

F8913 User Manual	Document Version	Page
	V2.0.0	
	Product Name: F8913	Total:44

F8913 User Manual

The user manual is suitable for the following model:

Model	Product Type
F8913-N-MS	Without PA, SMT
F8913-E-MS	With PA, SMT
F8913-N-NS	Without PA, DIP
F8913-E-NS	With PA, DIP



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Chapter 1 Brief Introduction of Product

1.1 Overview

F8913 ZigBee terminal is a kind of data terminal device that provides data transfer function by ZigBee network.

The product uses high-performance industrial-grade ZigBee solution, support transparent data transmission function; low power consumption design, the lowest working current can less than 1uA; supply 5 I/O channels, compatible 3 analog inputs and 2 pulse input counters.

It has been widely used on M2M fields, such as intelligent transportation, smart grid, industrial automation, telemetry, finance, POS, water supply, environment protection, post, weather, and so on.

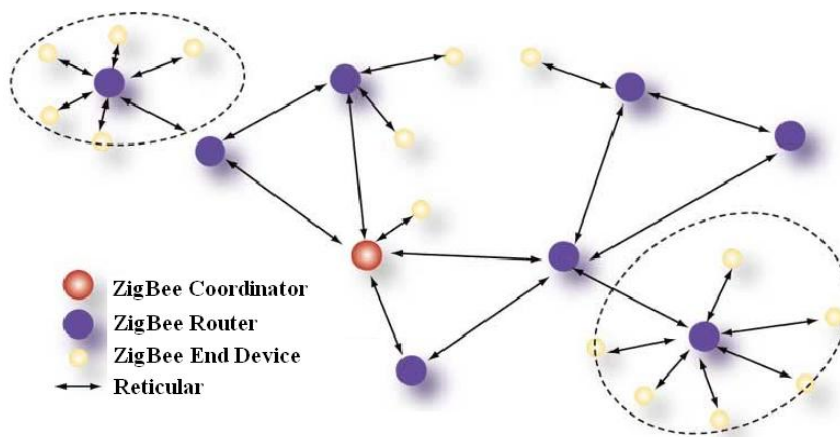


Figure 1-1 Application Topology

1.2 Features and Benefits

Design for Industrial Application

- ◆ High-powered industrial ZigBee chip
- ◆ Low power consumption design, support multi-sleep and trigger modes to reduce the power dissipation farthest
- ◆ Support UART
- ◆ **Power range: DC 2.2~3.6V**

Stability and Reliability

- ◆ Support hardware and software WDT
- ◆ Support auto recovery mechanism

Standard and Convenience

- ◆ Adopt a miniature package, support 2.0mm spacing stamp hole for SMT and 2.0mm spacing through-hole pins simultaneous
- ◆ Support intellectual mode, enter into communication state automatically when powered, support several work modes.
- ◆ Convenient configuration and maintenance interface
- ◆ Support for serial software upgrades

High-performance

- ◆ Support ZigBee wireless data transmission

- ◆ Support repeater and end-device function
- ◆ Support Point-to-Point, Point-to-Multipoint, Peer-to-Peer and Mesh network
- ◆ Support 65000 nodes
- ◆ Support center node, router node and terminal node
- ◆ Support broadcast and target address transfer
- ◆ Wide communication range
- ◆ Supply 5 I/O channels, compatible 3 analog inputs and 2 pulse input counters.

1.3 Specification

F8913 Model Sheet

Model	Content
F8913-N-MS	Without PA, SMT
F8913-E-MS	With PA, SMT
F8913-N-NS	Without PA, DIP
F8913-E-NS	With PA, DIP

ZigBee Specification

Item	Content
MCU	Industrial ZigBee Platform
Communication Protocol and Band	IEEE 802.15.4 ISM2.4~2.5GHz
Indoor/Urban Range	30m 90m(With PA)
Outdoor/RF Line-of-Sight Range	500m 2000m(With PA)
Transmit Power	2.82 mw (+4.5dBm) 100 mw (+20dBm) (With PA)
RF Data Rate	250Kbps
Receiver Sensitivity	-97dBm -103dBm (With PA)
Network Topology	Point-to-Point, Point-to-Multipoint, Peer-to-Peer and Mesh
Channels	11 to 26
Max Serial Buffer Size	300 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	U.FL RF connector, impedance 50 ohm
Package	Support 2.0mm spacing stamp hole for SMT and 2.0mm spacing through-hole pins simultaneous

Power Input

Item	Content
Recommended Power	DC 3.3V/0.5A
Power Range	DC 2.8~3.6V@21dBm/2.2~3.6V@4.5dBm

Power Consumption

Working States		Power Consumption
F8913-N	RX Mode	27.5~27.8mA@3.3VDC
	TX Mode	28.9 ~ 29.1mA@3.3VDC ,(the max pulse circuits ≤40mA)
	Timing wake up	1.1~1.2uA@3.3VDC
	Deep Sleep	0.3~0.5uA@3.3VDC
F8913-E	RX Mode	32.4~33.2mA@3.3VDC
	TX Mode	41.2 ~ 42.5mA@3.3VDC ,(the max pulse circuits ≤200mA)
	Timing wake up	1.2~1.3uA@3.3VDC
	Deep Sleep	0.3~0.5uA@3.3VDC

Physical Characteristics

Item	Content
Dimensions	37.5 x 22.1 x 2.8 mm
Weight	3.5 g

Environmental Limits

Item	Content
Operating Temperature	-40~+85°C (-104~+185 °F)
Storage Temperature	-40~+125°C (-104~+257°F)
Operating Humidity	95% (unfreezing)

Chapter 2 Module Interface

2.1 Module Signal Definition

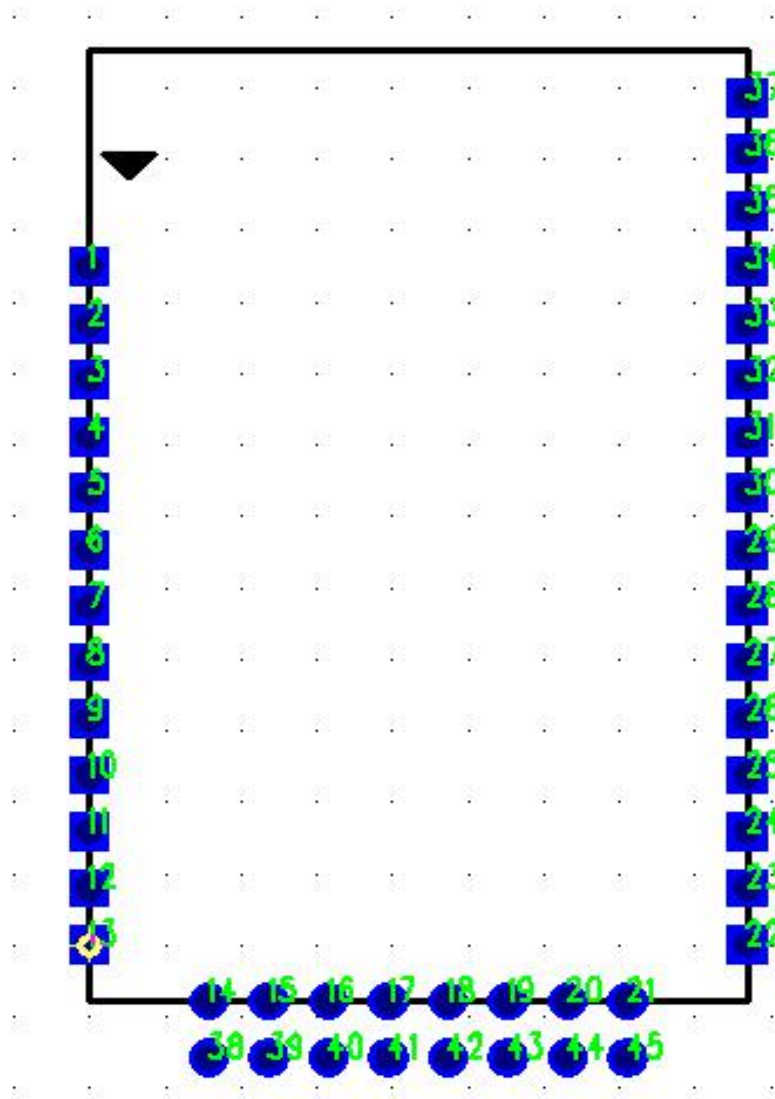


Figure 2-1 Module Pin Distributing

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

Pin Number	Signal Name	Input/Output	Description
1	GND	N/A	Ground
2	VCC	N/A	Power Supply
3	GND	N/A	Ground
4	[reserved]	N/A	N/A
5	[reserved]	N/A	N/A
6	DC	Input	Debug Clock
7	DD	Either	Debug Data
8	D4	Either	GPIO
9	SLEEP_RQ	Input	Pin Sleep Control Line
10	Associate	Output	Associate Indicator
11	[reserved]	N/A	N/A
12	RD/DE	Output	RD/DE
13	D3	Either	GPIO
22	D2	Either	ADC/GPIO
23	$\overline{\text{RTS}}$	Input	Request-to-Send
24	$\overline{\text{CTS}}$	Output	Clear-to-Send
25	DOUT	Output	UART Data Out
26	DIN	Input	UART Data In
27	D1	Either	ADC/GPIO
28	D0	Either	ADC/GPIO
29	RST	Input	Module Reset
30	[reserved]	Either	GPIO
31	[reserved]	Either	GPIO
32	[reserved]	Either	GPIO
33	SLEEP/ON	Output	SLEEP/ON
34	GND	N/A	Ground
35	VCC	N/A	Power Supply
36	GND	N/A	Ground
37	GND	N/A	Ground

Table 2-1-2 Module signal definition 2--DIP

Pin Number	Signal Name	Input/Output	Description
14	SLEEP_RQ	Input	Pin Sleep Control Line
15	Associate	Output	Associate Indicator
16	[reserved]	Either	N/A
17	RD/DE	Output	RD/DE
18	$\overline{\text{RTS}}$	Input	Request-to-Send
19	$\overline{\text{CTS}}$	Output	Clear-to-Send
20	D1	Either	ADC/GPIO
21	D0	Either	ADC/GPIO
38	DC	Input	Debug Clock
39	DD	Either	Debug Data
40	DIN	Input	UART Data In
41	DOUT	Output	UART Data Out
42	RST	Input	Module Reset
43	GND	N/A	Ground
44	VCC	N/A	Power Supply
45	D2	Either	ADC/GPIO

Notice: 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	25 (SMT)	41(DIP)
RX	26 (SMT)	40 (DIP)
CT	24 (SMT)	19 (DIP)
RT	23 (SMT)	18 (DIP)

Please reference the chapter 3 for the UART operation details.

