Ai-WB2-07S Specification

Version V1.1.0

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Document resume

Version	Date	Develop/revise content	Edition	Approve
V1.1.0	2023.09.21	First Edition	Ning Guan	Hong Xu

Content

1. Product Overview

Ai-WB2-07S 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 has a low-power 32-bit RISC CPU, 276KB RAM, and a wealth of peripheral interfaces, including SDIO, SPI, UART, I2C, IR Remote, PWM, ADC, DAC, PIR and GPIO etc. It can be widely used in Internet of Things (IoT), mobile devices, wearable electronic devices, smart home and other fields.

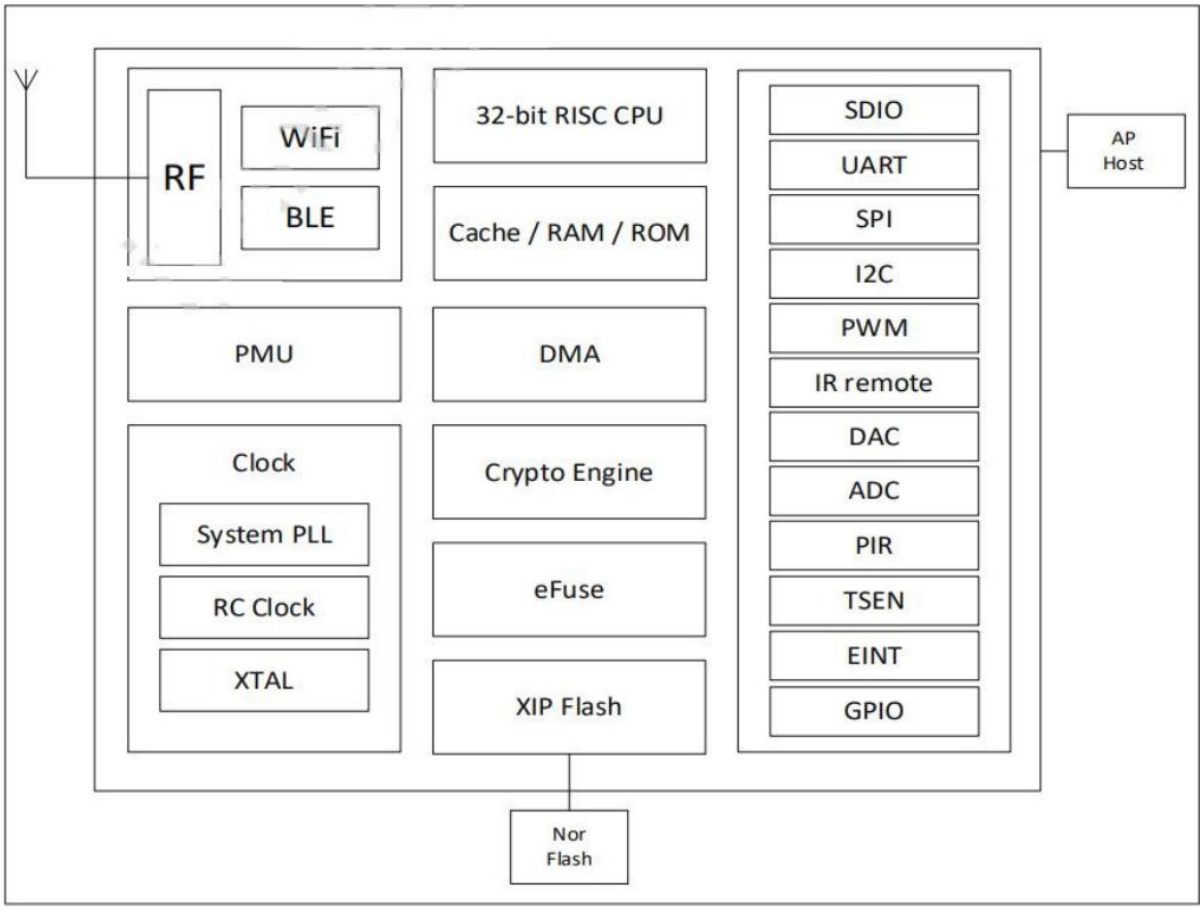


Figure 1 Main chip block diagram

1.1. Characteristic

- The package is SMD-16
- Support IEEE 802.11 b/g/n protocol
- Wi-Fi Security support WPS/WEP/WPA/WPA2 Personal/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 On-The-Fly AES Decryption, support AES 128 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 SDIO，SPI，UART，I2C，IR remote，PWM，ADC，DAC，PIR，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-WB2-07S
Package	SMD-16
Size	17.0*16.0*3.1(±0.2)mm
Antenna	IPEX connector
