# HJ-180IMH

Ultra-small Chip (5mm*5.5mm), ultra-low power Bluetooth 5.1 module

**DataSheet version: V1.921**

# CATALOG

# 1    Overview

## 1.1 Features

●Power supply: 1.7V~3.6V

●GPIO maximum number: 17

●Built-in high performance antenna(External antenna can also be used)

●Function

  - Support BLE 5.1, embedded Bluetooth low energy protocol stack and GATT service

  - BLE supported master-slave integration(Support 1 slave and 1 host. Host and slave work at the same time without affecting each other)

  - Supported standard edition of UART transparent transmission, supported WeChat, MiSDK. You also can develop your own firmware and download to the unprogrammed module.

●RF Features

  - Operating Frequency: 2.4GHz, Support ISM free Frequency band

  - Transmit Power: -20dBm ~ +4dBm

  - High Receive sensitivity: -96dBm

  - Peak Current at Transmitting and Receiving  < 4.6mA

  - On the open land and use built-in antenna, the transmission distance of wireless signal can spread more than 10 metres and less than 20 metres.

  - On the open land and use external antenna, the transmission distance of wireless signal can spread more than 40 metres and less than 80 metres.

●Low Power Dissipation

  - Dormant current $< 2\mu A$

  - One second broadcast current: $12.2\,\mu A$(0dBm)or $15.5\,\mu A$(+4dBm)

  - Two second broadcast current: $6.5\mu A$

●Package: LGA24, pad spacing: 0.75mm and 0.8mm

●Size: 5mm*5.5mm*1.3mm(Built-in antenna inside)

●Weight: 0.10g

●Operating temperature range: -40 ~ +85℃

●RoHS compliant

# 2 Hardware specification

## 2.1 Package and dimensions

The package of HJ-180IMH is LGA24, welding pad spacing is 0.75 mm transversely and 0.8 mm longitudinally. Detailed dimensions are shown in the figure 3-1, 3-2, 3-3, 3-4.
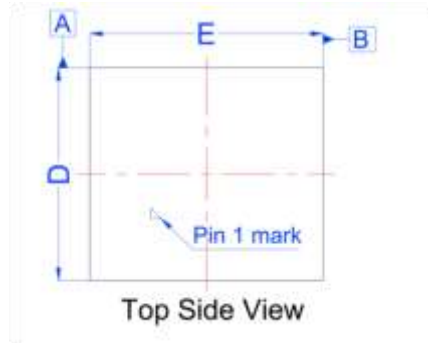


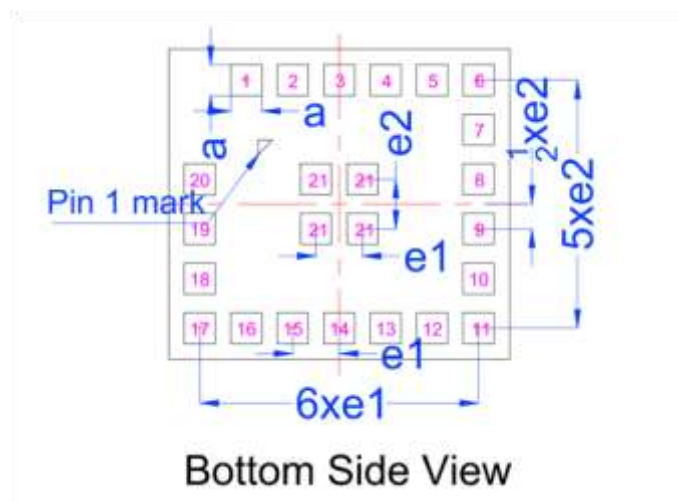Figure 3-1 Top view



Figure 3-2 Side view



Figure 3-3 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 3-4 Dimensions picture

## 2.2 Pin Definition

Table 3-1  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**<br>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**<br>When this pin's output is high level, the module as slave has been successfully connected by the mobile phone.<br>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**<br>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.<br>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)**<br>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 300-400 $\mu$A ; 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 15 $\mu$A. If the broadcast is stopped, the current consumption of the module will be less than 2 $\mu$A.<br>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** <br> When this pin is input to a high level, module allows APP to send instructions to configure all parameters of the module. <br> When this pin is input to low level, it is forbidden for APP to configure or read the parameters of the module. <br> 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** <br> 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. <br> 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** <br> When this pin is input to high level, then the slave enter the simple matching mode, the HJ-180IMH can binding this slave. <br> 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** <br> This is an input pin. <br> 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. <br> You can use command to read the status of IN0 all the time. <br> The default input mode for this pin is Pulldown. |
| 14 | P0.15 | IO | general purposed io port | **IN1** <br> This is an input pin. <br> The function of this pin is same to IN0. |
| 15 | P0.16 | IO | general purposed io port | **OUT0** <br> This is an output pin. <br> 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. You can read OUT0's output state every time.<br><br>**Enable External PA**<br>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**<br>This is an output pin.<br>The function of this pin is same to OUT0.<br><br>**Enabling External LNA**<br>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)**<br>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 On-board antenna, Short-circuit the Pin19 and Pin20. |
| 21 | GND | Ground | power ground | |

## 2.3 Matters needing attention in the use of products

A. The module should not be placed in a metal-based enclosure. If a metal enclosure is required, the antenna must be taken out.

