Shenzhen Hi-Link Electronic Co., LTD

60 GHz Vital signs detection radar module

Product Manual

Overview

This radar module uses millimeter wave radar technology to realize human biological perception and The radar detection module for human breathing detection. Through the synchronous sensing technology of Doppler parameters of human movement and physiological parameters of human, the human status in specific scenarios can be realized without any interference. Line perception.

- 60 GHz millimeter-wave radar sensors;
- antenna FOV : 120 degrees horizontally , 120 degrees vertically 120 degrees;
- Not affected by temperature, humidity, sound, dust, light, etc., suitable for harsh environments; ● It can realize presence detection and respiratory and heart rate monitoring;
- Maximum detection distance $1.5\,m$, only supports one person detection;
- General UART communication interface, providing communication protocol;

1. Electrical characteristics and pin parameters

1.1 Electrical characteristics

Working parameters	Minimum	Typical values	Maximum	unit

Operating voltage (V_{CC})	4.5	5	5.5	V
Operating Current (I_{CC})	100	150	200	mA
Operating temperature (T_{op})	-40	25	85	℃
Storage temperature (T_{st})	-40	25	125	℃

1.2 RF performance

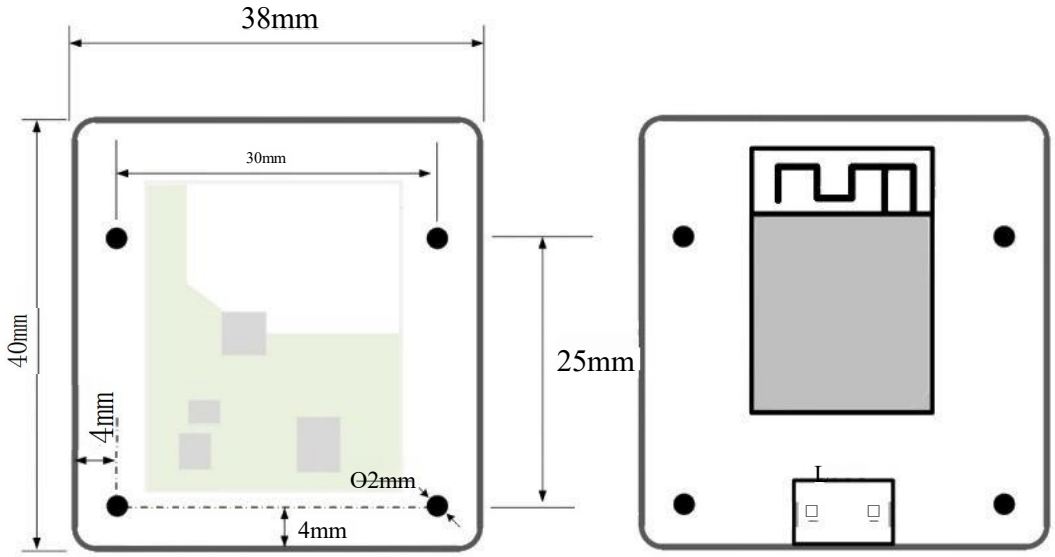
Transmission parameters	Minimum	Typical values	Maximum	unit

Operating frequency (①	58	/	62	GHz
Transmit power (Pout)	-	/	8	dBm
Antenna gain		4		dBi
FOV	-60		+60	o

2. Hardware Description

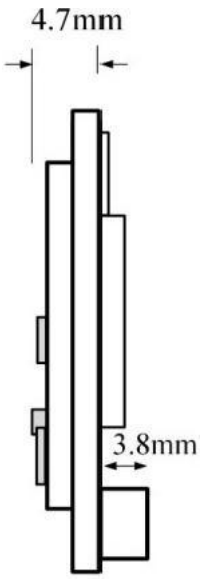
2.1 Module view and dimensions

The module size is 38*40*8.5 mm, and the relevant view is shown below.



