# MINEWSEMI

# Wi-Fi Command Module |

# MS13SF1

# DateSheet
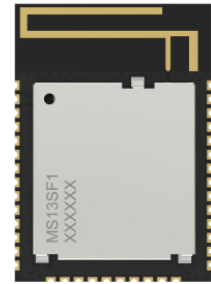
## V 1.0.0

| Applicable Product Model |
| --- |
| MS13SF1 |

# Version Note

| Version | Details | Contributor(s) | Date | Notes |
|---------|---------|----------------|------|-------|
| 1.0.0 | First edit | Vincle | 2023.09.22 | |
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# MS13SF1-ESP32

**High-performance, multi-functional, cost-effective, passthrough support, WiFi 4 + BLE 4.2 combo module with full development resource support**

MS13SF1 is a versatile, high-performance, and cost-effective wireless WiFi + BLE 4.2 combination module based on the ESP32-D0WD-V3 SoC. It features dual-core Xtensa® 32-bit LX6 processors running at a speed of up to 240 MHz. Additionally, it boasts a generous 448 KB + 8 MB FLASH for ample program storage, 536 KB of RAM for program execution and data storage, and integrates a 2.4 GHz transceiver, Low-Noise Amplifier (LNA), and other robust complementary resources, providing an ideal solution for 2.4 GHz WiFi/BLE connectivity. It has been tested to achieve a remarkable 80-meter range under real-world high-interference conditions.

## ■ Features

- ➢ 2.4G WiFi 4 (802.11b/g/n) + BT/BLE 4.2
- ➢ High-performance dual-core SoC
- ➢ Supports AP, STA, AP+STA modes
- ➢ Supports AT and ESP-IDF development
- ➢ ISO 11898-1 compatibility, i.e., CAN 2.0 standard
- ➢ Supports various interfaces, SDIO, SPI, UART, etc.
- ➢ Supports OTA (Over-The-Air) encrypted upgrades
- ➢ Supports AP configuration, SmartConfig, and BluFi configuration

## ■ Application

Smart Buildings

Consumer Electronics

Smart Healthcare

Security Equipment

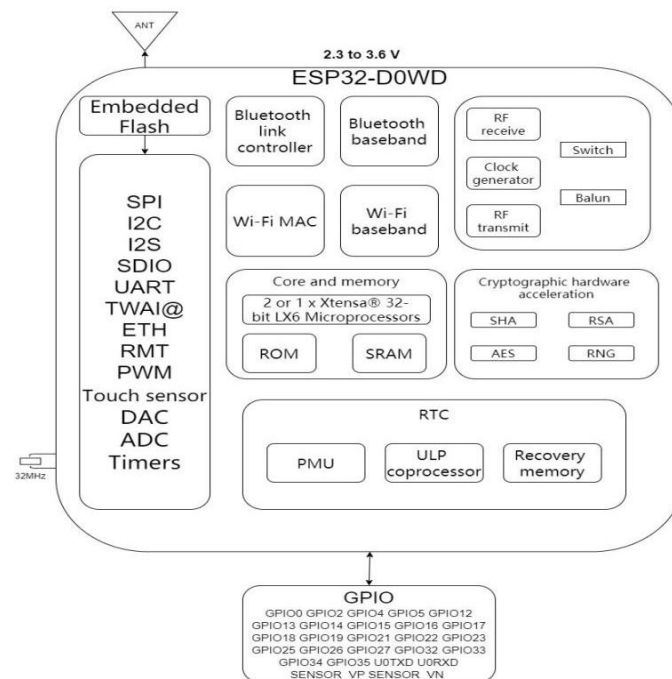Automotive Devices

Smart Agriculture

Industrial Automation

## ■ Key parameter

| Chip Model | ESP32-D0WD | Antenna | PCB |
|---|---|---|---|
| Module size | 25.5x18x2.2mm | GPIO | 21 |
| Flash | 8MB+448KB | RAM | 520KB+16KB |
| Receiving Sensitivity | BLE:-94dBm WiFi:-98dBm | Transmission Power | BLE:-12 ~ +9dBm WiFi:-12~ +20.5dBm |
| Current(TX) | 19.5dBm- 239mA | Current(RX) | 118mA |

# INDEX

# 1 Block Diagram



# 2 Electrical Specification

| Parameter | Values | Notes |
|---|---|---|
| Operating Voltage | 3.0V-3.6V | For RF operation, the supply voltage is recommended to be not less than 3.3V |
| Operating Temperature | -40℃~+85℃ | Storage temperature is -40℃~+105℃ |
| Transmission Power | BLE：-12 ~ +9dBm<br>WiFi：12 ~ + 20.5dBm | Configurable |
| Current(RX) | 118mA | RF receive current in maximum power mode. |
| Current(TX) | 239mA | RF transmit current at 19.5dB mode. |
| Module Dimension | 25.5*18*2.2mm | |
| Quantity of IO Port | 21 | |

# 3 Pin Description

| Left | Right |
|------|-------|
| 1: GND | 38: GND |
| 2: VDD33 | 37: IO23 |
| 3: EN | 36: IO22 |
| 4: SENSOR_VP | 35: TXD0 |
| 5: SENSOR_VN | 34: RXD0 |
| 6: GPIO34 | 33: IO21 |
| 7: IO35 | 32: NC |
| 8: IO32 | 31: IO19 |
| 9: IO33 | 30: IO18 |
| 10: IO25 | 29: IO5 |
| 11: IO26 | 28: IO17 |
| 12: IO27 | 27: IO16 |
| 13: IO14 | 26: IO4 |
| 14: IO12 | 25: IO0 |

