Discovery kit for IoT node with STM32U5 series

Introduction

The B-U585I-IOT02A Discovery kit provides a complete demonstration and development platform for the STM32U585AI microcontroller, featuring an Arm® Cortex®-M33 core with Arm® TrustZone® and Armv8-M mainline security extension, 2 Mbytes of flash memory and 786 Kbytes of SRAM, as well as smart peripheral resources.

This Discovery kit enables a wide diversity of applications by exploiting low-power communication, multiway sensing, and direct connection to cloud servers.

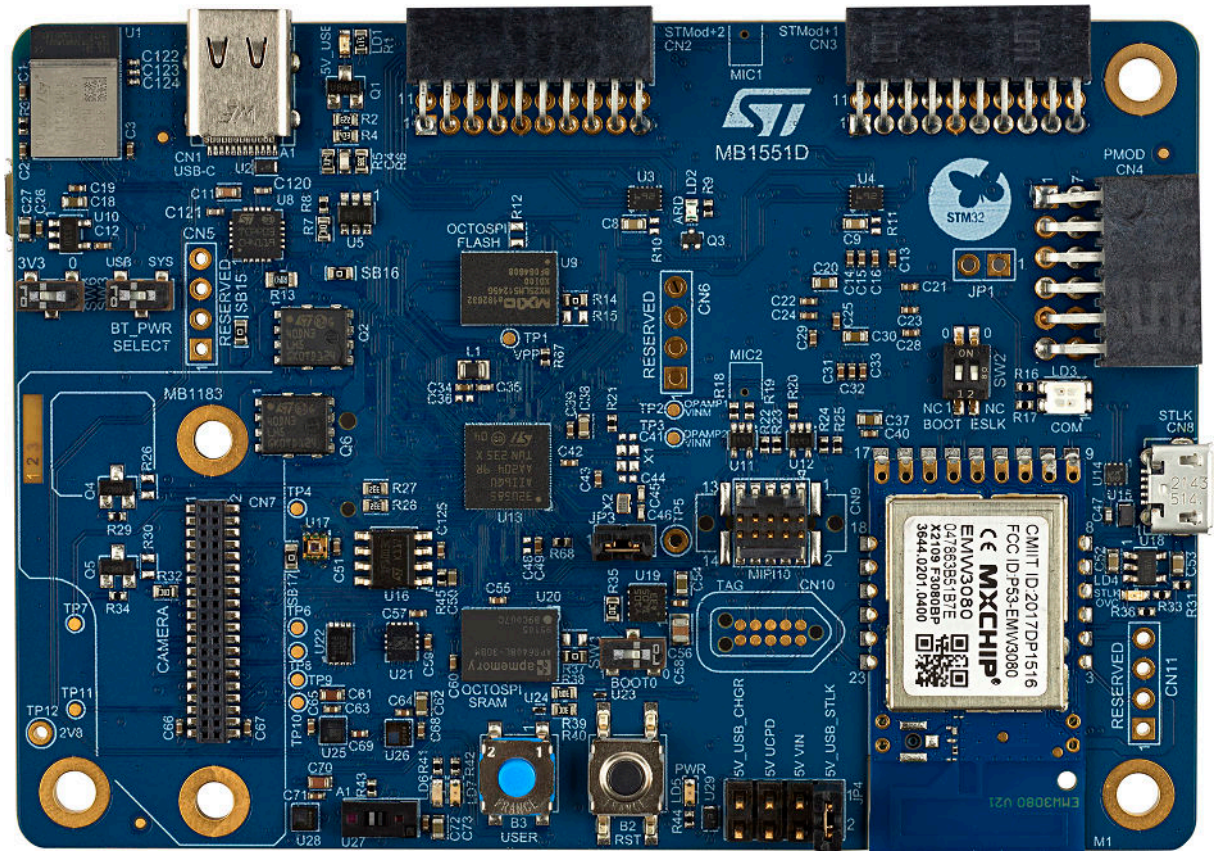
It includes Wi-Fi® and Bluetooth® modules, as well as microphones, temperature and humidity, magnetometer, accelerometer and gyroscope, pressure, Time-of-Flight, and gesture-detection sensors.

The support for ARDUINO® Uno V3, STMod+, and Pmod™ connectivity provides unlimited expansion capabilities with a large choice of specialized add-on boards.

For even more user-friendliness, the on-board STLINK-V3E debugger provides out-of-the-box loading and debugging capabilities, as well as a USB Virtual COM port bridge.

The B-U585I-IOT02A Discovery kit leverages the STM32U5 series key assets to enable prototyping for a variety of wearable or sensor applications in fitness, metering, industrial, or medical, with state-of-the-art energy efficiency and higher security.

Figure 1. B-U585I-IOT02A Discovery kit for the IoT node



Picture is not contractual.

1 Features

- Ultra-low-power STM32U585AII6Q microcontroller based on the Arm® Cortex®-M33 core with Arm® TrustZone®, 2 Mbytes of flash memory and 786 Kbytes of SRAM, and SMPS in UFBGA169 package
- 512-Mbit Quad-SPI flash memory, 64-Mbit Octo-SPI PSRAM, 256-Kbit I^2C EEPROM
- USB FS, Sink and Source power, 2.5 W power capability
- 802.11 b/g/n compliant Wi-Fi® module from MXCHIP
- Bluetooth® Low Energy from STMicroelectronics
- MEMS sensors from STMicroelectronics
  - 2 digital microphones
  - Relative humidity and temperature sensor
  - 3-axis magnetometer
  - 3D accelerometer and 3D gyroscope
  - Pressure sensor, 260-1260 hPa absolute digital output barometer
  - Time-of-Flight and gesture-detection sensor
- Ambient-light sensor
- STSAFE authentication and security for peripherals and IoT devices from STMicroelectronics
- 2 user LEDs
- User push-button
- Reset push-button
- Board connectors
  - USB Type-C®
  - ARDUINO® Uno V3 expansion connectors
  - Camera module expansion connector
  - 2× STMod+ expansion connectors
  - Pmod™ expansion connector
- Flexible power-supply options: ST-LINK USB V_{BUS}, USB connector, or external sources
- On-board STLINK-V3E debugger/programmer with USB re-enumeration capability: mass storage, Virtual COM port, and debug port
- Comprehensive free software libraries and examples available with the STM32CubeU5 MCU Package
- Support of a wide choice of Integrated Development Environments (IDEs) including IAR Embedded Workbench®, MDK-ARM, and STM32CubeIDE

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

2 Ordering information

To order the B-U585I-IOT02A Discovery kit, refer to Table 1. Additional information is available from the datasheet and reference manual of the target STM32.

Table 1. Ordering information

Order code	Board reference	Target STM32
B-U585I-IOT02A	MB1551	STM32U585AII6Q

2.1 Codification

The meaning of the codification is explained in Table 2.

Table 2. Codification explanation

B-XXXXM-AAANNT	Description	B-U585I-IOT02A
B	Discovery kit with application focus	Discovery kit for IoT node
XXXX	MCU product line in STM32 32-bit Arm Cortex MCUs	STM32U575/585 in the STM32U5 series of ultra-low-power microcontrollers
M	STM32 flash memory size: • I for 2 Mbytes	2 Mbytes
AAA	Application focus: • IOT for Internet of Things	Internet of Things
NN	Sequential number	Second Discovery kit for IoT node (after B-L475E-IOT01A and its B-L4S5I-IOT01A upgrade)
T	Connector type: • A for ARDUINO® • M for ST morpho • Z for Zio connector	ARDUINO® connector

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 Micro-B cable

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

3.2 Development toolchains

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

1. *On Windows® only.*

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 Delivery recommendations

Before the first use, check the board for any damage that might have occurred during shipment, and check that all socketed components are firmly fixed in their sockets and that none is loose in the plastic bag.

6 Getting started

1. Make sure that the jumpers and switches are in the default position according to Figure 27.
2. Install the STLINK-V3E USB driver available on the *www.st.com* website.
3. Connect the board to the laptop using the CN8 ST-LINK connector, which is a USB Micro-B port.
4. Open a terminal like Tera Term and configure it with the following parameters:
   – 115200 bps baud rate
   – 8-bit data size
   – No parity
5. The LD3 red COM LED is lit and the LD5 5V LED blinks.
6. Provide Wi-Fi® credential (SSID/PWD) via terminal.
7. Via the browser (client), it is possible to ping the server via IP.

Now, a web page appears on the browser and the web page content is accessible.

7 Hardware layout and configuration

The B-U585I-IOT02A Discovery kit is designed around the STM32U585AII6Q target microcontroller in a 169-pin BGA package. The hardware block diagram in Figure 2 illustrates the connection between the STM32 and peripherals:

Figure 2. Hardware block diagram

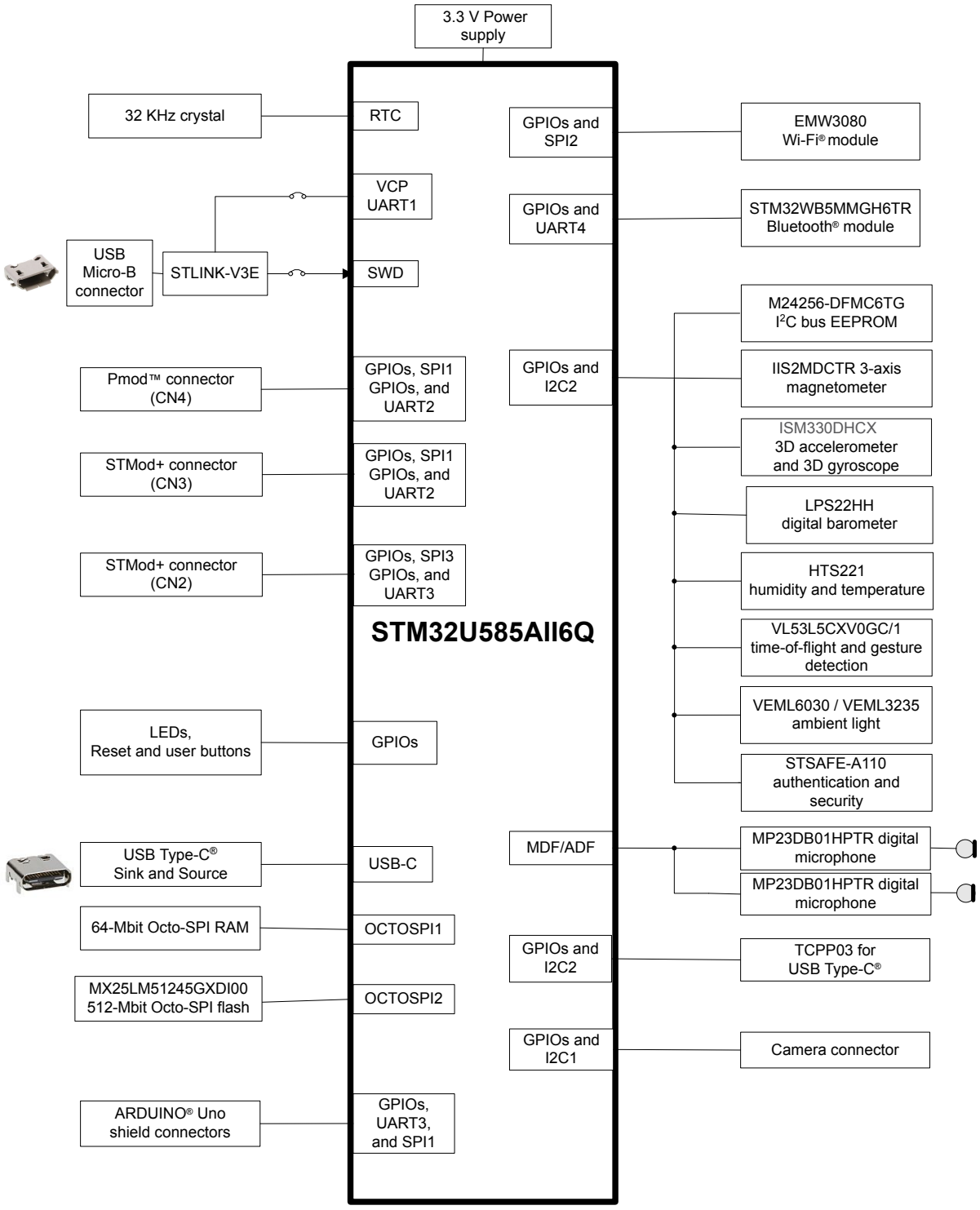
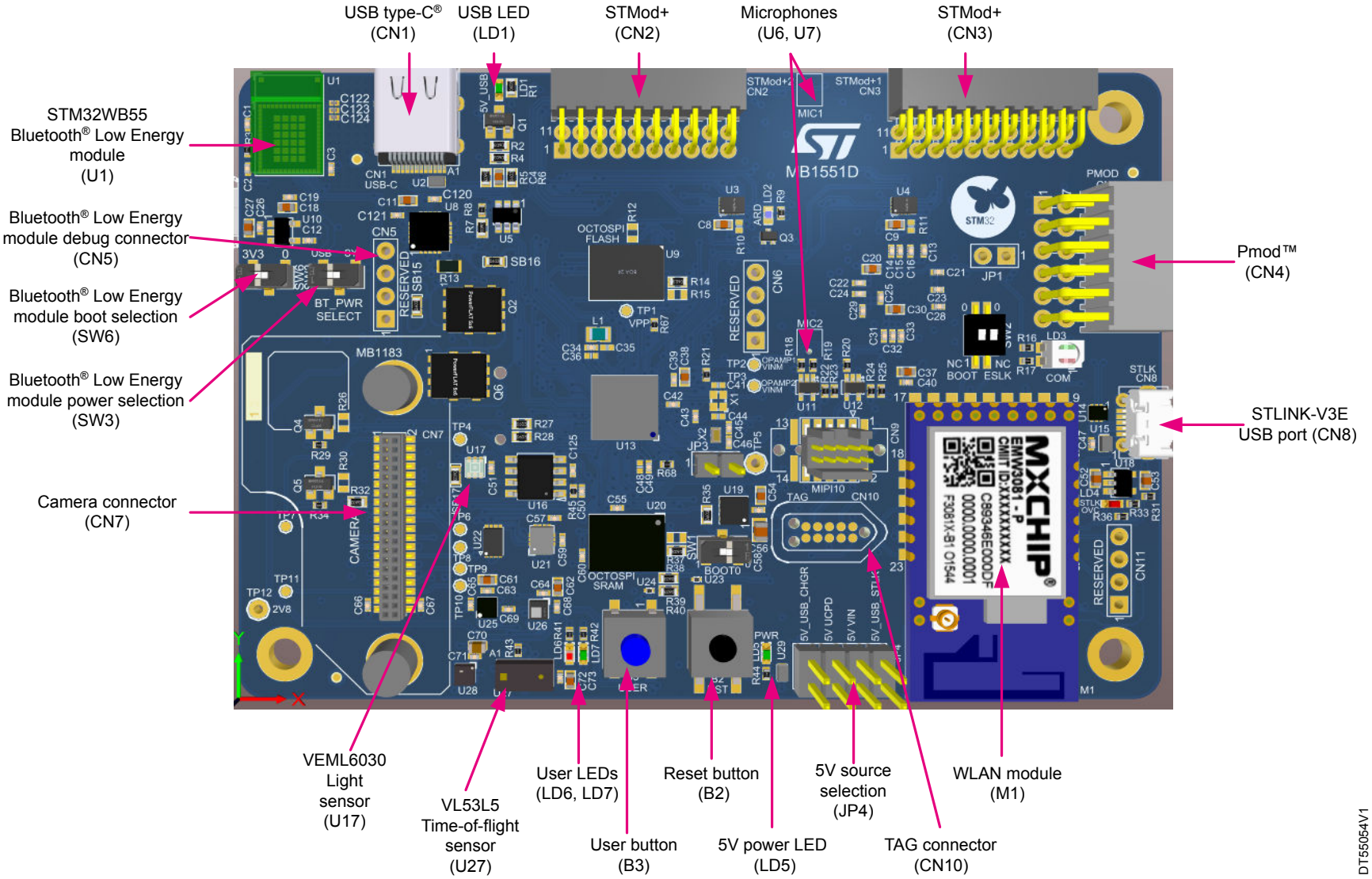
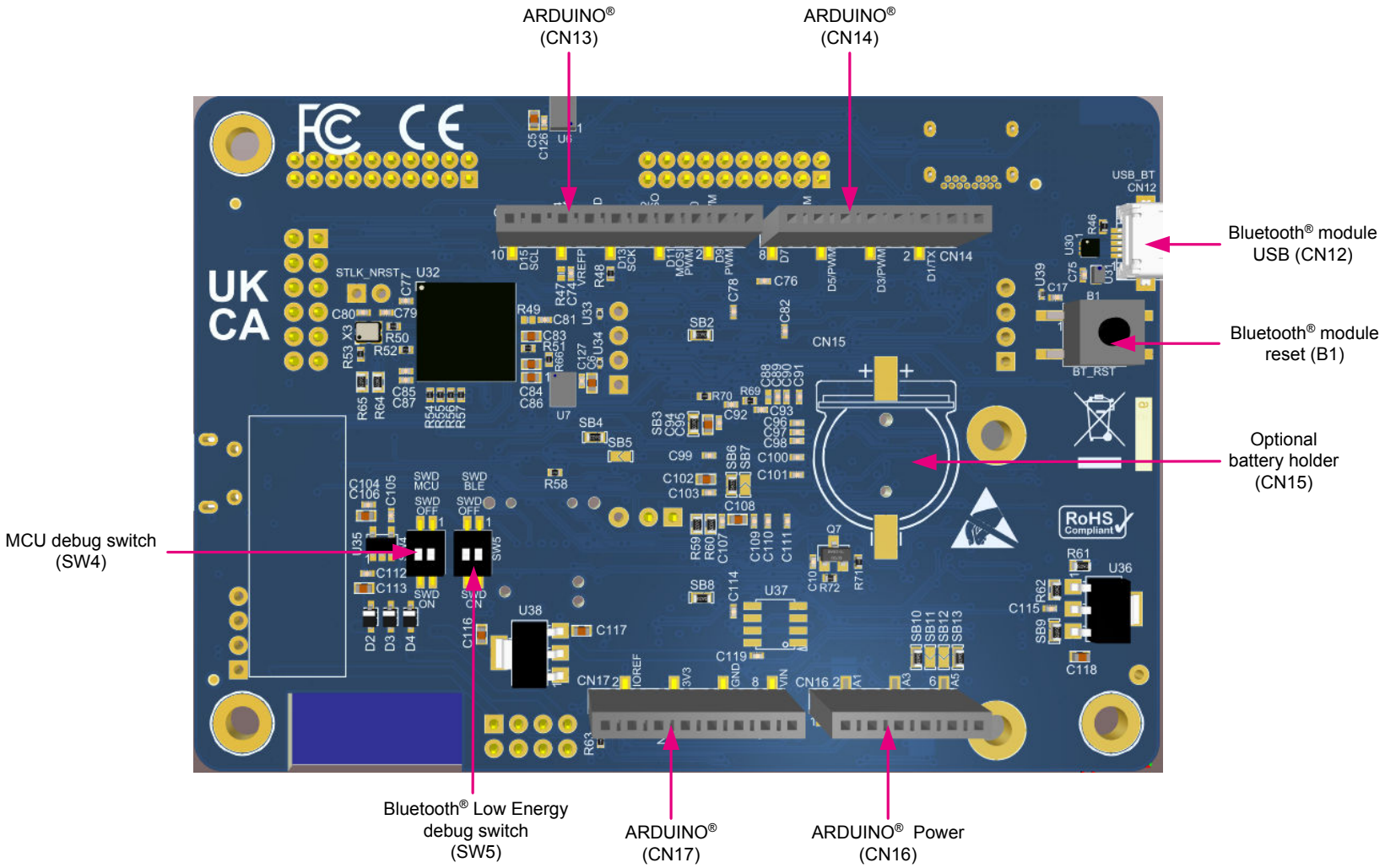


Figure 3. B-U585I-IOT02A Discovery kit layout (top view)



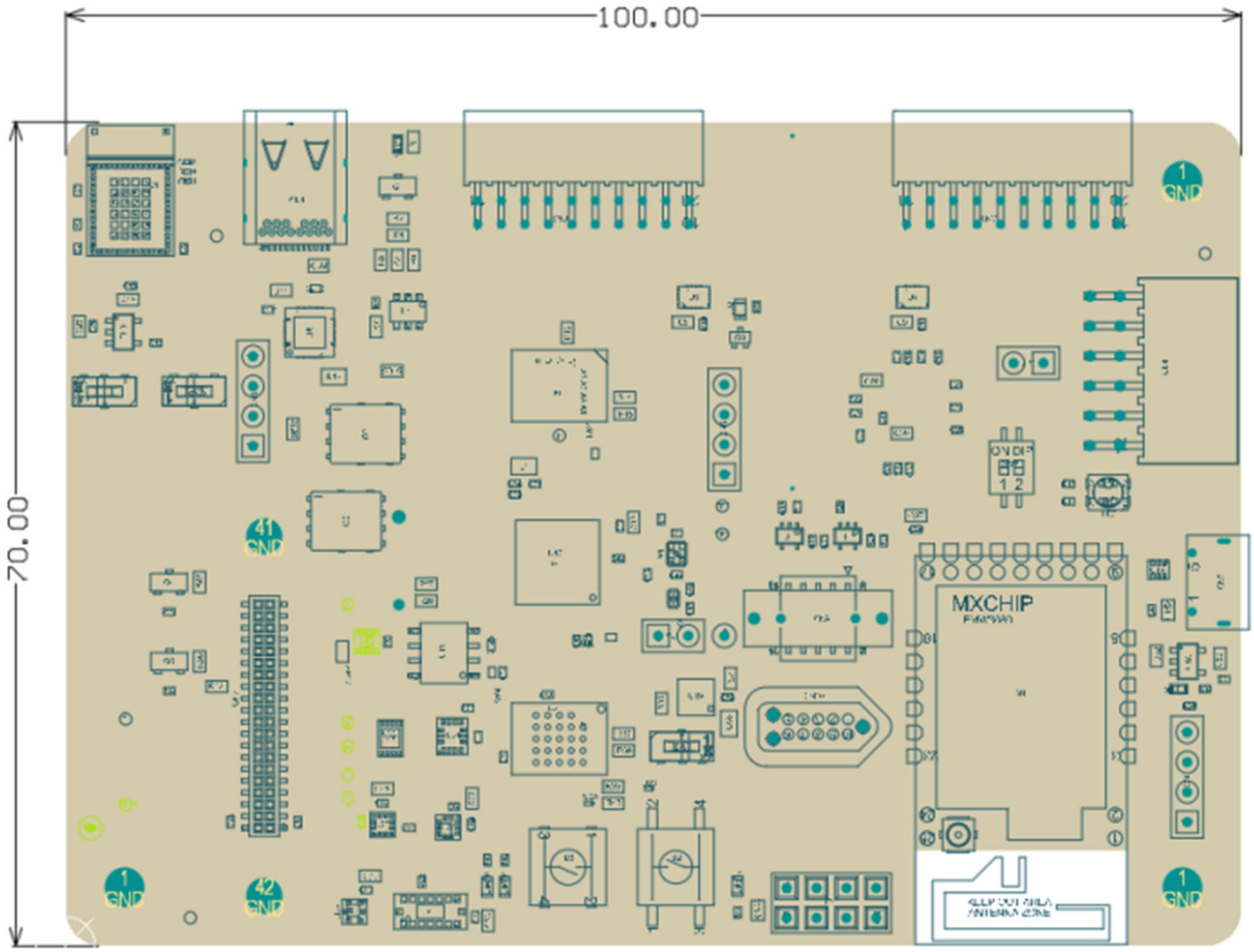
DT55054V1

Figure 4. B-U585I-IOT02A Discovery kit layout (bottom view)



DT55055V1

Figure 5. **B-U585I-IOT02A Discovery kit mechanical drawing in millimeters**



7.1 Embedded STLINK-V3E

7.1.1 Description

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

- Using the STLINK-V3E programming and debugging tool integrated into the B-U585I-IOT02A Discovery kit. Check that the SW5 switch is in the OFF position and SW4 in the ON position to make sure that the ST-LINK is connected to the target MCU.
- Using an external debug tool connected to the CN9 MIPI10 connector

The embedded STLINK-V3E supports only SWD and VCP for STM32 devices. For information about debugging and programming features, refer to the technical note *Overview of ST-LINK derivatives* (TN1235), which describes in detail all the STLINK-V3E features.

Features supported in STLINK-V3E:

- 5 V power supplied by the CN8 USB connector
- USB 2.0 high-speed-compatible interface
- JTAG and SWD protocols compatible with 3 to 3.6 V application voltage and 5 V tolerant inputs
- Serial Wire Viewer (SWV) output
- CN9 STDC14 MIPI10-compatible connector
- LD3 status COM LED blinking during communication with the PC
- LD4 OC fault red LED alerting on USB overcurrent request
- U18 5 V / 500 mA output power supply capability with current limitation
- LD5 5V power green LED

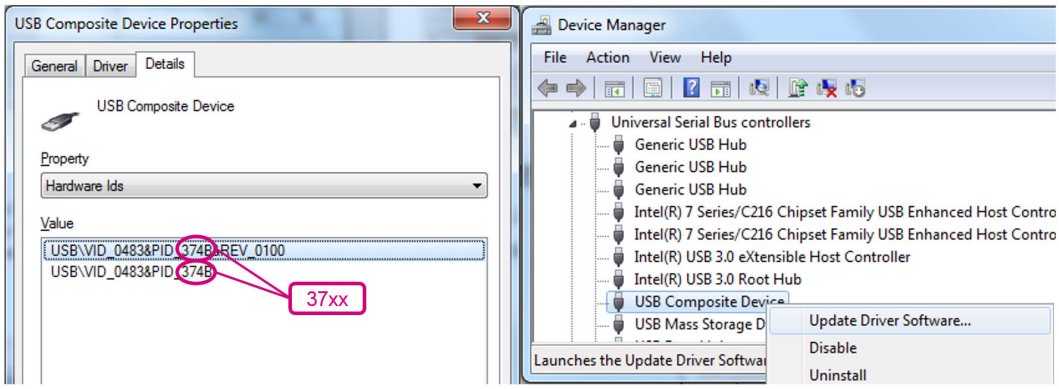
7.1.2 Drivers

Before connecting the Discovery kit for the IoT node board to a Windows® PC via USB, the user must install a driver for the STLINK-V3E. It is available on the *www.st.com* website.

In case the B-U585I-IOT02A Discovery kit board is connected to the PC before the driver is installed, some B-U585I-IOT02A Discovery kit interfaces may be declared as “Unknown” in the PC device manager. In this case, the user must install the dedicated driver files, and update the driver of the connected device from the device manager as shown in Figure 6.

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

Figure 6. USB composite device



7.1.3 STLINK-V3E firmware upgrade

The STLINK-V3E embeds a firmware upgrade mechanism through the USB port. As the firmware may evolve during the lifetime of the STLINK-V3E product to add new functionalities, fix bugs, and support new microcontroller families, it is recommended to visit the *www.st.com* website before starting to use the B-U585I-IOT02A Discovery kit and periodically, to stay up-to-date with the latest firmware version.

