EBYTES E220-400M22S Llcc68 433 / 40MHz 160mw SPI SMD Lora Module User Manual

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E220-400M22S
Llcc68 433 / 470MHz 160mw SPI SMD Lora Module
Chengdu Ebyte Electronic Technology Co.,Ltd.
E220-400M22S User Manual

Contents

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Features

- The measured distance can reach 5500m;
- The maximum transmitting power is 160mw, the software is multi-level adjustable;
- Support global license-free ISM 433 / 470MHz band;
- In LoRaTM 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 a 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.

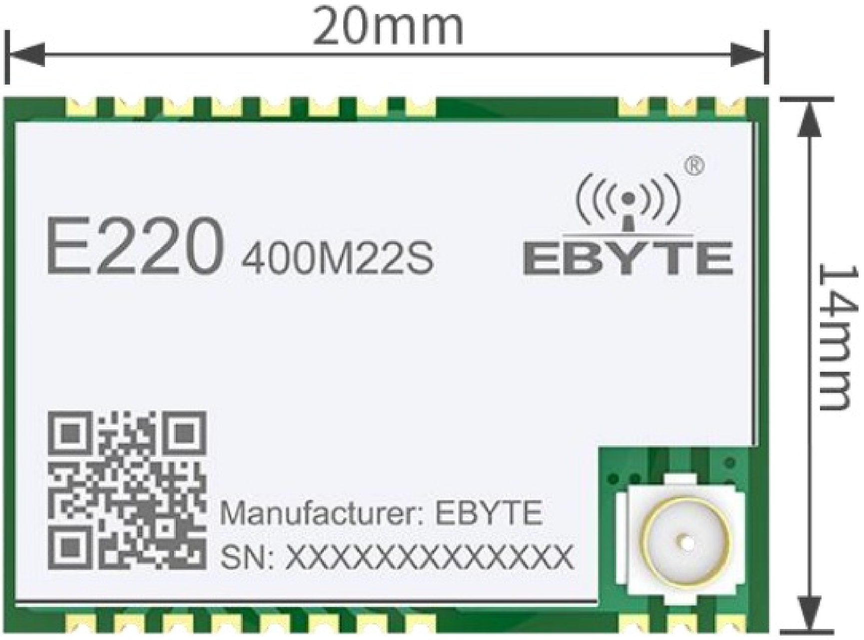
Introduction

1.1 Brief Introduction

E220-400M22S is a small module developed independently based on the generation of LoRaTM RF chip LLCC68 produced by Semtech company. LLCC68 is suitable for 433MHz and 470MHz SMD wireless modules and uses an industrial 32mhz crystal oscillator.
Compared with the previous generation of LoRaTM transceivers, its anti-jamming performance and communication distance have been further improved. Because of its new LoRaTM 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 homes, wireless meter reading, scientific research, medical, and long-distance wireless communication equipment. The product can cover 410 ~ 493mhz wide applicable frequency range.

Because the module is a pure RF transceiver module, it needs to use an 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.

