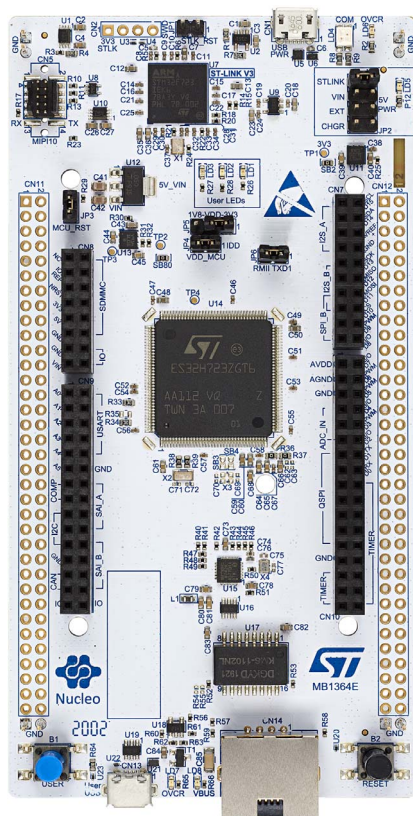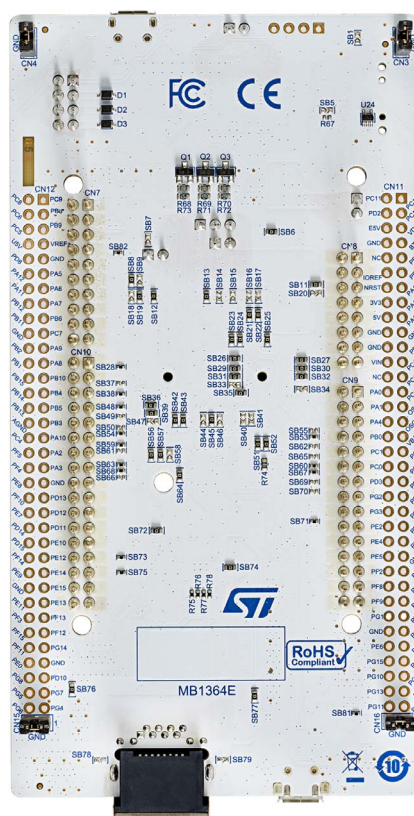STM32H7 Nucleo-144 boards (MB1364)

Introduction

The STM32H7 Nucleo-144 boards, based on the MB1364 reference board (NUCLEO-H723ZG, NUCLEO-H743ZI (order code NUCLEO-H743ZI2), and 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-V3E debugger/programmer. The STM32H7 Nucleo-144 boards come with comprehensive free software libraries and examples available with the STM32Cube MCU Package.

Note: *For NUCLEO-H743ZI (STM32H7 Nucleo-144 (MB1137) - order code NUCLEO-H743ZI), refer to UM1974.*

Figure 1. Nucleo-144 board (top view)   **Figure 2. Nucleo-144 board (bottom view)**

Pictures are not contractual.

Contents

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1   Features

The STM32H7 Nucleo-144 boards offer the following features:

- STM32H7 Arm®(a) Cortex® core-based microcontroller in an 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
    – MIPI-10
    – ST Zio including ARDUINO® Uno V3 expansion connectors
    – ST morpho expansion connector
- Flexible power supply options: ST-LINK USB V_{BUS} or external sources
- On-board STLINK-V3E debugger/programmer with SWD connector:
    – USB reenumeration capability: Virtual COM port, mass storage, debug port
    – STLINK-V3E standalone kit capability
- Comprehensive free software libraries and examples available with the STM32Cube package
- Support of a wide choice of Integrated Development Environments (IDEs) including IAR Embedded Workbench®, MDK-ARM, and STM32CubeIDE

arm

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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-H723ZG	MB1364[1]	STM32H723ZGT6	-
NUCLEO-H743ZI2		STM32H743ZIT6	-
NUCLEO-H753ZI		STM32H753ZIT6	Cryptography

1. Subsequently named main board in the rest of the document.

2.1 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 32-bit Arm Cortex MCUs	STM32H7 series
YY	MCU product line in the series	STM32H743
Z	STM32 package pin count	144 pins
T	STM32H7 flash memory size: -G for 1 Mbyte -I for 2 Mbytes	2 Mbytes
N	Board version: void or 2	STLINK-V3E

3 Development environment

3.1 System requirements

- Multi-OS support: Windows[®] 10, Linux[®] 64-bit, or macOS[®(a)(b)(c)]
- USB Type-A to Micro-B cable

3.2 Development toolchains

- IAR Systems[®] - IAR Embedded Workbench[®(d)]
- Keil[®] - MDK-ARM[(d)]
- STMicroelectronics - STM32CubeIDE

3.3 Demonstration software

The demonstration software, included in the STM32Cube MCU Package corresponding to the on-board microcontroller, is preloaded in the STM32 flash memory for easy demonstration of the device peripherals in standalone mode. The latest versions of the demonstration source code and associated documentation can be downloaded from *www.st.com*.

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

b. Linux is a registered trademark of Linus Torvalds.

c. Windows is a trademark of the Microsoft group of companies.

d. 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 conventions

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

In this document, for any information that is common to all sales types, the references are noted as the *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 development quickly with an STM32H7 series microcontroller in an LQFP144 package.

Before installing and using the product, accept the evaluation product license agreement (EPLA) from the www.st.com/epla web page. For more information on the STM32H7 Nucleo-144 and 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 component location, refer to *Figure 4*):

1. Check the jumper position on the board:

Table 4. Jumper configuration

Jumper	Definition	Position	Comment
JP1	STLK_RST	OFF	-
JP2	Power source selection	ON [1-2]	5V_USB_STLK (from ST-LINK)
JP3	T_NRST	ON	-
JP4	IDD measurement	ON	MCU current measurement
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

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. Power the board by connecting the STM32H7 Nucleo-144 board to a PC with a USB Type-A to Micro-B cable through the USB connector (CN1) on the ST-LINK. As a result, the PWR green LED (LD5) and COM LED (LD4) light up and the red LED (LD3) blinks.

4. Press B1 (left button).

5. Observe the blinking frequency of the three LEDs LD1 to LD3 changes, by clicking on the B1 button.

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-V3E, 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 shown in *Figure 6* and *Figure 7*.

Figure 3. Hardware block diagram
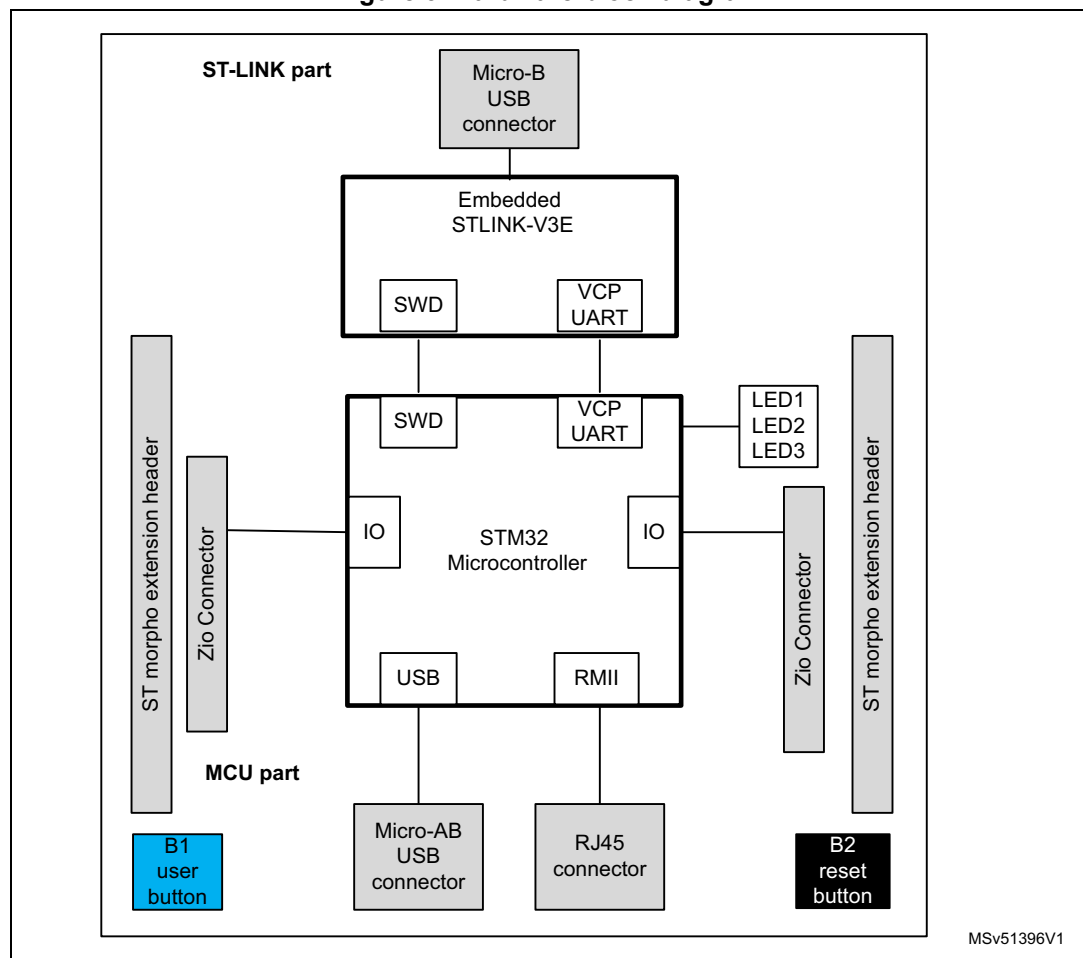
6.1 Nucleo-144 board layout

