



Ai-WB2-01F Specification

Version V1.0.2

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Document resume

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1. Product Overview

Ai-WB2-01F is a Wi-Fi&BT module developed by Shenzhen Ai-Thinker Technology Co., LTD. The module is equipped with BL602 chip as the core processor and supports Wi-Fi 802.11b/g/n protocol and BLE 5.0 protocol. The BL602 chip is equipped with a 32-bit RISC CPU with low power consumption, 192 Hz main frequency, 276KB RAM and abundant peripheral interfaces, including SPI, UART, I2C, PWM, ADC, DAC and GPIO. It can be widely used in the Internet of Things (IoT), mobile devices, wearable electronic devices, smart home and other fields.

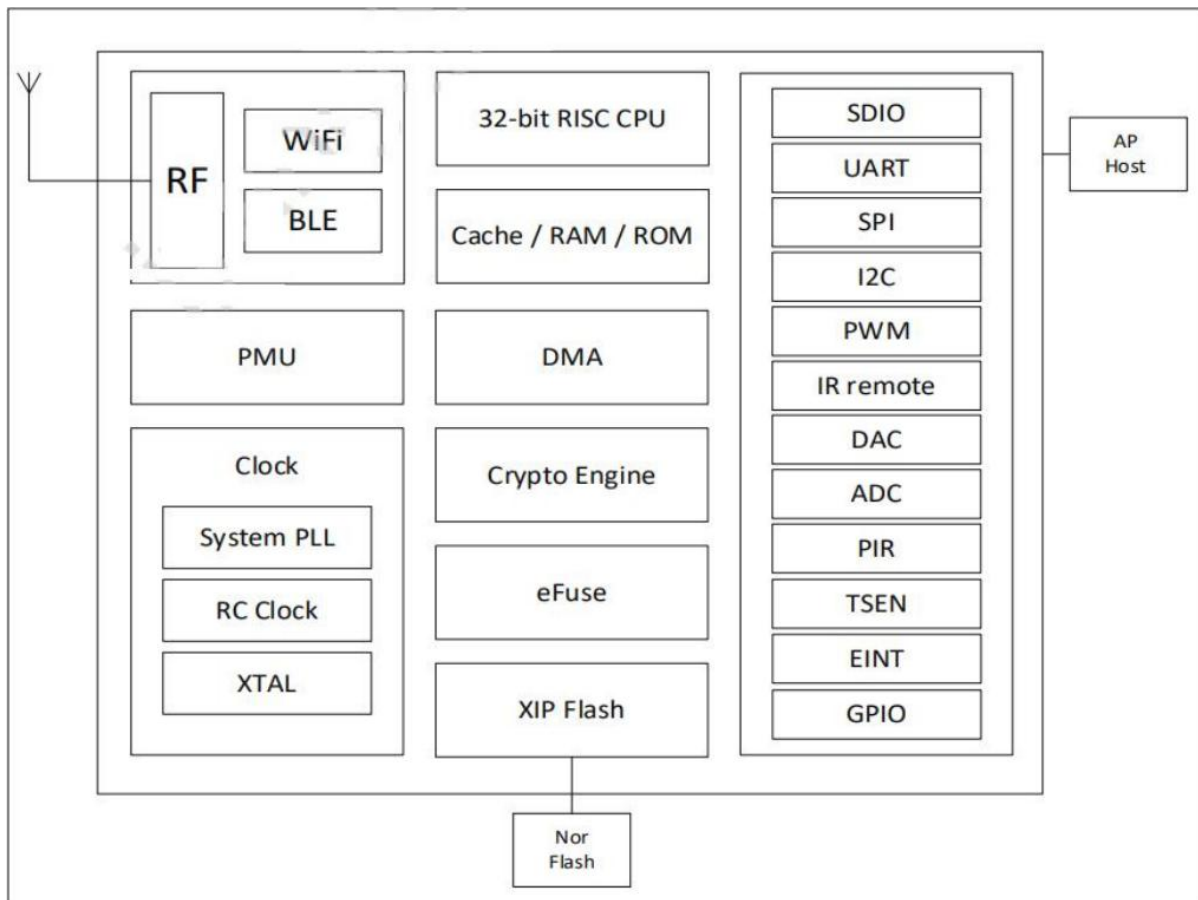


Figure 1 Main chip block diagram

1.1. Characteristic

- The package is SMD-18
- Support IEEE 802.11 b/g/n protocol
- Wi-Fi Security Support WPS/WEP/WPA/WPA2 Personal/WPA2 Enterprise/WPA3
- Support 20MHz bandwidth and Max rate is 72.2 Mbps
- Bluetooth BLE 5.0, Bluetooth Mesh
- Support Station + BLE mode、 Station + SoftAP + BLE mode
- Support 32-bit RISC CPU, 276KB RAM
- Secure start-up, supports mirroring with ECC-256 signature
- Support QSPI/SPI Flash instant AES decryption (OTFAD), support either AES128 CTR mode
- Support AES 128/192/256-bit encryption engine
- Support SHA-1/224/256
- Support true Random number generator (TRNG)
- Public key Accelerator (PKA), support large number basic operations, software provides signature, verification and other application program interface
- Support SPI, UART, I2C, PWM, ADC, DAC, GPIO etc
- Integrated Wi-Fi MAC/BB/RF/PA/LNA/BT