2.3 GPIO Specification

The F8913 have 5 GPIO. The DC characteristics as the Table 2-4.

Table 2-4 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			20	
Logic 0 input voltage, 4-mA pins (V)	Output load 4mA			0.5
Logic 1 input voltage, 4-mA pins (V)	Output load 4mA	2.4		
Logic 0 input voltage, 20-mA pins (V)	Output load 20mA			0.5
Logic 1 input voltage, 20-mA pins (V)	Output load 20mA	2.4		

Please reference the chapter 3 for the GPIO configuration and operation details.

2.4 Antenna Interface

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

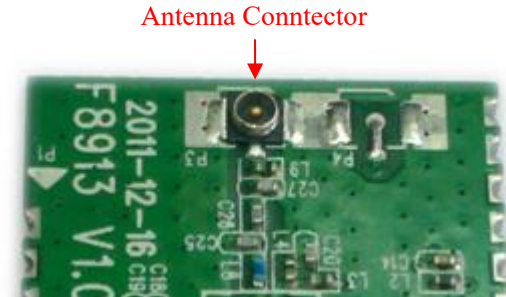


Figure 2-2 Antenna Connector

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

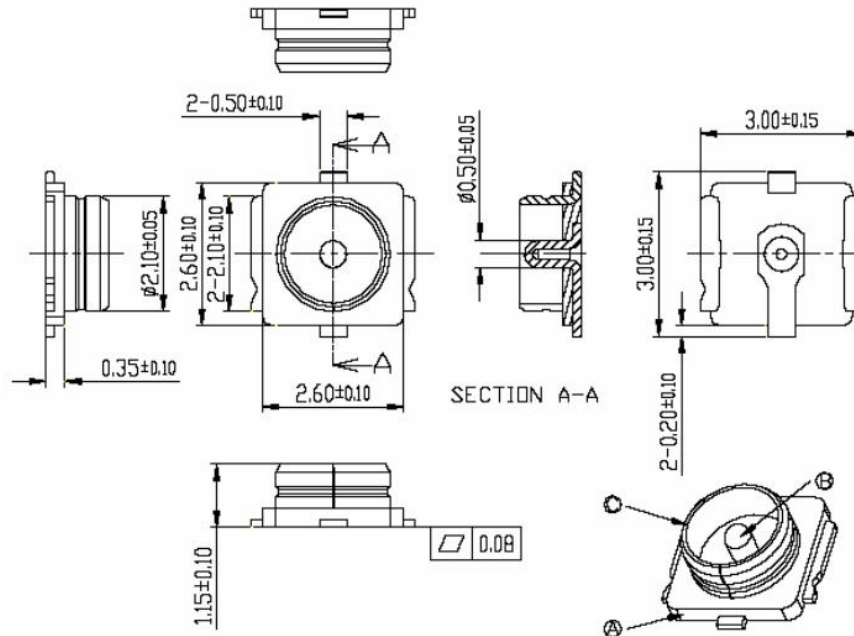


Figure 2-3 The MM9329-2700/Murata dimension

2.5 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.
- 4、 Reduce the extension cords of the antenna.

The performance of different antenna installation types, as the figure 2-4.

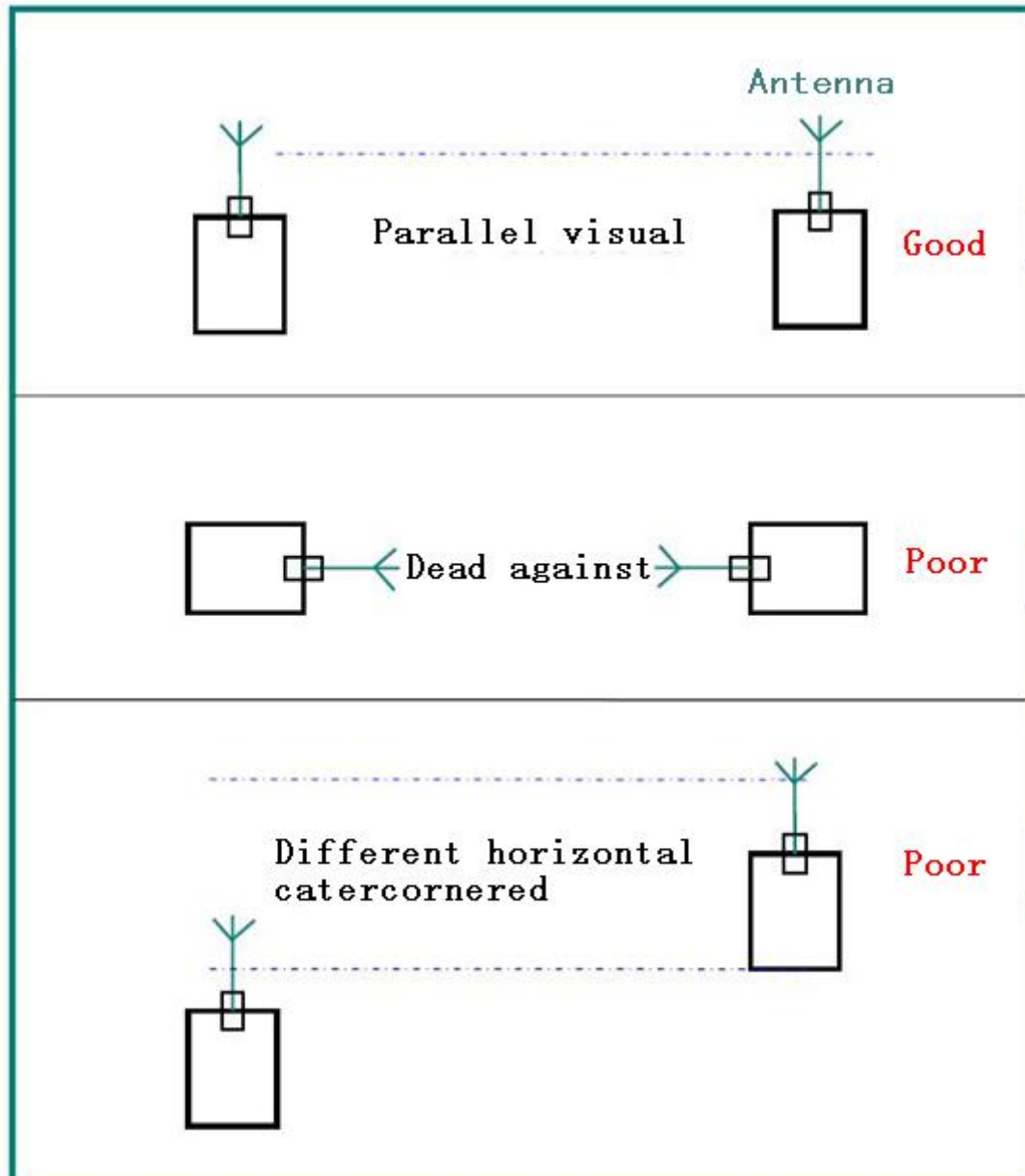


Figure 2-4 Different antenna installation types

2.6 Firmware Performance Specifications

Table 2-6 Firmware Performance Specification

UART	Baud rate	115200 (Default)
	Configuration	8/N/1 (Default)
	Max serial buffer size	300Bytes
	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 2-7 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

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

2.8 Online upgrade interface

2.8.1 Upgrade preparatory

Our module offer online upgrade interface convenient for update firmware if it necessary, it is Good if customs reserved upgrade interface to their own mainboard or lead out the update PIN with wire when upgrading module.

You will need those PIN from SMT module: PIN1: GND 、 PIN2: VCC 、 PIN25: DOUT、 PIN26: DIN、 PIN29: RESET(PIN number please reference to figure 2-1)

You will need those PIN from DIP module :PIN1: GND 、 PIN2: VCC 、 PIN25: DOUT、 PIN26: DIN、 PIN29: RESET(PIN number please reference to figure 2-1)

Recommend using 2.0mm CON5 connect customers mainboard(if already reserved upgrade interface)or the PIN above to module development board.

