Application Note AN-101

Choosing an Input Resistor for a Microelectronic Relay

by Bill Collins, International Rectifier

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APPLICATION NOTE

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Introduction

The International Rectifier Photovoltaic Relay (PVR) devices are current-controlled microelectronic relays with a specified current which must be supplied for turn-on. Therefore, a current limit resistor is necessary when operating from a voltage source. This application note gives the procedure for determining the proper resistor to program the microelectronic relays to operate from any control voltage.

Procedure

The selected resistor must be of sufficiently low value that the specified turn-on current flows at the minimum signal voltage and lowest operating temperature. Note that the input circuit shown in Figure 1 consists of the internal Light Emitting Diode (LED) plus the external resistor which is being selected.

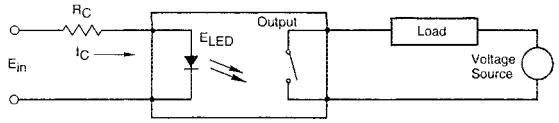

Figure 1. Input Circuit

To determine the maximum allowable value of R_C, the maximum LED forward voltage drop at the coldest operating temperature should be determined from the input characteristics curve found in each respective technical data sheet. An example is shown here as Figure 2.

The value normally used for -40°C operation is 1.6VDC. The following equation expresses the maximum allowable value for R_C .

$$R_C \leqq \frac{E_{in} - E_{LED}}{I_C \text{ (turn-on current)}}$$

Example: E_{in} (Min.) = 4.5 VDC;
I_C = 5 mA; $T_A \geqq$ -40°C

$$R_C \leqq \frac{4.5V - 1.6V}{.005A} \leqq 580 \text{ Ohms}$$

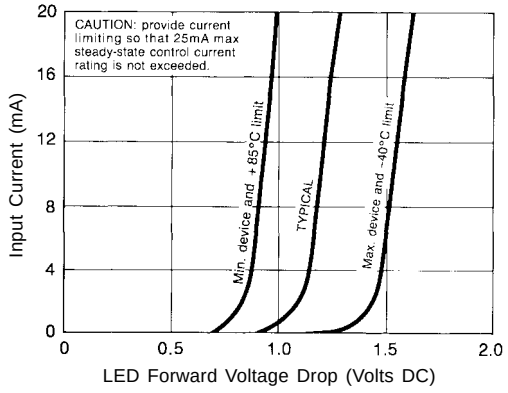

Figure 2. Input Characteristics (Current Controlled)

A minimum allowable value of R_C is set by the necessity of not allowing the input current to exceed 25 milliamperes at the highest signal voltage and maximum operating temperature. A high temperature LED drop of 0.9 volts is most commonly used.
In the above examples a resistor in the calculated range and near the maximum allowable value would be selected, for example 500 Ohms.

$$R_C \geqq \frac{E_{in} - E_{LED}}{I_C \text{ (Max. allowable current)}}$$

Example: E_{in} = 6.0V Max; I_C Max. = 25 mA; $T_A \leqq 85^oC$

$$R_C \geqq \frac{6.0V - 0.9V}{.025A} \geqq 204 \text{ Ohms}$$

Figure 3 is a plot of the above equations for two commonly used input currents: specifically, 6 mA and 12 mA. The minimum allowable value of R_C corresponding too 25 mA maximum input current also is plotted. These steps should be followed to determine an appropriate input resistor.

1. Determine the minimum available input volt age and read the maximum allowable R_C from the plot corresponding to the selected signal current (in this case, 6 mA or 12 mA).

2. Read the maximum allowable input voltage for the selected resistor value by checking the bottom "minimum allowable R_C" plot. The allowable input signal voltage range has now been determined. Note that by reading horizontally across a given input resistor value from the "Signal Plot" to the "Minimum Allowable R_C" plot the allowable input voltage range can be directly observed.

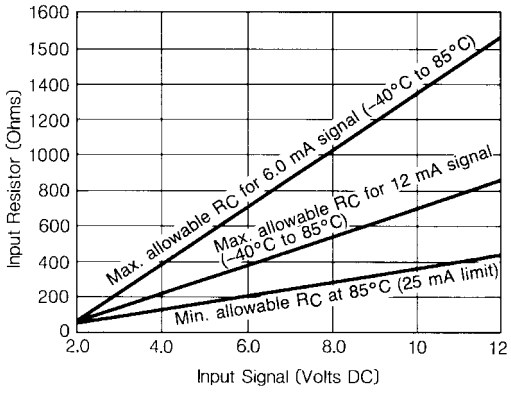

Figure 3. Input Resistor For Two Typical Input Currents