



E22-400M33S User Manual

SX1268 433/470MHz 2W SPI Chip LoRa Module



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1. Overview

1.1 Introduction

E22-400M33S is based on the new generation of LoRa™ RF chip SX1268 produced by Semtech in the United States as the core of independent research and development of the maximum power of 2W and suitable for 433/470MHz SMD LoRa™ wireless module, using industrial-grade high-precision 32MHz crystal oscillator.

Since the original imported SX1268 is used as the core of the module, the power amplifier (PA) and low noise amplifier (LNA) are built in on top of the original one, which makes the maximum transmitting power reach 2W and further improve the receiving sensitivity, and the overall communication stability is greatly improved compared with the products without power amplifier and low noise amplifier. Compared with the previous generation of LoRa™ transceivers, the anti-interference performance and communication distance have been improved, further widening the gap with products of FSK and GFSK modulation methods. The product can cover an ultra-wide applicable frequency range from 410 to 493MHz and is backward compatible with SX1278 and SX1276.

As this module is pure RF transceiver module, it needs to use MCU driver or use special SPI debugging tool.



1.2 Features

- Compared with the SX1278 module, the SX1268 module has the significant advantages of lower power consumption, higher speed and longer distance.
- Communication distance up to 16km under ideal conditions.
- Built-in PA+LNA, which substantially improves the communication distance and communication stability.
- Maximum transmitting power of 2W, adjustable in multiple levels by software.
- Support for global license-free ISM 433/470MHz band.
- Support multiple modulation modes, LoRa™/FSK/GFSK/MSK/GMSK/OOK;
- Support data transmission rate from 0.018k to 62.5kbps in LoRa™ mode.
- FSK mode support for data rates up to 300kpbs.
- Downward compatibility with SX1278/SX1276 series RF transceivers.
- Large FIFO capacity, supporting 256 Byte data cache.
- A new SF5 spread spectrum factor introduced to support dense networks.
- support for 3.3 to 5.5V power supply, greater than 5V power supply are available to ensure the best performance.

- Industrial-standard design, supporting extended use at -40 to +85° C.
- Dual antennas optional (IPEX/stamp hole) for user-friendly secondary development and easy integration.

1.3 Application Scenarios

- Home security alarms and remote keyless entry.
- Smart home as well as industrial sensors, etc..
- Wireless alarm security systems.
- Building automation solutions.
- Wireless industrial grade remote controls.
- Advanced meter reading architecture (AMI).
- Automotive industry applications.

2. Specification parameters

2.1 Limit parameters

Main parameters	Performance		Remarks
	Minimum value	Maximum value	
Supply Voltage (V)	0	5.5	Permanent module burnout above 5.5V
Blocking power (dBm)	-	10	The probability of burning is small when used in close proximity
Operating temperature (°C)	-40	+85	Industrial Grade

