



# TB-05 Specification

Version V1.0.1

Copyright ©2022

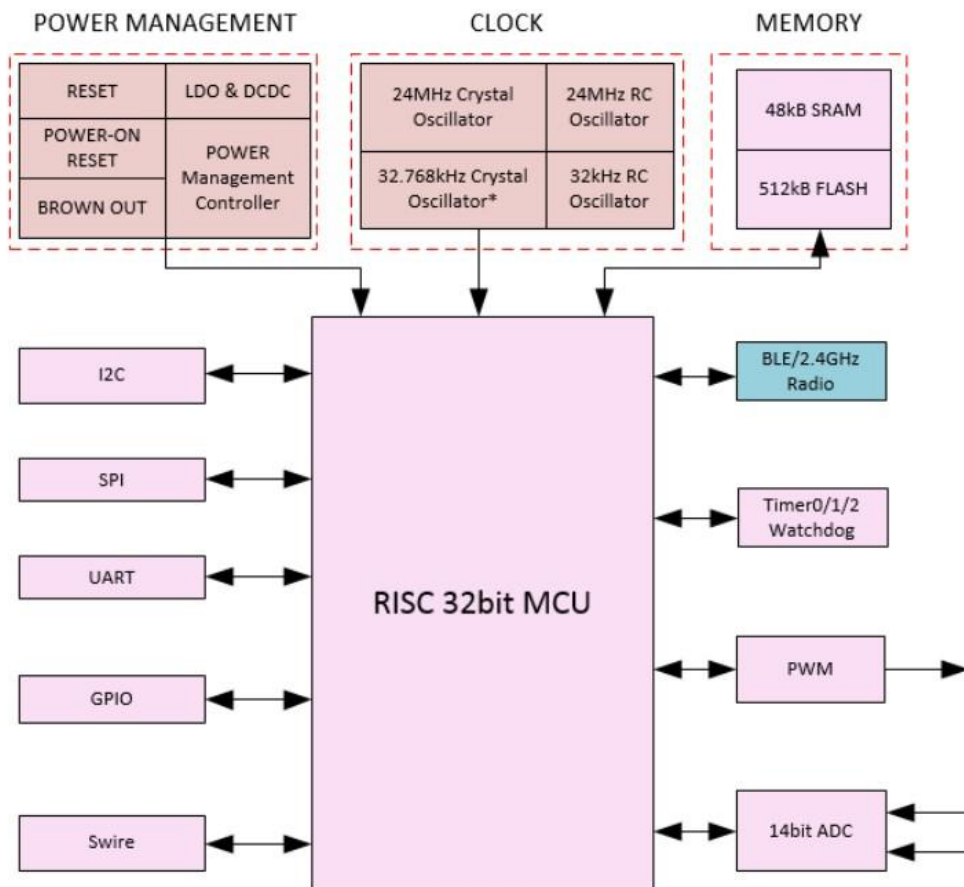


## Content

1. Product overview .....	4
1.1. Characteristics .....	5
2. Main parameters .....	6
2.1. Static electricity requirements .....	6
2.2. Electrical characteristics .....	7
2.3. BLE RF performance .....	8
2.4. Power consumption .....	8
3. Appearance dimensions .....	9
4. Pin definition .....	10
5. Schematic .....	12
6. Antenna parameters .....	13
6.1. Schematic of Antenna Test Prototype .....	13
6.2. Antenna S parameter .....	14
6.3. Antenna Gain and Efficiency .....	14
6.4. Antenna field type diagram .....	15
7. Design guidance .....	16
7.1. Application guidance circuit .....	16
7.2. Recommended PCB package size .....	16
7.3. Antenna layout requirements .....	17
7.4. Power supply .....	17
7.5. GPIO .....	18
8. Storage conditions .....	19
9. Reflow Welding Curve .....	19
10. Product packaging information .....	20
11. Contact us .....	20
Disclaimer and Copyright Notice .....	21
Notice .....	21

