PMP6014
TPS92074
120Vac Non Dimmable 8W LED Driver Reference Design

December, 2013

120Vac Non Dimmable 8W LED Driver Reference Design

1 Introduction

This TPS92074 reference design presents the TPS92074 controller driving a 30V string of LEDs at 250mA in a buck configuration. It is a non dimmable reference design.

2 Description

This reference design provides a high-brightness LED driver based on the TPS92074. It is designed to operate with an input voltage in the range of 90VAC to 132VAC with a 120 VAC nominal input voltage. This design is set up for a 250mA output current with an output voltage range of 25 V to 35 V.

2.1 Typical Applications

This converter design describes an application of the TPS92074 as an LED driver with the specifications listed below. For applications with a different output voltage or current range refer to the TPS92074 datasheet.

2.2 Features

2.2.1 Connector Description

This section describes the connectors of the reference design board.

2.2.1.1 J1

This connector is for the AC input to the board. Use the screw down terminal to connect Line and Neutral to the circuit.

2.2.1.2 J2, J3

This connector is for the LED load. J2 is connected to LED+ and J3 is connected to LED-

3 Electrical Performance Specifications

Table 1: TPS92074 120Vac Non Dimmable Buck Electrical Performance Specifications

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Input Characteristics					
Voltage range	Normal operation	90	120	132	VAC
Maximum input current	At 120VAC 60Hz input voltage		0.11		A
Output Characteristics					
Output voltage, VOUT		25	30	35	V
Output load current, IOUT	Input voltage = 120V 60Hz, Load = 30V LED	240	250	260	mA
Output current accuracy	Input voltage = 120V 60Hz, Load = 30V LED		< ±5		%
Output current ripple	Input voltage = 120V 60Hz, Load = 30V LED		<150		mApp
Output current line regulation	Input voltage 90V to 132V 60Hz, Load = 30V LED		< ±5		%
Systems Characteristics					
Switching frequency	Input voltage = 120V 60Hz, Load = 30V LED		55		kHz
Power Factor	Input voltage = 120V 60Hz, Load = 30V LED		0.97		
Efficiency	Input voltage = 120V 60Hz, Load = 30V LED		88		%

