Application Hint 59

Driving 20 White LEDs with a Single MIC2291 Step-Up Switching Regulator using a Simple Inductor

Introduction

With duty cycle limitations of typical step-up switching regulators it is very difficult to drive 20 white LEDs in a single series string using a simple inductor. The difficulty in driving 20 white LEDs in a single series string is with the maximum duty cycle specification of the particular step-up switching regulator being used, with 20 white LEDs the resulting duty cycle may exceed the maximum duty cycle capability of the particular step-up switching regulator. The circuit in Figure 1 illustrates how a typical step-up switching regulator (MIC2291) can drive 20 white LEDs without violating its maximum duty cycle specification

Circuit Description

In Figure 1 the first white LED string, D1→D5, with the R1 resistor is connected to the feedback voltage pin of the MIC2291. The R1 resistor sets the current that will flow through the other strings of white LEDs. The current matching to the other white LED strings of the transistor array is performed by the simple current mirror circuit configuration of the PNP or PMOS transistor array.

With each transistor in the array having the same V_{BE} (base-to-emitter voltage) or V_{GS} (gate-to-source voltage) voltage their collector (PNP) or drain (PMOS) bias currents will be closely matched. The *R resistors are optional resistors that minimize the impact of the Early effect, where differences in V_{CE} (collector-to-emitter) or V_{DS} (drain-to-source) voltages may result in mismatched bias currents through each member of the transistor array.

Bill of Material

Ref Des	Part Number	Description	Manufacturer
C1	C2012X5R1A225K	2.2µF 10V Ceramic Capacitor, Size 0805	TDK
	0805ZD225KAT	2.2µF 10V Ceramic Capacitor, Size 0805	AVX
C2	C2012X5R1E225K	2.2µF 25V Ceramic Capacitor, Size 0805	TDK
	12063D225KAT	2.2µF 25V Ceramic Capacitor, Size 1206	AVX
D	MBRM140	1A 40V Schottky Diode	On Semiconductor
	SS14	1A 40V Schottky Diode	Vishay
D1 … D20	TLMW3101	High Intensity SMD LED	Vishay
L	VLF4012AT-100MR79	10µH 800mA Inductor	TDK
	SD3812-100	10µH 778mA Inductor	Cooper Bussmann
R1	CRCW06031R00FRT1	1Ω Resistor, Size 0603	Vishay
	THAT320	Quad Low-Noise PNP Transistor Array	That Corporation
	ALD1107	Quad P-Channel Matched Pair MOSFET Array	Advanced Linear Devices
U1	MIC2291-34BML	MLF™ 1.2MHz PWM Step-Up Converter	Micrel

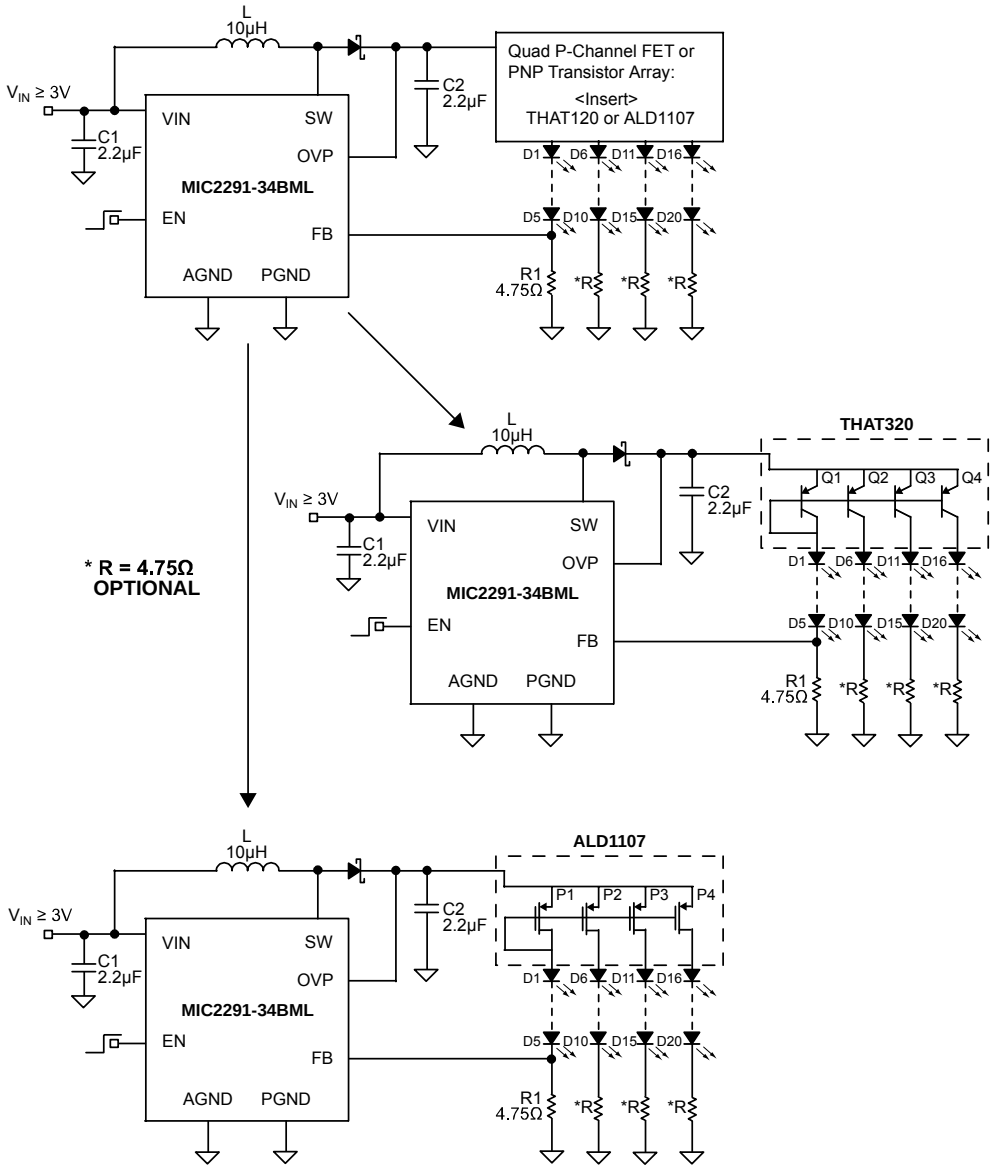

Figure 1

MICREL, INC. 2180 FORTUNE DRIVE SAN JOSE, CA 95131 USA
TEL +1 (408) 944-0800 FAX +1 (408) 474-1000 WEB http:/www.micrel.com