

General Description

BDE-BLEM205-Q1 is an AEC-Q100 qualified Bluetooth 5.1 single-mode compliant Bluetooth low energy module.

BDE-BLEM205-Q1 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 5.1 low energy compliant
- AEC-Q100 qualified
 - Device temperature grade 2: -40 °C to +105 °C ambient operating temperature range
 - Device HBM ESD Classification Level 2
 - Device CDM ESD Classification Level C3
- 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 timers
 - 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 2.15 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: 6.9mA
 - TX current @ 0dBm: 7.3mA
 - TX current @ 5dBm: 9.6mA

Applications

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

Table 0-1. BLEM205 Device Family

Part Number	Description	Size (mm)	Package	Core Chip
BDE-BLEM205	Normal grade, -40°C ~ 85°C	22.95 × 15 × 1.5	SMD-36	CC2642R
BDE-BLEM205-IN	Industrial grade, -40°C ~ 105°C	22.95 × 15 × 1.5	SMD-36	CC2642R
BDE-BLEM205-Q1	Automotive grade, -40°C ~ 105°C	22.95 × 15 × 1.5	SMD-36	CC2642R-Q1

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BDE-BLEM205-Q1

AEC-Q100 qualified BLE Module (BT5.1)

1. References

[1] CC2642R-Q1 resources: <https://www.ti.com/product/CC2642R-Q1>

BDE-BLEM205-Q1

AEC-Q100 qualified BLE Module (BT5.1)