## 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**

<b>Model</b>	TB-05
<b>Size</b>	12.2*18.6*2.8(±0.2)MM
<b>Package</b>	SMD-20
<b>Wireless standard</b>	Bluetooth 5.0
<b>Frequency</b>	2400~2483.5MHz
<b>Maximum Tx power</b>	Maximum 10.5dBm
<b>Receiving Sensitivity</b>	-93dBm
<b>Interface</b>	GPIO/PWM/SPI/ADC
<b>Operating temperature</b>	-40 °C ~ 85 °C
<b>Storage environment</b>	-40 °C ~ 125 °C , < 90%RH
<b>Power supply</b>	The power supply voltage is 2.7V ~ 3.6V, and the power supply current is ≥ 50mA
<b>Power consumption</b>	Deep sleep pattern: 0.8 μA
	Sleep mode: 1.8 μA
	TX:21.56mA
<b>Transmission distance</b>	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
<b>Output power</b>				
Rate mode	Min.	Typical value	Max.	Unit
1Mbps	7.1	8.5	10.5	dBm
<b>Receiving sensitivity</b>				
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

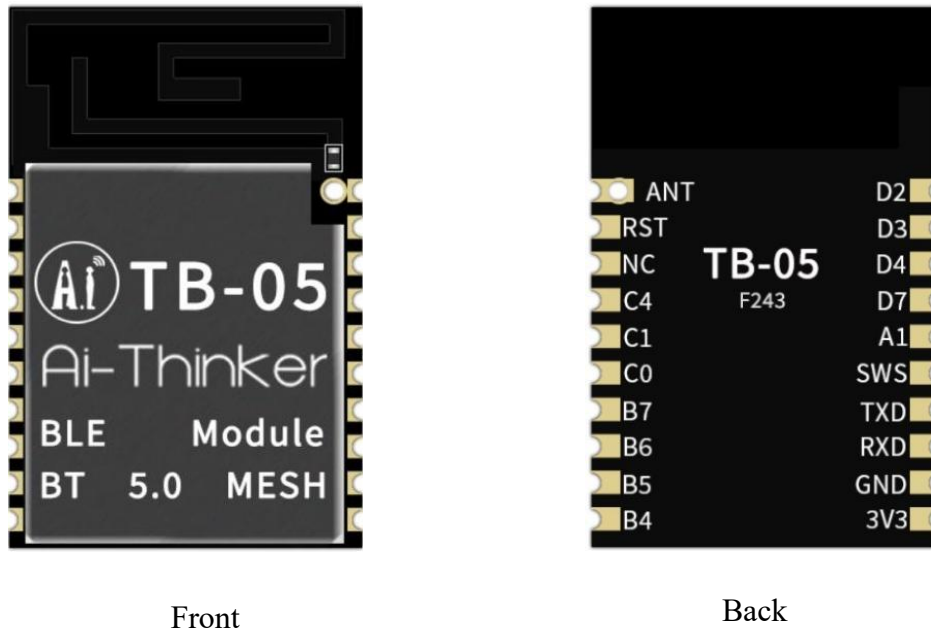


Figure 3 (for reference only)

