



Rd-03D_V2 Specification

Version V1.0.0

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1. Product overview

Rd-03D_V2 version is a radar module developed by Shenzhen Ai-Thinker Technology Co., LTD., which includes extremely simplified 24 GHz radar sensor hardware and intelligent algorithm firmware. The hardware of the module consists of AIoT millimeter-wave radar chip ICL1122, high-performance one-shot two-receiver microband antenna, MCU and peripheral auxiliary circuit. The intelligent algorithm firmware uses the proprietary advanced signal processing technology of FMCW waveform and ICL1122 chip.

Rd-03D_V2 version of the module can accurately perceive the movement state of the human body and the region. The intelligent algorithm can realize the identification and tracking of the movement track, and can detect multiple targets in the designated area and report the results in real time. To realize the speed measurement and ranging of the target in the region, with faster identification speed and lower power consumption.

Based on this design, users can quickly develop the corresponding target positioning tracking products. This scheme is mainly applied in ordinary indoor scenes, such as home, office and hotel, to realize the positioning and tracking of single or multiple human bodies. The module can be quickly configured, suitable for all kinds of public publicity facilities, intelligently distinguish the human body in the movement, micro and static form, control the equipment switch. The module has good resistance to external interference and is not affected by wireless signals such as WIFI.

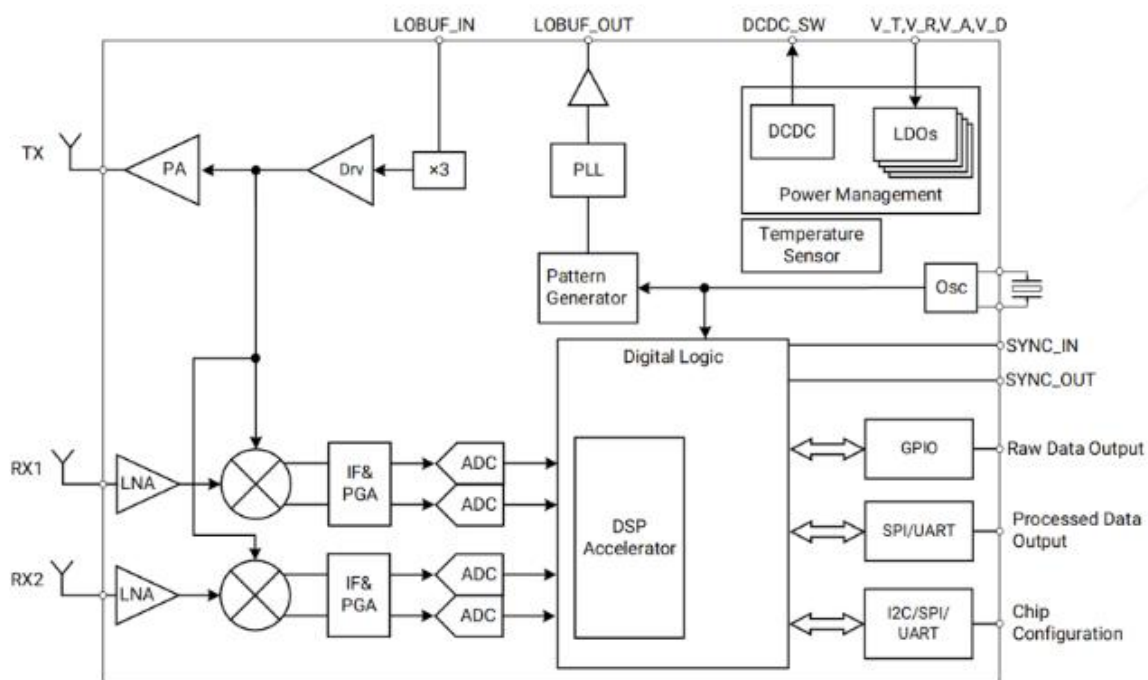


Figure 1 ICL1122 chip architecture diagram

1.1. Characteristic

- Use standard 1*4P-1.25mm socket interface
- The radar supports the 24GHz ISM frequency band
- High-performance two-receiver microband antenna
- Accurate target positioning and tracking
- The farthest induction distance is 8m
- The range azimuth ± 60 and pitch ± 30
- Support wall installation
- Provide visualization tools to support the configuration of tracking detection range, data reporting interval, and target retention time
