E220-900M30S

LLCC68 868/ 915MHz 1W SPI SMD Lora Module



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Contents

Disclaimer 3
Features 4
1 Introduction 5
1.1 Brief Introduction 5
1.2 Application 5
2 Specification and parameter 5
2.1 limit parameters 5
2.2 Operating parameter 6
3 Size and pin definition 7
4 Basic operation 8
4.1 Hardware design 8
4.2 Programming 9
5 Basic application 10
5.1 Basic circuit 10
6 FAQ 10
6.1 Communication range is too short 10
6.2 Module is easy to damage 11
6.3 BER(Bit Error Rate) is high 11
7 Production guidance 12
7.1 Reflow soldering temperature 12
7.2 Reflow soldering curve 12
8 E220 series 13
9 Antenna recommendation 13
9.1 Recommendation 13
10. Packing method for batch order 13
Revision history 14
About us 14

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Features

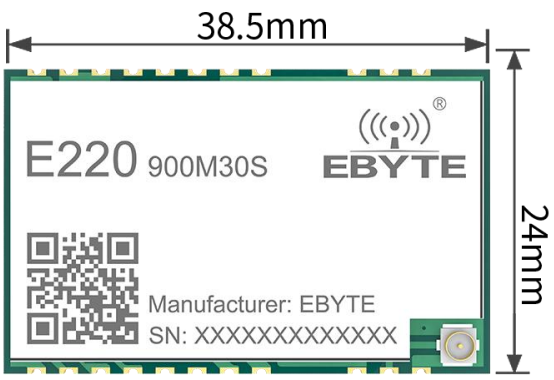
- Compared with the SX1276 module, the LLCC68 module has significant advantages of lower power consumption, faster speed and longer distance;
- The measured distance can reach 10km;
- Built-in PA+LNA, greatly improving the communication distance and stability;
- The maximum transmitting power is 1W, software is multi-level adjustable;
- Support global license free ISM 868 / 915MHz band;
- In LoRa™ mode, the data transmission rate is 1.76kbps ~ 62.5kbps;
- FSK mode supports up to 300kbps data transmission rate;
- FIFO has large capacity and supports 256 byte data cache;
- Support spread spectrum factor SF5, SF6, SF7, SF8, SF9, SF10, SF11;
- Support 3 ~ 5.5V power supply, more than 3.3V power supply can guarantee the best performance;
- Industrial standard design, support - 40 ~ 85 ° C long-term use;
- Dual RF interface is optional (IPEX / stamp hole), which is convenient for secondary development and integration.

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1 Introduction

1.1 Brief Introduction



E220-900M30S is 1W module developed independently based on new generation of LoRa™ RF chip LLCC68 from Semtech. LLCC68 is suitable for 868MHz/915MHz SMD wireless module and uses industrial 32mhz crystal oscillator.

The original imported LLCC68 is used as the core of the module, a power amplifier (PA) and a low noise amplifier (LNA) are built on the original basis, so that the maximum transmission power reaches 1W and the receiving sensitivity is further improved. In the overall communication Compared with products without power amplifier and low noise amplifier, the stability is greatly improved. Compared with the previous generation of LoRa™ transceivers, the anti-interference performance and communication distance have been improved, further opening the gap with FSK and GFSK modulation products. The product can cover an ultra-wide frequency range of 850~930MHz.

Because the module is a pure RF transceiver module, it needs to use MCU driver or special SPI debugging tool.

1.2 Application

- Home security alarm and remote keyless entry;
- Smart home and industrial sensors, etc;
- Wireless alarm security system;
- Building automation solutions;
- Wireless industrial remote controller;
- Health care products;
- Advanced meter reading architecture (AMI);
- Automotive industry applications.

