Crystal-less Multiprotocol 2.4G Wireless Module

Descriptions

Integrates the industry's first multiprotocol 2.4 GHz wireless crystal-less MCU with Bulk Acoustic Wave (BAW) resonator technology, BDE-RFM207B is a crystal-less multiprotocol 2.4G wireless module supports Thread, Zigbee®, Bluetooth® 5.1 Low Energy, IEEE 802.15.4, IPv6-enabled smart objects (6LoWPAN), proprietary systems, including the TI 15.4-Stack (2.4 GHz), and concurrent multiprotocol operation through the Dynamic Multiprotocol Manager (DMM) software driver.

BDE-RFM207B highly integrates a high efficiency PCB antenna, radio fronts, stack, profile and applications in a small package, without the need of using an external MCU. Integrated BAW resonator technology eliminates the need for external crystals without compromising latency or frequency stability. The module also offers flexible hardware interfaces for the sensor application.

It enables ultra-low power connectivity and data transfer for the applications that are sensitive to power consumption, size and cost.

Key Features

- Multiprotocol, Bluetooth 5 low energy, Zigbee, Thread
- Powerful ARM Cortex-M4F processor
  - Clock speed: up to 48MHz
  - 352KB of In-System programmable flash
  - 80KB SRAM
  - 8KB of cache SRAM
  - 2-Pin cJTAG and JTAG debugging
  - Support Over-the-Air upgrade (OTA)
  - Ultra-Low power sensor controller with 4KB of SRAM
  - 31 GPIOs
  - 4 x 32-Bit or 8 x 16-Bit general purpose timer
  - 12-Bit ADC, 200 kSamples/s, 8 channels
  - 2 x comparator with internal reference DAC
  - Programmable current source
  - 2 x UART
  - 2 x SSI (SPI, MICROWIRE, TI)
  - IIC, IIS

- Real-Time-Clock (RTC)
- AES 128- and 256-bit crypto accelerator
- ECC and RSA public key hardware accelerator
- SHA2 accelerator (Full suite up to SHA-512)
- True Random Number Generator (TRNG)
- Capacitive sensing, up to 8 channels
- Integrated temperature and battery monitor
- Integrated BAW resonator technology eliminates the need for external crystals
- On-Chip buck DC/DC converter

- RF performance
  - TX power: Output power up to +5 dBm with temperature compensation
  - RX sensitivity: up to -102dBm (LE coded PHY)
- Communication range: about 250 meters (LOS) – Long Range Mode
- Antenna: PCB antenna, 1.71 dBi average gain, 2.18 dBi peak gain
- Size: 22.95 mm x 15 mm x 2.15 mm (With Shielding)
- Ultra low power consumption:
  - Shutdown: 150nA (Wake up on external events)
  - Standby: 0.94uA (RTC running and RAM/CPU retention)
  - RX current: 7.3mA
  - TX current @ 0dBm: 7.9mA
  - TX current @ 5dBm: 10.2mA
- BQB, FCC, CE, RoHS compliant

