STM32H7P5II Nucleo-144 board (MB2233)

Introduction

The NUCLEO-H7P5II Nucleo-144 board board based on the MB2233 reference board (order code NUCLEO-H7P5II) provides 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 STM32H7Pxxx microcontroller.

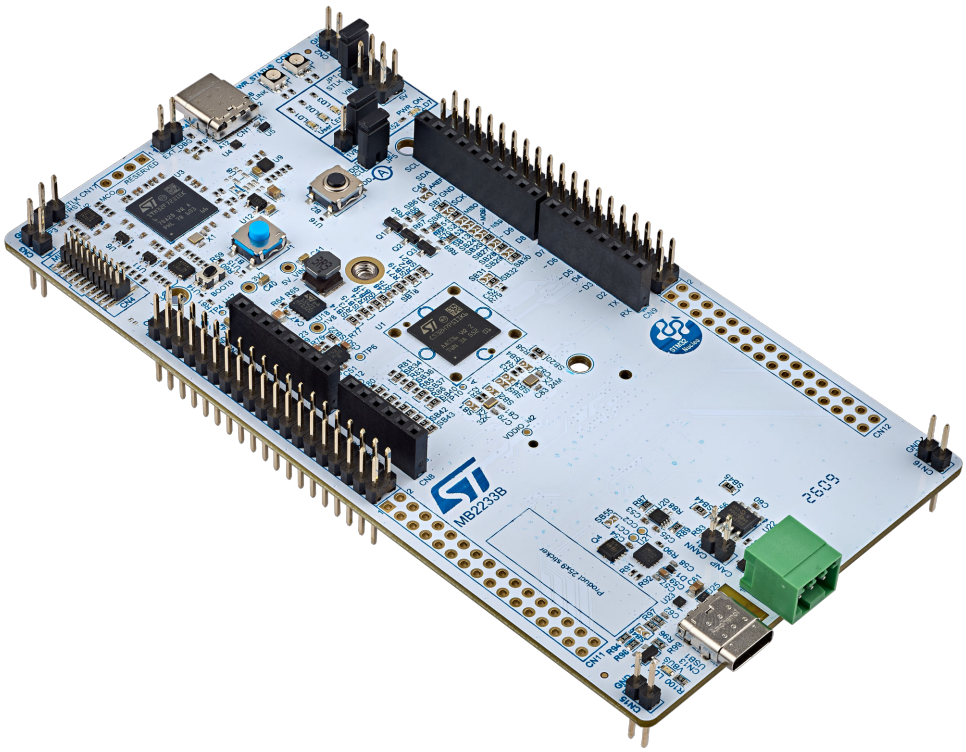
The NUCLEO-H7P5II Nucleo-144 board offers an easy means to expand the functionality of the Nucleo open development platform with a wide choice of specialized shields through several expansion connectors:

- ARDUINO® Uno V3 connector
- ST morpho headers providing access to the MCU I/O pins

The NUCLEO-H7P5II board does not require any separate probes as it integrates the STLINK-V3EC debugger/programmer.

The NUCLEO-H7P5II Nucleo-144 board board comes with the comprehensive free STM32 software libraries and examples available with the STM32CubeH7 MCU Package.

Figure 1. NUCLEO-H7P5II global view



Picture is not contractual.

1 Features

- STM32H7P5IIK6 microcontroller based on the Arm® Cortex®-M7 processor, featuring 2 Mbytes of dual bank flash memory and 736 Kbytes of SRAM, including TCM memories, in a UFBGA201 package
- Internal LDO to generate V_{core} logic supply
- USB Type-C® UFP sink device FS
- Three user LEDs
- Reset, user, and boot mode push-buttons
- 24 MHz HSE crystal oscillator
- 32.768 kHz LSE crystal oscillator
- Board connectors:
  - USB Type-C® connector
  - FDCAN connector
  - ARDUINO® Uno V3 connector
  - ST morpho extension pin headers for full access to most of the STM32 I/Os
  - M.2 Key A serial memory connector
- Flexible power-supply options: ST-LINK USB V_{BUS}, USB connector, or external sources
- Onboard STLINK-V3EC debugger/programmer with USB re-enumeration capability: mass storage, Virtual COM port, and debug port
- Comprehensive free software libraries and examples available with the STM32CubeH7 MCU Package
- Support of a wide choice of Integrated Development Environments (IDEs) including IAR Embedded Workbench®, MDK-ARM, and STM32CubeIDE

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2 Ordering information

To order the NUCLEO-H7P5II Nucleo-144 board, refer to Table 1. Additional information is available from the datasheet and reference manual of the target STM32.

Table 1. Ordering information

Order code	Board references	Target STM32
NUCLEO-H7P5II	MB2233(1)	STM32H7P5II

1. *Subsequently named main board in the rest of the documentation.*

2.1 Codification

The meaning of the codification is explained in Table 2.

Table 2. Codification explanation

NUCLEO-XXYYWT	Description	Example: NUCLEO-H7P5II
XX	MCU series in STM32 32-bit Arm Cortex MCUs	STM32H7 series
YY	MCU product line in the series	STM32H7P4/P5
W	STM32 package pin count: • I for 201 pins	201 pins
T	STM32 flash memory size: • I for 2 Mbytes	2 Mbytes

In this document, for any information that is common to all sale types, the references are noted as the STM32H7P5 Nucleo-144 board.

3 Development environment

3.1 System requirements

- Multi-OS support: Windows® 10 or 11, Linux® 64-bit, or macOS®
- USB Type-A or USB Type-C® to USB Type-C® cable

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

Linux® is a registered trademark of Linus Torvalds.

Windows is a trademark of the Microsoft group of companies.

3.2 Development toolchains

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

1. *On Windows® only.*

3.3 Demonstration software

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

3.4 EDA resources

All board design resources, including schematics, EDA databases, manufacturing files, and the bill of materials, are available from the NUCLEO-H7P5II product page at *www.st.com*.

4 Conventions

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

Table 3. ON/OFF convention

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

5 Safety recommendations

5.1 Targeted audience

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

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

5.2 Handling the board

This product contains a bare printed circuit board and like all products of this type, the user must be careful about the following points:

- The connection pins on the board might be sharp. Be careful when handling the board to avoid injury.
- This board contains static sensitive devices. To avoid damaging it, handle the board in an ESD-proof environment.
- While powered, do not touch the electric connections on the board with your fingers or anything conductive. The board operates at a voltage level that is not dangerous, but components might be damaged when shorted.
- Do not put any liquid on the board and avoid operating it close to water or at a high humidity level.
- Do not operate the board if it is dirty or dusty.
- The pins of the board are exposed and must not come into contact with a metal surface, as this can produce a short circuit and damage the board.

5.3 Delivery recommendations

Before the first use, inspect the board for any damage that may have occurred during shipment. Ensure that all socketed components are securely fixed in their sockets and that nothing is loose in the plastic bag.

5.4 Power supply

This equipment must be powered by a power supply unit or auxiliary equipment that complies with EN 62368-1:2014+A11:2017, or a replacement standard, and that provides safety extra-low voltage (SELV/ES1) with limited power capability (LPS/PS2).

6 Quick start

The NUCLEO-H7P5II board is a low-cost and easy-to-use development kit, to evaluate quickly and start development with an STM32H7P5IIK6 microcontroller in a UFBGA201 package.

Before installing and using the product, accept the evaluation product license agreement from the *www.st.com/epla* webpage. For more information on the NUCLEO-H7P5II board and demonstration software, visit the *www.st.com/stm32nucleo* webpage.

6.1 Getting started

Follow the sequence below to configure the NUCLEO-H7P5II board and launch the demonstration application (refer to Figure 4 for component locations):

1. Check the jumper position on the board (refer to Section 6.2 for the default board configuration).
2. To identify the device interfaces from the host PC, before connecting the board, install the STLINK-V3EC USB driver available on the *www.st.com* website.
3. Connect the NUCLEO-H7P5II board to a PC with a USB cable (USB Type-A or USB Type-C® to USB Type-C®) through the USB connector (CN1) to power the board.
4. The 5V_PWR (LD7), COM (LD4), and PWR status (LD6) LEDs light up and the three user LEDs (green LD1, red LD2, and blue LD3) are blinking.
5. Each press of the blue user button (B1) modifies the blinking of the LD1, LD2, and LD3 LEDs.
6. Download the demonstration software and several software examples to use the STM32 Nucleo features, available from the *st.com* website.
7. Develop a custom application using the available examples.

6.2 Default board configuration

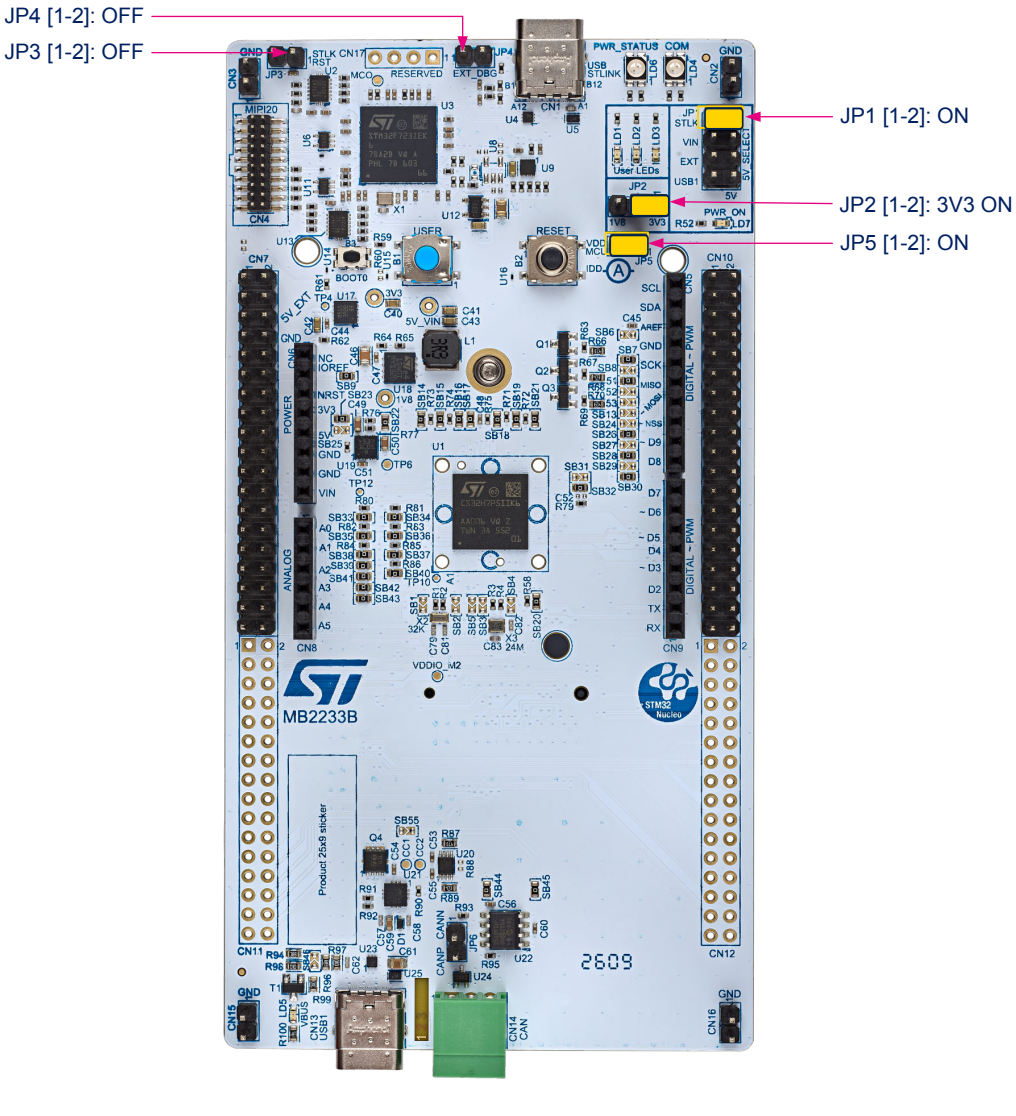
The jumper configurations and voltage settings are shown in Table 4, with the default configuration highlighted in bold.

Table 4. Jumper configuration

Jumper	Definition	Configuration(1)	Comments(1)
JP1	5 V power selection	**ON [1-2]**	**5 V source from STLINK-V3EC**
		ON [3-4]	5 V source from ARDUINO® VIN 7-12 V
		ON [5-6]	5 V source from 5V_EXT (ST morpho)
		ON [7-8]	5 V source from USB Type-C®
		OFF	No 5 V power source; configuration when external 3V3 is used
JP2	3V3 or 1V8 MCU voltage selection	**ON [1-2]**	**3.3 V voltage on MCU**
		ON [3-4]	1.8 V voltage on MCU
JP3	STLK_RST	ON [1-2]	Used to keep the STLINK-V3EC MCU in reset state when an external debug probe is used.
		OFF	**Normal mode: uses STLINK-V3EC debug probe**
JP4	EXT_DBG	ON [1-2]	Use to configure the DEBUG bus level shifter in HiZ when an external debug probe is used
		OFF	**Normal mode: uses STLINK-V3EC debug probe**
JP5	IDD measurement	**ON [1-2]**	**VDD_MCU is applied. The voltage depends on the JP2 configuration (1.8 V or 3.3 V)**
		OFF	Use ammeter to measure VDD_MCU power consumption, or an external 3V3 source can be connected to pin 2 (STLINK-PWR tools with STM32CubeMonitor-Power or ULPBench probe as an example).

1. *The default configuration is shown in bold.*

Figure 2. Default board configuration



7 Hardware layout and configuration

The NUCLEO-H7P5II board is designed around the STM32H7P5II microcontroller in an UFBGA201 package.

Figure 3 shows the connections between the MCU and its peripherals. Figure 4 and Figure 5 show the location of these features on the NUCLEO-H7P5II board.

