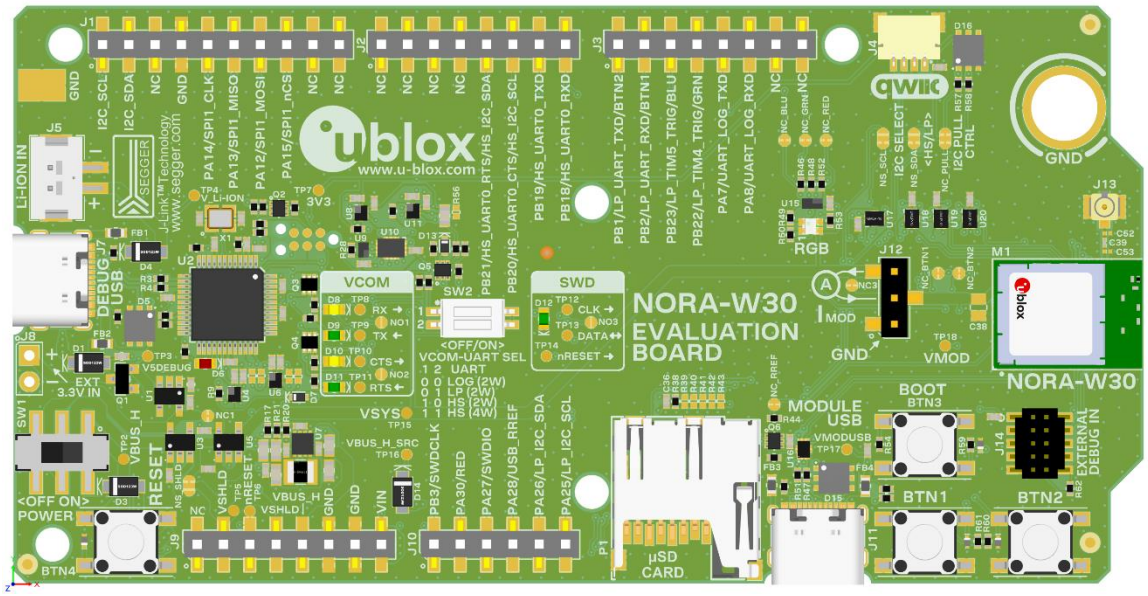
EVK-NORA-W30

Evaluation kit for NORA-W30 series modules

User guide



Abstract

This document describes how to set up the EVK-NORA-W30 evaluation kit for NORA-W30 series stand-alone modules. It also describes the different options for debugging and the development capabilities included in the evaluation board.

Document information

Title	**EVK-NORA-W30**
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Product status	Corresponding content status	
Functional sample	Draft	For functional testing. Revised and supplementary data will be published later.
In development / Prototype	Objective specification	Target values. Revised and supplementary data will be published later.
Engineering sample	Advance information	Data based on early testing. Revised and supplementary data will be published later.
Initial production	Early production information	Data from product verification. Revised and supplementary data may be published later.
Mass production / End of life	Production information	Document contains the final product specification.

This document applies to the following products:

Product name	Document status	Comment
EVK-NORA-W301	Advance information	
EVK-NORA-W306	Advance information	

Contents

1 Quick start guide

EVK-NORA-W30 software and documentation are available at the u-blox website.

Realtek SDK information and instructions are available on the Realtek Ameba IoT website [6].

1.1 USB device drivers

A SEGGER© J-Link-OB debug interface on EVK-NORA-W30 provides both a serial wire debug (SWD) and virtual COM port (VCOM) connection to the NORA-W30. The development PC requires an internet connection and sufficient access rights to automatically download and install the required device drivers when the EVK is plugged into an available upstream USB port.

1.2 Realtek SDK

Realtek provides application development information and SDKs through the Ameba IoT website [6] and repositories on GitHub [7].

1.2.1 Windows - install Cygwin 32-bit

As Cygwin x86 for Windows 10 and newer versions have reached “end-of-life” and can no longer be downloaded from the official web site, Realtek SDKs only support the 32-bit version.

To download and install the latest 32-bit version:

- Download the latest 32-bit Cygwin "`setup-x86.exe`" application here.
- Open the command prompt in administrator mode.
- Type "`start <setup-x86.exe location> --allow-unsupported-windows option --site http://ctm.crouchingtigerhiddenfruitbat.org/pub/cygwin/circa/2022/11/23/063457`"
- During the install, add `Devel > Make and Math > bc` into the Cygwin package. Use the Search function to find the individual packages. For search details, see the images at Realtek GitHub [8].

1.2.2 Linux

For installation of the tools on Linux, see the Realtek Ameba-D application note [5], section 1.2.2.

1.2.3 Standard SDK

NORA-W30 is supported through the standard Realtek SDK that covers Global Community Cloud (GCC) and IAR development environments. To use Cygwin in the GCC development environment, go to the Realtek GitHub Ameba-D Arduino repository [8] and see section [5], sections 3, 4, and 5. For IAR, see the Realtek Ameba-D application note [5], section 6.

1.2.4 Arduino IDE

NORA-W30 is supported through the Arduino IDE, version 2.1 and newer. See Arduino IDE website [11]. After installing the standard Arduino IDE, add support for NORA-W30 by following the available instructions at the Realtek GitHub Ameba-D Arduino repository [9]. Arduino IDE support for NORA-W30 was added in version 3.1.7.

☞ The UART on the debug interface on EVK-NORA-W30 supports baud rates up to 1 Mbps. The latest files at the Realtek GitHub site contain the necessary settings.

1.2.5 SDK support

Realtek provides SDK support through the issues and pull requests from the Realtek Ameba IoT site [7], standard SDK repository [8], Arduino repository [9], and IoT support forum [10].

2 Product description

2.1 Overview

The u-blox EVK-NORA-W30 evaluation kit is a versatile development platform that allows quick prototyping of a variety of Internet of Things (IoT) applications, using Bluetooth® LE 5.3 and Wi-Fi 4 (IEEE 802.11 a/b/g/n).

EVK-NORA-W30 boards are available in the following variants that accommodate alternative antenna and software solutions:

- EVK-NORA-W301, with a NORA-W301 open CPU module and an antenna pin. The antenna pin is routed to a U.FL connector on the EVK to allow use of different external antennas.
- EVK-NORA-W306, with a NORA-W306 open CPU module and an internal PCB trace antenna.