Specification and parameter

2.1 limit parameters

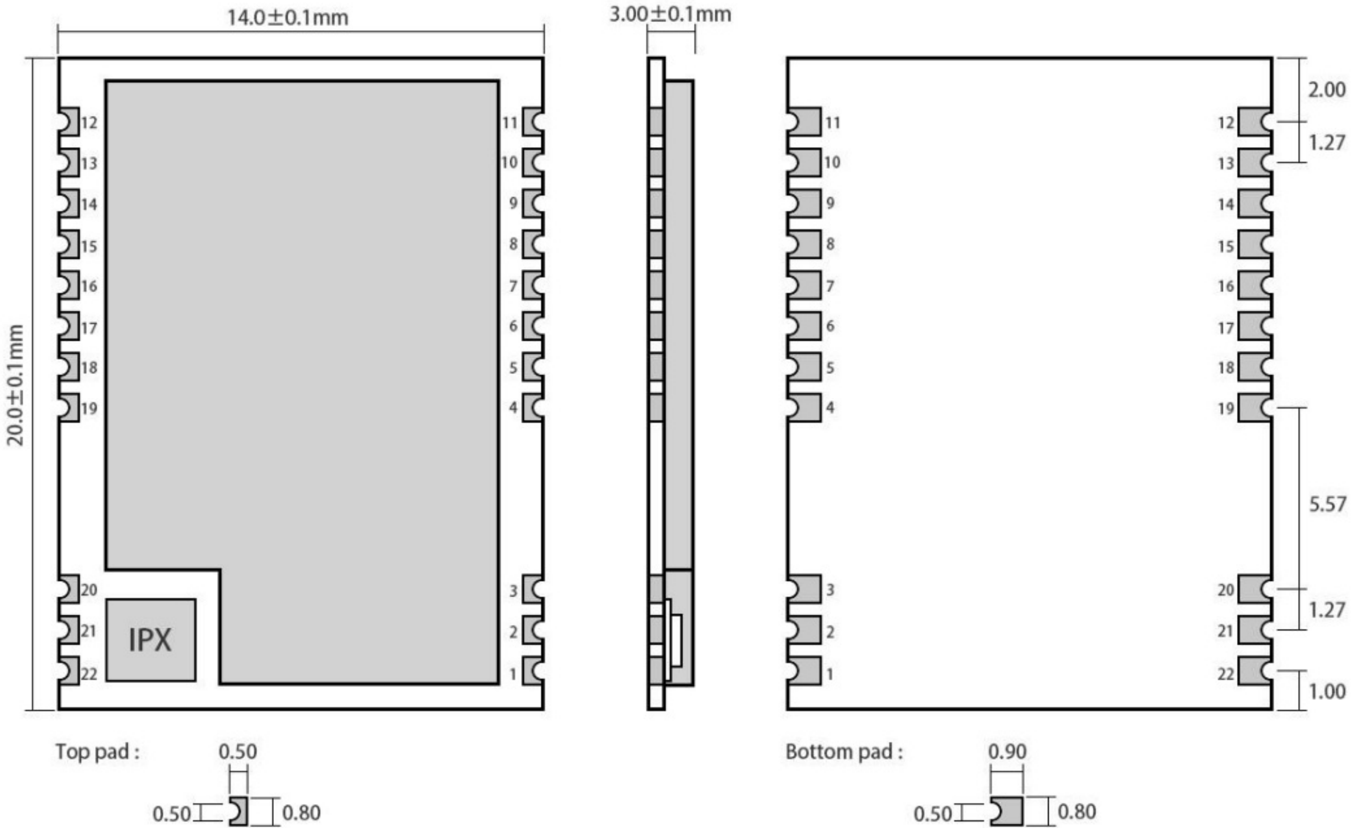
Main parameter	**Performance**		**Remarks**
	Min	Max	
Supply voltage (V)	0	3.7	Over 3.7V permanently burned module
Blocking power (DBM)	–	10	The burning probability is small in the close -range use
Working temperature (℃)	-40	+85	Industrial grade

2.2 Operating parameter

Main parameter		**Performance**			**Remarks**
		Min	**Type**	**Max**	
Working voltage (V)		1.8	3.3	3.7	≥3.3 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)		410	433/470/490	493	Support ISM band
Power Consump – tion	TX current mA	–	100	–	Instantaneous power consumption
	RX current mA	–	6.5	–	–
	Sleep current μA	–	180	–	Software shutdown
Max TX power dBm		21	21.5	22	–
Receiving sensitivity dBm		–	-129	–	BW_L=250kHz SF = 10 LORA^{TM}
Air data rate	LoRa bps	1.76k	–	62.5k	User programming control

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 airspeed is 2.4kbps.
FIFO	256Byte	Maximum length of a single transmission
Crystal frequency	32MHz	–
modulation mode	LoRa	Lora modulation is recommended
Packaging method	SMD	–
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	–

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)

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 an 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.			

