TB-05 Specification

Version　V1.0.1

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Document resume

Version	Date	Develop/revise content	Edition	Approve
V1.0.0	2022.11.8	First Edition	Jingran Xiao	Ning Guan
V1.0.1	2022.12.8	1、Update schematic. 2、Optimize the recommended PCB package size.	Jingran Xiao	Ning Guan

Content

1. Product overview

TB-05 is a BLE5.0 low-power consumption Tmall Genie Mesh Bluetooth module based on TLSR8250 chip. The Bluetooth module supports the direct control of Tmall Genie and has the function of Bluetooth mesh networking. The devices communicate through peer-to-peer star network and Bluetooth broadcast, which can ensure timely response in case of multiple devices. It is mainly used in intelligent light control, which can meet the requirements of low power consumption, low delay and short-range wireless data communication.
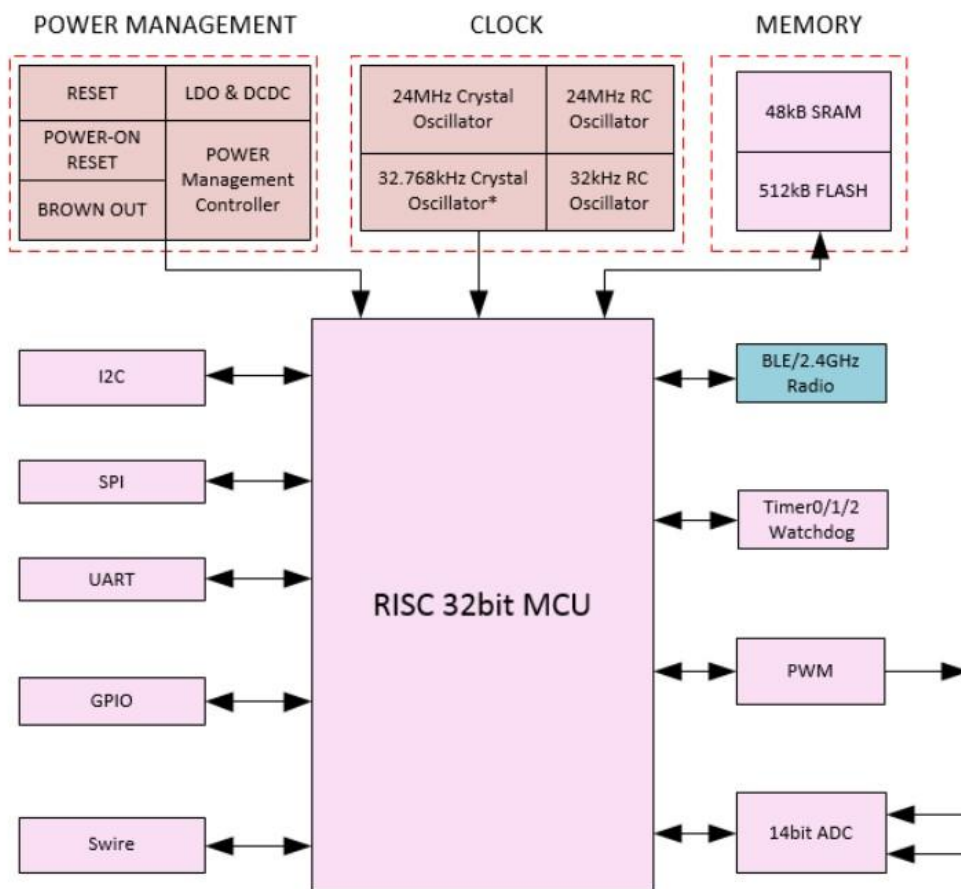
Figure 1 Main Chip Architecture Diagram

1.1. Characteristics

■ It can be directly controlled by the Tmall Genie without a gateway

■ 1.1mm pitch SMD-20 package

■ 6 PWM outputs

■ Onboard antenna, compatible with half-hole pad/through-hole pad

■ Brightness (duty cycle) adjustment range 5%-100%

■ Factory default cold color warm color duty cycle 50%

■ PWM output frequency 1KHz

■ With night light function

■ Color temperature switching function with wall switch

2. Main parameters

Table 1 Description of Main Parameters

Model	TB-05
Size	12.2*18.6*2.8(±0.2)MM
Package	SMD-20
Wireless standard	Bluetooth 5.0
Frequency	2400~2483.5MHz
Maximum Tx power	Maximum 10.5dBm
Receiving Sensitivity	-93dBm
Interface	GPIO/PWM/SPI/ADC
Operating temperature	-40 ℃ ~ 85 ℃
Storage environment	-40 ℃ ~ 125 ℃ , < 90%RH
Power supply	The power supply voltage is 2.7V ~ 3.6V, and the power supply current is ≥ 50mA
Power consumption	Deep sleep pattern: 0.8 µA
	Sleep mode: 1.8 µA
	TX:21.56mA
Transmission distance	Outdoor open sight distance: ≥ 100 m

2.1. Static electricity requirements

TB-05 is an electrostatic sensitive equipment and requires special precautions during handling

