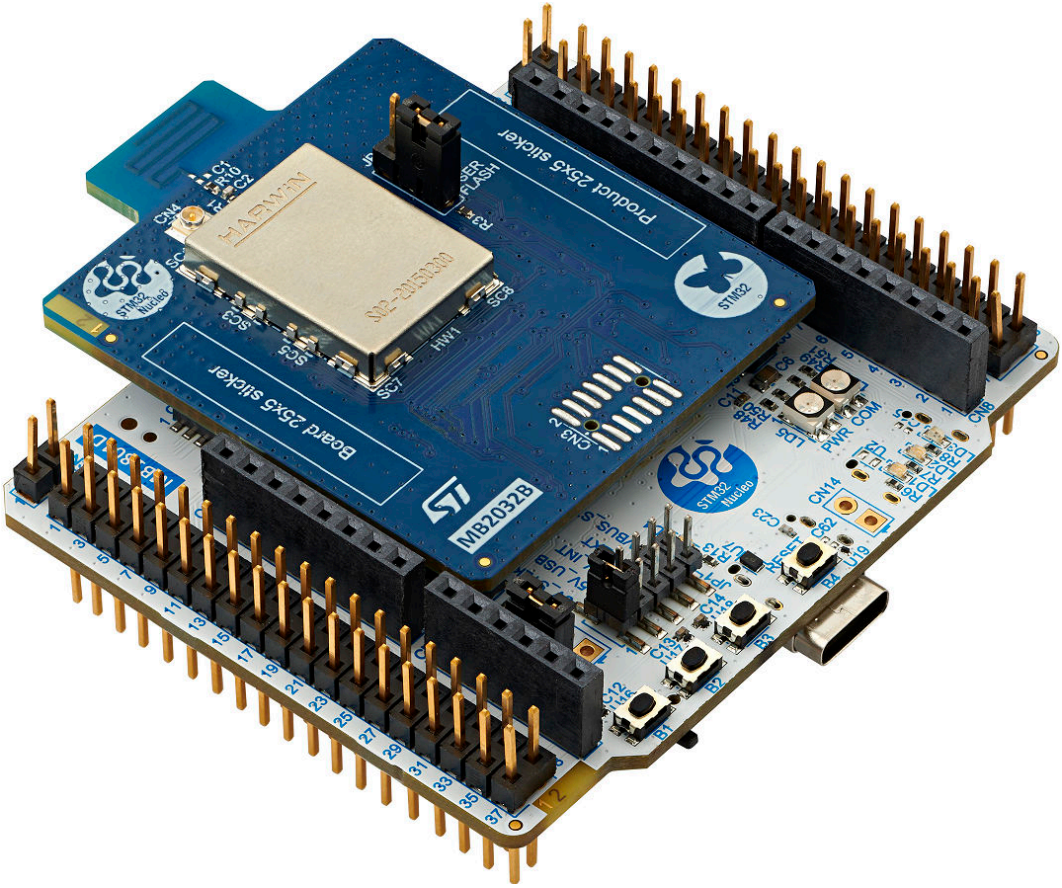
STM32WB09 Nucleo-64 board (MB1801 and MB2032)

Introduction

NUCLEO-WB09KE is a Bluetooth® Low Energy wireless and ultra-low-power board embedding a powerful and ultra-low-power radio compliant with the Bluetooth® Low Energy SIG specification v5.4.

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

Figure 1. NUCLEO-WB09KE global view



Picture is not contractual.

1 Features

- Ultra-low-power wireless STM32WB09KE microcontroller based on the Arm® Cortex®-M0+ core, featuring 512 Kbytes of flash memory and 64 Kbytes of SRAM in a VFQFPN32 package
- MCU RF board (MB2032):
  - 2.4 GHz RF transceiver supporting Bluetooth® specification v5.4
  - Built-in PCB antenna
- Three user LEDs
- Three user and one reset push-buttons
- Board connectors:
  - USB Type-C®
  - ARDUINO® Uno V3 expansion connector
  - ST morpho headers for full access to all STM32 I/Os
- Flexible power-supply options: ST-LINK USB V_{BUS} or external sources
- On-board STLINK-V3EC debugger/programmer with USB re-enumeration capability: mass storage, Virtual COM port, and debug port
- Comprehensive free software libraries and examples available with the STM32CubeWB0 MCU Package
- Support of a wide choice of Integrated Development Environments (IDEs) including IAR Embedded Workbench®, MDK-ARM, and STM32CubeIDE

Note: For information on Bluetooth®, refer to the www.bluetooth.com website

Note: Arm and Cortex are registered trademarks of Arm Limited (or its subsidiaries) in the US and/or elsewhere.

2 Ordering information

To order the NUCLEO-WB09KE board, refer to Table 1. Additional information is available from the datasheet and reference manual of the target STM32.

Table 1. Ordering information

Order code	Board references	Target STM32
NUCLEO-WB09KE	• MB1801[1] • MB2032[2]	STM32WB09KEV6

1. *Mezzanine board*
2. *MCU RF board*

2.1 Codification

The meaning of the codification is explained in Table 2.

Table 2. Codification explanation

NUCLEO-XXYYZT	Description	Example: NUCLEO-WB09KE
XX	MCU series in STM32 32-bit Arm Cortex MCUs	STM32WB0 series
YY	MCU product line in the series	STM32WB09 product line
Z	STM32 package pin count: • K for 32 pins	32 pins
T	STM32 flash memory size: • E for 512 Kbytes	512 Kbytes

3 Development environment

3.1 System requirements

- Multi-OS support: Windows® 10, Linux® 64-bit, or macOS®
- USB Type-A or USB Type-C® to USB Type-C® cable

Note: macOS® is a trademark of Apple Inc., registered in the U.S. and other countries and regions.
Linux® is a registered trademark of Linus Torvalds.
Windows is a trademark of the Microsoft group of companies.

3.2 Development toolchains

- IAR Systems® - IAR Embedded Workbench®(1)
- Keil® - MDK-ARM(1)
- STMicroelectronics - STM32CubeIDE

1. *On Windows® only.*

4 Conventions

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

Table 3. ON/OFF convention

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

5 Safety recommendations

5.1 Targeted audience

This product targets users with at least basic electronics or embedded software development knowledge like engineers, technicians, or students.

This board is not a toy and is not suited for use by children.

5.2 Handling the board

This product contains a bare printed circuit board. Like all products of this type, the user must pay attention to the following points:

- The connection pins on the board might be sharp. Be careful when handling the board to avoid 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 voltage levels that are 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.

6 Quick start

This section describes how to start development quickly using NUCLEO-WB09KE.

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

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

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

The Nucleo board is an easy-to-use development kit to evaluate quickly and start development with an STM32 microcontroller in a VFQFPN32 package.

6.1 Getting started

Follow the sequence below to configure the STM32WB09KE board and launch the demonstration application (refer to Figure 3 and Figure 5 for component location):

1. Check the jumper positions: JP2 ON, JP1 on USB_STLK [1-2] on the MB1801 board.
2. Check that switch SW1 is on the 3V3 power supply (switch on position [1-2]) on the MB1801 board.
3. Install ST Bluetooth® Low Energy sensor mobile application on a Bluetooth® Low Energy compatible mobile device from the App Store or Google Play.
4. Connect the Nucleo board to a PC with a USB cable Type-A or USB Type-C® to USB Type-C® through the ST-LINK USB connector (CN15). The green LEDs LD4 (5V) and LD5 (STLINK power status), and the red LED (LD6, STLINK COM status) light up. For more information about STLINK PWR and COM LEDs. Refer to the technical note *Overview of ST-LINK derivatives* (TN1235).
5. Use ST Bluetooth® Low Energy sensor mobile application to detect the STM32WB09 P2P server (P2PSRV) and connect it. The smartphone application displays the service and characteristics of the device.
6. Pushing the button (B1) on the board toggles the alarm on the smartphone display. On the smartphone, push the lamp to switch ON/OFF the Nucleo board blue LED (LD1).

7 Hardware layout and configuration

NUCLEO-WB09KE is designed around the STM32WB09KEV6. NUCLEO-WB09KE includes a mezzanine board and an MCU RF board. The hardware block diagram in Figure 2 illustrates the connection between STM32WB09KE and peripherals (ARDUINO® Uno V3 connectors, ST morpho connector, and embedded ST-LINK).

Figure 3 and Figure 5 help users locate these features on the NUCLEO-WB09KE board. The mechanical dimensions of the NUCLEO-WB09KE product are shown in Figure 6.