- Support a variety of sleep modes, deep sleep current 12μA
- Universal AT instruction for quick start
- Support secondary development, integrated Windows, Linux development environment

2. Main parameters

Table 1 Description of the main parameters

Model	Ai-WB2-01F
Package	SMD-18
Size	10.0*11.0*3.1(± 0.2)mm
Antenna	Half-hole antenna
Frequency	2400 ~ 2483.5MHz
Operating temperature	-40℃ ~ 85℃
Storage temperature	-40℃ ~ 125℃, < 90%RH
Power supply	Support voltage 2.7V ~ 3.6V, supply current $\geq 500\text{mA}$
Interface	UART/GPIO/ADC/DAC/PWM/I2C/SPI
IO	11
UART rate	Default 115200 bps
Security	WPS/WEP/WPA/WPA2 Personal/WPA2 Enterprise/WPA3
Flash	Default 2MByte, Supported Expansion

2.1. Static electricity requirement

Ai-WB2-01F is an electrostatic sensitive device. you need to take special precautions when carrying it.



Figure 2 ESD preventive measures

2.2. Electrical characteristics

Table 2 Electrical characteristics table

Parameters		Conditio	Min.	Typical value	Max.	Unit
Voltage Supply		VDD	2.7	3.3	3.6	V
I/O	VIL	-	-	-	0.3*VDDIO	V
	VIH	-	0.7*VDDIO	-	-	V
	VOL	-	-	0.1*VDDIO	-	V
	VOH	-	-	0.9*VDDIO	-	V
	IMAX	-	-	-	15	mA

2.3. Wi-Fi RF Performance

Table 3 Wi-Fi RF performance table

Description	Typical value			Unit
Frequency range	2400 ~ 2483.5MHz			MHz
Output Power				
Mode	Min.	Typical	Max.	Unit
11n Mode HT20, PA output power	-	16	-	dBm
11g Mode, PA output power	-	17	-	dBm
11b Mode, PA output power	-	19	-	dBm
Receive Sensitivity				
Mode	Min.	Typical	Max.	Unit
11b, 1 Mbps	-	-98	-	dBm
11b, 11 Mbps	-	-90	-	dBm
11g, 6 Mbps	-	-93	-	dBm
11g, 54 Mbps	-	-76	-	dBm
11n, HT20 (MCS7)	-	-73	-	dBm

