



TG-02F Specification

Version V1.0.0

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1. Product Overview

TG-02F is a bluetooth module developed by Shenzhen Ai-Thinker Technology Co., LTD. The core processor chip TG7120B(SOP16) is a highly integrated bluetooth System-level chip (SoC) with low power consumption, designed for Internet of Things (IoT), mobile devices, wearable electronic devices, smart home and other applications.

TG-02F module features a high-performance low-power 32-bit CK802 processor, 64KB SRAM, 512KB Flash, 96KB ROM, and 256 bit EFuse. In addition, TG-02F module supports SECURITY mechanism, application and OTA upgrade under BLE protocol, has a variety of unique hardware security mechanism, hardware encryption support AES algorithm.

TG-02F module provides a wealth of peripheral interfaces, including UART, PWM, ADC, I2C, SPI, PDM, DMA and up to 11 IO ports.

TG-02F module supports low power Bluetooth: BLE 5.1, BLE Mesh. Bluetooth speed support: 125Kbps, 500Kbps, 1Mbps, 2Mbps. Support broadcast extension, multi - broadcast, channel selection.

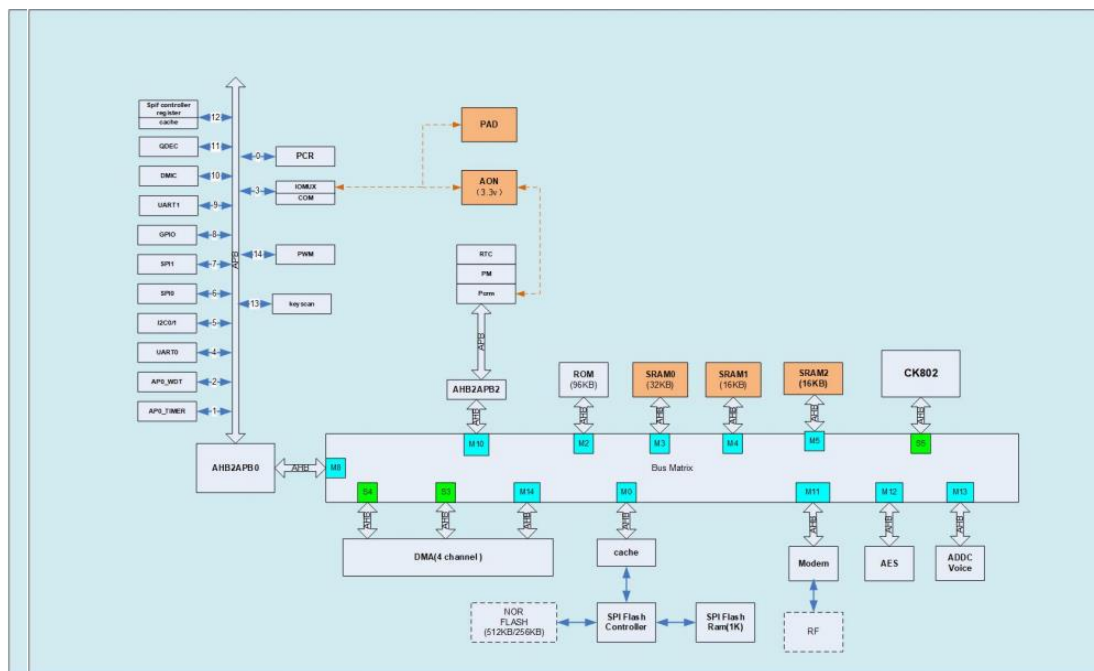


Figure 1 Main chip architecture diagram

1.1. Characteristic

- Support BLE5.1, Speed Support: 125Kbps,500Kbps,1Mbps,2Mbps
- 64 KB SRAM, 512KB flash, 96 KB ROM, 256 bit efuse
- Support UART/GPIO/ADC/PWM/I2C/SPI/PDM/DMA
- The package is SMD-20
- Multiple sleep modes are supported and the deep sleep current is less than 1uA
- Fixed universal AT instruction for quick use
- Support secondary development, integrated Windows development environment

2. Main parameters

Table 1 Description of the main parameters

| | |
|-----------------------|--|
| Model | TG-02F |
| Package | SMD-22 |
| Size | 24.0*16.0*2.8(± 0.2)mm |
| Antenna | on-board antenna |
| Frequency | 2400 ~ 2483.5MHz |
| Operating temperature | -40 °C ~ 85 °C |
| Storage temperature | -40 °C ~ 125 °C , < 90%RH |
| Power supply | Support voltage 2.7V ~ 3.6V,supply current ≥ 200 mA |
| Interface | UART/GPIO/ADC/PWM/I2C/SPI/PDM/DMA |
| IO | 11 |
| UART rate | Default 115200 bps |
| Bluetooth | BLE 5.1 |
| Security | AES-128 |
| SPI Flash | 512KB |

2.1. Static electricity requirements

TG-02F module is an electrostatic sensitive device. Therefore, you need to take special precautions when carrying it.



