ANS-BT301M

Specification V1.3

5.3 Audio Bluetooth Module

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Revision History

edition	date	take notes	author
1.0	2022/6/11	Initial Version	QZY
1.1	2023/6/14	Update pin definitions	ANS
1.2	2024/10/24	Update schematic	ANS
1.3	2025/12/29	Update error	ANS

As the product undergoes continuous iteration, the content of this manual may be subject to change without prior notice.

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1. Introduce

Summary

The ANS-BT301M is a high-performance data and audio Bluetooth module developed and manufactured by Shenzhen Anshuo Technology Co., Ltd. Featuring robust audio processing capabilities, the module supports analog audio output while integrating Dynamic Range Control (DRC) technology and a five-stage equalizer (5-stage EQ) adjustment function, delivering an exceptional audio quality experience to users. The ANS-BT301M supports a variety of mainstream protocols and practical functions, including BLE, SPP, AVRCP, and I2S, enabling it to meet diverse requirements across various application scenarios.

The ANS-BT301M uses UART as its programming interface. Users can read or write module configurations via UART using AT commands, thereby providing greater flexibility for the development of customer applications. For information on programming the ANS-BT301M, please refer to the relevant user programming guide.

Characteristic

Bluetooth version 5.3
Stamps in perforated envelopes
Transmit power class: Class 2.0
The default UART baud rate is 115,200 bps, supporting a range from 1,200 bps to 921.6 Kbps.
UARThardware interface
Bluetooth protocol support: BLE, SPP, AVRCP, A2DP, HFP, PBAP
Bluetooth decoding support: SBC, WAV
Supported audio interfaces: Bluetooth, analog audio (AUX), I2S, USB, TF (SD)
supportTWS
Supports built-in charging management

Apply

Automotive DSP/DSD audio system
Bluetooth audio
Car center console
meeting system
Bluetooth headset
Bluetooth receiver
Bluetooth USB sound card

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2. General Specifications

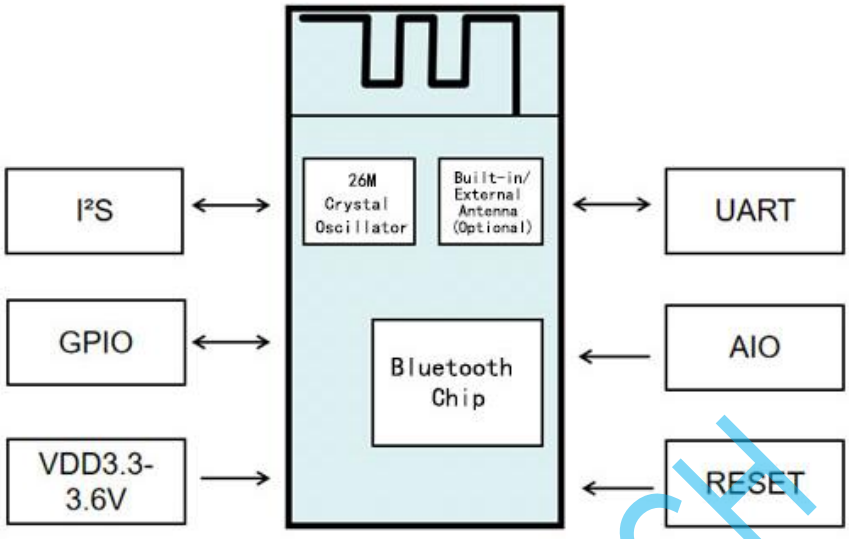
Table 1: General Specifications

feature	detailed information
model	ANS-BT301M
size	13.0mm(W) X 27.0mm(L) X 2.2mm(H)
Bluetooth version	Bluetooth 5.3
Operating voltage range	3.6 V (supports up to 3.3–4.2 V)
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	1,600 hops/sec, 1 MHz channel headroom, 80 channels
RF input impedance	50 ohms
Antenna type	PCB-bonded 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%–95% non-condensable
environment	accord withRoHS