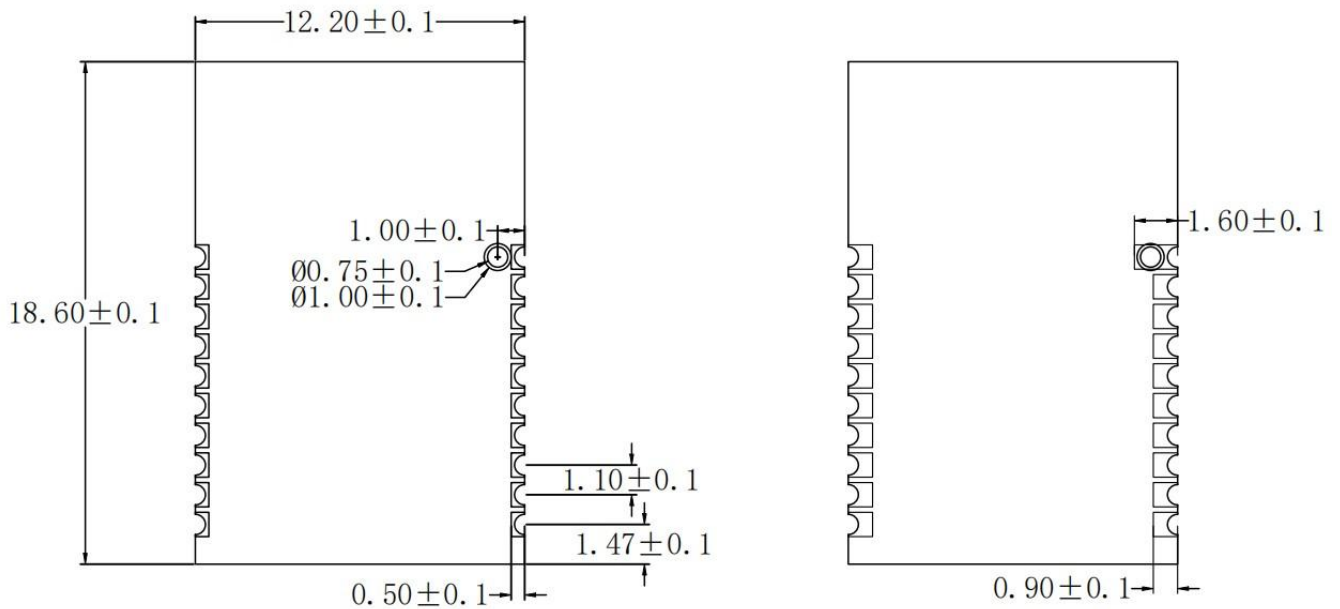
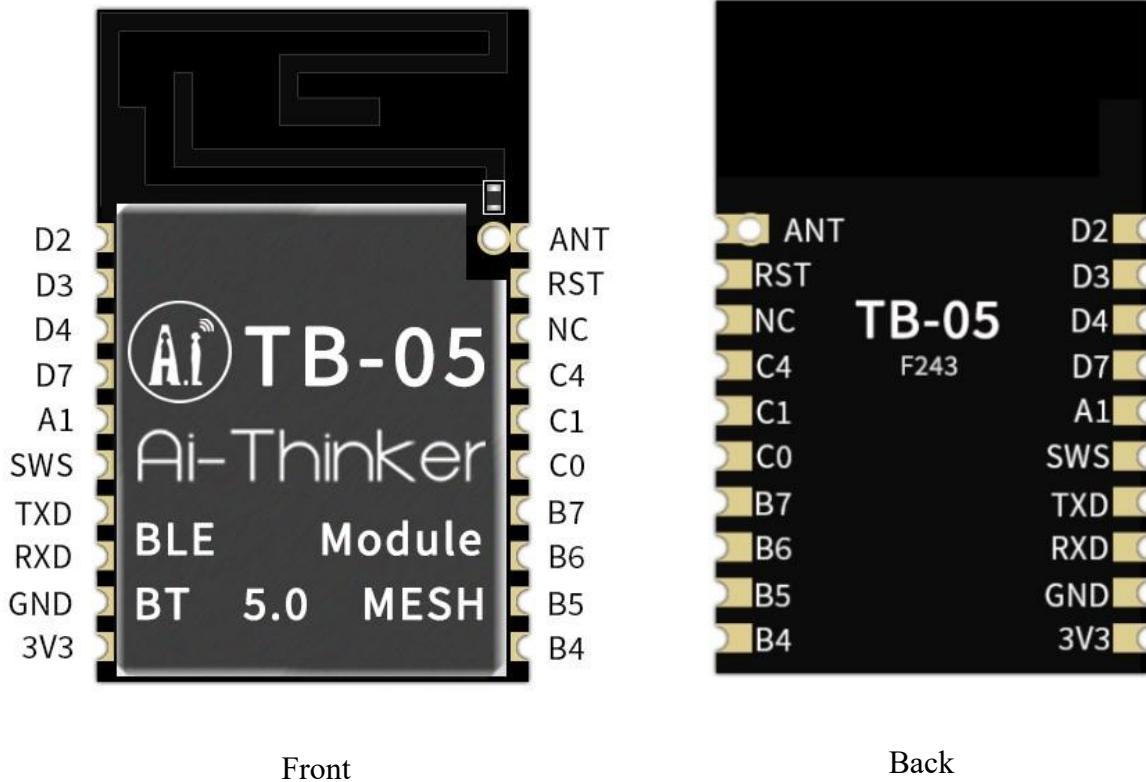


Figure 4 dimension diagram (unit: mm)

