User's Guide

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TPS61150EVM-150 / TPS61150AEVM-150

This user's guide describes the characteristics, operation, and use of the TPS61150EVM-150 and TPS61150AEVM-150 evaluation modules (EVM). These EVMs contain Texas Instruments either TPS61150 or TPS61150A based power solutions, each of which providing two independently regulated current outputs using a single inductor step-up (boost) converter. The two current outputs are ideal for driving WLED backlight for the sub and main displays in clam shell phones. This user's guide includes EVM specifications, recommended test setup, test results, bill of materials (BOM), and a schematic diagram.

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1 Introduction

The Texas Instruments TPS61150EVM-150 evaluation module contains a TPS61150 IC while the TPS61150AEVM-150 evaluation module contains a TPS61150A IC. Both EVMs provide two independently regulated current outputs using a single inductor step-up (boost) converter. One output drives two parallel strings of WLEDs. One string can be configured for two or four series WLEDs. The other string has four series WLEDs. The goal of these EVMs is to facilitate evaluation of the TPS61150 or TPS61150A IC in a typical WLED application.

1.1 Performance Specification Summary

Table 1 provides a summary of the TPS61150EVM-150 and TPS61150AEVM-150 performance specifications. All specifications are given for an ambient temperature of 25°C.

Table 1. Typical Performance Specification Summary

	CONDITION	MIN	TYP	MAX	UNITS
V_{IN} supply		3.0	3.6	6.0	V
V(TP1)	JP3 shorted, JP4 shorted, JP1=JP2=V_{IN}	13.0		17.4	V
	JP3 = JP4 = open, JP1=JP2=V_{IN}	27	28	29	V
IOUT1	JP3 shorted	13.3	15.1	17.3	mA
IOUT2	JP4 shorted	13.3	15.1	17.3	mA

1.2 Modifications

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

Changing components can improve or degrade EVM performance. For example, using inductors with larger dc resistances lowers efficiency of the solution.

The TPS61151 IC has the same pin out as the TPS61150. Therefore, it can be installed and evaluated on this EVM board.

2 Input/Output Connector Descriptions

J1–VIN This is the positive connection to the input power supply. The leads to the input supply should be twisted and kept as short as possible.

J2–GND This is the return (ground) connection to the input power supply.

JP1–EN LED1 Shorting this jumper ties the SEL1 pin to V_{IN}, thereby enabling the IC to provide an output voltage and a regulated output current controlled by IFB1. Due to the internal pull-down resistor on SEL1, opening this jumper causes the current feedback path through IFB1 to open, thereby turning off LEDs D1 through D4. If both JP1 and JP2 are open, the converter is disabled and will not provide an output voltage.

JP2–EN LED2 Shorting this jumper ties the SEL2 pin to V_{IN}, thereby enabling the IC to provide an output voltage and a regulated output current controlled by IFB2. Due to the internal pull-down resistor on SEL2, opening this jumper causes the current feedback path through IFB2 to open, thereby turning off LEDs D5 through D8. If both JP1 and JP2 are open, the converter is disabled and will not provide an output voltage.

JP3–LOAD1 Shorting this jumper inserts wLEDs D1 through D4 into the current feedback path, causing them to turn on. Removing this jumper removes the wLEDs D1 through D4 from the current feedback path, causing them to turn off.

JP4–LOAD2 Shorting this jumper inserts wLEDs D3 through D6 into the current feedback path, causing them to turn on. Removing this jumper removes wLEDs D3 through D6 from the current feedback path, causing them to turn off

JP5–LOAD3 Shorting this jumper bypasses wLEDs D3 and D4, thereby removing them from the current feedback path, causing them to turn off. Removing this jumper keeps wLEDs D3 and D4 in the current feedback path.

JP6–DIM2/GND/DIM1 With resistors R3 and R4 installed, this jumper facilitates the connection of an external DC voltage for implementing analog dimming of string 1 and/or string 2, respectively. With resistors R3 and R4 installed, this jumper facilitates the connection of an external DC voltage for implementing analog dimming of string 1 and/or string 2, respectively. With resistors R3, R5 and capacitor C3 and/or resistors R4, R6 and capacitor C4 installed, this jumper facilitates the connection of an external PWM signal for implementing PWM analog dimming of string 1 and/or string 2, respectively. With resistors R3 and R4 installed, this jumper facilitates the connection of an external DC voltage for implementing analog dimming of string 1 and/or string 2, respectively.

