Accent Lighting

Joe Peck

Accent Lights Make for a Crowning Achievement

As a way to set the mood in his family room, when he remodeled, Joe Peck put multi-color LEDs behind the crown molding. The major circuit uses a microcontroller and LED drivers located in a closet, and a small circuit board at each room corner to connect to red-green-blue LEDs. Perhaps Joe's lights will get you in the mood for something "interesting," like submitting your own Gadget Freak circuit.

Overview

When remodeling, homeowners will often add crown molding to enhance the appeal of a room. To create a distinctive touch, add multi-color LED lighting where sections of crown molding meet in each corner. With the addition of a microcontroller and three power field-effect transistors (FETs), you can control the LEDs to provide a variety of lighting moods and effects.

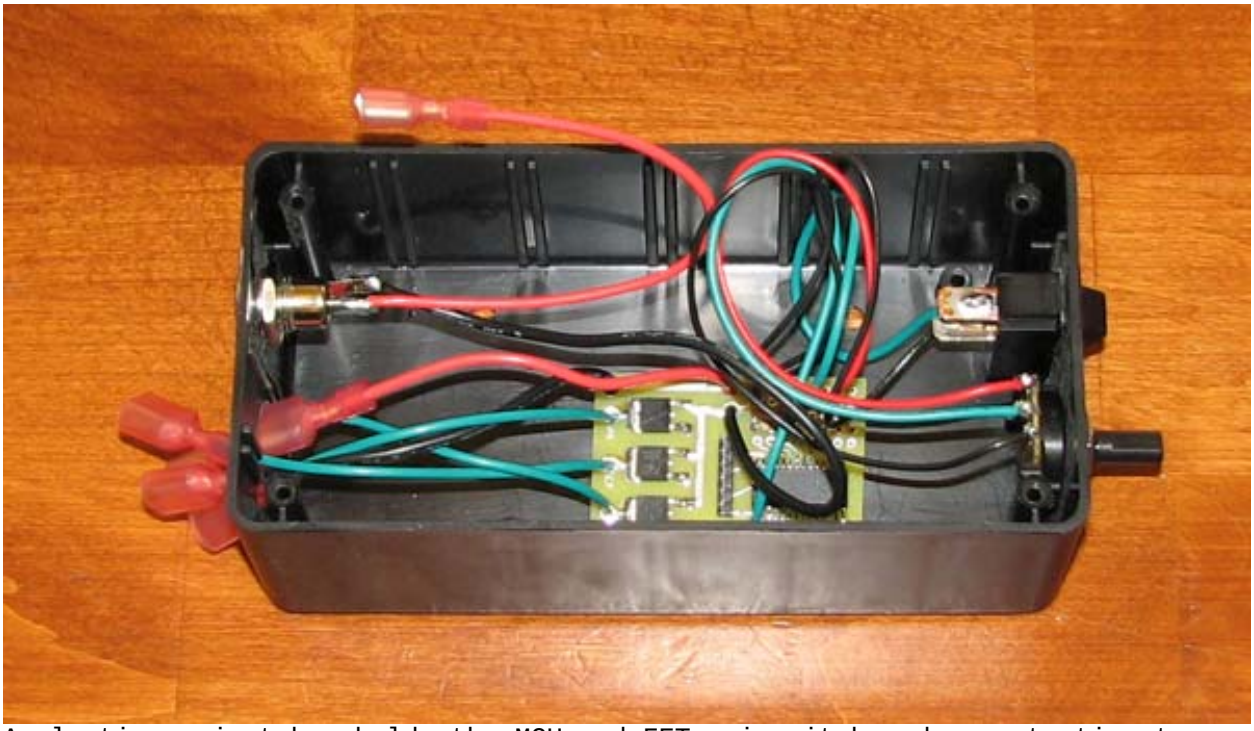
In this project, Joe added crown molding to an octagonal living room and placed LEDs in six corners. The wiring to each LED board runs behind the crown molding and snakes down a wall into an adjacent closet to the controller. A standard light switch turns dc power on or off to the LEDs and the controller. Joe used red-green-blue (RGB) LEDs so the MCU could independently control each color. The MCU drives each LED color in parallel rather than control each LED independently. The circuit board at each corner contains three RGB LEDs angled to project their light onto the ceiling. The controller includes a mode switch and potentiometer so user can change the lighting pattern and brightness. This arrangement allows for a variety of lighting options, limited only by the programming effort you put into the project.

