



# **INFRARED PARTS MANUAL**

**PIR325  
FL65**

**GLOLAB  
CORPORATION**

Thank you for buying our Pyroelectric Infrared components.

The goal of Glolab is to produce top quality electronic kits, products and components. All of our kits are designed by Glolab engineers and tested in our laboratory. Mechanical devices, prototypes and enclosures are fabricated in our precision machine shop.

Glolab Corporation has two locations in New York's Hudson Valley. Our electronics laboratory and kit packaging is located in Wappingers Falls and our machine shop is in Lagrangeville.

In addition to our kits, we supply some special and hard to find parts such as our Pyroelectric Infrared Sensor, Infrared Fresnel lens and machined enclosure for mounting our Fresnel lens. for those of you who want to design and build your own projects.

Technical help is available by email from [lab@glolab.com](mailto:lab@glolab.com).

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## ***Infrared Radiation***\_\_\_\_\_

Infrared radiation exists in the electromagnetic spectrum at a wavelength that is longer than visible light. Infrared radiation cannot be seen but it can be detected. Objects that generate heat also generate infrared radiation and those objects include animals and the human body whose radiation is strongest at a wavelength of 9.4 $\mu$ m.

## ***Pyroelectric Sensors***\_\_\_\_\_

The pyroelectric sensor is made of a crystalline material that generates a surface electric charge when exposed to heat in the form of infrared radiation. When the amount of radiation striking the crystal changes, the amount of charge also changes and can then be measured with a sensitive FET device built into the sensor. The sensor elements are sensitive to radiation over a wide range so a filter window is added to the TO5 package to limit incoming radiation to the 8 to 14 $\mu$ m range which is most sensitive to human body radiation.

Figure 1 shows how typically, the FET source terminal pin 2 connects through a pulldown resistor of about 100 K to ground and feeds into a two stage amplifier having signal conditioning circuits. Each of the two cascaded stages has a gain of 100 for a total gain of about 10,000. The amplifier is typically bandwidth limited to below 10Hz to reject high frequency noise and is followed by a window comparator that responds to both the positive and negative transitions of the sensor output signal. A well filtered power source of from 3 to 15 volts should be connected to the FET drain terminal pin 1.

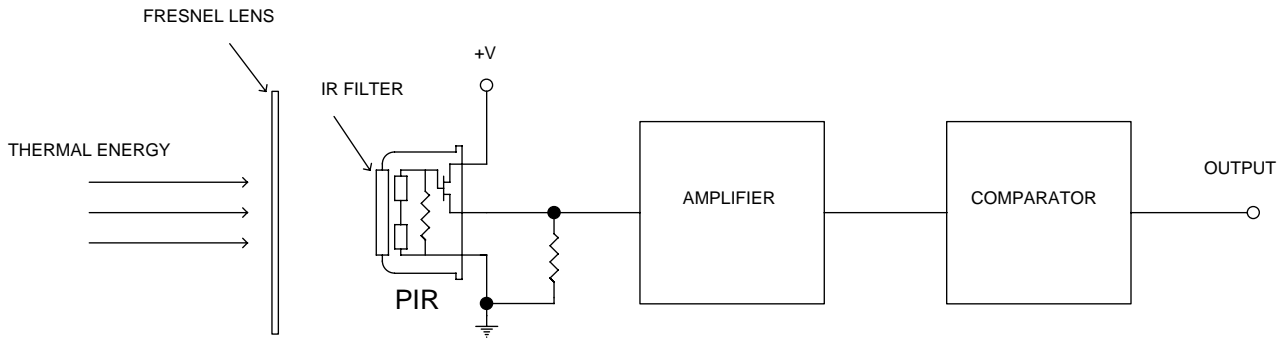
The PIR325 sensor has two sensing elements connected in a voltage bucking configuration. This arrangement cancels signals caused by vibration, temperature changes and sunlight. A body passing in front of the sensor will activate first one and then the other element as shown in figure 2 whereas other sources will affect both elements simultaneously and be cancelled. The radiation source must pass across the sensor in a horizontal direction when sensor pins 1 and 2 are on a horizontal plane so that the elements are sequentially exposed to the IR source.

Figure 3 shows the PIR325 electrical specifications and layout in its TO5 package. Please note that the distance from the front of the sensing elements to the front of the filter window is 0.045 inch (1.143mm). Figures 4 and 5 describe a Fresnel lens designed to be used with the PIR325 sensor.

