Bluetooth Module

AC6951

Specification

Harman International Industries, Incorporated

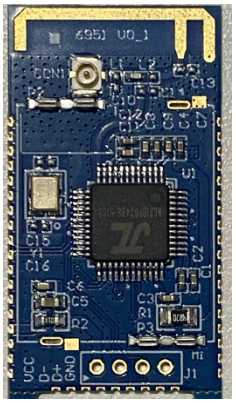
Contents

1 Overview

AC6951 Bluetooth module is an intelligent wireless audio data dual-mode transmission product independently developed by the company, which is high-end and efficient stereo wireless transmission scheme, the module adopts AC6951C series chips to provide the module with high quality sound quality and compatibility better performance.
The AC6951 Bluetooth module adopts the drive free mode. Customers only need to connect the module to the application product, and it can be fast realize the wireless transmission of music and enjoy the fun of wireless music.

2 Features

- Main Chipset： AC6951C,LQFP48
- High performance programmable Bluetooth
- 240 MHz Developer Processor for applications
- 32bit floating-point arithmetic unit
- Advanced audio algorithms
- High-performance 24-bit stereo audio interface
- Analog microphone interface
- Supports SBC and AAC audio codecs
- Serial interface:UART、USB 2.0
- Size: 34.1mm x 18.7mm x 3.0mm



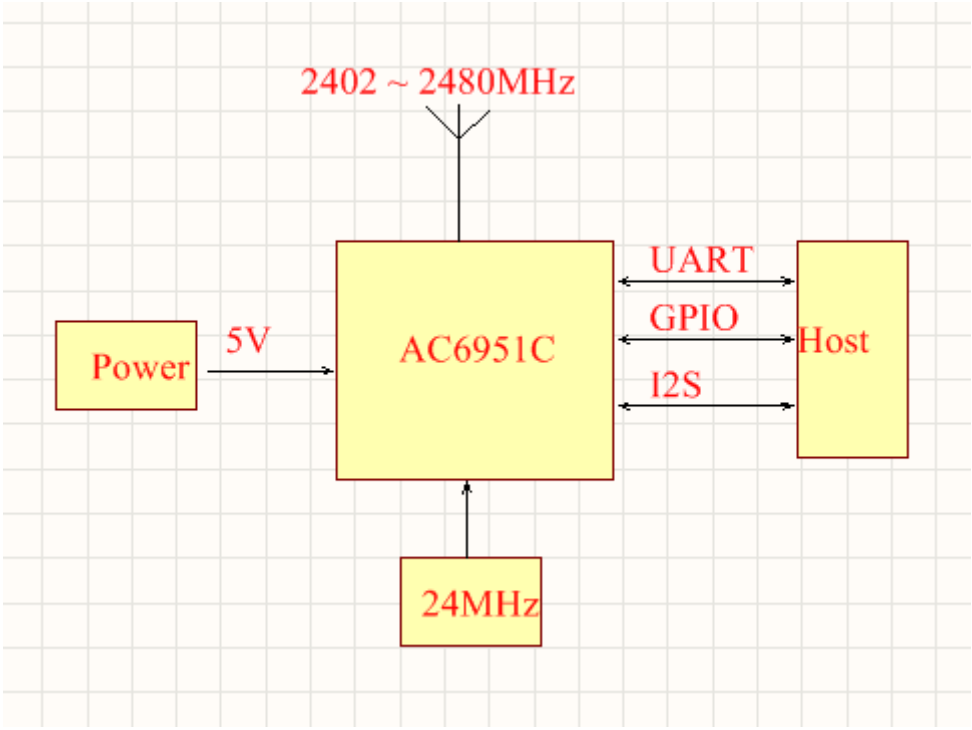
3 Applications

- Stereo wireless headphones。
- Wired stereo headphones and headsets。
- Portable stereo speakers。
- Home sound system。

