SHORT RANGE

NINA-W1 series

Stand-alone Wi-Fi modules

Data Sheet

Abstract

This technical data sheet describes the NINA-W1 series short range Wi-Fi modules. The NINA-W1 is an ultra-compact stand-alone Wi-Fi module ideal for critical IoT applications where security is important. The NINA-W1, supporting 802.11b/g/n in the 2.4 GHz ISM band, can act as a Wi-Fi station and a micro access point. It connects to a host system using either a UART or a high-speed RMII interface.

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Initial Production	Early Prod. Information	Data from product verification. Revised and supplementary data may be published later.
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This document applies to the following products:

Product name	Type number	u-blox connectivity software version	PCN reference	Product status
NINA-W131	NINA-W131-00B-00	0.9.0.8	N/A	Engineering Sample
NINA-W132	NINA-W132-00B-00	0.9.0.8	N/A	Engineering Sample

Contents

1 Functional description

1.1 Overview

The NINA-W1 series ultra-compact stand-alone Wi-Fi modules integrate a microcontroller (MCU) for applications. The NINA-W1, supporting 802.11b/g/n in the 2.4 GHz ISM band, can act as a Wi-Fi station and a micro access point. It connects to a host system using either a UART or a high-speed RMII* interface.

The NINA-W1 modules provide top grade security, thanks to secure boot, which ensures the module only boots up with original u-blox software. In addition, they will provide end-to-end security on the wireless link with the latest 802.11i (WPA2) standard and enterprise security to provide a secure connection to the infrastructure. This makes NINA-W1 ideal for critical IoT applications where security is important.

Intended applications include telematics, low power sensors, connected factories, connected buildings (appliances and surveillance), point-of-sales, and health devices. Device design is simplified as developers can choose to either use an external antenna (NINA-W131) or take advantage of the internal antenna (NINA-W132). Additionally, the NINA-W1 modules are pin-compatible with the NINA-B1 Bluetooth® low energy modules, thus offering maximum flexibility for development of similar devices offering different radio technologies.

NINA-W1 will initially be certified for the US, Europe, and Canada. Certifications for other countries are planned. The modules will be qualified for professional grade operation, supporting an extended temperature range of -40 °C to +85 °C.

* Planned feature and not supported in the current software version.

1.2 Applications

- Internet of Things (IoT)
- Wi-Fi networks
- Medical and industrial networking
- Access to laptops, mobile phones, and similar consumer devices
- Home/building automation
- Ethernet/Wireless Gateway

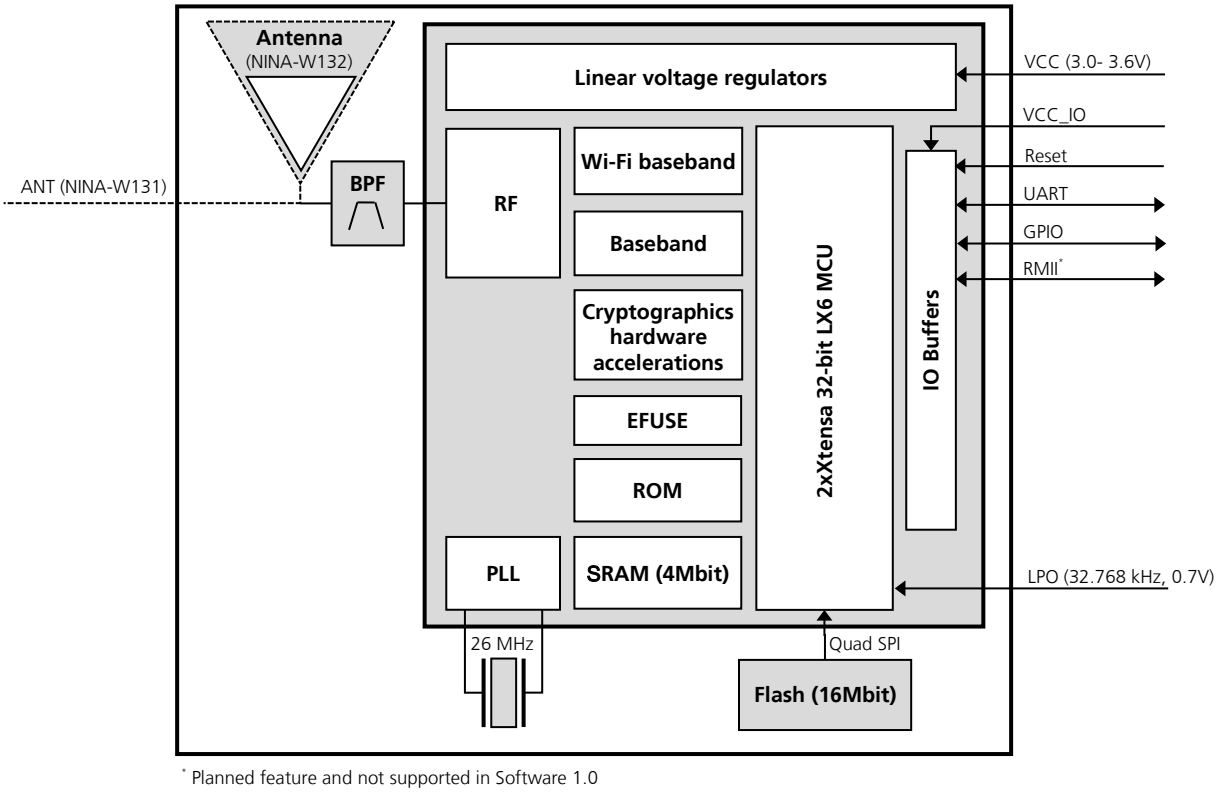
1.3 Product features*

Model	Radio				Interfaces			Features				Security					Grade		
	Wi-Fi IEEE 802.11 version	Wi-Fi output power EIRP [dBm]	Maximum Wi-Fi range [m]	Antenna type	UART	RMII	GPIO pins	Wi-Fi Station	Wi-Fi Micro access point	Point-to-Point Protocol [PPP]	Extended Data Mode [EDM]™	WPA / WPA2	WPS	Enterprise security	Secure MAC [802.11w]	Secure boot	Standard	Professional	Automotive
NINA-W131	b/g/n	19	300	P	•	•	•	•	•	•	•	•	•	•	•	•			
NINA-W132	b/g/n	19	250	I	•	•	•	•	•	•	•	•	•	•	•	•			

* = Planned attributes for the NINA-W1 series P = antenna pin I = internal antenna

Table 1: NINA-W1 series main features summary

1.4 Block diagram



* Planned feature and not supported in Software 1.0

Figure 1: Block diagram of NINA-W1

1.5 NINA-W1 product variants

NINA-W131 	**Antenna pin** The antenna pin modules do not use the internal antenna and thus the PCB outline has been trimmed to 10.0 x 10.6 mm. Instead of an internal antenna, the RF signal is available at a module pin for routing to an external antenna or antenna connector.
NINA-W132 	**Internal onboard antenna** The internal onboard antenna modules use an integrated antenna mounted on the PCB. The PCB outline is 10.0 x 14.0 mm. The RF signal pin is not connected to any signal path.

Table 2: NINA-W1 series product variants

1.6 Product description

1.6.1 Radio

The NINA-W1 series module supports Wi-Fi and conforms to IEEE 802.11b/g/n single-band 2.4 GHz operation.

Wi-Fi
IEEE 802.11b/g/n
Band support 2.4 GHz, channel 1-13*
Maximum conducted output power 16 dBm
Maximum radiated output power 19 dBm EIRP**
Best conducted sensitivity -96 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, MCS32, HT20/HT40 6.5-150 Mbit/s

* Maximum, supports 802.11d and depends on region.
** RF power including maximum antenna gain (3 dBi).