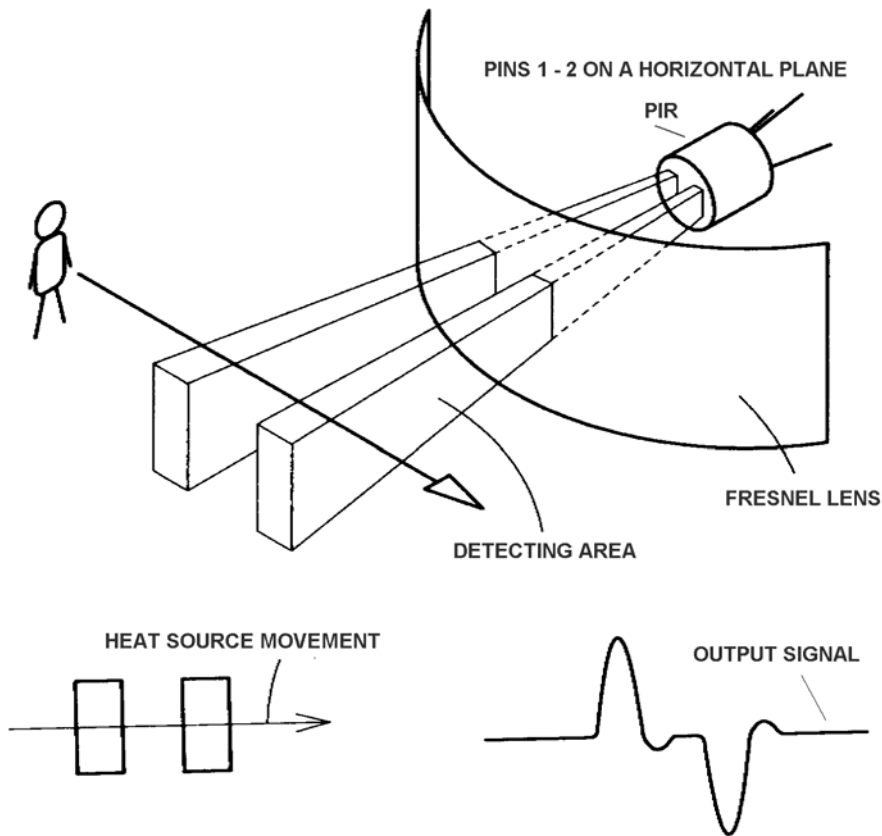
Figure 6 shows a typical application circuit that drives a relay. R10 and C6 adjust the amount of time that RY1 remains closed after motion is detected. When used with a PIR325 sensor and FL65 Fresnel lens, this circuit can detect motion at a distance of up to 90 feet.

Figure 7 shows an application circuit that will indicate the direction that an infrared radiating source is moving.

### TYPICAL CONFIGURATION



**FIGURE 1**



**FIGURE 2**

**FIGURE 2**

# PIR325 Infrared Pyroelectric Sensor

## Specifications and Dimensions

PIR325	
ELEMENT SIZE	2 x 1, 2 elements
SPECTRAL RESPONSE $\mu\text{m}$ (1)	5 ~ 14
NOISE $\mu\text{Vpp}$	20
OUTPUT mv pp (2)	3900
OFFSET VOLTAGE volts (3)	1.0
SUPPLY VOLTAGE volts (4)	2.5 ~ 15
OPERATING TEMPERATURE $^{\circ}\text{C}$	-30 ~ 70
STORAGE TEMPERATURE $^{\circ}\text{C}$	-40 ~ 80

### NOTES:

1. With built-in window filter
2. After 72 db amplifier gain
3. At source pin 2 with 5 volts and 100K load
4. Well filtered power supply