Figure 2 ESD preventive measures

2.2. Electrical characteristics

Table 2 Electrical characteristics table

| Parameters | Conditions | Min. | Typical value | Max. | Unit | |
|--------------|--------------|------|---------------|------|-----------------|----|
| Power Supply | VDD | 2.7 | 3.3 | 3.6 | V | |
| I/O | V_{IL}/V_I | - | -0.3/0.75VDD | - | 0.25VDD/VDD+0.3 | V |
| | V_{OL}/V | - | N/0.8VIO | - | 0.1VIO/N | V |
| | I_{MAX} | - | - | - | 12 | mA |

2.3. Bluetooth Rf Performance

Table 3 Bluetooth RF performance Table

| Description | Typical value | | | Unit |
|----------------------------|---------------|---------------|------|------|
| Working Central Frequency | 2400 - 2483.5 | | | MHz |
| Output Power | | | | |
| Model | Min. | Typical value | Max. | Unit |
| BLE 2Mbps | -20 | 8 | 10 | dBm |
| BLE 1Mbps | -20 | 8 | 10 | dBm |
| BLE 500Kbps | -20 | 8 | 10 | dBm |
| BLE 125kbps | -20 | 8 | 10 | dBm |
| Receive Sensitivity | | | | |
| Model | Min. | Typical value | Max. | Unit |
| BLE 2Mbps | - | -94 | - | dBm |

| | | | | |
|-----------|---|-----|---|-----|
| BLE 1Mbps | - | -95 | - | dBm |
|-----------|---|-----|---|-----|

2.4. Power

The following power consumption figures are based on a 3.3V power supply, an ambient temperature of 25°C, and an internal voltage regulator.

- All measurements were made at the antenna interface without SAW filter.
- All emission data are measured in TX_Burst_Test & RX_Burst_Test mode.

Table 4 Power consumption table

| Model | Min. | AVG | Max. | Unit |
|--|------|------|------|------|
| TX_Burst_Test Power output 8dBm | - | 11.5 | - | mA |
| TX_Burst_Test Power output 5dBm | - | 9.6 | - | mA |
| TX_Burst_Test Power output 0dBm | - | 8.6 | - | mA |
| RX_Burst_Test | - | 8 | - | mA |
| Sleep (IO wake up only) | - | 0.3 | - | uA |
| Sleep(with 32KHz RTC and all SRAM retention) | - | 6.5 | - | uA |
| Power ON | - | 6.24 | - | mA |

3. Appearance Dimensions

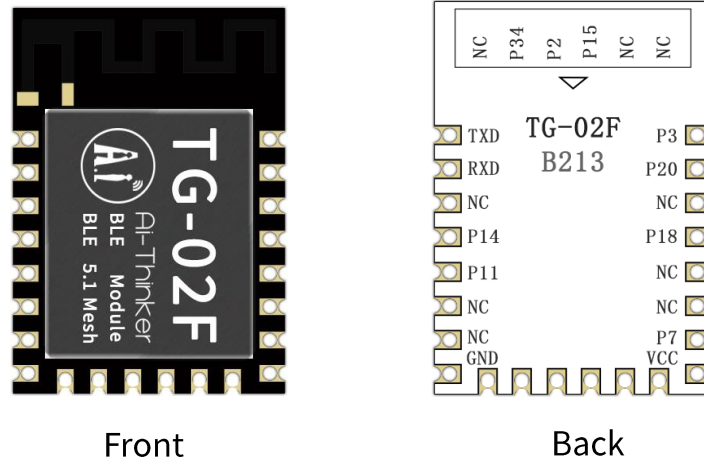


Figure 3 Appearance diagram pictures is for reference only,subject to physical objects)

