ESP-M1/M2

product manual

Ver V1.0

Fentures

■ SOC characteristics

- **Built-in Tensilica L106** ultra-low power Consumption 32-bit cpu, the main frequency Can be 80MHz and 160MHz, also support RTOS;
- Built-in TCP/IP protocol stack;
- Built-in 1 channel 10-bit high precision ADC;
- The outeide interfaces have HSPI, UART,I2C, I2S,IR Remote Control, PWM, GPIO;
- The deep-sleep current is about 10uA, and the Cut-off current is smaller than 5uA;
- Can be wake-up within 2 ms, and connect to Transmit data package;
- the consume power is smaller than 1.0mW (DTIM3) when at standby status;
- Built-in 1M byte for SPI Flash.

■   Wi-FI characteristics

- Support 802.11 b/g/n/e/i
- Support three modes: Station, SoftAP, and SoftAP+STA;
- Support Wi-Fi Direct(P2P);
- Support hardware acceleration for CCMP (CBC-MAC,computation mode),TKIP(MIC,

  RC4), WAPI(SMS4), WEP(RC4), CRC;
- P2P find, P2P GO mode/GC mode and P2P

Peripheral for Module

- 2*UART
- 1*En;
- 1*ADC;
- 1*wakeup pin;
- 1*HSPI;
- 1*I2C;
- 1*I2S;
- MAX 10* GPIOs;

■ Working temperature:-40℃-125℃

■ Module size:

  12.3*mm*15mm;(M1 version)
 12.3*mm*20mm;(M2 version)

Application

- Serial Transparent transmission;
- WiFi prober;
- Smart power piug/Smart LED light;
- Mesh networks;
- Sensor networks;
- Wearable electronics;
- Securit ID label;
- Wireless location recognition;
- Wireless location system beacon;
- Industrial wireless control;

Module Type

Name	Antenna Type
ESP-M1	IPEX external antenna
ESP-M2	PCB on board antenna

Module Structure

Power management;
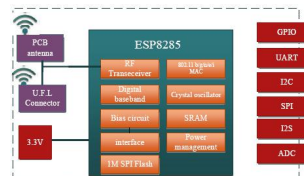
- **WPA/PA2 PSK and WPS;**

- **Support 80211 i security: pre-certification And TSN;**

- **Support 802.11n (2.4GHz);**

- **802.1h/RFC1042 frame encapsulation;**

- **Support seamless roam;**

- **Support AT remote updation and cloud OTA Updation;**

- **Support SmartConfig function for Android And iOS device SmartConfig.**

Context

Figures

Table

1. Introduction

The WiFi module ESP-M is manufactured by using a high-performance chip ESP8285. This small chip is encapsulated an enhanced Tensilica's L106 diamond series 32-bit kennel CPU with a SRAM. Thus, ESP8285 has the complete function Wi-Fi function; it not only can be applied independently, but can be used as a slaver working with other host CPU. When ESP8285 is applied as a slaver, it can start from the onboard Flash. The built-in high-speed buffer is not only benefit to improve the system performance, but optimize the store system. In addition, ESP8285 can be used as Wi-Fi adapter by SPI/SDIO or I2C/UART interface, when it is applied to other MCU design.

The ESP-M module supports the standard IEEE802.11 b/g/n/e/i protocol and the complete TCP/IP protocol stack. User can use it to add the WiFi function for the installed devices, and also can be viewed as a independent network controller. Anyway, ESP-M module provides many probabilities with the best price.

Parameters for ESP-M are listed as follows.

Table 1.1 Parameters for ESP-M

Types	Items	Parameters
Wi-Fi	Frequency scope	2.4G~2.5G(2400M~2483.5M)
	Transmit power	802.11b: +20 dBm
		802.11g: +17 dBm
		802.11n: +14 dBm
	Receiving sensitivity	802.11b: -91 dbm (11Mbps)
		802.11g: -75 dbm（54Mbps）
		802.11n: -72 dbm（MCS7）
	Antenna	PCB onboard antenna
Hardware	CPU	Tensilica L106 32 bit MCU
	Perpherl	UART/SDIO/SPI/I2C/I2S/IR control
		GPIO/ADC/PWM/SPI/I2C/I2S
	Working voltage	2.5V ~ 3.6V
	Working current	Average current: 80 mA
	Working temperature	-40°C ~125°C
	Environment temperature	-40°C ~ 125°C
	Size	16mm x 24mm x 3mm

Software	Wi-Fi mode	Station/SoftAP/SoftAP+Station
	Security mode	WPA/WPA2
	Encryption type	WEP/TKIP/AES
	Update firmware	UART Download/OTA (by internet)
	Software develop	Non-RTOS/RTOS/Arduino IDE etc.
	Network protocol	IPv4, TCP/UDP/HTTP/FTP/MQTT
	User configuration	AT+ command/cloud sever/ Android/iOS APP

