

F8913D User Manual	Product Version	Page
	V1.16	
	Product Name: F8913D	Total:43

# F8913D User Manual

The user manual is suitable for the following model:

Model	Product Type
F8913D-N-NS	Without PA, DIP
F8913D-E-NS	With PA, DIP



**Xiamen Four-Faith Communication Technology Co., Ltd.**

Add:J1-J3,3rd Floor,No.44,GuanRi Road,SoftWare Park,XiaMen,China

Zip Code: 361008

Tel: +86 592-5907276

Fax: +86 592-5912735

<http://en.four-faith.com>





## Files Revised Record

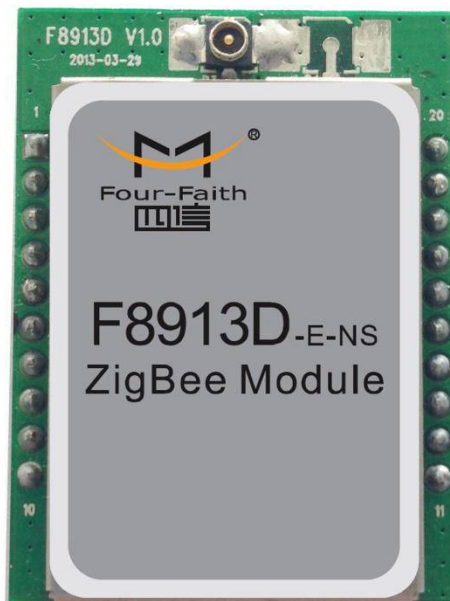
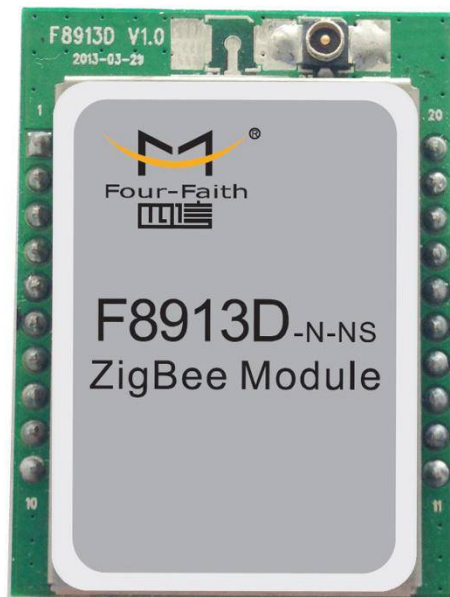
Date	Version	Remark	Author
2013-4-15	V1.00	Draft	Tady Chen
2013-07-04	V1.10	Add API configure command description, and route sleep mode configure .	Tady Chen
2014-09-20	V1.11	Add appendix	ZXZ
2014.09.22	V1.14	Add upgrade interface and upgrade steps description Add GPIO protection description Add re-flow temperature profile	Cm.chen
2015.05.25	V1.15	Update Power Consumption Update Power Reference	Cm.chen
2015.11.12	V1.16	Delete AT mode and API mode description	ZXZ

## Copyright Notice

All contents in the files are protected by copyright law, and all copyrights are reserved by Xiamen Four-Faith Communication Technology Co., Ltd. Without written permission, all commercial use of the files from Four-Faith are forbidden, such as copy, distribute, reproduce the files, etc., but non-commercial purpose, downloaded or printed by individual (all files shall be not revised, and the copyright and other proprietorship notice shall be reserved) are welcome.

## Trademark Notice

Four-Faith、四信、、、、 are all registered trademarks of Xiamen Four-Faith Communication Technology Co., Ltd., illegal use of the name of Four-Faith, trademarks and other marks of Four-Faith is forbidden, unless written permission is authorized in advance.



## Contents

Contents.....	5
Chapter 1 Brief Introduction of Product.....	7
1.1 Overview.....	7
1.2 Features and Benefits.....	7
1.3 Specification.....	8
Chapter 2 Module Interface.....	10
2.1 Module Signal Definition.....	10
2.2 UART.....	11
2.3 GPIO Specification.....	12
2.4 Antenna Interface.....	13
2.5 Antenna Installation.....	14
2.6 Firmware Performance Specifications.....	15
2.7 Absolute Maximum Ratings.....	15
2.8 Online upgrade interface.....	15
2.8.1 Upgrade preparatory.....	15
2.8.2 Upgrade steps.....	16
Chapter 3 Communication Interface Operation.....	20
3.1 UART.....	20
3.1.1 UART signal description.....	20
3.1.2 UART connections.....	20
3.1.3 UART Characteristics.....	21
3.2 Analog and Digital I/O.....	22
3.2.1 Signal Definition.....	22
3.2.2 Function Description.....	22
Chapter 4 Parameter Configuration.....	23
4.1 Zigbee Description.....	23
4.1.1 Device Type Description.....	23
4.1.1.1 Coordinator.....	23
4.1.1.2 Router.....	23
4.1.1.3 End Device.....	23
4.1.2 ZigBee Network Description.....	24
4.1.2.1 Form a ZigBee Network Procedure.....	24
4.1.2.2 Physical Channel.....	24
4.1.2.3 PAN ID.....	24
4.1.2.4 Node address.....	24
4.2 Configuration Connection.....	25
4.3 Configuration Introduction.....	25
4.4 Modes of Operation.....	27
4.4.1 Transparent mode.....	27

4.4.2 AT command mode.....	28
4.4.3 API mode.....	28
4.5 Device sleep mode configuration description.....	30
4.5.1 Timer sleep.....	30
4.5.2 Deep sleep.....	30
Chapter 5 Reference Circuit.....	31
5.1 Power.....	31
5.1.1 Power supply features.....	31
5.1.2 Decrease voltage drop.....	31
5.1.3 Reference design for power supply.....	32
5.1.4 Power supply suggestion.....	33
5.2 Communication.....	33
5.3 Reset.....	34
5.4 Digital I/O.....	35
5.5 ADC Sampling Circuit.....	35
5.6 GPIO protection circuit.....	35
Chapter 6 Dimension and solder.....	37
6.1 Outline Dimension.....	37
6.2 PCB Footprint.....	37
6.3 Re-flow Temperature Specification.....	38
Chapter 7 Ordering Information.....	40
Appendix.....	41
A1 Notes.....	41
A1.1 Serial port' s frame interval.....	41
A1.2 About the factory setting.....	41
A1.3 About the network parameters.....	41
A1.4 Sleep mode.....	41
A1.5 Work mode.....	41
A1.6 Power on timing.....	41
A1.7 Transmit Power.....	42
A2 FAQ.....	43
FAQ1: Configure parameters fail.....	43
FAQ2: With right parameters, but add network fail.....	43
FAQ3: In network, but send data fail.....	43
FAQ4: Can not enter sleep.....	43

# Chapter 1 Brief Introduction of Product

## 1.1 Overview

F8913D 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 5 GPIO channels, 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.

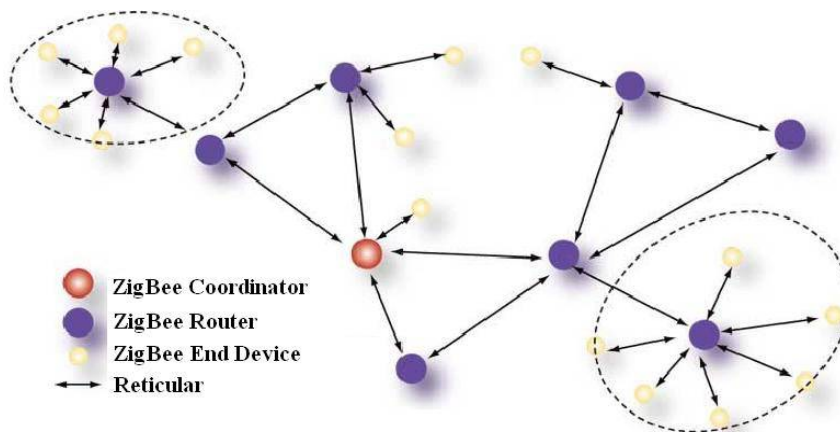


figure 1-1 Application Topology

## 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

**Xiamen Four-Faith Communication Technology Co.,Ltd.**

Add: J1-J3,3<sup>rd</sup>Floor,No.44,GuanRiRoad,SoftWare Park,XiaMen .China

http: //www.fourfaith.com Tel: +86 592-6300326 6300325 6300324

Fax: +86 592-5912735

### 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, 5 GPIO output channels, compatible 3 analog inputs and 2 pulse input counters.