Frequency	2400 ~ 2483.5MHz
Operating temperature	-40℃ ~105℃
Storage environment	-40℃ ~ 125℃, < 90%RH
Power supply	Support voltage 2.7V ~ 3.6V， supply current ≥500mA
Interface	UART/GPIO/ADC/PWM/I2C/SPI
IO	11
UART rate	Default 115200 bps
Security	WPS/WEP/WPA/WPA2 Personal/WPA3
Flash	Default 4MByte， support expansion

2.1. Static electricity requirement

Ai-WB2-07S 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		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 value**	**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 value**	**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 value**	**Max.**	**Unit**
1Mbps	-	9	15	dBm
Receive Sensitivity				
Rate Mode	**Min.**	**Typical value**	**Max.**	**Unit**
1Mbps sensitivity@30.8%PER	-	-96	-	dBm

2.5. Power

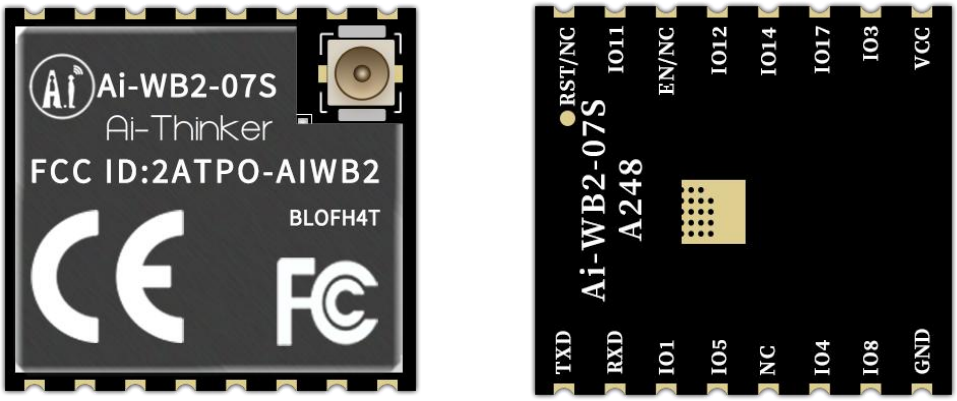
The following power consumption data are based on a 3.3V power supply, 25°C ambient temperature, and measured using an internal voltage regulator.

- All measurements are made at the antenna interface with a filter.
- All transmission data are based on 100% duty cycle in continuous transmission mode.

