E27-433M20S User Manual

SI4432 433MHz 100mW SMD wireless module



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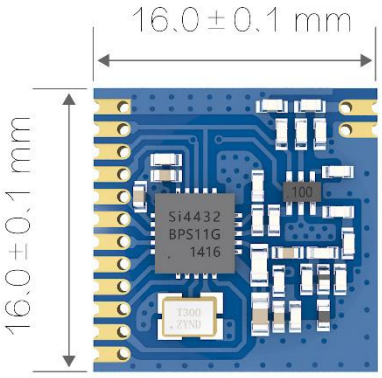
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1. Overview

1.1 Brief Introduction



E27-433M20S is a 20mW wireless transceiver module, operates at 433MHz with small-size, (1.27 Pin pitch). with excellent impedance matching, high transmitting power, high receiving sensitivity, low transmitting current and low harmonic.

E27-4333M20S is based on the original imported RF chip Si4432 from Silicon Labs. With diversified built-in antenna and excellent anti-interface performance, the chip supports frequency hopping. At the same time, the interior also has additional features, such as: Automatic wake-up timer, low battery detector, 64 bytes transmitter/receiver, automatic data packet processing, integrated temperature sensor, analog digital converter, power on reset etc.

E27-433M20S is a hard platform, can be used for second time developing.

1.2 Feature

- Communication distance tested is up to 1600m;
- Maximum transmission power of 100mW, software multi-level adjustable;
- ISM frequency band 433MHz；
- Support air date rate of 0.123-256kbps;
- Temperature sensor and 8-bit ADC;
- Support 1.8V~3.6V power supply, power supply over 3.3V can guarantee the best performance；
- Industrial grade standard design, support -40 ~ +85 °C for working over a long time；
- Stamp hole, which is convenient for development;
- RSSI reading is available；

1.3 Application

- Smart Home and Industrial Sensors;
- Wireless toy and remote control;
- Wireless alarm security system；
- Building automation solutions；
- Wireless PC peripherals;
- Tire pressure monitoring;
- Label Reader;
- Wireless industrial-grade remote control；
- Health care products；
- Advanced Meter Reading Architecture(AMI)；
- Automotive industry applications.

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2. Technical Parameters

2.1 Limit parameter

Main parameter	Performance		Remark
	Min	Max	
Voltage supply [V]	0	3.6	Voltage over 3.6V will cause permanent damage to module
Blocking power [dBm]	-	10	Chances of burn is slim when modules are used in short distance
Operating temperature [℃]	-40	+85	-