2.4. BLE RF Performance

Table 4 BLE RF performance table

Description	Typical value			Unit
Frequency range	2400 ~ 2483.5MHz			MHz
Output Power				
Rate Mode	Min.	Typical	Max.	Unit
1Mbps	-	9	15	dBm
Receive Sensitivity				
Rate Mode	Min.	Typical	Max.	Unit
1Mbps sensitivity@30.8%PER	-	-96	-	dBm

2.5. Power

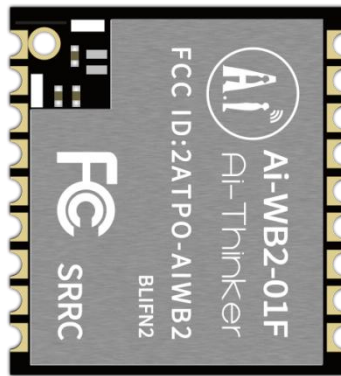
The following power consumption data is based on a 3.3V power supply and an ambient temperature of 25° C.

- All POUT power of the emission model is in the measured value of the antenna interface.
- All emission data is based on 100% of the duty ratio, measured in continuous emission mode.

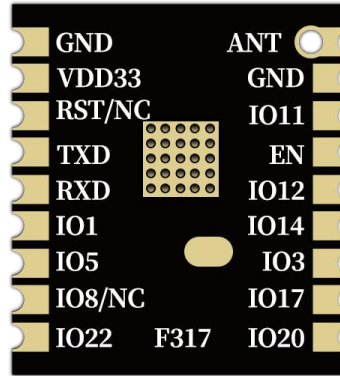
Table 5 Power consumption table

Mode	Min.	AVG	Max.	Unit
Tx 802.11b, 11Mbps, POUT=+21dBm	-	314	-	mA
Tx 802.11g, 54Mbps, POUT=+18dBm	-	265	-	mA
Tx 802.11n, MCS7, POUT=+17dBm	-	241	-	mA
Rx 802.11b, packet length 1024 byte	-	63	-	mA
Rx 802.11g, packet length 1024 byte	-	63	-	mA
Rx 802.11n, Packet length 1024 byte	-	63	-	mA
Deep-Sleep	-	12	-	μA

3. Appearance Dimensions

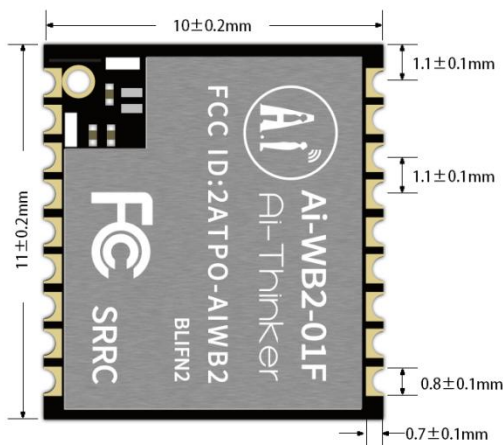


Front

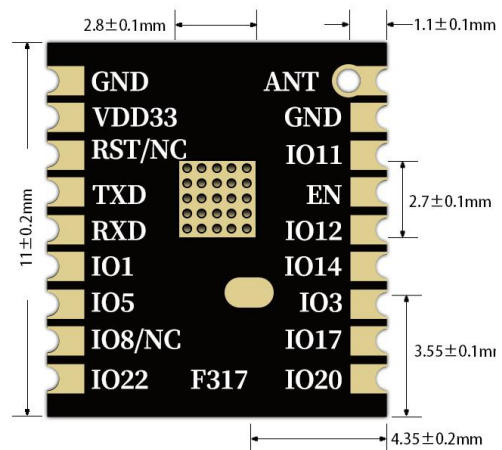


Back

Figure 3 Appearance diagram (Rendering figure is for reference only, subject to physical objects)



Front



Back

Figure 4 Dimension diagram (Unit: mm)