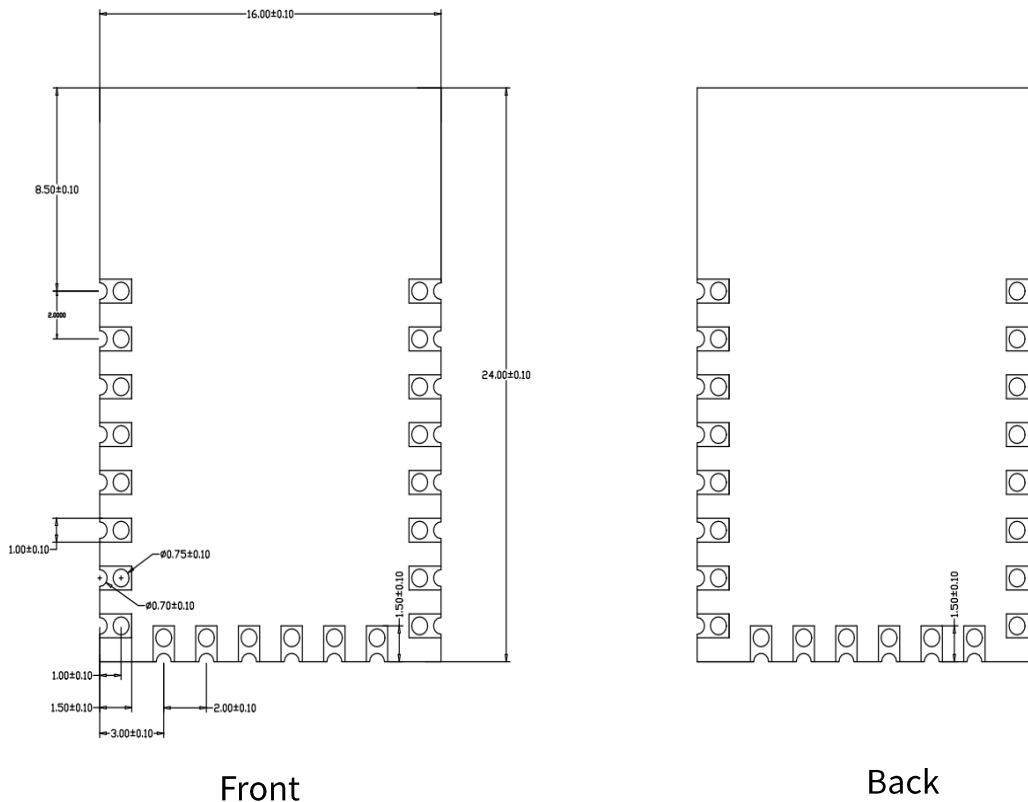


Figure 4 module size diagram

4. Pin definition

TG-02F module is connected with a total of 22 pins, as shown in the schematic diagram of pins, pin function definition table is the interface definition.

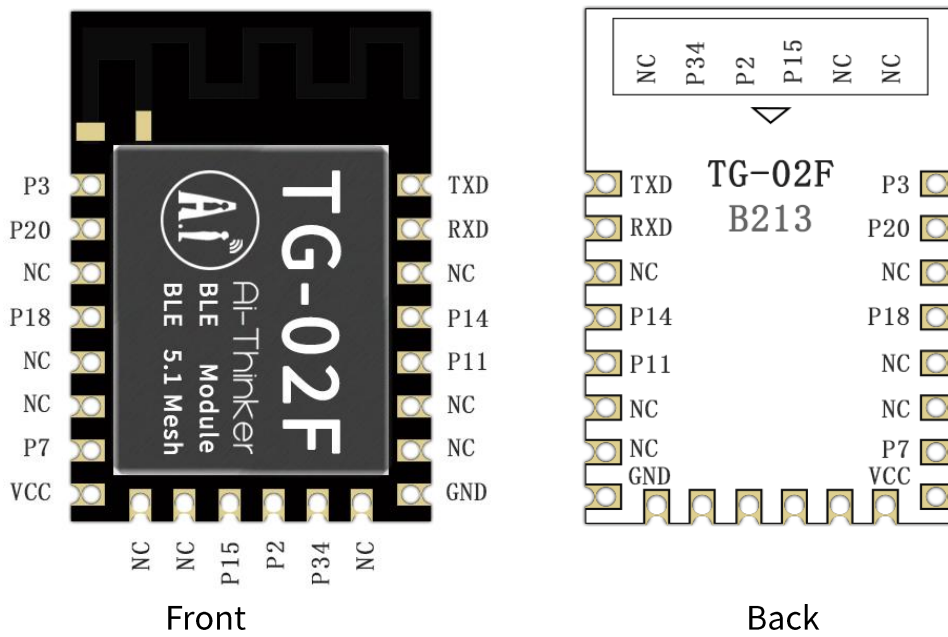


Figure 5 Schematic diagram of module pins(top view)

Table 6 Pin function definition table

| No. | Name | Function |
|-----|------|--|
| 1 | P3 | GPIO3 |
| 2 | P20 | GPIO20/ ADC input 9 / PGA positive input |
| 3 | NC | NC |
| 4 | P18 | GPIO18/ ADC input 7 / PGA negative input |
| 5 | NC | NC |
| 6 | NC | NC |
| 7 | P7 | GPIO7 |
| 8 | VCC | Power access (positive pole of power supply) |
| 9 | NC | NC |
| 10 | NC | NC |
| 11 | P15 | GPIO15/ ADC input 4 / micbias output |
| 12 | P2 | GPIO2 |
| 13 | P34 | GPIO34 |
| 14 | NC | NC |
| 15 | GND | Ground(Power negative electrode) |
| 16 | NC | NC |
| 17 | NC | NC |
| 18 | P11 | GPIO11/ADC input 0 |
| 19 | P14 | GPIO14/ADC input 3 |
| 20 | NC | NC |
| 21 | RXD | RXD/GPIO10 |
| 22 | TXD | TXD/GPIO9 |

