Bluetooth Low Energy (BLE) Data Transmission Module BTM2604RP

Table of Contents

1 Product Overview 3
2 Module Features 3
3 Electrical Characteristics 4
4 Module Function Description 4
5 Application Diagram 5
6 Module Pin 6
6.1 Module Pinout 6
6.2 Module Pin Definition 7
7 Package Specifications 8
8 Design Guidelines 8
Figure 6 PCB Recommended Layout 10
9 Q&A 10
9.1 Poor Transmission Distance 10
9.2 Damage——Abnormal Damage 10
9.3 High bit error rate 11
10 Soldering Recommendations 11
11 Electrostatic discharge warning 12
12 Version History 13
13 Contact Information 13

1 Product Overview

BMT2604RP is a BLE data transmission module, based on a BLE 5.2 SoC chip CMT4531(ARM Cortex-M0 32-bit processor, up to 64MHz working frequency, integrates 48KB SRAM and 256KB FLASH on-chip), equipped with an on-board PCB antenna. The module communicates with an external MCU via UART to quickly set up wireless connection and data transfer between BLE peripheral devices and BLE central devices (such as mobile phones and tablets). The external MCU has a low resource occupation and makes it easy for the developer to solve complex wireless communication challenges and accelerate time to market.

2 Module Features

- Based on ARM Cortex-M0 32-bit processor;
- Supports BLE protocol 5.2
- Up to 256KB of FLASH and 48KB of RAM
- Support 19general-purpose I/O ports, configurable mapping and flexible peripherals;
- Can be used as a BLE data transmission module or as an MCU alone;
- Support a universal serial interface UART communication;
- Support AT command to reset module, get MAC address;
- Support AT commands to adjust the BLE connection interval and control different forwarding rates (dynamic power consumption adjustment);
- Support AT commands to adjust the transmit power, modify the advertising interval, customize the advertising data, customize the device identification code, set the data delay (the preparation time for external MCU to receive data from serial port), modify the baud rate of serial port, modify the module name, and support data preservation when power is off;
- UART buffer can receive no more than 5K byte data at one time from the host MCU;
- Support mobile device APP to modify module name, serial baud rate, product identification code, and customize advertising data and interval;
- Support mobile device APP to reset module and set Tx power;
- Support APP to adjust the BLE connection interval, but the data will not be saved after power is off (dynamic power consumption adjustment);
- Support anti-hijacking password setting, modification and recovery to prevent malicious

third-party connection;

- Customize the advertising data including battery power, and custom device identification code (suitable for beacon applications);
- Support internal RTC real-time clock;

3 Electrical Characteristics

- Working Voltage：1.8V-3.6V
- Working Temperature：-40℃～+85℃
- Modulation Mode: GFSK Gaussian Frequency Shift Keying Modulation Frequency：2402MHz - 2483.5MHz
- RX Current：17mA @1Mbps GFSK
- TX Current：120mA @20dBm/3.3V
- Maximum Transmit Power: +20dBm
- Receiving Sensitivity：-96dBm @1Mbps GFSK

4 Module Function Description

The module will start advertising automatically when it is powered. The mobile device running a specific APP can scan and connect to the module. When a connection has been established, the module can be operated through the BLE protocol. The external MCU can carry out wireless communication with the mobile device through the serial port of the module, and the external MCU can also send the control commands to change the communication parameters through the serial port of the module.

The user's data package format is defined by the upper application. The mobile device can send data to the module through the APP, and then the data will be sent to the external MCU through the serial port of the module. After the module receives the data packet from the external MCU, it will automatically forward it to the connected mobile device. The user needs to complete the source code development of the external host MCU and APP running on the mobile device.