Table 3: NINA-W1 series Wi-Fi characteristics

1.6.2 CPU

The NINA-W1 series has a dual-core system with two Harvard Architecture Xtensa LX6 CPUs with max 240 MHz internal clock frequency. The internal memory of NINA-W1 includes the following:

- 448 Kbyte ROM for booting and core functions
- 520 Kbyte SRAM for data and instruction
- 16 Mbit FLASH for code storage including hardware encryption to protect programs and data
- 1 kbit EFUSE (non- erasable memory) for MAC addresses, module configuration, Flash-Encryption, and Chip-ID

1.7 Software upgrade

See section 2.6.2 and *NINA-W1 series System Integration Manual [1]* for information on how to upgrade the software.

1.8 AT command support

You can configure NINA-W131 and NINA-W132 connectivity modules with the u-blox s-center toolbox software using AT commands. See *u-blox Short Range AT Commands Manual [3]* for information about supported AT commands.

The s-center evaluation software supporting the AT commands is also available free of charge and can be downloaded from the u-blox website.

1.9 IEEE 802.11d and additional regulatory domains

The maximum output power is reduced on some channels depending on the regulatory requirements. For example, frequency band edge requirements can limit the output power on channels close to band edges.

1.10 MAC Addresses

The NINA-W1 module series has four unique consecutive MAC addresses reserved for each module, from which the three first addresses are stored in the configuration memory during production. The first Wi-Fi MAC address is available in the Data Matrix on the label (see section 9.1). The last MAC address is not stored in the configuration memory but is reserved for usage with the module.

MAC address	Assignment	Last bits of MAC address	Example
Module 1, address 1	Wi-Fi	00	*D4:CA:6E:90:04:90*
Module 1, address 2	RMII/Ethernet	01	*D4:CA:6E:90:04:91*
Module 1, address 3	Reserved	10	*D4:CA:6E:90:04:92*
Module 1, address 4	Reserved	11	*D4:CA:6E:90:04:93*
Module 2, address 1	Wi-Fi	00	*D4:CA:6E:90:04:94*
Module 2, address 2	RMII/Ethernet	01	*D4:CA:6E:90:04:95*
Module 2, address 3	Reserved	10	*D4:CA:6E:90:04:96*
Module 2, address 4	Reserved	11	*D4:CA:6E:90:04:97*

Table 4: Example MAC addresses assignment for two modules

1.11 Power modes

The NINA-W1 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 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 section 2.2).

See the *u-blox Short Range AT Commands Manual [3]* and *NINA-W1 series System Integration Manual [1]* for more information about power modes.

2 Interfaces

2.1 Power supply

The power for NINA-W1 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 (add 20% as margin over the listed type current consumption), as during operation, the current drawn from **VCC** and **VCC_IO** can vary significantly based on the power consumption profile of the Wi-Fi technology.

2.1.1 Module supply input (VCC)

The NINA-W1 series modules use an integrated Linear Voltage converter to transform the supply voltage presented at the **VCC** pin into a stable system voltage.

2.1.2 Digital I/O interfaces reference voltage (VCC_IO)

All modules in the NINA-W1 series provide an additional voltage supply input for setting the I/O voltage level.

The separate **VCC_IO** pin enables integration of the module in many applications with different voltage levels (for example, 1.8 V or 3.3 V) without any level converters. The NINA-W1 modules support only 3.3 V as IO voltage level currently.

2.2 Low Power Clock

The NINA-W1 series module does not have an internal low power oscillator (LPO), which is required for low power modes. An external 32.768 KHz LPO signal can be supplied externally via the **LPO_CLK** pin if low power modes are required.

The low power clock voltage level is lower (0/0.7 V) compared to the digital signal levels and a voltage divider can be required (see section 4.2.4).

2.3 Module reset

The NINA-W1 series modules can be reset (rebooted) in one of the following ways:

- Low level on the **RESET_N** pin, which is normally set high by an internal pull-up. This causes "hardware" reset of the module. The **RESET_N** signal should be driven by an open drain, open collector or contact switch. When **RESET_N** is low (off), the chip works at the minimum power.
- Using a reset AT command (see the *u-blox Short Range AT Commands Manual [3]*). This causes a "software" reset of the module.

2.4 Boot strapping pins

There are several boot configuration pins available on the module that needs to have the correct settings during boot. See *NINA-W1 series System Integration Manual [1]* for more information.

Pin	State during boot	Default	Behavior	Description
36	0		VDD_SDIO=3.3V	Voltage of Internal Flash
	1	**10kΩ pull-up**	**VDD_SDIO=1.8V (VDD_SDIO should always be 1.8 V)**	
27, 25	00		Download Boot	Booting Mode, see section 1.7 for information about software upgrade.
	01		Reserved, do not use	
	10	**Pull-up*, Pull-down***	**Normal Boot from internal Flash**	
	11		Normal Boot from internal Flash	

Pin	State during boot	Default	Behavior	Description
32	0		Silent	Debugging Log on U0TXD during booting
	1	**Pull-up***	**U0TXD Toggling**	
32, 28	00		Falling-edge input, falling-edge output	Timing of SDIO Slave
	01		Falling-edge input, rising-edge output	
	10		Rising-edge input, falling-edge output	
	11	**Pull-up*, Pull-up***	**Rising-edge input, rising-edge output**	

☞ * About 30 kΩ

Table 5: NINA-W1 boot strapping pins

2.5 RF antenna interface

The RF antenna interface of the NINA-W1 series supports 2.4 GHz Wi-Fi. The module is equipped with a 2.4 GHz bandpass filter between the radio chip and RF antenna interface (see section 1.4).

The NINA-W1 series supports either an internal antenna (NINA-W132) or external antenna connected through an antenna pin (NINA-W131).

2.5.1 Internal antenna

The NINA-W132 module has an internal (embedded) 2.4 GHz PIFA antenna. The internal antenna is a PIFA antenna specifically designed and optimized for the NINA form factor.

Keep a minimum clearance of 5 mm between the antenna and the casing. Keep a minimum of 10 mm free space from the metal around the antenna including the area below. If a metal enclosure is required, use NINA-W131 and an external antenna.

It is recommended to place the NINA-W132 module in such a way that the internal antenna is in the corner of the host PCB (the corner closest to Pin 16 should be in the corner). The antenna side (short side closest to the antenna), positioned along one side of the host PCB ground plane is the second best option. It is beneficial to have a large solid ground plane on the host PCB and have a good grounding on the NINA-W132 module. Minimum ground plane size is 24x30 mm but recommended is more than 50x50 mm.

See *NINA-W1 series System Integration Manual [1]* for more information about antenna related design.

⚠ **The ANT signal is not available on the solder pins of the NINA-W132 module.**

2.5.2 External RF antenna interface

The NINA-W131 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 using an external antenna via 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 *NINA-W1 series System Integration Manual [1]*) is available and must be followed to comply with the NINA-W1 FCC/IC modular approvals.

Also see the list of approved antennas (section 7.2).

2.6 IO signals

2.6.1 System status IO signals

The **RED**, **GREEN** and **BLUE** pins are used to signal the status. They are active low and are intended to be routed to an RGB LED. See *u-blox Short Range AT Commands Manual [3]* for more information about connectivity signals IOs.

Mode	Status	RGB LED Color	GREEN	BLUE	RED
Data mode	IDLE	Green	LOW	HIGH	HIGH
Command mode	IDLE	Orange	LOW	HIGH	LOW
Data mode, Command mode	CONNECTING*	Purple	HIGH	LOW	LOW
Data mode, Command mode	CONNECTED*	Blue	HIGH	HIGH	LOW

* = LED flashes on data activity

Table 6: System status indication

2.6.2 System control IO signals

The following input signals are used to control the system (see *u-blox Short Range AT Commands Manual [3]* for more information about connectivity signals IOs):

- **RESET_N** is used to reset the system. See section 2.6 for detailed information.
- If **SWITCH_2** is driven low during start up, the UART serial settings are restored to their default values.
- **SWITCH_2** can be used to open a connection to a peripheral device.
- If both **SWITCH_1** and **SWITCH_2** are driven low during start up, the system will enter the bootloader mode.
- If both **SWITCH_1** and **SWITCH_2** are driven low during start up and held low for 10 seconds, the system will exit the bootloader mode and restore all settings to their factory defaults.