## 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.



**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



## 6. Antenna parameters

### 6.1. Schematic of Antenna Test Prototype



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

## 6.2. Antenna S parameter

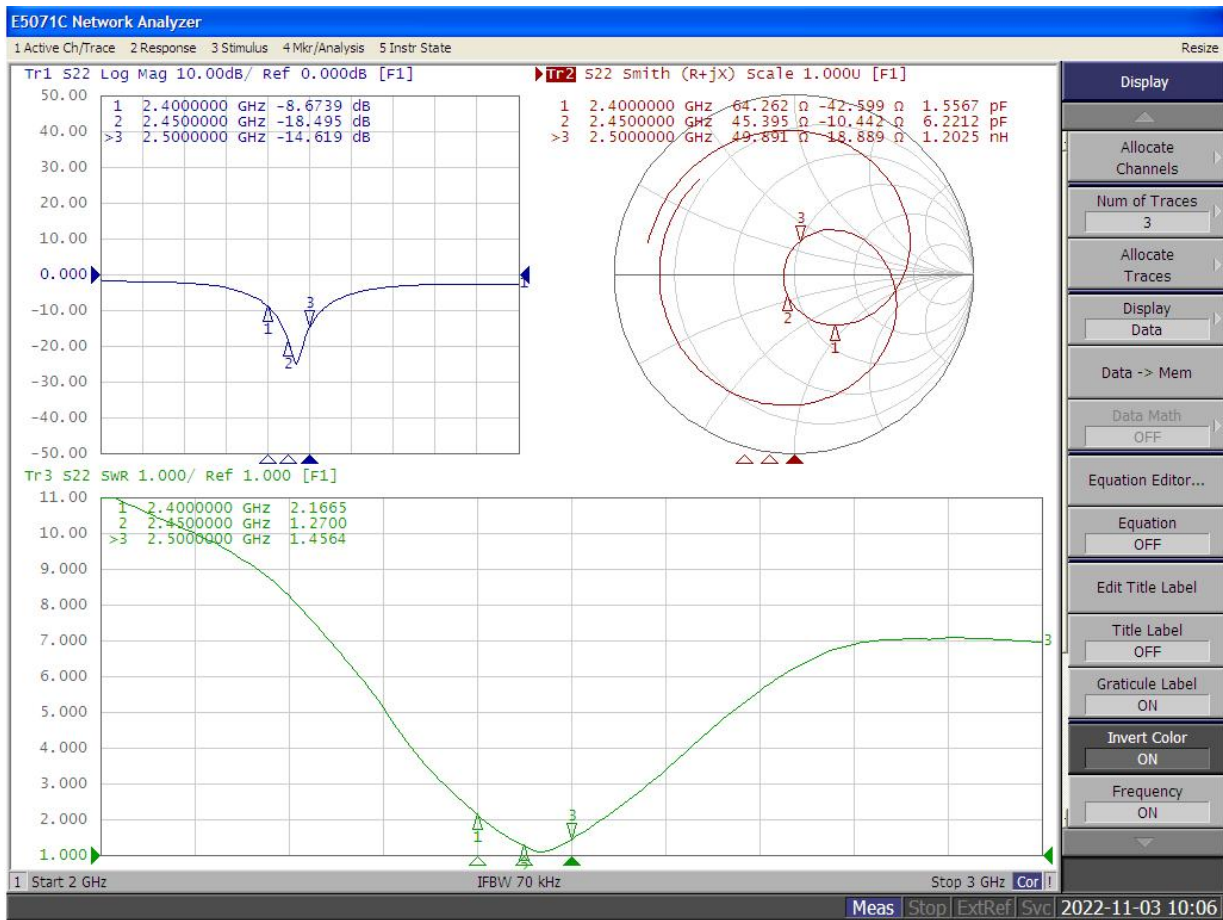


Figure 8 Antenna S parameters

## 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

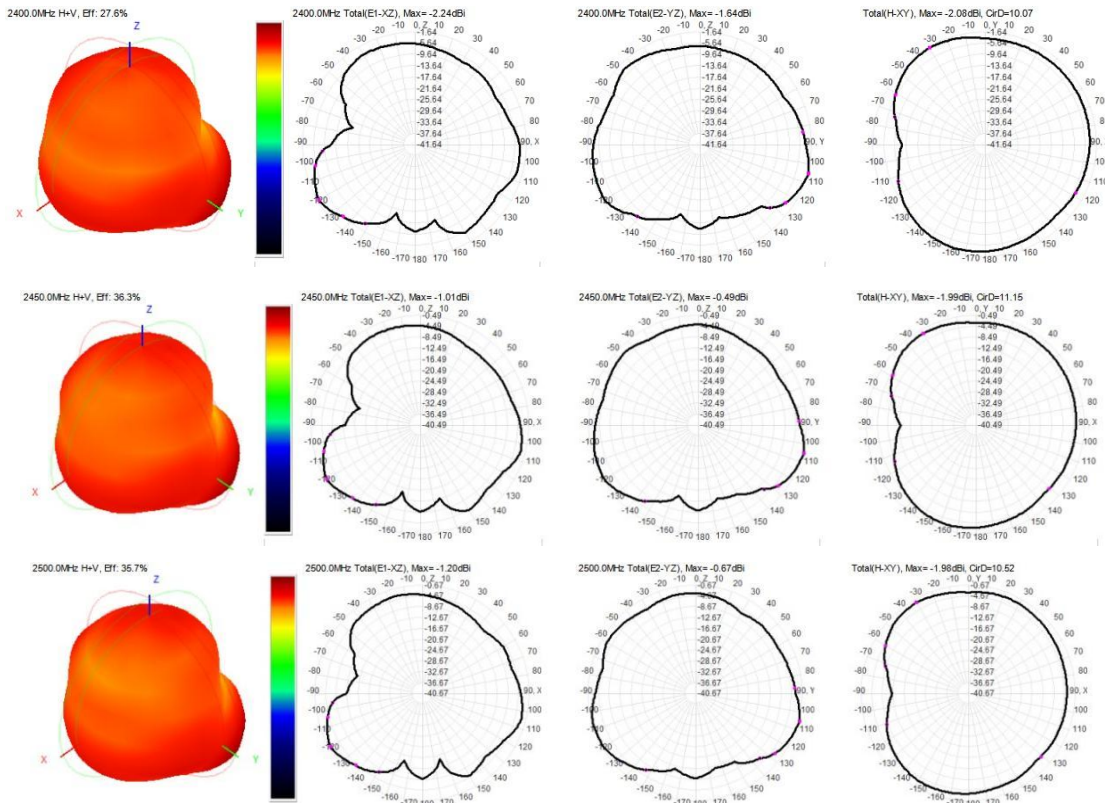


Figure 9 antenna field type diagram

