Handy Dandy Little Circuits

Handy Dandy Little Circuits #25

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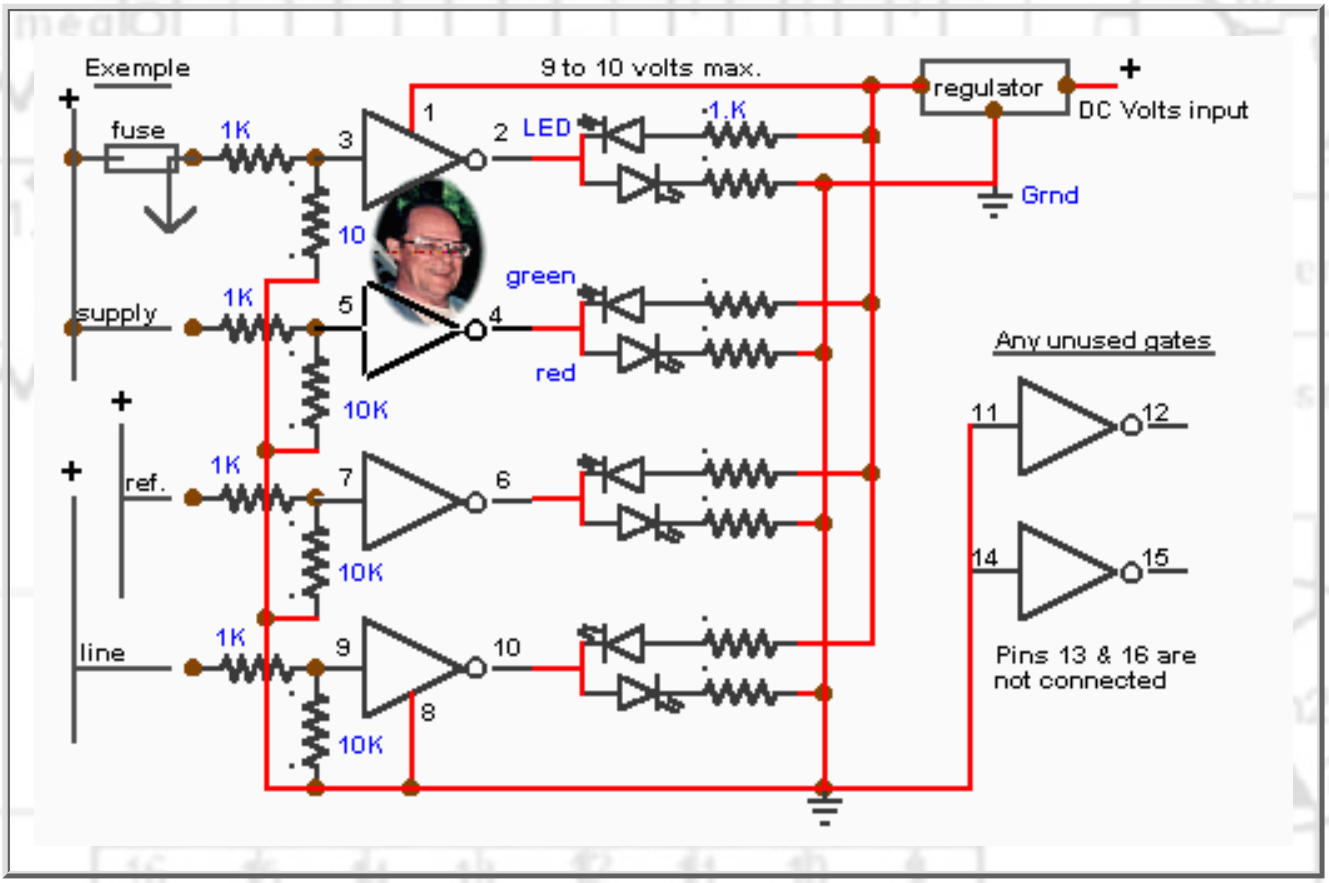
Fuse or Line Monitor

Following up upon a reader request for a circuit to monitor the fuses in his car , I designed the following circuit that can be used to monitor in addition to fuses any positive or negative voltage lines or fuses whether in a car , aircraft , boat or instrument circuitry .