Operating the Circuit

The controller Joe built provides five lighting modes: All LEDs on (red, green, blue), only red, only green, only blue or a slow continuing cycle between the three colors as each ramps on then off. When the wall switch is turned on, the microcontroller powers up and enters the default lighting mode (all LEDs on). Pressing a pushbutton changes the lighting mode to the next setting. A potentiometer on the controller dims the lights under software control via pulse-width modulation.

Main Controller

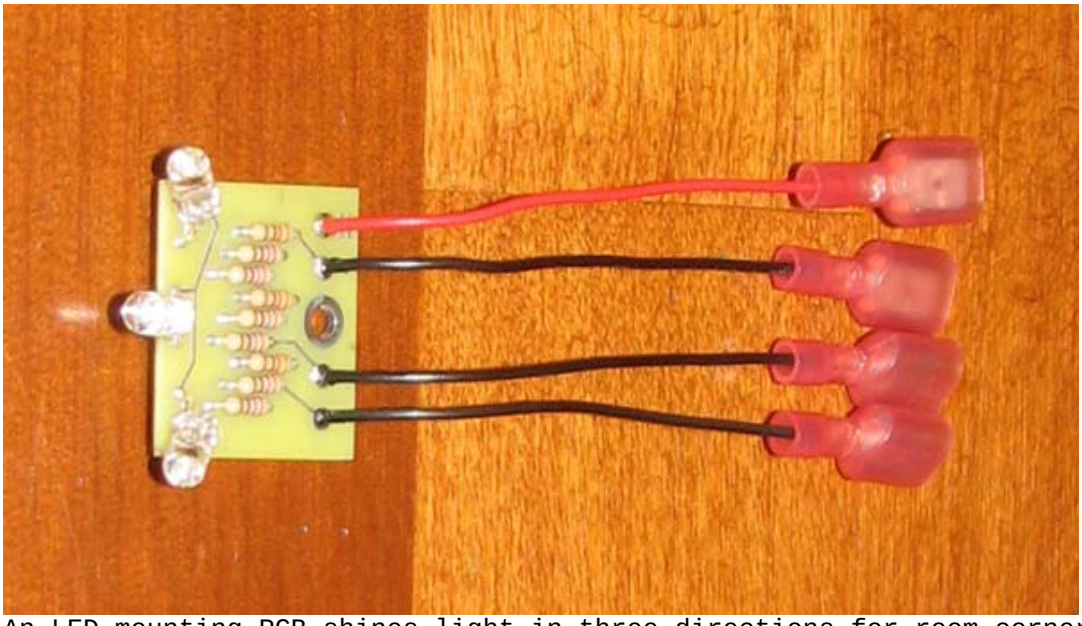
The controller and LEDs operates from 9V dc, provided by an external ac-to-dc power supply. To simplify construction and make the circuit robust, Joe designed a PCB that contains a linear regulator (to power the microcontroller), a Microchip PIC MCU, three low-impedance FETs (one per LED color) and several discrete components. A plastic "project box" holds the circuit board, power connector, pushbutton and potentiometer (**Figure 3**).



A plastic project box holds the MCU-and-FETs circuit board, a potentiometer, switch and connectors.

