

TPS780xxEVM-301

This user's guide describes the characteristics, operation, and use of the TPS780xxEVM-301 evaluation module (EVM). This EVM demonstrates the Texas Instruments TPS780330220 ultra low-power, low dropout (LDO) regulator with pin-selectable, dual-output voltage levels. The TPS780330220 supplies up to 150 mA of output current at a pin programmable output voltage of 3.3 V ($V_{SET} = \text{low}$) or 2.2 V ($V_{SET} = \text{high}$) from a 2.2 V to 5.5 V input source. See the TPS780330220 data sheet ([SBVS083](#)) for definitive device specifications. This EVM user's guide includes setup instructions, schematic diagram, bill of materials (BOM), and PCB layout drawings.

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1 Introduction

The TPS780xxEVM-301 evaluation module (EVM) assists designers in evaluating the operation and performance of the TPS780330220 low dropout regulator (LDO). This LDO provides up to 150 mA of output current at a pin-programmable output while maintaining ultra-low quiescent current ($I_Q = 500\text{ nA}$). The board features the small $2\text{ mm} \times 2\text{ mm}$ six-lead SON package (DRV) and the TSOT23-5 (DDC) package for small solution size.

Related Documentation from Texas Instruments

TPS780xx, Ultra Low-Power, 150mA Low Dropout Regulator, IQ 500nA with Pin-Selectable, Dual Output Voltage Levels, data sheet ([SBVS083](#))

2 Setup

Table 1 describes the jumpers and connectors on the EVM, as well as how to properly connect, set up, and use the TPS780xxxEVM-301.

Table 1. TPS780xxEVM-301 Jumpers and Connections

| Jumper | Connection Description | Connection Instructions |
|--------|-------------------------|--|
| J1 | U1 Input V (IN) | Connect the lead from the power terminal of the input source for the U1 circuit to this input |
| J2 | U1 Input Ground (GND) | Connect the lead from the return terminal of the input source for the U1 circuit to this input |
| J3 | U1 Output (OUT) | Connect the positive side of the load and/or output multimeter to this output |
| J4 | U1 Output Ground | Connect the ground side of the load and/or output multimeter to this output. |
| J5 | U2 Input V (IN) | Connect the lead from the power terminal of the input source for the U2 circuit to this input. |
| J6 | U2 Input Ground | Connect the lead from the return terminal of the input source for the U2 circuit to this input. |
| J7 | U2 Output | Connect the positive side of the load and/or output multimeter to this output. |
| J8 | U2 Output Ground | Connect the ground side of the load and/or output multimeter to this output. |
| JP1 | U1 EN | Enable input for the U1 device. Place a shunt across the H and EN pins of JP1 to enable U1. Place a shunt across the L and EN pins of JP1 to disable U1. A shunt must be installed on JP1 in either H or L positions and EN must not be left unconnected. |
| JP2 | U1 V _{SET} /FB | User can program the output voltage. Place a shunt across the H and V _{SET} pins of JP2 to set the output of U1 to the default value of 2.2 V. Place a shunt across the L and V _{SET} pins of JP2 to the output of U1 to the default value of 3.3 V. |
| JP3 | U2 EN | Enable input for the U2 device. Place a shunt across the H and EN pins of JP3 to enable U2. Place a shunt across the L and EN pins of JP3 to disable U2. A shunt must be installed on JP3 in either H or L positions and EN should not be left unconnected. |
| JP4 | U2 V _{SET} /FB | User to program the output voltage. Place a shunt across the H and V _{SET} pins of JP4 to set the output of U2 to the default value of 2.2 V. Place a shunt across the L and V _{SET} pins of JP4 to the output of U2 to the default value of 3.3 V. |

3 Operation

To setup the EVM Board operation

1. Connect the positive input power supply to the V_{IN} pins on J1/J5.
2. Connect the input power return (ground) to the GND pins on J2/J6. The TPS780xxEVM-301 has a maximum input voltage of 6 V. The recommended maximum operating input voltage is 5.5 V.
3. Connect the desired load between the V_{out} (J3/J7) and GND (J4/J8). The TPS780xxx supplies up to 150 mA of output current.
4. Configure jumpers JP1/JP3 and JP2/JP4 according to Table 1 and as required for your application.

