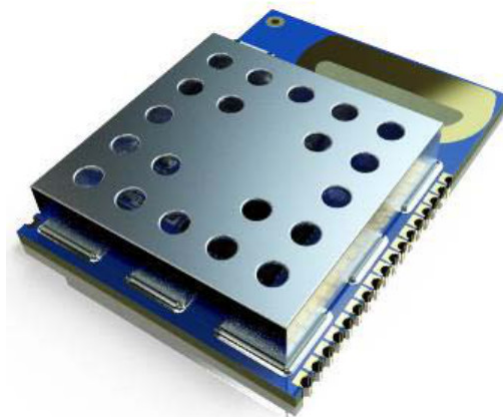


WIZZILAB UM-1 RTLS and Communication Module User Manual

[Home](#) » [WIZZILAB](#) » WIZZILAB UM-1 RTLS and Communication Module User Manual 

WIZZILAB

Connecting Things



U M -1 RTLS and Communication module

Description

The UM-1 Module is a full-function RTLS / wireless modem subsystem in a compact factor, composed of Qorvo DWM1001 hardware, and WizziLab proprietary firmware. The UM-1 module enables customers to quickly get an RTLS system up and running, and also provides additional over-the-air communication capabilities through the UWB, BLE and NFC interfaces. The UWB part of the system is designed to operate on 4.493 GHz (IEEE 802.15.4- 2011, Channel 3) and 6.490 GHz (IEEE 802.15.4- 2011, Channel 5) Nominal Centre Frequencies with a 500 MHz Bandwidth and data rates of 110 kbps and 850 kbps. It also features a BLE modem and a passive NFC-A listening device.



Key Features

Low-latency low-power two-way ranging for RTLS systems with up to 10 cm accuracy. 110 / 850 kbps data rate IEEE 802.15.4-2011. UWB compliant, on channels 3/5. Embedded PCB UWB antenna. DASH7 over UWB communication @ 110 / 850 kbps on channels 3/5. ETSI, FCC, ISSED Certified FCC ID: 2ARZVUM-1, IC:27701-UM1 BLE & NFC-A listening device. Tap-to-connect protocol and secured BLE connectivity Motion sensor: 3-axis accelerometer Bluetooth® connectivity & chip antenna Tap-to-connect Current consumption optimized for low power sleep mode: <5pA Supply voltage: 2.8 V to 3.6 V Size: 19.1 mm x 26.2 mm x 2.6 mm Operating temperature: -40 °C to 85 °C

Applications Indoor / outdoor high precision RTLS BLE sniffing and beaconing. BLE / NFC connectivity D7A over UWB communication

WizziLab product line at www.wizzilab.com/products

Contents

- [1 Overview](#)
- [2 Wireless Specification](#)
- [3 Functionality](#)
- [4 How to use](#)
- [5 FCC Caution](#)
- [6 ISERC Warning](#)
- [7 Revision history](#)
- [8 References](#)
- [9 Documents / Resources](#)
- [10 Related Posts](#)

Overview

The UM-1 Module is a full-function RTLS / wireless modem subsystem in a compact factor, composed of Qorvo DW1000 hardware, and WizziLab proprietary firmware.

1.1 UWB Transceiver DW1000

The UM-1 module has a DW1000 UWB transceiver mounted on the PCB. The DW1000 uses a 38.4 MHz reference crystal. The crystal has been trimmed in production to reduce the initial frequency error to approximately 3 ppm, using the DW1000 IC's internal on-chip crystal trimming circuit. Always-On (AON) memory can be used to retain DW1000 configuration data during the lowest power operational states when the on-chip voltage regulators are disabled. This data is uploaded and downloaded automatically. Use of DW1000 AON memory is configurable. The on-chip voltage and temperature monitors allow the host to read the voltage on the VDDAON pin and the internal die temperature information from the DW1000. See the DW1000 Datasheet [2] for more detailed information on device functionality, electrical specifications and typical performance.

1.2 Bluetooth® Microprocessor Nordic nRF52832

The nRF52832 is an ultra-low-power 2.4 GHz wireless system on chip (SoC) integrating the nRF52 Series 2.4 GHz transceiver and an ARM Cortex-M4 CPU with 512kB flash memory and 64kB RAM. See the nRF52832 datasheet [1] for more detailed information on device functionality, electrical specifications and typical performance.

1.3 Power Supply and Power Management

The power management circuit consists of a switch-mode regulator. It is a buck converter or step-down converter. The input voltage to the UM-1 can be in the range of 2.8V to 3.6V. Outputs from the converter provide 1.8V which is required by the DW1000 [2] transceiver.

