

TB-03F Specification

Version V1.1.0

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1. Product Overview

TB-03F intelligent lighting module is a Bluetooth module designed based on the TLSR8253F512AT32 chip and conforming to BT 5.0 low power Tmall Genie Mesh. This module supports the direct control of Tmall Genie and has the Bluetooth mesh networking function. The devices are peered through Star network communication, using Bluetooth broadcast for communication, can ensure timely response in the case of multiple devices. This module is applied to intelligent light control, which can meet the requirements of low power consumption, low latency and short-range wireless data communication.

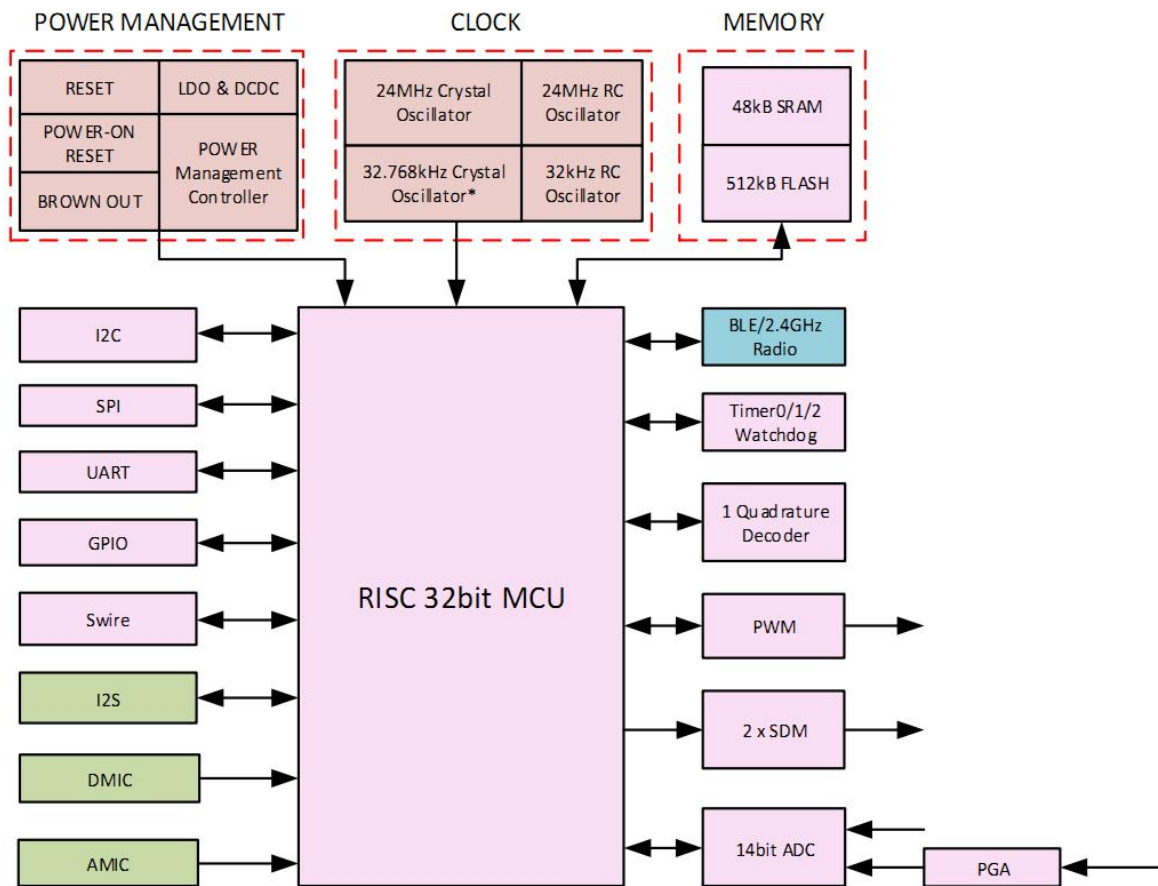


Figure 1 Main chip architecture diagram

1.1. Characteristic

- Can be directly controlled by Tmall Elf without a gateway
- SMD-22 package
- 6 PWM outputs
- With on-board antenna, no need to design antenna
- Brightness (duty cycle) adjustment range 5% -100%
- Factory default 50% duty cycle for cool and warm colors
- PWM output frequency 1KHz
- Support multiple sleep modes, deep sleep current as low as 0.4uA
- With wall switch to switch color temperature function
- Support secondary development

