## Introduction

The STM32 Nucleo-144 board (NUCLEO-F207ZG, NUCLEO-F303ZE, NUCLEO-F429ZI, NUCLEO-F446ZE, NUCLEO-F746ZG) provides an affordable and flexible way for users to try out new ideas and build prototypes with the STM32 microcontroller, choosing from the various combinations of performance, power consumption and features. The ST Zio connector, which extends the Arduino™ Uno connectivity, and the ST morpho headers provide access to a wider range of peripherals and make it easy to expand the functionality of the Nucleo open development platform with a large choice of specialized shields. The STM32 Nucleo-144 board does not require any separate probe as it integrates the ST-LINK/V2-1 debugger/programmer. The STM32 Nucleo-144 board comes with the STM32 comprehensive software HAL library, together with various packaged software examples, as well as the direct access to the ARM® mbed™ on-line resources at http://mbed.org.

| Figure 1. Nucleo 144 board (top view) | Figure 2. Nucleo 144 board (bottom view) |
| --- | --- |
|  |  |
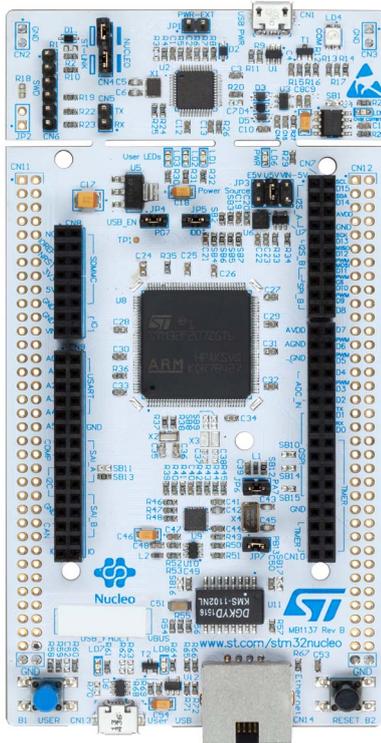
1. Pictures not contractual.

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# 1 Features

The STM32 Nucleo-144 boards offer the following features:

- STM32 microcontroller in LQFP144 package
- Two types of extension resources:
  - ST Zio connector including:
    Support for Arduino™ Uno Revision 3 connectivity (A0 to A5, D0 to D15)
    Additional signals exposing a wide range of peripherals (A6 to A8, D16 to D72)
  - ST morpho extension pin header footprints for full access to all STM32 I/Os
- ARM® mbed™ -enabled (see http://mbed.org), planned in the second quarter of 2016
- On-board ST-LINK/V2-1 debugger/programmer with SWD connector:
  - Selection-mode switch to use the kit as a standalone ST-LINK/V2-1
  - USB re-enumeration capability. Three different interfaces supported on USB:
    Virtual Com port
    Mass storage
    Debug port
- Flexible board power supply:
  - 5V from ST-LINK/V2-1 USB VBUS (U5V)
  - External power sources:
    3.3 V and 7 - 12 V on ST Zio or ST morpho connectors
    5 V on ST morpho connector
- USB OTG or device full speed with Micro-AB connector (depending on STM32 support)
- IEEE-802.3-2002 compliant Ethernet connector (depending on STM32 support)
- Three user LEDs
- Two push buttons: USER and RESET
- LSE crystal:
  - 32.768KHz crystal oscillator
- Comprehensive free software HAL library including a variety of software examples
- Supported by wide choice of Integrated Development Environments (IDEs) including IAR™, Keil®, GCC-based IDEs, ARM® mbed™

# 2 Product marking

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

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

- On the targeted STM32 that is soldered on the board (for 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.

# 3 Order code

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

**Table 1. Ordering information**

| Target STM32 | Order code |
|---|---|
| STM32F207ZGT6 | NUCLEO-F207ZG |
| STM32F303ZET6 | NUCLEO-F303ZE |
| STM32F429ZIT6 | NUCLEO-F429ZI |
| STM32F446ZET6 | NUCLEO-F446ZE |
| STM32F746ZGT6 | NUCLEO-F746ZG |

Order code codification NUCLEO-TXXXZY meaning:

- T describes the STM32 family (F or L)
- XXX describes the silicon special features
- Z describes the pin count (Z for 144 pins)
- Y describes the Flash memory size (E for 512K, G for 1MB, I for 2MB)

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

# 4 Conventions

*Table 2* provides the conventions used for the ON and OFF settings in the present document.

**Table 2. ON/OFF conventions**

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

In this document the references for all information, that is common to all sale types, are "STM32 Nucleo-144 board" and "STM32 Nucleo-144 boards".

# 5 Quick start

The STM32 Nucleo-144 board is a low-cost and easy-to-use Development Kit, used to quickly evaluate and start a development with an STM32 microcontroller in LQFP144 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 STM32 Nucleo-144 and for demonstration software, visit www.st.com/stm32nucleo webpage.

## 5.1 Getting started

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

1. Check jumper position on the board:

    JP1 OFF (PWR-EXT) selected (see *Section 6.3.1: Power supply input from ST-LINK/V2-1 USB connector* for details)

    JP3 on U5V (Power source) selected (see *Table 6: External power sources* for details)

    JP5 ON (IDD) selected (see *Section 6.6: JP5 (IDD)* for details)

    CN4 ON selected (see *Table 3: CN4 states of the jumpers* for details)

2. For the correct identification of all 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. Connect the STM32 Nucleo-144 board to a PC with a USB cable 'type A to micro-B' through USB connector CN1 to power the board. Green LED LD6 (PWR) and LD4 (COM) light up and the red LED LD3 blinks.

4. Press button B1 (left button).

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

6. The software demonstration and the several software examples, that allow the user to use the Nucleo features, are available at the www.st.com/stm32nucleo webpage.

7. Develop an application, using the available examples.

## 5.2 System requirements

- Windows® OS (XP, 7, 8)
- USB type A to Micro-B USB cable

# 6 Hardware layout and configuration

The STM32 Nucleo-144 board is designed around the STM32 microcontrollers in a 144-pin LQFP package.

*Figure 3* shows the connections between the STM32 and its peripherals (ST-LINK/V2-1, 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 STM32 Nucleo-144 board.

**Figure 3. Hardware block diagram**
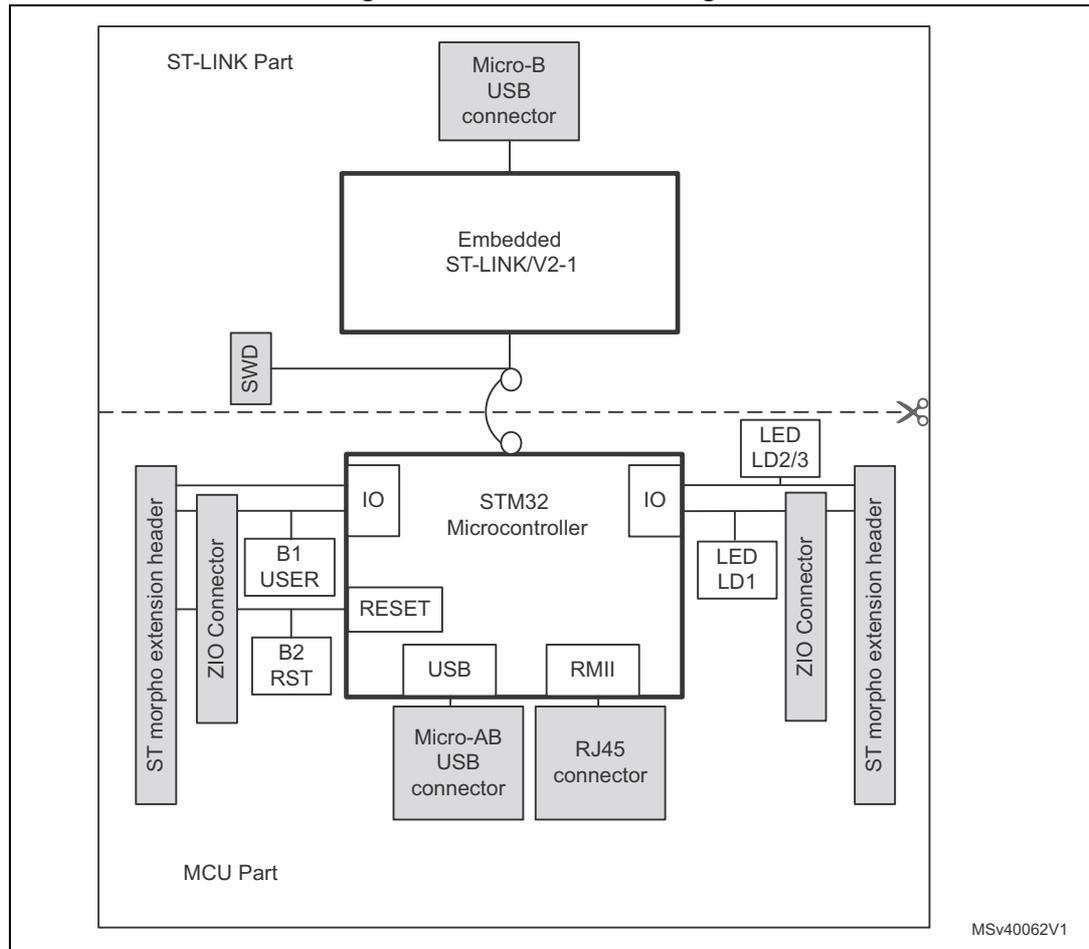
**Figure 4. Top layout**
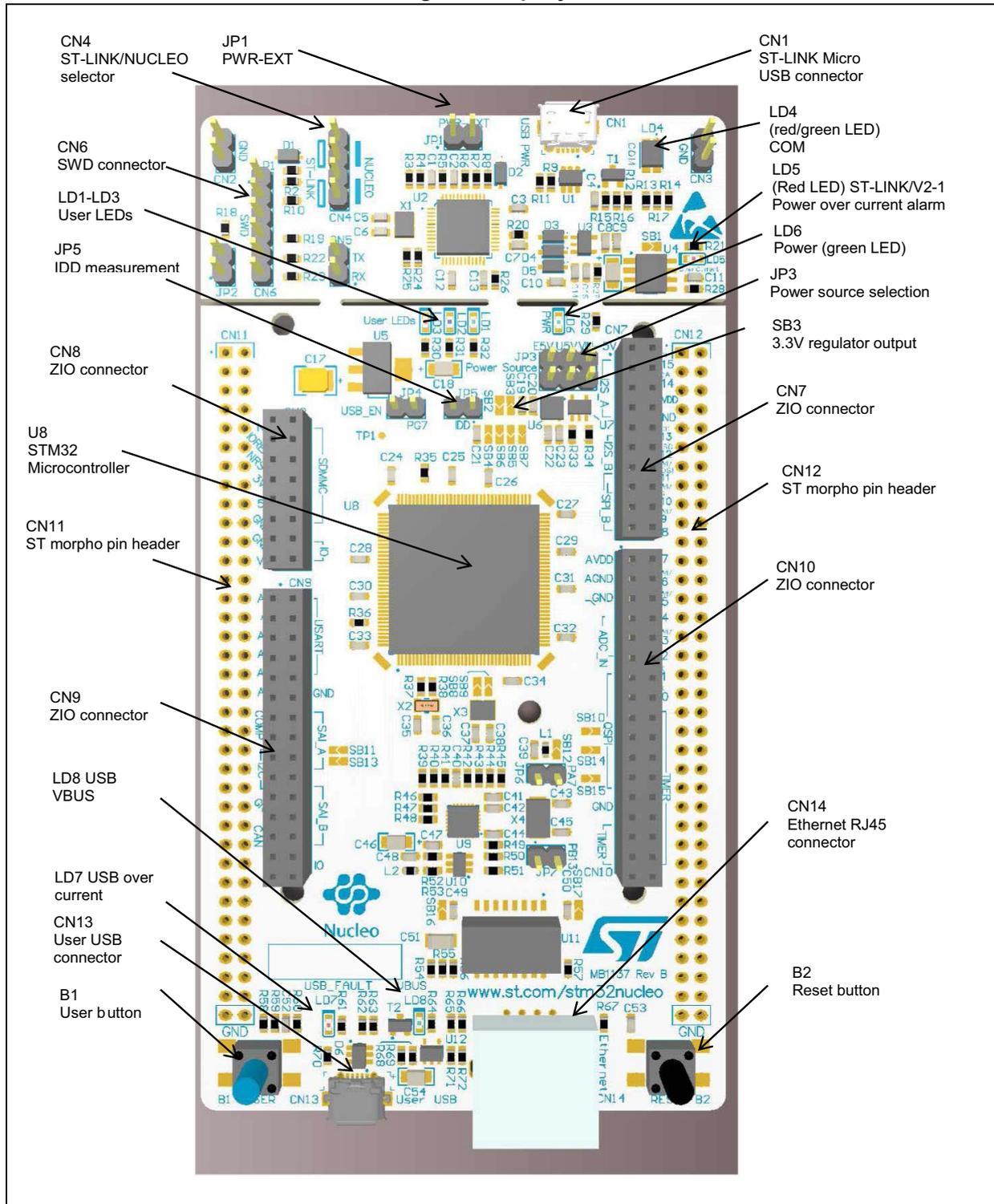
**Figure 5. Bottom layout**
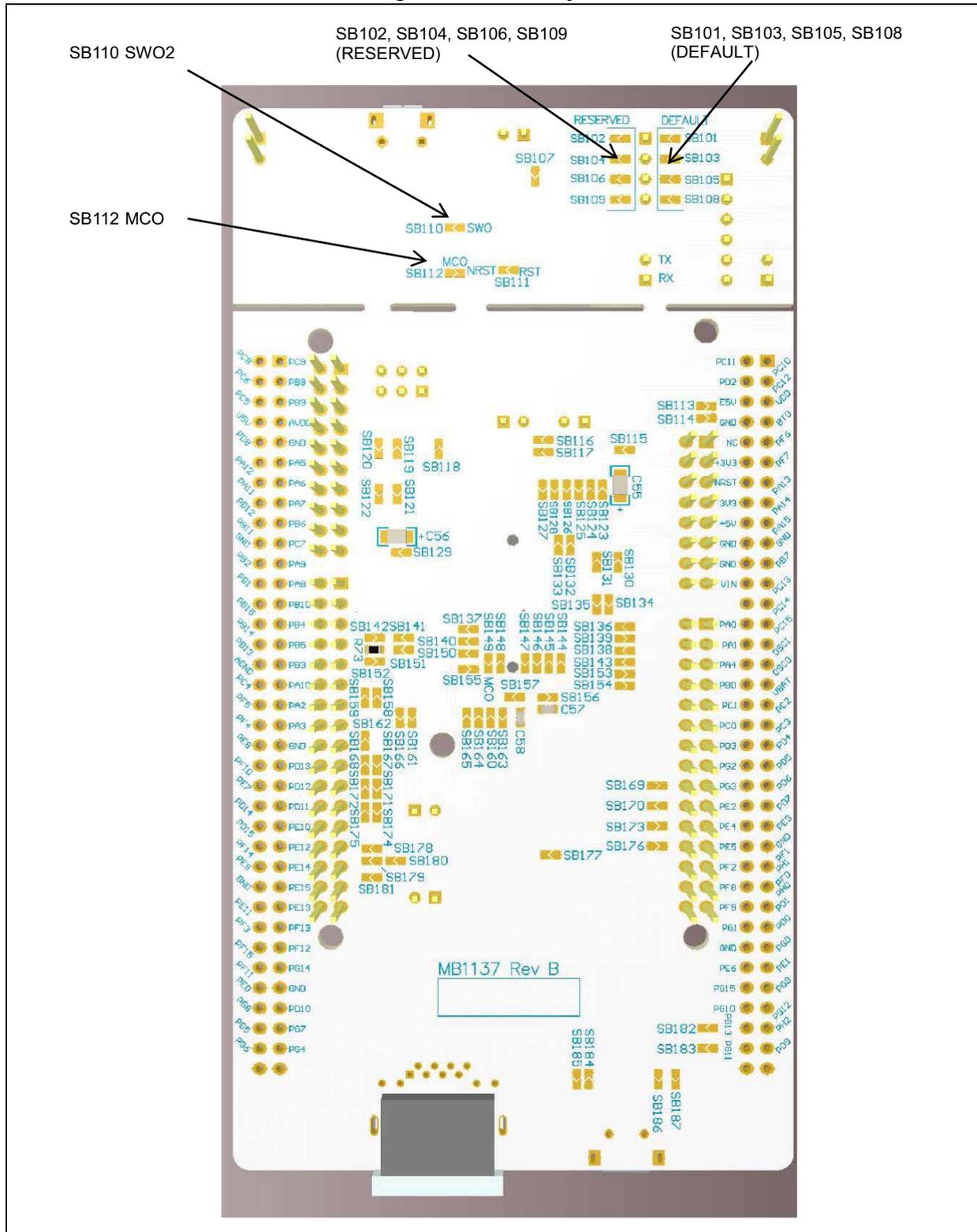
## 6.1 Cuttable PCB

The STM32 Nucleo-144 board is divided into two parts: ST-LINK and target STM32. The ST-LINK part of the PCB can be cut out to reduce the board size. In this case the remaining target STM32 part can only be powered by VIN, E5V and 3.3V on ST morpho connector CN11, or VIN and 3.3V on ST Zio connector CN8. It is still possible to use the ST-LINK part to program the main STM32, using wires between CN6 and SWD signals available on ST morpho connector (SWCLK CN11 pin 15, SWDIO CN11 pin 13 and NRST CN11 pin 14).

