HJ-180IMH-11

Bluetooth BLE5.1 module user manual V1.0

Module type：HJ-180IMH-11

Contents

1 Overview

1.1 Characteristic Parameter

- Working frequency 2.4GHz, supporting ISM free frequency band
- Embedding low-power Bluetooth protocol stack and GATT services
- Maximum transmission power:+4dBm
- High reception sensitivity: -97dBm
- Transmitting and receiving peak current<4.6mA
- Optional internal and external antennas
- Voltage supply: 1.7-3.6V
- Supporting BLE master-slave integration
- Extremely low power consumption: (1Mbps)
  - ✓Sleep current<2uA
  - ✓1s interval broadcast current 15.5uA
  - ✓2s interval broadcasting current 6.5uA
- Capable of providing up to 17 GPIOs
- Wireless transmission distance of external antennas in open areas: 40-80 meters
- Size package: 5mm * 5.5mm * 1.3mm, LGA24 package, weight: 0.1g, compliant with ROHS standards
- Working temperature range: -40-+85 ℃
- Support WeChat, Xiaomi MiSDK, or no program module for customers to develop firmware themselves

1.2 Electrical Parameters

●Absolute Maximum Ratings

Table 1-1 Absolute maximum ratings

Parameter	MIN	MAX	Unit
Power Supply Voltage (VCC)	1.7	3.8	V
IO Supply Voltage	0	VCC	V
Operating Temperature	-40	+85	℃
Storage Temperature	-40	+85	℃

●Recommended Operating Conditions

Table 1-2 Recommended operating conditions

Parameter	MIN	TYP	MAX	Unit
Power Supply Voltage (VCC)	1.8	3.3	3.6	V
IO Supply Voltage	0	3.3	VCC	V
Dormant working current		<2		μA
Maximum Operating Current		5		mA
Operating Temperature	-40	+25	+85	℃

●I/O DC Characteristics

Table 1-3 I/O DC Characteristics

I/O Pin	Driving Capability	MIN	MAX	Unit
Input low voltage		0	0.4	V
Input high voltage		0.7	VCC	V
Output low voltage	5mA	0	0.6	V
Output high voltage	5mA	3.3	VCC	V

●RF Features

Table 1-4 RF Features

Attribute	Value	Remarks
Modulation	GFSK	
Frequency range	2.402 ~ 2.480GHz	Bandwidth: 2MHz
Number of channels	40	
Air speed	1Mbps、2Mbps、125Kbps	
RF Port Impedance	50Ω	
Transmit Power	MAX: +4dBm	
TX Current consumption	TYP: 4.6mA@0dBm	
RX Current consumption	TYP: 4.6mA	
Receive sensitivity	TYP: -97dBm, MAX: -97dBm@1Mbps	
Antenna	External antenna or IPEX output	

2 Hardware specification

2.1 Package and dimensions

LGA24 package，welding pad spacing is 0.75 mm transversely and 0.8 mm longitudinally. Detailed dimensions are shown in the figure 2-1, 2-2, 2-3, 2-4.