Bottom:
15: GND
16: IO13
17: NC
18: NC
19: NC
20: NC
21: NC
22: NC
23: IO15
24: IO2
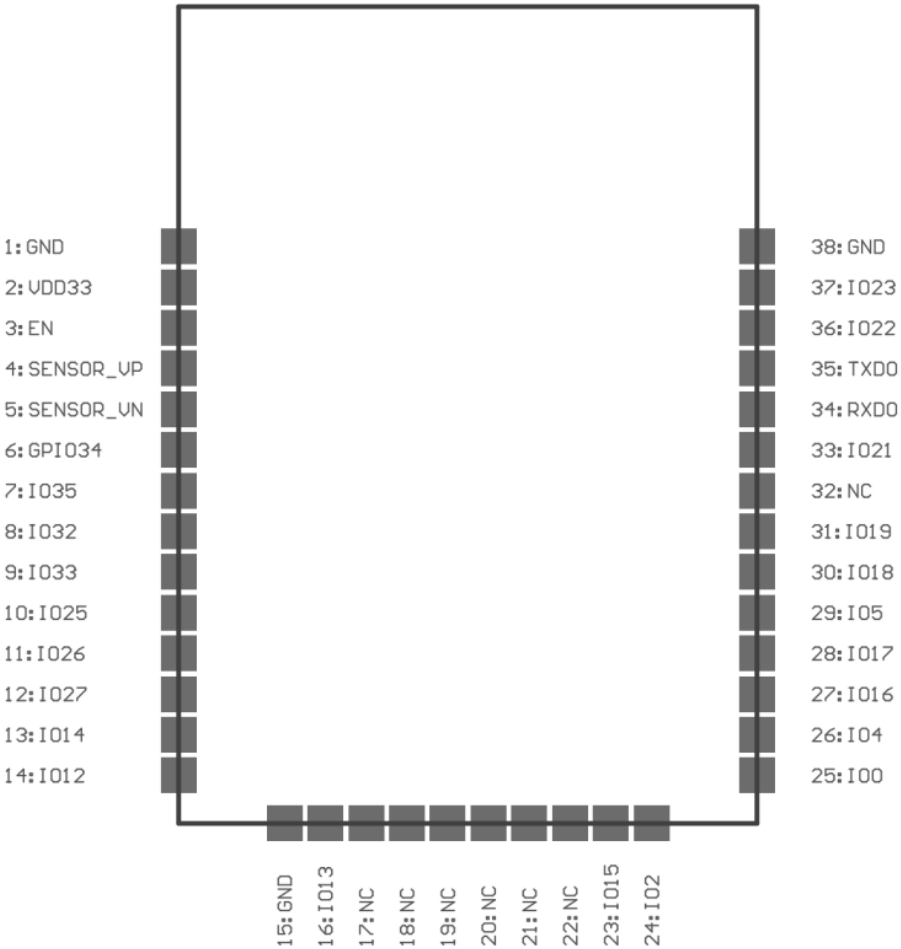
# 4 Pin Definition

| Symbol | Type | Definition |
|--------|------|------------|
| GND | ground | |
| VDD | power supply | Power supply, 3.0V-3.6V with this pin |
| EN | enable | High: Chip enable; Low: Chip off; Note: The EN pin cannot be left floating. |
| SENSOR_VP | I | ADC Input Pins |
| SENSOR_VN | I | ADC Input Pins |
| IO0 ,IO2 IO12, IO14 IO4 - IO5 IO13 - IO15 IO18 - IO19 IO21 - IO27 IO33 - IO34 | I/O | General IO Port |
| TXD0 | Serial Port TX | Firmware debugging in port |
| RXD0 | Serial port RX | Firmware debugging in port |
| NC | NC | NC |
| IO16 | Serial port RX | Communication serial port RXD |
| IO17 | Serial Port TX | Communication serial port TXD |

# 5 Description of Transmission Functions

This pass-through firmware includes BLE and WIFI pass-through, WIFI can be set as AP or STA mode for data transmission, WIFI can be connected to all kinds of cloud servers, such as AliCloud, BaiduCloud, AmazonCloud, etc. BLE and WIFI can be activated at the same time, but when transmitting data, BLE pass-through needs to exit the command mode to enter the pass-through mode, whereas the data transmission of WIFI is controlled by commands. BLE and WIFI can be activated at the same time, but when transmitting data, BLE needs to exit command mode to enter transmission mode, while WIFI data transmission is controlled by commands.

In order to ensure the normal operation of the module, it is necessary to provide a stable 3.3V voltage to the module, and the module will be woken up when the EN pin is pulled high, and the default mode is command mode, and the pass-through firmware has command mode as well as pass-through mode. In the command mode, the AT command can be used to configure the module's basic, BLE and WIFI parameters, please refer to the document of "MS13SF1-AT Command".

## 5.1 Serial port settings

Baud rate: 115200

Data bits: 8
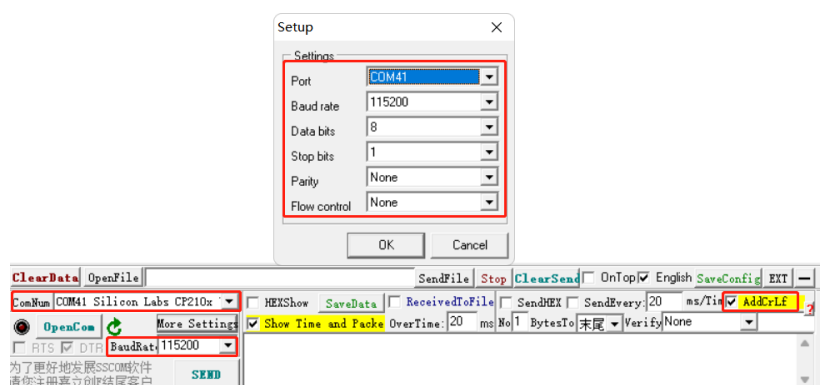
Date Bits: None

Stop bits: 1

Parity: None

Sends line feed settings:

CR&LF (\r\n) (Carriage Return Line Feed)

Send settings: ASCII

Receive setting: ASCII

## 5.1.1 WiFi Transmission

WIFI can be set to STA mode or Soft-AP mode, or a mixture of these two modes can also be achieved. under the default firmware, WiFi defaults to the open AP mode, which can directly search for SSIDs starting with ESP. in order to reduce the power consumption during the use of the commands, the RF function of the BLE is turned off, so you need to turn it on in the command mode before using the BLE normally. For more detailed description of WIFI commands, please refer to the WIFI Command section in the 《 MS13SF1-AT Command 》 document.

