Ai-M62-CBS Specification

Version V1.0.1

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Document resume

Version	Date	Develop/revise content	Edition	Approve
V1.0.0	2023.11.01	First Edition	Pengfei Dong	Ning Guan
V1.0.1	2024.06.11	Add instructions for screen printing of shielding cover	Ning Guan	Hong Xu

Content

1. Product Overview

Ai-M62-CBS is a Wi-Fi 6 + BLE 5.3 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 contains a low-power 32-bit RISC-V CPU with floating point cells, DSP units, cache, and memory, up to 320M.

The Ai-M62-CBS module has rich peripheral interfaces, including 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-CBS module Sec Eng module supports AES / SHA / PKA / TRNG and other functions, supports mirror encryption and signature startup, and meets the needs of various security applications in the field of the Internet of Things.

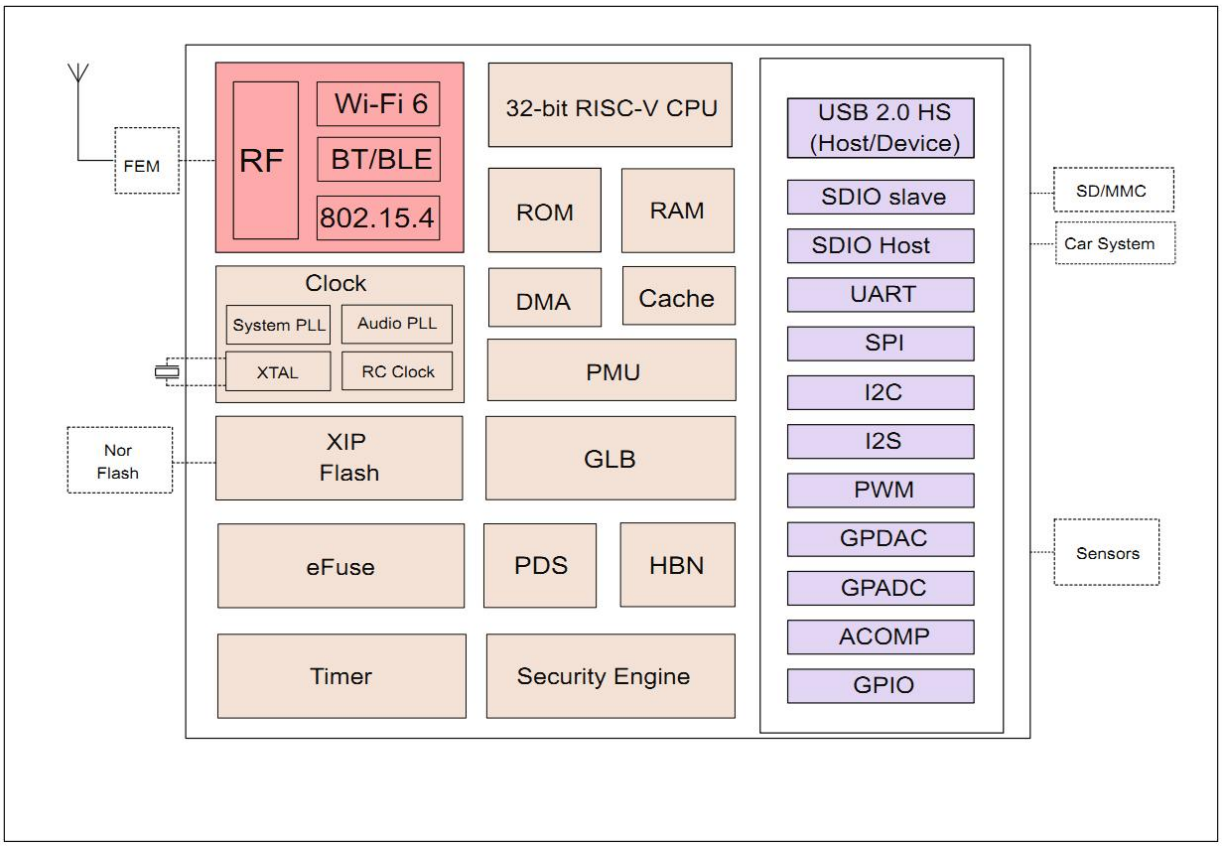


Figure 1 Main chip block diagram

1.1. Characteristic

- The package is SMD-44
- Support 2.4GHz working frequency
- 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
- Support 20/40MHz bandwidth，1T1R，speed up to 229.4Mbps
- Support STA、SoftAP、STA+SoftAP and sniffer mode
- A 32-bit RISC-VCPU with FPU and DSP, with a maximum main frequency of up to 320M
- 532KB SRAM，128KB ROM，4Kb eFuse
- Support for USB2.0, SDU, SD / MMC (SDH), SPI, UART, I2C, I2S, PWM, GPDAC, GPADC, ACOMP and GPIO, etc
- Integrated RF Balun、PA/LNA
- Support safe startup; safe debugging
- Support XIP QSPI On-The-Fly AES deciphering (OTFAD)
- Support TrustZone
- Support AES-CBC/CCM/GCM/XTS mode
- Support MD5、SHA-1/224/256/384/512
- Support TRNG（True random number generator）
