



# 60G Radar Module for Respiration and Heartbeat Monitoring IR60BH1A

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## 1. Overview

IR60BH1A radar module adopts 60G millimeter wave radar technology to realize the non-contact perception of personnel's respiratory rate and heart rate.

The radar module has the following working characteristics:

1. Radar detection based on FMCW signal;
2. Realize synchronous perception of human respiratory rate and heart rate;
3. The detection distance of respiration and heartbeat is 0.4-2m;
4. Low output power, no harm to human body;
5. It is not affected by temperature, humidity, noise, air flow, dust, light and other environmental factors;
6. The product supports secondary development and adapts to a variety of scenarios;
7. General UART communication interface, providing general protocol;
8. Four groups of I \ o are reserved, which can be input and output according to user-defined or simple interface simulation.

## 2. Main Parameters

### 2.1 Detection Angle and Distance

Parameter	Minimum	Typical	Maximum	Unit
<b>Operating Performance</b>				
Detection Distance (Chest)	0.4		2	m
Respiratory Measurement Accuracy		90		%
Heartbeat Measurement Accuracy		85		%
Update Time	1		30	S
Observation Establishment Time		20		S
<b>Operating Parameters</b>				
Operating Voltage (VCC)	4.6	5	6	V
Operating Current (ICC)		150		mA
Operating Temperature (TOP)	-20		60	°C
Storage Temperature (TST)	-40		80	°C
<b>Launch Parameters</b>				
Operating Frequency (fTX)	58	60	63.5	GHz
Transmitting Power (Pout)		6		dBm
<b>Antenna Parameters</b>				
Antenna Gain (GANT)		4		dBi
Horizontal Beam (-3dB)	-40		40	°
Vertical Beam (-3dB)	-40		40	°

### 3. Module Dimension and Pin Definition

#### 3.1 Outline Dimension

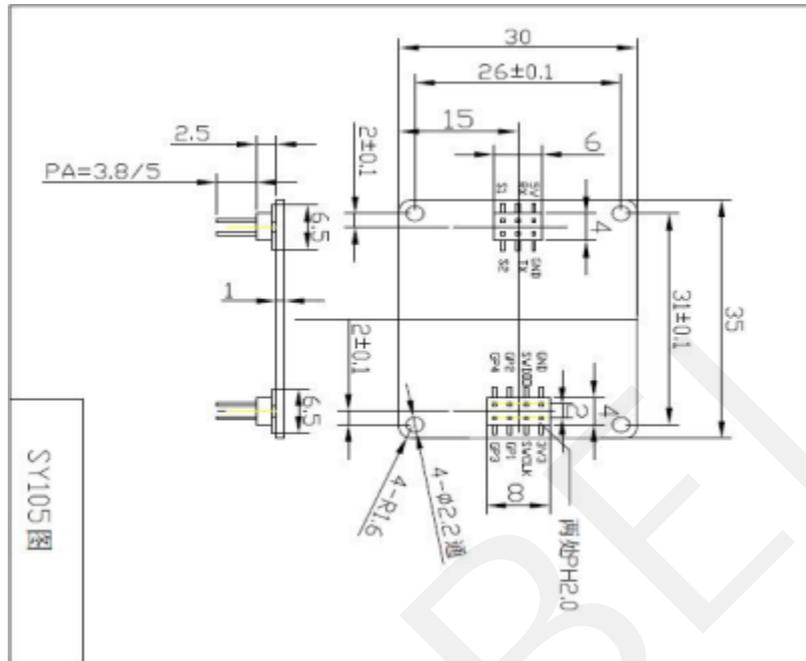


Figure 1 Diagram of Radar Module Outline Dimension

#### 3.2 Pin Definition

Interface	Pin	Description	Typical	Remark
Interface 1	1	5V	5.0V	Positive end of power input
	2	GND		Ground
	3	RX		Serial port receive
	4	TX		Serial port send
	5	S1	3.3V/0V	
	6	S2	3.3V/0V	
Interface 2	1	3V3	3.3V	Output power supply
	2	GND		Ground
	3	SL		Reserve
	4	SD		Reserve
	5	GP1		Spare extension pin
	6	GP2		Spare extension pin
	7	GP3		Spare extension pin
	8	GP4		Spare extension pin