Block Diagram

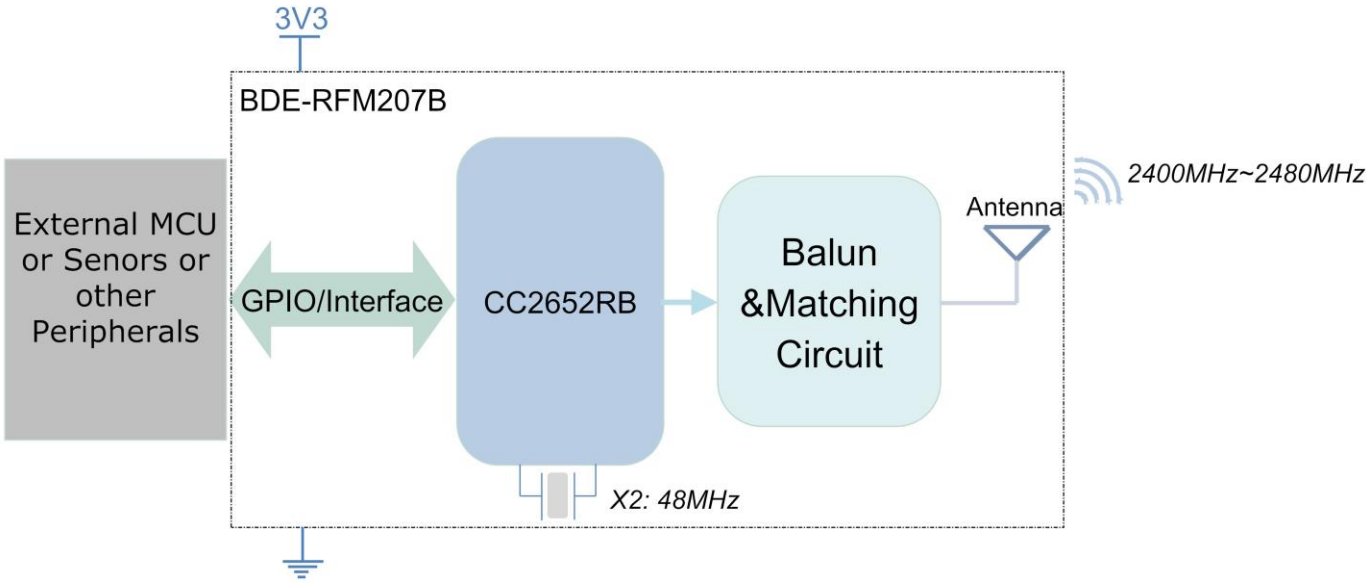

Fig. 1: The Block Diagram of BDE-RFM207B

Applications

- 2400 to 2480 MHz ISM and SRD systems with down to 4 kHz of receive bandwidth
- Building automation
- Grid infrastructure
- Industrial transport – asset tracking
- Factory automation and control
- Medical
- Electronic point of sale (EPOS) – Electronic Shelf Label (ESL)

Electrical Characteristics

- Absolute maximum rating

Rating	Min	Typ	Max	Unit	Notes
Storage Temperature	-40	-	125	℃	
VDD	-0.3	-	4.1	V	
Other Digital Terminals	-0.3	-	VDDS+0.3≤4.1	V	
Voltage on ADC input	-0.3	-	VDDS	V	Voltage scaling enabled
	-0.3	-	1.49	V	Voltage scaling disabled, internal reference
	-0.3	-	VDDS/2.9	V	Voltage scaling disabled, VDDS as reference

- Recommended operating conditions

Rating	Min	Typ	Max	Unit
Operating Temperature	-40	-	85	℃
VDD	1.8	3.3	3.8	V

Pinout

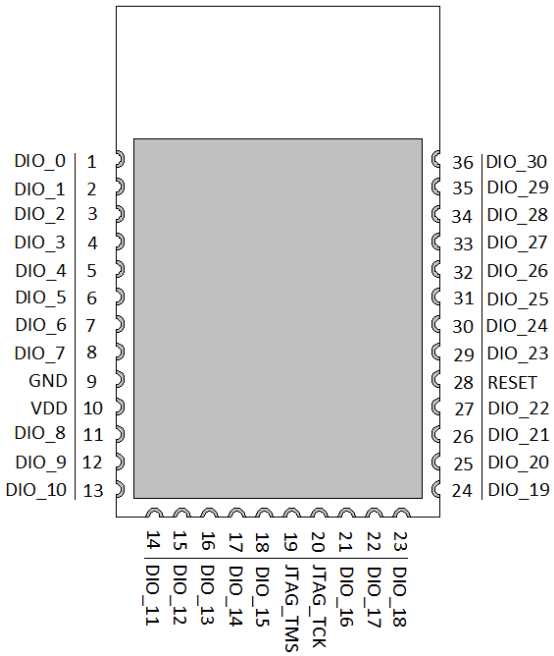

Fig. 2: The pinout of BDE-RFM207B (TOP VIEW)

