Offline supply drives LEDs

TA Babu, Chennai, India; Edited by Martin Rowe and Fran Granville - April 21, 2011

LEDs need power when rectifiedac-mains voltage drops during itscycle. The circuit in **Figure 1** lets youuse an inductor-less, switching, offlinepower supply as an LED driver for emergency-exit signs and neon-light replacements.The design uses off-the-shelfcomponents, offers efficient operationwithout an inductor in the dc side of thecircuit, has no high-voltage capacitors,operates directly from either 120 or230V ac, has minimal power dissipation,and has adjustable output voltage.

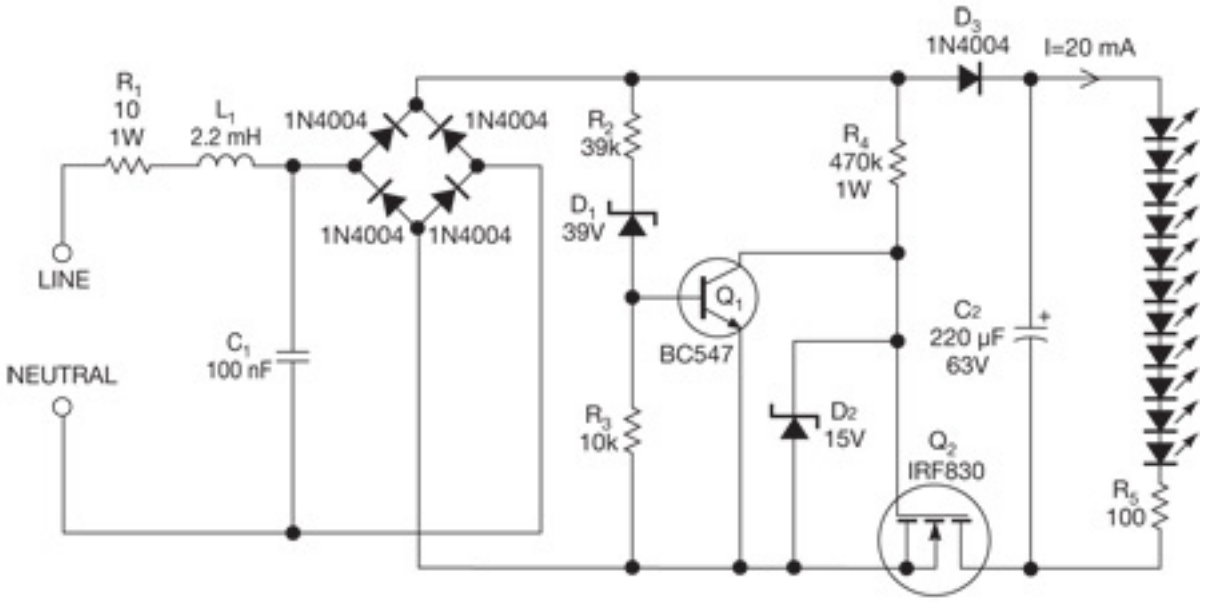

Figure 1 The transistor and MOSFET provide current to keep the LEDs lit.

The circuit operates by controllingthe conduction angle of MOSFET Q_2.When the rectified ac voltage is belowthe high-voltage threshold, VTH, whichD_1 sets, the series pass transistor turnson. The series pass transistor turns offwhen the output storage capacitor, C_2,charges up to the regulation point.

Read More
Design Ideas

The circuit's output voltage decayswhen Q_2 is off and when the rectifiedac is below the output voltage (**Figure2**). The load and the value of C_2 determinethe amount of decay. The switchconducts only when it has low voltagesacross it, minimizing power dissipation.The output capacitor charges onthe rising edge of a sine wave,which achieves reasonable efficiencies.Fusible resistor R_1 providescatastrophic-failure protectionand limits input inrush whenyou first apply ac power. A 15Vdiode, D_2, limits the voltage to thegate of Q_2 and limits the voltageacross transistor Q_1.

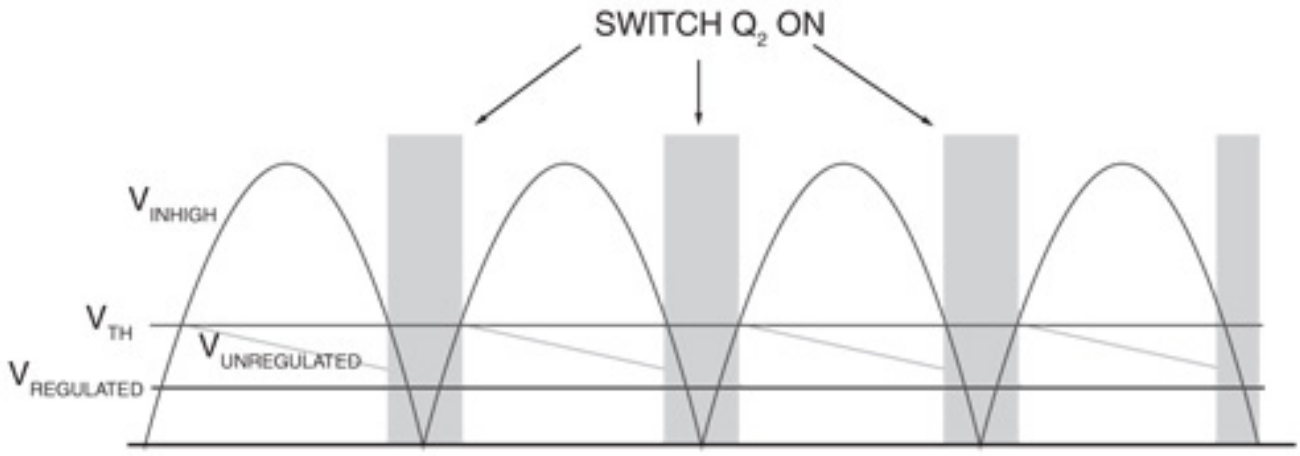

Figure 2 Switch Q_2 turns on when the rectified ac input voltage drops below a threshold.

The current interruption in theMOSFET causes ringing on thedrain-to-source voltage of Q_2, creatingconducted EMI (electromagneticinterference). The 2.2-mHchoke, L_1, and capacitor C 1 suppressEMI. This design maintainsa fairly constant illumination over a wide voltage variation in theinput. If necessary, you can adda few more such strings to suityour requirements.

Note that this circuit doesnot provide galvanic isolation.Touching any part of the circuitduring operation can give youan electric shock.