User Manual

E22-900M33S

SX1262 868/915 MHz 2Watts SPI SMD LoRa Module

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Contents

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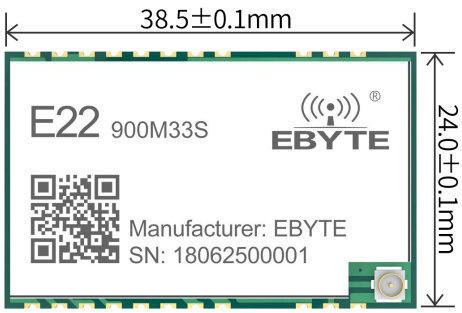
1 Overview

1.1 Introduction



E22-900M33S is independently developed based on the new generation LoRa ™ radio frequency chip SX1262 produced by Semtech in the United States . It has a maximum power of 2 W and is suitable for 868 / 915MHz patch-type LoRa ™ wireless modules . It uses an industrial-grade high-precision 32MHz crystal oscillator.

Since the imported SX1262 is used as the core of the module, a power amplifier (PA) and a low noise amplifier (LNA) are built-in on the original basis , so that the maximum transmit power reaches 2 W and the receiving sensitivity is further improved. In the overall communication The stability is greatly improved compared to products without power amplifier and low noise amplifier. Compared with the previous generation LoRa ™ transceiver, the anti-interference performance and communication distance have been improved, further widening the gap with products with FSK and GFSK modulation methods . This product can cover an ultra-wide applicable frequency range of 850 to 930 MHz and is backward compatible with SX1278 and SX1276.

Since this module is a pure radio frequency transceiver module, it needs to use an MCU driver or a dedicated SPI debugging tool.

1.2 Features

- S X1278 module, the SX1262 module has the significant advantages of lower power consumption, faster speed, and longer distance;
- Under ideal conditions, the communication distance can reach 1 6 km;
- Built-in PA +LNA , greatly improving communication distance and communication stability;
- The maximum transmit power is 2 W, multi-level software adjustable;
- Support global license-free ISM 868/915 MHz frequency band;
- Supports multiple modulation modes, LoRa ™ /GFSK ;
- LoRa ™ mode supports data transmission rates from 0.3 k to 62.5 kbps ;
- G FSK mode supports data transmission rate up to 300kpbs ;
- Backwards compatible with SX1278/SX1276 series RF transceivers;
- FIFO has large capacity and supports 256Byte data cache ;
- SF5 spreading factor introduced to support dense networks ;
- Supports 3.3 ~ 5.5V power supply, and any power supply greater than 5 V can ensure the best performance;
- Industrial grade standard design, supports long-term use at -40 ~ + 85 ℃;
- Optional dual antennas (IPEX/stamp hole) facilitate user secondary development and integration;

1.3 Application scenarios

- Home security alarm and remote keyless entry;
- Smart home and industrial sensors, etc.;
- Wireless alarm security system ;
- Building automation solutions;
- Wireless industrial grade remote control;
- Advanced Meter Infrastructure (AMI);
- Automotive industry applications.

2 Parameters

2.1 Limit parameters

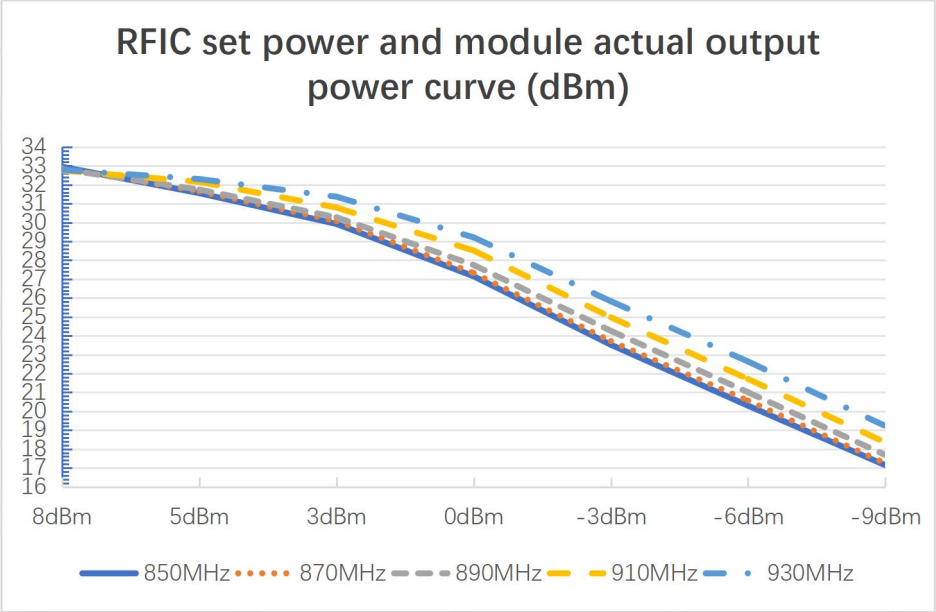
The main parameters	performance		Remark
	minimum value	maximum value	
Supply voltage (V)	3.3	5.5	Exceeding 5.5V will permanently burn the module
Blocking power (dBm)	-	10	Less likely to be burned if used at close range
Working temperature (℃)	-40	+85 _	Industrial grade

