

Log In

Create Account

Order History

Subscription

Products

Manufacturers

Applications

Services & Tools

Catalog

Help

Online Catalog



Blog Search

Blog Categories

- Audio (1)
- Circuit Protection (5)
- Connectors (1)
- General (33)
- Lighting (8)
- Low Power (6)
- Open Source (16)
- Power (4)
- Quality (5)
- RF (9)
- Sensors (1)
- Wide Bandgap (1)

Authors

- Erik Smith (8)
- Raymond Yin (1)
- Kelly Casey (5)
- Barry Manz (10)
- Lynnette Reese (13)
- Landa Culbertson (4)
- Caroline Storm (12)
- Paul Golata (9)
- Chuck Amsden (5)
- Justin Risedorf (3)
- Mike Parks (10)
- John Donovan (6)
- David Whittle (1)
- David Fambrough (1)
- Ian Chen (1)
- Gijs Werner (1)

View Blogs by Date

October 2014						
Su	Mo	Tu	We	Th	Fr	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

Don't Burn Out! Calculating LED Current Limiting Resistor

On April 8, 2014 in Open Source by Mike Parks

Light Emitting Diodes (LEDs) are one of the most fundamental output devices used in open source projects. They provide you a simple way to provide feedback to a user on the status of what's going on in a circuit. A popular use is a power indicator to let the user know if a device is on.



But connecting an LED directly to a power source can cause an LED to burn out. You have to utilize a [current limiting resistor](#) in series with the LED for protection.

Calculating the value of the resistor will require gathering a few bits of information about your LED from its data sheet. Specifically, we will need to determine the LED's [Forward Voltage](#) (Vf) and it's Maximum Current Rating (Imax). Vf tells us what voltage is required to bias the LED to turn on. Imax tells us the maximum current the LED can handle. We also need to know the voltage of the power supply that will be powering the LED. With this information in hand we can apply the

following formula:



Let's assume the following:

Vsupply = 5V

Vf = 1.7V

Imax = 20mA

Now we apply those variables to the formula and we get the following:

You may be asking yourself why are you rounding up to 220Ω when the calculation comes out to 165Ω? Simply put, this is where the academic separates from the real-world. When it comes to manufacturing of components, there are no 165Ω resistors manufactured. So you have to settle for the closet value that you can actually acquire from sources such as [Mouser Electronics](#).

So is that it? Well, not quite. Remember another important specification of a resistor is its power rating, measured in watts. To calculate the power rating of the resistor we have to use [Joule's power law](#):



Based on the calculation, then 1/8W resistor will work just fine, though a 1/4W resistor may be easier to get your hands on. A resistor of either power rating will work.

A word of caution when powering multiple LEDs. You may be tempted to save on board space or resistor count by using one resistor for many LEDs. Do not do this. LEDs, like most electronic components are not ideal. Some LEDs may have lower voltage drops then others, this will result in a greater current flowing through them thus possibly resulting in the LEDs destruction. Always use one resistor for each LED to compensate for the varying forward voltages. If you do need to

conserve board space then consider [resistor networks](#) that offer multiple resistors in one tiny package and share one common pin. See Figure 2 for an example.

There you have it, everything you need to know to appropriately size a current limiting resistor. You will user current limiting resistors in many applications, not just for powering LEDs. Hopefully this gives you enough of a background to get started building your own LED-powered projects.

[« Back](#)



Michael Parks, P.E. is the owner of [Green Shoe Garage](#), a custom electronics design studio and technology consultancy located in Southern Maryland. He produces the S.T.E.A.M. Power Podcast to help raise public awareness of technical and scientific matters. Michael is also a licensed Professional Engineer in the state of Maryland and holds a Master's degree in systems engineering from Johns Hopkins University.

Related Posts

Make Your Own Job with Open Source Hardware: What Students Don't Know

When jobs are scarce, open source hardware is opening doors for young engineers to gain experience, offering an alternative to simply waiting in between job searches. In slow economic times, engineers

Applying The Basics: The Voltage Divider

Hello, everyone! My series of posts are going to deal with applications of open source hardware. My goals are to share applications using open source hardware and teach some fundamentals of electronics and software to turn these projects from concept to

Analog Inputs In a Digital Only World

I am going to share a trade secret with you today. Did you know you could read an analog signal even if you only have digital inputs on your microcontroller or single board computer? It used to be a common practice, but maybe not so much anymore. [iudaina](#)

2403 Views

Tagged With: [Joule's power law](#), [LEDs](#), [Resistor](#)

Blog Archives

- 2014
 - January (3)
 - February (14)
 - March (12)
 - April (13)
 - May (11)
 - June (14)
 - July (5)
 - August (9)
 - September (7)
 - October (2)

Blog Tags

engineering LED Arduino Circuit Protection Open Source Quality RF STEM Technology Audio Education engineers Internet LEDs Lighting Maker MCU OSHW Wi-Fi Yun 24 Hours at Le Mans 5G 8-bit A-10 Warthog ADC ADI AESA Aliens Altera Amateur Radio

Tweets by [@MouserElec](#)

QUICK EMAIL SIGNUP

Submit

COMPANY

About Us
Educational Sales
Press Room
Careers @ Mouser
Quality
Environmental

QUICK LINKS

Mouser Blog
Newest Products
New Products
New Technologies

SUPPORT

Feedback
Help
Contact Us
Browser Support

MOUSER ELECTRONICS®

1000 North Main Street
Mansfield, TX 76063
USA

(800) 346-6873

[Privacy Policy](#) | [Terms and Conditions](#)
Copyright ©2014 Mouser Electronics, Inc. - A TTI and Berkshire Hathaway company.
Mouser® and Mouser Electronics® are trademarks of Mouser Electronics, Inc. All other trademarks are the property of their respective owners.
[VIEW MOBILE](#)

