HJSIP®

HJ-131IMH_Product Specification

Based on Dialog DA14531

Chip-level ultra-low power BLE 5.4 module

Version：V1.0

Date：2025/07/07

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Preface

Thanks for using the Bluetooth module provided by HJSIP. HJ-131IMH series standard Bluetooth module, is a high-performance iot Bluetooth transceiver. The module adopts LGA17 package and supports both external and internal antennas. The product also has the characteristics of low power consumption, small size, strong anti-interference ability, etc., suitable for a variety of application scenarios.

This module is mainly used for data communication, and the company does not assume responsibility for property losses or personal injuries caused by improper operations of users. Please develop the product according to the technical specifications and reference design in the manual. At the same time, pay attention to the general safety matters that should be concerned about when using mobile products.

Before the announcement, the company has the right to modify the content of this manual according to the needs of technological development.

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Version History

Version	Date	Change Description	Reviser	Reviewer
V1.0	2025/07/07	Initial Version	WYW	LMY

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Applicable module selection

No.	Module model	Type	Description
1	HJ-131IMH	Serial port transparent transmission standard version	It is equipped with built-in serial port transparent transmission firmware. This firmware module serves as a bridge for two-way communication between Bluetooth devices or mobile phones and the MCU. Users do not need to understand the Bluetooth protocol stack. They can operate and send and receive serial port data through serial port instructions. The operation is simple, shortening the user's development cycle and accelerating product launch.
2	HJ-131IMH_ CUS	Customized version for customers	This version supports customer customized firmware, customers according to product needs to propose functions, we will customize modules with dedicated firmware versions to supply to customers.
3	HJ-131IMH_ EMP	Customer development version	Provide standard SDK to facilitate customers' secondary development of OPEN CPU.

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1 Introduction

HJ-131IMH series standard Bluetooth module, is a high-performance iot Bluetooth transceiver. The module is packaged in LGA17 and supports both internal and external antenna. The product also has the characteristics of low power consumption, small size, strong anti-interference ability, etc., suitable for a variety of application scenarios.

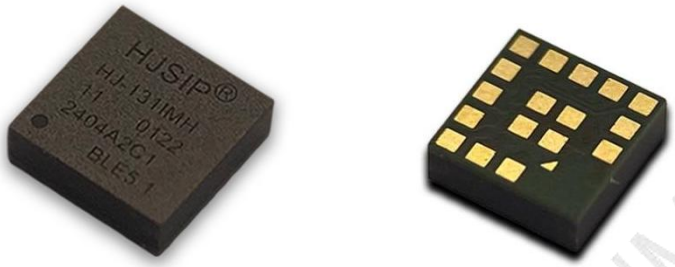

Figure 1.1：HJ-131IMH Top and bottom view

2 Product overview

2.1 Key features

Table 2-1：HJ-131IMH key characteristics

Characteristic	Description
Function	- Supports BLE 5.4, embedded low-power Bluetooth protocol stack and GATT service - Supports BLE master-slave integration (supports 1-slave 1-master or 3-slave, master and slave work simultaneously without affecting each other) - The built-in standard firmware supports transparent transmission of basic functions, or there is no program module for customers to develop their own firmware
Receiving sensitivity	-94dBm
Size	4mm*4mm*1.3mm（Regular version） 4mm*4mm*1mm（Ultra-thin version）（L*W*H，With antenna）
Packaging and weight	LGA17,The pad spacing is 0.8mm；0.1g；
supply voltage	High voltage mode：1.8V～3.3V，TYP 3V； Low voltage mode：1.1V～1.65V，TYP 1.5V； It can be powered by a single AA battery or a 1.5V zinc-air battery. It can also be powered by two AA batteries or lithium batteries after voltage stabilization.
Peak current for transmission	3.5mA@0dBm DC3V
Peak current for reception	2.2mA@DC3V
Dormant current	＜2uA
Operation Temperature	-40 ～ +85℃
Storage Temperature	-40 ～ +85℃
Working frequency band	2.402～2.480GHz(2.4GHz ISM Band)

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Transmission power	-19.5dBm～+2.5dBm
GPIO Port	6（Max）
Memory and ROM	- Built-in 32KB OTP - Built-in 48KB RAM - Built-in 4KB EEPROM - An external 512Kb EEPROM can be expanded to store user programs, or an external 1Mb EEPROM can be expanded to store user programs and for OTA use.
Transmission distance	The wireless transmission distance of the built-in antenna in open areas: 5 to 10 meters； External antenna：30～120m
Product Certification	BQB FCC CE SRRC ROHS REACH etc.

2.2 Application Scenarios

- 2.4GHz Bluetooth Low Energy system;
- Smart home, wireless remote control;
- Consumer electronics products such as sports and healthcare;
- Industrial monitoring;
- Intelligent transportation, etc.

2.3 Functional block diagram

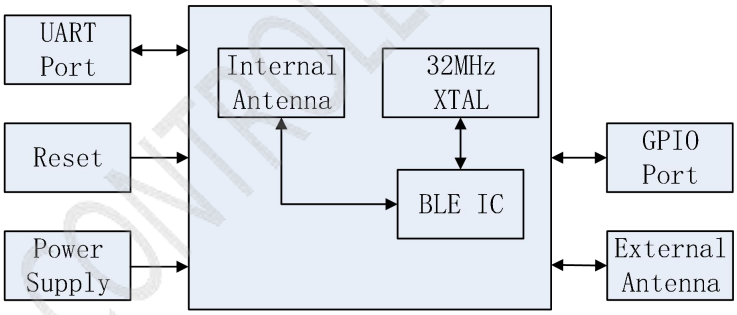

Figure 2.1：HJ-131IMH functional block diagram

2.4 Pins distribution diagram

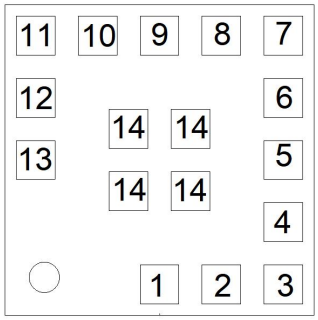

Figure 2.2：HJ-131IMH Pins distribution diagram(front view)

