

Bluetooth Low Energy (BLE) Transparent Transmission Module Specification

HM-BT4531B

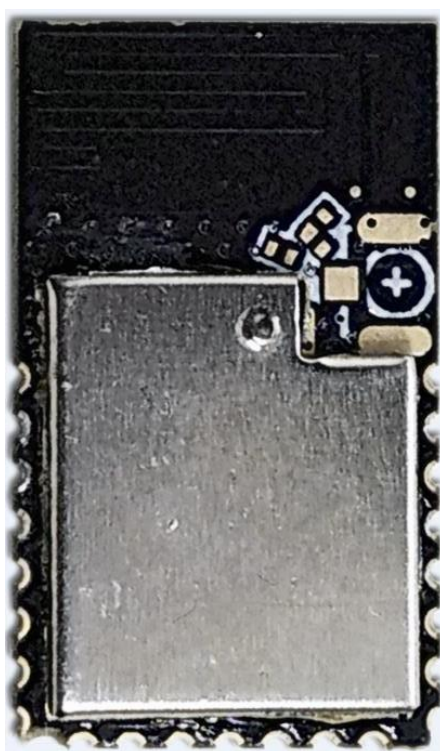


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1 product description

HM-BT4531B is a Bluetooth module based on a new generation of high-performance, ultra-low-power Bluetooth 5.1 chip CMT4531, using 32-bit ARM® Cortex®-M0 core with a maximum frequency of 64MHz and integrated 48KB on chip SRAM, 256KB FLASH, integrated advanced 5.1 BLE RF transceiver, equipped with integrated PCB antenna and external antenna base, supports wireless data transparent transmission function, and can quickly realize wireless connection and data communication between BLE slave devices and BLE master devices such as mobile phones and tablets by communicating with external MCU , The resource occupation of the external MCU is low, and the development process is simple.

2 Module Features

- ARM® -based Cortex®-M0 32 -bit processor core;
- Support low-power Bluetooth 2.4GHz multi-protocol;
- The low-power Bluetooth protocol stack can support 4.X to 5.1, and the protocol stack can be upgraded;

- - chip integrated 256KB FLASH and 48KB RAM ;
- 21 GPIOs that support multiplexing functions can be freely configured and mapped, and the use of peripherals is more flexible;
- It can be used as a transparent transmission module, or it can be used alone MCU;
- The module interface is a general-purpose serial port, full-duplex two-way communication;
- Support AT command software to reset the module and obtain the MAC address;
- Support AT commands to adjust the Bluetooth connection interval and control different forwarding rates (dynamic power consumption adjustment)
- Supports AT commands to adjust transmission power, modify broadcast interval, customize broadcast data, customize device identification code, set data delay (preparation time for external MCU serial port reception), modify serial port baud rate , modify module name, support off electric storage;
- 5K bytes of data can be input to the serial port at one time ;
- Support mobile device APP to modify module name, save after power failure, modify serial port baud rate, product identification code, customize broadcast content, and broadcast cycle;
- Support mobile device APP to reset the module and set the transmit power;
- Support mobile device APP to adjust the Bluetooth connection interval, and not save when power off (dynamic power consumption adjustment)
- Support anti-hijacking password setting, modification and recovery, prevent third-party malicious connection, can not be used;
- The broadcast content prompts the real-time status of the module, including battery power and custom device identification code (suitable for broadcast applications)
- Support internal RTC real-time clock;

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
- Receive current: 3.8mA @1Mbps GFSK
- Transmit current: 4.2mA @0dBm/3.3V

- Deep sleep mode: 1.4uA @3V deep Sleep (48KB RAM hold)
- Maximum transmit power: +6dBm
- Receive sensitivity: -94dBm @1Mbps GFSK

4 Module function description

After the module is started, it will automatically broadcast, and the mobile phone that has opened a specific APP will scan and connect to it. After a successful connection, it can be operated through the BLE protocol. The external MCU can communicate bidirectionally with the mobile device through the serial port of the module, and the external MCU can also control the communication parameters of the module through the serial port and control commands .

The user data format is defined by the upper application program. The mobile device can write to the module through the APP , and the written data will be sent to the external MCU through the module interface . After the module interface receives the data packet from the external MCU , it will automatically forward it to the connected mobile device. Users need to complete the code design of the external MCU and the APP code design of the mobile device.

5 Application Diagram

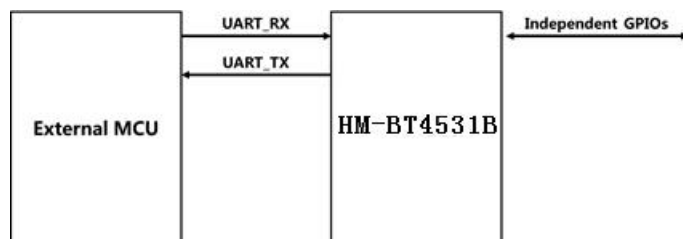


Figure 1 Application Diagram of Transparent Transmission Module

6 module pin

6.1 Module pinout

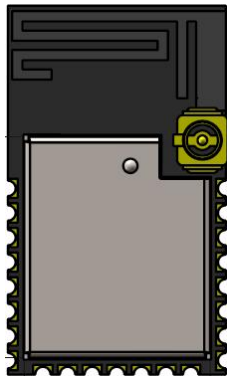


Figure 2 Module pin layout (front view)

