Bluetooth® LE connectivity expansion board for STM32 boards based on the STM32WBA5MMG module

Introduction

The B-WBA5M-WPAN connectivity expansion board provides an affordable and flexible way for users to try out new concepts and build prototypes with the STM32WBA5MMGH6 module.

The B-WBA5M-WPAN product requires a separate probe for programming and debugging. The STLINK-V3SET debugger can be connected through an STDC14 cable.

The B-WBA5M-WPAN connectivity expansion board integrates a USB Type-C® connector for power only.

The B-WBA5M-WPAN connectivity expansion board integrates an M.2 E-Key connector, turning it into an M.2 E-Key daughterboard providing a Bluetooth® LE interface to a host board including an M.2 E-Key host connector.

The M.2 E-Key connector follows the PCI-SIG standard and provides UART, SPI, I²C, and SAI interfaces for communication with the host.

The B-WBA5M-WPAN product includes the comprehensive STM32WBA software HAL library and various packaged software examples with the STM32CubeWBA MCU Package.
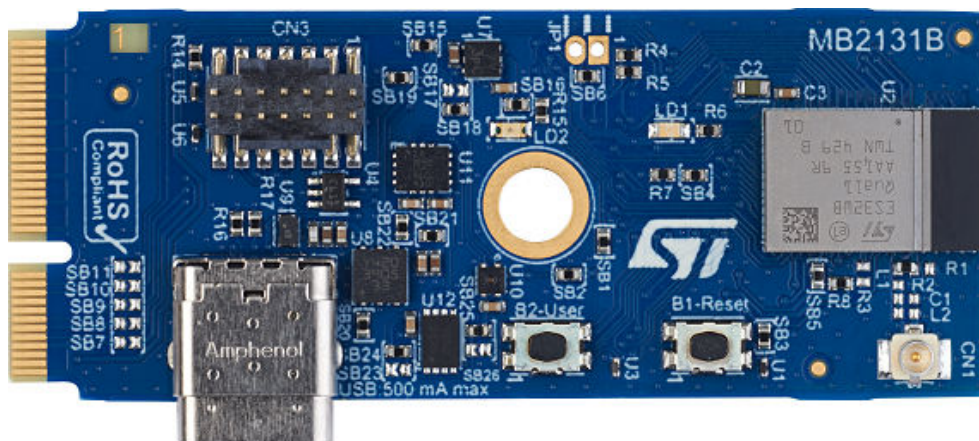

Figure 1. B-WBA5M-WPAN top view

Figure 2. B-WBA5M-WPAN bottom view

Pictures are not contractual.

UM3450 - Rev 1 - April 2025
For further information, contact your local STMicroelectronics sales office.

www.st.com

1 Features

- Connectivity expansion board embedding an STM32WBA5MMG module including:
    – Ultra-low-power Arm® Cortex®-M33 core-based STM32WBA55UG microcontroller, Bluetooth® LE, AES-256, featuring 1 Mbyte of flash memory and 128 Kbytes of SRAM, including 64 Kbytes with parity check
    – RF transceiver multistandard radio Bluetooth® LE
- 256-Kbit serial I^{2}C bus EEPROM
- MEMS sensors:
    – Integrated high-accuracy temperature sensor
    – 3D accelerometer and 3D gyroscope
- User LED
- User and reset push buttons
- Board connectors:
    – STDC14 debug
    – USB Type-C® for power only
    – M.2 E-Key
- Flexible power supply options: M.2 E-Key connector or USB V$_{BUS}$
- Comprehensive free software libraries and examples available with the STM32CubeWBA MCU Package
- Support of a wide choice of Integrated Development Environments (IDEs) including IAR Embedded Workbench®, MDK-ARM, and STM32CubeIDE

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

arm

2 Ordering information

To order the B-WBA5M-WPAN connectivity expansion board, refer to Table 1. Additional information is available from the datasheet and reference manual of the target microcontroller.

Table 1. List of available products

Order code	Board reference	Target STM32
B-WBA5M-WPAN	MB2131[1]	STM32WBA55UGI6

1. Connectivity expansion board

2.1 Codification

The meaning of the codification is explained in Table 2.

Table 2. Codification explanation

B-XXXYM-ZZZZ	Description	Example: B-WBA5M-WPAN
B	Expansion board	Connectivity expansion board
XXX	MCU series in STM32 32-bit Arm Cortex MCUs	STM32WBA series
YM	Module line in the MCU series	STM32WBA5M module line
ZZZZ	Wireless network	Wireless personal area network based on Bluetooth® LE certified

3 Development environment

3.1 System requirements

- Multi-OS support: Windows® 10 and 11, Linux® 64-bit, or macOS®

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 B-WBA5M-WPAN 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.

6 Quick start

The B-WBA5M-WPAN connectivity expansion board is an easy-to-use and low-cost development kit used to evaluate and start development quickly with an STM32WBA5MMG module. Before installing and using the product, accept the evaluation product license agreement from the www.st.com/epla webpage. For more information on the B-WBA5M-WPAN connectivity expansion board and demonstration software, visit *www.st.com*.

6.1 Standalone mode

Follow the sequence below to configure the B-WBA5M-WPAN connectivity expansion board and launch the demonstration application (refer to for component location):

1. Check the jumper position on board: JP1 (IDD) is OFF. The default jumper setting on the board is explained in Table 4.

2. Connect a USB Type-C® cable to CN4 to supply the board with an external 5 V supply source (voltage supply only–no other USB function).

3. Press the reset button (B1) of the B-WBA5M-WPAN connectivity expansion board and the demonstration starts.

4. This demonstration application software works associated with a Bluetooth® LE device, such as a mobile phone or tablet. The demonstration application is available in the usual stores, such as Android and Apple.

Table 4. Jumper default configuration

| Jumper	Definition	Position	Comment
JP1	IDD	OFF	For STM32WBA5MMG current measurements (RF part)

6.2 Coprocessor MCU (M.2 daughter mode)

B-WBA5M-WPAN can work as a connectivity board to provide Bluetooth® LE functionality to a system that lacks it. B-WBA5M-WPAN CEB is then considered the daughterboard of this system and is connected using the M.2 E-Key connector.

7 Hardware layout and configuration

The CEB (connectivity expansion board) MB2131 is designed around the STM32WBA5MMGH6 module, which includes an STM32WBA55UGI6 microcontroller. Figure 3 shows the connections between the STM32WBA5MMGH6 module and its peripherals, push buttons, LEDs, USB, and sensors. Figure 4 and Figure 5 show the location of these features on the CEB MB2131. The mechanical dimensions of the board are shown in Figure 6.

