Fall Detection Module HLK-LD6002C

User Manual

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CONTENTS

1. Product profile

HLK-LD6002C is a radar induction module developed based on ADT6101P chip, with a single-chip integrated 57-64GHz RF transceiver system, 2T2R PCB microstrip antenna, 1MB flash, radar signal processing unit, ARM ® Cortex ®- M3 kernel. This module is based on the FMCW signal processing mechanism, combined with radar signal processing algorithms, to achieve the perception of personnel status in specific places and timely report the fall status. Suitable for ceiling installation, single person scenarios in small areas of bathrooms and bathrooms.

2. Product characteristics

- Radar detection based on FMCW frequency modulated continuous wave signal
- Large detection angle, supporting horizontal ± 60 ° and elevation ± 60 ° detection
- Implement personnel fall detection function
- Universal UART interface, providing communication protocol
- Support UART parameter adjustment to meet different scenario requirements
- Compact in size, only 25 * 23mm, supports pin insertion
- Not affected by temperature, humidity, noise, airflow, dust, light and other environmental factors

3. Application scenarios

- ✧ Health care and care (bathroom, bathroom)
- ✧ Home security
- ✧ Smart home scenario application

4. Electrical characteristics and parameters

4.1 Functional parameters

Parameter content	Min	Typical	Max	unit
Fall monitoring detection radius			2	m
Fall recognition accuracy		90		%

4.2 Electrical characteristics

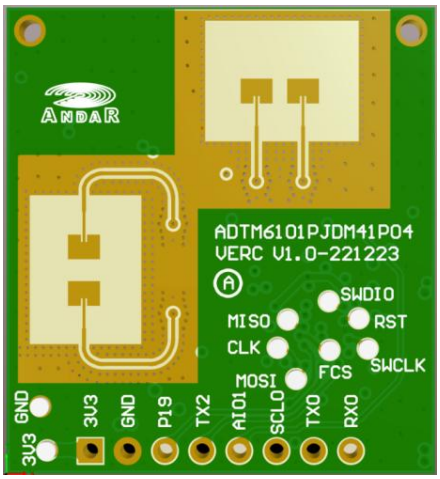
Operational parameter	Min	Typical	Max	unit
Operating voltage (VCC)	3.1	3.3	3.5	V
Operating current (ICC)			600	mA
Operating temperature (TOP)	-20		85	℃
Storage temperature (TST)	-40		85	℃

4.3 RF characteristics

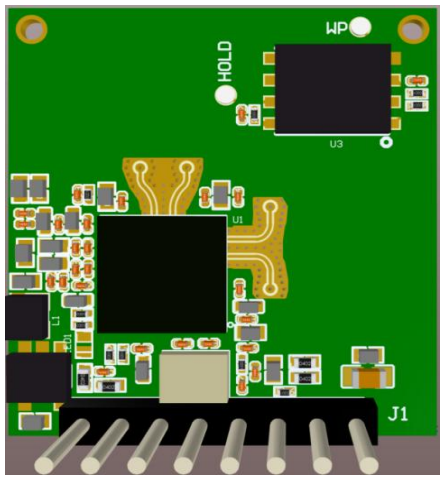
Operational parameter	Min	Typical	Max	unit
Operating Frequency	58		62	GHz
Emission Power (Pout)		12		dBm
Antenna gain		4		dBi
Horizontal beam (-3dB)	-60		60	°
Vertical beam (-3dB)	-60		60	°

