

**Bluetooth Low Energy (BLE)
Data Transmission Module
HM-BT4531B**

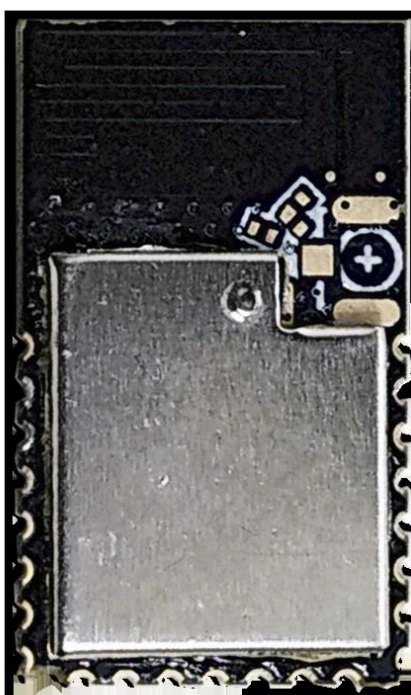


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1 Product Overview

HM-BT4531B is a BLE data transmission module, based on CMT4531 BLE 5.2 SoC chip (ARM Cortex-M0 32-bit processor, up to 64MHz working frequency) with 256KB Flash and 48KB RAM, features a high performance 2.4GHz transceiver, equipped with an on-board PCB antenna and the external antenna is optional with connector. 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

- 32-bit ARM Cortex-M0 processor with frequency up to 64MHz;
- Supports BLE protocol 5.2 and Bluetooth Mesh;
- Up to 256KB of FLASH and 48KB of RAM;
- Support universal serial interface UART communication with the host MCU, the baud rate can be 9600bps to 500000bps;
- Default connection interval is 30 millisecond for fast connection
- Support LE 1M / 2M PHY and LE Coded PHY
- Can be used as a BLE data transmission module or as an MCU alone;
- 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 2K 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. These settings can be saved after power-down;
- Support mobile device APP to reset module and set Tx power
- Support mobile device APP to adjust Bluetooth connection interval. The setting can not to be saved after power down
- Support passkey setting, modification and recovery to prevent MITM (man-in-the-middle) attacks;
- 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: -20°C ~ +85°C
- Modulation Mode: GFSK Gaussian Frequency Shift Keying
- Modulation Frequency: 2402MHz-2483.5MHz
- RX Current: 3.8mA @1Mbps GFSK
- TX Current: 4.2mA@0dBm
- Deep Sleep Mode Current: 1.4uA (all 48KB ram retention)
- Maximum Transmit Power: +6dBm
- Receiving Sensitivity: -94dBm @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