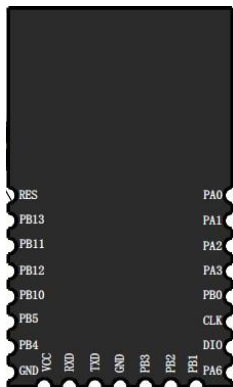


Figure 3 Module pin layout (rear view)

6.2Module 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	PB0	I/O	General GPIO
6	PA4	I/O	SWCLK; serial debug programming interface clock

7	PA5	I/O	SWDIO; serial debug programming interface data
8	PA6	I/O	General GPIO
9	PB1	I/O	General GPIO
10	PB2	I/O	General GPIO
11	PB3	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
twenty three	RES	I/O	Reset pin; active low

Table 1 Definition of module pins

7 module size

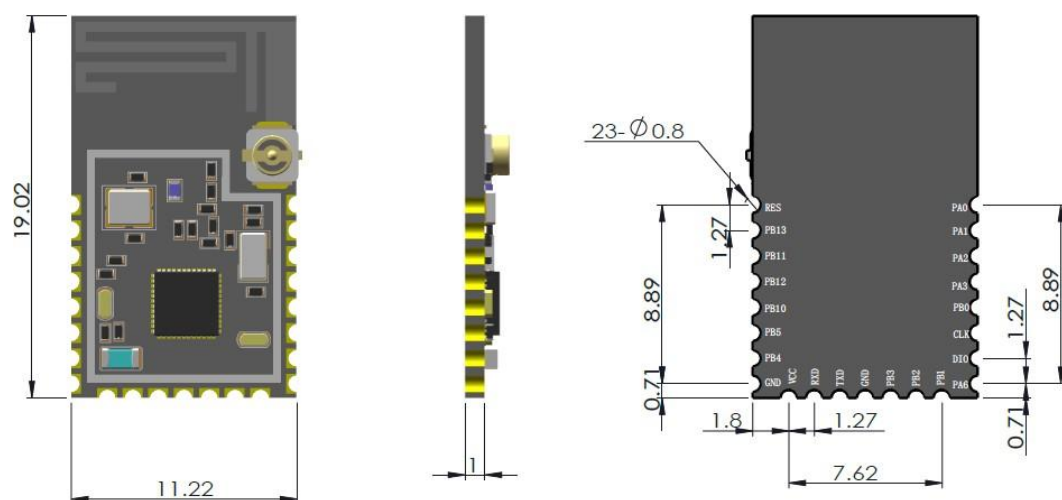


Figure 4 HM-BT4531B module size drawing (without shield cover)

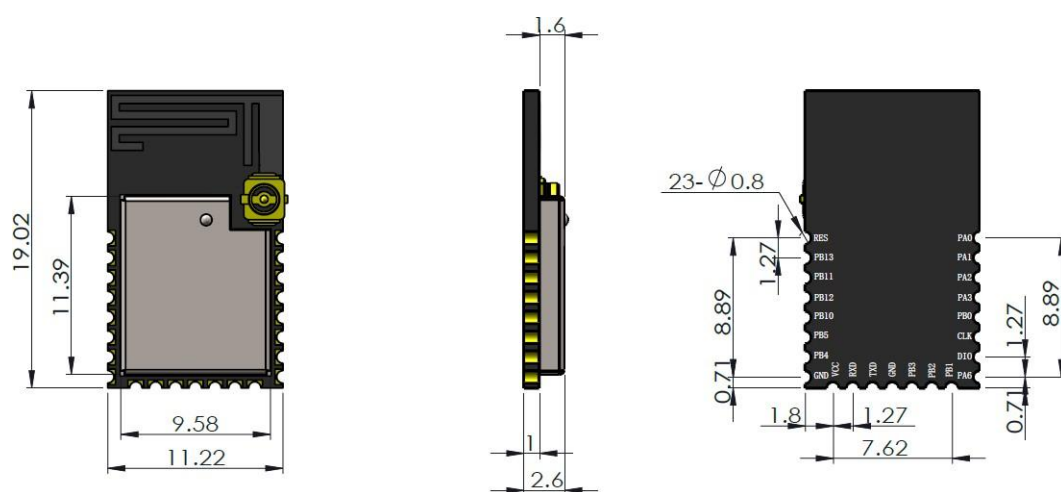


Figure 5 HM-BT4531B module size drawing (with shield cover)

8 Hardware Design Considerations

1. It is recommended to use a DC regulated power supply to supply power to the module. The ripple coefficient of the power supply should be as small as possible, and the module must be grounded reliably; please pay attention to the correct connection of the positive and negative poles of the power supply. Reverse connection may cause permanent damage to the module;
2. Please check the power supply to ensure that it is within the recommended power supply voltage. If it exceeds the maximum value, it will cause permanent damage to the module; please check the stability of the power supply, and the voltage cannot fluctuate greatly and frequently;
3. When designing the power supply circuit for the module, it is recommended to reserve more than 30% margin, which is conducive to the long-term stable operation of the whole machine; the module should be kept away from the power supply, transformer, high-frequency wiring and other parts with large electromagnetic interference;
4. High-frequency digital wiring, high-frequency analog wiring, and power wiring must avoid the bottom of the module. If it is necessary to pass through the bottom of the module, it is assumed that the module is welded on the Top Layer, Top in the contact part of the module Layer Lay the ground (all copper and well grounded) the wiring must be close to the digital part of the module, and the wiring must be on the Bottom Layer;
5. Assuming that the module is welded or placed on the Top Layer, at Bottom It is also wrong to randomly route layers or other layers, which will affect the stray and receiving sensitivity of the module to

varying degrees;

