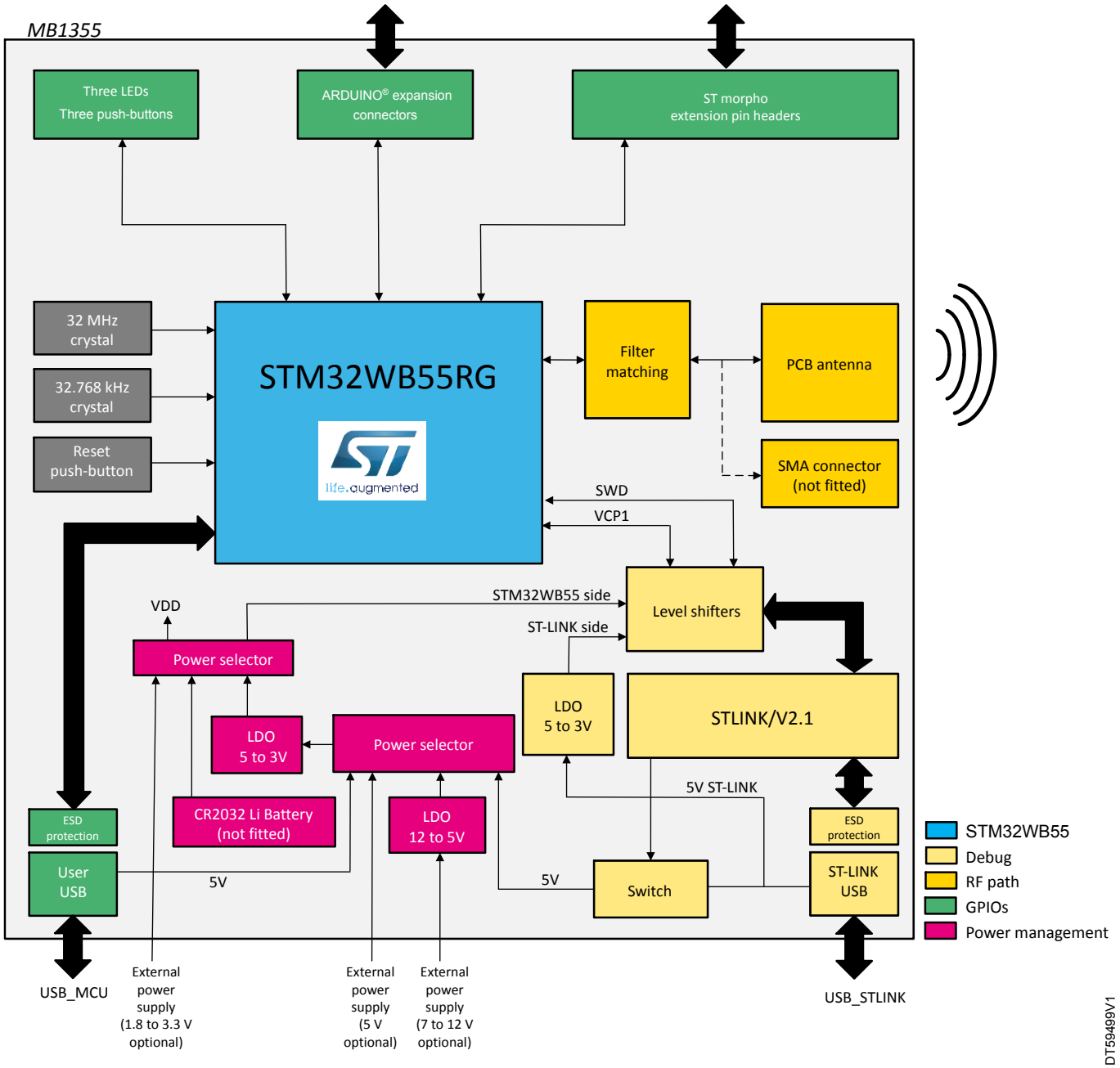


Figure 3. MB1355C and MB1355D PCB top side

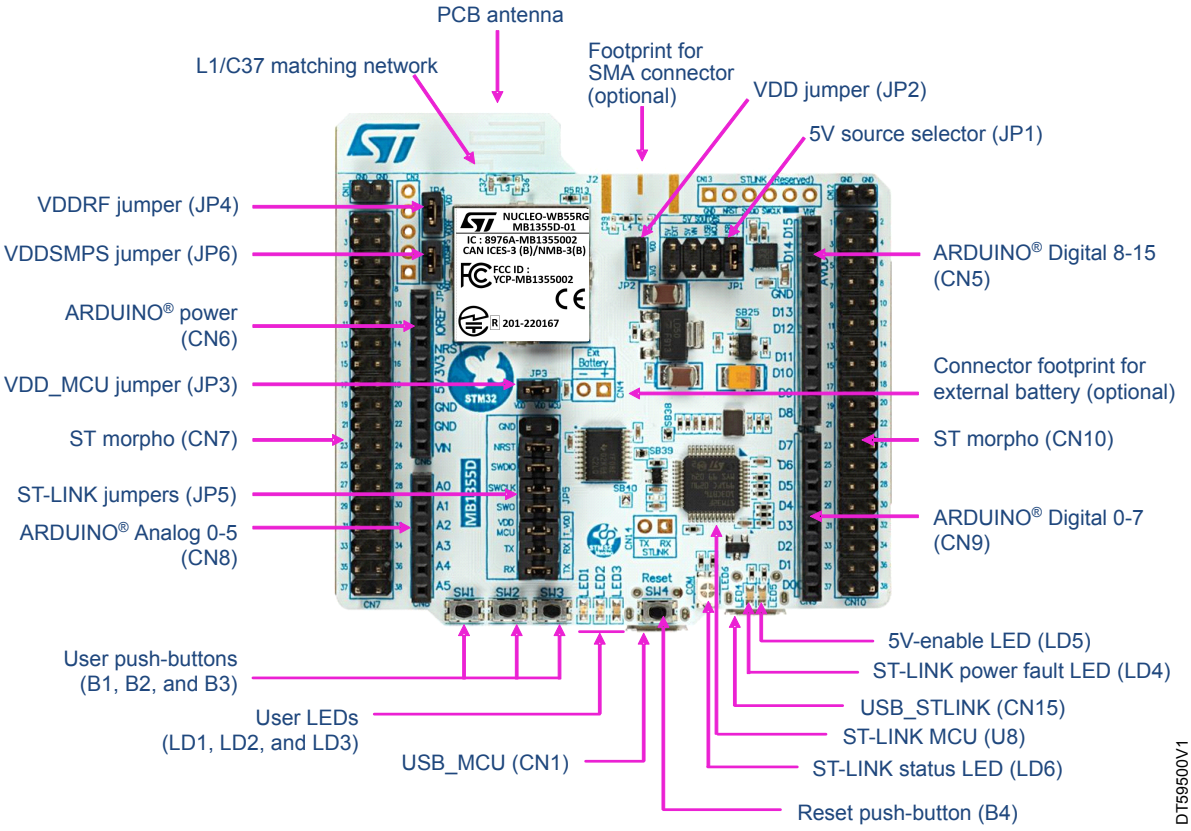


Figure 4. MB1355C PCB with details of the main part (SoC and RF)

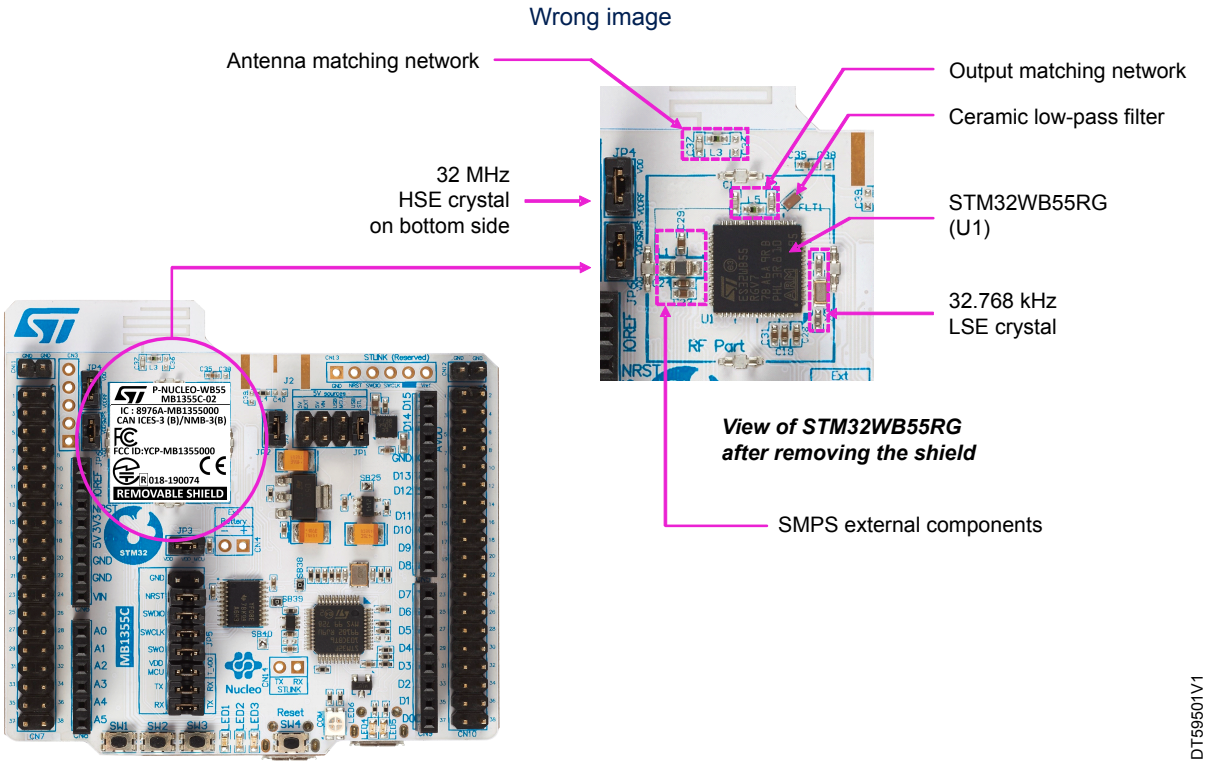


Figure 5. MB1355D PCB with details of the main part (SoC and RF)

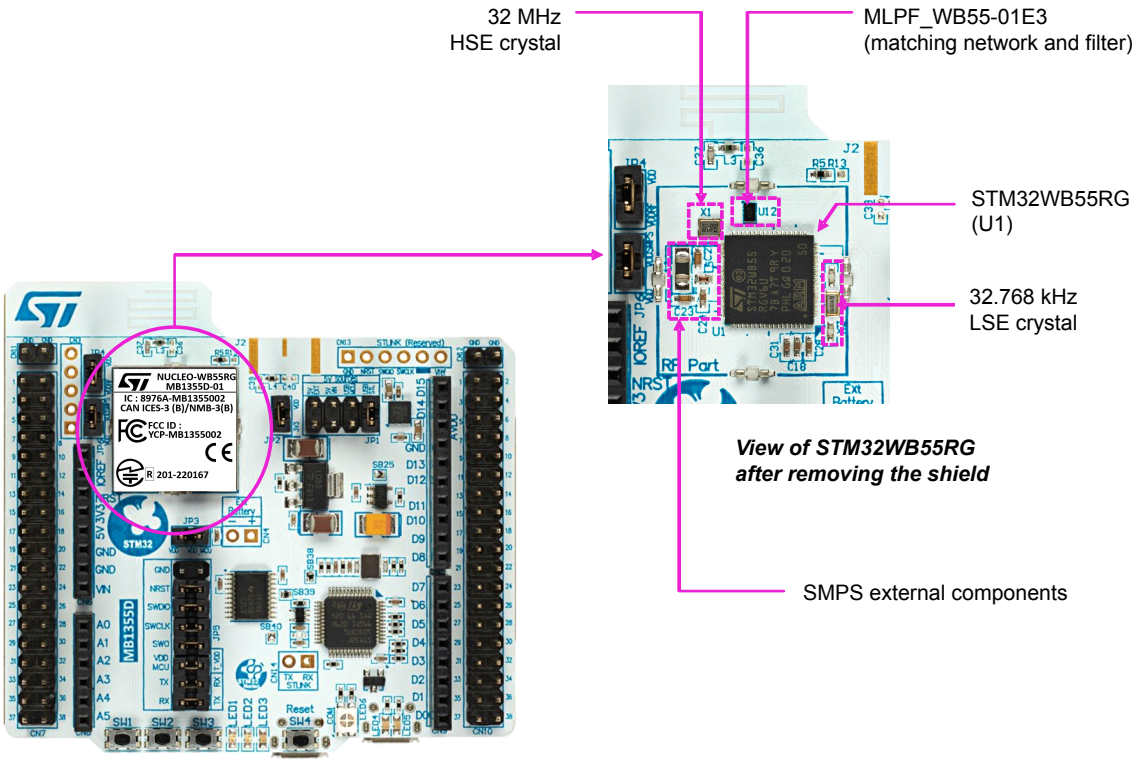


Figure 6. MB1355 PCB bottom side

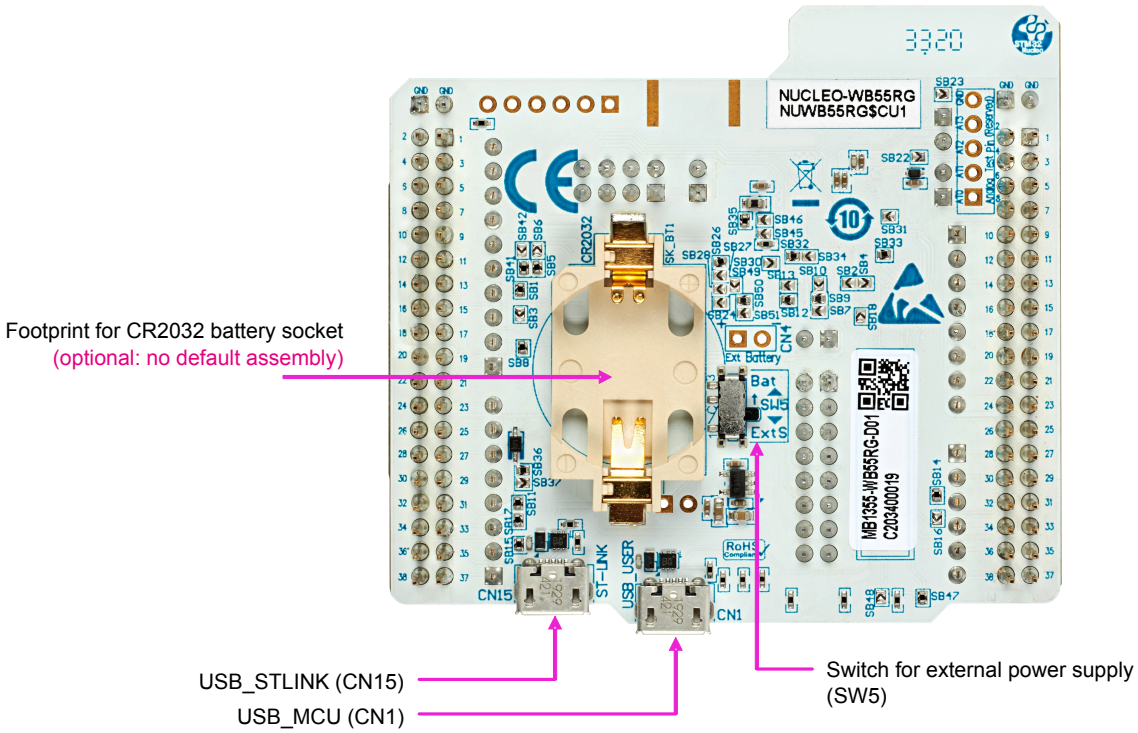
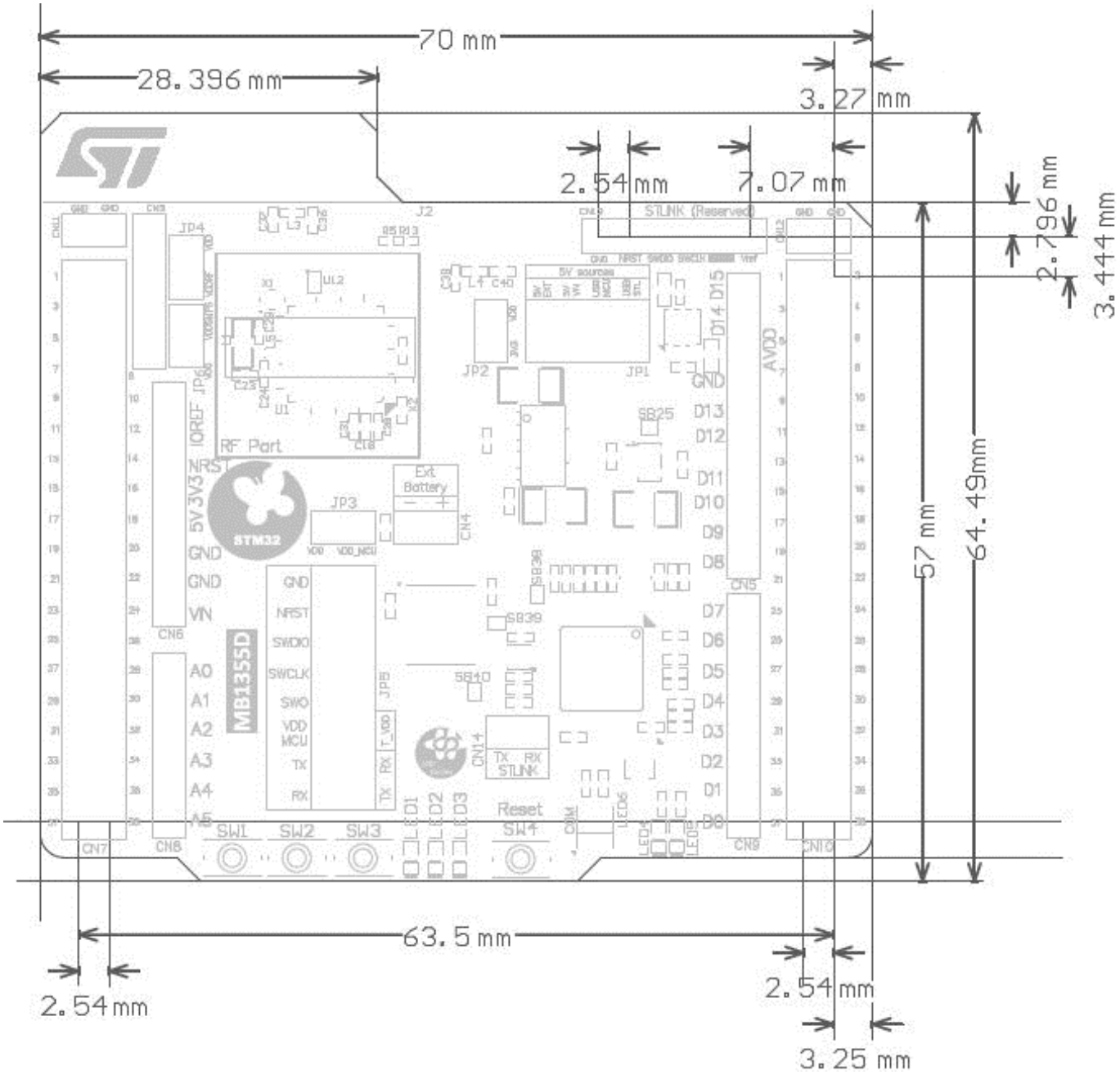