## 6.2 Embedded ST-LINK/V2-1

The ST-LINK/V2-1 programming and debugging tool is integrated in the STM32 Nucleo-144 boards.

The ST-LINK/V2-1 makes the STM32 Nucleo-144 boards mbed enabled.

The embedded ST-LINK/V2-1 supports only SWD for STM32 devices. For information about debugging and programming features refer to *ST-LINK/V2 in-circuit debugger/programmer for STM8 and STM32,* UM1075 User manual, which describes in details all the ST-LINK/V2 features.

The changes versus ST-LINK/V2 version are listed below.

New features supported on ST-LINK/V2-1:

- USB software re-enumeration
- Virtual com port interface on USB
- Mass storage interface on USB
- USB power management request for more than 100 mA power on USB

Features not supported on ST-LINK/V2-1:

- SWIM interface
- Minimum supported application voltage limited to 3 V

Known limitation:

- Activating the readout protection on ST-LINK/V2-1 target, prevents the target application from running afterwards. The target readout protection must be kept disabled on ST-LINK/V2-1 boards.

There are two different ways to use the embedded ST-LINK/V2-1, depending on the jumper state (see *Table 3*):

- Program/debug the STM32 on board
- Program/debug the STM32 in an external application board, using a cable connected to SWD connector CN6

**Table 3. CN4 states of the jumpers**

| Jumper state | Description |
|---|---|
| Both CN4 jumpers ON | ST-LINK/V2-1 functions enabled for on board programming (default). See *Section 6.2.3*. |
| Both CN4 jumpers OFF | ST-LINK/V2-1 functions enabled for external CN6 connector (SWD supported). See *Section 6.2.4*. |

### 6.2.1 Drivers

The ST-LINK/V2-1 requires a dedicated USB driver, which can be found on *www.st.com* for Windows® XP, 7, 8.

In case the STM32 Nucleo-144 board is connected to the PC before the driver is installed, some Nucleo interfaces may be declared as "Unknown" in the PC device manager. In this case the user must install the driver files (*Figure 6*), and from the device manager he must update the driver of the connected device.

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

**Figure 6. Updating the list of drivers in Device Manager**
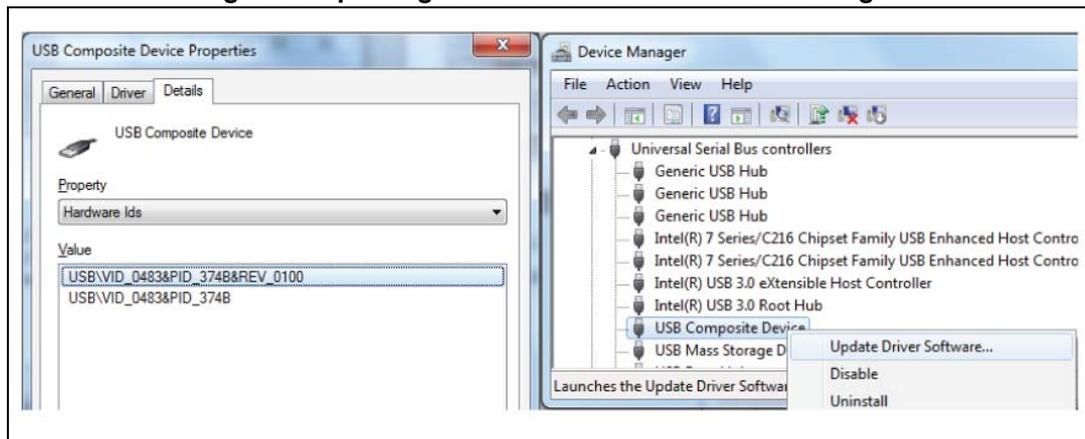


### 6.2.2 ST-LINK/V2-1 firmware upgrade

The ST-LINK/V2-1 embeds a firmware upgrade mechanism for in-situ upgrade through the USB port. As the firmware may evolve during the life time of the ST-LINK/V2-1 product (for example new functionalities, bug fixes, support for new microcontroller families), it is recommended to visit *www.st.com* before starting to use the STM32 Nucleo-144 board and periodically, in order to stay up-to-date with the latest firmware version.

### 6.2.3 Using the ST-LINK/V2-1 to program and debug the STM32 on board

To program the STM32 on board, place on the connector CN4 the two jumpers marked in red, as shown in *Figure 7*. The CN6 connector must not be used, since it could disturb the communication with the STM32 microcontroller of the Nucleo-144 board.

**Figure 7. Connecting the STM32 Nucleo-144 board to program the on-board STM32**
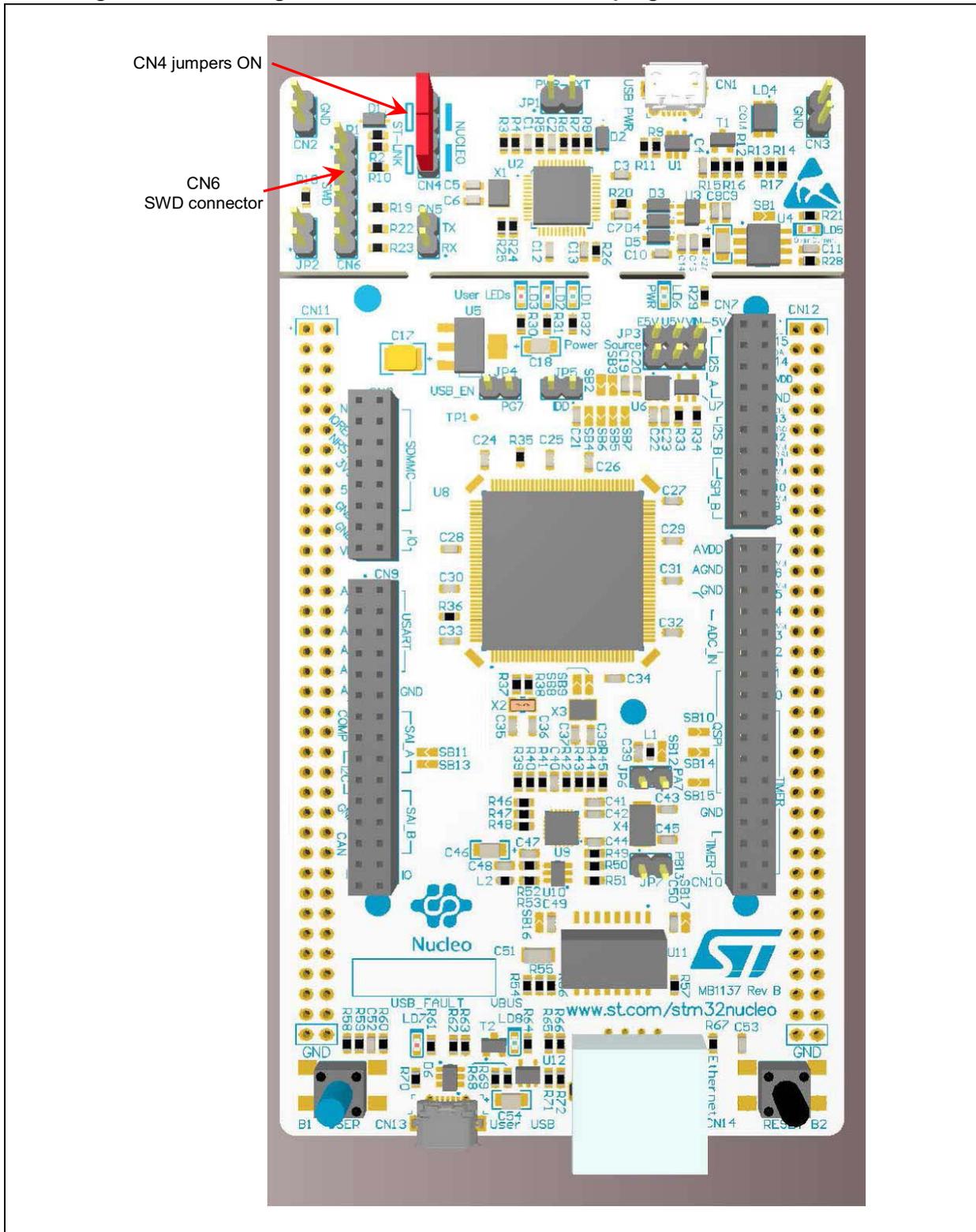
## 6.2.4 Using ST-LINK/V2-1 to program and debug an external STM32 application

It is very easy to use the ST-LINK/V2-1 to program the STM32 on an external application.

Simply remove the two jumpers from CN4, as shown in *Figure 8*, and connect the application to the CN6 debug connector according to *Table 4*.

*Note:* *SB111 NRST (target STM32 RESET) must be OFF when CN6 pin 5 is used in an external application.*

**Table 4. Debug connector CN6 (SWD)**

| Pin | CN6 | Designation |
|:---:|:---:|:---:|
| 1 | VDD_TARGET | VDD from application |
| 2 | SWCLK | SWD clock |
| 3 | GND | Ground |
| 4 | SWDIO | SWD data input/output |
| 5 | NRST | RESET of target STM32 |
| 6 | SWO | Reserved |

**Figure 8. Using ST-LINK/V2-1 to program the STM32 on an external application**
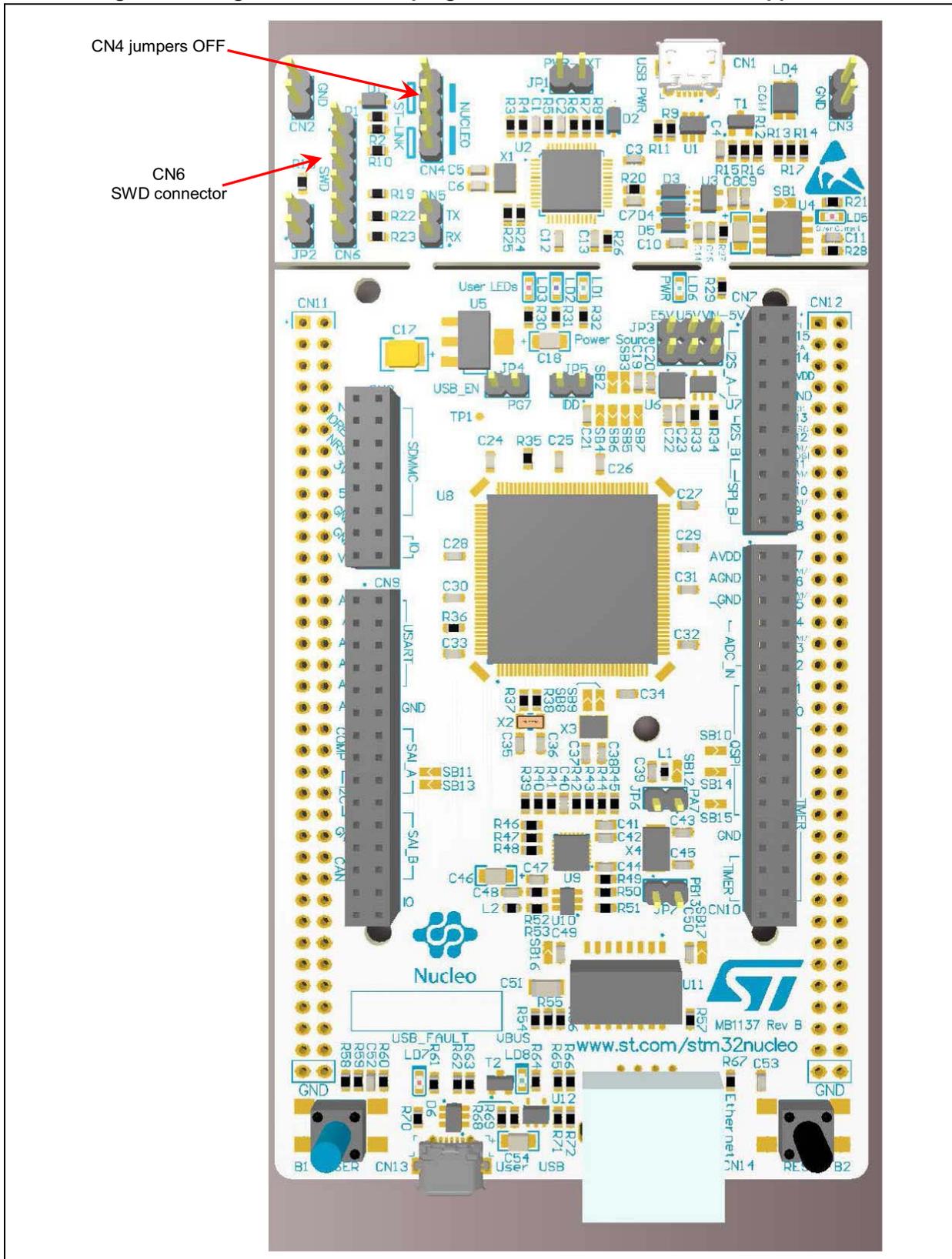
## 6.3 Power supply and power selection

The power supply is provided either by the host PC through the USB cable or by an external source: VIN (7V-12V), E5V (5V) or +3V3 power supply pins on CN8 or CN11. In case VIN, E5V or +3V3 is used to power the Nucleo-144 board, this power source must comply with the standard EN-60950-1: 2006+A11/2009 and must be Safety Extra Low Voltage (SELV) with limited power capability.

In case the power supply is +3V3, the ST-LINK is not powered and cannot be used.

### 6.3.1 Power supply input from ST-LINK/V2-1 USB connector

The STM32 Nucleo-144 board and shield can be powered from the ST-LINK USB connector CN1 (U5V), by placing a jumper between the pins 3 and 4 of JP3, as shown in *Table 7: Power related jumper*. Note that only the ST-LINK part is power supplied before the USB enumeration, as the host PC only provides 100 mA to the board at that time. During the USB enumeration, the STM32 Nucleo-144 board requires 300 mA of current to the host PC. If the host is able to provide the required power, the targeted STM32 microcontroller is powered and the green LED LD6 is turned ON, thus the STM32 Nucleo-144 board and its shield can consume a maximum of 300 mA current, not more. If the host is not able to provide the required current, the targeted STM32 microcontroller and the extension boards are not power supplied. As a consequence the green LED LD6 stays turned OFF. In such case it is mandatory to use an external power supply as explained in the next section.

After the USB enumeration succeeds, the ST-LINK U5V power is enabled, by asserting the PWR_EN pin. This pin is connected to a power switch (ST890), which powers the board. This power switch features also a current limitation to protect the PC in case of short-circuit on board. If an over current (more than 500 mA) happens on board, the red LED LD5 is lit.

JP1 is configured according to the maximum current consumption of the board when powered by USB (U5V). JP1 jumper can be set ON to inform the host PC that the maximum current consumption does not exceed 100 mA (including potential extension board or ST Zio shield). In such condition USB enumeration will always succeed, since no more than 100 mA is requested to the PC. Possible configurations of JP1 are summarized in *Table 5.*

**Table 5. JP1 configuration table**

| Jumper state | Power supply | Allowed current |
|---|---|---|
| JP1 jumper OFF | USB power through CN1 | 300mA max |
| JP1 jumper ON | | 100mA max |
| JP1 jumper (do not care) | VIN, +3V3, +5V power | For current limitation refer to *Table 7* |

**Warning:** **In case maximum the current consumption of the STM32 Nucleo-144 board and its shield boards exceed 300mA, it is mandatory to power the STM32 Nucleo-144 board, using an external power supply connected to E5V, VIN or +3V3.**

*Note:* *In case the board is powered by a USB charger, there is no USB enumeration, so the green LED LD6 stays in OFF state permanently and the target STM32 is not powered. In this*

*specific case the jumper JP1 needs to be set to ON, to allow the board to be powered anyway. But in any cases the current will be limited to 500 mA by U4 (ST890).*

## 6.3.2 External power supply inputs

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

When STM32 Nucleo-144 board is power supplied by VIN or E5V, the jumper configuration must be the following:

- Jumper JP3 on pin 1 and pin 2 for E5V or jumper JP3 on pin 5 and pin 6 for VIN
- Jumper JP1 OFF

**Table 6. External power sources**

| Input power name | Connector pins | Voltage range | Max current | Limitation |
|---|---|---|---|---|
| VIN | CN8 pin 15 CN11 pin 24 | 7V to 12V | 800mA | From 7V to 12V only and input current capability is linked to input voltage: 800mA input current when VIN=7V 450mA input current when 7V<VIN<9V 250mA input current when 9V<VIN<12V |
| E5V | CN11 pin 6 | 4.75V to 5.25V | 500mA | - |
| +3V3 | CN8 pin 7 CN11 pin 16 | 3V to 3.6V | - | Two possibilities: ST-LINK PCB is cut SB3 and SB111 OFF (ST-LINK not powered) |

The 5V power source is selected by the jumper JP3 as shown in *Table 7*.

