Power-Distribution Switch With Adjustable Current-Limit EVM

This user's guide describes the TPS255xDBVEVM-271 and TPS255xDRVEVM-271 evaluation modules (EVM). This guide contains the EVM schematic, bill of materials, assembly drawing, and top and bottom board layouts.

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1 Introduction

The TPS255xDBVEVM-271 and TPS255xDRVEVM-271 are evaluation modules (EVM) for Texas Instruments' family of power-distribution switches with adjustable current-limit. These EVMs operate over a 2.5-V to 6.5-V range. An onboard jumper sets the output current-limit to either 0.5 A or 1 A. Test points provide convenient access to all critical node voltages.

The silkscreen outline on the PCB top-side encloses components found in a typical USB application.

The PCB top-side accepts a power-distribution switch in a SOT23-6 package; the PCB bottom side accepts a power-distribution switch in the smaller SON package with a thermal pad. These switches have an enable input, an overcurrent status output, and overtemperature shutdown.

1.1 Related Documentation from Texas Instruments

TPS2550, TPS2551 data sheet (SLVS736)

2 Electrical Specifications

The EVM meets the electrical specifications in Table 1 over the recommended operating junction-temperature range of -40°C ≤ Tj ≤ 105°C for the DRV (SON) package and -40°C ≤ Tj ≤ 125°C for the DBV (SOT23-6) package.

Table 1. EVM Electrical Specifications

Parameter	Condition	Min	Typ	Max	Unit
Input voltage, V_{in}	J1	2.5	–	6.5	Volt
Short-Circuit Output Current-Limit, ILIMIT	J2 shorting-jumper is absent, J3 is short circuited, TPS255x is enabled	0.60	0.65	0.72	Ampere
	J2 shorting-jumper is present, J3 is short circuited, TPS255x is enabled	1.20	1.28	1.38	

2.1 Electrostatic Discharge

The EVM has been tested to IEC 61000-4-2. The level used was 8-kV contact discharge and 15-kV air discharge. Surges were applied to the EVM input and output. No damage to the TPS255x was observed.

3 Schematic and Bill of Materials

3.1 EVM Options

Table 2. EVM Options

EVM	Device	Device Package	Enable
TPS2550DBVEVM-271	TPS2550DBV	SOT23-6	Active Low
TPS2551DBVEVM-271	TPS2551DBV	SOT23-6	Active High
TPS2550DRVEVM-271	TPS2550DRV	SON	Active Low
TPS2551DRVEVM-271	TPS2551DRV	SON	Active High