## 1.3 Specification

### F8913D Model Sheet

Model	Content
F8913D-N-NS	Without PA, DIP
F8913D-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 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
F8913D-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
F8913D-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

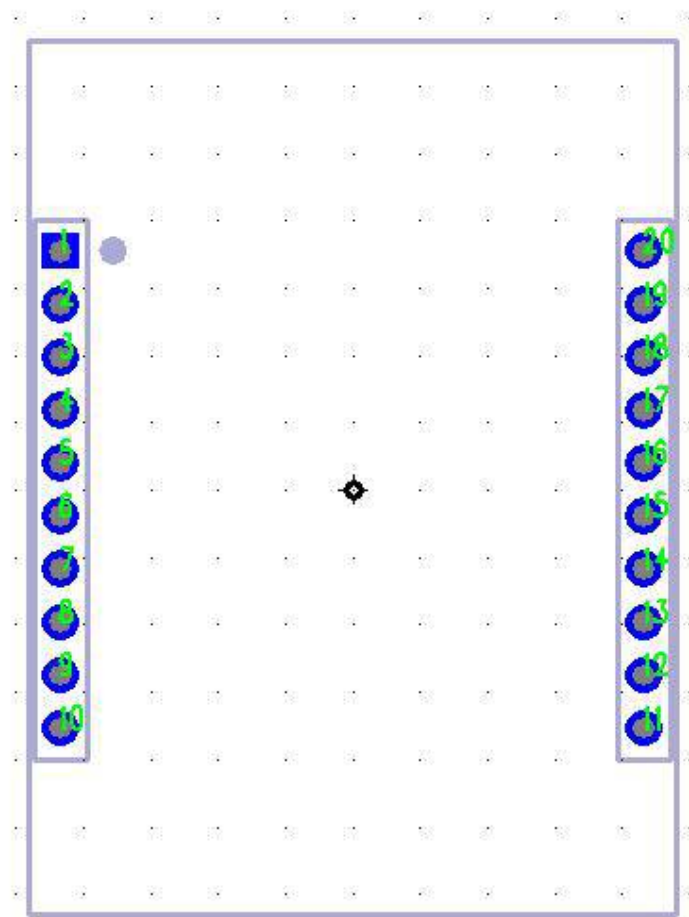


figure 2-1 Module Pin Distributing

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

Pin Number	Signal Name	Input/Output	Description
1	VCC	N/A	Power Supply
2	DOUT	Output	UART Data Out
3	DIN	Input	UART Data In
4	RD/DE	Output	RD/DE
5	RST	Input	Module Reset
6	D4	Either	GPIO
7	D3	Either	GPIO
8	[reserved]	N/A	N/A
9	SLEEP_RQ	Both	Pin Sleep Control Line
10	GND	N/A	Ground
11	D2	Input	ADC/GPIO
12	CTS	Output	Clear-to-Send
13	SLEEP/ON	Output	SLEEP/ON
14	AVDD5	N/A	VREF
15	Associate	Either	Associate Indicator
16	RTS	Input	Request-to-Send
17	DD	Either	Debug Data
18	DC	Input	Debug Clock
19	D1	Input	ADC/GPIO
20	D0	Input	ADC/GPIO

## 2.2 UART

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

**Table 2-2 UART Signal Assignments**

UART Signal Name	Pin Number
TX	2
RX	3
CT	12
RT	16

Please reference the chapter 3 for the UART operation details.

## 2.3 GPIO Specification

The F8913D have 5 GPIO. The DC characteristics as the Table 2-4.

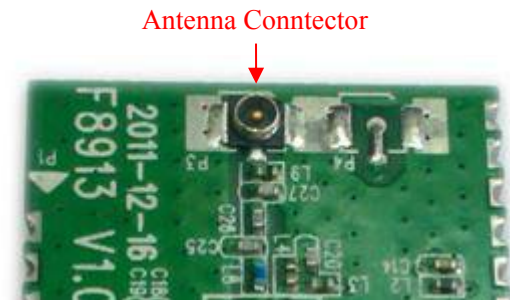
**Table 2-4 GPIO DC Characteristics (Ta=25°C, VCC=3V)**

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.

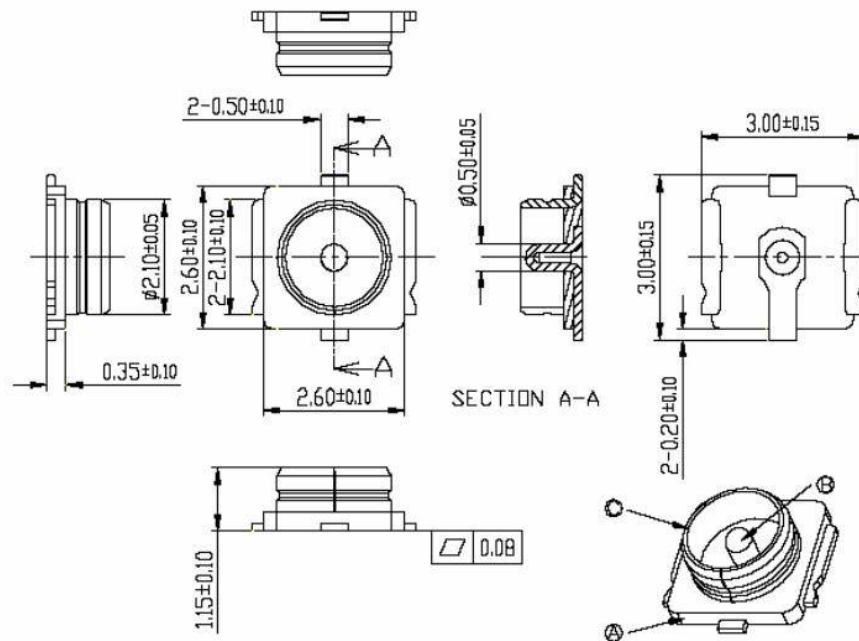
## 2.4 Antenna Interface

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.

