ESP-12F specification sheet

Version V1.1

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Document creation/revision/abolition resume

Version	date	Develop/revise content	formulate	approve
V0.9	2016.05.14	formulated for the first time	Yang Xiaofei	
V1.0	2019.10.29	Data update	Xie Yiji	
V1.1	2020.12.7	**Updates**	Xu Hong	

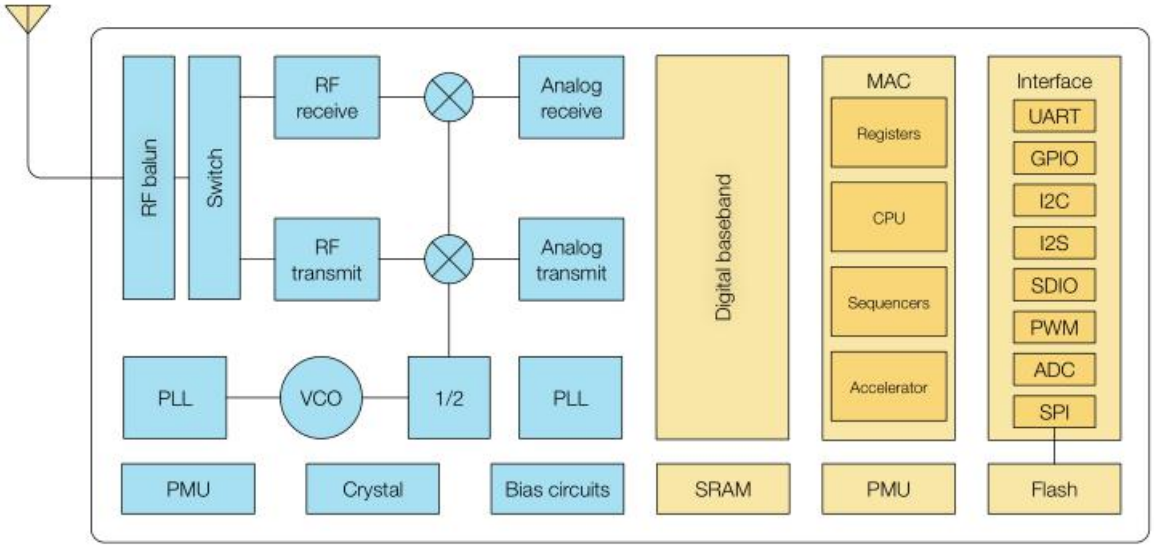
Table of contents

1. Product Overview

ESP-12F is a Wi-Fi module developed by Essence Technology. The core processor ESP8266 of this module is smaller in size. The industry-leading Tensilica L106 ultra-low power consumption 32-bit micro MCU is integrated into the 16-bit precision package. Simple mode, main frequency supports 80 MHz and 160 MHz, supports RTOS, and integrates Wi-Fi MAC/ BB/RF/PA/LNA.

The ESP-12F Wi-Fi module supports the standard IEEE802.11 b/g/n protocol and the 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 utility at the lowest cost, embedding Wi-Fi functionality into other The system offers endless possibilities.



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

in addition—In this case, ESP8266 can be used as a Wi-Fi interface only through the SPI/SDIO interface or UART interface. Adapter for use in any microcontroller-based design.

The powerful on-chip processing and storage capabilities of ESP8266 enable it to integrate sensors and other applications through the GPIO port. Specific equipment greatly reduces the cost of early development.

characteristic

- 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 Support RTOS
- Built-in 1 channel 10 bit high-precision ADC
- Support UART/GPIO/ADC/PWM/SPI/I2C interface
- Packaged in SMD-22
- Integrated Wi-Fi MAC/ BB/RF/PA/LNA
- Supports multiple sleep modes, deep sleep current as low as 20uA
- 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)
- General AT commands can help you get started quickly
- Supports secondary development and integrates Windows and Linux development environments

