

## LED LIGHTING ON A BUDGET

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LED based lighting is slowly entering the market of home lights side-to-side with traditional incandescent bulbs (which are [phasing out](#) in many countries) and more recent gas-discharge lights.

One of the best known advantage of LED lights is their power efficiency, which can be quite high when compared with traditional lights, but if you like to do a DIY light system for your house the most interesting aspect of LED is that you can dispose the single diodes in many ways to get the desired light effect.

LEDs can be obtained in many ways, and if you have some broken LED laptop display to tear down, then you can recycle that LEDs to do some ambient lighting in small environment.



Here I'll show a couple of example of how to use LED lights from broken laptop display, explaining how to drive the LED with series resistor or DC/DC converters.

### **Obtaining LEDs**

Most modern laptops are equipped with powerful LEDs for the screen backlight. These are white LEDs with a very cold light, and can be efficiently used to light up a small work area or to do some ambient light in small spaces.

LEDs are usually wired as a parallel of LED strings, and uses different power sources depending on the configuration.

In my cases the original led-strip were cut to reorganize the individual LEDs in a wider space...



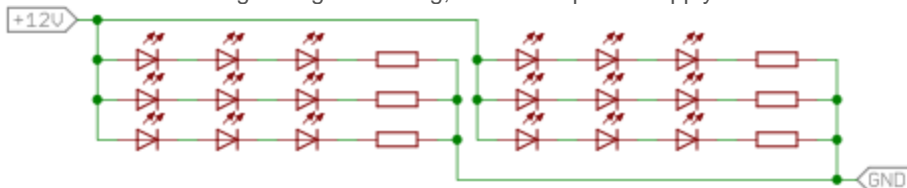
...or in a square shape for spot-lighting:



### Power Supply

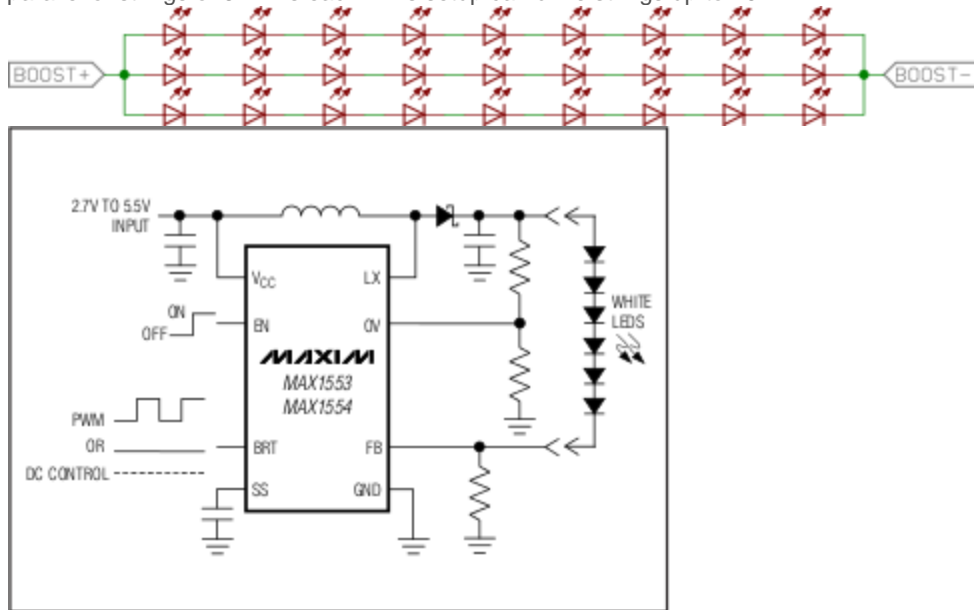
Depending on the number of LED in the strings and on the power source you intend to use, you can choose from a couple of different power supply configuration.

The simplest case is when you have short strings and a relatively high voltage supply. In this configuration you can have, for example, many strings of three white LEDs, which should drop about 3.3V each, a series resistor used to limit the current flowing through the string, and a 12V power supply.



The resistor value has to be calculated to keep a current on the string at about 10 to 20 mA. Keep in mind that LEDs will become very hot and break if overpowered so try to keep the current low if you just need ambient light. Also, this circuit has a very low efficiency as all the excess voltage has to be dissipated on the series resistor.

If you choose to use long string and you have a low voltage supply or if you just want a circuit with a better efficiency, you can use a boost converter with a current feedback. As an example, this is the reference circuit I used to light up a parallel of strings of 6 LEDs each. This setup can drive strings up to 40V!



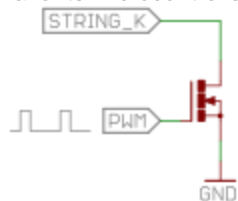
In this case the feedback is connected to a shunt resistor on the “FB” pin. To calculate the shunt value, use the equation in the component datasheet, keeping into account that you are controlling the current flowing into the three parallel strings summed together.

With this configuration you can use a very low voltage power source... I found this is a good way of recycling some old cell phone power supply! Also this circuit can have a quite high efficiency if designed properly, just follow the guidelines of the datasheet!

### Dimming

I’m a firmware guy, so I like to control stuff with software! If you want to use a microcontroller to dim the light in some cool way, that’s easy.

In the series-resistor case you just need to drive the strings with an N-MOSFET connected to a PWM signal of your favorite microcontroller (yes, I’m talking about AVR!).



The very common [BSS138](#) should be enough to drive small lights, if you need more you can try to recycle some power-MOSFET from old switching-mode power supplies. In this case, choose a high frequency for the PWM signal (anything above 500Hz should be good).

In the boost case, that’s easier! Many boost controller provides a dimmer input pin, which can be directly driven from the microcontroller. In other cases you can drive the “enable” pin of the boost controller.

As for the PWM, refer to the component datasheet to choose the driving frequency, as in the first case you want to use a fast signal (up to 10kHz for the [MAX1554](#)), but in the latter you need to slow down to let the booster circuit works. A common PWM frequency for EN-drive booster is between 120 and 200Hz.