2.6.2.1 UART IO signals

In addition to the normal **RXD**, **TXD**, **CTS,** and **RTS** signals, the NINA-W131/NINA-W132 software adds the **DSR** and **DTR** pins to the UART interface. Note that they are not used as originally intended, but to control the state of the NINA module. Depending on the current configuration, the **DSR pin** can be used to:

- Enter command mode
- Disconnect and/or toggle connectable status
- Enable/disable the rest of the UART interface
- Enter/wake up from sleep mode

2.7 Data interfaces

2.7.1 UART

The NINA-W131 and NINA-W132 modules include a 6-wire UART for communication with an application host processor (AT commands, Data communication, and software upgrades).

The following UART signals are available:

- Data lines (**RXD** as input, **TXD** as output)
- Hardware flow control lines (**CTS** as input, **RTS** as output)
- Link status (**DTR** as output, **DSR** as input). The **DTR/DSR** signals behavior is adapted to the u-blox connectivity software functionality and differs from the UART standard, see section 2.6.2.1 for additional information.
- Programmable baud-rate generator allows most industry standard rates, as well as non-standard rates up to 921600 bps.
- Frame format configuration:
  - 8 data bits
  - Even or no-parity bit
  - 1 stop bit
- Default frame configuration is 8N1, meaning eight (8) data bits, no (N) parity bit, and one (1) stop bit.

3 Pin definition

3.1 NINA-W131/NINA-W132 u-blox connectivity pin assignment

The pinout as shown in Figure 2 describes the pin configuration used in the NINA-W131 and NINA-W132 u-blox connectivity software modules.

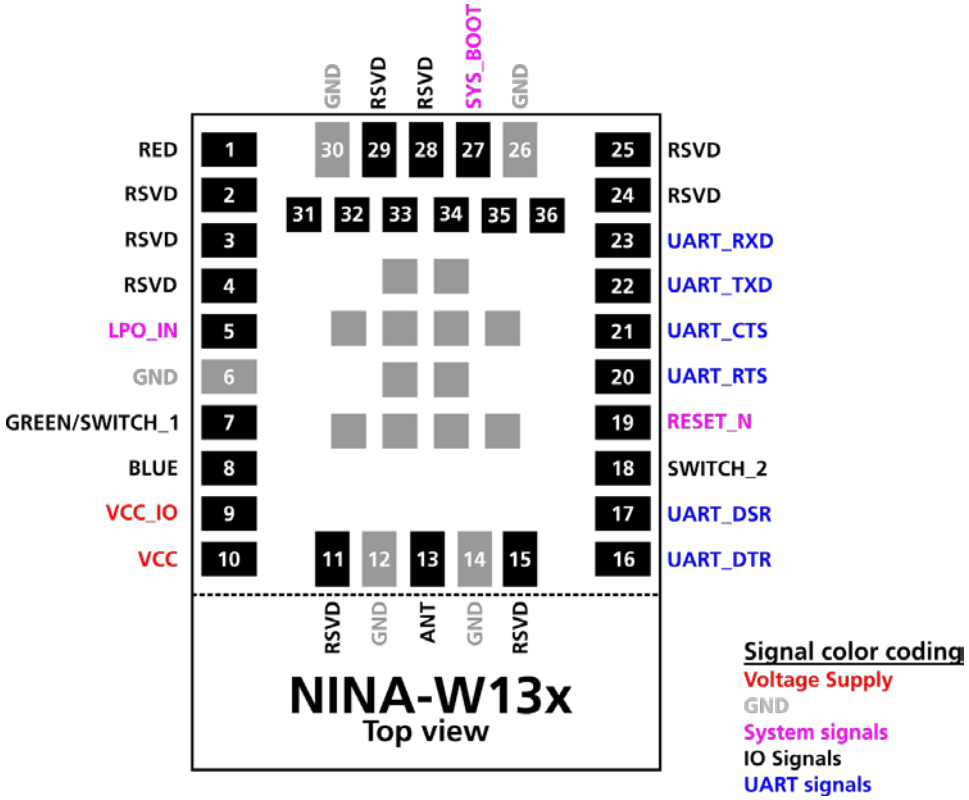


Figure 2: NINA-W13x pin assignment (top view)

The grey pins in the center of the modules are GND pins. The lower part below the dotted line is the antenna part of NINA-W132 and the outline of the NINA-W131 module ends at this line.

Some of the signals are boot strap signals (see Table 7). It is important that these signals are in the correct state during startup (see section 2.4).

Pin	Name	I/O	Description	Alt. Function	Remarks
1	RED	O	Logic Red LED Signal	GPIO_1	See section 2.6 for more info about IO functionality.
2	RSVD		Reserved for future use.	GPI_2	Do not connect.
3	RSVD		Reserved for future use.	GPI_3	Do not connect.
4	RSVD		Reserved for future use.	GPI_4	Do not connect.
5	LPO_IN	I	Low Power Oscillator Input	GPIO_5	**In LPO_IN mode the signal needs to be 0/0.7 V for example, via an external voltage divider.**
6	GND		Ground		
7	GREEN/ SWITCH_1	I/O	GREEN: System status signal / SWITCH_1: Restore UART serial settings / Enter bootloader.	GPIO_7	Active low. See section 2.6 for more info about IO functionality.
8	BLUE	O	Logic Blue LED Signal.	GPIO_8	See section 2.6 for more info about IO functionality.
9	VCC_IO	I	Module I/O level voltage input		3.3 V IO voltage supply.
10	VCC	I	Module supply voltage input		3.0-3.6 V module voltage supply.
11	RSVD		Reserved for future use.		Do not connect.
12	GND		Ground		
13	ANT	I/O	Antenna Tx/Rx interface		50 Ω nominal characteristic impedance, only used with NINA-W101 module.
14	GND		Ground		
15	RSVD		Reserved for future use.		Do not connect.
16	UART_DTR	O	UART Data Terminal Ready.	GPIO_16	The DTR signaling is not according to UART standard (see section 2.6.2.1).
17	UART_DSR	I	UART Data Set Ready.	GPIO_17	The DSR signaling is not according to UART standard (see section 2.6.2.1).
18	SWITCH_2	I	Connect on external signal / Enter bootloader.	GPIO_18	Active low. See section 2.6 for more info about IO functionality.
19	RESET_N	I	External system reset input.		Active low.
20	UART_RTS	O	UART request to send.	GPIO_20	Hardware flow control signal. Active low.
21	UART_CTS	I	UART clear to send.	GPIO_21	Hardware flow control signal. Active low.
22	UART_TXD	O	UART data output.	GPIO_22	
23	UART_RXD	I	UART data input.	GPIO_23	
24	RSVD		Reserved for future use.	GPIO_24	
25	RSVD		Reserved for future use.	GPIO_25	Boot strap pin (see section 2.4).
26	GND		Ground		
27	SYS_BOOT		Software download	GPIO_27	Pull low during startup for download software (see section 2.4).
28	RSVD		Reserved for future use.	GPIO_28	Do not connect.
29	RSVD		Reserved for future use.	GPIO_29	Do not connect.
30	GND		Ground		
31	RSVD		Reserved for future use.	GPIO_31	Do not connect.
32	RSVD		Reserved for future use.	GPIO_32	Boot strap pin (see section 2.4).
33	RSVD		Reserved for future use.		Do not connect.
34	RSVD		Reserved for future use.	GPI_34	Do not connect
35	RSVD		Reserved for future use.	GPIO_35	Do not connect.
36	RSVD		Reserved for future use.	GPIO_36	Boot strap pin (see section 2.4).

