TPS61140EVM-157

This user's guide describes the characteristics, operation, and use of the TPS61140EVM-157 evaluation module (EVM). This EVM contains Texas Instruments TPS61140 power solution which provides one regulated current output and one regulated voltage output using a single inductor step-up (boost) converter. Each output is independently set by external resistors. The voltage output for the device is intended to drive the OLED sub display and the current output is intended to drive the WLED backlight for the LCD main display in clamshell 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 TPS61140EVM-157 evaluation module contains a TPS61140 IC and supporting passives which provide a regulated current output and a regulated voltage output using a single inductor step-up (boost) converter. The current output drives four series WLEDs. The voltage output is taken to a header. The goal of the EVM is to facilitate evaluation of the TPS61140.

1.1 Performance Specification Summary

Table 1 provides a summary of the TPS61140EVM-157 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	$I_{SUPPLY} \geq 1.25$ A	3.0	3.6	6.0	V
V_{OUT}	SELV = V_{IN}, SELI = GND, $I(V_{OUT}) \leq 35$ mA	14.5	15.1	15.7	V
	SELV = SELI = V_{IN}, I_{OUT} = 15 mA, $I(V_{OUT}) \leq 35$ mA	14.5	15.1	15.7	V
$V(I_{OUT})$	SELI = V_{IN}, JP3 open	27	28	29	V
I_{OUT}	SELV = GND, SELI = V_{IN}, JP3 shorted	14.2	15.1	16.0	mA
	SELV = SELI = V_{IN}, JP3 shorted, $I(V_{OUT}) \leq 35$ mA	14.2	15.1	16.0	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 the efficiency.

The TPS61141 IC has the same pin out as the TPS61140. 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.

J3–VOUT This is the positive connection for the voltage output.

J4–GND This is the return (ground) connection for the voltage output.

JP1–EN VOUT Shorting the jumper ties the SELV pin to VIN, thereby enabling the IC to provide a regulated output voltage. Due to the IC's internal pull down resistor, opening this jumper disables the regulated output voltage.

JP2–EN IOUT Shorting the jumper ties the SELI pin to VIN, thereby enabling the IC to provide a regulated output current. Due to the IC's internal pull down resistor, opening this jumper disables the regulated output voltage.

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

JP4–DIM/GND With resistor R4 installed, this jumper facilitates the connection of an external DC voltage for analog dimming. With resistor R4, R5 and C4 installed, this jumper facilitates the connection of an external PWM signal for PWM analog dimming.

TP1–V(I_{OUT}) Connecting a voltmeter to this test point allows the user to measure the output voltage at the current output of the boost converter. 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 IFB 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 IFB. Because noise injected into the IFB pin can adversely affect IC operation, care should be taken when connecting to this test point.

2.1 Test Setup

Connect a power supply set between 3.0 V and 6.0 V output voltage and current limit set to at least 1.25 A. Short JP1 and/or JP2 to enable the voltage output and/or current output, respecitively. Short JP3 to place series LEDs D1 through D4 into the feedback path.

To implement analog dimming, use the datasheet to determine the size for resistor R4, install it and apply the appropriate DC voltage at JP4. To implement PWM analog dimming, use the datasheet to determine the size for resistors R4 and R5 and capacitor C5, install them and apply a PWM signal within the amplitude and frequency range specified in the datasheet to JP4. Alternatively, a PWM signal within the amplitude and frequency range specified in the datasheet and applied to the SELI pin through JP2 implements PWM dimming.

