

# TPS61054EVM-273

This user's guide describes the characteristics, operation, and use of the TPS61054EVM-273 evaluation module (EVM). This EVM demonstrates the Texas Instruments TPS61054 synchronous boost-converter-based high-power WLED driver. This document includes setup instructions, a schematic diagram, a bill of materials, and PCB layout drawings for the evaluation module.

## Contents

1	Introduction .....	2
2	Input/Output Connector Descriptions.....	2
3	Test Results .....	4
4	Board Layout .....	7
5	Schematic and Bill of Materials.....	10
6	Related Documentation From Texas Instruments .....	12

## List of Figures

1	LED Efficiency vs Input Voltage – Torch Mode with ILED=75mA.....	4
2	LED Efficiency vs Input Voltage – Single-Pulse Flash Mode with ILED=700mA.....	5
3	Torch Flash Sequence .....	5
4	Start-Up in Torch.....	6
5	Voltage-Mode Efficiency .....	6
6	Voltage-Mode Load Transient.....	7
7	Assembly Layer .....	8
8	Top Layer .....	8
9	Layer 2 .....	9
10	Layer 3 .....	9
11	Bottom Layer.....	10
12	TPS61054/5EVM-273 Schematic .....	11

## List of Tables

1	Typical Performance Specification Summary .....	2
2	Jumper Settings.....	4
3	HPA273E-1 Bill of Materials .....	12

## 1 Introduction

The Texas Instruments TPS61054EVM-273 evaluation module uses the TPS61054 synchronous boost converter-based high-power WLED driver. This WLED driver requires an input voltage between 2.5 V and 6 V. The driver is configurable by on-board jumpers to either regulate output voltage or the output current. The goal of the EVM is to facilitate evaluation of the TPS61054 IC.

### 1.1 Performance Specification Summary

Table 1 provides a summary of the TPS61054EVM-273 performance specifications. All specifications are given for an ambient temperature of 25°C.

**Table 1. Typical Performance Specification Summary**

	CONDITION	VOLTAGE RANGE (V)			CURRENT RANGE (mA)		
		MIN	TYP	MAX	MIN	TYP	MAX
V <sub>IN</sub> supply		2.5		6		2000	
V <sub>OUT</sub>	MODE0 = MODE1 = 1	4.85	5	5.15			
I <sub>LED</sub>	Torch current (MODE0 = 1 and MODE1 = 0 OR MODE0 = 0 and MODE1 = 1)					75 <sup>(1)</sup>	
	Flash current (MODE0 = 0 and MODE1 = 1 and FLASH_SYNC = 1)					700 <sup>(2)</sup>	

<sup>(1)</sup> ±15% tolerance

<sup>(2)</sup> ±12% tolerance

### 1.2 Modifications

To aid user customization of the EVM, the board was designed with devices having 0603 or larger footprints. A real implementation likely occupies less total board space.

Changing components can improve or degrade EVM performance. For example, adding a physically larger inductor with lower DCR improves efficiency.

## 2 Input/Output Connector Descriptions

This section describes the jumpers and connectors on the EVM as well as how properly to connect, set up, and use the TPS61054EVM-273.

### 2.1 J1 – VIN

This header is for the positive input supply voltage to the converter. The leads to the input supply should be twisted and kept as short as possible to minimize EMI transmission and reduce inductive voltage droop at a load transient event.

### 2.2 J2 – GND

This is the return connection for the input power supply of the converter.

### 2.3 J3 – FLASH / GND

This header connects to the FLASH\_SYNC pin of the IC and to GND. It can be used to measure the voltage on the FLASH\_SYNC pin and/or apply an external signal to the FLASH\_SYNC pin.

## 2.4 J4 – PULSE GEN / GND

This header can be used to connect an external pulse generator to drive the gate of transistor Q1. Transistor Q1, along with components R2–R4, can be used to perform load transient testing and confirm stability.

## 2.5 J5 – TRANS RES

This header connects to the drain of transistor Q1.

## 2.6 J6 – VOUT

This header connects to the VOUT pin IC. In voltage-regulation mode, it can be used to measure the regulated output voltage and connect an external load resistance. In current-regulation mode, it connects to the WLED cathode and can be used to measure the high-side WLED voltage.

## 2.7 J7 – LED

This header connects to the LED pin of the IC. In current-regulation mode, it connects to the WLED anode and can be used to measure the low-side WLED voltage. It is not used in voltage-regulation mode.

## 2.8 J8 – GND

This header connects to the board ground plane and is the return for the VOUT header.

## 2.9 JP1 – TX-TOFF

This jumper can be used to connect the TX-TOFF pin high (to the input voltage) or low (to ground).