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2.5 Pins description table

Table 2-2：HJ-131IMH Pins definition table

PIN	Name	Type	Description	(Customization/transparent transmission) function
1	VCC_LOW	Low Power In	Low-voltage power supply input	1.1V-1.65V
2	VCC_HIGH	High Power In	High-voltage power supply input	1.8V-3.3V
3	*EEPROM_VCC*	*HongJia Reserve*	*Internal EEPROM power supply pin*	*The power supply range is 1.7-3.6V. If needed, please connect to VCC_HIGH*
4	*EEPROM_SDA*	*HongJia Reserve*	*The SDA data pin of the internal EEPROM*	*If you need to use it, please connect to P03*
5	P03	IO	GPIO	If you need to use the internal EEPROM, please connect it to EEPROM_SDA
6	*EEPROM_SCL*	*HongJia Reserve*	*The SCL data pin of the internal EEPROM*	*If needed, please connect to P04*
7	P04	IO	GPIO	If you need to use the internal EEPROM, please connect it to EEPROM_SCL
8	P05/SWDIO	UART TX	UART Pin	BLE UART TX
9	P02/SCLK	WAKEUP/UART RX	Wake-up pin /UART pin	Wake up and BLE serial port RX (At low power consumption, the pin is by default the wake-up pin. Pulling the external high level up by more than 1ms can wake up BLE. After waking up, this pin becomes the serial port RX function and can perform normal data transmission and reception.)
10	P00/H_Reset	I/RST	Reset	High level 1 reset，the duration of the high level should be more than 1 second; Suspended or low level 0 normal operation. *Note： The RST pin must be connected to I/O. If not, a 1K strong pull-down resistor must be added.*
11	P01	O	Connect status pin	Connect status （connect=1;disconnect=0;）
12	ANT_OUT	RF OUT	RF output	RF output，connect external antenna
13	BOARD_ANT	Onboard ANT	Built-in antenna input	If you want to use the built-in antenna, just connect pins12 and 13 through the PI circuit
14	GND	Ground	Power GND	/

3 RF Features

The module can be configured in two modes: internal antenna and external antenna.

3.1 Antenna interface and operating frequency band

Module antenna interface characteristic impedance 50 ohms.

The radio frequency working band is 2.402 ~ 2.480GHz.

3.2 Antenna application reference

3.2.1 Use module built-in antenna wiring diagram

Connect PIN12 to PIN13 through a π-type filter circuit to enable the internal high-performance antenna,as shown in Figure 3.1 below.The communication distance in the open area is 5 to 10 meters.

It should be noted that no devices or traces should be placed near the antenna, and no devices should be placed on the back of the module. The copper coating should avoid the internal antenna area，(Except for the antenna part)the copper coating on the module's GND should be large enough, and the antenna should have as much clear space as possible.

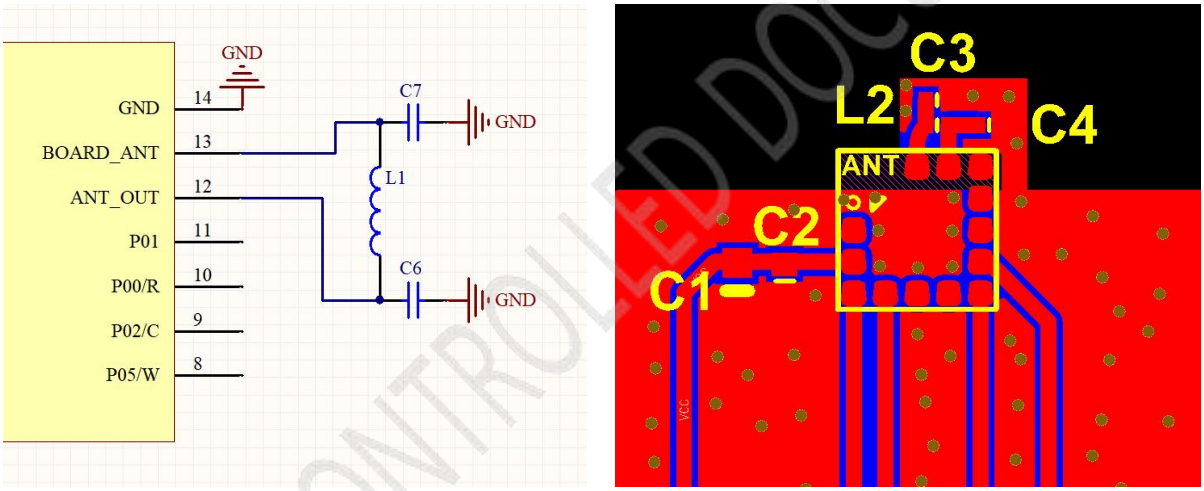

Figure 3.1：Use the module's built-in antenna

3.2.2 Use the external antenna wiring diagram

The PIN13 is suspended, and the PIN12 is connected to the PCB antenna through a π filter circuit, as shown in Figure 3.2 below, and the communication distance in open ground can reach 30~120 meters.

*** Special attention ***

1) If you have requirements for the distance of the product and the external π circuit needs to be matched, please send the PCBA circuit board to our company to complete this task.

2) When designing the circuit, no devices or wires should be placed near the antenna, and no devices should be placed on the back of the module. The copper cladding should cover the module and the π -shaped filter circuit, avoiding the PCB antenna.

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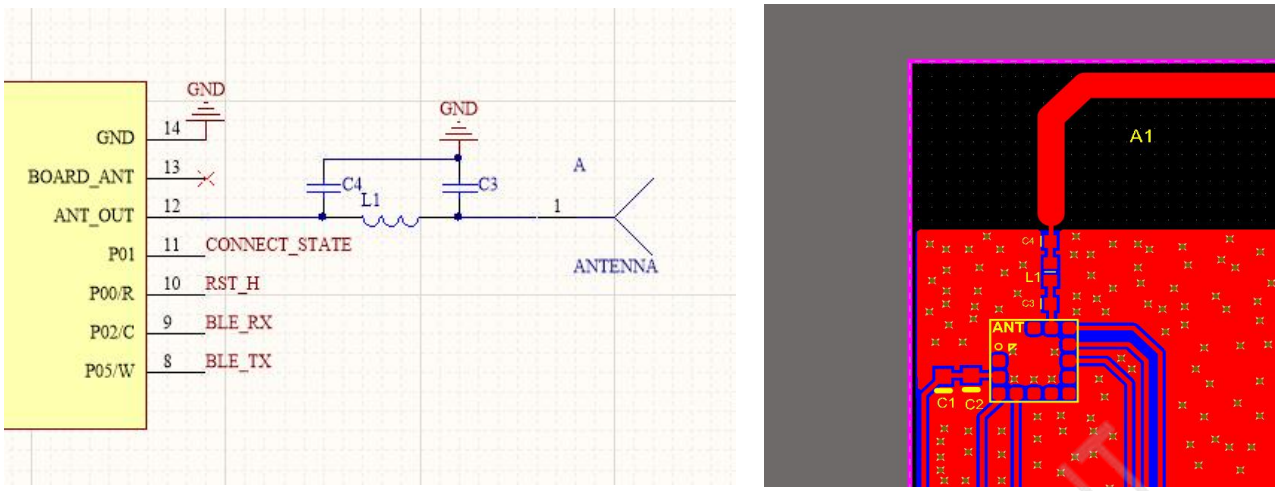

Figure 3.2：Use an external antenna

3.3 RF features

Table 3-1：RF features

Attribute	Value	Remarks
Wireless modulation mode	GFSK	/
Frequency range	2.402 - 2.480GHz	bandwidth：2MHz
Number of channels	40	/
Air speed	1Mbps	/
Rf port impedance	50Ω	/
Transmission power	MAX： +2.5dBm	/
Emission current	3.5mA@0dBm	DC3V
Receive current	2.2mA	DC3V
Receiving sensitivity	-94dBm	/
antenna	Built in antenna	Can also be connected to an external antenna

