HJSIP®

HJ-P30xx_LD_Hardware Design Manual

Based on PAN3029/PAN3060
11.5*11.6mm，SPI interface
High cost-performance LoRa module

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Preface

Thanks for using the wireless module provided by HJSIP. The HJ-P30xx_LD is a high-performance wireless LoRa module based on PAN3029/PAN3060, with working frequencies ranging from 408 to 565 MHz or 816 to 1080 MHz. The module is packaged in a postage-stamp-sized format,external antenna. The product also has the characteristics of low power consumption, small size, strong anti-interference ability, etc., suitable for a variety of application scenarios.

This module is mainly used for data communication, and the company does not assume responsibility for property losses or personal injuries caused by improper operations of users. Please develop the product according to the technical specifications and reference design in the manual. At the same time, pay attention to the general safety matters that should be concerned about when using mobile products.

Before the announcement, the company has the right to modify the content of this manual according to the needs of technological development.

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Contents

Version History

Version	Date	Change Description	Reviser	Reviewer
V1.0	2025/08/19	Initial Version	WYW	LMY
V1.1	2025/12/08	Change the module selection	WYW	LMY

Applicable module selection

No.	Module model	Type	Description
1	HJ-P3029_LD-P400	410～460MHz，passive 32MHz crystal oscillator	The RF matching is within the frequency range of 410 to 460 MHz. Passive crystal oscillator, the core chip is PAN3029.
2	HJ-P3029_LD-P500	470～535MHz，passive 32MHz crystal oscillator	The RF matching is within the frequency range of 470 to 535 MHz. Passive crystal oscillator, the core chip is PAN3029.
3	HJ-P3029_LD-P800	830～880MHz，passive 32MHz crystal oscillator	The RF matching is within the frequency range of 830 to 880 MHz. Passive crystal oscillator, the core chip is PAN3029.
4	HJ-P3029_LD-P900	900～930MHz，passive 32MHz crystal oscillator	The RF matching is within the frequency range of 900 to 930 MHz. Passive crystal oscillator, the core chip is PAN3029.
5	HJ-P3029_LD-A400	410～460MHz，active TCXO temperature-compensated oscillator 32 MHz	The RF matching is within the frequency range of 410 to 460 MHz. Active TCXO temperature-compensated oscillator, the core chip is PAN3029.
6	HJ-P3029_LD-A500	470～535MHz，active TCXO temperature-compensated oscillator 32 MHz	The RF matching is within the frequency range of 470 to 535 MHz. Active TCXO temperature-compensated oscillator, the core chip is PAN3029.
7	HJ-P3029_LD-A800	830～880MHz，active TCXO temperature-compensated oscillator 32 MHz	The RF matching is within the frequency range of 830 to 880 MHz. Active TCXO temperature-compensated oscillator, the core chip is PAN3029.
8	HJ-P3029_LD-A900	900～930MHz，active TCXO temperature-compensated oscillator 32 MHz	The RF matching is within the frequency range of 900 to 930 MHz. Active TCXO temperature-compensated oscillator, the core chip is PAN3029.
9	HJ-P3060_LD-P400	410～460MHz，passive 32MHz crystal oscillator	The RF matching is within the frequency range of 410 to 460 MHz. Passive crystal oscillator, the core chip is PAN3060.
10	HJ-P3060_LD-P500	470～535MHz，passive 32MHz crystal oscillator	The RF matching is within the frequency range of 470 to 535 MHz. Passive crystal oscillator, the core chip is PAN3060.
11	HJ-P3060_LD-P800	830～880MHz，passive 32MHz crystal oscillator	The RF matching is within the frequency range of 830 to 880 MHz. Passive crystal oscillator, the core chip is PAN3060.
12	HJ-P3060_LD-P900	900～930MHz，passive 32MHz crystal oscillator	The RF matching is within the frequency range of 900 to 930 MHz. Passive crystal oscillator, the core chip is PAN3060.