Front of the module of the module

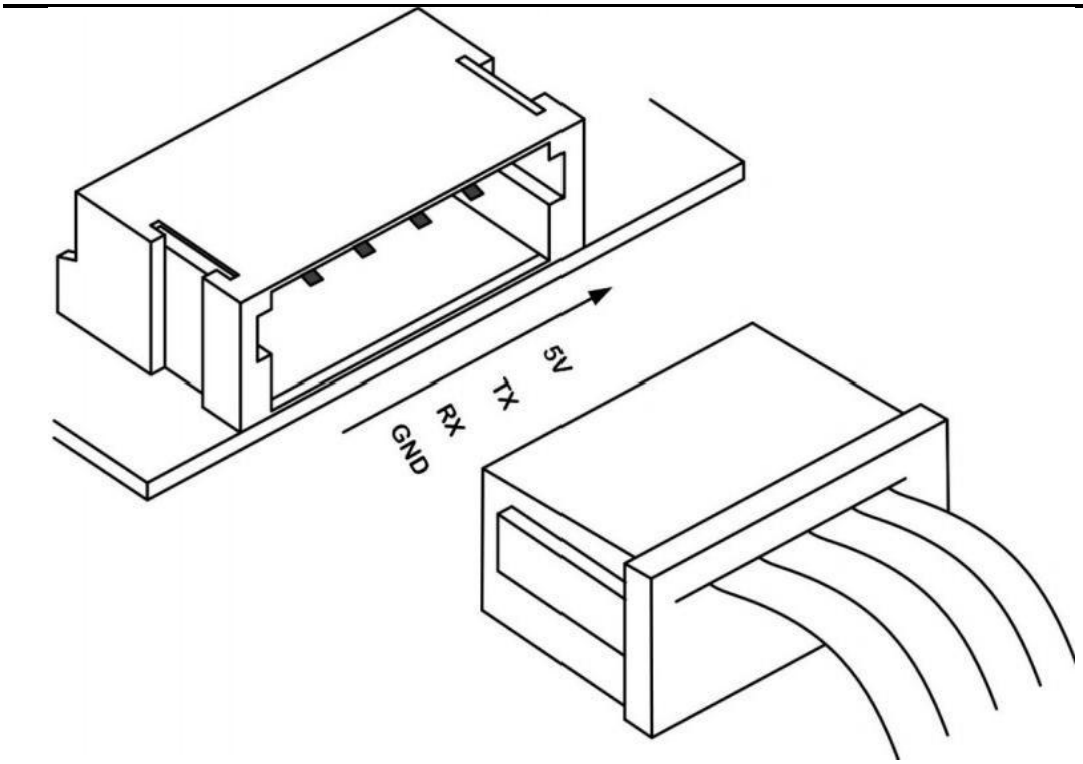
Back

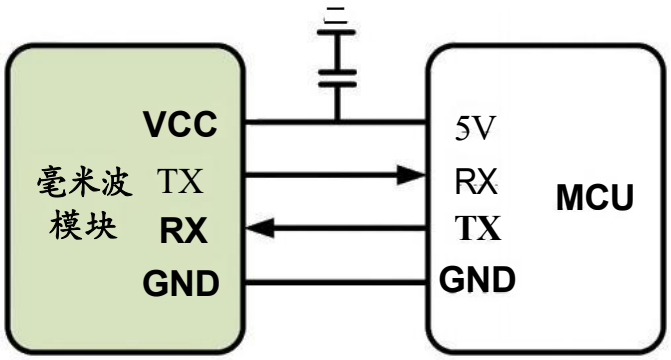


Module side view

2.2 Module wiring and related instructions

The module adopts 1.5 mm 1×4 male pin connector as the interface, the corresponding port model is HC-ZH-4PWT, You can use ZH1.5mm1×4 wire to connect to the module. The corresponding wires and pins are as follows As shown in the figure, the module pins from left to right are GND, RX, TX, 5V TX , RX are used to communicate with the serial port of the master


5V
TX
RX
GND



Radar module and peripheral connection diagram

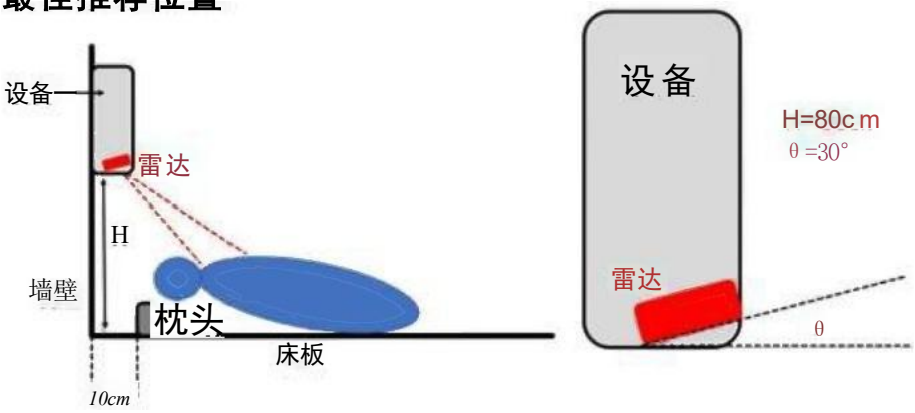
3. Installation method and working mode

Recommended installation method for the module: H is the height of the radar from the bed, θ is the distance between the radar and the horizontal Considering the actual use of the customer, this product is installed on the wall at the user's bedside. In actual use, the radar and the chest should be kept at an angle. Placed at 0.8-1.5 mThe chest cavity must be within the detection range of the radar antenna. (Refer to Considered values: radar height H is 0.8 m, θ is 30°).

