UM2407
User manual

STM32H7 Nucleo-144 boards (MB1364)

Introduction

The STM32H7 Nucleo-144 boards based on the MB1364 reference board (NUCLEO-H743ZI, NUCLEO-H753ZI) provide an affordable and flexible way for users to try out new concepts and build prototypes, by choosing from the various combinations of performance and power consumption features provided by the STM32H7 Series microcontroller. The ST Zio connector, which extends the Arduino™ Uno V3 connectivity, and the ST morpho headers provide an easy means of expanding the functionality of the Nucleo open development platform with a wide choice of specialized shields. The STM32H7 Nucleo-144 boards do not require any separate probe as they integrate the STLINK-V3 debugger/programmer. The STM32H7 Nucleo-144 boards come with the comprehensive free software libraries and examples available with the STM32Cube MCU Package.

Figure 1. Nucleo-144 board (top view)

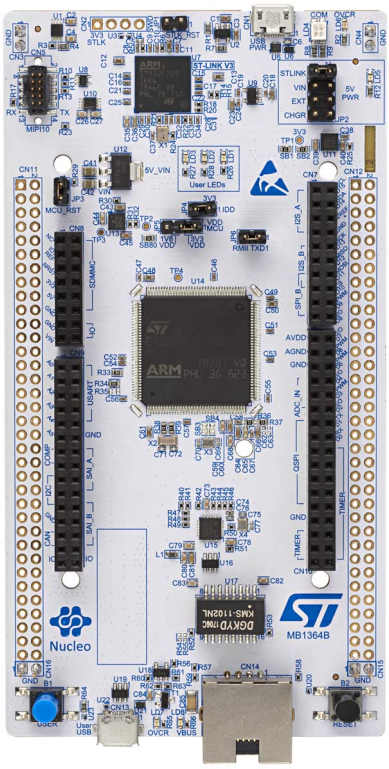
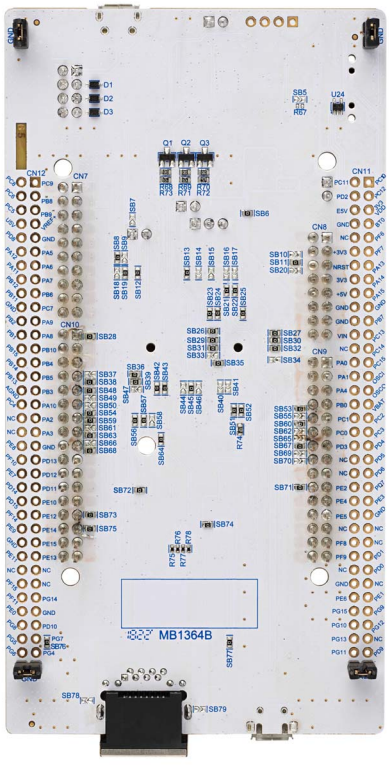


Figure 2. Nucleo-144 board (bottom view)



Pictures are not contractual.

Contents

List of tables

List of figures

1 Features

The STM32H7 Nucleo-144 boards offer the following features:

- STM32H7 Arm®(a) Cortex® core-based microcontroller in LQFP144 package
- Ethernet compliant with IEEE-802.3-2002 (depending on STM32H7 support)
- USB OTG full-speed
- 3 user LEDs
- 2 push-buttons: USER and RESET
- LSE crystal:
  - 32.768 kHz crystal oscillator
- Board connectors:
  - USB with Micro-AB
  - Ethernet RJ45
  - MIPI10
- Board expansion connectors:
  - ST Zio including Arduino™ Uno V3
  - ST morpho
- Flexible power-supply options: ST-LINK USB V_{BUS} or external sources
- On-board STLINK-V3 debugger/programmer with SWD connector:
  - USB re-enumeration capability: virtual COM port, mass storage, debug port
  - STLINK-V3 standalone kit capability
- Comprehensive free software libraries and examples available with the STM32Cube package
- Supported by wide choice of integrated development environments (IDEs) including IAR™, Keil® and GCC-based IDEs

arm

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

2 Ordering information

To order the Nucleo-144 board corresponding to the targeted STM32, use the order code given below in *Table 1*:

Table 1. Ordering information

Order code	Board reference	Target STM32H7	Differentiating feature
NUCLEO-H743ZI	MB1364	STM32H743ZIT6U	– Ethernet – USB OTG FS on Micro.AB connector – ST-LINK/V2-1
NUCLEO-H753ZI		STM32H753ZIT6U	– Ethernet – USB OTG FS on Micro.AB connector – STLINK-V3E – Cryptography

2.1 Product marking

Evaluation tools marked as “ES” or “E” are not yet qualified and therefore not ready to be used as reference design or in production. Any consequences deriving from such usage will not be at ST charge. In no event, ST will be liable for any customer usage of these engineering sample tools as reference design or in production.

“E” or “ES” marking examples of location:

- On the targeted STM32H7 that is soldered on the board (for illustration of STM32H7 marking, refer to the STM32H7 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.

These boards feature a specific STM32H7 device version which allows the operation of any stack or library. This STM32H7 device shows a "U" marking option at the end of the standard part number and is not available for sales.

2.2 Codification

The meaning of the codification is explained in *Table 2*.

Table 2. Codification explanation

NUCLEO-XXYYZTN	Description	Example: NUCLEO-H743ZI2
XX	MCU series in STM32 Arm Cortex MCUs	STM32H7 Series
YY	MCU Product line in the series	STM32H743
Z	STM32 package pin count	144 pins

Table 2. Codification explanation

NUCLEO-XXYYZTN	Description	Example: NUCLEO-H743ZI2
T	STM32H7 Flash memory size: -I for 2 Mbytes	2 Mbytes
N	Board version: -void = ST-LINK/V2-1 -2 = STLINK-V3E	STLINK-V3E

This order code is mentioned on a sticker placed on top side of the board.

3 Development environment

3.1 Development toolchains

- Keil® MDK-ARM(a)
- IAR™ EWARM(a)
- GCC-based IDEs

3.2 System requirements

- Windows® OS (7, 8 and 10), Linux® or macOS®(b)
- USB Type-A to Micro-B cable

3.3 Demonstration software

The demonstration software, included in the STM32Cube package, is preloaded in the STM32H7 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 the www.st.com/stm32nucleo web page.

a. On Windows only.

b. macOS is a trademark of Apple Inc., registered in the U.S. and other countries.

4 Conventions

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

Table 3. ON/OFF conventions

Convention	Definition
Jumper JPx ON	Jumper fitted
Jumper JPx OFF	Jumper not fitted
Solder bridge SBx ON	SBx connections closed by solder or 0 ohm resistor
Solder bridge SBx OFF	SBx connections left open

In this document, for any information that is common to all sales types, the references are noted “STM32H7 Nucleo-144 board” and “STM32H7 Nucleo-144 boards”.

5 Quick start

The STM32H7 Nucleo-144 board is a low-cost and easy-to-use development kit, used to evaluate and start a development quickly with an STM32H7 Series microcontroller in LQFP144 package.

Before installing and using the product, accept the Evaluation Product License Agreement from the www.st.com/epla web page. For more information on the STM32H7 Nucleo-144 and for demonstration software, visit the www.st.com/stm32nucleo web page.

5.1 Getting started

Follow the sequence below to configure the Nucleo-144 board and launch the demonstration application (for components location refer to *Figure 4*):

1. Check jumper position on the board:

Table 4. Jumper configuration

Jumper	Definition	Position	Comment
JP1	STLK_RST	OFF	-
JP3	T_NRST	ON	-
JP5	VDD_MCU power selection	ON [1-2] **(default)**	VDD_MCU supplied with 3V3_VDD
		ON [2-3] (optional)	VDD_MCU supplied with 1V8_VDD
JP4	IDD measurement	ON	MCU current measurement
JP2	Power source selection	ON [1-2]	5V_USB_STLK (from ST-LINK)

2. For the correct identification of the device interfaces from the host PC and before connecting the board, install the Nucleo USB driver available on the www.st.com/stm32nucleo website.
3. To power the board connect the STM32H7 Nucleo-144 board to a PC with a USB cable ‘Type-A to Micro-B’ through the USB connector CN1 on the ST-LINK. As a result, the green LED LD6 (PWR) and LD4 (COM) light up and the red LED LD3 blinks.
4. Press button B1 (left button).
5. Observe the blinking frequency of the three LEDs LD1 to LD3 changes, by clicking on the button B1.
6. The software demonstration and the several software examples, that allow the user to use the Nucleo features, are available at the www.st.com/stm32nucleo web page.
7. Develop an application, using the available examples.

6 Hardware layout and configuration

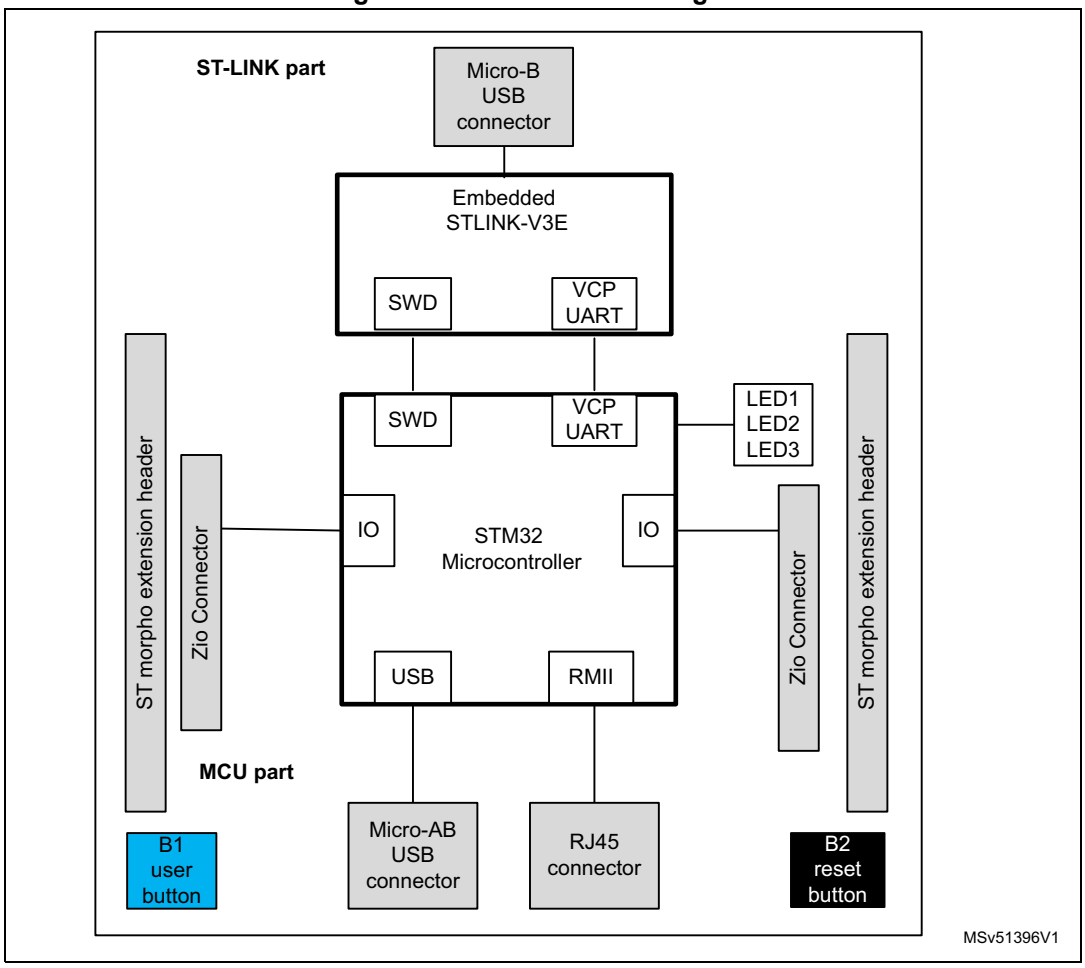
The STM32H7 Nucleo-144 board is designed around the STM32H7 Series microcontrollers in a 144-pin LQFP package.

