

Product Specification Sheet

Radar Sensing Module HLK-LD020

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Product Overview

The HLK-LD020 is a motion sensing module designed around an X-band radar chip, with a central frequency of 5.8GHz. This module features fixed-frequency, directional transmission and reception antennas (1T1R), integrated with functions such as intermediate frequency demodulation, signal amplification, and digital processing. It includes capabilities like delay settings, adjustable sensing range, and light intensity detection.

This product offers advantages such as non-intrusive sensing, interference resistance, compact size, effective suppression of clutter and high-order harmonics, high stability, and consistency. The module has a short initialization time and a fast detection mode, making it simple to test and operate when installed in lighting fixtures, which can effectively accelerate production testing. It is primarily aimed at low-cost applications.

This product is suitable for embedded concealed installations, unaffected by temperature/humidity, oil smoke, water mist, etc., and can be widely used in various types of lighting fixtures such as fluorescent lamps, light bulbs, spotlights, and ceiling lights.

Functional Features

- Based on Doppler radar principle
- Designed for motion sensing applications
- Sensing distance: 4-5m (ceiling mount), 10-12m (wall mount)
- Ceiling mount installation, 3dB beam width: $110^{\circ}\pm 10^{\circ}$
- Features quick detection mode
- Has light intensity detection capability (optional)

Application Scenarios

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

Product Specifications

TA=25°C

Table 1 Input Parameters

Symbol	Parameter	Test Conditions	Min	Typical	Max	Unit
VCC	Operating Voltage	DC Supply	5		12	V
I	Operating Current	VCC=5~12V	1.7	1.8	1.9	mA

Table 2 Output Parameters

Symbol	Parameter	Test Conditions	Min	Typical	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	Max	Unit
TA	Operating Temperature		-20		+70	°C
TB	Storage Temperature		-40		+85	°C
HA	Operating Humidity		10		95	%
HB	Storage Humidity		0		95	%

Table 4 Sensing Range

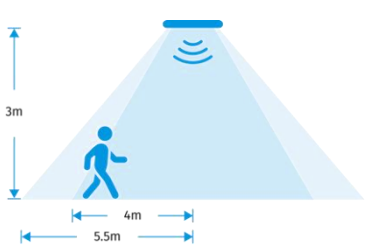
Symbol	Parameter	Test Conditions	Min	Typical	Max	Unit
	Sensing Distance	Pull up 3M	3	4	5	m
Td	Delay Time			5		s
Ts	Lockout Time			2		s

Table 5 ESD Characteristics

Symbol	Parameter	Test Conditions	Min	Typical	Max	Unit
	Contact Discharge			2		kV
	Air Discharge			2		kV

- Delay time refers to the time the state is maintained after being triggered, the default value is 5s;
- Lockout time is the time during which the output state does not respond to re-triggering after flipping, the default value is 2s;
- Power-on Initialization: The module outputs high on O port for 4s after power-on, then starts normal detection mode 3s after the light goes out.

Sensing Range Area

 Diagram 2: Sensing Indication Diagram	 Diagram 3: Sensing Range Indication Diagram	• Different test environments or motion targets may produce different test results; • Metal enclosures will shield radar electromagnetic waves, affecting the sensing distance; • The above test results were obtained in a standard test site. For specific test environments and conditions, please consult relevant technical personnel.
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Pin Configuration and Function Description

Table 6 Pin Configuration and Function Description

Section	Port	Description	Diagram
P1	V	DC 5-12V	
	O	TTL high-low level output	
	G	Power Ground	
	CDS	Light-sensitive input	
P2	Program Download Port 3V3 G R T RST		

Design Considerations for Supporting Power Supply

- Ensure that the output voltage, current, and ripple coefficient of the power supply meet the standards. Unstable power supply or strong electromagnetic radiation can cause radar module false alarms, no sensing, self-start cycles, etc.;
- The supporting power supply should be within 5~12V, with a peak-to-peak drive current of no less than 15mA, ripple amplitude controlled within 50mV, and low mains fluctuation;
- When assembling the power supply and radar module, avoid having the bottom or antenna side of the radar module facing the power supply module. Keep the radar module away from components with strong mains interference like rectifier bridges and switching transformers in the power supply module to prevent microwave signal interference;

Notes on Testing and Using Radar Modules

- In environments with walls or obstacles reflecting microwaves, the sensing distance and angle will have gains; in open environments, they will decrease;
- The microwave antenna is very sensitive to slight changes, so protect the antenna and avoid metal objects on the surface (e.g., solder wires) to prevent affecting the sensing distance;
- Handle gently, avoid violent shaking, and keep the radar module flat and undeformed; ensure no obstructions or coverings over light-sensitive components, especially around the light sensor D1 on the radar module;
- Keep the radar module in an independent use space with a free space interval of at least 2mm around it;
- There is approximately 7s of initialization noise analysis time after power-on, during which normal sensing work is not performed;
- If the light-sensitive components of the radar module are covered (e.g., by the shell), re-test to determine the light-sensitive threshold;
- During production line testing and aging operations, if a large number of radar modules are powered on and stacked together, self-oscillation may occur. Ensure a safety distance of at least 50cm between powered radar modules.

Notes on Installation of Devices with Built-in Radar Modules

- Devices with radar modules should be installed away from ventilation ducts, fire pipes, drain pipes, mechanical vibrations, or large metal equipment, as these can affect radar reflection and sensing;
- Strictly prohibit live operations to avoid misoperation, incorrect connections, circuit burnouts, or electric shocks;
- Avoid installation in places exposed to direct sunlight and rain to prevent damage and affect service life;
- Devices should be installed away from electromagnetic fields to avoid electromagnetic interference causing false operations; also install away from objects that rotate or swing (e.g., fans, swaying leaves, clothes drying in the wind) to avoid false operations;
- When multiple devices with built-in radar modules are installed, ensure a spacing of $\geq 0.5\text{m}$ between devices;
- The antenna side of the radar microwave module should be 3~5mm from the product enclosure, otherwise it will affect the sensing distance;



Diagram 4: Distance between Antenna Surface and Product Enclosure

- Devices with built-in radar modules should be placed horizontally or vertically within the effective sensing range, avoiding face-to-face installation of two or more devices;
- Avoid installing devices (e.g., lamps) with built-in radar modules near other light sources (e.g., emergency lights, guide lights) to prevent the built-in light-sensing function from failing, causing the device to malfunction (always off, mistakenly judged as daytime);
- If the device with a built-in radar module (e.g., lamp) is always on and cannot be turned on or off based on moving target detection, it may be due to medium-frequency interference causing the module to always detect a moving target within the sensing range. In this case, turn off the power, check the power board's power supply status, and whether the module space distance has changed;
- If the problem cannot be resolved, first turn off the power and observe the surrounding environment for interference factors; if the problem persists after restarting the power, consider replacing the device's power supply board or radar module for further verification.

Dimensional Information

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