4 Schematic

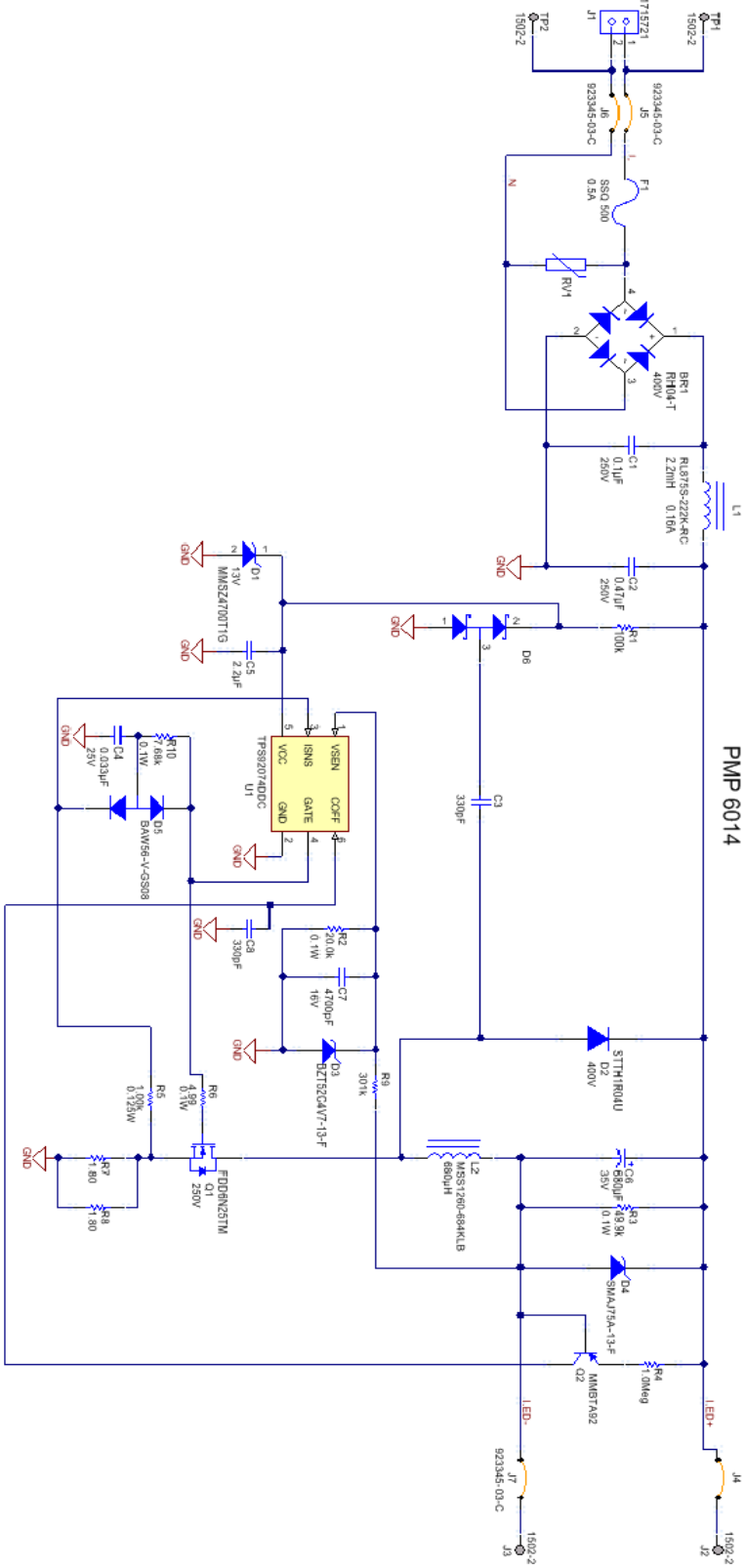

Figure 1: TPS92074 120Vac Non Dimmable 8W LED Driver Schematic

5 Performance Data and Typical Characteristic Curves

Figures 2 through 11 present typical performance curves for TPS92074 120Vac Non Dimmable 8W LED Driver

