E330-900T13S Product Specification

900MHz 20mW Wireless Module



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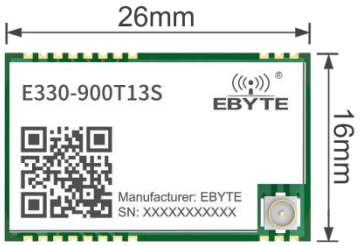
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Ⅰ Product Overview

1.1 Product Description



E330-900T13S is a small-size, low-power, low-cost, ultra-high-performance serial module with integrated transceiver, covering 868 and 900MHz bands. The module supports pass-through and fixed-point transmission modes, LDC single-point wake-up, and adjustable software airspeed, which can be applied to a variety of wireless transmission applications. At the same time, the module is easy to use, no need for complex configuration to quickly get started, to achieve the real ready to use.

1.2 Features

- Small size: 16 * 26mm;
- Low power consumption: LDC ultra-low power receiving mode;
- Support transparent transmission and fixed-point transmission;
- single-point wake-up: the module can support low-power single-point wake-up to solve the problem of false wake-up in the same frequency and reduce the overall power consumption of the system;
- Support 2~25kbps multi-level adjustable transmission rate;
- Multi-level adjustable output power;
- supports up to 73 configurable physical channels, covering 868 and 915MHz bands;

1.3 Application Scenario

- Industrial Smart Gateway;
- Industrial sensors;
- Wireless alarm security systems;
- Wireless remote control;
- Smart Agriculture;
- Sensors to the cloud;
- Intelligent light control systems;

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Ⅱ Specification parameters

2.1 Limit parameters

Main parameters	Minimum value	Typical value	Maximum values	Remarks
Supply Voltage (V)	3	3.3/5	5.5	Exceeding 5.5V may permanently fry the module (Designed with wide voltage supply)
operating temperature	-40℃	25℃	85℃	industrial grade
Operating frequency band (MHz)	860.125	868.125	932.125	Channel spacing 1MHz
Emission current (mA)	-	35mA	-	915MHz@13dBm
Receiving current (mA)	-	6.5mA	-	receivable
WOR mode (uA)	-	7	-	LDC:1000ms
Sleep Current (uA)	-	2	-	software shutdown
Maximum output power (dBm)	12	13	14	-
Receiving sensitivity (dBm)	-	-118	-	2Kbps
Air rate (bps)	2K	2K	25K	Multi-stage adjustable

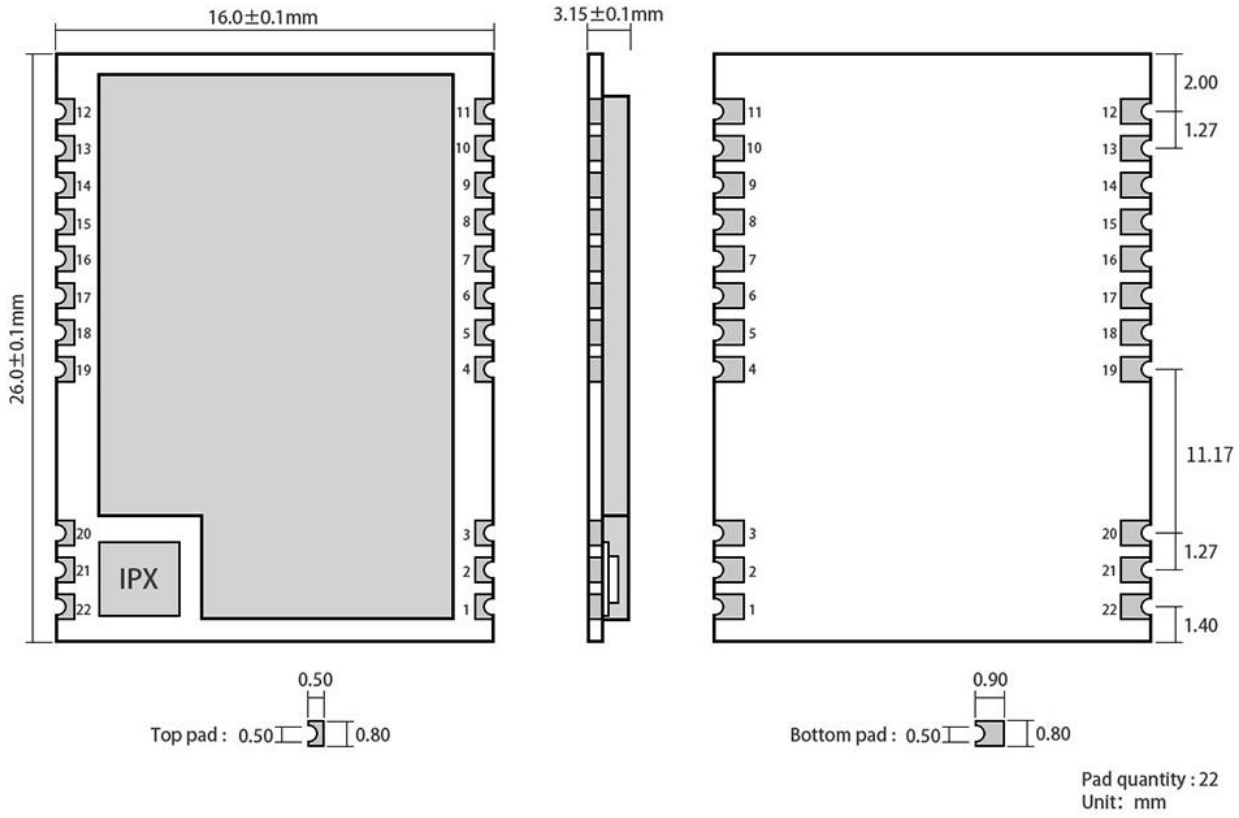
Main parameters	Descriptive	Remarks
Reference distance	1.0km	Clear and open, antenna gain 3.5dBi, antenna height 1.3m, air rate 2kbps
Transmission length	58 bytes	Maximum bytes transmitted over the air in a single pass
Cache capacity	80 bytes	Actual software debugging
Modulation method	FSK	
Communications interface	UART	8N1\8E1\E01, 1200~38400 Multi-stage adjustable
Package	SMD	stamp hole
Interface method	1.27 row of pins	
Overall	16*26mm	