Table 1: Pin definitions of BDE-RFM207B

Pin Number	Pin Name	Definitions
1	DIO_0	GPIO, Sensor Controller
2	DIO_1	GPIO, Sensor Controller
3	DIO_2	GPIO, Sensor Controller
4	DIO_3	GPIO, Sensor Controller
5	DIO_4	GPIO, Sensor Controller
6	DIO_5	GPIO, Sensor Controller, high-drive capability
7	DIO_6	GPIO, Sensor Controller, high-drive capability
8	DIO_7	GPIO, Sensor Controller, high-drive capability
9	GND	Power Ground
10	VDD	Power Supply
11	DIO_8	GPIO
12	DIO_9	GPIO
13	DIO_10	GPIO
14	DIO_11	GPIO
15	DIO_12	GPIO
16	DIO_13	GPIO
17	DIO_14	GPIO
18	DIO_15	GPIO

19	JTAG_TMS	JTAG TMSC, high-drive capability
20	JTAG_TCK	JTAG TCKC
21	DIO_16	GPIO, JTAG_TDO, high-drive capability
22	DIO_17	GPIO, JTAG_TDI, high-drive capability
23	DIO_18	GPIO
24	DIO_19	GPIO
25	DIO_20	GPIO
26	DIO_21	GPIO
27	DIO_22	GPIO
28	RESET	Reset, active-low
29	DIO_23	GPIO, Sensor Controller, Analog
30	DIO_24	GPIO, Sensor Controller, Analog
31	DIO_25	GPIO, Sensor Controller, Analog
32	DIO_26	GPIO, Sensor Controller, Analog
33	DIO_27	GPIO, Sensor Controller, Analog
34	DIO_28	GPIO, Sensor Controller, Analog
35	DIO_29	GPIO, Sensor Controller, Analog
36	DIO_30	GPIO, Sensor Controller, Analog

Overall Dimensions

Fig. 3 shows the overall dimensions of BDE-RFM207B. The module measures 22.95mm long by 15mm wide by 2.15mm high with the shield.

