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| F8L10D LoRa Module User Manual | Documentation No. | Document Version | Page |
| | | V2.0.0 | |
| | Product Name: F8L10D | | Total:32 |

F8L10D LoRa Module

User Manual

The user manual is suitable for the following model:

| Model | Product Type |
|--------------|------------------------------|
| F8L10D-N-433 | Without PA, Band: 410-441MHz |
| F8L10D-N-470 | Without PA, Band: 470-510MHz |
| F8L10D-N-868 | Without PA, Band: 850-890MHz |
| F8L10D-N-915 | Without PA, Band: 895-935MHz |
| F8L10D-E-433 | With PA, Band: 410-441MHz |
| F8L10D-E-470 | With PA, Band: 470-510MHz |



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Note: There may be different components and interfaces in different model, please in kind prevail.

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Chapter 1 Brief Introduction of Product

1.1 General

F8L10D F8L10D LoRa module is a kind of embedded device that provides data transfer function by LoRa network. It provides ultra-long range spread spectrum communication.

The product uses high-performance industrial-grade LoRa solution, support transparent data transmission function; low power consumption design, the lowest working current can less than 2uA; supply multil I/O channels, compatible analog inputs and pulse input counters.

It has been widely used on M2M fields, such as electric power, intelligent traffic, wireless metering, industrial automation, telemetry, water supply, environment protection, weather, and so on.

1.2 Features and Benefits

Design for Industrial Application

- ◆ High-powered industrial LoRa chip and MCU
- ◆ Power input: DC 3.3 ~ 5.0V
- ◆ Support a variety of frequency bands around the world (433/470/780/868/915 MHz)
- ◆ Low power design, support sleep and wake-up mode
- ◆ High receiving sensitivity, communication distance farther

Stability and Reliability

- ◆ Built-in watchdog, to ensure long-term stable operation of the system
- ◆ Built-in LDO, ensure stable power supply module
- ◆ Multi-data automatic packet transmission to ensure the integrity of the data packet is not lost
- ◆ Efficient cyclic interleaving error correction coding, maximum error correction 64bit, dual 256-ring FIFO

Standard and Convenience

- ◆ Adopt a miniature package, support 2.54mm*7pin spacing stamp hole for SMT and 2*2.0mm*10pin spacing stamp hole for SMT
- ◆ Support a variety of antenna connection, U.FL interface / SMA interface Convenient configuration and maintenance interface
- ◆ Intelligent data module, power can enter the data transmission status
- ◆ Easy to use, flexible, a variety of operating mode selection
- ◆ Convenient system configuration and maintenance interface
- ◆ Output standard 3.3V TTL level

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- ◆ Support serial software upgrade

High-performance

- ◆ Support OTA
- ◆ Support for wake-up function in the air
- ◆ Support a variety of baud rate, a variety of RF rates
- ◆ Flexible power level setting (5~20dBm; 30dBm with PA)

Application

- ◆ Power line on-line monitoring
- ◆ Smart parking
- ◆ Soil temperature and humidity monitoring
- ◆ Intelligent irrigation
- ◆ Wireless remote meter reading
- ◆ PV array monitoring

1.3 Specifications

LoRa Specification

| Item | Content |
|---------------------------------|---|
| Communication Protocol and Band | Support a variety of frequency bands around the world (433/470/780/868/915 MHz) |
| Indoor/Urban Range | F8L10D-N:1km F8L10D-E:2km |
| Outdoor/RF Line-of-Sight Range | F8L10D-N:3.5km F8L10D-E:11.5km |
| Transmit Power | F8L10D-E:30dBm(1W) F8L10D-N:20dBm(100mW) |
| Receiver Sensitivity | -140dBm |
| RF Data Rate | 6 level, 0.3、0.6、1.0、1.8、3.1、5.5Kbps |
| Max Serial Buffer Size | 4K Bytes |

Interface Type

| Item | Content |
|-------------------|---|
| UART | Data bits: 8 Stop bits: 1, 2 Checksum: none,odd,even Baud rate: 300, 600, 1200, 2400, 4800, 9600, 19200, 38400,57600, 115200 bps |
| Antenna connector | SMA female / U.FL RF connector, the characteristic impedance of 50 ohms |
| Package | Support double row 2 * 2.0mm * 10 pin / single row 2.54mm * 7 pin / SMT half hole |

Note: There may be different components and interfaces in different model, please in kind prevail.

Power supply

| Item | Content |
|-------------------|---|
| Recommended Power | F8L10D-N:DC 3.3V/0.5A F8L10D-E:DC 5V/1A |
| Power Range | DC 3.3~5V |

Note: F8L10D-E power supply voltage is less than 4V output power will be reduced, but little impact on the reception performance.

Power Consumption

| | Item | Content |
|----------|----------------|--|
| F8L10D-N | RX Mode | <22mA@3.3VDC |
| | TX Mode | 117~129mA@3.3VDC(Maximum pulse current≤150mA) |
| | Timing wake up | <3.0uA@3.3VDC |
| | Deep Sleep | <2.0uA@3.3VDC |
| F8L10D-E | RX Mode | <22mA@5VDC |
| | TX Mode | 180~200mA@ 5VDC(Maximum pulse current≤400mA) |
| | Timing wake up | <3.0uA@5VDC |
| | Deep Sleep | <2.0uA@5VDC |

Physical Characteristics

| | Item | Content |
|----------|------------|--|
| F8L10D-N | Dimensions | 24.4x37.5x4.2 mm (Without antenna and connector) |
| | Weight | 5.0g |
| F8L10D-E | Dimensions | 24.4x45.0x4.2 mm (Without antenna and connector) |
| | Weight | 8.0g |

Environmental Limits

| Item | Content |
|-----------------------|-------------------------|
| Operating Temperature | -40~+85°C(-40~+185°F) |
| Storage Temperature | -40~+125°C (-40~+257°F) |
| Operating Humidity | 95%(unfreezing) |

