E70-915NW30S User Manual

915MHz 1W Star Network SMD Wireless Module

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1. Overview

1.1 Introduction

E70-915NW30S is the star network module, operating at 915MHz, based on originally imported TI CC1310 and 15.4-Stack protocol, with coordinator and terminal as a whole. There are long range, standard range and high-speed transmission modes. Maximum 200 nodes can send data to one coordinator. Use industry-standard AT commands for operating configuration, which greatly simplifies user operations.

E70-915NW30S is the first 915MHz wireless module that solves a series of problems caused by traditional modules. Users will spend less effort to deal with complex network protocols, which greatly reduces the difficulty of customer development and shortens the user's development period. The protocol guarantees the stability and packet rate of the entire wireless communication system.

E70-915NW30S strictly follows design standards of FCC, CE, CCC and meets various RF certification requirements for exporting.

Model No.	Frequency	Transmit power	Reference distance(PCB/IPX)	Package	Antenna
E70 (915NW30S)	915M	30dBm	6500m	SMD	Stamp hole/IPEX

2. Features

[Ultra-low power consumption]: The average current in sleep mode is less than 4uA.

[Three transmission formats]: In coordinator mode, it supports broadcast transmission, short address transmission, and long address transmission.

[Multiple Sends and Receives]: Supports up to 200 nodes concurrently transmitting data to ensure the reliability and timeliness of data transmission.

[AES128 encryption]: Communication uses AES128 data encryption to ensure data packet security and reliability.

[Parameter saving]: After the parameters are set by the user, the module parameters will be saved and will not be lost when the power is turned off. After the power is turned on again, the module will work according to the set parameters.

[Three transmission modes]: The firmware integrates long-distance mode, standard transmission mode, and high-speed rate mode, which is suitable for many different applications.

[Low-power node]: Can be configured as a low-power node (sleeping node) mode. In this mode, the node periodically wakes up to request data.

[8 kinds of data output modes]: Users can configure multiple data output modes to meet different demand scenarios.
[CSMA / CA]: Supports carrier sense multiple access with collision avoidance (CSMA-CA).

3. Technical Parameters

3.1 General parameters

Model No.	Size	Net weight	working temperature	Working humidity	Storage temperature
E70 (915NW30S)	24 * 38.5 mm	4.9±0.1g	-40 ~ 85℃	10% ~ 90%	-40 ~ 125℃

3.2 Electrical parameters

3.1.1 Transmit current

Model No.	Min	Typ	Max	Unit	Remark
E70 (915NW30S)	580	600		mA	● When designing the power supply circuit for the module, it is often recommended to reserve more than 30% of the margin, as the whole machine is conducive to long-term stable work; ● The current required for the instant of launch is large but often because the transmission time is extremely short, the total energy consumed may be smaller; ● When customers use an external antenna, the degree of impedance matching between the antenna and the module at different frequency points will affect the magnitude of the transmit current to varying degrees.

3.1.2 Receiving current

Product model	Min	Typ	Max	Unit	Remark
E70 (915NW30S)	12	13	14	mA	● The current consumed by the RF chip in the pure receiving state is called the receiving current. Some RF chips with communication protocols or developers have loaded some self-developed protocols on the whole machine, which may cause the receiving current of the test to be too large； ● The current in the purely receiving state is often mA level, and the "receiving current" of the μA level needs to be processed by the developer through software;

3.1.3 Sleep current

Product model	Min	Typ	Max	Unit	Remark
E70 (915NW30S)	1.0	2.0	3.5	μA	● Sleep current usually refers to the current consumed by the CPU, RAM, clock and some registers reserved, and the SoC is in a very low power consumption state; ● Sleep current is often much smaller than the current consumed by the power supply part of the machine at no load, so it is not necessary to be too demanding.

3.1.4 Supply voltage

Product model	Min	Typ	Max	Unit	Remark
E70 (915NW30S)	3.3	5.0	5.2	V DC	● The power supply voltage is at the maximum value for a long time, and there is a risk of burning the module; ● The power supply pin has a certain anti-surge capability, but it must not be processed without the existence of pulses higher than the maximum supply voltage;

					● The power supply voltage is not recommended to be lower than the recommended value. When the power supply voltage is lower than the recommended value, the RF parameters will be affected to varying degrees.

3.1.5 Communication level

Product model	Min	Typ	Max	Unit	Remark
E70 (915NW30S)	2.5	3.3	3.6	V DC	● The communication level is higher than the maximum value of the module communication level, there is a high risk of burning the module; ● Although there are many ways to change the communication level, it will greatly affect the power consumption of the whole machine.

3.2 RF parameters

3.2.1 Transmit power

Product model	Min	Typ	Max	Unit	Remark
E70 (915NW30S)	29	30	30	dBm	● Since the material itself has a certain error, a single LRC component has an error of ±0.1%. However, since a plurality of LRC components are used in the entire RF loop, there is a case where error accumulation occurs, resulting in a difference in transmission current of different modules; ● Reducing the transmit power can reduce power consumption to some extent, but reducing the transmit power emissions for a number of reasons reduces the efficiency of the internal PA; ● Transmit power will decrease as the supply voltage decreases

