E290-M (3029) Series Product Specifications

PAN30 29 433/470MHz Ultra Small Size Chip Module



Chengdu Ebyte Electronic Technology Co.,Ltd.

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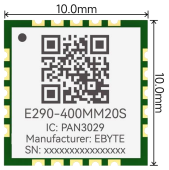
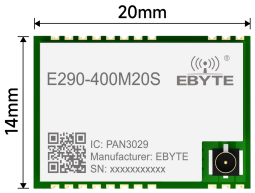
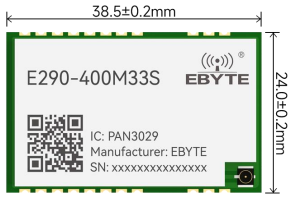
Chapter 1 Overview

1.1 Introduction

The E290-M (3029) series is a high-performance, chip-type ChirpIoT ™ wireless module that is independently developed based on Panqi Micro's new generation of domestically produced RF chip PAN3029 and is suitable for the 433MHz and 470MHz frequency bands .

Since PAN3029 is used as the core of the module, the anti-interference performance and communication distance are further improved. Since it adopts the new ChirpIoT ™ modulation technology, the anti-interference performance and communication distance are far superior to the current FSK and GFSK modulation products. This module is mainly aimed at smart homes, wireless meter reading, scientific research and medical treatment, as well as medium and long-distance wireless communication equipment , and uses industrial-grade high-precision 32MHz crystal oscillators.

in the figure below have different packaging and power , and are pure RF transceiver modules . They need to be driven by MCU or use a dedicated SPI debugging tool.

E290-400MM20S	E290-400M20S	E290-400M30S	E290-400M33S
			

1.2 Features

- Under ideal conditions, the maximum communication distance measured can reach 16 km;
- The maximum transmission power of this series of modules can reach +33dBm (2 W) and supports multi-level software adjustment;
- Supports the global license-free ISM 433/470MHz frequency band , and its operating frequency range is: 410～510Mhz ;
- ChirpIoT ™ mode supports data transmission rates of 0.5 to 59.9 Kbps;
- FIFO has large capacity and supports 256Byte data cache;
- Support SF5~ SF12 ;
- Support bandwidth: 62.5kHz, 125kHz, 250kHz, 500kHz;
- E290-400MM20S & E290-400M20S support 1.8V ~3.6V power supply , and ≥ 3.3V power supply can ensure the best performance ;
- E290-400M30S & E290-400M33S support 3.3V ~ 5.5V power supply , and ≥5V power supply can ensure the best performance ;

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- Industrial standard design, supports long-term use at -40 ~ 85 ℃ ;
- Equipped with rich interfaces, supports 4-wire SPI/3-wire SPI/I2C configuration interface, supports 4 GPIOs ;
- The sleep current can be as low as 200nA;
- The interface is a stamp hole, which is convenient for users to carry out secondary development and facilitates 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 remote control;
- Healthcare products;
- Advanced Metering Infrastructure (AMI);
- Automotive industry applications.

Chapter 2 Specifications

2.1 RF parameters

RF parameters	unit	model				Remark
		E290-400MM20S	E290-400M20S	E290-400M30S	E290-400M33S	
Transmit power	dBm	20	20	30	33	Support software multi-level adjustable
Reference distance	m	5000	5000	10000	16000	Clear and open air, antenna gain 5dBi, antenna height 2.5 meters, air rate 2.4 kbps
Working frequency band	MHz	410～ 510	410～ 510	410～ 510	410～ 510	Factory default 433MHz, supports ISM band
Air speed	bps	0.5K～59.9K	0.5K～59.9K	0.5K～59.9K	0.5K～59.9K	User programmable control

2.2 Electrical parameters

Electrical parameters	unit	model				Remark
		E290-400MM20S	E290-400M20S	E290-400M30S	E290-400M33S	

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Operating voltage		V	1.8 ～ 3.6	1.8 ～ 3.6	3.3～5.5	3.3～5.5	
Communication level		V	3.3	3.3	3.3	3.3	Using 5V TTL may burn out
Power consumption	Emission current	mA	120	120	493	900	Instantaneous power consumption
	Receiving current	mA	8.2	8.2	16.4	16.5	
	Sleep current	μA	0.2	0.2	4	4.3	Software shutdown
temperature	Operating temperature	℃	-40～+ 85				Industrial Grade
	Storage temperature		-40 ～ +125				

Note: When the working voltage of E290-400MM20S and E290-400M20S is ≥3V, the output power requirements can be met. When the working voltage exceeds 3.6V, there is a risk of burning. When the working voltage of E290-400M30S and E290-400M33S is ≥5V, the output power requirements can be met. When the working voltage exceeds 5.5V, there is a risk of burning.