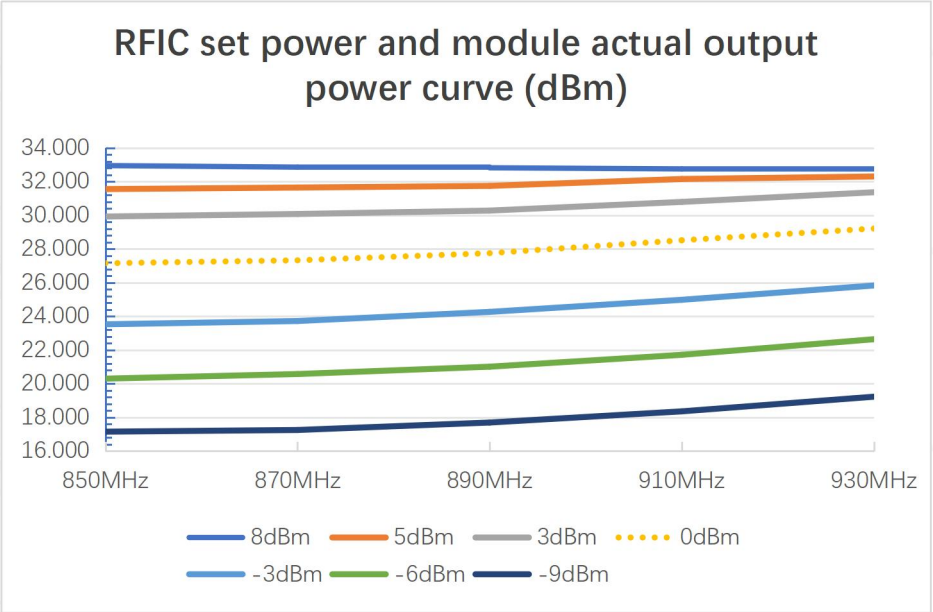
2.2 Working parameters

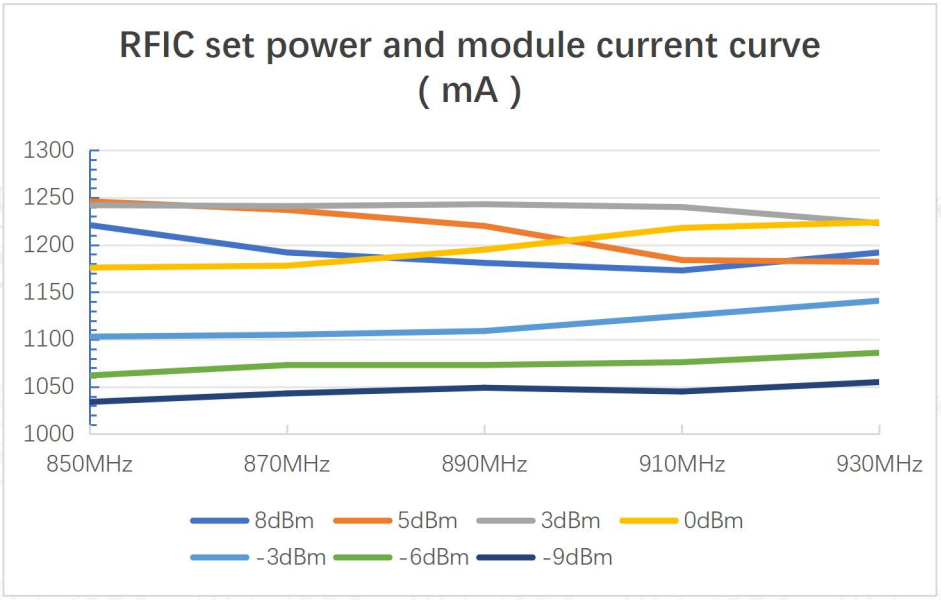
The main parameters		performance			Remark
		minimum value	Typical value	maximum value	
Working voltage (V)		3.3	5.0	5.5	≥5.0V guaranteed output power
Communication level (V)			3.3		Using 5V TTL risks burning out
Working temperature (℃)		-40	-	+85 _	Industrial grade design
Working frequency band (M Hz)		850	868/915	930	Support ISM frequency band
Power consumption	Emission current (mA)		1200		±100mA(33dBm&5V)
	Receive current (mA)		1 5		
	Sleep current (u A)		2		Software shutdown
Maximum transmit power (dBm)		32.5	33.0	33.5	**The output power of the RF chip cannot be greater than 9dBm**
Receiving sensitivity (dBm)		-1 34	-1 35	-1 36	LoRaSF9