Note: During installation, please keep the radar module antenna normal facing the chest.

When the module is working, the module surface must be free of metal covering. Different body positions may affect the radar range, and the radar does not guarantee that it can reach all states. To measure with high accuracy.

最佳推荐位置



In working mode, the radar periodically gives the status of the presence of people in the current radar detection area. and motion status, mainly including:

1. No one state;

2.Occupied state;

3.Respiratory rate and heart rate values when someone is present;

4.Notes

4.1. Startup time

When this product is initially powered on, the internal circuit needs to be completely reset to ensure The product works normally. Therefore, when the product is initially powered on, it needs to be stable for ≥ 60 seconds., To ensure the validity of subsequent output parameters. Signal processing requires a period of data accumulation, and there are many factors in the accumulation process. This affects the radar processing results, so occasional detection failures are normal.

4.2.Effective detection distance

Radar detection range and target RCS and environmental factors are closely related, and the effective detection distance may It changes with the environment and target, and with the age and body shape of the subjects. It is normal

for the effective detection distance to fluctuate within a certain range.

4.3. power supply

The radar module has higher requirements on power quality than conventional low-frequency circuits. The power supply must be free of threshold glitches or ripples, and must effectively shield the power supply from the accessory equipment. Noise. The radar module requires good grounding, and the noise from other circuits may also Causes radar module performance degradation or even malfunction; the most common result is a decrease in detection distance

Or the false alarm rate increases. In order to ensure the module internal VCO The normal operation of the circuit is very important for this module Power requirement is +5 V Left and right power supply, voltage ripple ≤ 100 mV At the same time, the external power supply must Provide sufficient current output capability and transient response capability.

4.4. Installation Location

Keep away from electrical outlets, such as electric fans, air conditioners, heaters, etc., to prevent damage to the internal core. Avoid installing in humid environments, such as humidifiers, bathrooms, etc.

5. Frequently Asked Questions

Interference factors: Radar is an electromagnetic wave detection sensor, and moving non-living objects can cause False alarm. The movement of metal or liquid can cause false positives. Usually, an electric fan is close to the radar. Pets and shaking metal curtains can cause misjudgment. The radar needs to be installed at an angle and Plan the installation site.

Non-interference factors: Radar electromagnetic waves can penetrate human clothing, curtains, thin wood, glass The installation angle and performance of the radar need to be determined according to the application.

Semi-interference factors: radar determines the presence of human body, so it is not suitable to face the air conditioner directly. The motor may cause the radar to misjudge. The radar product should not be directly facing the air conditioner. Adjust in the same direction.

6. Radome design

Radar cover is used to protect the radar antenna from rain, sunlight, wind and other external environmental influences. However, it has the following effects on the radar antenna: dielectric loss and reflection loss caused by the radome It will reduce the effective power of the radar and cause the antenna beam to be distorted, making the radar

The area changes; the reflection of electromagnetic waves by the shell makes the isolation of radar transmitting and receiving antennas worse , And it may cause receiver saturation; the phase of electromagnetic waves changes when they pass through the radar antenna cover. Therefore, the design of the radar antenna cover is to reduce the impact of the shell and improve the radar Performance is essential.

Design requirements:

1.When selecting the material of the radar antenna cover, the premise of ensuring the firmness and low cost is

In this case, the material with smaller dielectric

constant and loss tangent should be selected to reduce the

radar antenna cover. Impact on radar performance.

The dielectric constant and dissipation factor of commonly used materials are shown in the following table:

Material	Dielectric constant (ε_r)	Dissipation factor ($\tan\delta$)
polycarbonate	2.9	0.012
ABS	2.0-3.5	0.0050-0.019
PEEK	3.2	0.0048
PTFE (Teflon®)	2	<0.0002
Plexiglass®	2.6	0.009
Glass	5.75	0.003
ceramics	9.8	0.0005
PE	2.3	0.0003

PBT	2.9-4.0	0.002

2. The radar antenna cover is required to have a smooth surface and uniform thickness

3. Radome thickness design requirements

$$T = N \cdot \frac{c}{2f\sqrt{\varepsilon_r}} \quad N = 1,2,3 \ldots$$

T: Radome thickness

c: speed of light, m/s;

f: center frequency

ε_r: Material dielectric constant, DK

4. Design requirements for the height of the radar antenna from the inner surface of the shell

$$d = N \cdot \frac{c}{2f} \quad N = 1,2,3 \ldots$$

c: speed of light, 3×10^8 m/s;

f: Center frequency f =60 GHz

$c/2f$=2.5 mm

7. Disclaimer

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8.Historical version update notes

Version number	Modification time	Related Introduction
V1.0	2023/12/13	First Draft