# ESP-01D Specification

Version V1.1

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# Document development/revision/revocation resume

| Vision | Data | Revised content | Edition | Approve |
|---|---|---|---|---|
| V1.0 | 2019.10.30 | First Edition | Xie Yiji | |
| V1.1 | 2021.05.31 | Modify the antenna wielding plate length | Guan Ning | |
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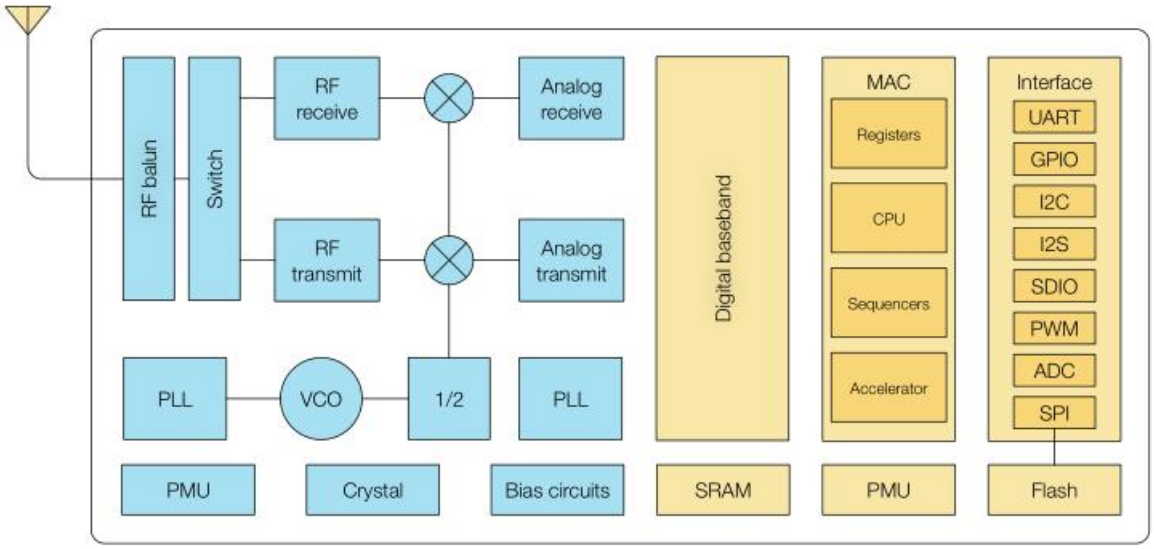
# CONTENT

# 1.Product Overview

The ESP-01D Wi-Fi module is developed by Ai-Thinker Technology, its core processor ESP8285 integrates the industry-leading Tensilica L106 ultra-low power 32-bit micro MCU, with 16-bit thin mode with 80 MHz and 160 MHz, support RTOS, integrated Wi-Fi MAC/ BB/RF/PA/LNA.

The ESP-01D WiFi module supports the standard IEEE802.11 b/g/n protocol, the full TCP/IP protocol stack. Users can use the module to add networking capabilities to existing devices or to build separate network controllers.

ESP8285 is high-performance wireless SOC, providing maximum utility at minimum cost, providing unlimited possibilities for Wi-Fi functionality embedding other systems.




ESP8285 is a complete and self-built Wi-Fi network solution that runs independently or as a slave to other host MCU. The ESP8285 is able to start directly from the external flash memory when carrying an application and serving as the only application processor in the device. The built-in buffered memory helps improve system performance and reduce memory requirements.

In addition , when ESP8285 is responsible for wireless Internet access to the Wi-Fi adapter, it can add it to any microcontroller based design, which is easy to connect, simply through the SPI /SDIO interface or I2C/UART interface.

ESP8285's powerful on-chip processing and storage capabilities enable to integrate sensors and

other applications through GPIO ports enable the minimum footprint of system resources in early development and operation.