6. Assuming that there are devices with large electromagnetic interference around the module, which will greatly affect the performance of the module, it is recommended to keep away from the module according to the intensity of the interference. If the situation permits, appropriate isolation and shielding can be done;
7. Assume that there are traces with large 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 away from the module. If the situation permits, proper isolation and shielding can be done;
8. If the communication line uses 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 2.4 GHz frequency band , such as USB3.0.
10. Please refer to the figure below for the module antenna layout:

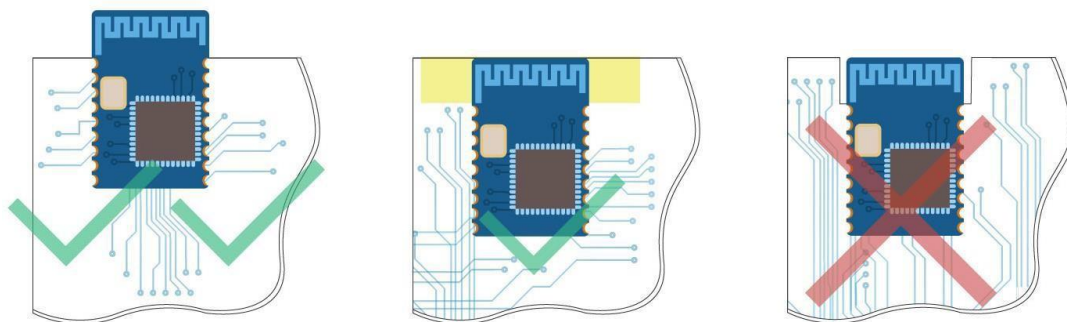


Figure 6 PCB Trace Recommendations

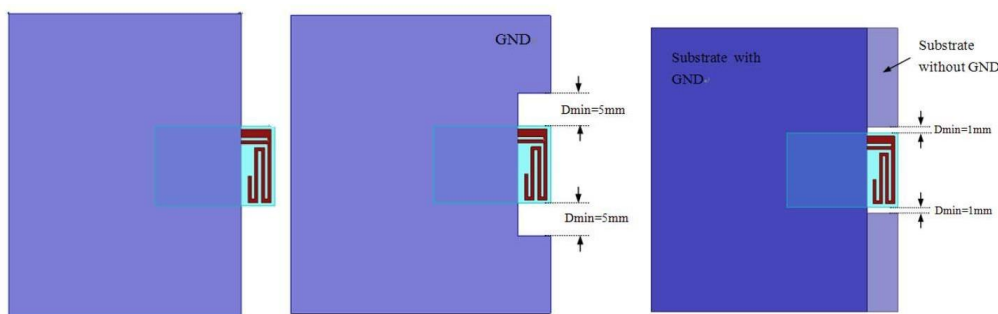


Figure 7 PCB Layout Recommendations

9 common problem

9.1 The transmission distance is not ideal

1. When there is a straight-line communication obstacle, the communication distance will be attenuated accordingly; temperature, humidity, same-frequency interference, It will lead to an increase in communication packet loss rate; the ground absorbs and reflects radio waves, and the test effect close to the ground is poor; 2. Seawater has a strong ability to absorb radio waves, so the seaside test effect is poor;
3. There are metal objects near the antenna, or placed in a metal case, the signal attenuation will be very serious;
4. The power register is set incorrectly, and the air speed is set too high (the higher the air speed, the closer the distance)
5. The power supply voltage at room temperature is lower than the recommended value, the lower the voltage, the lower the transmission power;
6. The matching degree between the antenna and the module is poor, or the quality of the antenna itself is faulty.

9.2 Fragile – abnormal damage

1. Please check the power supply to ensure that it is within the recommended power supply voltage. If it exceeds the maximum value, it will cause permanent damage to the module; please check the stability of the power supply, and the voltage cannot fluctuate greatly and frequently;
2. Please ensure anti-static operation during installation and use, high-frequency devices are electrostatic sensitive devices;

3. Please ensure that the humidity during installation and use should not be too high, some components are humidity sensitive devices; if there is no special requirement, it is not recommended to use it at too high or too low temperature.

9.3 BER is too high

1. There is interference from the same frequency signal nearby, stay away from the interference source or modify the frequency and channel to avoid interference;
2. Unsatisfactory power supply may also cause garbled characters, so be sure to ensure the reliability of the power supply;
3. If the quality of the extension line or the feeder line is too poor or too long, it will also cause a high bit error rate.

10 Reflow Soldering Conditions

1. Heating method: conventional convection or IR convection;
2. Allowable number of reflow soldering: 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.

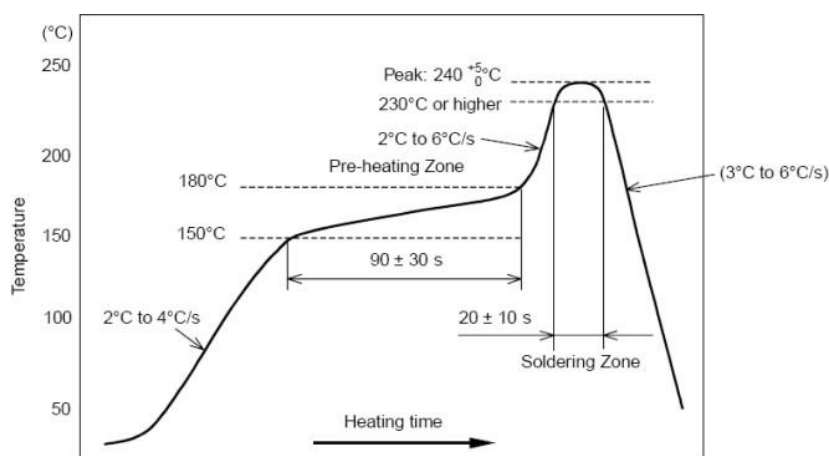


Figure 8 Soldering heat resistance temperature curve of components (soldering point)

11 Electrostatic Discharge Warning

Modules can be damaged due to electrostatic discharge, it is recommended that all modules should be handled under the following 3 precautions: 1. Anti-static measures must be followed, and the module cannot be held with bare hands.

