User's Guide
SLVU252–August 2008

TPS61054EVM-350

This user's guide describes the characteristics, operation, and use of the TPS61054EVM-350 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.

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1 Introduction

The Texas Instruments TPS61054EVM-350 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-350 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_{IN} supply		2.5		6		2000	
V_{OUT}	MODE0 = MODE1 = 1	4.85	5	5.15			
I_{LED}	Torch current (MODE0 = 1 and MODE1 = 0 OR MODE0 = 0 and MODE1 = 1)					75 (1)	
	Flash current (MODE0 = 0 and MODE1 = 1 and FLASH_SYNC = 1)					700 (2)	

(1) ±15% tolerance
(2) ±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-350.

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 JP4 – 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 TPS61054EVM-350 board.

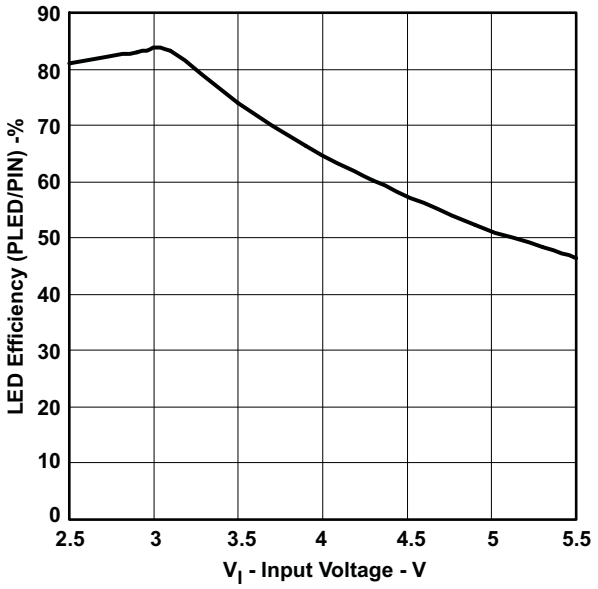

Figure 1. LED Efficiency vs Input Voltage – Torch Mode with ILED=75mA

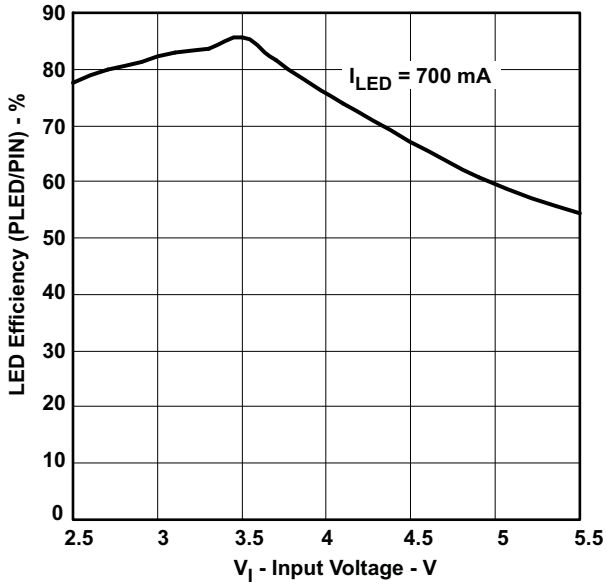

Figure 2. LED Efficiency vs Input Voltage – Single-Pulse Flash Mode with ILED=700mA