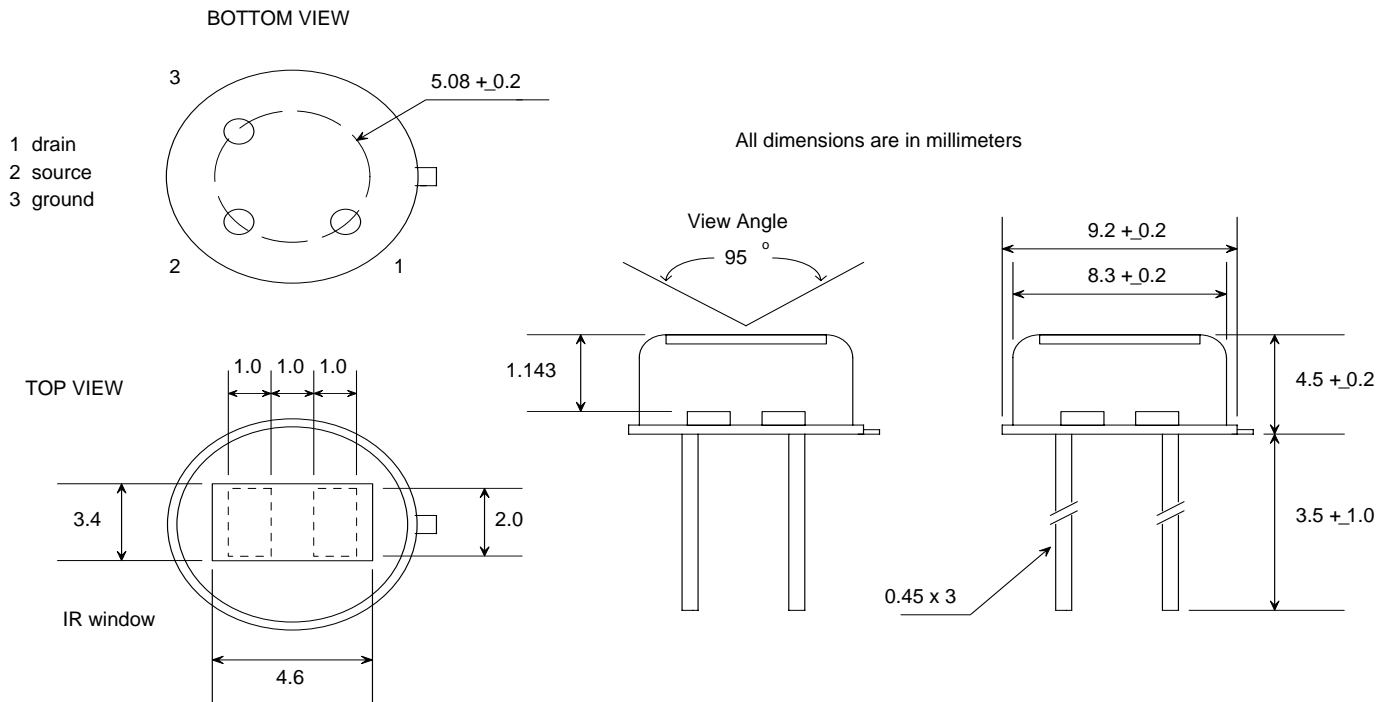


FIGURE 3

## **Fresnel Lens**\_\_\_\_\_

A Fresnel lens is a Plano Convex lens that has been collapsed on itself as in figure 5 to form a flat lens that retains its optical characteristics but is much smaller in thickness and therefore has less absorption losses.

