Rd-03H Specification

Version V 1.0.0

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Document Resume

Version	Date	Develop/revise content	Edition	Approval
V1.0.0	2025.03.12	First edition	Qiao Rongxin	Guan Ning

Content

1. Product overview

Rd-03H is a radar module developed by Shenzhen Ai-Thinker Technology Co., Ltd. , equipped with ICLEGEND Micro's S1KM0000 chip, a high-performance 24GHz one-transmit-one-receive antenna and peripheral circuits. S1KM0000 is an integrated single-chip millimeter wave sensor SoC based on FMCW radar transceiver technology. It uses FMCW frequency modulated continuous wave to detect targets in a set space. Combined with radar signal processing, it achieves high-sensitivity motion detection and micro-motion detection.

The Rd-03H module has a maximum sensing distance of 8m for moving human bodies. It can sense whether there are moving or slightly moving human bodies in the area and achieve real-time detection results. It provides a visual configuration tool that can easily configure the sensing distance range, sensing sensitivity in different intervals, and unattended delay time . It also supports automatic generation of detection thresholds, reduces manual debugging, improves detection accuracy, simplifies the installation process, and facilitates large-scale deployment.

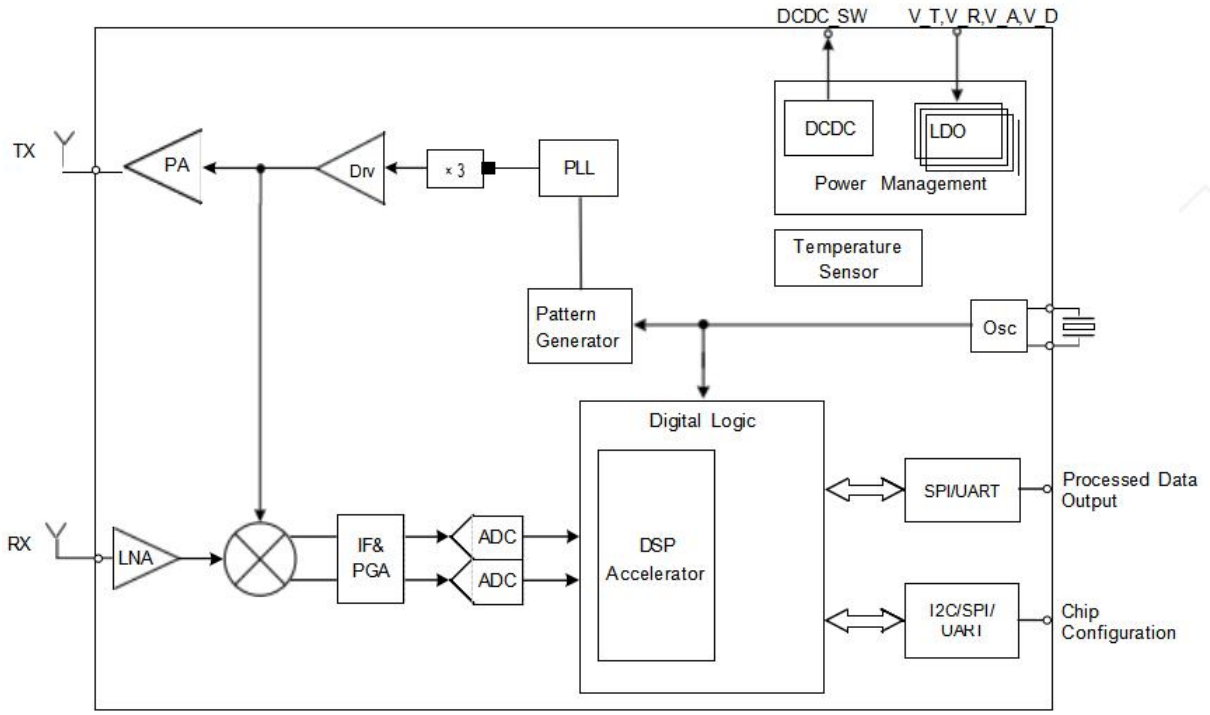


Figure 1 S1KM0000 chip architecture

1.1. Characteristic

- Use DIP package , standard 2.54mm pin header
- The radar supports 24GHz ISM band
- The radar antenna supports 1 receive and 1 transmit, with narrow antenna beam, high resolution, wide frequency band and strong anti-interference ability.
- The maximum sensing distance of the radar is up to 8 meters
- The radar has a large detection angle and a coverage range of up to ±60 degrees
- radar range, support sensing range division, and shield interference outside the range
- Ultra-small module size: 35 * 7 mm, plug and play, real-time reporting of detection results
- The radar can be intelligently adjusted through the serial port , which is convenient and fast.
- Supports multiple installation methods such as ceiling hanging and wall hanging
- Support automatic generation of detection thresholds
- Support UART
- 3.3V/5V power supply, supports 3.0~3.6V/4.5~5.5V wide voltage range; default 3.3V power supply version