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

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

1. Keep the embedded STLINK-V3E running. Power on the STLINK-V3E at first until the COM LED lights RED. Then connect the external debug tool through the CN9 MIPI10 debug connector.
2. Set the embedded STLINK-V3E in a high-impedance state. When the jumper JP1 (STLK_RST) is set ON, the embedded STLINK-V3E is in the RESET state, and all GPIOs are in high impedance. Then the user can connect his external debug tool to the CN9 debug connector or the CN10 TAG connector.

Figure 7. Connecting an external debug tool to program the on-board STM32

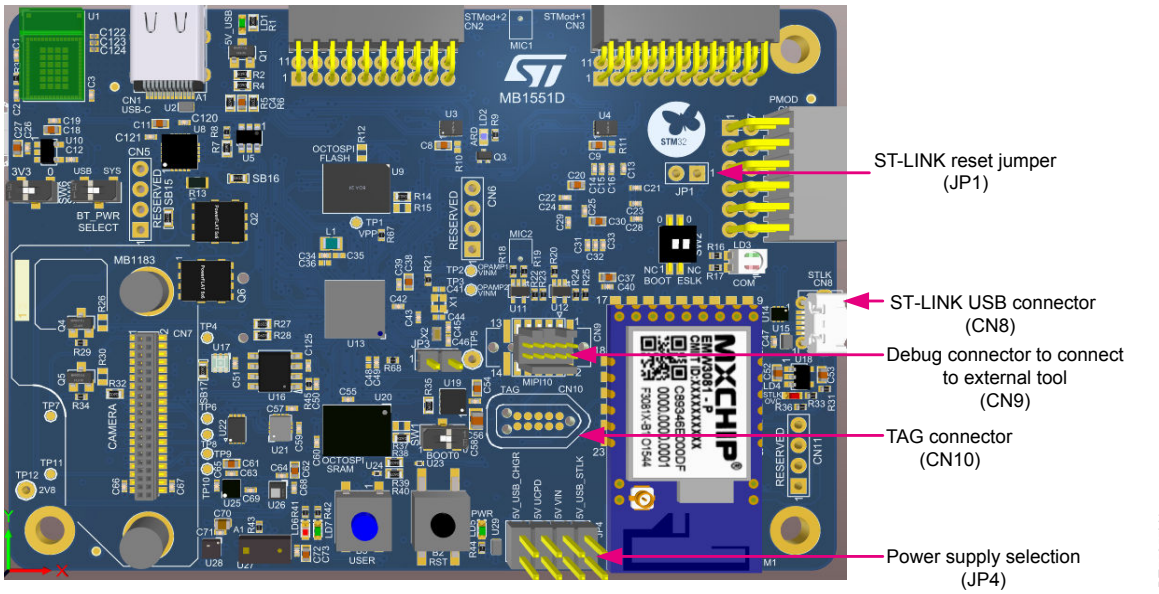


Table 4 describes the CN9 STDC14/MIPI10 debug connector pinout.

Table 4. CN9 STDC14/MIPI10 debug connector pinout

MIPI10	STDC14 pin	CN9	Designation
-	1	NC	Reserved
-	2	NC	Reserved
1	3	T_VCC	Target VCC
2	4	T_SWDIO	Target SWDIO using SWD protocol or Target JTMS (T_JTMS) using JTAG protocol
3	5	GND	Ground
4	6	T_SWCLK	Target SWCLK using SWD protocol or Target JCLK (T_JCLK) using JTAG protocol
5	7	GND	Ground
6	8	T_SWO	Target SWO using SWD protocol or Target JTDO (T_JTMS) using JTAG protocol
7	9	T_JRCLK	Not used by SWD protocol, Target JRCLK (T_JRCLK) using JTAG protocol, only for specific use
8	10	T_JTDI	Not used by SWD protocol, Target JTDI (T_JTDI) using JTAG protocol, only for external tools
9	11	GNDDetect	GND detection for plug indicator, used on SWD and JTAG
10	12	T_NRST	Target NRST using SWD protocol or Target JTMS (T_JTMS) using JTAG protocol

MIPI10	STDC14 pin	CN9	Designation
-	13	T_VCP_RX	Target RX used for VCP (UART supporting bootloader)
-	14	T_VCP_TX	Target TX used for VCP (UART supporting bootloader)

TAG connector

The CN10 TAG connector is implemented on the B-U585I-IOT02A Discovery kit. The TAG connector is a 10-pin footprint supporting SWD mode, which is shared with the same signals as the ST-LINK. The TC2050-IDC-NL cable is the recommended one to link ST-LINK and TAG connectors on the B-U585I-IOT02A Discovery kit so that the MCU can be easily programmed and debugged without any extra accessories.

Figure 8. TAG connector

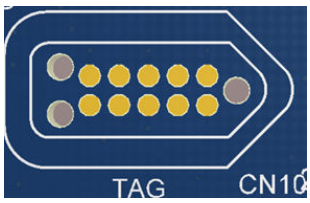


Figure 9. TC2050-IDC-NL cable

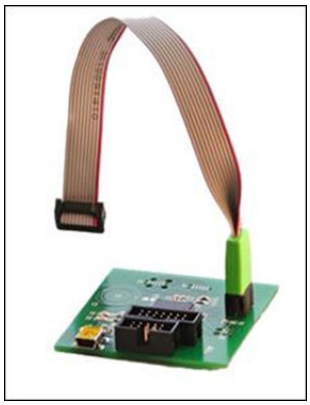


Table 5. TAG connector pinout

Connector	Pin number	Pin name	Signal name	STM32U5 pin	Function
CN10	1	3V3	3V3	-	Power
	2	SWD	T.SWDIO	PA13	Serial wire data I/O
	3	GND	-	-	Ground
	4	SWCLK	T.SWCLK	PA14	Serial wire clock
	5	GND	-	-	Ground
	6	SWO	T.SWO	PB3	Serial wire output
	7	NC	-	-	-
	8	JTDI	T.JTDI	PA15	Serial wire input
	9	NC	-	-	-
	10	NRST	NRST	NRST	RESET

7.2 Power supply

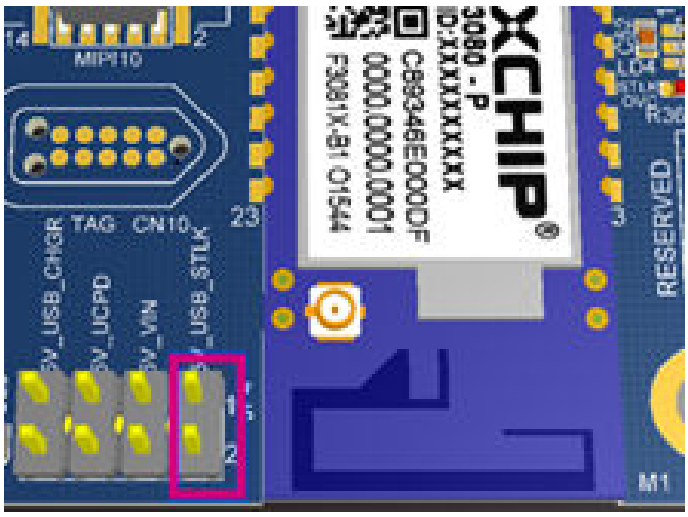
The B-U585I-IOT02A Discovery kit board is designed to be powered by a 5 V DC power supply. It is possible to configure the B-U585I-IOT02A Discovery kit using the JP4 jumper to select any of the four following power sources: 5V_USB_STLK, 5V_VIN, 5V_UCPD, 5V_VBAT, and 5V_USB_CHGR.

5V_USB_STLK: JP4 [1-2]

(Refer to Figure 10)

This is a 5 V DC power from the CN8 STLINK-V3E USB connector. This is the default setting. If the USB enumeration succeeds, the 5V_USB_STLK power is enabled, by asserting the T_PWR_EN signal (from STM32F723IEK). This pin is connected to an STMPS2151STR power switch, which powers the board. This power switch also features a current limitation to protect the PC in case of an onboard short circuit (the current is higher than 500 mA). The B-U585I-IOT02A Discovery kit can be powered from the CN8 ST-LINK USB connector, but only the ST-LINK circuit has the power before USB enumeration because the host PC only provides 100 mA to the board at that time. During the USB enumeration, the B-U585I-IOT02A Discovery kit asks for 500 mA power to the host PC. If the host can provide the required power, the STMPS2151STR power transistor is switched ON, and the LD3 red LED is turned ON, thus the B-U585I-IOT02A Discovery kit can consume up to 500 mA current, but no more. If the host cannot provide the requested current, the enumeration fails. Therefore, the STMPS2151STR remains OFF and the MCU part including the extension board is not powered. As a consequence, the LD3 red LED remains turned OFF. In this case, it is mandatory to use an external power supply.

Figure 10. JP4: 5V_USB_STLK selection

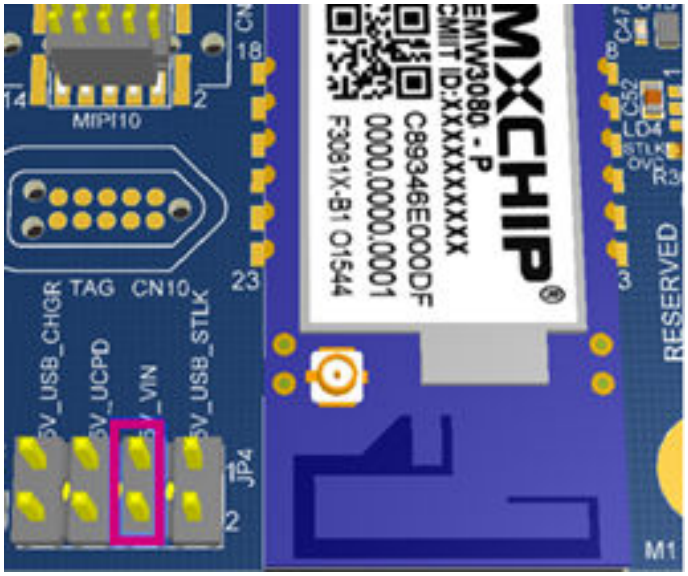


5V_VIN: JP4 [3-4]

(Refer to Figure 11)

This is the 7 to 12 V DC power from ARDUINO® CN17 pin 8 (named VIN on ARDUINO® connector silkscreen). In this case, the JP4 jumper must be fitted between pin 3 and pin 4 to select the 5V_VIN power source. In this case, the DC power comes from the power supply through the ARDUINO® Uno V3 battery shield (compatible with the Adafruit PowerBoost 500 shield).

Figure 11. **JP4: 5V_VIN selection from CN17 (VIN)**

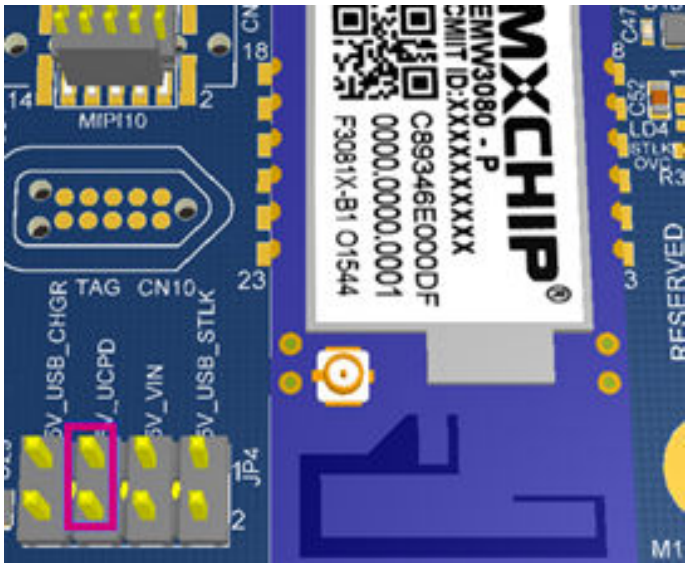


5V_UCPD: JP4 [5-6]

(Refer to Figure 12)

This is the DC power with a 500 mA limitation from the CN14 USB Type-C® connector. In this case, the JP4 jumper must be fitted between pin 5 and pin 6 to select the 5V_UCPD power source.

Figure 12. **JP4: 5V_UCPD**

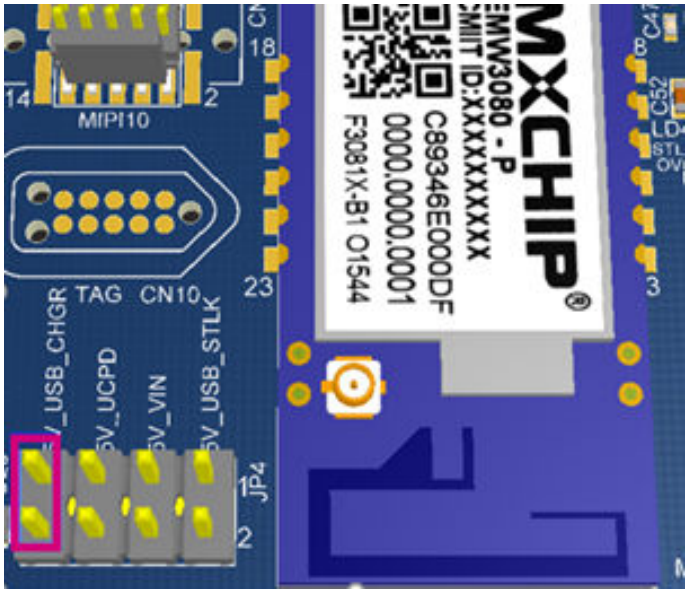


5V_USB_CHGR: JP4 [7-8]

(Refer to Figure 13)

This is the DC power charger connected to the CN8 USB ST-LINK connector. To select the 5V_USB_CHGR power source, the JP4 jumper must be fitted between pin 7 and pin 8. In this case, if the B-U585I-IOT02A Discovery kit is powered by an external USB charger, then the debug is not available. If the PC is connected instead of the charger, the limitation is no longer effective, and the PC might be damaged.

