E78-900M22S1A

ASR6505 868/915MHz LoRaWAN RF Module

Chengdu Ebyte Electronic Technology Co.,Ltd.

Contents

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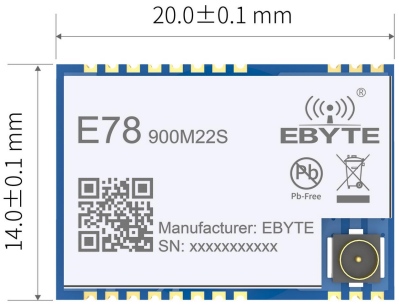
1.Overview

1.1 Introduction



The E78 series products are radio frequency transceiver modules with multiple frequency bands designed and produced by Ebyte, with long communication distance and extremely low current consumption in low power consumption mode. This module is a small-volume patch type (pin spacing 1.1mm).

The E78 series products use ASR's ASR6505 chip, which is a single-chip SoC integrated with ultra-low power LoRa, using Semtech's advanced low-power LoRa Transceiver SX1262, and integrates a STM8L152 low-power MCU, Flash capacity 64kB, SRAM Capacity 4kB, EEPROM capacity 2K, small size, ultra-low power consumption, support LoRaWAN, LinkWAN multiple protocol standards, suitable for a variety of Internet of Things application scenarios, is currently the best choice for LPWAN application chips.

The E78 series products are hardware platforms and cannot be used independently. Users need to carry out secondary development. (We can customize standard LoRaWan and Ali linkWan nodes)

Features:

Under ideal test conditions, the communication distance can reach 5.5km;
The maximum transmit power is 22dBm, and the software is multi-level adjustable;
Support license-free ISM 868/915MHz frequency band;
Support multiple modulation modes (GFSK Mode, LoRa);
Support 1.8～3.7V power supply, power supply greater than 3.3V can guarantee the best performance;
Industrial standard design, supporting long-term use at -40～+85℃;
Dual antennas are optional (IPX/PCB), which is convenient for users to develop and integrate;
Based on the ASR6505 chip development, users can directly use it for secondary development.

Applications:

Smart home and industrial sensors, etc.;
Security system, positioning system;
Wireless remote control, UAV;
Wireless game remote control;
Healthcare products;
Wireless voice, wireless headset;
Automotive industry applications.

2 Parameters

2.1 Limit Parameters:

Main Parameters	Value		Notice
	Min.	Max.	
Power supply voltage (V)	0	3.9	Over 3.9V will permanently burn the module
Blocking power (dBm)	-	10	The probability of burning is small when used at close range
Working temperature (℃)	-40	+85	Industrial grade

2.2 Operating Parameters:

Main Parameters		Value			Notice
		Min.	Typical	Max.	
Working voltage (V)		1.8	3.3	3.7	≥3.3V can guarantee output power
Communication level (V)		-	3.3	-	Using 5V TTL is risky to burn
Working temperature (℃)		-40	-	+85	Industrial design
Working frequency (MHz)		850	868/915	925	Support ISM frequency band
Power	Emission current (mA)	-	145	-	Instantaneous power consumption
	Receiving current (mA)	-	13	-	-
	Sleep current (μA)	-	2.0	-	Software shutdown
Maximum transmit power (dBm)		-	21.5	22	-
Receiving sensitivity (dBm)		-122	-123	-126	The air rate is 595kbps
Air rate	LoRa（bps）	-	-	62.5K	User programmable customization
	GFSK（bps）	-	-	300K	User programmable customization