5. Schematic

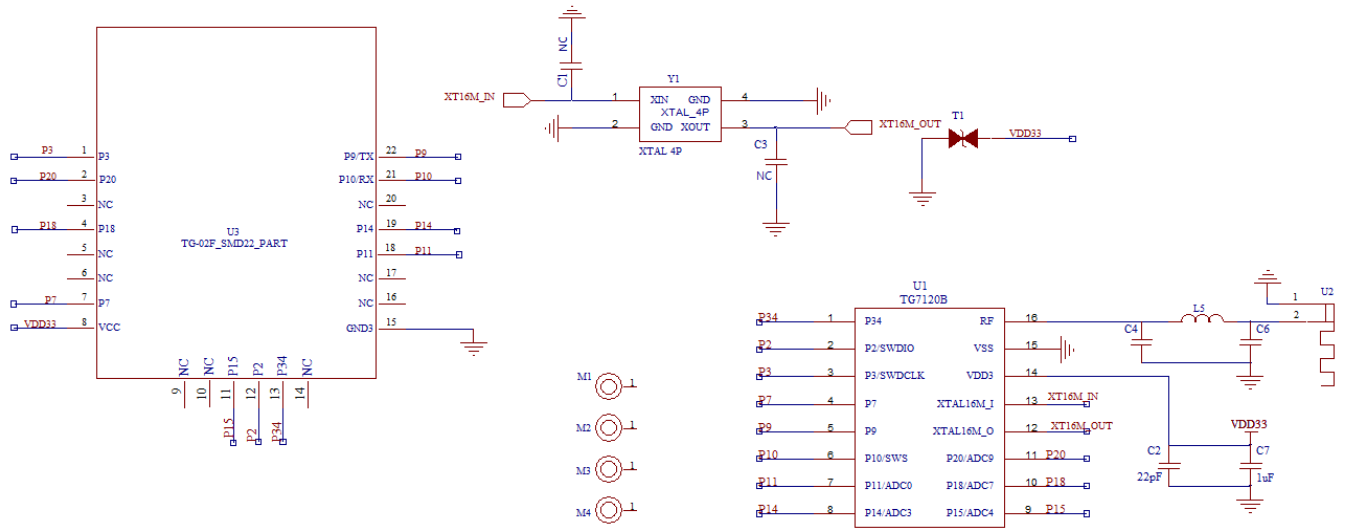


Figure 6 Module schematic

6. Antenna parameters

6.1. Test conditions for the antenna

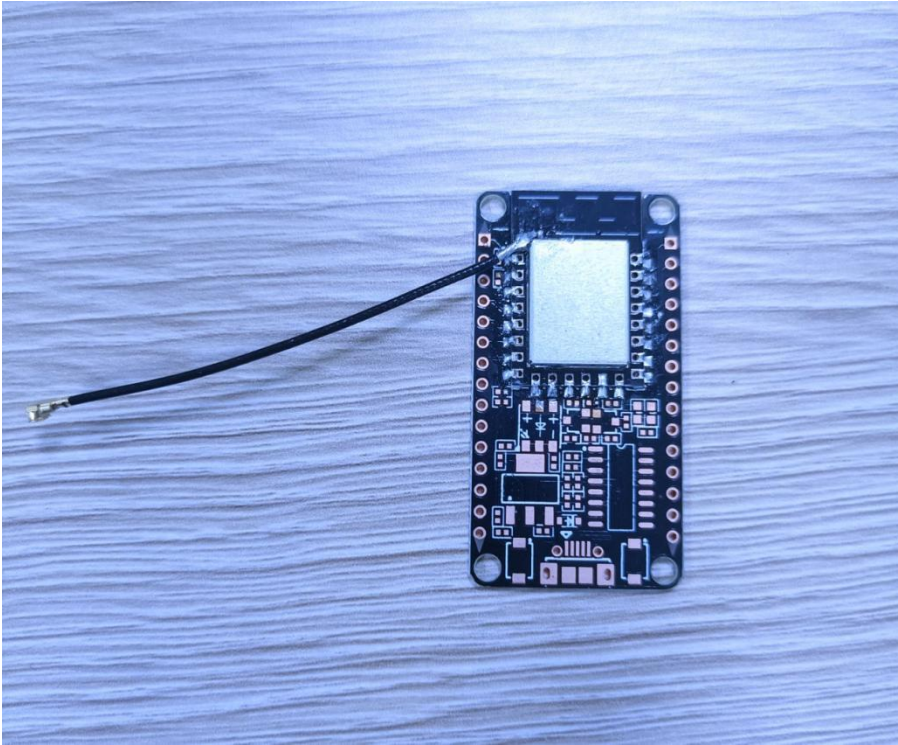


Figure 7 Antenna test conditions

6.2. Antenna S parameter

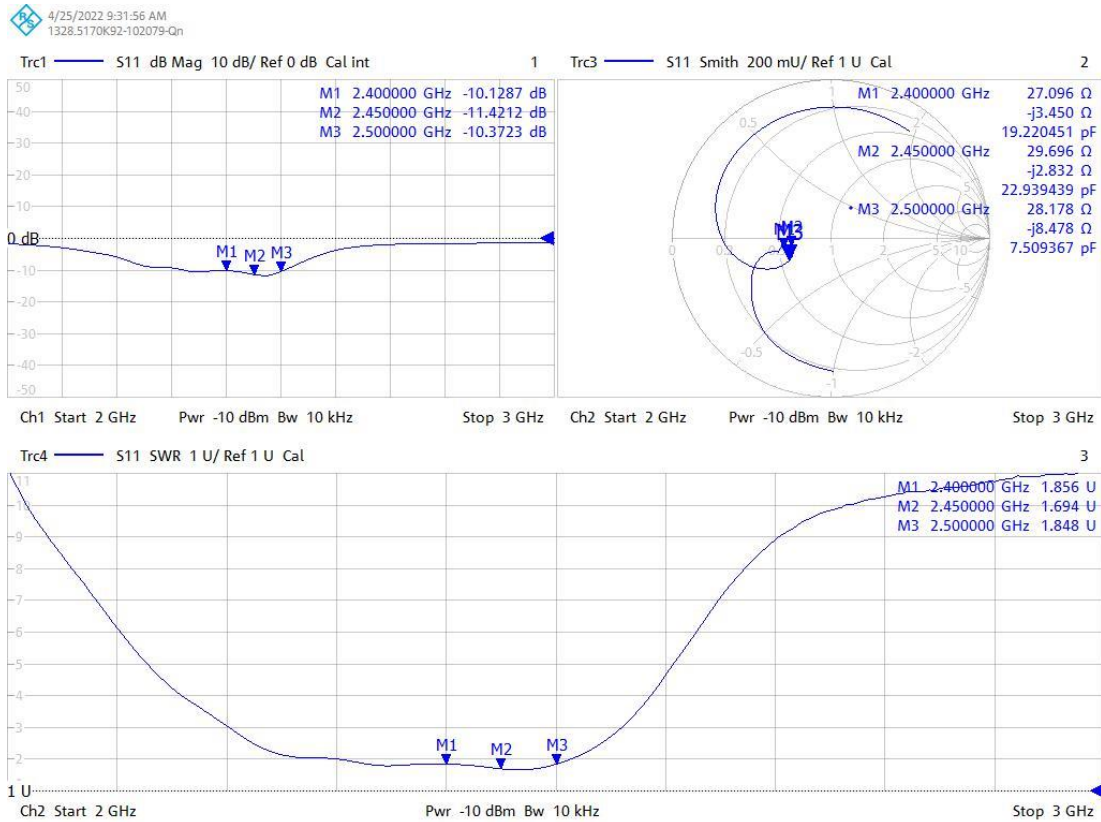


Figure 8 Antenna S parameters

6.3. Antenna Gain and Efficiency

Table 7 Antenna Gain and efficiency

| Frequency ID | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Frequency (MHz) | 2400.0 | 2410.0 | 2420.0 | 2430.0 | 2440.0 | 2450.0 | 2460.0 | 2470.0 | 2480.0 | 2490.0 | 2500.0 |
| Gain (dBi) | 2.28 | 2.29 | 2.24 | 2.28 | 2.03 | 2.60 | 2.67 | 2.62 | 2.45 | 2.22 | 2.10 |
| Efficiency (%) | 59.76 | 60.02 | 59.66 | 59.97 | 56.41 | 63.77 | 64.74 | 64.77 | 63.80 | 61.40 | 60.07 |

