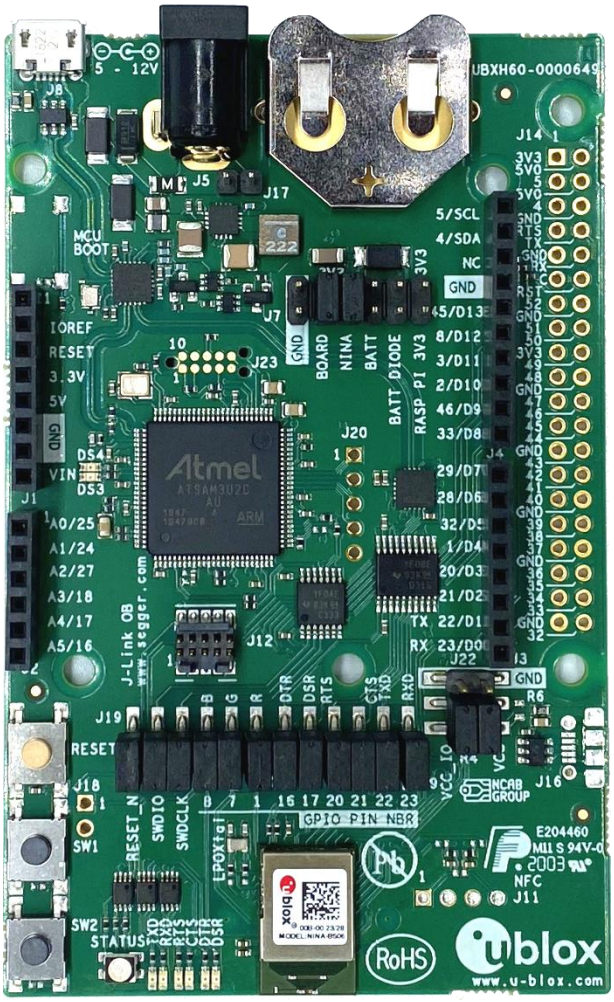
EVK-NINA-B50

Evaluation kit for NINA-B50 modules

User guide



Abstract

This document describes how to set up the EVK-NINA-B50 evaluation kit to evaluate NINA-B50 series standalone Bluetooth® 5.3 Low Energy modules. It also describes the different options for debugging and testing the development capabilities included in the evaluation board.

Document information

Title	**EVK-NINA-B50**	
Subtitle	Evaluation kit for NINA-B50 modules	
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This document applies to the following products:

Product name
EVK-NINA-B501
EVK-NINA-B506

Contents

1 Product description

1.1 Overview

The EVK-NINA-B50 evaluation kit is a versatile development and evaluation platform that allows quick prototyping of a variety of low-powered Internet of Things (IoT) applications, using Bluetooth 5.3 and IEEE 802.15.4.

EVK-NINA-B50 boards are available in the following two variants that accommodate alternative antenna solutions:

- EVK-NINA-B501, with open CPU NINA-B501 module, U.FL antenna connector for connecting to external antennas and no external 32 kHz crystal.
- EVK-NINA-B506, with open CPU NINA-B506 module that includes an internal PCB trace antenna and an external 32 kHz crystal.

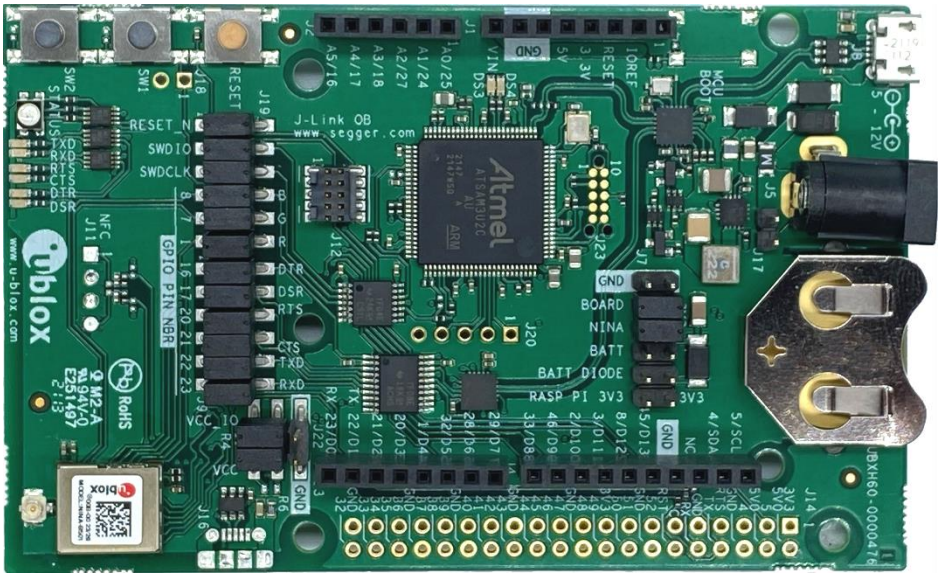

Figure 1: EVK-NINA-B501 evaluation board

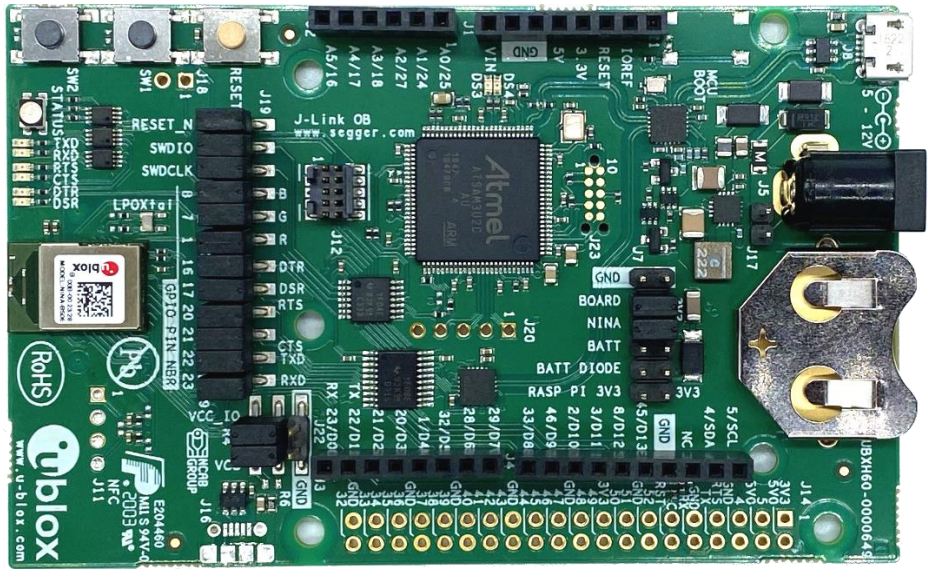

Figure 2: EVK-NINA-B506 evaluation board

EVK-NINA-B50 evaluation boards provide access to the 29 GPIO pins and interfaces that are supported on NINA-B50 modules. The interfaces are available through a variety of connectors, including the Arduino™ UNO R3 [1] and Raspberry Pi [2] header connectors. The boards also provide simple USB drag-n-drop programming and a SEGGER J-Link debug interface.

NXP, the manufacturer of the K32W1480 SoC, provide a free Software Development Kit (SDK) that includes a broad selection of drivers, libraries, and example applications that can be used for rapid prototyping.

1.2 Kit includes

The EVK-NINA-B50 evaluation kit includes the following:

- NINA-B50 evaluation board with NINA-B501 or NINA-B506 module
- 2.4 GHz external antenna with U.FL connector (only in EVK-NINA-B501)
- RP-SMA to U.FL antenna cable (only in EVK-NINA-B501)
- USB cable

1.3 Key features

EVK-NINA-B50boards provide:

- Evaluation board for NINA-B501 or NINA-B506 modules
- On-board programming and debug (SEGGER J-Link-OB)
- Support for developing your own software on the Open CPU NINA-B50 module
- USB-Serial interface for connection to host systems
- COM port isolation to remove USB-Serial to allow header use
- Additional flash memory support
- Multiple power supply options
  - 5–12 V power plug
  - 5 V USB supply
  - 5–12 V Arduino VIN input
  - CR2032 coin cell
- Jumper headers and level shifters allow for flexible powering options
- Buttons and status LEDs for user interaction
- Arduino UNO R3 and Raspberry Pi compatible pin socket interface [1]
- Current measurement access points from pin headers and jumpers

NINA-B50 open CPU modules, based on the NXP K32W1480, provide:

- IEEE 802.15.4 supporting Thread®, Matter™, and Zigbee™
- Bluetooth LE subsystem supporting Bluetooth 5.3 in 2.4 GHz band
- Bluetooth LE central, peripheral, and GATT client / server roles
- AT command set for Bluetooth protocol stack
- Peripherals[2]: ADC, GPIO, I2C, I3C, PWM, Camera IF, RTC, SDIO, SPI, UART, LCD

[1] Not fully compatible due to less or different configurations on the module.
[2] Not all peripherals available simultaneously

1.4 EVK-NINA-B50 block diagram

Figure 3 shows the major interfaces and internal connections of the EVK-NINA-B50.

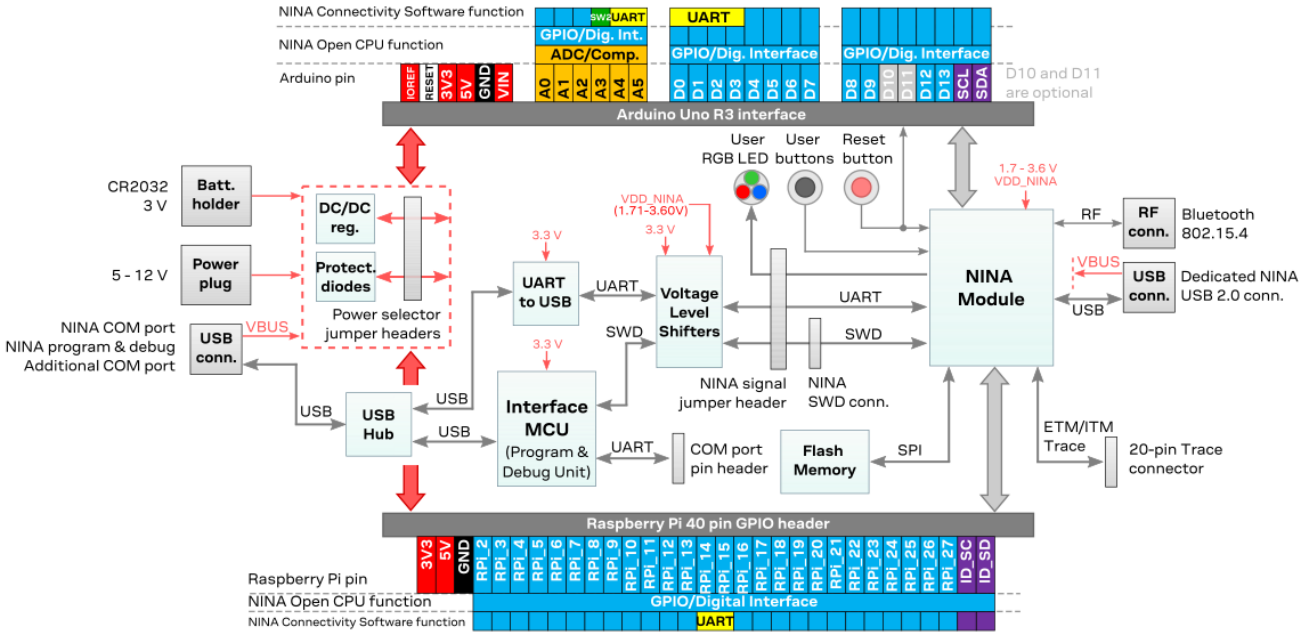

Figure 3: EVK-NINA-B50 block diagram

*Only supported on EVK-NINA-B506

1.5 Connectors

Table 1 describes the available connectors of the EVK-NINA-B50 shown in Figure 4.

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.
(J2)	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-B501.
J12	Cortex Debug connector	10-pin, 50 mil, pitch connector that can be used to connect external debuggers to the NINA-B50 module. NINA-B50 modules support Serial Wire debug (SWD) and Serial Wire Viewer, but not JTAG debug.
J8	Power supply, COM port and debug USB	The USB connector is used to program, debug, and communicate with the NINA module. It can also be used to power the entire board.