7.1 Hardware block diagram

Figure 3. B-WBA5M-WPAN hardware block diagram
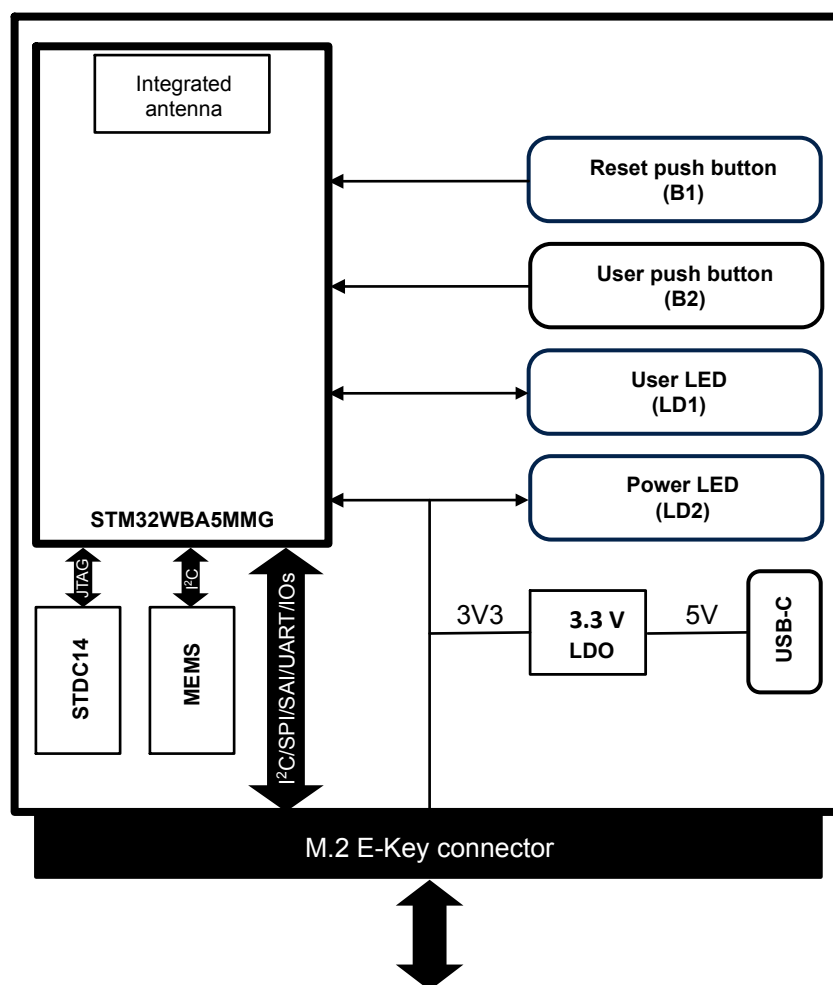
7.2 Hardware board layout

Figure 4. **B-WBA5M-WPAN PCB layout top side**

STM32WBA5MMG module
(U2)

User LED
(LD1)

Power LED
(LD2)

STDC14 connector
(CN3)

RF connector
(CN1-Not mounted)

Reset push button
(B1)

User push button
(B2)

Temperature sensor (U10)

EEPROM (U12)

Gyroscope (U11)

USB Type-C®
(CN4-5 V-500 mA max)
For power only

M.2 connector

DT59672V1
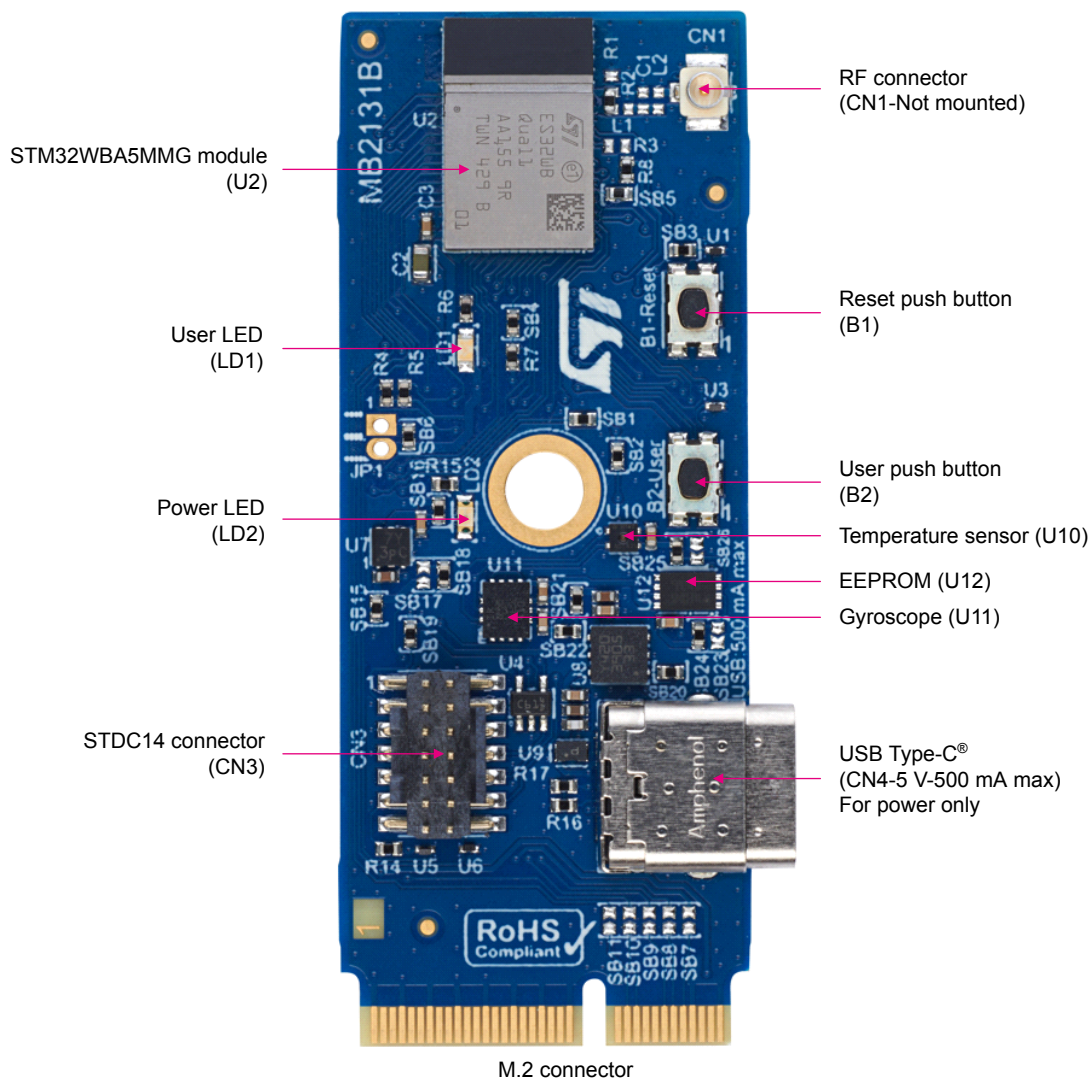
Figure 5. B-WBA5M-WPAN PCB layout bottom side