Figure 2. Hardware block diagram

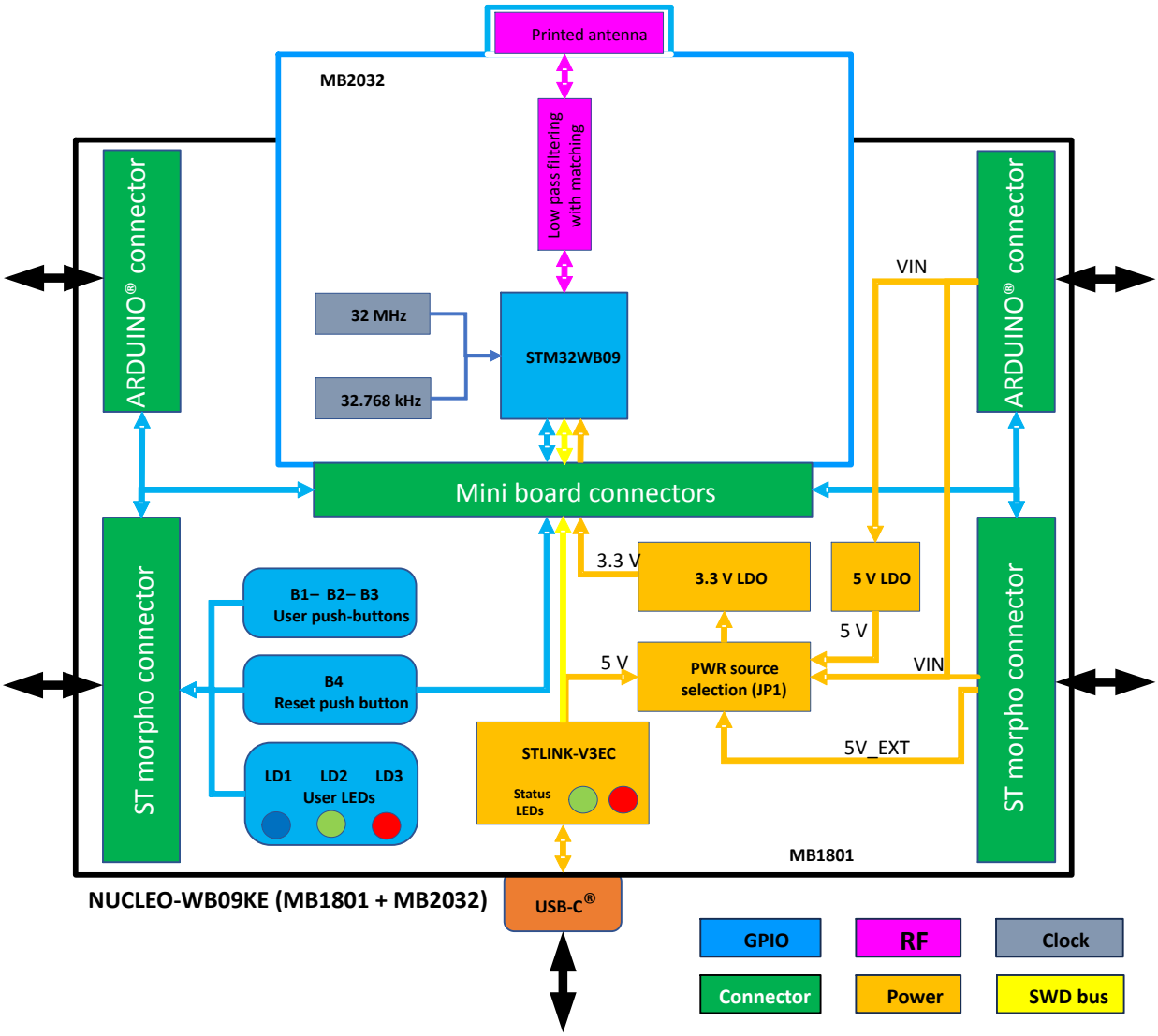


Figure 3. NUCLEO-WB09KE PCB top view

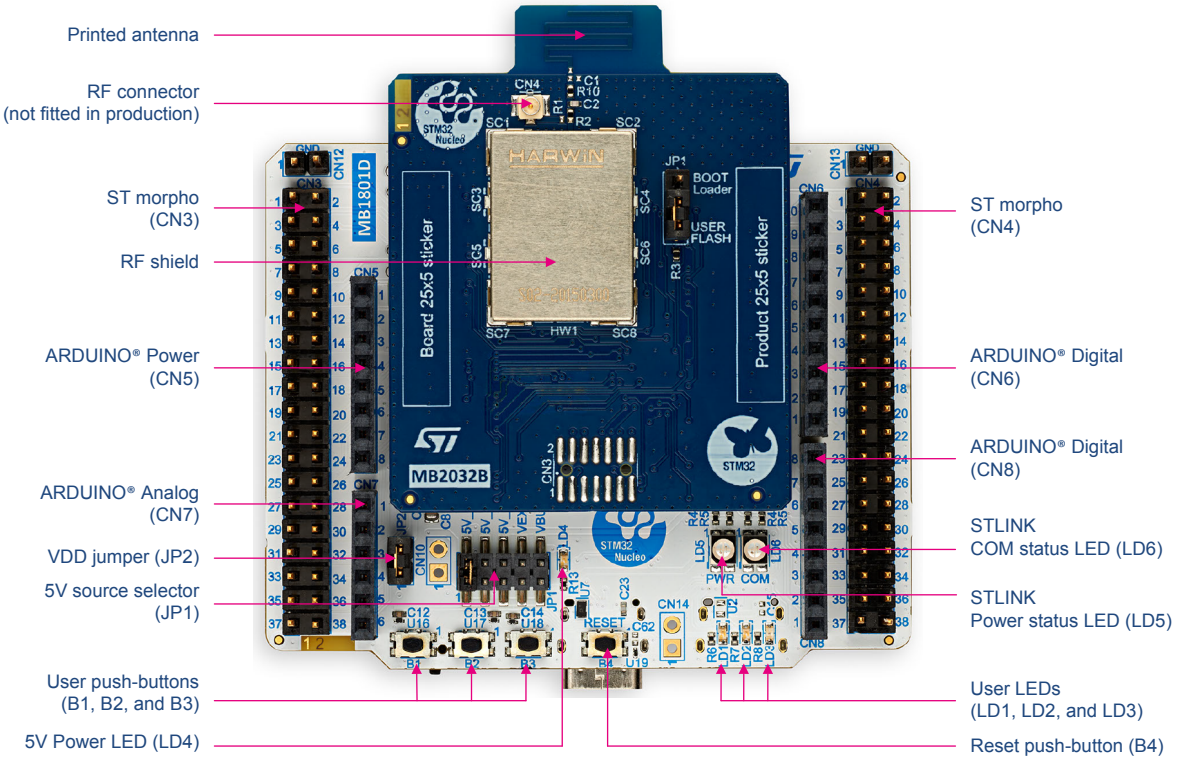


Figure 4. NUCLEO-WB09KE PCB details of the MCU RF board

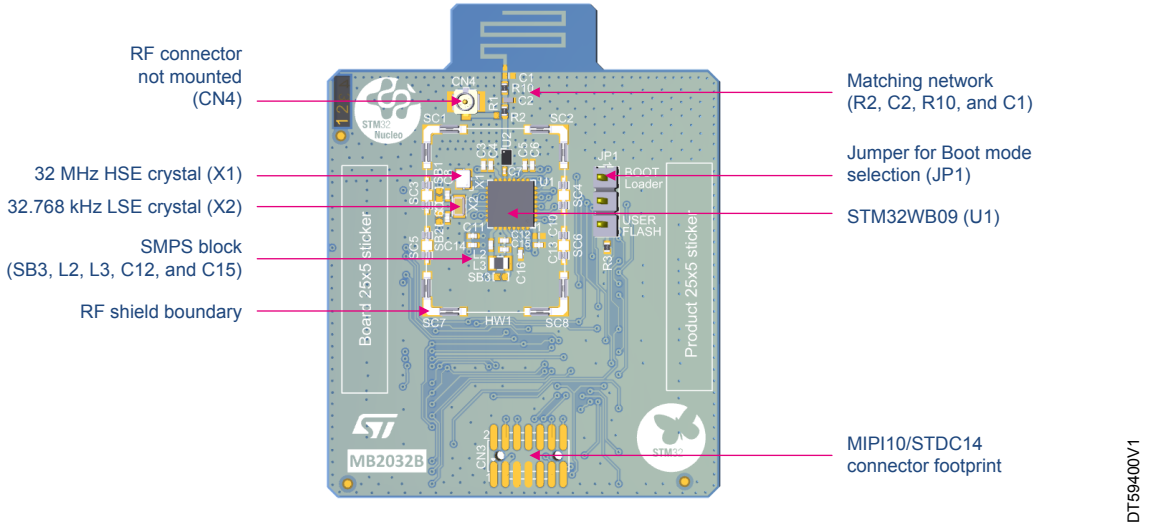


Figure 5. NUCLEO-WB09KE PCB bottom view

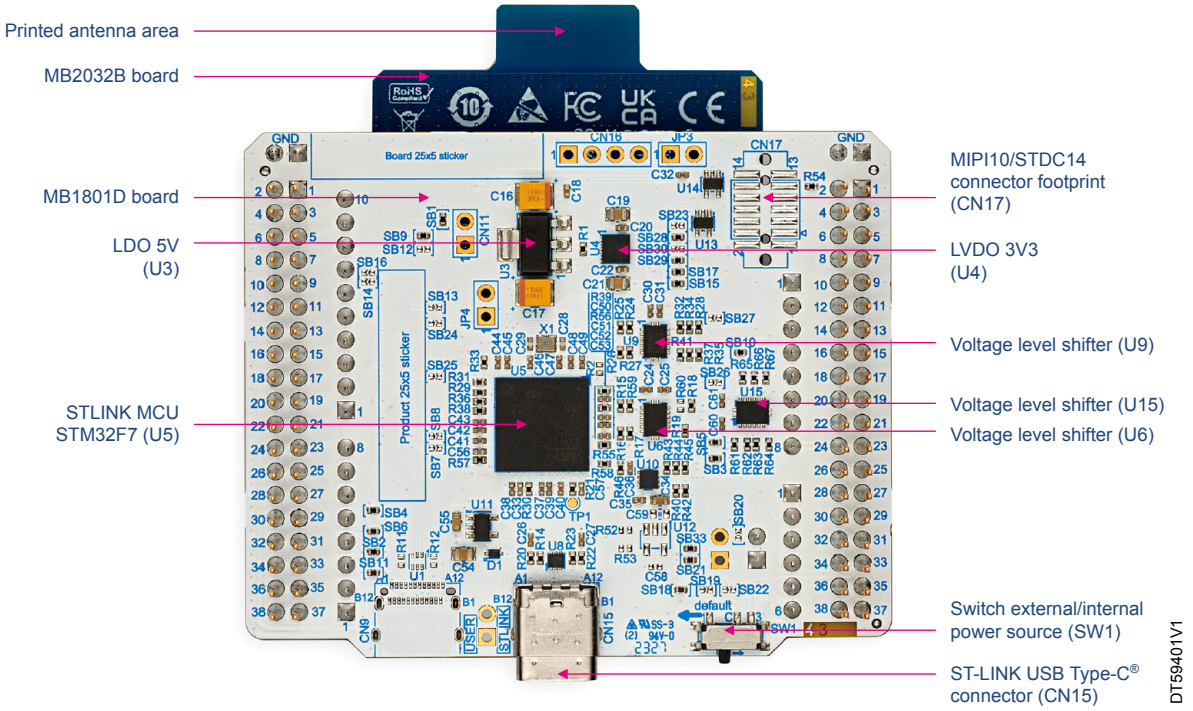
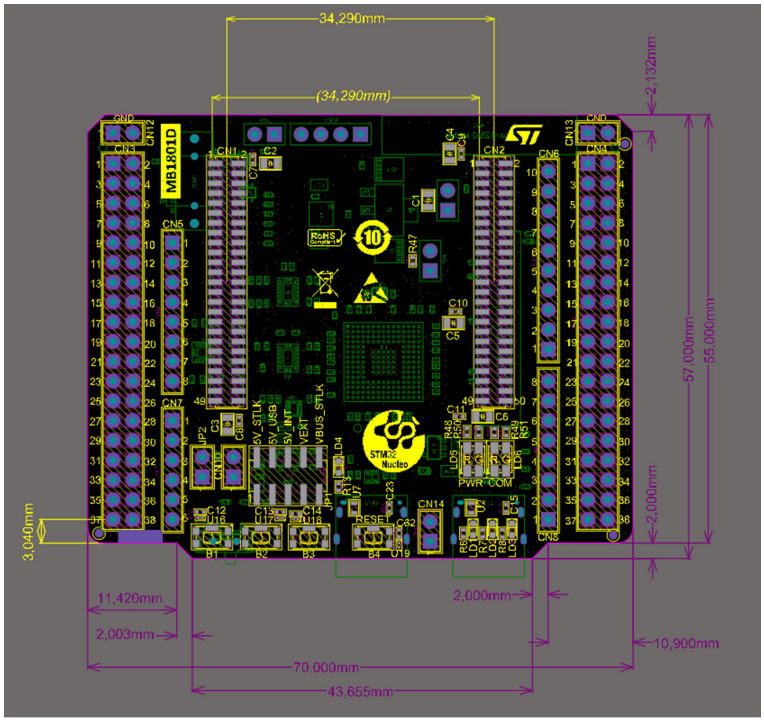
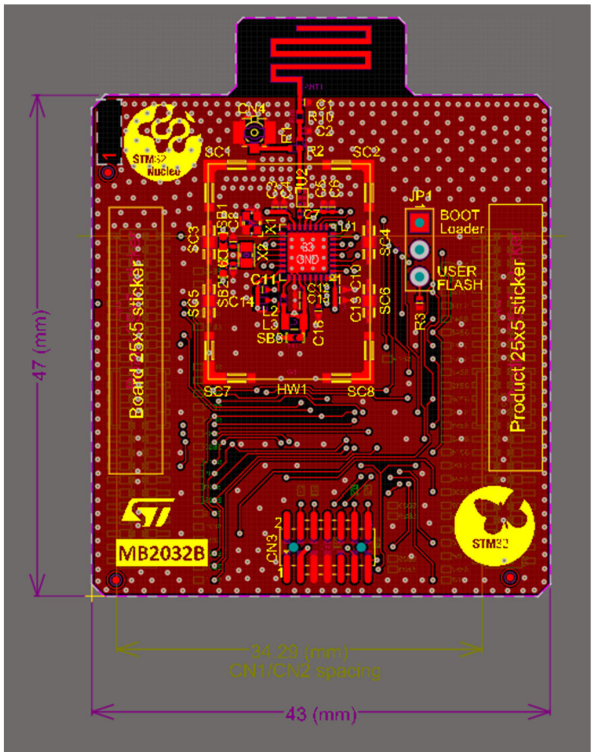


Figure 6. **NUCLEO-WB09KE mechanical dimensions (in millimeters)**



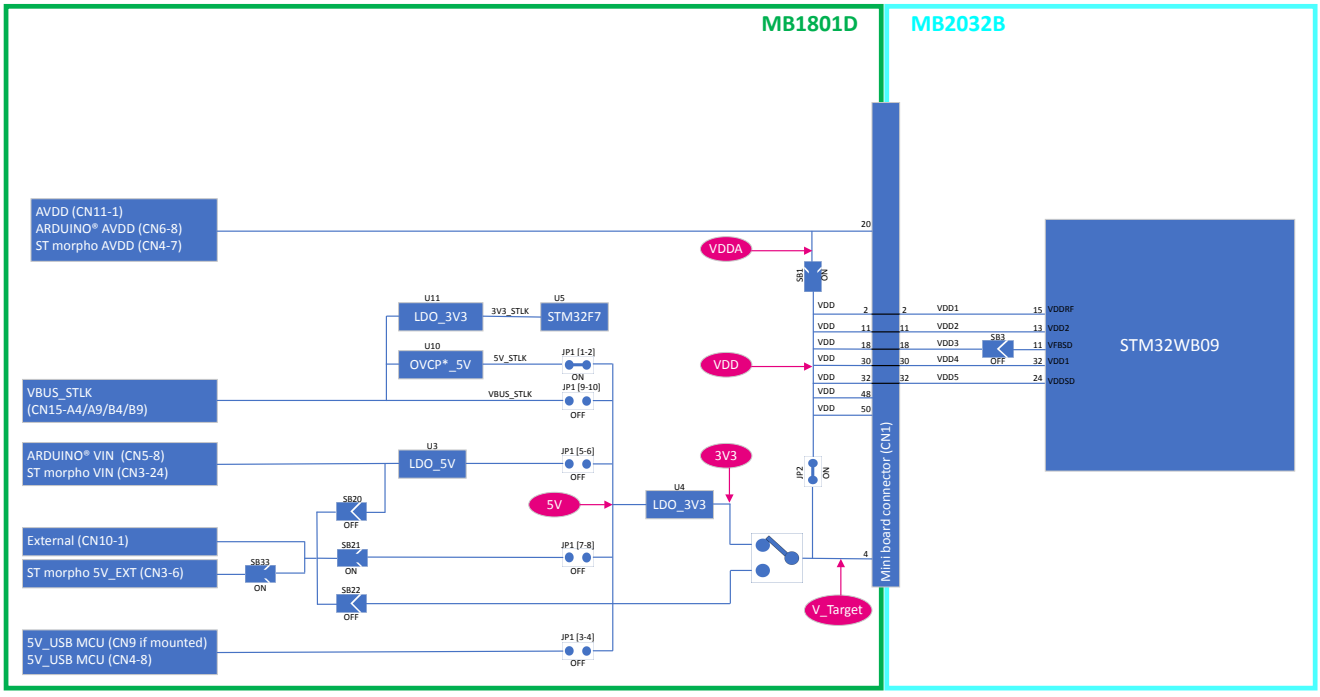


7.1 Power supply

7.1.1 General description

By default, the STM32WB09KE embedded on this Nucleo board is supplied by 3V3 but the board proposes many possibilities to supply the module. In fact, at first, the 3V3 can come from ST-LINK USB, ARDUINO®, or ST morpho connectors. Moreover, STM32WB09KE can be supplied by an external source (between 1.8 and 3.3 V). Thanks to level shifters, debugging by embedded STLINK is always possible even if the supply voltage of the target is different than 3V3 (ST-LINK supply). Figure 7 shows the power tree. Moreover, this figure also shows the default state of the jumpers and the solder bridges.

