ANS-BT301M

Specification Version V1.2

5.3 Audio Bluetooth Module

Revision Record

edition	date	take notes	author
1.0	2022/6/11	Initial Version	QZY
1.1	2023/6/14	Update pin definition	ANS
1.2	2024/10/24	Update the schematic diagram	ANS

CATALOGUE

1. Introduce

Summary

The ANS-BT301M is a high-performance data and audio Bluetooth module developed and manufactured by Shenzhen ANSIOT Technology Co., Ltd. Featuring robust audio processing capabilities, it supports analog audio output while integrating Dynamic Range Control (DRC) technology and a five-band equalizer (5-band EQ), delivering exceptional sound quality. The module supports multiple mainstream protocols and practical features such as BLE, SPP, AVRCP, and I2S, catering to diverse application scenarios.

The ANS-BT301M employs UART as its programming interface, allowing users to read or write module configurations via UART using AT commands, thereby offering greater flexibility for application development. For details on programming with the ANS-BT301M, refer to the corresponding user programming guide.

Characteristic

Bluetooth Version 5.3
Postage stamp hole encapsulation
Transmission power class: Class 2.0
The default UART baud rate is 115,200 bps, supporting speeds from 1,200 bps to 921.6 Kbps.
UART hardware interface
Support Bluetooth protocols: BLE, SPP, AVRCP, A2DP, HFP, PBAP
Support Bluetooth decoding: SBC, AAC
Support audio interfaces: BT, analog audio (AUX), I2S, USB, TF (SD)
Support TWS
Support built-in charging management

Apply

Automotive DSP/DSD audio system
Bluetooth audio
Car Central Control Panel
Meeting system
Bluetooth headset
Bluetooth receiver
Bluetooth USB Sound Card