2.3 Hardware Parameters

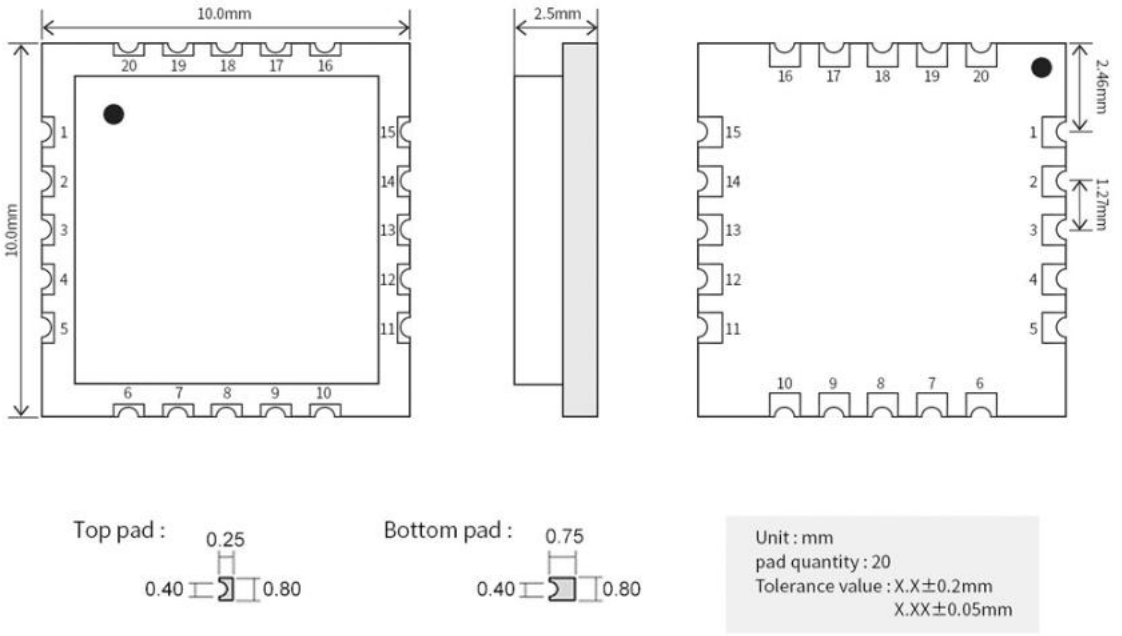
Hardware Parameters	model				Remark
	E290-400MM20S	E290-400M20S	E290-400M30S	E290-400M33S	
chip	PAN3029	PAN3029	PAN3029	PAN3029	
FIFO	256Byte	256Byte	256Byte	256Byte	Maximum length of a single transmission
Modulation	ChirpIoT™	ChirpIoT™	ChirpIoT™	ChirpIoT™	Next-generation ChirpIoT™ modulation technology
Interface	Stamp Holes	Stamp Holes	Stamp Holes	Stamp Holes	Pitch 1.27mm
Communication interface	SPI/IIC	SPI/IIC	SPI/IIC	SPI/IIC	The reference SPI rate is 3M
Product Net Weight	0.5g	1.5 g	4.9 g	5.1 g	Tolerance ±0.02g
Packaging	Patches	Patches	Patches	Patches	
Antenna interface	Stamp Holes	IPEX generation /stamp hole	IPEX generation /stamp hole	IPEX generation /stamp hole	Characteristic impedance is about 50 ohms
size	10*10*mm	20*14mm	24*38.5mm	24*38.5mm	

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Chatper 3 Mechanical dimensions and pin definition