- Typical application scenarios

✓ Human body sensor light control

✓ Human body induction wake-up for advertising screens and other equipment

✓ Life safety protection

✓ Smart Home Appliances

✓ Smart Security

✓ Smart lighting

✓ New energy charging/parking monitoring facilities

2. Main parameters

Table 1 Description of main parameters

Model	Rd-03H
Package	DIP-5
Size	35.0*7.0(±0.2)mm
Antenna type	Onboard antenna
Frequency range	24G ~ 24.25G Hz
Operating temperature	-40℃ ~ 85℃
Storage environment	-40℃ ~ 125℃, < 90%RH
Power supply range	Supply voltage 3.0 V ~ 3.6 V, supply current ≥ 200 mA
Supported interfaces	UART
Serial port rate	Default 115200 bps

2.1. Electrostatic Requirements

Rd-03H is an electrostatically sensitive device and requires special precautions when handling .

Figure 2 ESD anti-static diagram

2.2. Electrical Characteristics

Table 2 Electrical characteristics

Parameter		Condition	Min. value	Typical Value	Max. value	Unit
Supply voltage		VDD	3.0	3.3	3.6	V
I/O	VIL	-	0	-	0.8	V
	V I H	-	2.3	-	VDD	V
	VOL	-	0	-	0.45	V
	VOH	-	2.45	-	VDD	V

2.3. Radar sensing distance

Table 3 Radar sensing distance

Installation	Min. value	Typical Value	Max. value	Unit
Wall mounting method (±60° range)	-	8	-	meters
Ceiling hanging method (3m hanging height), circular projection radius	-	5	-	meters

Notice:

- The above sensing distance is based on the measurement of open space in Ai-Thinker and is for reference only.
- The radar sensing distance is greatly affected by the surrounding walls, ceilings, large objects, and installation methods. The specific data shall be based on the actual measurement of the installation environment.

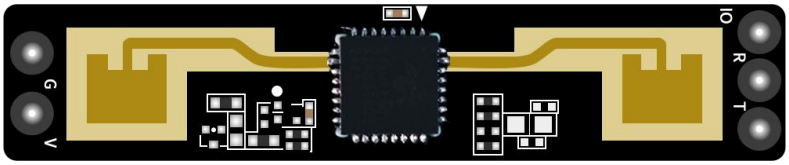
2.4. Power consumption

The following power consumption data is based on a 3.3 V power supply and an ambient temperature of 25°C .

Table 4 Power consumption

Mode	Min. value	Average value	Max. value	Unit
Working status	-	50	-	mA

3. Dimensions



Front

Back

Figure 3 Appearance (rendering is for reference only, the actual product shall prevail)

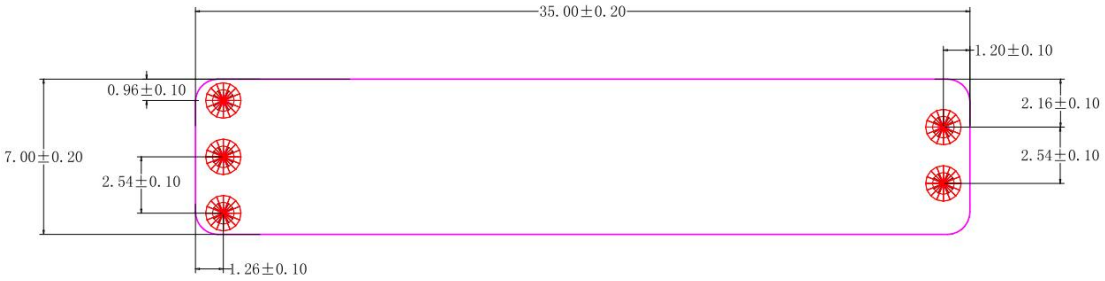


Figure 4 Dimensions (unit: mm)

4. Pin definition

The Rd-03H module has a total of 5 pins , as shown in the pin diagram. The pin function definition table is the interface definition.