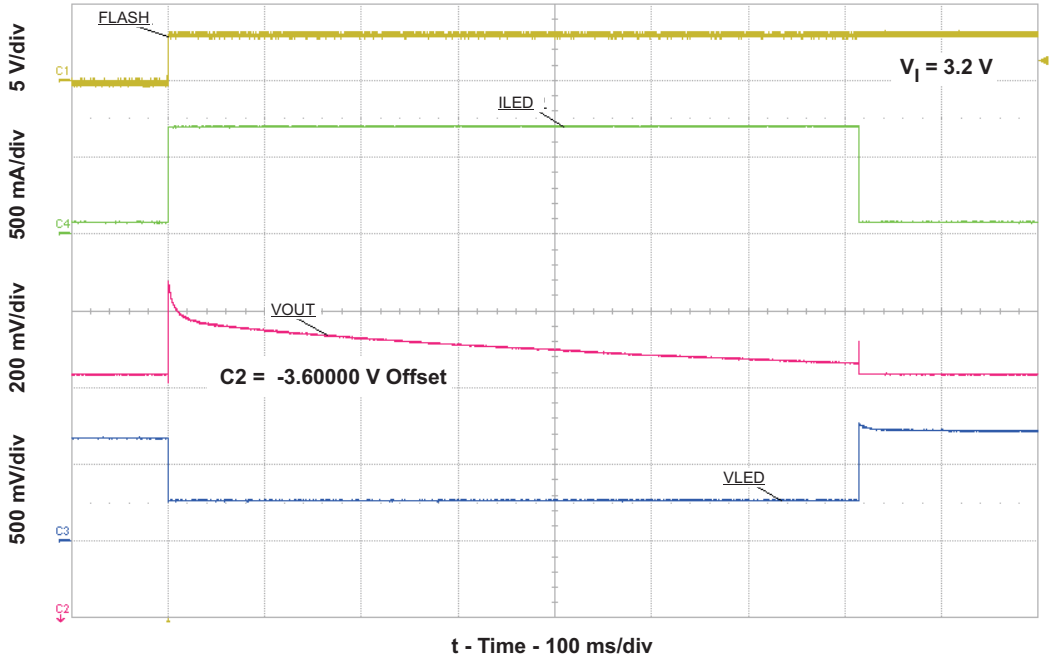

Figure 3. Torch Flash Sequence

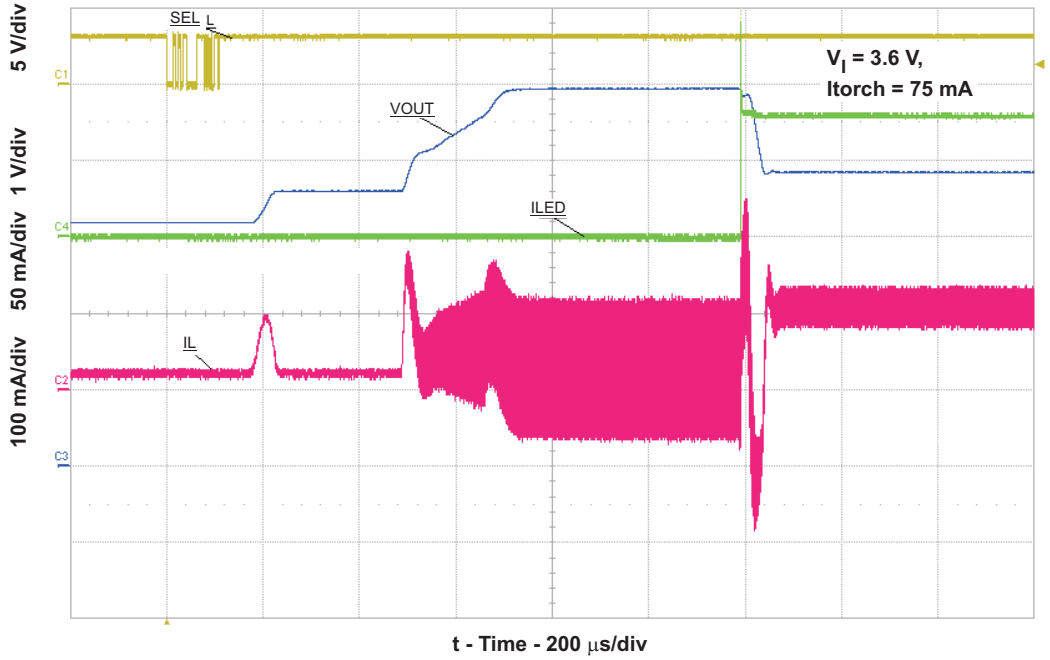

Figure 4. Start-Up in Torch

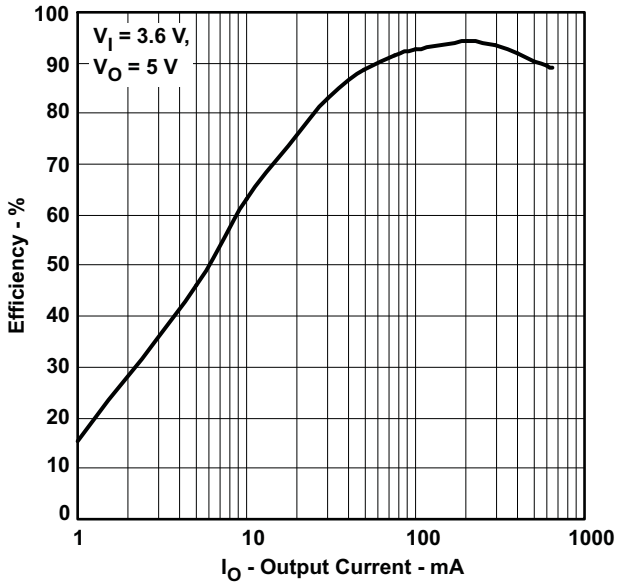

Figure 5. Voltage-Mode Efficiency