Table 5 Power consumption table

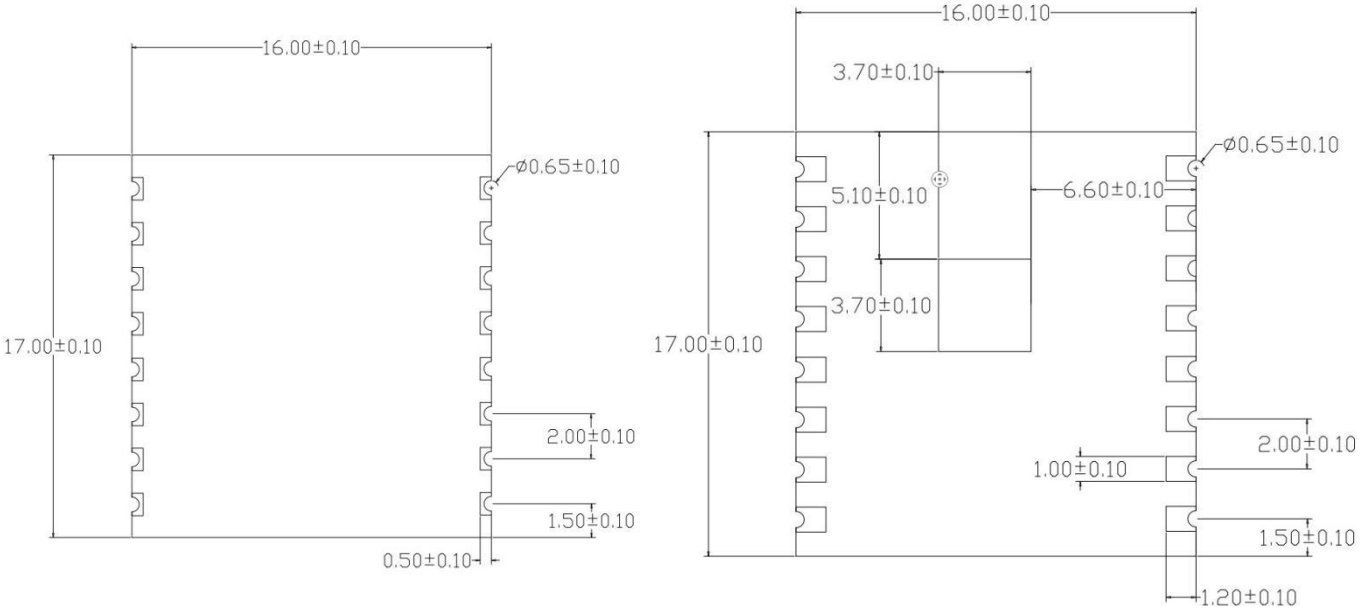
Mode	Min.	AVG	Max.	Unit
Tx 802.11b，11Mbps，POUT=+21dBm	-	260	-	mA
Tx 802.11g， 54Mbps， POUT =+18dBm	-	245	-	mA
Tx 802.11n， MCS7， POUT =+17dBm	-	230	-	mA
Rx 802.11b，packet length 1024 byte	-	65	-	mA
Rx 802.11g，packet length 1024 byte	-	65	-	mA
Rx 802.11n，packet length 1024 byte	-	65	-	mA
Deep-Sleep	-	12	-	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)

4. Pin definition

Ai-WB2-07S module is connected with a total of 16 pins, as shown in the pin schematic diagram, pin function definition table is the interface definition.

