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UWM210A, UWB (SR040) + BLE SoC (QN9090) Module

Applications

- ✓ IoT applications with coin cell battery
- ✓ UWB Trackers
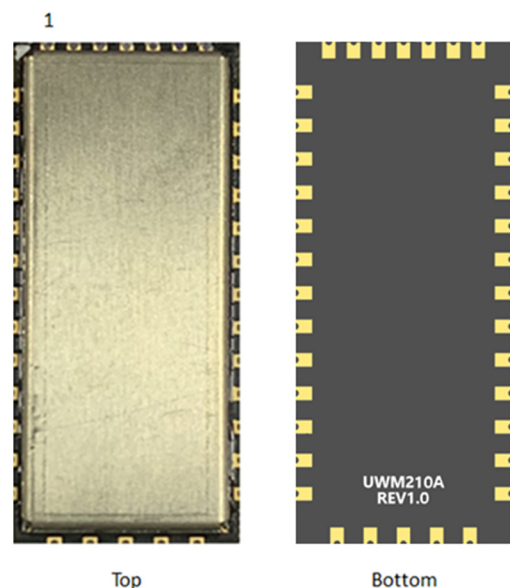- ✓ UWB Tags

Features & Supports

- ✓ UWB Transceiver: NXP SR040
- ✓ BLE SoC: NXP QN9090
- ✓ IEEE 802.15.4z HRP PHY compliant
- ✓ 6.24GHz to 8.24GHz UWB band
- ✓ 2.4GHz Bluetooth LE 5.0 Compliant
- ✓ Ranging technology

    Two Way Ranging (TWR)

    Time Difference of Arrival (TDoA)

- ✓ Reliable ranging accuracy <±10cm
- ✓ Low power consumption to support coin-cell battery operating
- ✓ Integrated all required RF components
- ✓ Interfaces: UART, I2C, SPI, SWD, GPIOs
- ✓ Supply Voltage: 3.3V
- ✓ Size [mm]: 13.0 (W) X 30.0 (L) X 2.8 (H)

Descriptions

UWM210A module provides UWB and BLE wireless solution with configurations of NXP UWB transceiver IC, SR040 and NXP BLE SoC chip, QN9090 on board.