## 5.1.2 Soft-AP Mode Example

The Soft-AP mode can be commonly referred to as a base station, to which other devices can connect through the WIFI emitted by the module. The basic usage of the module in AP mode is illustrated by a simple example of the module as a Soft-AP implementing the UART WIFI pass-through function in UDP transmission. The sequence and response of the serial commands are as follows:

① AT+CWMODE?                              // Check WIFI mode

Return: OK

② AT+CWMODE=2                            //Set WIFI mode to Soft-AP mode

Return: OK

③ AT+CWSAP="ESP32_softAP", "1234567890",5,3
                                         //Set the WIFI name and password in AP mode.
Return: OK

The module establishes UDP transmission with a fixed peer IP address and port to the corresponding port of the PC, with the remote IP address 192.168.4.2, remote port 8080, local port 2233, and mode 0.

④ AT+CIPSTART="UDP", "192.168.4.2",8080,2233,0

Return: CONNECT OK

⑤ AT+CIPAP? //Query the IP gateway information of the module.

Return: +CIPAP:ip: "192.168.4.1" +CIPAP:gateway: "192.168.4.1"
        +CIPAP:netmask: "255.255.255.0"

At this time, the module has generated a WIFI with the name of ESP32_xxxxxx(6-bit value after MAC), now you can use the PC to connect to the AP, after the connection is successful, use the Serial Network Data Debugger, select UDP for the port number, and create a UDP service transmission. Local IP address, select 192.168.4.2, port write 8080, remote IP address is 192.168.4.1 which is the gateway address queried by ⑤ command, port is 2233 which is the module port set by ④ command, and finally click connect.



⑥ AT+CIPMODE=1              //Enter UART WIFI Transparent Receiving Mode
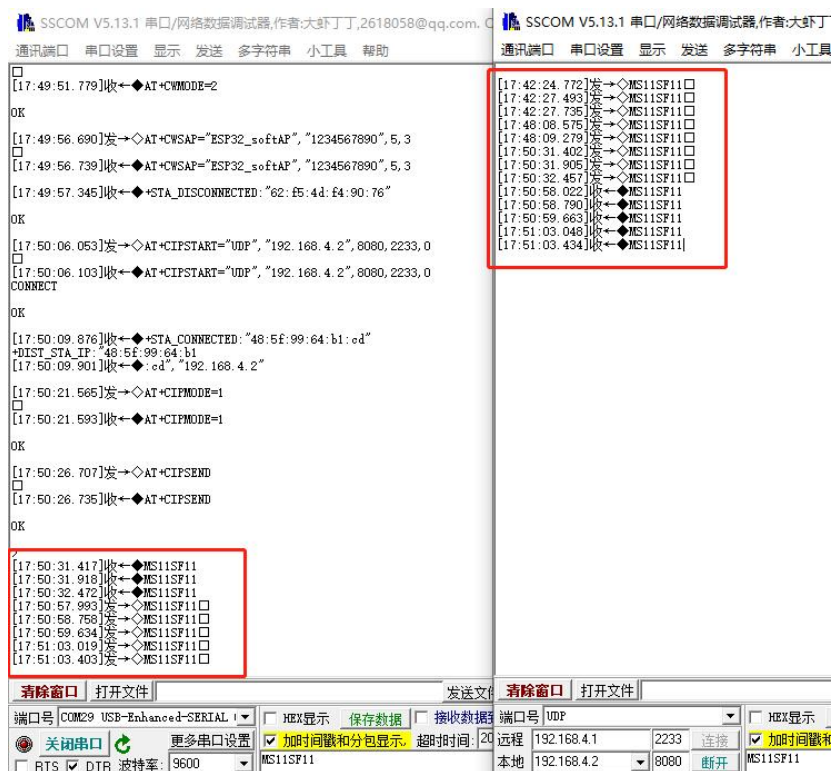
    Return: OK

After entering the transmission receiving mode, the PC can transmit WIFI to and from the module, but only in one direction, the module is now in the command mode and receives the WIFI transmission data from the PC.
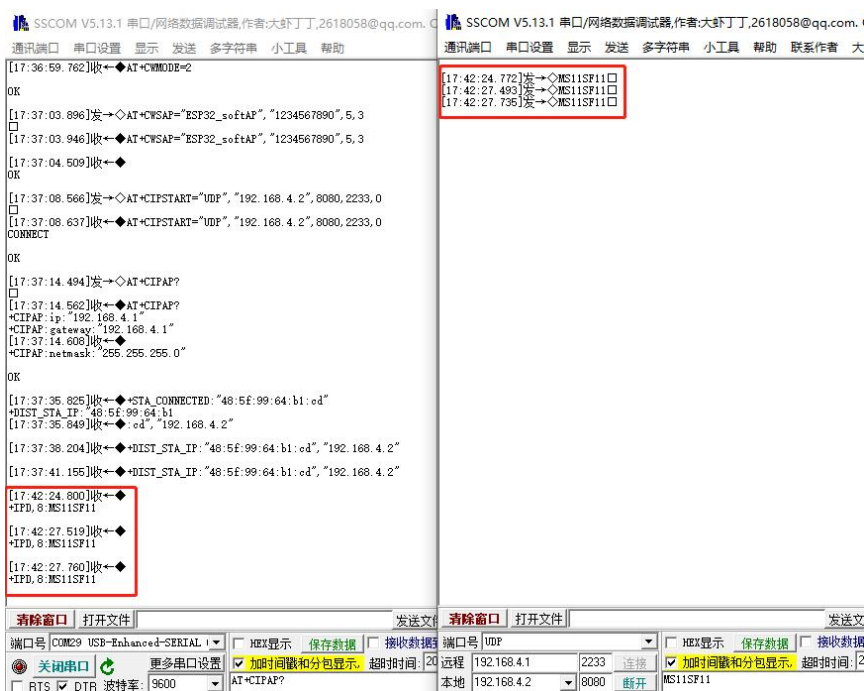
⑦ AT+CIPSEND          //Enter WIFI transmission mode to send and receive data.