The mechanical dimensions of the board are shown in Figure 6.

7.1 Hardware layout

Figure 3. NUCLEO-H7P5II block diagram

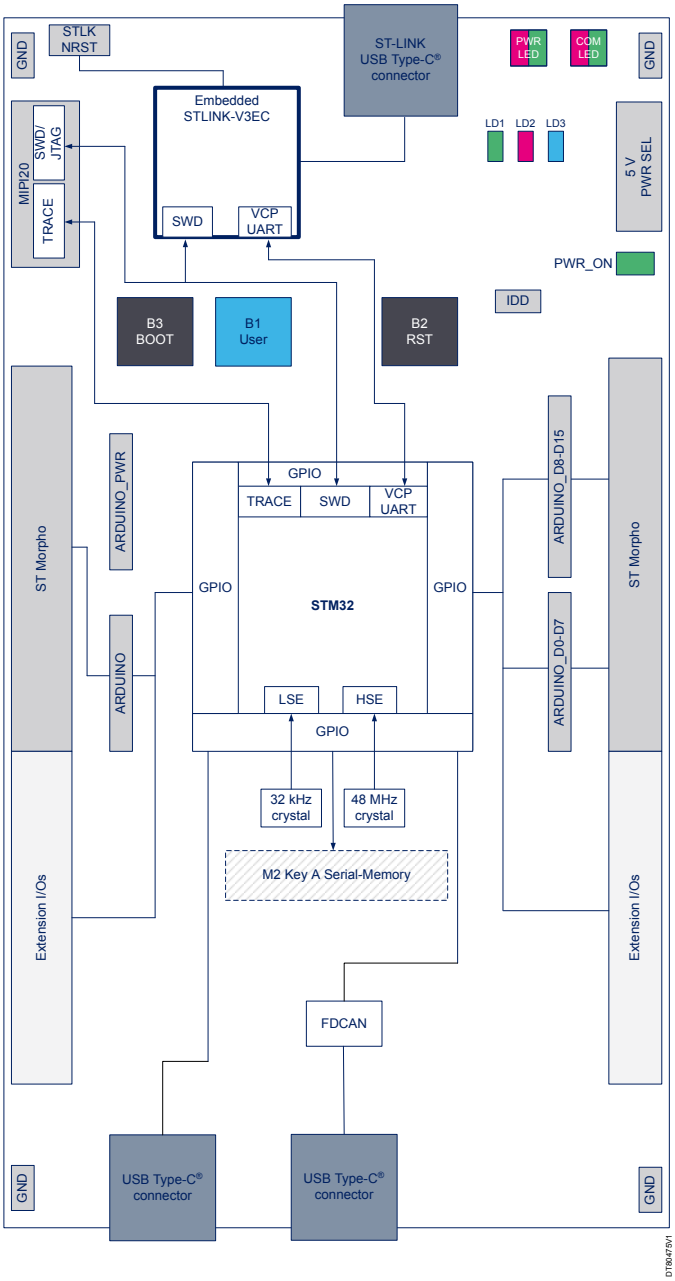


Figure 4. NUCLEO-H7P5II top layout

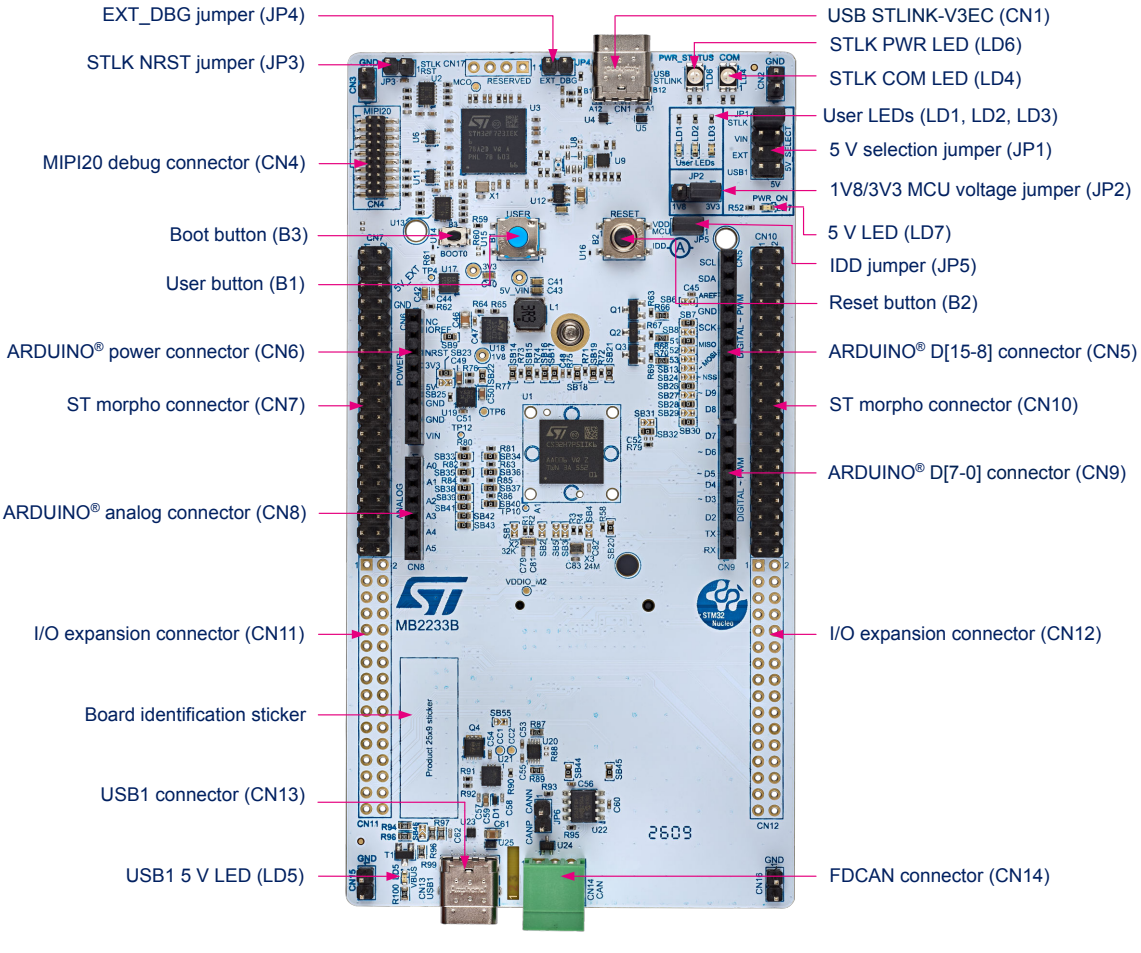
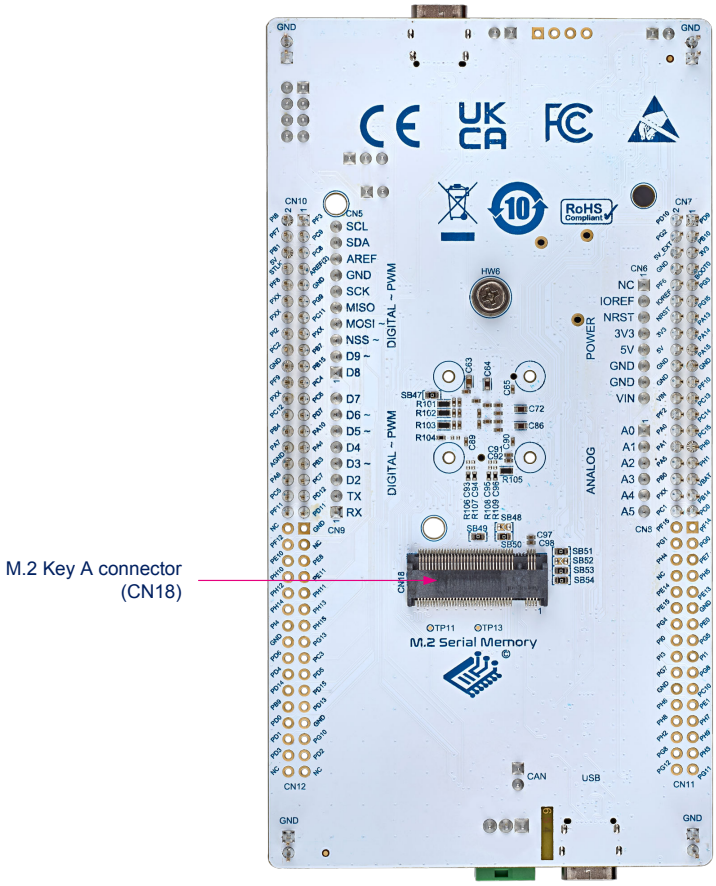
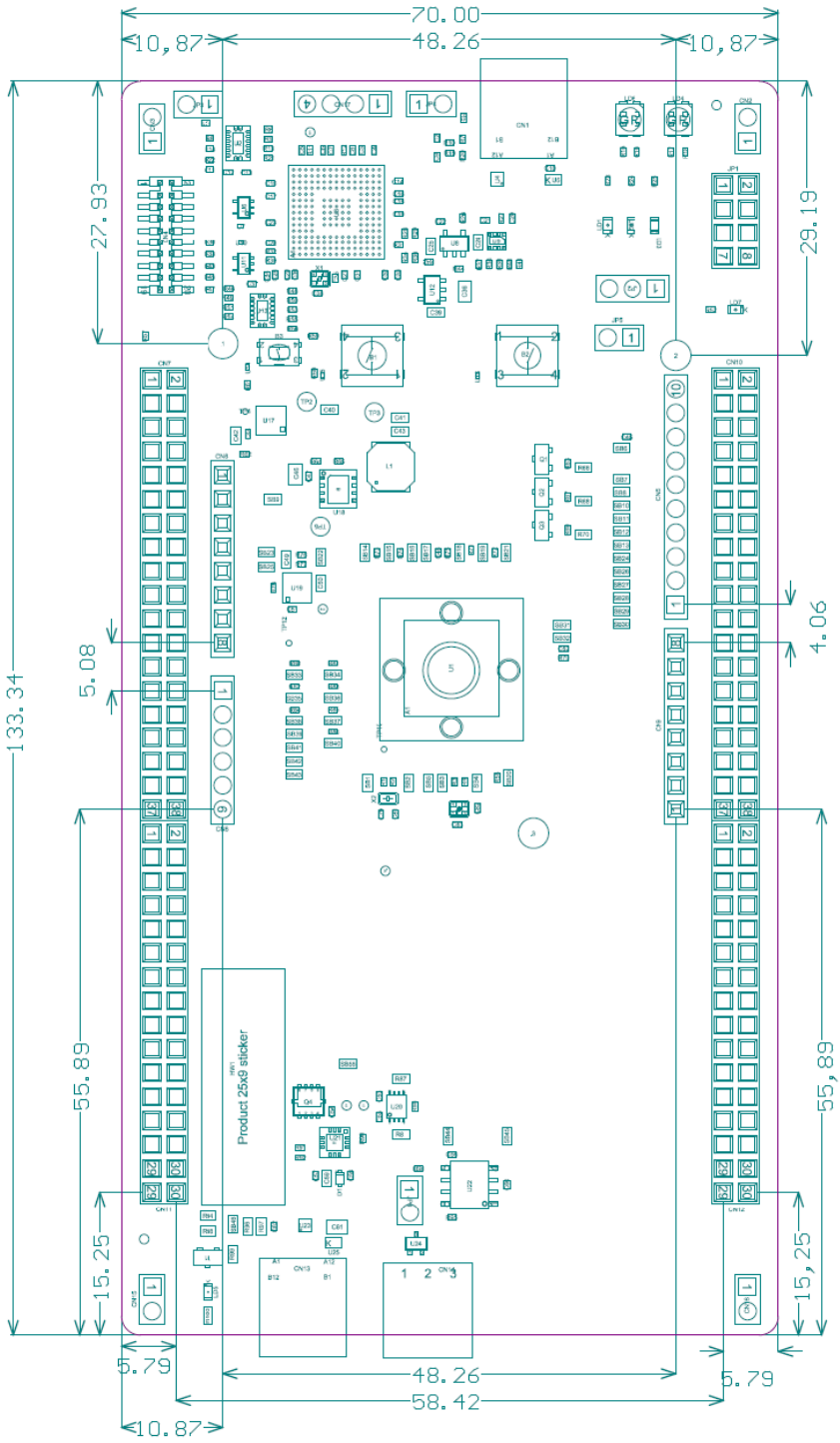


Figure 5. **NUCLEO-H7P5II bottom layout**



7.2 Mechanical dimensions

Figure 6. **NUCLEO-H7P5II mechanical drawing (in millimeters)**



7.3 Embedded STLINK-V3EC

STLINK-V3EC is the embedded version of the STLINK-V3 included in the design of the NUCLEO-H7P5II board. It allows access to the programming, debugging, and monitoring functions of the STM32 microcontroller through the USB STLK connector (CN1).

The following sections describe the implementation of STLINK-V3EC on this STM32H7P5 Nucleo-144 board.

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

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

7.3.1 Description

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

- Using the embedded STLINK-V3EC
- Using an external debug tool connected to the CN4 MIPI20 connector (SWD/JTAG/TRACE)

Refer to Table 4 to set JP3 correctly to switch between STLINK-V3EC and external debug probe.

The STLINK-V3EC facility for debugging and flashing is integrated into the NUCLEO-H7P5II board.

STLINK-V3EC supports the following features:

- 5 V/3 A power supplied by the USB Type-C® connector (CN1)
- USB 2.0 high-speed-compatible interface
- JTAG and Serial Wire Debug (SWD) with Serial Wire Viewer (SWV)
- Virtual COM port (VCP)
- COM status LED, which blinks during communication with the PC
- Power status LED, which gives information about STLINK-V3EC target power
- USB Type-C® overvoltage protection (U8) with current limitation

Two tricolor LEDs, green, orange, and red, provide information about the STLINK-V3EC communication status (LD4) and STLINK-V3EC power status (LD6).