Figure 13. **JP4: 5V_USB_CHGR selection**



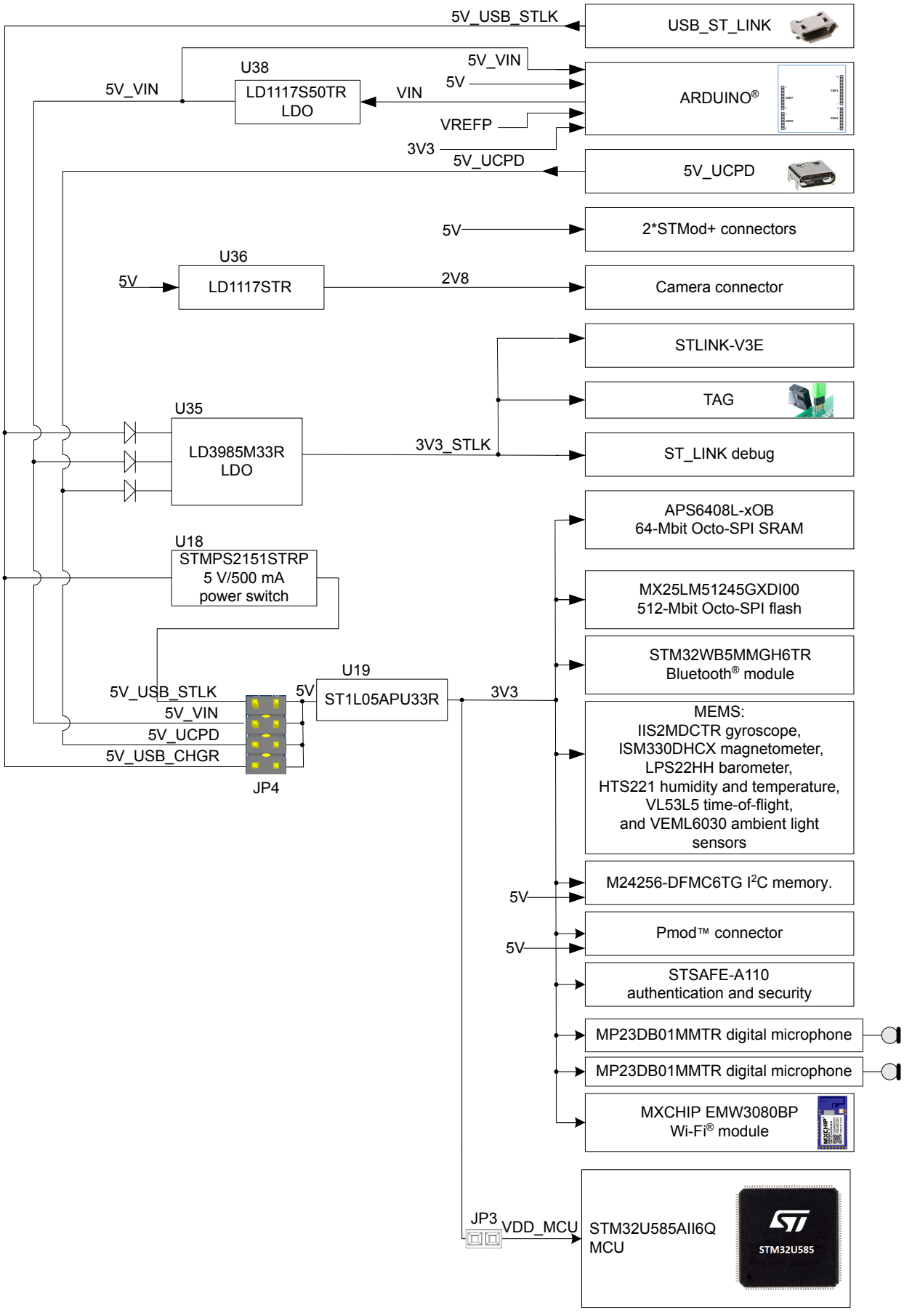
Note: If the board is powered by a USB charger, there is no USB enumeration, so the LD3 LED remains OFF permanently.

Caution: Do not connect the PC to the CN8 ST-LINK connector. The PC might be damaged or the board might not be powered correctly.

The LD5 green LED is lit when the B-U585I-IOT02A Discovery kit is powered by the 5 V correctly.

The power tree is shown in Figure 14.

Figure 14. **Power tree**



DT55062V1

7.3 Clock source

The board is designed with two crystals:

- X1: Crystal for the STM32U585AI HSE clock inputs. This component is optional and not fitted by default.
- X2: 32.768 kHz crystal for the STM32U585AI LSE clock inputs

Table 6. I/O configuration for the optional HSE

I/O	Solder bridge	Setting	Configuration
PH0	SB5	ON	PH0-OSC_IN is connected to STLK_MCO 8 MHz.
		OFF	PH0-OSC_IN terminal is not connected to STLK_MCO. PHO OSC_IN is connected to the 16 MHz HSE crystal.
PH1	SB4	ON	PH1 is used as GPIO MEMs enable.
		OFF	PH1 OSC_OUT is connected to the 16 MHz HSE crystal.

7.4 MCU management

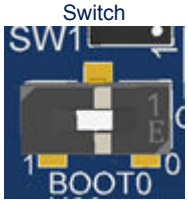
7.4.1 Reset sources

The active LOW reset sources are:

- The B2 reset button
- The reset signal coming from CN17 pin 3
- The reset signal coming from ST-LINK

7.4.2 MCU boot switch and jumper for current measurement

Table 7. MCU jumper and switch

Reference	Name	Comment
JP3	Jumper	Jumper for MCU current measurement The MCU current measurement can be performed on JP3. By default, a jumper is placed on JP3. For the current measurement configuration, an ammeter must replace the JP3 jumper.
SW1	Switch 	BOOT0 MCU-boot mode selection. Refer to the MCU specification for more details.

7.5 USB Type-C® FS port

The B-U585I-IOT02A Discovery kit supports USB full-speed (FS) communication. The CN1 USB connector is a USB Type-C® connector.

USB connectors can power the Discovery board at a 5 V DC voltage with a 500 mA current limitation.

A USB Power Delivery TCPP03 unit (U8) is also connected to VBUS_C for overvoltage protection.

- The LD1 LED is provided for VBUS_C detection.

The LD1 LED is ON when a 5V_UCPD from USB Type-C® is present.

Section 7.2 provides information on how to use the powering options.

7.5.1 Device and Host modes

When a USB host connection to the CN1 USB Type-C® connector of the B-U585I-IOT02A Discovery kit is detected, the board starts behaving as a USB device. Depending on the powering capability of the USB host, the board can take power from the V_{BUS} terminal of CN1. In the board schematic diagrams, the corresponding power voltage line is called 5V_UCPD.

It is possible to support the Host mode by mounting the 16 MHz HSE clock X1 and setting the SB4 and SB5 solder bridges OFF. In this configuration, be aware that the U27 VL53L5CXV0GC/1 Time-of-Flight sensor does not work anymore.

Refer to Table 6 in the Clock source section.

Note: In Sink mode, the JP4 jumper must be set on the 5V_UCPD position.

Note: In Source mode, the JP4 jumper must be set on the 5V_USB_STLK position.

7.5.2 UCPD description

USB Type-C® introduces the USB Power Delivery feature. The B-U585I-IOT02A board supports the Sink and Source modes.

In addition to the DP/DM I/Os directly connected to the USB Type-C® connector, some I/Os are also used for UCPD configuration: Configuration channel (CCx), VBUS-SENSE, IBUS_SENSE, I^2C interface, and UCPD_FAULT (FLT) feature.

To protect B-U585I-IOT02A from USB overvoltage, a PPS-compliant USB Type-C® port protection is used, the TCPP03-M20 IC-compliant with IEC6100-4-2 level 4.

Configuration channel I/Os

These UCPD_CCx signals are connected to the associated CCx line of the USB Type-C® connector through the ST TCPP03-M20 USB port protection. These lines are used for the configuration channel lines (CCx) to select the USB Type-C® current mode.

V_{BUS} fault detection

This UCPD_FLT signal is provided by the ST USB Type-C® port protection. It is used as fault reporting to MCU after a bad V_{BUS} level detection. By design, the B-U585I-IOT02A V_{BUS} protection is set to 6 V maximum with the RSENSE.

An I^2C bus drives the TCPP03-M20. The base I^2C-bus address is `0x68` (`0b 0110.100x`).

The hardware configuration for the USB FS interface is shown in Table 8.

Table 8. USB Type-C® FS Power Delivery configuration

I/O	Configuration
PB5	EN (UCPD_PWR)
PD13	IANA (USB.IANA)
PA15	CC1 (USB.UCPD_CC1)
PB15	CC2 (USB.UCPD_CC2)
PE8	FLGn (USB.UCPD_FLT)
PF14	USB.VBUS_SENSE
PH4	SCL (I2C2_SCL)
PH5	SDA (I2C2_SDA)

7.5.3 USB Type-C®

Figure 15. USB Type-C® (front view)

Table 9. USB Type-C® pinout

Connector	Pin number	Pin name	Signal name	STM32U5 pin	Function
CN1	A1	GND	GND	-	Ground
	A4	VBUS	VBUS_C	-	Power
	A5	CC1	-	PA15	USB-PD controller side for the CC1 pin
	A6	USB_P	-	PA12	USB differential pair P
	A7	USB_N	-	PA11	USB differential pair M
	A8	SBU1	-	-	-
	A9	VBUS	VBUS_C	-	Power
	A12	GND	-	-	-
	B1	GND	-	-	-
	B4	VBUS	VBUS_C	-	Power
	B5	CC2	-	PB15	USB-PD controller side for the CC2 pin
	B6	USB_P	-	PA12	USB diff pair P

Connector	Pin number	Pin name	Signal name	STM32U5 pin	Function
CN1	B7	USB_N	-	PA11	USB diff pair M
	B9	VBUS	VBUS_C	-	Power
	B12	GND	GND	-	Ground

7.6 NOR flash, PSRAM, and EEPROM memories

The MX25LM51245GXDI00 512-Mbit Octo-SPI NOR flash from Macronix, the APS6408L-3OB-BA 64-Mbit Octo-SPI PSRAM from AP Memory, and the M24256-DFMC6TG I^2C EEPROM from STMicroelectronics are available on the B-U585I-IOT02A Discovery kit.

The M24256-DFMC6TG is connected on ISC2 (PH4, PH5) with the `0xAC` address for a write operation and `0xAD` for a read operation.

In option, it is possible to mount a Quad-SPI SRAM APS1604M-3SQR-SN to replace the PSRAM.

Table 10. Octo-SPI flash I/O configuration

I/O	Configuration
PF0	SIO0 (OCTOSPI.F_IO0)
PF1	SIO1 (OCTOSPI.F_IO1)
PF2	SIO2 (OCTOSPI.F_IO2)
PF3	SIO3 (OCTOSPI.F_IO3)
PH9	SIO4 (OCTOSPI.F_IO4)
PH10	SIO5 (OCTOSPI.F_IO5)
PH11	SIO6 (OCTOSPI.F_IO6)
PH12	SIO7 (OCTOSPI.F_IO7)
PF12	DQS (OCTOSPI.F_DQS)
PF4	SCLK (OCTOSPI.F_CLK_P)
PI5	NCS (OCTOSPI.F_NCS)
NRST	NRESET (OCTOSPI_FLASH_RESET)

Table 11. Octo-SPI RAM I/O configuration

I/O	Configuration
PF8	DQ0/SIO0 (OCTOSPI.R_IO0)
PF9	DQ1/SIO1 (OCTOSPI.R_IO1)
PF7	DQ2/SIO2 (OCTOSPI.R_IO2)
PF6	DQ3/SIO3 (OCTOSPI.R_IO3)
PH2	DQ4 (OCTOSPI.R_IO4)
PI0	DQ5 (OCTOSPI.R_IO5)
PC3	DQ6 (OCTOSPI.R_IO6)
PD7	DQ7 (OCTOSPI.R_IO7)
PE3	DQS (OCTOSPI.R_DQS)
PB10	CLK/SCLK (OCTOSPI.R_CLK_P)
PB11	CE (NCS) (OCTOSPI.R_NCS)
NRST	RST (OCTOSPI_SRAM_RESET)

7.7 Virtual COM port

The integrated ST-LINK provides a Virtual COM port over the USB interface. It is connected to the USART1 of STM32U585AI.

For the demonstration software programmed when the board is shipped, the parameters are 115200 bit/s, 8-bit data, no parity, one stop bit, and no flow control.

7.8 RF modules

Two RF interfaces are available on the B-U585I-IOT02A Discovery kit:

1. Bluetooth® (V5.0 compliant) STM32WB5MMG module with integrated antenna
2. EMW3080 802.11 b/g/n compliant Wi-Fi® module from MXCHIP with integrated antenna

7.8.1 Bluetooth® (V5.0 compliant) STM32WB5MMG

The STM32WB5MMG is an ultra-low-power and small-form-factor-certified 2.4GHz wireless module. It supports Bluetooth® Low Energy V5.0, Zigbee® 3.0, OpenThread, dynamic and static concurrent modes, and 802.15.4 proprietary protocols. Based on the STMicroelectronics STM32WB55VGY wireless microcontroller, STM32WB5MMG provides best-in-class RF performance thanks to its good receiver sensitivity and a high output power signal. Its low-power features enable extended battery lifetime, small coin-cell batteries, or energy harvesting.

The STM32WB5MMG requires no RF expertise and is the best way to speed up any development and reduce associated costs. The module is completely protocol stack royalty-free.

