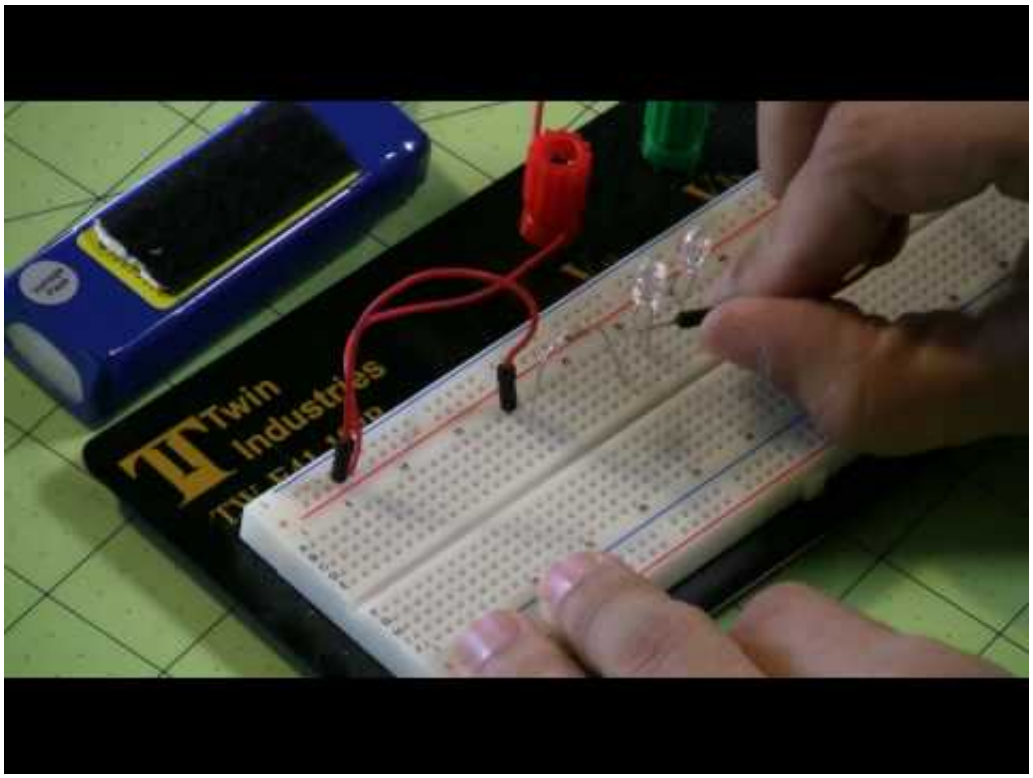
More Series LED Circuits

by erkrystof - Thursday, August 05, 2010

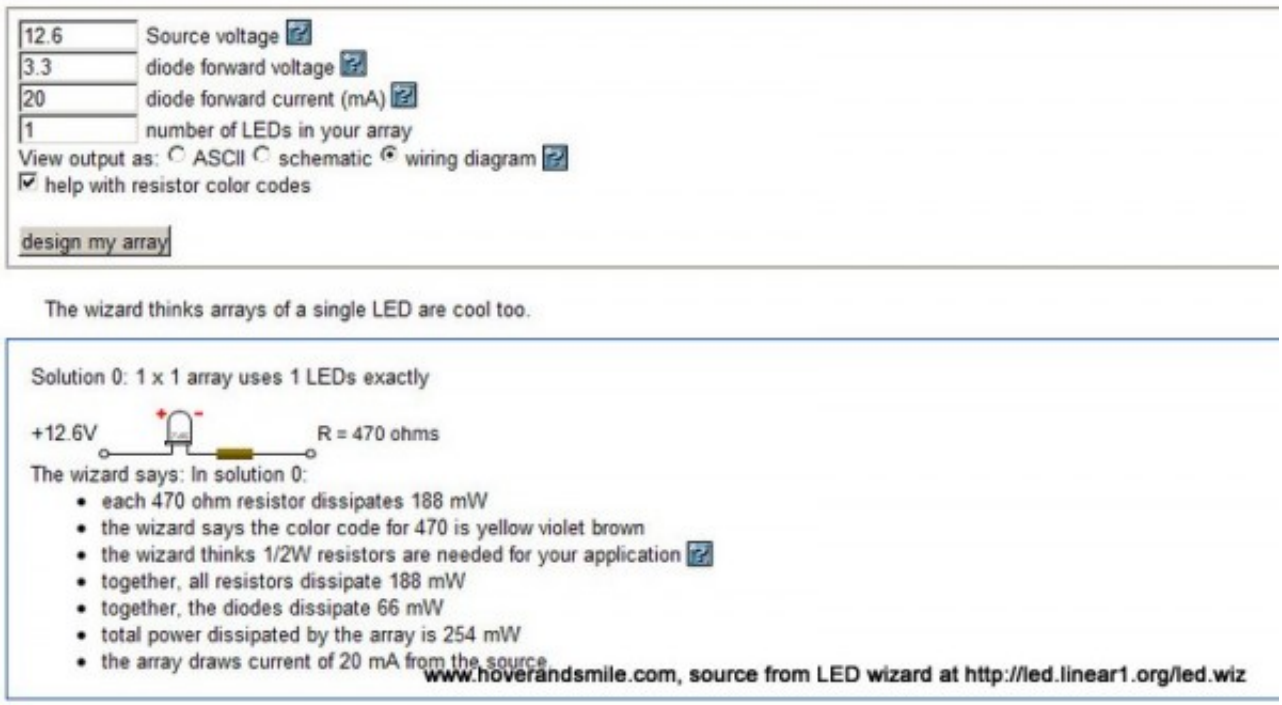
http://www.hoverandsmile.com/more-series-led-circuits/