## 2.10 JP2 – MODE0

This jumper can be used to connect the MODE0 pin high (to the input voltage) or low (to ground). See the device data sheet ([SLUS760](#)) for an explanation of configuration settings.

## 2.11 JP3 – MODE1

This jumper can be used to connect the MODE1 pin high (to the input voltage) or low (to ground). See the device data sheet ([SLUS760](#)) for an explanation of configuration settings.

## 2.12 JP5 – OPEN LED

This jumper is in series with power WLED D1. For the WLED to turn on, this jumper must be shorted. Placing an ammeter in series allows the user to measure current. The jumper in its default position is installed.

## 2.13 S1 – FLASH

This push-button switch connects to the IC FLASH\_SYNC pin and allows the user to initiate a WLED flash event.

## 2.14 Hardware Setup

Table 2 shows the DEFAULT board jumper settings.

**Table 2. Jumper Settings**

JUMPER	DEFAULT
JP1	LO
JP2	LO
JP3	LO
JP4	SHORTED

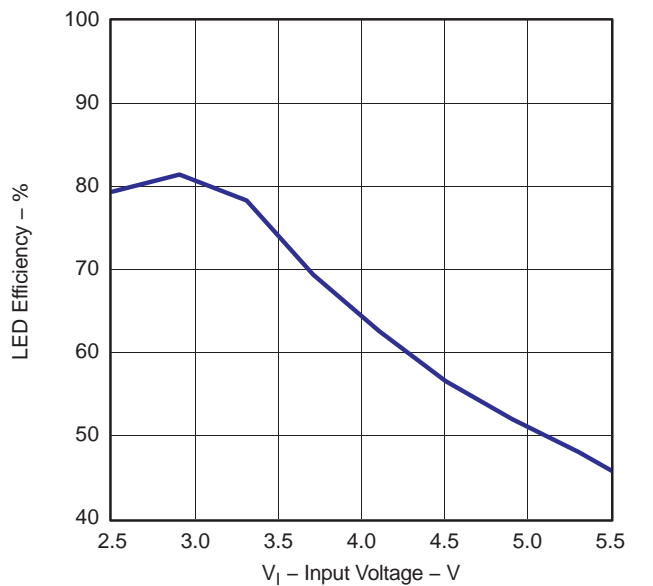
Connect to J1 and J2 an input power supply rated at least 2-A and set to provide between 2.5 V and 6 V. The leads should be very short. Additional input capacitance on the C4 pads may be required in order to mitigate the inductive voltage droop that occurs at torch-current start-up and especially when the flash pulse occurs. Turn on the power supply.

### **WARNING**

**WARNING: This EVM has a white LED that flashes very brightly. Protective eye wear and/or a diffuser to cover the white LED during operation is recommended.**

## 3 Test Results

This section provides typical performance waveforms for the TPS61054/5EVM-273 board.



**Figure 1. LED Efficiency vs Input Voltage – Torch Mode with ILED=75mA**

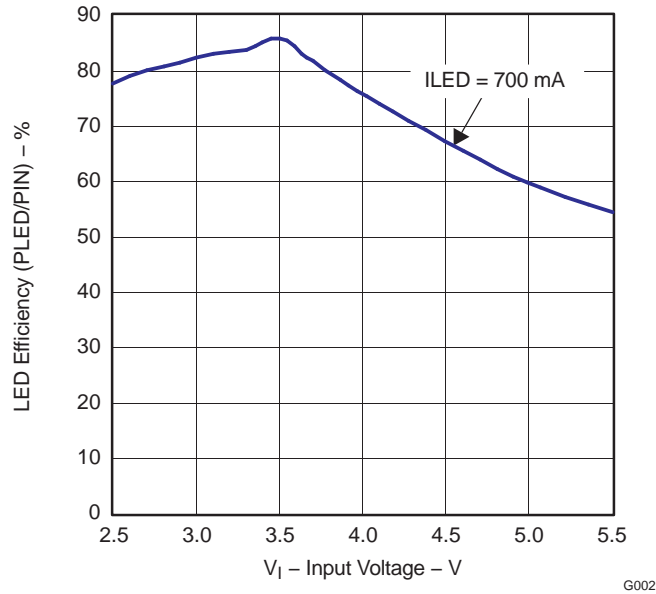


Figure 2. LED Efficiency vs Input Voltage – Single-Pulse Flash Mode with ILED=700mA