Figure 3 shows the connections between the STM32H7 and its peripherals (STLINK-V3, push-buttons, LEDs, USB, Ethernet, ST Zio connectors and ST morpho headers).

Figure 4 and *Figure 5* show the location of these features on the STM32H7 Nucleo-144 board.

The mechanical dimensions of the board are showed in *Figure 6* and *Figure 7*.

Figure 3. Hardware block diagram



6.1 Nucleo-144 board layout

Figure 4. Nucleo-144 board top layout

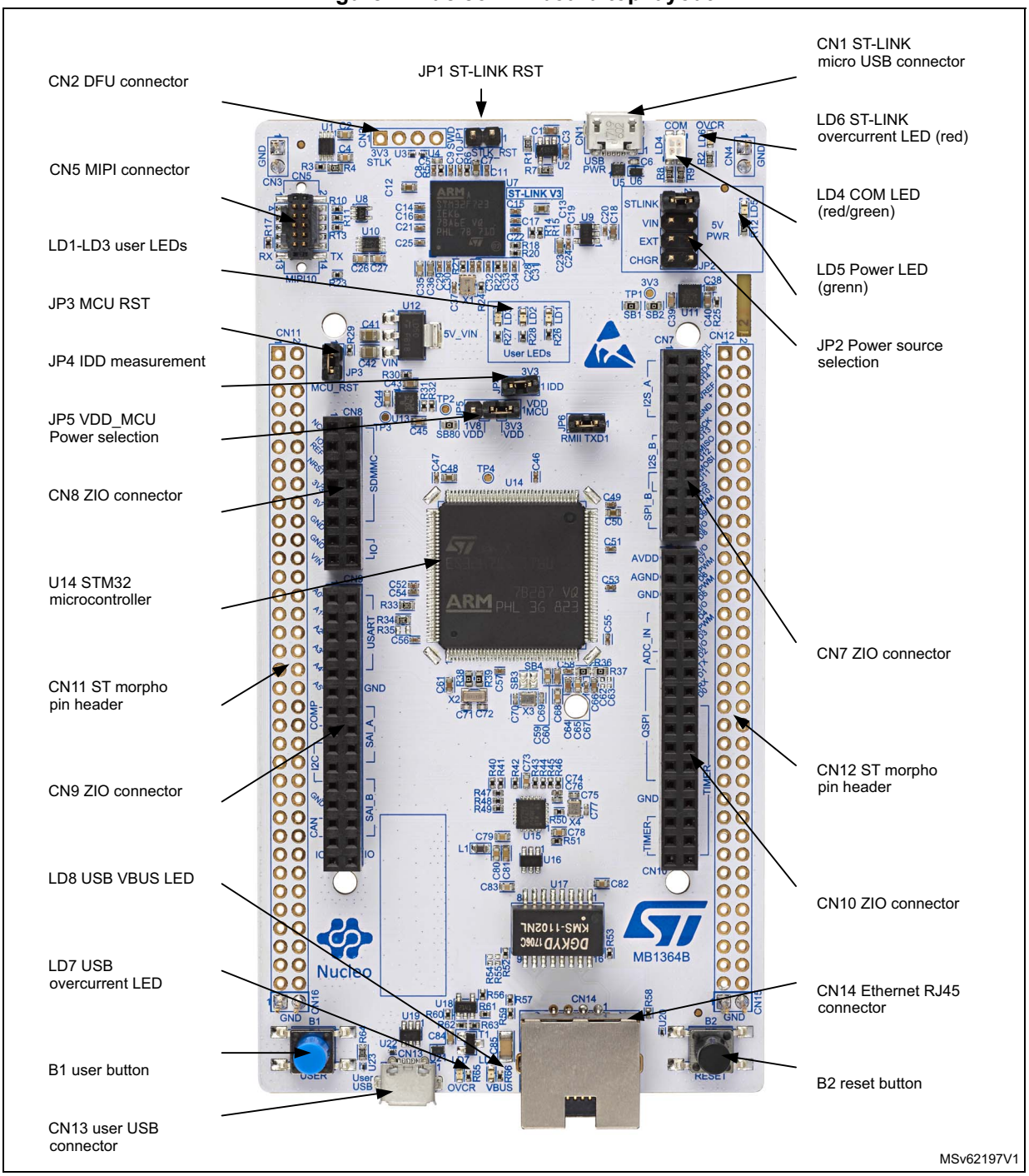
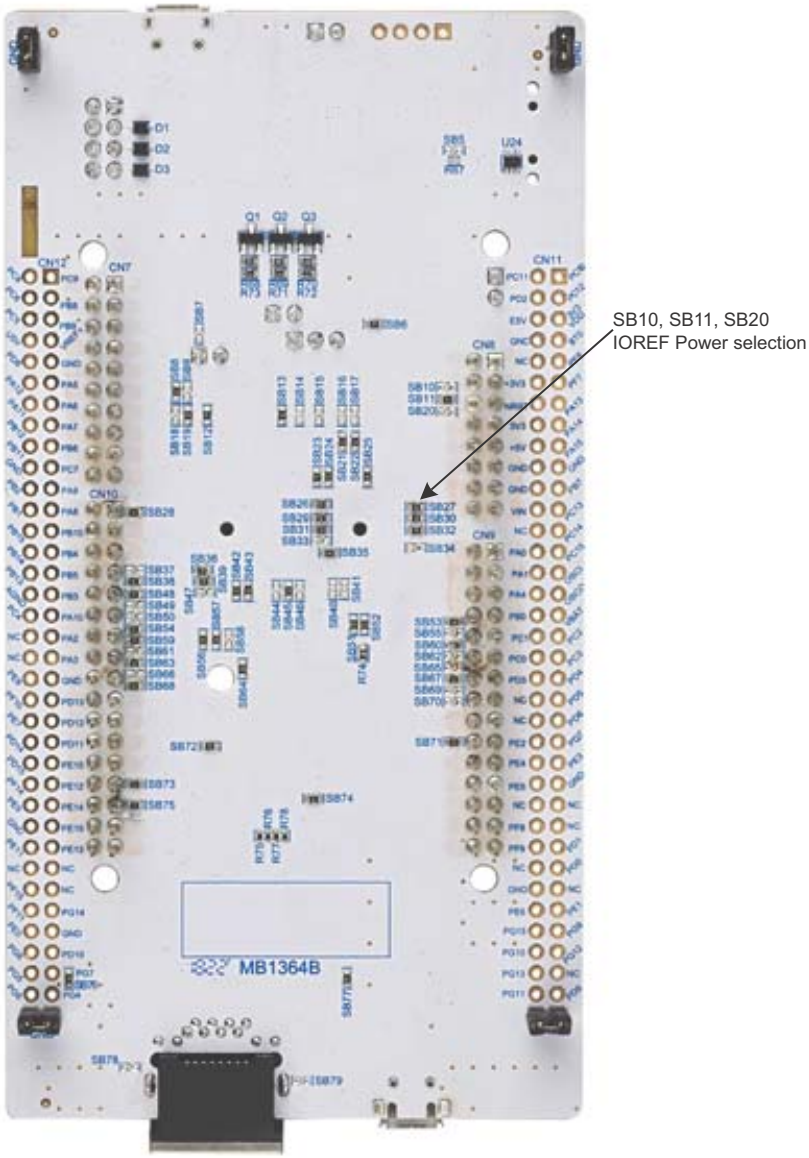


Figure 5. Nucleo-144 bottom layout



6.2 Mechanical drawing

Figure 6. Nucleo-144 board mechanical drawing in millimeter

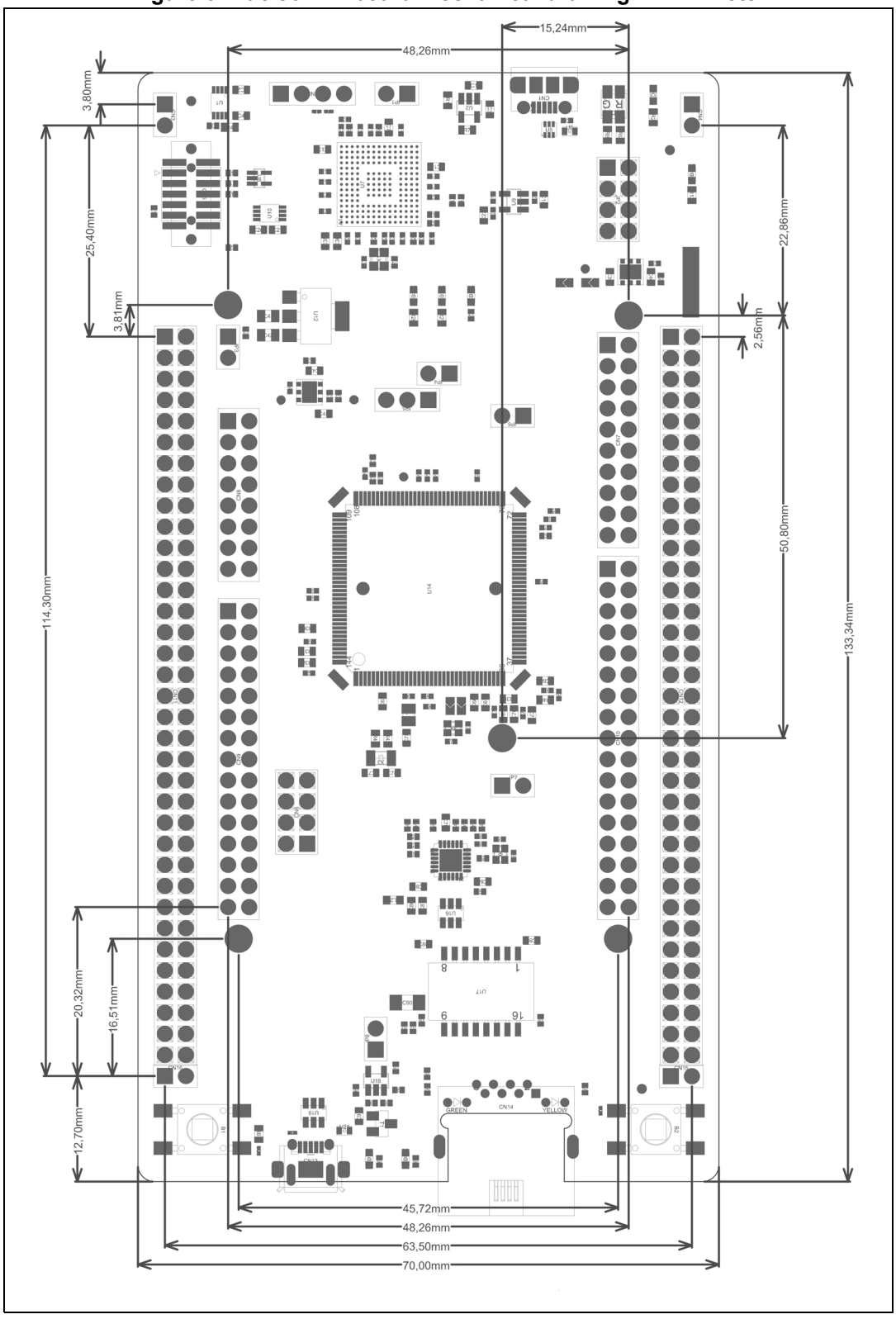
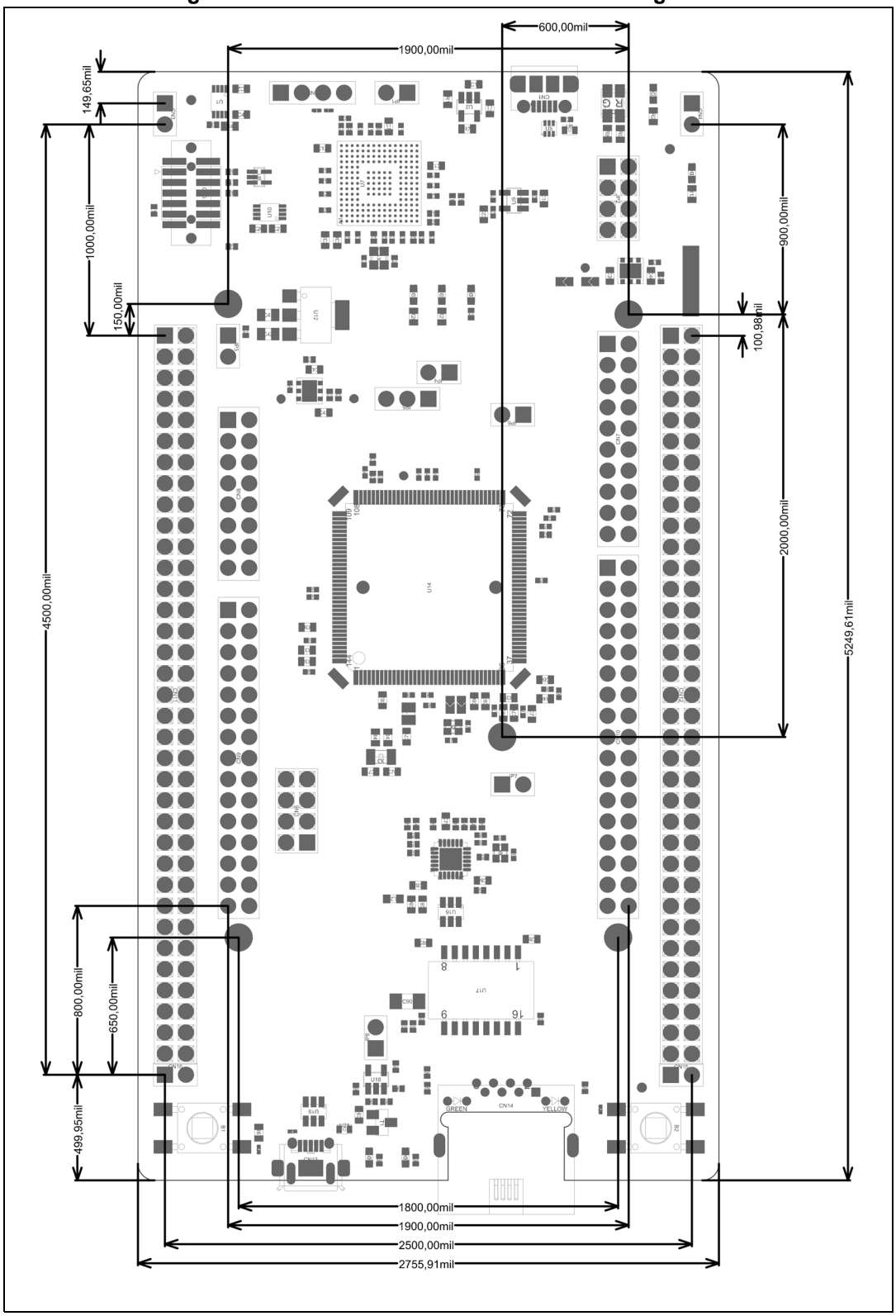