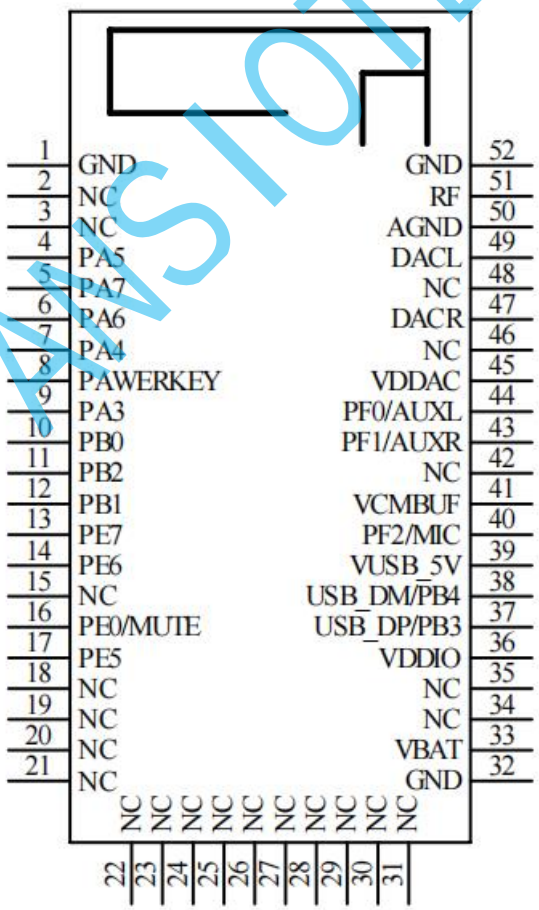
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3. Hardware Specifications

3.1 Block Diagram and Pinout Diagram



ANS-BT301M Block Diagram (Top View)



ANS-BT301M Pinout Diagram (Top View)

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3.2 Pin Definition Overview

Table 2: Pin Definitions

pin	Pin names	type	Pin Description
1	GND	VSS	Power Ground
2	NC	NC	
3	NC	NC	
4	PA5	I/O	Programmable I/O pins
5	PA7	I/O	Programmable I/O pins
6	PA6	I/O	Programmable I/O pins
7	PA4	I/O	Programmable I/O pins
8	PAWERKEY	I	Reset; pull down for 5 ms to reset
9	PA3	I/O	Programmable I/O pins
10	PB0	I/O	Programmable I/O pins
11	PB2	I/O	Programmable I/O pins
12	PB1	I/O	Programmable I/O pins
13	PE7	I/O	Programmable I/O pins; the default is the serial TX pin, which connects to an external RX pin.
14	PE6	I/O	Programmable I/O pins; the default is the serial RX pin, which connects to an external TX pin.
15	NC	NC	
16	PE0/MUTE	I/O	Programmable I/O pins; default low-level idle state
17	PE5	I/O	Programmable I/O pins; default LED indicator: connects to a high level in Bluetooth mode, flashes rapidly when not connected, and flashes slowly in other modes.
18	NC	NC	
19	NC	NC	
20	NC	NC	
21	NC	NC	
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 Ground
33	VBAT	PWR	Power input (3.3V–4.2V recommended)

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34	NC	NC	
35	NC	NC	
36	VDDIO	VDD	Power output (1.8V–3.3V)
37	PB3/USB_DP	I/O	Programmable I/O pins/USB interface
38	PB4/USB_DM	I/O	Programmable I/O 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	Channel negative output
42	NC	NC	
43	PE1/AUXR	I/O	Programmable I/O pins/AUXR right channel
44	PE0/AUXL	I/O	Programmable I/O pins / AUXL left channel
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
51	ANT	antenna	External antenna interface
52	GND	VSS	Power Ground

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4. Physical Interface

4.1 General-purpose digital I/O ports

The module contains 17 general-purpose GPIO pins, all of which can be configured via software to implement various functions, such as button control, LED driving, or interrupt signals from the main controller. When not in use, the pins remain floating and require no external circuitry. The I/O type of each I/O pin can be configured separately by software as either input or output mode.