M.2 connector

7.3 Mechanical drawing

Figure 6. **B-WBA5M-WPAN mechanical drawing (in millimeters)**
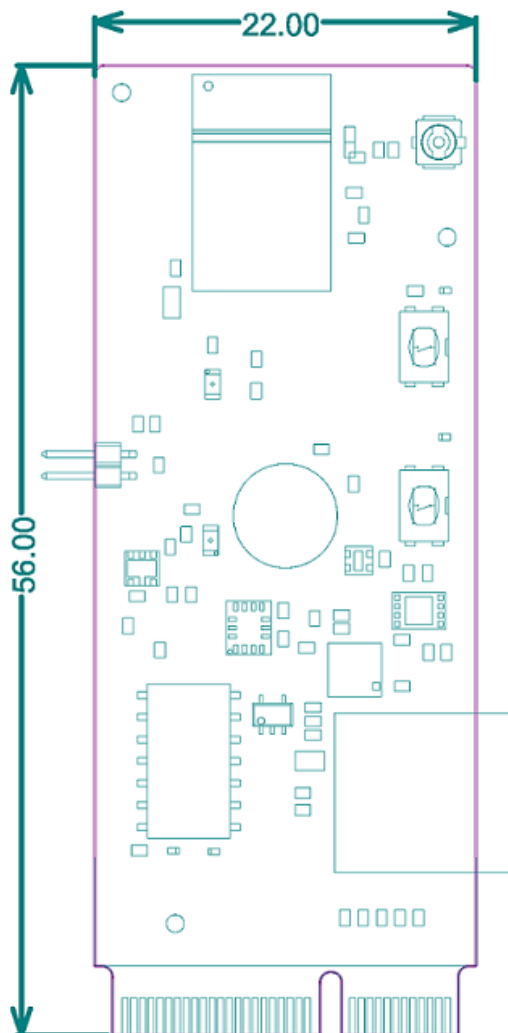
7.4 Download and debug

7.4.1 Description

As there is no embedded ST-LINK on the MB2131 CEB, the only way to program and debug the onboard STM32WBA5MMG module is by using an external debug tool connected to the STDC14 connector (CN3).

The external debugger recommended is the STLINK-V3SET debugger, which supports SWD and VCP for STM32 devices. For information about the debugging and programming features of STLINK-V3, refer to the user manual *STLINK-V3SETdebugger/programmer for STM8 and STM32* (UM2448), which describes in detail all the STLINK-V3E features.

B-WBA5M-WPAN can also be used with STLINK-V3MINI, STLINK-V3MINIE, and STLINK-V3PWR. Refer to Section 7.4.2.
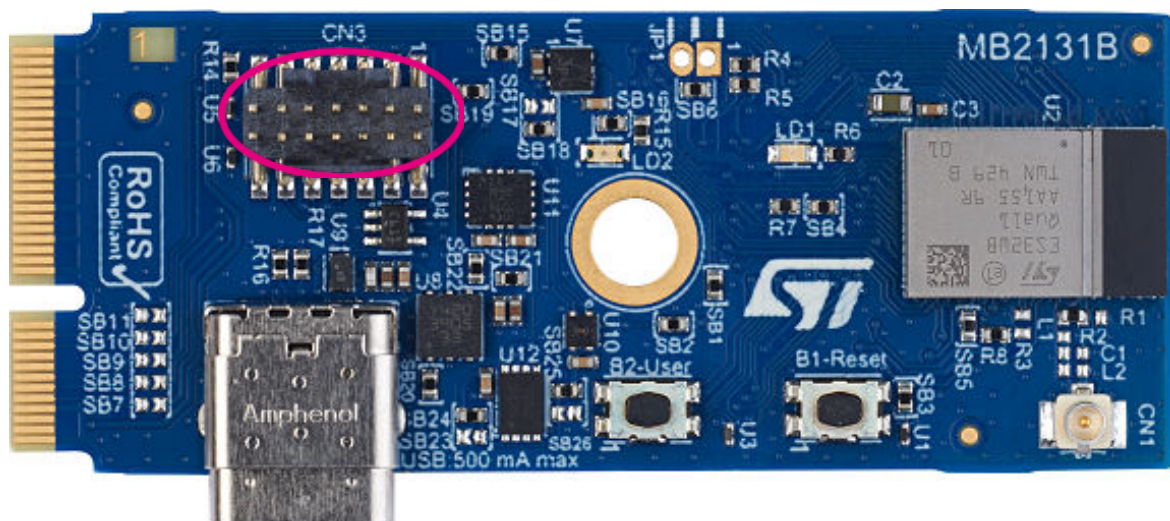
7.4.2 STLINK-V3SET

B-WBA5M-WPAN has no embedded ST-LINK device. To develop and debug software, it is necessary to use an STLINK-V3 device.

Figure 7. **STLINK-V3SET**
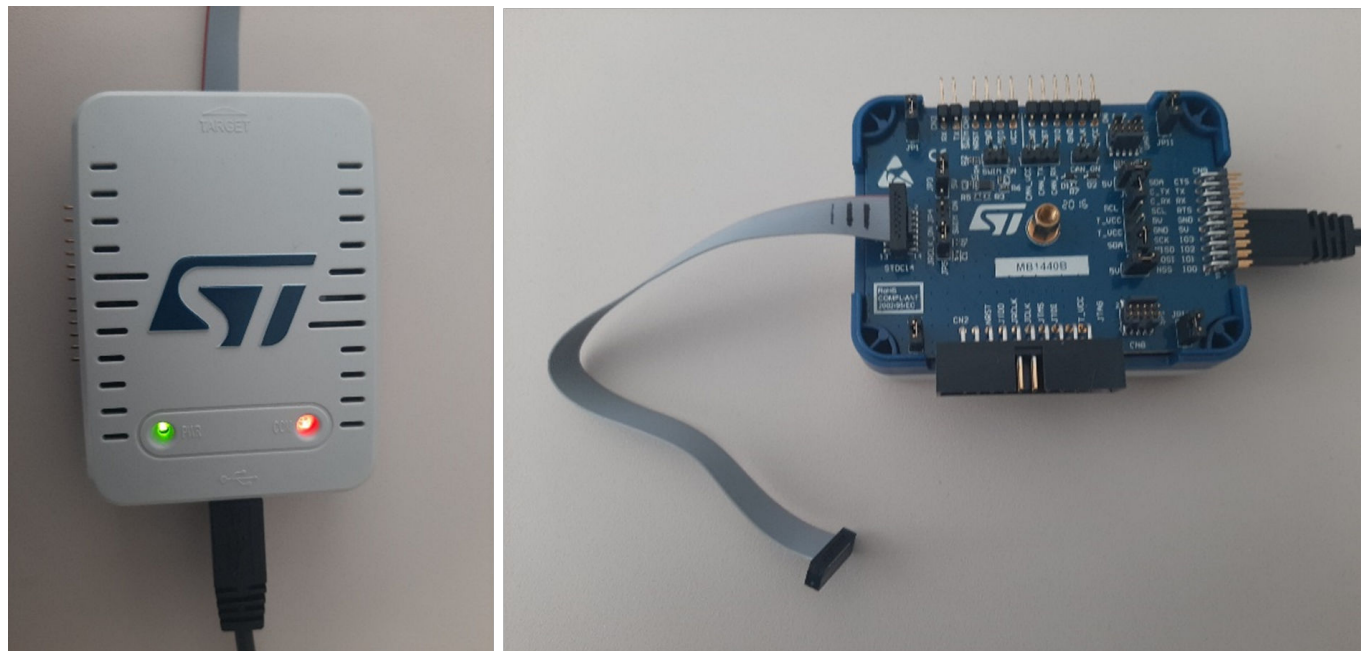
Connect STLINK-V3SET to the PC. The green PWR and red COM LEDs (red) must be ON. A 14-pin flat ribbon must be connected to the STDC14 connector.

Figure 8. **B-WBA5M-WPAN STDC14 connector**

7.5 Power supply

7.5.1 Power sources

Two different sources can provide the power supply:

1. CN4 USB Type-C® connector. It provides a 5 V DC voltage, converted into 3.3 V DC by the U8 LDO. The current is limited to 500 mA. It is highly recommended that this possibility be chosen for a standalone application.