3.2 Schematic

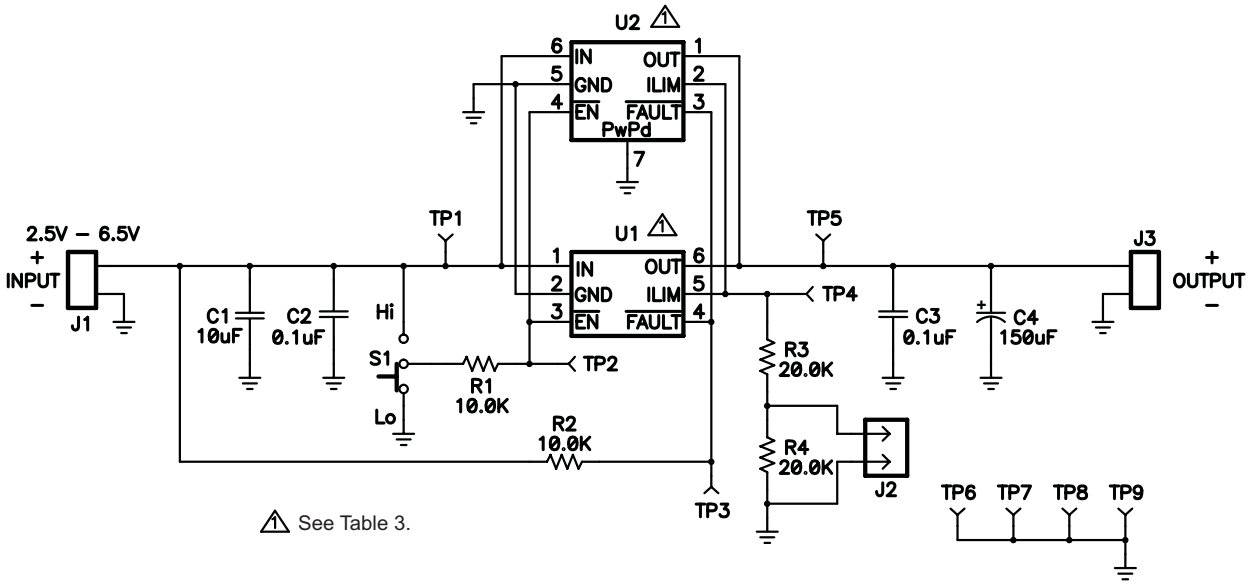

Figure 1. EVM Schematic

3.3 Bill of Materials

Table 3. EVM Bill of Materials

QTY				RefDes	Value	Description	Size	Part Number	MFR
-001	-002	-003	-004						
1	1	1	1	C1	10µF	Capacitor, Ceramic, 10-µF, X7R, 10V, 10%	1206	STD	STD
2	2	2	2	C2, C3	0.1µF	Capacitor, Ceramic, 16V, X7R, 10%	0805	STD	STD
1	1	1	1	C4	150µF	Capacitor, Tantalum, 150µF, 10V, 100mΩ, 10%	7343 (D)	B45197A2157K409	Kemet
1	0	0	0	U1	TPS2550DBV	IC, Power-Distribution Switch, Current-Limited	SOT-23-6	TPS2550DBV	TI
0	1	0	0	U1	TPS2551DBV	IC, Power-Distribution Switch, Current-Limited	SOT-23-6	TPS2551DBV	TI
0	0	1	0	U2	TPS2550DRV	IC, Power-Distribution Switch, Current-Limited	SON	TPS2550DRV	TI
0	0	0	1	U2	TPS2551DRV	IC, Power-Distribution Switch, Current-Limited	SON	TPS2551DRV	TI
1	1	1	1	--	HPA271	PCB, 2.25 In × 2.225 In × 0.062 In		HPA271	Any
2	2	2	2	R1, R2	10.0K	Resistor, Chip, 1/10W, 1%	0805	CRCW0805-1002F	Vishay
2	2	2	2	R3, R4	20.0K	Resistor, Chip, 1/10W, 1%	0805	CRCW0805-2002-F	Vishay

4 EVM Setup

4.1 Recommended Test Equipment

The following test equipment is recommended:

- Two-channel storage oscilloscope
- Current probe
- Voltage probe
- An adjustable power supply with a 2.5-V to 6.5-V output and a 5-A output current-limit
- Volt-ohm meter

- A passive or active load capable of handling 3 A.

4.2 Measuring the Short-Circuit Output Current-Limit

The user should read the TPS2550/1 data sheet before using the EVM.

Figure 2 shows the EVM test setup for measuring current-limit. Switch S1 enables the power-distribution switch into a short circuit for this measurement. Figure 3 shows the current waveform for the TPS2551DRVEVM-271 with a shorting jumper populating header J2; Figure 4 shows the current waveform with header J2 unpopulated.