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;

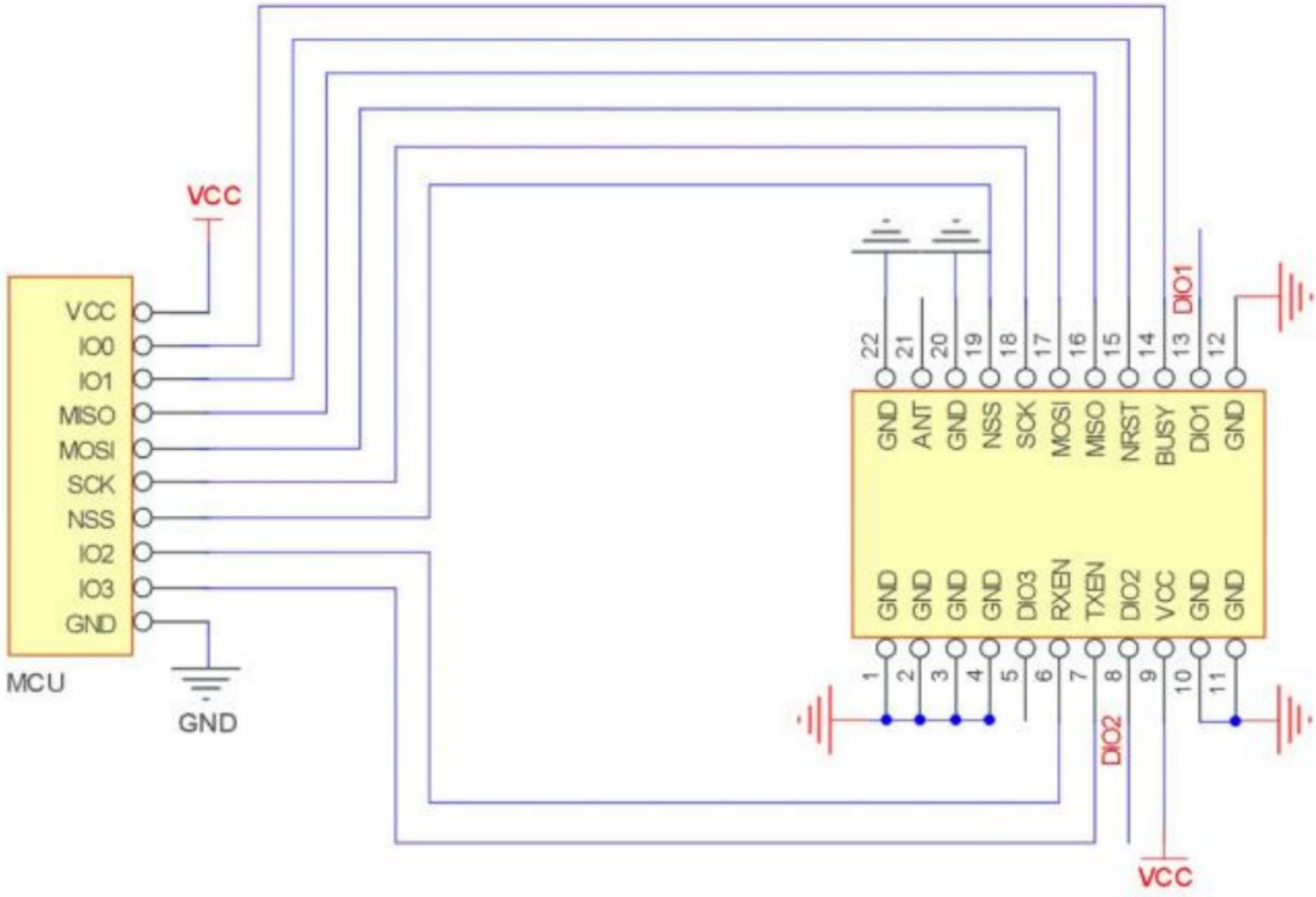
- Assuming that the module is welded or placed in the top layer, it is also wrong to route at will in the bottom layer or other layers, which will affect the spurious and receiving sensitivity of the module in different degrees;
- Assuming that there are large electromagnetic interference devices around the module that 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 still a risk of damage);
- Try to stay away from some TTL protocols with a 2.4GHz physical layer, such as USB3.0;
- 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.
- It is suggested to add 200R protection resistance in RDX / TXD of external MCU.