2. Main parameters

Table 1 Description of the main parameters

Module model	TB-03F
Dimension	24*16*3.1(±0.2)MM
Package	SMD-22
Wireless standard	BT 5.0
Frequency range	2400 ~ 2483.5MHz
Transmit power	Maximum 10dBm
Receive sensitivity	Typical -93dB
Interface	GPIO/PWM/SPI/ADC/I2S
Operating	-40°C ~ 105 °C
Storage	-40 °C ~ 125 °C , < 90%RH
Power supply	Voltage 2.7V ~ 3.6V, current≥50mA
Power consumption	deep sleep mode: 0.4uA
	Standby mode: 2.51mA
	TX(PRBS9)@10dBm:6.36mA
	TX(CarrierData)@10dBm:20.54mA
Transmission	Open Line of Sight: 80m ~ 150m

2.1. Static electricity requirement

TB-03F 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	Min.	Typical value	Max.	Unit
Power supply voltage	2.7	3.3	3.6	V
I/O voltage (VCCIO)	-0.3	-	3.6	V
Operating temperature	-40	-	+85	°C
Storage temperature	-40	-	+125	°C

2.3. BLE RF Performance

Table 3 BLE radio frequency performance table

Description	Typical value			Unit
Frequency range	2400 ~ 2483.5MHz			MHz
Output Power				
Rate Mode	Min.	Typical value	Max.	Unit
1Mbps	-	9.5	10	dBm
2Mbps	-	9.5	10	dBm
Receive Sensitivity				
Rate Mode	Min.	Typical value	Max.	Unit
1Mbps sensitivity@30.8%PER	-	-93	-	dBm
2Mbps sensitivity@30.8%PER	-	-93	-	dBm

2.4. Power

The following power consumption data are based on a 3.3V power supply and measured at an ambient temperature of 25°C.

- POUT power for all transmit modes is measured at the antenna interface.
- All emission data are measured in continuous emission mode based on 100% duty cycle.

Table 4 Power consumption table

Mode	Min.	Typical value	Max.	Unit
Transmit power (10dBm)	-	20.54	-	mA
Receive power	-	6.36	-	mA
Standby power consumption	-	2.51	-	mA
Light sleep	-	1.5	-	μA
Deep sleep	-	0.4	-	μA

3. Appearance Dimensions

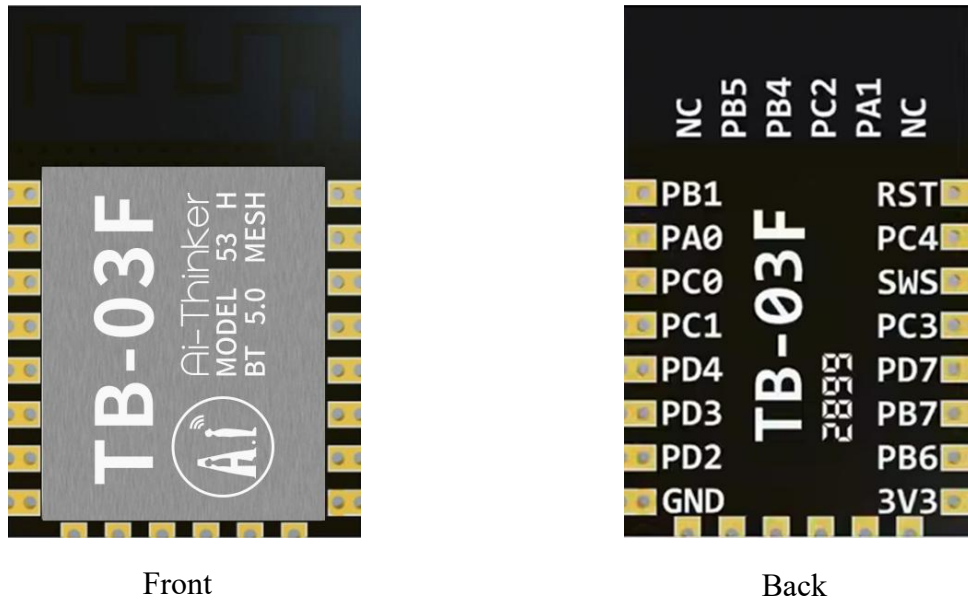


Figure 3 Appearance (rendering is for reference only, the actual object shall prevail)