Table 7: NINA-W131/NINA-W132 pinout

4 Electrical specifications

Stressing the device above one or more of the ratings listed in the Absolute maximum rating section may 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 section of this document should be avoided. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Operating condition ranges define those limits within which the functionality of the device is guaranteed. 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	3.9	V
DPV	Digital pin voltage	Input DC voltage at any digital I/O pin	-0.3	3.9	V
P_ANT	Maximum power at receiver	Input RF power at antenna pin		+10	dBm
Tstr	Storage temperature		-40	+85	°C

Table 8: Absolute maximum ratings

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

4.1.1 Maximum ESD ratings

Approvals are pending. The NINA-W1 series modules are in development status as mentioned in the table on page 2. Hence, the information in this section will be valid and available only when the module is fully tested and approved in the Initial Production stage.

Parameter	Min	Typical	Max	Unit	Remarks
ESD sensitivity for all pins except ANT pin			4	kV	Human body model according to JEDEC JS001
			750	V	Charged device model according to JESD22-C101
ESD indirect contact discharge			±8	kV	According to EN 301 489-1

Table 9: Maximum ESD ratings

NINA-W1 series modules are Electrostatic Sensitive Devices and require special precautions while handling. See section 8.4 for ESD handling instructions.

4.2 Operating conditions

The NINA-W1 series modules are in development status as mentioned in the table on page 2. Hence, the information in the following characterization section will be valid and available when the module is fully tested and approved in the Production Information stage.

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

Table 10: Temperature range

4.2.2 Supply/Power pins

Symbol	Parameter	Min	Typ	Max	Unit
VCC	Input supply voltage	3.0	3.3	3.6	V
VCC_IO	I/O reference voltage	3.0	3.3	3.6	V

Table 11: Input characteristics of voltage supply pins

4.2.3 RESET_N pin

Pin name	Parameter	Min	Typ	Max	Unit	Remarks
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 12: RESET_N pin characteristics

4.2.4 LPO clock

The NINA-W1 series module does not have an internal low power oscillator (LPO) required for low power modes. An LPO signal can be supplied to the LPO_IN pin from an external oscillator if low power modes are required.

The LPO_IN clock signal shall be limited to 0/0.7 V; for example, via an external voltage divider.

Symbol	Parameter	Min	Typ	Maximum	Unit
$LPO_{32.768kHz}$	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	%
V_{IH}	Input voltage limits (Square wave, DC-coupled)	0.50	0.7	0.8	V
V_{IL}				0.2	V
	Input capacitance			10	pF

Table 13: 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	Normal drive strength
		0		0.4	V	High drive strength
	Output characteristic: High-level output	VCC_IO-0.4		VCC_IO	V	Normal drive strength
		VCC_IO-0.4		VCC_IO	V	High drive strength
	Pull-up/pull-down resistance		30		kΩ	

Table 14: Digital pin characteristics

4.2.6 Current consumption

Typical current consumption of a NINA-W1 module is provided in * Power saving mode not implemented in the current software version

Table 15.

Power mode	Activity	Min	Typ	Max	Unit	Remarks
RF active	Wi-Fi Tx packet 16 dBm			320	mA	
	Wi-Fi Rx and listening			140	mA	
	Association sleep pattern (by light-sleep)		TBD*		mA	DTIM1, 0.9 mA@DTIM3
CPU running mode	Max speed		TBD*		mA	
	Normal speed		140		mA	
	Slow speed		TBD*		mA	
Light-sleep mode	TBD		TBD*		mA	
Deep-sleep mode	TBD		TBD*		µA	
Hibernate mode	TBD		TBD*		µA	

* Power saving mode not implemented in the current software version

Table 15: 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 – 2.500	GHz
Modulation	802.11b			CCK and DSSS	
	802.11g/n			OFDM	
Supported Data Rates	802.11b			1, 2, 5.5, 11	Mbps
	802.11g			6, 9, 12, 18, 24, 36, 48, 54	Mbps
	802.11n			MCS0 - MCS7, MCS32	
Supported Bandwidth	802.11n			20, 40	MHz
Supported Guard Interval	802.11n			400, 800	ns
Conducted Transmit Power (typical)	802.11b			16 ± 1	dBm
	802.11g/n			16 ± 1	dBm
Receiver Sensitivity (typical)	802.11b		1 Mbps	-96 ± 1	dBm
			11 Mbps	-88 ± 1	dBm
	802.11g		6 Mbps	-92 ± 1	dBm
			54 Mbps	-74 ± 1	dBm
	802.11n	20 MHz	MCS0	-91 ± 1	dBm
			MCS7	-71 ± 1	dBm
		40 MHz	MCS0	-87 ± 1	dBm
			MCS7	-67 ± 1	dBm
			MCS32	TBD	dBm

