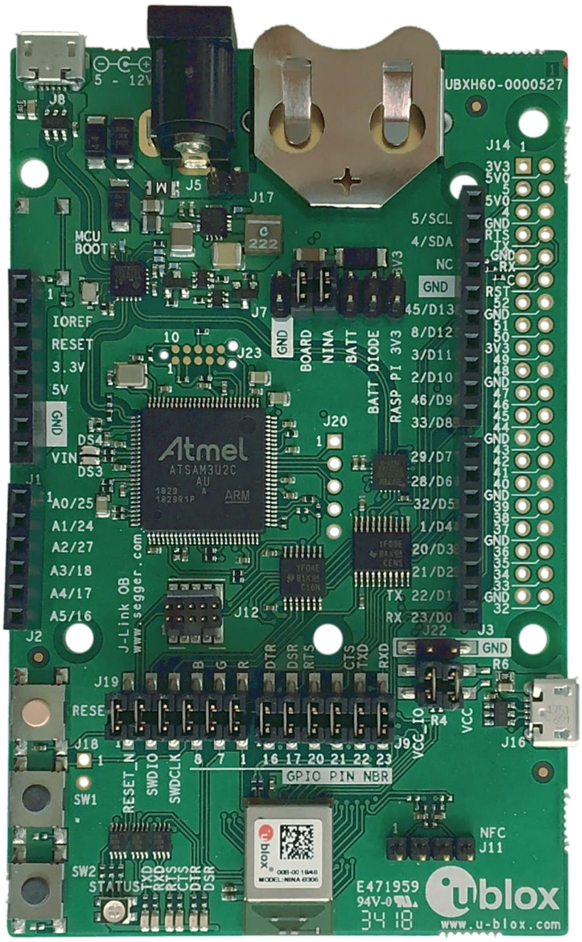
S

EVK-NINA-B4

Evaluation Kit for NINA-B4 modules

User guide



Abstract

This document describes how to set up the EVK-NINA-B4 evaluation kit to evaluate NINA-B4 series standalone Bluetooth® 5.1 low energy modules. It also describes the different options for debugging and the development capabilities included in the evaluation board.

www.u-blox.com

UBX-19054587 - R01

Document information

Title	**EVK-NINA-B4**	
Subtitle	Evaluation Kit for NINA-B4 modules	
Document type	User guide	
Document number	UBX-19054587	
Revision and date	R01	19-Dec-2019
Disclosure restriction		

This document applies to the following products:

Product name
EVK-NINA-B400
EVK-NINA-B410
EVK-NINA-B406
EVK-NINA-B416

Contents

Document information **2**
Contents **3**
1 Quick start guide **5**
2 Product description **6**
2.1 Overview 6
2.2 Kit includes 7
2.3 Key features 7
2.4 EVK-NINA-B4 block diagram 8
2.5 Connectors 9
3 Setting up the evaluation board **10**
3.1 Evaluation board setup 10
3.2 Starting up 10
3.2.1 EVK-NINA-B41x 10
3.2.2 EVK-NINA-B40x 11
3.3 Measuring current consumption 11
3.3.1 Using an ampere meter 11
3.3.2 Using a volt meter 11
3.3.3 Using an external power supply or power analyzer 12
4 Board configuration **13**
4.1 Powering options 13
4.1.1 Selecting the power configuration jumpers 13
4.1.2 Default power configuration, 3.3 V 16
4.1.3 Battery powered, 3 – 1.7 V 17
4.1.4 Battery powered with protection diode, 2.7 – 1.7 V 18
4.1.5 External supply, 3.6 – 1.7 V 19
4.1.6 Raspberry Pi HAT 20
4.2 Disconnecting NINA signals from board peripherals 20
5 Interfaces and peripherals **22**
5.1 Buttons and LEDs 22
5.2 Arduino interface 23
5.2.1 Arduino shield compatibility 25
5.3 Raspberry Pi compatible interface 25
5.3.1 Powering considerations 27
5.3.2 UART 28
5.3.3 EEPROM support 28
5.4 Additional Interfaces 28
5.4.1 Extra memory – external Flash 29
5.4.2 Extra USB to UART interface 30
5.4.3 CPU trace interface 30
Appendix **31**

A Schematics 31
B Glossary 31
Related documents 32
Revision history 32
Contact 33

1 Quick start guide

The EVK-NINA-B4 software and documentation is available at www.u-blox.com/evk-search. Supported Windows operating systems are 10.

Install s-center evaluation software:

- From the evk-search page, select the EVK-NINA-B4 product page.
- Under the Documentation & resources tab, download the latest s-center software. Run the executable following the instructions.
- When the installation is complete, you will find the s-center menu under the Windows Start button, All Programs > u-blox
- In the s-center menu, you will find the s-center application, user guide and uninstall options.

Driver installation:

- Connect the EVK-NINA-B4 board to your PC using the included USB cable.
- Verify that the USB drivers are installed successfully. NOTE: In case the drivers are not installed automatically, refer to 3.1.
- Once the drivers are installed, a COM port is enabled in Windows. Use the Windows Device Manager to view the port number (COM #) for the USB serial port.
- Start s-center and communicate with the module.

For EVK-NINA-B4x0 (with external antenna), attach the antenna to the antenna cable and connect the antenna cable to the U.FL connector.

⚠ The initial prototypes of EVK-NINA-B406, marked with PT1 (date code 1950 or older) have a different pin out and some hardware limitations. This is described in the sample delivery notes that come with the prototypes.

2 Product description

2.1 Overview

The u-blox EVK-NINA-B4 evaluation kit is a versatile development platform that allows quick prototyping of a variety of extremely low-powered Internet of Things (IoT) applications, using full Bluetooth 5.1, NFC, and IEEE 802.15.4.

The u-blox EVK-NINA-B4 boards are available in the following four variants, depending on the required antenna and software solution:

- EVK-NINA-B400, with open CPU NINA-B400 module and U.FL antenna connector for connecting to external antennas.
- EVK-NINA-B410, with u-connect NINA-B410 module pre-flashed with u-connectXpress software, and U.FL antenna connector for connecting to external antennas.
- EVK-NINA-B406, with open CPU NINA-B406 module that includes an internal PCB trace antenna.
- EVK-NINA-B416, with u-connect NINA-B416 module pre-flashed with u-connectXpress software and an internal PCB trace antenna.

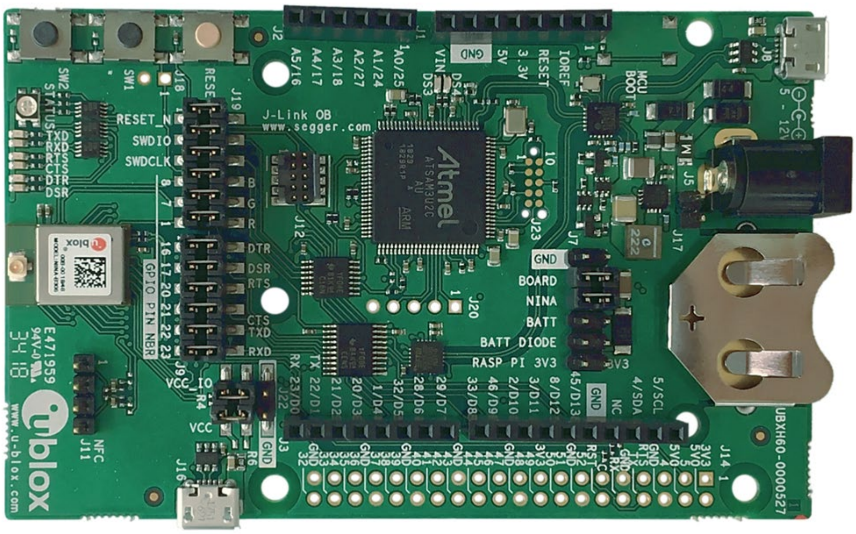


Figure 1: EVK-NINA-B400/-B410 evaluation board

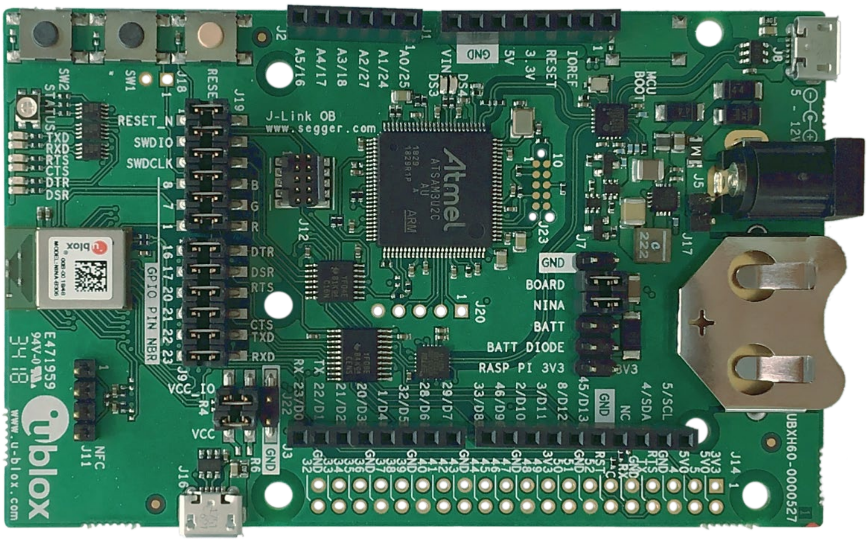


Figure 2: EVK-NINA-B406/-B416 evaluation board

The evaluation boards provide access to all the 38 GPIO pins and interfaces available on the NINA-B4 modules through a variety of connectors and interfaces including Arduino™ Uno R3 [1] and Raspberry Pi [2] header connectors.

The stand-alone NINA-B4 modules include an Arm® Cortex®-M4F microcontroller with 512kB internal flash and 128 kB RAM, running at a system clock of 64 MHz. This has been integrated inside the Nordic Semiconductor nRF52833 chip that the modules are based on. The evaulation board provides simple USB drag-n-drop programming and a SEGGER J-Link debug interface that can be used with the Open CPU variants of the EVK. Nordic Semiconductors, the manufacturer of the nRF52833 chip that the NINA-B4 series are based on, provides a free Software Development Kit (SDK) with a broad selection of drivers, libraries, and example applications that can be used for rapid prototyping.

2.2 Kit includes

The EVK-NINA-B4 evaluation kit includes the following:

- NINA-B4 evaluation board
- 2.4 GHz antenna with U.FL connector (only in EVK-NINA-B400 and EVK-NINA-B410)
- NFC antenna
- USB cable

2.3 Key features

- u-blox NINA-B4 Bluetooth low energy module based on the Nordic nRF52833 chipset
  - Full Bluetooth 5.1 support
  - NFC tag functionality
  - 802.15.4 PHY
  - Integrated Arm Cortex-M4 microcontroller with 512kB internal flash and 128 kB RAM, and 64 MHz system clock
  - USB 2.0
  - Wide 1.7-3.6 V supply range
- The NINA-B4 module supports different interfaces that can be configured to any of the 38 available GPIO pin(s):
  - 8 analog capable inputs
  - 16 PWM capable outputs
  - 4x SPI
  - 2x UART with HW flow control
  - 2x I2C
  - 1x I2S
  - 1x PDM input
  - 1x Quadrature decoder
- EVK-NINA-B41x: support for u-connectXpress software
- EVK-NINA-B40x: support for developing your own software on the Open CPU NINA-B4 module
- Full UART to USB converter with a Virtual COM port, allowing control of the extended UART features of the u-blox u-connect software
- On-board J-Link debugger/programmer
  - Mass Storage Device interface to PC, for drag-n-drop programming
  - Debug port
  - An additional Virtual COM port that, for example, may be connected to add-on boards or to a debug UART on the NINA-B4
- Dedicated USB connector for the NINA-B4 USB interface
- Additional flash memory can be added to the board for use by the NINA-B4 module
- RGB LED and push-buttons
- Arduino UNO R3 and Raspberry Pi compatible pin header interfaces

- Jumper headers and level shifters allow for flexible powering options of the NINA-B4 module, even with full board support. They isolate the module entirely and control each power net separately in order to precisely measure low power applications or disconnect only unused parts of the board to save battery life.
- Multiple board power supply options
    - 5-12 V power plug
    - 5 V USB supply
    - 5-12 V Arduino VIN input
- Battery holder supporting CR2032 coin cell batteries

2.4 EVK-NINA-B4 block diagram

The block diagram of EVK-NINA-B4 is shown in Figure 3. The block diagram shows the major interfaces and internal connections of the EVK-NINA-B4. The following sections describe in detail how the different interfaces are connected and may be used, as well as how the evaluation board may be configured to suit the needs of the user.