NXP SR040, a UWB controller provides highly reliable UWB ranging technologies like TWR and TDoA ranging achieving an accuracy of <±10cm in non-line of sight. The distance estimate is based on a Time of Flight measurement. Time of Flight-based distance bounding improves the measured distance with ultra-high reliability compared to an RSSI-based distance measurement. NXP QN9090 is a host processor supporting Bluetooth LE 5.0. It controls UWB IC via SPI interface on module.
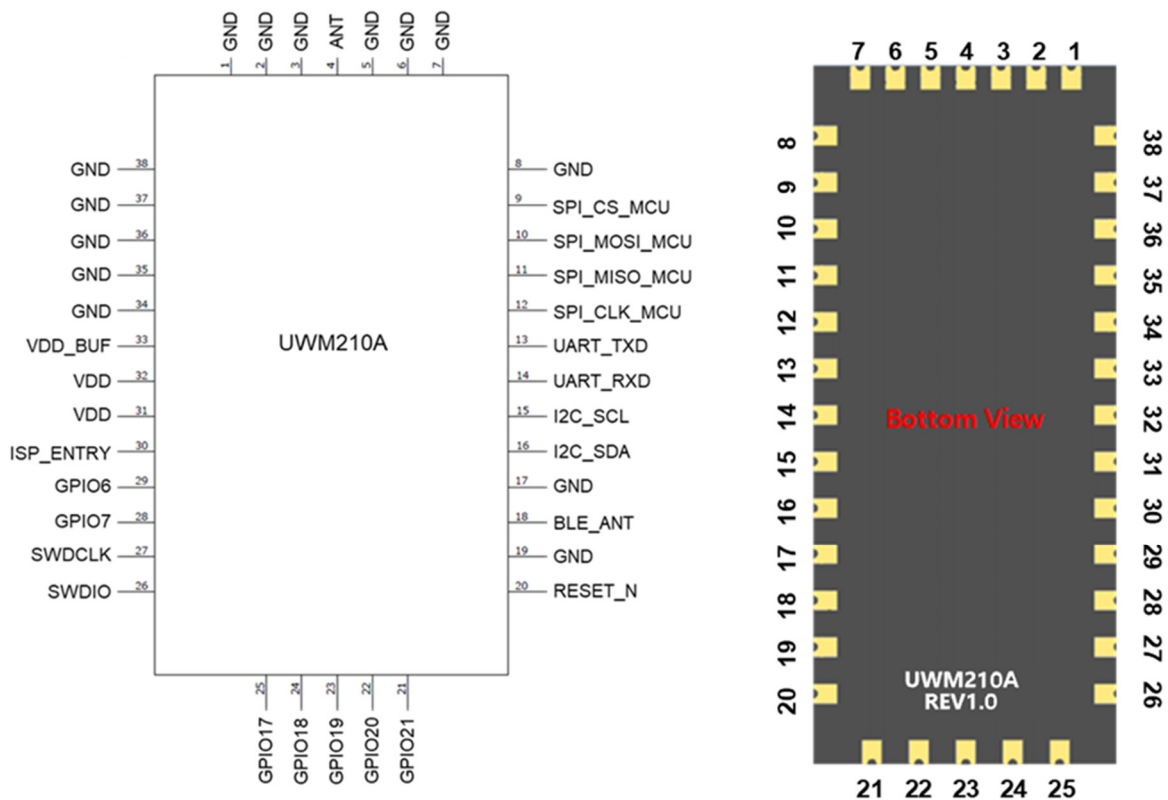
UWM210A module is designed to enable providing highly accurate ranging with these UWB technologies in IoT environment

Top   Bottom

The UWM210 module consists of the following components:

- ✓ QN9090, Bluetooth Low Energy 5.0 wireless MCU

- ✓ SR040, Ultra-Wideband Transceiver

- ✓ UWB RF bandpass filter

- ✓ 3 crystals for reference clock of transceiver IC and MCU

Pin Descriptions

UWM210A Pin Descriptions

Pin	Name	Type	Description
1	GND	-	Ground

2	GND	-	Ground
3	GND	-	Ground
4	UWB_ANT	RF In/Out	UWB RF TX Output/ RX Input
5	GND	-	Ground
6	GND	-	Ground
7	GND	-	Ground
8	GND	-	Ground
9	SPI_CS	Digital In/out	Serial Peripheral Interface-bus, Chip Select
10	SPI_MOSI	Digital In/out	Serial Peripheral Interface-bus, Master Output / Slave Input
11	SPI_MISO	Digital In/out	Serial Peripheral Interface-bus, Master Input / Slave Output
12	SPI_CLK	Digital In/out	Serial Peripheral Interface-bus, Clock
13	UART_TXD	Digital Output	UART Transmit Data Output
14	UART_RXD	Digital Input	UART Receiver Data Input
15	I2C_SCL	Digital In/out	I^{2}C-Bus master/slave SCL Input / Output
16	I2C_SDA	Digital In/out	I^{2}C-Bus master/slave SDA Input / Output
17	GND	-	Ground
18	BLE_ANT	RF In/Out	Bluetooth LE RF TX Output/ RX Input
19	GND	-	Ground
20	RESET_N	Digital In	Reset signal; Active low
21	GPIO21	Digital In/out	GPIO Input/ Output
22	GPIO20	Digital In/out	GPIO Input/ Output
23	GPIO19	Digital In/out	GPIO Input/ Output
24	GPIO18	Digital In/out	GPIO Input/ Output
25	GPIO17	Digital In/out	GPIO Input/ Output
26	SWDIO	Digital In/out	Serial Wire Data Input/ Output
27	SWCLK	Digital In/out	Serial Wire Clock Input/ Output
28	GPIO7	Digital In/out	GPIO Input/ Output
29	GPIO6	Digital In/out	GPIO Input/ Output
30	ISP ENTRY	Digital In	Enter ISP_ENTRY mode in active low on boot up.
31	VDD	Supply In	+3.3V Input supply
32	VDD	Supply In	+3.3V Input supply
33	VDD_BUF	Supply In	Buffer capacitor connection pin. When coin cell battery is used, connect buffer capacitor to VDD_BUF pin. When regulated supply is used, connect between VBAT and VDD_BUF.
34	GND	-	Ground
35	GND	-	Ground