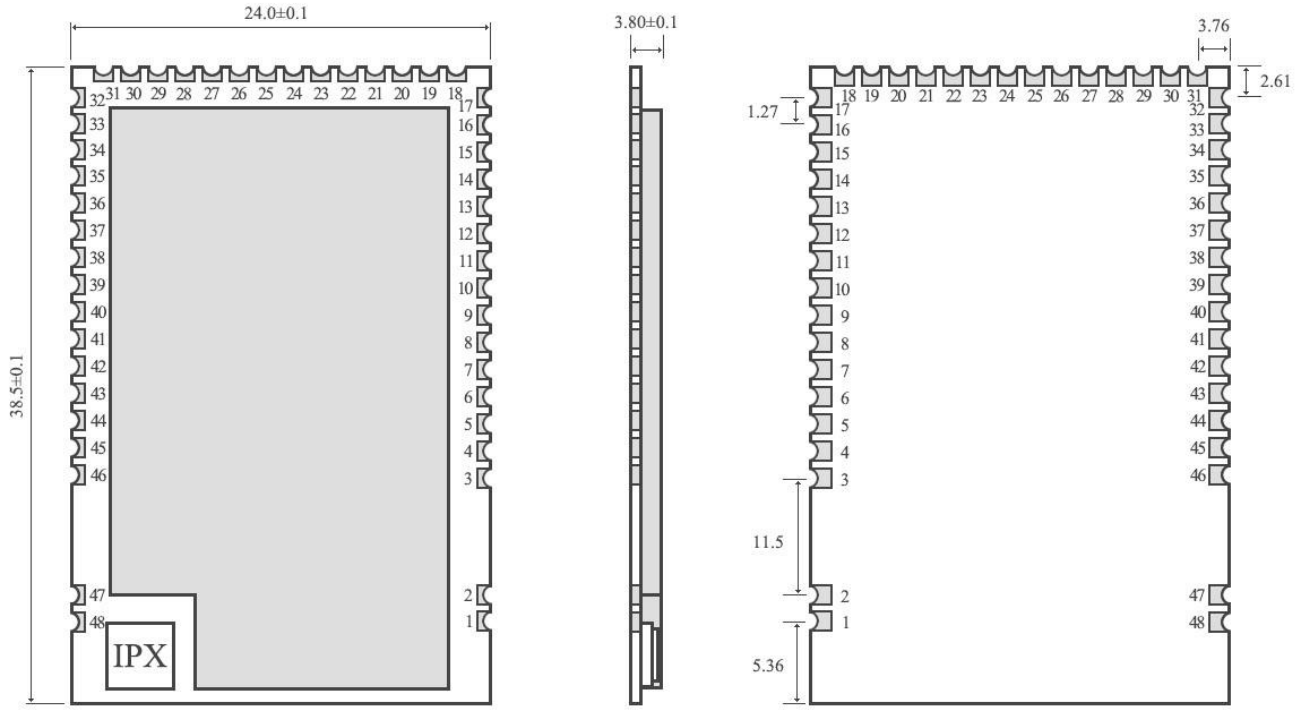
3.2.2 Receiving sensitivity

Product model	Min	Typ	Max	Unit	Remark
E70 (915NW30S)	-115	-116	-117	dBm	● The current sensitivity is tested at an air rate of 2.5kbps. ● Since the material itself has a certain error, a single LRC component has an error of ±0.1%. However, since a plurality of LRC components are used in the entire RF loop, there is a case where error accumulation occurs, resulting in a difference in receiving sensitivity of different modules; ● After increasing the airspeed of the module, the receiving sensitivity will decrease, resulting in a decrease in communication distance.

3.3 Coverage

Product model	Min	Typ	Max	Unit	Remark
E70 (915NW30S)	4000	4400	6000	m	● Clear and open, antenna gain is 5dBi, antenna height is 2.5 meters, and air rate is 2.5kbps; ● Each packet data interval is 2s, 100 packets of data are sent, each packet of data is 30 bytes, and the packet loss rate is less than 5% is effective communication distance; ● In order to obtain meaningful and reproducible test results, we choose to conduct tests in sunny and clear suburbs where almost has no electromagnetic interference; ● There are obstacles and electromagnetic interference, and the distance will decrease to varying degrees.

4 Size and pin definition



No.	Pin item	Pin direction	Application
1	GND	Ground	Ground electrode
2	GND	Ground	Ground electrode
3	GND	Ground	Ground electrode
4	NC	Reserved pin	Reserved, to be floated
5	NC	Reserved pin	Reserved, to be floated
6	NC	Reserved pin	Reserved, to be floated
7	NC	Reserved pin	Reserved, to be floated
8	NC	Reserved pin	Reserved, to be floated
9	NC	Reserved pin	Reserved, to be floated
10	NC	Reserved pin	Reserved, to be floated
11	NC	Reserved pin	Reserved, to be floated
12	NC	Reserved pin	Reserved, to be floated
13	NC	Reserved pin	Reserved, to be floated
14	NC	Reserved pin	Reserved, to be floated
15	NC	Reserved pin	Reserved, to be floated
16	LINK	output	For indicating the current network connection status of the module, it can be configured as drain open circuit output or push-pull output. For details, please refer to the parameter setting, a 1K protection resistor shall be connected in series externally (it can be suspended).

17	GND	Ground	Ground electrode
18	NC	Reserved pin	Reserved, to be floated
19	NC	Reserved pin	Reserved, to be floated
20	NC	Reserved pin	Reserved, to be floated
21	NC	Reserved pin	Reserved, to be floated
22	TCKC	Input	JTAG TCKC
23	TMSC	Input	JTAG TMSC
24	RESET	Input	Module reset pin, low level effective
25	NC	Reserved pin	Reserved, to be floated
26	M0	Input	M1M0 The four working modes of the module are determined by the joint combination. When in use, a 1K protection resistor shall be connected in series externally, and a 1M pull-up resistor shall be added (it shall not be suspended, otherwise, it can be grounded).
27	M1	Input	M1M0 The four working modes of the module are determined by the joint combination. When in use, a 1K protection resistor shall be connected in series externally, and a 1M pull-up resistor shall be added (it shall not be suspended, otherwise, it can be grounded).
28	VCC		Power supply：2.6V ~ 5.5V DC
29	VCC		Power supply ：2.6V ~ 5.5V DC
30	GND	Ground	Ground electrode
31	GND	Ground	Ground electrode
32	ACK	Output	The user indicates the data transmission result of the module, which is pulled down before transmission and pulled up after success. It can be configured as drain open circuit output or push-pull output. When it is used, a 1K protection resistor should be connected externally in series (it can be suspended).
33	NC	Reserved pin	Reserved, to be floated
34	NC	Reserved pin	Reserved, to be floated
35	NC	Reserved pin	Reserved, to be floated
36	RXD	Input	TTL UART inputs, connects to external (MCU, PC) TXD output pin. Can be configured as open-drain or pull-up input.
37	TXD	Output	TTL UART outputs, connects to external RXD (MCU, PC) input pin. Can be configured as open-drain or push-pull output
38	AUX	Output	To indicate module ’ s working status & wakes up the external MCU. During the procedure of self-check initialization, the pin outputs low level. Can be configured as push-pull output (suspending is allowed).
39	NC	Reserved pin	Reserved, to be floated
40	NC	Reserved pin	Reserved, to be floated
41	NC	Reserved pin	Reserved, to be floated
42	PA_EN	Output	Internal single chip microcomputer control PA pin, high level effective, connected 45 pin
43	LNA_EN	Output	Internal single chip microcomputer control LNA pin, high level effective, connected 44 pin

44	LNA_EN	Input	Internal single chip microcomputer control LNA pin, high level effective, connected 43 pin
45	PA_EN	Input	Internal single chip microcomputer control PA pin, high level effective, connected 42 pin
46	GND	Ground	Ground electrode
47	GND	Ground	Ground electrode
48	ANT		Antenna 50 ohm impedance

★ E70 (915NWxxS) series can achieve pin compatibility, Pin to Pin replacement.