B. Among the products that need to install this wireless module, some metal materials such as screws, inductors, etc. should be kept away from the RF antenna part of the wireless module.

C. On the wireless module antenna, Do not place other components. Because other components can degrade wireless performance.

D. The wireless module should be placed on the four sides of the motherboard as much as possible. The antenna part should be close to the side or corner of the motherboard. The motherboard PCB under the module antenna should be hollowed out with the keepout layer. If the request cannot be hollowed out, no copper or trace is allowed under the antenna. Otherwise it will affect RF performance.

E. Please pay attention to the pin diagram for all pins. Please pay attention to the IO mode and status of the IO connected to it.

F. GND must be sound grounding.

G. It is recommended that magnetic beads or inductance filters be applied to the input power supply.

# 3 Electrical Parameters

## 3.1 Absolute Maximum Ratings

Table 4-1 Absolute maximum ratings

| Parameter | MIN | MAX | Unit |
|---|---|---|---|
| Power Supply Voltage (VCC) | 1.7 | 3.6 | V |
| IO Supply Voltage | 0 | VCC | V |
| Operating Temperature | -40 | +85 | ℃ |
| Storage Temperature | -40 | +125 | ℃ |

## 3.2 Recommended Operating Conditions

Table 4-2 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 | ℃ |

## 3.3  I/O DC Characteristics

Table 4-3 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 |

## 3.4 RF Features

Table 4-4 RF Features

| Attribute | Value | Remarks |
|---|---|---|
| Modulation | GFSK | |
| Frequency range | 2.402 ~ 2.480Ghz | Bandwidth: 2Mhz |
| Number of channels | 40 | |
| Air speed | 1Mbps、2Mbps | |
| RF Port Impedance | 50Ω | |
| Transmit Power | MAX: +4dbm | |
| TX Current consumption | TYP: 4.6mA | |
| RX Current consumption | TYP: 4.6mA | |
| Receive sensitivity | TYP: -96dbm, MAX: -97dbm | |
| Antenna | Onboard PCB Antenna | External antenna can be used |

## 3.5 Power Dissipation

Table 4-5 Power Dissipation

| Test conditions | TYP | Unit |
|---|---|---|
| Dormancy mode | <2 | μA |
| 20ms Interval Broadcasting in Slave Mode | 705 | μA |
| 1S Interval Broadcasting in Slave Mode | 13.5 | μA |
| 20ms Connection Gap Holding Connection in Slave Mode | 138 | μA |
| 7.5ms Connection Gap Holding Connection in Slave Mode | 350 | μA |
| Scanning in Host Mode | 4.4 | mA |
| 20ms Connection Gap Holding Connection in Host Mode | 150 | μA |

# 4 Reflow Soldering Information

Reflow soldering is recommended for welding.

HJ-180IMH 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 5-1.

Table 5-1 Reflow soldering parameters

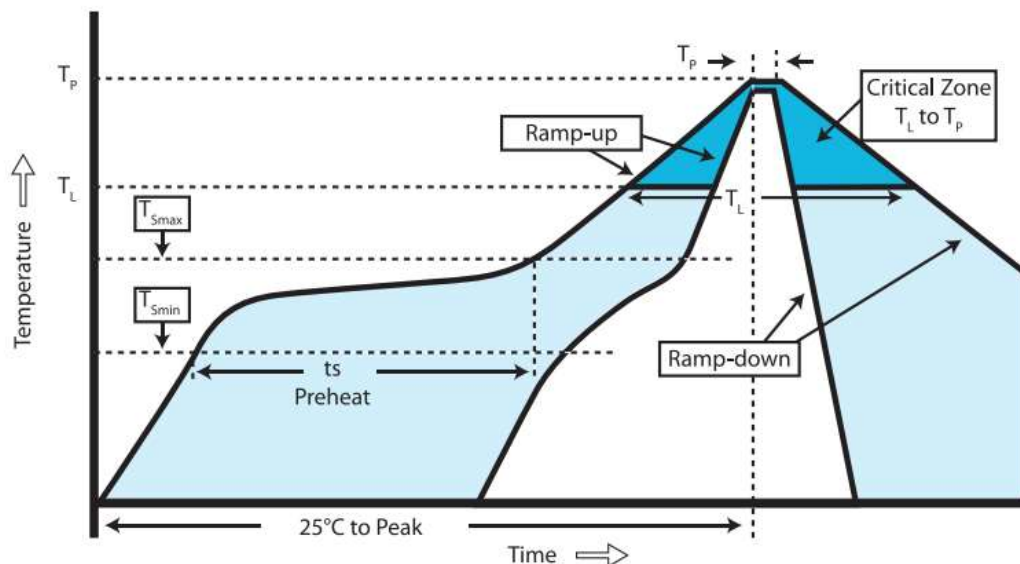| Parameter | Value |
|---|---|
| Features | Lead-free process |
| Average ramp up rate($T_{SMAX}$ to Tp) | 3℃/sec. max |
| Temperature Min($T_S$min) | 150℃ |
| Temperature Max(TSmax) | 200℃ |
| Preheat time (Min to Max) (tS) | 80~100sec. |
| Peak Temperature ($T_P$) | 250±5℃ |
| Ramp-down Rate | 6℃/sec. max |
| Time 25℃ to Peak Temp ($T_P$) | 8 min. max |



