

# 60GHz Millimeter wave Bio-sensing radar

R60AFD2-Fall detection radar

Datasheet (Ver. 1.0)

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## 1. Overview

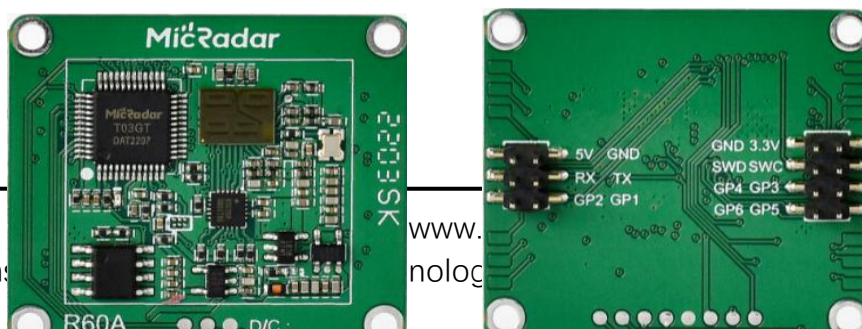
The R60AFD2 radar module is a radar module that uses 60G millimeter

wave radar technology to realize human motion and attitude perception, and then realize the function of fall detection. Based on the FMCW radar system, this module realizes wireless perception of the status of personnel in a specific place, and reports the fall status of personnel in a timely manner.

This module has one-transmit and three-receive antenna forms: Narrow beam radar module, wide beam radar module is mainly suitable for top-mounted installation mode, to achieve human fall detection in a certain angle range, accurate scanning of human body tomography; to achieve human body height difference and speed change Fall detection function.

**This radar module has the following working characteristics:**

- ◇ Realize the synchronous perception function of sports personnel and stationary personnel (sitting, sleeping);
- ◇ Realize the function of personnel fall detection;
- ◇ Detect various motion amplitudes and output numerical status in real time
- ◇ The detection object is a person with biological characteristics (moving or stationary), and the interference of other inanimate objects in the environment is excluded;
- ◇ The module can effectively eliminate the interference of non-living objects, and can also realize the detection of non-living moving objects;
- ◇ The product supports secondary development and adapts to various scenarios and applications;
- ◇ General UART communication interface, providing general protocol;
- ◇ 4 groups of I\O are reserved, which can be input and output according to user definition, or simple interface simulation;
- ◇ Low output power, no harm to human body;
- ◇ The module is not affected by temperature, light, dust and other factors, with high sensitivity and wide application fields.



(a) front photo

(b) back photo

## Model Description

- ✧ R60AFD 2 - Fall Detection Radar Sensor, 90° /60° Sector Beam  
(High measurement accuracy, fall radius  $\leq$  2m, trigger range is recommended to be used within 6 meters)

## Applications

- ✧ Nursing care (bathroom, kitchen)
- ✧ home security
- ✧ Whole house intelligence

## Product packaging

- ✧ Volume: 35mm×31mm×7.5mm
- ✧ Interface: Pitch 2.0mm double-row pin interface, 2\*3 and 2\*4 total  
2 sets of interfaces

## Serial output parameters

- ✧ Someone/Nobody
- ✧ fall state
- ✧ Body Motion Parameters 0-100
- ✧ Stationary dwell (time report can be set)

## Configurable parameters

- ✧ installation height
- ✧ Still Dwell Time Settings
- ✧ Fall/Stationary Park Switch

## output protocol

- ✧ Standard Serial Protocol
- ✧ Tuya Standard Protocol

## 2. Electrical Characteristics and Parameters

### 2.1. Detection angle and distance

Parameter content	minimum	Typical value	maximum value	unit
<b>R60AFD2</b>				
Motion trigger detection radius <sup>[1]</sup>	–	–	2.5	Meter
Fall Detection Radius <sup>[2]</sup>	–	–	2	Meter
Stationary Dwell Detection Radius	–	–	2	Meter
Radar detection angle (horizontal)	–	100	–	Spend
Radar detection angle (pitch)	–	100	–	Spend

Note: [1][2][3] The height of the radar is 2.4 meters, and the radius of the radar projection.