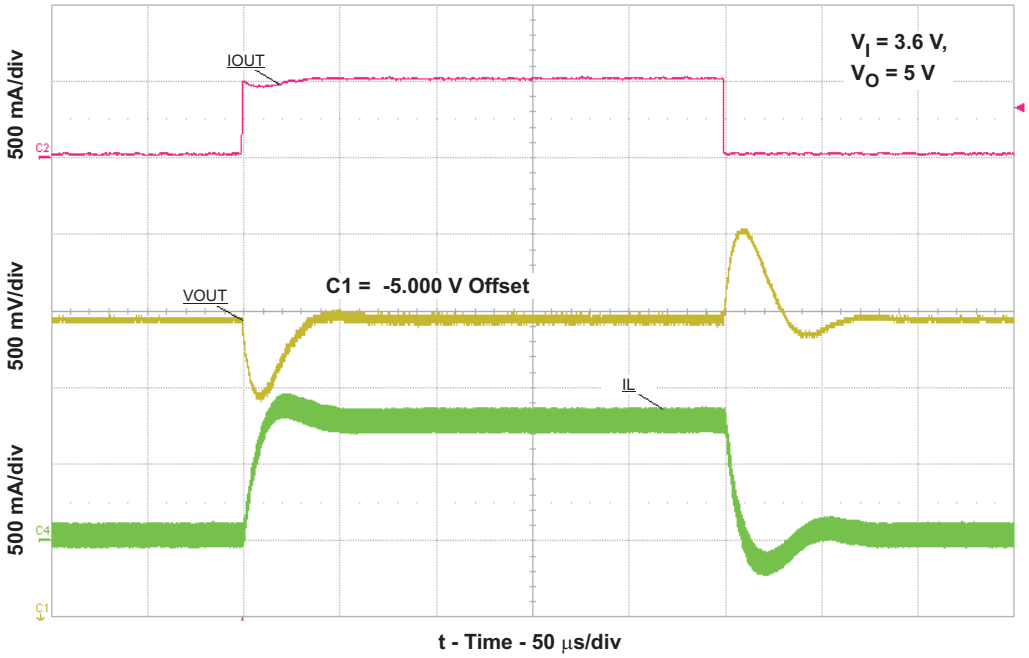

Figure 6. Voltage-Mode Load Transient

4 Board Layout

This section provides the TPS61054EVM-350 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-350 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.

