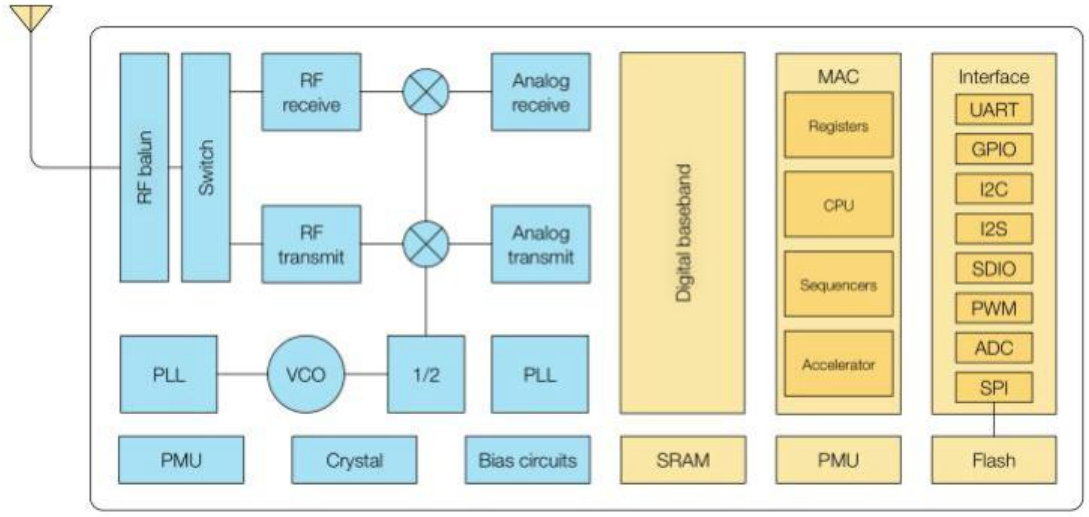
ESP-01S

1. Product Overview

ESP-01S is a Wi-Fi module developed by Essence Technology. The module's core processor ESP8266 integrates the industry-leading Tensilica L106 ultra-low power consumption 32-bit micro MCU in a smaller size package with 16-bit streamlined mode. The main frequency supports 80 MHz and 160 MHz, supports RTOS, and integrates Wi-Fi MAC/BB/RF/PA/LNA.

ESP-01S Wi-Fi module supports standard IEEE802.11 b/g/n protocol and complete TCP/IP protocol stack. Users can use this module to add networking capabilities to existing devices or build independent network controllers.

ESP8266 is a high-performance wireless SoC that provides maximum practicality at the lowest cost, providing unlimited possibilities for embedding Wi-Fi functionality into other systems.



ESP8266 has a complete and self-contained Wi-Fi network function, which can be used independently or as a slave to run on other host MCUs. When used independently, ESP8266 can be booted directly from external flash. The built-in cache memory helps improve system performance and optimizes the storage system.

In another case, ESP8266 can be used as a Wi-Fi adapter simply through the SPI/SDIO interface or UART interface, and can be applied to any microcontroller-based design.

The powerful on-chip processing and storage capabilities of ESP8266 enable it to integrate sensors and other application-specific devices through the GPIO port, greatly reducing the cost of early development.

Feature:

- Complete 802.11b/g/n Wi-Fi SoC module

- Built-in Tensilica L106 ultra-low power consumption 32-bit micro MCU, main frequency supports 80 MHz and 160 MHz, supports RTOS
- Built-in 1 channel 10 bit high-precision ADC
- Support UART/GPIO/PWM interface
- Available in DIP-8 package
- Integrated Wi-Fi MAC/ BB/RF/PA/LNA
- Supports multiple sleep modes, with standby power consumption as low as 1.0mW
- Serial port speed up to 4Mbps
- Embedded Lwip protocol stack
- Support STA/AP/STA+AP working mode
- Supports Android and IOS Smart Config (APP)/AirKiss (WeChat) one-click network configuration
- Supports serial port local upgrade and remote firmware upgrade (FOTA)
- Common AT commands allow you to get started quickly
- Supports secondary development and integrates Windows and Linux development environments