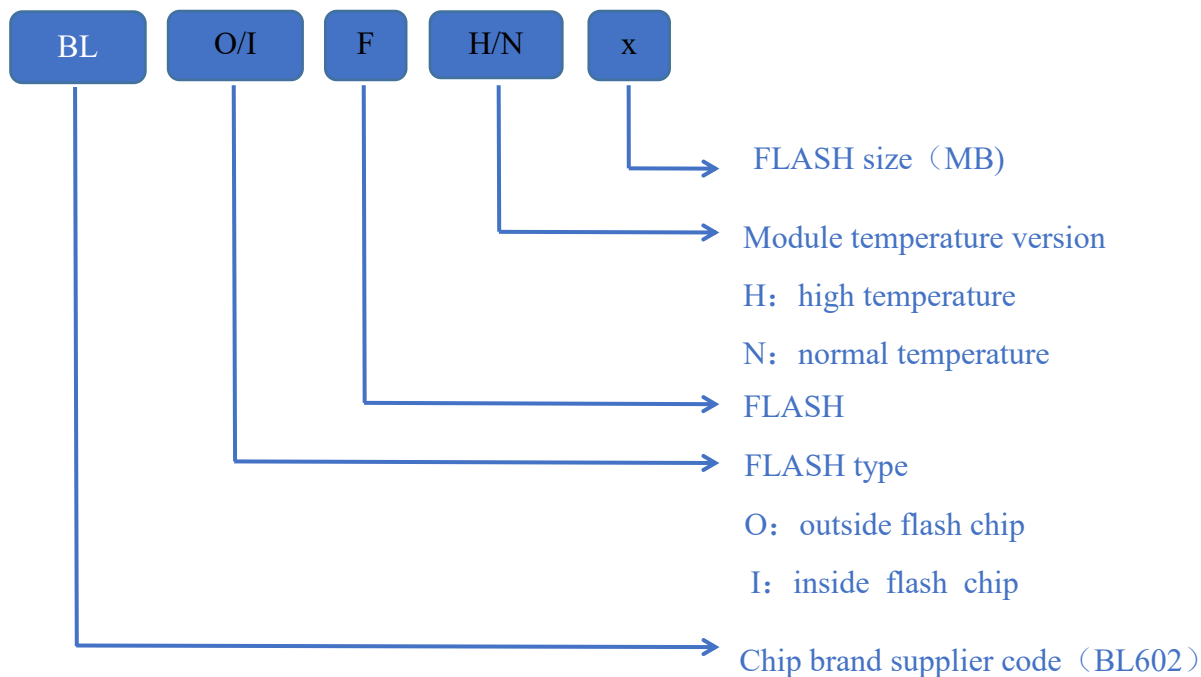


Figure 5 Shield printing information

4. Pin Definition

Ai-WB2-01F module is connected with a total of 18 pins, as shown in the pin schematic diagram, pin function definition table is the interface definition.

