

# Single-Channel, Power-Distribution Switch EVM

This user's guide describes the TPS20xxEVM-290 and TPS20xxEVM-292 evaluation modules (EVM). This guide contains the EVM schematics, bill of materials, assembly drawings, and top and bottom board layouts.

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## 1 Introduction

The TPS20xxEVM-290 and TPS20xxEVM-292 are evaluation modules (EVM) for the Texas Instruments family of single-channel, current-limited, power distribution switches. These EVMs operate over a 2.7-V to 5.5-V range and provide a continuous output current of up to 2 A (see [Table 1](#)). Test points provide convenient access to all critical node voltages.

The TPS20xxEVM-290 accepts an S0-8 packaged power-distribution switch whereas the TPS20xxEVM-292 accepts MSOP-8 packaged switch with a thermal pad. These switches have an enable input, an overcurrent status output, and overtemperature shutdown; the switch pinouts are identical.

[Table 1](#) and [Table 2](#) summarize the available EVM options.

## 2 Schematics and Bill of Materials

### 2.1 EVM Options

**Table 1. TPS20xxEVM-290 Options**

EVM	Device	Continuous Output Current (A)	ENABLE
TPS2020EVM-290	TPS2020D	0.2	Active Low
TPS2021EVM-290	TPS2021D	0.6	Active Low
TPS2022EVM-290	TPS2022D	1	Active Low
TPS2023EVM-290	TPS2023D	1.5	Active Low
TPS2024EVM-290	TPS2024D	2	Active Low
TPS2030EVM-290	TPS2030D	0.2	Active High
TPS2031EVM-290	TPS2031D	0.6	Active High
TPS2032EVM-290	TPS2032D	1	Active High
TPS2033EVM-290	TPS2033D	1.5	Active High
TPS2034EVM-290	TPS2034D	2	Active High
TPS2041BEVM-290	TPS2041BD	0.5	Active Low
TPS2045AEVM-290	TPS2045AD	0.25	Active Low
TPS2049EVM-290	TPS2049D	0.1	Active Low
TPS2051BEVM-290	TPS2051BD	0.5	Active High
TPS2055AEVM-290	TPS2055AD	0.25	Active High
TPS2061EVM-290	TPS2061D	1	Active Low
TPS2065EVM-290	TPS2065D	1	Active High

**Table 2. TPS20xxEVM-292 Options**

EVM	Device	Continuous Output Current (A)	ENABLE
TPS2041BEVM-292	TPS2041BDGN	0.5	Active Low
TPS2051BEVM-292	TPS2051BDGN	0.5	Active High
TPS2061EVM-292	TPS2061DGN	1	Active Low
TPS2065EVM-292	TPS2065DGN	1	Active High
TPS2065-1EVM-292	TPS2065DGN-1	1	Active High
TPS2068EVM-292	TPS2068DGN	1.5	Active Low
TPS2069EVM-292	TPS2069DGN	1.5	Active High