2.2 Test Results

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

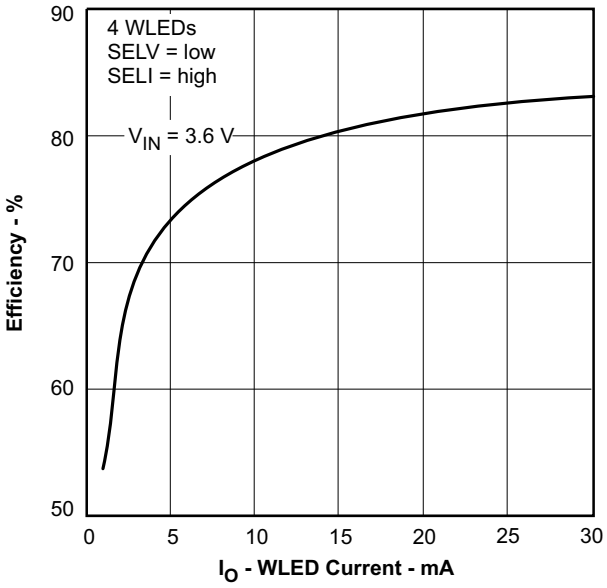

Figure 1. Efficiency vs. WLED Current

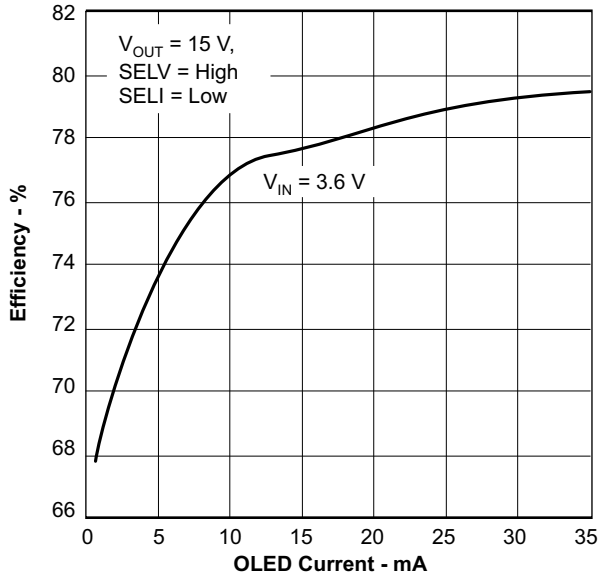

Figure 2. Efficiency vs. OLED Current

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 HPA157 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.

