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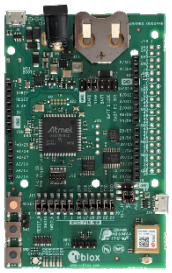
EVK-NINA-B3

Evaluation Kit for NINA-B3 modules

User Guide



Abstract

This document describes how to set up the EVK-NINA-B3 evaluation kit to evaluate NINA-B3 series standalone Bluetooth® 5 low energy modules. It also describes the different options for debugging and the development capabilities included in the evaluation board.

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Document Information

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This document applies to the following products:

Product name	Type number	Firmware version	PCN reference
EVK-NINA-B301	EVK-NINA-B301-00		-
EVK-NINA-B311	EVK-NINA-B311-00		-
EVK-NINA-B302	EVK-NINA-B302-00		-
EVK-NINA-B312	EVK-NINA-B312-00		-

Contents

1 Product description

1.1 Overview

The u-blox EVK-NINA-B3 evaluation kit is a versatile development platform that allows quick prototyping of a variety of extreme low-power Internet of Things (IoT) applications, using full Bluetooth 5, NFC, and IEEE 802.15.4.

The u-blox EVK-NINA-B3 boards are available in the following four variants, depending on the required antenna and software solution:

- EVK-NINA-B301, with an open CPU NINA-B301 module and an antenna connector for connecting to external antennas.
- EVK-NINA-B311, with a NINA-B311 module including u-blox connectivity software, and an antenna connector for connecting to external antennas.
- EVK-NINA-B302, with an open CPU NINA-B302 module that includes an internal antenna (a unique 2.4 GHz metal sheet antenna, soldered on to the module).
- EVK-NINA-B312, with a NINA-B312 module including u-blox connectivity software and an internal antenna (a unique 2.4 GHz metal sheet antenna soldered on to the module).

The evaluation board provides access to all of the 38 GPIO pins and interfaces available on the NINA-B3 modules through a variety of connectors and interfaces including Arduino™ Uno R3 and Raspberry Pi header connectors.

The stand-alone NINA-B3 modules include an Arm® Cortex®-M4F microcontroller with 1 MB internal flash and 256 kB RAM, running at a system clock of 64 MHz. This has been integrated inside the Nordic Semiconductor nRF52840 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 provides a free Software Development Kit (SDK) with a broad selection of drivers, libraries, and example applications that can be used for rapid prototyping.

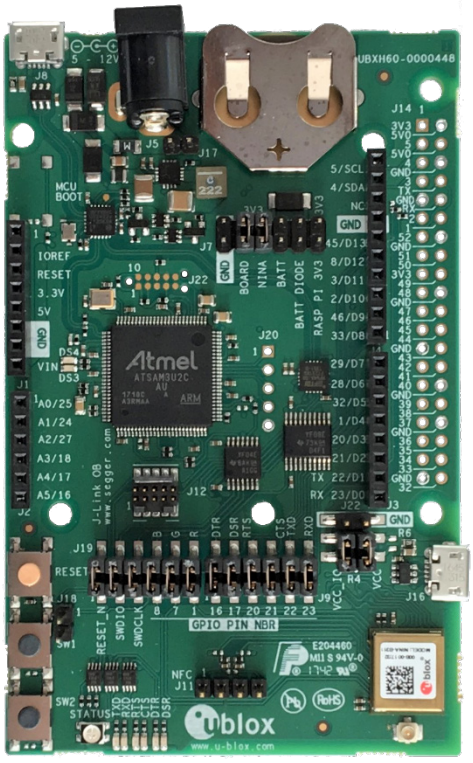


Figure 1: EVK-NINA-B311 evaluation board

⚠ Take care when handling the EVK-NINA-B302 or EVK-NINA-B312. Applying force to the NINA module might damage the internal antenna.

1.2 Kit includes

The EVK-NINA-B3 evaluation kit includes the following:

- NINA-B3 evaluation board
- 2.4 GHz antenna with u.fl connector (only in EVK-NINA-B301 and EVK-NINA-B311)
- NFC antenna
- USB cable
- Quick Start card

1.3 Key features

- u-blox NINA-B3 Bluetooth Low Energy module based on the Nordic nRF52840 chipset
    - Full Bluetooth 5 support
    - NFC tag functionality
    - 802.15.4 PHY
    - Integrated Arm Cortex-M4 microcontroller with 1 MB flash, 256 kB RAM, and 64 MHz system clock
    - USB 2.0
    - Wide 1.7-3.6 V supply range
- The NINA-B3 module supports different interfaces that can be configured to any of the 38 available GPIO pin(s):
    - 8 analog capable inputs
    - 12 PWM capable outputs
    - 3x SPI
    - 2x UART with HW flow control
    - 2x I2C
    - 1x I2S
    - 1x PDM input
    - 1x Quadrature decoder
- Full UART to USB converter with a Virtual COM port, allowing control of the extended UART features of the u-blox connectivity 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-B3
- Dedicated USB connector for the NINA-B3 USB interface
- Additional flash memory can be added to the board for use by the NINA-B3 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-B3 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

1.4 EVK-NINA-B3 block diagram

The block diagram of EVK-NINA-B3 is shown in Figure 2.

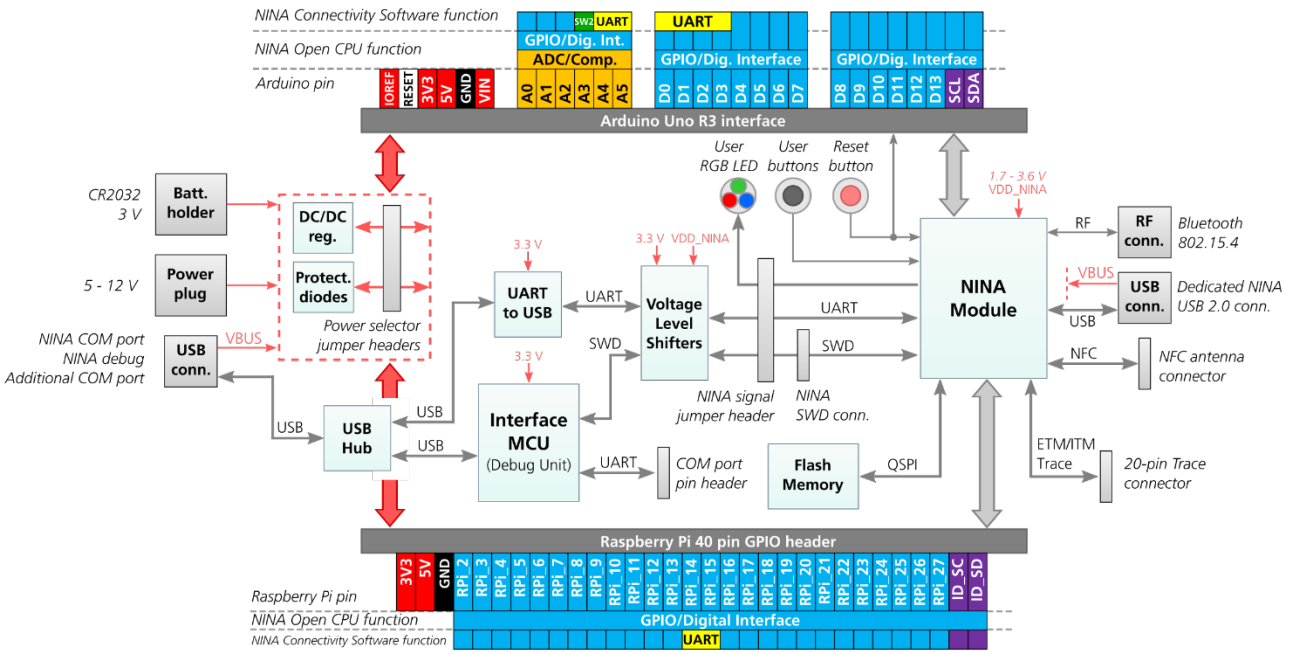


Figure 2: EVK-NINA-B3 block diagram

The block diagram shows the major interfaces and internal connections of the EVK-NINA-B3. The following sections describes 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.

