ESP-F2 Manual

ESP-F2 WiFi Module

Ver V1.1 Mar., 18, 2017 Num.: DM0012CN

Features

- **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 outside 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;
- **Wi-Fi characteristics**
  - Support 802.11 b/g/n/e/i
  - Support three modes: Station, SoftAP, and SoftAP+STA;
  - SupportWi-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 power management;
  - WPA/PA2 PSK and WPS;
  - Support 802.11 i security: pre-certification and TSN;
  - Support 802.11n (2.4 GHz);
  - 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.

Peripheral for Module

- 2*UART;
- 1*En;
- 1*ADC
- 1*wakeup pin
- 1*HSPI
- 1*I2C
- 1*I2S
- 4M byte Flash
- MAX 11* GPIOs;

- **Working temperature:** -40℃-85℃
- **Module size**: 16mm*24mm;

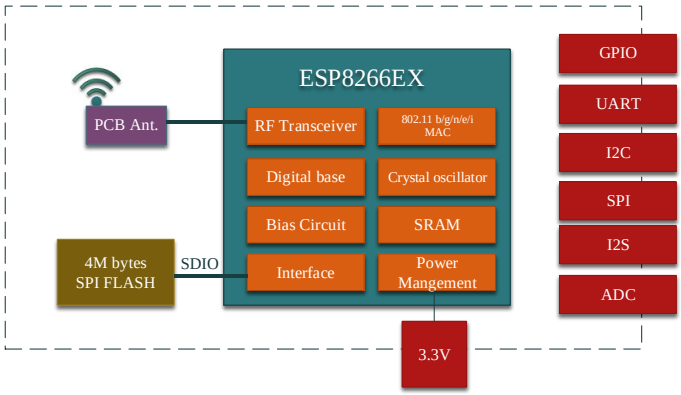
Applications

- Serial Transparent transmission;
- WiFi prober;
- Smart power plug/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-F2	PCB on board antenna

Module Structure



Achieve Update

date	version	content
2017-3-14	V1.0	initial
2017-3-18	V1.1	Adding Recommended PCB Design Chapters

Context

1. Introduction

The WiFi module ESP-F2 is manufactured by using a high-performance chip ESP8266EX. This small chip is encapsulated an enhanced Tensilica'sL106 diamond series 32-bit kennel CPU with a SRAM. Thus, ESP8266 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 ESP8266 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, ESP8266 can be used as Wi-Fi adapter by SPI/SDIO or I2C/UART interface, when it is applied to other MCU design.

The ESP-F2 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-F2 module provides many probabilities with the best price.

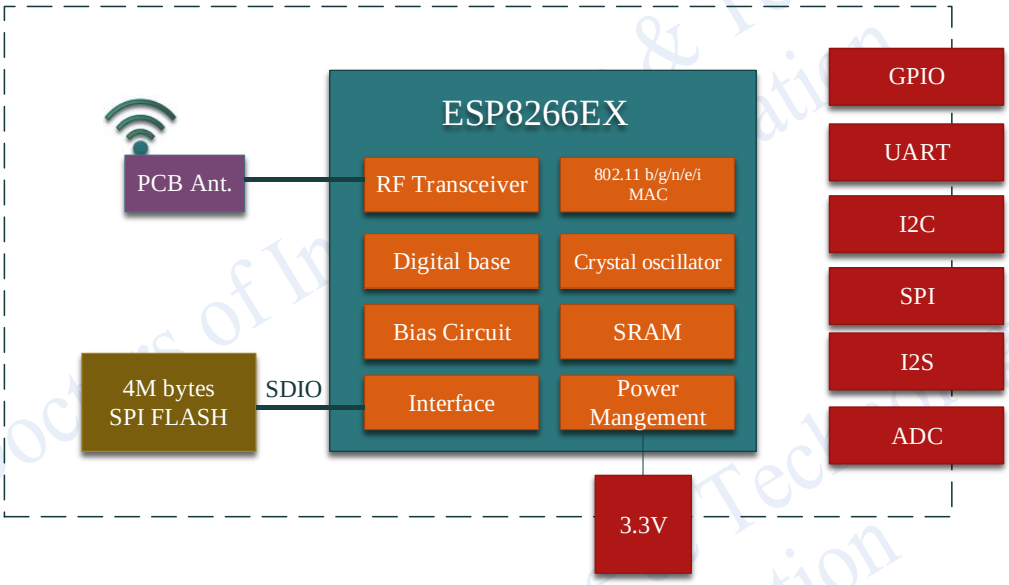


Fig. 1.1Module Structure

Parameters for ESP-F are listed as follows.