All signals are clearly marked on both top (Figure 1) and bottom (Figure 2) sides.

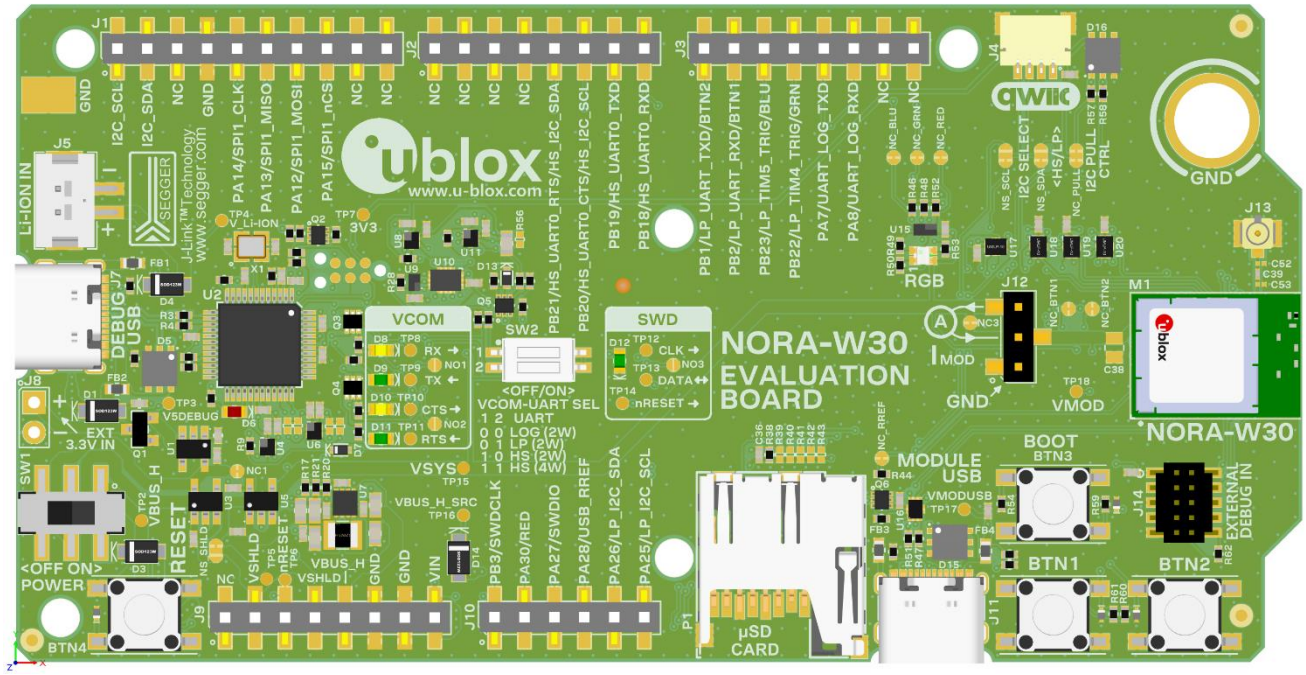

Figure 1: EVK-NORA-W30 top side (EVK-NORA-W306 shown)

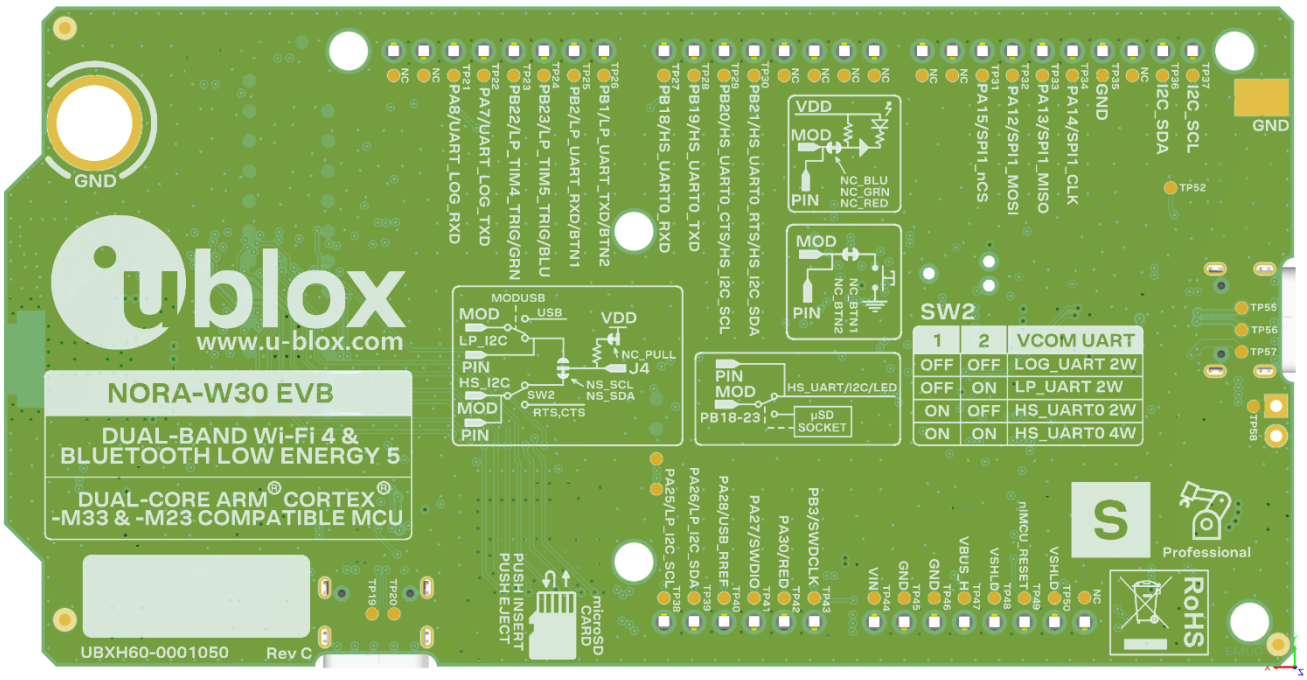

Figure 2: EVK-NORA-W30 bottom side

2.2 Kit includes

2.2.1 EVK-NORA-W301

- EVK-NORA-W30 evaluation board with NORA-W301 module
- USB-A to USB-C adapter cable
- Dual-band – U.FL antenna