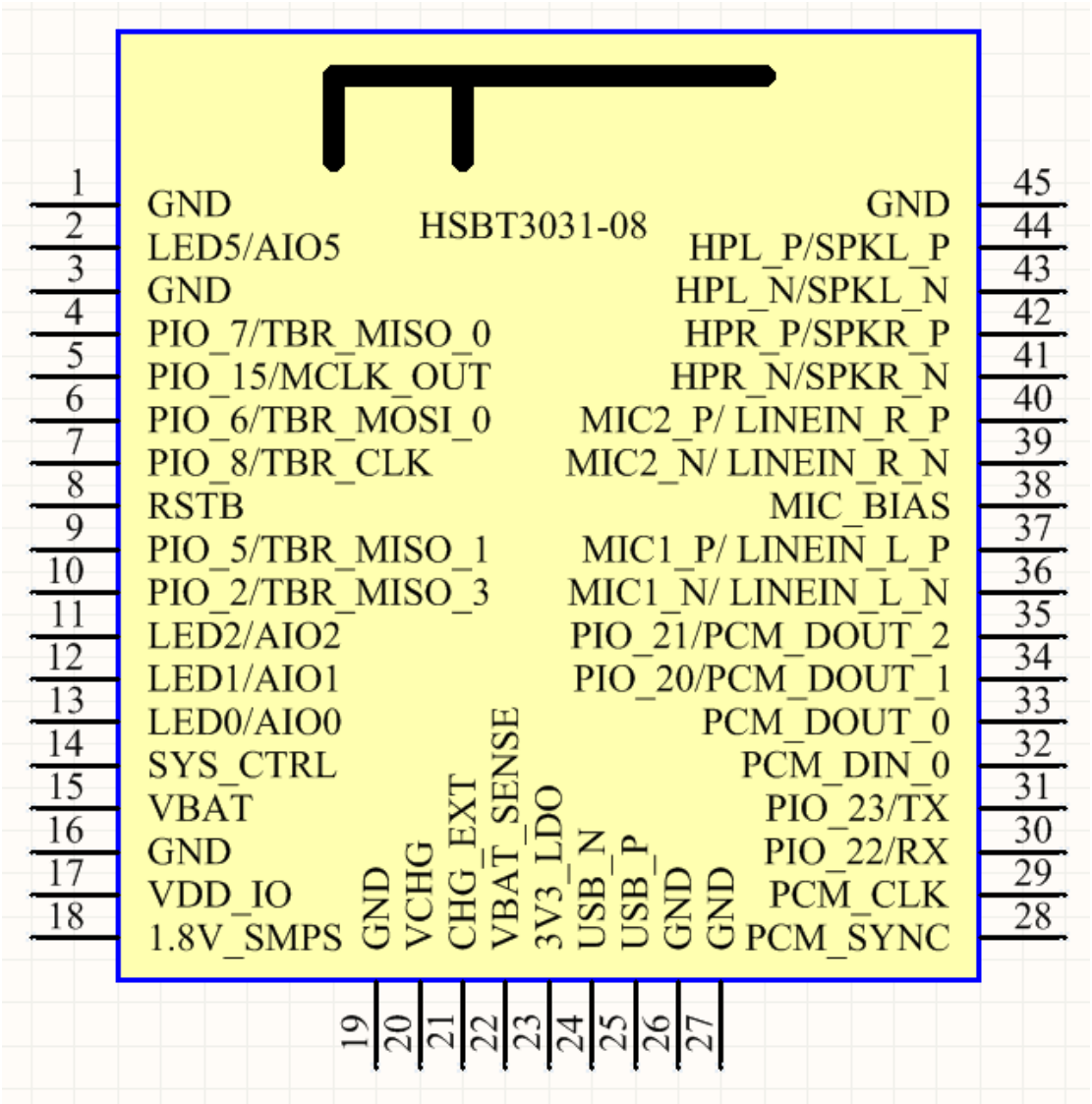
4 Specifications

Model	AC6951
Bluetooth specifications	V5.3+BR+EDR+BLE
Modulation mode	GFSK， π / 4 DQPSK，
Supply voltage	5V
Support Bluetooth protocol	A2DP 1.3.2， AVCTP 1.4， AVDTP 1.3， AVRCP 1.6.2， HFP 1.8， SPP 1.2， RFCOMM 1.1， PNP 1.3， HID1.1.1，SDP CORE5.3， I2CAP CORE5.3
Working current	≤ 20mA
Standby current	< 500uA
Temperature range	- 40 °C 至 + 85 °C
Wireless transmission range	more than 10m
Transmission power	support class 1 / class 2 / class 3 with maximum adjustable 4dbm
Sensitivity	- 85dBm
Frequency range	2.402GHz-2.480GHz
External interface	GPIO UART, USB, I2S, MIC, Lin, SPK (L / R)
Support system	Android、IOS and Windows
Audio decoding output	SBC and AAC
Audio SNR	≥75dB
Distortion	≤ 0.1%
Module size	30.9mm x 18.6mmx 3.0mm