You will need those PIN from development board: PIN1: VCC、 PIN2: DOUT、 PIN3: DIN、 PIN5: RESET、 PIN10: GND(PIN number please reference to figure 2-11)

Connection diagram as picture below:

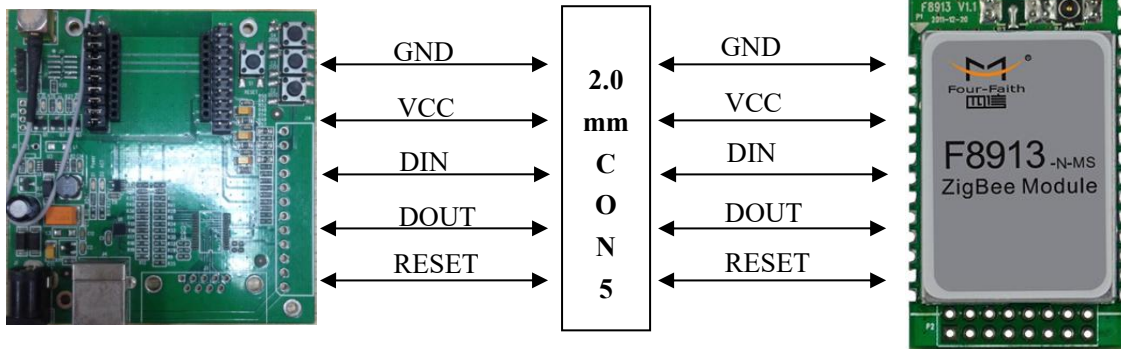


figure 2-5 Connection diagram

2.8.2 Upgrade steps

After connect module or customers mainboard to development board,you can start to upgrade:

1. Connect development board to PC with USB wire or DB9(in this way you may need anther 12V power supply),we recommend using USB wire.As the figure 2-6



figure 2-6 Development board connect to PC with USB wire

2. Run the upgrade tool

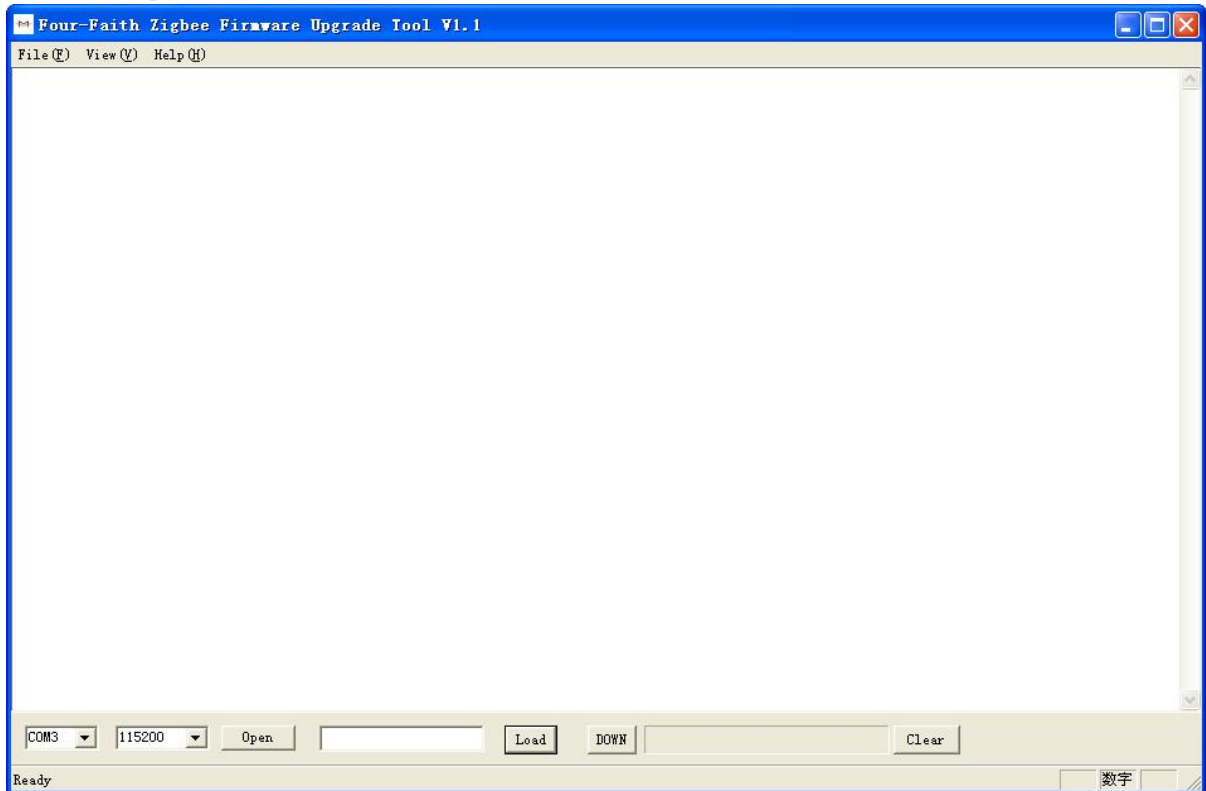


figure 2-7 Zigbee firmware upgrade tool interface

3. Press the “Open” button to open the serial port, press “Load” button to select the Zigbee upgrade firmware, Press “DOWN” button for the coming upgrade process.

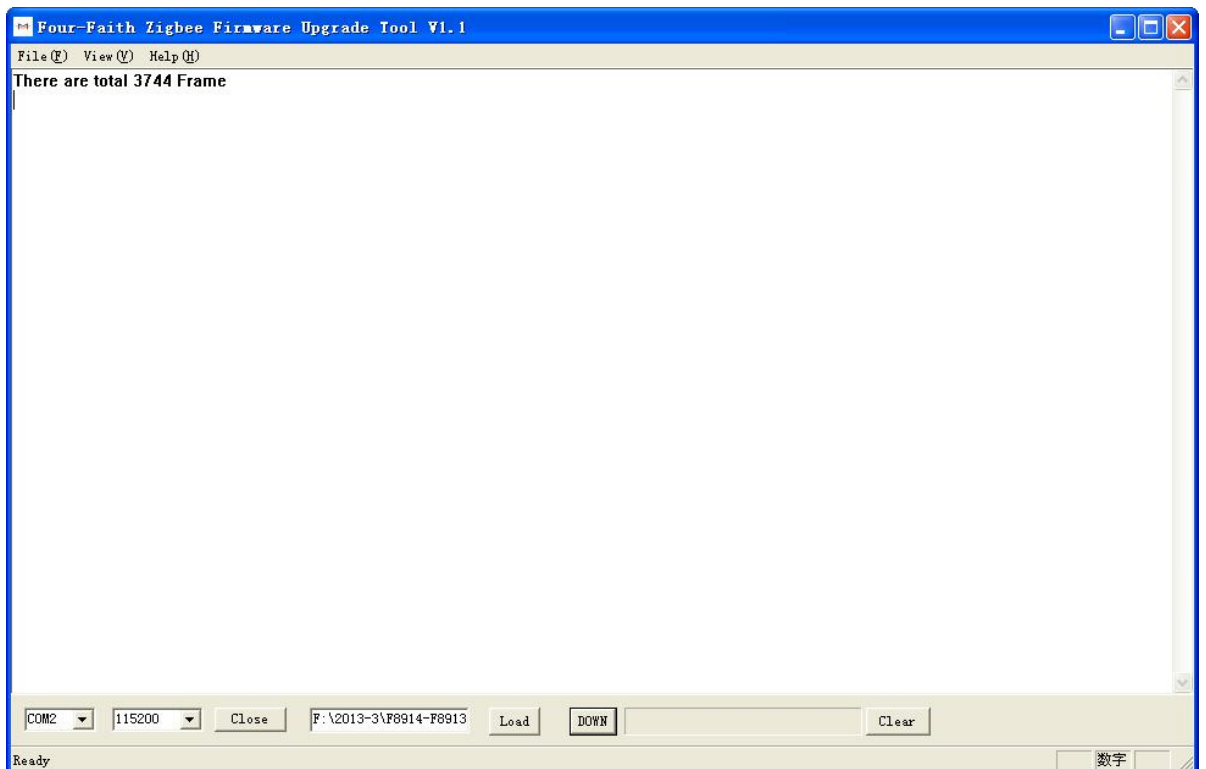


figure 2-8 Zigbee firmware upgrade tool waiting for module response

4. Press the “RESET” button on the development board, zigbee firmware upgrade tool start upgrading firmware. On the below of tool progress bar, we can see the process rate. The tool print “Upgrade Finished!!”, when upgrade progress finished. As figure 2-9 and 2-10.



figure 2-9 The “reset” button on the development board

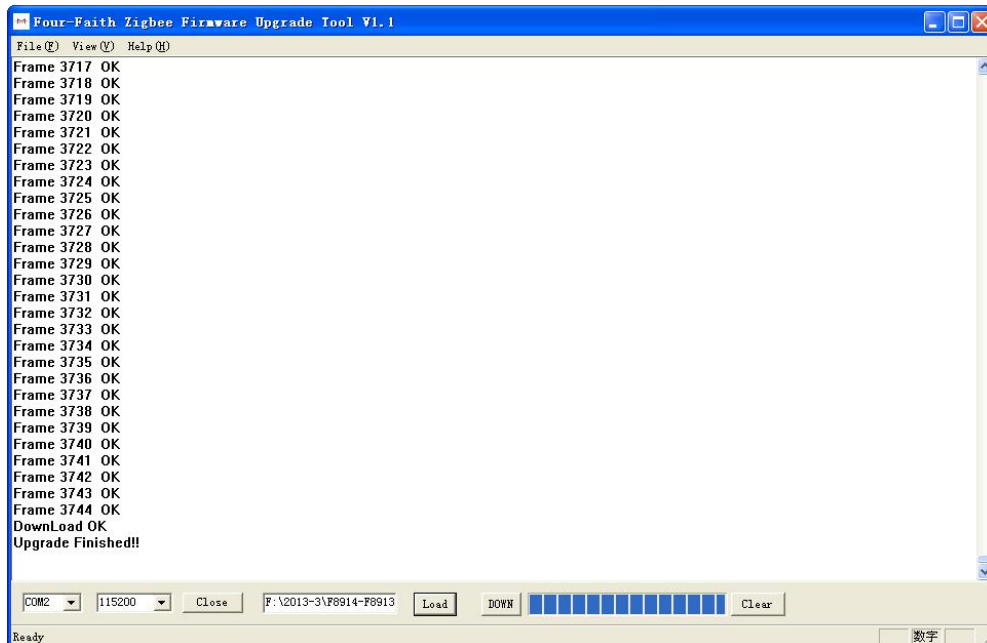


figure 2-10 Upgrade Finished!!