3.1 E290-400MM20S mechanical dimensions and pin definition diagram



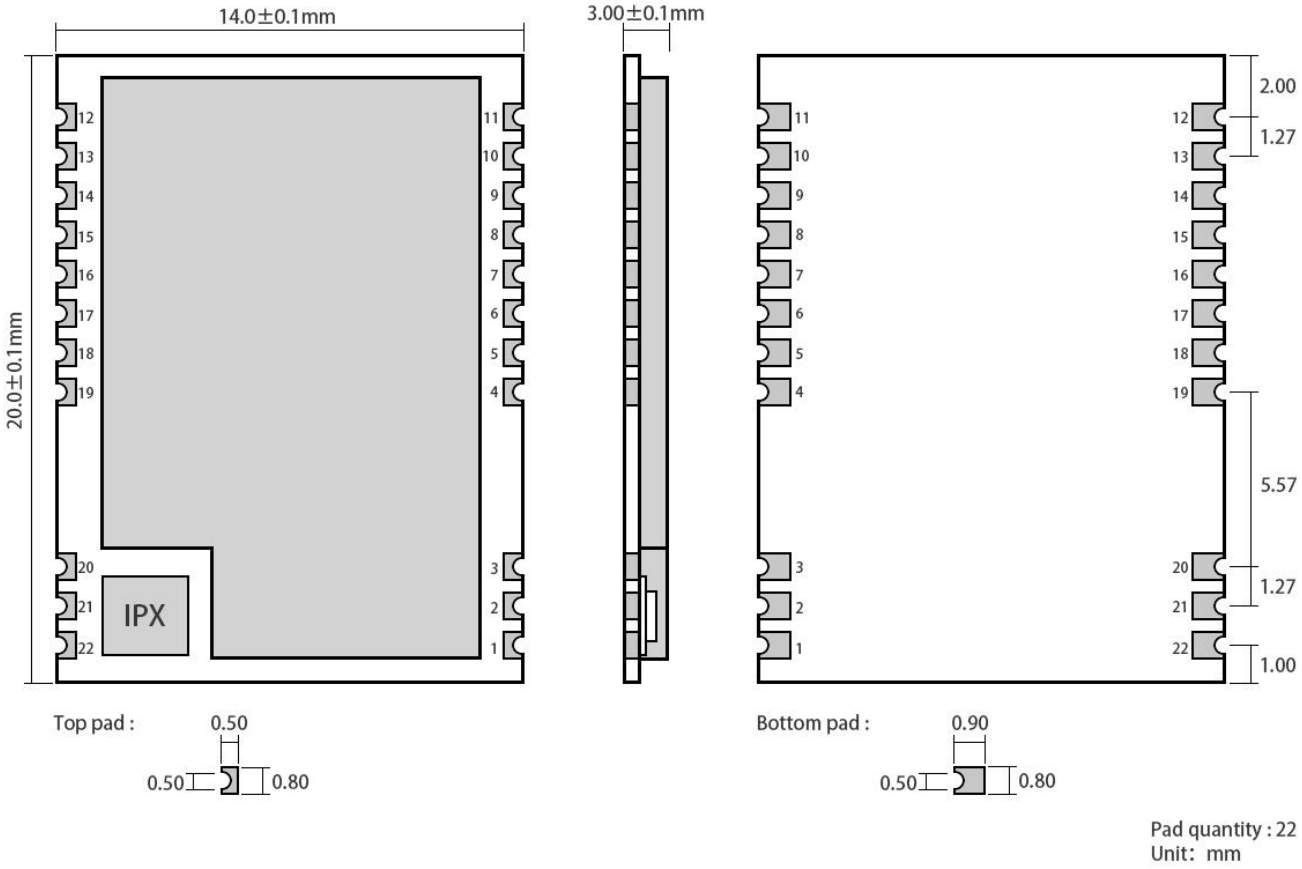
Pin number	Pin Name	Pin Direction	Pin Purpose
1	DCDC_IND		Internal DCDC output, connect external series inductor, refer to the recommended circuit
2	DCDC_FB		Internal DCDC feedback input, DCDC mode connected to VDD123, Reference recommended circuit
3	VDD123	power supply	Analog power supply, connect to VFB in DCDC mode, connect to main power supply in non-DCDC mode
4	VCC	power supply	Module power supply, voltage range 1.8V~3.6V
5	GND		Module Ground
6	TXEN	Output	Used for sending switching control, connected to internal GPIO0, can be left floating
7	RXEN	Output	Used for receiving switching control, connected to internal GPIO10, can be left floating
8	GND		Module Ground
9	GND		Module Ground
10	ANT	Output/ Input	RF antenna, theoretical output impedance 50Ω
11	GND		Module Ground
12	GND		Module Ground
13	CAD	Output	CAD interrupt pin, connected to internal GPIO11

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14	DIO3		Connected to internal GPIO3
15	IRQ	Output	RF interrupt pin, connected to internal GPIO1
16	MOSI	enter	SPI data input signal , IIC data pin
17	MISO	Output	SPI data output signal
18	SCK	enter	SPI clock input pin , IIC clock input pin
19	NSS	enter	SPI chip select signal , always high in IIC mode
20	NRST	enter	Reset pin

