Seeed Technology Co.,Ltd.

MR60FDA2

Fall detection module technical specifications (Beta Version)

Made by Seeed Technology Co.,Ltd.

March 5, 2024

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1. Product introduction

MR60FDC1 is a radar sensing module developed based on the ADT6101P chip. It monolithically integrates a 57~64GHz radio frequency transceiver system, 2T2R PCB microstrip antenna, 1MB flash, radar signal processing unit, and ARM® Cortex®-M3 core. This module is based on the FMCW signal processing mechanism and combined with the radar signal processing algorithm to realize the status awareness of people in specific places and report the fall status in a timely manner. Suitable for ceiling installation, single person scenes in small areas of bathrooms and toilets.

2. Product characteristics

- Radar detection based on FMCW frequency modulated continuous wave signal
- Realize personnel fall detection function
- Universal UART interface, providing communication protocol
- Support UART parameter adjustment to meet the needs of different scenarios
- Small size, only 25*31.5mm, supports pin header connection and patch connection.
- Not affected by temperature, humidity, noise, airflow, dust, light and other environmental influences

3. Application scenarios

- Wellness care (bathroom, bathroom)
- home security
- Whole house intelligence

4. Electrical characteristics and parameters

4.1 Function parameters

Parameter content	minimum value	Typical value	maximum value	unit
Fall detection detection radius			2	m
Fall recognition accuracy		90		%

4.2 Electrical characteristics

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Working parameters	minimum value	Typical value	maximum value	unit
Operating voltage (VCC)	3.1	3.3	3.5	V
Operating current (ICC)			600	mA
Operating temperature (TOP)	-20		85	℃
Storage temperature (TST)	-40		85	℃

4.3 RF characteristics

Working parameters	minimum value	Typical value	maximum value	unit
working frequency	5 8		6 2	GHZ
Transmit power (Pout)		12		dBm
Antenna gain		4		dBi
Horizontal beam (-3dB)	-60		60	°
Vertical beam (-3dB)	-60		60	°

5.Hardware description

5.1 Dimensions

Parameter content	minimum value	Typical value	maximum value	unit
Fall detection detection radius			2	m
Fall recognition accuracy		90		%