1 Introduction

The HJ-P30xx_LD is a high-performance wireless LoRa module based on PAN3029/PAN3060. Its operating frequency supports 408~565MHz or 816~1080MHz. It offers the option of using an passive crystal oscillator solution or a TCXO temperature-compensated crystal oscillator solution. The module using TCXO is more stable in low-rate, long-distance, and miniaturized design schemes. The maximum transmission power is +20dBm. The external interface is SPI. Users can achieve wireless data transmission and reception by connecting I/O with the MCU.

HJ-3029_LD：
Bandwidth：62.5kHz、125kHz、250kHz、500kHz；
SF factor：5~12；
Support low-rate mode：0.08~59.9kbps。
HJ-3060_LD：
Bandwidth：125kHz、250kHz、500kHz；
SF factor：5~9；
Support low-rate mode：0.5~59.9kbps。

2 Product overview

2.1 Key features

Table 2-1：HJ-P30xx_LD key characteristics

Characteristic	Description
Working current	- RX current:4.1 mA - TX current: - 490MHz: 91mA@20dBm，77mA@18dBm，13mA@-2dBm; - 915MHz: 100mA@20dBm,81mA@18dBm ，15mA@-2dBm;
sleep current	1uA
Power supply	2V~3.6V
Working frequency band	Support 408~565MHz or 816~1080MHz free frequency band
Modulation method	ChirpIoT™
TX power	-30dBm～20dBm
RX sensitivity	-143dBm@62.5kHz
Size	11.5mm * 11.6mm
Package	Postal stamp hole packaging, pad spacing 1.27mm
Working temperature（TCXO）	-30 ～ +85℃
Working temperature（XTAL）	-40 ～ +85℃
Storage temperature	-40 ～ +85℃

2.2 Application Scenarios

- Wireless remote control of smart home and data transmission；

- Wireless POS machine;
- Various electronic design competitions related to wireless applications;
- Industrial control;
- Toys related to iPhone or Android;
- Other wireless and low-power applications.

2.3 Functional block diagra

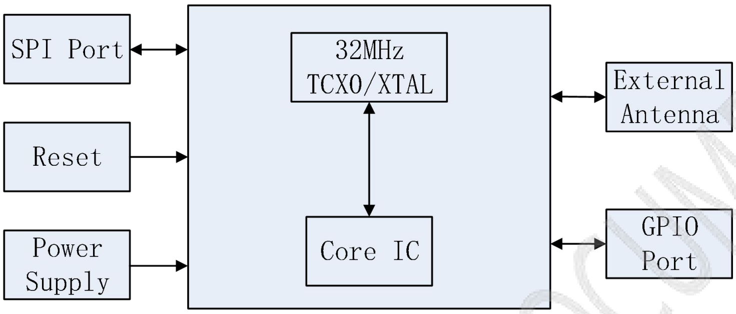

Figure 2.1：HJ-P30xx_LD functional block diagram

2.4 Pins distribution diagram

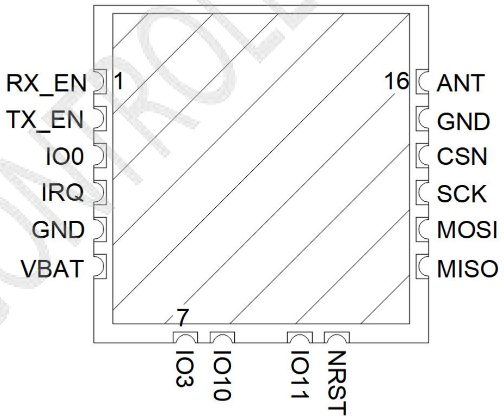

Figure 2.2：HJ-P30xx_LD pins distribution diagram(front view)

2.5 Pins description table

Table 2-2：HJ-P30xx_LD pins definition table

PIN	Name	Type	Description	note
1	RX_EN	I	Data reception control pin	When input a high voltage level, data reception is permitted; otherwise, input a low voltage level.
2	TX_EN	I	Data transmission control pin	When input a high voltage level, data can be sent; otherwise, input a low voltage level.
3	IO0	I/O	User-defined function	It is recommended to connect this pin to TX_EN for data transmission control. Alternatively, it can be controlled by an external MCU.