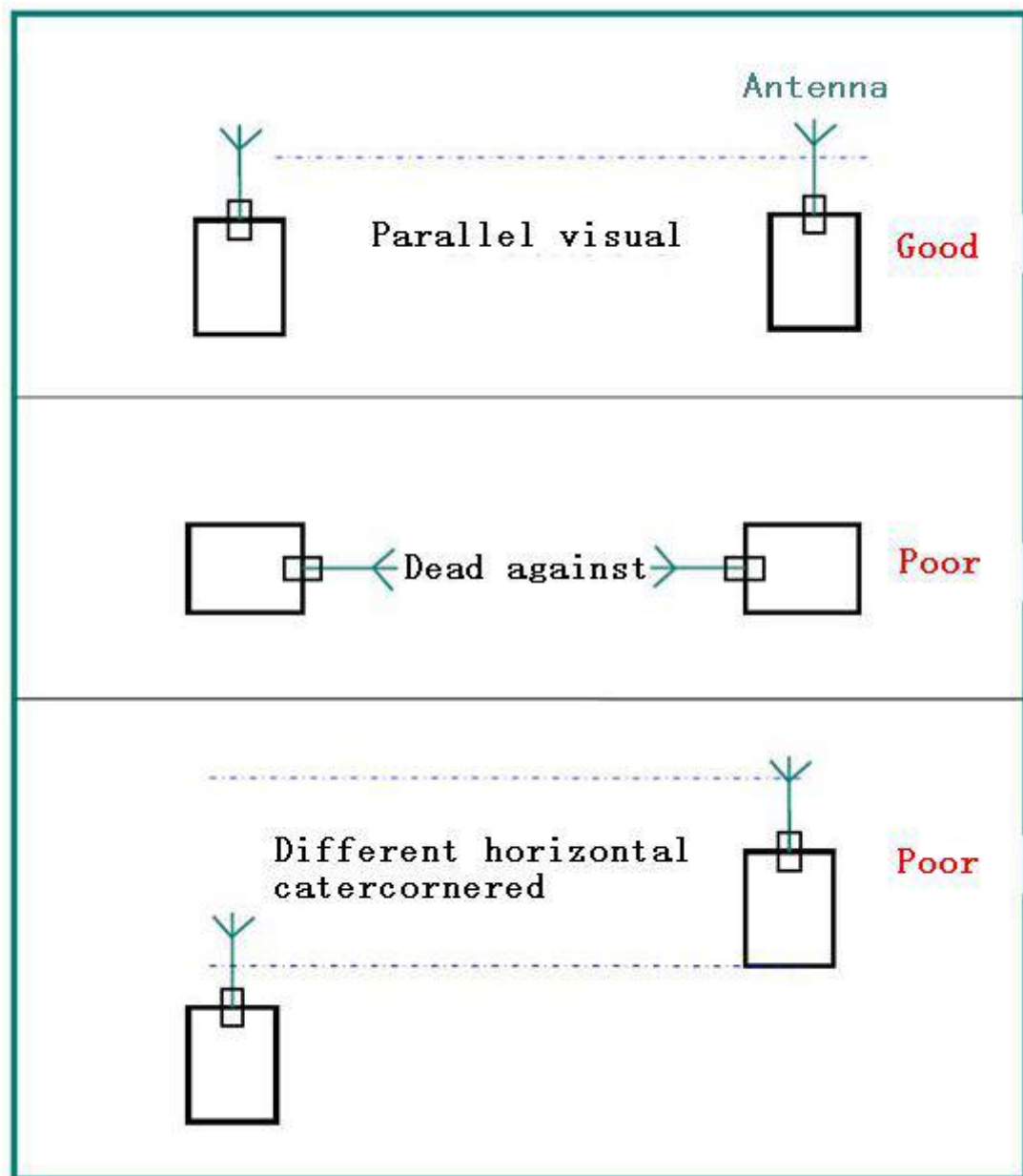


figure 2-4 Different antenna installation types

## 2.6 Firmware Performance Specifications

**Table 2-6 Firmware Performance Specification**

<b>UART</b>	Baud rate	115200 (Default)
	Configuration	8/N/1 (Default)
	Max serial buffer size	300Bytes
	XOR	1-byte XOR
	Command Mode	AT Command HEX Command
<b>Network</b>	Max nodes quantity	65000
	Node number range	0~65000 0: The center node 65535: Broadcast
<b>Wake up Mode</b>	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 ( $\leq 3.9$ )	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 DIP module :PIN1: VCC、PIN2: DOUT、PIN3: DIN、PIN5: RESET、PIN10: GND(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:

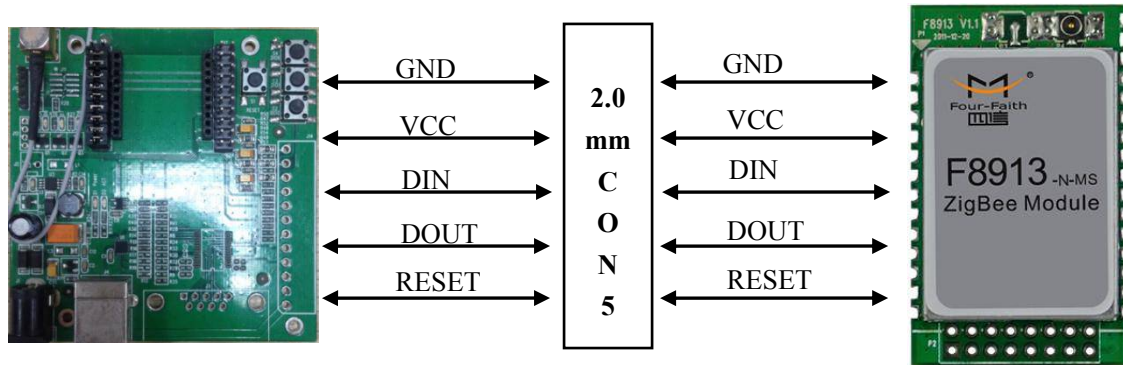


figure 2-5 Connection diagram

## 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 another 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

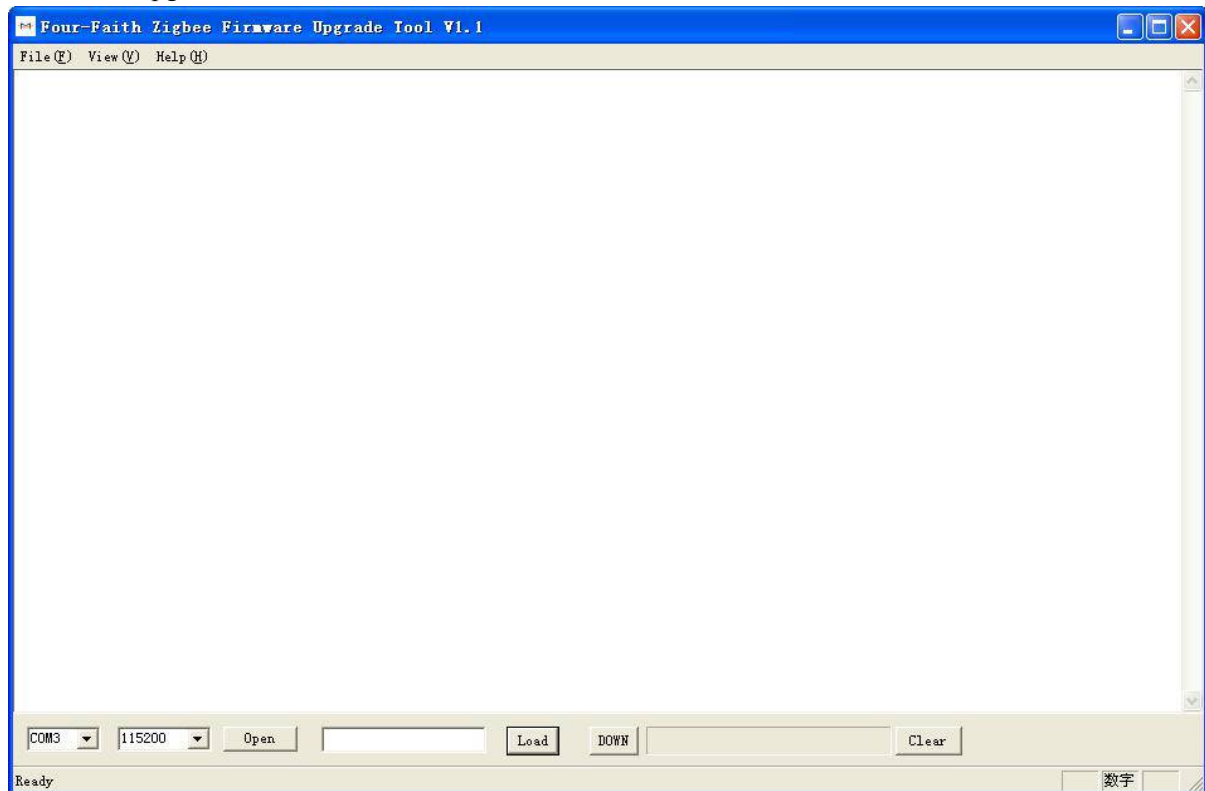


figure 2-7 Zigbee firmware upgrade tool interface

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.