2. Block Diagram

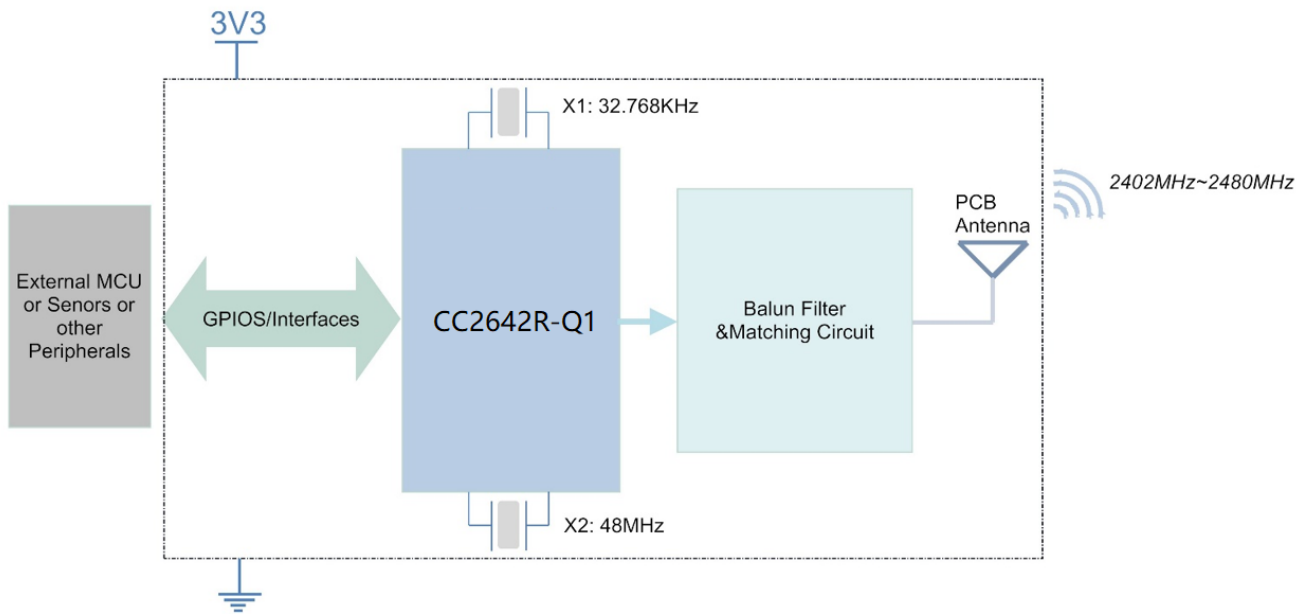


Figure 2-1. BDE-BLEM205-Q1 Module Block Diagram

3. Terminal Configuration and Functions

3.1 Pin Diagram

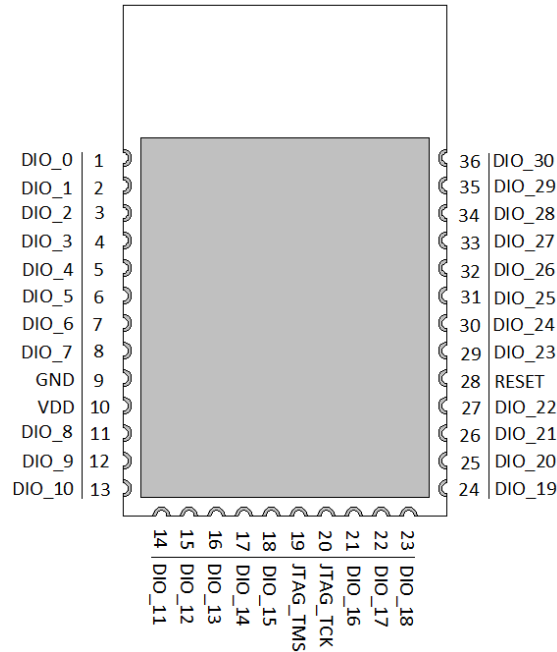


Figure 3-1. Pin Diagram (Top View)

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	-	105	°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