2.2 Operating parameter

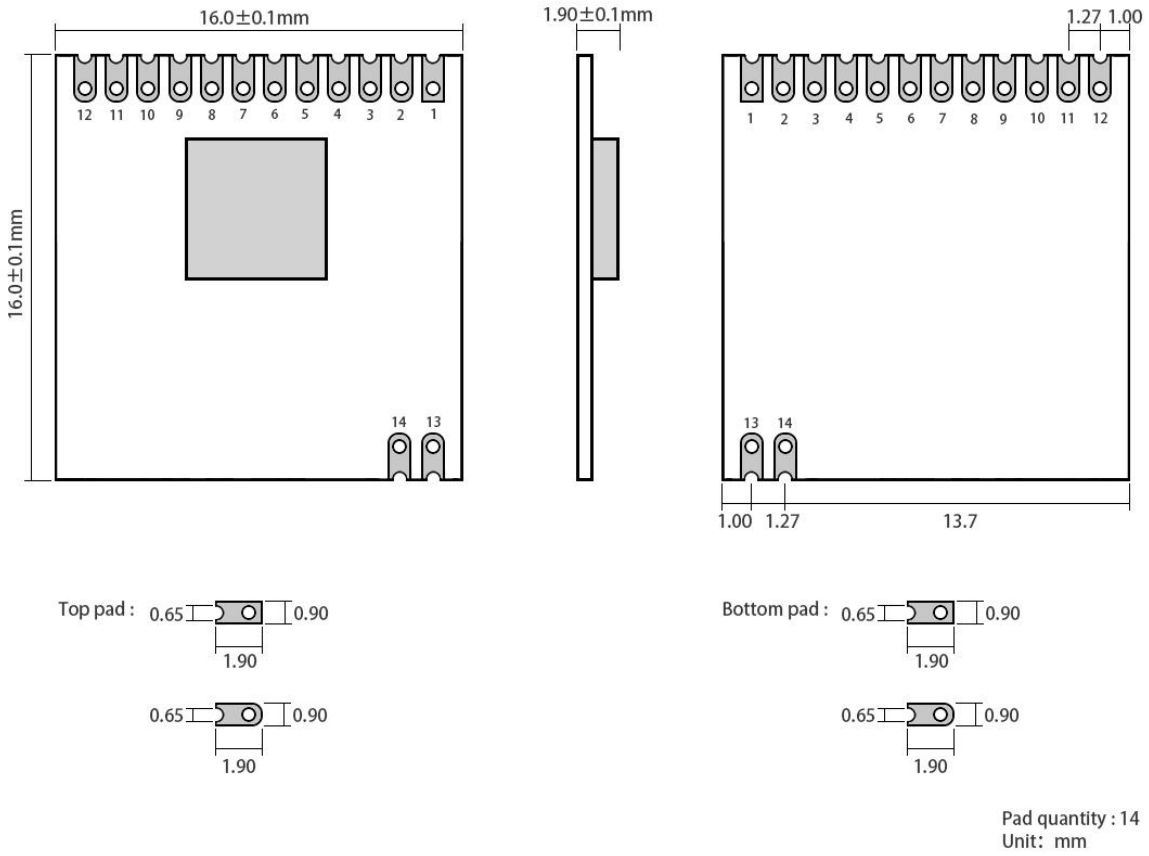
Main parameter		Performance			Remark
		Min.	Typ.	Max	
Operating voltage（V）		1.8	3.3	3.6	≥3.3V ensures output power
Communication level（V）			3.3		For 5V TTL, it may be at risk of burning down
Operating temperature（℃）		-40	-	85	Industrial design
Operating frequency（MHz）		425	433	525	Support ISM band
Power consumption	TX current（mA）		83		Instant power consumption
	RX current（mA）		18.5		
	Sleep current （μA）		0.5		Software is shut down
Max Tx power（dBm）		19	20	21	
Receiving sensitivity（dBm）		-119	-121	-123	Air data rate is 1kbps
Air data rate（bps）		0.123k	-	256k	Controlled via user’s programming

Main parameter	Description	Remark
Distance for reference	1600m	Test condition：clear and open area, antenna gain: 5dBi，antenna height: 2.5m，air data rate: 1kbps
FIFO	64Byte	Max length transmitted each time
Crystal frequency	30MHz	
Modulation	GFSK	
Package	SMD	
Connector	1.27mm pin	
Communication interface	SPI	0-10Mbps
Size	16 * 16mm	
Antenna	Stamp hole	50ohm impedance

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3. Size and pin definition



Pin No.	Pin item	Pin direction	Pin application
1	GND		Ground
2	GPIO0	Output	Configurable GPIO
3	GPIO1	Output	Configurable GPIO
4	GPIO2	Input/output	Configurable GPIO
5	VCC	Input/output	Power supply 1.8V~3.6V.
6	SDO	Output	SPI master input slave output
7	SDI	Input	SPI master output slave input
8	SLCK	Input	Serial Clock Input
9	NSEL	Output	SPI Chip select for starting SPI communication
10	IRQ	Output	SPI interrupt request
11	SDN		Shutdown Input Pin It is low level when working. (See SI4432 manual for more details)
12	GND		Ground
13	ANT		Antenna
14	GND		Ground

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4. Basic operation

4.1 Hardware design

5 This module is nRF24L01+PA+LNA, the drive mode is exactly equivalent to nRF24L01P, the user can operate according to the nRF24L01P manual (Please see nRF24L01P manual for more details).