**Table 7. Power related jumper**

| Jumper | Description |
|--------|-------------|
| JP3 | U5V (ST-LINK VBUS) is used as power source when JP3 is set as shown to the right (Default setting)<br><br>E5V U5V VIN-5V<br>2 ●  ● ● 6<br>1 ●  ● ● 5<br><br>E5V is used as power source when JP3 is set as shown to the right:<br><br>E5V U5V VIN-5V<br>2 ● ● ● 6<br>1 ● ● ● 5<br><br>VIN is used as power source when JP3 is set as shown to the right:<br><br>E5V U5V VIN-5V<br>2 ● ● ● 6<br>1 ● ● ● 5 |
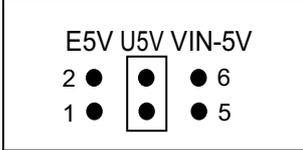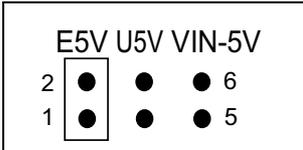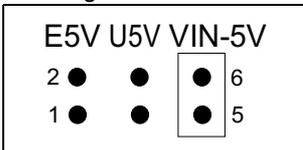
### Using VIN or E5V as an external power supply

When powered by VIN or E5V, it is still possible to use the ST-LINK for programming or debugging only, but it is mandatory to power the board first using VIN or E5V, then to connect the USB cable to the PC. By this way the enumeration will succeed anyway, thanks to the external power source.

The following power sequence procedure must be respected:

1. Connect jumper JP3 between pin 1 and pin 2 for E5V or between pin 5 and pin 6 for VIN
2. Check that JP1 is removed
3. Connect the external power source to VIN or E5V
4. Power on the external power supply 7V< VIN < 12V to VIN, or 5V for E5V
5. Check that the green LED LD6 is turned ON
6. Connect the PC to the USB connector CN1

If this order is not respected, the board may be powered by USB (U5V) first, then by VIN or E5V as the following risks may be encountered:

1. If more than 300 mA current is needed by the board, the PC may be damaged or the current supply can be limited by the PC. As a consequence the board is not powered correctly.
2. 300 mA is requested at enumeration (since JP1 must be OFF) so there is risk that the request is rejected and the enumeration does not succeed if the PC cannot provide such current. Consequently the board is not power supplied (LED LD6 remains OFF).

**External power supply input: + 3V3**

Using the +3V3 (CN8 pin 7 or CN11 pin 16) directly as power input, can be interesting, for instance, in case the 3.3 V is provided by a shield board. In this case, the ST-LINK is not powered thus the programming and debug features are not available.

Two different configurations are possible to use +3V3 to power the board:
- ST-LINK is removed (PCB cut)
- SB3 (3V3 regulator) and SB111 (NRST) are OFF.

## 6.3.3 External power supply output

When powered by USB, VIN or E5V, the +5V (CN8 pin 9 or CN11 pin 18) can be used as output power supply for a ST Zio shield or an extension board. In this case, the maximum current of the power source specified in *Table 6: External power sources* must be respected.

The +3.3 V (CN8 pin 7 or CN11 pin 16) can be used also as power supply output. The current is limited by the maximum current capability of the regulator U6 (500 mA max).

# 6.4 LEDs

**User LD1:** a green user LED is connected to STM32 I/O PB0 (SB120 ON and SB119 OFF) or PA5 (SB119 ON and SB120 OFF) corresponding to ST Zio D13.

**User LD2:** a blue user LED is connected to PB7.

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

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

**LD4 COM:** the tricolor LED (green, orange, red) LD4 provides information about ST-LINK communication status. LD4 default color is red. LD4 turns to green to indicate that communication is in progress between the PC and the ST-LINK/V2-1, with the following setup:
- Slow blinking red/off: at power-on before USB initialization
- Fast blinking red/off: after the first correct communication between PC and ST-LINK/V2-1 (enumeration)
- Red LED on: when the initialization between the PC and ST-LINK/V2-1 is complete
- Green LED on: after a successful target communication initialization
- Blinking red/green: during communication with target
- Green on: communication finished and successful
- Orange on: communication failure

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

**LD6 PWR:** the green LED indicates that the STM32 part is powered and +5V power is available on CN8 pin 9 and CN11 pin 18.

**LD7 and LD8 USB FS:** refer to *Section 6.9: USB FS OTG or device*.

## 6.5 Push buttons

**B1 USER:** the user button is connected to the I/O PC13 by default (Tamper support, SB173 ON and SB180 OFF) or PA0 (Wakeup support, SB180 ON and SB173 OFF) of the STM32 microcontroller.

**B2 RESET:** this push button is connected to NRST and is used to RESET the STM32 microcontroller.

## 6.6 JP5 (IDD)

Jumper JP5, labeled IDD, is used to measure the STM32 microcontroller consumption by removing the jumper and by connecting an ammeter.

- JP5 ON: STM32 is powered (default).
- JP5 OFF: an ammeter must be connected to measure STM32 current. If there is no ammeter, the STM32 is not powered.

In order to get a correct current consumption, Ethernet PHY should be set in power down mode or SB13 should be removed. Refer to *Section 6.10: Ethernet* for details.

## 6.7 OSC clock

### 6.7.1 OSC clock supply

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

- **MCO from ST-LINK (Default):** MCO output of ST-LINK is used as input clock. This frequency cannot be changed, it is fixed at 8 MHz and connected to PF0/PH0-OSC_IN of STM32 microcontroller. The following configuration is needed:
    - SB148 OFF
    - SB112 and SB149 ON
    - SB8 and SB9 OFF
- **HSE oscillator on-board from X3 crystal (not provided):** for typical frequencies and its capacitors and resistors, refer to STM32 microcontroller datasheet and to the AN2867 for oscillator design guide. The X3 crystal has the following characteristics: 8 MHz, 8 pF, 20 ppm. It is recommended to use NX3225GD-8.000M-EXS00A-CG04874 manufactured by NIHON DEMPA KOGYO CO., LTD. The following configuration is needed:
    - SB148 and SB163 OFF
    - SB8 and SB9 soldered
    - C37 and C38 soldered with 4.3 pF capacitors
    - SB112 and SB149 OFF
- **Oscillator from external PF0/PH0:** from an external oscillator through pin 29 of CN11 connector. The following configuration is needed:
    - SB148 ON
    - SB112 and SB149 OFF
    - SB8 and SB9 removed

• **HSE not used:** PF0/PH1 and PF1/PH1 are used as GPIOs instead of clock. The following configuration is needed:
  – SB148 and SB163 ON
  – SB112 and SB149 (MCO) OFF
  – SB8 and SB9 removed

### 6.7.2 OSC 32 KHz clock supply

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

• **On-board oscillator (Default):** X2 crystal. Refer to the AN2867 for oscillator design guide for STM32 microcontrollers. It is recommended to use NX3214SA-32.768KHZ-EXS00A-MU00525 (32.768KHz, 6pF load capacitance, 200ppm) from Nihon Dempa Kogyo CO, LTD.

*Note:*      *For STM32F0 and STM32F3 series it is recommended to use the low drive mode configuration of the LSE (low drive capability in LSEDRV register), due to the 6pF load capacitance of the crystal on board.*

• **Oscillator from external PC14:** from external oscillator through the pin 25 of CN11 connector. The following configuration is needed:
  – SB144 and SB145 ON
  – R37 and R38 removed

• **LSE not used:** PC14 and PC15 are used as GPIOs instead of low speed clock. The following configuration is needed:
  – SB144 and SB145 ON
  – R37 and R38 removed

## 6.8 USART communication

The USART3 interface available on PD8 and PD9 of the STM32 can be connected to ST-LINK or to ST morpho connector. The choice can be changed by setting the related solder bridges. By default the USART3 communication between the target STM32 and ST-LINK is enabled, in order to support Virtual Com Port for mbed (SB5 and SB6 ON).

**Table 8. USART3 pins**

| Pin name | Function | Virtual Com Port (default configuration) | ST morpho connection |
|----------|----------|-------------------------------------------|----------------------|
| PD8 | USART3 TX | SB5 ON and SB7 OFF | SB5 OFF and SB7 ON |
| PD9 | USART3 RX | SB6 ON and SB4 OFF | SB6 OFF and SB4 ON |

## 6.9 USB FS OTG or device

The STM32 Nucleo-144 board supports USB OTG or device full speed communication via a USB Micro-AB connector (CN13) and USB power switch (U12) connected to VBUS.

*Note:* *NUCLEO-F303ZE supports the USB device FS only. All the other STM32 Nucleo-144 support the USB OTG.*

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**Warning:** **USB Micro–AB connector (CN13) cannot power the Nucleo-144 board. In order to avoid damaging the STM32, it is mandatory to power the Nucleo-144 before connecting a USB cable on CN13. Otherwise there is a risk of current injection on STM32 IOs.**

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A green LED LD8 will be lit in one of these cases:

- Power switch (U12) is ON and STM32 Nucleo-144 board works as a USB host
- VBUS is powered by another USB host when STM32 Nucleo-144 board works as a USB device.

The red LED LD7 will be lit if over-current occurs when +5V is enabled on VBUS in USB host mode.

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

*2. JP4 must be closed when using USB OTG FS.*

NUCLEO-F303ZE does not support OTG function but it supports USB 2.0 full speed device mode communication via a USB Micro-AB connector (CN13). USB disconnection simulation can be implemented by PG6, which can control 1.5 K pull-up resistor (R70) on USB D+ line. Detection of 5 V power on USB connector (CN13) is available on PG7 thanks to R62 and R63 resistors bridge.

**Table 9. USB pins configuration**

| Pin name | Function | Configuration when using USB connector | Configuration when using ST morpho connector | Remark |
|---|---|---|---|---|
| PA8 | USB SOF | - | - | Test point TP1 |
| PA9 | USB VBUS | SB127 ON | SB127 OFF | Not on NUCLEO-F303ZE |
| PA10 | USB ID | SB125 ON | SB125 OFF | Not on NUCLEO-F303ZE |
| PA11 | USB DM | SB133 ON | SB133 OFF | - |
| PA12 | USB DP | SB132 ON | SB132 OFF | - |
| PG6 | USB GPIO OUT | NUCLEO-F303ZE: SB186 ON, SB187 OFF | NUCLEO-F303ZE: SB186 OFF | NUCLEO-F303ZE: D+ pull up control |
| | | All others Nucleo: SB186 OFF, SB187 ON | All others Nucleo: SB187 OFF | All others Nucleo: USB power switch control |

**Table 9. USB pins configuration (continued)**

| Pin name | Function | Configuration when using USB connector | Configuration when using ST morpho connector | Remark |
|---|---|---|---|---|
| PG7 | USB GPIO IN | NUCLEO-F303ZE: JP4 ON, SB184 ON, SB185 OFF | JP4 OFF | NUCLEO-F303ZE: VBUS detection |
| | | All others Nucleo: JP4 ON, SB184 OFF SB185 ON | | All others Nucleo: USB Over current alarm |

ESD protection part ESDA6V1BC6 is implemented on USB port because all USB pins on STM32 can be used as VBUS or GPIO on STM32 Nucleo-144 board.

*Note:*  *If these pins are dedicated to USB port only, the USBLC6-4SC6 protection part is more suitable to protect USB port. If USB pin ID is not used, USBLC6-2SC6 can be used.*

## 6.10  Ethernet

The STM32 Nucleo-144 board supports 10M/100M Ethernet communication by a PHY LAN8742A-CZ-TR (U9) and RJ45 connector (CN14). Ethernet PHY is connected to STM32 microcontroller via RMII interface. 50 MHz clock for the STM32 microcontroller is generated by the PHY RMII_REF_CLK.

*Note:*  *1. NUCLEO-F303ZE, and NUCLEO-F446ZE do not support Ethernet function.*

*2. JP6 and JP7 must be closed when using Ethernet.*

*3. Ethernet PHY LAN8742A should be set in power down mode (Ethernet PHY ref clock will be turned off in this mode) to achieve the expected low power mode current. This is done by configuring Ethernet PHY LAN8742A Basic Control Register (at address 0x00) Bit 11 (Power Down) to '1'. SB13 can be also removed to get the same effect.*

**Table 10. Ethernet pins**

| 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 | - | SB13 ON | SB13 OFF |
| PA2 | RMII MDIO | - | SB160 ON | SB160 OFF |
| PC1 | RMII MDC | - | SB164 ON | SB164 OFF |
| PA7 | RMII RX Data Valid | D11 | JP6 ON | JP6 OFF |
| PC4 | RMII RXD0 | - | SB178 ON | SB178 OFF |
| PC5 | RMII RXD1 | - | SB181 ON | SB181 OFF |
| PG11 | RMII TX Enable | - | SB183 ON | SB183 OFF |
| PG13 | RXII TXD0 | - | SB182 ON | SB182 OFF |
| PB13 | RMII TXD1 | I2S_A_CK | JP7 ON | JP7 OFF |

## 6.11 Solder bridges

SBxx can be found on top layer and SB1xx can be found on bottom layer.

**Table 11. Solder bridges**

| Bridge | State[1] | Description |
|---|---|---|
| SB2 (+3V3_PER) | **ON** | Peripheral power +3V3_PER is connected to +3V3. |
| | OFF | Peripheral power +3V3_PER is not connected. |
| SB3 (3.3V) | **ON** | Output of voltage regulator LD39050PU33R is connected to 3.3V. |
| | OFF | Output of voltage regulator LD39050PU33R is not connected. |
| SB7, SB4 (GPIO) | **ON** | PD8 and PD9 on STM32 are connected to ST morpho connectors CN11 and CN12. If these pins are used on ST morpho connectors, SB5 and SB6 should be OFF. |
| | OFF | PD8 and PD9 on STM32 are disconnected to ST morpho connectors CN11 and CN12. |
| SB5, SB6 (ST-LINK-USART) | **ON** | PA2 and PA3 on ST-LINK STM32F103CBT6 are connected to PD8 and PD9 to enable Virtual Com Port for mbed support. Thus PD8 and PD9 on ST morpho connectors cannot be used. |
| | OFF | PA2 and PA3 on ST-LINK STM32F103CBT6 are disconnected to PD8 and PD9 on STM32. |
| SB12 (VDDA) | **ON** | VDDA on STM32 is connected to VDD. |
| | OFF | VDDA on STM32 is not connected to VDD and can be provided from pin 7 of CN12 and pin 1 of CN10. |
| SB101,103,105,108 (DEFAULT) | **ON** | Reserved, do not modify. |
| SB102,104,106,109 (RESERVED) | **OFF** | Reserved, do not modify. |
| SB107 (STM_RST) | **OFF** | No incidence on ST-LINK STM32F103CBT6 NRST signal. |
| | ON | ST-LINK STM32F103CBT6 NRST signal is connected to GND (ST-LINK reset to reduce power consumption). |
| SB110 (SWO) | **ON** | SWO signal of the STM32 (PB3) is connected to ST-LINK SWO input. |
| | OFF | SWO signal of STM32 is not connected. |
| SB111 (NRST) | **ON** | Board RESET signal (NRST) is connected to ST-LINK reset control IO (T_NRST). |
| | OFF | Board RESET signal (NRST) is not connected to ST-LINK reset control IO (T_NRST). |
| SB113, SB114 (IOREF) | **OFF, ON** | IOREF is connected to +3V3. |
| | ON, OFF | IOREF is connected to +3V3_PER. |
| SB116 (SDMMC_D0), SB117 (SDMMC_D1) | **ON** | These pins are connected to ST morpho connector CN12. |
| | OFF | These pins are disconnected from ST morpho connector CN12 to avoid stub of SDMMC data signals on PCB. |

**Table 11. Solder bridges (continued)**

| Bridge | State[1] | Description |
|---|---|---|
| SB120, SB119 (LD1-LED) | **ON, OFF** | Green user LED LD1 is connected to PB0. |
| | OFF,ON | Green user LED LD1 is connected to D13 of Arduino signal (PA5). |
| | OFF, OFF | Green user LED LD1 is not connected. |
| | ON,ON | Forbidden |
| SB139 (LD2-LED) | **ON** | Blue user LED LD2 is connected to PB7. |
| | OFF | Blue user LED LD2 is not connected. |
| SB118 (LD3-LED) | **ON** | Red user LED LD3 is connected to PB14. |
| | OFF | Red user LED LD3 is not connected. |
| SB121, SB122 (D11) | **ON, OFF** | D11 (Pin 14 of CN7) is connected to STM32 PA7 (SPI_A_MOSI/TIM_E_PWM1). |
| | OFF,ON | D11 (Pin 14 of CN7) is connected to STM32 PB5 (SPI_A_MOSI/TIM_D_PWM2). |
| SB144,145 (X2 crystal) | **OFF** | PC14, PC15 are not connected to ST morpho connector CN11. (X2 used to generate 32 KHz clock). |
| | ON | PC14, PC15 are connected to ST morpho connector CN11. (R37 and R38 should be removed). |
| SB148 (PF0/PH0), SB163 (PF1/PH1) (Main clock) | **OFF, ON** | PF0/PH0 is not connected to ST morpho PF1/PH1 is connected to ST morpho connector CN11 (MCO is used as main clock for STM32 on PF0/PH0). |
| | OFF, OFF | PF0/PH0, PF1/PH1 are not connected to ST morpho connector CN11 (X3, C37, C38, SB8 and SB9 provide a clock as shown in *Section 7: Electrical schematics*. In this case SB149 must be removed). |
| | ON, ON | PF0/PH0 and PF1/PH1 are connected to ST morpho connector CN11. (SB8, SB9 and SB149 must be removed). |
| SB112, SB149 (MCO) | **ON** | MCO of ST-LINK (STM32F103CBT6) is connected to PF0/PH0 of STM32. |
| | OFF | MCO of ST-LINK (STM32F103CBT6) is not connected to PF0/PH0 of STM32. |
| SB8, SB9 (external 8M crystal) | **OFF** | PF0/PH0 and PF1/PH1 are not connected to external 8 MHz crystal X3. |
| | ON | PF0/PH0 and PF1/PH1 are connected to external 8 MHz crystal X3. |
| SB156 (VBAT) | **ON** | VBAT pin of STM32 is connected to VDD. |
| | OFF | VBAT pin of STM32 is not connected to VDD. |
| SB173, SB180 (B1-USER) | **ON, OFF** | B1 pushbutton is connected to PC13. |
| | OFF,ON | B1 pushbutton is connected to PA0 (Set SB179 OFF if ST Zio connector is used). |
| | OFF,OFF | B1 pushbutton is not connected. |
| SB179 (PA0) | **ON** | PA0 is connected to ST Zio connector (Pin 29 of CN10) |
| | OFF | PA0 is not connected to ST Zio connector (Pin 29 of CN10) |