The main parameters	describe	Remark
reference distance	16 km _	Sunny and open space, antenna gain 5dBi, antenna height 2.5 meters, air rate 0.3kbps
FIFO	256Bytes	Maximum length of a single send
Crystal frequency	32MHz	
Modulation	L o R a (recommended)	-
Packaging method	SMD type	
Interface mode	2.54mm	stamp hole
Communication Interface	SPI	0 ～ 10Mbps
Dimensions	38.5*24mm	
Antenna interface	Stamp hole/IPEX	Equivalent impedance is about 50 Ω
weight	5.1g	±0.1g

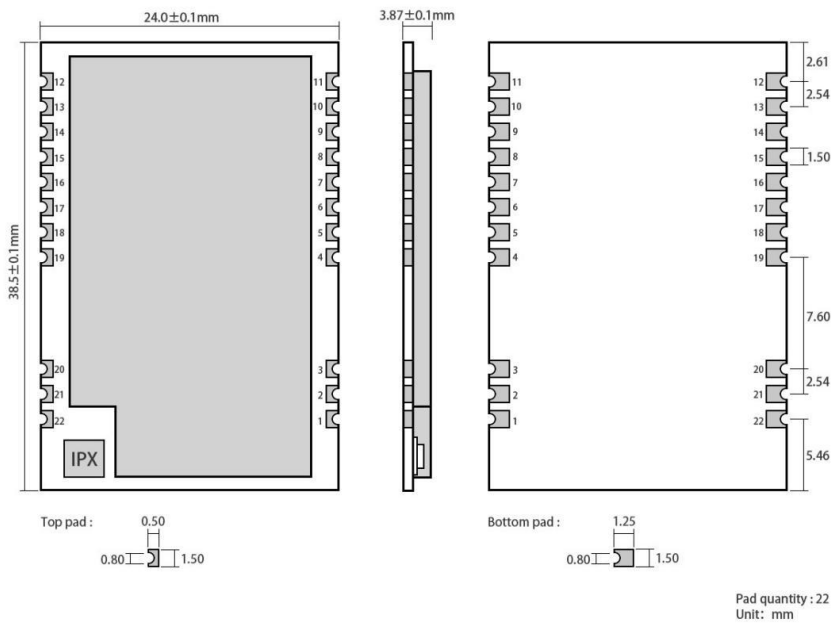
2.3 TX Power Curve







3 Mechanical Dimensions and Pin Definitions



Pin	Pin name	Pin direction	Pin usage
1	GND		Ground wire, connected to the power reference ground
2	GND		Ground wire, connected to the power reference ground
3	GND		Ground wire, connected to the power reference ground
4	GND		Ground wire, connected to the power reference ground
5	GND		Ground wire, connected to the power reference ground
6	RXEN	enter	The radio frequency switch receives the control pin, connects to the external microcontroller IO, and is active at high level.
7	TXEN	enter	RF switch emission control pin, connected to external microcontroller IO or DIO2, active at high level
8	DIO2	input Output	Configurable general IO port (see SX1262 manual for details)
9	VCC		Power supply, range 3.3 ~ 5.5V (it is recommended to add external ceramic filter capacitors)
10	VCC		Power supply, range 3.3 ~ 5.5V (it is recommended to add external ceramic filter capacitors)
11	GND		Ground wire, connected to the power reference ground
12	GND		Ground wire, connected to the power reference ground
13	DIO1	input Output	Configurable general IO port (see SX1262 manual for details)
14	BUSY	output	Used for status indication (see SX1262 manual for details)
15	NRST	enter	Chip reset trigger input pin, active low level
16	MISO	output	SPI data output pin
17	MOSI	enter	SPI data input pin
18	SCK	enter	SPI clock input pin
19	NSS	enter	Module chip select pin, used to start an SPI communication
20	GND		Ground wire, connected to the power reference ground
21	ANT		Antenna interface, stamp hole (50 Ω characteristic impedance)
22	GND		Ground wire, connected to the power reference ground