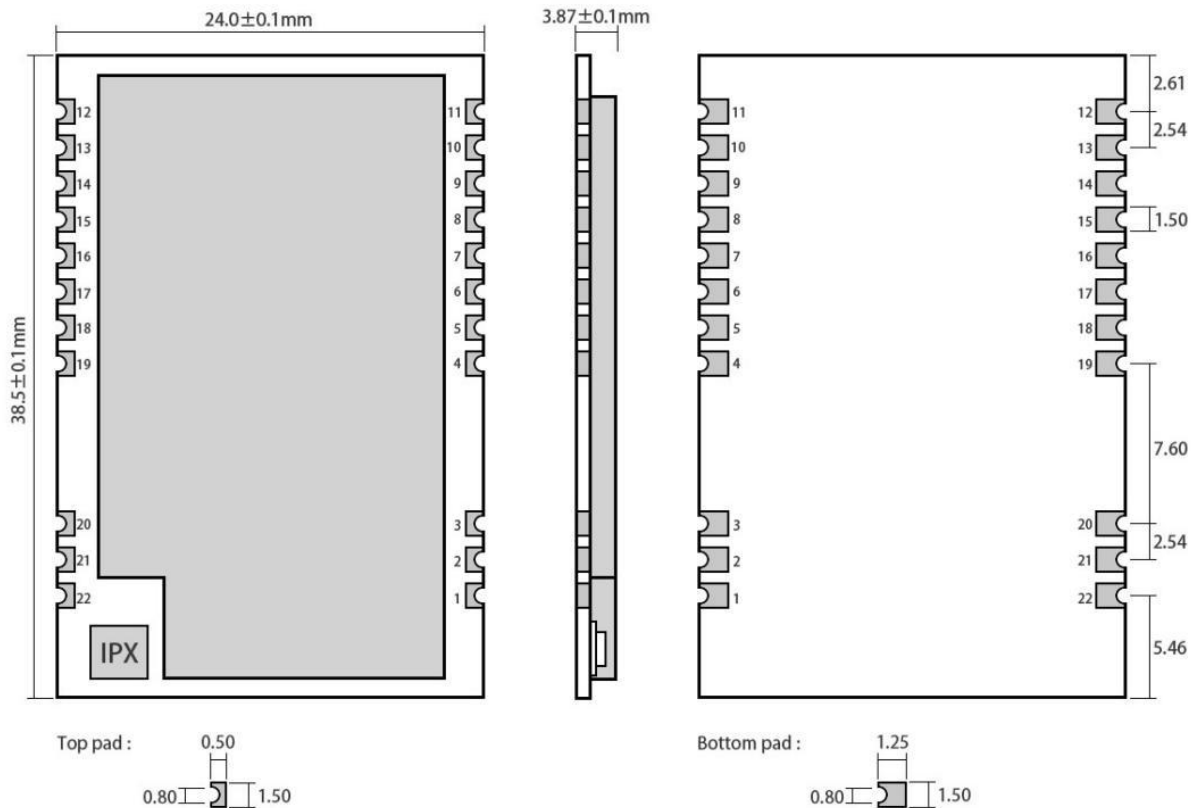
2.2 Working parameters

Main parameters		Performance			Remarks
		Minimum value	Typical values	Maximum value	
Operating Voltage (V)		3.3	5.0	5.5	≥5.0V Guaranteed output power
Communication level (V)			3.3		Risk of burnout with 5V TTL
Operating temperature (°C)		-40	-	+85	Industrial grade design
Operating Frequency Band (MHz)		410	433/470	493	ISM band support
Power consumption	Emission current (mA)		1200		Instantaneous power consumption
	Receiving current (mA)		14		

	Dormant current (uA)		2		Software shutdown
Maximum transmitting power (dBm)	32.5	33.0	33.5		
Reception sensitivity (dBm)	-124	-125	-126		Airspeed 0.3kbps
air speed (bps)	0.6k	-	300k		User-programmed control
	0.018k	-	62.5k		User-programmed control

Main parameters	Description	Remarks
Reference Distance	16km	Clear and open, antenna gain 5dBi, antenna height 2.5m, air rate 0.3kbps
FIFO	256Byte	Maximum length of a single transmission
Crystal Frequency	32MHz	
Modulation mode	LoRa(Recommend)	
Packaging method	SMD	
Interface method	2.54mm	Stamp Holes
Communication Interface	SPI	0 ~ 10Mbps
Dimension	38.5*24mm	
Antenna Interface	Stamp Holes/IPEX	Equivalent impedance about 50Ω
Weight	4.9g	±0.1g

3. Mechanical dimensions and pin definition



Pad quantity : 22
Unit: mm

Pin Serial Number	Pin Name	Pin Orientation	Pin Usage
1	GND		Ground wire, connected to power reference ground
2	GND		Ground wire, connected to power reference ground
3	GND		Ground wire, connected to power reference ground
4	GND		Ground wire, connected to power reference ground
5	GND		Ground wire, connected to power reference ground
6	RXEN	Input	RF switch receive control pin, connected to external microcontroller IO, active high
7	TXEN	Input	RF switch transmit control pin, connected to external microcontroller IO or DIO2, active high
8	DIO2	Input/Output	Configurable general purpose IO port (see SX1268 manual for details)
9	VCC		Power supply, range 3.3 to 5.5V (it is recommended to increase the external ceramic filter capacitor)
10	VCC		Power supply, range 3.3 to 5.5V (it is recommended to increase the external ceramic filter capacitor)
11	GND		Ground wire, connected to power reference ground
12	GND		Ground wire, connected to power reference ground
13	DIO1	Input/Output	Configurable general purpose IO port (see SX1268 manual for details)

14	BUSY	Output	For status indication (see SX1268 manual for details)
15	NRST	Input	Chip reset trigger Input pin, active low
16	MISO	Output	SPI Data Output Pin
17	MOSI	Input	SPI Data Input Pin
18	SCK	Input	SPI Clock Input Pin
19	NSS	Input	Module chip select pin to start an SPI communication
20	GND		Ground wire, connected to power reference ground
21	ANT		Antenna connector, stamp hole (50Ω characteristic impedance)
22	GND		Ground wire, connected to power reference ground