2 Specification and parameter

2.1 limit parameters

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Main parameter	Performance		Remarks
	Min	Max	
Supply voltage (V)	0	5.5	Over 5.5V permanently burned module
Blocking power (DBM)	-	10	The burning probability is small in close range use
Working temperature (℃)	-40	+85	Industrial grade

2.2 Operating parameter

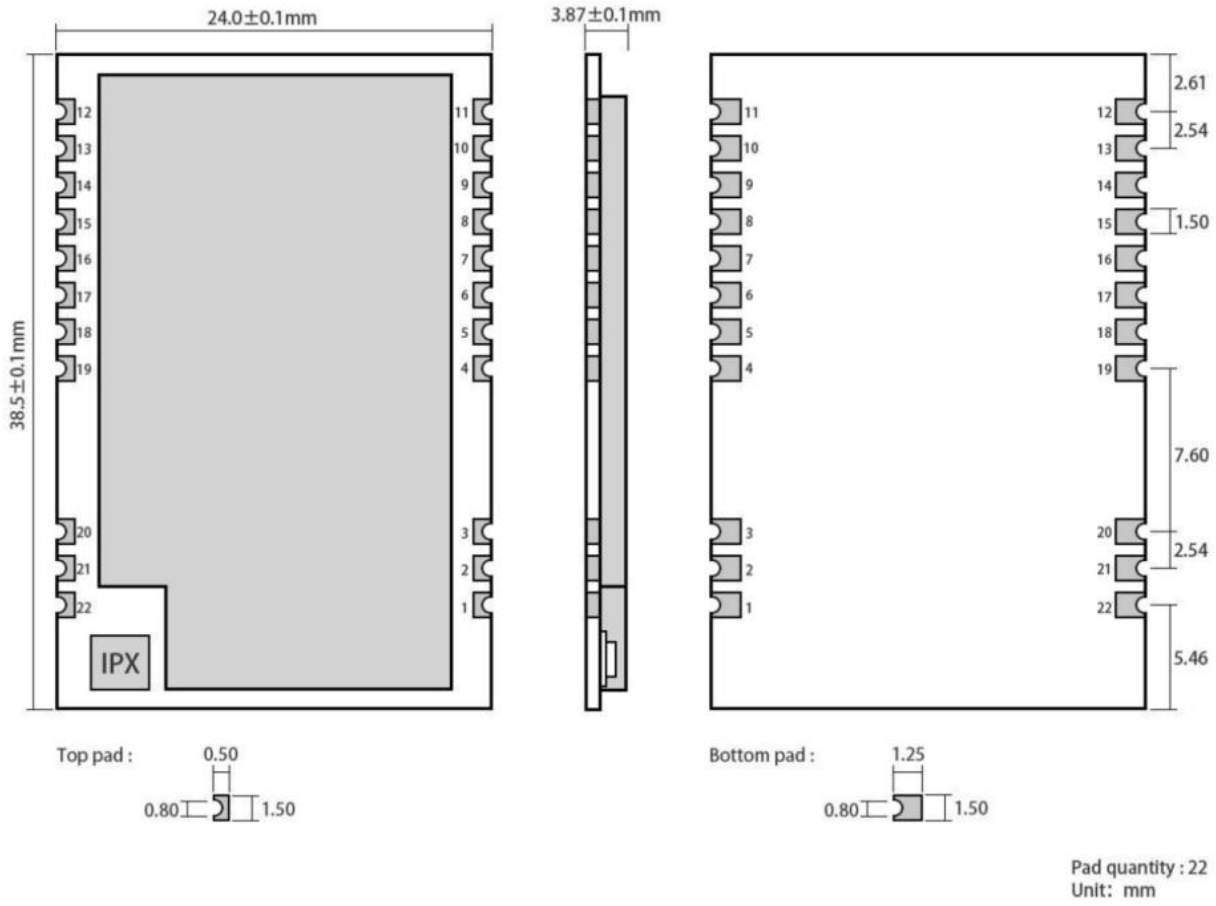
Main parameter		Performance			Remarks
		Min	Type	Max	
Working voltage (V)		3	5	5.5	≥5 V ensures output power
Communication level (V)			3.3		Probably burnout when using 5V TTL
Working temperature (℃)		-40	-	+85	Industrial Design
Operating frequency band (MHz)		850	868/915	930	Support ISM band
Power Consumption	TX current（mA）		700		Instantaneous power consumption
	RX current（mA）		14		-
	Sleep current （μA）		0.7		Software shutdown
Max TX power（dBm）		29.5	30	30.5	-
Receiving sensitivity（dBm）			-129		-124dbm,BW_L=125kHz,SF = 7,LORA™; -129dbm,BW_L=125kHz,SF = 9,LORA™; -121dbm,BW_L=250kHz,SF = 7,LORA™; -129dbm,BW_L=250kHz,SF =10,LORA™; -117dbm,BW_L=500kHz,SF = 7,LORA™; -127dbm,BW_L=500kHz,SF =11,LORA™;
Air data rate	GFSK（bps）	0.6k		300k	User programming control
	LoRa（bps）	1.76k		62.5k	User programming control