1.5 Connectors

Figure 3 shows the available connectors of the EVK-NINA-B3 and their layout. Table 1 describes the connectors and their uses in detail.

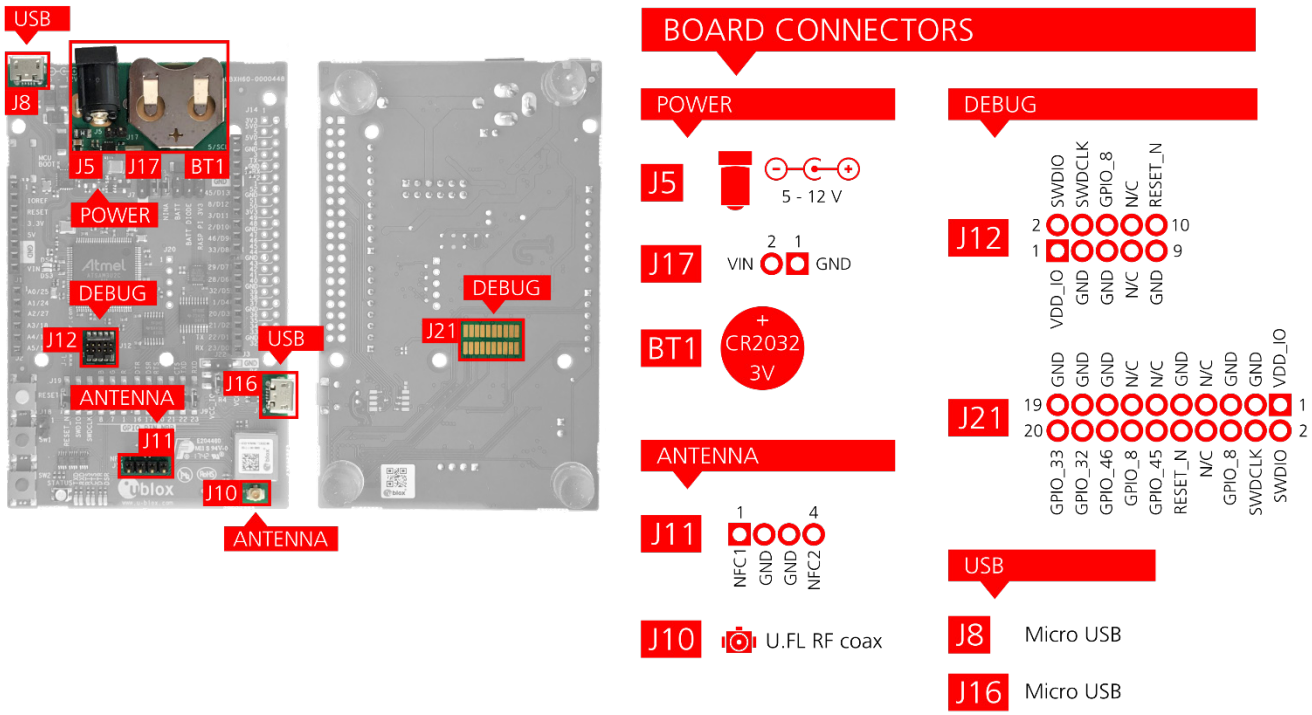


Figure 3: Available connectors and their pinout

Connector annotation	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.
J10	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-B301/EVK-NINA-B311.
J12	Cortex Debug connector	10-pin, 50 mil pitch connector that can be used to connect external debuggers to the NINA-B3 module. The NINA-B3 modules support Serial Wire debug (SWD) and Serial Wire Viewer, but not JTAG debug.
J21	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-B3 module. This requires a special external debugger. Note that the 50 mil pitch pin header is not soldered onto the evaluation board by default.
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-B3 USB interface. Can also be used to power the entire board.

Table 1: EVK-NINA-B3 connector description

1.6 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 pin
- 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 4.

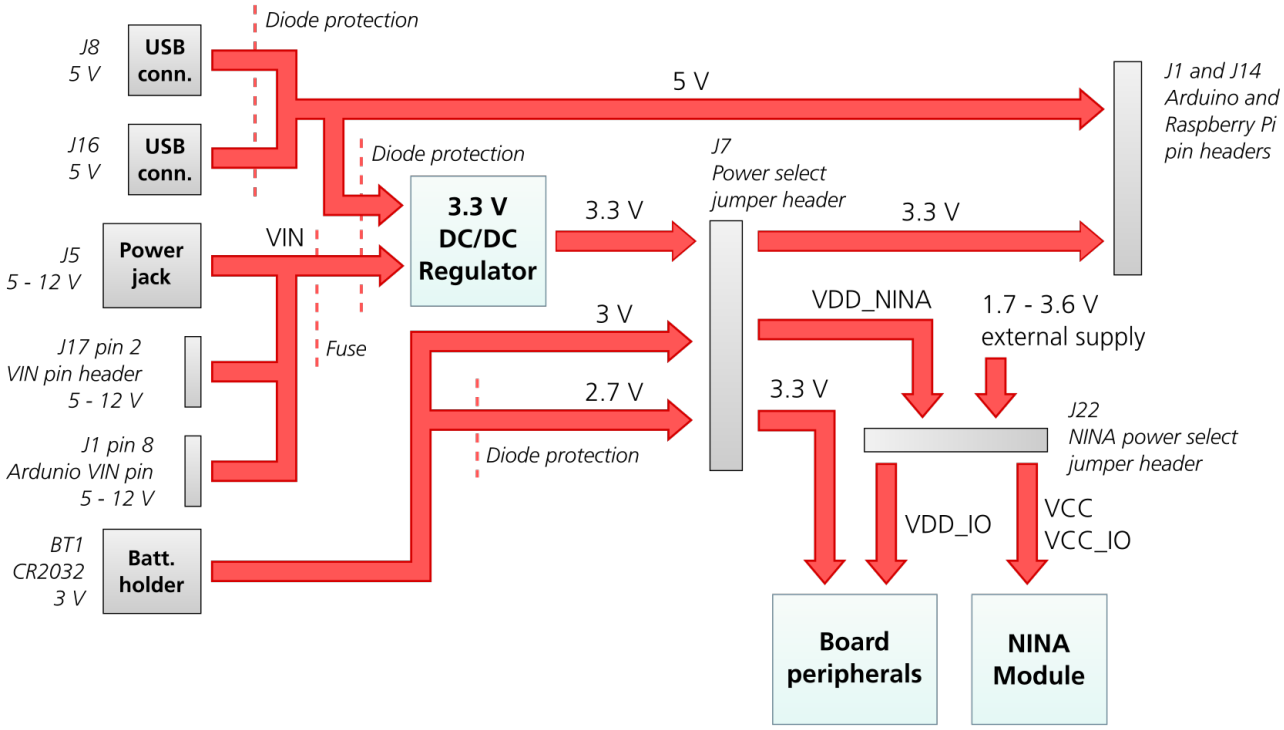


Figure 4: Block diagram of the power net distribution

1.6.1 Selecting the power configuration jumpers

The EVK-NINA-B3 offers flexible powering options for the NINA-B3 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 5 shows the location of the power configuration jumper headers. The 3V3 net is supplied by the board and will always be powered as long as any of the power sources shown in Figure 4 are connected. The 3V3 net will not provide power unless a jumper is added to jumper header J7.