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dimensions		
Antenna Interface	IPEX/Stamp Hole	Equivalent impedance approx. 50Ω

Ⅲ Mechanical Dimensions and Pin Definitions



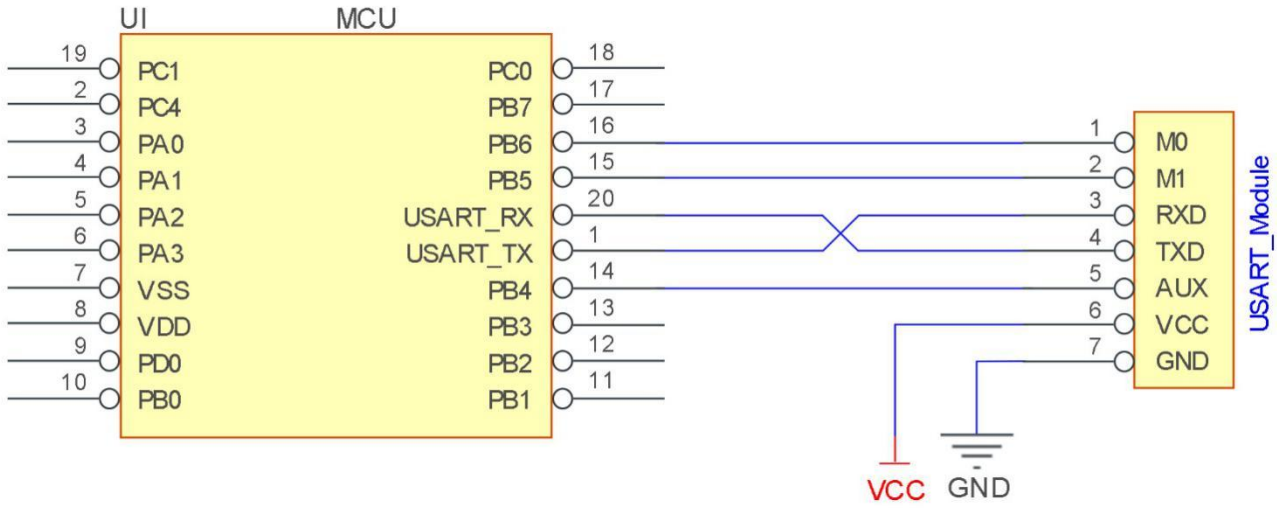
Pin Number	Pin Name	Pin orientation	Pin Usage
1	GND	-	Module Ground
2	GND	-	Module Ground
3	GND	-	Module Ground
4	GND	-	Module Ground
5	M0	Input (pull-up)	Works with M1 to determine the 4 operating modes of the module. (not suspendable, groundable if not in use)
6	M1	Input (pull-up)	Works with M0 to determine the 4 operating modes of the module. (not suspendable, groundable if not in use)
7	RXD	Input	TTL serial input, connected to external TXD output pin;
8	TXD	Output	TTL serial output connected to external RXD input pin;
9	AUX	Output	Used to indicate the working status of the module; the user wakes up the external MCU and outputs a low level during power-on