Table 1: EVK-NINA-B50 connector description

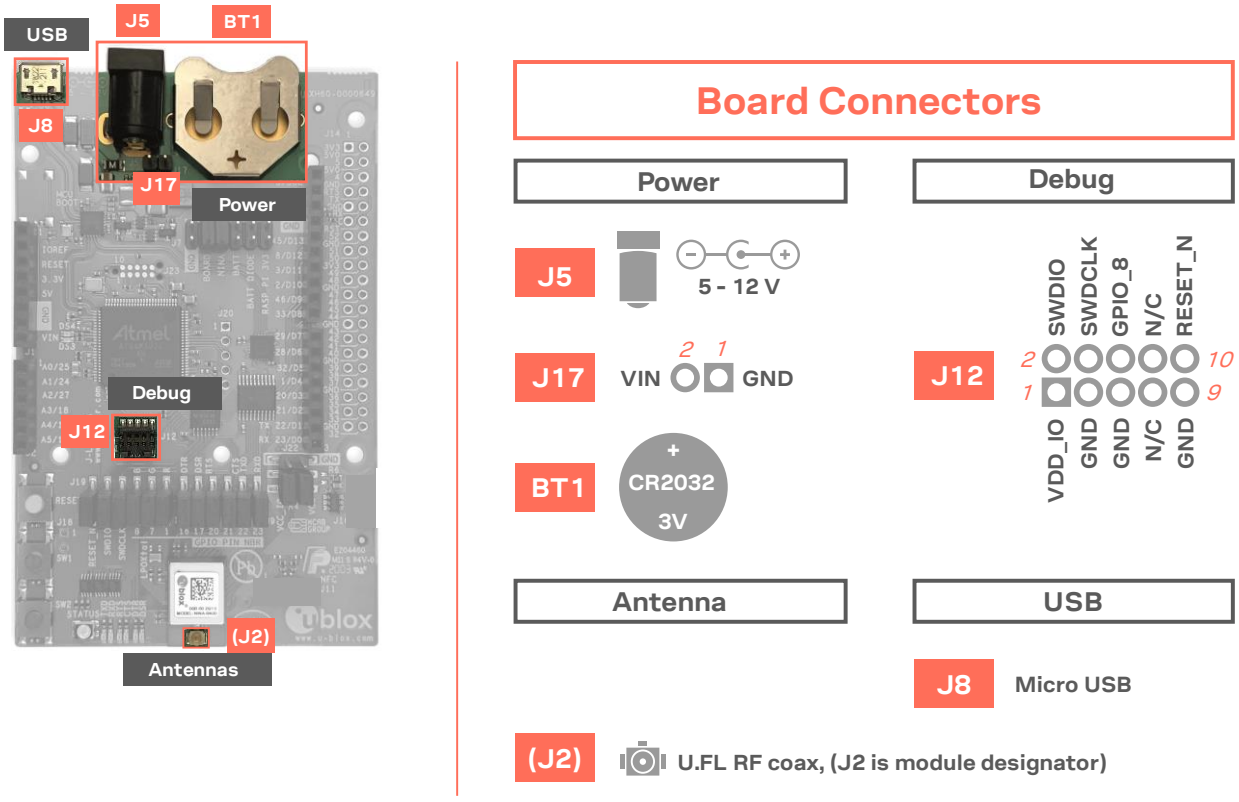

Figure 4: Available connectors and their pinout

2 Setting up the evaluation board

2.1 Evaluation board setup

To use Bluetooth Low Energy on EVK-NINA-B501 board, connect a 2.4 GHz antenna to the U.FL antenna connector. The EVK-NINA-B506 board variant includes an antenna 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.

☞ Make sure that the power configuration jumpers are connected according to your use case, as described in Powering options. The Default power configuration, 3.3 V works for most use cases.

⚠ Be careful to check polarity before connecting an external power supply to the EVK-NINA-B50 evaluation board. Center conductor is positive (+) and the ring is negative (-).

The operating system installs the correct drivers automatically. The drivers need only to be installed once when you connect the unit to a new computer.

⚠ If the drivers are not installed automatically, download the J-Link driver included in the J-Link / J-Trace Downloads

Two COM ports are automatically assigned to the unit by Windows:

- The COM port labelled “USB Serial Port” is used to communicate with the UART interface of the NINA-B50 module.
- The COM port labelled “JLink CDC UART Port” can be used as an extra USB to the UART interface. See also Extra USB to UART interface.

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

To view the assigned COM ports on Windows 7:

1. Open the Control Panel and select Hardware and Sound.
2. Open the Device Manager in Devices and Printers. This opens the Device Manager window where you can view the assigned COM ports.

2.2 Software Development

2.2.1 NXP SDK

To use the EVK-NINA-B50 together with NXP SDK it is necessary to:

- Create your own board file
- Adapt the examples in the NXP SDK to use this board file

For more information about performing these tasks, see the Software section of the NINA-B50 system integration manual [4]. See also the u-blox short range open CPU GitHub repository [6].

2.2.2 Software debug options

Use either of the following options to debug software with EVK-NINA-B50:

- Onboard debug solution available through the USB connector
- External debugger connected to J12 connector

An external debugger is useful when powering the evaluation board with a CR2032 coin cell battery, or through the J5 external power supply connector. It is also useful when the MCU interface has been disconnected from the NINA-B50 module using the jumpers on the J19 header.

SEGGER J-Link software [5] is necessary to debug with the onboard J-Link hardware on the EVK-NINA-B50.

2.3 Measuring current consumption

☞ Before starting the current consumption measurement, go through the Board configuration and define your configuration preferences. Find out what NINA signals must subsequently be isolated. The J22 jumper pins 1 and 3 must be removed to measure the current consumption.

Figure 5 shows some suggestions for connecting the various instruments when measuring module current consumption.

2.3.1 Using an ammeter

An ammeter should be connected in series with the power source and whatever is being measured. In this way, current can be measured when the NINA module is supplied from either the onboard 3.3 V regulator or an external supply.

2.3.2 Using a voltmeter

The EVK board must be modified before module current can be measured with a voltmeter.

To modify the board, solder a low resistance, high tolerance, 0402 sized resistor to the footprint labeled R6. This resistor replaces the jumper normally positioned between J22 pins 1 and 3. Any current passing through the resistor produces a voltage across its terminals. Measure this voltage with the voltmeter and calculate the current using Ohm's law.

2.3.3 Using an external power supply or power analyzer

Connect the terminals of the instrument to the EVK pins, as shown in Figure 5. An ammeter can also be added in series.

Since the external voltage of any connected instrument can never perfectly match the 3.3 V generated by the EVK, some small current leakage is apparent whenever the signal from the NINA module is connected to an EVK peripheral. The leakage is typically in the order of 100's of nano amps.

To reduce leakage current, 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.

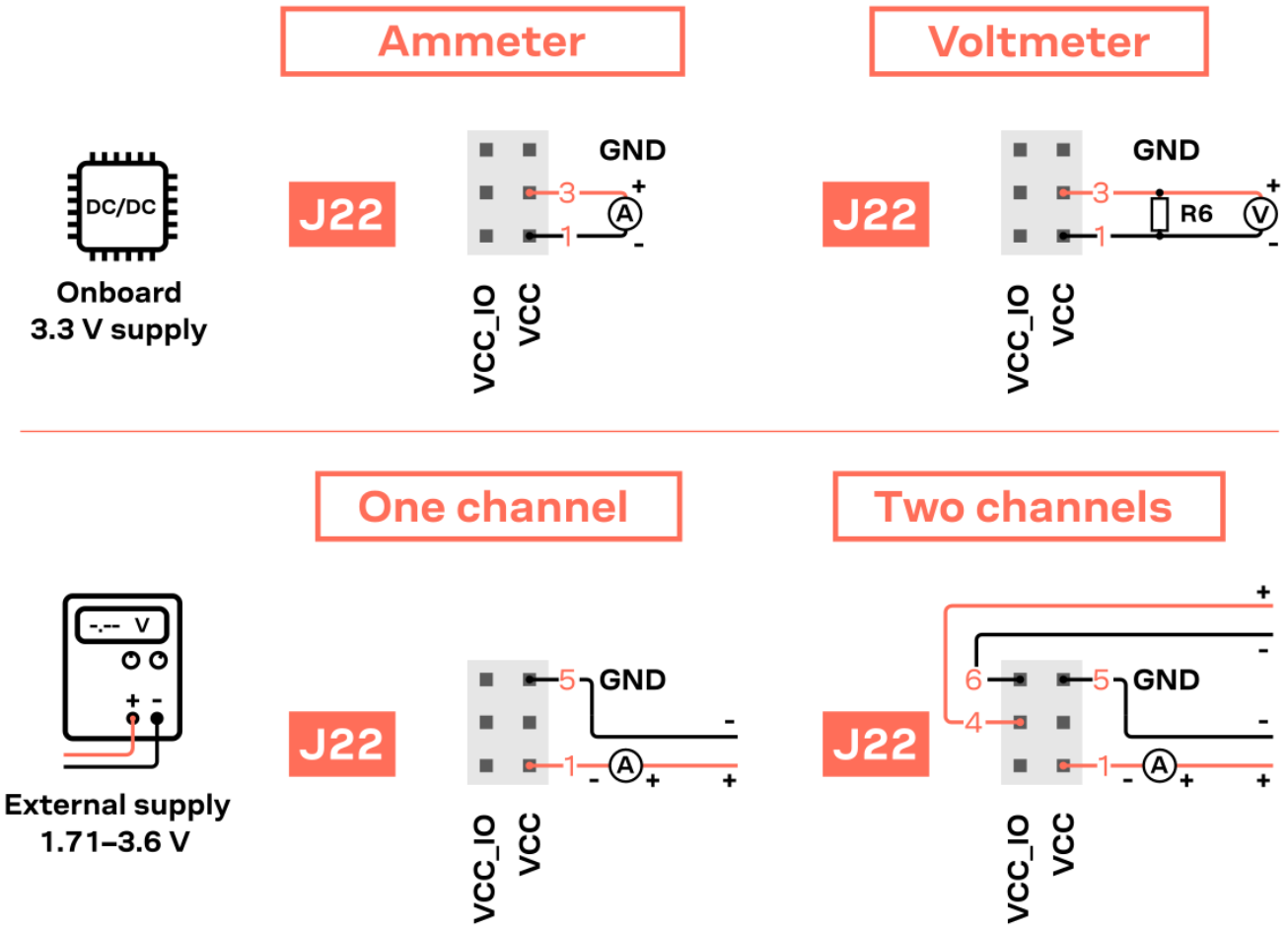

Figure 5: Different options when measuring NINA module current consumption

3 Board configuration

3.1 Powering options

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

- Via any of the USB connectors, J8
- 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.

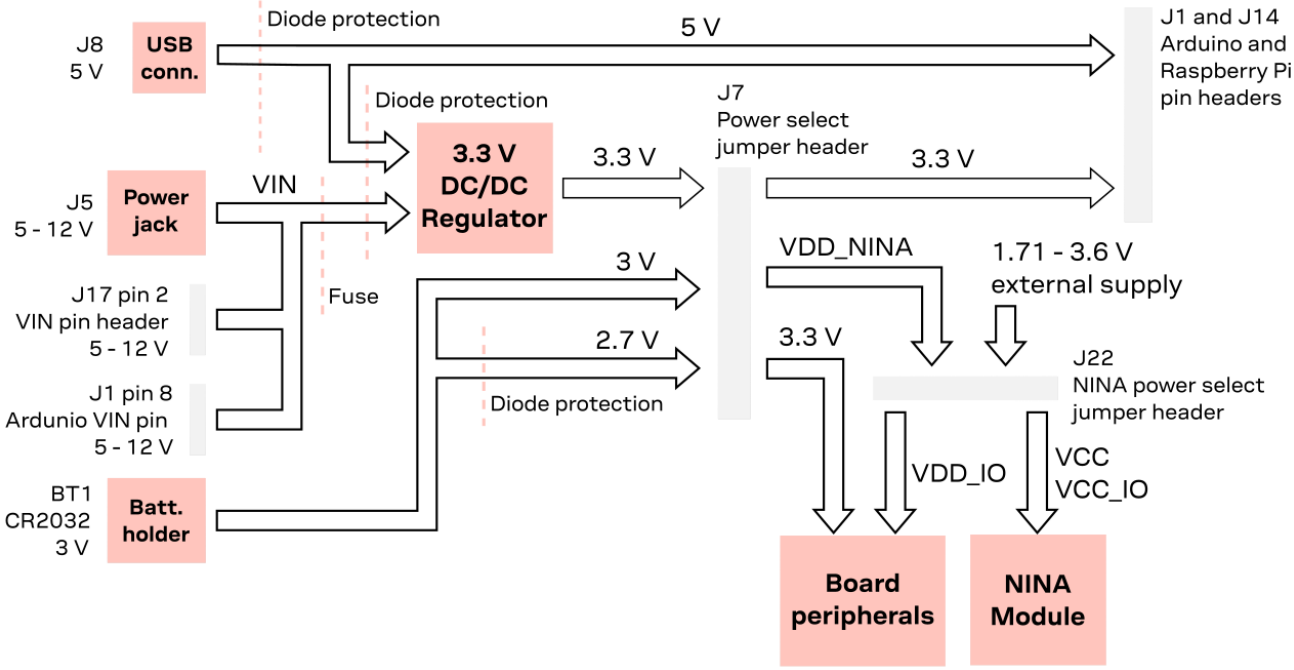

Figure 6: Block diagram of the power net distribution

3.1.1 Selecting the power configuration jumpers

EVK-NINA-B50 offers flexible powering options for the NINA-B50 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 any jumper is connected in a wrong way, it can permanently damage the components that are ON or connected to the board. Note also that some jumpers should not be mounted simultaneously.

