E290-M(3060) Series Product Specifications

PAN3060 433/470MHz Ultra Small Form Factor SMT Module



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1 Introduction

1.1 Brief Introduction

E290-M(3060) series is a high-performance ChirpIoT™ wireless module for 433MHz and 470MHz frequency bands, which is independently developed based on Granitech's new generation of domestic RF chip PAN3060.

Due to the use of PAN3060 as the core of the module, the anti-interference performance and communication distance have been further improved. Due to the new ChirpIoT™ modulation technology, the anti-interference performance and communication distance are far beyond the current FSK and GFSK modulation products. The module is mainly targeted at smart home, wireless meter reading, scientific research and medical research, as well as medium and long-distance wireless communication equipment, using industrial-grade high-precision 32MHz crystal.

The following four modules have different packages and power, and are pure RF transceiver modules, which need to be driven by MCU or use special SPI debugging tools.

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

1.2 Features

- The maximum transmit power of this series of modules can reach +33dBm (2W), and support software multi-level adjustable;
- Support the global license-free ISM 433/470MHz bands, and its operating band range: 410~493Mhz; ChirpIoT™ mode supports 0.5~59.9Kbps data transmission rate; FIFO capacity is large, supporting 256Byte data cache; ChirpIoT™ mode supports 0.5~59.9Kbps data transmission rate; 493Mhz;
- ChirpIoT™ mode supports 0.5~59.9Kbps data transfer rate;
- FIFO capacity is large and supports 256Byte data cache;
- Supports SF5~SF9;
- Supports bandwidths of 125kHz, 250kHz, 500kHz;
- E290-400MM20S supports 1.8V~3.6V power supply, and ≥3.3V power supply can ensure the best performance;
- E290-400M30S&E290-400M33S supports 3.3V~5.5V power supply, and ≥5V power supply can ensure the best performance; E290-400M33S supports 3.3V~5.5V power supply, and ≥5V power supply can guarantee the best performance. ≥5V power supply can ensure the best performance;
- Industrial standard design, support -40 ~ 85 ℃ long time use;

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- With rich interfaces, support for 4-wire SPI/3-wire SPI/I2C configuration interface, support for 4 GPIOs;
- Hibernation current can be as low as 200nA;
- The interface is a stamp hole, which makes it easy for users to develop it twice and facilitates integration.

1.3 Application

- Home Security Alarm and Remote Keyless Entry;
- Smart Home as well as Industrial Sensors, etc.;
- Wireless Alarm Security Systems;
- Building Automation Solutions;
- Wireless Industrial Grade Remote Controls;
- Healthcare Products;
- Advanced Meter Reading Architecture (AMI);
- Automotive Industry Applications.

2 Specification

2.1 RF parameters

RF parameters	unit	model number				Remarks
		E290-400MM20S	E290-400M20S	E290-400M30S	E290-400M33S	
firing power	dBm	20	20	30	33	Support software multi-level adjustable
Reference Distance	m	5000	5000	10000	16000	Clear and open, antenna gain 5dBi, antenna height 2.5m, air rate 2.4kbps
Operating Frequency	MHz	410～493	410～493	410～493	410～493	Factory default 433MHz, support 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 number				Remarks
		E290-400MM20S	E290-400M20S	E290-400M30S	E290-400M33S	
Operating Voltage	V	1.8～3.6	1.8～3.6	3.3～5.5	3.3～5.5	

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Communication Level		V	3.3	3.3	3.3	3.3	Risk of burn-in using 5V TTL
power wastage	Transmit current	mA	120	120	493	900	momentary power consumption
	Receive 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
	Storage temperature		-40～+125				

Note: E290-400MM20S and E290-400M20S can meet the output power demand when the operating voltage is ≥3V, and there is a risk of burnout when the operating voltage exceeds 3.6 V. E290-400M30S and E290-400M33S can meet the output power demand when the operating voltage is ≥5V, and there is a risk of burnout when the operating voltage exceeds 5.5V.