So, last time we introduced the simple LED circuit. A power supply (your battery), anLED (the light), and a resistor (to limit current). We introduced all the math you'd need to calculate this, but hey, let's not stand in the way of progress! Check out these links for online LED calculators that give you the exact resistance you'll need to handle whatever LED wiring configurations you like:

- LED Wizard
- LED Calculator
- HB LED Calc



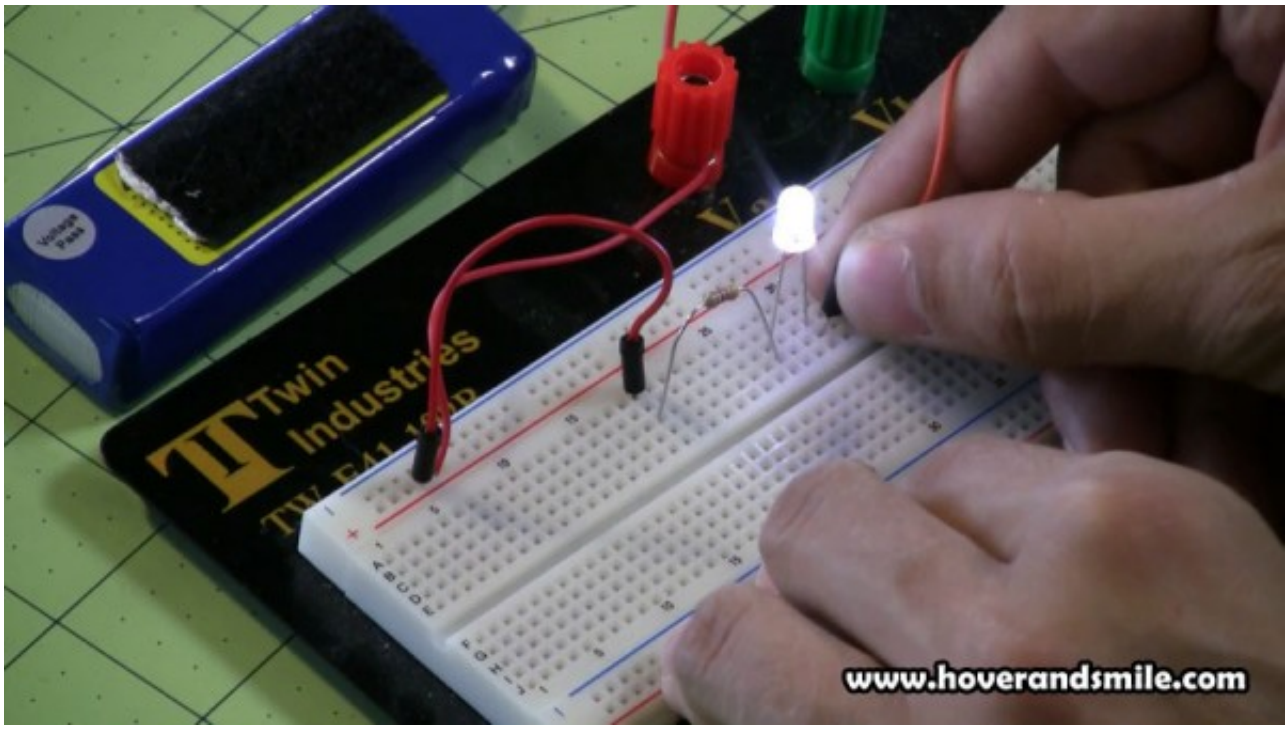
The example below is from the LED Wizard.



