

Product Specification

Product model: R24AVD4

Product name: Air conditioner 1T1R standard module

Product description: 24GHz, 1T1R, FMCW

Release date: 28/04/2024

Prepared by	Reviewed by	Approved by

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I. Product Introduction

This product is a highly sensitive 24GHz millimeter wave radar module, mainly used to detect the position of a target person within the radar coverage area.

The radar module mainly has the following characteristics:

- 1) It achieves personnel distance perception function based on the FMCW radar system;
- 2) It achieves real-time perception for both moving and stationary person.
- 3) It is capable of scene recognition, identifying the presence / absence of human body and their motion status.
- 4) It can be used in terrible environments without interference of temperature, humidity, noise, airflow, dust, light, etc.
- 5) It has low output power and no harm to the human body after prolonged exposure.

II. Scope of Application

This product is mainly developed for the needs from the air conditioner applications and is suitable for air conditioner and related home appliances.

This module can be applied to different models such as wall mounted air conditioners, standing type air conditioners, ceiling air conditioners, 3D air outlets.

III. Main Functions and Performance Parameters

1. Electric performance parameters

Parameters	Minimum value	Typical value	Maximum value	Unit
Power supply parameter				
Working voltage (VCC)	5.0		5.5	V
Working current (I _{CC})		70	100	mA
Emission parameters				
Working frequency (f _{TX})	24.0		24.25	GHz
Emission power (P _{out})		6	8	dBm
Antenna parameters				
Antenna gain (G _{ANT})		6		dBi
Horizontal beam (3dB)		100		°
Vertical beam (3dB)		80		°

2. Radar functions and performance parameters

Parameters	Minimum value	Typical value	Maximum value	Unit
Detection of moving objects				
Detection range		6.0		m
Range accuracy		0.5		m
Detection angle		±50		°
Response time		0.5		s
Detection of stationary personnel				
Detection range		5.0		m
Range accuracy		0.5		m
Detection angle		±50		°
Time from presence state to absence state		30		s

3. Description on environmental adaptability

- A. Working temperature: -20°C~70°C
- B. Storage temperature: -20°C~85°C
- C. Humidity: ≤85%, without condensation;

IV. Interface Specification

1. Description on hardware interface

The external interface of this radar adopts SM04B-GHS-TB (LF) (SN) miniaturized horizontal socket, and its interface is defined as follows

Interface	Definition	Description
1	5V	Power input
2	RX	Module serial port data reception
3	TX	Module serial port data transmission
4	GND	GND

Note: The external ports of the radar are designed with electrostatic protection functions.

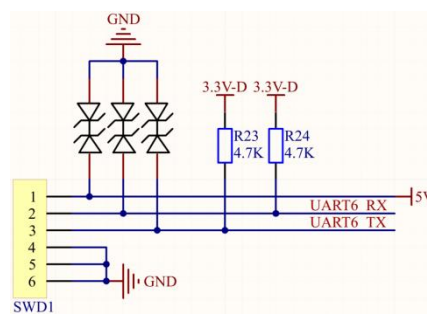


Figure1 Hardware interfaces diagram

2. Description on software and interface

The software version may vary depending on the vibration, mounting location, and height of the air conditioner.

The testing software used for this module is the wall mounted air conditioner, including standing air conditioner weak-vibration software (A), wall mounted air conditioner weak-vibration software (B), and wall mounted air conditioner strong-vibration software (C).

1) Standing air conditioner weak-vibration software (A)

Mounting method	Side-mounted, with a mounting height of 1m~1.5m
Functions	Presence detection of moving objects $\geq 6m$, Presence detection of stationary objects $\geq 4m$ [sitting still facing the radar]
	Range detection of the nearest person in a multi-person scenario
	Body motion parameters measurements. For example, the body motion value of a target that is completely still or sleeping is 1, and the more intense the person's movement, the larger the body motion parameters

2) Wall mounted air conditioner weak-vibration software (B)

Mounting method	Side-mounted, with a mounting height of 2.6m, inclined downwards at 30 degrees
Functions	Presence detection of moving objects $\geq 6m$ Presence detection of stationary objects $\geq 4m$ [sitting still facing the radar]
	Gesture control. Hand at a straight-line distance of 1.5m from the radar, horizontal detection angle of $\pm 30^\circ$, double-click accuracy of $\geq 90\%$
	Body motion parameters measurements. For example, the body motion value of a target that is completely still or sleeping is 1, and the more intense the person's movement, the larger the body

	motion parameters
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3) Wall mounted air conditioner strong-vibration software (C)

Mounting method	Side-mounted, with a mounting height of 2.6m, inclined downwards at 30 degrees
Functions	Presence detection of moving objects $\cong 6m$
	Gesture control. Hand at a straight-line distance of 1.5m from the radar, horizontal detection angle of $\pm 30^\circ$, double-click accuracy of $\cong 90\%$
	Body motion parameters measurements. For example, the body motion value of a target that is completely still or sleeping is 1, and the more intense the person's movement, the larger the body motion parameters

The application of other air conditioning categories supports software customization. The optional radar functions include:

2.2 Removal of interference from green plants, fans, etc.

The radar adopts UART interface for external communication, and detailed interface information can be found in the *User Manual*.