Table 16: Wi-Fi radio characteristics

5 Mechanical specifications

5.1 NINA-W131 Mechanical specification

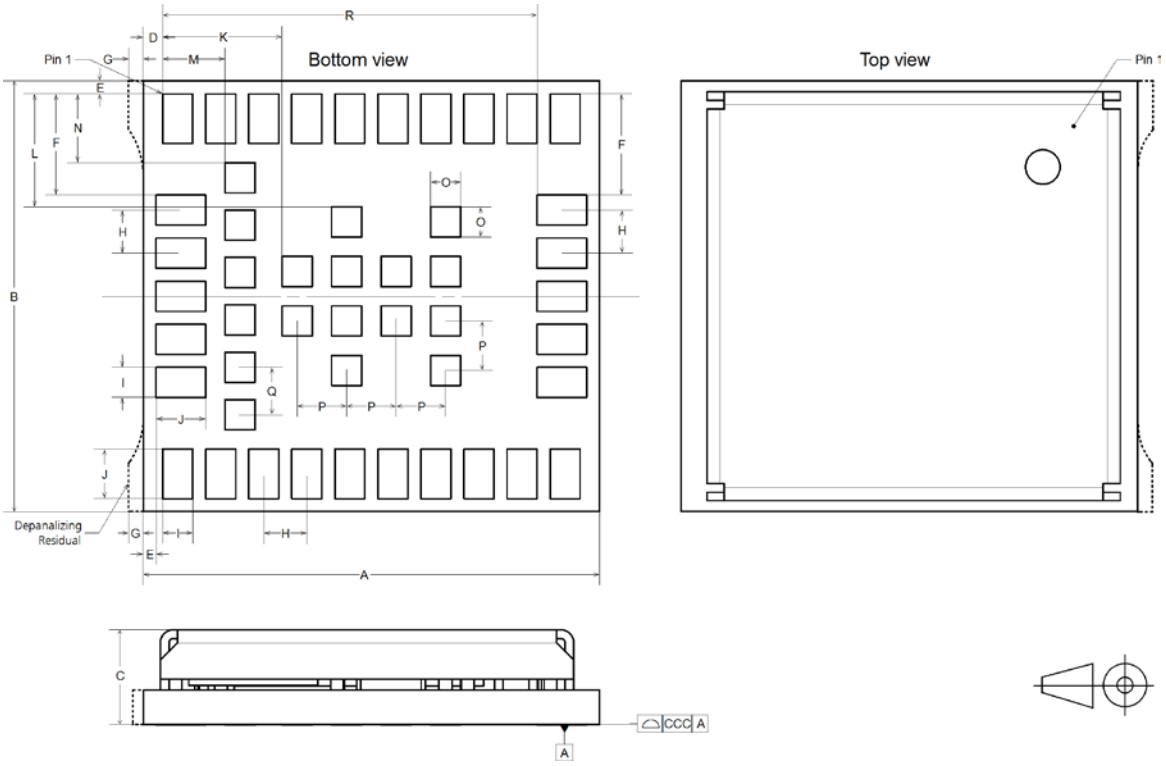


Figure 3: \NINA-W131 mechanical outline

Parameter	Description	Typical		Tolerance	
A	Module PCB Length [mm]	10.6	(417.3 mil)	+0.20/-0.10	(+7.9/-3.9 mil)
B	Module PCB Width [mm]	10.0	(393.7 mil)	+0.20/-0.10	(+7.9/-3.9 mil)
C	Module Thickness [mm]	2.2	(86.6 mil)	+0.40/-0.20	(+15.8/-7.9 mil)
ccc	Seating Plane Coplanarity [mm]	0.10	(3.9 mil)	+0.02/-0.10	(+0.8/-3.9 mil)
D	Horizontal Edge to Lateral Pin No 1 Edge [mm]	0.45	(17.7 mil)	+0.10/-0.10	(+3.9/-3.9 mil)
E	Vertical and Horizontal Edge to Lateral Pin No 1 Edge [mm]	0.30	(11.8 mil)	+0.10/-0.10	(+3.9/-3.9 mil)
F	Vertical Pin No1 Edge to Lateral Pin Edge [mm]	2.35	(92.5 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
G	Depanalizing Residual [mm]	0.10	(3.9 mil)	+0.25/-0.10	(+9.8/-3.9 mil)
H	Lateral and Antenna Row Pin to Pin Pitch [mm]	1.0	(39.4 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
I	Lateral and Antenna Row Pin Width [mm]	0.70	(27.6 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
J	Lateral and Antenna Row Pin Height [mm]	1.15	(45.3 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
K	Horizontal Pin No1 Edge to Central Pin Edge [mm]	2.78	(109.4 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
L	Vertical Pin No1 Edge to Central Pin Edge [mm]	2.63	(103.5 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
M	Horizontal Pin No1 Edge to Inner Row Pin Edge [mm]	1.45	(57.1 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
N	Vertical Pin No1 Edge to Inner Row Pin Edge [mm]	1.6	(63.0 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
O	Central Pin and Inner Row Width and Height [mm]	0.70	(27.6 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
P	Central Pin to Central Pin Pitch [mm]	1.15	(45.3 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
Q	Inner Row Pin to Pin Pitch [mm]	1.1	(43.3 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
R	Horizontal Pin No1 Edge to Antenna Row Pin Edge [mm]	8.7	(342.5 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
	Module Weight [g]	<1.0			

Table 17: NINA-W131 mechanical outline data

5.2 NINA-W132 Mechanical specification

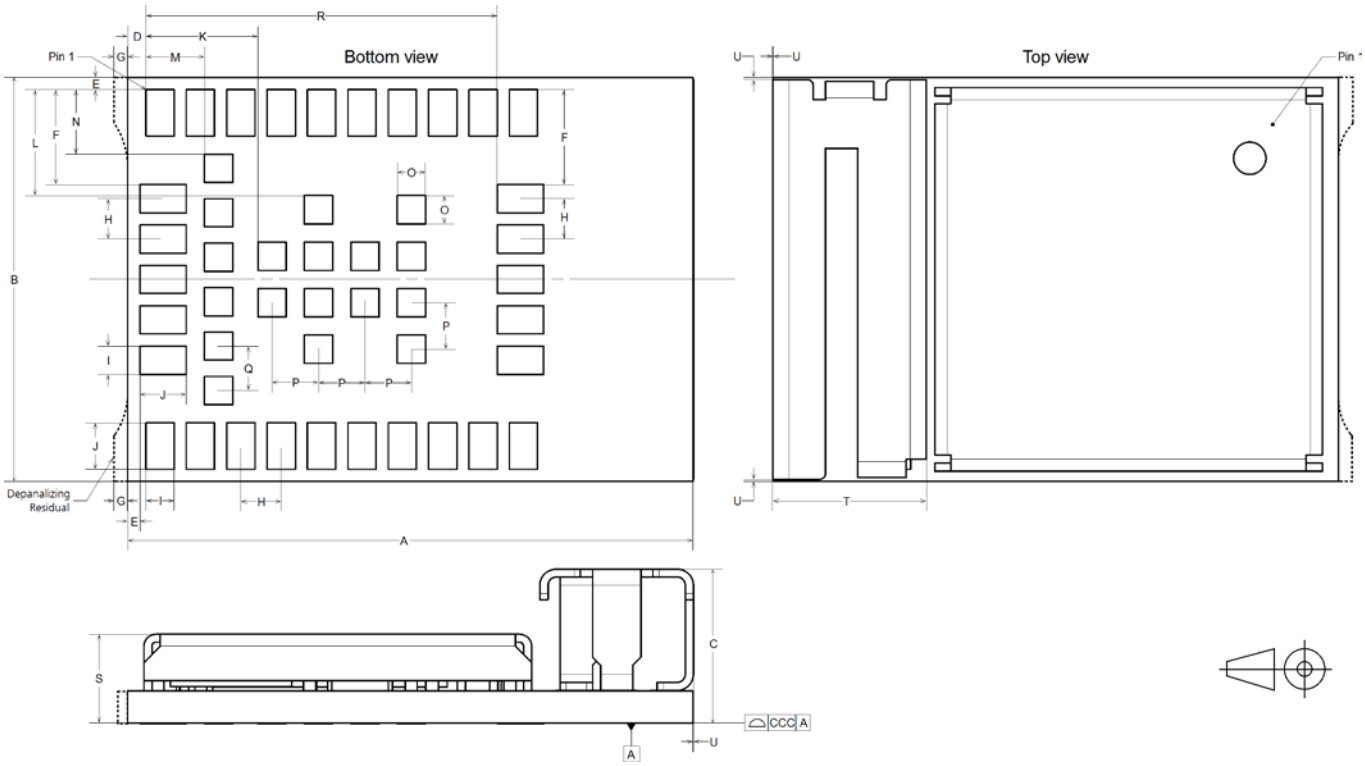


Figure 4: NINA-W132 mechanical outline

Parameter	Description	Typical		Tolerance	
A	Module PCB Length [mm]	14.0	(551.2 mil)	+0.20/-0.10	(+7.9/-3.9 mil)
B	Module PCB Width [mm]	10.0	(393.7 mil)	+0.20/-0.10	(+7.9/-3.9 mil)
C	Module Thickness [mm]	3.8	(149.6 mil)	+0.40/-0.20	(+15.8/-7.9 mil)
ccc	Seating Plane Coplanarity [mm]	0.10	(3.9 mil)	+0.02/-0.10	(+0.8/-3.9 mil)
D	Horizontal Edge to Lateral Pin No 1 Edge [mm]	0.45	(17.7 mil)	+0.10/-0.10	(+3.9/-3.9 mil)
E	Vertical and Horizontal Edge to Lateral Pin No 1 Edge [mm]	0.30	(11.8 mil)	+0.10/-0.10	(+3.9/-3.9 mil)
F	Vertical Pin No1 Edge to Lateral Pin Edge [mm]	2.35	(92.5 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
G	Depanalizing Residual [mm]	0.10	(3.9 mil)	+0.25/-0.10	(+9.8/-3.9 mil)
H	Lateral and Antenna Row Pin to Pin Pitch [mm]	1.0	(39.4 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
I	Lateral and Antenna Row Pin Width [mm]	0.70	(27.6 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
J	Lateral and Antenna Row Pin Height [mm]	1.15	(45.3 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
K	Horizontal Pin No1 Edge to Central Pin Edge [mm]	2.78	(109.4 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
L	Vertical Pin No1 Edge to Central Pin Edge [mm]	2.63	(103.5 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
M	Horizontal Pin No1 Edge to Inner Row Pin Edge [mm]	1.45	(57.1 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
N	Vertical Pin No1 Edge to Inner Row Pin Edge [mm]	1.6	(63.0 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
O	Central Pin and Inner Row Width and Height [mm]	0.70	(27.6 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
P	Central Pin to Central Pin Pitch [mm]	1.15	(45.3 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
Q	Inner Row Pin to Pin Pitch [mm]	1.1	(43.3 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
R	Horizontal Pin No1 Edge to Antenna Row Pin Edge [mm]	8.7	(342.5 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
S	PCB and Shield Cover Thickness [mm]	2.2	(86.6 mil)	+0.40/-0.20	(+15.8/-7.9 mil)
T	Module Antenna Width [mm]	3.8	(149.6 mil)	+0.20/-0.20	(+7.9/-7.9 mil)
U	Antenna overhang outside module outline on any side [mm]	0.0	(0.0 mil)	+0.60	(+23.6 mil)
	Module Weight [g]	<1.0			

Table 18: NINA-W132 mechanical outline data

6 Qualification and approvals

Approvals are pending.