Main parameter	Description	Remark
Reference distance	10km	In clear and open environment, the antenna gain is 5dBi, the antenna height is 2.5m, and the air speed is 2.4kbps.
FIFO	256Byte	Maximum length of single transmission
Crystal frequency	32MHz	Passive crystal oscillator, 24pF is recommended
Modulation mode	LoRa	Lora modulation is recommended
Packaging method	SMD	-
Interface mode	Stamp hole	The spacing is 2.54mm
Communication interface	SPI	0-10Mbps
Dimension	38.5*24 mm	Including shield
RF interface	Stamp hole / IPEX	-

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3 Size and pin definition



Pin No.	Item	Direction	Description
1	GND		Ground, connect to power reference ground
2	GND		Ground, connect to power reference ground
3	GND		Ground, connect to power reference ground
4	GND		Ground, connect to power reference ground
5	GND		Ground, connect to power reference ground
6	RXEN	Input	RF switch receive control pin, connect external MCU IO, high level effective
7	TXEN	Input	RF switch emission control pin, connected to external MCU IO or dio2, high level effective
8	DIO2	Input / output	Configurable universal IO port (see llcc68 manual for details)
9	VCC		Power supply, range 3V ~ 5.5V (it is recommended to add ceramic filter capacitor externally)
10	VCC		Power supply, range 3V ~ 5.5V (it is recommended to add ceramic filter capacitor externally)
11	GND		Ground, connect to power reference ground
12	GND		Ground, connect to power reference ground

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13	DIO1	Input / output	Configurable universal IO port (see LLCC68 manual for details)
14	BUSY	Output	For status indication (see LLCC68 manual for details)
15	NRST	Input	Chip reset trigger input pin, low level effective
16	MISO	Output	SPI data output pin
17	MOSI	Input	SPI data input pin
18	SCK	Input	SPI clock input pin
19	NSS	Input	The module chip selection pin is used to start a SPI communication
20	GND		Ground, connect to power reference ground
21	ANT		RF interface, stamp hole
22	GND		Ground, connect to power reference ground
For the pin definition, software driver and communication protocol of the module, please refer to the official LLCC68 datasheet of Semtech.			

4 Basic operation

4.1 Hardware design

- It is recommended to use a DC stabilized power supply. The power supply ripple factor is as small as possible and the module needs to be reliably grounded;
- 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 supply voltage. 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 keep more than 30% margin, which is conducive to the long-term stable operation of the whole machine;
- The module should be far away from the power supply, transformer, high frequency wiring and other parts with large electromagnetic interference;
- The high-frequency digital wiring, high-frequency analog wiring and power wiring must avoid the lower part of the module. If it is necessary to pass through the lower part of the module, it is assumed that the module is welded on the top layer, and the copper is laid on the top layer of the module contact part (all copper is laid and well grounded), which must be close to the digital part of the module and laid on the bottom layer;
- Assuming that the module is welded or placed in the top layer, it is also wrong to route at will in the bottom layer or other layers, which will affect the spurious and receiving sensitivity of the module in different degrees;
- Assuming that there are large electromagnetic interference devices around the module will greatly affect the performance of the module, it is recommended to keep away from the module according to the intensity of interference, and appropriate isolation and shielding can be done if the situation permits;
- Assuming that there are lines (high-frequency digital, high-frequency analog and power lines) with large electromagnetic interference around the module, the performance of the module will be greatly affected. According to the intensity of interference, it is recommended to keep away from the module. If the situation permits, appropriate isolation and shielding can be done;
- If 5V level is used for communication line, 1k-5.1k resistor must be connected in series (not recommended, there is