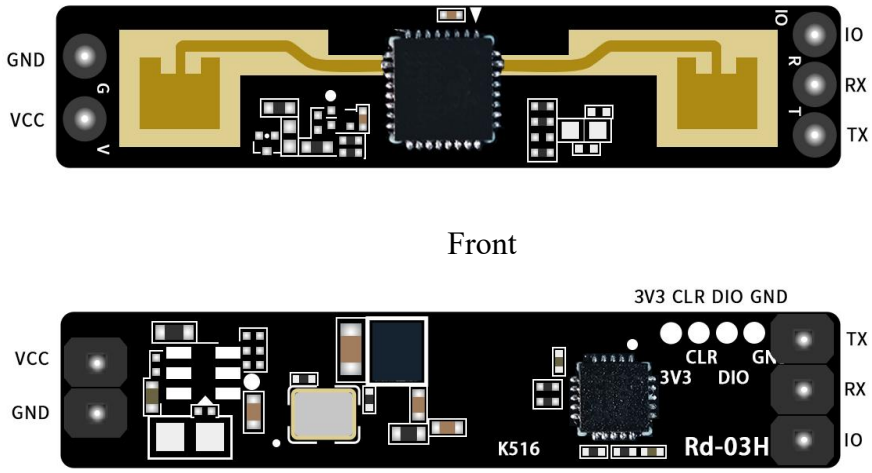


Figure 5 Pin Diagram

Table 5 Pin function definition table

Foote	Name	Functional Description
1	VCC	Input Power
2	GND	Ground
3	TX	UART_TX
4	RX	UART_RX
5	IO	Test result output