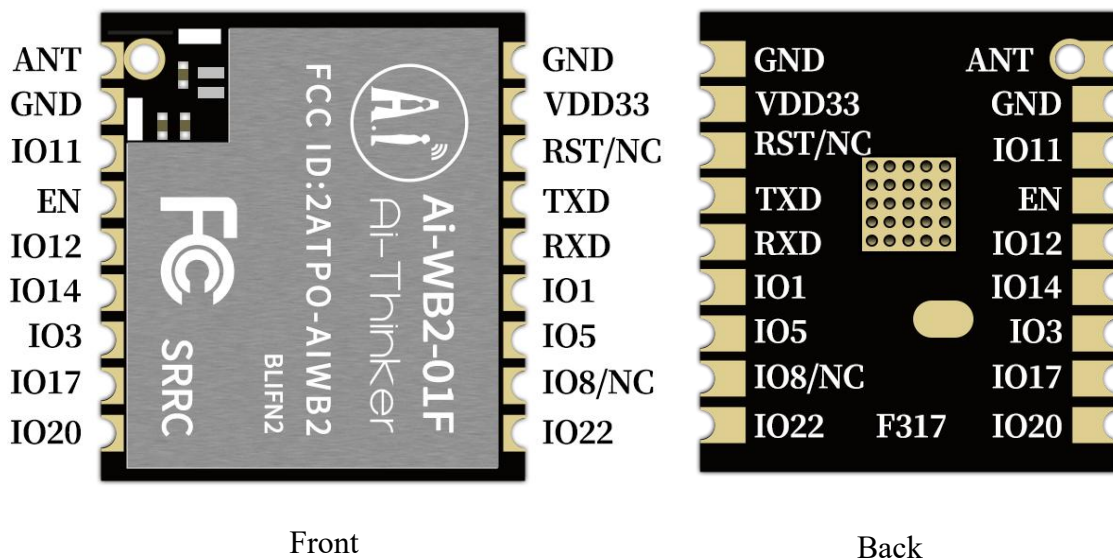


Figure 6 Pin diagram

Table 6 Pin function definition table

No.	Name	Function
1	ANT	2.4G RF output, requires an external antenna
2	GND	Ground
3	IO11	GPIO11/SPI_SCLK/IIC_SDA/ADC_CH10
4	EN	Default chip enable pin, active-high
5	IO12	GPIO12/SPI_MOSI/MISO/IIC_SCL/PWM_CH2/ADC_CH0
6	IO14	GPIO14/SPI_SS/IIC_SCL/PWM_CH4/ADC_CH2
7	IO3	GPIO3/SPI_SCLK/IIC_SDA/PWM_CH3
8	IO17	GPIO17/SPI_MOSI/MISO/IIC_SDA/PWM_CH2
9	IO20	GPIO20/SPI_MOSI/MISO/IIC_SCL/PWM_CH0
10	IO22	GPIO22/SPI_SS/IIC_SCL/PWM_CH2
11	IO8/NC	Default NC, unavailable
12	IO5	GPIO5/SPI_MOSI/MISO/IIC_SDA/PWM_CH0/ADC_CH4
13	IO1	GPIO1/SPI_MOSI/MISO/IIC_SDA/PWM_CH1
14	RXD	RXD/GPIO7/SPI_SCLK/IIC_SDA/PWM_CH2
15	TXD	TXD/GPIO16/SPI_MOSI/MISO/IIC_SCL/PWM_CH1
16	RST/NC	Default NC, unavailable
17	VDD33	3.3V power supply; It is recommended that the output current of the external power supply be higher than 500mA
18	GND	Ground
Station	IO8	Bootstrap/GPIO8/SPI_MOSI/MISO/IIC_SCL/PWM_CH3
Note: As Bootstrap, GPIO8 will be powered on at high power level, and the module will enter the burning mode. The power-on moment is at low power level, and the module starts normally.		