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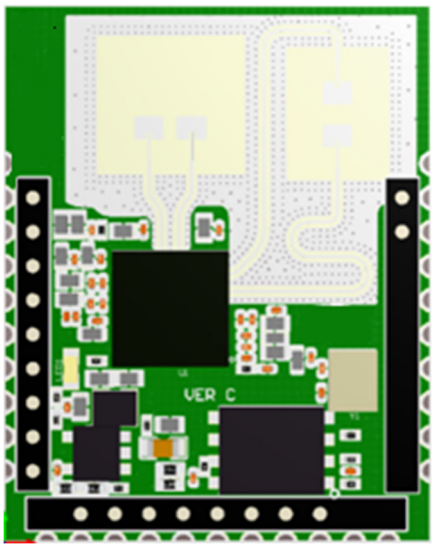
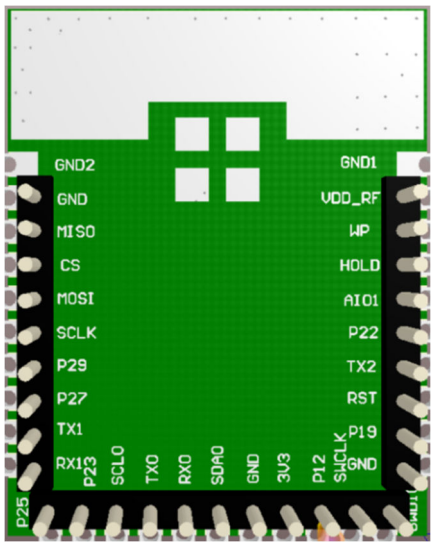
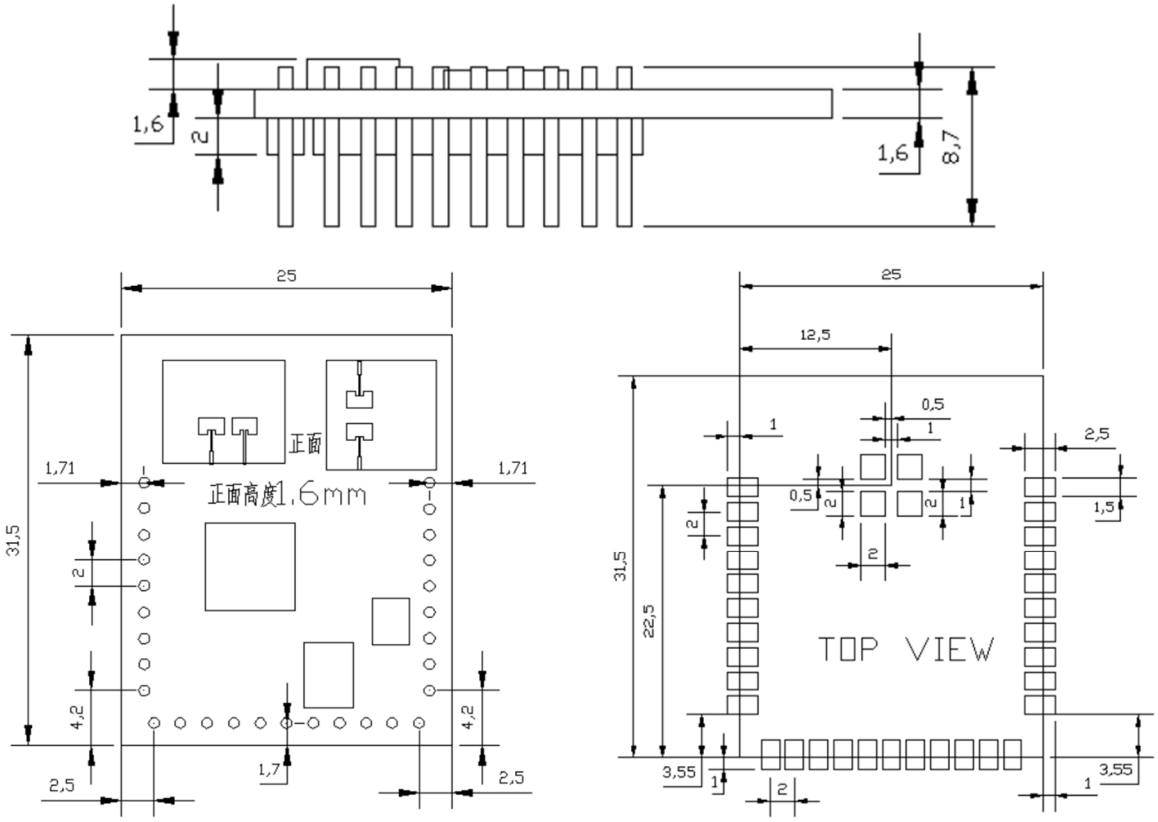