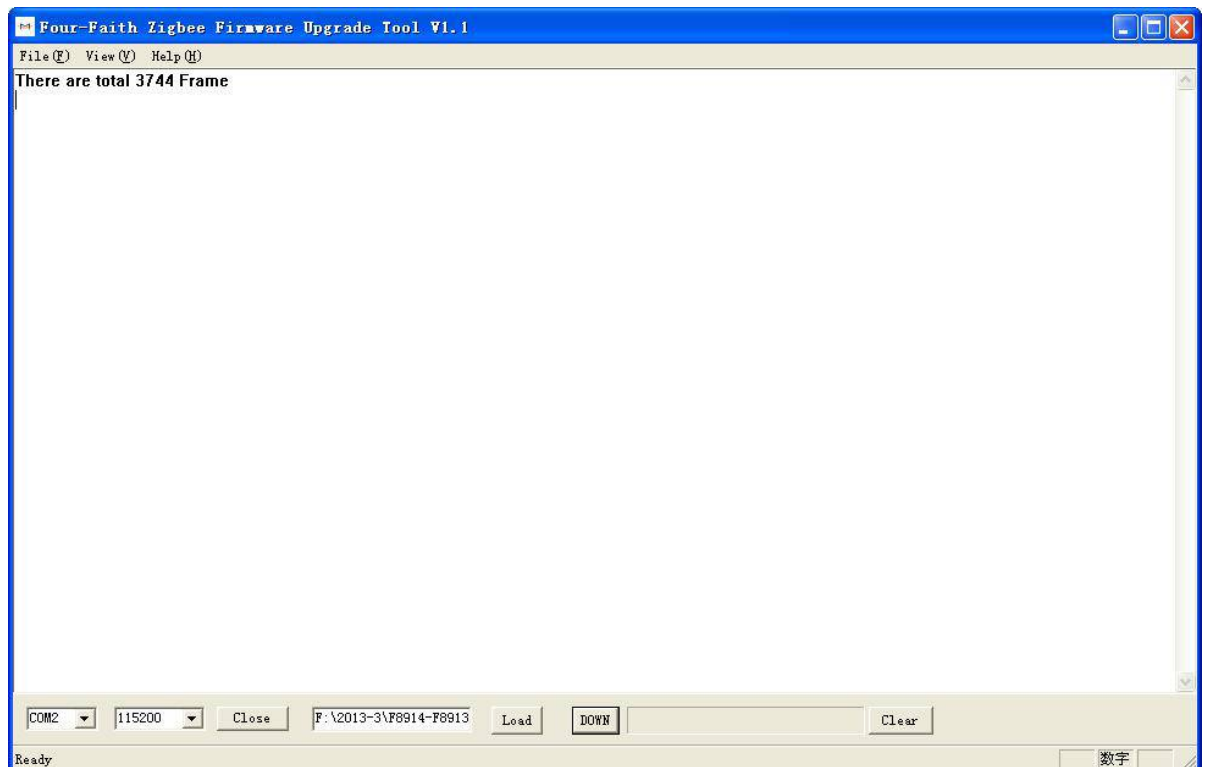


figure 2-8 Zigbee firmware upgrade tool waiting for module response

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

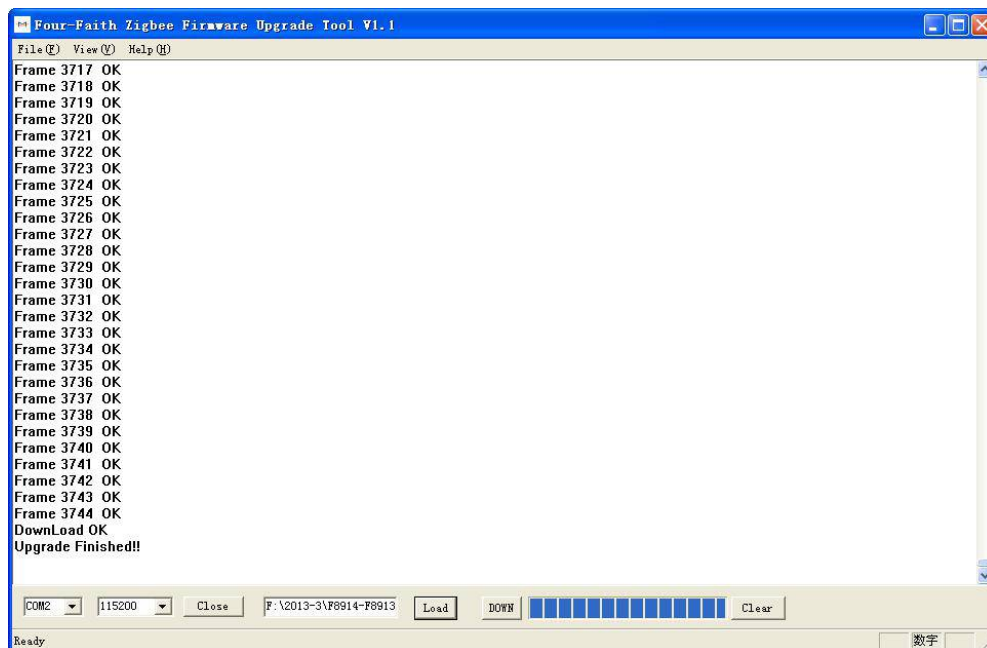


figure 2-10 Upgrade Finished!!

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

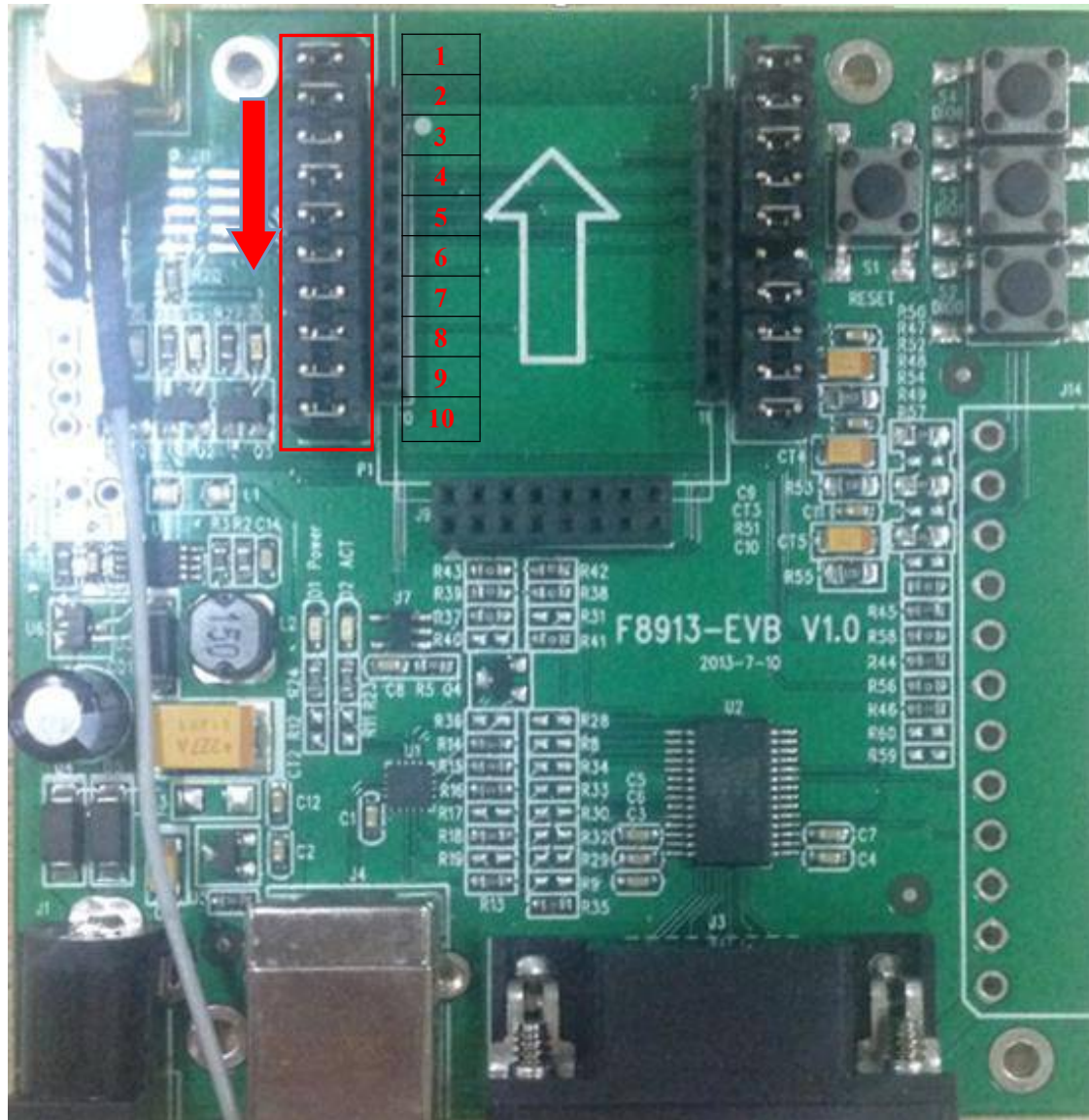


figure 2-11 Development board Pin Distributing

## 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

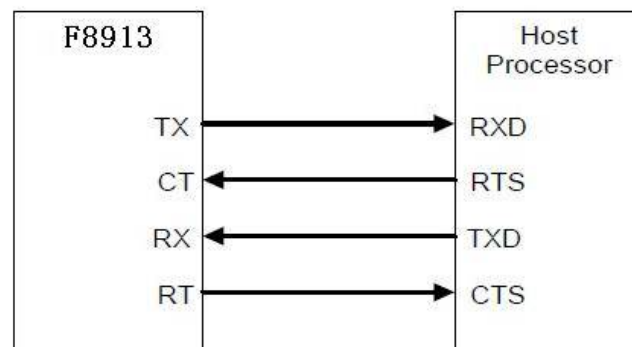


figure 3-1 UART connection diagram

**Note: device default has no hardware flow control**

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 F8913D directly.