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			self-test initialization; (can be suspended)
10	VCC	-	Module power supply positive reference, reference voltage range: 3.3~5.0V DC
11	GND	-	Module Ground
12	SDA	reserve	Users do not need to care, pins are suspended
13	GND	-	Module Ground
14	SCK	reserve	Users do not need to care, pins are suspended
15	VCC	reserve	Users do not need to care, pins are suspended
16	NC	reserve	Users do not need to care, pins are suspended
17	NC	reserve	Users do not need to care, pins are suspended
18	NC	reserve	Users do not need to care, pins are suspended
19	GND	-	Module Ground
20	GND	-	Module Ground
21	ANT	-	Antenna
22	GND	-	Module Ground

Ⅳ Recommended Connectivity Chart



Serial number	Brief connection description between the module and the microcontroller (the above figure takes the STM8L microcontroller as an example)
1	The wireless serial module is TTL level, please connect with TTL level MCU.
2	For some 5V microcontrollers, it may be necessary to add 4 to 10K pull-up resistors to the TXD and AUX pins of the module.

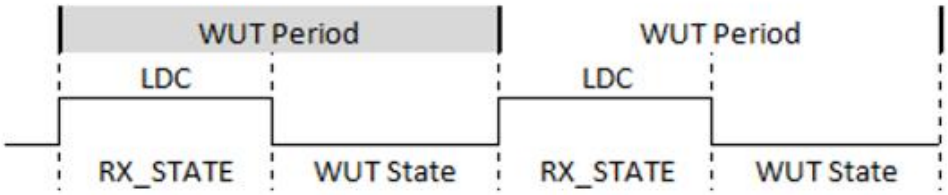
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V Functions in detail

5.1 LDC Receiving

E330-900T13S module LDC mode reception. This module power-up are in LDC (Low Duty Cycle) ultra-low-power reception mode, the specific working mechanism is that the module regularly wakes up from hibernation to detect the wireless wake-up code, if there is a valid wake-up code, then open the RX Windows, otherwise timeout and then enter hibernation again. As shown in the figure below:



LDC cycle can be configured by software

Transmit mode: the module can automatically load the wake-up code corresponding to the LDC period when sending data.

Receive mode: Both sides need to configure the same LDC cycle.

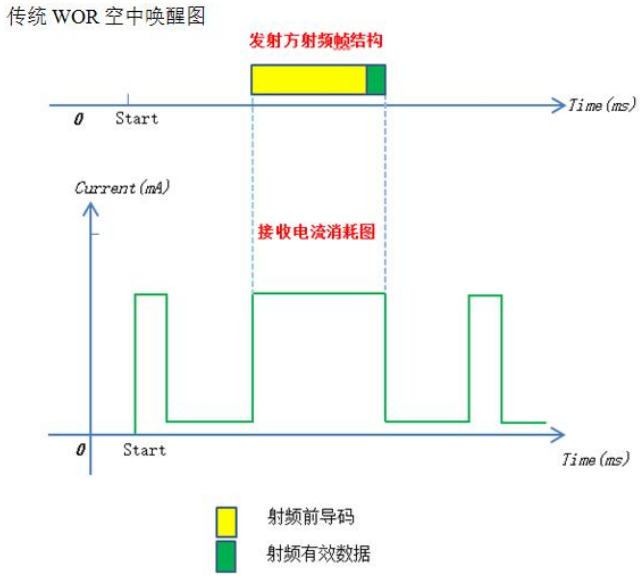
5.2 Single-point wakeup call

Module with a single-point wake-up function, can effectively inhibit the same frequency, different addresses between the device false wake-up problem; internal design, the module address will be configured as a hardware RF chip SYNC address, the address is used to receive the process of synchronization matching, sending and receiving synchronization word does not match the receiver chip will automatically filter this packet; sender, send wake-up code using a short leading code + synchronization word way;

