E22-400T30E

SX1268 433/470MHz 1W LoRa Wireless Module

Mini PCIE interface

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Contents

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1. Introduction

1.1 Brief Introduction

E22-400T30E is a new generation of LoRa wireless module. It is designed based on the wireless serial port module (UART) of SEMTECH's RF chip and the original SX1268 chip scheme of SEMTECH. It has a variety of transmission methods, works in the (410.125 ~ 493.125MHz) frequency band (default 433.125MHz), LoRa spread spectrum technology, TTL level output, compatible with 3.3V and 5V IO port voltage.

E22-400T30E adopts a new generation of LoRa spread spectrum technology. Compared with the traditional SX1278 solution, this solution has a longer transmission distance, faster speed, lower power consumption and smaller size; it supports air wake-up, wireless configuration, carrier monitoring, automatic middle It supports functions such as follow-up and communication key, supports sub-package length setting, and can provide customized development services.

1.2 Features

- Based on the new LoRa spread spectrum modulation technology developed by the SX1268 RF chip of SEMTECH, the communication distance is longer and the anti-interference ability is stronger;
- Automatic relay networking, multi-stage relay is suitable for ultra-long distance communication, multiple networks running in the same area are running simultaneously;
- Users to set their own communication keys and cannot be read, which greatly improves the confidentiality of user data;
- RSSI for evaluating signal quality, improving communication network, and ranging;
- With LBT for monitoring channel environmental noise before sending data, and for improving communication;
- Wireless parameter configuration, send command data packets wirelessly, remotely configure or read wireless module parameters;
- Wake-on-air, that is, ultra-low power consumption function, suitable for battery-powered applications;
- With fixed-point transmission, broadcast transmission, and channel monitoring;
- Support global license-free ISM 433MHz and 470Mhz for meter reading；
- In deep sleep mode, power consumption is 1.5mA；
- With PA+LNA, communication distance tested is up to 10 km；
- The parameters are saved after power-off. After power-on, the module will work according to the set parameters.
- High-efficiency watchdog design, once an exception occurs, the module will automatically restart and continue to work according to the previous parameter settings;
- Air date rate of 2.4k ~ 62.5kbps;
- 3.2 ~ 5.5V power supply, power supply over 5.0 V can guarantee the best performance；
- Industrial grade standard design, support -40 ~ 85 °C for working over a long time；
- 1st generation IPEX interface, easy to connect external antenna.

1.3 Application

- Home security alarm and remote keyless entry;
- Smart home and industrial sensors, etc.;
- Wireless alarm security system;
- Building automation solutions;
- Wireless industrial grade remote control;
- Healthcare products;
- Advanced Meter Reading Architecture (AMI);
- Automotive industry applications.

II. Specification and parameter

2.1 RF parameters

RF parameters	Parameters Value	Remark
Working frequency	410.125～493.125 MHz	Support ISM band
Transmit power	30 dBm	The software is adjustable, and users need to develop their own settings
Acceptance sensitivity	-125 dBm	Air rate 2.4 kbps
FIFO	240 Byte	It can be sent in packets of 32/64/128/240 bytes by setting the instruction
Modulation	LoRa	A new generation of LoRa modulation technology
Measured distance	10km	Clear and open environment, antenna gain 5dBi, antenna height 2.5 meters, air rate 2.4kbps

2.2 Hardware parameter

Hardware parameter	Description	Remark
Communication Interface	UART/RS485/RS232/USB	The communication interface only supports the simultaneous use of one
Packaging method	In-line	-
Interface	Mini PCIE	-

Dimensions	30*51mm	-
Antenna form	1st generation IPEX	Equivalent impedance is about 50Ω
Product Weight	7.2±0.5g	-

2.3 Electrical parameters

Electrical parameters	Minimum	Typical value	Maximum value	Unit	Remark
Voltage	3.2	5.0	5.5	V	≥5.0V can guarantee the output power More than 5.5V permanently burns the module
Communication level	-	3.3	-	V	It is recommended to add level shifting when using 5V TTL.
Emission current	-	650	-	mA	Instantaneous power consumption
Receive current	-	17	-	mA	-
Sleep current	-	1.5	-	mA	Software shutdown
Operating temperature	-40	20	85	℃	Industrial grade design
Working humidity	10	60	90	%	-
Storage temperature	-40	20	125	℃	-

III. Size and pin definition
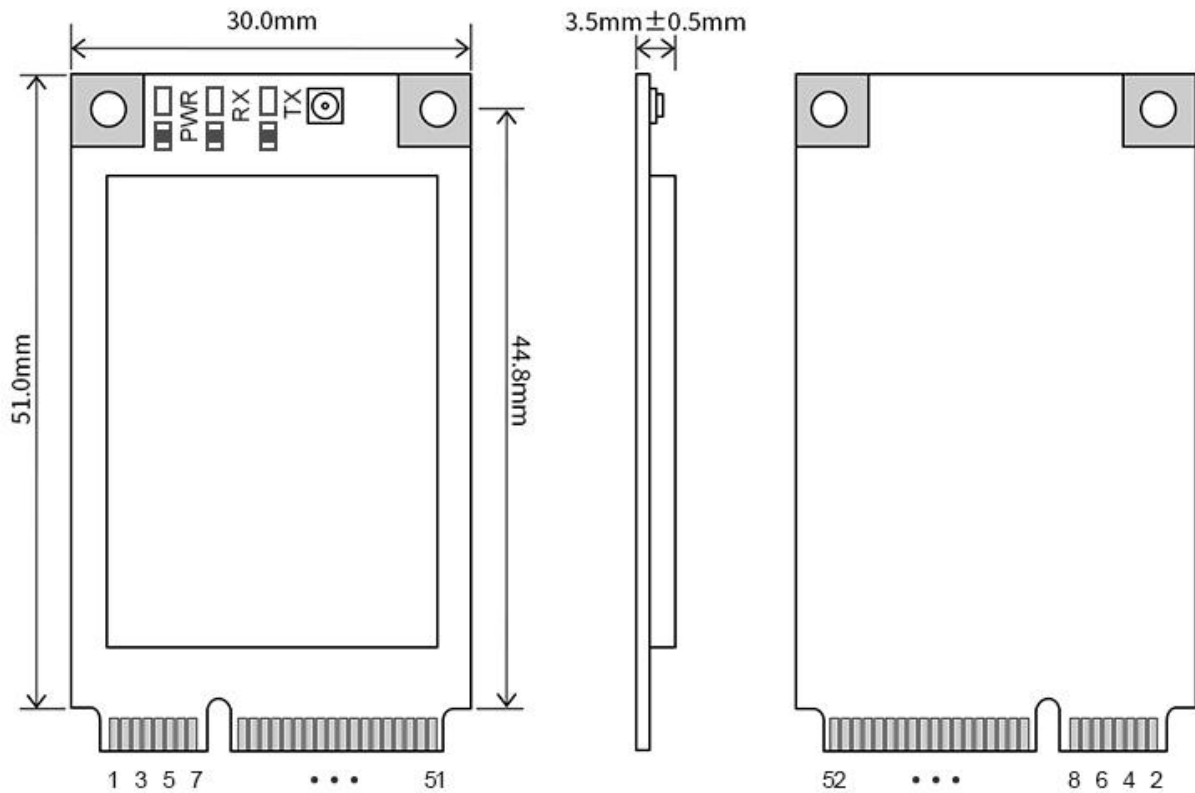
pad quantity : 52
Tolerance value : X.X±0.2mm
Unit : mm