2. CN2 M.2 E-Key interface. It directly provides a 3.3 V DC to the system. The current is limited to 200 mA. The U7 switch can open the path using the CEB_REG_ON input (refer to the M.2 E-Key interface description). It is highly recommended to reserve this possibility for the Bluetooth® LE extension mode through the M.2 E-Key connector.

Note: *In case an external voltage supply is used to power the MB2131 connectivity expansion board, this 5 or 3.3 V DC power source must comply with the EN 62368-1:2014+A11:2017 standard and must be safety extralow voltage (SELV) with limited power capability.*

7.5.2 Power tree

Figure 9 represents the power tree of the board.

Figure 9. MB2131 power tree
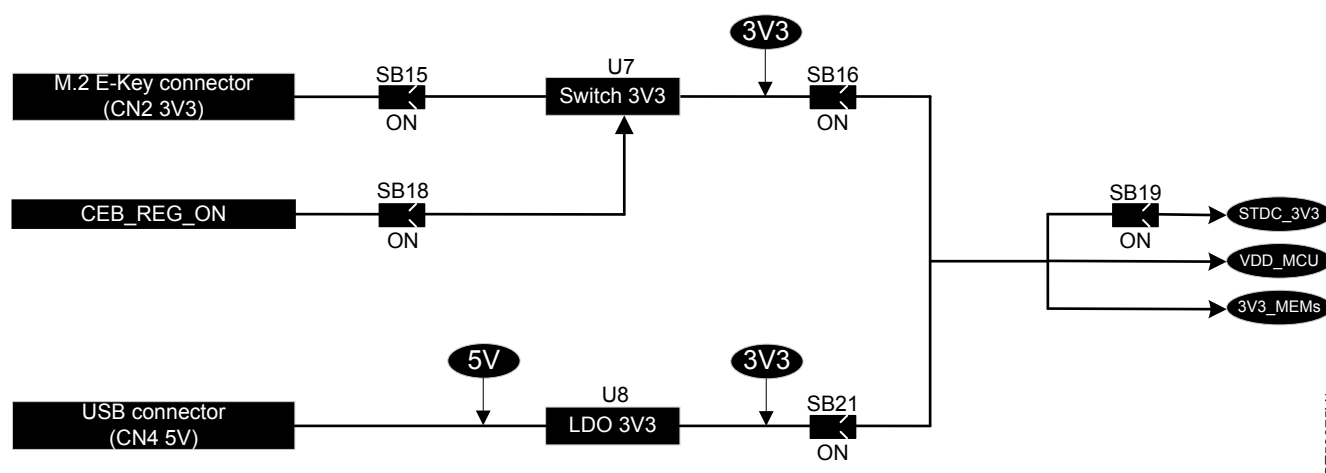
7.6 Clock source

The clock source is integrated into the STM32WBA5MMGH6 module.

7.7 Reset sources

The reset signal of the STM32WBA5MMGH6 module is active LOW. The internal pull-up resistor forces the RST signal to a high level.

The reset sources are:

- Reset button B1 (black button)
- STDC14 connector
- BT_EN signal, provided by the M.2 E-Key connector

7.8 Boot mode

The STM32WBA5MMG 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 memory with a user application using a serial communication channel (UART).

The pull-up resistor R3 activates the bootloader by forcing PA10 high during hardware reset. Otherwise, the application residing in flash memory is launched.

Figure 10. Boot mode pin
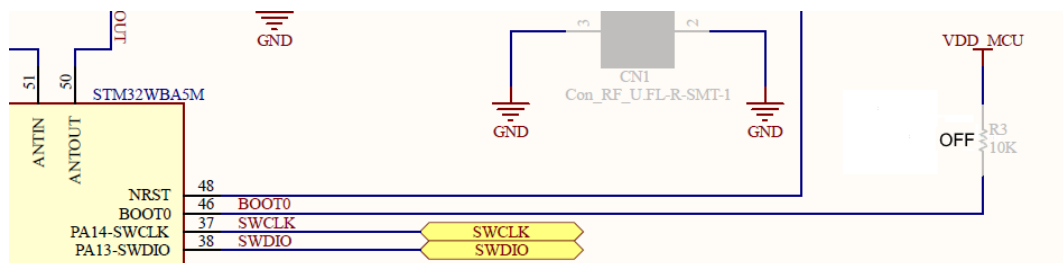
R3 OFF: The application residing in flash memory is launched (default position).

R3 ON: The bootloader is activated and the user can download a new application.

7.9 Audio

Audio interfacing is performed through the SAI1 bus and I2C1 interfaces of the STM32WBA5MMG module. The audio bus is connected to the M.2 E-Key connector on pins 8, 10, 12, and 14. Refer to M.2 E-Key connector. Table 5 describes the I/O configuration of the audio interface.

Table 5. I/O configuration for the audio interface

I/O	Configuration
PB7	Used as SAI1_SD_B shared with GPIO expansion
PB5	Used as SAI1_FS_B shared with GPIO expansion
PB6	Used as SAI1_SCK_B shared with GPIO expansion
PB14	Used as SA1_SD_A shared with GPIO expansion
PB2	Used as I2C1_SCL
PB3	Used as I2C1_SDA

7.10 LEDs

7.10.1 Description

The board has two LEDs:

- The blue LED (LD1) is used as a user-defined LED. It is connected to the MCU through the GPIO specified in Table 6 and is active at a low level.
- The green LED (LD2) is a power status LED. It lights up when the board is powered either by the M.2 E-Key or USB connectors.

7.10.2 Operating voltage

All LEDs operate in the 3.3 V voltage range.

7.10.3 I/O interface

Table 6 describes the I/O configuration for the LED interface.

Table 6. I/O configuration for the LED interface

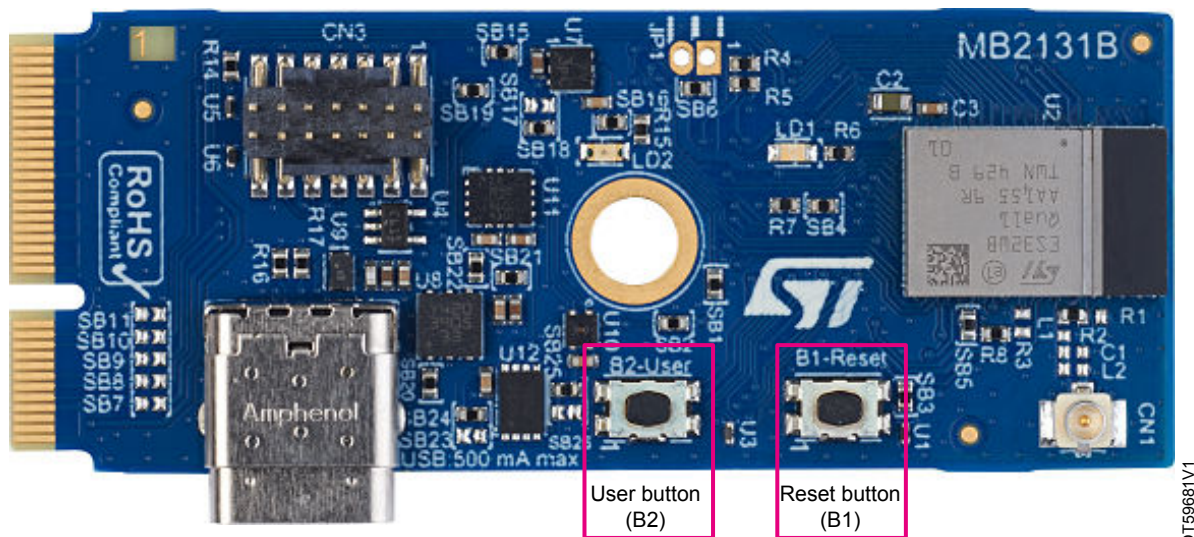| LED	Color	I/O	Configuration	Function
LD1	Blue	PA1	Active at low level	User LED
LD2	Green	N/A	Active when the board is powered	Power LED

7.11 Buttons

7.11.1 Description

The MB2131 board contains two buttons:

- Reset button (B1). It resets the board.
- User button (B2). It is connected to the PC13 input.

