ASR6501 900MHz Wireless Module

E78-900M22S

# Contents

1.Overview

1.1 Introduction

E78-900M22S is a SoC LoRa RF module designed by Ebyte with max transmitting power of 22dBm. With ASR company's ASR6501 chip, which is an ultra-low power LoRa integrated single chip SoC, Semtech advanced low power LoRa Transceiver SX1262, and integrated a Cypress 32-bit cor-m0 + low power MCU, Flash capacity 128kB, SRAM capacity 16kB, ultra-small size, ultra-low power, the module supports LoRaWAN, LinkWAN protocol standards, suitable for a variety of Internet of things application scenarios. It is currently the best choice for LPWAN application chips.
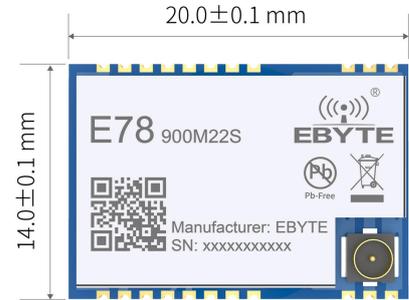
E78-900M22S is a hardware platform and cannot be used directly. Users need to conduct secondary development (Ebyte can customize standard LoRaWan and Alibaba linkWan nodes for you).

2 Main parameters

Model No.	Main parameters	Remarks
E78-900M22S	Core IC	ASR6501
	Operating temperature	-40 ~ 85℃
	Operating humidity	10% ~ 90%
	Storage temperature	-40 ~ 125°C
	Frequency	850-925MHz
	Transmitting power	21dBm
	Package	SMD
	Antenna	Stamp hole/IPEX
	Distance(Stamp hole/IPEX)	Km(Lora 2.4kbps)
	Size	20* 14*2.8 mm
	Weight	1.2g

2.1 E78-900M22S

Items	Min	Type	Max	Unit
Transmitting current (LoRa@2.4kbps)	130	144	155	mA
Receiving current (LoRa@2.4kbps)	13	14	15	mA
Turn-off current	2.4	2.5	2.6	uA
Transmitting power	21.0	21.2	21.8	dBm
Receiving sensitivity	-139	-140	-140	dBm
TCXO	32	32	32	MHz

TCXO voltage configuration	1.8	1.8	3.3	V
Frequency	850	868/900/915	925	MHz
Power supply	2.5	3.3	3.7	V
Communication level	2.5	3.3	3.7	V

2.2 Parameter description

- 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

Top pad :   0.50

0.50 ⊔ ⊓ 0.80

Bottom pad :   0.90

0.50 ⊔ ⊓ 0.80
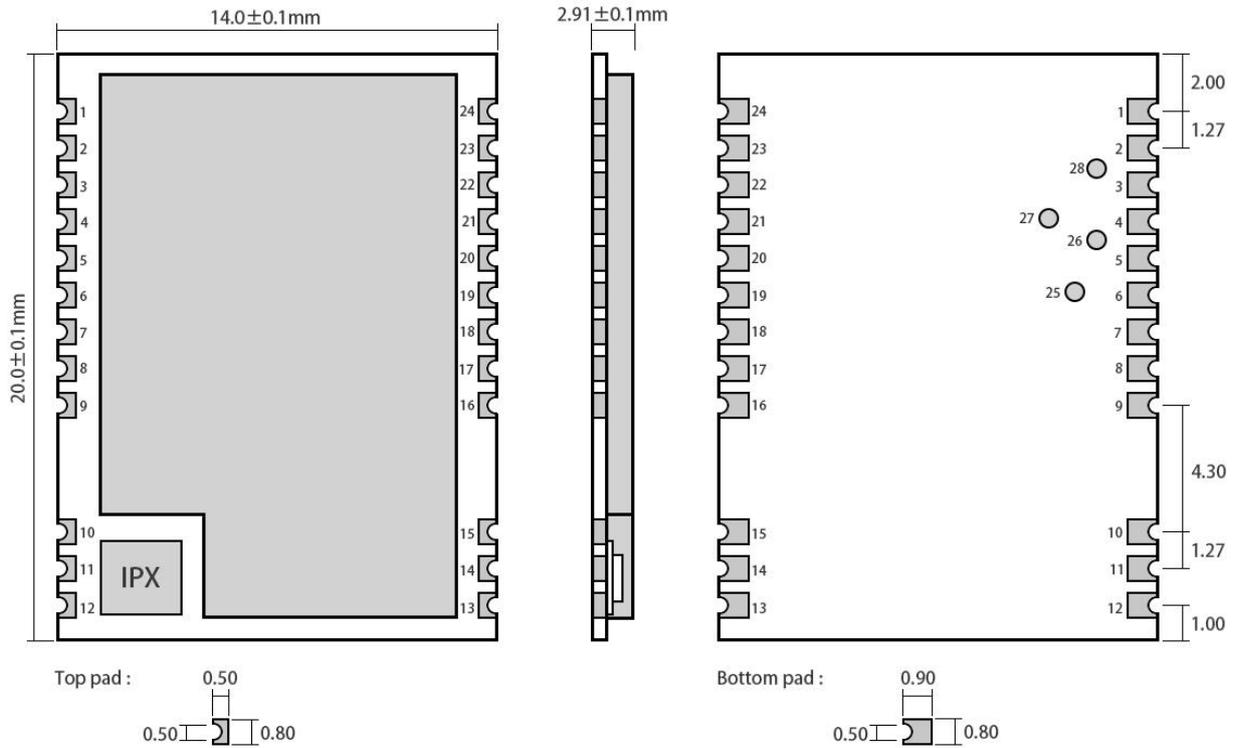
Weight : 1.2±0.1g
Pad quantity : 28
Unit : mm