Figure 7. Nucleo-144 board mechanical drawing in mil



6.3 Embedded STLINK-V3

There are two different ways to program or debug the on-board STM32H7 MCU:

- Using the embedded STLINK-V3
- Using an external debug tool connected to CN5 MIPI-10 connector.

The STLINK-V3 programming and debugging tool is integrated in the STM32H7 Nucleo-144 board.

The STLINK-V3 makes the STM32H7 Nucleo-144 board Mbed enabled.

The embedded STLINK-V3 supports only SWD and VCP for STM32H7 devices. For information about debugging and programming features refer to *Overview of ST-LINK derivatives*, Technical note (TN1235), which describes in details all the STLINK/V3 features.

Features supported on STLINK-V3STLINK-V3:

- 5 V power supplied by USB connector (CN1)
- USB 2.0 high-speed-compatible interface
- JTAG/serial wire debugging (SWD) specific features:
  - 3 V to 3.6 V application voltage on the JTAG/SWD interface and 5V tolerant inputs
  - JTAG
  - SWD and serial viewer (SWV) communication
- Direct firmware update feature (DFU) (CN2)
- STDC14 (MIPI10) compatible connector (CN5)
- Status COM LED (LD4) which blinks during communication with the PC
- Fault red LED (LD6) alerting on USB overcurrent request
- 5 V/300 mA output power supply capability (U2) with current limitation and LED
- Green LED ON: 5V enabled (LD5)

6.3.1 Drivers

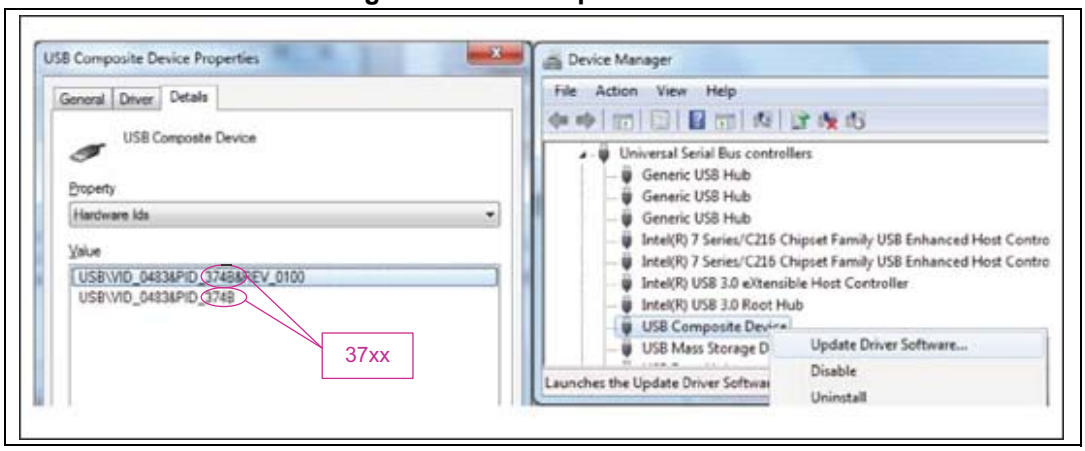
Before connecting the Nucleo-144 board to a Windows 7, Windows 8 or Windows XP PC via USB, a driver for STLINK-V3 must be installed (not require for Windows 10). The driver is automatically installed by the toolset supporting ST-LINK. It is also available from the *www.st.com* website.

In case the STM32H7 Nucleo-144 board is connected to the PC before installing the driver, the PC device manager may report some Nucleo interfaces as “Unknown”.

To recover from this situation, after installing the dedicated driver, the association of “Unknown” USB devices found on the STM32H7 Nucleo-144 board to this dedicated driver, must be updated in the device manager manually.

Note: It is recommended to proceed using USB composite device, as shown in Figure 8.

Figure 8. USB composite device



Note: 37xx = 374E for STLINK-V3 without bridges functions
374F for STLINK-V3 with bridges functions

6.3.2 STLINK-V3 firmware upgrade

The STLINK-V3 embeds a firmware upgrade mechanism for in-situ upgrade through the USB port. As the firmware may evolve during the lifetime of the STLINK-V3 product (for example new functionalities, bug fixes, support for new microcontroller families), it is recommended to keep the STLINK-V3 firmware up to date before starting to use the STM32H7 Nucleo-144 board. The latest version of this firmware is available from the *www.st.com* website.

6.3.3 Using an external debug tool to program and debug the on-boards STM32H7

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

1. Keep the embedded STLINK-V3 running.
   Power on the STLINK-V3 at first until the COM LED lights RED. Then connect your external debug tool through CN5 MIPI-10 debug connector.
2. Set the embedded STLINK-V3 in high impedance state:
   When you state the jumper JP1 (STLK_RST) ON, the embedded STLINK-V3 is in RESET state and all GPIOs are in high impedance, then you can connect your external Debug tool on the debug connector CN5.

Figure 9. Connecting an external debug tool to program the on-board STM32H7

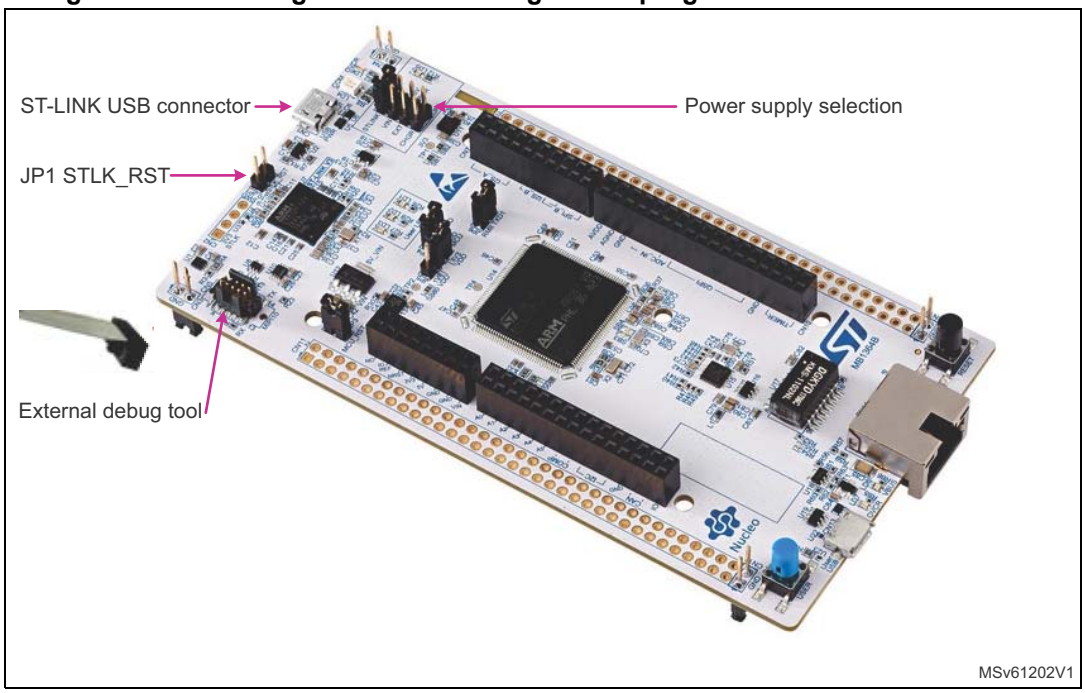


Table 5. MIPI-10 debug connector (CN5)

MIPI-10 Pin	STDC14 Pin	CN5	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 detect for plug indicator, used on SWD and JTAG neither
10	12	T_NRST	Target NRST using SWD protocol or Target JTMS (T_JTMS) using JTAG protocol

Table 5. MIPI-10 debug connector (CN5) (continued)

MIPI-10 Pin	STDC14 Pin	CN5	Designation
-	13	**T_VCP_RX**	Target RX used for VCP (must be UART dedicated to bootloader)
-	14	**T_VCP_TX**	Target TX used for VCP (must be UART dedicated to bootloader)

6.4 Power supply

The power supply can be provided by five different sources:

- A host PC connected to CN1 through a USB cable (default setting)
- An external 7 V to 12 V power supply connected to CN8 pin 15 or CN11 pin 24
- An external 5 V power supply connected to CN11 pin 6
- An external 5 V USB charger (5V_USB_CHGR) connected to CN1
- An external 3.3 V power supply (3V3) connected to CN8 pin 7 or CN11 pin 16

The power supply is provided either by the host PC through the USB cable or by an external source: V_{IN} (7 V to 12 V), E5V (5 V) or +3.3 V power supply pins on CN8 or CN11. In case V_{IN}, E5V or +3.3 V is used to power the Nucleo-144 board, this power source must comply with the standard EN-60950-1: 2006+A11/2009 and must be Safety Extra Low Voltage (SELV) with limited power capability.