Return: OK

After inputting this command, you can realise the two-way pass-through function, all the data inputted from the serial port are pass-through data, if you want to exit the pass-through state, input ++++ (no carriage return line feed) in the serial port to enter the normal command mode.

When you exit the pass-through mode with ++++, you return to the pass-through receive mode and the TCP connection is still active. You can continue to use the AT+CIPSEND command to resume the pass-through mode. To exit the UART WIFI pass-through mode, use the command: AT+CIPMODE=0, and close the TCP connection: AT+CIPCLOSE.

## 5.1.3 STA Model Example

STA mode, in general terms, means that the module can connect to a hotspot issued by a router or a mobile phone. The basic use of STA mode is illustrated by a simple example of the module as a TCP client in STA mode to realise the UART WIFI pass-through function. The sequence of serial commands and responses are as follows:
①AT+CWMODE?                              //Check the WIFI. mode
Return: OK

②AT+CWMODE=1                         //Set WIFI mode to STA mode
Return: OK

③AT+CWJAP="MS11SF1", "1234567890" //Name and password for connecting to other device hotspots

Return: WIFI CONNECTED WIFI GOT IP OK
The SSID and password you enter may be different from the commands above, so please use your device SSID and password.

④AT+CIPSTA?                              //Check the IP address of the device.

Return: +CIPSTA:ip: "172.16.1.193"
         +CIPSTA:gateway: "172.16.0.1"
         +CIPSTA:netmask: "255.255.254.0"
         OK

   The result of your query may be different from the above returns

   Then use the PC side to connect to the same hotspot as the device, and use the Serial Network Data Debugger on the PC to create a TCP server, select the local IP address 172.16.1.216, port 8080, and listen.

The module acts as a client to connect to the TCP server via TCP. The IP address of the server is the local IP address 172.16.1.216 set by the above debugger, and the port is 8080, so you can just connect via the command.

⑤ AT+CIPSTART="TCP", "172.16.1.216",8080

Return: CONNECT OK

⑥ AT+CIPMODE=1 //Enter UART WIFI Transmission Acceptance Mode

Return: OK

At this point the module enters the Transmission Receive and Command modes, allowing for simultaneous command output as well as data reception from the TCP server.

⑦ AT+CIPSEND

Return: OK >

After inputting this command, you can realise the two-way pass-through function, all the data inputted from the serial port are pass-through data, if you want to exit the pass-through state, input ++++ (no carriage return line feed) in the serial port to enter the normal command mode.
When you exit the pass-through mode with ++++, you return to the pass-through receive mode and the TCP connection is still active. You can continue to use the AT+CIPSEND command to resume the pass-through mode. To exit the UART WIFI pass-through mode, use the command: AT+CIPMODE=0, and close the TCP connection: AT+CIPCLOSE.
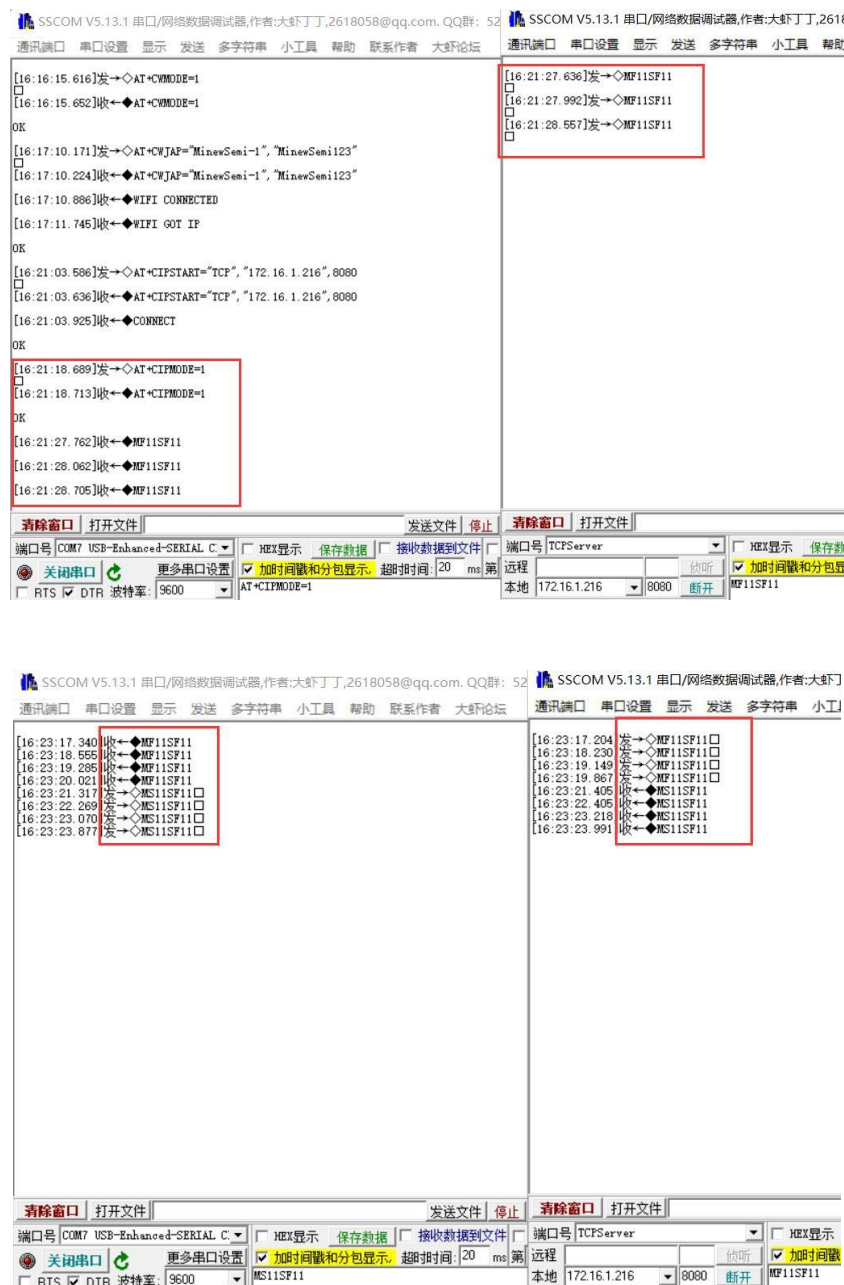
## 5.1.4 Soft-AP+STA Hybrid Mode Example