Chapter 2 Module Interface

2.1 Module Signal Definition

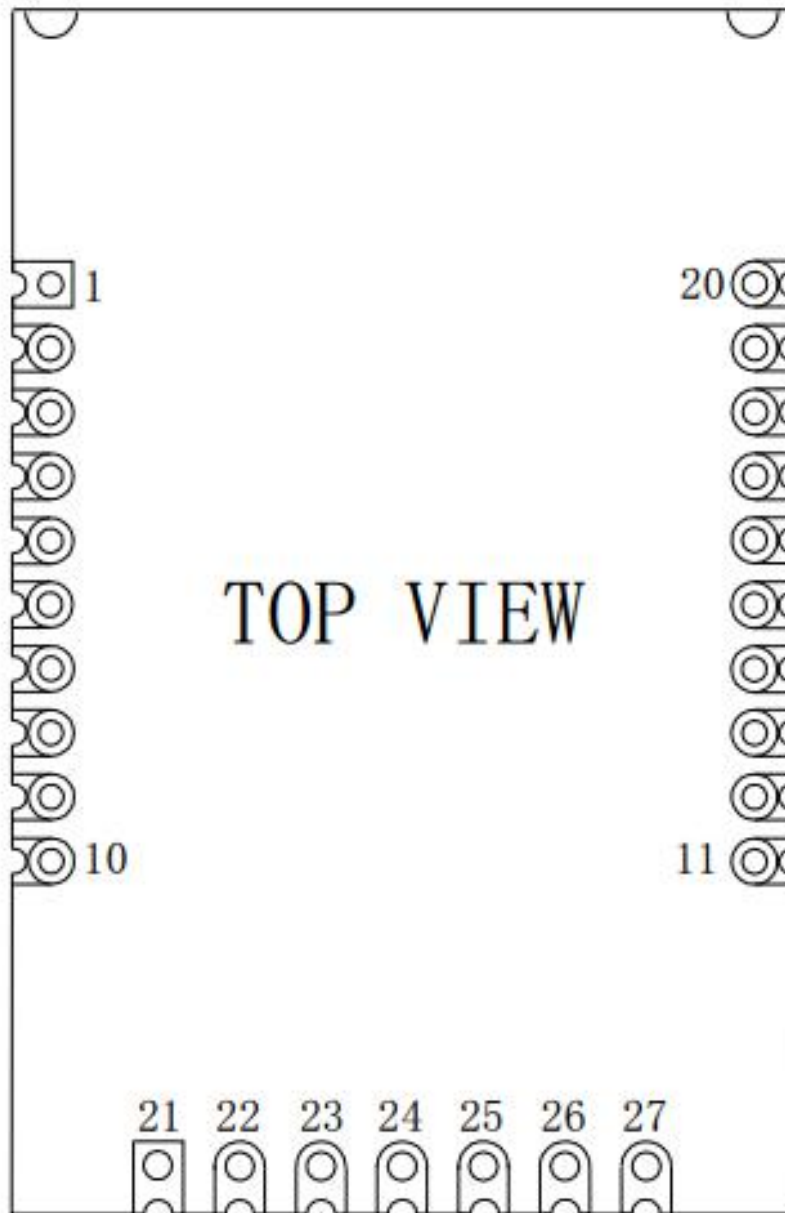


Figure 2-1 Module Pin Diagram F8L10D-N \ F8L10D-E

Table 2-1-1 Module signal definition 1--SMT

| Pin Number | Definition | Input /Output | Description |
|------------|------------|---------------|-------------|
|------------|------------|---------------|-------------|

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| | | | |
|----|--------------|--------|--------------------|
| 1 | VCC | N/A | Power Supply |
| 2 | TX | Output | UART Data Out |
| 3 | RX | Input | UART Data In |
| 4 | D6 | Either | GPIO |
| 5 | RST | Input | Module Reset |
| 6 | D7 | Either | GPIO |
| 7 | D8 | Either | GPIO |
| 8 | D9 | Either | GPIO |
| 9 | D1/SLEEP_RQ | Either | GPIO/SLEEP_CONTROL |
| 10 | GND | N/A | Ground |
| 11 | D3 | Either | GPIO/ADC |
| 12 | D12/SLEEP_RQ | Either | GPIO/SLEEP_CONTROL |
| 13 | STATUS | Either | SLEEP/ON |
| 14 | D10 | Either | GPIO |
| 15 | D2 | Either | GPIO |
| 16 | D11 | Either | GPIO |
| 17 | JIMS_SWDIO | Either | Debug Data |
| 18 | JTCK_SWCLK | Input | Debug Clock |
| 19 | D4 | Either | GPIO/ADC |
| 20 | D5 | Either | GPIO/ADC |
| 21 | STATUS | Either | SLEEP/ON |
| 22 | D12/SLEEP_RQ | Either | GPIO/SLEEP_CONTROL |
| 23 | RX | Input | UART Data In |
| 24 | TX | Output | UART Data Out |
| 25 | RST | Input | Module Reset |
| 26 | VCC | N/A | Power Supply |
| 27 | GND | N/A | Ground |

Note: The signal Input/Output relative to the module.

2.2 UART

The serial communication port 1 is UART. The signal define as **Table 2-2:**

Table 2-2 UART Signal Assignments

| UART Signal Name | Pin Number | |
|------------------|------------|---------|
| TX | 2(DIP) | 24(SMT) |
| RX | 3(DIP) | 25(SMT) |

Please reference the chapter 3 for the UART operation details.

2.3 GPIO Specification

The DC characteristics of F8L10D GPIO as the Table 2-3

Table 2-3 GPIO DC Characteristics (Ta=25°C,VCC=3V)

| Parameters | Test Conditions | Min | Type | Max |
|---|------------------|-----|------|-----|
| Logic 0 input voltage (V) | | | | 0.5 |
| Logic 1 input voltage (V) | | 2.5 | | |
| Logic 0 input current (nA) | Input equals 0V | -50 | | 50 |
| Logic 1 input current (nA) | Input equals VCC | -50 | | 50 |
| I/O-pin pullup and pulldown resistors(kΩ) | | 30 | 45 | 60 |
| GPIO capacity (pF) | | | 5 | |

2.4 Antenna Interface

F8910D support two way of antenna interfaces.

- 1) The Antenna connector part number: MM9329-2700/Murata, as the Figure 2-2:

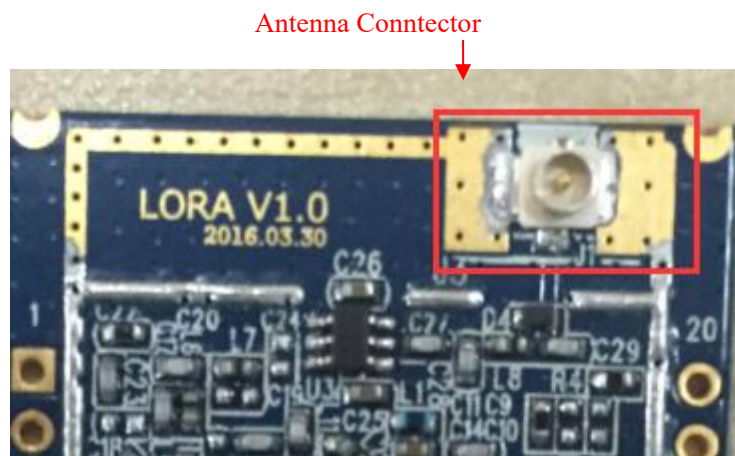


Figure 2-2 Antenna Connector

MM9329-2700/Murata dimension as the Figure 2-3:

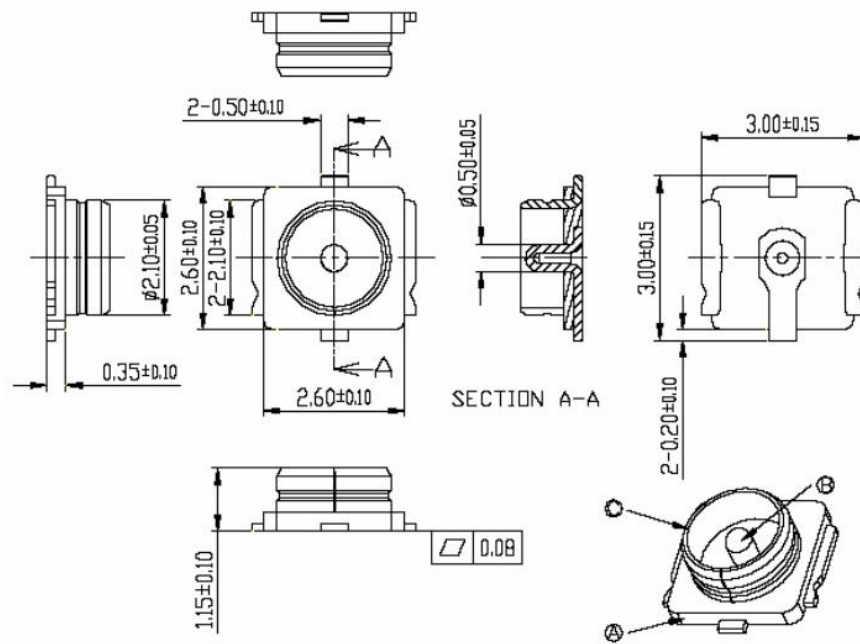


Figure 2-3 The MM9329-2700/Murata dimension

2) SMA, as Figure 2-4

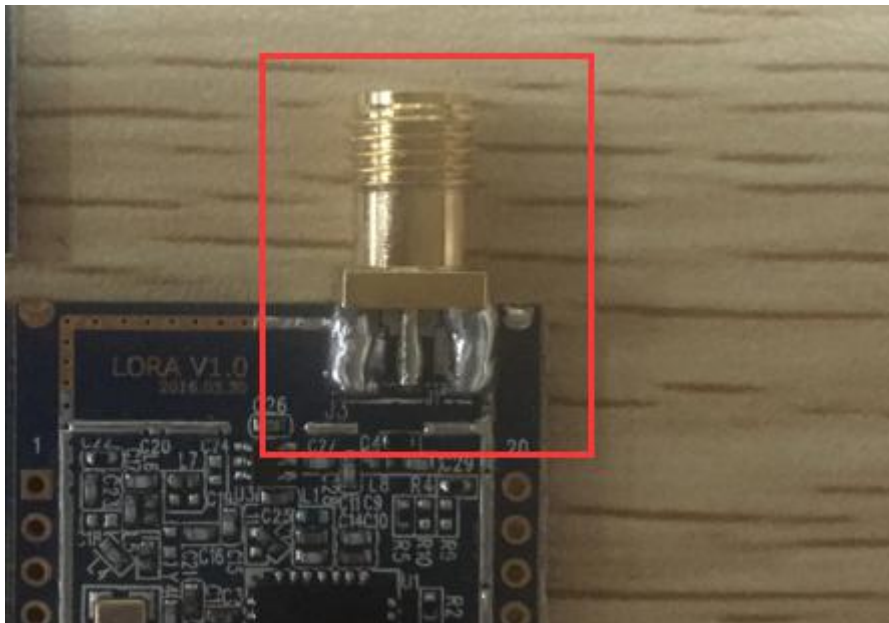


Figure 2-4 SMA master mode

2.5 Antenna Installation

- 1、 Install the antenna far away from the large area metal and ground.
- 2、 Keep the antennas visual.
- 3、 Minimize obstructions between the antennas.

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4、 Reduce the extension cords of the antenna.

The performance of different antenna installation types, as the figure 2-5

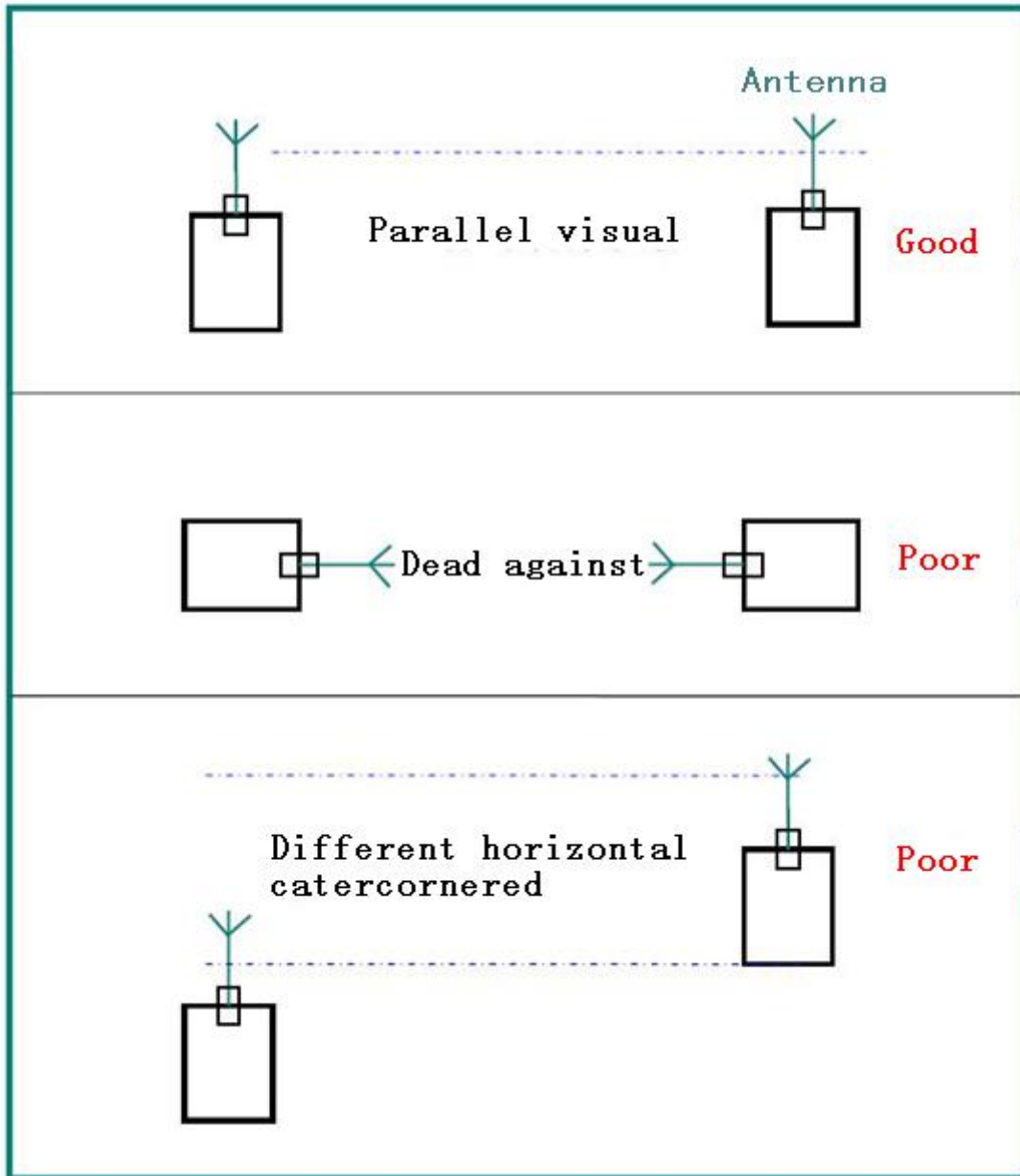


Figure 2-5 Different antenna installation types

2.6 Firmware Performance Specifications

Table 2-4 Firmware Performance Specification

| | | |
|-------------|------------------------|------------------|
| UART | Baud rate | 115200 (Default) |
| | Configuration | 8/N/1 (Default) |
| | Max serial buffer size | 4KBytes |

| | | |
|---------------------|-----------------------|---|
| | XOR | 1-byte XOR |
| | Command Mode | AT Command HEX Command |
| Network | Max nodes quantity | 65000 |
| | Node number range | 0~65000 0: The center node 65535: Broadcast |
| Wake up Mode | External Wake up Mode | |
| | Timer Wake up Mode | |

2.7 Absolute Maximum Ratings

Table 2-5 Absolute Maximum Ratings

| Parameters | Min | Max | Unit |
|----------------------------|---------|----------------|------|
| Supply Voltage | -0.3 | 3.9 | V |
| Voltage on any digital pin | VCC-0.3 | VCC+0.3 (≤3.9) | V |
| Input RF level | | 10 | dBm |
| Storage temperate range | -40 | 125 | °C |

Note: Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device.

2.8 Antenna selection

If the customer chooses the aerial, can refer to the following parameter:

| | |
|-------------|----------------|
| Impedance | 50 ohm Nominal |
| Return Loss | -10dBi |
| VSWR | 2.0MAX |
| Gain | 2~5dBi |

Customers can provide the whole product to the antenna manufacturers in accordance with the selected frequency matching debugging, in order to achieve the best results.