5. Schematic

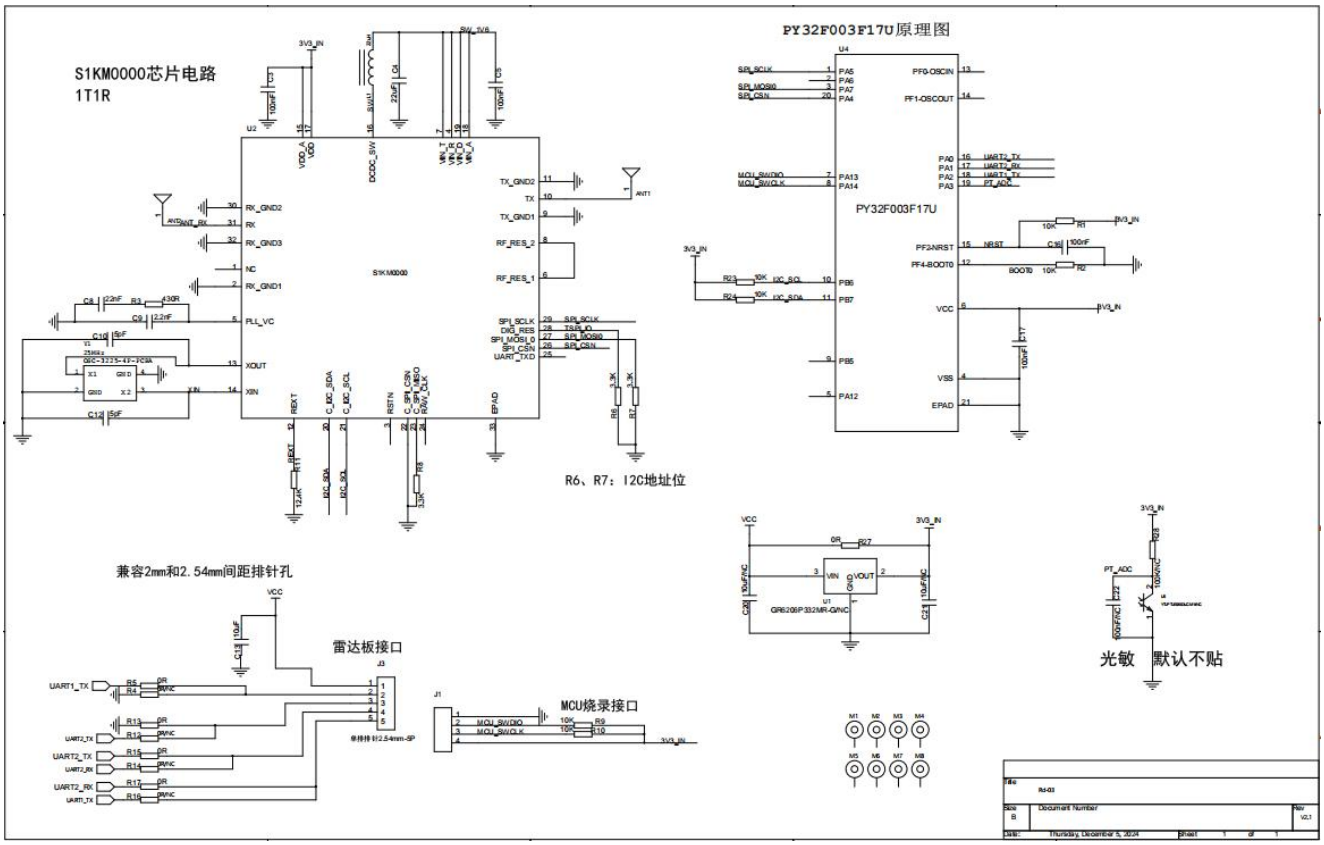


Figure 6 Schematic diagram

6. Design guidance

6.1. Application guide circuit

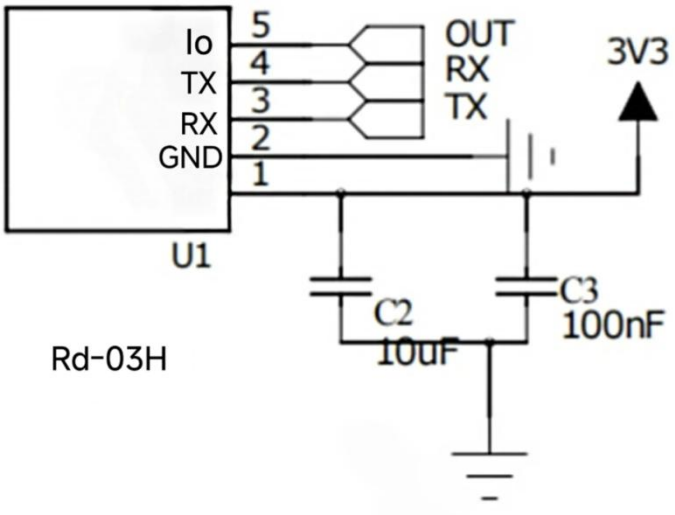


Figure 7 Application guidance circuit

6.2. Radar installation notes

- Installation methods are recommended for the mainboard installation location :

✓ Try to ensure that the radar antenna is facing the area to be detected and that there is open space around the antenna without any obstruction .

✓ It is necessary to ensure that the radar is installed firmly and stably; the shaking of the radar itself will affect the detection effect .

✓ Make sure that there is no object moving or vibrating behind the radar. Since radar waves are penetrating, the antenna signal backlobe may detect moving objects behind the radar. A metal shield or metal back plate can be used to shield the radar backlobe and reduce the impact of objects behind the radar .

✓ Due to differences in target size, status, RCS, etc., the target distance accuracy will fluctuate ; at the same time, the maximum distance will also fluctuate slightly .

✓ When there are multiple 24GHz radars, please avoid direct beam alignment and install them as far away as possible to avoid possible mutual interference.

- To ensure the performance of the onboard antenna, metal parts must not be placed around the antenna and must be kept away from high-frequency devices.
- The power input voltage range is 3.0V-3.6V, and the power ripple is required to be within 100kHz without obvious frequency peaks. Users need to consider the corresponding electromagnetic compatibility design such as ESD and lightning surge.

6.3. Installation environment requirements

This product needs to be installed in a suitable environment. If used in the following environment, the detection effect will be affected:

- There are non-human objects that are in continuous motion within the sensing area, such as animals, continuously swinging curtains, large green plants facing the air outlet , etc.
- There are large-area strong reflectors in the sensing area, and strong reflectors facing the radar antenna will cause interference .
- When wall-mounted, external interference factors such as air conditioners and electric fans on the ceiling of the room need to be considered .