- Ultra-small module size: 15 * 44mm
- Automatically load the default configuration, plug and play
- Support UART, you can realize the intelligent reference adjustment of radar through the serial port, convenient and fast
- 5V single power supply
- Typical application scenarios:
 - ✓ Smart home
 - ✓ Intelligent business
 - ✓ Bathroom
 - ✓ Smart lighting

2. Main parameter

Table 1 Description of the main parameters

Model	Rd-03D_V2
Package	Standard 1*4P-1.25mm socket interface
Size	15.0*44.0(±0.2)mm
Antenna type	On-board antenna
Frequency range	24G ~24.25GHz
Working temperature	-40°C ~ 85°C
Storage environment	-40°C ~ 125°C, < 90%RH
Power supply range	Power supply voltage 5V, power supply current ≥200mA
Support interface	UART
Serial port rate	Default 256000 bps

2.1. Electrostatic requirements

Rd-03D_V2 is electrostatic sensitive equipment requiring special precautions during handling.



Figure 2 ESD ESstatic diagram

2.2. Electrical character

Table 2 Electrical characteristics table

Parameter		Condition	Min.value	Typical value	Max.value	Unit
Supply voltage		VDD	-	5	-	V
I/O	VIL	VDD	-0.3	-	0.3*VDD	V
	VIH	VDD	0.7*VDD	-	VDD+0.3	V
	VOL	VDD	-	-	0.33	V
	VOH	VDD	2.7	-	-	V

2.3. Radar sensing distance

Table 3. Radar detect distance

Way to install	Min.value	Typical value	Max.value	Unit
Wall mounting	-	8	-	m

Notice:

- The above detect distance is based on the open field measurement from Ai-Thinker, for reference only
- The radar sensing distance is greatly affected by the surrounding wall, ceiling, large size objects and installation mode, etc., and the actual measurement data of the installation environment shall prevail

2.4. Power consumption

The following power consumption data are based on the 5V power supply and the ambient temperature of 25°C.

Table4 Power consumption table

Mode	Min.value	Typical value	Max.value	Unit
Working condition	-	92	-	mA

3. Appearance size

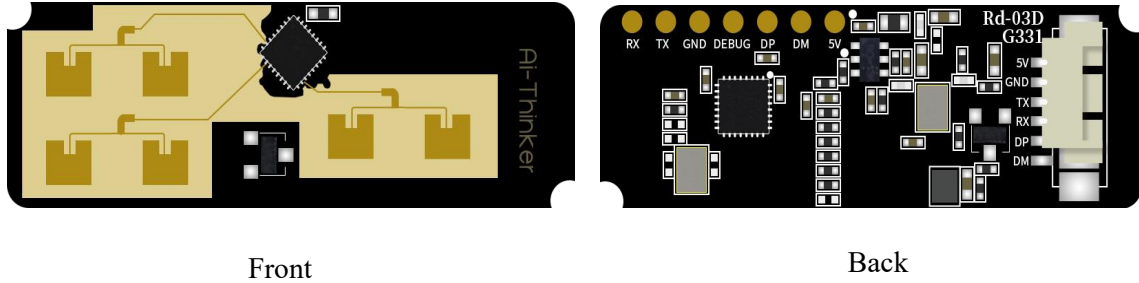


Figure 3 Appearance diagram (rendering diagram is for reference only, subject to physical objects)