7.3.2 Drivers

The installation of drivers is not mandatory from Windows 10® but allocates an ST-specific name to the STLINK-V3EC COM port in the system device manager.

7.3.3 STLINK-V3EC firmware upgrade

STLINK-V3EC embeds a firmware upgrade (STSW-LINK007) mechanism for in-place upgrades through the USB port. The firmware might evolve during the lifetime of the STLINK-V3EC product (for example, the addition of new functionalities, bug fixes, or support for new microcontroller families). It is recommended to visit the *st.com* website before using the NUCLEO-H7P5II board and to stay up-to-date with the latest firmware version.

7.3.4 Using an external tool to program and debug the onboard STM32 MCU

Before connecting an external debug tool to the MIPI20 debug connector (CN4), fit the jumper on JP3 and JP4 to disable the ST-LINK MCU (U2) and isolate the SWD and VCP signals from STLINK-V3EC. Refer to Table 4 for further details on the configuration of JP3 and JP4.

Once the jumpers are fitted on JP3 and JP4, an external debug tool can be connected to the MIPI20 debug connector (CN4).

When the external debug connector (CN4) is used with the STLINK-V3EC in Reset mode, the NUCLEO-H7P5II Nucleo-144 board board cannot be supplied through the USB ST-LINK connector (CN1). Select another power supply source through JP4, as described in Section 7.4.

Figure 7. Connecting an external tool to program and debug the onboard STM32H7P5II MCU

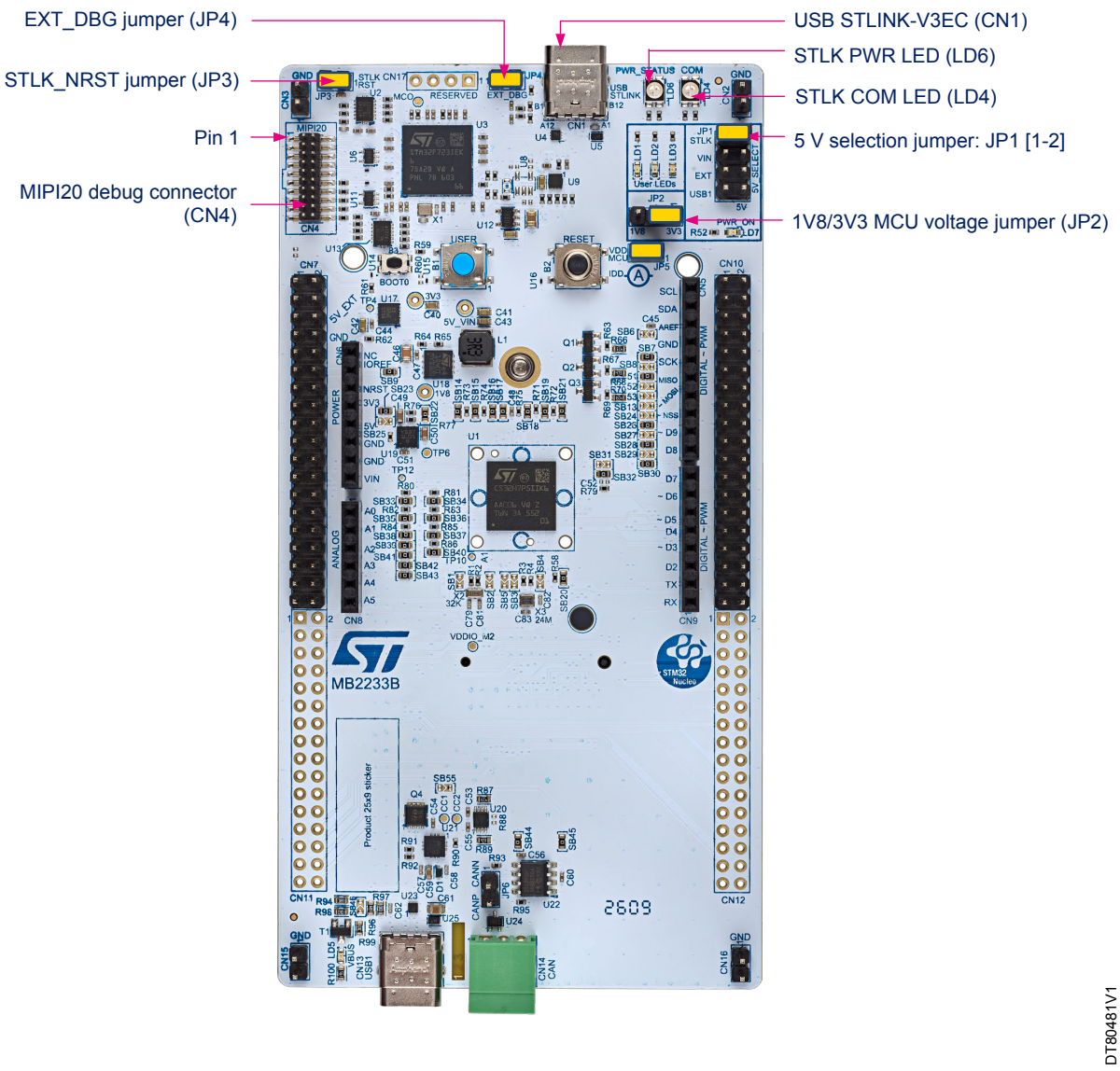


Table 5. MIPI20 debug connector pinout

MIPI20 pin	CN4	Designation
1	VTref	Target reference voltage (fed from 3V3)
2	SWDIO/JTMS	Target SWDIO using SWD protocol or target JTMS using JTAG protocol
3	GND	Ground
4	SWCLK/JTCK	Target SWCLK using SWD protocol or target JTCK using JTAG protocol
5	GND	Ground
6	SWO/JTDO	Target SWO using SWD protocol or target JTDO using JTAG protocol
7	KEY	Not connected
8	JTDI	Not used by SWD protocol, target JTDI using JTAG protocol
9	GND	Ground
10	NRST	Target NRST

MIPI20 pin	CN4	Designation
11	TgtPwr	5 V target power to the target MCU–Not used, to be disconnected (R50 OFF)
12	TRACECLK	Trace CLK
13	TgtPwr	5 V target power to the target MCU–Not used, to be disconnected (R50 OFF)
14	TRACED0	Trace Data0
15	GND	Ground
16	TRACED1	Trace Data1
17	GND	Ground
18	TRACED2	Trace Data2
19	GND	Ground
20	TRACED3	Trace Data3

7.4 Power supply and power selection

7.4.1 External power supply input

Five different sources can provide the power supply to the NUCLEO-H7P5II Nucleo-144 board:

- STLK: A host PC or a wall charger connected to the CN1 connector through a USB cable (default configuration).
- VIN/5V_VIN: An external 7 V to 12 V power supply connected to VIN connector (CN6, pin 8, or CN7, pin 24).
- EXT: An external 5 V connected to CN7, pin6, connector.
- USB1: A host PC connected to the USB Type-C® connector (CN13) through a USB cable.
- VDD/VDD_MCU: An external 1.8 V or 3.3 V power supply connected to VDD connector (JP2, pin 2).

In case VIN, EXT, or external VDD is used to power the NUCLEO-H7P5II 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 of an 1.8 V or 3.3 V external power supply, STLINK-V3EC is not powered and cannot be used.

In case the power supply is a wall charger on CN1, debugging through STLINK-V3EC is not possible. External debug tools should be used on CN4 (MIPI20 connector)

The power supply capabilities are summarized in Table 6.

Note: To power correctly the NUCLEO-H7P5II Nucleo-144 board and the associated shield, it is recommended to have a source supporting up to 5 V and 2 A, or 3.3 V and 1.5 A for the 3.3 V use case, or 1.8 V and 1.5 A for the 1.8 V use case.

Table 6. Power source capabilities

Input power name	Connector pins	Voltage range	Recommended current	Limitation
STLK	CN1 USB connector JP1 [1-2]	4.75 V to 5.25 V	2 A	Maximum current depending on the presence or absence of USB enumeration, and the USB power source used to power the board.
VIN/5V_VIN	CN6 pin 8 CN7 pin 24 JP1 [3-4]	7 V to 12 V	2 A	From 7 V to 12 V depending on the shield used.
EXT	CN7 pin 6 JP1 [5-6]	4.75 V to 5.25 V	2 A	Maximum current depending on the power source.
USB1	CN13 USB connector JP1 [7-8]	4.75 V to 5.25 V	2 A	Maximum current depending on the USB Host used to power the board.
VDD/ VDD_MCU	JP2 pin 2/ JP5 pin 2	1.8 V or 3.3 V	1.5 A	The maximum current depends on the source voltage. With external VDD/VDD_MCU voltage, STLINK-V3EC is not powered and cannot be used.

STLK

STLK is the 5 V DC power source coming from the STLINK-V3EC USB connector (CN1) to power the STM32H7P5 Nucleo-144 board and its shield. To select this power source, JP1 must be set on [1-2] (STLK) (refer to Figure 8). **This is the default configuration**.

If the USB enumeration succeeds, the STLINK power is enabled by asserting the T_PWR_EN signal from STLINK-V3EC. This pin is connected to a power switch (U8), which powers the board. This power switch also features a current limitation to protect the PC in case of an onboard short circuit. If an overcurrent (more than 3.2 A) occurs, the PWR_STATUS LED (LD6) lights up in red.

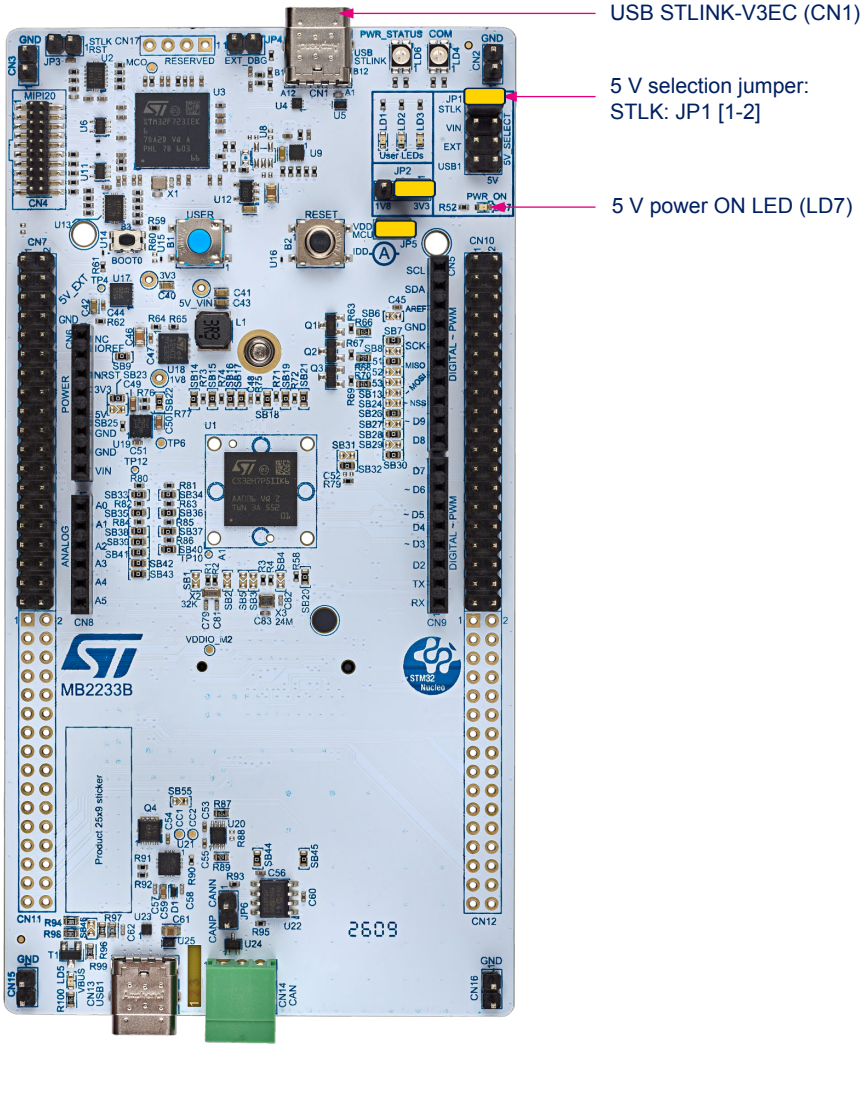
If the host can provide the required power, the power switch and the PWR_ON green LED (LD7) are turned on. The maximum current the board and its shield can consume is 3 A.

If the host is unable to provide the requested current, the enumeration fails.

Therefore, the power switch (U9) remains OFF and the MCU part, including the extension board, is not powered. Consequently, the PWR_ON green LED (LD7) remains turned OFF. In this case, it is mandatory to use an external power supply.

