User's Guide

SLUU347–June 2009

TPS79801DGNEVM-334

This user's guide describes the characteristics, operation, and use of the TPS79801DGNEVM-334 evaluation module (EVM). This EVM demonstrates the Texas Instruments TPS79801, a low-dropout linear regulator in a MSOP-8 package that is capable of 50 mA of output current. This user's guide includes setup instructions, a schematic diagram, thermal guidelines, a bill of materials, and printed-circuit board layout drawings for the EVM.

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1 Introduction

The TPS79801DGNEVM-334 EVM helps designers evaluate the operation and performance of the TPS79801 low-dropout (LDO) linear regulator in the MSOP-8 package. The TPS79801 is a 50-mA, micropower, linear regulator.

2 Setup

This section describes the jumpers and connectors on the EVM as well as how to properly connect, set up, and use the TPS79801EVM.

2.1 Input / Output Connector Descriptions

2.1.1 J1 – VIN

This is the positive input supply voltage. Twist the leads to the input supply, and keep them as short as possible to minimize EMI transmission. Add bulk capacitance between J1 and J3 if the supply leads are greater than six inches. An additional 47-µF or greater capacitor improves the transient response of the TPS79801 and helps to reduce ringing on the input when long supply wires are used.

2.1.2 J2 – VOUT

This is the positive connection from the output. Connect this pin to the positive input of the load.

2.1.3 J3 – GND

This is the return connection for the input power supply of the regulator.

2.1.4 J4 – GND

This is the return connection for the output.

2.1.5 J5 – ENABLE

This jumper is used to enable or disable the output of the TPS79801. Placing a shorting jumper between pins 1 and 2 (ON position) enables the TPS79801. Placing the shorting jumper between pins 2 and 3 (OFF position) disables the TPS79801.

2.1.6 J6 – Output Voltage Selection

This jumper is used to select the output voltage of the TPS79801. The jumper selects different feedback resistors to change the output voltage setting. The output voltage is set by inserting a shorting jumper across two pins of J6. The preprogrammed output voltages are configured as shown in Table 1.

Table 1. Output Voltage Setting

Output Voltage	Jumper Between Pins
12	1 and 2
5	3 and 4
3.3	5 and 6
2.5	7 and 8

Other output voltages can be configured by changing the feedback resistors on the board.

The pins of J6 connect directly to the feedback network of the TPS79801. The feedback network is high impedance and sensitive to noise or resistance value changes. Do not touch the pins of J6 while the device is powered because the impedance of a human is enough to alter the output voltage set point. The output voltage may increase or decrease if J6 is touched which may damage any load connected to the EVM.

3 Operation

This section provides information about the operation of the TPS79801EVM.

3.1 Operation

Connect the positive input power supply to J1. Connect the input power return (ground) to J3. The TPS79801EVM has an absolute maximum input voltage of 82 V. The recommended maximum operating voltage is 80 V. The actual highest input voltage may be less than 80 V due to thermal conditions. See the Thermal Considerations section of this manual to determine if the highest input voltage.

Connect the desired load between J2 (positive lead) and J4 (negative or return lead). Configure jumper J6 for the desired output voltage. The function of J6 is described in the Setup section of this manual.

3.2 Fixed Output TPS79801

The TPS79801EVM can be used to evaluate fixed output voltage versions of the TPS79801. The board layout and part footprints are the same between the adjustable version and fixed output voltage versions of the TPS79801. To evaluate a fixed output voltage version, the integrated circuit (IC) on the board needs to be changed to the desired fixed output voltage TPS79801. R1 must be shorted or removed from the EVM board and replaced with a 0-Ω resistor. C5 must be removed and left open. Do not install any jumpers on J6 for fixed output voltage version parts.

4 Thermal Guidelines

This section provides guidelines for the thermal management of the TPS79801DGNEVM-334 board.

4.1 Thermal Considerations

Thermal management is a key component of design of any power converter and is especially important when the power dissipation in the LDO is high. To better help you design the TPS79801 family into your application, use Equation 1 to approximate the maximum power dissipation at a particular ambient temperature:

$$T_J = T_A + P_d \times \theta_{JA} \quad (1)$$

where T_J is the junction temperature, T_A is the ambient temperature, P_d is the power dissipation in the IC and θ_{JA} is the thermal resistance from junction to ambient. All temperatures are in degrees Celsius.

The measured thermal resistance from junction to ambient for the TPS79801EVM has a typically value of 48°C/W. The recommended maximum operating junction temperature specified in the data sheet for the TPS79801 family is 125°C. With these two pieces of information, the maximum power dissipation can be found by using Equation 1.