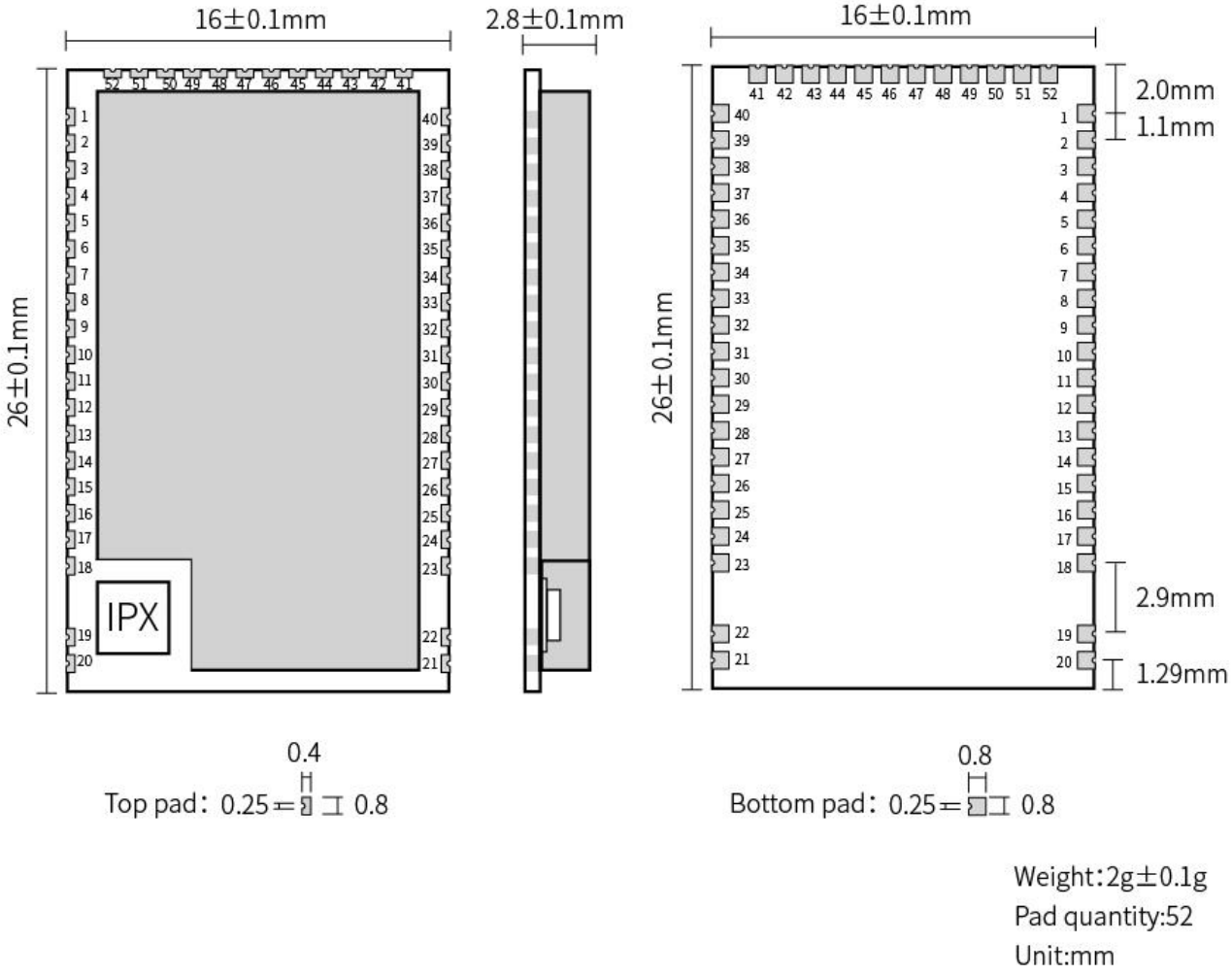
Parameters	Value	Notice
Ideal Range	5500m	At Max TX power and 2.4kbps air rate, Two modules in a line of sight, clear weather, with 5dbi antennas at 2.5meters.
Crystal frequency	32MHz	TXCO
Modulation	LoRa(recommended)	GFSK ， LoRa
Encapsulation method	SMA	-
Interface method	Stamp-hole	Diameter 1.1mm
Dimensions	26*16mm	-
RF interface	IPEX/stamp-hole	Equivalent impedance is about 50Ω

Hardware Notice:

- When designing the power supply circuit for the module, it is recommended to reserve more than 30% of the remaining amount, and the whole machine is beneficial for long-term stable operation;;
- The current required for the moment of launch is large but often because the launch time is extremely short, the total energy consumed may be smaller;
- When the customer uses an external antenna, the impedance matching degree between the antenna and the module at different frequency points will affect the magnitude of the emission current to varying degrees;
- The current consumed by the RF chip in the pure receiving state is called the receiving current. Some RF chips with communication protocols or developers have loaded some self-developed protocols on the whole machine, which may cause the receiving current of the test to be too large;
- When the customer uses an external antenna, the impedance matching degree between the antenna and the module at different frequency points will affect the magnitude of the emission current to varying degrees;
- The shutdown current is often much smaller than the current consumed by the power supply part of the whole machine at no load, without excessive demand;
- Due to the inherent error of the material itself, a single LRC component has an error of ±0.1%, but hesitant to use multiple LRC components in the entire RF loop, there will be accumulation of errors, resulting in differences in the emission current and the receiving current of different modules;
- Reducing the transmit power can reduce power consumption to a certain extent, but reducing the transmit power transmission for many reasons will reduce the efficiency of the internal PA.

3. Size and Pin definition

3.1 Size and Pin definition



3.2 Pin definition

No.	Name	Direction	Function
1	GND	-	Ground wire, connected to the power reference ground
2	LCD-SEG10	Input/Output	MCU GPIO
3	LCD-SEG11	Input/Output	MCU GPIO
4	LCD-SEG12	Input/Output	MCU GPIO
5	LCD-SEG13	Input/Output	MCU GPIO
6	LCD-SEG14	Input/Output	MCU GPIO
7	LCD-SEG15	Input/Output	MCU GPIO
8	LCD-SEG16	Input/Output	MCU GPIO
9	LCD-SEG17	Input/Output	MCU GPIO
10	I2C-SDA	Input/Output	I2C-SDA pin
11	I2C-SCL	Input/Output	I2C-SCL pin
12	ADC-IN0	Input	ADC input pin
13	ADC-IN1	Input	ADC input pin
14	GPIO2	Input/Output	MCU GPIO
15	GPIO3	Input/Output	MCU GPIO
16	GPIO4	Input/Output	MCU GPIO
17	ADC_IN2	Input	ADC input pin
18	GND	-	Ground wire, connected to the power reference ground
19	ANT	Output	Antenna interface, stamp hole (50 ohm characteristic impedance)
20	GND	-	Ground wire, connected to the power reference ground
21	GND	-	Ground wire, connected to the power reference ground
22	GND	-	Ground wire, connected to the power reference ground
23	GND	-	Ground wire, connected to the power reference ground
24	SPI-NSS	Input	SPI selection pin, external SPI can be selected
25	SPI-SCK	Input	SPI-SCK pin, can be used as external SPI
26	SPI_MISO	Output	SPI_MISO pin, can be used as external SPI
27	SPI_MOSI	Input	SPI MOSI pin, can be used as external SPI
28	LCD-SEG1	-	MCU GPIO
29	LCD-SEG2	Input/Output	MCU GPIO
30	SWIM	Input/Output	Programming pin
31	NRST	Input	External reset pin
32	LCD-COM0	Input/Output	MCU GPIO
33	LCD-COM1	Input/Output	MCU GPIO
34	LCD-COM2	Input/Output	MCU GPIO
35	VREFP	Input	ADC reference voltage input
36	UART1-RX	Input	UART1-RX pin
37	UART1-TX	Output	UART1-TX pin
38	VLCD	Input	VLCD pin

39	LCD-SEG0	Input/Output	MCU GPIO
40	GND	-	Ground wire, connected to the power reference ground
41	LCD-SEG3	Input/Output	MCU GPIO
42	LCD-COM3	Input/Output	MCU GPIO
43	LCD-SEG4	Input/Output	MCU GPIO
44	LCD-SEG5	Input/Output	MCU GPIO
45	UART0-RX	Input	UART0-RX pin
46	UART0-TX	Output	UART0-TX pin
47	LCD-SEG6	Input/Output	MCU GPIO
48	LCD-SEG7	Input/Output	MCU GPIO
49	LCD-SEG8	Input/Output	MCU GPIO
50	LCD-SEG9	Input/Output	MCU GPIO
51	VCC	-	Power supply, range 1.8V~3.7V (recommend to add ceramic filter capacitor)
52	GND	-	Ground wire, connected to the power reference ground
For more information about module pin definition, software driver and communication protocol, please see ASR6505 Datasheet			