36	GND	-	Ground
37	GND	-	Ground
38	GND	-	Ground

Electrical Specifications

Absolute Maximum Ratings

Symbol	Parameter	Min.	Max.	Unit.
V_{DD}	Supply voltage	-	3.96	V
V_{IO}	IO pins voltage	-	3.96	V
T_{stg}	Storage temperature	-40	+ 85	°C
V_{ESD}	Static Discharge Voltage*		±2	KV

* System level ESD : IEC 61000-4-2; C = 150pF, R = 330Ω

Recommended Operating Conditions

Symbol	Parameter	Min.	Max.	Unit.
V_{in}	Input voltage	2.8	3.6	V
V_{IO}	IO pins voltage	2.8	3.6	V
T_A	Operating ambient temperature	-30	+ 85	°C

Electrical Reference data – UWB

Parameter	Conditions	Min.	Typ	Max.	Unit.
Freq. Range	Operating frequency	6.24		8.24	GHz
Output Power	Calibrated power (RMS) at FCC limit			-41.3	dBm/MHz
Sensitivity	Ch5, 6.8Mbps data rate		-93		dBm
	Ch9, 6.8Mbps data rate		-91		dBm
ToF Accuracy	Line of sight accuracy when STS is used. [1]	-10		10	cm

 [1] The ToF performance is measured and verified in conducted and radiated test environment using UWM2X0 evaluation platform connected to UWB antennas. More details can be found in the application note 'AoA, ToF Performance Report'

Electrical Reference data – BLE RF

Parameter	Conditions	Min.	Typ	Max.	Unit.
Freq. Range	Operating frequency	2.40		2.48	GHz
Output Power	@Radiated Power		9		dBm
Sensitivity			-96		dBm

Electrical Reference data – Power consumption

@VDD=3.3V, T_A=25℃

Parameter	Conditions	Min.	Typ	Max.	Unit.
UWB / Peak Current RX	RX @9-channel(7.987GHz)	-	136	-	mA
UWB / Peak Current TX	TX Max output power @9-channel(7.987GHz)	-	117	-	mA
	TX Calibrated power (RMS) at FCC limit @9-channel(7.987GHz)	-	105	-	mA
UWB / DS-TWR average current consumption during active ranging	Controller/initiator average current consumption @9-channel(7.987GHz)	-	25	-	mA
UWB / DS-TWR average current consumption for 100ms ranging block	Controller/initiator average current consumption @9-channel(7.987GHz)	-	22	-	mA
UWB / DS-TWR Peak current with current limiter enabled[1]	Controller/initiator peak current consumption @Current limiter is set to '0x14', 9-channel(7.987GHz)	-	25	-	mA
	Controller/initiator peak current consumption @Current limiter is set to '0x0F', 9-channel(7.987GHz)	-	20	-	mA
BLE / TX Average Current	@19Channel(2440MHz), 1M, Max Power(+15dBm), PRBS9 random-payload	-	21	-	mA
BLE / TX (CW Mode) Average Current	@19Channel(2440MHz), 1M, Max Power(+15dBm)	-	27	-	mA
BLE / RX Average Current	@1Channel(2404MHz), 1M, RX Trigger mode test	-	13	-	mA
BLE / RX (Continuous) Average Current	@1Channel(2404MHz), 1M, RX Continuous mode test	-	14	-	mA
Supply Current	Active State, CPU Idle	-	4	-	mA
Sleep mode	@QN9090_Deep Power Down Mode	-	800	-	nA

[1] Using the coin cell battery (Voltage at TEST of the coin cell battery = 3.262V).