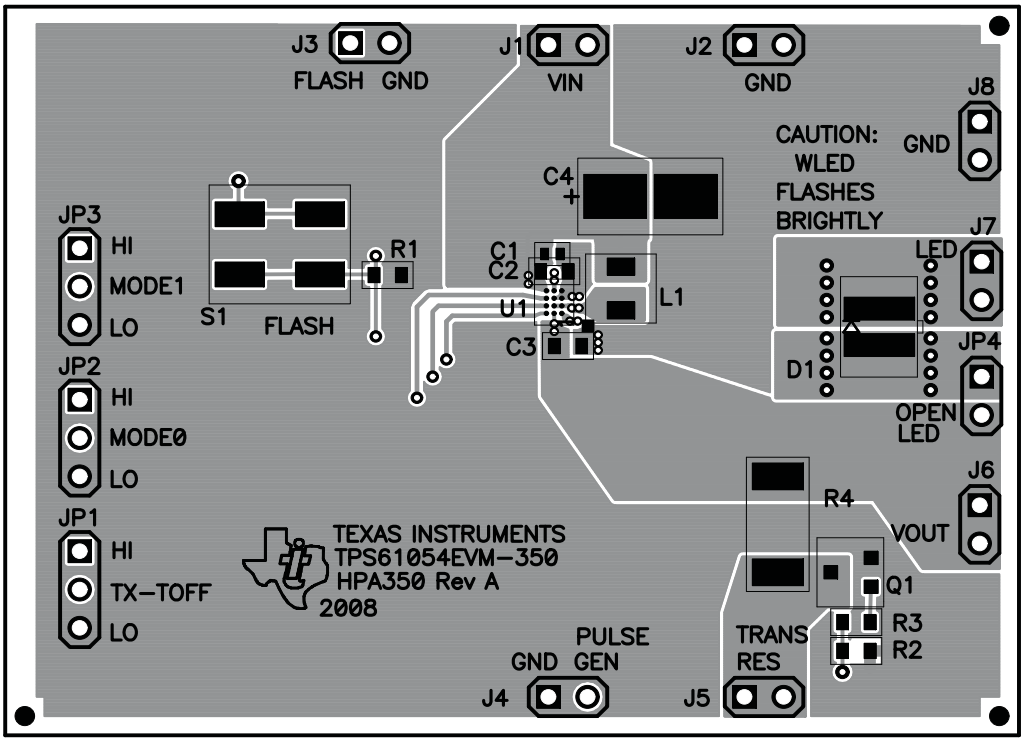

Figure 7. Assembly Layer

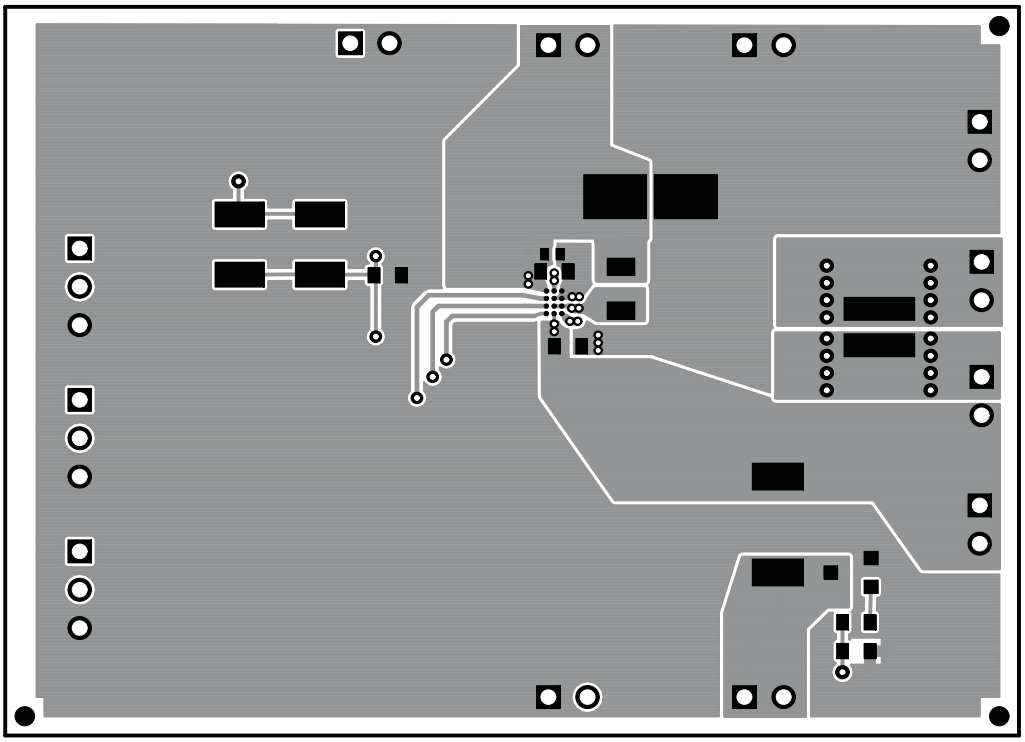

Figure 8. Top Layer