2.3 Hardware parameters

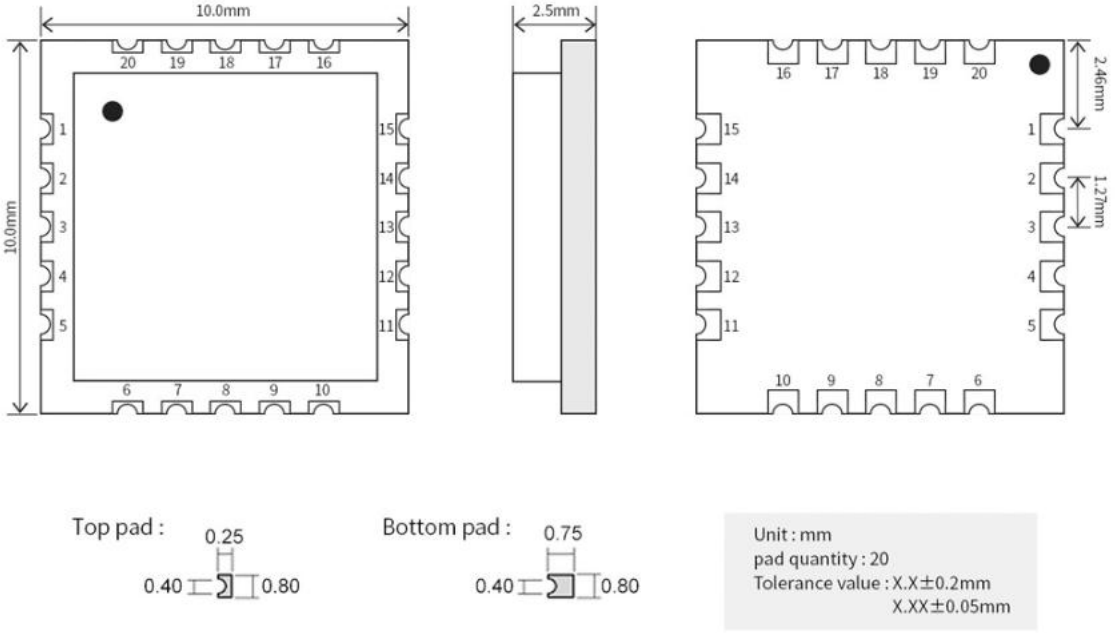
Hardware parameters	model number				Remarks
	E290-400MM20S	E290-400M20S	E290-400M30S	E290-400M33S	
Chip	PAN3060	PAN3060	PAN3060	PAN3060	
FIFO	256Byte	256Byte	256Byte	256Byte	Maximum length of a single transmission
Modulation	ChirpIoT™	ChirpIoT™	ChirpIoT™	ChirpIoT™	New generation ChirpIoT™ modulation technology
Interface	stamp hole	stamp hole	stamp hole	stamp hole	Pitch 1.27mm
Communication interface	SPI/IIC	SPI/IIC	SPI/IIC	SPI/IIC	Reference SPI rate of 3M
Product net weight	0.5g	1.5g	4.9g	5.1g	Tolerance of 0.02g
Package	SMD	SMD	SMD	SMD	
Antenna interface	stamp hole	IPEX 1 Generation/Stamp Holes	IPEX 1 Generation/Stamp Holes	IPEX 1 Generation/Stamp Holes	Characteristic impedance approx. 50 ohms
Dimensions	10*10*mm	20*14mm	24*38.5mm	24*38.5mm	

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3 Mechanical Dimensions and Pin Definitions