Figure 7 Module schematic

6. Design Guidance

6.1. Application circuit

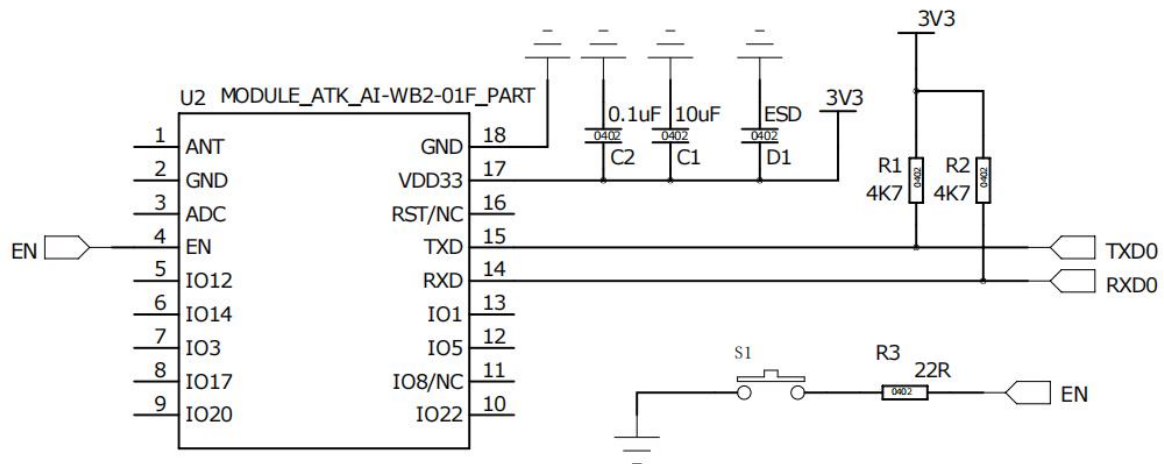


Figure 8 Application circuit diagram

- If IO used as PWM, it is recommended that the reserved on the fringes of the module of 4.7K pull down resistor. In particular, the application of the lamp control side prevents the flash phenomenon at the moment of power-on startup.
- IO8 / NC feet, unavailable by default. If you need to use it, please contact Ai-Thinker.

6.2. Recommend PCB footprint size

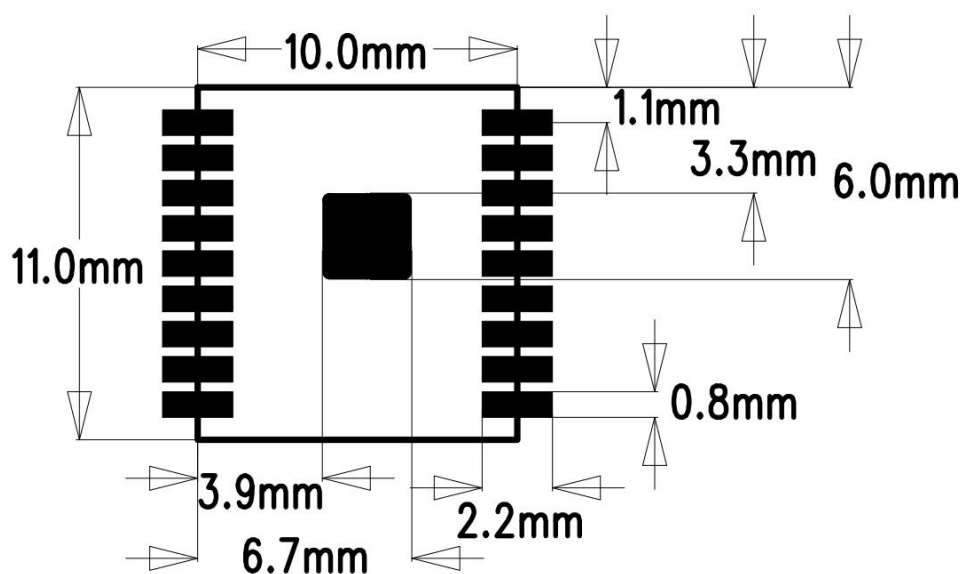


Figure 9 Recommend PCB footprint size

6.3. Antenna layout requirements

- The module need to use an external antenna.
- To meet the performance of the antenna, don't place metal parts around the antenna and keep away from high-frequency devices.

6.4. Power supply

- Recommendation 3.3 V voltage, more than 500mA peak current.
- LDO power supply is recommended; If using DC-DC, suggest to control ripple within 30mV.
- DC-DC power supply circuit suggested the reserved capacitance position, dynamic response can be large changes in load and optimize the output ripple.
- 3.3V power supply interface increases ESD device is recommended.