4.2 RF Interface

2400–2483.5 MHz, Bluetooth 5.3

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

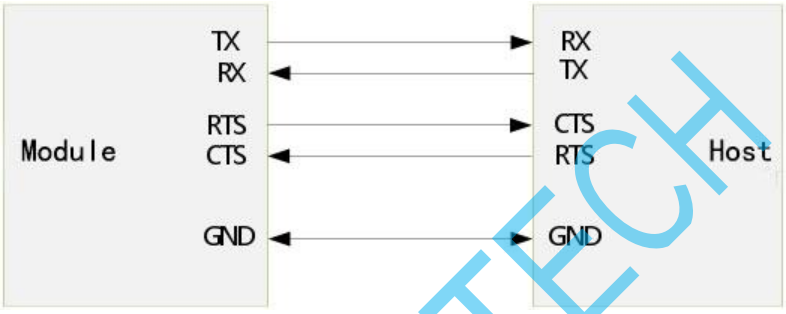
4.3 UART Interface

Pins 13 and 14 of the module are used to implement 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 the other pins UART_CTS and UART_RTS, they can be used to implement hardware flow control (requires firmware support); both are low-level active, meaning that transmission is permitted when the signal is at a low level and stopped when it is at a high level.

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, prime, or even
Number of stop positions		1
Bits per channel		8

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



Module-to-host connection diagram

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4.4 EQ 5band

Built-in support for 5-band EQ adjustment.

5. Electrical Characteristics

5.1 Maximum Rated Value

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

Table 4: Maximum Rated Value

parameter	least value	crest value	unit
VIN-I/O supply voltage (VDDIO)	-0.3	+3.3	V
VIN-Analog/Digital 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 supply voltage (VDDIO)	1.8	3.0	3.3	V

6. Humidity Sensitivity Grade & Anti-static Grade

Table 6: Humidity Sensitivity Levels and Anti-static Levels

parameter	price
Humidity sensitivity level:	Level 3
Anti-static rating:	Human body discharge mode: Class 2 Machine discharge mode: Class B

7. Reflow Soldering

Before performing any reflow soldering, it is essential to ensure that the module is in moisture-proof packaging containing desiccant (for moisture absorption) and a humidity indicator card, which indicates the level of dryness maintained during storage and transportation. If the module requires baking, 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 listed in the table below (above 65°C) is used, the module must be removed from the transport tray.

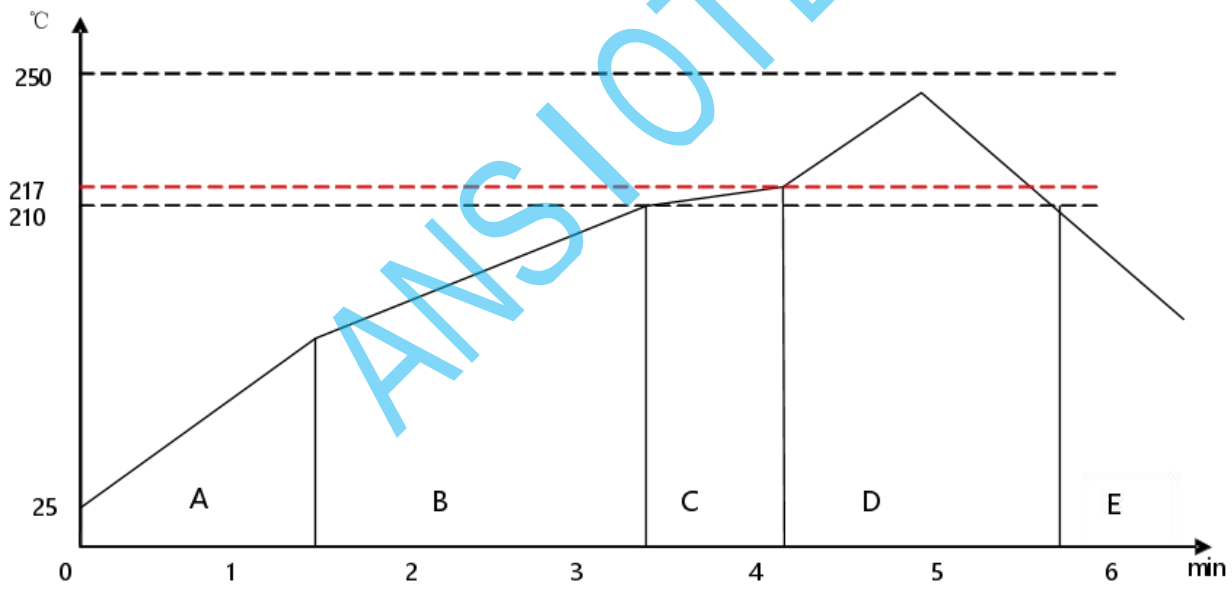
Any module that has been opened and has not been mounted within the specified time period shall be repackaged; the repackaged unit must contain an effective desiccant and a temperature and humidity indicator card. At an ambient temperature of 30°C / 60% RH, a module with an MSL (Humidity Sensitivity Level) of 3 shall not be stored in air for more than 168 hours.