Figure 2 ESD anti-static diagram

2.2. Electrical characteristics

Table 2 Table of Electrical Characteristics

Parameters		Condition	Min.	Typical value	Max.	Unit
Supply voltage		VDD	2.7	3.3	3.6	V
I/O supply voltage		VCCIO	-0.3	-	3.6	V
I /O	VIL	-	-	-	0.3*VDDIO	V
	VIH	-	0.7*VDDIO	-	VDDIO	V
	VOL	-	-	-	0.1*VDDIO	V
	VOH	-	0.9*VDDIO	-	VDDIO	V
Operating			-40	-	+85	°C
Storage			-40	-	+125	°C

2.3. BLE RF performance

Table 3 BLE RF Performance Table

Description	Typical value			Unit
Spectrum range	2400~2483.5MHz			MHz
Output power				
Rate mode	**Min.**	**Typical value**	**Max.**	**Unit**
1Mbps	7.1	8.5	10.5	dBm
Receiving sensitivity				
Rate mode	**Min.**	**Typical value**	**Max.**	**Unit**
1Mbps sensitivity @ 30.8% PER	-	-93	-	dBm

2.4. Power consumption

The following power consumption data is based on a 3.3V power supply, ambient temperature of 25°C, and measured using an internal voltage regulator.

■ All measurements are completed at the antenna interface with a filter.

■ All transmission data are measured in the continuous transmission mode based on the duty cycle of the 100%.

Table 4 Power consumption table

Mode	Min.	Average	Max.	Unit
Tx power consumption (10.5dBm)	-	21.56	-	mA
Rx consumption	-	6.4	-	mA
Standby power consumption	-	3	-	mA
Superficial sleep	-	1.8	-	μA
Deep sleep	-	0.8	-	μA