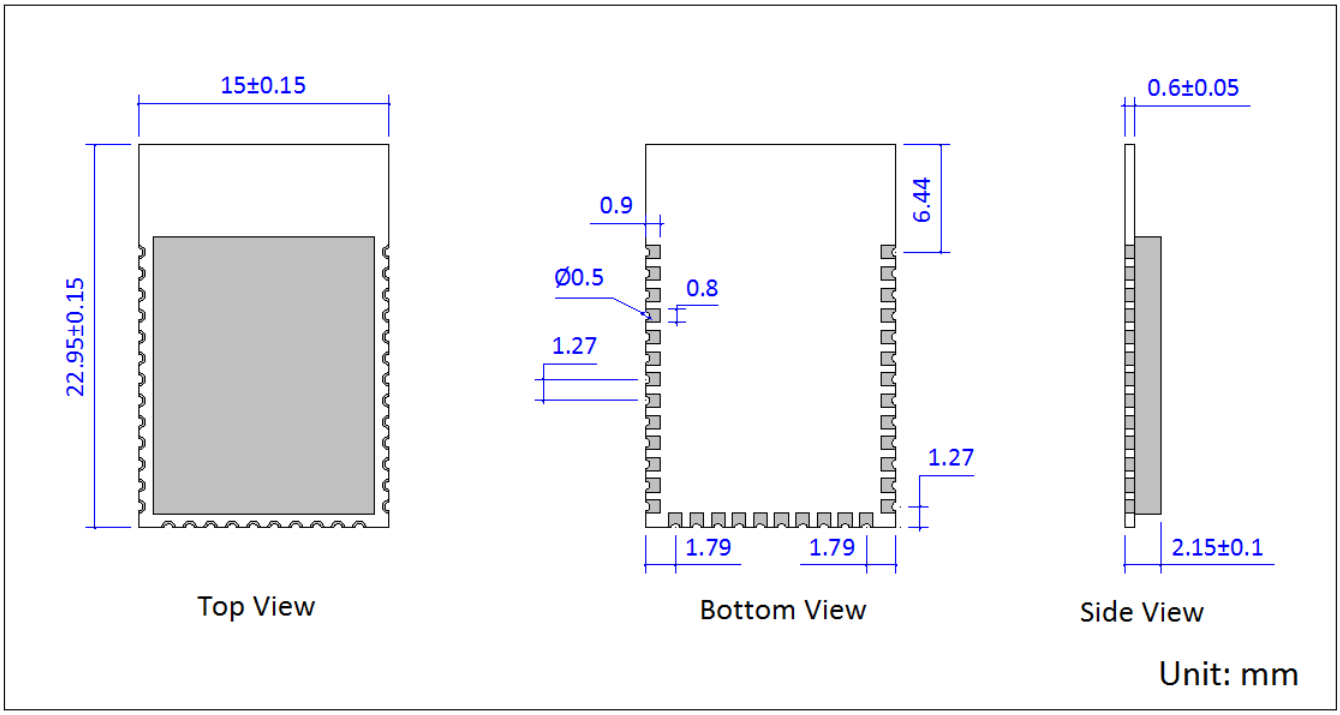

Fig. 3: Overall Dimensions of BDE-RFM207B

Module Location

In order to get a fine performance when integrate the module to your product, it is advised to use the recommended module location to the respective PCB.