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still risk of damage);

- The antenna installation structure has a great influence on the module performance, so it is necessary to ensure that the antenna is exposed, preferably vertically upward. When the module is installed inside the housing, the high-quality antenna extension line can be used to extend the antenna to the outside of the housing;
- The antenna must not be installed inside the metal shell, which will greatly weaken the transmission distance.

4.2 Programming

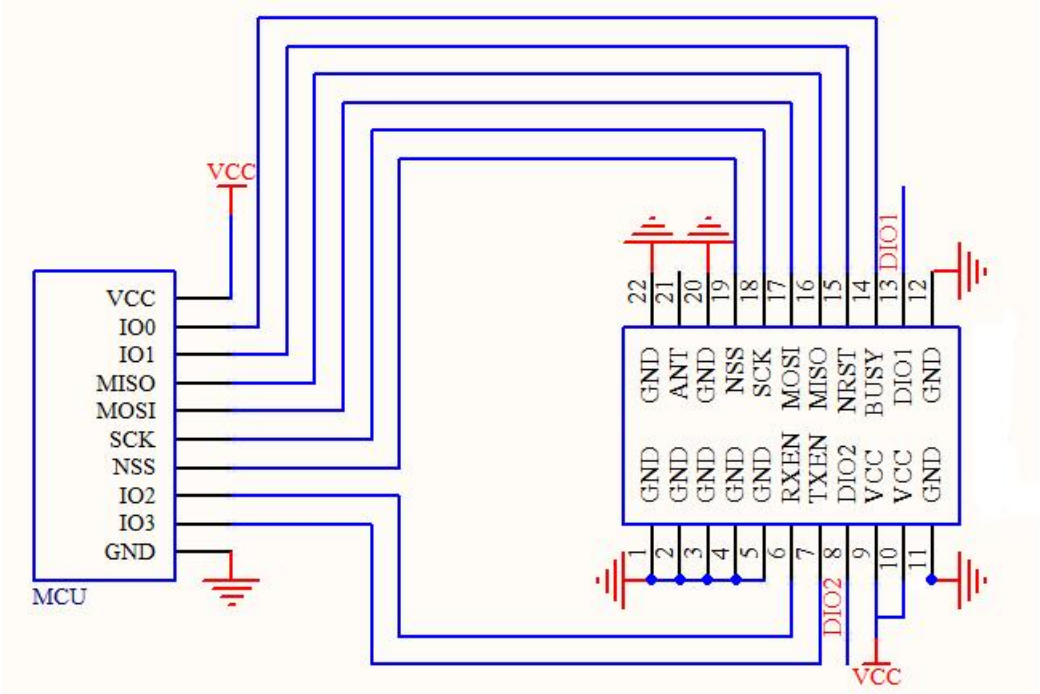
- This module is LLCC68+PA+LNA, and its driving method is completely equivalent to LLCC68, and users can operate in accordance with the LLCC68 chipset datasheet;
- DIO1, DIO2 and DIO3 are common IO ports, which can be configured into multiple functions. DIO2 can be connected to TXEN, not to IO port of MCU, and is used to control RF switch emission. See LLCC68 manual for details, and can be suspended if not used;
- The internal use of 32mhz passive crystal oscillator, without pin control, software program control can be;
- The differences between LLCC68 and SX1262 / SX1268 were as follows
    1. SX1262 / SX1268 supports spread spectrum factors SF5, SF6, SF7, SF8, SF9, SF10, SF11 and SF12;
       LLCC68 supports spread spectrum factors SF5, SF6, SF7, SF8, SF9, SF10 and SF11.
    2. LLCC68 can set the spread spectrum factor and receive bandwidth:
       LoRa® Rx/Tx, BW = 125 – 250 – 500 kHz
       LoRa®，SF = 5 - 6 - 7 - 8 - 9 for BW = 125 kHz ，
       LoRa®，SF = 5 - 6 - 7 - 8 - 9 - 10 for BW = 250 kHz ，
       LoRa®，SF = 5 - 6 - 7 - 8 - 9 - 10 - 11 for BW = 500 kHz；

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5 Basic application

5.1 Basic circuit



6 FAQ

6.1 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.

