EWM47-M Series Products User Manual

BC3603 433/470MHz Ultra-Small Size Chip Module



Chengdu Ebyte Electronic Technology Co.,Ltd.

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1 Overview

1.1 Introduction

The EWM47-M series products are low-cost, high-performance wireless transmission modules independently developed by Chengdu Ebyte Electronic Technology Co., Ltd. using the new generation of domestically produced RF chip BC3603.

This series of modules features an ultra-small package design, a built-in industrial-grade high-precision crystal oscillator, and is compatible with the 433MHz and 470MHz frequency bands, further improving overall anti-interference performance and communication distance. Supporting multiple modulation methods, this series of modules meets user needs in smart homes, wireless meter reading, scientific research and medical treatment, as well as medium and long-range wireless communication equipment .

The two modules in the figure below have different packages and are pure RF transceiver modules . They require an MCU driver or a dedicated SPI debugging tool.

EWM47-400MM20S	EWM47-400M20S
	

1.2 Features

- Under ideal conditions, the maximum communication distance can reach 3 km;
- The maximum transmit power can reach +20 dBm and supports multi-level software adjustment;
- The operating frequency band supports 433/470MHz band;
- Supports multiple modulation modes, and supports data transmission rates of 2Kbps to 250Kbps in GFSK mode ;
- Supports 1.8V ~3.6V power supply , recommended power supply voltage ≥ 3.3V;
- Support 4-wire SPI/3-wire SPI configuration interface ;
- Ultra-small package: 10*10mm (EWM47-400MM20S), 20*14mm (EWM47-400M20S)
- The stamp hole interface facilitates secondary development and integration for users.

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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-grade remote control;
- healthcare products;
- Advanced Metering Infrastructure (AMI);
- Automotive industry applications.

2 Specifications

2.1 RF Parameters

RF parameters	Unit	Model		Remark
		EWM47-400MM20S	EWM47-400M20S	
Transmit power	dBm	20dBm		Support software multi-level adjustable
Reference distance	m	3000m		Clear and open environment , antenna gain 5dBi, antenna in a height of 2.5 meters, air data rate 2.4 kbps
Operating frequency band	MHz	415～510 MHz		Factory default 433MHz , supports ISM band
Air speed	bps	2Kbps to 250Kbps		User programmable control

2.2 Electrical parameters

Electrical parameters		Unit	Model		Remark
			EWM47-400MM20S	EWM47-400M20S	
Operating voltage		V	1.8～3.6	1.8～3.6	
Power consumption	Transmission current	mA	98	98	Tested under 3.3V power supply conditions
	Receive current	mA	8.2	8.2	
Temperature	Operating temperature	℃	-40～+85	-40～+85	Industrial grade
	Storage temperature		-40～+125	-40～+125	

Note: When the operating voltage of EWM47-400MM20S and EWM47-400M20S is ≥3V, they can meet the output

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power requirements. If the operating voltage exceeds 3.6V, there is a risk of burning.