3.2 E290-400M20S mechanical dimensions and pin definition diagram



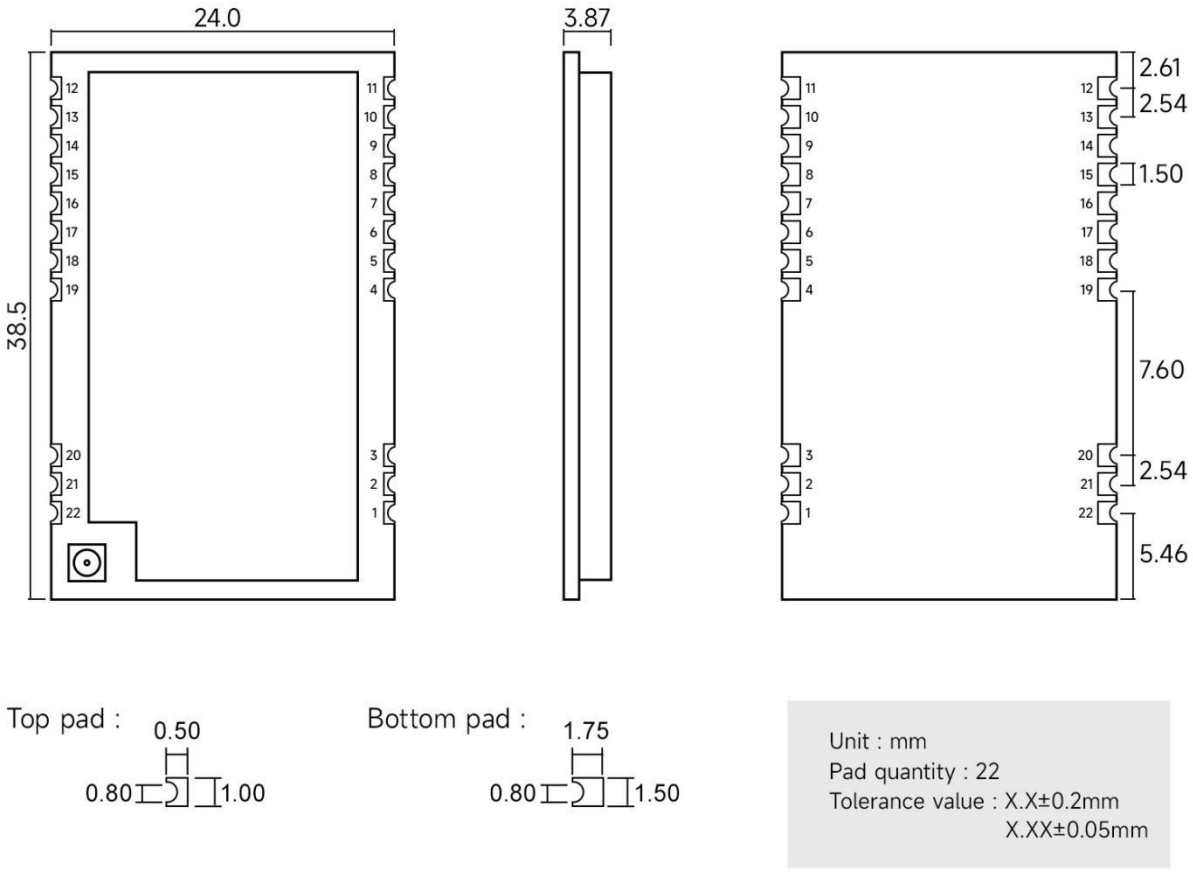
Pin number	Pin Name	Pin Direction	Pin Purpose
1	GND		Module Ground
2	GND		Module Ground
3	GND		Module Ground
4	GND		Module Ground
5	GND		Module Ground
6	RXEN	Output	Used for receiving switching control, connected to internal GPIO10, can be left floating
7	TXEN	Output	Used for sending switching control, connected to internal GPIO0, can be left floating

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8	DIO3		Connected to internal GPIO3
9	VCC	power supply	Module power supply, voltage range 1.8V~3.6V
10	GND		Module Ground
11	GND		Module Ground
12	GND		Module Ground
13	IRQ	Output	RF interrupt pin, connected to internal GPIO1
14	CAD	Output	CAD interrupt pin, connected to internal GPIO11
15	NRST	enter	Reset pin
16	MISO	Output	SPI data output signal
17	MOSI	enter	SPI data input signal , IIC data pin
18	SCK	enter	SPI clock input pin , IIC clock input pin
19	NSS	enter	SPI chip select signal , always high in IIC mode
20	GND		Ground wire, connected to the power reference ground
twenty one	ANT	Output/ Input	RF antenna, theoretical output impedance 50Ω
twenty two	GND		Ground wire, connected to the power reference ground

3. E290-400M30S&E290-400M33S mechanical dimensions and pin definition diagram



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Pin number	Pin Name	Pin Direction	Pin Purpose
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	NC	-	-
7	NC	-	-
8	GPIO11	-	The user can leave it unconnected, no function is defined yet
9	VCC	-	Power supply, range 2.5～5.5V (it is recommended to add external ceramic filter capacitor)
10	VCC	-	Power supply, range 2.5～5.5V (it is recommended to add external ceramic filter capacitor)
11	GND	-	Ground wire, connected to the power reference ground
12	GND	-	Ground wire, connected to the power reference ground
13	IRQ	Input/Output	Configurable general purpose IO ports
14	GPIO3	Input/Output	General IO port
15	NRST	enter	Chip reset trigger input pin, low level is effective
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
twenty one	ANT	-	Antenna interface, stamp hole (50Ω characteristic impedance).
twenty two	GND	-	Ground wire, connected to the power reference ground