4	IRQ	I/O	Transmit/Receive Interrupt Flag	When the IRQ corresponding function is enabled and the corresponding function is triggered, the IRQ will output the corresponding interrupt level.
5	GND	Ground	Power GND	/
6	VBAT	Power	Power supply	2V-3.6V
7	IO3	I/O	User-defined function	The corresponding functions can be achieved through programming the internal registers of the module.
8	IO10	I/O	User-defined function	It is recommended to connect this pin to RX_EN for data reception control. Alternatively, it can also be controlled by an external MCU.
9	IO11	I/O	User-defined function	CAD monitoring can be achieved through programming the internal registers of the module.
10	NRST	I	Reset pin	When the input voltage drops to a low level for more than 1 second, the module will reset.
11	MISO	O	For the chip, it is the serial data output DOUT!	Connected to the MISO of MCU
12	MOSI	I	For the chip, it is the serial data input DIN!	Connected to the MOSI of MCU
13	SCK	I	SPI interface synchronous clock input port	/
14	CSN	I	SPI interface chip select interface	When CSN is pulled low, the module is locked and SPI data transmission can be carried out; during the low-power sleep mode, pulling CSN low will wake up the module.
15	GND	Ground	Power GND	/
16	ANT	RF out	RF output	External antenna port

3 Electrical Parameters

3.1 Absolute Maximum Ratings

Table 3-1：Absolute Maximum Ratings

Parameter	MIN	MAX	Unit
supply voltage VCC	2	3.6	V
IO Supply Voltage	0	VCC	V
Operating Temperature（TCXO）	-30	+85	℃
Operating Temperature（XTAL）	-40	+85	℃
Storage Temperature	-40	+85	℃

3.2 DC Characteristics

Table 3-2：Recommended Operating Conditions

Parameter	MIN	TYP	MAX	Unit
Supply voltage VCC	2	3.3	3.6	V
IO Supply Voltage	0	3.3	VCC	V
Dormant working current	/	＜1	/	uA
Maximum Operating Current@+20dBm	/	91	/	mA
Operating Temperature（TCXO）	-30	+25	+85	℃
Operating Temperature（XTAL）	-40	+25	+85	℃

3.3 RF features

Table 3-3：RF features

Attribute	Value	Remarks
Wireless modulation mode	ChirpIoT™	/
Frequency range	408~565MHz，816~1080MHz	/
Wireless data rate	0.08~59.9kbps	/
TX power	MAX . +20dBm	/
RX sensitivity	-143dBm@ 62.5kHz	/
antenna	external antenna	/

4 Notices for Hardware Design

- Antennas are recommended to use dedicated antennas that match the specifications of the wireless frequency band, such as spring antennas, etc.
- Module antenna should be placed at the four edges of the circuit board. The antenna part should be close to the edge or corner of the main board. It is best to place the module in the corner of the circuit board.
- Vias need to be drilled throughout the copper-clad area of the entire circuit board, especially near the modules and antennas. As many vias as possible should be drilled.
- If space permits, it is best to reserve a π -type filter circuit between the module and the antenna.
- If there are high-power devices or high-voltage conversion circuits on the circuit board, the GND copper clad of the module should be isolated from the GND copper clad of other parts, connected in a single-point grounding manner, and as many vias as possible should be drilled to reduce interference to the RF signal.
- The module should not be placed in a metal housing. If a metal housing must be used, the antenna must be led out.
- In products that require the installation of this wireless module, some metal components such as screws, inductors, etc. should be kept as far away as possible from the radio frequency antenna part of the wireless module.
- The filter capacitor at the power supply should be placed as close as possible to the power input pin of the module. If it is powered by a capacitor or space is limited, the filter capacitor at the power input can be removed. The module already has filter capacitors inside.
- For non-battery-powered and mains power supply with reduced voltage, it is recommended to filter the input power with magnetic beads or inductors.
- Please pay attention to the pin diagram for all pins. Please pay attention to the IO mode and status of the IO connected to them. When the SPI port is connected to the MCU, it is best to add a 100-ohm resistor if there is sufficient space.