4 Test Results

This section provides typical performance waveforms (Figure 1 through Figure 4) using the TPS780xxxEVM-301 printed circuit board.

Figure 1. Startup from Enable

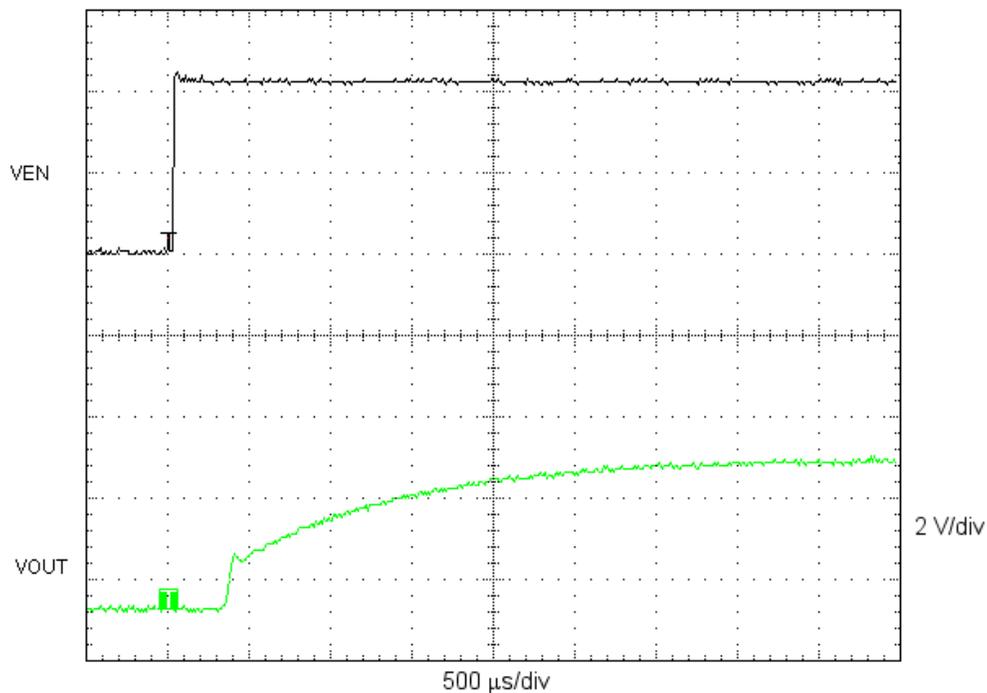


Figure 2. Load Transient, $V_I = 3.6\text{ V}$, $V_{OUT} = 2.5\text{ V}$, $I_{OUT} = 100\text{ mA}$ to 150 mA returning to 100 mA