Figure 16. STM32WB5MMG RF module

The main features of the STM32WB5MMG module are listed below:

- Bluetooth® V5.0 compliant (support of Master and Slave modes, multiple roles supported simultaneously)
- Embedded Bluetooth® Low Energy protocol stack (GAP, GATT, SM, L2CAP, LL, RFPHY)
- Bluetooth® Low Energy profiles provided separately
- Bluetooth® radio performance
  - Tx power: + 4 dBm
- Host interface: SPI, IRQ, and RESET. On-field stack upgrading available via UART
- Certification: CE qualified, FCC, IC modular approval certified, BQE qualified
- On-board chip antenna

7.8.2 Bluetooth® Low Energy module firmware update

The Bluetooth® Low Energy module firmware can be updated using the onboard ST-LINK that can be connected directly to the Bluetooth® Low Energy debug port (SWD port), by setting the SW5 switch to ON and switching SW4 to OFF. Another way is to connect an external ST-LINK directly to the CN5 SWD interface to update the module.

The STM32WB5MM module is shipped with the *BLE_MultiAppAt* application available in the STM32CubeWB MCU Package for STM32WB series.

Using the CN5 SWD interface or CN12 USB connector shown below, the Bluetooth® Low Energy module firmware can be updated.

The STM32WB5MM module is shipped with the following option bytes: nSWBOOT0=0, nBOOT0=1, and nBOOT1=1. So, as default, the BOOT0 pin is not used and the nBOOT0/nBOOT1 options bytes are used.

Note: The BOOT0 pin of the STM32WB chip is pulled down within the module, even if there is no pull-down outside the module, the STM32WB might boot on system flash if nSWBOOT0=1.

To program an application in the WB module an external ST-LINK interface is required, and debug signals must be connected to CN5. Pin 1: Target VCC, pin 2: SWCLK, pin 3: GND, and pin 4: SWDIO.

The STM32WB5MM module can also be programmed using the CN12 USB connector, but option bytes must be set as follows: SWBOOT0=0 and nBOOT0=0. This way the STM32WB boots on the flash system allowing it to flash using the USB port.

For more information about how to flash the STM32WB chip (FUS and wireless stack), refer to the `Release_Notes.html` file available in the STM32CubeWB MCU Package under the `Projects\STM32WB_Copro_Wireless_Binaries\STM32WB5x` directories.

Figure 17. Bluetooth® Low Energy module firmware update port

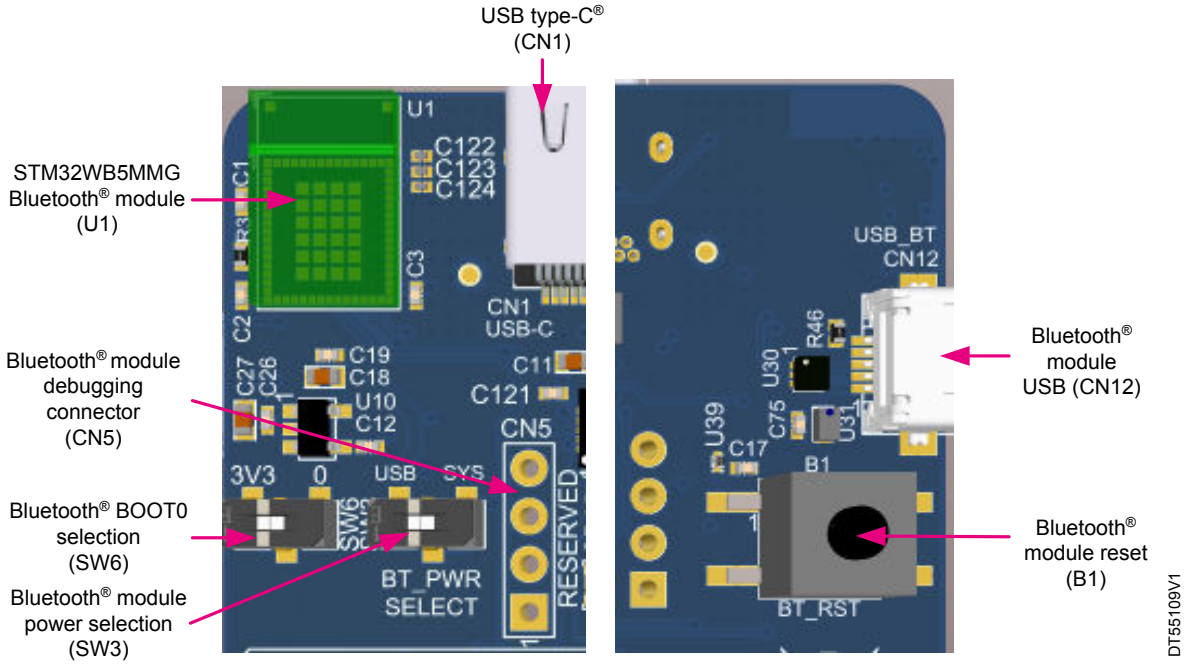
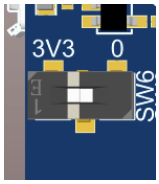
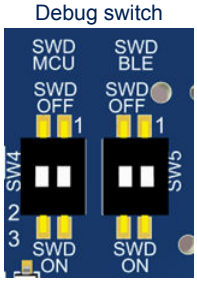
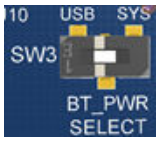


Table 12. Bluetooth® Low Energy module I/O configuration

MCU I/O	Configuration
PG6	PA0 (WRLS.WKUP_B)
PC11 (UART4_RX)	PA2 (WRLS.UART4_RX)
PC10 (UART4_TX)	PA3 (WRLS.UART4_TX)

Table 13. **Bluetooth® Low Energy power selection**

Reference	Name	Comment
SW6	BOOT0 switch 	Switch to select the Bluetooth® Low Energy module Boot mode. By default this switch is set to 0.
SW4, SW5	Debug switch 	Switch used to connect the onboard ST-LINK to the Bluetooth® module debug port. By default, ST-LINK is connected to the target MCU. Both switches must not be ON at the same time. To connect the onboard ST-LINK to the Bluetooth® module, set SW4 OFF and SW5 ON.
SW3	Power switch 	Bluetooth® module power selection This switch chooses to power the Bluetooth® module using the 3.3 V coming from the system or the Bluetooth® module USB connector, in case of debugging or flashing. Put the switch on the SYS position to select the system power.

7.8.3 MXCHIP EMW3080 (802.11 b/g/n compliant Wi-Fi® module)

The M1 MXCHIP EMW3080 module is implemented on the top side of the B-U585I-IOT02A Discovery kit board. This module is an embedded wireless internet connectivity device. The module uses the SPI (SPI2 of STM32U585AI) interface to communicate with the MCU. The Wi-Fi® module requires no operating system and has a completely integrated TCP/IP stack that only requires AT commands to establish connectivity.

This module complies with FCC/CE certification.

Figure 18. **EMW3080 module**

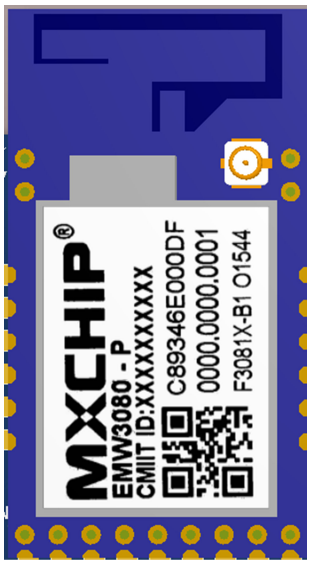
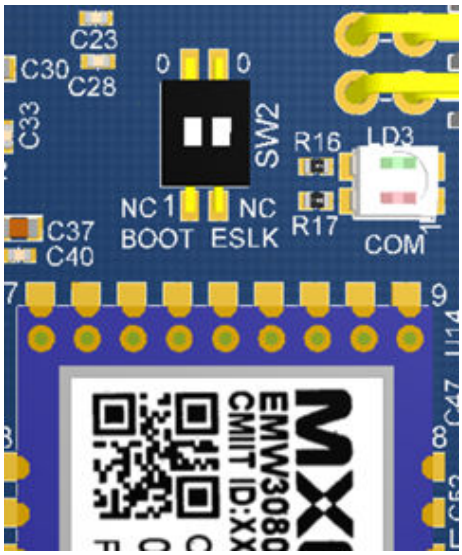


Table 14. **WLAN module I/O configuration**

MCU I/O	Configuration
PF15	Chip_En (WRLS.WKUP_W)
PD3	MISO (WRLS.SPI2_MISO)
PD4	MOSI (WRLS.SPI2_MOSI)
PD1	CK (WRLS.SPI2_SCK)
PB12	CS (WRLS.SPI2_NSS)
PG15	GPIO13 (WRLS.FLOW)
PD14	GPIO14 (WRLS.NOTIFY)

7.8.3.1 *EMW3080 firmware update*

Figure 19. **EMW3080 switch**



EMW3080 update procedure

First, the user must download the `EMW3080updateVxyz.bin` firmware from the X-WIFI-EMW3080B development tool location.

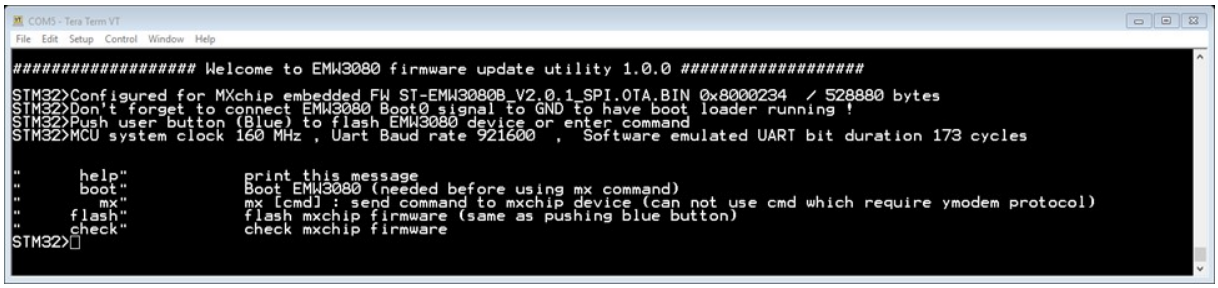
- Set the boot pin of the SW2 switch to 0.
- Connect the board to the host computer using the CN8 debug connector.

- Start TeraTerm (not mandatory, but helpful to see what is going on) and configure as shown in Figure 20.

Figure 20. Wi-Fi® firmware update configuration

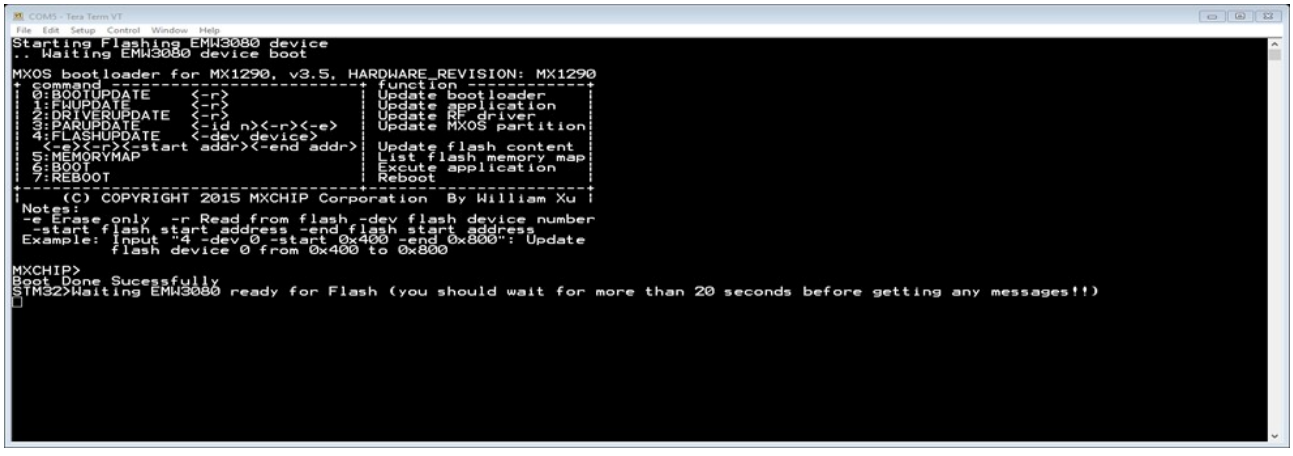
- Download `EMW3080updateVxyz.bin` binary file to STM32
  - The simple way is to drag and drop this file on the `DIS_U585ZI` board volume name that appears in Windows Explorer after connecting the board to the host computer using CN8.
- On TeraTerm, the following message appears:

Figure 21. Firmware update utility menu



- Press the reset black button to put the EMW3080 in Flash mode
- Press the blue button to start flashing, and receive the following message, while the green LED is ON. A red LED means failure.