LED Board

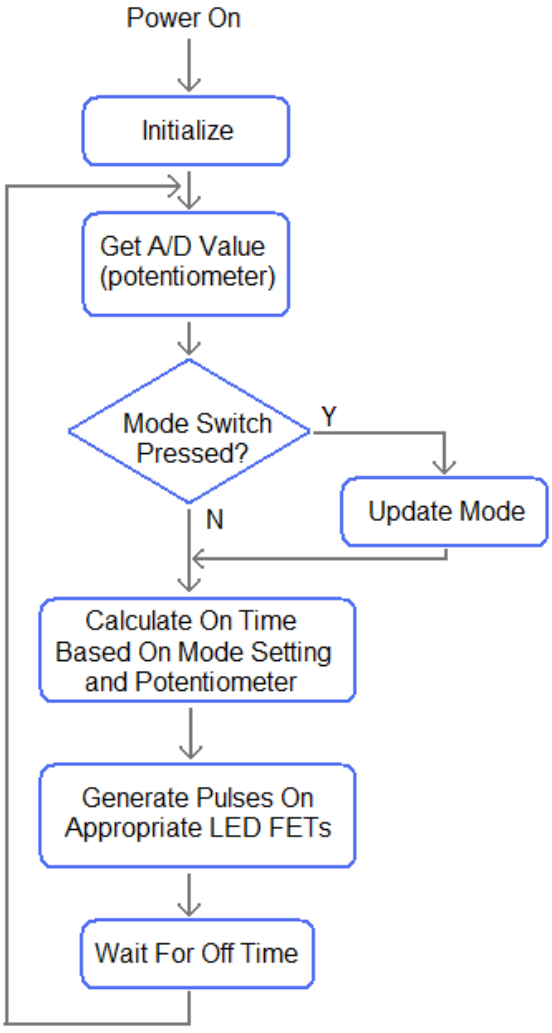
Joe also designed and assembled six small PCBs to hold the LEDs and current-limiting resistors (**Figure 4**). Common-anode LEDs allow the use of one power connection (+9V dc) and three control lines (one per LED color) that each go to an FET. Wire all LEDs of the same color in parallel on BOTH the LED PCB and between the LED boards. This arrangement lets a single FET control all LEDs of the same color.



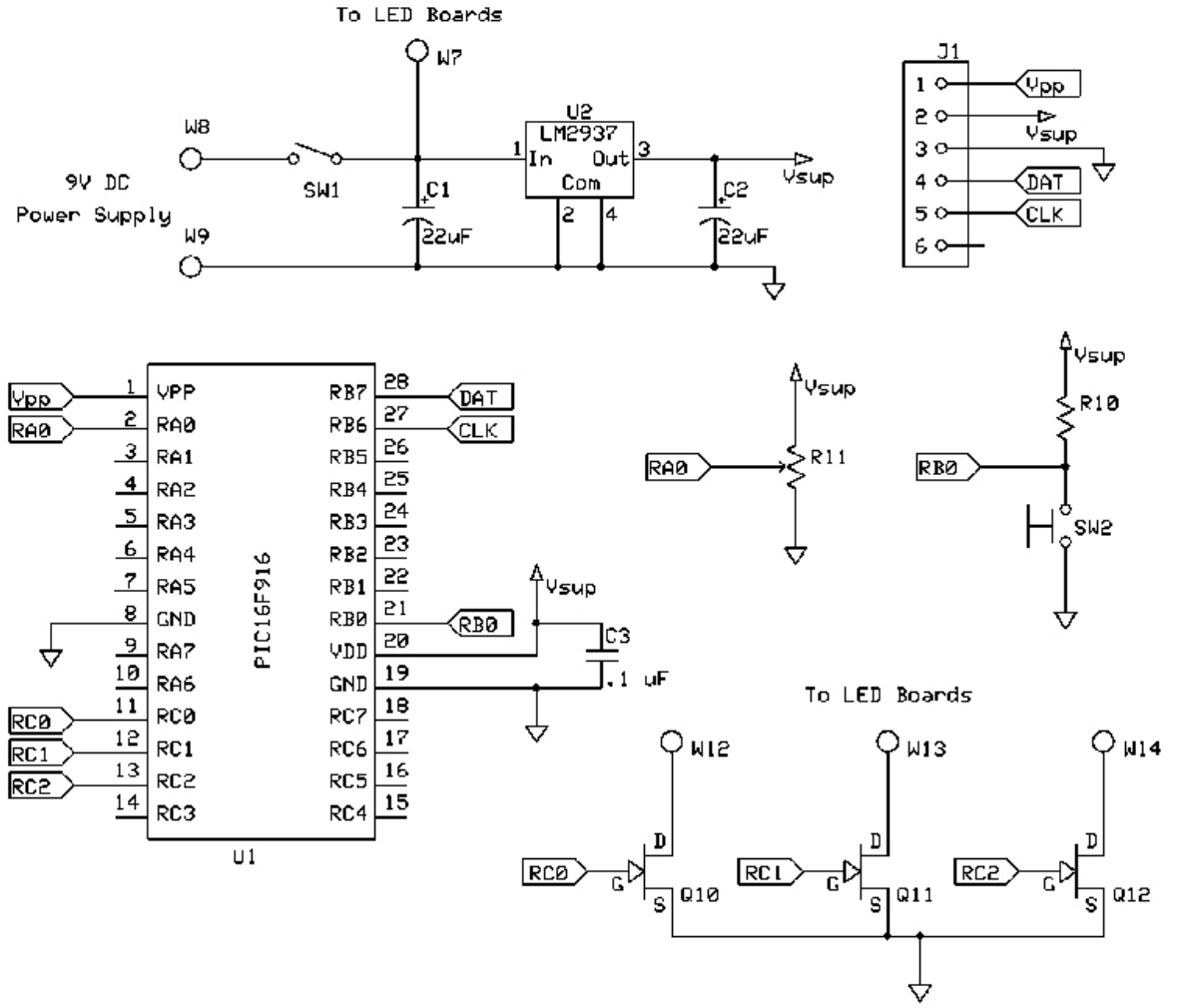
An LED mounting PCB shines light in three directions for room-corner illumination.