★ Single chip control PA, LNA truth table is as follows:

	PA_EN	LNA_EN
Transmitting	1	0
Receiving	0	1
Sleeping	0	0

5 Firmware Transmitting mode

5.1 Transparent transmission

	Format	Values
When the coordinator is set to transparent transmission, the coordinator will send broadcast message. At this time, all non-dormant nodes in the entire network will receive data.		

5.2 Short address transmission

	Format	Values
Coordinator short address transmission format: short address + valid data 00 00 or FF FF are broadcast address		
Coordinator	HEX	Sending：00 01 AA BB CC
Node A address 00 01	HEX	Receiving：AA BB CC
Node B address 00 02	HEX	Null
Node C address 00 03	HEX	Null
Coordinator	HEX	FF FF AA BB CC
Node A address 00 01	HEX	AA BB CC
Node B address 00 02	HEX	AA BB CC
Node C address 00 03	HEX	AA BB CC

5.3 Long address transmission

	Format	Values
Coordinator short address transmission format: short address + valid data 00 00 00 00 00 00 00 00 00 00 or FF FF FF FF FF FF FF FF are broadcast address;		
Coordinator	HEX	Sending：0A 01 AA 45 65 13 12 44 AA BB CC
Node A address: 0A 01 AA 45 65 13 12 44	HEX	Receiving：AA BB CC
Node B address： 0D 55 18 42 1A 27 29 64	HEX	Null
Node C address: A4 78 02 46 B5 1C 5A 02	HEX	Null
Coordinator	HEX	FF FF FF FF FF FF FF FF AA BB CC
Node A address: 0A 01 AA 45 65 13 12 44	HEX	AA BB CC
Node B address: 0A 01 AA 45 65 13 12 44	HEX	AA BB CC
Node C address: 0A 01 AA 45 65 13 12 44	1 HEX	AA BB CC

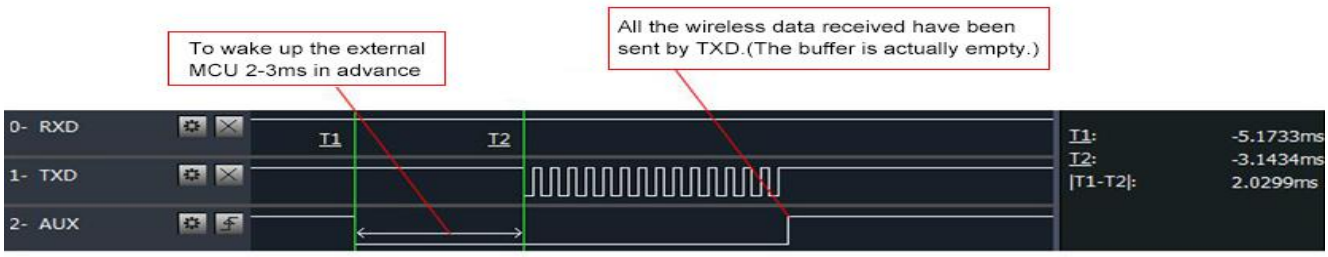
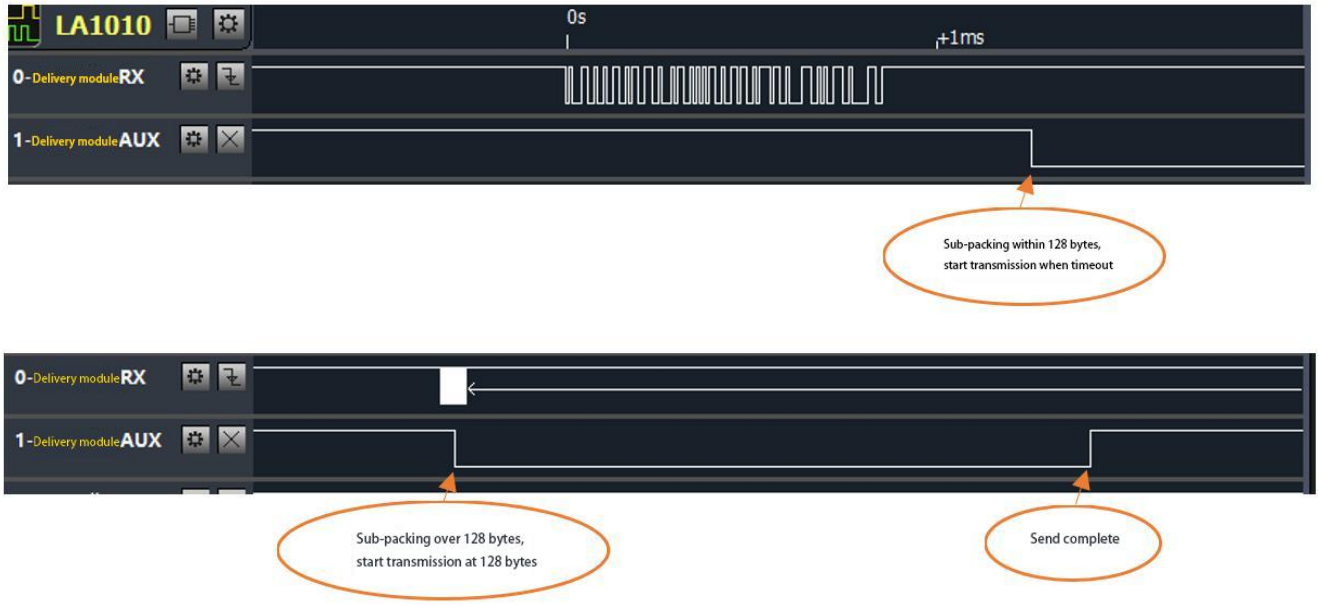
6.Device status

No	Description（STM8L MCU）
1	The UART module is TTL level.
2	For some MCU works at 5V DC, it may need to add 4-10K pull-up resistor for the TXD & AUX pin.

6.1 AUX description

It can indicate whether there are data that are yet to send via wireless way, or whether all wireless data has been sent through UART, or whether the module is still in the process of self-check initialization.

No.	Description

1	【Indication of UART output】can be used to wake up external MCU.  **Timing Sequence Diagram of AUX when TXD pin transmits**
2	【Indication of wireless transmitting】 1.The length of the buffer is 512 bytes, and the single packet must not exceed 128 bytes, when Aux=1, users can transmit data continuously within 128 bytes. 2.When AUX = 1, it means that all the UART data of the module have been transmitted already.  **Timing Sequence Diagram of AUX when RXD pin receives**

6.2 LINK description

- The LINK pin indicates the current network status, after the node is connected to the network, the current pin is pulled low. The external device can query the device network status through the pin level. In the coordinator mode, the pin indicates if the module establishes the network normally.

