

General Description



BDE-MP2652P7 is a multiprotocol 2.4-GHz wireless module series consisting of CC2652P74T0RGZ single-chip wireless microcontroller (MCU). This series provides six options. Customer can choose the suitable version for different application scenario.

- BDE-MP2652P7A32 (PCB antenna and on-board external 32M-bit flash)
- BDE-MP2652P7U32 (U.FL connector and on-board external 32M-bit flash)
- BDE-MP2652P7N32 (RF pad out for antenna and on-board external 32M-bit flash)
- BDE-MP2652P7A0 (PCB antenna, no external flash)
- BDE-MP2652P7U0 (U.FL connector, no external flash)
- BDE-MP2652P7N0 (RF pad out for antenna, no external flash)

Created for the IoT, the BDE-MP2652P7 is a multiprotocol 2.4-GHz wireless module that integrates an Arm® Cortex®-M4 MCU, which supports Thread, Zigbee®, Matter, Bluetooth® 5.0 Low Energy, IEEE 802.15.4g, IPv6-enabled smart objects (6LoWPAN), TI 15.4-Stack (2.4-GHz), and concurrent multiprotocol through a Dynamic Multiprotocol Manager (DMM) driver. It optimized for low-power wireless communication and advanced sensing in grid infrastructure, building automation, retail automation, personal electronics and medical applications.

The BDE-MP2652P7 supports operation in the 2360 to 2500-MHz frequency band. PHY and frequency switching can be done runtime through a dynamic multiprotocol manager (DMM) driver. It also has an integrated efficient power amplifier that supports +20 dBm output power in 2.4-GHz band, and a receive sensitivity of -104 dBm for 125-kbps Bluetooth® Low Energy Coded PHY.

The BDE-MP2652P7 has a low sleep current of 0.9 μ A with RTC and 144KB RAM retention. In addition to the main Cortex® M4F processor, the device also has an autonomous ultra-low power Sensor Controller CPU with fast wake-up capability. As an example, the sensor controller is capable of 1-Hz ADC sampling at 1- μ A system current. And it has Low SER (Soft Error Rate) FIT (Failure-in-time) for long operational lifetime. Always-on RAM parity minimizes risk for corruption due to potential radiation events. Consistent with many customers' 10 to 15 years or longer life cycle requirements.

The BDE-MP2652P7 highly integrates 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 enables ultra-low power connectivity and data transfer for the applications that are sensitive to power consumption, size and cost.

Key Features

- Multiprotocol 2.4-GHz module consisting of CC2652P74T0RGZ single-chip wireless microcontroller (MCU)
 - ◇ 799 μ A in 24 MHz mode
- Fully integrated module includes all required clocks and passives
- Wireless microcontroller
 - Powerful 48-MHz Arm[®] Cortex[®]-M4F processor
 - Integrated external serial 32M-bit Flash
 - ◇ BDE-MP2652P7A32
 - ◇ BDE-MP2562P7N32
 - ◇ BDE-MP2652P7U32
 - 704KB flash program memory
 - 256KB of ROM for protocols and library functions
 - 8KB of cache SRAM
 - 144KB of ultra-low leakage SRAM with parity for high-reliability operation
 - Dynamic multiprotocol manager (DMM) driver
 - Programmable radio includes support for 2-(G)FSK, 4-(G)FSK, MSK, Bluetooth[®]5.0 Low Energy, IEEE 802.15.4 PHY and MAC
 - Supports over-the-air upgrade(OTA)
- Ultra-low power sensor controller
 - Autonomous MCU with 4KB of SRAM
 - Sample, store, and process sensor data
 - Fast wake-up for low-power operation
 - Software defined peripherals; capacitive touch, flow meter, LCD
- Low power consumption
 - MCU consumption:
 - ◇ 3.10 mA active mode, CoreMark
 - ◇ 65 μ A/MHz running CoreMark
 - ◇ 0.9 μ A standby mode, RTC, 144KB RAM
 - ◇ 0.1 μ A shutdown mode, wake-up on pin
 - Ultra low-power sensor controller consumption:
 - ◇ 29.2 μ A in 2 MHz mode
- Radio Consumption:
 - ◇ 6.4 mA RX
 - ◇ 101 mA TX at +20 dBm
- Wireless protocol support
 - Thread, Zigbee[®], Matter
 - Bluetooth[®]5.0 Low Energy
 - SimpleLink[™] TI 15.4-stack
 - 6LoWPAN
 - Proprietary systems
- High performance radio
 - -104 dBm for Bluetooth[®] Low Energy 125-kbps
 - Output power up to +20 dBm with temperature compensation
- Regulatory compliance (On-going)
 - FCC
 - IC
 - CE-RED
 - Bluetooth SIG
- MCU peripherals
 - Digital peripherals can be routed to any GPIO
 - Four 32-bit or eight 16-bit general-purpose timers
 - 12-bit ADC, 200 kSamples/s, 8 channels
 - 8-bit DAC
 - Two comparators
 - Programmable current source
 - Two UART, Two SSI, I2C, I2S
 - Real-time clock (RTC)
 - Integrated temperature and battery monitor
- Security enablers
 - AES 128- and 256-bit cryptographic accelerator
 - ECC and RSA public key hardware accelerator
 - SHA2 Accelerator (full suite up to SHA-512)
 - True random number generator (TRNG)
- Operating range
 - On-chip buck DC/DC converter
 - 1.8-V to 3.8-V single supply voltage