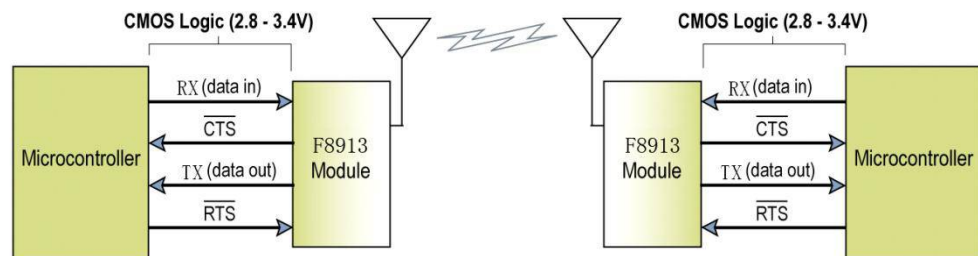


figure 3-2 The UART convert to RF system

### 3.1.3 UART Characteristics

**UART data format**

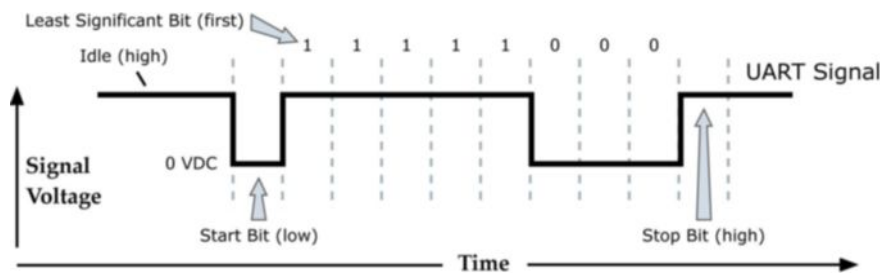
Start	D0	D1	D2	D3	D4	D5	D6	D7	Stop
-------	----	----	----	----	----	----	----	----	------

**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 F8913D 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

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

Pin Number	Pin Name	Default Function
6	D4	GPIO
7	D3	GPIO
11	D2	ADC/GPIO
19	D1	ADC/GPIO
20	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 2.4GHz(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, if received "AT+NID=65535", it will randomly assigned a node address.

### 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 F8913D with a host controller. The host controller could be a PC or other device which contain UART port. You can connect the F8913D with PC by the Four-Faith F8913D EVB, as showing in the figure 4-1.

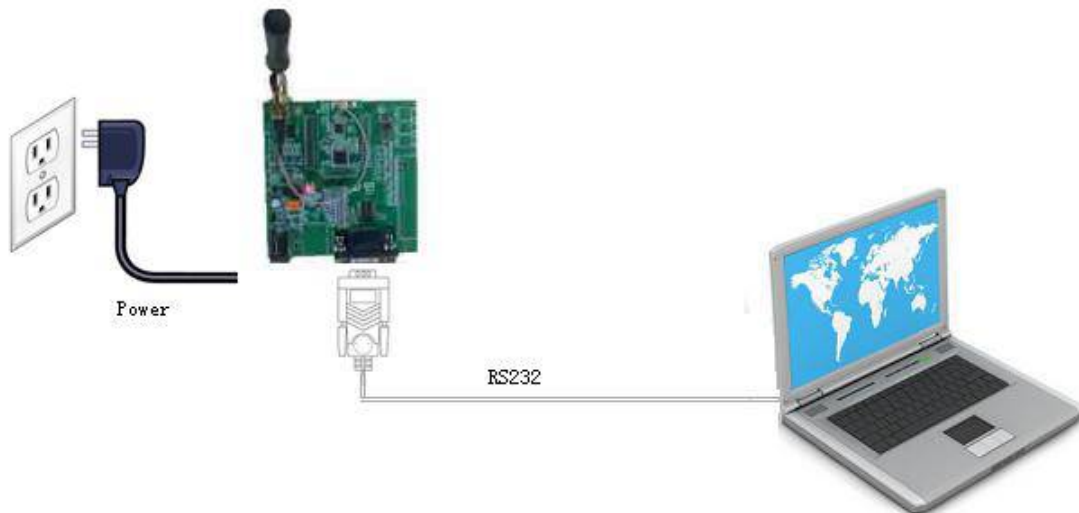


figure 4-1 F8913D EVB connect with PC

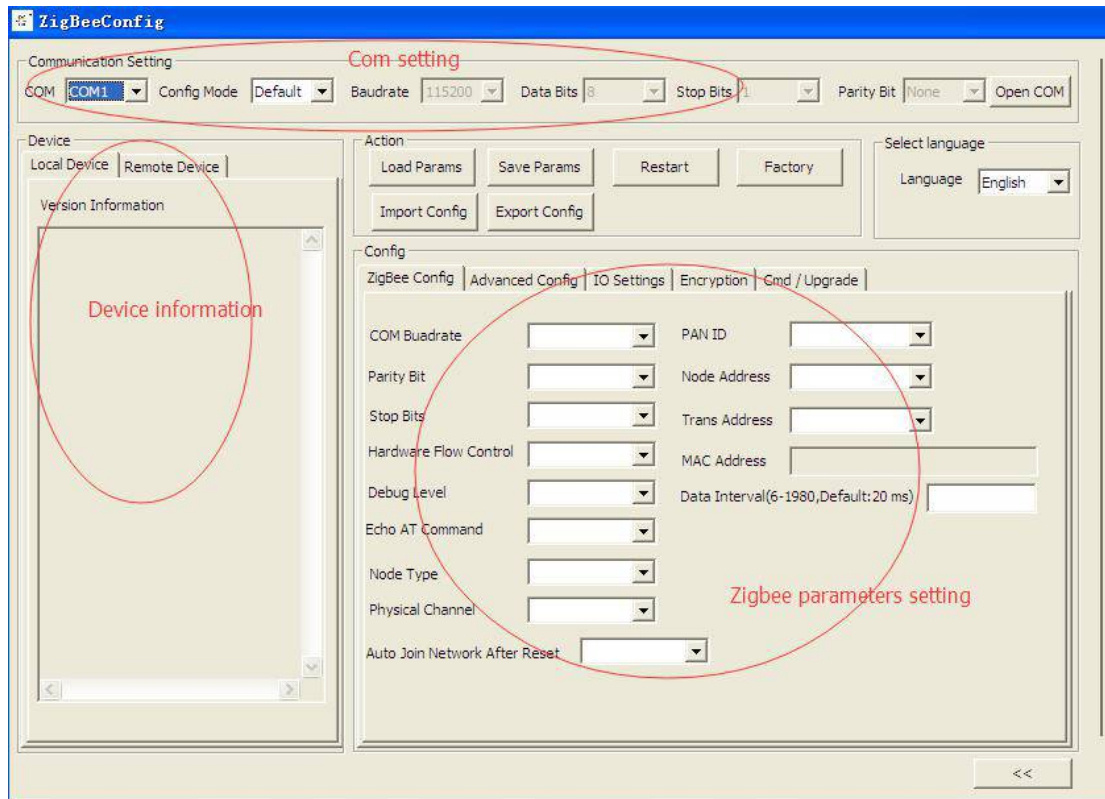
## 4.3 Configuration Introduction

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.




**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

F8913D 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

F8913D 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 configure d as end device or router and Timer Sleep.The sleep interval must be greater than 0.

### 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 configure d 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 F8913D-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.