2. Interface Definition

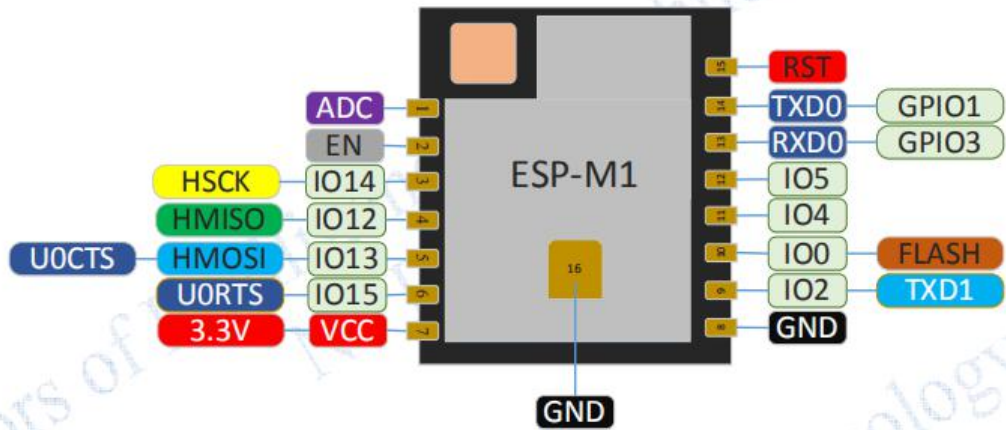Interface definition of ESP-M can be shown in the following.
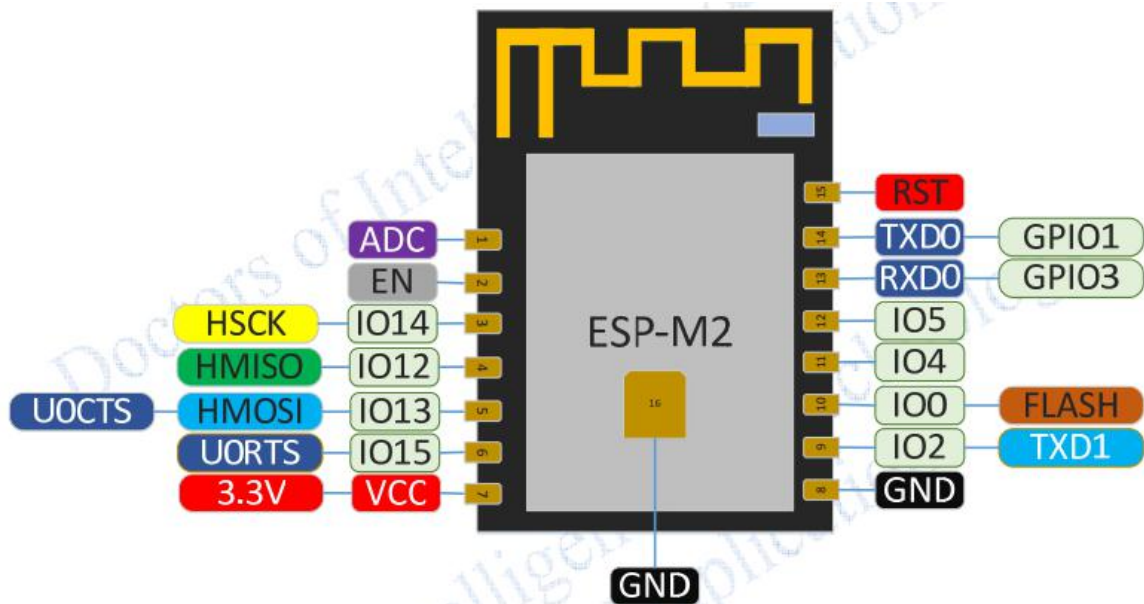
Fig. 2.1 ESP-M1 Definition for Pins

图 2.2 ESP-M2 Definition for Pins

Working mode and definition of pins:

Table 2.1 Pin Modes

Mode	IO0	IO2
UART download	low	high
Flash Boot mode	high	high

Table 2.2 Function Definition of Module Pins

Num	Pin Name	Type	Function Illustration
1	RXD	I/O	GPIO3; able to used as UART Rx for building in Flash
2	IO0	I/O	GPIO0; SPI_CS2; already connected to pull-up resistors
3	IO2	I/O	GPIO2; UART1_TXD; already connected to pull-up resistors
4	GND	P	GND
5	VCC	P	Power for module: 3.3V
6	RST	I	Reset signal (enable with low power), Reset; already connected to pull-up resistors
7	EN	I	Enable, Working with high power; chip closed with low power, just small current
8	TXD	I/O	GPIO1; able to built in Flash as UART Tx

3. Shape and Size

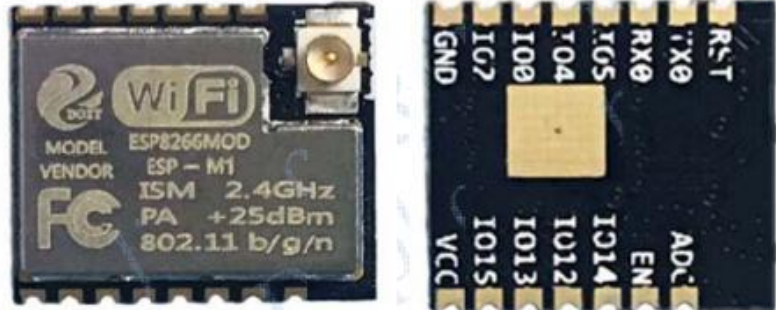Shape and size for this module can be shown as follows.