Figure 7. **MB1355 mechanical dimensions (in millimeters)**



7.2 MB1355 power supply

7.2.1 General description of the MB1355 power supply

By default, the STM32WB55RG microcontroller embedded on the board is supplied by 3V3, but the board offers many options to supply the device. The 3.3 V can first come from the ST-LINK USB, ARDUINO®, or ST morpho connectors. Moreover, STM32WB55RG can be supplied by an external source, between 1.8 and 3.3 V. The level shifter renders debugging with the embedded ST-LINK always possible even if the supply voltage of the target differs from 3V3 (ST-LINK supply). Figure 8 and Figure 9 show the power tree and the default state of the jumpers and solder bridges.

Figure 8. MB1355 revision C power tree

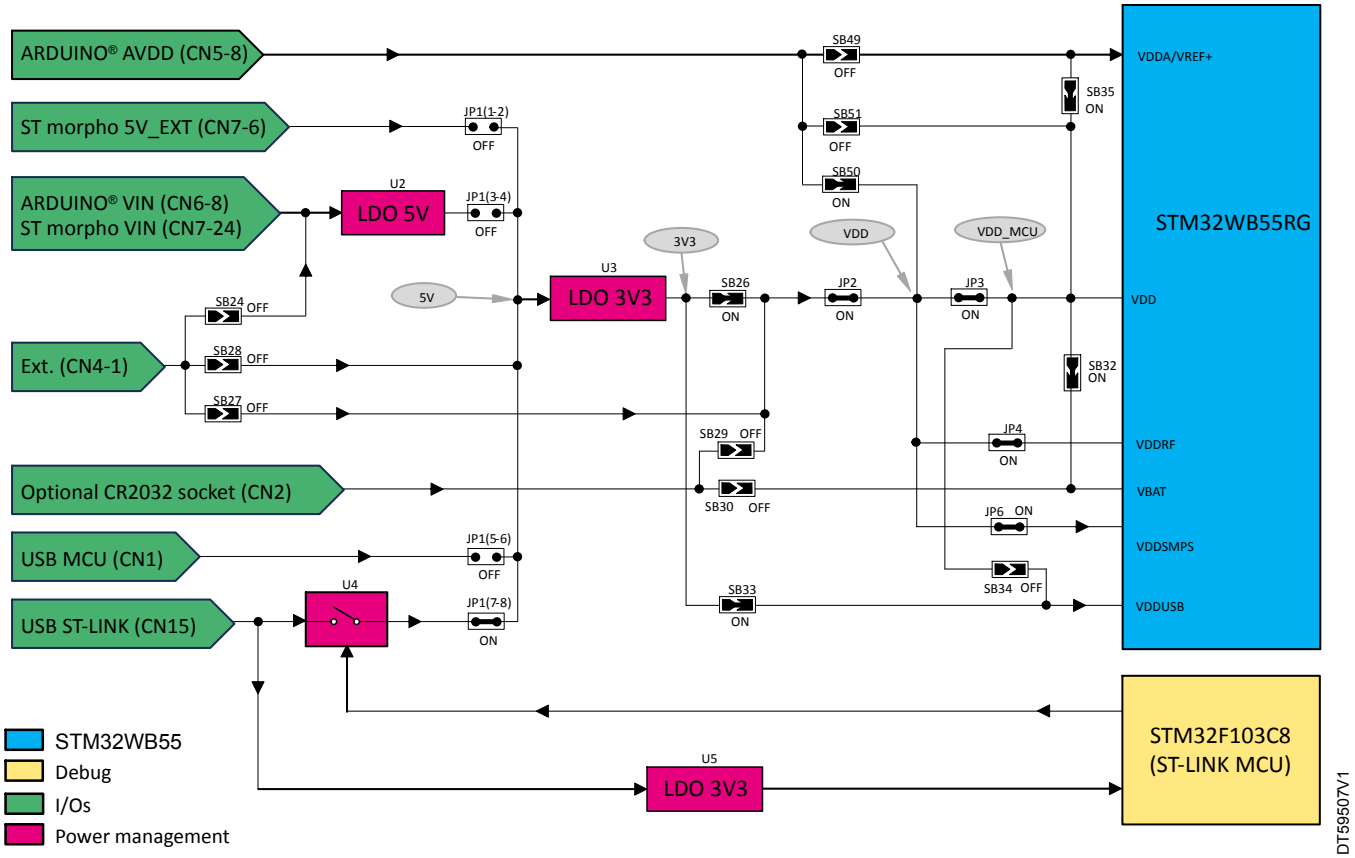
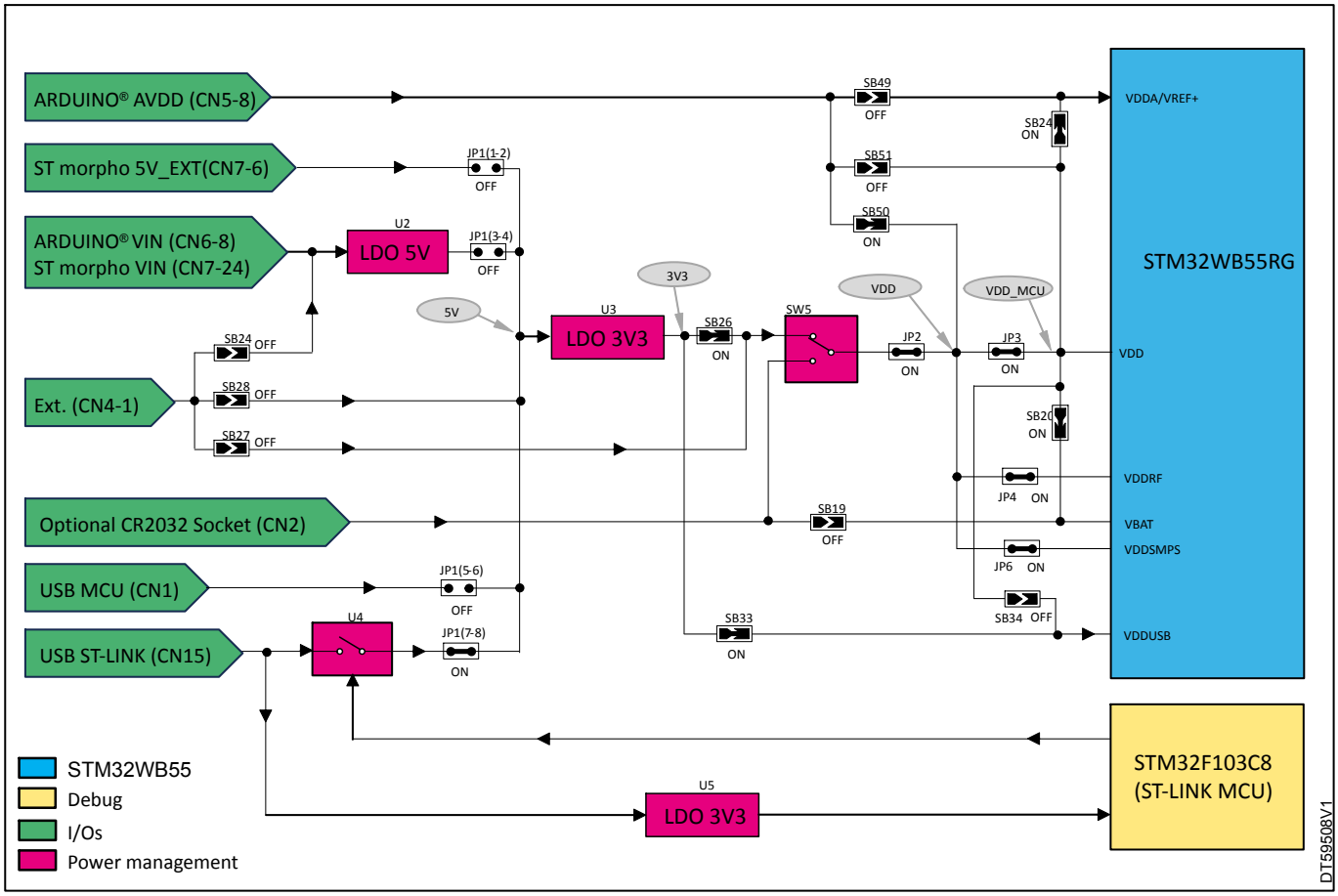


Figure 9. **MB1355 revision D power tree**



7.2.2 VIN: 7 to 12 V power supply

MB1355 can be powered with a 7 to 12 V DC power source. There are three access points for this type of DC level:

1. VIN CN6 pin 8 of the ARDUINO® connector. It is possible to apply until +12 V on this pin or use an ARDUINO® shield, which can deliver this type of voltage on the VIN pin.
2. VIN CN7 pin 24 of the ST morpho connector. It is possible to apply until +12 V on this pin, like for the ARDUINO® connection.
3. CN4 external input. In this case, it is important to pay close attention to the setting of the jumpers and solder bridges. Refer to Table 4 for further details.

These sources are connected to the U2 linear low-drop voltage regulator. The 5-V output of this regulator is a potential source of 5V. Refer to Section 7.2.3 for further details.

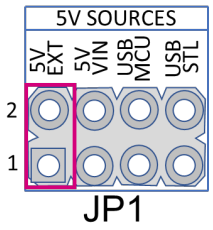
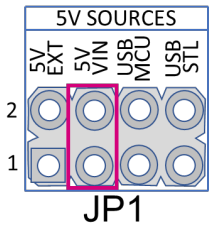
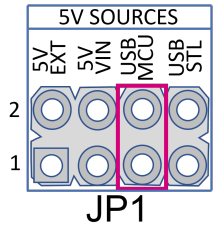
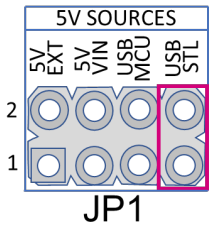
7.2.3 5 V power supply

MB1355 can be powered with a 5-V DC power source. The 5 V can come from several connectors:

1. 5V_USB_STLK connected to CN11 (default configuration for the supply of the board). This connector is dedicated to ST-LINK/V2 access and the Virtual COM port, and can therefore be supplied from the host computer. It is also possible to connect a USB charger to this connector. In this case, the ST-LINK and the VCP are inaccessible.
2. CN4 external input. In this case, it is important to pay close attention to the setting of the jumpers and solder bridges. Refer to Section 7.2.1 for more details.
3. 5V_EXT CN7 pin 6 of the ST morpho connector.
4. 7 to 12 V input through the U2 voltage regulator. Refer to Section 7.2.1 for further details.

The JP1 jumper selects the 5V source. Table 4 shows the configuration versus the selected source. Depending on the current needed by 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 the P-NUCLEO-WB55 is supplied with the correct power source depending on the required current.

Table 4. Power supply selector (JP1) description

Jumper/Solder bridge	Setting	Configuration
JP1 5V supply source selector		MB1355 directly supplied through CN7 pin 6
		MB1355 is supplied through the ARDUINO® CN6 pin 8, or ST morpho CN7 pin 24, or CN4. Refer to configuration details in the present power supply section.
		MB1355 supplied through the USB_USER Micro-B USB receptacle (CN1)
		**P-NUCLEO-WB55 supplied through the USB ST-LINK Micro-B USB receptacle (CN15)**(1)

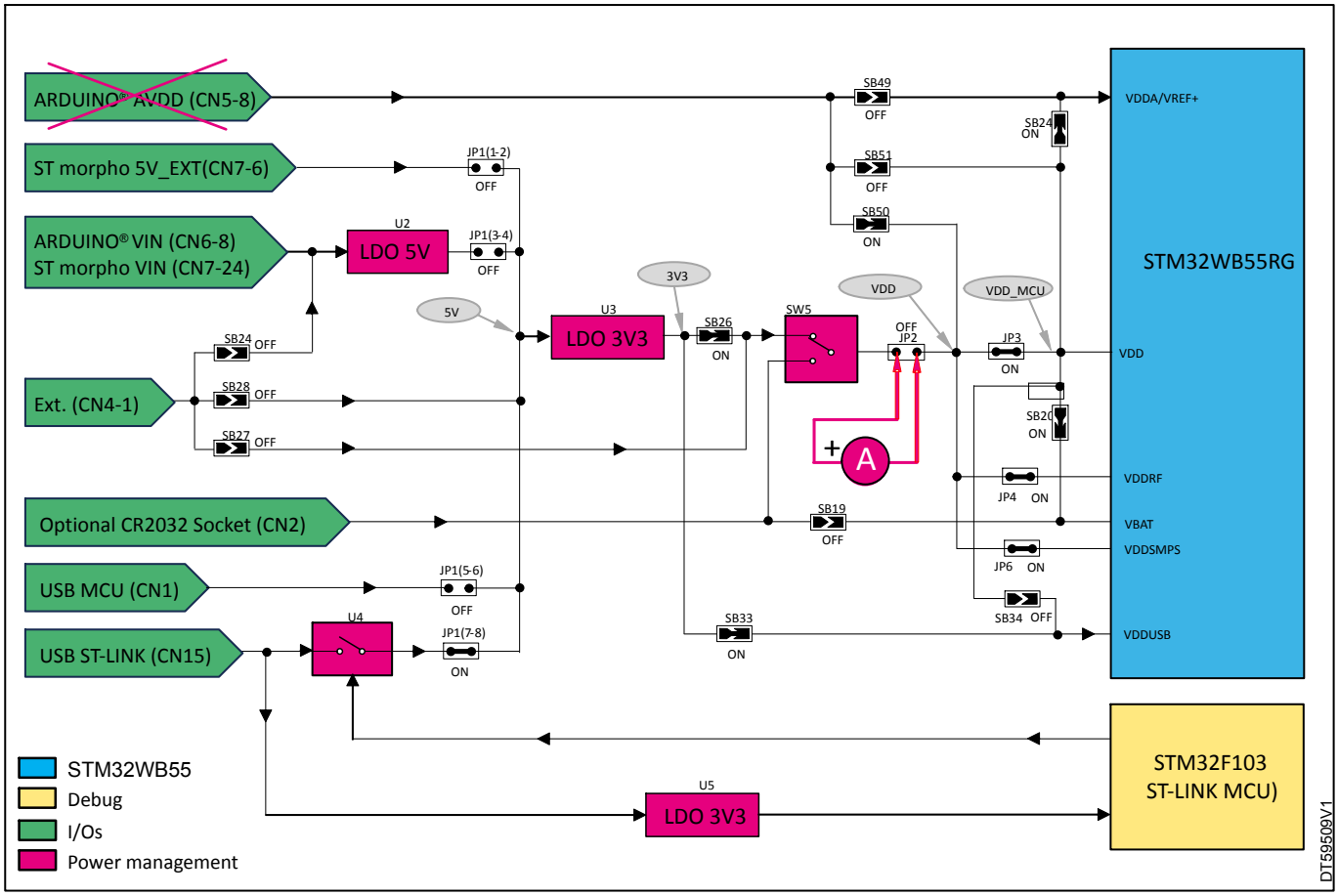
1. *The default configuration is shown in bold.*