5.1 Efficiency

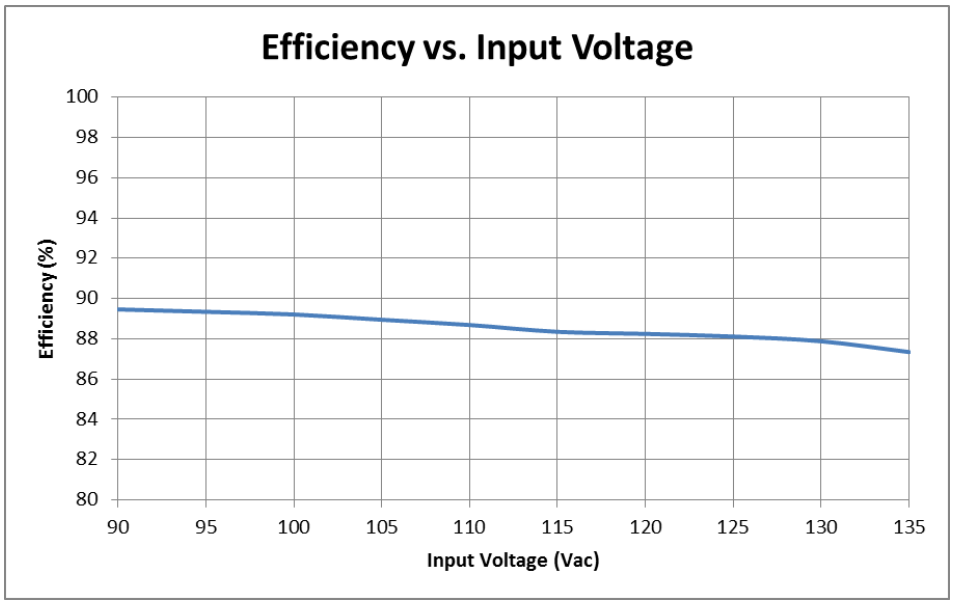

Figure 2: Efficiency with 30V LED stack

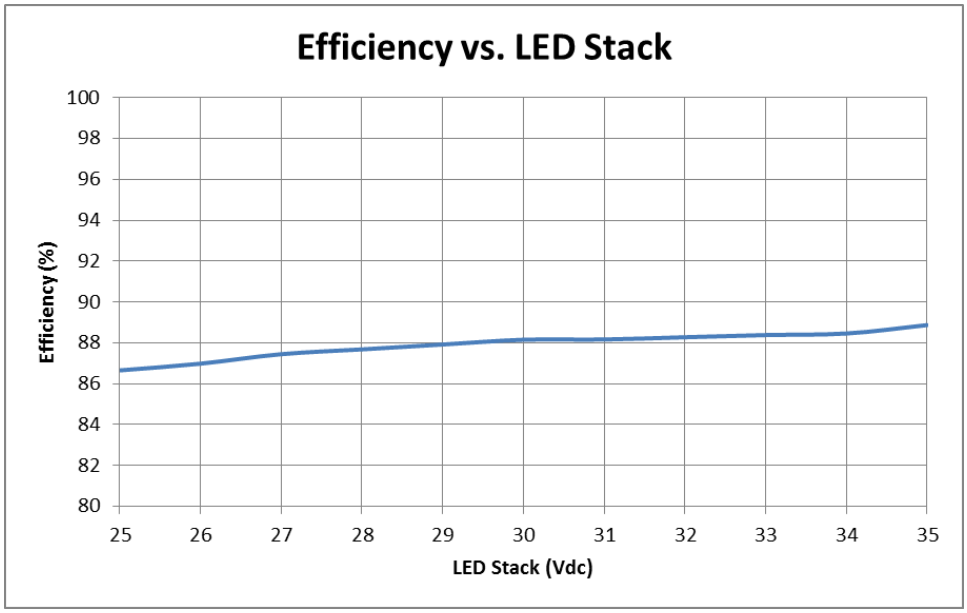

Figure 3: Efficiency at 120Vac 60Hz input

5.2 Current Regulation

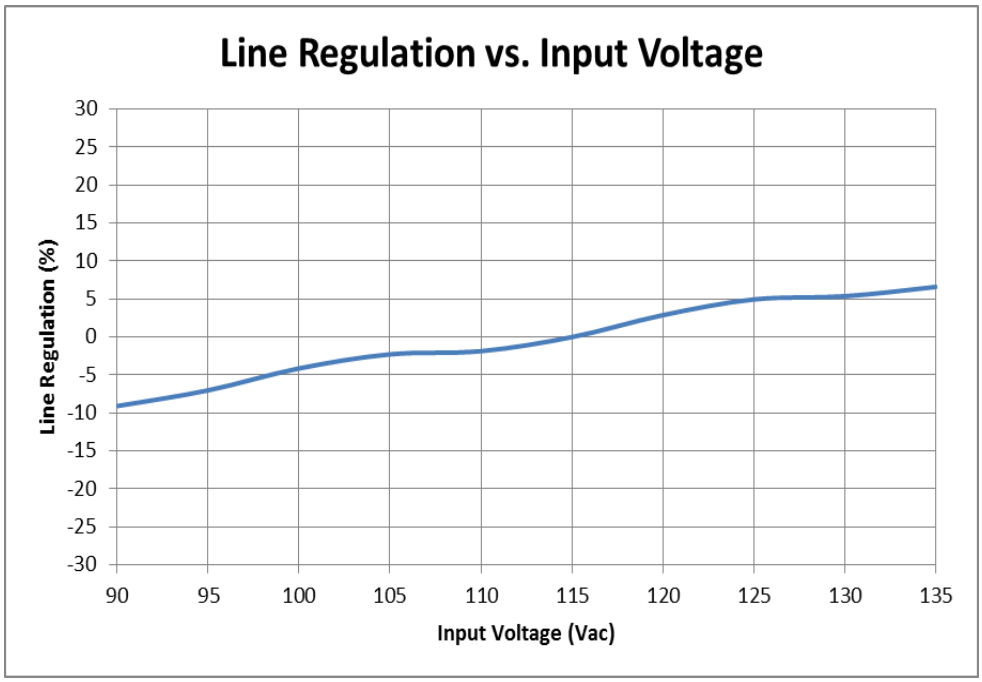

Figure 4: Line Regulation 30V LED stack

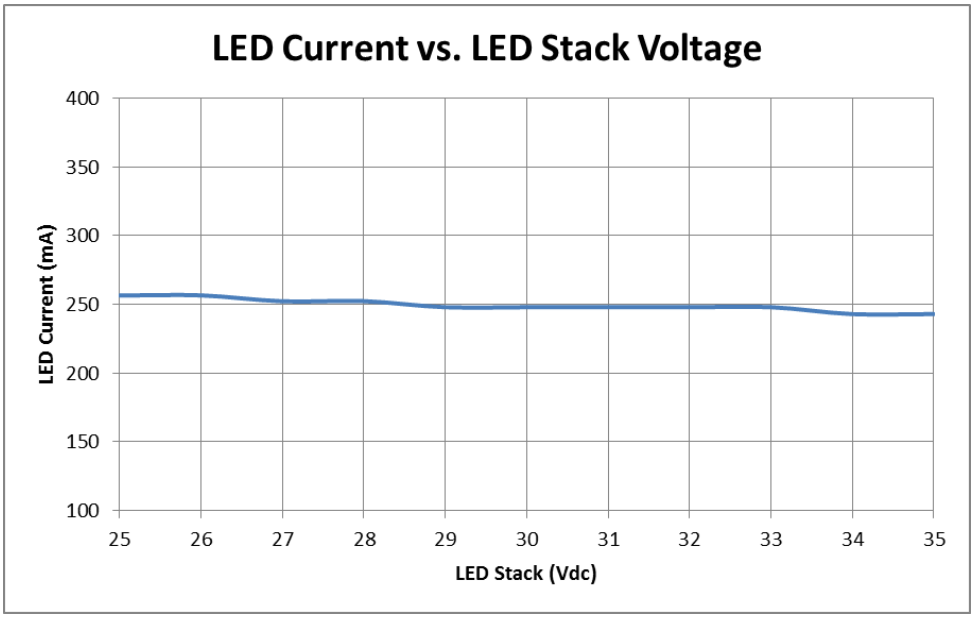