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6.2 Module is easy to damage

- Please check the power supply source, ensure it is within the recommended range, high voltage 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.

6.3 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;
- The clock waveform on SPI is not standard, check whether there is interference on SPI line, and SPI bus line should not be too long;
- 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.

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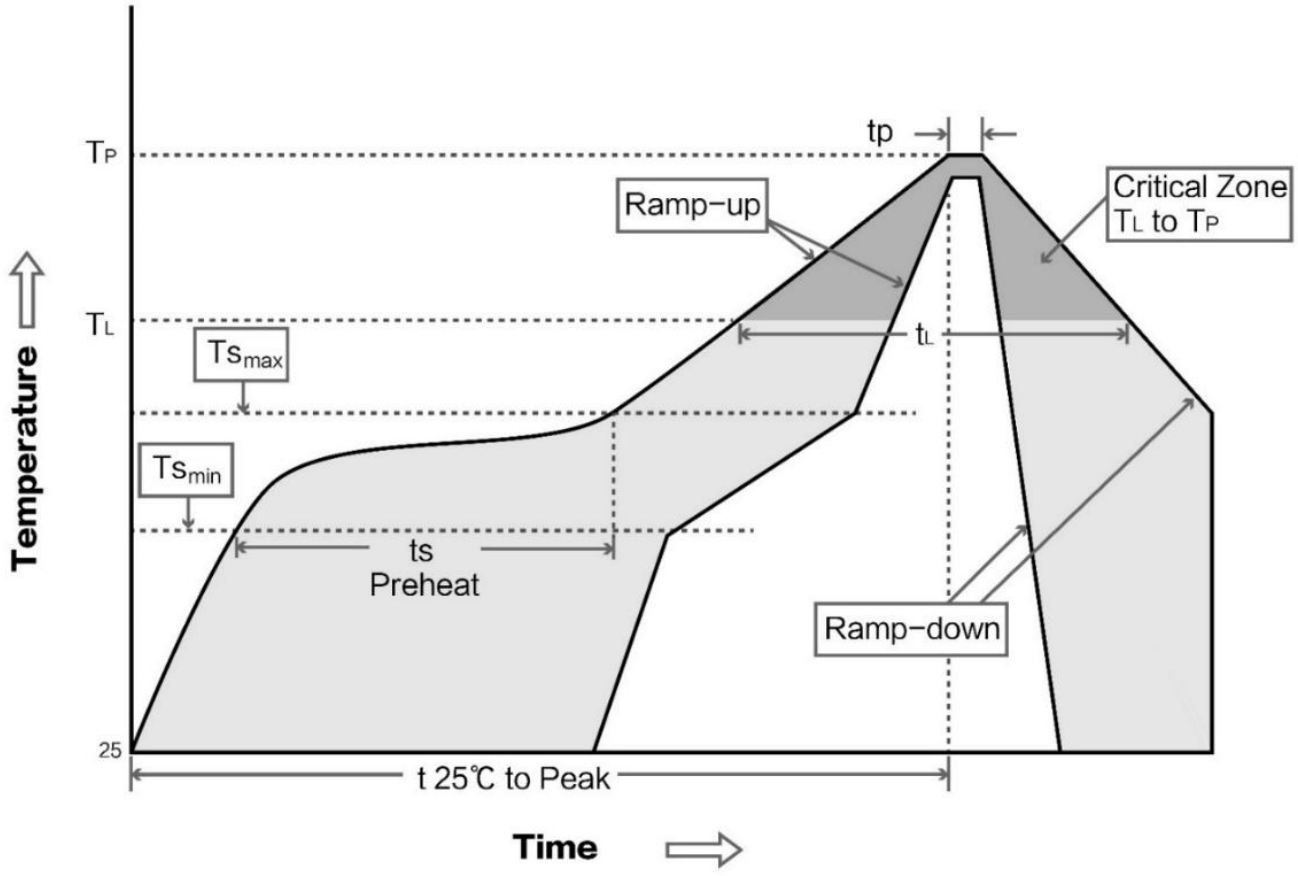
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7 Production guidance