## Characteristics

- Complete 802.11b/g/n Wi-Fi SOC module
- Built-in Tensilica L106 Ultra Low Power 32-bit Micro MCU, Master frequency Support 80 MHz and 160 MHz, Support RTOS
- Support for the GPIO/PWM interface
- Package in DIP-6
- Integrated Wi-Fi MAC/ BB/RF/PA/LNA s
- Supports multiple sleep modes
- Embedded Lwip stack
- Support for the STA/AP/STA + AP working mode
- Smart Config (APP) / AirKiss (WeChat) supporting Android and IOS
- Support for a remote firmware upgrade (FOTA)
- Universal AT instructions can be used quickly
- Support for secondary development, with an integrated Windows, Linux development environment

# Main parameters

**Table 1 main parameter descriptions**

| | |
|---|---|
| **Model Name** | ESP-01D |
| **Package** | DIP-6 |
| **Size** | 13.5*8.5*2.6(±0.2)MM |
| **Antenna** | External antenna |
| **Frequency range** | 2400 ~ 2483.5MHz |
| **Operating temperature** | -40 ℃ ~ 85 ℃ |
| **Storage temperature** | -40 ℃ ~ 125 ℃ , < 90%RH |
| **Power supply range** | Supply voltage 3.0V ~ 3.6V， supply current >500mA |
| **Support interface** | GPIO/PWM |
| **IO** | 3 |
| **Serial port rate** | Support 300 ~ 4608000 bps ， default 115200 bps |
| **Security** | WEP/WPA-PSK/WPA2-PSK |
| **SPI Flash** | 16Mbit(inside chip) |

# 2. Electrical parameters

## Electrical characteristics

| Parameters | | Conditions | Min | Typical value | Max | 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

| Description | Typical value | Unit |
|---|---|---|
| Operating frequency | 2400 - 2483.5 | MHz |
| 输出功率 | | |
| 11n mode，the PA output power is | 13±2 | dBm |
| 11g mode，the PA output power is | 14±2 | dBm |
| 11b mode，the PA output power is | 16±2 | dBm |
| **Receive sensitivity** | | |
| 11b, 1 Mbps mode | ＜＝-90 | dBm |
| 11b, 11 Mbps mode | ＜＝-85 | dBm |

| | | |
|---|---|---|
| 11g，6 Mbps mode | ＜＝-88 | dBm |
| 11g，54 Mbps mode | ＜＝-70 | dBm |
| HT20 ，MCS7 mode | ＜＝-67 | dBm |

## Power consumption

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

- All measurements are done at the antenna interface without the SAW filters.
- All the emission data are based on a 50% duty cycle, measured in the mode of continuous emission.

| Mode | Min | Typical value | Max | Unit |
|---|---|---|---|---|
| Transmitting 802.11b, CCK 11Mbps, POUT=+17dBm | - | 170 | - | mA |
| Transmitting 802.11g, OFDM 54Mbps, POUT =+15dBm | - | 140 | - | mA |
| Transmitting 802.11n, MCS7, POUT =+13dBm | - | 120 | - | mA |
| Receiving 802.11b, package length 1024bytes, -80dBm | - | 50 | - | mA |
| Receiving 802.11g, package length 1024bytes, -70dBm | - | 56 | - | mA |
| Receiving 802.11n, package length 1024bytes, -65dBm | - | 56 | - | mA |
| Modem-Sleep① | - | 20 | - | mA |
| Light-Sleep② | - | 2 | - | mA |
| Deep-Sleep③ | - | 20 | - | μA |
| Power Off | - | 0.5 | - | μA |
| | | | | |

## Description：

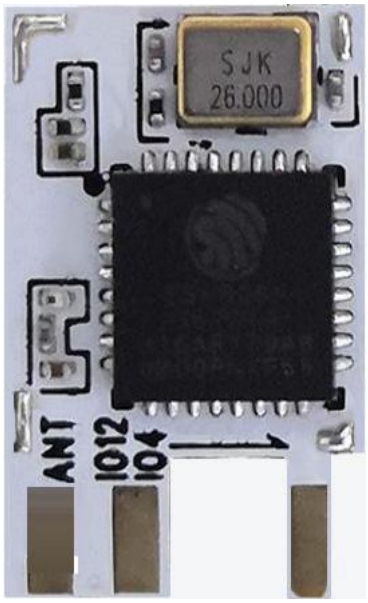
① Modem-Sleep for applications that require CPU to remain working such as PWM or I2S

