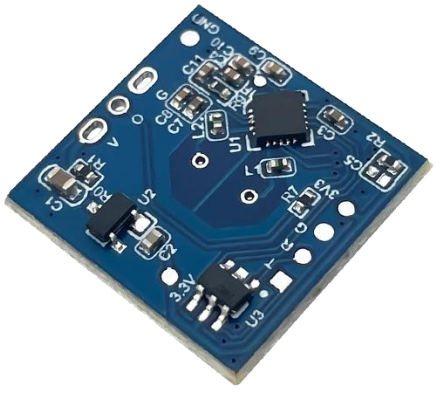
Shenzhen Hi-Link Electronic Co., Ltd.

HLK-LD021

Data Sheet



Version：V1.1 Revised date：2025-1-13

Content

1.Product Introduction

HLK-LD021 is a motion sensing module designed based on an X-band radar chip, with a center frequency of 5.8GHz. This module is designed with fixed frequency, directional transmitting and receiving antennas (1T1R), integrating functions such as intermediate frequency demodulation, signal amplification, and digital processing. It has the ability to set delay, adjust sensing range, and detect light intensity. This product has the advantages of not penetrating walls, anti-interference, small size, good suppression of clutter and high-order harmonics, high stability and consistency. The module initialization time is short, and it also has a fast inspection mode. It is easy to install and test in lighting fixtures, which can effectively accelerate production testing. This module is mainly aimed at low-cost application fields.

This product is suitable for embedded concealed installation and is not affected by temperature/humidity, oil fume, water mist, etc. It can be widely used in various types of lamps, such as fluorescent lamps, bulb lamps, tube lamps, ceiling lamps, etc;

2.Functional characteristics

●Based on the principle of Doppler radar

●This product is positioned as an application in motion perception scenarios

●Sensing distance: hanging height of 4-5m (sensing radius), wall mounted of 10-12 meters (radial)

●Ceiling mounted, 3dB beamwidth: 110 °± 10 °

●Equipped with fast inspection mode

●Capable of photosensitive detection (optional)

3.Application scenarios

Smart lighting: home, office, lighting, pet supplies, etc.

4.Product specifications

TA=25℃

Table 1 Input Parameters

Symbol	Parameter	Test conditions	Min	typical value	Max	Unit
VCC	Work Voltage	DC power supply	5		12	V
I	Operat current	VCC=5~12V	70	75	80	uA

Table 2 Output Parameters

Symbol	Parameter	Test conditions	Min	typical value	Max	Unit
fOSC	Microwave frequency	VCC=5~12V		5.8		GHz
Vout	Output voltage		3.2	3.3	3.4	V
Tw	Power on stability time			5	7	s

Table 3 Temperature and Humidity Range

Symbol	Parameter	Test conditions	Min	typical value	Max	Unit
T_A	Operating Temperature		-20		+70	℃
T_B	Storage temperature		-40		+85	℃
H_A	Operating Humidity		10		95	%
H_B	Storage humidity		0		95	%

Table 4 Perception Range

Symbol	Parameter	Test conditions	Min	typical value	Max	Unit
	sense distance	Hanging height 3m	3	4	5	m
Td	delay time			5		s
Ts	Lockdown time			2		s

Table 5 ESD Characteristics

Symbol	Parameter	Test conditions	Min	typical value	Max	Unit
	contact discharge			2		kV
	air discharge			2		kV

- The delay time is the time it takes to maintain this state after triggering, with a default value of 5 seconds;
- The blocking time refers to the time it takes for the output state to flip and trigger a non response again, with a default value of 2 seconds;
- Startup initialization: After the module's O port outputs a high voltage for 4 seconds, turn off the light and start normal detection mode 3 seconds later;

Perception range area

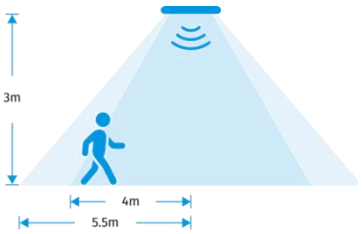


Figure 1 Perception Diagram

Figure 2 Schematic diagram of perception range

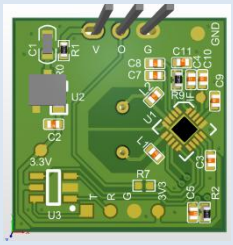
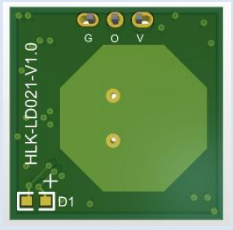
●The test results may vary depending on the testing environment or exercise objectives;

●The metal casing will have a shielding effect on radar electromagnetic waves, affecting the perception distance;

●The above test results were obtained from standard testing sites. For specific testing environments and conditions, please consult relevant technical personnel.