Figure 4. Nucleo-144 board top layout

MSv62197V3
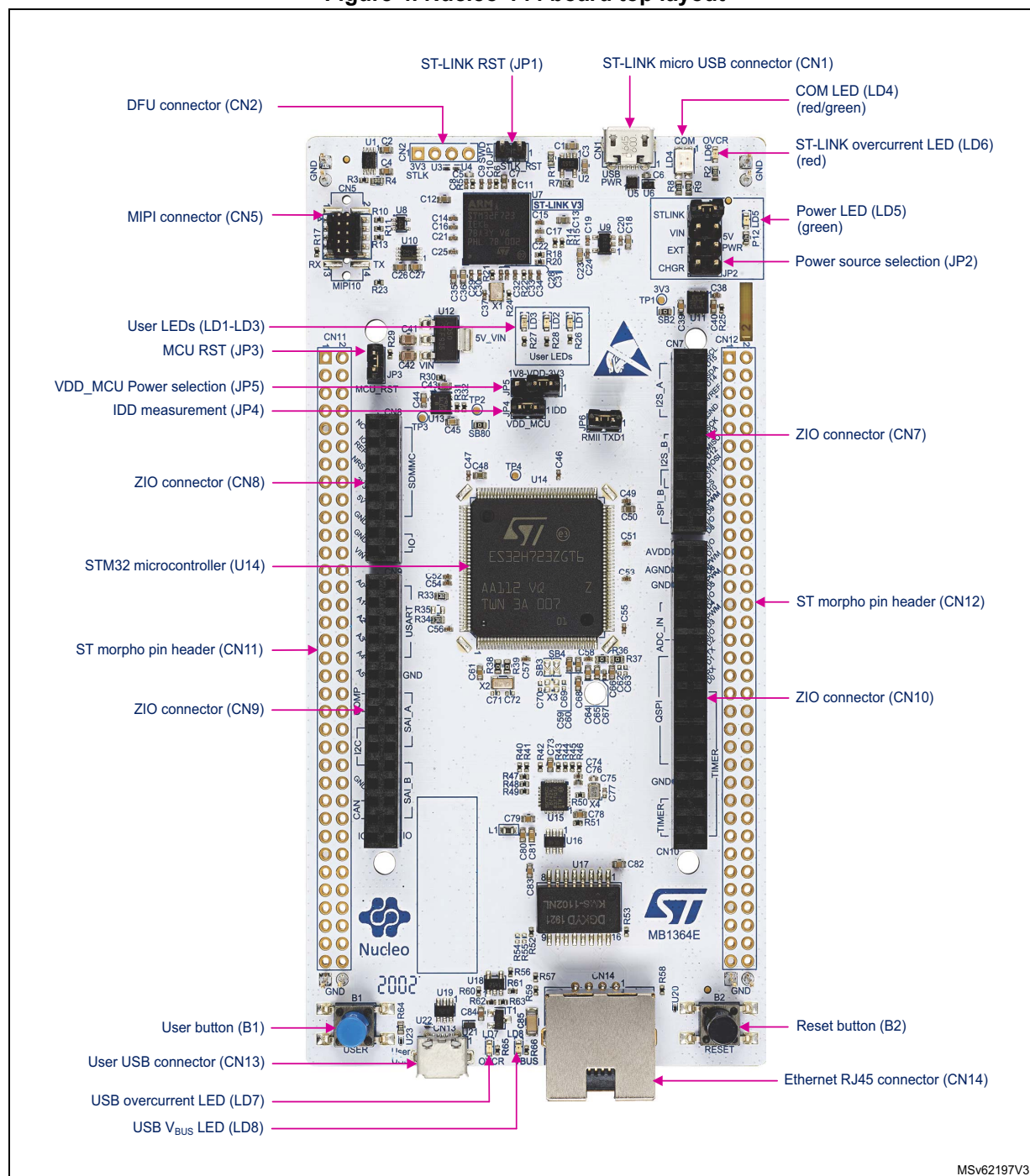
Figure 5. Nucleo-144 bottom layout

IOREF Power selection
(SB10, SB11, and SB20)