5 Block Diagram


2402 ~ 2480MHz
Power
5V
AC6951C
UART
GPIO
I2S
Host
24MHz

6 Pin view


HSBT3031-08
1 GND
2 LED5/AIO5
3 GND
4 PIO_7/TBR_MISO_0
5 PIO_15/MCLK_OUT
6 PIO_6/TBR_MOSI_0
7 PIO_8/TBR_CLK
8 RSTB
9 PIO_5/TBR_MISO_1
10 PIO_2/TBR_MISO_3
11 LED2/AIO2
12 LED1/AIO1
13 LED0/AIO0
14 SYS_CTRL
15 VBAT
16 GND
17 VDD_IO
18 1.8V_SMPS
19 GND
20 VCHG
21 CHG_EXT
22 VBAT_SENSE
23 3V3_LDO
24 USB_N
25 USB_P
26 GND
27 GND
45 GND
44 HPL_P/SPKL_P
43 HPL_N/SPKL_N
42 HPR_P/SPKR_P
41 HPR_N/SPKR_N
40 MIC2_P/ LINEIN_R_P
39 MIC2_N/ LINEIN_R_N
38 MIC_BIAS
37 MIC1_P/ LINEIN_L_P
36 MIC1_N/ LINEIN_L_N
35 PIO_21/PCM_DOUT_2
34 PIO_20/PCM_DOUT_1
33 PCM_DOUT_0
32 PCM_DIN_0
31 PIO_23/TX
30 PIO_22/RX
29 PCM_CLK
28 PCM_SYNC

7 Pin Assignment

Pin No.	Pin Name	Pin Type	Description
1	GND	GND	GND
2	LED5/AIO5	Digital: Bidirectional with programmable strength internal pullup/pull-down	GPIO
3	GND	GND	GND
4	TBR_MISO_0	Digital: Bidirectional with programmable strength internal pullup/pull-down	UART for debug
5	MCLK_OUT	Digital: Bidirectional with programmable strength internal pullup/pull-down	MCLK Output
6	TBR_MOSI_0	Digital: Bidirectional with programmable strength internal pullup/pull-down	UART for debug
7	TBR_CLK	NC	NC
8	RSTB	Digital: Bidirectional with programmable strength internal pullup/pull-down	Automatically defaults to RESET# mode when the device is unpowered, or in off modes. Reconfigurable as a PIO after boot. Alternative function: Programmable I/O line 1
9	TBR_MISO_1	Digital: Bidirectional with programmable strength internal pullup/pull-down	GPIO
10	TBR_MISO_3	Digital: Bidirectional with programmable strength internal pullup/pull-down	GPIO
11	LED2/AIO2	Digital: Bidirectional with programmable strength internal pullup/pull-down	GPIO。

12	LED1/AIO1	Digital: Bidirectional with programmable strength internal pullup/pull-down	GPIO。
13	LED0/AIO0	Digital: Bidirectional with programmable strength internal pullup/pull-down	GPIO。
14	SYS_CTRL	Digital: Bidirectional with programmable strength internal pullup/pull-down	GPIO
15	VBAT	Supply	Battery voltage input.
16	GND	GND	GND
17	VDD_IO	NC	NC
18	1V8_SMPS	NC	NC
19	GND	GND	GND
20	RSTB	NC	NC
21	CHG_EXT	NC	NC
22	VBAT_SENSE	NC	NC
23	3V3_LDO	NC	NC
24	USB_N	Digital	USB Full Speed device D- I/O.
25	USB_P	Digital	USB Full Speed device D+ I/O.
26	GND	GND	Common Ground
27	GND	GND	Common Ground
28	PCM_SYNC	Digital: Bidirectional with programmable strength internal pullup/pull-down	LRCLK
29	PCM_CLK	Digital: Bidirectional with programmable strength internal pullup/pull-down	BCLK
30	PIO_22	Digital: Bidirectional with programmable strength internal pullup/pull-down	UART_RX
31	PIO_23	Digital: Bidirectional with programmable strength internal pullup/pull-down	UART_TX
32	PCM_DIN_0	Digital: Bidirectional with programmable	PCM_DIN[0]

		strength internal pullup/pull-down	
33	PCM_DOUT_0	Digital: Bidirectional with programmable strength internal pullup/pull-down	PCM_DOUT[0]
34	PCM_DOUT_1	Digital: Bidirectional with programmable strength internal pullup/pull-down	PCM_DOUT[1]
35	PCM_DOUT_2	Digital: Bidirectional with programmable strength internal pullup/pull-down	PCM_DOUT[2]
36	MIC1_N/ LINEIN_L_N	GND	GND
37	MIC1_P/ LINEIN_L_P	Analog	Microphone differential 1 input, positive. Alternative function: ■ Differential audio line input left, positive
38	MIC_BIAS	Analog	Mic bias output.
39	MIC2_N/ LINEIN_R_N	Analog	Microphone differential 2 input, negative. Alternative function: ■ Differential audio line input right, negative
40	MIC2_P/ LINEIN_R_P	Analog	Microphone differential 2 input, positive. Alternative function: ■ Differential audio line input right, positive
41	HPR_N/SPKR_N	GND	GND
42	SPKR_P/HPR_P	Analog	Headphone/speaker differential right output, positive. Alternative function: ■ Differential right line output, positive
43	HPL_N/SPKL_N	GND	共同点
44	SPKL_P/HPL_P	Analog	Headphone/speaker differential left output, positive. Alternative function: ■ Differential left line output,

			positive
45	GND	GND	GND

8 Interfaces

8.1 USB Interface

HSBT6951 has a USB device interface: An upstream port, for connection to a host Phone/PC or battery charging adaptor.
The device port is a USB2.0 Full Speed (12 Mb/s) port. Typically HSBT3031-08 enumerates as a compound device with a hub with the enabled audio source / sink / HID / mass storage device appearing behind this hub.
The DP 1.5 k pull-up is integrated in HSBT3031-08. No series resistors are required on the USB data lines.
HSBT6951 contains integrated ESD protection on the data lines to IEC 61000-4-2 (device level). In normal applications, no external ESD protection is required.