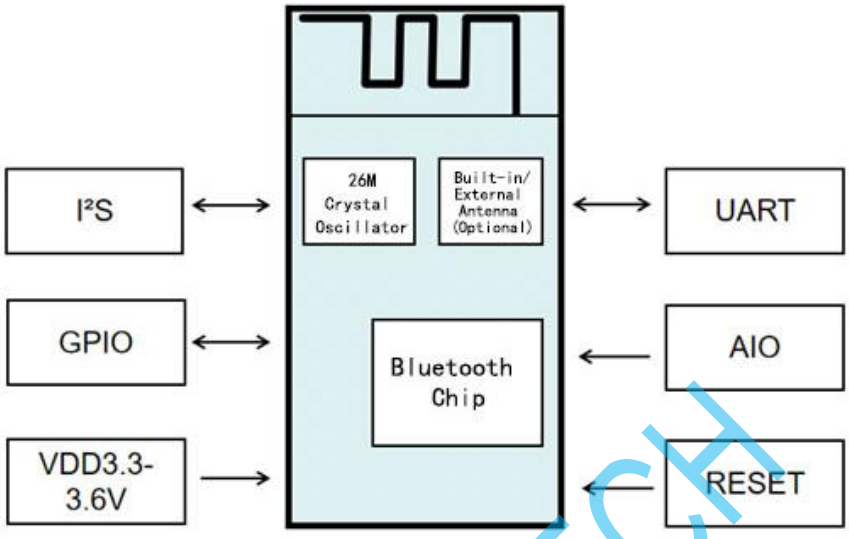
2. General Specifications

Table 1: General Specifications

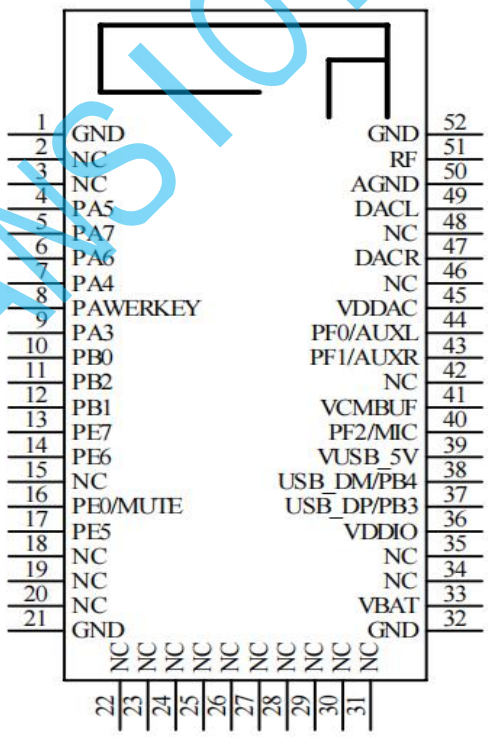
feature	detailed information
model	ANS-BT301M
size	13.0mm(W) X 27.0mm(L) X 2.2mm(H)
Bluetooth Version	Bluetooth 5.3
Working voltage range	3.6V (supports range from 3.3 to 4.2V)
transmitting power	Maximum 6 dBm
sensitivity	-97dBm@0.1%BER
frequency range	2400 ~ 2483.5MHz ISM band
modulation mode	GFSK, π/4-DQPSK, 8-DPSK
Baseband crystal oscillator	26MHz
Frequency hopping and channels	1600 hops/sec, 1 MHz channel bandwidth, 80 channels
Radio frequency input impedance	50 ohms
Antenna type	PCB board-mounted antenna/external antenna
hardware interface	UART/I²S
protocol	HID、BLE、SPP、AVRCP、A2DP、HFP、PBAP
Other Features	Supports low power consumption
working temperature	-40℃ to +80℃
Storage temperature	-40℃ to +105℃
humidity	10% to 95% non-condensing
environment	accord with RoHS

3. Hardware Specifications

3.1 Flowchart and Pin Definition Diagram



ANS-BT301M block diagram (top view)



ANS-BT301M Pin Definition Diagram (Top View)

3.2 Pin Definition Explanation

Table 2: Pin Definitions

pin	Pin name	type	Pin Description
1	GND	VSS	Power supply location
2	NC	NC	
3	NC	NC	
4	PA5	I/O	Programmable input/output pin
5	PA7	I/O	Programmable input/output pin
6	PA6	I/O	Programmable input/output pin
7	PA4	I/O	Programmable input/output pin
8	PAWERKEY	I	Reset, lower by 5 ms
9	PA3	I/O	Programmable input/output pin
10	PB0	I/O	Programmable input/output pin
11	PB2	I/O	Programmable input/output pin
12	PB1	I/O	Programmable input/output pin
13	PE7	I/O	Programmable input/output pins; default is serial TX, connect external RX
14	PE6	I/O	Programmable input/output pins, default serial port RX for external TX
15	NC	NC	
16	PE0/MUTE	I/O	Programmable input/output pin
17	PE5	I/O	Programmable input/output pin
18	NC	NC	
19	NC	NC	
20	NC	NC	
21	GND	VSS	Power supply location
22	NC	NC	
23	NC	NC	
24	NC	NC	
25	NC	NC	
26	NC	NC	
27	NC	NC	
28	NC	NC	
29	NC	NC	
30	NC	NC	
31	NC	NC	
32	GND	VSS	Power supply location
33	VBAT	PWR	Power input (preferably 3.3V to 4.2V)
34	NC	NC	
35	NC	NC	
36	VDDIO	VDD	Power output (1.8V to 3.3V)

37	PB3/USB_DP	I/O	Programmable input/output pins/USB interface
38	PB4/USB_DM	I/O	Programmable input/output pins/USB interface
39	VUSB_5V	I	USB 5V built-in charging port
40	PE2/MIC	I/O	Programmable I/O pins, default MIC input
41	VCMBUF	A	Anode output signal
42	NC	NC	
43	PE1/AUXR	I/O	Programmable input/output pin/AUXR right channel positive input
44	PE0/AUXL	I/O	Programmable input/output pin/AUXL left channel negative input
45	VDDAC	PWR	MIC bias power supply
46	NC	NC	
47	DACR	A	Right channel positive output
48	NC	NC	
49	DACL	A	Left channel positive output
50	AGND	AGND	Simulation Ground
51	ANT	antenna	External antenna interface
52	GND	VSS	Power supply location

4. Physical Interface

4.1 Universal Digital IO Port

The module contains 17 universal GPIO pins, all of which can be configured via software to perform various functions such as button control, LED driving, or interrupt signals for the main controller. When not in use, these pins remain idle and require no circuit connection. The I/O type of each pin can be individually configured by software to operate in either input or output mode.