5.Hardware description

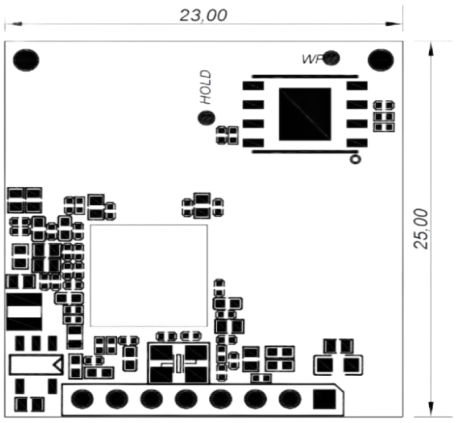
5.1 Overall dimensions

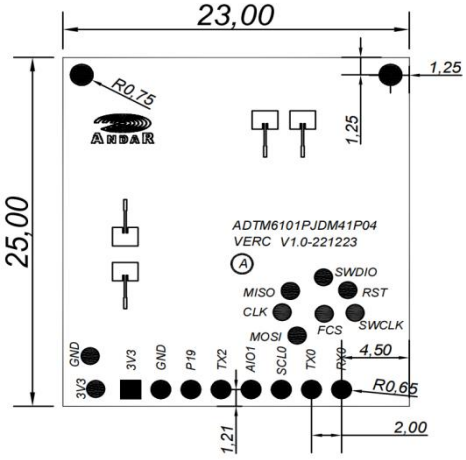


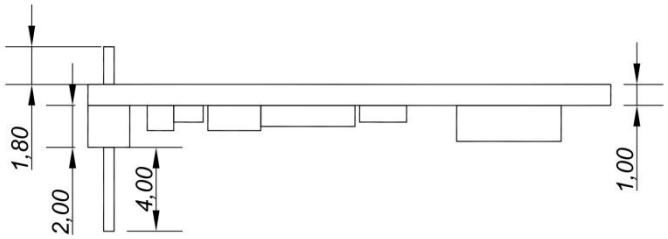
TOP View



Bottom View



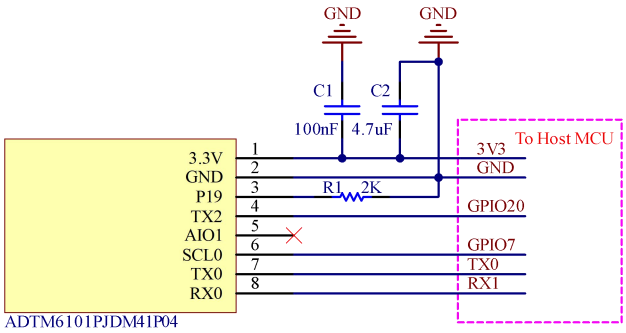




5.2 Pin definition

Pin order number	Pin name	Description	Remarks
1	3V3	POWER INPUT 3.3V	
2	GND	GND	
3	P19	GPIO19	Boot1
4	TX2	GPIO20	
5	AIO1	Analog IO	
6	SCL0	GPIO07	
7	TX0	Connected to external serial port TX	
8	RX0	Connected to external serial port RX	

5.3 module peripheral reference design



5.4 Boot configuration

	BOOT1	BOOT0	remarks
Configuration level	0	1	Flash starts within the module
Pip foot position number	Pin8	Pin12	

* BOOT 1, BOOT 0 module internal are pulled up. The BOOT 1 must be connected to a low level before the module starts

6. Usage and Configuration

6.1 Typical application circuit

The LD6002C module can directly use the TX2 pin to output detected target information (high level for falling output, low level for unmanned falling), while UART0 outputs detection results according to the specified protocol. The serial port data contains target falling information, and users can flexibly use it according to specific application scenarios.

