Shenzhen Hi-Link Electronic Co.,Ltd

# HLK-LD1020 Data sheet

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# Contents

# 1. Product Introduction

HLK-LD1020 is a micro/motion sensing module designed based on X-band radar chip with a center frequency of 10.525GHz. The module design adopts fixed-frequency, directional transmitting and receiving antenna (1T1R), integrates the functions of intermediate frequency demodulation, signal amplification and digital processing, and has the ability of delay setting, 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 higher harmonics, high stability and consistency. The integrated algorithm inside the chip can directly output the detection results without the need for an external single-chip microcomputer. In the module pulse power supply mode, the power consumption is at the microampere level. This module is mainly aimed at low-cost, low-power applications.

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 lamps, such as bulb lamps, down lights, ceiling lamps, etc.; Doorbell, peephole, door lock, low-power camera, etc.

# 2. Features

- Based on Doppler radar principle
- The product is positioned as a micro/motion perception scene application
- Sensing distance: hanging height 2-4m (Sensing radius), wall hanging 12m (Radial)
- Ceiling installation, 3dB beam width: 110°±10°
- Capable of photosensitive detection (Optional)

# 3. Application Scenarios

- Smart lighting: home, office, hotel, campus
- Home appliances, electrical appliances, etc.

# 4. Product Specification

TA=25℃

Table 1 Input parameters

| Symbol | Parameter | Test conditions | Minimum value | Typical value | Maximum value | Unit |
|---|---|---|---|---|---|---|
| VCC | Operating voltage | DC power supply | 3.3 | | 12 | V |
| I | Operating current | VCC=3.3~12V | 0.1(Pulse power supply) | | 16(Fully powered) | mA |

Table 2 Output parameters

| Symbol | Parameter | Test conditions | Minimum value | Typical value | Maximum value | Unit |
|---|---|---|---|---|---|---|
| fOSC | Microwave frequency | VCC=3.3~12V | 10.40 | 10.525 | 10.65 | GHz |
| Vout | Output voltage | | 3.2 | 3.3 | 3.4 | V |
| Tw | Power-on stabilization time | | 13 | 15 | 17 | s |

Table 3 Temperature and Humidity Range

| Symbol | Parameter | Test conditions | Minimum value | Typical value | Maximum value | Unit |
|---|---|---|---|---|---|---|
| TA | Operating temperature | | -20 | | +70 | ℃ |
| TB | Storage temperature | | -40 | | +85 | ℃ |
| HA | Operating humidity | | 10 | | 95 | % |
| HB | Storage humidity | | 0 | | 95 | % |

Table 4 Sensing range

| Symbol | Parameter | Test conditions | Minimum value | Typical value | Maximum value | Unit |
|---|---|---|---|---|---|---|
| | Sensing distance | Hanging height 3m | 2 | | 8 | m |
| Td | Delay time | | | 5 | | s |
| Ts | Block time | | | 2 | | s |

Table 5 ESD Characteristics

| Symbol | Parameter | Test conditions | Minimum value | Typical value | Maximum value | Unit |
|---|---|---|---|---|---|---|
| | Contact discharge | | | 2 | | kV |
| | Air discharge | | | 2 | | kV |

- The maximum power consumption of normal power supply is 15mA, and the maximum power consumption of pulse power supply is 110uA (R17 does not weld pulse power supply, welding 2k normal power supply)
- Light perception can be set and adjusted according to the actual needs of customers;
- The delay time is the time to keep the state after triggering, the default value is 5s, which can be set according to the demand;
- Blockout time refers to the time when the output state is reversed and the trigger does not respond again. The default value is 2s.

