E220-900M22S

Llcc68 868 / 915MHz 160mw SPI SMD Lora module



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Features

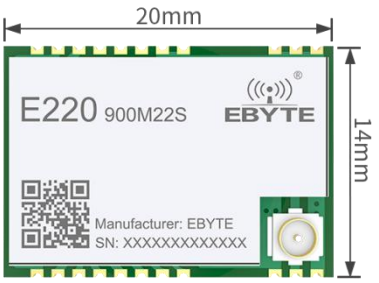
- The measured distance can reach 5500m;
- The maximum transmitting power is 160mw, and the software is multi-level adjustable;
- Support global license free ism 868 / 915MHz band;
- In LoRa™ mode, the data transmission rate is 1.76kbps ~ 62.5kbps;
- FSK mode supports up to 300kbps data transmission rate;
- FIFO has large capacity and supports 256 byte data cache;
- Support spread spectrum factor sF5, SF6, sf7, SF8, Sf9, SF10, SF11;
- Support 1.8V ~ 3.7V 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



E220-900m22s is an small module, self-developed based on the new generation of LoRa™ RF chip llcc68, produced by Semtech company. It is suitable for 868mhz and 915MHz LoRa™ wireless module and uses industrial 32mhz crystal oscillator.

Compared with the previous generation of LoRa™ transceiver, its anti-jamming performance and communication distance have been further improved. Because of its new LoRa™ modulation technology, its anti-jamming performance and communication distance are far superior to the current FSK and GFSK modulation products. The module is mainly aimed at smart home, wireless meter reading, scientific research and medical and medium and long distance wireless communication equipment. The product can cover a 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 parameter

Main parameter	Performance		Remarks
	Min	Max	
Supply voltage (V)	0	3.7	Over 3.7V permanently burned module
Blocking power (DBM)	-	10	The burning probability is small in close range use
Working temperature (℃)	-40	+85	Industrial grade

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2.2 Operating parameter

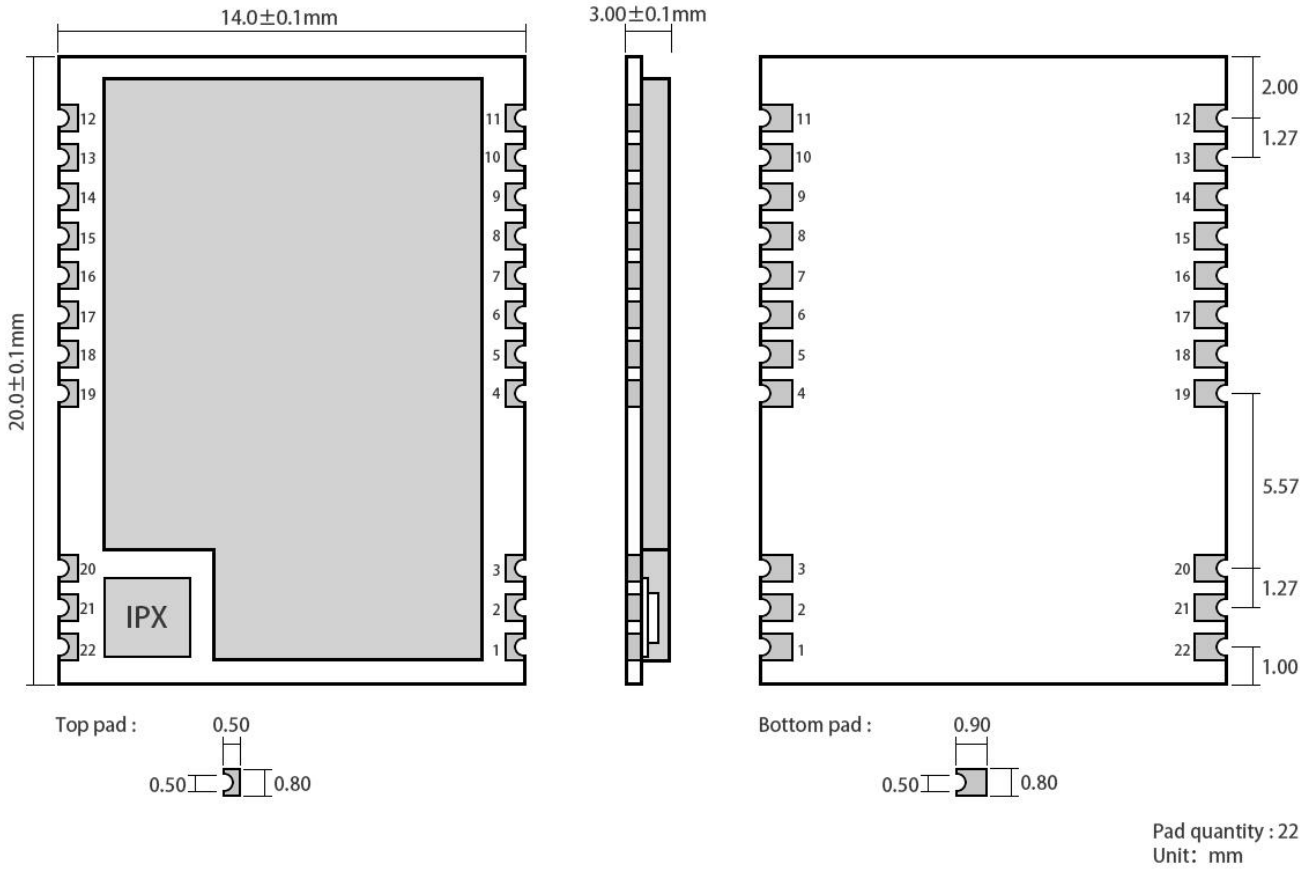
Main parameter		Performance			Remarks
		Min	Type	Max	
Operating voltage（V）		1.8	3.3	3.7	≥3.3 V ensures output power
Communication level（V）		-	3.3	-	For 5V TTL, it may be at risk of burning down
Operating temperature（℃）		-40	-	85	Industrial Design
Operating frequency（MHz）		850	868/915	930	Support ISM band
Power Consump-tion	TX current（mA）	-	130	-	Instantaneous power consumption
	RX current（mA）	-	6.5	-	-
	Sleep current （μA）	-	180	-	Software shutdown
Max TX power（dBm）		21.4	21.5	22	-
Receiving sensitivity（dBm）		-	-129	-	BW_L=250kHz，SF = 10，LORA™；
Air data rate（bps）		1.76k	-	62.5k	Controlled via user’s programming

