S

NORA-W10 series

Stand-alone multiradio modules

Data sheet

Abstract

This technical data sheet describes the NORA-W10 series stand-alone multiradio MCU module that integrates a powerful microcontroller (MCU) and a radio for wireless communication. The module has a number of important embedded security features, including secure boot, which ensures the module boots with authenticated software only.

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This document applies to the following products:

Product name	Type number	Hardware version	PCN reference	Product status
NORA-W101	NORA-W101-00B-00	02	N/A	Prototype
NORA-W106	NORA-W106-00B-00	02	N/A	Prototype

Contents

1 Functional description

1.1 Overview

NORA-W10 series are small stand-alone multiradio MCU modules integrate a powerful microcontroller (MCU) and a radio for wireless communication. With the open CPU architecture, customers can develop advanced applications running on the dual core 32-bit MCU. The radio provides support for Wi-Fi 802.11b/g/n in the 2.4 GHz ISM band and Bluetooth v5.0 (Bluetooth Low Energy communications).

These compact modules include the wireless MCU, flash memory, crystal, and other components for matching, filtering, antenna, decoupling, and antenna operation. Supporting integrated cryptographic hardware accelerators, NORA-W10 series modules are ideal for Internet of Things (IoT) devices, telematics, low power sensors, connected factories, connected buildings (appliances and surveillance), point-of-sales, health devices, and other design solutions that demand top-grade security.

The NORA-W10 module is the second-generation u-blox modules based on an Espressif ESP32-S3 Wi-Fi and Bluetooth chip. The first generation is the NINA-W1/B2 module series based on the Espressif ESP32 chip [3]. The simple device design allows developers to use an external antenna (NORA-W101) or utilize the internal antenna (NORA-W106) in the application design.

The mechanical design of NORA-W10 is based on the NORA form factor to be able to exchange between the form factor module NORA-B1 [6].

Approvals are pending: NORA-W10 modules are compliant with the Radio Equipment Directive (RED) and are certified as modular transmitters in the following countries: US (FCC), Canada (IC / ISED RSS), Japan (MIC), Taiwan (NCC), South Korea (KCC), Australia / New Zealand (ACMA), Brazil (Anatel), and South Africa (ICASA). The modules are also qualified according to u-blox qualification policy, based on AEC-Q104 standard for professional grade operation and support an extended temperature range of –40 °C to +85 °C.

1.2 Applications

NORA-W10 series are suitable for a wide range of applications, including:

- Wi-Fi networks
- Internet of Things (IoT)
- Bluetooth low energy applications
- Telematics
- Point-of-sales
- Medical and industrial networks
- Access to laptops, mobile phones, and similar consumer devices
- Home/building automation apps
- Wireless gateways

1.3 Block diagram

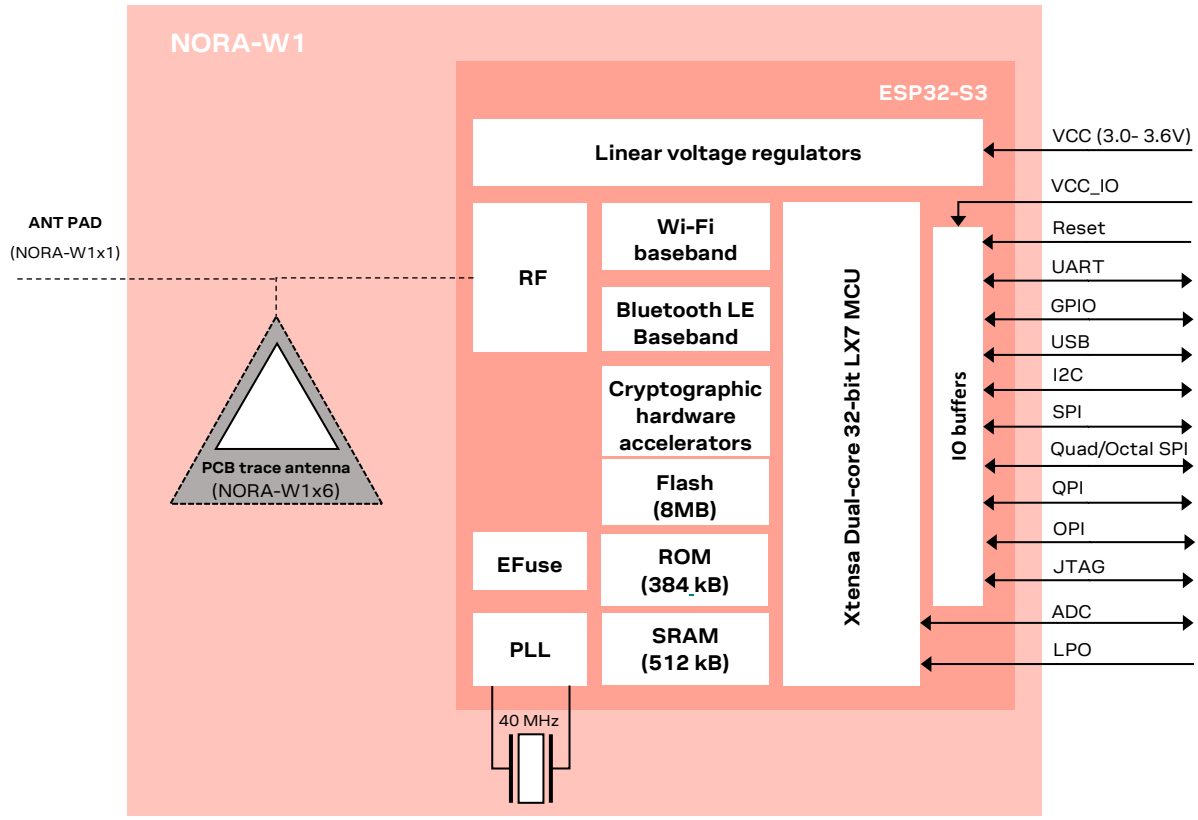


Figure 1: NORA-W10 series block diagram

1.4 Product variants

NORA-W10 modules have an open CPU architecture that is tailored towards OEMs that want to embed Wi-Fi, Bluetooth Basic Rate/Enhanced Data Rate (BR/EDR), and Bluetooth LE support into their own application.

1.4.1 NORA-W101

NORA-W101has no internal antenna, but the RF signal for routing to an external antenna or antenna connector signal is exposed through a dedicated module pin instead. The module outline is 10.4 x 14.3 mm with a height of 1.8 mm. See also the list of approved antennas in application note [7].

1.4.2 NORA-W106

NORA-W106 is equipped with an internal PCB trace antenna, using antenna technology licensed from ProAnt AB. The RF signal is not connected to any module pin. The module outline is 10.4 x 14.3 mm with a height of 1.8 mm.

1.5 Radio performance

NORA-W10 series (NORA-W101, and NORA-W106) modules support Wi-Fi and are conformant with IEEE 802.11b/g/n single-band 2.4 GHz operation, and Bluetooth LE specifications, as shown in Table 1.

Wi-Fi	Bluetooth Low Energy
IEEE 802.11b/g/n	Bluetooth 5.0 Bluetooth LE dual-mode
Band support Station mode: 2.4 GHz, channel 1-13* Access Point mode: 2.4 GHz, channel 1-11*	Band support 2.4 GHz, 40 channels
Typical conducted output power : 17 dBm	Typical conducted output power 10 dBm
Typical radiated output power: 20 dBm EIRP**	Typical radiated output power 10 dBm EIRP**
Conducted sensitivity -97 dBm	Conducted sensitivity -98 dBm
Data rates: IEEE 802.11b: 1 / 2 / 5.5 / 11 Mbit/s IEEE 802.11g: 6 / 9 / 12 / 18 / 24 / 36 / 48 / 54 Mbit/s IEEE 802.11n: MCS 0-7, HT20 (6.5-72 Mbit/s), HT40	Data rates: 1 / 2 Mbit/s 125 / 500 Kbps

* Maximum support for 802.11d depends on the region.

** RF power including maximum antenna gain (3 dBi).

Table 1: NORA-W10 series Wi-Fi and Bluetooth characteristics

⚠ Output power and sensitivity values are provisional.

1.6 CPU

NORA-W10 series modules have a dual-core system with two Harvard Architecture Xtensa LX6 CPUs operating at a maximum 240 MHz internal clock frequency.