4.2 RF Interface

2400–2483.5 MHz, Bluetooth 5.3

The maximum output power of TX is 6 dBm.
Maximum RX sensitivity: -97 dBm@0.1% BER

4.3 UART Interface

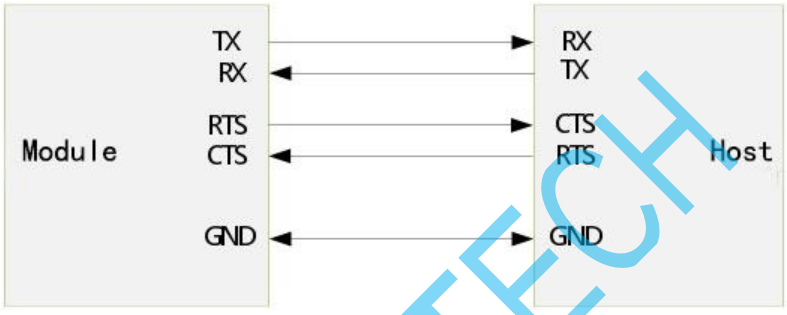
Pins 13 and 14 of the module handle UART functionality. When the ANS-BT301M is connected to another digital device, UART RX and UART TX transmit data between the two devices. In conjunction with pins UART_CTS and UART_RTS, these pins enable hardware flow control (requiring firmware support), with both being active at low level—allowing data transmission when low and stopping transmission when high.

Table 3: Possible UART Settings

parameter	probable value

Baud rate	Minimum	1200 baud (≤2%Error)
	standard	115200bps(≤1%Error)
	maximum	921600bps(≤1%Error)
flow control		RTS/CTS (default: none)
even-odd check		Odd, even, or neither
Number of stop positions		1
Number of bits per channel		8

Schematic diagram of the UART connection between the module and the host:



Module and Host Connection Diagram

4.4 EQ 5band

It supports 5-stage EQ adjustment.

5. Electrical Characteristics

5.1 Maximum rated value

The following lists the absolute maximum rated power supply voltages for the digital and analog pins of the module. Exceeding these values will cause permanent damage. The average GPIO pin output current is defined as the average current value flowing through any given pin over a 100 ms cycle. The total average GPIO pin output current is defined as the average current value flowing through all corresponding pins over the same 100 ms cycle. The maximum output current is defined as the peak current value flowing through any given pin.

Table 4: Maximum rated value

parameter	least value	crest value	unit
VIN – I/O power supply voltage (VDDIO)	-0.3	+3.3	V

VIN – Analog/Digital Power Supply Voltage (VDD)	-0.3	+4.2	V
TOT-Operating temperature	-40	+80	℃
TST – Storage Temperature	-40	+105	℃

5.2 Recommended Working Conditions

Table 5: Recommended Working Conditions

parameter	least value	typical case	crest value	unit
VIN – Core supply voltage (VDD)	3.0	3.3	4.2	V
VIN-I/O port power supply voltage (VDDIO)	1.8	3.0	3.3	V

6. Humidity sensitivity level & Anti-static level

Table 6: Humidity Sensitivity Levels and Anti-static Levels

parameter	price
Humidity sensitivity level:	Level 3
Antistatic rating:	Human discharge pattern: Class-2 Machine discharge mode: Class-B

7. Reflow soldering

Before performing any reflow soldering, it is essential to ensure the modules are packaged moisture-proof, with the packaging containing desiccant (to absorb moisture) and a humidity indicator card showing the dryness level maintained during storage and transportation. If module baking is required, refer to the table below and follow the instructions specified in IPC/JEDEC J-STD-033.

