

LM3410X LED Driver 6-Pin LLP Demo Board

National Semiconductor
Application Note 1774
Matthew Reynolds
February 1, 2008



Introduction

The demo board included in this shipment converts 2.7V to 5.5V input, and illuminates four 50mA LED's in series using the LM3410X 1.6MHz LED driver switching converter. This is a 2-layer board using the bottom layer as a Ground plane.

A bill of materials below describes the parts used on this demo board. A schematic and layout have also been included below

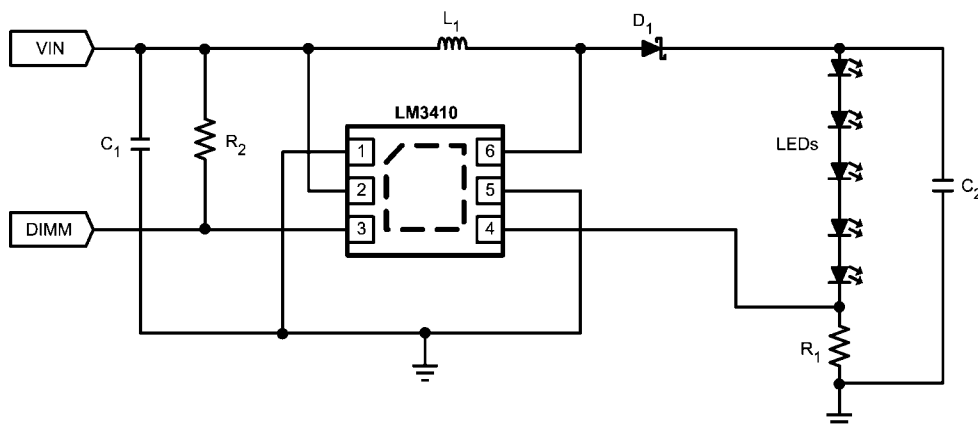
along with measured performance characteristics. The above restrictions for the input voltage are valid only for the demo board as shipped with the demo board schematic below.

Operating Conditions

$$V_{IN} = 2.7V \text{ to } 5.5V$$

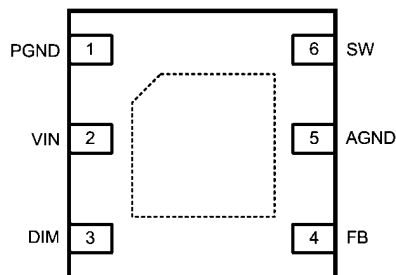
$$V_O \approx V_F \times 4 + V_{FB} \approx 3.6V \times 4 + 0.198V \approx 14.4V$$

$$I_O = 50mA$$



LM3410X 6-Pin LLP Schematic

30048801



Pinout

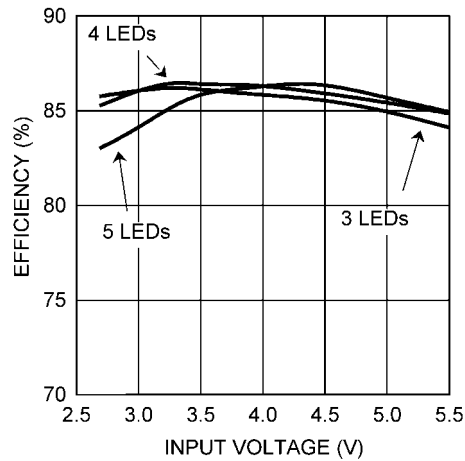
30048802

Pin Descriptions - 6 Pin LLP

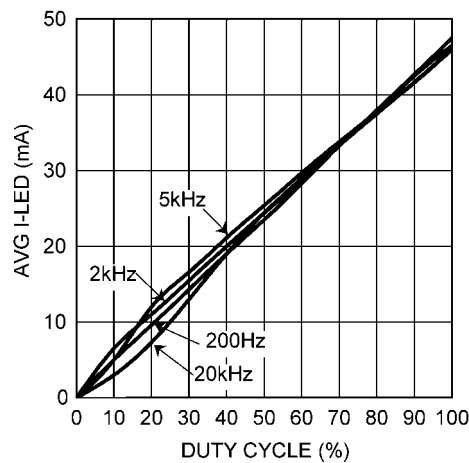
Pin	Name	Function
1	PGND	Power ground pin. Place PGND and output capacitor GND close together.
2	VIN	Supply voltage for power stage, and input supply voltage.
3	DIM	Dimming & shutdown control input. Logic high enables operation. Duty Cycle from 0 to 100%. Do not allow this pin to float or be greater than VIN + 0.3V.
4	FB	Feedback pin. Connect FB to external resistor divider to set output voltage.
5	AGND	Signal ground pin. Place the bottom resistor of the feedback network as close as possible to this pin & pin 4.
6	SW	Output switch. Connect to the inductor, output diode.
DAP	GND	Signal & Power ground. Connect to pin 1 & pin 5 on top layer. Place 4-6 vias from DAP to bottom layer GND plane.