Fig. 3.1 Shape for ESP-M1

15.00mm

12.30mm

0.90mm

1.50mm

0.90mm

(a) Vertical View

3.0mm

0.8mm

(b) Side View

Fig. 3.2 Size for ESP-M1

Fig. 3.3 Shape for ESP-M2
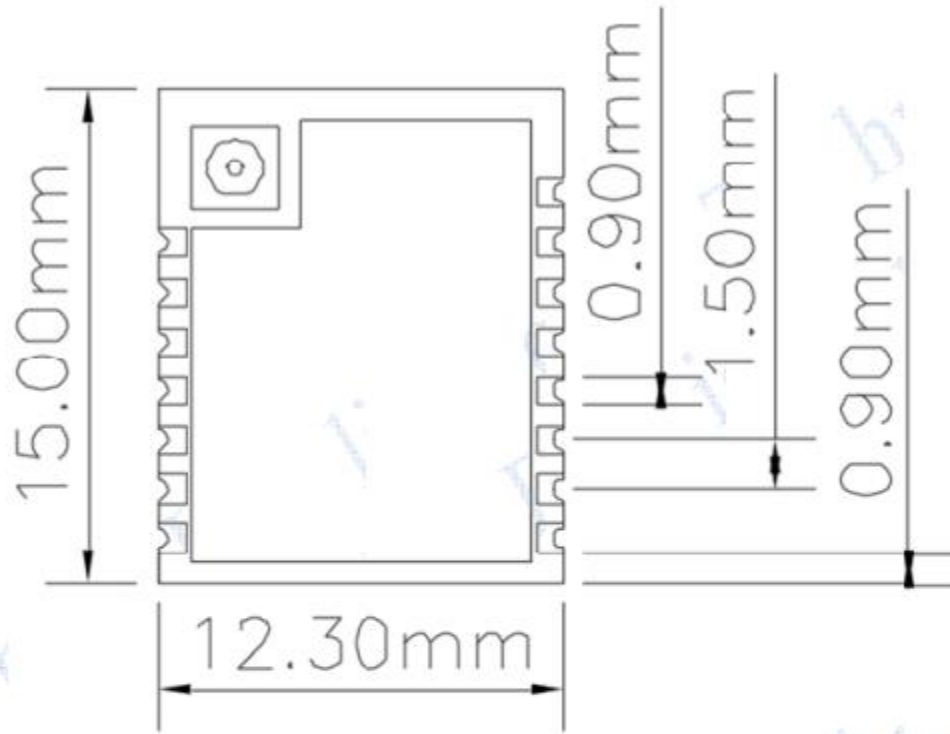
(a) Vertical View

(b) Side View

Fig. 3.4 Size for ESP-M1

Table 3.1 Size for ESP-M1

Length	Width	Height	PAD Size(bottom)	Distance between Pins
12.3mm	15mm	3 mm	0.9*1.7mm	1.5mm

Table 3.2 Size for ESP-M2

Length	Width	Height	PAD Size(bottom)	Distance between Pins
12.3mm	20mm	3 mm	0.9*1.7mm	1.5mm

