

Re: voltage divider or series current resistor

Source: <http://sci.tech--archive.net/Archive/sci.electronics.basics/2007-03/msg00159.html>

- *From:* byron@xxxxxxxxxxxxxx (Byron A Jeff)
 - *Date:* 5 Mar 2007 18:45:58 -0500
-

In article <op.top9lam6kz0nd4@giga>, NJM <guitchess@xxxxxxxxxxxxxx> wrote:

I am just a beginner so forgive me if this question is stupid.

This is a newsgroup for beginners. Welcome.

On a simple circuit, like 2 LEDs with a 12v supply, which would be better, a voltage divider to lower the voltage or a series resistor to restrict the current?

While LEDs are voltage controlled devices, the critical parameter is current.

Or am I completely wrong in my understanding of a voltage divider?

I think you may have gaps in your understanding of LEDs.

Please correct me if I am wrong, but it seems the divider would actually waste some energy because it is being sent to ground.

True. That's how they work.

What is the determining factor in deciding which to use?

The specifications of the LED. Specifically the maximum continuous allowable current.

Is the reason a series resistor with LEDs because the LED has a resistance of its own therefore creating a sort of divider?

Re: voltage divider or series current resistor

Interesting question. The answer is no. The LED provides minimal resistance once sufficient voltage to light it is present.

The answer is that an LED (like all diodes) will conduct all available current once they turn on. The problem is because of construction, if too much current goes across, then the diode burns up.

So the purpose of the resistor is to limit the amount of current in the circuit. Off the top of my head Kirchoff's law states that the amount of current across every component in a circuit is equal. A resistor impedes current based on its resistance. The LED is a virtual dead short once it turns on. So when you combine the two together, the amount of current that flows across the LED is the same as the current across the resistor. Hence the name current limiting resistor.

Hope this helps. You don't need a voltage divider. The LED will consume whatever voltage required to light it (its forward voltage drop) leaving the rest of the voltage to the rest of the circuit (which is the resistor).

A quick example. I once modified a cheap motion detecting floodlight for some security testing by connecting the 120VAC output to the LED of an optoisolator. Now since that circuit powered a 150W incandescent floodlight, there was well over an amp of power @ 120VAC available. Definitely needed a current limiting resistor.

The 2V that the LED actually consumes is negligible. So to simplify my calculation, I used a 130VAC (added some slop) voltage and wanted 15mA across the resistor. So:

$$V=IR$$
$$130V=0.015A * R$$
$$R = 8666 \text{ ohms.}$$

I think for good measure I used a 10K resistor giving a final current of 13mA. Finally I needed to compute the power

$$P=VI$$
$$P=130V*0.013A$$
$$P=1.69W$$

So I pulled a 2W 10K resistor for the project.

Finally LEDs (and other diodes) don't care for high reverse voltages either. So I put a second visible LED in reverse parallel to the opto LED. So one was on for half the AC cycle, and the other on for the other half. Plus it gave me a visual indicator of when the motion detector activated.

Note that all of this occurred with a 120 VAC input. No need to divide the voltage as long as the current is kept under control.

Re: voltage divider or series current resistor

Hope this helps.

BAJ

.