Module physical front view



Module actual rear view

5.2 Pin definition



Pin serial number	Pin name	describe	Remark

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GND1	GND	GND	Only supports patch packaging
1	VDDRF	External RF Power /1.35V	
2	WP	Write protection active low	Flash function pin
3	HOLD	To pause the device without deselecting the device	Flash function pin
4	AIO1	Temperature index test interface	Can be used as analog input
5	P22	interfaceGPIO_P22/LDO_EXT_EN_H	
6	TX2	GPIO_P20/uart2 txd	Control output (such as relay, etc.)
7	RST	Reset Signal input	
8	P19	GPIO_P19/ boot1	Boot
9	GND 0	GND	
10	SWDIO	SWD Debug Signal	
11	SWCLK	SWD Debug C lock	
12	P12	GPIO_P12/ boot0	
13	3.3V _	POWER INPUT 3.3V	
14	GND	GND	
15	SDA	GPIO_P08/IIC0_SDA	
16	RX0	GPIO_P01/uart0 _txd	
17	TX0	GPIO_P00/uart0 _txd	
18	SCL	GPIO_P07/IIC0_SCL	
19	P23	IOPAD_P23	
20	P25	IOPAD_P25	
21	RX1	GPIO_P11/uart1 rxd	
22	TX1	GPIO_P10/uart1 txd	
23	P27	IOPAD_P27	
24	P29	IOPAD_P29	
25	SCLK	IOPAD_P03/SPI0_SCLK	Can be used as RF ADC signal acquisition output terminal
26	MOSI	IOPAD_P06/SPI0_MOSI	Can be used as RF ADC signal acquisition output terminal
27	CS	IOPAD_P04/SPI0_CS	Can be used as RF ADC signal acquisition output terminal
28	MISO	IOPAD_P05/SPI0_MISO	
29	GND1	GND	
GND2	GND2	GND	Only supports patch packaging

5.3 Module peripheral reference design

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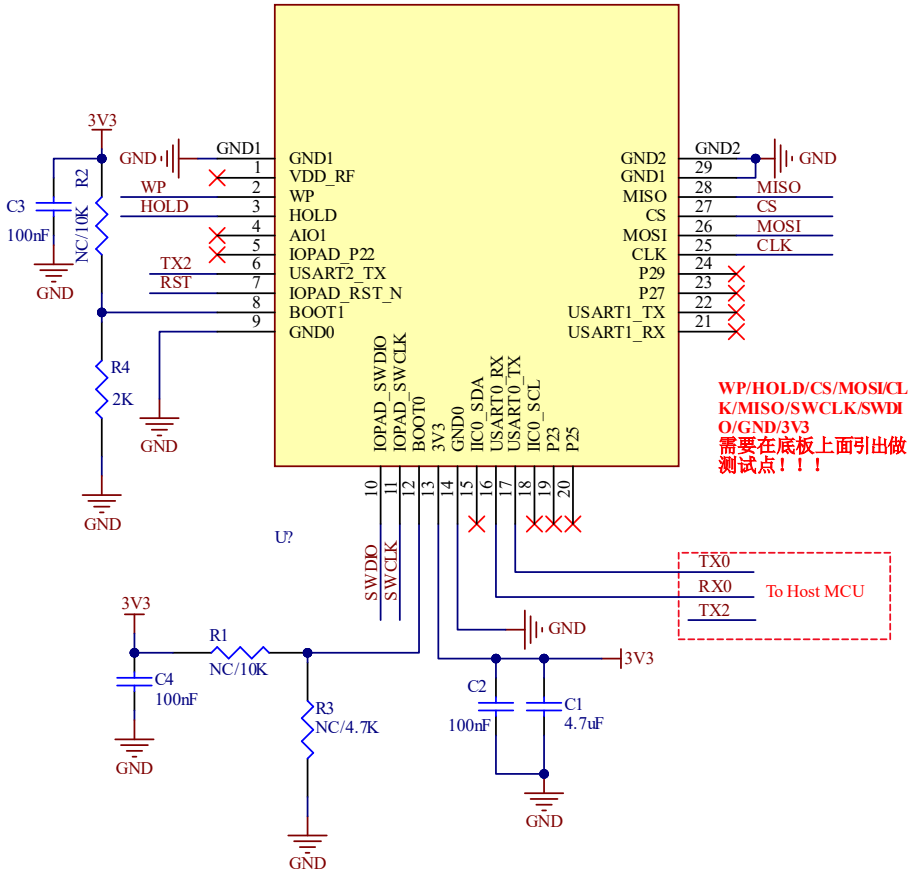

5.4 Startup configuration

BOOT1	BOOT0	Start mode	Remark
0	0	UART1	Serial port 1 starts
0	1	Flash	Flash startup in module
1	0	IIC0	This module does not support this method
1	1	Debug	For software debugging

6.Use and Configuration

6.1 Typical application circuit

The MR60FDC1 module can directly use the TX2 pin to output the detected target information (the fall output is high level, and no one fell down is low level). At the same time, UART0 outputs the detection result according to the specified protocol. The serial port data contains the target fall information. The user can customize the target according to the specific application. Scenarios can be used flexibly.