6.4. Installation and sensing range

■ Ceiling installation method

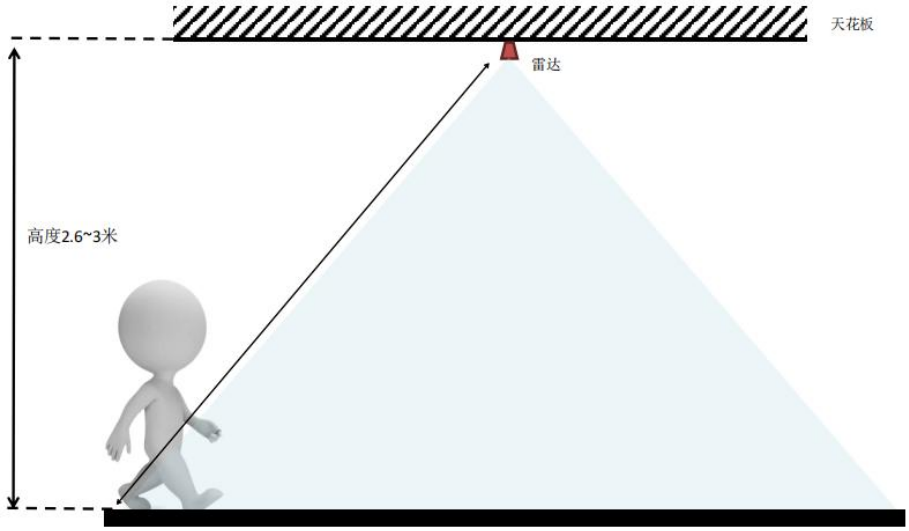


Figure 8 Schematic diagram of ceiling installation

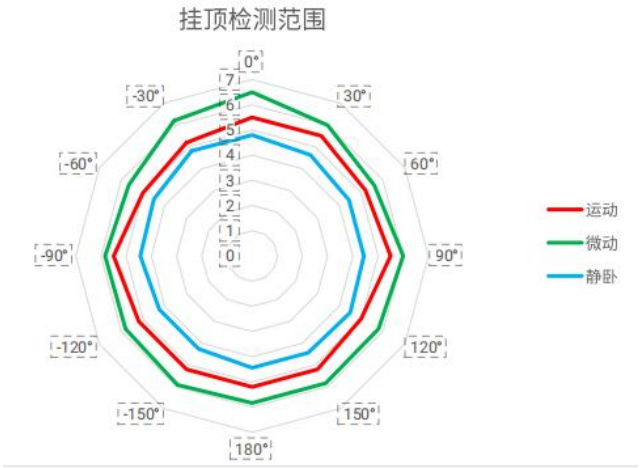


Figure 9 Ceiling radar chart

■ Wall mounting method

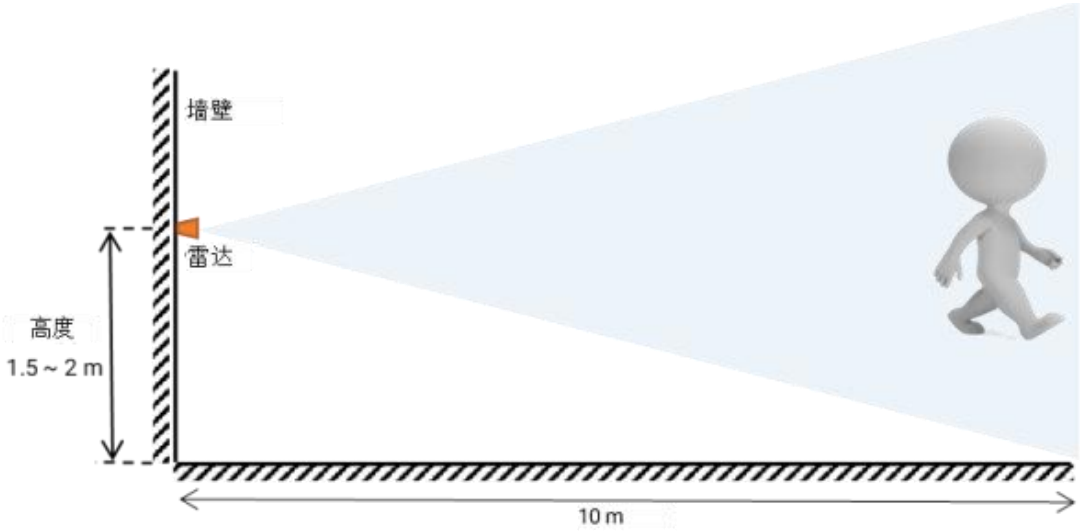


Figure 10 Schematic diagram of wall- mounted installation

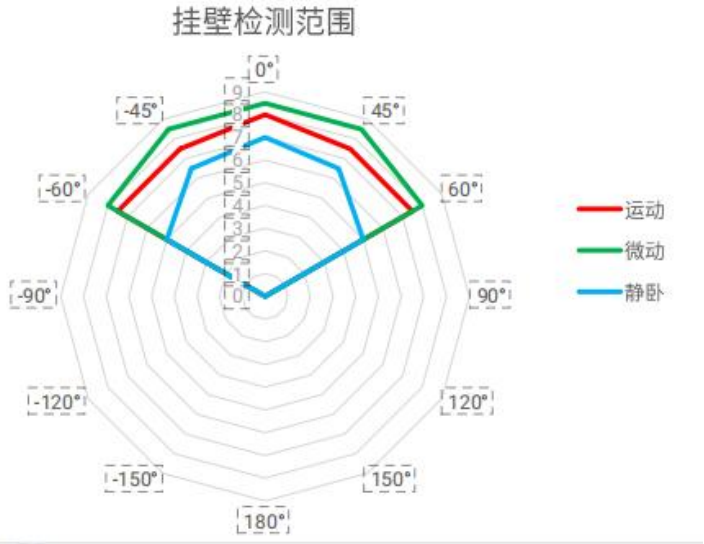


Figure 11 Wall-mounted radar chart

6.5. Power supply

- The recommended voltage is 3.3V and the peak current is above 200mA .
- It is recommended to use LDO power supply; if DC-DC is used, it is recommended to control the ripple within 30mV.
- It is recommended to reserve space for dynamic response capacitors in the DC-DC power supply circuit to optimize the output ripple when the load changes greatly.
- It is recommended to add ESD devices to the 3.3V power interface.

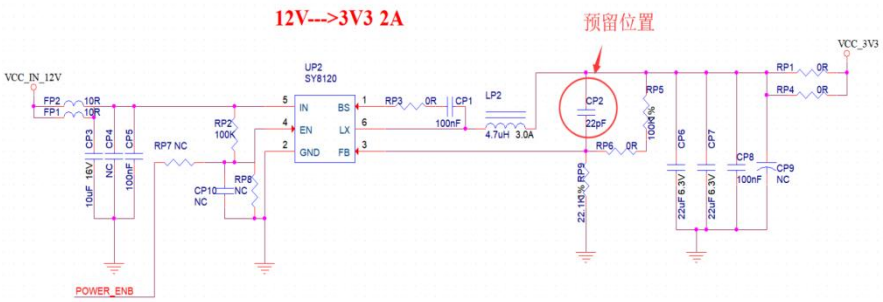


Figure 12 DC-DC buck circuit diagram

6.6. GPIO