3. Appearance dimensions

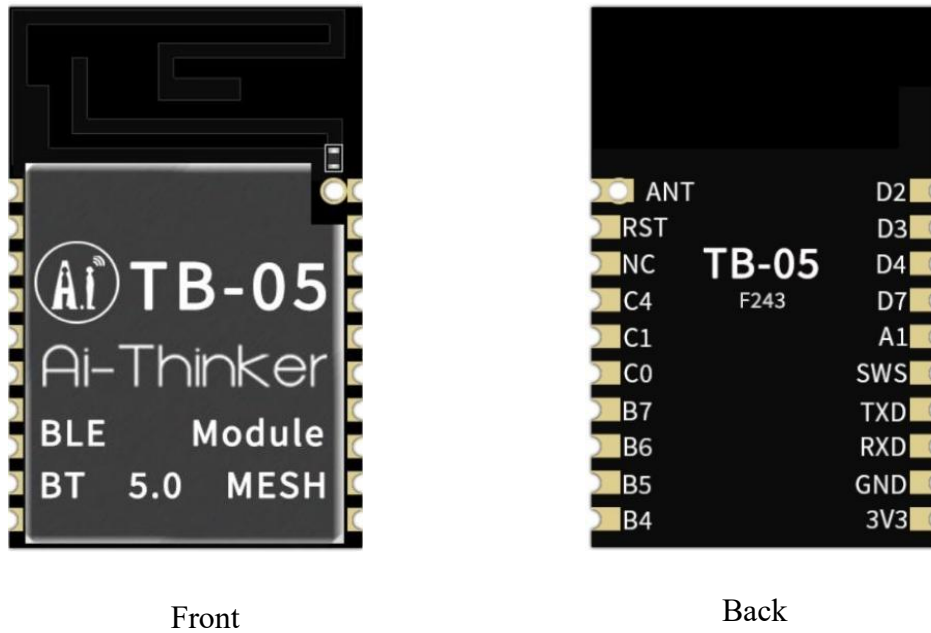Front   Back
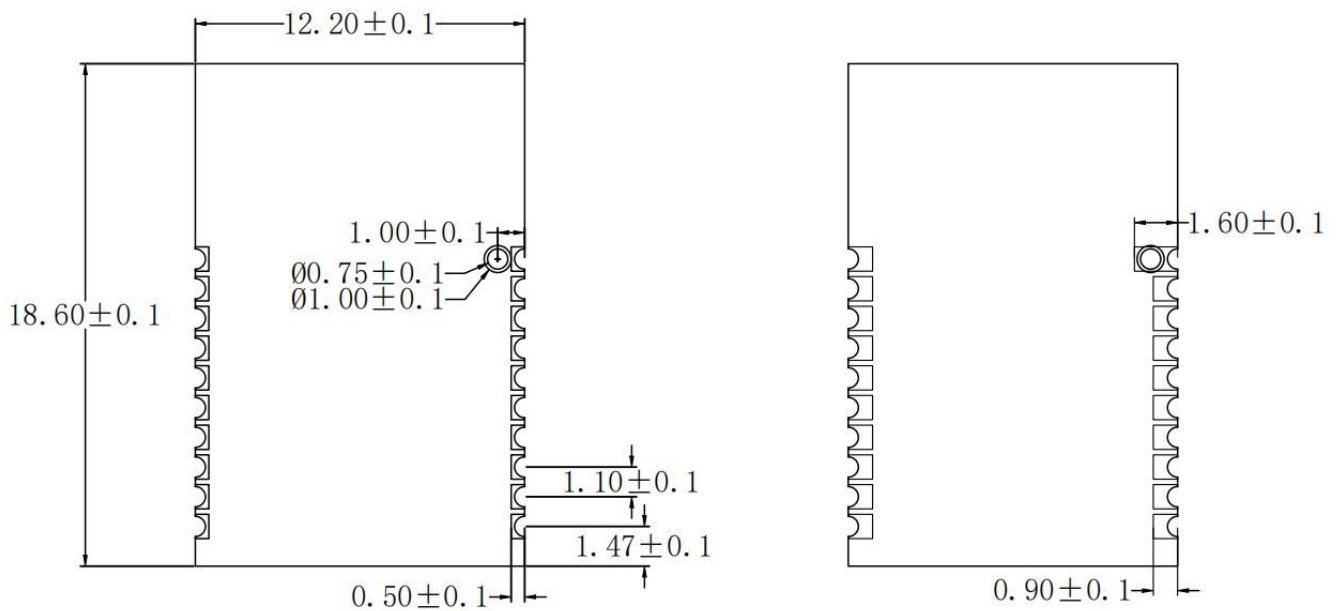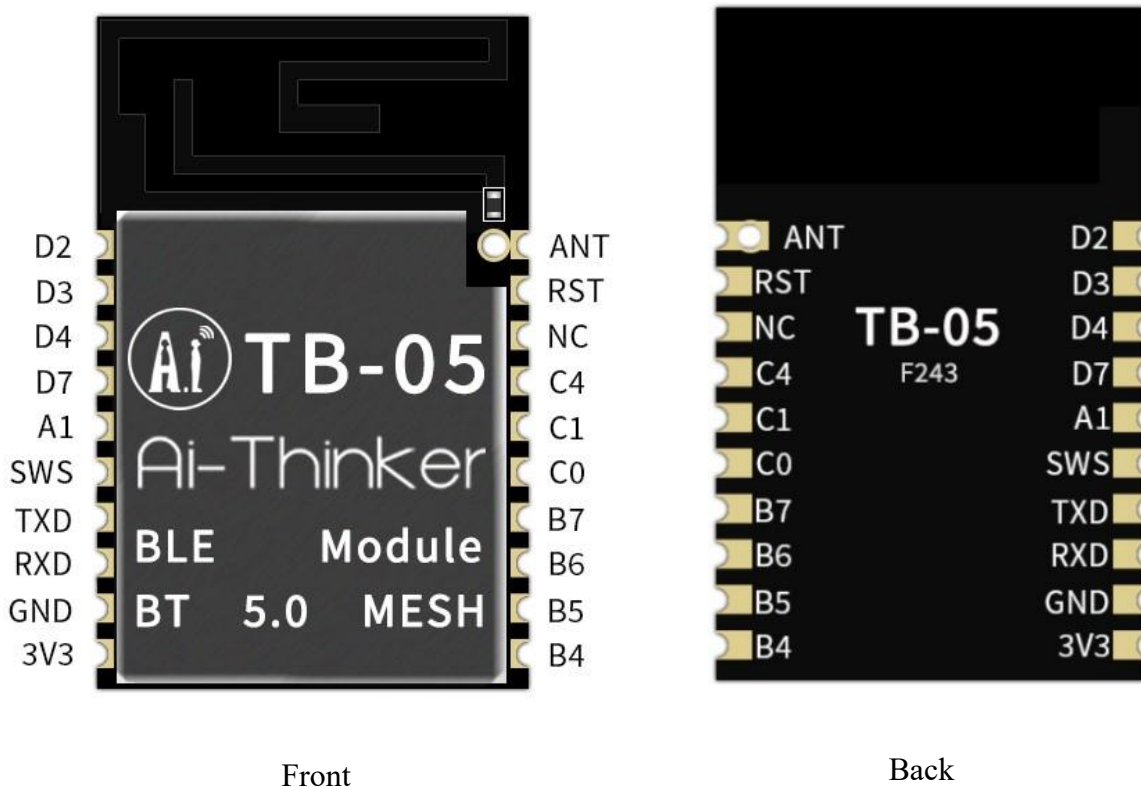
Figure 3 (for reference only)

Figure 4 dimension diagram (unit: mm)

4. Pin definition

TB-05 module has a total of 20 interfaces. As shown in below pin diagram, the pin function definition table is the interface definition.