4 Electrical Parameters

4.1 Absolute Maximum Ratings

Table 4-1：Absolute Maximum Ratings

Parameter	MIN	MAX	Unit
supply voltage VCC	1.1	3.6	V
IO Supply Voltage	0	VCC	V
Operating Temperature	-40	+85	℃
Storage Temperature	-40	+85	℃

4.2 DC Characteristics

Table 4-2：Recommended Operating Conditions

Parameter	MIN	TYP	MAX	Unit
Supply voltage VCC	1.1	3(1.5)	3.3	V
IO Supply Voltage	0	3(1.5)	VCC	V
Dormant working current	/	<2	/	μA

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Maximum Operating Current(Average value）	/	0.4	/	mA
Operating Temperature	-40	+25	+85	℃

Table 4-3：Dc features of I/O ports

IO Pin	Drive capability	Min	Max	Unit
Input low level	/	0	0.4	V
Input high level	/	0.7	VCC	V
Output low level	5mA	0	0.6	V
Output high level	5mA	3.3	VCC	V

Table 4-4：Electricity consumption

Test condition	TYP	Unit
sleep mode	＜2	μA
Broadcast at 20ms interval in slave mode	180	μA
Broadcast in slave mode with 1S gap	7.0	μA
Maintain the connection in slave mode with a 20ms connection gap	65	μA
The connection is maintained with a 7.5ms connection gap in slave mode	110	μA
Scan in host mode	2.3	mA
In host mode, the connection is maintained at a 20ms interval	78	μA

5 Reference Design

5.1 Low voltage mode

It can be powered by a single AA battery, with a range of 1.1V-1.65V.

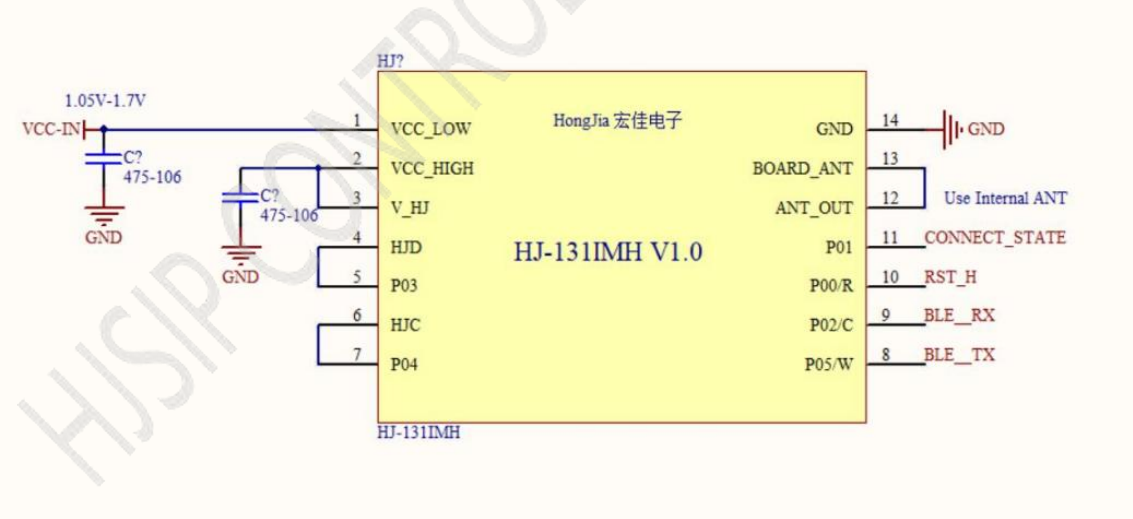

Figure 5.1：Low voltage mode

Note

For the above circuit, if space is limited, capacitors do not need to be connected to the VCC_LOW and VCC_HIGH pins.

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5.2 High voltage mode

Range：1.8V-3.3V

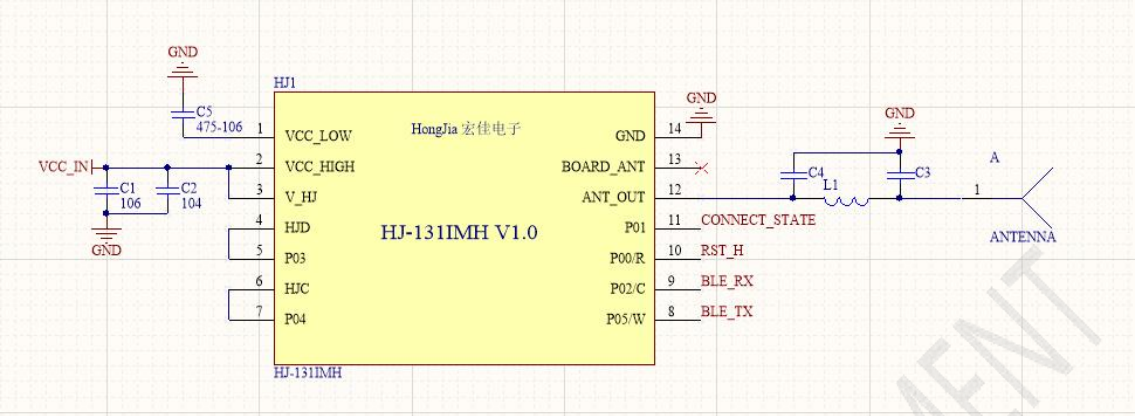

Figure 5.2：High voltage mode

Note

For the above circuit, if space is limited, capacitors do not need to be connected to the VCC_LOW and VCC_HIGH pins.

5.3 Notices for Hardware Design

- All IO ports can be led out for use. Please pay attention to the pin diagram for all pins. For the IO connected to them, please pay attention to the IO mode and status.
- The filter capacitor at the power supply should be placed as close as possible to the power input pin of the module. If it is powered by a capacitor or space is limited, the filter capacitor at the power input can be removed. The module already has 0.1uF+2.2uF filter capacitors inside.
- Each layer of the circuit board is fully copper-clad and connected to GND, and it is necessary to ensure that the copper-clad area is large enough (except for the antenna part) and is well grounded.
- When using an external antenna, be sure to contact our company and let us confirm whether the PCB design of your external PCB antenna or lead-out antenna is reasonable.
- The module should not be placed in a shell made of metal. If a metal shell must be used, the antenna must be led out.
- some metal material components, such as screws and inductors, should be kept as far away as possible from the radio frequency antenna part of the wireless module.
- Near and behind the antenna of the Bluetooth module, try not to place other components and do not run wires. If devices or wires are placed, it will affect the performance of Bluetooth.
- The module antenna should be placed at the four edges of the circuit board. The antenna part

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should be close to the edge or corner of the main board. It is best to place the module in the corner of the circuit board.

- Through holes need to be drilled in the entire copper-clad area of the circuit board, especially in the copper-clad areas near the module and antenna, as many through holes as possible should be drilled.
- If there are high-power devices or high-voltage conversion circuits on the circuit board, the GND copper cladding of the module needs to be isolated from the GND copper cladding of other parts, connected by single-point grounding, and as many vias as possible should be drilled to reduce the interference to the RF signal.
- Unnecessary pins can be left suspended.