5 Application Diagram

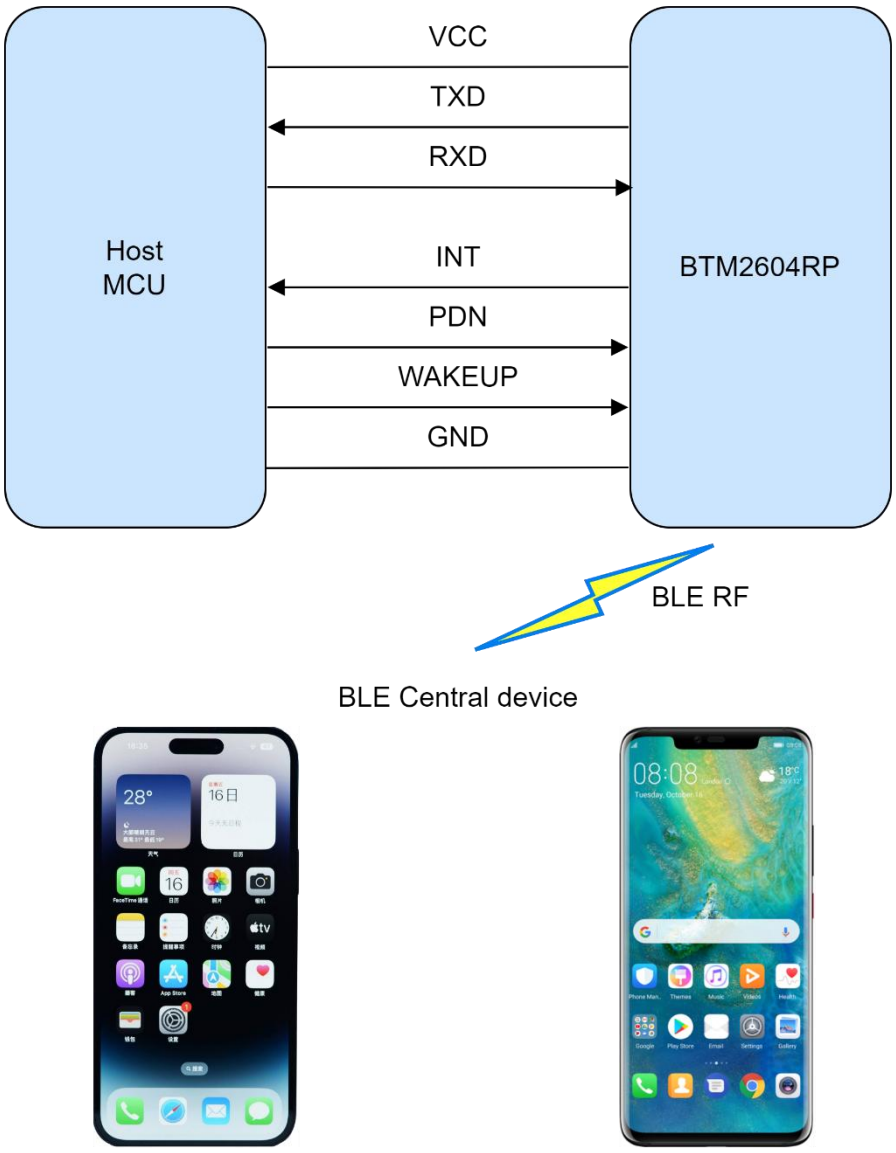

Figure 1 Data Module Application Diagram

6 Module Pin

6.1 Module Pinout

Figure 2. Module Pinout (Top view / Bottom view)

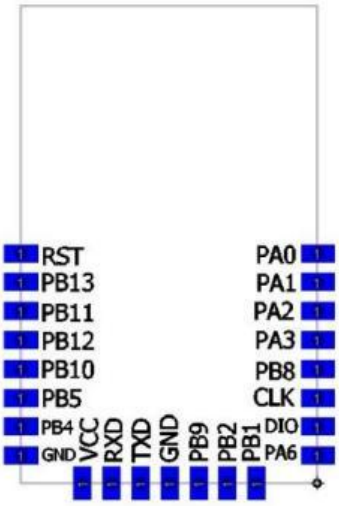

Figure 3．Module Pinout (Bottom View)

6.2 Module Pin Definition

Pin No	Pin Name	Type	Description
1	PA0	I/O	General GPIO
2	PA1	I/O	General GPIO
3	PA2	I/O	General GPIO
4	PA3	I/O	General GPIO
5	PB8	I/O	General GPIO
6	PA4	I/O	SWCLK；Serial Clock for Debugging and Programming
7	PA5	I/O	SWDIO；Serial Data for Debugging and Programming
8	PA6	I/O	General GPIO
9	PB1	I/O	General GPIO
10	PB2	I/O	General GPIO
11	PB9	I/O	General GPIO
12	GND	DG	Power Ground
13	PB6	I/O	UART TXD
14	PB7	I/O	UART RXD
15	VCC	DV	Power Supply 3.3V
16	GND	DG	Power Ground
17	PB4	I/O	General GPIO
18	PB5	I/O	General GPIO
19	PB10	I/O	General GPIO
20	PB12	I/O	General GPIO
21	PB11	I/O	General GPIO
22	PB13	I/O	General GPIO
23	RST	I/O	Reset Pin；Active Low