2. The module must be placed in a placement area that can prevent static electricity.

3. The anti-static circuit at the high-voltage input or high-frequency input should be considered in product design.

Static electricity can cause results ranging from subtle performance degradation to complete equipment failure. Due to very small parameter changes

Any change may cause the device not to comply with the value limit of its certification requirements, so that the module will be more vulnerable to damage

12. Document Change Log

surface 2 . Document Change Log

document version	change description	Updated
V 1 . 0	Initial Release	2023. 4. 03 _ _ _ _

13. Contact information

Shenzhen Hope Microelectronics Co., Ltd.

Floor 30 , Block A, Building 8, Phase III , Vanke

Cloud City, Xili Street, Nanshan District, Shenzhen

Tel: +86-0755-82973805

Website: www.hoperf.com

BLE transparent transmission module HM-BT4531B application guide

document version	Updated	Modify content
v1.0	2 023.2.14	first edition
v1.1	2 023.4.4	Update power consumption data Update module pin description
v1.2	2 023.4.25	Added rate setting command

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1. product description

HM-BT4531B is a wireless data transparent transmission module based on the CMT4531 low-power Bluetooth 5.1 chip . By connecting with the MCU controller of the device, it can quickly realize the connection and data communication between the device and BLE main devices such as mobile phones and tablets. MCU Low resource usage and simple development.

2. Module Features

- It is easy to use and does not require any experience in Bluetooth protocol stack applications.
- It can be used as a transparent transmission module and supports secondary development.
- The user interface adopts serial port communication, full-duplex two-way communication, and the baud rate support range can reach 9600bps-500000 bps (for detailed baud rate options, please refer to the AT command section).
- Support 2M PHY transmission and maximum transmission unit (MTU) dynamic setting.
- Provide rich AT commands for configuring module parameters (device name, connection interval, broadcast cycle, broadcast data, MAC address , transmit power, etc.), and support parameter power-off saving.
- Support the remote configuration and reset of the parameters of the module by the host device.
- 5K bytes of data can be input to the serial port at one time .
- Supports anti-hijacking password setting, modification and recovery to prevent third-party malicious connections.
- 1.4 uA with full RAM retention .

3. electrical characteristics

- Working voltage: 1.8V-3.6V
- Working temperature: -40℃~85℃
- Modulation mode: GFSK Gaussian Frequency Shift Keying
- Modulation frequency: 2402MHz-2480MHz
- Receive current: 3.8mA@3.3V
- Transmit current: 4.2mA@3.3V@0dBm
- Sleep current (48KB RAM retention) : 1.4uA@3V
- Transmission power: -20dBm~+6dBm
- Receive sensitivity: -94dBm@BLE 1Mbps data rate
-91dBm@BLE 2Mbps data rate

4. Module function description

After the module is powered on, it is recommended to wait for 10ms or the serial port Tx of the module outputs " TTM: SYSTEM-RST " before starting the operation. If PA6 (BLE function control port) and PB4 (wake-up control port) are not pulled down after power on, the module will be in sleep state, and the power consumption level will be maintained at about 1.4 uA.

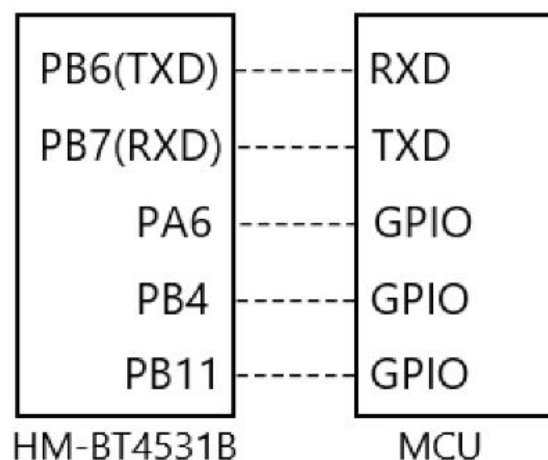
Pull down PA6 and keep it low, the module will start the BLE function, and broadcast according to the set broadcast interval. At this time, the host device can scan the module and initiate a connection. Operations such as transparent transmission and parameter configuration (refer to the BLE protocol chapter). The broadcast interval and the connection interval after the connection is established are in a dormant state (when PB4 is not pulled low), pulling PA6 high at any time will turn off the BLE function, turn off the broadcast and disconnect the connection.

Pull down PB4 and maintain low level, the module will remain in the working state and will not enter

dormancy. At this time, you can input the AT command through the serial port to configure the module parameters and transparently transmit the data to the host. When BLE receives the data and outputs it through the serial port Not affected by the state of this pin . It is recommended to pull down PB4 for at least 3 MS before sending data to the serial port. After the sending is completed, you need to wait at least 3MS before pulling the PB4 pin high . Pull PB4 high at any time , the module will no longer maintain the working state, and will enter the dormant state when there is no event .

