TPS6106xEVM User's Guide

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1 Introduction

The Texas Instruments TPS6106xEVM evaluation module (EVM) helps designers evaluate the operation and performance of the TPS6106x family of constant current LED drivers. These devices are high-efficiency, small-size boost converters that switch at 1 MHz.

The EVM contains two independent DC/DC converters (see Table 1).

Table 1. Device and Package Configurations

Converter	IC	Package
U1	TPS61061DRB	QFN-8
U4	TPS61061YZF	CSP-8 chipscale

Converter U1 is configured to demonstrate all features of the device. Converter U4 is optimized for minimum area to demonstrate small solution size.

2 Setup

This section describes the jumpers and connectors on the EVM as well as how to properly connect, set up, and use the TPS6106xEVM.

2.1 Input/Output Connector Descriptions

J1 and TP1 – Vin is the positive connection to the corresponding converter. The leads to the input supply should be twisted and kept as short as possible to minimize EMI transmission.

J2 and TP4 – GND is the return connection for the input power supply for the corresponding converter.

TP2 – LED Cathode is the chipscale converter, U4, output to an external LED cathode.

TP3 – LED Anode is the chipscale converter, U4, return from an external LED anode.

JP1 – EN jumper enables or disables the converter. Connect the shorting jumper from the center EN pin to either the ON or OFF position.

JP2 – ILED FIXED, or DIG CTRL jumper is used to select how the output current for converter U1 is controlled. When JP2 is in the FIXED position, jumper JP3 sets the output current HIGH (40 mA) or LOW (20 mA). When in the DIG CTRL position, pushbuttons S1 and S2 allow LED current to be stepped up or down in 1.25-mA increments between 0 mA and 40 mA.

JP3 – ILED LOW, or ILED HIGH jumper is used with JP2 to set the LED output current. When in the ILED LOW position, converter U1 regulates FB pin to a voltage of 250 mV at pin 4. This corresponds to an LED current of 20 mA. When in the ILED HIGH position, pin 4 is regulated to 500 mV, which corresponds to an LED current of 40 mA.

JP4 – OPEN LOAD jumper disconnects LED D5–D1 from converter U1 output. This can be used to demonstrate the converter's overvoltage protection or monitor LED current.

JP5 – BYPASS D1 jumper bypasses LED D1 to reduce the LED load to four.

2.2 Setup

Input voltage range for both converters is 2.7 volts to 6.0 volts. Converter U1 load (D5–D1) is on the EVM board. Converter U4 requires an external load for proper operation.

The factory-supplied TPS61061, used for U1 and U4, can be replaced with other converters from the TPS6106x family.

2.3 Operation

For proper operation of U1, JP1 and JP2 must be configured. The recommended setting, using shorting blocks is:

JP1 to ON

JP2 to DIG CTRL

JP4 shorted

In this configuration, the unit powers up when power is applied. LED current is under the control of S1 and S2.

JP2 ILED selects how the LED D5–D1 current is set, FIXED or DIG CTRL. FIXED position places control under jumper JP3. With JP3 set to the ILED LOW position, LED current is regulated at 20 mA; in the ILED HIGH position, LED current is regulated at 40 mA. With JP2 in the DIG CTRL position S1 UP and S2 DOWN control LED current. Each pushbutton steps the current up or down ~1.25 mA per step; the range is 0 mA to 40 mA.

3 Board Layout

Board layout is critical for all high-frequency switch-mode power supplies. Figure 1, Figure 2, and Figure 3 show the board layout for the TPS6106xEVM-091 PWB. The nodes with high switching frequencies and currents are kept as short as possible to minimize trace inductance.

The TPS6106x family of converters are high efficiency but do dissipate power. The QFN package has an exposed thermal pad to enhance thermal performance. This must be soldered to a substantial thermal plane.