6.4. Antenna Field Type Diagram

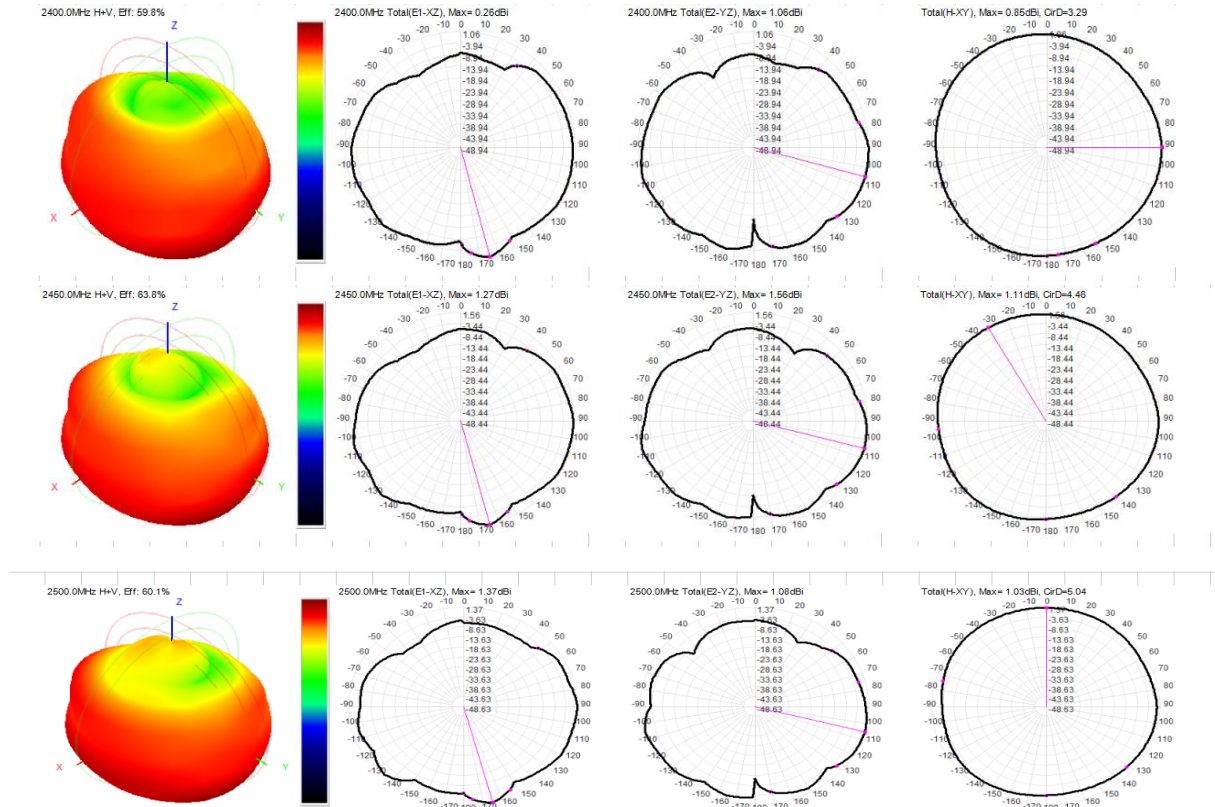


Figure 9 Antenna field type diagram

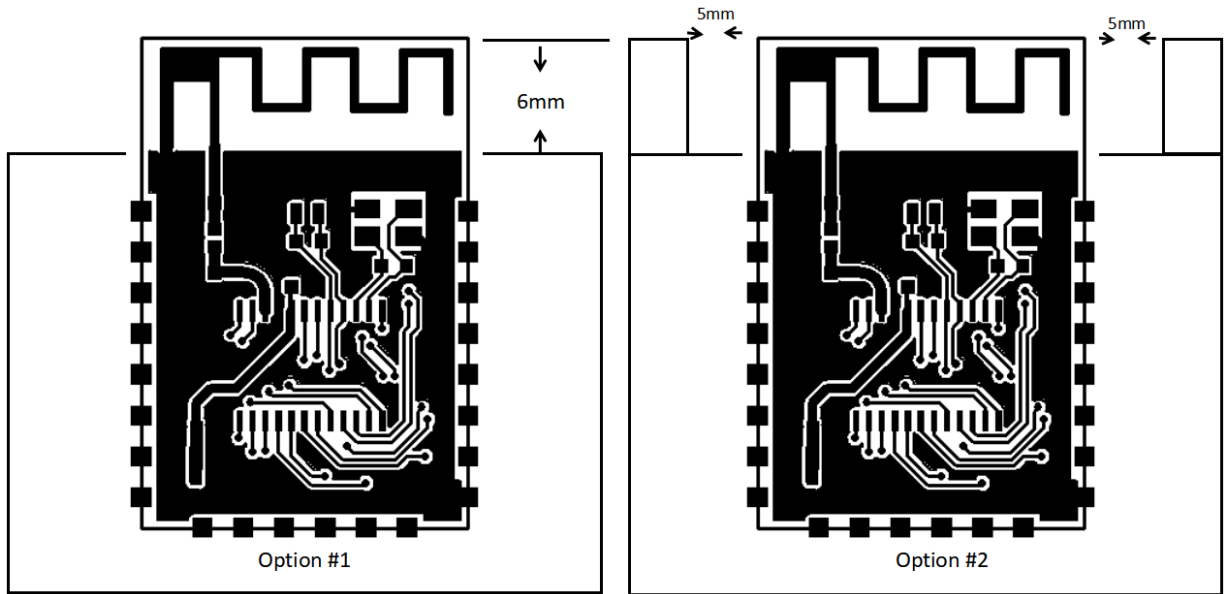


Figure 11 Antenna layout diagram

7.3. Power supply

- Recommended 3.3V voltage, peak current over 200mA.
- Power supply is recommend to use LDO; If the DC-DC is used, the ripple is recommended to be controlled within 30mV.
- DC-DC power supply circuit proposes to reserve the dynamic response capacitance to optimize the output ripple with large load changes.
- 3.3V power interface it is recommended to add ESD devices.