4 Notes for hardware and software

4.1 Hardware design

- It is recommended to use a DC regulated power supply to power the module. The power supply ripple coefficient should be as small as possible, and the module must 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 it is within the recommended power supply voltage. If it exceeds the maximum value, it will cause permanent damage to the module;
- Please check the stability of the power supply. The voltage cannot fluctuate greatly and frequently;
- When designing the power supply circuit for the module, it is often recommended to reserve more than 30% margin, so that the whole machine can work stably for a long time;
- The module should be kept as far away as possible from power supplies, transformers, high-frequency wiring and other parts with high electromagnetic interference;
- High-frequency digital traces, high-frequency analog traces, and power traces must be avoided under the module. If it is absolutely necessary to pass under the module, assuming that the module is welded on the Top Layer, lay copper ground on the Top Layer of the module contact part (all copper and well grounded), it must be close to the digital part of the module and routed on the Bottom Layer ;
- Assuming that the module is welded or placed on the Top Layer, it is also wrong to route traces randomly on the Bottom Layer or other layers, which will affect the module's spurious and receiving sensitivity to varying degrees ;
- Assuming that there are devices with large electromagnetic interference around the module, which will also greatly affect the performance of the module, it is recommended to stay away from the module according to the intensity of the interference. If the situation allows, appropriate isolation and shielding can be done;
- Assuming that there are traces with large electromagnetic interference around the module (high-frequency digital, high-frequency analog, power traces), it will also greatly affect the performance of the module. It is recommended to stay away from the module according to the intensity of the interference. If the situation allows, you can make appropriate adjustments. isolation and shielding;
- If the communication line uses 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 TTL protocols whose physical layer is also 2.4GHz, such as USB3.0;
- The antenna installation structure has a great impact on module performance. Make sure the antenna is exposed, preferably vertically upward. 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 a metal shell, as this will greatly reduce the transmission distance.
- to add a 200R protection resistor to the RXD/TXD of the external MCU .