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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 @ 30°C/85%	Minimum limit + 72 hours @ 30°C/60%	Saturated @ 30°C/85%	Minimum limit + 72 hours @ 30°C/60%	Saturated @ 30°C/85%	Minimum limit + 72 hours @ 30°C/60%
3	9 hours	7 hours	33 hours	23 hours	13 days	9 days

The design of surface-mount modules facilitates manufacturing, including reflow soldering onto a PCB motherboard. Customers are responsible for selecting the appropriate solder paste and ensuring that the furnace temperature during reflow meets the solder paste's requirements; surface-mount modules must comply with the J-STD-020D1 standard for reflow soldering temperatures. The soldering profile depends on the various parameters that need to be configured for each application; the data provided here are intended solely as guidance for reflow soldering.



Typical lead-free reflow

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 PCBs and components to 120–150 °C; during this stage, heat must be distributed uniformly across the PCBs and the solvent must be completely removed to minimize thermal shock to the components.

Balanced Zone 1 (B) – At this stage, the flux softens and uniformly encapsulates the solder particles,

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dispersing them across the PCB and preventing them from being re-oxidized. As the temperature rises and the flux liquefies, each activator and rosin are activated and begin to remove the oxide films formed on each solder particle and on the surface of the PCB. For this zone, a recommended temperature of 150°–210° and a duration of 60–120 seconds are recommended.

Balanced Zone 2 (C) (optional) – To address the issue associated with upright components, it is recommended to maintain the temperature at 210–217 °C for approximately 20–30 seconds.

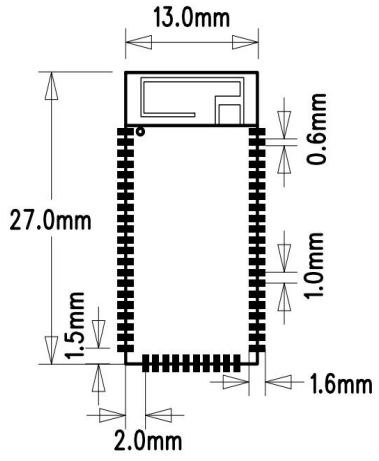
Return zone (D) – The curve shown in the figure was designed for Sn / Ag3.0 / Cu0.5 and can serve as a reference for other lead-free solder alloys. The peak temperature should be high enough to achieve good wetting, but not so high as to cause discoloration or damage to the component. An excessively long soldering time can lead to intermetallic growth, resulting in brittle solder joints. The recommended peak temperature (Tp) is 230–250 °C; when the temperature exceeds 217 °C, the soldering time should be 30 to 90 seconds.

Cooling zone (E) – The cooling rate should be sufficiently high to keep the solder particles small, which will result in a more durable joint; a typical cooling rate should be 4 °C.

8. Module Structural Parameters

8.1 Physical Dimensions

- Module nominal dimensions: 27.0 mm (L) × 13.0 mm (W) × 2.2 mm (H); tolerance: ±0.2 mm
- Pad dimensions: 1.6 mm × 0.6 mm; tolerance: ±0.1 mm
- Pad pitch: 1.0 mm; Tolerance: ±0.1 mm



ANS-BT301M package (top view)

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9. Hardware Design Recommendations

9.1 Welding Recommendations

ANS-BT301M is compatible with the industrial-standard reflow profiles for lead-free solder. The reflow profile used depends on the thermal mass of the fully assembled PCB, the heat-transfer efficiency of the oven, and the specific type of solder paste employed; please refer to the data sheet for the particular solder paste to determine the profile configuration.