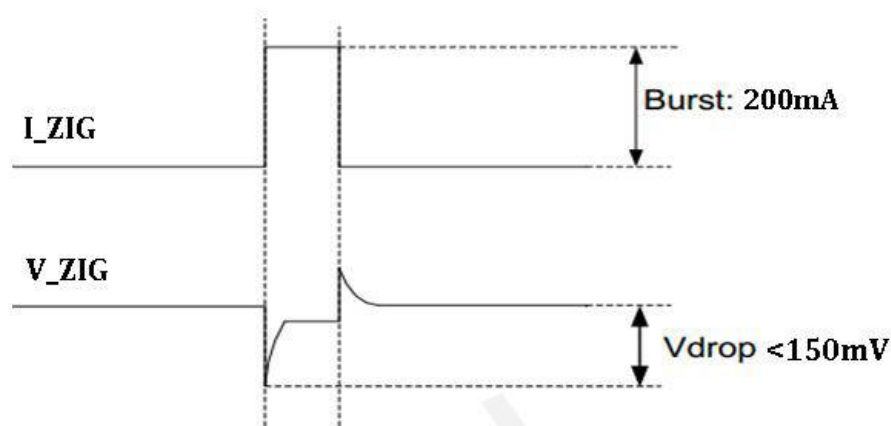


Figure 5-1 Voltage ripple during transmitting

#### 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 ( $ESR=0.7\Omega$ ) 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.

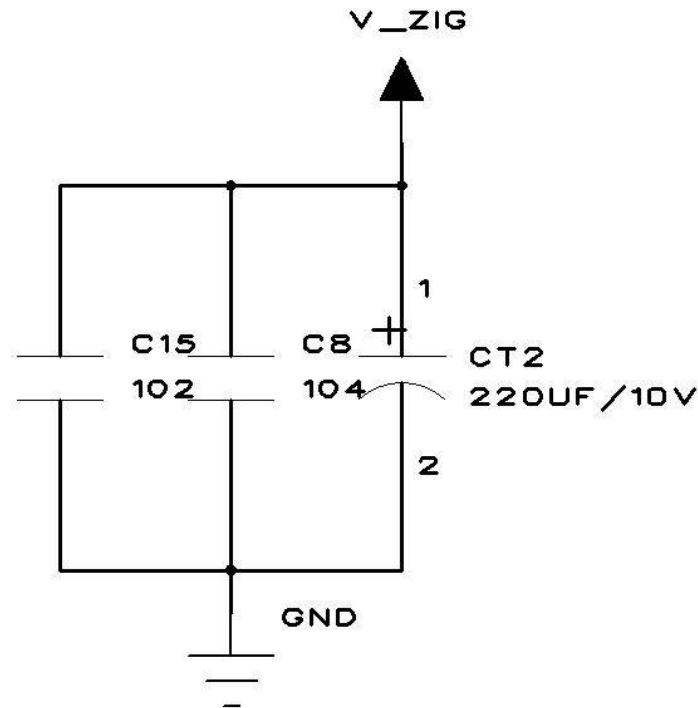


Figure 5-2 Reference circuit for the V\_ZIG input

### 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.

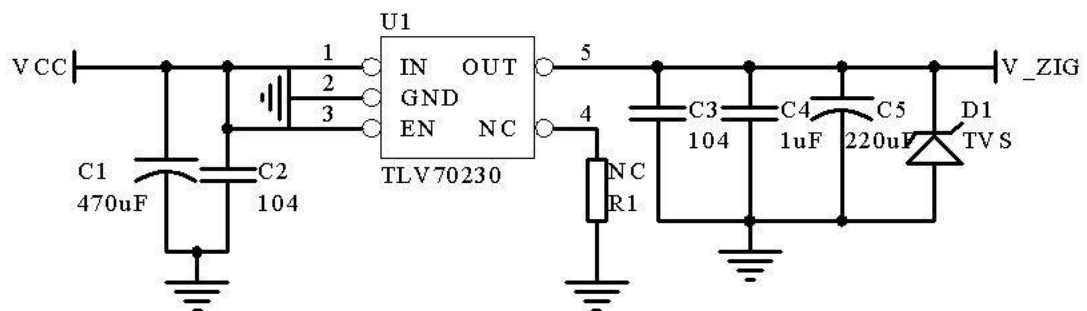


Figure 5-3 Reference circuit for power supply



## 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.

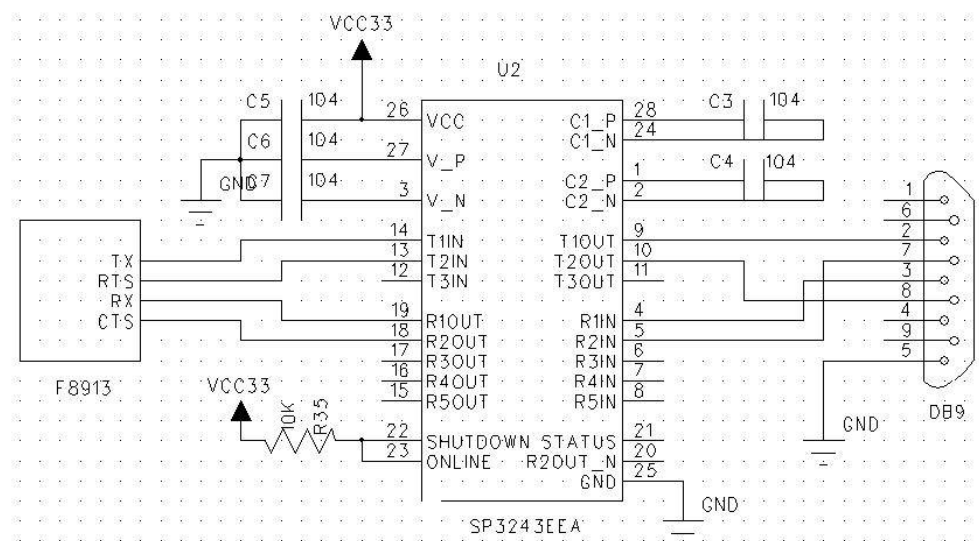


Figure 5-4 UART convert to RS232

- 2, Ipc as host controller: F8913D 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.

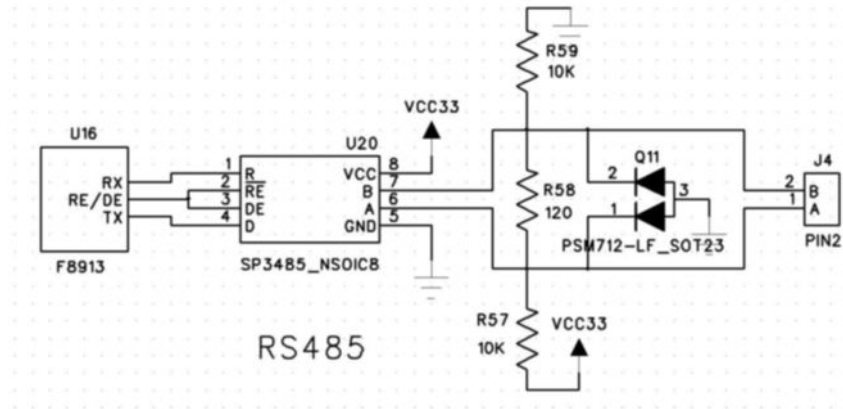


figure 5-5 F8913D and IPC RS485 connection reference circuit

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(continue more than 200 ms) the switch will reset the F8913D, as figure 5-4.