Front   Back

Figure 5 Pin Top View

Table 5 Pin Function Definition Table

No.	Name	Function
1	D2	SPI chip selection (active low)/PWM3 output/GPIO PD2
2	D3	PWM1 reverse output/GPIO PD3
3	D4	GPIO PD4/single-wire host/PWM2 reverse output
4	D7	GPIO PD7/SPI clock (I2C_SCK)
5	A1	GPIO PA1
6	SWS	Single-wire slave
7	TXD	PWM4 output/UART_TX/SAR ADC input/GPIO PB1
8	RXD	PWM0 reverse output/UART_RX/GPIO PA0
9	GND	Ground
10	3V3	3.3V power supply
11	B4	PWM4 output/SAR ADC input/GPIO PB4
12	B5	PWM5 output/SAR ADC input/GPIO PB5
13	B6	SPI data input (I2C_SDA)/UART_RTS/SAR ADC input/GPIO PB6
14	B7	SPI data output/UART_RX/SAR ADC input/GPIO PB7
15	C0	I2C serial data/PWM4 reverse output/UART_RTS / GPIO PC0
16	C1	I2C serial clock/PWM1 reverse output/pwm0 output/GPIO PC1
17	C4	PWM2 output/UART_CTS/PWM0 reverse output/SAR ADC input
18	NC	NOT CONNECTED
19	RST	Reset pin
20	ANT	Antenna interface