2.2.2 EVK-NORA-W306

- EVK-NORA-W30 evaluation board with NORA-W306 module
- USB-A to USB-C adapter cable
- A dual-band integrated PCB trace antenna (external antenna not supplied)

2.3 Key features

EVK-NORA-W30 boards provide:

- Evaluation board for NORA-W301 or NORA-W306 modules
- On-board programming and debug (SEGGER J-Link-OB)
- USB-C peripheral and power connector (USB 2.0 HS)
- USB-Serial interface for connection to host systems
- COM port isolation to remove USB-Serial to allow header use
- 18 GPIO signals that can be configured for specific peripherals
- Buttons and status LEDs for user interaction
- Arduino compatible pin socket interface
- Current measurement access points from pin headers and jumpers

NORA-W30 open CPU modules, based on the Realtek RTL8720DF, provide:

- IEEE 802.11 a/b/g/n protocol Wi-Fi subsystem in 2.4 and 5 GHz bands
- 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 Wi-Fi and Bluetooth protocol stacks
- TLS encryption
- MQTT protocols
- WPA2/WPA3 Wi-Fi enterprise security
- Peripherals[1]: ADC, GPIO, I2C, I2S, IR, Key-scan, PWM, QDEC, RTC, SDIO, SPI, UART, USB

2.4 lock diagram

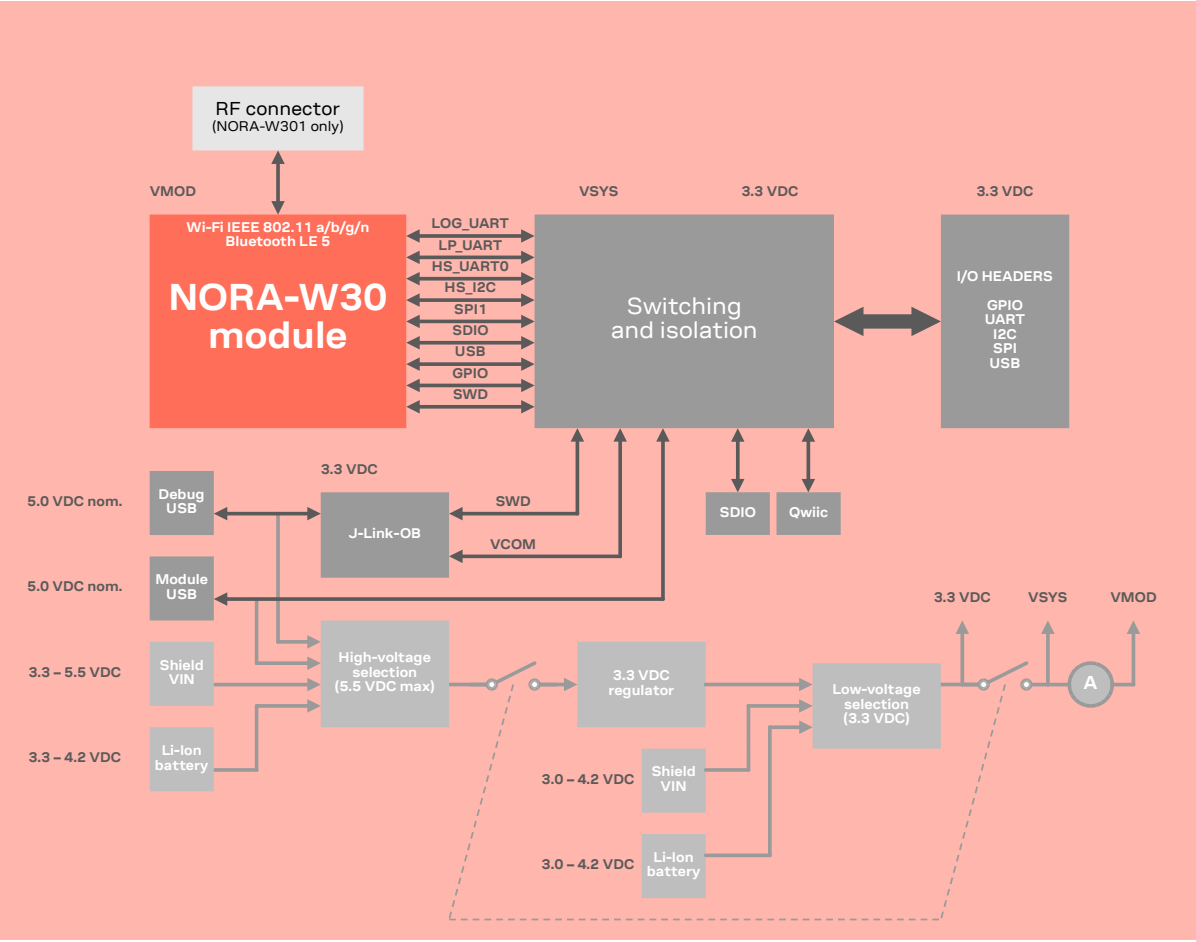

Figure 3: EVK-NORA-W30 block diagram

[1] Not all peripherals available simultaneously

3 Hardware description

The major functions provided by EVK-NORA-W30 are shown in Figure 4.