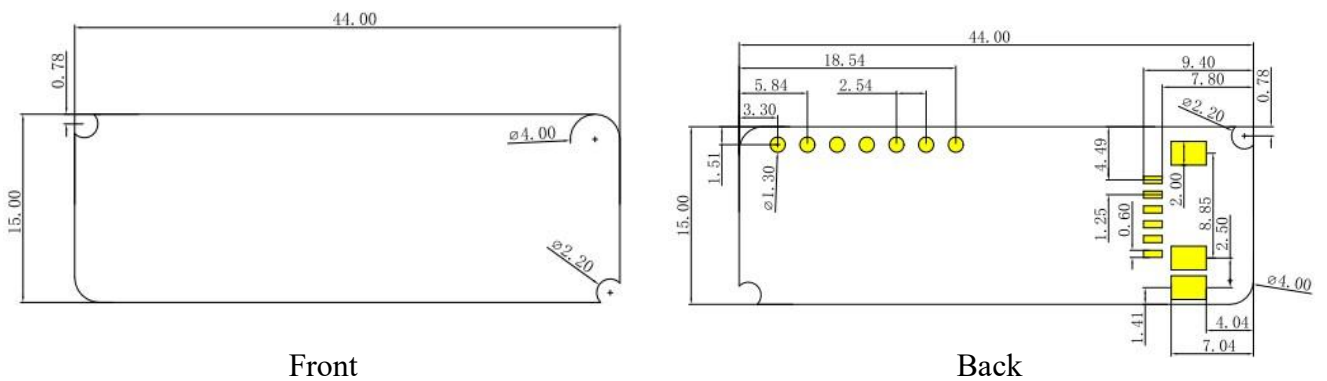


Figure 4 Size diagram

4. Pin definition

The Rd-03D_V2 module has a total of 4 pins, as shown in the pin diagram. The pin function definition table is the interface definition.

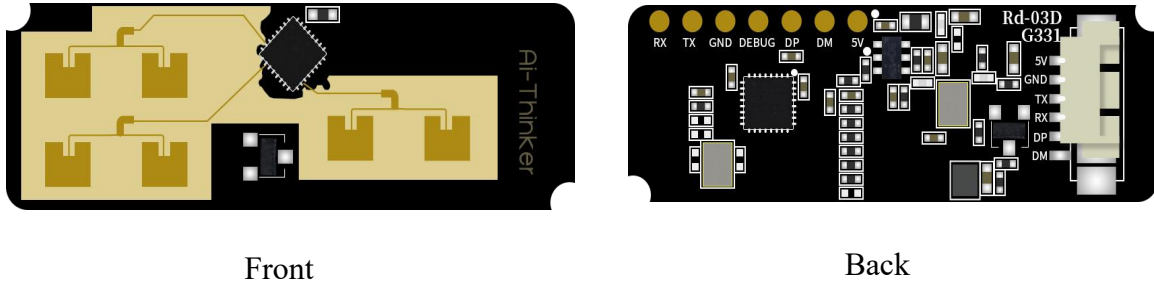


Figure 5 Schematic diagram of the tube feet

Table 5 Definition table of tube pin function

No	Pin name	Function description
1	5V	Input power
2	GND	Connect to Ground
3	TX	UART_TX
4	RX	UART_RX