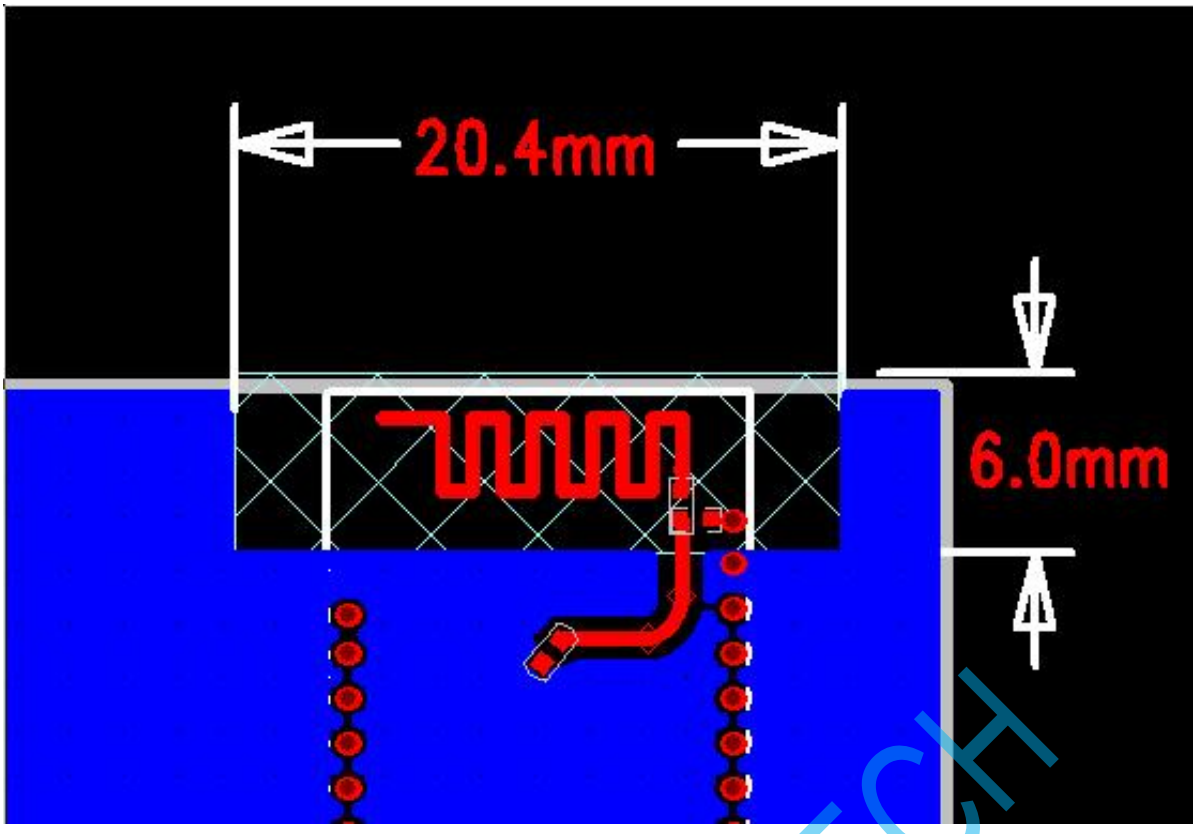
The following recommendations for soldering modules will be provided to ensure the reliability of solder joints and operations after soldering; since the reflow soldering profile used depends on the process and layout, the optimal reflow soldering profile should be determined on a case-by-case basis.

9.2 Layout Guidelines (Module-Built-in Antenna)

It is strongly recommended that sound layout practices be adopted to ensure the module operates correctly. Placing copper or any other metal near the antenna will affect antenna performance, thereby reducing its operating efficiency. Metal shielding around the antenna will block signal radiation; therefore, the metal enclosure should not be used together with the module. Please incorporate more grounding vias along the edges of the grounding area.

