TEXAS INSTRUMENTS

User's Guide

SLVU333A–August 2009–Revised March 2012

TPS73401DRV EVM

This User's Guide describes the characteristics, operation, and use of the TPS73401DRVEVM-527. This EVM demonstrates the Texas Instruments TPS73401, a Low Drop Out (LDO) linear regulator in a 2mm x 2mm SON-6 package that is capable of 250mA of output current. This user's guide includes setup instructions, a schematic diagram, thermal guidelines, a bill of materials (BOM), and PCB layout drawings for the evaluation module.

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1 Introduction

The TPS73401DRVEVM-527 evaluation module (EVM) helps designers evaluate the operation and performance of the TPS73401 LDO in the 2mm x 2mm SON-6 package. The TPS73401 is a 250mA, micropower, linear regulator.

1.1 Related Documentation From Texas Instruments

TPS73401 datasheet (SBVS089)

1.2 TPS73401DRVEVM Specifications

Input voltage range, Vin	2.7 V to 6.5 V
Output voltage range, Vout	1.25 V to 6.2 V
Operating temperature	85 °C

2 Setup

This chapter describes the jumpers and connectors on the EVM as well as how to properly connect, setup, and use the TPS73401EVM.

2.1 Input / Output Connector Descriptions

2.1.1 J1 –VIN

This is the positive input supply voltage. The leads to the input supply should be twisted and kept as short as possible to minimize EMI transmission. Additional bulk capacitance should be added between J1 and J2 if the supply leads are greater than six inches. An additional 47µF or greater capacitor improves the transient response of the TPS73401 and helps to reduce ringing on the input when long supply wires are used.

2.1.2 J2 – GND

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

2.1.3 J3 – VOUT

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

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 TPS73401. Placing a shorting jumper between pins 1 and 2 ('ON' position) will enable the TPS73401. Placing the shorting jumper between pins 2 and 3 ('OFF' position) will disable the TPS73401.

2.1.6 J6 – Output Voltage Selection

This jumper is used to select the output voltage of the TPS73401. 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 JP2. The pre-programmed output voltages are configured as shown in Table 1.

Table 1. Output Voltage Setting

Output Voltage	Jumper Between Pins
1.5	1 and 2
1.8	3 and 4
2.8	5 and 6
3.3	7 and 8

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

The pins of JP2 connect directly to the feedback network of the TPS73401.

The feedback network is high impedance and sensitive to noise or resistance value changes. The pins of JP2 should not be touched while the device is powered since the impedance of a human is enough to alter the output voltage set point. The output voltage may increase or decrease if JP2 is touched which may damage any load connected to the EVM.

3 Operation

Connect the positive input power supply to J1. Connect the input power return (ground) to J2. The TPS73401EVM has an absolute maximum input voltage of 7.0V. The recommended maximum operating voltage is 6.5V. The actual highest input voltage may be less than 6.5V due to thermal conditions. See the Thermal Considerations section of this manual to determine if the highest input voltage.

Connect the desired load between J3 (positive lead) and J4 (negative or return lead). Configure jumper JP2 for the desired output voltage. The function of JP2 is described in the Setup section (2.1.5) of this manual.

3.1 Fixed Output TPS734xx

The TPS73401 EVM can be used to evaluate fixed output voltage versions of the TPS734xx. The board layout and part footprints are the same between the adjustable version and fixed output voltage versions of the TPS734. To evaluate a fixed output voltage version, the IC on the board will need to be changed to the desired fixed output voltage TPS734xx. R1 must be shorted or removed from the EVM board and replaced with a zero ohm resistor. C3 must be removed and left open. There should not be any jumpers installed on JP2 for fixed output voltage version parts.

4 Thermal Guidelines

This chapter provides guidelines for the thermal management of the TPS73401DRVEVM-527 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 TPS73401 family into your application, the following formula should be used to approximate the maximum power dissipation at a particular ambient temperature:

$$T_J = T_A + P_d \times \theta_{JA} \tag{1}$$

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 TPS73401EVM has a typically value of 38˚C/W. The recommended maximum operating junction temperature specified in the datasheet for the TPS73401 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 TPS73401 with the output voltage configured to 3.3V if the ambient temperature is 85°C and the full 250mA of load current is required?

