

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

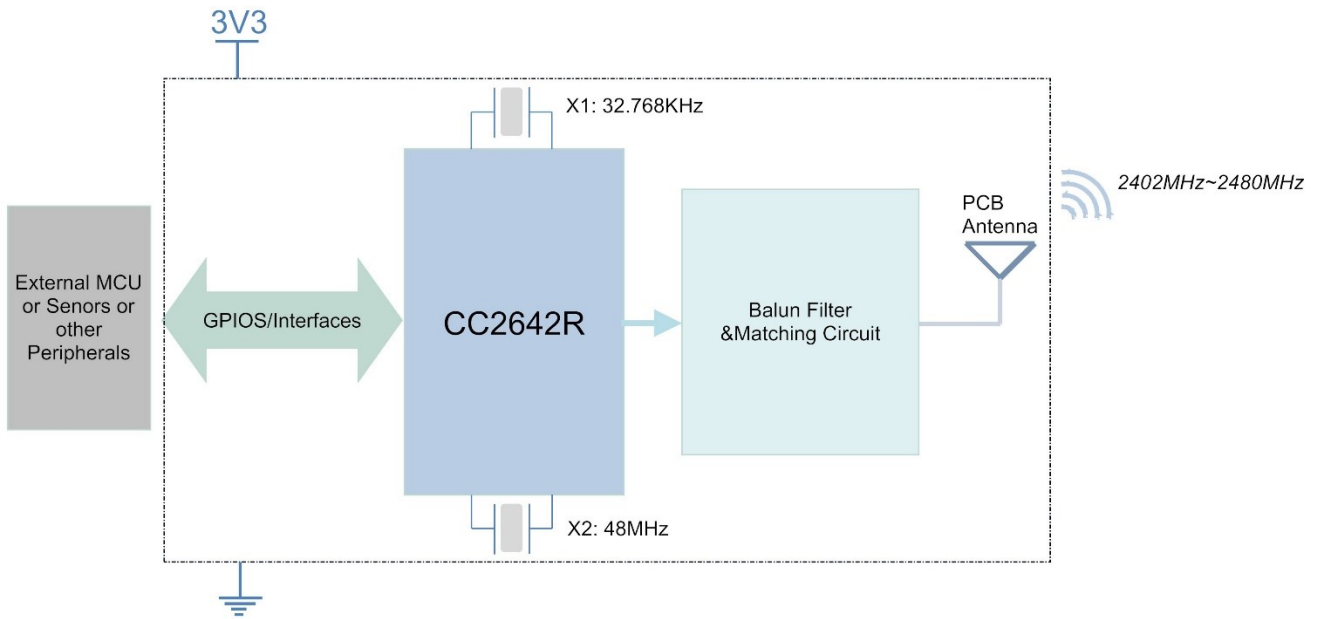


Figure 2-1. BDE-BLEM205 Module Block Diagram

3. Terminal Configuration and Functions

3.1 Pin Diagram

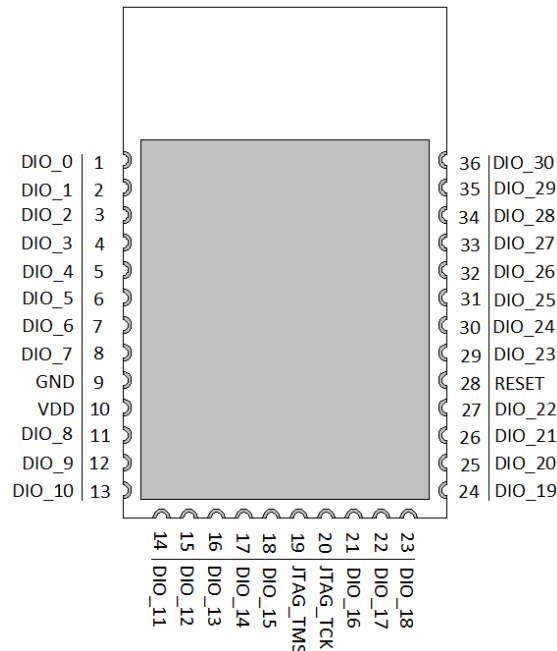


Figure 3-1. Pin Diagram (Top View)

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 TMS, high-drive capability |
| 20 | JTAG_TCK | JTAG TCK |
| 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 | $V_{DD5}+0.3 \leq 4.1$ | V | |
| Voltage on ADC input | -0.3 | VDDS | V | Voltage scaling enabled |
| | -0.3 | 1.49 | V | Voltage scaling disabled, internal reference |
| | -0.3 | $V_{DD5}/2.9$ | 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