6.3 ACK description

- The ACK pin is used to indicate the status of the last user's data transmission. Before transmitting, the pin is pulled low. After the transmission is successful, the pin is pulled high. The user can use this pin state to judge if the data has arrived successfully. This pin function cannot indicate the coordinator to send broadcast message.
- Note: In 802.15.4 protocol, the device will use the CSMA/MA technology to access the channel before sending data. When the receiving device receives the data, the returned ACK does not have this mechanism. This means that even if the receiving device can receive data in extreme conditions, sending device ACK pin indicates that the last data transmission failed.

7.Operating mode

	M1	M0	Description	Remarks
Coordinator mode	0	0	Set up a network to manage network node information	Transfer data according to input and output modes
Normal node	0	1	Send and receive data at any time	High real-time performance
Dormant node	1	0	Low-power reception, sending data at any time	Receive delay, send need to wake up the serial port
Sleep mode	1	1	Cannot send and receive data, system sleeps	The fixed baud rate is 115200 8N1

7.1.Coordinator mode

If the user configures the operating mode 4,（M0=0,M1=0）or the user configures the operating mode as 0, the module works in the coordinator mode. In the coordinator mode, the coordinator can set up the network, coordinator is the central node of the network, there must be a coordinator in the network.

The coordinator configurable data input mode is:

Broadcast transmission. When configured to broadcast, all non-dormant devices on the entire network will receive data. The ACK pin indicates transmission successfully all the time.

Short address transmission, when configured to short address transmission, the user must specify the short address before sending data.
Long address transmission. When configured to long address transmission, the user must specify the long address before sending data.

7.2.Normal node

If the user configures the operating mode 4, （M0=0,M1=1）or the user configures the operating mode as 1, the module works in the normal node mode. In the normal node mode, the data can be received and sent in real time. It is suitable for application with low power consumption but high real-time requirement.

7.3.Dormant node

If the user configures the operating mode as 4, M0=1,M1=0, or the user configures the operating mode as 2, the module works in the dormant node mode, the device request if there is data transmitted by coordinator according to the user-configured sleep period , The non-broadcast data sent by the coordinator will be temporarily stored inside the coordinator. The device is in low power consumption during the sleep period. If the sleep node wants to send data actively, the user should send no more than two bytes to wake up the device. After the byte data is used to wake up the device and the wake-up byte is sent, the user needs to wait for more than 100ms to send the real data. After the wake-up byte is sent, the user needs to wait for 100ms to send the real data and the wake-up data will be discarded. After the device was waken up, the module will open the serial port, receiving AT command, if more than 2 seconds, there is no data input, the module will close serial port and go to sleep.The sleep node is suitable for applications where the user requires high power consumption but does not require high real-time data. The input transmission format of the coordinator cannot be broadcast mode when sending data to the sleeping node , instead, the AT + TFICFG = Value command should be used to configure its input mode to short address or long address mode. Then Communicate with the sleeping node according to the usage of this AT command.

7.4 Configuration mode

When M0=1,M1=1,the device will switch to configuration mode. In the this mode, the serial port parameters are: 115200, 8N1, and the average operating current is 2uA. In this mode, the module cannot send and receive data. When the external AT instruction is configured, needs the serial port to send no more than two bytes data to wake up the device .After the wake-up byte is sent, the user needs to wait for 100ms to send the real data and the wake-up data will be discarded. After the device was waken up, the module will open the serial port, receiving AT command, if more than 2 seconds, there is no data input, the module will close serial port and go to sleep. The next AT command requires the user to resend the wake-up byte.

7.5 Mode switching

No	Remarks
1	The user can decide the operating mode by the combination of M1 and M0
2	In any work mode, the user can configure the operating mode through the AT command
3	When M0=1,M1=1, the serial port parameters are 115200, 8N1(fixed)

8.Quick start

8.1 Communication between normal node and coordinator

Coordinator configuration

Open the serial port assistant, select the serial port corresponding to the device, and set the serial port parameters (default is 115200, 8N1)

Enter "+++" without line breaks to enter the AT command mode. When receiving "Enter AT Mode", the AT mode is successfully entered. As shown in Figure 5-1:

Enter "AT+HELP" with line breaks to see all instructions. As shown in Figure 1:

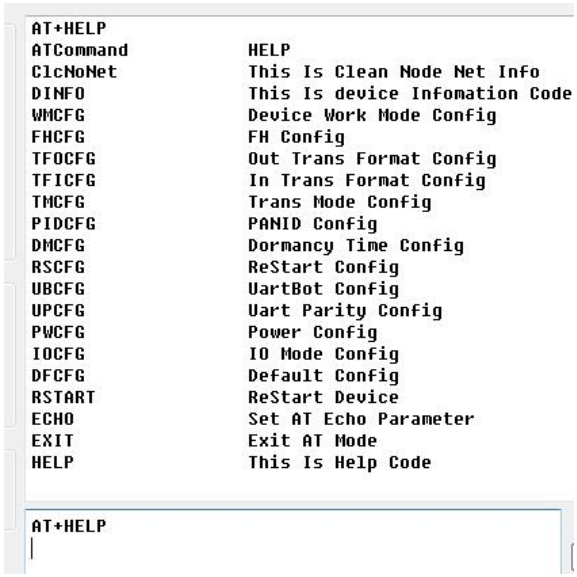


Figure 1

Then enter "AT+WMCFG=0" with line breaks to configure the device as the coordinator mode, as shown in Figure 2:

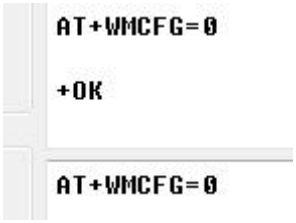


Figure 2

Then enter “AT+RSTART” to restart the device with a line break. The coordinator configuration is complete. As

shown in Figure 3:

Figure 3

Normal node configuration

Open the serial port assistant and select the serial port corresponding to the device. Set the baud rate to 115200, the data bit to 8 bits, the parity bit to none, the stop bit to 1 bit, and the flow control is disabled, open the serial port.

Enter "+++" without line breaks to enter the AT command mode. When receiving “Enter AT Mode", the AT mode is successfully entered.