5. Schematic
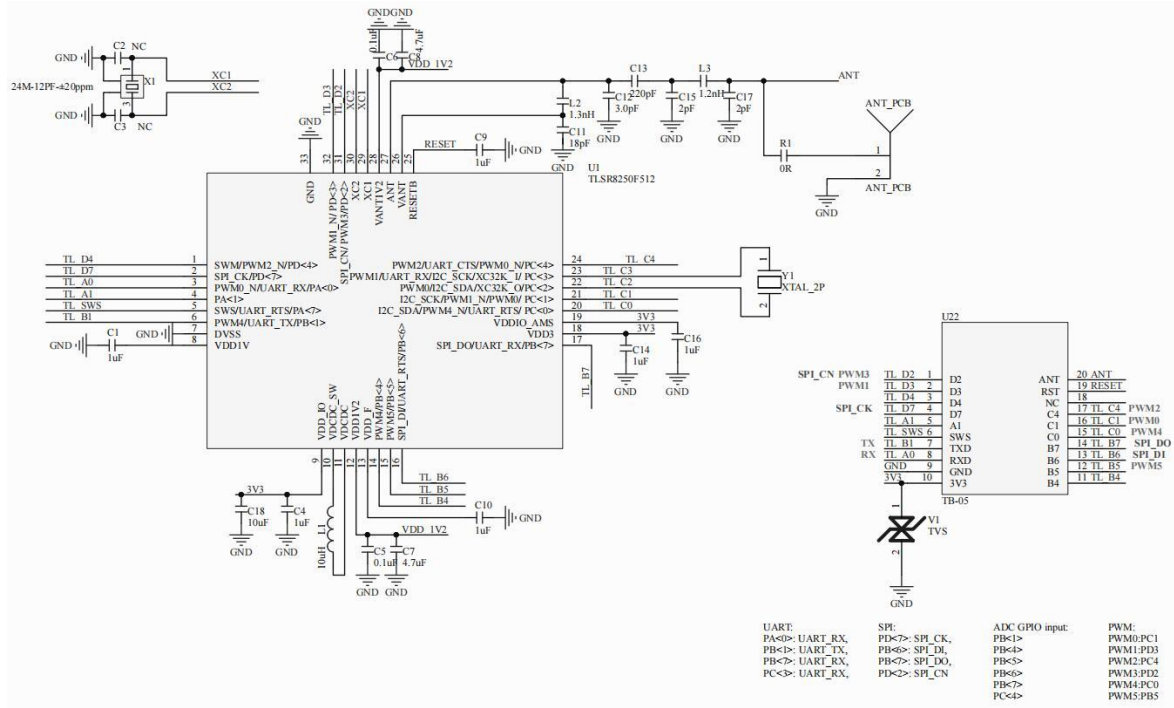
Figure 6 Schematic diagram

6. Antenna parameters

6.1. Schematic of Antenna Test Prototype

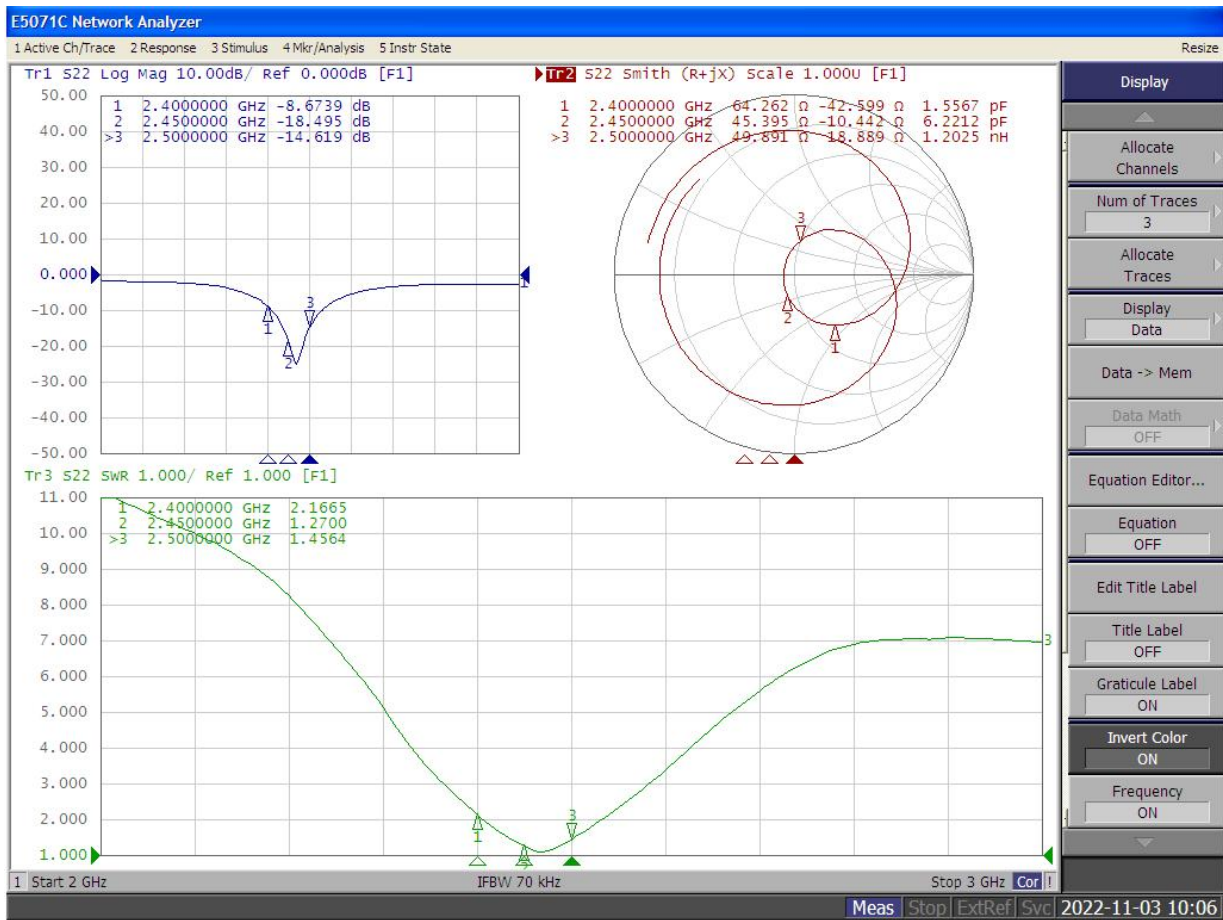**Figure 7 schematic diagram of antenna test prototype**

6.2. Antenna S parameter

Figure 8 Antenna S parameters

6.3. Antenna Gain and Efficiency

Table 6 Antenna Gain and Efficiency

Frequency ID	1	2	3	4	5	6	7	8	9	10	11
Frequency(MHz)	2400	2410	2420	2430	2440	2450	2460	2470	2480	2490	2500
Gain(dBi)	0.11	0.19	0.53	0.66	0.90	1.31	1.52	1.60	1.64	1.51	1.28
Efficiency(%)	27.64	28.55	31.13	32.06	33.47	36.26	36.85	37.13	36.93	36.74	35.69