Figure 5-1 Temperature Curve of Reflow Welding

# 5 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.

# 6 Supply Information

## 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 7-1.



Figure 7-1 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_SPPv2

Pb Free    Reflow(260℃)

DATE CODE:P16aI15bS17c001

QTY:500PCS    SEAL DATE:20170504

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.

Figure 7-2 Label Sample Diagram

# 7 FCC Warning

(OEM) Integrator has to assure compliance of the entire end-product incl. the integrated RF Module.
For 15 B (§15.107 and if applicable §15.107) compliance, the host manufacturer is required to
show compliance with 15 while the module is installed and operating.
Furthermore the module should be transmitting and the evaluation should confirm that the module's
intentional emissions (15C) are compliant (fundamental / out-of-band). Finally the integrator has
to apply the appropriate equipment authorization (e.g. Verification) for the new host device per
definition in §15.101.
Integrator is reminded to assure that these installation instructions
will not be made available to the end
-
user of the final host device.
The final host device, into which this RF Module isintegrated" hasto be labelled
with an auxilliary lable stating the FCC IDofthe RF
Module, such as "Contains FCC ID: 2AGPMHJ-180IMH

"This device complies with part 15 of the FCC rules. Operation is subject to the following two
conditions:
(1)this devicemay not cause harmful interference, and
(2)this devicemust accept any interference received, including
interference thatmay cause undesired operation."
NOTE: This equipment has been tested and found to comply with the limits for a Class B digital
device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable
protection
against harmful interference in a residential installation. This equipment generates, uses and can
radiate radio frequency energy and, if not installed and used in accordance with the instructions,
may cause harmful interference to radio communications. However, there is no guarantee that
interference will not occur in a particular installation. If this equipment does cause harmful
interference to radio or television reception, which can be determined by turning the equipment
off and on, the user is encouraged to try to correct the interference by one or more of the
following measures:
--Reorient or relocate the receiving antenna.
--Increase the separation between the equipment and receiver.
--Connect the equipment into an outlet on a circuit different from that to which the receiver is
connected.
--Consult the dealer or an experienced radio/TV technician for help.
Changes or modifications to this unit not expressly approved by the party responsible for
compliance could void the user's authority to operate the equipment.

Module Statement

The single-modular transmitter is a self-contained, physically delineated, component for which compliance can be demonstrated independent of the host operating conditions, and which complies with all eight requirements of § 15.212(a)(1) as summarized below.

1) The radio elements have the radio frequency circuitry shielded.

2) The module has buffered modulation/data inputs to ensure that the device will comply with Part 15 requirements with any type of input signal.

3) The module contains power supply regulation on the module.

4) The module contains a permanently attached antenna.

5) The module demonstrates compliance in a stand-alone configuration.

6) The module is labeled with its permanently affixed FCC ID label

7) The module complies with all specific rules applicable to the transmitter, including all the conditions provided in the integration instructions by the grantee.

8) The module complies with RF exposure requirements.

This transmitter/module must not be collocated or operating in conjunction with any other antenna or transmitter.

## 2.2 List of applicable FCC rules

FCC Part 15.247

## 2.3 Specific operational use conditions

This transmitter/module and its antenna(s) must not be co-located or operating in conjunction with any transmitter. This information also extends to the host manufacturer's instruction manual.

## 2.4 Limited module procedures

not applicable

## 2.5 Trace antenna designs

not applicable

## 2.6 RF exposure considerations

This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This compliance to FCC radiation exposure limits for an uncontrolled environment, and minimum of 20mm separation between antenna and body.

The host product manufacturer would provide the above information to end users in their end-product manuals.

## 2.7 Antennas

Integral Antenna; 3.25dBi; 2.402 GHz～2.480GHz

## 2.8 Label and compliance information

The end product must carry a physical label or shall use e-labeling followed KDB784748D01 and KDB 784748 stating "Contains Transmitter Module FCC ID: 2AGPMHJ-180IMH".

## 2.9 Information on test modes and additional testing requirements

For more information on testing, please contact the manufacturer.

## 2.10 Additional testing, Part 15 Subpart B disclaimer

The modular transmitter is only FCC authorized for the specific rule parts (FCC Part 15.247) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. The final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed when contains digital circuity.