- The pins that are not needed can be left in the air.

5 Machine Dimension

Interface method: Stamp hole (half hole); Hole spacing: 1.27mm

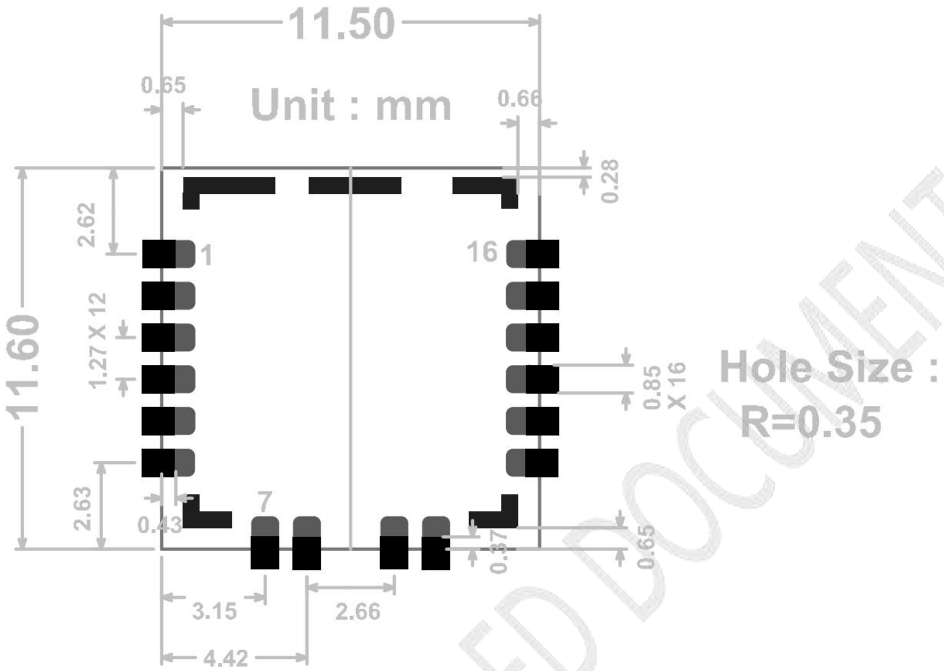

Figure 6.1：HJ-P30xx_LD mechanical dimensions

6 SMT production

6.1 Precautions for ultrasonic welding

Please carefully consider using ultrasonic welding technology. If it is necessary to use ultrasonic welding technology, please use 40KHz high frequency ultrasound welding technology. Keep the module away from the ultrasonic soldering line and the fixing column during the design method to prevent damage to the module!

For specific ultrasonic welding matters, please contact our company for technical consultation.

6.2 Soldering Recommendations

HJ-P30xx_LD module use high temperature resistant materials, manufacturing by Lead-free Process. The maximum temperature resistance is 265°C. Ten continuous reflow soldering has no effect on properties and strength. Specific parameters as shown in Table 6-1.