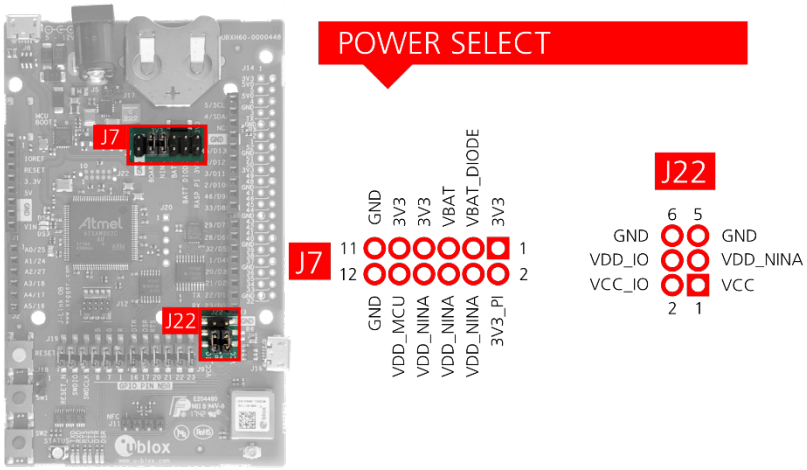


Figure 5: Jumper headers J7 and J22 are used to select power configurations

Connector annotation	Pin number	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 floating 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 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

The following sections describe different jumper configurations and power scenarios that is available on the board, including the default configuration.

⚠ 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.

1.6.2 Default power, 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 6: Jumper positions for default power configuration

Connector annotation	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

1.6.3 Battery powered, 3 V

When using a battery, Figure 7 shows the default configuration. The battery voltage is connected to VDD_NINA, which in turn, is connected to the NINA-B3 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.

Figure 7: Jumper positions for battery powered operation, two jumpers are optional

Connector annotation	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

1.6.4 Battery powered with protection diode, 2.7 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 that will typically damage a non-chargeable battery. To prevent this damage, a schottky diode can be added in series to the battery, which will block any back current surges. A jumper should then 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.

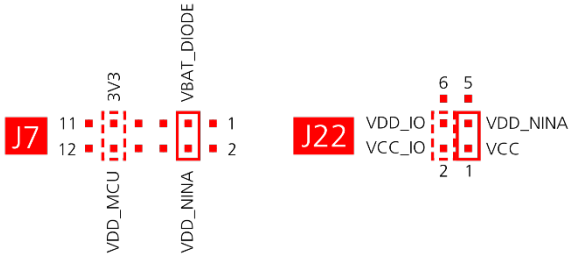


Figure 8: Jumper positions for battery powered operation with a protection diode, two jumpers are optional

Connector annotation	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

1.6.5 External supply

When measuring current consumption or performing other NINA-B3 module characterization measurements, it can be useful to power the module with an external source such as a DC power analyzer. 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-B3 module can be powered by connecting an external supply directly to the J22 pin 1 and GND.

☞ Take care that unpowered parts of the board are properly isolated. If a voltage is applied to the signal of an unpowered device, current might leak through various protection circuits of the device. This might give false readings when measuring current consumption etc.

Figure 9 below shows a few optional jumper connections that can be helpful when supplying the module with an external supply.

Figure 9: Optional jumper positons while using an external power supply

Connector annotation	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

1.6.6 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.

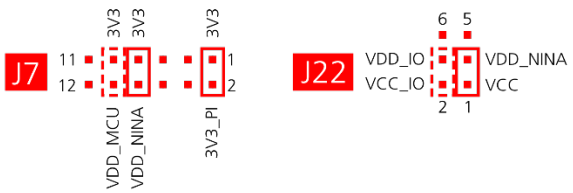


Figure 10: Jumper configuration when connected to a Raspberry Pi HAT

Connector annotation	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

1.7 Arduino interface

The EVK-NINA-B3 includes a set of pin headers and mounting holes that are compatible with certain Arduino or Arduino inspired shields. Figure 11 shows the layout of the Arduino interface and Table 8 explains the pinout in more detail. Section 1.7.1 describes what specifications must be met for a shield to be compatible for use with the EVK-NINA-B3.

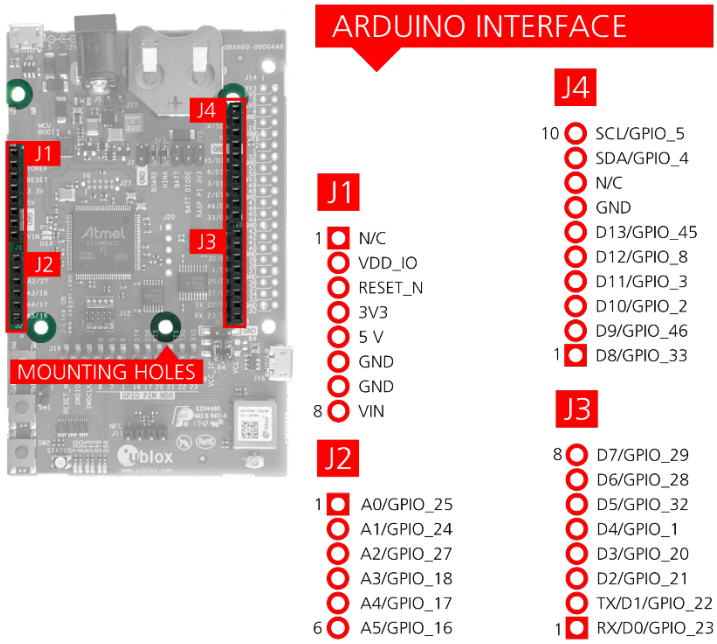


Figure 11: Pin headers that are compatible with some Arduino shields

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 1.6
	3	RESET	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	-	
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-B31. 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-B31
	6	A5	Analog input	UART_DTR/ GPIO_16	P0.03	Analog function capable GPIO, UART_DTR signal on NINA-B31
J3	1	D0/RX	Digital I/O, UART RX	UART_RXD/ GPIO_23	P0.29	UART_RXD signal on NINA-B31
	2	D1/TX	Digital I/O, UART TX	UART_TXD/ GPIO_22	P1.13	UART_TXD signal on NINA-B31
	3	D2	Digital I/O	UART_CTS/ GPIO_21	P1.12	UART_CTS signal on NINA-B31
	4	D3	Digital I/O	UART_RTS/ GPIO_20	P0.31	UART_RTS signal on NINA-B31
	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	P0.14	
	4	D11	Digital I/O	GPIO_3	P0.15	
	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	P0.24	

Table 8: Pinout of the Arduino UNO R3 compatible interface

1.7.1 Arduino shield compatibility

The EVK-NINA-B3 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-B3 has a pinout that is compatible with some Arduino or Arduino inspired shields. This section describes the features of the EVK pins that a shield must comply with:

- IOREF: The I/O voltage level of the NINA-B3 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 cannot be used to power the board, use the VIN pin instead.
- VIN: May be used as a 5 -12 V supply input to power the EVK-NINA-B3.
- Pin 0 (RX): Is connected to the NINA-B3 UART RX pin (NINA pin 23).
- Pin 1 (TX): Is connected to the NINA-B3 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-B3, 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 1.10 on how to disconnect these signals from the debug MCU.