Shown below is the circuit that will enable you to monitor just about any signal line as you wish the LED's to indicate whether a line signal is on/off or negative/positive or square , AC , or pulsing . (see application notes below)



Circuit Description

The circuit has been designed to be operated using a voltage supply of 9 to 14 volts as required and explained later . CMOS IC MC or CD4050 an HEX Non-Inverting Buffer is made of six non-inverting gates and can supply more current than the standard CMOS . Each can either drain or source depending on

its logic state being either high or low .
Using all gates of one IC will enable the monitoring of six lines . Any unused inputs gates must be connected to positive or negative ie., pin 1 or pin 8 .

Red ON , line zero : The input of the gate pin 3 is pulled down to ground through the connection of the 10K resistance to a logic LOW and the output will also be LOW as long as there is no positive input high enough for the gate to switch to a HIGH . When logic input is low , the current flows from positive through the 1.2k resistor , the red LED and the gate output , pin 2 , and is now said to be draining the current to the IC ground .

Green ON , line positive : The input pin 3 of the gate that we will name gate A is connected to the line that we wish to monitor through the 1K ohms input resistor when this line has a voltage with a positive polarity of at least 4.6 voltsat the gate input pin 3 it will keep the gate input at a logic high , this high positive voltage cannot be allowed to be higher than the IC supply voltage rail (see application notes below) . As long as a logic high is present at the input the output will also be high and the current will flow from pin 2 to the green LED through the 1.2K resistor to ground .

Application Notes

- **Voltage supply**

If the system is to be used only as an occasional test instrument a 9 volt battery may be sufficient as voltage supply . For a permanent installation a maximum IC permissible voltage (VCC) of 14 volts is allowed without any changes to the 1.2K current limiting resistors to limit the LED's current to 10 mA .

When used as fuse monitor for a car for exemple the current will fluctuate from a 12 volt battery voltage to 14.5 volts charging voltage and the LED's current as well as brightness will fluctuate . A 9 volt regulator should be used to protect the circuit as the regulator requires two (2) volts extra for good regulation allowing for a weak battery voltage .

- **Input Monitor voltage**

Exemples of voltage range input application AC or DC .

Allowing for diffrent IC's used , a minimum trigger voltage of 4.6 to 5 volts is required at the gate input , the 1K resistor will need at least 5.2 volts line input to trigger the gate to a logic HIGH and any voltatge below that level will be a logic LOW. With a supply of 9 volts (VCC) we can monitor a voltage range of 5.2 to 9.4 volts .

We can increase the voltage monitoring range by increasing the 1K resitance value to lets say 9.5 K ohms and still be in a positive trigger range to monitor a line voltage from 9.4 to 17 volts . Higher ranges can be used by calculating the voltage divider formed by the input and shunting resistance (10K) to the the gate input .

For multiple different line levels monitoring it would more pratical to replace the 1K input resistors with a 10K miniature pot to calibrate the trigger input level voltage

required .

We can monitor a square, sine or pulse signal and both LED's will flash indicate alternating HIGH and LOW logic at a low frequency up to about 30Hz , above this frequency the LED's will appear to be both ON without any fluctuation . This could be useful to detect a failed or overloaded rectified DC supply line .

Monitoring a Ground or Zero volt line is simply a matter of reversing the LED's colour meaning or the LED's pysically in the circuit .