**Table 11. Solder bridges (continued)**

| Bridge | State[1] | Description |
|---|---|---|
| SB142, SB152 (BOOT1, Only for F2 and F4 series) | **OFF, OFF** | BOOT1 (PB2) function is not used. |
| | ON, OFF | BOOT1 (PB2) is pulled up. |
| | OFF,ON | BOOT1 (PB2) is pulled down. |
| | ON, ON | Forbidden |
| SB147,SB157 (A4 and A5) Or SB167, SB171 (only for NUCLEO-F303ZE) | **ON** | ADC_IN are connected to A4 and A5 (pin 9 and 11) on ST Zio connector CN9. Thus SB138 and SB143 must be OFF. |
| | OFF | ADC_IN are not connected to A4 and A5 (pin 9 and 11) on ST Zio connector CN9. |
| SB138,SB143 (I2C on A4 and A5) | **OFF** | PB9 and PB8 (I2C) are not connected to A4 and A5 (pin 9 and 11) on ST Zio connector CN9. |
| | ON | PB9 and PB8 (I2C) are connected to A4 and A5 (pin 9 and 11) on ST Zio connector CN9. Thus SB147 and SB157 (or SB167 and SB171 for NUCLEO-F303ZE) must be OFF. |
| RMII Signals SB13 (PA1), SB164 (PC1), SB160 (PA2), SB178 (PC4), SB181 (PC5), SB182 (PG13), SB183 (PG11) | **ON** | These pins are used as RMII signals and connected to Ethernet PHY. **These port must not be used on ST morpho or ST Zio connectors.** |
| | OFF | These pins are used as GPIOs on ST morpho connectors and not connected to Ethernet PHY. |
| SB177 (Ethernet nRST) | **ON** | NRST of STM32 is connected to Ethernet PHY (U9). |
| | OFF | NRST of STM32 is not connected to Ethernet PHY (U9). |
| USB signals: SB186 (NUCLEO-F303ZE) or SB187 (all others Nucleo) (PG6) | **ON** | PG6 is connected to R70 to control USB D+ pull up (NUCLEO-F303ZE) PG6 is connected to 5V switch Enable (U12) to control VBUS or CN13 (All other NUCLEO). |
| | OFF | This pin is used as GPIO on ST morpho connectors. |
| SB132 (PA12), SB133 (PA11) | **ON** | These pins are used as D+ and D- on USB connector CN13. |
| | OFF | These pins are used as GPIOs on ST morpho connectors. |

1. Default SBx state is shown in bold.

All the other solder bridges present on the STM32 Nucleo-144 board are used to configure several IOs and power supply pins for compatibility of features and pinout with STM32 supported.

All STM32 Nucleo-144 boards are delivered with the solder-bridges configured according to the target STM32 supported.

## 6.12    Extension connectors

The following figures show the signals connected by default to ST Zio (including support for Arduino Uno Revision 3) connectors (CN7, CN8, CN9, CN10), for each STM32 Nucleo-144 board.

**Figure 9. NUCLEO-F746ZG/F429ZI/F207ZG**
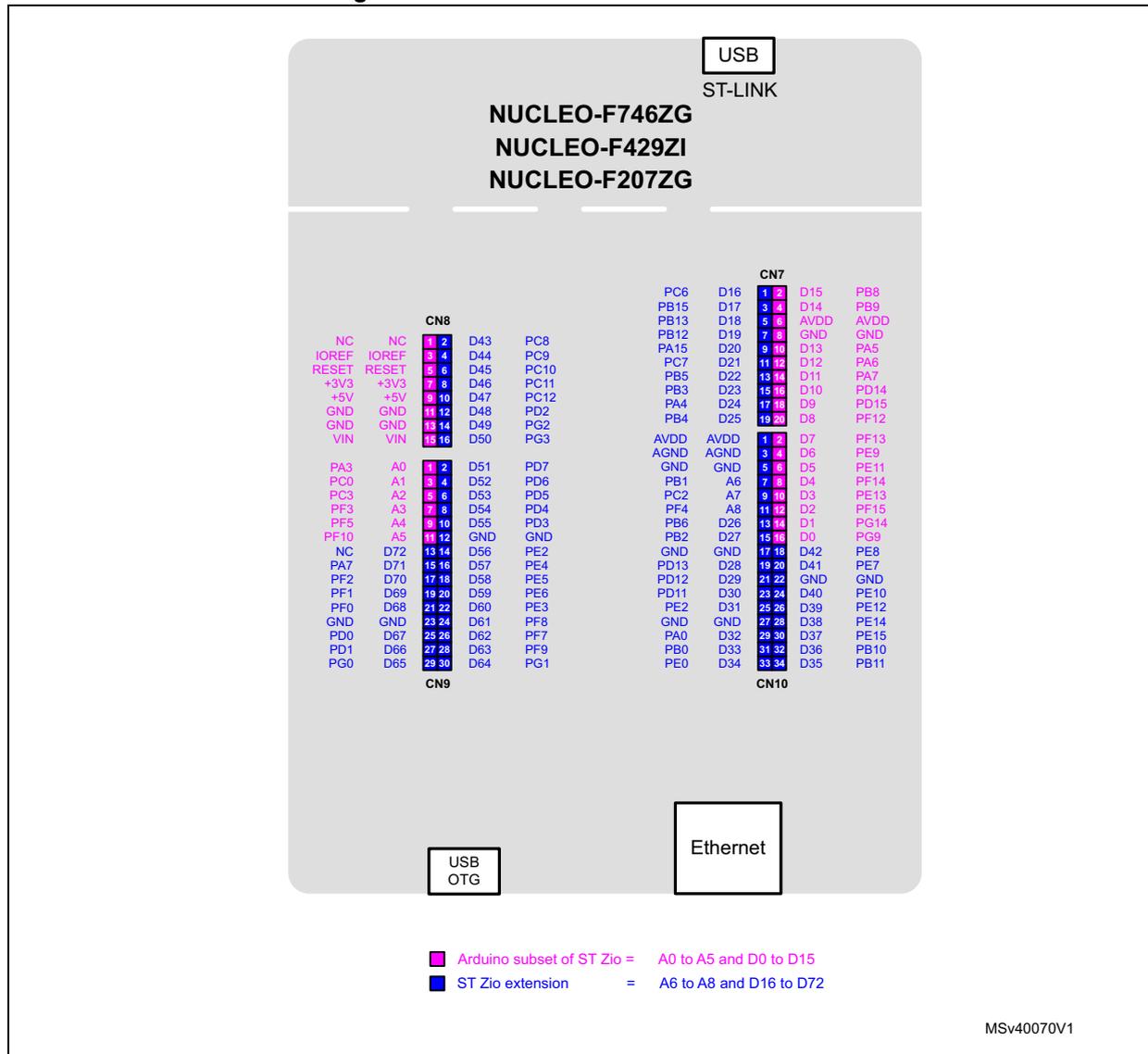
## Figure 10. NUCLEO-F303ZE
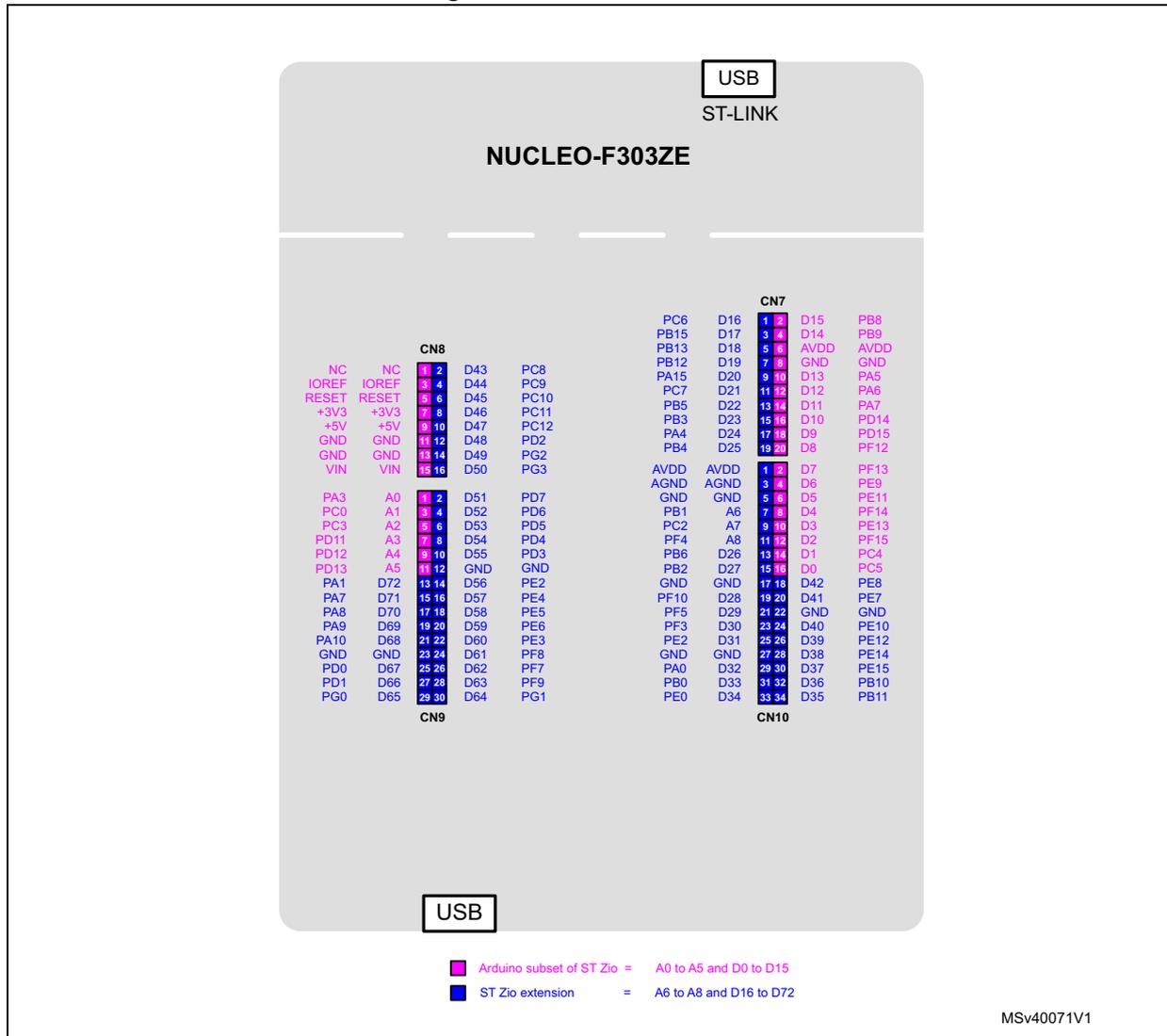
**Figure 11. NUCLEO-F446ZE**
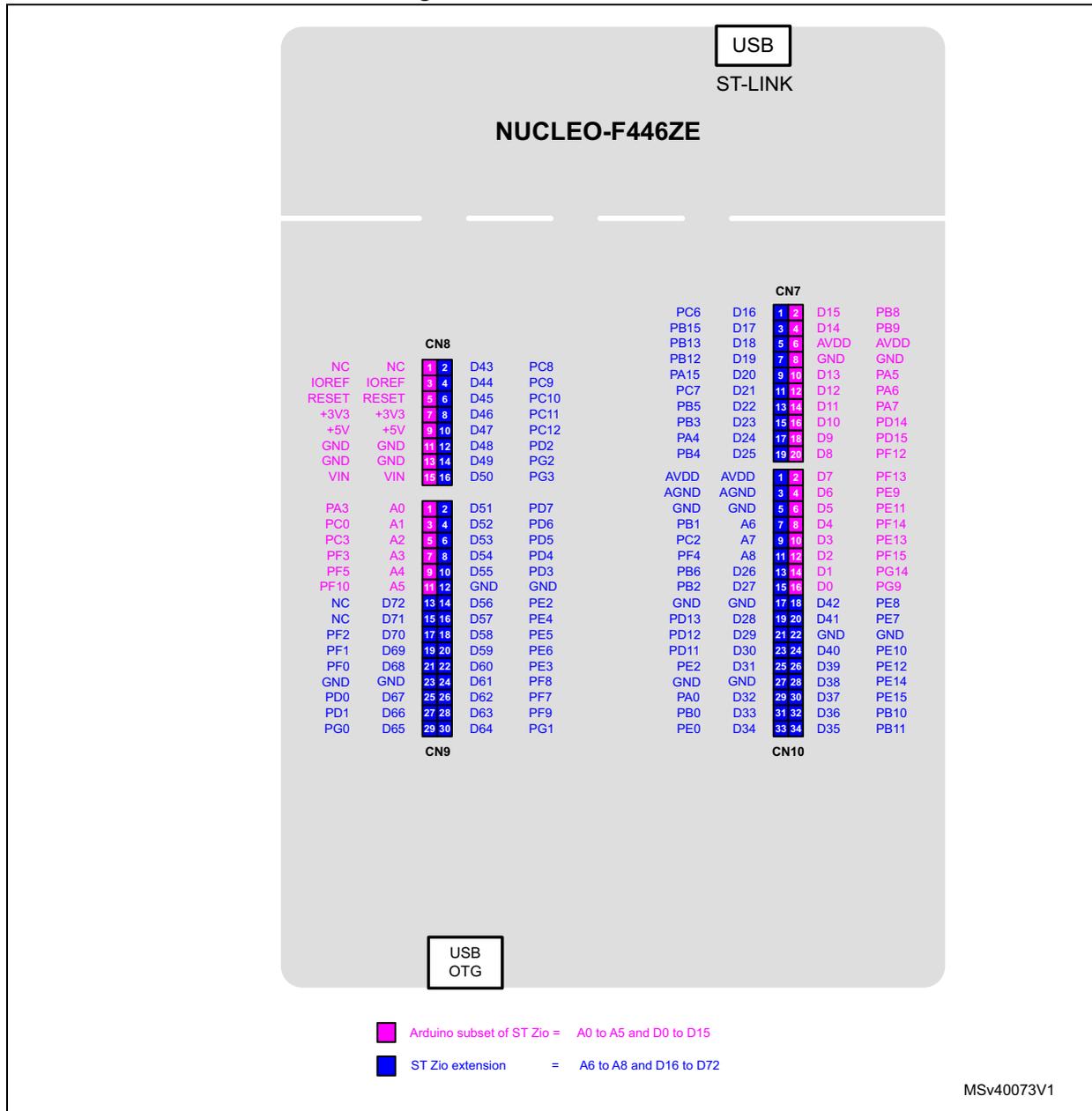


## 6.13 ST Zio connectors

CN7, CN8, CN9 and CN10 are female on top side and male on bottom side connectors. They include support for Arduino Uno Revision 3. Most shields designed for Arduino Uno can fit to the STM32 Nucleo-144 boards.

To cope with Arduino Uno Revision 3, apply the following modifications:

• SB138 and SB143 should be ON
• SB140/147/150/157/167/171 should be OFF to connect I2C on A4 (pin 5) and A5 (pin 6 of CN8).

**Caution:** The IOs of STM32 microcontroller are 3.3 V compatible instead of 5 V for Arduino Uno.

*Table 12* to *Table 16* show the pin assignment for each main STM32 microcontroller on ST Zio connectors.