The main features of the internal NORA-W10 memory include:

- 384 Kbyte ROM for booting and core functions
- 512 Kbyte SRAM for data and instruction
- 8 (NORA-W101 and NORA-W106) MByte FLASH for code storage, including hardware encryption to protect programs.
- 4 kbit EFUSE (non-erasable memory) for MAC addresses, module configuration, flash encryption, and chip ID

NORA-W10 Open CPU variants also support external PSRAM memory through the Dual/Quad SPI.

NORA-W10 has no software but includes an Open CPU architecture that allows customers to develop advanced applications running on the dual core 32-bit MCU. The radio provides support for Wi-Fi 802.11b/g/n in the 2.4 GHz ISM band, and Bluetooth LE communication.

The customer is responsible for the NORA-W10 certification and configuration, as described in Country approvals.

NORA-W10 series modules can be used to design solutions with top-grade security. Including integrated cryptographic hardware accelerators, the modules feature secure boot functionality that ensures that the module can only be restarted with authenticated software.

1.6.1 Software upgrade

For information about upgrading NORA-W10 series software, se the NORA-W10 system integration manual [1] .

1.7 MAC addresses

For information about MAC addresses, see https://docs.espressif.com/projects/esp-idf/en/latest/esp32s3/api-reference/system/misc_system_api.html#mac-address.

1.8 Power modes

NORA-W10 series modules are power efficient devices capable of operating in different power saving modes and configurations. Different sections of the module can be powered off when they are not needed, and complex wake up events can be generated from different external and internal inputs.

For the lowest current consumption modes an external LPO clock is required. See also Low power clock.

For more information about power modes, see the Espressif ESP32-S3 Datasheet [3].

2 Interfaces

2.1 Power supply

The power for NORA-W10 series modules is supplied through **VCC** and **VCC_IO** pins by DC voltage.

⚠ The system power supply circuit must be able to support peak power. As the current drawn from **VCC** and **VCC_IO** can vary significantly based on Wi-Fi power consumption profiles.

2.1.1 Module supply input (VCC)

NORA-W10 series modules use an integrated Linear Voltage converter to transform and stabilize the supply voltage applied to the **VCC** pin.

2.1.2 Digital I/O interfaces reference voltage (VCC_IO)

All NORA-W10 series modules support an additional supply input for setting the I/O voltage level.

The separate **VCC_IO** pin enables integration of the module into applications with different voltage levels (1.8 V or 3.3 V for example) without any level converters. NORA-W10 modules currently support a 3.3 V IO voltage level only.

2.2 Low power clock

NORA-W10 series modules do not have an internal low power oscillator (LPO), which is required for low power modes. If low power modes are required, an external 32.768 kHz LPO signal can be supplied externally.

2.3 Module reset

NORA-W10 series modules can be reset (rebooted) with a low-level input on the **RESET_N** pin. The logic level of this pin is normally set high using an internal pull-up resistor. The low-level input triggers a “hardware reset” of the module. The **RESET_N** signal should be driven by an open drain, open collector, or contact switch. The chip works at the minimum power when **RESET_N** is low (off).

2.4 Boot strap pins

Several module pins related to the boot configuration must be strapped correctly using either pull-up or pull-down resistors, as shown in Table 2.

⚠ Boot strap pins should be avoided if other GPIO pins can be used instead. Note that all module pins shown in bold are configured to their default state internally in the ESP32-S3 chip and must NOT be configured externally.

Pin	State during boot	Default	Behavior	Description
F8	0	Pull-down*	VDD_SDIO=3.3V	Internal flash voltage
	1		VDD_SPI=1.8V (VDD_SPI should always be at 1.8 V)	
F7, H7	00		Download Boot	Booting Mode
	01		Reserved, do not use	
	10	Pull-up*, Pull-down*	Normal Boot from internal Flash	
	11		Normal Boot from internal Flash	
J9	**0**		EFUSE_STRAP_JTAG_SEL=0 USB Serial/JTAG	JTAG Signal Selection
	0		EFUSE_STRAP_JTAG_SEL=1 PAD JTAG	
	1	N/A	USB Serial/JTAG	

*About 45 kΩ.

Table 2: NORA-W10 series boot strapping pins

2.5 RF antenna interface

The RF antenna interface of NORA-W10 modules supports Wi-Fi, and Bluetooth LE on the same antenna. The different communication protocols are time divided on the antenna to switch between the Bluetooth and Wi-Fi data. Although communication using these different protocols is (more or less) transparent in the application, these protocols are never active at exactly the same time in the module antenna.

NORA-W10 series modules support either an internal antenna (NORA-W106) or external antennas connected through a dedicated antenna pin (NORA-W101).

2.5.1 Internal antenna

NORA-W106 modules have internal antennas that are specifically designed and optimized for NORA modules. NORA-W106 module is equipped with a 2.4 GHz PCB trace antenna.

The suggestion for the PCB trace antenna in NORA-W106 modules is to place it in the middle – along the side edge of the host PCB.

For NORA-W106 designs, keep a minimum clearance of 5 mm between the antenna and the casing. Also, keep at least 10 mm of free space around the metal antenna including the area directly below it. If a metal enclosure is required, use NORA-W101 and an external antenna.

It is beneficial to have a large solid ground plane on the host PCB with a good grounding on the module. Minimum ground plane size is 24x30 mm but more than 50x50 mm is recommended.

For more information about antenna-related design, see also the NORA-W10 series system integration manual [1].

⚠ The ANT signal solder pin is not available on the NORA-W106 module.

2.5.2 External RF antenna interface

The NORA-W101 module has an antenna signal (**ANT**) pin with a characteristic impedance of 50 Ω for using an external antenna. The antenna signal supports both Tx and Rx.

The external antenna, for example, can be an SMD antenna (or PCB integrated antenna) on the host board. An antenna connector for use with an external antenna through a coaxial cable could also be implemented. A cable antenna might be necessary if the module is mounted in a shielded enclosure such as a metal box or cabinet.

An external antenna connector (U.FL. connector) reference design (see the NORA-W10 series system integration manual [1]) is available and must be followed to comply with the NORA-W10 FCC/IC modular approvals.

See also the list of approved antennas in application note [7].

2.6 IO signals

The NORA-W10 module has 82 pins in total. In NORA-W101 modules the pins can be used for both input and output. Four signals can be used for input only. 38 pins can be used for both input and output. The pins can be used as GPI(O) but are also multiplexed with the digital and analog interfaces. The input only signals (GPI) can only be input regardless of the selected function/interface.

It is also possible to multiplex all interfaces to any pin through an IO MUX, but the speed is limited. See also Digital pins.

2.6.1 Pulse Width Modulation (PWM)

The Pulse Width Modulation (PWM) functionality, for example, can be used to control the intensity of LEDs and driving digital motors. The controller consists of PWM timers, the PWM operator, and a dedicated capture sub-module. Each timer provides timing in synchronous or independent form, and each PWM operator generates the waveform for one PWM channel.

The PWM controller has 8 channels, which can generate independent waveforms that can be used to drive RGB LED devices. For maximum flexibility, the high-speed as well as the low-speed channels can be driven from one of four high-speed/low-speed timers. The PWM controller also has the ability to automatically increase or decrease the duty cycle gradually, allowing for fades without any processor interference. The PWM signals can be configured to be available on any of the GPIO pins via the IO MUX.

2.7 Data interfaces

2.7.1 UARTs

NORA-W10 modules have three UART interfaces, UART0 to UART2. Each interface provides asynchronous communication support for RS232, RS485, and IrDA standards (with external drivers).

UART0 serves as the primary interface port. The maximum speed for all UART interfaces is 4 Mbit/s.

All UART interfaces can be routed to any GPIO pin through the IO MUX. But, as firmware upgrades are performed through the default pins on UART0, it is recommended that this interface specifically is NOT routed to the other pins. For further information about the default pins, see also Pinout.

All UART interfaces provide hardware management of the CTS and RTS signals and software flow control (XON and XOFF).

2.7.2 SPI

Four SPI interfaces are available for the application. SPI with CS0 is configured to internal flash storage, it can only be used to operate internal flash. Additional flash cannot be connected to this SPI interface, but an external PSRAM can be connect, accessible through CS1.

