



**THE DATASHEET OF
TPS2041BEVM-292**



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

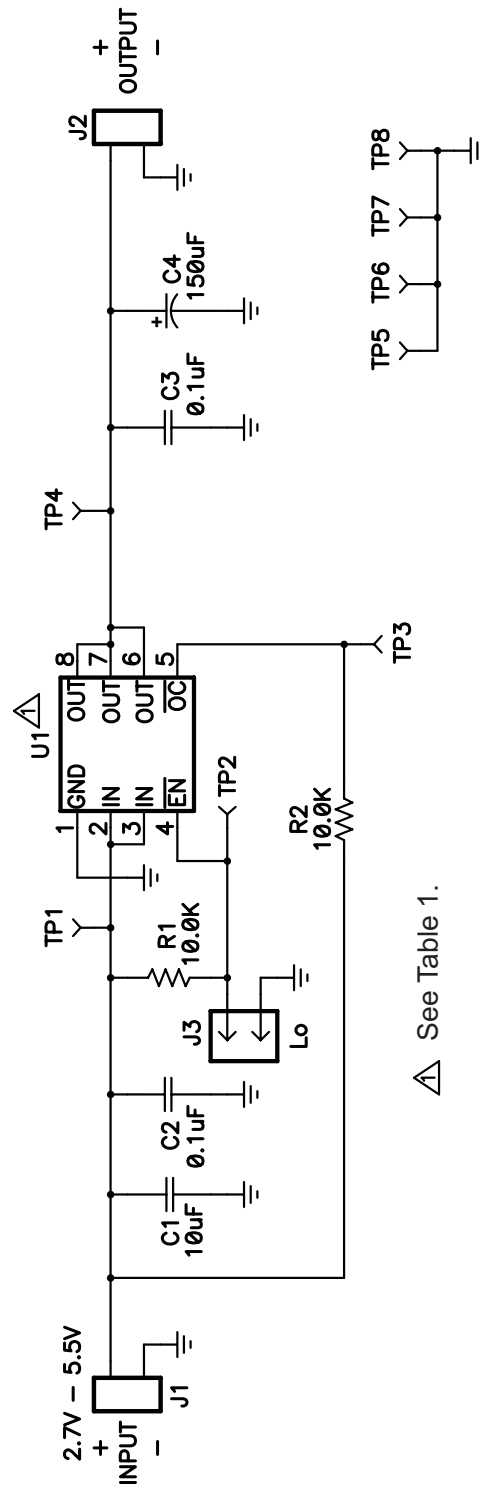
Table 1. TPS20xxEVM-290 Options

| 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

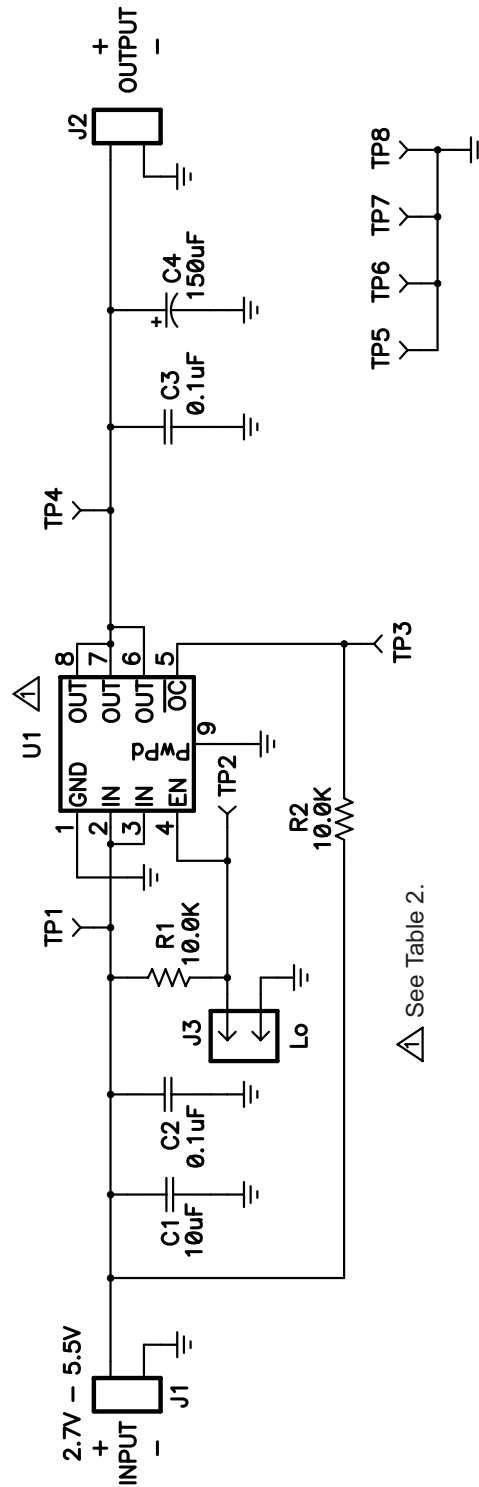
| EVM | Device | Continuous Output Current (A) | ENABLE |
|------------------|--------------|-------------------------------|-------------|
| TPS2041BEVM-292 | TPS2041BDGN | 0.5 | Active Low |
| TPS2051BEVM-292 | TPS2051BDGN | 0.5 | Active High |
| TPS2061EVM-292 | TPS2061DGN | 1 | Active Low |
| TPS2065EVM-292 | 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



△ See Table 1.

Figure 1. TPS20xxEVM-290 Schematic




 See Table 2.

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 2.225" | 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