5. Disconnect the USB wire and CON5, you can upgrade next module.

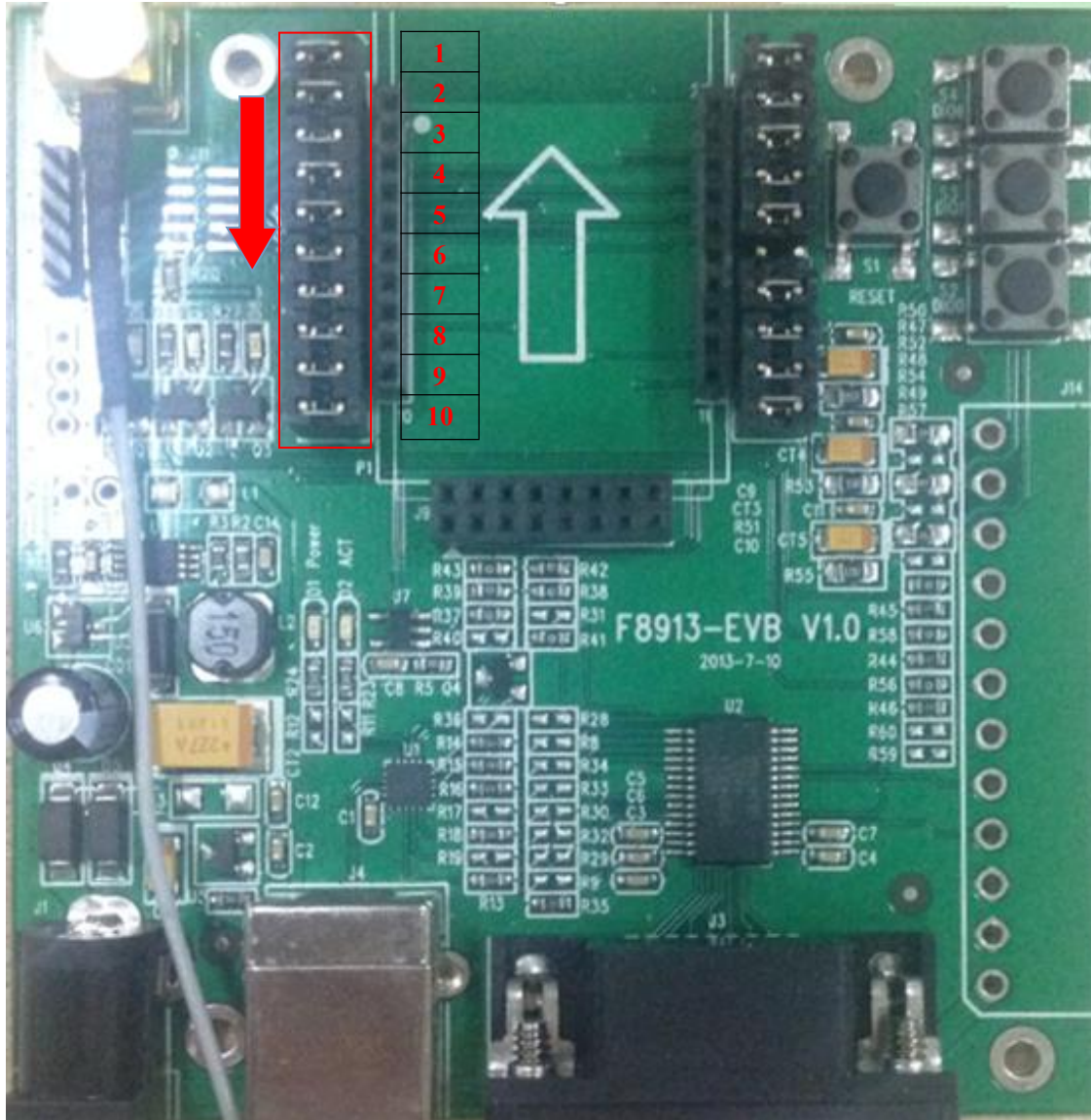


figure 2-11 Development board Pin Distributing

Chapter 3 Communication Interface Operation

3.1 UART

3.1.1 UART signal description

- TX: Data transmit
- RX: Data receive
- CT: Clear to Send
- RT: Request to send

3.1.2 UART connections

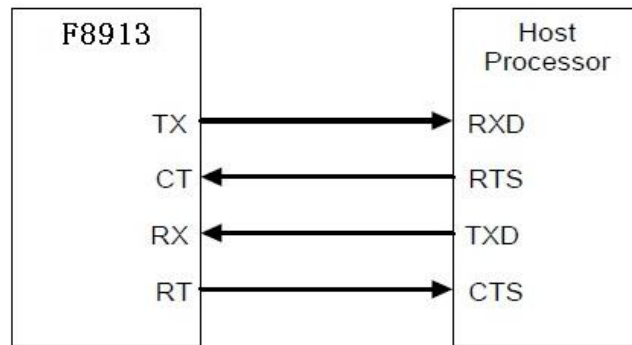


Figure 3-1 UART connection diagram

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 F8913 directly.

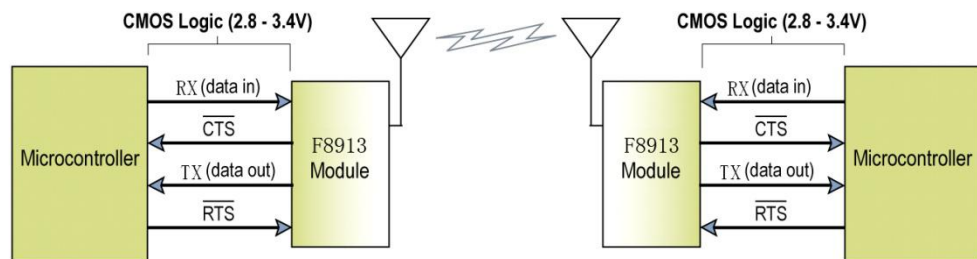


Figure 3-2 The UART convert to RF system

3.1.3 UART Characteristics

UART data format

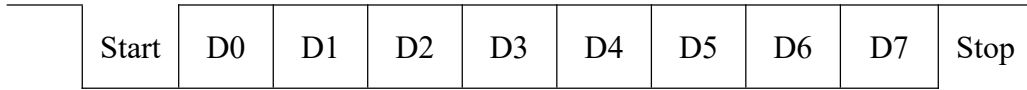


Figure 3-3 Data format

- 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) Checksum: 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.

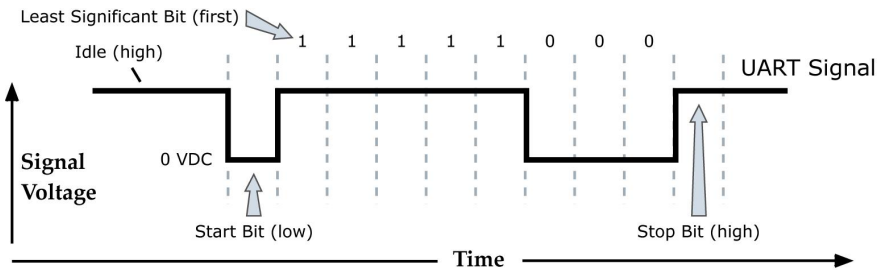


Figure 3-4 0x1F bit patterns

3.2 Analog and Digital I/O

3.2.1 Signal Definition

The F8913 support ADC and digital I/O line passing. The ADC and digital I/O can be inquired and configured by AT commands. The pins support ADC and digital I/O functions are listing in the table 3-1 and table 3-2.

Table 3-1 Analog and Digital I/O pins (SMT)

Pin Number	Pin Name	Default Function
8	D4	GPIO
13	D3	GPIO
22	D2	ADC/GPIO
27	D1	ADC/GPIO
28	D0	ADC/GPIO

Table 3-2 Analog and Digital I/O pins (DIP)

Pin Number	Pin Name	Default Function
45	D2	ADC/GPIO
20	D1	ADC/GPIO
21	D0	ADC/GPIO

3.2.2 Function Description

1. Digital I/O

The Digital D3&D4 support 4mA drive capability.

2. ADC

The ADC support 12 bits of resolution. The ADC input voltage range is 0V to 5V.

Please configure the right value when operate the I/O.

Table 3-3 I/O Configuration

Value	Description
0	Disabled
1	ADC
2	GPIO input
3	GPIO output low
4	GPIO output high
5	Pulse input count

Notice: Please reference the AT command “AT+DMn” in the chapter 4 for the details.

Chapter 4 Parameter Configuration

4.1 Zigbee Description

4.1.1 Device Type Description

ZigBee device has three types: coordinator,router and end device.They all can transmit and receive data.

4.1.1.1 Coordinator

This is the device that “starts” a ZigBee network. It is the first device on the network. The coordinator node scans the RF environment for existing networks, chooses a channel and a network identifier (also called PAN ID) and then starts the network.

Note that the role of the Coordinator is mainly related to starting up and configuring the network. Once that is accomplished, the Coordinator behaves like a Router node (or may even go away). The continued operation of the network does not depend on the presence of the Coordinator due to the distributed nature of the ZigBee network.

4.1.1.2 Router

A Router performs functions for allowing other devices to join the network multi-hop routing assisting in communication for its child battery-powered end devices.

In general, Routers are expected to be active all the time and thus have to be mains-powered.

4.1.1.3 End Device

An end-device has no specific responsibility for maintaining the network infrastructure, so it can sleep and wake up as it chooses. Thus it can be a battery-powered node.

4.1.2 ZigBee Network Description

4.1.2.1 Form a ZigBee Network Procedure

(1) The coordinator node scans the RF environment for existing networks, chooses a channel and a network identifier (also called PAN ID) and then starts the network.

(2) Router or end device also scans the RF environment for existing networks, chooses a channel and a network identifier (also called PAN ID) and then join the network.

(3) The coordinator’s node address fixed to 0x0000, router’s or end device’s node address can be assigned randomly or configured previously.

(4) The nodes in the network can use node address transmit or receive data.。

NOTE : In a ZigBee network , just only using one coordinator.

4.1.2.2 Physical Channel

ZigBee is based on IEEE 802.15.4 that has defined the MAC layer and physical layer. IEEE 802.15.4 also defined 3 work band 2.5GHz(global),868MHz(Europe) and 915MHz(USA),they respectively has highest 250kbit/s, 40kbit/s, 20kbit/s transmission rate. On the three band has 27

work channels in total. 2.4GHz has 16 channels, 915MHz has 10 channels, 868MHz has only one channel.

Four-Faith ZigBee product works on 2.4GHz band, and has 16 physical channel. In AT command mode ,we send “AT+CHA=N”,(N=11~26) to configure the channel. We recommend 15 ,20 ,25 ,26 channel .

4.1.2.3 PAN ID

ZigBee network also calls personal area network, every personal area network has unique Pan ID.This Pan ID is used on every device in a same ZigBee network.