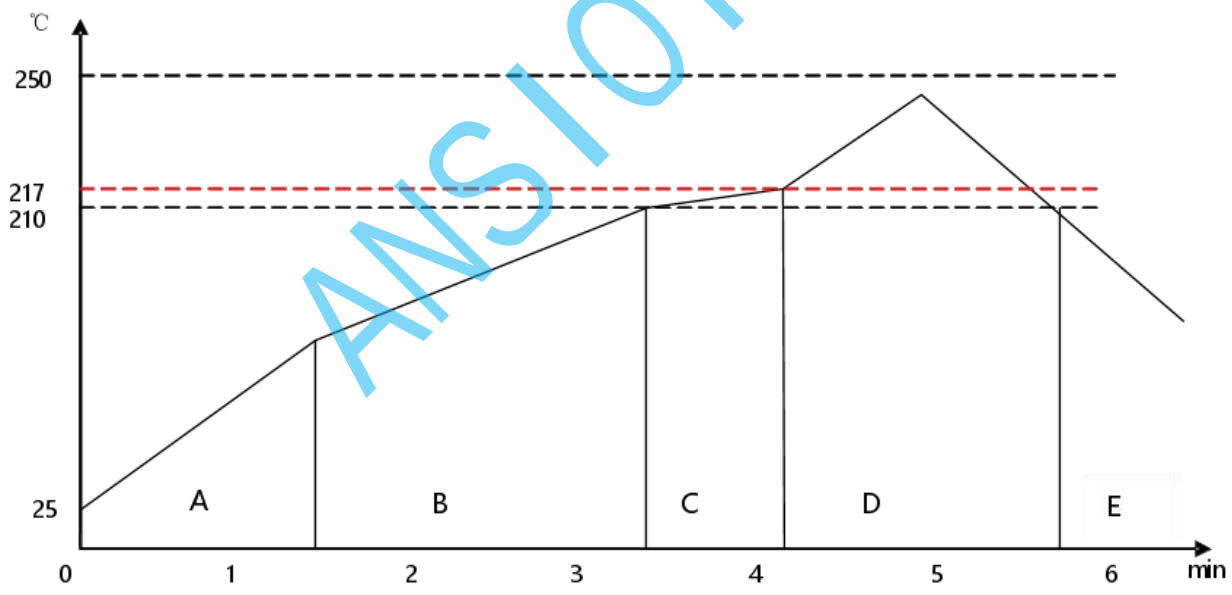
Note: The tray must not be heated above 65°C. If the high-temperature baking method specified in the table below (above 65°C) is used, the module must be removed from the transport tray.

Any module that has been opened and whose patch has not been applied within the specified time frame should be repackaged. The packaging must contain effective desiccant and a temperature and humidity indicator card. Under ambient conditions of 30°C/60% RH, MSL (Humidity-Sensitive Level) 3 modules shall not be stored in air for more than 168 hours.

Table 7: Recommended baking Time and Temperature

MSL	Baking temperature: 125°C		Baking temperature: 90°C/≤ 5% RH		Baking temperature: 40°C/≤ 5% RH	
	Saturated at 30°C/85%	Minimum limit + 72 hours @ 30°C/60%	Saturated at 30°C/85%	Minimum limit + 72 hours @ 30°C/60%	Saturated at 30°C/85%	Minimum limit + 72 hours @ 30°C/60%
3	9 hours	7 hours	33 hours	23 hours	13 days	9 days

Surface-mount modules are designed for easy manufacturing, including reflow soldering onto PCB motherboards. Customers are responsible for selecting the appropriate solder paste and ensuring that the furnace temperature during reflow meets the paste's specifications; surface-mount modules comply with the J-STD-020D1 standard for reflow soldering temperatures. The soldering configuration depends on various parameters required for each application; the provided data serves solely as guidance for reflow soldering.



Typical lead-free reflux

Preheating Zone (A) – This zone is heated at a controlled rate, typically 0.5–2°C/s. The purpose of this zone is to preheat the PCB board and components to 120–150°C. During this stage, heat must be evenly distributed across the PCB board, and all solvents must be completely removed to minimize thermal shock to the components.