MSv51398V3
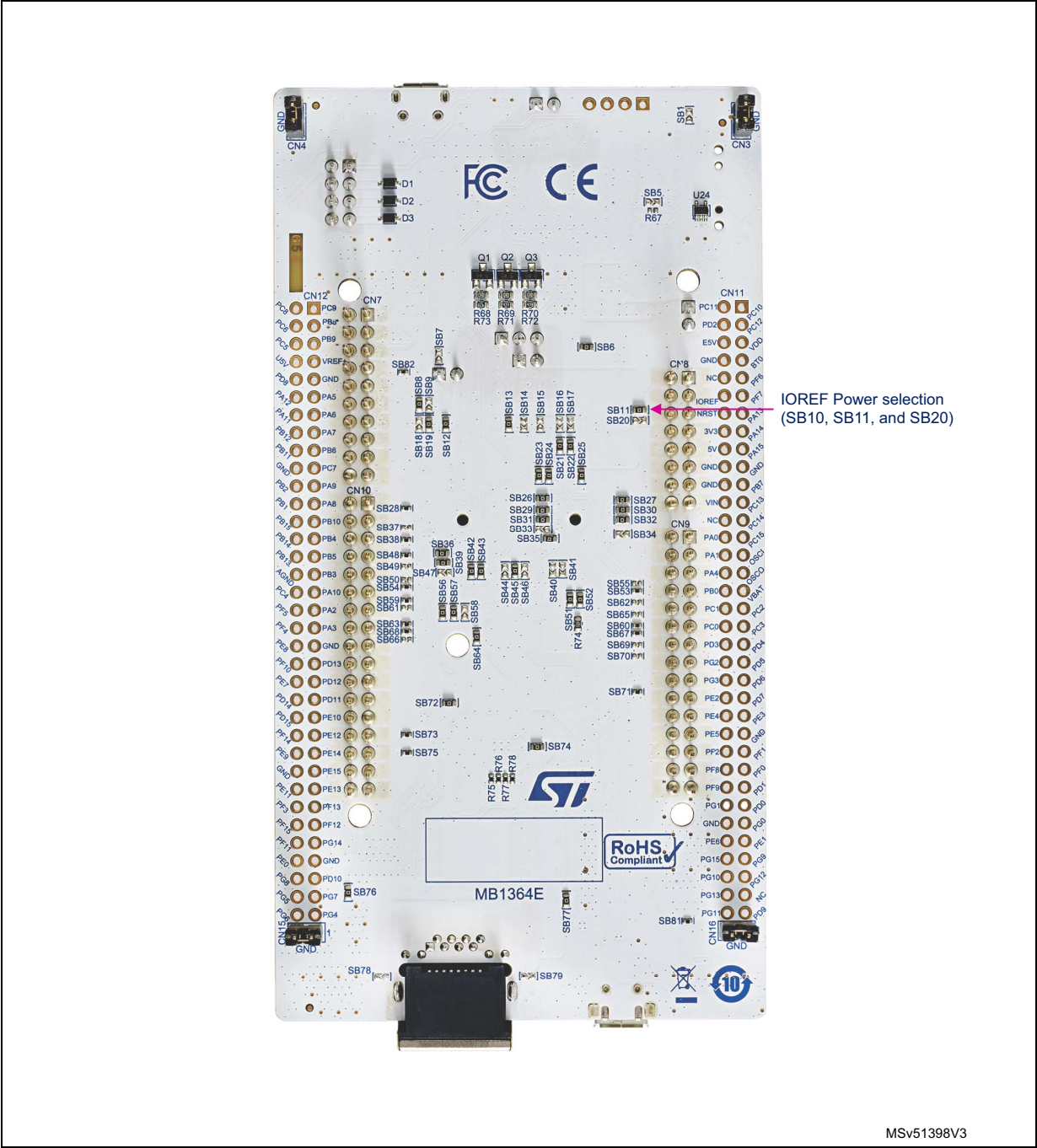
6.2 Mechanical drawing

Figure 6. Nucleo-144 board mechanical drawing in millimeters
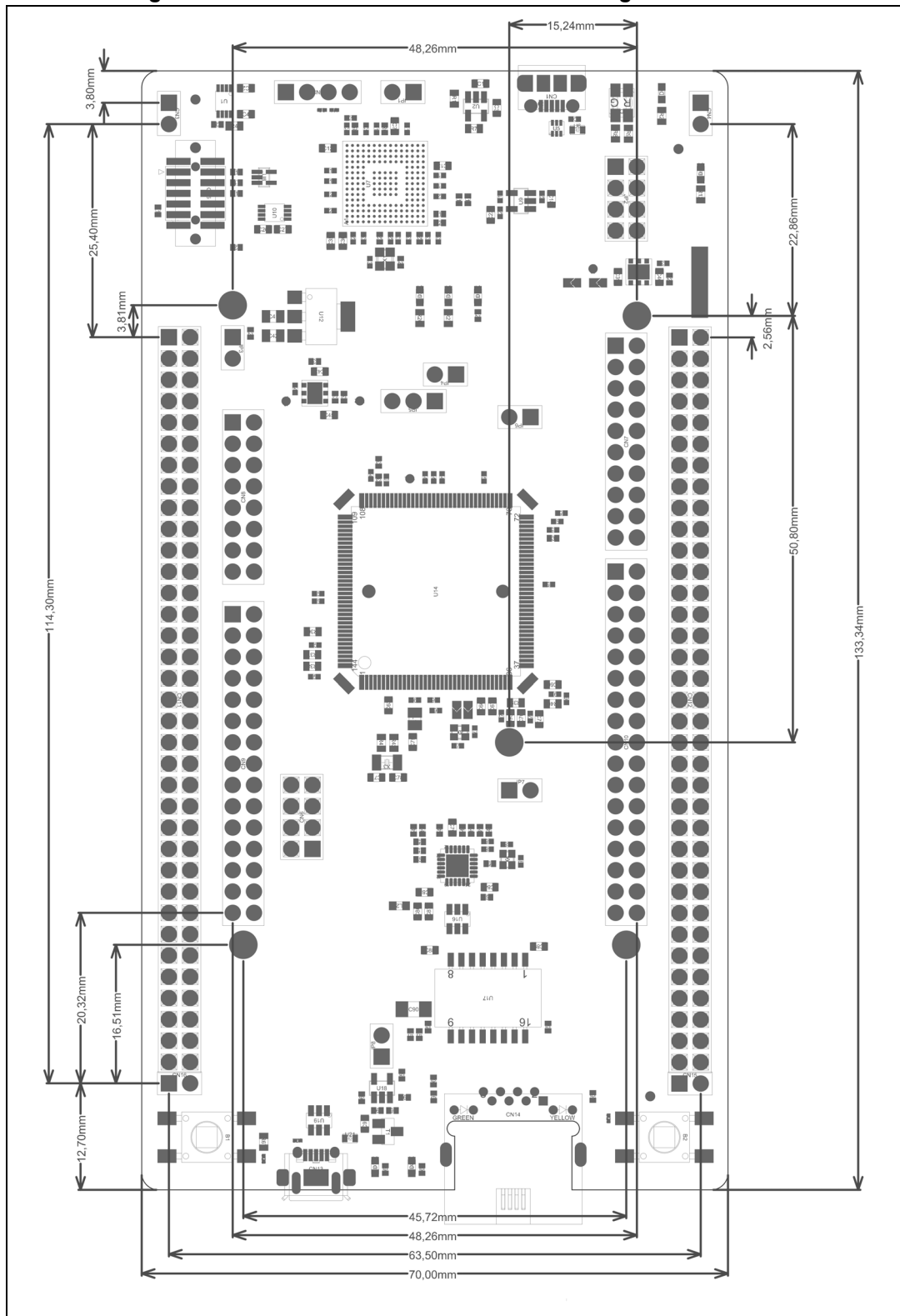
Figure 7. Nucleo-144 board mechanical drawing in mils
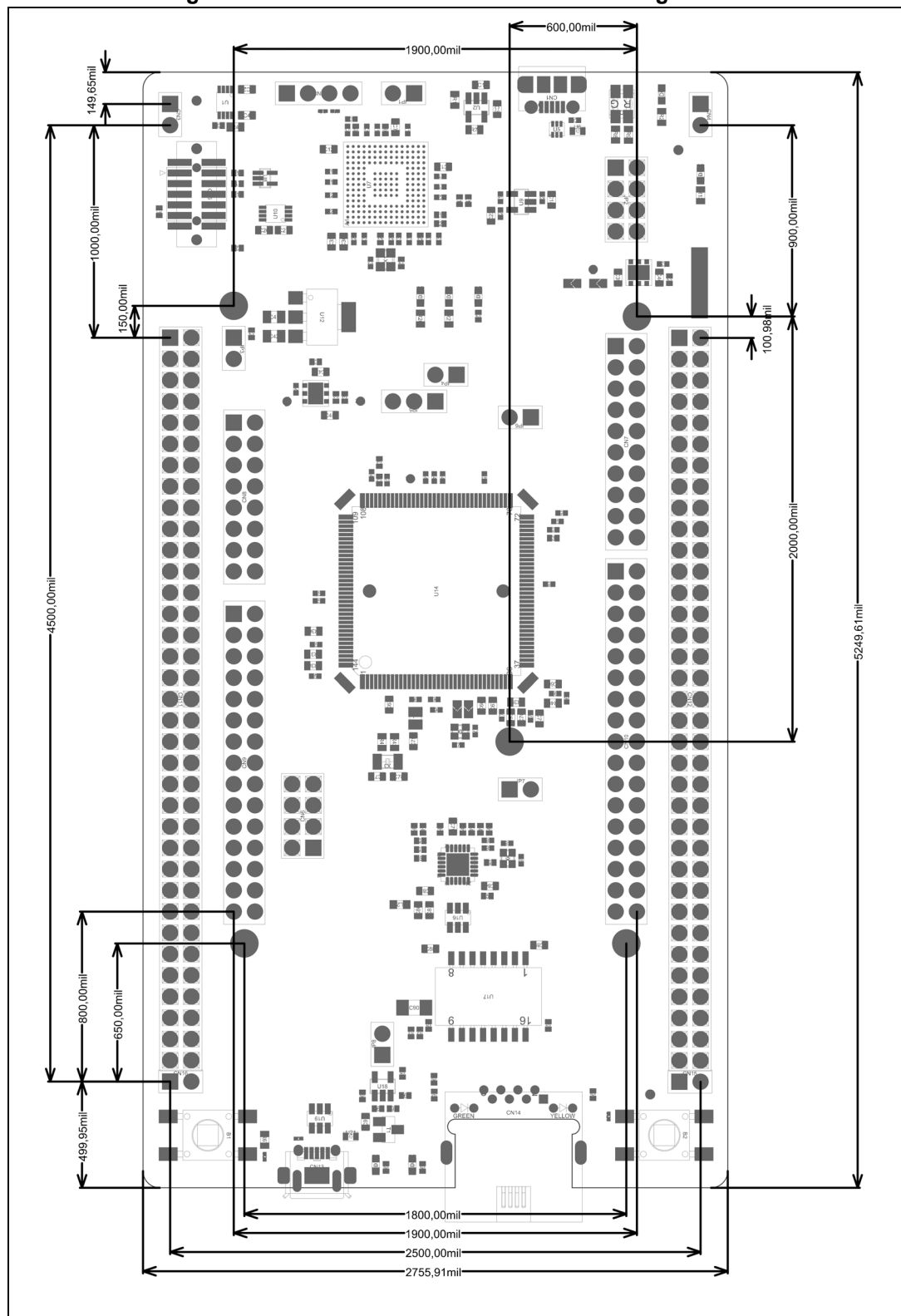
6.3 Embedded STLINK-V3E

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

- Using the embedded STLINK-V3E
- Using an external debug tool connected to the MIPI-10 connector (CN5).