6 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；

7 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；

8 Please check the power supply to ensure it is within the recommended voltage otherwise when it exceeds the maximum value the module will be permanently damaged;

9 Please check the stability of the power supply, the voltage cannot be fluctuated frequently；

10 When designing the power supply circuit for the module, it is often recommended to reserve more than 30% of the margin, so the whole machine is beneficial for long-term stable operation;

11 The module should be as far away as possible from the power supply, transformers, high-frequency wiring and other parts with large electromagnetic interference;

12 High-frequency digital routing, high-frequency analog routing, and power routing must be avoided under the module. If it is necessary to pass through the module, assume that the module is soldered to the Top Layer, and the copper is spread on the Top Layer of the module contact part(well grounded), it must be close to the digital part of the module and routed in the Bottom Layer；

13 Assuming the module is soldered or placed over the Top Layer, it is wrong to randomly route over the Bottom Layer or other layers, which will affect the module's spurs and receiving sensitivity to varying degrees；

14 It is assumed that there are devices with large electromagnetic interference around the module that will greatly affect the performance. It is recommended to keep them away from the module according to the strength of the interference. If necessary, appropriate isolation and shielding can be done；

15 Assume that there are traces with large electromagnetic interference (high-frequency digital, high-frequency analog, power traces) around the module that will greatly affect the performance of the module. It is recommended to stay away from the module according to the strength of the interference. If necessary, appropriate isolation and shielding can be done.

16 If the communication line uses a 5V level, a 1k-5.1k resistor must be connected in series (not recommended, there is still a risk of damage)；

17 Try to stay away from some physical layers such as TTL protocol at 2.4GHz , for example: USB3.0；

18 The mounting structure of antenna has a great influence on the performance of the module. It is necessary to ensure that the antenna is exposed, preferably vertically upward. When the module is mounted inside the case, use a good antenna extension cable to extend the antenna to the outside；

19 The antenna must not be installed inside the metal case, which will cause the transmission distance to be greatly weakened.

20 Conductors or other sources of interference should be avoided around the onboard PCB antenna.

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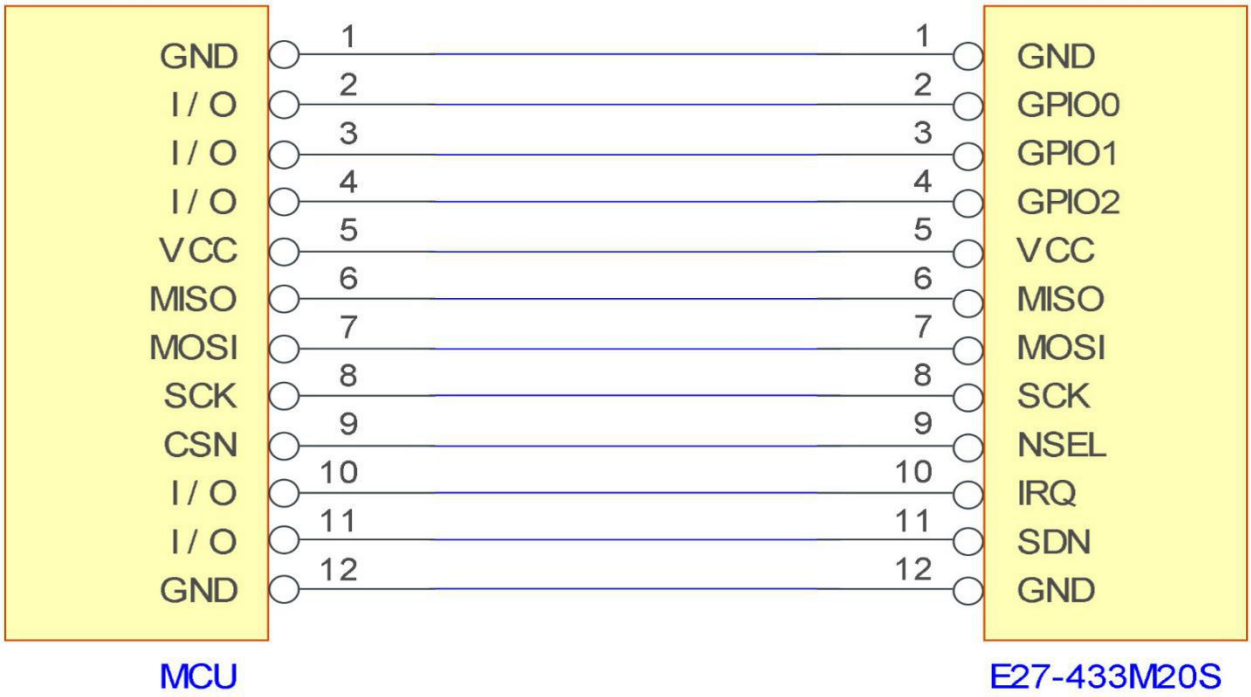
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4.2 Software editing