- -40 to +85°C
- Package
 - Dimension: 29.86 mm x 19.98 mm x 2.15 mm
 - QFM-42 (22 GPIOs)
 - ◇ BDE-MP2652P7A32
 - ◇ BDE-MP2652P7N32
 - ◇ BDE-MP2652P7U32
 - QFM-42 (26 GPIOs)
 - ◇ BDE-MP2652P7A0
 - ◇ BDE-MP2652P7N0
 - ◇ BDE-MP2652P7U0
 - RoHS-compliant package
- Antenna:
 - BDE-MP2652P7A32/BDE-MP2652P7A0:
 - Integrated PCB antenna
- BDE-MP2652P7N32/BDE-MP2652P7N0: No antenna included, RF pad for connecting external antenna
- BDE-MP2652P7U32/BDE-MP2652P7U0: U.FL connector for connecting external antenna
- Additional integrated components:
 - 48.0-MHz crystal
 - 32.768-kHz crystal (RTC)
 - 32M-bit SPI Serial Flash
 - ◇ BDE-MP2652P7A32
 - ◇ BDE-MP2652P7N32
 - ◇ BDE-MP2652P7U32
 - RF filter, switch and passive components

Applications

- 2400 to 2500 MHz ISM and SRD systems with down to 4 kHz of receive bandwidth
- Building automation
- Industrial transport – asset tracking
- Factory automation and control
- Medical
- Electronic point of sale (EPOS) – Electronic Shelf Label (ESL)
- Communication equipment
- Personal electronics

Reference

[1] CC2652P7 resources: <https://www.ti.com/product/CC2652P7>

Contents

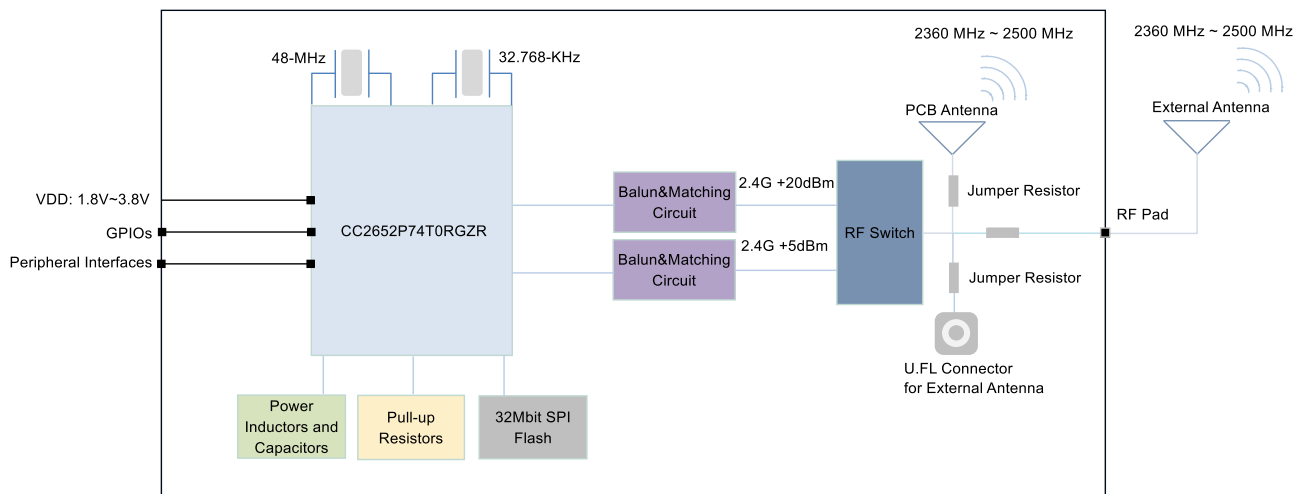
General Description	1
Key Features.....	2
Applications	3
Reference.....	4
Contents.....	5
1. Block Diagram.....	6
2. Pinout	7
2.1. Pinout Diagram	7
2.2. Pinout Description	7
3. Characteristics	9
3.1. Absolute Maximum Ratings	9
3.2. Recommended Operating Conditions.....	9
4. Mechanical Specifications	9
4.1. Dimensions	9
4.2. PCB Footprint	10
5. Marking	11
6. Typical Reflow Profile	12
7. Ordering Information	13
8. Revision History	13
Contacts	13