Figure 7. STM32WB09KE power tree



7.1.2 7 to 12 V power supply

A 7 to 12 V DC power source can power NUCLEO-WB09KE. There are three accesses for this type of level:

- Pin VIN of the ARDUINO® connector (CN5-8). 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.
- Pin VIN of the ST morpho connector (CN3-24). It is possible to apply until +12 V on this pin like for theARDUINO® connection.
- External input (CN10). Be careful, in this case, the states of the jumpers and solder bridge are significant. A solder bridge configuration might allow a direct supply of STM32WB09, **with a high risk of destruction if above 3.3 V**. Refer to Figure 7 and Table 4.

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

7.1.3 5 V power supply

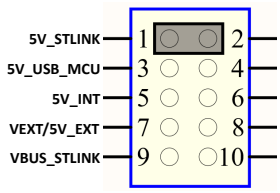
A 5 V DC power source can power NUCLEO-WB09KE. The 5 V can come from several connectors:

- External input (CN10). Be careful, in this case, the states of the jumpers and solder bridge are significant. A solder bridge configuration might allow a direct supply of STM32WB09KE, **with a high risk of destruction if above 3.3 V**. Refer to Figure 7 and Table 4.
- 5V_EXT from ST morpho connector (CN3-6)
- R7-12 V input through the voltage regulator (U3). Refer to Section 7.1.2: 7 to 12 V power supply.

The jumper (JP1) allows selecting the 5V source. Table 4 shows the configuration to apply the selected source. Depending on the current needed on the devices connected to the USB port, and the board itself, power limitations can prevent the system from working as expected. The user must ensure that NUCLEO-WB09KE is supplied with the correct power source depending on the current needed.

The jumper (JP1) allows selecting the 5V source. Table 4 shows the configuration to apply the selected source. Depending on the current needed on the devices connected to the USB port and the board itself, power limitations can prevent the system from working as expected. The user must ensure that NUCLEO-WB09KE is supplied with the correct power source depending on the current needed.

Table 4. Power supply selector (JP1) description

JP1 jumper	Setting[1]	Configuration
	**[1-2]**	NUCLEO-WB09KE is supplied through the ST-LINK USB Type-C® receptacle (CN15), with an overvoltage and an overcurrent protection device (U10-5V_STLINK). **This is the default setting.**
	[3-4]	Not available on NUCLEO-WB09KE.
	[5-6]	NUCLEO-WB09KE is supplied through the pin 8 of the ARDUINO® connector (CN5) or pin 24 of the ST morpho connector (CN3) or CN10 (setting SB20) Refer to the configuration details in the present Power supply section.
	[7-8]	NUCLEO-WB09KE is supplied through CN10 or through pin 6 of the ST morpho connector (CN3-5V_EXT). **Be highly careful with the applied supply voltage, SB22, and SW1 settings if CN10 is used.** Refer to the configuration details in the present Power supply section.
	[9-10]	NUCLEO-WB09KE is directly supplied by the USB Type-C® receptacle (CN15), **without any overvoltage and an overcurrent device protecting the PC** (VBUS_STLK).

1. *The default configuration is in bold.*

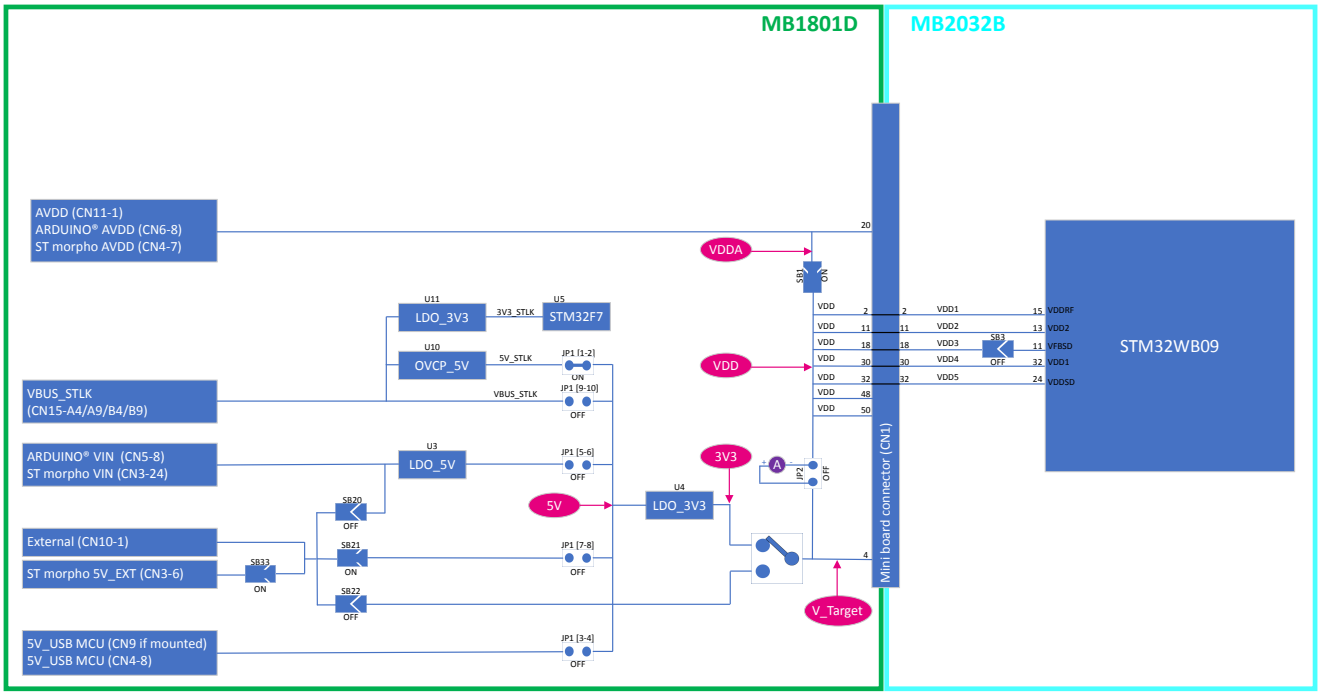
7.1.4 Current measurement

As the device has low-power features, it can be interesting to measure the current consumed by NUCLEO-WB09KE. To do this measurement easily, there are two possibilities:

1. Measure the supply current of the SoC using an ammeter in place of the jumper (JP2). Since the STM32WB09 power consumption is usually very low, an accurate instrument in the range of a few microamps is recommended.

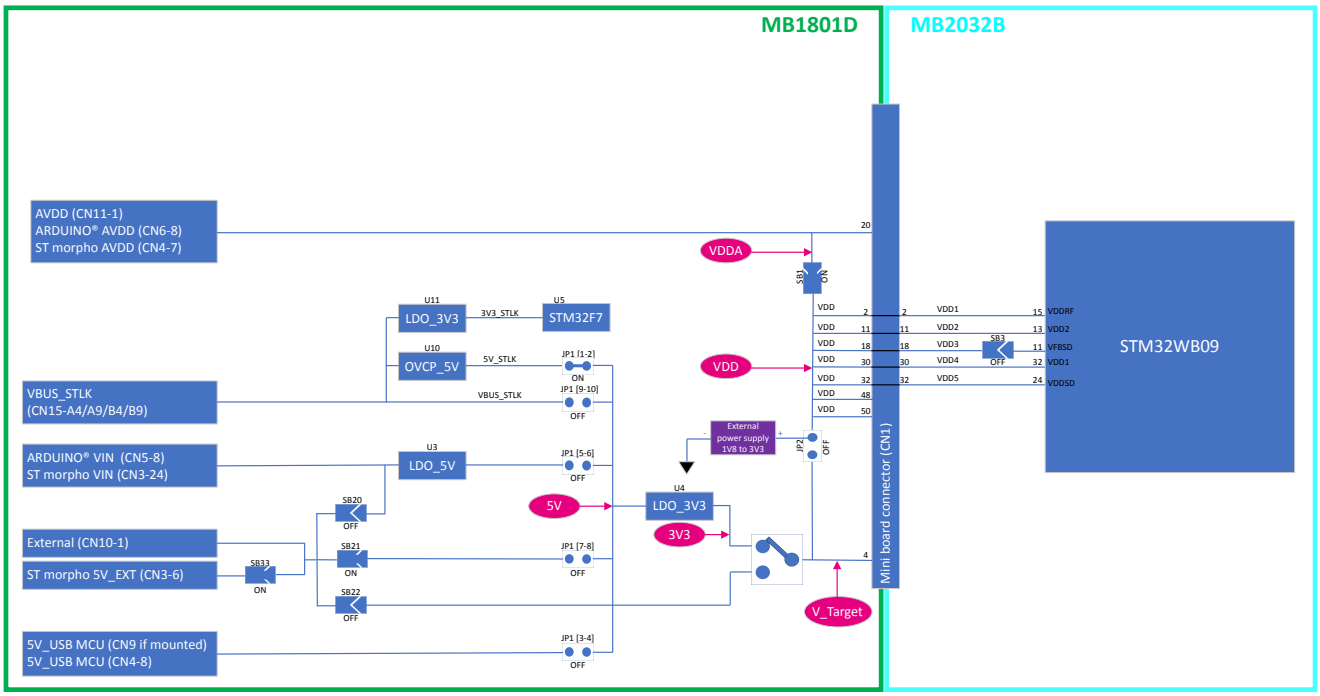
   All supply sources can be used except the AVDD coming from the ARDUINO® connector. Figure 8 shows the configuration.

Figure 8. Current measurement with an ammeter



2. Use an external power supply with current measurement capability. In this case, the jumper (JP2) must be removed, and the supply connected to pin 2 of JP2 (refer to Figure 9). The supply voltage must be between 1V8 and 3V3. AVDD input (CN6-8) must not be used during this measurement.

Figure 9. Current measurement with an external power supply

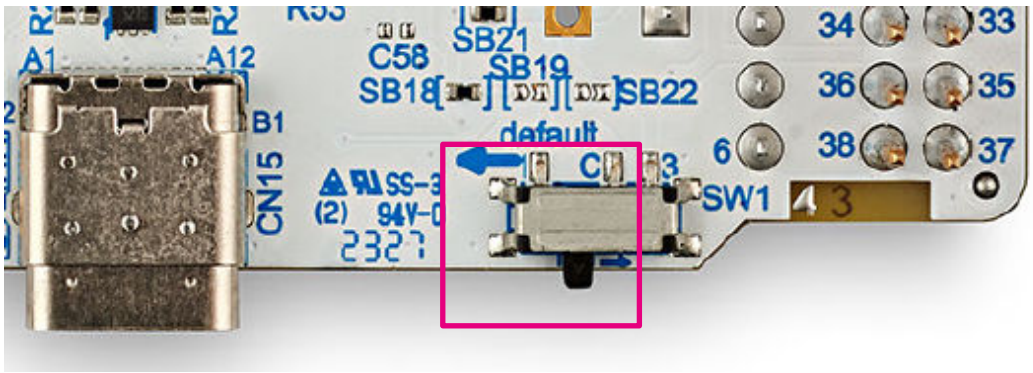


7.1.5 SW1 switch use

SW1 is a two-position switch that selects a power source to connect to V_Target and VDD. Therefore, it determines the supply voltage for STM32WB09.

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

Figure 10. SW1 default setting



DT59407V1

2. Position [3-2]: The power source is the voltage injected at VIN, 5V_EXT, or VEXT, depending on SB20, SB21, SB22, and SB33 configuration. **It is highly recommended never to use this configuration, as there is no system to ensure the correct value of the voltage.**

7.2 Clock sources

7.2.1 HSE clock references

The accuracy of the high-speed clock (HSE) of the MCU RF board is committed to a 32 MHz crystal oscillator.

7.2.2 LSE clock references

The accuracy of the low-speed clock (LSE) of the MCU RF board is committed to a 32.768 kHz crystal oscillator.

There are three ways to configure PB12 (OSC32_OUT) and PB13 (OSC32_IN) corresponding to the low-speed clock (LSE):

- On-board oscillator (default): X2 crystal connected to PB12 and PB13. Refer to the application note *Guidelines for oscillator design on STM8AF/AL/S and STM32 MCUs/MPUs* (AN2867). ST recommends using NX2012SA-32.768KHZ-EXS00A-MU00389 (32.768 kHz, 7 pF load capacitance, 20 ppm) from NDK. The configuration must be:
  - SB1 and SB2 OFF
- External clock injected in PB13. PB12 can be used as a GPIO. The configuration must be:
  - SB1 ON
  - SB2 OFF or ON
- LSE not used: PB12 and PB13 are used as GPIOs instead of the low-speed clock. The configuration must be:
  - SB1 and SB2 ON

7.3 Reset sources

The reset signal of NUCLEO-WB09KE is active LOW. The internal PU forces the RST signal to a high level. The sources of reset are:

- Reset push-button (B4)
- Embedded STLINK-V3EC
- ARDUINO® connector (CN5 pin 3), reset from the ARDUINO® board
- ST morpho connector (CN3 pin 14)

7.4 Embedded STLINK-V3EC

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

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

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

7.4.1 Description

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

- Using the embedded STLINK-V3EC programming and debugging tool on the NUCLEO-WB09KE board
- Using an external debug tool connected to the MIPI10 connector (CN17) on the MB1801 board

The STLINK-V3EC facility for debugging and flashing is integrated into the NUCLEO-WB09KE board.