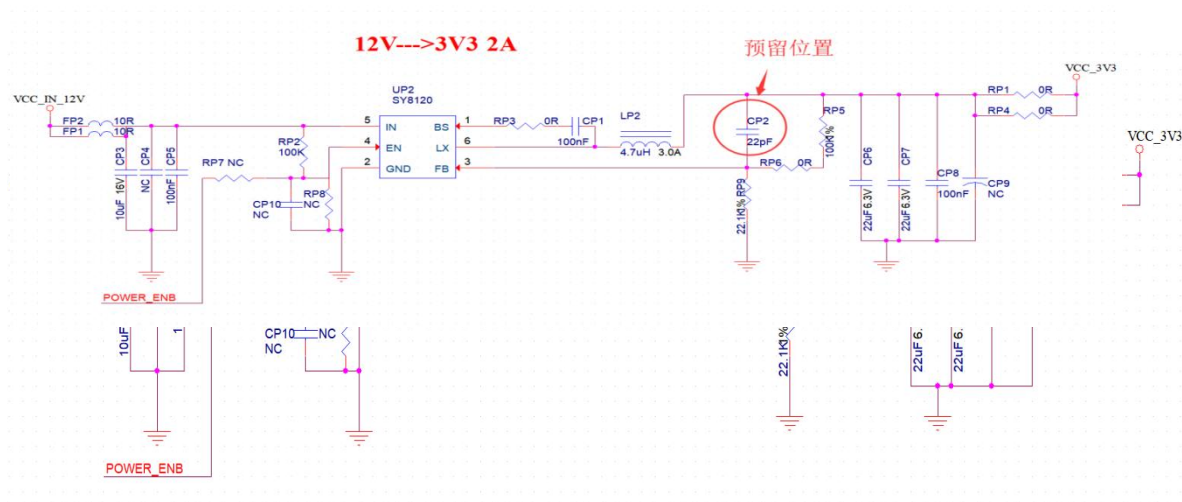


Figure 10 DC-DC step-down circuit diagram

6.5. GPIO

- Module peripheral raises some IO port, if you want to use advice on IO series resistance of 10-100ohm. This can inhibit overshoot and make both sides more stable. It's helpful for EMI and ESD.
- Special IO port pull up or down, need to refer to instructions on the use of the specification, here will affect the launch configuration module.
- Module IO port is 3.3V, if the master IO port level doesn't match with module, need to increase the level conversion circuit.
- If the IO port is directly connected to a peripheral port or a pin terminal, reserve an ESD component near the IO port.

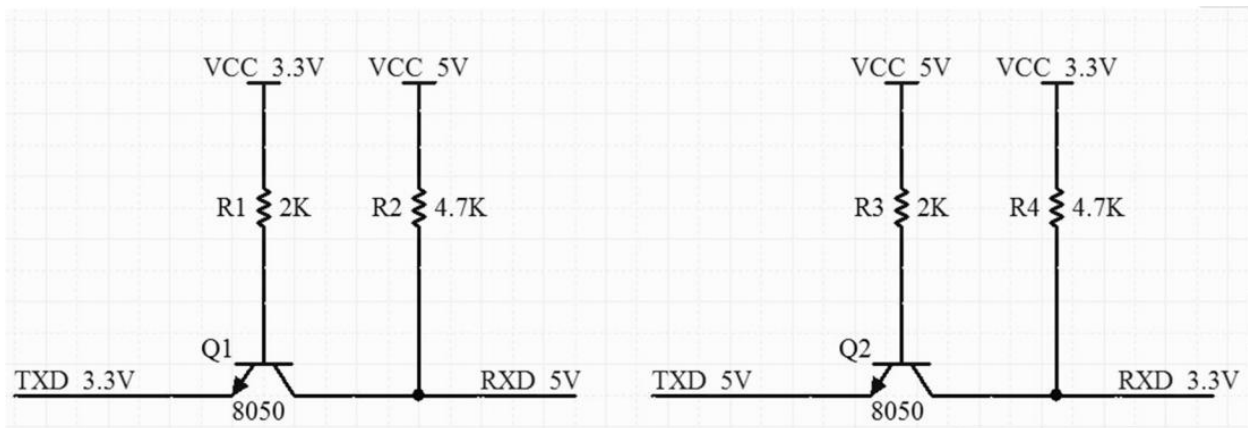


Figure 11 Level convert circuit

7. Storage conditions

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

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

After the vacuum bag is unwrapped, 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.