5.Pin configuration and functional description

Table 6 Pin Configuration and Function Description

Part	Port	Instructions	schematic diagram
P1	V	DC 5-12V	
	O	TTL high and low level output	
	G	power ground	
P2	Program download port 3V3 G R T RST		

6.Precautions for the design of supporting drive power supply

●It is necessary to use a driving power supply that meets the standards for output voltage, current, and ripple coefficient. Unstable driving power supply and strong electromagnetic radiation can cause radar module false alarms, lack of perception, and self starting cycles;

●The supporting driving power supply should be between 5-12V, the peak to peak driving current should not be less than 5mA, the ripple amplitude of the power supply should be controlled within

50mV, and the power frequency fluctuation amplitude should be small;

●When assembling the driving power supply and radar module, the bottom or antenna surface of the radar module should be avoided, facing directly towards the driving power supply module, and should be kept as far away as possible from components with high power frequency interference such as rectifier bridges and switching transformers inside the driving power supply module to prevent interference with microwave signals;

7.Precautions for Testing and Using Radar Modules

●When there are walls or obstacles reflecting microwaves around, there will be gains in perception distance and perception angle; In open surroundings, there will be a decrease in perceived distance and angle;

●Due to the fact that even small changes can alter the detection of microwave antennas, please protect the antenna and ensure that there are no metal objects (such as solder wires) on the surface to avoid affecting the sensing distance;

●Handle with care, avoid intense vibrations, and keep the radar module flat and not deformed; Light sensing devices should be unobstructed and covered, especially around the photosensitive element D1 on the radar module, and opaque obstructions should be avoided;

●The radar module maintains independent usage space, with a free space interval of at least 2mm around the perimeter;

●After power on, there is approximately 7 seconds for initializing noise analysis, during which it is considered abnormal sensing work;

●If there is obstruction on the photosensitive device of the radar module (such as the housing), it is necessary to retest to determine the photosensitive threshold value;

●During production line testing and aging operations, if a large number of radar modules are stacked together when powered on, self excitation may occur. Please ensure that a safe distance of at least 50cm is maintained between the powered radar modules.

8.Precautions for installation of devices with built-in radar modules

●Devices equipped with radar modules should be installed away from areas with strong vibrations such as ventilation ducts, fire pipes, drainage pipes, mechanical vibrations, or large metal equipment, as it can affect radar reflection waves and detection perception effects;

●Live working is strictly prohibited to avoid operational errors, misconnections, circuit damage, or electric shock;

●Avoid installation in places exposed to sunlight and rain to prevent damage and affect service life;

●The device must be installed in a place far away from electromagnetic fields to avoid electromagnetic interference and misoperation; It should also be installed in a place far away from fixed rotating or swinging objects (such as electric fans, swaying leaves, drying clothes in the wind, etc.) to avoid misoperation;

●When installing several components with built-in radar modules, it should be ensured that the distance between each component is ≥ 0.5m;

●The antenna surface of the radar microwave module is recommended to be 3-5mm away from the product casing, otherwise it will affect the sensing distance;

Figure 3 Distance between antenna surface and product casing

●After the device is equipped with a built-in radar module, it is recommended to place it horizontally or vertically. Within the effective sensing range, try to avoid installing two or more devices with built-in radar modules face-to-face;

●Avoid other lighting sources (such as emergency lights, directional lights, etc.) near devices with built-in radar modules (such as lighting fixtures), in order to avoid causing the built-in photosensitive judgment of the device (lighting fixture) to fail, resulting in the device (lighting fixture) not working properly (normally off, misjudged as daytime);

●If a device with a built-in radar module (such as a light fixture) keeps working (constantly on) and cannot be turned on or off based on moving target detection, it may be due to intermediate frequency interference on the radar module, causing the module to constantly determine that there is a moving target moving within its sensing range. At this point, the power should be turned off to check if the power supply status of the power board is normal and if the module's spatial distance has changed;

●If the above problems cannot be solved, please turn off the power first and observe the surrounding situation of the installation location to eliminate the influence of environmental interference factors; If the problem persists after restarting the power supply, consider replacing the device's driver power board or re verifying the radar module.

9.Size information

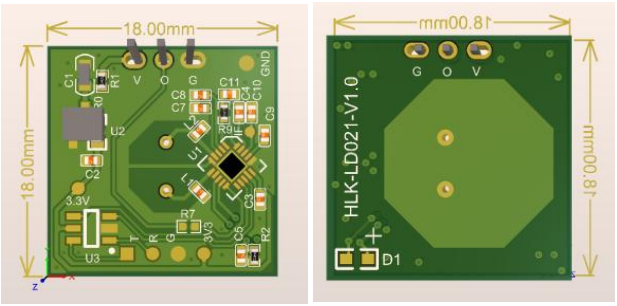


Figure 4 Reference dimensions (18mm * 18mm * 3mm)

The size unit is mm, and the P1 part has V, O, and G interface sequence. The hole spacing is compatible with 2mm and 2.54mm, and the aperture is 0.85mm.

Appendix A Document Revision Record

version number	Revision scope	Date	Reviser
V1.0	New design	2024-09-11	
V1.1	Modify pin definition	2025-01-13	Guan Zhenghua