LED Wizard Sample Output

It tells us, just like our calculations did, that we need a 470 Ohm resistor. It’s much faster than doing the calculations yourself, but at least this way you *know* what calculations it’s doing for you.

And here is a single LED with a 470 Ohm Resistor. A perfect match, lighting up nicely.



Simple single resistor LED Circuit

Now, since that lights up ONE LED, what happens if I plug another 3.3 Volt LED in series? I'm limiting my current already with the resistor, so it won't burn out, but will happen is that both LEDs will light up, but not as bright as one alone. This is because we've changed that sum of forward voltage. Time to re-calculate!

Resistance = (12.6 – 2*3.3) / .02 = **300 Ohms** (although some wizards will say 330 as it's a more common resistance value)

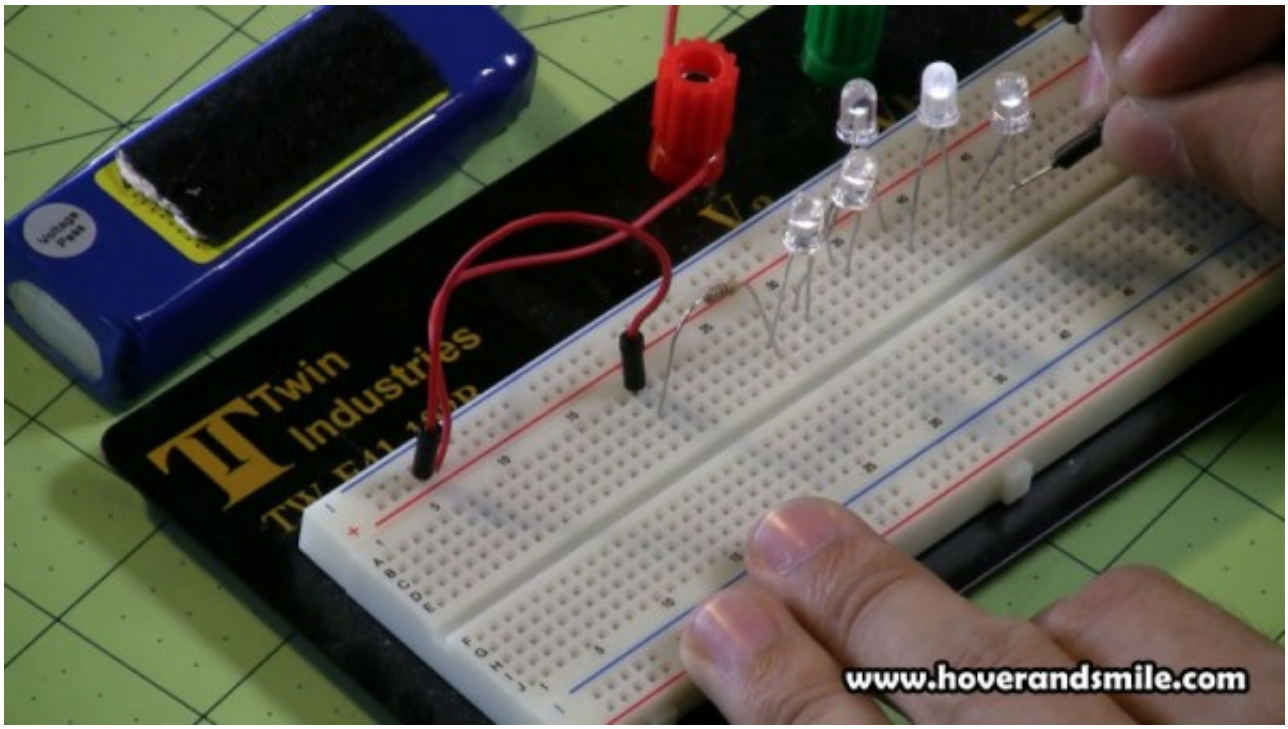
So now, if I use just two LEDs, I need to lower my resistance. If I use three LEDs, I lower it some more!