Bill of Materials LM3410X

Part ID	Part Value	Manufacturer	Part Number
U1	2.8A I_{SW} LED Driver	NSC	LM3410XSD
C1, Input Cap	10 μ F, 6.3V, X5R	TDK	C2012X5R0J106M
C2 Output Cap	2.2 μ F, 25V, X5R	TDK	C2012X5R1E225M
D1, Catch Diode	0.4V _f Schottky 500mA, 30V _R	Diodes Inc	MBR0530
L1	10 μ H 1.5A	Coilcraft	DO1608C-103
R1	4.02 Ω , 1%	Vishay	CRCW08054R02F
R2	100k Ω , 1%	Vishay	CRCW06031003F
LED's	SMD-1206, 50mA, V _f \approx 3.6V	Lite-On	LTW-150k

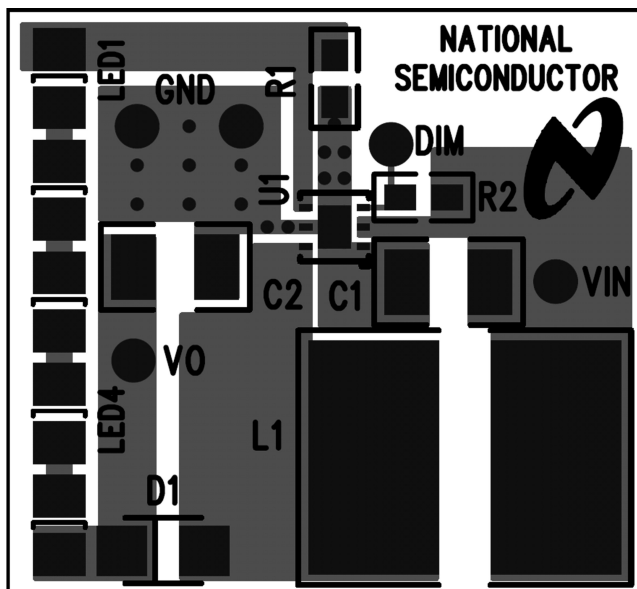


LM3410X Efficiency vs Input Voltage Series LEDs @ 50mA



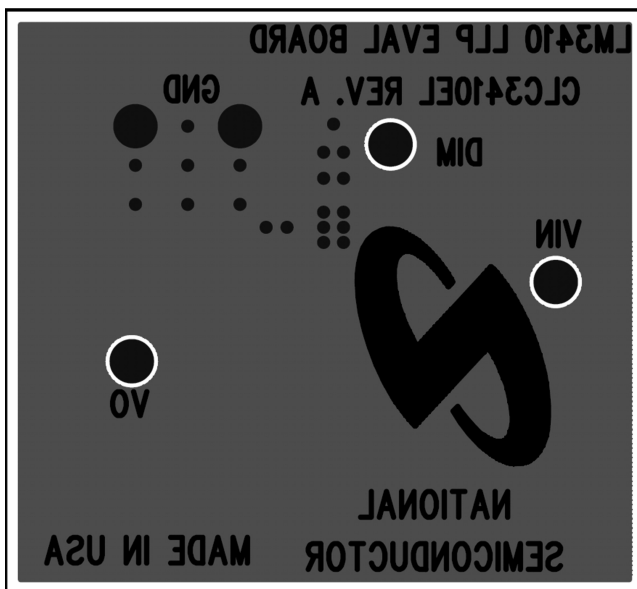
LM3410X Average LED Current vs Duty-Cycle & Dimming Frequency