8. Reflow welding curve diagram

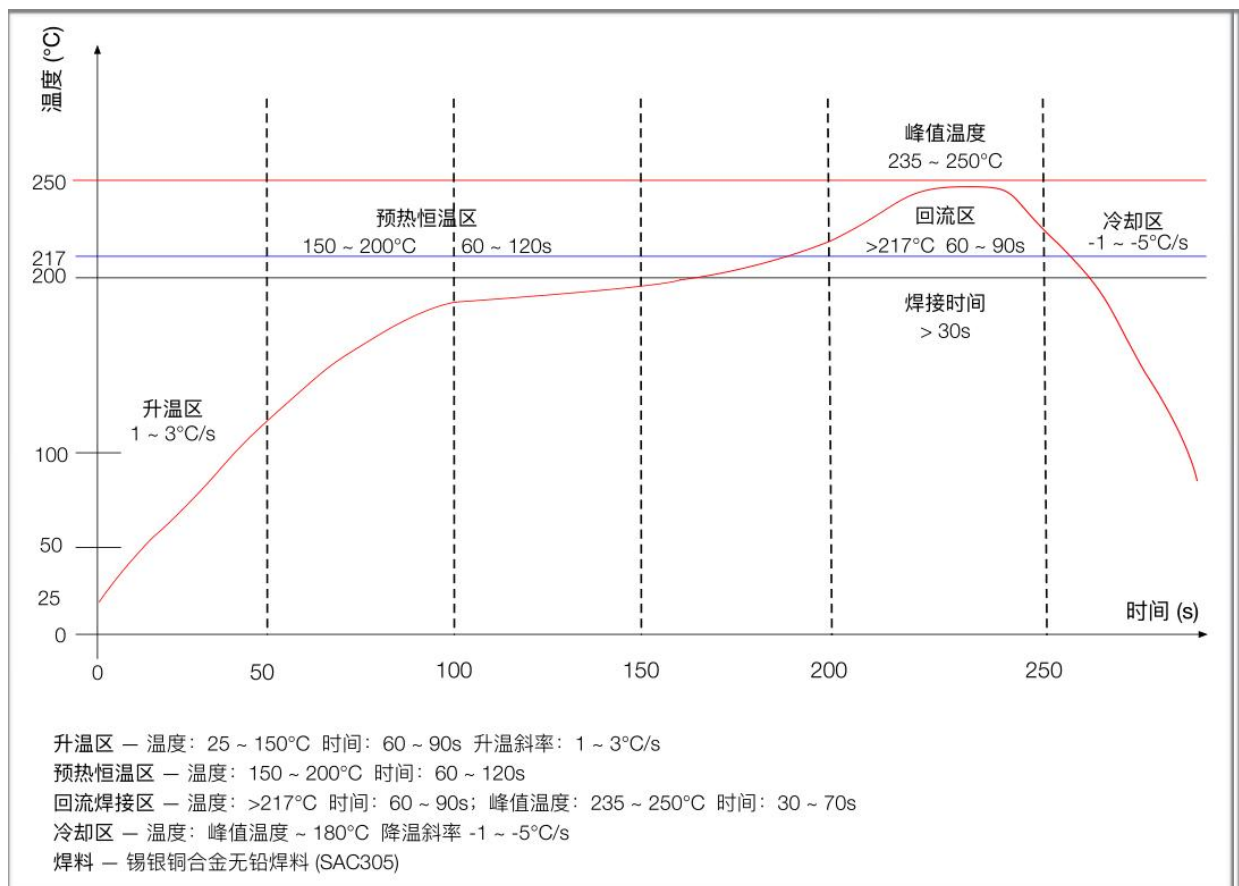


Figure 12 Reflow welding diagram

9. Product Packaging Information

Ai-WB2-01F module is package in a tape, 1300pcs/ reel. As shown in the picture below:



Figure 13 Package and packing diagram

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