The mixed mode of Soft-AP+STA can support the module to be connected by other devices and connect to the hotspot of other devices at the same time, but in this mode, it does not support the WIFI throughput function with devices at both ends at the same time, and it can be realised to connect to different clients or servers at different times to complete the throughput function. This mode is briefly illustrated by a basic hybrid example, and the sequence of serial port commands and responses are as follows:

①                    AT+CWMODE?         //Check the mode of WIFI.

Return: OK

② AT+CWMODE=3                    //Set WIFI mode to Mixed mode

Return: OK

③ AT+CWSAP="ESP32_softAP", "1234567890",5,3 //Set the WIFI name and password in AP mode.

Return: OK

④ AT+CWJAP="ESP32_softAP", "1234567890" //Name and password to connect to other device hotspot

Return: WIFI CONNECTED WIFI GOT IP OK

```
[16:59:30.237]发→◇AT+CWMODE=3
□
[16:59:30.256]收←◆AT+CWMODE=3

OK

[16:59:51.446]发→◇AT+CWSAP="ESP32_softAP", "1234567890",5,3
□
[16:59:51.495]收←◆AT+CWSAP="ESP32_softAP", "1234567890",5,3

[16:59:52.062]收←◆
OK

[17:00:37.546]发→◇AT+CWJAP="MinewSemi-1", "MinewSemi123"
□
[17:00:37.592]收←◆AT+CWJAP="MinewSemi-1", "MinewSemi123"

[17:00:37.755]收←◆WIFI CONNECTED

[17:00:38.299]收←◆WIFI GOT IP

OK

[17:00:54.352]收←◆+STA_CONNECTED:"26:92:6d:2d:ad:ea"

[17:00:54.575]收←◆+DIST_STA_IP:"26:92:6d:2d:ad:ea", "192.168.4.2"
```

After completing the above commands, the module's WIFI has been opened to be connected by other devices, and has also been connected to the WIFI hotspot of other devices, you can create a connection to do the pass-through through the single-mode passthrough example that has been described above, and will not repeat the instructions in this section. However, it should be noted that, for example, when doing a TCP client passthrough, you cannot do other passthroughs at the same time, and you need to disconnect the TCP connection in command mode, the command is AT+CIPCLOSE, which can turn off the single-connection mode or multiple-connection mode of TCP/UDP/SSL, please refer to the "MS13SF1-AT" file for more details on the TCP-IP example description. Command Set" file for more detailed TCP-IP examples, please refer to the "MS13SF1-AT Command Set" file for command examples and the AT Command Set section.