Table 1.1 Parameters for ESP-F2

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 ℃ ~85 ℃
	Environment temperature	-40 ℃ ~ 85 ℃
	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-F2 can be shown in the following.

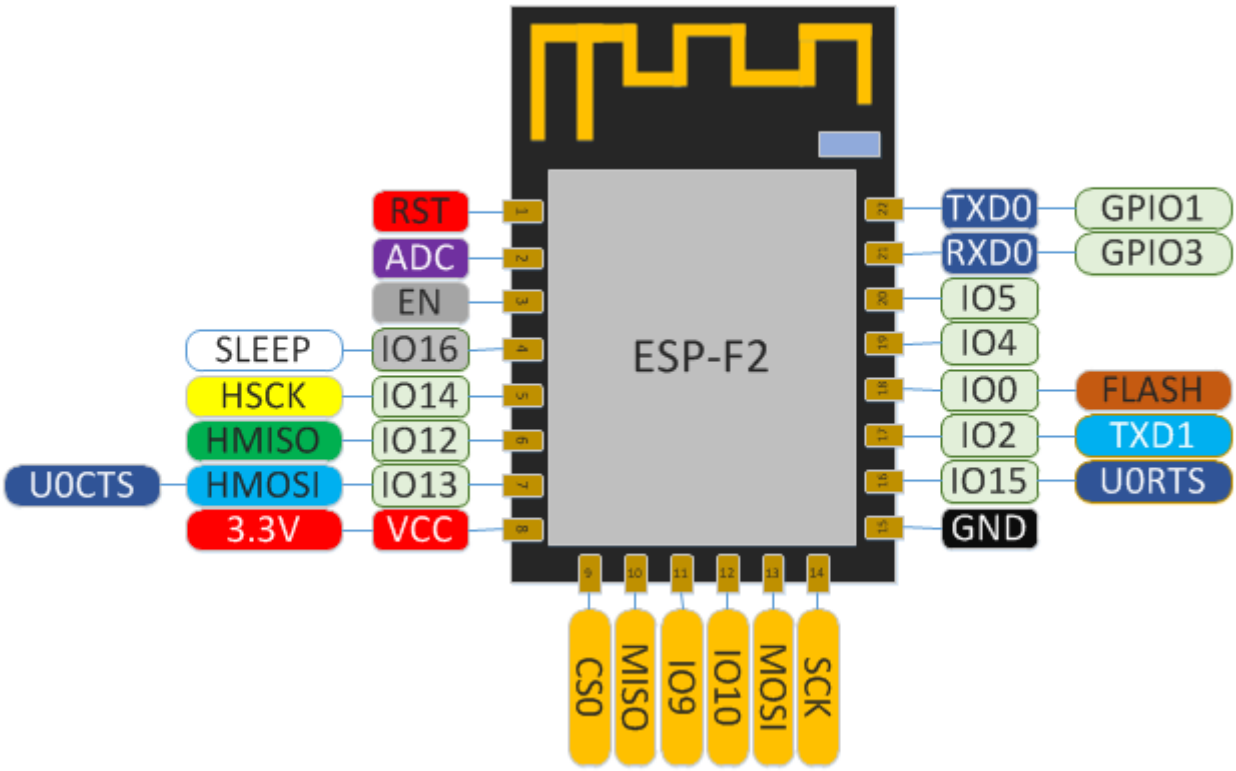


Fig. 2.1 ESP-F2 Definition for Pins

Working mode and definition of pins:

Table 2.1 Pin Modes

Mode	GPIO15	GPIO0	GPIO2
UART download	low	low	high
FlashBoot mode	low	high	high

Table 2.2 Function Definition of Module Pins

Num	Pin	Type	Function
1	RST	I	Reset the signal outside (enable with low), Reset module
2	ADC	I	A/D pin. Input voltage 0~1V, value: 0~1024
3	EN	I	Enable, high level: chip work normally; low level: chip closes with small current.
4	IO16	I/O	deep sleep/wakeup
5	IO14	I/O	GPIO14; HSPI_CLK
6	IO12	I/O	GPIO12;HSPI_MISO
7	IO13	I/O	GPIO13;HSPI_MOSI;UART0_CTS
8	VCC	P	Module working voltage: 3.3V
9	CS0	I/O	GPIO11; SD_CMD; SPI_CS0
10	MISO	I/O	GPIO7; SD_D0, SPI_MSIO
11	IO9	I/O	GPIO9; SD_D2 PIHD; HSPIHD
12	IO10	I/O	GPIO10; SD_D3;SPIWP; HSPIWP1
13	MOSI	I/O	GPIO8; SD_D1;SPI_MOSI1
14	SCLK	I/O	GPIO6; SD_CLK; SPI_CLK
15	GND	P	GND
16	IO15	I/O	GPIO15; MTDO;HSPICS;UART0_RTS
17	IO2	I/O	GPIO2; UART1_TXD
18	IO0	I/O	GPIO0;SPI_CS2
19	IO4	I/O	GPIO4
20	IO5	I/O	GPIO5
21	RXD	I/O	GPIO3; used to build in Flash as UART Rx
22	TXD	I/O	GPIO1; used to build in Flash as UART Tx

3. Shape and Size

Shape and size for this module can be shown as follows. Its size is 16mm*24mm*3mm, and the Flash is 4M bytes (32Mbits).

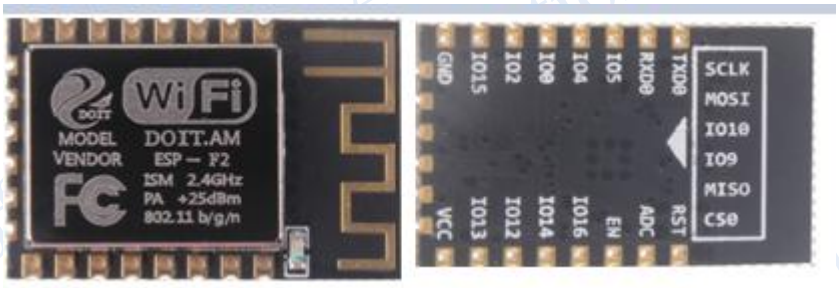
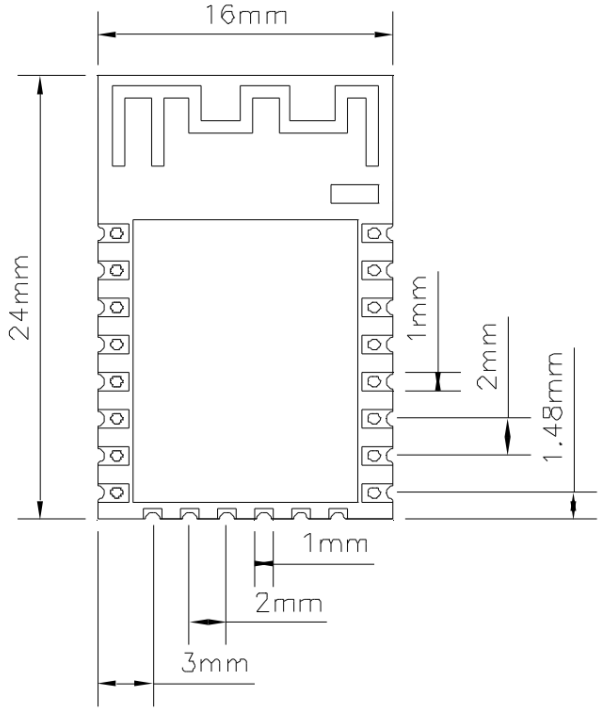