1.4 Three Axis Motion Detector

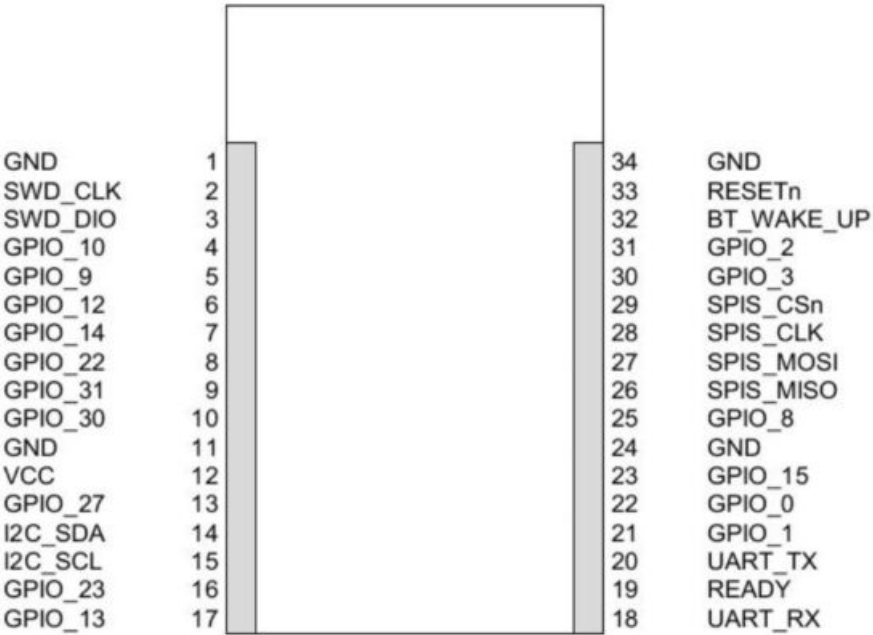
The LIS2DH12 is an ultra-low-power high-performance three-axis linear accelerometer with digital 12C/SPI serial interface standard output. The LIS2DH12 has user-selectable full scales of $\pm 2g/\pm 4g/\pm 8g/\pm 16g$ and is capable of measuring accelerations with output data rates from 1 Hz to 5.3 kHz. The self-test capability allows the user to

check the functionality of the sensor in the final application. The device may be configured to generate interrupt signals by detecting two independent inertial wake-up/free-fall events as well as by the position of the device itself. The LIS2DH12 is guaranteed to operate over an extended temperature range from -40 °C to +85 °C. See the LIS2DH12TR Datasheet [4] for more detailed information on device functionality, electrical specifications and typical performance.

1.5 Software on board

The UM-1 module comes loaded with embedded firmware which provides two-way ranging (TWR), D7A over UWB communication and BLE (tap-to-connect, beaconing and sniffing in Eddystone and IBeacon format) functions. The module can be configured and controlled via its API, accessible through its serial (UART or SPI) port. The API is based on the open ALP specification, elaborated by the D7A Alliance [6]. For further information, contact Wizzilab. The same firmware is also available as a stand alone, nonmodifiable library, which provides a function API. This allows executing the host firmware directly on the MCU of the UM-1.

2 Pin Connections



2.1 Pin Descriptions

Tabil 1 .pin Description

NAME	PIN	I/O	DESCRIPTION	REFERENCE
SWD_CLK	2	DI	Serial wire debug clock for nRF52 debug and programming	SWDCLK
SWD_DIO	3	DIO	Serial wire debug I/O for nRF52 debug and programming	SWDIO
GPIO_10	4	DIO	General-purpose I/O pin.	P0.10
GPIO_9	5	DIO	General-purpose I/O pin.	P0.09
GPIO_12	6	DIO	General-purpose I/O pin.	P0.12
GPIO_14	7	DIO	General-purpose I/O pin.	P0.14
GPIO_22	8	DIO	General-purpose I/O pin.	P0.22
GPIO_31	9	DIO	General-purpose I/O pin. ADC function of nRF52	P0.31
GPIO_30	10	DIO	General-purpose I/O pin. ADC function of nRF52	P0.30
GPIO_27	13	DIO	General-purpose I/O pin.	P0.27