- Support PKA for RSA / ECC（Public key accelerator）
- Support the Wi-Fi fast connection for BLE
- Support for the Linux development environments

2. Main Parameters

Table 1 Description of the main parameters

Model	Ai-M62-CBS
Package	SMD-44
Size	12.0*12.0*2.4(±0.2)mm
Antenna	Stamp hole
Frequency range	2400 ~ 2483.5MHz
Operation temperature	-40℃~ 85℃
Storage environment	-40℃~ 125℃, < 90%RH
Power supply	Supply voltage 2.97V ~ 3.6V， supply current≥500mA
Interface	USB2.0, SDU, SD / MMC (SDH), SPI, UART, I2C, I2S, PWM, GPDAC, GPADC, ACOMP and GPIO, etc
IO	18
Security	WPS/WEP/WPA/WPA2/WPA3
Flash	Three configurations: ①Not take Flash ②2MByte ③4MByte

2.1. Static electricity requirement

Ai-M62-CBS is an electrostatic sensitive device. Special precautions should be taken during handling.

Figure 2 ESD preventive measures

2.2. Electrical characteristic

Table 2 Electrical characteristics table

Parameters		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*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. 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 Table performance

Description	Typical value			Unit
Frequency range	2400 ~ 2483.5MHz			MHz
Output power				
Rate Mode	**Min. value**	**Typical value**	**Max. value**	**Unit**
1Mbps	-	10	15	dBm
2Mbps	-	10	15	dBm
Receiving sensitivity				
Rate Mode	**Min. value**	**Typical value**	**Max. value**	**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 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.	Typical value	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 byte	-	59	-	mA
Rx 802.11g，packet length 1024 byte	-	59	-	mA
Rx 802.11n，packet length 1024 byte	-	59	-	mA
Rx 802.11ax，packet length 1024 byte	-	59	-	mA