Main parameter	Description	Remark
Reference distance	5500m	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	-
Modulation mode	LoRa	Lora modulation is recommended
Packaging method	Chip mounted	-
Interface mode	Stamp hole	The spacing is 1.27mm
Communication interface	SPI	0-10Mbps
Dimensions	20* 14*2.8 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	DIO3		Configurable universal IO port (see llcc68 manual for details)
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 1.8V ~ 3.7V (it is recommended to add ceramic filter capacitor externally)
10	GND		Ground, connect to power reference ground
11	GND		Ground, connect to power reference ground
12	GND		Ground, connect to power reference ground
13	DIO1	Input / output	Configurable universal IO port (see llcc68 manual for details)
14	BUSY	output	For status indication (see llcc68 manual for details)

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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, reverse connection may cause permanent damage to the module;
- Please check the power supply to ensure that between the recommended supply voltage, if exceeding the maximum, the module will be permanently damaged;
- Please check the stability of the power supply. Voltage can 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 the whole machine is beneficial for long-term stable operation;
- The module should be as far away as possible from the power supply, transformers, high-frequency wiring and other parts with large electromagnetic interference;
- Bottom LayerHigh-frequency digital routing, high-frequency analog routing, and power routing must be avoided under the module. If it is necessary to pass through the module, assume that the module is soldered to the Top Layer, and the copper is spread on the Top Layer of the module contact part(well grounded), it must be close to the digital part of the module and routed in the Bottom Layer;
- Assuming the module is soldered or placed over the Top Layer, it is wrong to randomly route over the Bottom Layer or other layers, which will affect the module's spurs and receiving sensitivity to varying degrees;
- It is assumed that there are devices with large electromagnetic interference around the module that will greatly affect the performance. It is recommended to keep them away from the module according to the strength of the interference. If necessary, appropriate isolation and shielding can be done;
- Assume that there are traces with large electromagnetic interference (high-frequency digital, high-frequency analog, power traces) around the module that will greatly affect the performance of the module. It is recommended to stay away from the module according to the strength of the interference.If necessary, appropriate isolation and shielding can be done;
- If the communication line uses a 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 physical layers such as TTL protocol at 2.4GHz , for example: USB3.0;

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- The mounting structure of antenna has a great influence on the performance of the module. It is necessary to ensure that the antenna is exposed, preferably vertically upward. When the module is mounted inside the case, use a good antenna extension cable to extend the antenna to the outside;
- The antenna must not be installed inside the metal case, which will cause the transmission distance to be greatly weakened.