Figure 11. B-WBA5M-WPAN buttons

User button (B2)   Reset button (B1)

7.11.2 I/O interface

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

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

I/O	Configuration
NRST	Reset button (B1). Active at a low level.
PC13	User button (B2)

7.12 RF subsystem

7.12.1 Description

The ultra-low-power RF subsystem operates in the 2.4 GHz ISM band.

It supports Bluetooth® LE, Zigbee® 3.0, OpenThread, dynamic and static concurrent modes, and 802.15.4 proprietary protocols.

7.12.2 RF I/O stage

Figure 12. B-WBA5M-WPAN RF stage
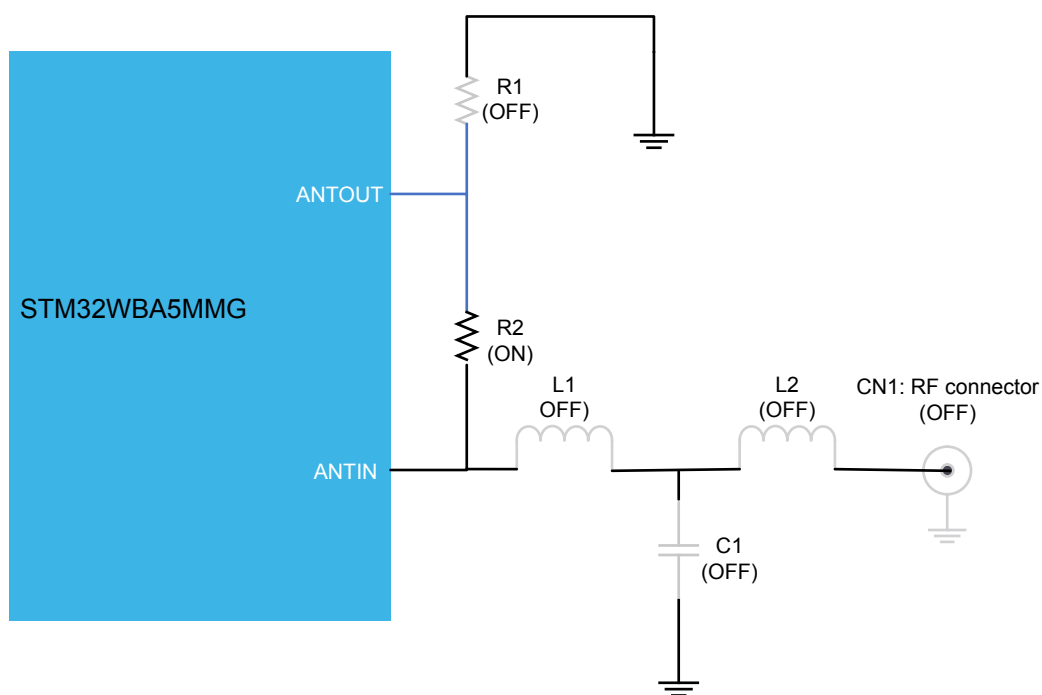
The STM32WBA5MMG module can work either with an integrated antenna, or an external antenna connected to the RF connector (CN1). By default, the integrated antenna is used. R2 is ON while R1, L1, L2, C1, and CN1 are OFF. To switch to an external antenna, R2 must be OFF, while R1 (0 Ω) and CN1 must be ON. Then, L1, L2, and C1 provide a matching circuit designed by the user.

7.13 Solder bridge configuration and purpose

MB2131 has 48 solder bridges; They allow an important number of configurations. Their description is in Table 8. The rows with bold text indicate the default configuration.

Table 8. Solder bridge configuration

Solder bridge	Value[1]	Purpose[1]	Mutual exclusivity
1	ON	**Connects BT_EN signal from M.2 E-Key connector to MCU to provide a reset signal from a host board (M.2 E-Key use only, in coprocessor mode–refer to Section 6.2)**	None
	OFF	BT_EN signal is inoperative.	
2	ON	**Reset signal from STDC14 connector. When fitted, ST-LINK can reset the MCU.**	None
	OFF	NRST signal from the STDC14 connector is inoperative.	
3	ON	**Reset signal from B1 button. B1 can reset the MCU.**	None
	OFF	B1 button is inoperative.	
4	ON	**I2C1 data signal (PB3) is connected to M.2 E-Key pin 58 for I^2C transfers to the host board (M.2 E-Key use only–refer to Section 6.2)**	None
	OFF	No I^2C transfer is possible. SWO connection to the STDC14 connector is possible.	
5	ON	**The I2C1 clock signal (PB2) is connected to M.2 E-Key pin 60 for I^2C transfers to the host board (M.2 E-Key use only–refer to Section 6.2)**	None
	OFF	No I^2C transfer is possible.	
6	ON	**Connects MCU power supply to MCU for standard use**	None
	OFF	The 3V3 power supply is not connected to the MCU. JP1 must be set and connected with a header or an ammeter (consumption measurement use)	
7	ON	MCU PA0 (SPI3_SCK) GPIO is connected to M.2 E-Key connector pin 9	None
	OFF	**MCU PA0 (SPI3_SCK) GPIO is not connected to M.2 E-Key connector**	
8	ON	MCU PB8 (SPI3_MOSI) GPIO is connected to M.2 E-Key connector pin 11	None
	OFF	**MCU PB8 (SPI3_MOSI) GPIO is not connected to M.2 E-Key connector**	
9	ON	MCU PB9 (SPI3_MISO) GPIO is connected to M.2 E-Key connector pin 13	None
	OFF	**MCU PB9 (SPI3_MISO) GPIO is not connected to M.2 E-Key connector**	
10	ON	M.2 E-Key connector pin 19 is connected to MCU PA5 SPI3_NSS	None
	OFF	**M.2 E-Key connector pin 19 is not connected to MCU PA5 SPI3_NSS**	
11	ON	M.2 E-Key connector pin 21 is connected to MCU PA4	None
	OFF	**M.2 E-Key connector pin 21 is not connected to MCU PA4**	