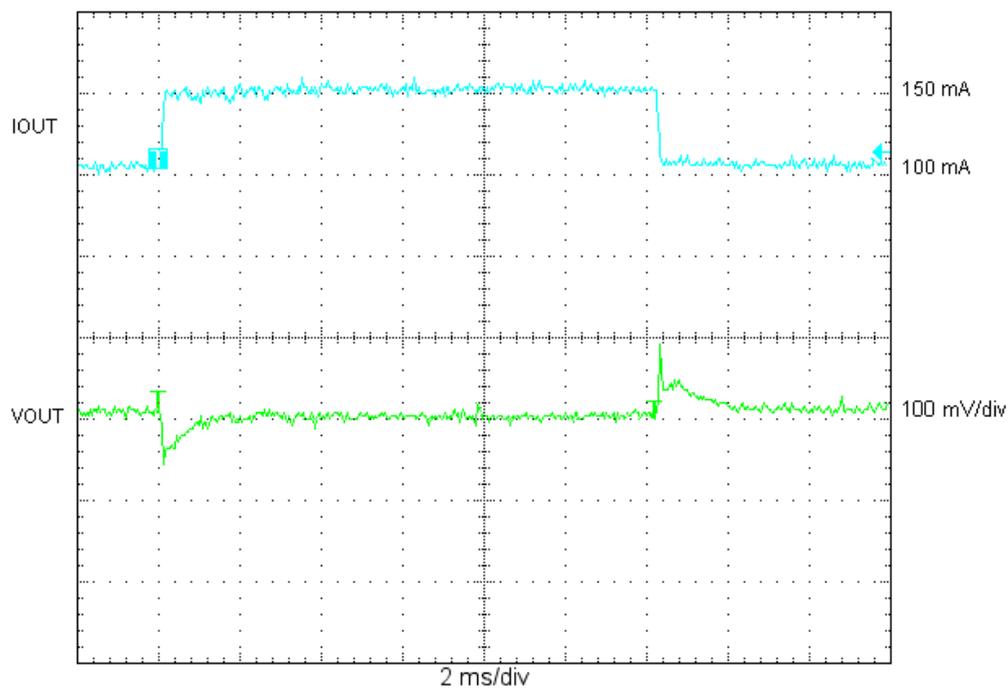


Figure 3. Low to High Output Transient (VOUT = 2.2 V to 3.3 V, R_{LOAD} = 22Ω)

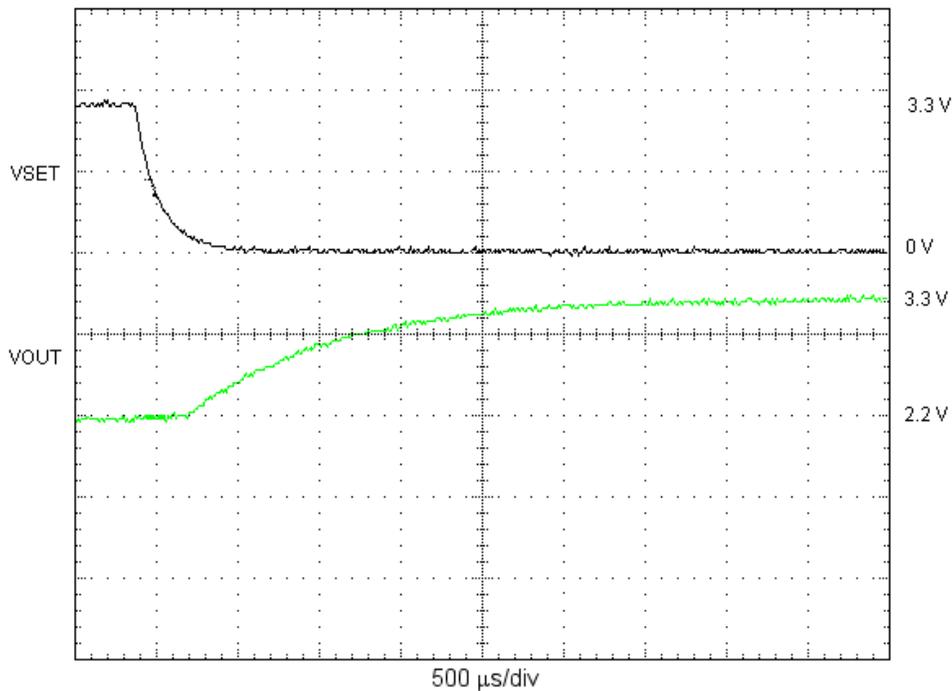
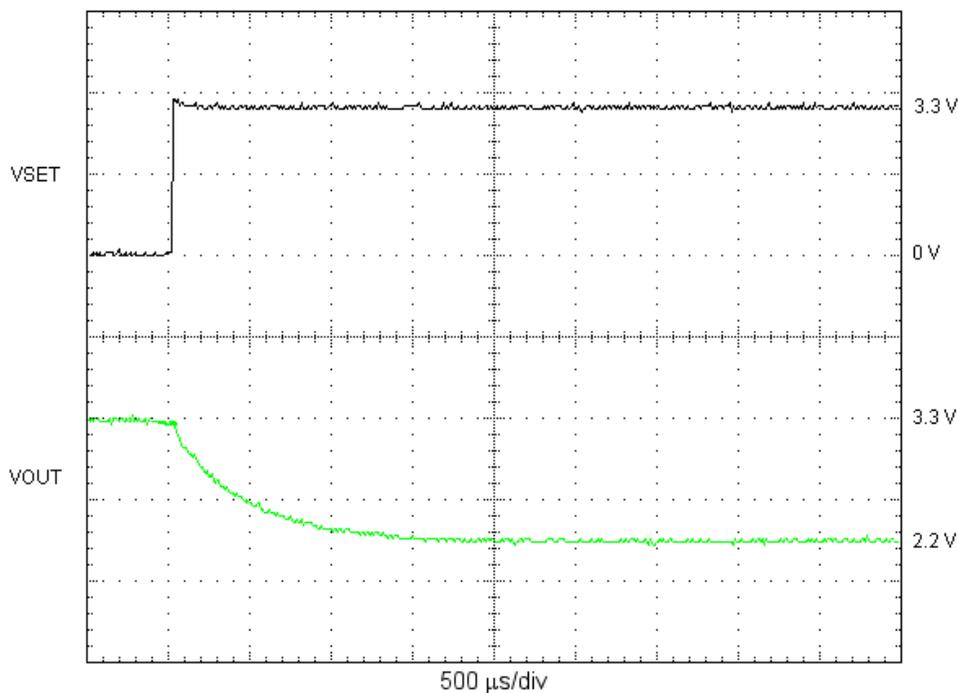