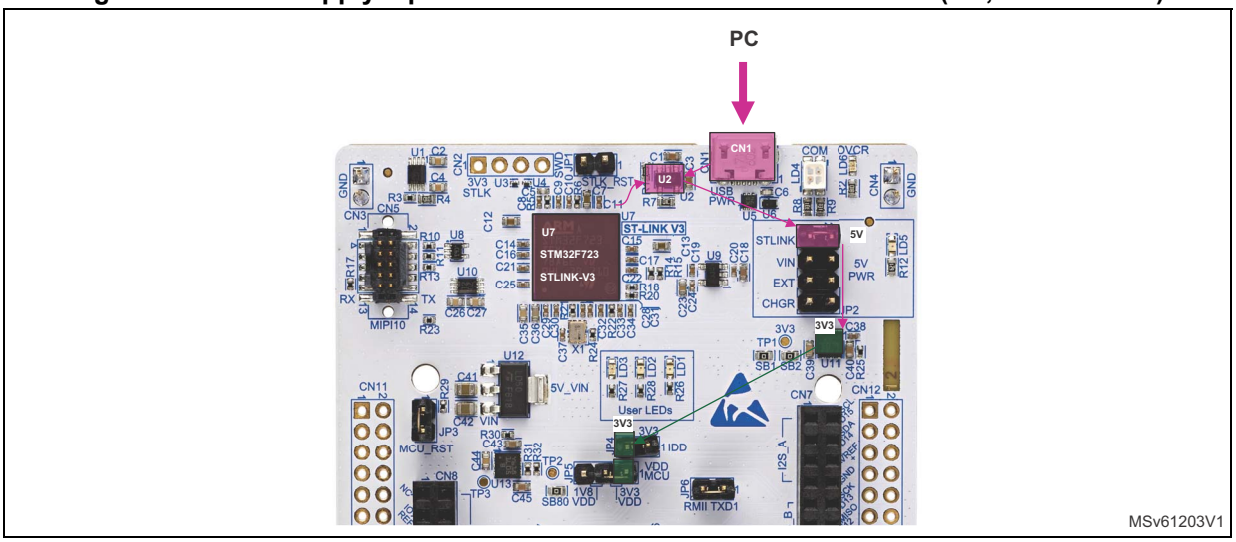
In case the power supply is +3.3 V, the ST-LINK is not powered and cannot be used.

6.4.1 Power supply input from STLINK-V3 USB connector (default setting)

The STM32H7 Nucleo-144 board and shield can be powered from the ST-LINK USB connector CN1 (5 V), by placing a jumper between the pins 1-2 of JP2 "STLINK" (see *Figure 10*).

This is the default setting.

Figure 10. Power supply input from ST-LINK USB connector with PC (5 V, 500 mA max)



If the USB enumeration succeeds, the 5V_ST_LINK power is enabled, by asserting the PWR_ENn signal from STM32F723IEK6 "STLINK V3" (U7). This pin is connected to a power switch STMPS2151STR (U2), which powers the board. The power switch STMPS2151STR (U2) features also a current limitation to protect the PC in case of short-circuit on board. If an overcurrent (more than 500 mA) happens on board, the red LED LD6 is lit.

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

During the USB enumeration, Nucleo board asks for the 500 mA power to the host PC.

- If the host is able to provide the required power, the enumeration finishes by a "SetConfiguration" command and then, the power switch STMPS2151STR is switched ON, the Green LED LD5 is turned ON, thus Nucleo board and its shield on it can consume 500 mA current, but no more.
- If the host is not able to provide the requested current, the enumeration fails. Therefore, the STMPS2151STR power switch (U2) remains OFF and the MCU part including the extension board is not powered. As a consequence, the GREEN LED LD5 remains turned OFF. In this case it is mandatory to use an external power supply.

Warning: In case the maximum current consumption of the STM32H7 Nucleo-144 board and its shield boards exceed 300 mA, it is mandatory to power the STM32H7 Nucleo-144 board, using an external power supply connected to E5V, V_{IN} or +3.3 V.

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

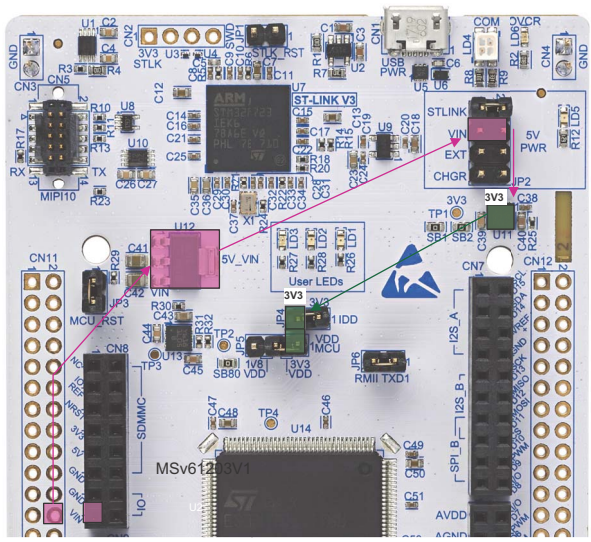
When STM32H7 Nucleo-144 board is power supplied by VIN (see *Table 6* and *Figure 11*), the jumper configuration must be the following: Jumper JP2 on pin 3-4 "VIN"

The Nucleo-144 board and its shield boards can be powered in three different ways from an external power supply, depending on the voltage used. The three power sources are summarized in the *Table 6*.

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

Input power name	Connector pins	Voltage range	Max current	Limitation
V_{IN}	CN8 pin 15 CN11 pin 24	7 V to 12 V	800 mA	From 7 V to 12 V only and input current capability is linked to input voltage: – 800 mA input current when V_{IN}=7 V – 450 mA input current when 7 V<V_{IN}<9 V – 250 mA input current when 9 V<V_{IN}<12 V

Figure 11. Power supply input from VIN (7 V to 12 V, 800 mA max)



Note: See Section 6.4.6 about debugging when using an external power supply.

6.4.3 External power supply input 5V_EXT (5 V, 500 mA max)

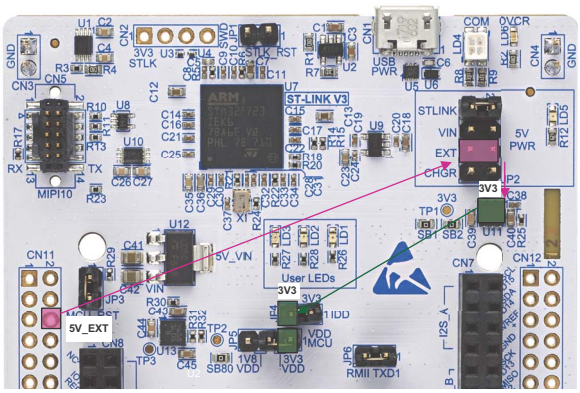
When STM32H7 Nucleo-144 board is power supplied by EXT (see *Table 7* and *Figure 12*), the jumper configuration must be the following: Jumper JP2 on pin 5-6 "EXT"

Table 7. External power sources: 5V_EXT

Input power name	Connector pins	Voltage range	Max current
EXT	CN11 pin 6	4.75 V to 5.25 V	500 mA

Note: See Section 6.4.6 about debugging when using an external power supply.

Figure 12. Power supply input from 5V_EXT (5 V, 500 mA max)



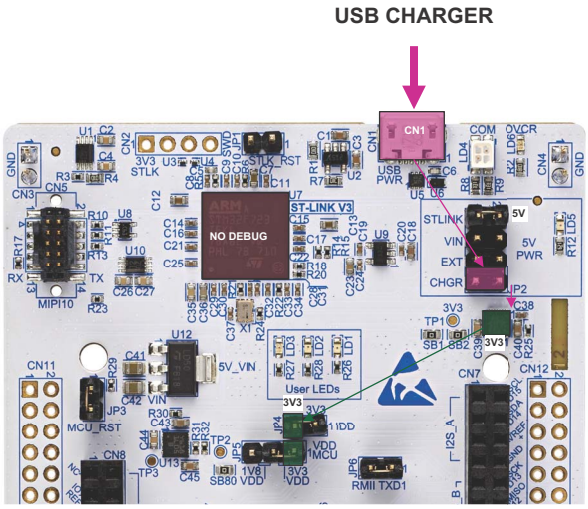
6.4.4 External power supply input from USB CHARGER (5 V)

When STM32H7 Nucleo-144 board is power supplied by a USB charger on CN1 (see *Table 8* and *Table 13*), the jumper configuration must be the following: Jumper JP2 on pin 7-8 "CHGR".

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

Input power name	Connector pins	Voltage range	Max current
CHGR	CN1	5 V	-

Figure 13. Power supply input from ST-LINK USB connector with USB charger (5 V)



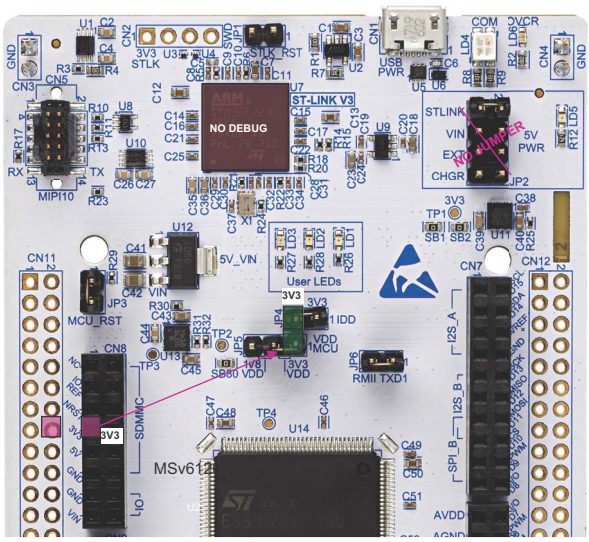
6.4.5 External power supply input from 3V3_EXT (3.3 V)

When the 3.3 V is provided by a shield board, it is interesting to use the 3V3 (CN8 pin 7 or CN11 pin 16) directly as power input (see *Table 9* and *Figure 14*). In this case the programming and debugging features are not available, since the ST-LINK is not powered.

Table 9. External power sources: 3V3_EXT (3.3 V)

Input power name	Connector pins	Voltage range	Max current
3V3	CN8 pin 7 CN11 pin 16	3 V to 3.6 V	1.3 A

Figure 14. Power supply input from 3V3_EXT (3.3 V)



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

When powered by VIN or EXT, it is still possible to use the ST-LINK for programming or debugging only, but it is mandatory to power the board first using VIN or EXT, then to connect the USB cable to the PC. In this way the enumeration succeeds, thanks to the external power source.

The following power-sequence procedure must be respected:

1. Connect jumper JP2 between pin 5 and pin 6 for EXT or between pin 3 and pin 4 for VIN
2. Connect the external power source to VIN or EXT
3. Power on the external power supply 7 V< VIN < 12 V to VIN, or 5 V for EXT
4. Check that the green LED LD5 is turned ON
5. Connect the PC to the USB connector CN1

If this order is not respected, the board may be powered by USB (U5V) first, then by VIN or EXT as the following risks may be encountered:

1. If more than 300 mA current is needed by the board, the PC may be damaged or the current supplied can be limited by the PC. As a consequence, the board is not powered correctly.
2. 300 mA is requested at enumeration so there is risk that the request is rejected and the enumeration does not succeed if the PC cannot provide such current. Consequently, the board is not power supplied (LED LD5 remains OFF).