Figure 5: LED Current vs. LED stack voltage 120Vac 60Hz input

5.3 Power Factor

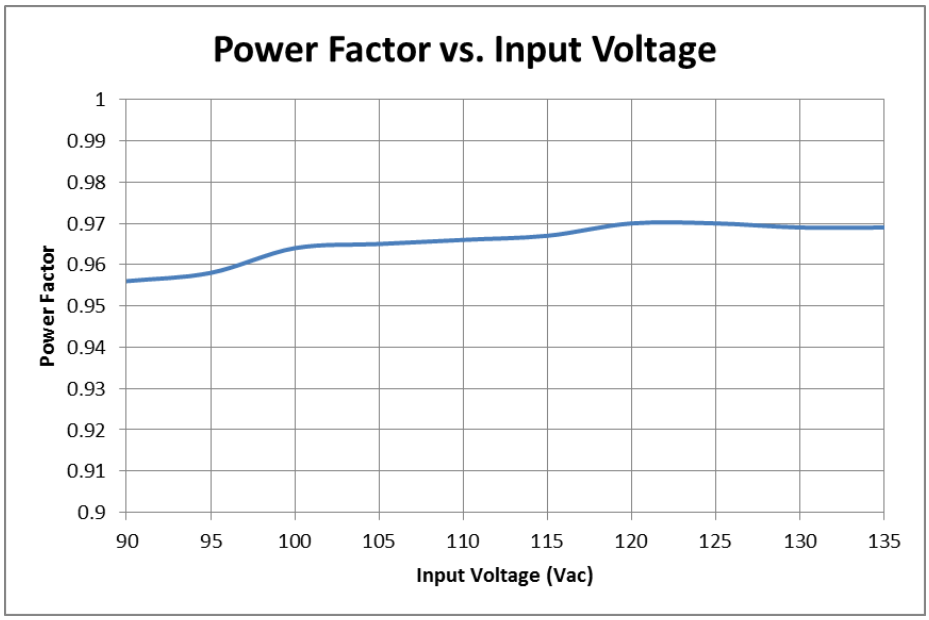

Figure 6: Power Factor 120Vac 60Hz input 30V LED stack

5.4 Waveforms

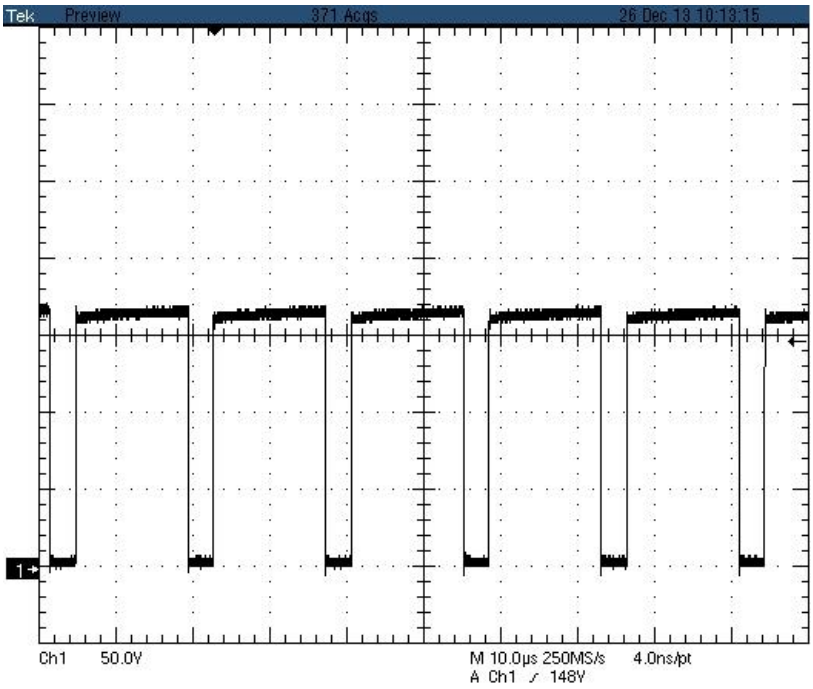

Figure 7: Q1 Drain Waveform at 120Vac 60Hz input

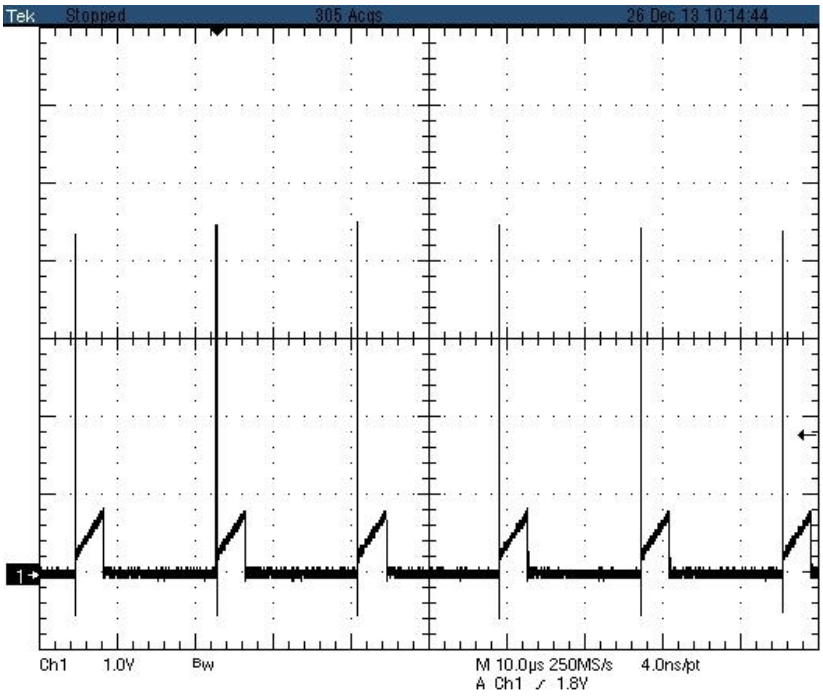