7.2.4 Current measurement

As the device has low-power features, it can be interesting to measure the MB1355 current consumption. There are two ways of doing this:

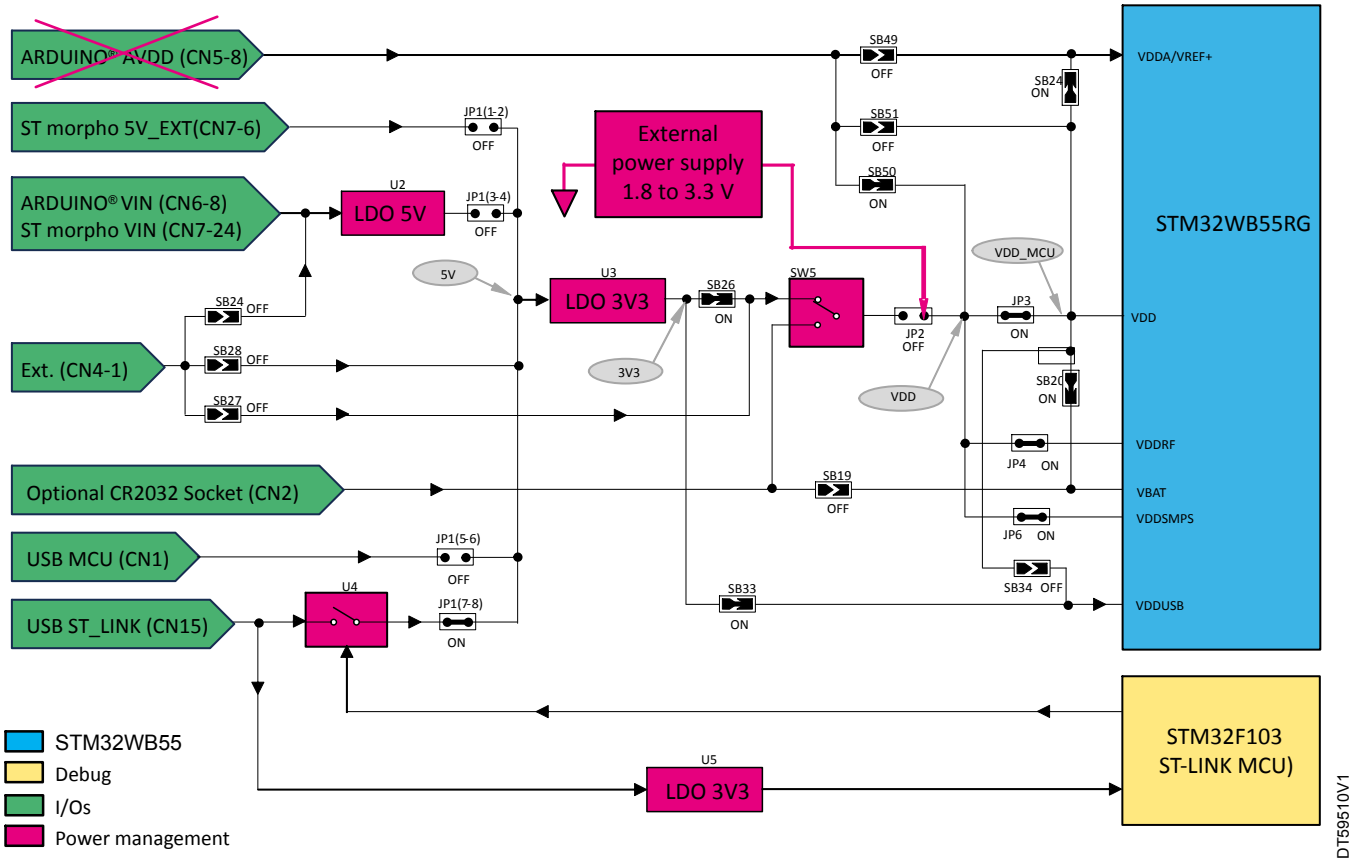
1. Measure the supply current of the SoC using an ammeter in place of the JP1 jumper. In this case, all supply sources can be used, except the AVDD coming from the ARDUINO® connector. Figure 10 shows the configuration.

Figure 10. Current measurement with an ammeter



2. Use an external power supply with current measurement capabilities. In this case, the JP2 jumper must be removed, and the supply connected to JP2 pin 2, as shown in Figure 11. The supply voltage must be between 1.8 and 3.3 V. AVDD input (CN1 pin 8) must not be used during this measurement.

Figure 11. Current measurement with an external power supply

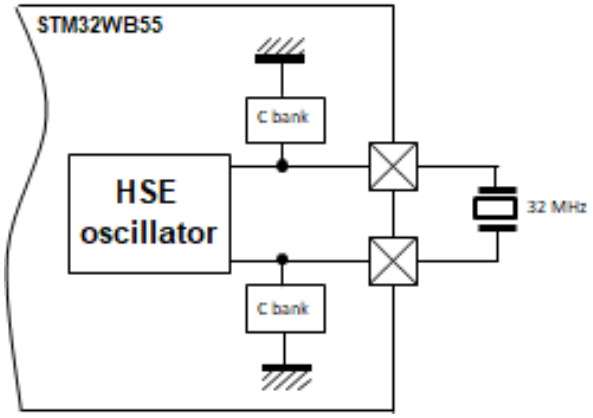


7.3 MB1355 clock sources

7.3.1 HSE clock reference

The accuracy of the high-speed clock (HSE) of the board is committed to a 32 MHz crystal oscillator. The HSE oscillator is trimmed during board manufacturing. No external capacitors are needed.

Figure 12. HSE oscillator

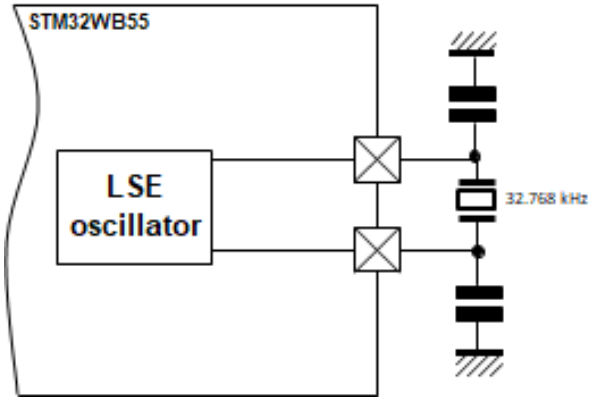


The HSE on board oscillator 32 MHz X1 crystal is provided for RF activities. Refer to the STM32WB55 datasheet and the application note *Guidelines for oscillator design on STM8AF/AL/S and STM32 MCUs/MPUs* (AN2867) for oscillator design. On MB1355C-02 SB44, SB43, C4, and C5 must be OFF.

7.3.2 LSE clock reference

The accuracy of the low-speed clock (LSE) of the MCU RF board is committed to a 32.768 kHz crystal oscillator. Two capacitors are needed. Their value depends on the crystal selected.

Figure 13. LSE oscillator



The LSE on-board oscillator X2 crystal 32.768 kHz, 7 pF, 20 ppm. Refer to the application note *Guidelines for oscillator design on STM8AF/AL/S and STM32 MCUs/MPUs* (AN2867) available at *www.st.com*. On MB1355C-02 and MB1355D-01, SB45 and SB46 must be OFF. Two external capacitors are needed. The value of these capacitors is 10 pF.

7.4 MB1355 reset sources

The reset signal of STM32WB55 is active LOW. The internal pull-up resistor forces the RST signal to a high level.

MB1355 has the following reset sources:

- Reset push-button (B4)
- Embedded ST-LINK/V2-1
- ARDUINO® connector (CN5 pin 3), reset from the ARDUINO® board
- ST morpho connector (CN3 pin 14)

7.5 MB1355 debugging

7.5.1 Embedded ST-LINK/V2-1

The Nucleo board (MB1355) has an integrated ST-LINK/V2-1 programming and debugging tool.

ST-LINK/V2-1 offers the following features:

- USB software re-enumeration
- Virtual COM port interface on USB
- Mass storage interface on USB
- USB power management requests higher than 100 mA on USB

For general information concerning debugging and programming features shared between the ST-LINK V2 and V2-1 versions, refer to the user manual *ST-LINK/V2 in-circuit debugger/programmer for STM8 and STM32* (UM1075) available from *www.st.com*.

The Nucleo board offers optional configurations for ST-LINK:

- The Nucleo board is divided into two parts: ST-LINK and target MCU parts. The PCB area dedicated to the first one can be cut to reduce board size. In this case, the second part can only be powered by VIN, E5V, and 3.3 V on ST morpho connectors, or VIN and 3.3 V on ARDUINO® connectors.
- It is still possible to use the ST-LINK part to program the main MCU using wires between the SWD connector and SWD signals available on ST morpho connectors.

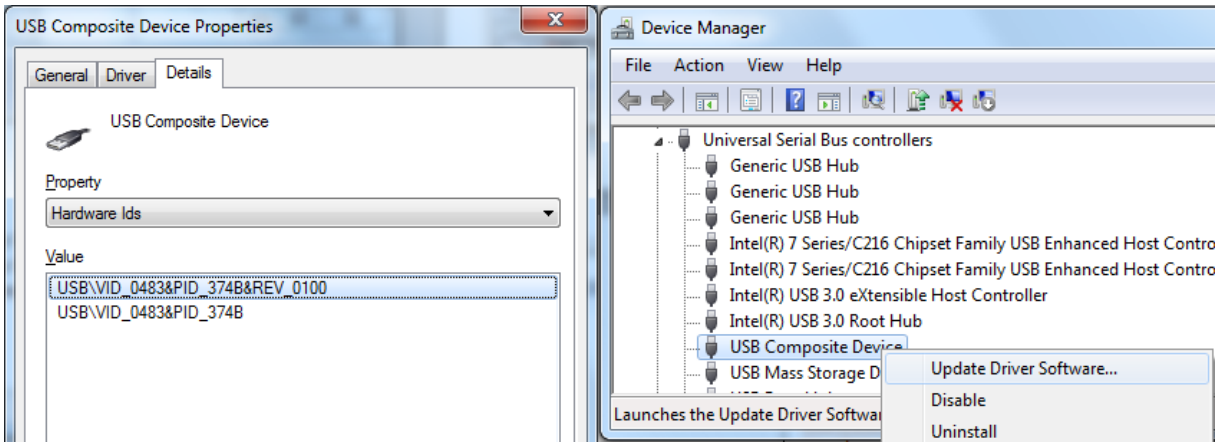
7.5.2 Drivers

When connecting the Nucleo board to a Windows 10® PC via USB, a driver for the ST-LINK is automatically installed.

If the Nucleo board is connected to the PC before the driver is fully installed, some interfaces might be declared as *Unknown* in the PC device manager. In this case, the user must wait for the end of the driver installation.

Note: Use the "USB Composite Device" handle for a full recovery.

Figure 14. USB composite device

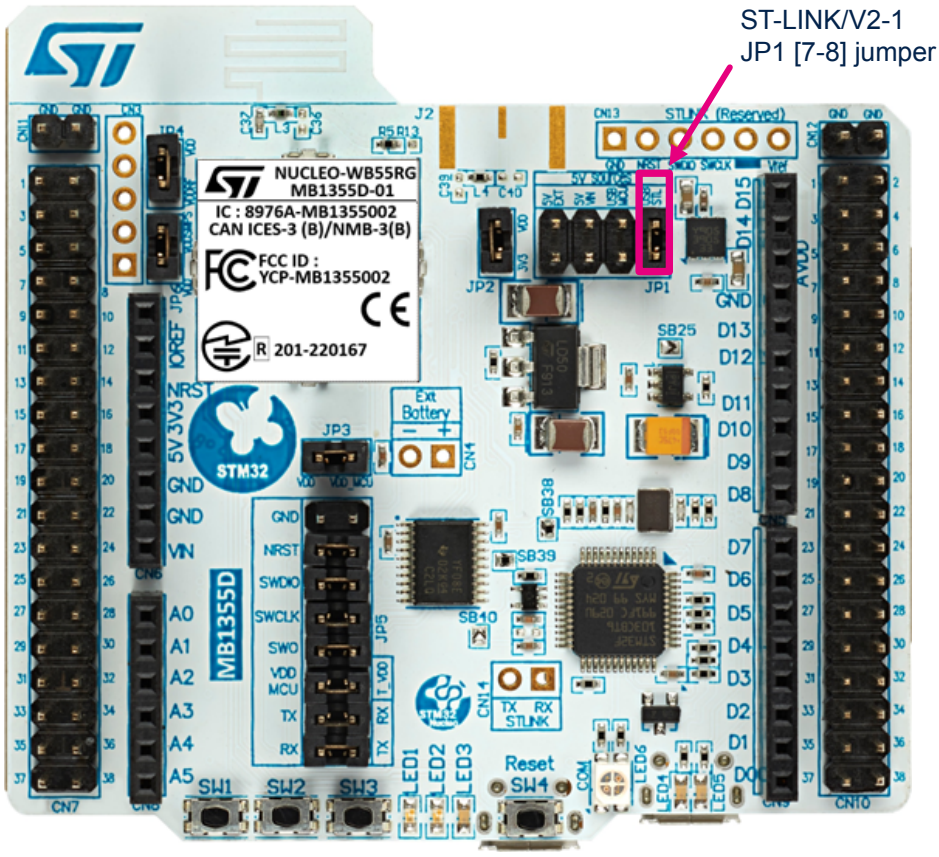


7.5.3 ST-LINK/V2-1 firmware upgrade

The ST-LINK/V2-1 embeds a firmware upgrade mechanism for in-place upgrades through the USB port. The firmware might evolve during the lifetime of ST-LINK/V2-1 (for example, new functionalities, bug fixes, and support for new microcontroller families). It is therefore recommended to check for updates on *www.st.com* before using the Nucleo-64 board.

To program the on-board STM32WB55 microcontroller, plug in the jumper JP1[7-8] connector, as shown in Figure 15.

Figure 15. ST-LINK debugger: JP1 configuration for on-board MCU



DT59514V1

7.5.4 ST-LINK/V2-1 Virtual COM port connected to USART1

On MB1355, the USART1 interface of the STM32 microcontroller on the Nucleo board can be connected to the ST-LINK/V2-1 MCU. The USART1 selection can be changed by setting the relevant solder bridges and jumpers.

Table 5. USART1 connections

Jumper and solder Bridge configuration	Feature
JP5[13-14] ON SB39 ON	USART1_TX (PB6) connected to ST-LINK VCP_RX
JP5[15-16] ON SB38 ON	USART1_RX (PB7) connected to ST-LINK VCP_TX

7.5.5 Level shifter

MB1355 has a system for supplying STM32WB55RG with a different voltage than ST-LINK. ST-LINK is always supplied by 3V3 sources. By default, STM32WB55RG is supplied by the same voltage value as ST-LINK, but it is possible to supply the SoC with another value. It accepts voltages between 1.8 and 3.3 V by using a specific component, the level shifter. This level shifter assures the voltage conversion between ST-LINK and the SoC. It drives SWD and UART signals connected to the VCP on ST-LINK.

The JP5 multifunction jumper can connect ST-LINK/V2-1 to STM32WB55RG. It is located between the level shifter and the SoC and referenced to the VDD domain (STM32WB55RG supply voltage domain).