Enter "AT+HELP" with line breaks to see all instructions. As shown in Figure 4:

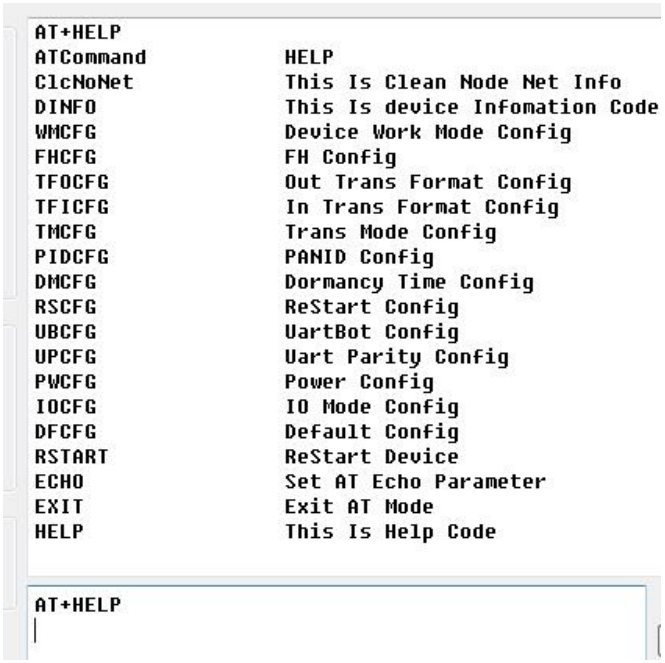


Figure 4

Then enter "AT+WMCFG=1" with line breaks to configure the device as the coordinator mode, as shown in Figure 5:

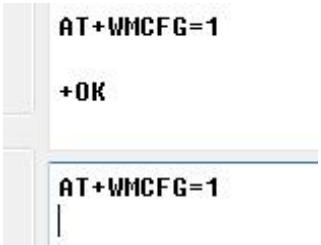


Figure 5

Then enter “AT+RSTART” to restart the device with a line break. The coordinator configuration is complete.

As shown in Figure 5-6:

Figure 6

Network transmission data transmission

When the configuration is complete, the coordinator restarts and the DIO11 pin is asserted low, indicating that the coordinator has started and is running. After an normal node device starts up, it will have a network access time of 10 to 20 seconds. When the network access is completed, the DIO11 pin will be set to low level, indicating that the network access is successful.

After waiting for the device to access the network successfully, the coordinator enters to AT mode, enters the command "AT+DINFO=ALLNODE" with a newline character, the coordinator will return the short address and long address of all the nodes that have already entered the network and recorded. As shown in Figure 5-7:

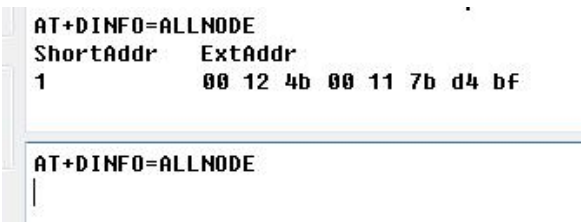


Figure 7

At this time, use “AT+EXIT” to exit the AT command mode with a newline character, and reclaim “Exit AT Mode” to exit AT mode. Next can transfer data, as shown in Figure 8:

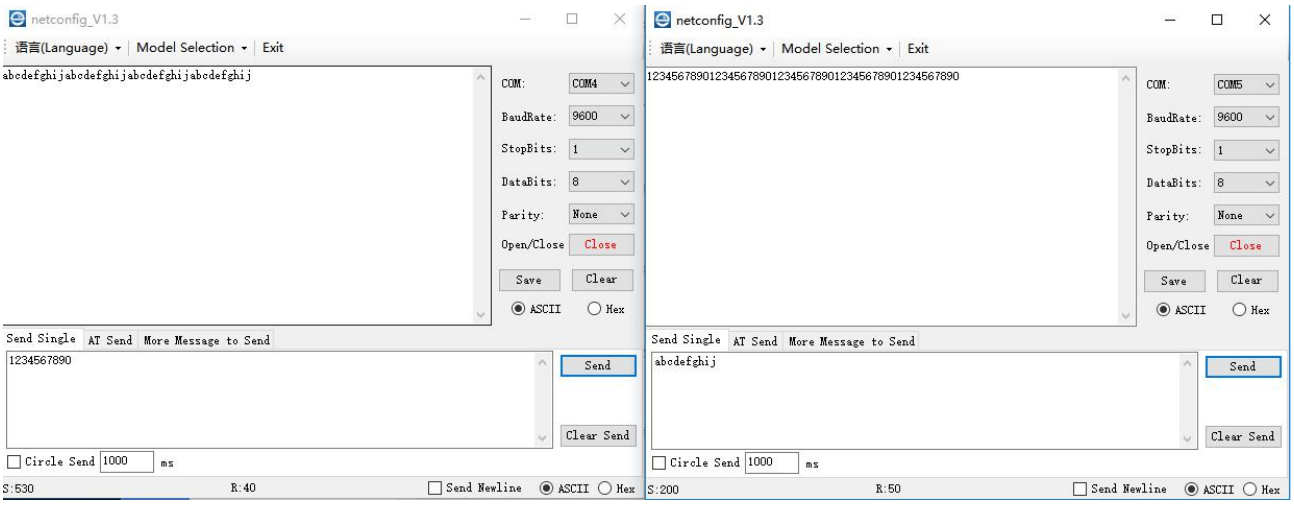


Figure 8

The coordinator and node devices can communicate with each other normally.

9. AT Command

When the serial port enters AT mode, it needs to open the serial port assistant, set the serial port (default parameter) baud

rate 115200, data bit 8 bit, stop bit 1 bit, open the serial port, input "+++" without carriage return. All parameter settings will reply "\r\n+OK\r\n".