Four-Faith ZigBee product can pre-configure a Pan ID and randomly select a Pan ID. In AT command mode ,we send “AT+PID=N”,(N=0-65531),if PID=65535 ,it will randomly select a Pan ID.

4.1.2.4 Node address

ZigBee device has two address types: 64 bit MAC address and 16 bit node address. 64 bit MAC address is unique in the world, and used in the product life. 16 bit node address usually assigned when the device joined in the network. It’s unique in a same Pan ID network. We use node address to send and receive data.

Four-Faith ZigBee product can pre-configure a node address and randomly assigned a node address. In AT command mode ,we send “AT+NID=N”,(N=0-65527), if NID=65535, it will randomly assigned a node address.

4.2 Configuration Connection

Before configuration, it’s need to connect the F8913 with a host controller.The host controller could be a PC or other device which contain UART port. You can connect the F8913 with PC by the Four-Faith F8913 EVB, as showing in the figure 4-1.

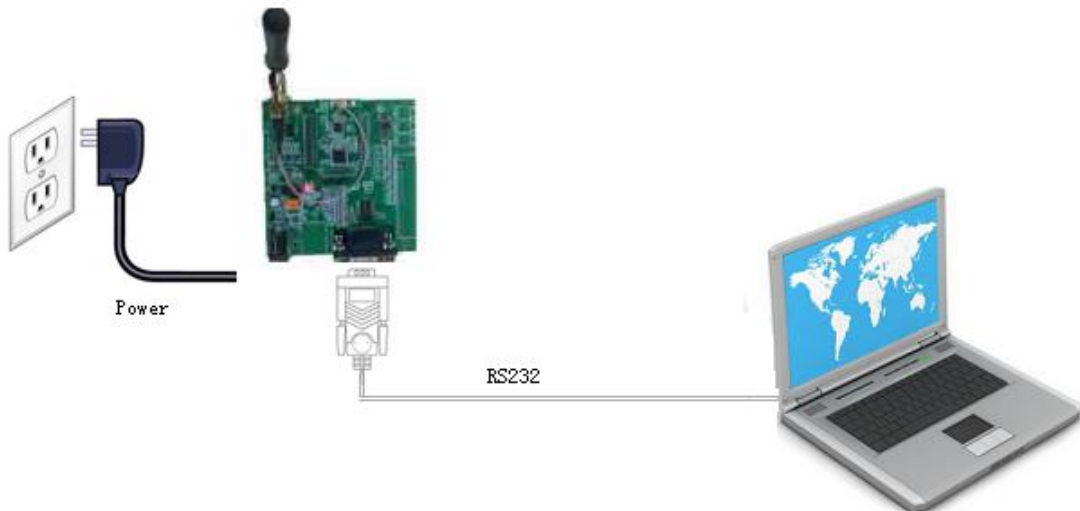


Figure 4-1 F8913 EVB connect with PC

4.3 Configuration Introduction

There are two ways to configure the device:

- ◆ Configuration software tool: 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.

The following describes how to configure device with AT command .At the same time, it gives out the corresponding the configure software tool of each configuration item.

Note: When device powers on, after three seconds, it is in configuration time(during 3 seconds, Please reference to Appendix in detail).During this time, the network not works,and the serial's baud rate is 115200,no parity, 1 stop bit. Send the 3-character command sequence“+++”twice through serial port.Then it goes into AT command configuration.

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

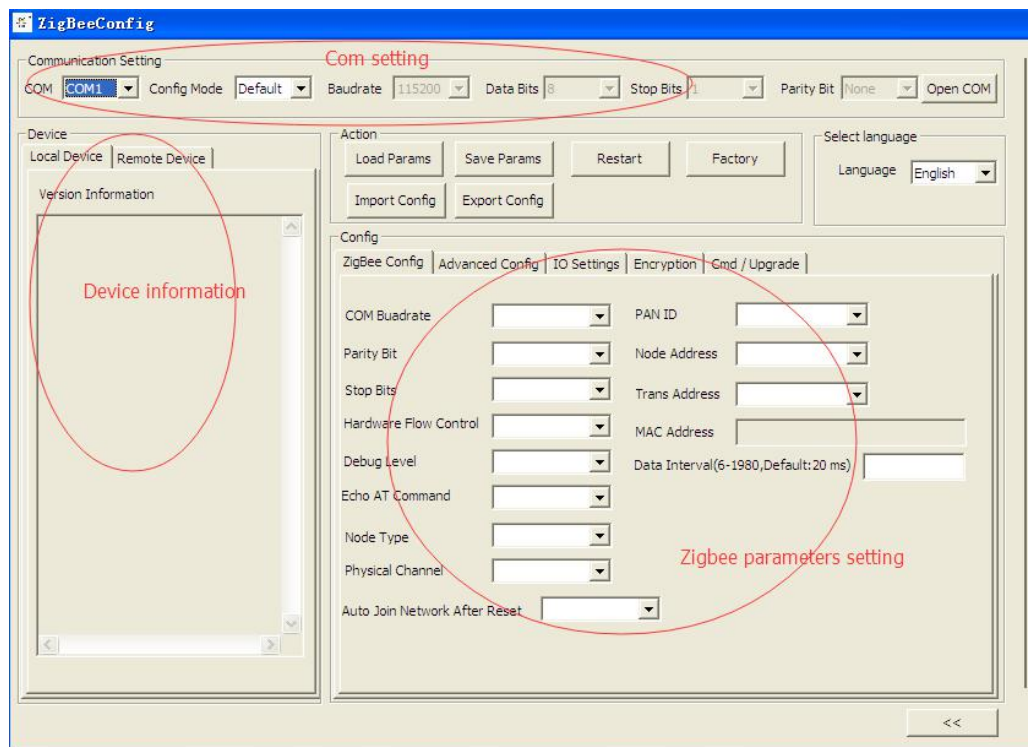



Figure 4-2 ZigbeeConfig tool

The “Communication Setting” column shows the current serial port settings. To configure ZigBee 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 you had configure the correct serial port, the device will enter configure state after power on.

The configure tool window contains “Com setting”, “Device information” and “Zigbee parameters setting”.

Press  button can show or hide the log information.

4.4 Modes of Operation

F8913 supports three modes of Operation: Transparent Mode, AT Command Mode and API Mode.

4.4.1 Transparent mode

When operating in transparent mode the modules act as a serial line replacement. All UART data received through the DIN pin is queued up for RF transmission. When data is received, the data is sent out through the DOUT pin.

Re-power module enter the transparent mode by default.

To enter transparent mode:

- In the AT command mode, send “AT+ESC<CR><LF>” through serial port.
- In the API mode, send “FE 01 21 2A 00 0A” through serial port.

4.4.2 AT command mode

AT command mode is a multiple function operation. This mode can configure the modules parameters, send data and receive data.

To enter AT command mode:

- In the transparent mode, send the 3-character command sequence “+++” twice through serial port.
- In the API mode, send “FE 01 21 2A 00 0A” through serial port.

CHECK the AT command mode, send “AT<CR><LF>” through serial port, it will return “OK”.

All AT command line should begin with “AT” or “at” and end with “<CR><LF>”. In general, the AT command includes three forms, as shown in table 3-1.

Table 3-1 AT command forms

Form	Description	Instance
Set	Set the custom parameters	AT+XXX=<.....>
Query	Query the current parameters value	AT+XXX?
Execute	Execute the command	AT+XXX

Note: every configure item is set, it should send save command. Network param(PAN ID, Physical Channel ,node address or device type changed), sleep param and serial param change should re-power device.

4.4.3 API mode

API operation requires that communication with the module be done through a structured interface (data is communicated in frames in a defined order). The API specifies how commands, command responses and module status messages are sent and received from the module using a UART Data Frame.

To enter API mode :

- In the transparent mode, send the 3-character command sequence“= = =”twice through serial port.
- In the AT command mode, send “AT+API<CR><LF>” through serial port.

The UART data frame structure is defined as follows:

SOF	Length	Command	Frame data	Frame check sequence
1 Byte	1 Byte	2 Bytes	xx Bytes (xx<82)	1 Byte

SOF (Start of Frame): This is a one byte field with value equal to 0xFE that defines the start of each general serial packet.

Length : 1 byte length of the actual data.

Command : 2 byte command Id.

Frame data : the data ranging from 0-82 bytes.

FCS (Frame Check Sequence):

This is a one byte field that is used to ensure packet integrity. This field is computed as an XOR of all the bytes in the message starting with LEN field and through the last byte of data. The following is a sample code FCS calculation:

```

unsigned char calcFCS(unsigned char *pMsg, unsigned char len)
{
    unsigned char result = 0;
    while (len--)
    {
        result ^= *pMsg++;
    }
    return result;
}

```

Note:1.Frame data some place need little-endian (node address,IO value and other set commands)
 2.Every configure item is set, it should send save command.Network param(PAN ID,Physical Channel ,node address or device type changed),sleep param and serial param change should re-power device.

4.5 Device sleep mode configuration description

F8913 support router and end device configure Timer sleep and Deep sleep.

4.5.1 Timer sleep

Function description :

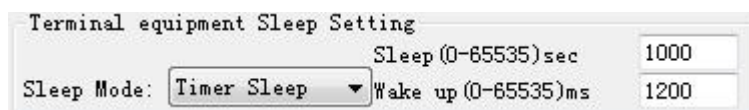
Timer sleep can set the sleep interval,when it wake up,the device will wake up a certain time then it goes to sleep again.

SLEEP/ON pin indicates device current work state: high level means sleep and low level means wake.

After device waking up, if device successfully joined in the network **Associate pin** will output low level to indicate online. If device unsuccessfully joined in the network or went into sleep **Associate pin** will output high level to indicate off-line.

Configuration conditions

- (1)Hardware: **SLEEP_RQ pin** must connect to high level (3V ~3.3V).
- (2)Software: Device should be configured as end device or router and Timer Sleep.The sleep interval must be greater than 0.



Terminal equipment Sleep Setting

Sleep Mode:	Timer Sleep	Sleep (0-65535)sec	1000
		Wake up (0-65535)ms	1200

4.5.2 Deep sleep

Function description :

Deep sleep is waked up by external interrupt. When **SLEEP_RQ pin** is low level ,device not goes to sleep. When **SLEEP_RQ pin** is high level(3V ~3.3V),device goes to deep sleep.