Why? Well, say we used 470 ohms with 2 LEDs. *Our current drops!* With a little algebra the equation would look like this using the first 470 Ohm resistor:

470 = (12.6-2*3.3) / I
I = (12.6-2*3.3)/470
I = .012 amps = 12 milliamps

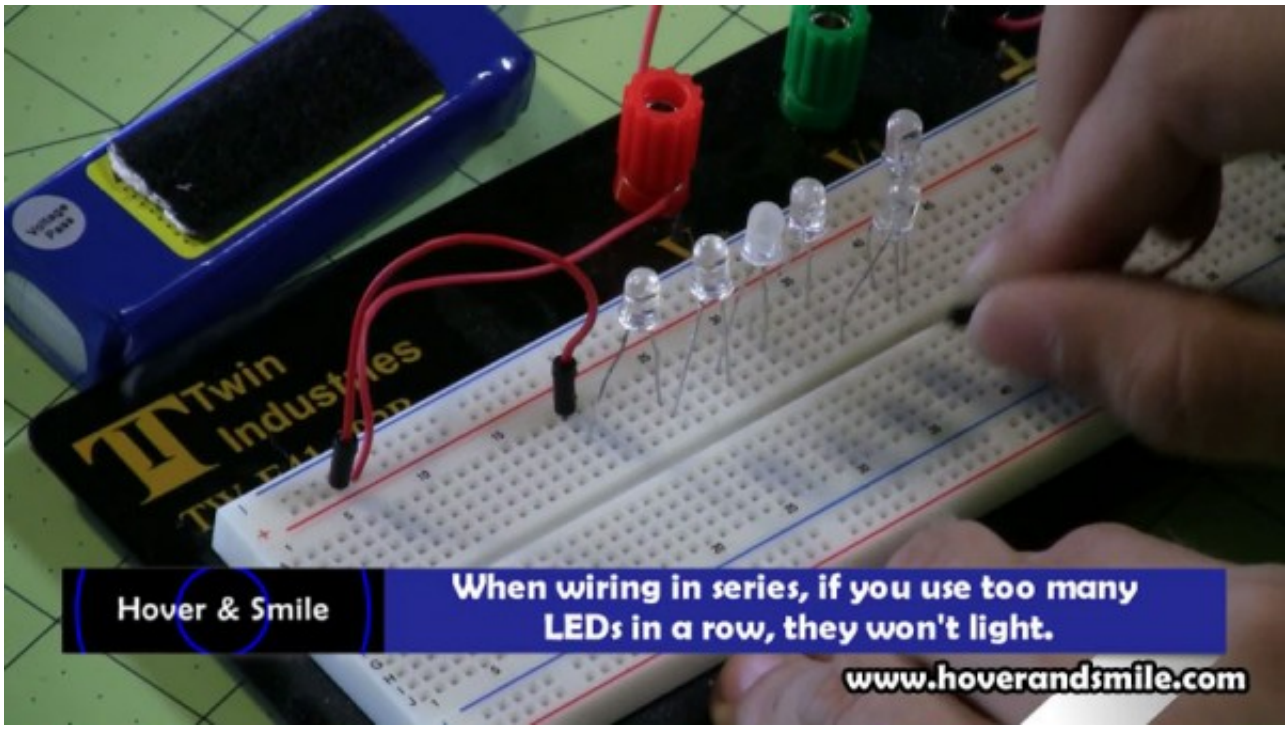
Only 12 milliamps is allowed through the circuit now. That's not as bright! We must lower the resistance of the circuit to allow the two LEDs to light up just as bright as the single LED because we've changed the voltage drops (even if the supply 12.6 volts remains the same). It's all proprotional. More voltage drops requires less resistance to maintain the proper current. Add an LED, remove an LED, and you must recalculate!