Fig. 3.1 Shape for ESP-F2



(a) Top View

(b) Side View

Fig. 3.2 Size for ESP-F2

Table 3.1Size for ESP-F2

Length	Width	Height	PAD	Distance between Pins

24mm	16mm	3mm	0.9*1.7mm	2.54mm

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

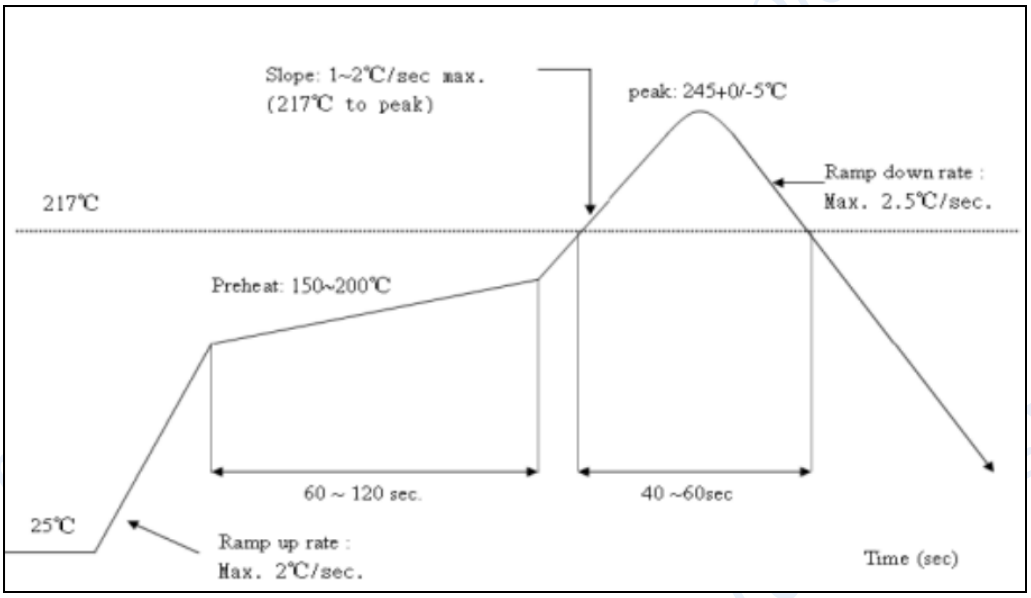


Fig. 7.1 Temperature Curve when Sold

8. Schematics for ESP-F2