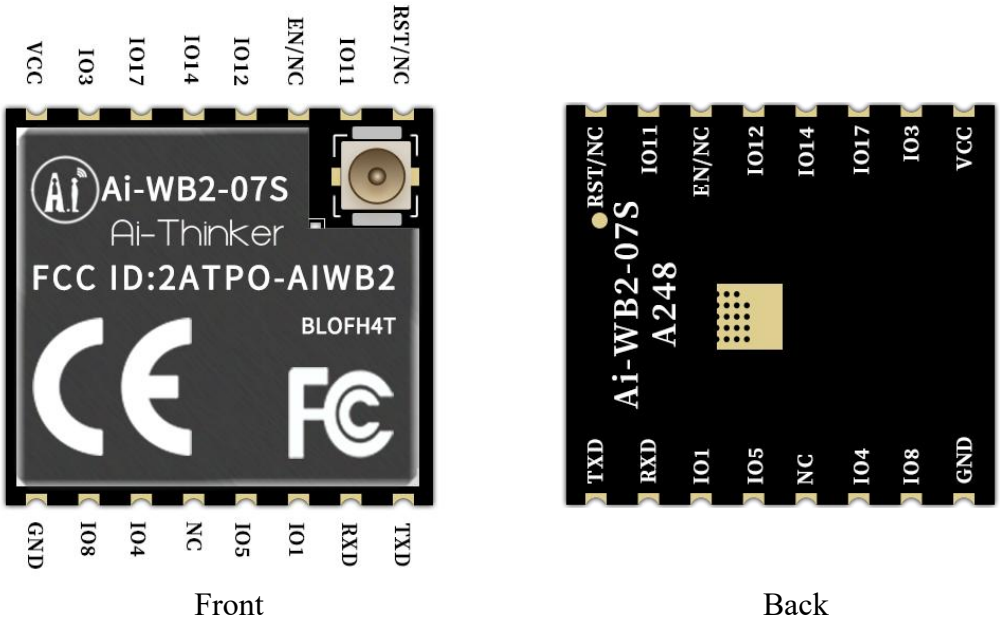


Figure 6 Schematic diagram of module pins

Table 6 Pin function definition table

No.	Name	Function
1	RST/NC	Corresponding chip EN pin, low level reset
2	IO11	GPIO11/SPI_SCLK/IIC_SDA/ADC_CH10
3	EN/NC	Corresponding chip EN pin, high level operation
4	IO12	GPIO12/SPI_MOSI/MISO/IIC_SCL/PWM_CH2/ADC_CH0
5	IO14	GPIO14/SPI_SS/IIC_SCL/PWM_CH4/ADC_CH2
6	IO17	GPIO17/SPI_MOSI/MISO/IIC_SDA/PWM_CH2
7	IO3	GPIO3/SPI_SCLK/IIC_SDA/PWM_CH3
8	VCC	3.3V power supply; the output current of external power supply is recommended to be above 500 mA
9	GND	Ground
10	IO8	GPIO4/SPI_MOSI/MISO/IIC_SCL/PWM_CH4/ADC_CH4
11	IO4	It is not recommended to use, this pin share with Flash inside the module. If need to use, please contact us, GPIO2/SPI_SS/IIC_SCL/PWM_CH2
12	NC	Default NC，not available
13	IO5	GPIO5/SPI_MOSI/MISO/IIC_SDA/PWM_CH0/ADC_CH4
14	IO1	It is not recommended use, this pin share with Flash inside the module. If need to use, please contact us, GPIO1/SPI_MOSI/MISO/IIC_SDA/PWM_CH1
15	RXD	RXD/GPIO7/SPI_SCLK/IIC_SDA/PWM_CH2
16	TXD	TXD/GPIO16/SPI_MOSI/MISO/IIC_SCL/PWM_CH1