4 Hardware and Software Guide

4.1 Hardware Design

- It is recommended to use a DC stabilized power supply to supply power to the module, and the power ripple coefficient should be as small as possible, and the module should 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, and the voltage should 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, and the whole machine is conducive to long-term stable operation;
- The module should be as far away as possible from the power supply, transformer, high-frequency wiring and other parts with large electromagnetic interference;
- High-frequency digital wiring, high-frequency analog wiring, and power wiring must avoid the bottom of the module. If it is necessary to pass under the module, assume that the module is soldered to the Top Layer, and the top layer of the contact part of the module is covered with copper (all copper And well grounded), it must be close to the digital part of the module and routed in the Bottom Layer;
- Assuming that the module is soldered or placed on the Top Layer, it is also wrong to randomly route the wires on the Bottom Layer or other layers, which will affect the stray and receiving sensitivity of the module to varying degrees;
- Assuming that there are devices with large electromagnetic interference around the module, it will greatly affect the performance of the module. According to the intensity of the interference, it is recommended to stay away from the module. If the situation permits, proper 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 wiring), it will also greatly affect the performance of the module. According to the intensity of the interference, it is recommended to stay away from the module. 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 part of the physical layer that is also 2.4GHz TTL protocol, for example: USB3.0;
- The antenna installation structure has a great impact on the performance of the module. Make sure that the antenna is exposed, preferably vertically upward. When the module is installed inside the case, a high-quality antenna extension cable can be used to extend the antenna to the outside of the case;

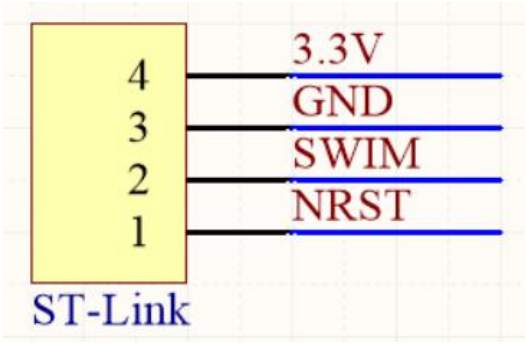
The antenna must not be installed inside the metal shell, which will greatly reduce the transmission distance.

4.1 Software Writing

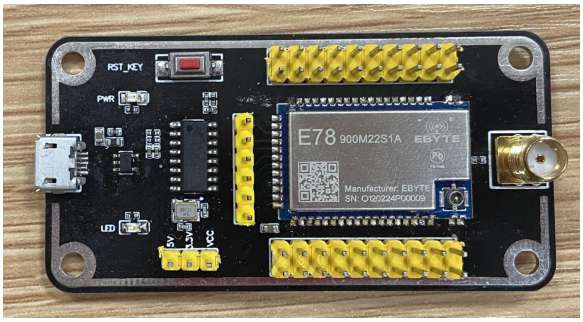
- This module is SX1262+STM8L152 integrated, and its driving method is completely equivalent to SX1262, and users can operate according to SX1262 or ASR6505 chip book;
- At the same time, please refer to the E78-900M22S1A and E78-900TBL-01A pin corresponding STM8 data provided by our company during the secondary development.
- The voltage range of the active crystal oscillator is 1.8V to 3V. 2.2V is recommended. 3.3V may be damaged.

4 Programming Diagram and Guide

4.1 E78-900M22S1A burning interface



Connect the module pins 30 and 31, and use ST-LINK or STM8 debugging tools to download the program.