4.2 Programming

- This module is llcc68 + peripheral circuit, users can operate according to llcc68 chip manual completely;
- Dio1, dio2, and DIO3 are common IO ports, which can be configured into multiple functions. Dio2 can be connected
  to TXEN, not to the 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

Basic application

5.1 Basic circuit



FAQ

6.1 Communication range is too short

- The communication distance will be affected when an 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 the ground;
- Seawater has a 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 a metal object or put in a metal case; the
- Power register was set incorrectly, the 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.

6.2 Module is easy to damage

- Please check the power supply source, ensure it is within the recommended range, the high voltage will damage the module;
- Please check the stability of the power source, the voltage cannot fluctuate too much;
- Please make sure antistatic measures are taken when installing and using, high-frequency devices that have electrostatic susceptibility;

- Please ensure the humidity is within a 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

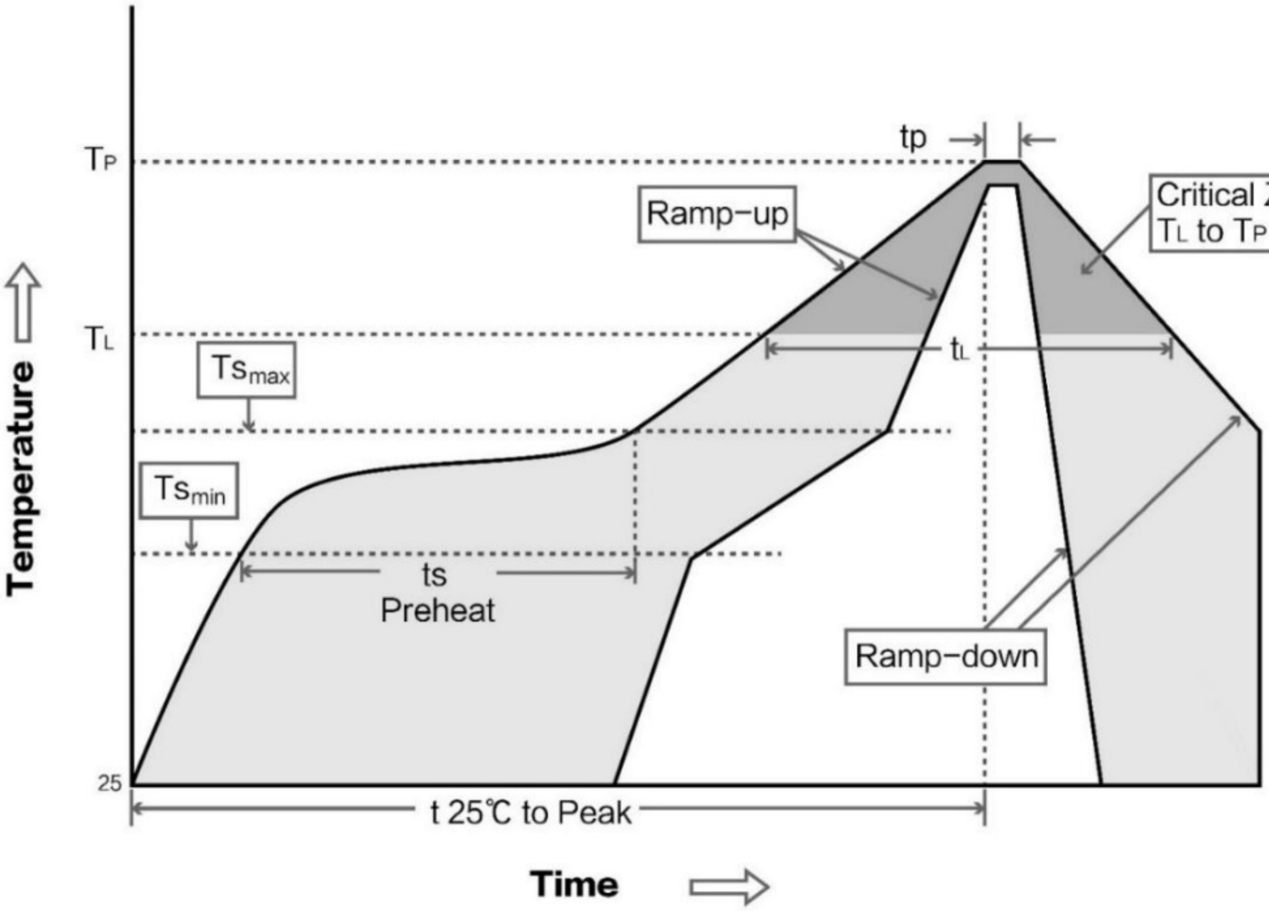
- There are co-channel signal interference nearby, please be away from interference sources or modify frequency and channel to avoid interference;
- The clock waveform on SPI is not standard, check whether there is interference on SPI line, and SPI bus line should not be too long;
- Poor power supply 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.

