Ai-M62-07S Specification

Version V2.0.0

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Version	Date	Develop/revise content	Edition	Approve
V2.0.0	2023.10.17	First Edition	Shengxin Zou	Ning Guan

Content

1. Product overview

Ai-M62-07S is a Wi-Fi 6 + BLE5.3 module developed by Shenzhen Ai-Thinker Technology Co., Ltd. The module is equipped with BL616 chip as the core processor, supports Wi-Fi 802.11b/g/n/ax protocol and BLE protocol, and supports Thread protocol. The BL616 system includes a low-power 32-bit RISC-V CPU with floating-point unit, DSP unit, cache and memory, with a maximum dominant frequency of 320M.

Ai-M62-07S module has rich peripheral interfaces, including Audio Codec, USB2.0, SDU, SD / MMC (SDH), SPI, UART, I2C, I2S, PWM, GPDAC, GPADC, ACOMP and GPIO. It can be widely used in audio and video multimedia, Internet of Things (IoT), mobile devices, wearable electronic devices, smart home and other fields.

Ai-M62-07S module Sec Eng module supports AES / SHA / PKA / TRNG and other functions, supports mirror encryption and signature startup, to meet the needs of various security applications in the field of the Internet of Things.

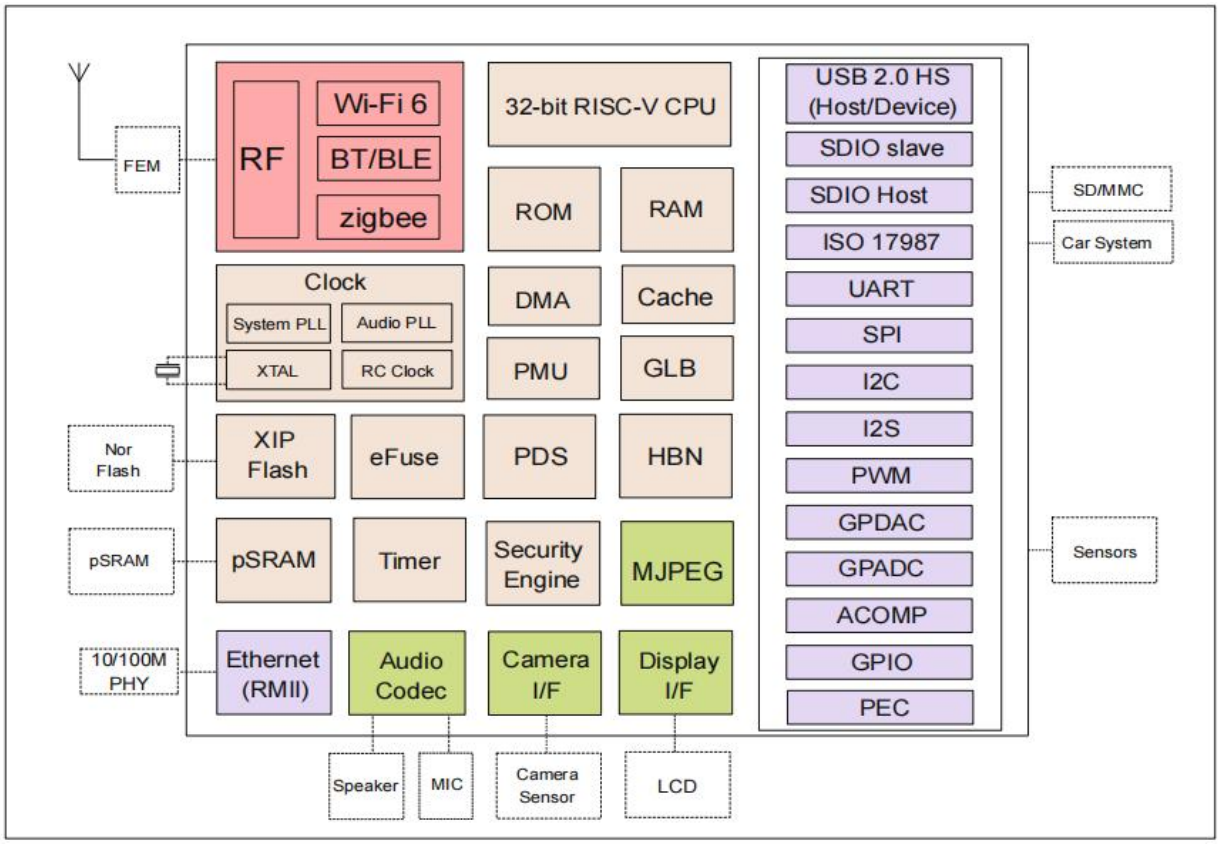

Figure 1 Main chip architecture diagram

1.1 Characteristics

- SMD-22 package
- Supports 2.4GHz operating frequency band
- Support IEEE 802. 11 B/g/n/ax
- Support BLE5.3
- Support Thread
- Support Wi-Fi/BLE/Thread coexistence
- Wi-Fi security support WPS/WEP/WPA/WPA2/WPA3
- Supports 20/40MHz bandwidth, 1T1R, maximum rate 229.4 Mbps
- Support STA, SoftAP, STA + SoftAP and sniffer modes
- 32-bit RISC-V CPU with FPU and DSP, with a maximum dominant frequency of 320M
- 532KB SRAM, 128KB ROM,4Kb eFuse
- Support USB2.0, SDU, SD/MMC(SDH), SPI, UART, I2C, I2S, PWM, GPDAC, GPDC, ACOMP, GPIO, etc.
- Integrated RF Balun, PA/LNA
- Support for safe startup and safe debugging
- Support XIP QSPI On-The-Fly AES decryption (OTFAD)
- Support TrustZone
- Support AES-CBC/CCM/GCM/XTS mode
- Support MD5, SHA- 1/224/256/384/512
- TRNG (True Random Number Generator) is supported
- Support PKA (Public Key Accelerator) for RSA/ECC