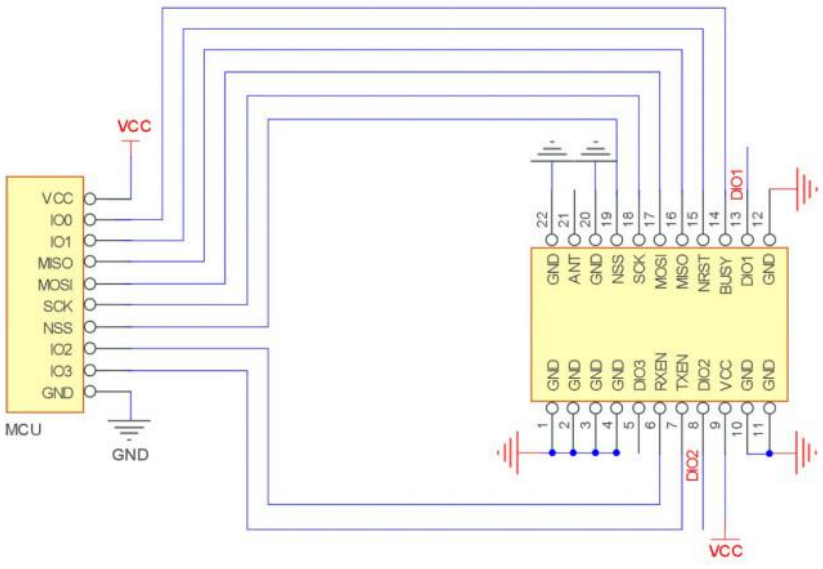
4.2 Programming

- This module is llcc68 + peripheral circuit, users can operate according to llcc68 chip book completely;
- 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；

5 basic application

5.1 Connection instructions to the emulator



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6 FAQ

6.1 Communication range is too short

- When there is a linear communication obstacle, the communication distance will be attenuated accordingly;
- Temperature, humidity and co frequency interference will increase the packet loss rate;
- The ground absorbs and reflects radio waves, and the test effect near the ground is poor;
- Seawater has a strong ability to absorb radio waves, so the seaside test effect is poor.
- If there are metal objects near the antenna or placed in the metal shell, the signal attenuation will be very serious;
- Power register setting error, air speed setting too high (the higher the air speed, the closer the distance);
- The lower the voltage is, the smaller the power is;
- The matching degree between the antenna and the module is poor or the quality of the antenna itself is poor.

6.2 Module is easy to damage

- 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.
- Please ensure that the installation process of anti-static operation, high-frequency device electrostatic sensitivity.
- Please ensure that the humidity should not be too high during installation and use, 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.

6.3 BER(Bit Error Rate) is high

- If there is interference of the same frequency signal nearby, stay away from the interference source or modify the 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;
- If the power supply is not ideal, it may cause garbled code, so it is necessary to ensure the reliability of the power supply;
- If the quality of extension line and feeder is poor or too long, the bit error rate will be high;

