PHOTO IC: AC-450

Spectral response close to human eye sensitivity

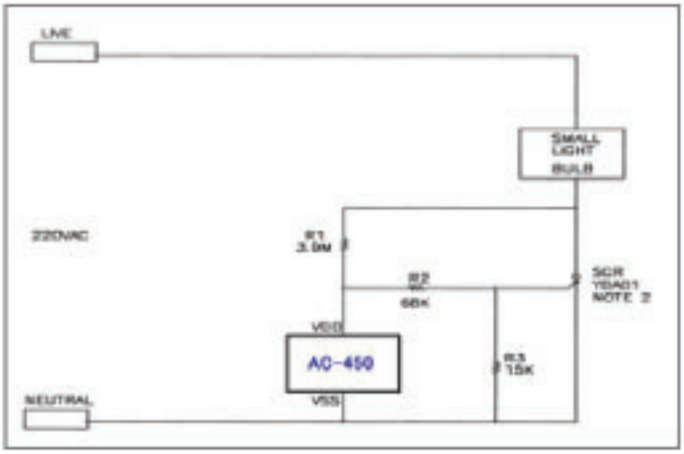
APPLICATION NOTE

- **••Automatic Night Light**

The lamp current is switched by a sensitive gate SCR. The Igt (typ) of the SCR should be less than 10• A.

When the light is above threshold, current flows between the VDD and VSS pins of the ASIC which diverts current away from the gate of the SCR.

The light switching threshold can be adjusted by choosing different values for R2 and R3.



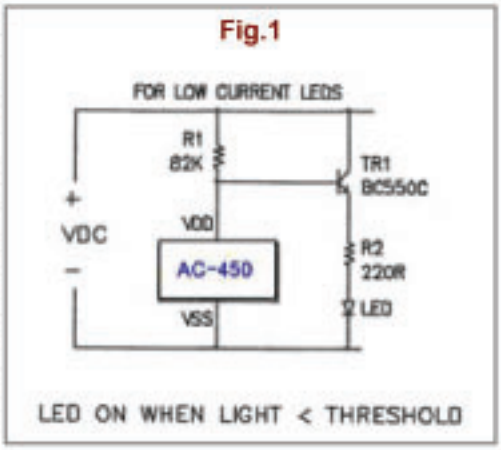
- **••LED Drivers**

➢ Simple low cost application [Fig. 1]

Fig. 1 shows a very simple low cost circuit using AC-450 to switch an LED. As the light increases, current flows between the VDD and VSS pins of the ASIC which pulls down the base of TR1. In dark conditions, R1 supplies current ot the base of TR1 to switch on the LED.

The base current of TR1 must be small compared to the photo current. This circuit should only be used when the current in the LED is less than 10mA. The DC current gain (hfe) of TR1 should be >400 to minimize the base current. The BC550C or equivalent is a suitable transistor for TR1. This circuit is not suitable for VDC <4V because of the headroom required for the LED and TR1. R1 should be adjusted by customers to obtain the switching threshold to suit the application. This circuit does not have a sharp switching threshold.•• The LED brightness decreases over a range of about 30 Lux as the ambient light level increases towards the cut-off point.

Fig.1

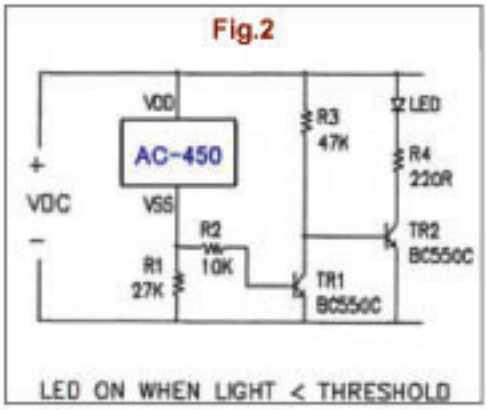


The LED current will switch off completely when R1 is pulled doen below about 2.5V. The advantage of this circuit is that it has the smallest number of components.