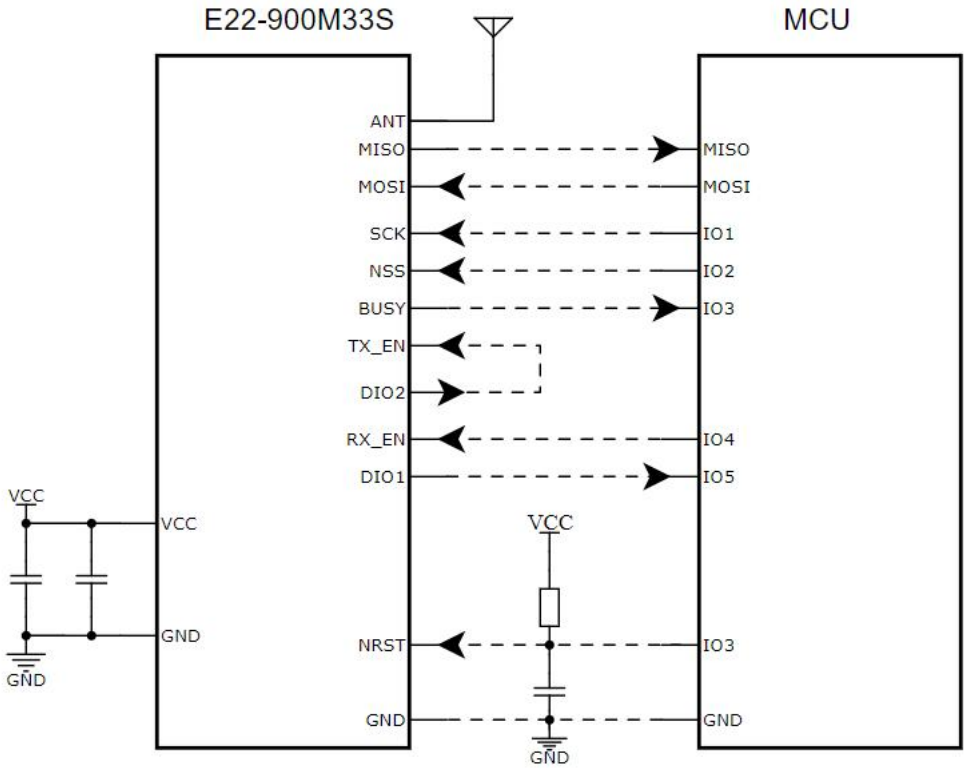
4.2 Software writing

- This module is SX1268/SX1262+PA+LNA , and its driving method is completely the same as SX1268/SX1262 . Users can operate it according to the SX1268/SX1262 chip manual;It should be noted that the TX_EN of PA_EN and RF_switch are connected together, and the RX_EN of LNA_EN and RF_switch are connected together, so users only need to control TX_EN when sending, and use TX_EN when receiving.
- DIO1 and DIO2 are general-purpose IO ports that can be configured into a variety of functions; DIO2 can be connected to TXEN, not connected to the IO port of the MCU, and is used to control radio frequency switch emission. For details, see the SX1262 manual. If not used , it can be left floating;RX_EN and TX_EN cannot be high at the same time. The level states must be opposite.
- is used internally to power the 32MHz TCXO crystal oscillator (DIO3 is configured to output 1.8V) .

```
void Ebyte_E22x_Init( void )
{
    /* IO复位+CS唤醒 模块*/
    Ebyte_E22x_Reset( );
    Ebyte_E22x_Wakeup( );

    /* 状态机设定 */
    OperatingMode = MODE_STDBY_RC;

    /* 进入 STDBY_RC 待机配置模式 */
    Ebyte_E22x_SetStandby( STDBY_RC );

    /* 启用TCXO(由DIO3控制) 并尝试进入STDBY_XOSC模式  3.3V输出 PLL会自动补偿33.4pf电容器 */
    Ebyte_E22x_SetDio3AsTcxoCtrl ( TCXO_CTRL_3_3V, 320 );
    Ebyte_E22x_WriteRegister ( REG_XTA_TRIM, 0x2F );

    /* 重新计算修正时钟 */
    CalibrationParams_t calibrationParams;
    calibrationParams.Value = 0xFF;
    Ebyte_E22x_Calibrate( calibrationParams );

    /* 进入 STDBY_XOSC 待机配置模式 */
    Ebyte_E22x_SetStandby ( STDBY_XOSC );

    /* 是否启用 DIO2 自动控制TXEN */
    Ebyte_E22x_SetDio2AsRfSwitchCtrl( 1 );

    /* 选择内部电压调节器模式 高效DC-DC */
    Ebyte_E22x_SetRegulatorMode( USE_DCDC );

    /* 内部FIFO读写地址复位 0x00 */
    Ebyte_E22x_SetBufferBaseAddress( 0x00, 0x00 );
```


5 MCU connection

5.1 Recommended connection



6 Frequently Asked Questions

6.1 Transmission distance is not ideal

- When there are straight-line communication obstacles, the communication distance will be correspondingly attenuated ;
- Temperature, humidity, and co-channel interference will cause the communication packet loss rate to increase ;
- The ground absorbs and reflects radio waves, and the test effect is poor when close to the ground ;
- Seawater has a strong ability to absorb radio waves, so the seaside test results are poor ;
- If there are metal objects near the antenna, or if it is placed in a metal case, the signal attenuation will be very serious ;
- The power register setting is wrong and the air rate is set 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 smaller the power generated ;
- There is a poor match between the antenna and the module or there is a problem with the quality of the antenna itself.

6. 2 modules are easily damaged

- Please check the power supply to ensure that it is within the recommended power supply voltage. If it exceeds the maximum value, it will cause permanent damage to the module ;
- Please check the stability of the power supply. The voltage cannot fluctuate greatly and frequently ;
- Please ensure anti-static operation during installation and use, as high-frequency devices are sensitive to static electricity ;
- Please ensure that the humidity during installation and use should not be too high, as some components are humidity-sensitive devices ;
- If there are no special needs, it is not recommended to use it at too high or too low temperature.