The main parameters:

Module model	ESP-01S
Encapsulation	DIP-8
Size	24.4*14.4*11.2(±0.2)MM Note: 11.2mm is the height of the pin header Antenna form Onboard PCB antenna
Spectrum range	2400~2483.5MHz
Operating temperature	-20℃~70℃
Storage environment	-40℃ ~ 125℃, < 90%RH
Power supply range	Power supply voltage 3.0V ~ 3.6V, power supply current >500mA Support interface UART/GPIO/PWM
Number of IO ports	2
Serial port speed	Support 110 ~ 4608000 bps, default 115200 bps security WEP/WPA-PSK/WPA2-PSK
SPI Flas	Default 8Mbit
Certification	RoHS

2. Electrical parameters

Electrical characteristics

Parameters	**Conditions**	**Minimum**	**Typical**	**Maximum**	**Unit**
Supply voltage	VDD	3	3.3	3.6	V

I/O	VIL/VIH	-	-0.3/0.75VIO	-	0.25VIO/3.6	V
	VOL/VOH	-	N/0.8VIO	-	0.1VIO/N	V
	IMAX	-	-	-	12	MA

RF performance

Describe	Typical value	Unit
Working frequency	2400 - 2483.5	MHz
Output Power		
In 11n mode, the PA output power is	13±2	dBm
In 11g mode, the PA output power is	14±2	dBm
In 11b mode, the PA output power is	16±2	dBm
Receive sensitivity		
CCK, 1 Mbps	<=-90	dBm
CCK, 11 Mbps	<=-85	dBm
6 Mbps (1/2 BPSK)	<=-88	dBm
54 Mbps (3/4 64-QAM)	<=-70	dBm
HT20 (MCS7)	<=-67	dBm

Power consumption

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

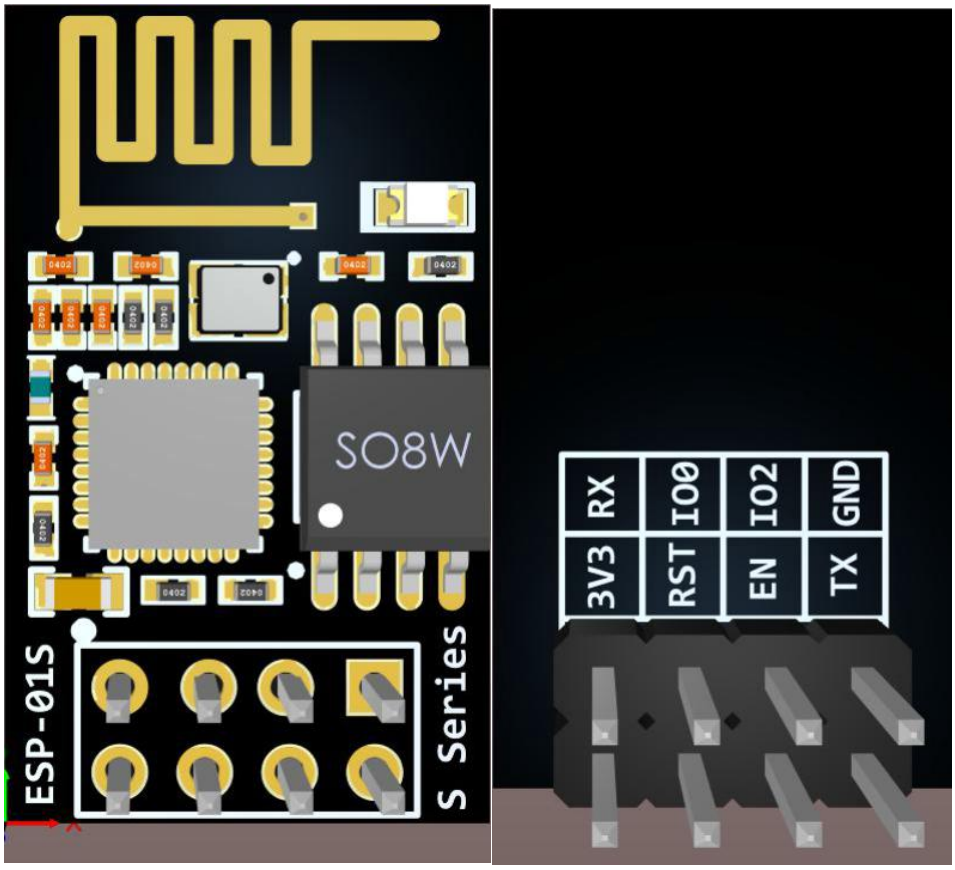
- All measurements are done at the antenna interface without SAW filter.
- All emission data are measured in continuous emission mode based on 90% duty cycle.

