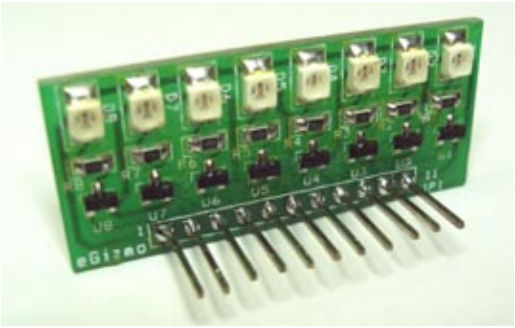
Buffered 8 channel

I/O LED Monitor



LED monitoring I/O lines of a controller bring several benefits. You can easily spot a non responsive output, a failed input device, spurious states, and hosts of other abnormal operations. It is like having all I/Os permanently watched with logic probes. This makes system trouble-shooting, debugging, and simulation a lot easier. And, of course, these blinking LEDs can be fun to watch too!

The I/O LED Monitor will work on 3 or 5V digital circuits, and is available in Green and Red LED colors.

Circuit Description

The circuit is fairly straightforward. Each LEDs are buffered by 'digital' transistors PDTC114E. This transistor has built-in input resistor network that presents itself as a high resistance load (>10K ohms), thereby making it essentially invisible to the I/O it monitors. Current to each LEDs are set to a desired level by their corresponding resistors R1 to R8.

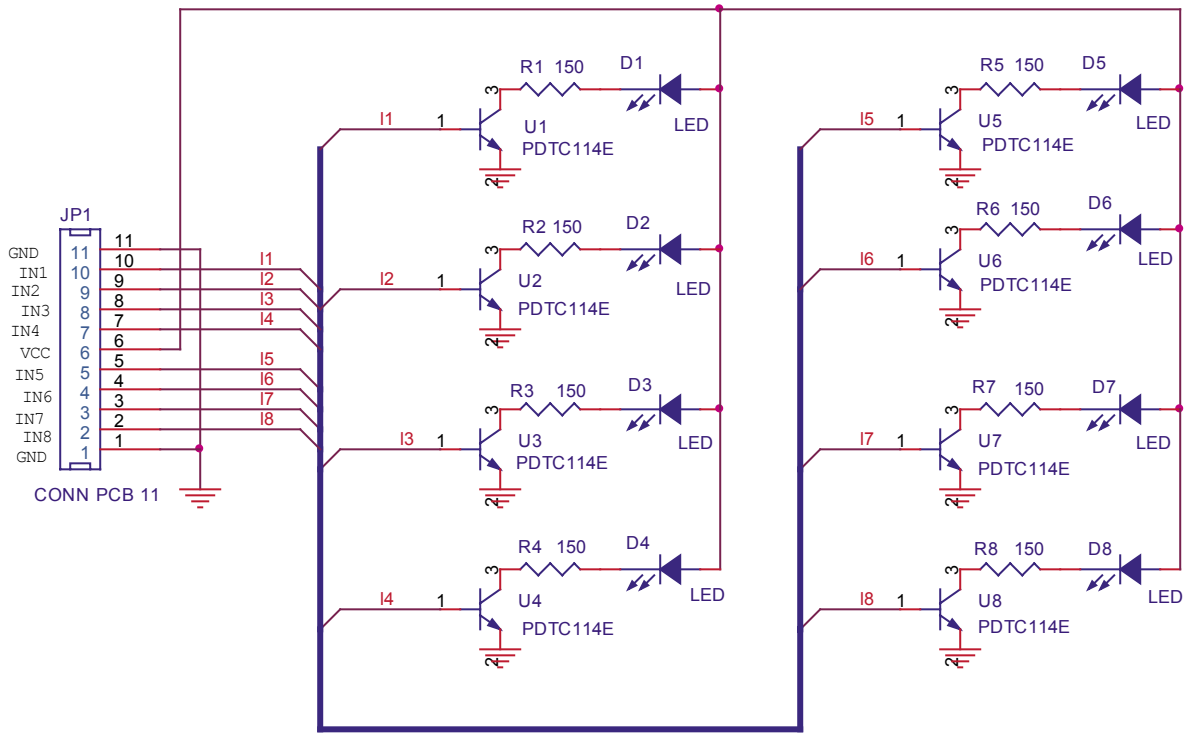


Figure 1. Schematic diagram of the I/O monitor. Vcc and GND pins arrangement allows you install the board in two ways.

The LED current limiting resistor actual value depends on the LED and the power supply voltage. Green LEDs uses 150 ohms with 3V circuits, and 330 ohms with 5V circuits. Red LEDs will work with 330 ohms at 3V, and 470 ohms at 5V.