The module supplies 3.3V power supply, and the input power supply capacity is required to be greater than 1A.

The module IO port output voltage is 3.3V. The default baud rate of the serial port is 115200, with no parity check.

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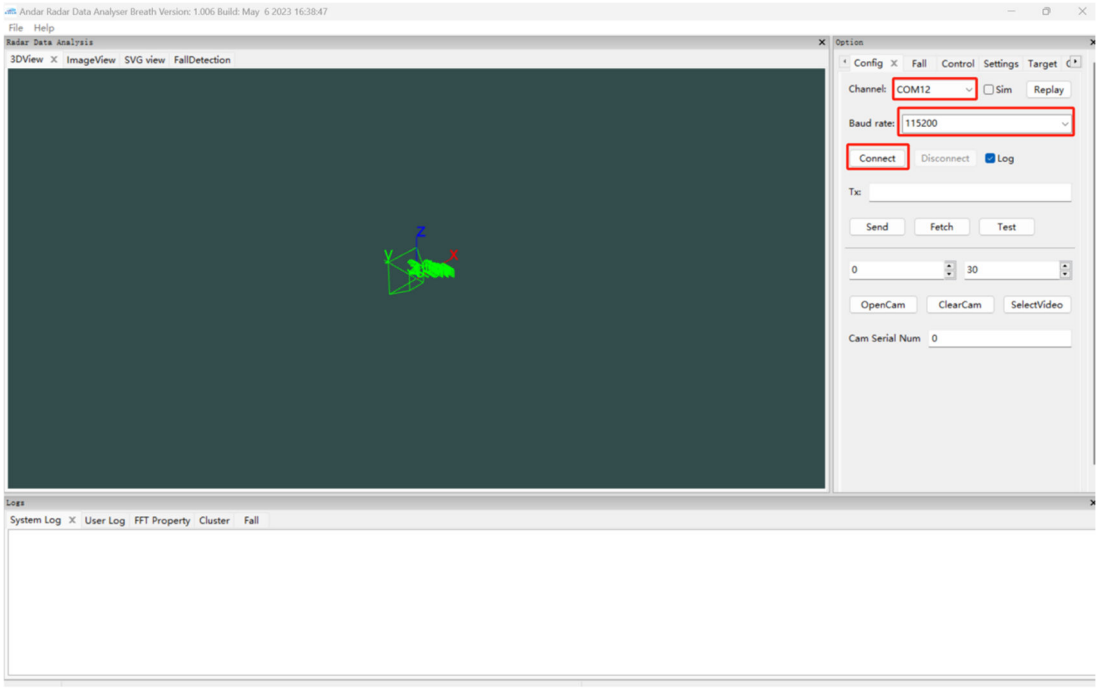
6.2 GUI visualization tool application

1. Device connection

1) Select the serial number corresponding to the connection

2) Set the baud rate to 115200

3) Click the [Connect] button and the module starts to detect



2. Data view

1) Select the [3D view] window

2) Use the mouse to drag the view in the picture to the appropriate size.

3) Check out the System Log window below

4) Check the message information. No fall detected. No abnormality detected.