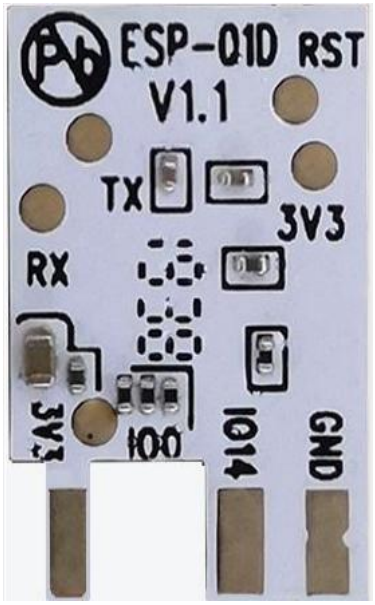
applications etc. When maintaining the Wi-Fi connection, without data transmission, according to 802.11 standards, such as U-APSD, turn off the Wi-Fi Modem circuit to save power. For example, at DTIM3, every 300 ms, sleep wakes up 3 ms to receive the Beacon package of AP, the overall average current is about 20 mA.

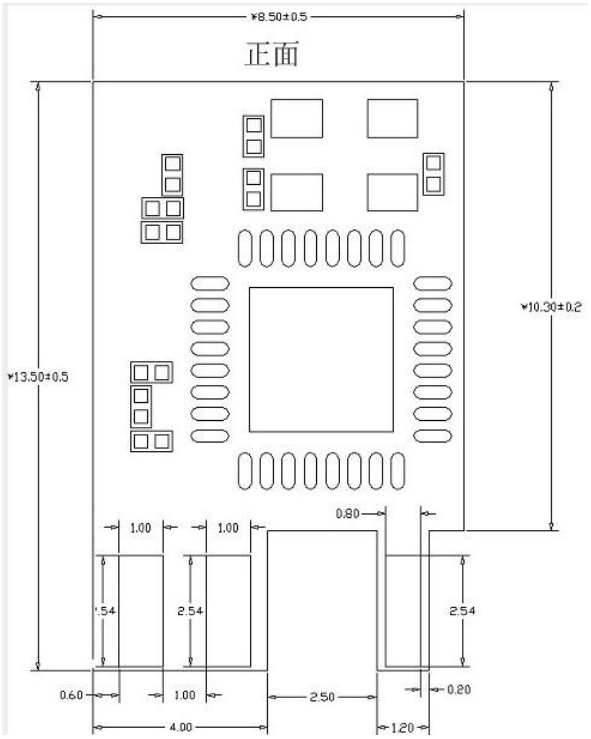
② Light-Sleep is used for CPU pause applications such as the Wi-Fi switch. When maintaining the Wi-Fi connection, if there is no data transmission, close the Wi-Fi Modem circuit and pause the CPU according to 802.11 standards, e. g. U-APSD. For example, at DTIM3, every 300 ms, sleep wakes up 3 ms to receive the Beacon package of AP, the overall average current is about 2 mA.