4. Basic operation

4.1 Hardware Design

- Recommend using a DC regulated power supply to power the module with as small a ripple coefficient as possible, and the module needs to be reliably grounded.
- Please pay attention to the correct connection of the positive and negative terminals of the power supply, as a reversed 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 it may cause permanent damage to the module.
- Please check the stability of the power supply, the voltage should not fluctuate significantly and frequently.
- When designing the power supply circuit for the module, it is often recommended to retain more than 30% margin to have the whole machine conducive to long-term stable operation.
- modules should be as far away as possible from the power supply, 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 it is necessary to pass below the module, assuming that the module is soldered in the Top Layer, in the module contact part of the Top Layer pavement copper (all pavement copper and good grounding), must be close to the digital part of the module and alignment in the Bottom Layer.
- Assuming that the module is soldered or placed in the Top Layer, it is also wrong to run wires randomly in the Bottom Layer or other layers, which will affect the spurious and reception sensitivity of the module to varying degrees.
- Assuming that there are large electromagnetic interference devices around the module will also greatly affect the performance of the module, according to the strength of the interference is recommended to be properly away from the module, if the situation allows the appropriate isolation and shielding.
- Assuming that there are large electromagnetic interference alignments around the module (high-frequency digital, high-frequency analog, power supply alignments) will also greatly affect the performance of the module, according to the intensity of the interference, it is recommended to keep away from the module, and if the situation permits,

appropriate isolation and shielding can be done.

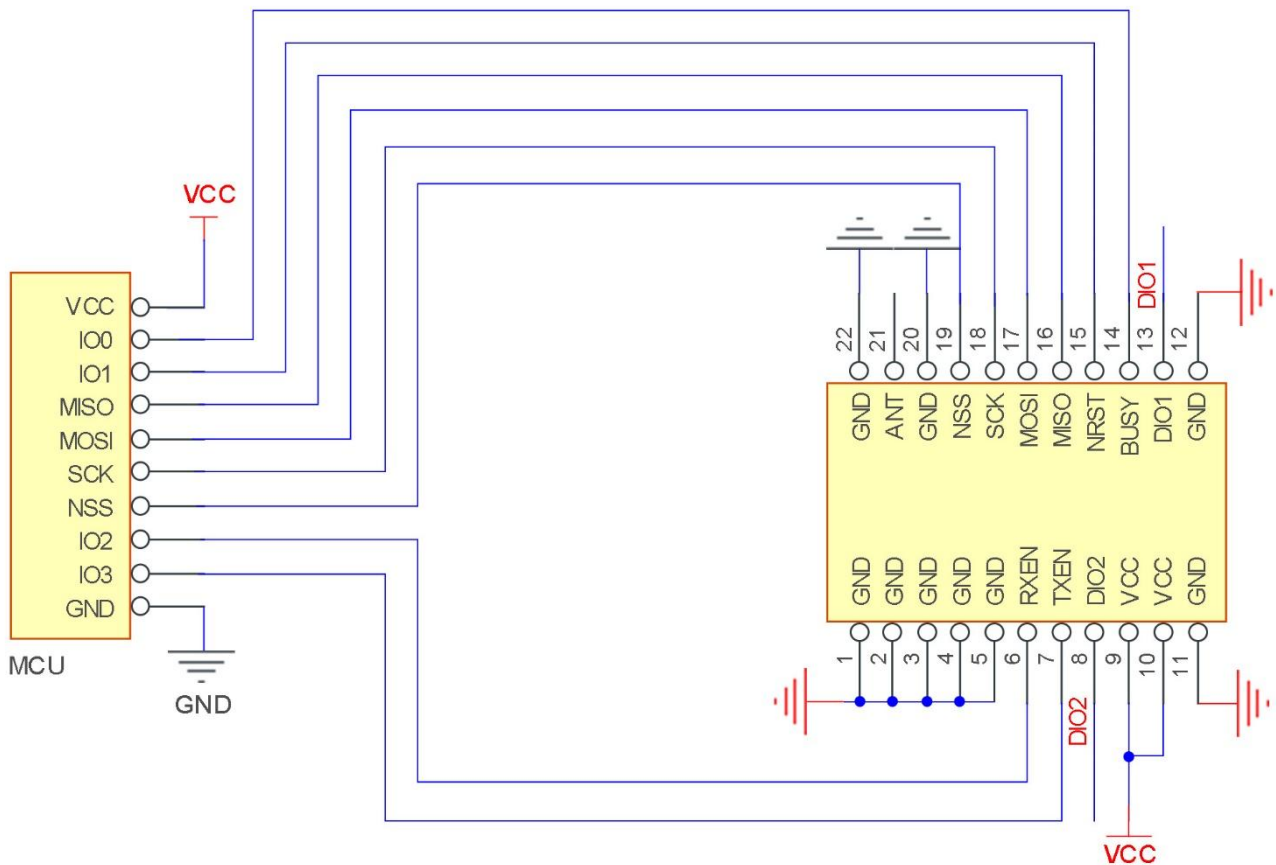
- communication line if the use of 5V level, must be connected in series with 1k-5.1k resistors (not recommended, there is still a risk of damage).
- try to stay away from some of the physical layer is also 2.4GHz TTL protocol, for example: USB3.0.
- Antenna mounting structure has a big impact on the module performance, make sure the antenna is exposed, preferably vertically up. When the module is installed inside the case, you can use a high quality antenna extension cable to extend the antenna to the outside of the case.
- The antenna must not be installed inside the metal case, it will cause the transmission distance to be greatly weakened.
- It is recommended to add 200R protection resistors to the RXD/TXD of the external MCU.