- Location in X-Y plane

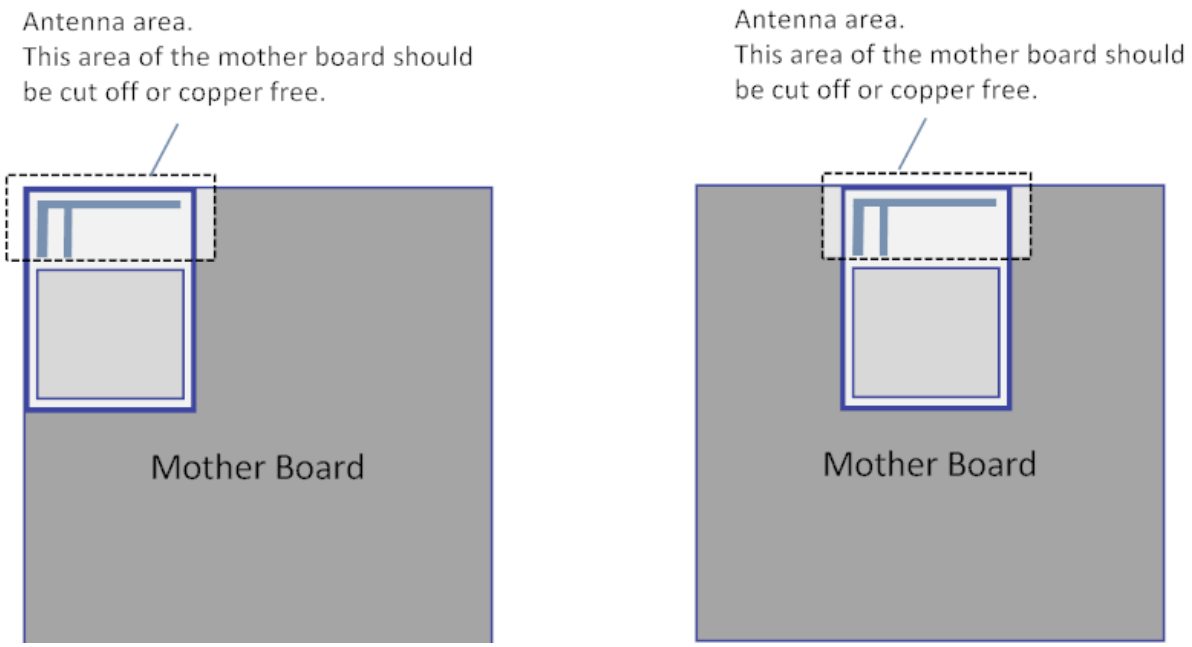

Fig. 4: Recommended location in X-Y plane

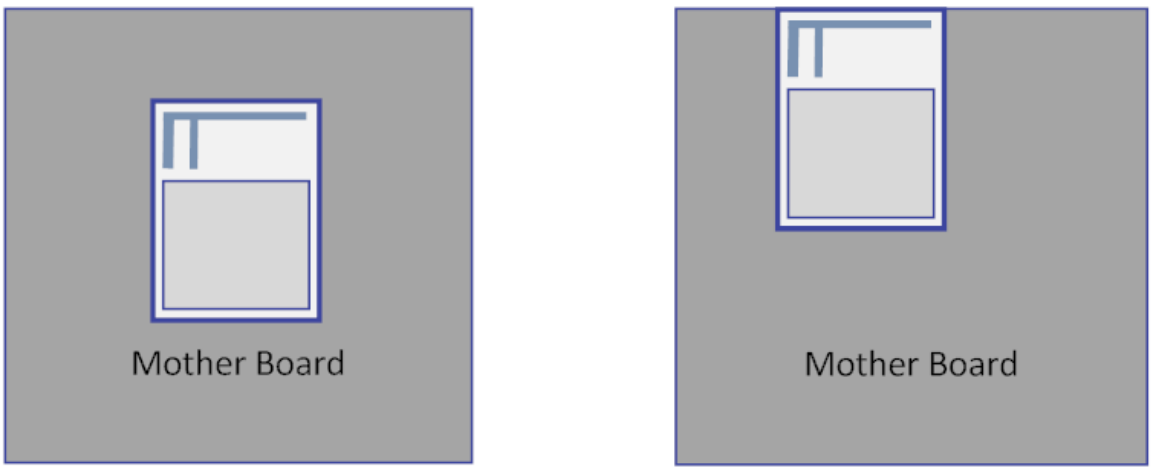

Fig. 5: Not recommended location in X-Y plane

- Location in Z plane

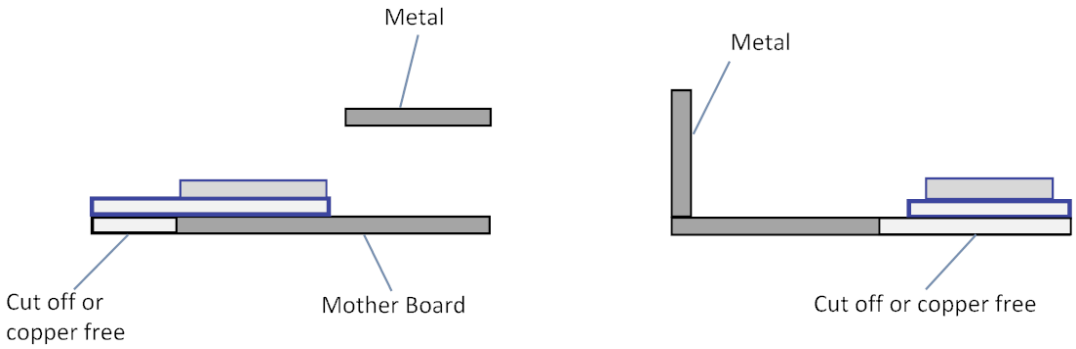

Fig. 6: Recommended location in Z plane

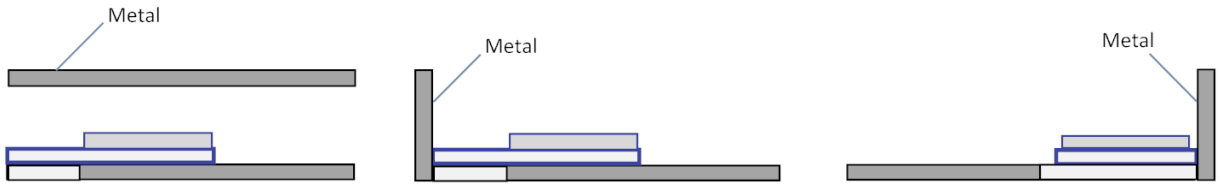

Fig. 7: Not recommended location in Z plane

Typical Solder Reflow Profile

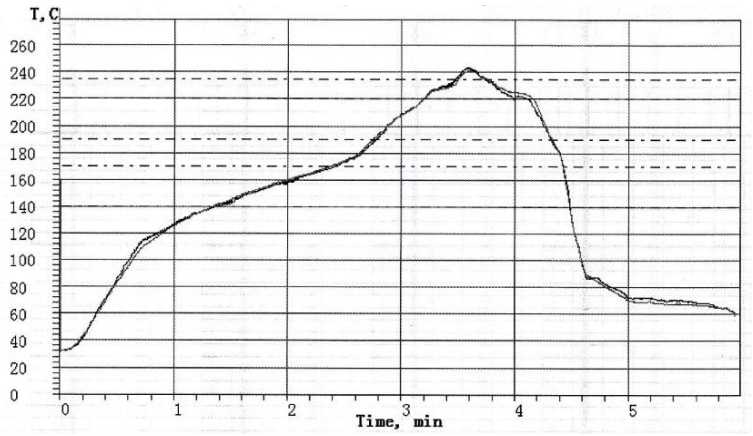

Fig. 8: Typical Solder Reflow Profile

Package Information

Fig. 9: Package

Regulatory Information

Integration Instructions

Integration instructions for host product manufacturers according to KDB 996369D03 OEM Manual v01

(1) List of applicable FCC rules
FCC Part 15.247

(2) Specific operational use conditions
This transmitter/module and its antenna must not be co-located or operating in conjunction with any transmitter. This information also extends to the host manufacturer's instruction manual.

(3) Limited module procedures
Not applicable.

(4) Trace antenna designs
Not applicable.

(5) RF exposure considerations
This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This compliance to FCC radiation exposure limits for an uncontrolled environment, and minimum of 20cm separation between antenna and body.
The host product manufacturer would provide the above information to end users in their end-product manuals.

(6) Antennas
PCB antenna: 1.71 dBi, 2.4 GHz~2.5 GHz
2.8 Label and compliance information
The end product must carry a physical label or shall use e-labelling followed KDB784748D01 and KDB 784748 stating "Contains Transmitter Module FCC ID: 2ABRU-RFM207B".

(7) Information on test modes and additional testing requirements
For more information on testing, please contact the manufacturer.

(8) Additional testing, Part 15 Subpart B disclaimer
The modular transmitter is only FCC authorized forthe specific rule parts (FCC Part 15.247) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. The final hostproduct still requires Part 15 Subpart B compliance testing with the modular transmitter installed when contains digital circuitry.

FCC Statement

Integrator is reminded to assure that these installation instructions will not be made available to the end user of the final host device.