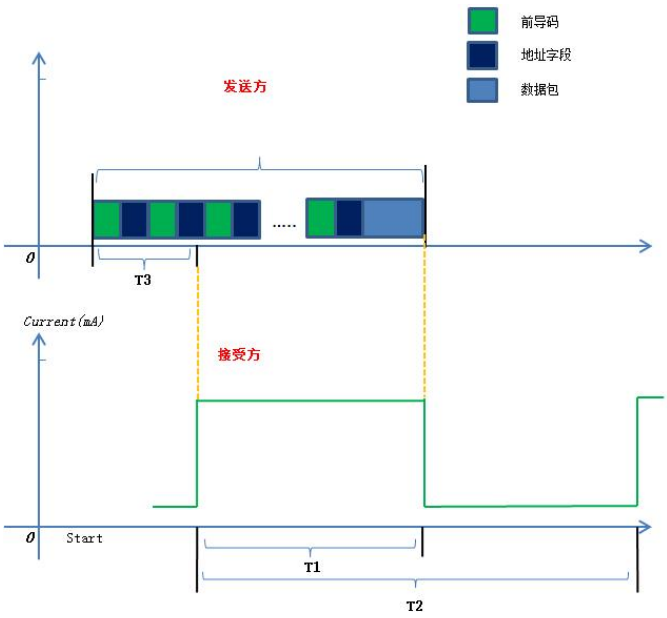
The traditional WOR over-the-air wake-up call:

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Single-point wake-up method:



5.3 Module reset

- After the module is powered on, AUX will immediately output a low level and perform hardware self-test, as well as set up the working mode according to the user parameters;

  During this process, AUX will keep low level, and when it is finished, AUX will output high level and start to work normally according to the working mode combined by M1 and M0;

  Therefore, the user needs to wait for the rising edge of AUX as the starting point of normal operation of the module.

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5.4 AUX

- AUX is used for wireless transceiver buffer indication and self-test indication.
- It indicates whether the module has data that has not yet been transmitted out over the wireless, or whether the wireless data that has been received has not yet been sent out in full over the serial port, or whether the module is in the process of initializing the self-test.

5.5 Notice

Serial number	AUX Notes
1	For Function 1 and Function 2 above, the output low level is prioritized, i.e.: when any of the output low level conditions are satisfied, the AUX outputs a low level; When all low level conditions are not satisfied, AUX outputs high level.
2	When AUX outputs low level, it indicates that the module is busy, and no working mode detection will be performed at this time; When the module AUX outputs high level within 1ms, the mode switching work will be completed.
3	After the user switches to a new operating mode, it takes at least 2ms after the rising edge of AUX for the module to actually enter that mode; If AUX stays high, then the mode switching will take effect immediately.
4	The module resets the user parameters when the user enters from mode 3 (sleep mode) or during a reset, during which the AUX output goes low.

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VI Operating mode

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

Mode (0-3)	M1	M0	Mode Introduction	Remarks
Send mode (0)	0	0	Serial port is turned on, wireless is turned on, and wake-up code is automatically added before sending packets;	Used with Mode 1
Receiving mode (1)	0	1	The serial port is closed for reception, the wireless is in cycle wake-up listening for air data, and after receiving the data, the serial port is opened to output the data;	Used with mode 0
Configuration mode (2)	1	0	Deep sleep mode, can send configuration commands via serial port, serial port fixed parameters 9600, 8N, 1	
Sleep mode (3)	1	1	Module deep sleep mode with serial and wireless turned off	

6.1 Mode switching

Serial number	Remarks
1	● Users can combine M1 and M0 with high and low levels to determine the module working mode. The 2 GPIOs of MCU can be used to control the mode switching; ● When changing M1, M0: If the module is idle, it can start working according to the new mode after 1ms; ● If the module has serial data that has not yet finished transmitting through wireless, it can only enter the new working mode after transmitting; ● If the module receives the wireless data and sends out the data through the serial port, it needs to finish transmitting before it can enter the new working mode; ● So the mode switching can only be effective when AUX outputs 1, otherwise the switching will be delayed.
2	● For example, if the user inputs a large amount of data continuously and switches modes at the same time, the switching mode operation is invalid at this time; the module will process all the user data before detecting a new mode; ● So the general suggestion is: detect the output status of AUX pin, wait for 2ms after output high level before switching.
3	● If there is data that has not been processed when the module is switched from other modes to sleep mode; ● The module will process this data (both receive and transmit) before entering sleep mode. This feature can be used for fast hibernation to save power consumption; for example: the transmitter module works in mode 0, the user initiates the serial data "12345", and then does not have to wait for the AUX pin to be idle (high), it can be directly switched to hibernation mode and the user's main MCU can be immediately put into hibernation, and the module will automatically send out the user's data through the wireless all 1ms. After sending out all the user data through wireless, the module will automatically enter hibernation within 1ms; ● thus saving the MCU's working time and reducing power consumption.

