General Description



BDE-BLEM205 is a Bluetooth 5.2 single-mode compliant Bluetooth low energy module targeted at low power sensors and PC/Phone accessories.

BDE-BLEM205 highly integrates Bluetooth Low Energy radio, stack, profile and applications in a SoC, without the need of using an external MCU. The module also offers flexible hardware interfaces for the sensor application. It supports 2 Mbps and PHY-coded which are the new added features from BT5.0. The module is Bluetooth, FCC, ISED and CE-RED certified.

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

Key Features

- Bluetooth 5.2 low energy compliant
- Powerful ARM Cortex-M4F processor
  - Clock speed: up to 48MHz
  - 352KB of In-System programmable flash with 8KB cache
  - 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 k Samples/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
  - On-Chip buck DC/DC converter
- RF performance
  - TX power: -21dBm to 5dBm
  - RX sensitivity: up to -105dBm (LE coded PHY)
- Communication range: about 250 meters (LOS) – Long Range Mode
- Antenna: PCB antenna
- Size: 22.95 mm x 15 mm x 2.1 mm (With Shielding)
- Ultra low power consumption
  - Shutdown: 120nA (Wake up on external events)
  - Standby: 0.95uA (RTC running and RAM/CPU retention)
  - RX current: 6.9mA
  - TX current @ 0dBm: 7.4mA
  - TX current @ 5dBm: 9.7mA
- Certifications
  - Bluetooth- DID: D050902, QDID: 151505
  - FCC ID: 2ABRUBDLEM205
  - IC: 25657-BLEM205
  - CE-RED

Applications

- Medical devices
- Sports and fitness equipment
- Home electronics
- Mobile and PC accessories
- Industry automation