It is possible to connect the remaining SPI interfaces to other pins via the IO MUX but the maximum speed will be reduced. It is also possible to configure the SPI interface as a dual or quad SPI (2 or 4-bit bidirectional data signals). See also Dual/Quad SPI.

2.7.3 Dual/Quad SPI

The dual/quad SPI (2 or 4 bi-bidirectional data signals) can be used for connecting an additional external PSRAM. The SPI to dual/quad SPI signal mappings is shown in Table 3.

SPI signal	Dual SPI signal	Quad SPI signal
MOSI	IO0	IO0
MISO	IO1	IO1
WP	-	IO2
HD	-	IO3
CS	CS	CS
CLK	CLK	CLK

Table 3: SPI to dual/quad SPI signal mapping

2.7.4 I2C

Three I2C interfaces can be routed over any GPIO pin.

NORA-W10 modules can operate as both the controller and peripheral on the I2C bus, using both standard (100 kbps) and fast (400 kbps) transmission speeds. The interface uses the **SCL** signal to clock instructions and data on the **SDA** signal.

2.7.5 SDIO

SDIO is multiplexed with the JTAG interface and the SPI_H interface. It is possible to connect the SDIO interfaces to other pin via the IO MUX but the speed is limited. See also Digital pins. Only SDIO host is supported (not SDIO slave).

2.7.6 CAN

NORA-W10 modules support CAN 2.0.

2.8 Debug interfaces

2.8.1 JTAG debug interfaces

NORA-W10 modules support the JTAG debug interface (**JTAG_TMS**, **JTAG_CLK**, **JTAG_TDI** and **JTAG_TDO**). The JTAG interface is multiplexed with the SDIO and SPI_H interface.

2.9 Analog interfaces

2.9.1 Analog to digital converters

NORA-W10 modules supports two 12-bit SAR Analog to Digital Converters (ADC). Any analog capable pin can be used for ADC application. All appropriate analog pins are shown in the Pinout.

For lower power consumption, NORA-W101, NORA-W106 modules can measure voltages in sleep mode and threshold settings can be used to wake the CPU.

☞ Analog pins cannot be re-routed to other pins through the IO MUX.

3 Pin definition

3.1 Input and output pins

- NORA-W101/NORA-W106 modules have 82 pins. 38 can be used for either input or output. Four are for input only.

3.2 NORA-W10 pin assignment

Figure 2 shows the multiplexed pinout for NORA-W101 and NORA-W106 Open CPU modules. These, and several additional interfaces not shown here, are described in Table 4.

Although it is also possible to multiplex all interfaces through an IO MUX using any pin, the maximum speed is limited. See also Digital pins.

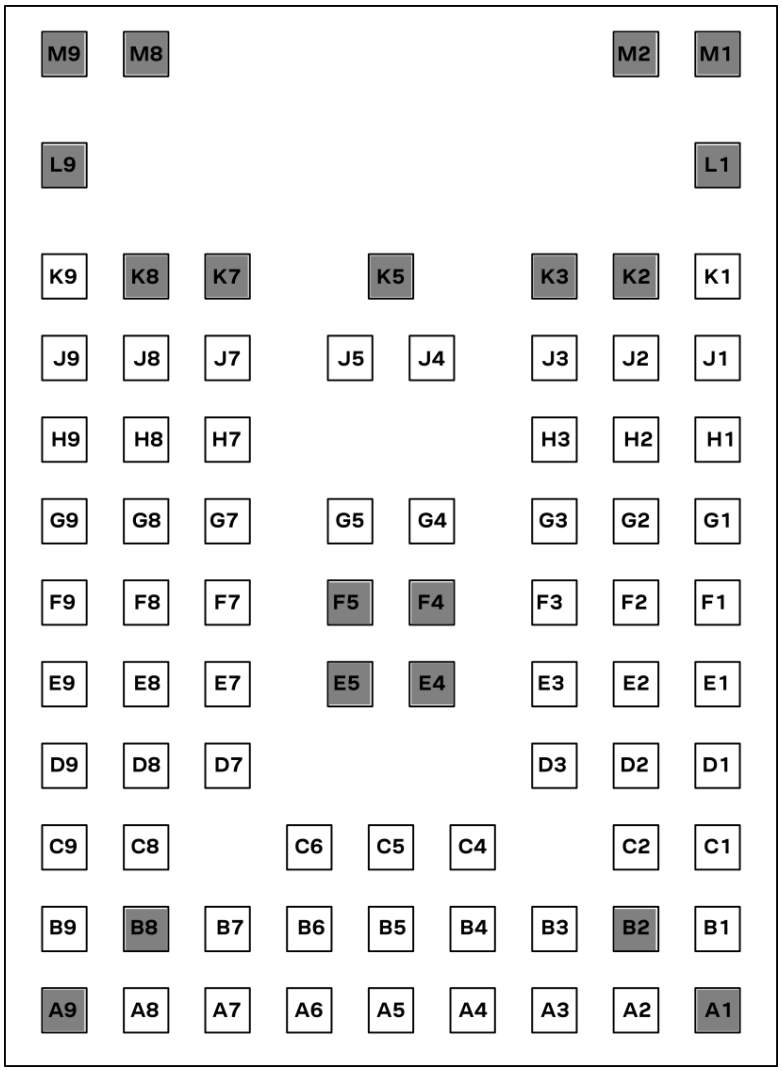


Figure 2: NORA-W101/W106 pin numbering (top view)

All grey pins located on the module are GND pins.

Pins A7, A8, B7, and J3 can only be used as (GPI) input signals – regardless of the selected function/interface.

☞ The signals for several pins are boot strapped. It is important that these signals, shown in Table 4, have the correct state during startup. See also Boot strap pins.

3.3 Pinout

Table 4 describes the common pinout for all NORA-W10 series modules.

No.	NORA Function	I/O	Description	ESP32-S3 pin	Remarks
A2	FSPIWP / GPIO38	I/O	SPI2 Write Protect / General Purpose I/O	FSPIWP / GPIO38	
A3	GPIO17	I/O	General Purpose I/O	GPIO17	Pin is analog capable, Digital to Analog Converter
A4	NC				
A5	FSPIDQS / GPIO14	I/O		FSPIDQS / GPIO14	Pin is analog capable, Digital to Analog Converter, Touch button input
A6	FSPIIO7 / GPIO13	I/O	SPI2 IO7 / General Purpose I/O	FSPIIO7 / GPIO13	Pin is analog capable, Digital to Analog Converter, Touch button input
A7	VCCIO	I	Module I/O level voltage input		VIO voltage supply.
A8	VCC	I	Module supply voltage input		3.0-3.6 V module voltage supply.
B1	FSPICLK / GPIO36	I/O	SPI2 clock / General Purpose I/O	FSPICLK / GPIO36	
B3	FSPICS0 / GPIO34	I/O	SPI2 Chip select / General Purpose I/O	FSPICS0 / GPIO34	
B4	GPIO18	I/O	General Purpose I/O	GPIO18	Pin is analog capable, Digital to Analog Converter
B5	NC				
B6	XTAL_32K_N / GPIO16	I/O	32KHz external clock input / General Purpose I/O	GPIO16	Pin is analog capable, Digital to Analog Converter
B7	VCCIO	I	Module I/O level voltage input		VIO voltage supply.
B9	NC				
C1	FSPIQ / GPIO37	I/O	SPI2 Controller Input Peripheral Output / General Purpose I/O	FSPIQ / GPIO37	
C2	FSPID / GPIO35	I/O	SPI2 Controller Output Peripheral Input / General Purpose I/O	FSPID / GPIO35	
C4	SPICS0	I/O	SPI0 Chip select	SPICS0 / GPIO29	Connected to internal flash. Do not connect
C5	NC				
C6	XTAL_32K_P / GPIO15	I/O	32KHz external clock input / General Purpose I/O	GPIO15	Pin is analog capable, Digital to Analog Converter
C8	GPIO21	I/O	General Purpose I/O	GPIO21	
C9	USB_P / GPIO20	I/O	USB differential data signal / General Purpose I/O	USB_D+ / GPIO20	Pin is analog capable, Digital to Analog Converter
D1	SPIWP	I/O	SPI0 Write Protect	SPIWP / GPIO28	Connected to internal flash. Connect only for PSRAM else do not connect
D2	SPID	I/O	SPI0 Controller Output Peripheral Input	SPID / GPIO32	Connected to internal flash. Connect only for PSRAM else do not connect
D3	FSPIHD / GPIO33	I/O	SPI2 Hold / General Purpose I/O	FSPIHD / GPIO33	
D7	NC	I/O			