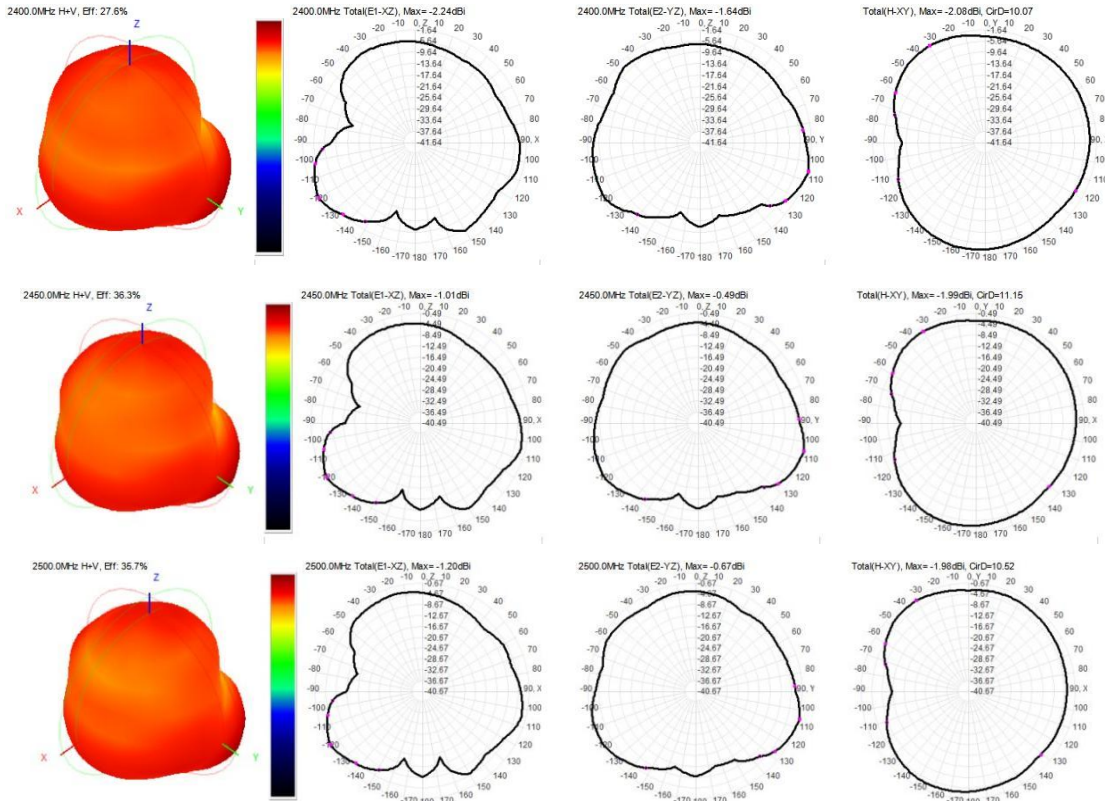## 6.4. Antenna field type diagram

Figure 9 antenna field type diagram

7. Design guidance
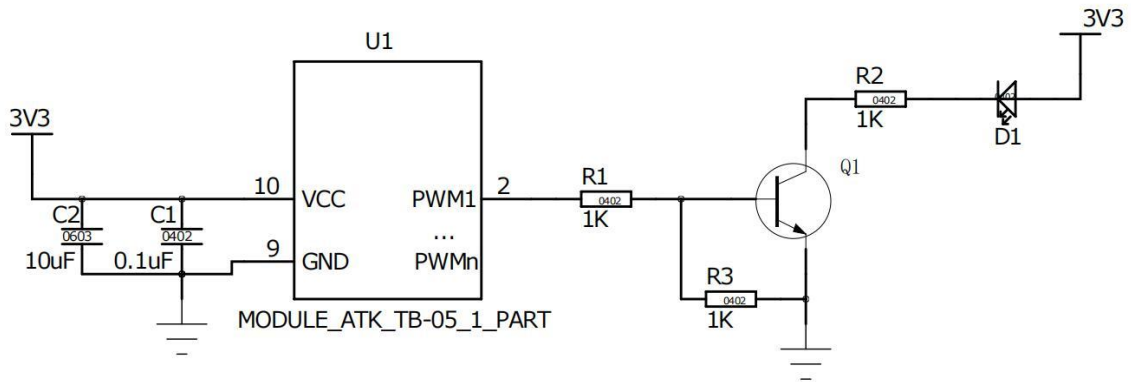
7.1. Application guidance circuit

Figure 10 Application Guidance Circuit

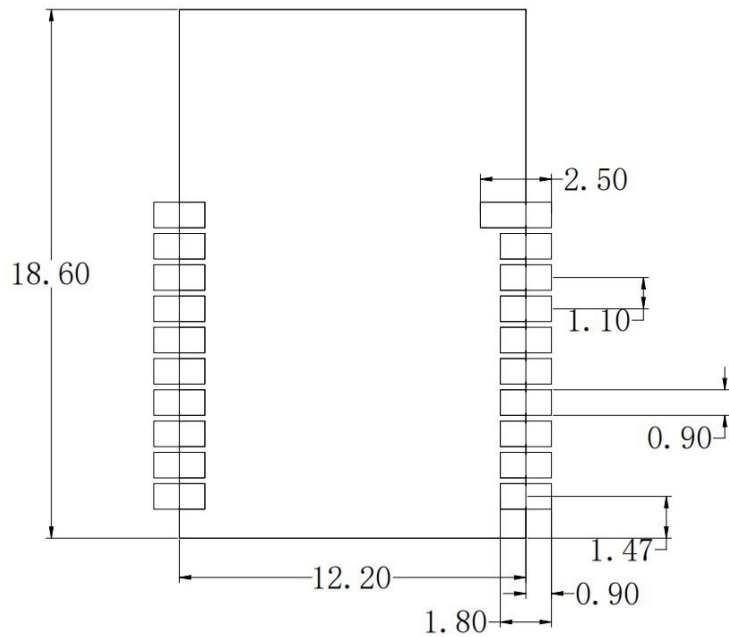## 7.2. Recommended PCB package size



Figure 111 Recommended PCB Package Size (Unit: mm)

7.3. Antenna layout requirements

■ In the installation position on the motherboard, the following 2 methods are recommended:

Scheme 1: Place the module on the edge of the main board, and the antenna area extends out of the edge of the main board

Scheme 2: Place the module on the edge of the motherboard, and the edge of the motherboard hollowed out an area at the antenna position