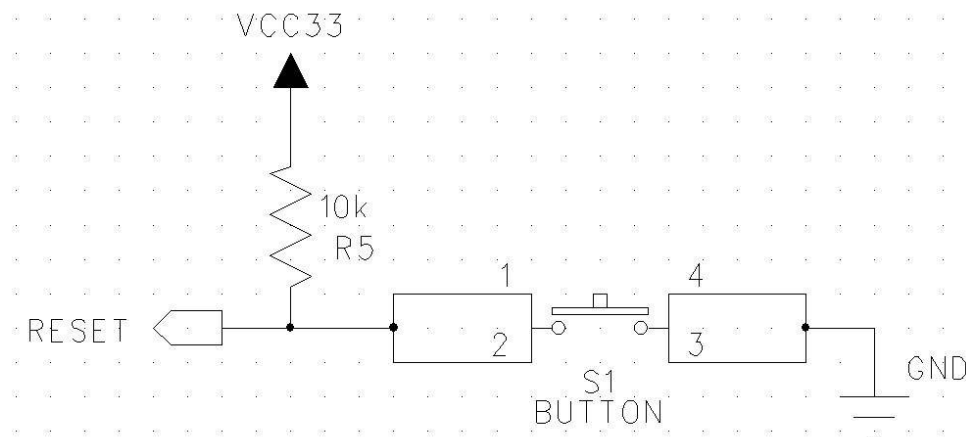


figure 5-6 Reset Circuit

## 5.4 Digital I/O

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

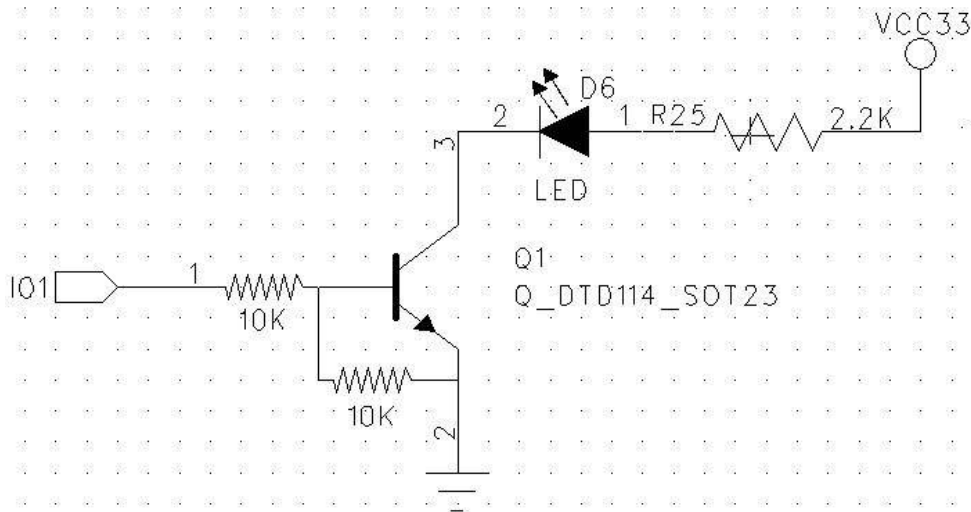


figure 5-7 Digital I/O Control a LED

## 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).

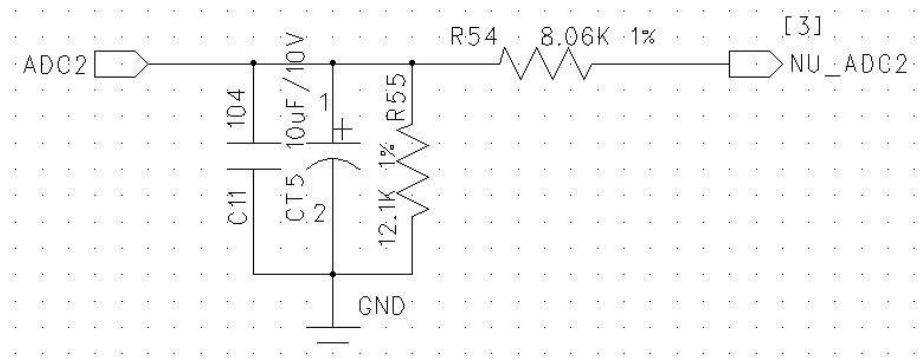


figure 5-8 Voltage Acquisition (0-5VDC)

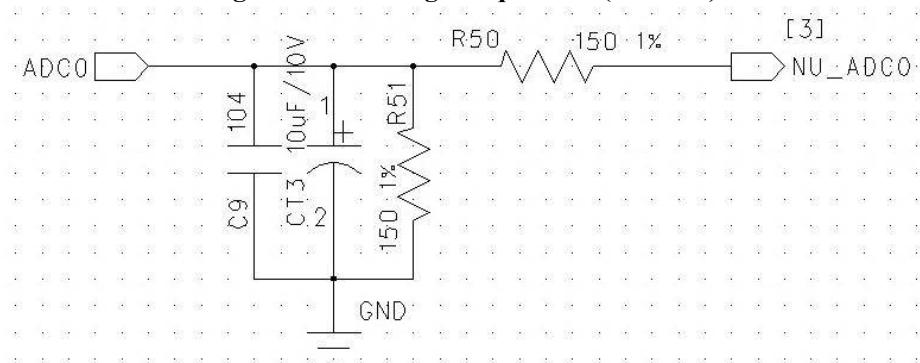


figure 5-9 Current Acquisition (0-20mA)

## 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

**Xiamen Four-Faith Communication Technology Co.,Ltd.**

Page 35 of 43

Add: J1-J3, 3<sup>rd</sup> Floor, No.44, GuanRi Road, SoftWare Park, XiaMen .China