No.	NORA Function	I/O	Description	ESP32-S3 pin	Remarks
D8	GPIO4	I/O	General Purpose I/O	GPIO4	Pin is analog capable, Digital to Analog Converter, Touch button input
D9	USB_N / GPIO19	I/O	USB differential data signal / General Purpose I/O	USB_D- / GPIO19	Pin is analog capable, Digital to Analog Converter
E1	SPICS1	I/O	SPI Chip select / General Purpose I/O	SPICS1 / GPIO26	PSRAM chip select.
E2	SPIQ	I/O	SPI0 Controller Input Peripheral Output	SPIQ / GPIO31	Connected to internal flash. Connect only for PSRAM else do not connect
E3	SPICLK_N / GPIO48	I/O	SPI Differential clock / General Purpose I/O	SPICLK_N / GPIO48	
E7	GPIO9	I/O	General Purpose I/O	GPIO9	Pin is analog capable, Digital to Analog Converter, Touch button input
E8	GPIO1	I/O	General Purpose I/O	GPIO1	Pin is analog capable, Digital to Analog Converter, Touch button input
E9	GPIO7	I/O	General Purpose I/O	GPIO7	Pin is analog capable, Digital to Analog Converter, Touch button input
F1	SPICLK	I/O	SPI0 clock	SPICLK / GPIO30	Connected to internal flash. Connect only for PSRAM else do not connect
F2	SPIHD	I/O	SPI0 Hold	SPIHD / GPIO27	Connected to internal flash. Connect only for PSRAM else do not connect
F3	SPICLK_P / GPIO47	I/O	SPI Differential clock / General Purpose I/O	SPICLK_P / GPIO47	
F7	GPIO0/ Boot	I/O	General Purpose I/O	GPIO0/ Boot	
F8	GPIO45	I/O	General Purpose I/O	GPIO45	
F9	GPIO6	I/O	General Purpose I/O	GPIO6	Pin is analog capable, Digital to Analog Converter, Touch button input
G1	MTDO / GPIO40	I/O	JTAG Test Data Out /	MTDO / GPIO40	
G2	FSPIIO6 / GPIO12	I/O	SPI2 IO6 / General Purpose I/O	FSPIIO6 / GPIO12	Pin is analog capable, Digital to Analog Converter, Touch button input
G3	FSPIIO5 / GPIO11	I/O	SPI2 IO5 / General Purpose I/O	FSPIIO5 / GPIO11	Pin is analog capable, Digital to Analog Converter, Touch button input
G4	NC				
G5	NC				
G7	NC				
G8	U0TXD / GPIO43	I/O	UART data output / General Purpose I/O	U0TXD / GPIO43	
G9	U0RXD / GPIO44	I/O	UART data input / General Purpose I/O	U0RXD / GPIO44	
H1	JTAG_TDI / GPIO41	I/O	JTAG Test Data In (debug interface) / General Purpose I/O	MTDI / GPIO41	
H2	JTAG_TMS / GPIO42	I/O	JTAG Test Mode Select / General Purpose I/O	MTMS / GPIO42	
H3	FSPII04 / GPIO10	I/O	SPI2 IO5 / General Purpose I/O	FSPII04 / GPIO10	Pin is analog capable, Digital to Analog Converter, Touch button input
H7	GPIO46	I/O	General Purpose I/O	GPIO46	
H8	GPIO2	I/O	General Purpose I/O	GPIO2	Pin is analog capable, Digital to Analog Converter, Touch button input

No.	NORA Function	I/O	Description	ESP32-S3 pin	Remarks
H9	GPIO8	I/O	General Purpose I/O	GPIO8	Pin is analog capable, Digital to Analog Converter, Touch button input
J1	VDD_SPI	O	SPI power supply: 1.8 V or VDD3P3_RTC	VDD_SPI	
J2	JTAG_TCK / GPIO39	I/O	JTAG Test clock / General Purpose I/O	MTCK / GPIO39	
J3	RESET_N	I	External system reset input.	RESET	Active low
J4	NC				
J5	NC				
J7	NC				
J8	GPIO5	I/O	General Purpose I/O	GPIO5	Pin is analog capable, Digital to Analog Converter, Touch button input
J9	GPIO3	I/O	General Purpose I/O	GPIO3	Pin is analog capable, Digital to Analog Converter, Touch button input
K1	NC				
K9	ANT	I/O	Antenna Tx/Rx interface	LNA_IN	50 Ω nominal characteristic impedance, only used with NORA-W101 modules. NC for NORA-W106
	EGP	-	Exposed Ground Pins		Exposed scattered grey pins on the module should be connected to GND
L1-M9	EAGP	-	Exposed Antenna Ground Pins		Exposed pins underneath the antenna area should be connected to GND

Table 4: NORA-W10 pinout

4 Electrical specifications

⚠ Stressing the device above one or more of the Absolute maximum ratings can cause permanent damage. These are stress ratings only. Operating the module at these or at any conditions other than those specified in the Operating conditions should be avoided. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

☞ Where application information is given, it is advisory only and does not form part of the specification.

4.1 Absolute maximum ratings

Symbol	Description	Condition	Min	Max	Unit
VCC/ VCC_IO	Module supply voltage	Input DC voltage at VCC and VCC_IO pins	-0.3	3.6	V
$I_{VCC\ MAX}$ + $I_{VCC\_IO\ MAX}$	Absolute maximum power consumption			500	mA
DPV	Digital pin voltage	Input DC voltage at any digital I/O pin	-0.3	3.6	V
P_ANT	Maximum power at receiver	Input RF power at antenna pin		0	dBm
Tstr	Storage temperature		-40	+85	°C

Table 5: Absolute maximum ratings

⚠ The product is not protected against overvoltage or reversed voltages. If necessary, voltage spikes exceeding the power supply voltage specification shown in Table 5 must be limited to values within the specified boundaries by using appropriate protection devices.

4.1.1 Maximum ESD ratings

Parameter	Min.	Typical	Max.	Unit	Remarks
ESD immunity			±8*	kV	Indirect discharge according to IEC 61000-4-2
ESD sensitivity, tested for all pins except ANT and RSVD pins #11, #15, #33			2.5	kV	Human body model according to JEDEC JS001

***** Tested on EVK-NINA-W1 evaluation board.

Table 6: Maximum ESD ratings

⚠ NORA-W10 series modules are Electrostatic Sensitive Devices, which means that some special precautions must be observed when handling them. See also ESD precautions.

4.2 Operating conditions

⚠ Operation beyond the specified operating conditions is not recommended and extended exposure beyond them may affect device reliability.

☞ Unless otherwise specified, all operating condition specifications are at an ambient temperature of 25 °C and at a supply voltage of 3.3 V.

4.2.1 Operating temperature range

Parameter	Min	Max	Unit
Operating temperature	-40*	+85	°C

* See voltage supply conditions for the lowest temperature range in Supply/Power pins.

Table 7: Temperature range

4.2.2 Supply/Power pins

Symbol	Parameter	Condition	Min	Typ	Max	Unit
VCC	Input supply voltage	Ambient temperature -40 °C to +85 °C	3.00	3.30	3.60	V
VCC_IO	I/O reference voltage	Ambient temperature -40 °C to +85 °C	3.00	3.30	3.60	V

Table 8: Input characteristics of voltage supply pins

4.2.3 RESET_N pin

Pin name	Parameter	Min	Typ	Max	Unit
RESET_N	Low-level input	0		0.3*VCC	V
	Internal pull-up resistance		100		kΩ
	Internal capacitance		10		nF
t_Startup	Startup time after release of reset		2.6		s

Table 9: RESET_N pin characteristics

4.2.4 LPO clock

NORA-W10 series modules do not have an internal low power oscillator (LPO) for low power modes. If low power modes are required, the LPO signal can be supplied to the **LPO_IN** pin from an external oscillator. The amplitude range is 0.6 V < Vpp < **VCC_IO**. If the input signal is square wave the bottom voltage should be higher than 200 mV.