5. Schematic

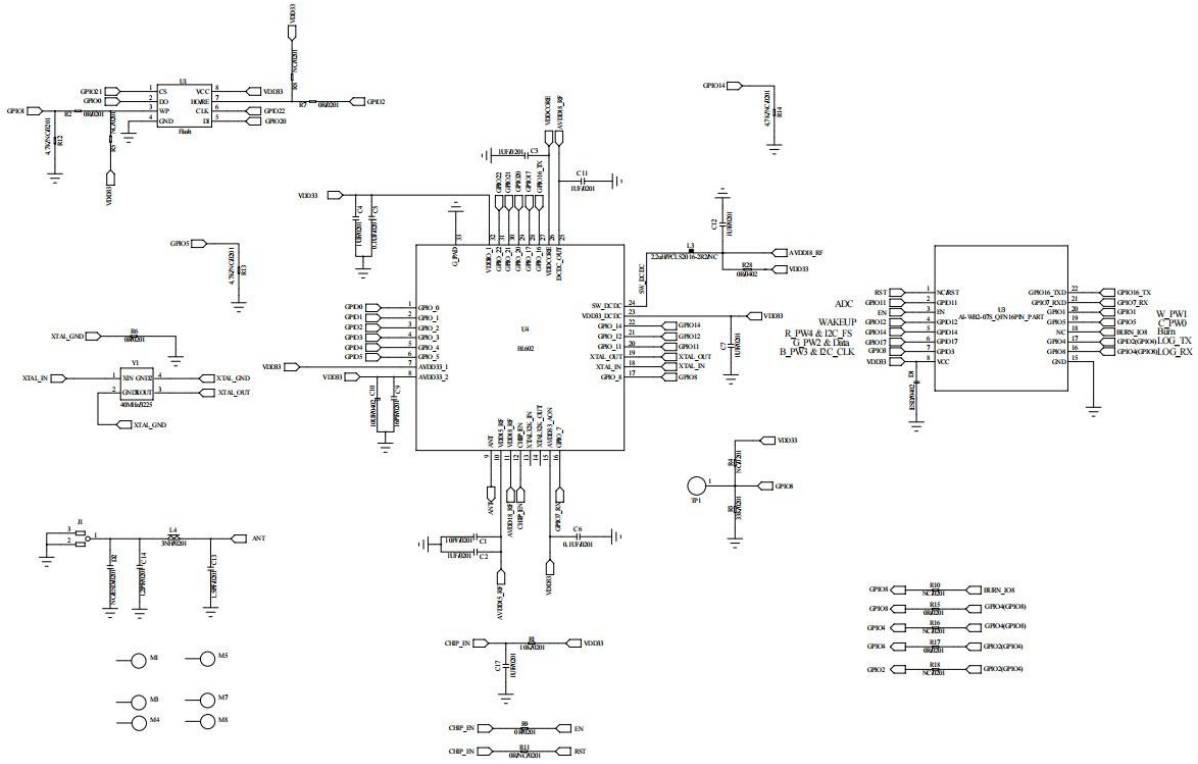


Figure 7 Module schematic

6. Design Guidance

6.1. Application circuit

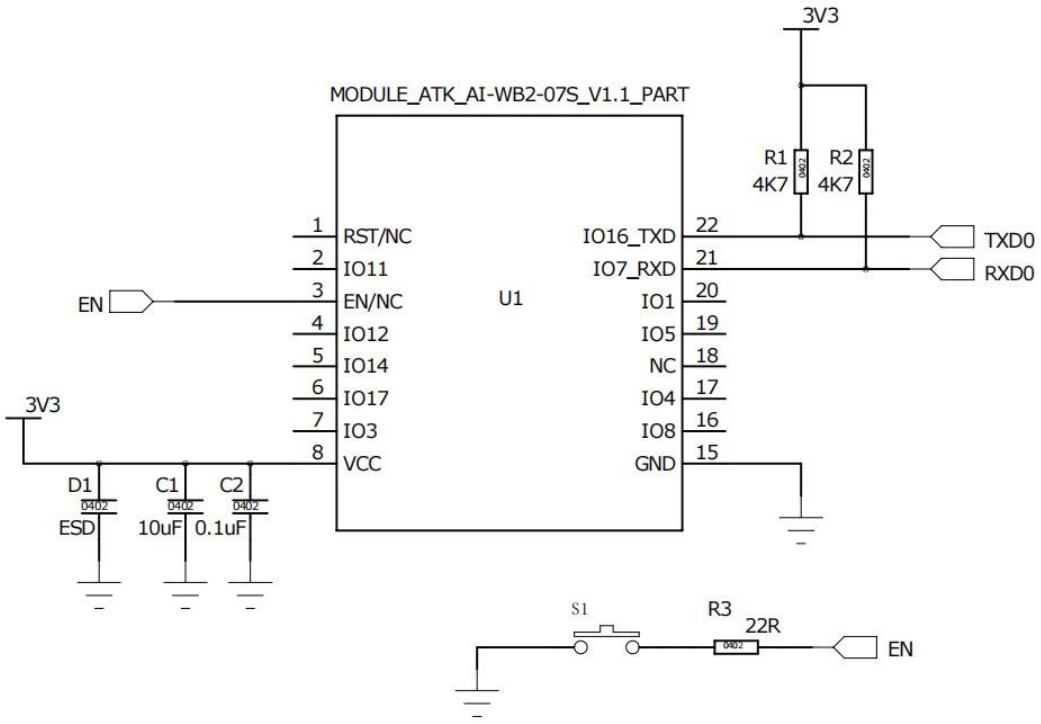


Figure 8 Application circuit diagram

- If the IO port is used as PWM, it is recommended to reserve a 4.7K pull-down resistor around the module. Especially in the application of light control, it can prevent the flashing light phenomenon at the moment of power-on start.
- The RST/NC pin, which are not available by default.If you need to use it, please contact Ai-Thinker.