4.2 Software Writing

- This module is SX1268/SX1262+PA+LNA, its driving method is fully equivalent to SX1268/SX1262, users can operate exactly according to SX1268/SX1262 chip book.
- DIO1 and DIO2 are general-purpose IO ports, which can be configured for various functions; among them, DIO2 can be connected to TXEN and not to the MCU IO port for controlling RF switch emission, see SX1262 manual for details, which can be suspended if not used.
- Internal use DIO3 for 32MHz TCXO crystal power supply (DIO3 configuration output 1.8V)

5. Basic Applications

5.1 Basic Circuits



6. Frequently Asked Questions

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 is lower than recommended under room temperature. The lower the voltage is, the smaller the transmitting power is.
- Due to antenna quality or poor matching between antenna and module.

6.2 Module is easy to damage

- Please check the power supply to ensure that it is within the recommended value. If it exceeds the maximum value, the module will be permanently damaged;
- Please check the stability of power source, the voltage cannot fluctuate too much.
- Please make sure anti-static measures 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 is too high

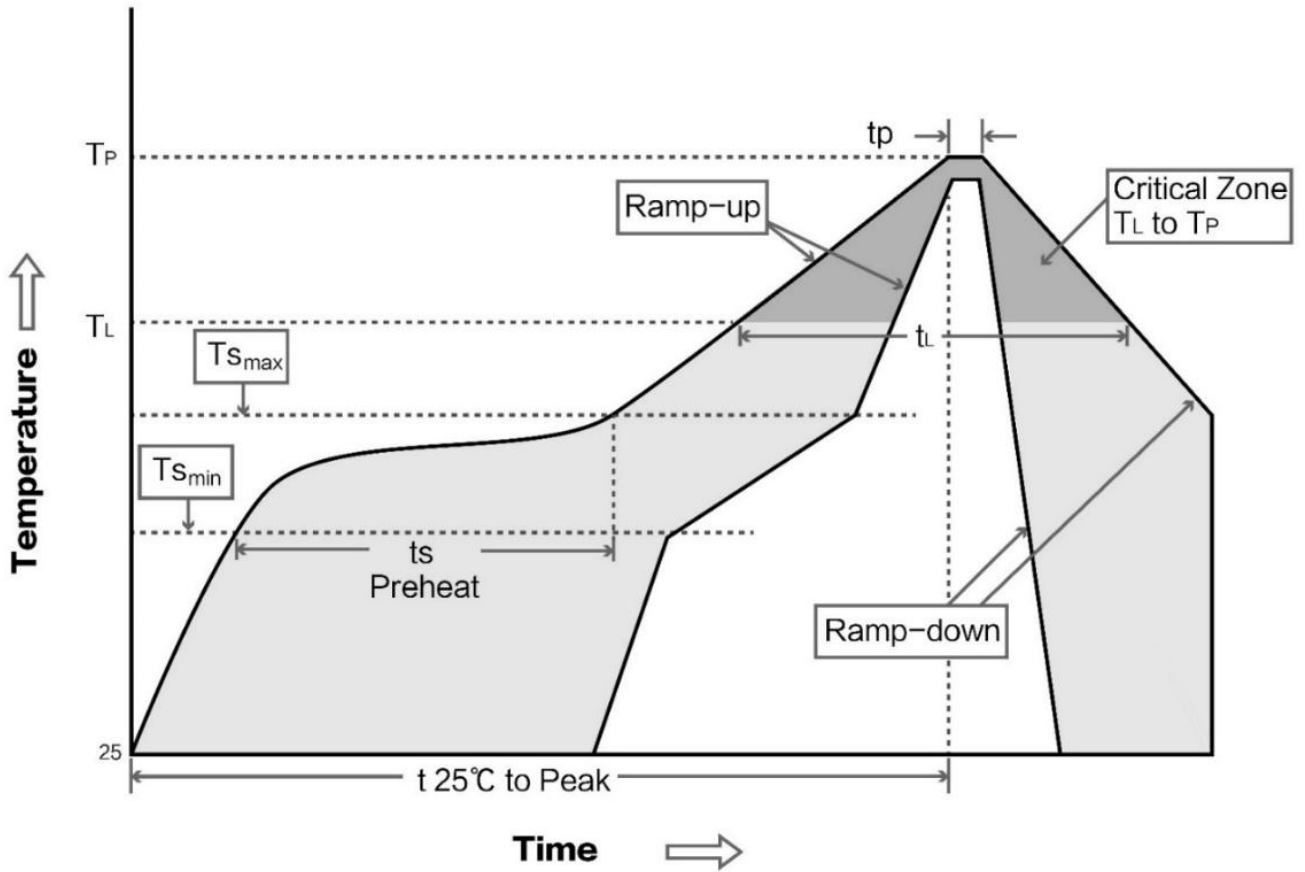
- There is interference from the same frequency signal nearby, stay away from the interference source or modify the frequency and channel to avoid interference.
- The clock waveform on the SPI is not standard, check whether there is interference on the SPI line, and the SPI bus alignment should not be too long.
- Unsatisfactory power supply may also cause garbled code, be sure to ensure the reliability of the power supply.
- Poor quality or too long extension cable or feeder line may also cause high BER.