Pin number	Pin name	Pin Orientation	Pin usage
1	AUX	Output	It is used to indicate the working state of the module; the user wakes up the external MCU, and outputs a low level during the power-on self-test initialization; (can be left floating).
2	VCC	Enter	Power input 5.0V
3	M0	Input (very weak pull-up)	Cooperate with M1 to determine the 4 working modes of the module (can not be suspended, if not used, it can be grounded)
4	GND	-	Power reference ground
5	M1	Input (very weak pull-up)	Cooperate with M0 to determine the 4 working modes of the module (can not be suspended, if not used, it can be grounded).
6	NC	-	–
7	NC	-	–
8	NC	-	–
9	GND	-	Power reference ground
10	SWD_DIO	Input/Output	Program download data interface (the module needs to be reset or chip erased before SWD programming).
11	RXD	enter	TTL serial port input, connect to external TXD output pin

12	SWD_CLK	Input / Output	Program download clock interface (the module needs to be reset or chip erased before SWD programming)
13	TXD	output	TTL serial output, connect to external RXD input pin
14	NC	-	-
15	GND	-	Power reference ground
16	NC	-	-
17	NC	-	-
18	GND	-	Power reference ground
19	NC	-	-
20	NC	-	Power reference ground
21	GND	-	Power reference ground
22	RESET	Input	Input high level module enters hardware reset state, input low level module returns to normal working state, this function is used for reset operation in emergency
23	NC	-	-
24	VCC	Input	Power input 5.0V
25	NC	-	-
26	GND	-	Power reference ground
27	GND	-	Power reference ground
28	NC	-	-
29	GND	-	Power reference ground
30	NC	-	-
31	NC	-	-
32	NC	-	-
33	NC	-	-
34	GND	-	Power reference ground
35	GND	-	Power reference ground
36	USB_D-	Input / Output	D- for external USB devices
37	GND	-	Power reference ground
38	USB_D+	Input / Output	D+ for external USB devices
39	VCC	Input	Power input 5.0V
40	GND	-	Power reference ground
41	VCC	Input	Power input 5.0V
42	NC	-	-
43	GND	-	Power input 5.0V
44	NC	-	-
45	RS232_RXD	Input	External TXD of other RS232 devices
46	NC	-	-
47	RS232_TXD	Output	External RXD of other RS232 devices
48	NC	-	-
49	RS485_A	Input / Output	Connect to the A terminal of other RS485 devices

50	GND	-	Power reference ground
51	RS485_B	Input / Output	Connect to the B terminal of other RS485 devices
52	VCC	Input	Power input 5.0V

IV. Recommended Wiring Diagram
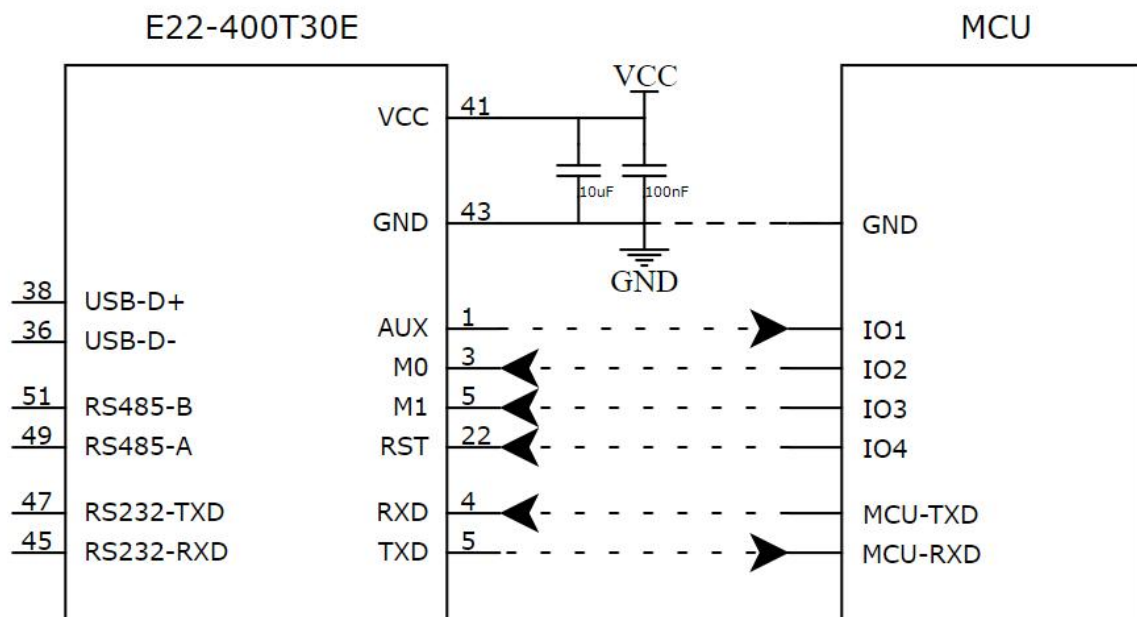
No.	Brief description of the connection between the module and the microcontroller (the above picture takes the STM8L microcontroller as an example)
1	The wireless serial port module is TTL level, please connect with TTL level MCU.
2	Some 5V microcontrollers may need to add 4~10K pull-up resistors to the TXD and AUX pins of the module.

