E48-433M20S User Manual

433MHz 20dBm SMD Wireless Module



Chengdu Ebyte Electronic Technology Co.,Ltd.

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1 Introduction

1.1 Brief Introduction



E48-433M20S is a cost-effective wireless digital transmission module launched by Chengdu Ebyte Electronic Technology Co.,Ltd., which is a pure hardware module developed based on the CMT2310A chip solution.

The E48-433M20S supports a maximum of 20 dBm to transmit power, and users can set a lower output power, thus reducing power consumption. The module works in the frequency band, covering the commonly used 433 MHz frequency band.

The module is a pure hardware RF transceiver module, using SPI interface and needs to be driven by external MCU.

1.2 Features

- The measured communication distance can reach 3.5km;
- Maximum transmission power is 20 dBm;
- Support the ISM 433MHz frequency band;
- Support the data transmission rate of 0.1 Kbps ~ 1000 Kbps;
- Support for low-power consumption mode, suitable for battery applications;
- Support for 2 (G) FSK / 4 (G) FSK / OOK modulation mode;
- Support for 1.8V~3.6V power supply;
- Support for fast and stable automatic frequency correction (AFC);
- Clock recovery system (CDR) with three different features;
- Support fast and accurate effective signal monitoring (PJD, RSSI);
- Support for ultra-low power consumption (SLP) and Duty Cycle reception;
- Support fast transmission or receiving frequency hopping;
- Support for carrier listening multiplex access (CSMA);
- Support for automatic ACK, and reissuance;
- Support a variety of ultra-low power consumption (SLP) receiving modes;
- Support NRZ format, Manchester, data whitening codec, FEC forward error correction;
- Antenna interface supports stamp hole and IPEX interface, users can choose to use according to their own needs;
- Industrial grade standard design, support-40~85℃ for long time use.

1.3 Applications

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- Smart home and industrial sensors;
- Security system, positioning system;
- Wireless remote control, UAV;
- Wireless game remote control;
- Health care products;
- Wireless voice, wireless headphones;
- Automotive industry applications.

2 Specification and parameters

2.1 Limit parameters

Table 2-1 Table of limit parameters

Main parameter	Performance		Remark
	Min	Max	
Supply voltage (V)	0	3.6	More than 3.6V may permanently burn out the module
Working temperature (℃)	-40	+85	Technical grade

2.2 Working parameters

Table 2-2 Table of operating parameters

Main parameter	Performance			Remark
	Min	Type	Max	
Working voltage (V)	1.8	3.3	3.6	More than 3.6V may permanently burn out the module
Communication level (V)	-	3.3	-	Use a 5V level to burn out the risk
Working temperature (℃)	-40	-	+85	technical grade

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Working frequency band (MHz)		410	-	450	-
Power Consumption	TX current (mA)	-	90	-	@ TX power of 20 dBm
	RX current (mA)	-	8.5	-	-
	Sleep current (nA)	400	-	800	-
Air rate (kbps)		0.1	-	1000	-
Max TX power (dBm)		-	20	-	-
Receiving sensitivity (dBm)		-	-120	-	@ Air rate of 2.4 kbps

Main parameter	Description	Remark
Reference distance	3.5km	Clear and empty, with antenna height 2.5 m, antenna gain 3.5 dBi, and air rate 2.4 kbps
Crystal Oscillator	32MHz	High-precision passive crystal vibration
Package	SMD	-
Interface	SPI	-
Size	20*14mm	-
Antenna	IPEX / Stamp hole	The equivalent impedance is about 50 Ω
Net weight	1.2±0.1g	-