6.5 Clock sources

6.5.1 HSE clock (high speed external clock)

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

- MCO from ST-LINK (default): MCO output of ST-LINK is used as input clock. This frequency cannot be changed, it is fixed at 8 MHz and connected to the PF0/PH0-OSC_IN of STM32H7 Series microcontroller. The configuration must be:
  - SB44 and SB46 OFF
  - SB45 ON
  - SB3 and SB4 OFF
- HSE on-board oscillator from X3 crystal (not provided): for typical frequencies and its capacitors and resistors, refer to the STM32H7 Series microcontroller data sheet and to the *Oscillator design guide for STM8AF/AL/S and STM32 microcontrollers* Application note (AN2867) for the oscillator design guide. The X3 crystal has the following characteristics: 25 MHz, 6 pF, 20 ppm. It is recommended to use NX2016SA-25MHz-EXS00A-CS11321 manufactured by NDK. The configuration must be:
  - SB44 and SB46 OFF
  - SB3 and SB4 ON
  - C69 and C70 soldered with 5.6 pF capacitors
  - SB45 OFF

Oscillator from external PF0/PH0: from an external oscillator through the pin 29 of the CN11 connector. The configuration must be:

  - SB46 ON
  - SB45 OFF
  - SB3 and SB4 OFF
- HSE not used: PF0/PH0 and PF1/PH1 are used as GPIOs instead of as clock. The configuration must be:
  - SB44 and SB46 ON
  - SB45 OFF
  - SB3 and SB4 OFF

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

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

- **On-board oscillator (default):** X2 crystal. Refer to the *Oscillator design guide for STM8AF/AL/S and STM32 microcontrollers* Application note (AN2867) for oscillator design guide for STM32H7 Series microcontrollers. It is recommended to use

NX3215SA-32.768kHZ-EXS00A-MU00525 (32.768 kHz, 6 pf load capacitance, 20 ppm) from NDK. The configuration must be:

  – SB40 and SB41 OFF
  – R38 and R39 ON

- **Oscillator from external PC14:** from external oscillator through the pin 25 of CN11 connector. The configuration must be:
  – SB40 and SB41 ON
  – R38 and R39 OFF
- **LSE not used:** PC14 and PC15 are used as GPIOs instead of low-speed clock. The configuration must be:
  – SB40 and SB41 ON
  – R38 and R39 OFF

6.6 Board functions

6.6.1 LEDs

User LD1: a green user LED is connected to the STM32H7 I/O PB0 (SB39 ON and SB47 OFF) or PA5 (SB47 ON and SB39 OFF) corresponding to the ST Zio D13.

User LD2: a yellow user LED is connected to PE1.

User LD3: a red user LED is connected to PB14.

These user LEDs are on when the I/O is HIGH value, and are off when the I/O is LOW.

LD4 COM: the tricolor LED LD4 (green, orange, red) provides information about ST-LINK communication status. LD4 default color is red. LD4 turns to green to indicate that communication is in progress between the PC and the STLINK-V3, with the following setup:

- Slow blinking red/off: at power-on before USB initialization
- Fast blinking red/off: after the first correct communication between PC and STLINK-V3 (enumeration)
- Red LED on: when the initialization between the PC and STLINK-V3 is complete
- Green LED on: after a successful target communication initialization
- Blinking red/green: during communication with target
- Green on: communication finished and successful
- Orange on: communication failure

LD5 PWR: the green LED indicates that the STM32H7 part is powered and +5 V power is available on CN8 pin 9 and CN11 pin 18.

LD6 USB power fault: LD5 indicates that the board power consumption on USB exceeds 500 mA, consequently the user must power the board using an external power supply.

LD7 and LD8 USB FS: refer to *Section 6.6.6: USB OTG FS*.

6.6.2 Push-buttons

B1 USER (blue button): the user button is connected to the I/O PC13 by default (tamper support, SB51 ON and SB58 OFF) or PA0 (Wakeup support, SB58 ON and SB51 OFF) of the STM32H7 Series microcontroller.

B2 RESET (black button): this push-button is connected to NRST and is used to reset the STM32H7 Series microcontroller.

6.6.3 MCU voltage selection: 1V8/3V3

The STM32H7 Nucleo-144 board offers the possibility to supply the STM32H7 Series microcontroller with 1.8 V or 3.3 V. JP5 is used to select the VDD_MCU power level.

- Place the JP5 jumper on 3V3 to supply the MCU with 3V3, connecting pins 1 and 2.
- Place the JP5 jumper on 1V8 to supply the MCU with 1V8, connecting pins 2 and 3.

6.6.4 Current consumption measurement (IDD)

Jumper JP4, labeled IDD, is used to measure the STM32H7 Series microcontroller consumption by removing the jumper and by connecting an ammeter:

- JP4 ON: STM32H7 is powered with 3V3_VDD (default)
- JP4 OFF: an ammeter must be connected to measure the STM32H7 current. If there is no ammeter, the STM32H7 is not powered

Warning: on MB1364 REV.C, "VDD_MCU" is also supplying Ethernet PHY (U15) and debug voltage translation (U1 and U10).

If needed, for low power measurement (for example standby mode), in order to measure only MCU (U7) power consumption, the user must remove the following components: R4, R43, R44, R45, R46, R47, R48, R49, R50, R51, R52, R53, R59, R61, U1, U10, U15 and SB45.

After removing these components, it becomes impossible to use Ethernet, and 1.8 V debug with ST-LINK.

6.6.5 Virtual COM port (VCP): LPUART/USART

The STM32H7 Nucleo-144 board offers the possibility to connect a LPUART or an USART interface to the ST-LINK or to the ST morpho connectors and Arduino™ Uno V3 connectors.

The selection is done by settings the related solder bridges. (Refer to *Table 10* and *Table 11* below).

By default the USART3 communication between the target STM32H7 and the STLINK is enabled, to support the Virtual COM port for the Mbed (SB5 and SB6 ON).

Table 10. USART3 connection

Pin name	Function	Virtual COM port (default configuration)	ST morpho connection
PD8	USART3 TX	SB5 ON and SB7 OFF	SB5 OFF and SB7 ON
PD9	USART3 RX	SB6 ON and SB4 OFF	SB6 OFF and SB4 ON

Table 11. LPUART1 connection

Pin name	Function	Virtual COM port	Arduino D0 and D1	ST morpho connection
PB6	LPUART1 TX	SB9 ON SB8 and SB18 OFF	SB8 ON SB9 and SB18 OFF	SB9 OFF and SB18 OFF
PB7	LPUART1 RX	SB34 ON SB12 and SB68 OFF	SB68 ON SB34 and SB66 OFF	SB12 OFF and SB34 OFF

Hardware connection required for USART bootloader:

The STM32H7x3 embeds USART bootloader. To use the USART bootloader (USART1), hardware modifications are required on the NUCLEO board. Flying wires have to be connected between PD8/PD9 (USART3 available on SB19/SB12) and PB10/PB11 (USART1 available on CN15).

6.6.6 USB OTG FS

The STM32H7 Nucleo-144 board supports USB OTG FS communication via a USB Micro-AB connector (CN13) and USB power switch (U18) connected to V_{BUS}.

Warning: USB Micro–AB connector (CN13) cannot power the Nucleo-144 board. To avoid damaging the STM32H7, it is mandatory to power the Nucleo-144 before connecting a USB cable on CN13. Otherwise there is a risk of current injection on STM32H7 I/Os.

A green LED LD8 lights in one of these cases:

- Power switch (U12) is ON and STM32H7 Nucleo-144 board works as a USB host
- V_{BUS} is powered by another USB host when the STM32H7 Nucleo-144 board works as a USB device.

The red LED LD7 lights if overcurrent occurs when +5 V is enabled on V_{BUS} in USB host mode.

Note: 1.It is recommended to power Nucleo-144 board by an external power supply when using USB OTG or host function.

2.SB76 must be ON when using USB OTG FS.

Table 12. USB pin configuration

Pin name	Function	Configuration when using USB connector	Configuration when using ST morpho connector	Remark
PA8	USB SOF	-	-	Test point TP4
PA9	USB V_{BUS}	SB23 ON	SB23 OFF	-
PA10	USB ID	SB24 ON	SB24 OFF	-
PA11	USB DM	SB21 ON	SB21 OFF	-

Table 12. USB pin configuration (continued)

Pin name	Function	Configuration when using USB connector	Configuration when using ST morpho connector	Remark
PA12	USB DP	SB22 ON	SB22 OFF	-
PD10	USB PWR EN	SB77 ON	SB77 OFF	-
PG7	USB FS OVCR	SB76 ON	SB76 OFF	-

ESD protection part USBLC6-2SC6 is implemented on USB port because all USB pins on STM32H7 are dedicated to USB port protection only on the STM32H7 Nucleo-144 board. USB pin ID is not used.

6.6.7 Ethernet

The STM32H7 Nucleo-144 board supports 10M/100M Ethernet communication by a PHY LAN8742A-CZ-TR (U15) and RJ45 connector (CN14). Ethernet PHY is connected to the STM32H7 Series microcontroller via the RMII interface. 50 MHz clock for the STM32H7 Series microcontroller is generated by the PHY RMII_REF_CLK.

Note: 1.JP6 and SB72 must be ON when using Ethernet.

2.Ethernet PHY LAN8742A should be set in power-down mode (in this mode Ethernet PHY ref clock turns off) to achieve the expected low-power mode current. This is done by configuring Ethernet PHY LAN8742A basic control register (at address 0x00) bit 11 (power down) to '1'. SB57 can also be OFF to get the same effect.

Table 13. Ethernet pin configuration

Pin name	Function	Conflict with ST Zio connector signal	Configuration when using Ethernet	Configuration when using ST Zio or ST morpho connector
PA1	RMII Reference Clock	-	SB57 ON	SB57 OFF
PA2	RMII MDIO	-	SB72 ON	SB72 OFF
PC1	RMII MDC	-	SB64 ON	SB64 OFF
PA7	RMII RX Data Valid	-	SB31 ON	SB31 OFF
PC4	RMII RXD0	-	SB36 ON	SB36 OFF
PC5	RMII RXD1	-	SB29 ON	SB29 OFF
PG11	RMII TX Enable	-	SB27 ON	SB27 OFF
PG13	RXII TXD0	-	SB30 ON	SB30 OFF
PB13	RMII TXD1	I2S_A_CK	JP6 ON	JP6 OFF

6.7 Solder bridges and jumpers

SBxx can be found on top layer and SB1xx can be found on bottom layer of the Nucleo-144 board.

