Bluetooth Low Energy (BLE)

Data Transmission Module

HM-BT4531(-1)

HM-BT4531

HM-BT4531-1

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1 Product Overview

HM-BT4531 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 3K 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;

- BQB Qualification

- FCC/CE/IC/SRRC Certification

3 Electrical Characteristics

- Working Voltage: 1.8V-3.6V

- Working Temperature: -20℃～+85℃

- 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.
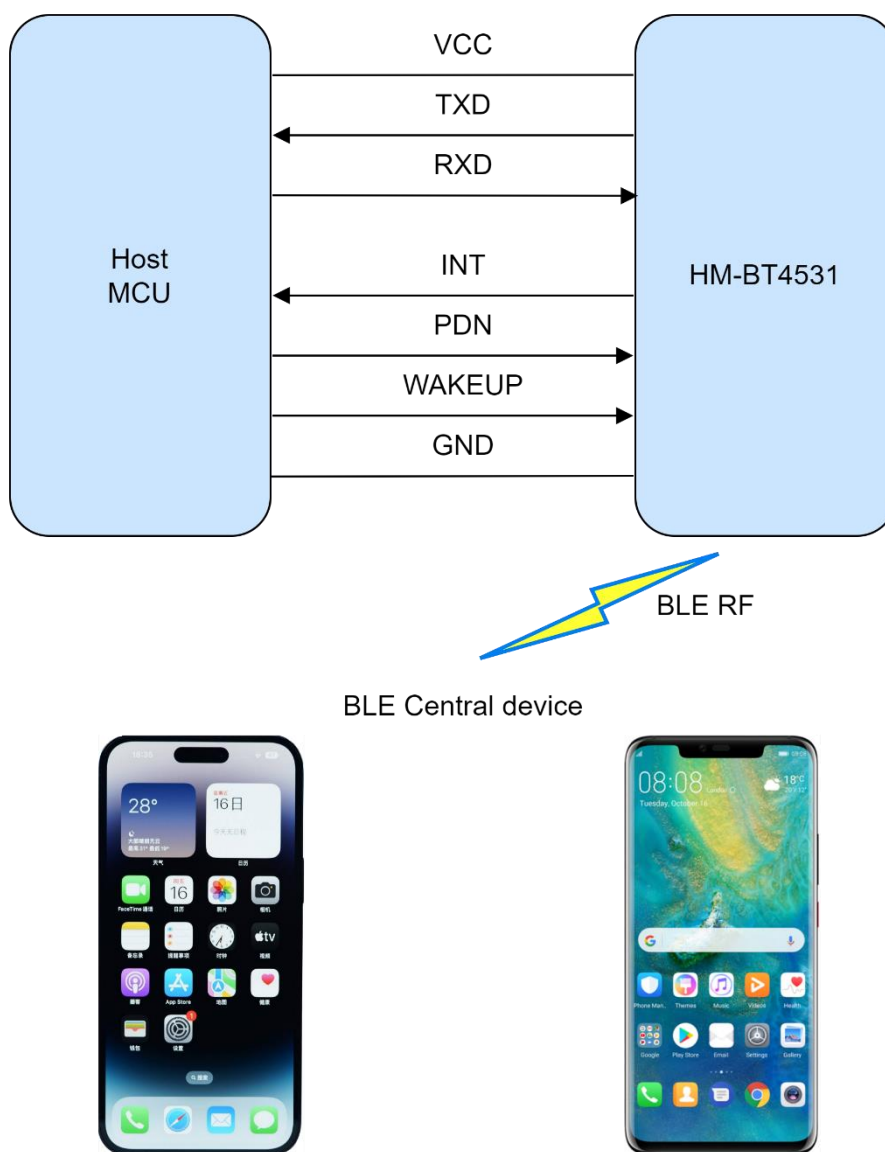
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5 Application Diagram