4. Electronical Characteristics

Table 4.1 Electronics

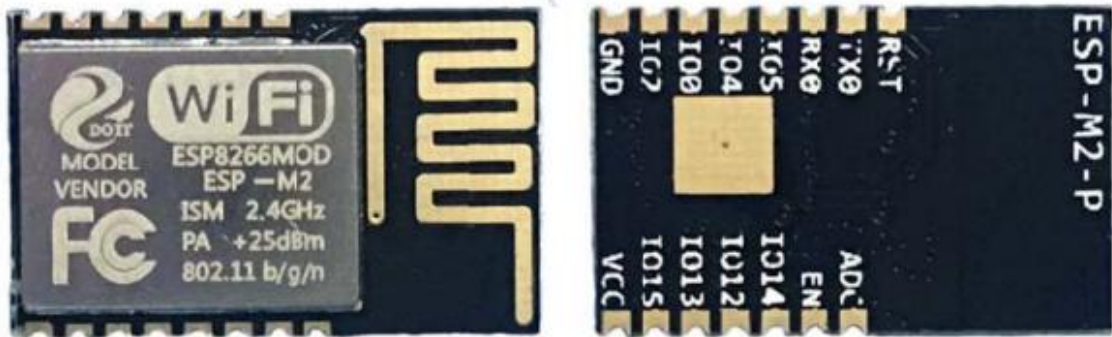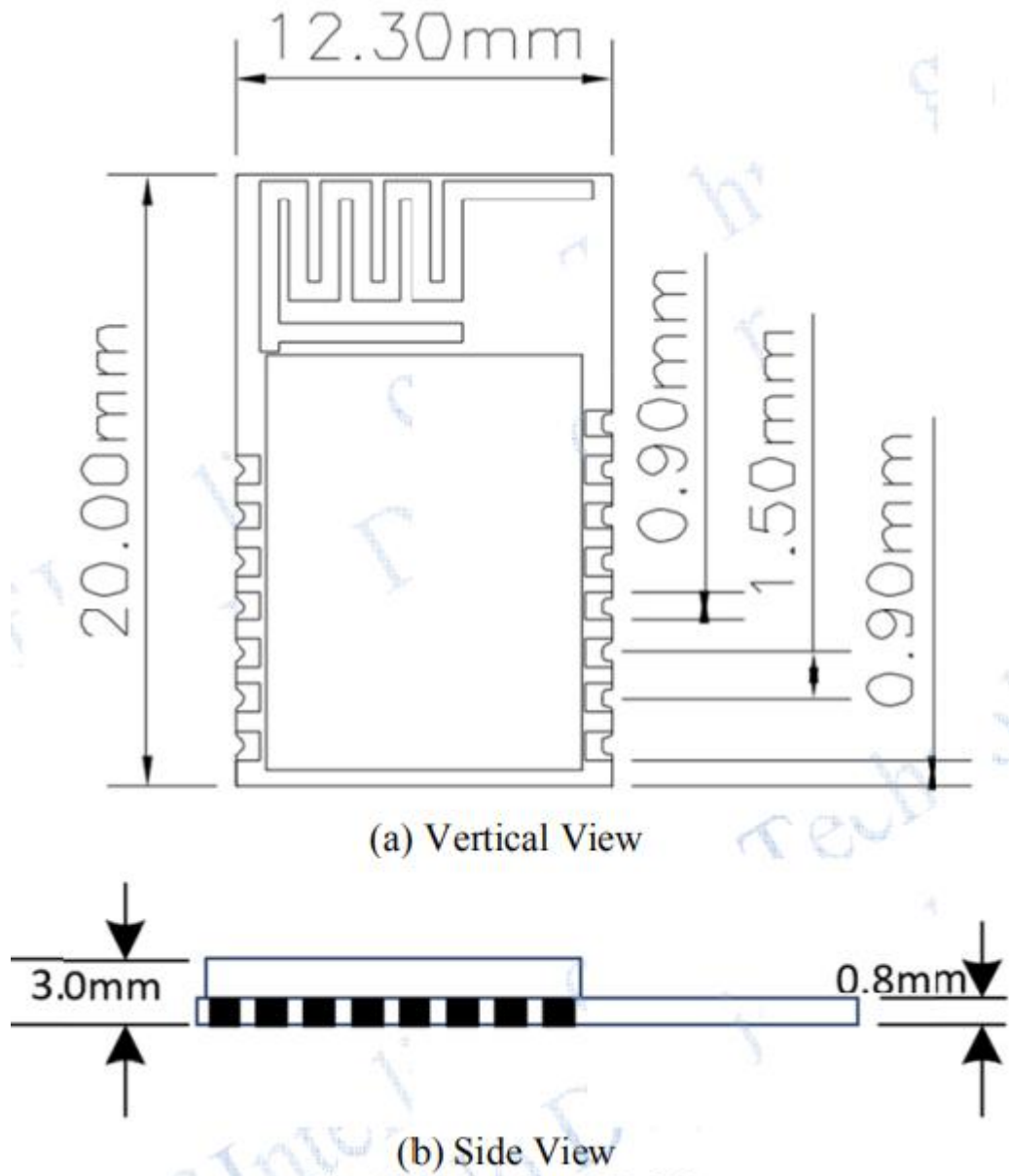| Parameters		Condition	Min	Classical	Max	Unite
Store Temperature		-	-40	Normal	125	℃
Sold Temperature		IPC/JEDEC J-STD-020	-	-	260	℃
Working Voltage		-	2.5	3.3	3.6	V
I/O	V_{IL}/V_{IH}	-	$-0.3/0.75V_{IO}$	-	$0.25V_{IO}/3.6$	V
	V_{OL}/V_{OH}	-	$N/0.8V_{IO}$	-	$0.1V_{IO}/N$	
	I_{MAX}	-	-	-	12	mA
Electrostatic release quantity (Human model)		TAMB=25℃	-	-	2	KV
Electrostatic release quantity (Human model)		TAMB=25℃	-	-	0.5	KV