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

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

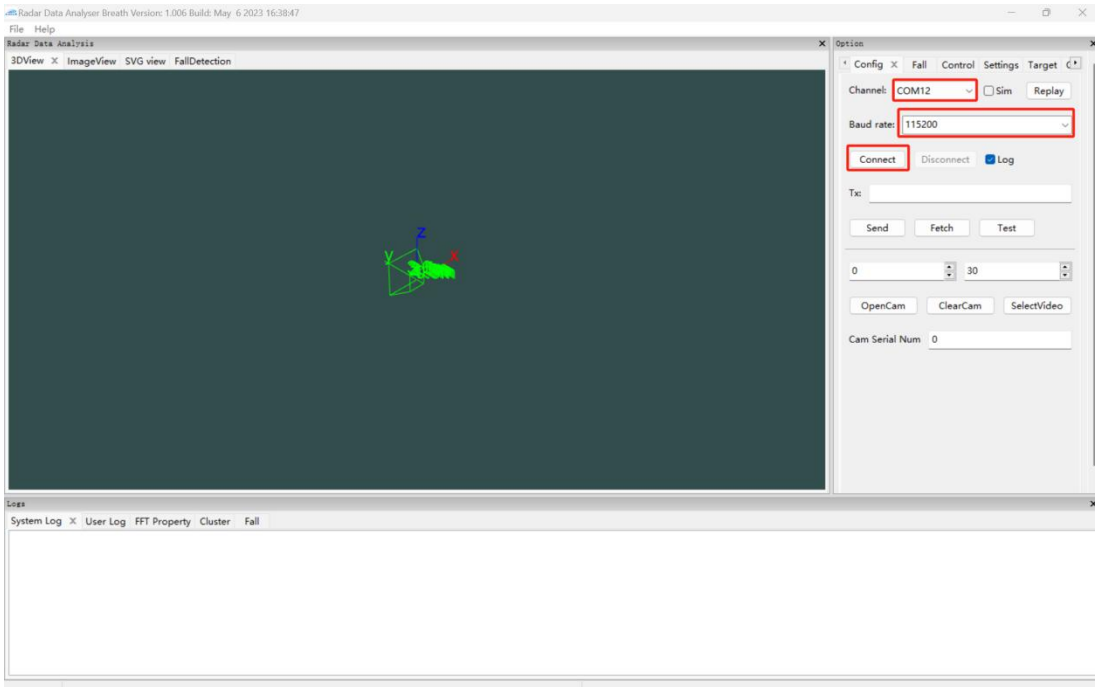
6.2 GUI visualization tool application

1. device connection

1) Select the connected serial port

2) Set the Baud rate to 115200

3) Click the [Connect] button, and the module will start to detect



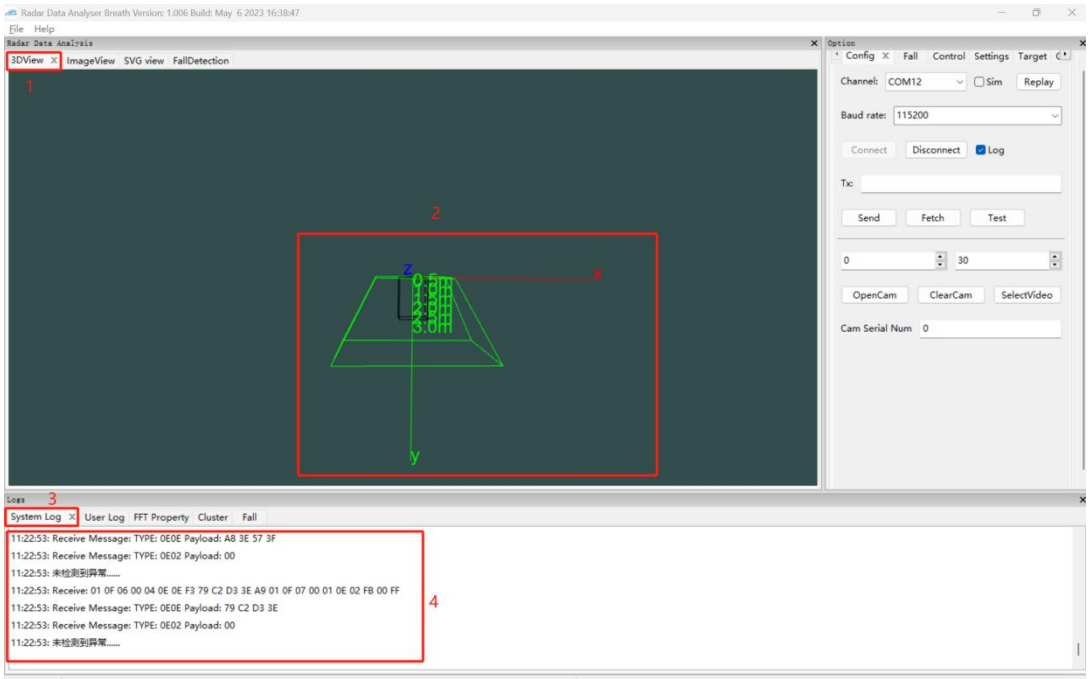
2. Date examining

1) Select the 3D view window

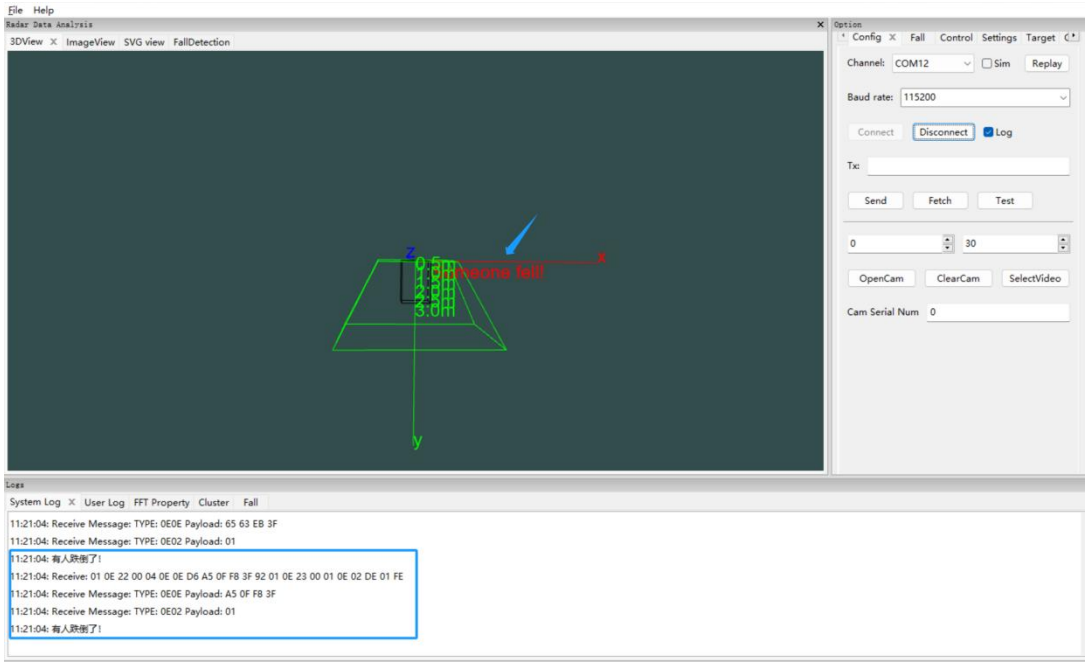
2) Drag and zoom the view in the image to the appropriate size with the mouse

3) View the System Log window below

4) Check the message information, no falls detected, no abnormalities detected