PCB Layout



30048805

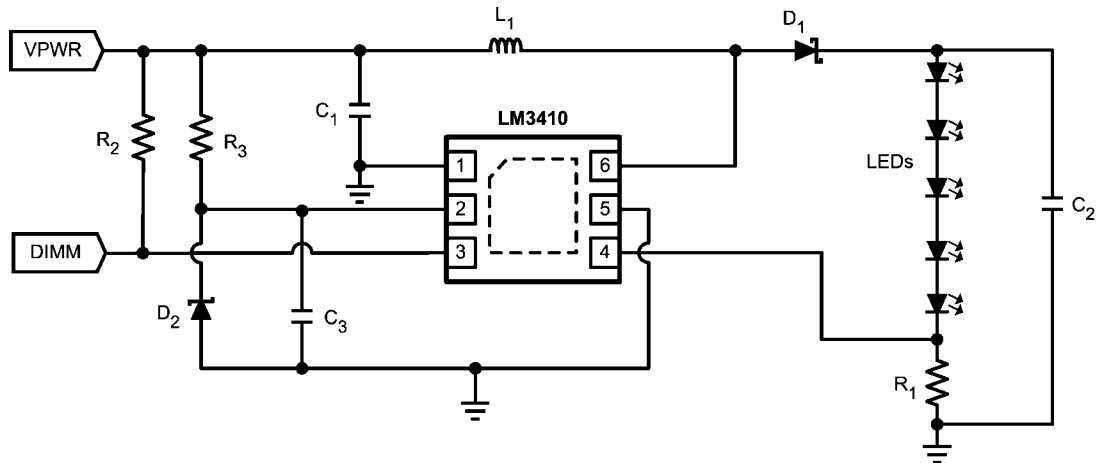
Demonstration Board Top Layer



30048806

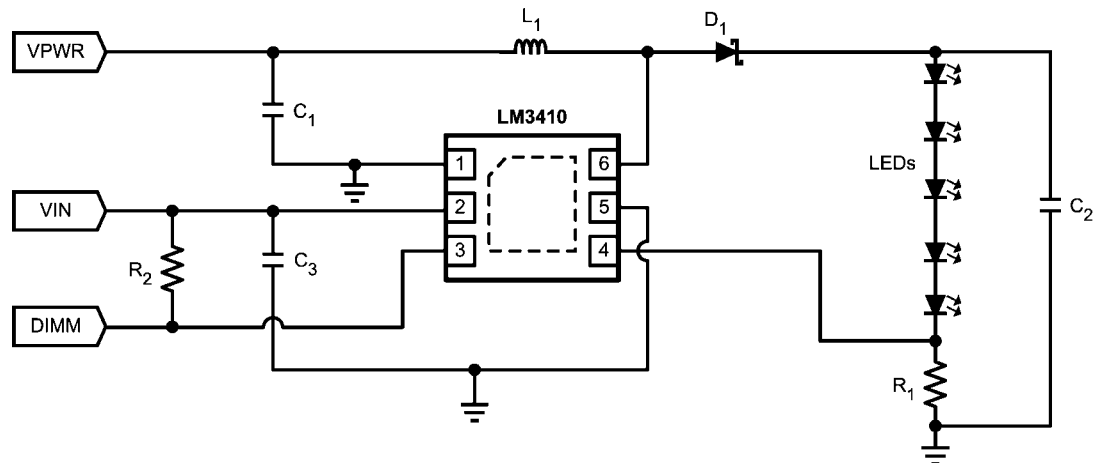
Demonstration Board Bottom Layer

16V > V_{PWR} > 5.5V Application Circuit



30048807

FIGURE 1.



30048808

FIGURE 2.

The demonstration board provided can easily be modified to allow the user to derive the power from an input supply that is larger than 5.5V. In figure 1 two separate supplies are needed. V_{IN} must be between 2.7V minimum to 5.5V maximum, but V_{PWR} can be as great as 16V.

The circuit shown in Figure 2 allows for a single supply to be used with a simple zener diode regulation circuit to provide

the LM3410 with a housekeeping and driver voltage that is below 5.5V.

The LM3410 VIN supply will draw approximately 7 mA while it is switching. Zener diode should have a breakdown voltage lower than 5V, and size R3 to allow for 7 mA of current draw.

Part ID	Part Value	Manufacturer	Part Number
U1	2.8A I_{SW} LED Driver	NSC	LM3410XSD
C1 V_{PWR} Input Cap	10 μ F, 6.3V, X5R	TDK	C1608X5R0J106K
C2 Output Cap	1 μ F, 25V, X5R	TDK	C2012X5R1E105K
C3 V_{IN} Input Cap	0.1 μ F, 16V, X5R	TDK	C1005X5R1C104K
D1, Catch Diode	0.43V _f , Schotky, 0.5A, 30V _R	Diodes Inc	B0530W
L1	6.8 μ H 2.7A	Coilcraft	MOS6020-682
R1	4.02 Ω , 1%	Vishay	CRCW08054R02FRT1
R2	100k Ω , 1%	Vishay	CRCW08051003F
R3	576 Ω , 1%	Vishay	CRCW08055760F
D2	3.3V Zener, SOT23	Diodes Inc	BZX84C3V3
LEDs	SMD-1206, 50mA, $V_f \approx 3.6V$		