Chapter 3 Communication Interface Operation

3.1 UART

3.1.1 UART signal description

- TX: Data transmit
- RX: Data receive

3.1.2 UART connections

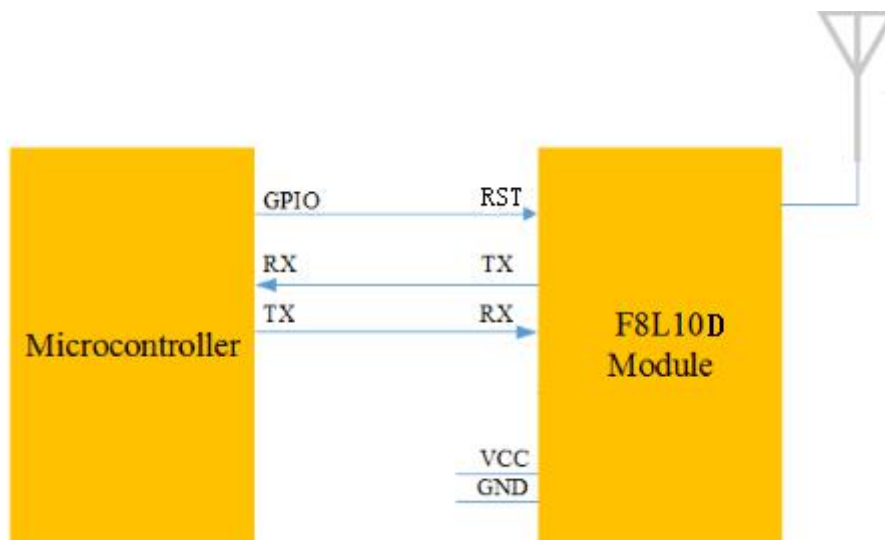


Figure 3-1 UART connection diagram

Note:the device has no hardware flow control by default.

Example: As the figure 3-2, The UART convert to RF system can be set up when the device with a UART interface connect to F8L10D directly.



Figure 3-2 The UART convert to RF system

3.1.3 UART Characteristics

UART data format

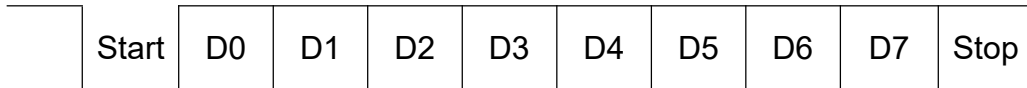


Figure 3-3 Data format

- 1) Communication interface: UART
- 2) Baud rate: 300,600,1200,2400,4800,9600 ,19200,38400,57600 ,115200 bps (default)
- 3) Start bit: 1bit
- 4) Data bit: 8bit
- 5) Stop bit: 1bit,2bit
- 6) Check bit: none,odd,even

UART support full-duplex. The communication can launch by an external device or the module itself.

The 8-N-1 mode, each data byte includes a start bit (low), 8 data, and a stop bit (high). The following figure 3-3 illustrates the serial data bit patterns. The data packet is 0x1F.

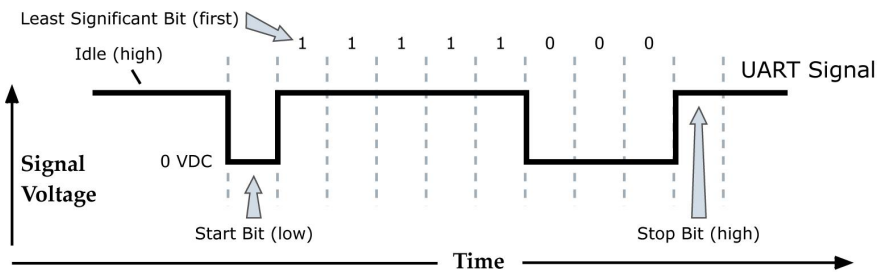


Figure 3-4 0x1F bit patterns

Chapter 4 Parameter Configuration

4.1 Configuration Connection

Before configuration, it's need to connect the F8L10D with a host controller. The host controller could be a PC or other device which contain UART port. You can connect the F8L10D with PC by the Four-Faith F8L10D EVB, as showing in the figure 4-1.

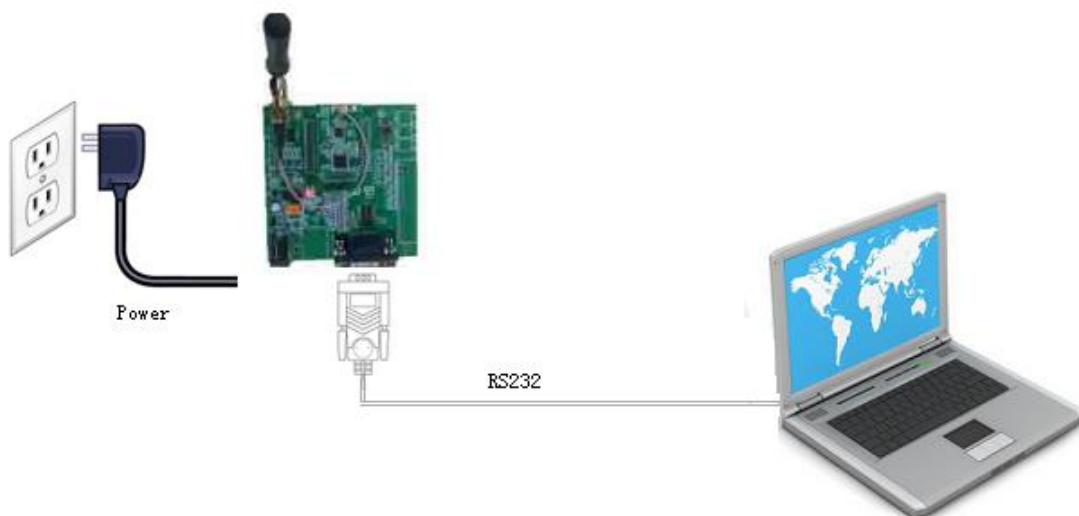


Figure 4-1 F8L10D EVB connect with PC

4.2 Configuration Introduction

There are two ways to configure the device:

- ◆ Four-Faith Configuration software tool "[LoRaConfig](#)": All the settings are configured through the shipped software tool. It's necessary to have one PC to run this tool.
- ◆ Extended AT command: All the settings are configured through AT command, so any device with serial port can configure it. Before configuration with AT command, you should make device enter configure state.

For more details, refer to "*AT command manual*".

Run the configure tool: LoRaConfig.exe,as showing in the figure 4-2

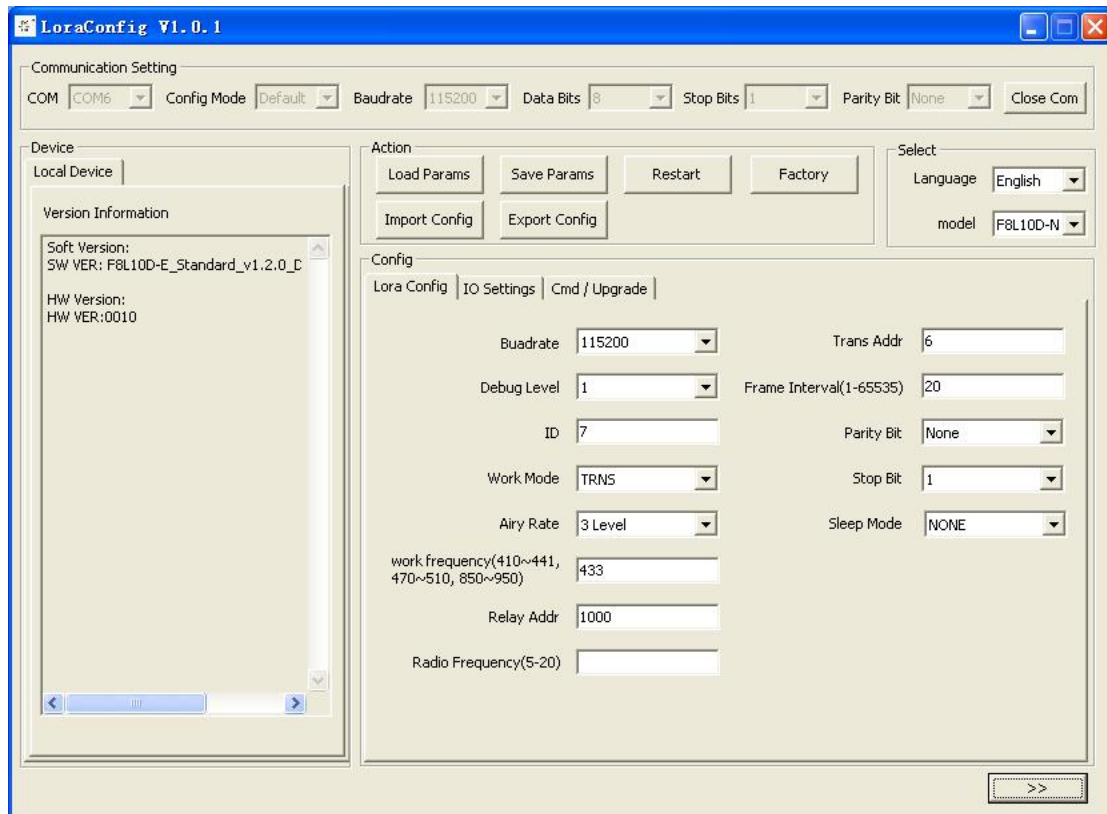


Figure 4-2 LoRa Configuration Tool

The “Communication Setting” column shows the current serial port settings. To configure LoRa modules, please choose the correct serial port parameters ,then open the serial port. If the button text is“Close”, it shows the serial port now has been opened. If the text is “Open”, you should open the port first.