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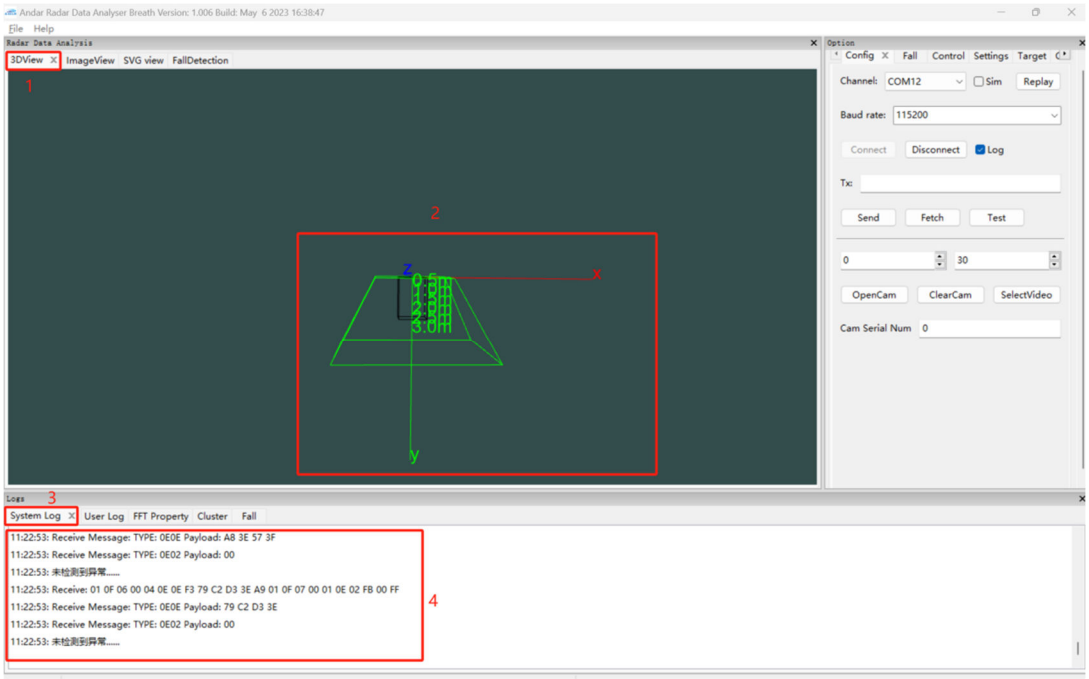
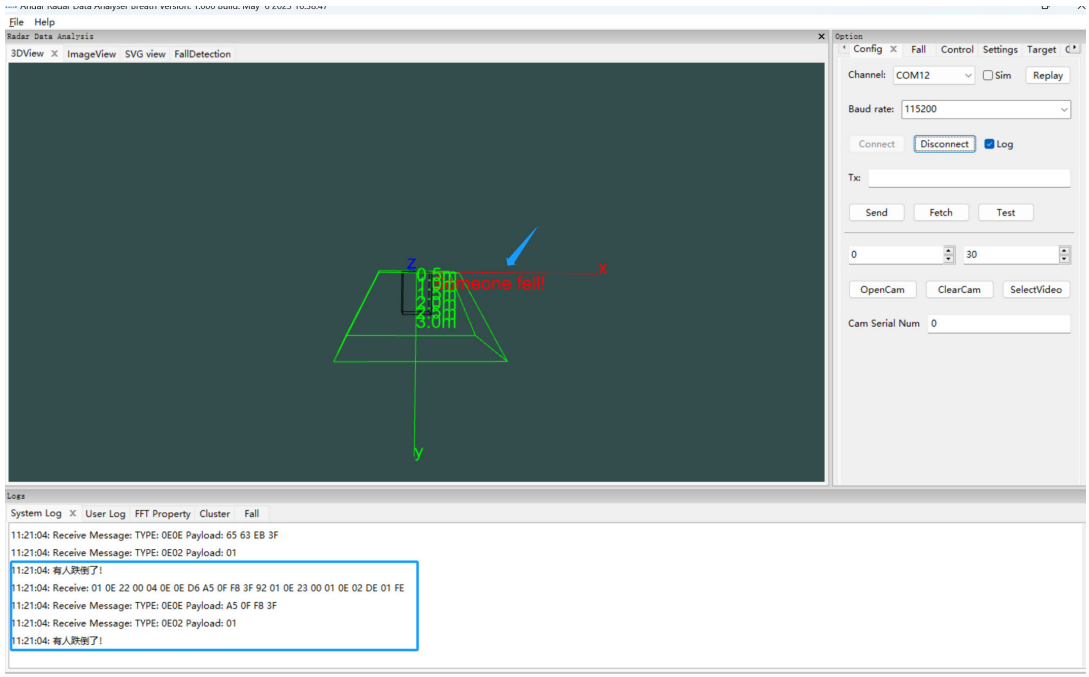