3.2 Pin definition

No.	Name	Direction	Function
1	GND		Ground wire, connected to the power reference ground
2	VCC		Power supply, range 2.5-3.7v (external ceramic filter capacitor is recommended)
3	SETB	Input/output	MCU GPIO
4	DIO1	Input/output	Multipurpose digital IO cannot be used as external GPIO
5	BUSY	Input/output	SPI busy indicator that cannot be used as an external GPIO
6	I2C_SDA	Input/output	I2C SCL pins
7	I2C_SCL	Input/output	I2C SDA pin
8	UART_CTS	Input/output	UART CTS pin
9	UART_RTS	Input/output	UART RTS pin
10	GND		Ground wire, connected to the power reference ground

11	ANT		Antenna interface, stamp hole (50 ohm characteristic impedance)
12	GND		Ground wire, connected to the power reference ground
13	GND		Ground wire, connected to the power reference ground
14	GND		Ground wire, connected to the power reference ground
15	GND		Ground wire, connected to the power reference ground
16	XRES	Input	External reset pins
17	ADC_IN	Input	ADC input pin
18	AUX	Input/output	MCU GPIO
19	SETA	Input/output	MCU GPIO
20	UART_RX	Input/output	UART RX pin
21	UART_TX	Input/output	UART TX pin
22	SWD_DATA	Input/output	SWD Data pins
23	SWD_CLK	Input/output	SWD Clock pin
24	GND		Ground wire, connected to the power reference ground
25	SPI_MISO	Input/output	SPI MISO test point, internally connected, cannot be used as external SPI
26	SPI_NSS	Input/output	SPI NSS test point, internally connected, cannot be used as an external SPI
27	SPI_MOSI	Input/output	SPI MOSI test point, internally connected, cannot be used as an external SPI
28	SPI_SCK	Input/output	SPI SCK test point, internally connected, cannot be used as external SPI
★ Please check details from 《ASR6501 Datasheet》 ★			