The STLINK-V3E programming and debugging tool is integrated into the STM32H7 Nucleo-144 board.

The embedded STLINK-V3E supports only SWD and VCP for STM32H7 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/V3 features.

Features supported on STLINK-V3E:

- 5 V power supplied by a USB connector (CN1)
- USB 2.0 high-speed-compatible interface
- JTAG/serial wire debugging (SWD) specific features:
    – 3.0 to 3.6 V application voltage on the JTAG/SWD interface and 5 V-tolerant inputs
    – JTAG
    – SWD and serial viewer (SWV) communication
- STDC14 (MIPI-10) 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: 5 V enabled (LD5)

6.3.1 Drivers

Before connecting the Nucleo-144 board to a Windows® PC via USB, a driver for STLINK-V3E must be installed (not required for Windows® 10). The toolset supporting ST-LINK automatically installs the driver. 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 might 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: *ST recommends the use of a USB composite device, as shown in Figure 8.*

Figure 8. USB composite device
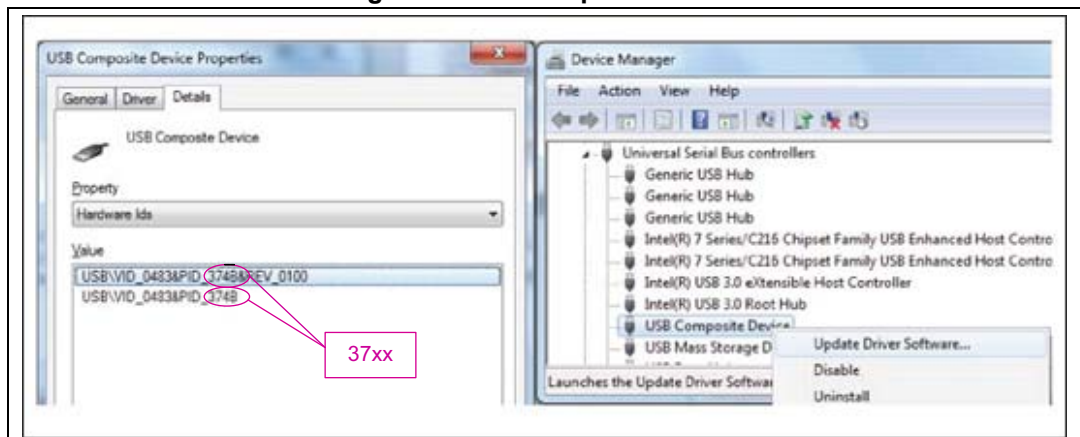
Note: *37xx = 374E for STLINK-V3E without bridge functions*
                 374F for STLINK-V3E with bridge functions

6.3.2 STLINK-V3E firmware upgrade

The STLINK-V3E embeds a firmware upgrade mechanism for an in-place upgrade through the USB port. As the firmware might evolve during the lifetime of the STLINK-V3E product (for example new functionalities, bug fixes, and support for new microcontroller families), ST recommends keeping the STLINK-V3E 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-board STM32H7

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 your external debug tool through the MIPI-10 debug connector (CN5).
2. Set the embedded STLINK-V3E in the high-impedance state:
    When the STLK_RST jumper (JP1) is ON, the embedded STLINK-V3E is in the RESET state, and all GPIOs are in high impedance. Then it is possible to connect the external debug tool to the debug connector (CN5).

Figure 9. Connecting an external debug tool to program the on-board STM32H7
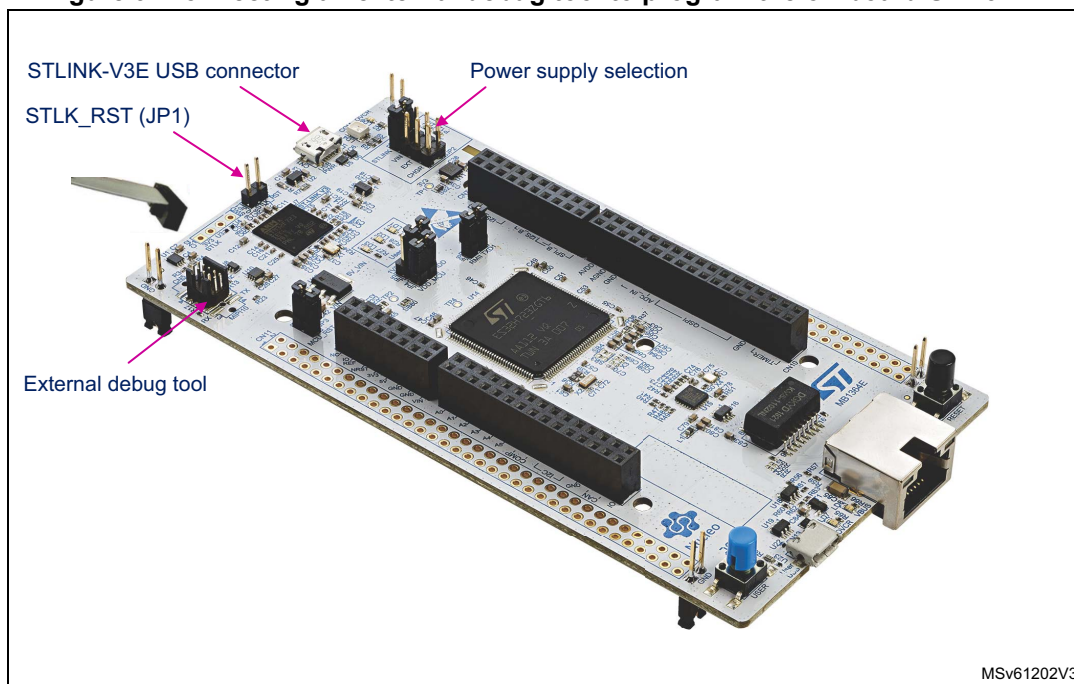
Table 5. MIPI-10 debug connector (CN5)

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 detection signal 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

Five different sources can provide the power supply:

- A host PC connected to CN1 through a USB cable (default setting)
- An external 7 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

Either the host PC through the USB cable, or an external source V_{IN} (7 to 12 V), E5V (5 V), or +3.3 V power supply pins on CN8 or CN11, provides the power supply. In case V_{IN}, E5V, or +3.3 V is used to power the Nucleo-144 board. This power source must comply with the EN-60950-1: 2006+A11/2009 standard and must be safety extra low voltage (SELV) with limited power capability.

In case the power supply is +3.3 V, the STLINK-V3E is not powered and cannot be used.

6.4.1 Power supply input from STLINK-V3E USB connector (default setting)

The 5 V signal on the STLINK-V3E USB connector (CN1) can power the STM32H7 Nucleo-144 board and its shield. Use the JP2 [1-2] configuration of the STLINK jumper (refer to *Figure 10*).

This is the default setting.