## 2.2 Schematics

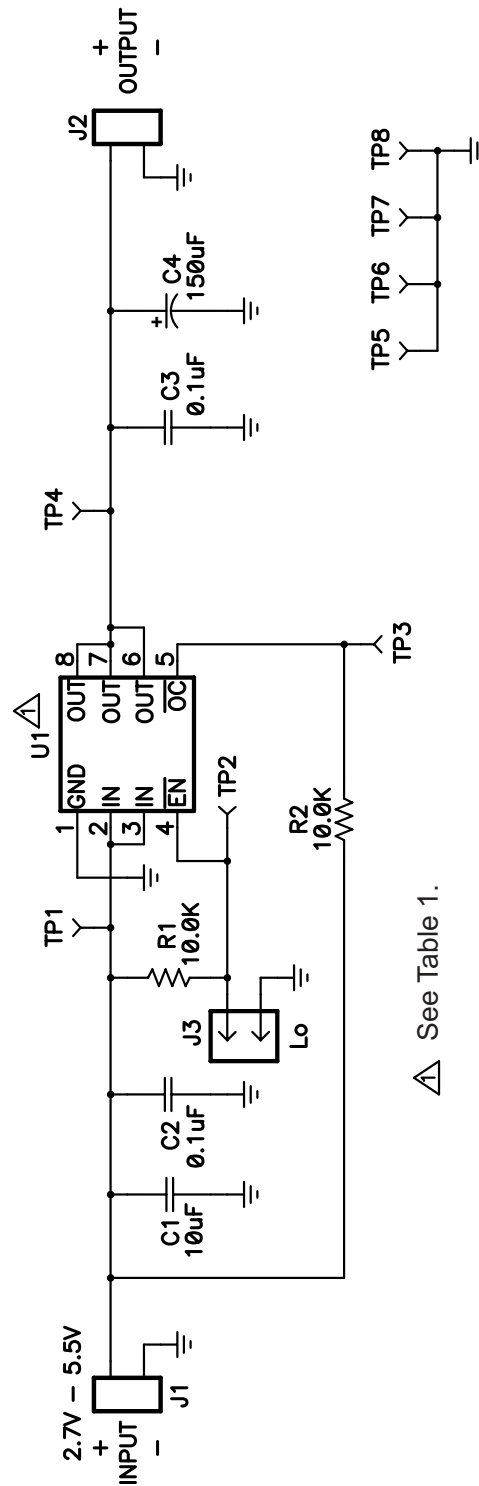


Figure 1. TPS20xxEVM-290 Schematic

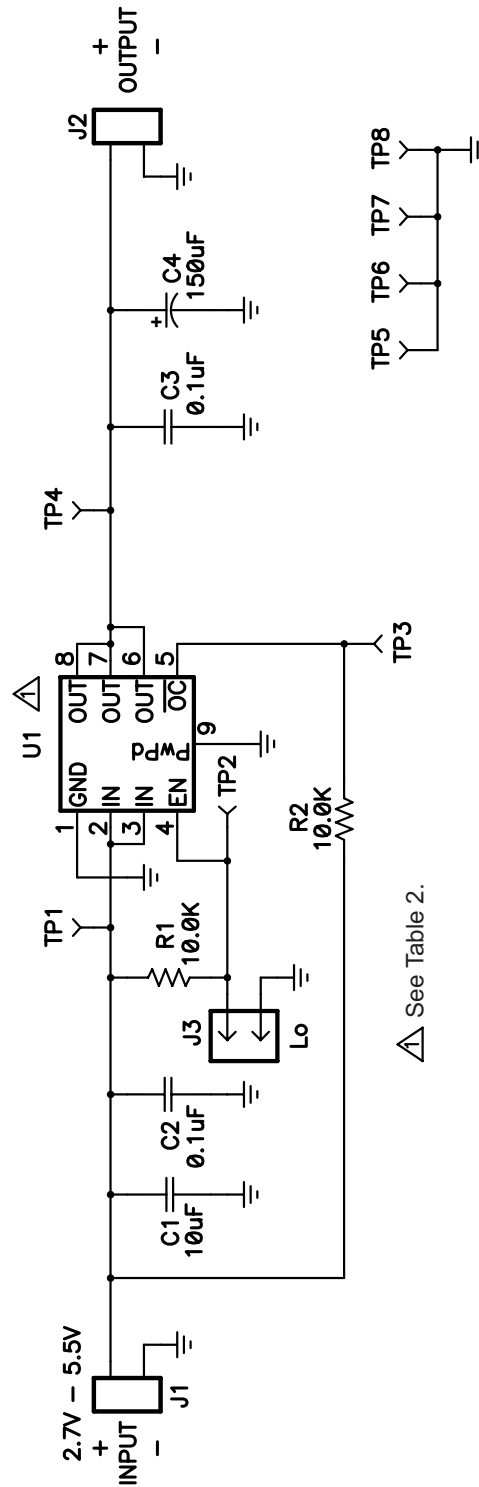


Figure 2. TPS20xxEVM-292 Schematic

## 2.3 Bill of Material

**Table 3. TPS20xxEVM-290 Bill of Materials**

QTY																	Ref Des	Value	Description	Size	Part No.	MFR
-001	-002	-003	-004	-005	-006	-007	-008	-009	-010	-011	-012	-013	-014	-015	-016	-017						
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	C1	10uF	Capacitor, Ceramic, 10-µF, X7R, 10V, 10%	1206	STD	STD
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	C2, C3	0.1uF	Capacitor, Ceramic, 16V, X7R, 10%	0805	STD	STD
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	C4	150uF	Capacitor, Tantalum, 150µF, 10V, 100milliohm, 10%	7343 (D)	B45197A2157K409	Kemet
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	U1	TPS2020D	IC, Current-Limited Power Distribution Switch, 5.5V, 200mA	SO8	TPS2020D	TI
0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	U1	TPS2021D	IC, Current-Limited Power Distribution Switch, 5.5V, 600mA	SO8	TPS2021D	TI
0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	U1	TPS2022D	IC, Current-Limited Power Distribution Switch, 5.5V, 1000mA	SO8	TPS2022D	TI
0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	U1	TPS2023D	IC, Current-Limited Power Distribution Switch, 5.5V, 1500mA	SO8	TPS2023D	TI
0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	U1	TPS2024D	IC, Current-Limited Power Distribution Switch, 5.5V, 2000mA	SO8	TPS2024D	TI
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	U1	TPS2030D	IC, Current-Limited Power Distribution Switch, 5.5V, 200mA	SO8	TPS2030D	TI
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	U1	TPS2031D	IC, Current-Limited Power Distribution Switch, 5.5V, 600mA	SO8	TPS2031D	TI
0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	U1	TPS2032D	IC, Current-Limited Power Distribution Switch, 5.5V, 1000mA	SO8	TPS2032D	TI