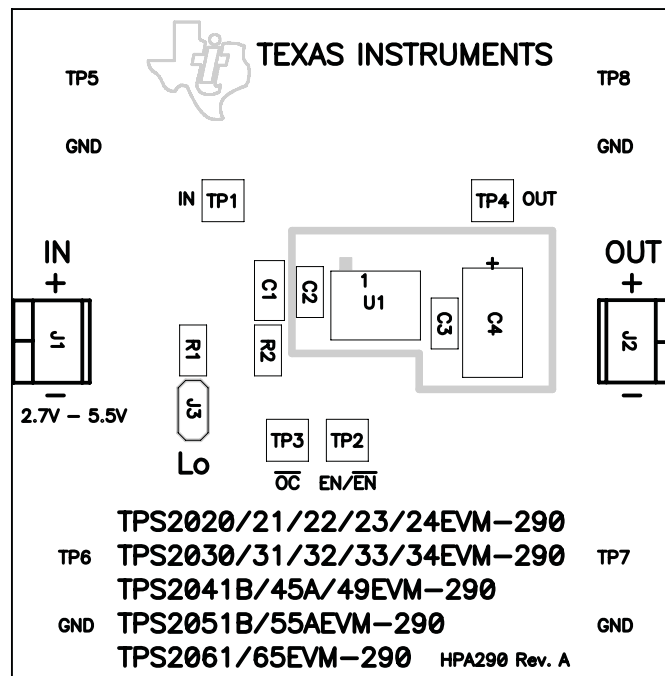


Figure 3. TPS20xxEVM-290 Component Placement

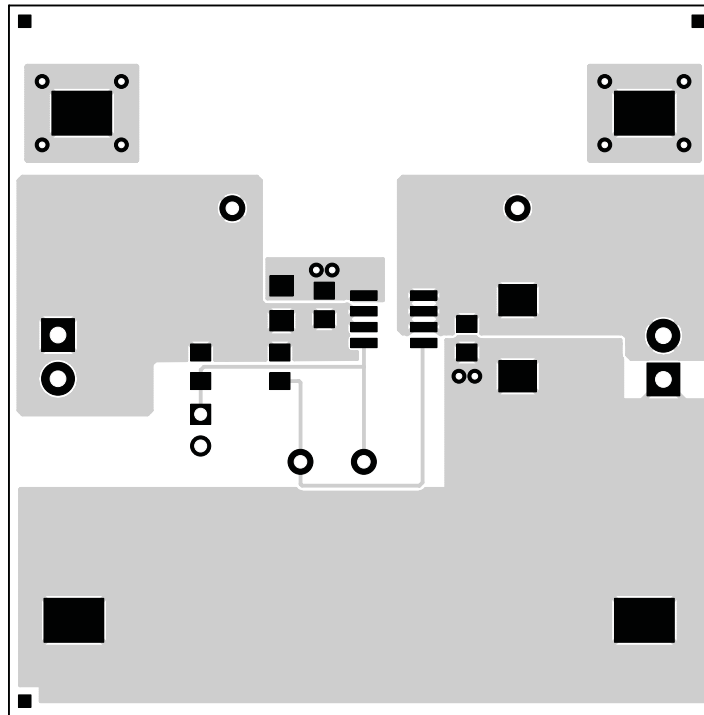


Figure 4. TPS20xxEVM-290 Top-Side Layout

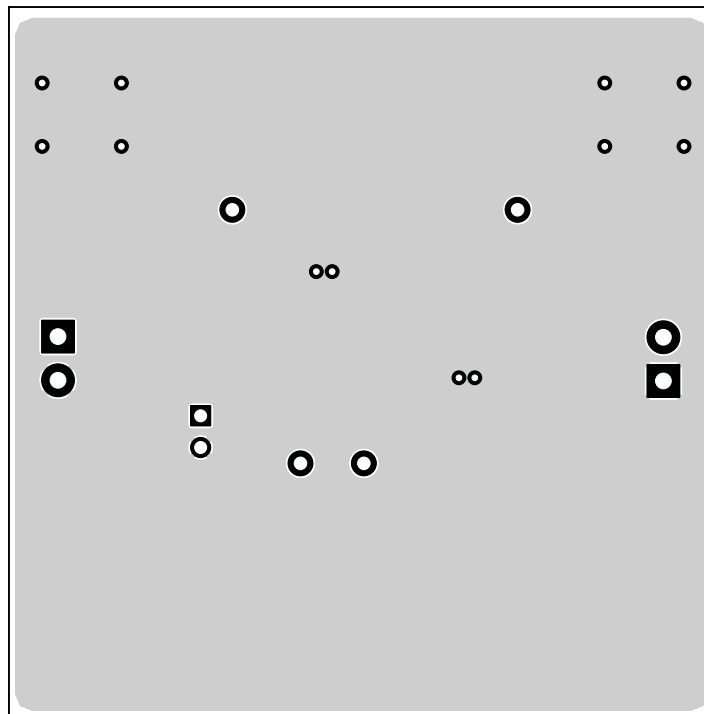