5. Schematic diagram

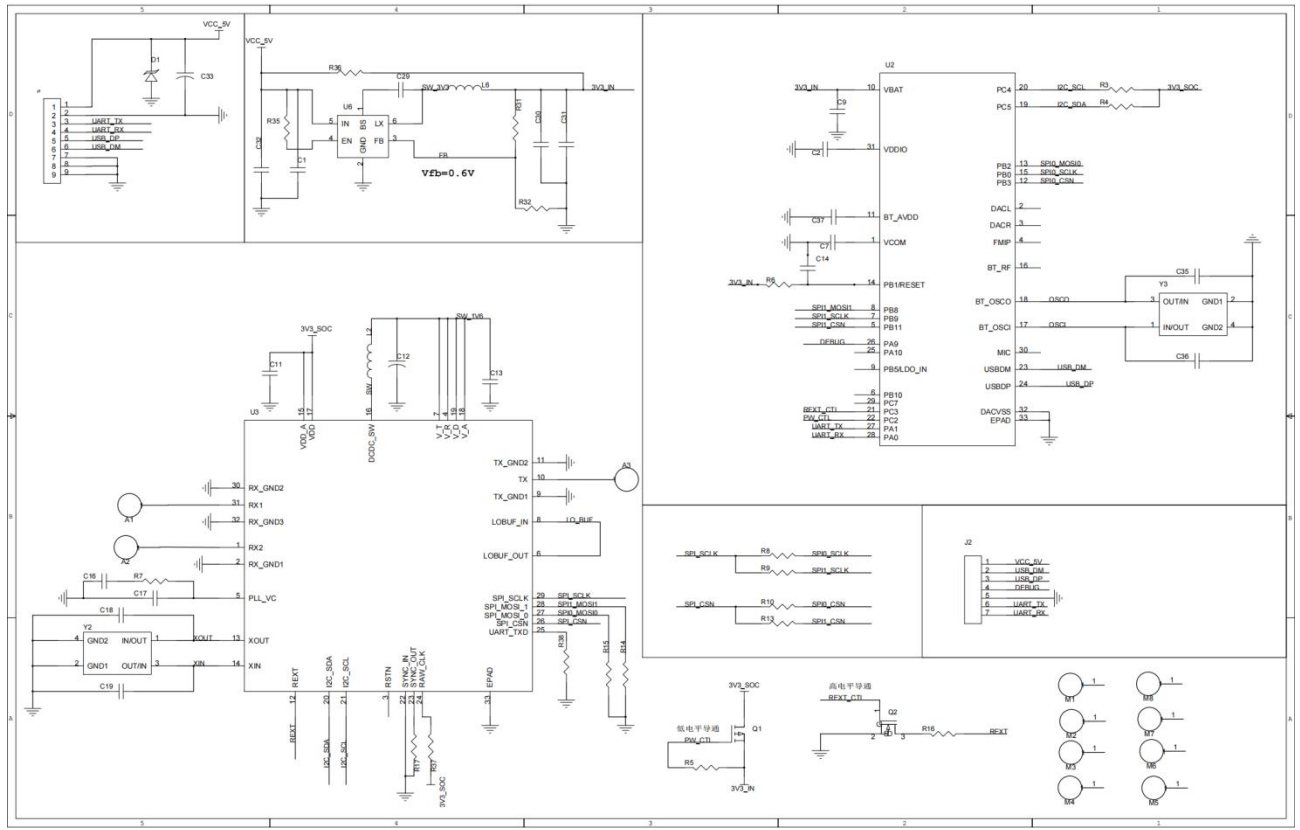


Figure 6 Schematic diagram

6. Design guidance

6.1. Application of guidance circuit

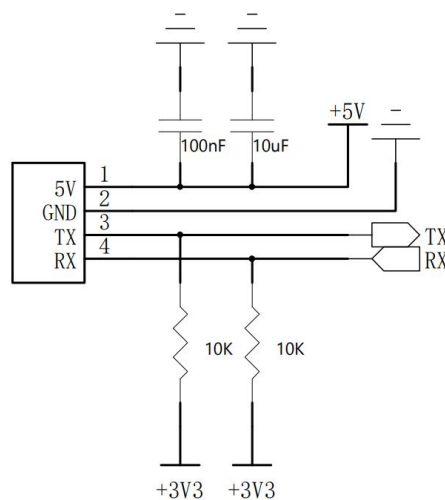


Figure 7 Application guidance circuit

7. Precautions for radar installation

- In the installation position on the motherboard, the following ways are recommended:
 - ✓ Try to ensure that the radar antenna is facing the area to be detected, and the antenna is open without shielding.
 - ✓ To ensure that the installation position of the radar is firm and stable, the shaking of the radar itself will affect the detection effect.
 - ✓ Make sure that there is no movement or vibration on the back of the radar. Due to the penetration of radar waves, the antenna signal back flap may detect moving objects on the back of the radar. Metal shield or metal backplane can be used to shield the radar back flap and weaken the impact of the radar back object.
 - ✓ Due to the difference of target shape, state, RCS, the target distance accuracy can also fluctuate slightly.
 - ✓ When there are multiple 24GHz band radars, please do not beam directly at them and try to install them far away from each other to avoid possible mutual interference.
- In order to meet the performance of on-board antenna, metal parts are prohibited around the antenna, away from high-frequency devices.
- The power input voltage range is 5V, and the power ripple supply should be controlled within 100 mV. Users should consider the corresponding EMC design such as ESD and lightning surge.