Figure 16. Interconnection bloc diagram between STM32WB55RG and ST-LINK/V2-1

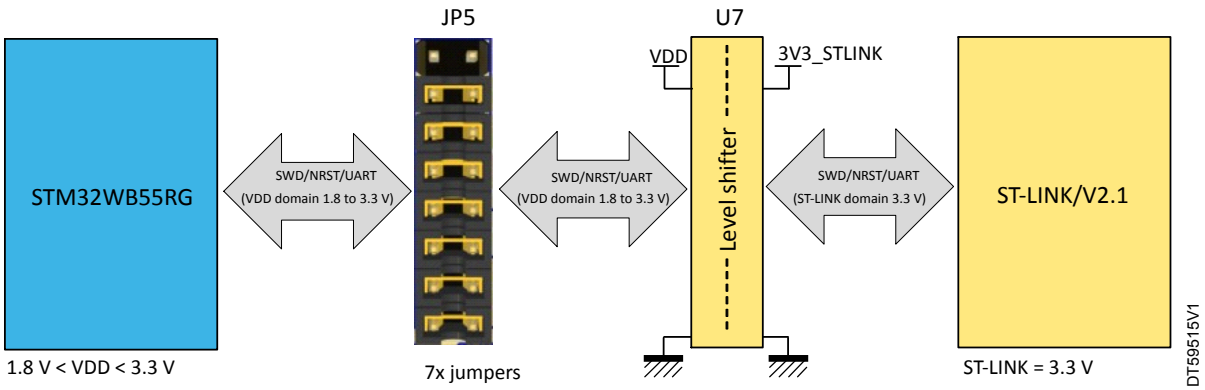


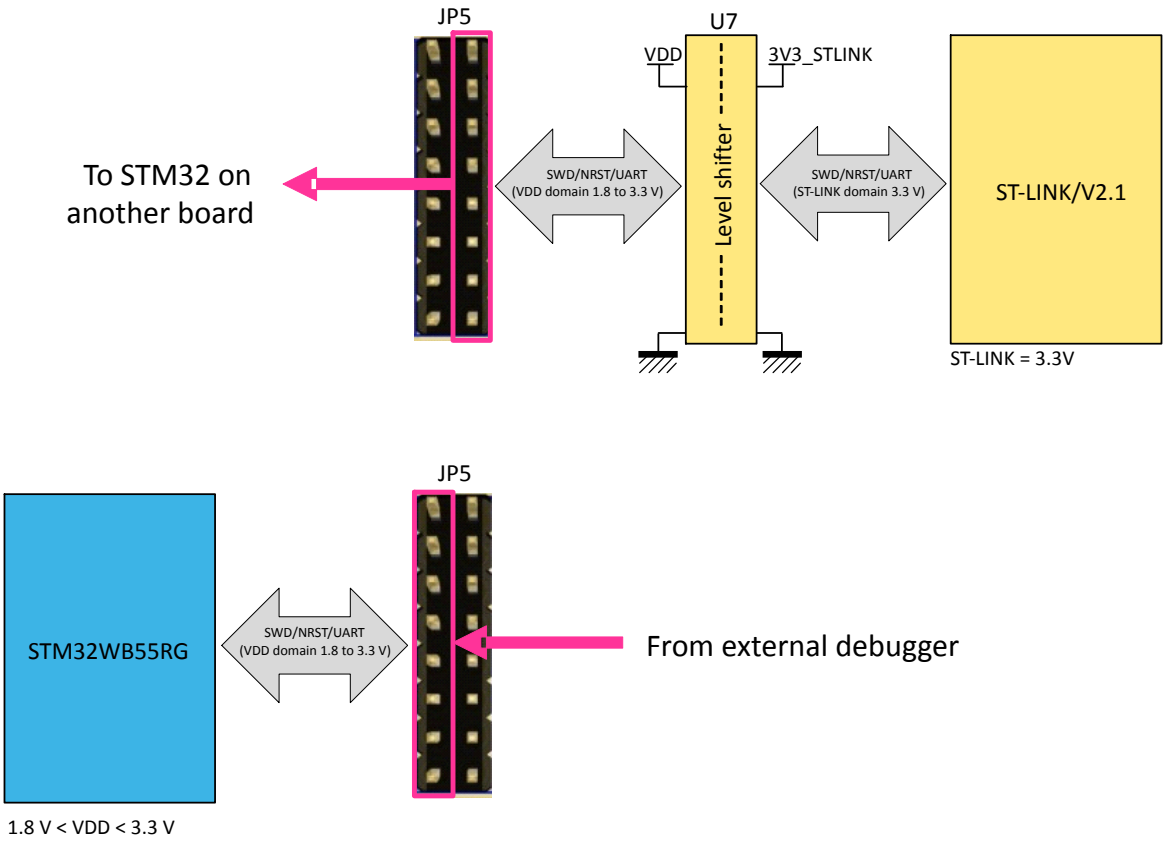
Table 6. JP5 pinout

STM32WB55RG side (VDD)	JP5 pinout		ST-LINK and level shifter side (T_VDD)
GND	1	2	GND
NRST	3	4	T_NRST
SWDIO (PA13)	5	6	T_SWDIO
SWCLK (PA14)	7	8	T_SWCLK
SWO (PB3)	9	10	T_SWO
VDD	11	12	T_VDD
USART1_TX (PA9)	13	14	ST-LINK_RX
USART1_RX (PA10)	15	16	ST-LINK_TX

By default, the jumpers are populated and ST-LINK is connected to STM32WB55RG through level shifters. However, if the jumpers are removed, two other features are available on JP5:

- Use of ST-LINK with another STM32 (connection on ST-LINK side)
- Use of an external debugger (connection on STM32WB55RG side).

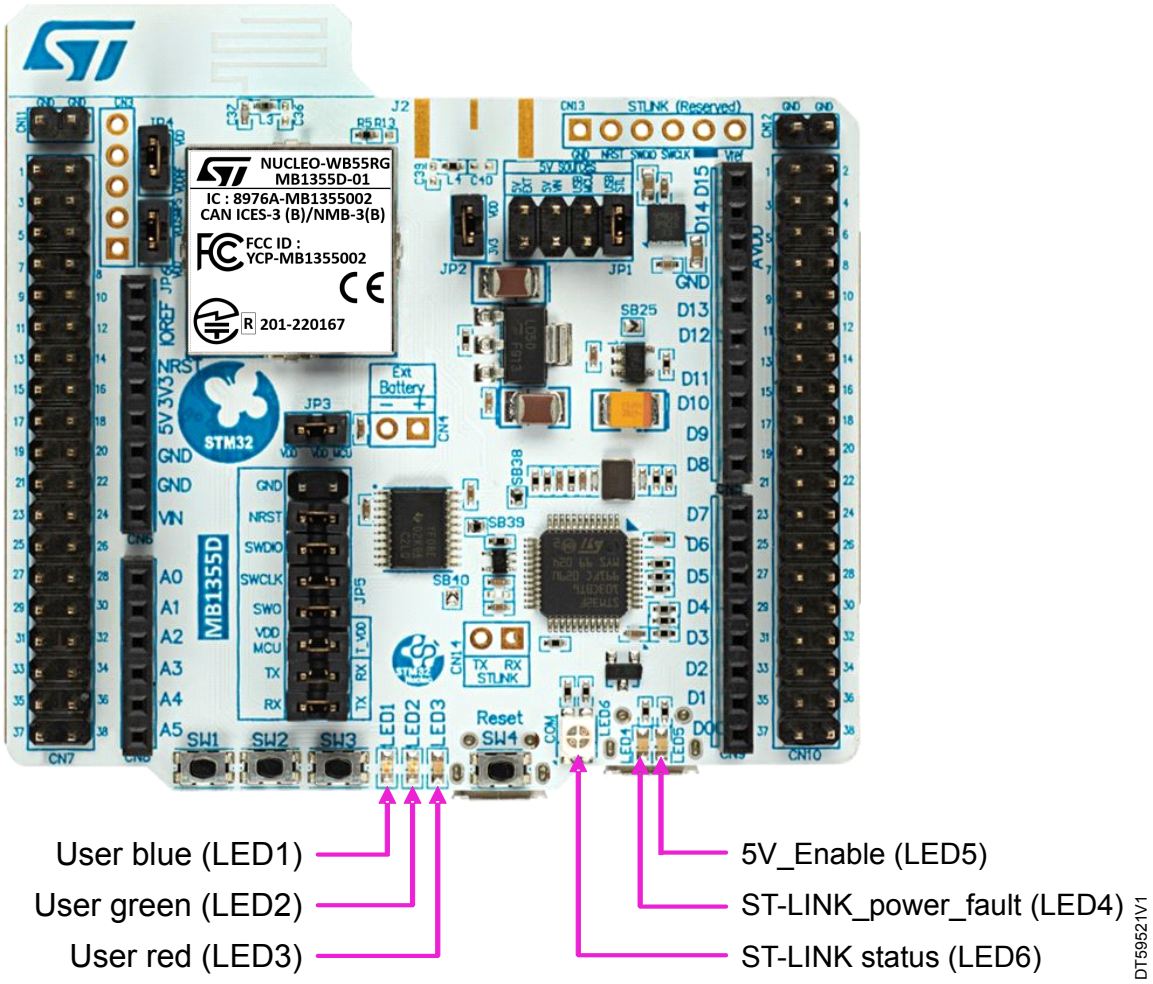
Figure 17. **Use case example when JP5 jumpers are removed**



7.6 MB1355 LEDs

The MB1355 board has several LEDs on the top side to help the user during application development.

Figure 18. **LED locations for MB1355**



MB1355 has two types of LEDs for user and board status:

- LED1: this blue LED is available for the user application.
- LED2: this green LED is available for the user application.
- LED3: this red LED is available for the user application.
- LED4 (5V_USB): this red LED switches ON when overcurrent is detected (more than 500 mA is requested) on USB V_{BUS}. In this case, it is recommended to supply the board by E5V or VIN, or in USB_CHARGER mode.
- LED5 (5V_PWR): this red LED indicates that an MCU part is powered, and 5-V power is available.
- LED6 COM: LED6 is a bi-color LED, whose default status is red and turns to green to indicate that communication is in progress between the PC and the ST-LINK/V2-1. It has the following modes:
  - Slow blinking red/OFF at power-on, before USB initialization
  - Fast blinking red/OFF after the first correct communication between PC and ST-LINK/V2-1 (enumeration)
  - Red ON when initialization between PC and ST-LINK/V2-1 is successfully finished
  - Green ON after successful target communication initialization
  - Blinking red/green during communication with the target
  - Green ON communication finished and OK
  - Orange ON communication failure

Table 7. Details of user LEDs on MB1355

LED	Description	STM32WB55RG GPIO
LED1	Blue LED	PB5
LED2	Green LED	PB0
LED3	Red LED	PB1

7.7 MB1355 push-buttons

The Nucleo board provides two types of push-buttons (user and reset):

- User1 push-button (SW1)
- User2 push-button (SW2)
- User3 push-button (SW3)
- Reset push-button (SW4), used to reset the Nucleo board

There are three push-buttons available for the user application. They are connected to PC4 or PC13 and PD0 and PD1. It is possible to use them with GPIO reading or to wake up the device (only B1).

Note that PC4, PC13, PD0, and PD1 are also connected to ARDUINO® or ST morpho connectors as GPIOs.

Figure 19. Push-button locations for MB1355

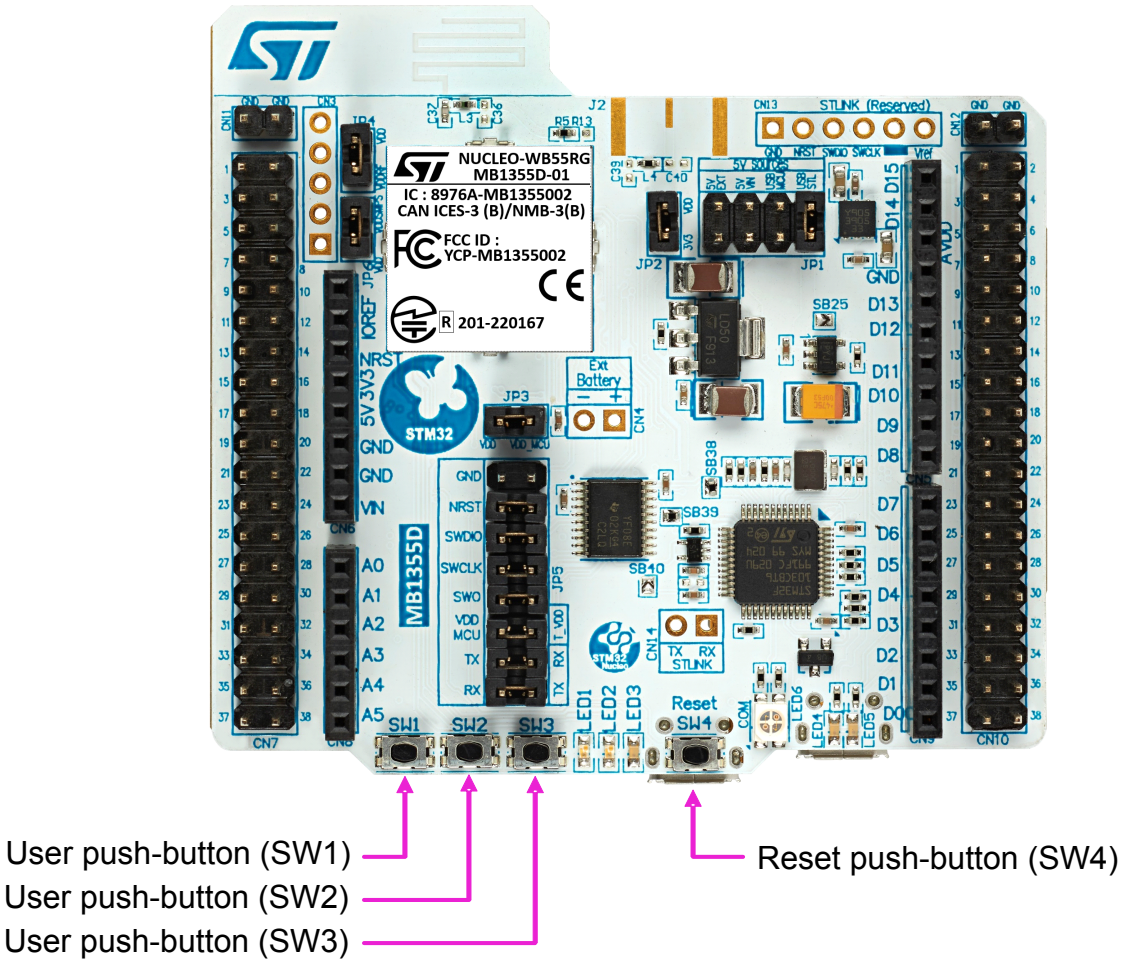


Table 8. MB1355 I/O configuration for the physical user interface

Name	I/O	Wake-Up available
SW1	PC4 if SB47 ON and SB48 OFF (default)	None
	PC13 if SB47 OFF and SB48 ON	WKUP2
SW2	PD0	None
SW3	PD1	None

7.8 STM32WB55 SMPS configuration and external components

The STM32WB55 microcontroller on the MB1355 board embeds a DC-DC converter: SMPS (switched-mode power supply). The goal of this SMPS is to optimize the power consumption of the device depending on the supply voltage. STM32WB55 can be used in both modes: SMPS-enabled (SMPS mode) or disabled (LDO mode). The usefulness of the SMPS mode depends on the use case.

Figure 20. Schematic with SMPS mode

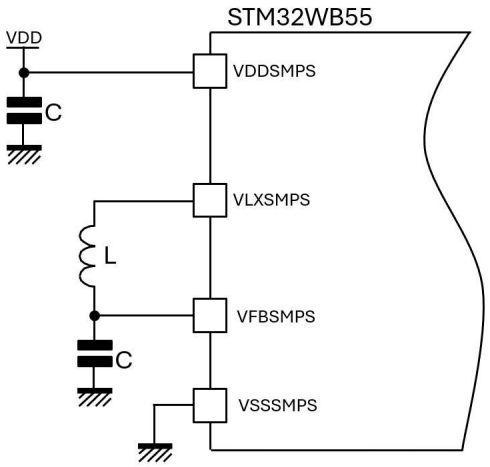
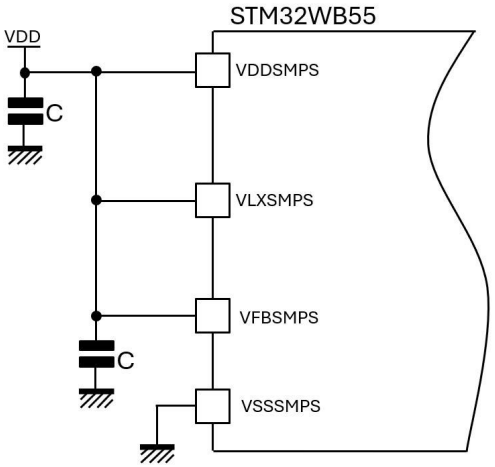


Figure 21. Schematic with LDO mode



Warning: *When the SMPS is not used, it is important to set correctly the configuration registers. Refer to the SMPS sections in the datasheet and reference manual of the product.*

For evaluation reasons, two configurations are possible. For SMPS mode, the solder bridge is OFF (configuration by default). For LDO mode, the solder bridge is ON to bypass the SMPS. One or more coils can remain on the circuit without impact due to low DC impedance.

Figure 22. MB1355C-02 schematic

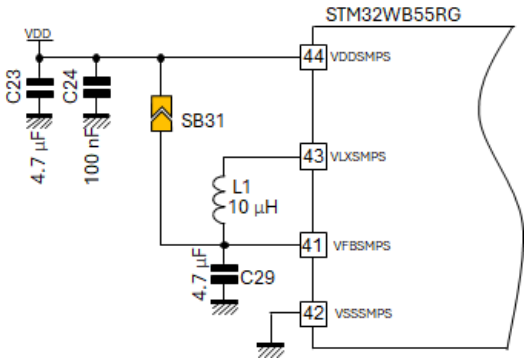
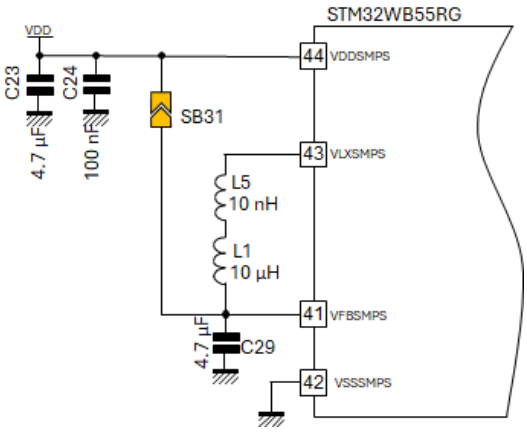


Figure 23. MB1355D-01 schematic



On MB1355D-01, an extra RF coil (L5=10 nH) is added to improve the stability and the performance of the SMPS.

To ensure optimal performance of the SMPS, the external components are very important. Table 9 shows the recommended parts to use.