Configurable current limit from 15mA to 20 mA, in steps of 1 mA.

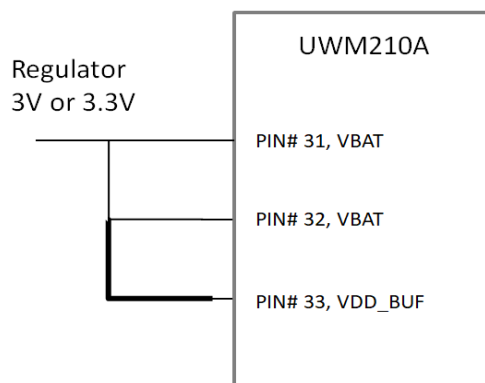# Mechanical Specifications

TOP VIEW

BOTTOM VIEW

SIDE VIEW

Reference Circuit

Power management circuit according to external power supply use cases

1) Supplied with regulated 3V (3.3V) supply

   When the UWM210A is supplied by a regulated supplied (with appreciate peak current capability) then VBAT pins (pin31 and pin32) and VDD_BUF pin (pin33) have to be connected externally to same supply source.
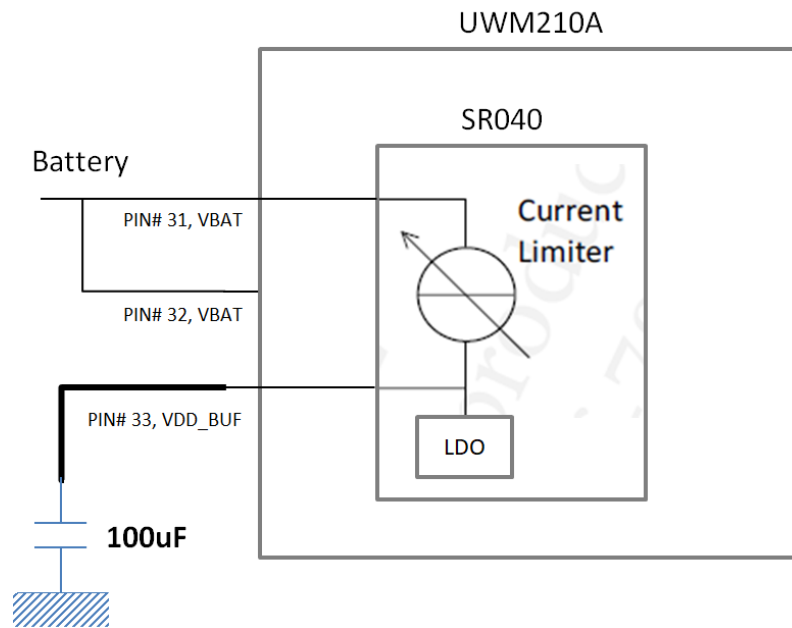

2) Supplied with battery

   In case of the UWM210A is supplied by a battery with limited peak current capability such as coin-cell, then current limiter built in SR040 IC of this module should be enabled and decoupling capacitor values should be adjusted. Due to typical coin cell battery cannot provide a high peak current in operating UWB use cases, the current limiter is intended to avoid exceeding battery capability, minimizes battery stress and maximizes the lifetime of it.

   The current limiter of SR040 chip is internally connected between VBAT_IO and VDD_BUF. In external circuit of module, it is only needed a buffer capacitor connected to VDD_BUF pin (pin#33) as following picture.