6.2. Recommend PCB footprint size

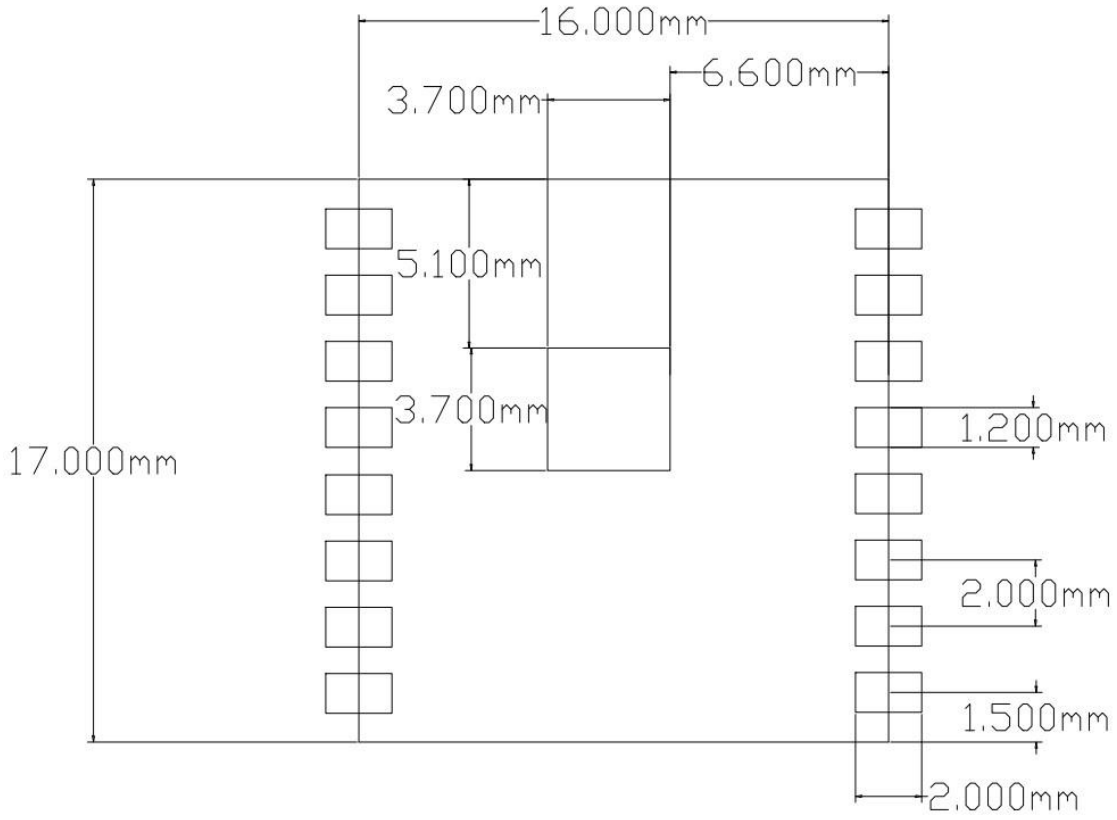


Figure 9 Recommend PCB footprint size

6.3. Antenna layout requirements

- This module need to use with an external antenna
- In order to meet the performance of antenna, it is forbidden to place metal parts around the antenna and keep away from high frequency devices.

6.4. Power supply

- Recommended 3.3V voltage,peak current over 500mA
- 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.

- It is recommended to add ESD devices to the 3.3V power interface.