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1. References

[1] CC2642R resources: https://www.ti.com/product/CC2642R

2. Block Diagram

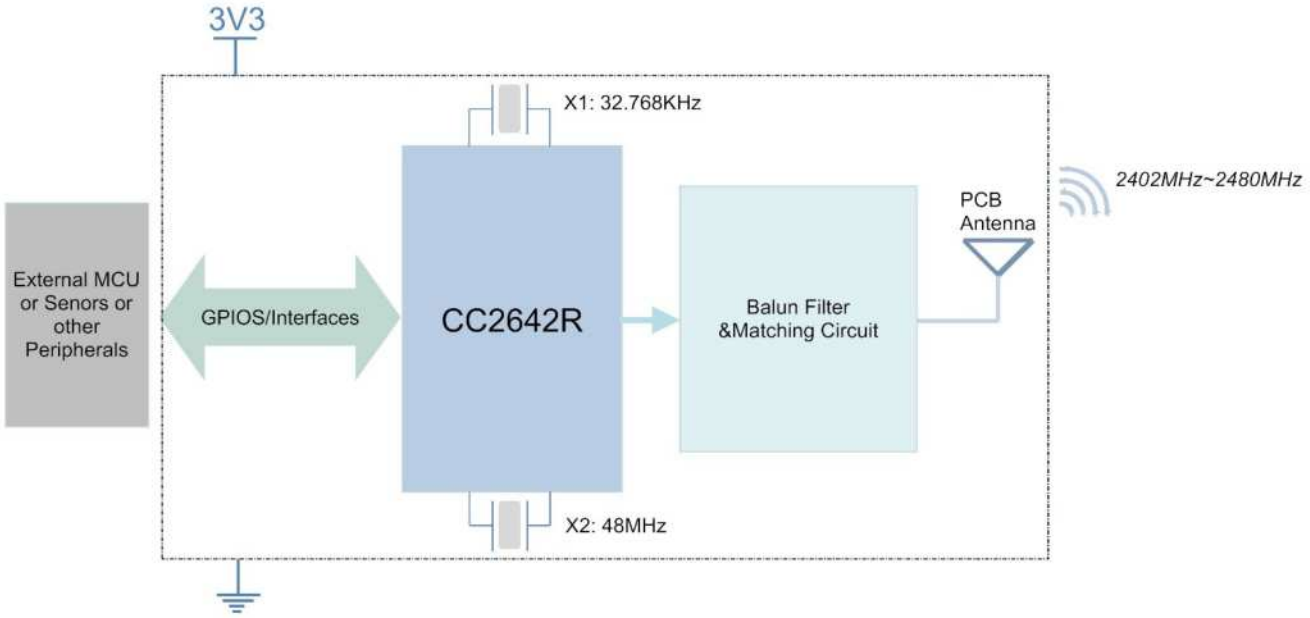

Figure 2-1. BDE-BLEM205 Module Block Diagram

3. Terminal Configuration and Functions

3.1 Pin Diagram

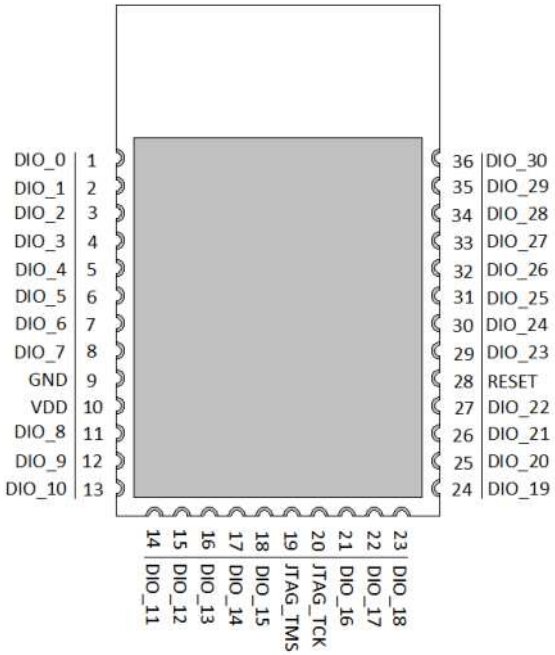

Figure 3-1. Pin Diagram (Top View)

3.2 Pin Attributes and Pin Multiplexing

Table 3-1. Pin Description

Pin #	Pin Name	Description
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

Pin #	Pin Name	Description
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

4. Specifications

4.1 Absolute Maximum Ratings

PARAMETER	MIN	MAX	UNIT	Notes
VDDS	-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
Storage Temperature	-40	125	°C	