3 Size and pin definition

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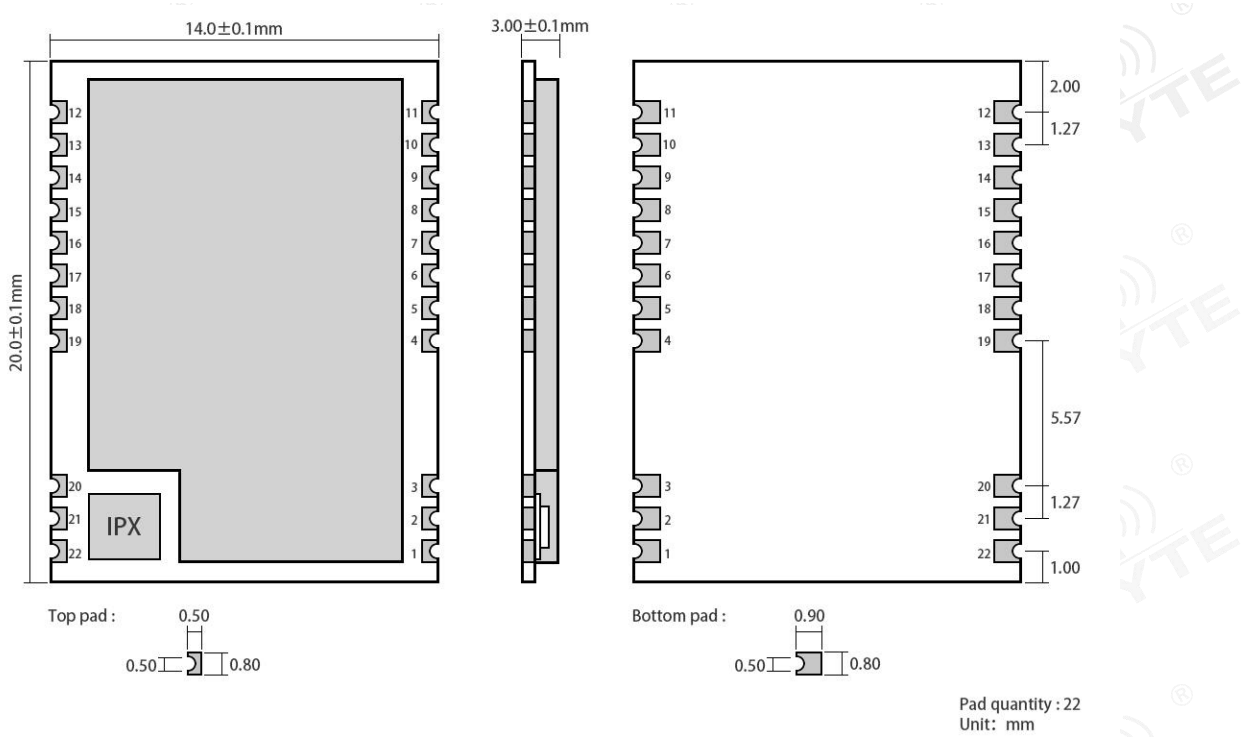


Figure 3-1 Definitions of mechanical size and pins

Table 3-1 pin definition table

Pin No.	Item	Direction	Description
1	GND	-	Ground wire, connected to the power supply reference site
2	GND	-	Ground wire, connected to the power supply reference site
3	GND	-	Ground wire, connected to the power supply reference site
4	GND	-	Ground wire, connected to the power supply reference site
5	GND	-	Ground wire, connected to the power supply reference site
6	GPIO 4	DI/O	Configurable multifunctional IO port (see CMT2310A manual for details)
7	GPIO 5	DI/O	Configurable multifunctional IO port (see CMT2310A manual for details)
8	GPIO3	DI/O	Configurable multifunctional IO port (see CMT2310A manual for details)
9	VCC	-	Power supply, power supply input foot support 1.8-3.6V

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10	GND	-	Ground wire, connected to the power supply reference site
11	GND	-	Ground wire, connected to the power supply reference site
12	GND	-	Ground wire, connected to the power supply reference site
13	GPIO0	DI/O	Configurable multifunctional IO port (see CMT2310A manual for details)
14	NIRQ	DI/O	Configurable multifunctional IO port (see CMT2310A manual for details)
15	GPIO2	DI/O	Configurable multifunctional IO port (see CMT2310A manual for details)
16	MISO	DO	Data output of the SPI
17	MOSI	DI	Data input for the SPI
18	SCLK	DI	The SPI clock pin
19	CSB	DI	Selection of the SPI access register
20	GND	-	Ground wire, connected to the power supply reference site
21	ANT	-	Block RF stamp hole interface, equivalent impedance of about 50 Ω
22	GND	-	Ground wire, connected to the power supply reference site