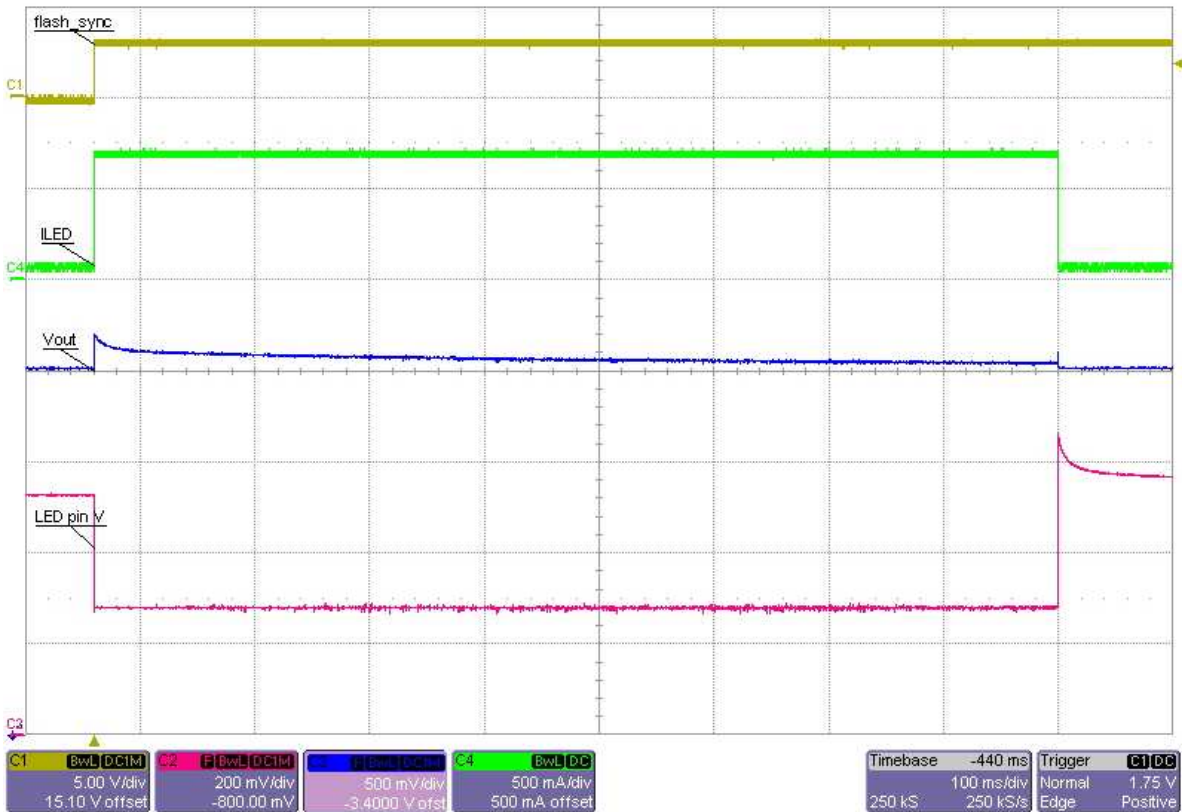


Figure 3. Torch Flash Sequence



Figure 4. Start-Up in Torch

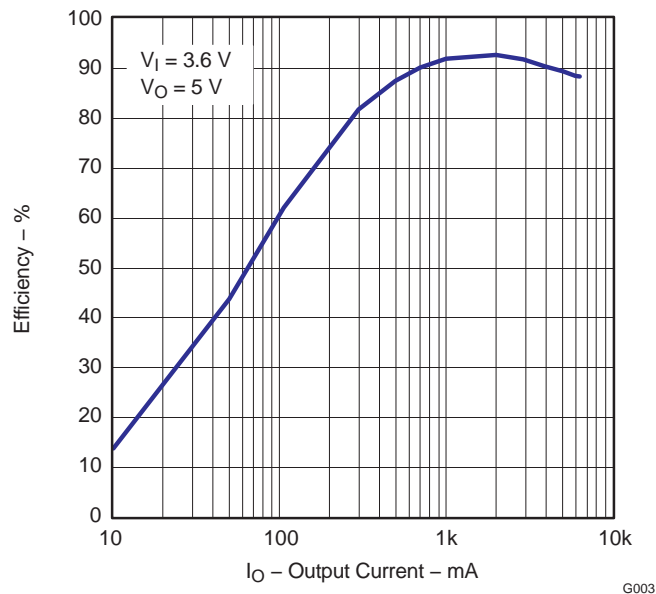


Figure 5. Voltage-Mode Efficiency

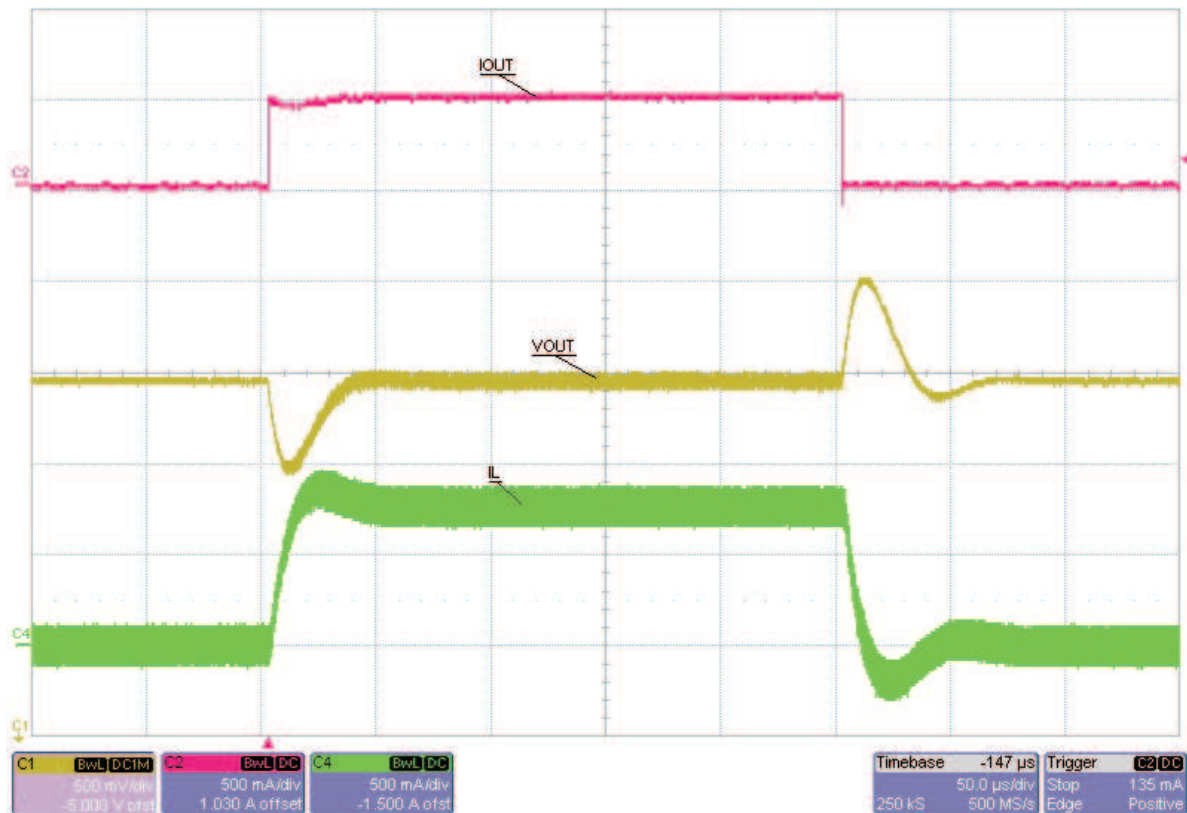


Figure 6. Voltage-Mode Load Transient

#### 4 Board Layout

This section provides the TPS61054EVM-273 board layout and illustrations.

Board layout is critical for all high-frequency, switch-mode power supplies. Figure 7 through Figure 11 show the board layout for the TPS61054EVM-273 PCB. The nodes with high switching frequencies and currents are kept as short as possible to minimize trace inductance. Careful attention has been given to the routing of high-frequency current loops, and a single-point grounding scheme is used. See the device data sheet ([SLUS760](#)) for specific layout guidelines.