4 Circuit diagram

4.1 E78-900M22S burning interface
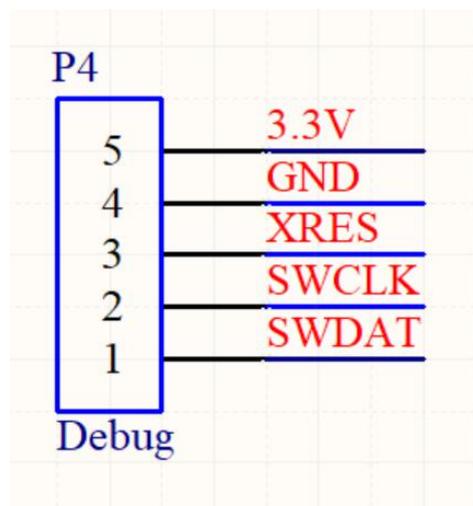
Connect the XRES, SWD_CLK, SWD_DATA, GND, and 3V3 of the test board to the XRES, SCLK, SDAT, GND, and 3V3 of the downloader respectively, and make sure that both green lights are on to download. If there is any abnormality, please press this button to ensure two green lights are on. (For details, please refer to the official ASR6501 burning instructions)
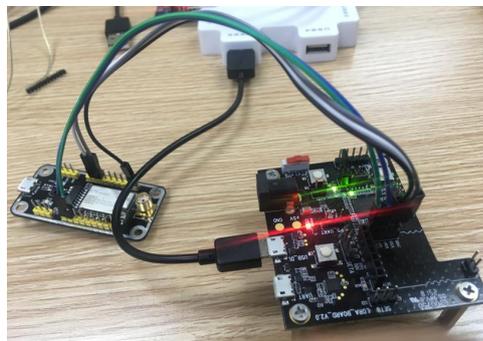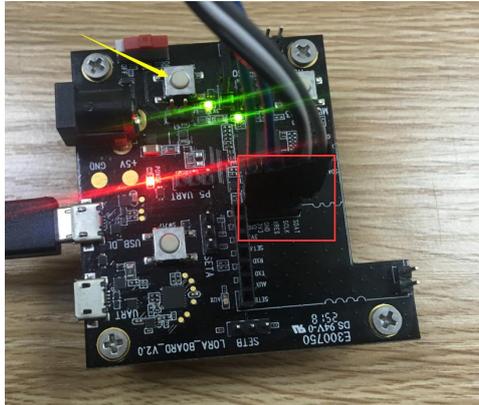
Notes: for secondary development, it is recommended to use test board E78-TBL-01. It is convenient and efficient.

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
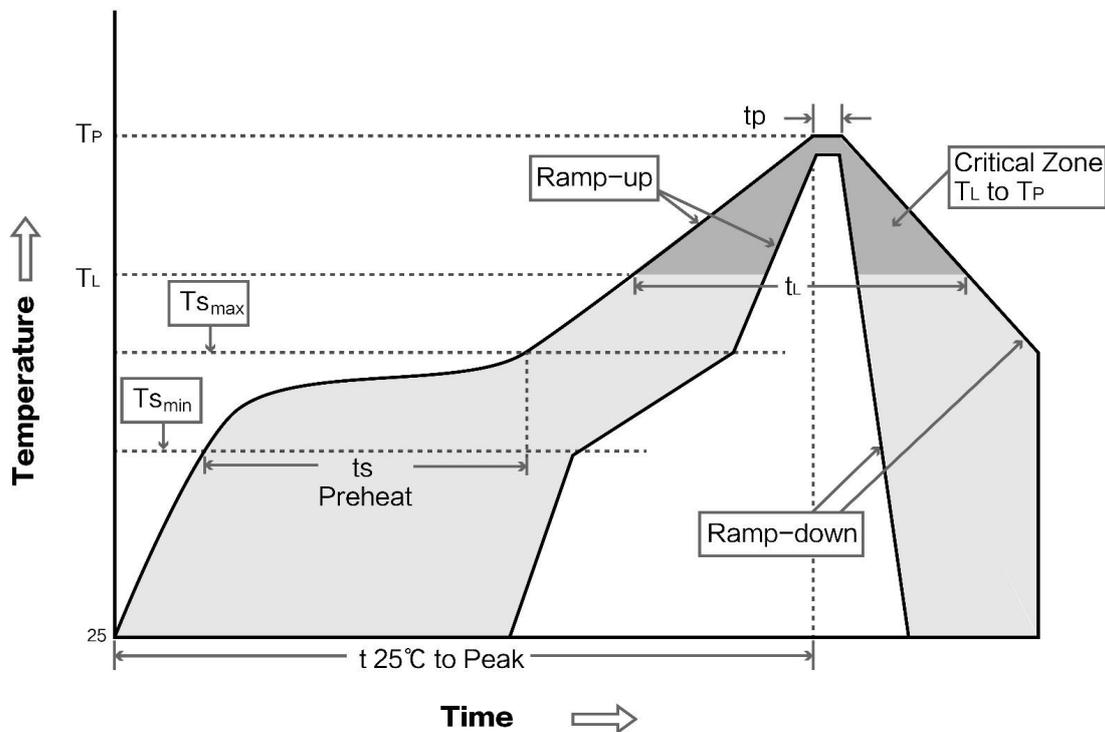
6.FAQ

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	2019-08-20	Initial version	-
1.1	2019-09-02	Error correction	Lyl

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