Warning: *If the maximum current consumption of the STM32H7P5 Nucleo-144 board and its shield exceeds 3.2 A, it is mandatory to power the STM32H7P5 Nucleo-144 using an external power supply connected to EXT, or VIN.*

Figure 8. JP1 [1-2]: 5 V from STLK power source

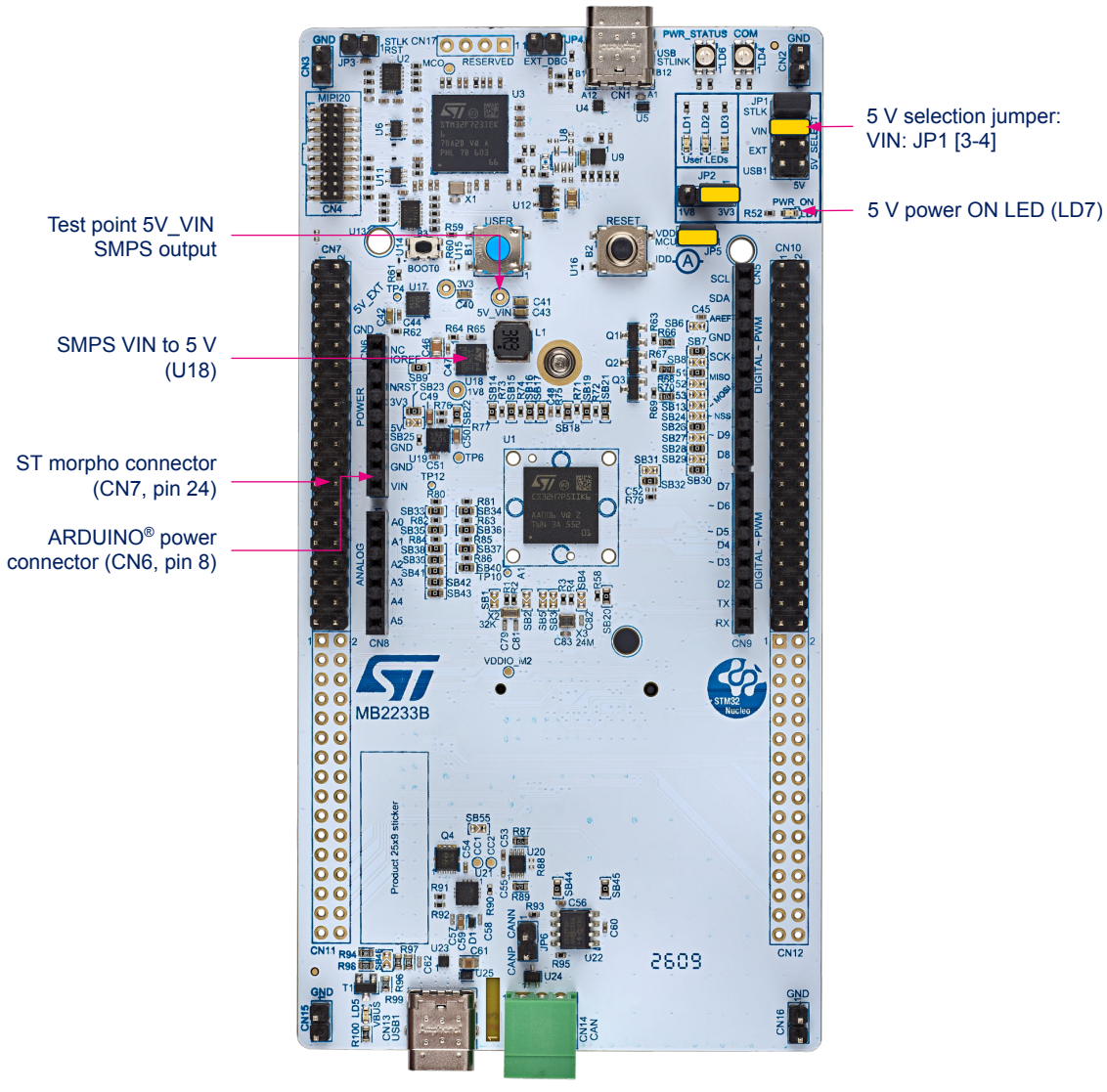


This power supply input can also be used with a USB charger. In this case, the embedded ST-LINK cannot be used for debugging. Refer to Section 7.3.4 for further details.

VIN

VIN is the 7 V to 12 V DC power from the ARDUINO® connector (CN6) pin 8, named VIN, on the connector silkscreen or from the ST morpho connector CN7 pin 24. In this case, the JP1 jumper must be on pin [3-4]. An onboard step-down converter (U18) with a 5 V/2 A rating is used to provide a fixed 5 V from VIN (7-12 V).

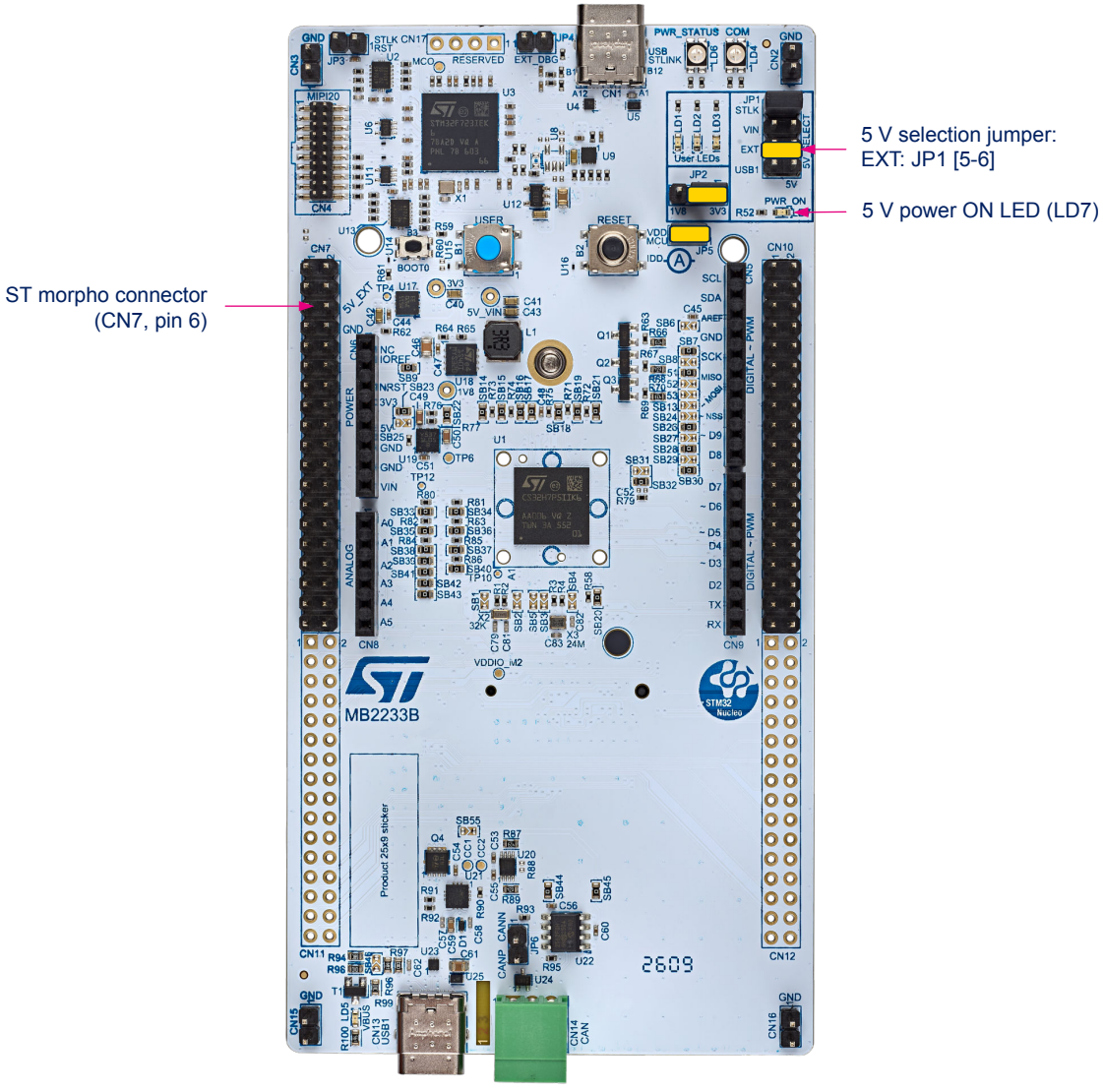
Figure 9. JP1 [3-4]: 5 V from VIN power source



EXT

EXT is the DC power coming from an external 5 V DC power source connected to the ST morpho connector (CN7, pin 6). The 5 V jumper selection (JP1) must be on pin [5-6].

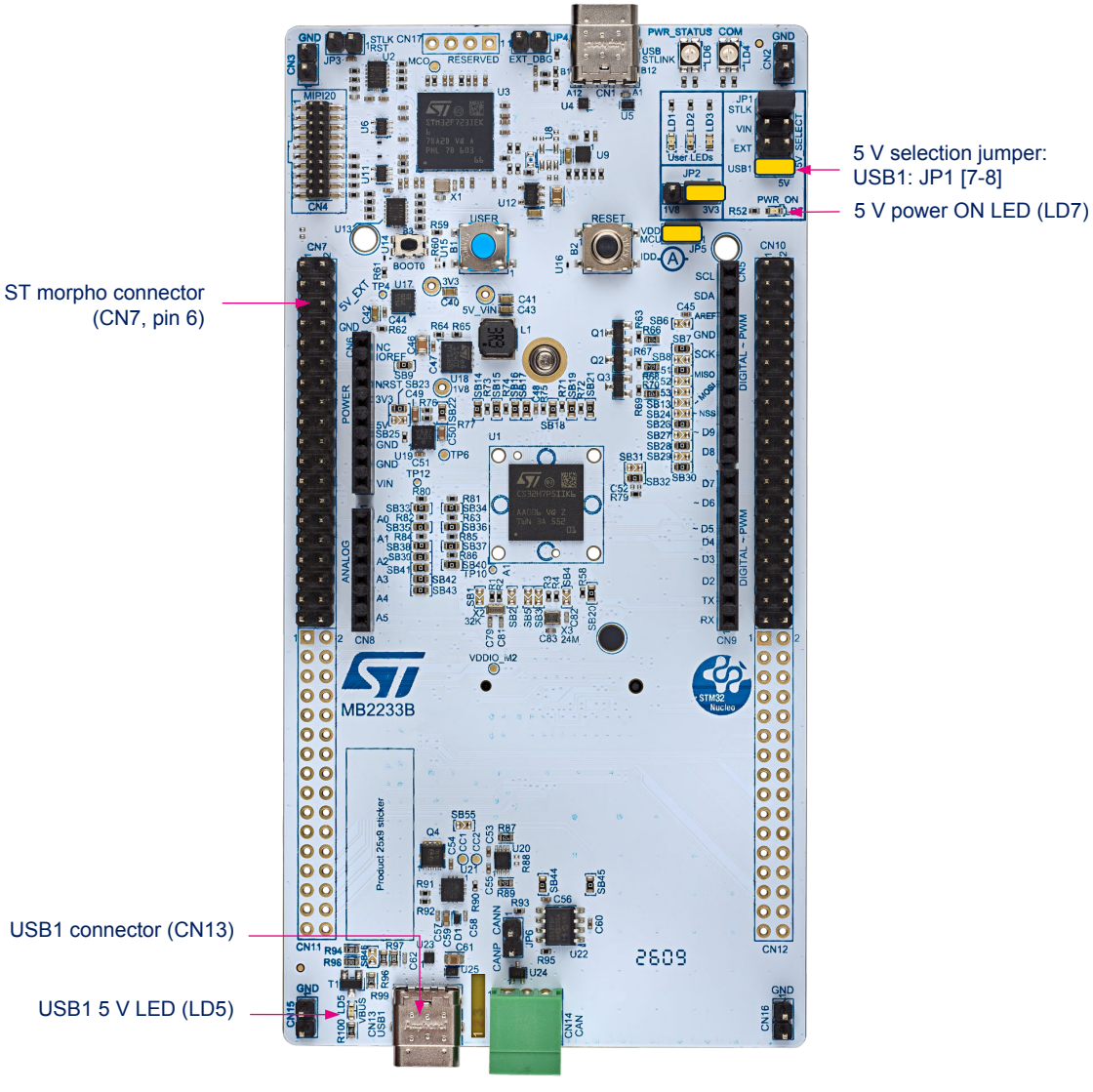
Figure 10. JP1 [5-6]: 5 V from EXT power source



USB1

USB1 is the DC power supply coming from the user USB Type-C® connector (CN13). To select this power source, the JP1 jumper must be on pin [7-8].

Figure 11. JP1 [7-8]: 5 V from USB1 power source



External VDD power supply input

In some situations, it is interesting to use an external power source connected to VDD (JP2, pin 2). In this case, the STLINK-V3EC is not powered and programming, debugging, and some features are unavailable.

The STM32H7P5II device is compatible with 1.8 V or 3.3 V. Therefore, the external voltage on VDD can be 1.8 V or 3.3 V.

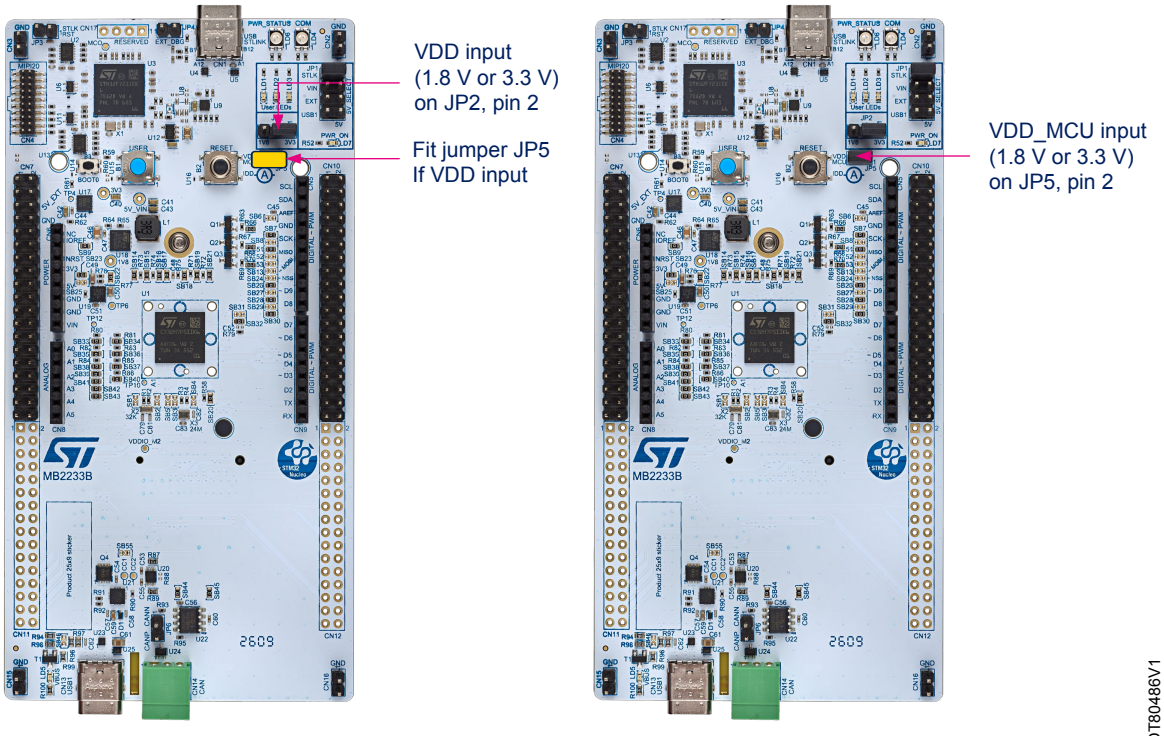
To apply an external voltage to the VDD power supply (JP2, pin 2), keep the jumper on JP5 to supply the STM32H7P5II target. In this case, STLINK-V3EC, LEDs, and other peripherals are not supplied.