## 7. Design guidance

### 7.1. Application guidance circuit

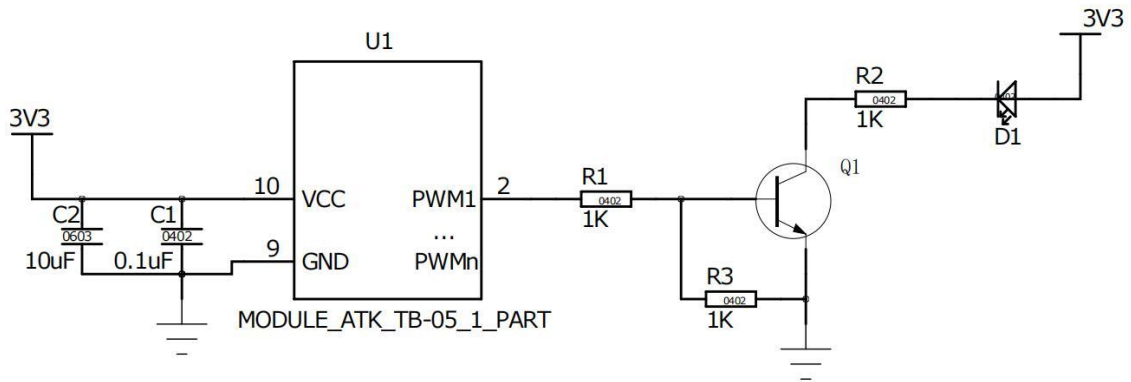


Figure 10 Application Guidance Circuit

### 7.2. Recommended PCB package size

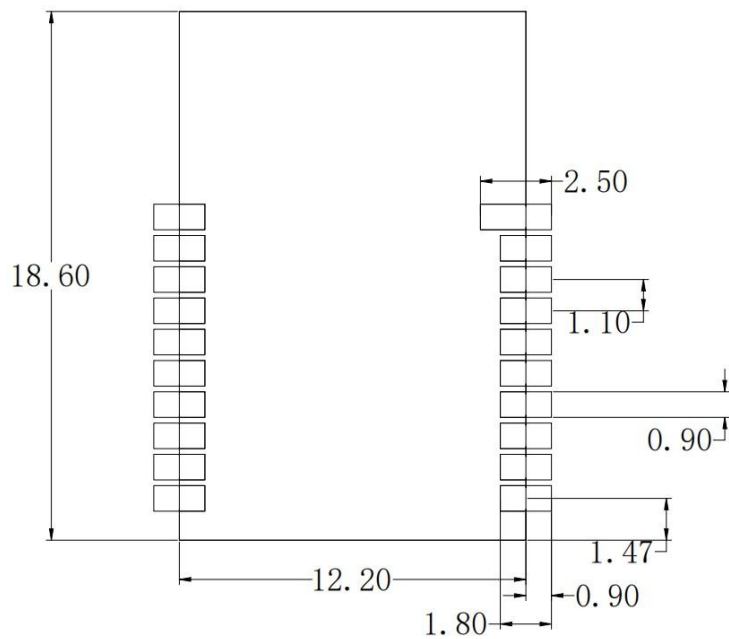


Figure 111 Recommended PCB Package Size (Unit: mm)