When the serial port has beed opened, press “Save Params” button and LoRaConfig.exe will load parameters automatically. Then, you can configure all parameters of LoRa, showed by figure 4-2.

4.3 LoRa Parameters Setting

4.3.1 Serial Com Set

It can set the Serial Com port parameters, such as baud rate, data bit, check bit and stop bit

The default value: baud rate is 115200. Data bit is 8. Check bit is N, and stop bit is 1.

4.3.2 Work Mode

There are three work modes, "TRNS", "AT" and "API".

TRNS --Transparent Data to LoRa. The "Transparent Address" must be set.

AT --AT operating mode, refer to "*AT Command Manual*", which is usually used for parameter configuration and manual testing.

API --API operating mode, refer to "*API Command Manual*", whose payload's length must be less than 100 Bytes.

Default value is TRNS.

4.3.3 ID

The ID of LoRa Module, id range is 0~65535

4.3.4 Work Frequency

The data transmission frequency of module. The work frequency bands are divided into low frequency band (525MHz below) and high frequency band (525MHz above) for different modules. Typical operating frequency bands contain 410M ~ 441MHz, 470M ~ 510MHz, 850 ~ 950MHz, etc., 1000KHz for a channel. Different application areas have different frequency band restrictions, so what we should do is to adjust the value to local conditions.

The default value for the low-band hardware module is 433, and the default for the high-band module is 868.

4.3.5 Airy Rate

The Airy Rate is the speed of data transferring. The bigger the Bit Rate, the faster of

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the data transfer data speed.

Note: The Bit Rate should keep the same value, while transferring data between two module.

The default is 3.

4.3.6 Radio Frequency

The module without PA can set the radio frequency from 5dBm to 20dBm. But the ones with PA is fixed to 30dBm.

Default value: 20

4.3.7 Relay Address

The relay address will be adopted when the transmission distance between nodes is too long. This parameter is set as the ID of the relay node, and the relay node will help transmit the data to the final destination node.

Default value:1000

4.3.8 Sleep Mode

The module work on different power mode, such as None,Time and Deep.

None sleep mode -- Max power consumption on

Time sleep mode -- wake up the module by RTC timer.

Deep sleep mode -- wake up the module by RST or SLEEP_RQ pin.

When Sleep mode is Time, the Wake-up Time and Sleep Time Must Set.

Default value is None.

When the sleep is set Time Mode, the Wake-up Time is the duration of the module keep activity. The unit is millisecond.

When the sleep is set "Time" Mode, the "Sleep Time" is the duration of the module keep inactivity. The unit is millisecond.

4.3.9 Debug Level

Debug information is used to debug software when there is software problem. As showing in the figure 4-3

0 --- no debug information output

- 1 --- simple prompt information output
- 2 --- detail debug information output

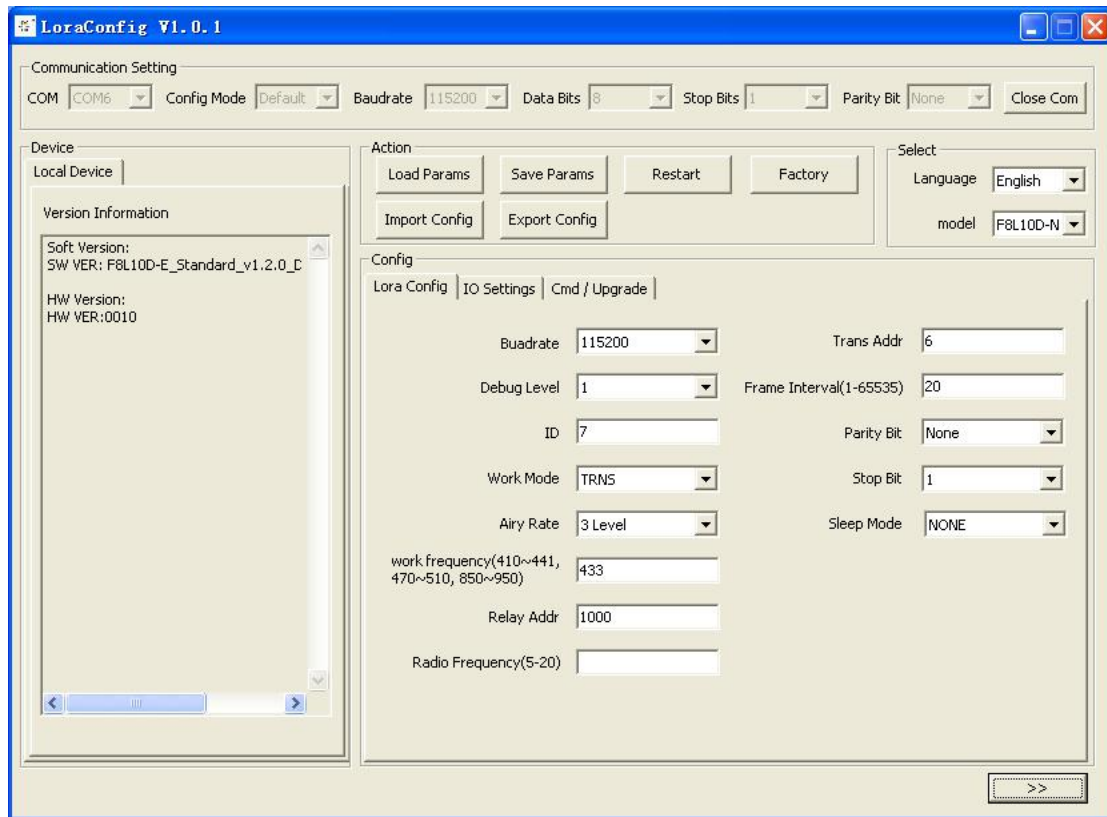


Figure 4-3 LoRa Configuration Tool

Chapter 5 Reference Circuit

5.1 Communication

There are three modes:

1, The host controller support RS232 (such as: PC).The figure 5-1 is the recommend UART convert to RS232 circuit.