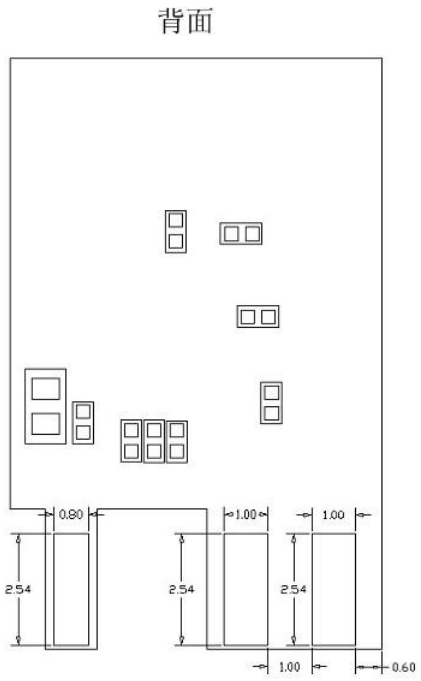
③ Deep-Sleep is used for applications without maintaining a long packet connection, such as sensors measuring temperature every 100s. For example, 0.3 s ~ 1 s requires AP send data every 300s, the overall average current can be far less than 1 mA. The current value of 20 μA is measured at 2.5V.

# 3.Appearance dimensions



# 4.Pin definition

ESP-01D module is connected to 6interfaces, refer to pin diagram 4.1, pin function definition table is interface definition.

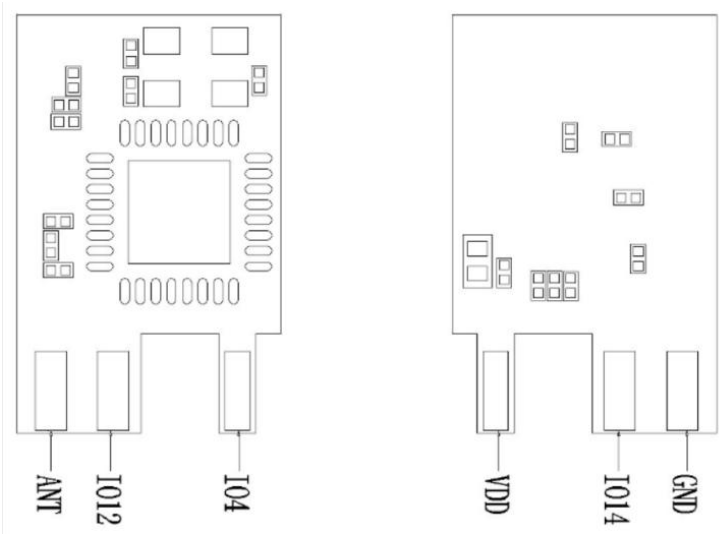



Figure 4.1 ESP-01D Diagram of Pin

Table 4.1 Pin function definition

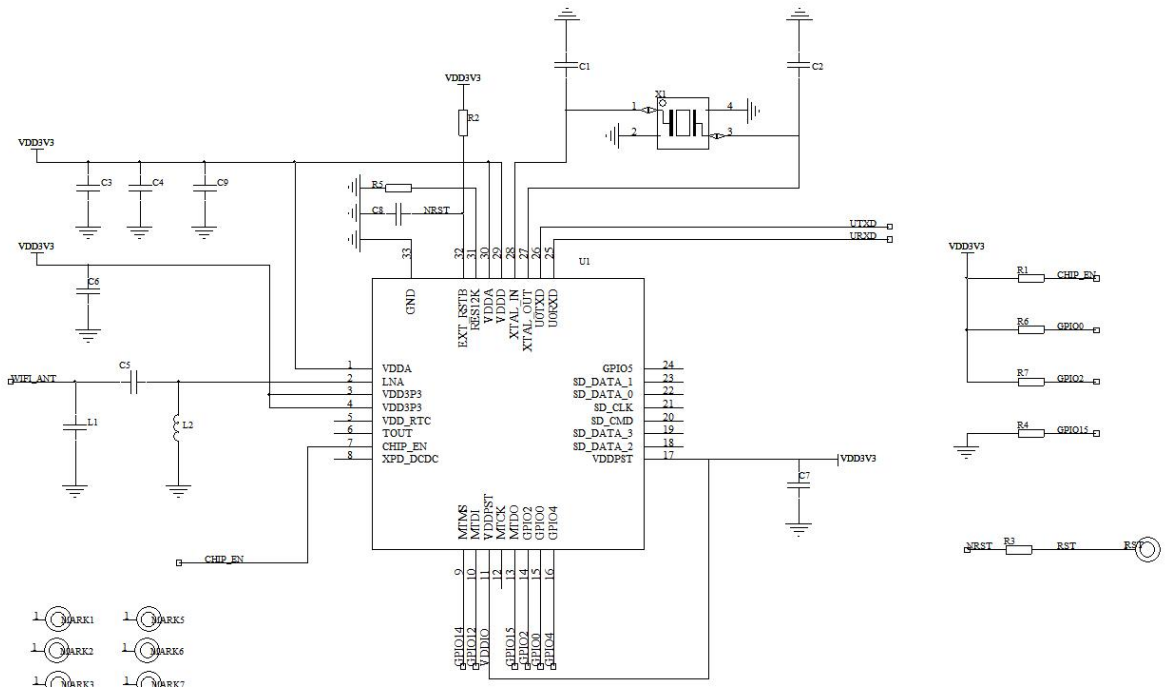
| Pin No. | Name | Function |
|---|---|---|
| 1 | ANT | RF antenna interface, requiring an external antenna |
| 2 | IO12 | GPIO12 |
| 3 | IO4 | GPIO4 |
| 4 | VDD | 3.3V power supply; the proposed power supply output current is above 500mA |
| 5 | IO14 | GPIO14 |
| 6 | GND | Ground |