7.1. Installation environment requirements

The product needs to be installed in the suitable environment, if used in the following environment, the test effect will be affected:

- There are non-human objects with continuous movement in the induction area, such as animals, curtains that keep swinging, and large green plants facing the air outlet.
- There is a large area of strong reflector in the induction area, which will cause interference to the radar antenna.
- When installing the hanging wall, it is necessary to consider the external interference factors such as the air conditioning and electric fan on the top of the room.

7.2. Installation method and sensing range

■ Radar hanging wall mounting method

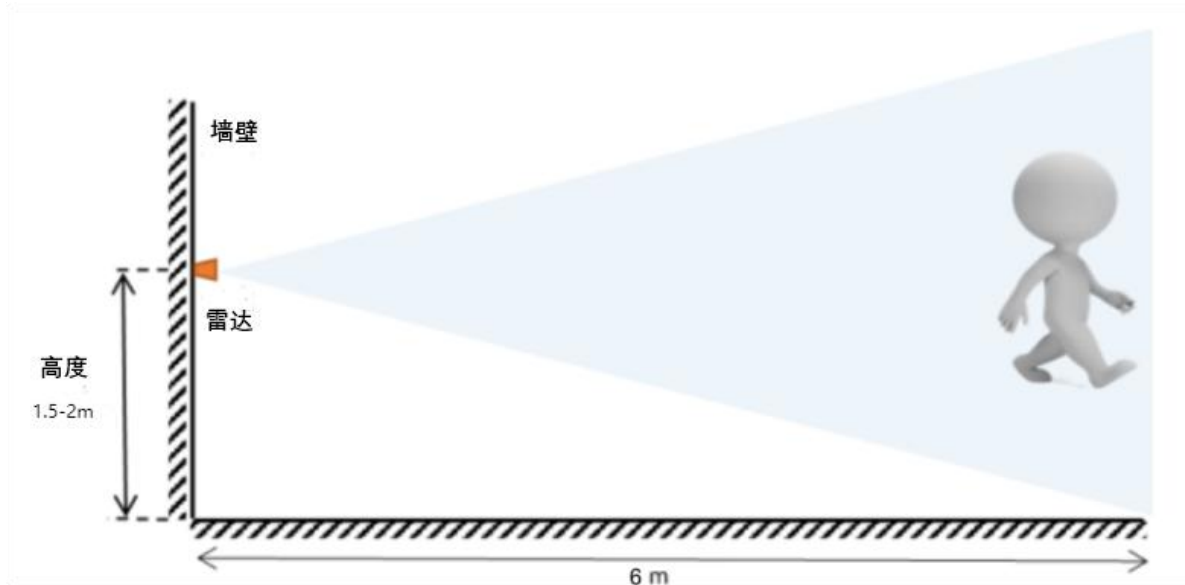


Figure 8 Schematic diagram of the hanging wall installation

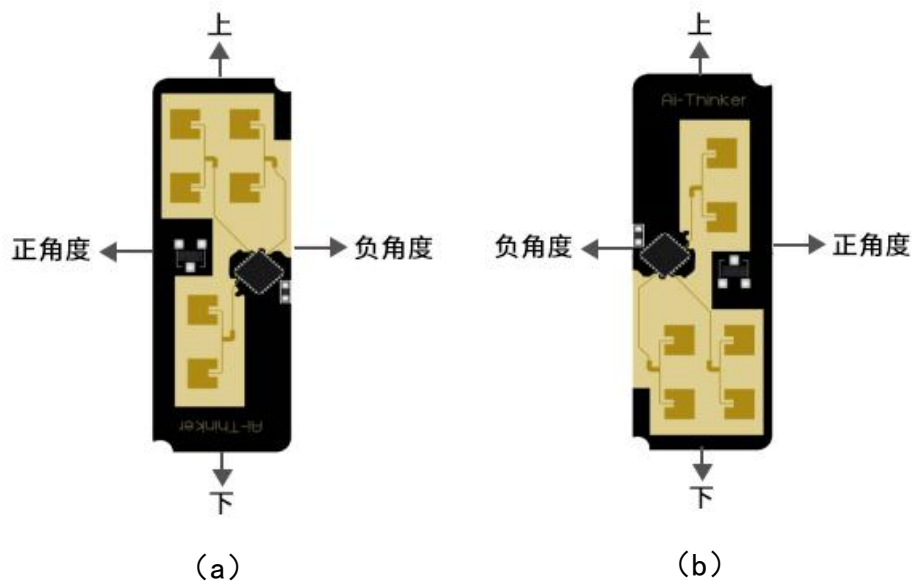


Figure 9 Schematic diagram of the hanging wall detection range

Note: The recommended radar installation orientation is FIG. 10 (a) or (b), the positive and negative direction is azimuth, the upper and lower direction is elevation, and the normal direction of radar antenna is 0°

- The azimuth Angle of the detection range is ± 60 , the pitch Angle is ± 30 , and the maximum detection distance in the normal direction is 8m



- Recommended 5V voltage, peak current above 200mA.
- It is recommended to use LDO power supply; if DC-DC is used, the ripple control should be less than 100mV.