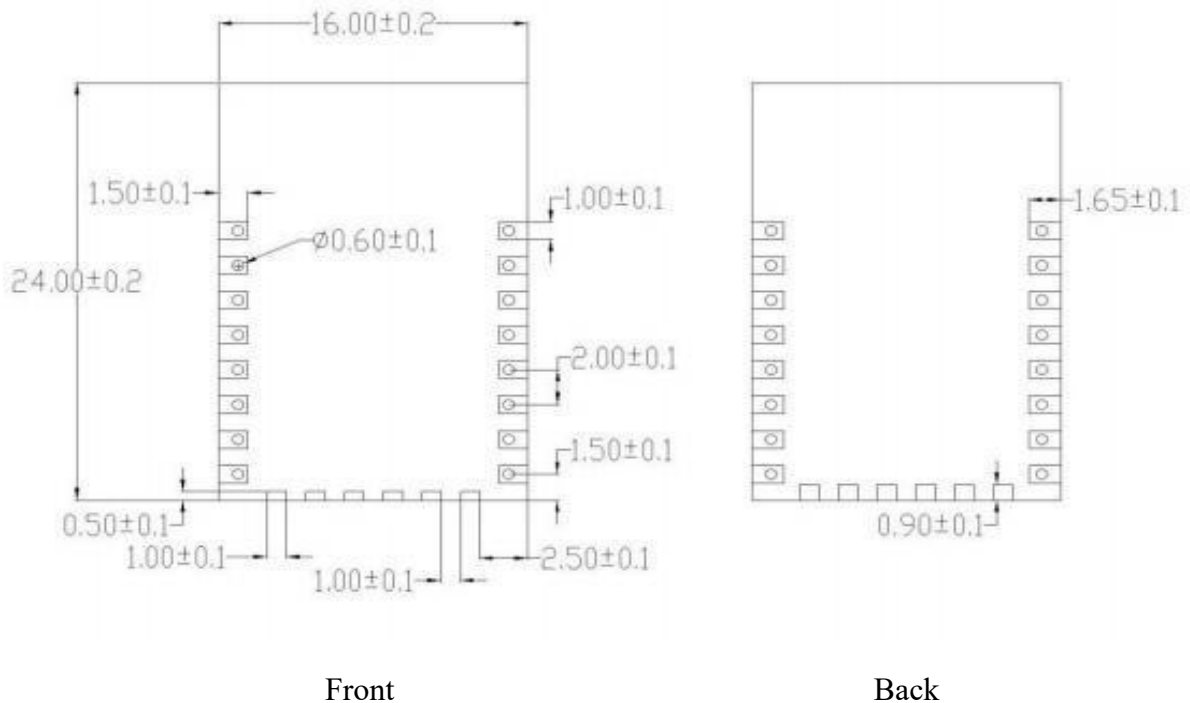


Figure 4 Dimension diagram

4. Pin Definition

The TB-03F module has a total of 22 interfaces. For example, the pin diagram, the pin function definition table is the interface definition.