0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	U1	TPS2033D	IC, Current-Limited Power Distribution Switch, 5.5V, 1500mA	SO8	TPS2033D	TI
0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	U1	TPS2034D	IC, Current-Limited Power Distribution Switch, 5.5V, 2000mA	SO8	TPS2034D	TI
0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	U1	TPS2041BD	IC, Current-Limited Power Distribution Switch, 5.5V, 500mA	SO8	TPS2041BD	TI
0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	U1	TPS2045AD	IC, Current-Limited Power Distribution Switch, 5.5V, 250mA	SO8	TPS2045AD	TI
0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	U1	TPS2049D	IC, Current-Limited Power Distribution Switch, 5.5V, 100mA	SO8	TPS2049D	TI

**Table 3. TPS20xxEVM-290 Bill of Materials (continued)**

QTY																	Ref Des	Value	Description	Size	Part No.	MFR
-001	-002	-003	-004	-005	-006	-007	-008	-009	-010	-011	-012	-013	-014	-015	-016	-017						
0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	U1	TPS2051BD	IC, Current-Limited Power Distribution Switch, 5.5V, 500mA	SO8	TPS2051BD	TI
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	U1	TPS2055AD	IC, Current-Limited Power Distribution Switch, 5.5V, 250mA	SO8	TPS2055AD	TI
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	U1	TPS2061D	IC, Current-Limited Power Distribution Switch, 5.5V, 1500mA	SO8	TPS2061D	TI
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	U1	TPS2065D	IC, Current-Limited Power Distribution Switch, 5.5V, 1500mA	SO8	TPS2065D	TI
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	--	HPA290	PCB, 3 ln x 3 ln x 0.062 ln	2.25 inch x 2.225 inch	HPA290	Any
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	R1, R2	10.0K	Resistor, Chip, 1/10W, 1%	0805	CRCW0805-1002F	Vishay

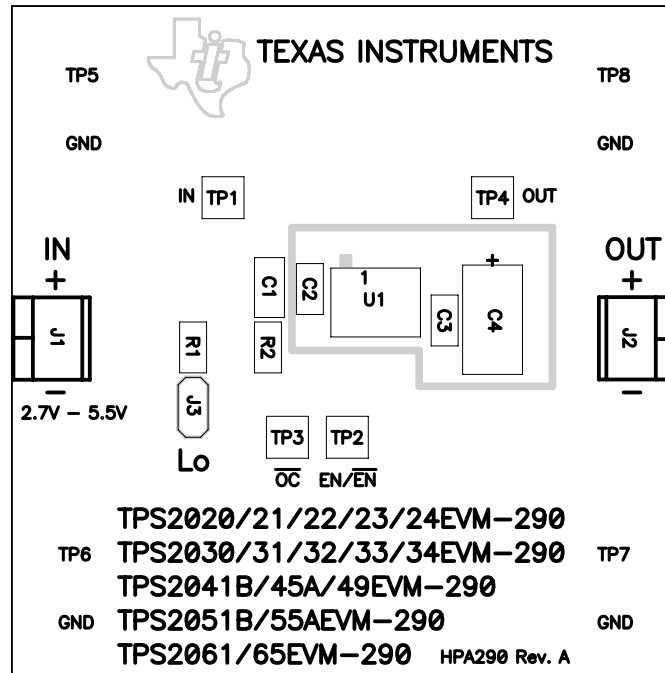
**Table 4. TPS20xxEVM-292 Bill of Materials**