### 2.2. Electrical Characteristics

Working parameters	minimum	Typical value	maximum value	unit
Operating voltage (VCC)	4.5	5.0	6	V
Working current (I <sub>CC</sub> )	90	93	100	mA
Operating temperature (T <sub>OP</sub> )	–20	–	+60	° C
Storage temperature (T <sub>ST</sub> )	–40	–	+105	° C

### 2.3. RF performance

launch parameters				
Operating frequency ( $f_{TX}$ )	61	–	61.5	GHz
Transmit power ( $P_{out}$ )	–	–	6	dBm

### 3. Module size and pin description

#### 3.1. Module size package

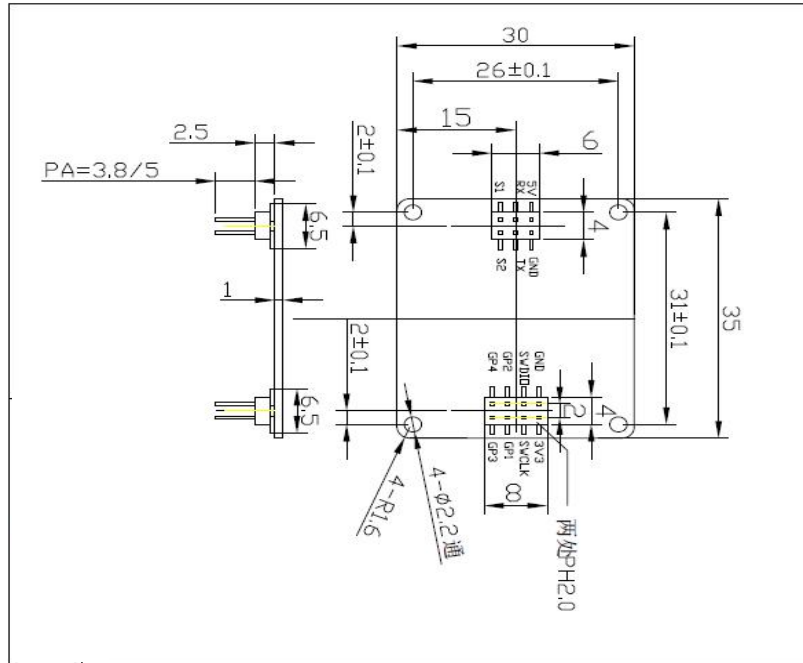


Figure 1 Schematic diagram of the structure of the radar module

#### 3.2. Pin Description

interface	pin	describe	Typical value	illustrate
interface 1	1	5V	5.0V	Power input positive terminal
	2	GND		land
	3	RX		Serial receive
	4	TX		Serial send
	5	GP1	3.3V/0V	
	6	GP2	3.3V/0V	
interface 2	1	3V3	3.3V	input power
	2	GND		land
	3	SL		reserve
	4	SD		reserve
	5	GP 3		Spare expansion pins
	6	GP 4		Spare expansion pins
	7	GP 5		Spare expansion pins
	8	GP 6		Spare expansion pins



### 3.3. Use wiring diagrams

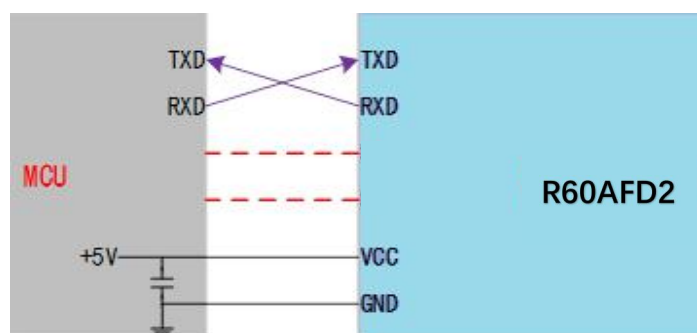
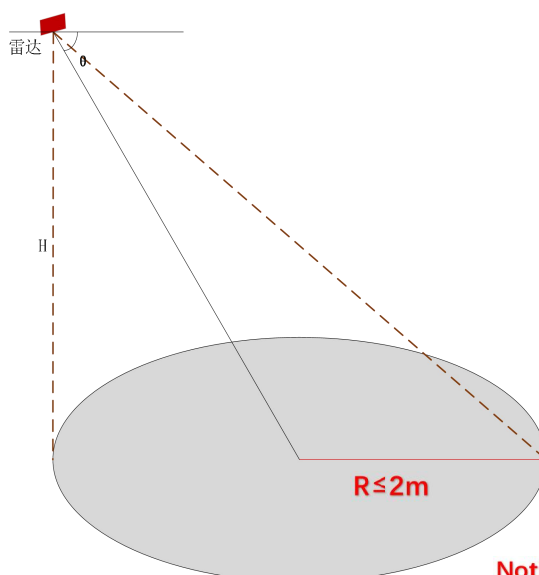


Figure 2 Schematic diagram of the connection between the radar module and the peripherals

## 4. Main work performance

### 4.1. Radar module working range

radar module beam coverage is shown in the figure. The radar coverage is a three-dimensional sector of  $100^\circ$  horizontally and  $100^\circ$  vertically.



**Notice: R is fall detection radius**

Affected by the characteristics of the radar beam, the radar's working distance in the normal direction of the antenna surface is relatively long, but the working distance away from the antenna normal direction will be shorter.