<table>
<tr><td rowspan="4">1</td><td colspan="2">Enters” +++” into AT Command</td></tr>
<tr><td>+++</td><td>Parameter Description:
Nonparametric
Response:
Enter AT Mode</td></tr>
<tr><td colspan="2">Example：+++</td></tr>
<tr><td colspan="2">Note: 1. The AT command can be used only after entering the AT command mode
2. After entering the AT command mode, the AT command mode can be used again only after exiting the AT command mode, reset or restart the module
3. When writing this instruction, the serial debugging assistant must be set not to send new lines; writing other AT commands must be set to send new lines.</td></tr>
<tr><td rowspan="3">2</td><td colspan="2">AT+EXIT Exit AT command mode</td></tr>
<tr><td>AT+EXIT</td><td>Parameter Description:
Null
Response:
Exit AT Mode</td></tr>
<tr><td colspan="2">Example：AT+EXIT
Note: AT commands are invalid after exiting AT command mode</td></tr>
<tr><td rowspan="3">3</td><td colspan="2">AT + CNCFG Set / Query device channel</td></tr>
<tr><td>AT+CNCFG=?
AT+CNCFG=Value</td><td>Parameter specification:
Query the current working channel
Response：
Channel：0
Parameter specification:
Value：0~63 （Factory default parameter is 0）</td></tr>
<tr><td colspan="2">Note: 1. In the long-distance mode and standard transmission mode, the frequency range is (908.2MHz ~ 920.8MHz), the channel interval is 0.2MHz, and Fre = 908.2 + (Channel * 0.2);
In high-rate mode, the frequency range is 902.4MHz ~ 927.6MHz, the channel interval is 0.4MHz, and Fre = 902.4 + (Channel * 0.4);
2. After setting the channel, the network information will be cleared</td></tr>
<tr><td rowspan="3">4</td><td colspan="2">AT+ WMCFG Setting /Querying working mode (reboot valid)</td></tr>
<tr><td>AT+ WMCFG =?</td><td>Description:
Gets working mode
Response：
WMCFG：4</td></tr>
<tr><td>AT+ WMCFG =Value</td><td>Description:
Value：0~4
0，Coordinator；</td></tr>
</table>

		1, Normal node; 2, Dormant Node； 3, Sleep mode； 4, (factory default), dial switch control
	Example：AT+ WMCFG =4	
	Note: 1. After setting a new mode, it needs to be reset or power off and restart	
5	**AT+DINFO** Get facility information	
	AT+DINFO=ALLNODE	Description: Query the short and long address of all node, and return by UART. It works only when the device works in the coordinator mode
	AT+DINFO=SELFS	Description: Get short address and return by UART
	AT+DINFO=SELFE	Description: Get long address and return by UART
	Example：AT+DINFO=SELFE	
6	**AT+ TFOCFG** Setting/Querying output format configuration (can be saved without reboot)	
	AT+ TFOCFG=?	Description: Gets output format configuration Response： TFOCFG:0
	AT+ TFOCFG=Value	Description: Value：0~7 0：Output: valid data (transparent transmission)） 1： Output: Valid Data +Long Address 2：Output: Valid Data +Short Address 3：Output: Valid Data+RSSI 4：Output：Valid Data+Long Address+Short Address 5：Output：Valid Data+Long Address+RSSI 6：Output：Valid Data+Short Address+RSSI 7：Output：Valid Data+Long Address+Short Address+RSSI
	Example：AT+ TFCFG=0	
7	**AT+ TFICFG** Setting/Querying input transmission format configuration (can be saved without reboot)	
	AT+ TFICFG=?	Description: Gets input transmission format configuration Response： TFICFG:0

<table>
<tr><td rowspan="3"></td><td>AT+ TFICFG=Value
（This instruction is valid for coordinator only）</td><td>Description:
Value：0~2
0：Input Broadcast(Only the coordinator works)
1：Input Short Address+Data (0x0000 0xfff) are broadcast address
2：Input Long Address+Data
（0x000000000000 0xffffffffffffffff）are broadcast address</td></tr>
<tr><td colspan="2">Example：AT+TFICFG=0</td></tr>
<tr><td rowspan="4">8</td><td colspan="2">AT+TMCFG Setting/Querying transport mode configuration (reboot valid)</td></tr>
<tr><td>AT+TMCFG=?</td><td>Description:
Gets transport mode configuration
Response：
TMCFG:0</td></tr>
<tr><td>AT+TMCFG=Value</td><td>Description：
Value：0 or 1
0：Long Range mode，LRM
1：Standard transmission mode,GFSK</td></tr>
<tr><td colspan="2">Example：AT+TMCFG=0
Note: The coordinator and node should have the same transmission mode before they can access the network.</td></tr>
<tr><td rowspan="4">9</td><td colspan="2">AT+ PIDCFG Setting/Querying PANID configuration（reboot valid）</td></tr>
<tr><td>AT+PIDCFG=?</td><td>Description:
Gets PANID configuration
Response：
PIDCFG:65535</td></tr>
<tr><td>AT+PIDCFG=Value</td><td>Description:
Value:0~65535</td></tr>
<tr><td colspan="2">Example：AT+PIDCFG=65535
Note: The node can only join the same network as its PANID (any network can be added when it is configured as 65535)</td></tr>
<tr><td rowspan="4">10</td><td colspan="2">AT+ DMCFG Setting/Querying dormancy time configuration(reboot valid)</td></tr>
<tr><td>AT+DMCFG=?</td><td>Description:
Gets dormancy time configuration
Response:
DMCFG:0~60</td></tr>
<tr><td>AT+DMCFG=Value</td><td>Description: Configure wakeup period of sleep node
Value: dormant time, per unit second (S). 0~60 S.
Note: When configured as 0, the node will never wake up, that is, the node cannot receive data but can upload data</td></tr>
<tr><td colspan="2">Example：AT+DMCFG=0</td></tr>
</table>

<table>
<tr><td rowspan="4">11</td><td colspan="2">AT+RSCFG Setting/Querying the reboot parameter configuration
(reboot valid)</td></tr>
<tr><td>AT+RSCFG=?</td><td>Description:
Gets the reboot parameter configuration
Response：
RSCFG:0</td></tr>
<tr><td>AT+RSCFG=Value</td><td>Description:
Value：0 or 60~65535（S）
When the value less than 60s, the system judges 60, equals 0s, does not restart</td></tr>
<tr><td colspan="2">Example：AT+RSCFG=0</td></tr>
<tr><td></td><td colspan="2">Note: This parameter can be used for node disconnection detection. It is recommended to open it.</td></tr>
<tr><td rowspan="4">12</td><td colspan="2">AT+UBCFG Setting /Querying the baud rate parameter (reboot valid)</td></tr>
<tr><td>AT+UBCFG=?</td><td>Description：
Obtains the baud rate parameter
Response：
UBCFG:7</td></tr>
<tr><td>AT+UBCFG=Value</td><td>Description：
Value:0~7
0：1200
1：2400
2：4800
3：9600
4：19200
5：38400
6：57600
7：115200</td></tr>
<tr><td colspan="2">Example：AT+UBCFG=7</td></tr>
<tr><td rowspan="3">13</td><td colspan="2">AT+UPCFG Setting /Querying the device parity parameter (reboot valid)</td></tr>
<tr><td>AT+UPCFG=?</td><td>Description
Gets the device parity parameter
Response：
UPCFG:0</td></tr>
<tr><td>AT+UPCFG=Value</td><td>Description：
Value:0~2
0：None
1：Odd parity</td></tr>
</table>