3. Appearance Dimensions

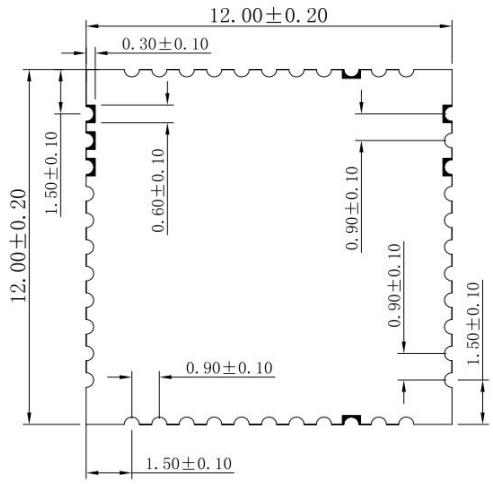
Front

Front

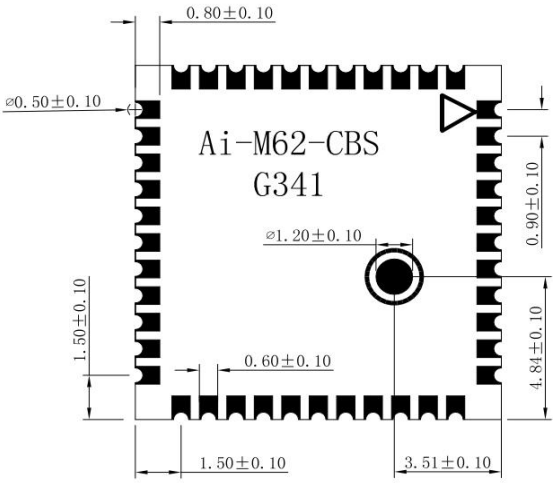
Front

Back

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



Front



Back

Figure 4 Size diagram

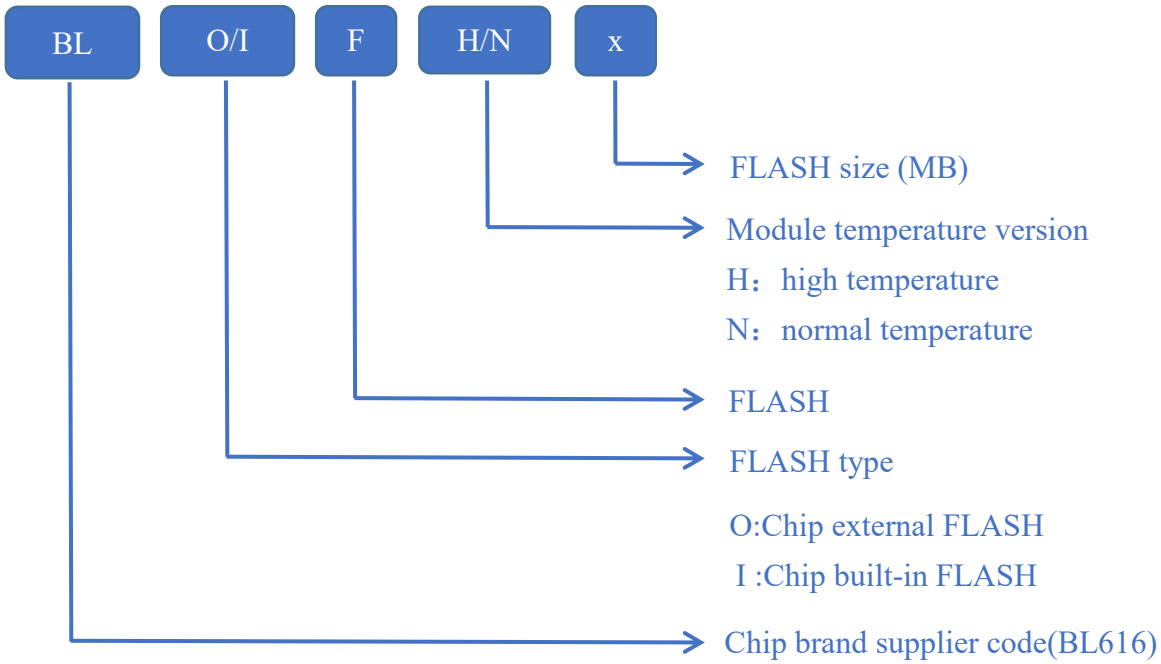
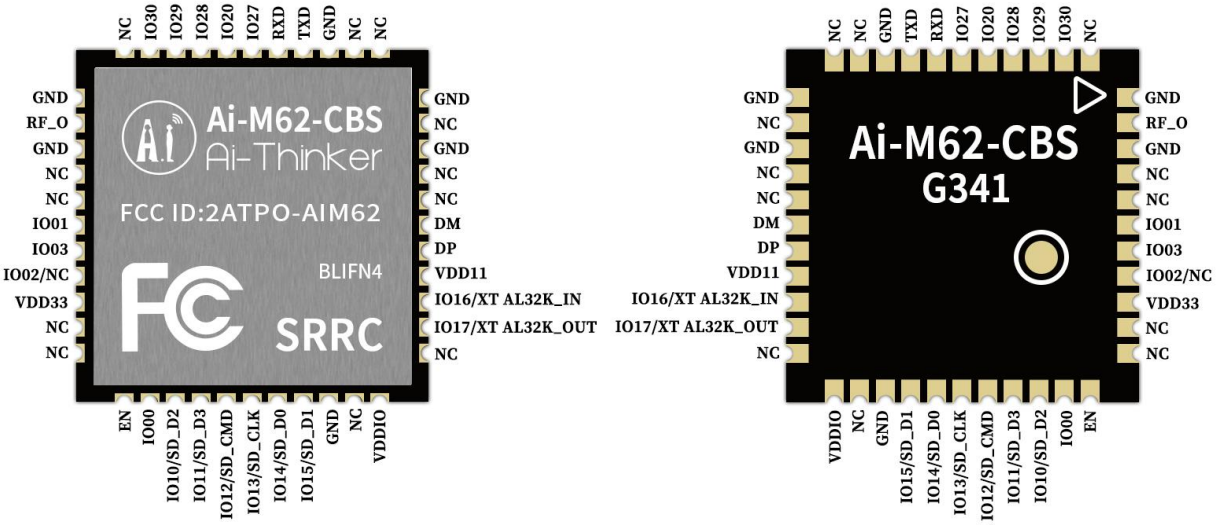


Figure 5 Shield printing information

4. Pin Definition

Ai-M62-CBS module is connected to a total of 44 pins, such as the schematic diagram of the pin, the pin function definition table is the interface definition.