**Table 12. NUCLEO-F746ZG pin assignments**

| Connector | Pin | Pin name | Signal name | STM32 pin | Function | Remark |
|---|---|---|---|---|---|---|
| Left connectors | | | | | | |
| CN8 | 1 | NC | NC | - | - | Arduino support |
| | 3 | IOREF | IOREF | - | 3.3V Ref | |
| | 5 | RESET | RESET | NRST | RESET | |
| | 7 | +3V3 | +3V3 | - | 3.3V input/output | |
| | 9 | +5V | +5V | - | 5V output | |
| | 11 | GND | GND | - | Ground | |
| | 13 | GND | GND | - | Ground | |
| | 15 | VIN | VIN | - | Power input | |
| | 2 | D43 | SDMMC_D0 | PC8 | SDMMC/I2S_A | - |
| | 4 | D44 | SDMMC_D1/ I2S_A_CKIN | PC9 | | |
| | 6 | D45 | SDMMC_D2 | PC10 | | |
| | 8 | D46 | SDMMC_D3 | PC11 | | |
| | 10 | D47 | SDMMC_CK | PC12 | | |
| | 12 | D48 | SDMMC_CMD | PD2 | | |
| | 14 | D49 | I/O | PG2 | I/O | |
| | 16 | D50 | I/O | PG3 | | |
| CN9 | 1 | A0 | ADC | PA3 | ADC123_IN3 | Arduino support |
| | 3 | A1 | ADC | PC0 | ADC123_IN10 | |
| | 5 | A2 | ADC | PC3 | ADC123_IN13 | |
| | 7 | A3 | ADC | PF3 | ADC3_IN9 | |
| | 9 | A4 | ADC | PF5 or PB9[1] | ADC3_IN15 (PF5) or I2C1_SDA (PB9) | |
| | 11 | A5 | ADC | PF10 or PB8[1] | ADC3_IN8 (PF10) or I2C1_SCL (PB8) | |

**Table 12. NUCLEO-F746ZG pin assignments (continued)**

| Connector | Pin | Pin name | Signal name | STM32 pin | Function | Remark |
|---|---|---|---|---|---|---|
| CN9 | 13 | D72 | NC | - | - | - |
| | 15 | D71 | I/O | PA7[2] | I/O | |
| | 17 | D70 | I2C_B_SMBA | PF2 | I2C_2 | |
| | 19 | D69 | I2C_B_SCL | PF1 | | |
| | 21 | D68 | I2C_B_SDA | PF0 | | |
| | 23 | GND | GND | - | Ground | |
| | 25 | D67 | CAN_RX | PD0 | CAN_1 | |
| | 27 | D66 | CAN_TX | PD1 | | |
| | 29 | D65 | I/O | PG0 | I/O | |
| | 2 | D51 | USART_B_SCLK | PD7 | USART_2 | |
| | 4 | D52 | USART_B_RX | PD6 | | |
| | 6 | D53 | USART_B_TX | PD5 | | |
| | 8 | D54 | USART_B_RTS | PD4 | | |
| | 10 | D55 | USART_B_CTS | PD3 | | |
| | 12 | GND | GND | - | Ground | |
| | 14 | D56 | SAI_A_MCLK | PE2[3] | SAI_1_A | |
| | 16 | D57 | SAI_A_FS | PE4 | | |
| | 18 | D58 | SAI_A_SCK | PE5 | | |
| | 20 | D59 | SAI_A_SD | PE6 | | |
| | 22 | D60 | SAI_B_SD | PE3 | SAI_1_B | |
| | 24 | D61 | SAI_B_SCK | PF8 | | |
| | 26 | D62 | SAI_B_MCLK | PF7 | | |
| | 28 | D63 | SAI_B_FS | PF9 | | |
| | 30 | D64 | I/O | PG1 | I/O | |
| Right Connectors | | | | | | |
| CN7 | 1 | D16 | I2S_A_MCK | PC6 | I2S_2 | - |
| | 3 | D17 | I2S_A_SD | PB15 | | |
| | 5 | D18 | I2S_A_CK | PB13[4] | | |
| | 7 | D19 | I2S_A_WS | PB12 | | |
| | 9 | D20 | I2S_B_WS | PA15 | I2S_3 / SPI3 | |
| | 11 | D21 | I2S_B_MCK | PC7 | | |
| | 13 | D22 | I2S_B_SD/ SPI_B_MOSI | PB5 | | |
| | 15 | D23 | I2S_B_CK/ SPI_B_SCK | PB3 | | |
| | 17 | D24 | SPI_B_NSS | PA4 | | |
| | 19 | D25 | SPI_B_MISO | PB4 | | |
| | 2 | D15 | I2C_A_SCL | PB8 | I2C1_SCL | Arduino support |

**Table 12. NUCLEO-F746ZG pin assignments (continued)**

| Connector | Pin | Pin name | Signal name | STM32 pin | Function | Remark |
|---|---|---|---|---|---|---|
| CN7 | 4 | D14 | I2C_A_SDA | PB9 | I2C1_SDA | |
| | 6 | AREF | AREF | - | AVDD | |
| | 8 | GND | GND | - | Ground | |
| | 10 | D13 | SPI_A_SCK | PA5 | SPI1_SCK | |
| | 12 | D12 | SPI_A_MISO | PA6 | SPI1_MISO | |
| | 14 | D11 | SPI_A_MOSI/ TIM_E_PWM1 | PA7[1][2] or PB5[1] | SPI1_MOSI/ TIM14_CH1 | |
| | 16 | D10 | SPI_A_CS/ TIM_B_PWM3 | PD14 | SPI1_CS/ TIM4_CH3 | |
| | 18 | D9 | TIMER_B_PWM2 | PD15 | TIM4_CH4 | |
| | 20 | D8 | I/O | PF12 | - | |
| CN10 | 1 | AVDD | AVDD | - | Analog VDD | - |
| | 3 | AGND | AGND | - | Analog Ground | |
| | 5 | GND | GND | - | Ground | |
| | 7 | A6 | ADC_A_IN | PB1 | ADC12_IN9 | |
| | 9 | A7 | ADC_B_IN | PC2 | ADC123_IN12 | |
| | 11 | A8 | ADC_C_IN | PF4 | ADC3_IN14 | |
| | 13 | D26 | QSPI_CS | PB6 | QSPI_BK1 | |
| | 15 | D27 | QSPI_CLK | PB2 | QSPI_CLK | |
| | 17 | GND | GND | - | Ground | |
| | 19 | D28 | QSPI_BK1_IO3 | PD13 | QSPI_BK1 | |
| | 21 | D29 | QSPI_BK1_IO1 | PD12 | | |
| | 23 | D30 | QSPI_BK1_IO0 | PD11 | | |
| | 25 | D31 | QSPI_BK1_IO2 | PE2[3] | | |
| | 27 | GND | GND | - | Ground | |
| | 29 | D32 | TIMER_C_PWM1 | PA0 | TIM2_CH1 | |
| | 31 | D33 | TIMER_D_PWM1 | PB0 | TIM3_CH3 | |
| | 33 | D34 | TIMER_B_ETR | PE0 | TIM4_ETR | |
| | 2 | D7 | I/O | PF13 | - | Arduino support |
| | 4 | D6 | TIMER_A_PWM1 | PE9 | TIM1_CH1 | |
| | 6 | D5 | TIMER_A_PWM2 | PE11 | TIM1_CH2 | |
| | 8 | D4 | I/O | PF14 | - | |
| | 10 | D3 | TIMER_A_PWM3 | PE13 | TIM1_CH3 | |
| | 12 | D2 | I/O | PF15 | - | |
| | 14 | D1 | USART_A_TX | PG14 | USART6 | |
| | 16 | D0 | USART_A_RX | PG9 | | |
| | 18 | D42 | TIMER_A_PWM1N | PE8 | TIM1_CH1N | - |
| | 20 | D41 | TIMER_A_ETR | PE7 | TIM1_ETR | |
| | 22 | GND | GND | - | Ground | |

**Table 12. NUCLEO-F746ZG pin assignments (continued)**

| Connector | Pin | Pin name | Signal name | STM32 pin | Function | Remark |
|-----------|-----|----------|-------------|-----------|----------|--------|
| CN10 | 24 | D40 | TIMER_A_PWM2N | PE10 | TIM1_CH2N | - |
| | 26 | D39 | TIMER_A_PWM3N | PE12 | TIM1_CH3N | |
| | 28 | D38 | I/O | PE14 | I/O | |
| | 30 | D37 | TIMER_A_BKIN1 | PE15 | TIM1_BKIN1 | |
| | 32 | D36 | TIMER_C_PWM2 | PB10 | TIM2_CH3 | |
| | 34 | D35 | TIMER_C_PWM3 | PB11 | TIM2_CH4 | |

1. Refer to *Table 11: Solder bridges* for details.

2. PA7 is used as D11 and connected to CN7 pin 14 by default, if JP6 is ON, it is also connected to both Ethernet PHY as RMII_DV and CN9 pin 15. In this case only one function of Ethernet or D11 could be used.

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

4. PB13 is used as I2S_A_CK and connected to CN7 pin 5 by default, if JP7 is ON, it is also connected to Ethernet PHY as RMII_TXD1. In this case only one function of Ethernet or I2S_A could be used.

**Table 13. NUCLEO-F446ZE pin assignments**

| Connector | Pin | Pin name | Signal name | STM32 pin | Function | Remark |
|-----------|-----|----------|-------------|-----------|----------|--------|
| Left connectors | | | | | | |
| CN8 | 1 | NC | NC | - | - | Arduino support |
| | 3 | IOREF | IOREF | - | 3.3V Ref | |
| | 5 | RESET | RESET | NRST | RESET | |
| | 7 | +3V3 | +3V3 | - | 3.3V input/output | |
| | 9 | +5V | +5V | - | 5V output | |
| | 11 | GND | GND | - | Ground | |
| | 13 | GND | GND | - | Ground | |
| | 15 | VIN | VIN | - | Power input | |
| | 2 | D43 | SDMMC_D0 | PC8 | SDMMC/I2S_A | - |
| | 4 | D44 | SDMMC_D1/ I2S_A_CKIN | PC9 | | |
| | 6 | D45 | SDMMC_D2 | PC10 | | |
| | 8 | D46 | SDMMC_D3 | PC11 | | |
| | 10 | D47 | SDMMC_CK | PC12 | | |
| | 12 | D48 | SDMMC_CMD | PD2 | | |
| | 14 | D49 | I/O | PG2 | I/O | |
| | 16 | D50 | I/O | PG3 | | |

**Table 13. NUCLEO-F446ZE pin assignments (continued)**

| Connector | Pin | Pin name | Signal name | STM32 pin | Function | Remark |
|---|---|---|---|---|---|---|
| CN9 | 1 | A0 | ADC | PA3 | ADC123_IN3 | Arduino support |
| | 3 | A1 | ADC | PC0 | ADC123_IN10 | |
| | 5 | A2 | ADC | PC3 | ADC123_IN13 | |
| | 7 | A3 | ADC | PF3 | ADC3_IN9 | |
| | 9 | A4 | ADC | PF5 or PB9[1] | ADC3_IN15 (PF5) or I2C1_SDA (PB9) | |
| | 11 | A5 | ADC | PF10 or PB8[1] | ADC3_IN8 (PF10) or I2C1_SCL (PB8) | |
| | 13 | D72 | NC | - | - | - |
| | 15 | D71 | NC | | | |
| | 17 | D70 | I2C_B_SMBA | PF2 | I2C_2 | |
| | 19 | D69 | I2C_B_SCL | PF1 | | |
| | 21 | D68 | I2C_B_SDA | PF0 | | |
| | 23 | GND | GND | - | Ground | |
| | 25 | D67 | CAN_RX | PD0 | CAN_1 | |
| | 27 | D66 | CAN_TX | PD1 | | |
| | 29 | D65 | I/O | PG0 | I/O | |
| CN9 | 2 | D51 | USART_B_SCLK | PD7 | USART_2 | - |
| | 4 | D52 | USART_B_RX | PD6 | | |
| | 6 | D53 | USART_B_TX | PD5 | | |
| | 8 | D54 | USART_B_RTS | PD4 | | |
| | 10 | D55 | USART_B_CTS | PD3 | | |
| | 12 | GND | GND | - | Ground | |
| | 14 | D56 | SAI_A_MCLK | PE2[2] | SAI_1_A | |
| | 16 | D57 | SAI_A_FS | PE4 | | |
| | 18 | D58 | SAI_A_SCK | PE5 | | |
| | 20 | D59 | SAI_A_SD | PE6 | | |
| | 22 | D60 | SAI_B_SD | PE3 | SAI_1_B | |
| | 24 | D61 | SAI_B_SCK | PF8 | | |
| | 26 | D62 | SAI_B_MCLK | PF7 | | |
| | 28 | D63 | SAI_B_FS | PF9 | | |
| | 30 | D64 | I/O | PG1 | I/O | |
| Right Connectors | | | | | | |
| CN7 | 1 | D16 | I2S_A_MCK | PC6 | I2S_2 | - |
| | 3 | D17 | I2S_A_SD | PB15 | | |

**Table 13. NUCLEO-F446ZE pin assignments (continued)**

| Connector | Pin | Pin name | Signal name | STM32 pin | Function | Remark |
|---|---|---|---|---|---|---|
| CN7 | 3 | D17 | I2S_A_SD | PB15 | I2S_2 | - |
| | 5 | D18 | I2S_A_CK | PB13 | | |
| | 7 | D19 | I2S_A_WS | PB12 | | |
| | 9 | D20 | I2S_B_WS | PA15 | I2S_3 / SPI3 | |
| | 11 | D21 | I2S_B_MCK | PC7 | | |
| | 13 | D22 | I2S_B_SD/ SPI_B_MOSI | PB5 | | |
| | 15 | D23 | I2S_B_CK/ SPI_B_SCK | PB3 | | |
| | 17 | D24 | SPI_B_NSS | PA4 | | |
| | 19 | D25 | SPI_B_MISO | PB4 | | |
| | 2 | D15 | I2C_A_SCL | PB8 | I2C1_SCL | Arduino support |
| | 4 | D14 | I2C_A_SDA | PB9 | I2C1_SDA | |
| | 6 | AREF | AREF | - | AVDD | |
| | 8 | GND | GND | - | Ground | |
| | 10 | D13 | SPI_A_SCK | PA5 | SPI1_SCK | |
| | 12 | D12 | SPI_A_MISO | PA6 | SPI1_MISO | |
| | 14 | D11 | SPI_A_MOSI/ TIM_E_PWM1 | PA7[1] or PB5[1] | SPI1_MOSI/ TIM14_CH1 | |
| | 16 | D10 | SPI_A_CS/ TIM_B_PWM3 | PD14 | SPI1_CS/ TIM4_CH3 | |
| | 18 | D9 | TIMER_B_PWM2 | PD15 | TIM4_CH4 | |
| | 20 | D8 | I/O | PF12 | - | |
| CN10 | 1 | AVDD | AVDD | - | Analog VDD | - |
| | 3 | AGND | AGND | - | Analog Ground | |
| | 5 | GND | GND | - | Ground | |
| | 7 | A6 | ADC_A_IN | PB1 | ADC12_IN9 | |
| | 9 | A7 | ADC_B_IN | PC2 | ADC123_IN12 | |
| | 11 | A8 | ADC_C_IN | PF4 | ADC3_IN14 | |
| | 13 | D26 | QSPI_CS | PB6 | QSPI_BK1 | |
| | 15 | D27 | QSPI_CLK | PB2 | QSPI_CLK | |
| | 17 | GND | GND | - | Ground | |

**Table 13. NUCLEO-F446ZE pin assignments (continued)**

| Connector | Pin | Pin name | Signal name | STM32 pin | Function | Remark |
|---|---|---|---|---|---|---|
| CN10 | 19 | D28 | QSPI_BK1_IO3 | PD13 | QSPI_BK1 | - |
| | 21 | D29 | QSPI_BK1_IO1 | PD12 | | |
| | 23 | D30 | QSPI_BK1_IO0 | PD11 | | |
| | 25 | D31 | QSPI_BK1_IO2 | PE2[2] | | |
| | 27 | GND | GND | - | Ground | |
| | 29 | D32 | TIMER_C_PWM1 | PA0 | TIM2_CH1 | |
| | 31 | D33 | TIMER_D_PWM1 | PB0 | TIM3_CH3 | |
| | 33 | D34 | TIMER_B_ETR | PE0 | TIM4_ETR | |
| | 2 | D7 | I/O | PF13 | - | Arduino support |
| | 4 | D6 | TIMER_A_PWM1 | PE9 | TIM1_CH1 | |
| | 6 | D5 | TIMER_A_PWM2 | PE11 | TIM1_CH2 | |
| | 8 | D4 | I/O | PF14 | - | |
| | 10 | D3 | TIMER_A_PWM3 | PE13 | TIM1_CH3 | |
| | 12 | D2 | I/O | PF15 | - | |
| | 14 | D1 | USART_A_TX | PG14 | USART6 | |
| | 16 | D0 | USART_A_RX | PG9 | | |
| | 18 | D42 | TIMER_A_PWM1N | PE8 | TIM1_CH1N | - |
| | 20 | D41 | TIMER_A_ETR | PE7 | TIM1_ETR | |
| | 22 | GND | GND | - | Ground | |
| | 24 | D40 | TIMER_A_PWM2N | PE10 | TIM1_CH2N | |
| | 26 | D39 | TIMER_A_PWM3N | PE12 | TIM1_CH3N | |
| | 28 | D38 | I/O | PE14 | I/O | |
| | 30 | D37 | TIMER_A_BKIN1 | PE15 | TIM1_BKIN1 | |
| | 32 | D36 | TIMER_C_PWM2 | PB10 | TIM2_CH3 | |
| | 34 | D35 | TIMER_C_PWM3 | PB11 | TIM2_CH4 | |