1.8 Raspberry Pi compatible interface

The EVK-NINA-B3 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-B3 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 9 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 9: Compatible Raspberry Pi boards

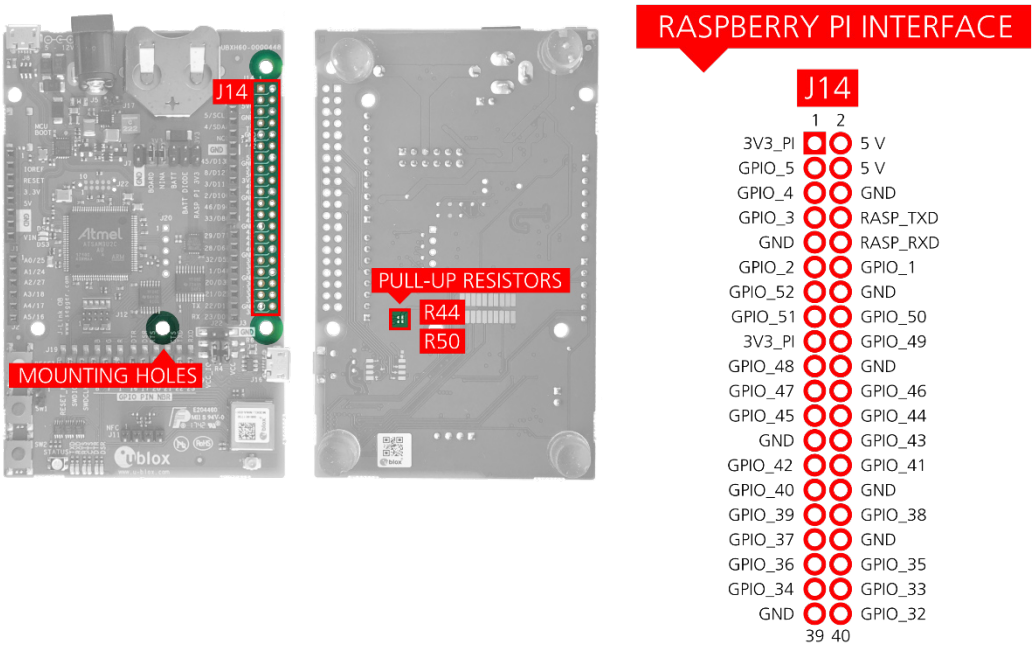


Figure 12: Pin header J14 that is compatible with the Raspberry Pi GPIO connectors

Figure 12 shows the layout of the Raspberry Pi interface and Table 10 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.

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 1.6
	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	P0.24	
	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	P0.15	
	8	GPIO14	Digital I/O, UART TX/RX	RASP_TXD	P0.29	Connected to NINA UART_RXD pin by default, see section 1.8.2
	9	GND	Ground	GND	GND	
	10	GPIO15	Digital I/O, UART RX/TX	RASP_RXD	P1.13	Connected to NINA UART_TXD pin by default, see section 1.8.2
	11	GPIO17	Digital I/O	GPIO_2	P0.14	
	12	GPIO18	Digital I/O	GPIO_1	P0.13	
	13	GPIO27	Digital I/O	GPIO_52	P0.19	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	P0.17	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 1.6
	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	P0.23	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	P0.06	
	27	ID_SD	EEPROM config I2C data signal	GPIO_42	P0.26	Should only be used to read or simulate HAT EEPROMs, see section 1.8.3
	28	ID_SC	EEPROM config I2C clock signal	GPIO_41	P1.14	Should only be used to read or simulate HAT EEPROMs, see section 1.8.3
	29	GPIO05	Digital I/O	GPIO_40	P1.15	
	30	GND	Ground	GND	GND	
	31	GPIO06	Digital I/O	GPIO_39	P1.11	

Conn.	Pin No.	Raspberry Pi pin	Description	Schematic net name	nRF52 pin	Alternate functions and notes
	32	GPIO12	Digital I/O	GPIO_38	P1.10	
	33	GPIO13	Digital I/O	GPIO_37	P1.03	
	34	GND	Ground	GND	GND	
	35	GPIO19	Digital I/O	GPIO_36	P1.02	
	36	GPIO16	Digital I/O	GPIO_35	P1.01	
	37	GPIO26	Digital I/O	GPIO_34	P1.08	
	38	GPIO20	Digital I/O	GPIO_33	P1.09	
	39	GND	Ground	GND	GND	
	40	GPIO21	Digital I/O	GPIO_32	P0.11	

Table 10: Pinout of the Raspberry Pi compatible interface

1.8.1 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 1.6.6 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.

1.8.2 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-B30 is used, this switch can also be made in the software. By default, the EVK-NINA-B3 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.

1.8.3 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-B3 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-B30 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** can 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.

1.9 Buttons and LEDs

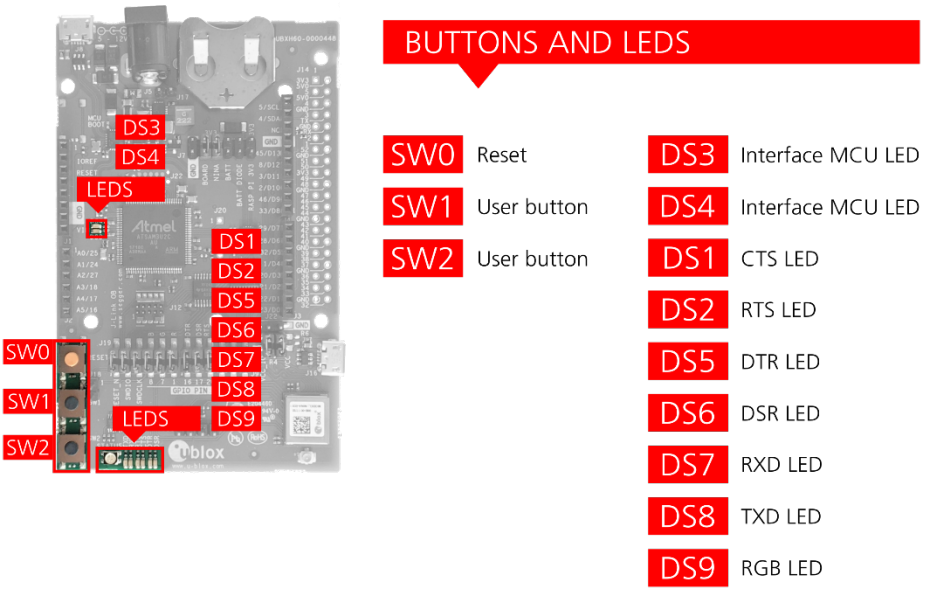


Figure 13: Position of the push-buttons and LEDs on the evaluation board

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 11: EVK-NINA-B3 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	

Table 12: EVK-NINA-B3 LED indicators

1.10 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-B3 module by default. This might not suit all evaluation scenarios. All peripherals can be switched off by disconnecting their power supplies (see section 1.6), 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.