V. Detailed Function

5.1 Fixed point transmission
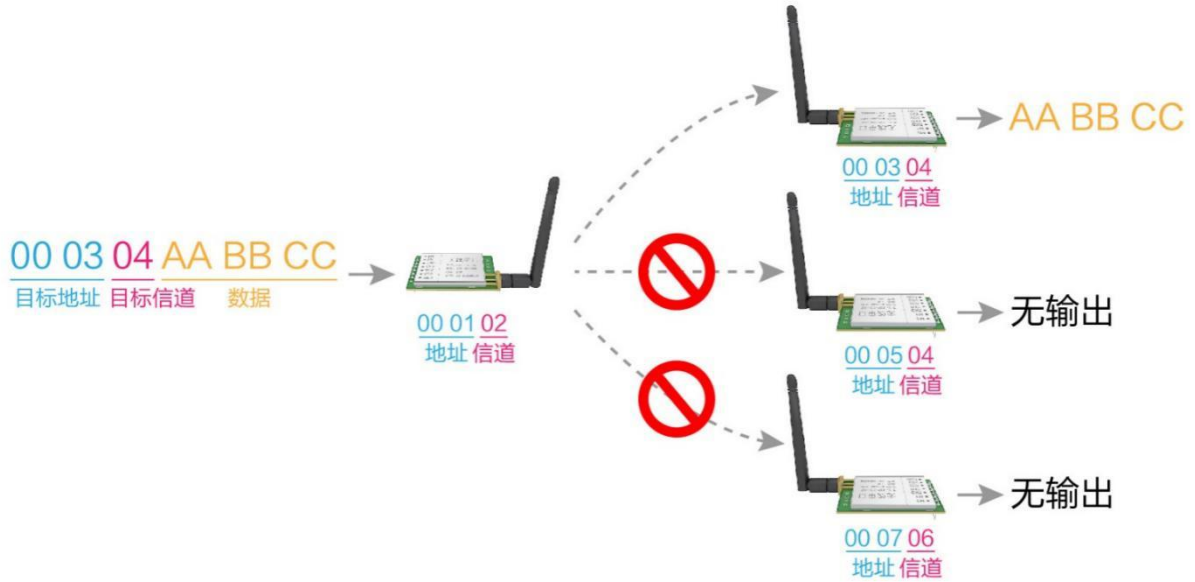
5.2 Broadcast transmission
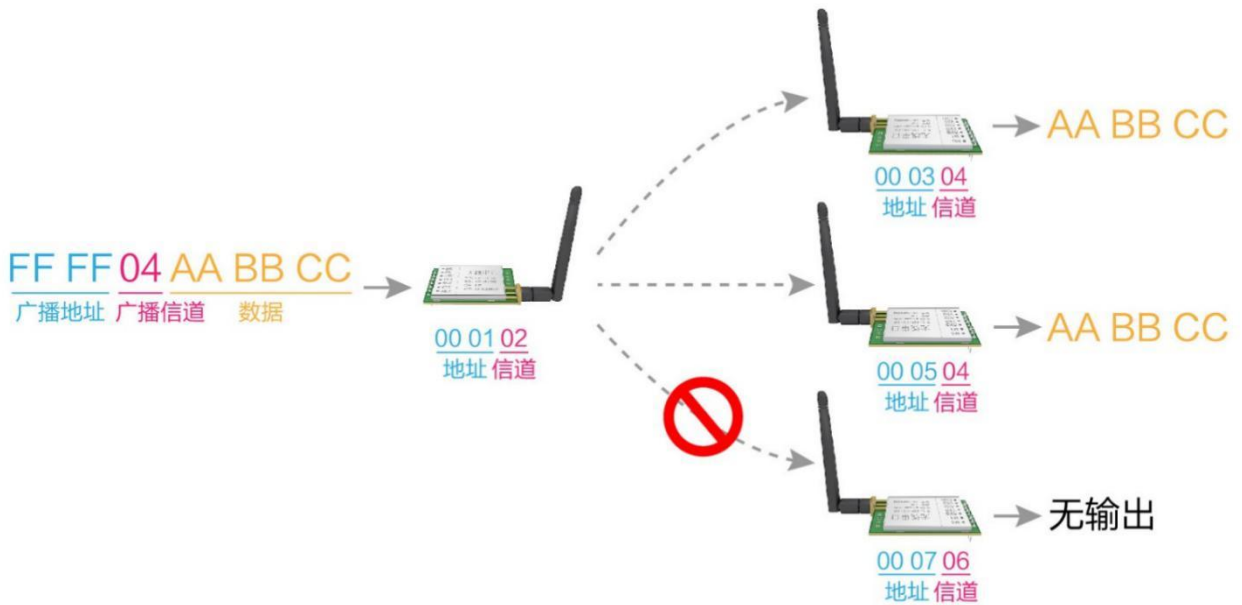
5.3 Broadcast address

● Example: Set the module A address to 0xFFFF and the channel to 0x04.

● When module A is used as a transmitter (same mode, transparent transmission mode), all receiving modules under the 0x04 channel can receive data to achieve the purpose of broadcasting.

5.4 Listen address

● Example: Set the module A address to 0xFFFF and the channel to 0x04.

● When module A is used as a receiver, it can receive all the data under the 0x04 channel to achieve the purpose of monitoring.

5.5 Module reset

● After the module is powered on, AUX will output low level immediately, perform hardware self-check, and set the working mode according to user parameters;

● During this process, the AUX keeps the low level, and after the completion, the AUX outputs the high level, and starts to work normally according to the working mode composed of M1 and M0; Therefore, the user needs to wait for the rising edge of AUX as the starting point for the normal operation of the module.

5.6 AUX Detailed Description

● AUX is used for wireless transceiver buffer indication and self-check indication

● It indicates whether the module has data that has not been transmitted wirelessly, or whether the received wireless data has not been sent through the serial port, or the module is in the process of initializing and self-checking.

5.6.1 Serial data output indication

● Used to wake up the external MCU in sleep;


模块串口外发数据时，AUX引脚时序图

5.6.2 Wireless transmission indication

● The buffer is empty: the data in the internal 1000-byte buffer is written to the wireless chip (automatically subdivided);

When AUX=1, the user continuously initiates data less than 1000 bytes without overflow;

When AUX=0, the buffer is not empty: the data in the internal 1000-byte buffer has not been completely written to the wireless chip and the started the transmission. At this time, the module may be waiting for the end of the user data to time out, or the wireless packet transmission is in progress.

[Note]: When AUX=1, it does not mean that all serial port data of the module has been transmitted wirelessly, the last packet of data may be being transmitted.
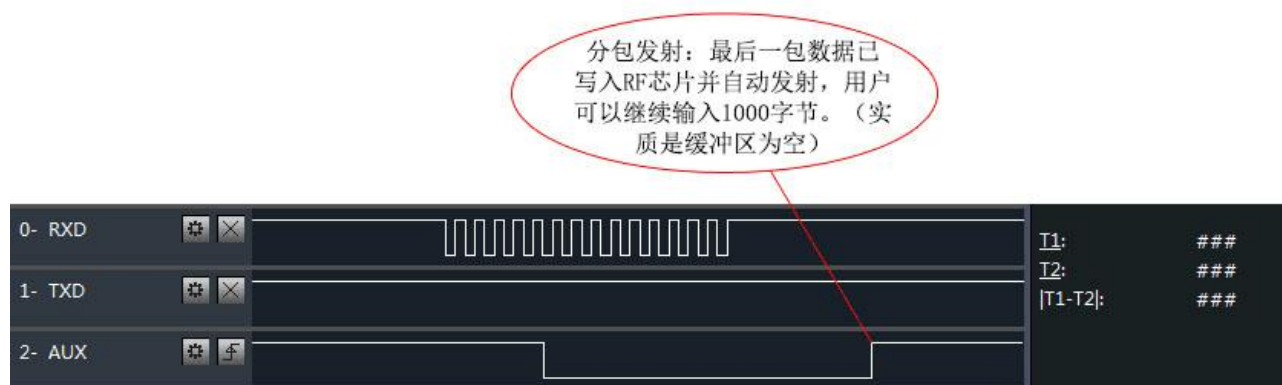
模块接收串口数据时，AUX引脚时序图

5.6.3 Module is being configured

● Only when resetting and exiting sleep mode;
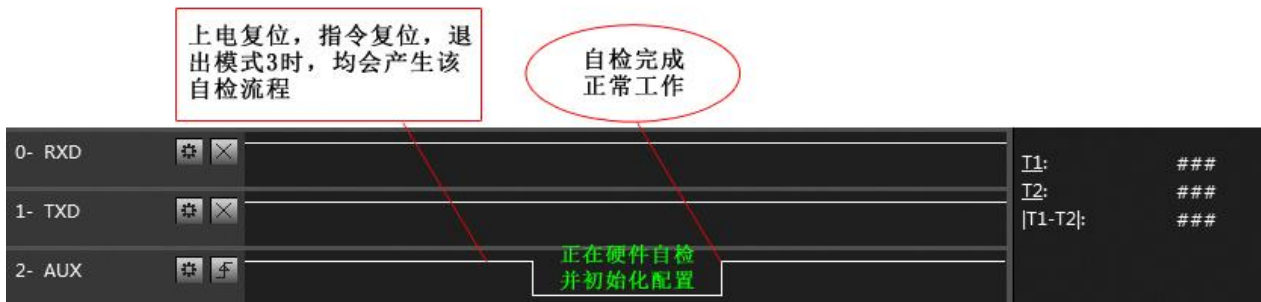
自检期间，AUX引脚时序图