Figure 10. Power supply input from STLINK-V3E USB connector with PC (5 V, 500 mA max)
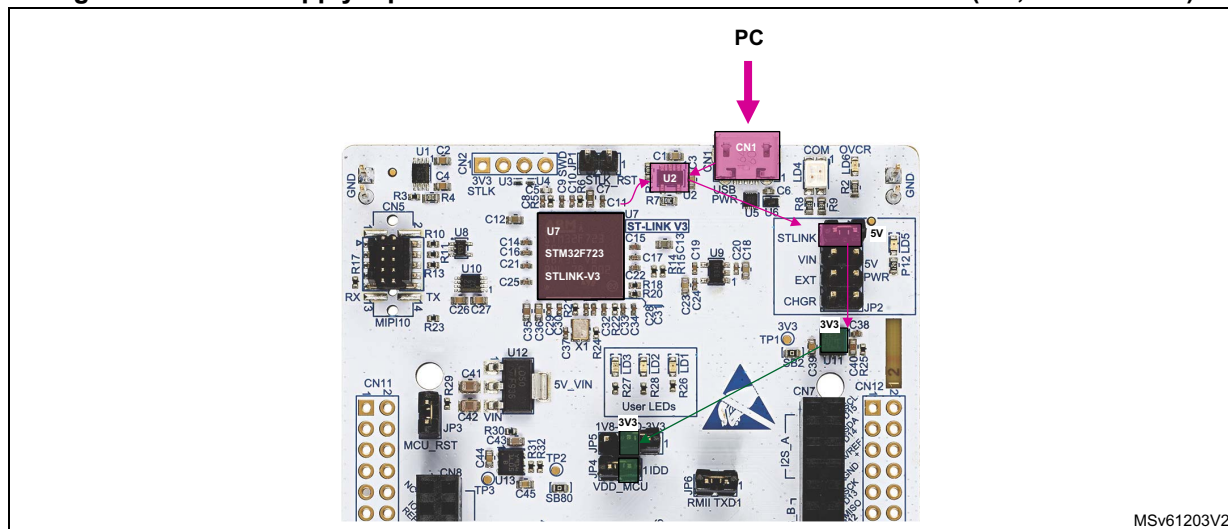
If the USB enumeration succeeds, the 5V_ST_LINK power is enabled, by asserting the PWR_ENn signal from STM32F723IEK6 'STLINK-V3E' (U7). This pin is connected to a power switch (U2), which powers the board. The power switch (U2) features also a current limitation to protect the PC in case of a short-circuit onboard. If an overcurrent (more than 500 mA) happens onboard, the red LED (LD6) is lit.

The STLINK-V3E USB connector (CN1) can power the Nucleo board with its shield. However, the STLINK-V3E circuit gets power before USB enumeration because the host PC only provides 100 mA to the board at that time.

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

- If the host can provide the required power, the enumeration finishes with a *SetConfiguration* command. Then, the power switch and the green LED (LD5) are turned ON. Thus, the Nucleo board and its shield can consume 500 mA current, but no more.

- If the host is not able to provide the requested current, the enumeration fails. Therefore, the 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 to 12 V, 800 mA max)

When the STM32H7 Nucleo-144 board is power supplied by VIN (refer to *Table 6* and *Figure 11*), the jumper (JP2) configuration must be [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 *Table 6*.

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

Input power name	Connector pins	Voltage range	Max current	Limitation
V_{IN}	CN8 pin 15 CN11 pin 24	7 to 12 V	800 mA	From 7 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 to 12 V, 800 mA max)
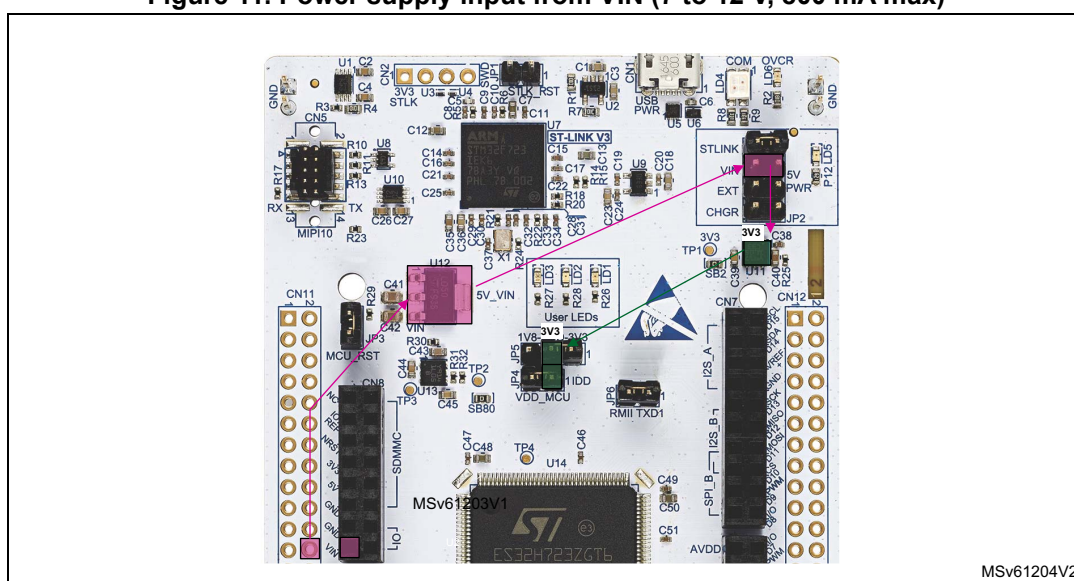
Note: *Refer to Section 6.4.6 about debugging when using an external power supply.*

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

When the STM32H7 Nucleo-144 board is power supplied by EXT (refer to *Table 7* and *Figure 12*), the jumper configuration must be the following: JP2 jumper 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: *Refer to 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)

MSv61205V2
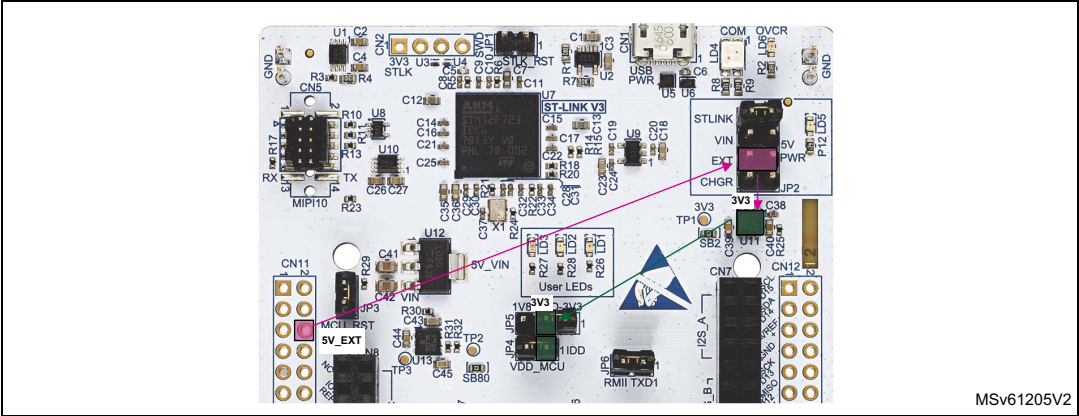
6.4.4 External power supply input from a USB charger (5 V)

When the STM32H7 Nucleo-144 board is power supplied by a USB charger on CN1 (refer to *Table 8* and *Table 13*), the jumper configuration must be JP2 [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 STLINK-V3E USB connector with a USB charger (5 V)

MSv61206V3
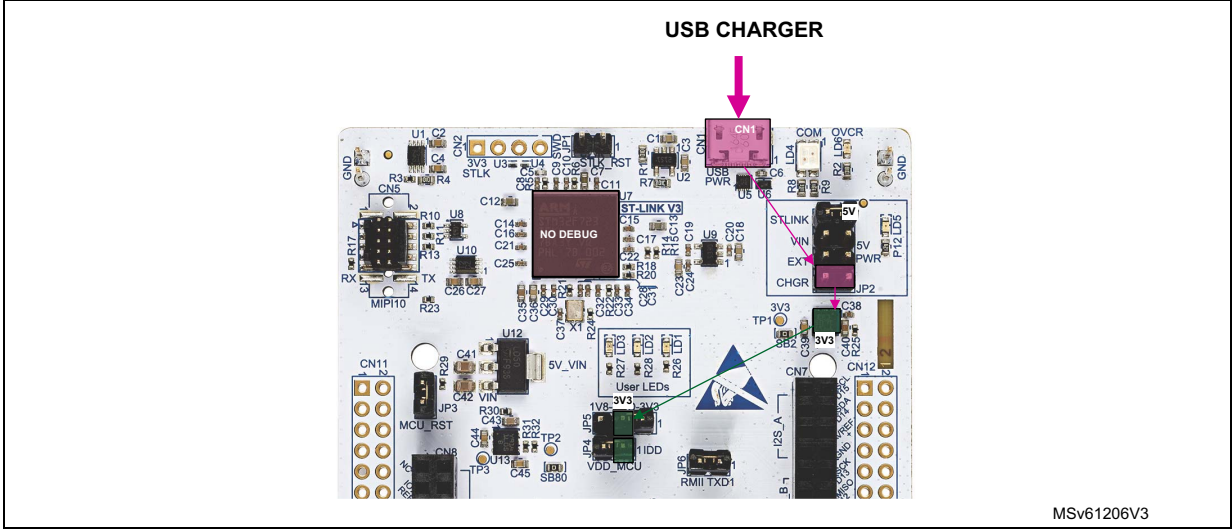
6.4.5 External power supply input from 3V3_EXT (3.3 V)