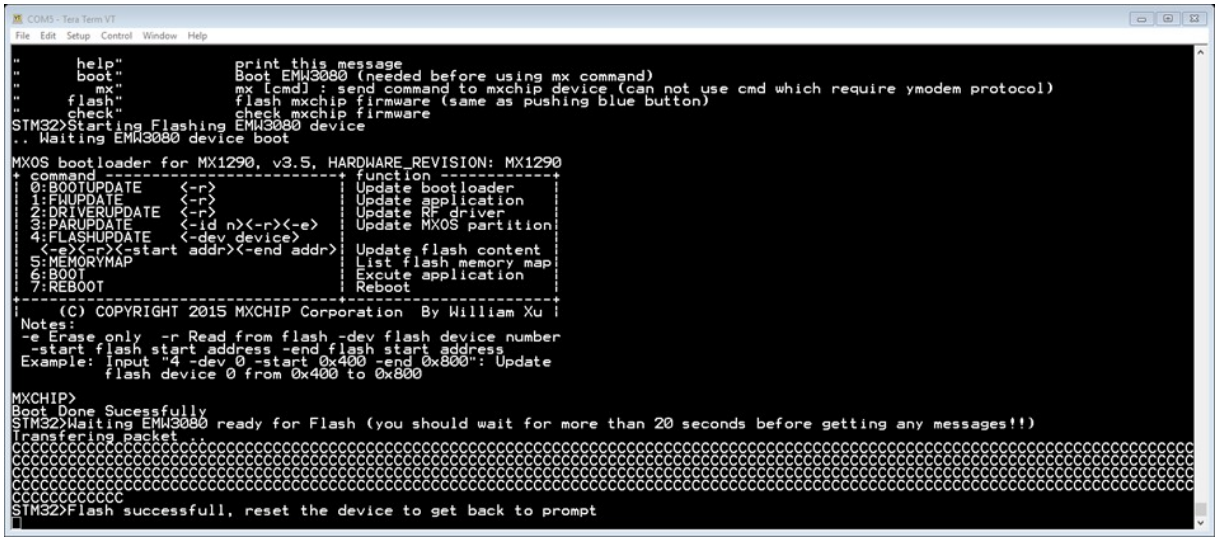
Figure 22. Firmware update utility message



- Wait until the end of the flash procedure. The green LED flashes quickly while flashing, slowly when the flash procedure is over and successful. A red LED means failure.

The *check* command on the console might check if the flash procedure is correct. If the user has not seen any issue during the process, Figure 23 shows completion without error messages.

Figure 23. Firmware update utility successful completion



7.9 MEMS

Several STMicroelectronics MEMS modules are available on the B-U585I-IOT02A Discovery kit board all connected on I2C2 (PH4, PH5).

Table 15. I²C addresses for MEMS

Module	Description	SAD[7:0] + R/W	I²C write address	I²C read address
HTS221	Capacitive digital sensor for relative humidity and temperature	1011111x	0xBE	0xBF
IIS2MDCTR	3-axis magnetometer	0011110x	0x3C	0x3D
LPS22HH	MEMS nano pressure sensor	1011101x	0xBA	0xBB
ISM330DHCX	3D accelerometer and 3D gyroscope	1101011x	0xD6	0xD7
VL53L5CXV0GC/1	Time-of-Flight ranging and gesture-detection sensor	0101001x	0x52	0x53
STSAFE-A110	Authentication and security	0100000x	0x40	0x41
VEML6030/VEML3235	Ambient light sensor. On the IoT board, VEML6030 (BU585IIO2A$GTx) or VEML3235 (BU585IIO2A1$GTx) is mounted.	0010000x	0x20	0x21

7.9.1 Two on-board MEMS audio sensor omnidirectional digital microphones (MP23DB01HPTR)

The B-U585I-IOT02A Discovery kit provides two MP23DB01HP digital MEMS microphones. The microphones are connected to the MCU's ADF/MDF interface. The clock needs to be configurated accordingly. The I/O interface is described in Table 16.

Table 16. **Microphones I/O configuration**

Microphones I/O		I/O
Mic1 (U6)	CLK	PE9 (MIC_CCK0
	DOUT	PE10 (MIC_SDINx
Mic2 (U7)	DOUT	PB1 (MIC_SDIN0)
	CLK	PF10 (MIC_CCK1)

7.9.2 Capacitive digital sensor for relative humidity and temperature (HTS221)

HTS221 is an ultracompact sensor for relative humidity and temperature. The interface used to communicate with the MCU is I^2C. The sensor I^2C address is provided in Table 15. The I/O interface is described in Table 17.

Table 17. **Humidity sensor I/O interface**

I/O	Configuration
-	DRDY
PH4	I2C_SCL
PH5	I2C_SDA

7.9.3 High-performance 3-axis magnetometer (IIS2MDCTR)

IIS2MDCTR is an ultra-low-power high-performance three-axis magnetic sensor. The device might be configured to generate interrupt signals for magnetic field detection.

An I/O is provided on the Discovery board for this interruption. The communication interface with the STM32U585AII6Q is I^2C. The I^2C address is provided in Table 15. The I/O interface is described in Table 18.

Table 18. **Magnetometer I/O interface**

I/O	Configuration
PD10	INT/DRDY (Mems.INT_IIS2MDC)
PH4	I2C_SCL
PH5	I2C_SDA

7.9.4 3D accelerometer and 3D gyroscope (ISM330DHCX)

ISM330DHCX is a system-in-package featuring a high-performance 3D digital accelerometer and 3D digital gyroscope tailored for Industry 4.0 applications.

The interface connection with STM32U585AII6Q is I^2C. An interrupt port is also provided. The I^2C address is provided in Table 15. The I/O interface is described in Table 19.

Table 19. **Accelerometer I/O interface**

I/O	Configuration
PE11	INT1 (Mems.ISM330DLC_INT1)
PH4	I2C_SCL
PH5	I2C_SDA

7.9.5 260 to 1260 hPa absolute digital output barometer (LPS22HH)

LPS22HH is an ultracompact piezoresistive absolute pressure sensor that functions as a digital output barometer.

The communication interface with the STM32U585AII6Q is I^2C. The I^2C address is provided in Table 15. The I/O interface is described in Table 20.

Table 20. **Pressure sensor I/O interface**

I/O	Configuration
PG2	INT/DRDY (Mems.INT_LPS22HH)
PH4	I2C_SCL
PH5	I2C_SDA

7.9.6 Time-of-Flight and gesture-detection sensor (VL53L5)

VL53L5 is a state-of-the-art, Time-of-Flight (ToF), laser-ranging sensor enhancing the ST FlightSense product family.

The communication interface with STM32U585AII6Q is I^2C. A shutdown control and interruption input is also provided on STM32U585AII6Q. The I^2C address is provided in Table 15. The I/O interface is described in Table 20.

Caution: The laser output power must not be increased by any means and optics must not be used to focus the laser beam. Use of controls or adjustments or performance of procedures other than those specified herein might result in hazardous radiation exposure. Refer to the VL53L5 datasheet for more details.

Figure 24. **Label for Class 1 laser products**

Table 21. **Time-of-Flight I/O interface**

I/O	Configuration
PG5	GPIO1 (Mems.VLX_GPIO)
PH1	LPn (Mems.VL53_xshut)
PH4	I2C_SCL
PH5	I2C_SDA

7.9.7 STSAFE authentication and security for peripherals and IoT devices (STSAFA110S8SPL03)

The PF11 I/O is introduced to enable or shut down the STSAFE:

- Set PF11 to 0 to enable the STSAFE
- Set PF11 to 1 to disable the STSAFE

Table 22. **STSAFE I/O configuration**

I/O	Configuration
PF11	STASAFE enable/disable
PH4	I2C_SCL
PH5	I2C_SDA

7.10 Buttons and LEDs

The B2 black button located on the top side is the reset of the STM32U585AII6Q microcontroller. Refer to Figure 3.

The B3 blue button located on the top side is available to be used as a user button. Refer to Figure 3.

The LD6 and LD7 green LEDs located on the top side are available for the user. To light a LED, a HIGH logic state must be written in the corresponding GPIO. Table 23 gives the assignment of the control ports to the LED indicators.

Table 23. Button and LED control ports

I/O	Reference	Color	Name	Comment
NRST	B2	Black	RST	System reset
-	B1	Black	BT_RST	Bluetooth® module reset
PC13	B3	Blue	USER	User button
-	LD3	Bicolor (red and green)	COM	Blinking when flashing or debugging
-	LD4	Red	STLK_OVC	Red when the current is upper than 500 mA
PH7	LD7	Green	LD7	User LED lights up when PH7 is set to 0.
PH6	LD6	Red	LD6	User LED lights up when PH6 is set to 0.
-	LD5	Green	PWR	Available 5 V
PE13	LD2	Blue	ARD	ARDUINO® LED lights up when PE13 is set to 1.
-	LD1	Green	5V_USB	Available VBUS_C

7.11 ARDUINO® Uno V3 connectors

CN13, CN14, CN16, and CN17 are female connectors (SMD component devices) compatible with ARDUINO® standard. Most shields designed for ARDUINO® can fit the B-U585I-IOT02A Discovery kit board.

The ARDUINO® connector on the B-U585I-IOT02A Discovery kit board supports the ARDUINO® Uno V3.

The I/Os of the STM32U585AII6Q microcontroller are 5V tolerant, so no issue with ARDUINO® compatibility.

Figure 25. ARDUINO® connector (front view)

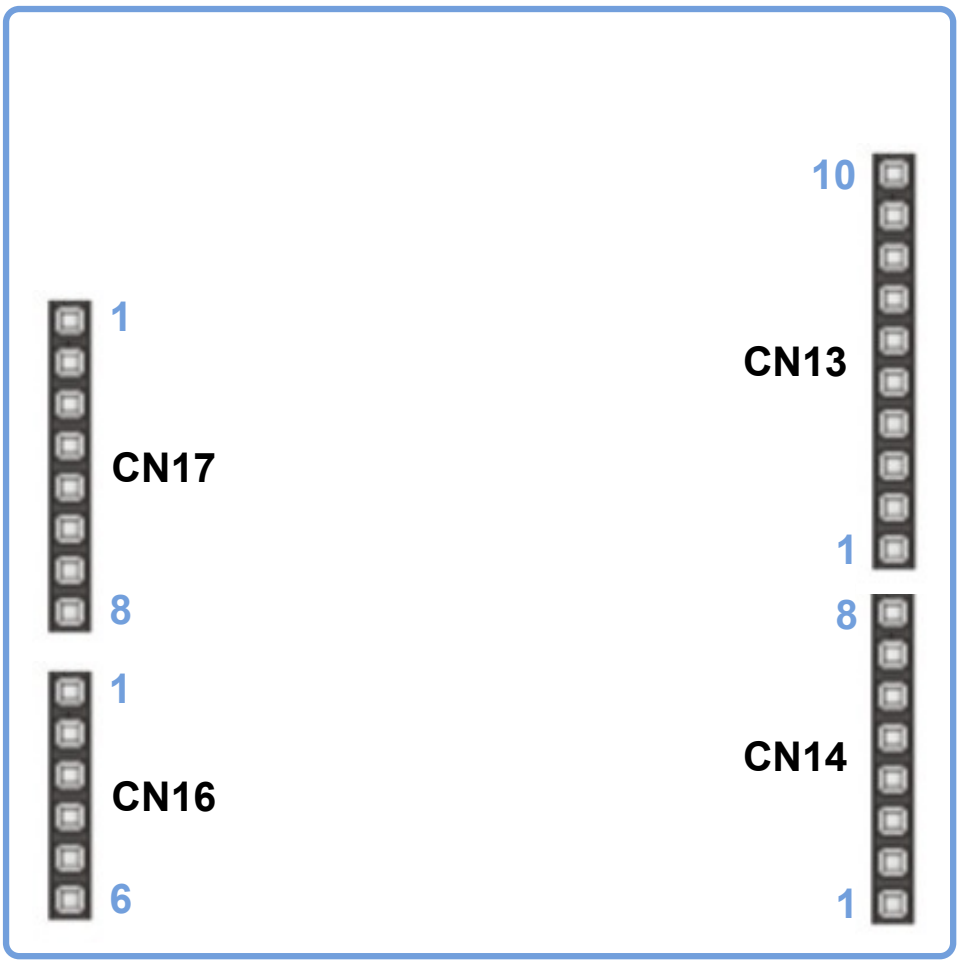


Table 24. **ARDUINO® connector pinout**

Connector	Pin number	Pin name	Signal name	STM32U5 pin	Function
CN17	1	NC	-	-	-
	2	IOREF	-	-	3.3 V reference
	3	NRST	NRST	NRST	Reset
	4	3V3	-	-	3.3 V I/O
	5	5V	-	-	5 V
	6	GND	-	-	GND
	7	GND	-	-	GND
	8	VIN	-	-	Power input
CN16	1	A0	ARD_ADC_A0	PC0	ADC
	2	A1	ARD-ADC_A1	PC2	ADC
	3	A2	ARD-ADC_A2	PC4	ADC
	4	A3	ARD-ADC_A3	PC5	ADC
	5	A4	ARD-ADC_A4	PA7	ADC / I2C1_SDA
	6	A5	ARD-ADC_A5	PB0	ADC / I2C1_SCL
CN13	10	SCL/D15	I2C1_SCL	PB8	I2C1_SCL
	9	SDA/D14	I2C1_SDA	PB9	I2C1_SDA
	8	VREFP	VREFP	-	VREFP
	7	GND	GND	-	GND
	6	SCK/D13	ARD.D13_SPI1_SCK	PE13	SPI1_SCK / LD2
	5	MISO/D12	ARD.D12_SPI1_MISO	PE14	SPI1_MISO
	4	PWM/MOSI/D11	ARD.D11_SPI1_MOSI	PE15	SPI1_MOSI / TIM1_CH4N
	3	PWM/CS/D10	ARD.D10_TIM_SPI1_NSS	PE12	SPI1_NSS / TIM1_CH3N
	2	PWM/D9	ARD.D9_TIM	PA8	TIM1_CH1
	1	D8	ARD.D8_IO	PC1	GPIO
CN14	8	D7	ARD.D7_IO	PF13	GPIO
	7	PWM/D6	ARD.D6_TIM	PB6	TIM4_CH1
	6	PWM/D5	ARD.D5_TIM	PE0	TIM16_CH1
	5	D4	ARD.D4_INT	PE7	GPIO
	4	PWM/D3	ARD.D3_TIM	PB2	TIM8_CH4N
	3	D2	ARD.D2_IO	PD15	GPIO
	2	TX/D1	ARD.D1_TX	PD8	UART3_TX
	1	RX/D0	ARD.D0_RX	PD9	UART3_RX

Caution: ARDUINO® UART is shared with STMod+ CN2 UART so both cannot be used at the same time.