Front Back

Figure 6 Schematic diagram of the module pin

Table 6 Pin function definition table

No.	Name	Function
1	GND	Ground
2	RF_O	RF output pin
3	GND	Ground
4	NC	Not connect
5	NC	Not connect
6	IO01	GPIO1/SPI_SCLK/I2S_FS/I2C_SDA/ADC_CH8/PWM1
7	IO03	GPIO3/SPI_MOSI/I2S_DO/I2S_RCLK_O/I2C_SDA/ADC_CH3/PWM3
8	IO2/NC	Default NC，not available to use, if you need to use please contact with sales. If pin out, it will support as Bootstrap/GPIO2/SPI_MISO/I2S_DI/I2S_RCLK_O/I2C_SCL/ADC_CH2/PWM2
9	VDD33	3.3V power supply；the output current of the external power supply is recommended to be above 500mA

10	NC	Not connect
11	NC	Not connect
12	EN	Reset pin, low level is effective
13	IO00	GPIO0/SPI_SS/I2S_BCLK/I2C_SCL/ADC_CH9/PWM0
14	IO10/SD_D2	SDIO_DATA_2/GPIO10/SPI_MISO/I2S_DI/I2S_RCLK_O/I2C_SCL/ADC_CH7/PWM2
15	IO11/SD_D3	SDIO_DATA_3/GPIO11/SPI_MOSI/I2S_DO/I2S_RCLK_O/I2C_SDA/PWM3
16	IO12/SD_CMD	SDIO_DATA_CMD/GPIO12/SPI_SS/I2S_BCLK/I2C_SCL/ADC_CH6/PWM0
17	IO13/SD_CLK	SDIO_DATA_CLK/GPIO13/SPI_SCLK/I2S_FS/I2C_SDA/ADC_CH5/PWM1
18	IO14/SD_D0	SDIO_DATA_0/GPIO14/SPI_MISO/I2S_DI/I2S_RCLK_O/I2C_SCL/ADC_CH4/PWM2
19	IO15/SD_D1	SDIO_DATA_1/GPIO15/SPI_MOSI/I2S_DO/I2S_RCLK_O/I2C_SDA/PWM3
20	GND	Ground
21	NC	Not connect
22	VDDIO	GPIO0 to GPIO15 Pin power supply, support for 3.3V and 1.8V input
23	NC	Not connect
24	IO17/XTAL32K_OUT	Default is available. The IO port is shared with the 32.768KHz crystal vibration output pin inside the module. GPIO17/SPI_SCLK/I2S_FS/I2C_SDA/XTAL_32K_OUT/PWM1
25	IO16/XTAL32K_IN	Default is available. The IO port is shared with the 32.768KHz crystal vibration output pin inside the module. GPIO16/SPI_SS/I2S_BCLK/I2C_SCL/XTAL_32K_OUT/PWM0
26	VDD11	DVDD11 power supply；Ultra-low power consumption use scenarios, require external power supply 1.1V；Non-ultra-low power consumption use scenarios, suspended processing.
27	DP	USB_DP
28	DM	USB_DM
29	NC	Not connect
30	NC	Not connect
31	GND	Ground
32	NC	Not connect
33	GND	Ground

34	NC	Not connect
35	NC	Not connect
36	GND	Ground
37	GPIO21/ TXD	TXD/GPIO21/SPI_SCLK/I2S_FS/I2C_SDA/ADC_RCAL_VOUT/PWM1
38	GPIO22/ RXD	RXD/GPIO22/SPI_MISO/I2S_DI/I2S_RCLK_O/I2C_SCL/PWM2
39	IO27	GPIO27/SPI_MOSI/I2S_DO/I2S_RCLK_O/I2C_SDA/ADC_CH10/PWM3
40	IO20	GPIO20/SPI_SS/I2S_BCLK/I2C_SCL/ADC_CH0/PWM0
41	IO28	GPIO28/SPI_SS/I2S_BCLK/I2C_SCL/ADC_CH11/PWM0
42	IO29	GPIO29/SPI_SCLK/I2S_FS/I2C_SDA/PWM1
43	IO30	GPIO30/SPI_MISO/I2S_DI/I2S_RCLK_O/I2C_SCL/PWM2
44	NC	Not connect
Measure point	IO2	Bootstrap/GPIO2/SPI_MISO/I2S_DI/I2S_RCLK_O/I2C_SCL/ADC_CH,shangdian2/PWM2， Internal default pull-up
Note： 1. Measure point IO2 is Bootstrap, and the module enters the burning mode when the moment is high level; when the moment is low level, the module starts normally.		