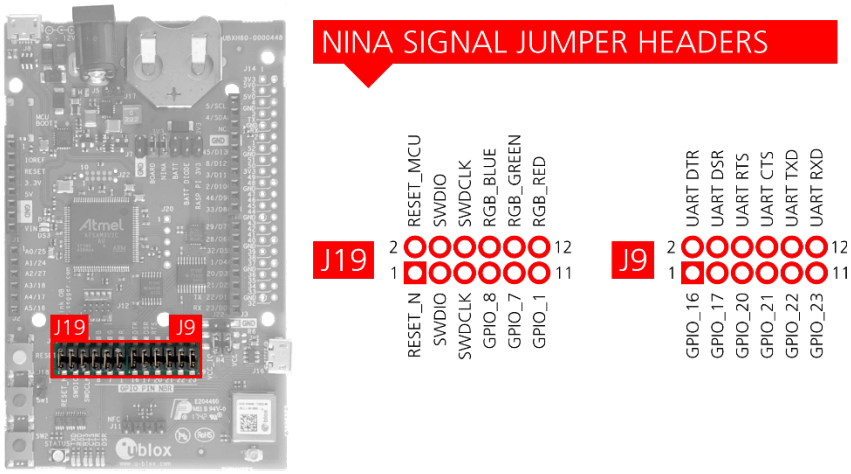


Figure 14: Jumper headers J19 and J9 that are used to isolate specific NINA signals

Connector annotation	Pin number	Schematic net name	Description
J19	1	RESET_N	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-B30: GPIO or TRACE NINA-B31: BLUE signal
	8	BLUE	RGB diode blue signal, active low
	9	GPIO_7/ SWITCH_1	NINA-B30: GPIO, can be used as either user LED output or push-button input NINA-B31: SWITCH_1 and GREEN signal
	10	GREEN	RGB diode green signal, active low
	11	GPIO_1	NINA-B30: GPIO, can be used as user LED output NINA-B31: RED signal
	12	RED	RGB diode red signal, active low
J9	1	GPIO_16/ UART_DTR	NINA-B30: analog capable GPIO signal NINA-B31: UART DTR output
	2	UART_DTR_I	UART to USB DTR signal
	3	GPIO_17/ UART_DSR	NINA-B30: analog capable GPIO signal NINA-B31: UART DSR input
	4	UART_DSR_I	UART to USB DSR signal
	5	GPIO_20/ UART_RTS	NINA-B30: analog capable GPIO signal NINA-B31: UART RTS output
	6	UART_RTS_I	UART to USB RTS signal
	7	GPIO_21/ UART_CTS	NINA-B30: GPIO signal NINA-B31: UART CTS input
	8	UART_CTS_I	UART to USB CTS signal
	9	GPIO_22/ UART_TXD	NINA-B30: GPIO signal NINA-B31: UART TXD output
	10	UART_TXD_I	UART to USB TXD signal
	11	GPIO_23/ UART_RXD	NINA-B30: analog capable GPIO signal NINA-B31: UART RXD input
	12	UART_RXD_I	UART to USB RXD signal

Table 13: Pinout of jumper headers - J19 and J9

1.11 Software debug options

You can debug the software using the following two options in EVK-NINA-B3:

- 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 the CR2032 coin cell battery, or through the external power supply connector J5. It could also be useful in a scenario where the debug MCU interface has been disconnected from the NINA-B3 module using the jumpers on J9 header. The SEGGER J-Link software [4] is required to debug using the onboard J-Link hardware on the EVK-NINA-B3.

2 Setting up the evaluation board

2.1 Evaluation board setup

The EVK-NINA-B311/EVK-NINA-B312 will be delivered with the u-blox connectivity software 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-B311/EVK-NINA-B301, connect a 2.4 GHz antenna to the U.FL antenna connector (J10). The EVK-NINA-B312/EVK-NINA-B302 has an onboard antenna.

Plug in either an external power supply in J5 connector or connect to a USB host with a USB cable attached to J8 connector. You can also power the evaluation board with a CR2032 coin cell battery. The status light (**DS6**) will turn green, indicating it has power. The NFC antenna can be connected to the J11 connector.

⚠ Be careful to check polarity before connecting an external power supply to the EVK-NINA-B3 evaluation board. Center conductor is positive (+) and the ring is negative (-).

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

⚠ If the drivers are not installed automatically, download the nRFgo Studio from www.nordicsemi.com to get the Jlink CDC UART driver.

A COM port will automatically be assigned to the unit by Windows. 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 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.

2.2 Starting up

2.2.1 EVK-NINA-B311 and EVK-NINA-B312

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. You will now be able to communicate with the module through AT commands.

For a list of available AT commands, see the u-blox Short Range AT Commands Manual [3]. To get started with basic use case set up of the EVK-NINA-B3 with u-blox connectivity software, see the NINA-B31 Getting Started [5].

2.2.2 EVK-NINA-B301 and EVK-NINA-B302

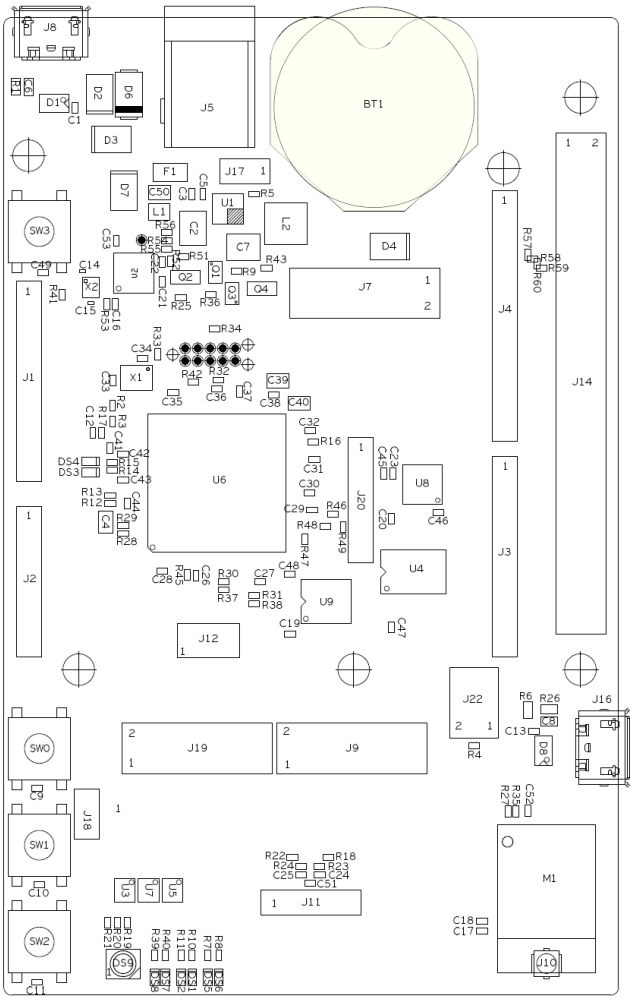
If you would like to use the EVK-NINA-B3 together with Nordic Semiconductor SDK, refer to the Software section of the NINA-B3 System Integration Manual [2].