Symbol	Parameter	Min	Typ	Max	Unit
LPO	Input clock frequency		32.768		kHz
	Input slow clock accuracy (Initial + temp + aging)			±150	ppm
Tr/Tf	Input transition time Tr/Tf -10% to 90%			100	ns
	Frequency input duty cycle	20	50	80	%
VIH	Input voltage limits (Square wave, DC-coupled)			VCC_IO	V
VIL		0		0.6	V
	Input capacitance			10	pF

Table 10: External LPO clock characteristics

4.2.5 Digital pins

Pin name	Parameter	Min	Typ	Max	Unit	Remarks
Any digital pin	Input characteristic: Low-level input	0		0.3*VCC_IO	V	
	Input characteristic: high-level input	0.7*VCC_IO		VCC_IO	V	
	Output characteristic: Low-level output	0		0.4	V	
	Output characteristic: High-level output	VCC_IO-0.4		VCC_IO	V	
	Drive capability			12	mA	Source/Sink
	Pull-up/pull-down resistance		45		kΩ.	
Signals rerouted through the IO MUX	Output signal speed			20	MHz	
	Input signal speed			10	MHz	The GPIO-Matrix delays the input signals by two cycles of the AHB-clock typical 80 MHz -> 25 ns delay

Table 11: Digital pin characteristics

4.2.6 Current consumption

The typical current consumption of a NORA-W10 module is shown in Table 12. The current consumption is highly dependent on the application implementation. All measurements taken with 3.3 V supply at 25 °C.

☞ The current consumption figures are inherited from the Espressif ESP 32 data sheet [3].

Power mode	Activity	Typ	Unit	Remarks
Wi-Fi	Wi-Fi Tx packet POUT 21 dBm	190	mA	50% duty cycle, transmit 802.11b, 1 Mbit/s
	Wi-Fi Rx and listening	95	mA	
Bluetooth LE	Bluetooth Tx Pout 0 dBm	130	mA	50% duty cycle
	Bluetooth Rx and listening	95	mA	
Modem-sleep mode	CPU speed 240 MHz, dual core	30	mA	Immediate wake-up
	CPU speed 160 MHz, dual core	27	mA	
	CPU speed 80 MHz The CPU is operational. The radio is turned off.	20	mA	
Light-sleep mode	The CPU is paused. The RTC memory and RTC peripherals, as well as the ULP co-processor is running. Any wake-up events (MAC, host, RTC timer, or external interrupts) will wake up the chip.	800	µA	
Deep-sleep mode	The ULP co-processor is powered on	150	µA	
	ULP sensor-monitored pattern	100	µA	@ 1% duty cycle
	RTC timer and RTC memory	10	µA	
Hibernate mode	RTC timer only	5	µA	

Table 12: Current consumption during typical use cases

4.2.7 Wi-Fi radio characteristics

V_{CC} = 3.3 V, T_{amb} = 25 °C

Parameter	Operation mode			Specification	Unit
RF Frequency Range	802.11b/g/n			2.400 – 2.4835	GHz
Modulation	802.11b			CCK and DSSS	
	802.11g/n			OFDM	
Supported Data Rates	802.11b			1, 2, 5.5, 11	Mbit/s
	802.11g			6, 9, 12, 18, 24, 36, 48, 54	Mbit/s
	802.11n			MCS0 – MCS7	
Supported Bandwidth	802.11n			20	MHz
Supported Guard Interval	802.11n			400, 800	ns
Conducted Transmit Power (typical)	802.11b	Channel 6	1 Mbit/s	16* ± 1	dBm
			11 Mbit/s	16* ± 1	dBm
	802.11g	Channel 6	6 Mbit/s	16* ± 1	dBm
			54 Mbit/s	16* ± 1	dBm
	802.11n	Channel 6	MCS0	16* ± 1	dBm
			MCS7	16* ± 1	dBm
Receiver Sensitivity (typical)	802.11b		1 Mbit/s	-98 ± 2	dBm
			11 Mbit/s	-88 ± 2	dBm

Parameter	Operation mode			Specification	Unit
	802.11g		6 Mbit/s	-93 ± 2	dBm
			54 Mbit/s	-76 ± 2	dBm
	802.11n	20 MHz	MCS0	-912± 2	dBm
			MCS7	-74 ± 2	dBm

* There is lower output power on band edge channels and also on the highest data rates.

Table 13: Wi-Fi radio characteristics

4.2.8 Bluetooth LE characteristics

V_{CC} = 3.3 V, T_{amb} = 25 °C

Parameter	Specification	Unit
RF Frequency Range	2.400 – 2.4835	GHz
Supported Modes	Bluetooth v5.0	
Number of channels	40	
Modulation	GFSK	
Transmit Power (typical)	10 ± 1	dBm
Receiver Sensitivity (typical)	-97 ± 2	dBm

* Conducted output power.

Table 14: Bluetooth LE characteristics

4.2.9 Antenna radiation patterns

The radiation patterns described here (showing PCB Trace Antenna performance) are based on the performance of similar u-blox modules. These preliminary radiation patterns will be updated specifically for NORA-W106 modules when all test data is available."

Figure 3 provides an overview of the measurement procedure and describes how the NORA-W106 module is aligned to the XYZ-coordinate system. A measurement is taken at every dotted position above the module image (shown left). Each measurement is represented as a grid point in the radiation pattern (shown right).

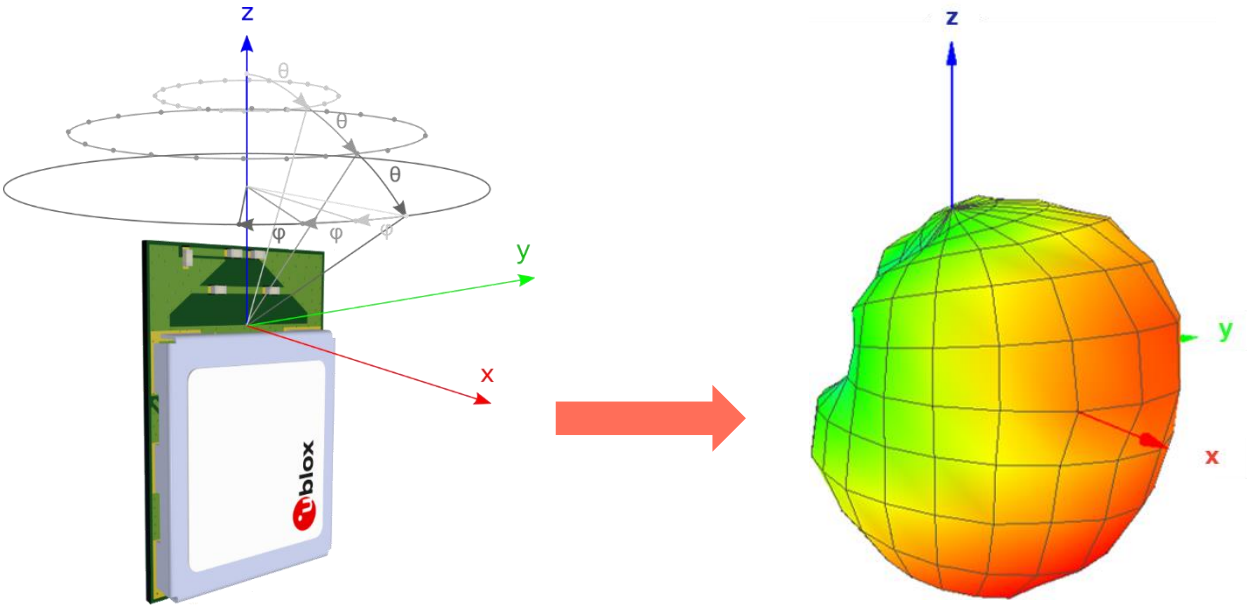


Figure 3: Measurement procedure for radiation patterns

Table 15 shows the displayed radiation patterns of the internal PCB trace antenna in NORA-W106.