Chapter 4 Basic Operations

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 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, the module will be permanently damaged.
- Please check the stability of the power supply. The voltage should not fluctuate greatly or frequently.
- When designing the power supply circuit for the module, it is often recommended to retain more than 30% margin, which is conducive to long-term stable operation of the whole machine;
- The module should be kept as far away as possible from parts with large electromagnetic interference, such as power supplies, transformers, and high-frequency wiring;
- High-frequency digital routing, high-frequency analog routing, and power routing must avoid the bottom of the module. If it is necessary to pass under the module, assuming that the module is soldered on the Top Layer, ground copper is laid on the Top Layer of the module contact part (all copper is laid and well grounded), and it must be close to the digital part of the module and routed on the Bottom Layer;
- Assuming the module is soldered or placed on the Top Layer, it is also wrong to randomly route the wires on the

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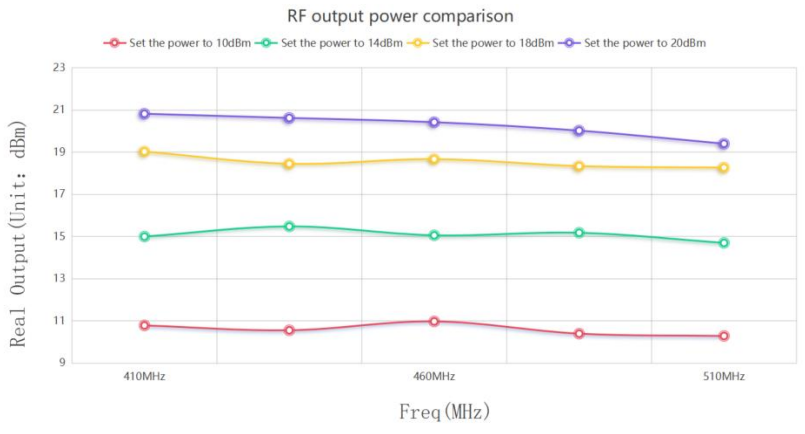
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Bottom Layer or other layers, which will affect the module's spurious signal and receiving sensitivity to varying degrees;

- If there are devices with large electromagnetic interference around the module, it will also greatly affect the performance of the module. It is recommended to keep them away from the module according to the intensity of the interference. If possible, appropriate isolation and shielding can be performed.
- If 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 keep them away from the module according to the intensity of the interference. If possible, appropriate isolation and shielding can be performed.
- 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 the performance of the module. Make sure the antenna is exposed and preferably vertically upward. When the module is installed inside the housing, use a high-quality antenna extension cable to extend the antenna to the outside of the housing;
- The antenna must not be installed inside a metal shell, as this will greatly reduce the transmission distance.
- It is recommended to add a 200R protection resistor to the RXD/TXD of the external MCU.

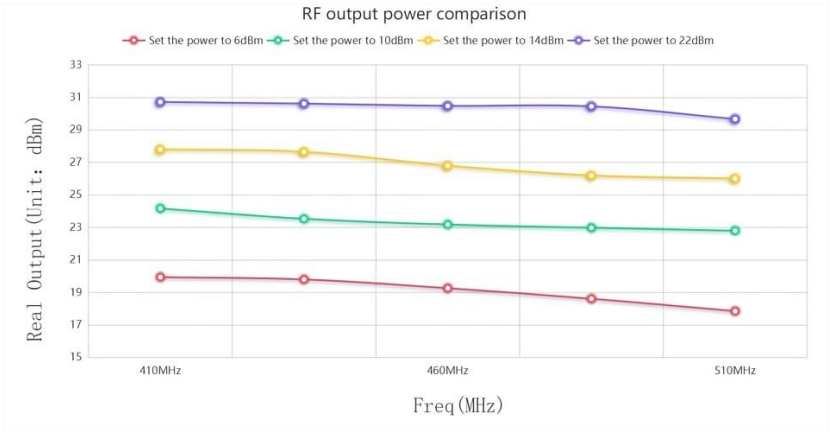
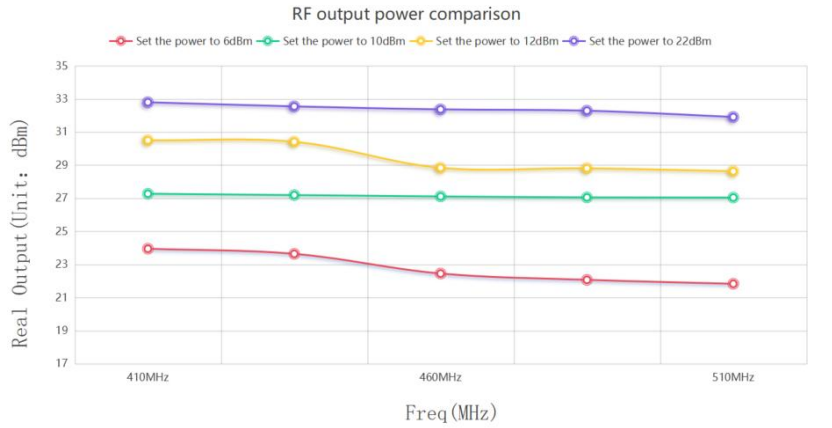
4.2 Software Writing