With an example forward voltage of 3 volts per LED and power supply of 9 Volts, you could wire up all 3 LEDs in series and not need a resistor at all (although a resistor is still a good idea with LEDs – even a single Ohm resisotr). However, say you wanted to wire four LEDs? If you wired them in series, you'd get 'no-joy'. The sum of forward voltage of your LEDs has to be less than your supply voltage.

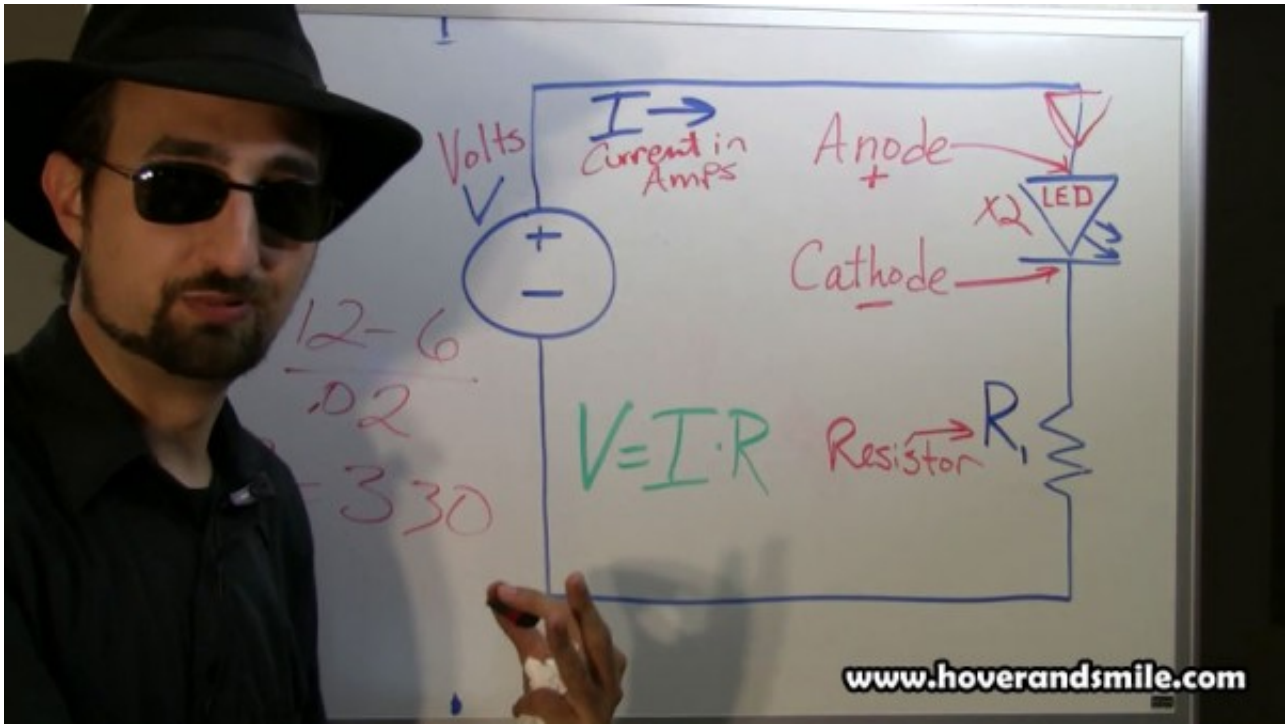


LEDs in series

Here we have the same 470 Ohm resistor but with 5-6 LEDs. Each time we add an LEDin series we get less light, and if the sum of our forward voltage (add up all the LEDforward voltage numbers) is greater than our power supply of 12.6, you'll either get dimly lit lights, or NO lighting at all.



Too many LEDs for 12.6 volts wired in series, resistor or not.



Series LED Diagram

Vinnie says that if you use too many LEDs in series, they won't light up, depending on how many volts of supply you use.

If you can only light so many in series, how do you add more LEDs?

PARALLEL CIRCUITS

If you've looked at the LED calculators or watched this movie by now, you may have noticed that if I have 1 LED, 2 LEDs, or 3 LEDs in series, although the voltage drops increase, my current does not. I'm still only pulling .02 amps through the circuit.

But if we have to wire LEDs in parallel to get more to light up than just a couple, *each parallel line* will have it's own separate current draw. So with parallel circuits, your current will increase.

We'll go over the parallel circuits in the next part!

Comments? (0)

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