QTY							RefDes	Value	Description	Size	Part Number	MFR
-001	-002	-003	-004	-005	-006	-007						
1	1	1	1	1	1	1	C1	10uF	Capacitor, ceramic, 10-μF, X7R, 10V, 10%	1206	STD	STD
2	2	2	2	2	2	2	C2, C3	0.1uF	Capacitor, Ceramic, 16V, X7R, 10%	0805	STD	STD
1	1	1	1	1	1	1	C4	150uF	Capacitor, Tantalum, 150μF, 10V, 100mΩ, 10%	7343 (D)	B45197A2157K409	Kemet
1	0	0	0	0	0	0	U1	TPS2041BDGN	IC, Current-Limited Power Distribution Switch, 5.5V, 500mA	MSOP-8	TPS2041BDGN	TI
0	1	0	0	0	0	0	U1	TPS2051BDGN	IC, Current-Limited Power Distribution Switch, 5.5V, 500mA	MSOP-8	TPS2051BDGN	TI
0	0	1	0	0	0	0	U1	TPS2061DGN	IC, Current-Limited Power Distribution Switch, 5.5V, 1000mA	MSOP-8	TPS2061DGN	TI
0	0	0	1	0	0	0	U1	TPS2065DGN	IC, Current-Limited Power Distribution Switch, 5.5V, 1000mA	MSOP-8	TPS2065DGN	TI
0	0	0	0	1	0	0	U1	TPS2065DGN-1	IC, Current-Limited Power Distribution Switch, 5.5V, 1000mA	MSOP-8	TPS2065DGN-1	TI
0	0	0	0	0	1	0	U1	TPS2068DGN	IC, Current-Limited Power Distribution Switch, 5.5V, 1500mA	MSOP-8	TPS2068DGN	TI
0	0	0	0	0	0	1	U1	TPS2069DGN	IC, Current-Limited Power Distribution Switch, 5.5V, 1500mA	MSOP-8	TPS2069DGN	TI
1	1	1	1	1	1	1	--	HPA292	PCB, 3 In x 3 In x 0.062 In	2.25" x 2.25"	HPA292	Any
2	2	2	2	2	2	2	R1, R2	10.0K	Resistor, Chip, 1/10W, 1%	0805	CRCW0805-1002F	Vishay

### 3 Board Layout

This section contains three views of the TPS20xxEVM-290 and the TPS20xxEVM-292 evaluation boards as well as some layout considerations.