- BLE-enabled Wi-Fi fast connection
- Universal AT command can be used quickly.
- Supports secondary development and integrates Windows and Linux development environments

2. Main parameters

Table 1 Description of main parameters

Model	Ai-M62-07S
Package	SMD-22
Size	17.0*16.0*3.1(±0.2)mm
Antenna	IPEX antenna
Frequency	2400 ~ 2483.5MHz
Operating temperature	-40℃~ 85℃
Storage temperature	-40℃~ 125℃, < 90%RH
Power supply	Power supply voltage 2.97V ~ 3.6V，power supply current≥500mA
Interface	USB2.0, SDU, SD / MMC (SDH), SPI, UART, I2C, I2S, PWM, GPDAC, GPADC, ACOMP and GPIO, etc
IO	15
UART rate	Default 115200 bps
Security	WPS/WEP/WPA/WPA2/WPA3
Flash	Default 4MByte，max support 16MByte

2.1. Electrostatic requirements

Ai-M62-07S are electrostatic sensitive equipment, special precautions need to be taken when handling.

Figure 2 ESD preventive measures

2.2. Electrical characteristics

Table 2 Electrical characteristics table

Parameter		Condition	Min.value	Typical value	Max. value	Unit
Supply voltage		VDD	2.97	3.3	3.6	V
I/O	VIL	-	-	-	0.3*VDDIO	V
	VIH	-	0.7*VDDI	-	-	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. value**	**Typical value**	**Max. value**	**Unit**
11ax mode HE40，PA output power	-	16	-	dBm
11ax mode HE20，PA output power	-	17	-	dBm
11n mode HT40， PA output power	-	19	-	dBm
11n mode HT20， PA output power	-	19	-	dBm
11g mode， PA output power	-	19	-	dBm
11b mode， PA output power	-	22	-	dBm
Receiving sensitivity				
Mode	**Min. value**	**Typical value**	**Max. value**	**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
11ax， HE20 (MCS9)	-	-70	-	dBm
11ax， HE40 (MCS9)	-	-67	-	dBm

2.4. BLE RF performance

Table 4 BLE RF performance table

Description	Typical value			Unit
Frequency range	2400 ~ 2483.5MHz			MH
Output power				
Rate mode	**Min.**	**Average**	**Max.**	**Unit**
1Mbps	-	10	15	dBm
2Mbps	-	10	15	dBm
Receiving sensitivity				
Rate mode	**Min.**	**Average**	**Max.**	**Unit**
1Mbps sensitivity @30.8%PER	-	-99	-	dBm
2Mbps sensitivity @30.8%PER	-	-97	-	dBm

2.5. Power consumption

The following power consumption data are based on the 3.3V power supply and the ambient temperature of 25° C.