Balancing Zone 1 (B) – At this stage, the flux softens and uniformly encapsulates the solder particles, distributing them across the PCB board to prevent re-oxidation. As the temperature rises and the flux liquefies, each activator and rosin is activated, beginning to remove the oxide film formed on each solder particle and the PCB surface. For this zone, the recommended temperature range is 150°–210°, with a treatment duration of 60–120 seconds.

Balancing Zone 2 (C) (Optional) – To address the upright component issue, it is recommended to maintain the temperature at 210–217 for approximately 20–30 seconds.

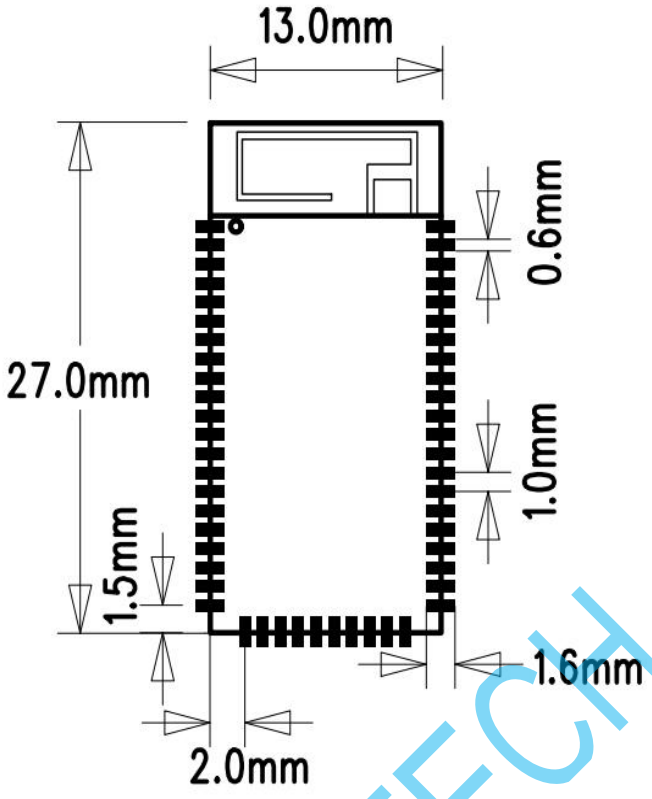
Reflow Zone (D) – The curve in the diagram is designed for Sn/Ag3.0/Cu0.5 and serves as a reference for other lead-free solder formulations. The peak temperature should be sufficiently high to ensure good wettability, but not so high as to cause component discoloration or damage. Excessively long soldering time can lead to intermetal growth, resulting in brittle solder joints. The recommended peak temperature (Tp) ranges from 230 to 250°C; when the temperature exceeds 217°C, the soldering time should be 30 to 90 seconds.

Cooling Zone (E) – The cooling rate should be rapid to maintain small solder particles, resulting in a more durable solder joint; the typical cooling rate is 4°C.

8. Module structure parameters

8.1 Physical Dimensions

- Module nominal dimensions: 27.0 mm (L) x 13.0 mm (W) x 2.2 mm (H) Tolerance: ±0.2 mm
- Pland dimensions: 1.6 mm × 0.6 mm; Tolerance: ±0.1 mm
- Pland spacing: 1.0 mm Tolerance: ±0.1 mm



ANS-BT301M package (top view)

9. Hardware Design Recommendations

9.1 Welding Recommendations

The ANS-BT301M is compatible with the industrial standard reflow curves for lead-free solder. The specific reflow curve employed depends on the thermal mass of the entire assembled PCB, the heat transfer efficiency of the oven, and the particular type of solder paste used. Refer to the data sheet of the specific solder paste for details on the profile configuration.