Table 14. Solder bridge and jumper configuration

Bridge	State(1)	Description
SB1 (3V3_PER)	**ON**	Peripheral power 3V3_PER is connected to 3V3.
	OFF	Peripheral power 3V3_PER is not connected.
SB2 (3V3)	ON	Output of voltage regulator ST1L05CPU33R is connected to 3V3.
	OFF	Output of voltage regulator ST1L05CPU33R is not connected.
SB80 (1V8_VDD)	ON	Output of voltage regulator ST1L05BPUR is connected to 1V8_VDD.
	OFF	Output of voltage regulator ST1L05BPUR is not connected.
SB6	ON	Input of voltage regulator ST1L05BPUR is connected to 3V3_VDD.
	OFF	Input of voltage regulator ST1L05BPUR is not connected.
SB12, SB19 (ST-LINK-USART)	**ON**	PG9 and PG14 on ST-LINK STM32F723IEK6 are connected to PD8 and PD9 to enable virtual COM port for Mbed support. Thus PD8 and PD9 on ST morpho connectors cannot be used.
	OFF	PG9 and PG14 on ST-LINK STM32F723IEK6 are disconnected to PD8 and PD9 on STM32H7.
JP1 (ST-LINK_RST)	**OFF**	No incidence on ST-LINK STM32F723IEK6 NRST signal.
	ON	ST-LINK STM32F723IEK6 signal is connected to GND (ST-LINK reset to reduce power consumption).
SB32 (SWO)	**ON**	SWO signal of the STM32H7 (PB3) is connected to ST-LINK SWO input. (SB26 must be removed)
	OFF	SWO signal of STM32H7 is not connected.
JP3 (NRST)	**ON**	Board RESET signal (NRST) is connected to ST-LINK reset control I/O (T_NRST).
	OFF	Board RESET signal (NRST) is not connected to ST-LINK reset control I/O (T_NRST).
SB10, SB11, SB20 (IOREF)	**OFF, ON, OFF**	IOREF is connected to VDD_MCU.
	ON, OFF, OFF	IOREF is connected to 3V3_PER.
	OFF, OFF, ON	IOREF is connected to 3V3.
SB14 (SDMMC_D0), SB15 (SDMMC_D1)	ON	These pins are connected to ST morpho connector CN12.
	OFF	These pins are disconnected from ST morpho connector CN12 to avoid stub of SDMMC data signals on PCB.

Table 14. Solder bridge and jumper configuration (continued)

Bridge	State(1)	Description
SB39, SB47 (LD1-LED)	**ON, OFF**	Green user LED LD1 is connected to PB0.
	OFF,ON	Green user LED LD1 is connected to D13 of Arduino signal (PA5).
	OFF, OFF	Green user LED LD1 is not connected.
	ON, ON	Forbidden
SB33, SB35 (D11)	OFF, ON	D11 (Pin 14 of CN7) is connected to STM32H7 PB5 (SPI_A_MOSI/ TIM_D_PWM2)
	ON,OFF	D11 (Pin 14 of CN7) is connected to STM32H7 PA7 (SPI_A_MOSI/ TIM_E_PWM1)
SB40,SB41 (X2 crystal)	**OFF, OFF**	PC14, PC15 are not connected to ST morpho connector CN11. (X2 used to generate 32 kHz clock).
	ON, ON	PC14, PC15 are connected to ST morpho connector CN11. (R38 and R39 should be removed).
SB44 (PF1/PH1) SB46 (PF0/PH0) (Main clock)	ON, OFF	PF0/PH0 is not connected to ST morpho connector CN11 PF1/PH1 is connected to ST morpho connector CN11 (MCO is used as main clock for STM32H7 on PF0/PH0 – SB45 ON).
	OFF, OFF	PF0/PH0, PF1/PH1 are not connected to ST morpho connector CN11 (X3, C69, C70, SB3 and SB4 provide a clock as shown in *Section Appendix A: Electrical schematics*. In this case SB45 must be removed).
	ON, ON	PF0/PH0 and PF1/PH1 are connected to ST morpho connector CN11. (SB3, SB4 and SB45 must be removed).
SB45 (STLK_MCO)	**ON**	MCO of ST-LINK (STM32F723IEK6) is connected to PF0/PH0 of STM32H7.
	OFF	MCO of ST-LINK (STM32F723IEK6) is not connected to PF0/PH0 of STM32H7.
SB3, SB4 (external 25M crystal)	**OFF, OFF**	PF0/PH0 and PF1/PH1 are not connected to external 25 MHz crystal X3.
	ON, ON	PF0/PH0 and PF1/PH1 are connected to external 25 MHz crystal X3.
SB52 (V_{BAT})	**ON**	V_{BAT} pin of STM32H7 is connected to V_{DD_MCU}.
	OFF	V_{BAT} pin of STM32H7 is not connected to V_{DD_MCU}.
SB51, SB58 (B1-USER)	ON, OFF	B1 push-button is connected to PC13.
	OFF,ON	B1 push-button is connected to PA0 (Set SB51 OFF if ST Zio connector is used).
	OFF,OFF	B1 push-button is not connected.

Table 14. Solder bridge and jumper configuration (continued)

Bridge	State(1)	Description
SB75 (PA0)	**ON**	PA0 is connected to ST Zio connector (Pin 29 of CN10).
	OFF	PA0 is not connected to ST Zio connector (Pin 29 of CN10).
RMII Signals SB57 (PA1), SB64 (PC1), SB72 (PA2), SB36 (PC4), SB29 (PC5), SB30 (PG13), SB27 (PG11), SB31 (PA7), JP6 (PB13)	**ON**	These pins are used as RMII signals and connected to Ethernet PHY. (SB7 must be removed) These pins must not be used on ST morpho or ST Zio connectors.
	OFF	These pins can be used as GPIOs on ST morpho connectors. PB13 can be used as I2S_A_CK on ST Zio (Pin 5 of CN7) if not used on ST morpho.
SB74 (Ethernet nRST) RMII Signal	**ON**	NRST of STM32H7 is connected to Ethernet PHY (U15).
	OFF	NRST of STM32H7 is not connected to Ethernet PHY (U15).
SB76 (PG7)	ON	USB overcurrent alarm is connected.
	OFF	USB overcurrent alarm is not connected. PG7 is used as GPIO on ST morpho connector (CN12).
SB77 (PD10)	ON	PD10 is connected to Enable for Power switch (U18) to control V_{BUS}.
	OFF	PD10 is used as GPIO on ST morpho connector (CN12).
SB23 (PA9)	ON	PA9 is connected to USB V_{BUS}.
	OFF	PA9 is not connected to USB V_{BUS}. PA9 is used as GPIO on ST morpho connector (CN12).
SB24 (PA10)	ON	PA10 is connected to USB ID.
	OFF	PA10 is not connected to USB ID. PA10 is used as GPIO on ST morpho connector (CN12).
SB21 (PA11), SB22 (PA12)	ON	These pins are used as D- and D+ on USB connector CN13. (SB16 and SB17 must be OFF).
	OFF	These pins are used as GPIOs on ST morpho connectors.
SB13	ON	VDD33_USB_1 is connected to 3V3_VDD.
	OFF	VDD33_USB_1 is not supplied.
SB25	ON	VDD_MMC_1 is connected to VDD_MCU.
	OFF	VDD_MMC_1 is not supplied.
SB59 (PG6)	ON	PG6 is connected to QSPI_CS (SB61 must be OFF).
	OFF	PG6 is used as GPIO on ST morpho connector (CN12).
SB63 (PB2)	ON	PB2 is connected to QSPI_CLK. (SB69 must be OFF)
	OFF	PB2 is not connected to QSPI_CLK and can be used as COMP1_INP (SB69 ON) or used as GPIO on ST morpho connector CN12. (SB69 OFF)

Table 14. Solder bridge and jumper configuration (continued)

Bridge	State[1]	Description
SB71, SB73 (PE6)	ON, OFF	PE6 is connected to SAI_A_SD (D59 of CN9)
	OFF, ON	PE6 is connected to TIMER_A_BKIN2 (D38 of CN10)
SB67 (PE2)	ON	PE2 is connected to SAI_A_MCLK (D56 of CN9). QSPI_BK1_IO2 cannot be used (D31 of CN10).
	OFF	PE2 is used as QSPI_BK1_IO2 (D31 of CN10).
SB53 (PC2) and SB60 (PF10)	ON	ADC_IN are connected to A4 and A5 (pin 9 and 11) on ST Zio connector CN9. Thus SB55 and SB62 must be OFF
	OFF	ADC_IN are connected to A4 and A5 (pin 9 and 11) on ST Zio connector CN9. Thus SB55 and SB62 can be ON (I^2C)
SB65 (PF11)	OFF	On NUCLEO-H743ZI2 and NUCLEO-H753ZI, PF11 is used only as GPIO on ST morpho connector (CN12) and must not be used as ADC_IN.
I^2C SB55 (PB9) and SB62 (PB8)	ON	PB9 and PB8 (I2C) are connected to A4 and A5 (pin 9 and 11) on ST Zio connector CN9. Thus SB60 and SB53 must be OFF
	OFF	PB9 and PB8 (I2C) are not connected to A4 and A5 (pin 9 and 11) on ST Zio connector CN9.
SB28 and SB70 (PE9)	ON, OFF	PE9 is used as TIMER_A_PWM1 (Pin 4) on ST Zio connector CN10.
	OFF, ON	PE9 is used as COMP2_INP (Pin 15) on ST Zio connector CN9.
SB37 (PF12) and SB38 (PF4)	OFF, ON	ADC_IN is connected to A6 (pin 7) on ST Zio connector CN10. PF12 must not be used as ADC_IN (SB37 must be OFF)
SB48 (PF5) and SB49 (PF13)	ON, OFF	ADC_IN is connected to A7 (pin 9) on ST Zio connector CN10. PF13 must not be used as ADC_IN (SB49 must be OFF)
SB50 (PF14) and SB54 (PF6)	OFF, ON	ADC_IN is connected to A8 (pin 11) on ST Zio connector CN10. PF14 must not be used as ADC_IN (SB50 must be OFF)
SB5	OFF	NUCLEO-H743ZI2 and NUCLEO-H753ZI support 1V8 and 3V3 for VDD_MCU. Thus U10 level shifter is needed and SB5 must be OFF.
	ON	If the MCU is supplied with 3V3, U10 can be by-passed and SB5 can be ON.

1. Default SBx state is shown in bold.

All the other solder bridges present on the STM32H7 Nucleo-144 board are used to configure several I/Os and power supply pins for compatibility of features and pinout with the target STM32H7 supported.

The STM32H7 Nucleo-144 board is delivered with the solder bridges configured, according to the target STM32H7 supported.

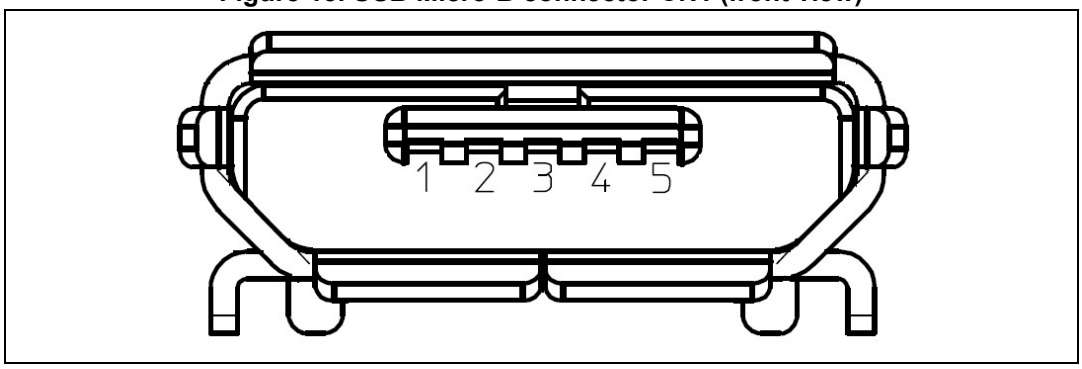
7 Board connectors

Several connectors are implemented on the STM32H7 Nucleo-144 board.

7.1 STLINK-V3 USB Micro-B connector CN1

The USB Micro-B connector CN1 is used to connect embedded STLINK-V3 to the PC for the programming and debugging purposes.

Figure 15. USB Micro-B connector CN1 (front view)



The related pinout for the USB ST-LINK connector is listed in *Table 15*.