In addition, the PB11 pin is a notification pin, which is used to notify the host computer that data is coming, and can also be used to wake up the host computer device. When the serial port has data to be sent to the host computer, the PB11 pin will pull down the level for N ms (configurable, See the AT command chapter for the method) and then start sending data, and the PB11 pin will be pulled high after the sending is completed .

5. Module Application Connection Diagram

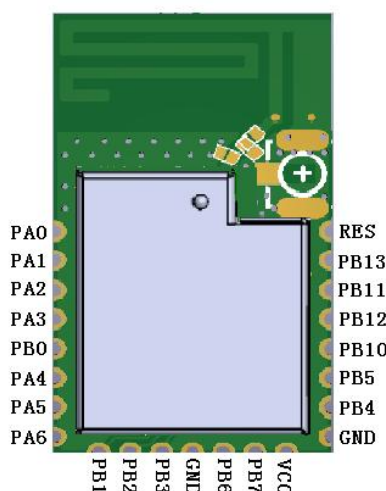


The basic application of the module generally

connects five pins: TXD, RXD, PA6, PB4 , PB11. TXD and RXD are the communication pins of the serial port data, PA6 is used to start the BLE function, PB4 is used to keep the module in the wake-up state to keep the serial port RX working, the low level is active , and PB11 will output when the serial port has data to send Low level signal indication, normally in high level .

the PB4 and PA6 pins can be pulled down externally, and the PB11 signal indication is not required, and can be directly suspended. To save the IO resources of the upper computer MCU.

6. module pin



Pin Name	type	Description
PA0	I /O	SPI1_NSS(I2S1_WS) / KEY1
PA1	I /O	SPI1_CLK(I2S1_CLK) / KEY2
PA2	I /O	SPI1_MOSI(I2S1_SD) / KEY3
PA3	I /O	SPI1_MISO(I2S1_MCK) / KEY4
PB0	I /O	TIM1_CH1/SPI2_NSS(I2S2_WS)/USART1_RTS / LPUART_RTS/KEY11
PA 4	I /O	SWDCLK/TIM1_CH3N / USART1_TXD / KEY9
P A5	I /O	SWDIO/TIM1_ETR/USART1_RXD/KEY10
P A6	I	BLE function control port, active low

P B1	I /O	TIM1_CH2/SPI2_CLK(I2S2_CLK)/USART1_CTS/ LPUART_TXD/KEY12/ANT_SW4
P B2	I /O	TIM1_CH3 / SPI2_MOSI/LPUART_RXD/KEY13/ ANT_SW5
P B3	I /O	TIM1_CH4/SPI2_MISO(I2S_MCK)/LPUART_CTS/ PA_LDO_EN/ANT_SW1
GND	DG	Digital Ground
—		
P B6	o	B LE UART transparent transmission T XD
P B7	I	B LE UART transparent transmission R XD
V CC	AP, DP	Power Supply: 1.8V~3.6V
P B4	I	Wake-up mode enable port, active low
P B5	I /O	SPI2_MISO(I2S2_MCK) / TIM3_CH2(IRC_RX)/ USART2_RXD (7816_RST2)/RCC_MCO/ANT_SW7
P B10	I /O	TIM1_CH3/LPUART_RTS/USART2_RXD/IIC_SMBA/ KEY6
P B12	I /O	TIM1_CH1N / LPUART_TXD/USART2_CTS
P B11	o	UART Tx Signal
P B13	I /O	TIM1_CH2N/LPUART_CTS/USART2_CK
R ES	I	Reset port, low effective

Module pin description

7. Serial port transparent transmission protocol description

The module is connected to the user MCU through a serial port to establish a two-way communication between the user MCU and the mobile device. The user can use the specified AT command to set the serial port baud rate, BLE connection interval and other parameters through the serial port (see the serial port AT command chapter for details) . For different serial port baud rates , BLE connection intervals , and different packet sending intervals,

the module will have different data throughput capabilities. The default serial port configuration is 115200bps 8N1. The serial port R x of the module can input a maximum of 5K bytes at a time, and the module will subpackage or send the complete package according to the Bluetooth protocol negotiation . The data packets sent from the host to the module must be sent on the corresponding service channel. After the module receives the wireless packet from the host, it will first output a low-level signal from the PB11 port and then output data from the Tx port of the module serial port.

with "T TM: " and ending with "\r \n\0 " will be parsed and executed as an AT command , and the execution result will be returned ("T TM:OK\r\n\0 " or " TTM:ERP\r\n\0 " etc.). The serial port data packets that do not conform to the AT command rules will be regarded as transparent transmission data .

\r\n\0 " at the end of the command will not be repeated when introducing the command below .

8. AT command table

8.1 TTM:CIT- Xms change connection interval

command type	command format	response	response description
set command	T TM:CIT - Xms	TTM:OK TTM:ERP	successfully set Parameter error
Parameter Description	1. x is the connection interval to be set, the unit is M S . 2. The parameter range is 2 0-2000 and must be a multiple of 1 0 .		
instruction manual	1. This parameter is saved after power off.		