3.1 E290-400MM20S Mechanical Dimensions and Pin Definition Drawing



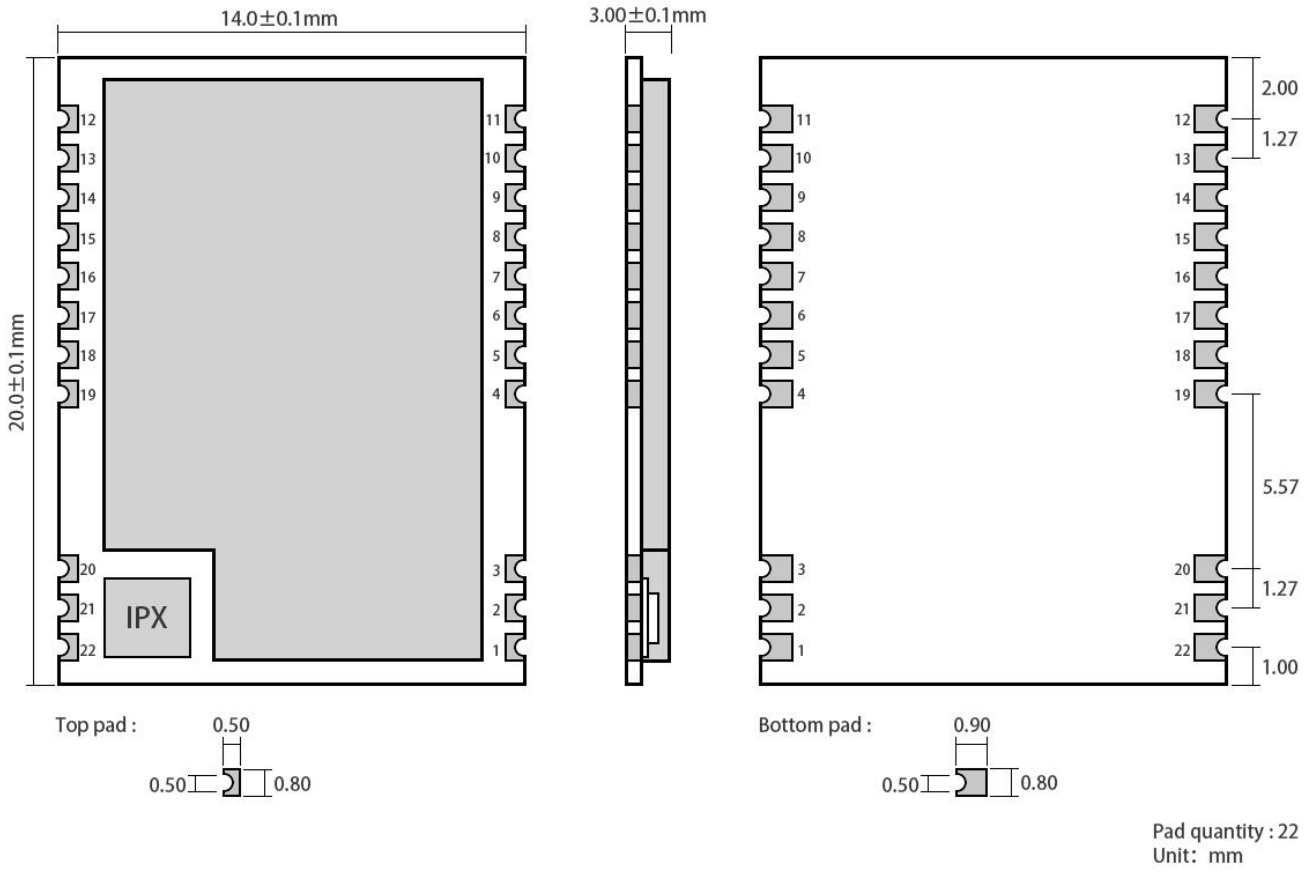
No	Name	Pin orientation	Pin Usage
1	DCDC_IND		Internal DCDC output, connected to external series inductor, refer to recommended circuitry
2	DCDC_FB		Internal DCDC feedback input, DCDC mode connected to VDD123,
3	VDD123	Power supply	refer to recommended circuitry
4	VCC	power supply	Analog power supply, DCDC mode connected to VFB, non-DCDC mode connected to mains
5	GND		Module power supply, voltage range 1.8V~3.6V
6	TXEN	Output	Module Ground
7	RXEN	Output	Used for transmit toggle control, connected to internal GPIO0, can dangle Module Ground , can be suspended
8	GND		Used for receive toggle control, connected to internal GPIO10, can be suspended
9	GND		Module Ground
10	ANT	Outputs/Inputs	Module Ground
11	GND		RF antenna, theoretical output impedance 50Ω
12	GND		Module Ground
13	CAD	Output	Module Ground

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14	DIO3		CAD interrupt pin, connected to internal GPIO11
15	IRQ	Output	Connected to internal GPIO3
16	MOSI	Input	RF interrupt pin, connected to internal GPIO1
17	MISO	Output	SPI data output signal
18	SCK	Input	SPI clock input pin, IIC clock input pin
19	NSS	Input	SPI chip select signal, constant high in IIC mode
20	NRST	Input	Reset pin

3.2 E290-400M20S Mechanical Dimensions and Pin Definition Diagrams



No	Name	Pin orientation	Pin Usage
1	GND		Module Ground
2	GND		Module Ground
3	GND		Module Ground
4	GND		Module Ground
5	GND		Module Ground
6	RXEN	Output	For receive switching control, connected to internal GPIO10, can be suspended
7	TXEN	Output	For transmit switching control, connected to internal GPIO0, can be