1. Block Diagram

BDE-MP2652P7 module is based on the Texas Instruments CC2652P7 single chip wireless MCU. With clocks, other required passives and antenna/connector (optional), it allows faster time to market at reduced development cost.

The three modules include BDE-MP2652P7A32, BDE-MP2652P7U32 and BDE-MP2652P7N32, as seen in Figure 1-1, comprises of:

- 48-MHz XTAL
- 32.768-kHz XTAL
- 32M-bit SPI Flash
- Power Inductors and Capacitors
- Pull-up Resistors
- Balun & Matching Circuit
- PCB trace antenna / U.FL connector for external antenna / RF pad for external antenna



Note: No 32Mbit Flash for BDE-MP2652P7A0/BDE-MP2652P7U0/BDE-MP2652P7N0

Figure 1-1. The block diagram of BDE-MP2652P7

2. Pinout

2.1. Pinout Diagram

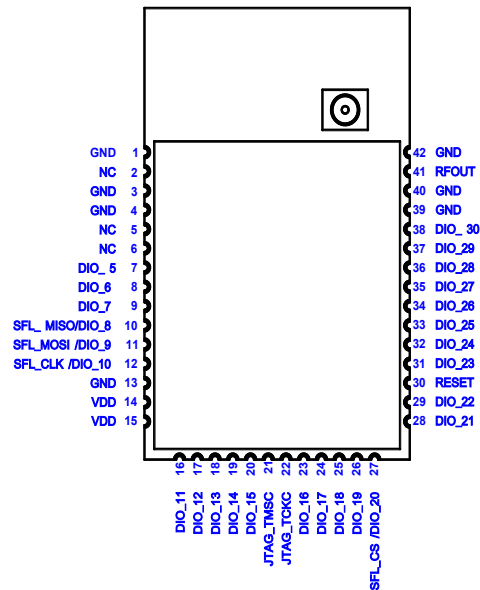


Figure 2-1. Pinout Diagram of BDE- MP2652P7 Top View

2.2. Pinout Description

Table 2-1 describes the definitions of the pins of the module. Pin number of CC2652P7 chip is also stated here, because the VQFN pin is referred to in the software design kit (SDK).

Table 2-1. Pin Description ⁽¹⁾

Module Pin #	Pin Name	Type	CC2652P7 Pin #	Description
1	GND	-	-	Ground
2	NC	-	-	Unused. Do not connect
3	GND	-	-	Ground
4	GND	-	-	Ground
5	NC	-	-	Unused. Do not connect
6	NC	-	-	Unused. Do not connect
7	DIO_5	I/O	10	GPIO
8	DIO_6	I/O	11	GPIO
9	DIO_7	I/O	12	GPIO
10	SFL_MISO/DIO_8 ⁽²⁾	I/O	14	SFL_MISO/GPIO
11	SFL_MOSI/DIO_9 ⁽²⁾	I/O	15	SFL_MOSI/GPIO