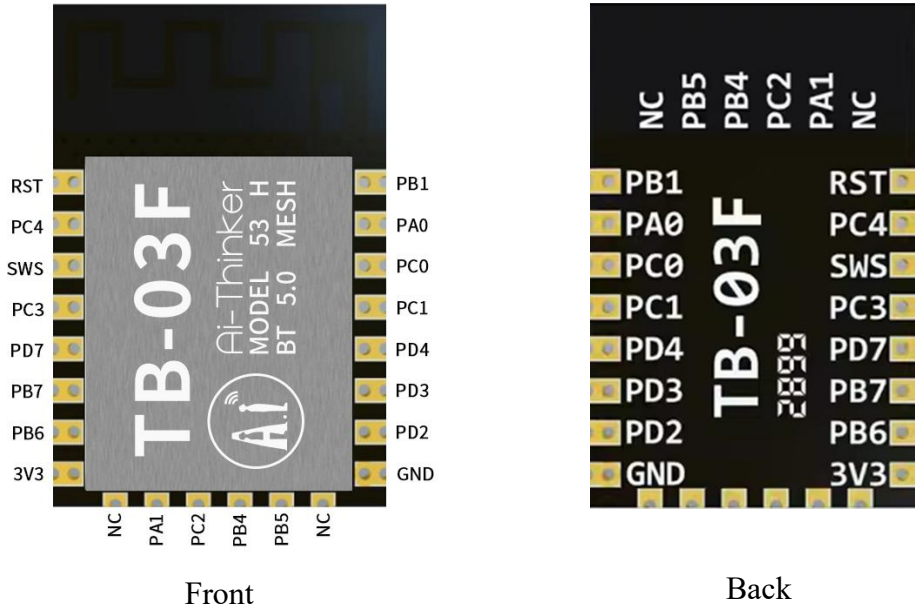


Figure 5 Schematic diagram of module pins

Table 5 Pin function definition table

No.	Name	Function
1	RST	Reset active low
2	PC4	PWM2 output/UART_CTS/PWM0 Inverted output/SAR ADC input /GPIO PC4
3	SWS	Single line slave/UART_RTS/GPIO PA7
4	PC3	PWM1 output/UART_RX/I2C Serial clock/32kHz Crystal input (optional)/GPIO PC3
5	PD7	GPIO PD7/SPI clock (I2C_SCK)
6	PB7	SPI_DO Data output/UART_RX/SAR ADC input/GPIO PB7
7	PB6	SPI_DI data input (I2C_SDA) /UART_RTS/SAR ADC input/GPIO PB6
8	3V3	Power supply
9	NC	Blank
10	PA1	GPIO PA1/ I2S_clock
11	PC2	PWM0 output/I2C serial data/32kHz Crystal output (optional) /GPIO PC2
12	PB4	PWM4 output/SAR ADC input/GPIO PB4
13	PB5	PWM5 output/SAR ADC input/GPIO PB5
14	NC	Blank
15	GND	Ground
16	PD2	GPIO PD2/PWM3 output/SPI Chip selection (active low)/I2S_LR
17	PD3	GPIO PD3/PWM1 Inverted output/I2S_SDI
18	PD4	GPIO PD4/Single line host SWM/PWM2 Inverted
19	PC1	I2C_CLK/PWM1 Inverted output/PWM0 output/GPIO PC1
20	PC0	I2C_SDA/PWM4 Inverted output/UART_RTS /GPIO PC0
21	PA0	UART_RX/GPIO PA0/PWM0 Inverted output
22	PB1	UART_TX/GPIO PB1/PWM4 output/SAR ADC input