SLEEP/ON pin indicates device current work state: high level means sleep and low level means wake.

After device waking up, if device successfully joined in the network **Associate pin** will output low level to indicate online. If device unsuccessfully joined in the network or went into sleep **Associate pin** will output high level to indicate off-line.

Configuration conditions

- (1) Hardware :Operate on **SLEEP_RQ pin** level.
- (2) Software : Device should be configured as end device or router and Deep Sleep.

Chapter 5 Reference Circuit

5.1 Power

5.1.1 Power supply features

The power supply is one of key issue in the designing ZIGBEE module. Due to the burst emission in ZIGBEE module when sending data. Power supply must be able to deliver high current peaks in a burst period. During these peaks, drop on the power supply voltage must not exceed 150mV.

For F8913-E ZIGBEE module, the max current consumption could reach 200mA under the max Tx Power levels, it will cause a large voltage drop on the V_ZIG. In order to ensure stable operation of the ZIGBEE module, it is recommend that the max voltage drop during the transmit burst does not exceed 150mV.

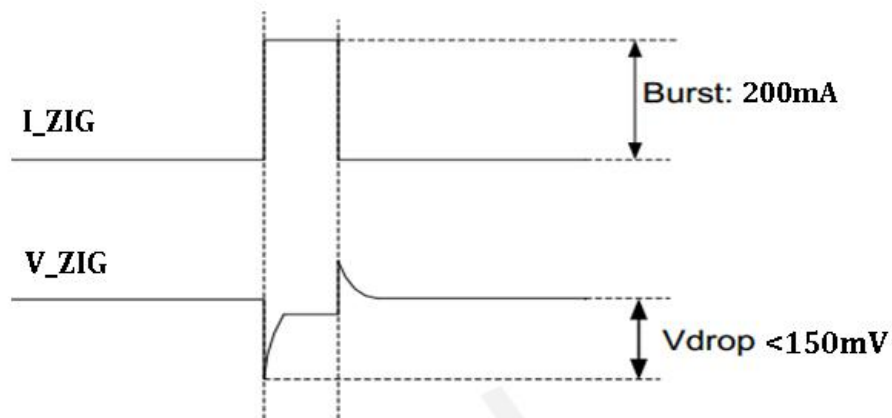


Figure 5-1 Voltage ripple during transmitting

5.1.2 Decrease voltage drop

ZIGBEE module power supply rang is 2V to 3.6V, make sure the V_drop will never exceed 150mV ever in a transmitting. For better power performance, it is recommend to place a 220uF tantalum capacitor with low ESR (ESR=0.7Ω) and ceramic capacitor 104, 102 near the V_ZIG pin. The reference circuit is illustrated in figure below.

The V_ZIG route should be wide enough to ensure that there is not too much voltage drop occurring during transmit burst. The wide of trace should be no less than 1mm and the principle of the V_ZIG route is the longer route, the wider trace.

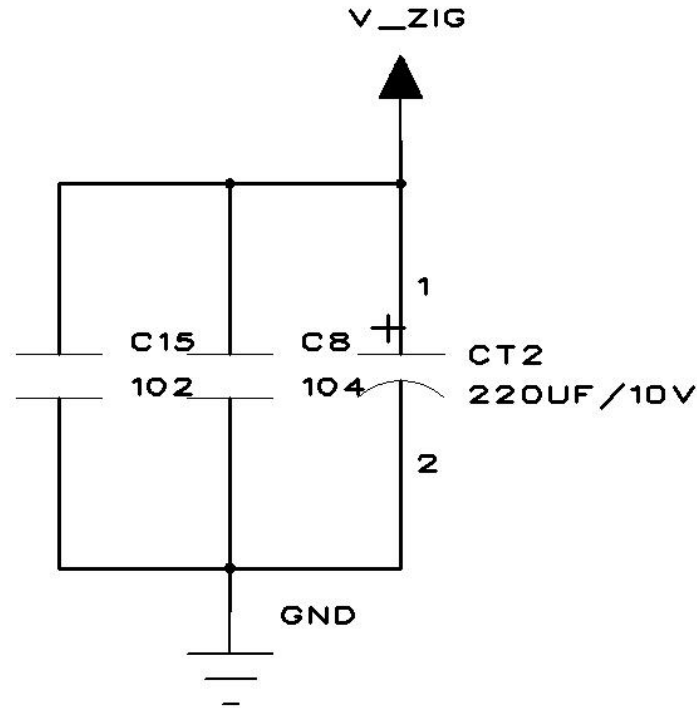


Figure 5-2 Reference circuit for the V_ZIG input

5.1.3 Reference design for power supply

The power design for ZIGBEE module is very important, since the performance of power supply for module largely depends on the power source. The power supply is capable of providing the sufficient current up to 300mA at least. If the voltage drop between input and output is not too high, it is suggested to use a LDO as power supply, if there is a big voltage difference between input source and the desired output (V_ZIG), a switcher power converter is preferred to use as a power supply.

The following figure shows a reference design for 3.6V battery input power source. Using the LDO chip form IT, the module is TLV70230, output 3V and the maximum load current is 300mA. In addition, in order to get a stable output voltage, a TVS is placed close to the pins of V_ZIG. As to the TVS, it is suggested which reverse voltage is 4V.

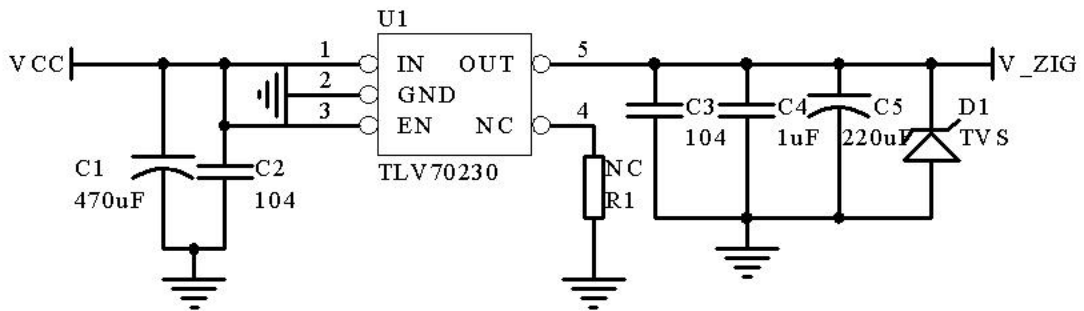


Figure 5-3 Reference circuit for power supply

5.1.4 Power supply suggestion

The requirements of power and GND for ZIGBEE module is very strict,the following suggestion should be taken when using our ZIGBEE module:

- 1.The power source drive capacity does not less than 300 mA;
- 2.The max voltage drop during the transmit burst does not exceed 150mV;
- 3.Filtering for power and GND,the ripple wave should not exceed 100mV.Separate module power from other power in case of affect the performance of the radio frequency;

4.The wide of power trace should be no less than 1mm and the principle of the V_ZIG route is the longer route, the wider trace.Ensure the integrity of the earth;

5.Need to consider the voltage drop long with energy losing if using battery as power source.

WARNING:If the power source does not meet the above requirements ZIGBEE module may produce unpredictable exceptions.

5.2 Communication

There are three modes:

- 1, The host controller support RS232 (such as: PC).The figure 5-2 is the recommend UART convert to RS232 circuit.

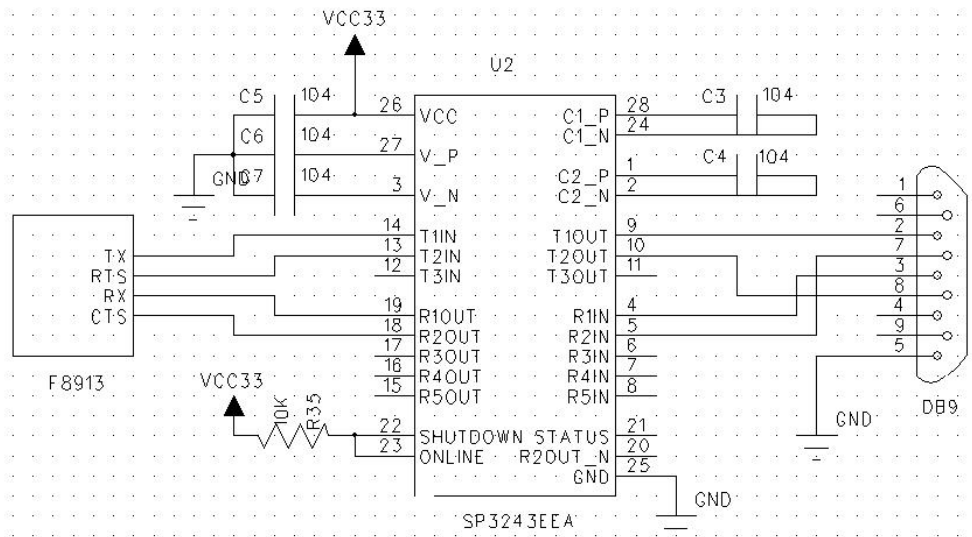


Figure 5-4 UART convert to RS232

- 2, Ipc as host controller: F8913 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 5-3.

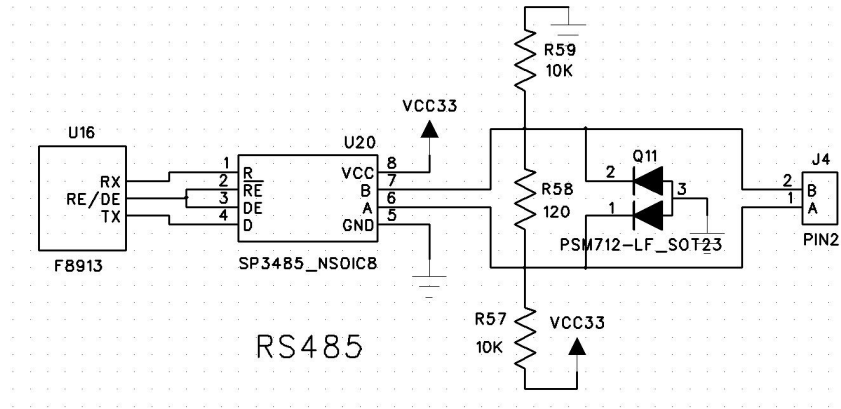


Figure 5-5 F8913 and ipc RS485 connection reference circuit

3, The host controller support UART/SPI.The connection please reference figure 3-1 and figure 3-5.