The main parameters

Table 1 Description of main parameters

Module model	ESP-12F
encapsulation	SMD-22
size	24*16*3(±0.2)MM**(PCB thickness 0.8MM)**
Antenna form	Onboard PCB antenna
spectrum range	2400~2483.5MHz
Operating temperature	- 40 °C ~ 85 °C
Storage environment	- 40 °C ~ 125 °C , < 90%RH
Power supply range	Supply voltage 3.0V ~ 3.6V, supply current >500mA
Support interface	UART/GPIO/ADC/PWM/SPI/I2C
Number of IO ports	9
Serial port speed	Support 110 ~ 4608000 bps, default 115200 bps
safety	WEP/WPA-PSK/WPA2-PSK
SPI Flash	Default 32Mbit
Certification	FCC, CE, IC, REACH, RoHS, SRRC, NCC, TELEC, ANATEL, KCC

2. Electrical parameters

Electrical characteristics

parameter		condition	minimum value	Typical value	maximum value	unit
Supply voltage		VDD	3.0	3.3	3.6	V
I/O	V_{IL}/V_{IH}	-	- 0.3/0.75VIO	-	0.25VIO/3.6	V
	V_{OL}/V_{OH}	-	N/0.8VIO	-	0.1VIO/N	V
	I_{MAX}	-	-	-	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, PA output power	16±2	dBm
Receive sensitivity		
CCK, 1Mbps	<=-90	dBm
CCK, 11Mbps	<=-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 power supply, an ambient temperature of 25°C, and measured using the internal voltage regulator.

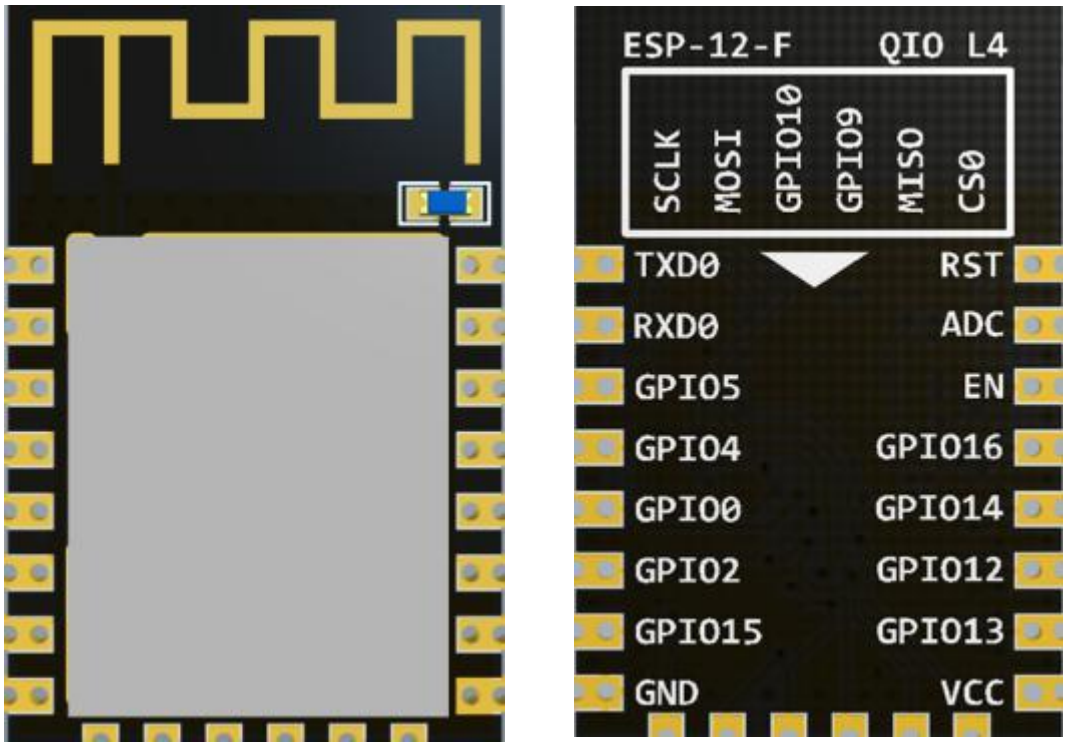
- All measurements are done at the antenna interface without SAW filter. All emission
- data are measured in continuous emission mode based on 90% duty cycle.