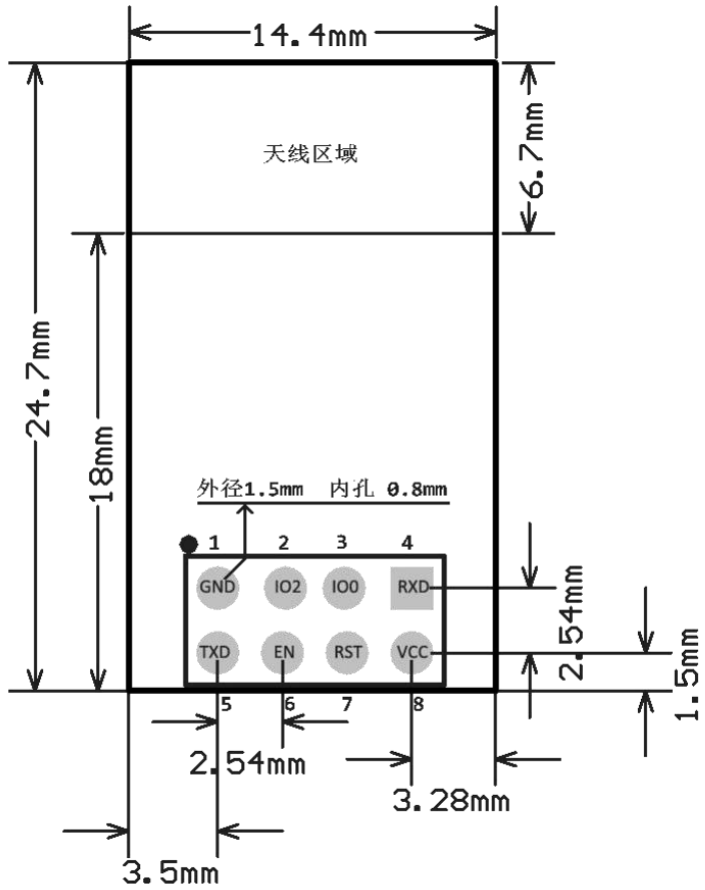
Model	**Minimum**	**Typical**	**Maximum**	**Unit**
Transmit 802.11b, CCK 11Mbps, POUT=+17dBm		170	-	mA
Transmit 802.11g, OFDM 54Mbps, POUT =+15dBm		140		mA
Transmission 802.11n, MCS7, POUT =+13dBm	-	120	-	mA
Receive 802.11b, packet length 1024 bytes, -80dBm	-	50	—	mA
Receive 802.11g, packet length 1024 bytes, -70dBm	-	56	-	mA
Receive 802.11n, packet length 1024 bytes, -65dBm	-	56	—	mA
Modem-Sicep①	-	20	-	mA
Light-Sleep②	-	2	—	mA
Deep-Sleep③	-	20	-	uA
Power Off	-	0.5	—	uA

Illustrate:

- Modem-sleep is used for applications that require the CPU to be working all the time, such as PWM or I2S applications. When maintaining a Wi-Fi connection, if there is no data transmission, the Wi-Fi Modem circuit can be turned off to save power according to the 802.11 standard (such as U-APSD). For example, in DTIM3, every 300 ms of sleep and 3 ms of wake-up to receive the AP's Beacon packet, etc., the overall average current is about 20 mA.
- Light-sleep is used for applications where the CPU can be paused, such as Wi-Fi switches. When maintaining a Wi-Fi connection, if there is no data transmission, the Wi-Fi Modem circuit can be turned off and the CPU can be suspended to save power according to the 802.11 standard (such as U-APSD). For example, in DTIM3, every 300 ms of sleep and 3 ms of wake-up to receive the AP's Beacon packet, etc., the overall average current is about 2 mA.
- Deep-sleep is used for applications that do not need to maintain a Wi-Fi connection all the time and send data packets for a long time, such as a sensor that measures temperature every 100 seconds. For example, if it takes 0.3s ~ 1s to connect to the AP and send data after waking up every 300s, then the overall average current can be much less than 1 mA. The current value of 20 μA is measured at 2.5V.

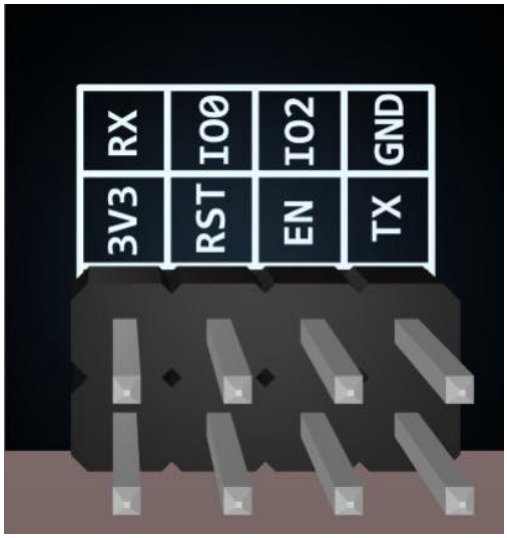
3. Physical dimension:





4. Pin definition

The ESP-01S module has a total of 8 interfaces, as shown in the pin diagram and the pin function definition table is the interface definition.



PIN	Name	Function Description
1	GND	Ground

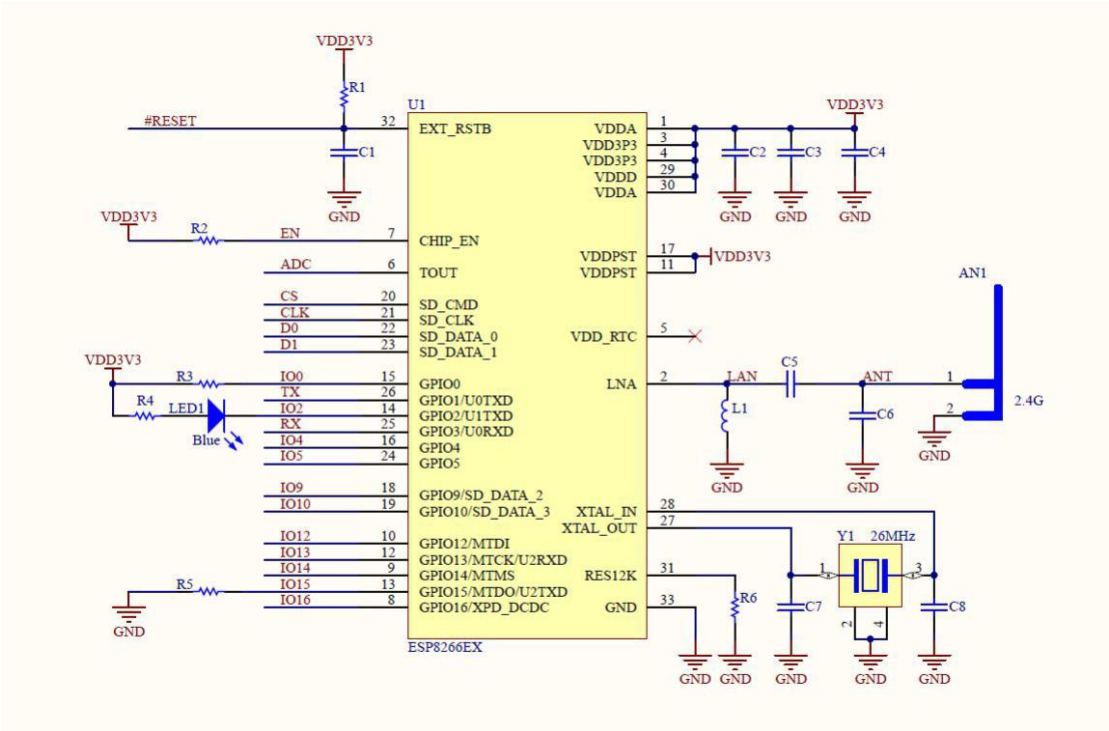
2	102	GPI02/UARTI_TXD
3	100	GPI00: Download mode: externally pulled low; operating mode: floating or externally pulled high
4	RXD	UART0_RXD/GPI03
5	TXD	UART0_TXD/GPI01
6	EN	Chip enable terminal, active at high level
7	RST	Reset
8	VCC	3. 3V power supply (VDD); the output current of the external power supply is recommended to be above 500mA.