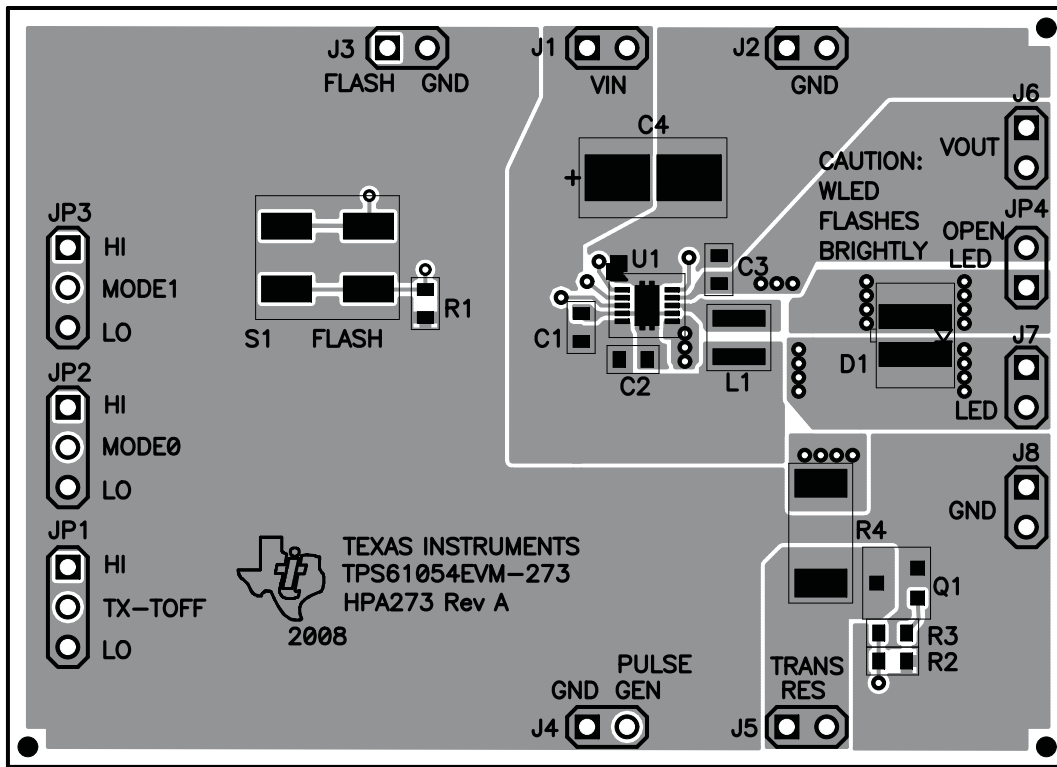


Figure 7. Assembly Layer