Supported features in STLINK-V3EC:

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

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

For detailed information about the management of these LEDs, refer to the technical note *Overview of ST-LINK derivatives* (TN1235).

7.4.2 Drivers

The installation of drivers is not mandatory from Windows® 10 but allocates an ST-specific name to the ST-LINK COM port in the system device manager.

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

7.4.3 STLINK-V3EC firmware upgrade

STLINK-V3EC embeds a firmware upgrade (STSW-LINK007) mechanism through the USB Type-C® port. As the firmware might evolve during the lifetime of the STLINK-V3EC product (for example to add new functionalities, fix bugs, and support for new microcontroller families), it is recommended to keep the STLINK-V3EC firmware up-to-date before starting to use the NUCLEO-WB09KE board. The latest version of the ST-LINK firmware is available from the *www.st.com* website.

For detailed information about firmware upgrades, refer to the technical note *Overview of ST-LINK derivatives* (TN1235).

7.4.4 Using an external debug tool to program and debug NUCLEO-WB09KE

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

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

Table 5. JP4 configuration

Jumper	Definition	Setting	Comment
JP4	Debugger selection	ON [1-2]	An external debugger connected to the STDC14 connector (CN17) can be used. The level shifter (U9) is in high impedance (high-Z). STLINK-V3EC no longer drives the embedded STM32F7
		OFF	The embedded STLINK-V3EC is selected (default configuration)

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

7.4.5 STLINK-V3EC USB connector (CN15)

The main function of this connector is the access to STLINK-V3EC embedded on NUCLEO-WB09KE for the debugging as explained above. It allows supplying the board (refer to Section 7.1: Power supply). The connector is a standard USB Type-C® connector.

7.4.6 Virtual COM port USART

STLINK-V3EC offers a USB Virtual COM port bridge. This feature allows access to the USART of NUCLEO-WB09KE by the ST-LINK USB connector (CN15). By default, the USART interface of NUCLEO-WB09KE is connected to the VCP1 of the STLINK-V3EC MCU (STM32F723IEK6).

An intermediate connection allows the use of this VCP differently. On the CN14 connector, both signals (Tx and Rx) are available, and two resistors (R55 – 0 Ω and R56 – 33 Ω on MB1801) allow disconnecting the UART coming from the SoC.

Table 6. UART interface pinout description

STM32WB09KEV6	CN3	STM32F723IEK6
USART Rx (PB0)	Pin 13	STLINK_VCP_TX (PG14)
USART Tx (PA1)	Pin 14	STLINK_VCP_RX (PG9)

7.4.7 Virtual COM port LPUART1

It is possible to replace the mass storage interface with a second Virtual COM port. To do so, the SB7 and SB8 solder bridges must be ON. It is also necessary to do a firmware upgrade through STM32CubeProgrammer (refer to the technical note *Overview of ST-LINK derivatives* (TN1235) at *www.st.com*.

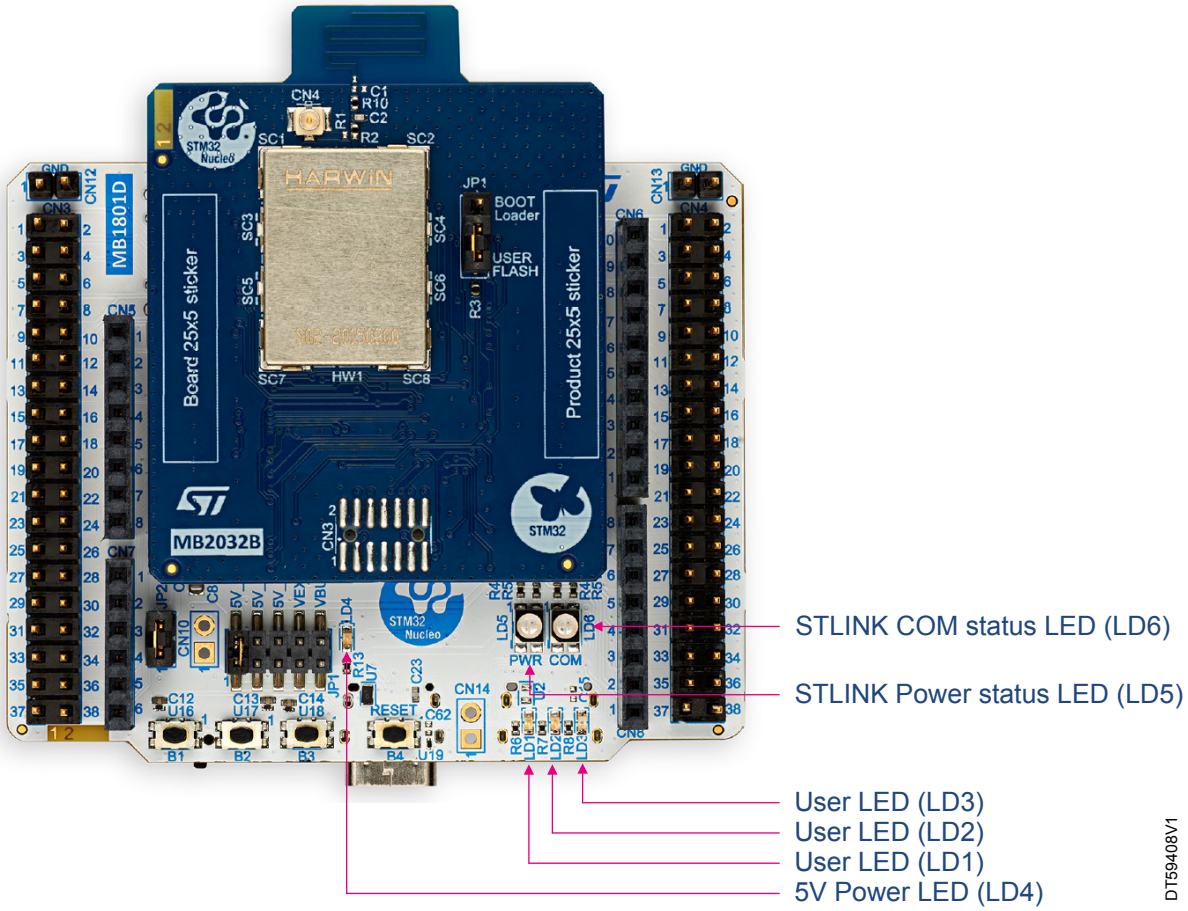
7.4.8 Level shifter

NUCLEO-WB09KE has a system for supplying STM32WB09KE with a different voltage than the ST-LINK. ST-LINK is always supplied by 3V3 sources. By default, the STM32WB09KE is supplied by the same voltage value as ST-LINK, but it is possible to supply the SoC with another value. It accepts voltage between 1.8 and 3.3 V trust to a specific component (U9 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.

7.5 LEDs

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

Figure 11. LEDs location



- LD1: This blue LED is available for user application.
- LD2: This green LED is available for user application.
- LD3: This red LED is available for user application.
- LD4: This LED turns green when a 5V source is available (to select the 5V source, refer to Section 7.1.3: 5 V power supply).
- LD5: This LED indicates the power budget provided by the host PC compared to the board requirement.
  - The LED is OFF: the target is not powered by the ST-LINK.
  - The LED is orange: The requested board power budget is higher than the USB power budget. The ST-LINK starts working normally, but there is a risk of exceeding the USB budget to supply the ST-LINK and the target application. Connect the board to a more powerful USB port for correct functioning.
  - The LED is green: The requested board power budget is less than or equal to the USB power budget.
  - The LED is red: an overcurrent is detected on the board and the target power is switched off automatically (overcurrent protection). The cause of the overcurrent must be investigated, or the board must be connected to a more powerful USB port.
  - The LED is blinking red: internal error; update the board with the most recent firmware available at www.st.com. If the issue persists, contact STMicroelectronics support.

- LD6: This LED shows the ST-LINK status, whatever the connection type.
  - The LED is blinking red: the first USB enumeration with the PC is taking place. If an ST-LINK upgrade application is running, the firmware is being programmed.
  - The LED is red: ST-LINK is in the idle state (the USB enumeration with the PC is finished and ST-LINK is waiting for an application to connect).
  - The LED is blinking green and red alternately: data is being exchanged between the target and the PC.
  - The LED is green: the last communication with the target has been successful.
  - The LED is orange: the last communication with the target has failed.

For more information about LEDs, you can refer to the user manual *STLINK-V3MODS and STLINK-V3MINI debugger/programmer tiny probes for STM32 microcontrollers* (UM2502) and to the technical note *Overview of ST-LINK derivatives* (TN1235) for details, at *www.st.com*.

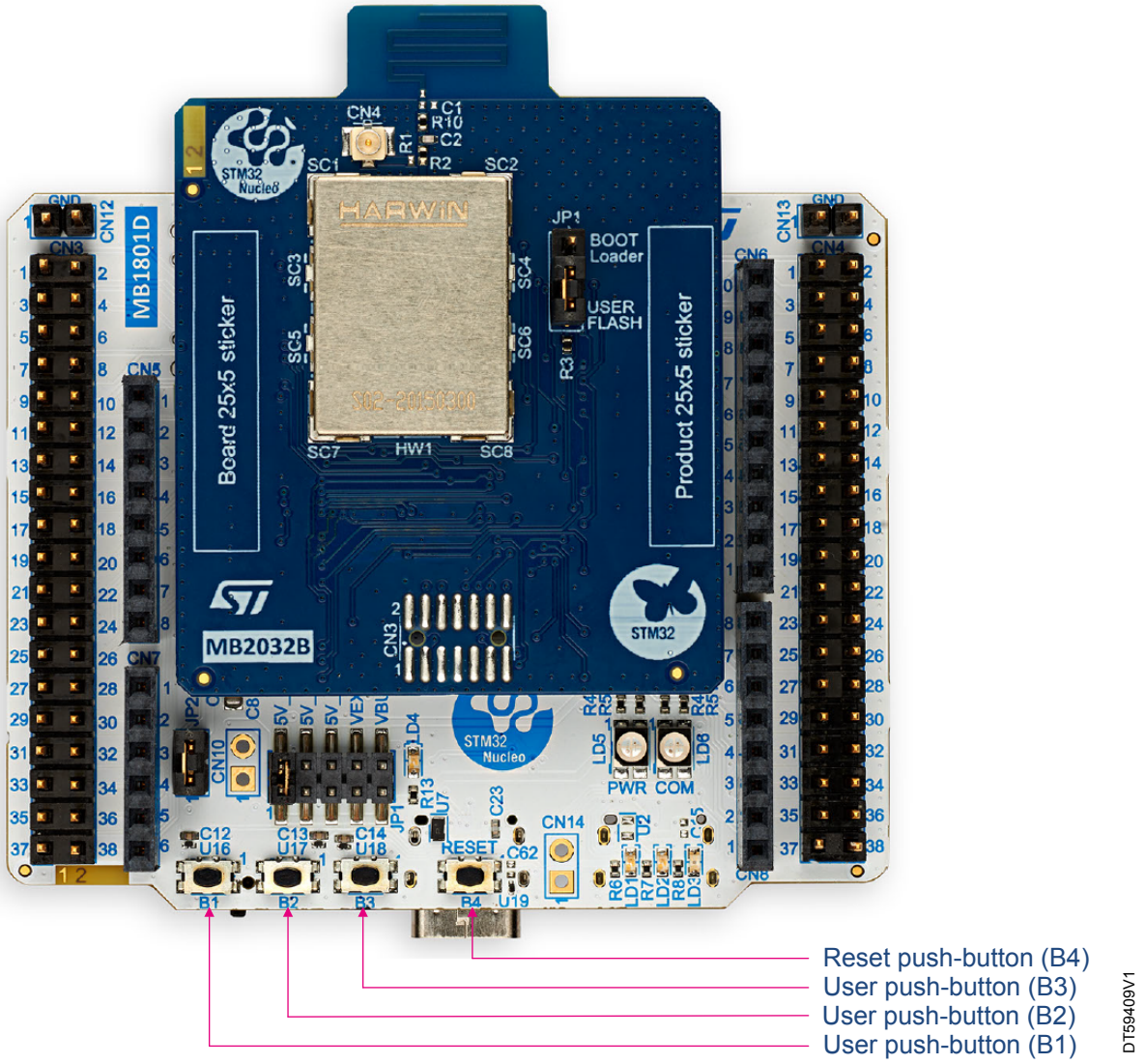
7.6 Push-buttons

7.6.1 Description

NUCLEO-WB09KE provides two types of buttons:

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

Figure 12. Push-button location



7.6.2 Reset push-button

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

7.6.3 User push-buttons

There are three push-buttons available for the user application. They are connected to PA0, PB5, and PB14. It is possible to use them with GPIO reading or to wake up the device (only B1).

Note that PA0 is also connected to the ARDUINO® and ST morpho connectors as a GPIO, depending on the use case that can generate conflict with B1. In this case, it is possible to remove the connection of B1 (SB2 OFF on the MB1801 mezzanine board).