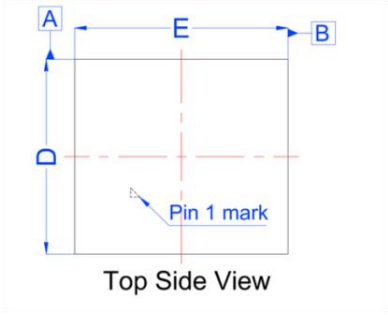

Figure 2-1 Top view

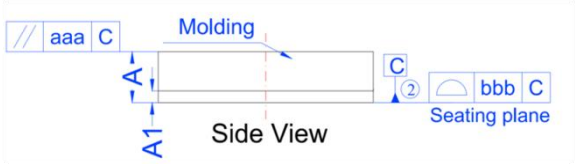

Figure 2-2 Side view

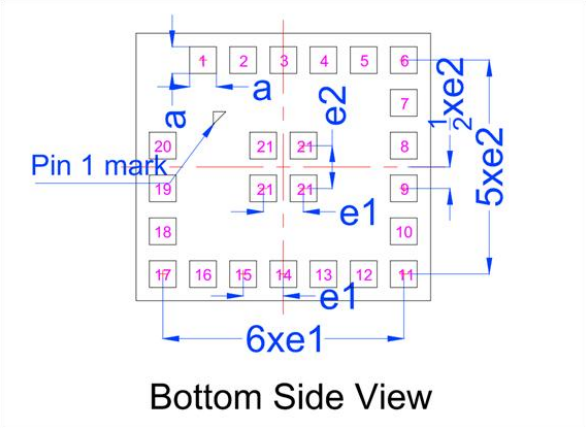

Figure 2-3 Bottom view

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	*4.90*	*5.00*	*5.10*		
E	*5.40*	*5.50*	*5.60*		
a	*0.45*	*0.50*	*0.55*		
e1	*0.75 REF*				
e2	*0.80 REF*				

Figure 2-4 Dimensions picture

2.2 Pin Definition

Table 2-1 Pin definition table

Pin	Name	Type	Description	Functions of transparent transmission mode
1	SWDCLK	INPUT	Clock Line of SWD Interface	
2	P0.17	IO	general purposed io port	**Host Connection Status Indicator Pin** When this pin's output is high level, the module has been successfully connected to the external slave. When this pin's output is low level, the module has disconnected from the external slave.
3	P0.14	IO	general purposed io port	**Transmit Path Selection Pin for Data Received by Serial Port** Assuming that the module has been connected to the slave. When this pin is input at high level, the data received by the module from the serial port is sent to the connected slaves. When this pin is input at low level or not connected, the data received by the module from the serial port is sent to the host or mobile APP which connected to module. When the module is not connected to the external slave, no matter what the state of this pin is, the data is sent to the host or mobile APP which connected to the module.
4	P0.12	IO	general purposed io port	**BLE-TX Pin** In the transparent transmission mode, this pin is the TX pin of the serial port, which is connected to the RX pin of the MCU.
5	P0.08	IO	general purposed io port	**BLE-RX Pin** In the transparent transmission mode, this pin is the RX pin of serial port, which is connected to the TX pin of the MCU.
6	P0.11	IO	general purposed io port	**Slave Connection Status Indicator Pin** When this pin's output is high level, the module as slave has been successfully connected by the mobile phone. When this pin's output is low level, the module as slave has been disconnected by the mobile phone.
7	VCC_IN	POWER INPUT	Power input port, supply volrage: DC1.7V ~ 3.6V	
8	P0.05/AIN3	IO/AI	general purposed io port/Analog input 3	**APP Receiving Data Indicator Pin** When the module receives the data sent by the mobile APP or the external device which connected to the module, the BLE module needs to send data through the TX pin of the module's serial port. Whether the module is a host or slave, this pin is raised T1 before data is sent out through the TX pin of the module's serial port, and this pin can be lowered only after data is sent out. T1 is a parameter, it can be set 1~255, It's in milliseconds. Usually this pin keeps a low level to represent idleness. This pin is used as a wake-up sign for long-time connections to low-power devices.

9	P0.01/XL2	IO/LF_XO P	general purposed io port/external 32.768KHz crystal input port	**Serial Port Receiving Function Enabling Pin (Can Be Set, The Default Is Active Low)** When the setting is active low, P0.01=0, serial port receiving function enabled. At this time, the module works at full speed. It can send instructions or transmit data in transparent transmission mode.The current consumption of the module will be up 300-400μA ; P0.01=1, the serial port receiving function has been disabled. Module working in low power mode. If you broadcast once a second, the current consumption of the module will be less than 15μA. If the broadcast is stopped, the current consumption of the module will be less than 2μA. When the setting is active high, P0.01=1, serial port receiving function enabled;P0.01=0, the serial port receiving function has been disabled.
10	P0.03/AIN1	IO/AI	general purposed io port/Analog input 1	**App's Configuration Function Enable Pin** When this pin is input to a high level, module allows APP to send instructions to configure all parameters of the module. When this pin is input to low level, it is forbidden for APP to configure or read the parameters of the module. The default input mode for this pin is Pulldown.
11	P0.04/AIN2	IO/AI	general purposed io port/Analog input 2	**At the host mode, successful flag for writing data with feedback response** When sending data to slave devices which has the function of sending data with feedback response, if P0.04=0, the slave is idle at this time, and the module can continue to send data. If P0.04=1, data is being sent, you need to wait until P0.04=0 to send the next data.
12	P0.00/XL1	IO/LF_XO N	general purposed io port/external 32.768KHz crystal input port	**the Control Pin of Whether the Slave Can Enter the Simple Matching Mode** When this pin is input to high level, then the slave enter the simple matching mode, the HJ-180IMH-11 can binding this slave. When this pin is input to low level, then the slave exit the simple matching mode.
13	P0.18	IO	general purposed io port	**IN0** This is an input pin. 1.Using UART command or APP command, you can set the period of the automatic reporting status function for IN0. The input status of this pin will be reported to APP in the “configble channel(0XFFF3)” by notification. The based time is 100ms. 2.You can use command to read the status of IN0 all the time. 3.The default input mode for this pin is Pulldown.
14	P0.15	IO	general purposed io port	**IN1** This is an input pin. The function of this pin is same to IN0.
15	P0.16	IO	general purposed io port	**OUT0** This is an output pin. 1.Using UART command or APP command, you can set the state of OUT0 to high or low, you also

