

[Type text]

PMP6007
TPS92074
230Vac Non Dimmable 10W LED Driver Reference
Design



October, 2013

230Vac Non Dimmable 10W LED Driver Reference Design

1 Introduction

This TPS92074 reference design presents the TPS92074 controller driving a 75V string of LEDs at 110mA 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 180VAC to 277VAC with a 230-VAC nominal input voltage. This design is set up for an 8W output power with an output voltage range of 50 V to 100 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 J8

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 J5

This connector is for the LED load. Use the screw down terminal to connect the LED anode to the pin marked LED+ and connect the LED cathode to the pin marked LED-.

3 Electrical Performance Specifications
Table 1: TPS92074 230Vac Non Dimmable Buck Electrical Performance Specifications

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Input Characteristics					
Voltage range	Normal operation	180	230	277	VAC
Maximum input current	At 230VAC 50Hz input voltage		0.06		A
Output Characteristics					
Output voltage, VOUT		50	75	100	V
Output load current, IOUT	Input voltage = 230V 50Hz, Load = 75V LED	100	110	120	mA
Output current regulation	Input voltage = 230V 50Hz, Load = 75V LED		< ±5		%
Output current ripple	Input voltage = 230V 50Hz, Load = 75V LED		<40		mApp
Output current line regulation	Input voltage 208V to 254V 50Hz, Load = 75V LED		< ±5		%
Output current line regulation	Input voltage 180V to 277V 50Hz, Load = 75V LED		< ±10		%
Systems Characteristics					
Switching frequency	Input voltage = 230V 50Hz, Load = 75V LED		75		kHz
Power Factor	Input voltage = 230V 50Hz, Load = 75V LED		0.9		
Efficiency	Input voltage = 230V 50Hz, Load = 75V LED		89		%