The following recommendations help prevent EMC issues in design. Since every design is unique, the descriptions below do not cover all fundamental design rules—for example, avoiding capacitive coupling between signal traces. These descriptions are intended to prevent EMC issues caused by the RF section of a module, thereby avoiding problems with digital signals in the design and ensuring that signal trace loops remain as short as possible. For example, if a signal enters an inner layer via a via, always use a ground via around the pad and place them closely and symmetrically around the signal via. Any traces or loops for sensitive signals should, wherever possible, be routed on the inner layers of the PCB; sensitive signal traces should be surrounded by ground regions on both the top and bottom layers. If this is not feasible, ensure that the return path is as short as possible (for example, by using a ground trace adjacent to the signal trace).

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9.3 Layout Guidelines (External Antenna)

In the absence of an onboard antenna design, module placement and PCB layout are critical to optimizing the module's RF performance.

1、The microstrip line (the trace from the antenna to the EXT_ANT port of the module) should have a 50-ohm impedance;

2、Microstrip lines should be routed as straight as possible and as short as possible; when a bend is unavoidable, the route should follow an arc whenever possible.

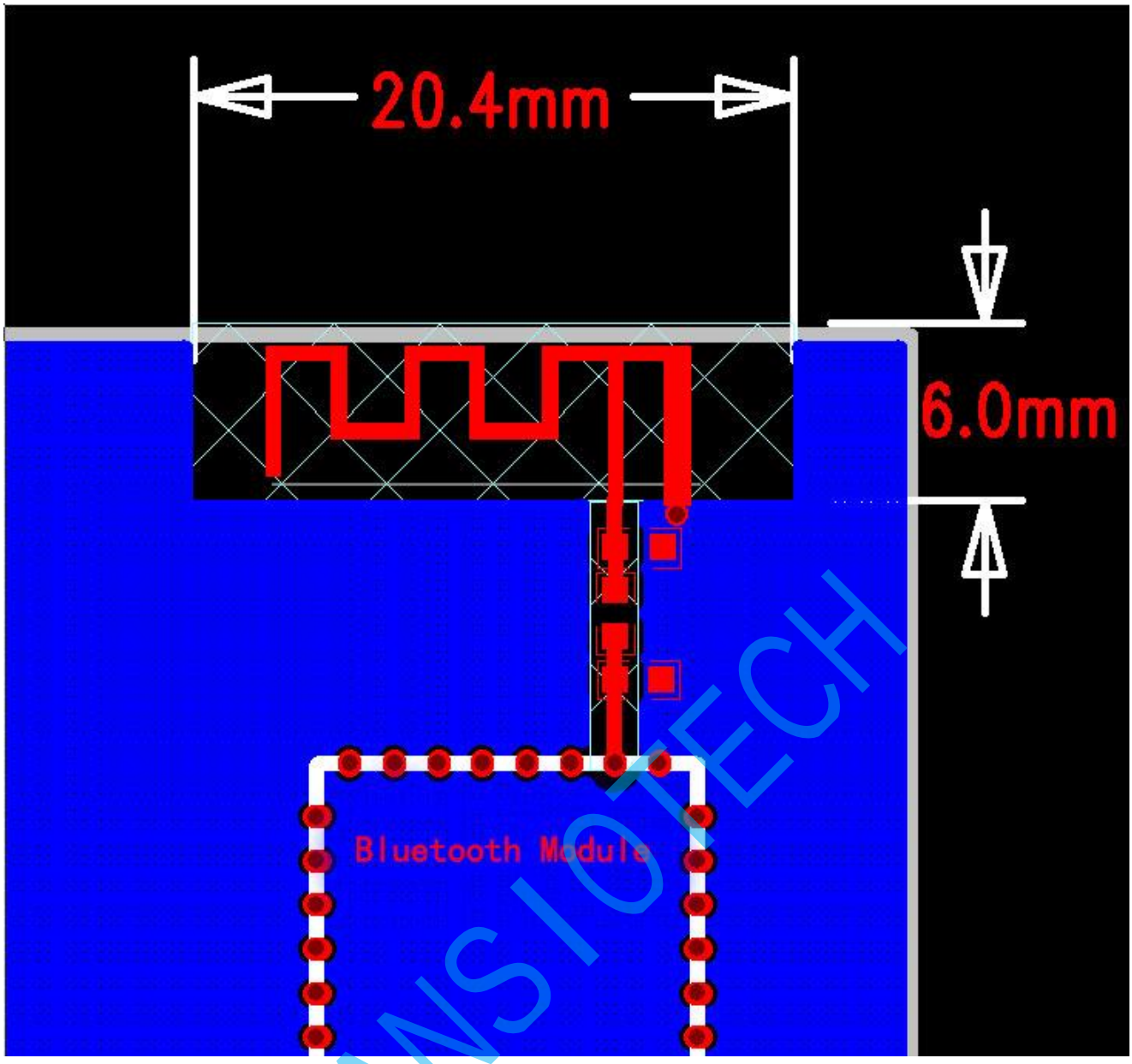
3、The microstrip line width is approximately 0.5 mm; a distance of approximately 0.5 mm from the copper cladding to the microstrip line is considered appropriate.