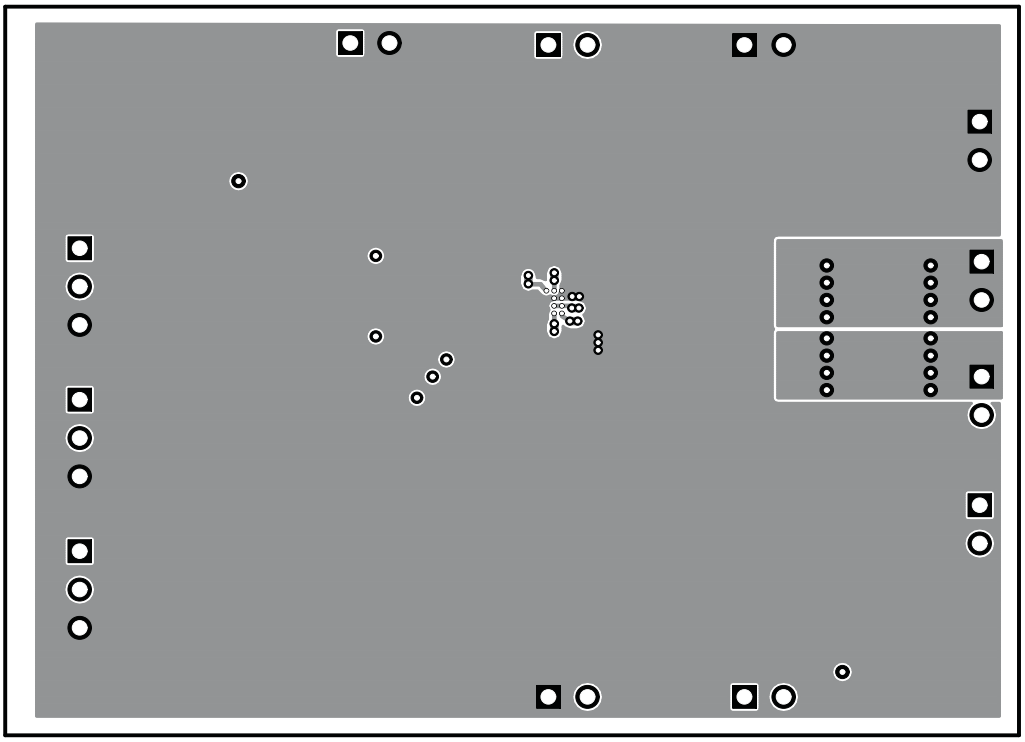

Figure 9. Layer 2

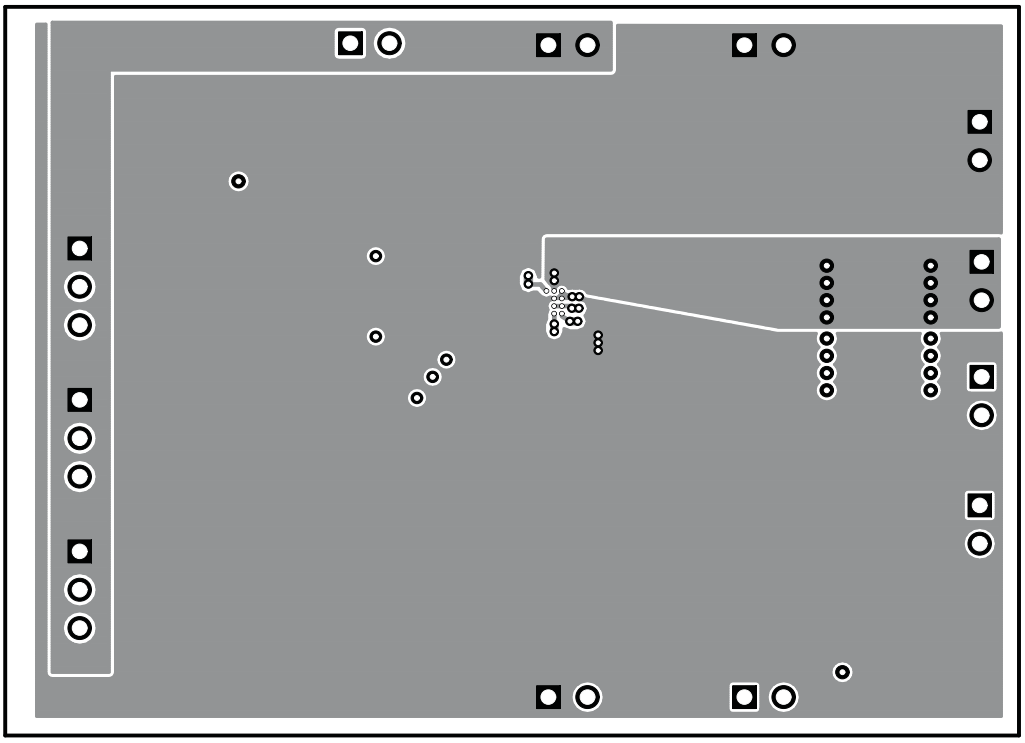

Figure 10. Layer 3

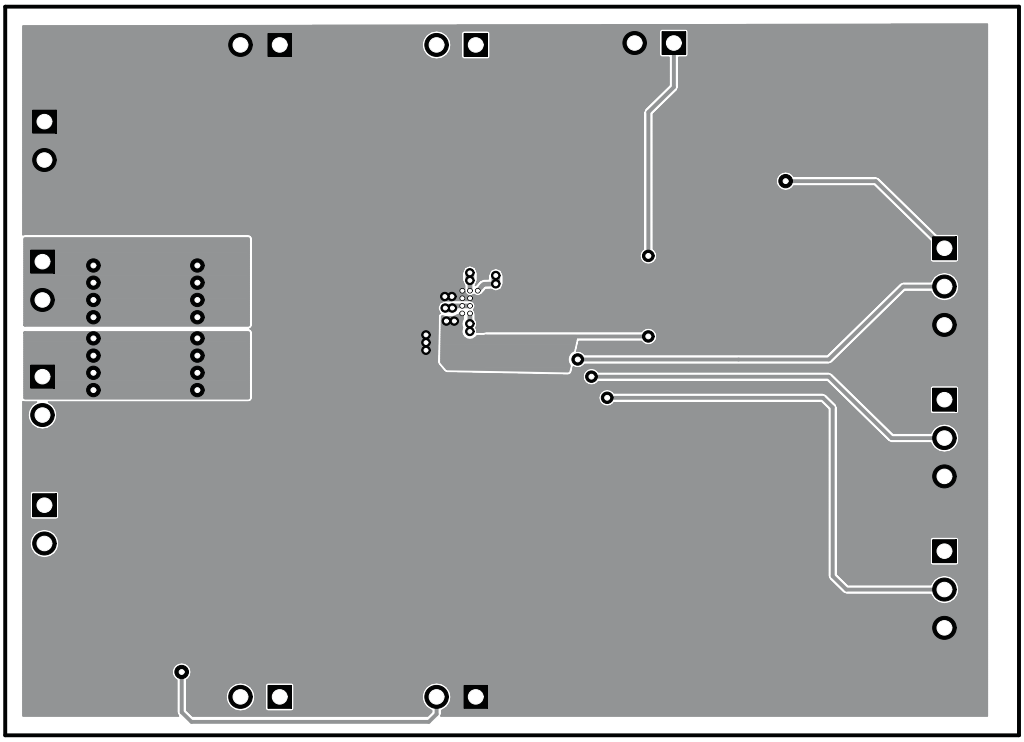

Figure 11. Bottom Layer

5 Schematic and Bill of Materials

This section provides the TPS61054EVM-350 schematic and bill of materials.