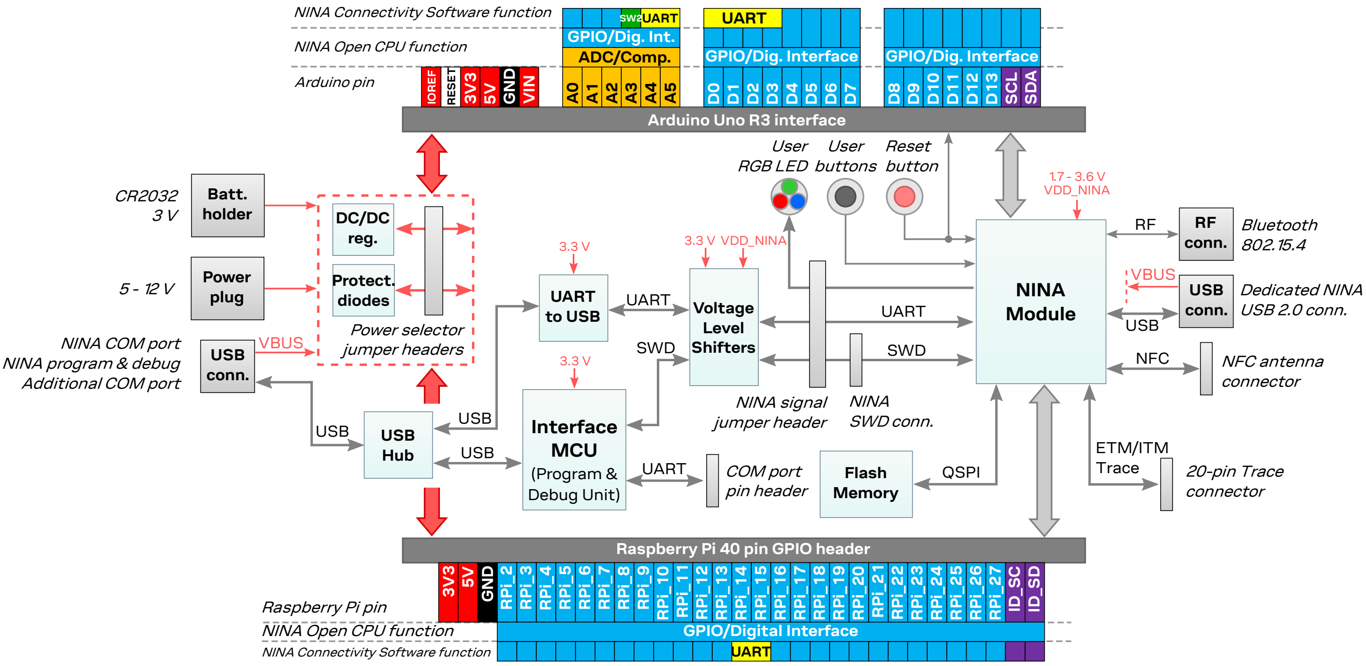


Figure 3: EVK-NINA-B4 block diagram

2.5 Connectors

Table 1 describes the available connectors of the EVK-NINA-B4 and their uses in detail. Figure 4 shows the layout of the connectors on the EVK-NINA-B4.

Connector	Function	Description
J5	Power supply	2.1 mm power jack, the center pin is the positive terminal. 5 – 12 V input.
J17	Power supply	Pin header that can be used to connect external power supplies. 5 – 12 V input.
BT1	Battery holder	CR2032 coin cell battery holder. CR2032 usually has a 3 V potential when fully charged.
J11	NFC antenna connector	Pin header that connects to the u-blox NFC antenna included in the kit. The antenna can be mounted in either direction.
	2.4 GHz RF antenna connector	U.FL coaxial connector that can be used to connect antennas or RF equipment. This connector is only included in the EVK-NINA-B400/EVK-NINA-B410.
J12	Cortex Debug connector	10-pin, 50 mil pitch connector that can be used to connect external debuggers to the NINA-B4 module. The NINA-B4 modules support Serial Wire debug (SWD) and Serial Wire Viewer, but not JTAG debug.
J8	Power supply, COM port and debug USB	The main USB connector that is used to program, debug, and communicate with the NINA module. It can also be used to power the entire board.
J16	Power supply and NINA USB port	Additional USB connector directly connected to the NINA-B4 USB interface. Can also be used to power the entire board.

Table 1: EVK-NINA-B4 connector description

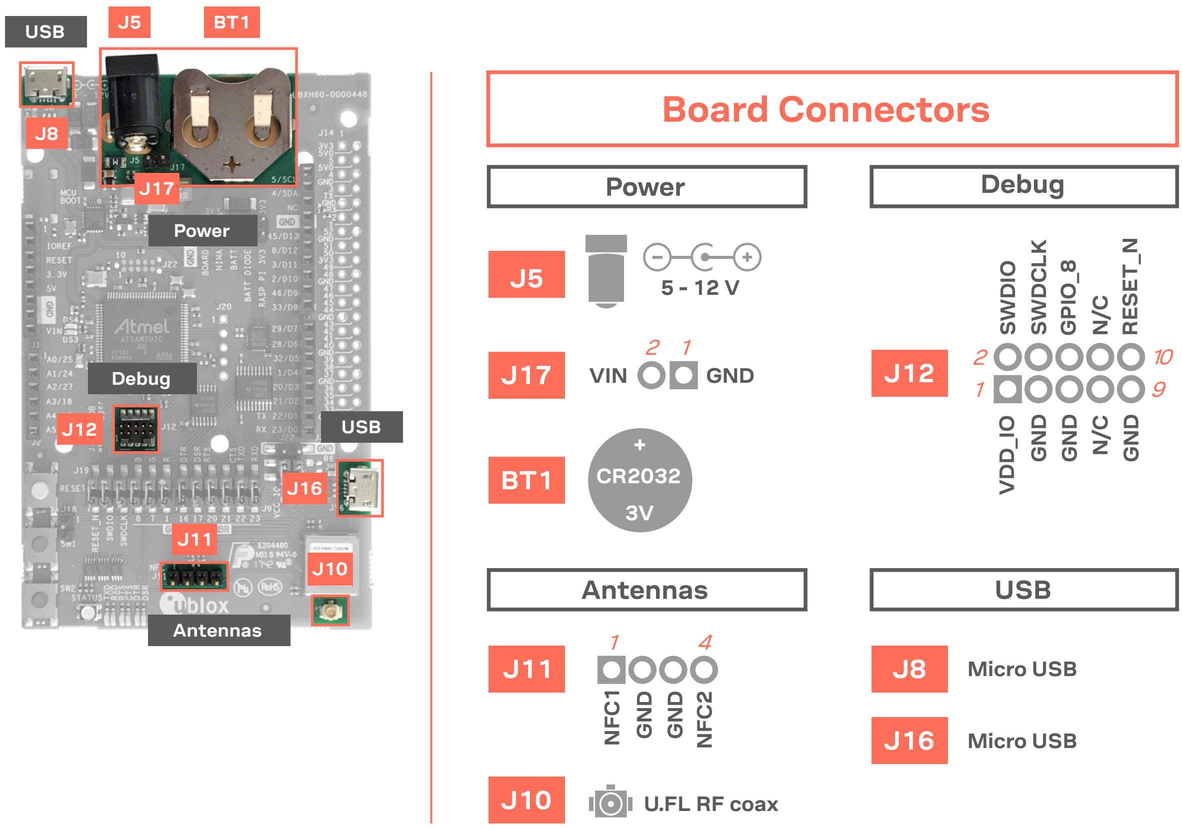


Figure 4: Available connectors and their pinout

3 Setting up the evaluation board

3.1 Evaluation board setup

The EVK-NINA-B410/-B416 will be delivered with the u-blox u-connectXpress software version 1.0.0 installed on the module.

Before connecting the module, download and install the latest u-blox s-center evaluation software from the u-blox website.

To use Bluetooth low energy on the EVK-NINA-B400/-B410, connect a 2.4 GHz antenna to the U.FL antenna connector. The other EVK versions include antennas on the NINA module.

Plug in either an external power supply in the J5 connector or connect to a USB host with a USB cable attached to the J8 connector. You can also power the evaluation board with a CR2032 coin cell battery. The NFC antenna can be connected to the J11 connector.

☞ Make sure that the power configuration jumpers are connected according to your use case. See Section 4.1 for details, the default configuration shown in section 4.1.2 will work for most use cases.

⚠ Be careful to check polarity before connecting an external power supply to the EVK-NINA-B4 evaluation board. Center conductor is positive (+) and the ring is negative (-).

The operating system will install the correct drivers automatically. The drivers will have to be installed only the first time you connect the unit to a new computer.

⚠ If the drivers are not installed automatically, download the nRF Connect from www.nordicsemi.com to get the J-Link CDC UART driver.

Two COM ports will automatically be assigned to the unit by Windows:

- The COM port labeled “USB Serial Port” is used to communicate with the NINA module’s UART interface.
- The COM port labeled “JLink CDC UART Port” can be used as an extra USB to the UART interface; see section 5.4.2 for more information.

Do the following to view the assigned COM ports on Windows 7:

- Open the Control Panel and click Hardware and Sound.
- Click Device Manager in Devices and Printers. This will open the Device Manager window where you can view the assigned COM ports.

To view the assigned COM ports on Windows 10, right click on the Windows Start button and select Device Manager.

3.2 Starting up

3.2.1 EVK-NINA-B41x

Perform the following steps to enable communication with the module:

1. Start the u-blox s-center evaluation software.
2. Use the default baudrate 115200, 8N1 with flow control.
3. Now, you will be able to communicate with the module through AT commands.

For a list of available AT commands, see the u-connect AT Commands Manual [5]. To get started with the basic use case set up of the EVK-NINA-B4 with u-blox u-connect software, see the NINA-B41 Getting Started [7].

3.2.1.1 u-connect software

The EVK-NINA-B41x is equipped with a NINA-B41x module that runs the u-connectXpress software. The EVK is delivered with the u-connectXpress software.

☞ Go to the u-blox support webpage to obtain the latest available software. Instructions on reflashing the EVK-NINA-B4 can be found in the Software section of the NINA-B4 System Integration Manual [4].

3.2.2 EVK-NINA-B40x

If you would like to use the EVK-NINA-B40x together with Nordic Semiconductor SDK, refer to the Software section of the NINA-B4 System Integration Manual [4].

3.2.2.1 Software debug options

You can debug the software using the following two options in EVK-NINA-B4:

- Onboard debug solution available on the USB connector
- Using an external debugger connected to J12 connector

An external debugger connected to the J12 connector is useful when powering the evaluation board with a CR2032 coin cell battery, or through the J5 external power supply connector. It could also be useful in a scenario where the debug MCU interface has been disconnected from the NINA-B4 module using the jumpers on the J19 header. The SEGGER J-Link software [6] is required in order to debug using the onboard J-Link hardware on the EVK-NINA-B4.

3.3 Measuring current consumption

☞ Before starting the current consumption measurement, go through Chapter 4 and identify which power configuration you will need and if you need to isolate any NINA signals. The jumper connecting J22 pins 1 and 3 must be removed in order to be able to measure current consumption.

Figure 5 shows some suggestions for measuring the current consumption of the NINA-B4 module, and how to connect the various instruments.

3.3.1 Using an ampere meter

An ampere meter should be connected in series with whatever the power source is and what is being measured. It is possible to measure current this way both while supplying the NINA module from the onboard 3.3 V regulator and from an external supply.

3.3.2 Using a volt meter

In order to use a volt meter to measure current, the EVK must first be modified. Solder a low resistance, high tolerance, 0402 sized resistor to the footprint labeled R6. This resistor will replace the jumper normally positioned between J22 pins - 1 and 3, and any current running through, it will produce a voltage across its terminals. Measure this voltage using the volt meter and calculate the current using Ohm’s law.

3.3.3 Using an external power supply or power analyzer

Connect the instruments' terminals to the EVK pins as shown in Figure 5, an ampere meter may be added in series. Since an external instrument's voltage can never perfectly match the EVK's generated 3.3 V, there will be a very small current leakage whenever a NINA module signal is connected to an EVK peripheral, typically in the order of 100's of nano amps. To reduce this leakage, use a second external power channel to supply the EVK peripherals. This second channel must also be used to enable PC communication when using NINA supply voltages other than 3.3 V.