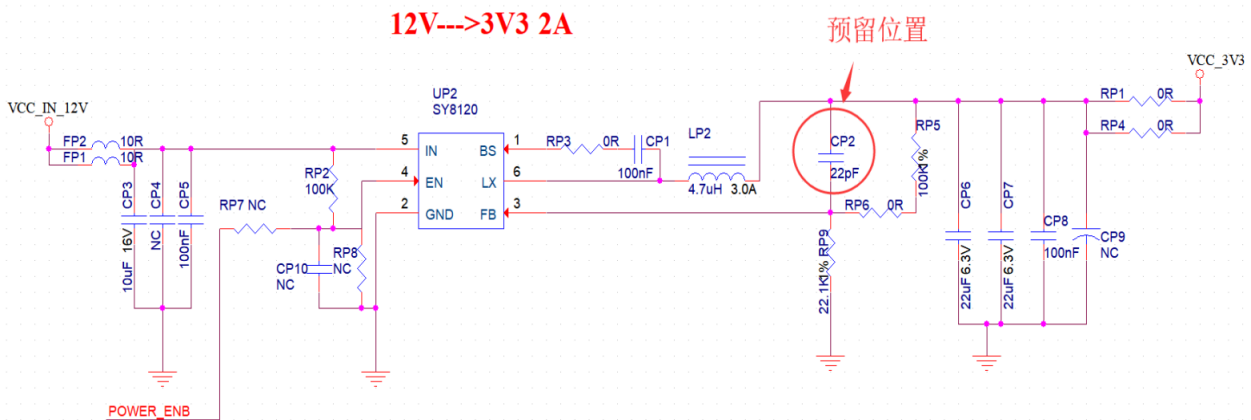


Figure 12 Dc-dc step-down circuit diagram

7.4. GPIO

- Some IO ports are introduced outside the module. If necessary, it is recommended to use a resistor of 10-100 ohms in series on the IO ports. This inhibits overshoot and makes both sides level more stable. It is helpful for EMI and ESD.
- For special I/O ports to be pulled up and down, refer to the usage instructions in the specifications, which may affect the module startup configuration.
- The IO port of the module is 3.3V. If the IO level of the main control and the module do not match, a level conversion circuit needs to be added.
- If the I/O port is directly connected to a peripheral port or terminals, for example, a pin row, reserve an ESD device near the terminal of the I/O cable.