	2. It is recommended to set it before building a link . 3. the connection interval is lower than 30MS, modifying any parameters saved after power-off may cause the Bluetooth connection to be disconnected. 4. a connection interval request of 100-200MS will be submitted to the host .
example	TTM: CIT -100ms TTM:OK

8.2 TTM:NAM -? query module name

command type	command format	response	response description
query command	TTM:NAM- ?	TTM:NAM - x	x is the returned device name
Parameter Description	none		
instruction manual	none		
example	TTM:NAM- ? TTM:NAM -CMT4531B-33445566		

8.3 TTM:REN- x Change device name

command type	command format	response	response description
set command	TTM: REN - x	TTM:OK TTM:ERP	successfully set Parameter error
Parameter	1. x is the name of the Bluetooth device		

Description	to be set , and the length is 1-20 bytes.
instruction manual	1. This parameter is saved after power off. 2. The default name is CMT4531B-<4 bytes after the MAC address >, for example, the device MAC address is 112233445566, then the default name is CMT4531B-33445566.
example	TTM:REN - HopeRf TTM:OK

8.4 TTM:BPS -? Query the serial port baud rate

command type	command format	response	response description
query command	TTM:BPS- ?	x	x is the serial port baud rate
Parameter Description	none		
instruction manual	none		
example	TTM:BPS- ? 115200		

8.5 TTM:BPS-x set serial port baud rate

command type	command format	response	response description
set command	TTM:BPS -x	TTM:OK TTM: ERP	successfully set Parameter error
Parameter Description	1. x: The baud rate to be set. 2. The baud rates that can be set are:		

	9600 , 19200 , 38400 , 57600 , 115200 , 250000 , 500000 .
instruction manual	1. This parameter is saved after power off. 2. The default baud rate is 115200.
example	TTM: BPS -115200 TTM:OK

8.6 TTM: MAC-? Get MAC address

command type	command format	response	response description
query command	TTM:MAC-?	TTM:MAC-x	x is the MAC address
Parameter Description	none		
instruction manual	none		
example	TTM:MAC-? TTM: MAC-112233445566		

8.7 TTM:MAC-x set MAC address

command type	command format	response	response description
set command	TTM:MAC-x	TTM:OK TTM: ERP	successfully set Parameter error
Parameter Description	1. x is the MAC address to be set .		
instruction manual	1. This parameter is saved after power off. 2. After the setting is successful, a reset will be automatically generated.		

example	TTM: MAC-112233445566 TTM:OK
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8.8 T T M:PHY-x set PHY rate

command type	command format	response	response description
set command	TTM:PHY -x	TTM:OK TTM: ERP	successfully set Parameter error
Parameter Description	1. x is the index of the rate value that needs to be set : "0" : 1M bps " 1 ": 2Mbps " 2 ":500Kbps " 3 ":125Kbps "4": full support		
instruction manual	1. This parameter is saved after power off. 2. Default x =0(1M bps) .		
example	TTM:PHY -0 TTM:OK		

8.9 TTM:ADP-(x) set broadcast interval

command type	command format	response	response description
set command	TTM:ADP-(x)	TTM:OK TTM:ERP	successfully set Parameter error
Parameter Description	1. x is the broadcast interval that needs to be set.		

	2. Broadcast interval =x*100ms , where x can be set in the range of 1-50 (100-5000ms) .
instruction manual	1. This parameter is saved after power off. 2. The default broadcast interval is 200MS .
example	TTM:ADP-(1) TTM:OK

8.10 TTM:RSI- x Set up R SSI printing

command type	command format	response	response description
set command	TTM:RSI -x	TTM:OK TTM:ERP	successfully set Parameter error
Parameter Description	1. x can be ON or OFF , and will get RSSI at 1 S frequency after it is turned on .		
instruction manual	1. Used in the link building state .		
example	TTM:RSI -ON TTM:RSI --63		

8.11 TTM:ICVOLTAGE -? Get battery voltage

command type	command format	response	response description
query command	TTM:ICVOLTAGE - ?	TTM:ICVOLTAGE - x	return voltage value
Parameter Description	1. x is the voltage value (unit M V) .		

n	
instruction manual	none.
example	TTM:ICVOLTAGE- ? TTM:ICVOLTAGE -3305

8.12 TTM:ADD-x set custom broadcast data

command type	command format	response	response description
set command	TTM:ADD - x	TTM:OK TTM:ERP	successfully set Parameter error
Parameter Description	1. x is the broadcast data content that needs to be set, with a length of 1-16 bytes .		
instruction manual	1. This parameter is saved after power off. 2. The set content will be in the 0xFF field of the broadcast data.		
example	TTM:ADD - H o p e R f TTM:OK		

8.13 TTM:PID- x Modify PID

command type	command format	response	response description
set command	TTM:PID - x	TTM:OK TTM: ERP	successfully set Parameter error
Parameter Description	1. x is a two-byte product identification code , and each character is input to the serial port RX in ASCII code format .		
instruction	1. This parameter is saved after power		

manual	off. 2. After setting, it will appear in the 0xFF field of the broadcast data .
example	TTM:PID -RS TTM:OK

8.14 TTM:SERUUID-x Set serial port service U UID

command type	command format	response	response description
set command	TTM:SERUUID -x	TTM:OK TTM:ERP	successfully set Parameter error
Parameter Description	1. x is a 2-byte or 16 - byte UUID .		
instruction manual	1. This parameter is saved after power off. 2. Default is 2 bytes U UID: F FE0 . 3. Reboot after setting to take effect.		
example	TTM:SERUUID -7788 TTM:OK		

8.15 TTM:RXUUID-x set serial port service R X channel U UID

command type	command format	response	response description
set command	TTM:RXUUID - x	TTM:OK TTM: ERP	successfully set Parameter error
Parameter Description	1. x is a 2-byte or 16 - byte UUID .		
instruction	1. This parameter is saved after power		

manual	off. 2. The default is 2-byte UUID : F FE9 . 3. the channel UUID and the length of the service UUID must be the same, otherwise the default UUID will be used . 4. Restart after setting to take effect.
example	TTM: RXUUID -7788 TTM:OK