Module Pin #	Pin Name	Type	CC2652P7 Pin #	Description
12	SFL_CLK/DIO_10 ⁽²⁾	I/O	16	SFL_CLK/GPIO
13	GND	-	-	Ground
14	VDD	-	-	Power
15	VDD	-	-	Power
16	DIO_11	I/O	17	GPIO
17	DIO_12	I/O	18	GPIO
18	DIO_13	I/O	19	GPIO
19	DIO_14	I/O	20	GPIO
20	DIO_15	I/O	21	GPIO
21	JTAG_TMSC	I/O	24	JTAG_TMSC, High-drive Capability
22	JTAG_TCKC	I/O	25	JTAG_TCKC
23	DIO_16	I/O	26	GPIO, JTAG_TDO, High-drive Capability
24	DIO_17	I/O	27	GPIO, JTAG_TDI, High-drive Capability
25	DIO_18	I/O	28	GPIO
26	DIO_19	I/O	29	GPIO
27	SFL_CS/DIO_20 ⁽²⁾	I/O	30	SFL_CS/GPIO
28	DIO_21	I/O	31	GPIO
29	DIO_22	I/O	32	GPIO
30	RESET	I/O	35	Power on reset, No internal pullup resistor
31	DIO_23	I/O	36	GPIO
32	DIO_24	I/O	37	GPIO
33	DIO_25	I/O	38	GPIO
34	DIO_26	I/O	39	GPIO
35	DIO_27	I/O	40	GPIO
36	DIO_28 ⁽³⁾	I/O	41	GPIO
37	DIO_29 ⁽³⁾	I/O	42	GPIO
38	DIO_30 ⁽³⁾	I/O	43	GPIO
39	GND	-	-	Ground
40	GND	-	-	Ground
41	RFOUT	-	-	2.4-GHz RF Output Port
42	GND	-	-	Ground

Note ⁽¹⁾: For pin multiplexing details, refer to the [CC2652P7 SimpleLink™ Multiprotocol 2.4-GHz Wireless MCU with Integrated Power Amplifier](#);

Note ⁽²⁾: These four pins are used as the SPI interface for a serial SPI flash on board when on-board 32Mbit versions are selected, otherwise, they can be used as GPIOs or peripheral interface for user;

Note ⁽³⁾: These three pins are used as the RF switch control pins on-board, not recommended for use to the user.

3. Characteristics

3.1. Absolute Maximum Ratings

Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, so functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specification are not implied. Exposure to Absolute Maximum Rating conditions for extended periods may affect device reliability.

Table 3-1. 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
Analog Pins	-0.3	1.49	V	Voltage scaling disabled, internal reference
Operating temperature (T _A)	-0.3	VDDS/2.9	V	Voltage scaling disabled, VDDS as reference
Storage Temperature	-40	125	°C	

3.2. Recommended Operating Conditions

Over operating free-air temperature range (unless otherwise noted)

Table 3-2. Recommended Operating Conditions

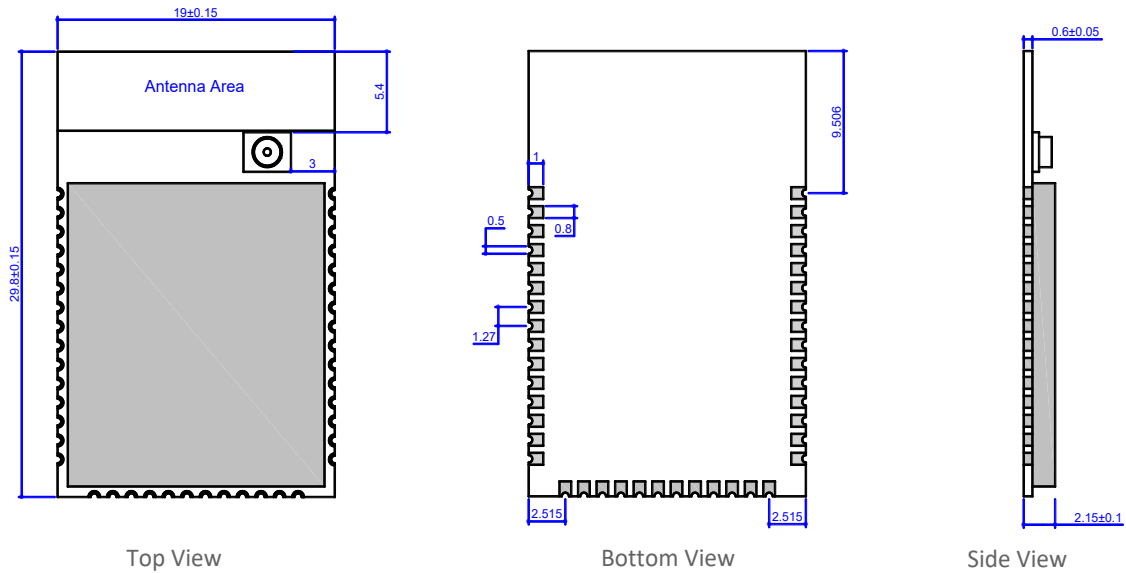
PARAMETER	MIN	TYP	MAX	UNIT
VDDS	1.8	3.3	3.8	V
Operating Temperature	-40		85	°C
Rising supply voltage slew rate	0		100	mV/μs
Falling supply voltage slew rate	0		20	mV/μs

