TPS61183EVM-528

This user's guide describes the characteristics, operation, and use of the TPS61183 evaluation module (EVM). This EVM contains Texas Instruments' TPS61183, a WLED power solution providing up to six independently regulated current outputs using a single inductor step-up (boost) converter. The current outputs are ideal for driving a WLED backlight in notebook/laptop computers. This user's guide includes EVM specifications, recommended test setup, test results, bill of materials, and a schematic diagram.

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Table 1 provides a summary of the TPS61183EVM-528 performance specifications. All specifications are given for an ambient temperature of 25°C.

Table 1. TPS61183EVM-528 Electrical and Performance Specifications

Parameter		Notes and Conditions [1]	Min	Typ	Max	Unit
INPUT CHARACTERISTICS						
V_{IN}	Input Voltage		4.5		24	V
En	EN Logic high		2.1		20	V
PWM	PWM Logic high		2.1		20	V
I_{q_VIN}	Input quiescent Current	Device enable, switching 600 KHz and no load, V_{IN} = 21 V			4	mA
V_{IN_UVLO}	Input UVLO	V_{IN} ramp down			3.50	V
		V ramp up			3.75	
OUTPUT CHARACTERISTICS						
V_{OUT}	V(TP2)	J6 connected to 10 WLED configured WLEDEVM-260, JP5 shorted, JP6-13 shorted, EN/PWM =VDDIO, SEL=open		32	38	V
I_{OUT}	I(JP1) =6 X IFBx	V_{IN} = Min to Max, R1 = 62k		120		mA
SYSTEMS CHARACTERISTICS						
F_S	Switching Frequency	R_{FSW} = 499K	0.8	1	1.2	MHz

(1) The user can estimate the input current by solving the power balance equation, eff = P_{OUT}/P_{IN} = ($V_O \times I_O$)/($V_{IN} \times I_{IN}$), for I_{IN} and estimating the efficiency to be a conservative 85%. For example, for V_O = 32V, V_{IN} = 5V and I_O = 6 × 20mA = 120mA, I_{IN} = (32V × 120mA)/(5V × 0.85) = 0.904A

3 Modifications

See the datasheet (SLVSAB4) when changing components such as R1 to set the LED current or R4 and R5 to set the OVP threshold. To aid in such customization of the EVM, the board was designed with devices having 0603 or larger footprints. A real implementation likely occupies less total board space.

Note that changing components can improve or degrade EVM performance. For example, using inductors with larger dc resistances lowers the dc/dc conveter's efficiency.

4 Connector and Test Point Descriptions

4.1 Input/Output Connections

The connections points are described in the following paragraphs.

4.1.1 J1 – VIN

This header is the positive connection to the input power supply. Twist the input supply and GND leads to the input supply and keep them as short as possible.

4.1.2 J2 – S+/S-

This header provides connection for the positive and negative sense leads for some power supplies. Connecting sense will help ensure proper regulation of the input voltage.

4.1.3 J3 – GND

This header is the return connection to the input power supply.

4.1.4 J4 – 14-Pin Connector

This header facilitates connecting the TPS61183EVM-528 to the WLEDEVM-260 or WLEDEVM-461, LED EVM boards. These boards must be ordered separately from the TPS61183EVM.

4.1.5 J5 – FPO

This header is the connection for the fault protection output that will indicate fault conditions including OVP, OC, and OT.

4.1.6 J6 – GND

This header connects to the board's ground plane.

4.1.7 J7 & J8 – GND

This header connects to the board's ground plane.

4.1.8 JP1 – LEDs ON

The user can remove the shunt on this jumper and connect the high side of external LED strings. When using the WLEDEVM-260 or WLEDEVM-461 LED EVMs, installing the shunt on this jumper connects the output of the boost converter to J4. Removing the jumper removes the WLEDs from the boost converter feedback path and causes the IC’s over-voltage protection circuitry to activate. Instead of the shunt, the user can place an ammeter across the jumper to measure the total output current (i.e., 6×IFBx).