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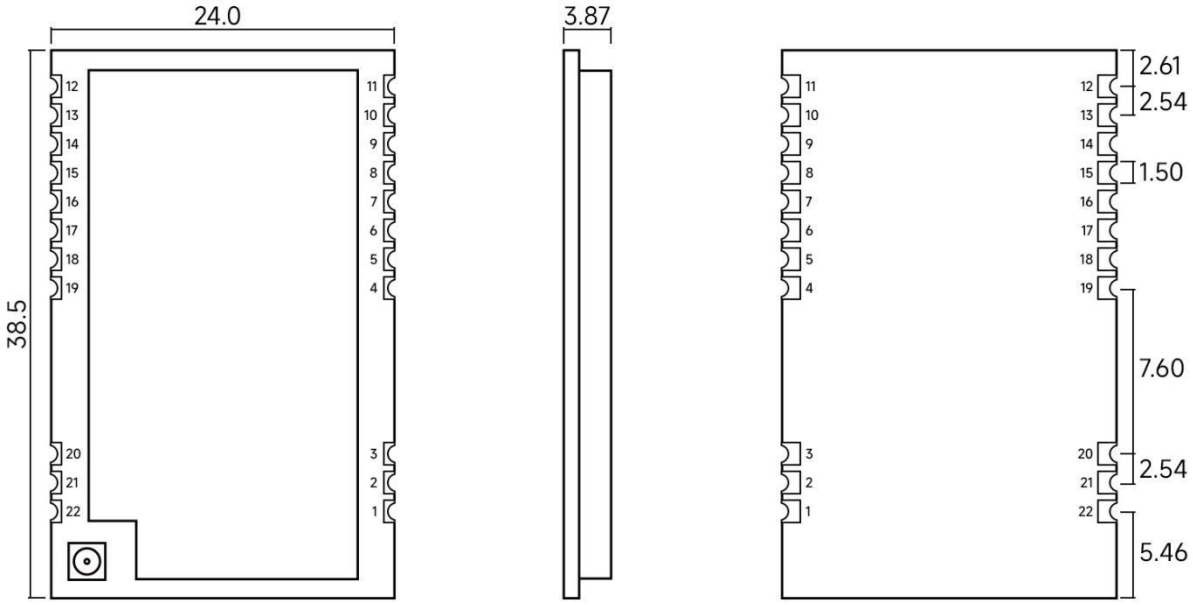
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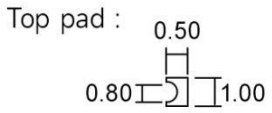
			suspended
8	DIO3		Connected to internal GPIO3
9	VCC	power supply	Module power supply, voltage range 1.8V~3.6V
10	GND		Module Ground
11	GND		Module Ground
12	GND		Module Ground
13	IRQ	Output	RF interrupt pin, connected to internal GPIO1
14	CAD	Output	CAD interrupt pin, connected to internal GPIO11
15	NRST	Input	Reset pin
16	MISO	Output	SPI Data Output Signal
17	MOSI	Input	SPI Data Input Signal, IIC Data Pin
18	SCK	Input	SPI Clock Input Pin, IIC Clock Input Pin
19	NSS	Input	SPI Chip Select Signal, Constant High in IIC Mode
20	GND		Ground, Connected to Power Supply Reference Ground
21	ANT	Outputs/Inputs	RF Antenna, Theoretical Output impedance 50Ω
22	GND		Ground, connect to power reference ground

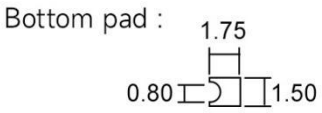
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3.3 E290-400M30S & E290-400M33S Mechanical Dimensions and Pin Definition Diagrams







Unit : mm
Pad quantity : 22
Tolerance value : X.X±0.2mm
X.XX±0.05mm

No	Name	Pin orientation	Pin Purpose
1	GND		Ground, connects to power reference ground
2	GND		Ground, connects to power reference ground
3	GND		Ground, connects to power reference ground
4	GND		Ground, connects to power reference ground
5	GND		Ground, connects to power reference ground
6	NC	-	-
7	NC	-	-
8	GPIO11	-	User dangling, no function defined at this time
9	VCC	-	Power supply, range 2.5 to 5.5V (external ceramic filter capacitor is recommended)
10	VCC	-	Power supply, range 2.5 to 5.5V (external ceramic filter capacitor is recommended)
11	GND	-	Ground, connect to power supply reference ground
12	GND	-	Ground, connect to power supply reference ground
13	IRQ	Input/Output	Configurable general-purpose IO ports
14	GPIO3	Input/Output	General-purpose IO ports
15	NRST	Input	Chip reset trigger input pin, active-low
16	MISO	Output	SPI data output pins
17	MOSI	Input	SPI data input pin

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18	SCK	Input	SPI clock input pin
19	NSS	Input	Module chip select pin to start an SPI communication
20	GND	-	Ground, connected to power reference ground
21	ANT	-	Antenna connector, stamp hole (50Ω characteristic impedance).
22	GND	-	Ground, connect to power reference ground