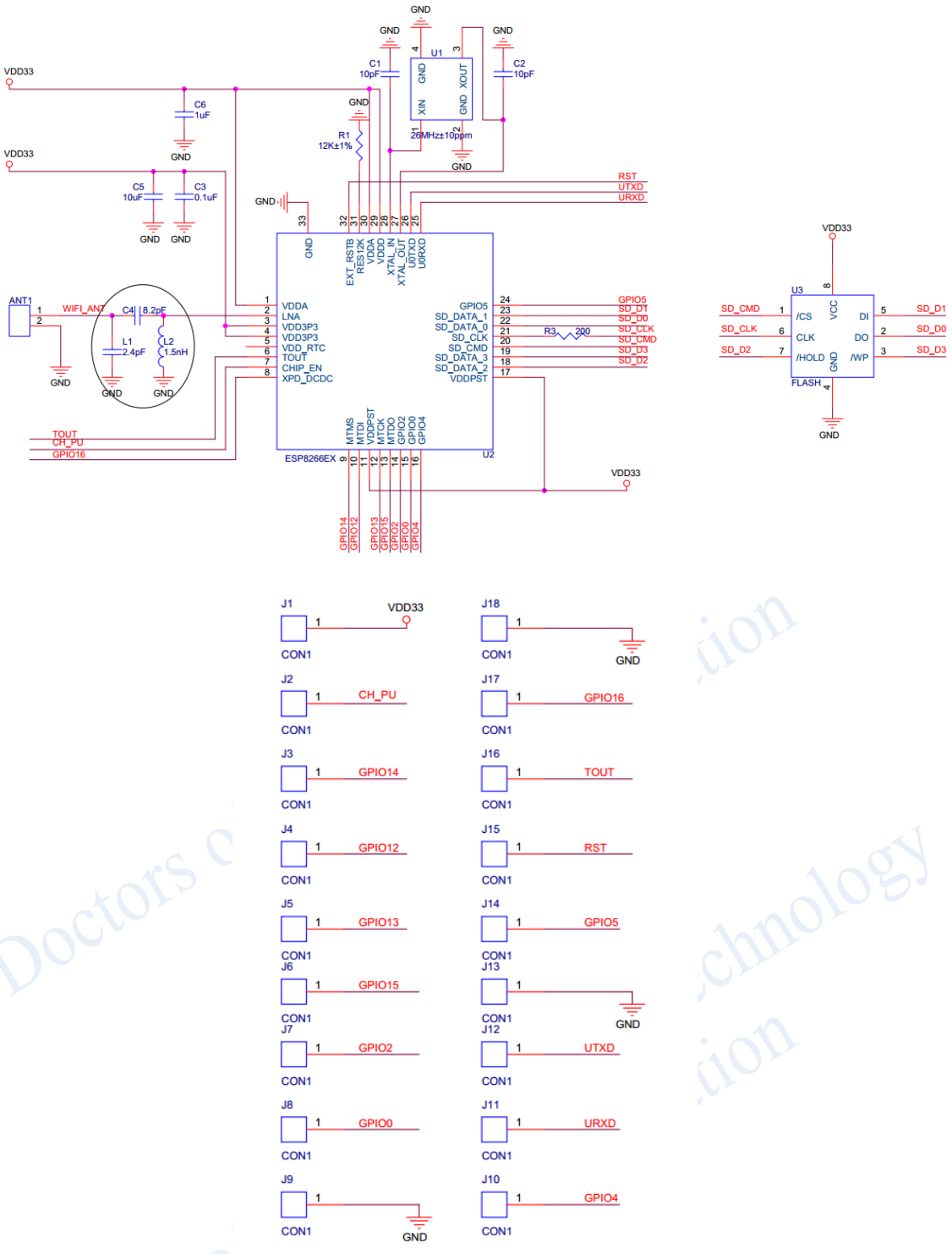


Fig. 8.1 Schematics for ESP-F2

9. Minimum System

This module can work just at 3.3V working voltage.

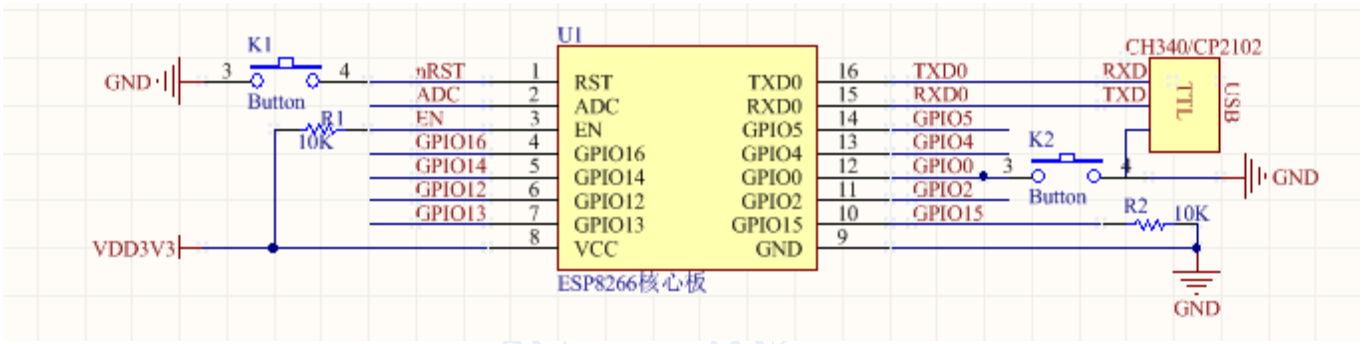


Fig.9.1 Minimum System

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.

10. 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.

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.