4.1.9 JP2 – EN-VDDIO

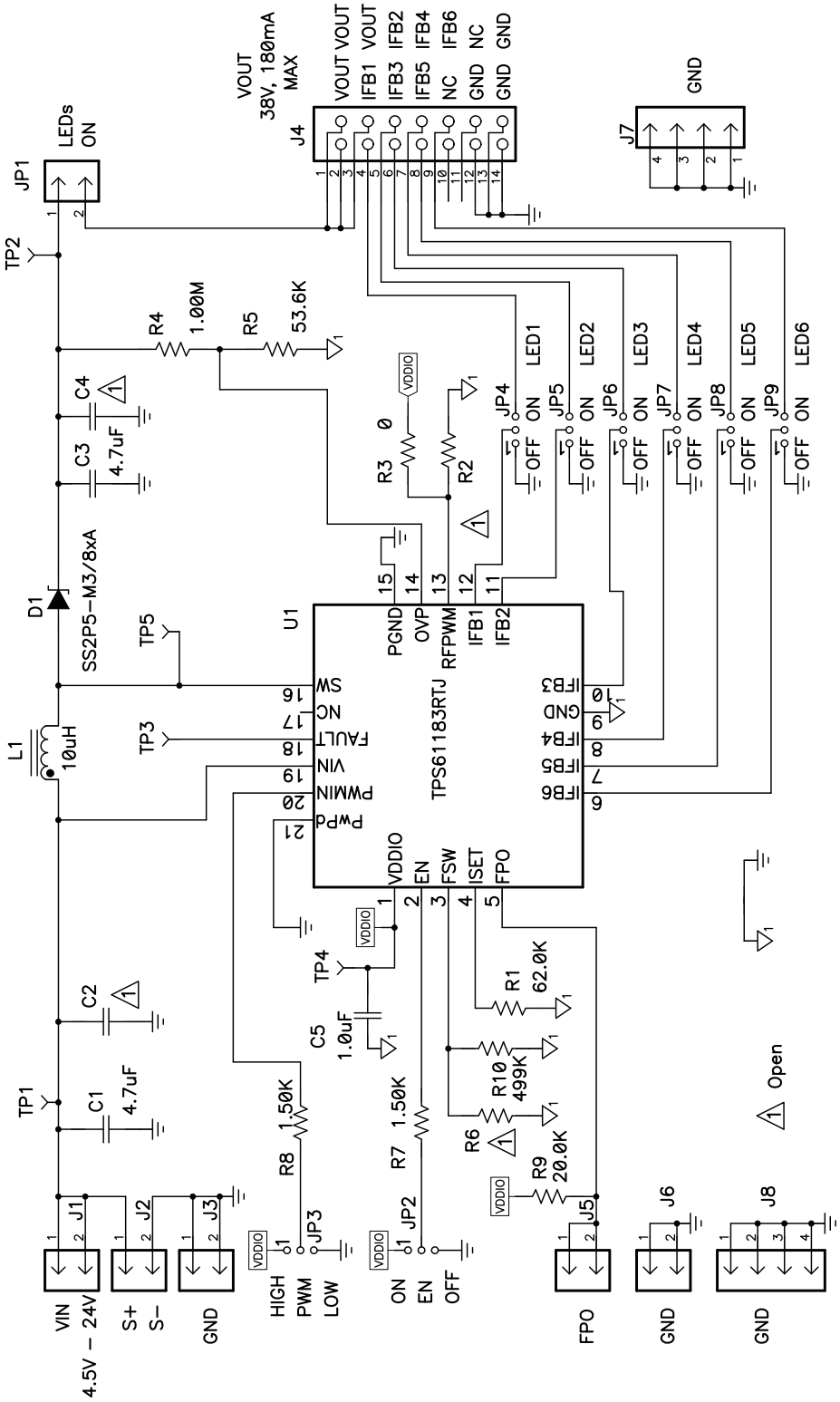
Installing the shunt on this jumper sets the ENABLE pin voltage to VDDIO, thereby enabling the IC's boost converter. Removing the logic high signal allows the internal pulldown resistor to pull EN to ground, which disables the IC's boost converter.