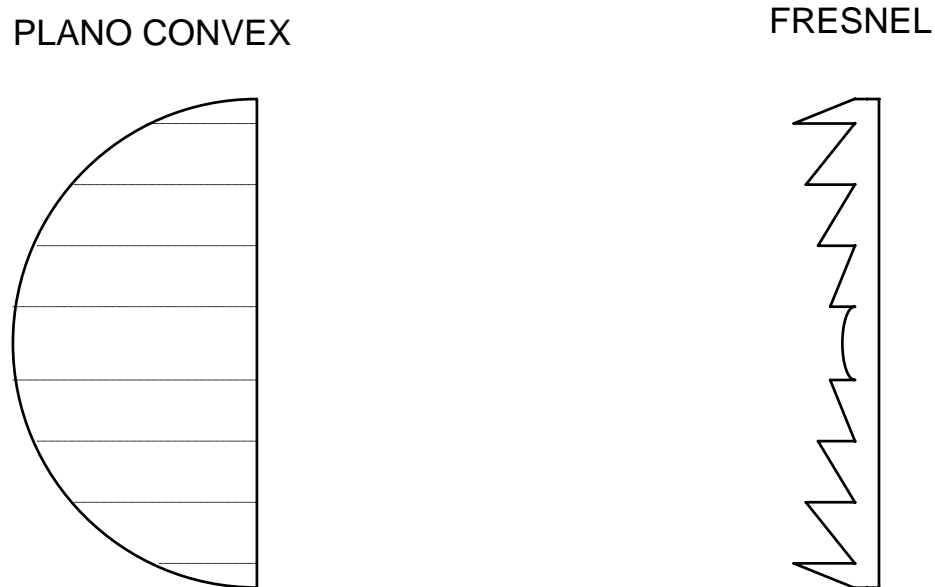
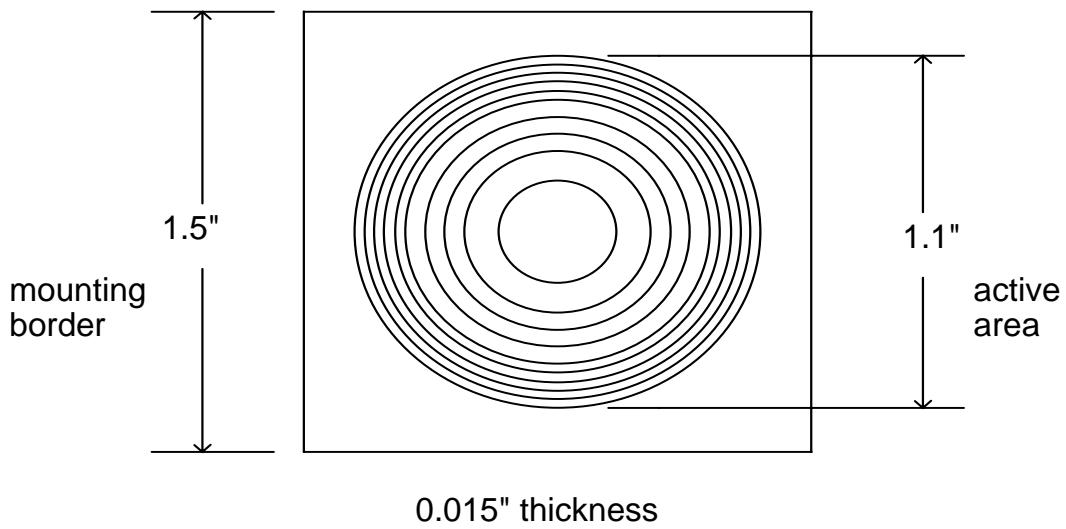
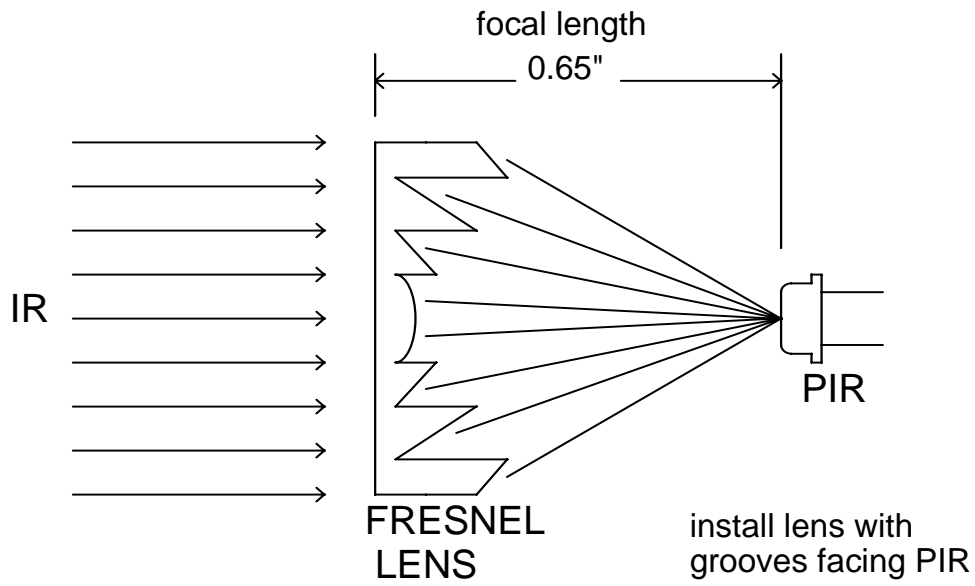


FIGURE 4

The FL65 Fresnel lens is made of an infrared transmitting material that has an IR transmission range of 8 to 14  $\mu\text{m}$  that is most sensitive to human body radiation. It is designed to have its grooves facing the IR sensing element so that a smooth surface is presented to the subject side of the lens which is usually the outside of an enclosure that houses the sensor.