External VDD_MCU power supply input

Apply voltage to VDD_MCU only (JP5, pin 2) to power only the STM32. In this case, STLINK-V3EC and the other peripherals are not supplied. This option can be used to optimize microcontroller (MCU) power consumption measurement.

The STM32H7P5II device is compatible with 1.8 V or 3.3 V. Therefore, the external voltage on VDD_MCU can be 1.8 V or 3.3 V.

Figure 12. VDD and VDD_MCU source only



7.4.2 Programming/debugging when the power supply is not from STLINK-V3EC (STLK)

When the board is powered by VIN, EXT, or USB1, STLINK-V3EC can still be used for programming or debugging. In this case, power the board first by VIN, EXT, or USB1. Then connect the STLINK-V3EC USB cable from CN1 to the PC. The external power source enables successful enumeration.

Follow this power sequence:

1. Set the JP1 jumper according to the external 5 V power source.
2. Connect the external power source.
3. Power ON the external power supply.
4. Check that the green PWR_ON LED (LD7) is turned ON.
5. Connect the PC to the ST-LINK USB connector (CN1).

If this sequence is not followed, the board may be powered first by V_{BUS} from STLINK-V3EC, which can cause the following issues:

- If the board requires more current than the STLINK-V3EC or PC can supply, the PC may be damaged or limit the current, resulting in incorrect board power.
- If the current requested during enumeration is too high, the PC may reject the request, causing enumeration to fail. Consequently, the board does not power on and the green LED (LD7) remains turned OFF.

7.4.3 Power supply output

5V

Regardless of the power source (STLINK-V3EC, VIN, EXT, or USB1), the 5 V generated is available on CN6 pin 5 or CN7 pin 18. It can be used as an output power supply for an ARDUINO® shield or an extension board. In this case, the maximum current of the power source specified in Table 6 must be respected.

3V3

The internal 3.3 V supply, available on CN6 pin 4 or CN7 pin 16, can also be used as a power output. The current is limited by the maximum capacity of the LDO (3.3 V/2 A, U17), which must support both the Nucleo board and any connected shield consumption.

7.4.4 VDD_MCU: IDD measurement

The labeled IDD jumper (JP5) is used to measure the current consumption of the STM32 MCU by removing the jumper and connecting an ammeter or another current measurement device.

- Jumper ON (by default): the MCU is powered by the internal VDD (3.3 V or 1.8 V).
- Jumper OFF: an ammeter, or external 1.8 V or 3.3 V power source, must be connected to power the MCU and measure its current consumption.

7.5 LEDs

The NUCLEO-H7P5II Nucleo-144 board contains six LEDs:

- Three user LEDs:
  - The green LED (LD1) is connected either to STM32 I/O PB15 (SB8 on and SB7 off, optional configuration) and shared with Arduino® UNO R3 connector D13, or to STM32 I/O PG9 (SB7 on and SB8 off, default configuration) for applications where the green LED is isolated from Arduino® UNO R3 connector D13.
  - The red LED (LD2) is connected to the PF1 STM32 I/O.
  - The blue LED (LD3) is connected to the PF4 STM32 I/O

  A transistor is present for each of these three LEDs. This transistor isolates the green LED on Arduino® UNO R3 connector D13 and supports STM32 I/O operation at 1.8 V or 3.3 V.
  These three user LEDs are off when the STM32 I/O is low and on when the STM32 I/O is high.
- STLINK-V3EC tricolor LEDs (LD4 and LD6): The tricolor (green, orange, and red) LEDs provide information about the STLINK-V3EC communication status (LD4) and power status (LD6).
  For delated information about these LEDs, refer to the technical note *Overview of ST-LINK derivatives* (TN1235).
- USB Type-C® LED (LD5): This green LED (LD5) indicates the V_{BUS} presence on the user USB1 USB Type-C® connector (CN13).
- PWR_ON LED (LD7): This green LED indicates that the NUCLEO-H7P5II Nucleo-144 board is powered by a 5 V source. This source is available on CN6, pin 5, and CN7, pin 18.

7.6 Push-buttons

Three push-buttons are available on the NUCLEO-H7P5II Nucleo-144 board: the user button (B1), the reset button (B2), and the boot mode button (B3).

Blue user button (B1)

The blue user button is connected to the STM32 PC13 I/O pin. This I/O supports the wake-up functionality of the STM32H7 series microcontroller.

A pull-down resistor is present for the tamper function. This resistor can be removed in I/O wake-up mode, by setting the internal I/O pull-up inside the STM32H7P5xx.

When the button is pressed, the logic state is HIGH; otherwise, it is LOW.

Black reset button (B2)

This black push-button is connected to the STM32 NRST pin and is used to reset the STM32H7P5xx device.

When the button is pressed, the logic state is LOW; otherwise, the logic state is HIGH.

The other sources of reset include:

- STLINK-V3EC (CN1)
- ARDUINO® connector (CN6 pin 3)
- ST morpho connector (CN7 pin 14)

Black boot mode button (B3)

This black push-button is connected to the STM32 BOOT0 pin and is used to control the MCU boot mode.

When the user option byte PRODUCT_STATE is 0xED (Open), the two boot areas can be selected through the BOOT0 pin on the NUCLEO-H7P5II Nucleo-144 board board. The boot base address is programmed in the BOOTADD option byte as shown in Table 7.

Table 7. Boot options

Boot pin level(1)	Boot address option bytes(1)	Boot space(1)
0	**BOOTADD[23:0]**	**Boot address is defined by user option byte BOOTADD[23:0] ST programmed value: Flash memory at 0x1800 0000**
1	-	Boot address is ST defined to secure boot within system flash (0x1Cxx xxxx).

1. *The default configuration is in bold.*

The boot button must be pressed during the RESET state of the board to assert the BOOT0 pin level. When the button is pressed the logic state is HIGH, otherwise, the logic state is LOW.

7.7 Oscillator clock sources

7.7.1 Low-speed external (LSE) clock: 32.768 kHz

There are three methods to set up the pins associated with the low-speed external clock (LSE), which are detailed below.

Onboard oscillator X2 crystal (default configuration)

For typical frequencies, capacitors, and resistors, refer to the application note *Guidelines for oscillator design on STM8AF/AL/S and STM32 MCUs/MPUs* (AN2867). The application note provides guidance for oscillator design in STM32H7P5II devices.

For example, the crystal embedded in the STM32H7P5 Nucleo-144 board has the following characteristics: 32.768 kHz, 6 pF load capacitance, 20 ppm.

To use the embedded crystal, the following configuration is needed:

- R1 and R2: ON
- SB1 and SB2: OFF

External oscillator on PC14

The input clock comes from an external oscillator via the PC14 signal on the ST morpho connector (CN7 pin 25). The following configuration is needed:

- SB1: ON
- R1, R2, and SB2 OFF

LSE not used

PC14 and PC15 are used as GPIOs instead of low-speed clocks. They are available on connector CN7, pin 25 and 27. The following configuration is needed:

- SB1 and SB2: ON
- R1 and R2: OFF

7.7.2 High-speed external (HSE) clock

There are four ways to configure the pins corresponding to the high-speed external clock (HSE), which are detailed below.

HSE onboard oscillator from X3 crystal (default configuration

For typical frequencies, capacitors, and resistors, refer to the application note *Guidelines for oscillator design on STM8AF/AL/S and STM32 MCUs/MPUs* (AN2867).

For example, the X3 crystal embedded in the NUCLEO-H7P5II board has the following characteristics: 48 MHz, 6 pF load capacitance, 20 ppm.

To use the embedded crystal, the following configuration is needed:

- R3 and R4: ON
- SB3, SB4, and SB5: OFF

MCO from STLINK-V3EC

The MCO output of the STLINK-V3EC MCU is used as an input clock for the STM32H7P5xx device. The MCO clock frequency cannot be changed. It is fixed at 8 MHz. The MCO is connected to the PH0-OSC_IN pin of the MCU.

The clock frequency can be changed (4.8, 6, or 8 MHz) by using the STLinkUpgrade user interface.

The configuration must be:

- SB5: ON
- R3, R4, SB3, and SB4: OFF

HSE not used

PH0 and PH1 are used as GPIOs instead of clocks. The I/Os are available on connector CN7, pins 29 and 31. The configuration must be:

- SB3 and SB4: ON
- R3, R4, an SB5: OFF

7.8 Virtual COM port (VCP)

An STM32 serial interface is connected to the STLINK-V3EC debug interface.

The communication between the target MCU and the STLINK-V3EC MCU is enabled on USART2 through the MCU I/Os PA2 (USART3_TX) and PA3 (USART2_RX) because this interface supports the BOOTLOADER mode.

7.9 USB Type-C® FS

The NUCLEO-H7P5II board supports USB full speed (FS) communication through the USB Type-C® connector (CN13). It operates exclusively in USB Type-C® Sink mode. When V_{BUS} is powered by a USB Host and the board functions as a USB Device, the green LED (LD5) illuminates.

USB FS Device

With the USB stack inside the microcontroller, when a USB Host connects to the USB Type-C® connector (CN13) on the NUCLEO-H7P5II board, the board operates as a USB Device.

Depending on the power capability of the USB Host, the board can be powered through the CN13 VBUS terminal, referred to as USB1 in the schematic diagrams. The board supports a 5 V USB supply ranging from 4.75 to 5.25 V. On the MCU side, the VDD_USB pin supports only 3.3 V. Refer to Section 7.4 for further information on USB1 power options.

The USB FS data interface connects directly between CN13 and the STM32H7P5xx PA 11 and PA 12 pins.

USB Type-C® Power Delivery (UCPD)

USB Type-C® introduces the USB Type-C® Power Delivery (UCPD) feature. The NUCLEO-H7P5II board supports dead-battery and Sink modes.

In addition to the DP and DM I/Os directly connected to the USB Type-C® connector, five additional I/Os are used for UCPD configuration:

- Configuration channel (UCPD_CC1 and UCPD_CC2)
- VBUS-SENSE
- UCPD dead battery (UCPD_DBn)
- UCPD_FLT (FAULT) feature.

To protect the NUCLEO-H7P5II board from USB overvoltage, a programmable power supply (PPS)-compliant USB Type-C® port protection is used: TCPP01-M12 IEC6100-4-2 level 4-compliant IC:

- **Configuration channel I/O (UCPD_CCx):** connected through the USB port protection IC (TCPP01-M12) to the CCx lines of the USB Type-C® connector. These lines select the USB Type-C® current mode. The board supports Sink current mode only.
- **Dead-battery I/O (UCPD_DBn):** connected to the DBn line of TCPP01-M12, which internally manages dead-battery resistors.
- **VBUS fault detection (UCPD_FLT):** provided by the USB Type-C® port protection IC to report faults to the MCU after detecting abnormal V_{BUS} levels. The NUCLEO-H7P5II board V_{BUS} protection is set to a maximum of 6 V (R91 is 24 kΩ to select this level).

For detailed information on UCPD with the TCPP01-M12 USB Type-C® port protection in Sink applications, refer to the application note *Introduction to USB Type-C® Power Delivery for STM32 MCUs and MPUs* (AN5225).

Table 8 provides the hardware configuration for the USB Type-C® Power Delivery feature.

Table 8. UCPD hardware configuration

Pin name	Function	Description
PA8	UCPD_CC1	Connected to the USB Type-C® port protection and used as UCPD_CC1.
PA9	UCPD_CC2	Connected to the USB Type-C® port protection and used as UCPD_CC2.
PE9	VBUS_DETECT	Detects the presence of V_{BUS} through a GPIO interrupt mode. Depending on the VDD voltage (1.8 V or 3.3 V), SB46 must be fitted or left open.
PF5	UCPD_DBn	Connected to the USB Type-C® port protection and is used as a dead battery feature.
PF0	UCPD_FLT	Connected to the USB USB Type-C® port protection and used as overvoltage fault reporting to the MCU

7.10 FDCAN

The NUCLEO-H7P5II Nucleo-144 board supports the CAN FD communication protocol.

A standard 3-hole connector (CN14) with a 2.5 mm pitch provides access to the external CAN_P/CAN_N differential pair signals.

The jumper JP6 inserts a 120 Ω resistor between CAN_P and CAN_N.

The transceiver is connected to the MCU through three I/Os.

Table 10. FDCAN pin configuration

Pin name	Function	Description
PB13	FDCAN.TX	Used as FDCAN_TX
PB12	FDCAN.RX	Used as FDCAN_RX
PD8	FDCAN.STBY	Used as FDCAN_STBY

7.11 M.2 Key A serial memory connector (CN18)

The bottom side of the NUCLEO-H7P5II Nucleo-144 board contains an M.2 Key A serial memory connector (CN18) to support external serial memory extensions.