Note: With Vin applied, VDDIO/VDD does not reach full regulation until EN is pulled high. While it is possible to enable the IC by tying the EN pin to the unregulated VDDIO/VDD output for evaluation, it is not recommended in a real application.

4.1.10 JP3 – PWM-VDDIO

Installing the shunt on this jumper sets the PWM pin voltage to VDDIO, which sets the current sinks to 100% current and therefore any attached LEDs to full brightness. The user must connect an external PWM signal or use JP4 to take PWM to a logic high (above 2.1 V but no higher than 20 V) in order to enable the current sinks.

5 Schematic and Bill of Materials



NOTE: \For Reference Only, See Table 2. Bill of Materials for Specific Values

Figure 1. HPA528EVM Schematic

Table 2. Bill of Materials

Count	RefDes	Value	Description	Size	Part Number	MFR
1	C1	4.7uF	Capacitor, Ceramic, 25V, X7R, 10%	1206	Std	Std
0	C2	Open	Capacitor, Ceramic, 25V, X7R, 10%	1206	Std	Std
1	C3	4.7uF	Capacitor, Ceramic, 50V, X5R, 10%	1206	Std	Std
0	C4	Open	Capacitor, Ceramic, 50V, X5R, 10%	1206	Std	Std
1	C5	1.0uF	Capacitor, Ceramic, 10V, X5R, 10%	0603	Std	Std
1	D1	SS2P5-M3/84A	Diode, High Current SMD Schottky Rectifier, 2A, 50VDC	DO-220AA	SS2P5-M3/84A or alt. SS2P6-M3/84A or alt. SS2P5-E3/84A or alt. SS2P6-E3/84A	Vishay
5	J1, J2, J3,J5, J6	PEC02SAAN	Header, Male 2-pin, 100mil spacing	0.100 inch x 2	PEC02SAAN	Sullins
1	J4	N2514-6002RB	Connector, Male Straight 2x7 pin, 100mil spacing, 4 Wall	0.100 inch x 2X7	N2514-6002RB	3M
2	J7, J8	PEC04SAAN	Header, Male 4-pin, 100mil spacing	0.100 inch x 4	PEC04SAAN	Sullins
1	JP1	PEC02SAAN	Header, Male 2-pin, 100mil spacing	0.100 inch x 2	PEC02SAAN	Sullins
8	JP2 – JP9	PEC03SAAN	Header, Male 3-pin, 100mil spacing,	0.100 inch x 3	PEC03SAAN	Sullins
1	L1	10uH	Inductor, 90mohm DC resistance, ±20%	0.205 x 0.205 inch	#A915AY-100M	Toko
1	R1	62K	Resistor, Chip, 1/16W, 1%	0603	Std	Std
0	R2, R6	Open	Resistor, Chip, 1/16W, 1%	0603 0603 0603 0603 0603 0603 0603	Std	Std
1	R3	0	Resistor, Chip, 1/16W, 1%	0603	Std	Std
1	R4	1.00M	Resistor, Chip, 1/16W, 1%	0603	Std	Std
1	R5	53.6K	Resistor, Chip, 1/16W, 1%	0603	Std	Std
2	R7, R8	1.50K	Resistor, Chip, 1/16W, 1%	0603	Std	Std
1	R9	20.0K	Resistor, Chip, 1/16W, 1%	0603	Std	Std
1	R10	499K	Resistor, Chip, 1/16W, 1%	0603	Std	Std
5	TP1, TP2, TP3, TP4, TP5	5000	Test Point, Red, Thru Hole Color Keyed	0.100 x 0.100 inch	5000	Keystone
1	U1	TPS61183RTJ	IC, WLED Driver for Notebooks	QFN-20	TPS61183RTJ	TI
1			PCB, 1.75" x 3.5" x 0.062"		HPA528	Any
9	—		Shunt, 100-mil, Black	0.100	929950-00	3M

6 Test Requirements and Setup

6.1 Hardware Requirements

This EVM requires an external power supply capable of providing up to 24V at 3A.