- The POUT power for all transmission modes is measured at the antenna interface.
- All emission data were measured based on a 100% duty cycle, in a continuous emission mode.

Table 5 Power consumption table

Mode	Min.	Average	Max.	Unit
Tx 802.11b，11Mbps，POUT=+22dBm	-	394	-	mA
Tx 802.11g， 54Mbps， POUT =+19dBm	-	302	-	mA
Tx 802.11n， MCS7， POUT =+19dBm	-	302	-	mA
Tx 802.11ax， MCS9， POUT =+17dBm	-	269	-	mA
Rx 802.11b，packet length 1024 bytes	-	59	-	mA
Rx 802.11g，packet length 1024 bytes	-	59	-	mA
Rx 802.11n，packet length 1024 bytes	-	59	-	mA
Rx 802.11ax，packet length 1024 bytes	-	59	-	mA

3. Appearance size

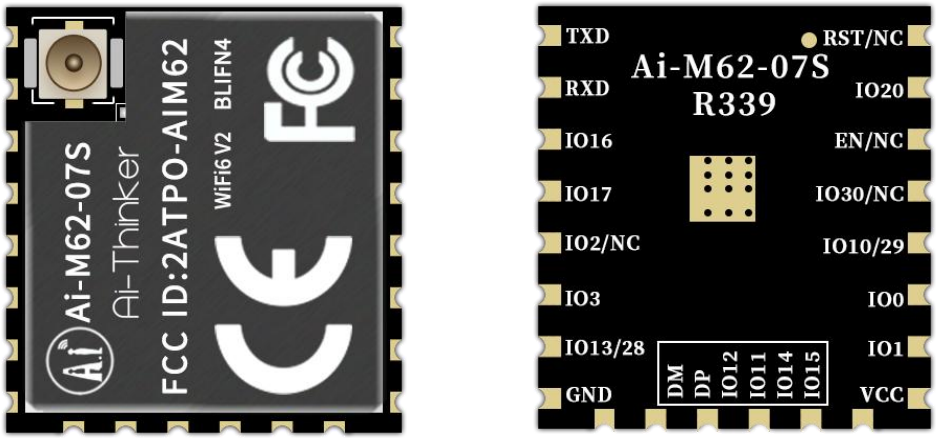

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Figure 3 Appearance diagram (the picture is for reference only, subject to the physical object)