- The built-in RF chip of this module is PAN3029 , and its driving method is exactly the same as PAN3029 , users can follow PAN3029 chip manual for operation .
- E290-400MM20S & E290-400M20S is controlled by the RF chip GPIO0, and the RXEN pin is controlled by the RF chip GPIO10. Users need to configure them by themselves.
- After CAD mode is turned on, customers are required to set GPIO11 to CAD interrupt output mode.
- For more information, please refer to the official SDK program.
- The DCDC mode requires the support of external hardware. Generally, customers can use the LDO mode.
- The chip supports I2C by default. The I2C signals SCL and SDA multiplex the SPI's SCK and MOSI signals.
- Power classification comparison chart:

Use module model	RF output power comparison curve
E290-400MM20S&E290-400M20S	

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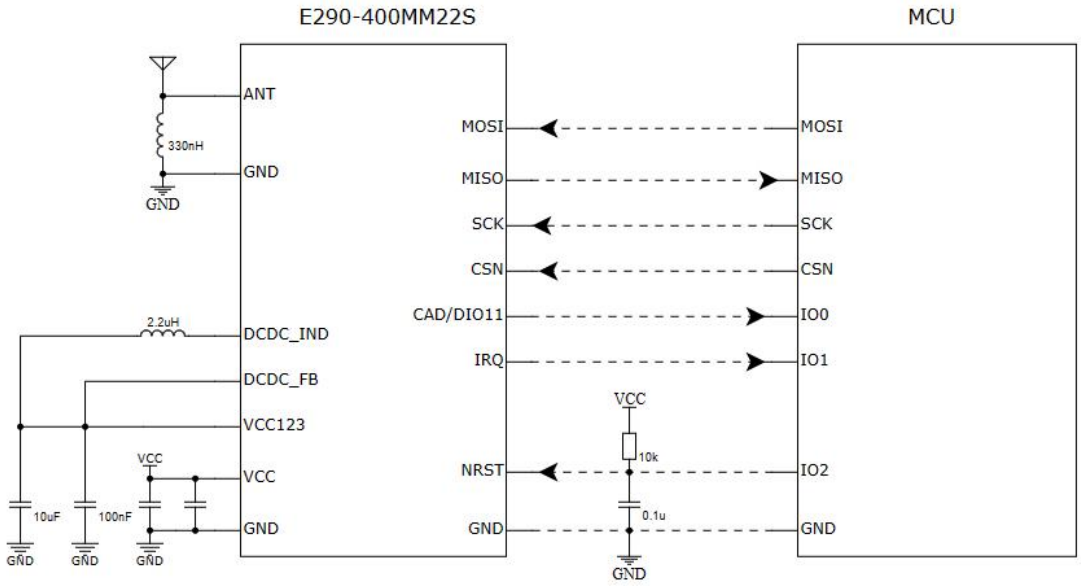
E290-400M 3 0S	
E290-400M 33 S	

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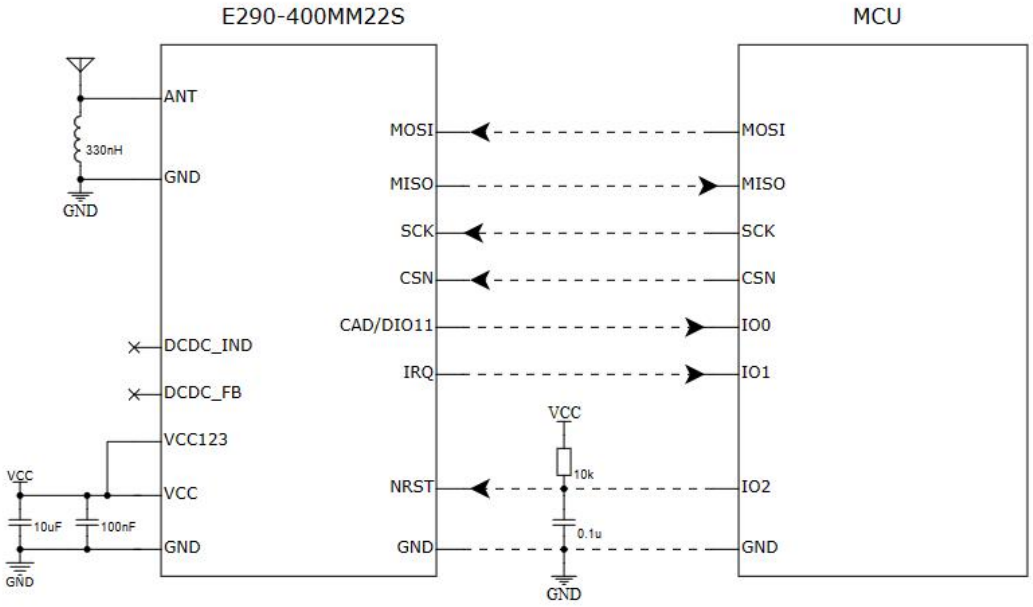
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Chapter 5 Recommended Circuits