Construction Details

The I/O Buffered LED Monitor has terminal configuration that allows you to install it 180 degrees either ways.

Standard 2.54mm pitch connectors lets you to use it with standard prototyping PCB (fig. 2) , or even on a bread-board (fig. 3).

The connector pins protrudes all the way to the component side (fig. 4). You can use these as auxiliary wafer connector terminal, or test point terminals (fig. 5). You can cut off the protruding connector pins if it does not serve any purpose in your applications.

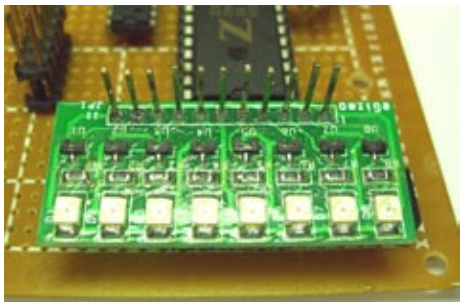


Figure 2.

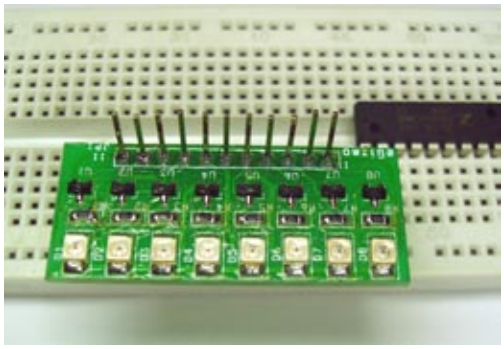


Figure 3.

Using the LED Monitor

The LED monitor will stay OFF with input voltages below 1.2V. Hence, input voltages below 1.2V will be displayed as logic low. You will observe increasing brightness as the input voltage increases from 1.3V to 1.5V. Full brightness, corresponding to logic 1 state, is displayed when input voltage exceeds 1.6V. You should take note that this may not correspond to the actual interpretation of logic levels in your system.

To illustrate this limitation, let us assume that you connected the LED monitor to check the logic level of a 74LV00 input. The datasheet of this device guarantees a worst case condition of logic 0 at 0.8V and below, and logic 1 level at 2.0V and above. Comparing it with the logic level of the LED monitor as just discussed, it is easy to see that there may be a disagreement between the LED displayed logic state and the one read by the 74LV00 gate when the input voltage falls between 0.8 and 2V. Fortunately, actual usage shows that disagreement does not occur too often. In most cases, you need not worry about this. ☻

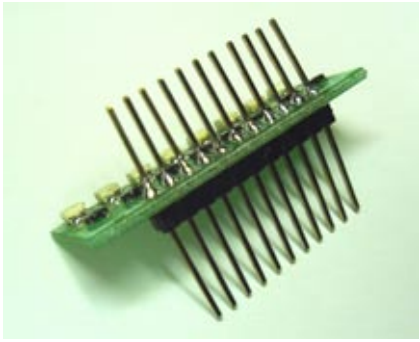


Figure 4.

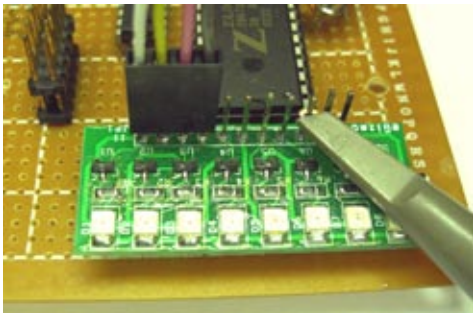
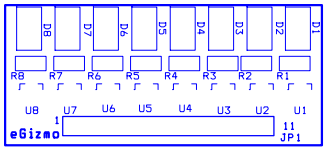


Figure 5.

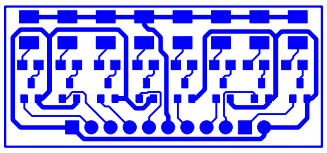
Bill of Materials

Item	Qty	Reference Designation	Description
1	8	D1,D2,D3,D4,D5,D6,D7,D8	SMD LED Green size 1210
2	1	JP1 CONN PCB 11	
3	8	R1,R2,R3,R4,R5,R6,R7,R8	150ohms SMD size 0805
4	8	U1,U2,U3,U4,U5,U6,U7,U8	PDTC114E Digital transistor SOT-23
5	1	JP1	11 pins header connector
6	1		PCB

PCB Layout



Parts silk screen print (Top View)



Copper pattern (Top View)