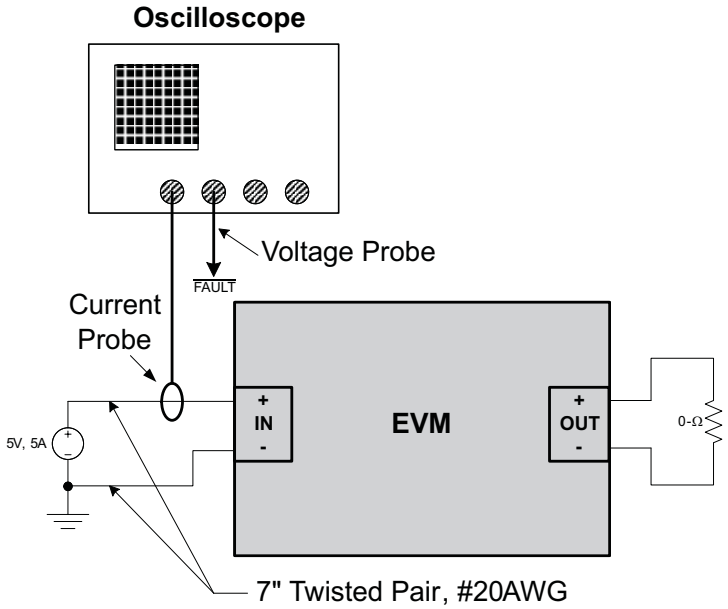

Figure 2. EVM Setup For Measuring Current-Limit

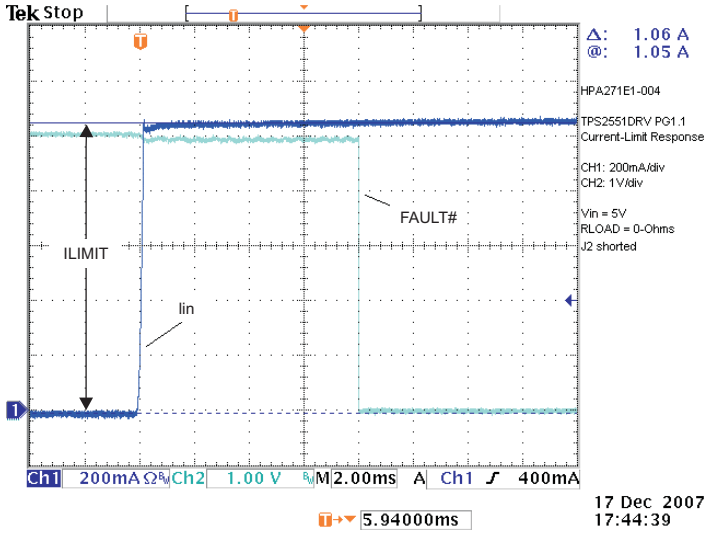

Figure 3. TPS2551DRVEVM-271 Short-Circuit Output Current and FAULT Status With J2 Shorting Jumper Present.

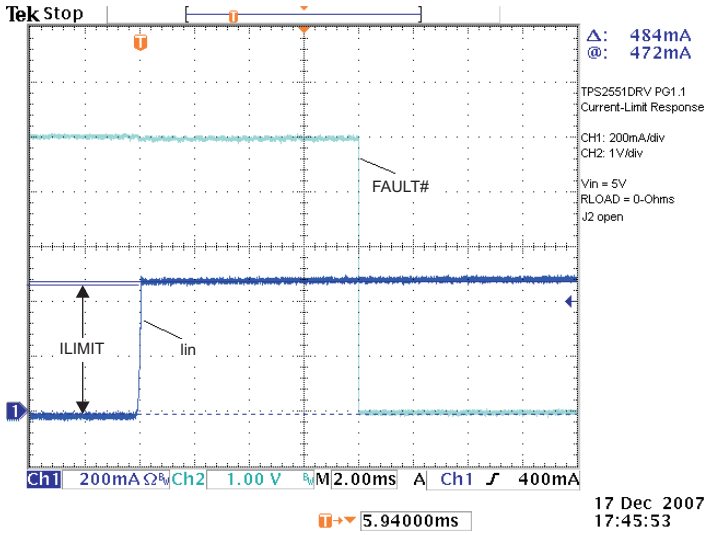

Figure 4. TPS2551DRVEVM-271 Short-Circuit Output Current and FAULT Status With J2 Shorting Jumper Absent.

4.3 Adjusting the Short-Circuit Output Current-Limit

The EVM provides two current-limit settings. If a different setting is required, then populate header J2 with a shorting jumper and modify resistor R3 according to Equation 1:

$$R3 = \left(\frac{28700}{ILIMIT}\right)^{\frac{1}{1.114}} \quad (1)$$

Where: 15 kΩ ≤ R3 ≤ 80.6 kΩ.

The current-limit programming resistance, R3, is expressed in kΩ and the *typical* current-limit, ILIMIT, is expressed in mA. See the TPS2550/1 data sheet for the worst-case current-limit variation.