5. FLASH and BOOT foot resistance instructions

There are three versions of Ai-M62-CBS (BLOFN0, BLIFN2, BLIFN4), and the main differences are as follows:

- BLOFN0 No internal FLASH, the internal BOOT (IO2) foot resistance pull-up, applicable to the network card scheme scenarios.
- BLIFN2 Internal FLASH is 2M Byte, internal BOOT (IO2) foot resistance pull-down, suitable for IOT scheme scenarios.
- BLIFN4 Internal FLASH is 4M Byte, internal BOOT (IO2) foot resistance pull-down, suitable for IOT scheme scenarios.

6. Schematic Diagram

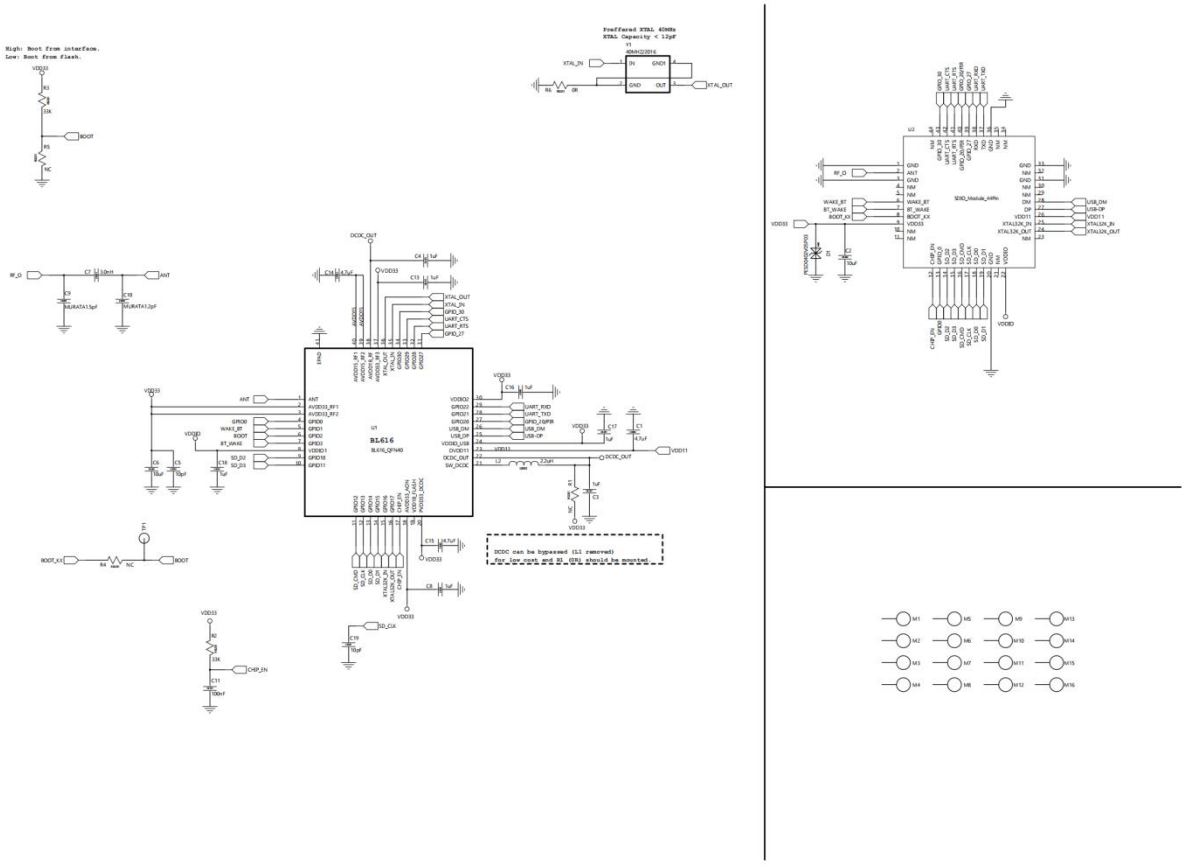


Figure 7 Schematic diagram

6.1. Application circuit guidance

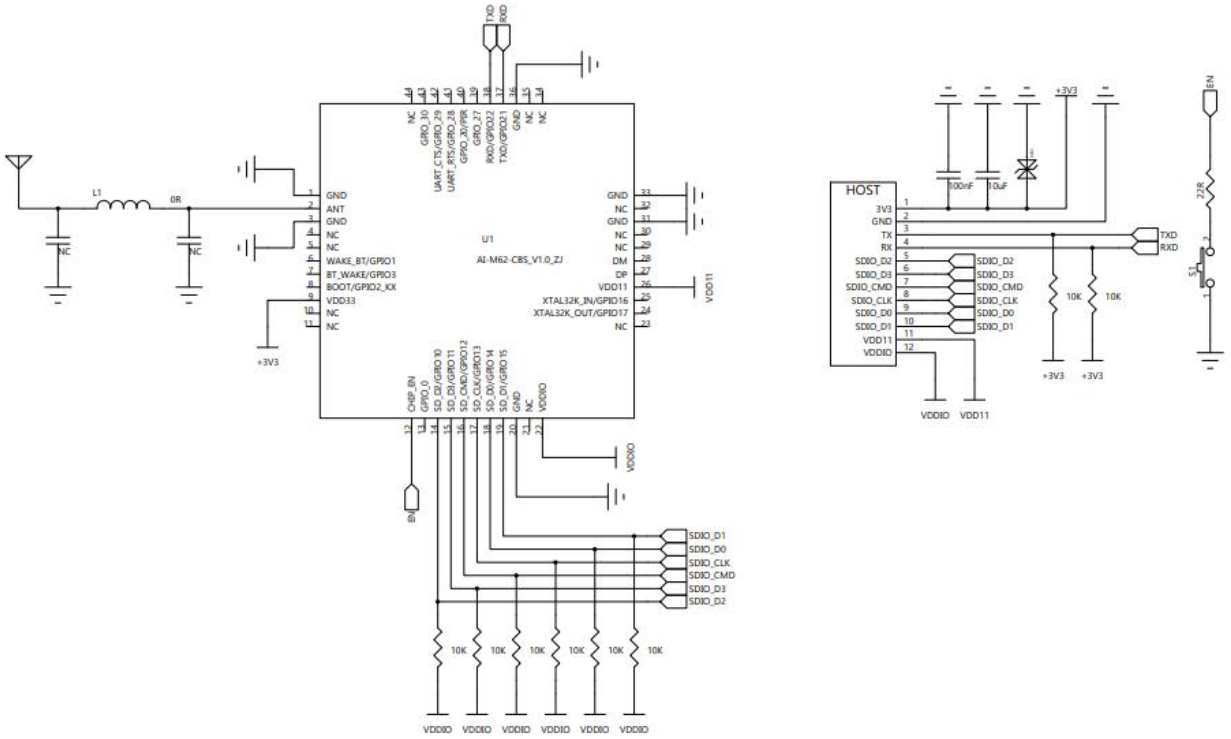