4 Basic operations

4.1 Hardware design

- Recommend the use of DC regulated power supply to the module for power supply, power supply ripple factor as small as possible, the module needs to be reliably grounded;
- Please note that the power supply positive and negative poles of the correct connection, such as reverse may lead to permanent damage to the module;
- Please check the power supply to ensure that the power supply voltage in the recommended supply voltage, such as more than the maximum value will cause permanent damage to the module;
- Please check the stability of the power supply, the voltage should not be large and frequent fluctuations;
- in the design of power supply circuit for module In the design of power supply circuit for the module, it is often recommended to retain more than 30% of the margin, the whole machine is conducive to long-term stable work;
- module should be as far away as possible from the power supply, transformers, high-frequency alignment and other electromagnetic interference parts;
- high-frequency digital alignments, high-frequency analog alignments, power supply alignments must be avoided below the module, if it is really necessary to pass through the module below the assumption that the module is welded in the Top Layer, the module in contact with some of the Top Layer paved copper (all of them are). Top Layer copper (all copper and good grounding), must be close to the digital part of the module and alignment in the Bottom Layer;
- assuming that the module is welded or placed in the Top Layer, in the Bottom Layer or other layers of the arbitrary alignment is also wrong, will affect the module's stray to varying degrees, as well as the sensitivity of the reception;
- assuming that the module is surrounded by the existence of a larger Electromagnetic interference devices around the module will also greatly affect the performance of the module, according to the intensity of the interference is recommended to be appropriate away from the module, if the situation permits you can do appropriate isolation and shielding;
- Assuming that the module is surrounded by a large electromagnetic interference of the alignment (high-frequency digital, high-frequency analog, power supply alignment) will also greatly affect the performance of the module, according to the intensity of the interference is recommended to be appropriate away from the module, if the situation permits you can do appropriate isolation and shielding ;
- communication line if you use 5V level, must be connected in series with 1k-5.1k resistor (not recommended, there is still a risk of damage);
- try to stay away from some of the physical layer is also 2.4GHz TTL protocols, such as: USB3.0;

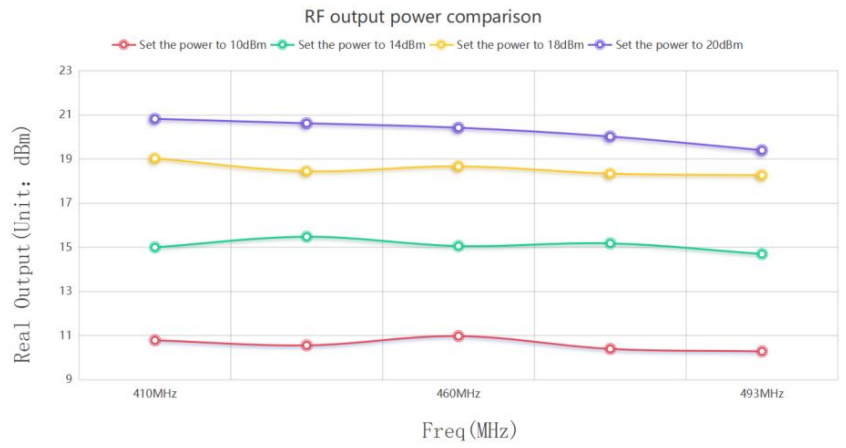
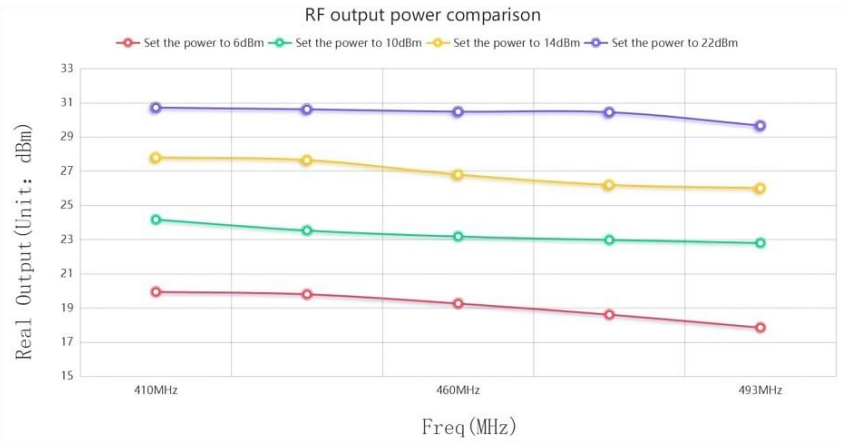
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- antenna mounting structure of the module has a greater impact on the performance of the antenna to ensure that the antenna is exposed, preferably vertically upward. When the module is installed inside the chassis, you can use a high-quality antenna extension cable to extend the antenna to the outside of the chassis;
- antenna must not be installed inside the metal shell, which will lead to a significant weakening of the transmission distance.
- It is recommended to add a 200R protection resistor to the RXD/TXD of the external MCU.