➢ General purpose [Fig. 2]

The LED switches ON when the light is less than the switching threshold (Slux). The base current of TR1 will affect the switching threshold. To minimize this effect, the base current into TR1 should be less than 10• A under all conditions of temperature and supply voltage. When the ambient light > Slux TR1 pulls down R3 and switches off TR2. For battery operated applications low current drain is important and the value R3 should be as high as possible so that when the LED is off the circuit quiescent current is low. Slux is controlled by R1 and the base emitter voltage of TR1. R2 limits the base current into TR1 to prevent excess current with high illumination. R4 controls the LED current.

Fig.2



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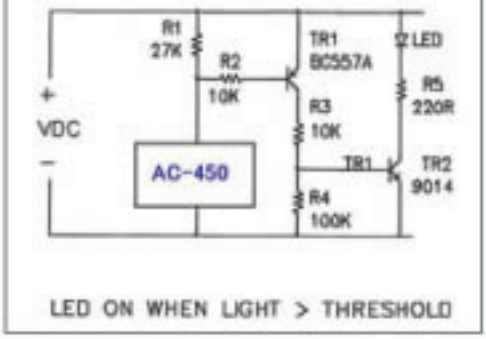
- LED switches ON when the light is above the switching threshold Slux. [Fig. 3]
  The value of R3 in this circuit can be lower than that in 3B because the current in TR1 is switched off in low light conditions.

Fig.3



- ••**Relay Drivers**
  - The relay coil is energized when the light < Slux. [Fig.4]
    The Slux threshold is set by R1 in same way as explained in the description for circuit 3C.
    For battery operated circuits, the hfe of TR2 should be high to allow a high value for R3.
    The hfe of TR1 should be high so that a low base current will be able to pusll R3 down.
    Example:

VDC	6V
Relay coil resistance	100R
Min. hfe of TR2	100
Min. hfe of TR1	200
Coil current	56mA
Min. base current to switch on TR2	0.56 mA
R3	10K
Min. base current of TR1 (0.56mA/200)	2.8• A

With the above value for R3, the quiescent current when the relay is off would be around 0.6mA which might be too high for some battery operated circuit.

  - The relay coil is energized when light > Slux. [Fig.5]
    In this case the quiescent current is low in dark conditions because TR1 is switched OFF at the same time as TR2 and the relay coil. The customer can control the current to the application and the quiescent current by choosing a normally open (NO) or normally closed (NC) relay.

Fig.4

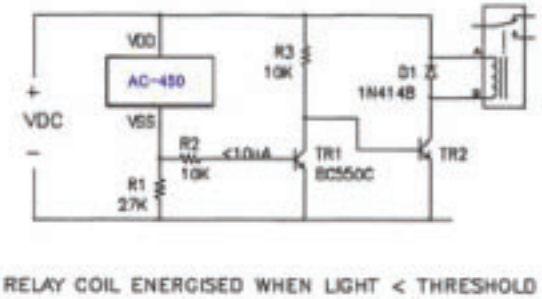
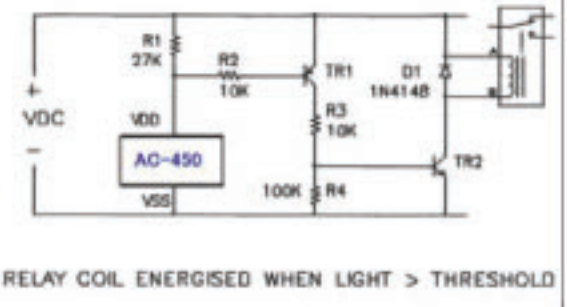


Fig.5



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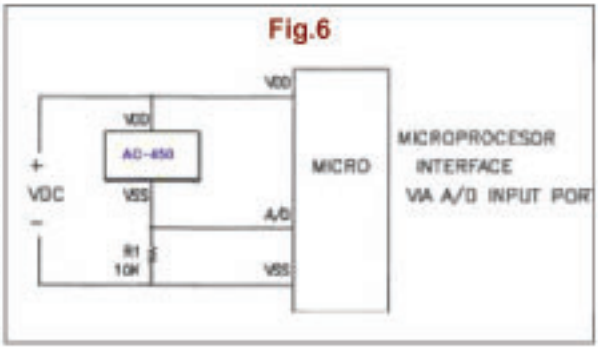
• ••Interface Circuit Examples

➢ Fig.6 shows an inter face to a microprocessor.