## 5. The Relationship Between the External Configuration Resistance Value and the Threshold and Delay Time

| Gear | External resistor value（R14） | Sensitivity level (The smaller the value, the higher the sensitivity and the farther the distance) | Gear | External resistor value (R14) | Sensitivity level (The smaller the value, the higher the sensitivity and the farther the distance) |
|---|---|---|---|---|---|
| **1** | 18K_1% | 1 | 9 | 340K_1% | 9 |
| **2** | 56K_1% | 2 | 10 | 374K_1% | 10 |
| **3** | 93.1K_1% | 3（Front 6-8m） | 11 | 422K_1% | 11 |
| **4** | 130K_1% | 4 | 12 | 464K_1% | 12 |
| **5** | 169K_1% | 5 | 13 | 510K_1% | 13 |
| **6** | 210K_1% | 6 | 14 | 560K_1% | 14 |
| **7** | 255K_1% | 7 | 15 | 619K_1% | 15 |
| **8** | 294K_1% | 8 | 16 | 680K_1% | 16 |
| **Gear** | **External resistor value (R16)** | **Delay time** | **Gear** | **External resistor value (R16)** | **Delay time** |
| **1** | 18K_1% | 5s | 9 | 340K_1% | 180s |
| **2** | 56K_1% | 10s | 10 | 374K_1% | 240s |
| **3** | 93.1K_1% | 15s | 11 | 422K_1% | 300s |
| **4** | 130K_1% | 20s | 12 | 464K_1% | 600s |
| **5** | 169K_1% | 30s | 13 | 510K_1% | 900s |
| **6** | 210K_1% | 45s | 14 | 560K_1% | 1200s |
| **7** | 255K_1% | 60s | 15 | 619K_1% | 1800s |

| | | | | | |
|---|---|---|---|---|---|
| **8** | 294K_1% | 120s | 16 | 680K_1% | 3600s |

- Resistor R14 is the resistor to adjust the sensing threshold, the default third gear; R14: the larger the resistance value, the closer the sensing distance; (default R14=93.1K)
- R16 is the resistor to adjust the delay time, the default is the first R16: the larger the resistance value, the longer the delay time. (default R16=20K)

## 6. Perception Range Area

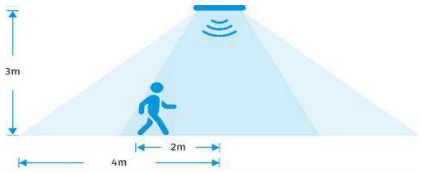



Figure 1 Schematic diagram of perception

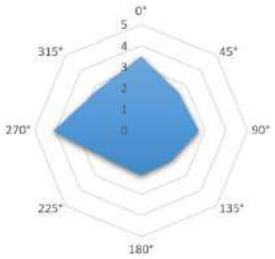
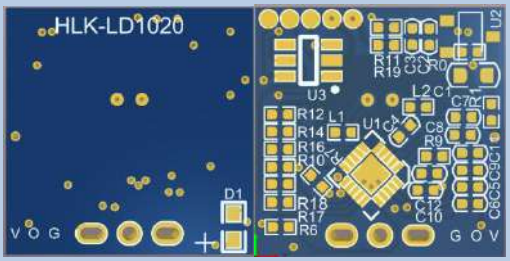



Figure 2. Schematic diagram of sensing range

- 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 from the standard test site. For specific test environments and conditions, please consult relevant technical personnel.

## 7. Pin Configuration and Function Description

Table 6 Pin configuration and function description

| Part | Port | Directions | Schematic diagram |
|---|---|---|---|
| **P1** | V | DC 3.3-12V |  |
| | O | TTL high and low level output | |
| | G | Power ground | |
| **P2**<br>**Pad** | V | DC 3.3V | |
| | GND | Power ground | |
| | IIC-EN | Download debug port | |
| | SDA | Download debug port | |
| | SCL | Download debug port | |

## 8. Supporting Drive Power Design Considerations

- Be sure to use a drive power supply that meets the standards for output voltage, current, and ripple coefficient. The drive power supply is unstable and the electromagnetic radiation is too strong, which will cause false alarms, no perception, and cycle self-starting of the radar module;
- The supporting driving power should be 3.3~12V, the driving current should not be lower than 1mA (or 100mA), the power supply ripple amplitude should be controlled within 100mV, and the power frequency fluctuation should be small;
- When assembling the drive power supply and the radar module, avoid the bottom of the radar module or the antenna surface, facing the drive power supply module, and keep away from devices with large power frequency interference such as rectifier bridges and switching transformers in the drive power supply module to prevent interfere with microwave signals