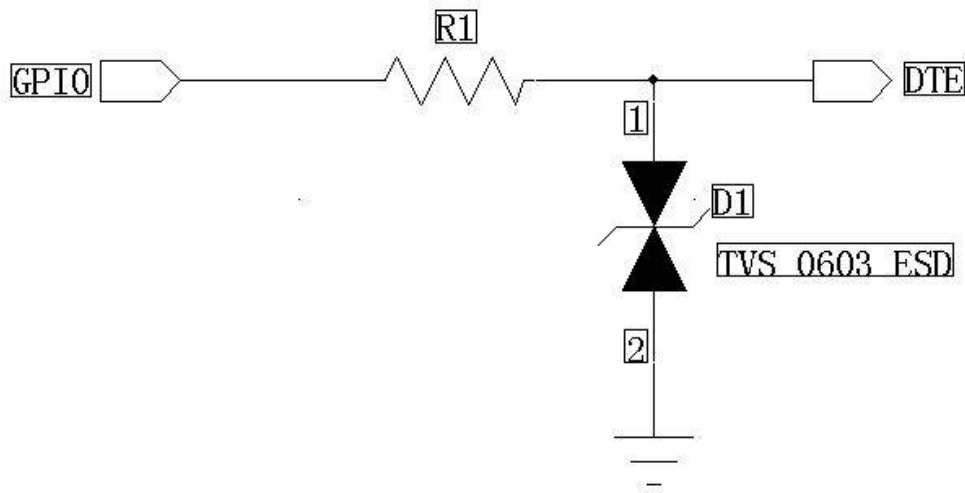
http: //www.fourfaith.com

Tel: +86 592-6300326

6300325 6300324

Fax: +86 592-5912735

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

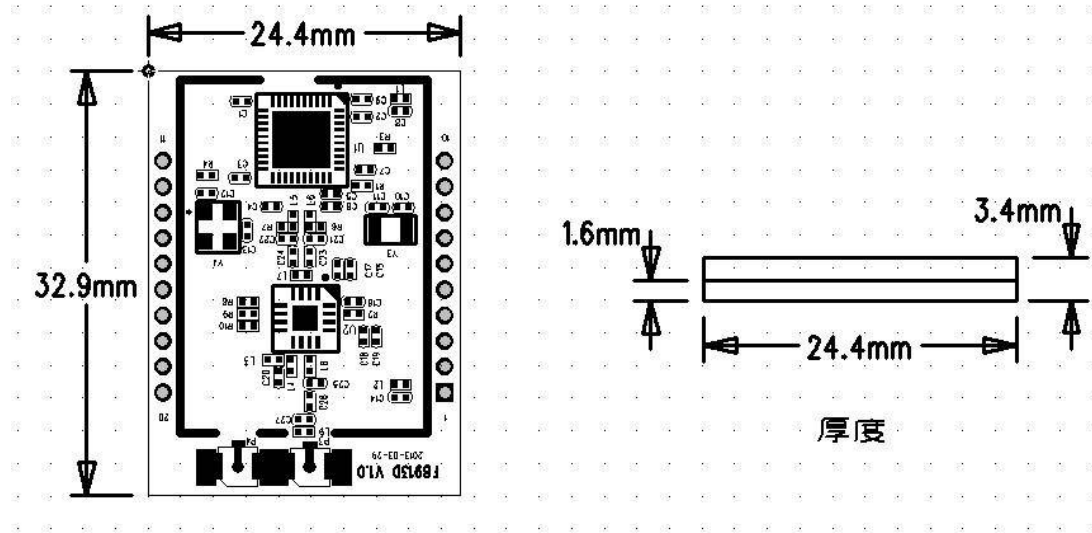


figure 6-1 Outline Dimension

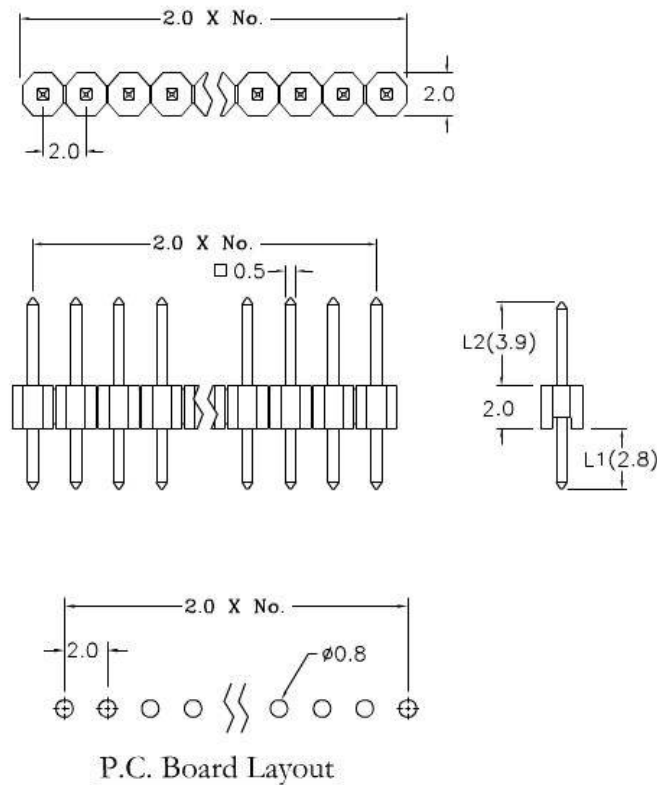


figure 6-2 Pin Header Dimension (optional)

### 6.2 PCB Footprint

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

**Xiamen Four-Faith Communication Technology Co.,Ltd.**

Page 37 of 43

Add: J1-J3,3<sup>rd</sup>Floor,No.44,GuanRiRoad,SoftWare Park,XiaMen .China

http: //www.fourfaith.com Tel: +86 592-6300326 6300325 6300324 Fax: +86 592-5912735

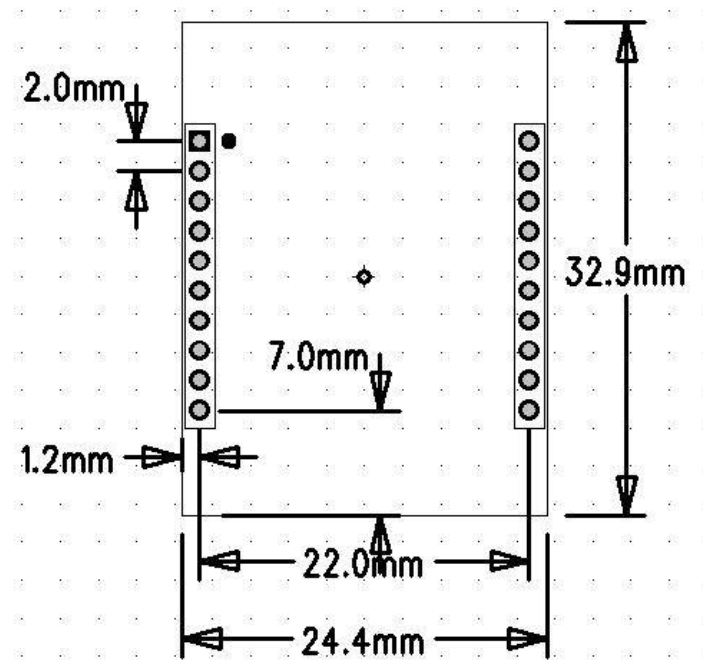


figure 6-3 PCB Footprint (DIP)

## 6.3 Re-flow Temperature Specification

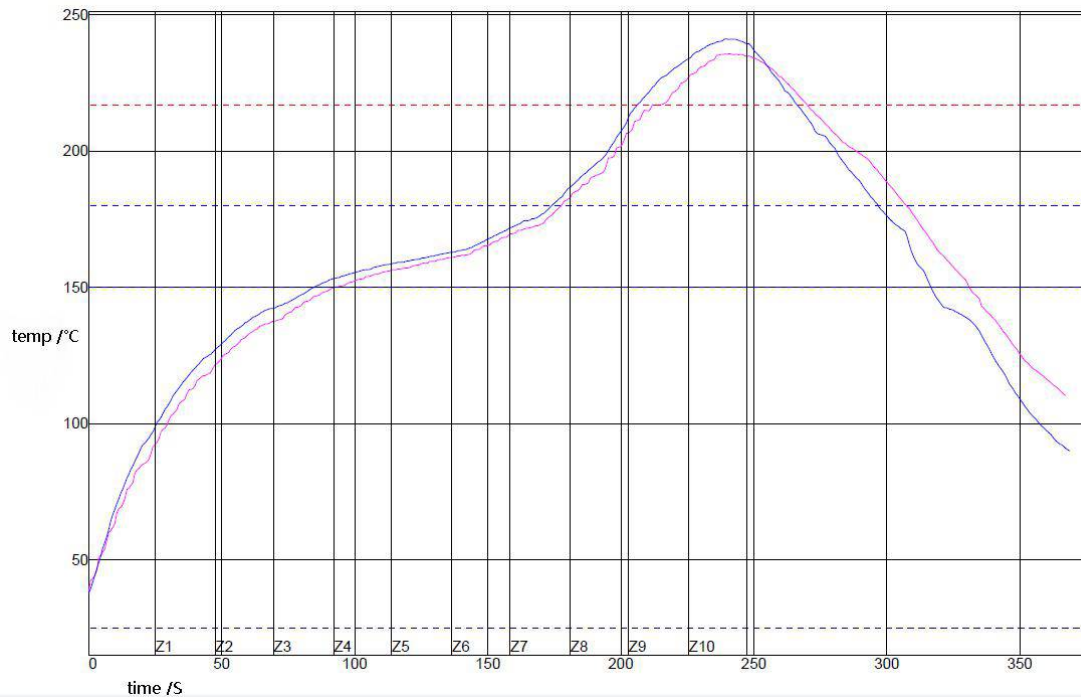
Please reference the IPC/JEDEC J-STD-020B for the Re-flow.

### Soldering temperature

Using thermostat soldering iron do not exceed 340℃,and do not more then 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℃	
	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℃		Re-flow 217℃		Maximum temperature		Descending slop 250~200℃	
	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: J1-J3,3rd Floor,No.44,GuanRi Road,SoftWare

Park,XiaMen,China

Zip Code:361008

Tel: +86 592-6300326 , 6300325, 6300324

Fax:+86 592-5912735

<http://www.fourfaith.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.

### 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

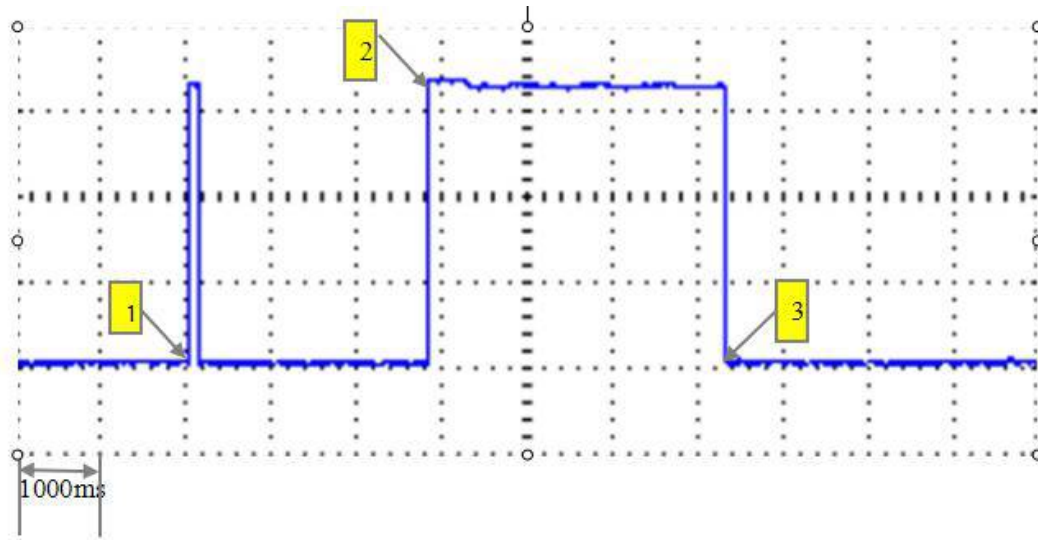


figure A1-1 Module's power on timing

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)