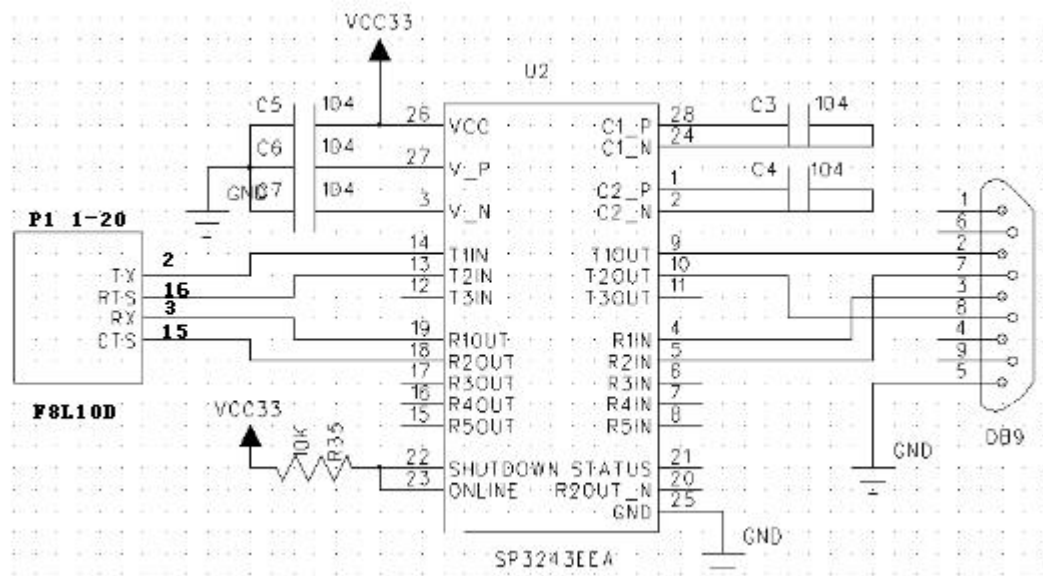


Figure 5-1 UART convert to RS232

2, IPCas host controller: F8L10D and IPC through the RS485 bus is linked together, need to use level conversion chips for level conversion (such as SP3485), as shown in figure 5-2.

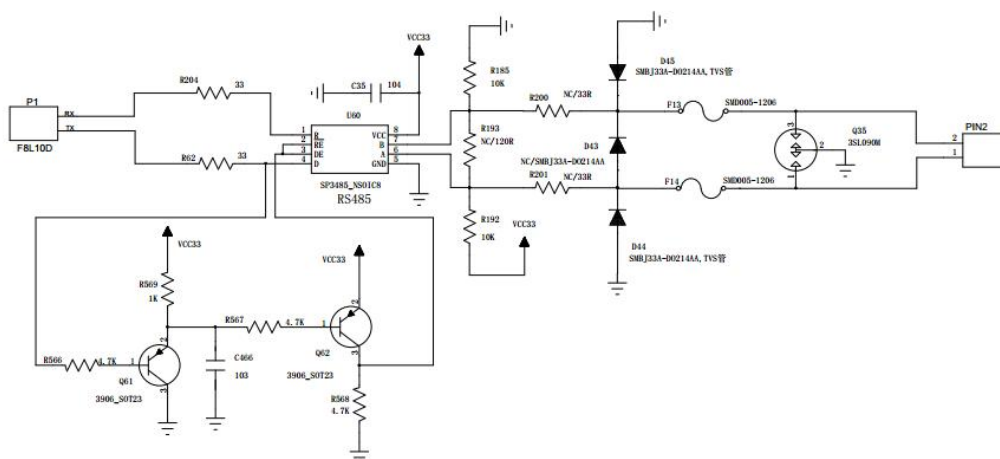


Figure 5-2 F8L10D and IPC RS485 connection reference circuit

3, The host controller support UART.The connection please reference figure 3-1.

5.2 Reset

F8L10D default power-on reset the module immediately, there is no boot and shutdown pins, but provides a hardware reset pin, digital input, active low, if the normal work need to reset the module, need to do this pin .

Module because of the complex operating environment, long working hours, there are crashes, false connections and other unusual problems. When an exception occurs, how to automatically restore, the application module design must be fully considered. We recommend two ways:

1), the module's main power supply can be controlled, turn off the main power supply, and then re-power. This way the most thorough, most reliable, unattended equipment, it is recommended in this way.

2), control RESET pin (reset) is low 200ms, the module hard reset, similar to the processor hard reset. This method is generally used for battery-powered handheld devices, if this method can not be restored, you may need to manually power-off.

For hardware reset circuit design recommendations (**strongly recommended to use mode two**):

1, the use of micro-button to manually reset, press the reset pin to the ground, open and disconnect the connection to the ground, as shown below.

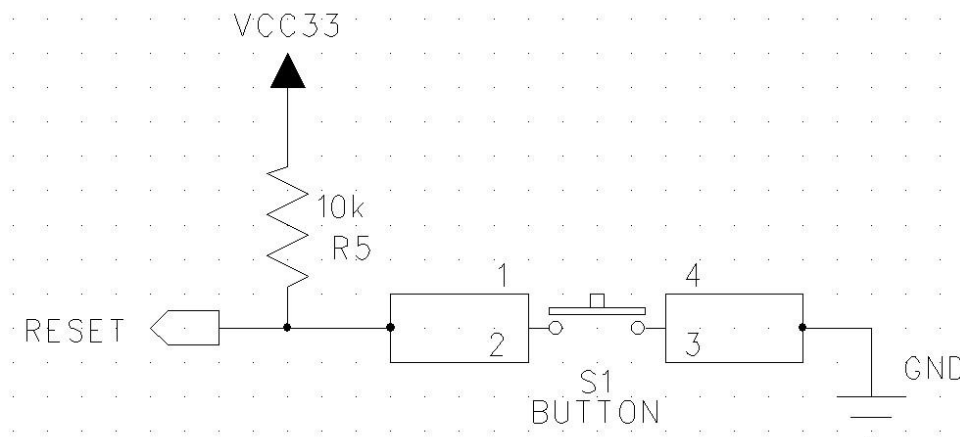


Figure 5-3 Reset Circuit

2, the use of MCU control transistor to pull down the RESET module hardware reset, as shown below:

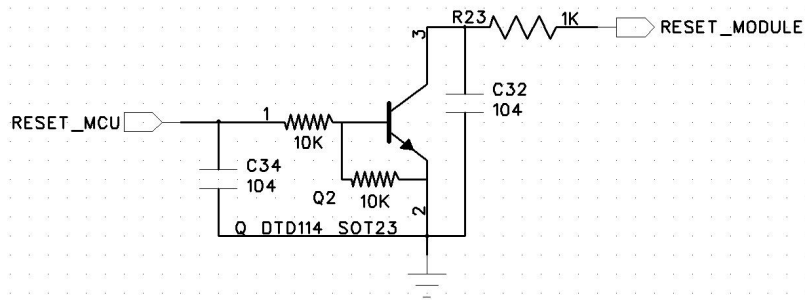


Figure 5-4 MCU Control Triode Reset Reference Circuit

3, RESET hardware reset pulse width of at least 200ms, the effective low level can not be higher than 0.4V, otherwise it may not make the module completely reset.

5.3 GPIO protection circuit

The voltage on any digital pin must be bigger than -0.3V, smaller than VDD+0.3V. If the voltage was bigger than +3.9V, it may damage module immediately. We didn't provide GPIO protection circuit. If you need protect it, the general method is using TVS, as figure below.