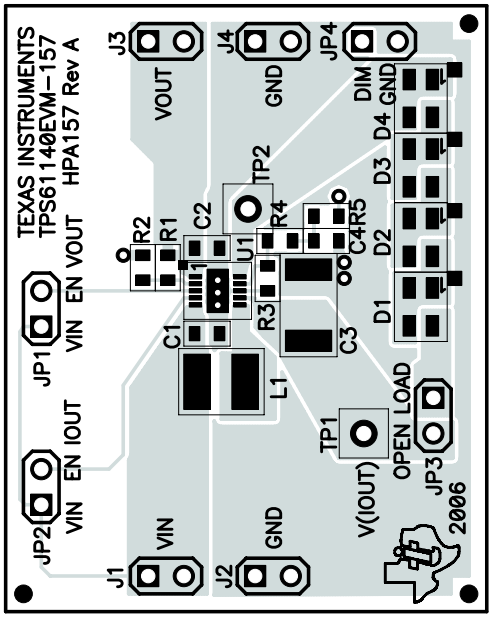

Figure 3. Top Assembly Layer

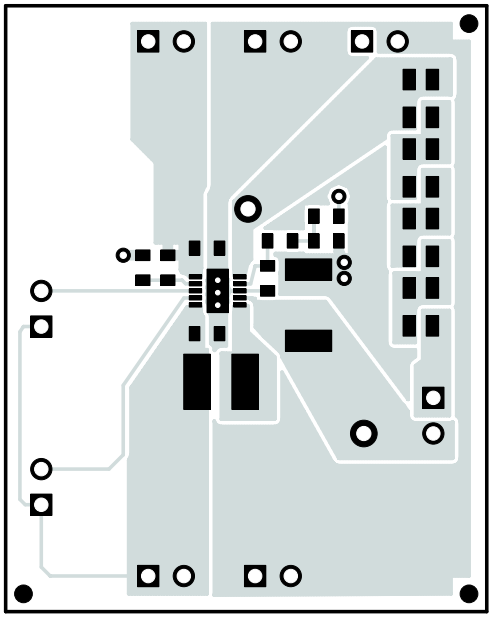

Figure 4. Top Layer

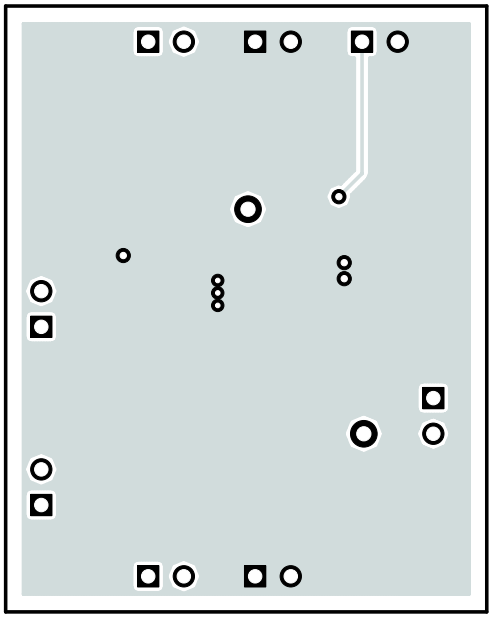

Figure 5. Bottom Layer

4 Bill of Materials and Schematic

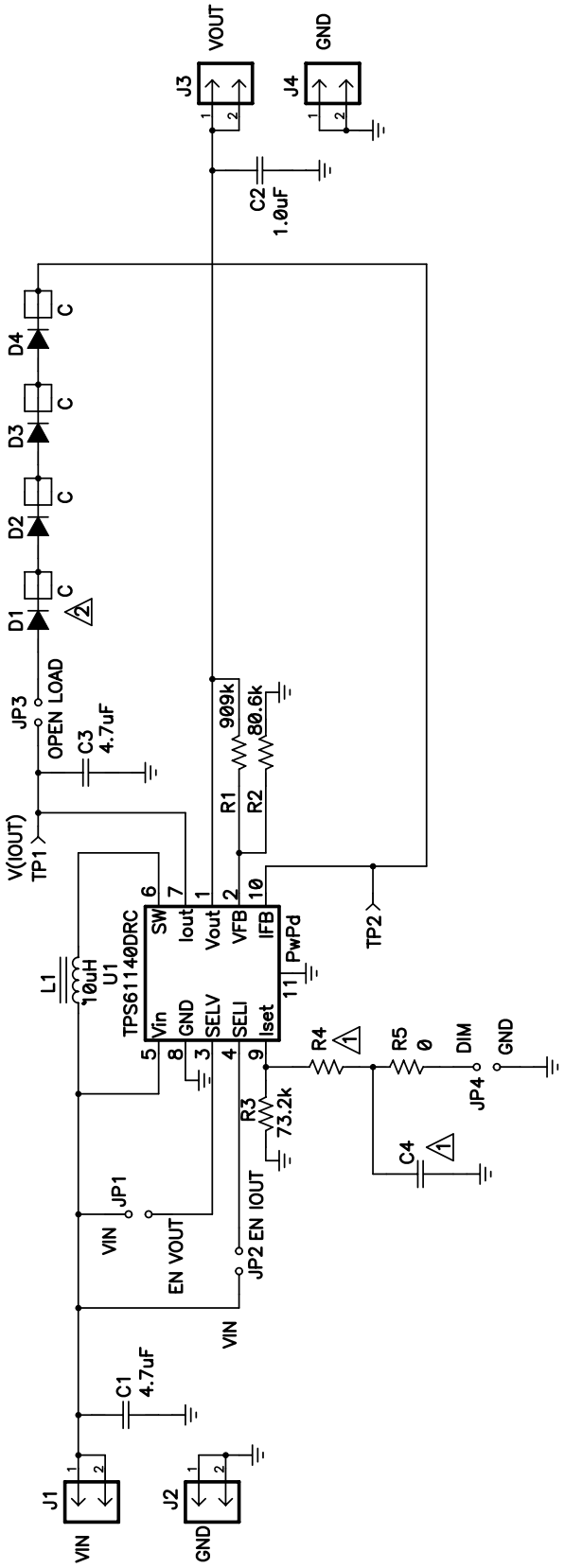

Figure 6. Schematic

4.1 Bill of Materials

Table 2. HPA157 Bill of Materials

COUNT	REF DES	VALUE	DESCRIPTION	SIZE	PART NUMBER	MFR
1	C1, C2	4.7 µF	Capacitor, Ceramic, 10 V, X5R, 10%	0603	C1608X5R1A475K	TDK
1	C3	4.7 µF	Capacitor, Ceramic, 50 V, X5R, 10%	1812	C4532X5R1H475K	TDK
1	C4	Open	Capacitor, Ceramic, vvV	0603		
4	D1–D4		Diode, LED, White, 30 mA, Common Anode	P-LCC-4	LW E67C-U2V2-5K8L-1	Osram
4	J1–J4		Header, 2-pin, 100 mil spacing, (36-pin strip)	0.100 × 2	PTC36SAAN	Sullins
4	JP1–JP4		Header, 2-pin, 100 mil spacing, (36-pin strip)	0.100 × 2	PTC36SAAN	Sullins
1	L1	10 µH	Inductor, SMT, 1.26 A, 163 mΩ	0.137 × 0.147	VLF4018AT-100MR74-2	TDK
1	R1	909 k	Resistor, Chip, 1/16 W, 1%	0603	Std	Std
1	R2	80.6 k	Resistor, Chip, 1/16 W, 1%	0603	Std	Std
1	R3	73.2 k	Resistor, Chip, 1/16 W, 1%	0603	Std	Std
1	R4	Open	Resistor, Chip, 1/16 W	0603	Std	Std
1	R5	0	Resistor, Chip, 1/16 W, 1%	0603	Std	Std
2	TP1, TP2		Test Point, Red, Thru Hole Color Keyed	0.100 × 0.100	5000	Keystone
1	U1		IC, Dual Output Boost Regulator Using Single Inductor	DRC10	TPS61140DRC	TI
1	–		PCB, 1.7 In × 1.35 In × 0.062 In		HPA157	Any
4	–		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 14.5 V to 15.7 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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