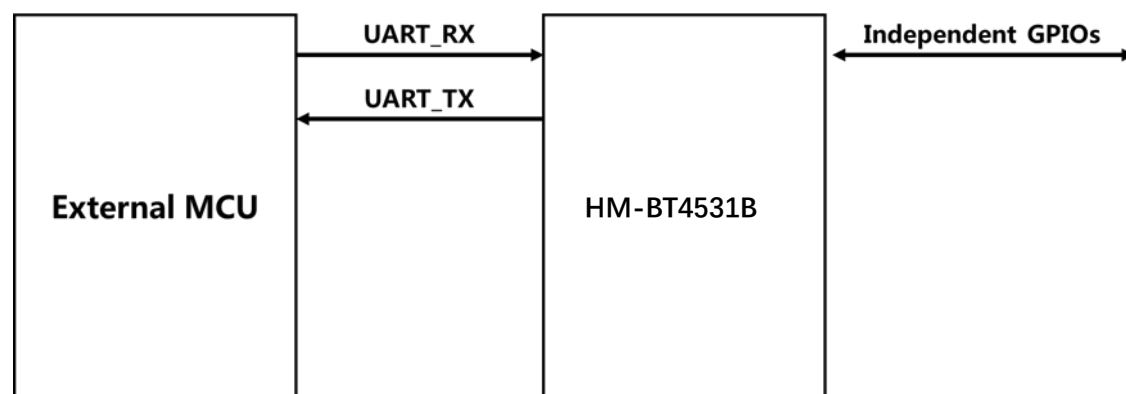


Figure 5.1 Block diagram between HM-BT4531B and External MCU

6 Module Pin

6.1 Module Pinout

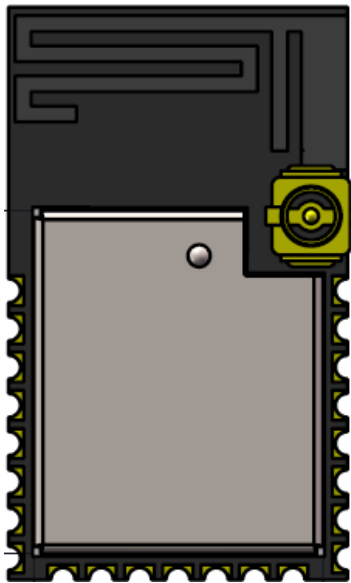


Figure 6.1 Module Pinout (Top View)

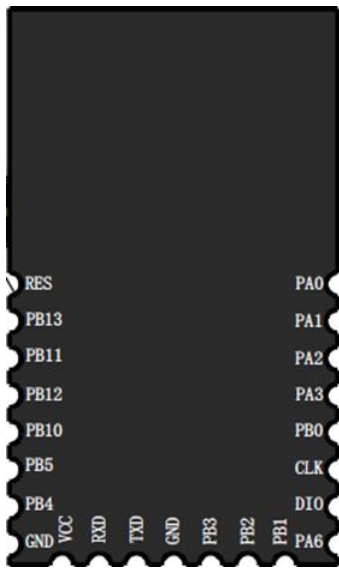


Figure 6.2 Module Pinout (Bottom View)

6.2 Module Pin Definition

Pin No	Pin Name	Type	Description
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1	PA0	I/O	General Purpose Input/Output
2	PA1	I/O	General Purpose Input/Output
3	PA2	I/O	General Purpose Input/Output
4	PA3	I/O	General Purpose Input/Output
5	PB0	I/O	General Purpose Input/Output
6	PA4	I/O	SWCLK/PA4: Serial Clock for Debugging and Programming
7	PA5	I/O	SWDIO/PA5: Serial Data for Debugging and Programming
8	PA6	I/O	General Purpose Input/Output
9	PB1	I/O	General Purpose Input/Output
10	PB2	I/O	General Purpose Input/Output
11	PB3	I/O	General Purpose Input/Output
12	GND	DG	Ground
13	PB6	I/O	UART TXD
14	PB7	I/O	UART RXD
15	VCC	DV	Power Supply; 1.8V~3.6V
16	GND	DG	Ground
17	PB4	I/O	General Purpose Input/Output
18	PB5	I/O	General Purpose Input/Output
19	PB10	I/O	General Purpose Input/Output
20	PB12	I/O	General Purpose Input/Output
21	PB11	I/O	General Purpose Input/Output
22	PB13	I/O	General Purpose Input/Output
23	RES	I/O	Reset

Table 6-1 Module Pin Definition

7 Package Specifications

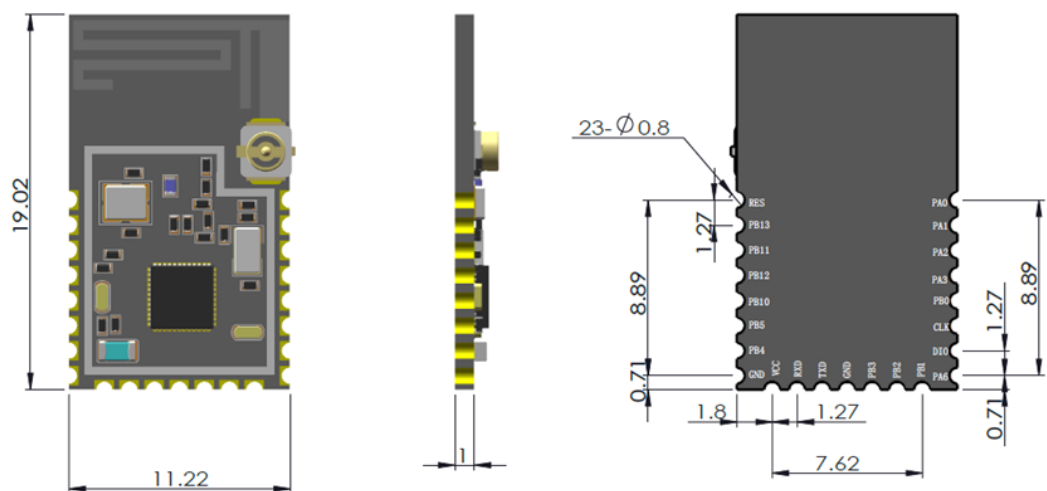


Figure 7.1 HM-BT4531B Module Size (no shield) (Unit: mm)