The NINA-W1 series modules are in development status as mentioned in the table on page 2. Hence, the information in this section will be valid and available only when the module is fully tested and approved in the Initial Production stage.

6.1 Compliance with the RoHS directive

The NINA-W1 series modules comply with the "Directive 2011/65/EU of the European Parliament and the Council on the Restriction of Use of certain Hazardous Substances in Electrical and Electronic Equipment" (RoHS).

No natural rubbers, hygroscopic materials, or materials containing asbestos are employed.

6.2 European Union regulatory compliance

Approvals are pending.

The NINA-W1 series modules are in development status as mentioned in the table on page 2. Hence, the information in this section will be valid and available only when the module is fully tested and approved in the Initial Production status.

The NINA-W1 module will comply with the essential requirements and other relevant provisions of Radio Equipment Directive (RED) 2014/53/EU.

6.3 Safety Compliance

In order to fulfill the safety standard EN 60950-1, the NINA-W1 series modules must be supplied with a Class-2 Limited Power Source.

6.4 FCC/IC Compliance

Approvals are pending.

The NINA-W1 series modules are in development status as mentioned in the table on page 2. Hence, the information in this section will be valid and available only when the module is fully tested and approved in the Initial Production status.

This device complies with Part 15 of the FCC Rules and with Industry Canada license-exempt RSS standard(s).

Model	FCC ID	IC ID
NINA-W1	XPYNINAW1	8595A-NINAW1

Table 19: FCC and IC IDs for different models of the NINA-W1 series modules

For more information about compliance with FCC/IC regulations for the NINA-W1 module, see the *NINA-W1 Series System Integration Manual [1].*

6.5 Japan radio equipment compliance

Approvals are pending.

The NINA-W1 series modules are in development status as mentioned in the table on page 2. Hence, the information in this section will be valid and available only when the module is fully tested and approved in the Initial Production status.

For information about compliance of the NINA-W1 module with the Giteki certification, see the *NINA-W1 Series System Integration Manual [1]*.

7 Antennas

Approvals are pending.

The NINA-W1 series modules are in development status as mentioned in the table on page 2. Hence, the information in this section will be valid and available only when the module is fully tested and approved in the Initial Production stage.

This chapter gives an overview of the different external antennas that can be used together with the module.

7.1 Antenna accessories

Name	U.FL to SMA adapter cable
Connector	U.FL and SMA jack (outer thread and pin receptacle)
Impedance	50 Ω
Minimum cable loss	0.5 dB, The cable loss must be above the minimum cable loss to meet the regulatory requirements. Minimum cable length 100 mm.
Comment	The SMA connector can be mounted in a panel. See *NINA-W1 series System Integration Manual [1]* for information how to integrate the U.FL connector.
Approval	

Name	U.FL to Reverse Polarity SMA adapter cable
Connector	U.FL and Reverse Polarity SMA jack (outer thread and pin)
Impedance	50 Ω
Minimum cable loss	0.5 dB, The cable loss must be above the minimum cable loss to meet the regulatory requirements. Minimum cable length 100 mm.
Comment	The Reverse Polarity SMA connector can be mounted in a panel. See *NINA-W1 series System Integration Manual [1]* for information how to integrate the U.FL connector. It is required to followed this reference design to comply with the LILY-W1 FCC/IC modular approvals.
Approval	

7.2 Approved antennas

7.2.1 Single band antennas

NINA-W102 / NINA-W132	
Manufacturer	ProAnt
Gain	TBD
Impedance	50 Ω
Size (HxWxL)	3.0x3.8x9.9 mm
Type	PIFA
Comment	SMD PIFA antenna on NINA-W102 / NINA-W132. Should not be mounted inside a metal enclosure, see section for more info 2.5.1.
Approval	

Ex-IT 2400 RP-SMA 28-001	
Manufacturer	ProAnt
Polarization	Vertical
Gain	+3.0 dBi
Impedance	50 Ω
Size	Ø 12.0 x 28.0 mm
Type	Monopole
Connector	Reverse Polarity SMA plug (inner thread and pin receptacle).
Comment	This antenna requires to be mounted on a metal ground plane for best performance. To be mounted on the U.FL to Reverse Polarity SMA adapter cable. An SMA version antenna is also available but not recommended for use (Ex-IT 2400 SMA 28-001).
Approval	

ANT-2.4-CW-RH-RPS	
Manufacturer	Linx
Polarization	Vertical
Gain	-1.0 dBi
Impedance	50 Ω
Size	Ø 7.4 x 27.0 mm
Type	Monopole
Connector	Reverse Polarity SMA plug (inner thread and pin receptacle).
Comment	To be mounted on the U.FL to Reverse Polarity SMA adapter cable. An SMA version antenna is also available but not recommended for use (ANT-2.4-CW-RH-SMA).
Approval	

Ex-IT 2400 MHF 28	
Manufacturer	ProAnt
Polarization	Vertical
Gain	+2.0 dBi
Impedance	50 Ω
Size	Ø 12.0 x 28.0 mm
Type	Monopole
Cable length	100 mm
Connector	U.FL. connector
Comment	This antenna requires to be mounted on a metal ground plane for best performance. To be mounted on a U.FL connector. See *NINA-W1 series System Integration Manual [1]* for information how to integrate the U.FL connector. It is required to followed this reference design to comply with the NINA -W1 FCC/IC modular approvals.
Approval	

Ex-IT 2400 RP-SMA 70-002	
Manufacturer	ProAnt
Polarization	Vertical
Gain	+3.0 dBi
Impedance	50 Ω
Size	Ø 10 x 83 mm
Type	Monopole
Connector	Reverse Polarity SMA plug (inner thread and pin receptacle)
Comment	To be mounted on the U.FL to Reverse Polarity SMA adapter cable. An SMA version antenna is also available but not recommended for use (Ex-IT 2400 SMA 70-002).
Approval	

Ex-IT 2400 MHF 70-001	
Manufacturer	ProAnt
Polarization	Vertical
Gain	+3.0 dBi
Impedance	50 Ω
Size	Ø 9.4 x 70.5 mm
Type	Monopole
Cable length	100 mm
Connector	U.FL. connector
Comment	To be mounted on a U.FL connector. See *NINA-W1 series System Integration Manual [1]* for information how to integrate the U.FL connector. It is required to followed this reference design to comply with the NINA -W1 FCC/IC modular approvals.
Approval	

InSide-2400	
Manufacturer	ProAnt
Gain	+3.0 dBi
Impedance	50 Ω
Size	27 x 12 mm (triangular)
Type	Patch
Cable length	100 mm
Connector	U.FL. connector
Comment	Should be attached to a plastic enclosure or part for best performance. To be mounted on a U.FL connector. See *NINA-W1 series System Integration Manual [1]* for information how to integrate the U.FL connector. It is required to followed this reference design to comply with the NINA -W1 FCC/IC modular approvals.
Approval	

FlatWhip-2400	
Manufacturer	ProAnt
Gain	+3.0 dBi
Impedance	50 Ω
Size	Ø 50.0 x 30.0 mm
Type	Monopole
Connector	SMA plug (inner thread and pin)
Comment	To be mounted on the U.FL to SMA adapter cable.
Approval	