7. Welding work instruction

7.1 Reflow 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 (T _{smin})	Minimum preheating temperature	100°C	150°C
Preheat temperature max (T _{smax})	Maximum preheating temperature	150°C	200°C
Preheat Time (T _{smin} to T _{smax})(t _s)	Warm-up time	60-120 sec	60-120 sec
Average ramp-up rate(T _{smax} to T _p)	Average rise rate	3°C/second max	3°C/second max
Liquidous Temperature (TL)	liquid phase temperature	183°C	217°C
Time (t _L) Maintained Above (TL)	Time above the liquid phase line	60-90 sec	30-90 sec
Peak temperature (T _p)	Peak temperature	220-235°C	230-250°C
Average ramp-down rate (T _p to T _{smax})	Average drop rate	6°C/second max	6°C/second max
Time 25°C to peak temperature	Time from 25°C to peak temperature	6 minutes max	8 minutes max

7.2 Reflow Profile



8. Related Models

SKU	Chip	Frequency Hz	Transmitting power dBm	Test Distance km	Package	Size mm	Communication Interface
E22-400M22S	SX1268	433/470M	22	7	SMD	14*20	SPI
E22-900M22S	SX1262	868/915M	22	7	SMD	14*20	SPI
E22-400M33S	SX1268	433/470M	33	16	SMD	24*38.5	SPI
E22-900M30S	SX1262	868/915M	30	12	SMD	24*38.5	SPI
E22-230T22S	SX1262	230M	22	5	SMD	16*26	TTL
E22-400T22S	SX1268	433/470M	22	5	SMD	16*26	TTL
E22-900T22S	SX1262	868/915M	22	5	SMD	16*26	TTL
E22-230T30S	SX1262	230M	30	10	SMD	25*40.5	TTL
E22-400T30S	SX1268	433/470M	30	10	SMD	25*40.5	TTL
E22-900T30S	SX1262	868/915M	30	10	SMD	25*40.5	TTL