4 Schematic

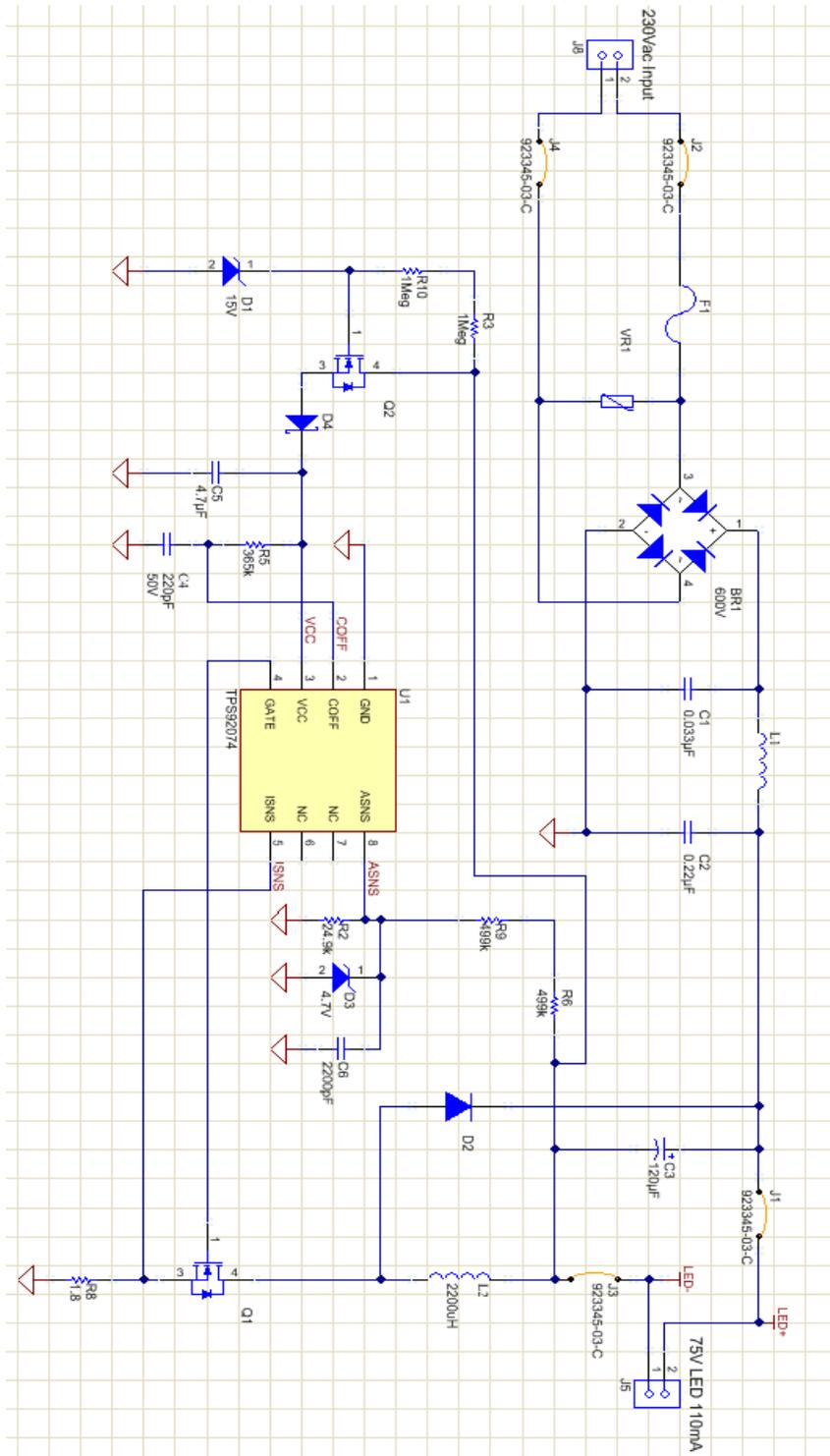


Figure 1: TPS92074 230Vac Non Dimmable 10W LED Driver Schematic

5 Performance Data and Typical Characteristic Curves

Figures 2 through 12 present typical performance curves for TPS92074 230Vac Non Dimmable 10W LED Driver