Solder bridge	Value[1]	Purpose[1]	Mutual exclusivity
12	ON	M.2 E-Key connector pin 44 is connected to MCU PA9 (GPIO function)	None
	OFF	**M.2 E-Key connector pin 44 is not connected to MCU PA9**	
13	ON	M.2 E-Key connector pin 46 is connected to MCU PA2	None
	OFF	**M.2 E-Key connector pin 46 is not connected to MCU PA2**	
14	ON	M.2 E-Key connector pin 48 is connected to MCU PA10	None
	OFF	**M.2 E-Key connector pin 48 is not connected to MCU PA10**	
15	**ON**	**Connects the CEB power supply to the 3V3 provided by M.2 E-Key connector pins 2, 4, 72, and 74.**	None
	OFF	M.2 E-Key connector cannot provide power supply	
16	**ON**	**3V3 provided by M.2 E-Key is connected to CEB. It is highly advised not to change this solder bridge.**	None
	OFF	3V3 not provided by M.2 E-Key. It is strongly recommended to keep this solder bridge ON.	
17	ON	The u7 switch is always enabled.	SB44
	OFF	**The CEB_REG_ON signal can disable the U7 switch.**	
18	**ON**	**The CEB_REG_ON signal can disable the U7 switch.**	SB43
	OFF	U7 switch cannot be software-driven.	
19	**ON**	**This provides a 3V3 probe to the STDC14/ST-LINK device. It must be set otherwise some ST-LINK features do not work. It is highly advised not to change this solder bridge.**	None
	OFF	3V3 is not provided to the ST-LINK 3V3 probe. It might generate some malfunctions	
20	**ON**	**U8 LDO is always enabled**	None
	OFF	U8 LDO is always disabled	
21	**ON**	**3V3 provided by USB/LDO is connected to CEB. It is highly advised not to change this solder bridge.**	None
	OFF	USB/LDO cannot provide 3V3. It is strongly recommended to keep this solder bridge ON.	
22	**ON**	**Connects MEMS power supply to 3V3**	None
	OFF	The MEMS are not operational. Possibility to measure current consumption with an ammeter	
23	ON	Connects pin E1 of U6 EEPROM to GND to change the I^2C address.	SB24
	OFF	**Disconnects pin E1 of U6 EEPROM from GND to change I^2C address.**	
24	**ON**	**Connects pin E1 of U6 EEPROM to VCC to change the I^2C address.**	SB23
	OFF	Disconnects pin E1 of U6 EEPROM from VCC to change I^2C address.	
25	**ON**	**Connects pin E2 of U6 EEPROM to VCC to change the I^2C address.**	SB26

Solder bridge	Value[1]	Purpose[1]	Mutual exclusivity
25	OFF	Disconnects pin E2 of U6 EEPROM from VCC to change I^{2}C address.	SB26
26	**ON**	Connects pin E2 of U6 EEPROM to GND to change the I^{2}C address.	SB25
	OFF	**Disconnects pin E2 of U6 EEPROM from GND to change I^{2}C address.**	

1.   *The default configuration is in bold.*

7.14   Short-circuited resistors

MB2131 has five short-circuited resistors. Their role is similar to that of solder bridges. They are made with a resistor footprint, with pads linked with a track.

Figure 13. Footprint of a short-circuited resistor

The initial configuration can be changed by cutting the track, with the possibility of going back by soldering a 0-ohm resistor. Their description is in Table 9.

Table 9. Short-circuited resistors

Resistor	Purpose	Mutual exclusivity
R9	MCU PB8 (SPI3_MOSI) GPIO is connected to M.2 connector pin 38	None
R10	MCU PB9 (SPI3_MISO) GPIO is connected to M.2 connector pin 40	None
R11	MCU PA0 (SPI3_SCK) GPIO is connected to M.2 connector pin 42	None
R12	M.2 E-Key connector pin 64 is connected to MCU PA5 SPI3_NSS	None
R13	SWCLK connected to STDC14 pin 9 (JRCLK)	None

7.15 Embedded devices

7.15.1 I²C interface

Two embedded sensors and an EEPROM are connected to the STM32WBA5MMG module with an I²C bus. The accelerometer/gyroscope, and temperature sensors are connected to the STM32WBA5MMG I2C3 bus.

The address is a 7-bit address with an additional read/write bit (HIGH for reading, LOW for writing). Table 10 describes the different read or write addresses for each component:

Table 10. I²C MEMS addresses

Device	Action	Address
Accelerometer-gyroscope sensor (U5)	Read	11010101 (D5h)
	Write	11010100 (D4h)
Temperature sensor (U4)	Read	10001001 (89h)
	Write	1000 1000 (88h)
U6 (EEPROM) Memory array	Read	10101101 (ADh)
	Write	10101100 (ACh)
U6 (EEPROM) Identification page	Read	10111101 (BDh)
	Write	10111100 (BCh)

7.15.2 Temperature sensor

U1 measures the ambient temperature. It is connected to the STM32WBA5MMG module through the I²C interface.

7.15.3 3D accelerometer and 3D gyroscope (U5)

U5 is a system-in-package featuring a high-performance 3D digital accelerometer and 3D digital gyroscope tailored for Industry 4.0 applications.

It is connected to STM32WBA5MMG through the I²C interface.

Figure 14. 3D direction for acceleration and angular rate
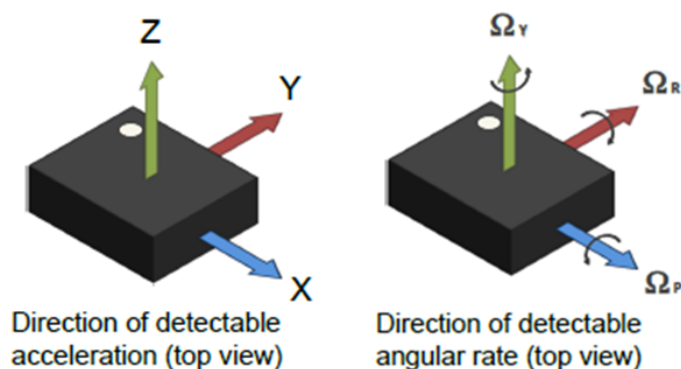
7.15.4 EEPROM (U6)

U6 is an EEPROM featuring 256 Kbits (32 Kbytes). It is connected to the STM32WBA5MMG module through the I2C3 interface. Its addresses are specified in Table 10. It is used for board identification and storage.

It has an OTP page which might be preloaded with CEB CPN as an ASCII string to autodetect and make sure that the STM32 software is compatible with the CEB. The remaining EEPROM data area allows the user to *save* to the CEB some user settings.

8 Main connectors

8.1 STDC14 connector (CN3)

The STDC14 connector is a 2x7-pin 1.27-mm pitch male connector. It allows the connection to an STM32 target using the JTAG or SWD protocol, respecting (from pin 3 to 12) the MIPI10/ARM10 pinout (Arm® Cortex® debug connector). Then, the STDC14 connector is implemented so that an external STLINK-V3SET debug tool can be used to program and debug the MB2131 board. The related pinout for the STDC14 connector is listed in Table 11. STDC14 pin assignment.