V. External Dimensions and Product Photos

1. External dimensions

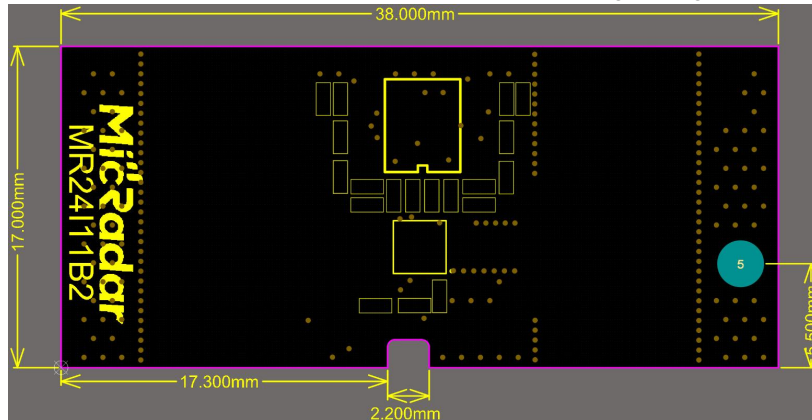


Figure2 External dimension of hardware

2. Schematic diagram of product appearance

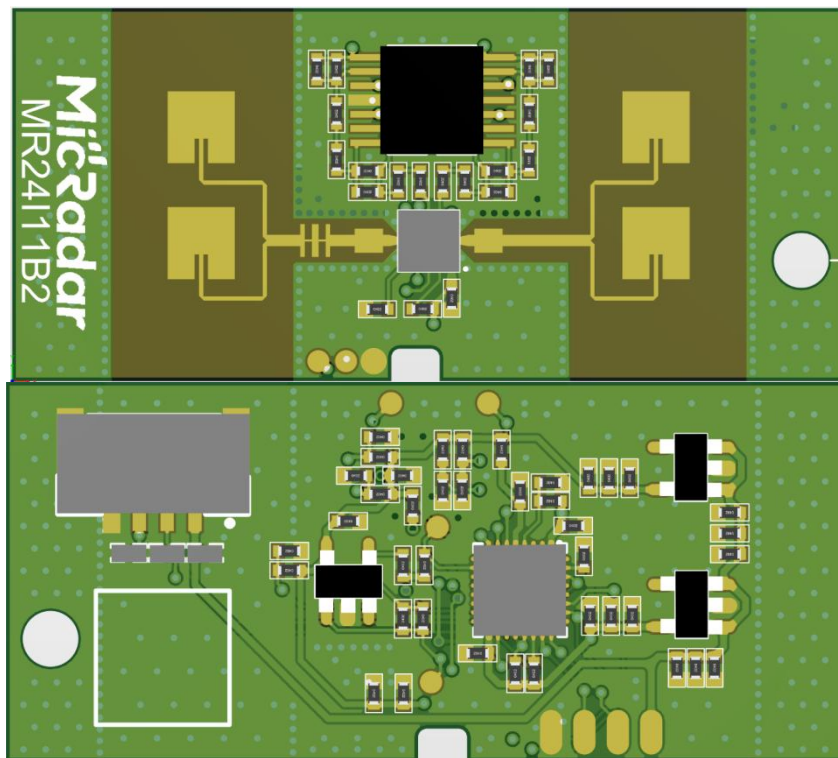


Figure3-4 Schematic diagram of hardware

VI. Instructions to Mounting and Use

This module supports various mounting methods, such as side-mounted and inclined mounting. It can be adjusted according to air conditioner application.

Taking inclined mounting as an example, this mounting method is mainly to detect people in the room and is mainly suitable for living rooms, bedrooms, etc..

The recommended radar mounting height is about 2.6 meters, and the downward

angle of inclination of the radar is 30° . There are no obvious obstructions or coverings in front of the radar.

The normal direction of the radar is aligned with the main detection position to ensure that the main beam of the radar antenna covers the detection area, and the radar beam covers the human activity airspace.

Please note that in this mode, there may be surveillance blind spots directly below the radar and adjacent areas. As the downward angle of inclination increases, the human detection range will be significantly compressed.

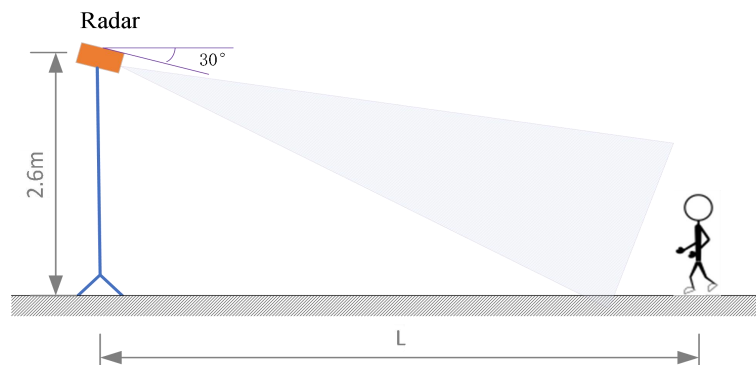


Figure5 Downward mounting installation diagram

Notes:

- The different mounting methods above all require the main beam of the radar to cover the main activity area of the human body.
- Due to changes in the horizontal projection of the coverage area, the horizontal action range will correspondingly decrease during downward inclined mounting;
- During module operation, there should be no metal objects covering the surface of the module;
- Due to the electromagnetic wave transmission characteristics, the radar operating range is related to the target RCS, target coverage material, and thickness, and the effective operating range of the radar will vary to a certain extent;
- Corresponding to human detection in stationary states, different body positions will affect the radar's operating range, and the radar does not guarantee that all states will reach their maximum operating range.