6 Appoint

6.1 Protocol stack byte sequence specification

In the instructions for all functions listed in this document, all bytes use Big-end mode. All instruction characters are encoded using ASCII. All instructions begin with '<' and end with '>' without any return line breaks at the end.

All instructions are divided into two parts according to the direction of sending, one part is sent from the MCU to the BLE module, mainly responsible for setting and querying, using uppercase ASCII characters. The other part is sent from the BLE module to the MCU and is mainly responsible for answering and feedback, using lowercase ASCII characters.

For instructions sent from the MCU to the BLE module, the instructions with the setting function start with "<ST", and the instructions with the reading function start with "<RD".

For instructions sent from the BLE module to the MCU, the BLE module replies to the result of the execution of the setup instruction with an instruction beginning with "<st". The BLE module replies to the result of a read command with an instruction beginning with "<rd".

For example, if we set the BLE name to "HongJia", we need to send the command "<ST_NAME=HongJia>" and return "<st_name=ok>" after the setting is successful. For example, if the BLE name is "HongJia" and the command "<RD_NAME>" is sent, the command "<rd_name=HongJia>" is returned after read successed.

6.2 Noun interpretation

We can use the MCU to send instructions to the BLE module to control the BLE module. At the same time, the BLE module will process and send feedback information to the MCU after receiving instructions from the MCU. The instructions sent from the MCU to the BLE module constitute the instruction stream. Each instruction that reads or writes to the same property constitutes an

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instruction pack. Feedback information sent from the BLE module to the MCU constitutes a response stream. Each type of feedback to the same instruction packet constitutes a reply packet.

7 Module working mode description

7.1 Bluetooth working mode

The HJ-131IMH is equipped with a high-performance protocol stack. We have optimized the software, and our software can automatically distinguish between instructions and data without the need for mode switching operations. It is simple and easy to use.

At the same time, we have reused the BLE wake-up pin with the UART RX pin. The simplest circuit only requires connecting the power supply and the TX and RX of the serial port, saving external MCU resources.

7.2 Data transparent mode and command mode

For the information sent to HJ-131IMH, the firmware program within the module can determine whether the incoming data is an instruction or a piece of data. For instructions sent to the module, the module enters the instruction mode to process and respond. For data sent to the module, the module enters the data forwarding mode and forwards the data. The instruction mode and data forwarding mode of HJ-131IMH work simultaneously without interfering with each other. Competitors usually switch using an IO port or AT commands, which is a more cumbersome operation. We have simplified the process to make the module more user-friendly.

8 Serial port instruction set and description

8.1 Set/read the English name of Bluetooth

Table 8.1-1：The instruction pack format of set/read the Bluetooth English name

Instruction flow direction: MCU→BLE module	
Instruction type	**Instruction format**
Write instruction	<ST_NAME=xx..xx>
Read instruction	<RD_NAME>
Instructions: 1, xx... xx indicates the name to be set. The value can contain up to 29 bytes.	

Table 8.1-2：The response packet format of set/read the Bluetooth English name

Answer flow direction: BLE module →MCU	
Response type	**Reply format**
Write successful	<st_name=ok>
Read successful	<rd_name=HJ-131IMH> （For example, the name is HJ-131IMH）
Read/write failure	No return

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8.2 Advising start and stop/query

Table 8.2-1：The instruction pack format of advising start and stop/query

Instruction flow direction: MCU→BLE module	
Instruction type	**Instruction format**
Write instruction	<ST_ADV_ONOFF=X>
Read instruction	<RD_ADV_ONOFF>
Instructions: 1. When X is 1, BLE starts advising. When X is 0, BLE disables advising.	

Table 8.2-2：The response packet format of advising start and stop/query

Answer flow direction: BLE module →MCU	
Response type	**Reply format**
Write successful	<st_adv_onoff=ok>
Read successful	<rd_adv_onoff=x>
Read/write failure	No return

8.3 Set/read advising data

Table 8.3-1：The instruction pack format of set/read advising data

Instruction flow direction: MCU→BLE module	
Instruction type	**Instruction format**
Write instruction	<ST_ADV_DATA=xx..xx>
Read instruction	<RD_ADV_DATA>
Instructions: 1, xx... xx indicates the advising data to be set. The maximum length is 16 bytes and must be HEX data. For example, if the advising data is set to "0X12 0X13 0X14 0X15 0X16", send "<ST_ADV_DATA=1213141516>", because the set is HEX, the number of data set must be a multiple of 2. 2, can be set to Chinese characters, Chinese characters follow UTF-8 encoding; A Chinese character is 3-byte HEX. A maximum of 5 Chinese characters can be set.	

Table 8.3-2：The response packet format of set/read advising data

Answer flow direction: BLE module →MCU	
Response type	**Reply format**
Write successful	<st_adv_data=ok>
Read successful	<rd_adv_data=xx..xx>
Read/write failure	No return
Instructions: 1, Read the return XX... XX indicates the read advising data, which is HEX data. Two characters are one HEX data. Note the conversion.	

8.4 Set/read the advising gap

Table 8.4-1：The instruction pack format of set/read the advising gap

Instruction flow direction: MCU→BLE module	
Instruction type	**Instruction format**
Write instruction	<ST_ADV_GAP=xx..xx>
Read instruction	<RD_ADV_GAP>
Instructions: 1, xx... xx indicates that the advising gap needs to be set. The set range is 20-10000, corresponding to 20ms-10s.	

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Table 8.4-2：The response packet format of set/read the advising gap

Answer flow direction: BLE module →MCU	
Response type	**Reply format**
Write successful	<st_adv_gap=ok>
Read successful	<rd_adv_gap=xx..xx>
Read/write failure	No return

8.5 Actively disconnection command / Read current connection status

Table 8.5-1:The instruction pack format of slave mode actively disconnection command/read connection status

Instruction flow direction: MCU→BLE module	
Instruction type	**Instruction format**
Disconnect the connection write instruction	<ST_DISCONNECT_LINK>
Read the current connection status	<RD_LINK>
Instructions: 1、Setting it to 0 means disconnecting the connection in the slave state.	

Table 8.5-2：The response packet format of slave mode actively disconnection command/read connection status

Answer flow direction: BLE module →MCU	
Response type	**Reply format**
Write successful	<st_disconnect_link=ok>
Read successful	<rd_link=x>
Read/write failure	No return
Instructions: 1. The slave is disconnected from the host immediately after execution. 2. Read the current connection status. When x is 1, it indicates that the current connection is normal; when x is 0, it means that the Bluetooth is in a disconnected state.	

8.6 Set/read module transmit power

Table 8.6-1：The instruction pack format of set/read module transmit power

Instruction flow direction: MCU→BLE module	
Instruction type	**Instruction format**
Write instruction	<ST_TX_POWER=xx..xx>
Read instruction	<RD_TX_POWER>
Instructions: 1、There are 5 power levels that can be set，respectively -19.5dBm,-5dBm,-3.5dBm, 0dBm and +2.5dBm. For example, if the transmit power is set to +2.5dbm, sent <ST_TX_POWER=+2.5>,if the transmit power is set to -19.5dBm,sent<ST_TX_POWER=-19.5>.	