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4	● Similarly, for any mode switching, this feature can be utilized. After the module has processed the current mode event, within 1ms, it will automatically enter the new mode, thus saving the user's work of querying the AUX, and it can achieve the purpose of fast switching; ● For example, switching from transmit mode to receive mode; the user MCU can also go to sleep earlier before mode switching and use the external interrupt function to get the AUX change so as to switch modes.
5	● This operation method is very flexible and efficient, completely designed according to the user's MCU's operating convenience, and can minimize the workload of the whole system, improve system efficiency and reduce power consumption.

6.2 General mode (mode 0)

Type	When M0 = 0 and M1 = 0, the module operates in mode 0
Emission	Before sending data, the module will automatically internally increase the wireless wake-up code to wake up the receiving module under the corresponding wake-up cycle.
Rception	The module's wireless reception function is turned on, and wireless data will be output via the serial port TXD pin when received.

6.3 Receiving mode (mode 1)

Type	When M0 = 1 and M1 = 0, the module operates in mode 1
Emission	Data can be sent when the LDC cycle is 0. This is equivalent to mode 0, otherwise data cannot be sent.
Reception	The module can periodically wake up to receive data, and the wake-up period can be configured by command.

6.4 Configuration mode (mode 2)

Type	Module operating parameters can be configured through the serial port (M0 = 0,M1 = 1) Serial port parameters: 9600, 8N1
Emission	Unable to send data wirelessly
Reception	Unable to send data wirelessly
Configurations	Module operating parameters can be set via a special command format

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6.5 Deep sleep mode (mode 3)

Type	Module deep sleep mode (M0 = 1,M1 = 1)
Emission	Unable to send data wirelessly
Reception	Unable to send data wirelessly
Others	Module-related functions are all disabled, and only the M1M0 pin can be used to exit hibernation mode.

Ⅶ Register read/write control

7.1 Command format

The list of supported commands in the configuration mode (Mode 2: M1=1, M0=0) is as follows (**only 9600, 8N1 format is supported during setup**):

Serial number	Command format	Explanation
1	C0+ Operating Parameters	Sends C0 + 5 bytes of operating parameters in hexadecimal format for a total of 6 bytes, which must be sent continuously (power-down save)
2	C1+C1+C1	Three C1s are sent in hexadecimal format and the module returns the saved parameters, which must be sent consecutively.
3	C2+ operating parameters	Sends C2 + 5 bytes of operating parameters in hexadecimal format, for a total of 6 bytes, which must be sent continuously (power-down is not saved)
4	C3+C3+C3	Three C3s are sent in hexadecimal format and the module returns the version information, which must be sent consecutively.

7.2 Reading of operating parameters

Command format	Explanation
C1+C1+C1	In configuration mode (MOD=2), issue the command (HEX format): C1 C1 C1, to the module serial port. The module will return the current configuration parameters, e.g., C1 00 00 18 0F 14.

7.3 Version number reading

Command format	Explanation
C3+C3+C3	In configuration mode (MOD=2), issue the command (in HEX format): C3 C3 C3 to the

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	module serial port. The module will return the current configuration parameters, for example: C3 33 0A 13 01; This is mainly used for the upper computer configuration option selection, the customer does not need to understand the meaning.
AT+DEVTYPE=?	ASCII code, return DEVTYPE=E330-900T13S/D
AT+FWCODE=?	ASCII code, return FWCODE=7374-1-xx

7.4 Reset command

Command format	Explanation
C4+C4+C4	In configuration mode (MOD=2), issue the command (in HEX format): c4 c4 c4 to the module serial port. The module will generate a reset; During the reset process, the module performs self-test and AUX outputs a low level; after the reset is completed, AUX outputs a high level and the module starts to work normally. At this time, mode switching or initiating the next command can be performed.