4.2 Recommended Operating Conditions

PARAMETER	MIN	TYP	MAX	UNIT
VDDS	1.8	3.3	3.8	V
Operating Temperature	-40	-	85	°C

5. Reference Design

5.1 Design Recommendations

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

- Location in X-Y plane

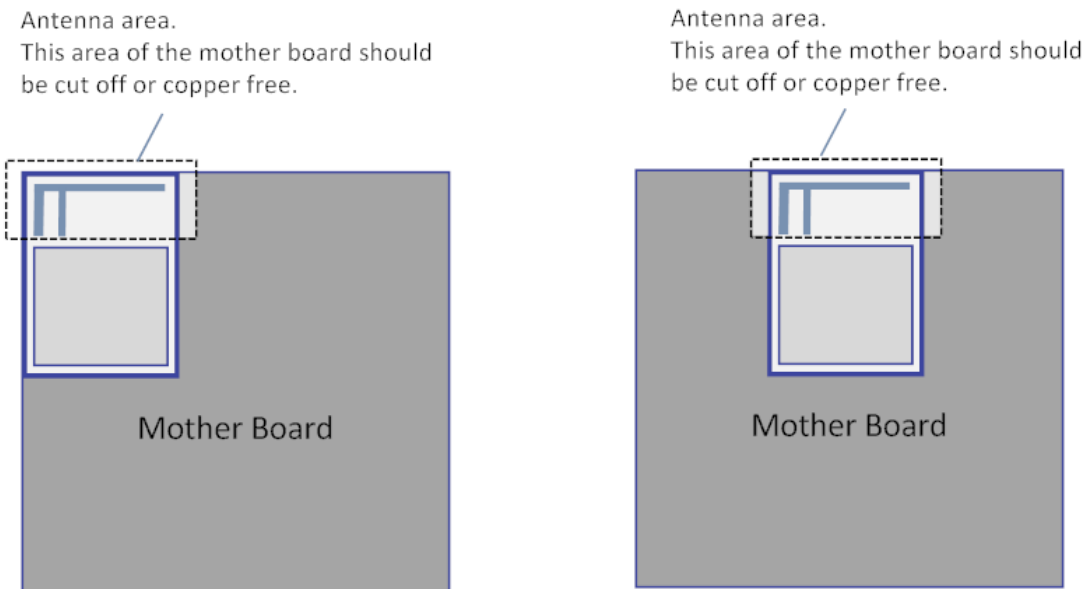

Fig 5-1. Recommended location in X-Y plane

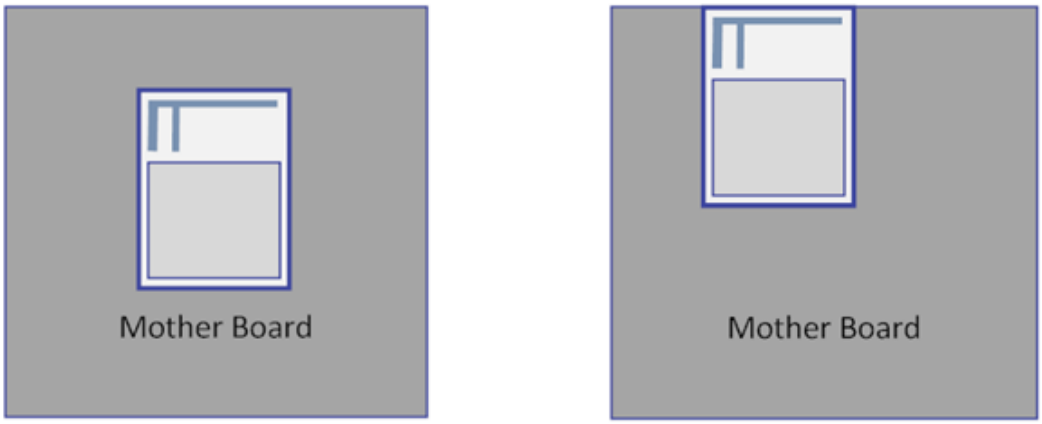

Fig 5-2. Not recommended location in X-Y plane

■ Location in Z plane

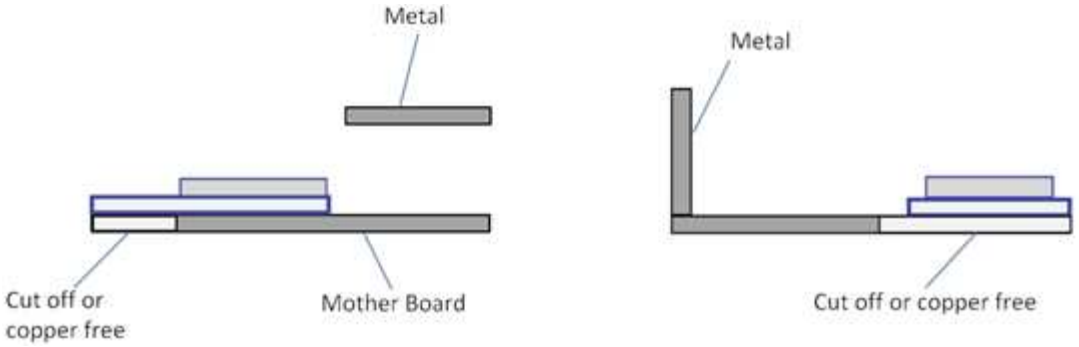

Fig 5-3. Recommended location in Z plane

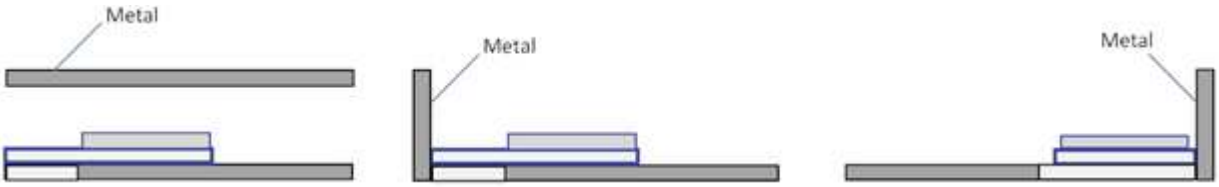

Fig 5-4. Not recommended location in Z plane

6. Typical Solder Reflow Profile

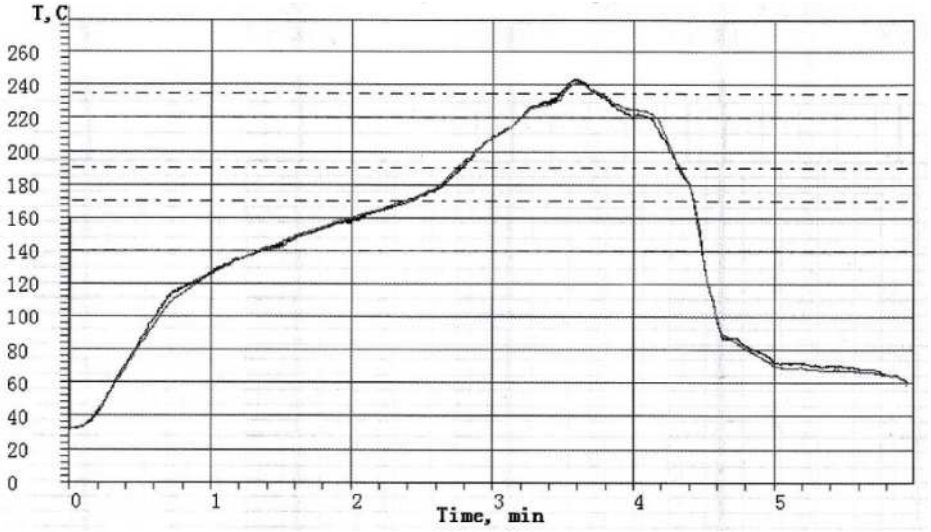

Fig 6-1. Typical Solder Reflow Profile

7. Mechanical Specifications

7.1 Dimensions

Fig 7-1 shows the overall dimensions of BDE-BLEM205. The module measures 22.95mm long by 15mm wide by 2.1mm high with the shield.