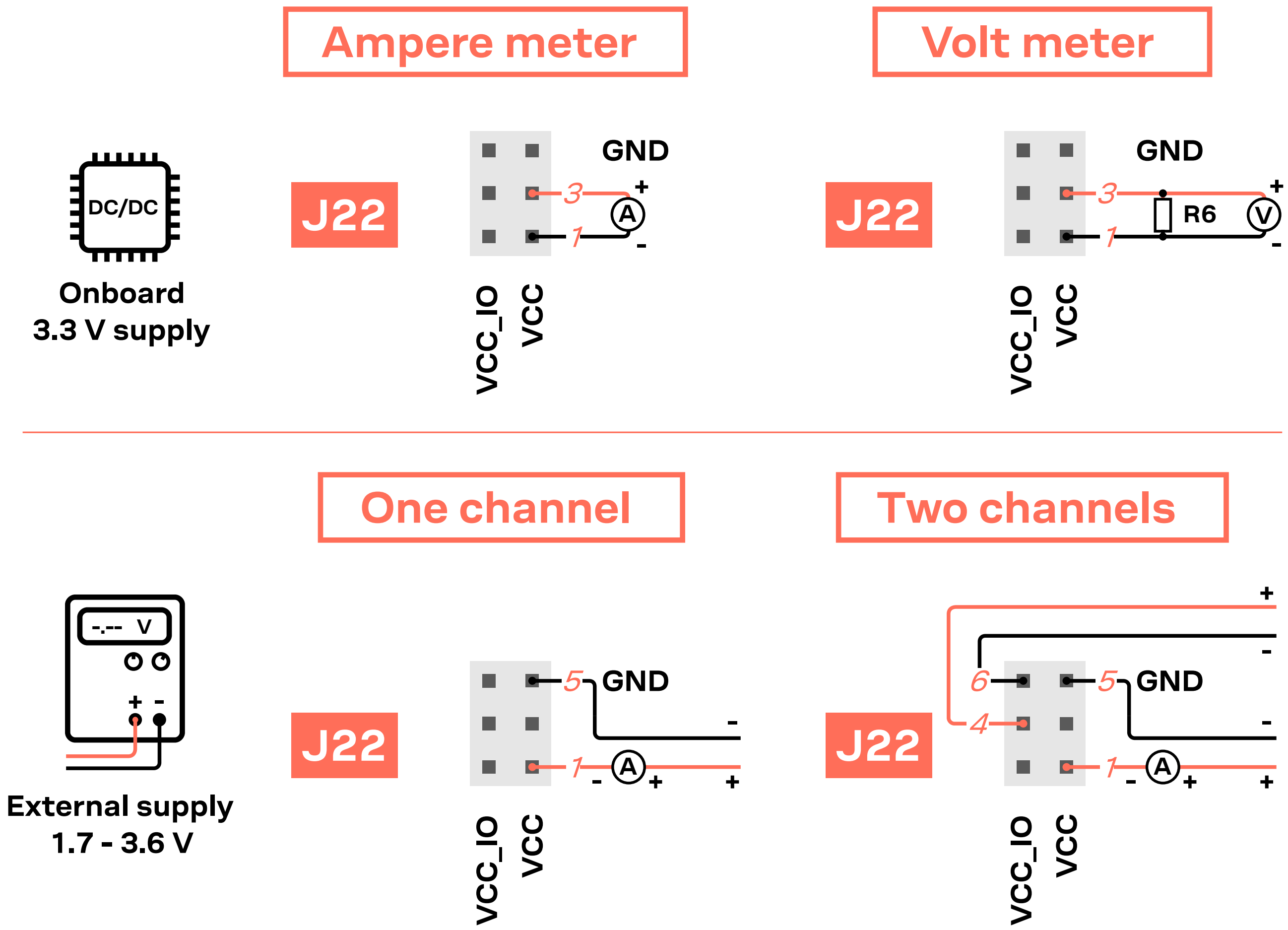


Figure 5: Different options when measuring the NINA module's current consumption

4 Board configuration

4.1 Powering options

Power can be supplied to the board in any of the following ways:

- Via any of the USB connectors, J8 or J16
- Using the power jack, J5
- Using the Arduino interface VIN or 5V pin, J1.8 or J1.5
- Using the Raspberry Pi interface 5V pins, J14.2 or J14.4
- Using the pin header J17
- Plugging in a battery to the battery holder BT1

These power supply sources are distributed to the rest of the board as shown in Figure 6.

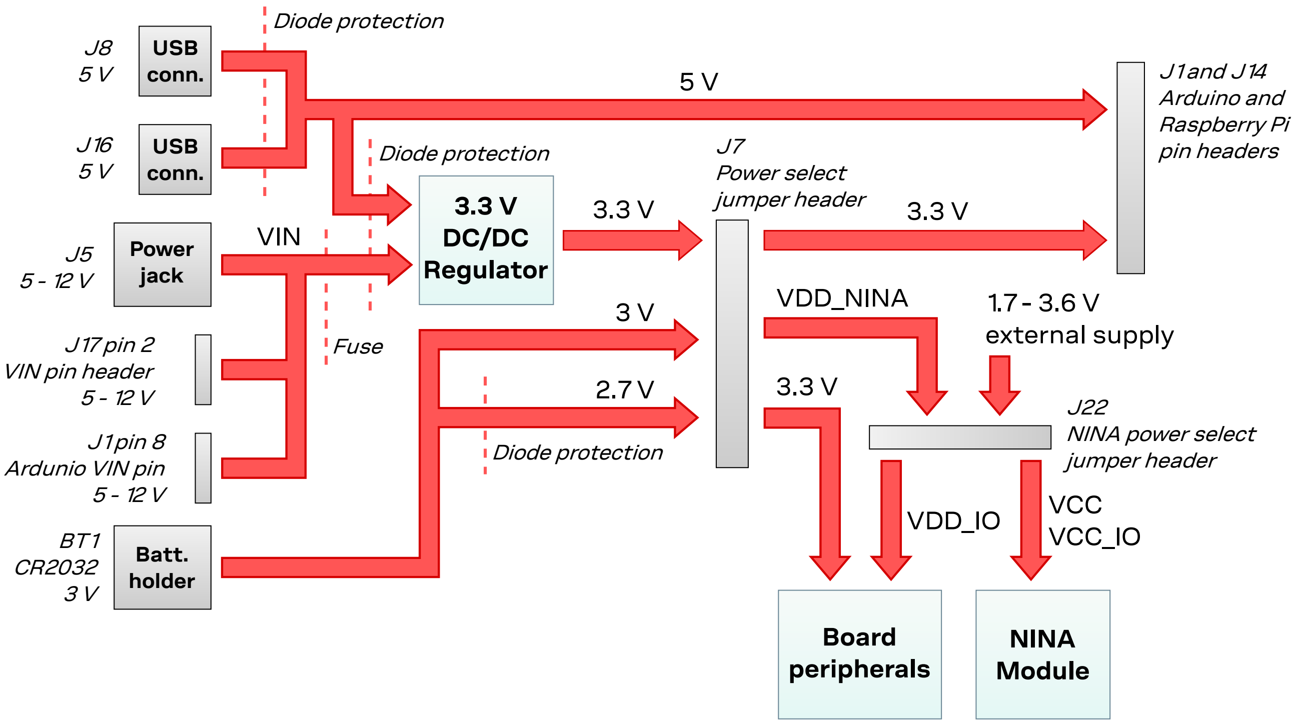


Figure 6: Block diagram of the power net distribution

4.1.1 Selecting the power configuration jumpers

The EVK-NINA-B4 offers flexible powering options for the NINA-B4 module and the board itself. To configure this, jumpers are added or removed to pin headers, shorting two of the pins together and connecting or disconnecting different power nets on the evaluation board. Figure 7 shows an overview of the available power sources and targets. Figure 8 shows the location of the power configuration jumper headers.

⚠ Check the jumper positions carefully; if a jumper is connected in a wrong way, it can permanently damage the components that are ON or connected to the board. Also note that some jumpers should not be mounted simultaneously.

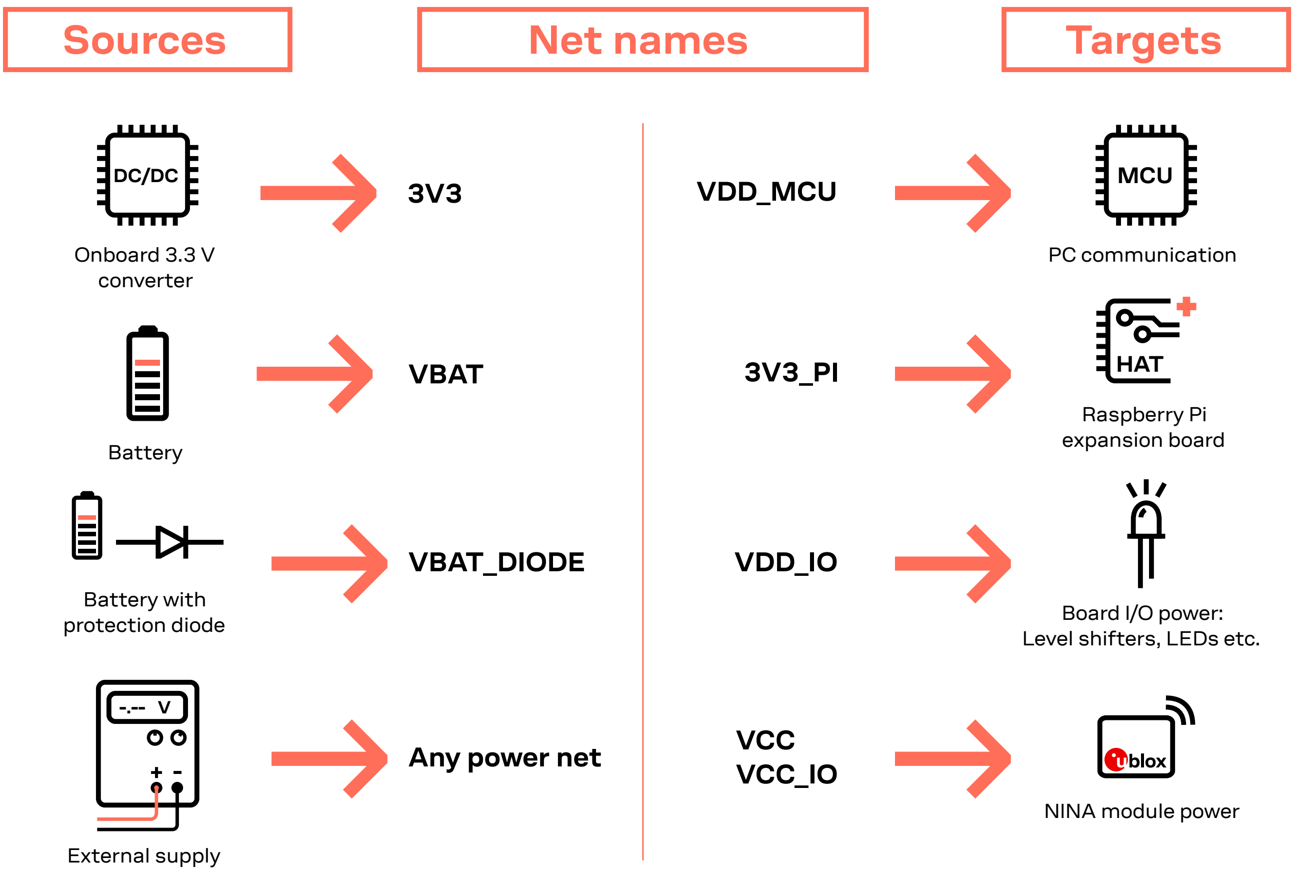


Figure 7: Overview of the available power sources and targets on the EVK, and the schematic net names they are connected to