5. Schematic

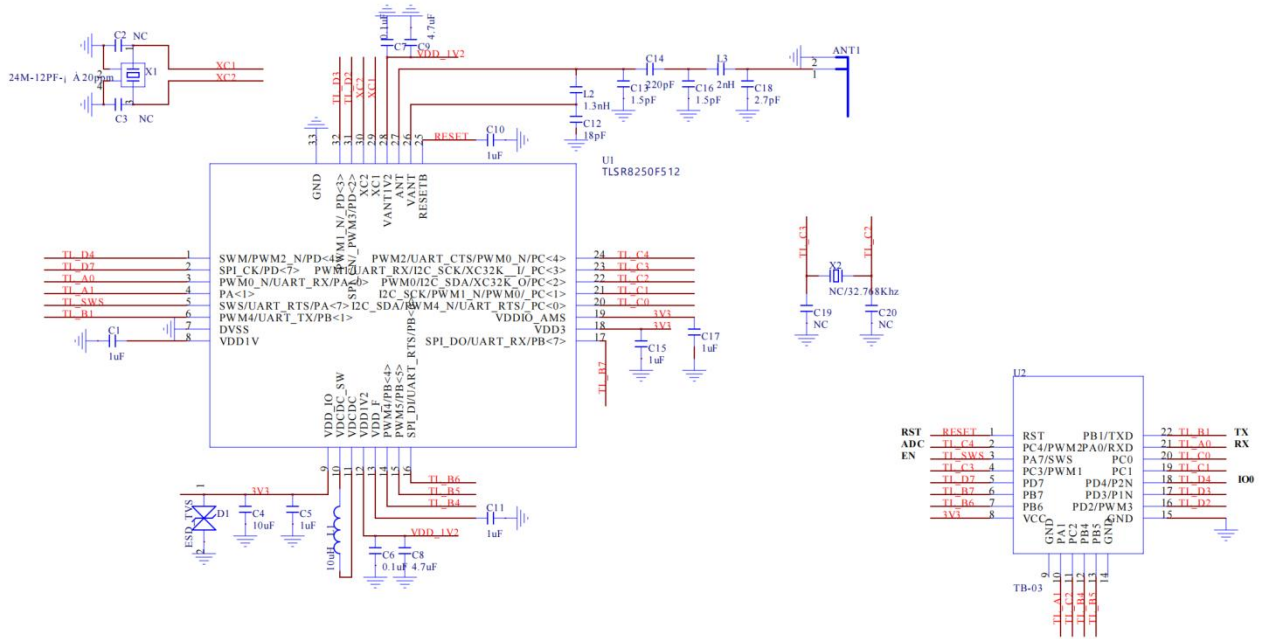


Figure 6 Schematic diagram

6. Design guidance

6.1. Application guidance circuit

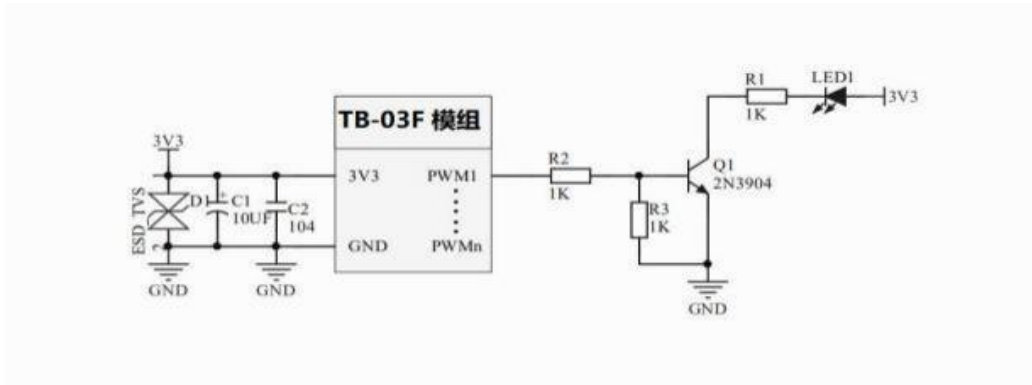


Figure 7 Application guidance circuit

6.2. Recommended PCB package size

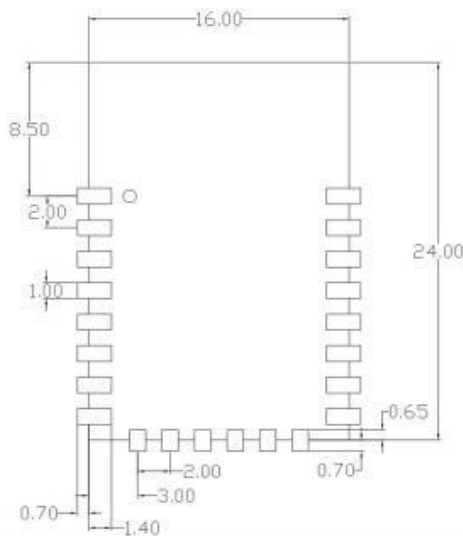


Figure 8 Recommended PCB package size (top view)

Note:

- Below is the TB-03F module package diagram, it is recommended to design the PCB board according to this diagram, so that the module can work normally on the PCB board; and pay attention to the design of the pad, the design of the pads on the PCB can not be offset from the corresponding pads of the module, and the expansion of the PCB pads relative to the module pads does not affect the use of the module.

6.3. Antenna layout requirements

- Regarding the installation position on the motherboard, the following two methods are recommended:
 - ✓ Solution 1: Place the module on the edge of the motherboard, and the antenna area extends beyond the edge of the motherboard.
 - ✓ Option 2: Place the module on the edge of the motherboard, and hollow out an area at the edge of the motherboard where the antenna is located.
- In order to meet the performance of the onboard antenna, it is forbidden to place metal parts around the antenna and keep away from high-frequency devices.