The final host device, into which this RF Module is integrated has to be labelled with an auxiliary label stating the FCC ID of the RF Module, such as "Contains FCC ID: 2ABRU-RFM207B".

"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."

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 anexperienced radio/TV technician for help.

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

(OEM) Integrator has to assure compliance of the entire end-product incl. the integrated RF Module.

For 15 B (§15.107 and if applicable §15.107) compliance, the host manufacturer is required to show compliance with 15 while the module is installed and operating.

Further more the module should be transmitting and the evaluation should confirm that the module's intentional emissions (15C) are compliant (fundamental / out-of-band). Finally the integrator has to apply the appropriate equipment authorization (e.g. Verification) for the new host device per definition in §15.101.

Module Statement

The single-modular transmitter is a self-contained, physically delineated, component for which compliance can be demonstrated independent of the host operating conditions, and which complies with all eight requirements of § 15.212(a)(1) as summarized below.

(1) The radio elements have the radio frequency circuitry shielded.

(2) The module has buffered modulation/data inputs to ensure that the device will comply with Part 15 requirements with any type of input signal.

(3) The module contains power supply regulation on the module.

(4) The module contains a permanently attached antenna.

(5) The module demonstrates compliance in a stand-alone configuration.

(6) The module is labeled with its permanently affixed FCC ID label.

(7) The module complies with all specific rules applicable to the transmitter, including all the conditions provided in the integration instructions by the grantee.

(8) The module complies with RF exposure requirements.
This transmitter/module must not be collocated or operating in conjunction with any other antenna or transmitter.

Revision History

Table 2. Revision History Information

Revision	Date	Description
V1.2	8- Jan -2021	Initial Release

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