- Some IO ports are connected to the module. If you need to use them, it is recommended to connect a 10-100 ohm resistor in series to the IO ports. This can suppress overshoot and make the levels on both sides more stable. It is helpful for EMI and ESD.
- For the pull-up and pull-down of special IO ports, please refer to the instructions in the specification, which will affect the startup configuration of the module.
- The IO port of the module is 3.3V. If the IO port levels of the main control and the module do not match, a level conversion circuit needs to be added.
- If the IO port is directly connected to a peripheral interface, or a terminal such as a pin header, it is recommended to reserve ESD devices near the terminals in the IO port routing.

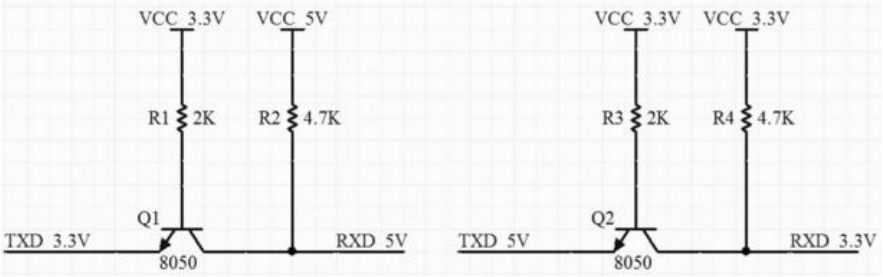


Figure 13 Level conversion circuit

7. Storage conditions

Products sealed in moisture-proof bags should be stored in a non-condensing atmosphere of <40°C/90%RH.