Table 9. External components for SMPS optimal performance

Designator on MB1355	Designator on MB1293	Component value	Component part number
C23	C9	4.7 µF	GRM155R60J475ME87 (Murata)
C24	-	100 nF	CC0402KRX7R7BB104 (Yageo)
L1	L2	10 µH	74479777310A (Wurth)
L5	-	10 nH	LQP15MN10NG02 (Murata)
C29	C10	4.7 µF	GRM155R60J475ME87 (Murata)

7.9 MB1355 RF I/O stage

The RF stage is an important bloc of the board. It is important to give special attention to this part. The role of this part is the filtering of the spurious and the matching of the impedances.

The output of STM32WB55 is not 50 Ω, so it requires external components. The matching of the output is different from the package, so different boards require different external components.

7.9.1 MB1355C-02

As explained above, the C1, L5, and C2 components match the STM32 output to 50 Ω. FLT1 is a ceramic filter (Murata), which helps reduce the harmonic signal. After this filter, there are two ways to route the RF signal. The first one (assembled by default) connects the PCB antenna with its matching network. The second allows an output on an SMA connector for RF measurements. This last configuration must change the position of the 10-nF capacitor (move from C35 to C38 footprint) and SMA solder connector. Figure 25 and Figure 26 show the modification to do.

An example of the SMA reference is 142-0701-851 from Cinch Connectivity Solutions.

Figure 24. Schematic of the RF path (MB1355C-02)

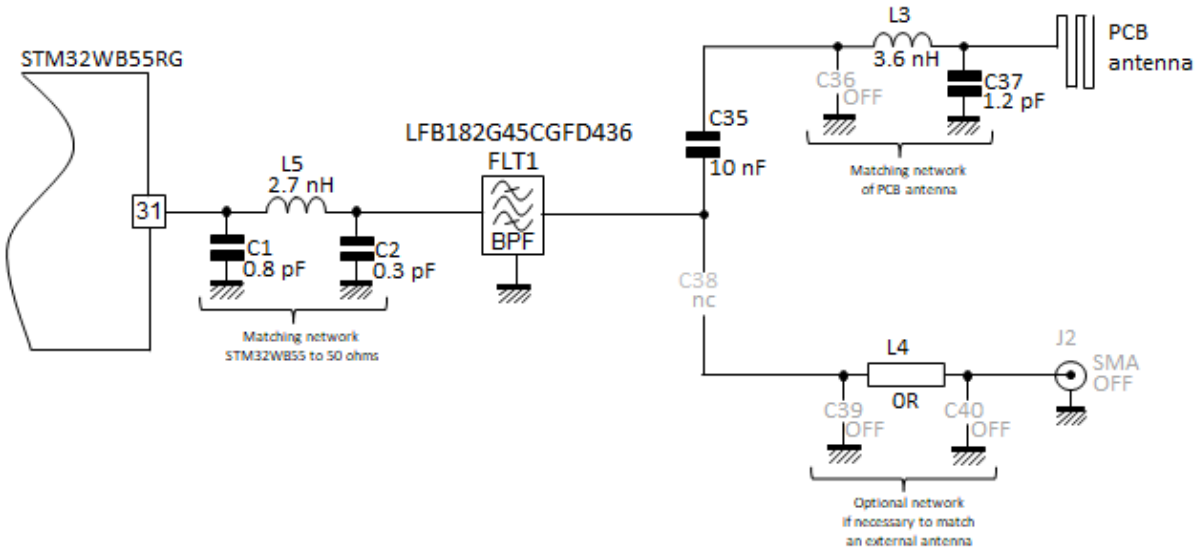


Figure 25. Modification for SMA path (MB1355C-02)

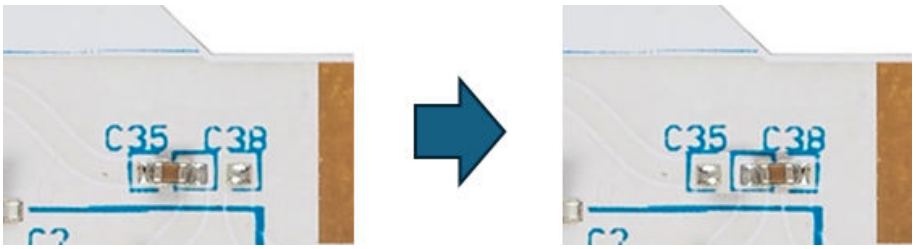
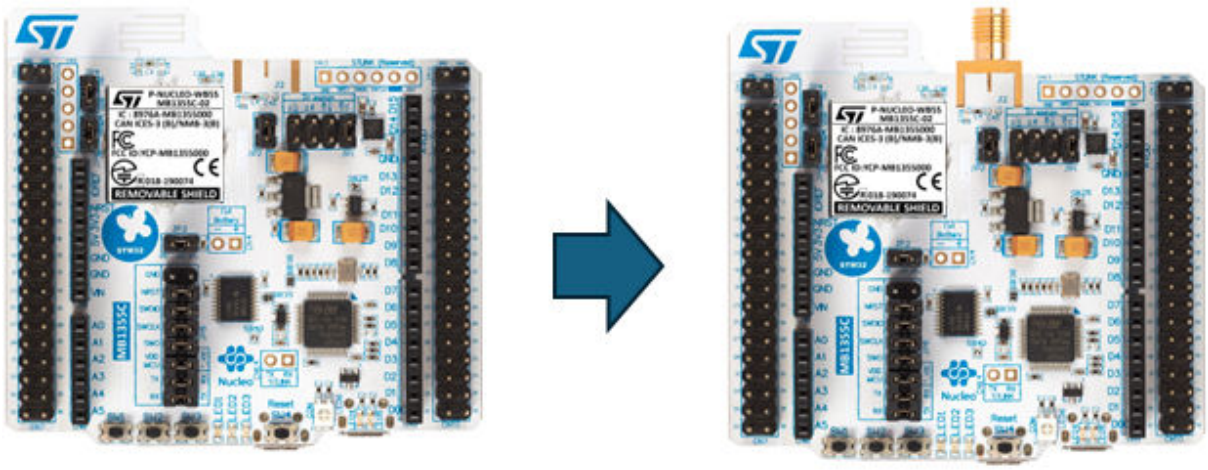


Figure 26. **SMA connector addition to MB1355C-02**



7.9.2 MB1355D-01

For the MB1355D-01 release, the output selection between the PCB antenna and the SMA connector is similar to MB1355C-02. The selection is made by a 0-Ω resistor (R1 footprint) for the PCB antenna (default) and R5 for the SMA connector.

Like for MB1355C-02, the SMA connector footprint is compatible with 142-0701-851 from Cinch Connectivity Solutions, for instance.

On this version, the STMicroelectronics-specific IPD filter (U13) replaces the matching network of the STM32WB55 and the filter of MB1355C-02. It is a low-pass filter with an impedance that is directly compatible with STM32WB55.

Figure 27. **Schematic of the RF path (MB1355D-01)**

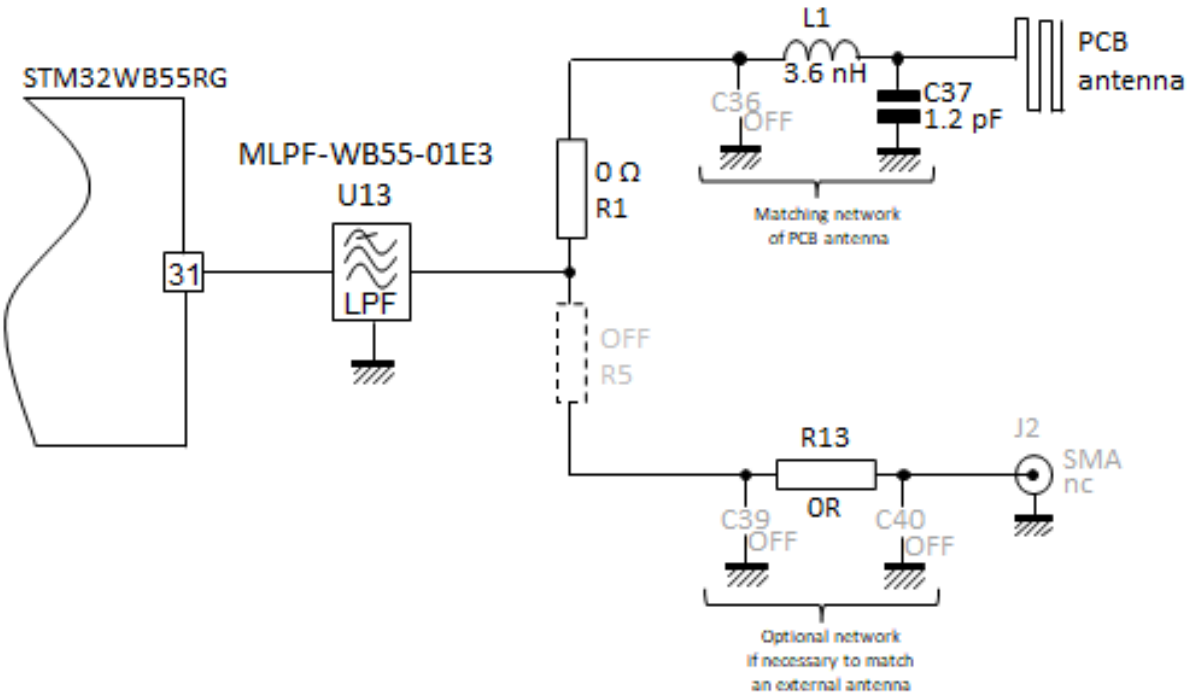


Figure 28. **Modification for SMA path (MB1355D-01)**

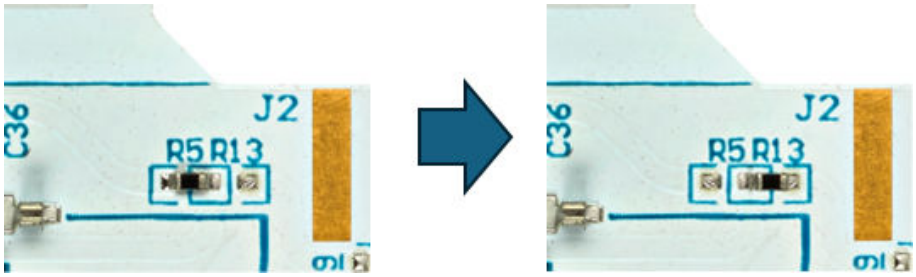
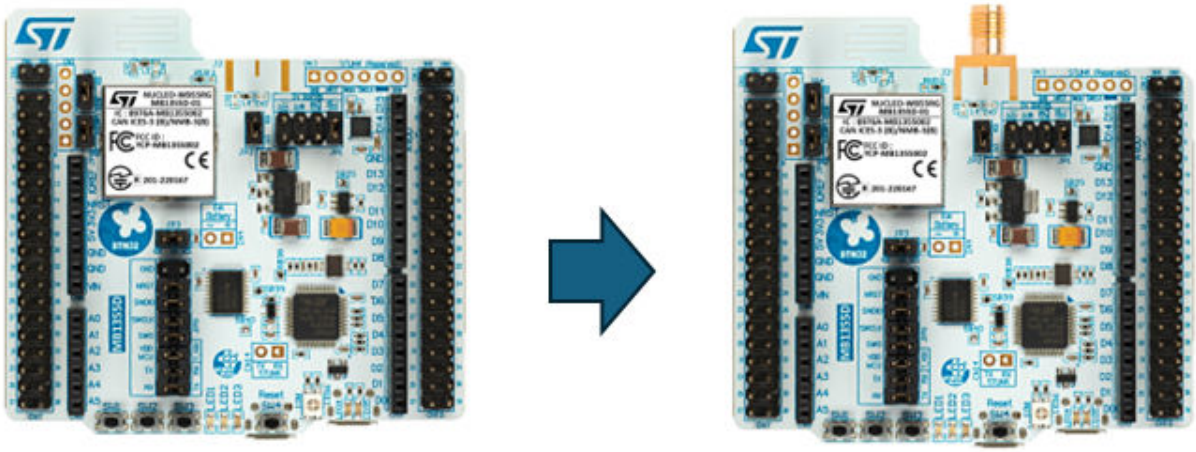
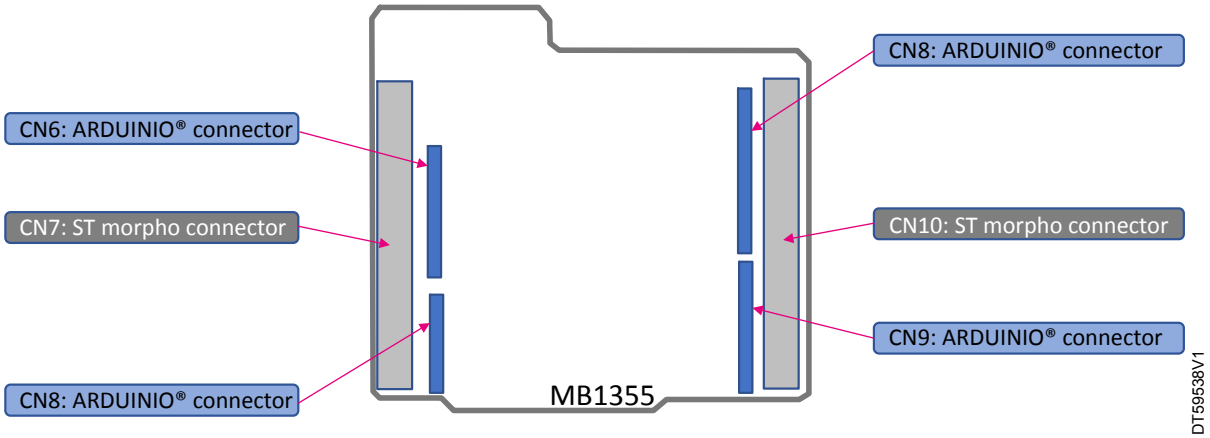


Figure 29. **SMA connector addition to MB1355D-01**



7.10 MB1355 extension connector interface and pinout

Figure 30. **MB1355 connector location and naming**

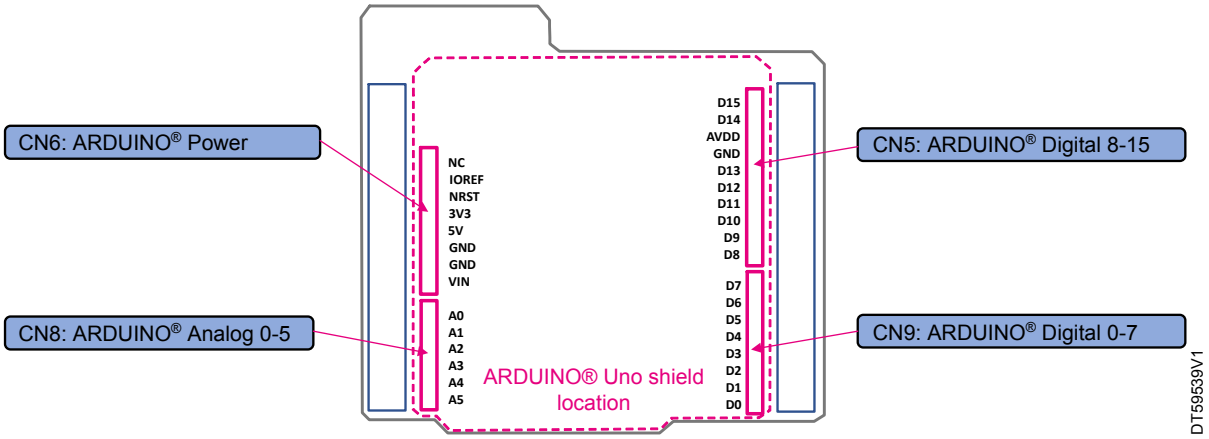


7.10.1 ARDUINO® interface and pinout

Description

On the bottom side of the board, there is an ARDUINO® Uno R3 extension socket. It is built around four standard connectors (CN5, CN6, CN7, and CN8). Most shields designed for ARDUINO® can fit with the Discovery kits to offer flexibility in small form factor applications.

Figure 31. ARDUINO® Uno connectors and ARDUINO® shield location



Operating voltage

The ARDUINO® Uno R3 connectors support 5 V, 3.3 V, and VDD for I/O compatibility.