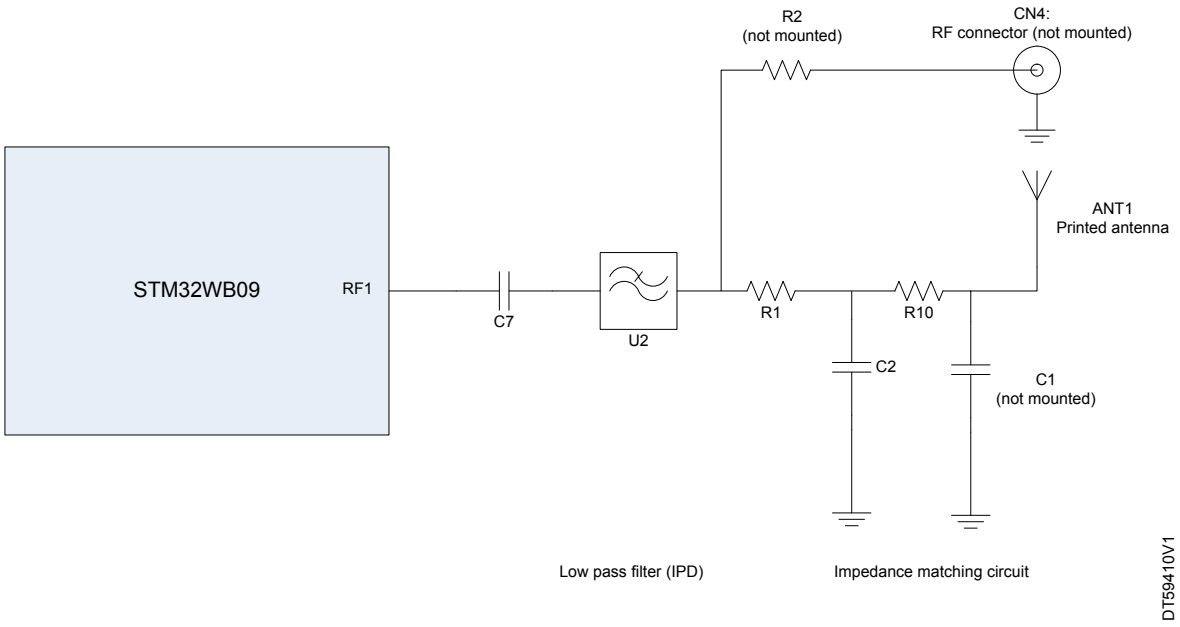
Table 7. I/O configuration for the physical user interface

Name	I/O	Wake-up available
USER1 push button (B1).	PA0	WKUP1
USER2 push button (B2)	PB5	WKUP2
USER3 push button (B3)	PB14	WKUP3

7.7 RF I/O stage

The RF output stage is configured by default to use a PCB antenna. The components ahead of the antenna are used for two functions: low-pass filtering of the signal and matching the impedance of the circuit and the antenna.

Figure 13. RF I/O stage



The component U2 is an IPD (integrated passive device) designed with an integrated harmonic filter to facilitate compliance with EMC regulations.

C1, C2, and R10 provide impedance matching between U2 and PCB antenna.

R1 and R2 provide the possibility to switch between the antenna or an RF connector CN4 (not mounted by default).

7.8 ARDUINO® connectors

7.8.1 Description

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

7.8.2 ARDUINO® interface and pinout

Figure 14 shows the position of the ARDUINO® shield when it is plugged into NUCLEO-WB09KE with the pinout. The pinout shown in Figure 14 corresponds to standard ARDUINO® naming. To see the correspondence with the STM32, refer to Table 8.

Figure 14. ARDUINO® Uno connectors and shield location

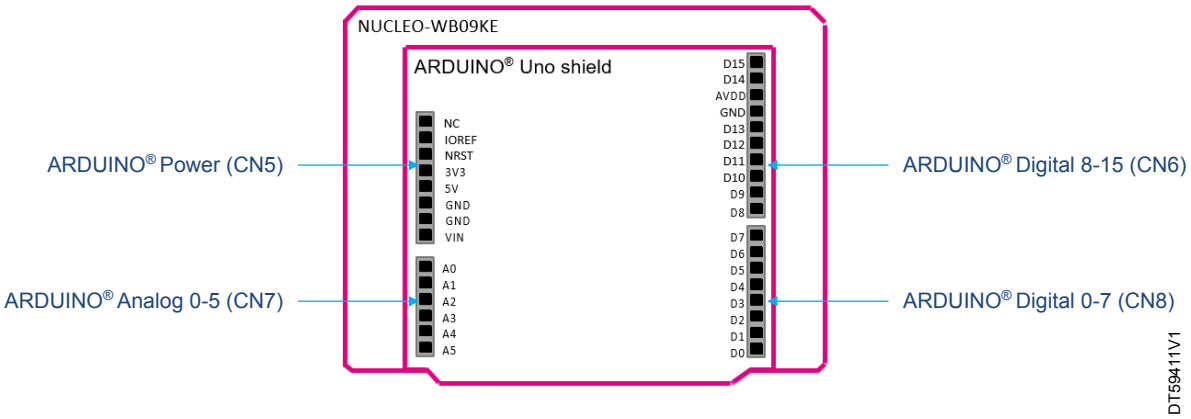


Table 8. Pinout of the ARDUINO® connectors

Connector	Pin number	Signal name	STM32 port	GPIO	Comment
CN5	1	NC	-	NA	NC (reserved for tests)
	2	IOREF	V_TARGET	NA	IOREF = 3V3 by default
	3	NRST	NRST	NA	NRST
	4	3V3	-	NA	3V3
	5	5V	-	NA	5V
	6	GND	-	NA	GND
	7	GND	-	NA	GND
	8	VIN	-	NA	External supply input (+12 V)
CN7	1	A0	PB3	GPIO11	Not connected by default (SB15 OFF)
	2	A1	PB2	GPIO12	Not connected by default (SB13 OFF)
	3	A2	PB1	GPIO17	Not connected by default (SB10 OFF)
	4	A3	PB0	GPIO18	Not connected by default (SB8 OFF)
	5	A4	PB5	GPIO21	Not connected by default (SB21 OFF)
	6	A5	PB4	GPIO22	Not connected by default (SB18 OFF)
CN6	1	ARD_D15	PB6	GPIO28	I2C1_SCL (SB32 ON)
	2	ARD_D14	PB7	GPIO29	I2C1_SDA (SB34 ON)
	3	VDDA	NA	NA	-
	4	GND	GND	GND	-
	5	ARD_D13	PB3	GPIO31	SPI3_SCK (SB14 ON)
	6	ARD_D12	PA8	GPIO33	SPI3_MISO (SB41 ON)
	7	ARD_D11	PA11	GPIO34	SPI3_MOSI (SB43 ON)
	8	ARD_D10	PA9	GPIO37	SPI3_NSS (SB47 ON)
	9	ARD_D9	PA0	GPIO39	Not connected by default (SB12 OFF)
	10	ARD_D8	PB15	GPIO41	PB15
CN8	1	ARD_D7	PA8	GPIO42	Not connected by default (SB39 OFF)
	2	ARD_D6	PB6	GPIO44	Not connected by default (SB40 OFF)
	3	ARD_D5	PB7	GPIO47	Not connected by default (SB42 OFF)
	4	ARD_D4	PA11	GPIO49	Not connected by default (SB44 OFF)
	5	ARD_D3	PB3	GPIO50	Not connected by default (SB24 OFF)
	6	ARD_D2	PB14	GPIO52	Not connected by default (SB36 OFF)
	7	ARD_D1	PB4	GPIO54	Not connected by default (SB29 OFF)
	8	ARD_D0	PB5	GPIO55	Not connected by default (SB31 OFF)

Note: In this table, solder bridge references (SBxx) are those of the MB2032 MCU RF board.

7.8.3 Operating voltage

The ARDUINO® Uno V3 connectors support 5 V, 3.3 V, and VDD for I/O compatibility.

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

Caution: If STM32WB09KE is supplied using CN10 (VEXT), great care must be taken with the settings of SB22 and SW1. If SB22 is mounted and SW1 set to [2-3], STM32WB09KE is then **directly supplied by VEXT**, with destructive damages if VEXT is above 3.3 V.

Furthermore, if it is necessary to supply the Nucleo board by the ARDUINO® connector, a dedicated pin is available. VIN allows supplying the board directly. To use this feature, refer to Section 7.1.2: 7 to 12 V power supply.

7.9 ST morpho interface and pinout

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.

Figure 15. ST morpho connectors

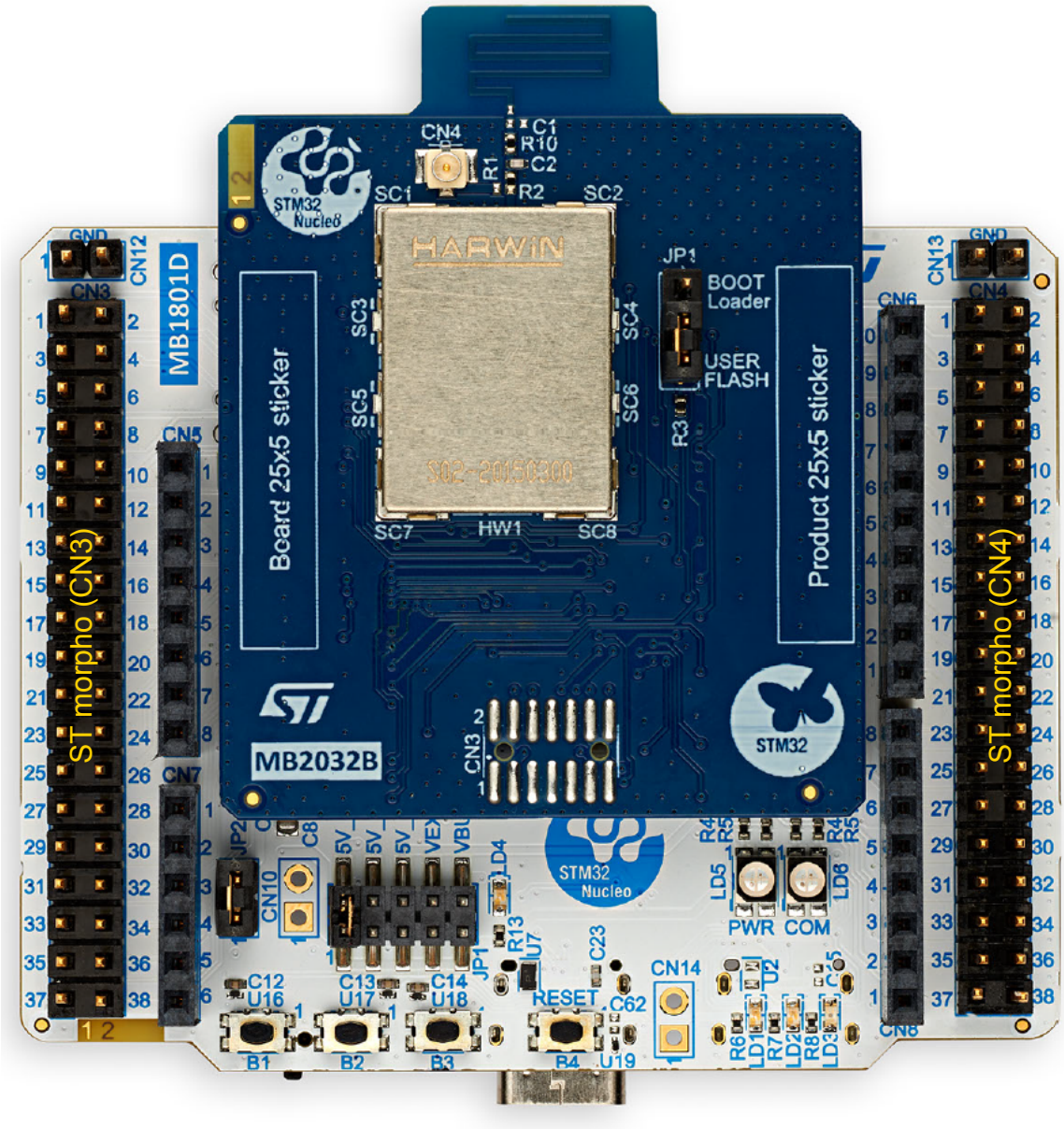


Table 9. Pinout of the ST morpho connector (CN3)

CN	Main function	STM32WB09 pin name	GPIO	Pin number		GPIO	ARDUINO	STM32WB09 pin name	Main function
CN3	-	-	GPIO0	1	2	GPIO2	-	PB0[1]	LPUART_RTS
	-	-	GPIO1	3	4	GPIO4	-	-	-
	-	-	VDD	5	6	5V	-	-	-
	BOOT0	PA10	GPIO3	7	8	GND	-	-	-
	T_SWDIO	PA2	GPIO5	9	10	5V INT	-	-	-
	T_SWDCLK	PA3	GPIO6	11	12	V_TARGET	IOREF	-	-
	-	-	GPIO8	13	14	NRST	NRST	NRST	RESET
	-	-	GPIO9	15	16	3V3	3V3	-	-
	-	-	GPIO10	17	18	5V	5V	-	-
	-	-	GND	19	20	GND	GND	-	-
	-	-	GPIO13	21	22	GND	GND	-	-
	LED2	PB4	GPIO14	23	24	VIN	VIN	-	-
	OSC32_IN	PB12	GPIO15	25	26	GPIO7	-	-	-
	OSC32_OUT	PB13	GPIO16	27	28	GPIO11	A0	PA0[1] - PB3[1]	T_VCP_CTS
	OSC_IN	-	GPIO19	29	30	GPIO12	A1	PA1[1] - PB2[1]	-
	OSC_OUT	-	GPIO20	31	32	GPIO17	A2	PB2[1] - PA3[1]	T_VCP_RTS
	-	-	VBAT	33	34	GPIO18	A3	PA2[1] - PB0[1]	-
	T_VCP_RX	PB0 - PA8[1]	GPIO23	35	36	GPIO21	A4	PB5[1]	-
	T_VCP_TX	PA1 - PA9[1]	GPIO24	37	38	GPIO22	A5	PA0[1] - PB4[1]	-