4.2 Software authoring

- The built-in RF chip of this module is PAN3060, and its driving method is completely equivalent to PAN3060, users can follow the PAN3060 chip manual completely.
- E290-400MM20S pin TXEN is controlled by RF chip GPIO0 and pin RXEN is controlled by RF chip GPIO10, users need to configure it by themselves.
- After CAD mode is turned on, customers need to set GPIO11 to CAD interrupt output mode.
- For more, please refer to the official SDK program provided.
- DCDC mode requires external hardware support, usually customers can use LDO mode.
- The chip supports I2C by default, and the I2C signals SCL and SDA multiplex the SCK and MOSI signals of SPI.
- Power staging control chart:

Module Model	RF Output Power Versus Curve
E290-400MM20S&E290-400M20S	
E290-400M30S	

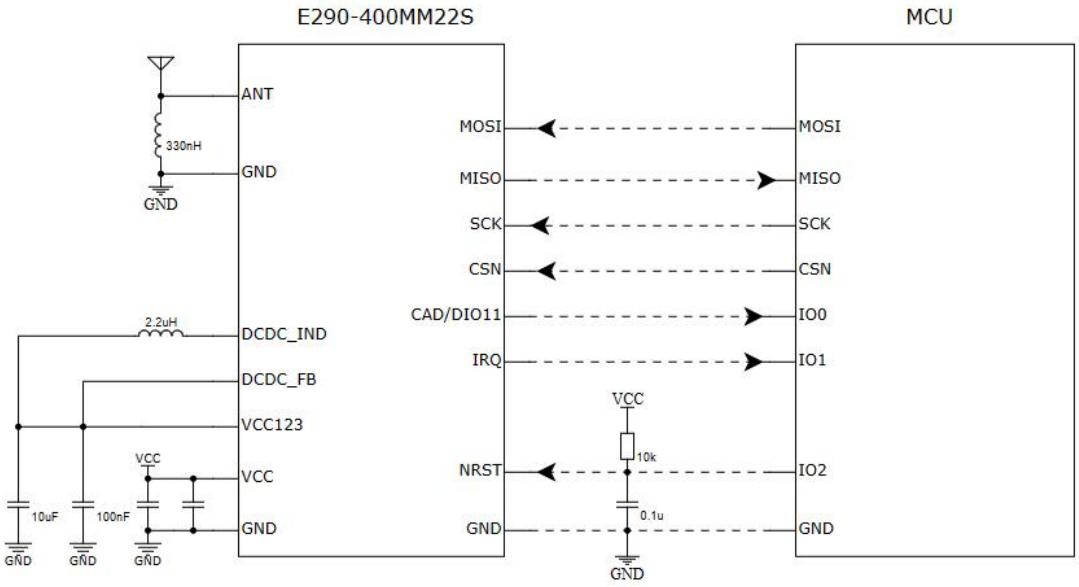
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E290-400M33S	