7.5 Parameter setting commands

Serial number	Name	Descriptions	Remarks
0	HEAD	Fixed 0xC0 or 0xC2, indicating that this frame data is a control command	Must be 0xC0 or C2 C0: The set parameters are saved by power-down. C2: The set parameters will not be saved by power-down.
1	ADDH	High byte of module address (default 00H)	00H - FFH
2	ADDL	Module address low byte (default 00H)	00H - FFH
3	SPED	Rate parameters, including serial rate and air rate 7, 6: Serial port parity bit 00: 8N1 (default) 01: 8O1 10: 8E1 11: 8N1 (equivalent to 00) --- 5, 4, 3: TTL serial port rate in bps 000: serial port baud rate of 1200 001: Serial port baud rate of 2400 010: Serial port baud rate is 4800 011: Serial port baud rate is 9600 (default) 100：Serial port baud rate is 19200 101：Serial port baud rate is 38400 110: Serial port baud rate is 38400 111: Serial port baud rate is 38400 --- 2：Retention of unused --- 1, 0: Wireless air rate (bps) 00: Air rate is 2.0k (default) 01: Air rate is 5.0k 10: Air rate is 10.0k 11: Air rate is 25.0k	Serial port modes can be different on both sides of the communication --- The baud rate of both sides can be different The serial port baud rate is independent of the wireless transmission parameters and does not affect the wireless transceiver characteristics. --- --- The lower the air rate, the longer the distance and the longer the transmission time. The airborne radio transmission rate must be the same for both sides of the communication.
4	CHAN	Communication channel, default 08H (868.125MHz)	00H-48H, corresponding to 860.125~932.125 MHz Corresponding frequency is: 860.125 + CH[7:0]*1 MHz

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5	OPTION	7: Fixed transmit enable bit 0: Transparent transmission mode (default) 1: Fixed-point transmission mode --- 6: Retention of unused --- 5,4: LDC cycle 00: 0ms 01: 1000ms (default) 10: 2000ms 11: 3000ms --- 3: Retention of unused --- 2: IO drive mode (default 1) 1: TXD, AUX push-pull output, RXD pull-up input 0: TXD, AUX open output, RXD open input --- 1,0: Transmit power (approximate) 00: 13dBm (default) 01: 10dBm 10: 7dBm 11: 4dBm	When this function is turned on, the first 3 bytes of each user data frame will be used as the high and low address and channel. The module will automatically change the address and channel when transmitting and restore the original settings after transmitting. --- --- The larger the LDC period, the lower the power consumption, but the greater the reception delay The wake-up time set by both sides must be the same; --- --- This bit is used to enable the module's internal pull-up resistor. The open-drain method is more level-adaptive and may require an external pull-up resistor in some cases --- The greater the output power of the transmitter, the greater the communication distance, the greater the corresponding transmitter power consumption.

Example (Meaning of the byte "SPED" in serial number 3):

Binary bits of this byte	7	6	5	4	3	2	1	0
Specific values (user-configurable)	0	0	0	1	1	0	0	0
representativeness	Serial port parity bit 8N1		Serial port baud rate of 9600			The air rate is 2k		
Corresponding hexadecimal	1				8			

7.6 Factory Default Parameters

Type	Factory default parameter value: C0 00 00 18 08 14						
Module Model	frequency	address	signal path	airspeed	baud	Serial Port Format	firing power
E330-900T13S	868.125MHz	0x0000	8	2.0Kbps	9600	8N1	13dBm

Note: The module wake-up time is 1000ms when restoring the factory settings, and there will be a delay of about 1.2S for reception.

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Ⅷ Configuration instructions for the host computer



- The following figure shows the E330-900T13S configuration upper computer display interface, users can switch to configuration mode through M0, M1, in the upper computer for quick configuration and reading of parameters.
- In the Configuration Upper, the module address, frequency channel, network ID, and key are displayed in decimal display mode; where each parameter takes a range of values:

  Baud rate: 1200~38400

  Network address: 0~65535

  Frequency channel: 0～72
- Users need to pay special attention when using the upper computer configuration mode, because in the upper computer each parameter is decimal display mode, so the module address filling in the module needs to be converted by converting the system.

Ⅸ Hardware design

- It is recommended to use a DC regulated power supply to power this module, the power supply ripple factor should be as small as possible, and the module should be reliably grounded;
- Please pay attention to the correct connection of the positive and negative terminals of the power supply, if reversed it may cause permanent damage to the module;