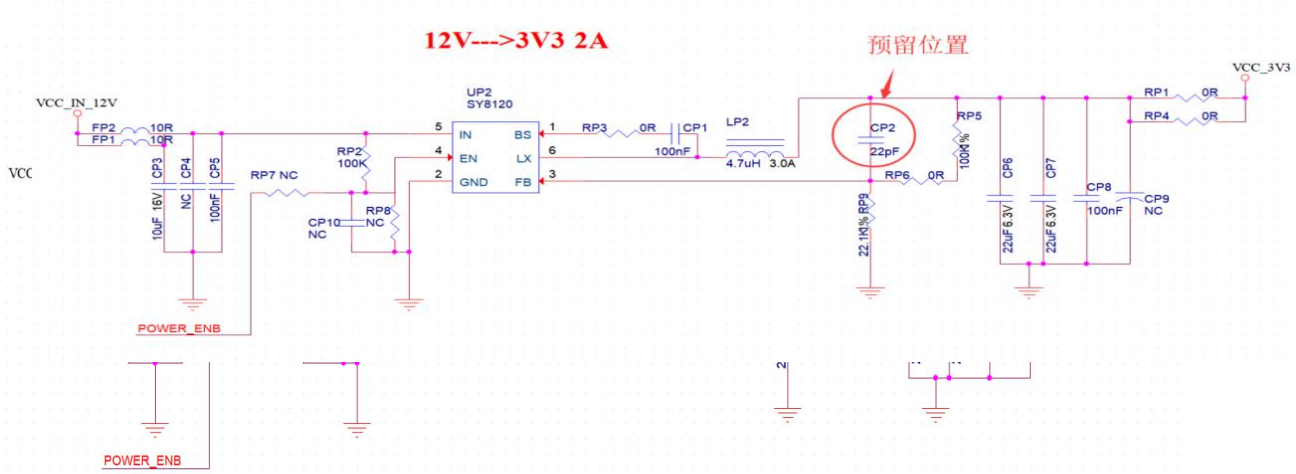


Figure 10 DC-DC step-down circuit diagram

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 with the IO port. 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 direction for use in the specifications, which may affect the module start-up 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 convert 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.

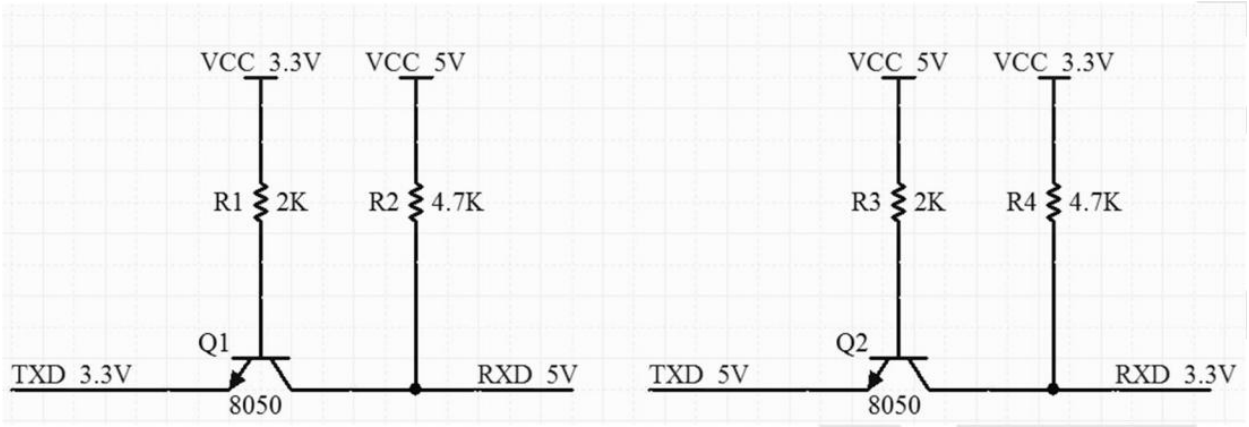


Figure 11 Level convert circuit

7. Storage conditions

Products sealed in moisture-proof bags should be stored in a non-condensing atmosphere of <40 ° C /90%RH.