Table 4.2 Module startup Description

| Mode | CH_PD(EN) | RST | GPIO15 | GPIO0 | GPIO2 | TXD0 |
|---|---|---|---|---|---|---|
| Download mode | High | High | Low | Low | High | High |
| Running mode | High | High | Low | High | High | High |

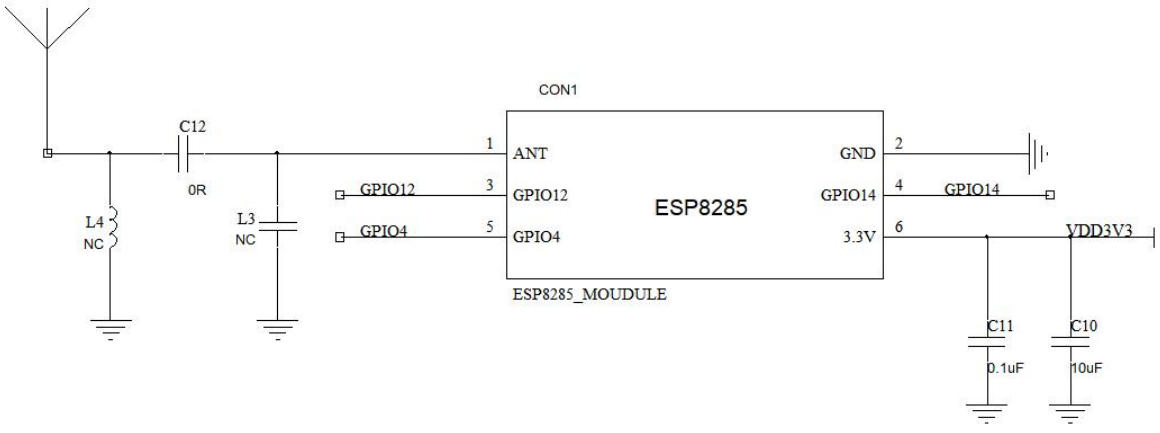
Note: Some pins have been pulled up internally, please refer to the schematic diagram