Figure 15. STDC14 pinout
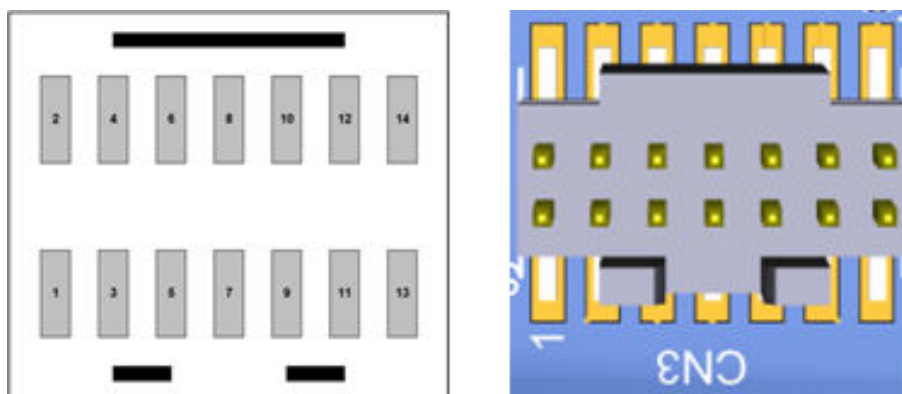
Table 11. STDC14 pin assignment

Pin number	Description	Pin number	Description
1	N.C.	2	N.C.
3	VDD (3V3 - Input)	4	SWDIO (PA13)
5	GND	6	SWCLK (PA14)
7	KEY(connected to GND)	8	SWO (PB3) Shared with I2C1_SDA
9	SWCLK	10	JTDI (PA15)
11	GNDDetect (connected to GND through a 100 Ω resistor)	12	NRST
13	VCP_RX (PA8)	14	VCP_TX (PB12)

8.2 USB Type-C® connector

The USB Type-C® connector has only a power supply function. It has no alternative functionality.

8.3 M.2 E-Key connector

8.3.1 Presentation

M.2 E-Key is a standard for internally mounted expansion cards. It is a derivative of the mSATA and PCIe mini card standards. The PCI-SIG group standardizes it. Refer to https://pcisig.com.

It is useful to add missing functions on a host device, such as a PC, laptop, or microcontroller card. It is a module with a special connector, defined by the main function.

It has several kinds of use:

- Memory
- Storage (SSD)
- Connectivity (such as Wi-Fi®, Bluetooth® LE, and cellular)

It covers several different high-speed interface bus standards, like PCIe, serial ATA, USB, and SDIO.

8.3.2 M.2 E-Key pinning

M.2 E-Key pinning globally respects the PCI-SIG standard and Embedded Artists recommendations (https://www.embeddedartists.com). The M.2 E-Key connector has 75 pins. Pins 23 to 31 do not exist, according to E-Key implementation. It means 67 useful pins. The odd pins are on the top side. The even ones are on the bottom side.

Figure 16. M.2 E-Key connector top side (odd pins)
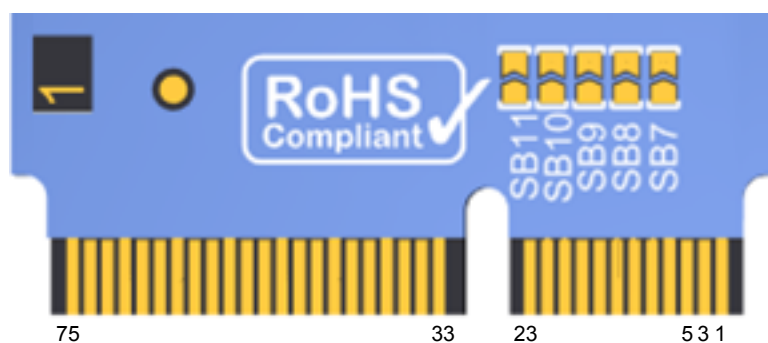
Figure 17. M.2 E-Key connector top side (even pins)
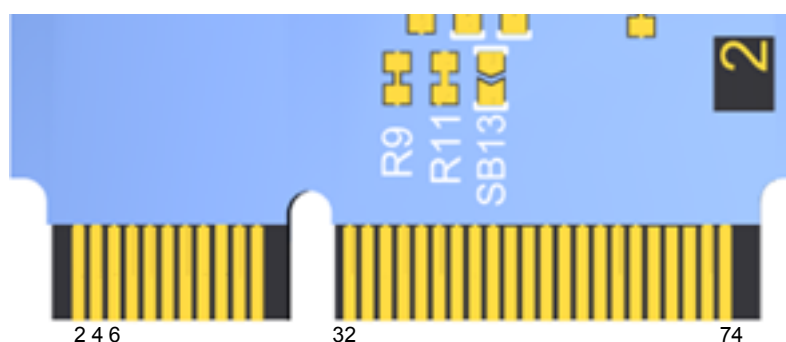
Table 12 gives the pinning of the M.2 E-Key connector.

Table 12. M.2 E-Key connector pin assignment

M.2 E-Key pinning	Pin name	Function
1	GND	Ground
2	3V3	3V3 power supply provided by host
3	USB_D+	NC
4	3V3	3V3 power supply provided by host
5	USB_D-	NC
6	LED_1#	GPIO to drive an external LED
7	GND	Ground
8	I2S_SCK	SAI1_SCK_B - Clock for audio bus
9	SDIO_CLK	SPI3_SCK through SB10 OFF
10	I2S_WS	SAI1_FS_B - Frame selection for audio bus
11	SDIO_CMD	SPI3_MOSI through SB12 OFF
12	I2S_SD_OUT	SAI1_SB_B–Output signal for audio bus
13	SDIO_DATA0	SPI3_MISO through SB14 OFF
14	I2S_SD_IN	SAI1_SB_A–Input signal for audio bus
15	SDIO_DATA1	NC
16	LED_2#	GPIO to drive an external LED
17	SDIO_DATA2	NC
18	VIO_CFG	GND
19	SDIO_DATA3	SPI3_NSS through SB18 OFF
20	UART_WAKE#	BT_HOST_WAKE–Wake up host board
21	SDIO_WAKE	GPIO possible connection through SB20 OFF
22	UART_TXD	USART2_TX to host
23	SDIO_RESET#	NC
24	E-Key id	No connection
25		
26		
27		
28		
29		
30		
31		
32	UART_RXD	USART2_RX from host
33	GND	Ground
34	UART_RTS	USART2_RTS to host
35	PERp0	NC
36	UART_CTS	USART2_CTS from host
37	PERn0	NC
38	SPI_TXD_MOSI	MOSI signal for SPI3 transfer to host

M.2 E-Key pinning	Pin name	Function
39	GND	Ground
40	SPI_RXD_MISO	MISO signal for SPI3 transfer to host
41	PETp0	NC
42	SPI_CLK	CLK signal for SPI3 transfer to host
43	PETn0	NC
44	COEX3	Possible connection to a GPIO through SB27 OFF
45	GND	Ground
46	COEX_TXD	LPUART1_TX–Possible connection to LPUART
47	REFCLKp0	NC
48	COEX_RXD	LPUART1_RX–Possible connection to LPUART
49	REFCLKn0	NC
50	SUSCLK	NC
51	GND	Ground
52	PERST0#	NC
53	CLKREQ0#	NC
54	W_DISABLE2#	BT_EN signal for the host to reset the module
55	PEWAKE0#	NC
56	W_DISABLE1#	CEB_REG_ON signal for the host to switch off CEB
57	GND	Ground
58	I2C_SDA	I2C1_SDA–Data line for I^2C transfer to host
59	RESERVED	NC
60	I2C_SCL	I2C1_SCL–Clock line for I^2C transfer to host
61	RESERVED	NC
62	SPI_INT	SPI3_INT–GPIO acting as interruption linked to SPI
63	GND	Ground
64	SPI_SSEL	SPI3_NSS–Chip select for SPI transfer
65	RESERVED	NC
66	UIM_SWP	NC
67	RESERVED	NC
68	UIM_POWER_SNK	NC
69	GND	Ground
70	UIM_POWER_SRC	NC
71	RESERVED	NC
72	3V3	3V3 power supply provided by the host
73	RESERVED	NC
74	3V3	3V3 power supply provided by the host
75	GND	Ground

9 STM32WBA5MMGH6 GPIO assignment

Table 13 presents the assignments of the STM32WBA5MMGH6 pins.