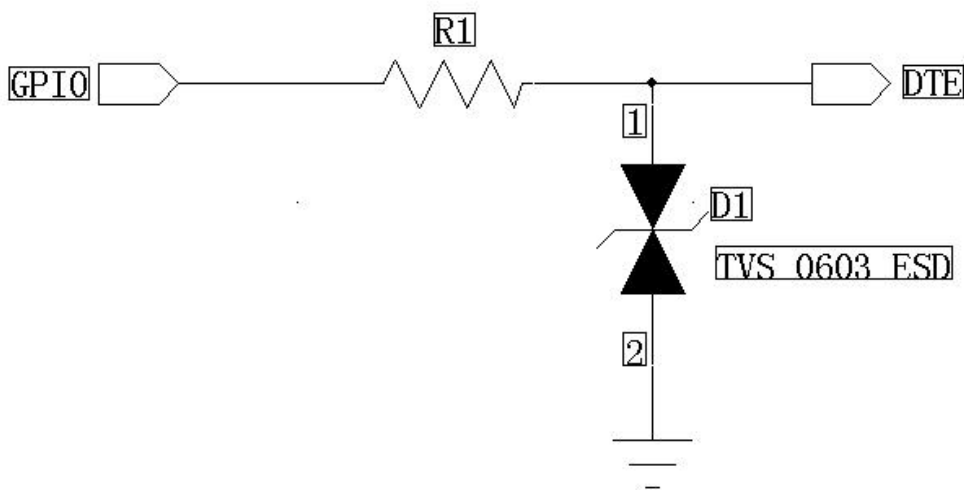


Figure 5-5 TVS protection circuit for digital pin

Chapter 6 Dimension and solder

6.1 PCB Footprint

With shielding cover thickness of about 4.2mm, excluding connectors
 F8L10D-N-433/F8L10D-N-470 Outline Package, unit: mm