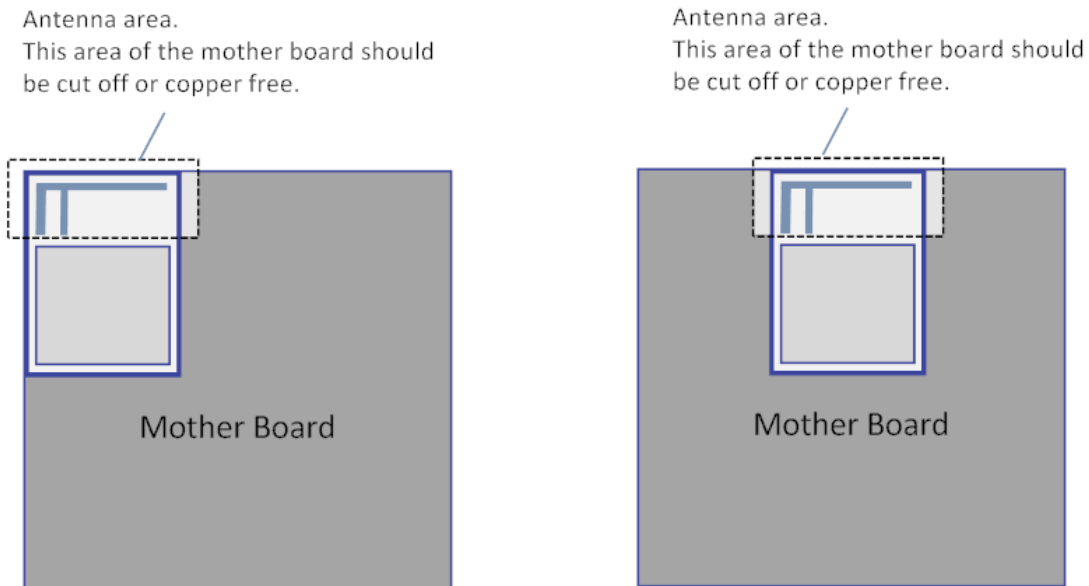


Fig 5-1. Recommended location in X-Y plane

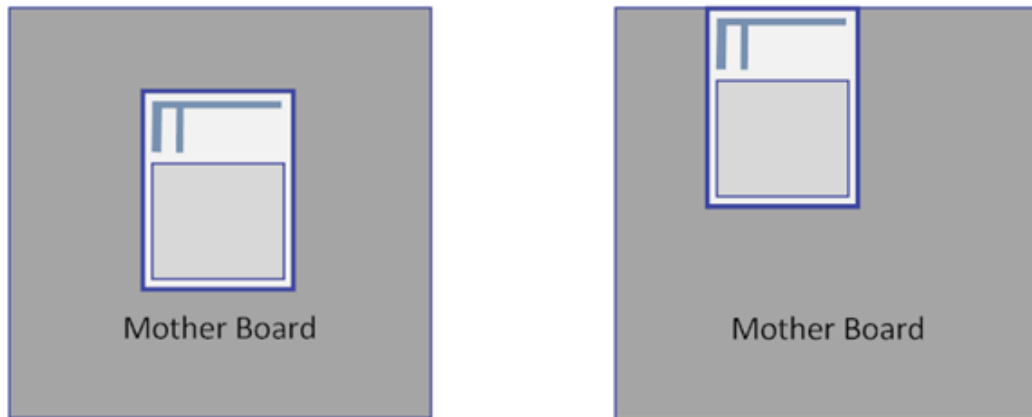


Fig 5-2. Not recommended location in X-Y plane

■ Location in Z plane

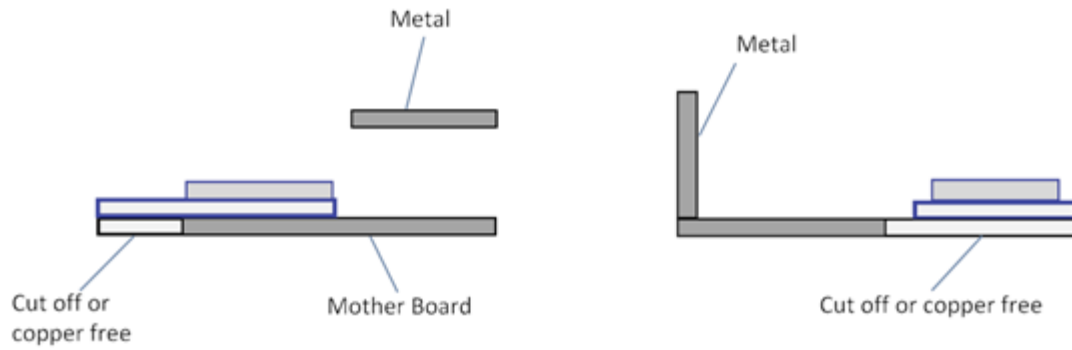


Fig 5-3. Recommended location in Z plane



Fig 5-4. Not recommended location in Z plane

6. Typical Solder Reflow Profile

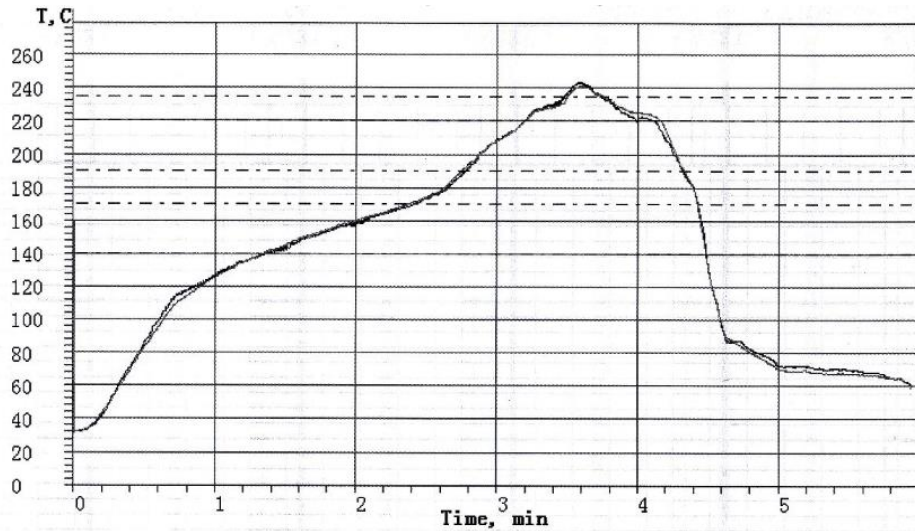


Fig 6-1. Typical Solder Reflow Profile

BDE-BLEM205-Q1

AEC-Q100 qualified BLE Module (BT5.1)

7. Mechanical Specifications

7.1 Dimensions

Fig 7-1 shows the overall dimensions of BDE-BLEM205-Q1. The module measures 22.95mm long by 15mm wide by 2.1mm high with the shield.