# 5.Schematic diagram




# 6.Design guidance

## 1). Application circuit




## 2).Antenna layout requirements

（1).ESP-01D requires welding antenna, with antenna welding plate on the module

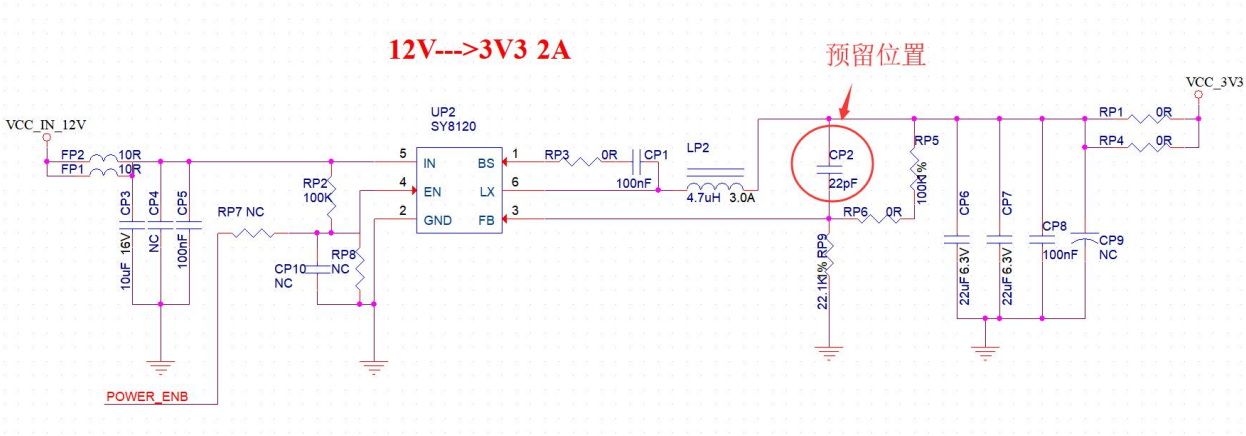
（2).In order to achieve the optimal effect, the antenna assembly should be located away from the metal parts.

**3).Power supply**

（1）.Recommended 3.3V voltage, peak current above 500mA

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

（3）.DC-DC the power supply circuit, it is suggested to reserve the position of output ripple can be optimized when the load changes greatly.




**4).GPIO Interface**

（1）The module periphery leads to some GPIO ports, such as the recommended resistance of 10-100 Ohms in series on the IO port. This can suppress overshoot, to ensure both sides of the level more stable. helpful for both EMI and ESD.

（2） For special IO, please refer to the specification, which will affect the starting configuration of the module.

（3）The IO port of the module voltage is 3.3 V, if the main control does not match the IO level of the module, require to add the level conversion circuit.

（4） When the IO port is connected directly to the peripheral interface, or the pin header and other terminals, it is recommended to reserve ESD device near the terminal.