Figure 5. TPS20xxEVM-290 Bottom-Side Layout

3.2 TPS20xxEVM-292 Board

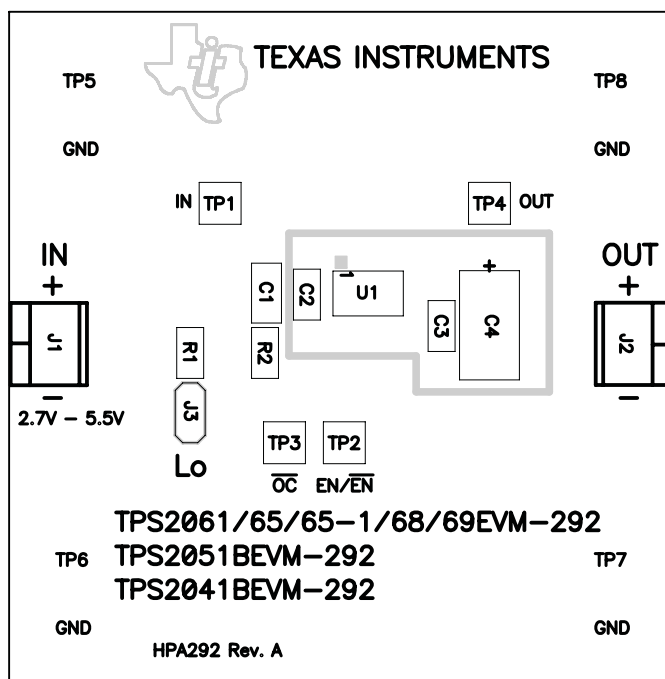


Figure 6. TPS20xxEVM-292 Component Placement

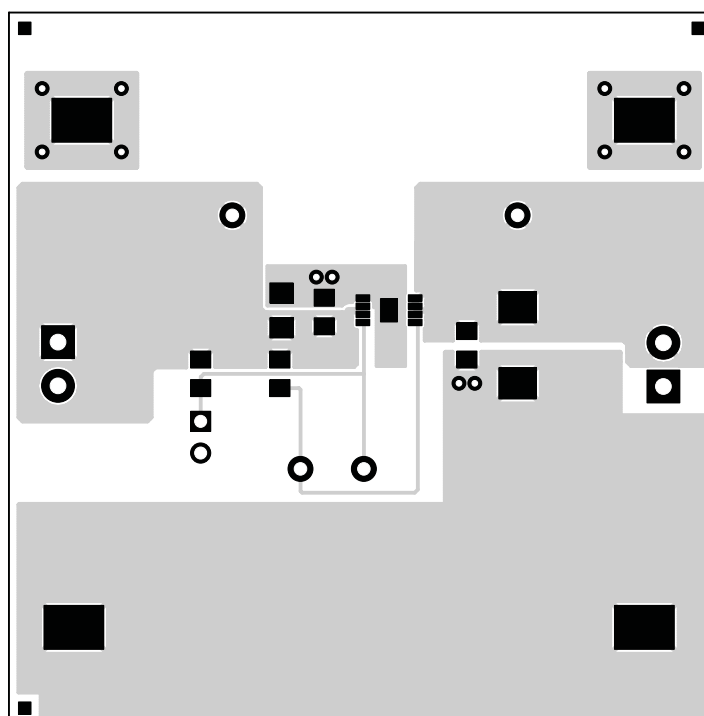


Figure 7. TPS20xxEVM-292 Top-Side Layout