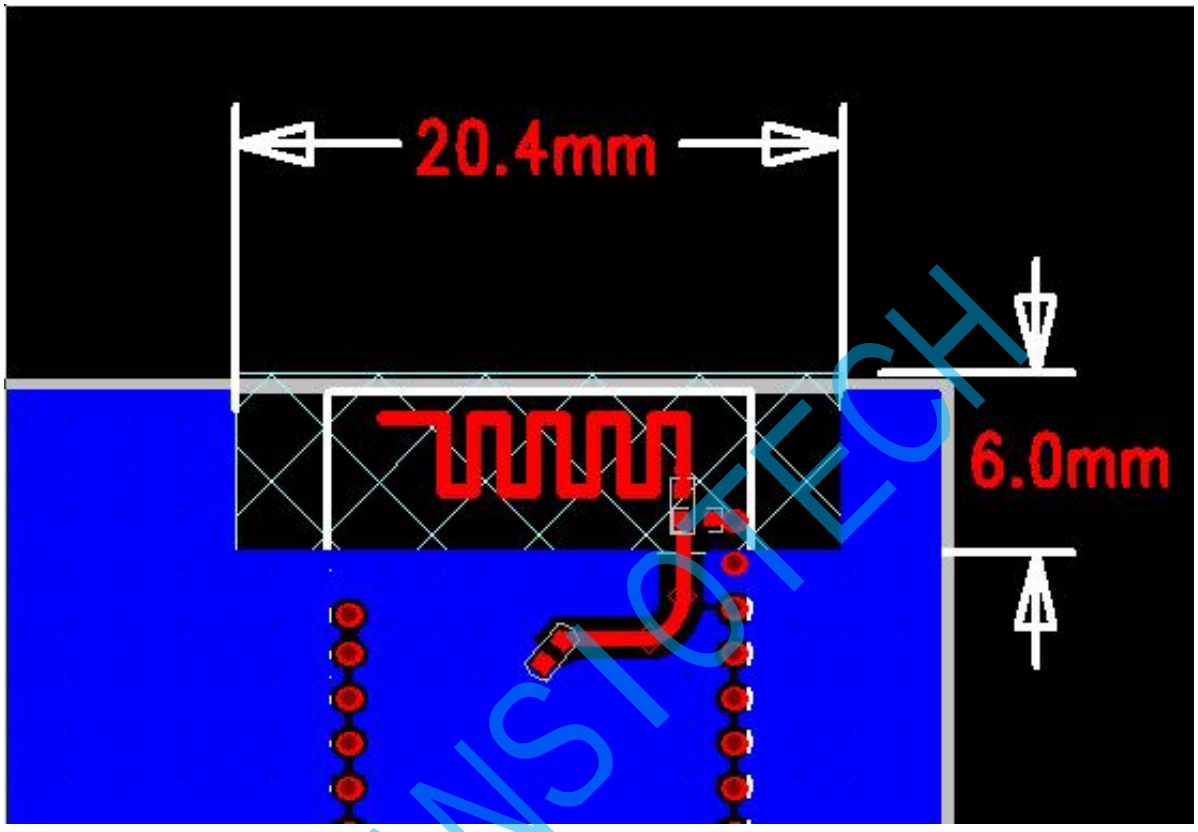
The following recommendations for welding modules are provided to ensure the reliability of weld joints and operations after welding. Since the reflow soldering curve used depends on the process and layout, the optimal reflow soldering curve should be determined case-by-case.

9.2 Layout Guide (Module Built-in Antenna)

It is strongly recommended to adopt sound layout practices to ensure proper module operation. Placing copper or any metal near the antenna may degrade its performance, reducing efficiency. Metal shielding around the antenna blocks signal radiation; therefore, metal enclosures should not be used with the module. Instead, employ multiple grounding vias at the edges of the ground area.

The following recommendations help prevent EMC issues in designs. Since each design is unique, the descriptions below do not cover all fundamental design rules—for example, avoiding capacitive

coupling between signal lines. These guidelines aim to mitigate EMC problems caused by the RF components of modules, prevent digital signal interference, and ensure signal lines have the shortest possible paths. For instance, when signals enter via internal layers, always use ground vias around pads and arrange them symmetrically around signal vias. The routing and paths for sensitive signals should be completed on the inner layers of the PCB, with sensitive signal lines surrounded by ground planes above and below. If this is not feasible, ensure the return path is minimized (e.g., by using a ground trace adjacent to the signal line).