### 3.3 Wiring Diagram

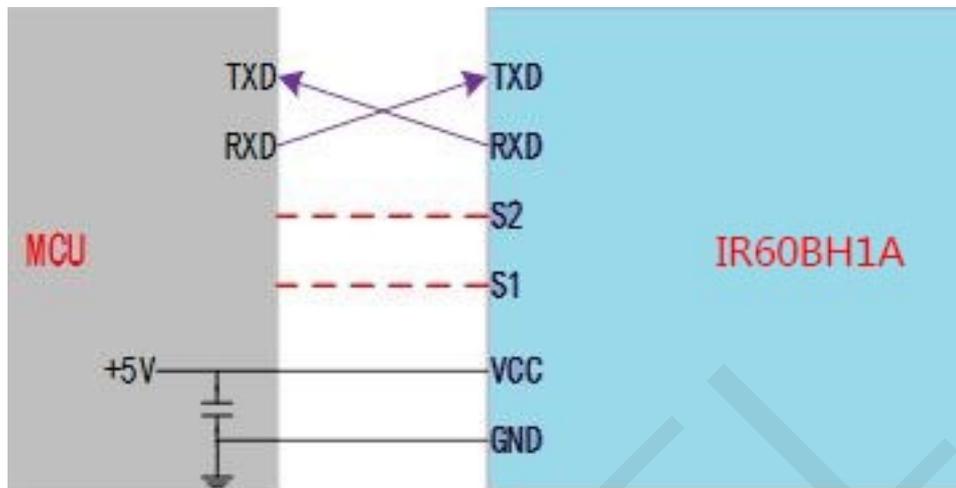
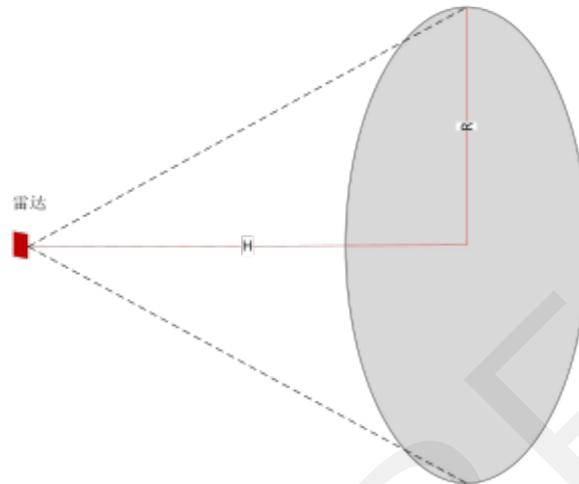


Figure 2 Wiring Diagram of Radar Module and Peripheral Equipment

## 4. Main Operating Performance

### 4.1 Radar Module Operating Coverage

The beam coverage of radar module is shown in. The radar coverage is a three-dimensional sector area with 80 ° horizontal and 80 ° pitch.



Due to the influence of radar beam characteristics, the radar operates far in the normal direction of the antenna surface, but the operating distance deviates from the normal direction of the antenna will become shorter.

When the radar is installed on the top or obliquely, the radar action range will be reduced due to the influence of the radar beam range and effective radiation space, which requires additional attention during use.

### 4.2 Main Functions and Performance

#### 1) Main functions and performance

##### a. Detection of respiration

###### a) Detection distance:

i.  $0.4\text{m} \leq x \leq 2\text{m}$  // Detection distance between chest and radar antenna surface

###### b) Accuracy: $\geq 90\%$

##### b. Detection of heart rate

###### a) Detection distance:

i.  $0.4\text{m} \leq x \leq 2\text{m}$  // Detection distance between chest and radar antenna surface

###### b) Accuracy: $\geq 85\%$

c. Perception of presence

a) Detection distance:  $\leq 3\text{m}$  // Distance between antenna surface and personnel

b) Accuracy:  $\geq 90\%$

d. Detection of movement

a) Motion-triggered

b) Motion direction and position perception

## 5. Radar Operation and Installation Mode

### 5.1 Installation

Radar detection is based on the undulating movement of the large body surface caused by respiratory rhythm and the undulation of the human chest and back will become obvious. Therefore, the radar needs to be installed facing the chest or back of the human body.

