

Project Overview

A versatile kit that can be configured to drive either constant voltage LED arrays or constant current LEDs. Use the kit to dim under-cabinet LED lighting using flexible LED strips or build your own LED desk lamp using High Brightness LEDs.

The majority of the circuit is identical for both types of LEDs. Two inexpensive NPN transistors and a few resistors are added to the circuit for constant current LEDs. It uses the ability of a MOSFET transistor to act either as a digital switch or linear current regulator.

Constant voltage LED arrays include built-in current limiting resistors. Typically these arrays come in a flexible tape form (such as Jameco 2128631) but may also be constructed from discrete LEDs and appropriate current limiting resistors (for example a string of 3 white LEDs wired in series with a 120 ohm resistor designed to operate at 20 mA with a 12 VDC power supply). When configured to drive constant voltage LED arrays, the dimmer circuit acts as a digital switch that turns on and off hundreds or thousands of times per second to modulate the LED brightness.

Constant current LEDs do not have any built-in current limiting and depend on the dimmer circuit to limit the current. The dimmer circuit is configured to drive 1 Watt High Brightness LEDs (such as Jameco 2006895) at a regulated 330 mA. It can drive between 1 and 3 High Brightness LEDs wired in series depending on the power supply voltage. The inexpensive precision voltage reference that provides the reference for the micro-controller ADC is also used with a simple current mirror to control the gate voltage based on the current flowing through a current sense resistor providing accurate and temperature stable current limiting.

An inexpensive micro-controller and voltage reference provide pro-level features including:

- Non-linear 1000:1 dimming range over 256 steps to account for the eye's sensitivity to changes at low intensity levels
- Short Circuit detection and automatic shutdown with fault indicator
- Smooth intensity changes

Construction notes - use wire (e.g. power), leads bent over (e.g. reset resistor)

Required tools or supplies

Soldering Iron

Solder - size

Needle Nose Pliers

Wire Cutters

Wire Stripper

18 AWG Solid Core Wire

28-30 AWG Solid Core Wire

Heat Sink Grease

Screw and nut to attach MOSFET and Heatsink to the Protoboard

Additional Parts

Screw + Nut

1 megohm resistor

Steps

1. Familiarize yourself with the schematic: Select schematic options for the type of LED or LED array you will be driving. Select the power supply.
 - Constant Voltage 12 VDC Flexible LED Array requires a regulated 12 VDC power supply with enough current to power the array. For example use at least a 2 A power supply for a 5 meter flexible LED
 - Constant Current LEDs require a DC power supply about 3 volts higher than the forward voltage of the High Brightness LEDs
 - 1 HB LED => 6 VDC Power Supply
 - 2 HB LEDs => 9 VDC Power Supply
 - 3 HB LEDs => 12 VDC Power Supply
2. Drill hole for MOSFET heatsink
3. Mount large components
 - Heatsink + MOSFET
 - Connectors
 - Potentiometer
 - IC Sockets
4. Add the +5 Volt Regulator components
5. Add the 1.235 Volt reference components
6. Add the Fault Indicator components
7. Add the Micro-controller components
8. Add the Fault detection components
9. [Optional for Constant Current circuit] Add the current regulator components
10. Wire power connections on backside of board
11. Wire 1.235 volt reference connections
12. Wire Fault indicator connection
13. Wire Fault detection connections
14. [Optional for Constant Voltage circuit] Wire MOSFET
15. [Optional for Constant Current circuit] Wire MOSFET and Constant current regulator components
16. Insert Micro-controller and Comparator ICs
17. Connect to Power Supply and LEDs