2.3 Getting the latest software

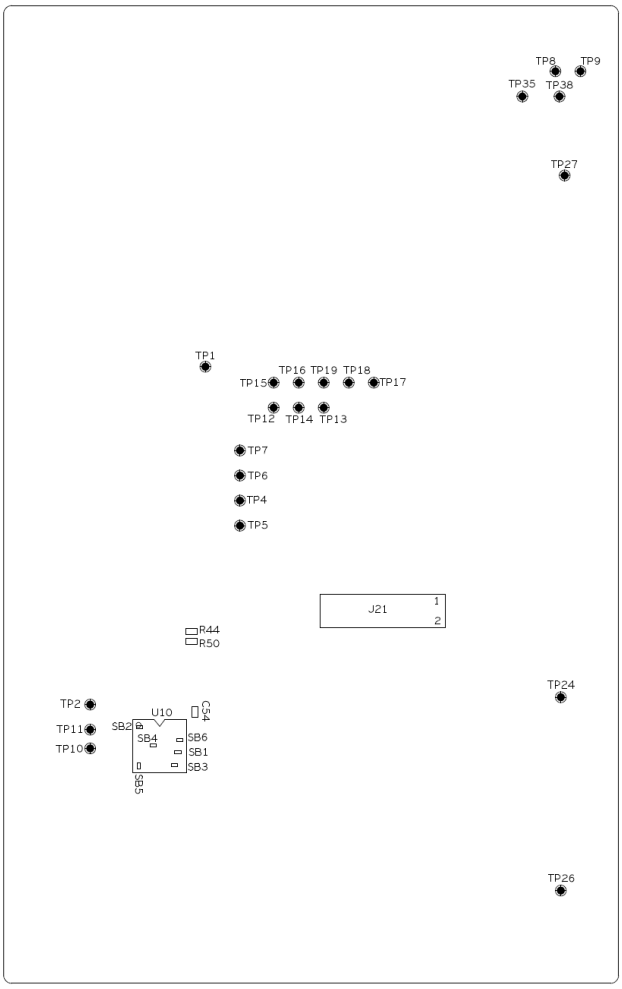
Go to the u-blox support webpage to obtain the latest available firmware. Instructions on reflashing the EVK-NINA-B3 can be found in the Software section of the NINA-B3 System Integration Manual [2].