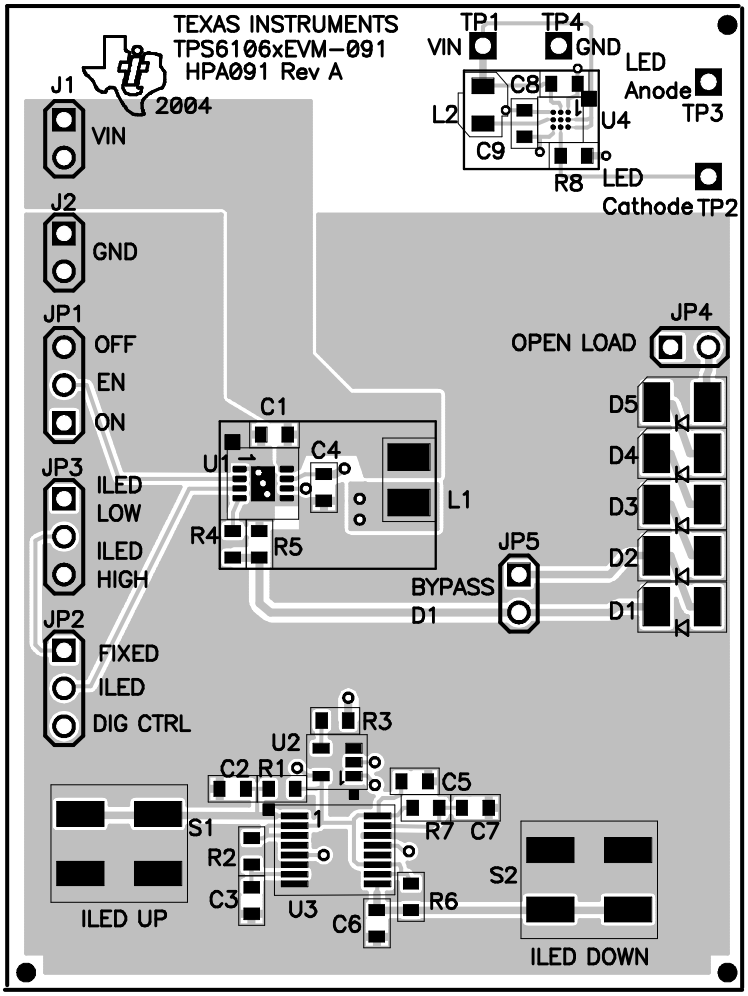

Figure 1. Top Assembly Layer

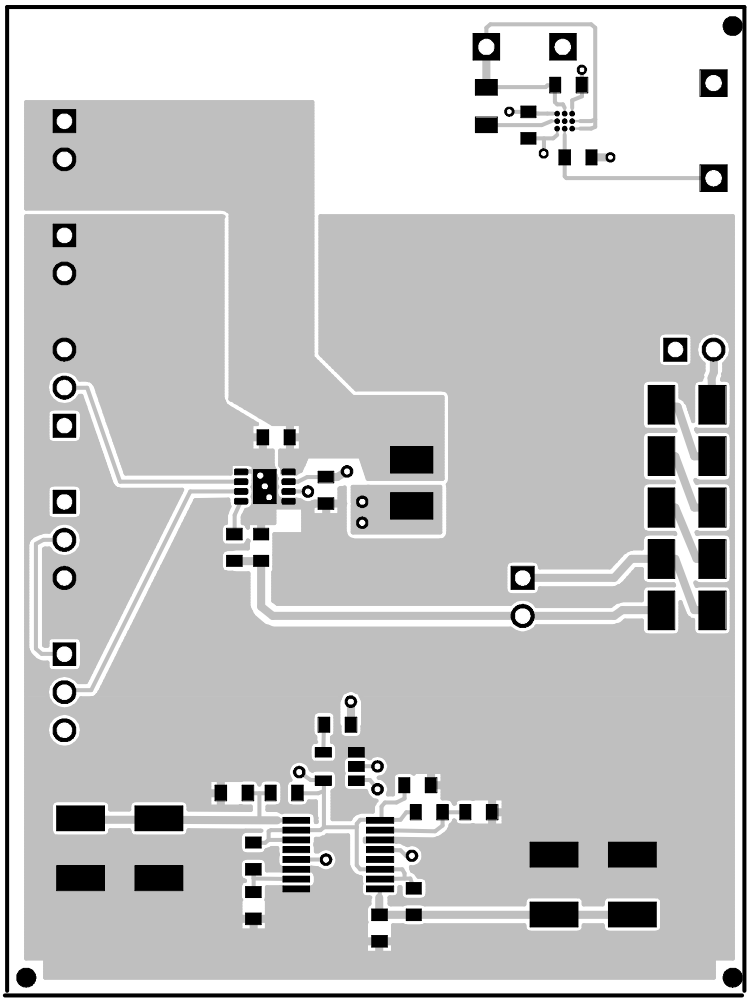

Figure 2. Top Layer Routing

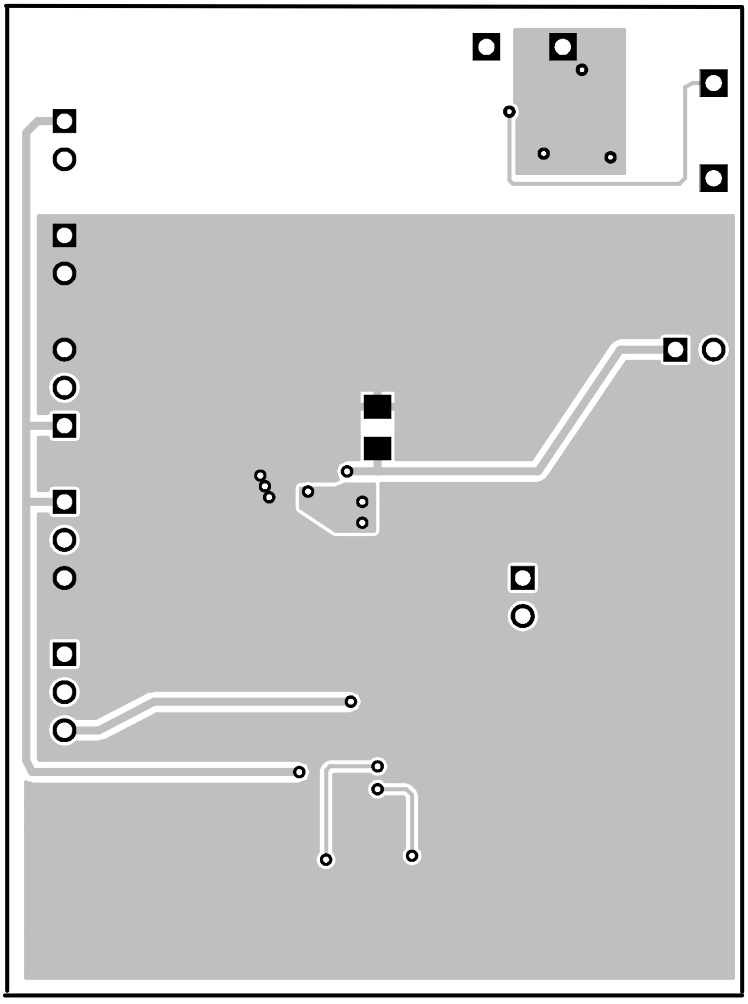

Figure 3. Bottom Layer Routing

4 Schematic

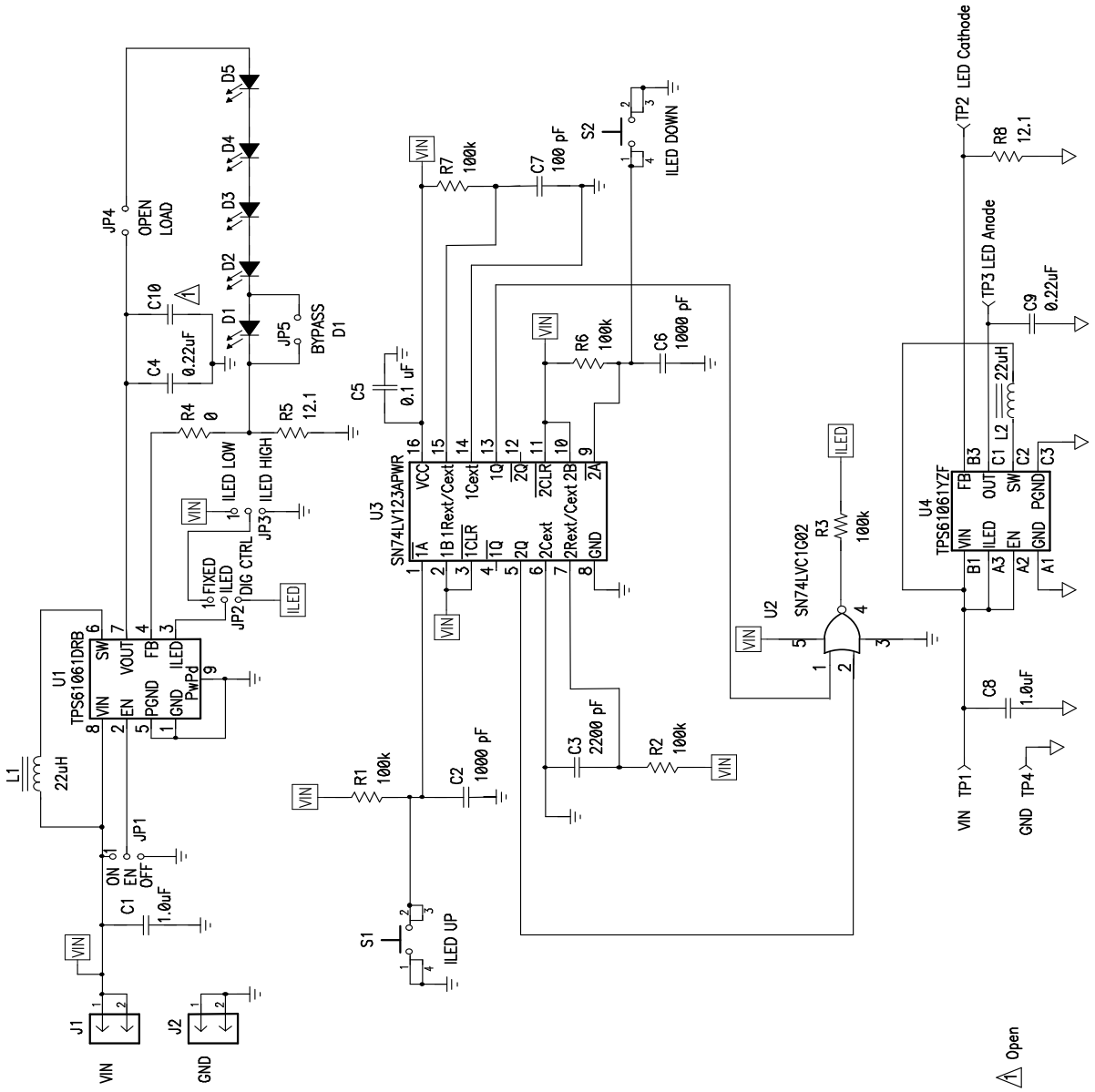

Figure 4. TPS6106xEVM Schematic

Table 5. TPS6106xEVM Bill of Materials

COUNT	Ref Des	DESCRIPTION	SIZE	MFR	PART NUMBER
2	C1, C8	Capacitor, ceramic, 1-µF, 16-V, X7R, 10%	603	TDK	C1608X7R1C105KT
0	C10	Capacitor, ceramic, xxx-µF, vv-V	1206		
2	C2, C6	Capacitor, ceramic, 1000-pF, 50-V, X7R, 10%	603	TDK	C1608X7R1H102K
1	C3	Capacitor, ceramic, 2200-pF, 50-V, X7R, 10%	603	TDK	C1608X7R1H222K
2	C4, C9	Capacitor, ceramic, 0.22-µF, 10-V, X5R, 10%	603	TDK	C1608X5R1A224K
1	C5	Capacitor, ceramic, 0.1-µF, 16-V, X7R, 10%	603	TDK	C1608X7R1C104K
1	C7	Capacitor, ceramic, 100-pF, 50-V, C0G, 5%	603	TDK	C1608C0G1H101J
5	D1–D5	Diode, LED, White, 30 mA	1210	Lumex	SML-LX2832UWC-TR