Given: T_J = 125°C, T_A = 85°C, θ_{JA} = 38°C/W

Using Equation 1, we substitute in the given values above and find that the maximum power dissipation for the part is P_d =1.053W.

$$125°C=85°C + P_d\ (38°C/W) \tag{2}$$

This means that the total power dissipation of the TPS73401 must be less than 1.053W. Now the input voltage can be calculated.

$$P_d = (V_{in} – V_{out}) \times I_{out} = (Vin – 3.3V) \times 0.25A = 1.053W \tag{3}$$

So the maximum input voltage would need to be 7.51V or less in order to maintain a safe junction temperature. But since the maximum recommended input voltage is 6.5V, the supply voltage is limited to 6.5V.

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 will depend on the output voltage.

Table 2. Maximum Calculated Input Voltage

Output voltage (V)	Maximum Calculated Input Voltage (V)	
	At Ambient Temperature = 25°C	At Ambient Temperature = 85°C
1.5	12.03 (cannot exceed 6.5)	5.71
1.8	12.33 (cannot exceed 6.5)	6.01
2.8	13.33 (cannot exceed 6.5)	7.01 (cannot exceed 6.5)
3.3	13.83 (cannot exceed 6.5)	7.51 (cannot exceed 6.5)

5 Board Layout

This chapter provides the TPS73401DRVEVM-527 board layout and illustrations.