If dimming via an external PWM signal is desired, then a function generator capable of providing a PWM signal between 100 Hz to 22 kHz is required to avoid screen flickering and maintain dimming linearity.

6.2 Hardware Setup

- Connect a power supply capable of supplying up to 24 V at 3 A between the VIN pin and GND (J1 and J3). Do not turn on the power supply.
- JP1 should be connected directly or through an ammeter to the high side of external LED strings. Or, the shunt installed or replaced with an ammeter and the WLEDEVM-260 or WLEDEVM-461 connected to J4.
- Either use JP2 or connect a voltage source supplying at least 2.1-V but no more than 20-V signal to the high impedance EN pin (JP2) referenced to the same ground as J3.
- For PWM Dimming, either use JP3 or connect a second logic signal capable of providing at least 2.1-V but no more than 20-V signal to the PWM input.
- Properly configure JP4-JP9 so that each IFB line either connects directly to an LED string, to the J4 connector, or to GND. Unused IFBx lines should have the appropriate JP4-JP9 jumpers shunted to ground.

7 TPS61183EVM-528 Assembly Drawings and Layout

The following figures (Figure 2 through Figure 4) show the design of the TPS61183EVM-528 printed circuit board. The EVM has been designed using a 2-Layer, 2oz copper-clad circuit board 6.58 cm × 5.44 cm with all components in a 1.9cm × 2.2cm active area on the top side and all active traces to the top and bottom layers to allow the user to easily view, probe and evaluate the TPS61195 control IC in a practical double-sided application. Moving components to both sides of the PCB or using additional internal layers can offer additional size reduction for space constrained systems.