The lens element is round with a diameter of 1 inch and has a flange that is 1.5 inches square. This flange is used for mounting the lens in a suitable frame or enclosure. Mounting can best and most easily be done with strips of Scotch tape. Silicone rubber adhesive can also be used to form a more waterproof seal.

The FL65 has a focal length of 0.65 inches from the lens to the sensing element. It has been determined by experiment to have a field of view of approximately 10 degrees when used with a PIR325 Pyroelectric sensor. Figure 6 shows the lens dimensions.



Optimum transmittance in the 8 to 14  $\mu\text{m}$  region

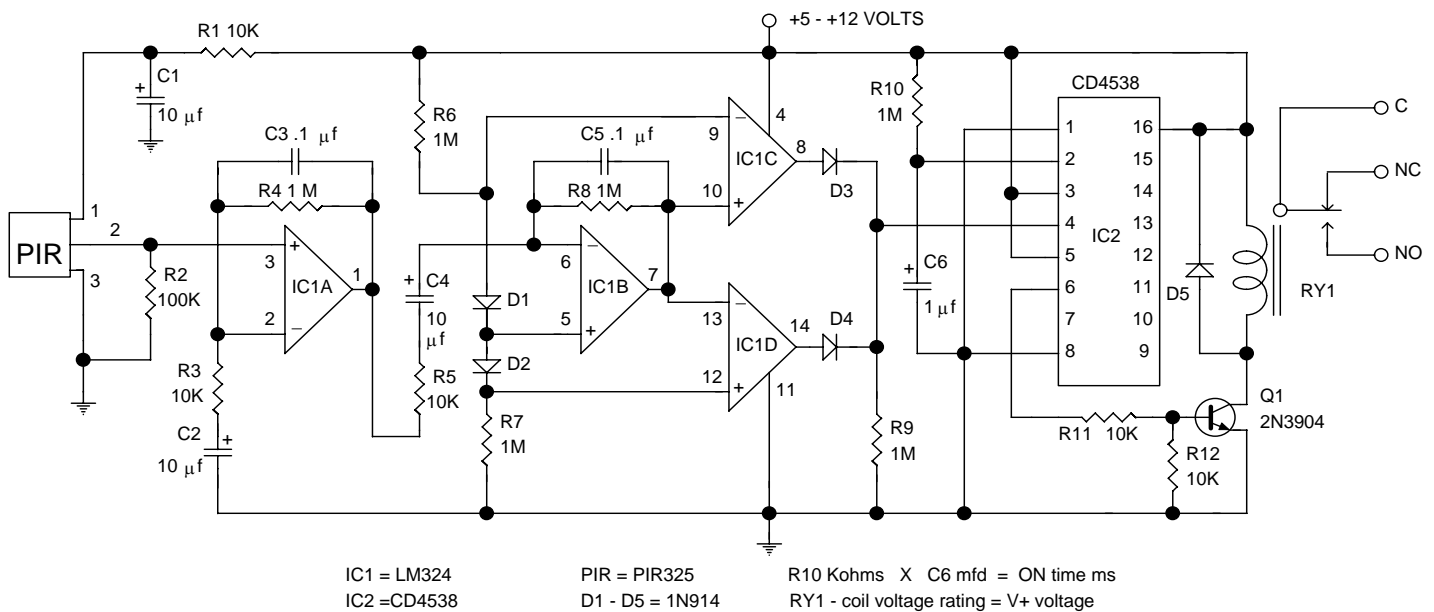
FIGURE 5

## General purpose motion detector\_\_\_\_\_

This motion detector circuit uses a low cost LM324 quad operational amplifier as both a two stage amplifier and a window comparator. Amplifiers IC1A and IC1B have a gain of 100 each for a total of about 10,000.

IC1C and IC1D form a window comparator that responds to signals about 200 millivolts above and 200 millivolts below  $V_{cc}/2$ . This window is set by the low current voltage drops across D1 and D2. Comparator outputs feed through D3 and D4 that pass only the positive transitions into CD4538 CMOS single shot IC2 which feeds into Q1 that drives relay RY1.