Figure 8: Current sense voltage at 120Vac 60Hz input

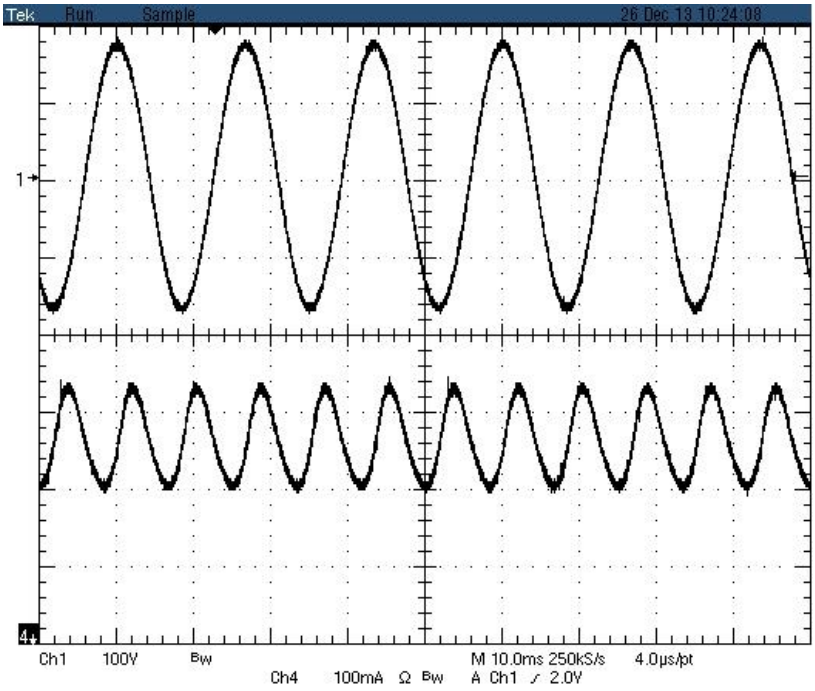

Figure 9: Ch1 Input AC Voltage Ch4 Output LED Current

120Vac 60Hz input 30V LED stack

5.5 EMI Performance

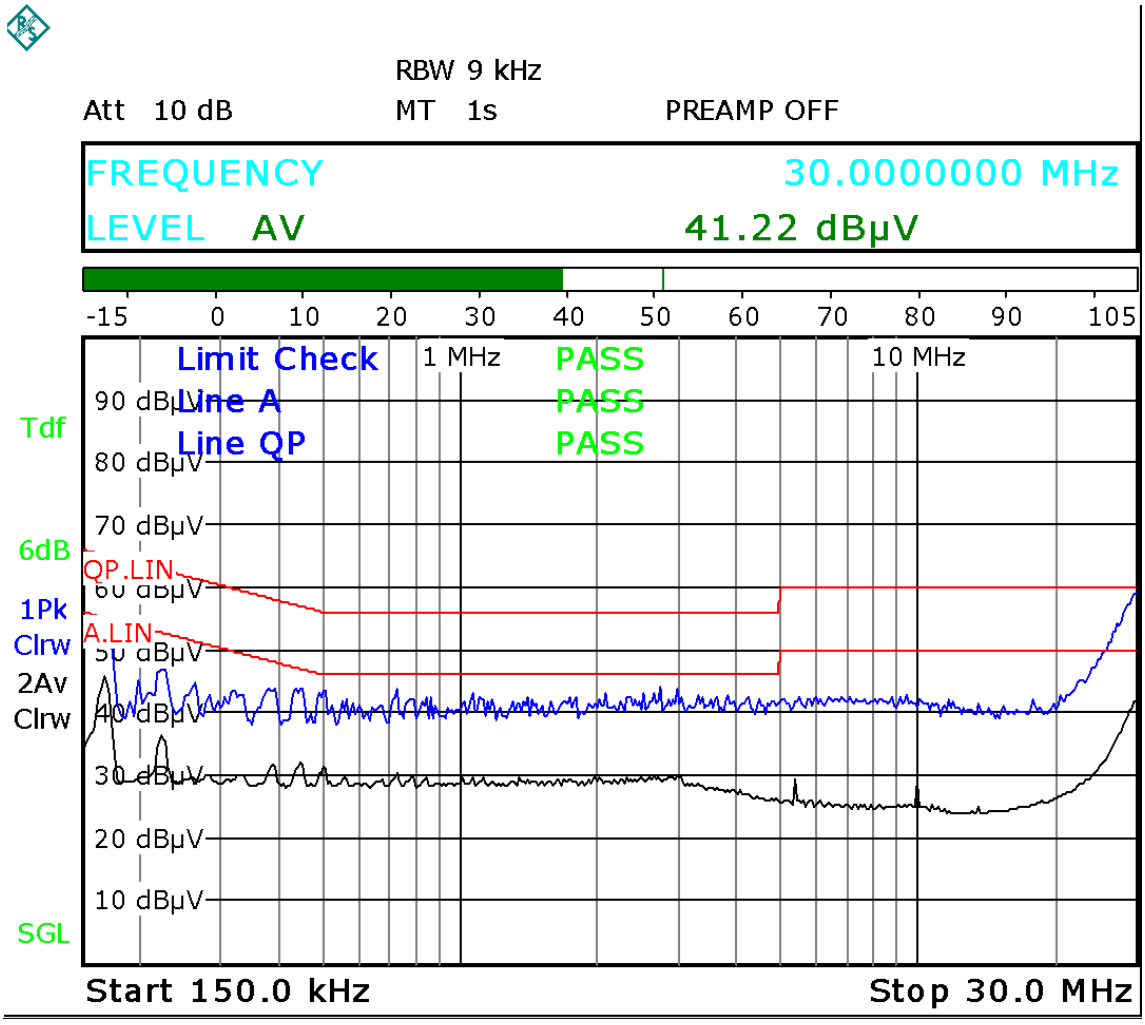

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Figure 10: 120VAC Line-Conducted Average EMI Scan