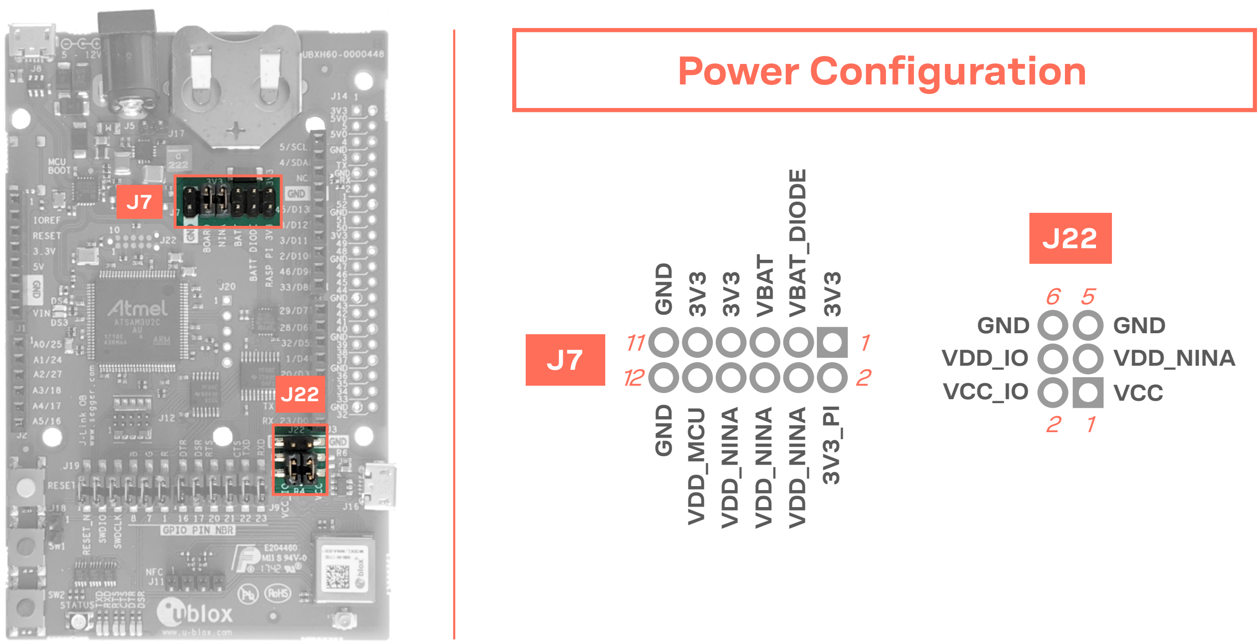


Figure 8: Jumper headers J7 and J22 board location and pinout

Connector	Pin no.	Schematic net name	Description
J7	1	3V3	Regulated 3.3 V net. This net is supplied by the board and will always be powered as long as a power source is connected.
	2	3V3_PI	Connects to the Raspberry Pi header's (J14) 3V3 pins. If a Raspberry Pi is connected, this net must be unconnected to prevent back currents. If a HAT is connected, this net can be shorted to the EVK 3.3 V supply to power the HAT.
	3	VBAT_DIODE	To protect the battery from current back surges, connect the battery to the NINA module via a protection diode using this pin.
	4	VDD_NINA	Connects to J22 pin 3, from where it can be connected to the module supply pin or somewhere else.
	5	VBAT	Battery + terminal
	6	VDD_NINA	Connects to J22 pin 3, from where it can be connected to the module supply pin or somewhere else.
	7	3V3	Regulated 3.3 V net. This net is supplied by the board and will always be powered as long as a power source is connected.
	8	VDD_NINA	Connects to J22 pin 3, from where it can be connected to the module supply pin or somewhere else.
	9	3V3	Regulated 3.3 V net. This net is supplied by the board and will always be powered as long as a power source is connected.
	10	VDD_MCU	Supply net for the board functions not directly connected to the NINA module; Interface MCU, USB hub, UART to USB converter etc.
	11	GND	Ground net.
	12	GND	Ground net.
J22	1	VCC	NINA module voltage supply that connects to the module VCC pin. Shorted to the VCC_IO net via 0 Ω resistor R4 by default.
	2	VCC_IO	Connects to the NINA module VCC_IO pin. Shorted to the VCC net via 0 Ω resistor R4 by default.
	3	VDD_NINA	Connects to J7 pins 4, 6 and 8. Short J22 pins 1 and 3 allow the EVK to power the NINA module.
	4	VDD_IO	Supply net for level shifters, LEDs and peripherals connected directly to the NINA module. Short J22 pins 2 and 4 use the NINA module I/O voltage as supply.
	5	GND	Ground net.
	6	GND	Ground net.

Table 2: Pinout of jumper headers J7 and J22 used to configure the board power nets

4.1.2 Default power configuration, 3.3 V

This is the default power configuration for the evaluation board, and the jumpers are installed out of the box with this power configuration. All board peripherals are powered up, the NINA module is directly supplied by the board and everything is running at 3.3 V.

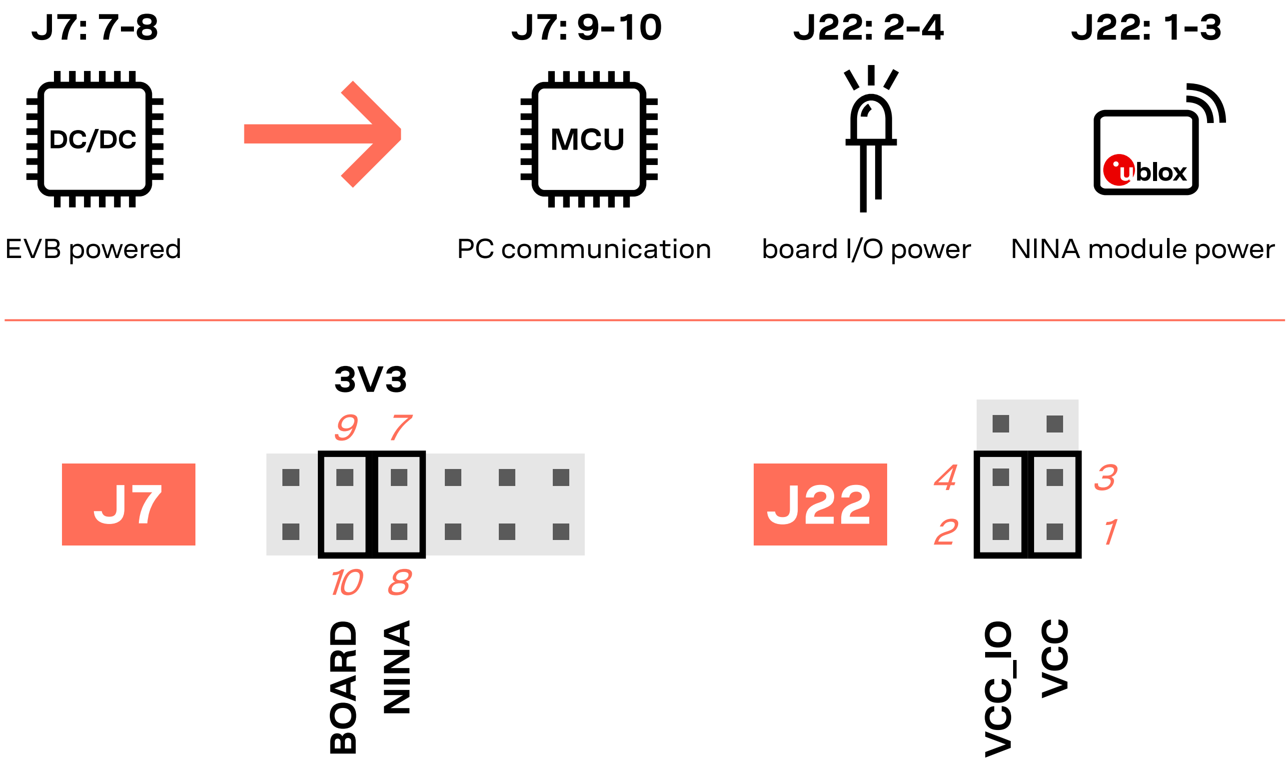


Figure 9: Jumper positions for default power configuration

Connector	Add jumper to pins	Description
J7	7, 8	Selects the board regulated 3.3 V net as source for the VDD_NINA net.
	9, 10	Powers up the Interface MCU, USB hub, and UART to USB converter with 3.3 V.
J22	1, 3	Powers up the NINA module. The NINA VCC and VCC_IO pins are connected to the selected source for the VDD_NINA net.
	2, 4	Powers up the peripherals directly connected to NINA such as LEDs and external memory with the NINA supply voltage.

Table 3: Jumper positions for default power configuration

4.1.3 Battery powered, 3 – 1.7 V

When using a battery, Figure 10 shows the default configuration. The battery voltage is connected to VDD_NINA, which in turn, is connected to the NINA-B4 VCC supply. If needed, a jumper can be added to J22 pins - 2 and 4 to supply LEDs and other peripherals with power, as long as this does not exceed the maximum current rating of the battery. If the NINA module has to be configured, the VDD_MCU net can be connected to enable PC communications by adding a jumper to J7 pins - 9 and 10.

☞ Jumpers must be connected to both J7: 9-10 and J22: 2-4 to be able to communicate with the NINA module from a PC. If possible, the EVB power configuration should be switched to the default 3.3 V configuration, as connecting an extra board peripheral might deplete the battery.

⚠ Do not connect jumpers J7: 5-6 and J7: 7-8 at the same time while a battery is connected! This might cause damage to the battery.

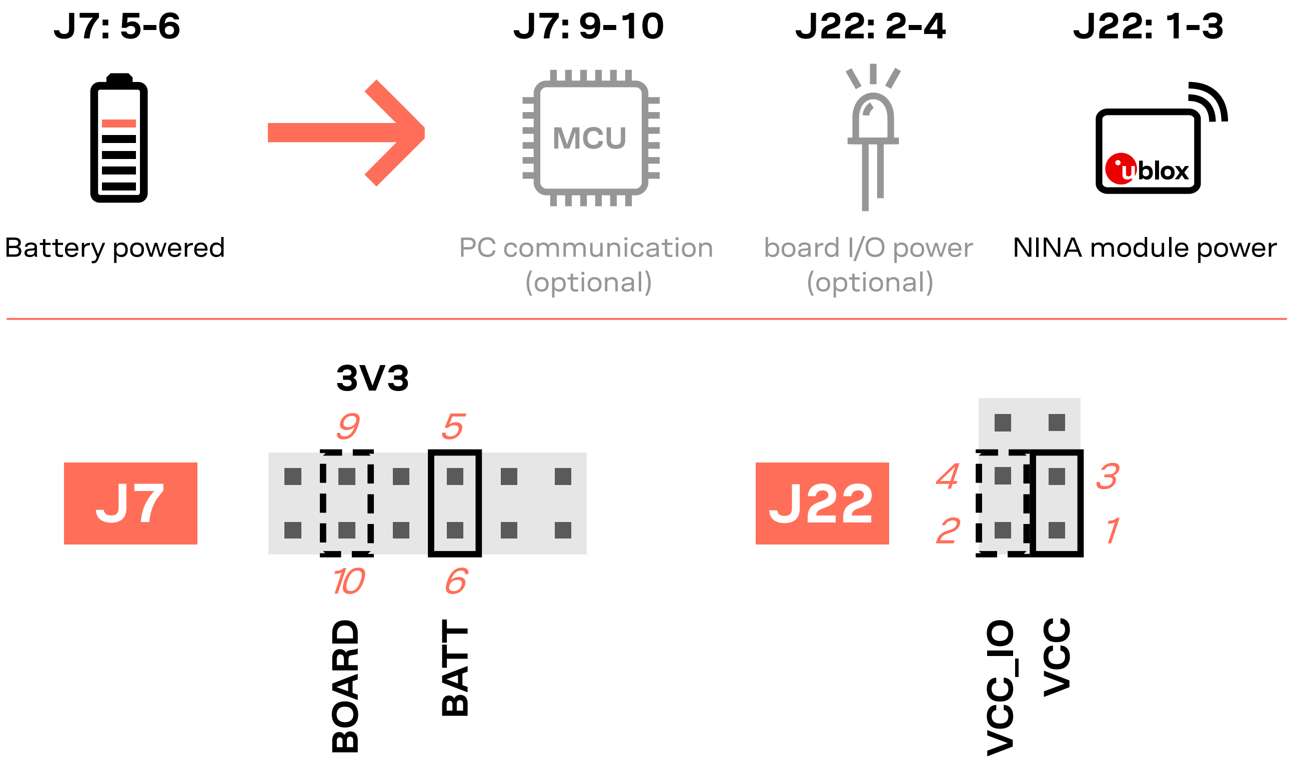


Figure 10: Jumper positions for battery powered operation, the jumpers shown in dashed lines are optional

Connector	Add jumper to pins	Description
J7	5, 6	Selects the battery connected to the battery holder as source for the VDD_NINA net.
	9, 10	(Optional) Powers up the Interface MCU, USB hub, and UART to USB converter with 3.3 V.
J22	1, 3	Powers up the NINA module. The NINA VCC and VCC_IO pins are connected to the selected source for the VDD_NINA net.
	2, 4	(Optional) Powers up the peripherals directly connected to NINA such as LEDs and external memory with the NINA supply voltage.

Table 4: Jumper positions for battery powered operation, two jumpers are optional

4.1.4 Battery powered with protection diode, 2.7 – 1.7 V

This use case is meant to protect the battery from current back surges. When using the NFC interface, there is a risk that the applied electromagnetic field can cause back surges on the module's power supply lines that will typically damage a non-chargeable battery. To prevent this damage, a schottky diode is added in series to the battery, which will block any back current surges. A jumper should be added to J7 pins - 3 and 4 instead of 5 and 6.

☞ The diode will lower the voltage level of the battery by about 0.3 V.