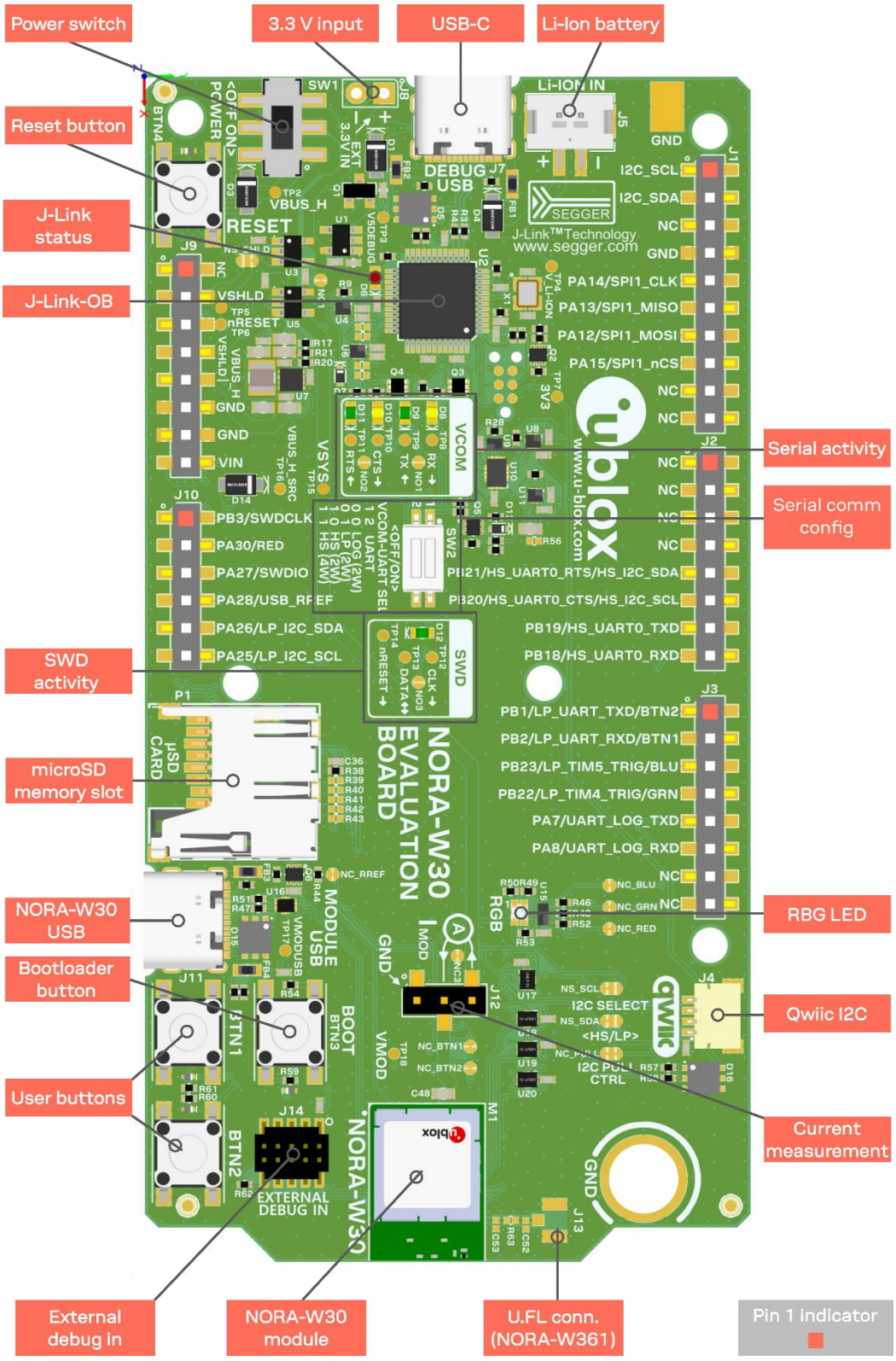

Figure 4: Header and major function locations

3.1 Power

EVK-NORA-W30 can be powered from five sources:

Source	Component / pin	Input range	Remarks
USB-C (debug/UART)	J7	5.0 VDC nominal	Power provided by upstream USB port
USB-C (NORA-W30)	J11	5.0 VDC nominal	Power provided by upstream USB port
Li-Ion battery	J5	3.3 – 4.2 VDC	An external charger may be connected during operation
VIN	J9, pin 8	3.3 – 5.5 VDC	Arduino power input
VSHLD	J9, pins 2 and 4	3.0 – 3.6 VDC	Arduino shield power (requires changing jumper NS_SHLD)
Power header	J8	3.0 – 3.6 VDC	

Table 1: EVK-NORA-W30 power sources

The power sources are protected from reverse polarity by protection diodes, allowing multiple sources to be present simultaneously.

VSHLD is normally a power output for a connected shield. The EVK may be powered by **VSHLD** when the jumper NS_SHLD is changed. Cut the upper trace and solder across the lower pads.

When powering the EVK from either **VSHLD** or the power header, the Li-Ion battery and USB power sources can be isolated by cutting jumper NC1, as shown in Figure 5. This allows disconnecting the USB cable or battery while continuing to power the module through J8 or J10, **VSHLD**.

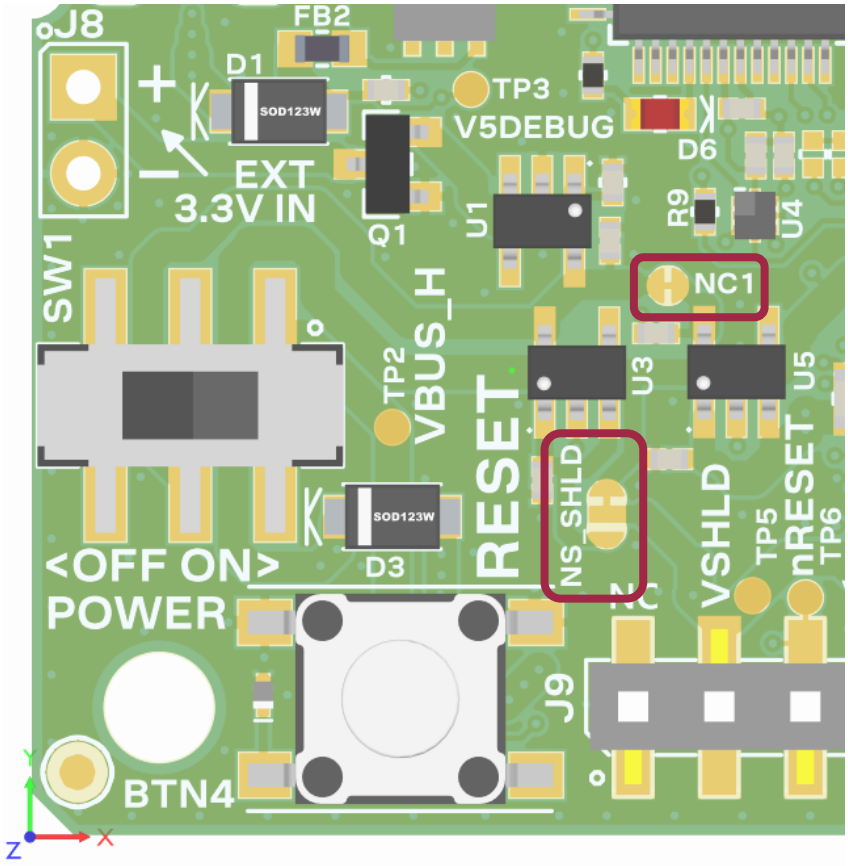

Figure 5: Power configuration

After applying power to one of the sources, slide SW1 to the ON position to power-on the EVK.