5.1 Efficiency

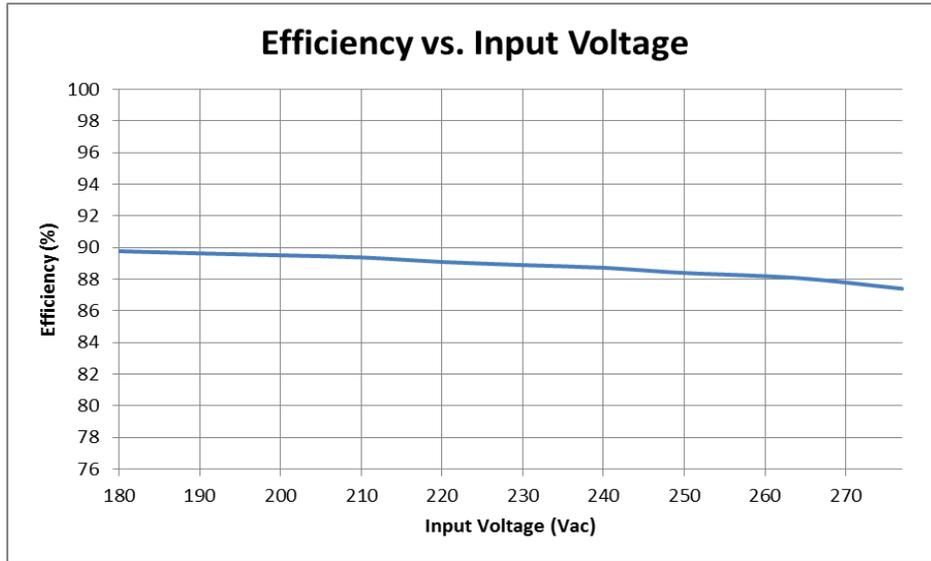


Figure 2: Efficiency with 75V LED stack

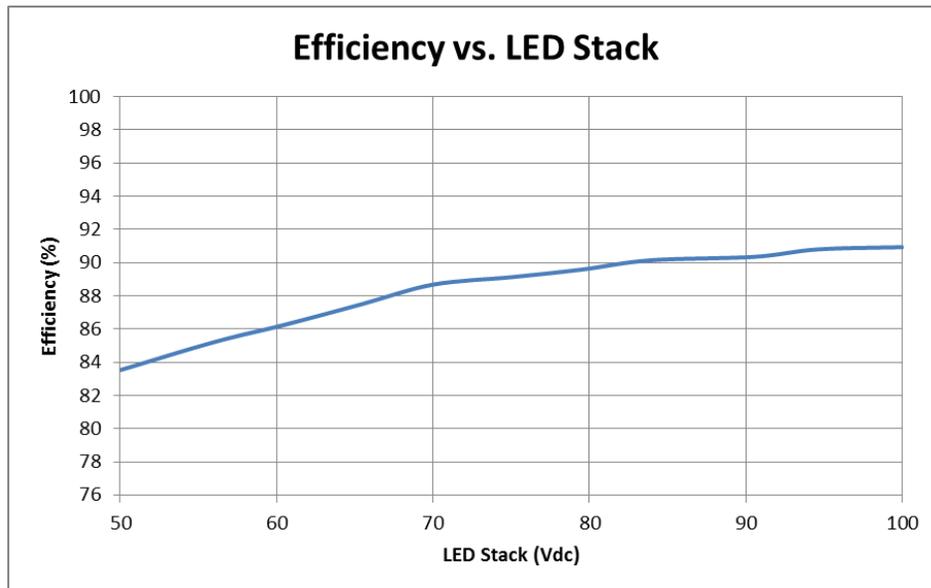


Figure 3: Efficiency at 230Vac 50Hz input

5.2 Current Regulation

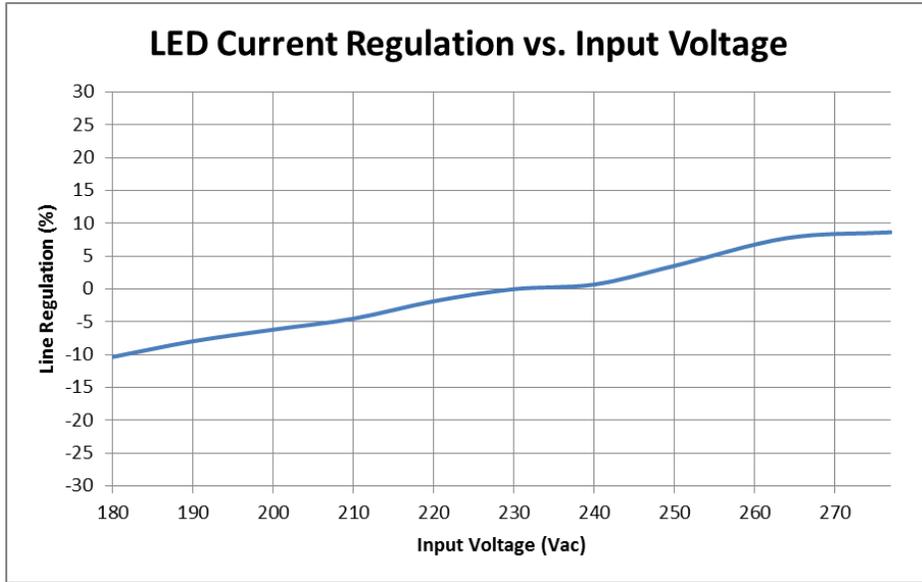


Figure 4: Line Regulation 75V LED stack