				Chicago Miniature	CMD67-21UWC
2	J1, J2	Header, 2-pin, 100-mil spacing, (36-pin strip)	0.100 X 2	Sullins	PTC36SAAN
3	JP1, JP2, JP3	Header, 3-pin, 100-mil spacing, (36-pin strip)	0.100 X 3	Sullins	PTC36SAAN
2	JP4, JP5	Header, 2-pin, 100-mil spacing, (36-pin strip)	0.100 X 2	Sullins	PTC36SAAN
1	L1	Inductor, SMT, 22-µH, 580-mA, 160-mΩ	1210	Coilcraft	ME3220-223KX
1	L2	Inductor, SMT, 22-µH, 580-mA, 800-mΩ	0.102 X 0.110	TDK	VLF3012AT-220MR33
5	R1, R2, R3, R6, R7	Resistor, chip, 100-kΩ, 1/16-W, 1%	603	Std	Std
1	R4	Resistor, chip, 0-Ω, 1/16 W, 5%	603	Std	Std
2	R5, R8	Resistor, chip, 12.1-Ω, 1/16 W, 1%	603	Std	Std
2	S1, S2	Switch, SPST, PB-Momentary, Sealed, Washable	0.245 X 0.251	C&K	KT11P2JM
2	TP1, TP3	Test point, red, 1-mm	0.038	Farnell	240-345
2	TP2, TP4	Test point, black, 1-mm	0.038	Farnell	240-333
1	U1	IC, constant current LED driver with digital brightness control	QFN-8P	TI	TPS61061DRB
1	U2	IC, single 2-input positive-NOR gate	SOT23-5	TI	SN74LVC1G02DBVR
1	U3	IC, dual retriggerable Monostable multivibrators with Schmitt-Trigger inputs	PW16	TI	SN74LV123APWR
1	U4	IC, constant current LED driver with digital brightness control	WCSP-9	TI	TPS6106YZF
1	--	PCB, 2.6-inch x 1.95-inch x 0.062-inch		Any	HPA091
5	--	Shunt, 100-mil, black	0.100	3M	929950-00

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This equipment is intended for use in a laboratory test environment only. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to subpart J of 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.

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It is important to operate this EVM within the input voltage range of -0.3 V to 7.0 V and the output voltage range of 0 V to 33 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 60° 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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