TP1–LED VOUT Connecting a voltmeter to this test point allows the user to measure the output voltage of the boost regulator. Due to the WLEDs' forward voltage variation, the voltage at this test point may vary between 13.0 V and 17.4 V during normal operation.

TP2 – This test point connects to the IFB1 pin. With JP3 removed, an external WLED string can be attached between this testpoint and TP1. This test point can also be used to measure the voltage at IFB1. Because noise injected into the IFB1 pin can adversely affect IC operation, care should be taken when connecting to this test point.

TP3 – This test point connects to the IFB2 pin. With JP4 removed, an external WLED string can be attached between this testpoint and TP1. This test point can also be used to measure the voltage at IFB2. Because noise injected into the IFB2 pin can adversely affect IC operation, care should be taken when connecting to this test point.

2.1 Test Setup

The TPS61150 and TPS61150A are designed to operate with a maximum input voltage of 6V. Connect a power supply set between 2.5 V and 6.0 V output voltage and current limit set to at least 1 A. Short jumper JP1 and/or JP2 to enable the boost converter. Short JP3 and open JP5 to enable LEDs D1 through D4. Short JP4 to enable LEDs D5 through D6.

To implement analog dimming, use the datasheet to determine the size for resistors R3 and/or R4, install one or both and apply a DC voltage to appropriate pin of JP6. To implement PWM analog dimming, use the datasheet to determine the size for resistors R3, R5 and capacitor C3 and/or resistors R4, R6 and capacitor C4, install one or both component sets and apply a PWM signal within the amplitude and frequency specified in the datasheet to the appropriate pin of JP6. Alternatively, a PWM signal within the range specified in the datasheet applied to the SEL1 and/or SEL2 pins through JP1 and/or JP2, respectively, implements PWM dimming.

2.2 Test Results

Below are the test results at T_A = 25°C using this EVM:

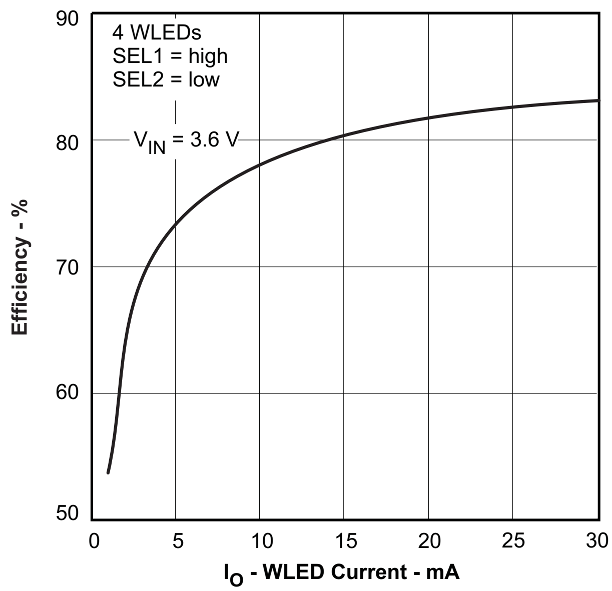

Figure 1. Efficiency vs. WLED Output Current

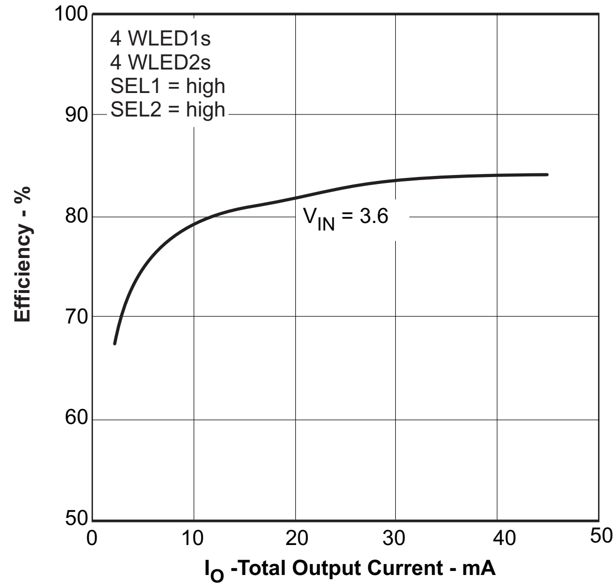

Figure 2. Both On Efficiency vs. Total Output Current

Note that when measuring the WLED output voltage for the efficiency computation, the output voltage from the IC's I_{OUT} pin to ground was used, which includes the voltage drop across the series ammeter, used to measure the WLED current, as well as the voltage drop across the internal current sink circuit and external current setting resistor.