4 Basic operation

4.1 Hardware design

- It is recommended to use DC voltage regulator power to supply the module, the power ripple coefficient is as small as possible, and the module should be reliably grounded;
- Please note the correct connection of the positive and negative poles of the power supply, which may cause permanent damage to the module;
- Please check the power supply to ensure that between the recommended supply voltage, exceeding the maximum value will cause permanent damage to the module;
- Please check the stability of the power supply, and the voltage cannot fluctuate substantially and frequently;
- When designing power supply circuit for modules, it is often recommended to retain more than 30% allowance, and the whole machine is conducive to long-term stable work;

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- Modules should be as far as possible away from the power supply, transformer, high frequency wiring and other electromagnetic interference parts;
- High frequency digital routing, high frequency analog wiring, power wiring must avoid below the module, if you have to go through the module, assuming that the module is welded in Top Layer, Top Layer in the contact part of the module paving copper (all copper and good grounding), must be close to the digital part of the module and line in Bottom Layer;
- Assuming that the module is welded or placed in Top Layer, it is also wrong to walk randomly in Bottom Layer or other layers, which will affect the stray dispersion and receiving sensitivity of the module to different degrees;
- Assuming that there are devices with large electromagnetic interference around the module will also greatly affect the performance of the module, according to the strength of the interference according to the module, if the situation allows to do appropriate isolation and shielding;
- Assuming that there is a wiring around the module with large electromagnetic interference (high frequency digital, high frequency simulation, power wiring) will also greatly affect the performance of the module, according to the strength of the interference is recommended to stay away from the module, if the situation allows to do appropriate isolation and shielding;
- Keep away from the 2.4GHz TTL protocol, such as USB3.0;
- The antenna installation structure has a great impact on the performance of the module, so make sure that the antenna is exposed, preferably vertical upward. When the module is installed inside the casing, a high-quality antenna extension line can be used to extend the antenna to the outside of the casing;
- The antenna must not be installed inside the metal shell, which will greatly weaken the transmission distance.

4.2 Programming

- This module, the chip is CMT2310A, its drive mode is SPI, the user can fully in accordance with the CMT2310A chip manual operation;
- GPIO 0 / GPIO 2 / G PIO 3 / GPIO 4 / GPIO 5 / NIRQ is a general I / O port, see CMT2310A manual for detail.