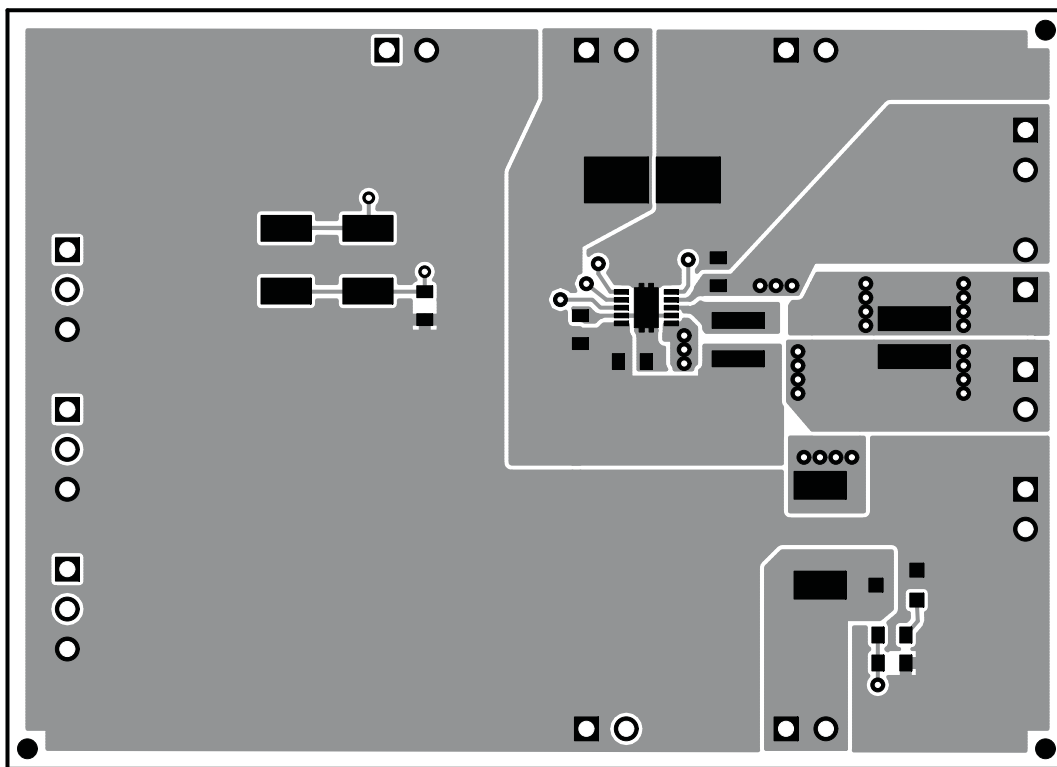
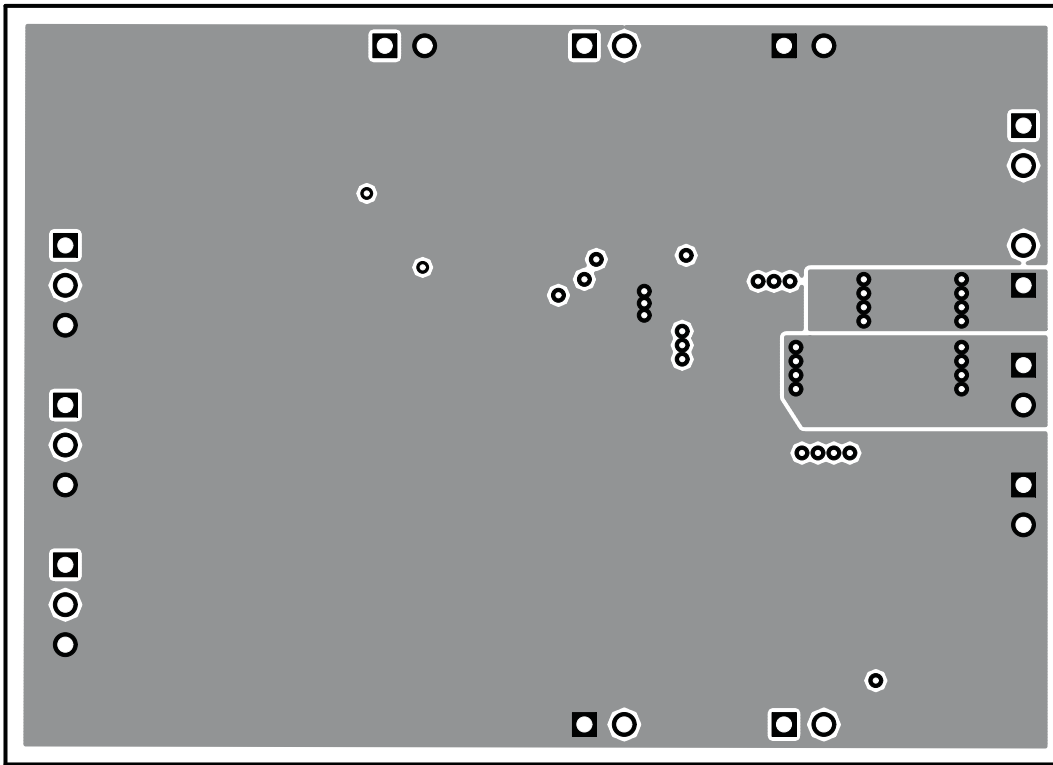