■ In order to meet the performance of the on-board antenna, it is forbidden to place metal parts around the antenna, away from high-frequency devices
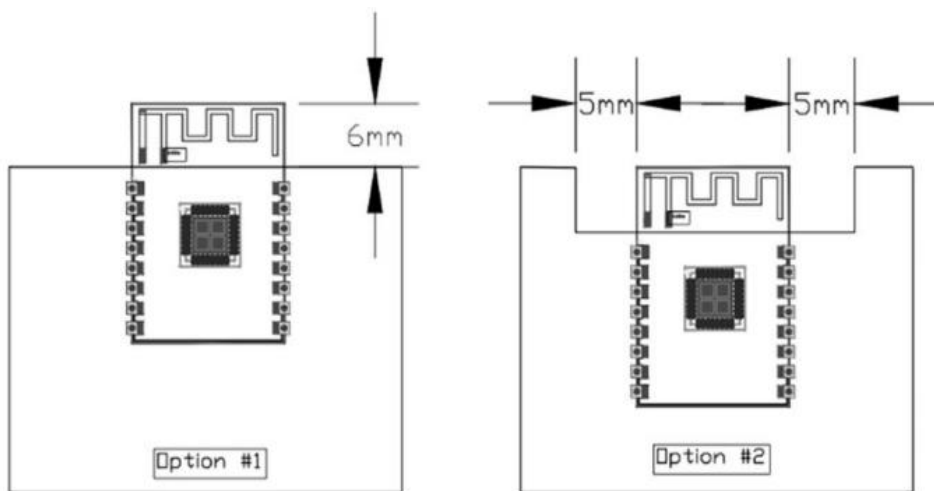
Figure 12 Antenna Layout

7.4. Power supply

■ Recommended 3.3V voltage, peak current above 50mA

■ LDO is recommended for power supply; If DC-DC is used, it is recommended that the ripple be controlled within 30mV

■ The DC-DC power supply circuit suggests to reserve the position of the dynamic response capacitor, which can optimize the output ripple when the load changes greatly

■ It is recommended to add ESD devices to the 3.3V power interface
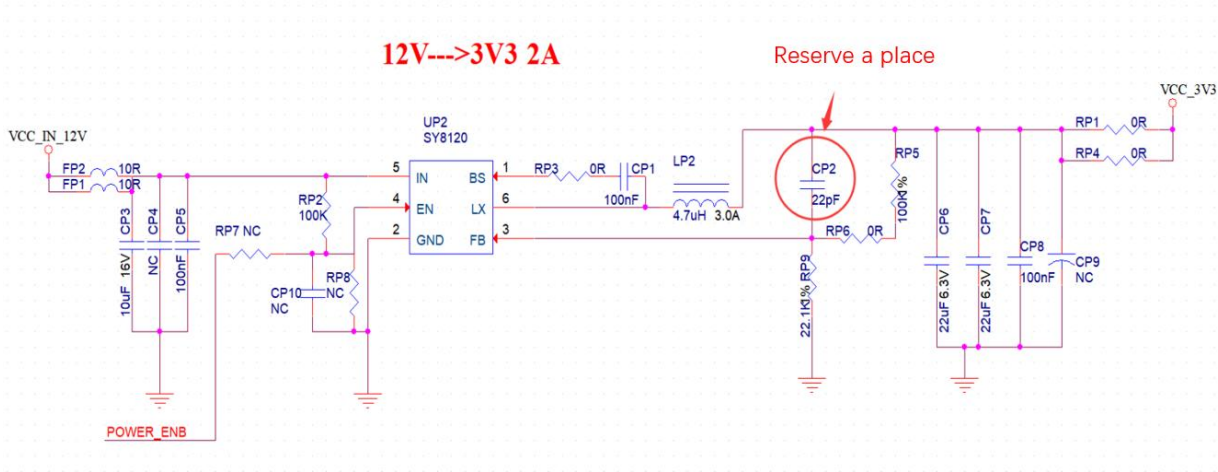
Figure 13 DC-DC Buck Circuit Diagram

7.5. GPIO

■ Some IO ports are led out from the periphery of the module. If you need to use a resistor of 10-100 ohms in series on the IO port. This can suppress overshoot and make the level on both sides more stable. It is helpful for both EMI and ESD

■ For the up and down of the special IO port, please refer to the instructions in the specification, which will affect the startup configuration of the module

■ The IO port of the module is 3.3V. If the level of the IO port of the main control and the module does not match, a level conversion circuit needs to be added

■ If the IO port is directly connected to the peripheral interface or terminals such as pins, it is recommended to reserve ESD devices at the IO port wiring close to the terminals
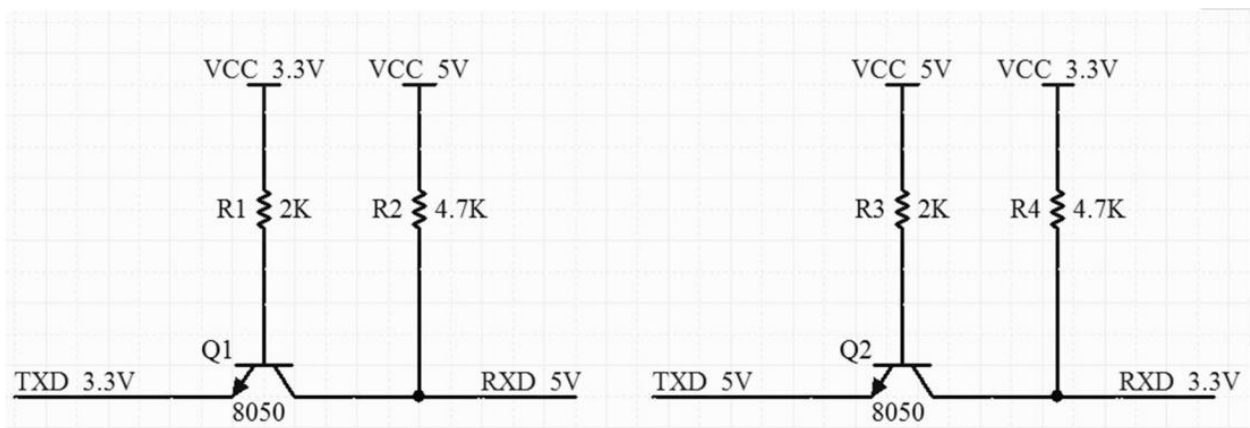
Figure 14 Level convert Circuit