5 Recommended Circuits

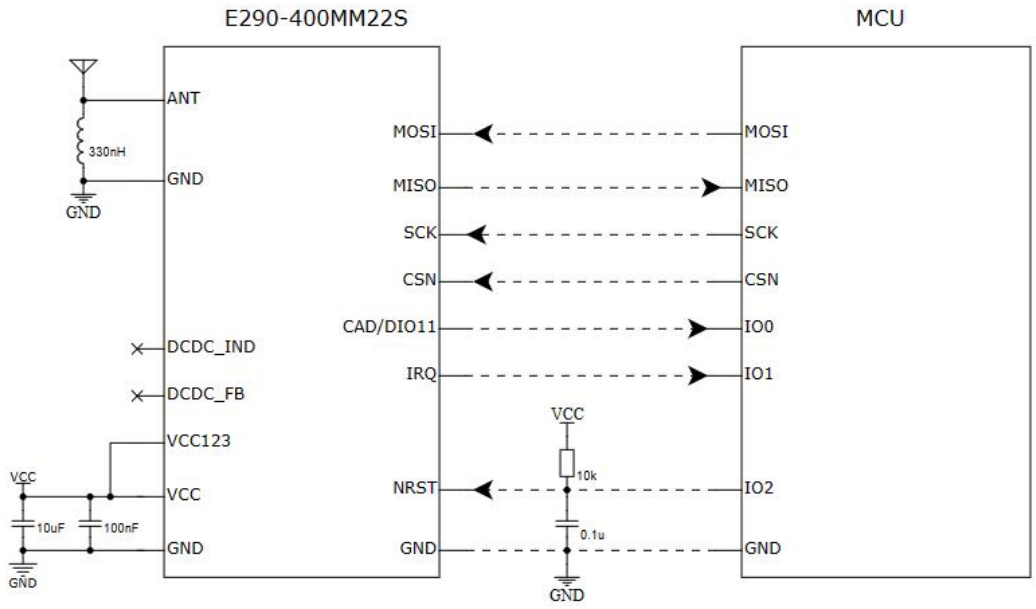
5.1 DC-DC mode



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5.2 LDO mode



6 Common problems

6.1 Unsatisfactory transmission distance

- When there is a straight line communication obstacle, the communication distance will be attenuated accordingly;
- Temperature, humidity, and co-frequency interference, which will lead to the communication packet loss rate increase;
- The ground absorbs and reflects the radio waves, and the test effect is poor near the ground;
- Seawater has a strong ability to absorb the radio waves, so the effect of the test is poor at the seaside.
- There are metal objects near the antenna, or placed in the metal shell, the signal attenuation will be very serious;
- Power register setting error, air rate setting is too high (the higher the air rate, the closer the distance);
- The low voltage of the power supply under room temperature is lower than the recommended value, the lower the voltage, the lower the hair power;
- The use of the antenna and the module is poorly matched or the antenna itself quality issues

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6.2 Modules are fragile

- Please check the power supply to ensure that it is between the recommended supply voltages, if it exceeds the maximum value it will cause permanent damage to the module.
- Please check the stability of the power supply, the voltage can not be large and frequent fluctuations.
- Please ensure that the installation and use process of anti-static operation, high-frequency devices electrostatic sensitivity.
- Please ensure that the installation and use of the process of humidity should not be too high, part of the components for the humidity-sensitive devices.
- If there is no special demand is not recommended in too high, too low temperature use.

6.3 BER is too high

- Nearby is the same frequency signal interference, away from the source of interference or modify the frequency, channel to avoid interference;
- SPI on the clock waveform is not standard, check whether there is interference on the SPI line, SPI bus alignment should not be too long;
- power supply is not ideal may cause garbled, be sure to ensure the reliability of the power supply;
- extension cable, feeder line quality is poor or too long, will also cause a high bit error rate;

7 Welding instructions

7.1 Reflow temperature

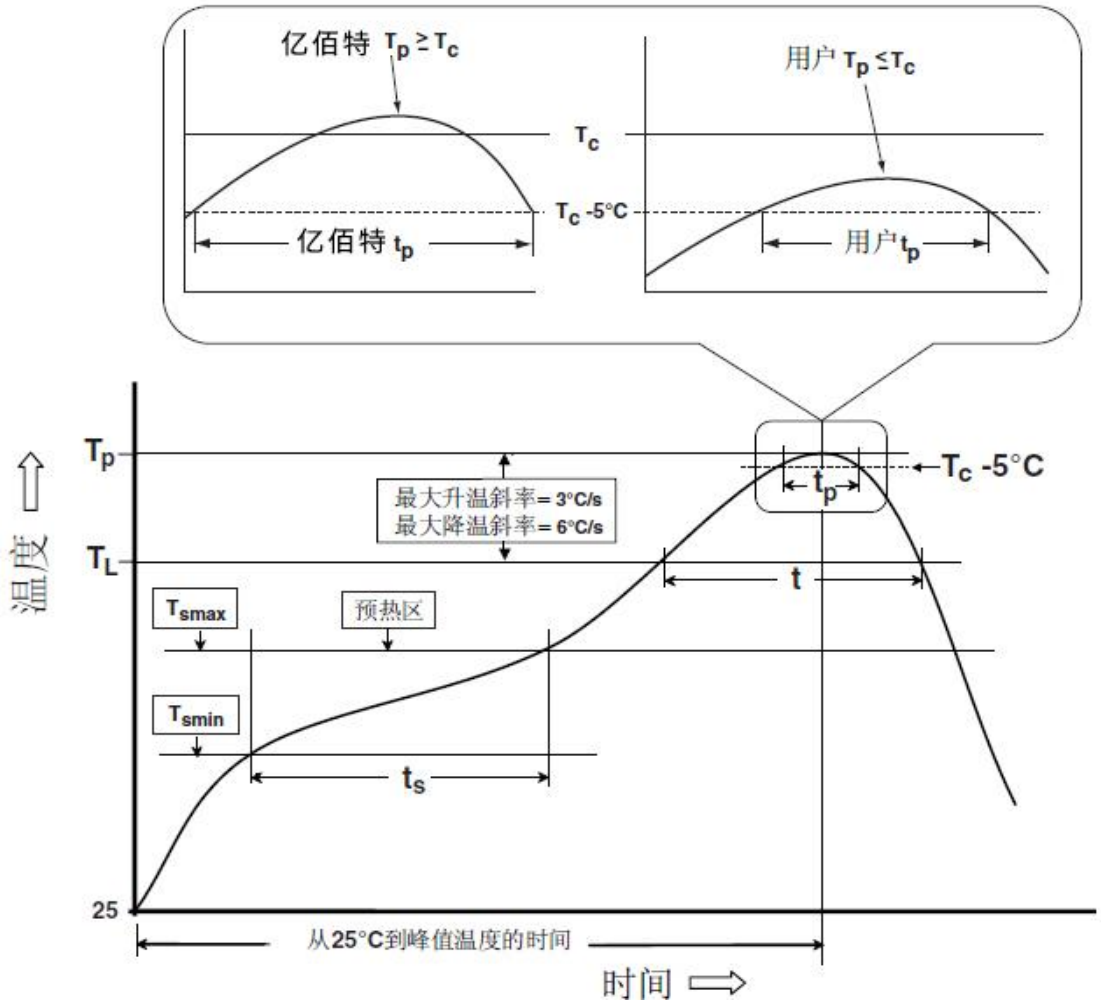
Reflow Profile Characteristics		Leaded process assembly	Lead-free process assembly
Preheating/Holding	Tsmin	100℃	150℃
	Tsmax	150℃	200℃
	Tsmin~Tsmin	60-120 S	60-120 S
Temperature Ramp-Up Slope (TL~Tp)		3°C/sec, max.	3°C/sec, max.
Liquid Phase Temperature (TL)		183°C	217°C
Holding Time Above TL		60~90 sec	60~90 sec
Encapsulated Body Peak Temperature Tp		The user must not exceed the temperature indicated on the product's “Moisture Sensitivity” label.	The user must not exceed the temperature indicated on the product's “Moisture Sensitivity” label.
Time (Tp) within 5°C of the specified classification temperature (Tc), see figure below		20S	30S