Table 10. Pinout of the ST morpho connector (CN4)

CN	Main function	STM32WB09 pin name	ARDUINO	GPIO	Pin number		GPIO	STM32WB09 pin name	Main function
CN4	-	-	-	GPIO26	1	2	GPIO25	-	-
	I2C_SCL	PB6	D15	GPIO28	3	4	GPIO27	-	-
	I2C_SDA	PB7	D14	GPIO29	5	6	GPIO30	PB1	LED1
	-	-	AVDD	VDD	7	8	5V	-	-
	-	-	GND	GND	9	10	GPIO32	-	-
	SPI_SCK	PB3	D13	GPIO31	11	12	GPIO35	-	-
	SPI_MISO	PA8	D12	GPIO33	13	14	GPIO36	-	-
	SPI_MOSI	PA11 - PB1(1)	D11	GPIO34	15	16	GPIO38	PA10(1)	LPUART_CTS
	SPI_NSS	PA9	D10	GPIO37	17	18	GPIO40	-	-
	-	PB14 - PA0(1)	D9	GPIO39	19	20	GND	-	-
	-	PB15	D8	GPIO41	21	22	GPIO43	-	-
	-	PA8(1)	D7	GPIO42	23	24	GPIO45	-	-
	-	PB6(1)	D6	GPIO44	25	26	GPIO46	PA10(1)	LPUART_CTS
	-	PB7(1)	D5	GPIO47	27	28	GPIO48	-	-
	-	PA11(1)	D4	GPIO49	29	30	GPIO51	PB5	BUTTON2
	-	PB3(1)	D3	GPIO50	31	32	GND	-	-
	-	PB14(1)	D2	GPIO52	33	34	GPIO53	PB14	BUTTON3
	LPUART_TX	PB4(1) - PB6(1)	D1	GPIO54	35	36	GPIO56	PA0	BUTTON1
	LPUART_RX	PB5(1) - PB7(1)	D0	GPIO55	37	38	GPIO57	PB2	LED3

1. *Optional, need to change the state of solder bridges.*

7.10 MCU RF board interface and pinout

The MCU RF board connectors (CN1 and CN2) are accessible on the bottom side of the board. They are used to plug the MCU RF board into the mezzanine board.

Figure 16. Pinout of the MCU RF board connectors

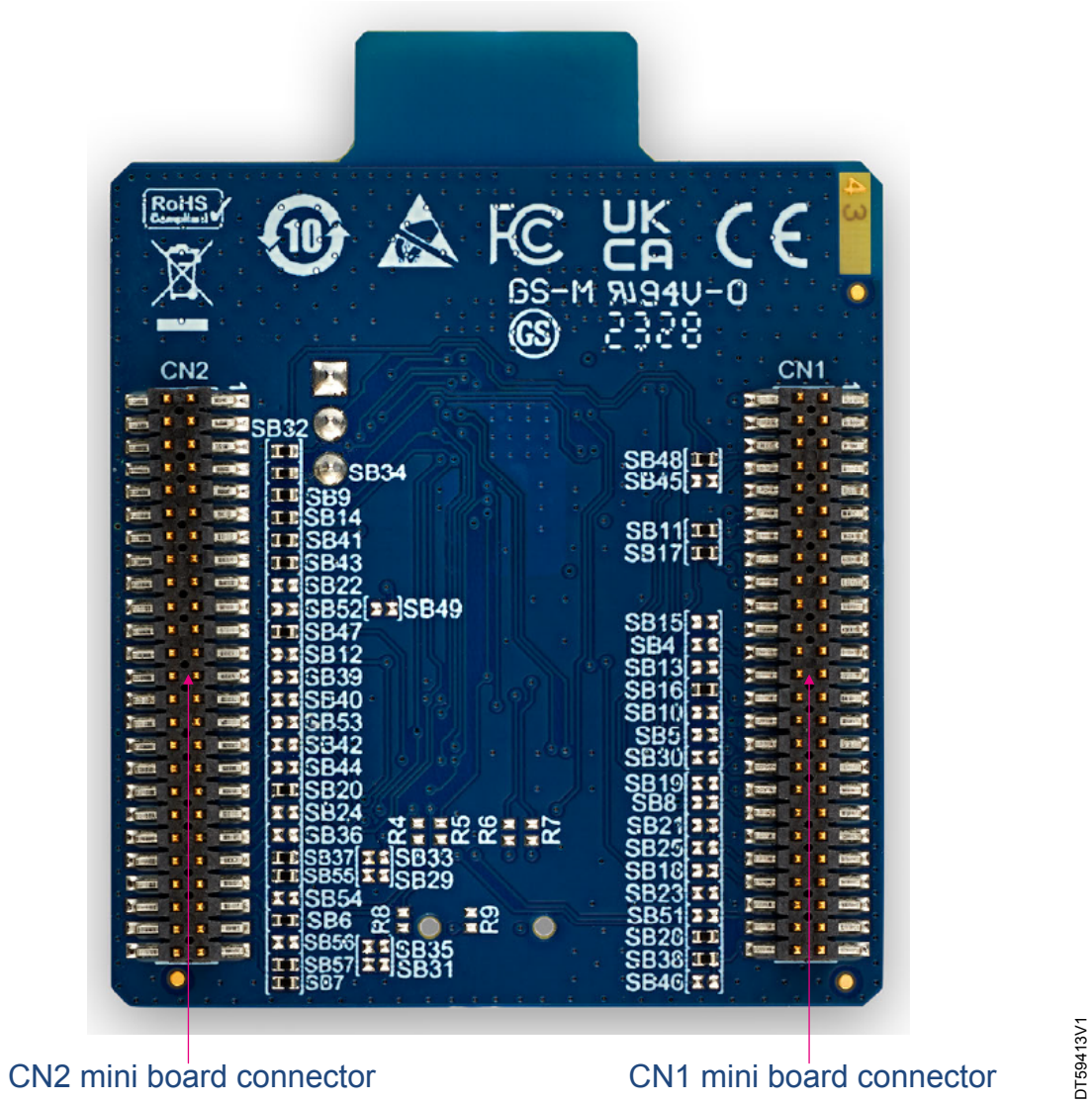


Table 11. Pinout of the MCU RF board connectors

CN1				CN2			
Pin number	STM32WB09KE pin name	Pin number	STM32WB09KE pin name	Pin number	STM32WB09KE pin name	Pin number	STM32WB09KE pin name
1	GND	2	VDDRF	1	NC	2	GND
3	NC	4	NC	3	NC	4	NC
5	NC	6	GND	5	NC	6	NC

CN1				CN2			
Pin number	STM32WB09KE pin name	Pin number	STM32WB09KE pin name	Pin number	STM32WB09KE pin name	Pin number	STM32WB09KE pin name
7	GND	8	PB0[1] (LPUART_RTS)	7	PB6 (I2C1_SCL)	8	GND
9	BOOT0	10	NC	9	PB7 (I2C1_SDA)	10	PB1
11	VDD2	12	NRST	11	PB3 (SPI3_SCK)	12	NC
13	PA2 (T_SWDIO)	14	GND	13	PA8 (SPI3_MISO)	14	GND
15	PA3 (T_SWCLK)	16	NC	15	PA11–PB1[1] (SPI3_MOSI)	16	NC
17	GND	18	VFBSD[1]	17	NC	18	NC
19	NC	20	NC	19	NC	20	GND
21	NC	22	GND	21	PA9 (SPI3_NSS)	22	PA10[1]
23	NC	24	PA0[1] - PB3[1] (ARD_A0)	23	PA0[1]	24	NC
25	GND	26	PA1[1] - PB2[1] (ARD_A1)	25	PB15	26	GND
27	NC	28	GND	27	PA8[1]	28	NC
29	PB4 (LD2)	30	VDD1	29	PB6[1]	30	NC
31	GND	32	VDDSD	31	NC	32	GND
33	PB13 (OSC32_IN)	34	GND	33	NC	34	PA10
35	PB12 (OSC32_OUT)	36	PB2[1] - PA3[1] (ARD_A2)	35	PB7[1]	36	NC
37	GND	38	PA2[1] - PB0[1] (ARD_A3)	37	PA11[1]	38	GND
39	NC	40	GND	39	PB3[1]	40	PB5
41	NC	42	PB5 (ARD_A4)	41	PB14[1]	42	PB14
43	NC	44	PA0[1] - PB4[1] (ARD_A5)	43	PB4[1] - PB6[1] - PA9[1] - PA1	44	GND
45	PB0 (T_VCP_RX)	46	GND	45	PB7[1] - PB5[1] - PA8[1] - PB0	46	PA0
47	PA1 (T_VCP_TX)	48	NC	47	NC	48	PB2
49	GND	50	NC	49	NC	50	GND

1. *Optional, need to change the state of solder bridges.*

7.11 Solder bridge configuration and purpose

MB1801 has 33 solder bridges and MB2032 has 57 solder bridges. They allow an important number of configurations. Table 12 describes them for MB1801 and Table 13 for MB2032. Bolded rows indicate the default configuration.

Table 12. Solder bridges for MB1801

MB1801			
SB number	**Value**	**Purpose**	**Mutual exclusivity**
1	**ON**	**This connects the VDD supply domain to VDDA and the CN11 connector (not mounted). Never apply a power source on CN11 (risk of conflict with other power sources and destructive damage if the voltage is too high).**	None
	OFF	The VDD supply domain is disconnected from the VDDA and CN11 connector (not mounted). AVDD provided by the ST morpho, ARDUINO®, or CN11 connectors (**unrecommended configuration**).	
2	**ON**	**Button 1 (USER1) is connected to STM32WB09 (PA0) through pin 46 of mini board connector CN2.**	None
	OFF	Button 1 (USER1) is not connected to STM32WB09 (PA0) through pin 46 of mini board connector CN2 and has no effect.	
3	**ON**	**Connects the VCP1_T_TX signal from STDC14 pin 14 and from STLINK V3EC to STM32WB09 (PA1) through CN1 pin 47. (1)Note that STCD14 is not mounted.**	None
	OFF	VCP1_T_TX signal from STDC14 pin 14 to CN1 pin 47 is not connected and has no impact on STM32WB09.	
4	**ON**	**Button 2 (USER2) is connected to STM32WB09 (PB5) through pin 40 of mini board connector CN2. (1)**	None
	OFF	Button 2 (USER2) is not connected to STM32WB09 (PB5) through pin 40 of mini board connector CN2 and has no effect.	
5	**ON**	**Connects the VCP1_T_RX signal from STDC14 pin 13 and from STLINK V3EC to STM32WB09 (PB0) through CN1 pin 45. (1) Note that STCD14 is not mounted.**	None
	OFF	VCP1_T_RX signal from STDC14 pin 13 to CN1 pin 45 is not connected and does not affect STM32WB09KE.	
6	**ON**	**Button 3 (USER3) is connected to STM32WB09 (PB14) through pin 42 of mini board connector CN2. (1)**	None
	OFF	Button 3 (USER3) is not connected to STM32WB09KE (PB14) pin 42 of mini board connector CN2, and has no effect.	
7	**ON**	**Connects the VCP2_T_RX signal from STM32F7 (U5 - UART) to CN2 pin 45.**	None
	OFF	VCP2_T_RX signal from STM32F7 (U5 - UART) to CN2 pin 45 is not connected.	
8	**ON**	**Connects the VCP2_T_TX signal from STM32F7 (U5 - UART) to CN2 pin 43.**	None
	OFF	VCP2_T_TX signal from STM32F7 (U5 - UART) to CN2 pin 43 is not connected.	
9	**ON**	**LED 1 (LD1) is connected to STM32WB09 (PB1) through pin 10 of mini board connector CN2. (1)**	None
	OFF	LED 1 (LD1) is not connected to STM32WB09 (PB1) through pin 10 of the mini board connector CN2 and STM32WB09 cannot drive it.	
10	**ON**	**LED 2 (LD2) is connected to STM32WB09 (PB4) through pin 29 of mini board connector CN1. (1)**	None

