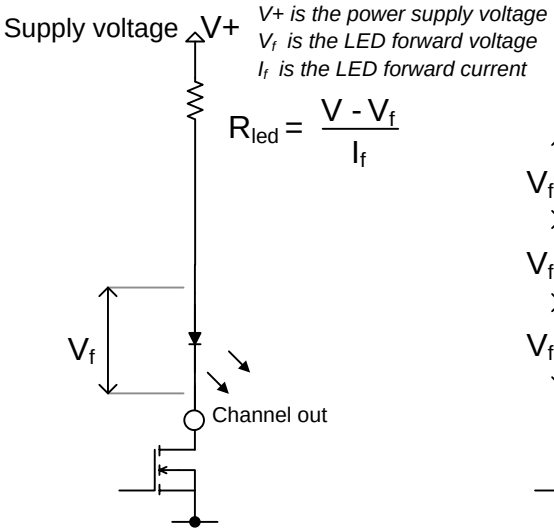
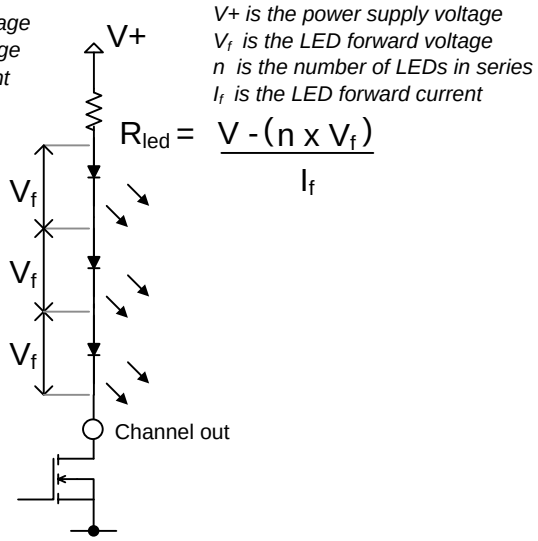
Connecting LEDs to the PWM Power MOSFET LED Chaser output

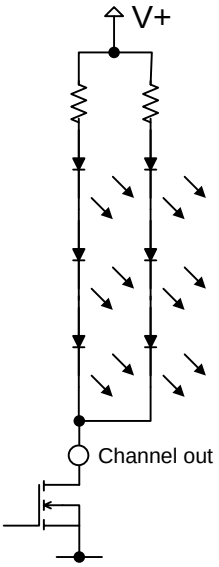
http://picprojects.org.uk



Driving a single LED



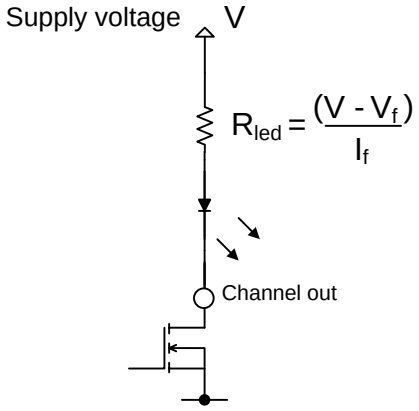
Connecting multiple LEDs in series



The configuration above can be used when the number of LEDs in series would be greater than the supply voltage. Try to work with a margin of 1 volt or greater between the supply and the total LED forward voltage.

- *The supply voltage should be a regulated DC source.*
- *When connecting multiple LEDs in series, the number of LEDs must be such that the sum of their forward voltages is less than the supply voltage otherwise they can't operate.*

How to calculate the value for the LED current limiting resistor



V is the power supply voltage

R_{led} is the current limit resistor value

V_f is the LED forward voltage

I_f is the LED forward current

These parameters should be taken from the datasheet for the specific LED being used. If this isn't available you will need to measure the forward voltage (see below)

You can't measure the forward current so if you don't know it you should work with a value of 15mA

Example $\frac{(10 \text{ volts} - 2 \text{ volts})}{0.015 \text{amps}} = 533 \text{ ohms}$

Resistors come in standard values, pick the nearest higher standard value to the one calculated – in this example it would be 560 ohms

How to calculate the power rating for the LED current limiting resistor

The larger the difference between the power supply voltage and the LED forward voltage, the more power the LED current limiting resistor has to dissipate. The resistor used must have a power rating greater than the power it will have to dissipate. This is calculated as shown here