5.6.4 Module power-on initialization process

● Figure '1': represents the initialization of the peripherals of the microcontroller (initialization time is 4-5ms);

● Figure '2': represents the initialization of the RF chip configuration parameters (the initialization time is about 12ms);

● When the AUX pin is initialized by the microcontroller, the pin will be pulled low for a short time due to the configuration of the GPIO peripheral, as shown in the figure below.
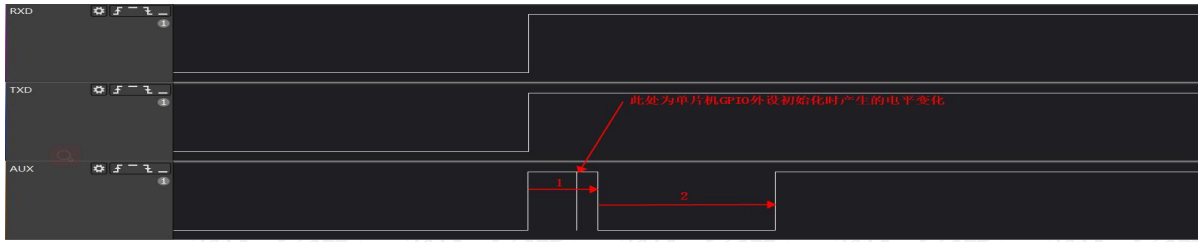
5.6.5 Module mode switching process

The process of switching mode through M0 and M1 hardware:

1. External interrupt triggered by M0 and M1 pins;

2. AUX pulls down the pin;

3. Exit the current task mode, and then read the M0 and M1 pin levels to determine the new mode;

4. Enter the new mode task, pull AUX high to complete the mode switch (switching time is about 20ms).

Hardware mode switching AUX timing

Software mode switching AUX timing

Note: The software mode switching time will increase relative to the mode switching time due to the time required for serial data processing (the switching time is about 26ms).

5.6.6 Precautions
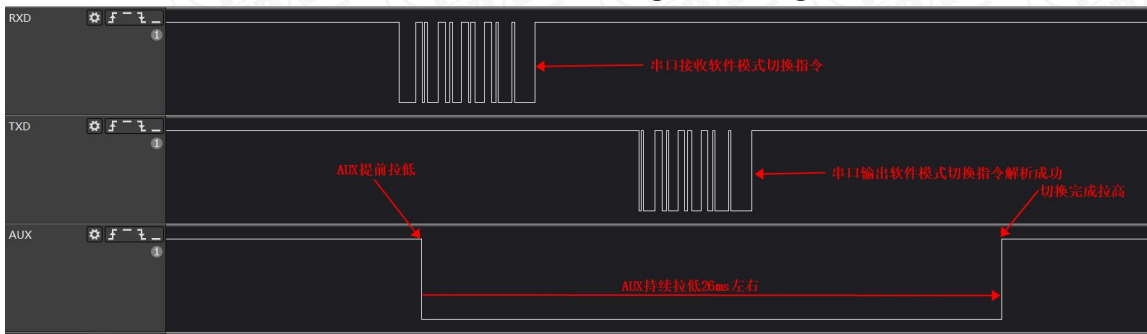
No.	AUX Precautions
1	For the above functions 1 and 2, the output low level is given priority, that is, if any one of the output low level conditions is met, the AUX outputs the low level; When all low level conditions are not satisfied, AUX outputs high level.
2	When AUX outputs a low level, it means that the module is busy, and the working mode detection will not be performed at this time; When the module AUX outputs a high level within 1ms, the mode switching will be completed.
3	After the user switches to the new working mode, the module will enter this mode at least 2ms after the rising edge of AUX; if AUX is always at a high level, the mode switching will take effect immediately.
4	When the user enters other modes from mode 3 (sleep mode) or during the reset process, the module will reset the user parameters, during which AUX outputs a low level.

5.7 Detailed explanation of wireless sending and receiving instructions

1 ） It is used for wireless data sending and receiving processing instructions, and the flip frequency is 100ms (according to the actual data size, airspeed, and baud rate, it may be pulled up or pulled down in advance if it is less than 100ms);

2 ） It indicates whether the module has data that has not been transmitted through the wireless, or whether the wireless data has been received and has not been sent through the serial port.
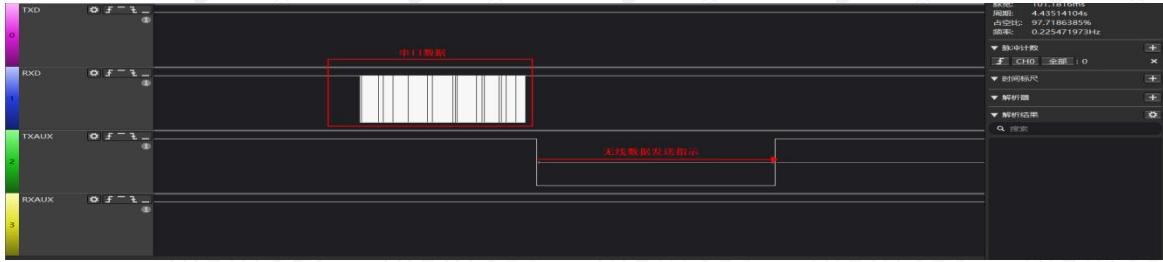
Wireless data transmission TX_AUX timing

Note: TX_AUX for wireless data transmission starts to pull low after the serial port has received data and the wireless data packet is established (the flip frequency is 100ms), and it will not flip until the radio frequency data transmission is completed, and it will remain high.
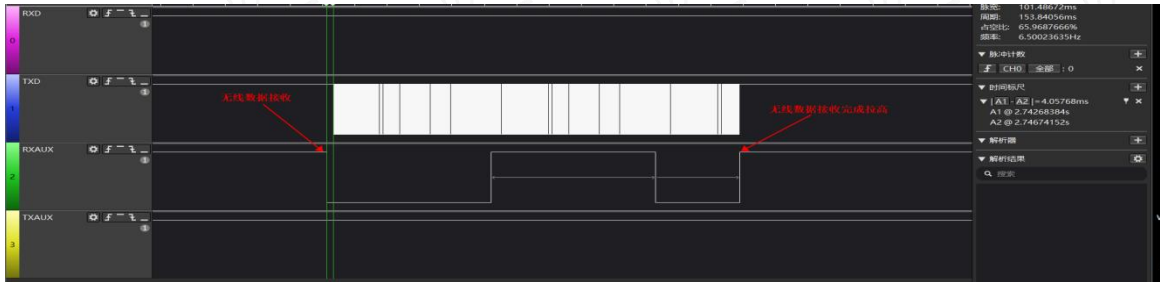
Wireless data reception RX_AUX timing

Note: RX_AUX for wireless data reception starts to be pulled down 3-4ms before the serial port outputs data (the flip frequency is 100ms), and it will not flip until the serial port output wirelessly receives data and remains high.