7.12 STMod+ connector

On the B-U585I-IOT02A Discovery kit node board, there are two STMod+ connectors, to support flexibility in small form factor applications. The STMod+ connector extends SPI, UART, and spare I/Os for different peripheral expansions like cellular modems.

Pin assignment is based on the existing STMod+ standard.

A switch is used to select either UART or SPI from the MCU to the STMod+ connector. The CN3 STMOD+.UART2_SPI1_SEL (PH13 I/O) and CN2 STMOD+.UART3_SPI3_SEL (PH15 I/O) are used for selection. Set these I/Os to HIGH to select UART or LOW to select SPI.

Caution: CN4 Pmod™ and CN3 STMod+ cannot be used at the same time because they share the same signals.

Table 25. CN2 STMod+ connector mapping

Alternate configuration (UART) PH15 set HIGH		Standard configuration (SPI) PH15 set LOW		-			
STM32U5 pin	Pin name	STM32U5 pin	Pin name	STMod+pin number		Pin name	MCU pin
PD11	STMOD+.2_UART3_CTS	PG12	STMOD+.2_SPI3_NSS	1	11	STMOD+.2_INT	PE6
PD8	STMOD+2_UART3_TX	PD6	STMOD+.2_SP31_MOSI	2	12	STMOD+.2_RST	PB13
PD9	STMOD+.2_UART3_RX	PG10	STMOD+.2_SPI3_MISO	3	13	STMOD+.2_ADC	PG0
PD12	STMOD+.2_UART3_RTS	PG9	STMOD+.2_SPI3_SCK	4	14	STMOD+.2_TIM	PC9
GND				5	15	5V	
5V				6	16	GND	
PH4	I2C2_SCL			7	17	STMOD+.2_17	PG1
PC12	STMOD+.2_SPI3_MOSI_alt1			8	18	STMOD+.2_18	PD2
PB4	STMOD+.2_SPI3_MISO_alt1			9	19	STMOD+.2_19	PD5
PH5	I2C2_SDA			10	20	STMOD+.2_20	PG8

Table 26. CN3 STMod+ connector mapping

Alternate configuration (UART) PH13 set HIGH		Standard configuration (SPI) PH13 set LOW		-			
MCU pin	Pin name	MCU pin	Pin name	STMod+pin number		Pin name	MCU pin
PA0	STMOD+.1_UART2_CTS	PA4	STMOD+.1_SPI1_NSS	1	11	STMOD+.1_INT	PE4
PA2	STMOD+.1_UART2_TX	PE15	STMOD+.1_SPI1_MOSI	2	12	STMOD+.1_RST	PG7
PA3	STMOD+.1_UART2_RX	PE14	STMOD+.1_SPI1_MISO	3	13	STMOD+.1_ADC	PA5
PA1	STMOD+.1_UART2_RTS	PE13	STMOD+.1_SPI1_SCK	4	14	STMOD+.1_TIM	PE5
GND				5	15	5V	
5V				6	16	GND	
PB8	I2C1_SCL			7	17	STMOD+.1_17	PE2
PG4	STMOD+.1_SPI1_MOSI_alt1			8	18	STMOD+.1_18	PD0
PG3	STMOD+.1_SPI1_MISO_alt1			9	19	STMOD+.1_19	PF5
PB9	I2C1_SDA			10	20	STMOD+.1_20	PB14

7.13 Pmod™ connector

On the Discovery kit, the Pmod™ connector provides flexibility in a small form factor application. Based on Digilent's Pmod™ standard popular in connectivity, the Pmod™ connector is implemented in types 2A and 4A.

The related STM32U5 I/Os for the Pmod™ function are listed in Table 27. The Pmod™ connector is 2x6-pin with a 2.54 mm pitch and right angle female connector.

Caution: CN4 Pmod™ and CN3 STMod+ cannot be used at the same time because they share the same signals.

Table 27. Pmod™ solder bridge configuration

Alternate configuration (UART) PH13 set HIGH		Standard configuration (SPI) PH13 set LOW		-			
MCU pin	Pin name	MCU pin	Pin name	Pmod™ pin number		Pin name	MCU pin
PA0	STMOD+.1_UART2_CTS	PA4	STMOD+.1_SPI1_NSS	1	7	STMOD+.1_INT	PE4
PA2	STMOD+.1_UART2_TX	PE15	STMOD+.1_SPI1_MOSI	2	8	STMOD+.1_RST	PG7
PA3	STMOD+.1_UART2_RX	PE14	STMOD+.1_SPI1_MISO	3	9	-	-
PA1	STMOD+.1_UART2_RTS	PE13	STMOD+.1_SPI1_SCK	4	10	-	-
GND				5	11	GND	
3V3				6	12	3V3	

7.14 Camera daughterboard connector

On the B-U585I-IOT02A Discovery kit, it is possible to connect a camera module such as B-CAMS-OMV using the CN7 camera connector.

Figure 26. CN7 camera daughterboard connector (top view)

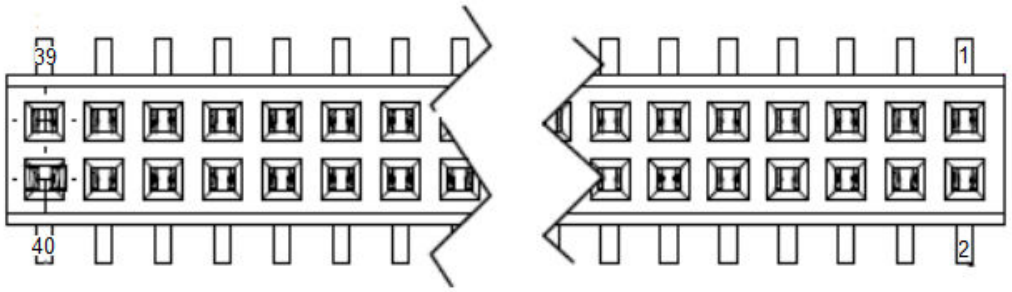
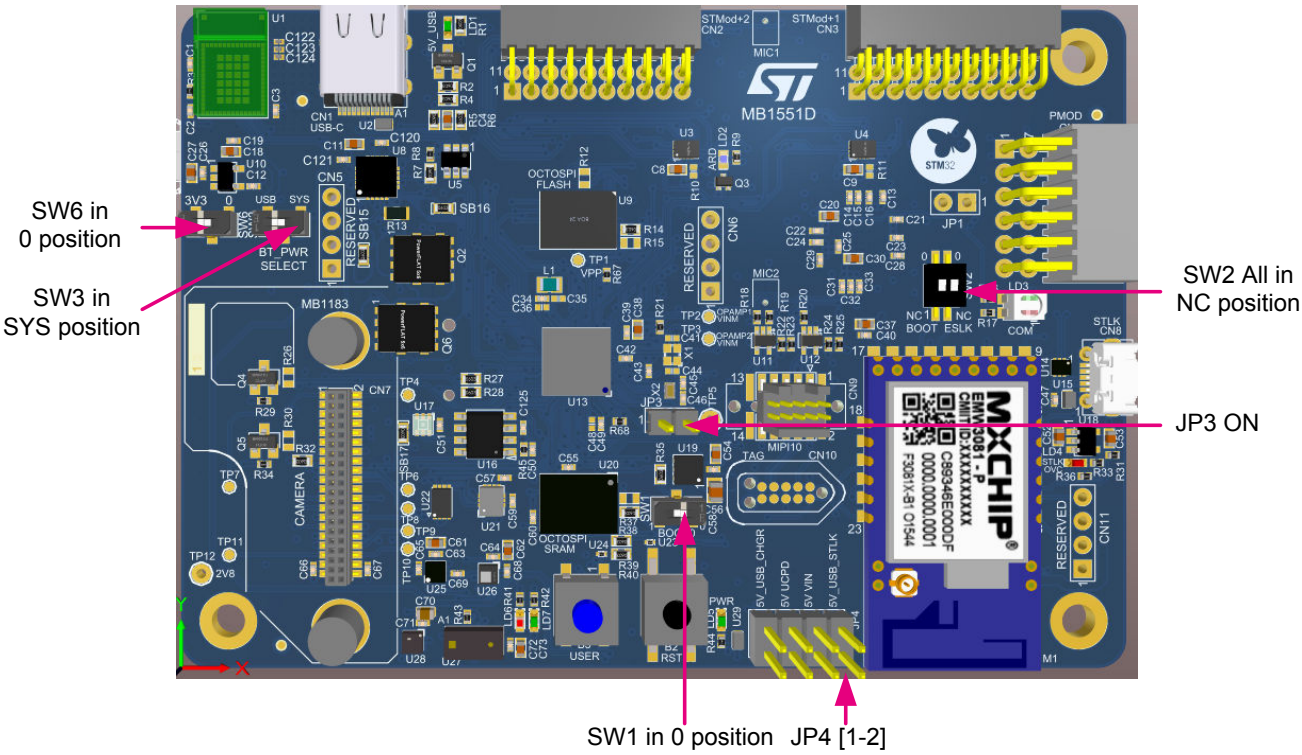


Table 28. CN7 camera daughterboard connector pinout

Pin number	Description	Pin connection	Pin number	Description	Pin connection
1	TP7	-	2	TP4	-
3	GND	GND	4	GND	GND
5	-	-	6	D11	PH15
7	GND	GND	8	GND	GND
9	-	-	10	-	-
11	GND	GND	12	GND	GND
13	I2C_SCL	PB8	14	I2C_SDA	PB9
15	PLUG	PI1	16	GND	GND
17	RSTI	PI2	18	TP6	-
19	XSDN	PI3	20	TP8	-
21	GND	GND	22	GND	GND
23	D0	PC6	24	D1	PC7
25	D2	PC8	26	D3	PE1
27	D4	PH14	28	D5	PI4
29	D6	PI6	30	D7	PI7
31	HSYNC	PH8	32	VSYNC	PB7
33	PIXCLK	PA6	34	TP9	-
35	TP11	-	36	TP10	-
37	GND	GND	38	GND	GND
39	2.8 V	2V8	40	2.8 V	2V8

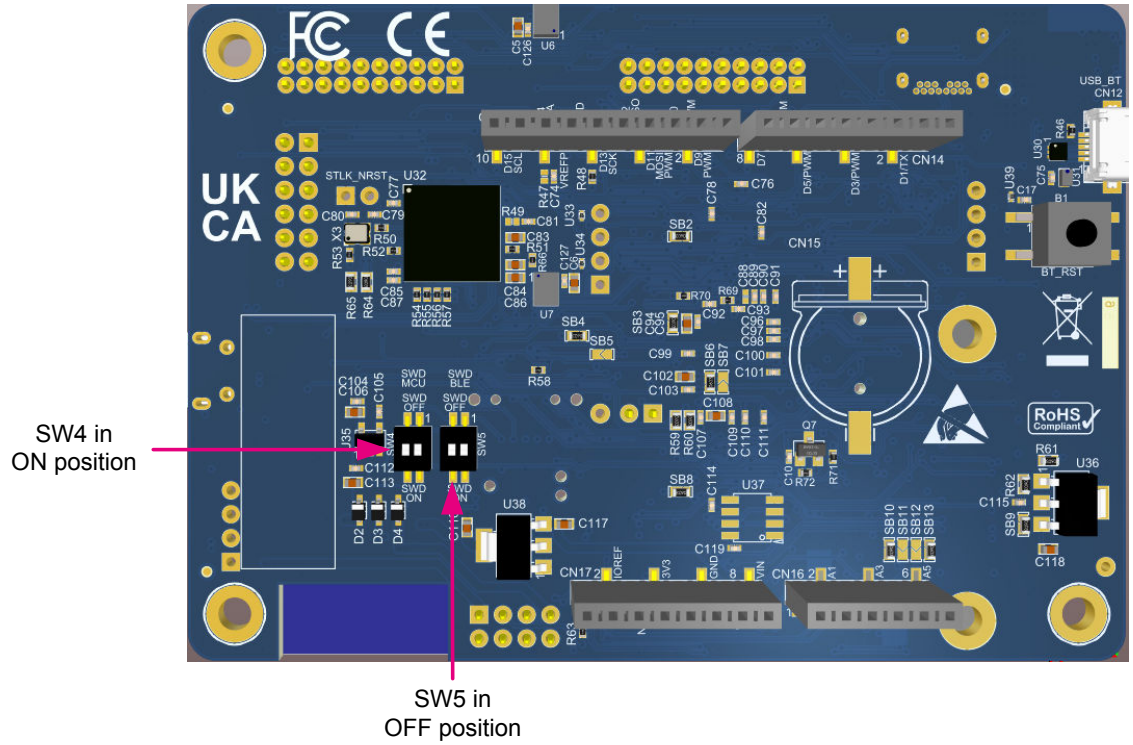
8 B-U585I-IOT02A jumper summary

Figure 27. **B-U585I-IOT02A jumper summary top**



DT55110V1

Figure 28. **B-U585I-IOT02A jumper summary bottom**



DT56151V1

9 B-U585I-IOT02A I/O assignment

Table 29. **B-U585I-IOT02A I/O assignment**

BGA pinout	Pin name	Main function pinout assignment	Alternate function pinout assignment
A1	PE2	STMOD+.1_17	-
D3	PE3	OCTOSPI.R_DQS	-
C2	PE4	STMOD+.1_INT	-
D2	PE5	STMOD+.1_TIM	-
E4	PE6	STMOD+.2_INT	-
C1	VBAT	-	-
F2	VSS_SW	-	-
E3	PC13	USER_BUttON	-
D1	PC14-OSC32_IN	PC14-OSC32_IN	-
E1	PC15-OSC32_OUT	PC15-OSC32_OUT	-
E2	PF0	OCTOSPI.F_IO0	-
F3	PF1	OCTOSPI.F_IO1	-
F4	PF2	OCTOSPI.F_IO2	-
G5	PF3	OCTOSPI.F_IO3	-
G6	PF4	OCTOSPI.F_CLK_P	-
G4	PF5	STMOD+.1_19	-
H2	VSS_5	-	-
G1	VDD_5	-	-
H6	PF6	OCTOSPI.R_IO3	-
G2	PF7	OCTOSPI.R_IO2	-
F1	PF8	OCTOSPI.R_IO0	-
G3	PF9	OCTOSPI.R_IO1	-
H4	PF10	MIC_CCK1	-
H1	PH0-OSC_IN	PH0-OSC_IN	T.MCO
J1	PH1-OSC_OUT	PH1-OSC_OUT	Mems.VL53_xshut
H3	NRST	NRST	-
J2	PC0	ARD_ADC.A0	-
J3	PC1	ARD.D8_IO	-
J4	PC2	ARD_ADC.A1	-
K1	PC3	OCTOSPI.R_IO6	-
K2	VSSA	-	-
L1	VREF+	-	-
L2	VDDA	-	-
K3	PA0	STMOD+.1_UART2_CTS	-
M1	OPAMP1_VINM	-	-
L3	PA1	STMOD+.1_UART2_RTS	-
M2	PA2	STMOD+.1_UART2_TX	-