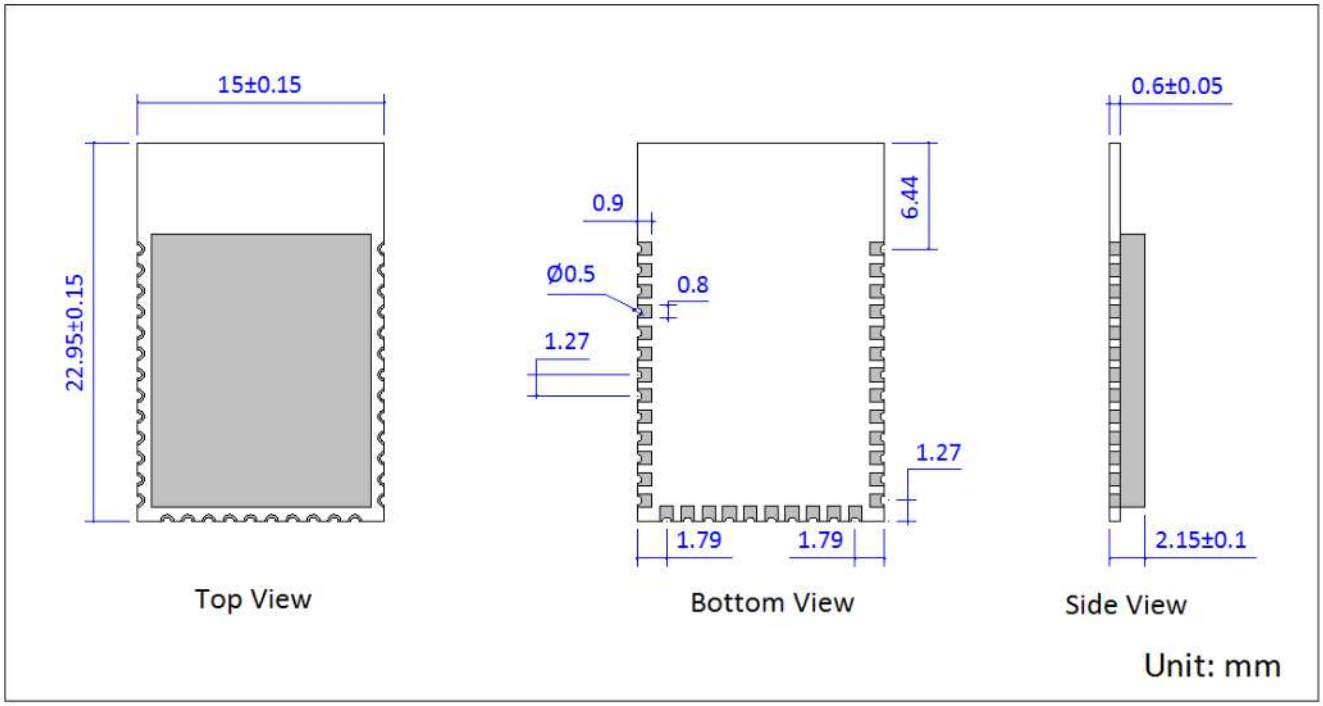

Figure 7-1. Mechanical Drawing

8. Packaging Information



Figure 8-1. Package

9. Ordering Information

Part Number	Size (mm)	Core Chip	Package	MOQ
BDE-BLEM205	22.95×15×2.15	CC2642R	Tray	1K

10. Revision History

Revision	Date	Description
V1.0	21-Mar-2019	Initial Release
V1.1	29-Aug-2019	Editorial Correction
V2.0	14-Apr-2021	Replaced template

11. FCC statements

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

The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications or changes to this equipment. Such modifications or changes could void the user's authority to operate the equipment.

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.

The SAR limit of USA (FCC) is 1.6 W/kg averaged over one gram of tissue. Device types Panasonic ELUGA Ray 600 (FCC ID: 2APTIS60ER6) has also been tested against this SAR limit.The highest SAR value reported under this standard during product certification for use when properly worn on the body is 0.681 W/kg and for head is 0.898 W/kg. Simultaneous RF exposure is 1.233W/Kg. This device was tested for typical body - worn operations with the back of the handset kept 10mm from the body. To maintain compliance with FCC RF exposure requirements, use accessories that maintain a 10mm separation distance between the user's body and the back of the handset. The use of belt clips, holsters and similar accessories should not contain metallic components in its assembly. The use of accessories that do not satisfy these requirements may not comply with FCC RF exposure requirements, and should be avoided.

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