MB1801			
SB number	**Value**	**Purpose**	**Mutual exclusivity**
10	OFF	LED 2 (LD2) is not connected to STM32WB09 (PB4) through pin 29 of mini board connector CN1 and STM32WB09 cannot drive it.	None
11	**ON**	**LED 3 (LD3) is connected to STM32WB09 (PB2) through pin 48 of mini board connector CN2.** (1)	None
	OFF	LED 3 (LD3) is not connected to STM32WB09 (PB2) through pin 48 of the mini board connector CN2 and STM32WB09 cannot drive it.	
12	ON	JTDO signal for JTAG use. It connects STM32F7 (U5) to the ST morpho connector (CN4 pin 10) and mini board connector (CN2 pin 12). (1)	None
	OFF	The **STM32F7 (U5) JTAG JTDO signal is not connected to the ST morpho connector (CN4 pin 10) and mini board connector (CN2 pin 12).**	
13	ON	JTDO signal for JTAG use. It connects STM32F7 (U5) to the ST morpho connector (CN4 pin 16) and mini board connector (CN2 pin 22). (1) If ON SB24 must be OFF.	SB24
	OFF	**The STM32F7 (U5) JTAG JTDO signal is not connected to the ST morpho connector (CN4 pin 16) and to the mini board connector (CN2 pin 22).**	
14	ON	USB Type-C® connector (CN9) is connected to the ST morpho connector (CN4 pin 14) and mini board connector (CN2 pin 18). Note that the corresponding pin on the MB2032 connector is not connected, and CN9 is not mounted, so this configuration is useless.	None
	OFF	**USB Type-C® connector (CN9) is not connected to the ST morpho connector or the mini board connector.**	
15	**ON**	**Connection of SWD bus - clock signal. It is connected to CN3 pin 11 (ST morpho) and CN1 pin 15 (mini board connector). Il allows the debug and the firmware load of the target (STM32WB09).**	None
	OFF	The SWD bus is not connected to STM32WB09. Firmware download using the SWD bus is not possible.	
16	ON	The USB Type-C® connector (CN9) is connected to the ST morpho connector (CN4 pin 12) and mini board connector (CN2 pin 16). Note that the corresponding pin on the MB2032 connector is not connected, and CN9 is not mounted, so this configuration is useless.	None
	OFF	**The USB Type-C® connector (CN9) is not connected to the ST morpho connector or the mini board connector.**	
17	**ON**	**Connection of the SWD bus - clock signal. It is connected to the CN3 (ST morpho) pin 9 and pin 13 of CN1 (mini board connector). Il allows the debug and the firmware load of the target (STM32WB09).**	None
	OFF	The SWD bus is not connected to STM32WB09. Firmware download using the SWD bus is not possible.	
18	**ON**	**LEDs LD1, LD2, and LD3 are supplied by V_Target. Refer to Figure 7. STM32WB09KE power tree. Beware: SB19 must be OFF.**	SB19
	OFF	LEDs LD1, LD2, and LD3 are not supplied by V_Target. Refer to Figure 7. STM32WB09KE power tree.	
19	ON	LEDs LD1, LD2, and LD3 are supplied by 3V3. Refer to Figure 7. STM32WB09KE power tree. Beware: SB18 must be OFF.	SB18
	OFF	**LEDs LD1, LD2, and LD3 are not supplied by 3V3. Refer to Figure 7. STM32WB09KE power tree.**	

MB1801			
SB number	**Value**	**Purpose**	**Mutual exclusivity**
20	ON	VEXT is provided by VIN from ARDUINO® (CN5 pin 8-12 V) or ST morpho connector (CN3 pin 24) and is possibly distributed to JP1 (position [7-8] through SB21) and SW1 (position [2-3] through SB22). SB33 must be OFF (risk of conflict with 5 V). **Be very careful with this configuration, as 12 V might be directly injected into the MCU, generating destructive damage! This configuration is not recommended.** Refer to Figure 7. STM32WB09KE power tree.	None
	OFF	**VEXT is not connected to VIN. Through SB33, it is connected to 5V_EXT and is possibly distributed to JP1 (position [7-8] through SB21) and SW1 (position [2-3] through SB22). This is why it is highly recommended to keep SB22 OFF and more globally to keep the default configuration of SB20, SB21, SB22, and SB33.**	
21	**ON**	**Supply of the system using VEXT or 5V_EXT. It is connected to LDO U4, setting JP1 to the [7-8] position.**	None
	OFF	System cannot be supplied using VEXT or 5V_EXT.	
22	ON	STM32WB09 can be directly supplied using VEXT or 5V_EXT (provided by pin 6 of the CN3 ST morpho connector) when SB22 is ON and SW1 is in [2-3] position. Be very careful with this setting as it can inject a destructive power supply in STM32WB09. **It is highly recommended not to use it**.	None
	OFF	**STM32WB09 cannot be directly supplied using VEXT or 5V_EXT.**	
23	ON	Connects the VCP2_T_RTS signal from STM32F7 (U5) to CN1 pin 8.	SB26
	OFF	**VCP2_T_RTS signal from STM32F7 (U5) to CN1 pin 8 is not connected.**	
24	ON	Connects the VCP2_T_CTS signal from STM32F7 (U5) to CN2 pin 22.	SB13 - SB25 - SB27
	OFF	**VCP2_T_CTS signal from STM32F7 (U5) to CN2 pin 22 is not connected.**	
25	ON	Connects the VCP2_T_CTS signal from STM32F7 (U5) to CN2 pin 34 (GPIO46).	SB24 - SB27
	OFF	**The VCP2_T_CTS signal from STM32F7 (U5) to CN2 pin 34 (GPIO46) is not connected.**	
26	ON	Connects the VCP2_T_RTS signal from STM32F7 (U5) to CN1 pin 36 (GPIO17).	SB23
	OFF	**The VCP2_T_RTS signal from STM32F7 (U5) to CN1 pin 36 (GPIO17) is not connected.**	
27	ON	Connects the VCP2_T_CTS signal from STM32F7 (U5) to CN1 pin 24 (GPIO11).	SB24 - SB25
	OFF	**The VCP2_T_CTS signal from STM32F7 (U5) to CN1 pin 24 (GPIO11) is not connected.**	
28	ON	STM32F7 (U5) provides the BOOT0 signal to the target (mini board connector CN1 pin 9) and ST morpho connector (CN3 pin 7).	None
	OFF	The BOOT0 signal is disconnected from STM32F7 (U5) which therefore cannot provide the BOOT0 signal to the target and ST morpho connector.	
29	**ON**	**The push-button B4 provides the reset signal to STM32F7 (U5).**	None
	OFF	The push-button B4 cannot provide the reset signal to STM32F7 (U5).	

MB1801			
SB number	**Value**	**Purpose**	**Mutual exclusivity**
30	ON	The push-button B4 provides the reset signal to the ST morpho connector (CN3 pin 14).	None
	OFF	**The push-button B4 cannot provide the reset signal to the ST morpho connector (CN3 pin 14).**	
33	**ON**	**This permits the supply of the system using the 5V_EXT voltage provided by pin 6 of the CN3 ST morpho connector.**	None
	OFF	The 5V_EXT voltage provided by pin 6 of the CN3 ST morpho connector cannot be used to supply the system.	

1. *Depending on the solder bridge configuration of the MB2032. Refer to Table 13 below.*

Table 13. Solder bridges for MB2032

MB2032			
SB number	**Value**	**Purpose**	**Mutual exclusivity**
1	ON	The 32,768 kHz frequency is provided by an external crystal.	None
	OFF	**The 32,768 kHz frequency is not provided by an external crystal.**	
2	ON	The 32,768 kHz frequency is provided by an external crystal.	None
	OFF	**The 32,768 kHz frequency is not provided by an external crystal.**	
3	ON	STM32WB09 is supplied by an external VDD voltage supply (3.3 V).	None
	OFF	**STM32WB09 is supplied by internal SMPS.**	
4	ON	T_VCP_CTS is connected from CN1 pin 24 to PA0 pin of STM32WB09. **Be sure to leave** SB6, SB12, and SB23 OFF.	SB6, SB12, SB23
	OFF	**T_VCP_CTS is not connected from CN1 pin 24 to PA0 pin of STM32WB09.**	
5	ON	T_VCP_RTS is connected from CN1 pin 36 to the PB2 pin of STM32WB09. Be sure to leave SB7 and SB13 OFF.	SB5, SB7, SB13
	OFF	**T_VCP_RTS is not connected from CN1 pin 36 to the PB2 pin of STM32WB09.**	
6	**ON**	**Button 1 (USER1) is connected from CN2 pin 46 to PA0 pin of STM32WB09. Be sure to leave SB4, SB12, and SB23 OFF.**	SB4, SB12, SB23
	OFF	Button 1 (USER1) is not connected from pin 46 of mini board connector CN2 to STM32WB09 (PA0).	
7	**ON**	**LED3 is connected from CN2 pin 48 to the PB2 pin of STM32WB09. Be sure to leave SB5 and SB13 OFF.**	SB5, SB7, SB13
	OFF	LED3 is not connected from CN2 pin 48 to the PB2 pin of STM32WB09.	
8	ON	ADC3 is connected from CN1 pin 38 to the PB0 pin of STM32WB09. Be sure to leave SB28 and SB45 OFF.	SB8, SB28, SB45
	OFF	**ADC3 is not connected from CN1 pin 38 to the PB0 pin of STM32WB09.**	
9	**ON**	**LED1 is connected from CN2 pin 10 to the PB1 pin of STM32WB09. Be sure to leave SB10 and SB22 OFF.**	SB9, SB10, SB22
	OFF	LED1 is not connected from CN2 pin 10 to the PB1 pin of STM32WB09.	
10	ON	ADC2 is connected from CN1 pin 36 to the PB1 pin of STM32WB09. Be sure to leave SB9 and SB22 OFF.	SB9, SB10, SB22

MB2032			
SB number	**Value**	**Purpose**	**Mutual exclusivity**
10	**OFF**	**ADC2 is not connected from CN1 pin 36 to the PB1 pin of STM32WB09.**	SB9, SB10, SB22
11	**ON**	**T_SWDIO is connected from CN1 pin 13 to the PA2 pin of STM32WB09. Be sure to leave SB19 OFF.**	SB19
	OFF	T_SWDIO is not connected from CN1 pin 13 to the PA2 pin of STM32WB09.	
12	ON	TIM2_CH3 is connected from CN2 pin 23 to PA0 pin of STM32WB09. Be sure to leave SB4, SB6, and SB23 OFF.	SB4, SB6, SB23
	OFF	**TIM2_CH3 is not connected from CN2 pin 23 to PA0 pin of STM32WB09.**	
13	ON	ADC1 is connected from CN1 pin 26 to the PB2 pin of STM32WB09. Be sure to leave SB7 and SB13 OFF.	SB5, SB7, SB13
	OFF	**ADC1 is not connected from CN1 pin 26 to the PB2 pin of STM32WB09.**	
14	**ON**	**SPI3_SCK is connected from CN2 pin 11 to the PB3 pin of STM32WB09. Be sure to leave SB15 and SB24 OFF.**	SB14, SB15, SB24
	OFF	SPI3_SCK is not connected from CN2 pin 11 to the PB3 pin of STM32WB09.	
15	ON	ADC0 is connected from CN1 pin 24 to the PB3 pin of STM32WB09. Be sure to leave SB14 and SB24 OFF.	SB14, SB15, SB24
	OFF	**ADC0 is not connected from CN1 pin 24 to the PB3 pin of STM32WB09.**	
16	**ON**	**LED2 is connected from CN1 pin 29 to the PB4 pin of STM32WB09. Be sure to leave SB18 and SB29 OFF.**	SB16, SB18, SB29
	OFF	LED2 is not connected from CN1 pin 29 to the PB4 pin of STM32WB09.	
17	**ON**	**T_SWCLK is connected from CN1 pin 15 to the PA3 pin of STM32WB09. Be sure to leave SB30 OFF.**	SB30
	OFF	T_SWCLK is not connected from CN1 pin 15 to the PA3 pin of STM32WB09.	
18	ON	ADC5 is connected from CN 1 pin 44 to the PB4 pin of STM32WB09. Be sure to leave SB16 and SB29 OFF.	SB16, SB18, SB29
	OFF	**ADC5 is not connected from CN 1 pin 44 to the PB4 pin of STM32WB09.**	
19	ON	ADC3 is connected from CN1 pin 38 to the PA2 pin of STM32WB09. Be sure to leave SB11 OFF.	SB11
	OFF	**ADC3 is not connected from CN1 pin 38 to the PA2 pin of STM32WB09.**	
20	**ON**	**Button 2 (USER2) is connected from CN2 pin 40 to the PB5 pin of STM32WB09. Be sure to leave SB21 and SB31 OFF.**	SB20, SB21, SB31
	OFF	Button 2 (USER2) is not connected from CN2 pin 40 to the PB5 pin of STM32WB09.	
21	ON	ADC4 is connected from CN 1 pin 42 to the PB5 pin of STM32WB09. Be sure to leave SB20 and SB31 OFF.	SB20, SB21, SB31
	OFF	**ADC4 is connected from CN 1 pin 42 to the PB5 pin of STM32WB09.**	
22	ON	TIM16_CH1N is connected from CN2 pin 15 to the PB1 pin of STM32WB09. Be sure to leave SB9 and SB10 OFF.	SB9, SB10, SB22
	OFF	**TIM16_CH1N is not connected from CN2 pin 15 to the PB1 pin of STM32WB09.**	