8.2 Standard I/O

The standard digital I/O pins (PIO) on HSBT3031-08 are split into separate pad domains. Each VDD_PADS domain can be separately powered, from 1.7 V to 3.6 V. When PIOs in a supply domain are used for a high-speed interface, decoupling the respective VDD_PADS pin with a 100 nF decoupling capacitor may be beneficial. The VDD_PADS of a particular pin should be powered before voltages are applied to any PIO powered by that domain, otherwise back
powering can occur through the electrostatic discharge (ESD) protection in the pad.
PIO can be programmed to have a pull-up or pull down with two strengths (weak and strong).
PIO can also be programmed with a sticky function where they are strongly pulled to their current input state. PIO have a reset pull state, after reset the pulls can be re-configured by software.
PIO also have a programmable drive strength capability of 2, 4, 8, or 12 mA.
All PIO are readable by all subsystems, but for write access are assigned by software to particular subsystem control. PIO inputs are via Schmitt triggers.

8.3 RESET# reset

The HSBT6951 digital reset pin (RESET#) is an active low reset signal.

8.4 SYS_CTRL

SYS_CTRL is an IO pin that acts as a GPIO for Host. It can also be used as an input

8.5 Audio interfaces

■ 24‑bit I² S interface with 1 input and 3 output channels

■ Programmable audio master clock (MCLK).

■ Stereo analog Class-AB headphone outputs:

☐ Class-AB signal-to-noise ratio (SNR): ⩾75dB.

☐ Class-AB total harmonic distortion plus noise (THD +N): ⩽0.1%.

■ Dual analog inputs configurable as single ended line inputs or, unbalanced or balanced analog microphone inputs:

☐ SNR single-ended: ⩾75dB.

☐ THD+N single-ended: ⩾75dB.

■ 1 microphone bias (single bias shared by the two channels).

☐ Crosstalk attenuation between two inputs using recommended application circuit: ⩾75dB.

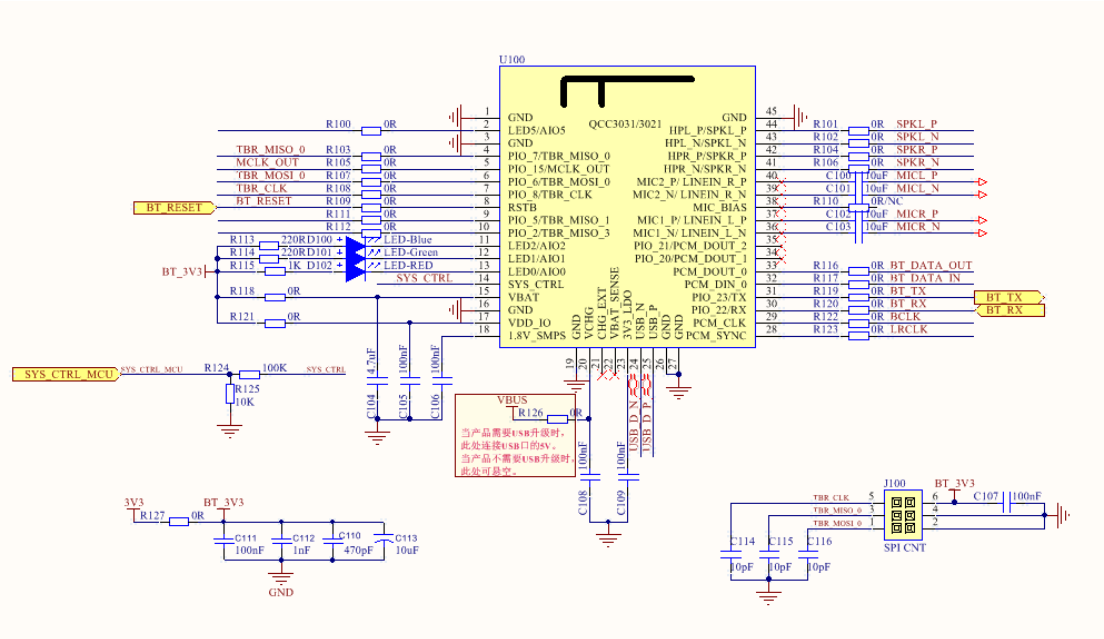
■ Digital microphone inputs with capability to interface up to 6 digital microphones.