<table>
<tr><td></td><td></td><td>2：Even parity</td></tr>
<tr><td></td><td colspan="2">Example：AT+UPCFG=0</td></tr>
<tr><td rowspan="4">14</td><td colspan="2">AT+PWCFG Setting /Querying the power parameter(reboot valid)</td></tr>
<tr><td>AT+PWCFG=?</td><td>Description：
Gets the power parameter
Response：
PWCFG:3</td></tr>
<tr><td>AT+PWCFG=Value</td><td>Description：
Value:0~3
0：Polar Altitude
1：High
2：Medium
3：Low</td></tr>
<tr><td colspan="2">Example：AT+ PWCFG=3</td></tr>
<tr><td rowspan="4">15</td><td colspan="2">AT+IOCFG Setting /Querying the IO parameter</td></tr>
<tr><td>AT+IOCFG=?</td><td>Description：
Gets the IO parameter
Response：
IOCFG:0</td></tr>
<tr><td>AT+IOCFG=Value</td><td>Description：
Value：0 or 1
0：Push-pull
1：open-drain</td></tr>
<tr><td colspan="2">Example：AT+IOCFG=0</td></tr>
<tr><td rowspan="3">16</td><td colspan="2">AT+DFCFG Restore the default parameter</td></tr>
<tr><td>AT+DFCFG</td><td>Description：Null
Restore the default parameter</td></tr>
<tr><td colspan="2">Example：AT+DFCFG</td></tr>
<tr><td rowspan="3">17</td><td colspan="2">AT+RSTART Device Restart</td></tr>
<tr><td>AT+RSTART</td><td>Description：Null
Device Restart</td></tr>
<tr><td colspan="2">Example：AT+RSTART</td></tr>
<tr><td rowspan="3">18</td><td colspan="2">AT+ECHO Sets up the AT instruction to turn off the back display</td></tr>
<tr><td>AT+ECHO=Value</td><td>Description:
Value:0 or 1
1：Close the echo</td></tr>
<tr><td colspan="2"></td></tr>
</table>

<table>
<tr><td rowspan="3"></td><td></td><td>0：Open the echo</td></tr>
<tr><td colspan="2">Example：AT+ECHO=1</td></tr>
<tr><td colspan="2">Note：This setting only applies when the power is turned on. After the restart, the default settings are restored and the echo is enabled by default.</td></tr>
<tr><td rowspan="3">19</td><td colspan="2">AT+VER Reading the version number</td></tr>
<tr><td>AT+VER</td><td>Description:</td></tr>
<tr><td colspan="2">Example：AT+VER</td></tr>
<tr><td rowspan="4">20</td><td colspan="2">AT+CLINFO Clearing network information</td></tr>
<tr><td>AT+CLINFO</td><td>Description:</td></tr>
<tr><td colspan="2">Example：AT+CLINFO</td></tr>
<tr><td colspan="2">Note: The network cannot be re-established after the module is cleared (this command can clear all the information when the number of coordinator node devices reaches 50).</td></tr>
<tr><td rowspan="4">21</td><td colspan="2">AT+TLCFG Setting/Querying the concurrency performance parameter (reboot valid)</td></tr>
<tr><td>AT+TLCFG=?</td><td>Description:
Gets the concurrency performance parameter
Response：
TLCFG:0</td></tr>
<tr><td>AT+TLCFG=value</td><td>Description:
Value:0~3
0：Low concurrency
1：Medium concurrency
2：High concurrency
3：Highest concurrency</td></tr>
<tr><td colspan="2">Example: AT+ TLCFG =0
(Note: This parameter is mainly used to configure the concurrency performance of the module. That is, when various nodes concurrently transmit data, the maximum number of nodes is supported. The higher the performance, the greater the number of concurrent systems, but the delay in sending data. The average power consumption of the nodes will increase; the lower the performance, the higher the real-time performance of the data sent by the nodes, but the data may be lost when the environment has large interference or multiple nodes transmit simultaneously.)</td></tr>
</table>

10. Notes

1. In the sleep mode, the serial baud rate format is 115200, 8N1. If users forget the current baud rate, they can use AT command to reconfigure in this mode.
2. After the node is associated with the coordinator, the node's information will be saved, and the information still exists after the node is disconnected from the network. This mechanism has two advantages:
   A. When the same node joins the network established by the coordinator, increase the network access speed;
   B. After a node enters the network, as long as the current network exists, the short address will never change;

If the coordinator has associated more than 200 devices and wants to continue to associate new devices, it needs to call the AT + CLINFO command to clear the current network information

3. The average power consumption of a low-power node depends on the wake-up period configured by the user. The larger the period, the lower the power consumption.

4. Low power consumption nodes cannot receive broadcast data from the coordinator.

5. When using the default parameters, if the node is powered on for more than 60 seconds and has not yet entered the network, the system reset will be initiated.

6. When the node PANID is set to 0Xffff (65535), the node can join any network, otherwise it will only join the network with the same PANID.

7. E70 (915NW30S) configure parameters AT + TMCFG = 0 and AT + TMCFG = 1, their modes are long-distance mode.

8. When using AT + TFICFG = value to set the input transmission format configuration and AT + TFOCFG = value to set the output transmission format configuration, parameters can be saved without restarting.

11 FAQ

11.1 Communication range is too short

- The communication distance will be affected when obstacle exists.
- Data lose rate will be affected by temperature, humidity and co-channel interference.
- The ground will absorb and reflect wireless radio wave, so the performance will be poor when testing near ground.
- Sea water has great ability in absorbing wireless radio wave, so performance will be poor when testing near the sea.
- The signal will be affected when the antenna is near metal object or put in a metal case.
- Power register was set incorrectly, air data rate is set as too high (the higher the air data rate, the shorter the distance).
- The power supply low voltage under room temperature is lower than 2.5V, the lower the voltage, the lower the transmitting power.
- Due to antenna quality or poor matching between antenna and module.

11.2 Module is easy to damage

- Please check the power supply source, ensure it is 2.0V~3.6V, voltage higher than 3.6V will damage the module.
- Please check the stability of power source, the voltage cannot fluctuate too much.
- Please make sure antistatic measure are taken when installing and using, high frequency devices have electrostatic susceptibility.
- Please ensure the humidity is within limited range, some parts are sensitive to humidity.
- Please avoid using modules under too high or too low temperature.