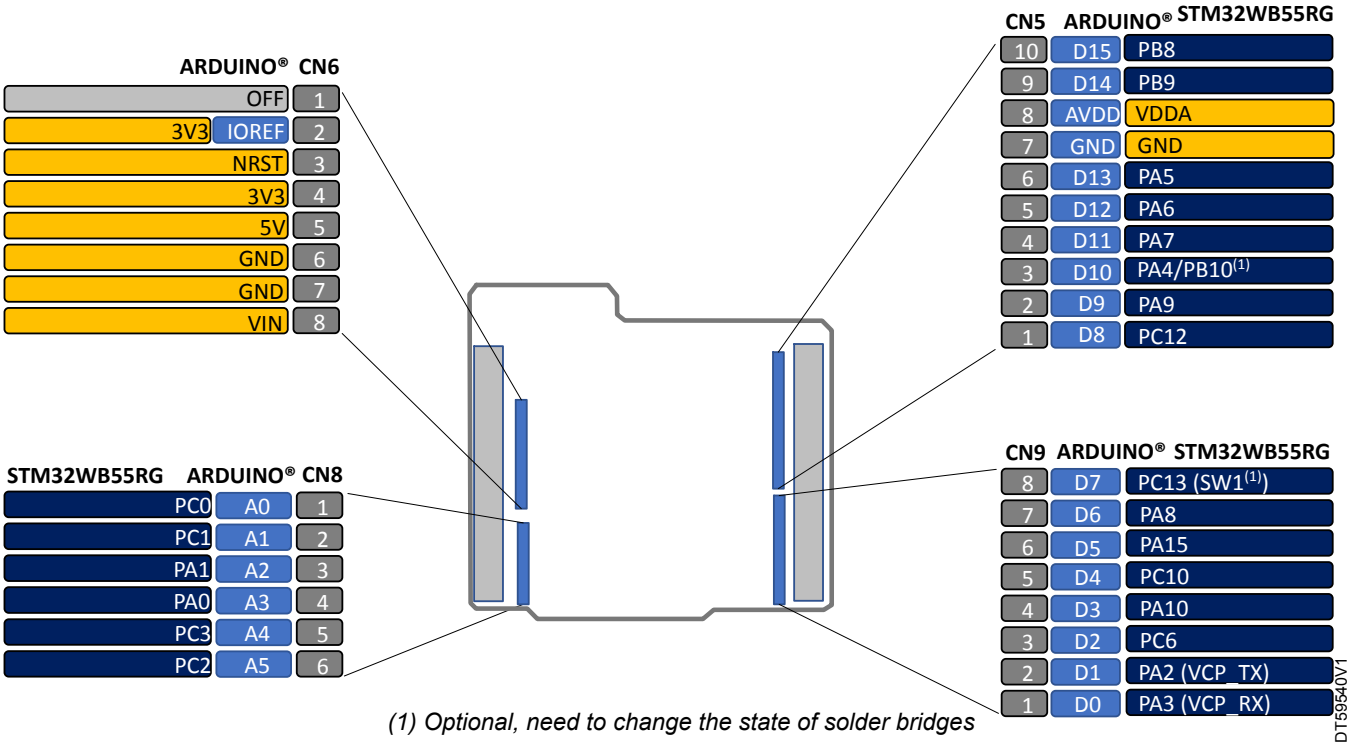
Caution: *Do not supply 3.3 or 5 V from the ARDUINO® shield as this might damage the Nucleo board.*

Furthermore, if it is necessary to supply the Nucleo board through the ARDUINO® connector, a dedicated pin is available. VIN supplies power directly to the board. To use this feature, refer to Section 7.2.2: VIN: 7 to 12 V power supply.

ARDUINO® pinout

Figure 30 and Figure 31 show the position of the ARDUINO® shield when it is plugged into NUCLEO-WB55CG. The pinout shown in Figure 32 corresponds to standard ARDUINO® naming. To see the correspondence with the STM32 device, refer to Table 10.

Figure 32. ARDUINO® connector pinout



(1) Optional, need to change the state of solder bridges

Table 10. ARDUINO® connector pinout

Connector	Pin number	Signal name	STM32 port	Comment
CN6	1	NC	-	NC (reserved for tests)
	2	3V3 (IOREF)	-	IOREF
	3	NRST	NRST	NRST
	4	3V3	-	3V3
	5	5V	-	5V
	6	GND	-	GND
	7	GND	-	GND
	8	VIN	-	External supply input (+12 V maximum)
CN8	1	A0	PC0	ADC1_IN1
	2	A1	PC1	ADC1_IN2
	3	A2	PA1	ADC1_IN6
	4	A3	PA0	ADC1_IN5
	5	A4	PC3	ADC1_IN4
	6	A5	PC2	ADC1_IN3
CN9	1	D0	PA3	TIM2_CH4
	2	D1	PA2	TIM2_CH3
	3	D2	PC6	-
	4	D3	PA10	TIM1_CH3
	5	D4	PC10	-
	6	D5	PA15	TIM2_CH1
	7	D6	PA8	TIM1_CH1
	8	D7	PC13 (SW1[1])	-
CN5	1	D8	PC12	-
	2	D9	PA9	TIM1_CH2
	3	D10	PA4/PB10[1]	SPI1_NSS
	4	D11	PA7	SPI1_MOSI
	5	D12	PA6	SPI1_MISO
	6	D13	PA5	SPI1_SCK
	7	GND	-	GND
	8	AVDD	-	VDDA
	9	D14	PB9	I2C1_SDA
	10	D15	PB8	I2C1_SCL

1. *Optional: This requires to change the state of solder bridges.*

7.10.2 ST morpho interface and pinout

Description

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

ST morpho pinout

Figure 33. MB1355 ST morpho connector pinout

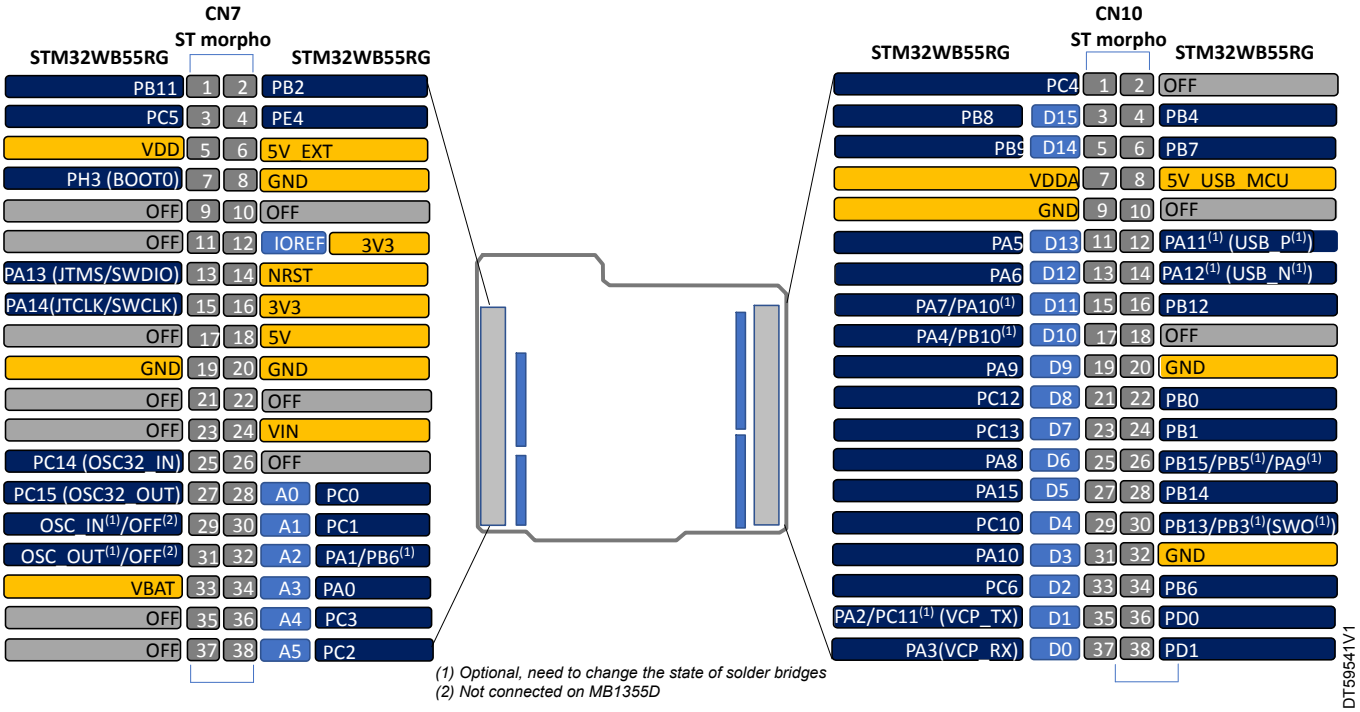


Table 11. ST morpho connector pinout

CN7				CN10			
Pin number	STM32WB55RG pin name	Pin number	STM32WB55RG pin name	Pin number	STM32WB55RG pin name	Pin number	STM32WB55RG pin name
1	PB11	2	PB2	1	PC4	2	OFF
3	PC5	4	PE4	3	PB8	4	PB4
5	VDD	6	5V_EXT	5	PB9	6	PB7
7	PH3/BOOT0	8	GND	7	VDDA	8	5V_USB_MCU
9	OFF	10	OFF (reserved for tests)	9	GND	10	OFF
11	OFF	12	3V3 (IOREF)	11	PA5	12	PA11(1) (USB_P(1))
13	PA13	14	NRST	13	PA6	14	PA12(1) (USB_N(1))
15	PA14	16	3V3	15	PA7/PA10(1)	16	PB12
17	OFF	18	5V	17	PA12PA4/PB10(1)	18	OFF
19	GND	20	GND	19	PA9	20	GND
21	OFF	22	OFF	21	PC12	22	PB0
23	OFF	24	VIN	23	PC13	24	PB1
25	PC14 (OSC32_IN)	26	OFF	25	PA8	26	PB15/PB5(1)/PA9(1)
27	PC15 (OSC32_OUT)	28	PC0	27	PA15	28	PB14
29	OSC_IN(1)/OFF(2)	30	PC1	29	PC10	30	PB13/PB3(1) (SWO(1))
31	OSC_OUT(1)/ OFF(2)	32	PA1/PB6(1)	31	PA10	32	GND
33	VBAT	34	PA0	33	PC6	34	PB6
35	OFF	36	PC3	35	PA2/PC11(1) (VCP_TX)	36	PD0
37	OFF	38	PC2	37	PA3 (VCP-RX)	38	PD1

1. *Optional: This requires to change the state of solder bridges.*
2. *Not connected on MB1355D-01.*

8 MB1293 hardware layout and configuration

This section presents the architecture and available functions of the MB1293 USB dongle.

8.1 MB1293 description

MB1293 is designed around the STM32WB55CG microcontroller. The hardware block diagram in Figure 34 illustrates the connection between STM32WB55CG and peripherals (LEDs, push-button, and extension connectors). Figure 35 helps users locate these features on the MB1293 board. The mechanical dimensions are shown in Figure 36.

Figure 34. MB1293 hardware block diagram

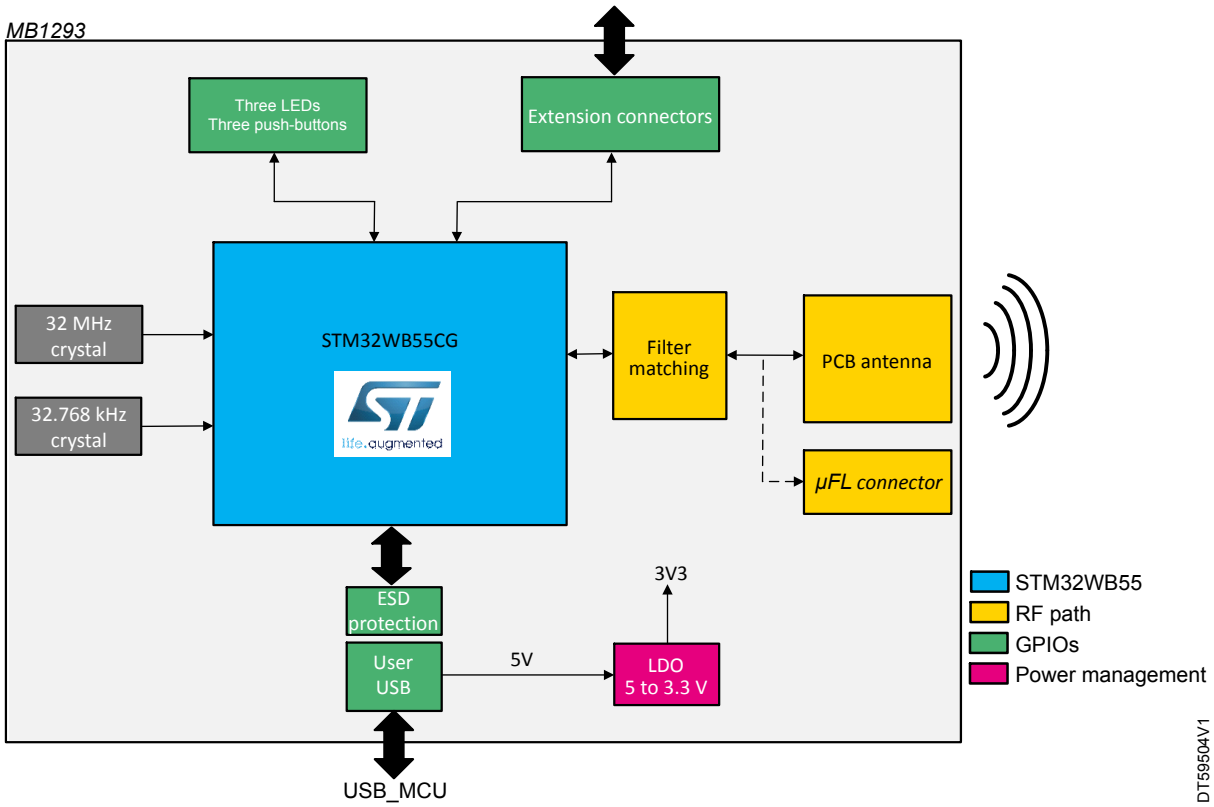


Figure 35. **MB1293 PCB top view**

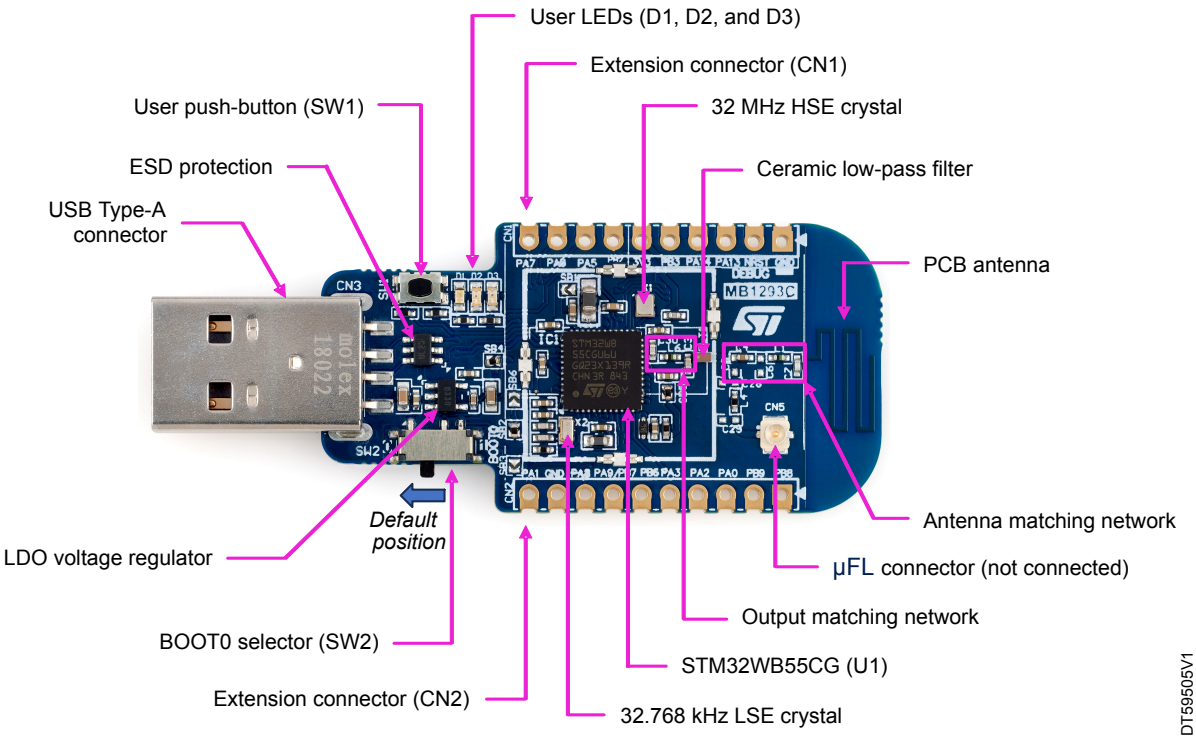
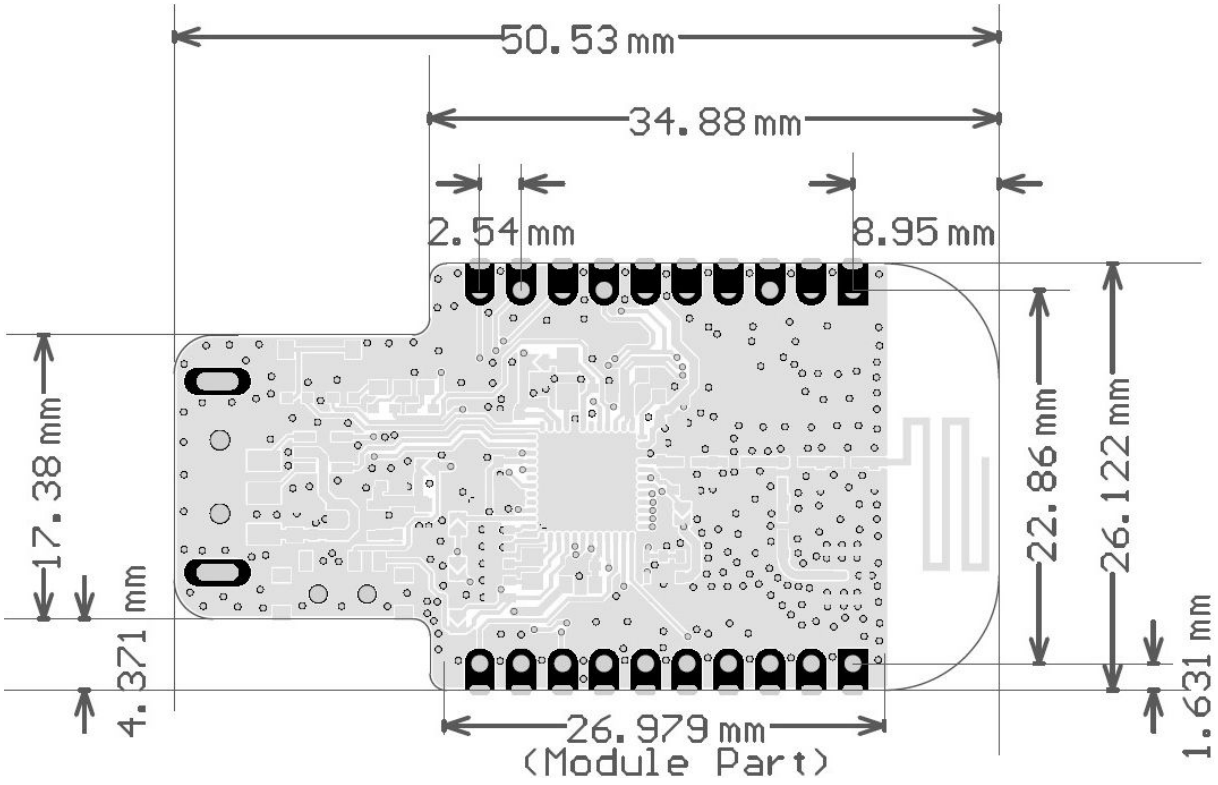