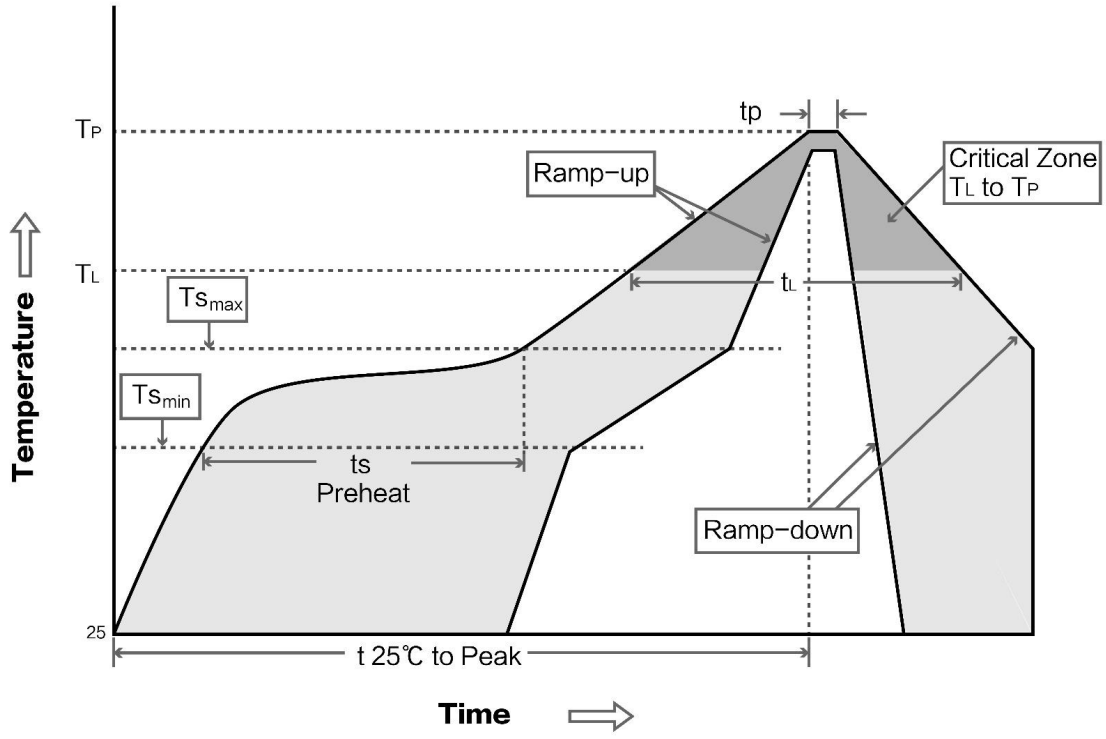
For secondary development, you are recommended to use test kit E78-900TBL-01A. It is convenient and efficient. First, power the module through the serial port of the test kit, and then connect the NRST pin and SWIM pin of ST-LINK to the test kit to download the program. As shown above.

5. Production guidance

5.1 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)	Min preheating temp.	100℃	150℃
Preheat temperature max (Tsmax)	Mx preheating temp.	150℃	200℃
Preheat Time (Tsmin to Tsmax)(ts)	Preheating time	60-120 sec	60-120 sec
Average ramp-up rate(Tsmax to Tp)	Average ramp-up rate	3℃/second max	3℃/second max
Liquidous Temperature (TL)	Liquid phase temp.	183℃	217℃
Time(tL)Maintained Above(TL)	Time below liquid phase line	60-90 sec	30-90 sec
Peak temperature(Tp)	Peak temp.	220-235℃	230-250℃
Average ramp-down rate(Tp to Tsmax)	Average ramp-down rate	6℃/second max	6℃/second max
Time 25℃ to peak temperature	Time to peak temperature for 25℃	6 minutes max	8 minutes max

5.2 Reflow soldering curve



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.

6.2 Module is easy to damage

- Please check the power supply source, ensure it is 2.0V~3.6V, voltage higher than 3.6V 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;
- 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;

Revision history

Version	Date	Description	Issued by
1.0	2021-03-1	Initial version	Linson

About us

Website: www.ebyte.com Sales: info@cdebyte.com Support: support@cdebyte.com

Tel: +86-28-61399028 Ext. 812 Fax: +86-28-64146160

Address: Innovation Center B333~D347, 4# XI-XIN road,High-tech district (west), Chengdu, Sichuan, China

Chengdu Ebyte Electronic Technology Co.,Ltd.