				can save the output state of OUT0. This pin save the final state after each power cut. 2.You can read OUT0's output state every time. **Enable External PA** When the function of this pin is to enable external PA, this pin will automatically control the output level of this pin according to the transmission status of the antenna of the current Bluetooth module, and the external PA of the module can automatically control according to the level of this pin.
16	P0.20	IO	general purposed io port	**OUT1** This is an output pin. The function of this pin is same to OUT0. **Enabling External LNA** When the function of this pin is to enable external LNA, this pin will automatically control the output level of this pin according to the receiving status of the antenna of the current Bluetooth module, and the external LNA of the module can automatically control according to the level of this pin.
17	SWDIO	Debug Port	Input and Output Ports of SWD Interface	
18	P0.21/ nRESET	IO/Reset Pin	general purposed io port/External reset pin(Active low)	**External reset pin(Active low)** If reset is required, this pin needs to be kept at least 10 ms low.
19	EXT-ANT	EXT ANT RF OUTPUT	Interface of External Antenna, it can realize the output of radio frequency signal.	
20	OB-ANT	Onboard ANT	On-board antenna input port	If you want to use a built-in antenna, Short-circuit the Pin19 and Pin20.
21	GND	Ground	power ground	

3 Announcements

3.1 Notices for Hardware Design

1. All IO ports can be used for export. Please pay attention to the pin diagram for all pins, and pay attention to the IO mode and status of the connected IO.

2. It is recommended to use magnetic beads or inductance filtering for the input power supply.

3. When using an external antenna, be sure to contact our company and let us confirm whether your external PCB antenna or IPEX lead out antenna PCB design is reasonable.

4. The module should not be placed in a metal shell. If a metal shell must be used, the antenna must be led out.

5. In products that require the installation of this wireless module, some metal components such as screws, inductors, etc. should be kept as far away from the RF antenna part of the wireless module as possible.

6. Try to avoid placing other components near and on the back of the Bluetooth module antenna, and avoid wiring. Placing devices or wiring will affect Bluetooth performance.

7. The module antenna should be placed around the edges of the circuit board, with the antenna part close to the edges or corners of the motherboard. It is best to place the module in the corners of the circuit board.

8. Make sure that each layer of the circuit board is covered with copper and GND, and ensure that the module, especially the antenna part, has a large enough copper area and is well grounded.

9. It is necessary to punch through holes in the copper clad area of the entire circuit board, especially in the copper clad area near modules and antennas. As many through holes as possible should be punched.

10. If there are high-power devices or high-voltage conversion circuits on the circuit board, it is necessary to isolate the GND copper coating of the module from the GND copper coating of other parts, connect them using a single point grounding method, and drill as many through holes as possible to reduce interference with the RF signal.

11. Unneeded pins can be suspended for processing.

3.2 Notices for Ultrasound Welding

Warning: 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.

4 Soldering Recommendations

Reflow soldering is recommended for welding.

HJ-180IMH-11 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 4-1.