3.1.1 Current sensing header

A single header is provided for measuring the current to the NORA-W30 power supply pins. Cut the normally closed jumper, NC3, to enable use of J12.

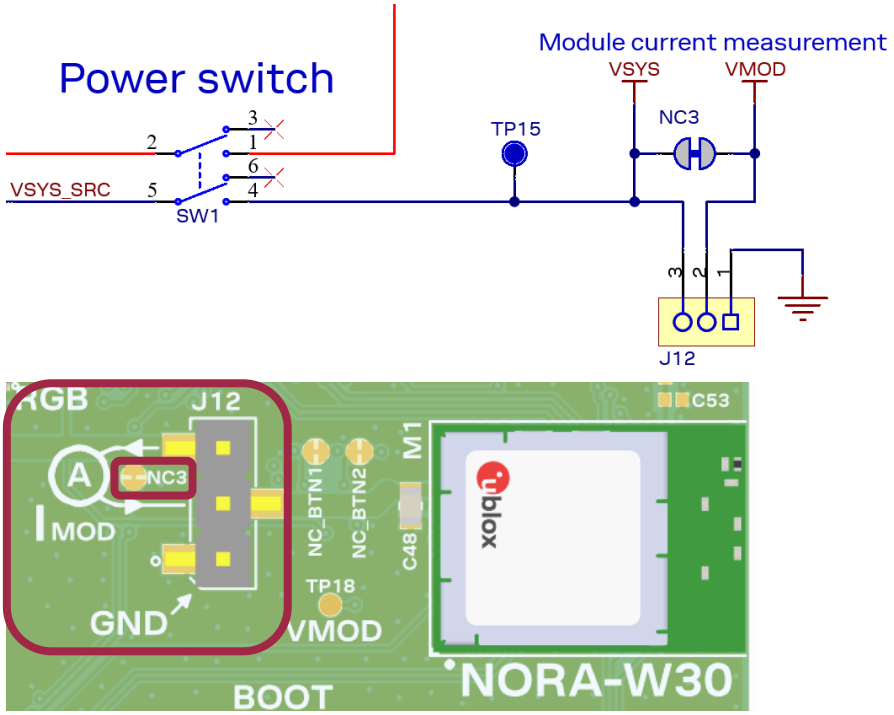

Figure 6: Current measurement

After cutting NC3, place an ammeter or power analyzer in line with pins 2 and 3. Only the current supplied to NORA-W30 through the **VMOD** power signal, connected the **VDD** pins, is measured. Current sunk by the GPIO pins is not measured.

⚠ Pin 1 of J12 is connected to ground.

3.2 Reset

An active-low reset signal – **nRESET** – is connected to the NORA-W30 module, the Arduino header J10, pin 3, and a momentary button switch. Pressing the switch or driving the signal low resets NORA-W30. **nRESET** is pulled high internally, so an open-drain source may be used. Figure 7 shows the reset circuit.

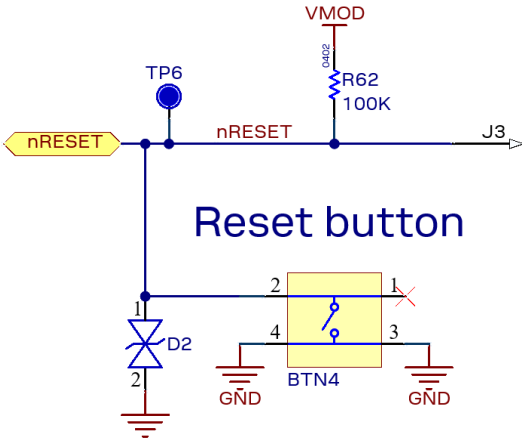

Figure 7: Reset circuit

3.2.1 Bootloader

The RTL8720DF within NORA-W30 includes a ROM bootloader from the factory. To use the Realtek ImageTool, see the Ameba-D application note [5], section 8.

3.3 Debug interface

A SEGGER J-Link-OB debug interface chip is provided on the EVK. One SWD and one VCOM interface allow debugging and UART communications to a development PC.

The EVK provides several LEDs to indicate the status of SWD and VCOM communications to the J-Link-OB interface. The SWD LED is solid when SWD port is active, either when programming or debugging the module. The VCOM LEDs are active low and flicker with activity on each signal. The SWD and VCOM LEDs are described in Table 2.

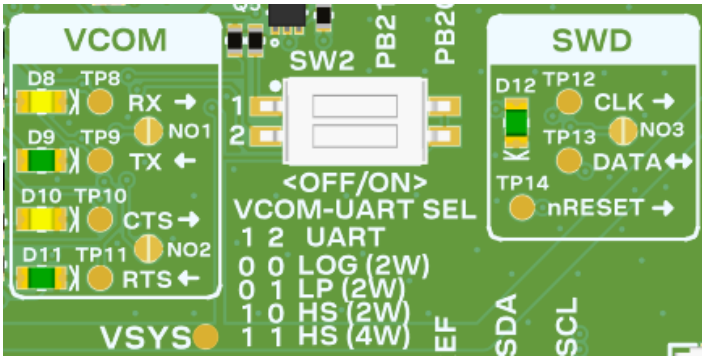

Figure 8: Communication status LEDs

J-Link-OB interface	LED	Signal	Test point	Direction on NORA-W30	Isolation jumper
SWD	D12	SWDIO	TP13	I/O	NO3
		SWDCLK	TP12	Input	
		nRESET	TP14	Input	
VCOM	D8	_RXD	TP8	Input	NO1
	D9	_TXD	TP9	Output	
	D10	_CTS	TP10	Input	NO2
	D11	_RTS	TP11	Output	

Table 2: J-Link-OB communication signals and status LED definitions

☞ Test point voltages are referenced to the J-Link-OB interface.