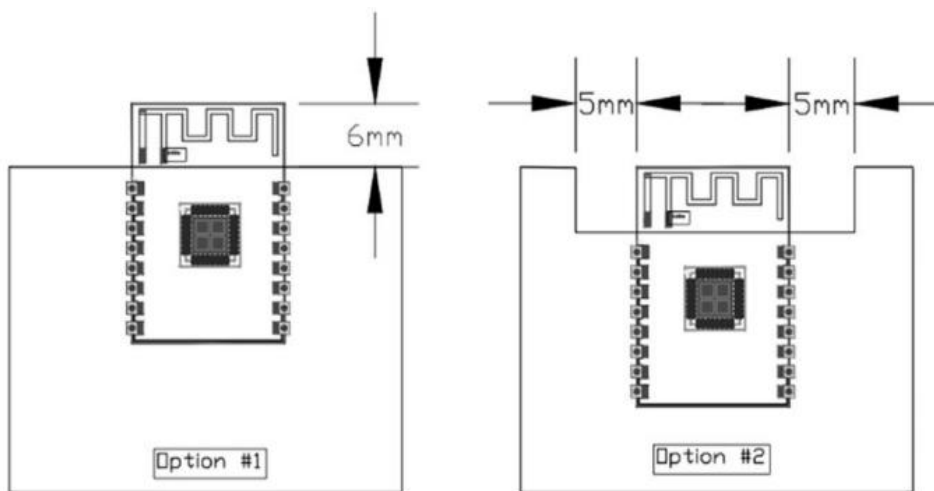
### 7.3. Antenna layout requirements

- 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

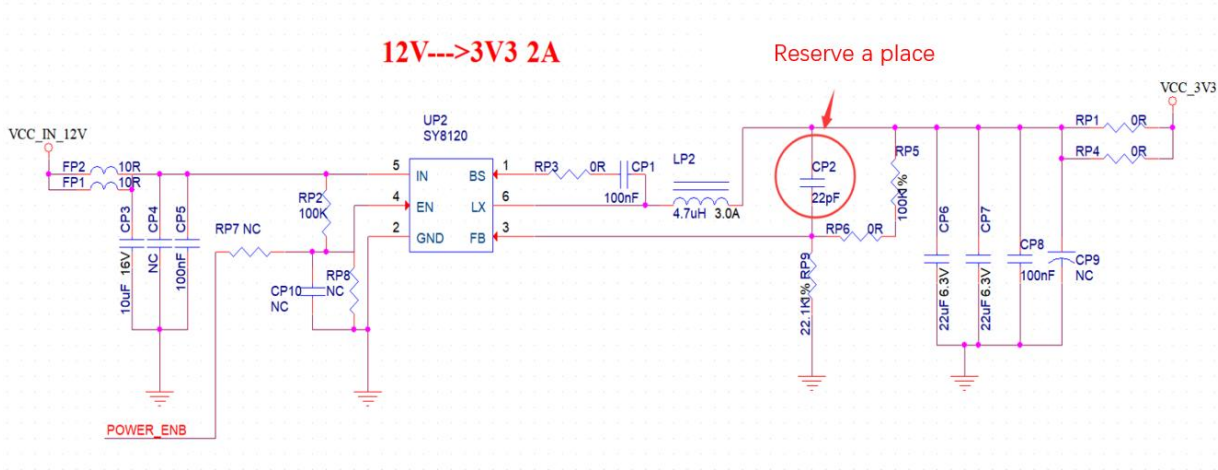


Figure 13 DC-DC Buck Circuit Diagram

## 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

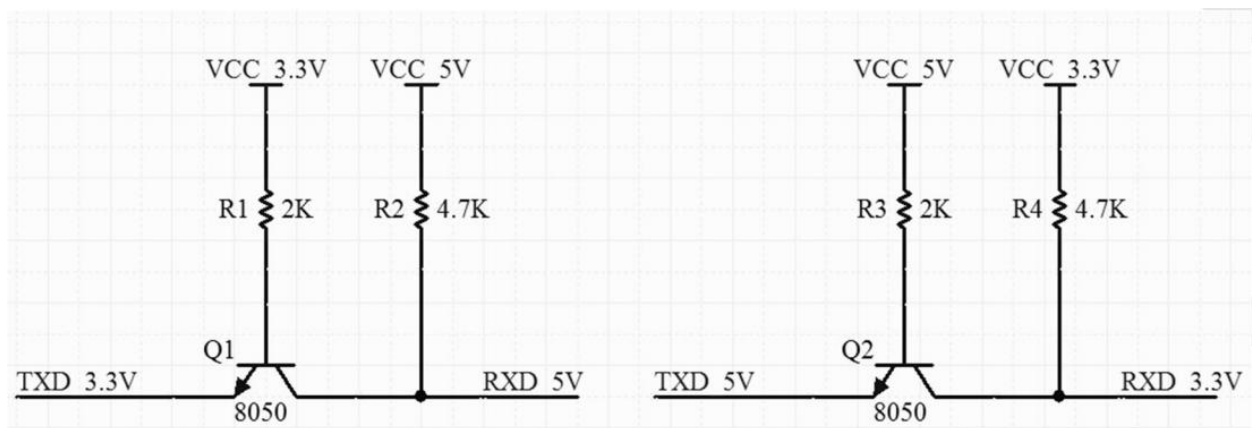


Figure 14 Level convert Circuit

## 8. Storage conditions

- The product sealed in the moisture-proof bag should be stored in a non-condensing atmosphere of <math><40^{\circ}\text{C}/90\% \text{RH}</math>.
- 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  $25\pm 5^{\circ}\text{C}/60\% \text{RH}$ , otherwise it needs to be baked before it can be put on line again.