When the 3.3 V is provided by a shield board, it is worthy to use the 3V3 (CN8 pin 7 or CN11 pin 16) directly as power input (refer to *Table 9* and *Figure 14*). In this case, programming and debugging features are not available, since the STLINK-V3E 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)
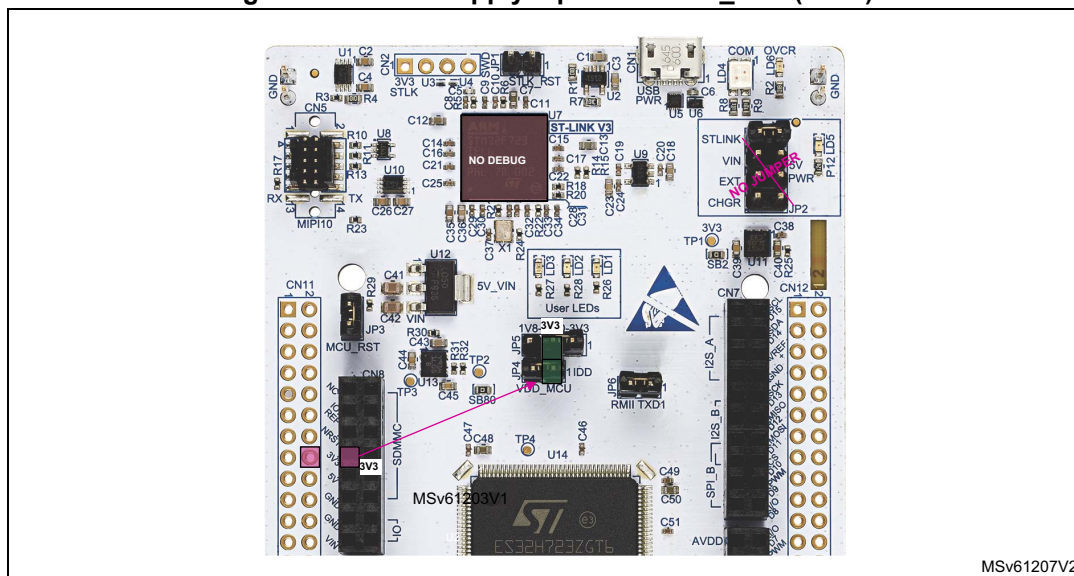
6.4.6 Debugging while using VIN or EXT as an external power supply

When powered by VIN or EXT, it is still possible to use the STLINK-V3E for programming or debugging only. In this case, 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. Configure the JP2 jumper [5-6] for EXT or [3-4] 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, V_{BUS} coming from STLINK-V3E might power the board, and the following risks might be encountered:

1. If the board needs more than 300 mA current, the PC might be damaged, or the PC can limit the supplied current. As a consequence, the board is not powered correctly.
2. 300 mA is requested during enumeration. So, there is a 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. The green 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 STLINK-V3E (default): The MCO output of ST-LINK is used as an input clock. This frequency cannot be changed. It is fixed at 8 MHz and connected to the PF0/PH0-OSC_IN of the 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 its typical frequencies, capacitors, and resistors, refer to the STM32H7 series microcontroller datasheet and the application note *Oscillator design guide for STM8AF/AL/S and STM32 microcontrollers* (AN2867) for the oscillator design guide. The X3 crystal has the following characteristics: 25 MHz, 6 pF, 20 ppm. The configuration must be:
  - SB44 and SB46 OFF
  - SB3 and SB4 ON
  - C69 and C70 ON with 5.6 pF capacitors
  - SB45 OFF
- Oscillator from external PF0/PH0: from an external oscillator through 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 clocks. 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 the low-speed clock (LSE):

- **On-board oscillator (default):** X2 crystal. Refer to the application note *Oscillator design guide for STM8AF/AL/S and STM32 microcontrollers* (AN2867) for oscillator design guide for STM32H7 series microcontrollers. The configuration must be:
    - SB40 and SB41 OFF
    - R38 and R39 ON
- **Oscillator from external PC14:** From an external oscillator through pin 25 of the 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 the 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.

COM LD4: The tricolor (green, orange, and red) LED (LD4) provides information about ST-LINK communication status. LD4 default color is red. LD4 turns to green to indicate that the communication is in progress between the PC and the STLINK-V3E, with the following setup:

- Slow blinking red/OFF at power-on before USB initialization
- Fast blinking red/OFF after the first correct communication between the PC and STLINK-V3E (enumeration)
- Red LED ON when the initialization between the PC and STLINK-V3E is complete
- Green LED ON after a successful target communication initialization
- Blinking red/green during communication with the target
- Green ON communication finished and successful
- Orange ON communication failure

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

USB power fault LD6: The red LED (LD6) indicates that the board power consumption on USB exceeds 500 mA, consequently, the user must power the board using an external power supply.

USB FS LD7 and LD8: Refer to *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 (wake-up 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)

The IDD jumper (JP4) is used to measure the STM32H7 series microcontroller consumption by removing the jumper and connecting an ammeter:

- JP4 must be ON when STM32H7 is powered with 3V3_VDD (default)
- If JP4 is 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), 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 STLINK-V3E.

6.6.5 Virtual COM port (VCP): LPUART/USART

The STM32H7 Nucleo-144 board enables connecting an LPUART or a USART interface to the STLINK-V3E, or to the ST morpho and ARDUINO® Uno V3 connectors.

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

By default the USART3 communication between the target STM32H7 and the STLINK-V3E is enabled, to support the Virtual COM port (SB12 and SB19 ON).

Table 10. USART3 connection

Pin name	Function	Virtual COM port (default configuration)	ST morpho connection
PD8	USART3 TX	SB19 ON SB9, SB18, and SB82 OFF	SB82 ON SB18 and SB19 OFF
PD9	USART3 RX	SB12 ON SB34, SB66, and SB81 OFF	SB81 ON SB12 and SB66 OFF

Table 11. LPUART1 connection

Pin name	Function	Virtual COM port	ARDUINO® D0 and D1	ST morpho connection
PB6	LPUART1 TX	SB9 and SB18 ON SB8, SB19, and SB61 OFF	SB8 and SB19 ON SB9, SB18, and SB61 OFF	SB8, SB9, and SB61 OFF
PB7	LPUART1 RX	SB34 and SB66 ON SB12 and SB68 OFF	SB12 and SB68 ON SB34 and SB66 OFF	SB34 and SB68 OFF

Hardware connection required for USART bootloader:

The STM32H7x3 embeds a USART bootloader. To use the USART bootloader (USART1), hardware modifications are required on the Nucleo board. Flying wires must 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 the USB Micro-AB connector (CN13) and the 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 the 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.ST recommends powering the Nucleo-144 board with an external power supply when using the 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, SB16 OFF	SB16 ON, SB21 OFF	-
PA12	USB DP	SB22 ON, SB17 OFF	SB17 ON, SB22 OFF	-
PD10	USB PWR EN	SB77 ON	SB77 OFF	-
PG7	USB FS OVCR	SB76 ON	SB76 OFF	-

ESD protection part is implemented on the 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 (U15) and RJ45 connector (CN14). Ethernet PHY is connected to the STM32H7 series microcontroller via the RMII interface. The PHY RMII_REF_CLK generates the 50 MHz clock for the STM32H7 series microcontroller.

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

2.The Ethernet PHY must be set in power-down mode (in this mode, the Ethernet PHY reference clock turns off) to achieve the expected low-power mode current. This is done by configuring the Ethernet PHY basic control register (at address 0x00) bit 11 (power down) to 0b1. 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 the top layer and SB1xx can be found on the 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 the Virtual COM port. Thus, PD8 and PD9 on the ST morpho connectors cannot be used.
	OFF	PG9 and PG14 on ST-LINK STM32F723IEK6 are disconnected from 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 the ST-LINK SWO input. (SB26 must be OFF)
	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.