## 9. Radar Module Testing and Usage Precautions

- When there are walls or obstacles reflecting microwaves, the perception distance and perception angle will gain; in the case of relatively open surroundings, the perception distance and angle will be attenuated;
- Because the microwave antenna can change the detection by a small change, please protect the antenna, and there should be no metal objects (such as solder wire) on the surface, so as not to affect the sensing distance;
- Handle with care, avoid violent vibrations, 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 interval of more than 2mm;
- There is an initial noise analysis time of about 15s after power-on, which is abnormal sensing work during this period;
- If the photosensitive device of the radar module is covered (such as the casing, etc.), it is necessary to re-test to determine the photosensitive threshold;
- During production line testing and burn-in 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 more than 50cm is maintained between powered-on radar modules.

## 10. Installation Precautions for Device Applications with Built-in Radar Modules

- For devices equipped with radar modules, the installation location should be far away from ventilation pipes, fire pipes, drainage pipes, mechanical vibrations, or places with strong vibration objects such as large metal equipment, because it will affect radar reflection waves and detection and perception effects;
- Live working is strictly prohibited to avoid wrong action, wrong connection, burning circuit or electric shock;
- Avoid installing in places exposed to the sun and rain to prevent damage and affect service

life;

- The device must be installed away from the electromagnetic field to avoid malfunction caused by electromagnetic interference; it must also be installed away from objects that rotate or swing (such as electric fans, swinging leaves, drying clothes in the wind, etc.) to avoid malfunction produce;
- When several devices with built-in radar modules are fixed and installed, the distance between each device should be ≥0.5m;
- The antenna surface of the radar microwave module is recommended to be 3~5mm away from the product shell, otherwise it will affect the sensing distance;


Figure 3 The distance between the antenna surface and the product shell

• 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, etc. interfering light sources) near devices with built-in radar modules (such as lamps), so as not to cause the built-in photosensitive judgment of the device (lamp) to fail, so that the device (lamp) cannot work normally ( always off, mistakenly judged as daytime);

• If the device (such as a lamp) with a built-in radar module is always working (steady on), and cannot be turned on or off according to the moving target detection, 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 Operate within the range of perception. At this time, the power should be turned off, and check whether the power supply status of the power board is normal and whether the distance between the modules has changed;

• If the above problems cannot be solved, please cut off the power first and observe the surrounding conditions of the installation location, and first eliminate the influence of the surrounding environmental interference factors; if the problem persists after restarting the power supply, consider replacing the drive power board of the device, or verify the radar module .

## 11. Sensing Direction & Light Sensing Device

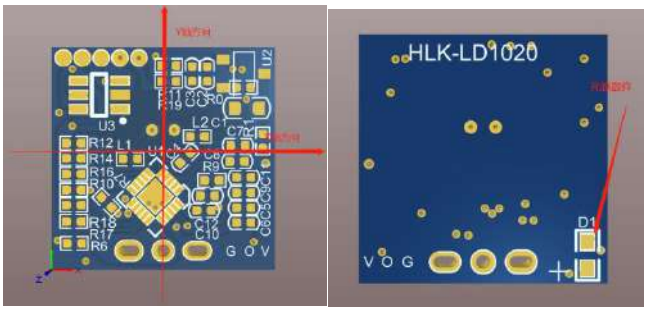



Figure 4 Sensing direction and light sensor

## 12. Size Information

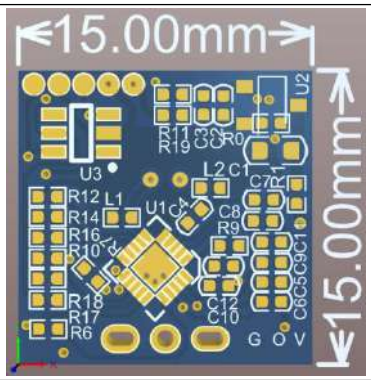



Figure 5 Reference Dimensions
(15mm*15mm*2mm)

Dimension unit: mm，
V、O、G interface sequence，
Hole spacing is 2.54mm，
Aperture is 0.85mm。

## 13. History revision record

| Version | Scope of revision | Date |
|---|---|---|
| V1.0 | Initial version | 2022-12-13 |