1. Refer to *Table 11: Solder bridges* for details.

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

**Table 14. NUCLEO-F303ZE pin assignments**

| Connector | Pin | Pin name | Signal name | STM32 pin | Function | Remark |
|---|---|---|---|---|---|---|
| Left connectors | | | | | | |
| CN8 | 1 | NC | NC | - | - | Arduino support |
| | 3 | IOREF | IOREF | - | 3.3V Ref | |
| | 5 | RESET | RESET | NRST | RESET | |
| | 7 | +3V3 | +3V3 | - | 3.3V input/output | |
| | 9 | +5V | +5V | - | 5V output | |
| | 11 | GND | GND | - | Ground | |
| | 13 | GND | GND | - | Ground | |
| | 15 | VIN | VIN | - | Power input | |
| | 2 | D43 | I/O | PC8 | I/O | - |
| | 4 | D44 | I2S_A_CKIN | PC9 | I2S_A | |
| | 6 | D45 | I/O | PC10 | I/O | |
| | 8 | D46 | I/O | PC11 | | |
| | 10 | D47 | I/O | PC12 | | |
| | 12 | D48 | I/O | PD2 | | |
| | 14 | D49 | I/O | PG2 | I/O | |
| | 16 | D50 | I/O | PG3 | | |
| CN9 | 1 | A0 | ADC | PA3 | ADC1_IN4 | Arduino support |
| | 3 | A1 | ADC | PC0 | ADC12_IN6 | |
| | 5 | A2 | ADC | PC3 | ADC12_IN9 | |
| | 7 | A3 | ADC | PD11 | ADC34_IN8 | |
| | 9 | A4 | ADC | PD12 or PB9[1] | ADC34_IN9 (PD12) or I2C1_SDA (PB9) | |
| | 11 | A5 | ADC | PD13 or PB8[1] | ADC34_IN10 (PD13) or I2C1_SCL (PB8) | |
| | 13 | D72 | COMP1_INP | PA1 | COMP | - |
| | 15 | D71 | COMP2_INP | PA7[2] | | |
| | 17 | D70 | I2C_B_SMBA | PA8 | I2C_2 | |
| | 19 | D69 | I2C_B_SCL | PA9 | | |
| | 21 | D68 | I2C_B_SDA | PA10 | | |
| | 23 | GND | GND | - | Ground | |
| | 25 | D67 | CAN_RX | PD0 | CAN_1 | |
| | 27 | D66 | CAN_TX | PD1 | | |
| | 29 | D65 | I/O | PG0 | I/O | |

**Table 14. NUCLEO-F303ZE pin assignments (continued)**

| Connector | Pin | Pin name | Signal name | STM32 pin | Function | Remark |
|-----------|-----|----------|-------------|-----------|----------|--------|
| CN9 | 2 | D51 | USART_B_SCLK | PD7 | USART_2 | - |
| | 4 | D52 | USART_B_RX | PD6 | | |
| | 6 | D53 | USART_B_TX | PD5 | | |
| | 8 | D54 | USART_B_RTS | PD4 | | |
| | 10 | D55 | USART_B_CTS | PD3 | | |
| | 12 | GND | GND | - | Ground | |
| | 14 | D56 | I/O | PE2[3] | I/O | |
| | 16 | D57 | I/O | PE4 | | |
| | 18 | D58 | I/O | PE5 | | |
| | 20 | D59 | I/O | PE6 | | |
| | 22 | D60 | I/O | PE3 | I/O | |
| | 24 | D61 | I/O | PF8 | | |
| | 26 | D62 | I/O | PF7 | | |
| | 28 | D63 | I/O | PF9 | | |
| | 30 | D64 | I/O | PG1 | I/O | |
| Right Connectors | | | | | | |
| CN7 | 1 | D16 | I2S_A_MCK | PC6 | I2S_2 | - |
| | 3 | D17 | I2S_A_SD | PB15 | | |
| | 5 | D18 | I2S_A_CK | PB13 | | |
| | 7 | D19 | I2S_A_WS | PB12 | | |
| | 9 | D20 | I2S_B_WS | PA15 | I2S_3 / SPI3 | |
| | 11 | D21 | I2S_B_MCK | PC7 | | |
| | 13 | D22 | I2S_B_SD/ SPI_B_MOSI | PB5 | | |
| | 15 | D23 | I2S_B_CK/ SPI_B_SCK | PB3 | | |
| | 17 | D24 | SPI_B_NSS | PA4 | | |
| | 19 | D25 | SPI_B_MISO | PB4 | | |
| | 2 | D15 | I2C_A_SCL | PB8 | I2C1_SCL | Arduino support |
| | 4 | D14 | I2C_A_SDA | PB9 | I2C1_SDA | |
| | 6 | AREF | AREF | - | AVDD | |
| | 8 | GND | GND | - | Ground | |
| | 10 | D13 | SPI_A_SCK | PA5 | SPI1_SCK | |
| | 12 | D12 | SPI_A_MISO | PA6 | SPI1_MISO | |
| | 14 | D11 | SPI_A_MOSI/ TIM_E_PWM1 | PA7[1][2] or PB5[1] | SPI1_MOSI/ TIM14_CH1 | |

**Table 14. NUCLEO-F303ZE pin assignments (continued)**

| Connector | Pin | Pin name | Signal name | STM32 pin | Function | Remark |
|---|---|---|---|---|---|---|
| CN7 | 16 | D10 | SPI_A_CS/ TIM_B_PWM3 | PD14 | SPI1_CS/ TIM4_CH3 | Arduino support |
| | 18 | D9 | TIMER_B_PWM2 | PD15 | TIM4_CH4 | |
| | 20 | D8 | I/O | PF12 | - | |
| CN10 | 1 | AVDD | AVDD | - | Analog VDD | - |
| | 3 | AGND | AGND | - | Analog Ground | |
| | 5 | GND | GND | - | Ground | |
| | 7 | A6 | ADC_A_IN | PB1 | ADC3_IN1 | |
| | 9 | A7 | ADC_B_IN | PC2 | ADC12_IN8 | |
| | 11 | A8 | ADC_C_IN | PF4 | ADC3_IN14 | |
| | 13 | D26 | I/O | PB6 | I/O | |
| | 15 | D27 | I/O | PB2 | | |
| | 17 | GND | GND | - | Ground | |
| | 19 | D28 | I/O | PF10 | I/O | |
| | 21 | D29 | I/O | PF5 | | |
| | 23 | D30 | I/O | PF3 | | |
| | 25 | D31 | I/O | PE2[3] | | |
| | 27 | GND | GND | - | Ground | |
| | 29 | D32 | TIMER_C_PWM1 | PA0 | TIM2_CH1 | |
| | 31 | D33 | TIMER_D_PWM1 | PB0 | TIM3_CH3 | |
| | 33 | D34 | TIMER_B_ETR | PE0 | TIM4_ETR | |
| | 2 | D7 | I/O | PF13 | - | Arduino support |
| | 4 | D6 | TIMER_A_PWM1 | PE9 | TIM1_CH1 | |
| | 6 | D5 | TIMER_A_PWM2 | PE11 | TIM1_CH2 | |
| | 8 | D4 | I/O | PF14 | - | |

**Table 14. NUCLEO-F303ZE pin assignments (continued)**

| Connector | Pin | Pin name | Signal name | STM32 pin | Function | Remark |
|---|---|---|---|---|---|---|
| CN10 | 10 | D3 | TIMER_A_PWM3 | PE13 | TIM1_CH3 | - |
| | 12 | D2 | I/O | PF15 | - | |
| | 14 | D1 | USART_A_TX | PC4 | USART1 | |
| | 16 | D0 | USART_A_RX | PC5 | | |
| | 18 | D42 | TIMER_A_PWM1N | PE8 | TIM1_CH1N | |
| | 20 | D41 | TIMER_A_ETR | PE7 | TIM1_ETR | |
| | 22 | GND | GND | - | Ground | |
| | 24 | D40 | TIMER_A_PWM2N | PE10 | TIM1_CH2N | |
| | 26 | D39 | TIMER_A_PWM3N | PE12 | TIM1_CH3N | |
| | 28 | D38 | TIMER_A_BKIN2 | PE14 | TIM1_BKIN2 | |
| | 30 | D37 | TIMER_A_BKIN1 | PE15 | TIM1_BKIN1 | |
| | 32 | D36 | TIMER_C_PWM2 | PB10 | TIM2_CH3 | |
| | 34 | D35 | TIMER_C_PWM3 | PB11 | TIM2_CH4 | |

1. Refer to *Table 11: Solder bridges* for details.

2. PA7 is used as D11 and connected to CN7 pin 14 by default, if JP6 is ON, it is also connected to CN9 pin 15 as COMP2_INP. In this case only one function of Comparator input or D11 could be used.

3. PE2 is connected to both CN9 pin 14 (IO) and CN10 pin 25 (IO). Only one connector pin can be used at one time.

**Table 15. NUCLEO-F207ZG pin assignments**

| Connector | Pin | Pin name | Signal name | STM32 pin | Function | Remark |
|---|---|---|---|---|---|---|
| | | | Left connectors | | | |
| CN8 | 1 | NC | NC | - | - | Arduino support |
| | 3 | IOREF | IOREF | - | 3.3V Ref | |
| | 5 | RESET | RESET | NRST | RESET | |
| | 7 | +3V3 | +3V3 | - | 3.3V input/output | |
| | 9 | +5V | +5V | - | 5V output | |
| | 11 | GND | GND | - | Ground | |
| | 13 | GND | GND | - | | |
| | 15 | VIN | VIN | - | Power input | |
| | 2 | D43 | SDMMC_D0 | PC8 | SDMMC/I2S_A | - |
| | 4 | D44 | SDMMC_D1/ I2S_A_CKIN | PC9 | | |
| | 6 | D45 | SDMMC_D2 | PC10 | | |
| | 8 | D46 | SDMMC_D3 | PC11 | | |
| | 10 | D47 | SDMMC_CK | PC12 | | |
| | 12 | D48 | SDMMC_CMD | PD2 | | |
| | 14 | D49 | I/O | PG2 | I/O | |
| | 16 | D50 | I/O | PG3 | | |
| CN9 | 1 | A0 | ADC | PA3 | ADC123_IN3 | Arduino support |
| | 3 | A1 | ADC | PC0 | ADC123_IN10 | |
| | 5 | A2 | ADC | PC3 | ADC123_IN13 | |
| | 7 | A3 | ADC | PF3 | ADC3_IN9 | |
| | 9 | A4 | ADC | PF5 or PB9[1] | ADC3_IN15 (PF5) or I2C1_SDA (PB9) | |
| | 11 | A5 | ADC | PF10 or PB8[1] | ADC3_IN8 (PF10) or I2C1_SCL (PB8) | |
| | 13 | D72 | NC | - | - | - |
| | 15 | D71 | I/O | PA7[2] | I/O | |
| | 17 | D70 | I2C_B_SMBA | PF2 | I2C_2 | |
| | 19 | D69 | I2C_B_SCL | PF1 | | |
| | 21 | D68 | I2C_B_SDA | PF0 | | |
| | 23 | GND | GND | - | Ground | |
| | 25 | D67 | CAN_RX | PD0 | CAN_1 | |
| | 27 | D66 | CAN_TX | PD1 | | |
| | 29 | D65 | I/O | PG0 | I/O | |

**Table 15. NUCLEO-F207ZG pin assignments (continued)**

| Connector | Pin | Pin name | Signal name | STM32 pin | Function | Remark |
|---|---|---|---|---|---|---|
| CN9 | 2 | D51 | USART_B_SCLK | PD7 | USART_2 | - |
| | 4 | D52 | USART_B_RX | PD6 | | |
| | 6 | D53 | USART_B_TX | PD5 | | |
| | 8 | D54 | USART_B_RTS | PD4 | | |
| | 10 | D55 | USART_B_CTS | PD3 | | |
| | 12 | GND | GND | - | Ground | |
| | 14 | D56 | I/O | PE2[3] | I/O | |
| | 16 | D57 | I/O | PE4 | | |
| | 18 | D58 | I/O | PE5 | | |
| | 20 | D59 | I/O | PE6 | | |
| | 22 | D60 | I/O | PE3 | | |
| | 24 | D61 | I/O | PF8 | | |
| | 26 | D62 | I/O | PF7 | | |
| | 28 | D63 | I/O | PF9 | | |
| | 30 | D64 | I/O | PG1 | | |
| Right Connectors | | | | | | |
| CN7 | 1 | D16 | I2S_A_MCK | PC6 | I2S_2 | - |
| | 3 | D17 | I2S_A_SD | PB15 | | |
| | 5 | D18 | I2S_A_CK | PB13[4] | | |
| | 7 | D19 | I2S_A_WS | PB12 | | |
| | 9 | D20 | I2S_B_WS | PA15 | I2S_3 / SPI3 | |
| | 11 | D21 | I2S_B_MCK | PC7 | | |
| | 13 | D22 | I2S_B_SD/ SPI_B_MOSI | PB5 | | |
| | 15 | D23 | I2S_B_CK/ SPI_B_SCK | PB3 | | |
| | 17 | D24 | SPI_B_NSS | PA4 | | |
| | 19 | D25 | SPI_B_MISO | PB4 | | |
| | 2 | D15 | I2C_A_SCL | PB8 | I2C1_SCL | Arduino support |
| | 4 | D14 | I2C_A_SDA | PB9 | I2C1_SDA | |
| | 6 | AREF | AREF | - | AVDD | |
| | 8 | GND | GND | | Ground | |
| | 10 | D13 | SPI_A_SCK | PA5 | SPI1_SCK | |
| | 12 | D12 | SPI_A_MISO | PA6 | SPI1_MISO | |
| | 14 | D11 | SPI_A_MOSI/ TIM_E_PWM1 | PA7[1][2] or PB5[1] | SPI1_MOSI/ TIM14_CH1 | |
| | 16 | D10 | SPI_A_CS/ TIM_B_PWM3 | PD14 | SPI1_CS/ TIM4_CH3 | |
| | 18 | D9 | TIMER_B_PWM2 | PD15 | TIM4_CH4 | |
| | 20 | D8 | I/O | PF12 | - | - |

**Table 15. NUCLEO-F207ZG pin assignments (continued)**

| Connector | Pin | Pin name | Signal name | STM32 pin | Function | Remark |
|-----------|-----|----------|-------------|-----------|----------|--------|
| CN10 | 1 | AVDD | AVDD | | Analog VDD | - |
| | 3 | AGND | AGND | - | Analog Ground | |
| | 5 | GND | GND | | Ground | |
| | 7 | A6 | ADC_A_IN | PB1 | ADC12_IN9 | |
| | 9 | A7 | ADC_B_IN | PC2 | ADC123_IN12 | |
| | 11 | A8 | ADC_C_IN | PF4 | ADC3_IN14 | |
| | 13 | D26 | I/O | PB6 | I/O | |
| | 15 | D27 | I/O | PB2 | | |
| | 17 | GND | GND | - | Ground | |
| | 19 | D28 | I/O | PD13 | I/O | |
| | 21 | D29 | I/O | PD12 | | |
| | 23 | D30 | I/O | PD11 | | |
| | 25 | D31 | I/O | PE2[3] | | |
| | 27 | GND | GND | - | Ground | |
| | 29 | D32 | TIMER_C_PWM1 | PA0 | TIM2_CH1 | |
| | 31 | D33 | TIMER_D_PWM1 | PB0 | TIM3_CH3 | |
| | 33 | D34 | TIMER_B_ETR | PE0 | TIM4_ETR | |
| | 2 | D7 | I/O | PF13 | - | Arduino support |
| | 4 | D6 | TIMER_A_PWM1 | PE9 | TIM1_CH1 | |
| | 6 | D5 | TIMER_A_PWM2 | PE11 | TIM1_CH2 | |
| | 8 | D4 | I/O | PF14 | - | |
| | 10 | D3 | TIMER_A_PWM3 | PE13 | TIM1_CH3 | |
| | 12 | D2 | I/O | PF15 | - | |
| | 14 | D1 | USART_A_TX | PG14 | USART6 | |
| | 16 | D0 | USART_A_RX | PG9 | - | |
| | 18 | D42 | TIMER_A_PWM1N | PE8 | TIM1_CH1N | - |
| | 20 | D41 | TIMER_A_ETR | PE7 | TIM1_ETR | |
| | 22 | GND | GND | - | Ground | |
| | 24 | D40 | TIMER_A_PWM2N | PE10 | TIM1_CH2N | |
| | 26 | D39 | TIMER_A_PWM3N | PE12 | TIM1_CH3N | |
| | 28 | D38 | I/O | PE14 | I/O | |
| | 30 | D37 | TIMER_A_BKIN1 | PE15 | TIM1_BKIN1 | |
| | 32 | D36 | TIMER_C_PWM2 | PB10 | TIM2_CH3 | |
| | 34 | D35 | TIMER_C_PWM3 | PB11 | TIM2_CH4 | |

1. Refer to *Table 11: Solder bridges* for details.

2. PA7 is used as D11 and connected to CN7 pin 14 by default, if JP6 is ON, it is also connected to both Ethernet PHY as RMII_DV and CN9 pin 15. In this case only one function of Ethernet or D11 could be used.

3. PE2 is connected to both CN9 pin 14 (IO) and CN10 pin 25 (IO). Only one connector pin can be used at one time.

4. PB13 is used as I2S_A_CK and connected to CN7 pin 5 by default, if JP7 is ON, it is also connected to Ethernet PHY as RMII_TXD1. In this case only one function of Ethernet or I2S_A could be used.