Outside-2400	
Manufacturer	ProAnt
Gain	+3.0 dBi
Impedance	50 Ω
Size	36.0 x 18.0 x 16.0 mm
Type	Patch
Cable length	70 mm
Connector	U.FL. connector
Comment	To be mounted on a U.FL connector. See *NINA-W1 series System Integration Manual [1]* for information how to integrate the U.FL connector. It is required to followed this reference design to comply with the NINA -W1 FCC/IC modular approvals.
Approval	

7.2.2 Dual-band antennas

InSide-WLAN	
Manufacturer	ProAnt
Gain	+3.0 dBi
Impedance	50 Ω
Size	27 x 12 mm (triangular)
Type	Patch
Cable length	100 mm
Connector	U.FL. connector
Comment	Should be attached to a plastic enclosure or part for best performance. Dual-band (2.4 GHz / 5 GHz) antenna to be mounted on a U.FL connector. See *NINA-W1 series System Integration Manual [1]* for information how to integrate the U.FL connector. It is required to followed this reference design to comply with the NINA-W1 FCC/IC modular approvals.
Approval	

InSide-WLAN Square	
Manufacturer	ProAnt
Gain	+3.0 dBi
Impedance	50 Ω
Size	24x22x1 mm with mounting hole
Type	Patch
Cable length	100 mm
Connector	U.FL. connector
Comment	Should be attached to a plastic enclosure or part for best performance. Dual-band (2.4 GHz / 5 GHz) antenna to be mounted on a U.FL connector. See *NINA-W1 series System Integration Manual [1]* for information how to integrate the U.FL connector. It is required to followed this reference design to comply with the NINA-W1 FCC/IC modular approvals.
Approval	

Ex-IT WLAN RPSMA	
Manufacturer	ProAnt
Type	½ wave dipole dual-band antenna
Polarization	Vertical
Gain	+3 dBi
Impedance	50 Ω
Size	107 mm (Straight)
Type	Monopole
Connector	Reverse Polarity SMA plug (inner thread and pin receptacle)
Comment	To be mounted on the U.FL to Reverse Polarity SMA adapter cable.
Approval	

7.3 NINA-W132 radiation patterns

The below radiation patterns show the relative output power of an EVB-NINA-W132 transmitting at 0 dBm output power. Both horizontal and vertical antenna polarizations were used. The NINA-W1 module was rotated 360° around the azimuth axis while being kept at 0°, 90° and 180° elevation as shown in Figure 5.

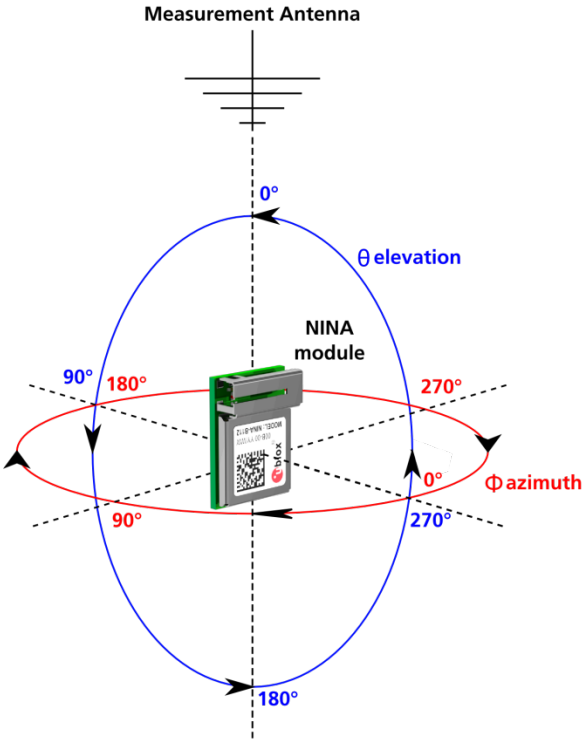


Figure 5: Azimuth and elevation rotation axes relative to the measurement antenna

8 Product handling

8.1 Packaging

The NINA-W1 series modules are in development status as mentioned in the table on page 2. Hence, the information in this section will be valid and available only when the module is fully tested and approved in the Initial Production stage.

8.1.1 Reels

The NINA-W1 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].

NINA-W1 modules are deliverable in quantities of 500 pieces on a reel. The reel types for the NINA-W1 modules are provided in Table 20 and detailed information about the reel types are described in *u-blox Package Information Guide [2].*

Model	Reel Type
NINA-W131	B
NINA-W132	A

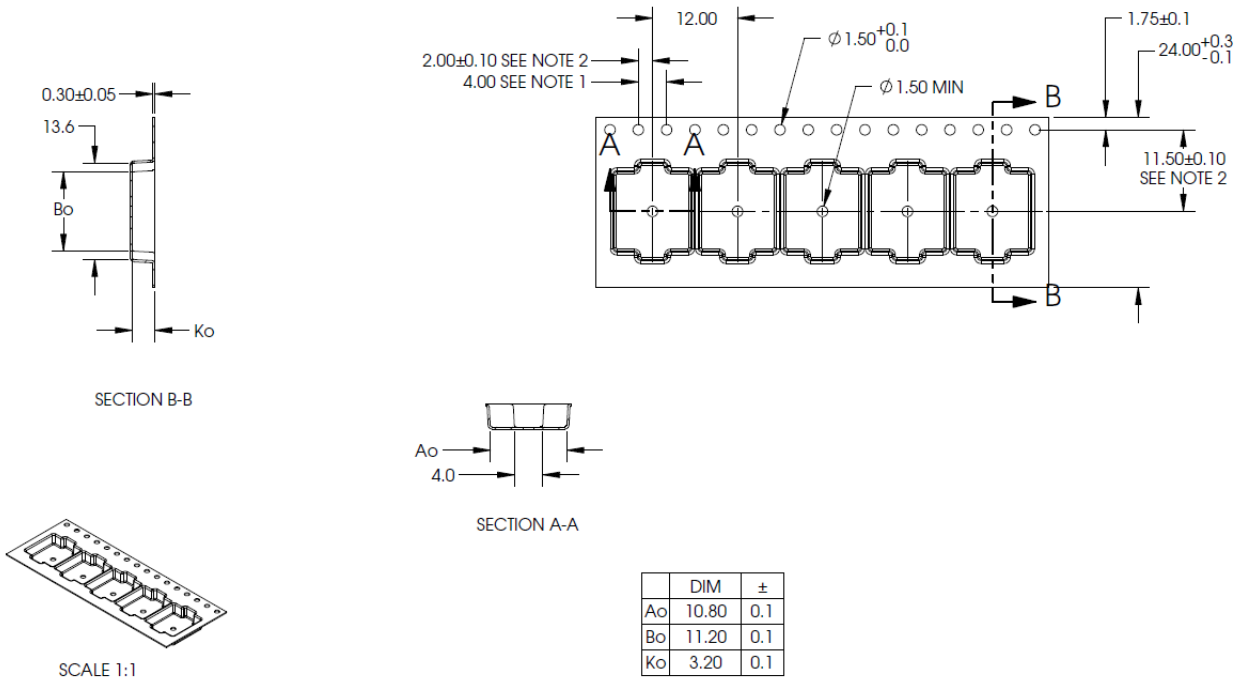
Table 20: Reel types for different models of the NINA-W1 series

8.1.2 Tapes

Figure 6 and Figure 7 shows the position and orientation of the NINA-W1 modules as they are delivered on tape. The dimensions of the tapes are specified in Figure 8 and Figure 9.