5. Power Consumption

Table 5.1 Power Consumption

Parameters	Min	Classical	Max	Unite
Tx802.11b, CCK 11Mbps, POUT=+17dBm	-	170	-	mA
Tx802.11g, OFDM 54 Mbps, POUT =+15dBm	-	140	-	mA
Tx802.11n,MCS7,POUT =+13dBm	-	120	-	mA
Rx 802.11b，1024 Bytes, -80dBm	-	50	-	mA
Rx 802.11g，1024 Bytes, -70dBm	-	56	-	mA
Rx 802.11n，1024 Bytes, -65dBm	-	56	-	mA
Modem-sleep①	-	15	-	mA
Light-sleep②	-	0.9	-	mA
Deep-sleep③	-	20	-	μA
close	-	0.5	-	μA

Note

①: Modem-Sleep mode can be used for the case that CPU is always working, e.g., PWM or I2S etc. If WiFi is connected and no data is to transmitted, in this case, WiFi modem can be closed to save power energy. For example, if at DTIM3 status, keep asleep at 300ms, Then, the module can wake up to receive the Beacon package within 3ms and the current being 15mA.

②: Light-Sleep mode can used for the case that CUP can stop the application temporally, e.g., Wi-Fi Switch . If Wi-Fi is connected and there is no data packet to transmitted, by the 802.11 standard (e.g., U-APSD), module can close Wi-Fi Modem and stop CPU to save power. For example, at DTIM3, keep up sleeping at 300ms, it would receive the Beacon package from AP after each 3ms, then the whole average current is about 0.9mA.

③ Deep-Sleep mode is applied to the case that Wi-Fi is not necessary to connect all the time, just send a data packet after a long time (e.g., transmit one temperate data each 100s) . it just need 0.3s-1s to connect AP after each 300s, and the whole average current is much smaller 1mA.

6. Wi-Fi RF Characteristics

The data in the following Table is gotten when voltage is 3.3V and1.1V in the indoor temperature environment.

Table 6.1 Wi-Fi RF Characteristics

| Parameters	Min	Classical	Max	Unite
Input frequencey	2412	-	2484	MHz
Input impedance	-	50	-	Ω
Input reflection	-	-	-10	dB
At 72.2Mbps, output power consumption for PA	15.5	16.5	17.5	dBm
At 11b mode, output power consumption for PA	19.5	20.5	21.5	dBm
Sensibility	-	-	-	-
DSSS, 1Mbps	-	-98	-	dBm
CCK11, Mbps	-	-91	-	dBm
6Mbps(1/2 BPSK)	-	-93	-	dBm
54Mbps(3/4 64-QAM)	-	-75	-	dBm
HT20, MCS7(65 Mbps, 72.2 Mbps)	-	-72	-	dBm
Adjacent Inhibition				
OFDM, 6Mbps	-	37	-	dB
OFDM, 54Mbps	-	21	-	dB
HT20, MCS0	-	37	-	dB
HT20, MCS7	-	20	-	dB

7. The Recommended Sold Temperature Curve
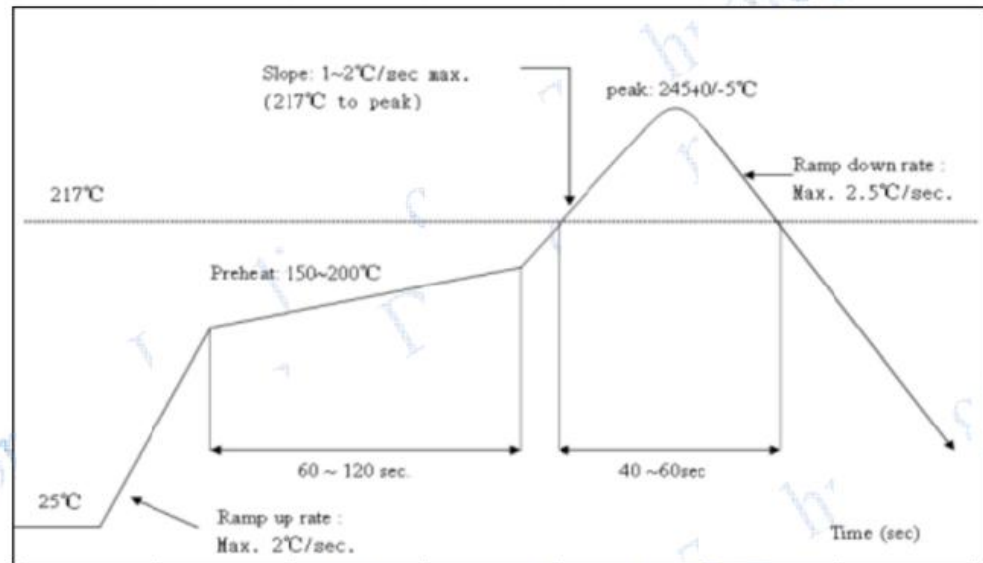
Fig. 7.1 Temperature Curve when Sold

Note

(1) the working voltage for module is DC 3.3V;

(2) the max current from IO of this module is 12mA;

(3) RST Pin is enabled when it is low level; and EN pin is enabled when it is high level;

(4) WiFi module is at update mode: GPIO0 is low level, then module reset to power; Wi-Fi module is at working mode: GPIO0 is at high level, and then reset to power;

(5) Wi-Fi module is connected to RXD of the other MCU, and TXD is connected to RXD of the other MCU.