Example Calculation:

For example, what is the maximum input voltage that can be applied to a TPS79801 with the output voltage configured to 3.3 V if the ambient temperature is 85°C and the full 50 mA of load current is required?

$$\text{Given: } T_J = 125°C,\ T_A = 85°C,\ \theta_{JA} = 48°C/W \quad (2)$$

Using Equation 1, substitute the preceding given values, and find that the maximum power dissipation for the part is P_d = 0.833 W.

$$125°C = 85°C + P_d\,(48°C/W) \quad (3)$$

This means that the total power dissipation of the TPS79801 must be less than 0.833 W. Now the input voltage can be calculated.

$$P_d = (V_{in} - V_{out}) \times I_{out} = (Vin - 3.3V) \times 0.05A = 0.833W \quad (4)$$

So, the maximum input voltage needs to be 19.9 V or less in order to maintain a safe junction temperature.

Similar analysis can be performed to determine the maximum input voltage at room temperature (25°C) to provide full output current while maintaining the junction temperature at or below 125°C. The answer depends on the output voltage.

Output Voltage	Maximum Input Voltage
12	53.6
5	46.6
3.3	44.9
2.5	44.1

5 Board Layout

This section provides the TPS79801DGNEVM-334 board layout and illustrations.

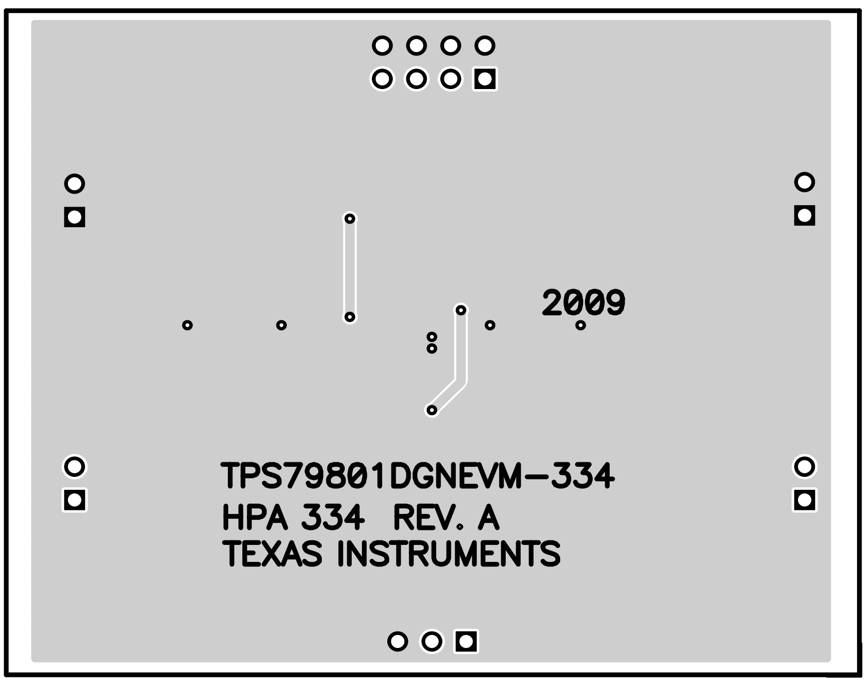

Figure 1. Top Layer Assembly

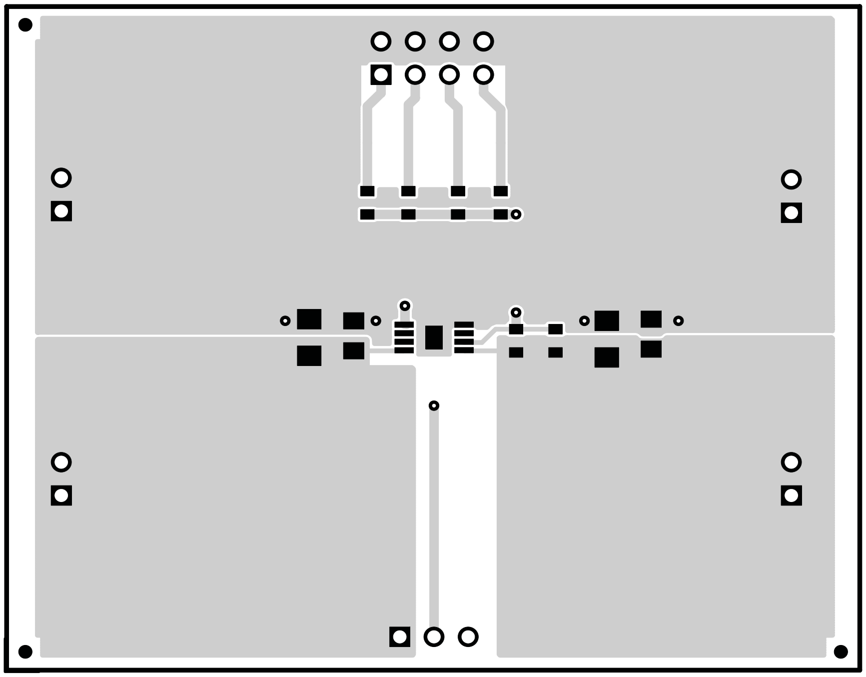

Figure 2. Top Layer Routing

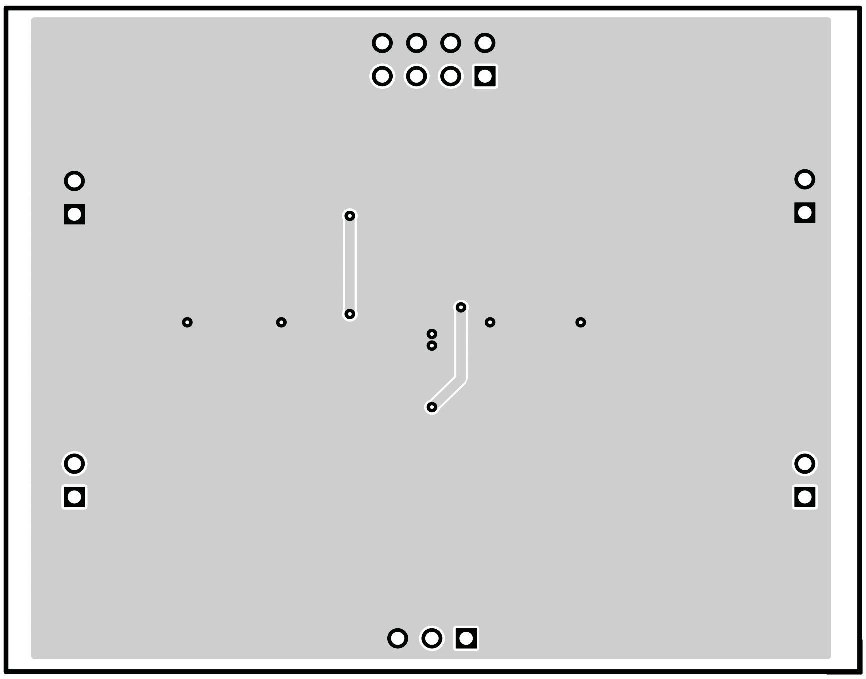

Figure 3. Bottom Layer Routing

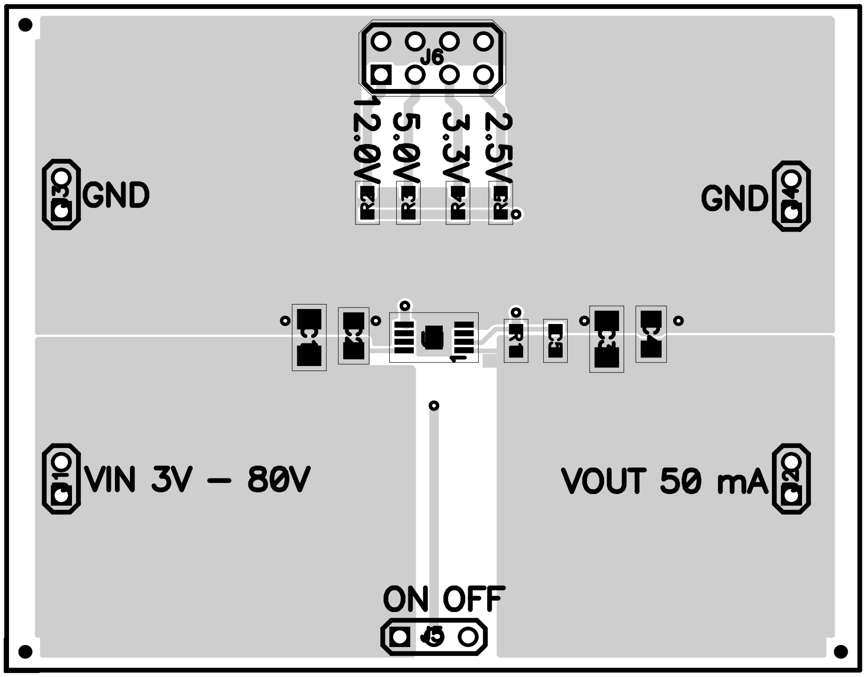

Figure 4. Bottom Layer Assembly

6 Schematic and Bill of Materials

This section provides the TPS79801DGNEVM-334 schematic and bill of materials.