Pin Connections

I2C SDA	14	DIO	Master 12C Data Line.	P0.29
I2C SCL	15	DO	Master 12C Clock Line	P0.28
GPIO 23	16	DIO	General-purpose I/O pin.	P0.23
GPIO 13	17	DIO	General-purpose I/O pin.	P0.13
UART_RX	18	DO	UART_RX	P0.11
READY	19	DO	Generated interrupt from the device.	P0.26
UART_TX	20	DIO	UART_TX, This is also the ADC function of the nRF52	P0.05
GPIO 1	21	DIO	General-purpose I/O pin.	GP101
GPIO 0	22	DIO	General-purpose I/O pin.	GP100
GPIO 15	23	DIO	General-purpose I/O pin.	P0.15
GPIO 8	25	DIO	General-purpose I/O pin.	P0.08
SPIS MISO	26	DI	SPI data output	P0.07
SPIS MOSI	27	DO	SPI data input	P0.06
SPIS CLK	28	DI	SPI clock	P0.04
SPIS_CSn	29	DI	SPI chip select	P0.03
GPIO 3	30	DO	General-purpose I/O pin.	GP103
GPIO 2	31	DO	General-purpose I/O pin.	GP102
BT_WAKE_UP	32	DIO	General-purpose I/O pin.	P0.02
RESETn	33	DI	Reset pin. Active Low Input.	P0.21
VCC	12	P	External supply for the module. 2.8V – 3.6V	
GND	1 11 24 34	G	Common ground	

Table 2. I2C slave devices address I2C

12C slave device	Address
LIS2DH12	0x19

3 Electrical specification The following tables give detailed specifications for the UM-1 module. T amb = 25 °C for all specifications given.

3.1 Nominal operating conditions Table 3. Recommended operating conditions

Symbol	Parameter	Min.	Typ.	Max.	Units
TA	Operating ambient temperature range	-40	25	85	C
Vcc	Supply voltage	3.8	3.3	3.4	V
VDIT	Digital input voltage high	0.7 x Vcc		Vcc	V
VDIH	Digital input voltage low	GND		0.3 x Vcc	V
VDOH	Digital output voltage high	0.7 x Vcc		Vcc	V
VDOL	Digital output voltage low	GND		0.3xVcc	V

Wireless Specification

4.1 UWB

Table 5. UWB transceiver operating conditions

Symbol	Parameter	Min.	Typ.	Max.	Units
Bane	RX/TX frequency range	4493(FCC)		6490(FCC/IC)	MHz

4.2 BLE

Table 6. BLE transceiver operating conditions

Symbol	Parameter	Min.	Typ.	Max.	Units
BLE	RX/TX frequency range	2402		2480	MHz
	Maximum Conducted Peak Output Power			2.	dBm

Functionality

5.1 General Purpose

The UM-1 Module is a full-function RTLS / wireless modem subsystem in a compact factor. composed of Qom DW1000 hardware, and WizziLab proprietary firmware. The UM-1 module enables customers to quickly get an RTLS system up and running, and also provides additional over-the-air communication capabilities through the UWB, BLE and NFC interfaces. The UWB part of the system is designed to operate on 4.493 GHz (IEEE 802.15.4- 2011, Channel 3) and 6.490 GHz (IEEE 802.15.4- 2011, Channel 5) Nominal Centre Frequencies with a 500 MHz Bandwidth and data rates of 110 kbps and 850 kbps. It also features a BLE modem and a passive NFC-A listening device.

5.2 Two-way ranging

The UM-1 provides a two-way ranging function (TWR), as described in the DW1000 Datasheet [2]. The ranging is performed through the exchanges of 4 timestamped packets allowing to compute a time of flight estimation. The initiating device and the target device are awoken through an out-of-band event, so the TWR does not involve any polling, repetition, or any other transmission activity aimed to maintain a link between the devices. The TWR routine does not exceed 100 ms, transmission periods do not exceed 10 ms.

5.3 DASH7 over UWB

The UM-1 embeds a D7A protocol stack for the purpose of exchanging data between nodes. The stack is an implementation of the open specification elaborated by the D7A Alliance [7], which is by construction connects (it is based on an asynchronous MAC). The transmission of data is initiated by the application. A DASH7 transaction is a single request followed by a single per-device response. The DASH7 protocol does not involve any polling or

any other continuous transmission activity in aims to maintain a link between the devices. The DASH7 routine does not exceed 100 ms. transmission periods do not exceed 10 ms.

5.4 BLE beaconing and sniffing

The UM-1 embeds a BLE protocol stack, based on the Nordic Semiconductors SoftDevice library. The device supports tap-to-connect, beaconing and sniffing functions, in Eddystone and ! beacon format.

5.5 Tap-to-connect

A device, supporting the tap-to-connect protocol, can establish a BLE connection with the tag. The format. A device, supporting the tap-to-connect protocol, can establish BLE connection with the tag. The procedure is initiated by an NFC access event that triggers the immediate exit from monitoring mode and disabling of all OASH7 (sub-GHz) and UWB interfaces. The tag start blinking in blue. The tap-to connect is meant to be used as an alternative for configuration and report dumping.