Table 8.6-2：The response packet format of set/read module transmit power

Answer flow direction: BLE module →MCU	
Response type	**Reply format**
Write successful	<st_tx_power=ok>
Read successful	<rd_tx_power=xx..xx>
Read/write failure	No return

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8.7 BLE reset command

Table 8.7-1：The instruction pack format of BLE reset command

Instruction flow direction: MCU→BLE module	
Instruction type	**Instruction format**
Write instruction	<ST_RESET_BLE>

Table 8.7-2：The response packet format of BLE reset command

Answer flow direction: BLE module →MCU	
Response type	**Reply format**
Write successful	<st_reset_ble=ok>
write failure	No return
Instructions: 1. After the module feedback is successful, the BLE module will be reset after about 1s.	

8.8 Set/read the baud rate of the serial port

Table 8.8-1：The instruction pack format of set/read the baud rate of the serial port

Instruction flow direction: MCU→BLE module	
Instruction type	**Instruction format**
Write instruction	<ST_BAUD=xx..xx>
Read instruction	<RD_BAUD>
Instructions: 1. The maximum baud rate can be set to 1000000bps， For example, if the baud rate is set to 19200bps, send <ST_BAUD=19200>. 2.The baud rate can be set: 1200bps，2400bps，4800bps，9600bps，14400bps，19200bps，28800bps，38400bps，57600bps， 115200bps， 230400bps， 460800bps， 500000bps， 921600bps and 1000000bps.	

Table 8.8-2：The response packet format of set/read the baud rate of the serial port

Answer flow direction: BLE module →MCU	
Response type	**Reply format**
Write successful	<st_baud=ok>
Read successful	<rd_baud=xx..xx>
Read/write failure	No return

8.9 Set/read the minimum connection gap of the slave

Table 8.9-1：The instruction pack format of set/read the minimum connection gap of the slave

Instruction flow direction: MCU→BLE module	
Instruction type	**Instruction format**
Write instruction	<ST_CON_MIN_GAP=xx..xx>
Read instruction	<RD_CON_MIN_GAP>
Instructions: 1, xx... xx indicates the minimum connection gap. The value ranges from 75 to 40000, corresponding to 7.5ms to 4s. We expand the time value (in milliseconds) by a factor of 10 and write it into the instruction as a parameter. 2, the maximum connection gap must be greater than or equal to the minimum connection gap, otherwise an error will be reported.	

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Table 8.9-2：The response packet format of set/read the minimum connection gap of the slave

Answer flow direction: BLE module →MCU	
Response type	**Reply format**
Write successful	<st_con_min_gap=ok>
Read successful	<rd_con_min_gap=xx..xx>
Read/write failure	No return

8.10 Set/read the maximum connection gap of the slave

Table 8.10-1：The instruction pack format of set/read the maximum connection gap of the slave

Instruction flow direction: MCU→BLE module	
Instruction type	**Instruction format**
Write instruction	<ST_CON_MAX_GAP=xx..xx>
Read instruction	<RD_CON_MAX_GAP>
Instructions: 1, yy... yy is the maximum connection gap, and the setting range is 75~40000, corresponding to 7.5ms~4s. After expanding the time value (in milliseconds) by 10 times, it is written into the instruction as a parameter. 2, the maximum connection gap must be greater than or equal to the minimum connection gap, otherwise an error will be reported.	

Table 8.10-2：The response packet format of set/read the maximum connection gap of the slave

Answer flow direction: BLE module →MCU	
Response type	**Reply format**
Write successful	<st_con_max_gap=ok>
Read successful	<rd_con_max_gap=xx..xx>
Read/write failure	No return

8.11 Set/read connection timeout of the slave

Table 8.11-1：The instruction pack format of set/read connection timeout of the slave

Instruction flow direction: MCU→BLE module	
Instruction type	**Instruction format**
Write instruction	<ST_CON_TIMEOUT=xx..xx>
Read instruction	<RD_CON_TIMEOUT>
Instructions: 1.The value of xx ranges from 500 to 8000, which corresponds to 500ms to 8s.	

Table 8.11-2：The response packet format of set/read connection timeout of the slave

Answer flow direction: BLE module →MCU	
Response type	**Reply format**
Write successful	<st_con_timeout=ok>
Read successful	<rd_con_timeout=xx..xx>
Read/write failure	No return

8.12 Inquire the MAC address of the local BLE module

Table 8.12-1：The instruction pack format of inquire the MAC address of the local BLE module

Instruction flow direction: MCU→BLE module	
Instruction type	**Instruction format**
Read instruction	<RD_BLE_MAC>

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Table 8.12-2：The response packet format of inquire the MAC address of the local BLE module

Answer flow direction: BLE module →MCU	
Response type	**Reply format**
Read successful	<rd_ble_mac=xxxxxxxxxxxx>
Read failure	No return
Instructions: 1. xxxxxxxxxxxx is a 6-byte MAC address, which is returned in big-endian mode.	

8.13 Set local MAC address

Table 8.13-1：The instruction pack format of set local MAC address

Instruction flow direction: MCU→BLE module	
Instruction type	**Instruction format**
Write instruction	<ST_OWN_MAC=xxxxxxxxxxxx>
Instructions: 1. xxxxxxxxxxxx indicates the MAC address to be configured.	

Table 8.13-2：The response packet format of set local MAC address

Answer flow direction: BLE module →MCU	
Response type	**Reply format**
Write successful	<st_own_mac=ok>
Write failure	No return
Instructions: 1.After the setup, the module will automatically restart, and then advising with the new user-defined MAC address.	

8.14 Cancel set local MAC address

Table 8.14-1：The instruction pack format of cancel set local MAC address

Instruction flow direction: MCU→BLE module	
Instruction type	**Instruction format**
Write instruction	<ST_OWN_MAC=0>

Table 8.14-2：The response packet format of cancel set local MAC address

Answer flow direction: BLE module →MCU	
Response type	**Reply format**
Write successful	<st_own_mac=ok>
Write failure	No return
Instructions: 1. After you cancel the user-defined MAC address, the module will return to the default MAC address.	

8.15 Enable or disable serial port verification/query serial port verification status

Table 8.15-1：The instruction pack format of enable/query serial port verification

nstruction flow direction: MCU→BLE module	
Instruction type	**Instruction format**
Write instruction	<ST_UART_PARITY=x..x>
Read instruction	<RD_UART_PARITY>

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Instructions:
1. When x...x is EVEN, it represents even parity check; when it is ODD, it represents odd parity check; and when it is NONE, it indicates no parity check.
2. The settings will take effect immediately after being completed.
3. The format of the serial port with parity check is: 8 data bits, 1 parity bit.