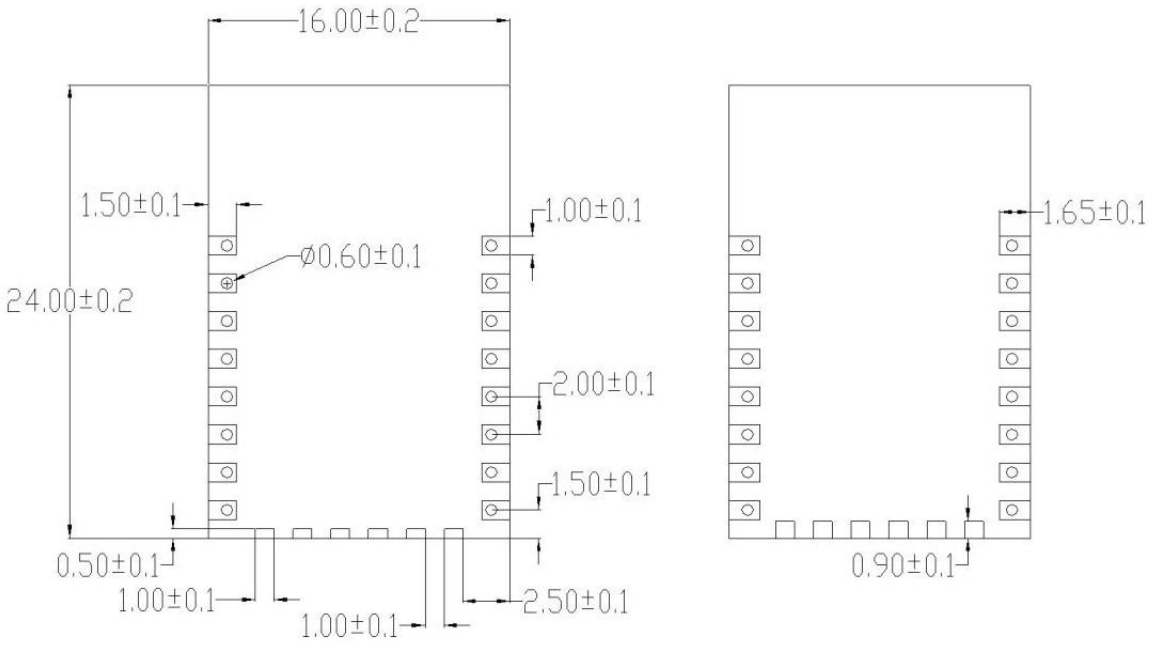
model	minimum value	Typical value	maximum value	unit
Transmit 802.11b, CCK 11Mbps, POUT=+17dBm	-	170	-	mA
Transmit 802.11g, OFDM 54Mbps, POUT =+15dBm	-	140	-	mA
Transmit 802.11n, MCS7, POUT =+13dBm	-	120	-	mA
Receive 802.11b, packet length 1024 bytes, -80dBm	-	50	-	mA
Receive 802.11g, packet length 1024 bytes, -70dBm	-	56	-	mA
Receive 802.11n, packet length 1024 bytes, -65dBm	-	56	-	mA
Modem-Sleep①	-	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. exist When maintaining Wi-Fi connection, if there is no data transmission, it can be turned off according to the 802.11 standard (such as U-APSD). Wi-Fi Modem circuit to save power. For example, in DTIM3, every 300 ms of sleep, wake up 3 ms of receiving AP Beacon package, 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. While maintaining a Wi-Fi connection, such as If there is no data transmission, you can turn off the Wi-Fi Modem circuit and temporarily Stop the CPU to save power. For example, in DTIM3, every 300 ms of sleep, wake up for 3 ms to receive the AP's Beacon. package, 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 only send data packets once for a long time, such as A sensor that measures temperature every 100 seconds. For example, it takes 0.3s ~ 1s to connect to the AP after waking up every 300s. If data is sent, the overall average current can be much less than 1 mA. The current value of 20 μA is measured at 2.5V.