5.1 DC-DC Mode



5. 2 LDO Mode



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Chapter 6 Frequently Asked Questions

6.1 The transmission distance is not ideal

- When there is a straight-line communication obstacle, the communication distance will be attenuated accordingly;
- Temperature, humidity, and co-channel interference can increase the communication packet loss rate;
- The ground absorbs and reflects radio waves, so the test results are poor when close to the ground;
- Seawater has a strong ability to absorb radio waves, so the testing effect at the seaside is poor.
- If there are metal objects near the antenna, or the antenna is placed in a metal shell, the signal attenuation will be very serious;
- The power register is set incorrectly, or the air rate is set too high (the higher the air rate, the closer the distance);
- The power supply voltage at room temperature is lower than the recommended value. The lower the voltage, the lower the power output.
- The antenna used does not match the module well or the antenna itself has quality issues.

6.2 Module is easily damaged

- Please check the power supply and make sure it is within the recommended voltage range. If it exceeds the maximum value, the module may be permanently damaged.
- Please check the power supply stability. The voltage cannot fluctuate greatly or frequently.
- Please ensure anti-static operation during installation and use, as high-frequency components are electrostatically sensitive.
- Please ensure that the humidity is not too high during installation and use, as some components are humidity sensitive.
- If there is no special requirement, it is not recommended to use it at too high or too low temperature.

6.3 Bit Error Rate is Too High

- There is interference from the same frequency signal nearby. Stay away from the interference source or change 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.
- An unsatisfactory power supply may also cause garbled characters, so the reliability of the power supply must be ensured;
- Poor quality or too long extension cables and feeder cables can also cause high bit error rates;

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Chapter 7 Welding Operation Instructions