The M.2 Key A serial memory connector connects to the MCU XSPI1 interface and can support Quad-SPI, Octo-SPI, and Hexa-SPI memory.

Table 9. M.2 Key A connector (CN18) pinout

STM32 pin	Signal name	Pin name	Pin	Pin	Pin name	Signal name	STM32 pin
-	-	GND	1	2	3V3	3V3 or VDD (1V8 or 3V3)	-
-	-	NC	3	4	3V3	3V3 or VDD (1V8 or 3V3)	-
-	-	NC	5	6	VDDIO1	VDDIO_M2	-
GND			7	KEY A			
KEY A			16	GPIO_SPI_SCK		SPI5_SCK	PH6
PH8	SPI5_MOSI	GPIO_SPI_MOSI	17	18	GPIO_LDO_EN	GPIO	PG13
PH7	SPI5_MISO	GPIO_SPI_MISO	19	20	XSPI1_CS2N(1)	XSPI1_NCS1 XSPI1_NCS2	PG10 PD1
PH9	SPI5_NSS	GPIO_SPI_NSS	21	22	XSPI_CS1N	XSPI1_NCS1	PB6
GND			23	24	GND		
PD0	XSPI1_DQS0	XSPI1_DQS0	25	26	XSPI_D6	XSPI_IO6	PD13
PB9	XSPI_IO7	XSPI1_D7	27	28	XSPI_D5	XSPI_IO5	PD14
GND			29	30	GND		
PD15	XSPI1_IO4	XSP1_D4	31	32	XSPI_D3	XSPI1_IO3	PD4
GND			33	34	XSPI_D2	XSPI1_IO2	PD5
PD6	XSPI_IO1	XSPI_D1	35	36	GND		
PC3	XSPI_IO0	XSPI_D0	37	38	GPIO_LED2	GPIO	PG12
GND			39	40	GPIO_ERR_INT1	GPIO	PI4
PD2	XSPI1_CLK	XSPI_CLK1	41	42	GPIO_LED1	GPIO	PG11
PD3	XSPI1_NCLK	XSPI_NCLK1	43	44	GND		
GND			45	46	RESERVED	-	-
PB9	XSPI1_IO7	XSPI_D15	47	48	RESERVED	-	-
PD13	XSPI1_IO6	XSPI_D14	49	50	GND		
GND			51	52	XSPI1_CS4N	-	-
PD14	XSPI1_IO5	XSPI_D13	53	54	XSPI1_CS3N	XSPI1_NCS2	PD1
P15	XSPI1_IO4	XSPI_D12	55	56	XSPI_DQS1	XSPI1_DQS0	PD0
GND			57	58	I2C_SDA	I2C1_SDA	PH3
PD4	XSPI1_IO3	XSPI_D11	59	60	I2C_SCL	I2C1_SCL	PH2
PD5	XSPI1_IO2	XSPI_D10	61	62	GPIO_ERR_INT2	GPIO	PG8
GND			63	64	VDDIO_SPI_I2C	3V3 or VDD (1V8 or 3V3)	-
PD6	XSPI1_IO1	XSPI_D9	65	66	NRST	NRST	PG14
PD11	XSPI1_IO0	XSPI_D8	67	68	-	-	-
GND			69	70	GND		
PD2	XSPI1_CLK	XSPI_CLK2	71	72	3V3	3V3 or VDD (1V8 or 3V3)	-
PD3	XSPI1_NCLK	XSPI_NCLK2	73	74	3V3	3V3 or VDD (1V8 or 3V3)	-
GND			75	-			

1. *The NCSx selection on pin 20 of the M2 CN18 connector is set by a solder bridge: SB50 for NCS1 (default configuration) and SB48 for NCS2 (optional configuration).*

7.12 Motor control tuning

To finely tune the six analog-to-digital (ADC) motor control signals, an RC low-pass filter is present on each ADC signal. By default, the resistors are ON with 0 Ω and capacitors are OFF.

Table 10. Pinout of ADC motor control RC low-pass filter

Connector	Pin	Signal name	STM32 pin	Main MCU function
CN7	28	ADC1	PA0	ADC1_INP1 or ADC2_INP1
CN7	30	ADC2	PA1	ADC1_INP2 or ADC2_INP2
CN10	18	ADC3	PC2	ADC1_INP8 or ADC2_INP8
CN7	34	ADC4	PB0	ADC3_INP12 or ADC1_INP15
CN7	36	ADC5	PB11/PE12	ADC2_INP14 or ADC1_INP14/ADC3_INP16(1)
CN7	38	ADC6	PC1	ADC1_INP7 or ADC2_INP7

1. *ADC5 can be connected to PB11 (through SB31) or PE12 (through SB32), depending on the motor control shield connected to ST morpho connectors CN7/CN10. By default, SB31 is OFF, and SB32 is ON.*

8 Expansion connectors

Eight expansion connectors are implemented on the STM32H7P5 Nucleo-144 board:

- CN5, CN6, CN8, and CN9: ARDUINO® Uno V3 connectors
- CN7 and CN10: ST morpho connectors
- CN11 and CN12: To probe I/Os used internally on the STM32H7P5 Nucleo-144 board

8.1 ARDUINO® Uno V3 connectors (CN5, CN6, CN8, CN9)

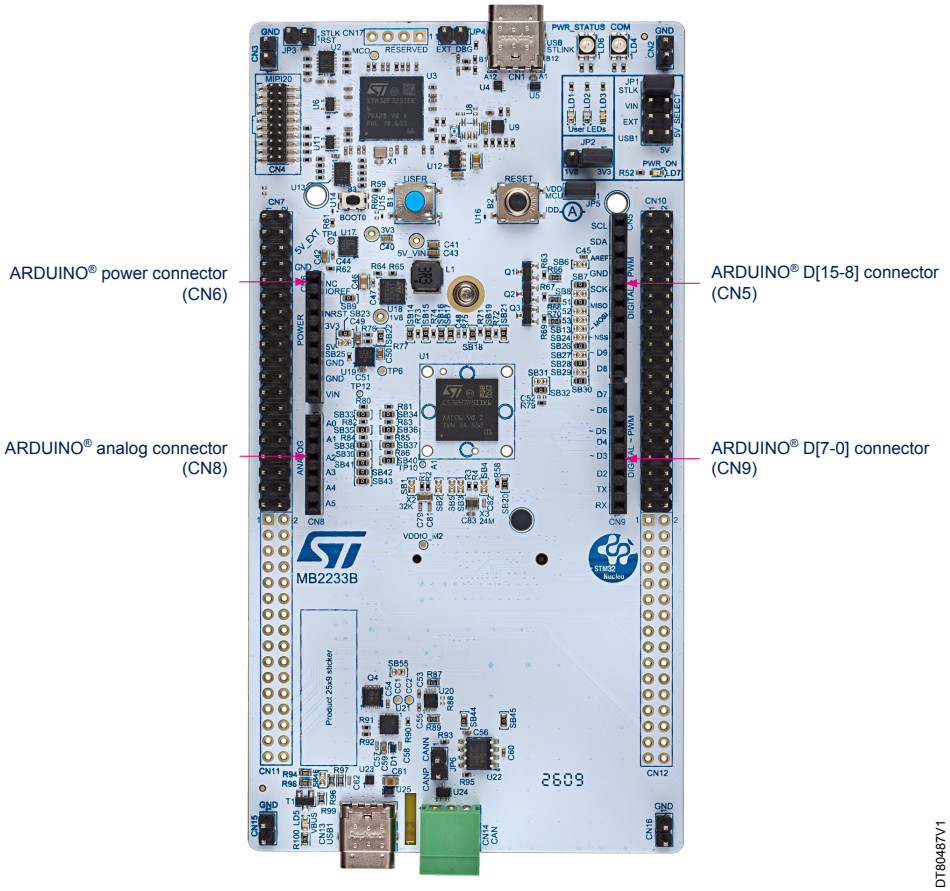
The ARDUINO® connectors (CN5, CN6, CN8, and CN9) are female connectors supporting the ARDUINO® Uno V3 standard. Most shields designed for ARDUINO® can fit the NUCLEO-H7P5II board.

Caution: *Most of the STM32 microcontroller I/Os are 5 V tolerant, but some are only compatible with 3V3. However, ARDUINO® Uno V3 operates at 5 V only. Refer to the STM32H7P4/P5 device data brief and datasheet for the detailed I/O structure.*

Caution: *ARDUINO® is not compatible with 1.8 V. If the STM32 I/Os are configured for 1.8 V through JP2, this setting is not suitable for the ARDUINO® connector.*

Figure 13 indicates where the connectors are located on the board.

Figure 13. ARDUINO® Uno V3 connectors



The pinout for the ARDUINO® connectors is listed in Table 11, Table 12, Table 13, and Table 14.

Table 11. Pinout of ARDUINO® power connector CN6

Pin	Pin name	STM32 pin	Main MCU function
1	-	-	RESERVED
2	IOREF	-	5 V IO REF
3	NRST	NRST	RESET
4	3V3	-	3.3 V VOUT (from MB2233 to ARDUINO® shield)
5	5V	-	5 V VOUT (from MB2233 to ARDUINO® shield)
6	GND	-	GND
7	GND	-	GND
8	VIN	-	7-12 V VIN (from ARDUINO® shield to MB2233)

Table 12. Pinout of ARDUINO® analog connector CN8

Pin	Pin name	STM32 pin	Main MCU function
1	A0	PA0	ADC1_INP1 or ADC2_INP1
2	A1	PA1	ADC1_INP2 or ADC2_INP2
3	A2	PA5	DAC2_OUT1 or ADC2_INP13
4	A3	PB0	ADC3_INP12 or ADC1_INP15
5	A4	PB11/PE12	ADC2_INP14 or ADC1_INP14/ADC3_INP16(1)
6	A5	PC1	ADC1_INP7 or ADC2_INP7

1. *The ARDUINO® analog pin A4 can be connected to PB11 (through SB31) or PE12 (through SB32), depending on the configuration of the motor control shield connected to the ST morpho connectors CN7/CN10. In both cases, the ARDUINO® analog pin A4 can be connected to an analog-to-digital converter (ADC) of the MCU. By default, SB31 is OFF, and SB32 is ON.*

Table 13. Pinout of ARDUINO® D[7-0] connector CN9

Pin	Pin name	Signal name	STM32 pin	Main MCU function
1	D0	UART_RX	PD11	UART4_RX
2	D1	UART_TX	PD12	UART4_TX
3	D2	IO	PC7	GPIO
4	D3	PWM	PB3	TIM2_CH2
5	D4	IO	PA4	GPIO
6	D5	PWM	PA10	TIM1_CH3
7	D6	PWM	PD7	TIM2_CH3
8	D7	IO	PC6	GPIO

Table 14. Pinout of ARDUINO® D[15-8] connector CN5

Pin	Pin name	Signal name	STM32 pin	Main MCU function
1	D8	IO	PC4	GPIO
2	D9	PWM	PB15	TIM15_CH2
3	D10	SPI_NSS/PWM	PB7	SPI1_NSS/TIM12_CH2
4	D11	SPI_MOSI/PWM	PB2	SPI1_MOSI/TIM5_CH1(1)
5	D12	SPI_MISO	PC11	SPI1_MISO
6	D13	SPI_SCK	PG9	SPI1_SCK
7	GND	-	-	-
8	AREF	AREF	VREFP	VREFP(2)
9	D14	I2C_SDA/I3C_SDA	PC9	I2C3_SDA/I3C1_SDA
10	D15	I2C_SCL/I3C_SCL	PC8	I2C3_SCL/I3C1_SCL

1. *The ARDUINO® pin D11 can be connected to PB2 (through SB28), or PA7 (through SB27), depending on the configuration of the motor control shield connected to the ST morpho connectors CN7/CN10. To enable the SPI_MOSI/PWM feature on D11, SB28 is ON (default configuration), and SB27 is OFF.*
2. *A solder bridge (SB6) is used to disconnect the MCU VREFP pin from the ARDUINO® connector CN5, pin 8, also called the AREF pin:*
   - *SB6 OFF: VREFP is not connected to the ARDUINO® connector CN5, pin 8 (default configuration). The STM32 VREF is directly connected to the internal 3.3 V through R101 (ON).*
   - *SB6 ON: VREFP is connected to the ARDUINO® connector CN5, pin 8, for external analog reference. R101 must be OFF.*

8.2 ST morpho connectors (CN7, CN10)

The ST morpho connector (CN7 and CN10) consists of two 2.54 mm pitch male pin headers. They can be used to connect the NUCLEO-H7P5II board to X-NUCLEO extension modules or to prototype or wrapping boards placed on top of it. An oscilloscope, a logic analyzer, or a voltmeter can also use this connector.

The default STM32 X-NUCLEO shield configurations compatible with the NUCLEO-H7P5II ST morpho connector pinout are as follows:

- Priority 1: X-NUCLEO-IHM16M1: Three-phase brushless DC motor driver expansion board
- Priority 2: X-NUCLEO-IHM09M2: Motor control expansion board
- Priority 3: X-NUCLEO-IHM08M1: Low-voltage brushless DC motor driver expansion board
- Priority 4: ARDUINO®
- Priority 5: X-NUCLEO-IHM17M1: Low-voltage three-phase brushless DC motor driver expansion board

By default, the multiplexing supports X-NUCLEO-IHM16M1.