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Cooling slope (Tp~TL)	6°C/sec, max.	6°C/S，max
Time from room temperature to peak temperature	6 min, max.	8 minutes, max.
※The peak temperature (Tp) tolerance of the temperature profile is defined as the user's upper limit.		

7.2 Reflow Profile



8 Related Models

Model	chip	Carrier frequency Hz	firing power dBm	Test Distance km	Package form	Product Size mm	Antenna form
E290-400T20S	PAN3060	430M 470M	20	5	SMD	16*26	Stamp

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							Holes/IP EX
E290-400T30S	PAN3060	433M 470M	30	10	SMD	24*38.5	Stamp Holes/IP EX
E290-900T20S	PAN3060	868M 915M	20	5	SMD	16*26	Stamp Holes/IP EX
EWM290-400R20D	PAN3060	433M 470M	20	5	DIP	38*23	SMA-K
EWM290-400R30D	PAN3060	433M 470M	30	10	DIP	26*48mm	SMA-K

9 Antenna Guide

9.1 Antenna Recommendations

Antenna is an important role in the communication process, often poor-quality antenna will have a great impact on the communication system, so we recommend some of the antennas as a supporting our wireless module and the performance is more excellent and reasonably priced antenna.

Model	type	frequency band Hz	interface	Gain dBi	Height mm	Feeder cm	Features
TX433-JZ-5	Gumstick Antennas	433M	SMA-J	2.0	52	-	Ultra Short Straight, Omni-Directional Antenna
TX433-JZG-6	Gumstick Antennas	433M	SMA-J	2.5	62	-	Ultra Short Straight, Omni-Directional Antenna
TX433-JW-5	Gumstick Antennas	433M	SMA-J	2.0	50	-	Bendable Rubber Stick, Omni-Directional Antenna
TX433-JWG-7	Gumstick Antennas	433M	SMA-J	2.5	75	-	Bendable Rubber Stick, Omni-Directional Antenna
TX433-JK-11	Gumstick Antennas	433M	SMA-J	2.5	110	-	Bendable Rubber Stick, Omni-Directional Antenna
TX433-XPL-100	Suction Cup Antennas	433M	SMA-J	3.5	185	100	Small Sucker Antenna, Cost Effective
TX433-XP-200	Suction Cup Antennas	433M	SMA-J	4.0	190	200	Neutral Sucker Antenna, Low Loss
TX433-XPH-300	Suction Cup Antennas	433M	SMA-J	6.0	965	300	Large Sucker Antenna, High Gain
TX490-JZ-5	Gumstick Antennas	470/490M	SMA-J	2.0	50	-	Ultra Short Straight, Omni-Directional Antenna
TX490-XPL-1	Suction Cup	470/490	SMA-J	3.5	120	100	Small Sucker Antenna,

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00	Antennas	M					Cost Effective

Revision history

Version	revision date	Revision Notes	maintainer
V1.0	2024-3-29	Initial version	Hao
V1.1	2024-12-26	Add E290-400M30S and E290-400M33S models	Hao
V1.2	2025-7-9	Add E290-400M20S (3060) version	Hao

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