4、To avoid interfering with the module signals; the external antenna and the module's EXT_ANT port should be positioned far from any noise sources and digital lines; the antenna should be placed close to the board edge, with no components or copper-clad areas placed around it, and routing should be minimized as much as possible so that the board remains intact;

5、A Π-type matching network is required between the microstrip lines, and it should be placed as close to the antenna as possible to achieve better impedance matching;

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

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9.4 External Antenna

General design recommendations:

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

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

The distance between the connection and the bonding area on the top layer should be at least as large as the dielectric thickness.

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

To minimize signal loss, microstrip traces should avoid being routed in sharp-angle configurations. Traces with chamfers or rounded corners should take precedence over rectangular traces; 45-degree angled routing is preferable to pure 90-degree routing.

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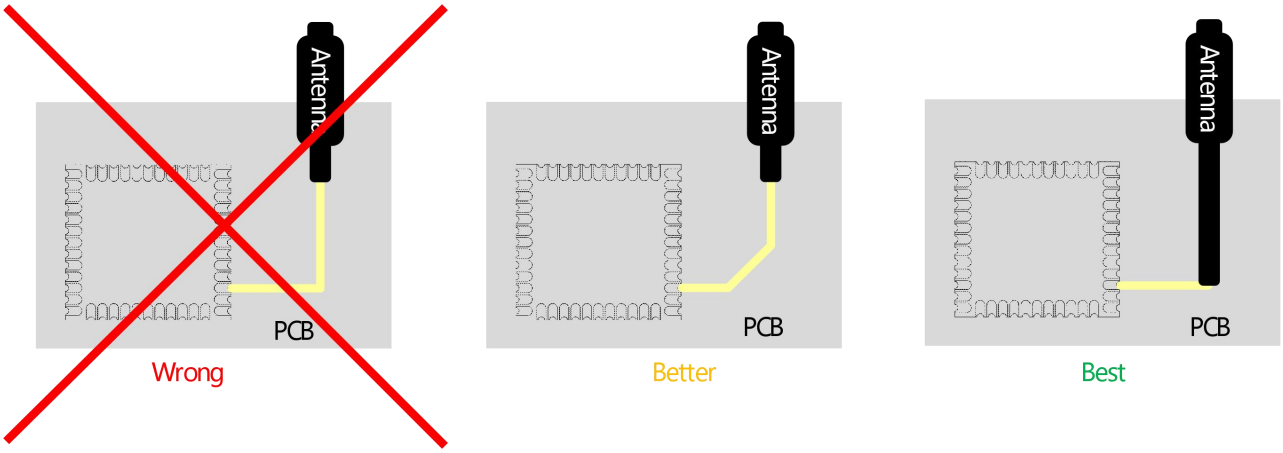


Figure 11: Recommended wiring for connecting the antenna to the module

RF connections should be avoided on the opposite side of the module; the distance from the microstrip line to the ground plane at the bottom of the receiver is extremely small and exhibits a very large tolerance. Consequently, the impedance of this section of the trace cannot be controlled, so vias should be used as extensively as possible to connect to the ground plane.