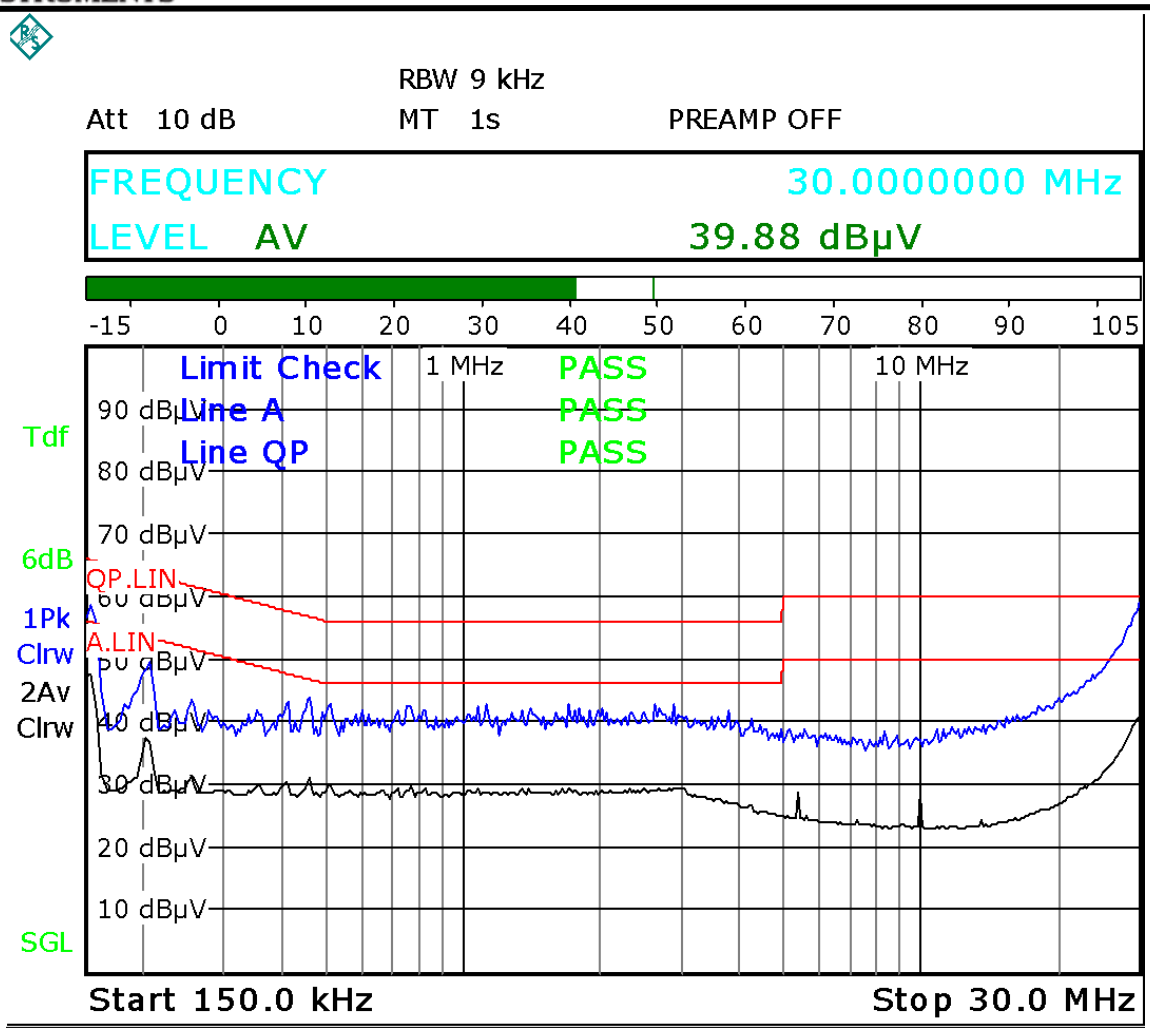

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Figure 11: 120VAC Neutral-Conducted Average EMI Scan

6 TPS92074 120Vac Non Dimmable 8W LED Driver Reference Design PCB layout

The following figures (Figure 12 through Figure 13) show the design of the printed circuit board.