When the radar is installed obliquely, due to the influence of the radar beam range and the effective radiation space, the radar's range of action will be reduced, which needs to be paid attention to when using it.

## 4.2. Main functions and performance

- a. Fall detection function
  - a) Detection distance:  $\leq 2$  meters (when installed obliquely, the radar projection radius)
  - b) Accuracy rate:  $\geq 90\%$
- b. Stationary park detection function
  - a) Detection distance:  $\leq 2$  meters (when installed obliquely, the radar projection radius)
  - b) Accuracy rate:  $\geq 95\%$
- c. presence awareness
  - a) Detection distance:  $\leq 2.5$  meters (when installed obliquely, the radar projection radius)
  - b) Accuracy rate:  $\geq 95\%$
- d. Motion detection function
  - a) Motion trigger:  $\leq 2.5$  meters (when installed tilted, radar projection radius)
  - b) Movement direction and position awareness

## 5. Radar work and installation

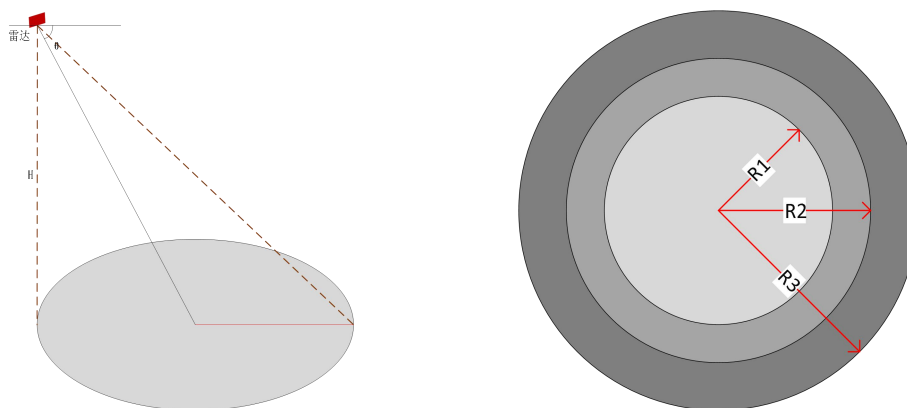
### 5.1. Inclined installation mode

The radar is mounted on the wall and slanted downward.

The radar installation height is  $H = 2$  meters to  $2.4$  meters; the radius of the radar beam coverage area is  $R$ . In the radar projection area, it is considered to further divide the projection area into fall detection area, stationary parking detection area, presence detection area and

motion trigger detection area, the schematic diagram of the area is shown in the figure below.

For this type of installation, consider using a gyroscope sensor at home on the radar to measure the radar inclination, and then assist the radar to perform angle correction. In this installation mode, the maximum radius of fall detection/stationary resident detection is  $R1 \approx 2m$ ; the maximum radius of human static presence detection is  $R2 \approx 2m$ ; the maximum radius of human motion detection is  $R3 \approx 2.5m$ ;



(a) Schematic diagram of radar projection (b) Schematic diagram of beam division

## 6. Typical application

- A. The product is suitable for small area scenes such as bathrooms, toilets, and kitchens.
- B. The product is suitable for inclined installation mode.
- C. Product is suitable for single person situation.
- D. Products need to eliminate interfering actions in combination with application scenarios.

## 7. Precautions

### 7.1. Start Time

Since the module starts to work at the initial power-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 power-on stabilization time of  $\geq 30$ s to ensure the validity of subsequent output parameters.

## 7.2. Effective detection distance

The detection distance of the radar module is closely related to the target RCS and environmental factors. The effective detection distance may change with the change of the environment and the target. This module does not have the ranging function for the time being, so it is normal for the effective detection distance to fluctuate within a certain range.

## 7.3. Radar Biodetection Performance

Since human biometrics belong to ultra-low frequency and weak reflection characteristic signals, radar processing requires a relatively long time accumulation process. During the accumulation process, many factors may affect the radar parameters, so the occasional detection failure is a normal phenomenon.

## 7.4. Power supply

Radar modules have higher requirements on power quality than conventional low-frequency circuits. When supplying power to the module, it is required that the power supply has no threshold glitches or ripples, and the power supply noise caused by the accessory equipment is effectively shielded.

The radar module needs to be well grounded. Due to the ground noise brought by other circuits, the performance of the radar module may also be degraded or even work abnormally; the most common cause is to shorten the detection distance or increase the 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~+6V power supply, and the voltage ripple is less than or equal to 100mV.

The external power supply must provide sufficient current output capability and transient response capability.

## 8. Disclaimer

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## 11. Historical version update instructions

Revision	Release Data	Summary
V1.0_0519	202 2/05/19 _ _ _ _	first draft