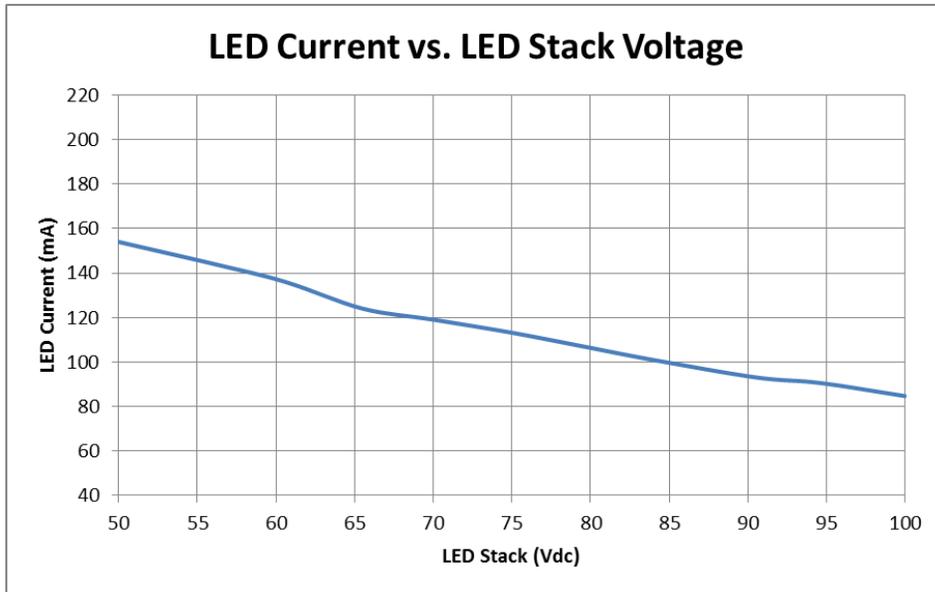


Figure 5: LED Current vs. LED stack voltage 230Vac 50Hz input

5.3 Power Factor

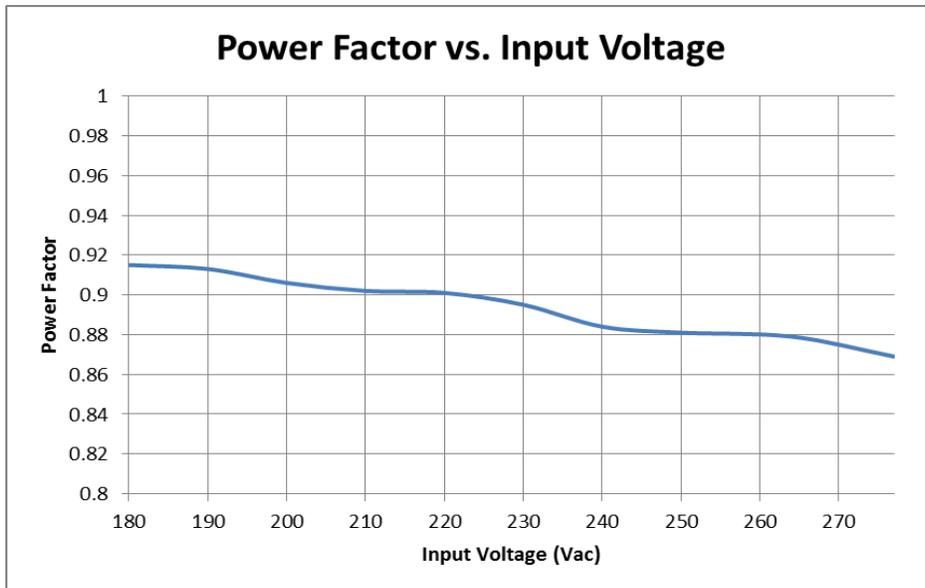


Figure 6: Power Factor 230Vac 50Hz input 75V LED stack

5.4 Waveforms

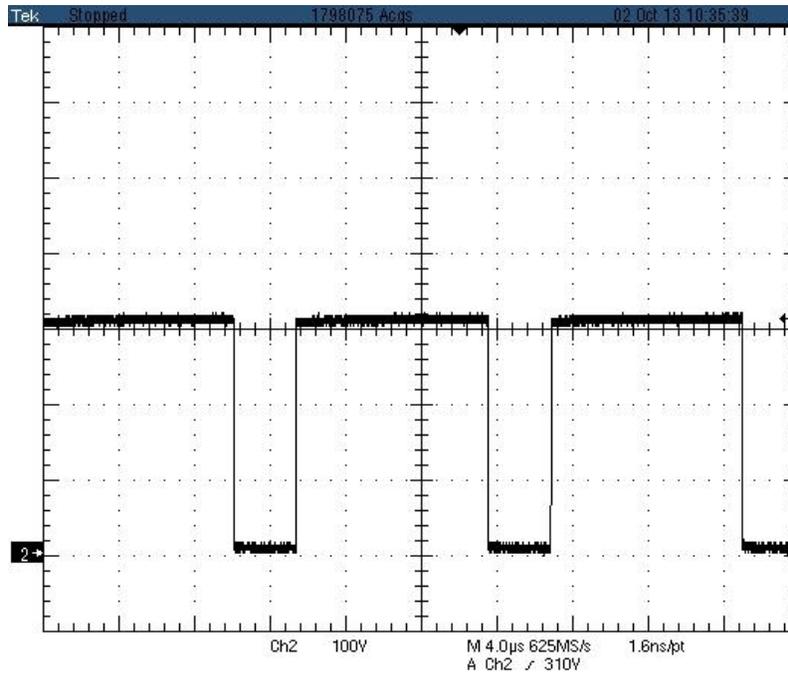