8.16 TTM:TXUUID-x Set serial port service TX channel U UID

command type	command format	response	response description
set command	TTM:TXUUID - x	TTM:OK TTM: ERP	successfully set Parameter error
Parameter Description	1. x is 2 bytes or 16 bytes U UID .		
instruction manual	1. This parameter is saved after power off. 2. Defaults to 2-byte UUID : F FE4 . 3. the channel UUID and the length of the service UUID must be the same, otherwise the default UUID will be used . 4. Restart after setting to take effect.		
example	TTM:TXUUID -7788 TTM:OK		

8.17 TTM: CDL- Xms Set INT delay

command type	command format	response	response description
set command	TTM: CDL - Xms	TTM:OK TTM:ERP	successfully set Parameter error
Parameter Description	1. x is the signal delay time to be set (0-30ms) .		
instruction manual	1. This parameter is saved after power off. 2. In order to allow the user MCU to have enough time to wake up from sleep and receive serial port data. The module provides the setting of this delay (x) ms . Before the serial port of the module sends data, PB11 will be set low , and the delay between PB11 output low and module TX output data is set by this parameter, and the actual delay will have a slight error. 3. Default x =1 .		
example	TTM: CDL -1ms TTM:OK		

8.18 TTM: TPL-x set transmit power

command type	command format	response	response description
set command	TTM: TPL - x	TTM:OK TTM:ERP	successfully set Parameter error
Parameter Description	1. x is the power setting value index. "0" : 0dbm		

	" 1 ": -2dbm " 2 ": -4dbm " 3 ": -8dbm "4 ": -15dbm "5 ": -20dbm "6": 2dbm "7": 3dbm "8": 4dbm "9": 6dbm
instruction manual	1. This parameter is saved after power off. 2. Default x =0(0dbm) .
example	TTM:TPL -0 TTM:OK

8.19 TTM:RST-SYSTEMRESET soft reset module

command type	command format	response	response description
set command	TTM:RST - SYSTEMRESET	TTM:OK TTM:ERP	successfully set Parameter error
Parameter Description	none		
instruction manual	1. This command will make the module generate a soft reset. Note: After reset, it is recommended to wait for the module serial port T x to output " TTM: SYSTEM-RST " before starting the operation . During this period, please do not send data to the module through the serial port, so as not to generate messy data and affect the module configuration parameters.		
example	TTM:RST -SYSTEMRESET		

	TTM:OK
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8.20 REV-? Get firmware version number

command type	command format	response	response description
set command	TTM:REV- ?	TTM:REV - CMT4531B-V x . x	version number
Parameter Description	none		
instruction manual	none		
example	TTM:REV- ? TTM:REV -CMT4531B-V1.0		

8.21 TTM: RESETPARAMETER-0 restore factory settings

command type	command format	response	response description
set command	TTM: RESETPARAMETER - 0	TTM:OK TTM: ERP	successfully set Parameter error
Parameter Description	none		
instruction manual	1. This command will erase all the user information area, restore the device to the initial state, and generate a soft reset.		
example	TTM: RESETPARAMETER -0 TTM:OK		

9. BLE protocol description

9.1 Transparent transmission data channel [Service U UID : 0xFFE0]

Eigenvalue U UID	Actionable	Bytes	Remark
F FE9	WRITE	Follow MTU length	The written data will be output from the module serial port Tx .
F FE4	NOTIFY	Follow MTU length	The data input from the module serial port Rx will generate a notification on this channel and send it to the host.

B LE data is transferred to the serial port for output. After the host side writes through the "F FE9 " channel, the data will be output from the module's serial port Tx. Serial port input to BLE data output , if the notification enable switch of the " FFE4 " channel is turned on , the transparent transmission data received by the module serial port Rx will be sent to "F FE4 " through the notify event .

9.2 Anti-hijacking key [Service UUID: 0xFFC0]

The module supports anti-hijacking encryption, which can effectively prevent unauthorized hosts from connecting to the module . The initial password of the module is 000000 (ASCII). In this case, the APP does not need to submit the password,

which is regarded as not using a password, and any host can initiate a connection to it. If a new password (not all 0) is set and the anti-hijacking password is enabled, after the host connects to this module, it must submit a connection password to the module within 20 seconds after the connection , otherwise the module will disconnect. Before the host submits the correct password to the module , it cannot perform any write operation on the service channel except for submitting the password. If you want to reset the password, you need to restore the module to factory settings first. The protocol provides a password channel to implement password submission, modification and cancellation of password services. It also provides a password event notification service to notify the host of the results of password operations, including four events: correct password, wrong password , successful password modification, and cancellation of password use.

Eigenvalue UID	permissions	Bytes	example	Remark
FFC1	WRITE	1 2	1 23456 123456	Submit the current password 1 23456, the new password must be consistent with the old password.
			1 23456 888888	the old password 123456 to the new password 888888, the old password must be correct .

			888888 000000	Cancel the password and change the new password to 000000, the old password must be correct .
F FC2	N OTIF Y	1	0	The submit password is correct.
			1	Submission password error.
			2	Password reset complete.
			3	Cancel password.

illustrate:

1. The password structure is 12-byte ASCII code , the first 6 digits in red large font is the current password , and the last 6 digits in black small font is the new password.
2. The current password is "000000" by default before it is modified by the host .
3. By enabling the notification of the channel FFC2 , a notification about the execution result of the cryptographic operation will be generated on this channel .
4. When the host submits the password "123456123456", the new password is the same as the current password, and the host will get a notification: 0 on the FFC2 channel , indicating that the submitted password is correct .
5. When the password submitted by the host (the red part) is inconsistent with the current password , such as : "123455xxxxxx" , no matter what value the x part is, the host will get a notification: 1 on the FFC2 channel, indicating that the password was submitted incorrectly .