Figure 5.1 Block diagram between HM-BT4531 and External MCU

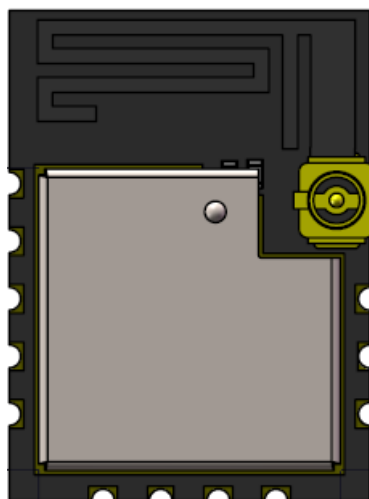**www.hoperf.com**

6 Module Pin

6.1 Module Pinout

Figure 6.1 Module Pinout (Top View)
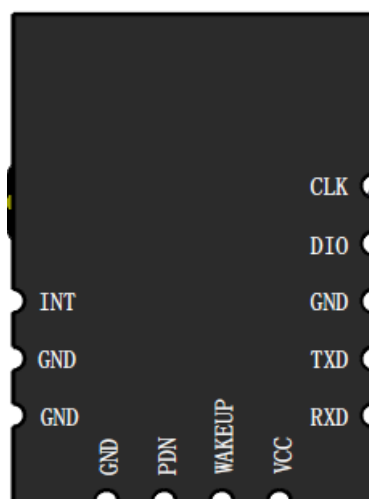
Figure 6.2 Module Pinout (Bottom View)

6.2 Module Pin Definition

Pin No	Pin Name	Type	Description
1	INT	DO	Interrupt Pin, Module to MCU; 1-0: Module UART Start to Send Data

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			0-1: Module UART Stop Sending Data
2	GND	DG	Digital Ground
3	GND	DG	Digital Ground
4	GND	DG	Digital Ground
5	PDN	DI	Power-down Pin; MCU to Module; 1-0: Module BLE Start to Advertise 0-1: Stop BLE functionality, including advertising and connections.
6	WAKEUP	DI	Wakeup Pin; MCU to Module 1-0: Module UART Start to Receive Data 0-1: Module Go to Sleep
7	VDD	AP,DP	Power Supply; 1.8V~3.6V
8	RXD	DI	UART RXD
9	TXD	DO	UART TXD
10	GND	DG	Digital Ground
11	DIO	I/O	SWDIO/PA5: Serial Data for Debugging and Programming
12	CLK	I/O	SWCLK/PA4: Serial Clock for Debugging and Programming

Table 6-1 Module Pin Definition
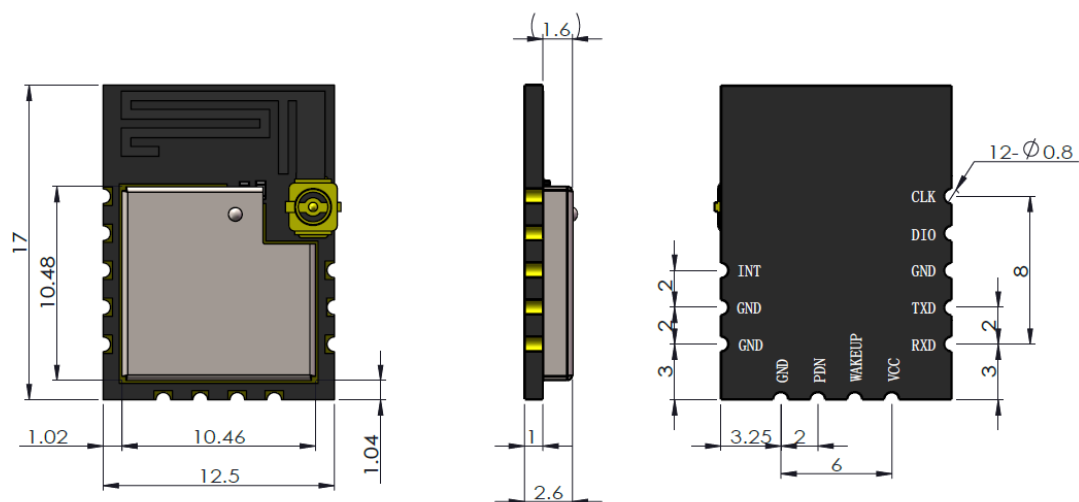
7　Package Specifications