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7 Production guidance

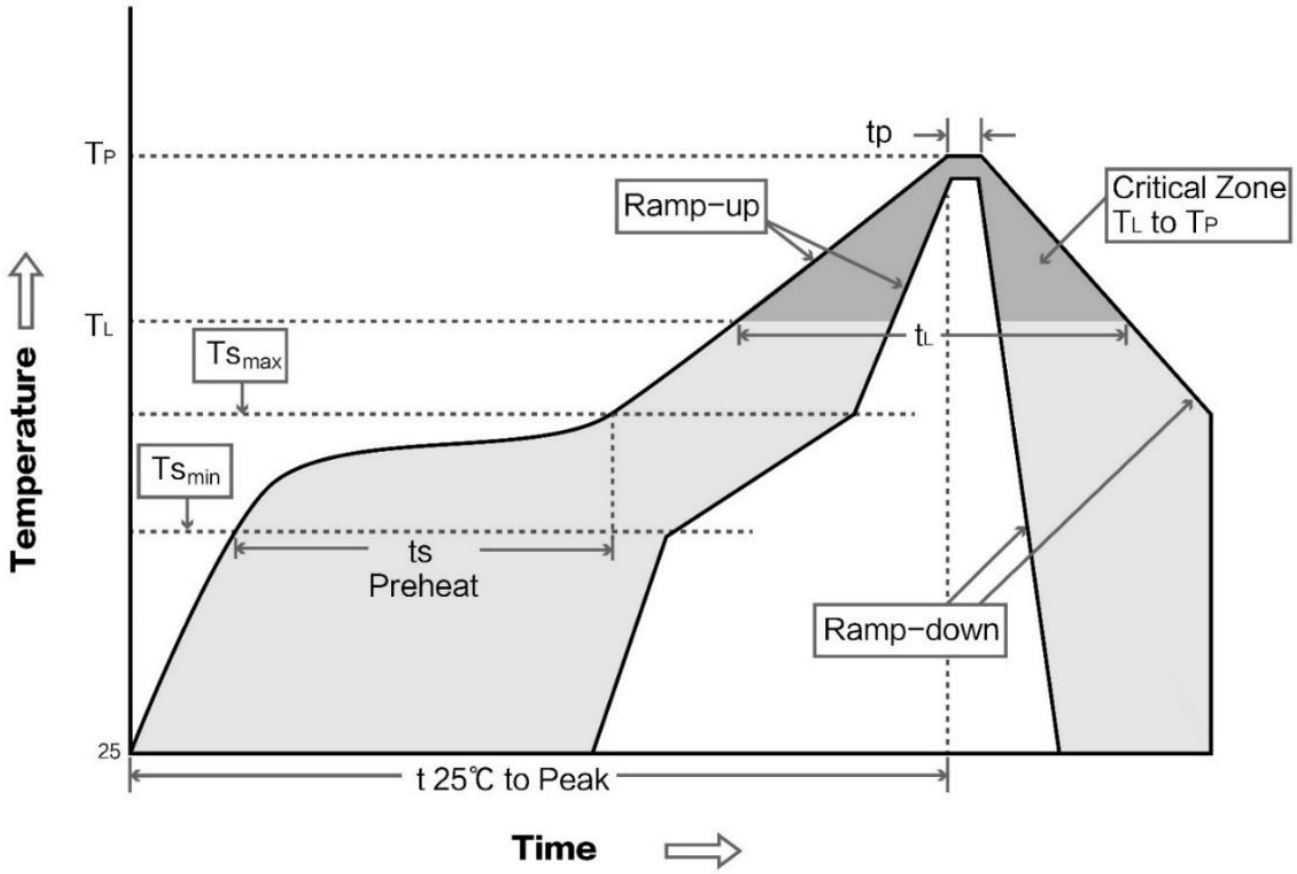
7.1 Reflow soldering temperature

Profile Feature	Curve characteristics	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 degrees	150 degrees.
Preheat temperature max (Tsmax)	Maximum preheating temperature	150 degrees.	200 degrees
Preheat Time (Tsmin to Tsmax)(ts)	Preheating time	60-120 sec	60-120 sec
Average ramp-up rate(Tsmax to Tp)	Average rising rate	3℃/second max	3℃/second max
Liquidous Temperature (TL)	Liquid temperature	183 degrees.	217 degrees.
Time（tL）Maintained Above（TL）	Time above liquidus	60-90 sec	30-90 sec
Peak temperature（Tp）	Peak temperature	220-235 degrees	230 to 250 degrees.
Aveage ramp-down rate（Tp to Tsmax）	Average descent rate	6℃/second max	6℃/second max
Time 25℃ to peak temperature	Time from 25 ℃ to peak temperature	6 minutes max	8 minutes max

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7.2 Reflow soldering curve



8 E220 series

Model No.	IC	Frequency Hz	Tx power dBm	Distance km	Package	Size mm	Antenna
E220-900M22S	LLCC68	868M/915M	22	5.5	SMD	14*20	SPI
E22-400M22S	SX1268	433M/470M	22	5.0	SMD	14*20	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.

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Model No.	Type	Frequeny Hz	Interface	Gain dBi	Hright	Cable	Function feature
TX868-JZ-5	Rubber rod antenna	868M	SMA-J	2.0	52	-	Ultra short direct omnidirectional antenna
TX868-JK-20	Rubber rod antenna	868M	SMA-J	3.0	210	-	Bendable rubber rod, omnidirectional antenna
TX868-XPL-100	Sucker antenna	868M	SMA-J	3.5	290	100	Small suction cup antenna, high cost performance
TX915-JZ-5	Rubber rod antenna	915M	SMA-J	2.0	52	-	Ultra short direct omnidirectional antenna
TX915-JK-11	Rubber rod antenna	915M	SMA-J	2.5	110	-	Bendable rubber rod, omnidirectional antenna
TX915-JK-20	Rubber rod antenna	915M	SMA-J	3.0	210	-	Bendable rubber rod, omnidirectional antenna
TX915-XPL-100	Sucker antenna	915M	SMA-J	3.5	290	100	Small suction cup antenna, high cost performance

Revision history

Version	Date	Description	Issued by
1.0	2021-01-04	Initial version	Linson

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