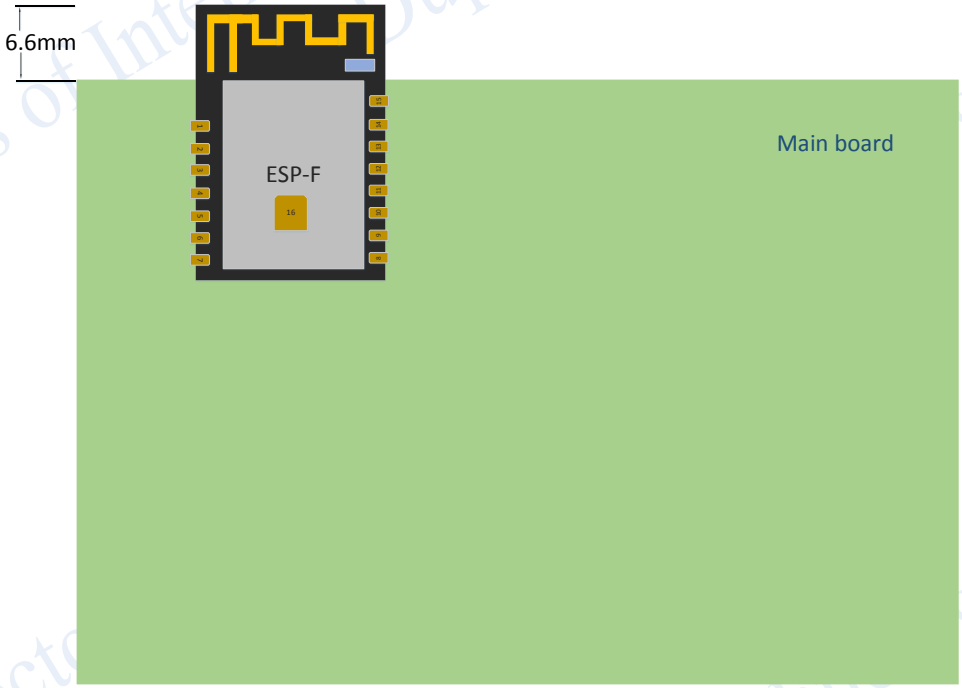


Fig. 10.1 scheme1: Antenna is at the outside of the board

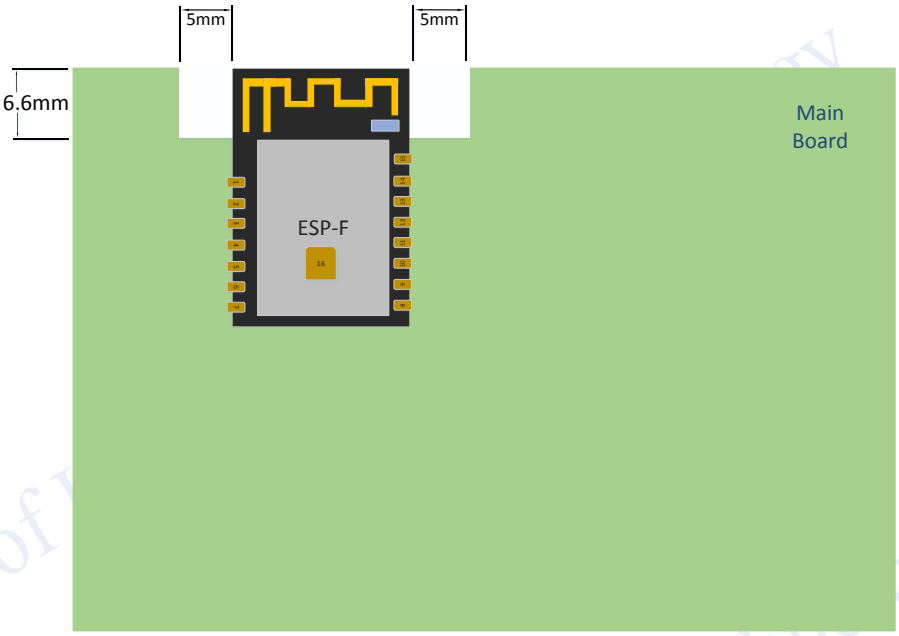


Fig. 10.2 Scheme 2: Antenna is placed along with side of the board, and it is blank at the bottom of the board.

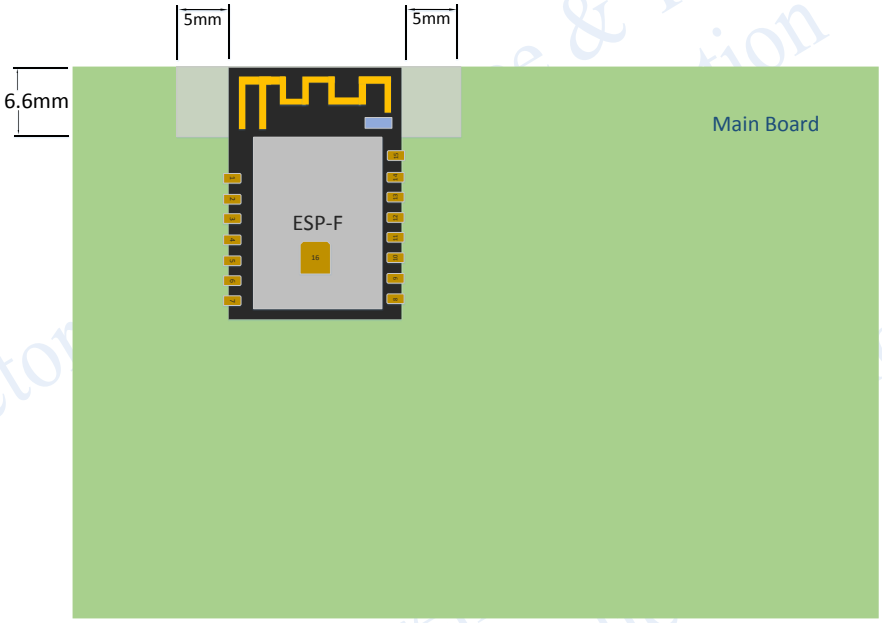


Fig. 10.3 Scheme 3: Antenna is placed along with the side of the board, and don't cover copper under the module

11. 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).

Appendix.

From DOIT	
Official site	www.doit.am
Chinese book	ESPDuino 智慧物联开发宝典
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