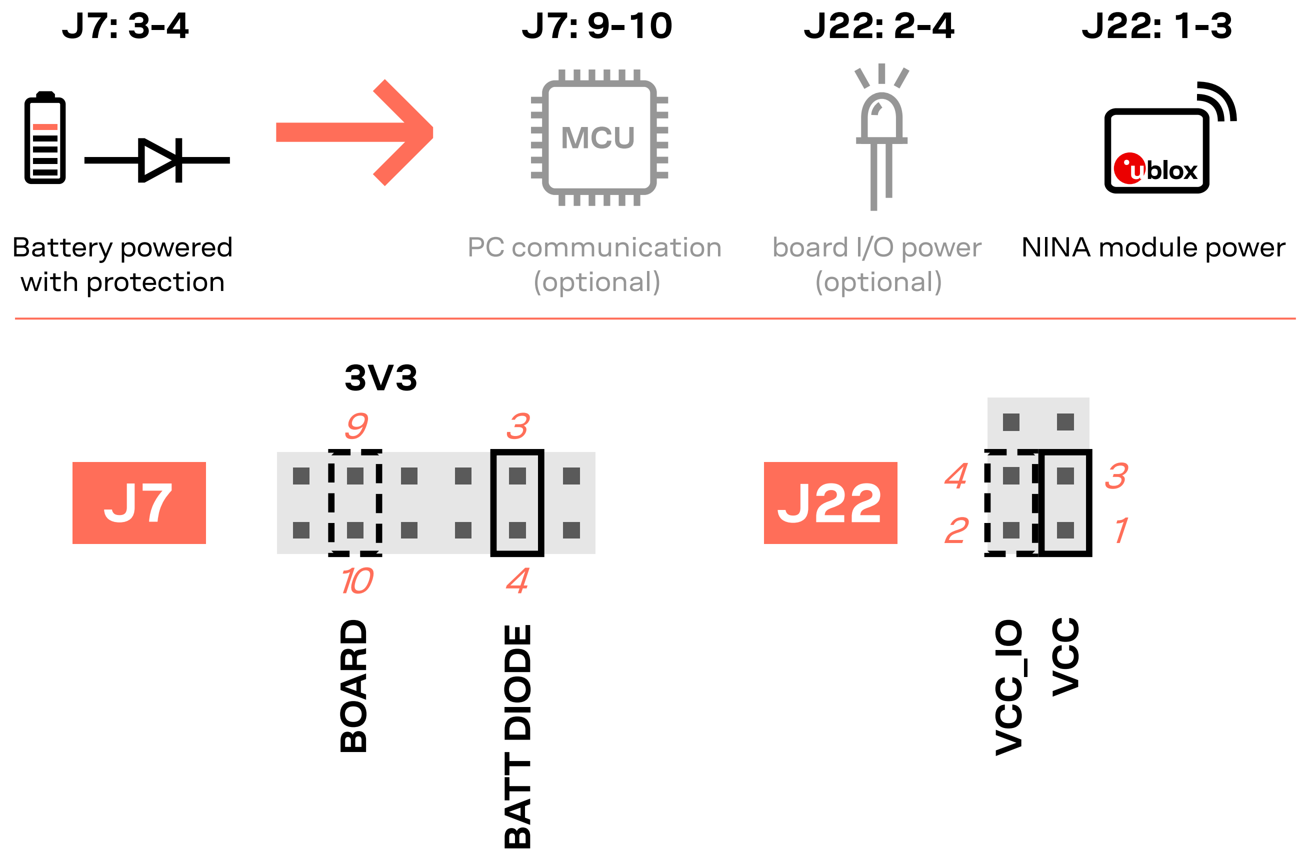


Figure 11: Jumper positions for battery powered operation with a protection diode, the jumpers shown in dashed lines are optional

Connector	Add jumper to pins	Description
J7	3, 4	Selects the diode protected battery as a source for the VDD_NINA net.
	9, 10	(Optional) Powers up the Interface MCU, USB hub, and UART to USB converter with 3.3 V.
J22	1, 3	Powers up the NINA module. The NINA VCC and VCC_IO pins are connected to the selected source for the VDD_NINA net.
	2, 4	(Optional) Powers up the peripherals directly connected to NINA such as LEDs and external memory with the NINA supply voltage.

Table 5: Jumper positions for battery powered operation with a protection diode, two jumpers are optional

4.1.5 External supply, 3.6 – 1.7 V

When measuring current consumption or performing other NINA-B4 module characterization measurements, it can be useful to power the module with an external source such as a lab power supply. In such a case, all jumpers can be removed and the required supply nets can be fed externally by connecting to the pin headers. For example, the NINA-B4 module can be powered by connecting an external supply directly to the J22 pin 1 and GND. See section 3.5 for more information on how to connect external power supplies.

☞ Make sure that unpowered parts of the board are properly isolated from the NINA module. If a voltage is applied to the signal of an unpowered device/component, current might leak through various protection circuits of this device. This might give false readings when measuring current consumption etc. Isolation can be achieved by removing NINA signal jumpers (see section 4.2) for example.

Figure 12 below shows a few optional jumper connections that can be helpful when supplying the module with an external supply.

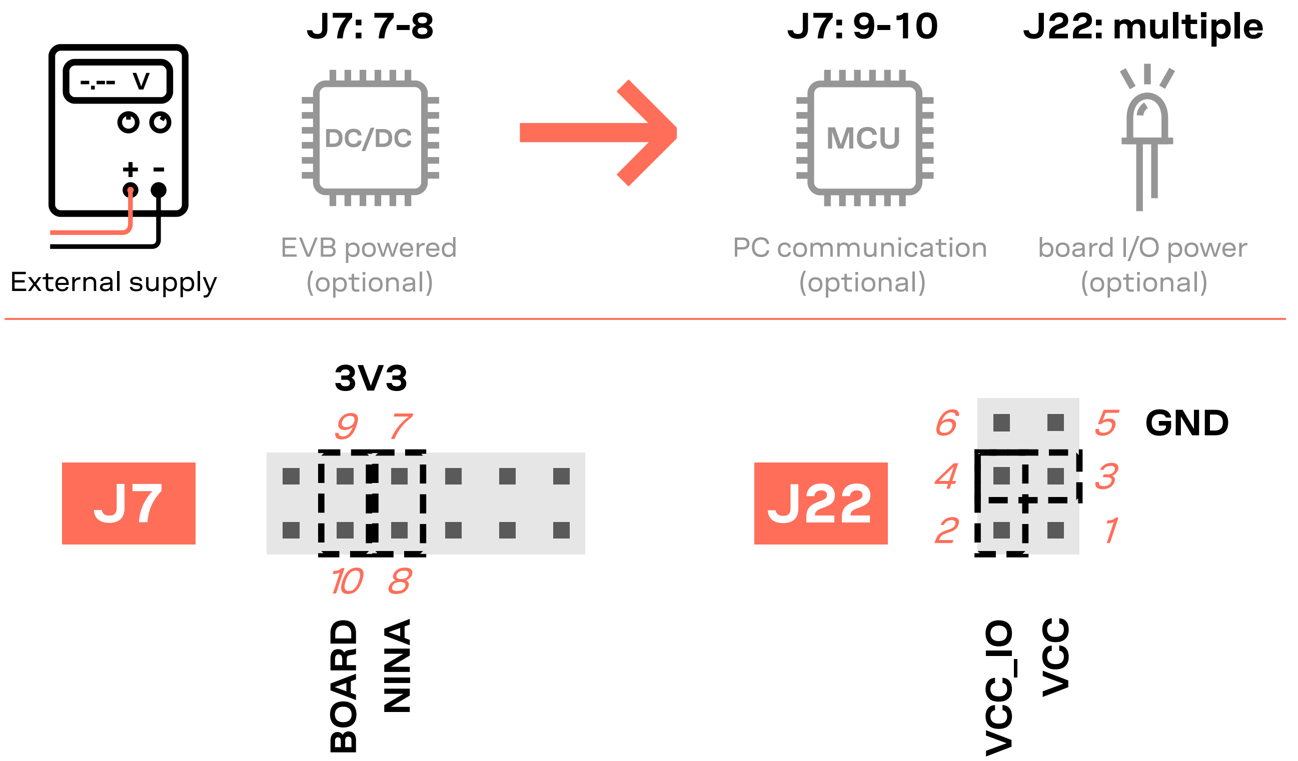


Figure 12: Optional jumper positons while using an external power supply

Connector	Add jumper to pins	Description
J7	7, 8	(Optional) Selects the board regulated 3.3 V net as a source for the VDD_NINA net.
	9, 10	(Optional) Powers up the Interface MCU, USB hub, and UART to USB converter with 3.3 V.
J22	3, 4	(Optional) Powers up the peripherals directly connected to NINA such as LEDs and external memory with the selected source for the VDD_NINA net.

Table 6: Optional jumper positons while using an external supply

4.1.6 Raspberry Pi HAT

When connecting a HAT to the Raspberry Pi interface, the following jumper configuration can be used. Depending on how the NINA module should communicate with a test PC over USB or with the HAT, the VDD_MCU net could be left unpowered.

⚠ The 3V3_PI supply net must only be powered when connecting to a Raspberry Pi expansion board (HAT). If connecting to a Raspberry Pi board, the jumper must be disconnected.

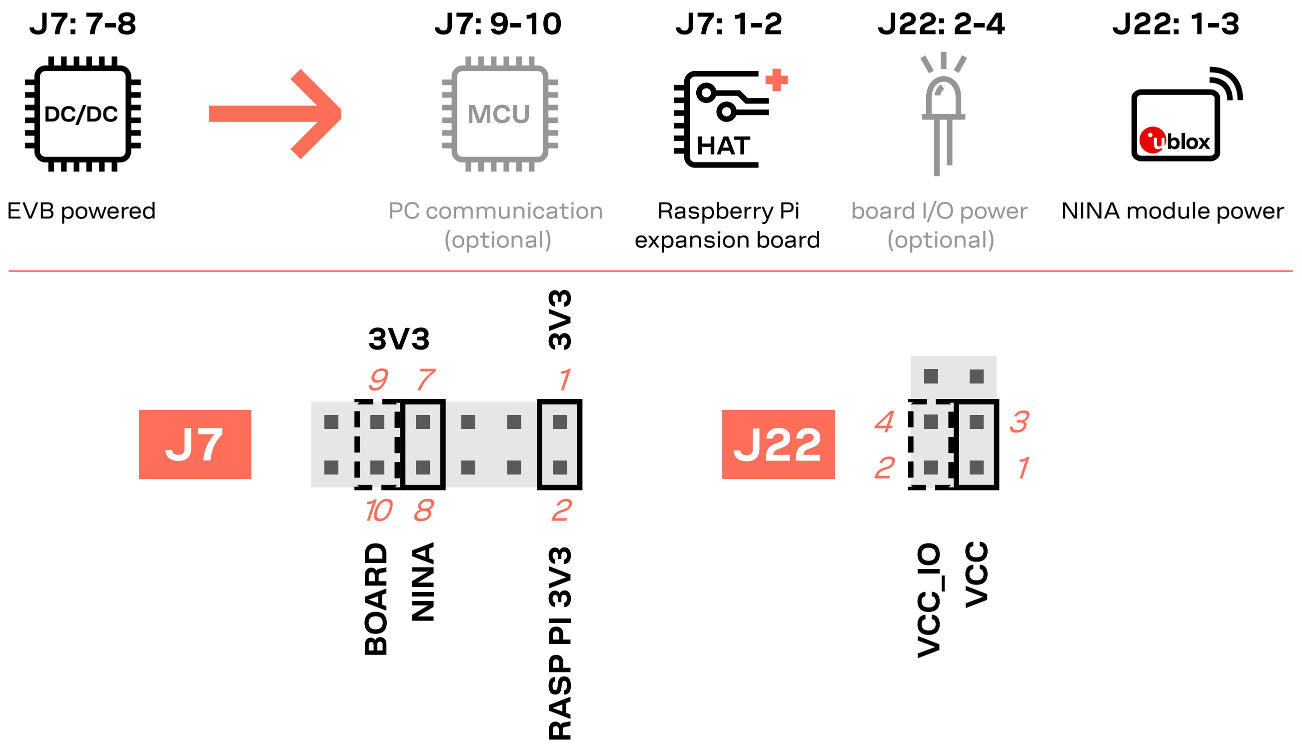


Figure 13: Jumper configuration when connected to a Raspberry Pi HAT, the jumpers shown in dashed lines are optional

Connector	Add jumper to pins	Description
J7	1,2	Connects the 3V3_PI net to the regulated 3.3 V supply.
	7, 8	Selects the board regulated 3.3 V net as a source for the VDD_NINA net.
	9, 10	(Optional) Powers up the Interface MCU, USB hub, and UART to USB converter with 3.3 V.
J22	1, 3	Powers up the NINA module. The NINA VCC and VCC_IO pins are connected to the selected source for the VDD_NINA net.
	2, 4	(Optional) Powers up the peripherals directly connected to NINA such as LEDs and external memory with the NINA supply voltage.

Table 7: Jumper configuration when connected to a Raspberry Pi HAT

4.2 Disconnecting NINA signals from board peripherals

All evaluation board peripherals, such as level shifters, LEDs, and the interface MCU will be connected to the NINA-B4 module by default. This might not suit all evaluation scenarios. All peripherals can be switched off by disconnecting their power supplies (see section 4.1), but if only specific signals have to be isolated, it will require finer control. All the NINA module signals that are connected to board peripherals have thus been routed via jumper headers, so that jumpers can be pulled or added as needed by the evaluation board user, isolating, or connecting specific signals. Figure 14 shows the layout of these jumper headers.