3. Appearance size





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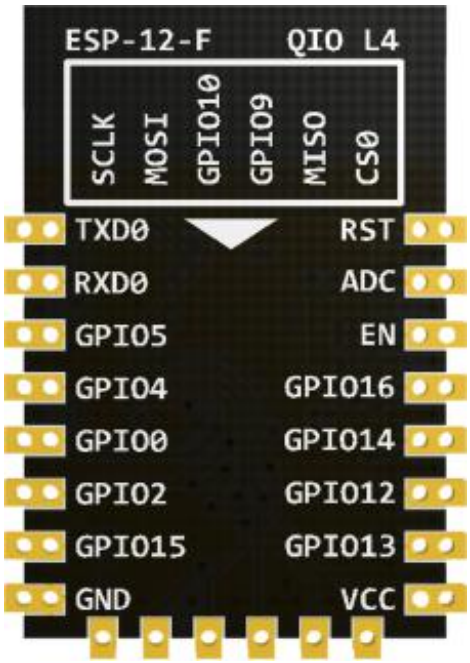
4. Pin definition

The ESP-12F module has a total of 16 interfaces, such as the pin diagram and the pin function definition table.



ESP-12F pin diagram

Table pin function definition

foot sequence	name	Function Description
1	RST	reset
2	ADC	A/D conversion result. Input voltage range: 0~1V, value range: 0~1024
3	EN	Chip enable terminal, active at high level
4	IO16	GPIO16/ can be used to wake up from deep sleep when connected to the RST pin.
5	IO14	GPIO14/HSPI_CLK
6	IO12	GPIO12/HSPI_MISO
7	IO13	GPIO13/HSPI_MOSI/UART0_CTS
8	VCC	3.3V power supply (VDD); the output current of the external power supply is recommended to be above 500mA
9	GND	ground
10	IO15	GPIO15/MTDO/HSPICS/UART0_RTS
11	IO2	GPIO2/UART1_TXD

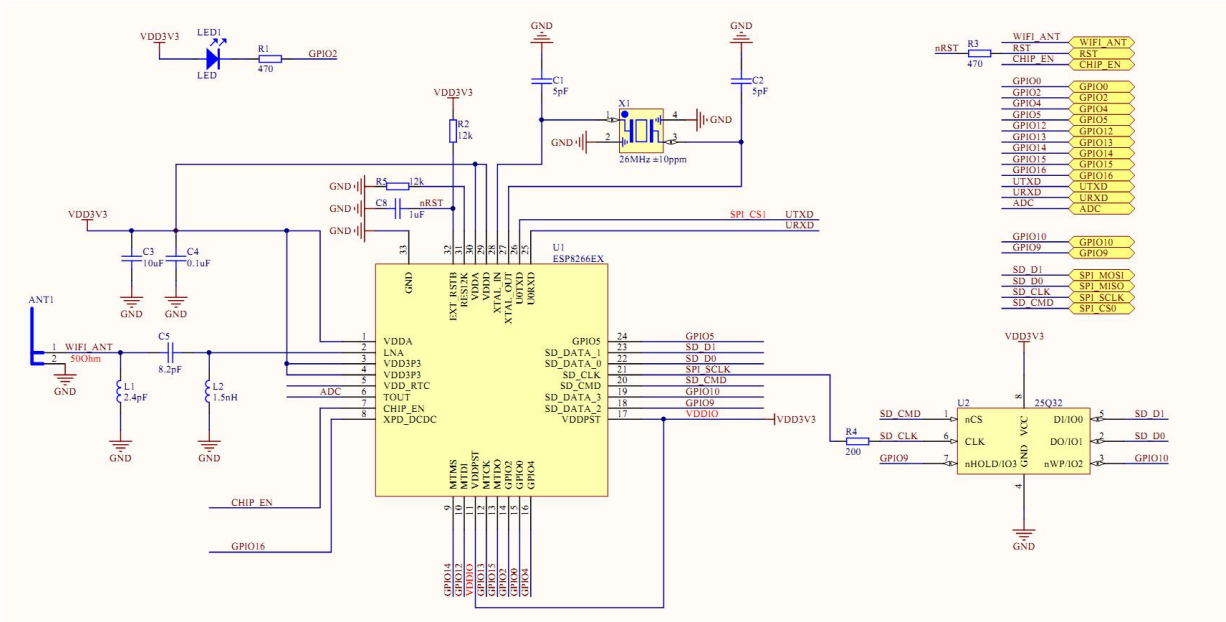
12	IO0	GPIO0; download mode: externally pulled low, operating mode: floating or externally pulled high
13	IO4	GPIO4
14	IO5	GPIO5/IR_R
15	RXD	UART0_RXD/GPIO3
16	TxD	UART0_TXD/GPIO1