Table 1 Module Pin Definition

7 Package Specifications

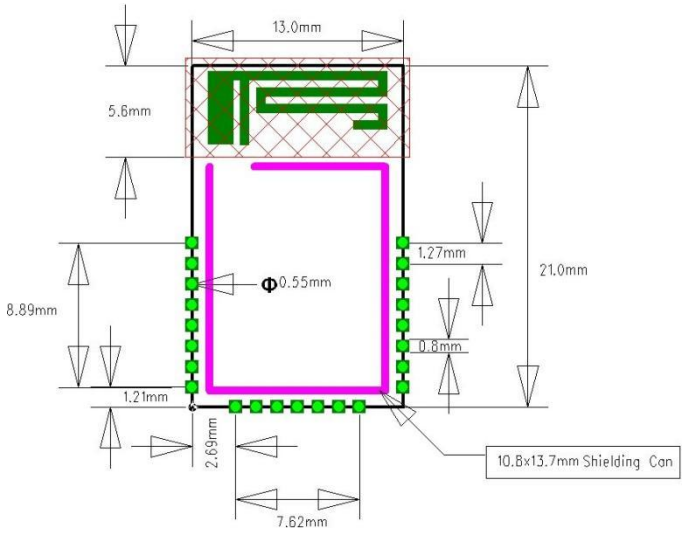

Figure 4 Module Size(with shield)

8 Design Guidelines

1. Suggest to use a DC regulated power supply to power the module. The ripple coefficient of the power supply should be as small as possible, and the module needs to be reliably grounded. Please pay attention to the correct connection of the positive and negative poles of the power supply. If connected in reverse, it may cause permanent damage to the module；
2. Please check the power supply to ensure it is within the recommended voltage range. Exceeding the maximum value may cause permanent damage to the module. Please check the stability of the power supply. The voltage should not fluctuate greatly or frequently；
3. When designing the power supply circuit for the module, it is recommended to leave a margin of more than 30%, which is conducive to the long-term stable operation of the entire machine. Modules should be kept as far away as possible from parts with significant electromagnetic interference such as power supplies, transformers, and high-frequency traces；
4. High-frequency digital traces, high-frequency analog traces, and power traces must be kept away from the bottom of the module. If it is absolutely necessary to pass under the module, assuming the module is soldered to the Top Layer, ground should be laid on the Top Layer of

the module contact part (all copper should be laid and well grounded), and the traces must be close to the digital part of the module And the wires are routed on the Bottom Layer；

5. Assuming that the module is soldered or placed on the Top Layer, it is also incorrect to randomly trace the wires on the Bottom Layer or other layers, which will affect the stray and receiving sensitivity of the module to varying degrees；
6. If there are devices with significant electromagnetic interference around the module, it will also greatly affect the performance of the module. According to the intensity of the interference, it is recommended to stay away from the module appropriately. If the situation permits, appropriate isolation and shielding can be carried out；
7. If there are traces with significant electromagnetic interference around the module (high-frequency digital, high-frequency analog, power traces), it will also greatly affect the performance of the module. According to the intensity of the interference, it is recommended to keep them away from the module appropriately. If the situation permits, appropriate isolation and shielding can be carried out；
8. If the communication line uses a 5V level, a level conversion circuit must be used；
9. Try to stay away from some TTL protocols whose physical layer is also in the 2.4GHz frequency band, such as USB3.0。
10. Recommended Layout