Module startup mode description

Model	CH_PD(EN)	RST	GPIO15	GPIO0	GPIO2	TXD0
Download mode	High	High	Low	Low	High	High
Operating mode	High	High	Low	High	High	High

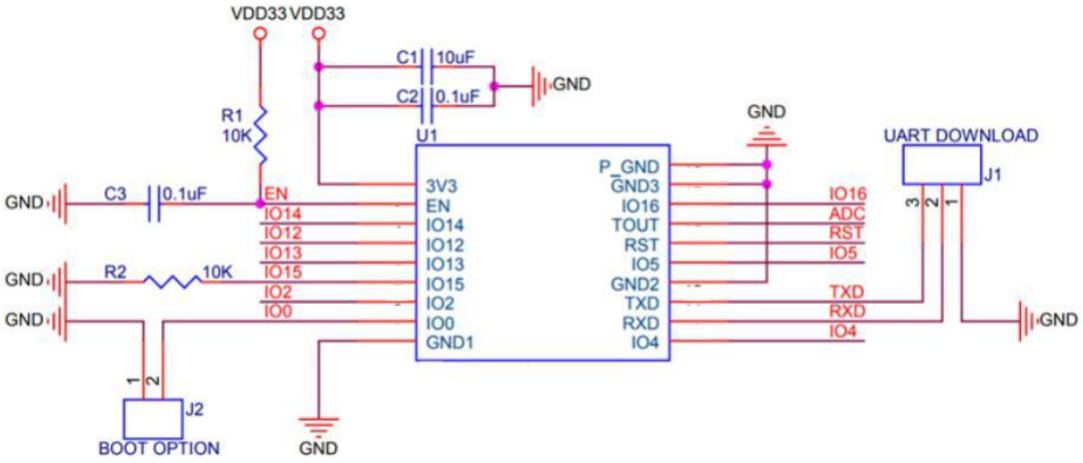
Note: Some pins have been pulled up internally, please refer to the schematic diagram

5. Schematic diagram



6. Design guidance

1. Application circuit



Notice:

(1) For the module peripheral circuit, GPIO0 must be pulled up to VCC, and GPIO15 must be pulled down to GND.