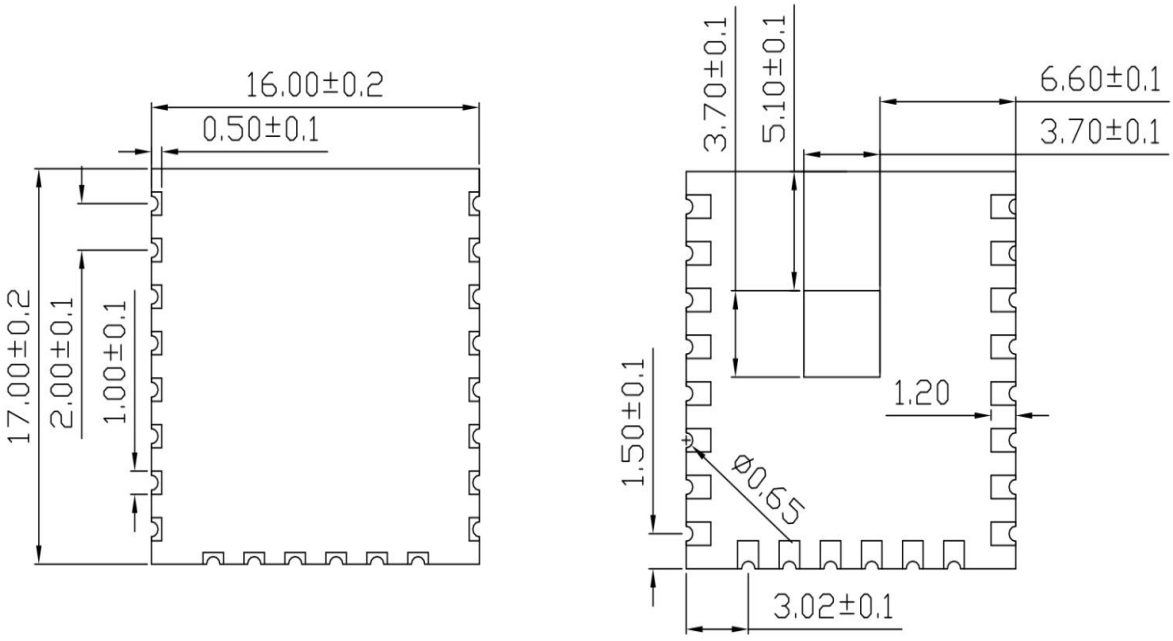

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Figure 4 Size diagram

4. Pin definition

Ai-M62-07S module is connected to a total of 22 pins, refer to the schematic diagram of the pin, the pin function definition table is the interface definition.

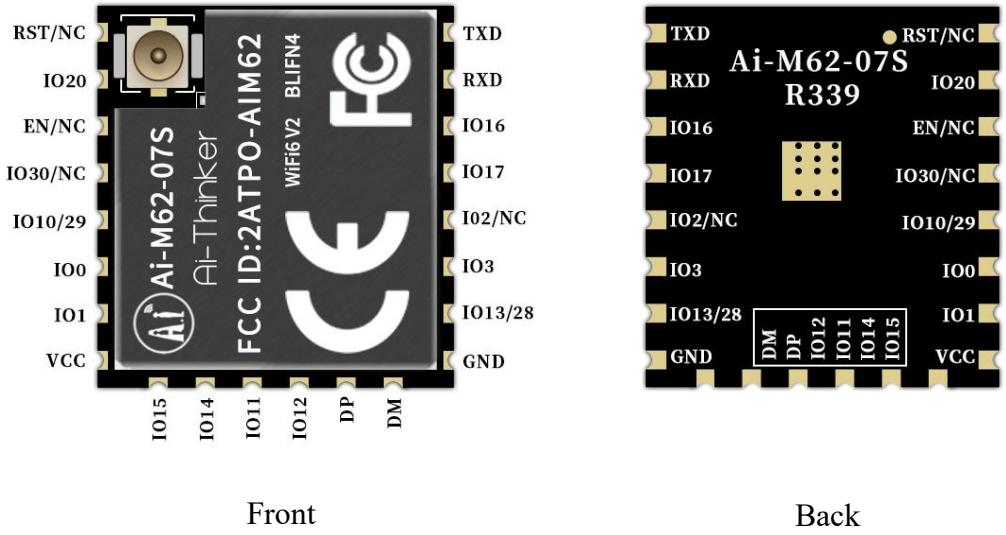

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Figure 5 Schematic diagram of pin

Table 6 Definitions of pin function

No.	Name	Function
1	RST/NC	Default NC, can be customized to reset pin, low level effective, if you need to use please contact Ai-Thinker
2	IO20	GPIO20/SPI_SS/I2S_BCLK/I2C_SCL/ADC_CH0/PWM0
3	EN/NC	Default as a chip enabled, high level is effective, with RST can not be used at the same time
4	IO30/NC	GPIO30/SPI_MISO/I2S_DI/I2S_RCLK_O/I2C_SCL/PWM0
5	IO10/29	Defaut as IO29，GPIO29/SPI_SCLK/I2S_FS/I2C_SDA/PWM0
6	IO0	GPIO0/SPI_SS/I2S_BCLK/I2C_SCL/ADC_CH9/PWM0
7	IO1	GPIO1/SPI_SCLK/I2S_FS/I2C_SDA/ADC_CH8/PWM0
8	VCC	3.3V power supply; the output current of external power supply is recommended to be above 500 mA
9	IO15	GPIO15/SPI_MOSI/I2S_DO/I2S_RCLK_O/I2C_SDA/PWM0