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5 Basic application

5.1 Basic circuit

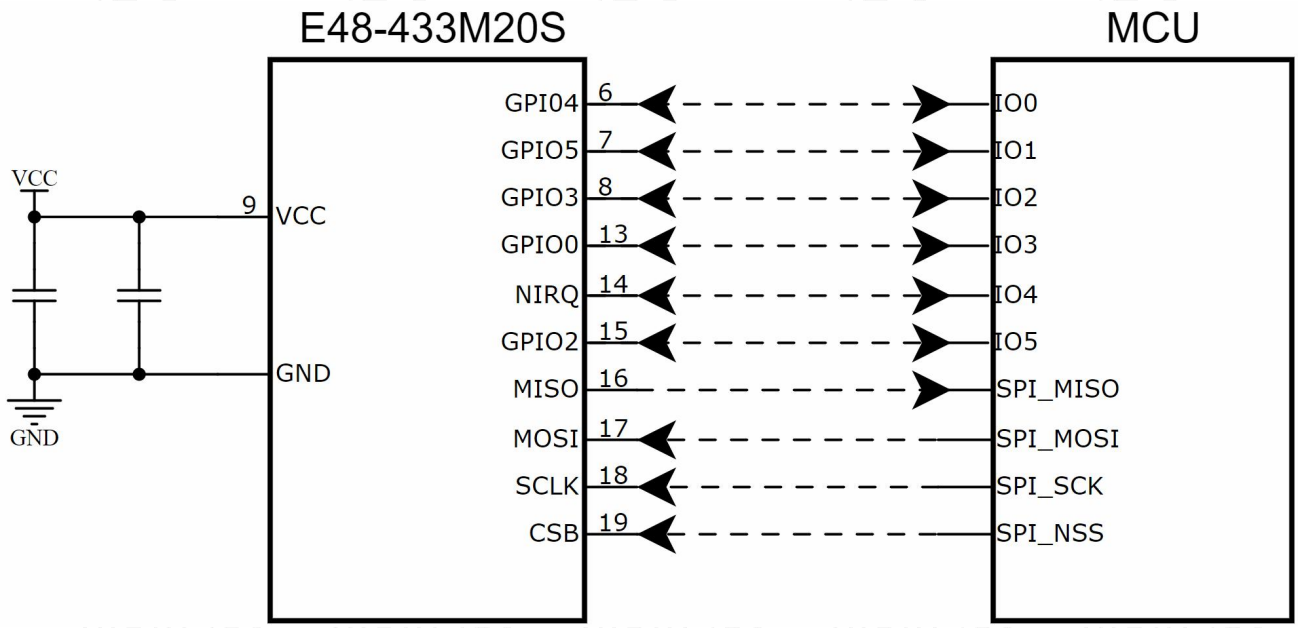


Figure 5-1, the circuit diagram

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6 FAQ

6.1 Communication range is too short

- When there is a linear communication obstacle, the communication distance will decay accordingly;
- Temperature, humidity, the same frequency interference, will lead to the communication packet loss rate increased;
- Ground absorption, reflection of radio waves, close to the ground test effect is poor;
- Seawater has a strong ability to absorb radio waves, so the seaside test effect is poor;
- There are metal objects near the antenna, or placed in the metal shell, the signal attenuation will be very serious;
- Power register setting is wrong, the air rate setting is too high (the higher the air rate, the closer the distance);
- At room temperature, the low voltage of the power supply is lower than the recommended value, and the lower the voltage, the lower the power generation;
- The antenna is poor to match the module or the quality of the antenna itself.

6.2 Module is easy to damage

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

6.3 BER(Bit Error Rate) is high

- There is the same frequency signal interference nearby, stay away from the interference source or modify the frequency, channel to avoid interference;
- The lock waveform on SPI is not standard, check whether there is interference on SPI line, SPI bus line should not be too long;
- The power supply is not ideal may also cause disorderly code, be sure to ensure the reliability of the power supply;
- Extension line, feeder quality is poor or too long, will also cause high bit error rate.

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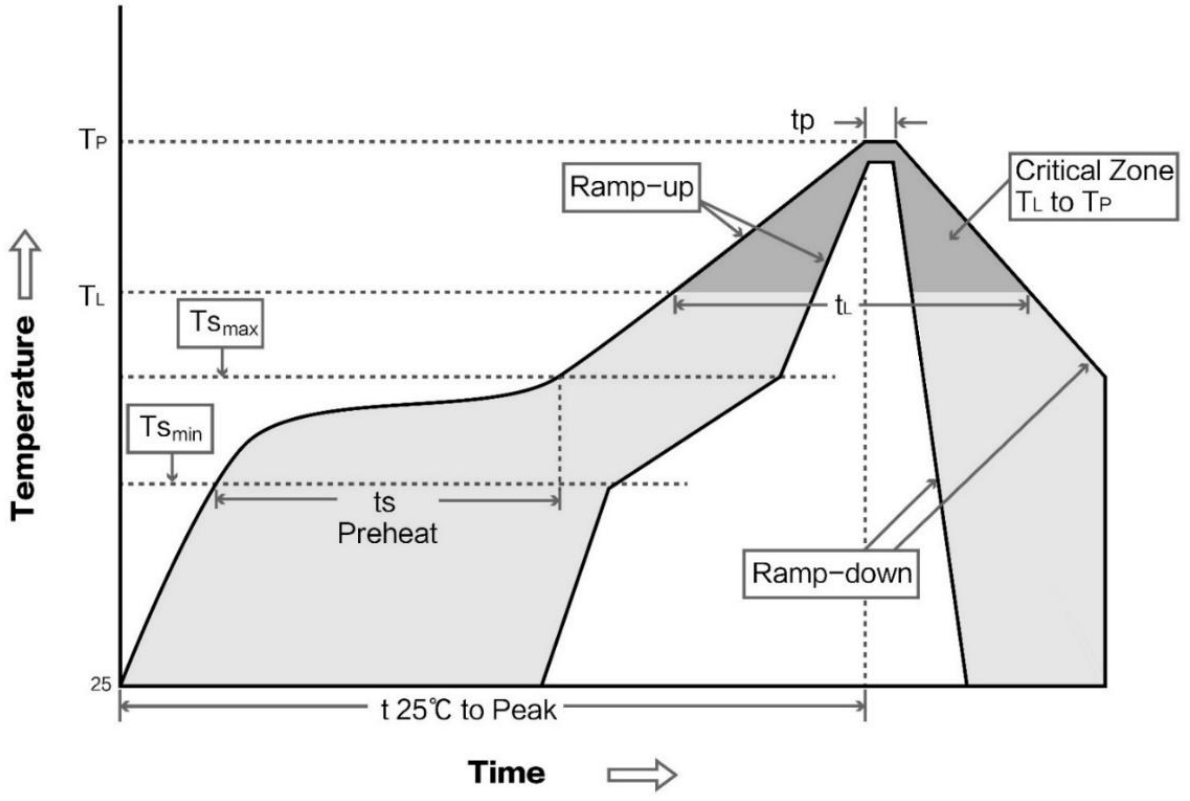
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7 Production guidance