Figure 6: Orientation of NINA-W131 module on tape

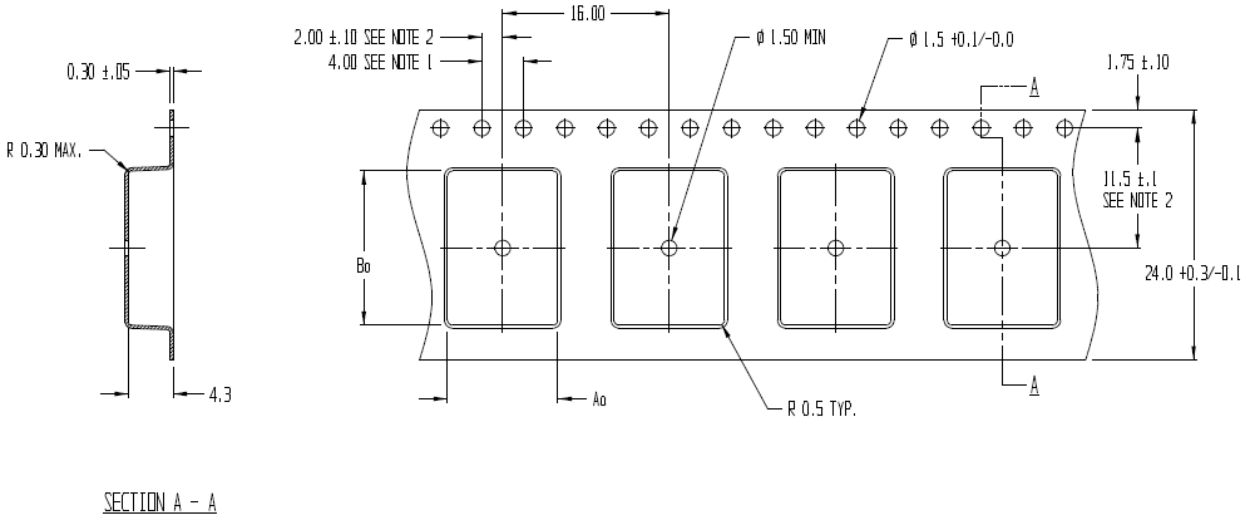
Figure 7: Orientation of NINA-W132 module on tape



	DIM	±
Ao	10.80	0.1
Bo	11.20	0.1
Ko	3.20	0.1

NOTES:
1. 10 SPROCKET HOLE PITCH CUMULATIVE TOLERANCE ±0.2
2. POCKET POSITION RELATIVE TO SPROCKET HOLE MEASURED AS TRUE POSITION OF POCKET, NOT POCKET HOLE.
3. Ao AND Bo ARE MEASURED ON A PLANE AT A DISTANCE "R" ABOVE THE BOTTOM OF THE POCKET.

Figure 8: NINA-W131 tape dimension



Ao = 10.6
Bo = 14.8
Ko = 4.3

NOTES:
1. 10 SPROCKET HOLE PITCH CUMULATIVE TOLERANCE ±0.2
2. POCKET POSITION RELATIVE TO SPROCKET HOLE MEASURED AS TRUE POSITION OF POCKET, NOT POCKET HOLE
3. Ao AND Bo ARE CALCULATED ON A PLANE AT A DISTANCE "R" ABOVE THE BOTTOM OF THE POCKET.

Figure 9: NINA-W132 tape dimension

8.2 Moisture sensitivity levels

The NINA-W1 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 NINA-W1 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.

8.3 Reflow soldering

Reflow profiles are to be selected according to u-blox recommendations. See *NINA-W1 series System Integration Manual [1]* for more information.

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

8.4 ESD precautions

The NINA-W1 series modules contain highly sensitive electronic circuitry and are Electrostatic Sensitive Devices (ESD). Handling the NINA-W1 series modules without proper ESD protection may destroy or damage them permanently.

The NINA-W1 series modules are electrostatic sensitive devices (ESD) and require special ESD precautions typically applied to ESD sensitive components. Section 4.1.1 provides the maximum ESD ratings of the NINA-W1 series modules.

Proper ESD handling and packaging procedures must be applied throughout the processing, handling and operation of any application that incorporates the NINA-W1 series module. The ESD precautions should be implemented on the application board where the module is mounted as described in the *NINA-W1 series System Integration Manual [1]*.

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

9 Labeling and ordering information

9.1 Product labeling

The labels of the NINA-W1 series modules include important product information as described in this section.

Figure 8 illustrates the label of all the NINA-W1 series modules, which includes product type number and revision, production date, Data Matrix with unique serial number (MAC address) and the u-blox logo.

Figure 10: Location of product type number on the NINA-W1 series module label

Reference	Description
1	Date of unit production encoded YY/WW (year, week)
2	Major and minor product version info
3	Product model name
4	Data Matrix with unique serial number of 19 alphanumeric symbols. The 3 first symbols represent the unique module type number: 866: NINA-W131 867: NINA-W132 The next 12 symbols represent the unique hexadecimal Wi-Fi MAC address of the module AABBCCDDEEFF, and the last 4 symbols represent the hardware and software version encoded HHFF. See section 1.10 for more information about MAC addresses.
5	u-blox logo. The red dot is also indicating pin no 1.

Table 21: NINA-W1 series label description

9.2 Explanation of codes

Three different product code formats are used. The **Product Name** is used in documentation such as this data sheet and identifies all u-blox products, independent of packaging and quality grade. The **Ordering Code** includes options and quality, while the **Type Number** includes the hardware and software versions. Table 22 below details these three different formats:

Format	Structure
Product Name	PPPP-TGVV
Ordering Code	PPPP -TGVV-TTQ
Type Number	PPPP -TGVV-TTQ-XX

Table 22: Product code formats

Table 23 explains the parts of the product code.

Code	Meaning	Example
PPPP	Form factor	NINA
TG	Platform (Technology and Generation) T – Dominant technology, For example, W: Wi-Fi, B: Bluetooth G - Generation	W1: Wi-Fi Generation 1
VV	Variant based on the same platform; range [00…99]	31: u-blox connectivity product with antenna pin
TT	Major Product Version	00: first revision
Q	Quality grade • A: Automotive • B: Professional • C: Standard	B: professional grade
XX	Minor product version (not relevant for certification)	Default value is 00

Table 23: Part identification code

9.3 Ordering information

Ordering Code	Product
NINA-W131-00B-00	Wi-Fi IEEE802.11b/g/n module with antenna pin. With u-blox connectivity software including secure boot.
NINA-W132-00B-00	Wi-Fi IEEE802.11b/g/n module with internal onboard antenna. With u-blox connectivity software including secure boot.

Table 24: Product ordering codes

Appendix

A Glossary

Abbreviation	Definition
ADC	Analog to Digital Converter
BPF	Band Pass Filter
CTS	Clear To Send
DAC	Digital to Analog Converter
DC	Direct Current
DSR	Data Set Ready
DTR	Data Terminal Ready
ESD	Electro Static Discharge
FCC	Federal Communications Commission
GATT	Generic ATTribute profile
GND	Ground
GPIO	General Purpose Input/Output
I	Input (means that this is an input port of the module)
I^2C	Inter-Integrated Circuit
IC	Industry Canada
IEEE	Institute of Electrical and Electronics Engineers
IoT	Internet of Things
L	Low
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
O	Output (means that this is an output port of the module)
PCN/IN	Product Change Notification / Information Note
PD	Pull-Down
PRD	Product Requirement Document
PU	Pull-Up
QSPI	Quad Serial Peripheral Interface
RED	Radio Equipment Directive
RMII	Reduced Media Independent Interface
RTS	Request To Send
RXD	Receive Data
SoC	System-on-Chip or
TBD	To be Defined
TXD	Transmit Data
UART	Universal Asynchronous Receiver/Transmitter

Table 25: Explanation of abbreviations used

Related documents

[1] NINA-W1 Series System Integration Manual, document number UBX-17005730

[2] u-blox Package Information Guide, document number UBX-14001652

[3] u-blox Short Range AT Commands Manual, document number UBX-14044127

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

Revision history

Revision	Date	Name	Comments
R01	23-Mar-2017	mwej	Initial release.
R02	30-Jun-2017	mwej	Updated the product status to Engineering Sample. Added information about band pass filter (sections 1.4 and 2.5). Updated maximum UART speed to 921600 bps (section 2.7.1). Updated best conducted Wi-Fi sensitivity to -96 dBm (sections 1.6.1 and 4.2.7). Updated the information in section 6.2.

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