4. Mechanical Specifications

The following pages include mechanical, footprint drawings, and marking information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document.

4.1. Dimensions

The module dimensions are presented in the following figure:

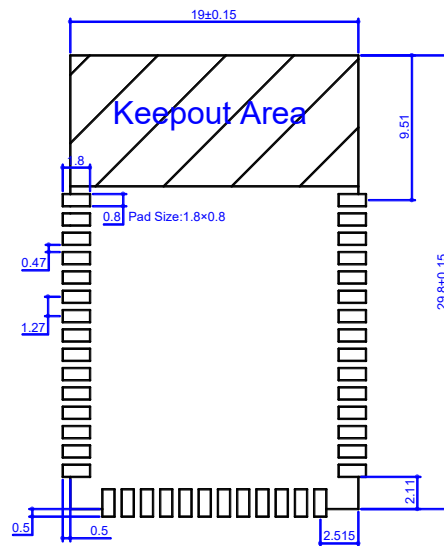


Note: All dimensions are in millimeter

Figure 4-1. Mechanical Drawing for BDE-MP2652P7

4.2. PCB Footprint

The footprint for the PCB is presented in the following figures:



Note:

1. All dimensions are in millimeter;
2. Solder mask should be the same or 5% larger than the dimension of the pad;
3. Solder paste must be the same as the pin for all peripheral pads.