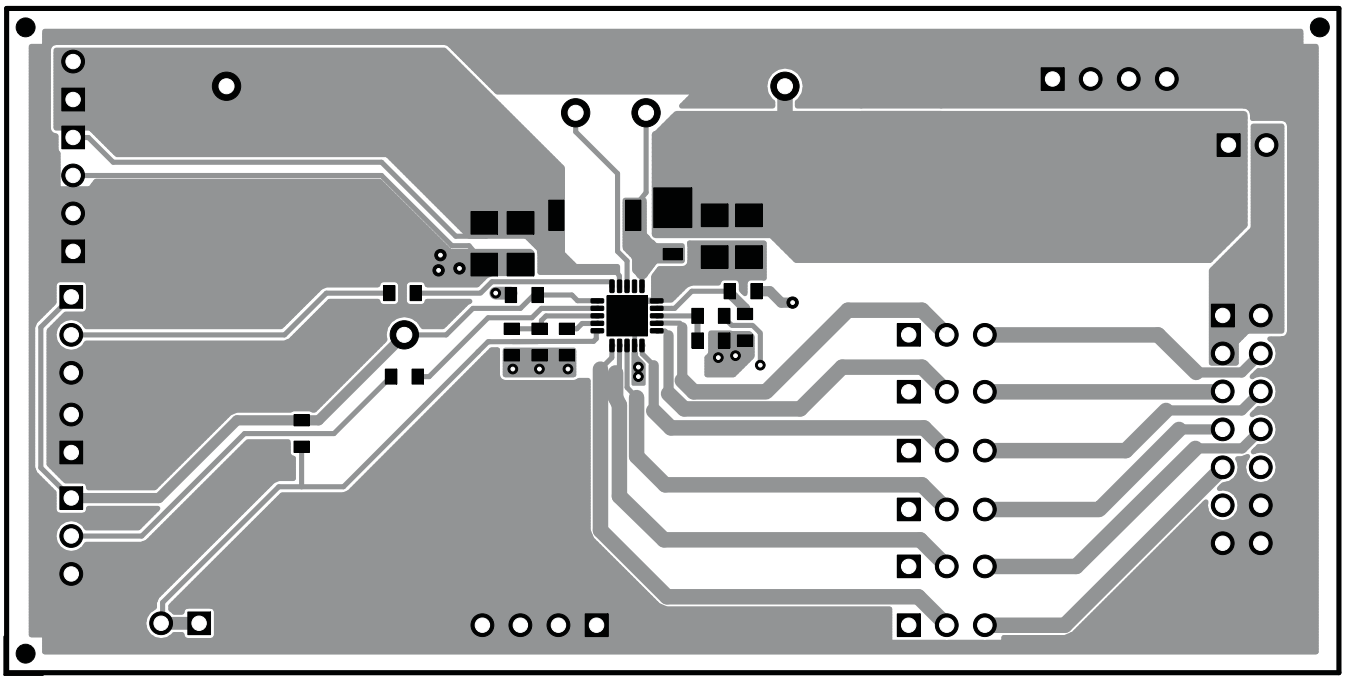


Figure 2. TPS61183EVM-528 Component Placement (Viewed from Top)

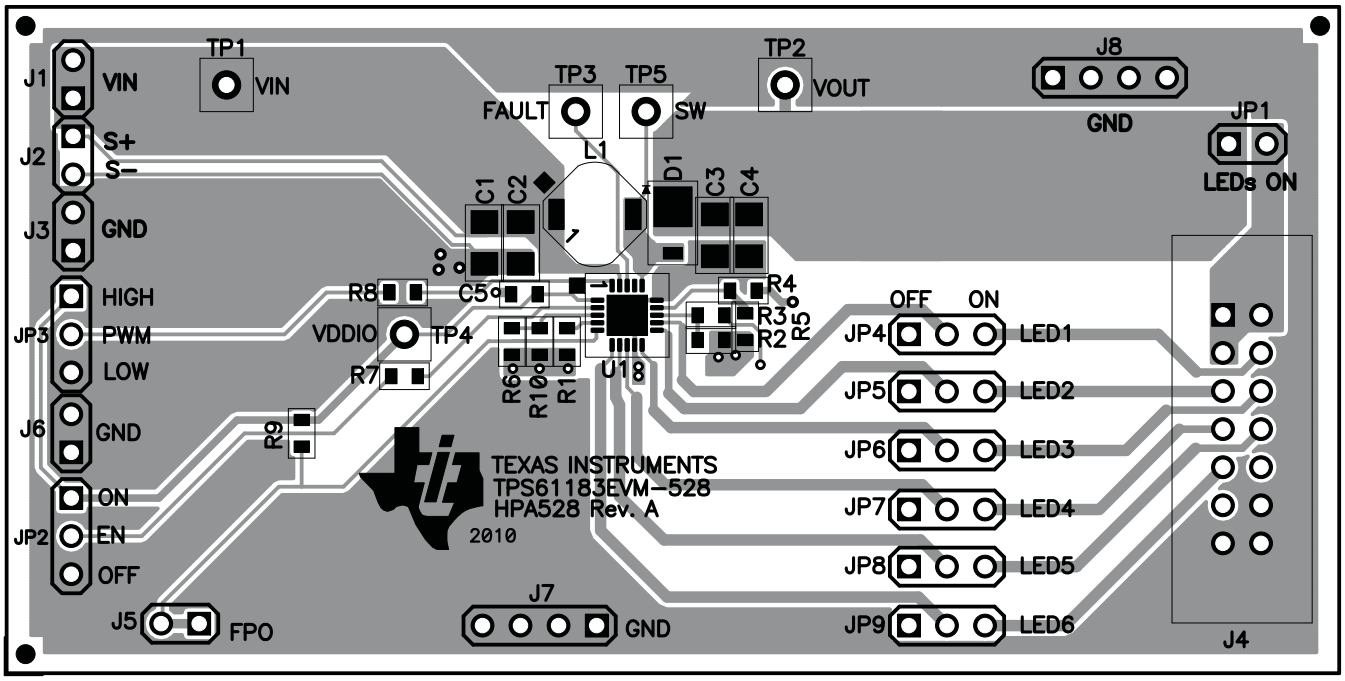


Figure 3. TPS61183EVM-528 Top Copper (Viewed from Top)