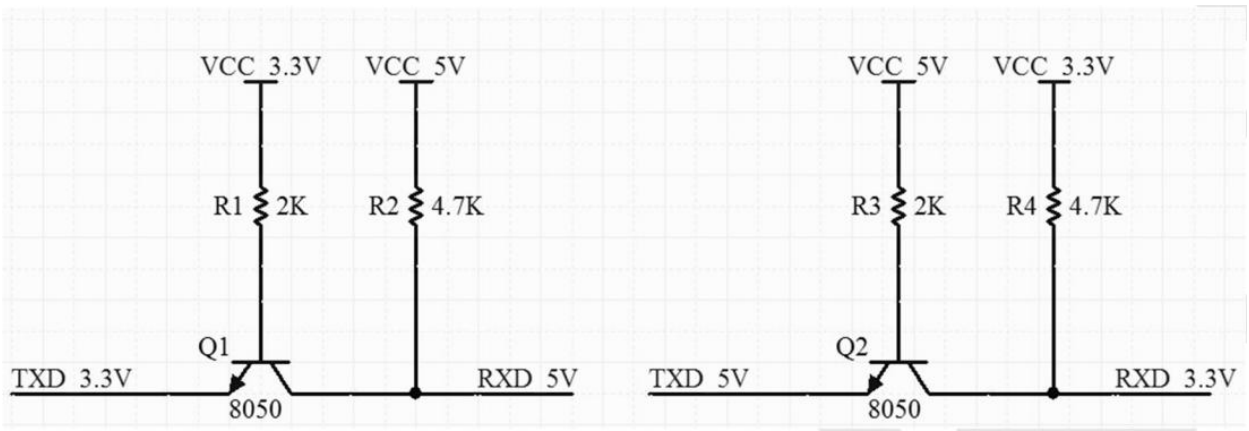
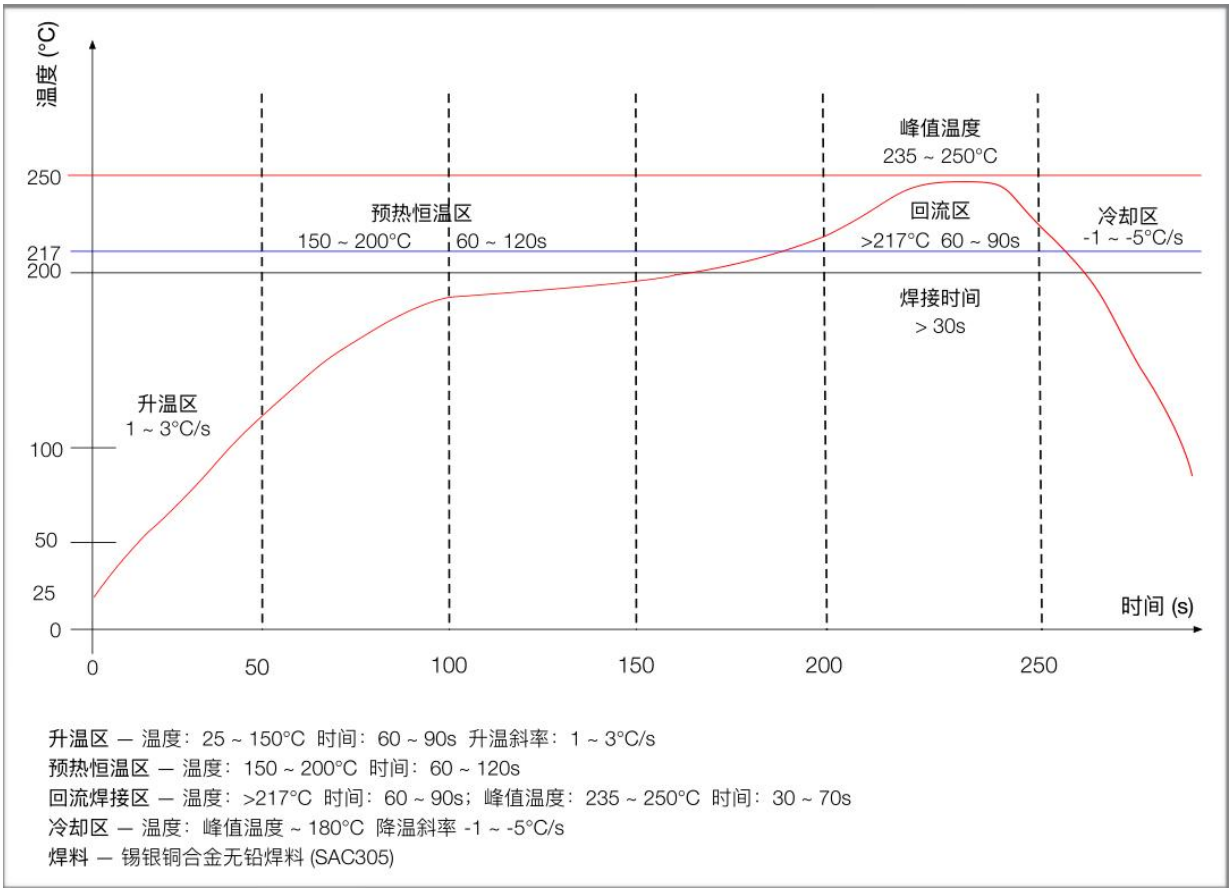



Figure Electrical level conversion circuit

# 7.Reflow soldering




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

ESP-01D is package in tray。(Package pictures are schematic drawings, for reference only)

# 9.Contact us

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

Development DOCS ： https://docs.ai-thinker.com

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