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- Please check the power supply to ensure that it is between the recommended supply voltages, if it exceeds the maximum value, it may cause permanent damage to the module;
- Check the stability of the power supply to ensure that the voltage does not fluctuate significantly and frequently;
- When designing the power supply circuit for the module, it is often recommended to keep more than 30% of the residual capacity, and the whole machine is conducive to long-term stable operation;
- Modules should be kept as far as possible from power supplies, transformers, high-frequency alignments and other parts of the electromagnetic interference;
- high-frequency digital alignment, high-frequency analog alignment, power supply alignment must be avoided below the module, if you really need to go through the module below, assuming that the module is welded in the Top Layer, in the module contact part of the Top Layer laying ground copper (all laying copper and a good ground), it must be close to the digital part of the module and the alignment in the Bottom Layer;
- Assuming that the module is soldered or placed in the Top Layer, it is also a mistake to run the wires in the Bottom Layer or any other layer, which will affect the spuriousness of the module as well as the reception sensitivity to varying degrees;
- It is assumed that the module is surrounded by a large electromagnetic interference devices will also greatly affect the performance of the module, according to the intensity of the interference is recommended to stay away from the module, if the situation permits you can do appropriate isolation and shielding;
- assuming that there is a large electromagnetic interference around the module alignment (high-frequency digital, high-frequency analog, power supply alignment) will also greatly affect the performance of the module, according to the intensity of the interference is recommended to stay away from the module, if the situation permits you can do appropriate isolation and shielding;
- If 5V level is used for the communication line, 1k-5.1k resistors must be connected in series (not recommended, there is still a risk of damage);
- Try to stay away from TTL protocols where part of the physical layer is also 2.4GHz, e.g. USB3.0;
- The antenna mounting structure has a great impact on the module performance, make sure the antenna is exposed and preferably vertically upward;
- When the module is installed inside the chassis, a good quality antenna extension cable can be used to extend the antenna to the outside of the chassis;
- The antenna must not be installed inside the metal case, which will cause the transmission distance to be greatly weakened.

X Frequently asked questions

10.1 Unsatisfactory transmission distance

- When there is a straight line communication barrier, the communication distance will be attenuated accordingly;
- temperature, humidity, and co-channel interference, can lead to increased communication packet loss;
- The ground absorbs and reflects radio waves, and the test results are poor near the ground;
- seawater has a very strong ability to absorb radio waves, so the effect of testing on the seashore is poor;
- There are metal objects near the antenna, or placed in a metal shell, the signal attenuation will be very

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serious;

- wrong power register setting, air rate setting is 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, the lower the voltage the lower the transmit power;
- The antenna used is poorly matched to the module or the antenna itself is of poor quality.

10.2 Modules are fragile

- Please check the power supply to ensure that it is between the recommended supply voltages, exceeding the maximum value can cause permanent damage to the module;
- Please check the stability of the power supply, the voltage should not fluctuate significantly and frequently;
- Please ensure that the installation and use of the process of anti-static operation, high-frequency device electrostatic sensitivity;
- Please ensure that the installation and use of the process of humidity should not be too high, part of the components for humidity-sensitive devices;
- If there is no special demand, it is not recommended to use it under too high or too low temperature.

10.3 BER is too high

- There is interference from the same frequency signal nearby, stay away from the interference source or modify the frequency and channel to avoid interference;
- Poor power supply may also cause garbled code, make sure the reliability of the power supply;
- Poor quality or too long extension cables and feeder cables may also cause high BER.

XI Welding instructions

This product is a chip-type module, welders must follow the anti-static operation specification when welding the module;

This product is static-sensitive products, not according to the norms of arbitrary welding module may lead to permanent damage to the module.