Table 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

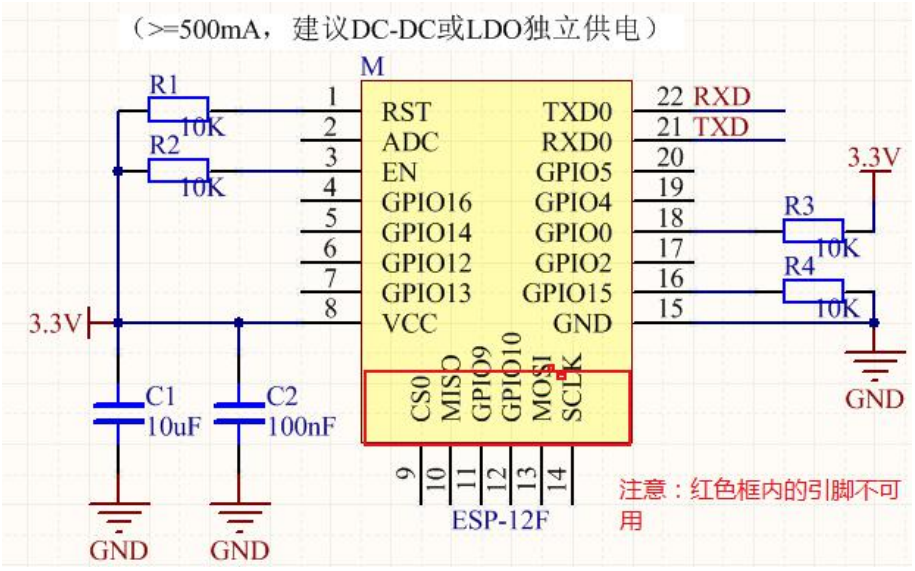
Note: Some pins have been pulled up internally, please refer to the schematic diagram

5. Schematic diagram



6. Design guidance

1. Application circuit

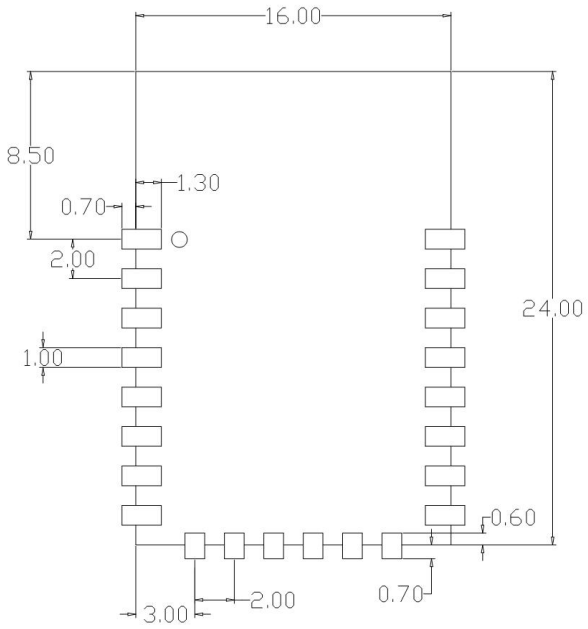


Notice:

(1) For the module peripheral circuit, GPIO0 must be pulled up to VCC, and GPIO15 must be pulled down to GND. (2), EN pin and RST pin must be pulled up to VCC.