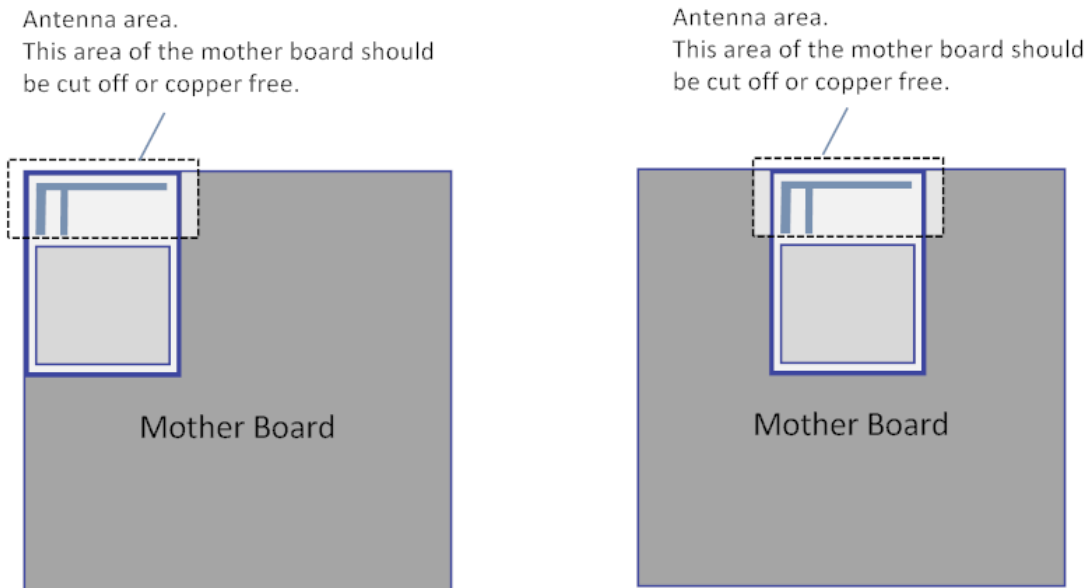


Fig 5-1. Recommended location in X-Y plane

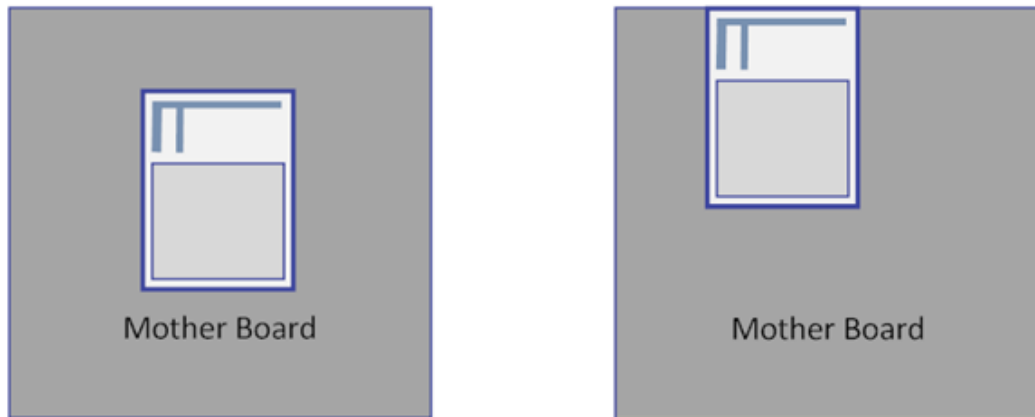


Fig 5-2. Not recommended location in X-Y plane

■ Location in Z plane

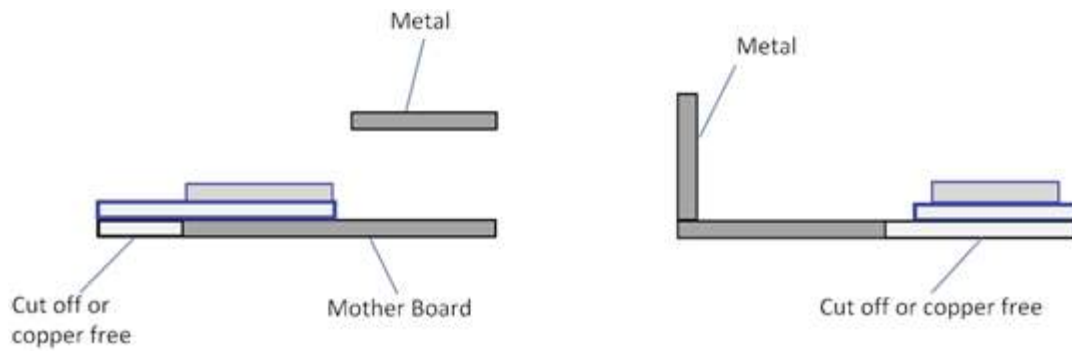


Fig 5-3. Recommended location in Z plane



Fig 5-4. Not recommended location in Z plane