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）	Minimum preheating temperature	100℃	150℃
Preheat temperature max (Tsmax)	Maximum preheating temperature	150℃	200℃
Preheat Time (Tsmin to Tsmax)(ts)	Preheating time	60-120 sec	60-120 sec
Average ramp-up rate(Tsmax to Tp)	Average rise rate	3℃/second max	3℃/second max
Liquidous Temperature (TL)	Fluid phase temperature	183℃	217℃
Time（tL）Maintained Above（TL）	Time above the liquid-phase line	60-90 sec	30-90 sec
Peak temperature（Tp）	Peak temperature	220-235℃	230-250℃
Aveage ramp-down rate（Tp to Tsmax）	Average decrease rate	6℃/second max	6℃/second max
Time 25℃ to peak temperature	25℃ to peak temperature	6 minutes max	8 minutes max

7.2 Reflow soldering curve



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8 E48 series

Model No.	IC	Frequency Hz	Tx power dBm	Distance km	Product Size	Package	Interface
E49-400T20S	CMT2310A	410~450MHz	20	1	26*16	SMD	UART
E49-400T20D	CMT2310A	410~450MHz	20	1	36*21	DPI	UART

9 Antenna recommendation

9.1 Recommendation

Antenna is an important role in the communication process, and often inferior antenna will have a great impact on the communication system, so our company recommends some antennas as antennas supporting our wireless modules with excellent performance and reasonable price.

Model No.	Type	Frequeny Hz	Gain dBi	Hight	Cable	Interface	Function feature
TX433-JW-5	Rubber antenna	433M	2	50mm	-	SMA-J	Bendable adhesive rod, omnidirectional antenna
TX433-JWG-7	Rubber antenna	433M	2.5	75mm	-	SMA-J	Bendable adhesive rod, omnidirectional antenna
TX433-JK-20	Rubber antenna	433M	3	210mm	-	SMA-J	Bendable adhesive rod, omnidirectional antenna
TX433-JK-11	Rubber antenna	433M	2.5	110mm	-	SMA-J	Bendable adhesive rod, omnidirectional antenna
TX433-XP-200	Sucker antenna	433M	4	19cm	200cm	SMA-J	Sucker antenna, high gain
TX433-XP-100	Sucker antenna	433M	3.5	18.5cm	100cm	SMA-J	Sucker antenna, high gain
TX433-XPH-300	Sucker antenna	433M	6	96.5cm	300cm	SMA-J	Car suction cup antenna, super high gain
TX433-JZG-6	Rubber antenna	433M	2.5	52mm	-	SMA-J	Ultra-short straight, omnidirectional antenna
TX433-JZ-5	Rubber antenna	433M	2	52mm	-	SMA-J	Ultra-short straight, omnidirectional antenna
TX490-XP-100	Sucker antenna	490M	50	12cm	100cm	SMA-J	Sucker antenna, high gain
TX490-JZ-5	Rubber antenna	490M	50	50mm	-	SMA-J	Ultra-short straight, omnidirectional antenna

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10 Revision history

Version	Date	Description	Issued by
1.0	2024-01-17	The initial version	Bin

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