9.3 Layout Guidelines (External Antenna)

In the absence of an onboard antenna design, the placement of modules and PCB layout are critical for optimizing their RF performance.

1、The microstrip line (the path from the antenna to the EXT_ANT port on the module) should have a 50-ohm impedance.

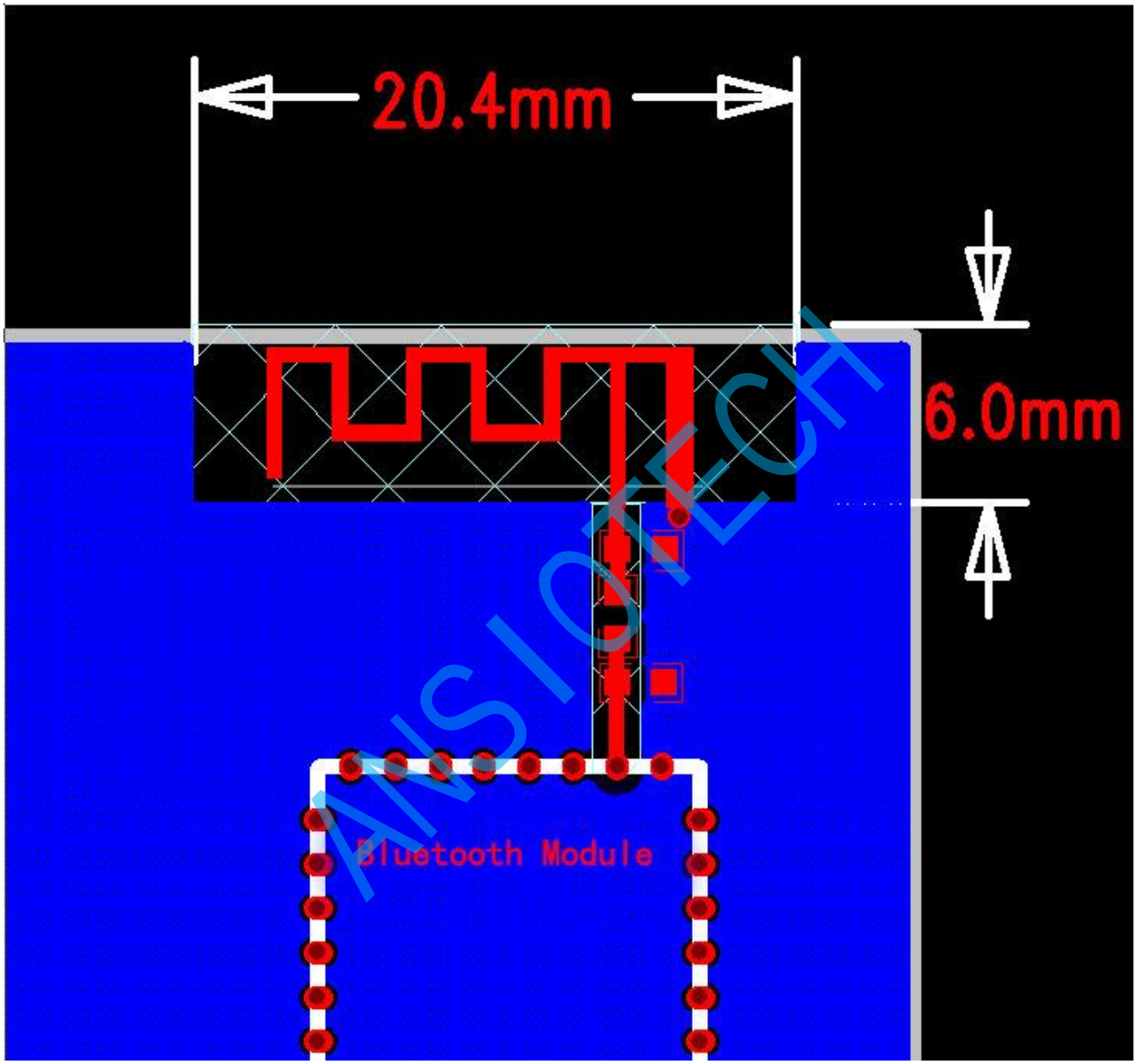
2、The microstrip line should be as straight and as short as possible; when a turn is unavoidable, it should follow an arc.