Table 14. Solder bridge and jumper configuration (continued)

Bridge	State[1]	Description
SB14 (SDMMC_D0), SB15 (SDMMC_D1)	**ON**	These pins are connected to the ST morpho connector (CN12).
	OFF	These pins are disconnected from the ST morpho connector (CN12) to avoid stubs of SDMMC data signals on the PCB.
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 the 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 and PC15 are not connected to the ST morpho connector (CN11). X2 is used to generate the 32 kHz clock.
	ON, ON	PC14 and PC15 are connected to the ST morpho connector (CN11). R38 and R39 must be OFF.
SB44 (PF1/PH1) SB46 (PF0/PH0) (main clock)	ON, OFF	PF0/PH0 is not connected to the ST morpho connector (CN11). PF1/PH1 is connected to the ST morpho connector (MCO is used as the main clock for STM32H7 on PF0/PH0–SB45 ON).
	OFF, OFF	PF0/PH0 and PF1/PH1 are not connected to the ST morpho connector (CN11). X3, C69, C70, SB3, and SB4 provide a clock. In this case, SB45 must be OFF.
	ON, ON	PF0/PH0 and PF1/PH1 are connected to the ST morpho connector (CN11). SB3, SB4, and SB45 must be OFF.
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 an external 25 MHz crystal X3.
	ON, ON	PF0/PH0 and PF1/PH1 are connected to an 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 the 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 the ST Zio connector (pin 29 of CN10).
	OFF	PA0 is not connected to the 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 OFF. These pins must not be used on the ST morpho or the ST Zio connectors.
	OFF	These pins can be used as GPIOs on the ST morpho connectors. PB13 can be used as I2S_A_CK on ST Zio (pin 5 of CN7) if not used on the 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 the ST morpho connector (CN12).
SB77 (PD10)	**ON**	PD10 is connected to the USB power switch (U18) to control V_{BUS}.
	OFF	PD10 is used as GPIO on the 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 the ST morpho connector (CN12).
SB24 (PA10)	**ON**	PA10 is connected to the USB ID.
	OFF	PA10 is not connected to the USB ID. PA10 is used as GPIO on the ST morpho connector (CN12).
SB21 (PA11), SB22 (PA12)	**ON**	These pins are used as D- and D+ on the USB connector (CN13). SB16 and SB17 must be OFF.
	OFF	These pins are used as GPIOs on the ST morpho connectors. SB16 and SB17 must be ON.
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 the 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 the ST morpho connector (CN12). SB69 must be 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 (pins 9 and 11) on the ST Zio connector (CN9). Thus, SB55 and SB62 must be OFF
	OFF	ADC_IN are connected to A4 and A5 (pins 9 and 11) on the ST Zio connector (CN9). Thus, SB55 and SB62 can be ON (I²C)
SB65 (PF11)	OFF	On NUCLEO-H723ZG, NUCLEO-H743ZI2, and NUCLEO-H753ZI, PF11 is used only as GPIO on the ST morpho connector (CN12). It must not be used as ADC_IN.
I²C SB55 (PB9) and SB62 (PB8)	ON	PB9 and PB8 (I²C) are connected to A4 and A5 (pins 9 and 11) on the ST Zio connector (CN9). Thus, SB60 and SB53 must be OFF
	OFF	PB9 and PB8 (I²C) are not connected to A4 and A5 (pins 9 and 11) on the ST Zio connector (CN9).
SB28 and SB70 (PE9)	**ON, OFF**	PE9 is used as TIMER_A_PWM1 (pin 4) on the ST Zio connector (CN10).
	OFF, ON	PE9 is used as COMP2_INP (pin 15) on the ST Zio connector (CN9).
SB37 (PF12) and SB38 (PF4)	OFF, ON	ADC_IN is connected to A6 (pin 7) on the 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 the 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 the ST Zio connector (CN10). PF14 must not be used as ADC_IN. SB50 must be OFF.
SB5	**OFF**	NUCLEO-H723ZG, NUCLEO-H743ZI2, and NUCLEO-H753ZI support 1V8 and 3V3 for VDD_MCU. Thus, the level shifter (U10) 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.
SB81	**ON**	USART_RX connected to ST morpho (CN11)
	OFF	USART_RX not connected to ST morpho (CN11)
SB82	**ON**	USART_TX connected to ST morpho (CN12)
	OFF	USART_TX not connected to ST morpho (CN12)

1. The 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 supported target STM32H7.

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

7 Board connectors

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

7.1 STLINK-V3E USB Micro-B connector (CN1)

The USB Micro-B connector (CN1) is used to connect embedded STLINK-V3E to the PC for programming and debugging purposes.

The related pinout for the USB STLINK-V3E connector is listed in *Table 15*.

Table 15. USB Micro-B connector (CN1) 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)

A USB OTG full-speed communication link is available at the USB Micro-AB receptacle connector (CN13). Micro-AB receptacle enables USB Host and USB Device features.

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

Table 16. USB OTG_FS Micro-AB connector (CN13) 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 PHY (U15) and integrated RJ45 connector (CN14). The Ethernet PHY is connected to the MCU via the RMII interface.

The X4 oscillator generates the 25 MHz clock for the PHY. 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 15. Ethernet RJ45 connector (CN14) front view
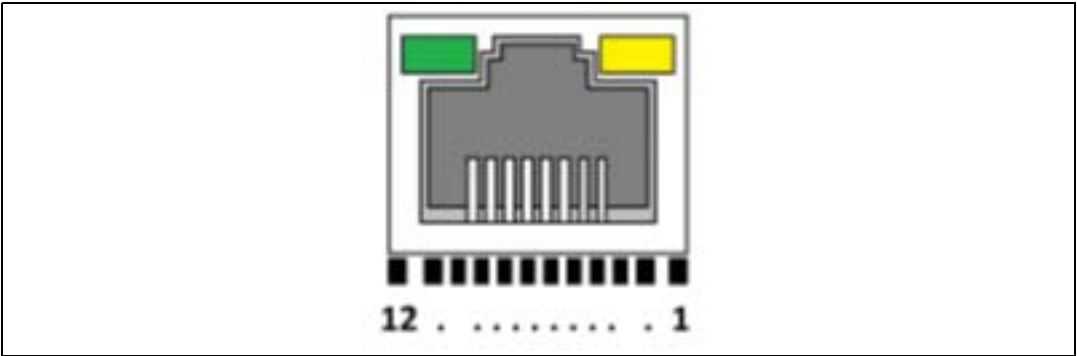
1. Green LED: Ethernet traffic
2. Amber LED: Ethernet connection

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

Table 17. Ethernet RJ45 connector (CN14) 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 all STM32H7 Nucleo-144 boards, *Figure 16* shows the signals connected by default to the ST Zio connectors (CN7, CN8, CN9, and CN10), including the support of ARDUINO® Uno V3.

Figure 16. NUCLEOH7 Nucleo-144 board

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

To cope with ARDUINO® Uno V3, apply the following modifications:

- SB55 and SB62 must be ON
- SB53/60/65 must be OFF to connect I²C on A4 (pin 9) and A5 (pin 11 of CN9).
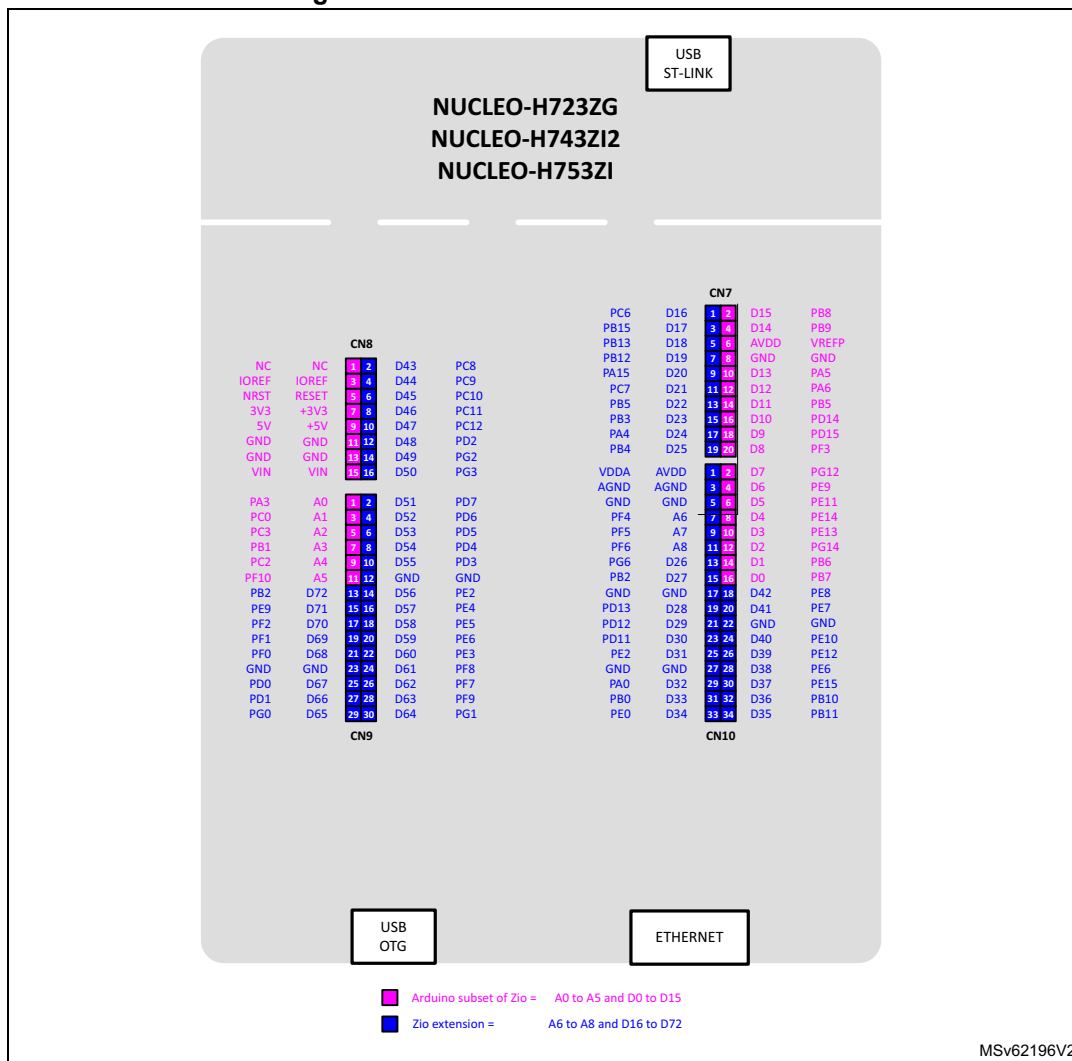
Caution:1   The I/Os of the STM32H7 series microcontroller are 3.3 V compatible instead of 5 V for ARDUINO® Uno V3.

Caution:2   R37 must be OFF before implementing the ARDUINO® shield with V_{REF+} power provided on CN7 pin 6. Refer to *Table 14: Solder bridge and jumper configuration* for details on R37.

NUCLEO-H723ZG, NUCLEO-H743ZI2, and NUCLEO-H753ZI pin assignments

Table 18. ZIO connector (CN7) 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 Ethernet PHY as RMII_CRS_DV. In this case, only one function of the Ethernet or D11 must be used.

Table 19. ZIO connector (CN8) 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 reference	4	D44	SDMMC_D1 I2S_A_CKIN	PC9	SDMMC I2S_CKIN
5	NRST	NRST	NRST	RESET	6	D45	SDMMC_D2	PC10	SDMMC

Table 19. ZIO connector (CN8) 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. ZIO connector (CN9) 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	PE9	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. ZIO connector (CN9) 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. ZIO connector (CN10) 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 of two male pin header footprints (CN11 and CN12, both soldered by default). They are used to connect the STM32H7 Nucleo-144 board to an extension board or a prototype/wrapping board placed on the top of the STM32H7 Nucleo-144 board. All signals and power pins of the STM32H7 are available on the ST morpho connector. An oscilloscope, logical analyzer, or voltmeter can also probe this connector.

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

Table 22. Pin assignment of the ST morpho connector

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
53	PF0	54	PF8	53	PE15	54	GND

Table 22. Pin assignment of the ST morpho connector (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
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. The default state of BOOT0 is 0. It can be set to 1 when a jumper is plugged into CN11 [5-7].

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-V3E. ST does not recommend using them as I/O pins.

9   Nucleo-144 boards (MB1364) information

9.1   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.

"E" or *"ES"* 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.

9.2 Nucleo-144 boards (MB1364) product history

Table 23. Product history

Order code	Product identification	Product details	Product change description	Product limitations
NUCLEO-H743ZI2	NUH743ZI$AT1	MCU: – STM32H743ZIT6 revision 'V' MCU errata sheet: – *STM32H742xI/G and STM32H743xI/G device limitations (ES0392)* Board: – MB1364-H743ZI-C01 (main board)	Initial revision	The IDD measurement of the STM32H7x3 MCU cannot be performed in Standby mode because of ETH PHY (U15) and the pull-up resistors (R40, R43, R46, R47, and R48) supplied by VDD_MCU.
	NUH743ZI$AT2	MCU: – STM32H743ZIT6 revision 'V' MCU errata sheet: – *STM32H742xI/G and STM32H743xI/G device limitations (ES0392)* Board: – MB1364-H743ZI-E01 (main board)	The IDD measurement of the STM32H7x3 MCU can be measured in Standby mode. The ETH PHY is powered by VDD and is separated from VDD_MCU. The silkscreen is corrected on the morpho connectors.	No limitation
NUCLEO-H753ZI	NUH753ZI$AT1	MCU: – STM32H753ZIT6 revision 'V' MCU errata sheet: – *STM32H750xB and STM32H753xI device limitations (ES0396)* Board: – MB1364-H753ZI-C01 (main board)	Initial revision	The IDD measurement of the STM32H7x3 MCU cannot be performed in Standby mode because of ETH PHY (U15) and the pull-up resistors (R40, R43, R46, R47, and R48) supplied by VDD_MCU.
	NUH753ZI$AT2	MCU: – STM32H753ZIT6 revision 'V' MCU errata sheet: – *STM32H750xB and STM32H753xI device limitations (ES0396)* Board: – MB1364-H753ZI-E01 (main board)	The IDD measurement of the STM32H7x3 MCU can be measured in Standby mode. The ETH PHY is powered by VDD and is separated from VDD_MCU. The silkscreen is corrected on the morpho connectors.	No limitation

Table 23. Product history (continued)

Order code	Product identification	Product details	Product change description	Product limitations
NUCLEO-H723ZG	NUH723ZG$AT1	MCU: – STM32H723ZGT6 revision 'Z' MCU errata sheet: – *STM32H72xx/73xx device errata (ES0491)* Board: – MB1364-H723ZG-E01 (main board)	Initial revision	No limitation
	NUH723ZG$AT2	MCU: – STM32H723ZGT6 revision 'Z' MCU errata sheet: – *STM32H72xx/73xx device errata (ES0491)* Board: – MB1364-H723ZG-E01 (main board)	Packaging: Plastic blister replaced by a carton box	No limitation

9.3 Board revision history

Table 24. Board revision history

Board reference	Board variant and revision	Board change description	Board limitations
MB1364 (main board)	MB1364-H743ZI-C01 MB1364-H753ZI-C01	Initial revision	The IDD measurement of the STM32H7x3 MCU cannot be performed in Standby mode because of ETH PHY (U15) and the pull-up resistors (R40, R43, R46, R47, and R48) supplied by VDD_MCU.
	MB1364-H743ZI-E01 MB1364-H753ZI-E01 MB1364-H723ZG-E01	The IDD measurement of the STM32H7x3 MCU can be measured in Standby mode. The ETH PHY is powered by VDD and is separated from VDD_MCU. The silkscreen has been corrected on the morpho connectors.	No limitation

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

10.1   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 instructions, 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 the interference by one or more of the following measures:

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

Note: *Use only shielded cables.*

Responsible party (in the USA)

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10.2   ISED Compliance Statement

Compliance Statement

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

Déclaration de conformité

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

Revision history

Table 25. Document revision history

Date	Revision	Changes
14-Mar-2019	1	Initial version
11-Jun-2020	2	Added: – NUCLEO-H723ZG board – *Section 9* with *Board revision history* and *Known limitations* Updated: – *Section 6.3* switch to STLINK-V3E – *Figure 1* to *Figure 5*, and *Figure 9* to *Figure 14*
16-Jun-2023	3	Updated: – *Table 14* with SB16, SB17, SB81, and SB82 added configurations – *Table 20* with pin 15 corrected connection – *Nucleo-144 boards (MB1364) information* Removed: – Direct firmware update in *Embedded STLINK-V3E* features – Former *Figure 15* and *Figure 16* USB connectors Removed the references to Arm® Mbed™.
12-Oct-2023	4	Added NUH723ZG\$AT2 product identification to *Table 23*.

IMPORTANT NOTICE – READ CAREFULLY