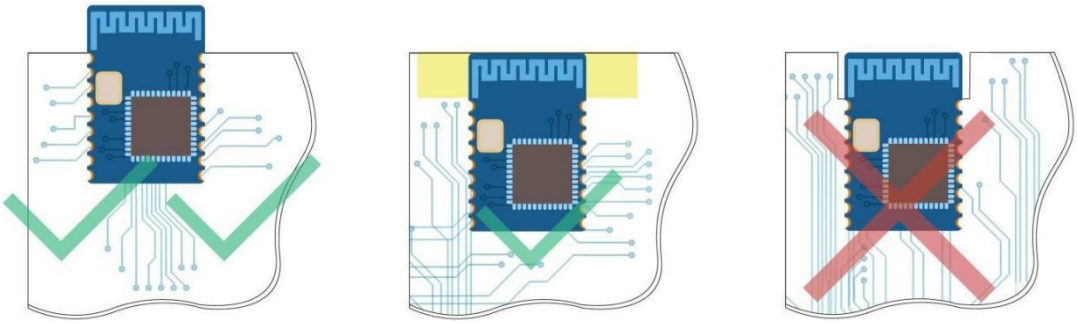

Figure 5 PCB Recommended Wiring

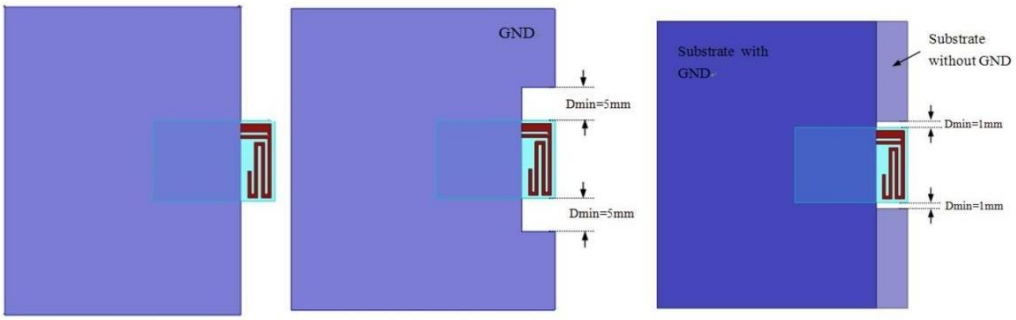

Figure 6 PCB Recommended Layout

9 Q&A

9.1 Poor Transmission Distance

1. When there is a linear communication obstacle, the communication distance will correspondingly attenuate. Factors such as temperature, humidity, and co-channel interference can increase the packet loss rate. Ground absorption and reflection of radio waves may degrade performance in near-ground testing conditions；
2. Seawater has a strong ability to absorb radio waves, resulting in poor communication performance in coastal or marine environments；
3. Severe signal attenuation may occur if metal objects are present near the antenna or if the module is placed inside a metal enclosure；
4. Incorrect power register settings or an excessively high over-the-air (OTA) data rate (higher OTA rates reduce communication range) can negatively impact performance)；
5. If the power supply voltage at room temperature falls below the recommended value, the transmission power decreases proportionally with voltage drop；
6. Poor antenna-module impedance matching or the use of a low-quality antenna can significantly degrade signal performance.

9.2 Damage——Abnormal Damage

1. Please check the power supply to ensure it is within the recommended voltage range. Exceeding the maximum value may cause permanent damage to the module. Please check the stability of

the power supply. The voltage should not fluctuate greatly or frequently；

2. Please ensure anti-static operation during installation and use. High-frequency devices are electrostatically sensitive devices；
3. Please ensure that the humidity is not too high during installation and use. Some components are humidity-sensitive devices. It is not recommended to use it at excessively high or low temperatures unless there are special requirements。

9.3 High bit error rate

1. Co-channel interference may occur—keep away from the source or adjust the frequency/channel to avoid it；
2. Unstable power supply may cause data corruption—ensure reliable power；
3. Poor/long extension cables or feeders can increase the bit error rate。

10 Soldering Recommendations

1. Heating method: Conventional convection or IR convection；
2. Allowed reflow soldering times: 2 times, based on the following reflow soldering (conditions)(see the figure below)；

3. Temperature curve: Reflow soldering should follow the following temperature curve (see the figure below)；
4. Maximum temperature：245°C。

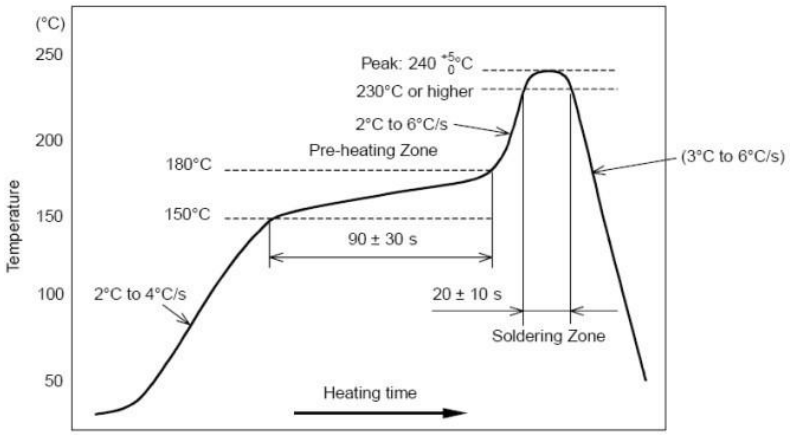

Figure 7 Classification Profile

11 Electrostatic discharge warning

ESD (Electrostatic Discharge) may damage the module. Follow these 3 precautions when handling：

1. Always use ESD protection—avoid touching the module with bare hands。
2. Store modules in ESD-safe areas to prevent static buildup。
3. Incorporate ESD protection circuits in design for high-voltage/high-frequency inputs。
4. Potential impacts: Minor performance degradation to complete failure. Even slight parameter shifts may cause the module to fall out of certified limits, increasing vulnerability.

12 Version History

Table 2. Version History

Version	Modification	Date
V1.0	Initial version	2025.8.4

13 Contact Information

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