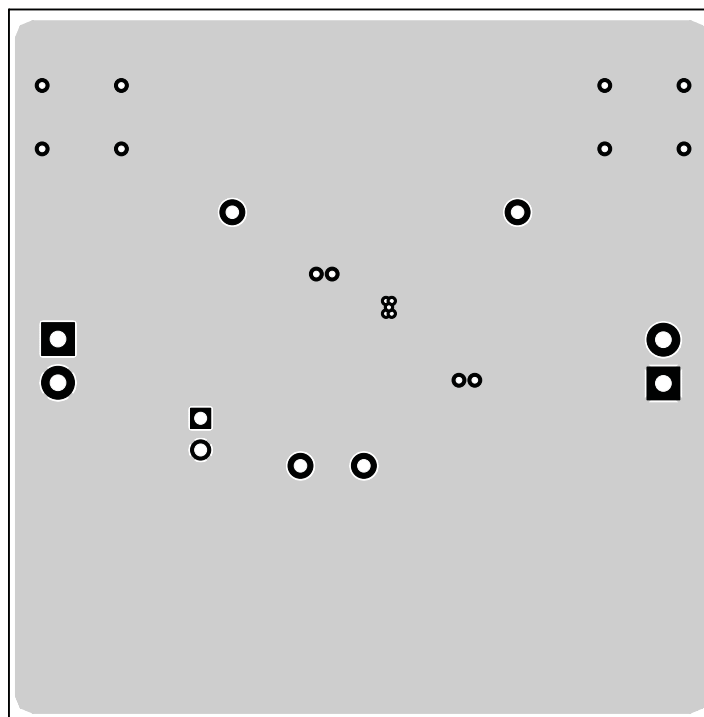


Figure 8. TPS20xxEVM-292 Bottom-Side Layout

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- μ 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.