5 Board Layout

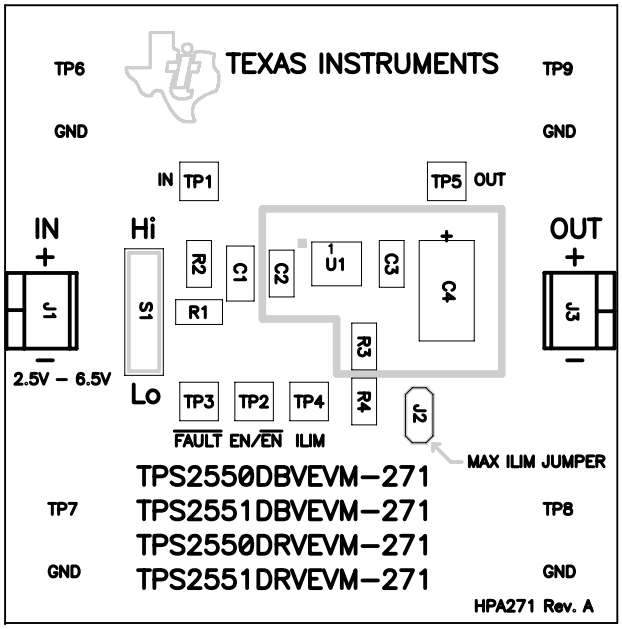

Figure 5. EVM Top Assembly

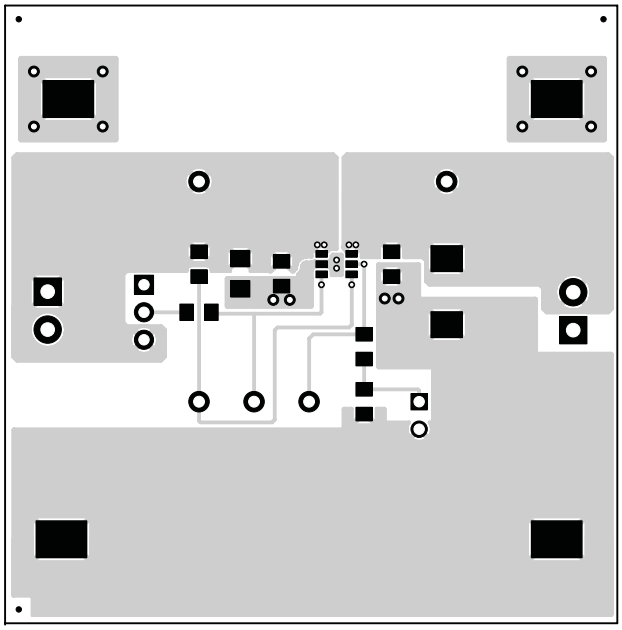

Figure 6. EVM Top-Side Layout

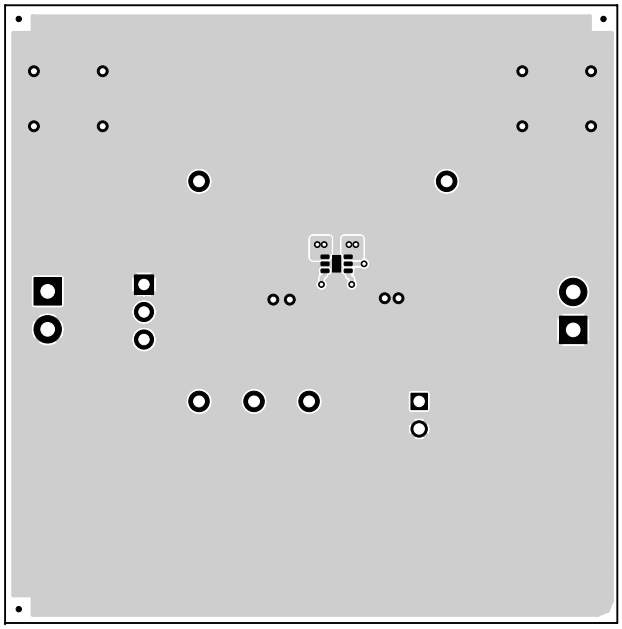

Figure 7. EVM Bottom-Side Layout

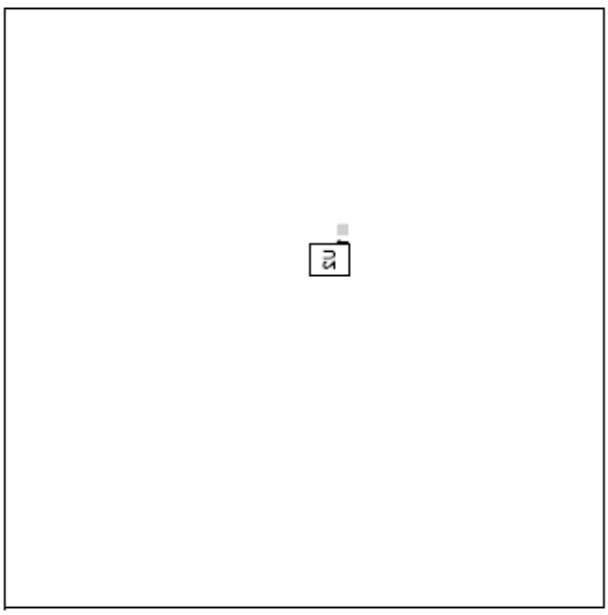

Figure 8. EVM Bottom Assembly

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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 6.5 V and the output voltage range of 2.5 V to 6.5 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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