11.1 Reflow temperature

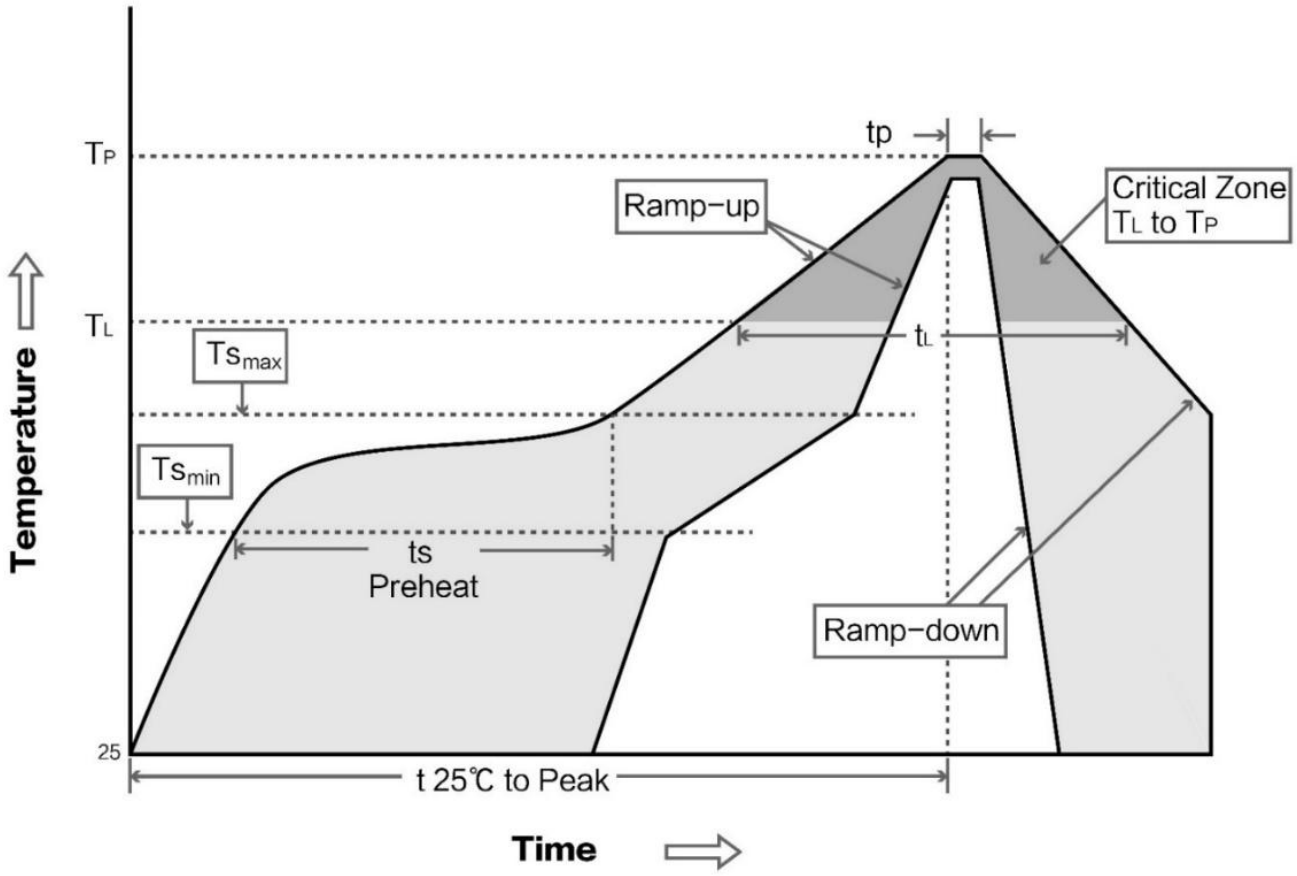
Profile Feature	Curve characteristic	Sn-Pb Assembly	Pb-Free Assembly
Solder Paste	solder paste	Sn63/Pb37	Sn96.5/Ag3/Cu0.5
Preheat Temperature min （Tsmin）	Minimum preheating temperature	100℃	150℃

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Preheat temperature max (Tsmax)	Maximum preheating temperature	150℃	200℃
Preheat Time (Tsmin to Tsmax)(ts)	preheating time	60-120 sec	60-120 sec
Average ramp-up rate(Tsmax to Tp)	Average rate of increase	3℃/second max	3℃/second max
Liquidous Temperature (TL)	liquid-phase temperature	183℃	217℃
Time（tL）Maintained Above（TL）	Time above the liquid phase line	60-90 sec	30-90 sec
Peak temperature（Tp）	peak temperature	220-235℃	230-250℃
Aveage ramp-down rate（Tp to Tsmax）	Average rate of decline	6℃/second max	6℃/second max
Time 25℃ to peak temperature	Time from 25°C to peak temperature	6 minutes max	8 minutes max

11.2 Reflow Profile



XII Antenna Guide

12.1 Antenna Recommendations

Antenna is an important role in the communication process, often poor-quality antenna will have a great impact on the communication system, so we recommend some of the antennas as a supporting our wireless module and the performance is more excellent and reasonably priced antenna.

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Product Model	Type	Frequency Hz	Interface	Gain dBi	Heights mm	Feeder cm	Functional Features
TXGN-FPC-3308	Flexible Antenna	868/915M	IPXE-1	3.0	33*0.8	-	Built-in flexible, FPC soft antenna
TX900-FPC-4420	Flexible Antenna	868/915M	IPXE-1	3.0	44*20	-	Built-in flexible, FPC soft antenna
TX868-JKD-20	glue stick antenna	868M	SMA-J	3.0	170	-	Bending Rubber Stick, Omni-Directional Antenna
TX868-JKD-20	glue stick antenna	915M	SMA-J	3.5	170	-	Bending Rubber Stick, Omni-Directional Antenna
TX868-XPL-100	suction cup antenna	868M	SMA-J	3.5	290	100	Neutral suction cup antenna, low loss
TX915-XPL-100	suction cup antenna	915M	SMA-J	3.5	260	100	Neutral suction cup antenna, low loss

Revision History

Version	Revision date	Revised description	Maintainer
1.0	2023-05-09	Initial version	Weng
1.1	2023-09-13	Modify Pin Description	Ning

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