Figure 36. **MB1293 mechanical dimensions (in millimeters)**

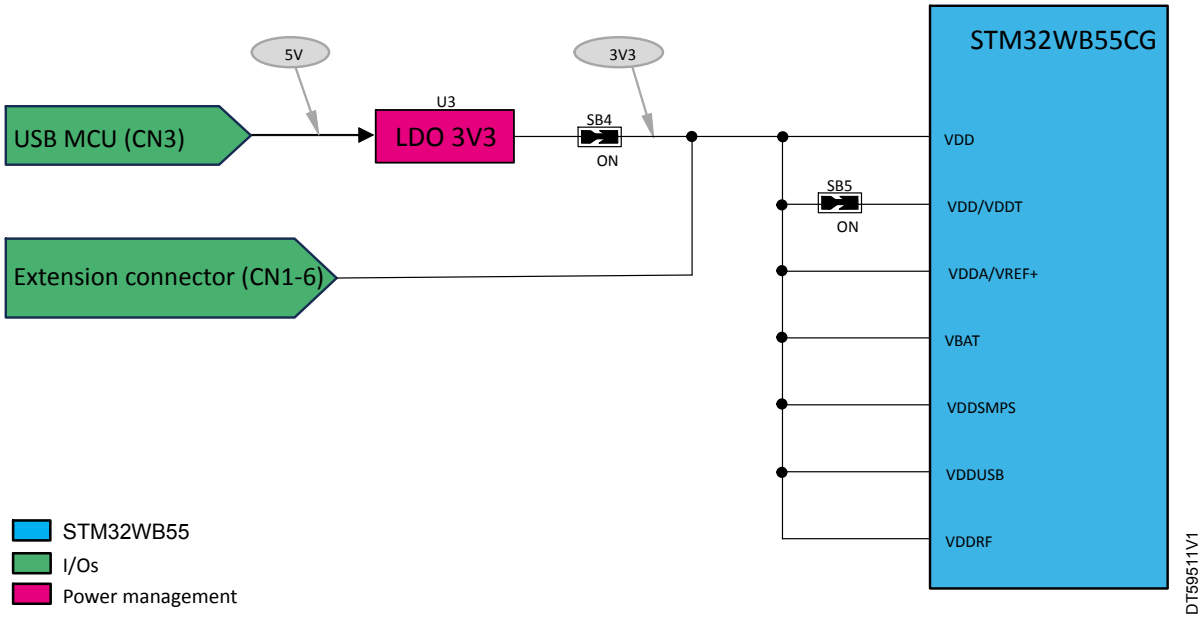


8.2 MB1293 power supply

By default, the embedded STM32WB55RG microcontroller is supplied by 3V3, but the board offers another possibility to supply the device through the extension connector.

The 3.3 V can first come from the USB and the LDO (5 to 3.3 V). Moreover, STM32WB55RG can be supplied by an external source, between 1.8 and 3.3 V. If the USB connector cannot supply the MCU, it is necessary to turn SB4 OFF and connect a power supply to the extension connector (pin 6 of the CN1 connector). Figure 37 shows the power tree and default state of the solder bridges.

Figure 37. MB1293 power tree



8.3 MB1293 clock sources

The MB1293 USB dongle has the same HSE and LSE crystals and schematics as MB1355. Refer to Section 7.3: MB1355 clock sources for further details.

8.4 MB1355 reset sources

MB1293 has the following reset sources:

- Extension connector (CN1-2)
- Power on reset

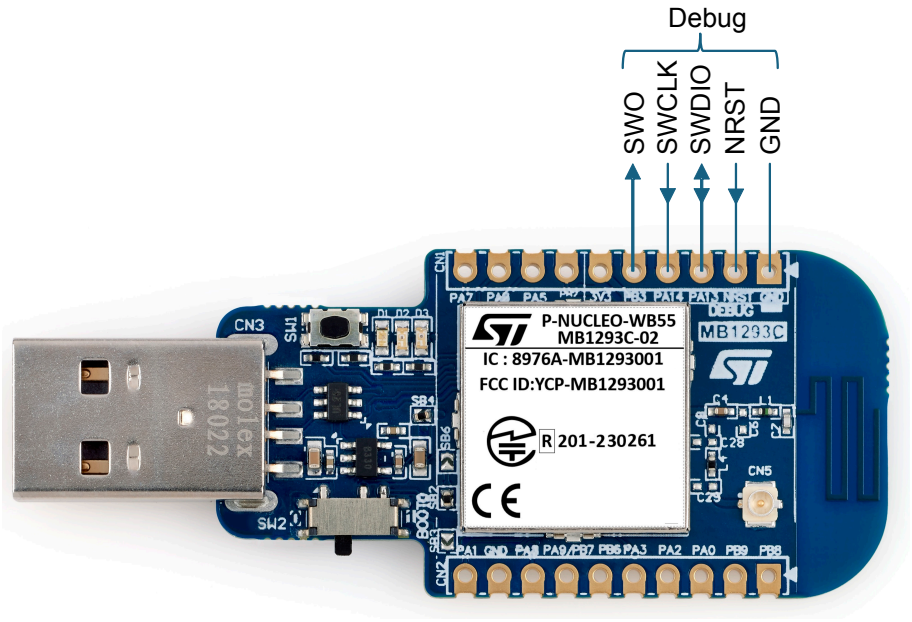
8.5 MB1293 debugging

By default, the out-of-the-box configuration of the USB dongle is to run the demonstration firmware (peer-to-peer server). However, it is possible to change this configuration to run other applications.

8.5.1 Debugging on the USB dongle

If it is necessary to debug new firmware, an ST-LINK/V2 or STLINK-V3 debugging probe can be used. It must be connected to dedicated pins on the extension connector, where all the SWD pins are available.

Figure 38. Debug access on MB1293 (SWD)



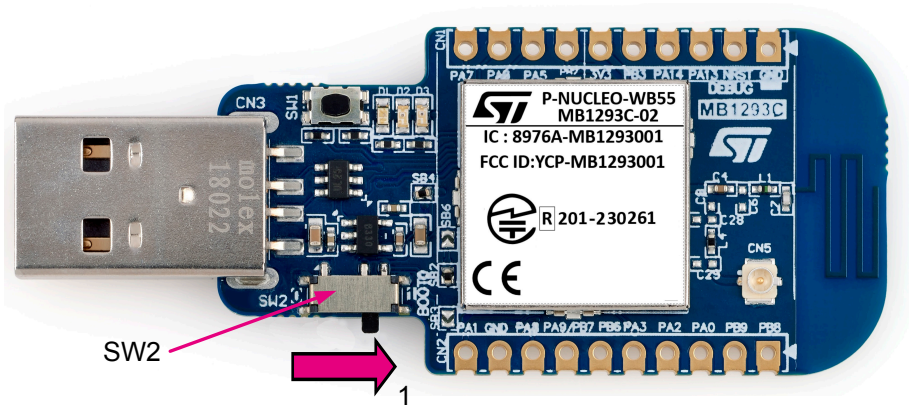
During the debug phase, the USB connector is in charge of the supply of the board. The level voltage of the SWD is fixed to 3.3 V.

8.5.2 Programming STM32WB55CG embedded on the USB dongle

To upload new firmware only, the easiest solution is to use the USB connector, which uses the USB bootloader.

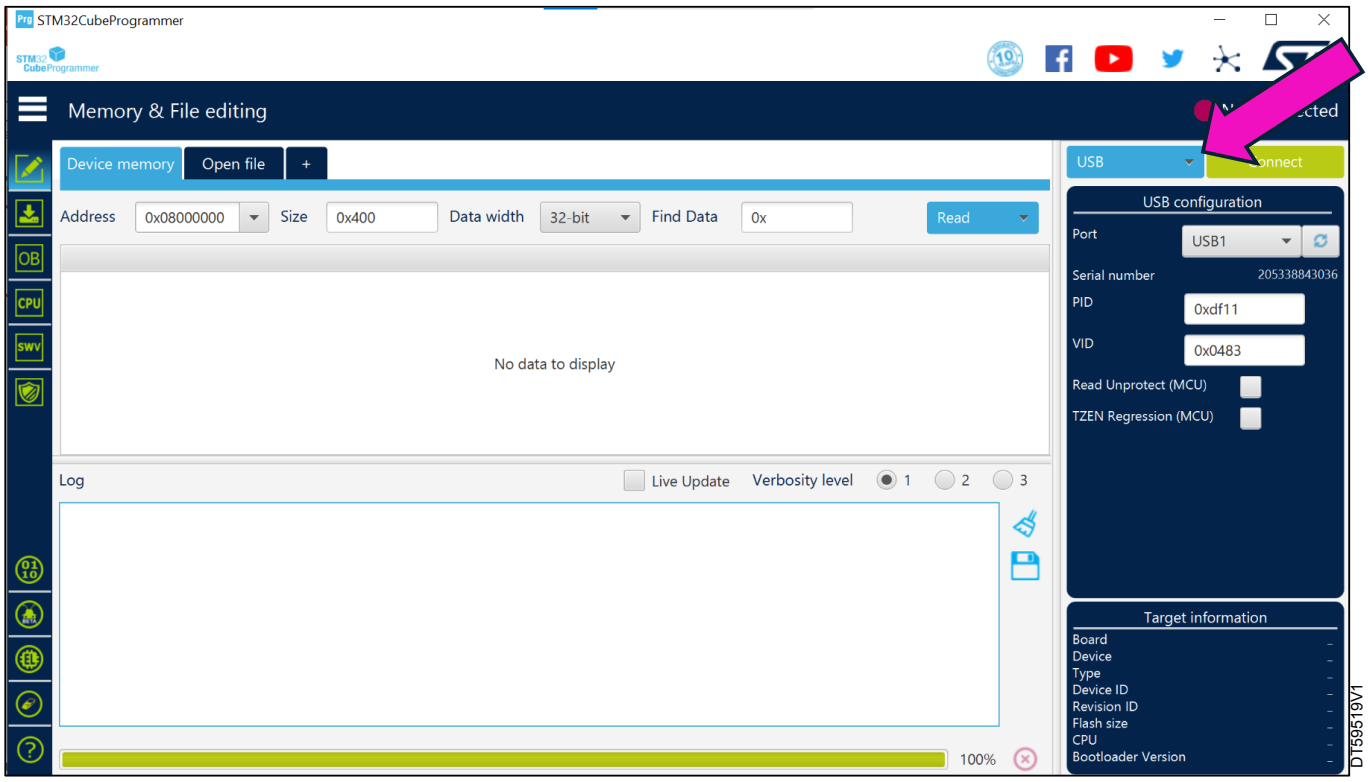
1. Before plugging the USB dongle into the PC, change the state of BOOT0 (BOOT0 = 1). To do this, change the position of the SW2 switch. By default, BOOT0 = 0.

Figure 39. BOOT0=1 to use bootloader on MB1293 (SWD)



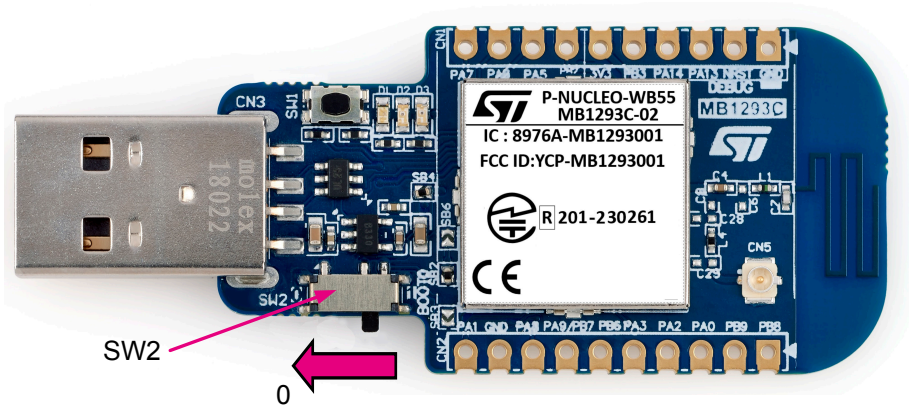
2. Plug the USB dongle into the computer.
3. Run STM32CubeProgrammer and select *USB* as the programming interface.

Figure 40. STM32CubeProgrammer with USB configuration



4. After the firmware update, set the SW2 to its initial position (BOOT0 = 0).

Figure 41. BOOT0=0, the default value to run user firmware on MB1293 (SWD)



DT59520V1

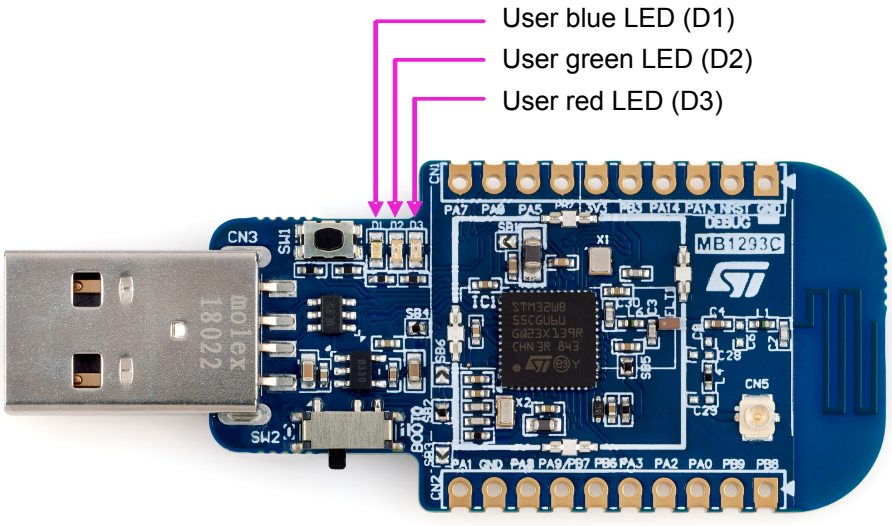
5. Reset STM32WB55CG: unplug the USB dongle from the computer or use the reset pin.

The USB dongle is ready to use with the new firmware.

8.6 MB1293 LEDs

Like the Nucleo board, the USB dongle has several user LEDs. Figure 42 shows where these LEDs are located on the dongle.

Figure 42. LED locations for MB1293



DT59522V1

Table 12. Details of user LEDs on MB1355

LED	Description	STM32WB55CG GPIO
LED1	Blue LED	PA4
LED2	Green LED	PB0
LED3	Red LED	PB1

8.7 MB1293 push-button

The USB dongle has one push-button (SW1) available for the user application.