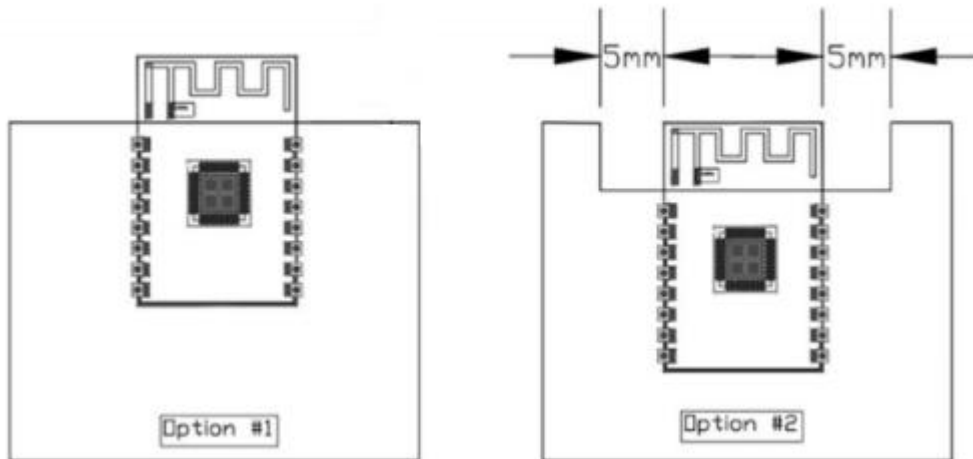


Figure 9 Schematic diagram of antenna layout

6.4. Power supply

- Recommended 3.3V voltage, peak current above 500 mA.
- It is recommended to use LDO; if DC-DC, ripple control within 30 mV.
- 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 change is large.
- 3.3V power interface, it is recommended to add ESD devices.
- If the power supply is boosted from 1.5V to 3.0V for more than 15 ms, add the voltage reset IC or use the wide voltage version Flash.
- During the repeated up and down process, if the voltage cannot be less than 0.3V, the voltage reset IC must be increased.

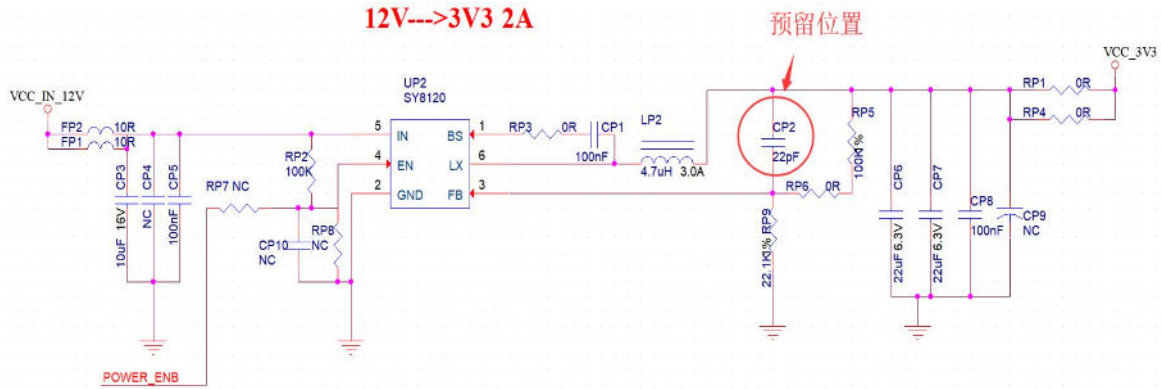


Figure 10 DC-DC step-down circuit diagram

6.5. GPIO

- There are some IO ports on the periphery of the module. If you need to use it, it is recommended to connect a 10-100 ohm resistor in series to the IO port. This can suppress overshoot and make the levels on both sides more stable. Helps with both EMI and ESD.
- For the up and down pull-down of the special IO port, please refer to the instructions in the specification sheet, which will affect the startup configuration of the module.
- The IO port of the module is 3.3V. If the level of the main control and the IO port of the module do not match, a level conversion circuit needs to be added.
- If the IO port is directly connected to a peripheral interface or a terminal such as a pin header, it is recommended to reserve ESD devices near the terminals in the IO port wiring.