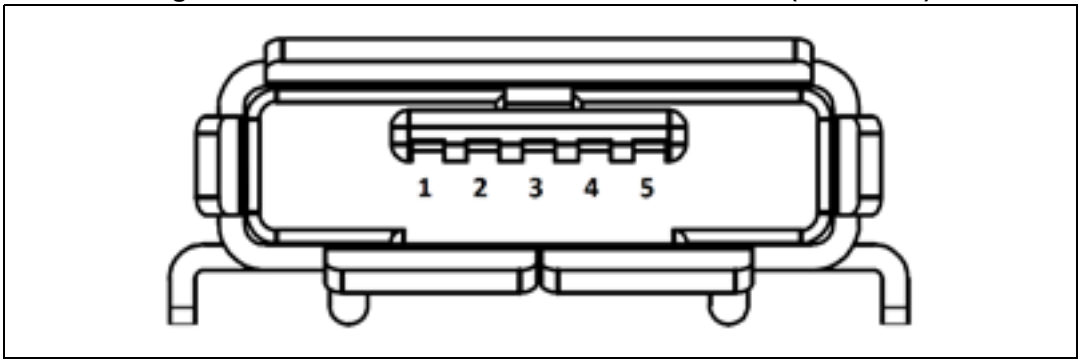
Table 15. USB Micro-B connector pinout

Connector	Pin number	Pin name	Signal name	ST-LINK MCU pin	Function
CN1	1	VBUS	5V_USB_CHGR	-	5 V power
	2	DM	USB_DEV_HS_CN_N	PB14	USB differential pair N
	3	DP	USB_DEV_HS_CN_P	PB15	USB differential pair P
	4	ID	-	-	-
	5	GND	-	-	GND

7.2 USB OTG FS connector CN13

An USB OTG Full Speed communication link is available at USB Micro-AB receptacle connector CN13. Micro-AB receptacle enables USB Host and USB Devices features.

Figure 16. USB OTG FS Micro-AB connector CN13 (front view)



The related pinout for the USB OTG FS connector is listed in *Table 16*.

Table 16. USB OTG FS Micro-AB connector pinout

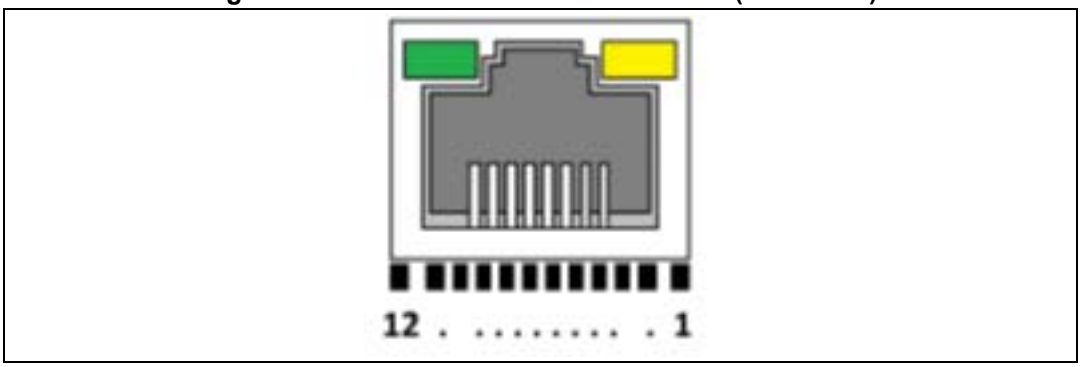
Connector	Pin number	Pin name	Signal name	MCU pin	Function
CN13	1	VBUS	USB_FS_VBUS	PA9	5 V power
	2	DM	USB_FS_N	PA11	USB differential pair M
	3	DP	USB_FS_P	PA12	USB differential pair P
	4	ID	USB_FS_ID	PA10	-
	5	GND	-	-	GND

7.3 Ethernet RJ45 connector CN14

The STM32H7 Nucleo-144 board supports 10Mbps/100Mbps Ethernet communication with the U15 LAN8742A-CZ-TR PHY from MICROCHIP and CN14 integrated RJ45 connector. The Ethernet PHY is connected to the MCU via the RMII interface.

The 25 MHz clock for the PHY is generated by oscillator X4. The 50 MHz clock for the MCU (derived from the 25 MHz crystal oscillator) is provided by the RMII_REF_CLK of the PHY.

Figure 17. Ethernet RJ45 connector CN14 (front view)



1. Green LED: Ethernet traffic
2. Amber LED: Ethernet connection

The related pinout for the Ethernet connector is listed in *Table 17*.

Table 17. Ethernet connector pinout

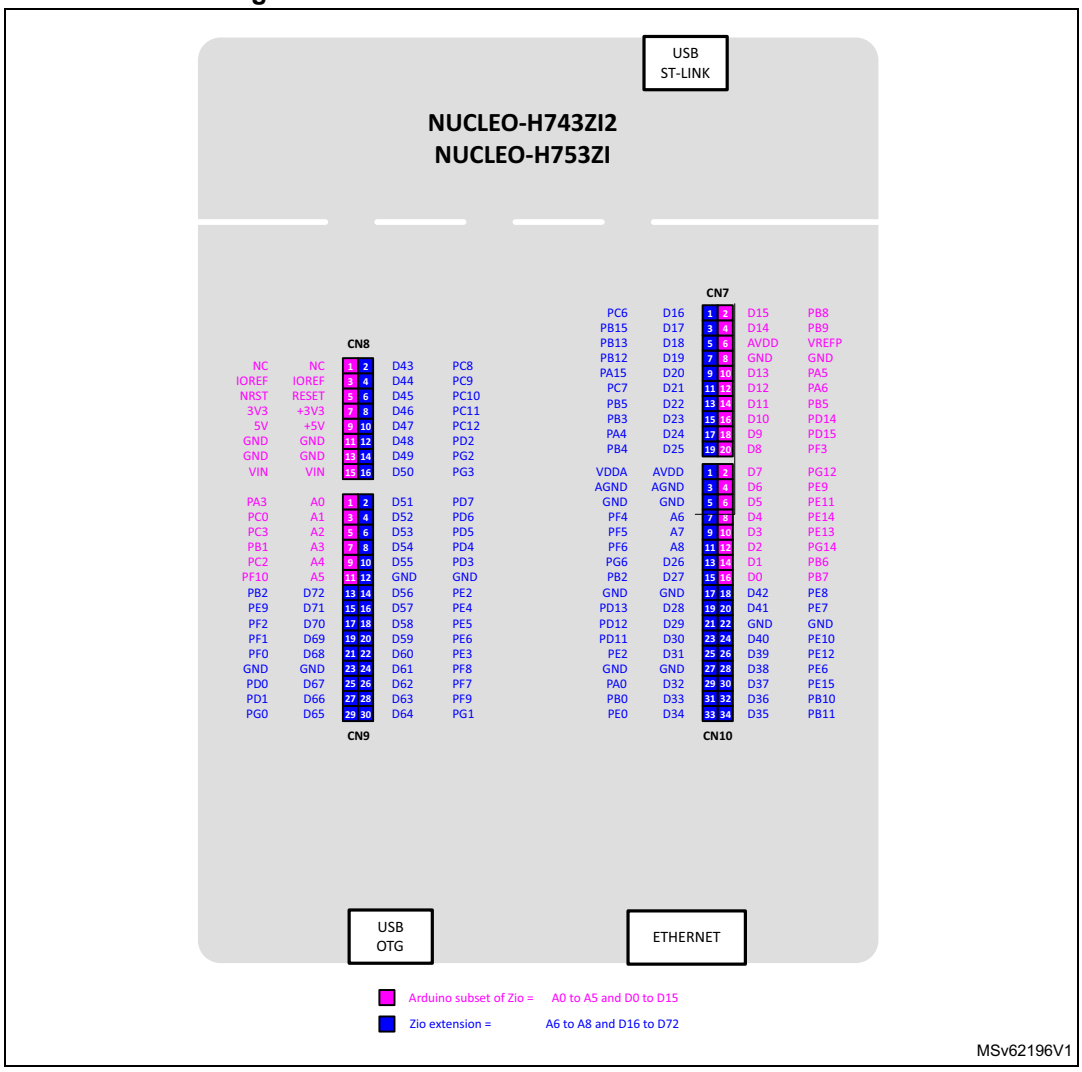
Connector	Pin number	Description	MCU pin	Pin number	Description	MCU pin
CN14	1	TX+	-	7	NC	-
	2	TX-	-	8	NC	-
	3	RX+	-	9	K, yellow LED	-
	4	NC	-	10	A, yellow LED	-
	5	NC	-	11	K, green LED	-
	6	RX-	-	12	A, green LED	-

8 Extension connectors

8.1 ST Zio connectors

For each STM32H7 Nucleo-144 board, the following figures show the signals connected by default to the ST Zio connectors (CN7, CN8, CN9, CN10), including the support for Arduino Uno V3.

Figure 18. NUCLEO-H743ZI2 and NUCLEO-H753ZI



CN7, CN8, CN9 and CN10 are female on top side and male on bottom side connectors. They include support for Arduino Uno V3. Most shields designed for Arduino Uno V3 can fit to the STM32H7 Nucleo-144 board.

To cope with Arduino Uno V3, apply the following modifications:

- SB55 and SB62 should be ON
- SB53/60/65 should be OFF to connect I^2C on A4 (pin 9) and A5 (pin 11 of CN9).

Caution:1 The I/Os of STM32H7 Series microcontroller are 3.3 V compatible instead of 5 V for Arduino Uno V3.

Caution:2 R37 should be removed before implementing Arduino shield with V_{REF+} power being provided on CN7 pin 6. Refer to *Table 14: Solder bridge and jumper configuration* for details on R37.

NUCLEO-H743ZI2, NUCLEO-H753ZI pin assignments

Table 18. CN7 ZIO included Arduino™ connector pinout(1)

Pin	Pin name	Signal name	STM32H7 pin	MCU Function	Pin	Pin name	Signal name	STM32H7 pin	MCU Function
1	**D16**	I2S_A_MCK	PC6	I2S_2	**2**	**D15**	I2C_A_SCL	PB8	I2C_1_SCL
3	**D17**	I2S_A_SD	PB15	I2S_2	**4**	**D14**	I2C_A_SDA	PB9	I2C_1_SDA
5	**D18**	I2S_A_CK	PB13(2)	I2S_2	**6**	**VREFP**	VREFP	-	VDDA/VREFP
7	**D19**	I2S_A_WS	PB12	I2S_2	**8**	**GND**	GND	-	-
9	**D20**	I2S_B_WS	PA15	I2S_3	**10**	**D13**	SPI_A_SCK	PA5	SPI1_SCK
11	**D21**	I2S_B_MCK	PC7	I2S_3	**12**	**D12**	SPI_A_MISO	PA6	SPI1_MISO
13	**D22**	I2S_B_SD/ SPI_B_MOSI	PB5	I2S_3/ SPI3	**14**	**D11**	SPI_A_MOSI / TIM_E_PWM1	PB5(3)	SPI1_MOSI/ TIM3_CH2
15	**D23**	I2S_B_CK/ SPI_B_SCK	PB3	I2S_3/ SPI3	**16**	**D10**	SPI_A_CS / TIM_B_PWM3	PD14	SPI1_CS/ TIM4_CH3
17	**D24**	SPI_B_NSS	PA4	SPI3	**18**	**D9**	TIM_B_PWM2	PD15	TIM4_CH4
19	**D25**	SPI_B_MISO	PB4	SPI3	**20**	**D8**	I/O	PF3	-

1. For more details refer to *Table 14: Solder bridge and jumper configuration*.
2. PB13 is used as I2S_A_CK and connected to CN7 pin 5. If JP6 is ON, it is also connected to Ethernet PHY as RMII_TXD1. In this case only one function of the Ethernet or I2S_A must be used.
3. PA7 is used as D11 and connected to CN7 pin 14. If SB31 is ON, it is also connected to both Ethernet PHY as RMII_CRS_DV. In this case only one function of the Ethernet or D11 must be used.