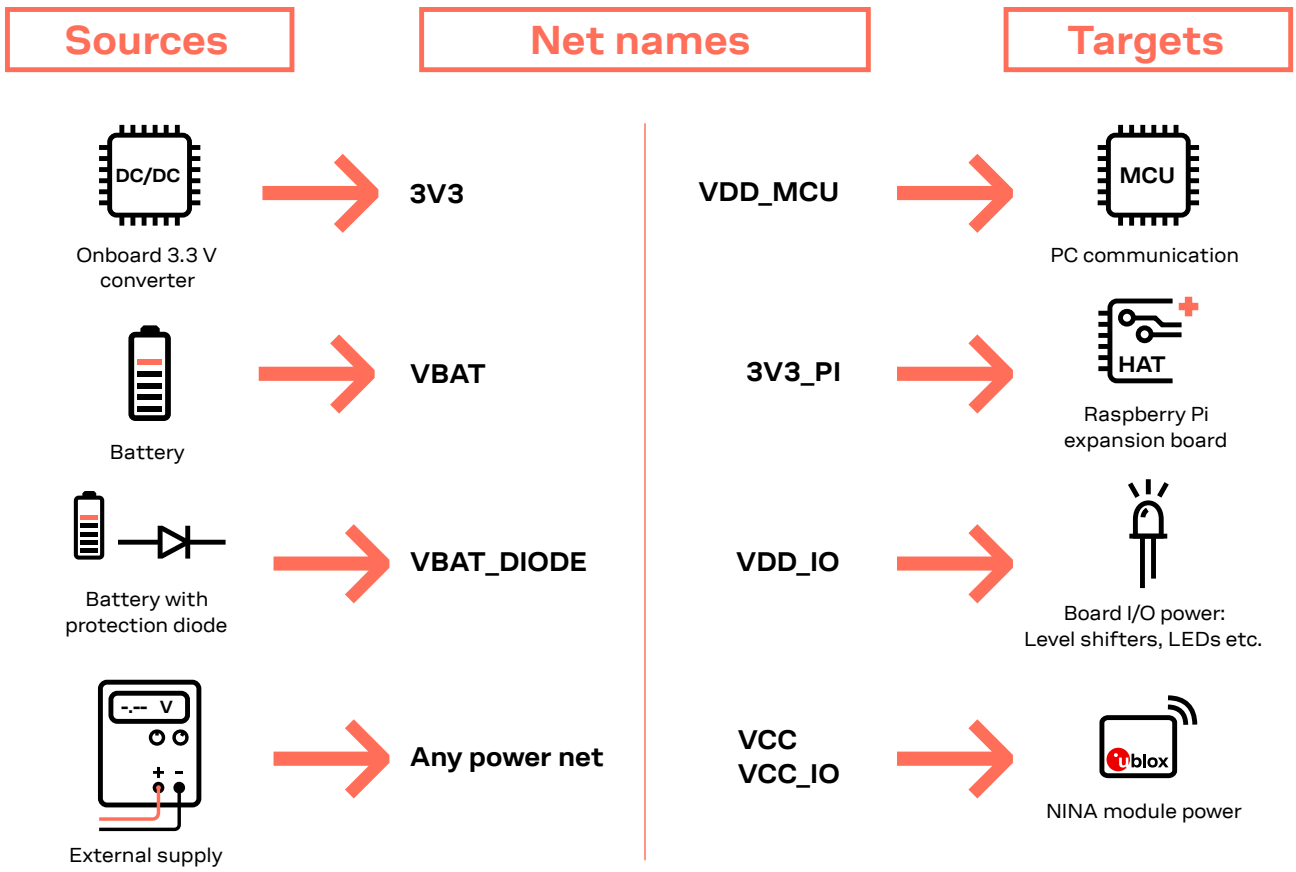

Figure 7: Overview of EVK power sources and targets showing connected schematic net names

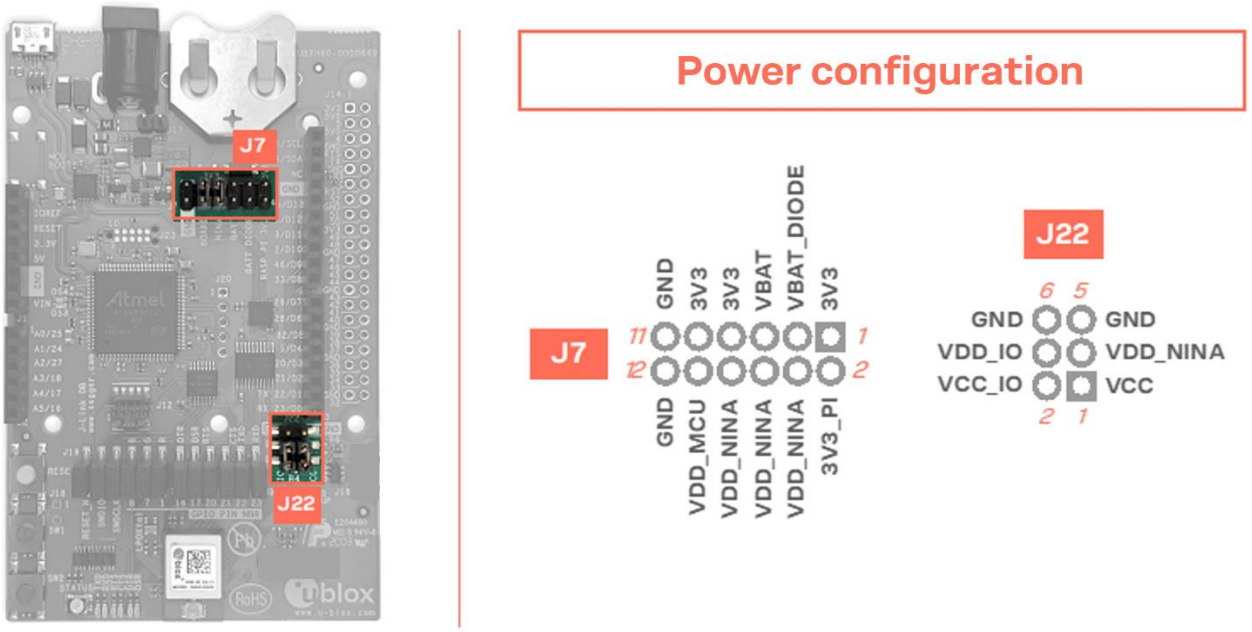

Figure 8: Jumper headers J7 and J22 board location and pinout

Connector	Pin no.	Schematic net	Description
J7	1	3V3	Regulated 3.3 V net. This net is supplied by the board and is always 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 and 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 is always 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 is always 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

3.1.2 Default power configuration, 3.3 V

Figure 9 shows the default “out-of-the-box” power configuration for the evaluation board. In this configuration, all board peripherals are powered up and the NINA module is directly supplied by the board. Everything runs at 3.3 V.

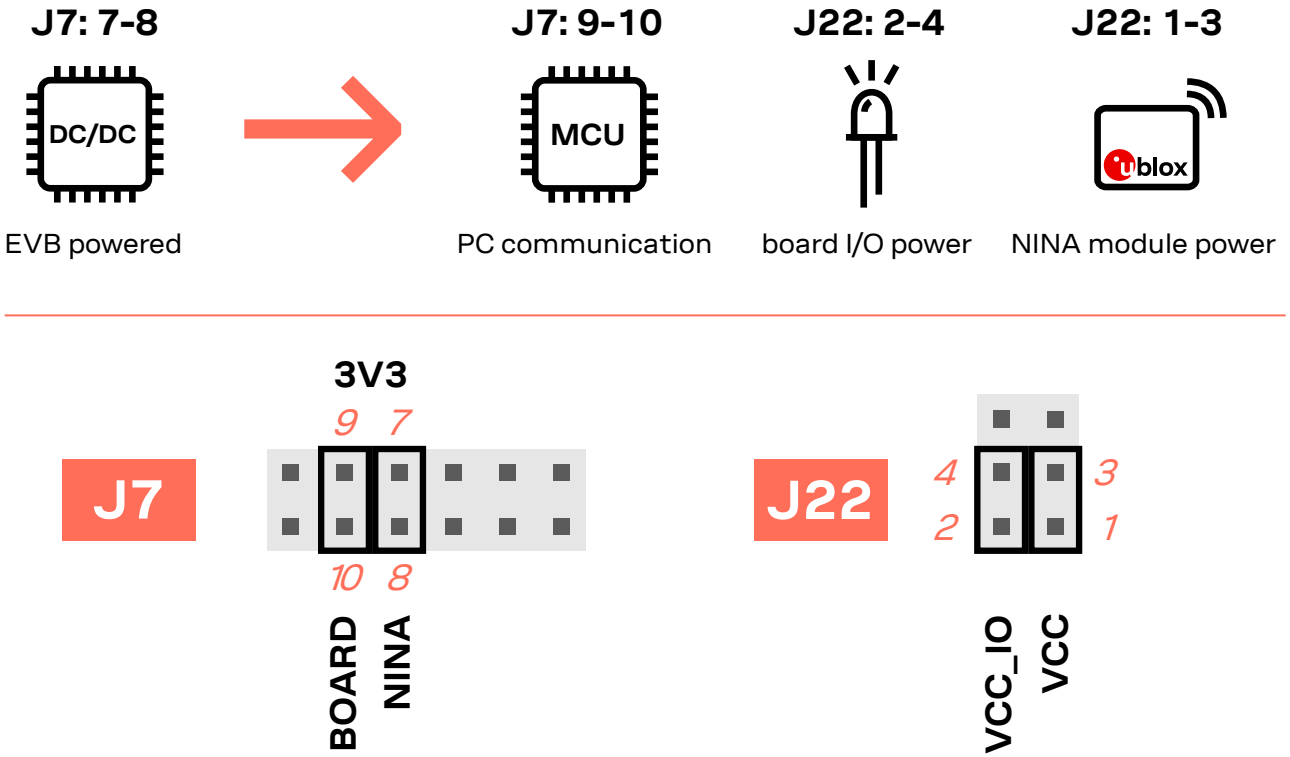

Figure 9: Jumper positions for default power configuration

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

3.1.3 Battery powered, 3 –1.71 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-B50 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 must 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.

⚠ Less than 3 V voltage level at **VCC** and **VCC_IO** has negative impact on Tx output power.

⚠ 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.

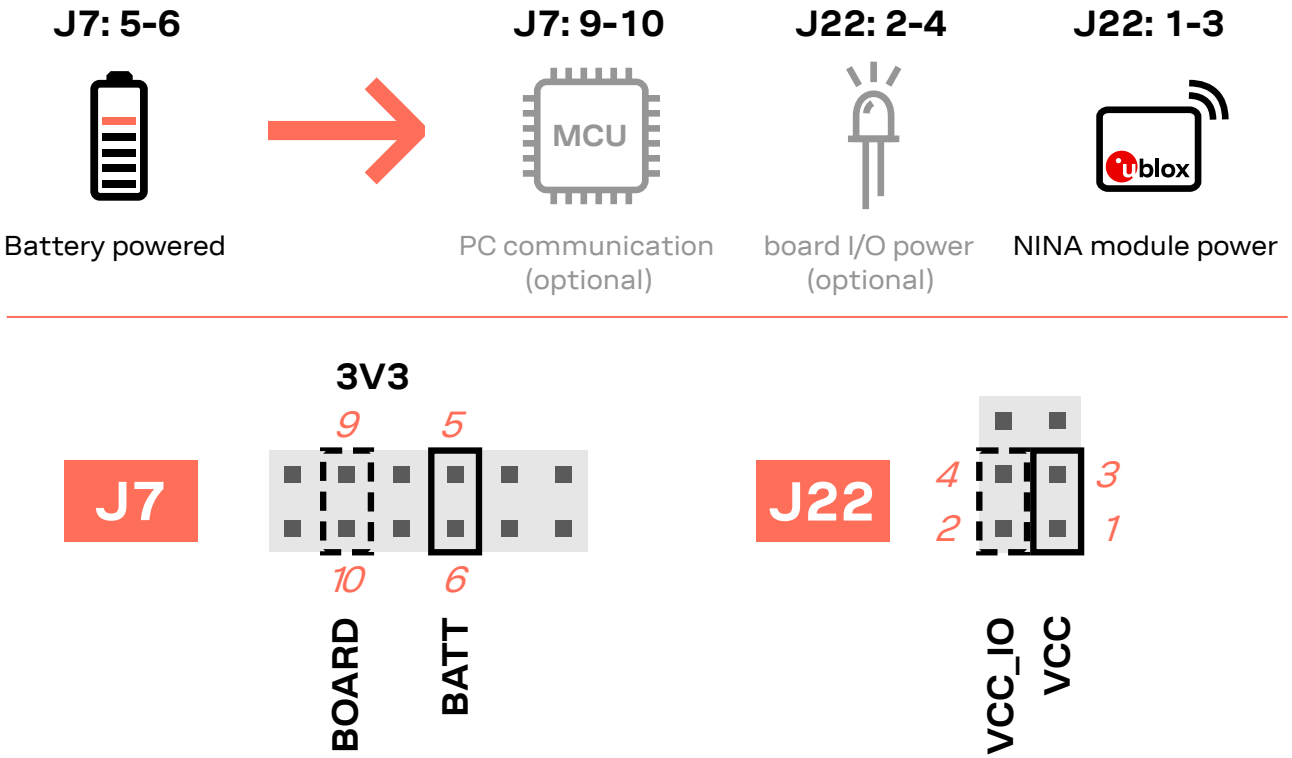

Figure 10: Jumper positions for battery powered operation - with optional jumpers shown as dashed lines

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 – with two optional jumpers

3.1.4 Battery powered with protection diode, 2.7–1.71 V

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

⚠ Less than 3 V voltage level at **VCC** and **VCC_IO** has negative impact on Tx output power.