10	IO14	GPIO14/SPI_MISO/I2S_DI/I2S_RCLK_O/I2C_SCL/ADC_CH4/PWM0
11	IO11	GPIO11/SPI_MOSI/I2S_DO/I2S_RCLK_O/I2C_SDA/PWM0
12	IO12	GPIO12/SPI_SS/I2S_BCLK/I2C_SCL/ADC_CH6/PWM0
13	DP	USB_DP
14	DM	USB_DM
15	GND	Ground
16	IO13/28	Default as IO28， GPIO28/SPI_SS/I2S_BCLK/I2C_SCL/ADC_CH11/PWM0
17	IO3	GPIO3/SPI_MOSI/I2S_DO/I2S_RCLK_O/I2C_SDA/ADC_CH3/PWM0
18	IO2/NC	Default NC，if need to use IO2，please contact Ai-Thinker, support Bootstrap/GPIO2/SPI_MISO/I2S_DI/I2S_RCLK_O/I2C_SCL/ADC_CH,shangdian2/PWM0
19	IO17	The default is available. The IO port is shared with the 32.768KHz crystal vibration output PIN pin inside the module. If the module of the internal patch 32.768KHz crystal vibration is customized, the IO is in the NC state.GPIO17/SPI_SCLK/I2S_FS/I2C_SDA/XTAL_32K_OUT/PWM0
20	IO16	The default is available. The IO port is shared with the 32.768KHz crystal vibration output PIN pin inside the module. If the module of the internal patch 32.768KHz crystal vibration is customized, the IO is in the NC state.GPIO16/SPI_SS/I2S_BCLK/I2C_SCL/XTAL_32K_OUT/PWM0
21	RXD	RXD/GPIO22/SPI_MISO/I2S_DI/I2S_RCLK_O/I2C_SCL/PWM0
22	TXD	TXD/GPIO21/SPI_SCLK/I2S_FS/I2C_SDA/ADC_RCAL_VOUT/PWM0
Test point	IO2	Bootstrap/GPIO2/SPI_MISO/I2S_DI/I2S_RCLK_O/I2C_SCL/ADC_CH,shangdian2/PWM0
Note: 1. When the measuring point IO2 is Bootstrap, the module enters the burning mode; when the power-on moment is low level, the module starts normally.		