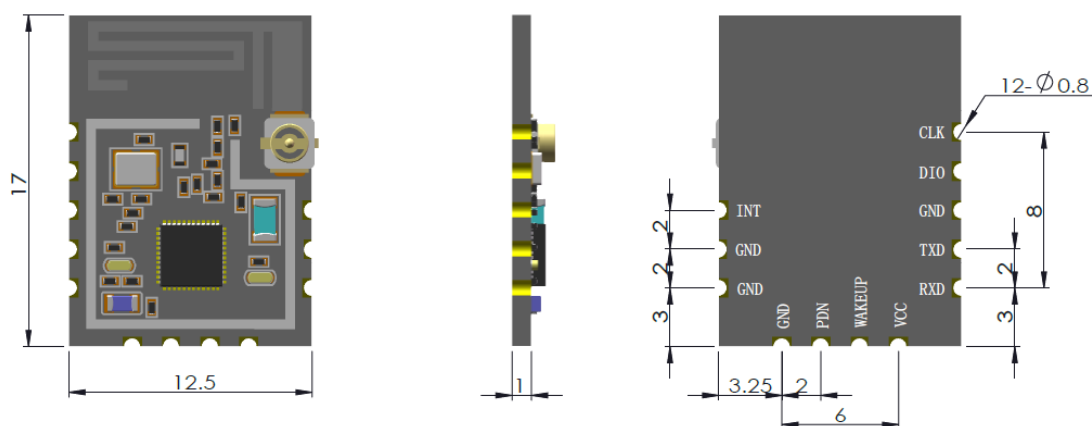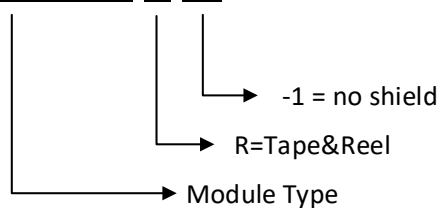Figure 7.1 HM-BT4531 Module Size (with shield) (Unit: mm)

Figure 7.2 HM-BT4531-1 Module Size (no shield) (Unit: mm)

8　Ordering Information

HM-BT4531 R -1

-1 = no shield

R=Tape&Reel

Module Type

Module	Feature List
HM-BT4531(R)	CPU：ARM Cortex-M0@64MHz FLASH：256KB RAM：48KB TX power：+6dBm
HM-BT4531(R)-1	Same as HM-BT4531, except without a shield and no certification.

9   Design Guidelines

9.1 Layout and Placement

For optimal performance of the HM-BT4531,

• 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.

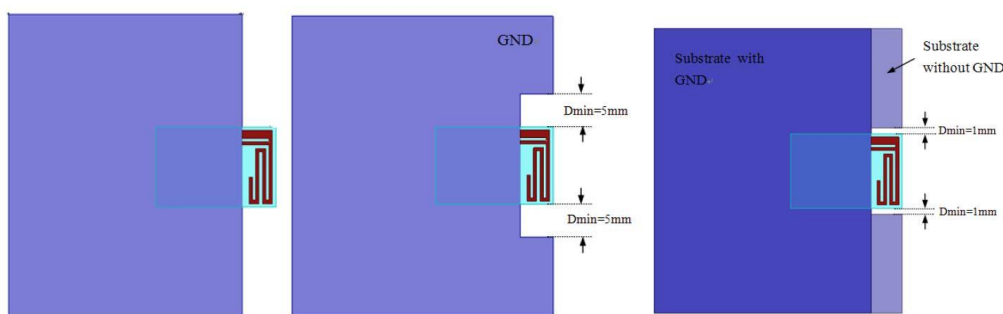• Do not place plastic or any other dielectric material in contact with the antenna.
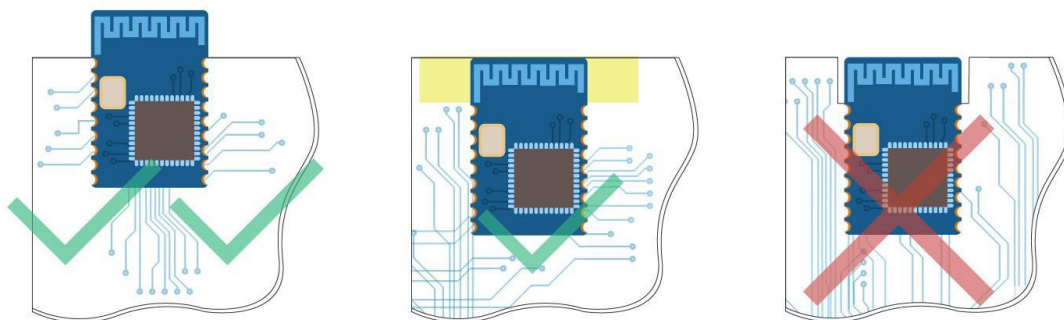
Figure 9.1 Recommended Layout