VI. Operating mode

The module has four working modes, which are set by pins M1 and M0; the details are shown in the following table:

Mode（0-3）	M1	M0	Mode Introduction	Remarks
0 transmission mode	0	0	Serial port open, wireless open, transparent transmission	Support special command over-the-air configuration
1 WOR mode	0	1	Can be defined as WOR sender and WOR receiver	Support air wake-up
2 Configuration Mode	1	0	Users can access the registers through the serial port to control the working status of the module	It needs to be configured at a baud rate of 9600
3 Deep sleep	1	1	Module goes to sleep	Support software mode switching function

6.1 Mode switch

No.	Remarks
1	● Users can combine M1 and M0 with high and low levels to determine the working mode of the module. The 2 GPIOs of the MCU can be used to control the mode switching; ● After changing M1 and M0: if the module is idle, after 1ms, it can start to work according to the new mode; ● If the module has serial port data that has not been transmitted wirelessly, the new working mode can only be entered after the transmission is completed; ● If the module receives the wireless data and sends out the data through the serial port, it needs to be sent out before it can enter the new working mode; ● Therefore, the mode switching can only be effective when the AUX output is 1, otherwise the switching will be delayed.
2	● For example: if the user continuously inputs a large amount of data and switches the mode at the same time, the mode switching operation is invalid at this time; the module will process all the user data before performing the new mode detection; ● So the suggestion is: Detect the output state of the AUX pin, wait for 2ms, after output the high level, and then switch mode.
3	● When the module is switched from other modes to sleep mode, if there is data that has not been processed yet; the module can only enter sleep mode after processing these data (including receiving and sending). This feature can be used for fast sleep to save power consumption; for example: the transmitter module works in mode 0, the user initiates serial port data "12345", and then does not need to wait for the AUX pin to be idle (high level), and can directly switch to sleep mode, The main MCU of the user is put to sleep immediately, and the module will automatically go to sleep within 1ms after sending all the user data wirelessly, thereby saving the working time of the MCU and reducing power consumption.
4	● Similarly, this feature can be used for any mode switching. After the module processes the current mode event, it will automatically enter the new mode within 1ms; thus saving the user's work of querying AUX, and achieving the purpose of fast switching ; For example, switching from transmit mode to receive mode; the user MCU can also go to sleep in advance before the mode switch, and use the external interrupt function to obtain the AUX change, so as to switch the mode.
5	● This operation mode is very flexible and efficient, and is completely designed according to the user's MCU operation convenience, and can reduce the workload of the entire system as much as possible, improve system efficiency, and reduce power consumption.

6.2   Normal Mode (Mode 0)

Type	When M0 = 0, M1 = 0, the module works in mode 0
Emission	Users can input data through the serial port, and the module will start wireless transmission.
Receive	The wireless receiving function of the module is turned on, and after receiving wireless data, it will be output through the serial port TXD pin.

6.3 WOR Mode (Mode 1)

Type	When M0 = 1, M1 = 0, the module works in mode 1
Emission	When defined as a transmitter, a wake-up code for a certain period of time will be automatically added before transmission.
Receive	Data can be received normally, and the receiving function is equivalent to mode 0.

6.4 Configuration Mode (Mode 2)

Type	When M0 = 0, M1 = 1, the module works in mode 2
Emission	Wireless transmission off
Receive	Wireless reception is off
Configuration	User can access registers to configure module operating status

6.5 Deep Sleep Mode (Mode 3)

Type	When M0 = 1, M1 = 1, the module works in mode 3
Emission	Unable to transmit wireless data.
Receive	Unable to receive wireless data.
Note	When entering other modes from sleep mode, the module will reconfigure parameters. During the configuration process, AUX remains low;Mode switching can be performed by software; after completion, it outputs a high level, so it is recommended that users detect the rising edge of T_BUSY.

VII. Register Read and Write Control

7.1 Instruction format

In configuration mode (mode 2: M1=1, M0=0), the list of supported commands is as follows (when setting, only 9600 and 8N1 formats are supported):

No.	Instruction format	Detailed Description

1	Register Setting	Command: C0+start address+length+parameter Response: C1+start address+length+parameter Example 1: Configure the channel as 0x09 Command Start Address Length Parameter Send: C0 05 01 09 Return: C1 05 01 09 Example 2: Configure the module address (0x1234), network address (0x00), serial port (9600 8N1), and airspeed (2.4K) at the same time Send: C0 00 04 12 34 00 62 Return: C1 00 04 12 34 00 62
2	Register Reading	Instruction: C1+start address+length Response: C1+start address+length+parameter Example 1: Reading a channel Command Start Address Length Parameter Send: C1 05 01 Return: C1 05 01 09 Example 2: Read module address, network address, serial port, airspeed (2.4k) at the same time Send: C1 00 04 Return: C1 00 04 12 34 00 62
3	Set temporary register	Command: C2 + start address + length + parameter Response: C1 + start address + length + parameter Example 1: Configure the channel as 0x09 Command Start Address Length Parameter Send: C2 05 01 09 Return: C1 05 01 09 Example 2: Configure the module address (0x1234), network address (0x00), serial port (9600 8N1), and airspeed (2.4K) at the same time Send: C2 00 04 12 34 00 62 Return: C1 00 04 12 34 00 62
4	Wireless Configuration	Command: CF CF + regular command Response: CF CF + regular response Example 1: Wireless configuration channel is 0x09 Wireless Command Header Command Start Address Length Parameter Send: CF CF C0 05 01 09 Return: CF CF C1 05 01 09 Example 2: Wirelessly configure the module address (0x1234), network address (0x00), serial port (9600 8N1), and airspeed (2.4K) at the same time Send: CF CF C0 00 04 12 34 00 62 Return: CF CF C1 00 04 12 34 00 62
5	Wrong format	Malformed response FF FF FF

7.2 Register Description

No.	Read and Write	Name	Description				Remark
00H	Read/Write	ADDH	ADDH（Default 0）				Module address high byte and low byte; Note: When the module address is equal to FFFF, it can be used as the broadcast and listening address, that is, the module will not perform address filtering at this time.
01H	Read/Write	ADDL	ADDL（Default 0）				
02H	Read/Write	NETID	NETID（Default 0）				Network address, used to distinguish the network; When communicating with each other, they should be set to the same.
03H	Read/Write	REG0	7	6	5	UART serial rate (bps)	For the two modules that communicate with each other, the serial port baud rate can be different, and the verification method can also be different; When continuously transmitting large data packets, users need to consider the data blocking caused by the same baud rate, and may even be lost; It is generally recommended that both sides of the communication have the same baud rate.
			0	0	0	Serial port baud rate is 1200	
			0	0	1	Serial port baud rate is 2400	
			0	1	0	Serial port baud rate is 4800	
			0	1	1	Serial port baud rate is 9600 (default)	
			1	0	0	Serial port baud rate is 19200	
			1	0	1	Serial port baud rate is 38400	
			1	1	0	Serial port baud rate is 57600	
			1	1	1	Serial port baud rate is 115200	
			4	3	Serial check digit		The serial port modes of both sides of the communication can be different;
			0	0	8N1 (default)		
			0	1	8O1		
			1	0	8E1		
			1	1	8N1 (equivalent to 00)		
			2	1	0	Wireless air rate (bps)	The air speed of both parties must be the same; The higher the air rate, the lower the delay and the shorter the transmission distance.
			0	0	0	Air rate 2.4k	
			0	0	1	Air rate 2.4k	
			0	1	0	Air rate 2.4k (Default)	
			0	1	1	Air rate 4.8k	
			1	0	0	Air rate 9.6k	
			1	0	1	Air rate 19.2k	
			1	1	0	Air rate 38.4k	
			1	1	1	Air rate 62.5k	
04H	Read/Write	REG1	7	6	Subcontracting settings		When the data sent by the user is less than the packet length, the serial output of the receiving end is presented as uninterrupted
			0	0	240 bytes (default)		
			0	1	128 bytes		