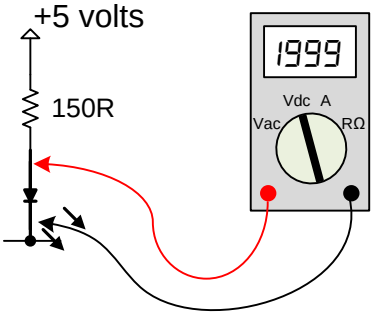
$P_{watts} = I_f \times I_f \times R$

Example (0.015 amps x 0.015 amps x 560 ohms = 0.126 watts

How to measure the LEDs Forward Voltage (V_f)

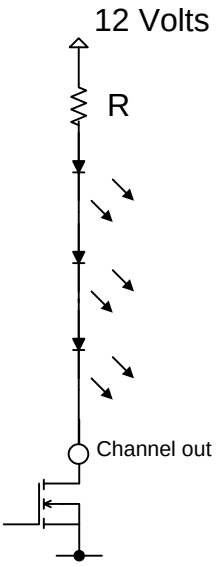
If you don't have the datasheet for the LEDs you plan to use, or just want to check the actual forward voltage you can measure it using the test circuit shown here. Make sure the LED is illuminated and then measure the voltage across the LED with a voltmeter.

The forward voltage for a standard red, yellow and green 5mm LEDs will be around 1.8 Volts to 2.2 Volts. For high brightness LEDs it will typically be 3 volts to 4 volts.



Examples

http://picprojects.org.uk



LED parameters

V_f = 3.2 volts

I_f = 20mA

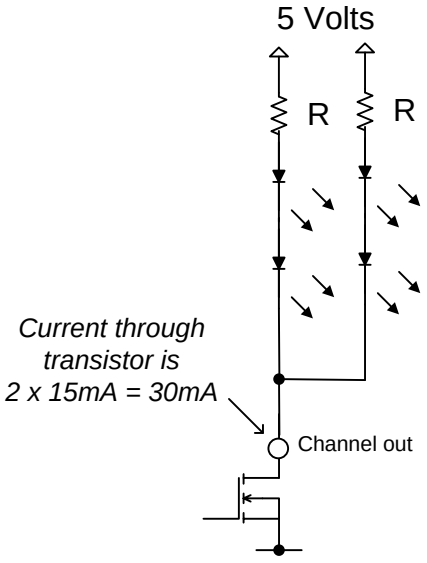
Calculate value for R

$$\frac{12 \text{ volts} - (3 \times 3.2 \text{ volts})}{20\text{mA}} = \frac{2.4}{0.02} = \textbf{120 ohms}$$

Calculate power rating for R

20mA x 20mA x 120 ohms = **0.048 watts**

In this case we can use a standard 120 ohm resistor with a power rating of at least 0.125 watt



LED parameters

V_f = 2.1 volts

I_f = 15mA

Calculate value for R

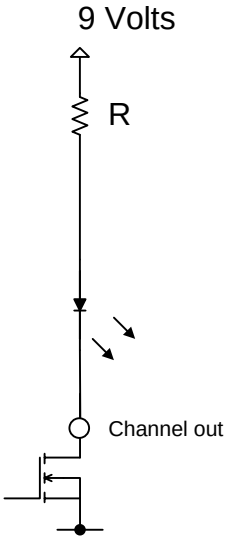
$$\frac{5 \text{ volts} - (2 \times 2.1 \text{ volts})}{15\text{mA}} = \frac{0.8}{0.015} = \textbf{53.3 ohms}$$

53.3 ohms isn't a standard value so we'll use 56 ohms

Calculate power rating for R

15mA x 15mA x 56 ohms = **0.126 watts**

Use a resistor with a power rating of at least 0.25 watt



LED parameters

V_f = 1.8 volts

I_f = 35mA

Calculate value for R

$$\frac{9 \text{ volts} - 1.8 \text{ volts}}{35\text{mA}} = \frac{7.2}{0.035} = \textbf{205 ohms}$$

205 ohms isn't a standard value so we'll use 220 ohms

Calculate power rating for R

35mA x 35mA x 220 ohms = **0.269 watts**

Use a resistor with a power rating of at least 0.5 watts