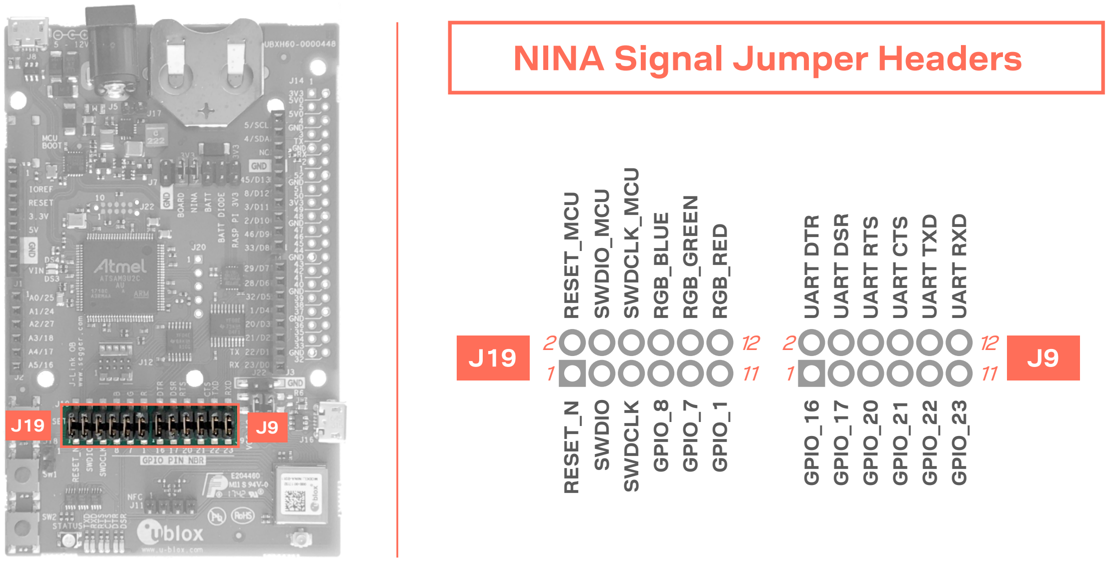


Figure 14: Jumper headers J19 and J9 that are used to isolate specific NINA signals

Connector	Pin no.	Schematic net name	Description
J19	1	RESET_N	NINA reset signal, active low
	2	RESET_N_I	Connects to the Interface MCU's reset line
	3	SWDIO	SWD data signal
	4	SWDIO_I	Interface MCU SWD data signal, used to program/debug the NINA module
	5	SWDCLK	SWD clock signal
	6	SWDCLK_I	Interface MCU SWD data signal, used to program/debug the NINA module
	7	GPIO_8	NINA-B40: GPIO or TRACE, NINA-B41: BLUE signal
	8	BLUE	RGB diode blue signal, active low
	9	GPIO_7/ SWITCH_1	NINA-B40: GPIO, can be used as either user LED output or push-button input NINA-B41: SWITCH_1 and GREEN signal
	10	GREEN	RGB diode green signal, active low
	11	GPIO_1	NINA-B40: GPIO, can be used as user LED output, NINA-B41: RED signal
	12	RED	RGB diode red signal, active low
J9	1	GPIO_16/ UART_DTR	NINA-B40: analog capable GPIO signal NINA-B41: UART DTR output
	2	UART_DTR_I	UART to USB DTR signal
	3	GPIO_17/ UART_DSR	NINA-B40: analog capable GPIO signal NINA-B41: UART DSR input
	4	UART_DSR_I	UART to USB DSR signal
	5	GPIO_20/ UART_RTS	NINA-B40: analog capable GPIO signal NINA-B41: UART RTS output
	6	UART_RTS_I	UART to USB RTS signal
	7	GPIO_21/ UART_CTS	NINA-B40: GPIO signal NINA-B41: UART CTS input
	8	UART_CTS_I	UART to USB CTS signal
	9	GPIO_22/ UART_TXD	NINA-B40: GPIO signal NINA-B41: UART TXD output
	10	UART_TXD_I	UART to USB TXD signal
	11	GPIO_23/ UART_RXD	NINA-B40: analog capable GPIO signal NINA-B41: UART RXD input
	12	UART_RXD_I	UART to USB RXD signal

Table 8: Pinout of the jumper headers - J19 and J9

5 Interfaces and peripherals

5.1 Buttons and LEDs

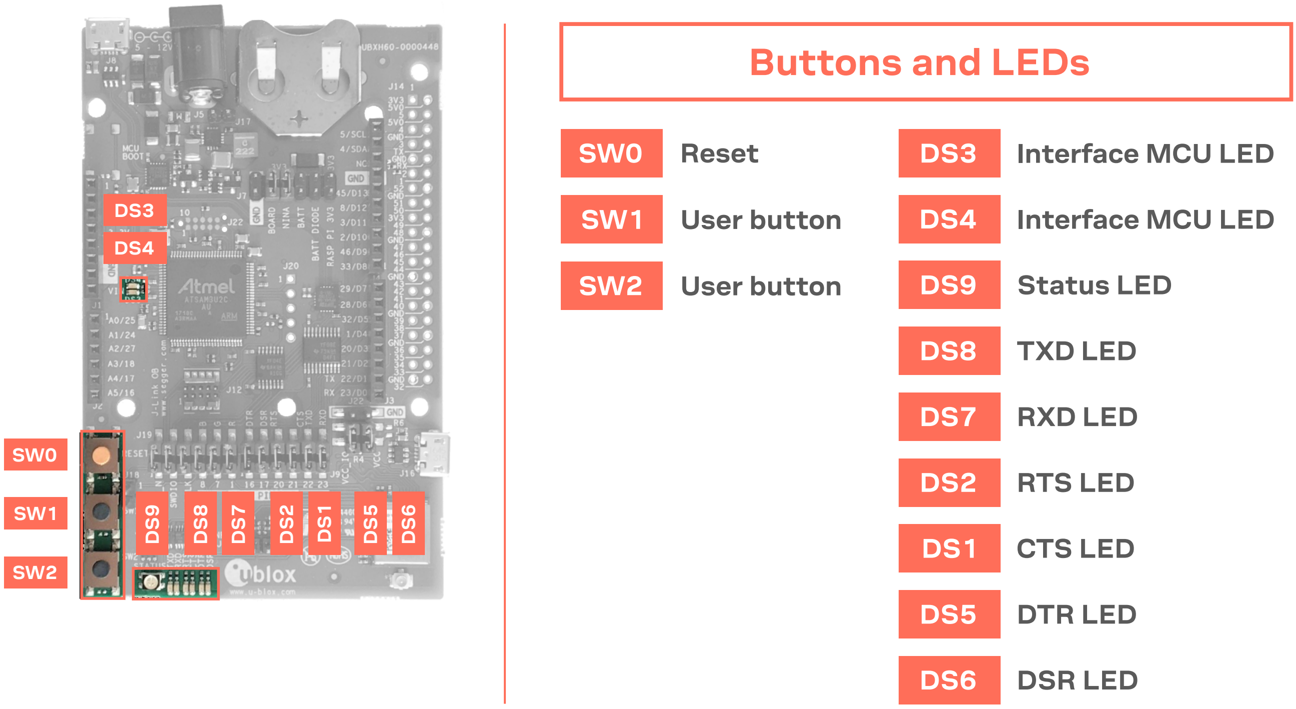


Figure 15: Position of the push buttons and LEDs on the evaluation board

Annotation	Function	Description
SW0	Reset button	Connected directly to the NINA RESET_N pin.
SW1	User button	Push button for application use. Connected directly to the NINA SWITCH_1 (GPIO_7) pin
SW2	User button	Push button for application use. Connected directly to the NINA SWITCH_2 (GPIO_18) pin.

Table 9: EVK-NINA-B4 buttons

Annotation	Function	Description	Color
DS1	UART CTS LED	Connected to the NINA UART_CTS (GPIO_21) pin via jumper header J9	
DS2	UART RTS LED	Connected to the NINA UART_RTS (GPIO_20) pin via jumper header J9	
DS3	Interface MCU LED	Blinks on USB enumeration and activity, lit when the Interface MCU is connected via USB	
DS4	Interface MCU LED	Error LED	
DS5	UART DTR LED	Connected to the NINA UART_DTR (GPIO_16) pin via jumper header J9	
DS6	UART DSR LED	Connected to the NINA UART_DSR (GPIO_17) pin via jumper header J9	
DS7	UART TXD LED	Connected to the NINA UART_TXD (GPIO_22) pin via jumper header J9	
DS8	UART RXD LED	Connected to the NINA UART_RXD (GPIO_23) pin via jumper header J9	
DS9	RGB LED	Connected to the NINA RED (GPIO_1), GREEN (GPIO_7) and BLUE (GPIO_8) pins via jumper header J19. The RGB LED shows the status for the u-connect applications. ☞ See the NINA-B4 data sheet [3] for additional information.	

Table 10: EVK-NINA-B4 LED indicators

5.2 Arduino interface

The EVK-NINA-B4 includes a set of pin headers and mounting holes that are compatible with certain Arduino or Arduino inspired shields. Figure 16 shows the layout of the Arduino interface and Table 11 explains the pinout in more detail. Section 5.2.1 describes what specifications must be met for a shield to be compatible for use with the EVK-NINA-B4.

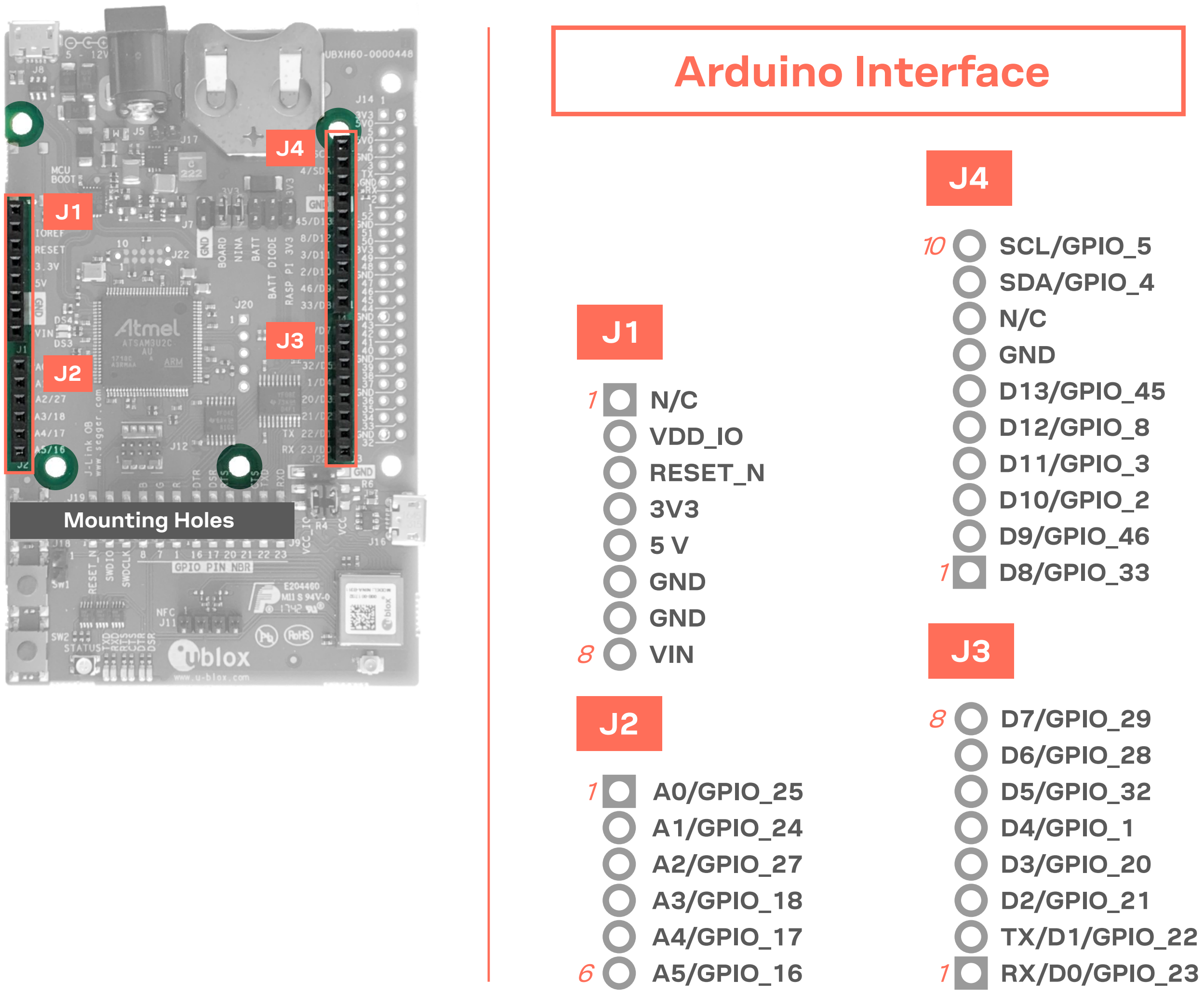


Figure 16: Pin headers that are compatible with some Arduino shields

Conn.	Pin No.	Arduino pin	Description	Schematic net name	nRF52 pin	Alternate functions and notes
J1	1	N/C	Not Connected	-	-	Not connected
	2	IOREF	I/O reference voltage level. Selectable by user to 1.7 – 3.6 V	VDD_IO	-	See section 4.1
	3	RESET	NINA reset signal input. Active low logic	RESET_N	P0.18	
	4	3.3V	3.3 V DC regulated supply output	3V3	-	
	5	5V	5 V regulated supply output	5V	-	Cannot be used as supply input, use VIN instead. Only supplied by USB VBUS.
	6	GND	Ground	GND	GND	
	7	GND	Ground	GND	GND	
	8	VIN	External DC supply input, 5 – 12 VDC	VIN	-	