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℃	150℃
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 rising rate	3℃/second max	3℃/second max
Liquidous Temperature (TL)	Liquid temperature	183℃	217℃
Time to Maintained Above TL	Time above liquidus	60-90 sec	30-90 sec
Peak temperature Tp	Peak temperature	220-235℃	230-250℃
Aveage ramp-down rate Tp to Ts max	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

7.2 Reflow soldering curve



Relevant models

Product model	IC	Frequency Hz	TX power dBm	Test distance km	Package	Size mm	Communication interface
E22-400M22S	SX1268	433M/470M	22	5.0	SMD	14*20	SPI
E22-900M22S	SX1262	868M/915M	22	5.5	SMD	14*20	SPI

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 prices.

Model No.	Type	Frequency Hz	Interface	Gain dBi	Height	Cable	Function feature

TX433-NP-4310	Flexible PCB antenna	433M	SMA-J	2	43.8*9.5mm	–	Built-in flexible, FPC soft antenna
TX433-JW-5	Rubber antenna	433M	SMA-J	2	50mm	–	Flexible &omnidirectional
TX433-JWG-7	Rubber antenna	433M	SMA-J	2.5	75mm	–	Flexible &omnidirectional
TX433-JK-20	Rubber antenna	433M	SMA-J	3	210mm	–	Flexible &omnidirectional
TX433-JK-11	Rubber antenna	433M	SMA-J	2.5	110mm	–	Flexible &omnidirectional
TX433-XP-200	Sucker antenna	433M	SMA-J	4	19cm	200cm	Sucker antenna, high gain
TX433-XP-100	Sucker antenna	433M	SMA-J	3.5	18.5cm	100cm	Sucker antenna, high gain
TX433-XPH-300	Sucker antenna	433M	SMA-J	6	96.5cm	300cm	Car mounted sucker antenna, ultra-high gain
TX433-JZG-6	Rubber antenna	433M	SMA-J	2.5	52mm	–	Flexible &omnidirectional
TX433-JZ-5	Rubber antenna	433M	SMA-J	2	52mm	–	Flexible &omnidirectional
TX490-XP-100	Sucker antenna	490M	SMA-J	50	12cm	100cm	Sucker antenna, high gain
TX490-JZ-5	Rubber antenna	490M	SMA-J	50	50mm	–	Flexible &omnidirectional

Revision history

Version	Date	Description	Issued by
1.0	2021-01-04	Initial version	Linson
1.1	2021-8-5	Error correction	Linson

About us

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Documents / Resources

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References

- User Manual