Figure 4-3. Module Footprint for BDE-MP2652P7 Top View

5. Marking

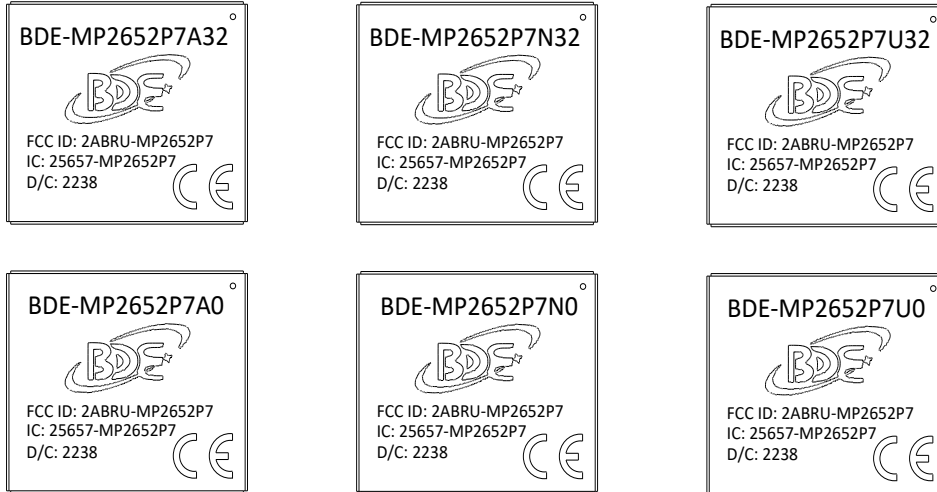


Figure 5-1. Module Marking

6. Typical Reflow Profile

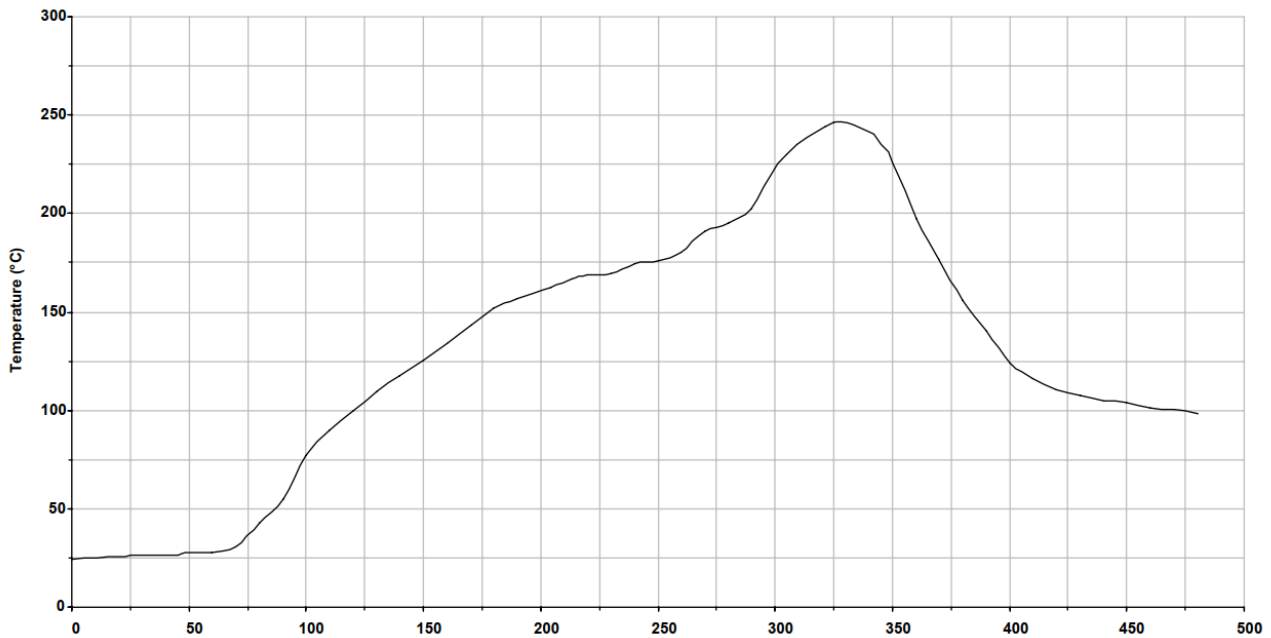


Figure 6-1. Typical Reflow Profile

Key features of the profile:

- Initial ramp = 1-2.5°C/sec to 175°C ±25°C equilibrium
- Equilibrium time = 60 to 180 seconds
- Ramp to maximum temperature (245°C) = 3°C/sec max.
- Time above liquidus temperature (217°C): 45-90 seconds
- Device absolute maximum reflow temperature: 260°C

7. Ordering Information

Part Number	Description	Size (mm)	Package	MOQ
BDE-MP2652P7A32	BDE Multiprotocol 2.4-GHz Wireless Module Based on CC2652P7, PCB Antenna and On-board External 32M-bit Flash	29.8 x 19 x 2.15	Tape & Reel	900
BDE-MP2652P7U32	BDE Multiprotocol 2.4-GHz Wireless Module Based on CC2652P7, U.FL Connector and On-board External 32M-bit Flash	29.8 x 19 x 2.15	Tape & Reel	900
BDE-MP2652P7N32	BDE Multiprotocol 2.4-GHz Wireless Module Based on CC2652P7, RF Pad Out for Antenna and On-board External 32M-bit Flash	29.8 x 19 x 2.15	Tape & Reel	900
BDE-MP2652P7A0	BDE Multiprotocol 2.4-GHz Wireless Module Based on CC2652P7, PCB Antenna, No External Flash	29.8 x 19 x 2.15	Tape & Reel	900
BDE-MP2652P7U0	BDE Multiprotocol 2.4-GHz Wireless Module Based on CC2652P7, U.FL Connector, No External Flash	29.8 x 19 x 2.15	Tape & Reel	900
BDE-MP2652P7N0	BDE Multiprotocol 2.4-GHz Wireless Module Based on CC2652P7, RF Pad Out for Antenna, No External Flash	29.8 x 19 x 2.15	Tape & Reel	900

8. Revision History

Revision	Date	Description
V1.0	10-October-2022	Initial Release

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