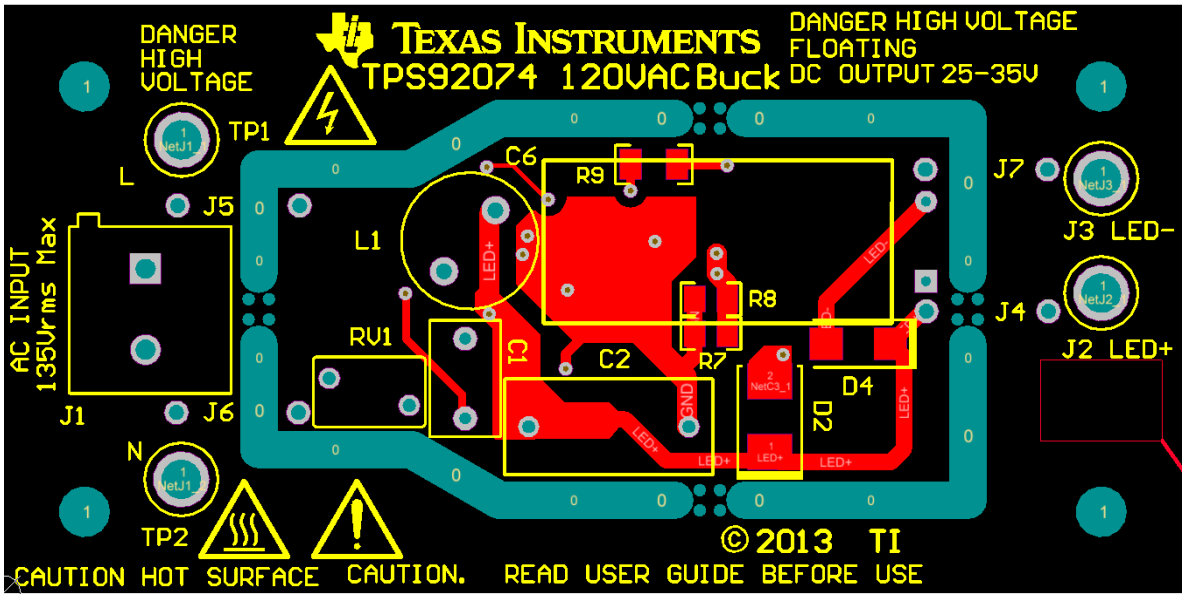

Figure 12: Top Layer and Top Overlay (Top view)

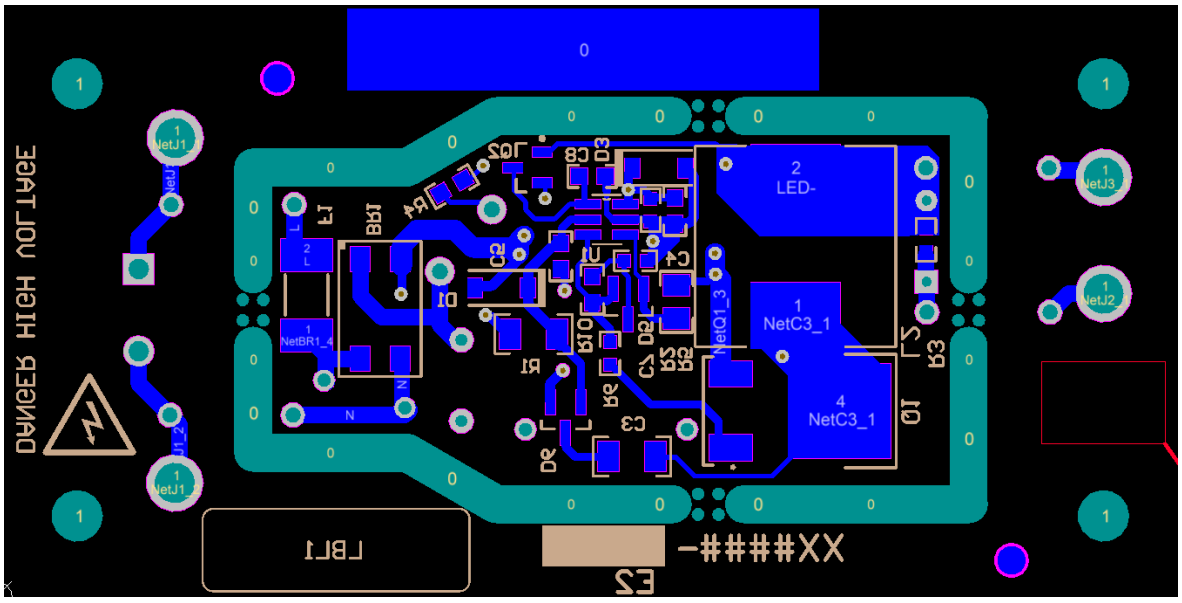

Figure 13: Bottom Layer and Bottom Overlay (Bottom view)