## 5.1.5 Connecting Cloud Servers to MQTT

MS13SF1 can communicate with AliCloud, BaiduCloud, TencentCloud, AmazonCloud and other cloud servers, the specific communication steps have the relevant cloud connection documents, MS13SF1 with PC clients, Android clients and IOS clients for MQTT communication steps see the test document of MQTT communication between each client and module, please contact us to provide.
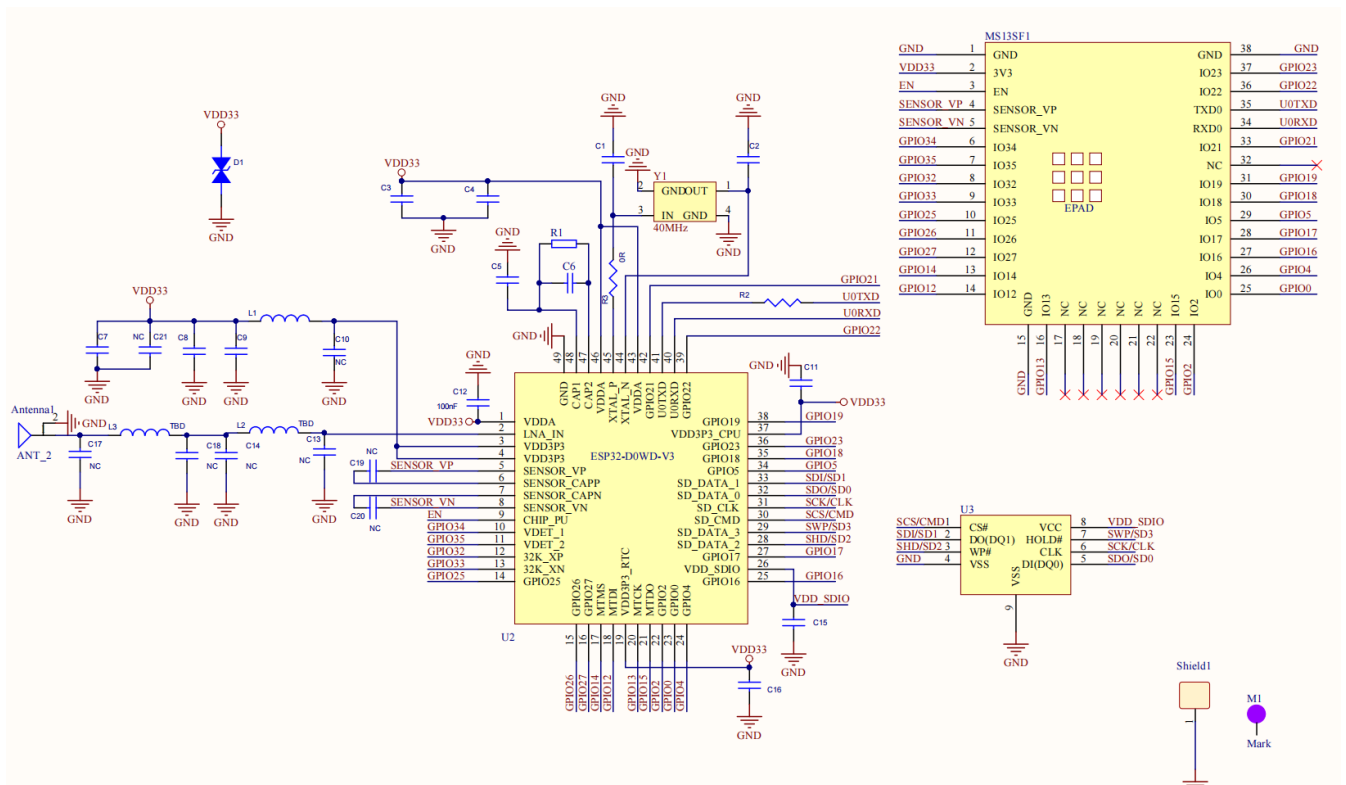
# 6 Mechanical Drawing
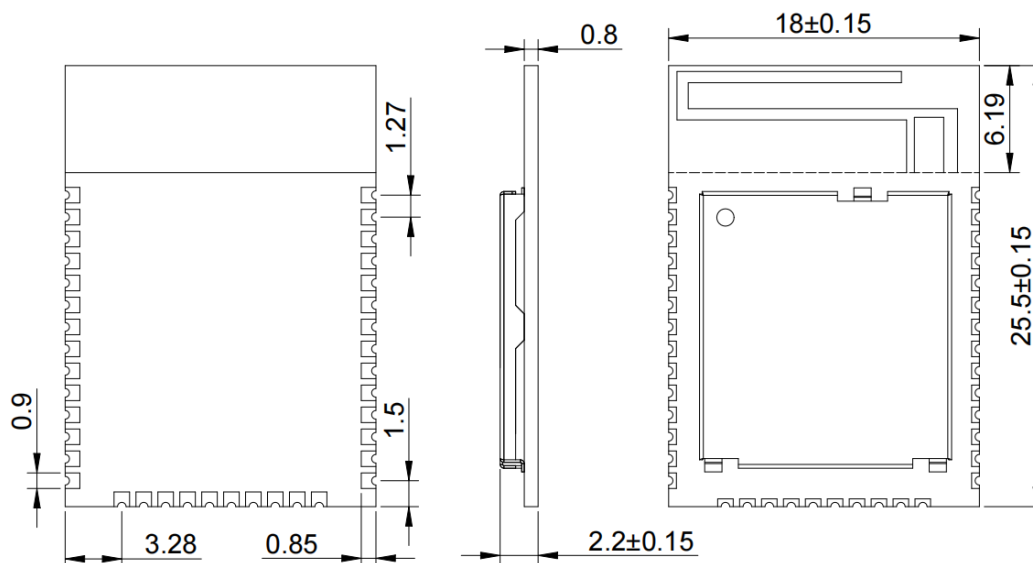