9. The Recommended PCB Design

Wi-Fi module can be inserted into the PCB board directly. For the high RF performance for the end device, please note the placement for the antenna and the module.

Especially, since the antenna is external for ESP-M1, the antenna can be placed by the project requirements. The connector for external antenna is shown in the following.
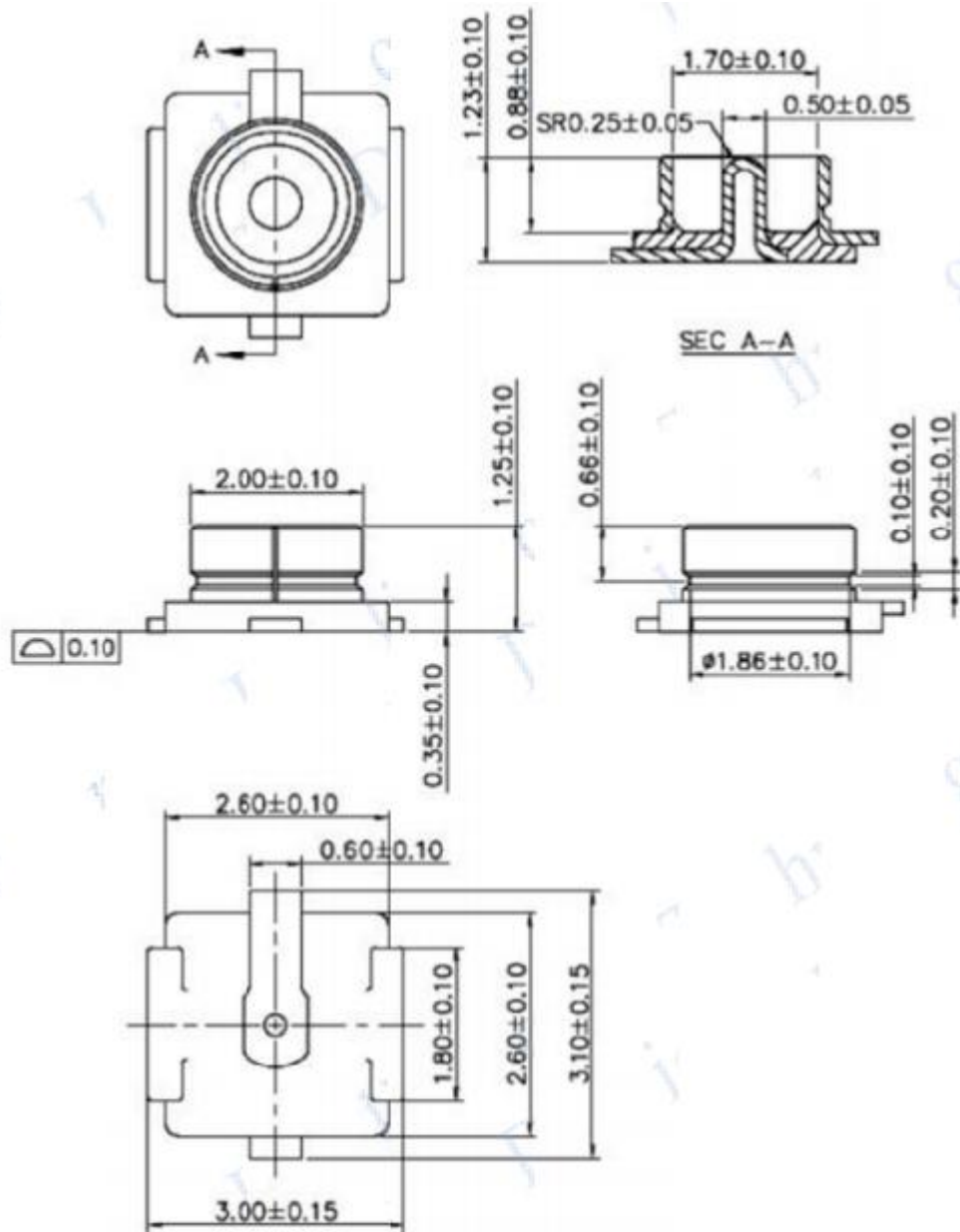
Fig. 9. 1 Connector for the external antenna

It is suggested that the module is placed along with PCB side, the antenna is placed outside the board, or along with the PCB side, and the below board is blank, please refer to the scheme 1 and scheme 2; if the PCB antenna must placed on the board, please do not cover the copper at the bottom of PCB antenna, as can be shown at scheme 3.