5.3 Reset

The RST pin should be pull-up with a 10kΩ resistance for the module power on normally.The hardware reset can execution by a switch.Press down the swich will reset the F8913, as figure 5-4.

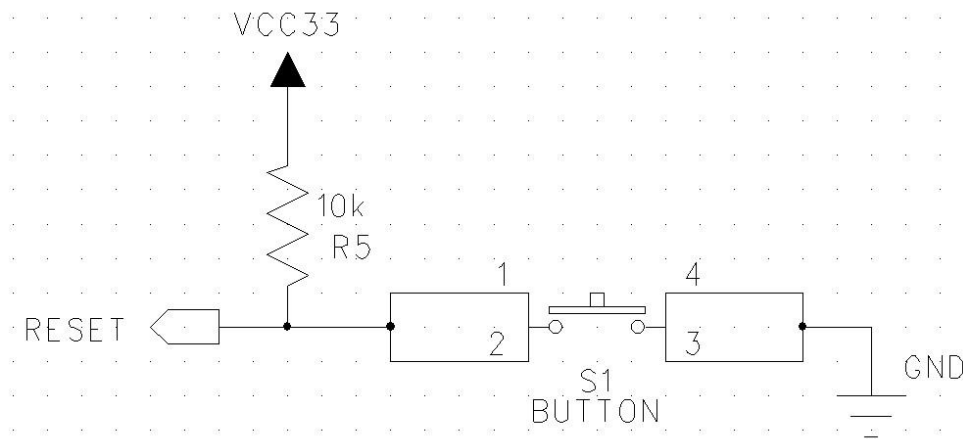


Figure 5-6 Reset Circuit

5.4 Digital I/O

The figure 5-5 is the demo circuit of the digital I/O control a LED.

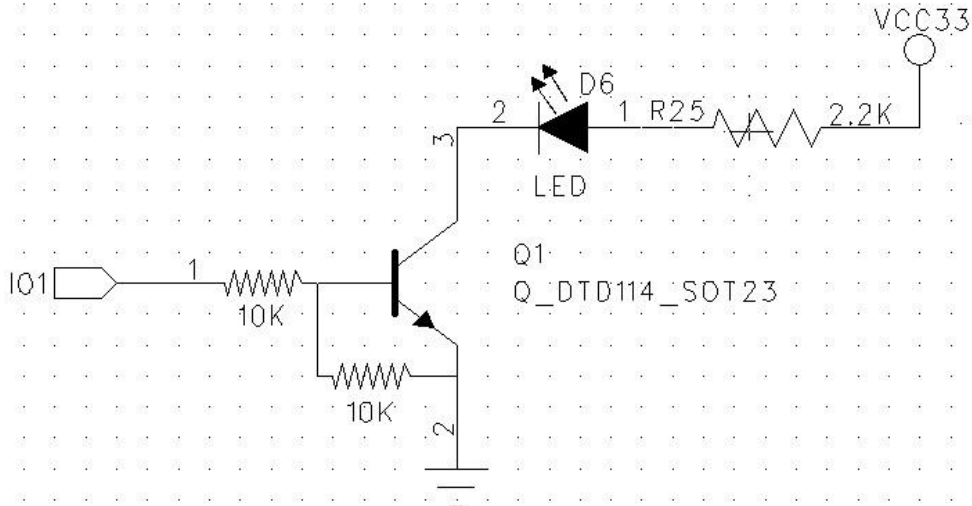


Figure 5-7 Digital I/O Control a LED

5.5 ADC Sampling Circuit

The figure 5-6 is applies to voltage acquisition (0-5VDC).The figure 5-7 is applies to current acquisition (0-20mA).

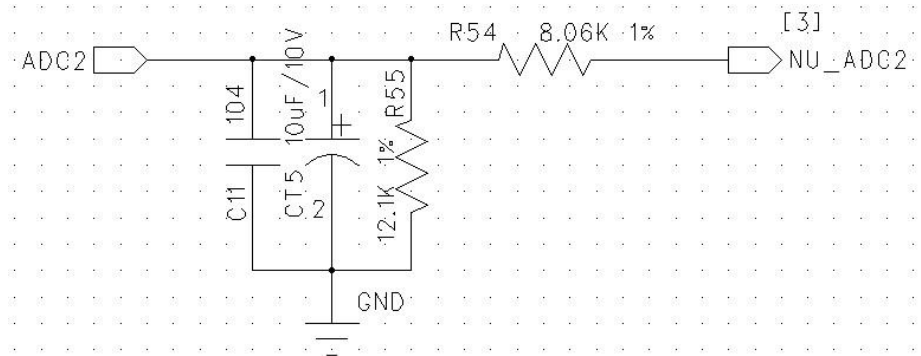


Figure 5-8 Voltage Acquisition (0-5VDC)

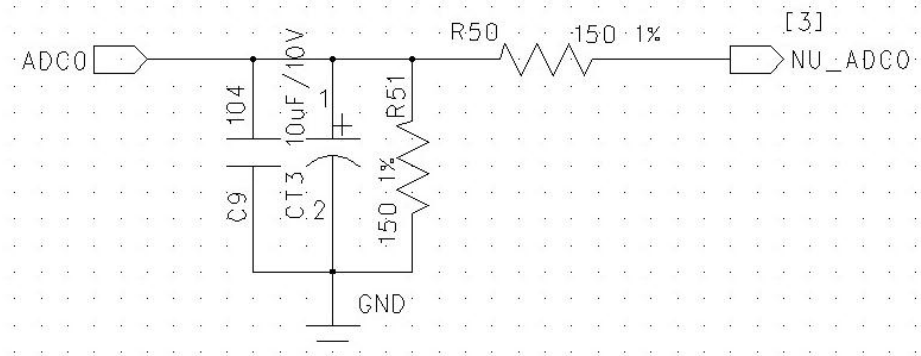


Figure 5-9 Current Acquisition (0-20mA)

5.6 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.

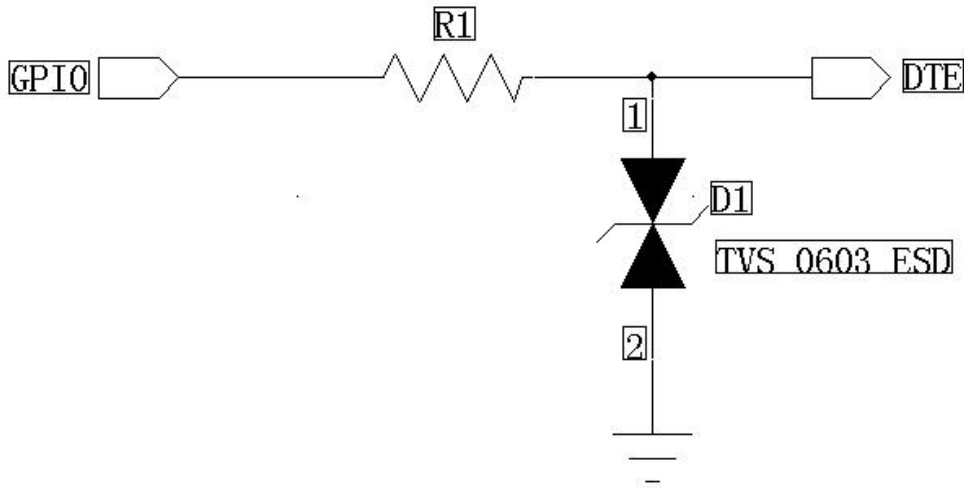


Figure 5-10 TVS protection circuit for digital pin

Chapter 6 Dimension and solder

6.1 Outline Dimension

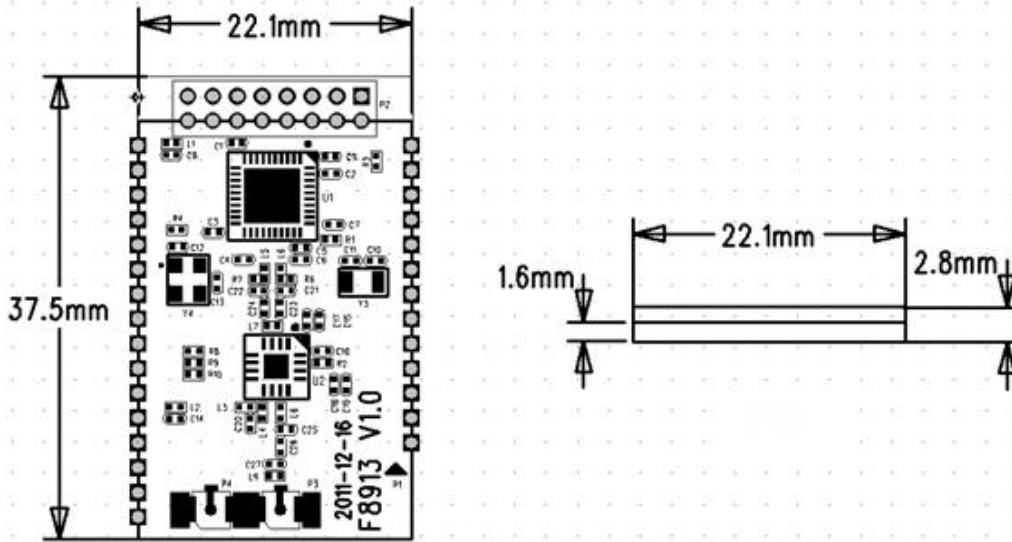


Figure 6-1 Outline Dimension

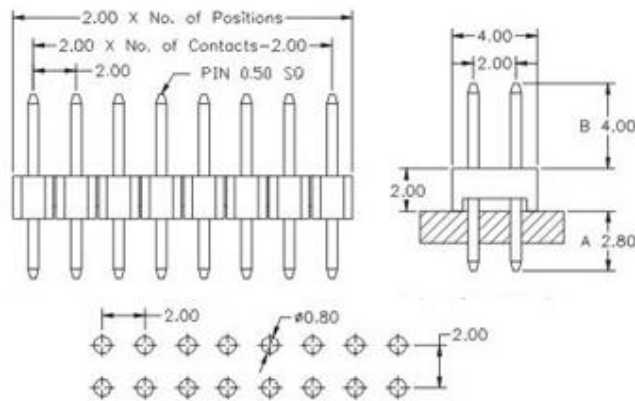


Figure 6-2 Pin Header Dimension (optional)