Figure 7: Q1 Drain Waveform at 230Vac 50Hz input

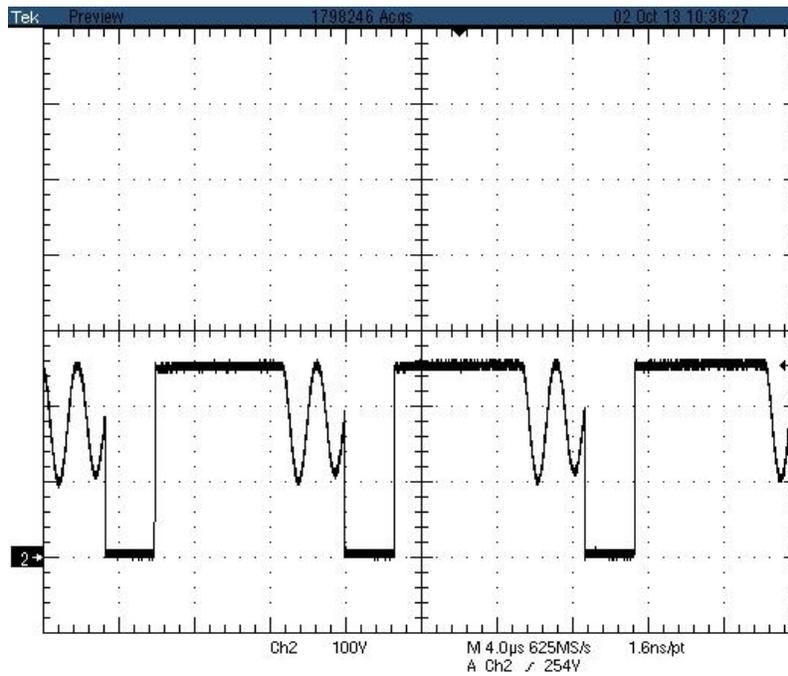


Figure 8: Q1 Drain Waveform at 230Vac 50Hz input

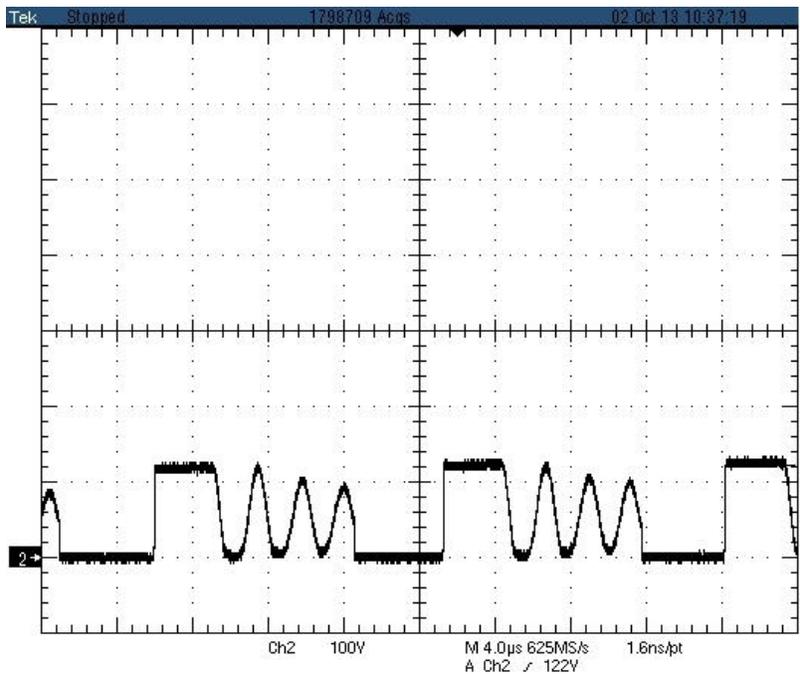
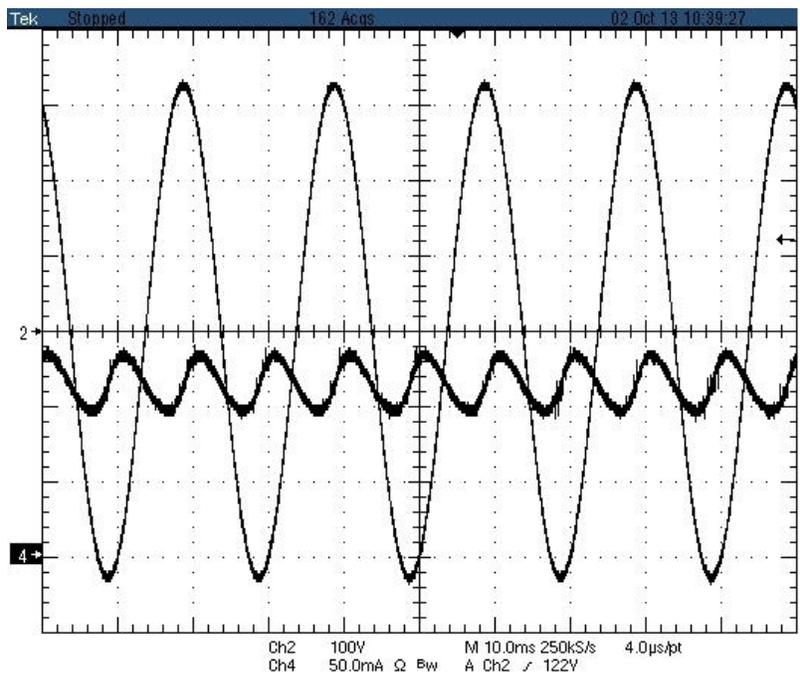
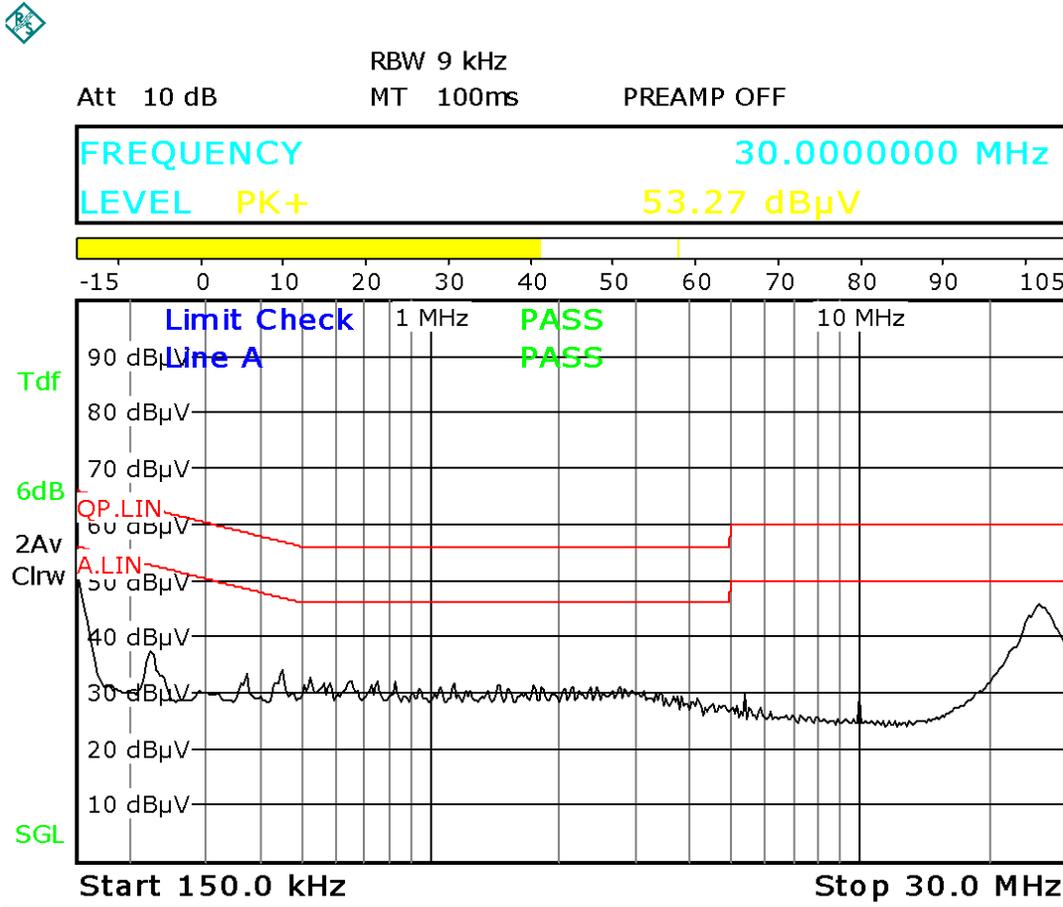