5) When it is detected that someone has fallen, the 3D View displays the words Someone fell , and the System Log window message displays "Someone fell!"



3. Parameter configuration

1) Select the [Fall] button in the Option window to enter the parameter configuration interface as shown below

2) [Mounting Height]: Set according to the actual installation height

3) [Fall Threshold]: Fall height threshold setting. Currently, fall determination is based on the height of the point cloud from the ground. Can be modified and debugged according to usage scenarios

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4) [Fall Sensitivity]: Sensitivity setting, currently not recommended to modify

5) [DetectRectXL]: Detect the left boundary of the area

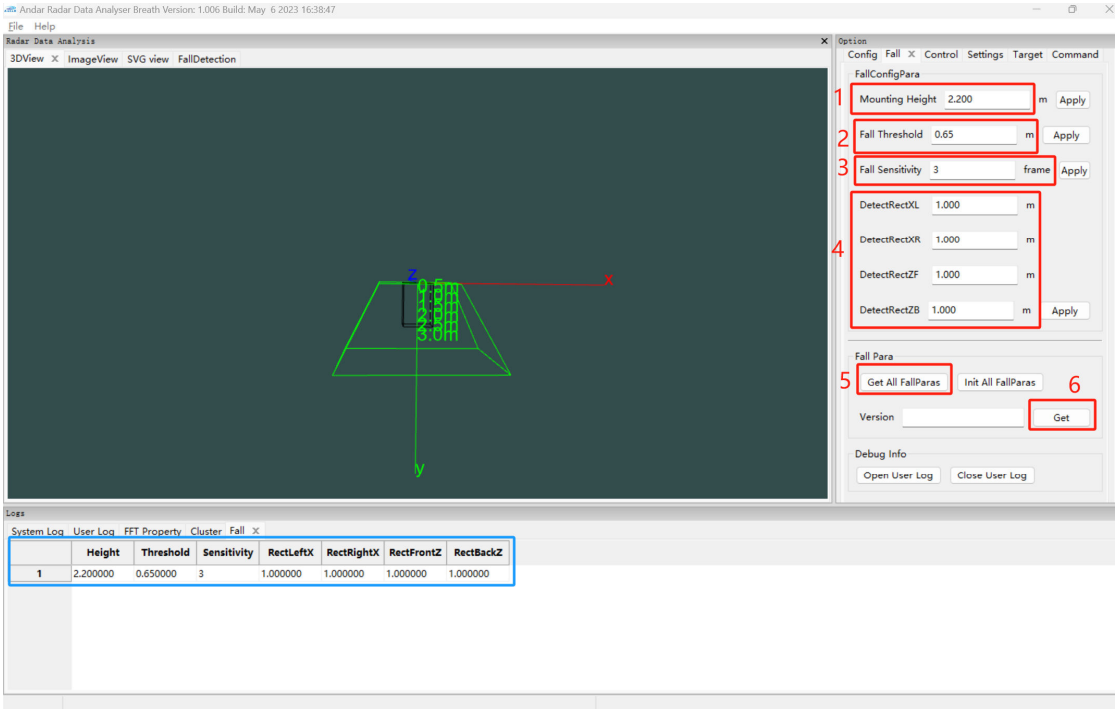
6) [DetectRectXR]: Detect the right boundary of the area

7) [DetectRectZF]: detect the front boundary of the area

8) [DetectRectZB]: Detection area rear boundary

9) After filling in the parameters that need to be set for each configuration item, you need to click the corresponding [Apply] button at the back to complete the configuration. Confirm whether the corresponding parameters in the [Fall] window in the lower left corner are the set parameters.