5. Schematic diagram

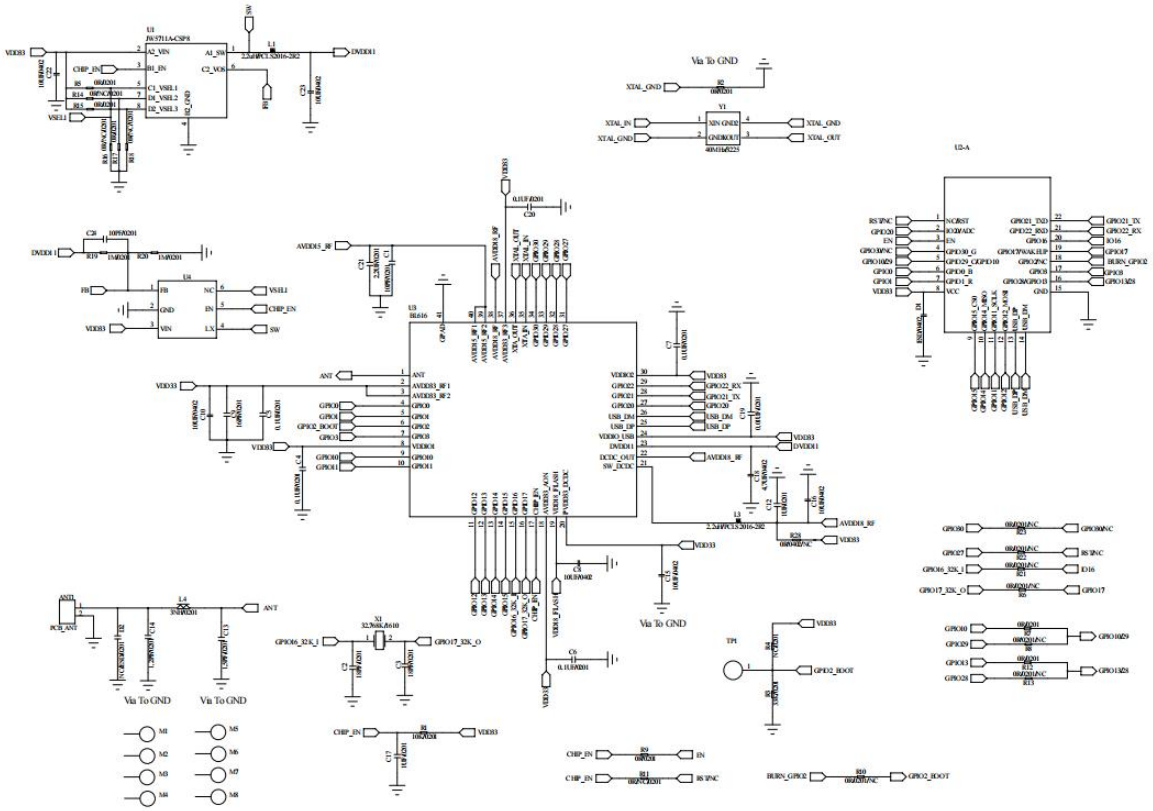

Figure 6 Schematic diagram

6. Design guidance

6.1. Guidance of application circuit

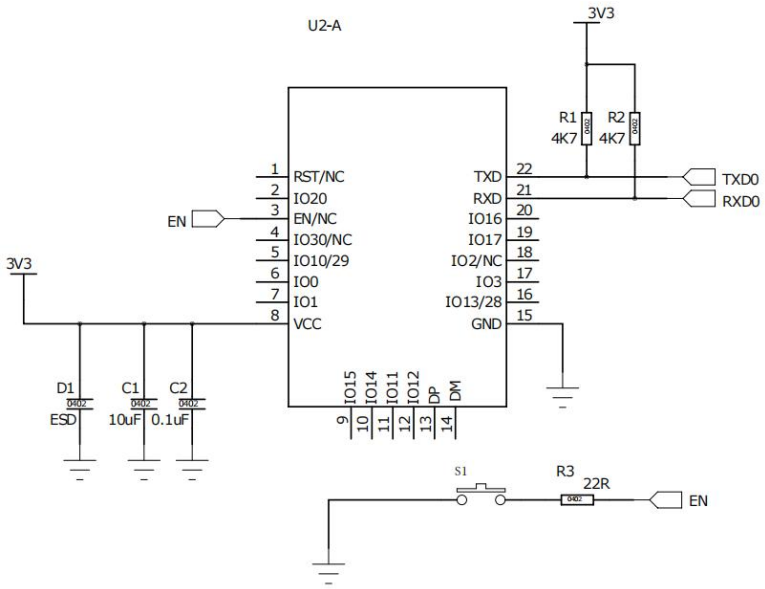

Figure 7 Guidance of application circuit

- IO16、IO17，the default is available. The IO port is shared with the 32.768KHz crystal vibration output PIN foot inside the module. If the module of the internal patch 32.768KHz crystal vibration is customized, this IO is in the NC state.

6.2. Recommend PCB package size

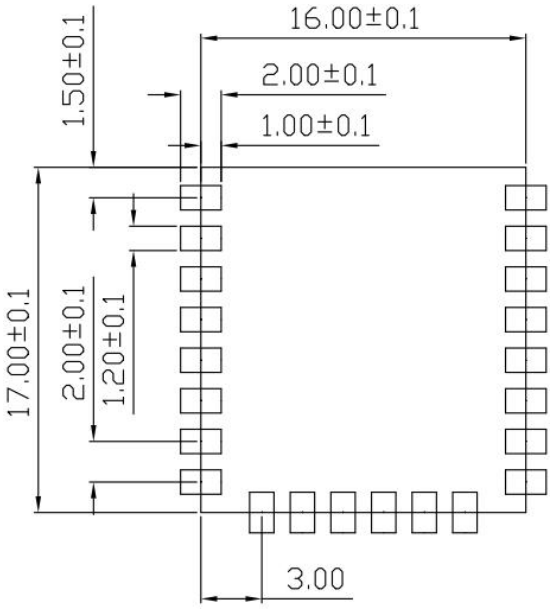

Figure 8 Recommended PCB package sizes (Unit mm)

6.3. Antenna layout requirements

- The module requires use with an external antenna.
- In order to satisfy the performance of the antenna, metal parts are not placed around the antenna, away from high frequency devices.