Figure 14. **ST morpho connectors (CN7 and CN10)**

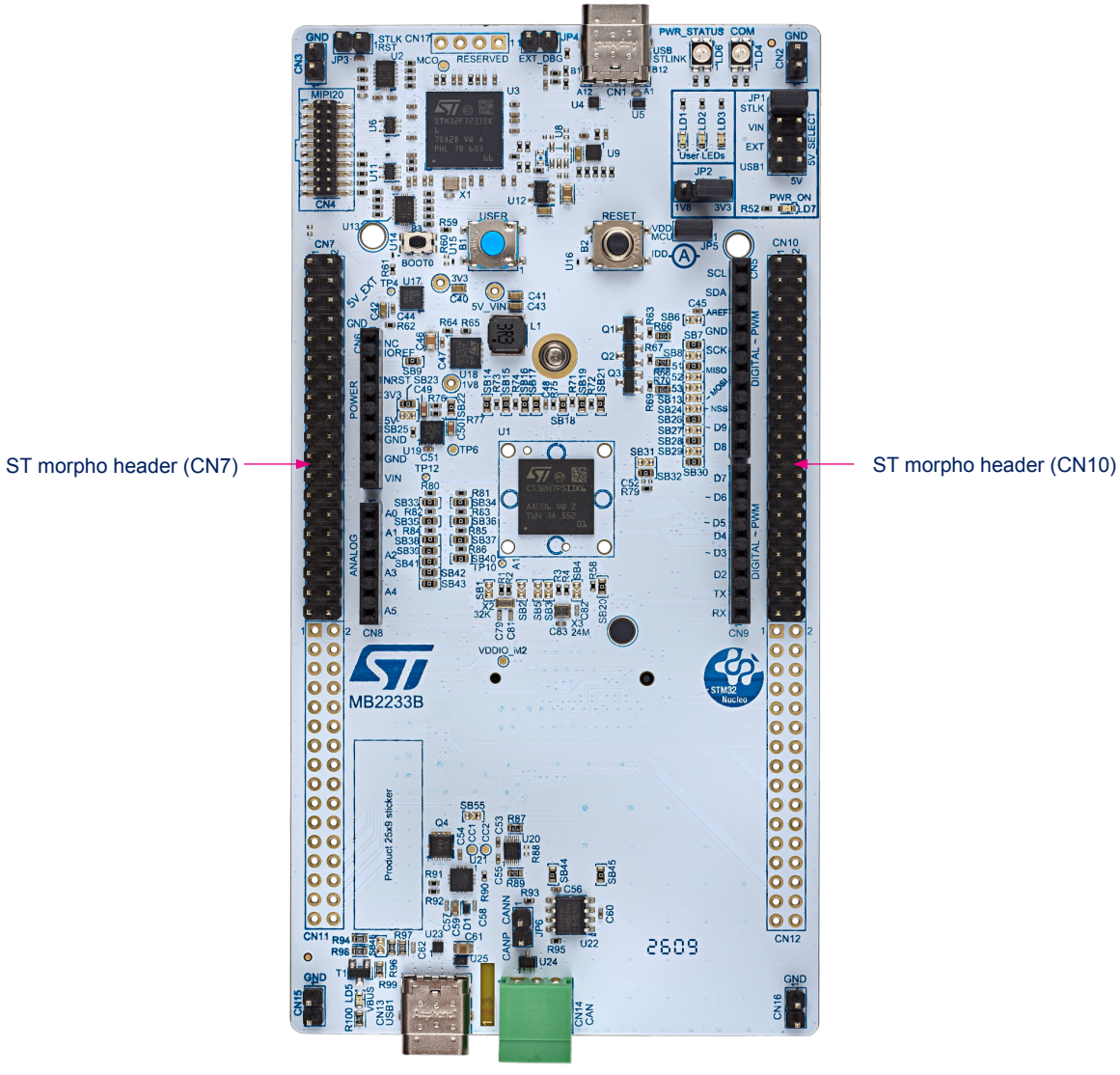


Table 15 and Table 16 show the pin assignments for the STM32 microcontroller on the ST morpho connector.

Table 15. ST morpho left connector (CN7) pinout

STM32 pin	Main MCU function	ST morpho	Pin	Pin	ST morpho	Main MCU function	STM32 pin
PD9	GPIO(1)	NTC Bypass	1	2	Dis.Break	GPIO(1)	PD10
PB10	GPIO	GPIO	3	4	GPIO	GPIO	PG2
-	-	3.3 V	5	6	5V_EXT	-	-
BOOT0	BOOT0	BOOT Mode	7	8	GND	-	-
PG3	GPIO	GPIO	9	10	GPIO	GPIO	PF6
PG15	GPIO	GPIO	11	12	IOREF(2)	-	-
PA13	SWDIO(3)	SWDIO	13	14	NRST(2)	NRST	NRST
PA14	SWCLK(3)	SWCLK	15	16	3.3 V(2)	-	-
PA15	JTDI(3) TIM2_CH1(1) I2S1_WS	JTDI/PWM	17	18	5V(2)	-	-
-	-	GND	19	20	GND(2)	-	-
PF10	GPIO	GPIO	21	22	GND(2)	-	-
PC13	WKUP3	WKUP(4)	23	24	VIN(2)	-	-
PC14	OSC32_IN	LSE_IN	25	26	GPIO	GPIO	PF2
PC15	OSC32_OUT	LSE_OUT	27	28	HSP_ADC1(2)	ADC1_INP1 or ADC2_INP1(1)	PA0
PH0	OSC_IN	HSE_IN	29	30	HSP_ADC2(2)	ADC1_INP2 or ADC2_INP2(1)	PA1
PH1	OSC_OUT	HSE_OUT	31	32	ADC(2)/ DAC	ADC2_INP13/ DAC2_OUT1	PA5
VBAT	VBAT	VBAT	33	34	HSP_ADC4/ TIM(2)	ADC3_INP12 or ADC1_INP15/ TIM8_CH2N(1)	PB0
PB14	ADC1_INP13(1)	ADC	35	36	HSP_ADC5(2)	ADC2_INP14 or ADC1_INP14/ ADC3_INP16(1)	PB11/ PE12(5)
PC0	ADC1_INP6 or ADC2_INP6(1)	ADC	37	38	HSP_ADC6(2)	ADC1_INP7 or ADC2_INP7(1)	PC1

1. *Main feature to support the X-NUCLEO-IHMxxxx motor control shield.*
2. *Shared pin with the ARDUINO® Uno V3 connector.*
3. *I/Os shared with the SWD signals connected to STLINK-V3EC.*
4. *Shared pin with the WKP user button B1.*
5. *Multiple STM32 pins are multiplexed through solder bridges. Refer to Section 8.4 for details.*

Table 16. ST morpho right connector (CN10) pinout

STM32 pin	Main MCU function	ST morpho-64	Pin	Pin	ST morpho-64	Main MCU function	STM32 pin
PF3	GPIO	BEMF	1	2	GPIO	GPIO	PI8
PC8	I2C3_SCL/ I3C1_SCL	I2C_SCL(1)/ I3C_SCL(2)	3	4	GPIO	GPIO	PF7
PC9	I2C3_SDA/ I3C1_SDA	I2C_SDA(1)/ I3C_SDA(2)	5	6	GPIO/ HSP_ADC8	ADC3_INP1 or ADC1_INP12	PB1
VREFP	VREFP (4)	AREF(1)	7	8	5V_STLK(6)	-	-
-	-	GND(1)	9	10	GPIO	GPIO	PF8
PG9	SPI1_SCK	SPI_SCK(1)	11	12	USB_DP/ CPOUT/ STOP PWM	TIM8_ETR/ USB_DP	PB8/ PG3/ PD11/ PA12(5)
PC11	SPI1_MISO	SPI_MISO(1)	13	14	USB_DM/ TIM	TIM8_BKIN2/ USB_DM	PI2/ PA11(5)
PB2/ PA7(5)	SPI1_MOSI or TIM5_CH1/ TIM8_CH1(3)	SPI_MOSI/ PWM(1)	15	16	PWM_BKIN	TIM8_BKIN2(3)	PI2
PB7	SPI1_NSS/ TIM3_CH1(3)	SPI_NSS/ PWM(1)	17	18	HSP_ADC3	ADC1_INP8 or ADC2_INP8(3)	PC2
PB15	TIM3_CH2(3)	PWM(1)	19	20	GND	-	-
PC4	TIM8_CH2(3)	TIM_VH(1)	21	22	RED LED	TIM5_CH4	PF9
PC6	TIM8_CH1(3)	TIM_UH(1)	23	24	ADC/ TIM	ADC2_INP0/ TIM8_CH3N	PF13/ PC12(5)
PD7	TIM2_CH3 or TIM2_ETR(3)	TIM_H3(1)	25	26	TIM_WL(3)	TIM8_CH3N(3)	PC12
PA10	TIM1_CH3(3)	TIM_CUR_REF (1)	27	28	TIM_VL(3)	TIM8_CH2N(3)	PB4
PF5	DAC1_OUT1 or TIM3_CH4 or ADC2_INP17(3)	DAC/ PWM/ ADC(1)	29	30	TIM_UL(3)	TIM8_CH1N(3)	PA7
PB3	TIM2_CH2(3)/ SWO	TIM_H2/ SWO(1)	31	32	AGND	VREFM	VREFM
PC7	TIM8_CH3(3)	TIM_WH/ GPIO(1)	33	34	ADC(3)	ADC2_INP3(3)	PA6
PD12	UART4_TX	UART_TX(1)	35	36	GPIO	GPIO	PC5
PD11	UART4_RX	UART_RX(1)	37	38	GPIO	GPIO	PF11

1. *Shared pin with the ARDUINO® Uno V3 connector.*
2. *Shared pin with the ARDUINO® Uno V3 connector but with I3C feature on the ST morpho connector.*
3. *Main feature to support the X-NUCLEO-IHMxxxx motor control shield.*
4. *A solder bridge (SB6) is used to disconnect the STM32H7P5xx VREFP pin from the ARDUINO® connector (CN5, pin 8). Refer to Section 8.4 for details.*
5. *Multiple STM32 pins are multiplexed through solder bridges. Refer to Section 8.4 for details.*
6. *5V_STLK is the 5 V power signal, coming from the STLINK-V3EC USB connector. It rises before the 5 V signal of the board.*

8.3 Expansion connectors (CN11, CN12)

The expansion connectors consist of two footprints, CN11 and CN12. The connectors are not mounted by default. Use these footprints to connect the NUCLEO-H7P5II board to an extension board, a prototype board, or a wrapping board with a 2.54-mm pitch. An oscilloscope, a logic analyzer, or a voltmeter can also probe this connector.

The following functions are present on these expansion connectors: GPIOs, SPI, I²C, ADCs, HSP_SNPx, ADC_HSP, and duplicated M.2 serial memory XSPI signals.

Figure 15. Expansion connectors

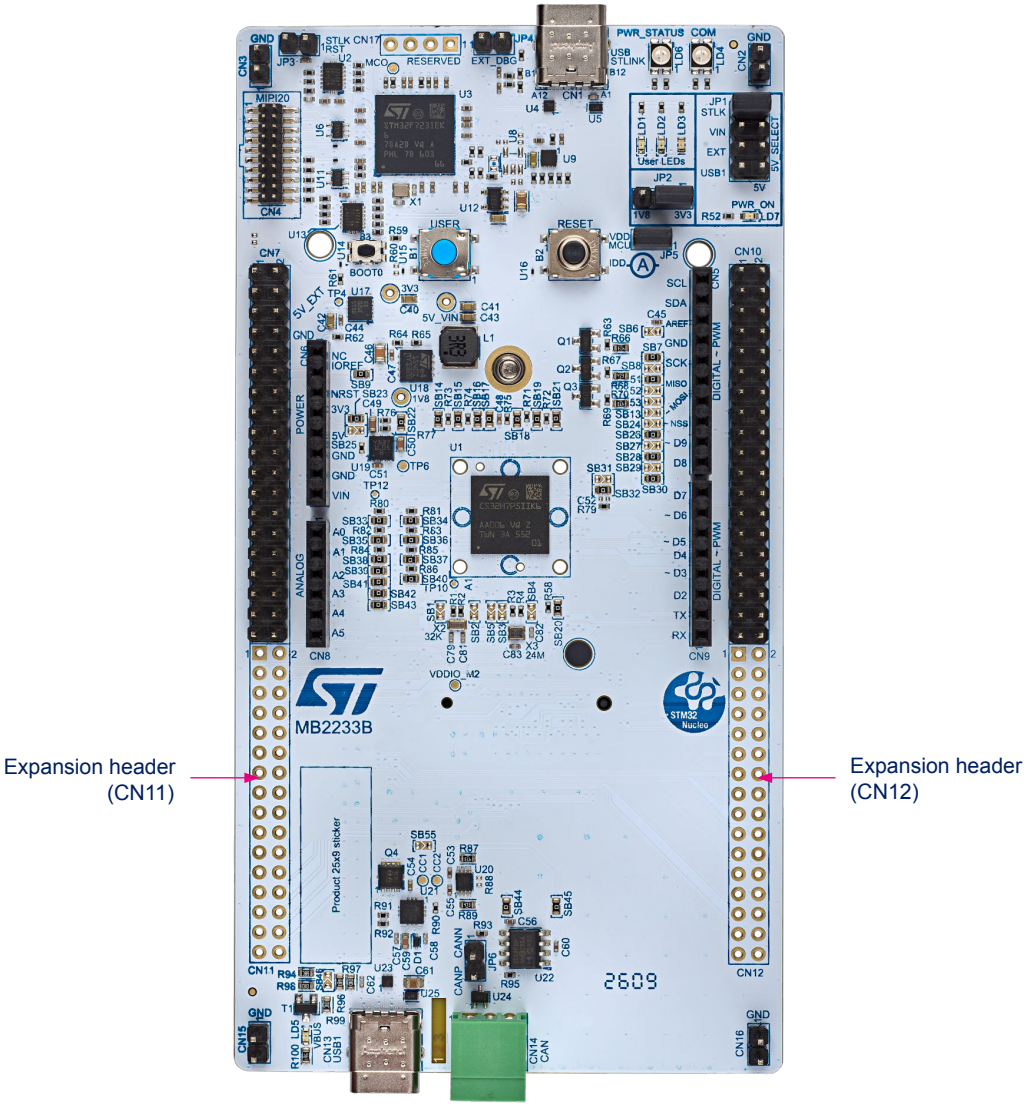


Table 17 and Table 18 demonstrate the pin assignments for the expansion connectors.