Figure 8 Application circuit guidance

- IO 2 is the module start control foot, in normal working mode at low level and burning firmware mode at high level. The module is default by 33K resistance.
- IO2/NC, default not connect.
- IO 16 and IO 17 are available by default, and the IO port is shared with the 32.768KHz crystal vibration PIN feet. The module does not contain 32.768KHz crystal vibration, please increase in the peripheral circuit of the module.
- It is suggested that SDIO and UART should increase the pull-up resistance to enhance the driving ability.

6.2. Recommended the PCB package size

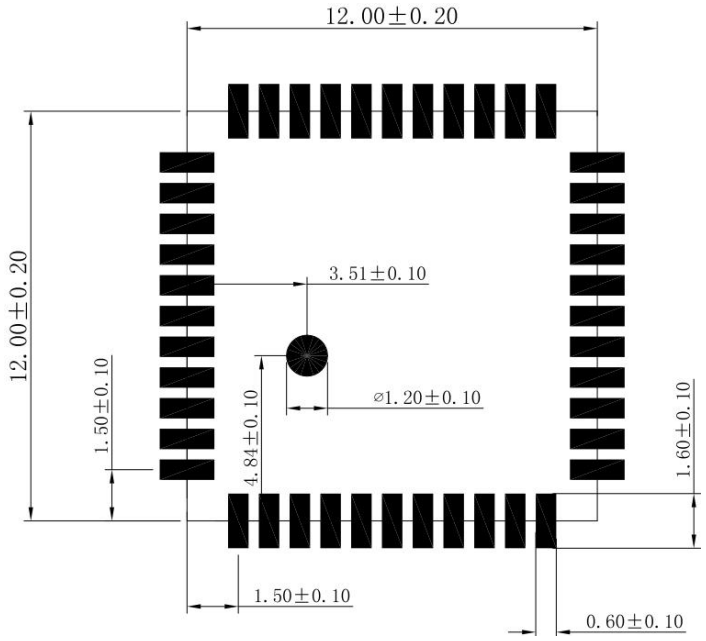


Figure 9 Recommended PCB package sizes (unit: mm)