10. Product Packaging Information

pallet packing

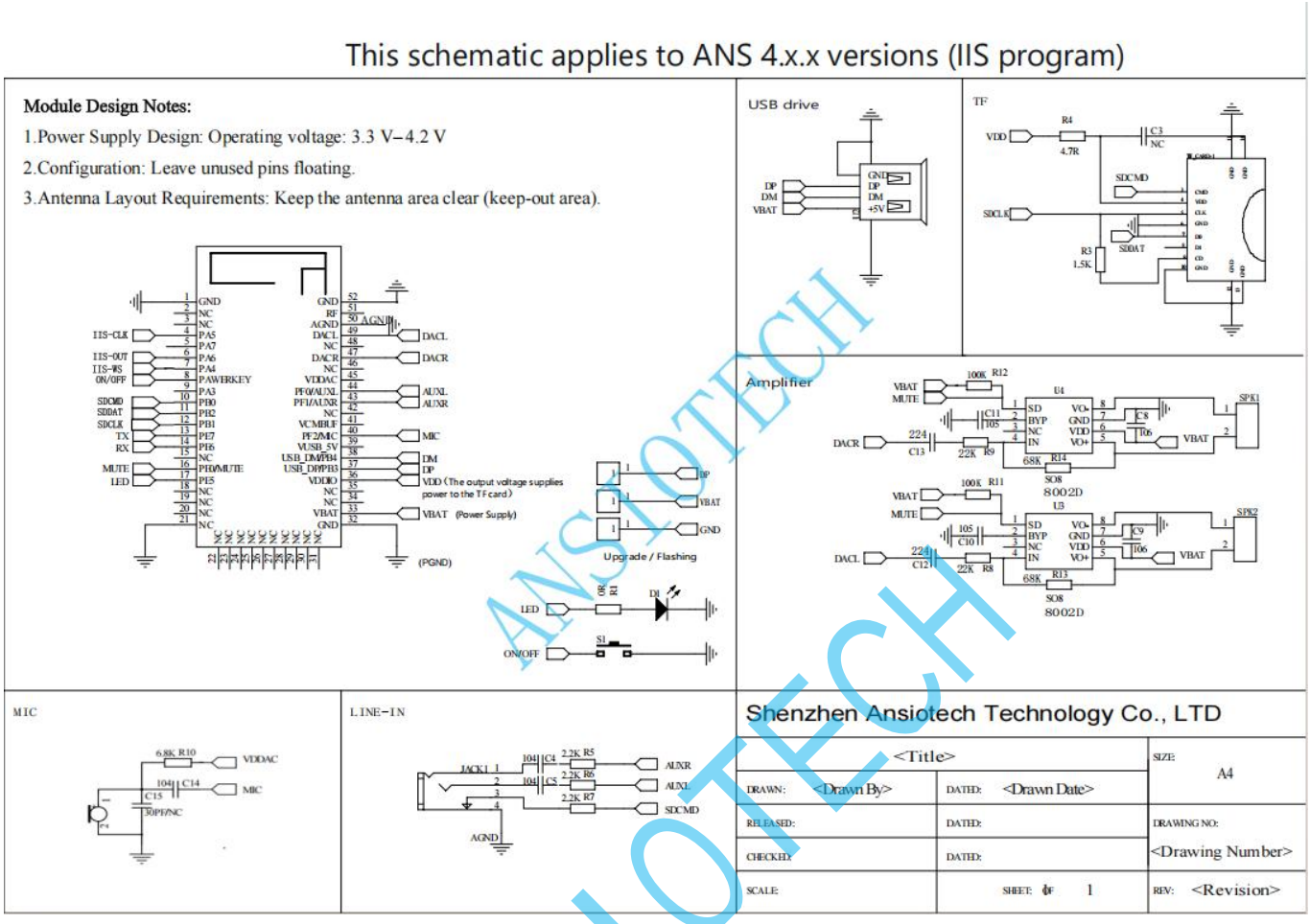
Pallet dimensions: 180 mm × 195 mm

50 pcs/disc

Minimum packaging: 1,000 pcs

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11. Application Circuit Diagram



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