Table 8.15-2：The response packet format of enable/query serial port verification

Answer flow direction: BLE module →MCU	
Response type	**Reply format**
Write successful	<st_uart_parity=ok>
Read successful	<rd_uart_parity=even> or <rd_uart_parity=odd> or <rd_uart_parity=none>
Read/write failure	No return

8.16 Set/Read the delay time for entering low power mode after wake-up

Table 8.16-1：The instruction pack format of set/Read the delay time for entering low power mode after wake-up

Instruction flow direction: MCU→BLE module	
Instruction type	**Instruction format**
Write instruction	<ST_SLEEP_DELAY=x>
Read instruction	<RD_SLEEP_DELAY>

Instructions:
1. X is the value that needs to be set; The setting range is 10-255, corresponding to 1s~25.5s, the default parameter is 30 ,time is 3 second.
2. When the RX pin is pulled high to wake up, the system will delay the set time and enter a low-power state.

Table 8.16-2：The response packet format of set/Read the delay time for entering low power mode after wake-up

Answer flow direction: BLE module →MCU	
Response type	**Reply format**
Write successful	<st_sleep_delay=ok>
Read successful	<rd_sleep_delay=x>
Read/write failure	No return

8.17 Factory data reset

Table 8.17-1：The instruction pack format of factory data reset

Instruction flow direction: MCU→BLE module	
Instruction type	**Instruction format**
Write instruction	<ST_FACTORY=1>

Table 8.17-2：The response packet format of factory data reset

Answer flow direction: BLE module →MCU	
Response type	**Reply format**
Write successful	<st_factory=ok>
Write failure	No return

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8.18 Set/read the Bluetooth Chinese name

Table 8.18-1：The instruction pack format of set/read the Bluetooth Chinese name

Instruction flow direction: MCU→BLE module	
Instruction type	**Instruction format**
Write instruction	<ST_CH_NAME=xx..xx>
Read instruction	<RD_CH_NAME>
Instructions: 1, xx... xx indicates the HEX data of the Chinese name to be set. Because kanji follows UTF-8 encoding, one kanji takes up 3 bytes of HEX data. Therefore, to set the Chinese name, the number of bytes must be a multiple of 3. You can set a maximum of 9 characters. 2. For example, if the HEX data corresponding to the Chinese name " 宏 佳 电 子 "is e5ae8fe4bdb3e794b5e5ad90, send <ST_CH_NAME=e5ae8fe4bdb3e794b5e5ad90>. For conversion tests, refer to the website "https://tool.lu/hexstr/".	

Table 8.18-2：The response packet format of set/read the Bluetooth Chinese name

Answer flow direction: BLE module →MCU	
Response type	**Reply format**
Write successful	<st_ch_name=ok>
Read successful	<rd_ch_name=xx..xx>
Read/write failure	No return
Instructions: 1, xx.. xx indicates HEX data.	

8.19 Set/Clear/read the Bluetooth connection password of the slave

The function of the connection password for the slave device is to ensure the security of the Bluetooth connection. When any mobile phone APP or host connects to the BLE module, they must send the password we set (which is set to "0xFFF2") to the APP -> BLE channel within the specified timeout period (default 15 seconds). For example, if the password is set to "123456", then it will send "123456". If the verification is successful, the module will notify "SECRET_CONFIRM" in BLE -> APP (0xFFF1). If the verification fails, the connection will be immediately disconnected, and the connection will also be disconnected if the timeout occurs.

Table 8.19-1：The instruction pack format of set/clear/read the Bluetooth connection password of the slave

Instruction flow direction: MCU→BLE module	
Instruction type	**Instruction format**
Write instruction	<ST_SECRET=xx..xx>
Clear instruction	<ST_CLEAR_SECRET>
Read instruction	<RD_SECRET>
Instructions: 1. xx... xx indicates the password to be set. The maximum length is 8 bytes.	

Table 8.19-2：The response packet format of set/clear/read the Bluetooth connection password of the slave

Answer flow direction: BLE module →MCU	
Response type	**Reply format**
Password set successfully	<st_secret=ok>

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Password clear successfully	<st_clear_secret=ok>
Read successful	<rd_secret=xx..xx>
The current password is empty	<rd_secret=null>
Instructions: 1. When the password is empty, there is no password authentication process during connection.	

8.20 Enable APP configuration permissions

Table 8.20-1：The instruction pack format of enable APP configuration permissions

Instruction flow direction: MCU→BLE module	
Instruction type	**Instruction format**
Write instruction	<ST_APP_CONFIG>

Table 8.20-2：The response packet format of enable APP configuration permissions

Answer flow direction: BLE module →MCU	
Response type	**Reply format**
Write successful	<st_app_config=ok>
Write failure	No return
Instructions: 1. After the command is sent, within the current connection, the APP configuration function is enabled, allowing the user to send commands to the BLE module and receive feedback via the app config (0XFFF3) channel. When the BLE module disconnects, the APP configuration is disabled. If APP configuration needs to be re-enabled during the next connection, the command must be resent via the MCU to the BLE module to activate it. 2. If the BLE module has password authentication enabled, the APP configuration function will always be permitted during the BLE connection after a successful password authentication.	

8.21 Enables the BLE module continuously running at full speed during this connection

Table 8.21-1：The instruction pack format of enables the BLE module continuously running at full speed during this connection

Instruction flow direction: MCU→BLE module	
Instruction type	**Instruction format**
Write instruction	<ST_WAKE=ONCE>

Table 8.21-2：The response packet format of enables the BLE module continuously running at full speed during this connection

Answer flow direction: BLE module →MCU	
Response type	**Reply format**
Write successful	<st_wake=ok>
In a disconnected state	<st_wake=disconnect>
Write failure	No return
Instructions: 1. In the connected state, after the command is sent, the BLE module will not enter a low-power state during this connection. The BLE module will run at full speed, with a power consumption of about 250uA. The serial port RX does not need to first pull up the RX before sending data. This function is suitable for large data volume and long-term data interaction in this connection. 2. When the connection is disconnected, this function will be automatically cancelled, and the BLE module will enter a low-power state according to the ST_SLEEP_DELAY set in 4.16. 3. When in a disconnected state, sending a command will return<stw_ake=disconnect>to indicate that the	

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connection is disconnected and this function cannot be executed.

8.22 Always enable BLE module to run at full speed

Table 8.22-1：The instruction pack format of always enable BLE module to run at full speed

Instruction flow direction: MCU→BLE module	
Instruction type	**Instruction format**
Write instruction	<ST_WAKE=FOREVER>

Table 8.22-2：The response packet format of always enable BLE module to run at full speed

Answer flow direction: BLE module →MCU	
Response type	**Reply format**
Write successful	<st_wake=ok>
Write failure	No return
Instructions: 1. After the command is sent, the BLE module will always run at full speed (saved after power failure, i.e. still valid after restart), and will not enter a low-power state. The BLE module will run at full speed. In order to speed up the connection speed in this mode, the advising gap will be automatically changed to 20ms, and the power consumption is about 400uA. The serial port RX does not need to first pull up the RX before sending data. This function is suitable for situations where power consumption is not considered.	