For more National Semiconductor product information and proven design tools, visit the following Web sites at:

Products		Design Support	
Amplifiers	www.national.com/amplifiers	WEBENCH	www.national.com/webench
Audio	www.national.com/audio	Analog University	www.national.com/AU
Clock Conditioners	www.national.com/timing	App Notes	www.national.com/appnotes
Data Converters	www.national.com/adc	Distributors	www.national.com/contacts
Displays	www.national.com/displays	Green Compliance	www.national.com/quality/green
Ethernet	www.national.com/ethernet	Packaging	www.national.com/packaging
Interface	www.national.com/interface	Quality and Reliability	www.national.com/quality
LVDS	www.national.com/lvds	Reference Designs	www.national.com/refdesigns
Power Management	www.national.com/power	Feedback	www.national.com/feedback
Switching Regulators	www.national.com/switchers		
LDOs	www.national.com/ldo		
LED Lighting	www.national.com/led		
PowerWise	www.national.com/powerwise		
Serial Digital Interface (SDI)	www.national.com/sdi		
Temperature Sensors	www.national.com/tempsensors		
Wireless (PLL/VCO)	www.national.com/wireless		

THE CONTENTS OF THIS DOCUMENT ARE PROVIDED IN CONNECTION WITH NATIONAL SEMICONDUCTOR CORPORATION ("NATIONAL") PRODUCTS. NATIONAL MAKES NO REPRESENTATIONS OR WARRANTIES WITH RESPECT TO THE ACCURACY OR COMPLETENESS OF THE CONTENTS OF THIS PUBLICATION AND RESERVES THE RIGHT TO MAKE CHANGES TO SPECIFICATIONS AND PRODUCT DESCRIPTIONS AT ANY TIME WITHOUT NOTICE. NO LICENSE, WHETHER EXPRESS, IMPLIED, ARISING BY ESTOPPEL OR OTHERWISE, TO ANY INTELLECTUAL PROPERTY RIGHTS IS GRANTED BY THIS DOCUMENT.

TESTING AND OTHER QUALITY CONTROLS ARE USED TO THE EXTENT NATIONAL DEEMS NECESSARY TO SUPPORT NATIONAL'S PRODUCT WARRANTY. EXCEPT WHERE MANDATED BY GOVERNMENT REQUIREMENTS, TESTING OF ALL PARAMETERS OF EACH PRODUCT IS NOT NECESSARILY PERFORMED. NATIONAL ASSUMES NO LIABILITY FOR APPLICATIONS ASSISTANCE OR BUYER PRODUCT DESIGN. BUYERS ARE RESPONSIBLE FOR THEIR PRODUCTS AND APPLICATIONS USING NATIONAL COMPONENTS. PRIOR TO USING OR DISTRIBUTING ANY PRODUCTS THAT INCLUDE NATIONAL COMPONENTS, BUYERS SHOULD PROVIDE ADEQUATE DESIGN, TESTING AND OPERATING SAFEGUARDS.

EXCEPT AS PROVIDED IN NATIONAL'S TERMS AND CONDITIONS OF SALE FOR SUCH PRODUCTS, NATIONAL ASSUMES NO LIABILITY WHATSOEVER, AND NATIONAL DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY RELATING TO THE SALE AND/OR USE OF NATIONAL PRODUCTS INCLUDING LIABILITY OR WARRANTIES RELATING TO FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

LIFE SUPPORT POLICY

NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS PRIOR WRITTEN APPROVAL OF THE CHIEF EXECUTIVE OFFICER AND GENERAL COUNSEL OF NATIONAL SEMICONDUCTOR CORPORATION. As used herein:

Life support devices or systems are devices which (a) are intended for surgical implant into the body, or (b) support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in a significant injury to the user. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system or to affect its safety or effectiveness.

National Semiconductor and the National Semiconductor logo are registered trademarks of National Semiconductor Corporation. All other brand or product names may be trademarks or registered trademarks of their respective holders.

Copyright© 2008 National Semiconductor Corporation

For the most current product information visit us at www.national.com



**National Semiconductor
Americas Technical
Support Center**
Email:
new.feedback@nsc.com
Tel: 1-800-272-9959

**National Semiconductor Europe
Technical Support Center**
Email: europe.support@nsc.com
German Tel: +49 (0) 180 5010 771
English Tel: +44 (0) 870 850 4288

**National Semiconductor Asia
Pacific Technical Support Center**
Email: ap.support@nsc.com

**National Semiconductor Japan
Technical Support Center**
Email: jpn.feedback@nsc.com