6. Typical Solder Reflow Profile

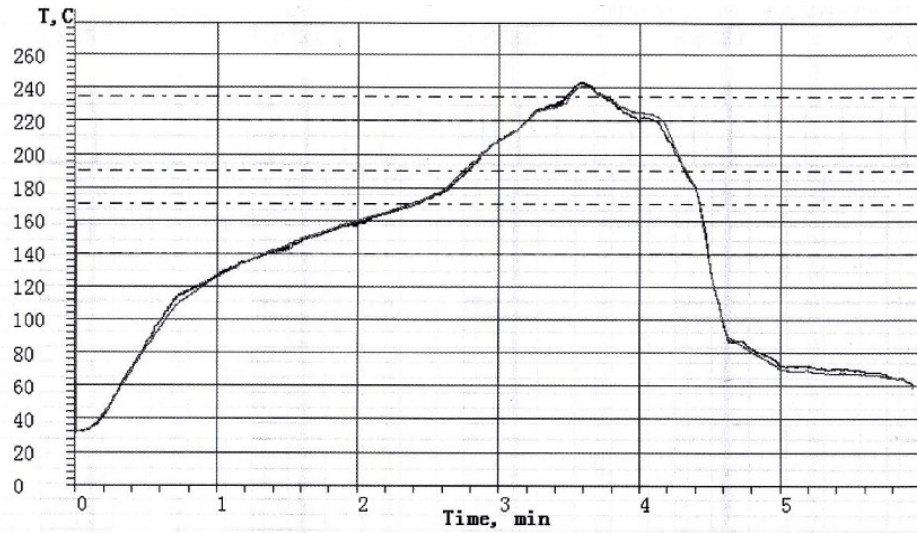


Fig 6-1. Typical Solder Reflow Profile

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.

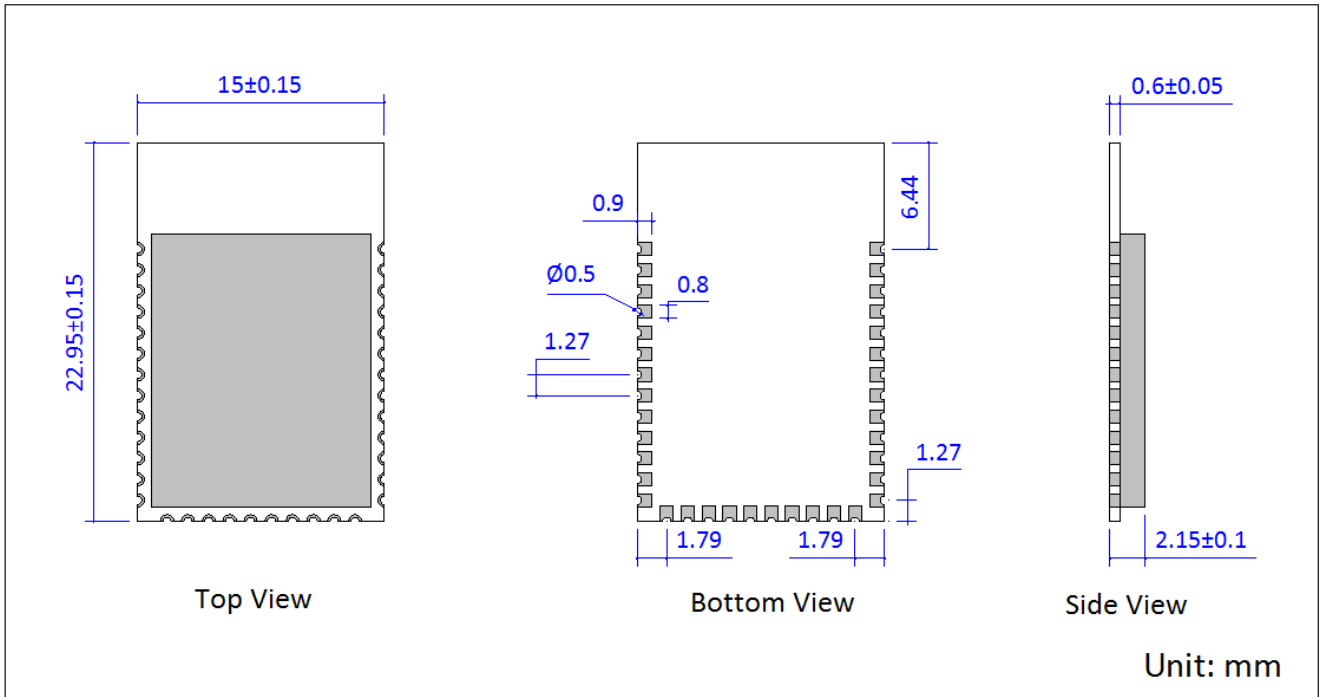


Figure 7-1. Mechanical Drawing

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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