8.23 Set the BLE module to normal wake-up mode

Table 8.23-1：The instruction pack format of set the BLE module to normal wake-up mode

Instruction flow direction: MCU→BLE module	
Instruction type	**Instruction format**
Write instruction	<ST_WAKE=NORMAL>

Table 8.23-2：The response packet format of set the BLE module to normal wake-up mode

Answer flow direction: BLE module →MCU	
Response type	**Reply format**
Write successful	<st_wake=ok>
Write failure	No return
Instructions: 1. After the command is sent, the BLE module will switch to the normal wake-up working mode. In this mode, to wake up the BLE module, the RX pin needs to be pulled up for at least 1ms. After waking up, normal data and command transmission can be carried out. If there is no data for serial transmission and reception within the ST_SLEEP_DELAY time set in 4.16, it will automatically enter low-power mode.	

8.24 Read BLE module wake-up working mode

Table 8.24-1：The instruction pack format of read BLE module wake-up working mode

Instruction flow direction: MCU→BLE module	
Instruction type	**Instruction format**
Read instruction	<RD_WAKE>

Table 8.24-2：The response packet format of read BLE module wake-up working mode

Answer flow direction: BLE module →MCU	
Response type	**Reply format**
Read successful	<rd_wake=forever> or <rd_wake=normal> or <rd_wake=once>
Read failure	No return

8.25 Serial port RX reception enable low-level enable/disable

Table 8.25-1：The instruction pack format of serial port RX reception enable

Instruction flow direction: MCU→BLE module	
Instruction type	**Instruction format**
Write instruction	<ST_RX_LOW_WAKEUP=x>
Read instruction	<RD_RX_LOW_WAKEUP>

Table 8.25-2：The response packet format of serial port RX reception enable

Answer flow direction: BLE module →MCU	
Response type	**Reply format**
Write successful	<st_rx_low_wakeup=ok>
Read successful	<rd_rx_low_wakeup=x>

8.26 Obtaining the Software Version

Table 8.26-1：The instruction pack format of obtaining the Software Version

Instruction flow direction: MCU→BLE module	
Instruction type	**Instruction format**
Read instruction	<RD_SOFT_VERSION>

Table 8.26-2：The response packet format of obtaining the Software Version

Answer flow direction: BLE module →MCU	
Response type	**Reply format**
Read successful	<rd_soft_version=xxx>
Instructions: 1. If the version is vh5.0, <rd_soft_version=vh5.0> is displayed.	

9 Serial port operation instructions for transparent transmission mode and instruction mode

- Firstly, continuously send 3-5 bytes of 0XAA data to the RX pin of the BLE module to immediately wake up the BLE module.
- Delay of 500us-1ms after sending.
- If in a connected state, data can be continuously sent to the APP through the RX pin; Or directly send instructions for reading and writing configuration parameters.
- ***Special note: When the APP sends data to BLE in a connected state, BLE will automatically wake up and send the data through UART. After sending, it will automatically enter a low-power state.***

Attention
If the BLE module operates in FOREVER always full speed mode, the following operations can be ignored and data reception and command control can be directly performed.

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10 Instructions for configuring module parameters through mobile App

To facilitate users in configuring the parameters of the module, we allow the APP to read or write all the parameters of the module.However, for security reasons, only when the external MCU sends the <ST_APP_CONFIG> command and the APP configuration enable instruction is set or the connection password is configured, can the APP perform the configuration.

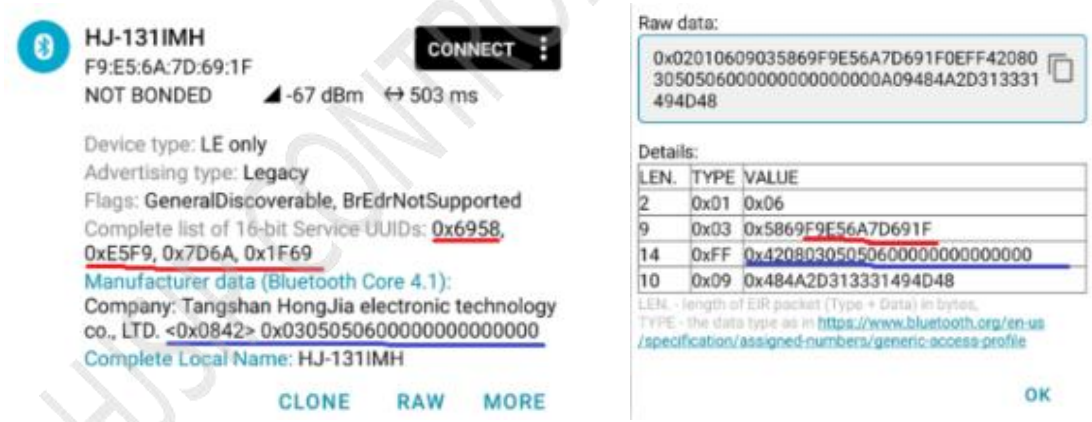
Reference steps:

- First, please ensure that the BLE module is connected and the notification function of the app config (0XFFF3) channel is enabled.
- Send the command <ST_APP_CONFIG> via the serial port to enable the APP configuration enablement. (Skip this step if the BLE module has enabled the connection password.)
- Then, you can send commands and read parameters through the app config (0XFFF3) channel.

note：
1. When the APP configuration is enabled, if the command does not exist, the message "<st_cmd_error>" will be returned on the app config (0XFFF3) channel. If the command exists and the rules are met, it will be returned according to the command table.
2. When the APP configuration is disabled, regardless of the sent command data, the message "<st_dis_config>" will be returned on the app config (0XFFF3) channel.

11 Description of BLE Module Advising Data Format

We conducted the scan using Android, and the results are as follows (the left side shows the processed data, and the right side shows the original data):



The MAC address of the BLE module is F9E56A7D691F. We have placed the MAC address in the advising data in the form of UUID, as shown in the red part. This section is mainly used for the IOS device to identify and read the MAC address for use; the first two bytes 0X58 0X69 remain unchanged and serve as the device identification header data.

The user-defined data is in the blue part. The advising data of the BLE module is set through instructions, and this section will become the set data.