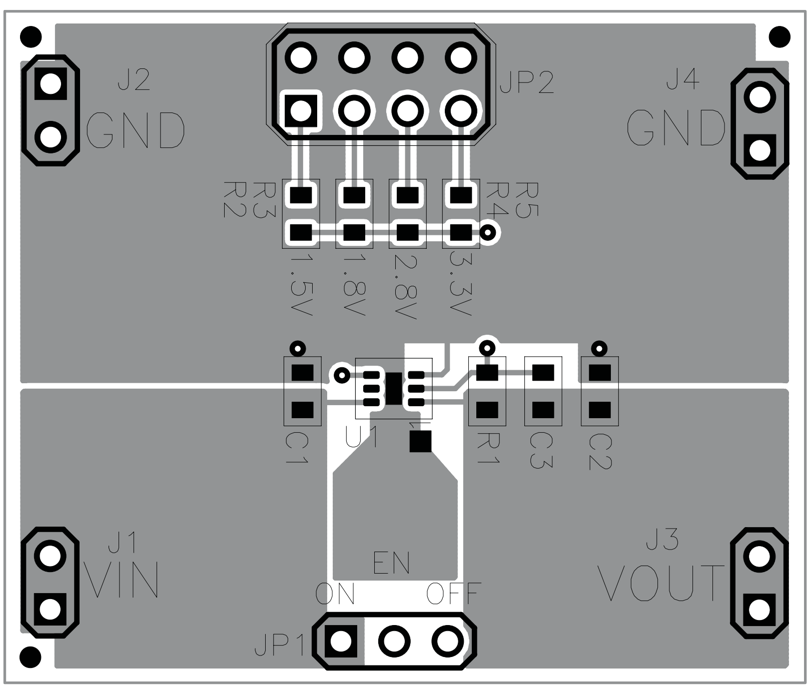

Figure 1. Top Layer Assembly

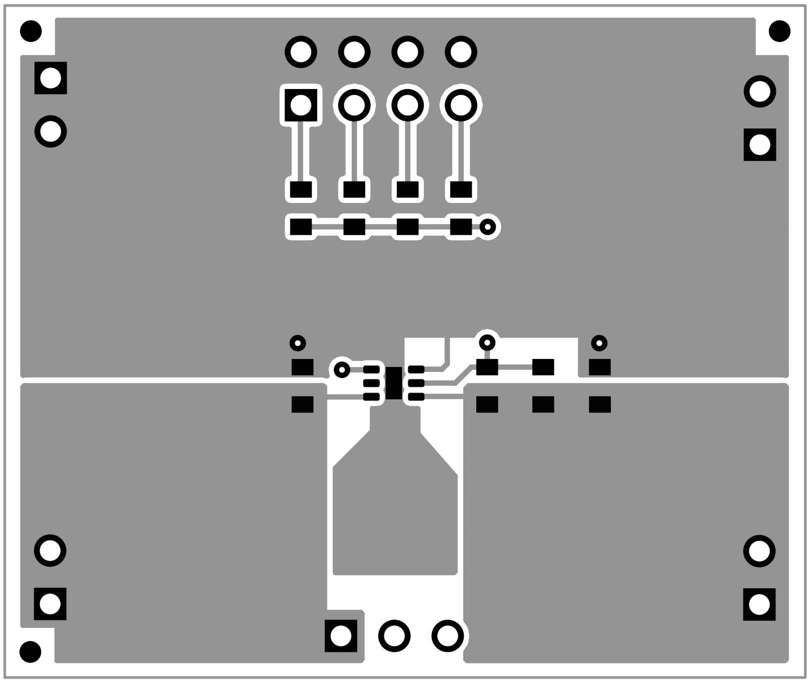

Figure 2. Top Layer Routing

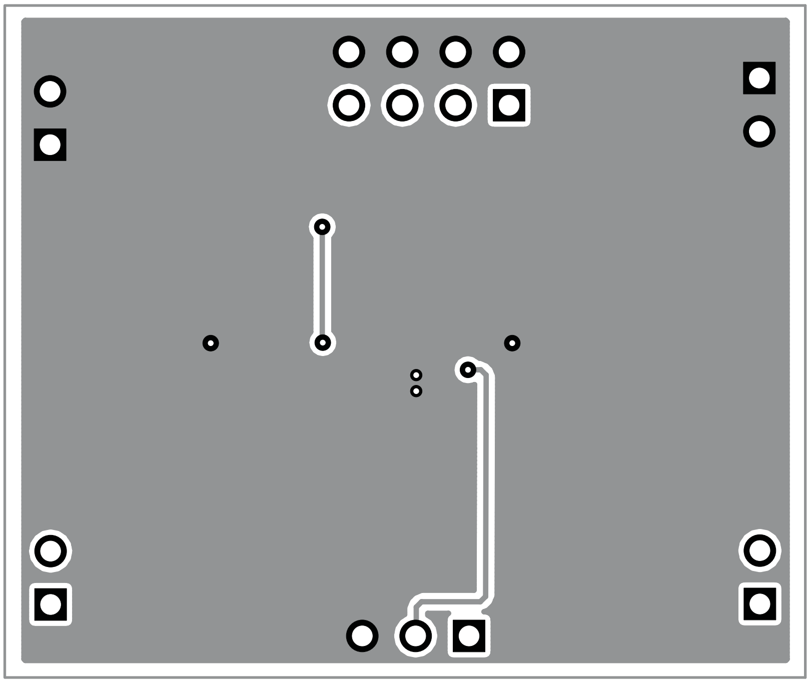

Figure 3. Bottom Layer Routing

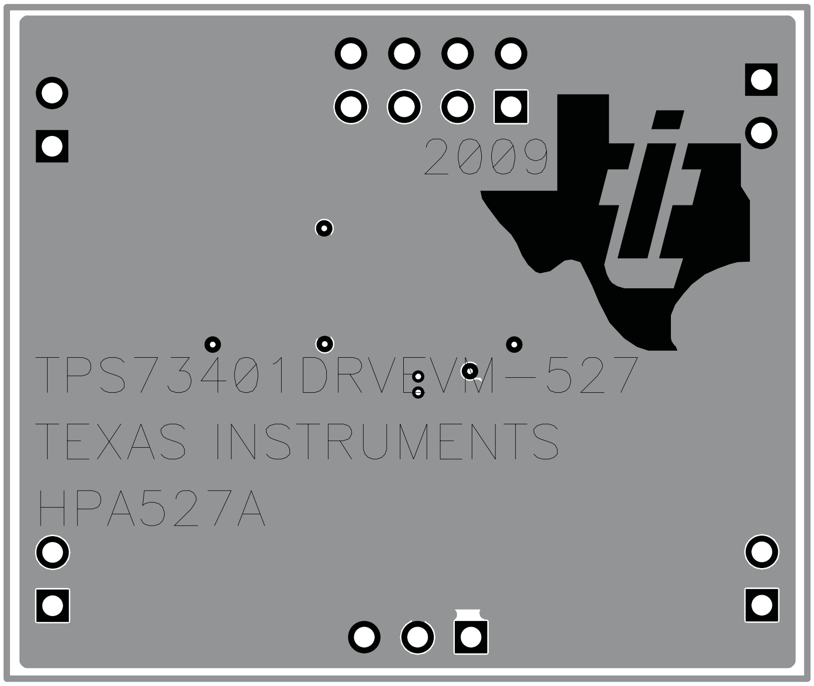

Figure 4. Bottom Layer Assembly

6 Schematic and Bill of Materials

This chapter provides the TPS73401DRVEVM-527 schematic and bill of materials.