■ Both analog-to-digital converter (ADC)s and digital-toanalog converter (DAC)s support sample rates of 8, 16, 32, 44.1, 48, 96 kHz. DACs also support 192 kHz.

9 Power supply

Single 4.2V only supply (3.3V for I/O)

For improving the noise, recommend adding one 10Uf capacitor on the power supply pin



10 General Specifications

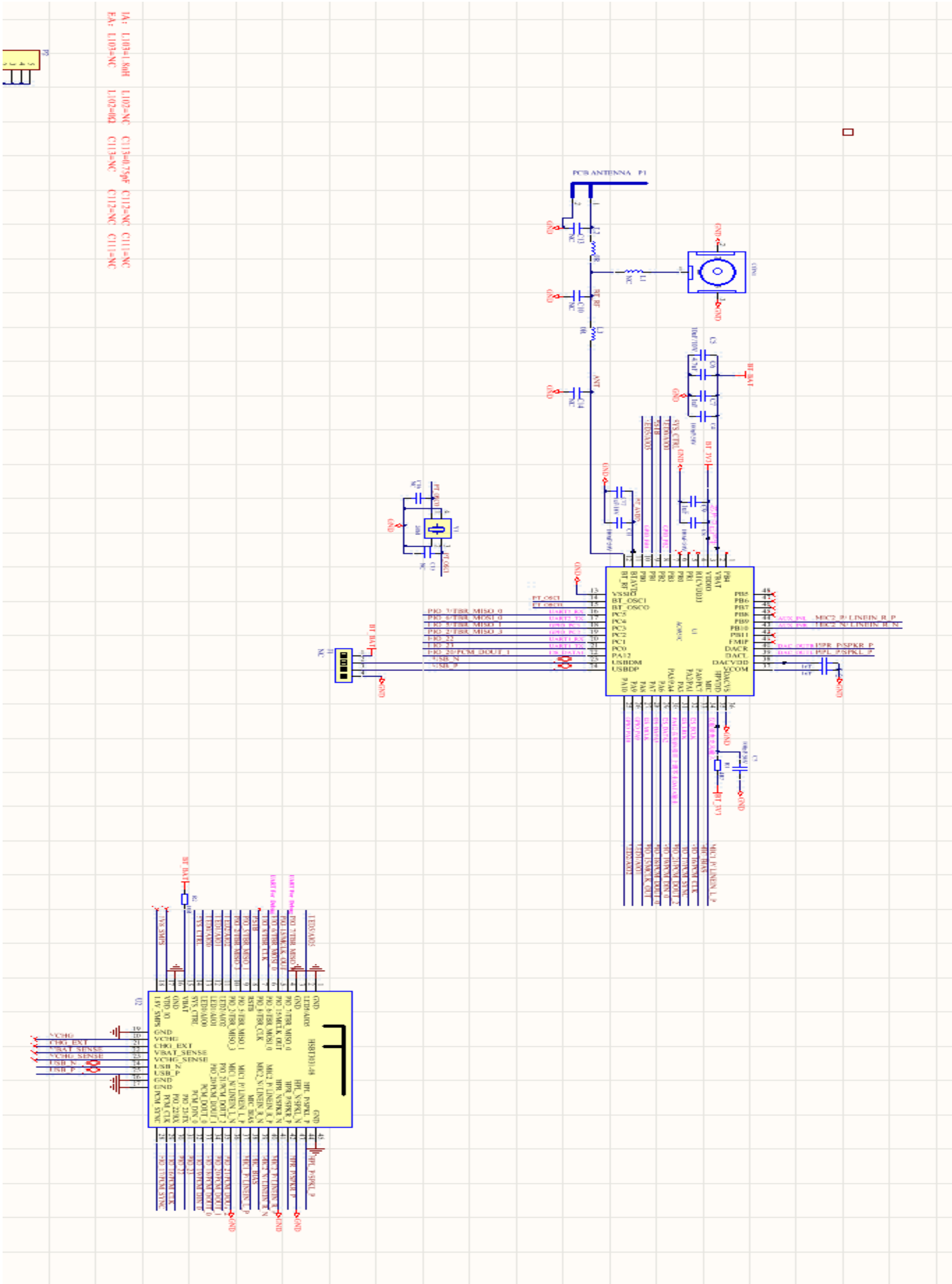
10.1 Absolute Maximum Ratings：

Ratings	Min.	Max.	Unit
Storage Temperature	-40	+85	℃
Power	-0.4	5.5	V
RSTB	-0.4	3.8	V
GPIO	-0.4	3.8	V
SYS_CTRL	-0.4	3.8	V