3.3.1 Serial wire debug (SWD)

SWD is a debug interface specified by ARM® as a low pin count alternative to the traditional 4-wire JTAG debug interface. It consists of two signals, SWDCLK and SWDIO. SWD is used for programming and interactively debugging NORA-W30.

The on-board SWD interface can be isolated from NORA-W30 by soldering jumper NO3 or by connecting an external debugger to J14. See Figure 8.

☞ When J14 is connected to an external debug probe, the on-board J-Link-OB interface is disabled.

3.3.2 Serial communication (VCOM)

A standard universal asynchronous receiver transmitter (UART) is also available through the J-Link-OB interface. Four signals are present, _RXD, _TXD, _RTS, and _CTS as defined in Table 2.

To isolate the VCOM interface from NORA-W30 signals, use SW2 to direct the VCOM to other, unused, signal lines. Alternatively, solder jumpers NO1 and NO2. If VCOM **RTS** and **CTS** are not required, disable the signals by setting SW2 to 1,0 or by only soldering NO2.

The VCOM interface can be connected to one of the three available UART peripherals on the NORA-W30. Use SW2 to set your preferred configuration, as defined in Table 3.

Function	SW2, pos 1	SW2, pos 2	NORA-W30 connection to VCOM port
LOG_UART (default)	Off	Off	UART_LOG_TXD / UART_LOG_RXD
LP_UART	Off	On	LP_UART_TXD / LP_UART_RXD
HS_UART0 (2-wire)[2]	On	Off	HS_UART0_TXD / HS_UART0_RXD
HS_UART0 (4-wire)[2]	On	On	HS_UART0_TXD / HS_UART0_RXD HS_UART0_RTS[3] / HS_UART0_CTS[3]

Table 3: NORA-W30 UART selections for J-Link-OB VCOM port

☞ LOG_UART is used for the Realtek ROM bootloader. See also Bootloader.

3.4 Buttons

EVK-NORA-W30 has four momentary push-button switches.

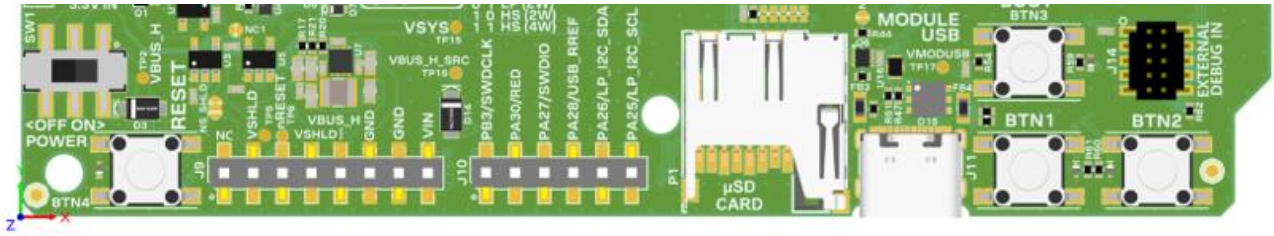

Figure 9: Button locations

Button function	Reference designator	Remarks
BTN_1	BTN1	User button Shares signal with LP_UART_RXD
BTN_2	BTN2	User button Shares signal with LP_UART_TXD
BOOT	BTN3	Pressing BTN3 while power-cycling the EVK or resetting the module (BTN4) will start the Realtek bootloader Shares signal with UART_LOG_TXD. See also Bootloader.
RESET	BTN4	Pressing BTN4 resets module and circuitry connected to J10, pin 3

Table 4: Button definitions

[2] External storage not available for applications
[3] GPIO PB[20], PB[21] not available for applications

3.5 User RGB LED

The active-low tricolor RGB LED is available on PA[30], PB[22], and PB[23].

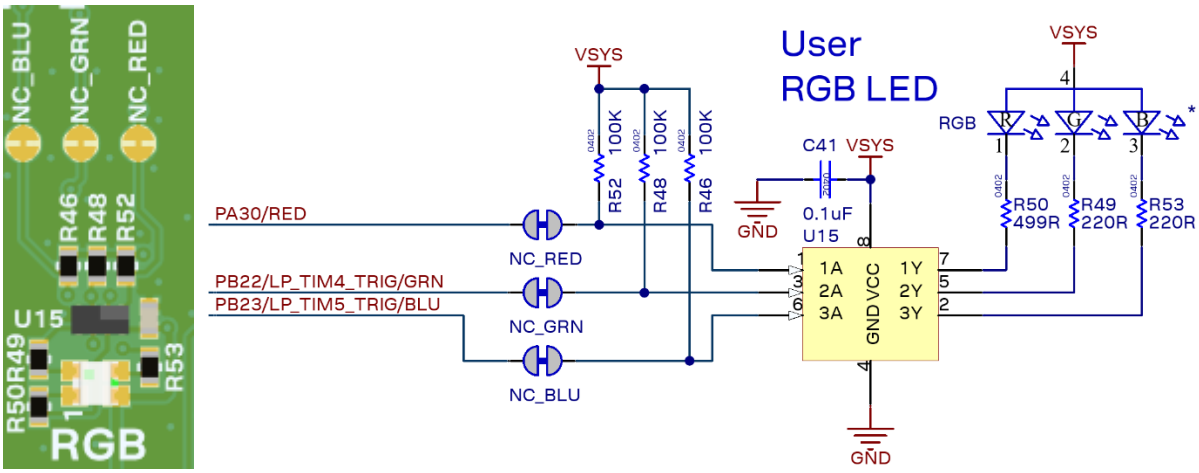

Figure 10: RGB LED and schematic

Each element and corresponding pull-up resistor of the RGB LED can be disabled by cutting its associated jumper, as shown in Figure 10 and Table 5.

RGB color	Disable jumper	GPIO signal
Red	NC_RED	PA[30]/RED
Green	NC_GRN	PB[22]/LP_TIM4/GRN
Blue	NC_BLU	PB[23]/LP_TIM5/BLU

Table 5: User RGB LED configuration

3.6 USB

A Universal Serial Bus (USB) connection is available on NORA-W30. The second USB connector, J11, is connected whenever the port is connected to an upstream USB port.