The voltage across R1 varies linearly with the illumination of the sensor.

The current between the Vdd and Vss pins is approximately 1• A/lux, so with a 10K resistor, the voltage at the A/D input will be 10mV per lux. The AC-450 was designed for low lux applications and the headroom required between Vdd and Vss becomes a problem at higher lux levels. These parts are not ideally suited to control room lighting applications especially if the microprocessor supply voltage is low.

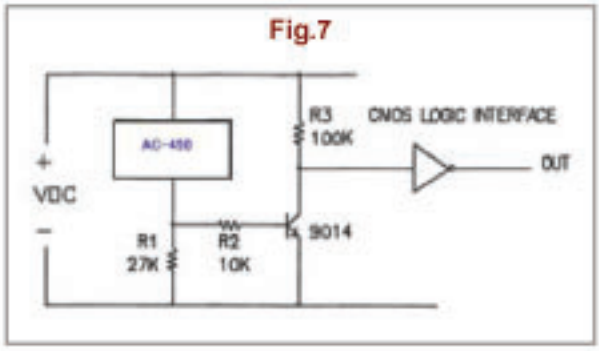
Fig.6



For higher lighting applications such as the control of room ambient lighting or backlighting applications for TVs, computers or mobile phones a lower gain version is planned.

➢ Fig.7 is a circuit which uses a transistor to provide a light level switching interface between the AC-450 and CMOS logic. The switching threshold is set by R1 and the base of TR1 as explained for previous circuit examples. The OUT signal will be high when the illumination is above the threshold and low when it is below the threshold. Using a buffer instead of an inverter will change the polarity of the OUT signal.

Fig.7



➢ Fig. 8 is a circuit which uses a comparator (or op-amp) to provide a level switching interface for the AC-450. OUT will be high when the voltage at Vss < 0.1*Vdd.

➢ Fig. 9 is the same as Fig. 8 except that OUT will be high when the voltage Vss > 0.1*Vdd.

Fig.8

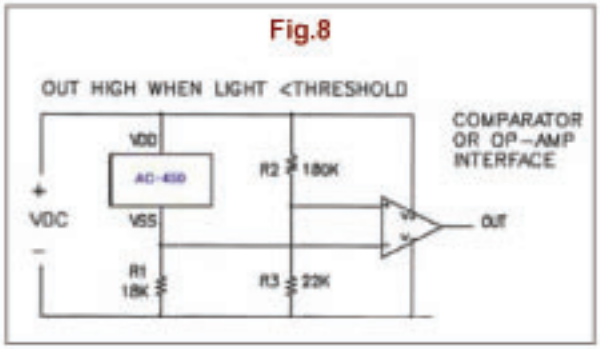
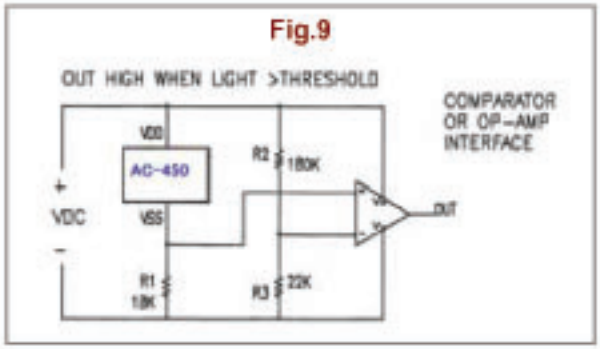


Fig.9



➢ Fig. 10 is the op-amp circuit which amplifies the output voltage at Vss.

VOUT = (1+R3/R2)1photo*R1

Fig.10