Figure 9: Q1 Drain Waveform at 230Vac 50Hz input



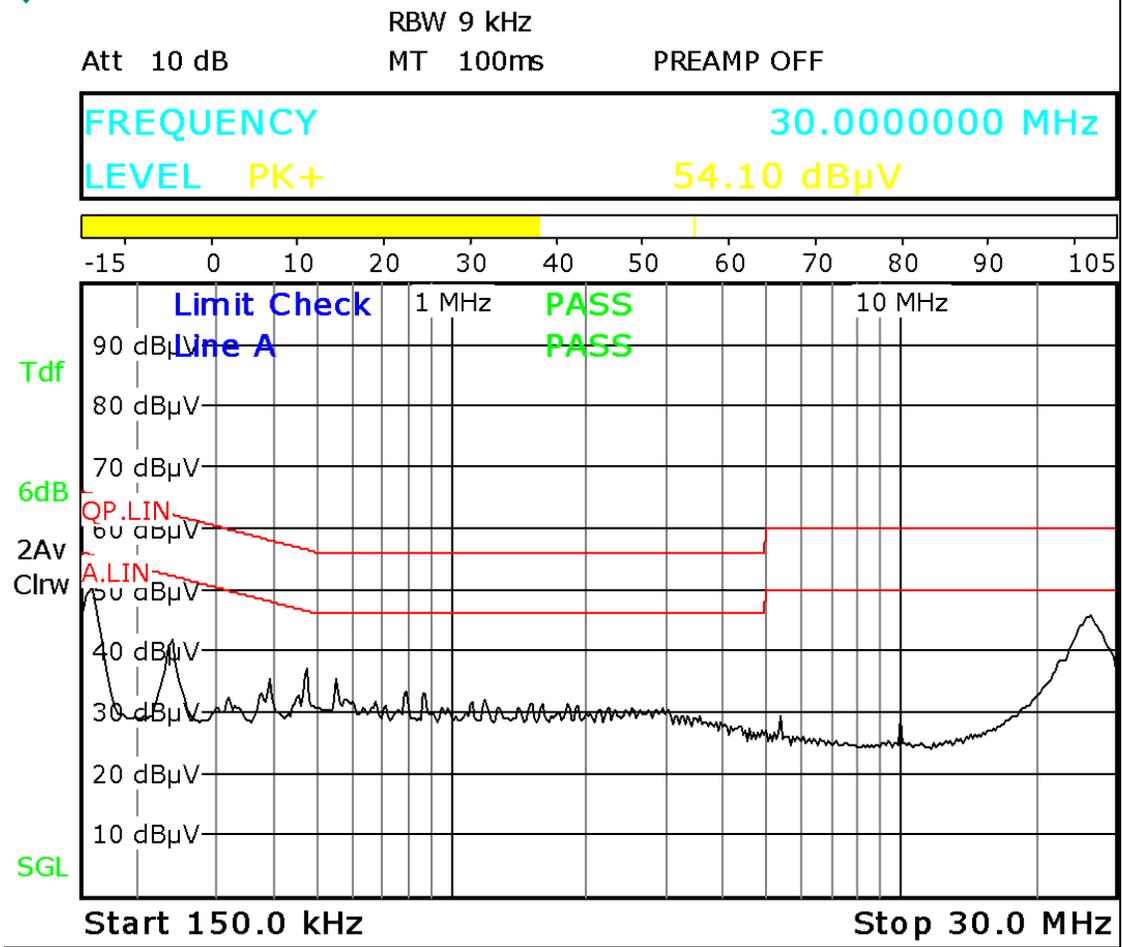
**Figure 10: Ch2 Input AC Voltage Ch4 Output LED Current
230Vac 50Hz input 75V LED stack**