Table 17. Expansion connector (left side, CN11)

STM32 pin	Function	Pin	Pin	Function	STM32 pin
PF14	GPIO	1	2	GPIO	PF15
PG0	GPIO	3	4	GPIO	PG1
PE7	GPIO	5	6	GPIO	PH4
PH5	GPIO	7	8	NC	-
PE13	GPIO	9	10	GPIO	PE14
-	GND	11	12	GPIO	PE15
PE0	GPIO	13	14	GPIO	PG4
PG5	GPIO	15	16	GPIO	PI0
PI1	GPIO	17	18	GPIO	PI3
PG6	GPIO	19	20	GPIO	PG7
PC10	GPIO	21	22	GND	-
PE1	GPIO	23	24	SPI5_SCK	PH6
PH7	SPI5_MISO	25	26	SPI5_MOSI	PH8
PH9	SPI5_NSS	27	28	I2C1_SCL	PH2
PH3	I2C1_SDA	29	30	XSPI_INT	PG8
PG11	XSPI_LED1	31	32	XSPI_LED2	PG12

Table 18. Expansion connector (right side, CN12)

STM32 pin	Function	Pin	Pin	Function	STM32 pin
-	GND	1	2	NC	NC
NC	NC	3	4	ADC3_INP8 (HSP_ADC9)	PF12
PE8	ADC4_INP6 (HSP_ADC10)	5	6	ADC4_INP14 (HSP_ADC11)	PE10
PE11	ADC4_INP15 (HSP_ADC12)	7	8	HSP1_SNP0	PH10
PH11	HSP1_SNP1	9	10	HSP1_SNP2	PH12
PH13	HSP1_SNP3	11	12	HSP1_SNP4	PH14
PH15	HSP1_SNP5	13	14	XSPI_GPIO	PI4
PG13	XSPI_LDO_EN	15	16	GND	-
PC3	XSPI1_IO0(1)	17	18	XSPI1_IO1(1)	PD6
PD5	XSPI1_IO2(1)	19	20	XSPI1_IO3(1)	PD4
PD15	XSPI1_IO4(1)	21	22	XSPI1_IO5(1)	PD14
PD13	XSPI1_IO6(1)	23	24	XSPI1_IO7(1)	PB9
-	GND	25	26	XSPI1_DQS0(1)	PD0
PG10	XSPI1_NCS1(1)	27	28	XSPI1_NCS2(1)	PD1
PD2	XSPI1_CLK(1)	29	30	XSPI1_NCLK(1)	PD3
NC	NC	31	32	-	-

1. *Solder bridges are present to disconnect the signals from the M2 serial memory. By default, SBxx is ON.*

8.4 Solder bridge configuration

Table 19 summarizes the solder bridges on the NUCLEO-H7P5II board that configure the internal or external usage of the I/O signals on the expansion connector.

Table 19. Solder bridge configuration

Function	Solder bridge	Setting (1)(2)	Comments(1)
LSE (PC13, PC14)	SB1, SB2	**OFF**	**PC14 and PC15 are connected to the internal crystal for LSE function (R1/R2 ON).**
		ON	PC14 and PC15 are connected to ST morpho connector. 32 kHz crystal is not used (R1/R2 must be OFF).
HSE (PH0, PH1)	SB3, SB4	**OFF**	**PH0 and PH1 are connected to internal crystal for HSE function (R3/R4 ON).**
		ON	PH0 and PH1 are connected to ST morpho connector. 24 MHz crystal is not used (R3/R4 must be OFF).
	SB5	**OFF**	**8 MHz MCO from STLINK-V3EC is not used for HSE.**
		ON	8 MHz MCO from STLINK-V3EC can be used for HSE. 24 MHz crystal is not used (SB3 and R3 must be OFF).
DEBUG SWD/JTAG (PA13, PA14, PA15, PB3)	SB39, SB41, SB42, SB43	OFF	GPIOs used for debugging are not connected to expansion connectors. Only SWD/JTAG interface with STLINK-V3EC is connected. This configuration avoid conflict between STLINK-V3EC and external interface on the extension connector.
		ON	**GPIOs, used for debugging, are shared between expansion connectors and SWD/JTAG interface. This configuration helps to probe the SWD/JTAG interface on the expansion connector.**
VREF	SB6	**OFF**	**VREFP is not connected to the ARDUINO® connector CN5, pin 8, AREF (default configuration). The STM32 VREF is directly connected to the internal 3.3 V through R101 ON.**
		ON	VREFP is connected to the ARDUINO® connector CN5, pin 8, AREF for external analog reference. R101 must be OFF.
M2_NRST (PG14)	SB54	OFF	PG14 not connected to M2_NRST function.
		ON	**PG14 is used for the M2_NRST function.**
M2_XSPI_NCS selection (PG10, PD1)	SB48	**OFF**	**PD1 not used for XSPI_NCS2 function.**
		ON	PD1 used for XSPI_NCS2 function.
	SB49	OFF	PD1 not used for XSPI_NCS3 function.
		ON	**PD1 used for XSPI_NCS3 function.**
	SB50	OFF	PG10 not used for XSPI_NCS2 function.
		ON	**PG10 used for XSPI_NCS2 function.**
VBUS DETECT (PE9)	SB46	**OFF**	**UCPD.VBUS_DETECT signal high level is 2.97 V for VDD board at 3.3 V.**
		ON	UCPD.VBUS_DETECT signal high level is 1.65 V for VDD board at 1.8 V.
Green LED	SB7, SB8	**ON/ OFF**	**LED1 is driven by ARDUINO® D13 (PG9).**
		OFF/ ON	LED1 is driven by MCU PB15 pin.
XSPI to expansion connector CN12	See details on Table 20	**ON**	**The XSPI bus is connected to expansion connector CN12.**
		OFF	The XSPI bus is disconnected from the expansion connector CN12 to optimize performance of M.2. serial memory.
Morpho CN10, pin 15	SB27	**OFF**	**PA7 is not used to connect to CN10, pin 15.**
		ON	PA7 is connected to CN10, pin 15, to support TIM8_CH1N function for motor control IHM09/08 shields.
	SB28	OFF	PB2 is not used to connect to CN10, pin 15.

Function	Solder bridge	Setting (1)(2)	Comments(1)
Morpho CN10, pin 15	SB28	**ON**	**PB2 is connected to CN10, pin 15, to support SPI1_MOSI or ADC2_INP2 or TIM5_CH1 function for motor control IHM16/17 shields or for ARDUINO®.**
Morpho CN10, pin 24	SB29	**OFF**	**PC12 is not used to connect to CN10, pin 24.**
		ON	PC12 is connected to CN10, pin 24, to support TIM8_CH3N function for motor control IHM09/08 shields.
	SB30	OFF	PF13 is not used to connect to CN10, pin 24.
		ON	**PF13 is connected to CN10, pin 24, to support ADC2_INP0 function for motor control IHM16/17 shields.**
Morpho CN7, pin 36	SB31	**OFF**	**PB11 is not used to connect to CN7, pin 36.**
		ON	PB11 is connected to CN7, pin 36, to support ADC2_INP14 or ADC1_INP14 function for motor control IHM09/08/17 shields.
	SB32	OFF	PE12 is not used to connect CN7, pin 36.
		ON	**PE12 is connected to CN7, pin 36, to support ADC3_INP16 function for ZEST on motor control IHM16 shield.**
Morpho CN10, pin 14	SB24	**OFF**	**USB_FS_N is not used to connect to CN10, pin 14.**
		ON	USB_FS_N is connected to CN10, pin 14, to support Morpho standard.
	SB26	OFF	**PI2 is not used to connect to CN10, pin 14.**
		ON	**PI2 is connected to CN10, pin 14, to support TIM8_BKIN2 function for motor control shields.**
Morpho CN10, pin 12	SB10	OFF	PB8 is not used to connect to CN10, pin 12.
		ON	**PB8 is connected to CN10, pin 12, to support TIM8_ETR function for IHM8/17 motor control shields.**
	SB11	**OFF**	**PD11 is not used to connect to CN10, pin 12.**
		ON	PD11 is connected to CN10, pin 12, to support UART_RX function.
	SB12	**OFF**	**PG3 is not used to connect to CN10, pin 12.**
		ON	PG3 is connected to CN10, pin 12, for spare.
	SB13	**OFF**	**USB_FS_P is not used to connect to CN10, pin 12.**
		ON	USB_FS_P is connected to CN10, pin 12, to support Morpho standard.

1. *The default configuration is shown in bold.*
2. *All Nucleo products are shipped with solder bridges configured to match the supported target MCU.*

The table below illustrates the details of the XSPI connection to the expansion connector CN12.

Table 20. Details of XSPI connection to expansion connector CN12

STM32 pin	Function	Solder bridge	CN12 pin	CN12 pin	Solder bridge	Function	STM32 pin
PC3	XSPI1_IO0	SB20	17	18	SB40	XSPI1_IO1	PD6
PD5	XSPI1_IO2	SB37	19	20	SB33	XSPI1_IO3	PD4
PD15	XSPI1_IO4	SB19	21	22	SB18	XSPI1_IO5	PD14
PD13	XSPI1_IO6	SB21	23	24	SB38	XSPI1_IO7	PB9
-	GND	GND	25	26	SB14	XSPI1_DQS0	PD0
PG10	XSPI1_NCS1	SB35	27	28	SB16	XSPI1_NCS2	PD1
PD2	XSPI1_CLK	SB34	29	30	SB36	XSPI1_NCLK	PD3

9 NUCLEO-H7P5II product information

9.1 Product marking

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

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

  Single-sticker example:

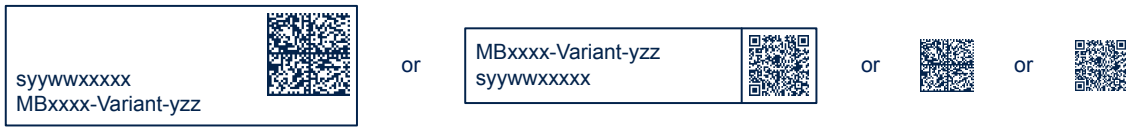
  

  Dual-sticker example:

- Other boards if any: board reference with revision and serial number.

  Examples:

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

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

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

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

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

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

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

9.2 NUCLEO-H7P5II product history

Table 21. Product history

Order code	Product identification	Product details	Product change description	Product limitations
NUCLEO-H7P5II	NUH7P5II$CR1	MCU: STM32H7P5IIK6 silicon revision "A"	Initial revision	The silkscreen labels PC9 and PC8 on the bottom side, close to CN10, pin 3, and CN10, pin 5, are swapped. CN10, pin 3 is physically connected to PC8. CN10, pin 5 is physically connected to PC9.
		MCU errata sheet: *STM32H7Pxxx device errata* (ES0678)		
		Board: MB2233-H7P5II-B02 (main board)		

9.3 Board revision history

Table 22. Board revision history

Board reference	Board variant and revision	Board change description	Board limitations
MB2233 (main board)	H7P5II-B02	Initial revision	The silkscreen labels PC9 and PC8 on the bottom side, close to CN10, pin 3, and CN10, pin 5, are swapped. CN10, pin 3 is physically connected to PC8. CN10, pin 5 is physically connected to PC9.

10 Compliance statements and conformity declarations

10.1 Federal Communications Commission (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 interference by one or more of the following measures:

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

Note: Use only shielded cables.

Responsible Party - U.S. Contact Information:

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

10.2 Innovation, Science and Economic Development Canada (ISED) compliance statement

This product complies with the ICES-003 standard class B of the ISED regulation.

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

Note: Use only shielded cables.

Ce produit est conforme à la norme NMB-003 classe B de la ISDE.

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

Note: Utiliser uniquement des câbles blindés.

10.3 UKCA conformity

Simplified UK declaration of conformity

Hereby, the manufacturer STMicroelectronics, declares that the equipment type NUCLEO-H7P5II is in compliance with the UK Electromagnetic Compatibility Regulations 2016 (UK SI 2016 No. 1091) and with the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 (UK SI 2012 No. 3032).

Note: Use only shielded cables.

10.4 CE conformity

10.4.1 Simplified EU declaration of conformity

Hereby, STMicroelectronics declares that the equipment type NUCLEO-H7P5II is in compliance with directives 2011/53/EU and 2015/863/EU (RoHS), and 2014/30/EU (EMC).

Note:
- *RoHS: Restriction of hazardous substances*
- *EMC: Electromagnetic compatibility*

Note: Use only shielded cables.

10.4.2 Déclaration de conformité UE simplifiée

STMicroelectronics déclare que l'équipement électrique du type NUCLEO-H7P5II est conforme aux directives 2011/53/UE et 2015/863/UE (LdSD), et à la directive 2014/30/UE (CEM).

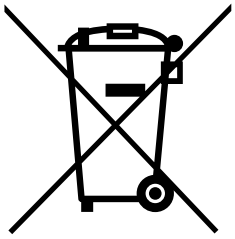
Note:
- *LdSD : directive sur la limitation de l'utilisation des substances dangereuses*
- *CEM : compatibilité électromagnétique*

Note: Utiliser uniquement des câbles blindés.

11 Product disposal

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

(Applicable in Europe)



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

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

Household users:

Contact the retailer that you purchased the product from or your local authority for details of your nearest designated collection point.

Business users:

Contact your dealer or supplier for further information.

Revision history

Table 23. **Document revision history**

Date	Revision	Changes
12-Oct-2026	1	Initial release.

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