3、The microstrip line width is approximately 0.5 mm, and a distance of about 0.5 mm between the copper cladding and the microstrip line is optimal.

4、To avoid interference with module signals, the external antenna and the EXT_ANT port of the module should be positioned away from any noise sources and digital circuits. The antenna should be placed along the board edge, with no components or copper-clad layers nearby, and traces should be minimized to maintain structural integrity.

5、A π-type matching network circuit is required between the microstrip lines, and it should be positioned as close as possible to the antenna to achieve optimal impedance matching.

6、The RF key circuit of the module must be clearly separated from any digital circuit on the system board.



9.4 External Antenna

General design recommendations:

Wireless products are not suitable for use with external metal casings or large metal components in the vicinity.

The length of PCB traces or connections should be as short as possible.

The distance between the connections and the grounding areas on the top layer should be at least equal to the thickness of the dielectric material.

Avoid placing RF components near the digital section of the system board.

To minimize signal loss, avoid routing microstrip lines at sharp angles. Bevel or rounded corners are preferred over rectangular routes; a 45-degree angle is preferable to a straight 90-degree angle.

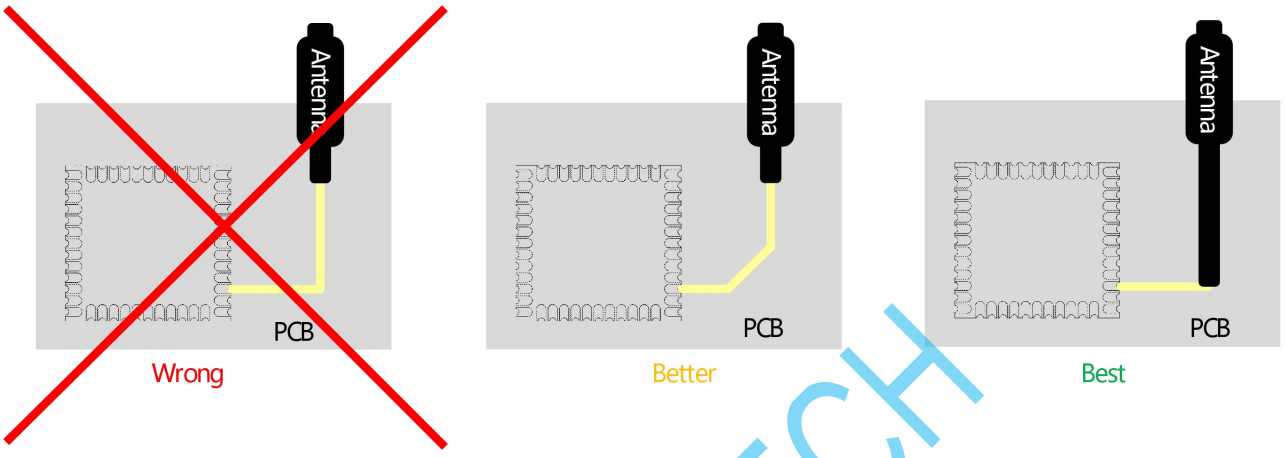


Figure 11: Recommended routing connection between the antenna and the module

RF connections should be avoided on the opposite side of the module. The distance between the microstrip line and the ground plane at the receiver's bottom is extremely short, with significant tolerance. Consequently, the impedance of this section of the trace cannot be controlled, necessitating extensive use of vias to connect to the ground plane.

10. Product Packaging Information

pallet packing

Tray dimensions: 180mm × 195mm

50 pieces per tray

Minimum packaging: 1000 pieces

11. Application Circuit Diagram