12 Default parameter for BLE module

- Serial Port Parameters

-- Default serial port parameters: 19200bps N 8 1

-- Default transmission power: +2.5dBm

- Normal advising enable for module

-- Default advising gap for slave: 500ms

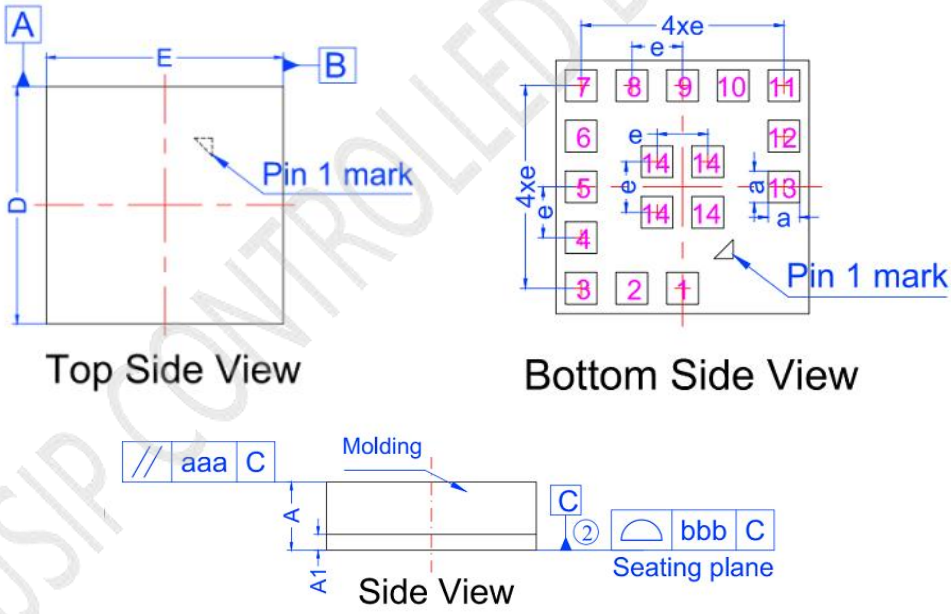
-- Default minimum connection gap for slave: 15ms

-- Default maximum connection gap for slave: 15ms

-- Default connection timeout time for slave: 3s

- Waiting time for entering low power state after waking up is 3s
- Custom MAC address disabled. Default uses the random address provided by the module
- Connection password function disabled. Connection does not require password authentication
- Wake-up working mode is normal mode

13 Machine Dimension



DIMENSIONAL REFERENCES *Units:mm*

SYMBOL	DIMENSIONAL REQMTS			SYMBOL	Tolerance of Form &Position
	MIN	NOM	MAX	aaa	0.10
A	1.26	1.30	1.34	bbb	0.10
A1	0.27	0.30	0.33		
D	3.90	4.00	4.10		
E	3.90	4.00	4.10		
a	0.45	0.50	0.55		
e	0.80 REF				

Note:

1. All dimensions are in mm

② Datum 'C' is the mounting surface, with which the package is in contact

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Note: The normal value of the ultra-thin model A is 1mm, and other parameters are the same as those of the regular model

Figure 13.1：HJ-131IMH dimension

14 SMT production

14.1 Precautions for ultrasonic welding

Please carefully consider using ultrasonic welding technology. If it is necessary to use ultrasonic welding technology, please use 40KHz high frequency ultrasound welding technology. Keep the module away from the ultrasonic soldering line and the fixing column during the design method to prevent damage to the module!

For specific ultrasonic welding matters, please contact our company for technical consultation.

14.2 Soldering Recommendations

HJ-131IMH module use high temperature resistant materials, manufacturing by Lead-free Process. The maximum temperature resistance is 265℃. Ten continuous reflow soldering has no effect on properties and strength. Specific parameters as shown in Table 14-1.

Table 14-1：Reflow soldering parameters

Parameter	Value
Features	Lead-free process
Average ramp up rate(T_{SMAX} to Tp)	max3℃/sec. max
Temperature Min($T_S$min)	150℃
Temperature Max(TSmax)	200℃
Preheat time (Min to Max) (tS)	80~100sec
Peak Temperature (T_P)	250±5℃
Ramp-down Rate	6℃/sec. max
Time 25℃ to Peak Temp (T_P)	8 min. max

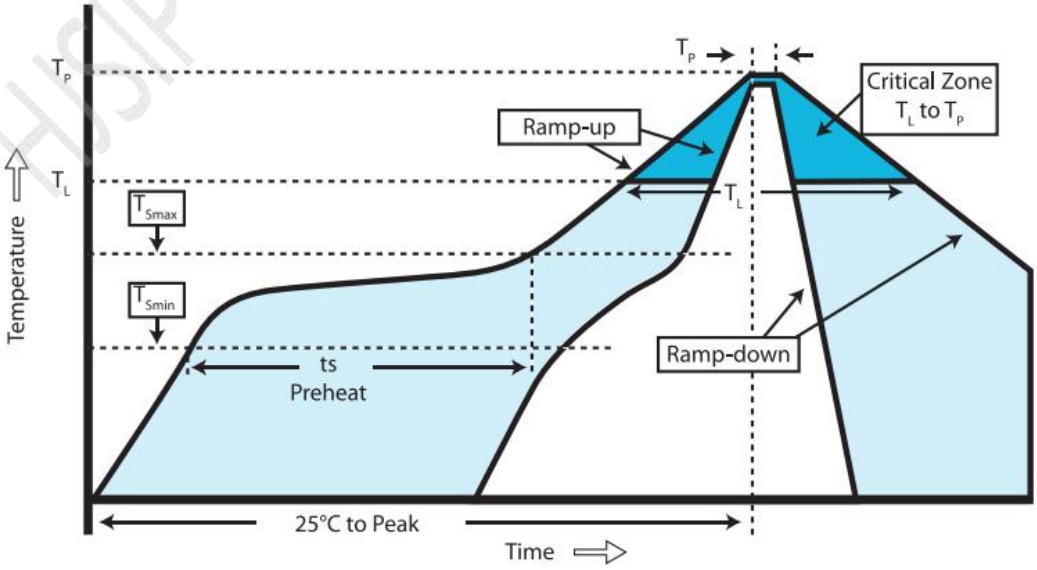

Figure 14.1：Temperature Curve of Reflow Welding

14.3 Humidity sensing properties

The HJ-131IMH module has a humidity sensitivity of level 3.

If any of the following two conditions are met, the HJ-131IMH module should be fully baked prior before reflow soldering, otherwise the module may cause permanent damage during reflow soldering.

- After unpacking or vacuum packaging is damaged and air leaks, the module needs to be SMT within 168 hours when the temperature is less than 30 degrees and the relative humidity is less than 60%. If the above conditions are not met, bake.
- Vacuum packaging is not opened, but beyond the shelf life, also need to be baked.

15 Packaging

15.1 Packaging method

Table 15-1：Packaging method

Type	Packaging method	Minimum packing quantity(PCS)
HJ-131IMH_XX	Roll tape	4000

Use chip-grade anti-static aluminum foil bags to seal and pack with braid. Each bag is put in desiccant. Industrial grade vacuum pump ensures no air leakage, moisture, water and dust (IP65). The actual packaging effect is shown in Figure 15.1.

Figure 15.1：package figure

15.2 Label information

All packages are labeled with cargo information, ROHS label, anti-static label, etc.

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【A】Tangshan Hongjia electronic Technology Co., LTD
【B】HJ-XXX-XXX
【C】Pb Free Reflow(260℃)
【D】Date Code:2508　HJ0218
【E】Note: Must be stored in a vacuum Seal
【F】Warning: Humidity sensitivity level MSL:XX
【G】QTY:1500PCS SEAL DATE:20250218

Figure 15.2：Product label drawing

Table 15-2：Module information description

No.	Description
A	company name
B	product model
C	Lead-free reflow mark and reflow temperature setting value
D	Production date Example: 2508 HJ0218 represents the product produced in the 8th week of 2025, on February 18
E	Storage precautions
F	Humidity sensitivity level
G	Quantity of product + date of sale

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