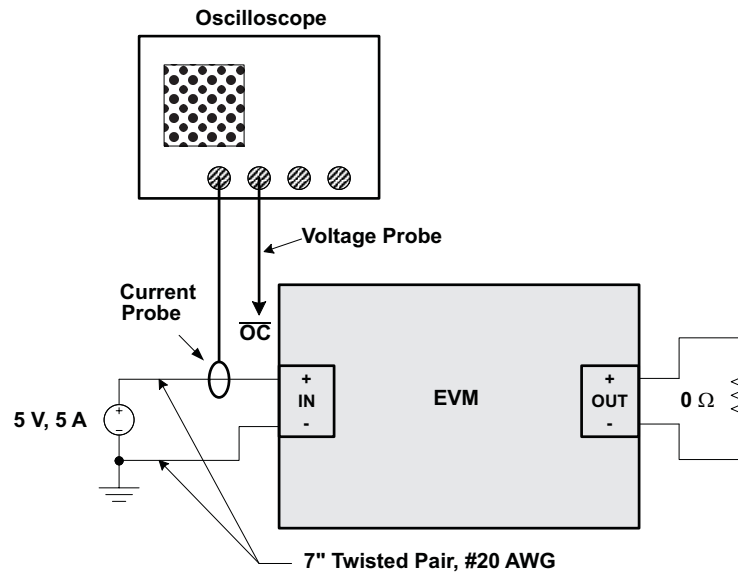


Figure 9. EVM Setup For Measuring Current Limit

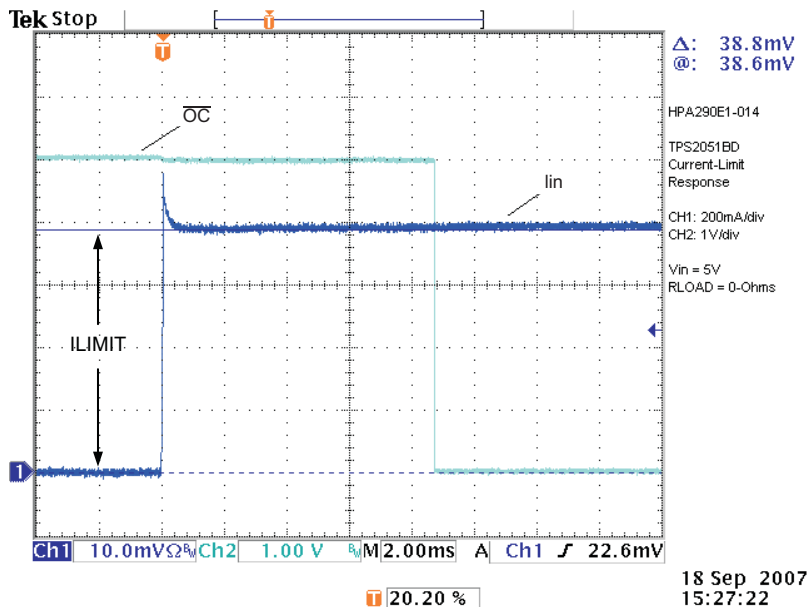


Figure 10. TPS2051BEVM-290 Short-Circuit Output Current and \overline{OC} Status

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

- *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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|-----------------------|--|---------------------|--|
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| Data Converters | dataconverter.ti.com | Automotive | www.ti.com/automotive |
| DSP | dsp.ti.com | Broadband | www.ti.com/broadband |
| Interface | interface.ti.com | Digital Control | www.ti.com/digitalcontrol |
| Logic | logic.ti.com | Military | www.ti.com/military |
| Power Mgmt | power.ti.com | Optical Networking | www.ti.com/opticalnetwork |
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| RFID | www.ti-rfid.com | Telephony | www.ti.com/telephony |
| Low Power Wireless | www.ti.com/lpw | Video & Imaging | www.ti.com/video |
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