



APPLICATION NOTE 4381

# MR-16 LED Driver with a 5V Auxiliary Output to Power a Pulsating LED Cooler

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*Abstract: This application note presents a reference design for a 4S1P MR-16 LED driver that provides 750mA to a string of four white LEDs (WLEDs). The circuit operates from a 24V source and is based around the MAX16820 hysteretic LED driver. Also included is a MAX5033 24V-to-5V, 150mA switching power supply to power a Nuventix® pulsating LED cooler.*

## Overview

This reference design details a driver circuit using the [MAX16820](#) hysteretic LED driver for a 4-LED MR-16 lamp with an associated power source ([MAX5033](#)) for a pulsed air cooler.

The following are the electrical input requirements and output capabilities.

$V_{IN}$ : 24V<sub>DC</sub> ±5%

Temperature: +80°C (max) ambient

$V_{LED}$  configuration: 4 LEDs in series (16V<sub>DC</sub>, max), 750mA

Auxiliary output power: 5V at 150mA (average), 300mA (peak)

The reference design is discussed in detail below, with analysis of the main circuit blocks and layout considerations.



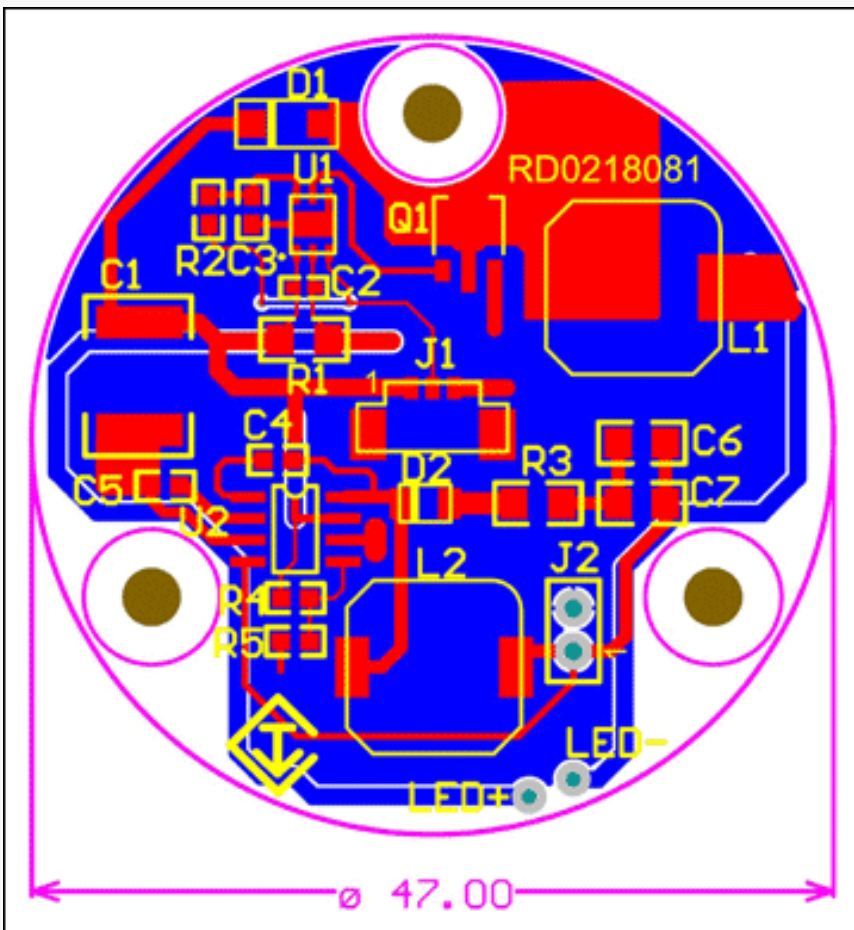


Figure 3. Revised layout of the PCB (updated from the board in Figure 2).

## Design Analysis

Designed to fit directly into an MR-16 assembly, this reference design delivers 750mA to a string of 4 LEDs from a 24V power source. The MAX16820 provides hysteretic control and regulates the current through the inductor and the LEDs. Meanwhile, the MAX5033 provides power to a pulsating cooler through the J2 connector. The cooler presents a sinusoidal load of 300mA peak and 150mA average to the power supply.

The R3 resistor is in the circuit to satisfy the stability requirements (with a ceramic output capacitor) of the MAX5033.

A provision was made for PWMing, but not tested. The center pin of J1 was routed directly to the DIM input of the MAX16820.

## Power-Up Procedure

1. Connect 4 LEDs in series to the LED+ (anode) and LED- (cathode) pins.
2. Attach a 300mA load to J2.
3. Attach a 24V, 1A power supply to J1.
4. Turn on the power supply.

**Table 1. Bill of Materials (BOM)**

Designator	Component	Description	Footprint	Quantity
C1	Nonpolarized capacitor	10 $\mu$ F, 50V, X7R	2220	1
C2	Nonpolarized capacitor	470pF, 50V, COG	0402	1
C3	Nonpolarized capacitor	1 $\mu$ F, 16V, X7R	0603	1
C4, C5	Nonpolarized capacitors	0.1 $\mu$ F, 25V, X7R	0603	2
C6, C7	Nonpolarized capacitors	10 $\mu$ F, 10V, X7R	1206	2
D1	Schottky diode	STPS2L60A	SMA	1
D2	Schottky diode	RB160M-60	SOD123F	1
J1	3 x 1 connector	—	1.25mm	1
J2	2 x 1 connector	—	100mil	1
L1	Inductor	82 $\mu$ H, MSS1038-823	10.2mm x 10mm	1
L2	Inductor	390 $\mu$ H, MSS1038-394	10.2mm x 10mm	1
Q1	n-channel MOSFET	2SK2857	SOT89	1
R1	Resistor	0.24 $\Omega$ , 1%	1206	1
R2	Resistor	10k $\Omega$ , 1%	0603	1
R3	Resistor	0.27 $\Omega$ , 5%	1206	1
R4	Resistor	100k $\Omega$ , 1%	0603	1
R5	Resistor	10k $\Omega$ , 1%	0603	1
U1	LED driver	MAX16820ATT	6-TDFN	1
U2	Buck DC-DC converter	MAX5033BUSA	8-SO	1

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### Related Parts

MAX16820: [QuickView](#) -- [Full \(PDF\) Data Sheet](#) -- [Free Samples](#)

MAX5033: [QuickView](#) -- [Full \(PDF\) Data Sheet](#) -- [Free Samples](#)

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