7.1 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℃
Aveage ramp-down rate（Tp to Tsmax）	6℃/second max	6℃/second max
Time 25℃ to peak temperature	6 minutes max	8 minutes max

7.2 Reflow soldering curve



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8 E220 series

Model	IC	Frequency Hz	TX power dBm	Test distance km	Package	Size mm	Communication interface
E220-900M22S	LLCC68	868/915M	22	5.5	SMD	20*14	SPI

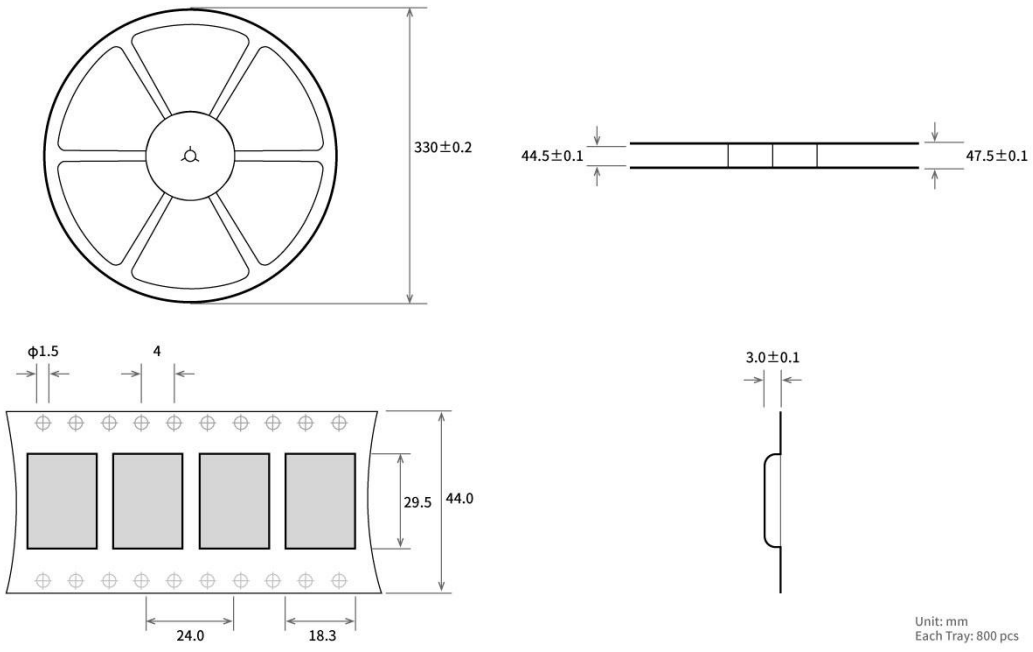
9 Antenna recommendation

9.1 Recommendation

The antenna is an important role in the communication process. A good antenna can largely improve the communication system. Therefore, we recommend some antennas for wireless modules with excellent performance and reasonable price.

Model No.	Type	Frequeny Hz	Interface	Gain dBi	Size	Cable	Function feature
TX868-XPL-100	Sucker antenna	868M	SMA-J	3.5	290	100	Sucker antenna, high gain
TX915-XPL-100	Sucker antenna	915M	SMA-J	3.5	290	100	Sucker antenna, high gain

10. Packing method for batch order



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Revision history

Version	Date	Description	Issued by
1.0	2021-07-02	Initial version	Linson

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