Table 6-1：Reflow soldering parameters

Parameter	Value
Features	Lead-free process

Average ramp up rate(TSMAX to Tp)	max3°C/sec. max
Temperature Min(Tsmin)	150°C
Temperature Max(TSmax)	200°C
Preheat time (Min to Max) (tS)	80~100sec
Peak Temperature (TP)	250±5°C
Ramp-down Rate	6°C/sec. max
Time 25°C to Peak Temp (TP)	8 min. max

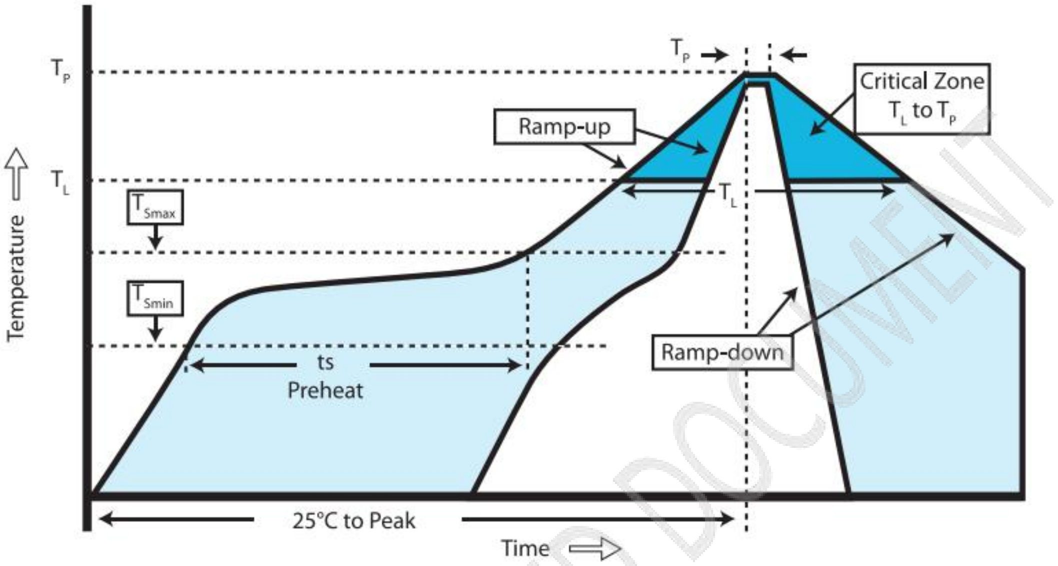

Figure 6.1： Temperature Curve of Reflow Welding

6.3 Humidity sensing properties

The HJ-P30xx_LD module has a humidity sensitivity of level 3.

If any of the following two conditions are met, the HJ-P30xx_LD module should be fully baked prior before reflow soldering, otherwise the module may cause permanent damage during reflow soldering.

- After unpacking or vacuum packaging is damaged and air leaks, the module needs to be SMT within 168 hours when the temperature is less than 30 degrees and the relative humidity is less than 60%. If the above conditions are not met, bake.
- Vacuum packaging is not opened, but beyond the shelf life, also need to be baked.

7 Packaging

7.1 Packaging method

Table 7-1： Packaging method

Type	**Packaging method**
HJ-P30XX_LD-XX	Roll tape

Use chip-grade anti-static aluminum foil bags to seal and pack with braid. Each bag is put in desiccant. Industrial grade vacuum pump ensures no air leakage, moisture, water and dust (IP65). The actual packaging effect is shown in Figure 7.1.

Figure 7.1： package figure

7.2 Label information

All packages are labeled with cargo information, ROHS label, anti-static label, etc.

【A】Tangshan Hongjia electronic Technology Co., LTD
【B】HJ-XXX-XXX
【C】Pb Free Reflow(260℃)
【D】Date Code:2508 HJ0218
【E】Note: Must be stored in a vacuum Seal
【F】Warning: Humidity sensitivity level MSL:XX
【G】QTY:1500PCS SEAL DATE:20250218

Figure 7.2： Product label drawing

Table 7-2： Module information description

No.	Description
A	company name
B	product model
C	Lead-free reflow mark and reflow temperature setting value
D	Production date Example: 2508 HJ0218 represents the product produced in the 8th week of 2025, on February 18
E	Storage precautions
F	Humidity sensitivity level
G	Quantity of product + date of sale