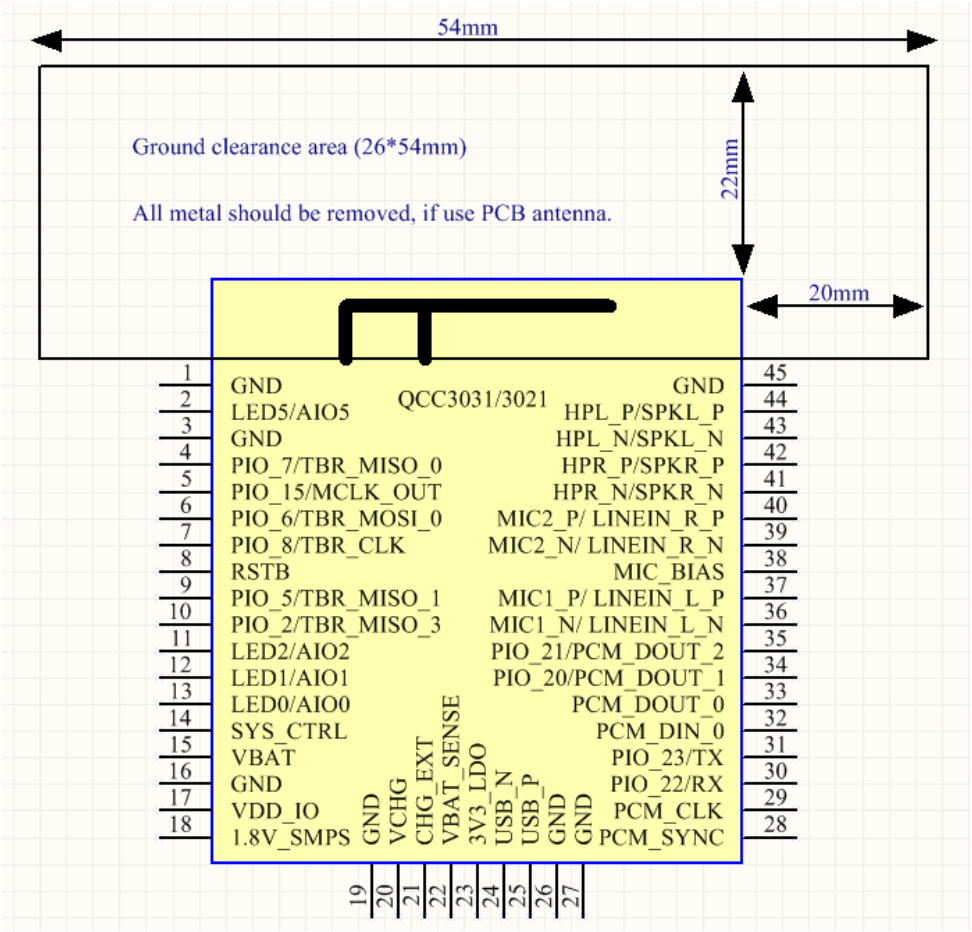
10.2 Recommended Operating Condition：

Ratings	Min	Typ	Max	Unit
Operating Temperature range	-40	20	+85	℃
Power	3.7	4.2	5.5	V
RSTB	0	-	3.3	V
GPIO	0	-	3.3	V
SYS_CTRL	0	-	3.3	V

11 Module Schematics


IA: L103=1.8nH L102=NC C113=0.75pF C112=NC C111=NC
EA: L103=NC L102=0Ω C113=NC C112=NC C111=NC
PCB ANTENNA P1
ANT
BT_RF
BT_BAT
BT_3V3
GND
VCHG
CHG_EXT
VBAT_SENSE
VCHG_SENSE
USB_N
USB_P

12 Layout Notes



A. If there is battery, metal, LCD, loudspeaker, etc. beside the module antenna, it is required to be at least 15mm away from the antenna