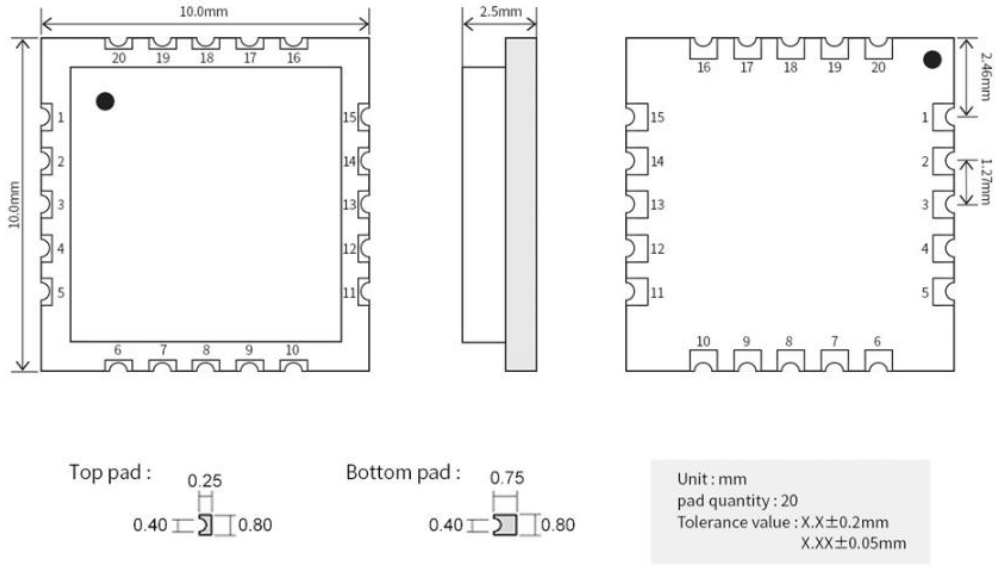
2.3 Hardware Parameters

Hardware Parameters	Model		Remark
	EWM47-400MM20S	EWM47-400M20S	
Chip	BC3603	BC3603	
Modulation method	GFSK/OOK	GFSK/OOK	-
Interface	stamp holes	stamp holes	Pitch 1.27mm
Communication interface	SPI	SPI	
Product Net Weight	0.5g	1.5 g	Tolerance ±0.02g
Packaging	SMD	SMD	
Antenna interface	stamp holes	IPEX-1 /stamp hole	Characteristic impedance about 50 ohms
Size	10*10*mm	20*14mm	±0.2mm

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3 Mechanical dimensions and pin definitions

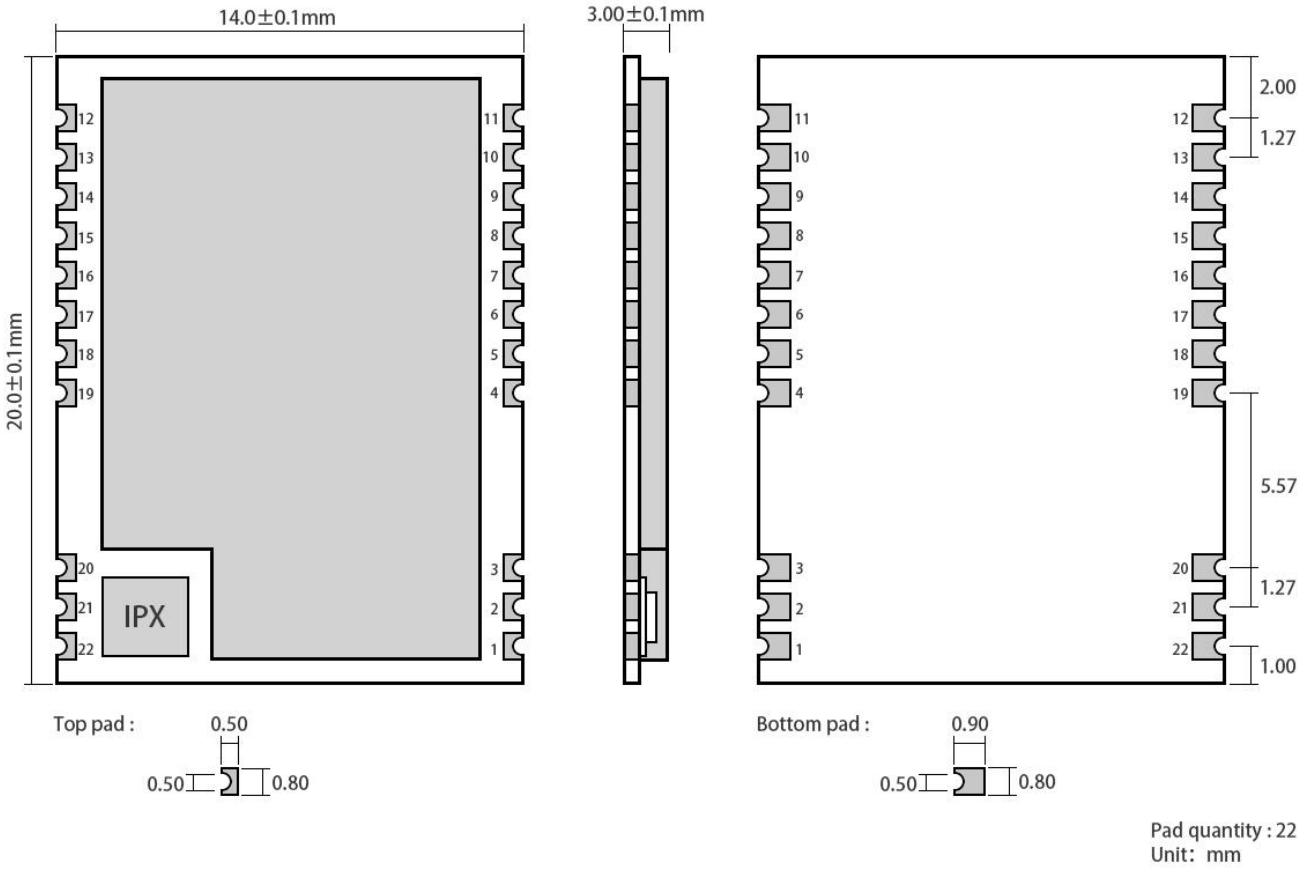
3.1 EWM47-400MM20S mechanical dimensions and pin definition diagram