			1	0	64 bytes	continuous output;
			1	1	32 bytes	If the data sent by the user is larger than the packet length, the serial port of the receiving end will be output in packets.
			5	RSSI Ambient Noise Enable		After it is enabled, the C0 C1 C2 C3 instruction can be sent in the transmission mode or the WOR transmission mode to read the register; Register 0x00: Current ambient noise RSSI; Register 0X01: RSSI when data was last received (Current channel noise is: dBm =-RSSI/2); Instruction format: C0 C1 C2 C3+start address+read length; Return: C1 + address + read length + read valid value; such as: send C0 C1 C2 C3 00 01 Return C1 00 01 RSSI (address can only start from 00)
			0	Disabled (default)		
			1	Enable		
			4	3	Retain	
			2	Software mode switch		If you do not want to use the MO M1 pin to switch the working mode, you can enable this function and use a specific serial port command to switch working modes. Format: C0 C1 C2 C3 02 + working mode Send C0 C1 C2 C3 02 00 to switch to transparent transmission mode Send C0 C1 C2 C3 02 01 switch to WOR mode Send C0 C1 C2 C3 02 02 to switch to configuration mode Send C0 C1 C2 C3 02 03 switch to sleep mode Return: C1 C2 C3 02 + working mode Note: After enabling this function, WOR mode and sleep mode only support 9600 baud rate.
			0	Disabled (default)		
			1	Enable		
			1	0	Transmit power	Power and current have a non-linear relationship, and the power supply efficiency is the highest at the maximum power; The current does not decrease proportionally as the power decreases.
			0	0	30dBm（default）	
			0	1	27dBm	
			1	0	24dBm	
			1	1	21dBm	
05H	Read/ Write	REG2	Channel Control (CH) 0-83 respectively represent a total of 84 channels			Actual frequency= 410.125 + CH *1M
06H	Read/ Write	REG3	7	Enable RSSI bytes		When enabled, the module receives wireless data and outputs it through the serial port TXD, followed by an RSSI strength byte.
			0	disabled (default)		
			1	enable		
			6	transfer method		During fixed-point transmission, the module will recognize the first three bytes of the
			0	transparent transmission (default)		

			1	fixed point transmission		serial port data as: address high + address low + channel, and use it as the wireless transmission target.
			5	Relay function		After the relay function is enabled, if the target address is not the module itself, the module will start a forwarding; In order to prevent data return, it is recommended to use in conjunction with fixed-point mode; that is, the destination address and the source address are different.
			0	Disable relay function (default)		
			1	Enable relay function		
			4	LBT enable		After enabling, the wireless data will be monitored before transmission, which can avoid interference to a certain extent, but may cause data delay; The maximum stay time of LBT is 2 seconds, and it will be issued forcibly when it reaches two seconds.
			0	Disabled (default)		
			1	Enable		
			3	WOR Mode Transceiver Control		Only valid for mode 1; 1. In the receiving mode of WOR, the module can modify the delay time after wake-up, the default time is 0; 2. The receiver needs to send the command C0 09 02 03 E8 in the configuration mode (C0 is the write command, 09 is the register starter address, 02 is the length, 03 E8 is the set delay, the maximum FFFF is 65535ms, set to 0 disables wakeup delay.) 3. Data can be sent within the delay
			0	WOR receiver (default),Working in WOR monitor mode, the monitor cycle is shown below (WOR cycle), which can save a lot of power consumption.		
			1	WOR transmitter The transceiver is turned on, and a wake-up code for a certain period of time is added when transmitting data.		

			2	1	0	WOR cycle	Only valid for mode 1; Period T= (1+WOR)*500ms, the maximum is 4000ms, and the minimum is 500ms; The longer the WOR monitoring interval period, the lower the average power consumption, but the greater the data delay; The sender and receiver must be the same (very important)
			0	0	0	500ms	
			0	0	1	1000ms	
			0	1	0	1500ms	
			0	1	1	2000ms	
			1	0	0	2500ms	
			1	0	1	3000ms	
			1	1	0	3500ms	
			1	1	1	4000ms	

07H	Write	CRYPT_H	Key high byte (default 0)	Write only, read returns 0; It is used for encryption to avoid the interception of wireless data in the air by similar modules; The module will use these two bytes as a calculation factor to transform and encrypt the air wireless signal.
08H	Write	CRYPT_L	key low byte (default 0)	
80H～86H	Read	PID	Product information 7 bytes	Product information 7 bytes

7.3 Factory Default Parameters

Model	Factory default parameter value：C0 00 00 62 00 00

Module model	Frequency	Address	Channel	Air Rate	Baud Rate	Serial Format	Transmit Power
E22-400T30E	433.125MHz	0x0000	0x17	2.4kbps	9600	8N1	30dbm

VIII. Use of relay networking mode

No	Relay Mode Description
1	After setting the relay mode through the configuration mode, switch to the general mode, and the relay starts to work.
2	In relay mode, ADDH and ADDL are no longer used as module addresses, but are forwarded and paired corresponding to NETID respectively. If one network is received, it will be forwarded to the other network;The network ID of the repeater itself is invalid.
3	In relay mode, the relay module cannot send and receive data, and cannot perform low-power operation.
4	When the user enters other modes from mode 3 (sleep mode) or during the reset process, the module will reset the user parameters, during which AUX outputs a low level.

Relay networking rules description:

1. Forwarding rules, the relay can forward data between two NETIDs in both directions.

2. In relay mode, ADDH\ADDL is no longer used as module address, but as NETID forwarding pairing.

As shown in the figure:

①First-level relay

"Node 1" NETID is 08.

"Node 2" NETID is 33.

The ADDH\ADDL of relay 1 are 08 and 33 respectively.

So the signal sent by node 1 (08) can be forwarded to node 2 (33)

At the same time, the addresses of node 1 and node 2 are the same, so the data sent by node 1 can be received by node 2.

②Secondary relay

The ADDH\ADDL of relay 2 are 33 and 05 respectively.

So relay 2 can forward relay 1's data to network NETID: 05.

Therefore, node 3 and node 4 can receive the data of node 1. Node 4 outputs data normally, and node 3 and node 1 have different addresses, so no data is output.