- The DC-DC power supply circuit suggests to reserve the position of the dynamic response capacitor, which can optimize the output ripple when the load change is large.
- The 5V power interface is recommended to add ESD components.



7.4. GPIO

- Outside the module, there are some IO ports, such as using the recommended resistance of 10 to 100 ohms in series on the IO port. This suppresses overshoot and smoother both levels, helpful for both EMI and ESD.
- The pull-up and pull-down of the special IO port should refer to the usage instructions in the specification book, which will affect the startup configuration of the module.
- The IO port of the module is 3.3V. If the main control does not match the IO port level of the module, the level conversion circuit needs to be added.
- If the IO port is directly connected to the peripheral interface or terminals, it is recommended to reserve ESD devices at the IO port line near the terminal.

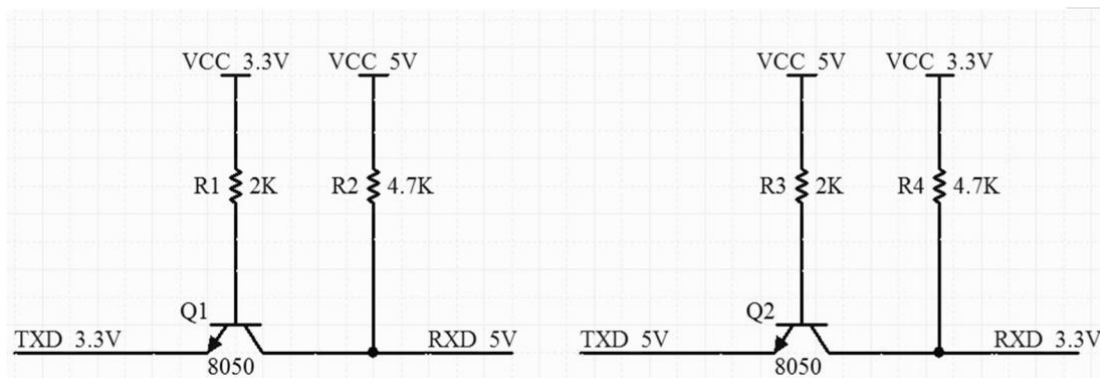


Figure 12 Level conversion circuit

8. Storage condition

Products sealed in moisture bags should be stored in a non-condensing atmosphere with $<40^{\circ}\text{C}/90\%\text{RH}$. The moisture sensitivity level MSL of the module is 3.

After unpacking the vacuum bag, it must be used up within 168 hours under $25\pm 5^{\circ}\text{C}/60\%\text{RH}$, otherwise it needs to be baked before being put online again.