Appendix

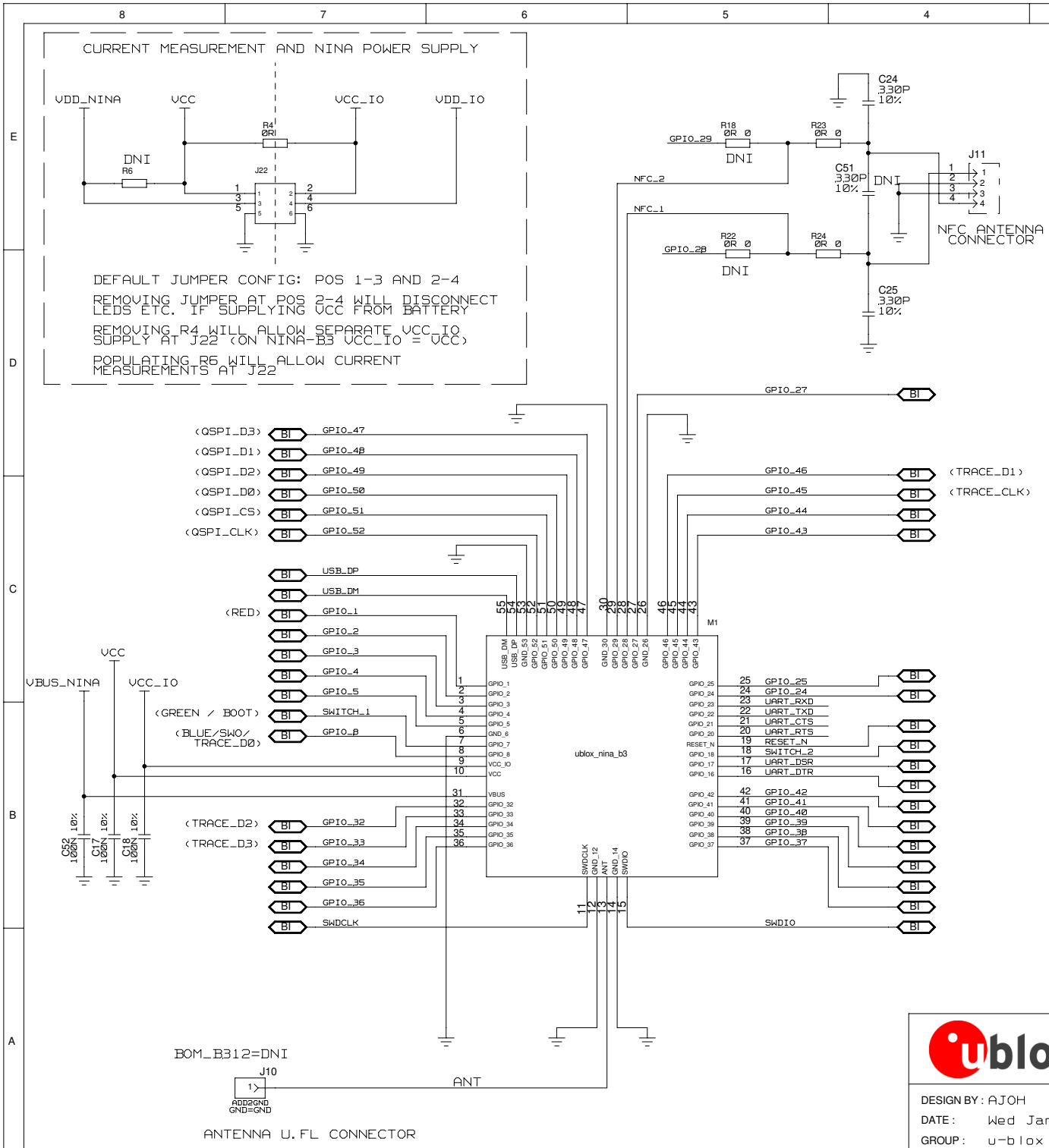
A Schematics



Top view



Bottom view


CURRENT MEASUREMENT AND NINA POWER SUPPLY
VDD_NINA
VCC
VCC_IO
VDD_IO
R4 0R
DNI
R6
J22
DEFAULT JUMPER CONFIG: POS 1-3 AND 2-4
REMOVING JUMPER AT POS 2-4 WILL DISCONNECT LEDS ETC. IF SUPPLYING VCC FROM BATTERY
REMOVING R4 WILL ALLOW SEPARATE VCC_IO SUPPLY AT J22 (ON NINA-B3 VCC_IO = VCC)
POPULATING R6 WILL ALLOW CURRENT MEASUREMENTS AT J22
C24 3.3Ø P 10%
GPIO_29
R18 0R Ø
R23 0R Ø
DNI
C51 3.3Ø P 10%
DNI
J11
NFC_2
NFC_1
NFC ANTENNA CONNECTOR
GPIO_28
R22 0R Ø
R24 0R Ø
DNI
C25 3.3Ø P 10%
GPIO_27
(QSPI_D3)
(QSPI_D1)
(QSPI_D2)
(QSPI_D0)
(QSPI_CS)
(QSPI_CLK)
GPIO_47
GPIO_48
GPIO_49
GPIO_50
GPIO_51
GPIO_52
GPIO_46
GPIO_45
GPIO_44
GPIO_43
(TRACE_D1)
(TRACE_CLK)
USB_DP
USB_DM
(RED)
GPIO_1
GPIO_2
GPIO_3
GPIO_4
GPIO_5
(GREEN / BOOT)
SWITCH_1
(BLUE/SWO/ TRACE_D0)
GPIO_8
M1
ublox_nina_b3
VCC
VBUS_NINA
VCC_IO
C52 100N 10%
C17 100N 10%
C18 100N 10%
(TRACE_D2)
(TRACE_D3)
GPIO_32
GPIO_33
GPIO_34
GPIO_35
GPIO_36
SWDCLK
SWDIO
GPIO_25
GPIO_24
UART_RXD
UART_TXD
UART_CTS
UART_RTS
RESET_N
SWITCH_2
UART_DSR
UART_DTR
GPIO_42
GPIO_41
GPIO_40
GPIO_39
GPIO_38
GPIO_37
BOM_B312=DNI
J10
ANT
ADD2GND
GND=GND
ANTENNA U.FL CONNECTOR
SWDIO_I
SWDCLK_I
BLUE_
RESET_N_I
UART_DTR_
UART_DSR_
UART_RTS_
UART_CTS_
UART_TXD_
UART_RXD_
NOTE!
DNI = N
PRODUCT
BOM B31
MOUNT N
BOM B31
MOUNT N
J10 DNI
U-BLOX AG
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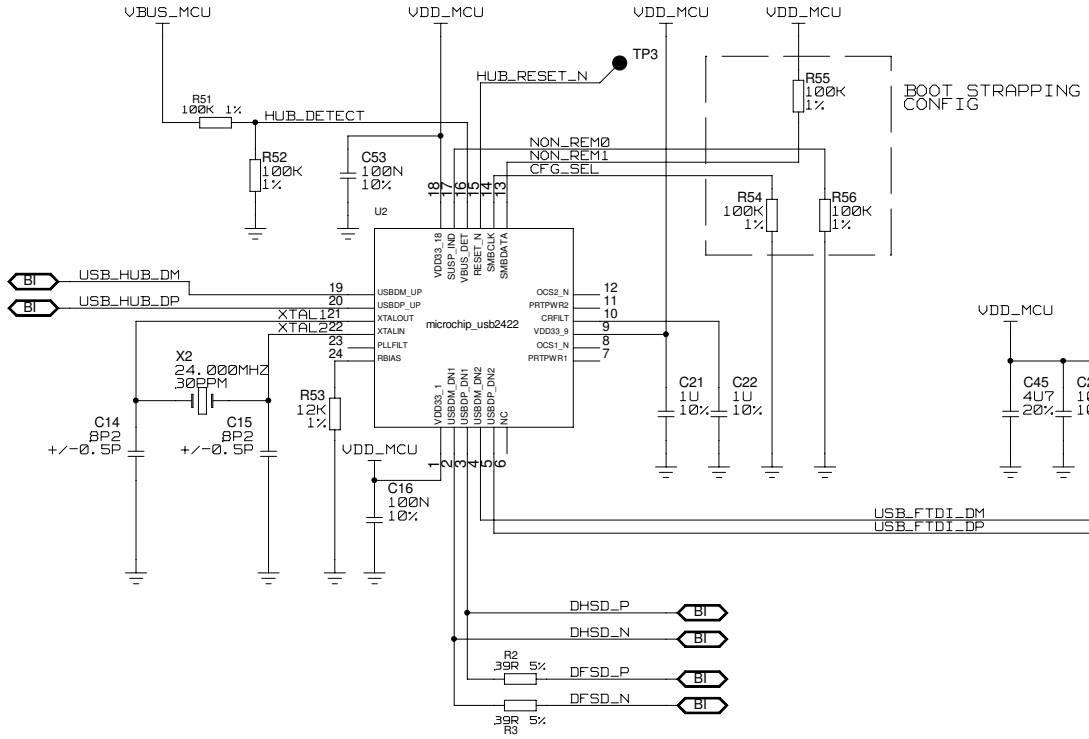

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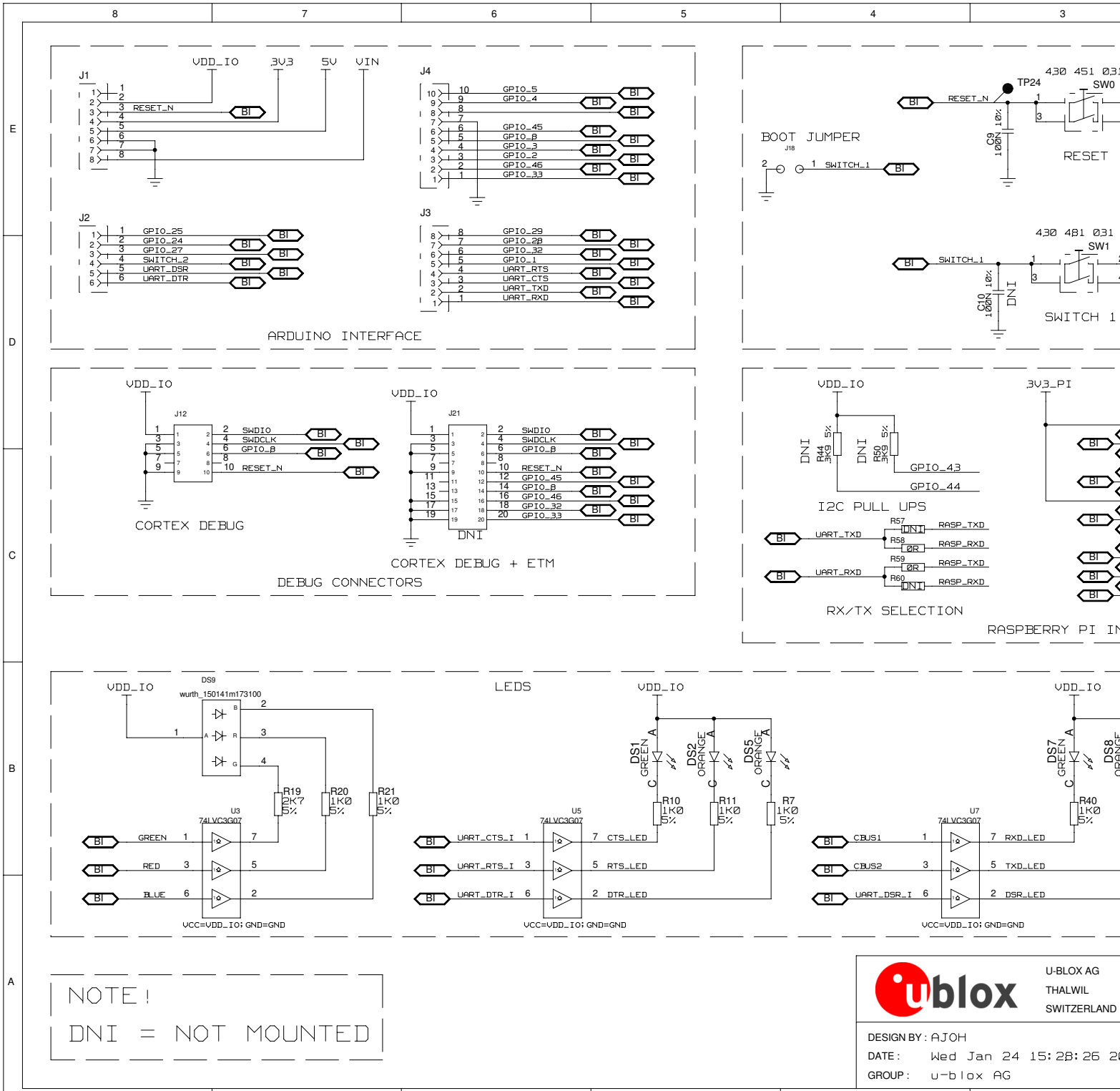