**Table 16. NUCLEO-F429ZI pin assignments**

| Connector | Pin | Pin name | Signal name | STM32 pin | Function | Remark |
|-----------|-----|----------|-------------|-----------|----------|--------|
| | | | Left connectors | | | |
| CN8 | 1 | NC | NC | - | - | Arduino support |
| | 3 | IOREF | IOREF | | 3.3V Ref | |
| | 5 | RESET | RESET | NRST | RESET | |
| | 7 | +3V3 | +3V3 | | 3.3V input/output | |
| | 9 | +5V | +5V | | 5V output | |
| | 11 | GND | GND | - | Ground | |
| | 13 | GND | GND | | | |
| | 15 | VIN | VIN | | Power input | |
| | 2 | D43 | SDMMC_D0 | PC8 | SDMMC/I2S_A | - |
| | 4 | D44 | SDMMC_D1/ I2S_A_CKIN | PC9 | I/O | |
| | 6 | D45 | SDMMC_D2 | PC10 | | |
| | 8 | D46 | SDMMC_D3 | PC11 | | |
| | 10 | D47 | SDMMC_CK | PC12 | | |
| | 12 | D48 | SDMMC_CMD | PD2 | | |
| | 14 | D49 | I/O | PG2 | | |
| | 16 | D50 | I/O | PG3 | | |
| CN9 | 1 | A0 | ADC | PA3 | ADC123_IN3 | Arduino support |
| | 3 | A1 | ADC | PC0 | ADC123_IN10 | |
| | 5 | A2 | ADC | PC3 | ADC123_IN13 | |
| | 7 | A3 | ADC | PF3 | ADC3_IN9 | |
| | 9 | A4 | ADC | PF5 or PB9[1] | ADC3_IN15 (PF5) or I2C1_SDA (PB9) | |
| | 11 | A5 | ADC | PF10 or PB8[1] | ADC3_IN8 (PF10) or I2C1_SCL (PB8) | |
| | 13 | D72 | NC | - | - | - |
| | 15 | D71 | I/O | PA7[2] | I/O | |
| | 17 | D70 | I2C_B_SMBA | PF2 | I2C_2 | |
| | 19 | D69 | I2C_B_SCL | PF1 | | |

**Table 16. NUCLEO-F429ZI pin assignments (continued)**

| Connector | Pin | Pin name | Signal name | STM32 pin | Function | Remark |
|---|---|---|---|---|---|---|
| CN9 | 21 | D68 | I2C_B_SDA | PF0 | I2C_2 | - |
| | 23 | GND | GND | - | Ground | |
| | 25 | D67 | CAN_RX | PD0 | CAN_1 | |
| | 27 | D66 | CAN_TX | PD1 | | |
| | 29 | D65 | I/O | PG0 | I/O | |
| | 2 | D51 | USART_B_SCLK | PD7 | USART_2 | |
| | 4 | D52 | USART_B_RX | PD6 | | |
| | 6 | D53 | USART_B_TX | PD5 | | |
| | 8 | D54 | USART_B_RTS | PD4 | | |
| | 10 | D55 | USART_B_CTS | PD3 | | |
| | 12 | GND | GND | - | Ground | |
| | 14 | D56 | SAI_A_MCLK | PE2[3] | SAI_1_A | |
| | 16 | D57 | SAI_A_FS | PE4 | | |
| | 18 | D58 | SAI_A_SCK | PE5 | | |
| | 20 | D59 | SAI_A_SD | PE6 | | |
| | 22 | D60 | SAI_B_SD | PE3 | SAI_1_B | |
| | 24 | D61 | SAI_B_SCK | PF8 | | |
| | 26 | D62 | SAI_B_MCLK | PF7 | | |
| | 28 | D63 | SAI_B_FS | PF9 | | |
| | 30 | D64 | I/O | PG1 | I/O | |
| Right Connectors | | | | | | |
| CN7 | 1 | D16 | I2S_A_MCK | PC6 | I2S_2 | - |
| | 3 | D17 | I2S_A_SD | PB15 | | |
| | 5 | D18 | I2S_A_CK | PB13[4] | | |
| | 7 | D19 | I2S_A_WS | PB12 | | |
| | 9 | D20 | I2S_B_WS | PA15 | I2S_3 / SPI3 | |
| | 11 | D21 | I2S_B_MCK | PC7 | | |
| | 13 | D22 | I2S_B_SD/ SPI_B_MOSI | PB5 | | |
| | 15 | D23 | I2S_B_CK/ SPI_B_SCK | PB3 | | |
| | 17 | D24 | SPI_B_NSS | PA4 | | |

**Table 16. NUCLEO-F429ZI pin assignments (continued)**

| Connector | Pin | Pin name | Signal name | STM32 pin | Function | Remark |
|---|---|---|---|---|---|---|
| CN7 | 19 | D25 | SPI_B_MISO | PB4 | I2S_3 / SPI3 | - |
| | 2 | D15 | I2C_A_SCL | PB8 | I2C1_SCL | Arduino support |
| | 4 | D14 | I2C_A_SDA | PB9 | I2C1_SDA | |
| | 6 | AREF | AREF | - | AVDD | |
| | 8 | GND | GND | | Ground | |
| | 10 | D13 | SPI_A_SCK | PA5 | SPI1_SCK | |
| | 12 | D12 | SPI_A_MISO | PA6 | SPI1_MISO | |
| | 14 | D11 | SPI_A_MOSI/ TIM_E_PWM1 | PA7[1][2] or PB5[1] | SPI1_MOSI/ TIM14_CH1 | |
| | 16 | D10 | SPI_A_CS/ TIM_B_PWM3 | PD14 | SPI1_CS/ TIM4_CH3 | |
| | 18 | D9 | TIMER_B_PWM2 | PD15 | TIM4_CH4 | |
| | 20 | D8 | I/O | PF12 | - | |
| CN10 | 1 | AVDD | AVDD | - | Analog VDD | - |
| | 3 | AGND | AGND | | Analog Ground | |
| | 5 | GND | GND | | Ground | |
| | 7 | A6 | ADC_A_IN | PB1 | ADC12_IN9 | |
| | 9 | A7 | ADC_B_IN | PC2 | ADC123_IN12 | |
| | 11 | A8 | ADC_C_IN | PF4 | ADC3_IN14 | |
| | 13 | D26 | I/O | PB6 | I/O | |
| | 15 | D27 | I/O | PB2 | | |
| | 17 | GND | GND | - | Ground | |
| | 19 | D28 | I/O | PD13 | I/O | |
| | 21 | D29 | I/O | PD12 | | |
| | 23 | D30 | I/O | PD11 | | |
| | 25 | D31 | I/O | PE2[3] | | |
| | 27 | GND | GND | - | Ground | |
| | 29 | D32 | TIMER_C_PWM1 | PA0 | TIM2_CH1 | |
| | 31 | D33 | TIMER_D_PWM1 | PB0 | TIM3_CH3 | |
| | 33 | D34 | TIMER_B_ETR | PE0 | TIM4_ETR | |
| | 2 | D7 | I/O | PF13 | - | Arduino support |

**Table 16. NUCLEO-F429ZI pin assignments (continued)**

| Connector | Pin | Pin name | Signal name | STM32 pin | Function | Remark |
|---|---|---|---|---|---|---|
| CN10 | 4 | D6 | TIMER_A_PWM1 | PE9 | TIM1_CH1 | Arduino support |
| | 6 | D5 | TIMER_A_PWM2 | PE11 | TIM1_CH2 | |
| | 8 | D4 | I/O | PF14 | - | |
| | 10 | D3 | TIMER_A_PWM3 | PE13 | TIM1_CH3 | |
| | 12 | D2 | I/O | PF15 | - | |
| | 14 | D1 | USART_A_TX | PG14 | USART6 | |
| | 16 | D0 | USART_A_RX | PG9 | | |
| | 18 | D42 | TIMER_A_PWM1N | PE8 | TIM1_CH1N | - |
| | 20 | D41 | TIMER_A_ETR | PE7 | TIM1_ETR | |
| | 22 | GND | GND | - | Ground | |
| | 24 | D40 | TIMER_A_PWM2N | PE10 | TIM1_CH2N | |
| | 26 | D39 | TIMER_A_PWM3N | PE12 | TIM1_CH3N | |
| | 28 | D38 | I/O | PE14 | I/O | |
| | 30 | D37 | TIMER_A_BKIN1 | PE15 | TIM1_BKIN1 | |
| | 32 | D36 | TIMER_C_PWM2 | PB10 | TIM2_CH3 | |
| | 34 | D35 | TIMER_C_PWM3 | PB11 | TIM2_CH4 | |

1. Refer to *Table 11: Solder bridges* for details.

2. PA7 is used as D11 and connected to CN7 pin 14 by default. If JP6 is ON, it is also connected to both Ethernet PHY as RMII_DV and CN9 pin 15. In this case only one function of Ethernet or D11 could be used.

3. PE2 is connected to both CN9 pin 14 (SAI_A_MCLK) and CN10 pin 25 (IO). Only one function can be used at one time.

4. PB13 is used as I2S_A_CK and connected to CN7 pin 5 by default. If JP7 is ON, it is also connected to Ethernet PHY as RMII_TXD1. In this case only one function of Ethernet or I2S_A could be used.

## 6.14 ST morpho connector

The ST morpho connector consists in male pin header footprints CN11 and CN12 (not soldered by default). They can be used to connect the STM32 Nucleo-144 board to an extension board or a prototype/wrapping board placed on top of the STM32 Nucleo-144 board. All signals and power pins of the STM32 are available on ST morpho connector. This connector can also be probed by an oscilloscope, logical analyzer or voltmeter.

*Table 17* and *Table 18* show the pin assignment of each main STM32 on ST morpho connector.

**Table 17. ST morpho connector for NUCLEO-F207ZG,
NUCLEO-F429ZI, NUCLEO-F446ZE, NUCLEO-F746ZG**

| CN11 odd pins | | CN11 even pins | | CN12 odd pins | | CN12 even pins | |
|---|---|---|---|---|---|---|---|
| Pin | Pin name | Pin | Pin name | Pin | Pin name | Pin | Pin name |
| 1 | PC10 | 2 | PC11 | 1 | PC9 | 2 | PC8 |
| 3 | PC12 | 4 | PD2 | 3 | PB8 | 4 | PC6 |
| 5 | VDD | 6 | E5V | 5 | PB9 | 6 | PC5 |
| 7 | BOOT0[1] | 8 | GND | 7 | AVDD | 8 | U5V[2] |
| 9 | PF6 | 10 | - | 9 | GND | 10 | PD8 |
| 11 | PF7 | 12 | IOREF | 11 | PA5 | 12 | PA12 |
| 13 | PA13[3] | 14 | RESET | 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 | - | 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 |
| 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 |

**Table 17. ST morpho connector for NUCLEO-F207ZG, NUCLEO-F429ZI, NUCLEO-F446ZE, NUCLEO-F746ZG (continued)**

| CN11 odd pins | | CN11 even pins | | CN12 odd pins | | CN12 even pins | |
|---|---|---|---|---|---|---|---|
| Pin | Pin name | Pin | Pin name | Pin | Pin name | Pin | Pin name |
| 67 | - | 68 | PG13 | 67 | PG7 | 68 | PG5 |
| 69 | PD9 | 70 | PG11 | 69 | PG4 | 70 | PG6 |

1. Default state of BOOT0 is 0. It can be set to 1 when a jumper is on pins 5-7 of CN11.

2. U5V is 5V power from ST-LINKV2-1 USB connector and it rises before +5V.

3. PA13 and PA14 are shared with SWD signals connected to ST-LINK/V2-1. It is not recommended to use them as IO pins if ST-LINK part is not cut.

**Table 18. ST morpho connector for NUCLEO-F303ZE**

| CN11 odd pins | | CN11 even pins | | CN12 odd pins | | CN12 even pins | |
|---|---|---|---|---|---|---|---|
| Pin No. | Name | Pin No. | Name | Pin No. | Name | Pin No. | Name |
| 1 | PC10 | 2 | PC11 | 1 | PC9 | 2 | PC8 |
| 3 | PC12 | 4 | PD2 | 3 | PB8 | 4 | PC6 |
| 5 | VDD | 6 | E5V | 5 | PB9 | 6 | PC5 |
| 7 | BOOT0[1] | 8 | GND | 7 | AVDD | 8 | U5V[2] |
| 9 | PF6 | 10 | - | 9 | GND | 10 | PD8 |
| 11 | PF7 | 12 | IOREF | 11 | PA5 | 12 | PA12 |
| 13 | PA13[3] | 14 | RESET | 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 | - | 25 | PB10 | 26 | PB15 |
| 27 | PC15 | 28 | PA0 | 27 | PB4 | 28 | PB14 |
| 29 | PF0 | 30 | PA1 | 29 | PB5 | 30 | PB13 |
| 31 | PF1 | 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 |

**Table 18. ST morpho connector for NUCLEO-F303ZE (continued)**

| CN11 odd pins | | CN11 even pins | | CN12 odd pins | | CN12 even pins | |
|---|---|---|---|---|---|---|---|
| Pin No. | Name | Pin No. | Name | Pin No. | Name | Pin No. | Name |
| 47 | PE3 | 48 | PE4 | 47 | PE10 | 48 | PD15 |
| 49 | GND | 50 | PE5 | 49 | PE12 | 50 | PF14 |
| 51 | PH1 | 52 | PF2 | 51 | PE14 | 52 | PE9 |
| 53 | PH0 | 54 | PF8 | 53 | PE15 | 54 | GND |
| 55 | PD1 | 56 | PF9 | 55 | PE13 | 56 | PE11 |
| 57 | PD0 | 58 | PG1 | 57 | PF13 | 58 | PF3 |
| 59 | PG0 | 60 | GND | 59 | PF12 | 60 | PF15 |
| 61 | PE1 | 62 | PE6 | 61 | PG14 | 62 | PF11 |
| 63 | PG9 | 64 | PG15 | 63 | GND | 64 | PE0 |
| 65 | PG12 | 66 | PG10 | 65 | PD10 | 66 | PG8 |
| 67 | PH2 | 68 | PG13 | 67 | PG7 | 68 | PG5 |
| 69 | PD9 | 70 | PG11 | 69 | PG4 | 70 | PG6 |

1. Default state of BOOT0 is 0. It can be set to 1 when a jumper is on pin 5-7 of CN11.

2. U5V is 5V power from ST-LINK/V2-1 USB connector and it rises before +5V.

3. PA13 and PA14 are shared with SWD signals connected to ST-LINK/V2-1, it is not recommended to use them as IO pins if ST-LINK part is not cut.