6.3 Bit error rate too high

- If there is co-channel signal interference nearby, stay away from the interference source or modify the frequency or channel to avoid interference;
- The clock waveform on SPI is not standard . Check whether there is interference on the SPI line . The SPI bus line should not be too long;
- Unsatisfactory power supply may also cause garbled code, so be sure to ensure the reliability of the power supply;
- Poor quality or too long extension cords and feeders can also cause a high bit error rate.

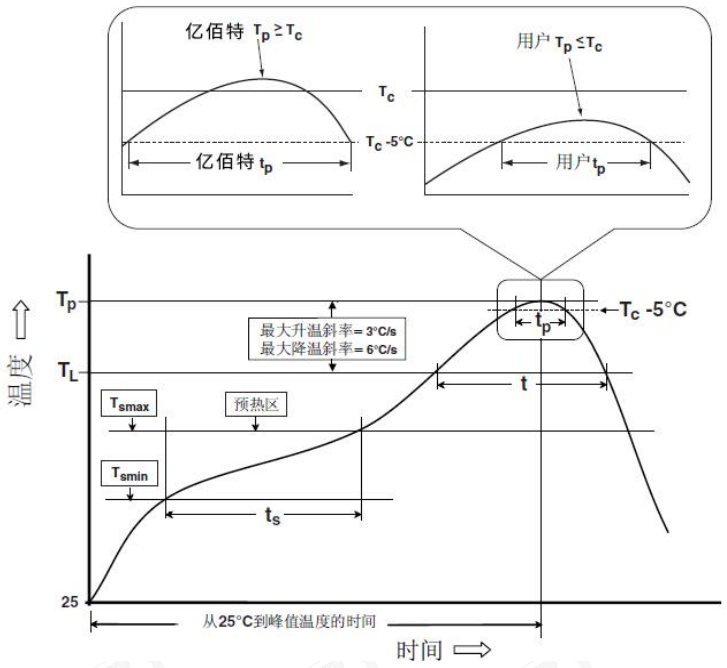
7 Welding Operation Guidance

7.1Reflow soldering temperature

Reflow soldering curve characteristics		Lead process assembly	Lead-free process assembly
Preheat/keep warm	Minimum temperature (Tsmin)	100℃	150℃
	Maximum temperature (Tsmax)	150℃	200℃
	Time (Tsmin~Tsmin)	60-120 seconds	60-120 seconds
Temperature rise slope (TL~Tp)		3℃/second, maximum	3℃/second, maximum
Liquidus temperature (TL)		183℃	217℃
Holding time above TL		60~ 90 seconds	60~ 90 seconds
Package peak temperature Tp		Users should not exceed the temperature indicated on the	Users should not exceed the temperature indicated on the

	product's "Moisture Sensitivity" label.	product's "Moisture Sensitivity" label.
The time (Tp) within 5℃ of the specified classification temperature (Tc), see the figure below	20 seconds	30 seconds
Cooling slope (Tp~TL)	6℃/second, maximum	6℃/second, maximum
Time from room temperature to peak temperature	6 minutes, maximum	8 minutes, maximum
※The peak temperature (Tp) tolerance definition of the temperature curve is the upper limit of the user		

7.2 Reflow soldering curve



8 Related Models

Product number	Chip solution	carrier frequency Hz	Transmit power dBm	Test distance km	Package form	Product Size mm	Communication Interface
E22-400M22S	SX1262	433/470M	twenty two	7	patch	14*20	SPI _
E22-900M22S	SX1262	868/915M	twenty two	7	patch	14*20	SPI _
E22-900M33S	SX1262	433/470M	3 3	1 6	patch	24*38.5	SPI _
E22-900M30S	SX1262	868/915M	30	12	patch	24*38.5	SPI _
E22-230T22S	SX1262	230M	twenty two	5	patch	16*26	TTL

E22-400T22S	SX1262	433/470M	twenty two	5	patch	16*26	TTL
E22-900T22S	SX1262	868/915M	twenty two	5	patch	16*26	TTL
E22-230T30S	SX1262	230M	30	1 0	patch	25*40.5	TTL
E22-400T30S	SX1262	433/470M	30	1 0	patch	25*40.5	TTL
E22-900T30S	SX1262	868/915M	30	1 0	patch	25*40.5	TTL