The R10 and C6 time constant determine how long the relay remains energized after motion is detected. All components can operate on 5 to 12 volts. This type of circuit is often used to turn a light on outside of a house when motion is detected.



MOTION DETECTOR

APPLICATION CIRCUIT FIGURE 6

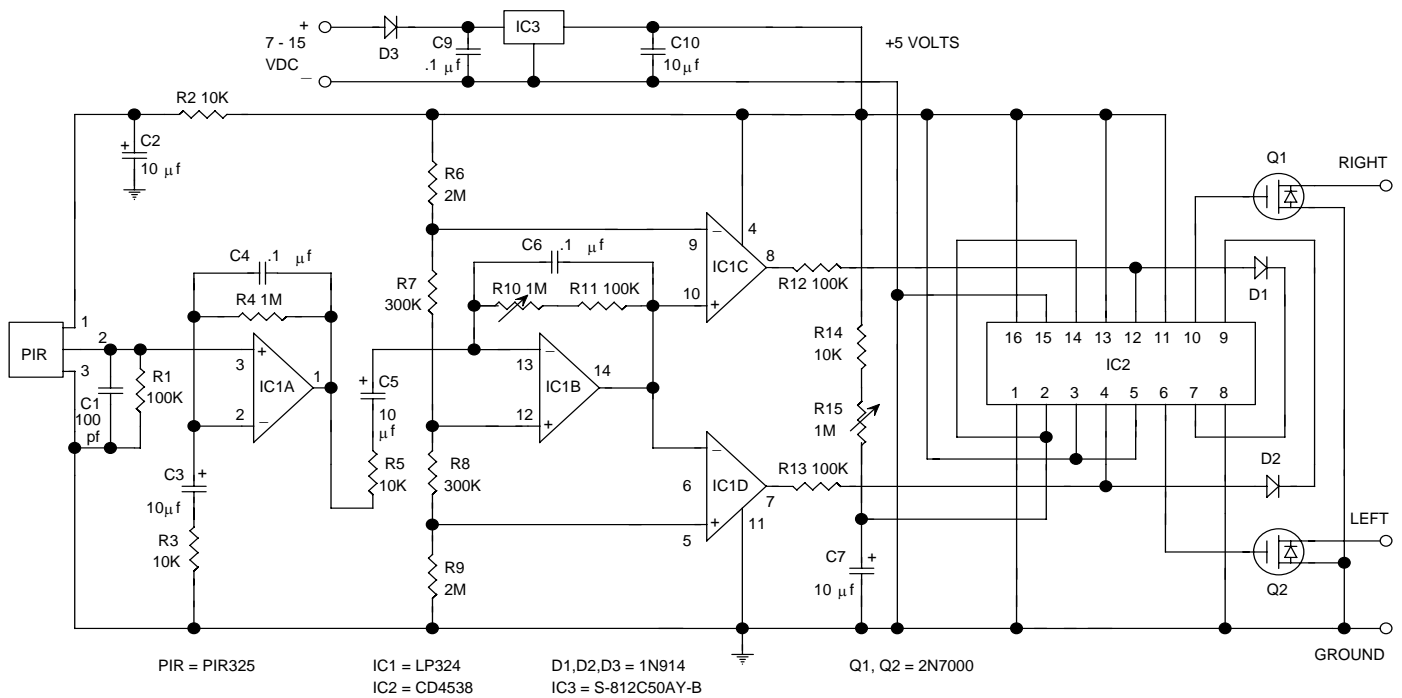


## Direction sensing motion detector \_\_\_\_\_

This motion detector circuit will both detect motion and indicate the direction that an infrared emitting body is moving. The amplifier and comparator circuits are similar to those in figure 6. Potentiometer R10 is a sensitivity adjustment to vary the detection range.

IC2 is a CD4538 dual single shot. The first single shot to receive a trigger input from IC1C or IC1D will turn its output on to indicate the direction of detection and will also inhibit the other single shot so that it cannot be triggered while the first single shot is on. Potentiometer R15 adjusts the amount of time that an output remains on after motion is detected.

This type of motion detector can be used to indicate people entering or leaving a building or in some robotic applications.



APPLICATION CIRCUIT      FIGURE 7







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