5.5 EMI Performance



Date: 25.SEP.2013 05:51:19

Figure 11: 230VAC Line-Conducted Average EMI Scan



Date: 25.SEP.2013 06:07:37

Figure 12: 230VAC Neutral-Conducted Average EMI Scan

6 TPS92074 230Vac Non Dimmable 10W LED Driver Reference Design PCB layout

The following figures (Figure 10 through Figure 11) show the design of the printed circuit board.

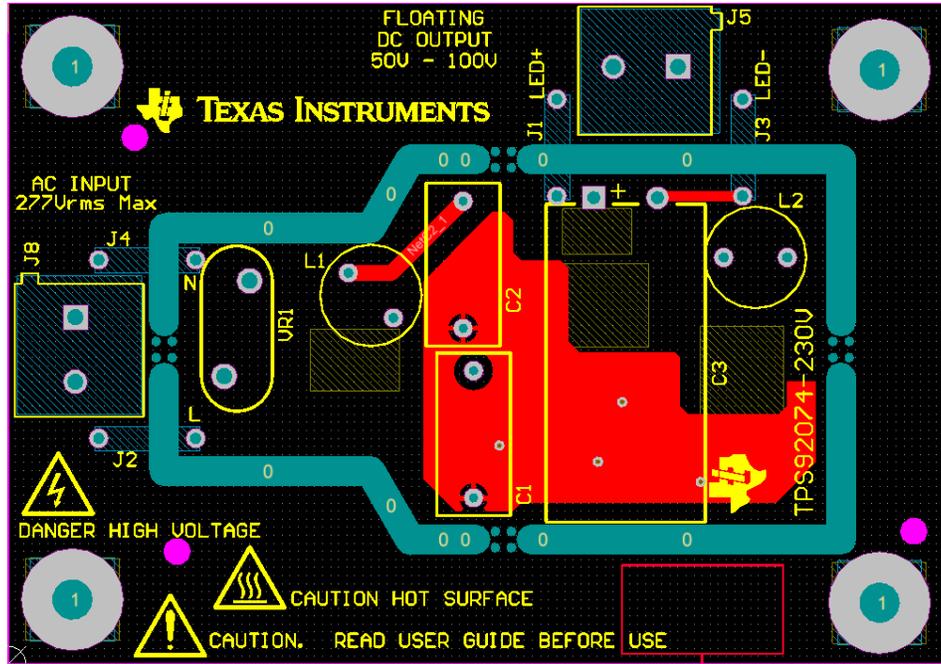


Figure 13: Top Layer and Top Overlay (Top view)

