



Datasheet

Radar sensor module HLK-LD1041

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Production

HLK-LD1041 is a motion sensing module designed based on X-band radar chip with a center frequency of 10.525GHz. The module is designed with fixed frequency, directional transmitting and receiving antennas (1T1R), integrating intermediate frequency demodulation, signal amplification and digital processing, and has the ability to set delays, adjustable sensing range and light intensity detection. 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 has a short initialization time and a quick inspection mode. It is easy to install in the lamp for testing, which can effectively accelerate production testing. This module is mainly aimed at low-cost applications.

This product is suitable for embedded concealed installation, is not affected by temperature/humidity, oil smoke, water mist, etc., and can be widely used in various lamps, such as bulbs, down-lights, ceiling lamps, etc..

Features

Based on the principle of Doppler radar,	Ceiling installation, 3dB beam width: $110^{\circ}\pm 10^{\circ}$
This product is positioned for motion sensing scene applications.	With quick detection mode
Sensing distance: hanging height 3-4m (sensing radius), wall hanging 8-10 meters (radial)	With photo-sensitivity detection capability (optional)

Application

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

Parameters

TA=25°C

Table 1 Input parameter

No.	Parameters	Testing condition	Min	Typ	Max	Unit
VCC	Working voltage	Dc power	5		12	V
I	Working current	VCC=5~12V	48	50	53	uA

Table 2 Output parameter

No.	Parameters	Testing condition	Min	Typ	Max	Unit
fOSC	Microwave frequency	VCC=5~12V		10.525		GHz
Vout	Output voltage		3.2	3.3	3.4	V
Tw	Power-on stabilization time			7	9	s

Table 3 Temperature and humidity range

No.	Parameters	Testing condition	Min	Typ	Max	Unit
TA	Working temperature		-20		+70	°C
TB	Storage temperature		-40		+85	°C
HA	Working humidity		10		95	%
HB	Storage humidity		0		95	%

Table 4 Perception range

No.	Parameters	Testing condition	Min	Typ	Max	Unit
	Sensing distance	Hanging height 3m	2	3	4	m
Td	Delay time			5		s
Ts	Block time			2		s

Table 5 ESD feature

No.	Parameters	Testing condition	Min	Typ	Max	Unit
	Contact discharge			2		kV
	Air discharge			2		kV

- The delay time is the time to maintain the state after triggering, and the default value is 5s;
- The blocking time refers to the time that the output state is flipped and the output state is not triggered again. The default value is 2s.
- There are two types of boot initialization with different software configurations:
 - Description of initialization status without quick detection mode: After the module is powered on, the O port outputs high for 1s, then remains low, and after 7s, it starts the normal detection mode.
 - Description of initialization status with quick detection mode: After the module is powered on, the O port outputs high (1s) and low (0.5s) levels 3 times, and after another 5s, it enters the sensing mode. The first sensing is the quick detection mode test (the sensing delay is fixed at 3s), and then it enters the normal detection mode.

Sensing range area

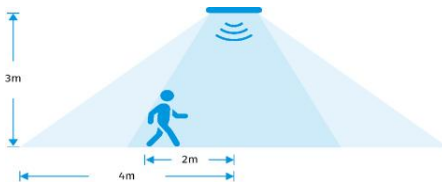


Figure 2 Perception diagram



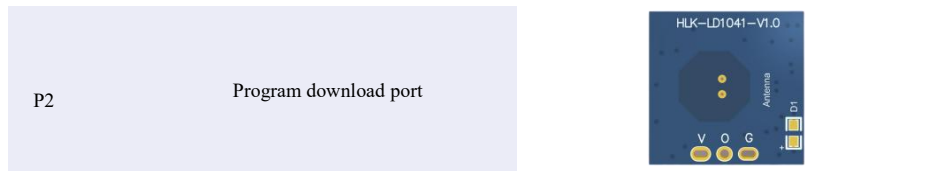
Figure 3 Sensing range diagram

- The test results may vary in different test environments or sports targets;
- The metal shell will shield the radar electromagnetic waves and affect the sensing distance;
- The above test results are obtained by testing in a standard test site. For specific test environment and conditions, please consult relevant technical personnel.