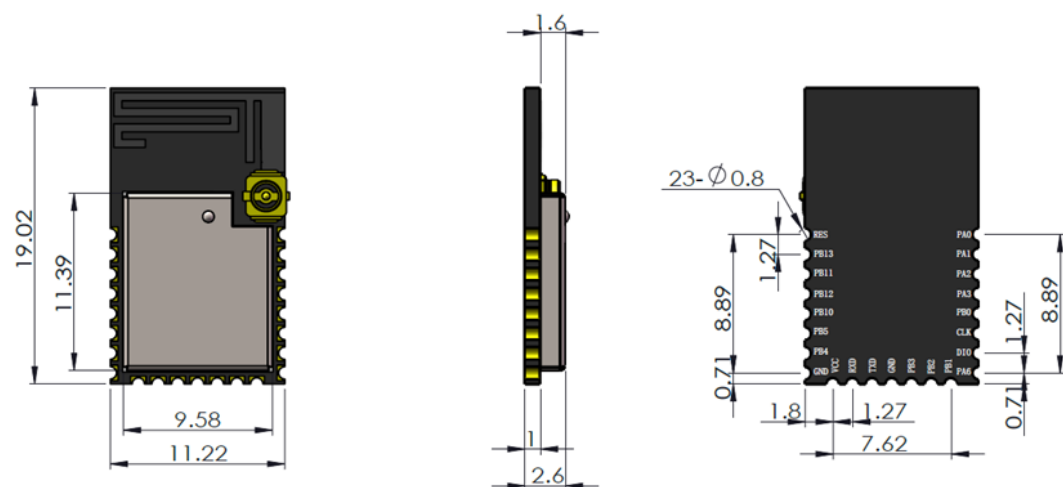


Figure 7.2 HM-BT4531B Module Size (with shield) (Unit: mm)

8 Ordering Information

Module	Feature List
HM-BT4531B	CPU: ARM Cortex-M0@64MHz FLASH: 256KB; RAM: 48KB TX power: +6dBm

9 Design Guidelines

9.1 Layout and Placement

For optimal performance of the HM-BT4531B,

- Place the module aligned to the edge of the application PCB or leave the antenna area out of the application PCB, as illustrated in the figures below.
- Leave the antenna clearance area void of any traces, components, or copper on all layers of the application PCB if you are going to use the on-board chip antenna
- Connect all ground pads directly to a solid ground plane.
- Place the ground vias as close to the ground pads as possible.
- Do not place plastic or any other dielectric material in contact with the antenna.