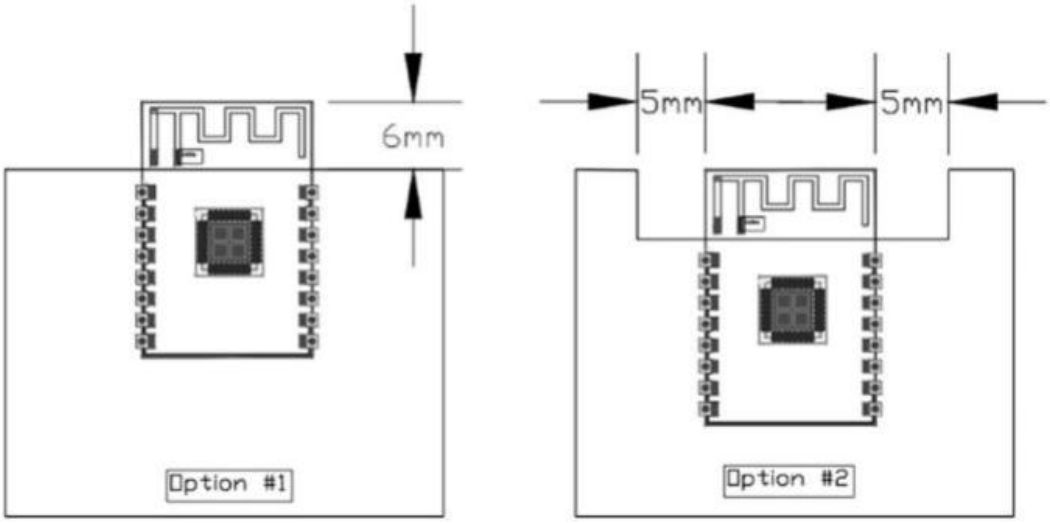
(2) The EN pin and RST pin must be pulled up to VCC.

2. Antenna layout requirements

(1) For 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. (2) In order to meet the performance of the onboard antenna, it is prohibited to place metal parts around the antenna and keep away from high-frequency devices.

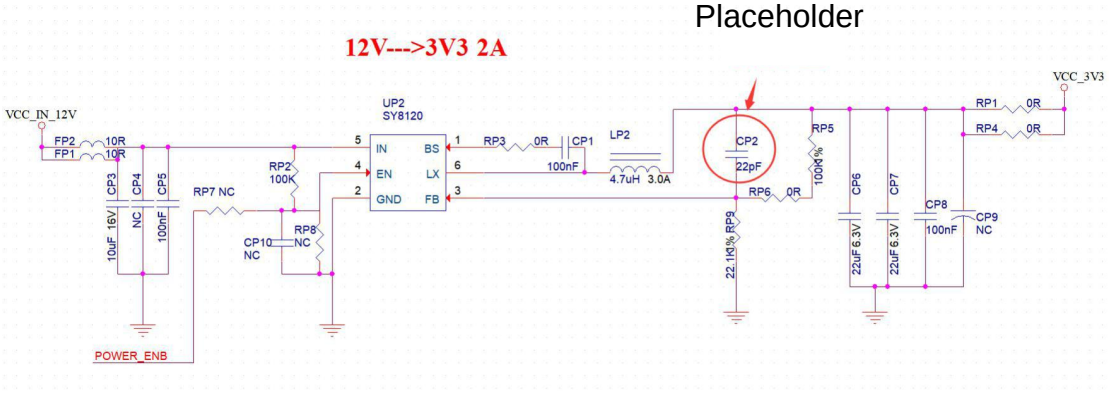


3. Power supply

(1). Recommended voltage of 3.3V, peak current of more than 500mA

(2) It is recommended to use LDO for power supply; if DC-DC is used, it is recommended that the ripple be controlled within 30mV.

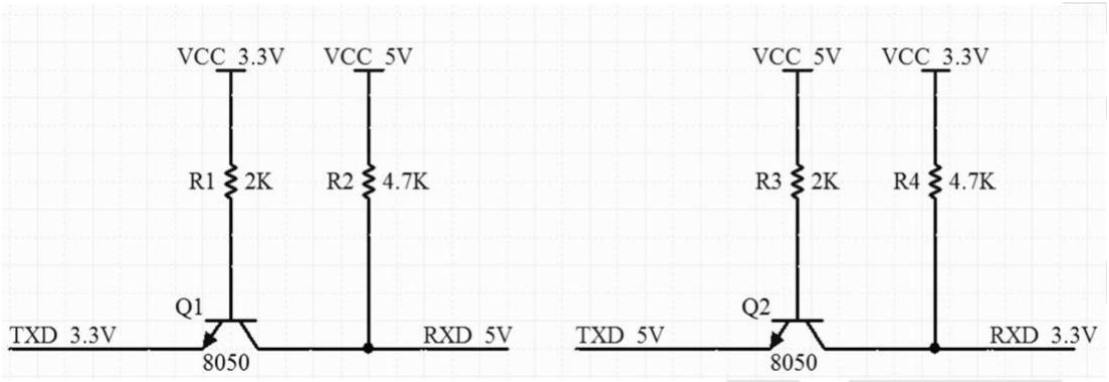
(3) In the DC-DC power supply circuit, it is recommended to reserve the position of the dynamic response capacitor to optimize the output ripple when the load changes greatly.