4) When someone falls, the 3D view displays the word "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 in the following figure

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

3) [Fall Threshold]: The threshold setting for falling height is currently based on the distance from the point cloud to the ground for falling detection. Can be modified and debugged according to usage scenarios

4) [Fall Sensitivity]: Sensitivity setting, currently not recommended for modification

5) DetectRectXL: Left boundary of detection area

6) DetectRectXR: Detect the right boundary of the detection area

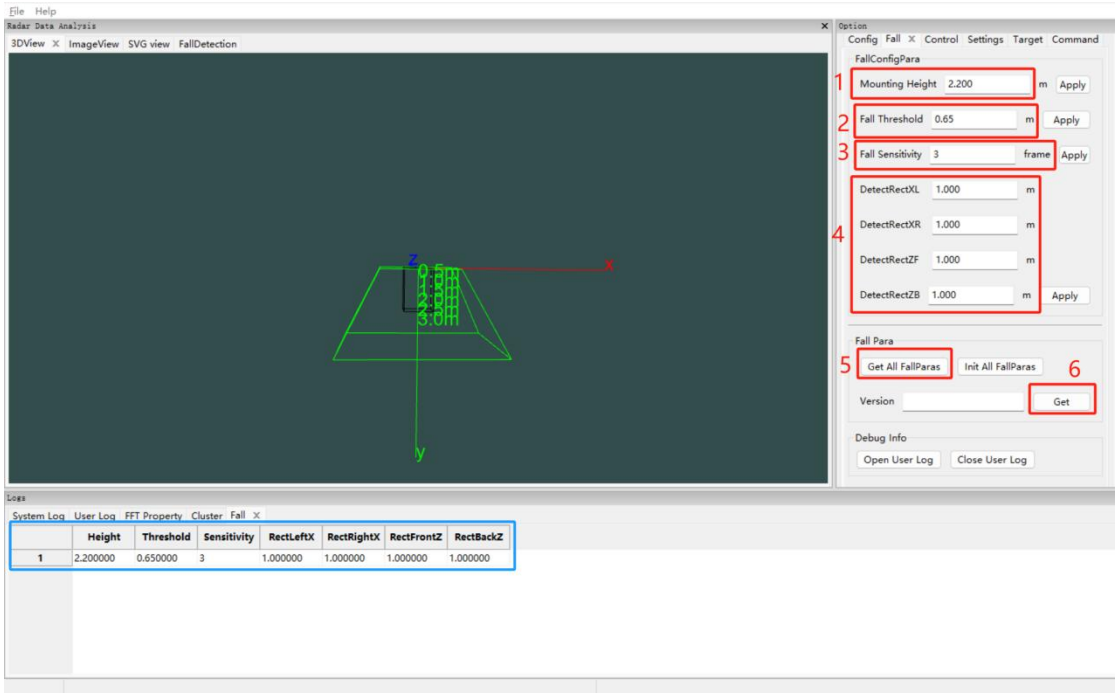
7) DetectRectZF: Detect the front boundary of the detection area