How to use

6.1 Serial API

The device can be controlled by a separate host over the UART or SPI serial port. The API is based on the open ALP specification, elaborated by the D7A Alliance [6]. Please contact WizziLab for a detailed description.

6.2 Function API The same firmware is also available as a stand-alone, nonmodifiable library, which provides a function API. This allows executing the host firmware directly on the MCU of the UM-1. Please contact WizziLab for a detailed description.

FCC Caution

Any Changes or modifications not expressly approved by the party responsible for compliance could void the users authority to operate the equipment.

7.1 Compliance

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.

IMPORTANT NOTE: 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 or more 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.

7.2 Radiation Exposure

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. This device may not be employed for the operation on board an aircraft, a ship or a satellite is prohibited.

7.3 UWB Operation Restriction

The module UM-1 meets general requirements specified in FCC§15.519 (a)

Host devices intended for indoor use must comply with the requirements of §15.517 (a). The host's user manual shall bear a statement on the device or in the instruction manual stating, "This equipment may only be operated indoors. Operation outdoors violates 47 U.S.C. 301 and could subject the operator to serious legal penalties.

- Host devices with any potential for outdoor usage shall comply with the handheld limitations of § 15.519 (a).

- For both an indoor or primarily handheld host, the module integration manual shall state that under § 15.521 (a) UWB devices may not be employed to operate toys. Operation on board an aircraft, a ship, or a satellite is prohibited

This device may not be employed for the operation on board an aircraft, a ship or a satellite is prohibited. To avoid any installation mistake or any harm to user since lack of technical knowledge, it has to be installed by a professional person.

ISED Warning

This device complies with Innovation, Science, and Economic Development Canada licence-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.

Manual v01

2.2 List of applicable FCC rules

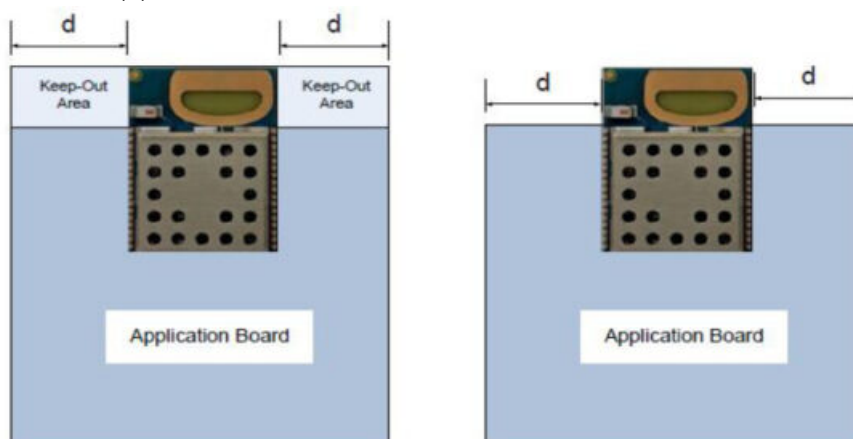
CFR 47 FCC PART 15 SUBPART C&F has been investigated. It is applicable to the modular. 2.3 Specific operational use conditions This module is stand-alone modular. If the end product will involve the Multiple simultaneously transmitting condition or different operational conditions for a stand-alone modular transmitter in a host, the host manufacturer have to consult with the module manufacturer for the installation method in the end system.

2.4 Limited module procedures

Not applicable

2.5 Trace Antenna designs

We supply the internal PCB antenna with UWB and Ceramic Antenna with BLE. When designing the PCB onto which the DW1000 will be soldered, the proximity of the DW1000 onboard antenna to metal and other non-RF transparent materials needs to be considered carefully. Two suggested placement schemes are shown below. For best RF performance, ground copper should be flooded in all areas of the application board, except in the areas marked "Keep-Out Area", where there should be no metal on either side, above or below (e.g. do not place the battery under the antenna). The two placement schemes in Figure 4 show an application board with no metallic material in the keep-out area. The diagram on the right is an application board with the antenna projecting off of the board so that the keep-out area is in free space. The diagram on the left shows an application board that does not have the module in free space but has the PCB copper removed on either side (and behind) the module antenna. (Note: the rectangular area above the shield on the module is the antenna area) It is also important to note that the ground plane on the application board affects the DW1000 antenna radiation pattern. There must be a minimum spacing of 10 mm (d) without metal on either side of the module antenna.



2.6 RF exposure considerations

To maintain compliance with FCC's RF exposure guidelines.

2.7 Antennas

This radio transmitter FCC ID: 2ARZVUM-1 has been approved by Federal Communications Commission to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