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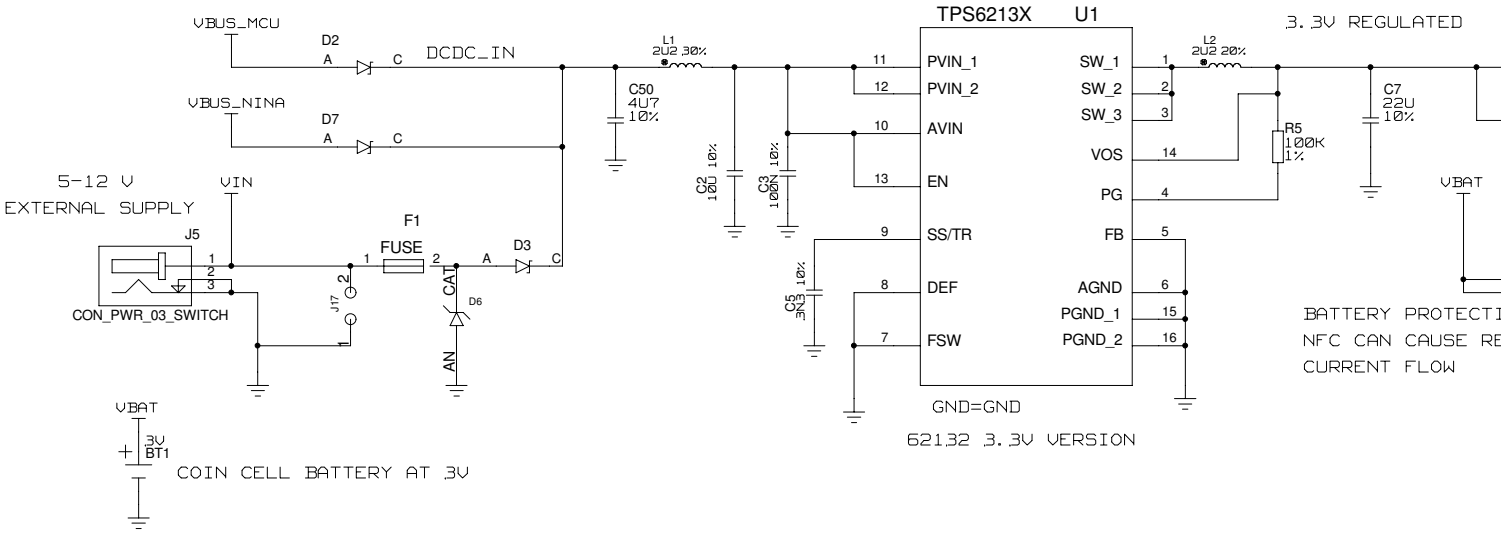

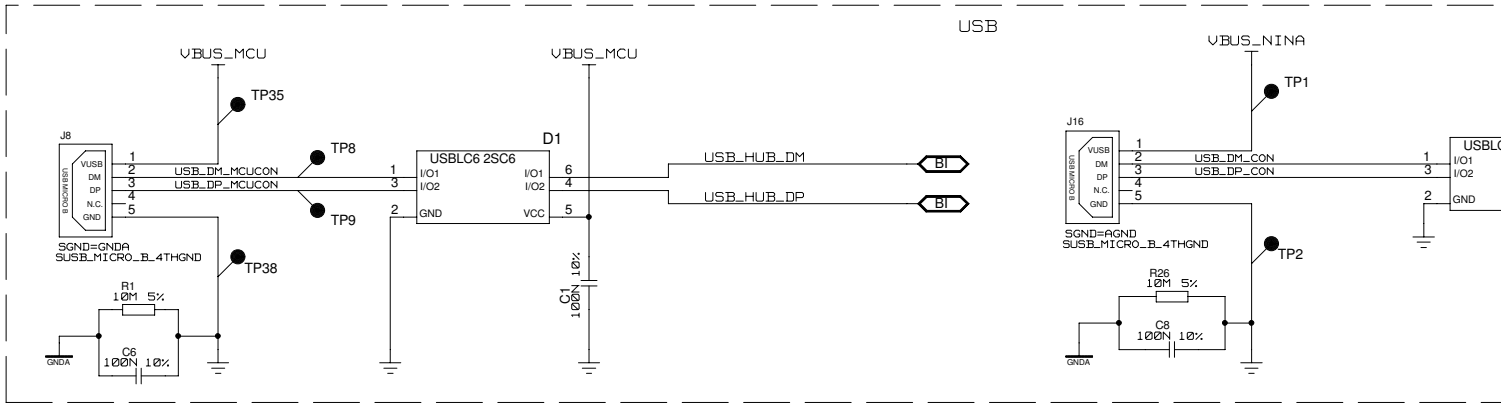

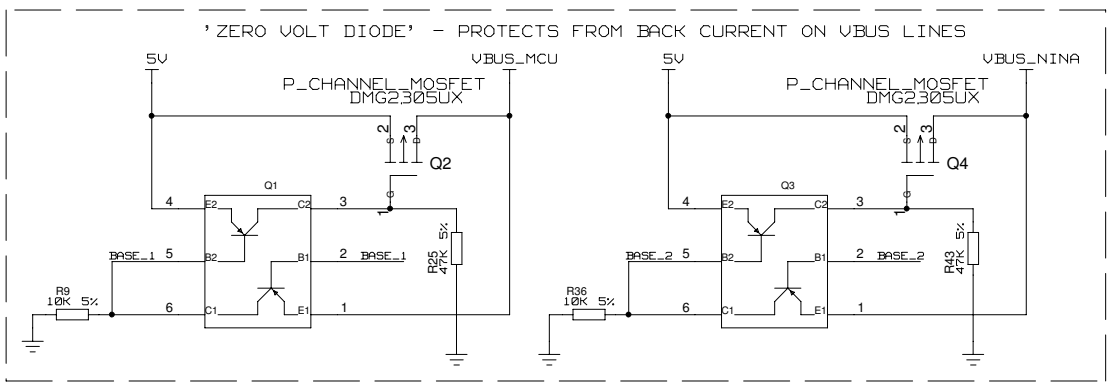

5V NET CAN ONLY BE POWERED BY USB

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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 14: Explanation of the abbreviations and terms used

Related documents

[1] NINA-B3 Data Sheet, document number UBX-17052099
[2] NINA-B3 Series System Integration Manual, document number UBX-17056748
[3] u-blox Short Range AT Commands Manual, document number UBX-14044127
[4] SEGGER J-Link software - https://www.segger.com/jlink-software.html
[5] NINA-B31 Getting Started, document number UBX- 18022394

☞ 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	07-Feb-2018	cmag, ajoh, kgom	Initial release.
R02	6-Jul-2018	kgom	Included reference to NINA-B31 Getting Started guide in section 2.2.1.
R03	13-Sep-2018	mape	Added information about Open CPU devices and how to use them on Windows 10 host (section 2.1).

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