③Two-way relay

As shown in the configuration: the data sent by node 1 can be received by nodes 2 and 4, and the data sent by nodes 2 and 4 can also be received by node 1.
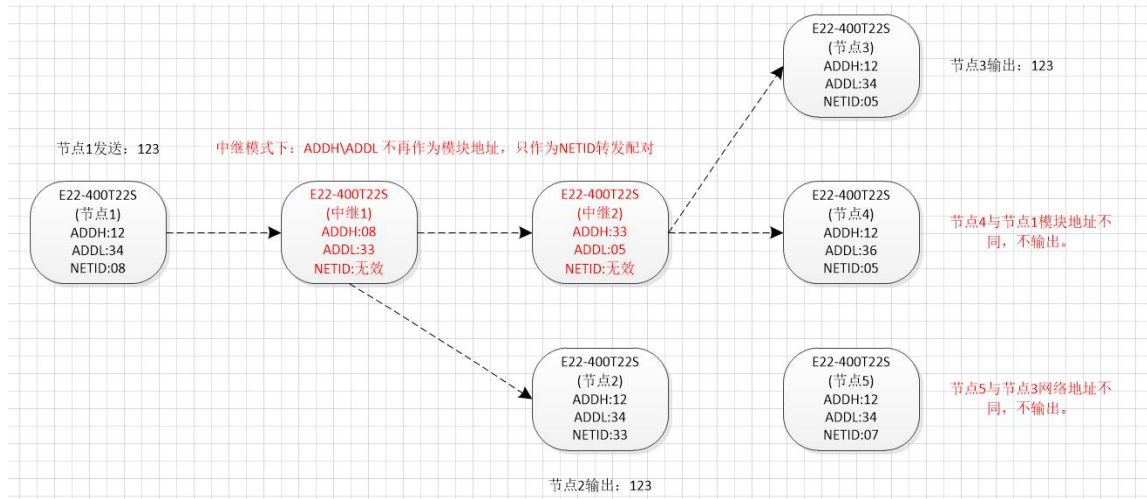
IX. Host computer configuration instructions

- The following figure shows the display interface of the E22-400T30E configuration host computer. Users can switch to the command mode through M0 and M1, and quickly configure and read parameters on the host computer.

- In the configuration of the host computer, the module address, frequency channel, network ID, and key are all displayed in decimal mode; the value range of each parameter is:

  Network address: 0～65535

  Frequency channel: 0～83

  Network ID: 0～255

  Key: 0～65535

- Users need to pay special attention when using the host computer to configure the relay mode, because in the host computer, each parameter is displayed in decimal mode, so the module address and network ID need to be converted into decimal when filling in;

For example, the network ID input by transmitter A is 02, and the network ID input by receiver B is 10, then when relay terminal R sets the module address, convert the hexadecimal value 0X020A to decimal value 522 and fill in as relay terminal R the module address;

That is, the module address value that needs to be filled in by the relay terminal R at this time is 522.

Ⅹ. **Hardware Design**

- It is recommended to use a DC regulated power supply to power the module, the power supply ripple coefficient should be as small as possible, and the module should be grounded reliably;
- Please pay attention to the correct connection of the positive and negative poles of the power supply, such as reverse connection may cause permanent damage to the module;
- Please check the power supply to ensure that it is between the recommended power supply voltages. If it exceeds the maximum value, the module will be permanently damaged;
- Please check the stability of the power supply, the voltage should not fluctuate greatly and frequently;
- When designing the power supply circuit for the module, it is often recommended to reserve more than 30% of the margin, so that the whole machine can work stably for a long time;
- The module should be kept away from the parts with large electromagnetic interference such as power supply, transformer and high-frequency wiring as far as possible;
- High-frequency digital traces, high-frequency analog traces, and power traces must avoid the underside of the module. If it is necessary to pass under the module, assuming that the module is soldered on the Top Layer, lay copper on the Top Layer of the contact part of the module (all copper). And well grounded), it must be close to the digital part of the module and routed on the Bottom Layer;
- Assuming that the module is soldered or placed on the Top Layer, it is also wrong to arbitrarily route wires on the Bottom Layer or other layers, which will affect the stray and receiving sensitivity of the module to varying degrees;
- Assuming that there are devices with large electromagnetic interference around the module, it will also greatly affect the performance of the module. It is recommended to stay away from the module according to the intensity of the interference. If the situation allows, appropriate isolation and shielding can be done;
- Assuming that there are traces with large electromagnetic interference around the module (high-frequency digital, high-frequency analog, power traces), it will also greatly affect the performance of the module. It is recommended to stay away from the module according to the intensity of the interference. Proper isolation and shielding;
- If the communication line uses 5V level, a 1k-5.1k resistor must be connected in series (not recommended, there is still a risk of damage);
- Try to stay away from some TTL protocols whose physical layer is also 2.4GHz, for example: USB3.0;
- The antenna installation structure has a great influence on the performance of the module, make sure that the antenna is exposed and preferably vertically upward;
- When the module is installed inside the casing, a high-quality antenna extension cable can be used to extend the antenna to the outside of the casing;
- The antenna must not be installed inside the metal shell, which will greatly weaken the transmission distance.

XI. Common Issue

11.1 The transmission distance is not ideal

- When there is a straight line communication obstacle, the communication distance will be correspondingly attenuated;
- Temperature, humidity, and co-channel interference will increase the communication packet loss rate;
- The ground absorbs and reflects radio waves, and the test effect close to the ground is poor;
- Seawater has a strong ability to absorb radio waves, so the seaside test effect is poor;
- There are metal objects near the antenna, or placed in a metal shell, the signal attenuation will be very serious;
- The power register is set incorrectly, and the air rate is set too high (the higher the air rate, the closer the distance);
- The low voltage of the power supply at room temperature is lower than the recommended value, and the lower the voltage, the lower the output power;
- The antenna and the module are poorly matched or the quality of the antenna itself is a problem.

11.2 Module is easily damaged

- Please check the power supply to ensure that it is between the recommended power supply voltages. If it exceeds the maximum value, the module will be permanently damaged;
- Please check the stability of the power supply, the voltage should not fluctuate greatly and frequently;
- Please ensure that the installation and use of anti-static operation, high-frequency components electrostatic sensitivity;
- Please ensure that the humidity during installation and use should not be too high, and some components are humidity-sensitive devices;
- If there is no special requirement, it is not recommended to use it at too high or too low temperature.

11.3 Bit error rate too high

- There is co-frequency signal interference nearby, stay away from the interference source or modify the frequency and channel to avoid interference;
- Unsatisfactory power supply may also cause garbled characters, be sure to ensure the reliability of the power supply;
- The extension line and feeder line are of poor quality or too long, which will also cause a high bit error rate.