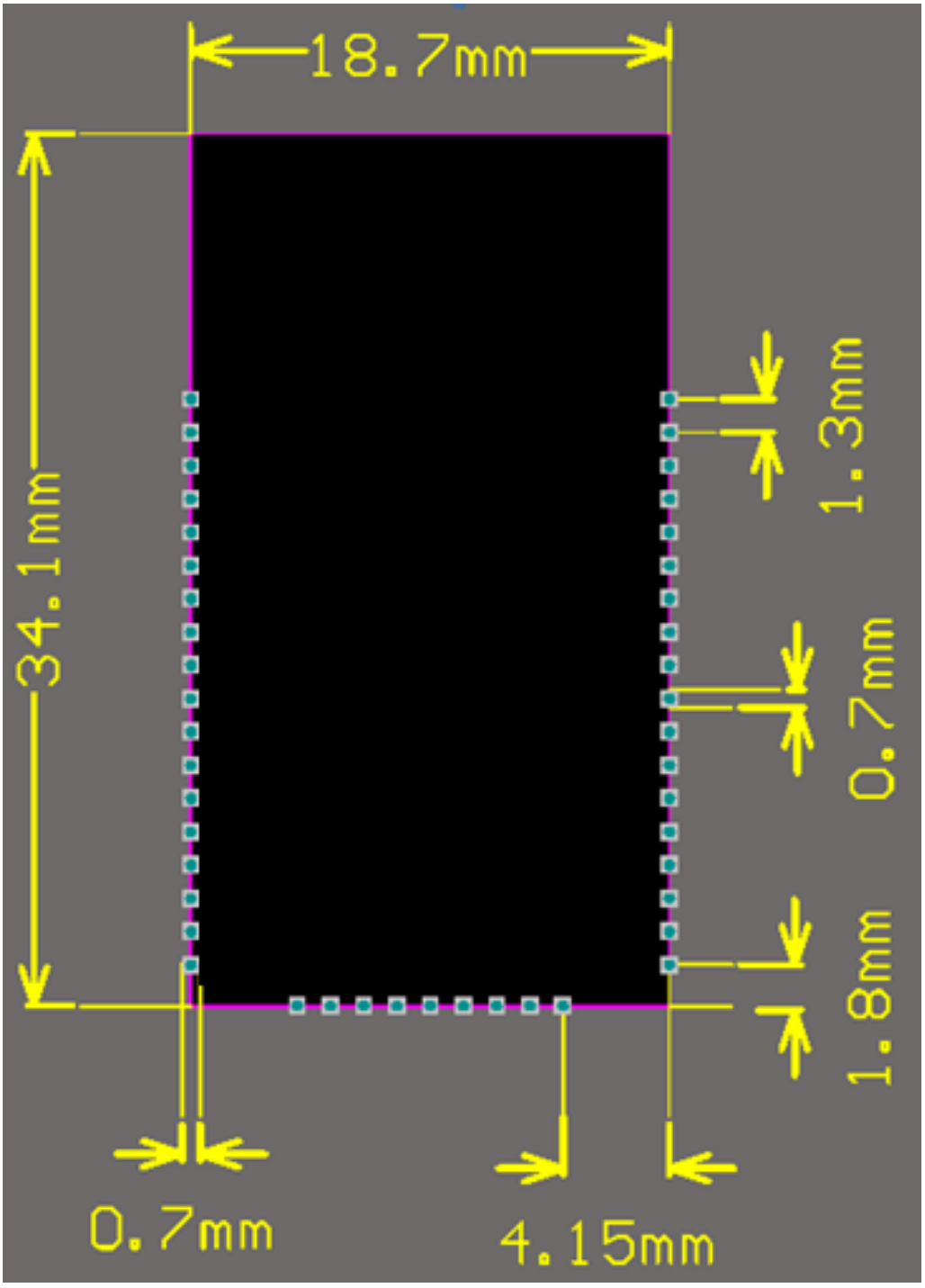
B. It is recommended to use star routing for the power supply line during layout, and ensure that the power supply linearity of Bluetooth module is good, and the ground of BT is also available

It must be separated from the ground of operational amplifier, power amplifier, MCU, etc., and there shall be no other interference ground under BT

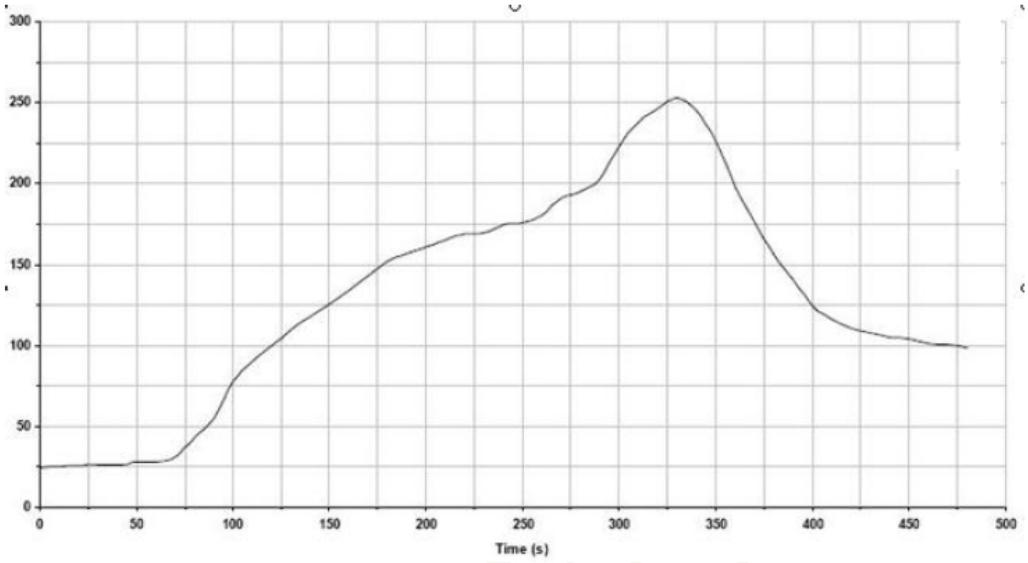
C. Do not walk around the antenna control line, power line, audio line, MIC and other interference lines