6.3. Power supply

- Recommended 3.3V voltage, peak current up to 500 mA.
- It is recommended to use LDO for power supply; If DC-DC is used, it is recommended to control the ripple within 100mV.
- DC-DC power supply circuit suggests to reserve the position of dynamic response capacitor, which can optimize the output ripple when the load changes greatly.
- It is suggested to add ESD devices to the 3.3V power interface.

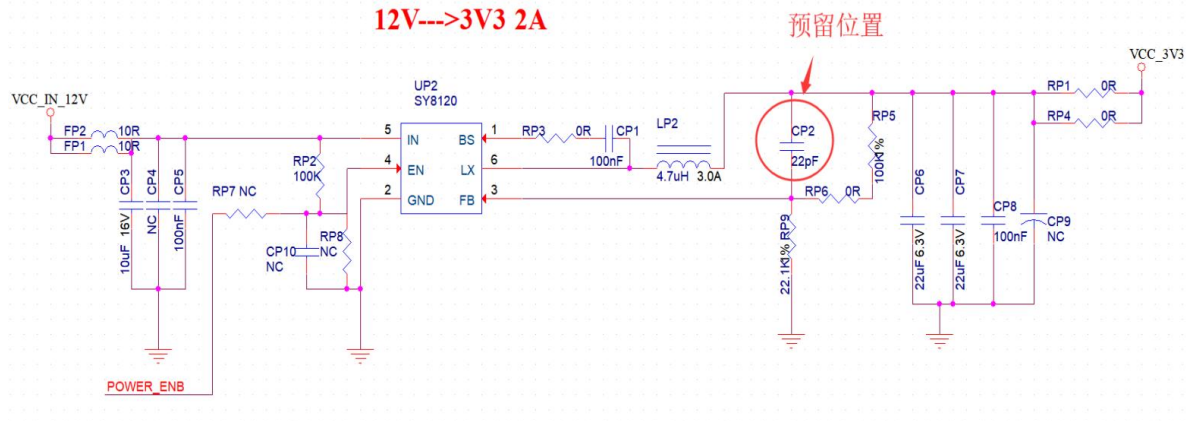


Figure 10 DC-DC step-down circuit diagram

6.4. GPIO

- Some IO ports are led out from the periphery of the module. If necessary, it is recommended to connect 10-100 ohm resistors in series on the IO ports. This can suppress overshoot and make the levels on both sides more stable. It is helpful for EMI and ESD.
- The pull-up and pull-down of special IO ports need to refer to the instructions in the specification, which will affect the startup configuration of the module.
- Part of the IO port of the module is 3.3V, If the level of the main control does not match the level of the IO port of the module, a level conversion circuit needs to be added.
- If the IO port is directly connected to the peripheral interface, or terminals such as pin arrangement, it is recommended to reserve ESD devices near the terminals of the IO port.

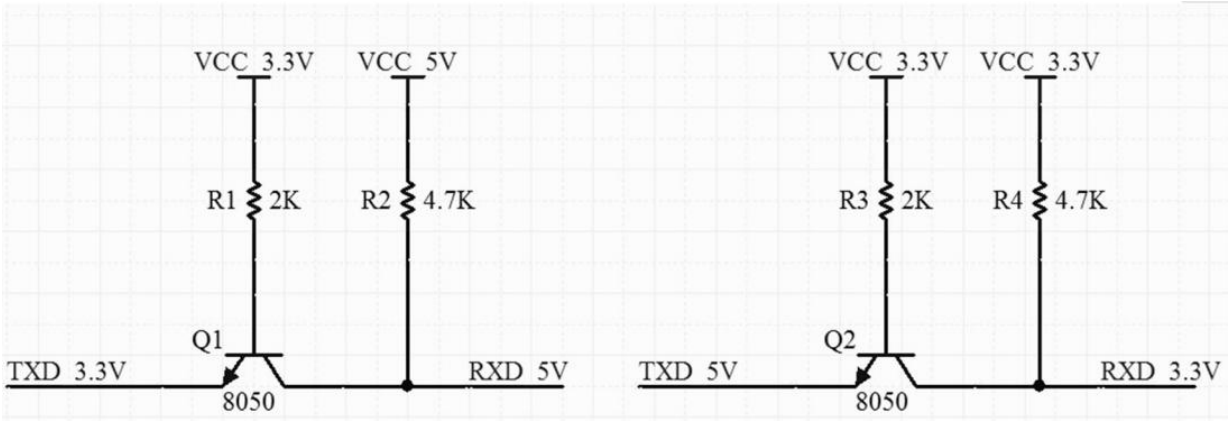


Figure11 Electrical Level conversion circuit

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 use.