9. Reflow welding curve

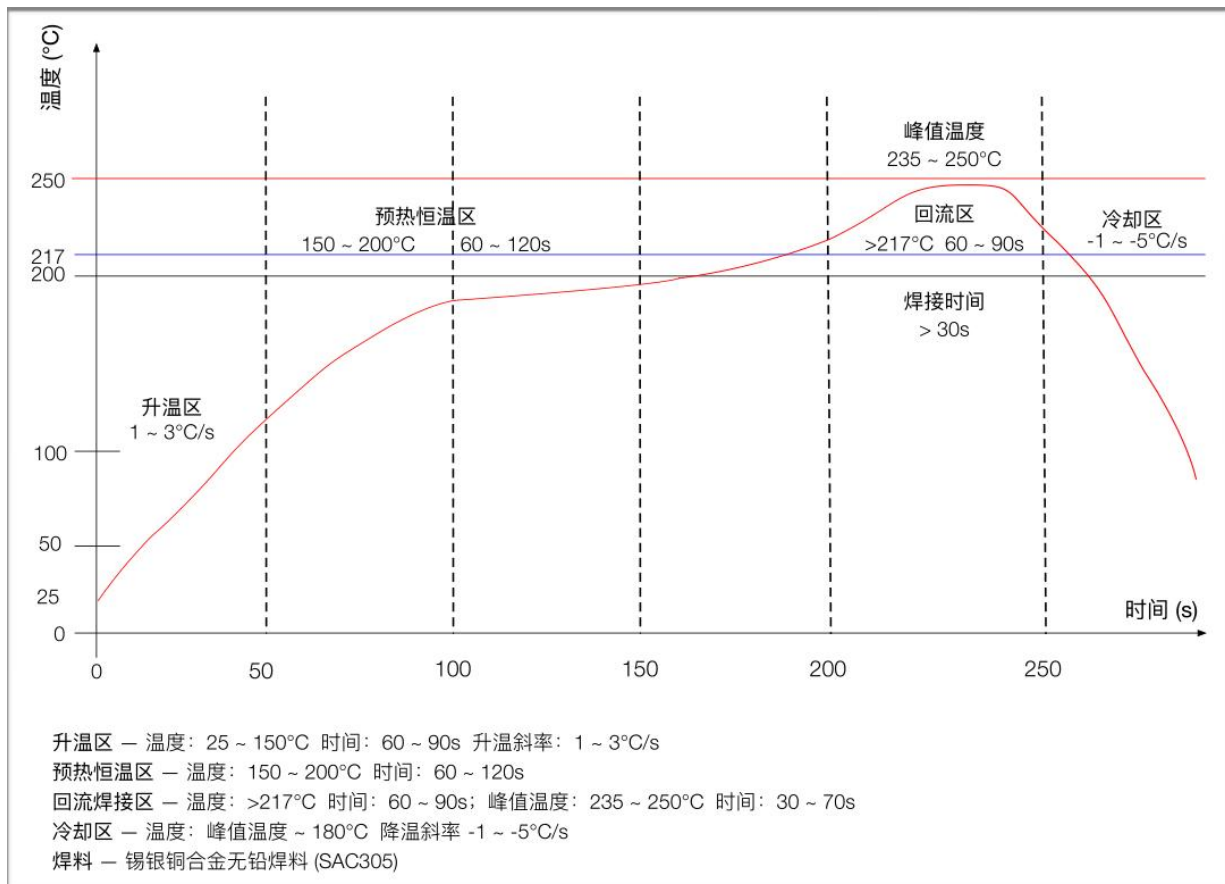


Figure 13 Reflow weld curve diagram

10. Product packaging information

Rd-03D_V2 module is packaged with 500 pcs / disk. As shown in the figure below:

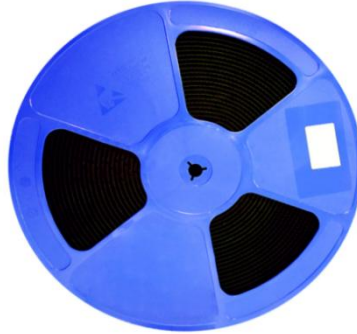


Figure 14 Packing tape diagram

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