The module's moisture sensitivity level MSL is level 3.

After the vacuum bag is unsealed, it must be used within 168 hours at 25±5℃/60%RH, otherwise it needs to be baked before it can be put online again.

8. Reflow soldering curve

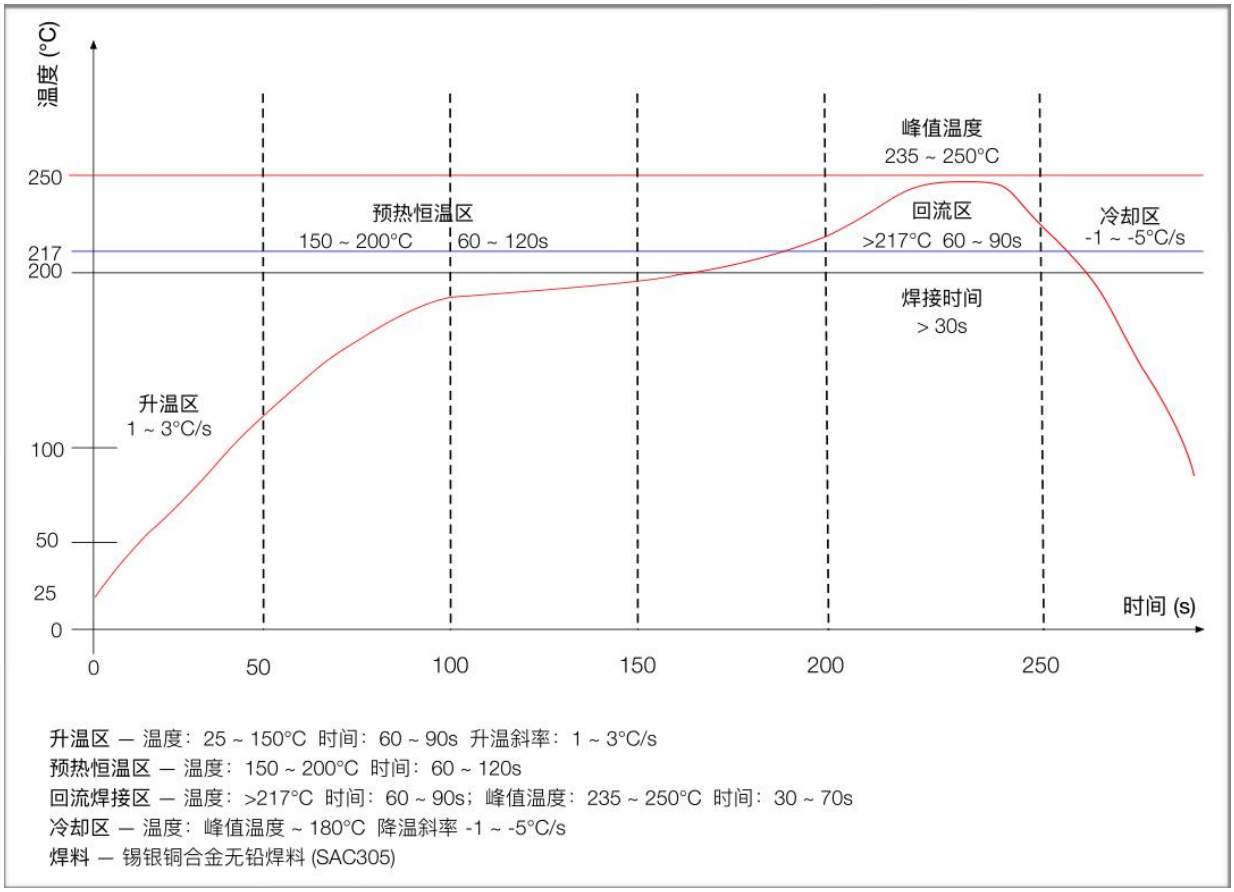


Figure 14 Reflow soldering curve

9. Product packaging information

Rd-03H module is packed in tape, 200 pcs/reel. As shown in the following figure:

Figure 15 Packaging Taping Diagram

10.Contact us

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