8. Flow Welding Curve Diagram

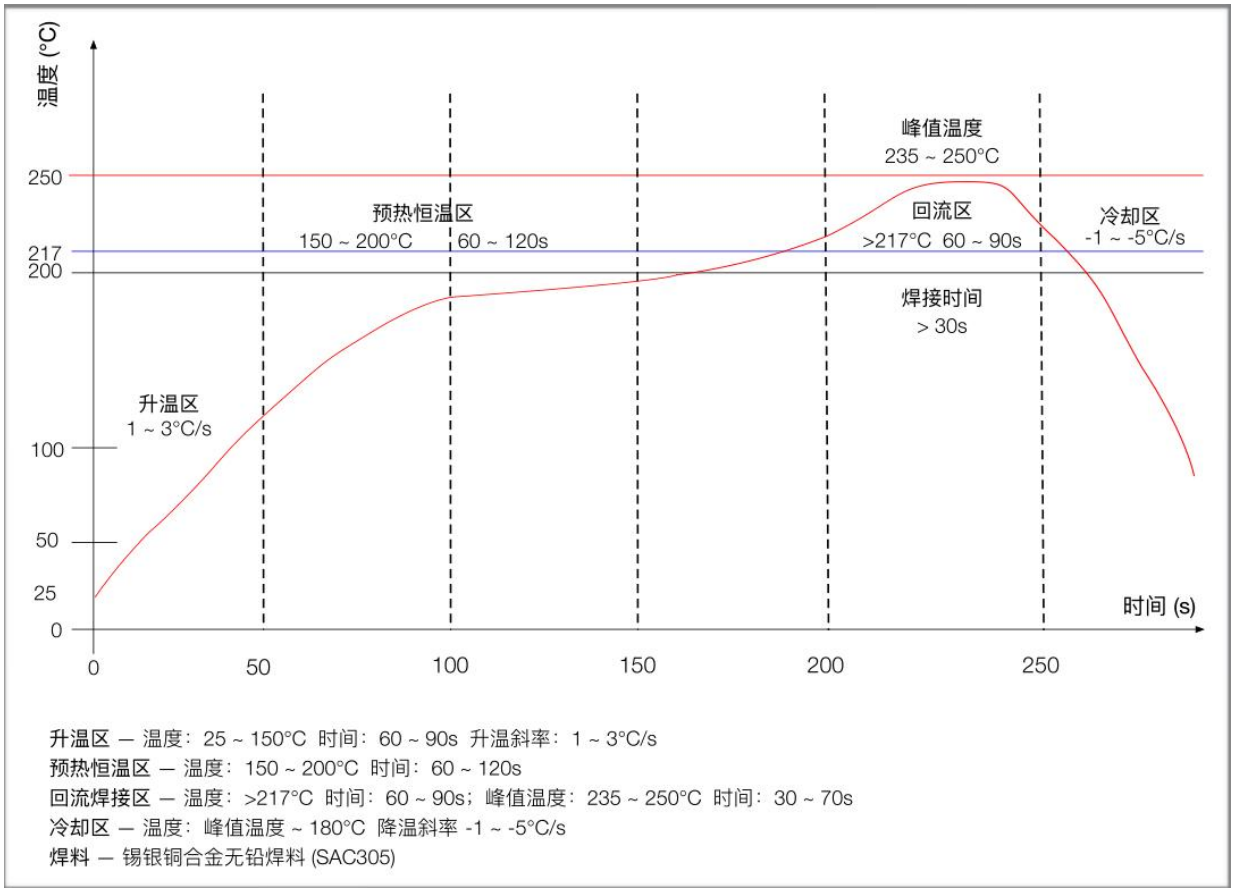


Figure 12 Reflow weld curve diagram

9. Product Packing Information

Ai-M62-CBS module is packaged with a tape， 1400pcs/reel. Below figure for reference：

Figure 13 Braided packaging diagram

10.Contact us

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