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

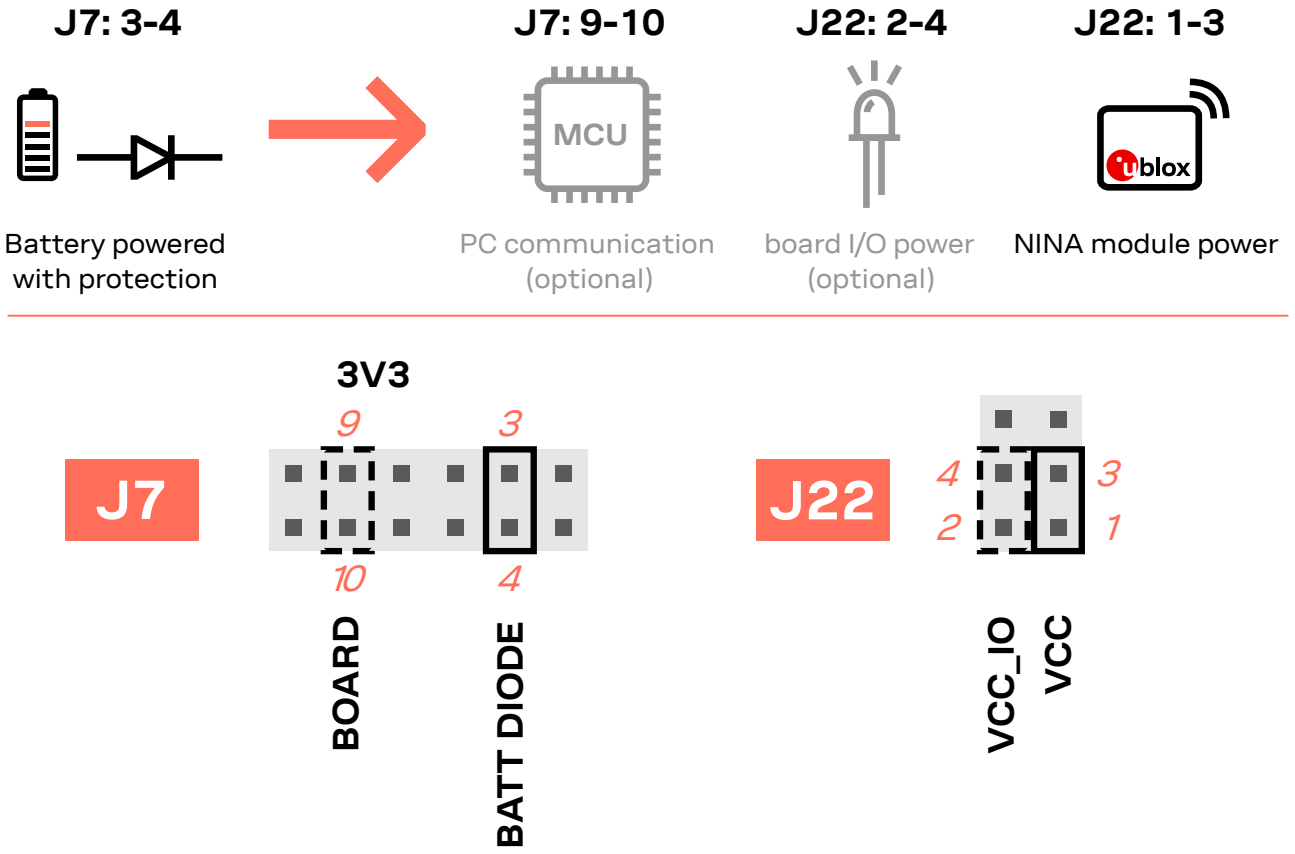

Figure 11: Jumper positions for battery powered operation with a protection diode (dashed lines show optional jumpers)

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 (with two optional jumpers)

3.1.5 External supply, 1.71- 3.60 V

When measuring current consumption or performing other NINA-B50 module characterization measurements, it can be useful to power the module with an external source such as a lab power supply. In such cases, all jumpers can be removed, and the required supply nets can be fed externally by connecting to the pin headers. For example, the NINA-B50 module can be powered by connecting an external supply directly to the J22 pin 1 and GND. See also Using an external power supply or power analyzer.

☞ 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. Isolation can be achieved by removing NINA signal jumpers. See also Disconnecting NINA signals from board peripherals.

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

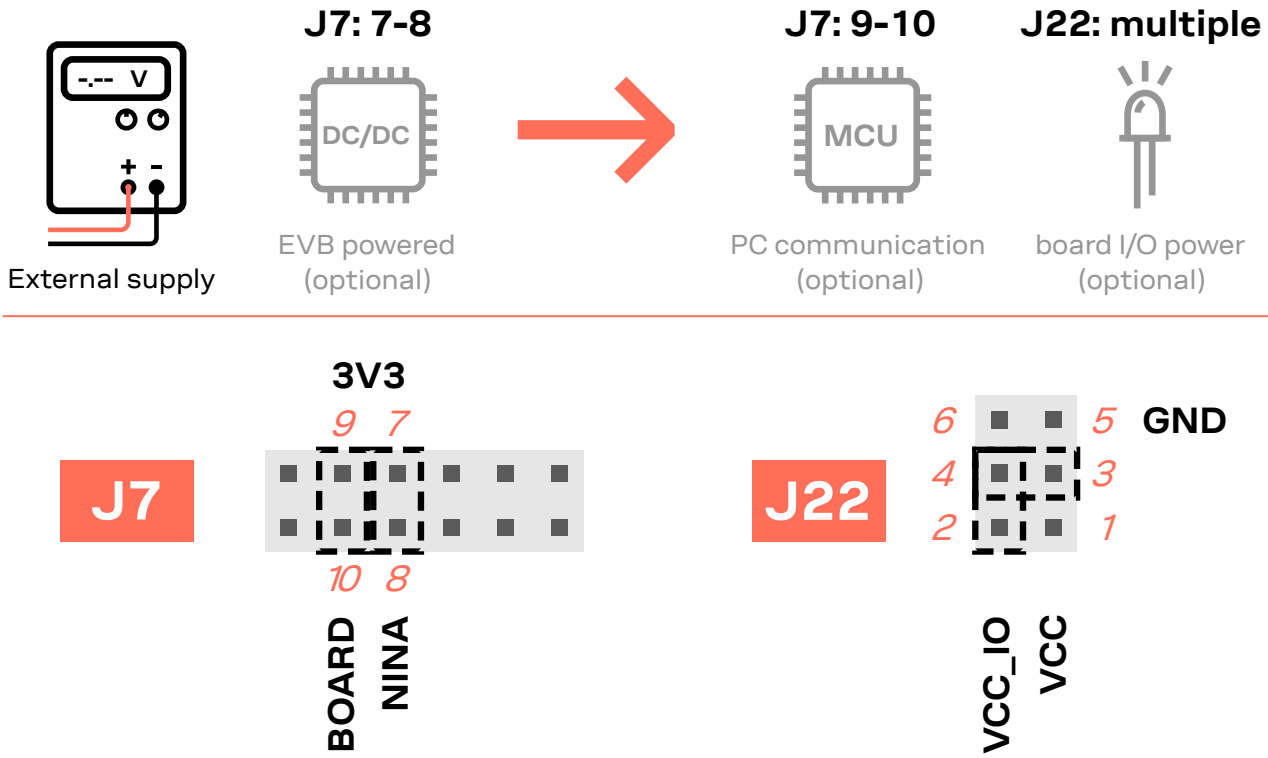

Figure 12: Optional jumper positions while using an external power supply

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 positions while using an external supply

3.1.6 Raspberry Pi HAT

When connecting a HAT to the Raspberry Pi interface, use the jumper configuration shown in Figure 13. Depending on how the NINA module is to 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.

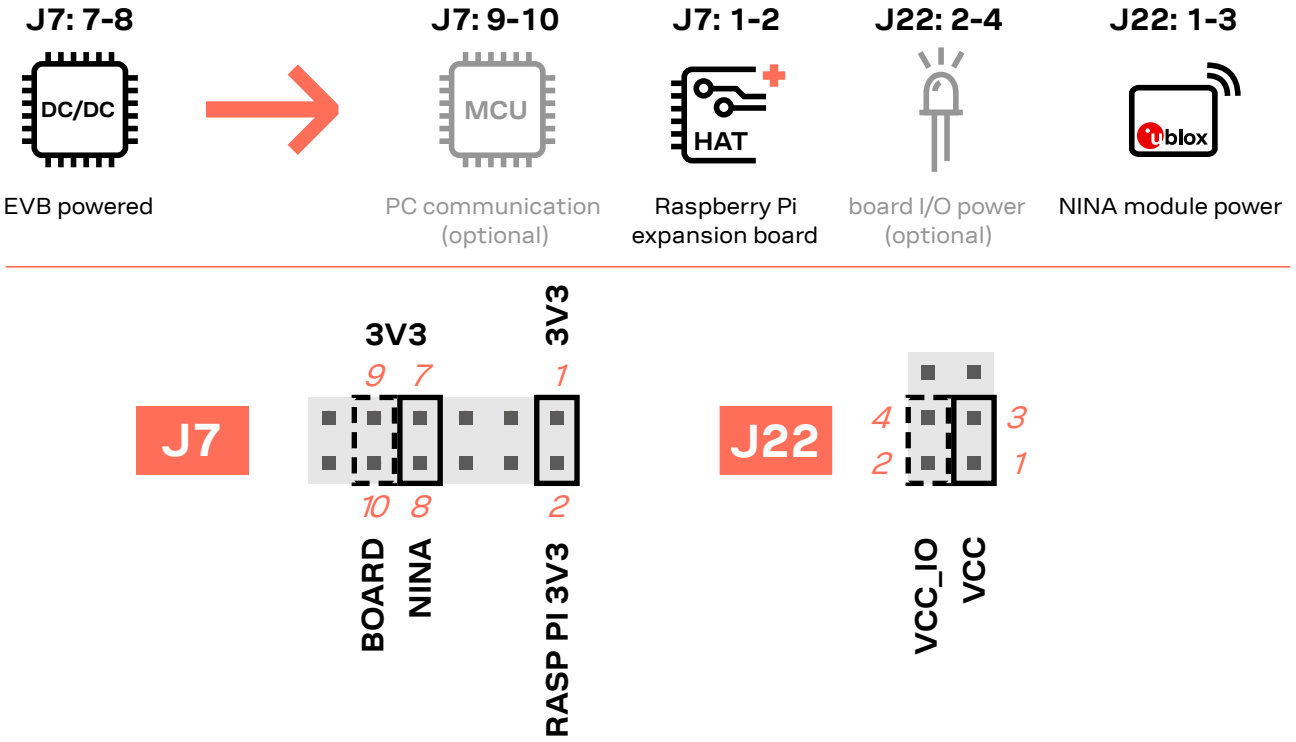

Figure 13: Jumper configuration when connected to a Raspberry Pi HAT (dashed lines show optional jumpers)

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

3.2 Disconnecting NINA signals from board peripherals

All evaluation board peripherals, such as level shifters, LEDs, and the interface MCU are connected to the NINA-B50 module by default. This might not suit all evaluation scenarios.

All peripherals can be switched off by disconnecting their power supplies (see also Selecting the power configuration jumpers) but finer control is needed to isolate specific signals. Consequently, all NINA module signals that are connected to board peripherals are routed through jumper headers. In this way, jumpers can be added or removed to isolate or connect specific signals. Figure 14 shows the layout of the jumper headers.