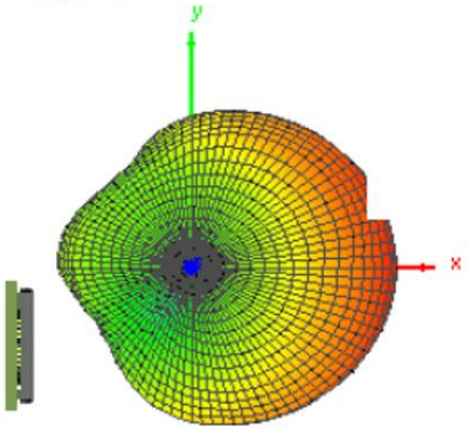
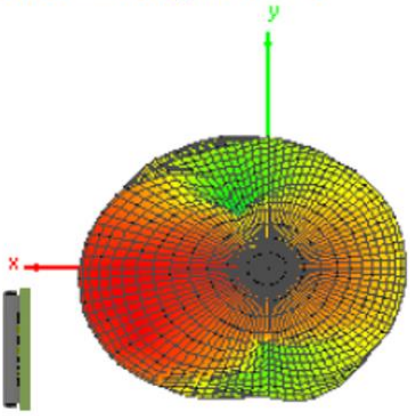
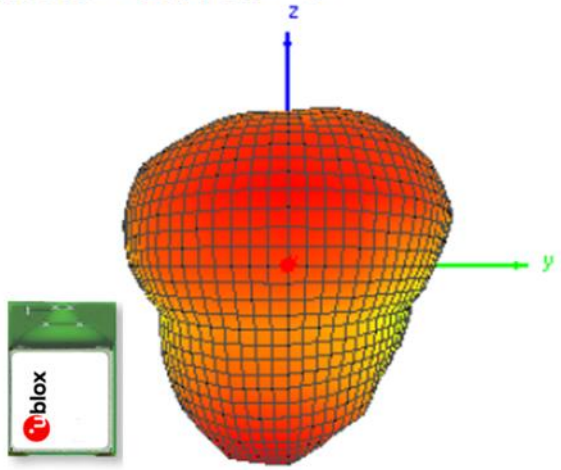
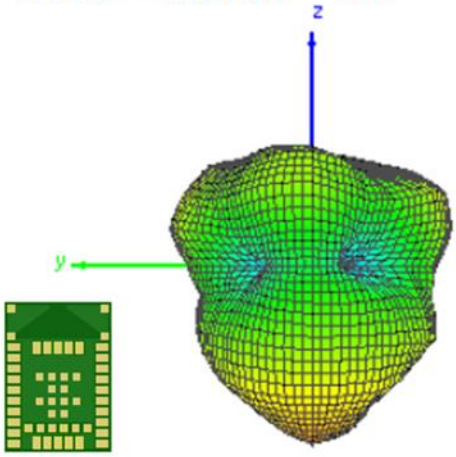
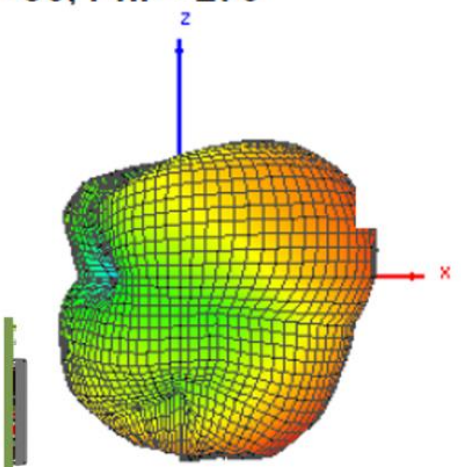
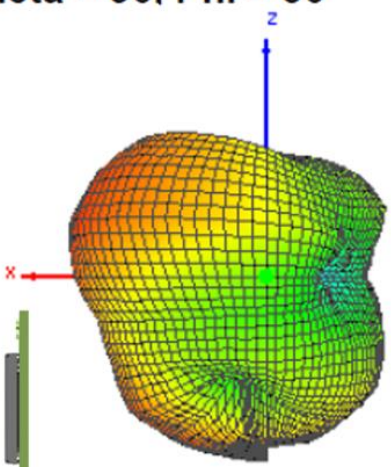
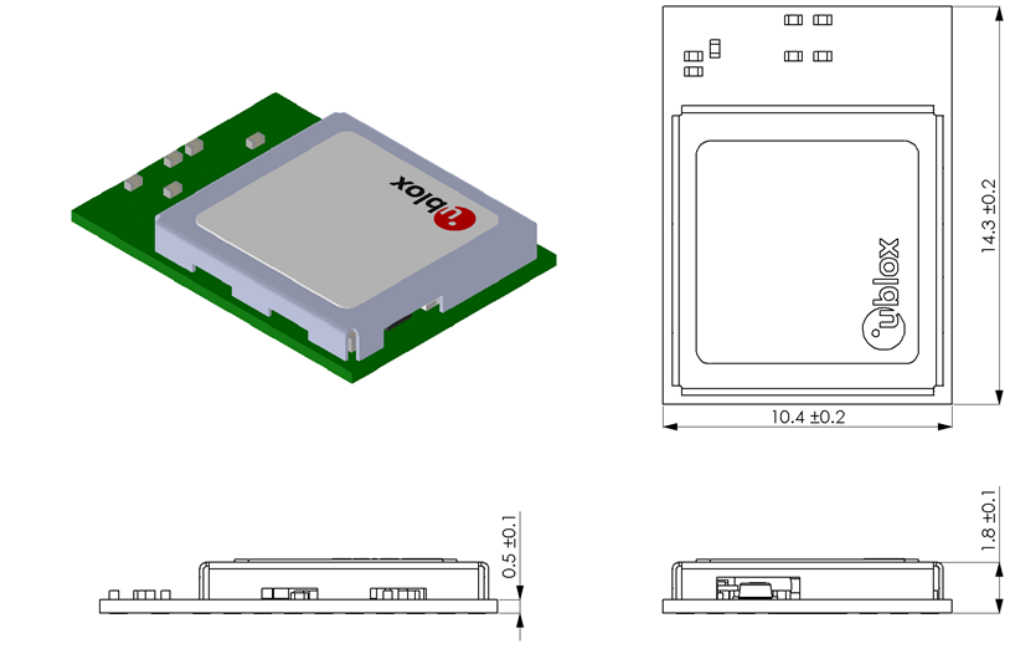
Theta = 0, Phi = 0 	Theta = 180, Phi = 0 
Theta = 90, Phi = 0 	Theta = 90, Phi = 180 
Theta = 90, Phi = 270 	Theta = 90, Phi = 90 

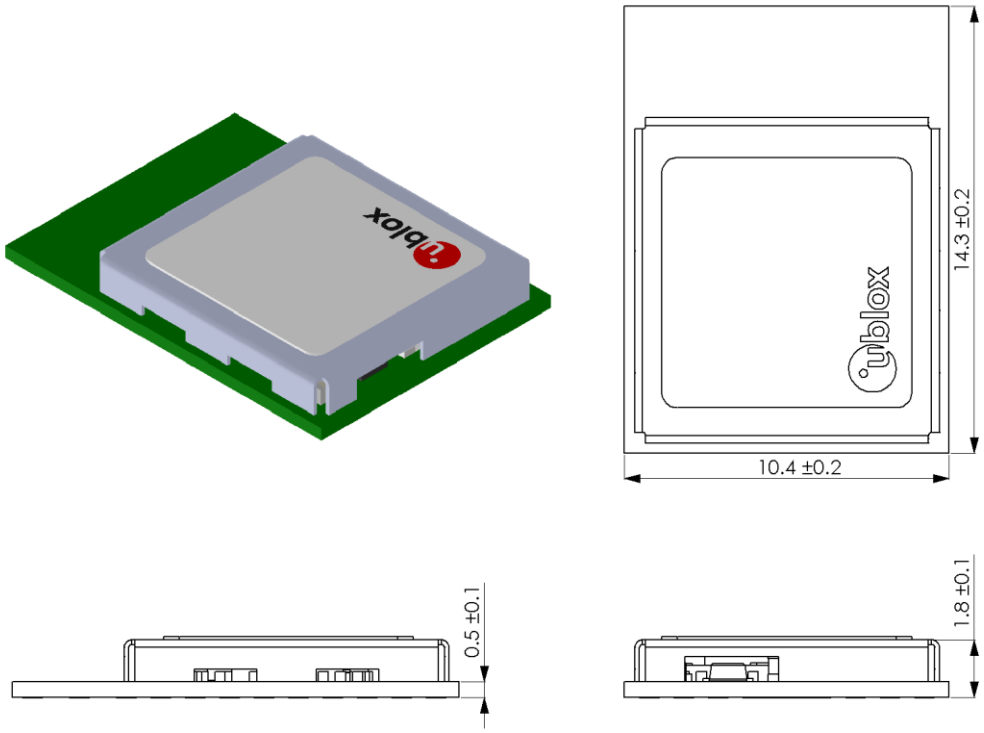
Table 15: NORA-W106 antenna radiation patterns