Bill of Materials

Designator	Quantity	Value	Description	Package	PartNumber	Manufacturer
BR1	1	400V	Diode, Switching-Bridge, 400V, 0.5A, MiniDip	4-SMD	RH04-T	Diodes Inc
C1	1	0.1uF	CAP, Film, 0.1uF, 250V, +/-5%, TH	7.3x9.5x4.5mm	B32529C3104K	EPCOS Inc
C2	1	0.47uF	CAP, Film, 0.47uF, 250V, +/-10%, TH	13x12x6mm	B32521C3474K	EPCOS Inc
C3	1	330pF	CAP, CERM, 330pF, 630V, +/-5%, C0G/NP0, 1206	1206	C3216C0G2J331J	TDK
C4	1	0.033µF	CAP, CERM, 0.033uF, 25V, X7R, 20%, 0603	0603 (1608 Metric)	C1608X7R1E333M	TDK Corporation
C5	1	2.2uF	CAP, CERM, 2.2uF, 16V, +10/%, X5R, 0603	0603	GRM188R61C225KE15	MuRata
C6	1	680µF	CAP, Alum, 680uF, 35V, +/-20%, Radial	Radial, Can	EEU-FR1V681	Panasonic
C7	1	4700pF	CAP, CERM, 4700pF, 16V, X7R, 10%, 0603	0603	C0603C472K4RACTU	Kemet
C8	1	330pF	CAP, CERM, 330pF, 50V, +1/%, C0G/NP0, 0603	0603	06035A221FAT2A	AVX
D1	1	13V	Diode, Zener, 13V, 500mW, SOD-123	SOD-123	MMSZ4700T1G	ON Semiconductor
D2	1	400V	Diode, Ultra Fast, 400V, 1A, SMB	DO-214AA, SMB	STTH1R04U	STMicroelectronics
D3	1	4.7V	Diode, Zener, 4.7V, 500mW, SOD-123	SOD-123	BZT52C4V7-13-F	Diodes Inc
D4	1	75V	Diode, TVS, 75V, 400W, SMA	DO-214AC, SMA	SMAJ75A-13-F	Diodes Inc
D5	1	75V	Diode, Sw Dual, Common Anode, 75V, 350mW, SOT23	SOT-23-3	BAW56-V-GS08	Vishay
D6	1	30V	Diode, Schottky, 30V, 0.2A, SOT-23	SOT-23	BAT54S-7-F	Diodes Inc.
F1	1	0.5A	Fuse, 0.5A, 125V, SMD	6.10x2.54x2.54mm	SSQ 500	Bel Fuse
L1	1	2.2mH	Inductor, Shielded, Ferrite, 2.2mH, 0.16A, 7.56 ohm, TH	Dia 7.8 x 7.5mm	RL875S-222K-RC	Bourns
L2	1	680uH	Inductor, Shielded Drum Core, Ferrite, 680uH, 0.8A, 0.87 ohm, SMD	12x6x12mm	MSS1260T-474KLB	Coilcraft
Q1	1	250V	MOSFET, N-CH, 250V, 4.4A, DPAK	TO-252-3, DPak	FDD6N25TM	Fairchild
Q2	1	300V	Transistor, PNP, 300V, 0.2A, SOT-23	SOT-23	MMBTA92	Fairchild
R1	1	100k	RES, 100k ohm, 1%, 0.25W, 1206	1206	STD	STD
R2	1	20.0k	RES, 20.0k ohm, 1%, 0.1W, 0603	0603	STD	STD
R3	1	49.9k	RES, 49.9k ohm, 1%, 0.1W, 0603	0603	STD	STD
R4	1	1.00M	RES, 1.00meg ohm, 1%, 0.1W, 0603	0603	STD	STD
R11	1	1.00k	RES, 1.00k ohm, 1%, 0.125W, 0805	0805	STD	STD
R6	1	4.99	RES, 4.99 ohm, 1%, 0.1W, 0603	0603	STD	STD
R7	1	1.80	RES, 1.80 ohm, 1%, 0.125W, 0805	0805	STD	STD
R8	1	1.80	RES, 1.80 ohm, 1%, 0.125W, 0805	0805	STD	STD
R9	1	301k	RES, 301k ohm, 1%, 0.25W, 1206	1206	STD	STD
R10	1	7.68k	RES, 7.68k ohm, 1%, 0.1W, 0603	0603	STD	STD
RV1	1	200V	Varistor, 200V, 600A, 5MM Radial, TH	7x4.4x10mm Radial	ERZ-V05D201	Panasonic
U1	1		Non-Isolated, Buck PFC LED Driver with Digital Reference Control	DDC0006A	TPS92074DDC	Texas Instruments

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