Conn.	Pin No.	Arduino pin	Description	Schematic net name	nRF52 pin	Alternate functions and notes
J2	1	A0	Analog input	GPIO_25	P0.04	Analog function capable GPIO
	2	A1	Analog input	GPIO_24	P0.30	Analog function capable GPIO
	3	A2	Analog input	GPIO_27	P0.05	Analog function capable GPIO
	4	A3	Analog input	SWITCH_2/ GPIO_18	P0.02	Analog function capable GPIO, SWITCH_2 on NINA-B41. This signal is pulled low when the button SW2 is pressed
	5	A4	Analog input	UART_DSR/ GPIO_17	P0.28	Analog function capable GPIO, UART_DSR signal on NINA-B41
	6	A5	Analog input	UART_DTR/ GPIO_16	P0.03	Analog function capable GPIO, UART_DTR signal on NINA-B41
J3	1	D0/RX	Digital I/O, UART RX	UART_RXD/ GPIO_23	P0.29	UART_RXD signal on NINA-B41
	2	D1/TX	Digital I/O, UART TX	UART_TXD/ GPIO_22	P1.05	UART_TXD signal on NINA-B41
	3	D2	Digital I/O	UART_CTS/ GPIO_21	P0.23	UART_CTS signal on NINA-B41
	4	D3	Digital I/O	UART_RTS/ GPIO_20	P0.31	UART_RTS signal on NINA-B41
	5	D4	Digital I/O	GPIO_1	P0.13	
	6	D5	Digital I/O	GPIO_32	P0.11	
	7	D6	Digital I/O	GPIO_28	P0.09	Signal not connected by defualt, configured for NFC use
	8	D7	Digital I/O	GPIO_29	P0.10	Signal not connected by defualt, configured for NFC use
J4	1	D8	Digital I/O	GPIO_33	P1.09	
	2	D9	Digital I/O	GPIO_46	P0.12	
	3	D10	Digital I/O	GPIO_2	P0.00	Disconnected by default Connected to 32Khz LPO clock. To connect GPIO 2 to J4 header instead of LPO clock, remove R66 and add R64 (zero ohm resistor)
	4	D11	Digital I/O	GPIO_3	P0.01	Disconnected by default Connected to 32Khz LPO clock. To connect GPIO 3 to J4 header instead of LPO clock, remove R67 and add R65 (zero ohm resistor)
	5	D12	Digital I/O	GPIO_8	P1.00	
	6	D13	Digital I/O	GPIO_45	P0.07	
	7	GND	Ground	GND		
	8	AREF	Analog reference voltage level	-	-	Not connected
	9	SDA	I2C data signal	GPIO_4	P0.16	
	10	SCL	I2C clock signal	GPIO_5	P0.17	

Table 11: Pinout of the Arduino UNO R3 compatible interface

5.2.1 Arduino shield compatibility

☞ The EVK-NINA-B4 has an I/O voltage range of 1.7-3.6 V. It can therefore be used only with shields that also support an I/O voltage within this range.

The EVK-NINA-B4 has a pinout that is compatible with some Arduino, or Arduino inspired, shields. This section describes the features of certain EVK pins that a shield must comply with:

- IOREF: The I/O voltage level of the NINA-B4 module is 3.3 V by default, but the EVK can be modified to allow other voltages (1.7-3.6 V).
- RESET: Is connected to the RESET button (SW0).
- 3.3 V: A regulated 3.3 V output. Should not be used as a voltage supply input, use the VIN pin instead.
- 5 V: Is only a 5 V supply output if the EVK is being powered by USB. If any other power configuration is used, this pin will be unconnected (floating). It is safe to connect an external 5 V supply to this pin even when a USB cable is connected. This pin may be used to power the board.
- VIN: May be used as a 5 -12 V supply input to power the EVK-NINA-B4.
- Pin 0 (RX): Is connected to the NINA-B4 UART RX pin (NINA pin 23).
- Pin 1 (TX): Is connected to the NINA-B4 UART TX pin (NINA pin 22).

Note on SCL/SDA: On some Arduino boards, the I^2C signals, SCL, and SDA are connected to the pins A4 and A5 and to the SCL and SDA pins in the top right hand corner. Since these pins will be shorted together it might cause problems when connected to the EVK-NINA-B4, which has not shorted these pins together.

Note on digital I/O pins: Some of the digital I/O pins can be connected to the on-board debug MCU, thus allowing serial communication and flashing/debugging over USB. This can cause interference on the signals that are also used by an Arduino shield, see section 4.2 on how to disconnect these signals from the debug MCU.

5.3 Raspberry Pi compatible interface

The EVK-NINA-B4 includes a 40-pin GPIO header that can be used to interface with either a Raspberry Pi computer board or with a Raspberry Pi expansion board (HAT). The EVK-NINA-B4 uses different hardware and software configurations depending on if it is connected to a Pi or a HAT; the differences are covered in this section. The default configuration is to connect to a Pi.

Not all the Raspberry Pi versions and HATs are supported, since it requires the 40-pin GPIO header, which older versions did not have. Table 12 lists the compatible Raspberry Pi versions.

Compatible Raspberry Pi boards
Raspberry Pi 1 Model A+
Raspberry Pi 1 Model B+
Raspberry Pi 2 Model B
Raspberry Pi 3 Model B
Raspberry Pi Zero
Raspberry Pi Zero W

Table 12: Compatible Raspberry Pi boards

Figure 17 shows the layout of the Raspberry Pi interface and Table 13 explains the pinout in detail. There are three mounting holes that can be used for increased mechanical stability. The two on either side of connector J14 are common to all Raspberry Pi boards, but the third one is only compatible with the Pi Zero boards.

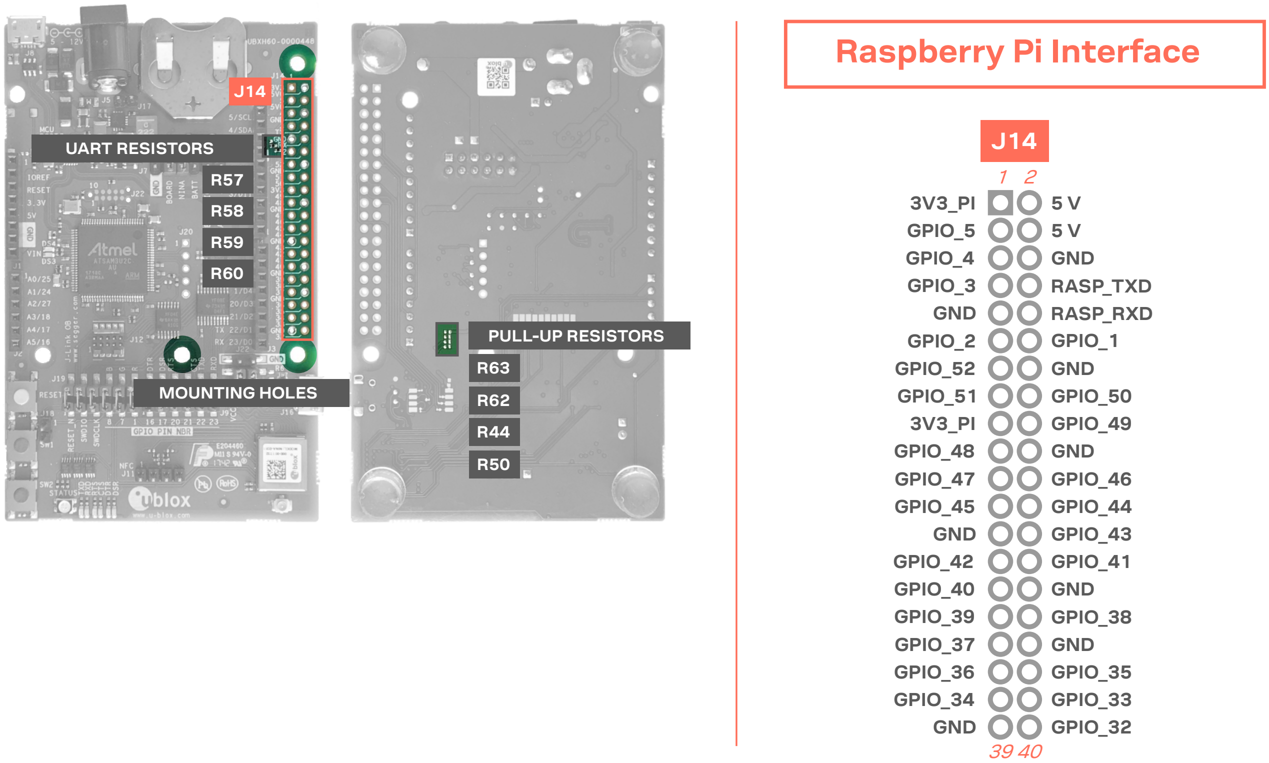


Figure 17: Pin header J14 that is compatible with the Raspberry Pi GPIO connectors

Conn.	Pin No.	Raspberry Pi pin	Description	Schematic net name	nRF52 pin	Alternate functions and notes
J14	1	3.3 V	3.3 V supply pin	3V3_PI	-	Not connected by default, see section 4.1
	2	5 V	5 V supply pin	5V	-	Cannot be used as supply input. Supplied by USB VBUS and protected from back powering.
	3	GPIO02	Digital I/O	GPIO_5	P0.17	
	4	5 V	5 V supply pin	5V	-	Cannot be used as supply input. Supplied by USB VBUS and protected from back powering.
	5	GPIO03	Digital I/O	GPIO_4	P0.16	
	6	GND	Ground	GND	GND	
	7	GPIO04	Digital I/O	GPIO_3	P0.01	Disconnected by default Connected to 32Khz LPO clock. To connect GPIO 3 to J4 header instead of LPO clock, remove R67 and add R65 (zero ohm resistor)
	8	GPIO14	Digital I/O, UART TX/RX	RASP_TXD	P0.29	Connected to NINA UART_RXD pin by default, see section 5.3.2
	9	GND	Ground	GND	GND	
	10	GPIO15	Digital I/O, UART RX/TX	RASP_RXD	P1.05	Connected to NINA UART_TXD pin by default, see section 5.3.2
	11	GPIO17	Digital I/O	GPIO_2	P0.00	Disconnected by default Connected to 32Khz LPO clock. To connect GPIO 2 to J4 header instead of LPO clock, remove R66 and add R64 (zero ohm resistor)
	12	GPIO18	Digital I/O	GPIO_1	P0.13	

Conn.	Pin No.	Raspberry Pi pin	Description	Schematic net name	nRF52 pin	Alternate functions and notes
	13	GPIO27	Digital I/O	GPIO_52	P0.08	Connected to NINA through a solder bridge, if the solder bridge is cut this pin will be left floating
	14	GND	Ground	GND	GND	
	15	GPIO22	Digital I/O	GPIO_51	P1.08	Connected to NINA through a solder bridge, if the bridge is cut this pin will be left floating
	16	GPIO23	Digital I/O	GPIO_50	P0.20	Connected to NINA through a solder bridge, if the bridge is cut this pin will be left floating
	17	3.3 V	3.3 V supply pin	3V3_PI	-	Not connected by default, see section 4.1
	18	GPIO24	Digital I/O	GPIO_49	P0.22	Connected to NINA through a solder bridge, if the bridge is cut this pin will be left floating
	19	GPIO10	Digital I/O	GPIO_48	P0.21	Connected to NINA through a solder bridge, if the bridge is cut this pin will be left floating
	20	GND	Ground	GND	GND	
	21	GPIO09	Digital I/O	GPIO_47	P0.06	Connected to NINA through a solder bridge, if the bridge is cut this pin will be left floating
	22	GPIO25	Digital I/O	GPIO_46	P0.12	
	23	GPIO11	Digital I/O	GPIO_45	P0.07	
	24	GPIO08	Digital I/O	GPIO_44	P0.27	
	25	GND	Ground	GND	GND	
	26	GPIO07	Digital I/O	GPIO_43	P0.15	
	27	ID_SD	EEPROM config I2C data signal	GPIO_42	P0.26	Should only be used to read or simulate HAT EEPROMs, see section 5.3.3
	28	ID_SC	EEPROM config I2C clock signal	GPIO_41	P1.03	Should only be used to read or simulate HAT EEPROMs, see section 5.3.3
	29	GPIO05	Digital I/O	GPIO_40	P0.19	
	30	GND	Ground	GND	GND	
	31	GPIO06	Digital I/O	GPIO_39	P1.07	
	32	GPIO12	Digital I/O	GPIO_38	P0.25	
	33	GPIO13	Digital I/O	GPIO_37	P1.06	
	34	GND	Ground	GND	GND	
	35	GPIO19	Digital I/O	GPIO_36	P1.02	
	36	GPIO16	Digital I/O	GPIO_35	P1.04	
	37	GPIO26	Digital I/O	GPIO_34	P0.14	
	38	GPIO20	Digital I/O	GPIO_33	P1.09	
	39	GND	Ground	GND	GND	
	40	GPIO21	Digital I/O	GPIO_32	P0.11	

Table 13: Pinout of the Raspberry Pi compatible interface

5.3.1 Powering considerations

There are two voltage nets used in the Raspberry Pi interface - 3V3_PI and 5V. Both the 3V3_PI and 5V nets can be used to power HATs, but should not be used when connecting to a Raspberry Pi. See section 0 for more information.