Pin number	Pin Name	Pin direction	Pin Purpose
1	VCC	——	Power supply, range 1.8V~3.6V
2	GND	——	Grounding
3	NC	——	——
4	NC	——	——
5	NC	——	——
6	ANT	Input/Output	Antenna interface, stamp hole (50 ohm characteristic impedance)
7	GND	——	Grounding
8	NC	——	——
9	NC	——	——
10	NC	——	——
11	NC	——	——
12	MISO/GIO1	Input/Output	SPI data output (4-wire multiplexing)
13	MOSI	Input	SPI data input
14	CSN	Input	SPI chip select input
15	SCK	Input	SPI clock input
16	GND	——	Grounding
17	NC	--	--
18	GIO2	Input/Output	See the official user manual of the chip for details. It can be used as a sending and receiving interrupt signal.
19	NC	--	--
20	GIO3	Input/Output	See the official user manual of the chip for details.

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3.2 EWM47-400M20S mechanical dimensions and pin definition diagram



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	——	No connection required
7	NC	——	No connection required
8	NC	——	No connection required
9	VCC	——	Power supply, range 1.8V~3.6V
10	NC	——	No connection required
11	GND	——	Ground wire, connected to the power reference ground
12	GND	——	Ground wire, connected to the power reference ground
13	NC	——	No connection required
14	GIO3	Input/Output	See the official user manual of the chip for details.
15	GIO2	Input/Output	See the official user manual of the chip for details. It can be used as a

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			sending and receiving interrupt signal.
16	MISO/GIO 1	Input/Output	SPI data output (4-wire multiplexing)
17	MOSI	Input	SPI data input
18	SCK	Input	SPI clock input
19	CSN	Input	SPI chip select input
20	GND	——	Ground wire, connected to the power reference ground
21	ANT	Input/Output	Antenna interface, stamp hole (50 ohm characteristic impedance)
22	GND	——	Ground wire, connected to the power reference ground