8) DetectRectZB: Detect the back boundary of the detection area

9) After filling in the required parameters for each configuration item, you need to click the corresponding 【 Apply 】 button to complete the configuration. Confirm whether the corresponding parameters in the [Fall] window in the bottom left corner are the set parameters.

10) [Get All FallParas] Read the parameters set within the module

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

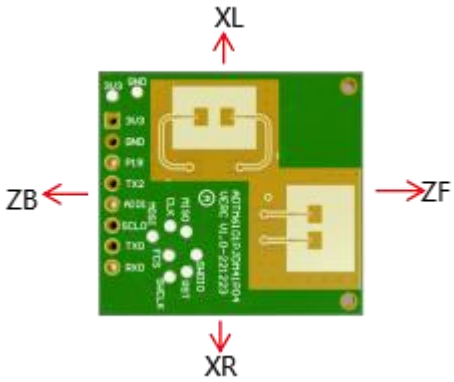


6.3 OTA Upgrade

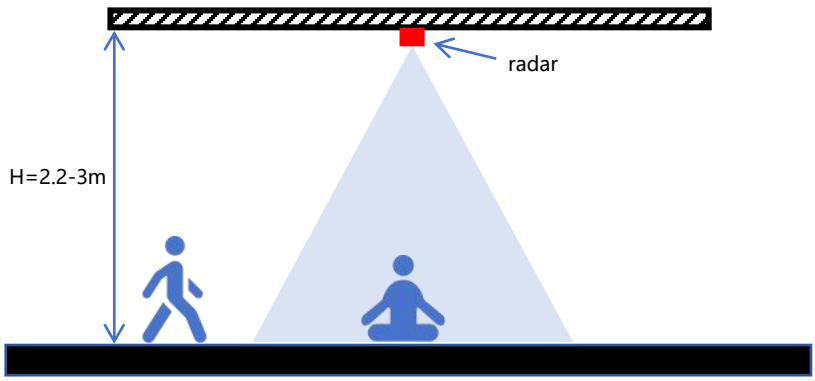
Please refer to the document "OTA Upgrade Tool User Manual V1.0"

6.4 Installation method and sensing range

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



Installation direction annotation



Schematic diagram of top installation

7. Precautions

1. The detection distance of the radar module is closely related to the target RCS and environmental factors, and the effective detection distance may vary with changes in the environment and target. Therefore, it is normal for the effective detection distance 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 ripple ≤ 50mV, and current ≥ 1A. If using a DCDC power supply, the switching frequency is required to be no less than 2MHz.

3. This product is only suitable for small area scenarios in bathrooms and bathrooms, and single person situations.

4. The product needs to be combined with application scenarios to eliminate interference actions.

8. Radome design

The radome is used to protect the radar antenna from rain, external environment, and wind. However, it has the following effects on the radar antenna: the dielectric loss and reflection loss caused by the antenna cover will reduce the effective power of the antenna; cause the distortion of the antenna beam, which affects the measurement of the Angle. Therefore, it is very necessary to design the radome to reduce the impact of the shell and improve the radar performance.

design requirement:

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

Dielectric constant and dissipation factor of common materials are shown below:

material	dielectric constant () ε_r	Disguetion factor (tan δ)
Merlon	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
pottery and porcelain	9.8	0.0005
PE	2.3	0.0003
PBT	2.9-4.0	0.002

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

3. Radome antenna thickness design requirements

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

T: Radome thickness

c: light speed, 3×10^8 m/s;

f: Center frequency

ε_r : Material permittivity, DK

4. Design requirements of radar antenna from the inner surface of the enclosure

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

c: light speed, 3×10^{8} m/s;
f: center frequency
f=60GHz
c/2f=2.5mm

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