- **LED Current Resistance**

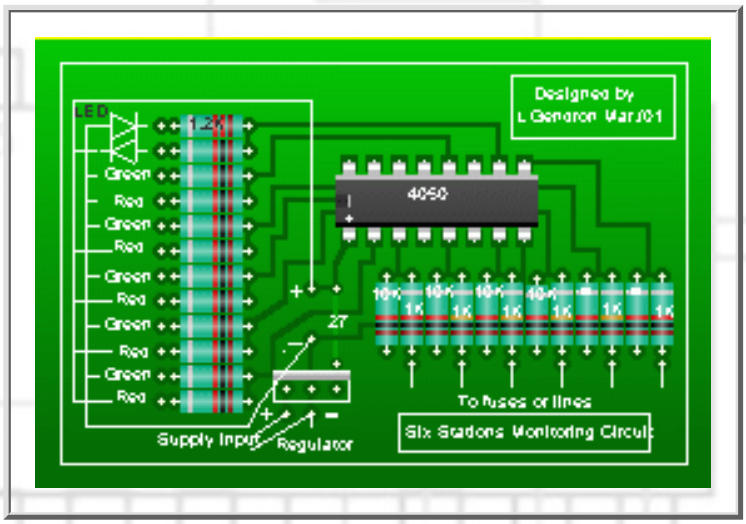
The 1.2K LED current limitimg resistance value has been chosen to limit the current to 10 Ma with a 14 volts supply with an acceptable lower level of brightness at 9 volts .
When changing the supply voltage the LED current resistance value can be found as Supply voltage minus 1.5v (LED voltage) divided by the LED allowed current (10 mA) . Thus for a supply voltage of 9 volts , R = 9 - 1.5 = 7.5 / .010 = 750 ohms.

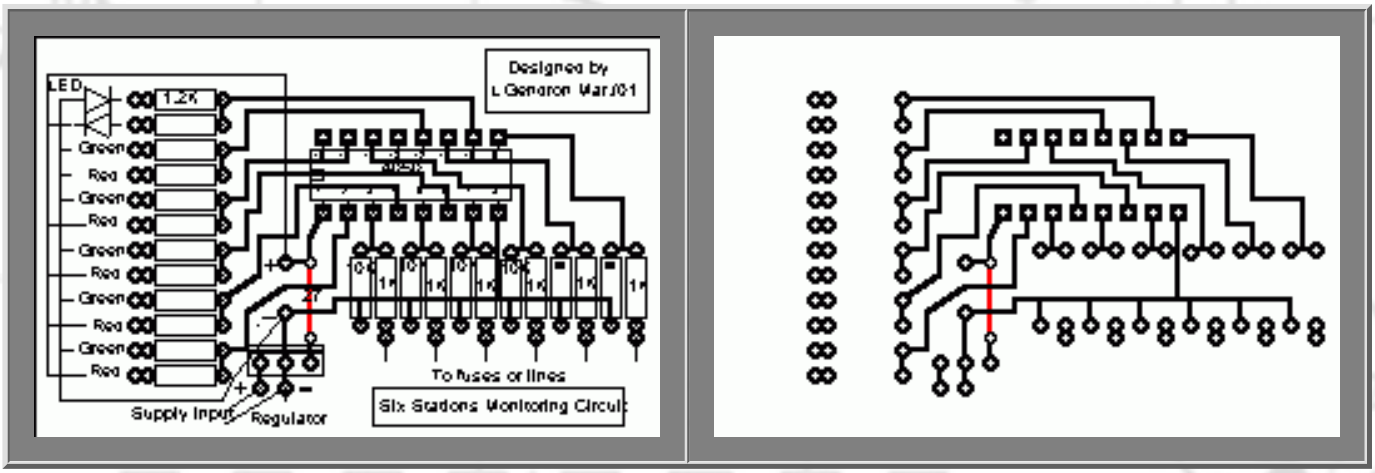
- To monitor line voltage level lower than 5 volts a voltage amplifier can be used made of simply one transistor or an op-amp inserted between the line to be monitored and the gate resistance input to raise the level to the gate minimum trigger level of 5 volts.

Have fun !

Layout

The suggested following layout has been designed for a six lines monitoring capability . Any number of lines below that number can be used and the unused gates input pins must be connected to ground or positive , and associated components can be omitted .





Questions? Email me at roma60@home.com

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