Figure 4. High to Low Output Transient (VOUT = 3.3 V to 2.2 V, R_{LOAD} = 22Ω)



5 Board Layout, Schematic, and Bill of Materials

This section provides the TPS780xxxEVM-301 board layout, schematic, and bill of materials.

5.1 Board Layout

Board layout is critical for all high-frequency switch mode power supplies. If the layout is not carefully done, the regulator could show stability problems as well as EMI problems. Therefore, use wide and short traces for the main current path and for the power ground tracks. The input and output capacitor, plus the inductor should be placed as close as possible to the IC. Use a common ground node for power ground to minimize the effects of ground noise. [Figure 5](#) through [Figure 7](#) shows the board layout for the TPS780xxEVM-301 PCB.

Figure 5. Top Assembly Layer

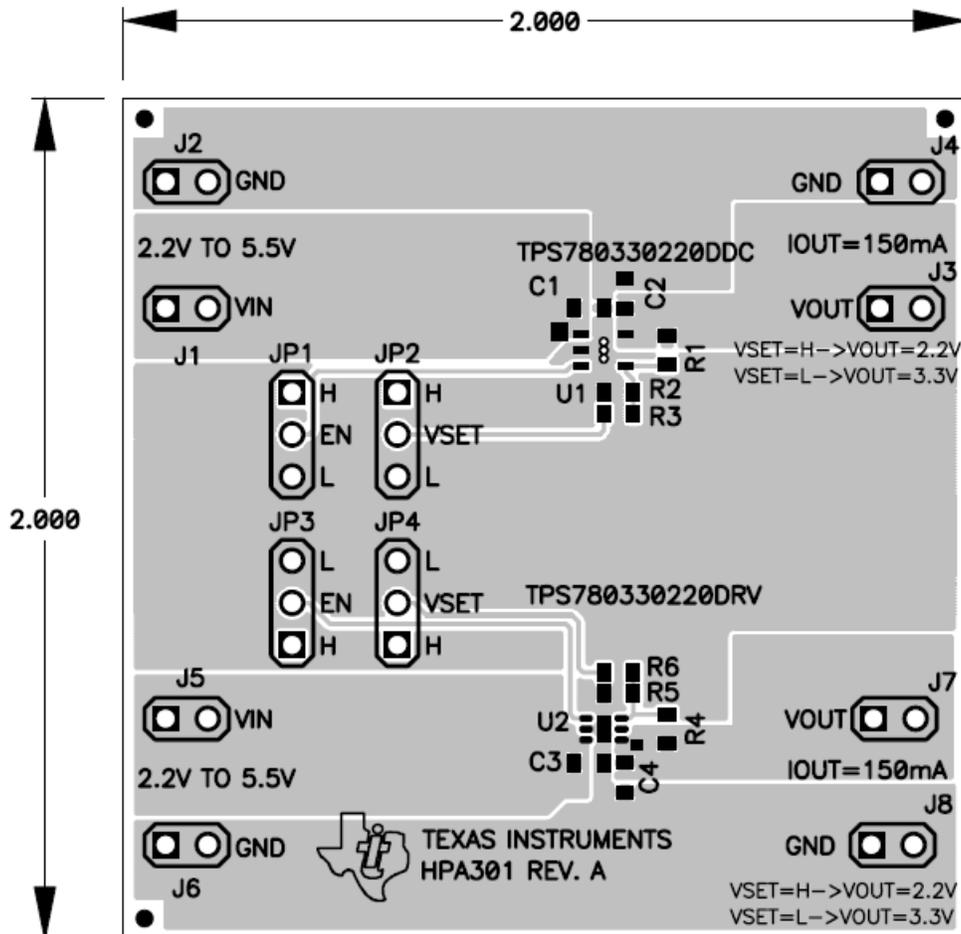


Figure 6. Top Layer

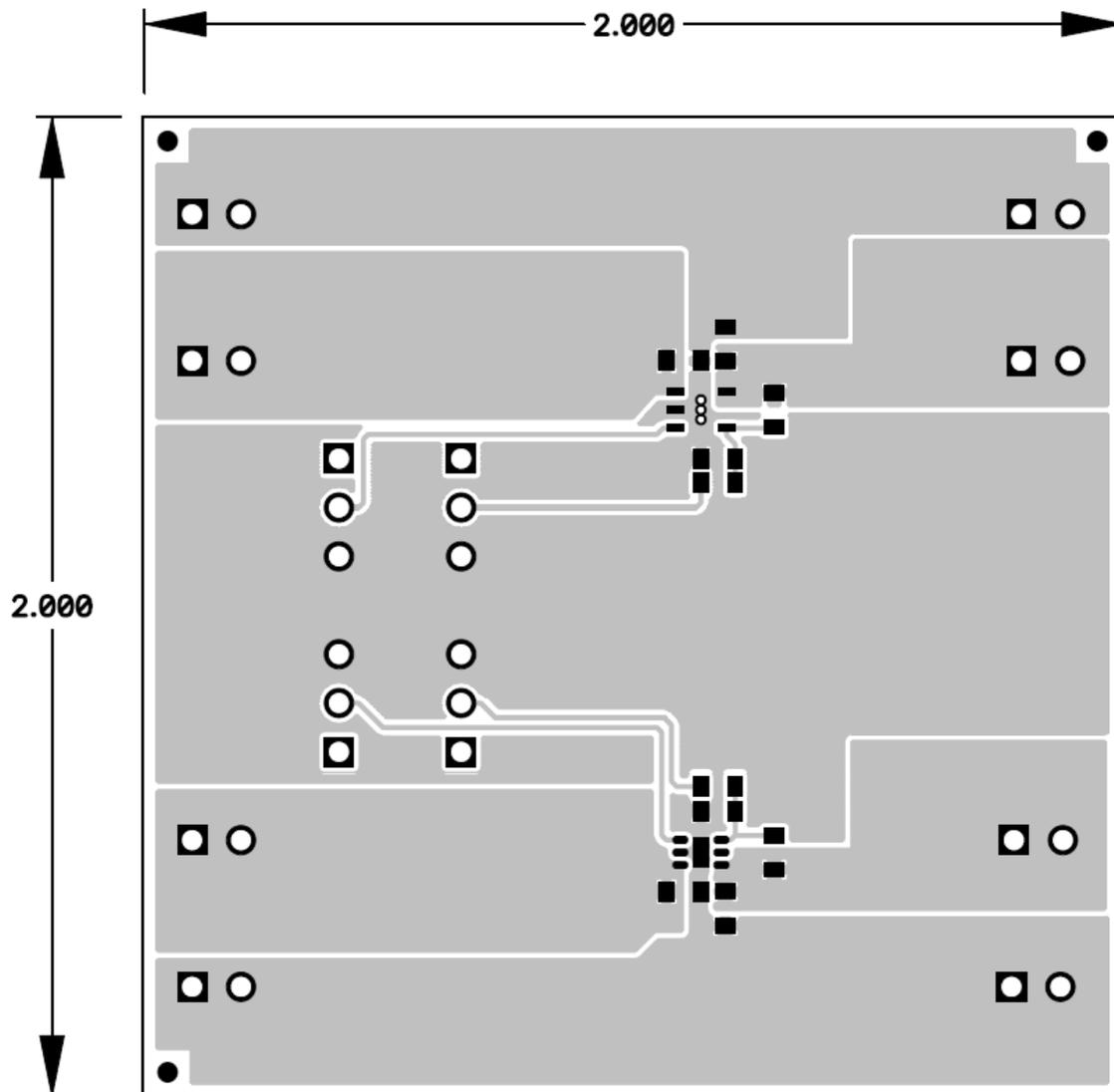
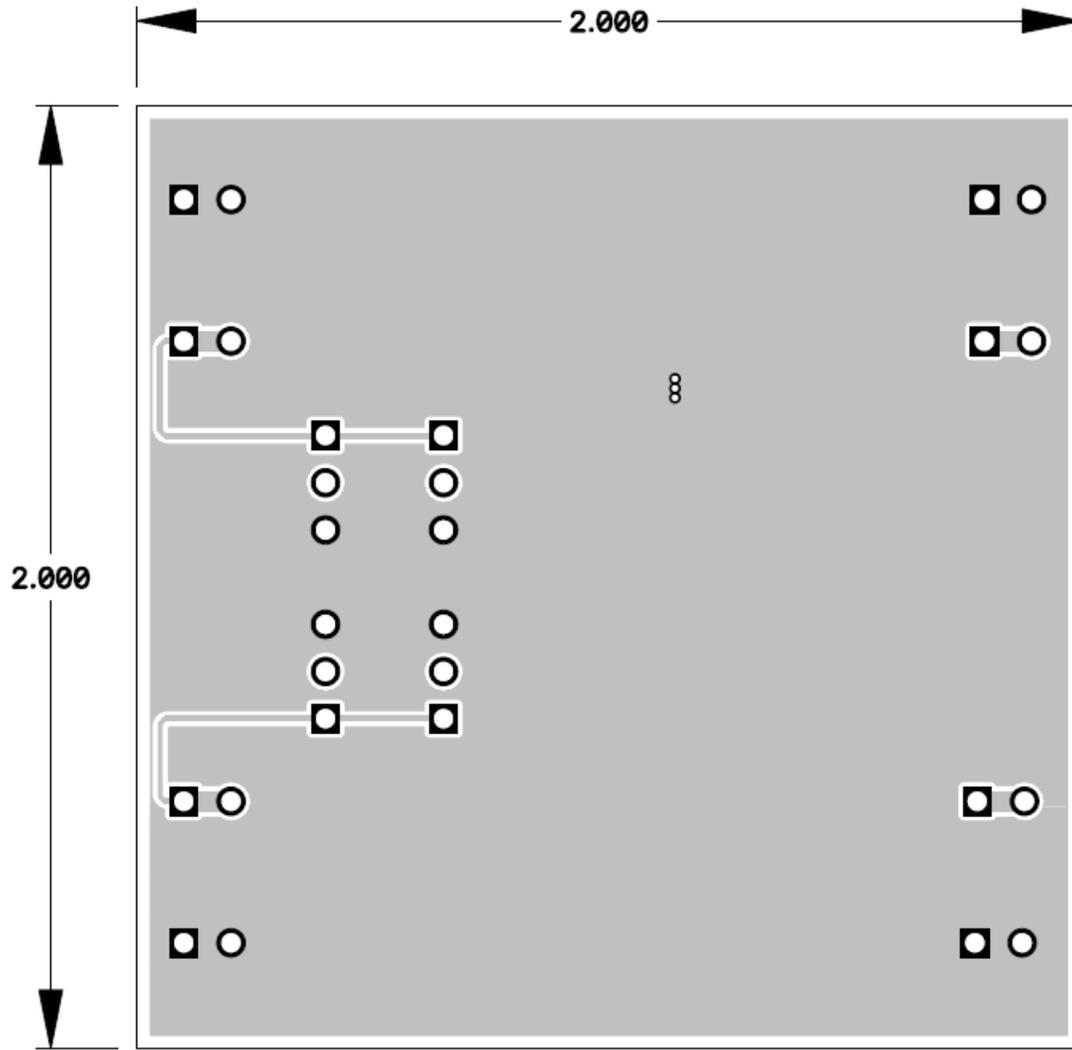
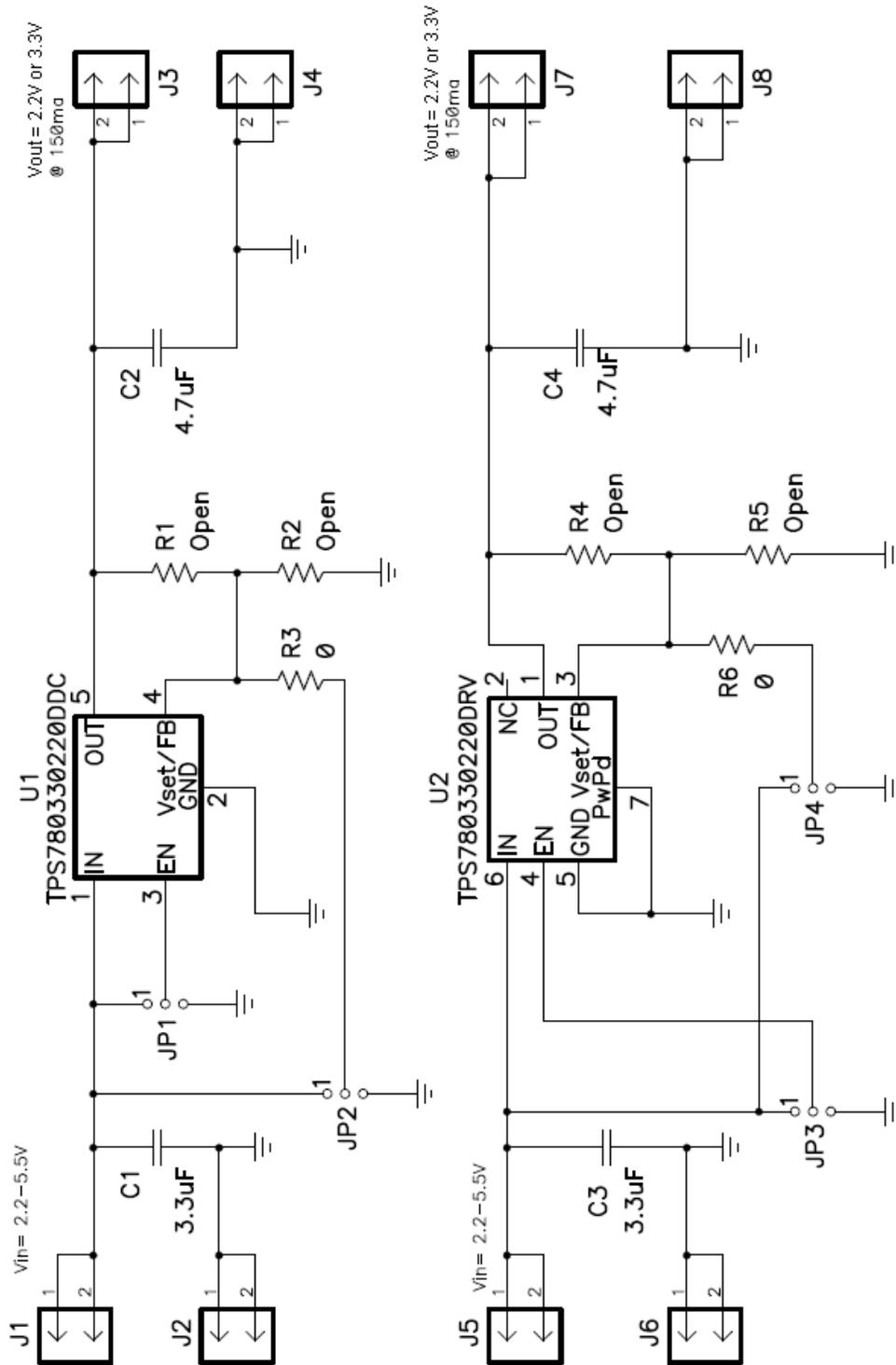