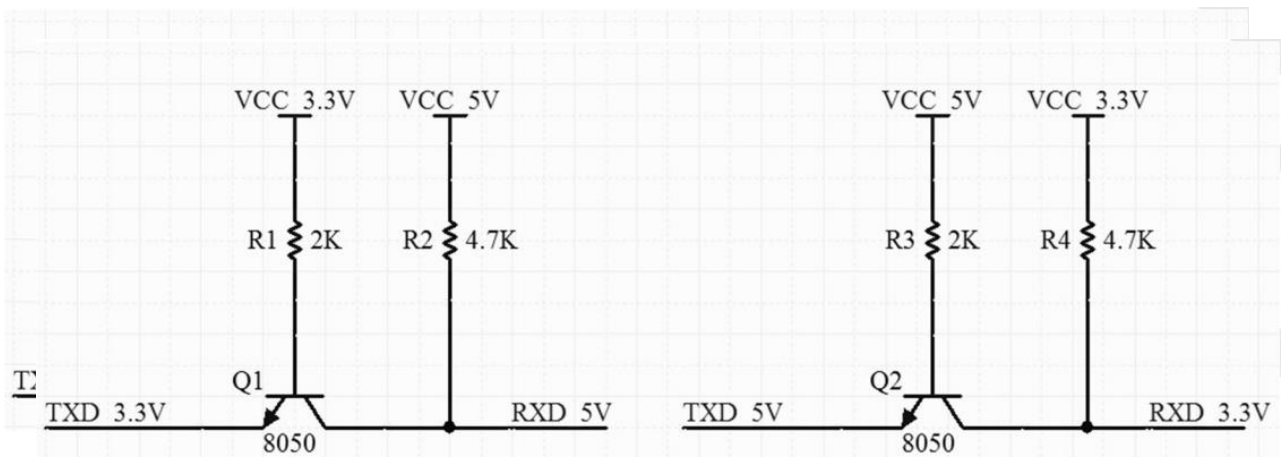


Figure 13 Level convert circuit

8. Flow welding curve diagram

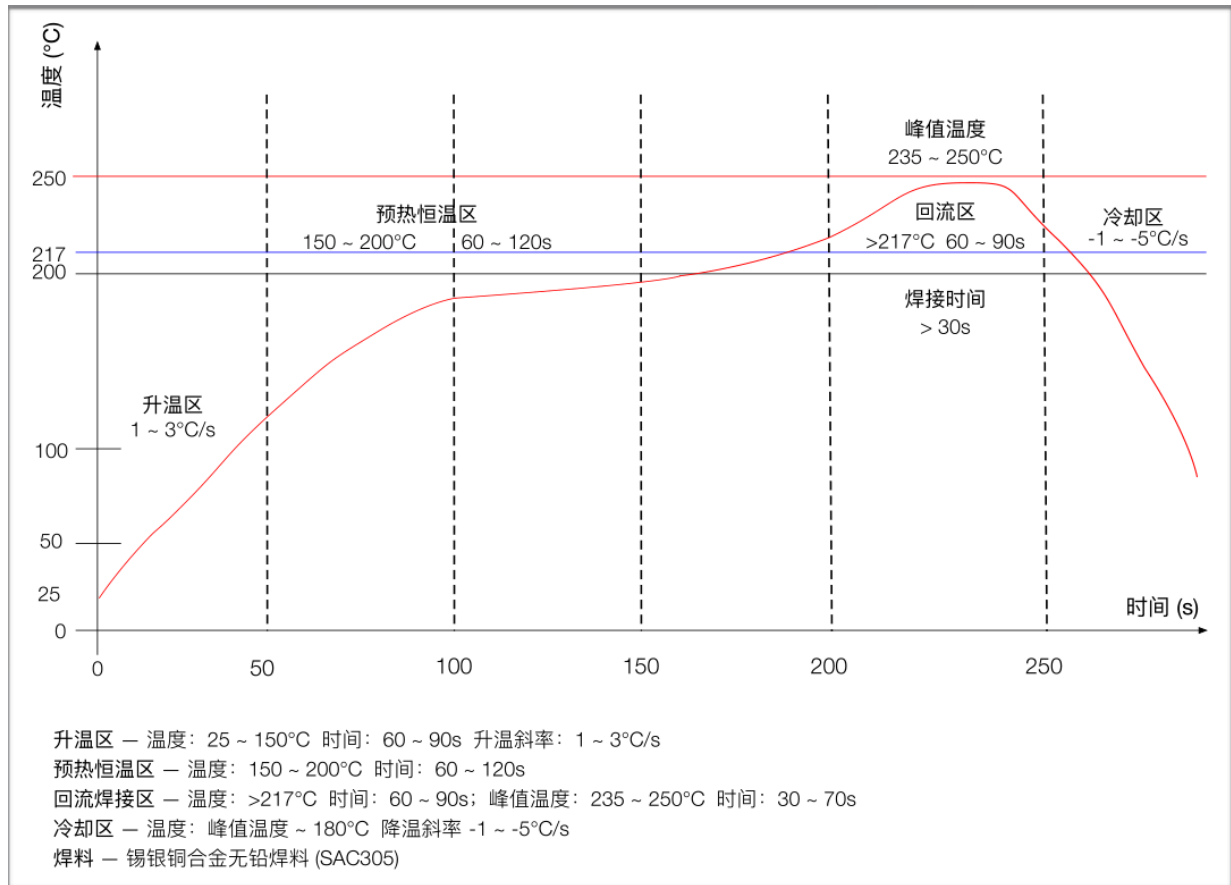


Figure 14 Flow welding diagram

9. Product related models

Table 8 Product related model list

| Model | Power Supply | Package | Size | Antenna |
|---|---------------------------------------|-------------------------------|------------------------------|--|
| TG-02F | 2.7V ~ 3.6V, $I \geq 200\text{mA}$ | SMD-22 | 24.0*16.0*3.1(± 0.2)mm | Default on-board PCB antenna Optional external spring antenna |
| TG-02M | 2.7V ~ 3.6V, $I \geq 200\text{mA}$ | DIP-18 Gold finger plug-in | 18.0*18.0*2.8(± 0.2)mm | On-board PCB antenna |
| TG-02 | 2.7V ~ 3.6V, $I \geq 200\text{mA}$ | SMD-20 | 18.6*12.2*2.8(± 0.2)mm | On-board PCB antenna |
| TG-02F-Kit | 5V, $I > 200\text{mA}$ | DIP-30 | 49.66*25.40(± 0.2)mm | On-board PCB antenna |
| TG-02M-Kit | 5V, $I > 200\text{mA}$ | DIP-20 | 32.73*28.45(± 0.2)mm | On-board PCB antenna |
| TG-02-Kit | 5V, $I > 200\text{mA}$ | DIP-19 | 45.54*29.93(± 0.2)mm | On-board PCB antenna |
| Product related information : https://docs.ai-thinker.com | | | | |

10. Product packaging information

TG-02F module was packaged in a tape, 1350pcs/reel. As shown in the below image:



Figure 15 Package and packing diagram

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