6.6mm

ESP-M2

16

Main board

Fig. 9.2 scheme1: Antenna is at the outside of the board

5mm 5mm

6.6mm

ESP-M2

16

Main
Board
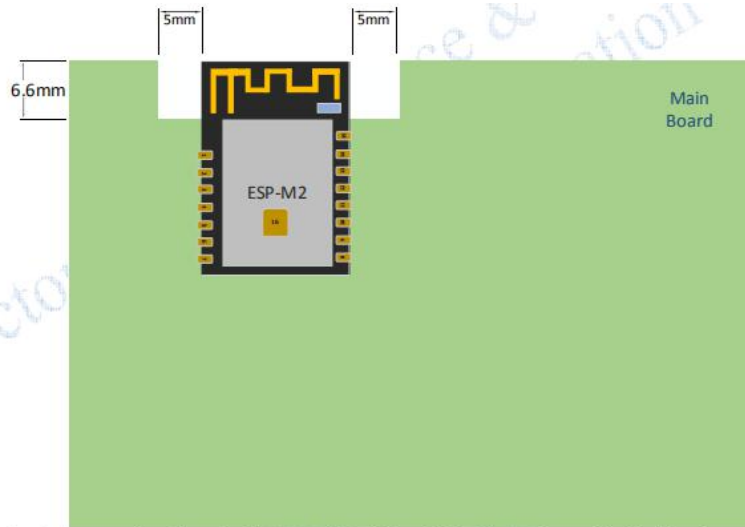
Fig. 9.3 Scheme 2: Antenna is placed along with side of the board, and it is blank at the bottom of the board.

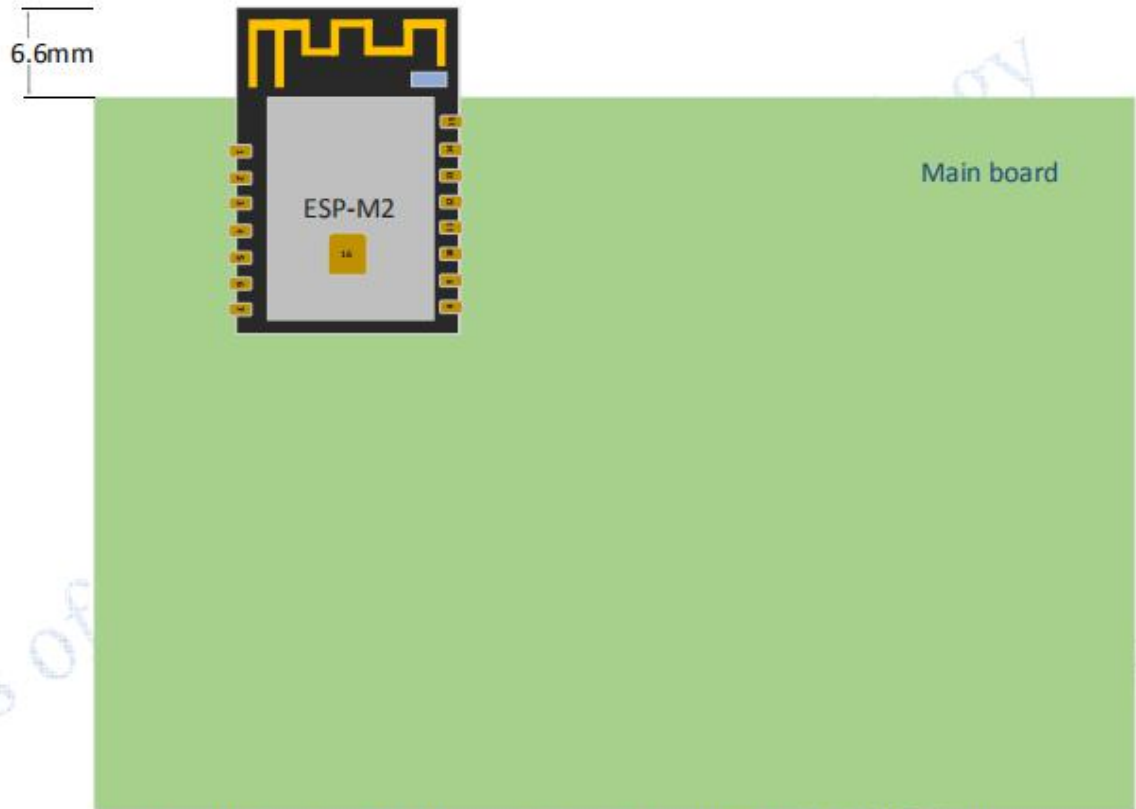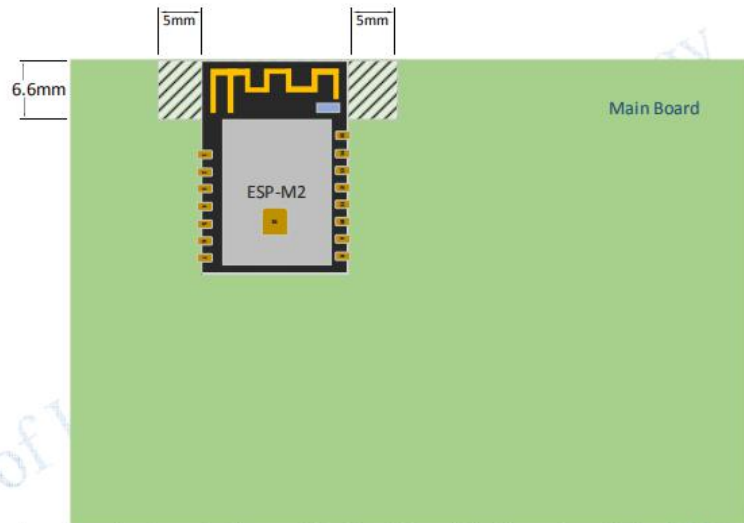Fig. 9.4 Scheme 3: Antenna is placed along with the side of the board, and don't cover copper under the module