When he installed the LED PCBs, Joe angled the LEDs to control the projection of the light on the ceiling. The LEDs used in this project have a slight separation between the individual LEDs in the molded plastic body. So, due to their slight separation, they do not project their light uniformly through the plastic lens. As a result, they do not project white light when the FETs turn on all three colors. Instead, you see some separation of the red, blue, and green colors.

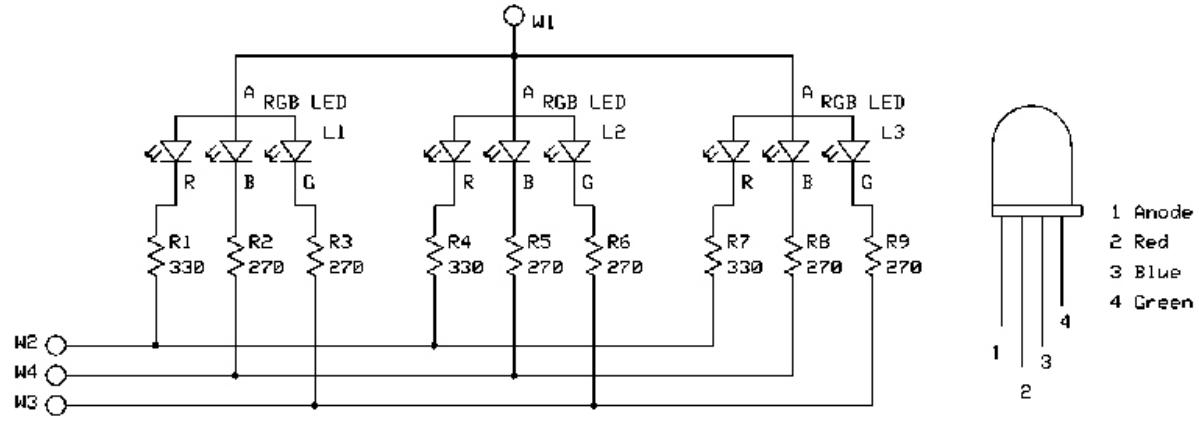
Figure 5 provides a flow chart of the MCU program. **Figures 6** and **7** provide the schematic diagrams for the controller and LED boards.



The flow chart for the MCU's code provides the fundamental framework for the assembly-language code.



Schematic diagram for the controller circuit.



Schematic diagram for the LED circuit used at each corner. Note the 330-ohm current-limit resistor used for the red section of each LED.

Joe used the standard, free MPLAB software tools that Microchip provides, along with a PICkit-2 programming pod to load assembled code into the MCU.

Bill of Materials

Controller Board

Description	Allied #	Ref Des
PIC16F916, SOIC28	383-0502	U1
22 uF, 25V	213-1132	C1, C2
0.1 uF, 25V	213-0110	C3
LM2937, 5V, SOT223	288-0444	U2
Programming Header	618-5001	J1
FET, IRLR7843	273-2194	Q10 – Q12
Switch, on/off	757-5013	SW1
Switch, momentary	757-5014	SW2
4.7k ohm, 1/4W	296-4769	R10
Potentiometer, 10k ohm, 1 turn	753-2264	R11
Nut	753-0001	N/A
Lock washer	753-0011	N/A
Miscellaneous wire, connectors, project box, etc.	N/A	N/A

LED Board

Description	Allied #	Ref Des
RGB LED (common anode)	N/A	L1 – L3
270 ohm, 1/4W	296-4760	R2,3,5,6,8,9
330 ohm, 1/4W	296-4764	R1,4,7