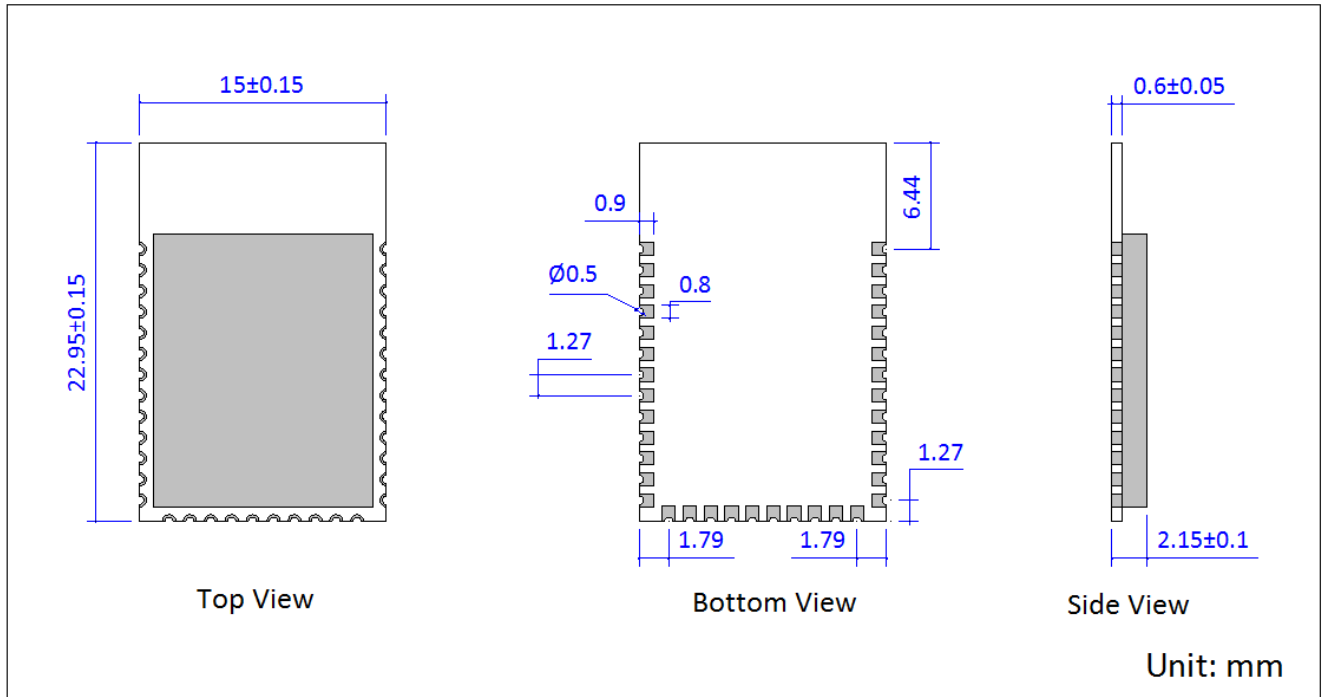


Figure 7-1. Mechanical Drawing

BDE-BLEM205-Q1

AEC-Q100 qualified BLE Module (BT5.1)

8. Packaging Information



Figure 8-1. Package

BDE-BLEM205-Q1

AEC-Q100 qualified BLE Module (BT5.1)

Datasheet

9. Ordering Information

Part Number	Size (mm)	Core Chip	Package	MOQ
BDE-BLEM205	22.95×15×2.15	CC2642R	Tray/Tape & Reel	1K
BDE-BLEM205-IN	22.95×15×2.15	CC2642R	Tray/Tape & Reel	1K
BDE-BLEM205-Q1	22.95×15×2.15	CC2642R-Q1	Tray/Tape & Reel	1K

10. Revision History

Revision	Date	Description
V1.0	3-Jun-2021	Initial Release

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