Table 13. STM32WBA5MMGH6 GPIO assignment

Pin name	Function	Description
PA14	SWCLK	For software download/debugging
PA13	SWDIO	For software download/debugging
PA10	LPUART1_RX	For UART transfer to host through M.2 E-Key connector pin 48
PA9	GPIO	Connected to M.2 E-Key pin 44
PB14	SAI1_SD_A	Audio bus to M.2 E-Key connector pin 14
PB13	BT_HOST_WAKE	GPIO connected to M.2 E-Key connector pin 20
PB12	VCP_TX	Connected to STDC14 connector
PB11	LED_1#	GPIO function connected to M.2 E-Key connector pin 6
PA8	VCP_RX	Connected to STDC14 connector
PA7	I2C3_SDA	Connected to MEMS
PA6	I2C3_SCL	Connected to MEMS
PA4	SDIO_WAKE	GPIO connected to M.2 E-Key connector pin 21
PA3	ISM330DLC_INT1	Interruption from the MEMS
PA0	SPI3_SCK	Clock signal for SPI transfer to host–connected to M.2 E-Key pin 42
PB9	SPI3_MISO	SPI transfer to host–connected to M.2 E-Key pin 40
PA5	SPI3_NSS	SPI transfer to host–connected to M.2 E-Key pin 64
PC13	GPIO	Drive of user button
PB8	SPI3_MOSI	SPI transfer to host–connected to M.2 E-Key pin 38
PB6	SAI1_SCK_B	Audio bus to M.2 E-Key connector pin 8
PB7	SAI1_SD_B	Audio bus to M.2 E-Key connector pin 12
PB3	I2C1_SDA	Connected to M.2 E-Key connector pin for I^{2}C transfer to host 58
PB5	SAI1_FS_B	Audio bus to M.2 E-Key connector pin 10
PA15	JTDI	For software download/debugging
PB4	SPI_INT	GPIO for SPI transfer to host–connected to M.2 E-Key pin 62
PA12	LED_2#	GPIO function connected to M.2 E-Key connector pin 16
PA11	USART2_RX	USART transfer to host–connected to M.2 E-Key connector pin 32
PB2	I2C1_SCL	Connected to M.2 E-Key connector pin 60 for I^{2}C transfer to host
PB1	USART2_RTS	USART transfer to host–connected to M.2 E-Key connector pin 34
PB0	USART2_TX	USART transfer to host–connected to M.2 E-Key connector pin 22
PB15	USART2_CTS	USART transfer to host–connected to M.2 E-Key connector pin 36

10   B-WBA5M-WPAN product information

10.1   Product marking

The product and each board composing the product are identified with one or several stickers. The stickers, located on the top or bottom side of each PCB, provide product information:

- Main board featuring the target device: product order code, product identification, serial number, and board reference with revision.

    Single-sticker example:

Product order code Product identification syywwxxxxx MBxxxx-Variant-yzz

    Dual-sticker example:

Product order code Product identification	and	MBxxxx-Variant-yzz syywwxxxxx
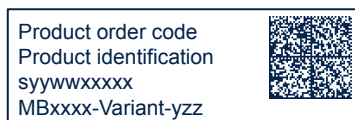
- Other boards if any: board reference with revision and serial number.

    Examples:

syywwxxxxx MBxxxx-Variant-yzz	or	MBxxxx-Variant-yzz syywwxxxxx	or		or	

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

On all board stickers, the line formatted as *"MBxxxx-Variant-yzz"* shows the board reference *"MBxxxx"*, the mounting variant *"Variant"* when several exist (optional), the PCB revision *"y"*, and the assembly revision *"zz"*, for example B01. The other line shows the board serial number used for traceability.

Products and parts labeled as *"ES"* or *"E"* are not yet qualified or feature devices that are not yet qualified. STMicroelectronics disclaims any responsibility for consequences arising from their use. Under no circumstances will STMicroelectronics be liable for the customer's use of these engineering samples. Before deciding to use these engineering samples for qualification activities, contact STMicroelectronics' quality department.

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

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

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

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

10.2 B-WBA5M-WPAN product history

Table 14. Product history

Order code	Product identification	Product details	Product change description	Product limitations
B-WBA5M-WPAN	BWBA5MWPAN$CZ1	Module: • STM32WBA5MMGH6 revision "Z" MCU errata sheet: • None Board: • MB2131-WBA5M-B02 (connectivity expansion board)	Initial revision	No limitation

10.3 Board revision history

Table 15. Board revision history

Board reference	Board variant and revision	Board change description	Board limitations
MB2131 (connectivity expansion board)	WBA5M-B02	Initial revision	No limitation

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

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

11.1 FCC Compliance Statement

This product contains certified module STM32WBA5MMG from STMicroelectronics with
FCC ID: YCP-32WBA5MMG01

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

11.2 ISED Compliance Statement

This product contains certified module STM32WBA5MMG from STMicroelectronics with
IC: 8976A-32WBA5MMG01

Compliance Statement

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

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

Déclaration de conformité

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

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

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 20 cm 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 20 cm avec les personnes et ne doit pas être installé à proximité ou être utilisé en conjonction avec une autre antenne ou un autre émetteur.

12 UKCA Compliance Statement

SIMPLIFIED UK DECLARATION OF CONFORMITY

Hereby, the manufacturer STMicroelectronics, declares that the radio equipment type "B-WBA5M-WPAN" is in compliance with the UK Radio Equipment Regulations 2017 (UK S.I. 2017 No. 1206). The full text of the UK Declaration of Conformity is available at the following internet address: *www.st.com*.

13 CE conformity

13.1 Simplified EU declaration of conformity

Hereby, STMicroelectronics declares that the radio equipment type "B-WBA5M-WPAN" is in compliance with Directive 2014/53/EU.

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

13.2 Déclaration de conformité UE simplifiée

STMicroelectronics déclare que l'équipement radioélectrique du type "B-WBA5M-WPAN" est conforme à la directive 2014/53/UE.

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

14 Product disposal

Disposal of this product: WEEE (Waste Electrical and Electronic Equipment)

(Applicable in Europe)

This symbol on the product, accessories, or accompanying documents indicates that the product and its electronic accessories should not be disposed of with household waste at the end of their working life.

To prevent possible harm to the environment and human health from uncontrolled waste disposal, please separate these items from other type of waste and recycle them responsibly to the designated collection point to promote the sustainable reuse of material resources.

Household users:

You should contact either the retailer where you buy the product or your local authority for further details of your nearest designated collection point.

Business users:

You should contact your dealer or supplier for further information.

Revision history

Table 16. Document revision history

Date	Revision	Changes
15-Apr-2025	1	Initial release.

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IMPORTANT NOTICE – READ CAREFULLY