6. When the host submits the password "123456888888", the new password is "888888", and the current password is " 123456", the APP will get a notification: 2 on the FFC2 channel, indicating that the password has been changed successfully .
7. When the APP submits the password "888888000000" and the new password is changed to all 0s, it means that the password is cancelled , and the APP will be notified on the FFC2 channel notify:3.

9.3 Module parameter setting [Service UUID: 0xFF90]

9.3.1 Module device name setting

Eigenvalue U UID	Actionable	Bytes	Whether to save when power off
F F91	Read/write	1-20 _	yes
default parameters	The default name is CMT4522-<the last 4 digits of the MAC address>, for example, the MAC address of the device is 112233445566, then the default name is CMT4522-33445566.		
instruction manual	none		

9.3.2 Connection interval setting

Eigenvalue U UID	Actionable	Bytes	Whether to save when power off
F F92	Read/write	2	yes
default parameters	a connection interval request of 100-200MS will be submitted to the host .		
instruction manual	1. The input interval range needs to be in 2 0-2000 , and must be a multiple of 1 0 . 2. the connection interval is lower		

	than 30MS, modifying any parameters saved after power-off may cause the Bluetooth connection to be disconnected. 3. It is recommended to set it before building a link . 4. By default, a 100-200MS connection interval application will be submitted to the host. 5. For the connection interval read back, * 1.25 is required for the value in MS units . For example, read back 160 , then it is 160*1.25=200ms .
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9.3.3 Serial port baud rate setting

Eigenvalue U UID	Actionable	Bytes	Whether to save when power off
F F93	Read/write	4	yes
default parameters	1 15200 bps 8N1 .		
instruction manual	1. Parameter range that can be set: 9600 , 19200 , 38400 , 57600 , 115200 , 250000 , 500000 . _		

9.3.4 Remote reset and factory reset

Eigenvalue U UID	Actionable	Bytes	Whether to save when power off
F F94	write	1	none
default parameters	none		
instruction manual	1. Writing 0x55 , 0x35 will soft reset the module. 2. Writing 0x36 will reset the module		

	to factory settings and soft reset .
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9.3.5 Broadcast cycle setting

Eigenvalue U UID	Actionable	Bytes	Whether to save when power off
F F95	Read/write	1	yes
default parameters	The default broadcast interval is 200MS .		
instruction manual	1. The allowable range of parameters is 1-50, broadcast interval=x *100ms . 2. To read the returned interval, * 0.625 is required to be the value of MS unit . For example, read back 320, then 320*0.625=200ms .		

9.3.6 Product identification code setting

Eigenvalue U UID	Actionable	Bytes	Whether to save when power off
F F96	Read/write	2	yes
default parameters	0 0 00		
instruction manual	1. After setting, it will appear in the 0xFF field of the broadcast data .		

9.3.7 Transmission power setting

Eigenvalue U UID	Actionable	Bytes	Whether to save when power off
F F97	Read/write	1	yes
default parameters	0		
instruction manual	1. The parameter is the power setting value index: " 0": 0dbm " 1": -2dbm		

	" 2": -4dbm
	" 3": -8dbm
	" 4": -15dbm
	" 5": -20dbm
	" 6": 2dbm
	" 7": 3dbm
	" 8": 4dbm
	" 9": 6dbm

9.3.8 Custom broadcast data settings

Eigenvalue U UID	Actionable	Bytes	Whether to save when power off
F F98	Read/write	1-16 _	yes
default parameters	0 0		
instruction manual	1. After setting, it will appear in the 0xFF field of the broadcast data .		

9.4 Device Information Service 【 Service UUID : 0x180A 】

Eigenvalue UUID	Actionable	Remark
2 A28	r ead	Used to read the module software version number: " CMT4531B-Vx.x "

10. Other return information

returned messages	information description
TTM: CONNECT	Establish a link with the host successfully.
TTM: DISCONNECT	The link is actively disconnected.

TTM: DISCONNECT FOR TIMEOUT	The link response timed out and disconnected.
TTM: SYSTEM -RST	It will be printed once when the system reset is complete.
TTM:REV -CMT4531B-V x .x	The firmware version number will be printed once when the system is reset, and the version number will change with the firmware update.

11. power consumption table

1 1.1 Broadcast power consumption table

broadcast interval (ms)	Average power consumption (ua)
1 00	1 29
2 00	67
3 00	46
4 00	3 5
5 00	2 8
6 00	2 4
8 00	1 8
1 000	1 5

1 1.2 Connection power consumption table

connection interval (ms)	Average power consumption (ua)
1 00	8 4
2 00	4 4
3 00	3 0
4 00	2 3
5 00	1 9
6 00	1 6

8 00	1 3
1 000	1 1

Note: The power consumption data is only for H M-BT4531B transparent transmission module using standard transparent transmission firmware , The broadcast data is default, the power is 0 dbm , the power supply is 3.3V , and it is tested in a normal environment.

The data is for reference only, the actual measurement shall prevail.

12. Contact information

Shenzhen Huapu Microelectronics Co., Ltd.
Floor 30, Block A, Building 8, Phase III, Vanke Cloud City, Xili Street, Nanshan District, Shenzhen
Tel: +86-0755-82973805
Email: sales@hoperf.com
URL: <http://www.hoperf.cn>