8. Storage conditions

■ The product sealed in the moisture-proof bag should be stored in a non-condensing atmosphere of <40℃/90% RH.

■ The moisture sensitivity level MSL of the module is level 3.

■ After the vacuum bag is unpacked, it must be used within 168 hours at 25±5℃/60% RH, otherwise it needs to be baked before it can be put on line again.
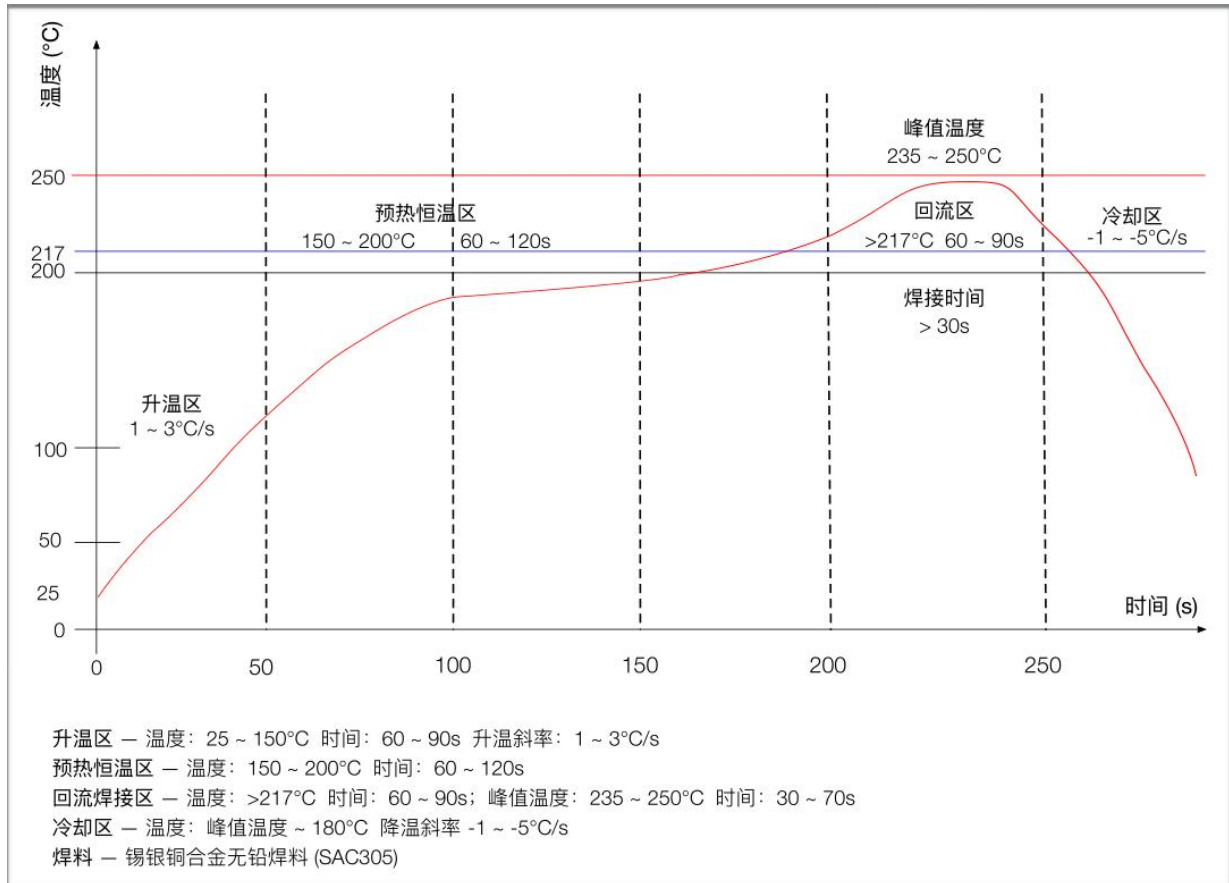
9. Reflow Welding Curve

Figure 15 reflow welding diagram

10. Product packaging information

TB-05 module is packaged in a tape, 1350pcs/reel. As shown in the below image

Figure 16 Package and packing diagram

11. Contact us

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