(3). Pin9-pin14 of the module are unavailable.

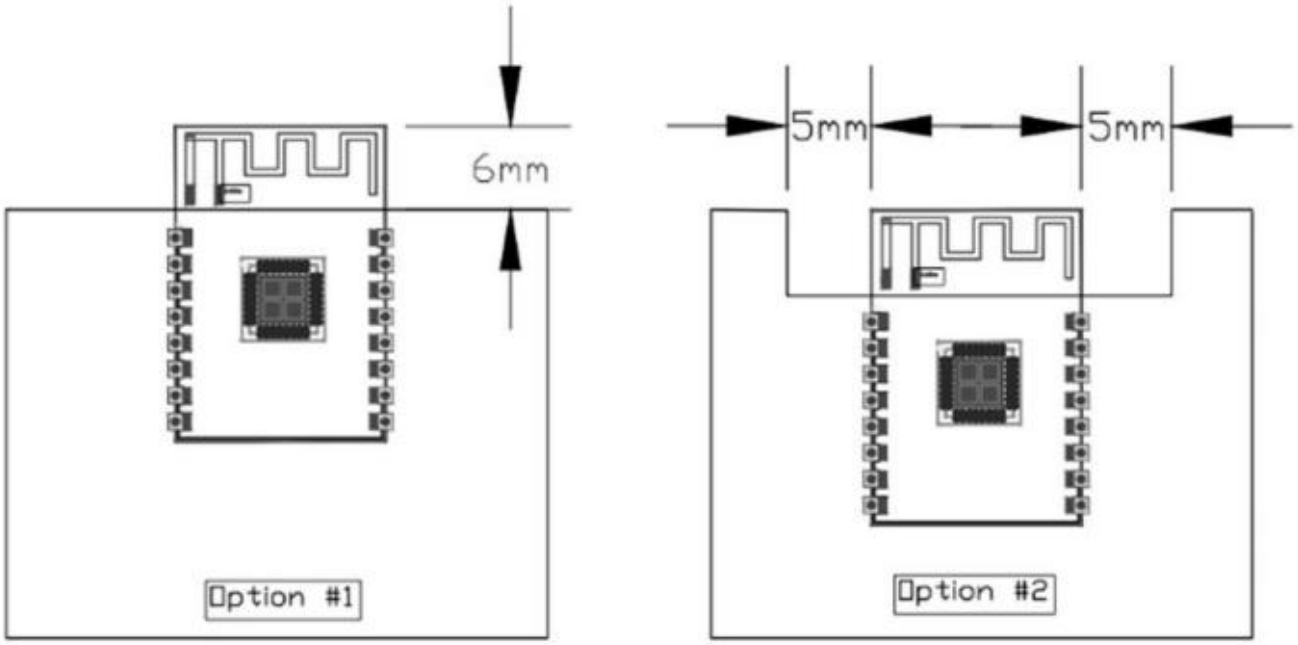
2. Recommended module package design size



Notice: *This is the package diagram of the ESP-12F module. It is recommended to design the PCB board according to this diagram so that the module can work normally on the PCB board; and when designing the pads, you need to pay attention. Do not design the pads on the PCB to be smaller than the module. The pad shrinks and deviates, while the PCB pad expands relative to the module pad, which does not affect the use of the module.*

3. Antenna layout requirements

(1) For the installation position on the motherboard, the following two methods are recommended: Option 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.