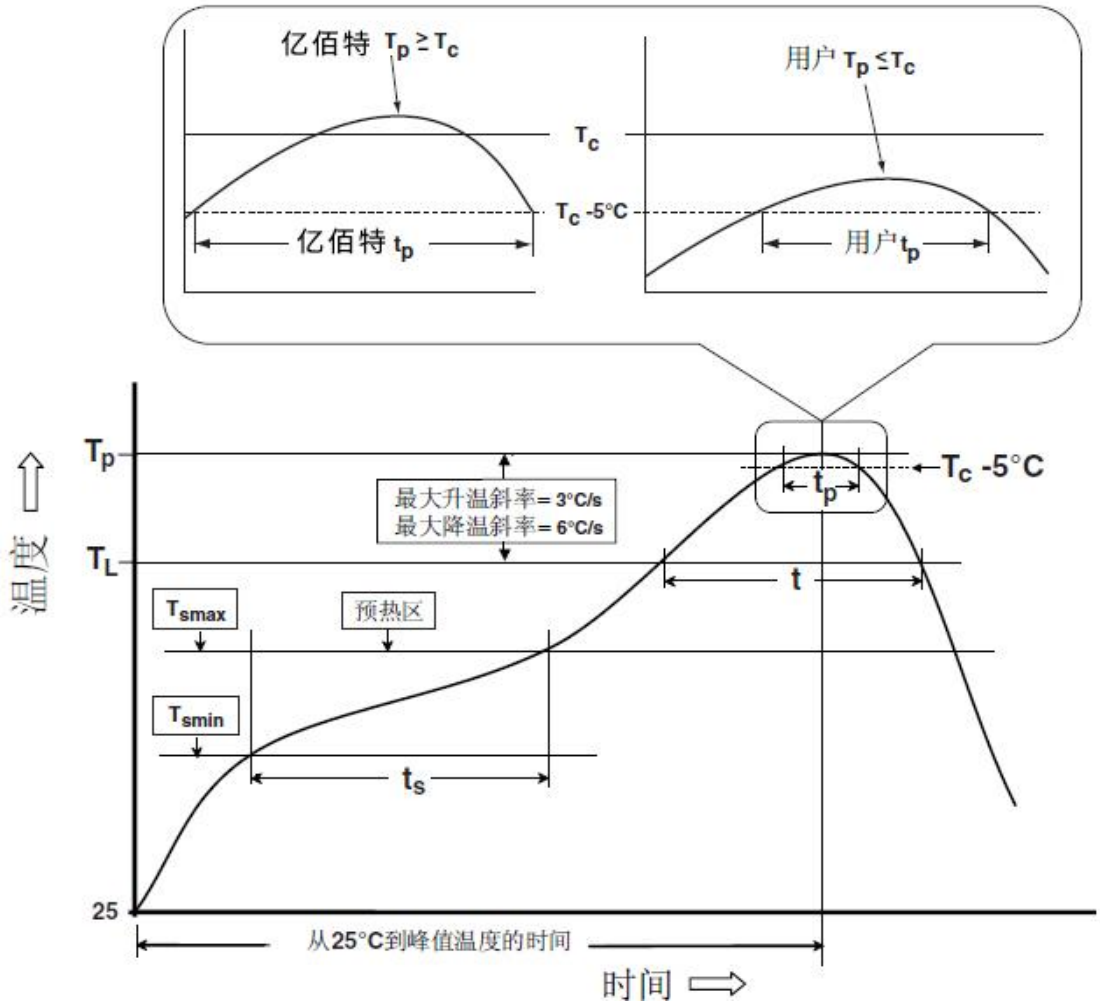
7.1 Reflow Temperature

Reflow profile characteristics		Leaded process assembly	Lead-free assembly
Preheating/keeping	Minimum temperature (Tsmin)	100℃	150℃
	Maximum temperature (T smax)	150℃	200℃
	Time (T smin ~T smin)	60-120 seconds	60-120 seconds
Heating slope (T L ~T p)		3℃/sec, max.	3℃/sec, max.
Liquidus temperature (TL)		183℃	217℃
T L above the holding time		60~ 90 seconds	60~ 90 seconds
Package peak temperature Tp		Users must not exceed the temperature stated on the product's "Moisture Sensitivity" label.	Users must not exceed the temperature stated on the product's "Moisture Sensitivity" label.
p) within 5°C of the specified classification temperature (Tc) is shown in the figure below.		20 seconds	30 seconds
Cooling slope (T p ~T L)		6℃/sec, max.	6℃/sec, max.
Time from room temperature to peak temperature		6 minutes, longest	8 minutes, longest
※The peak temperature (Tp) tolerance of the temperature curve is defined as the upper limit of the user			

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7.2 Reflow Oven Curve



Chapter 8 Related Models

Product Model	Chip Solution	Carrier frequency Hz	Transmit power dBm	Test distance km	Package	Product size mm	Antenna type
E290-400T20S	PAN3060	430M 470M	2 0	5	Patches	16*26	Stamp hole/IPEX
E290-400T30S	PAN3060	433M 470M	30	1 0	Patches	24*38.5	Stamp hole/IPEX
E290-900T20S	PAN3060	868M 915M	2 0	5	Patches	16*26	Stamp hole/IPEX
EWM290-400R20D	PAN3060	433M 470M	2 0	5	Plugins	38*23	SMA-K
EWM290-400R30D	PAN3060	433M 470M	30	1 0	Plugins	26*48mm	SMA-K

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Chapter 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 supporting antennas for our wireless modules with excellent performance and reasonable prices.

Product Model	type	Frequency band Hz	interface	Gain dBi	high mm	Feeder cm	Features
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	62	-	Ultra-short straight, omnidirectional antenna
TX433-JW-5	Glue stick antenna	433M	SMA-J	2.0	50	-	Bend the glue stick, omnidirectional antenna
TX433-JWG-7	Glue stick antenna	433M	SMA-J	2.5	75	-	Bend the glue stick, omnidirectional antenna
TX433-JK-11	Glue stick antenna	433M	SMA-J	2.5	110	-	Bendable glue stick, omnidirectional antenna
TX433-XPL-100	Suction cup antenna	433M	SMA-J	3.5	185	100	Small suction cup antenna, cost-effective
TX433-XP-200	Suction cup antenna	433M	SMA-J	4.0	190	200	Neutral suction cup antenna, low loss
TX433-XPH-300	Suction cup antenna	433M	SMA-J	6.0	965	300	Large suction cup antenna, high gain
TX490-JZ-5	Glue stick antenna	470/490M	SMA-J	2.0	50	-	Ultra-short straight, omnidirectional antenna
TX490-XPL-100	Suction cup antenna	470/490M	SMA-J	3.5	120	100	Small suction cup antenna, cost-effective

Revision History

Version	Revision Date	Revision Notes	Maintainer
V1.0	2025-7-9	Initial release	Hao

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