The PA[26] (HSDP or USB_D+) and PA[25] (HSDM or USB_D–) signals can be configured for other peripheral functions by disconnecting the module USB port, J11. A 12 kΩ resistor connected between USB_RREF and ground is required for USB functionality. The resistor is automatically attached to the PA[28] signal whenever the module USB port, J11, is connected to an upstream USB port. If the signal is required for other functions and USB is not needed, the resistor can also be removed from the PA[28] signal by cutting NC_RREF of PA[28].

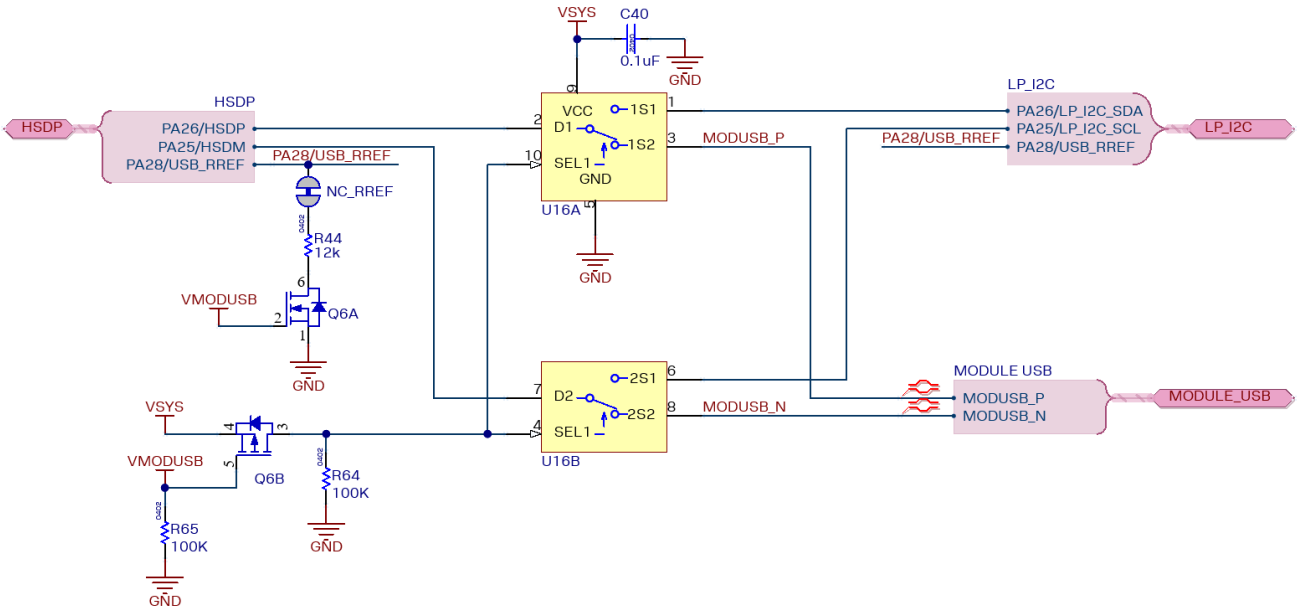

Figure 11: USB / I2C function selection

3.7 I2C / Qwiic

Two I2C peripherals are available on EVK-NORA-W30. See USB for EVK pin configuration.

The HS_I2C peripheral is shared with HS_UART pins and the LP_I2C peripheral with the USB pins. Configure SW2, positions 1 and 2 for HS_UART0 (2-wire) to disable the UART hardware flow control and allocate these signals to **HS_USI_I2C_SCL** and **HS_USI_I2C_SDA** on the EVK. See Table 3. In this configuration, the HS_UART0 and HS_USI_I2C peripherals can both be enabled by the application.

3.8 SPI

EVK-NORA-W30 supports usage of the SPI1 peripheral on PA[12] through PA[15] and these signals are accessible on the J1 Arduino header at pins 5-8.

3.8.1 SDIO / microSD socket

A SDIO interface is available in the form of a microSD socket. Inserting a memory card or adapter into the socket enables the SDIO interface and disables HS_UART0, HS_I2C, the green and blue elements of the RGB LED and any other peripherals on PB[18]-PB[23]. External storage may be added to the EVK with the microSD socket.

The microSD socket can also be used as a high-speed SDIO interface to obtain the highest Wi-Fi throughput.

3.9 Header pin-out

EVK-NORA-W30 can be used independently, with a host PC over USB, or connected to an Arduino host/shield through headers J1, J2, J3, J9, and J10.

J1 pin	Direction	GPIO port	Available peripherals	Remarks
1	I/O	I2C_SCL		Except when SW2 configured for HS_UART0 with hardware flow control. Defaults to HS_I2C peripheral. See also Table 3
2	I/O	I2C_SDA		Except when SW2 configured for HS_UART0 with hardware flow control Defaults to HS_I2C peripheral. See also Table 3
3		n/c		
4		GND		
5	I/O	PA[14]	SPI1_CLK, LP_UART_RTS, I2S_SD_TX2, KEY_ROW2	Only certain peripherals are available at one time. See [2], pin multiplexing table data. Arduino D13
6	I/O	PA[13]	SPI1_MISO, LP_UART_RXD, HS_PWM1, LP_PWM1, I2S_SD_TX1, KEY_ROW1	Only certain peripherals are available at one time. See [2], pin multiplexing table data. Arduino D12
7	I/O	PA[12]	SPI1_MOSI, LP_UART_TXD, HS_PWM0, LP_PWM0, I2S_MCLK, KEY_ROW0	Only certain peripherals are available at one time. See [2], pin multiplexing table data. Arduino D11
8	I/O	PA[15]	SPI1_CS, LP_UART_CTS, KEY_ROW2, KEY_COL6	Only certain peripherals are available at one time. See [2], pin multiplexing table data. Arduino D10
9		n/c		
10		n/c		