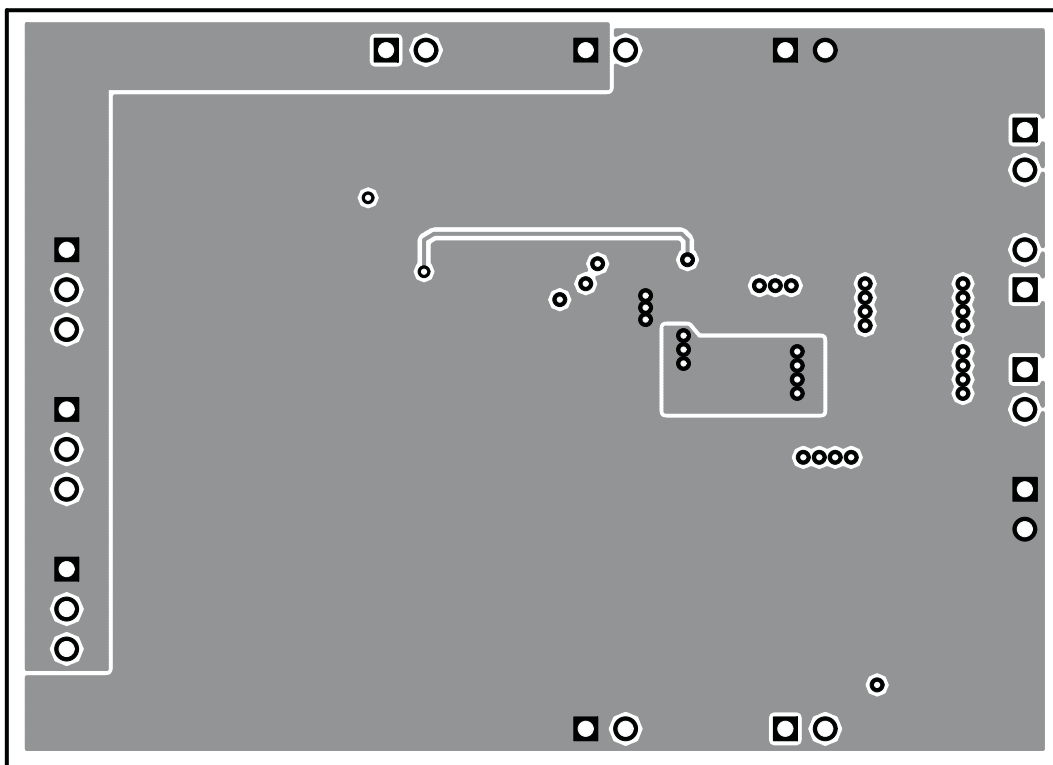
Figure 8. Top Layer





K003

Figure 9. Layer 2



K004

Figure 10. Layer 3

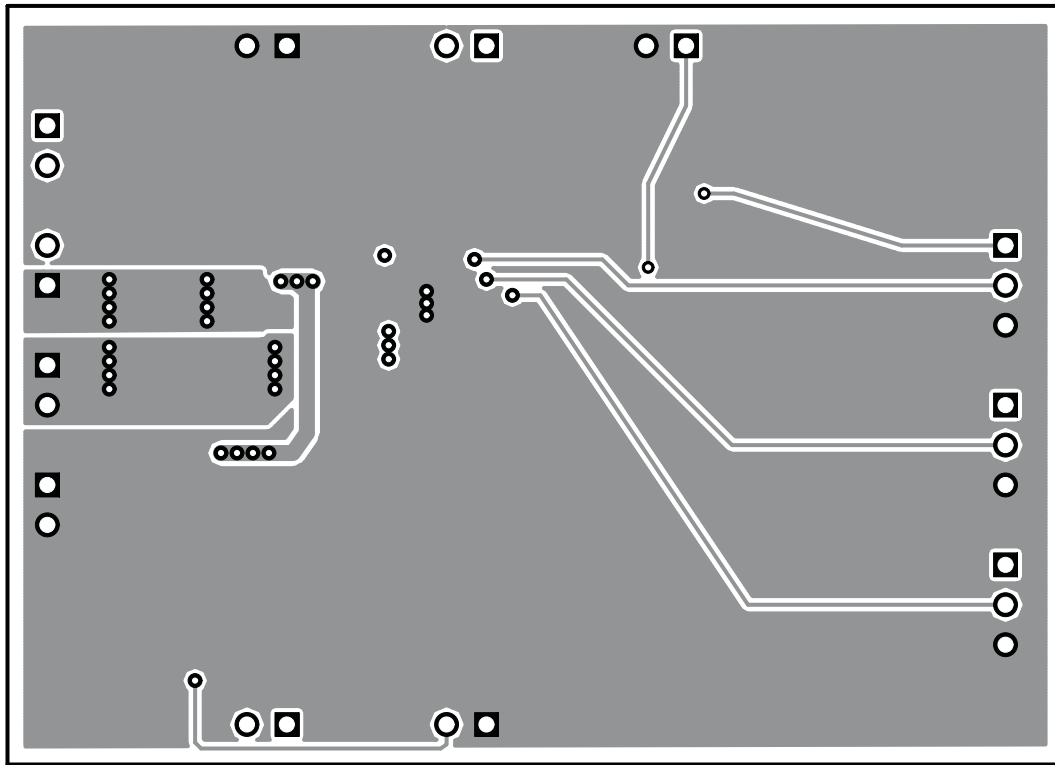


Figure 11. Bottom Layer

## 5 Schematic and Bill of Materials

This section provides the TPS61054EVM-273 schematic and bill of materials.