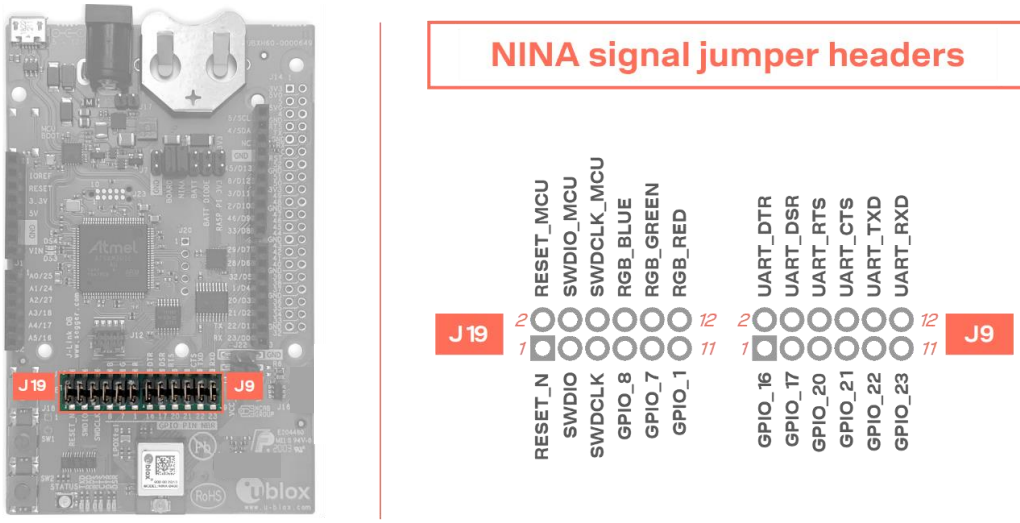

Figure 14: Jumper headers J19 and J9 that are used to isolate specific NINA signals

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	GPIO or TRACE
	8	BLUE	RGB diode blue signal, active low
	9	GPIO_7/ SWITCH_1	GPIO, can be used as either user LED output or push-button input
	10	GREEN	RGB diode green signal, active low
	11	GPIO_1	GPIO, can be used as user LED output
	12	RED	RGB diode red signal, active low
J9	1	GPIO_16/ UART_DTR	analog capable GPIO signal
	2	UART_DTR_I	UART to USB DTR signal
	3	GPIO_17/ UART_DSR	analog capable GPIO signal
	4	UART_DSR_I	UART to USB DSR signal
	5	GPIO_20/ UART_RTS	analog capable GPIO signal
	6	UART_RTS_I	UART to USB RTS signal
	7	GPIO_21/ UART_CTS	GPIO signal
	8	UART_CTS_I	UART to USB CTS signal
	9	GPIO_22/ UART_TXD	GPIO signal
	10	UART_TXD_I	UART to USB TXD signal
	11	GPIO_23/ UART_RXD	analog capable GPIO signal
	12	UART_RXD_I	UART to USB RXD signal

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

4 Interfaces and peripherals

4.1 Buttons and LEDs

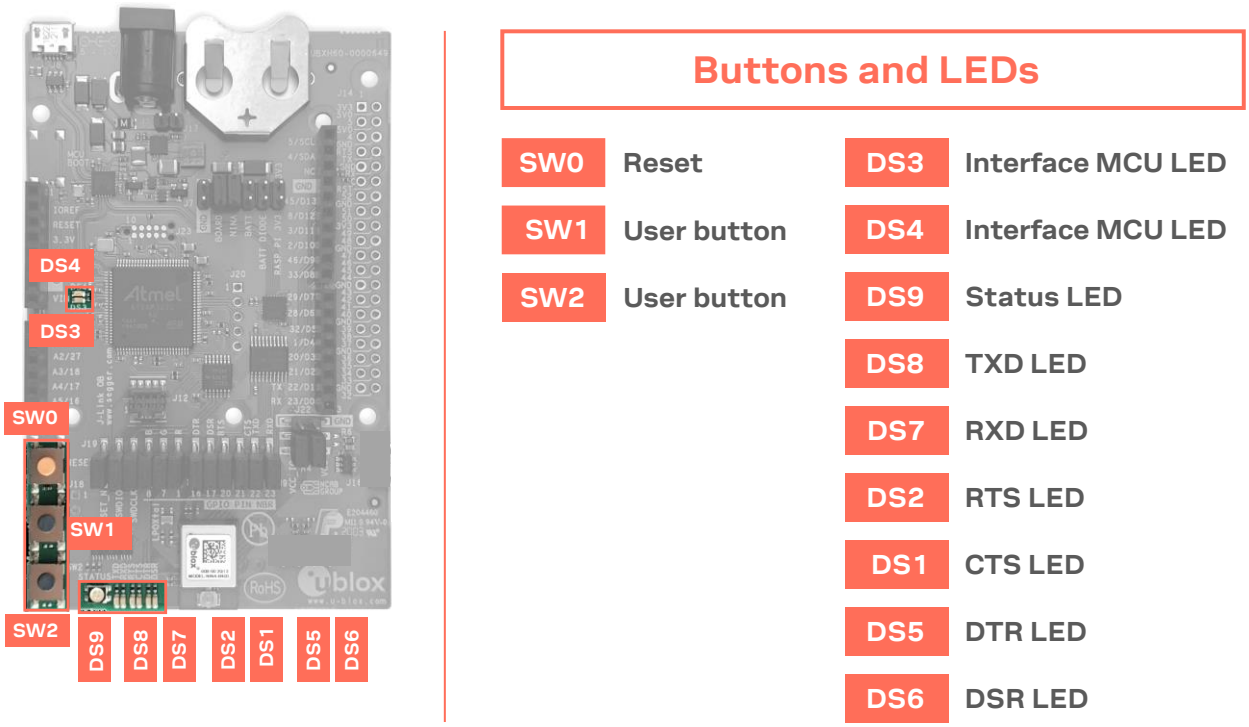

Figure 15: Position of the push buttons and LEDs on the evaluation board

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-B50 buttons

Annotation	Function	Description
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 through jumper header J19. ☞ See also the NINA-B50 data sheet [3].

Table 10: EVK-NINA-B50 LED indicators

4.2 Arduino interface

The EVK-NINA-B50 includes a set of pin headers and mounting holes that are compatible with certain Arduino or Arduino inspired shields. However, in EVK-NINA-B50 a reduced number GPIOs are available.

⚠ NINA-B50 is not fully compatible with Arduino due to reduced number of GPIOs.

Figure 16 shows the layout of the Arduino interface described in Table 11. For information about compatible shields for EVK-NINA-B50, see also Arduino shield compatibility.

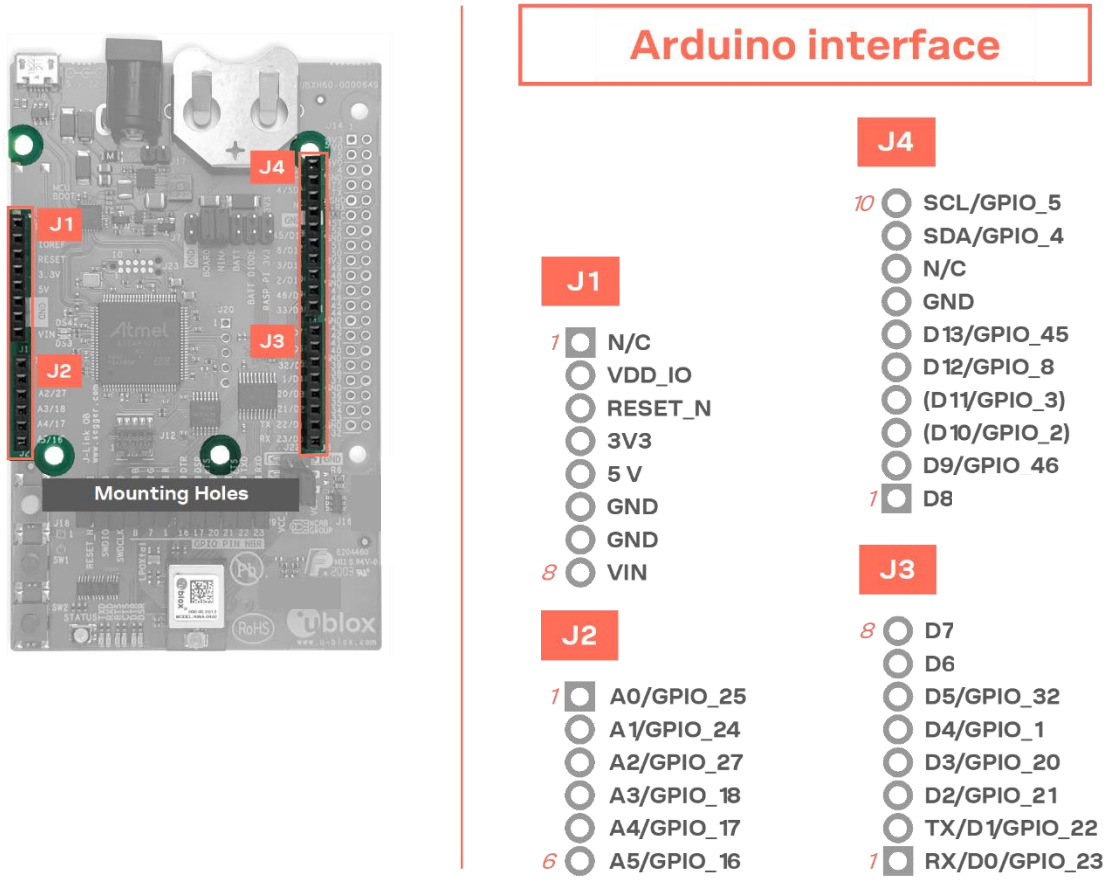

Figure 16: Pin headers that are compatible with some Arduino shields

Conn.	Pin No.	Arduino pin	Description	NINA-B4 schematic net name*	K32W 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 also Selecting the power configuration jumpers
	3	RESET	NINA reset signal input. Active low logic	RESET_N	PTD0	
	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	

Conn.	Pin No.	Arduino pin	Description	NINA-B4 schematic net name*	K32W pin	Alternate functions and notes
	8	VIN	External DC supply input, 5 – 12 VDC	VIN	-	
J2	1	A0	Analog input	GPIO_25	PTA20	Analog function capable GPIO
	2	A1	Analog input	GPIO_24	PTC6	Analog function capable GPIO
	3	A2	Analog input	GPIO_27	PTA21	Analog function capable GPIO
	4	A3	Analog input	SWITCH_2/ GPIO_18	PTD3	Analog function capable GPIO, SWITCH_2 on NINA-B501. This signal is pulled low when the button SW2 is pressed
	5	A4	Analog input	UART_DSR/ GPIO_17	PTD2	Analog function capable GPIO, UART_DSR signal on NINA-B501
	6	A5	Analog input	UART_DTR/ GPIO_16	PTD1	Analog function capable GPIO, UART_DTR signal on NINA-B501
J3	1	D0/RX	Digital I/O, UART RX	UART_RXD/ GPIO_23	PTC2	UART_RXD signal on NINA-B501
	2	D1/TX	Digital I/O, UART TX	UART_TXD/ GPIO_22	PTC3	UART_TXD signal on NINA-B501
	3	D2	Digital I/O	UART_CTS/ GPIO_21	PTB4	UART_CTS signal on NINA-B501
	4	D3	Digital I/O	UART_RTS/ GPIO_20	PTB5	UART_RTS signal on NINA-B501
	5	D4	Digital I/O	GPIO_1	PTA16	
	6	D5	Digital I/O	GPIO_32	PTA18	
	7	D6	Digital I/O	GPIO_28	-	Signal not connected by default.
	8	D7	Digital I/O	GPIO_29	-	Signal not connected by default.
J4	1	D8	Digital I/O	GPIO_33	-	Signal not connected by default.
	2	D9	Digital I/O	GPIO_46	PTA17	
	3	D10	Digital I/O	GPIO_2	PTD4	Disconnected by default Connected to 32 KHz LPO Xtal. To connect GPIO 2 to J4 header instead of LPO Xtal, remove R66 and add R64 (zero ohm resistor)
	4	D11	Digital I/O	GPIO_3	PTD5	Disconnected by default Connected to 32 KHz LPO Xtal. To connect GPIO 3 to J4 header instead of LPO Xtal, remove R67 and add R65 (zero ohm resistor)
	5	D12	Digital I/O	GPIO_8	PTC5	Blue LED
	6	D13	Digital I/O	GPIO_45	SWITCH_WAKEUP_B	
	7	GND	Ground	GND		
	8	AREF	Analog reference voltage level	-	-	Not connected
	9	SDA	I2C data signal	GPIO_4	PTC4	
	10	SCL	I2C clock signal	GPIO_5	PTA19	

Table 11: Pinout of the Arduino UNO R3 compatible interface

*See Table 16

4.2.1 Arduino shield compatibility

☞ As EVK-NINA-B50 has an I/O voltage range of 1.71–3.60 V, it can only be used with shields that support an I/O voltage in this range.

The EVK-NINA-B50 has a pinout that is compatible with some Arduino, or Arduino-inspired, shields The characteristics of certain EVK pins demand that shields support the features described in Table 12.