4 Basic Operations

4.1 Hardware Design

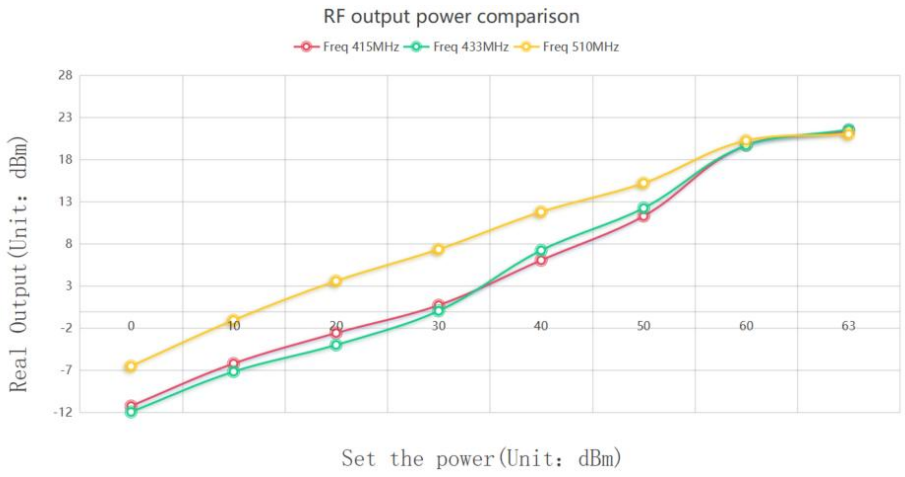
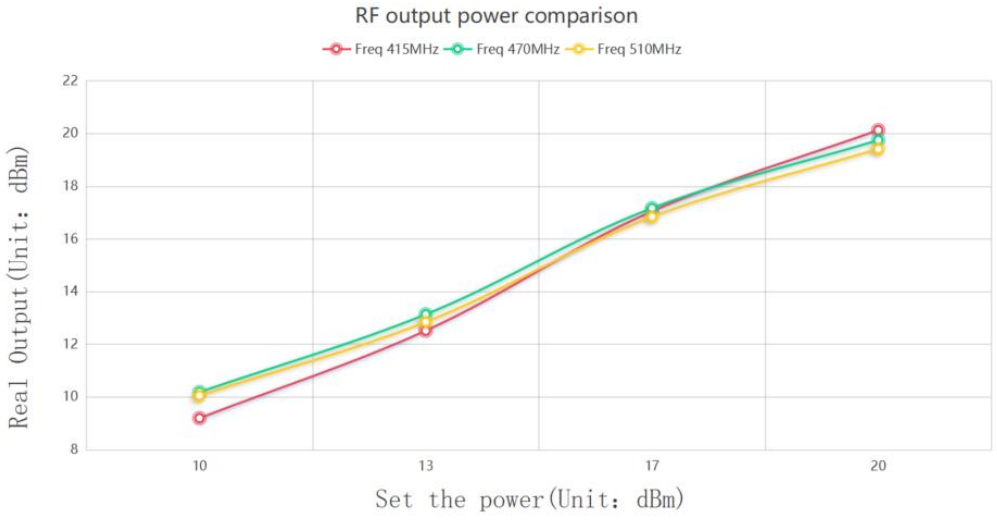
- It is recommended to use a DC regulated power supply to power the module. The power ripple coefficient should be as small as possible and the module must be reliably grounded.
- Please pay attention to the correct connection of the positive and negative poles of the power supply. Reverse connection may cause permanent damage to the module.
- Please check the power supply to ensure that it is within the recommended power supply voltage. Exceeding the maximum value may cause permanent damage to the module.
- Please check the power supply stability, 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 entire machine;
- The module should be kept as far away as possible from power supplies, transformers, high-frequency wiring and other parts with large electromagnetic interference;
- High-frequency digital traces, high-frequency analog traces, and power traces must avoid the bottom of the module. If they must pass under the module, assuming the module is soldered to the top layer, lay ground copper on the top layer of the module contact part (all copper is laid and well grounded). They must be close to the digital part of the module and routed on the bottom layer.
- If the module is soldered or placed on the top layer, it is also wrong to randomly route the wires on the bottom layer or other layers, which will affect the module's spurious emission and receiving sensitivity to varying degrees.
- If there are devices with large electromagnetic interference around the module, it will 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 strong electromagnetic interference around the module (high-frequency digital, high-frequency analog, power supply traces), it will greatly affect the module's performance. 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.
- The antenna installation structure has a significant impact on the module's performance. Make sure the antenna is exposed, preferably pointing 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 significantly reduce the transmission distance.

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- It is recommended to add a 200R protection resistor to the RXD/TXD of the external MCU.

4.2 Software Writing

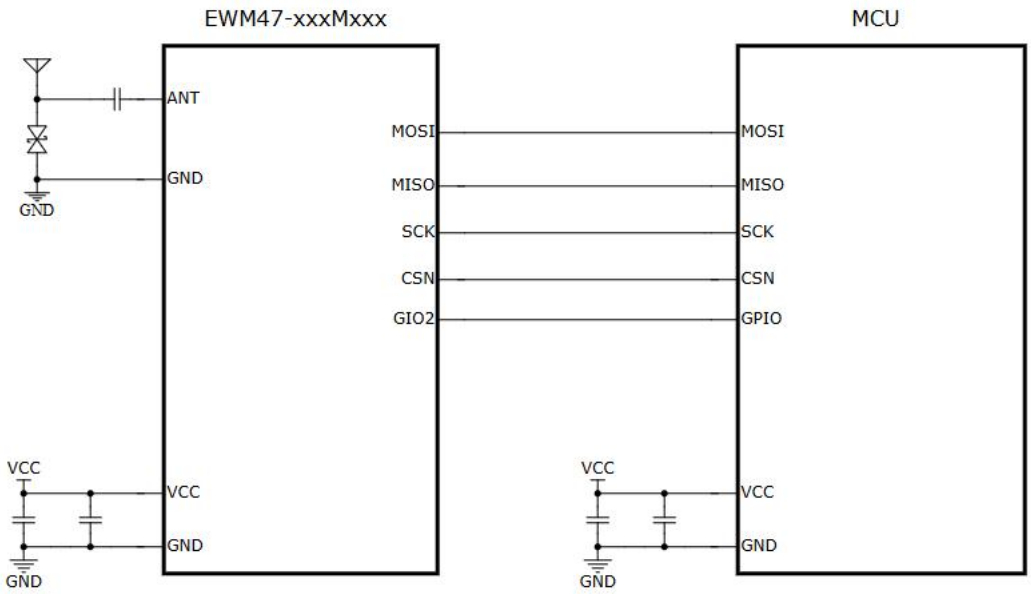
- The built-in RF chip of this module is BC3603 , and its driving mode is exactly the same as BC3603 , users can completely follow BC3603 chip manual for operation .
- For more information, please refer to the sample programs provided by our company .
- Power classification comparison chart:

Module model	RF output power comparison curve
EWM47-400M20S	
EWM47-400MM20S	

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5 Recommended Circuits

5.1 Recommended circuit wireframe diagram



Note: It is recommended to add ESD protection design at the antenna connection. EWM47-400MM20S requires adding DC blocking capacitors at the antenna position.

6 Frequently Asked Questions

6.1 Transmission distance is not ideal

- When there is a straight-line communication obstacle, the communication distance will be reduced 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 if it 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 is lower than the recommended value at room temperature. The lower the voltage, the lower the power output.
- The antenna used does not match the module well or the antenna itself may have quality issues.

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6.2 Module is easily damaged

- Please check the power supply and ensure that it is within the recommended supply voltage. Exceeding the maximum value may cause permanent damage to the module.
- Please check the power supply stability and the voltage should not 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 temperatures.

6.3 Bit Error Rate Too High

- There is interference from the same frequency signal nearby. Move away from the interference source or change the frequency or channel to avoid interference.
- The SPI clock waveform 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 excessive length of extension cables or feeders can also cause high bit error rates;

7 Welding Operation Instructions

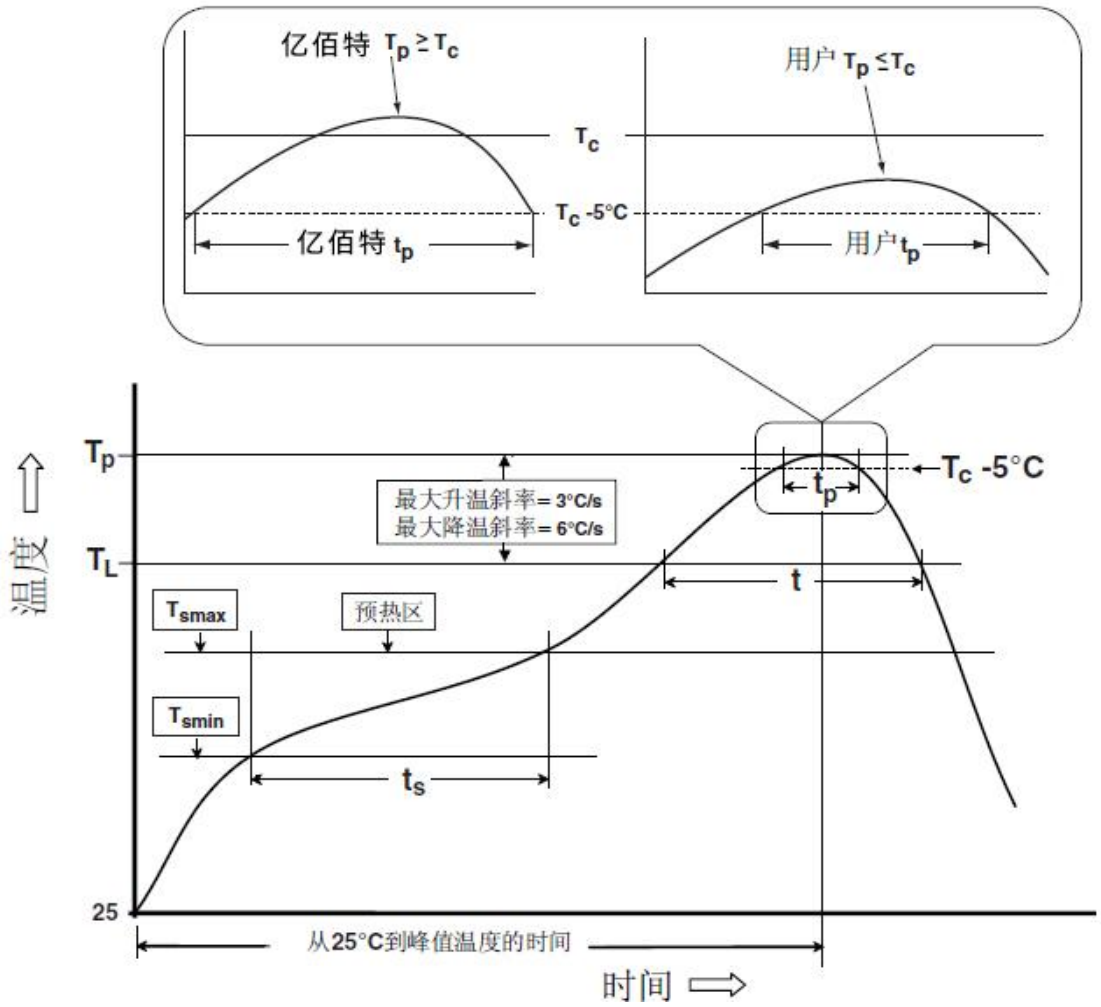
7.1 Reflow Temperature

Reflow profile characteristics		Leaded process assembly	Lead-free process assembly
Preheating/ keeping warm	Minimum temperature (Tsmin)	100℃	150℃
	Maximum temperature (Tsmax)	150℃	200℃
	Time (Tsmin ~Tsmin)	60-120 seconds	60-120 seconds
Heating slope (TL ~ Tp)		3℃/second, maximum	3℃/second, maximum
Liquidus temperature (TL)		183℃	217℃
TL above the holding time		60~ 90 seconds	60 to 90 seconds
Package peak temperature Tp		must not exceed the temperature indicated on the product's "Moisture Sensitivity" label.	must not exceed the temperature indicated on the product's "Moisture Sensitivity" label.