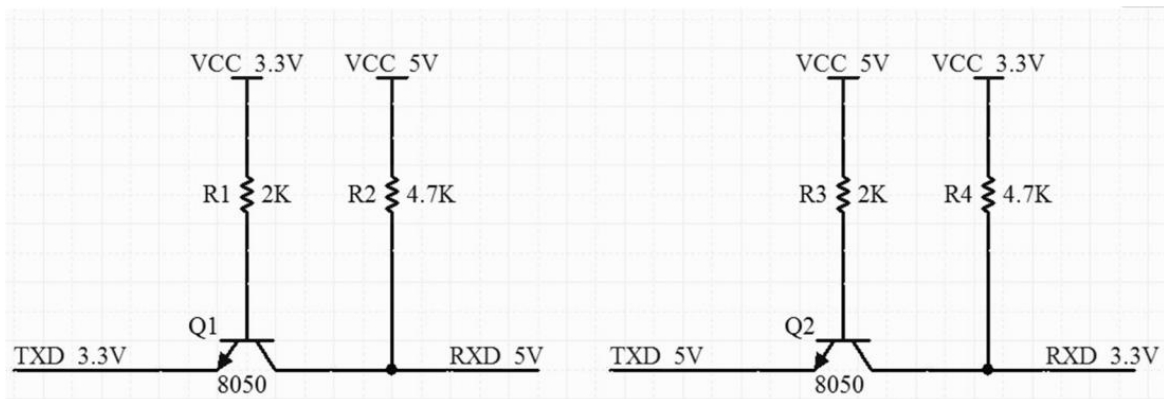


Figure 11 Level conversion circuit

6.6. Design description of PWM dimming scheme

For lamps that require dimming, you only need to connect the PWM pins of the corresponding color to the control end of the driving circuit of the subsequent stage; the PWM independently outputs a digital signal with a 100-level adjustable duty cycle, and the latter circuit can be a voltage The driving type may be a current driving type.

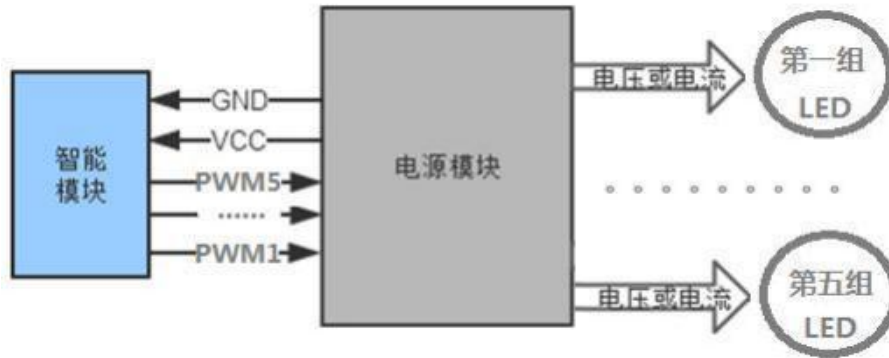


Figure 12 Schematic diagram of the connection

6.7. LED Drive Reference Design

TB-03F module application only needs 3.3V power supply and simple driving circuit to achieve intelligent light control. Take MOS tube to drive a channel of white light as an example, the design reference is as follows; CW_I is the module's positive white light PWM output pin , Q1 is MOS tube, WW is LED lamp bead, the other 4 road lamp driving circuit is the same as this road design method.

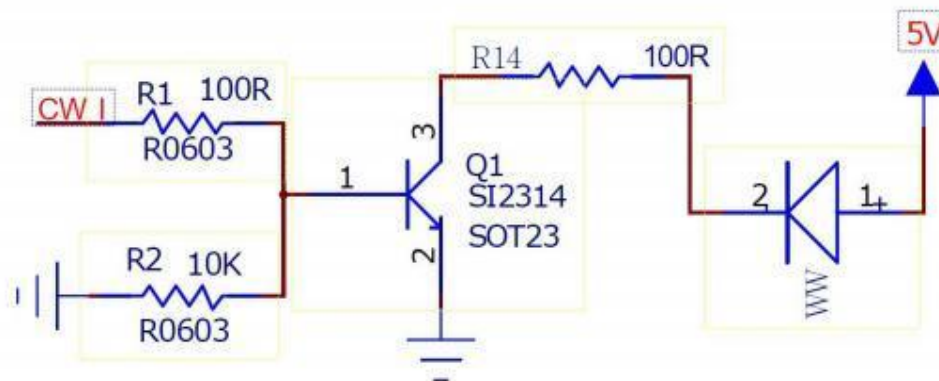


Figure 13 Driver circuit diagram

6.8. Secondary development

The TB-03F module supports users to write firmware programs to achieve customized functions.

If you use a Linux machine to develop the firmware, you can refer to the SDK, documentation and source address of Anxin's collation:

https://github.com/Ai-Thinker-Open/Telink_825X_SDK.