Table 19. CN8 ZIO included Arduino™ connector pinout

Pin	Pin name	Signal name	STM32H7 pin	MCU Function	Pin	Pin name	Signal name	STM32H7 pin	MCU Function
1	**NC**	NC	-	-	**2**	**D43**	SDMMC_D0	PC8	SDMMC
3	**IOREF**	IOREF	-	3.3 V Ref	**4**	**D44**	SDMMC_D1 I2S_A_CKIN	PC9	SDMMC I2S_CKIN
5	**NRST**	NRST	NRST	RESET	**6**	**D45**	SDMMC_D2	PC10	SDMMC

Table 19. CN8 ZIO included Arduino™ connector pinout (continued)

Pin	Pin name	Signal name	STM32H7 pin	MCU Function	Pin	Pin name	Signal name	STM32H7 pin	MCU Function
7	**3V3**	3V3	-	3.3 V input/output	**8**	**D46**	SDMMC_D3	PC11	SDMMC
9	**5V**	5V	-	5 V output	**10**	**D47**	SDMMC_CK	PC12	SDMMC
11	**GND**	GND	-	ground	**12**	**D48**	SDMMC_CMD	PD2	SDMMC
13	**GND**	GND	-	ground	**14**	**D49**	I/O	PG2	-
15	**VIN**	VIN	-	Power input	**16**	**D50**	I/O	PG3	-

Table 20. CN9 ZIO included Arduino™ connector pinout

Pin	Pin name	Signal name	STM32H7 pin	MCU Function	Pin	Pin name	Signal name	STM32H7 pin	MCU Function
1	**A0**	**ADC**	PA3	ADC12_INP15	**2**	**D51**	USART_B_SCLK	PD7	USART_2
3	**A1**	**ADC**	PC0	ADC123_INP10	**4**	**D52**	USART_B_RX	PD6	USART_2
5	**A2**	**ADC**	PC3	ADC12_INP13	**6**	**D53**	USART_B_TX	PD5	USART_2
7	**A3**	**ADC**	PB1	ADC12_INP5	**8**	**D54**	USART_B_RTS	PD4	USART_2
9	**A4**	**ADC**	PC2/ PB9	ADC123_INP12/ I2C1_SDA	**10**	**D55**	USART_B_CTS	PD3	USART_2
11	**A5**	**ADC**	PF10/ PB8	ADC3_INP6/ I2C1_SCL	**12**	**GND**	GND	-	-
13	**D72**	**COMP1_INP**	PB2	COMP1_INP	**14**	**D56**	SAI_A_MCLK	PE2(1)	SAI_1_A
15	**D71**	**COMP2_INP**	PE0	COMP2_INP	**16**	**D57**	SAI_A_FS	PE4	SAI_1_A
17	**D70**	**I2C_B_SMBA**	PF2	I2C2	**18**	**D58**	SAI_A_SCK	PE5	SAI_1_A
19	**D69**	**I2C_B_SCL**	PF1	I2C2	**20**	**D59**	SAI_A_SD	PE6	SAI_1_A
21	**D68**	**I2C_B_SDA**	PF0	I2C2	**22**	**D60**	SAI_B_SD	PE3	SAI_1_B
23	**GND**	**GND**	-	-	**24**	**D61**	SAI_B_SCK	PF8	SAI_1_B
25	**D67**	**CAN_RX**	PD0	CAN_1	**26**	**D62**	SAI_B_MCLK	PF7	SAI_1_B

Table 20. CN9 ZIO included Arduino™ connector pinout (continued)

Pin	Pin name	Signal name	STM32H7 pin	MCU Function	Pin	Pin name	Signal name	STM32H7 pin	MCU Function
27	**D66**	**CAN_TX**	PD1	CAN_1	**28**	**D63**	SAI_B_FS	PF9	SAI_1_B
29	**D65**	**I/O**	PG0	-	**30**	**D64**	I/O	PG1	-

1. PE2 is connected to both CN9 pin 14 (SAI_A_MCLK) and CN10 pin 25 (QSPI_BK1_IO2). Only one function must be used at one time.

Table 21. CN10 ZIO included Arduino™ connector pinout

Pin	Pin name	Signal name	STM32H7 pin	MCU Function	Pin	Pin name	Signal name	STM32H7 pin	MCU Function
1	**AVDD**	VDDA	-	Analog VDD	**2**	**D7**	I/O	PG12	I/O
3	**AGND**	AGND	-	Analog GND	**4**	**D6**	TIMER_A_PWM1	PE9	TIM1_CH1
5	**GND**	GND	-	GND	**6**	**D5**	TIMER_A_PWM2	PE11	TIM1_CH2
7	**A6**	ADC_A_IN	PF4	ADC3_INP9	**8**	**D4**	I/O	PE14	I/O
9	**A7**	ADC_B_IN	PF5	ADC3_INP4	**10**	**D3**	TIMER_A_PWM3	PE13	TIM1_CH3
11	**A8**	ADC_C_IN	PF6	ADC3_INP8	**12**	**D2**	I/O	PG14	I/O
13	**D26**	QSPI_CS	PG6	QSPI1_NCS	**14**	**D1**	USART_A_TX	PB6	LPUART1
15	**D27**	QSPI_CLK	PB2	QSPI1_CLK	**16**	**D0**	USART_A_RX	PB7	LPUART1
17	**GND**	GND	-	GND	**18**	**D42**	TIMER_A_PWM1N	PE8	TIM1_CH1N
19	**D28**	QSPI_BK1_IO3	PD13	QSPI1_IO	**20**	**D41**	TIMER_A_ETR	PE7	TIM1_ETR
21	**D29**	QSPI_BK1_IO1	PD12	QSPI1_IO	**22**	**GND**	GND	-	GND
23	**D30**	QSPI_BK1_IO0	PD11	QSPI1_IO	**24**	**D40**	TIMER_A_PWM2N	PE10	TIM1_CH2N
25	**D31**	QSPI_BK1_IO2	PE2(1)	QSPI1_IO	**26**	**D39**	TIMER_A_PWM3N	PE12	TIM1_CH3N
27	**GND**	-	-	-	**28**	**D38**	TIMER_A_BKIN2	PE6	TIM1_BKIN2
29	**D32**	TIM_C_PWM1	PA0	TIM2_CH1	**30**	**D37**	TIMER_A_BKIN1	PE15	TIM1_BKIN1
31	**D33**	TIM_D_PWM1	PB0	TIM3_CH3	**32**	**D36**	TIMER_C_PWM2	PB10	TIM2_CH3
33	**D34**	TIM_B_ETR	PE0	TIM4_ETR	**34**	**D35**	TIMER_C_PWM3	PB11	TIM2_CH4

8.2 ST morpho connector

The ST morpho connector consists in male pin header footprints CN11 and CN12 (not soldered by default). They are used to connect the STM32H7 Nucleo-144 board to an extension board or a prototype/wrapping board placed on top of the STM32H7 Nucleo-144 board. All signals and power pins of the STM32H7 are available on the ST morpho connector. This connector can also be probed by an oscilloscope, logical analyzer or voltmeter.

Table 22 shows the pin assignments of each STM32H7 on the ST morpho connector.

Table 22. ST morpho connector pin assignment

CN11 odd pins		CN11 even pins		CN12 odd pins		CN12 even pins	
Pin nbr	**Pin name**	**Pin nbr**	**Pin name**	**Pin nbr**	**Pin name**	**Pin nbr**	**Pin name**
1	PC10	**2**	PC11	**1**	PC9	**2**	PC8
3	PC12	**4**	PD2	**3**	PB8	**4**	PC6
5	3V3_VDD	**6**	5V_EXT	**5**	PB9	**6**	PC5
7	BOOT0(1)	**8**	GND	**7**	VREFP	**8**	5V_USB_STLK(2)
9	PF6	**10**	NC	**9**	GND	**10**	PD8
11	PF7	**12**	IOREF	**11**	PA5	**12**	PA12
13	PA13(3)	**14**	NRST	**13**	PA6	**14**	PA11
15	PA14(3)	**16**	3V3	**15**	PA7	**16**	PB12
17	PA15	**18**	5V	**17**	PB6	**18**	PB11
19	GND	**20**	GND	**19**	PC7	**20**	GND
21	PB7	**22**	GND	**21**	PA9	**22**	PB2
23	PC13	**24**	VIN	**23**	PA8	**24**	PB1
25	PC14	**26**	NC	**25**	PB10	**26**	PB15
27	PC15	**28**	PA0	**27**	PB4	**28**	PB14
29	PH0	**30**	PA1	**29**	PB5	**30**	PB13
31	PH1	**32**	PA4	**31**	PB3	**32**	AGND
33	VBAT	**34**	PB0	**33**	PA10	**34**	PC4
35	PC2	**36**	PC1	**35**	PA2	**36**	PF5
37	PC3	**38**	PC0	**37**	PA3	**38**	PF4
39	PD4	**40**	PD3	**39**	GND	**40**	PE8
41	PD5	**42**	PG2	**41**	PD13	**42**	PF10
43	PD6	**44**	PG3	**43**	PD12	**44**	PE7
45	PD7	**46**	PE2	**45**	PD11	**46**	PD14
47	PE3	**48**	PE4	**47**	PE10	**48**	PD15
49	GND	**50**	PE5	**49**	PE12	**50**	PF14
51	PF1	**52**	PF2	**51**	PE14	**52**	PE9

Table 22. ST morpho connector pin assignment (continued)

CN11 odd pins		CN11 even pins		CN12 odd pins		CN12 even pins	
Pin nbr	**Pin name**	**Pin nbr**	**Pin name**	**Pin nbr**	**Pin name**	**Pin nbr**	**Pin name**
53	PF0	**54**	PF8	**53**	PE15	**54**	GND
55	PD1	**56**	PF9	**55**	PE13	**56**	PE11
57	PD0	**58**	PG1	**57**	PF13	**58**	PF3
59	PG0	**60**	GND	**59**	PF12	**60**	PF15
61	PE1	**62**	PE6	**61**	PG14	**62**	PF11
63	PG9	**64**	PG15	**63**	GND	**64**	PE0
65	PG12	**66**	PG10	**65**	PD10	**66**	PG8
67	NC	**68**	PG13	**67**	PG7	**68**	PG5
69	PD9	**70**	PG11	**69**	PG4	**70**	PG6

1. Default state of BOOT0 is 0. It can be set to 1 when a jumper is plugged on the pins 5-7 of CN11.
2. 5V_USB_STLK is the 5 V power coming from the ST-LINKV3 USB connector that rises before and it rises before the +5 V rising on the board.
3. PA13 and PA14 are shared with SWD signals connected to STLINK-V3. It is not recommended to use them as I/O pins.

Appendix A Federal Communications Commission (FCC) and Industry Canada (IC) Compliance

A.1 FCC Compliance Statement

A.1.1 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.

A.1.2 Part 15.105

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

A.1.3 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.

A.2 IC Compliance Statement

This device complies with FCC and Industry 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.

A.2.1 Compliance Statement

Notice: This device complies with Industry Canada license-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.

Industry Canada ICES-003 Compliance Label: CAN ICES-3 (A)/NMB-3(A)

A.2.2 Déclaration de conformité

Avis: Le présent appareil est conforme aux CNR d'Industrie 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'Industrie Canada: CAN ICES-3 (A)/NMB-3(A)

Appendix B CISPR32

B.1 Warning

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

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

Revision history

Table 23. Document revision history

Date	Revision	Changes
14-Mar-2019	1	Initial version