5 Mechanical specifications

5.1 NORA-W101/W106 mechanical specifications



Dimensions in mm



Dimensions in mm

Figure 4: NORA-W106 and NORA-W101 dimensions

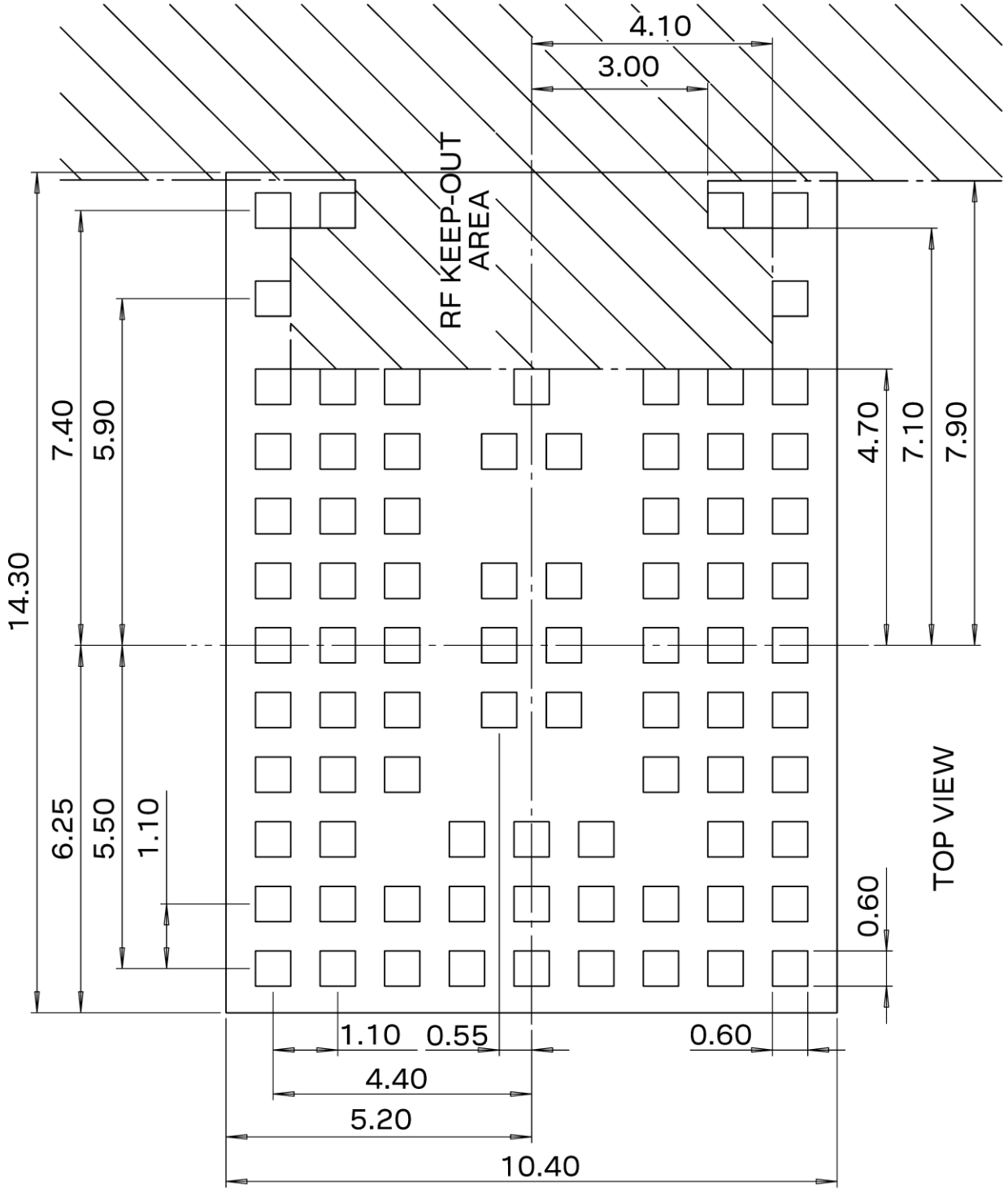


Figure 5: NORA-W101 mechanical outline

6 Qualification and approvals

⚠ Approval for NORA-W106 is currently pending.

6.1 Country approvals

The NORA-W10 module series will be certified for use in the following countries/regions:

- Europe (RED)
- USA (FCC)
- Canada (IC)
- Japan (MIC)
- Taiwan (NCC)
- South Korea (KCC)
- Brazil (ANATEL)
- Australia and New Zeeland (ACMA)
- South Africa (ICASA)

☞ For detailed information about the regulatory requirements that must be met when using NORA-W10 modules in an end product, see the NORA-W10 series certification application note [7].

6.2 Bluetooth qualification information

The NORA-W101 and NORA-W106 modules will be qualified as a controller subsystem according to the Bluetooth 4.2 specification.

Model	Product type	QD ID	Listing date
NORA-W101	Controller subsystem	-	Pending
NORA-W106	Controller subsystem	-	Pending

Table 16: NORA-W101/NORA-W106 Bluetooth QD ID

For information on how to list and declare your product, see the NORA-W10 series system integration manual [1].

7 Product handling

7.1 Packaging

⚠ NORA-W10 series modules are currently in development, as shown in the Product status. Consequently, the information in this section will be valid and available only when the module is fully tested and approved in the Initial Production stage.

7.1.1 Reels

NORA-W10 series modules are delivered as hermetically sealed, reeled tapes to enable efficient production, production lot set-up and tear-down. For more information about packaging, see the u-blox package information guide [2].

NORA-W10 modules are delivered in quantities of 500 pieces on a reel.

The reel types for NORA-W10 modules are shown in Table 17, with more detailed information included in the u-blox package information guide [2].

Model	Reel type
NORA-W101	B
NORA-W106	A

Table 17: Reel types for different NORA-W10 series modules

7.1.2 Tapes

Figure 6 and Figure 7 show the position and orientation of NORA-W10 modules as they are delivered on tape. The dimensions of the tapes are specified in Figure 6 and Figure 7.