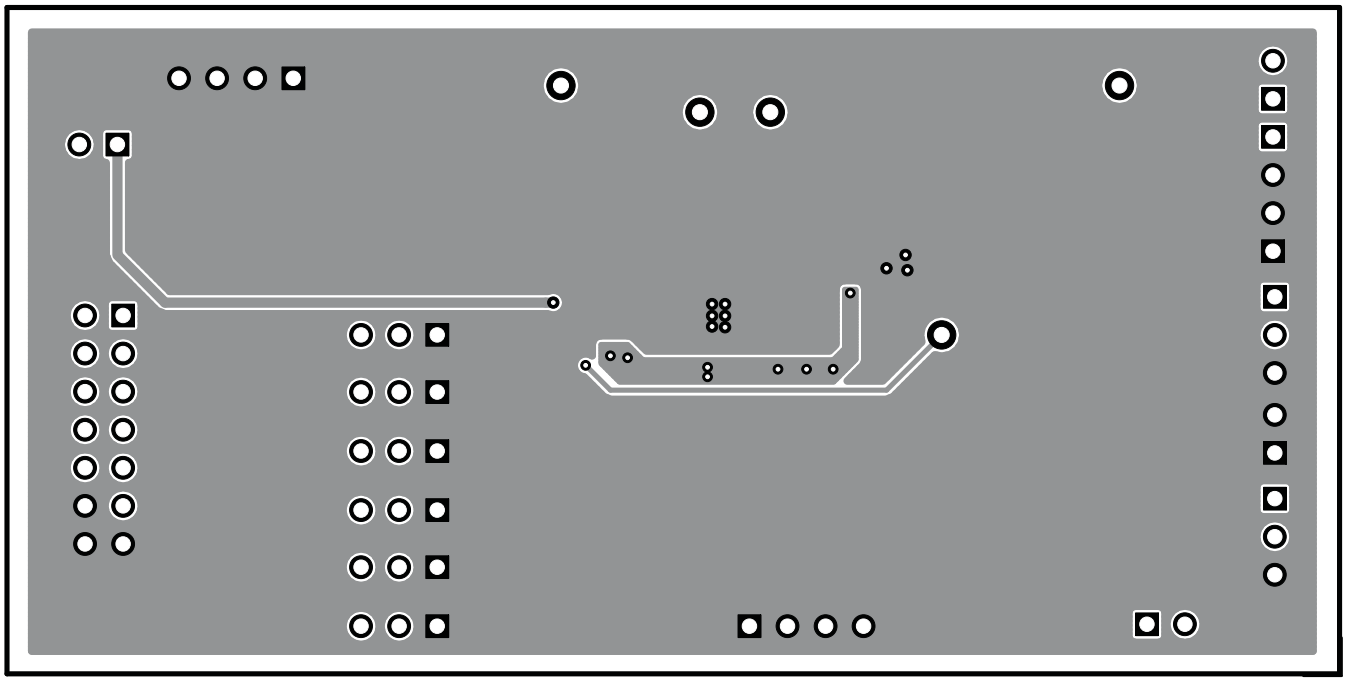


Figure 4. TPS61183EVM-528 Bottom Copper (Viewed from Bottom)

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EVM Warnings and Restrictions

It is important to operate this EVM within the input voltage range of 4 V to 24 V and the output voltage range of 32 V to 46 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.

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