Table 4-1 Reflow soldering parameters

Parameter	Value
Features	Lead-free process
Average ramp up rate(T_{SMAX} to Tp)	3℃/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

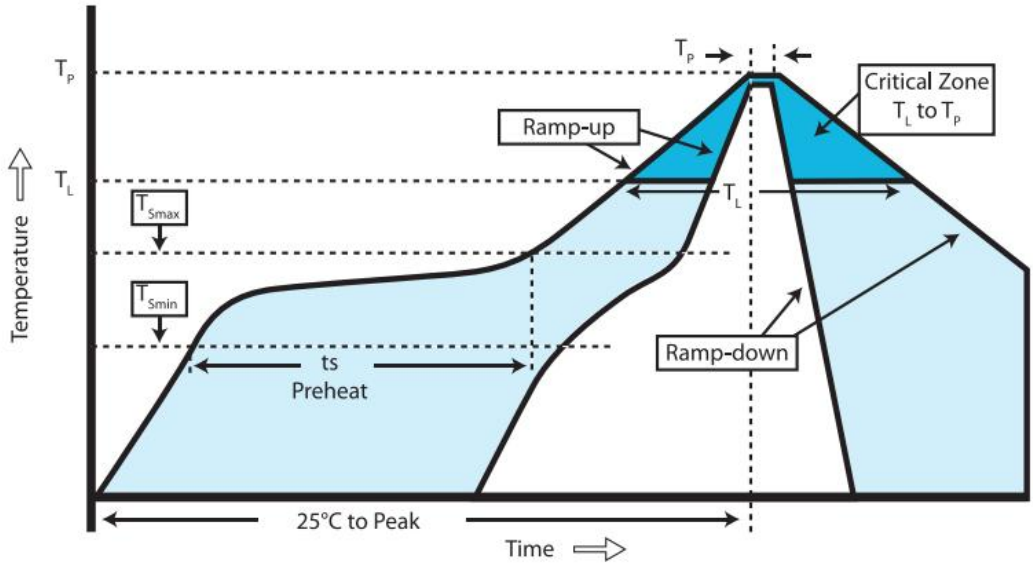

Figure 4-1 Temperature Curve of Reflow Welding

Note: If possible, use low-temperature solder paste.

5 Supply Information

5.1 Model Definition

Type	Model	Description
Standard Edition of uart transparent transmission	HJ-180IMH-11_SPPv2	Include UART port transparent transmission firmware, the firmware module is a bridge between the Bluetooth device or the mobile phone and the MCU. The Customer does not need to understand the BLE protocol stack, and control the UART port command operation and the UART port data, and the operation is simple, short Development cycle to speed up product launch.
Custom version	HJ-180IMH-11_CUSv2	This version supports custom firmware, the customer proposes functions according to the product requirements, and we will customize the module with the special version firmware to supply the customer.
MI profile Version	HJ-180IMH-11_MICv2	This version of the firmware is similar to the "Custom Version", but it include Xiaomi MISDK certification protocol, other functional requirements are also customized according to customer requirements.
WeChat Edition of uart transparent transmission	HJ-180IMH-11_WSPPv2	This version of the firmware adds the WeChat serial port transparent transmission function based on the "Standard Edition of uart transparent transmission" version. The external GPIO can select the WeChat data transmission and reception method.
Customer development Version	HJ-180IMH-11_EMP	This version of the module has no built-in firmware, customer can develop their own firmware according to the Nordic official chip datasheet and support documents, and only need to provide firmware for us to burn.

5.2 Packaging method

Packaging with tapes and reel. Sealed with chip-level anti-static aluminum foil bag, each bag contains desiccant, use industrial grade vacuum machine to ensure airtight, moisture-proof, waterproof and dustproof (IP65). The actual packing effect is shown in Figure 5-1.

Figure 5-1 External Packing Image

All packages will be labeled with goods information. All packages will be marked with the cargo information, including ROHS and anti-static signs. The production batch information in the item number is 15 bits.

TangShan HongJia Electronic Technology Co., Ltd.

HJ-180IMH-11_SPPv2

Pb Free Reflow(260℃)

DATE CODE:P16aI15bS17c001

QTY:1500PCS SEAL DATE:20170504

图 5-2 标签示例图

Remarks: P16a I15b S17c001 represents PCB production in January 2016, IC production in February 2015, and SMT patch in the first time in March 2017.

6 Version History

Table 6-1 Revision History

No.	Version Number	Time	Description
1	V1.0	20231117	First edition