The module has a moisture sensitivity rating of MSL 3 class.

After the vacuum bag is opened, 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.

8. Reflow welding curve diagram

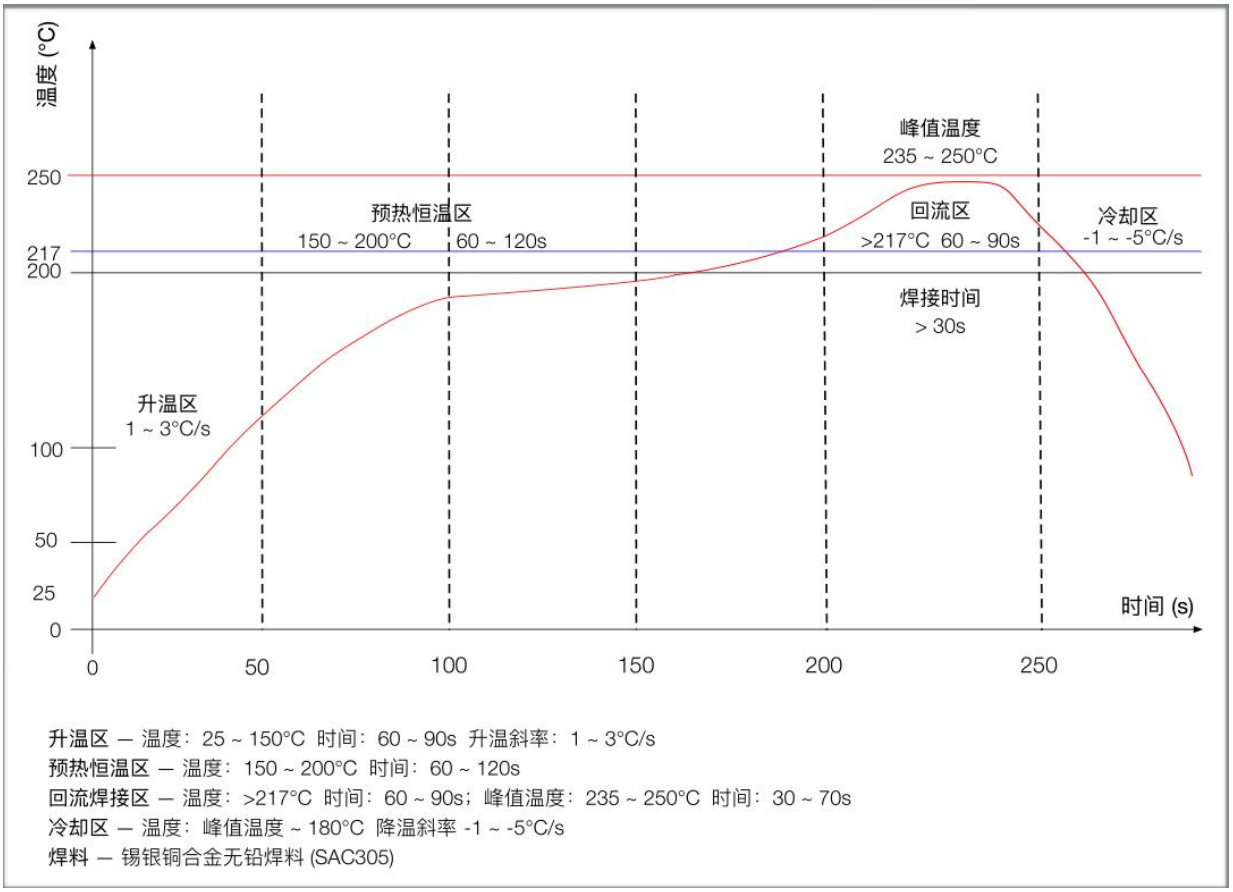


Figure 12 Reflow welding diagram

9. Product Packaging Information

Ai-WB2-07S module was packaged in a tape, 800pcs/reel. As shown in the below image:

Figure 13 Package and packing diagram

10.Contact us

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