Figure 7. Bottom Layer



5.2 Schematic

Figure 8. TPS780xxEVM-301 Schematic



5.3 Bill of Materials
Table 2. TPS780xxEVM-301 Bill of Materials

| Count | RefDes | Value | Description | Size | Part Number | Manufacturer |
|-------|--------------------------------|-----------------|--|----------------|--------------------|--------------|
| 2 | C1, C3 | 3.3 μ F | Capacitor, Ceramic, 10 V, X5R, 10% | 0603 | GRM188R61A335KE15B | muRata |
| 2 | C2, C4 | 4.7 μ F | Capacitor, Ceramic, 6.3 V, X5R, 10% | 0603 | GRM188R60J475KE19B | muRata |
| 8 | J1, J2, J3, J4, J5, J6, J7, J8 | PTC36SAAN | Header, Male 2-pin, 100 mil spacing, (36-pin strip) | 0.100 inch x 2 | PTC36SAAN | Sullins |
| 4 | JP1, JP2, JP3, JP4 | | Header, 3-pin, 100mil spacing, (36-pin strip) | 0.100 inch x 3 | PTC36SAAN | Sullins |
| 0 | R1, R2 | Open | Resistor, Chip, 1/16W | 0603 | Std | Std |
| 2 | R3, R6 | 0 | Resistor, Chip, 1/16W, 1% | 0603 | CRCW0603-0000-Z | Vishay |
| 0 | R4, R5 | Open | Resistor, Chip, 1/16W, 1% | 0603 | N/A | Vishay |
| 4 | – | | Shunt, 100 mil, Black | 0.1 | 929950-00 | 3M |
| 1 | U1 | TPS780330220DDC | IC, Dual OutPut LDO Linear Regulator Iq 500 nA With Pin-Selectable | TSOT23-5 | TPS780330220DDC | TI |
| 1 | U2 | TPS780330220DRV | IC, Dual OutPut LDO Linear Regulator Iq 500 nA With Pin-Selectable | TSOT23-5 | TPS780330220DRV | TI |
| 1 | – | | PCB, 2 In x 2 In x 0.0062 In | | HPA301 | Any |

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EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the input voltage range of 2.2 V to 5.5 V and the output voltage range of 0.8 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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