If you use Windows development, please refer to the original SDK provided by the chip manufacturer, download address:

<http://wiki.telink-semi.cn>

7. Storage conditions

Products sealed in moisture-proof bags should be stored in a non-condensing atmospheric environment $<40^{\circ}\text{C}/90\%\text{RH}$.

The module's moisture sensitivity level MSL is level 3.

After the vacuum bag is unsealed, it must be used within 168 hours at $25\pm 5^{\circ}\text{C}/60\%\text{RH}$, otherwise it will need to be baked before it can be put online again.

8. Reflow soldering curve

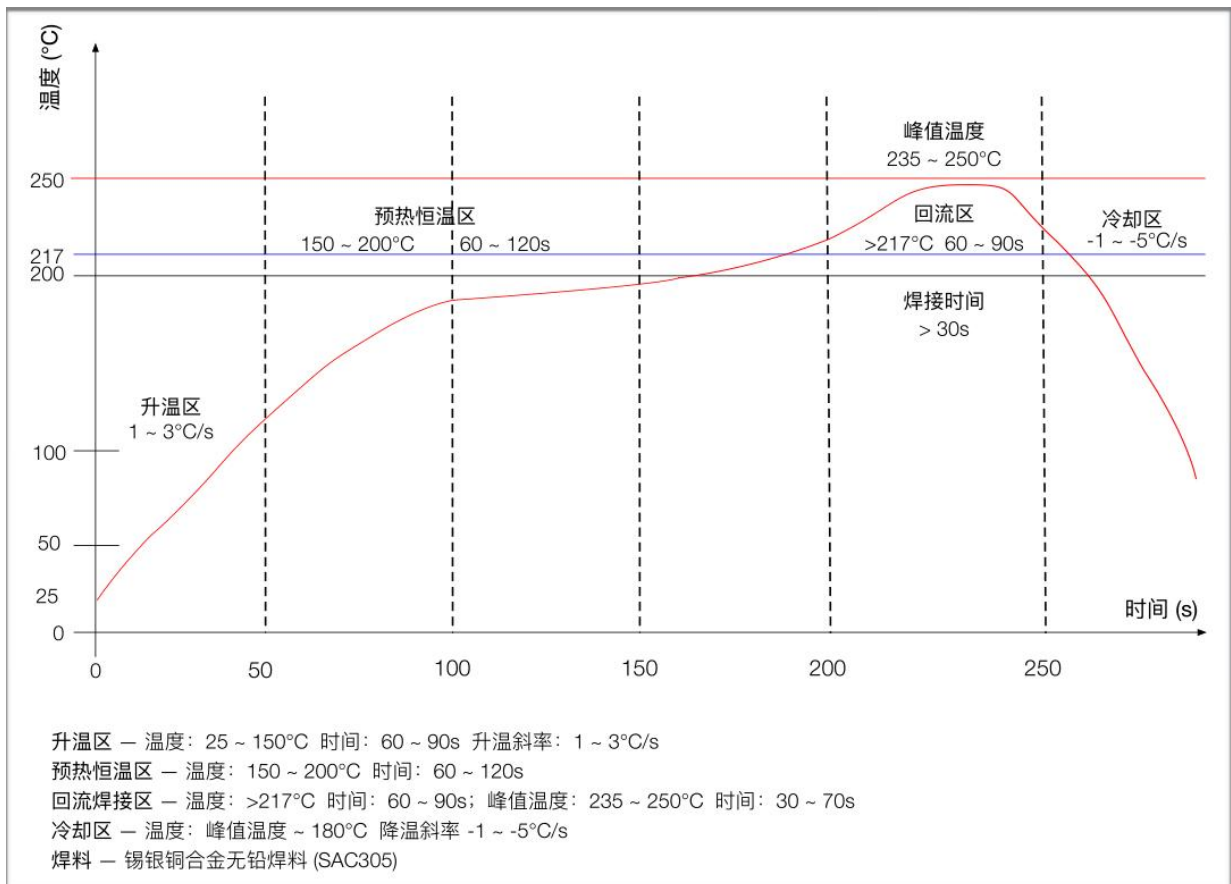


Figure 14 Reflow soldering curve

9. Product Packaging Information

TB-03F module is packaged with 800 pcs / disk.. As shown below:



Figure 15 Packaging and taping diagram

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