D. If there is a row base near the module antenna and the shell has metal iron mesh which has an impact on the signal, it is recommended to select a professional high-rise heater beneficial antenna。

13 Module Dimension



14 Reflow temperature



Key features of the profile:

-Initial Ramp=1-2.5℃/sec to 175℃ equilibrium
-Equilibrium time=60 to 80 seconds
-Ramp to Maximum temperature (250℃)=3℃/sec Max
-Time above liquidus temperature(217℃): 45 - 90 seconds
-Device absolute maximum reflow temperature: 250℃

15 FCC ISED Statement

FCC statement

Important Notice to OEM integrators

1. This module is limited to OEM installation ONLY.
2. This module is limited to installation in mobile or fixed applications, according to Part 2.1091(b).
3. The separate approval is required for all other operating configurations, including portable configurations with respect to Part 2.1093 and different antenna configurations
4. For FCC Part 15.31 (h) and (k): The host manufacturer is responsible for additional testing to verify compliance as a composite system. When testing the host device for compliance with Part 15 Subpart B, the host manufacturer is required to show compliance with Part 15 Subpart B while the transmitter module(s) are installed and

operating. The modules should be transmitting and the evaluation should confirm that the module's intentional emissions are compliant (i.e. fundamental and out of band emissions). The host manufacturer must verify that there are no additional unintentional emissions other than what is permitted in Part 15 Subpart B or emissions are complaint with the transmitter(s) rule(s). The Grantee will provide guidance to the host manufacturer for Part 15 Subpart B requirements if needed.

notice that any deviation(s) from the defined parameters of the antenna trace, as described by the instructions, require that the host product manufacturer must notify to Hansong (Nanjing) Technology Co,LTD. that they wish to change the antenna trace design. In this case, a Class II permissive change application is required to be filed by the USI, or the host manufacturer can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application.

When the module is installed in the host device, the FCC ID label must be visible through a window on the final device or it must be visible when an access panel, door or cover is easily re-moved. If not, a second label must be placed on the outside of the final device that contains the following text: “Contains FCC ID:API-AC6951”. The FCC ID can be used only when all FCC compliance requirements are met.

(1) The antenna must be installed such that 20 cm is maintained between the antenna and users,
(2) The transmitter module may not be co-located with any other transmitter or antenna.
In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.
To comply with FCC regulations limiting both maximum RF output power and human exposure to RF radiation, maximum antenna gain (including cable loss) must not exceed below.

Antenna Type	Manufacturer	Antenna Gain (dBi)
External Rod Antenna (Dipole Antenna)	Suzhou point positive electronic technology co.,ltd	1.24dBi for 2.4 ~ 2.5GHz band 3.47dBi for 5.15 ~ 5.85GHz band

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user’s manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2)

this device must accept any interference received, including interference that may cause undesired operation.
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 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.

Caution: Any changes or modifications not expressly approved by Hansong (Nanjing) Technology Co,LTD. for compliance could void the user's authority to operate this equipment.
This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

This module has been tested and found to comply with FCC Part 15C requirements for Modular Approval.
The modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) 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. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuity), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and
2) The transmitter module may not be co-located with any other transmitter or antenna.

As long as 2 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

This equipment complies with FCC radiation exposure limits set forth for an

uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator & your body.

ISED statement:

This device complies with Industry Canada licence-exempt RSS standard(s).
Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any
interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est
autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter
tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.
:
The proposed FCC IC label format is to be placed on the module. If it is not visible when the module is installed into the system,
“Contains FCC ID: API-AC6951, Contains IC: 6132A-AC6951” shall be placed on the outside of final host system.

This equipment complies with IC RSS-102 radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.
Cet équipement est conforme aux limites d'exposition aux radiations IC CNR-102 établies pour un environnement non contrôlé. Cetéquipement doit être installé et utilisé avec une distance minimale de 20 cm entre le radiateur et votre corps.

— This radio transmitter [6132A-AC6951] has been approved by Innovation, Science and Economic Development Canada to operate
with the antenna types listed above, with the maximum permissible gain indicated. Antenna types not included in this list and that have a
gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.
— Le présent émetteur radio [6132A-AC6951] a été approuvé par Innovation, Sciences et Développement économique Canada pour
fonctionner avec les types d'antenne énumérés cidessous et ayant un gain admissible maximal. Les types d'antenne non inclus dans
cette liste, et dont le gain est supérieur au gain maximal indiqué pour tout type figurant sur la liste, sont trictement interdits pour
l'exploitation de l'émetteur.