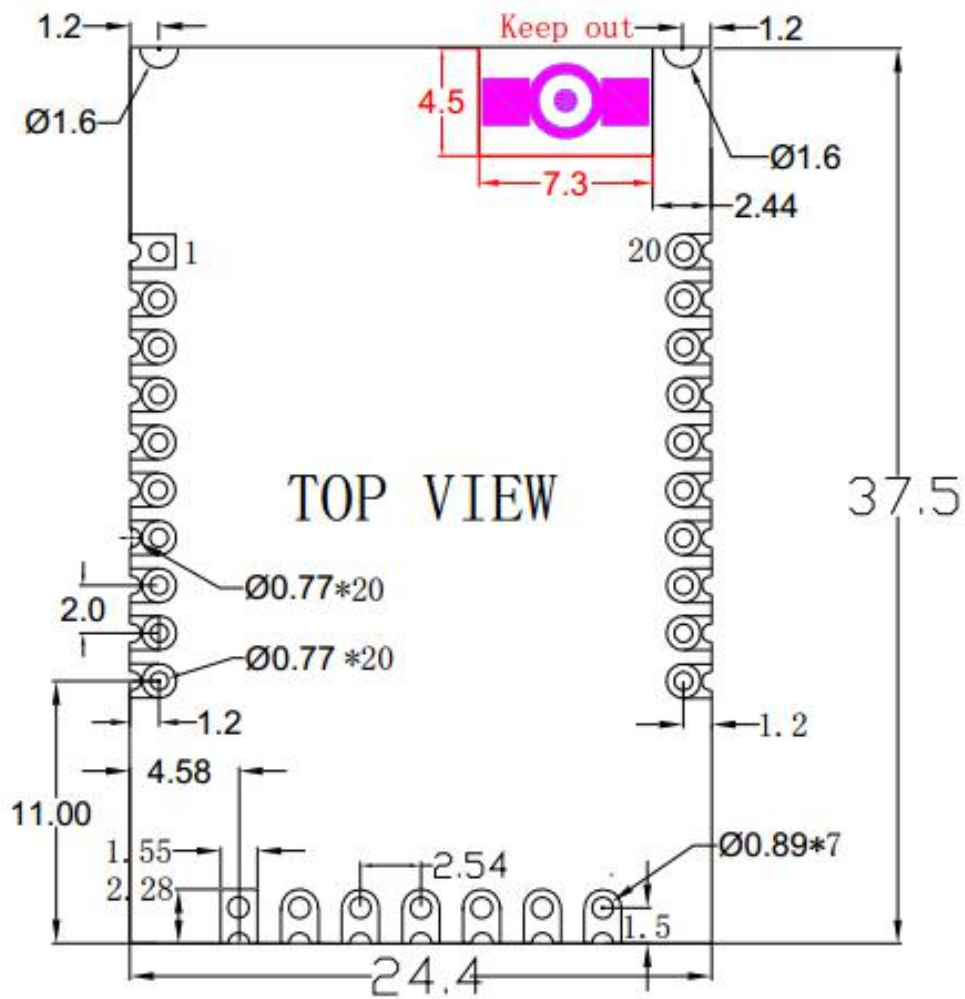


Figure 6-1 F8L10D-N-433/F8L10D-N-470 Outline Package

F8L10D-N-868/F8L10D-N-915 Outline Package, **unit: mm**

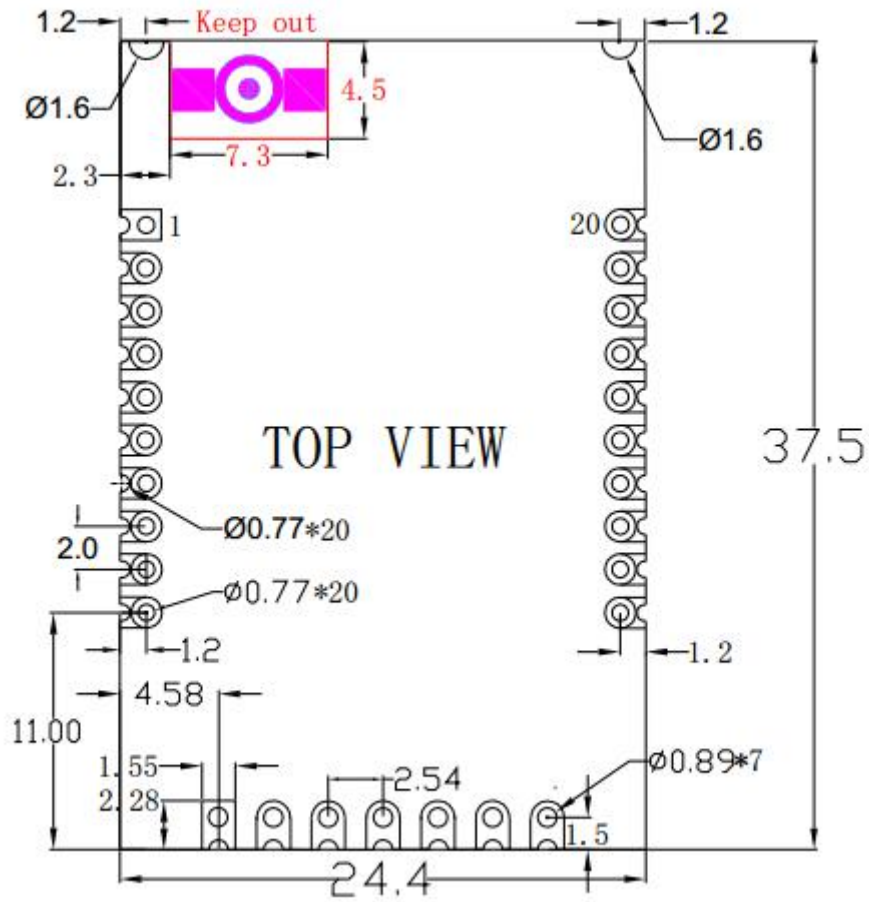


Figure 6-2 F8L10D-N-868/F8L10D-N-915 Outline Package

F8L10D-E-433/F8L10D-E-470 Outline Package , **unit: mm**

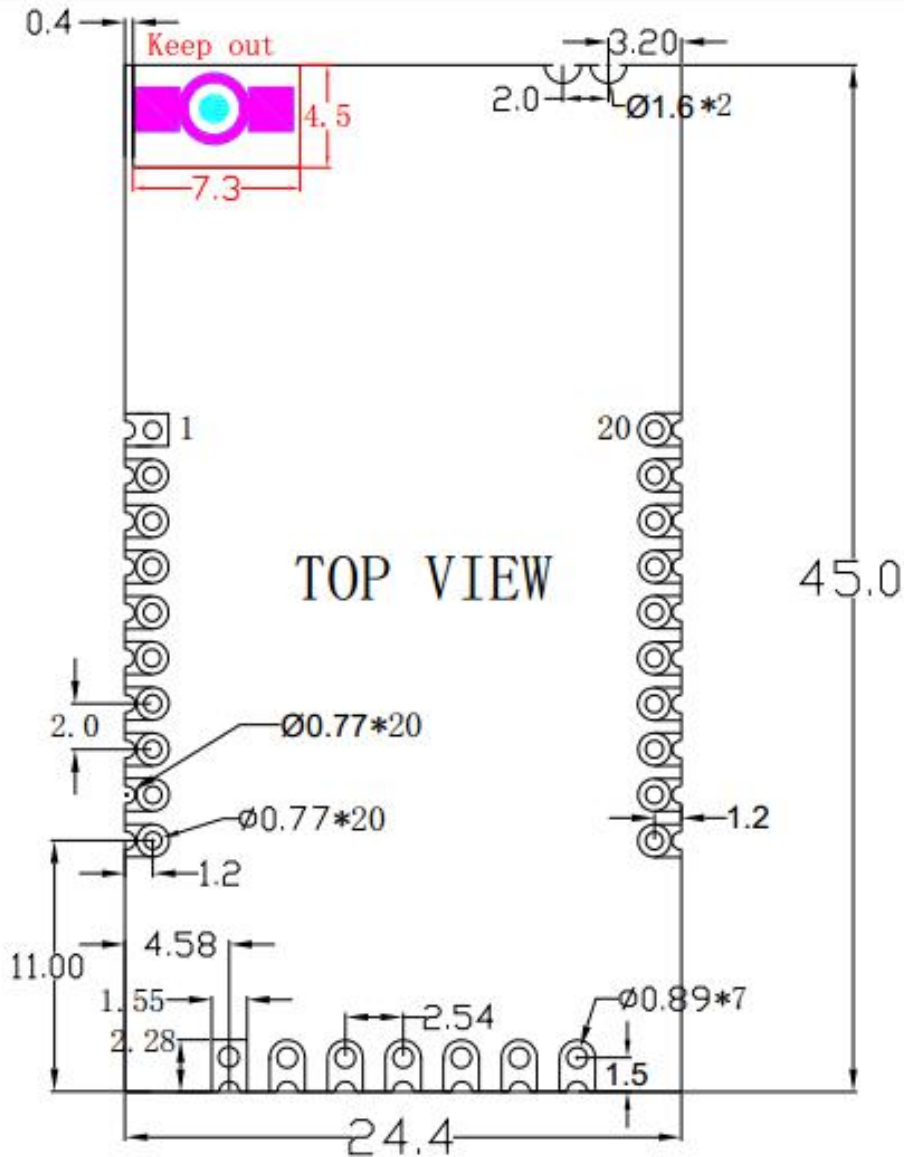


Figure 6-3 F8L10D-E-433/F8L10D-E-470 Outline Package

6.2 Re-flow Temperature Specification

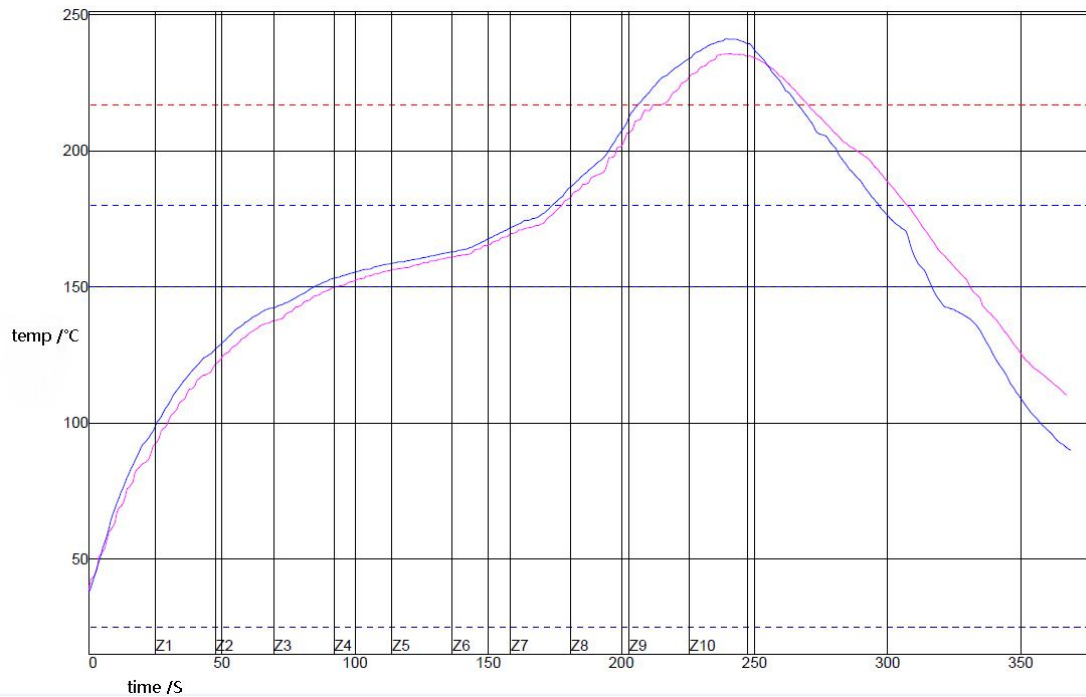
Please reference the IPC/JEDEC J-STD-020B for the Re-flow.

Soldering temperature

Using thermostat soldering iron do not exceed 340°C, and do not more than 2S every pin

Re-flow temperature

Recommend using the temperature profile below for re-flow



| PWI=94% | | Rising slop | | Descending slop | | pre-heat 25~150°C | |
|---------|---|-------------|-----|-----------------|-----|----------------------|-----|
| | 2 | 1.96 | -4% | -1.28 | 72% | 93.1 | 23% |
| | 3 | 2.05 | 5% | -1.43 | 57% | 84.4 | 2% |
| D-Value | | 0.09 | | 0.15 | | 8.70 | |

| PWI=94% | | Constant 150~180°C | | Re-flow 217°C | | Maximum temperature | | Descending slop 250~200°C | |
|---------|---|-----------------------|------|------------------|------|------------------------|------|---------------------------------|-----|
| | 2 | 85.4 | -15% | 55.5 | -27% | 235.8 | -54% | -1.15 | 94% |
| | 3 | 89.4 | -2% | 60.5 | -14% | 241.3 | -10% | -1.48 | 81% |
| D-Value | | 4 | | 4.5 | | 5.5 | | 0.33 | |

Chapter 7 Ordering Information

You can contact the sales of Xiamen Four-Faith Communication Technology Co., Ltd to buy the modules or EVB. Please specify the model you need.

Contact Four-Faith:



[Xiamen Four-Faith Communication Technology Co., Ltd.](#)

Add: Floor 11, Area A06, No 370, chengyi street, Jimei, Xiamen

Tel: +86 592-5907276 Fax:+86 592-5912735

Web:en.four-faith.com

Appendix

A1 Notes

A1.1 Serial port's frame interval

Say serial port's baud rate 115200.

The serial port's frame interval is 20 ms. To ensure one packet in a frame, the interval must be smaller than 20 ms.

When the application received serial's data, the frame interval should be greater than 20 ms.

Please modify the frame interval value in other baud rate, corresponding to the case of the baud rate with 115200.

A2 FAQ

FAQ1: Configure parameters fail

Solution: Please check the serial port number and the property of the serial ports, such as baud rate, parity.

FAQ2: With right parameters, but add network fail

Solution : First Check that the antenna installation was OK. Then check the network parameters were correct,such as pan id, node address, physical channel. If everything is all right, try to factory the device,then add network and send data.

FAQ3: In network, but send data fail

Solution: Please check the distance of the two device, make sure the distance is greater then 20 cm. Then confirm that the way of send data is right in the current work mode(eg. AT+TXA or AT+TXH on AT work mode). Please refer to the chapter 4.4.21 和 4.4.2.22

FAQ4: Can not enter sleep

Solution: 1. On timer sleep mode, if the sleep time and awake time is 0, then the device will not enter sleep.

2. On deep sleep mode. Please check the sleep control(SLEP_REQ) pin's wire splice is OK and the control level is OK(high level make device sleep, otherwise awake)