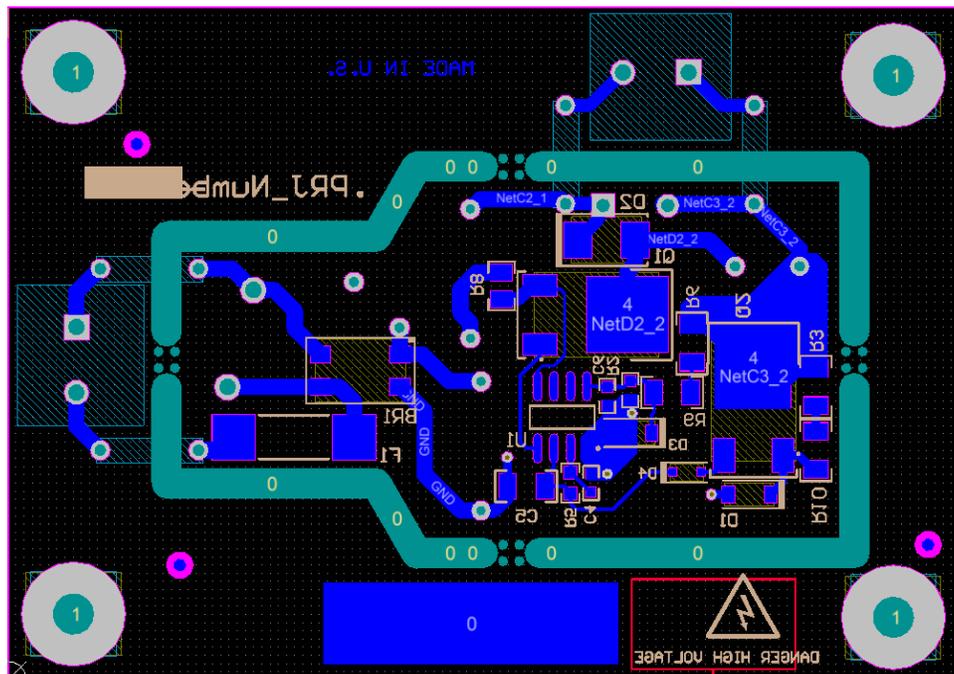


Figure 14: Bottom Layer and Bottom Overlay (Bottom view)

EVALUATION BOARD/KIT/MODULE (REF DESIGN) WARNINGS, RESTRICTIONS AND DISCLAIMER

For Feasibility Evaluation Only, in Laboratory/Development Environments. The REF DESIGN is not a complete product. It is intended solely for use for preliminary feasibility evaluation in laboratory / development environments by technically qualified electronics experts who are familiar with the dangers and application risks associated with handling electrical / mechanical components, systems and subsystems. It should not be used as all or part of a production unit.

Your Sole Responsibility and Risk. You acknowledge, represent and agree that:

1. You have unique knowledge concerning Federal, State and local regulatory requirements (including but not limited to Food and Drug Administration regulations, if applicable) which relate to your products and which relate to your use (and/or that of your employees, affiliates, contractors or designees) of the REF DESIGN for evaluation, testing and other purposes.
2. You have full and exclusive responsibility to assure the safety and compliance of your products with all such laws and other applicable regulatory requirements, and also to assure the safety of any activities to be conducted by you and/or your employees, affiliates, contractors or designees, using the REF DESIGN. Further, you are responsible to assure that any interfaces (electronic and/or mechanical) between the REF DESIGN and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard.
3. Since the REF DESIGN is not a completed product, it may not meet all applicable regulatory and safety compliance standards (such as UL, CSA, VDE, CE, RoHS and WEEE) which may normally be associated with similar items. You assume full responsibility to determine and/or assure compliance with any such standards and related certifications as may be applicable. You will employ reasonable safeguards to ensure that your use of the REF DESIGN will not result in any property damage, injury or death, even if the REF DESIGN should fail to perform as described or expected.

Certain Instructions. Exceeding the specified REF DESIGN ratings (including but not limited to input and output voltage, current, power, and environmental ranges) may cause property damage, personal injury or death. If there are questions concerning these ratings please contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may result in unintended and/or inaccurate operation and/or possible permanent damage to the REF DESIGN and/or interface electronics. Please consult the REF DESIGN User's Guide prior to connecting any load to the REF DESIGN output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, some circuit components may have case temperatures greater than 60°C as long as the input and output ranges are maintained at nominal ambient operating temperature. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors which can be identified using the REF DESIGN schematic located in the REF DESIGN User's Guide. When placing measurement probes near these devices during normal operation, please be aware that these devices may be very warm to the touch.

Agreement to Defend, Indemnify and Hold Harmless. You agree to defend, indemnify and hold TI, its licensors and their representatives harmless from and against any and all claims, damages, losses, expenses, costs and liabilities (collectively, "Claims") arising out of or in connection with any use of the REF DESIGN that is not in accordance with the terms of this agreement. This obligation shall apply whether Claims arise under the law of tort or contract or any other legal theory, and even if the REF DESIGN fails to perform as described or expected.

Safety-Critical or Life-Critical Applications. If you intend to evaluate TI components for possible use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, such as devices which are classified as FDA Class III or similar classification, then you must specifically notify TI of such intent and enter into a separate Assurance and Indemnity Agreement.

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, or other requirements. These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to TI's Terms of Sale (<https://www.ti.com/legal/termsofsale.html>) or other applicable terms available either on [ti.com](https://www.ti.com) or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2021, Texas Instruments Incorporated