BGA pinout	Pin name	Main function pinout assignment	Alternate function pinout assignment
N2	PA3	STMOD+.1_UART2_RX	-
M3	VSS_4	-	-
N3	VDD_4	-	-
N1	PA4	STMOD+.1_SPI1_NSS	-
K4	PA5	STMOD+.1_ADC	-
N4	PA6	CAM_PIXCLK	-
H5	OPAMP2_VINM	-	-
J5	PA7	ARD_ADC.A4	-
L4	PC4	ARD_ADC.A2	-
M4	PC5	ARD_ADC.A3	-
K5	PB0	ARD_ADC.A5	-
N5	PB1	MIC_SDIN0	-
L5	PB2	ARD.D3_TIM	-
M5	PF11	STSAFE_EN	-
K6	PF12	OCTOSPI.F_DQS	-
M7	VSS_6	-	-
N7	VDD_6	-	-
M6	PF13	ARD.D7_IO	-
L6	PF14	USB.VBUS_SENSE	-
N6	PF15	WRLS.WKUP_W	-
J6	PG0	STMOD+.2_ADC	-
H7	PG1	STMOD+.2_17	-
L7	PE7	ARD.D4_INT	-
K7	PE8	USB.UCPD_FLT	-
J7	PE9	MIC_CCk0	-
[M7]	VSS_7	-	-
[N7]	VDD_7	-	-
H8	PE10	MIC_SDINx	-
M8	PE11	Mems.ISM330DLC_INT1	-
N8	PE12	ARD.D10_TIM_SPI1_NSS	-
L8	PE13	ARD.D13_SPI1_SCK	ARDUINO® LED LD2
K8	PE14	ARD.D12_SPI1_MISO	-
M9	PE15	ARD.D11_TIM_SPI1_MOSI	-
K9	PB10	OCTOSPI.R_CLK	-
L9	PB11	OCTOSPI.R_NCS	-
N9	VLXSMPS	-	-
N10	VDDSMPS	-	-
M10	VSSSMPS	-	-
N11	V11_1	-	-
M11	VSS_1	-	-

BGA pinout	Pin name	Main function pinout assignment	Alternate function pinout assignment
N12	VDD_1	-	-
L10	PB12	WRLS_SPI2_NSS	-
N13	PB13	STMOD+.2_RST	-
M12	PB14	STMOD+.1_20	-
L11	PB15	USB.UCPD_CC2	-
L12	PD8	STMOD+.2_UART3_TX	ARD.D1_TX
L13	PD9	STMOD+.2_UART3_RX	ARD.D0_RX
K11	PD10	Mems.INT_IIS2MDC	-
M13	PD11	STMOD+.2_UART3_CTS	-
K10	PD12	STMOD+.2_UART3_RTS	-
K12	PD13	USB.IANA	-
J12	VSS_8	-	-
J13	VDD_8	-	-
J10	PD14	WRLS.NOTIFY	-
J11	PD15	ARD.D2_IO	-
K13	PG2	Mems.INT_LPS22HH	-
J8	PG3	STMOD+.1_SPI1_MISO_alt1	-
H11	PG4	STMOD+.1_SPI1_MOSI_alt1	-
J9	PG5	Mems.VLX_GPIO	-
H10	PG6	WRLS.WKUP_B	-
G8	PG7	STMOD+.1_RST	-
H9	PG8	STMOD+.2_20	-
[J12]	VSSIO_1	-	-
H12	VDDIO_1	-	-
H13	PC6	CAM.D0	-
G12	PC7	CAM.D1	-
G10	PC8	CAM.D2	-
G9	PC9	STMOD+.2_TIM	-
G7	PA8	ARD.D9_TIM	-
G11	PA9	T.VCP_TX	-
F11	PA10	T.VCP_RX	-
G13	PA11	USB.C_N	-
F13	PA12	USB.C_P	-
F12	PA13	T.SWDIO	-
[E12]	VSSUSB	-	-
E13	VDDUSB	-	-
E12	VSS_2	-	-
D13	VDD_2	-	-
C10	PA14	T.SWCLK	-
A10	PA15	USB.UCPD_CC1	T.JTDI
C9	PC10	WRLS.UART4_TX	-

BGA pinout	Pin name	Main function pinout assignment	Alternate function pinout assignment
A9	PC11	WRLS.UART4_RX	-
E8	PC12	STMOD+.2_SPI3_MOSI_alt1	-
B9	PD0	STMOD+.1_18	-
F6	PD1	WRLS.SPI2_SCK	-
F7	PD2	STMOD+.2_18	-
D8	PD3	WRLS.SPI2_MISO	-
C8	PD4	WRLS.SPI2_MOSI	-
E7	PD5	STMOD+.2_19	-
B8	VSS_9	-	-
A8	VDD_9	-	-
B7	PD6	STMOD+.2_SPI3_MOSI	-
D7	PD7	OCTOSPI.R_IO7	-
A7	PG9	STMOD+.2_SPI3_SCK	-
C7	PG10	STMOD+.2_SPI3_MISO	-
E6	PG12	STMOD+.2_SPI3_NSS	-
[B8]	VSSIO_2	-	-
A6	VDDIO_2	-	-
A5	PG15	WRLS.FLOW	-
D6	PB3	T.SWO	-
B6	PB4	STMOD+.2_SPI3_MISO_alt1	-
C6	PB5	UCPD_PWR	-
B5	PB6	ARD.D6_TIM	-
F5	PB7	CAM_VSYNC	-
C5	PH3-BOOT0	-	-
E5	PB8	I2C1_SCL	-
D5	PB9	I2C1_SDA	-
D4	PE0	ARD.D5_TIM	-
C4	PE1	CAM.D3	-
A4	V11_2	-	-
B4	VSS_3	-	-
A3	VDD_3	-	-
B11	VSS_10	-	-
[D13]	VDD_10	-	-
F10	PH2	OCTOSPI1_IO4	-
E10	PH4	I2C2_SCL	-
F9	PH5	I2C2_SDA	-
E11	PH6	LED_RED	-
F8	PH7	LED_GREEN	-
D12	PH8	CAM_HSYNC	-
E9	PH9	OCTOSPI.R_IO4	-
C13	PH10	OCTOSPI.F_IO5	-

BGA pinout	Pin name	Main function pinout assignment	Alternate function pinout assignment
D9	PH11	OCTOSPI.F_IO6	-
B13	PH12	OCTOSPI.F_IO7	-
C12	PH13	STMOD+.UART2_SPI1_SEL	-
C11	PH14	CAM.D4	-
A13	PH15	STMOD+.UART3_SPI3_SEL	-
[B11]	VSS_11	-	-
A11	VDD_11	-	-
B12	PI0	OCTOSPI.R_IO5	-
A12	PI1	CAM_PLUG	-
D11	PI2	CAM_RSTI	-
D10	PI3	CAM_XSDN	-
B2	VSS_12	-	-
B1	VDD_12	-	-
B10	PI4	CAM.D5	-
B3	PI5	OCTOSPI.F_NCS	-

10 B-U585I-IOT02A product information

10.1 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.

10.2 B-U585I-IOT02A product history

Table 30. **Product history**

Order code	Product identification	Product details	Product change description	Product limitations
B-U585I-IOT02A	BU585IIO2A$GT1	MCU: • STM32U585AII6Q silicon revision "X"	Initial revision	No limitation
		MCU errata sheet: • *STM32U575xx and STM32585xx device errata* (ES0499)		
		Board: • MB1551-U585AI-C02		
	BU585IIO2A$GT2	MCU: • STM32U585AII6Q silicon revision "X"	Board revision changed	No limitation
		MCU errata sheet: • *STM32U575xx and STM32585xx device errata* (ES0499)		
		Board: • MB1551-U585AI-D01		
	BU585IIO2A1$GT2	MCU: • STM32U585AII6Q silicon revision "X"	VEML6030 replaced by VEML3235 on this product	No limitation
		MCU errata sheet: • *STM32U575xx and STM32585xx device errata* (ES0499)		
		Board: • MB1551-U585AI1-D01		
	BU585IIO2A$GT3	MCU: • STM32U585AII6Q silicon revision "W"	MCU revision changed	No limitation
		MCU errata sheet: • *STM32U575xx and STM32585xx device errata* (ES0499)		
		Board: • MB1551-U585AI-D01		
	BU585IIO2A1$GT3	MCU: • STM32U585AII6Q silicon revision "W"	VEML6030 replaced by VEML3235 on this product	No limitation
		MCU errata sheet: • *STM32U575xx and STM32585xx device errata* (ES0499)		
		Board: • MB1551-U585AI1-D01		

10.3 Board revision history

Table 31. Board revision history

Board reference	Board variant and revision	Board change description	Board limitations
MB1551	MB1551-U585AI-C02	Initial revision	• JTAG is exclusive with USB Type-C®. • The CN17, CN16, CN14, and CN13 female headers of the ARDUINO® Uno V3 connector need to be carefully manipulated. The user must carefully remove the inserted shield from the ARDUINO® connector to avoid breaking the ARDUINO® connector or damaging the ARDUINO® shield. • CN4 Pmod™ cannot be used at the same time as CN3 STMod+.
	MB1551-U585AI-D01	• Bluetooth® Low Energy programmable now using onboard STLINK-V3E • Switch added on BOOT0 to select the Boot mode • Possibility to enable or shut down the STSAFE added • Octo-SPI signal integrity improved by resistors added on the MCU clock and chip select outputs • Bluetooth® Low Energy module footprint updated to the reflow soldering	
	MB1551-U585AI1-D01	• Bluetooth® Low Energy programmable now using onboard STLINK-V3E • Switch added on BOOT0 to select the Boot mode • Possibility to enable or shut down the STSAFE added • Octo-SPI signal integrity improved by resistors added on the MCU clock and chip select outputs • Bluetooth® Low Energy module footprint updated to improve the reflow soldering • VEML6030 replaced by VEML3235	

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

11.1 FCC Compliance Statement

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.

Note: Use only shielded cables.

Responsible party (in the USA)

Terry Blanchard
Americas Region Legal | Group Vice President and Regional Legal Counsel, The Americas
STMicroelectronics, Inc.
750 Canyon Drive | Suite 300 | Coppell, Texas 75019
USA
Telephone: +1 972-466-7845

11.2 ISED Compliance Statement

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.

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

To satisfy FCC and ISED Exposure requirements for mobile devices, 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 closer than this distance is not recommended. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Pour satisfaire aux exigences FCC et ISED concernant l'exposition aux champs RF pour les appareils mobiles, une distance de séparation de 20 cm ou plus doit être maintenu entre l'antenne de ce dispositif et les personnes pendant le fonctionnement. Pour assurer la conformité, il est déconseillé d'utiliser cet équipement à une distance inférieure. Cet émetteur ne doit pas être co-situé ou fonctionner conjointement avec une autre antenne ou un autre émetteur.

12 CE conformity

12.1 CE / RED

EN 55032 / CISPR32 (2012) Class B product

Warning: this device is compliant with Class B of EN55032 / CISPR32. In a residential environment, this equipment may cause radio interference.

Avertissement : cet équipement est conforme à la Classe B de la EN55032 / CISPR 32. Dans un environnement résidentiel, cet équipement peut créer des interférences radio.

Simplified CE declaration of conformity:

ST Microelectronics hereby declares that the device B-U585I-IOT02A conforms with the essential requirements of Directive 2014/53/EU. The declaration of conformity can be found at *www.st.com*.

Revision history

Table 32. **Document revision history**

Date	Revision	Changes
22-Sep-2021	1	Initial release.
3-Dec-2021	2	Removed the references to Arm® Mbed™. Updated: • *Figure 2. Hardware block diagram* • *Bluetooth® Low Energy module firmware update* • *MEMS* topic and table titles • Data brief detailed descriptions removed from sensor sections
9-Dec-2021	3	Updated *Table 2. Codification explanation*
30-May-2023	4	Updated: • Figure 1 to Figure 5, Figure 7, and Figure 17 • MXCHIP EMW3080 (802.11 b/g/n compliant Wi-Fi® module) • B-U585I-IOT02A product information with Product history and Board revision history Added Section 7.9.7 STSAFE authentication and security for peripherals and IoT devices (STSAFA110S8SPL03) Removed *Demonstration software*

Contents

List of tables

List of figures