## 9. Reflow Welding Curve

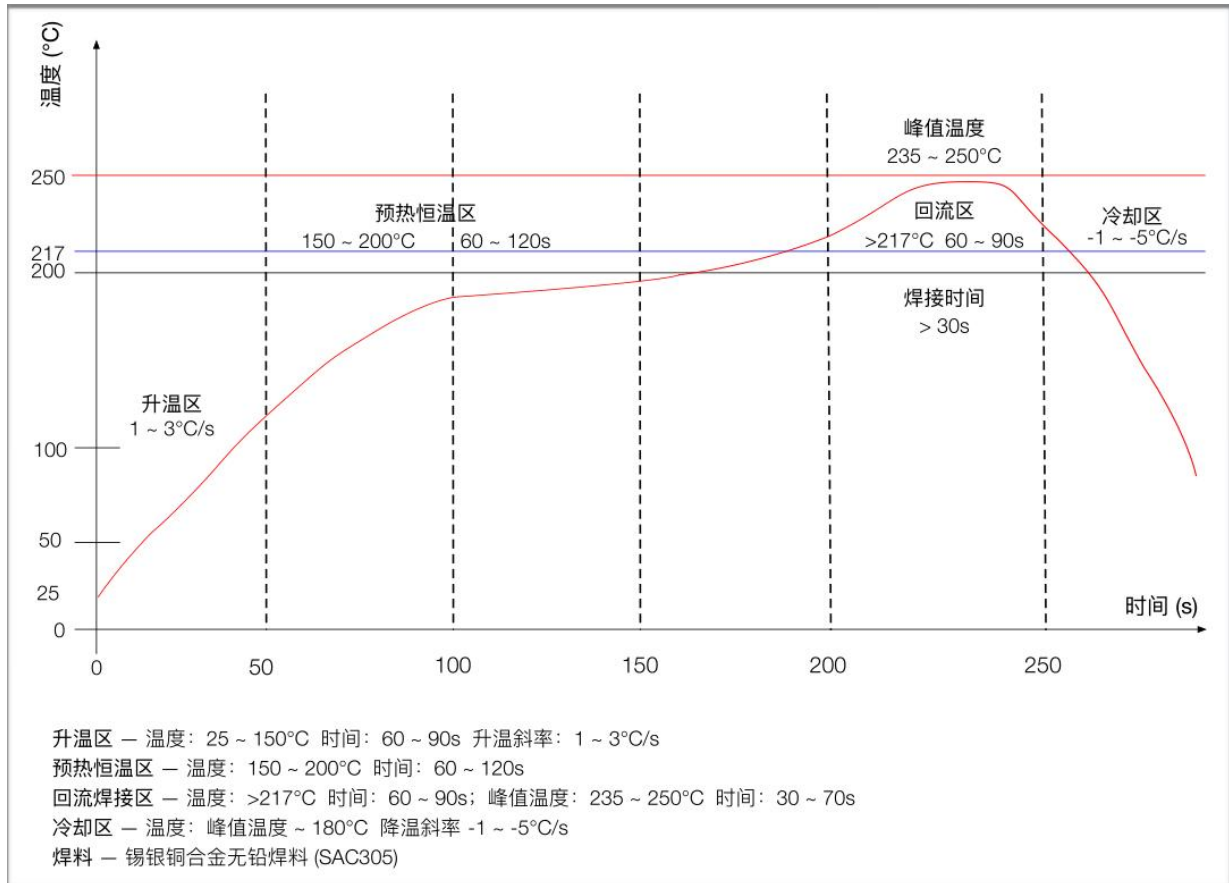


Figure 15 reflow welding diagram

## 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

[Ai-Thinker official website](#)

[Office forum](#)

[Develop DOCS](#)

[LinkedIn](#)

[Tmall shop](#)

[Taobao shop](#)

[Alibaba shop](#)

Technic support email: [support@aithinker.com](mailto:support@aithinker.com)

Domestic business cooperation: [sales@aithinker.com](mailto:sales@aithinker.com)

Overseas business cooperation: [overseas@aithinker.com](mailto:overseas@aithinker.com)

Company Address: Room 403,408-410, Block C, Huafeng Smart Innovation Port, Gushu 2nd Road, Xixiang, Baoan District, Shenzhen.

Tel: 0755-29162996



Wechat mini program



WeChat official account

## Disclaimer and Copyright Notice

The information in this article, including the URL address for reference, is subject to change without notice.

The document is provided "as is" without any warranty, including any warranty of merchantability, suitability for a particular purpose or non-infringement, and any warranty mentioned elsewhere in any proposal, specification or sample. This document is not responsible for any infringement of any patent rights arising from the use of the information in this document. This document does not hereby grant any license for the use of intellectual property, whether express or implied, by estoppel or otherwise.

The test data obtained in this paper are all obtained by the laboratory test of Ai-Thinker, and the actual results may be slightly different.

It is hereby declared that all trade names, trademarks and registered trademarks mentioned in this article are the property of their respective owners.

The final interpretation right belongs to Shenzhen Ai-Thinker Technology Co., Ltd.

## Notice

The contents of this manual may change due to product version upgrades or other reasons.

Shenzhen Ai-Thinker Technology Co., Ltd. reserves the right to modify the contents of this manual without any notice or prompt.

This manual is only used as a guide. Shenzhen Ai-Thinker Technology Co., Ltd. makes every effort to provide accurate information in this manual. However, Shenzhen Ai-Thinker Technology Co., Ltd. does not ensure that the contents of the manual are completely error-free, and all statements, information and suggestions in this manual do not constitute any express or implied guarantee.