3 Board Layout

Board layout is critical for all switch mode power supplies. Figure 3, Figure 4, and Figure 5 show the board layout for the HPA150 PWB. The switching nodes with high-frequency noise are isolated from the noise-sensitive feedback circuitry, and careful attention has been given to the routing of high-frequency current loops. See the data sheet for more specific layout guidelines.

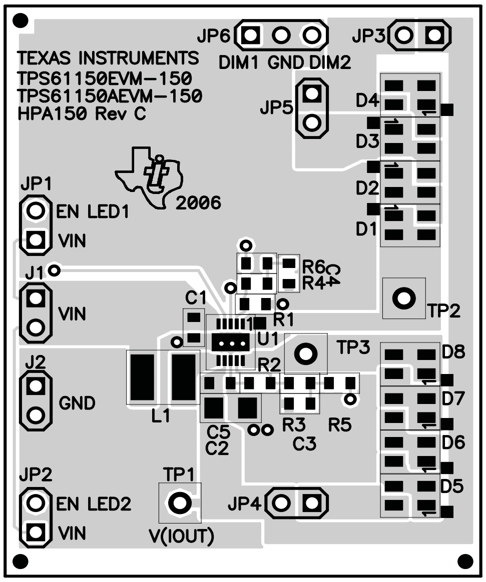

Figure 3. Top Assembly Layer

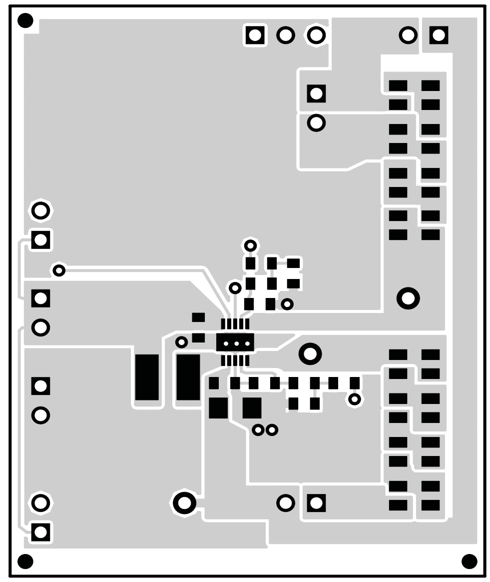

Figure 4. Top Layer

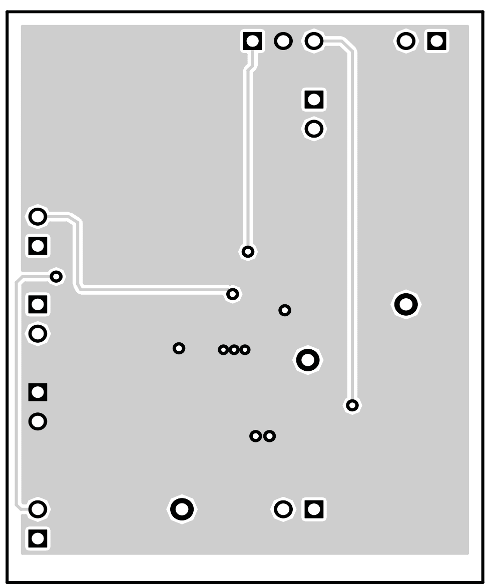

Figure 5. Bottom Layer

4 Bill of Materials and Schematic

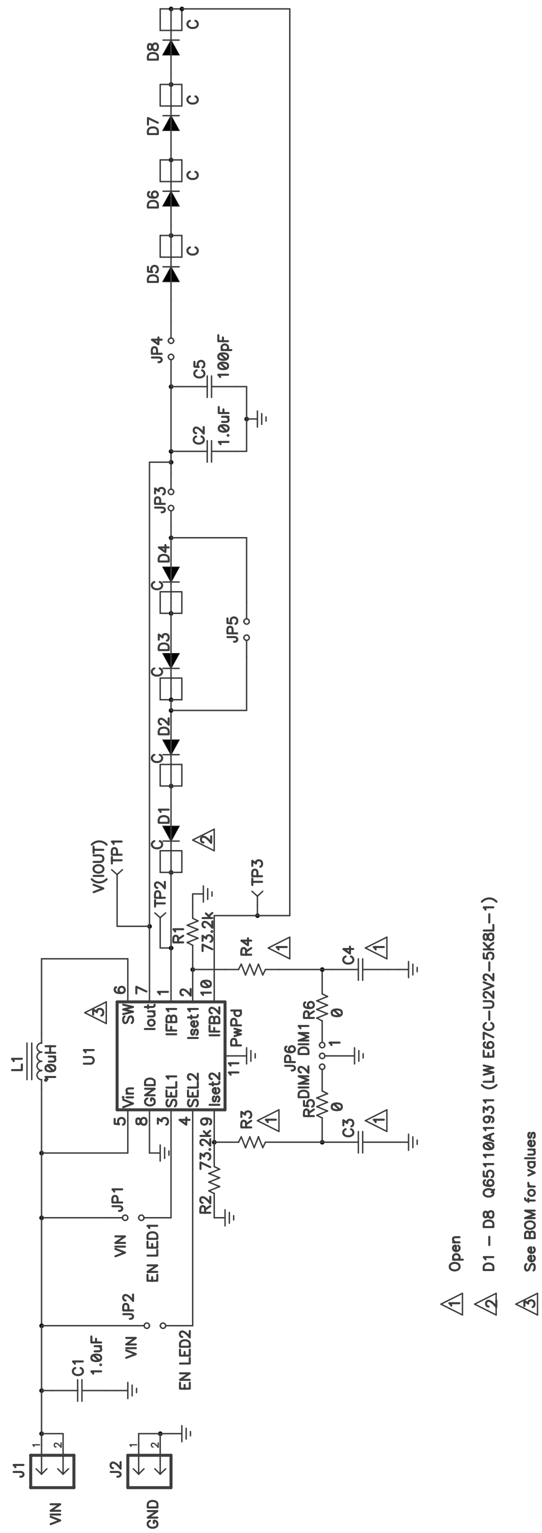

Figure 6. Schematic

4.1 Bill of Materials

Table 2. HPA150 Bill of Materials

COUNT -001	COUNT -002	REF DES	VALUE	DESCRIPTION	SIZE	PART NUMBER	MFR
1	1	C1	1.0 µF	Capacitor, Ceramic, 25 V, X5R, 10%	0603	C1608X5R1E105K	TDK
1	1	C2	1.0 µF	Capacitor, Ceramic, 50 V, X7R, 10%	1206	C3216X7R1H105K	TDK
0	0	C3, C4	Open	Capacitor, Ceramic, vvV	0603		
1	1	C5	100 pF	Capacitor, Ceramic, 50 V C0G 5%	0603	C1608C0G1H101J	TDK
8	8	D1–D8		Diode, LED, White, 30 mA, Common Anode	P-LCC-4	Q65110A1931 LW E67C-U2V2-5K8L-1	Osram