⚠ The 3V3_PI power net must not be connected to the 3.3 V supply when connected to a Raspberry Pi board. It could damage both the boards.

5.3.2 UART

The Raspberry Pi interface provides two pins that can be used for UART communications **GPIO14** and **GPIO15**. In UART communications, signals are always connected RX <-> TX and vice versa. This means that on a Raspberry Pi board **GPIO14** will be TX and on a HAT it will be RX. To support talking to both HATs and Pi boards, the zero Ω resistors - R57, R58, R59 and R60 can be used to toggle the NINA TX and RX pins between **GPIO14** and **GPIO15**. If a NINA-B40 is used, this switch can also be made in the software. By default, the EVK-NINA-B4 will be configured to simulate a HAT, and **GPIO14** is connected to the NINA **UART_RXD** pin and **GPIO15** is connected to the NINA **UART_TXD** pin.

5.3.3 EEPROM support

The Raspberry Pi interface supports a unique EEPROM solution to store the HAT specific GPIO configurations on the HAT board, to be read by the Raspberry Pi before configuring its GPIOs. The two pins used for this - **ID_SD** and **ID_SC**, are connected to the NINA-B4 module. The NINA module can thus either read the GPIO configuration from a HAT, or simulate an EEPROM and send configurations to a connected Pi. This requires a NINA-B40 module and a custom built application.

It is not mandatory to use this EEPROM solution; if not used, the two NINA pins **GPIO_42** and **GPIO_41** should be left unconfigured.

Two pull-up resistors - R44 and R50, can be added to the I^2C lines if needed. They are not mounted on the evaluation board by default.

Visit https://github.com/raspberrypi/hats/blob/master/designguide.md for more information on the ID EEPROM specification.

5.4 Additional Interfaces

In addition to the normal interfaces most commonly used, there are a few expansion options available for the user. These extra interfaces require some modifications of the EVB before they can be used.

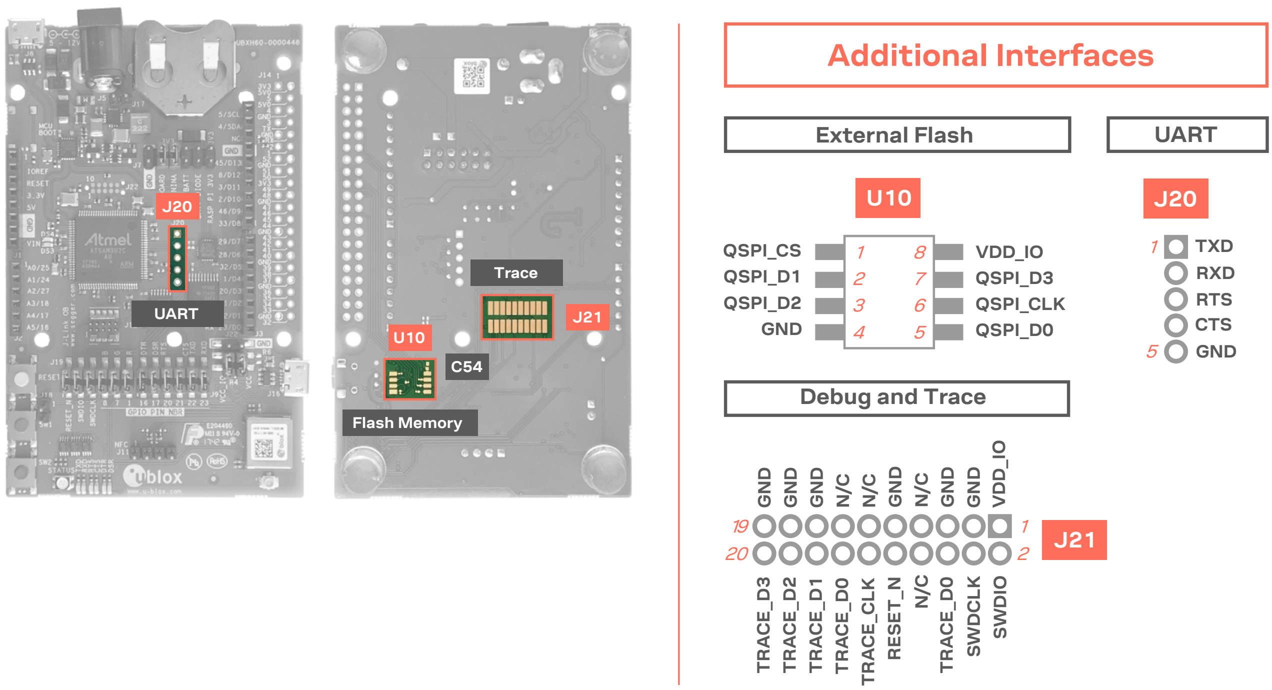


Figure 18: These additional interfaces requires some soldering before use

Connector annotation	Pin number	Schematic net name	nRF52 pin	Description
U10	1	SPI_CS/GPIO_51	P1.08	Chip select input signal, active low
	2	SPI_MISO/GPIO_48	P0.21	MISO in single SPI mode, or data I/O signal in dual/quad mode
	3	GPIO_49	P0.22	
	4	GND	GND	Ground
	5	SPI_MOSI/GPIO_50	P0.20	MOSI in single SPI mode, or data I/O signal in dual/quad mode
	6	SPI_CLK/GPIO_52	P0.08	Chip clock input signal, up to 32 MHz supported
	7	GPIO_47	P0.06	
	8	VDD_IO	-	Supply net for LEDs and peripherals connected directly to the NINA module. Supply for the external memory chip.
J20	1	MCU_TXD	-	Interface MCU data output signal
	2	MCU_RXD	-	Interface MCU data input signal
	3	MCU_RTS	-	Interface MCU flow control output signal
	4	MCU_CTS	-	Interface MCU flow control input signal
	5	GND	GND	Ground
J21	1	VDD_IO	-	Supply net for LEDs and peripherals connected directly to the NINA module. Supply for the external memory chip.
	2	SWDIO	SWDIO	Serial Wire Debug data I/O signal
	3	GND	GND	Ground
	4	SWDCLK	SWDCLK	Serial Wire Debug clock signal
	5	GND	GND	Ground
	6	TRACE_D0/SWO/ GPIO_8	P1.00	Serial trace data signal / Parallell trace data signal
	7	N/C	-	Not connected
	8	N/C	-	Not connected
	9	GND	GND	Ground
	10	RESET_N	P0.18	NINA reset signal, active low
	11	N/C	-	Not connected
	12	TRACE_CLK/GPIO_45	P0.07	Parallell trace clock signal
	13	N/C	-	Not connected
	14	TRACE_D0/SWO/ GPIO_8	P1.00	Serial trace data signal / Parallell trace data signal
	15	GND	GND	Ground
	16	TRACE_D1/GPIO_46	P0.12	Parallell trace data signal
	17	GND	GND	Ground
	18	TRACE_D2/GPIO_32	P0.11	Parallell trace data signal
	19	GND	GND	Ground
	20	TRACE_D3/GPIO_33	P1.09	Parallell trace data signal

Table 14: Pinout of the additional interfaces

5.4.1 Extra memory – external Flash

The NINA-B4 series module supports adding extra memory outside of the module. This memory space can be used to store data and/or expand the application code size. SPI (Serial Peripheral Interface) is used by the NINA-B4 module to communicate with the external flash memory. Information about the SPI interface, the supported modes and supported clock frequencies can be found in the NINA-B4 series Data Sheet [1].

The signals used in the SPI interface are shared with other interfaces and GPIO functions, and they have been routed both to the flash memory footprint on the bottom side of the evaluation board and to the GPIO pin header J14 (Raspberry Pi interface). To reduce the risk of interference on the SPI interface, solder bridges have been added to the signal lines and they should be cut to isolate the copper traces routed to J14, before soldering the flash memory to the board. Figure 19 shows where to cut the solder bridges.

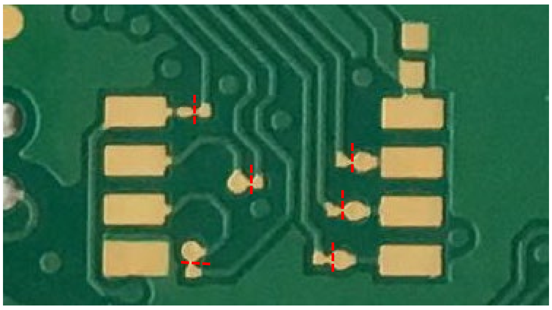


Figure 19: Cut these solder bridges before soldering the external memory

The PCB footprint has been designed for SOIC-8 packages with 5.3 mm body width. A 0402 size decoupling capacitor footprint has also been added (labeled C54 in the schematics), typically 100 nF should be used.

5.4.2 Extra USB to UART interface

If the evaluation board is connected to a PC using the USB connector J8, two serial COM ports will be available. The COM port labeled 'JLink CDC UART' (on a Windows PC) is not normally connected to anything, but routed as a 4-pin UART interface to the pin header J20. This interface could be connected to a secondary UART interface on the NINA-B4 module, or to a UART interface on an Arduino shield etc.

5.4.3 CPU trace interface

The Arm Cortex-M4Fprocessor of the NINA-B4 modules supports tracing of CPU instructions via Cortex Debug+ETM connector 20-pin, 50 mil pitch connector. This extended connector has the same features as J12, but also allows for instruction trace operations via the Embedded Trace Macrocell (ETM) of the Cortex-M4 microcontroller inside the NINA-B4 module. This requires a special external debugger. Note that the 50 mil pitch pin header is not soldered onto the evaluation board by default.

Appendix

A Schematics

☞ For the first prototype build (marked PT1) EVK-NINA-B3 schematic can be used as a reference.

B Glossary

Abbreviation	Definition
API	Application programming interface
CTS	Clear To send
EVK	Evaluation kit
GND	Ground
GPIO	General-Purpose Input/Output
LED	Light-Emitting Diode
MCU	Micro controller unit
MSD	Mass storage device
NFC	Near Field Communication
U.FL	Coaxial RF connector
USB	Universal serial bus
RTS	Request To send
SDK	Software development kit
SPA	Serial port application
UART	Universal Asynchronous Receiver/Transmitter

Table 15: Explanation of the abbreviations and terms used

Related documents

[1] Arduino – https://www.arduino.cc
[2] Raspberry Pi - https://www.raspberrypi.org/
[3] NINA-B4 data sheet, doc. no. UBX-19049405
[4] NINA-B4 series system integration manual, doc. no. UBX-19052230
[5] u-blox Short range AT commands manual, doc. no. UBX-14044127
[6] SEGGER J-Link software - https://www.segger.com/jlink-software.html
[7] u-connectXpress_UserGuide, document number UBX-16024251

☞ For regular updates to u-blox documentation and to receive product change notifications, register on our homepage (www.u-blox.com).

Revision history

Revision	Date	Name	Comments
R01	05-Dec-2019	fbro	Initial release.

Contact

For complete contact information, visit us at www.u-blox.com.

u-blox Offices

North, Central and South America

u-blox America, Inc.

Phone: +1 703 483 3180
E-mail: info_us@u-blox.com

Regional Office West Coast:

Phone: +1 408 573 3640
E-mail: info_us@u-blox.com

Technical Support:

Phone: +1 703 483 3185
E-mail: support@u-blox.com

Headquarters
Europe, Middle East, Africa

u-blox AG

Phone: +41 44 722 74 44
E-mail: info@u-blox.com
Support: support@u-blox.com

Asia, Australia, Pacific

u-blox Singapore Pte. Ltd.

Phone: +65 6734 3811
E-mail: info_ap@u-blox.com
Support: support_ap@u-blox.com

Regional Office Australia:

Phone: +61 2 8448 2016
E-mail: info_anz@u-blox.com
Support: support_ap@u-blox.com

Regional Office China (Beijing):

Phone: +86 10 68 133 545
E-mail: info_cn@u-blox.com
Support: support_cn@u-blox.com

Regional Office China (Chongqing):

Phone: +86 23 6815 1588
E-mail: info_cn@u-blox.com
Support: support_cn@u-blox.com

Regional Office China (Shanghai):

Phone: +86 21 6090 4832
E-mail: info_cn@u-blox.com
Support: support_cn@u-blox.com

Regional Office China (Shenzhen):

Phone: +86 755 8627 1083
E-mail: info_cn@u-blox.com
Support: support_cn@u-blox.com

Regional Office India:

Phone: +91 80 405 092 00
E-mail: info_in@u-blox.com
Support: support_in@u-blox.com

Regional Office Japan (Osaka):

Phone: +81 6 6941 3660
E-mail: info_jp@u-blox.com
Support: support_jp@u-blox.com

Regional Office Japan (Tokyo):

Phone: +81 3 5775 3850
E-mail: info_jp@u-blox.com
Support: support_jp@u-blox.com

Regional Office Korea:

Phone: +82 2 542 0861
E-mail: info_kr@u-blox.com
Support: support_kr@u-blox.com

Regional Office Taiwan:

Phone: +886 2 2657 1090
E-mail: info_tw@u-blox.com
Support: support_tw@u-blox.com