XII. Welding Work Guide

12.1 Reflow Temperature

Profile Feature	Curve feature	Sn-Pb Assembly	Pb-Free Assembly
Solder Paste	Solder Paste	Sn63/Pb37	Sn96.5/Ag3/Cu0.5
Preheat Temperature min （Tsmin）	Preheat Temperature min （Tsmin）	100℃	150℃
Preheat temperature max (Tsmax)	Preheat temperature max (Tsmax)	150℃	200℃
Preheat Time (Tsmin to Tsmax)(ts)	Preheat Time (Tsmin to Tsmax)(ts)	60-120 sec	60-120 sec
Average ramp-up rate(Tsmax to Tp)	Average ramp-up rate(Tsmax to Tp)	3℃/second max	3℃/second max
Liquidous Temperature (TL)	Liquidous Temperature (TL)	183℃	217℃
Time（tL）Maintained Above（TL）	Time（tL）Maintained Above（TL）	60-90 sec	30-90 sec
Peak temperature （Tp）	Peak temperature （Tp）	220-235℃	230-250℃
Aveage ramp-down rate （Tp to Tsmax）	Aveage ramp-down rate （Tp to Tsmax）	6℃/second max	6℃/second max
Time 25℃ to peak temperature	Time 25℃ to peak temperature	6 minutes max	8 minutes max

12.2 Reflow Soldering Curve
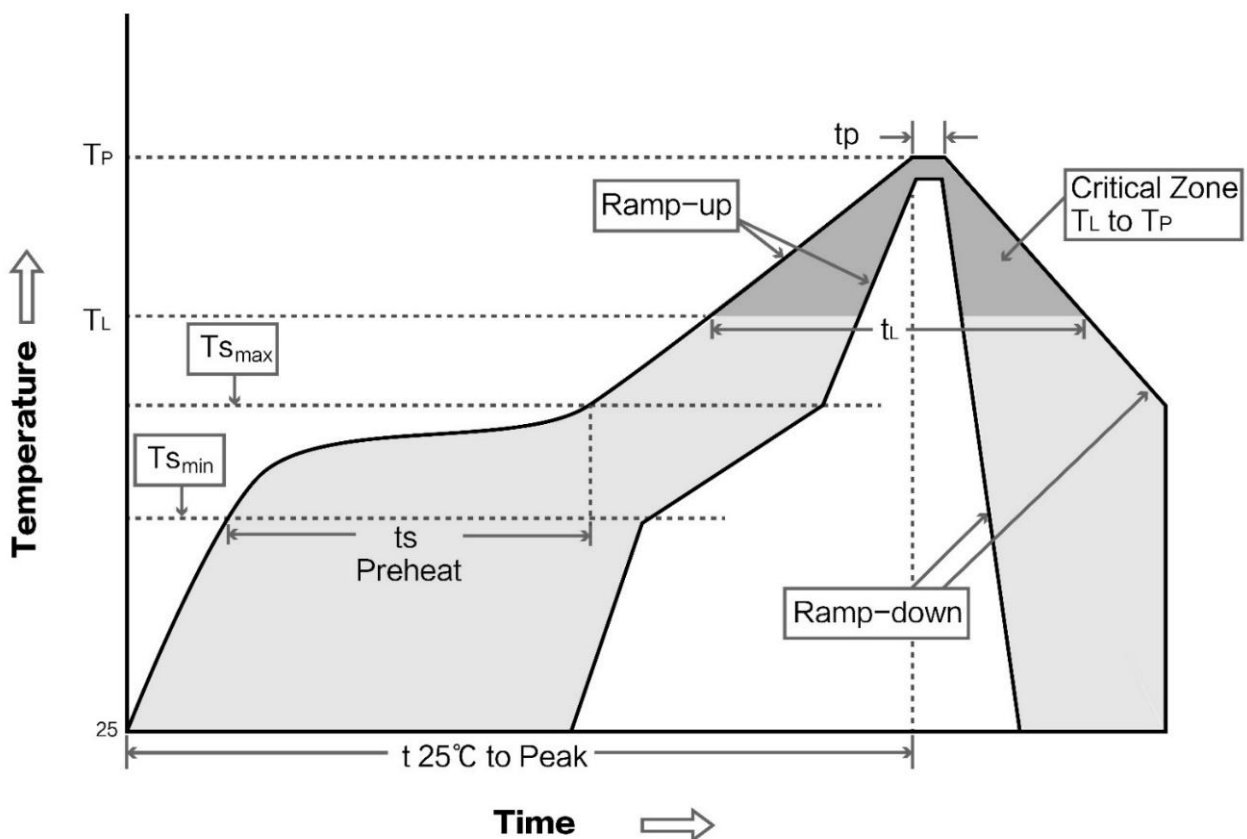
XIII.Related models

Product Model	Chip Solution	Carrier Frequency Hz	Transmit power dBm	Test distancekm	Package form Product size	Product size mm	communication interface
E22-230T22S	SX1262	230M	22	5	SMT	16*26	TTL
E22-230T30S	SX1262	230M	30	10	SMT	20*40.5	TTL
E22-400T22S	SX1268	433/470M	22	5	SMT	16*26	TTL
E22-400T30E	SX1268	433/470M	30	10	SMT	20*40.5	TTL
E22-900T22S	SX1262	868/915M	22	5	SMT	16*26	TTL
E22-900T30S	SX1262	868/915M	30	10	SMT	20*40.5	TTL
E22-400M22S	SX1268	433/470M	22	7	SMT	14*20	SPI
E22-400M30S	SX1268	433/470M	30	12	SMT	24*38.5	SPI
E22-900M22S	SX1262	868/915M	22	7	SMT	14*20	SPI
E22-900M30S	SX1262	868/915M	30	12	SMT	24*38.5	SPI

XIV. Antenna Guide

14.1 Antenna recommendation

Antennas play an important role in the communication process, and often inferior antennas will have a great impact on the communication system. Therefore, our company recommends some antennas as antennas with excellent performance and reasonable price for our wireless modules.

Product Model	Type	Band Hz	Interface	Gain dBi	Height mm	Feeder cm	Features
TX433-NP-4310	Flexible antenna	433M	Welding	2.0	43.8*9.5	-	Built in flexible, FPC soft antenna
TX433-JZ-5	Rubber rod antenna	433M	SMA-J	2.0	52	-	Ultra short straight, omnidirectional antenna
TX433-JZG-6	Rubber rod antenna	433M	SMA-J	2.5	62	-	Ultra short straight, omnidirectional antenna
TX433-JW-5	Rubber rod antenna	433M	SMA-J	2.0	50	-	Bending rubber rod, omnidirectional antenna
TX433-JWG-7	Rubber rod antenna	433M	SMA-J	2.5	75	-	Bending rubber rod, omnidirectional antenna
TX433-JK-11	Rubber rod antenna	433M	SMA-J	2.5	110	-	Bendable rubber rod, omnidirectional antenna
TX433-JK-20	Rubber rod antenna	433M	SMA-J	3.0	210	-	Bendable rubber rod, omnidirectional antenna

TX433-XPL-100	Sucker antenna	433M	SMA-J	3.5	185	100	Small sucker antenna, cost performance
TX433-XP-200	Sucker antenna	433M	SMA-J	4.0	190	200	Neutral sucker antenna, low loss
TX433-XPH-300	Sucker antenna	433M	SMA-J	6.0	965	300	Large sucker antenna, high gain
TX490-JZ-5	Rubber rod antenna	470/490M	SMA-J	2.0	50	-	Ultra short straight, omnidirectional antenna
TX490-XPL-100	Sucker antenna	470/490M	SMA-J	3.5	120	100	Small sucker antenna, cost performance

Revision history

Version	Revision Date	Revision Description	Maintainer
1.0	2022.09.15	Initial version	Bin

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