Figure 43. Push-button location for MB1293

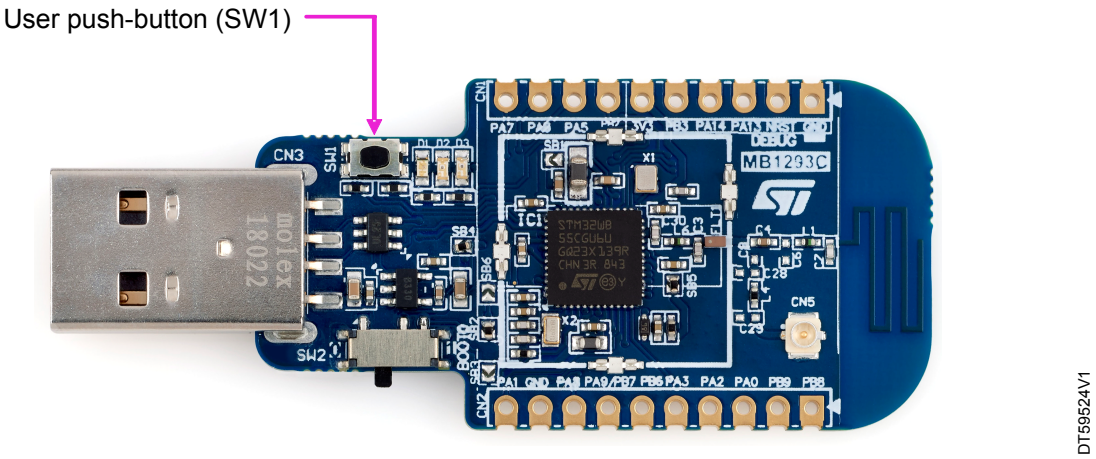


Table 13. MB1293 I/O configuration for the physical user interface

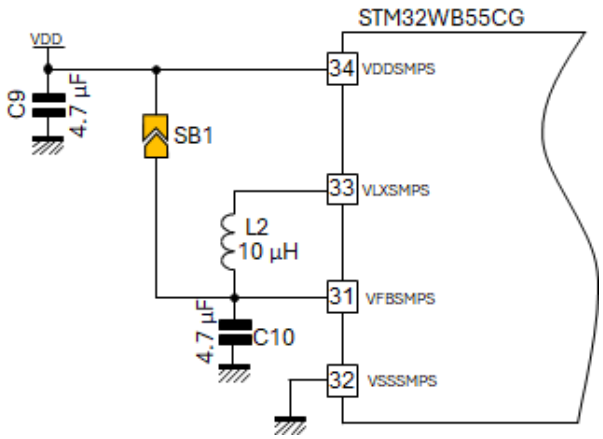
Name	I/O
SW1	PA10

8.8 SMPS configuration and external components

The STM32WB55 microcontroller on the MB1293 USB dongle embeds a DC-DC converter: SMPS (switched-mode power supply).

On the USB dongle, the capacitor of 100 nF is removed due to the proximity of the main power supply. All parts are in a small area. This capacitor is not mandatory.

Figure 44. MB1293C-02 schematic



For evaluation reasons, two configurations are possible. For SMPS mode, the solder bridge is OFF (configuration by default). For LDO mode, the solder bridge is ON to bypass the SMPS. One or more coils can remain on the circuit without impact due to low DC impedance.

For details about the external components that ensure optimal performance of the SMPS, refer to Table 9. External components for SMPS optimal performance.

8.9 MB1293 RF I/O stage

8.9.1 MB1293C-02

C30 matches the STM32 output to 50 Ω. FLT1 is a ceramic filter (Murata), which helps reduce the harmonic signal. After this filter, there are two ways to route the RF signal to the antenna. The first one, assembled by default, connects the PCB antenna with its matching network. The second transmits the RF signal to a µFL connector for RF measurements. This last configuration requires changing the position of the 10-nF capacitor from the C4 footprint to the C8 footprint. Figure 45 and Figure 46 show the modifications to apply.

Figure 45. Schematic of the RF path (MB1293C-02)

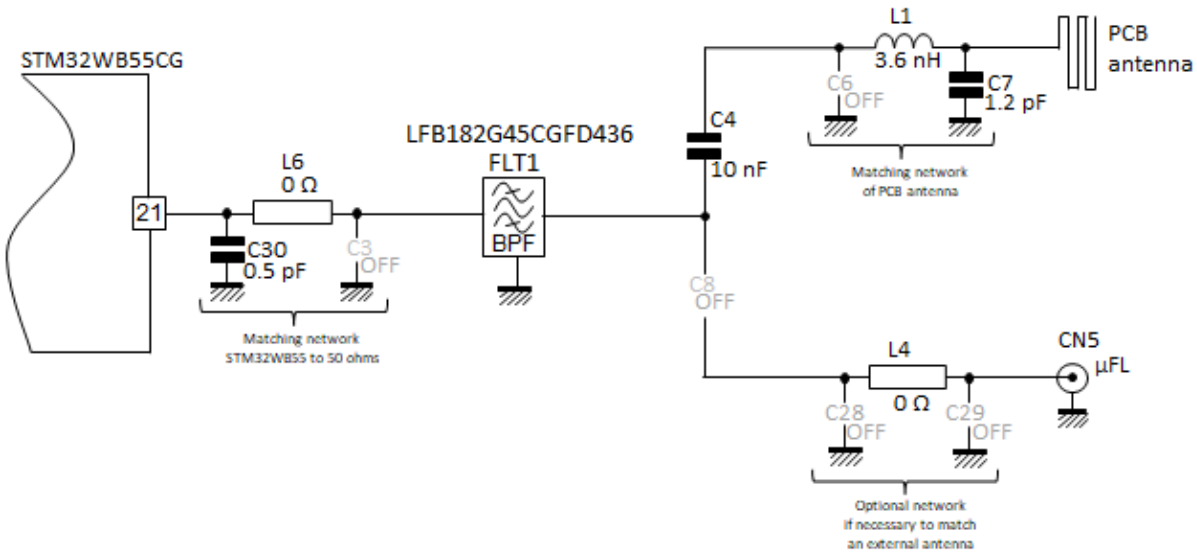
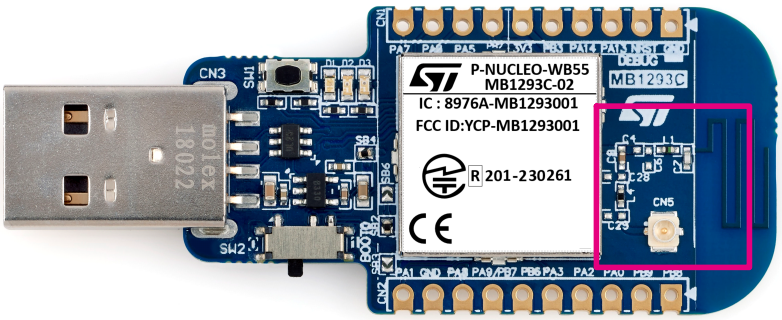
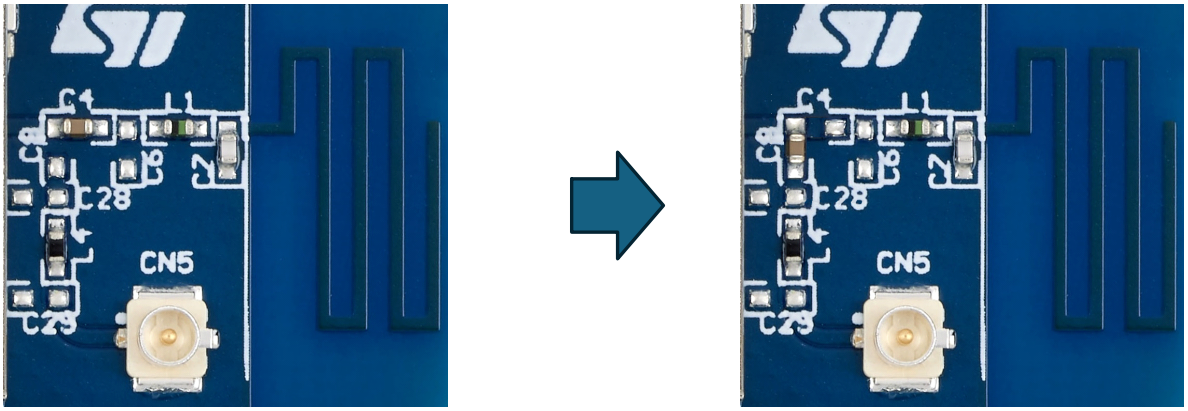


Figure 46. **Schematic of the µFL path (MB1293C-02)**





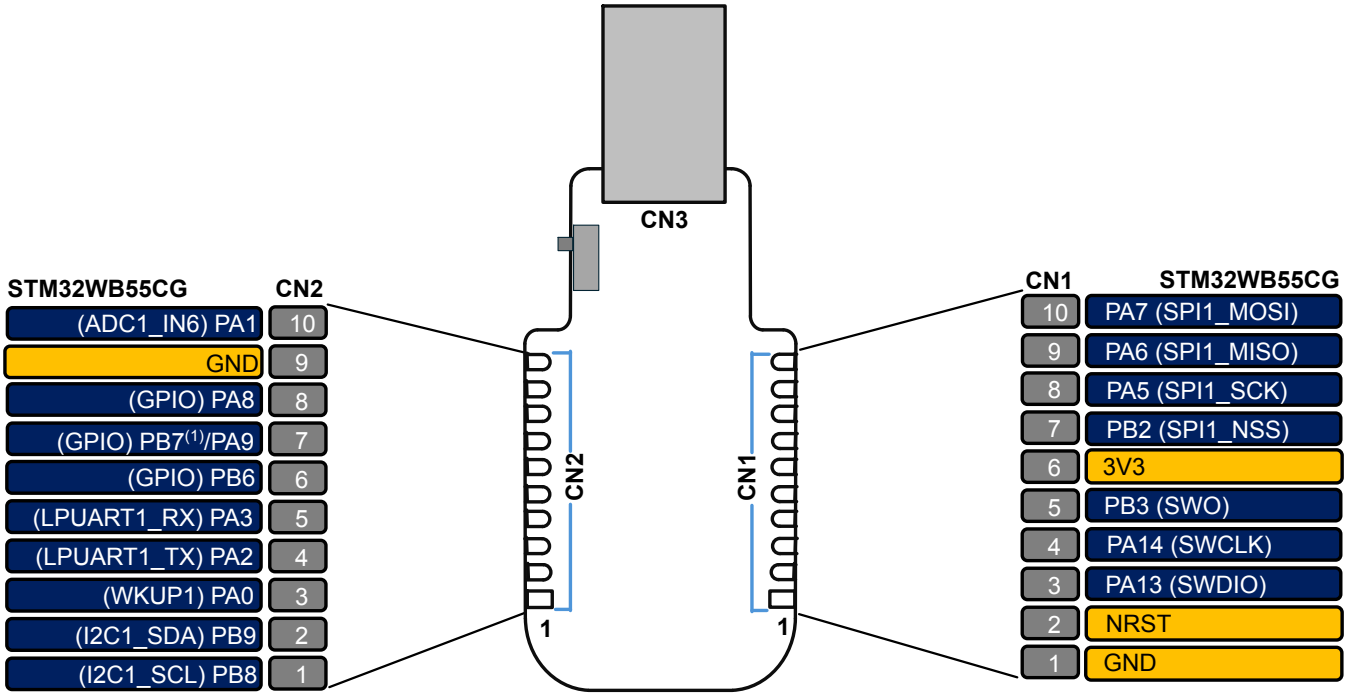
Default configuration:
PCB antenna connected
C4 = 10 nF
C8 OFF

µFL configuration:
C4 OFF
C8 = 10 nF

DT59537V1

8.10 MB1293 extension connector interface and pinout

Figure 47. **MB1293 extension connector pinout**



(1) Optional, need to change the state of solder bridges

Table 14. MB1293 extension connector pinout

Connector	Pin number	STM32 port	Comment
CN1	1	-	GND
	2	NRST	Reset
	3	PA13	SWDIO
	4	PA14	SWCLK
	5	PB3	SWO
	6	-	3V3
	7	PB2	SPI1_NSS
	8	PA5	SPI1_SCK
	9	PA6	SPI1_MISO
	10	PA7	SPI1_MOSI
CN2	1	PB8	I2C1_SCL
	2	PB9	I2C1_SDA
	3	PA0	WKUP1
	4	PA2	LPUART1_TX
	5	PA3	LPUART1_RX
	6	PB6	GPIO
	7	PA9/PB7[1]	GPIO
	8	PA8	GPIO
	9	-	GND
	10	PA1	ADC1_IN6

1. *Optional: This requires to change the state of solder bridges.*

9 P-NUCLEO-WB55 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:

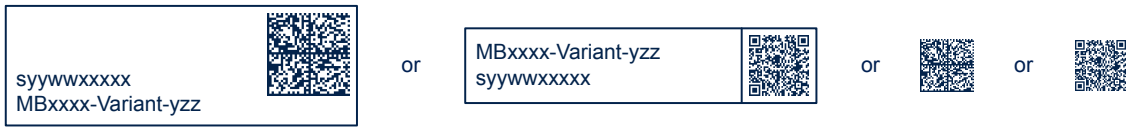
  

  Dual-sticker example:

- 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 P-NUCLEO-WB55 product history

Table 15. Product history

Order code	Product identification	Product details	Product change description	Product limitations
P-NUCLEO-WB55	PNWB55$CU2	MCUs: • STM32WB55RGU6 silicon revision "Y" • STM32WB55CGU6 silicon revision "Y"	Initial revision	No limitation
		MCU errata sheet: *STM32WB55xx/ STM32WB35Cx device errata* (ES0394)		
		Boards: • MB1355C-02 (main board) • MB1293C-02 (USB dongle)		
	PNWB55$CU3	MCUs: • STM32WB55RGU6 silicon revision "Y" • STM32WB55CGU6 silicon revision "Y"	Removed battery socket (CE/RED constraints)	No limitation
		MCU errata sheet: *STM32WB55xx/ STM32WB35Cx device errata* (ES0394)		
		Boards: • MB1355C-02 (main board) • MB1293C-02 (USB dongle)		
	PNWB55$CU4	MCUs: • STM32WB55RGU6 silicon revision "X" • STM32WB55CGU6 silicon revision "X"	• Main board revision changed • MCU silicon revision changed on both boards	No limitation
		MCU errata sheet: *STM32WB55xx/ STM32WB35Cx device errata* (ES0394)		
		Boards: • MB1355D-01 (main board) • MB1293C-02 (USB dongle)		

9.3 Board revision history

Table 16. **Board revision history**

Board reference	Board variant and revision	Board change description	Board limitations
MB1355 (main board)	MB1355C-02	Initial revision	No limitation
	MB1355D-01	• Replace ceramic filter with IPD • Add filtering coil on SMPS network	No limitation
MB1293 (USB dongle	MB1293C-02	Initial revision	No limitation

10 Federal Communications Commission (FCC) and ISED Canada compliance statements

10.1 FCC compliance statement

Identification of products: P-NUCLEO-WB55

Contains FCC ID for PNWB55$CU2:

- MB1355: YCP-MB1355000
- MB1293: YCP-MB1293000

Contains FCC ID for PNWB55$CU3:

- MB1355: YCP-MB1355000
- MB1293: YCP-MB1293000

Contains FCC ID for PNWB55$CU4:

- MB1355: YCP-MB1355002
- MB1293: YCP-MB1293001

Warning: *This certification is only valid for an RF output power of 0 dBm (programmed).*

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

10.2 ISED compliance statement

Identification of products: P-NUCLEO-WB55

Contains IC for PNWB55$CU2:

- MB1355: 8976A-MB1355000
- MB1293: 8976A-MB1293000

Contains IC for PNWB55$CU3:

- MB1355: 8976A-MB1355000
- MB1293: 8976A-MB1293000

Contains IC for PNWB55$CU4:

- MB1355: 8976A-MB1355002
- MB1293: 8976A-MB1293001

Identification du produit : P-NUCLEO-WB55

Contient sous-ensemble certifié IC pour PNWB55$CU2 :

- MB1355 : 8976A-MB1355000
- MB1293 : 8976A-MB1293000

Contient sous-ensemble certifié IC pour PNWB55$CU3 :

- MB1355 : 8976A-MB1355000
- MB1293 : 8976A-MB1293000

Contient sous-ensemble certifié IC pour PNWB55$CU4 :

- MB1355 : 8976A-MB1355002
- MB1293 : 8976A-MB1293001

Warning: *This certification is only valid for an RF output power of 0 dBm (programmed).*

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.

This product complies 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.

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.

Ce produit est conforme 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 des câbles blindés.

11 UKCA conformity

Simplified UK declaration of conformity

Hereby, the manufacturer STMicroelectronics, declares that the radio equipment type P-NUCLEO-WB55 is 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*.

12 CE conformity

12.1 Simplified EU declaration of conformity

Hereby, STMicroelectronics declares that the radio equipment type P-NUCLEO-WB55 is in compliance with directives 2011/53/EU and 2015/863/EU (RoHS), and 2014/53/EU (RED).

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*

12.2 Déclaration de conformité UE simplifiée

STMicroelectronics déclare que l'équipement radioélectrique du type P-NUCLEO-WB55 est conforme aux directives 2011/53/UE et 2015/863/UE (LdSD), et à la directive 2014/53/UE (RED).

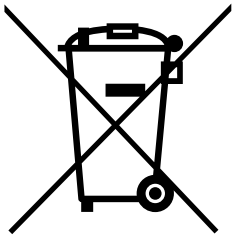
Le texte complet de la déclaration UE de conformité est disponible sur demande à l'adresse internet suivante : *www.st.com*.

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

13 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 17. **Document revision history**

Date	Revision	Changes
28-Sep-2018	1	Initial release.
01-Apr-2019	2	Added *Section 9: Federal Communications Commission (FCC) and Industry Canada (IC) compliance statements* and its subsections. Minor text edits across the whole document.
22-Sep-2025	3	Reshuffled document to align with the latest standards and created separate sections for MB1355 and MB1293. Added a new version of MB1355 (D-01) with detailed description. Updated: • Section Introduction • Product marking • FCC, ISED, UKCA, and CE conformity and compliance statements Added Section 5.3: Power supply and Section 13: Product disposal.

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