MB2032			
SB number	**Value**	**Purpose**	**Mutual exclusivity**
23	ON	I2C1_SCL is connected from CN1 pin 44 to PA0 pin of STM32WB09. Be sure to leave SB4, SB6, and SB12 OFF.	SB4, SB6, SB12
	OFF	**I2C1_SCL is not connected from CN1 pin 24 to PA0 pin of STM32WB09.**	
24	ON	TIM2_CH4 is connected from CN2 pin 39 to the PB3 pin of STM32WB09. Be sure to leave SB14 and SB15 OFF.	SB14, SB15, SB24
	OFF	**TIM2_CH4 is connected from CN2 pin 39 to the PB3 pin of STM32WB09.**	
25	ON	I2C1_SDA is connected from CN1 pin 42 to PA1 pin of STM32WB09. Be sure to leave SB38 OFF.	SB38
	OFF	**I2C1_SDA is not connected from CN1 pin 42 to PA1 pin of STM32WB09.**	
28	**ON**	**T_VCP_RX is connected from CN1 pin 45 to the PB0 pin of STM32WB09. Be sure to leave SB8 and SB45 OFF.**	SB8, SB28, SB45
	OFF	T_VCP_RX is not connected from CN1 pin 45 to the PB0 pin of STM32WB09.	
29	ON	LPUART_TX is connected to the CN2 pin 43 to the PB4 pin of STM32WB09. Be sure to leave SB16 and SB18 OFF. SB55 must be ON.	SB16, SB18, SB29, SB55
	OFF	**LPUART_TX is not connected to the CN2 pin 43 to the PB4 pin of STM32WB09.**	
30	ON	ADC2 is connected from CN1 pin 36 to the PA3 pin of STM32WB09. Be sure to leave SB17 OFF.	SB17
	OFF	**ADC2 is not connected from CN1 pin 36 to the PA3 pin of STM32WB09.**	
31	ON	LPUART_RX is connected to the CN2 pin 45 to the PB5 pin of STM32WB09. Be sure to leave SB20 and SB21 OFF. SB57 must be ON.	SB20, SB21, SB31, SB57
	OFF	**LPUART_RX is not connected to the CN2 pin 45 to the PB5 pin of STM32WB09.**	
32	**ON**	**I2C1_SCL is connected from CN2 pin 7 to the PB6 pin of STM32WB09. Be sure to leave SB33 and SB40 OFF.**	SB32, SB33, SB40
	OFF	I2C1_SCL is not connected from CN2 pin 7 to the PB6 pin of STM32WB09.	
33	ON	LPUART_TX is connected to the CN2 pin 43 to the PB6 pin of STM32WB09. Be sure to leave SB32 and SB41 OFF. SB55 must be ON.	SB32, SB33, SB41
	OFF	**LPUART_TX is not connected to the CN2 pin 43 to the PB6 pin of STM32WB09.**	
34	**ON**	**I2C1_SDA is connected from CN2 pin 9 to the PB7 pin of STM32WB09. Be sure to leave SB35 and SB42 OFF.**	SB34, SB35, SB42
	OFF	I2C1_SDA is not connected from CN2 pin 9 to the PB7 pin of STM32WB09.	
35	ON	LPUART_RX is connected to the CN2 pin 45 to the PB7 pin of STM32WB09. Be sure to leave SB34 and SB42 OFF. SB57 must be ON.	SB34, SB35, SB42
	OFF	**LPUART_TX is not connected to the CN2 pin 45 to the PB7 pin of STM32WB09.**	
36	ON	ARDUINO® digital 2 (ARD_D2) output is connected from CN2 pin 41 to the PB14 pin of STM32WB09. Be sure to leave SB37 OFF.	SB36, SB37

MB2032			
SB number	**Value**	**Purpose**	**Mutual exclusivity**
36	**OFF**	**ARDUINO® digital 7 (ARD_D2) output is not connected from CN2 pin 41 to the PB14 pin of STM32WB09.**	SB36, SB37
37	**ON**	**Button 3 (USER3) is connected from CN2 pin 42 to the PB14 pin of STM32WB09. Be sure to leave SB36 OFF.**	SB36, SB37
	OFF	Button 3 (USER3) is not connected from CN2 pin 42 to the PB14 pin of STM32WB09.	
38	**ON**	**T_VCP_TX is connected from CN1 pin 47 to PA1 pin of STM32WB09. Be sure to leave SB25 OFF.**	SB25
	OFF	T_VCP_TX is not connected from CN1 pin 47 to PA1 pin of STM32WB09.	
39	ON	ARDUINO® digital 7 (ARD_D7) output is connected from CN2 pin 27 to PA8 pin of STM32WB09. Be sure to leave SB41 and SB51 OFF.	SB39, SB41, SB51
	OFF	**ARDUINO® digital 7 (ARD_D7) output is not connected from CN2 pin 27 to PA8 pin of STM32WB09.**	
40	ON	TIM2_CH1 is connected from CN2 pin 29 to the PB6 pin of STM32WB09. Be sure to leave SB32 and SB33 OFF.	SB32, SB33, SB40
	OFF	**TIM2_CH1 is not connected from CN2 pin 29 to the PB6 pin of STM32WB09.**	
41	**ON**	**SPI3_MISO is connected from CN2 pin 13 to PA8 of STM32WB09. Be sure to leave SB39 and SB51 OFF.**	SB39, SB41, SB51
	OFF	SPI3_MISO is not connected from CN2 pin 13 to PA8 of STM32WB09.	
42	ON	TIM2_CH2 is connected from CN2 pin 35 to the PB7 pin of STM32WB09. Be sure to leave SB34 and SB35 OFF.	SB34, SB35, SB42
	OFF	**TIM2_CH2 is not connected from CN2 pin 35 to the PB6 pin of STM32WB09.**	
43	**ON**	**SPI3_MOSI is connected from CN2 pin 15 to the PA11 pin of STM32WB09. Be sure to leave SB44 OFF.**	SB43, SB44
	OFF	SPI3_MOSI is not connected from CN2 pin 15 to the PA11 pin of STM32WB09.	
44	ON	ARDUINO® digital 4 (ARD_D4) output is connected from CN2 pin 37 to PA11 pin of STM32WB09. Be sure to leave SB41 and SB51 OFF.	SB43, SB44
	OFF	**ARDUINO® digital 4 (ARD_D4) output is not connected from CN2 pin 37 to PA11 pin of STM32WB09.**	
45	ON	LPUART_RTS is connected from CN1 pin 8 to the PB0 pin of STM32WB09. Be sure to leave SB8 and SB28 OFF.	SB8, SB28, SB45
	OFF	LPUART_RTS is not connected from CN1 pin 8 to the PB0 pin of STM32WB09.	
46	ON	T_VCP_TX is connected from CN1 pin 47 to PA9 pin of STM32WB09. Be sure to leave SB47 OFF.	SB46, SB47
	OFF	**T_VCP_TX is not connected from CN1 pin 47 to PA9 pin of STM32WB09.**	
47	**ON**	**ARDUINO® digital 10 (ARD_D10) output is connected from CN2 pin 21 to PA9 pin of STM32WB09. This signal supports SPI3_NSS and TIM17_CH1. Be sure to leave SB46 OFF.**	SB46, SB47
	OFF	ARDUINO® digital 10 (ARD_D10) output is not connected from CN2 pin 21 to PA9 pin of STM32WB09.	

MB2032			
SB number	**Value**	**Purpose**	**Mutual exclusivity**
48	**ON**	**BOOT0 is connected form CN1 pin 9 to PA10 pin of STM32WB09. Be sure to leave SB49 OFF.**	SB48, SB49
	OFF	BOOT0 is not connected form CN1 pin 9 to PA10 pin of STM32WB09.	
49	ON	LPUART_CTS is connected from CN2 pins 22 and 34 to the PA10 pin of STM32WB09. Be sure to leave SB48 OFF and that SB52 and SB53 are ON.	SB48, SB49, SB52, SB53
	OFF	**LPUART_CTS is not connected from CN2 pins 22 and 34 to the PA10 pin of STM32WB09.**	
51	ON	T_VCP_RX is connected from CN1 pin 45 to PA8 pin of STM32WB09. Be sure to leave SB39 and SB41 OFF.	SB39, SB41, SB51
	OFF	**T_VCP_RX is not connected from CN1 pin 45 to PA8 pin of STM32WB09.**	
52	ON	CN2 pin 22 is connected to the LPUART_CTS signal. Note that SB49 must also be ON.	SB49, SB52, SB53
	OFF	**CN2 pin 22 is not connected to the LPUART_CTS signal.**	
53	ON	CN2 pin 34 is connected to the LPUART_CTS signal. Note that SB49 must also be ON.	SB49, SB52, SB53
	OFF	**CN2 pin 34 is not connected to the LPUART_CTS signal.**	
54	ON	T_VCP_TX is connected to CN2 pin 43. Be sure to leave SB54 OFF.	SB54, SB55
	OFF	**T_VCP_TX is not connected to CN2 pin 43.**	
55	**ON**	**LPUART_TX is connected to CN2 pin 43. Be sure to leave SB55 OFF.**	SB54, SB55
	OFF	LPUART_TX is not connected to CN2 pin 43.	
56	ON	T_VCP_RX is connected to CN2 pin 45. Be sure to leave SB57 OFF.	SB56, SB57
	OFF	**T_VCP_RX is not connected to CN2 pin 45.**	
57	**ON**	**LPUART_RX is connected to CN2 pin 45. Be sure to leave SB56 OFF.**	SB56, SB57
	OFF	LPUART_RX is not connected to CN2 pin 45.	

7.12 Boot control

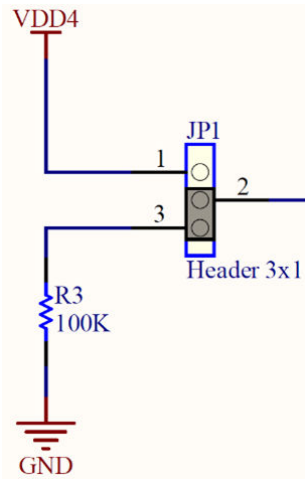
STM32WB09KE has a preprogrammed bootloader supporting the UART protocol with automatic baud rate detection. The main features of the embedded bootloader are:

- Auto baud rate detection up to 1 Mbps
- Flash mass erase, section erase
- Flash programming
- Flash readout protection enable or disable

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

The jumper JP1 activates the bootloader by forcing PA10 high during hardware reset, otherwise, the application residing in flash memory is launched.

Figure 17. JP1 (MB2032 board) default setting



Jumper connects 2 and 3: The application residing in flash memory is launched (default position)

Jumper connects 2 and 1: The bootloader is activated and the user can download a new application.

Note:

Note: With the `BLE_p2pserver` demo programmed in the NUCLEO-WB09KE, the low-power mode is enabled to offer the best low-power performances. Therefore, on STM32WB09KE, the SWD lines are OFF and the tool cannot connect with the device anymore.
To reconnect or reprogram the Nucleo board, it is necessary to enter the Bootloader mode. To do this, the JP1 jumper on the MB2032 MCU RF board must connect 2 and 1.

8 NUCLEO-WB09KE product information

8.1 Product marking

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

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

  Product order code
  Product identification

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

  MBxxxx-Variant-yzz
  syywwxxxxx

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

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

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

"ES" or *"E"* marking examples of location:

- On the targeted STM32 that is soldered on the board (for an illustration of STM32 marking, refer to the STM32 datasheet *Package information* paragraph at the *www.st.com* website).
- Next to the evaluation tool ordering part number that is stuck, or silk-screen printed on the board.

Some boards feature a specific STM32 device version, which allows the operation of any bundled commercial stack/library available. This STM32 device shows a *"U"* marking option at the end of the standard part number and is not available for sales.

To use the same commercial stack in their applications, the developers might need to purchase a part number specific to this stack/library. The price of those part numbers includes the stack/library royalties.

8.2 NUCLEO-WB09KE product history

Table 14. Product history

Order code	Product identification	Product details	Product change description	Product limitations
NUCLEO-WB09KE	NUWB09KE$CR1	MCU: STM32WB09KEV6 silicon revision "Z"	Initial revision	No limitation
		MCU errata sheet: *STM32WB09xE device limitations* (ES0584)		
		Boards: • MB1801-NoUSB-D03 (mezzanine board) • MB2032-WB09-B02 (MCU RF board)		

8.3 Board revision history

Table 15. **Board revision history**

Board reference	Board variant and revision	Board change description	Board limitations
MB1801 (mezzanine board)	MB1801-NoUSB-D03	Initial revision	No limitation
MB2032 (MCU RF board)	MB2032-WB09-B02	Initial revision	No limitation

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

9.1 FCC Compliance Statement

Identification of product: NUCLEO-WB09KE
FCC ID: YCP-MB203201

Radio Frequency (RF) Exposure Compliance of Radio communication: To satisfy FCC RF Exposure requirements, a separation distance of 20cm 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 co-located or operating in conjunction with any other antenna or transmitter.

Part 15.19

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Part 15.21

Any changes or modifications to this equipment not expressly approved by STMicroelectronics may cause harmful interference and void the user's authority to operate this equipment. Part 15.105 This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception which can be determined by turning the equipment off and on, the user is encouraged to try to correct interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Responsible party (in the USA)

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

9.2 ISED Compliance Statement

Identification of product: NUCLEO-WB09KE
IC: 8976A-MB203201

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.

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.

RF exposure statement

This device complies with ISED radiation exposure limits set forth for general population. This device must be installed to provide a separation distance of at least 20cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

Le présent appareil est conforme aux niveaux limites d’exigences d’exposition RF aux personnes définies par ISDE. L’appareil doit être installé afin d’offrir une distance de séparation d’au moins 20cm avec les personnes et ne doit pas être installé à proximité ou être utilisé en conjonction avec une autre antenne ou un autre émetteur.

10 RED Compliance Statement

Déclaration de conformité CE simplifiée

STMicroelectronics déclare que l'équipement radioélectrique du type "NUCLEO-WB09KE" est conforme à la directive 2014/53/UE.

Bande de fréquence utilisée en transmission et puissance maximale rayonnée dans cette bande :

- Bande de fréquence : 2400-2483.5 MHz (Bluetooth®)
- Puissance maximale : 8 mW p.i.r.e

Simplified EC compliance statement

Hereby, STMicroelectronics declares that the radio equipment type "NUCLEO-WB09KE" is in compliance with Directive 2014/53/EU.

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

- Frequency range: 2400-2483.5 MHz (Bluetooth®)
- Maximal power: 8 mW e.i.r.p

Revision history

Table 16. **Document revision history**

Date	Revision	Changes
03-Jul-2024	1	Initial release.

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