2	2	J1, J2		Header, 2-pin, 100 mil spacing, (36-pin strip)	0.100 × 2	PTC36SAAN	Sullins
5	5	JP1–JP5		Header, 2-pin, 100 mil spacing, (36-pin strip)	0.100 × 2	PTC36SAAN	Sullins
1	1	JP6		Header, 3-pin, 100 mil spacing, (36-pin strip)	0.100 × 3	PTC36SAAN	Sullins
1	1	L1	10 µH	Inductor, SMT, 1.26 A, 163 mΩ	0.137 × 0.147	VLF4018AT-100MR74-2	TDK
2	2	R1, R2	73.2 kΩ	Resistor, Chip, 1/16 W, 1%	0603	Std	Std
0	0	R3, R4	Open	Resistor, Chip, 1/16 W	0603		
2	2	R5, R6	0	Resistor, Chip, 1/16 W, 1%	0603	Std	Std
3	3	TP1–TP3		Test Point, Red, Thru Hole Color Keyed	0.100 x 0.100	5000	Keystone
1	0	U1		IC, Dual Output Boost Regulator Using Single Inductor	DRC10	TPS61150DRC	TI
0	1	U1		IC, Dual Output Boost Regulator Using Single Inductor	DRC10	TPS61150ADRC	TI
1	1	–		PCB, 1.95 In × 1.55 In × 0.062 In		HPA150	Any
6	6	–		Shunt, 100-mil, Black	0.100	929950-00	3M

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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 6.0 V and the output voltage range of 13.0 V to 17.4 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 25°C . The EVM is designed to operate properly with certain components above 25°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.

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