- This module is SI4432, the drive mode is exactly equivalent to SI4432, the user can operate according to the SI4432 manual (Please see SI4432 manual for more details).
- GDO0 is general purpose I/O, please see Si4432 manual for more configured details.
- GDO2 is generally configured as an IRQ-like function, or it can be disconnected. The SPI query mode can be used to obtain the interrupt status, but it is recommended to use the external interrupt of the MCU.
- After the SI4432 resumes the IDLE mode or configures the sleep mode, it is recommended to reinitialize the power configuration table.SI4432;

5. Basic application

5.1 Basic circuit diagram



No.	Brief introduction of connection between module and MCU (STM8L)
1	The external GPIO0, GPIO1 and GPIO_0 and GPIO_1 of SI4432 are connected to the TXEN and RXEN of RF switches at the same time. It can be directly controlled by the external MCU, or it can be automatically controlled by the SI4432 RF chip (see SI4432 manual for details).
2	The IRQ can be disconnected. The SPI query mode can be used to obtain the interrupt status. It is recommended to connect the external interrupt of the MCU.
3	Please note that the grounding should be good in a large area, and the power ripple should be small. Filter capacitor should be increased as close as possible to the VCC and GND pin of the module.

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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;

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7.Soldering guidance

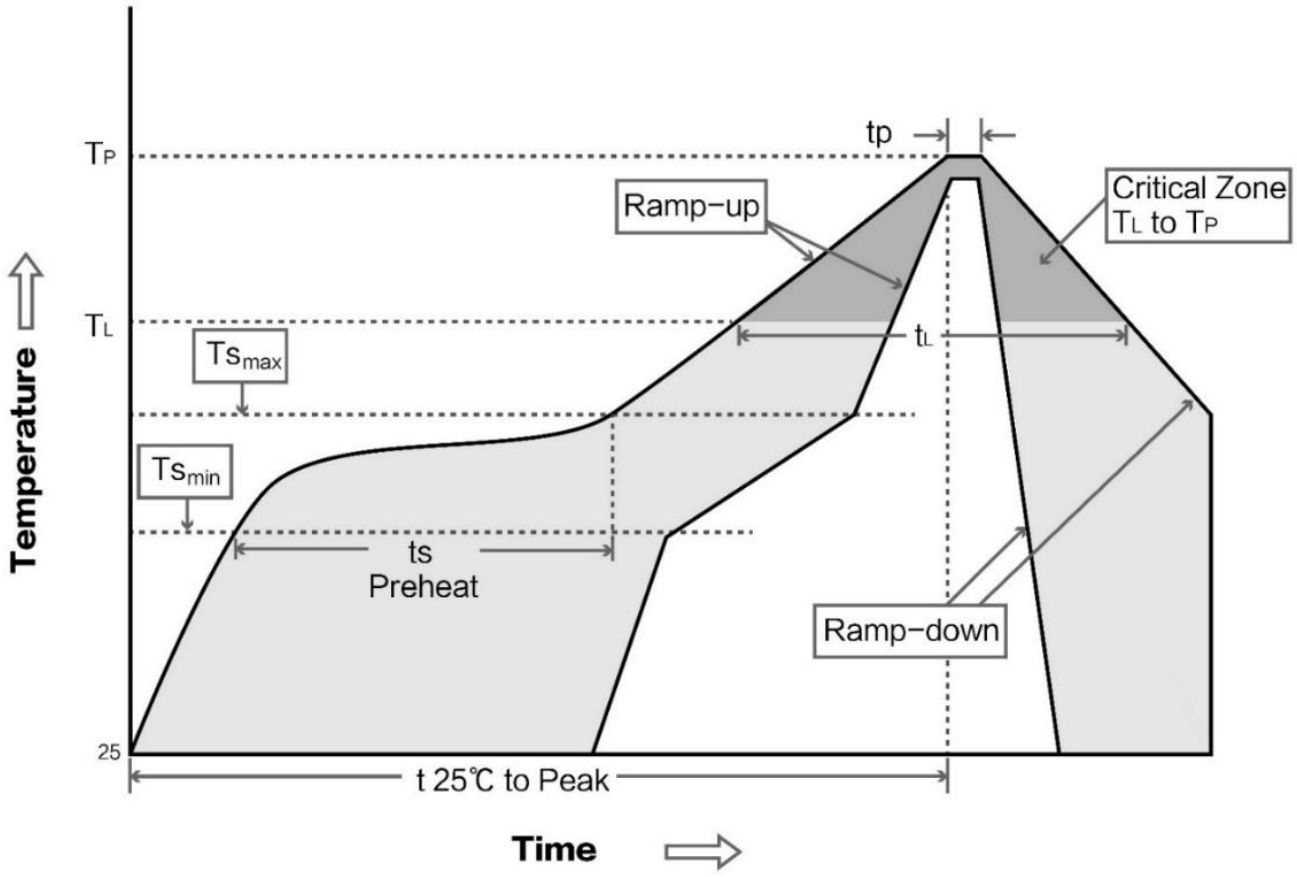
7.1 Reflow soldering temperature