9 Antenna Guide

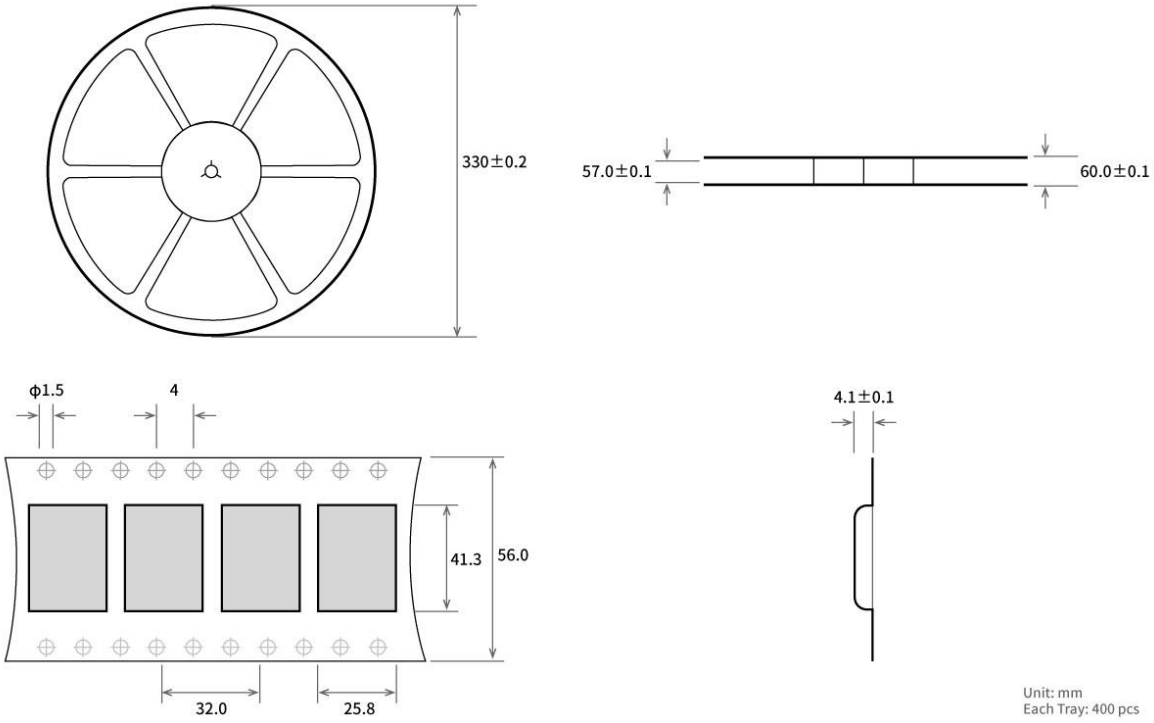
9.1 Antenna recommendations

Antennas play an important role in the communication process. Often poor-quality antennas will have a great impact on the communication system. Therefore, our company recommends some antennas as antennas that support our wireless modules and have excellent performance and reasonable prices.

Product number	type	frequency band Hz	interface	Gain dBi	high m m	feeder c m	Features
TX433-NP-4310	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, omnidirectional antenna
TX433-JZG-6	glue stick antenna	433M	SMA-J	2.5	6 2	-	Ultra-short straight, omnidirectional antenna
TX433-JW-5	glue stick antenna	433M	SMA-J	2.0 _	50	-	Bend glue stick, omnidirectional antenna
TX433-JWG-7	glue stick antenna	433M	SMA-J	2.5	75	-	Bend glue stick, omnidirectional antenna
TX433-JK-11	glue stick antenna	433M	SMA-J	2.5	110	-	Bendable glue stick, omnidirectional antenna
TX433-JK-20	glue stick antenna	433M	SMA-J	3.0 _	210	-	Bendable glue stick, omnidirectional antenna
TX433-XPL - 100	suction cup antenna	433M	SMA-J	3.5	18 5	100	Small suction cup antenna, cost-effective
TX433-XP-200	suction cup antenna	433M	SMA-J	4.0 _	19 0	200	Neutral suction cup antenna, low loss
TX433-XPH-300	suction cup antenna	433M	SMA-J	6.0 _	96 5	300	Large suction cup antenna, high gain
TX490-JZ-5	glue stick antenna	4 7 0 /490 M	SMA-J	2.0	50	-	Ultra-short straight, omnidirectional antenna

TX490-XPL - 100	suction cup antenna	4 7 0 / 490M	SMA-J	3.5	12 0	100	Small suction cup antenna, cost-effective

10 Standard Package



Revise History

Version	Revision date	Revision Notes	Maintenance man
1.0	2024-1-24	Manual release	Hao

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