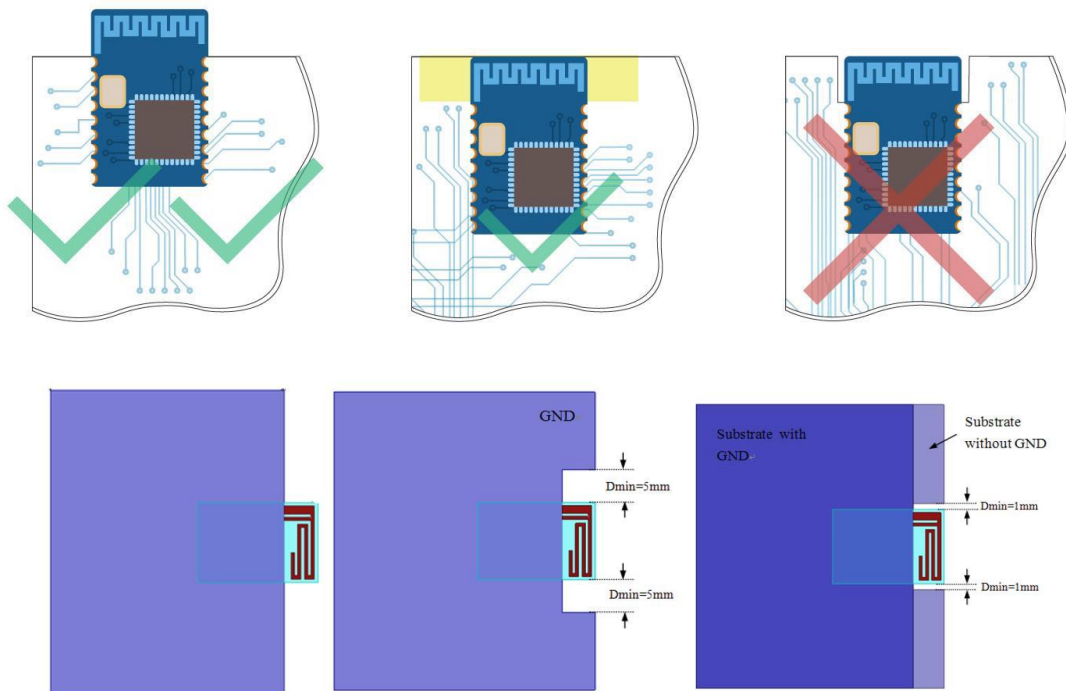


Figure 9.1 Recommended Layout

10 Soldering Recommendations

It is recommended that final PCB assembly of the HM-BT4531B follows the industry

standard as identified by the Institute for Printed Circuits (IPC). Sometimes a PCB must be reflowed multiple times based on the nature of the design and components used or limitations of the assembly line. During a single reflow cycle, every component is exposed to and stressed with high temperature. Exposing parts to high temperature for multiple times can damage the parts. It is always recommended to avoid more than two reflow cycles of the parts. The figure below illustrates the recommended reflow profile that follows IPC / JEDEC-020, and the peak temperature should not exceed 245°C.

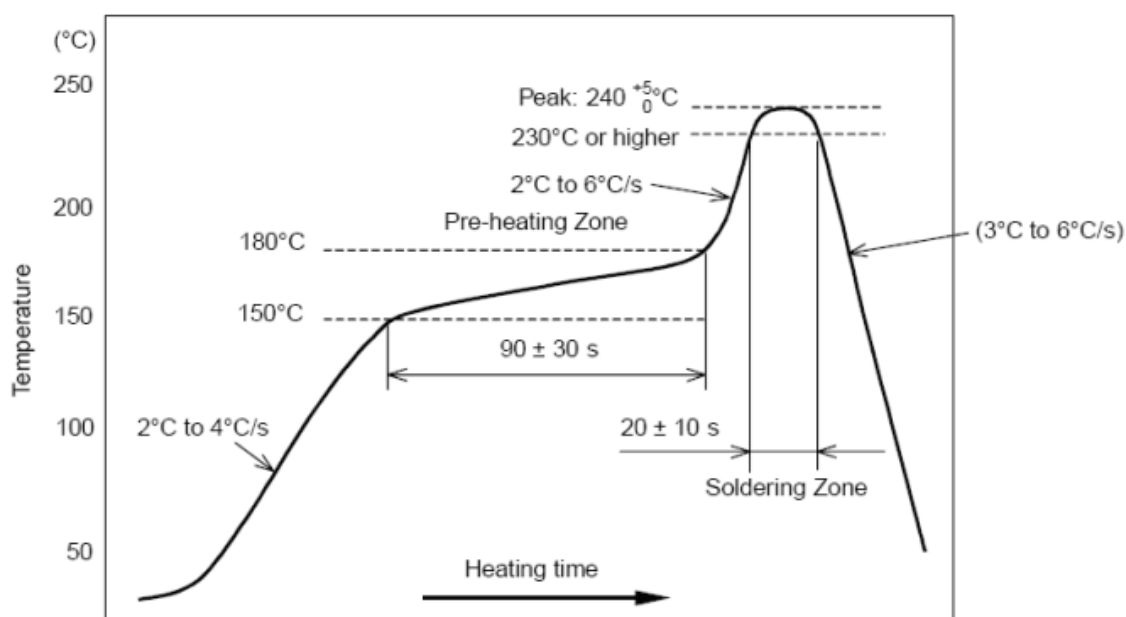


Figure 10.1 Classification Profile

11 Version History

Date	Version	Modification
2023/9/23	V1.0	Initial version

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