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）	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℃
Aveage 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

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7.2 Reflow soldering curve



8. E27 Series

Model No.	IC	Frequency Hz	Tx power dBm	Test distance km	Packing	Size mm	Antenna
E27-433M20S	SI4432	433M	20	1.6	SMD	16 * 16	Stamp hole

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9.Guidance for choosing antenna

9.1 Antenna recommendation

Antenna plays important role in the communication process. Good antenna can largely improve the communication system. Therefore, we recommend some antennas with excellent performance and reasonable price.

Model	Type	Frequency Hz	Interface	Gain dBi	siza	Fender	Feature
TX433-NP-4310	FPC	433M	SMA-J	2	43.8*9.5mm	-	FPC
TX433-JW-5	Whip	433M	SMA-J	2	50mm	-	Omnidirectional antenna
TX433-JWG-7	Whip	433M	SMA-J	2.5	75mm	-	Omnidirectional antenna
TX433-JK-20	Whip	433M	SMA-J	3	210mm	-	Omnidirectional antenna
TX433-JK-11	Whip	433M	SMA-J	2.5	110mm	-	Omnidirectional antenna
TX433-XP-200	Sucker	433M	SMA-J	4	19cm	200cm	High gain
TX433-XP-100	Sucker	433M	SMA-J	3.5	18.5cm	100cm	High gain
TX433-XPH-300	Sucker	433M	SMA-J	6	96.5cm	300cm	High gain
TX433-JZG-6	Whip	433M	SMA-J	2.5	52mm	-	Omnidirectional antenna
TX433-JZ-5	Whip	433M	SMA-J	2	52mm	-	Omnidirectional antenna

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Revision history

Version	Date	Description	Issued by
1.00	2017/11/15	Original version	huaa
1.10	2018/5/22	Content updated	huaa
1.20	2018/9/13	Model No. split	huaa

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