5.1 Schematic

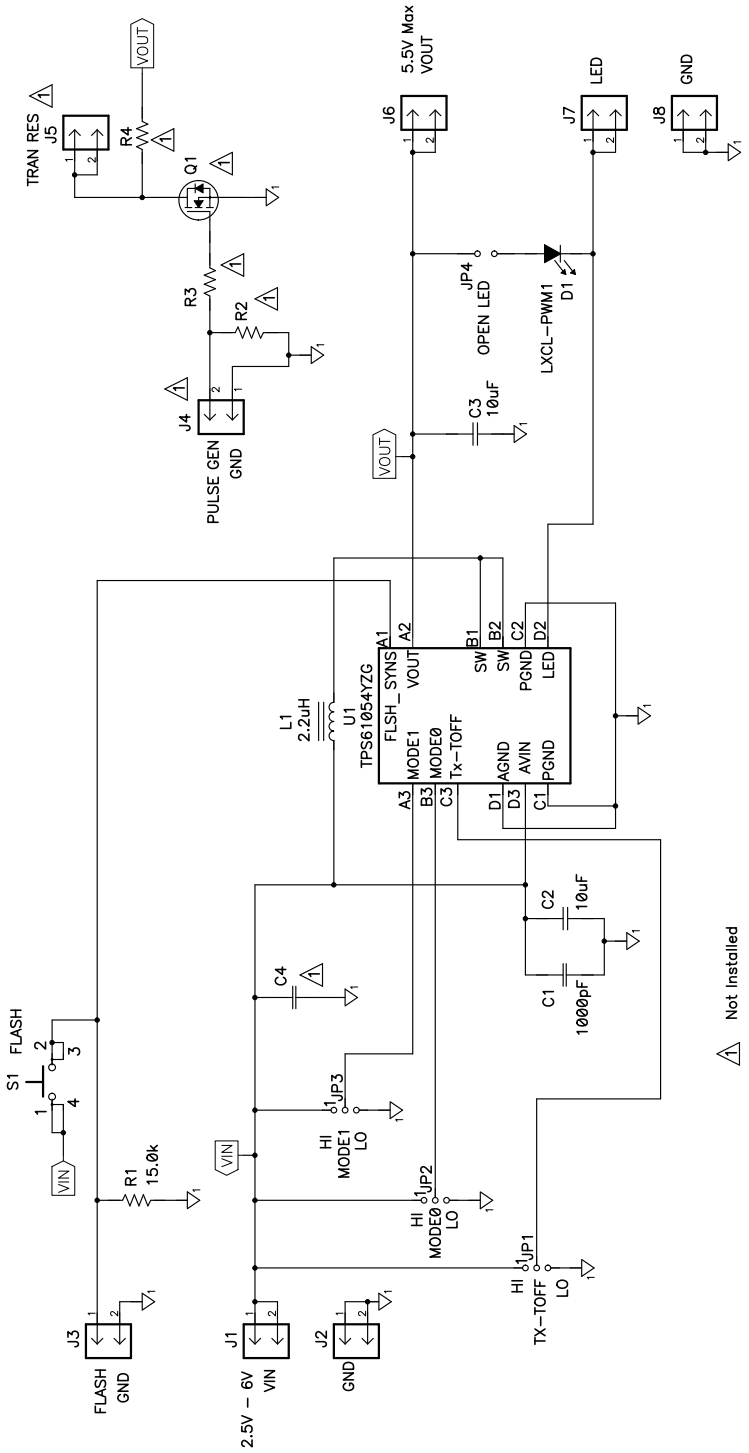

Figure 12. TPS61054/5EVM-350 Schematic

5.2 Bill of Materials

Table 3. HPA350A Bill of Materials

Count	RefDes	Value	Description	Size	Part Number	MFR
1	C1	1000 pF	Capacitor, Ceramic, 50V, C0G, 5%	0402	Std	Std
2	C2, C3	10 µF	Capacitor, Ceramic, 6.3V, X5R, 20%	0603	Std	Std
0	C4	Open	Capacitor, Multipattern, 603 - D Case	7343 (D)		
1	D1	LXCL-PWM1	LED, White, 350 mA	0.166 × 0.232 inch	LXCL-PWM1	Lumileds
6	J1, J2, J3, J6, J7, J8	PTC36SAAN	Header, 2-pin, 100 mil spacing, (36-pin strip)	0.100 inch × 2	PTC36SAAN	Sullins
0	J4, J5	Open	Header, 2-pin, 100 mil spacing, (36-pin strip)	0.100 inch × 2	PTC36SAAN	Sullins
3	JP1, JP2, JP3	PTC36SAAN	Header, 3 pin, 100 mil spacing, (36-pin strip)	0.100 x 3	PTC36SAAN	Sullins
1	JP4	PTC36SAAN	Header, 2-pin, 100 mil spacing, (36-pin strip)	0.100 inch × 2	PTC36SAAN	Sullins
1	L1	2.2 µH	Inductor, SMT, 2.3A, 160 mΩ	0.130 × 0.130 inch	FDSE0312-2R2M=P3	Toko
0	Q1	Open	MOSFET, N-ch, 20V, 2.4A, 0.085 mΩ	SOT23	Si2302ADS	Vishay
1	R1	15.0 k	Resistor, Chip, 1/16W, 1%	0603	Std	Std
0	R2, R3	Open	Resistor, Chip, 1/16W, 1%	0603		
0	R4	Open	Resistor, Chip, 1W, 1%	2512		
1	S1	KT11P2JM	Switch, SPST, PB Momentary, Sealed Washable	0.245 × 0.251 inch	KT11P2JM	C & K
1	U1	TPS61054YZG	IC, High Power White LED Driver	CSP-12	TPS61054YZG	TI
1	—		PCB, 2.585 In x 1.9 In x 0.062 In		HPA350	Any
4	—		Shunt, 100 mil, Black	0.1	929950-00	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)

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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.

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