*（Default unit：mm    Default tolerance：±0.1）

**Notice**：The recommended pad size is 0.9mm with a pad extension of 0.5mm
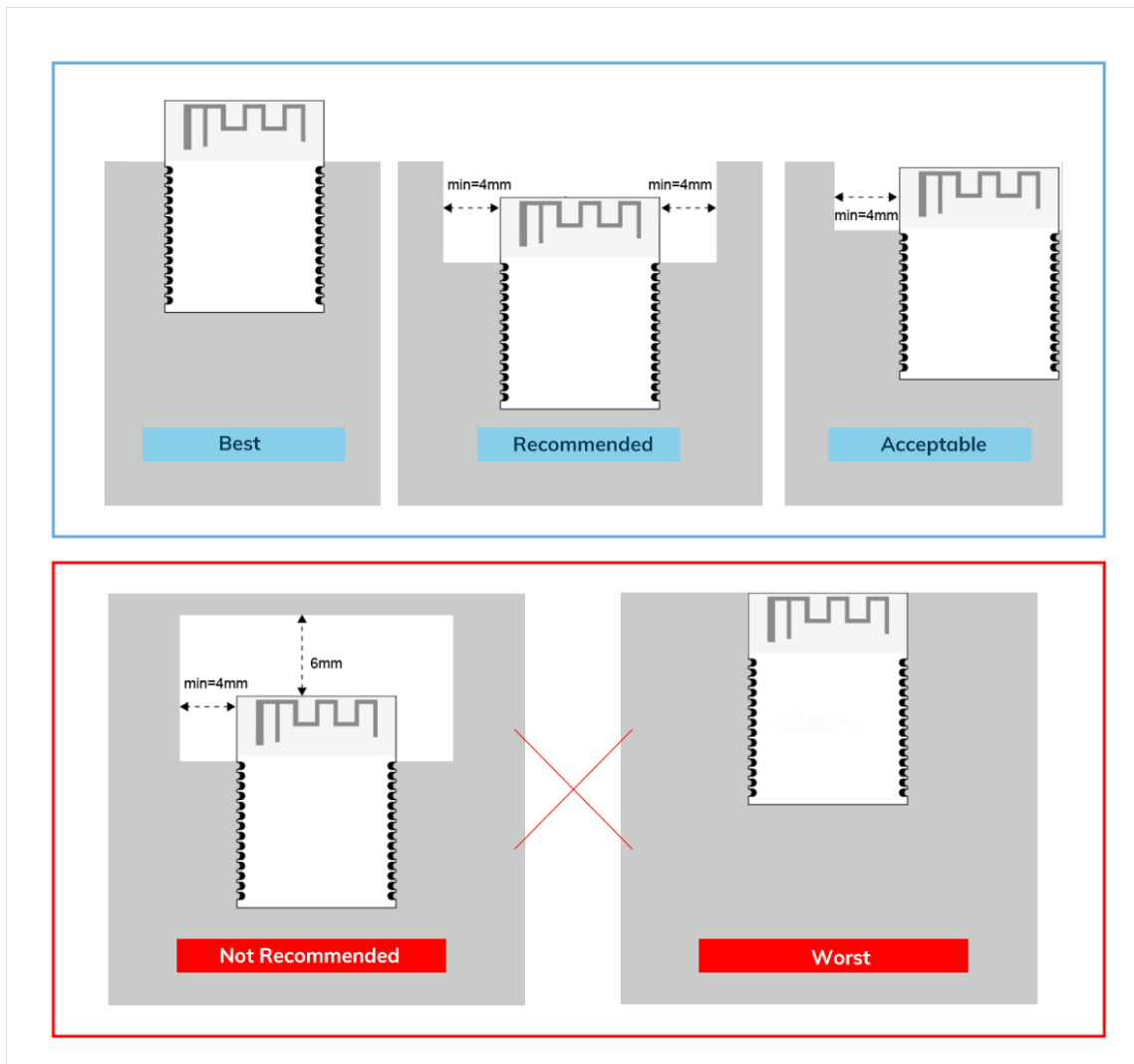
# 7 Electrical Schematic



**Notice**：Before placing an order, please confirm the specific configuration required with the salesperson.

# 8 PCB Layout

Module antenna area couldn't have GND plane or metal cross line, couldn't place components nearby. It is better to make hollow out or clearance treatment or place it on the edge of PCB board.

**Notice:** Refer to examples as below, and highly suggest to use the first design and the adjustment of modules antenna design according to the first wiring.

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**Layout notes：**

1) Preferred Module antenna area completely clearance and not be prevented by metals, otherwise it will influence antenna's effect (as above DWG. indication).

2) Cover the external part of module antenna area with copper as far as possible to reduce the main board's signal cable and other disturbing.

3) It is preferred to have a clearance area of 4 square meter or more area around the module antenna (including the shell) to reduce the influence to antenna.

4) Device should be grounded well to reduce the parasitic inductance.

5) Do not cover copper under module's antenna in order to avoid affect signal radiation or lead to transmission distance affected.

6) Antenna should keep far from other circuits to prevent radiation efficiency reduction or affects the normal operation of other lines.

7) Module should be placed on edge of circuit board and keep a distance away from other circuits.

8) Suggesting to use magnetic beads to insulate module's access power supply.

# 9 Reflow and Soldering

1) Do SMT according to above reflow oven temperature deal curve. Max. Temperature is 260℃;

   Refer to IPC/JEDEC standard；Peak TEMP<260℃；Times：≤2 times，suggest only do once reflow soldering on module surface in case of SMT double pad involved. Contact us if special crafts involved.
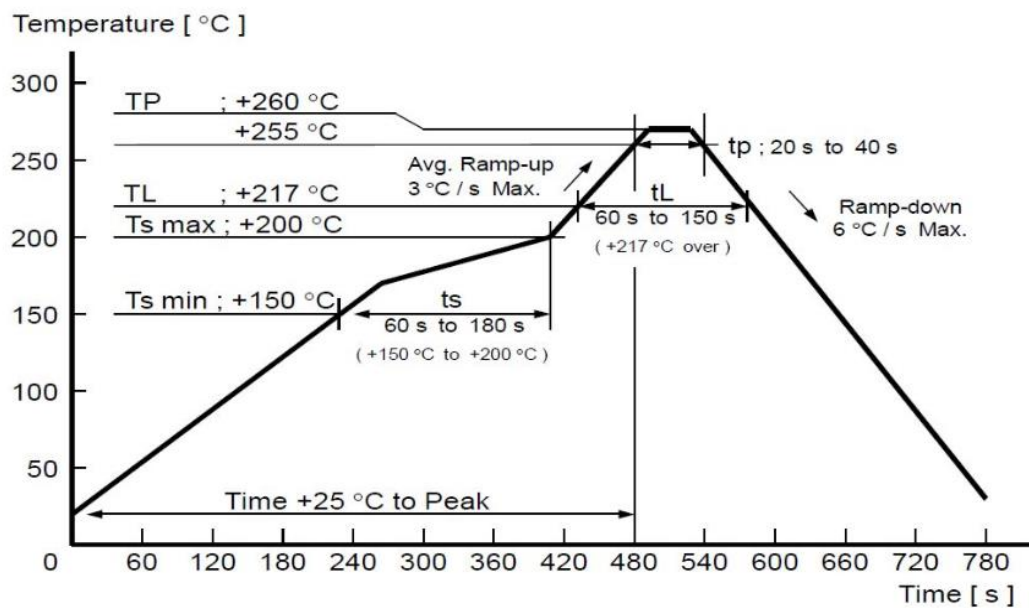


2) Suggesting to make 0.2mm thickness of module SMT for partial ladder steel mesh, then make the opening extend 0.8mm

3) After unsealing, it cannot be used up at one time, should be vacuumed for storage, couldn't be exposed in the air for long time. Please avoid getting damp and soldering-pan oxidizing. If there are 7 to 30 days interval before using online SMT, suggest to bake at 65-70 ℃ for 24 hours without disassembling the tape.