10. Peripheral Line Suggestion

Wi-Fi module is already integrated into high-speed GPIO and Peripheral interface, which may be generated the switch noise. If there is a high request for the power consumption and EMI characteristics, it is suggested to connect a serial 10~100 ohm resistance, which can suppress overshoot when switching power supply, and can smooth signal. At the same time, it also can, to a certain extent, prevent electrostatic discharge (ESD).

Note 1: This module certified complies with RF exposure requirement under mobile or fixed condition; this module is to be installed only in mobile or fixed applications.

A mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons. Transmitting devices designed to be used by consumers or workers that can be easily re-located, such as wireless devices associated with a personal computer, are considered to be mobile devices if they meet the 20 centimeter separation requirement.

A fixed device is defined as a device is physically secured at one location and is not able to be easily moved to another location.

Note 2: Any modifications made to the module will void the Grant of Certification, this module is limited to OEM installation only and must not be sold to end-users, end-user has no manual instructions to remove or install the device, only software or operating procedure shall be placed in the end-user operating manual of final products.

Note 3: Additional testing and certification may be necessary when multiple modules are used.

Note 4: The module may be operated only with the antenna with which it is authorized. Any antenna that is of the same type and of equal or less directional gain as an antenna that is authorized with the intentional radiator may be marketed with, and used with, that intentional radiator.

Note 5: To ensure compliance with all non-transmitter functions the host manufacturer is responsible for ensuring compliance with the module(s) installed and fully operational. For example, if a host was previously authorized as an unintentional radiator under the Supplier's Declaration of Conformity procedure without a transmitter certified module and a module is added, the host manufacturer is responsible for ensuring that the after the module is installed and operational the host continues to be compliant with the part 15B unintentional radiator requirements. Since this may depend on the details of how the module is integrated with the host, the manufacturer shall provide guidance to the host manufacturer for compliance with the part 15B requirements.

Note6: The FCC ID label on the final system must be labeled with"Contains FCC ID:2ASVX-ZJWFMA"

or"Contains transmitter module FCC ID: 2ASVX-ZJWFMA"

Note7: The module meets the requirements of FCC CFR 47 PART 15 C (15.247) standard

Note8:This module belongs to the single module

Note9:The product is not designed to Trace antenna

When the ISED certification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use the wording "Contains transmitter module IC: 25218-ESPM2" or "Contains IC: 25218-ESPM2".

FCC Warning

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any inte rference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interferenceto radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

Radiation Exposure Statement This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.

· Reorient or relocate the receiving antenna.
· Increase the separation between the equipment and receiver.
· Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
· Consult the dealer or an experienced radio/TV technician for help.

Radiation Exposure Statement This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.

ISED Statement

English: This device complies with Industry Canada license‑exempt RSS standard(s). Operation is subject to the following two conditions: (1) This device may not cause interference, and (2) This device must accept any interference, including interference that may cause undesired operation of the device. The digital apparatus complies with Canadian CAN ICES‑3 (B)/NMB‑3(B).

‑ French: Le pr é sentappareilestconforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitationestautoris é e aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareildoit accepter tout brouillageradio é lectriquesubi, m ê mesi lebrouillageest susceptible d'encompromettre le fonctionnement.Cet appareil num é rique de la classe B est conforme à la norme NMB-003 du Canada.Radiation Exposure Statement

This equipment complies with Canada radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

D é claration d'exposition aux radiations Cet é quipement est conforme Canada limites d'exposition aux radiations dans un environnement non contrôl é .Cet é quipement doit ê tre install é et utilis é à distance minimum de 20cm entre le radiateur et votre corps.