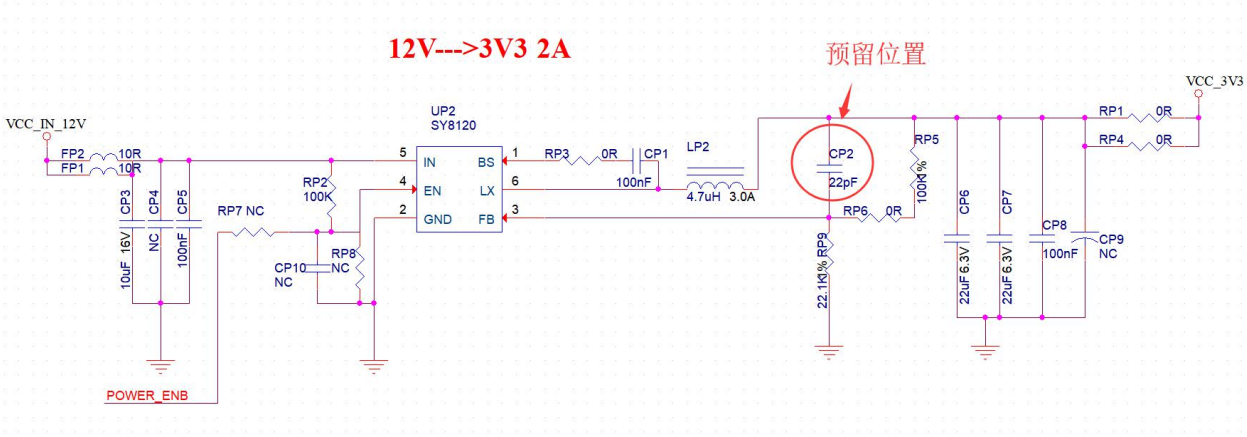
4. Power supply

(1). Recommended voltage is 3.3V, peak current is 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, which can optimize the output ripple when the load changes greatly.

(4) It is recommended to add ESD devices to the 3.3V power interface.



5. Use of GPIO port

(1). There are some GPIO ports on the periphery of the module. If you need to use them, 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 terminals on the IO trace.