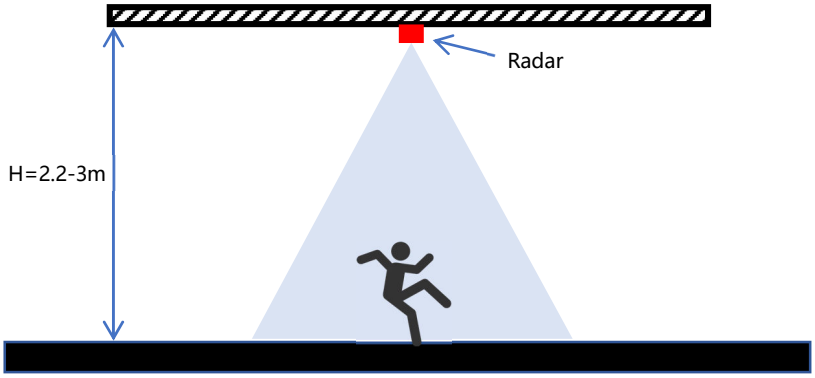
10) 【Get All FallParas】Read the parameters set in the module



11) Click the [Get] button in the Version window to obtain the current software version number.

6.4 Installation method and sensing range

Top-mounted hanging height 2.2-3.0m, maximum sensing radius 2m



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Top installation diagram

7. Precautions

1. The detection range of the radar module is closely related to the target RCS and environmental factors. The effective detection range may change as the environment and target change. Therefore, it is normal for the effective detection range to fluctuate within a certain range.

2. The radar module has extremely high power requirements, requiring an input voltage of 3.1~3.5V, power supply ripple ≤50mV, and current ≥1A. If a DCDC power supply is used, the switching frequency is required to be no less than 2MHZ.

3. This product is only suitable for use in bathrooms, small bathroom areas, and single-person situations.

4. The product needs to be combined with the application scenario to eliminate interfering actions.

8.Radar radome design

Radomes are used to protect radar antennas from external environmental influences such as rain, sunlight, wind, etc. However, it has the following effects on the radar antenna: the dielectric loss and reflection loss caused by the radome will reduce the effective power of the radar; it will cause the antenna beam to be distorted, causing the radar's area of action to change; the reflection of electromagnetic waves by the shell will cause the radar transmitting and receiving antenna to The isolation becomes worse and may cause receiver saturation; the phase of electromagnetic waves changes when they pass through the radar radome, affecting the angle measurement. Therefore, it is very necessary to design the radar radome to reduce the impact of the shell and improve the radar performance.

Design requirements:

1. When selecting the material of the radome, under the premise of ensuring the sturdiness and low cost, materials with smaller dielectric constant and loss tangent should be selected to reduce the impact of the radome on radar performance.

The dielectric constant and dissipation factor of commonly used materials are as follows:

Material	Dielectric constant (ε_r)	Dissipation factor (tan δ)
polycarbonate	2.9	0.012
ABS	2.0-3.5	0.0050-0.019
PEEK	3.2	0.0048

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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 radome is required to have a smooth surface and uniform thickness.

3. Radar radome thickness design requirements

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

T: radome thickness

c: speed of light , 3×10^8 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 housing

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

c: speed of light , 3×10^8 m/s;

f: center frequency

f=60GHz

c/2f=2.5mm

Revision History

Revison	Release Date	Description
V1.0	2024/03/05	Beta version

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