## 5.2 Bill of Materials

**Table 3. HPA273E-1 Bill of Materials**

RefDes	Count	Value	Description	Size	Part Number	MFR
C1	1	1000 pF	Capacitor, ceramic, 50-V, X7R, 10%	0603	C1608X7R1H102K	TDK
C2, C3	2	10 $\mu$ F	Capacitor, ceramic, 6.3-V, X5R, 20%	0603	C1608X5R0J106MT	TDK
C4	0	Open	Capacitor, multipattern, 16-V, X5R, 20%	7343 (D)	Std	Std
D1	1	LXCL-PWM1	LED, white, 350-mA	0.166 $\times$ 0.232 in. (4.22 $\times$ 5.89 mm)	LXCL-PWM1	Lumileds
J1, J2, J3, J6, J7, J8	6	PTC36SAAN	Header, 2-pin, 100-mil (2.54-mm) spacing, (36-pin strip)	0.100 in. (2.54 mm) $\times$ 2	PTC36SAAN	Sullins
J4, J5	0	Open	Header, 2-pin, 100-mil (2.54-mm) spacing, (36-pin strip)	0.100 in. (2.54 mm) $\times$ 2	PTC36SAAN	Sullins
JP1, JP2, JP3	3	PTC36SAAN	Header, 3-pin, 100-mil (2.54-mm) spacing, (36-pin strip)	0.100 in. (2.54 mm) $\times$ 3	PTC36SAAN	Sullins
JP4	1	PTC36SAAN	Header, 2-pin, 100-mil (2.54-mm) spacing, (36-pin strip)	0.100 in. (2.54 mm) $\times$ 2	PTC36SAAN	Sullins
L1	1	2.2 $\mu$ H	Inductor, SMT, 1.5-A, 110-m $\Omega$	0.118 $\times$ 0.118 in. (3 $\times$ 3 mm)	LPS3015-222ML	Coilcraft
Q1	0	Open	MOSFET, N-ch	SOT23		
R1	1	15 k $\Omega$	Resistor, chip, 1/16-W, 1%	0603	Std	Std
R2, R3	0	Open	Resistor, chip, 1/16-W, 1%	0603	Std	Std
R4	0	Open	Resistor, chip, 1-W, 1%	2512	Std	Std
S1	1	KT11P2JM	Switch, SPST, PB momentary, sealed washable	0.245 $\times$ 0.251 in. (6.22 $\times$ 6.38 mm)	KT11P2JM	C & K
U1	1	TPS61054DR C	IC, high-power white LED driver	SON-10	TPS61054DRC	TI
-	4		Shunt, 100-mil (2.54-mm), black	0.1	929950-00	3M
-	1		PCB, 1.9 $\times$ 3.35 $\times$ 0.062 in. (48.3 $\times$ 85.1 $\times$ 1.58 mm)		HPA273 Rev A	Any

## 6 Related Documentation From Texas Instruments

TPS61054, TPS61055 High Power White LED Driver 2-MHz Synchronous Boost Converter With Standard Logic Interface data sheet ([SLUS760](#))

## EVALUATION BOARD/KIT IMPORTANT NOTICE

Texas Instruments (TI) provides the enclosed product(s) under the following conditions:

This evaluation board/kit is intended for use for **ENGINEERING DEVELOPMENT, DEMONSTRATION, OR EVALUATION PURPOSES ONLY** and is not considered by TI to be a finished end-product fit for general consumer use. Persons handling the product(s) must have electronics training and observe good engineering practice standards. As such, the goods being provided are not intended to be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including product safety and environmental measures typically found in end products that incorporate such semiconductor components or circuit boards. This evaluation board/kit does not fall within the scope of the European Union directives regarding electromagnetic compatibility, restricted substances (RoHS), recycling (WEEE), FCC, CE or UL, and therefore may not meet the technical requirements of these directives or other related directives.

Should this evaluation board/kit not meet the specifications indicated in the User's Guide, the board/kit may be returned within 30 days from the date of delivery for a full refund. **THE FOREGOING WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.**

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies TI from all claims arising from the handling or use of the goods. Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge.

**EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.**

TI currently deals with a variety of customers for products, and therefore our arrangement with the user **is not exclusive.**

TI assumes **no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein.**

Please read the User's Guide and, specifically, the Warnings and Restrictions notice in the User's Guide prior to handling the product. This notice contains important safety information about temperatures and voltages. For additional information on TI's environmental and/or safety programs, please contact the TI application engineer or visit [www.ti.com/esh](http://www.ti.com/esh).

No license is granted under any patent right or other intellectual property right of TI covering or relating to any machine, process, or combination in which such TI products or services might be or are used.

### FCC Warning

This evaluation board/kit is intended for use for **ENGINEERING DEVELOPMENT, DEMONSTRATION, OR EVALUATION PURPOSES ONLY** and is not considered by TI to be a finished end-product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC rules, which are designed to provide reasonable protection against radio frequency interference. Operation of this equipment in other environments may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

### EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the input voltage range of 2.5 V to 6 V and the output voltage range of 4.85 V to 5.15 V.

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's Guide prior to connecting any load to the EVM 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 85°C. The EVM is designed to operate properly with certain components above 85°C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright = 2006, Texas Instruments Incorporated

## IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for 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, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

### Products

Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
RF/IF and ZigBee® Solutions	<a href="http://www.ti.com/lprf">www.ti.com/lprf</a>

### Applications

Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Automotive	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Broadband	<a href="http://www.ti.com/broadband">www.ti.com/broadband</a>
Digital Control	<a href="http://www.ti.com/digitalcontrol">www.ti.com/digitalcontrol</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Military	<a href="http://www.ti.com/military">www.ti.com/military</a>
Optical Networking	<a href="http://www.ti.com/opticalnetwork">www.ti.com/opticalnetwork</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Telephony	<a href="http://www.ti.com/telephony">www.ti.com/telephony</a>
Video & Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>
Wireless	<a href="http://www.ti.com/wireless">www.ti.com/wireless</a>

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2008, Texas Instruments Incorporated