#### 3.1 TPS20xxEVM-290 Board



**Figure 3. TPS20xxEVM-290 Component Placement**

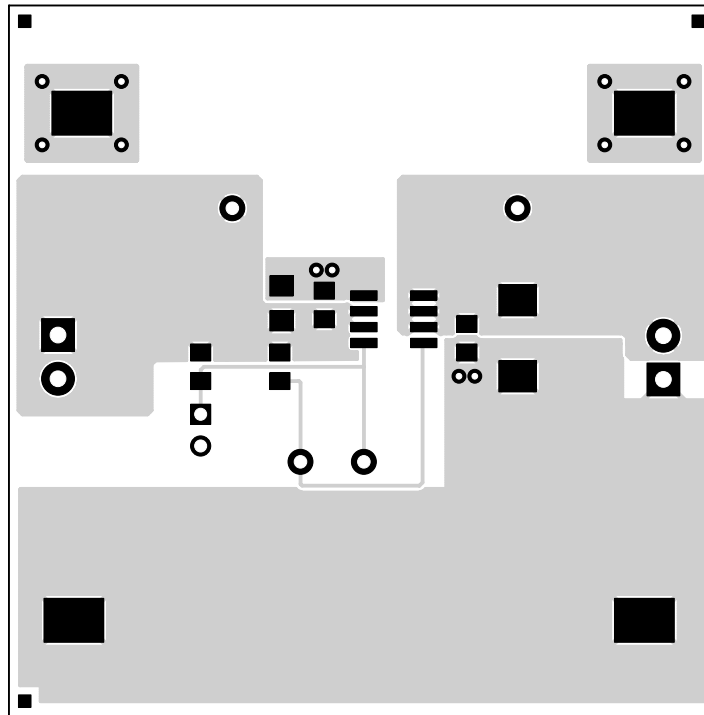


Figure 4. TPS20xxEVM-290 Top-Side Layout

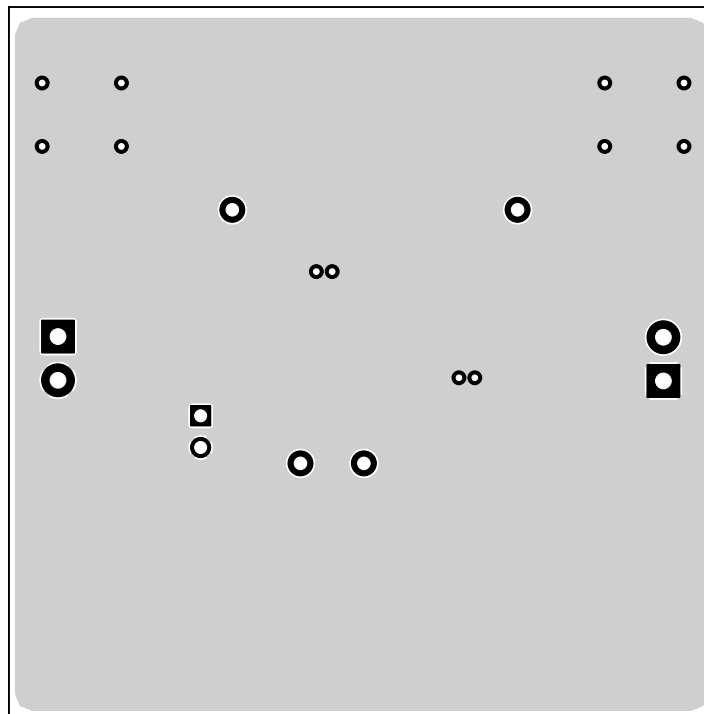


Figure 5. TPS20xxEVM-290 Bottom-Side Layout



### 3.2 TPS20xxEVM-292 Board

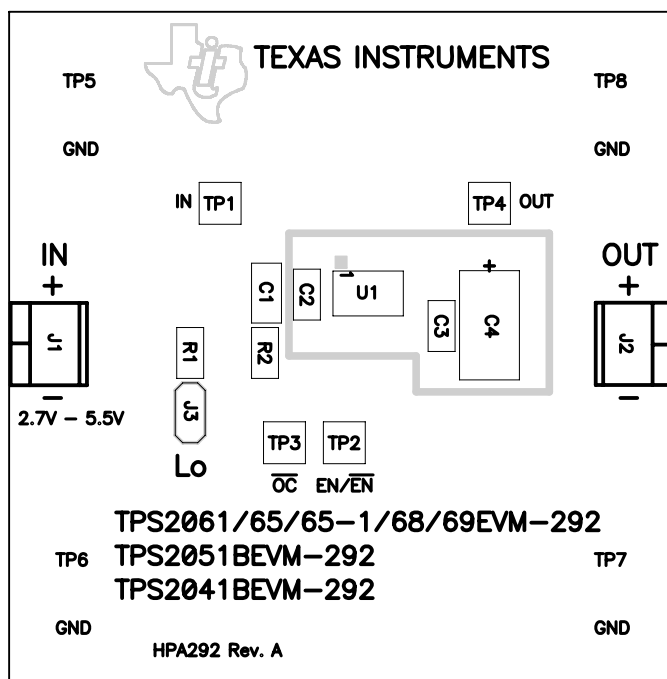


Figure 6. TPS20xxEVM-292 Component Placement

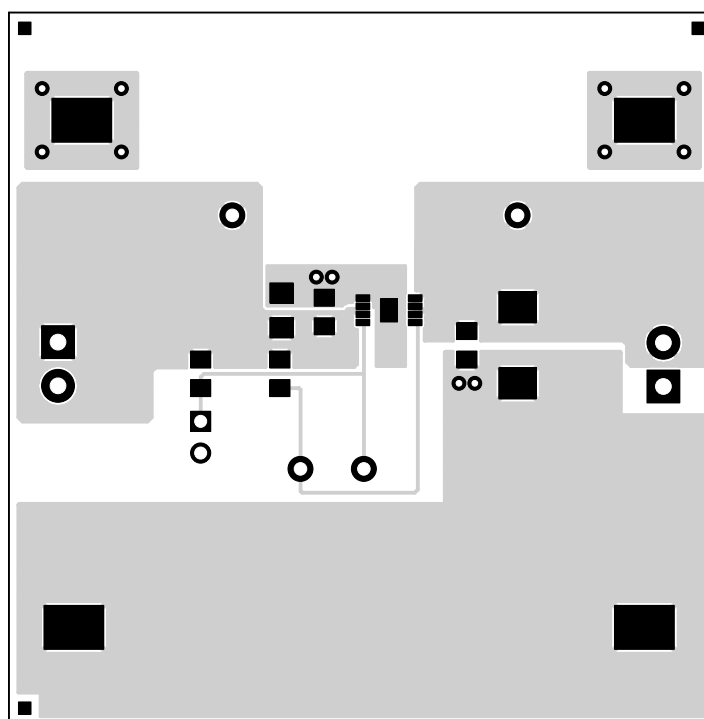
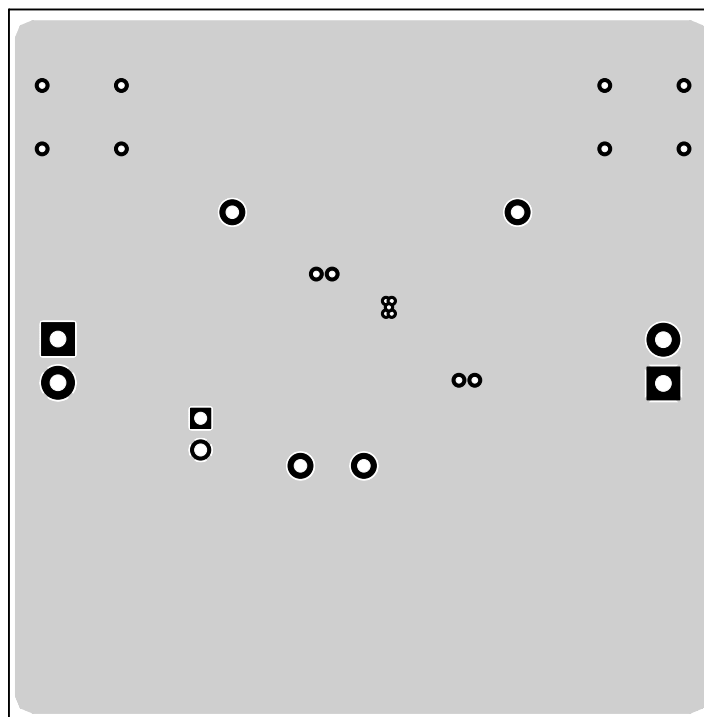


Figure 7. TPS20xxEVM-292 Top-Side Layout



**Figure 8. TPS20xxEVM-292 Bottom-Side Layout**

### 3.3 *Layout Considerations*

The IN and OUT pins of U1 can carry significant current; so, traces to these pins should be of suitable length and width to minimize the voltage drop to the load. Locate the 0.1- $\mu$ F bypass capacitors close to the IN and OUT pins of U1.

## 4 **EVM Setup**

### 4.1 *Recommended Test Equipment*

The following test equipment is recommended:

- Two-channel storage oscilloscope
- Current probe
- Voltage probe
- 5 V at 5-A power supply
- Volt-ohm meter
- A passive or active load

### 4.2 *Measuring Current Limit*

The user should read the applicable data sheet before using the EVM.

[Figure 9](#) shows the EVM test set up for measuring current limit. The power distribution switch is enabled into a short circuit for this measurement. [Figure 10](#) shows the current waveform for TPS2051BEVM-290.