6.2 PCB Footprint

The figure 6-3 and figure 6-4 are the recommend PCB Footprint. (Unit:mm)

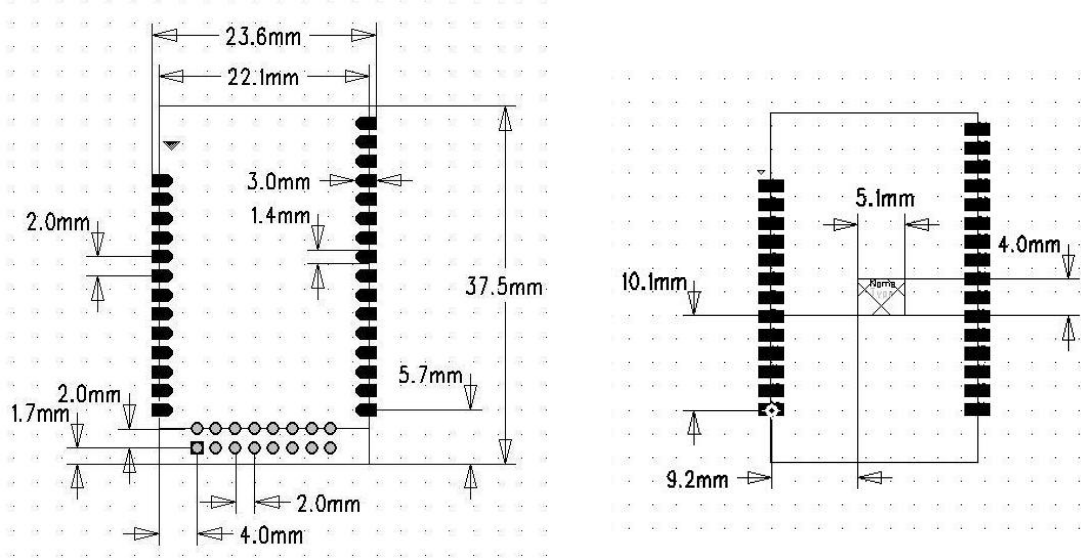


Figure 6-3 PCB Footprint (SMT)

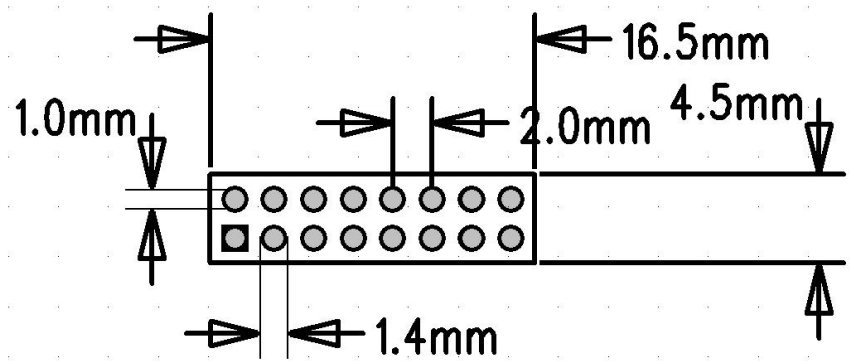


Figure 6-4 PCB Footprint (DIP)

6.3 Re-flow Temperature Specification

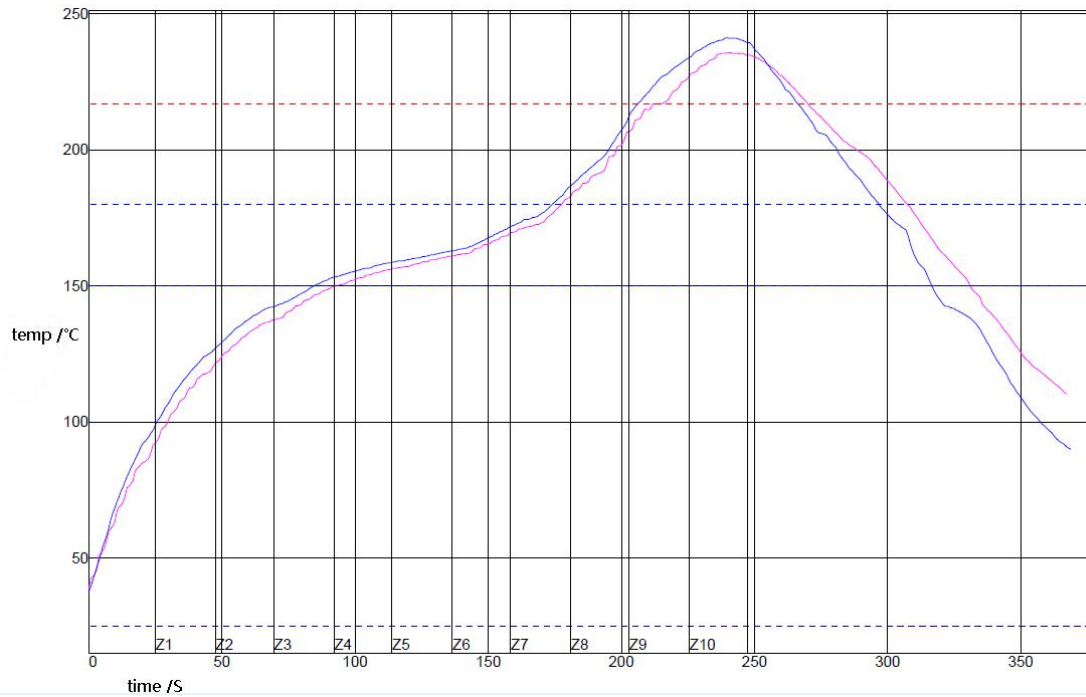
Please reference the IPC/JEDEC J-STD-020B for the Re-flow.

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 Smart Power Technology Co., Ltd.

Add : 11th Floor, A-06 Are, No 370, Chengyi Street, Jimei, Xiamen, Fujian, China.

Tel : +86 17750019379 Email: business@four-faith.com

Web:<http://en.four-faith.net>

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.

A1.2 About the factory setting

Make sure to do factory setting, before modifying Pan ID, Physical channel and

A1.3 About the network parameters

In a ZigBee network, it has only one pan id and only one node address. Unpredictable errors occurred in a ZigBee network with two same pans ids or node addresses.

A1.4 Sleep mode

Sleep mode contains timer sleep and deep sleep. The power consume in timer sleep is greater in deep sleep. So in actual application, we suggested that the zigbee device work on deep sleep mode.

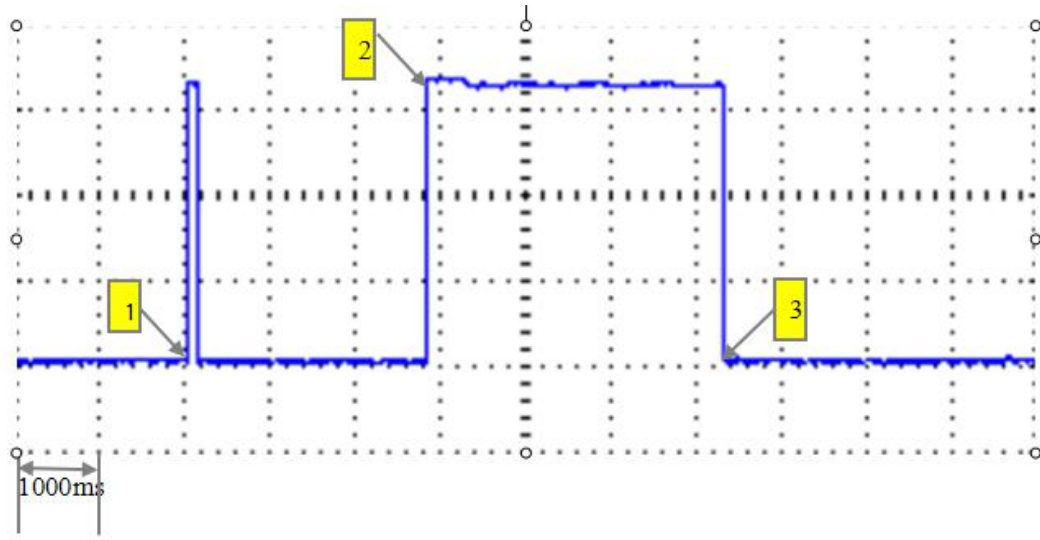
However, we suggest the route device should not work on deep sleep mode. Because in deep sleep work mode, it need more time to send data after device awake.

A1.5 Work mode

On API work mode, the serial data should be avoid of 0xFE data.

On transparent work mode, the serial data should be avoid “+++” and “===” string.

A1.6 Power on timing



FigureA1-1 Module’s power on timing

As Figure A1-1, point 1 to 2 is system start up time, 2.9 second. During this period, the ZigBee module did not respond to any commands.

Point 2 to Point 3 is configure time, 3.2 second. During this period, the Zigbee module’s serial port’s baud rate is 115200 bps and work mode is transparent mode. After receiving “+++” string twice, responding to the peer with “OK”, the module will change to AT work mode. The interval between two ”+++” string, should in 50ms~200ms.100ms is recommended.

After Point 3, the module work on the pre-setting work mode. It can change the work mode to AT mode by sending twice “+++” string any time in normal work state. It will back to the original work mode, if it did not received any commands within one minute.

A1.7 Transmit Power

Keep more than 20cm distance between two ZigBee device, when tested or in practical application

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)