6.1 Schematic

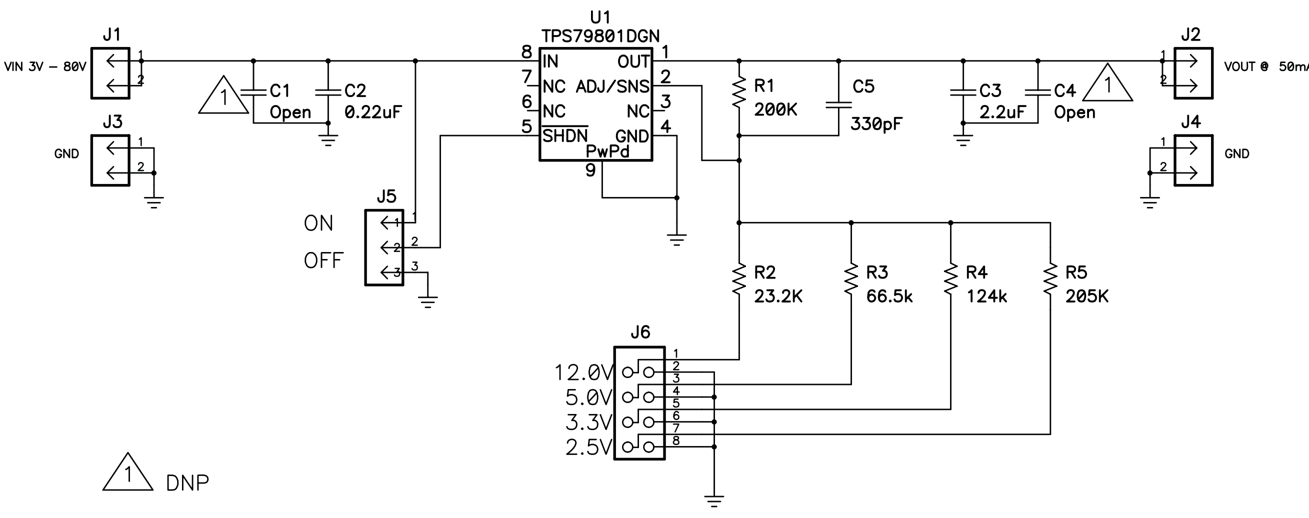

Figure 5. TPS79801DGNEVM-334 Schematic

6.2 Bill of Materials

Table 2. TPS79801DGNEVM-334 Bill of Materials

Count	RefDes	Value	Description	Size	Part Number	MFR
0	C1	Open	Capacitor, Ceramic	1206		
1	C2	0.22 µF	Capacitor, Ceramic, 100V, X7R, 10%	0805	STD	Any
1	C3	2.2 µF	Capacitor, Ceramic, 50V, X7R, 10%	1206	STD	Any
0	C4	Open	Capacitor, Ceramic	0805		
1	C5	330pF	Capacitor, Ceramic, 50V, COG, 5%	0603	STD	Any
4	J1-J4	PEC36SAAN	Header, Male 2-pin, 100mil spacing	TH	PEC36SAAN	Sullins
1	J5	PEC36SAAN	Header, Male 3-pin, 100mil spacing	TH	PEC36SAAN	Sullins
1	J6	PEC36DAAN	Header, Male 2x4-pin, 100mil spacing	TH	PEC36DAAN	Sullins
1	R1	200K	Resistor, Chip, 1/16W, 1%	0603	STD	Any
1	R2	23.2K	Resistor, Chip, 1/16W, 1%	0603	STD	Any
1	R3	66.5K	Resistor, Chip, 1/16W, 1%	0603	STD	Any
1	R4	124K	Resistor, Chip, 1/16W, 1%	0603	STD	Any
1	R5	205K	Resistor, Chip, 1/16W, 1%	0603	STD	Any
1	U1	TPS79801DGN	IC, LDO Micropower Linear Regulator, 3V-80V, 50mA	MSOP-8	TPS79801DGN	TI
2	–		Shunt, 100-mil, Black	0.100	929950-00	3M
1	–		PCB, 2.50 In × 2.00n × 0.062 In		HPA334	Any

Notes: 1. These assemblies are ESD sensitive, ESD precautions shall be observed.

2. These assemblies must be clean and free from flux and all contaminants. Use of no clean flux is not acceptable.
3. These assemblies must comply with workmanship standards IPC-A-610 Class 2.
4. Reference designators marked with an asterisk ('**') cannot be substituted. All other components can be substituted with equivalent MFG's components.

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EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the input voltage range of 3 V to 80 V and the output voltage range of 1.25 V to 32 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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