Based on the radar action mode, the following installation modes are mainly considered:

#### 1) Top-mounted

For people that are bedridden or with sleep needs, it is recommended to install on the top (as shown in Figure 4): the radar beam is vertically downward facing the human body, and the center of the radar beam is facing the human chest.

In this installation mode, the distance between the radar and the human body to be measured is required to be  $\leq 2\text{m}$ .



Figure 4 Top-mounted

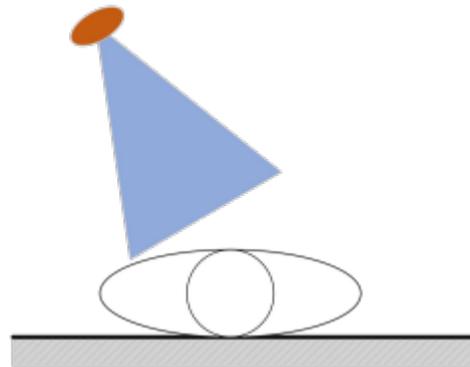


Figure 5 Obliquely-mounted

## 2) Oblique-mounted

When the radar is installed obliquely, it needs to be fixed on the wall or beside the bed. The radar is installed obliquely (as shown in Figure 5): the radar beam irradiates the human body obliquely, and the center of the radar beam is facing the chest of the human body.

In this installation mode, the radial distance between the radar and the human body to be measured is required to be  $\leq 2\text{m}$ .

## 3) Horizontal-mounted

The radar is installed horizontally (as shown in Figure 6), and the radar is fixed on the wall or placed on the desktop: the radar beam irradiates the human body in a positive direction, and the center of the radar beam is facing the chest of the human body.

In this installation mode, the radial distance between the radar and the human body to be measured is required to be  $\leq 2\text{m}$ .

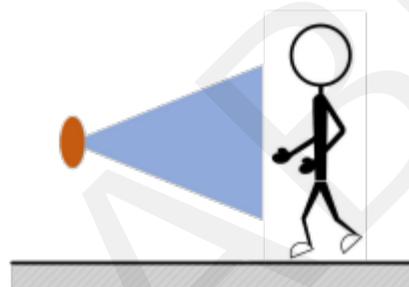


Figure 6 Horizontal-mounted

## 6. Precautions

### 6.1. Start Time

When the module starts to work when it is initially powered on, it is necessary to completely reset the internal circuit of the module and fully evaluate the environmental noise to ensure the normal operation of the module. Therefore, when the module is initially powered on, it needs a startup stability time of 20s to ensure the validity of subsequent output parameters.

### 6.2. Limitations on Heartbeat Monitoring

Since this module is a respiratory and heartbeat detection radar, the detection distance should not be too far, and the appropriate distance is 0.4m-2m. When there are objects with stronger reflectivity than the measured target around the measured target, the radar may track the strongly reflected target during operation. At this time, the radar detection parameters are abnormal and the radar position needs to be adjusted.

At present, the radar module can only measure a single target, and multi-target measurement is temporarily unavailable. Therefore, when multiple people are located in the radar detection area, the detection parameters are disordered, which needs attention.

### 6.3. Radar biological detection performance

Because human biological characteristics belong to ultra-low frequency and weak reflection characteristic signals, radar processing requires a relatively long cumulative processing. During the cumulative process, many factors may affect the radar parameters, so occasional detection failure is normal.

### 6.4. Power

The radar module requires higher power quality than conventional low frequency circuits. When powering the module, it is required that the power supply has no threshold glitches or ripples and that it effectively shields the power supply noise caused by accessory equipment. The radar module needs to be well grounded. Due to the ground noise brought by other circuits, the performance of the radar module may even be reduced or even work abnormally; the most common cause is a shorter detection distance or an increased false alarm rate.

In order to ensure the normal operation of the VCO circuit inside the module, the power supply requirement for this module is +5V- +9V power supply, voltage of power supply no less than 5V. The external power supply must provide sufficient current output capability and transient response capability.

## 7. Disclaimer

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