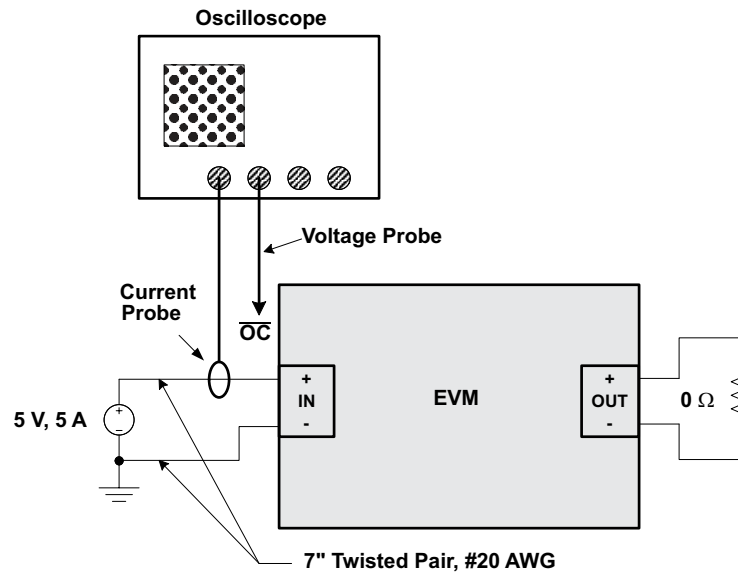


Figure 9. EVM Setup For Measuring Current Limit

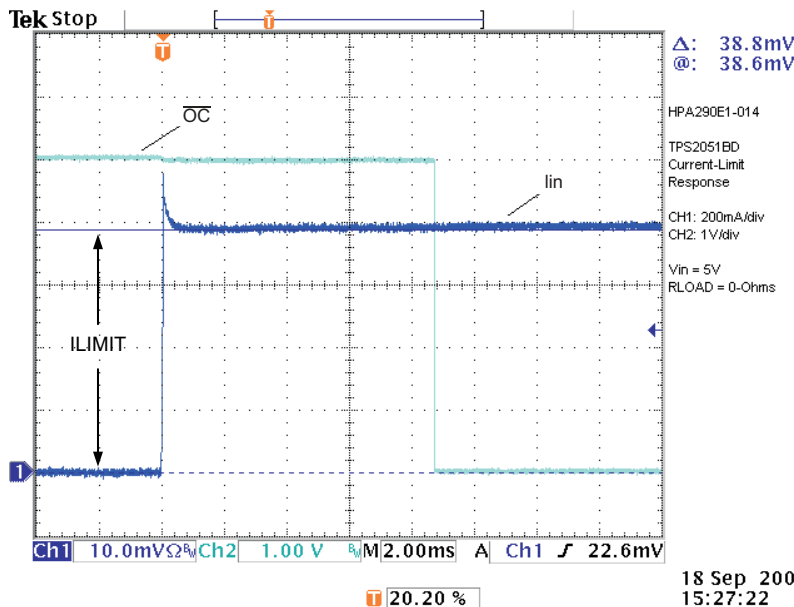


Figure 10. TPS2051BEVM-290 Short-Circuit Output Current and  $\overline{OC}$  Status

## 5 Related Documentation from Texas Instruments

- *TPS2020, TPS2021, TPS2022, TPS2023, TPS2024, Power-Distribution Switches* data sheet ([SLVS175](#))
- *TPS2030, TPS2031, TPS2032, TPS2033, TPS2034, Power-Distribution Switches* data sheet ([SLVS190](#))
- *TPS2041B, TPS2042B, TPS2043B, TPS2044B, TPS2051B, TPS2052B, TPS2053B, TPS2054B, Current-Limited, Power-Distribution Switches* data sheet ([SLVS514](#))
- *TPS2045A, TPS2046A, TPS2047A, TPS2056A, TPS2057A, TPS2058A, Current-Limited, Power-Distribution Switches* data sheet ([SLVS251](#))
- *TPS2049, Single-Channel 100 mA Power Switch* data sheet ([SLVS713](#))

*Related Documentation from Texas Instruments*

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- *TPS2061, TPS2062, TPS2063, TPS2065, TPS2066, TPS2067, Current-Limited, Power-Distribution Switches* data sheet ([SLVS490](#))
- *TPS2061-1, TPS2065-1, TPS2066-1, Current-Limited, Power-Distribution Switches* data sheet ([SLVS714](#))
- *TPS2060, TPS2064, TPS2068, TPS2069, Current-Limited, Power-Distribution Switches* data sheet ([SLVS553](#))

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### EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the input voltage range of 2.7 V to 5.5 V and the output voltage range of 2.7 V to 5.5 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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Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>	Automotive	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>	Broadband	<a href="http://www.ti.com/broadband">www.ti.com/broadband</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>	Digital Control	<a href="http://www.ti.com/digitalcontrol">www.ti.com/digitalcontrol</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>	Military	<a href="http://www.ti.com/military">www.ti.com/military</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>	Optical Networking	<a href="http://www.ti.com/opticalnetwork">www.ti.com/opticalnetwork</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>	Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>	Telephony	<a href="http://www.ti.com/telephony">www.ti.com/telephony</a>
Low Power Wireless	<a href="http://www.ti.com/lpw">www.ti.com/lpw</a>	Video & Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>
		Wireless	<a href="http://www.ti.com/wireless">www.ti.com/wireless</a>

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