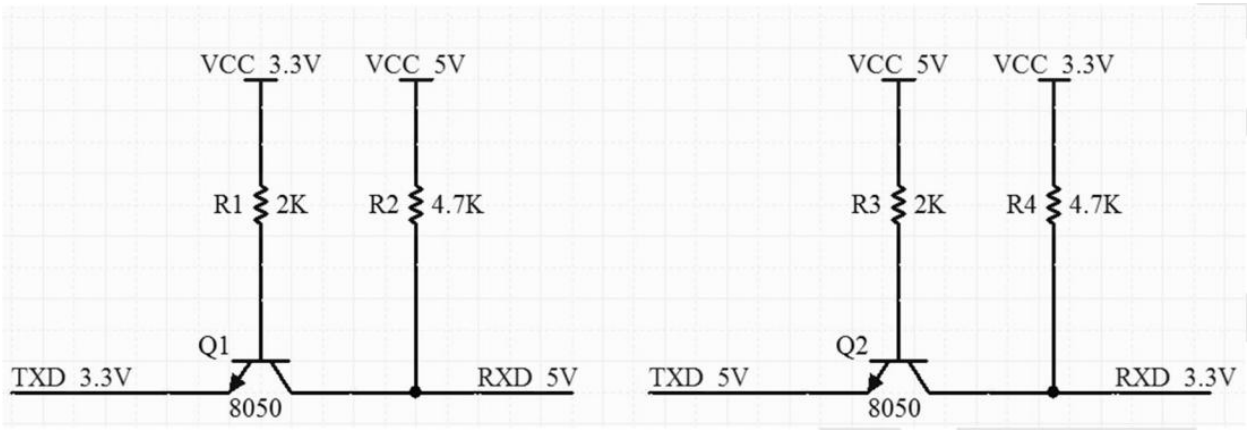
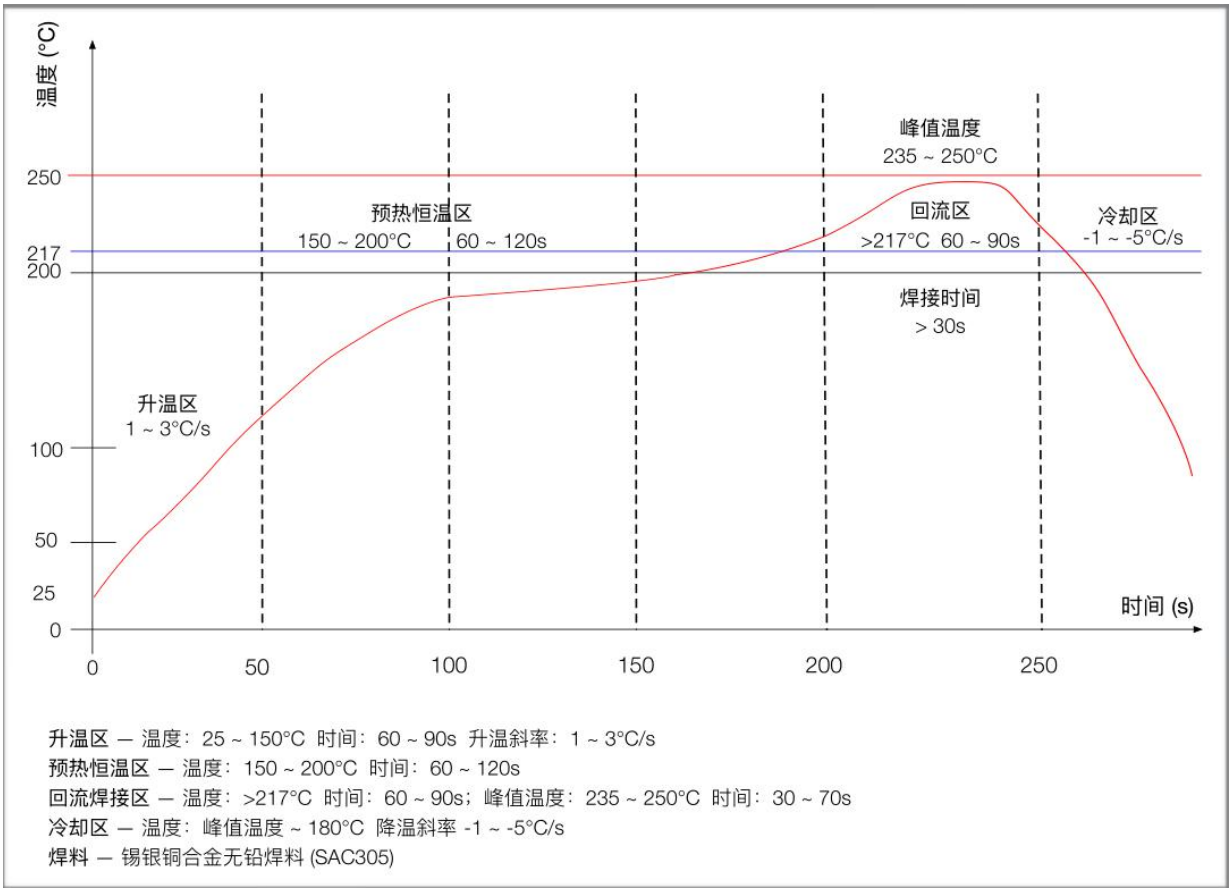


Figure level conversion circuit

7. Reflow soldering curve



升温区 — 温度：25 ~ 150°C 时间：60 ~ 90s 升温斜率：1 ~ 3°C/s
预热恒温区 — 温度：150 ~ 200°C 时间：60 ~ 120s
回流焊接区 — 温度：>217°C 时间：60 ~ 90s；峰值温度：235 ~ 250°C 时间：30 ~ 70s
冷却区 — 温度：峰值温度 ~ 180°C 降温斜率 -1 ~ -5°C/s
焊料 — 锡银铜合金无铅焊料 (SAC305)

8. Packaging information

As shown below,ESP-12FThe packaging is tape.

9. Contact us

Official website:https://www.ai-thinker.com

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Official Forums:http://bbs.ai-thinker.com

Sample purchase:https://anxinke.taobao.com

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