Arduino pin	EVK-NINA-B50 pin	EVK-NINA-B50 pin characteristics
IOREF	VDD_IO	The I/O voltage level of the NINA-B50 module is 3.3 V by default, but the EVK can be modified to allow other voltages (1.71–3.60 V)
RESET	RESET_N	Connected to the RESET button (SW0)
3.3V	3V3	A regulated 3.3 V output. Should not be used as a voltage supply input. Use the VIN pin instead
5V	5V	5 V supply output only for use when the EVK is powered by USB. If any other power configuration is used, this pin is unconnected (floating). It is safe to connect an external 5 V supply to this pin even when a USB cable is connected. The pin can be used to power the board.
SCL/SDA	GPIO5/GPIO4	On some Arduino boards, the I2C signals, SCL, and SDA are connected to pins A4 and A5. The signals are also connected to the SCL and SDA pins located in the top right-hand corner of the board. As these pins are to be shorted together, problems can occur when they are connected to the EVK-NINA-B50 (in which they are not normally connected).
Digital I/O pins	See Table 11	For serial communication and flashing/debugging over USB, some digital I/O pins can be connected to the on-board debug MCU. In these instances, the connected pins can cause some interference on the signals that are also used by an Arduino shield. See also Disconnecting NINA signals from board peripherals.

Table 12: EVK pin characteristics

4.3 Raspberry Pi interface

EVK-NINA-B50 includes a 40-pin GPIO header that can be used to interface with either a Raspberry Pi computer board or Raspberry Pi Hardware Attached on Top (HAT) expander. EVK-NINA-B50 uses different hardware and software configurations depending on whether it is connected to a Pi or HAT. The default configuration is for connection to a P computer board. Compatible Raspberry Pi versions are described in Table 13.

⚠ NINA-B50 is not fully compatible with Raspberry Pi due to reduced number of GPIOs. The GPIOs not supported are marked “Not Connected” in Table 14.

☞ Older Pi and HAT versions that do not use a 40-pin GPIO header are not supported.

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

Table 13: Compatible Raspberry Pi boards

Figure 17 shows the layout of the Raspberry Pi interface described in Table 14. Three mounting holes can be used for increasing the mechanical stability. The two holes on each side of connector J14 are common to all Raspberry Pi boards, but the third one is only compatible with the Pi Zero boards.

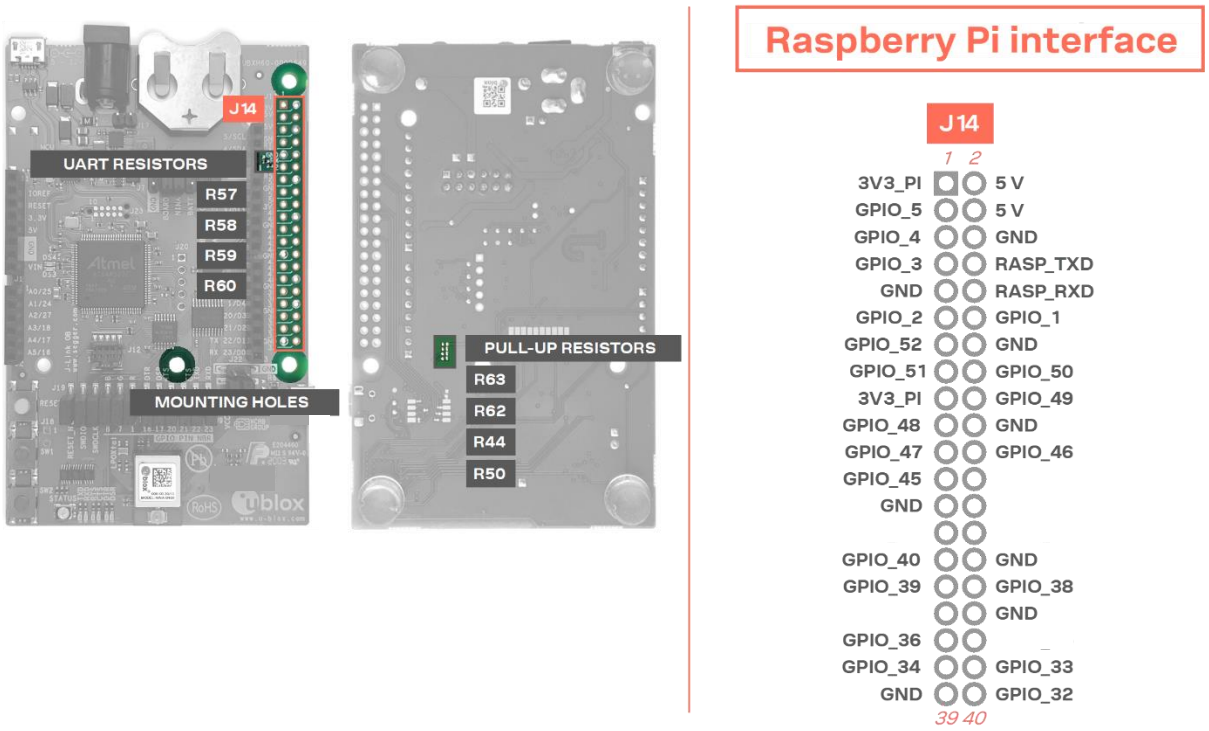

Figure 17: Pin header J14 that is compatible with the Raspberry Pi GPIO connectors

Conn.	Pin no.	Raspberry Pi pin	Description	NINA-B4 schematic net name*	K32W pin	Alternate functions and notes
J14	1	3.3 V	3.3 V supply pin	3V3_PI	-	Not connected by default.See also Powering options.
	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_4	PTC4	
	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_5	PTA19	
	6	GND	Ground	GND		
	7	GPIO04	Digital I/O	GPIO_3	PTD5	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	PTC2	Connected to NINA UART_RXD pin by default. See also UART.
	9	GND	Ground	GND		
	10	GPIO15	Digital I/O, UART RX/TX	RASP_RXD	PTC3	Connected to NINA UART_TXD pin by default. See also UART.
	11	GPIO17	Digital I/O	GPIO_2	PTD4	Disconnected by default Connected to 32Khz LPO clock. To connect GPIO 2 to J4 header instead of LPO clock, remove R66 and add R64 (0 Ω resistor)

Conn.	Pin no.	Raspberry Pi pin	Description	NINA-B4 schematic net name*	K32W pin	Alternate functions and notes
	12	GPIO18	Digital I/O	GPIO_1	PTA16	
	13	GPIO27	Digital I/O	GPIO_52	PTB2	Connected to NINA through a solder bridge. If the solder bridge is cut this pin is left floating.
	14	GND	Ground	GND		
	15	GPIO22	Digital I/O	GPIO_51	PTB0	Connected to NINA through a solder bridge. If the solder bridge is cut this pin is left floating.
	16	GPIO23	Digital I/O	GPIO_50	PTB3	Connected to NINA through a solder bridge. If the solder bridge is cut this pin is left floating.
	17	3.3 V	3.3 V supply pin	3V3_PI	-	Not connected by default. See also Powering options
	18	GPIO24	Digital I/O	GPIO_49	PTC0	Connected to NINA through a solder bridge. If the solder bridge is cut this pin is left floating.
	19	GPIO10	Digital I/O	GPIO_48	PTB1	Connected to NINA through a solder bridge. If the solder bridge is cut this pin is left floating.
	20	GND	Ground	GND		
	21	GPIO09	Digital I/O	GPIO_47	PTC1	Connected to NINA through a solder bridge. If the solder bridge is cut this pin is left floating.
	22	GPIO25	Digital I/O	GPIO_46	PTA17	
	23	GPIO11	Digital I/O	GPIO_45	SWITCH_WAKEUP_B	SWITCH_WAKEUP
	24	GPIO08	Digital I/O	GPIO_44	-	Not connected
	25	GND	Ground	GND		
	26	GPIO07	Digital I/O	GPIO_43	-	Not connected
	27	ID_SD	EEPROM config I2C data signal	GPIO_42	-	Not connected
	28	ID_SC	EEPROM config I2C clock signal	GPIO_41	-	Not connected
	29	GPIO05	Digital I/O	GPIO_40	PTC7	
	30	GND	Ground	GND		
	31	GPIO06	Digital I/O	GPIO_39	VREFO	
	32	GPIO12	Digital I/O	GPIO_38	XTAL_OUT	
	33	GPIO13	Digital I/O	GPIO_37	-	Not connected
	34	GND	Ground	GND		
	35	GPIO19	Digital I/O	GPIO_36	VOUT_SWITCH	
	36	GPIO16	Digital I/O	GPIO_35	-	Not connected
	37	GPIO26	Digital I/O	GPIO_34	-	Not connected
	38	GPIO20	Digital I/O	GPIO_33	-	Not connected
	39	GND	Ground	GND		
	40	GPIO21	Digital I/O	GPIO_32	PTA18	

Table 14: Pinout of the Raspberry Pi compatible interface

*See Table 16

4.3.1 Powering considerations

Two voltage nets are used in the Raspberry Pi interface, **3V3_PI** and **5V**. Both the **3V3_PI** and **5V** nets can be used to power HATs, but these nets should not be used when connecting to a Raspberry Pi. See also Raspberry Pi HAT.

⚠ Do not connect the **3V3_PI** power net m to the 3.3 V supply when connected to a Raspberry Pi board. Failure to do so can cause serious damage to both boards.

4.3.2 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 **GPIO14** is TX on a Raspberry Pi board, but RX on a HAT. To support communication with both HATs and Pi boards, the 0 Ω resistors (R57, R58, R59 and R60) can be used to toggle the NINA TX and RX pins between **GPIO14** and **GPIO15**. This switch can also be made in the software. By default, the EVK-NINA-B50 is configured to simulate a HAT, with **GPIO14** connected to the NINA **UART_RXD** pin and **GPIO15** connected to the NINA **UART_TXD** pin.

4.4 Additional Interfaces

In addition to the normally most used interfaces, several other expansion options are also available to the user. These extra interfaces require some modifications to the EVB before they can be used.

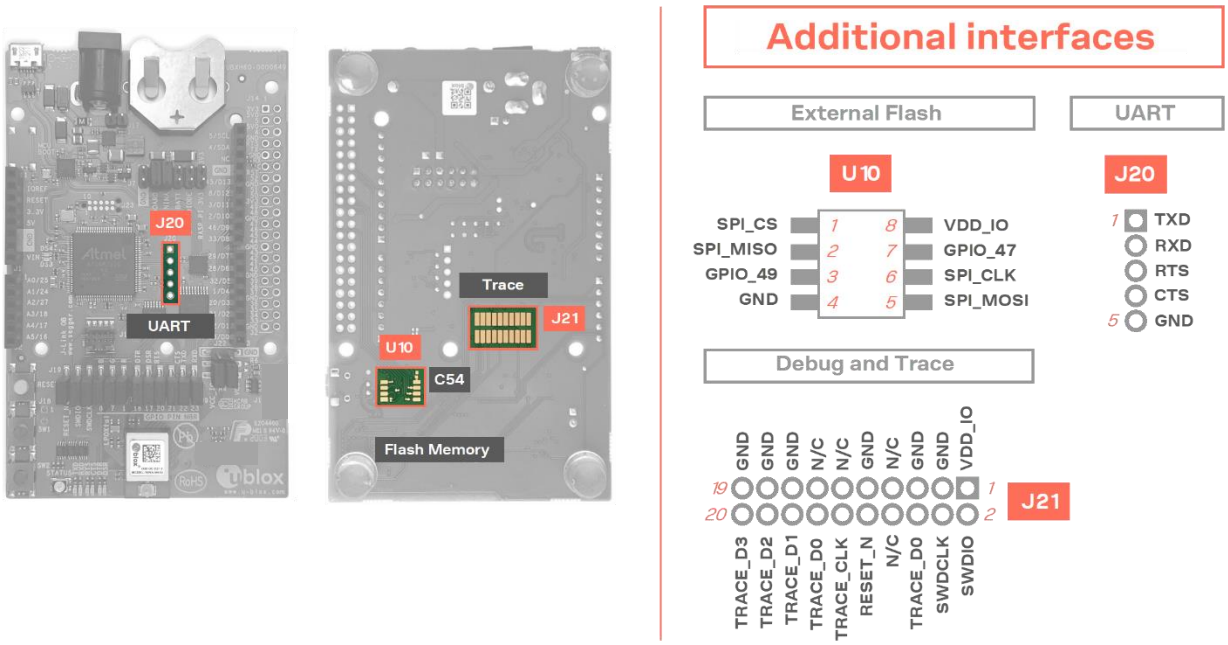

Figure 18: Additional interfaces that require some soldering before use

Connector annotation	Pin no.	Schematic net name	K32W pin	Description
U10	1	SPI_CS/GPIO_51	PTB0	Chip select input signal, active low
	2	SPI_MISO/GPIO_48	PTB1	MISO in single SPI mode, or data I/O signal in dual/quad mode
	3	GPIO_49	PTC0	
	4	GND	GND	Ground
	5	SPI_MOSI/GPIO_50	PTB3	MOSI in single SPI mode, or data I/O signal in dual/quad mode
	6	SPI_CLK/GPIO_52	PTB2	Chip clock input signal, up to 32 MHz supported
	7	GPIO_47	PTC1	
	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	PTC5	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		NINA reset signal, active low
	11	N/C	-	Not connected
	12	GPIO_45	SWITCH_ WAKEUP	SWITCH_WAKEUP
	13	N/C	-	Not connected
	14	TRACE_D0/SWO/ GPIO_8	PTC5	Serial trace data signal / Parallell trace data signal. Blue LED
	15	GND	GND	Ground
	16	TRACE_D1/GPIO_46	PTA17	Parallell trace data signal
	17	GND	GND	Ground
	18	TRACE_D2/GPIO_32	PTA18	Parallell trace data signal
	19	GND	GND	Ground
	20	GPIO_33	-	DNI

Table 15: Pinout of the additional interfaces

4.4.1 Extra memory – external Flash

NINA-B50 series modules can accommodate extra memory outside of the module. The memory space can be used to store data and/or expand the application code size.