# 7 Electrical schematics

**Figure 12. Top and Power**
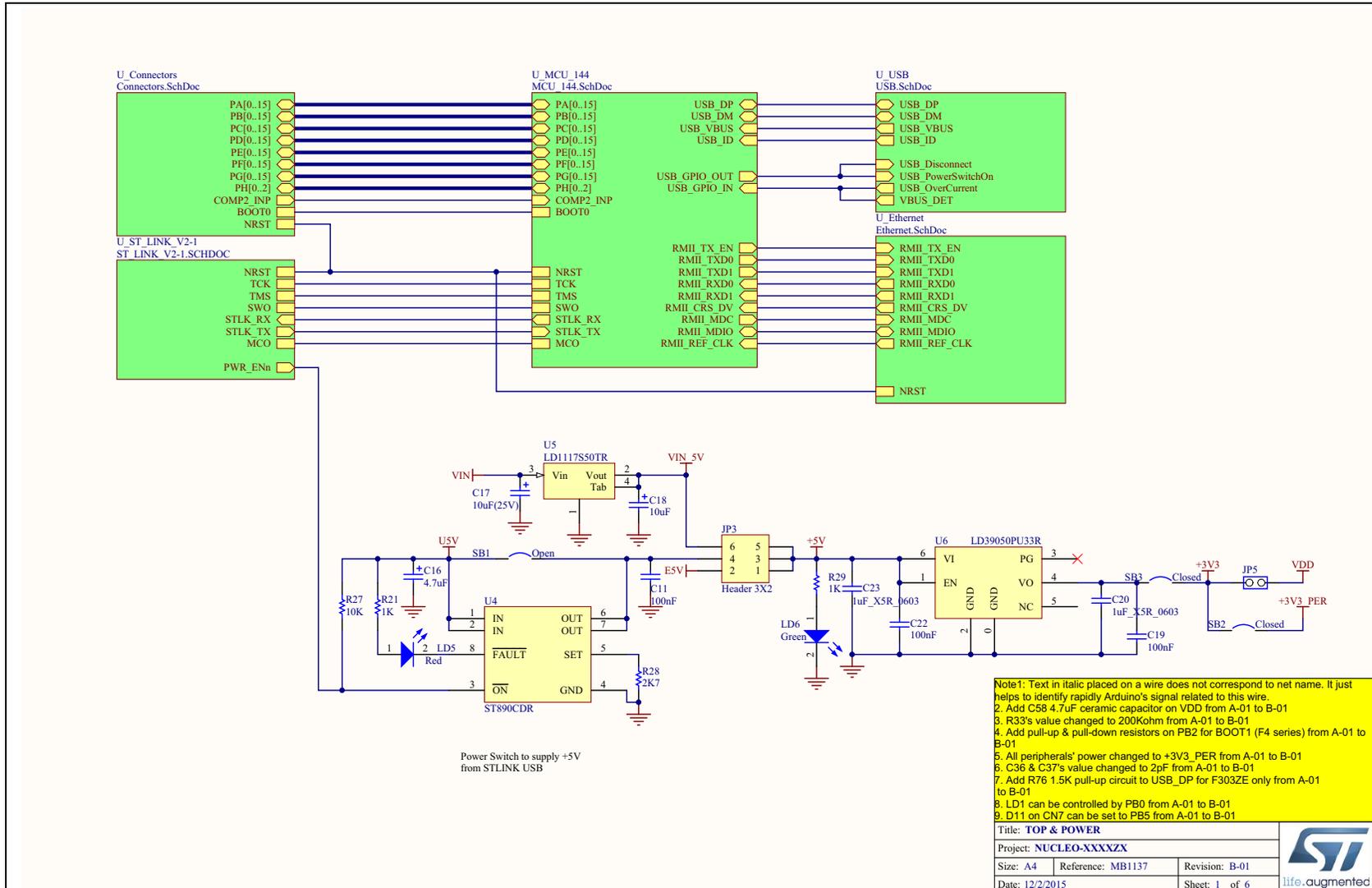
# Figure 13. MCU
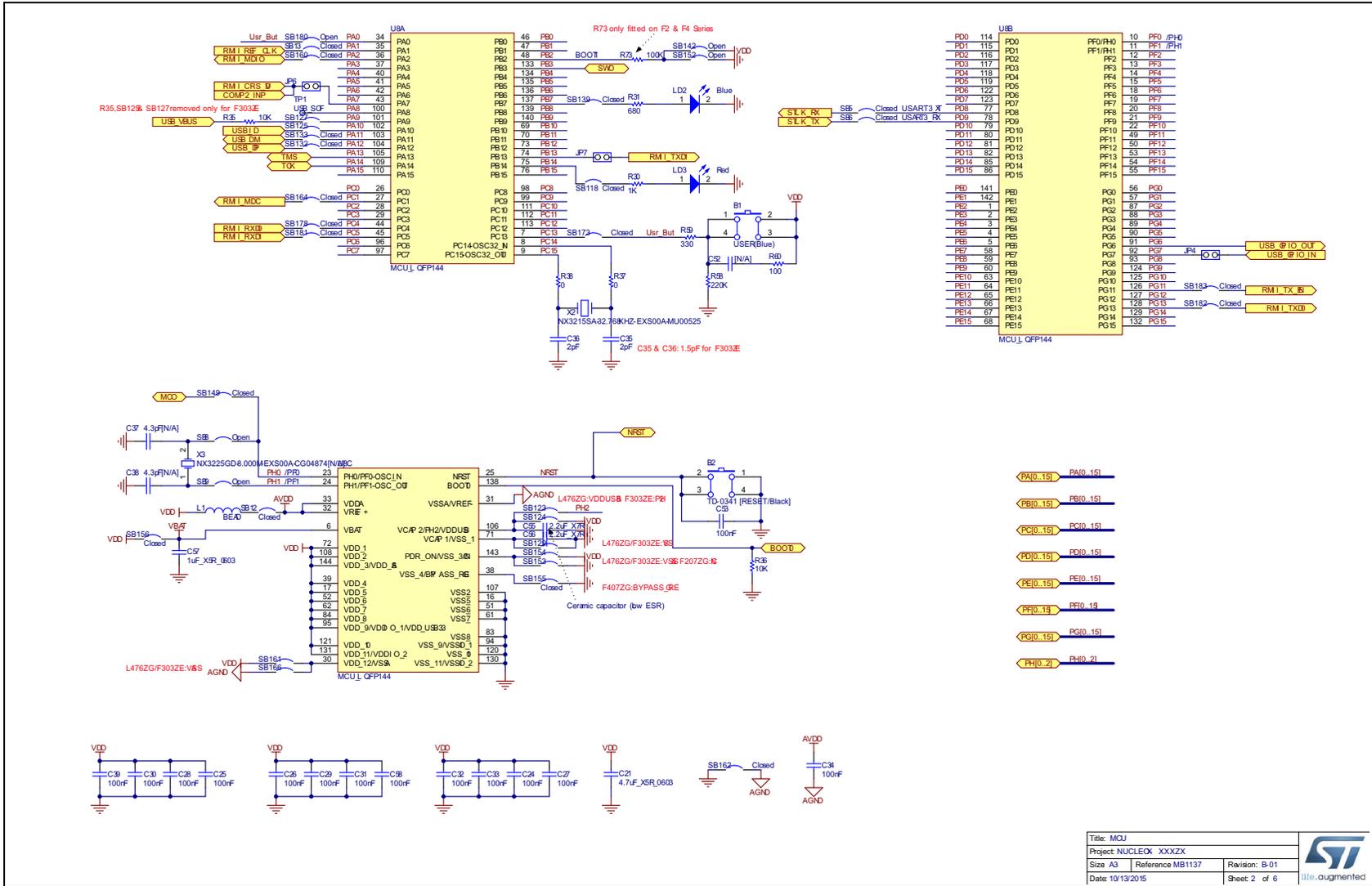


Title: MCU
Project: NUCLEO- XXXZX
Size A3   Reference MB1137   Revision: B-01
Date: 10/13/2015   Sheet 2 of 6

## Figure 14. ST-LINK/V2-1

**Figure 15. USB**

# Figure 16. Ethernet PHY with RJ45 connector

## Figure 17. Extension connectors
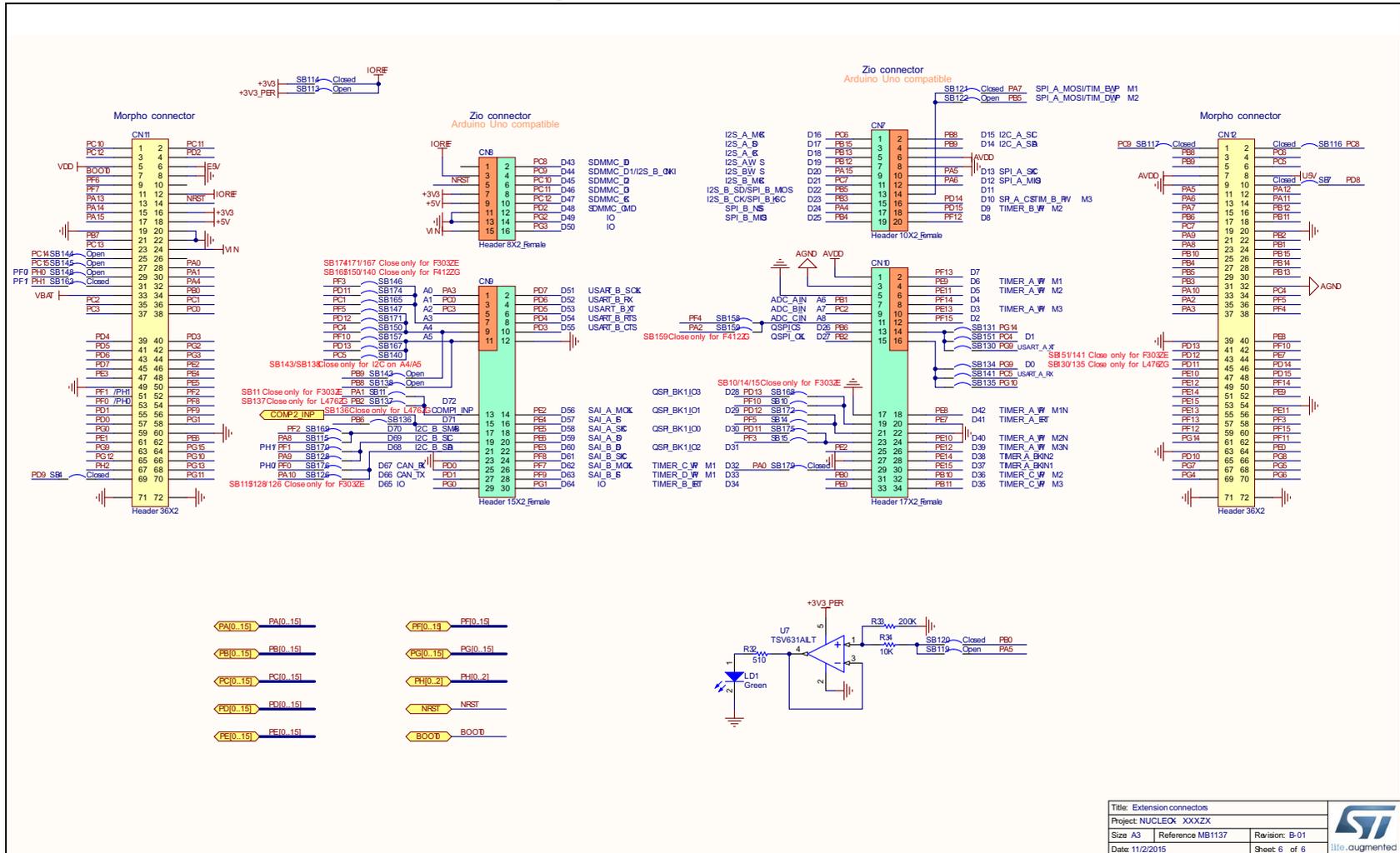
# 8 Mechanical drawing

**Figure 18. Nucleo-144 board mechanical drawing in millimeter**
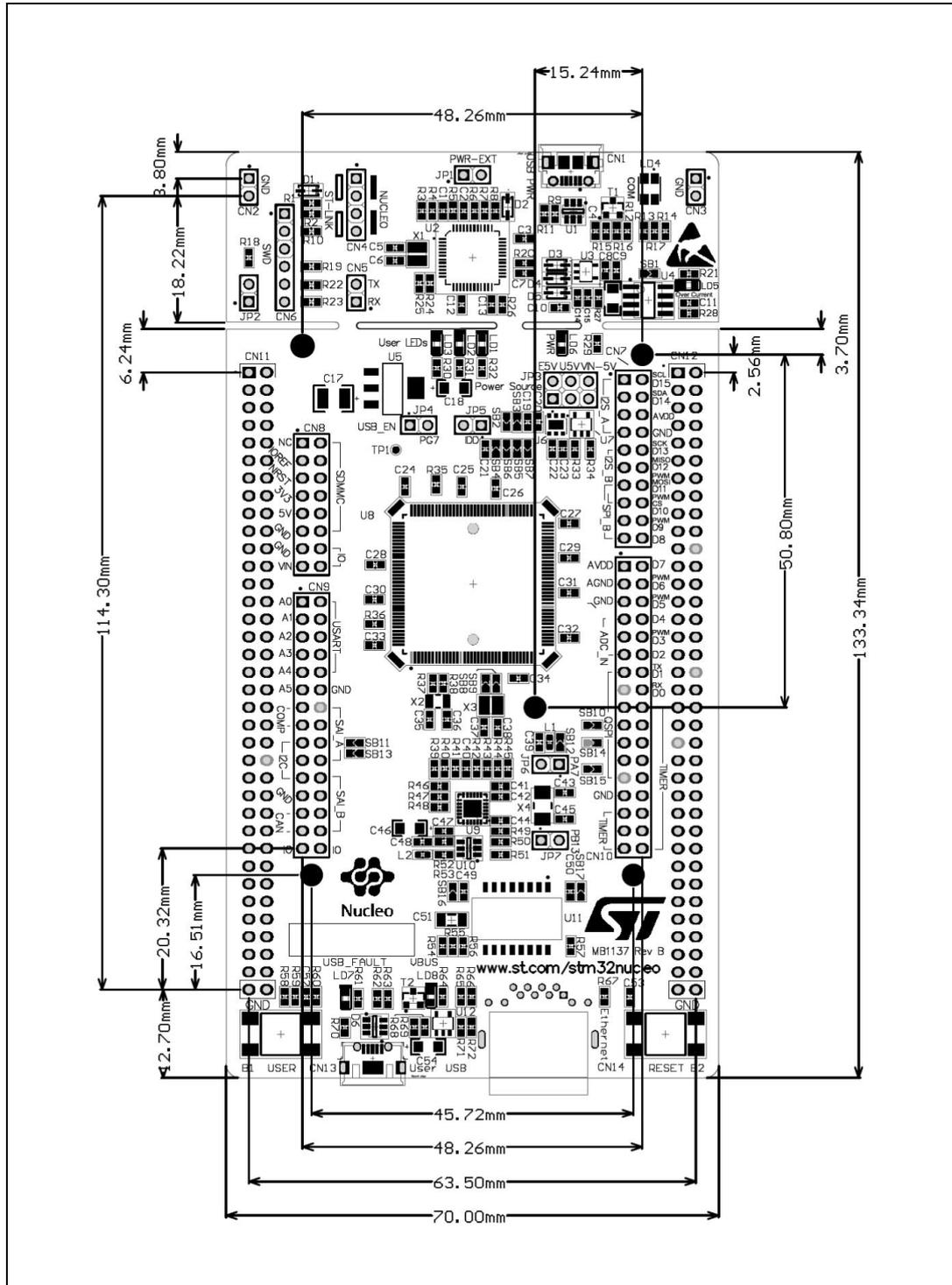
**Figure 19. Nucleo-144 board mechanical drawing in mil**
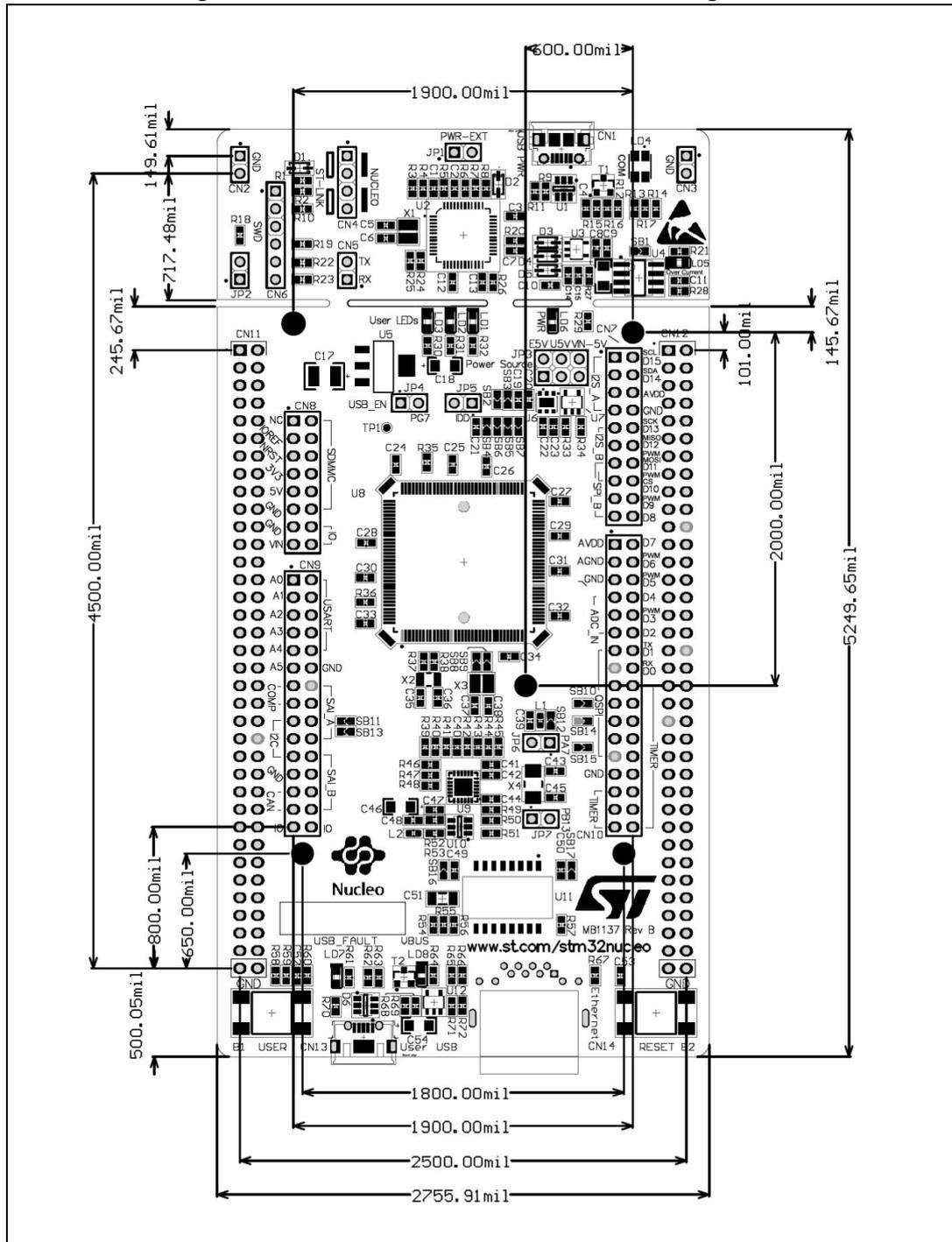
# 9 Revision history

**Table 19. Document revision history**

| Date | Revision | Revision Details |
|------|----------|------------------|
| 21-Dec-2015 | 1 | Initial version. |

**IMPORTANT NOTICE – PLEASE READ CAREFULLY**