Figure 6: NORA-W101 module on tape orientation

Figure 7: NORA-W106 module on tape orientation

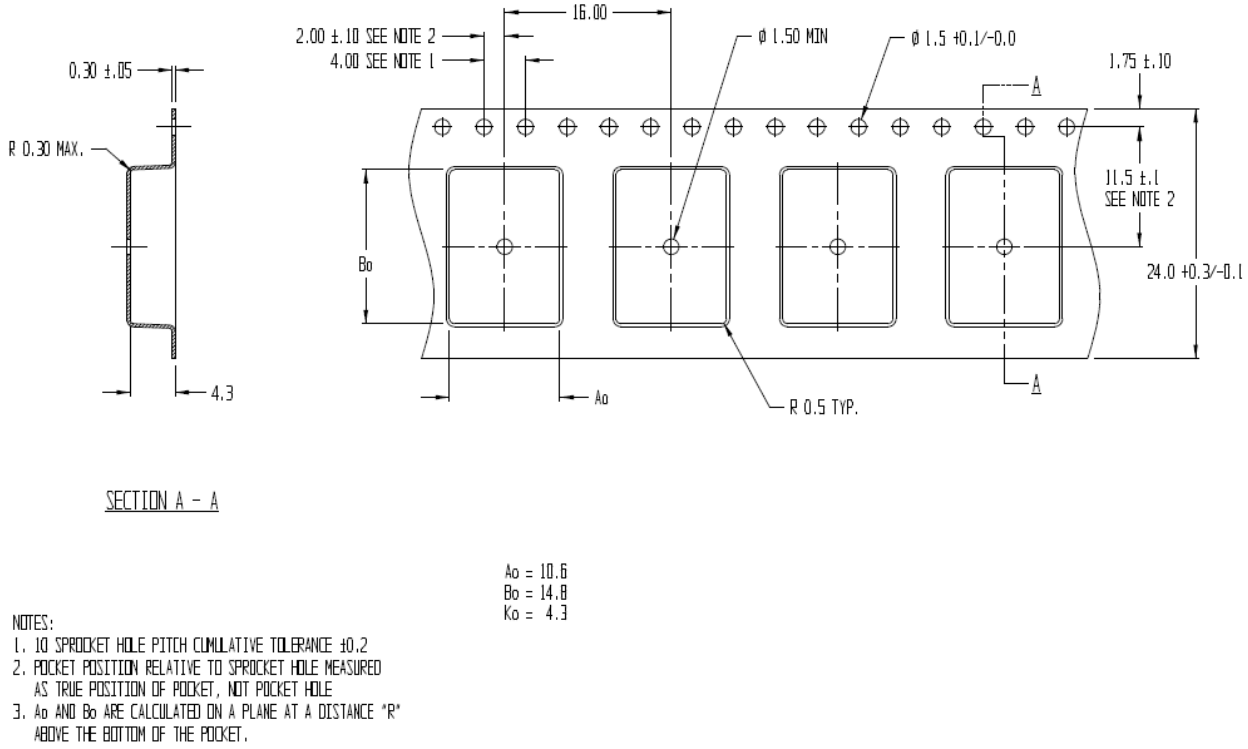


Figure 8: NORA-W101/NORA-W106 tape dimensions

7.2 Moisture sensitivity levels

⚠ The NORA-W10 series modules are Moisture Sensitive Devices (MSD) in accordance with the IPC/JEDEC specification.

The Moisture Sensitivity Level (MSL) relates to the required packaging and handling precautions. The NORA-W10 series modules are rated at MSL level 4. For more information regarding moisture sensitivity levels, labeling, and storage, see the u-blox package information guide [2].

☞ For MSL standards, see IPC/JEDEC J-STD-020, which can be downloaded from www.jedec.org.

7.3 Reflow soldering

Reflow profiles are to be selected according to u-blox recommendations. See NORA-W10 series system integration manual [1] for more information.

⚠ Failure to observe these recommendations can result in severe damage to the device.

7.4 ESD precautions

⚠ NORA-W10 series modules contain highly sensitive electronic circuitry and are Electrostatic Sensitive Devices (ESD). Handling the NORA-W10 series modules without proper ESD protection may destroy or damage them permanently.

NORA-W10 series modules are electrostatic sensitive devices (ESD) and require special ESD precautions typically applied to ESD sensitive components. See also Maximum ESD ratings.

Proper ESD handling and packaging procedures must be applied throughout the processing, handling and operation of any application that incorporates the NORA-W10 series module. The ESD precautions should be implemented on the application board where the module is mounted as described in the NORA-W10 series system integration manual [1].

⚠ Failure to observe these recommendations can result in severe damage to the device.

8 Labeling and ordering information

8.1 Product labeling

The labels (8 x 8 mm) of the NORA-W10 series modules described in the section include important product information.

Figure 9 shows the label of all the NORA-W10 series modules, which includes product type number and revision, production date, and data matrix that bears a unique serial number and the u-blox logo.

All units in mm unless specified otherwise

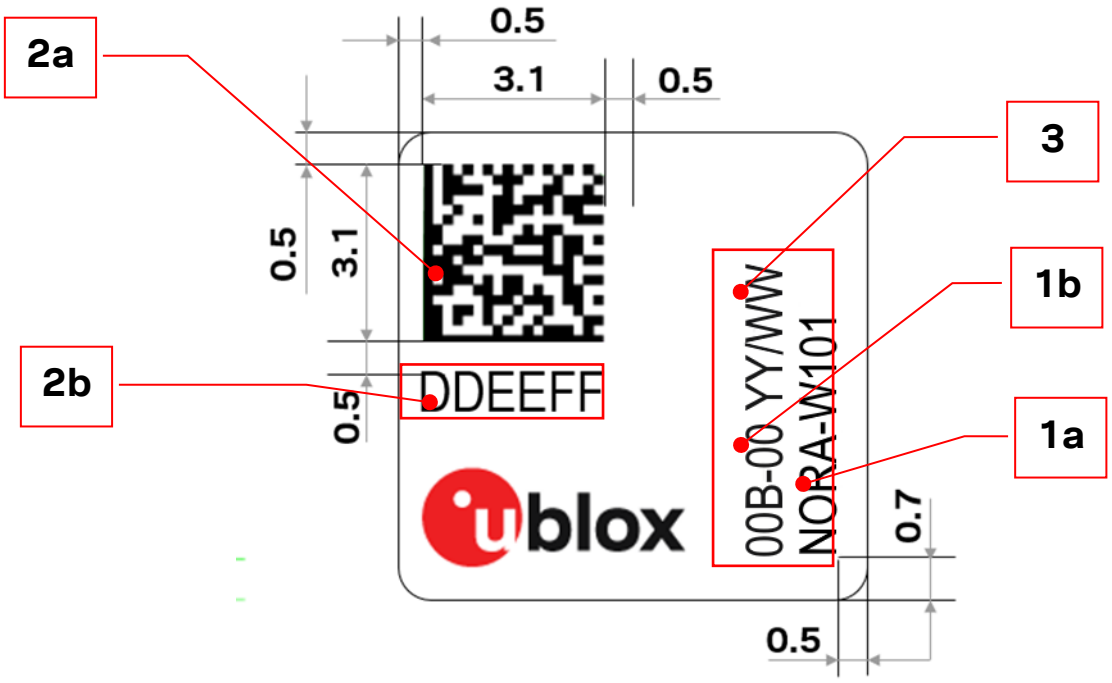


Figure 9: Location of product type number on the NORA-W10 series module label

Reference	Description
1a	Text box containing Product Name and approval ID:s (Applicable model names: NORA-W1xx).
1b	Product type number.
2a	DataMatrix (product identifier, serial number, datacode) • Product identifier: 3 digits defined by Flex. • Serial number: MAC address assigned by FlexFlow to the module. • Datacode: 4 digits, defined in the PSP.
2b	The six last hex symbols of the MAC address (AABBCC**DDEEFF**).
3	Date of production encoded YY/WW (year/week).

Table 18: NORA-W10 series label description

8.2 Ordering information

Ordering code	Product
NORA-W101-00B	Module with antenna pin. Open CPU version. Using ESP32-S3FN8.
NORA-W106-00B	Module with internal PCB trace antenna. Open CPU version. Using ESP32-S3FN8.

Table 19: Product ordering codes

Appendix

A Glossary

Abbreviation	Definition
ADC	Analog to Digital Converter
BPF	Band Pass Filter
BR/EDR	Basic rate/Enhanced data rate
CAN	Controller Area Network
CTS	Clear To Send
DAC	Digital to Analog Converter
DC	Direct Current
DSR	Data Set Ready
ESD	Electro Static Discharge
FCC	Federal Communications Commission
GATT	Generic ATTribute profile
GND	Ground
GPIO	General Purpose Input/Output
I2C	Inter-Integrated Circuit
IC	Industry Canada
IEEE	Institute of Electrical and Electronics Engineers
IoT	Internet of Things
LPO	Low Power Oscillator
MCU	Micro Controller Unit
MDIO	Management Data Input / Output
MII	Media-Independent Interface
MIMO	Multi-Input Multi-Output
MRD	Market Requirement Document
MSD	Moisture Sensitive Device
N/A	Not Applicable
PCN	Product Change Notification
PIFA	Planar Inverted IF Antenna
QSPI	Quad Serial Peripheral Interface
RTS	Request To Send
RXD	Receive Data
SDIO	Secure Digital Input Output
SDK	Software Development Kit
SPI	Serial Peripheral Interface
TBD	To Be Defined
TXD	Transmit Data
UART	Universal Asynchronous Receiver/Transmitter

Table 20: Explanation of the abbreviations and terms used

Related documents

[1] NORA-W10 series system integration manual, UBX-17005730
[2] u-blox package information guide, UBX-14001652
[3] Espressif System ESP32-S3 Datasheet, version 3.6
[4] NORA-W10 declaration of conformity, UBX-18007184
[5] NORA-W10 series product summary, UBX-17051775
[6] NORA-B1 datasheet, UBX-20027119
[7] NORA-W10 series certification application note

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	03-May-2021	asoh	Initial release of the data sheet for NORA-W10 series with open CPU architecture.

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