NINA-B50 modules support an SPI (Serial Peripheral Interface) to communicate with the external flash memory. For information about the supported modes, clock frequencies and other features of the SPI, see the NINA-B50 series data sheet [1].

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

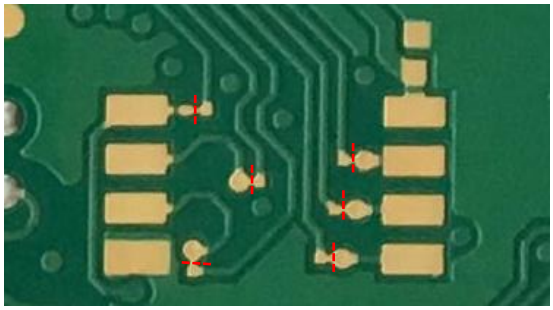

Figure 19: Cut these solder bridges before soldering the external memory

The board outline is designed with a footprint for SOIC-8 packages with 5.3 mm body width. The smaller footprint above this can accommodate a 0402 sized ~100 nF decoupling capacitor, which is recommended to stabilize the memory supply.

4.4.2 Extra USB to UART interface

If the evaluation board is connected to a PC using the USB connector J8, two serial COM ports are available. The COM port labeled “JLink CDC UART” (on a Windows PC) is not normally connected to anything. It is instead 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-B50 module, or to a UART interface on an Arduino shield for example.

4.4.3 CPU trace interface

The Arm Cortex-M33 processor in NINA-B50 modules supports tracing of CPU instructions through the 20-pin, 50 mil pitch, Cortex Debug + ETM connector. This extended connector has the same features as J12, but also accommodates instruction trace operations through the Embedded Trace Macrocell (ETM) of the Cortex-M33 microcontroller in the NINA-B50 module. Tracing instructions through this connector 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

Provided here as an information reference, Figure 20 and following tables in this appendix show the EVK-NINA-B4 schematics, which except for the module pin names and unsupported functionality are the same as the currently unavailable EVK-NINA-B50 schematics.

The correlation between the signal names for EVK-NINA-B4 against those supported in EVK-NINA-B50 are described in Table 16.

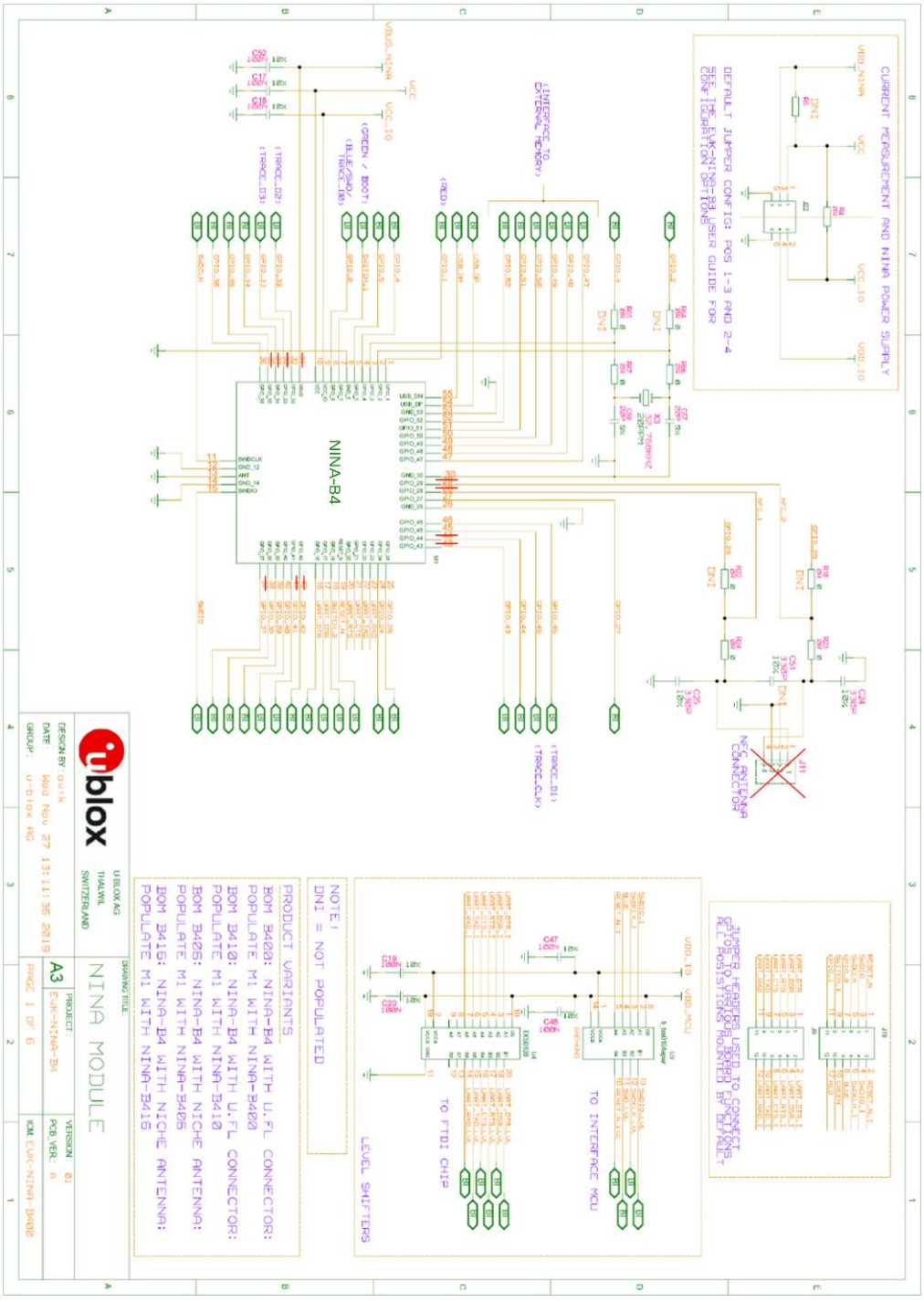

Figure 20: NINA module – schematic

☞ All “crossed-out” circuits in the above schematic are associated with functionality supported in EVK-NINA-B4 but not supported in EVK-NINA-B50.

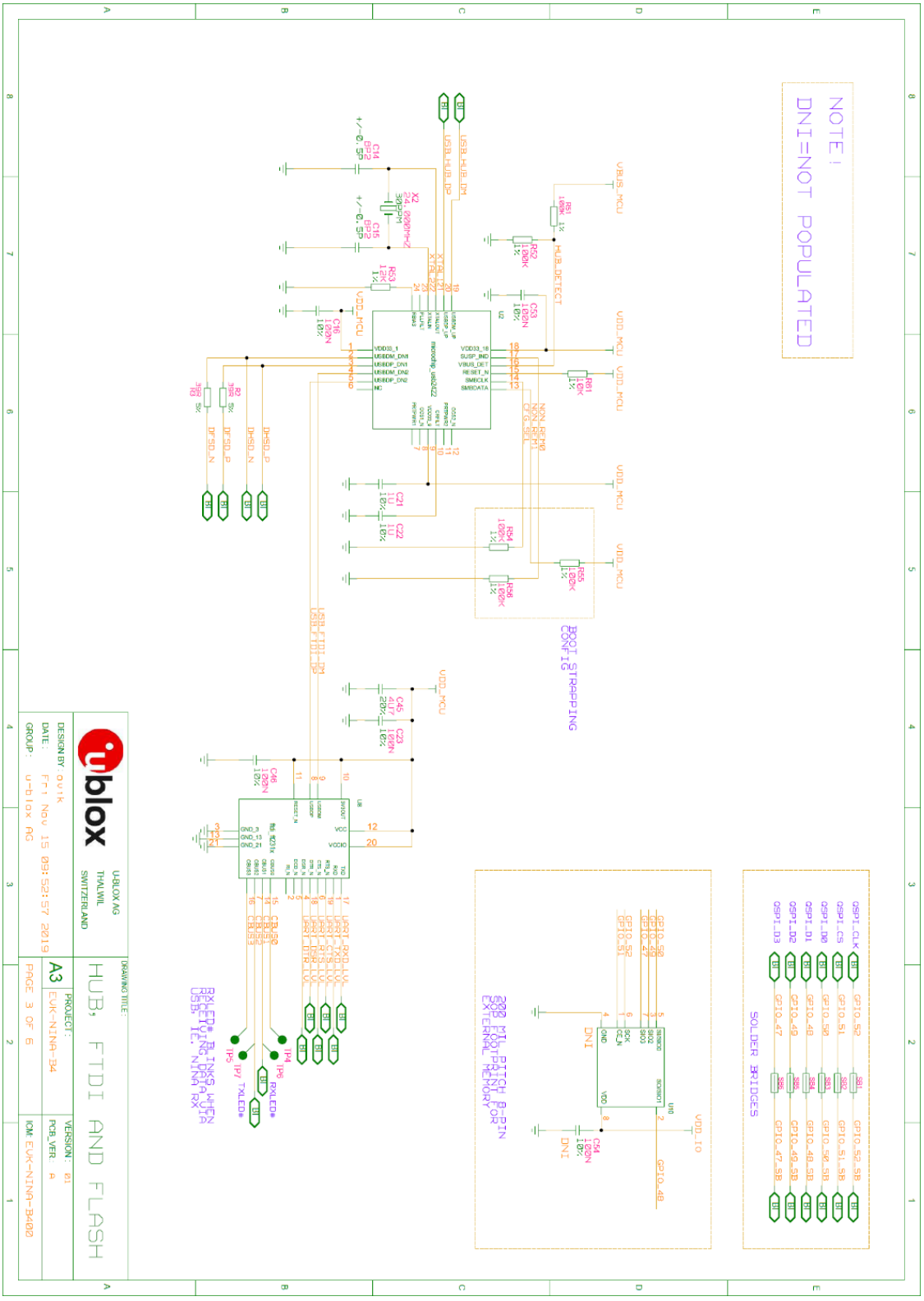

Figure 21: Hub, FTDI and flash – schematic

☞ Pages 2 of the schematics are intentionally omitted.