4) Before using SMT, please adopt ESD protection measure.

# 10 Package Information
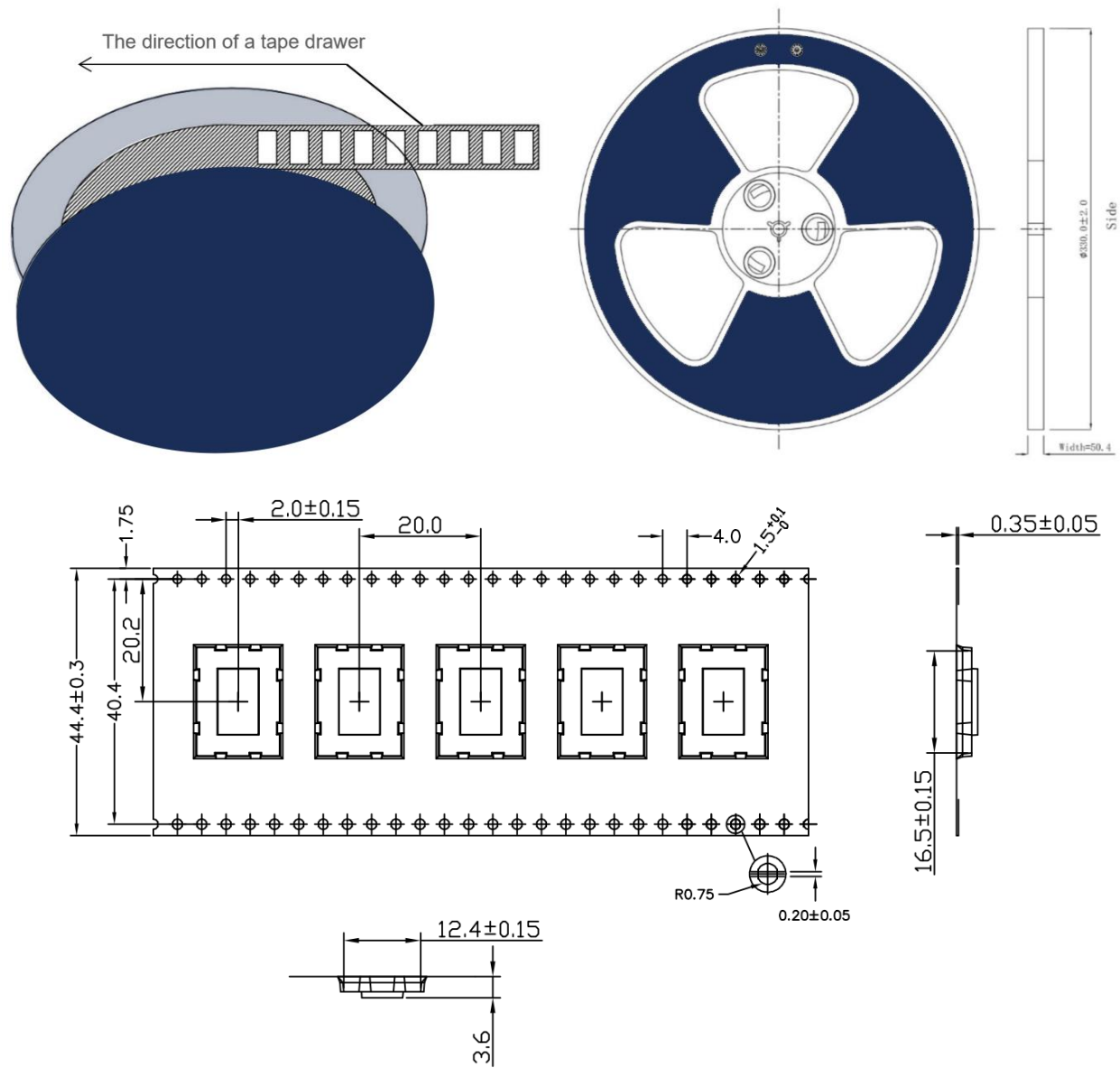


* （Default unit：mm  Default tolerance：±0.1）

| Packing detail | Specification | Net weight | Gross weight | Dimension |
|---|---|---|---|---|
| Quantity | 900PCS | / | / | W=44mm, T=0.35mm |

* **Note:** Default weight tolerance all are within 10g（except the special notes)

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Cognizant of our commitment to quality, we operate our own factory equipped with state-of-the-art production facilities and a meticulous quality management system. We hold certifications for ISO9001, ISO14001, ISO27001, OHSA18001, BSCI. Every product undergoes stringent testing, including transmit power, sensitivity, power consumption, stability, and aging tests. Our fully automated module production line is now in full operation, boasting a production capacity in the millions, capable of meeting high-volume production demands.

# ● Contact Us

Shenzhen Minewsemi Co., Ltd. is committed to swiftly delivering top-quality connectivity modules to our customers. For assistance and support, please feel free to contact our relevant personnel, or contact us as follows:

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