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 changes greatly.
- 3.3V power interface, it is recommended to add ESD devices.

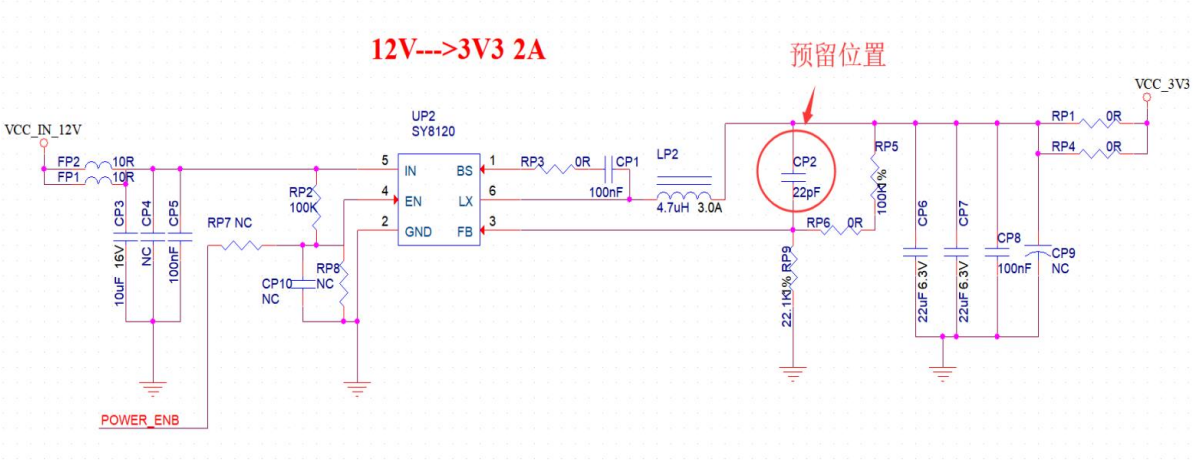

Figure 9 The DC-DC step-down circuit diagram

6.5. GPIO

- Outside the module are some IO ports, with a recommended resistance of 10 to 100 ohms on the IO port in series. This can suppress the overshoot and make the level on both sides more stable. For both EMI and ESD.
- Pull up and down of the special IO port, refer to the instructions of the specification, which will affect the startup configuration of the module.
- The IO port of the module is 3.3V. If the main control does not match the IO port level of the module, the level conversion circuit should be added.
- If the IO port is directly connected to the peripheral interface or terminals, it is

recommended to reserve ESD devices at the IO port line near the terminal.

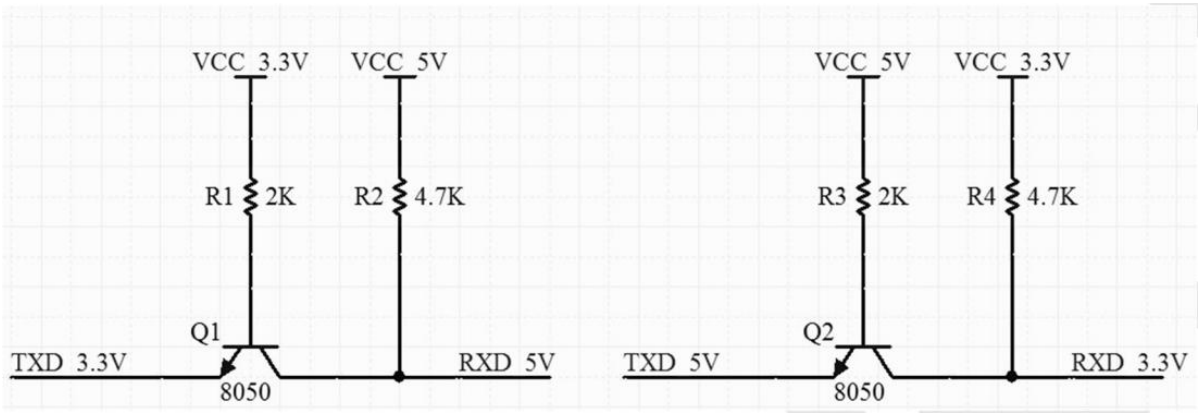

Figure 10 The level conversion circuit

7. Storage condition

Products sealed in a moisture-proof bag shall be stored in a non-condensing atmosphere of <40℃ / 90% RH.