The buffer capacitor size is typically required 100uF(± 10%) when coin cell battery powered. The capacitor size is a critical value as the ranging energy is temporarily stored here. For practical implementations, it is a critical component due to costs and required board space. Reducing the capacitor value will on one side reduce the physical dimensions, on the other side it will also lead to a faster and deeper voltage drop during the transmission or reception of a ranging frame.

For stable operation the ranging sequence and the buffer capacitor size must be adjusted in a way that the minimal buffer capacitor voltage (VDD_BUF) will never drop below 1.8 V

FCC Part 15.19

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

FCC Part 15.21

Any changes or modifications(including the antennas) to this device that are not expressly approved by the manufacturer may void the user's authority to operate the equipment.

FCC Information to User

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may

cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

·Reorient or relocate the receiving antenna.

·Increase the separation between the equipment and receiver.

·Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

·Consult the dealer or an experienced radio/TV technician for help.

Caution

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

RF Radiation Exposure Statement

This equipment complies with FCC/ISED radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines and RSS-102 of the ISED

radio frequency (RF) Exposure rules as this equipment has very low levels of RF energy.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

IMPORTANT NOTE

This device complies with FCC & ISED radiation exposure limits set forth for an uncontrolled environment. This device should be installed and must not be co-located or operating in conjunction with any other antenna or transmitter.

This device is intended only for OEM integrators under the following conditions:

1) This module may not be co-located with any other transmitters or antennas.

2) The antenna must be installed such that 20cm is maintained between the antenna and users.

As long as 2 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements with this module installed.

In the event that these conditions cannot be met, then the FCC & IC authorizations are no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product including this module and obtaining separate FCC & IC authorizations.

RSS-102 RF Exposure

Cet equipement est conforme aux limites d'exposition aux rayonnements enoncees pour un environnement non controle et respecte les regles les radioelectriques (RF) de la FCC lignes directrices d'exposition et d'exposition aux frequences radioelectriques (RF) CNR-102 de l'IC. Cet equipement emet une energie RF tres faible qui est consideree comme conforme sans evaluation du debit d'absorption specifique (DAS).

§ 15.519 Technical requirements for hand held UWB systems.

(a) UWB devices operating under the provisions of this section must be hand held, i.e., they are

relatively small devices that are primarily hand held while being operated and do not employ a fixed infrastructure.

(1) A UWB device operating under the provisions of this section shall transmit only when it is sending information to an associated receiver. The UWB intentional radiator shall cease transmission within 10 seconds unless it receives an acknowledgement from the associated receiver that its transmission is being received. An acknowledgment of reception must continue to be received by the UWB intentional radiator at least every 10 seconds or the UWB device must cease transmitting.

(2) The use of antennas mounted on outdoor structures, e.g., antennas mounted on the outside of a building or on a telephone pole, or any fixed outdoors infrastructure is prohibited. Antennas may be mounted only on the hand held UWB device.

(3) UWB devices operating under the provisions of this section may operate indoors or outdoors.

UWB. modules can only be granted under the requirements specified in §15.519 (b) – (e) and only used in a host intended to operate under the conditions of §15.519 (a). Host device with potential for outdoor use.

OEM/integrators Installation Manual

the modules limited to OEM installation only

the OEM integrator is responsible for ensuring that the end-user has no manual instruction to remove or install module.

the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

Instructions to the OEM/integrator

The OEM integrator must include the instructions or statements required by part 15.19 and 15.21 in the user manual.

the OEM integrator must include a separate section in the host user's manual concerning the operating conditions to satisfy RF exposure compliance.

there is requirement that the grantee provide guidance to the host manufacturer for compliance with part 15b requirements.

End Product Labeling

To satisfy FCC exterior labeling requirements, the following text must be placed on the exterior of the end product.

Contains Transmitter module FCC ID: 2AS8LUWM210

IC: 25119-UWM210