Time (Tp) within 5° C of the specified		20 seconds	30 seconds

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classification temperature (Tc), shown in the figure below.		
Cooling slope (Tp ~ TL)	6℃/second, maximum	6℃/second, maximum
Time from room temperature to peak temperature	6 minutes, the longest	8 minutes, the longest
※The peak temperature (Tp) tolerance of the temperature curve is defined as the upper limit of the user		

7.2 Reflow Oven Curve



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8 Related Models

Product Model	Chip Solutions	Carrier frequency Hz	Transmit power dBm	Test distance km	Package	Product size mm	Antenna type
E290-400T20S	PAN3060	430M 470M	20	5	SMD	16*26	Stamp holes/IPEX
E290-400T30S	PAN3060	433M 470M	30	10	SMD	24*38.5	Stamp holes/IPEX
E290-900T20S	PAN3060	868M 915M	20	5	SMD	16*26	Stamp holes/IPEX
EWM290-400R20D	PAN3060	433M 470M	20	5	Plug-in	38*23	SMA-K
EWM290-400R30D	PAN3060	433M 470M	30	1 0	Plug-in	26*48	SMA-K

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	Rubber antenna	433M	SMA-J	2.0	52	-	Ultra-short straight, omnidirectional antenna
TX433-JZG-6	Rubber antenna	433M	SMA-J	2.5	62	-	Ultra-short straight, omnidirectional antenna
TX433-JW-5	Rubber antenna	433M	SMA-J	2.0	50	-	Flexible, omnidirectional rubber antenna
TX433-JWG-7	Rubber antenna	433M	SMA-J	2.5	75	-	Flexible, omnidirectional rubber antenna
TX433-JK-11	Rubber antenna	433M	SMA-J	2.5	110	-	Flexible, omnidirectional rubber antenna
TX433-XPL-100	Magnetic Mount Antenna	433M	SMA-J	3.5	185	100	Small size magnetic mount antenna, cost-effective

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TX433-XP-200	Magnetic Mount Antenna	433M	SMA-J	4.0	190	200	Medium size magnetic mount antenna, low loss
TX433-XPH-300	Magnetic Mount Antenna	433M	SMA-J	6.0	965	300	Large size magnetic mount antenna, high gain
TX490-JZ-5	Rubber antenna	470/490M	SMA-J	2.0	50	-	Ultra-short straight, omnidirectional antenna
TX490-XPL-100	Magnetic Mount Antenna	470/490M	SMA-J	3.5	120	100	Small size mMagnetic mount antenna, cost-effective

Revision History

Version	Revision Date	Revision Notes	Maintainer
V1.0	2025-8-28	Initial version	Hao

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