11.3 BER(Bit Error Rate) is high

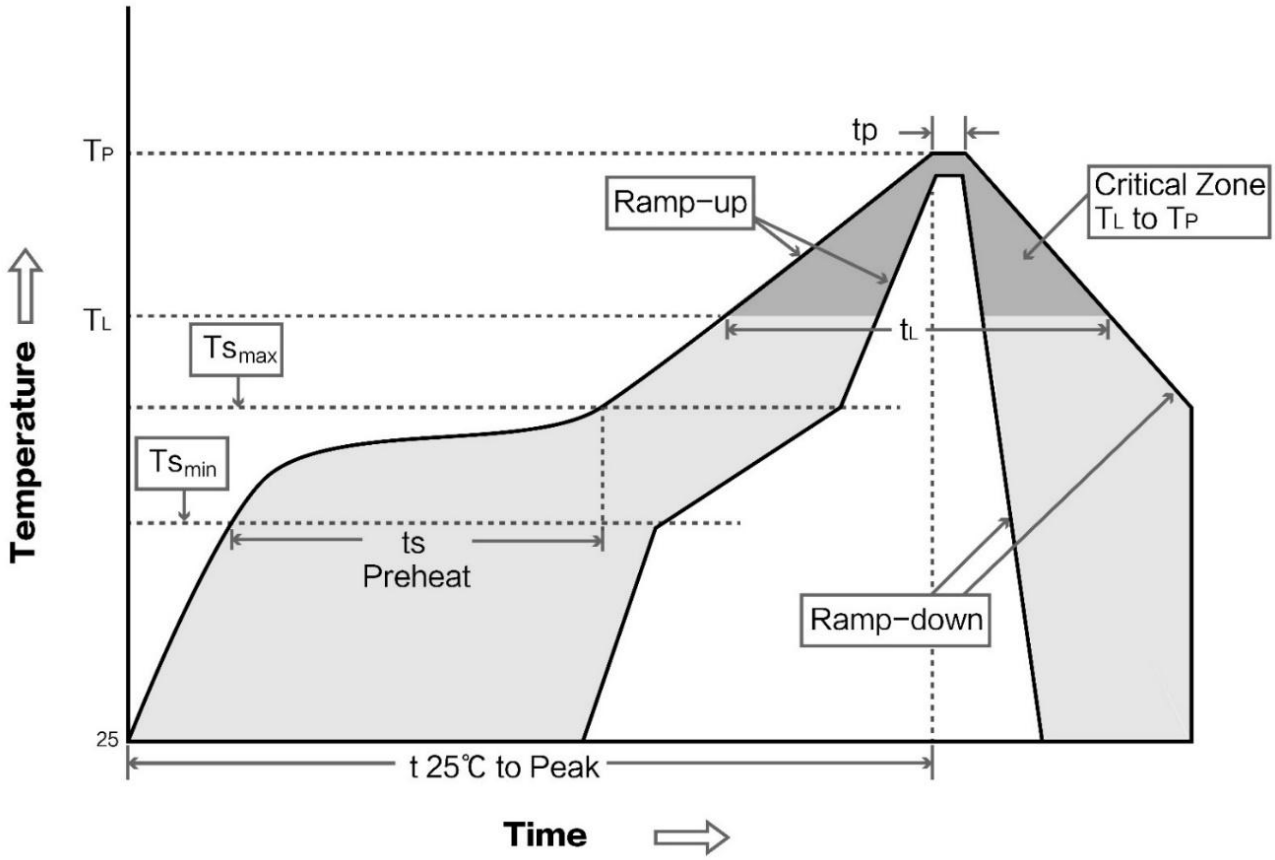
- There are co-channel signal interference nearby, please be away from interference sources or modify frequency and channel to avoid interference;
- Poor power supply may cause messy code. Make sure that the power supply is reliable.
- The extension line and feeder quality are poor or too long, so the bit error rate is high;

12.Production guidance

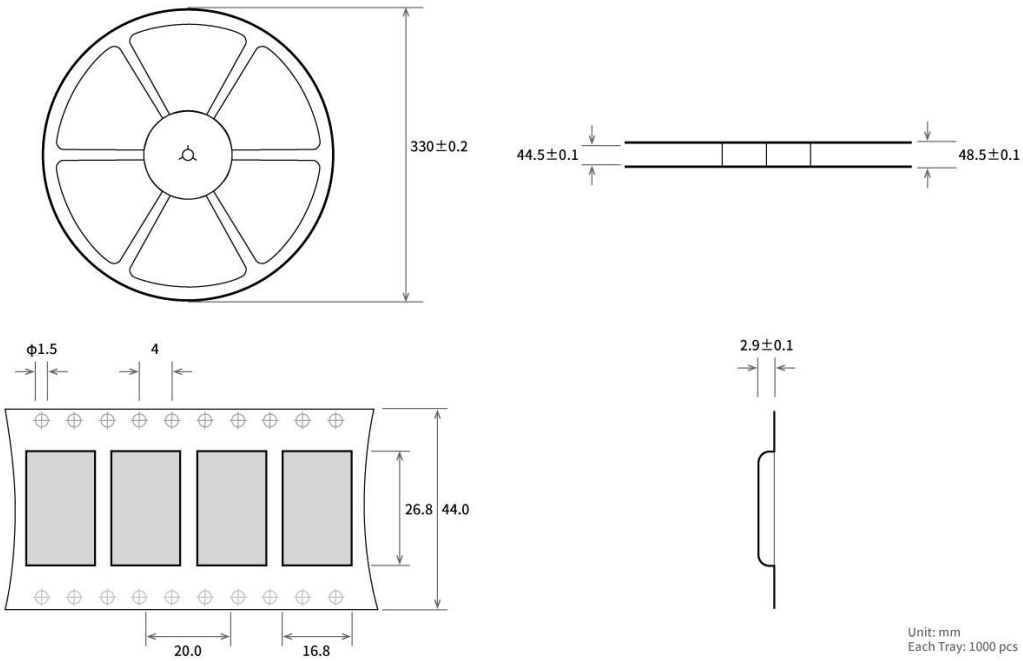
12.1. Reflow Soldering Temperature

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

12.2 **Reflow Soldering Curve**



13. Package for batch order



Revision history

version	Date	Description	Issued by
1.00	2019-09-18	Initial version	huaa
1.10	2019-10-09	content updating	Ren
1.40	2021-2-21	Image optimization	Linson

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