4. Use of GPIO port

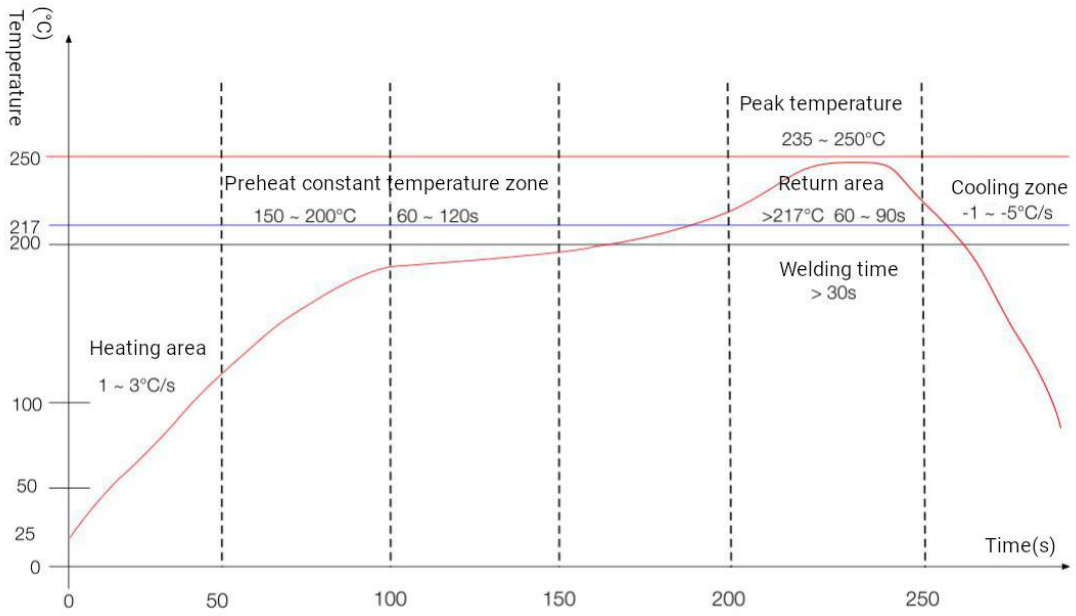
(1). There are some GPIO ports on the periphery of the module. If you need to use it, it is recommended to connect a 10-100 ohm resistor in series to the IO port. This can suppress overshoot and make the levels on both sides more stable. Helps with both EMI and ESD.

(2) 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. (3). 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 conversion circuit needs to be added. (4) If the IO port is directly connected to the peripheral interface or pin header and other terminals, it is recommended to reserve ESD devices near the IO traces near the terminals.



Level conversion circuit

6. Reflow soldering curve



Heating zone -- Temperature: 25 ~ 150℃ Time: 60 ~ 90s Heating slope: 1 ~ 3℃/s

Preheating constant temperature zone -- Ttemperature: 150 ~ 200℃ Ttime: 60 ~ 120s

Reflow soldering area -- Temperature: >217℃ Time: 60 - 90s; Peak temperature: 235 ~ 2500c Time: 30 - 70s

Cooling zone -- Temperature: Peak temperature ~ 180℃ Cooling slope -1 - -5℃/s

Solder -- Tin Silver Copper Alloy Lead Free Solder (SAC305)