Pin configuration and function description

Table 6 Pin configuration and function description

Part	Connector	Description	Diagram
P1	V	DC 5-12V	
	O	TTL high and low level output	
	G	Power ground	



Considerations for designing the matching drive power supply

- Be sure to use a driving power supply that meets the standards for output voltage, current and ripple factor. An unstable driving power supply and strong electromagnetic radiation will cause false alarms, no perception, and self-starting of the radar module;
- The matching driving power supply should be 5~12V, the driving current should not be less than 5mA, the power supply ripple amplitude should be controlled within 100mV, and the power frequency fluctuation amplitude should be small;
- When assembling the driving power supply and radar module, avoid placing the bottom or antenna surface of the radar module directly opposite the driving power supply module, and try to keep it away from the rectifier bridge, switching transformer and other devices with large power frequency interference inside the driving power supply module to prevent interference with microwave signals.

Radar module testing and usage precautions

- When there are walls or obstacles around to reflect microwaves, the sensing distance and angle will be increased; when there is a relatively open space around, the sensing distance and angle will be attenuated;
- Since the detection of microwave antennas can be affected by even the slightest change, please protect the antennas well and avoid any metal objects (such as solder wire) on the surface to avoid affecting the sensing distance;
- Handle with care and avoid violent vibration. Keep the radar module flat and not deformed. The photosensitive device should not be blocked or covered, especially around the photosensitive element D1 on the radar module. There should be no opaque obstructions;
- The radar module maintains an independent use space, and the surrounding space maintains a free space of more than 2mm;
- After power-on, there is about 7 seconds of initial noise analysis time, during which it is not a normal sensing operation;
- If the radar module's photosensitive device is blocked (such as by a shell, etc.), retesting is required 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 there is a safe distance of more than 50 cm between powered radar modules.

Precautions for installing and using built-in radar modules

- Devices equipped with radar modules should be installed away from ventilation ducts, fire ducts, drainage ducts, mechanical vibrations, or places with strong vibration objects such as large metal equipment, as they will affect the radar reflection wave and detection perception effect;
- It is strictly forbidden to work with electricity, so as to avoid mistakes, wrong connection, circuit burnout or electric shock;
- Avoid installing in places exposed to the sun and rain to prevent damage and shorten service life;

- The device must be installed away from electromagnetic fields to avoid malfunction caused by electromagnetic interference; it must also be installed away from places where there are fixed rotating or swinging objects (such as electric fans, swaying leaves, clothes drying in the wind, etc.) to avoid malfunction;
- When several devices with built-in radar modules are fixedly installed, the distance between each device should be $\geq 0.5\text{m}$;
- It is recommended that the antenna surface of the radar microwave module be 3-5mm away from the product housing, otherwise it will affect the sensing distance;



Figure 4 Distance between antenna surface and product housing

- After the device has 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 objects (such as emergency lights, guide lights, and other interfering light sources) near devices (such as lamps) with built-in radar modules, so as to avoid failure of the built-in light-sensing judgment of the device (lamp), making the device (lamp) unable to work normally (often off, misjudged as daytime);
- If a device (such as a lamp) with a built-in radar module is always working (always on) and cannot be turned on or off according to the detection of moving targets, it may be that the radar module is interfered by the intermediate frequency, causing the module to always judge that there is a moving target in the sensing range. At this time, the power supply should be turned off, and the power supply status of the power board should be checked to see if it is normal and whether the spatial distance of the module has changed;
- If the above problems cannot be solved, please turn off the power and observe the surrounding conditions of the installation location to eliminate the influence of interference factors in the surrounding environment. If the problem still exists after restarting the power, consider replacing the device's drive power board or the radar module for re-verification.

Size information

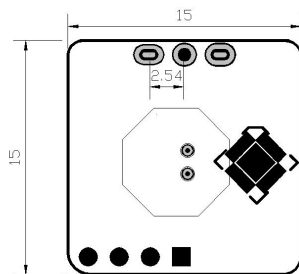


Figure 6 Dimension(15mm*15mm*3mm)

The dimension unit is mm. The P1 part has V, O, G interface order. The hole spacing is compatible with 2mm and 2.54mm. The hole diameter is 0.85mm.