10 Soldering Recommendations

It is recommended that final PCB assembly of the HM-BT4531 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℃.
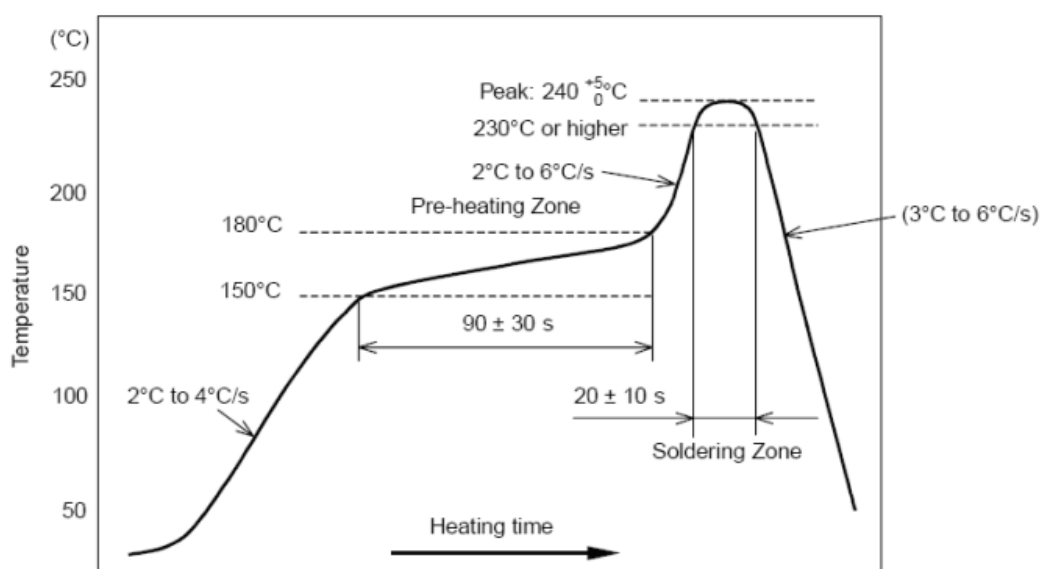

Figure 10.1 Classification Profile

11 Certifications

11.1 Bluetooth Qualification

The HM-BT4531 modules come with a pre-qualified Profile Subsystem by referring to the pre-qualified Controller Subsystem having Declaration ID of D065629, and can be combined with the pre-qualified Host Subsystem when in the process of qualifying the end-product via the SIG's Launch Studio.

11.2 CE – EU

The HM-BT4531 module has been tested in according to Radio Equipment Directive 2014/53/EU with the following standards. The product complies with standard(s) recognized as giving presumption of compliance with the principal protection requirement of the EC Council Directive of 2014/53/EU.

ETSI EN 301 489-1 V2.2.3 (2019-11)

ETSI EN 301 489-17 V3.2.4 (2020-09)

ETSI EN 300 328 V2.2.2: 2019

EN 62479: 2010,EN 50663: 2017

EN IEC 62368-1:2020+A11:2020

11.3 FCC – USA

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 undesirable operation.

OEM Responsibilities to comply with FCC Regulations

This module has been tested for compliance to FCC Part 15.

OEM integrator has to assure compliance of the entire end-product include the integrated RF Module. For 15 B (§15.107 and if applicable §15.107) compliance, the host manufacturer is required to show compliance with FCC Part 15 while the module is installed and operating.

Integrator is reminded to assure that these installation instructions will not be made available to the end-user of the final host device.

End Product Labeling

HM-BT4531 modules are labeled with their own FCC ID. The final host device, into which this RF Module is integrated has to be labelled with an auxiliary label stating the FCC ID of the RF Module: **2ASEO-HM-BT4531**.

Class B Device Notice

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

11.4 ISED – Canda

The HM-BT4531 module has been tested and certified under Innovation, Science and Economic Development Canada (ISED Canada, formerly Industry Canada) with the certification number: **IC: 24999-HMBT4531**

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference; and

2. This device must accept any interference, including interference that may cause undesired operation of the device

11.5 SRRC - China

After examination, the HM-BT4531 module conforms to the Radio Regulations of the People's Republic of China.

12 Version History

Date	Version	Modification
2023/9/23	V1.0	Initial version
2024/07/29	V1.1	Update the section of Ordering Information.

Liability Disclaimer

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Contact Information

Shenzhen Hope Microelectronics Co., Ltd.
Address: 30th floor of 8th Building, C Zone, Vanke Cloud City, Xili Sub-district, Nanshan, Shenzhen, GD, P.R. China
Tel: +86-755-82973805
Post Code: 518055
Email: sales@hoperf.com
Website: www.hoperf.com