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

After the vacuum bag is unsealed, it must be used within 168 hours at 25 ± 5℃ / 60% RH, otherwise it needs to be baked before the secondary production.

8. Reflow welding curve diagram

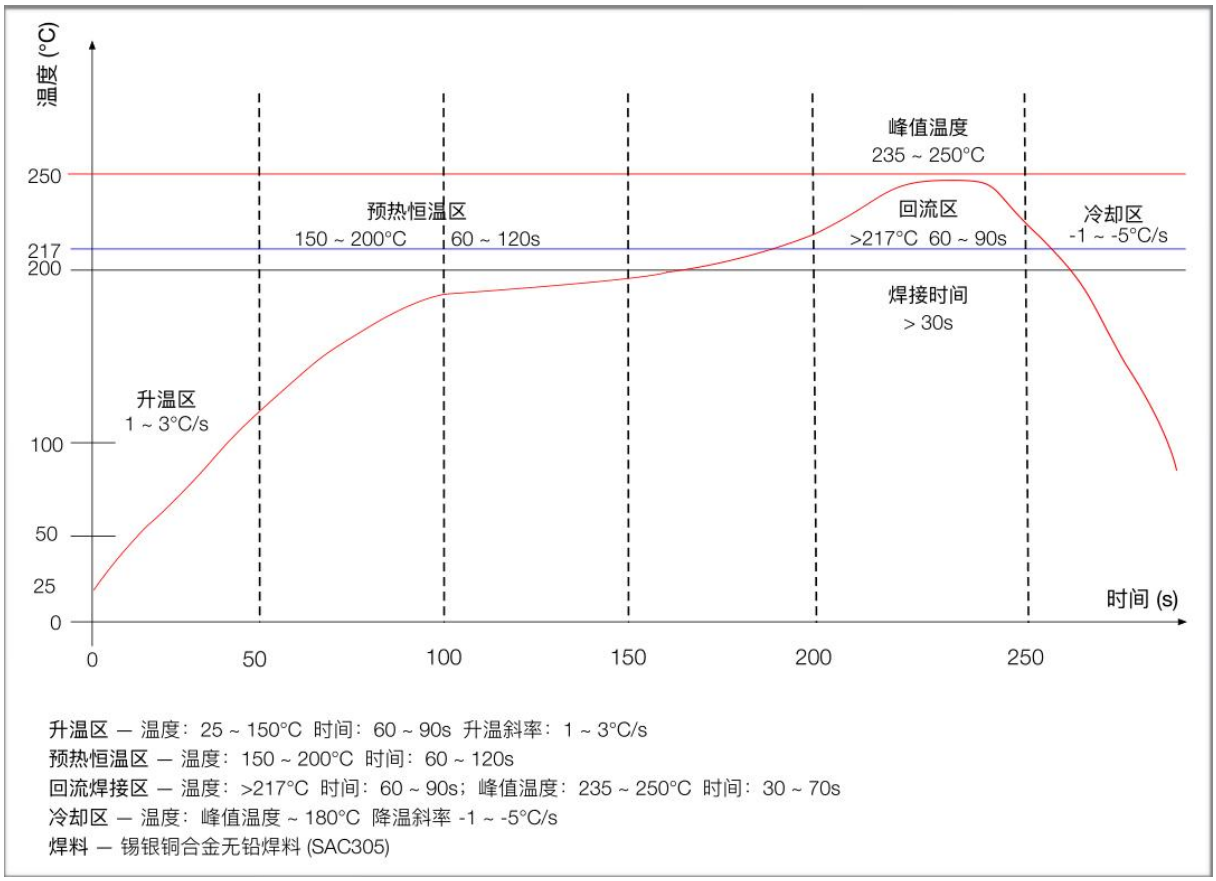

Figure 11 Reflow welding curve diagram

9. Product packaging information

Ai-M62-07S module is packaged with 800 pcs / reel. As shown in the figure below:

Figure 12 Reel packing diagram

10.Contact us

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