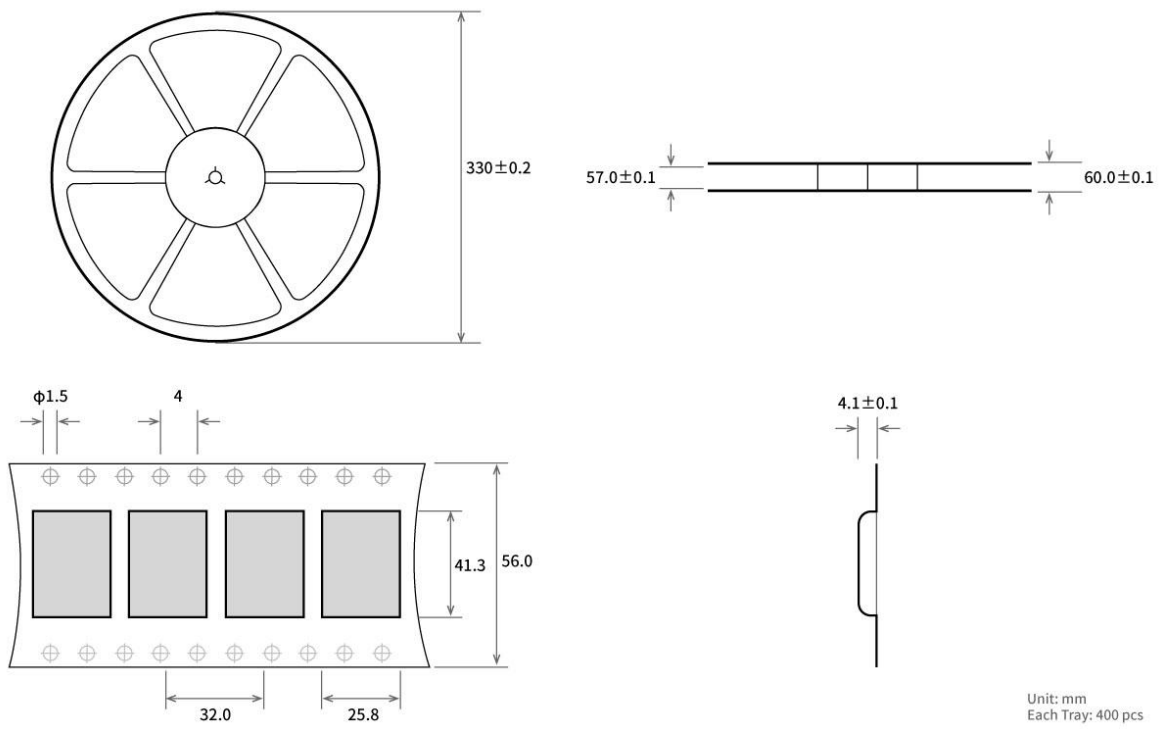
9. Antenna Guide

9.1 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 antennas as supporting our wireless module and more excellent performance and reasonable price.

SKU	Type	Frequency Hz	Interface	Gain dBi	Height mm	Feeders cm	Function
TX433-NP-431 0	Flexible Antenna	433M	Welding	2.0	43.8*9.5	-	Built-in flexible, FPC soft antenna
TX433-JZ-5	Glue Stick Antenna	433M	SMA-J	2.0	52	-	Ultra Short Straight, Omni-directional Antenna
TX433-JZG-6	Glue Stick Antenna	433M	SMA-J	2.5	62	-	Ultra Short Straight, Omni-directional Antenna
TX433-JW-5	Glue Stick Antenna	433M	SMA-J	2.0	50	-	Bendable glue stick, omni-directional antenna
TX433-JWG-7	Glue Stick Antenna	433M	SMA-J	2.5	75	-	Bendable glue stick, omni-directional antenna
TX433-JK-11	Glue Stick Antenna	433M	SMA-J	2.5	110	-	可 Bendable glue stick, omni-directional antenna
TX433-JK-20	Glue Stick Antenna	433M	SMA-J	3.0	210	-	可 Bendable glue stick, omni-directional antenna
TX433-XPL-10 0	Suction cup antenna	433M	SMA-J	3.5	185	100	Small Suction cup antenna, Cost effectiveness
TX433-XP-200	Suction cup antenna	433M	SMA-J	4.0	190	200	Middle Suction cup antenna, Low loss
TX433-XP-30 0	Suction cup antenna	433M	SMA-J	6.0	965	300	Big Suction cup antenna, High Gain
TX490-JZ-5	Glue Stick Antenna	470/490M	SMA-J	2.0	50	-	Ultra Short Straight, Omni-directional Antenna
TX490-XPL-10 0	Suction cup antenna	470/490M	SMA-J	3.5	120	100	Small Suction cup antenna, Cost effectiveness

10. Batch packing method



Revision history

Version	Revision Date	Revision Notes	Maintaining people
1.0	2022-10-20	Manual Release	Yan
1.1	2022-12-6	Bug fixes	Yan
1.2	2023-7-12	Bug fixes	Hao
1.3	2023-8-25	Bug fixes	Bin

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