Table 6: J1 pin-out

J2 pin	Direction	Signal	Available peripherals	Remarks
1		n/c		
2		n/c		
3		n/c		
4		n/c		
5	I/O	PB[21]	HS_UART0_RTS, HS_USI_I2C_SDA, HS_USI_UART_RXD, SPI0_CS, SD_CLK, HS_PWM13, LP_PWM1, I2S_WS, QDEC_IDX	Only certain peripherals are available at one time. See [2], pin multiplexing table data. Arduino D3
6	I/O	PB[20]	HS_UART0_CTS, HS_USI_I2C_SCL, HS_USI_UART_TXD, SPI0_CLK, SD_CMD, HS_PWM12, LP_PWM0, I2S_CLK	Only certain peripherals are available at one time. See [2], pin multiplexing table data. Arduino D2
7	I/O	PB[19]	HS_UART0_TXD, HS_USI_UART_CTS, SPI0_MISO, SD_D3, HS_PWM11, LP_PWM5, SWD_DATA, I2S_SD_TX0	Only certain peripherals are available at one time. See [2], pin multiplexing table data. Arduino D1 / TXD
8	I/O	PB[18]	HS_UART0_RXD, HS_USI_UART_RTS, SPI0_MOSI, SD_D2, HS_PWM10, LP_PWM4, SWD_CLK	Only certain peripherals are available at one time. See [2], pin multiplexing table data. Arduino D0 / RXD

Table 7: J2 pin-out

J3 pin	Direction	Signal	Available peripherals	Remarks
1	I/O	PB[1]	LP_UART_TXD, HS_TIM4_TRIG	Analog capable Only certain peripherals are available at one time. See [2], pin multiplexing table data. Arduino D14 / UART out
2	I/O	PB[2]	LP_UART_RXD, HS_TIM5_TRIG	Analog capable Only certain peripherals are available at one time. See [2], pin multiplexing table data. Arduino D15 / UART in
3	I/O	PB[23]	LP_TIM5_TRIG, SD_D1, HS_PWM15, LP_PWM3, I2S_MCLK, QDEC_PHA, EXT_32K	RGB LED - blue element control Only certain peripherals are available at one time. See [2], pin multiplexing table data. Arduino D16
4	I/O	PB[22]	LP_TIM4_TRIG, SD_D0, HS_PWM14, LP_PWM2, I2S_SD_RX, QDEC_PHB	RGB LED – green element control Only certain peripherals are available at one time. See [2], pin multiplexing table data.. Arduino D17
5	I/O	PA[7]	UART_LOG_TXD	Only certain peripherals are available at one time. See [2], pin multiplexing table data. Arduino D18
6	I/O	PA[8]	UART_LOG_RXD	Only certain peripherals are available at one time. See [2], pin multiplexing table data. Arduino D19
7		n/c		
8		n/c		

Table 8: J3 pin-out

J9 pin	Direction	Signal	Remarks – see also Power
1		n/c	
2		VSHLD	3.3 VDC nominal Arduino IOREF
3	I	nRESET	Active-low reset input
4		VSHLD	3.3 VDC nominal Arduino 3V3
5		VBUS_H	5.0 VDC nominal with USB, 3.3 – 4.2 VDC with Li-Ion Arduino 5V
6		GND	
7		GND	
8		VIN	5.0 VDC nominal Arduino 5V

Table 9: J9 pin-out

J10 pin	Direction	Signal	Available peripherals	Remarks
1	I/O	PB[3]	SWD_CLK	SWD_CLK default, analog capable Only certain peripherals are available at one time. See [2], pin multiplexing table data. Arduino A0
2	I/O	PA[30]	HS_USI_SPI_CLK, HS_PWM7, LP_PWM1	RGB LED - red element control Only certain peripherals are available at one time. See [2], pin multiplexing table data. Arduino A1
3	I/O	PA[27]	SWD_DATA, LP_UART_RTS	SWD_DATA default, Only certain peripherals are available at one time. See [2], pin multiplexing table data. Arduino A2
4	I/O	PA[28]	USB_RREF, LP_UART_CTS, HS_USI_SPI_CS, HS_PWM6, LP_PWM0	Only certain peripherals are available at one time. See [2], pin multiplexing table data. Arduino A3
5	I/O	PA[26]	LP_UART_TXD, HS_USI_SPI_MISO, IR_RX, LP_I2C_SDA, HS_PWM5, LP_PWM5, HSDP	Only certain peripherals are available at one time. See [2], pin multiplexing table data. Arduino A4
6	I/O	PA[25]	LP_UART_RXD, HS_USI_SPI_MOSI, IR_TX, LP_I2C_SCL, HS_PWM4, LP_PWM4, HSDM	Only certain peripherals are available at one time. See [2], pin multiplexing table data. Arduino A5

Table 10: J10 pin-out

Appendix A

Glossary

Abbreviation	Definition
ARM	Arm (Advanced RISC Machines) Holdings
GPIO	General Purpose Input / Output
I2C	Inter-Integrated Circuit
LE	Low Energy
PCB	Printed Circuit Board
PCBA	Printed Circuit Board Assembly
PWM	Pulse Width Modulation
Q-Decoder (also QDEC)	Quadrature Decoder
RAM	Random Access Memory
RF	Radio Frequency
RTC	Real-Time Clock
SDK	Software Development Kit
SPI	Serial Peripheral Interface
SWD	Serial Wire Debug
UART	Universal Asynchronous Receiver Transmitter
USI	Universal Serial Interface (see I2C, SPI, and UART)
WPA	Wi-Fi Protected Access

Table 11: Explanation of the abbreviations and terms used

Related documentation

[1] NORA-W30 data sheet, UBX-22021117
[2] NORA-W30 system integration manual, UBX-22021119
[3] Realtek RTL8720 data sheet, UM0401
[4] Realtek Ameba-D user manual, UM0400
[5] Realtek Ameba-D application note, AN0400
[6] Realtek Ameba IoT website
[7] Realtek GitHub Ameba IoT site
[8] Realtek GitHub Ameba-D standard SDK repository
[9] Realtek GitHub Ameba-D Arduino repository
[10] Realtek Ameba IoT support forum
[11] Arduino IDE website

☞ For product change notifications and regular updates of u-blox documentation, register on our website, www.u-blox.com.

Revision history

Revision	Date	Name	Comments
R01	06-Nov-2023	brec	Initial release

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