6.1 Schematic

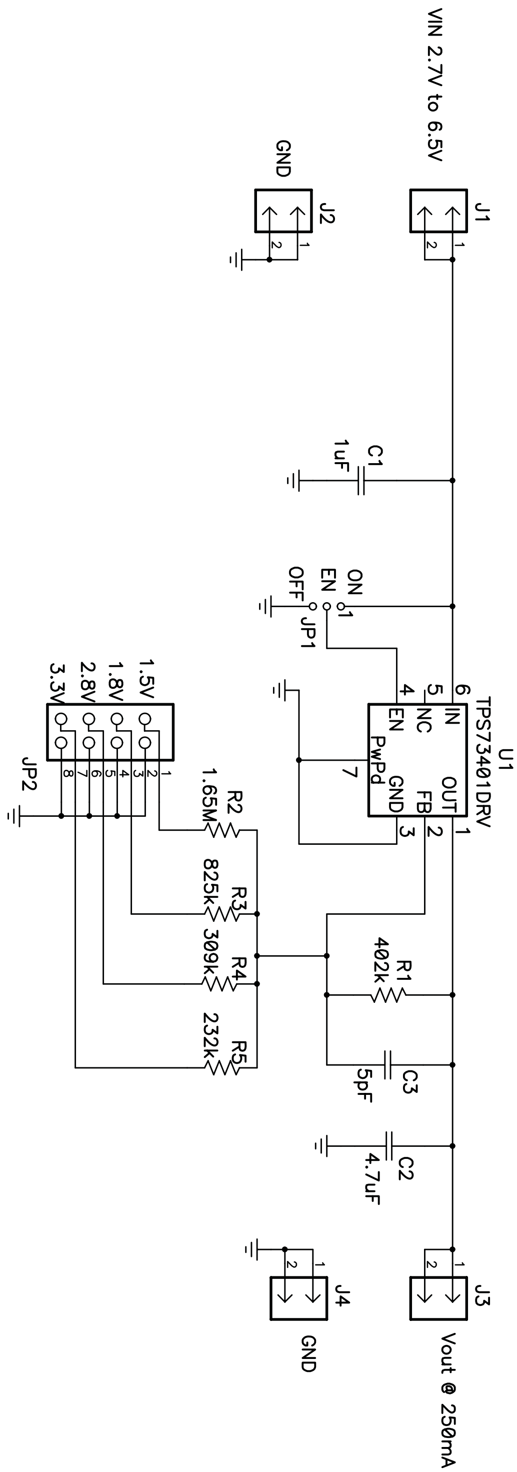

Figure 5. TPS73401DRVEVM-527 Schematic

6.2 Bill of Materials (BOM)

Table 3. Bill of Materials

Count	RefDes	Value	Description	Size	Part Number	MFR
1	C1	1uF DRV	Capacitor, Ceramic, 6.3V, X5R, 10%	0603	STD	STD
1	C2	4.7uF1	Capacitor, Ceramic, 10V, X5R, 10%	0603	STD	STD
1	C3	5pF	Capacitor, Ceramic, 16V, X5R, 10%	0603	STD	STD
4	J1, J2, J3, J4	PEC02SAAN	Header, Male 2-pin, 100mil spacing	0.100 inch x 2	PEC02SAAN	Sullins
1	JP1	PEC03SAAN	Header, Male 3-pin, 100mil spacing	0.100 inch x 3	PEC03SAAN	Sullins
1	JP2	PEC04DANN	Header, Male 2x4-pin, 100mil spacing	0.100 inch 2 x 4	PEC04DANN	Sullins
1	R1	402k	Resistor, Chip, 1/16W, 1%	0603	STD	STD
1	R2	1.65M	Resistor, Chip, 1/16W, 1%	0603	STD	STD
1	R3	825k	Resistor, Chip, 1/16W, 1%	0603	STD	STD
1	R4	309k	Resistor, Chip, 1/16W, 1%	0603	STD	STD
1	R5	232k	Resistor, Chip, 1/16W, 1%	0603	STD	STD
1	U1	TPS7340	"IC, 250mA, Low Quiescent Current, Ultra-Low Noise, High PSRR LDO Linear Regulator"	SON-6	TPS73401DRV	TI
2	--		Shunt, 100-mil, Black	0.100	929950-00	3M
1	--		PCB, 1.26 In x 1.50 In x 0.062 In		HPA527	Any

7 Related Documentation From Texas Instruments

- TPS734xx Datasheet: 250mA, Low Quiescent Current, Ultra-Low Noise, High PSRR Low-Dropout Linear Regulator.

For additional assistance, please contact your local TI sales representative.