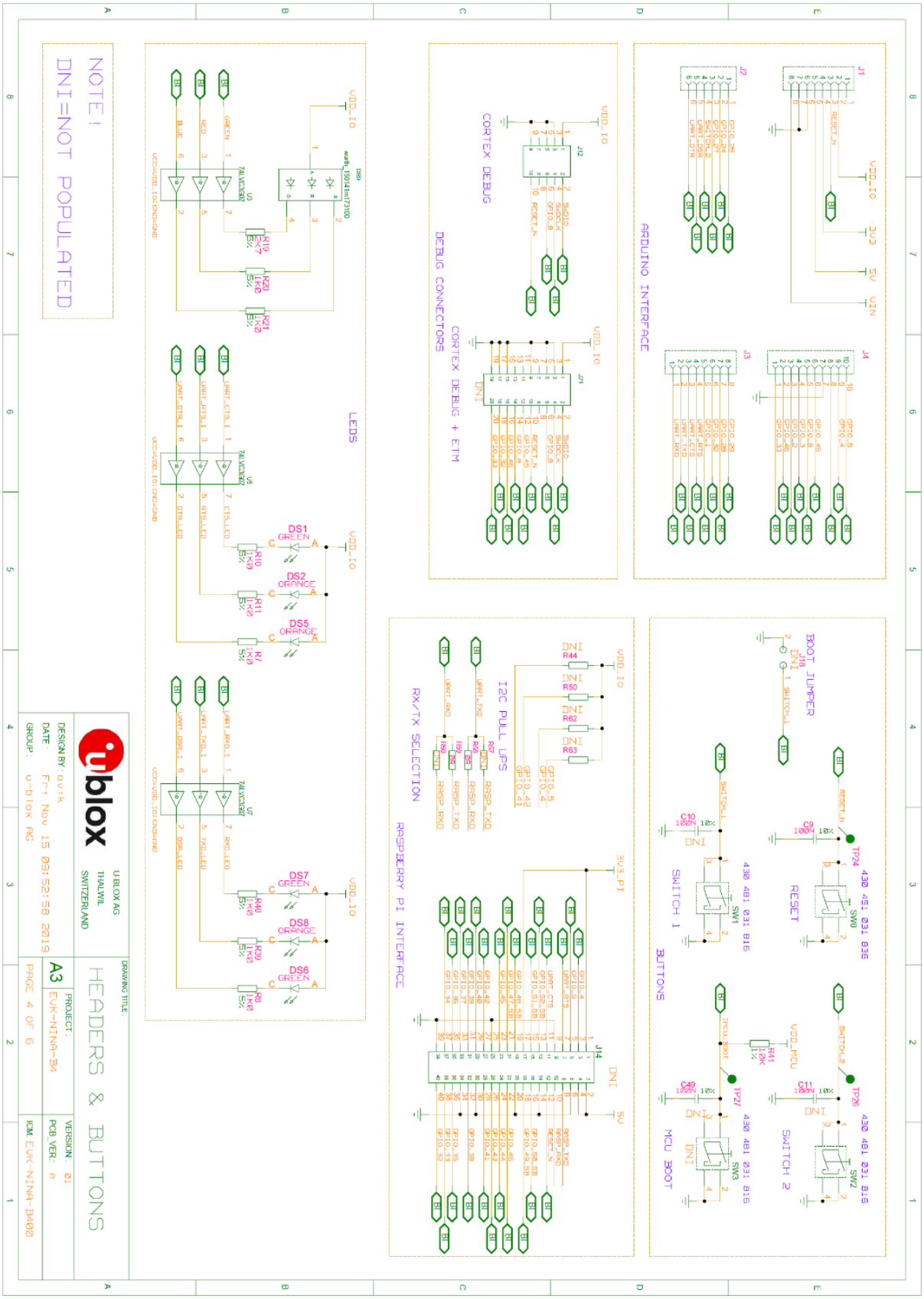

Figure 22: Headers and buttons - schematic

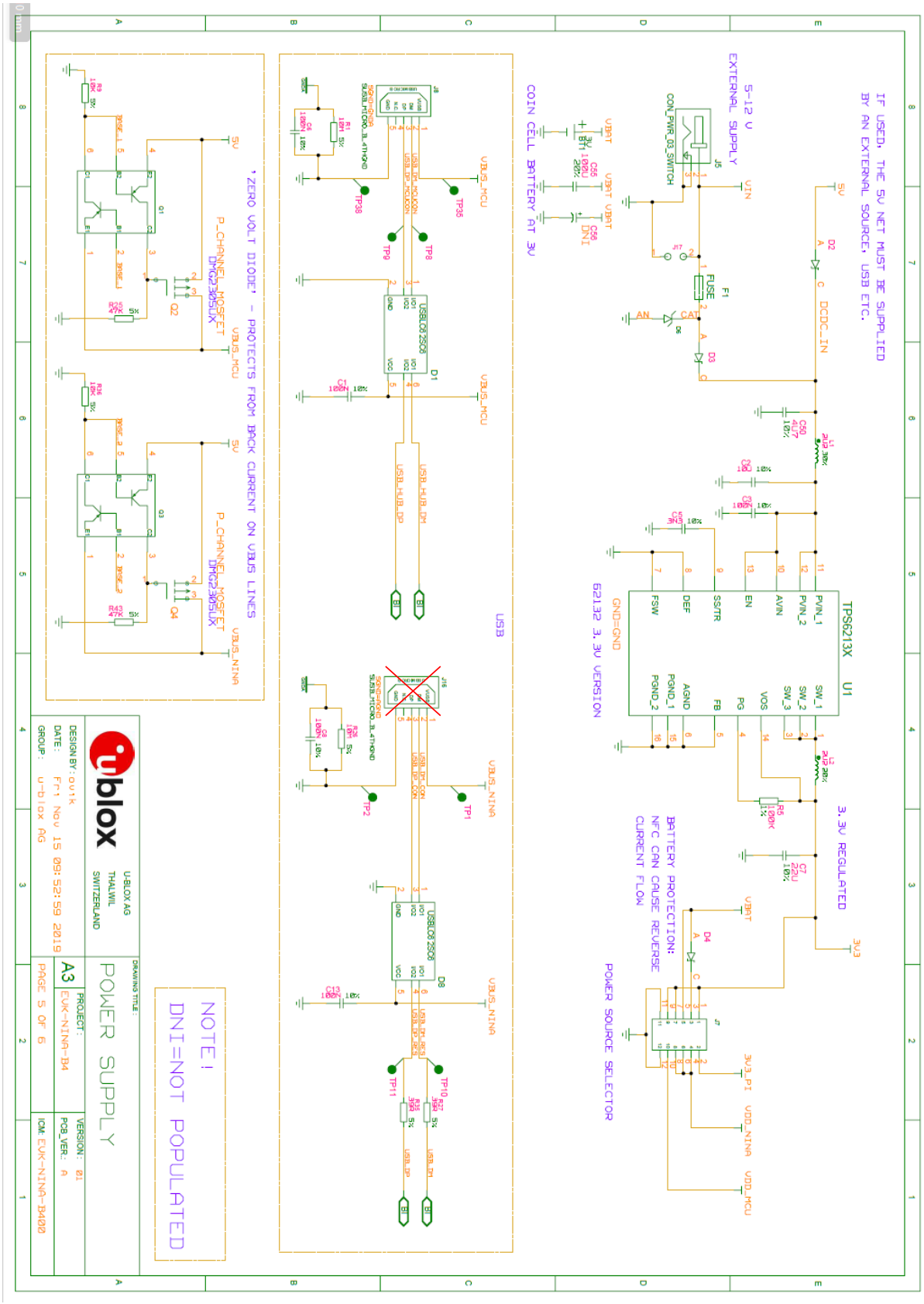

Figure 23: Power supply schematic

☞ All “crossed-out” circuits in the above schematic are associated with functionality supported in EVK-NINA-B4 but not supported in EVK-NINA-B50.

☞ Page 6 of the schematics is intentionally omitted.

A.1 NINA-B4 to NINA-B50 pin correlation

Table 16 describes the pin allocations for NINA-B50 against those for older NINA-B4 module shown in the EVK-NINA-B4 schematics.

No.	Name NINA-B4	I/O	Description NINA-B4	Name NINA-B50	Description NINA-B50
1	GPIO_1	I/O	General purpose I/O	PTA16	General purpose I/O
2	GPIO_2	I/O	General purpose I/O	PTD5/EXTAL32K	General purpose I/O
3	GPIO_3	I/O	General purpose I/O	PTD4/XTAL32K	General purpose I/O
4	GPIO_4	I/O	General purpose I/O	PTC4	General purpose I/O
5	GPIO_5	I/O	General purpose I/O	PTA19	General purpose I/O
6	GND	-	Ground	GND	Ground
7	GPIO_7	I/O	General purpose I/O	PTA4/BOOT_CONFIG	General purpose I/O
8	SWO/TRACE_D0/ GPIO_8	I/O	General purpose I/O	PTC5	General purpose I/O
9	VCC_IO	I	Module I/O level voltage input	VDD_IO	Module DCDC, I/O and system input supply
10	VCC	I	Module supply voltage input	VDD	Module power switch input supply
11	SWDCLK	I	Serial Wire Debug port clock signal	PTA1/SWDCLK	Serial Wire Debug port clock signal
12	GND	-	Ground	GND	Ground
13	ANT	I/O	Tx/Rx antenna interface	ANT	Tx/Rx antenna interface
14	GND	-	Ground	GND	Ground
15	SWDIO	I/O	Serial Wire Debug port data signal	PTA0/SWDIO	Serial Wire Debug port data signal
16	GPIO_16	I/O	Analog function enabled GPIO	PTD1/ADC0_B5/UART_DTR	General purpose I/O
17	GPIO_17	I/O	Analog function enabled GPIO	PTD2/ADC0_A6/UART_DSR	General purpose I/O
18	GPIO_18	I/O	Analog function enabled GPIO	PTD3/ADC0_B6	General purpose I/O
19	RESET_N	I/O	System reset input	RESET_N	System reset input
20	GPIO_20	I/O	Analog function enabled GPIO	PTB5/LPUART1_RTS	General purpose I/O
21	GPIO_21	I/O	General purpose I/O	PTB4/LPUART1_CTS	General purpose I/O
22	GPIO_22	I/O	General purpose I/O	PTC3/LPUART1_TX	General purpose I/O
23	GPIO_23	I/O	Analog function enabled GPIO	PTC2/LPUART1_RX	General purpose I/O
24	GPIO_24	I/O	Analog function enabled GPIO	PTC6/ADC0_A8	General purpose I/O
25	GPIO_25	I/O	Analog function enabled GPIO	PTA20/ADC0_A14	General purpose I/O
26	GND	-	Ground	GND	Ground
27	GPIO_27	I/O	Analog function enabled GPIO	PTA21/ADC0_A15	General purpose I/O
28	NFC1/GPIO_28	I/O	NFC pin 1 (default)	RSVD	Not connected
29	NFC2/GPIO_29	I/O	NFC pin 2 (default)	RSVD	Not connected
30	GND	-	Ground	GND	Ground
31	VBUS	I	USB interface 5 V input	RSVD	Not connected
32	TRACE_D2/GPIO_32	I/O	General purpose I/O	PTA18	General purpose I/O

No.	Name NINA-B4	I/O	Description NINA-B4	Name NINA-B50	Description NINA-B50
33	TRACE_D3/GPIO_33	I/O	General purpose I/O	RSVD	Not connected
34	GPIO_34	I/O	General purpose I/O	RSVD	Not connected
35	GPIO_35	I/O	General purpose I/O	RSVD	Not connected
36	GPIO_36	I/O	General purpose I/O	VOUT_SWITCH	General purpose I/O
37	GPIO_37	I/O	General purpose I/O	RSVD	Not connected
38	GPIO_38	I/O	General purpose I/O	XTAL_OUT	General purpose I/O
39	GPIO_39	I/O	General purpose I/O	VREFO	General purpose I/O
40	GPIO_40	I/O	General purpose I/O	PTC7	General purpose I/O
41	GPIO_41	I/O	General purpose I/O	RSVD	Not connected
42	GPIO_42	I/O	General purpose I/O	RSVD	Not connected
43	GPIO_43	I/O	General purpose I/O	RSVD	Not connected
44	GPIO_44	I/O	General purpose I/O	RSVD	Not connected
45	TRACE_CLK/GPIO_45	I/O	General purpose I/O	SWITCH_WAKEUP	General purpose I/O
46	TRACE_D1/GPIO_46	I/O	General purpose I/O	PTA17	General purpose I/O
47	QSPI_D3/GPIO_47	I/O	General purpose I/O	PTC1/LPSPI1_PCS3	General purpose I/O
48	QSPI_D1/GPIO_48	I/O	General purpose I/O	PTB1/LPSPI1_SIN	General purpose I/O
49	QSPI_D2/GPIO_49	I/O	General purpose I/O	PTC0/LPSPI1_PCS2	General purpose I/O
50	QSPI_D0/GPIO_50	I/O	General purpose I/O	PTB3/LPSPI1_SOUT	General purpose I/O
51	QSPI_CS/GPIO_51	I/O	General purpose I/O	PTB0/LPSPI1_PCS0	General purpose I/O
52	QSPI_CLK/GPIO_52	I/O	General purpose I/O	PTB2/QSPI1_SCK	General purpose I/O
53	GND	-	Ground	GND	Ground
54	USB_DP	I/O	USB differential data signal	RSVD	Not connected
55	USB_DM	I/O	USB differential data signal	RSVD	Not connected
	EGP	-	Exposed Ground Pins	EGP	Exposed Ground Pins
	EAGP	-	Exposed Antenna Ground Pins	EAGP	Exposed Antenna Ground Pins

Table 16: NINA-B4 and NINA-B5 pin correlation

B Glossary

Abbreviation	Definition
ADC	Analog Digital Converter
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
U.FL	Coaxial RF connector
USB	Universal serial bus
RTS	Request To send
SDK	Software development kit
SOIC	Small outline integrated circuit
SPA	Serial port application
TPM	Timer/PWM Module
UART	Universal Asynchronous Receiver/Transmitter

Table 17: Explanation of the abbreviations and terms used

Related documents

[1] Arduino – https://www.arduino.cc
[2] Raspberry Pi - https://www.raspberrypi.org/
[3] NINA-B50 data sheet, UBX-22021114
[4] NINA-B50 series system integration manual, UBX-22021116
[5] SEGGER J-Link software - https://www.segger.com/jlink-software.html
[6] U-blox open CPU repository: https://github.com/u-blox/u-blox-sho-OpenCPU
[7] FTDI chip home page: https://ftdichip.com/

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Revision history

Revision	Date	Name	Comments
R01	22-Aug-2023	hekf	Initial release
R02	30-Nov-2023	lkis, mape	Minor editorial changes throughout document. Added K32W pin column in Table 14.

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