User's Guide

TPS22997 Evaluation Module

ABSTRACT

This user's guide describes the characteristics, operation, and use of the TPS22997 adjustable rise time load switch evaluation module (EVM). This document contains the complete EVM schematic diagram, printed-circuit board layouts, bill of materials, and necessary instructions on how to operate the EVM.

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1 Introduction

The TPS22997 EVM is a two-layer PCB containing the TPS22997 load switch device. The VIN and VOUT connections to the device and the PCB layout routing are capable of handling high continuous currents and provide a low-resistance pathway into and out of the device under test. Test point connections allow the EVM user to control the device with user-defined test conditions and make accurate R_{ON} measurements.

1.1 Description

Table 1 lists a short description of the TPS22997 load switch performance specification. For additional details on load switch performance, application notes, and data sheet, see www.ti.com/loadswitch.

Table 1-1. TPS22997 Characteristics

EVM	Device	Rise Time Typical (µs)	V_{BIAS} (V)	V_{IN} (V)	Enable (ON Pin)	Quick Output Discharge
PSIL155	TPS22997	Adjustable	1.5 V to 5.5 V	0.1 V to 5.5 V	Active High	Adjustable

1.2 Features

This EVM has the following features:

- V_{IN} input voltage range: 0.1 V to 5.5 V
- Access to the VIN, VOUT, ON, VBIAS, PG, GND, and QOD pins of the TPS22997 load switch
- Onboard CIN and COUT capacitors with landing pads for optional additional capacitance
- Adjustable rise timing

2 Electrical Performance

See the *TPS22997x 5.5 V, 4-mΩ, 10-A Load Switch with Adjustable Rise Time data sheet* for detailed electrical characteristics of the TPS22997.

3 Schematic

Figure 1 illustrates the TPS22997EVM schematic.

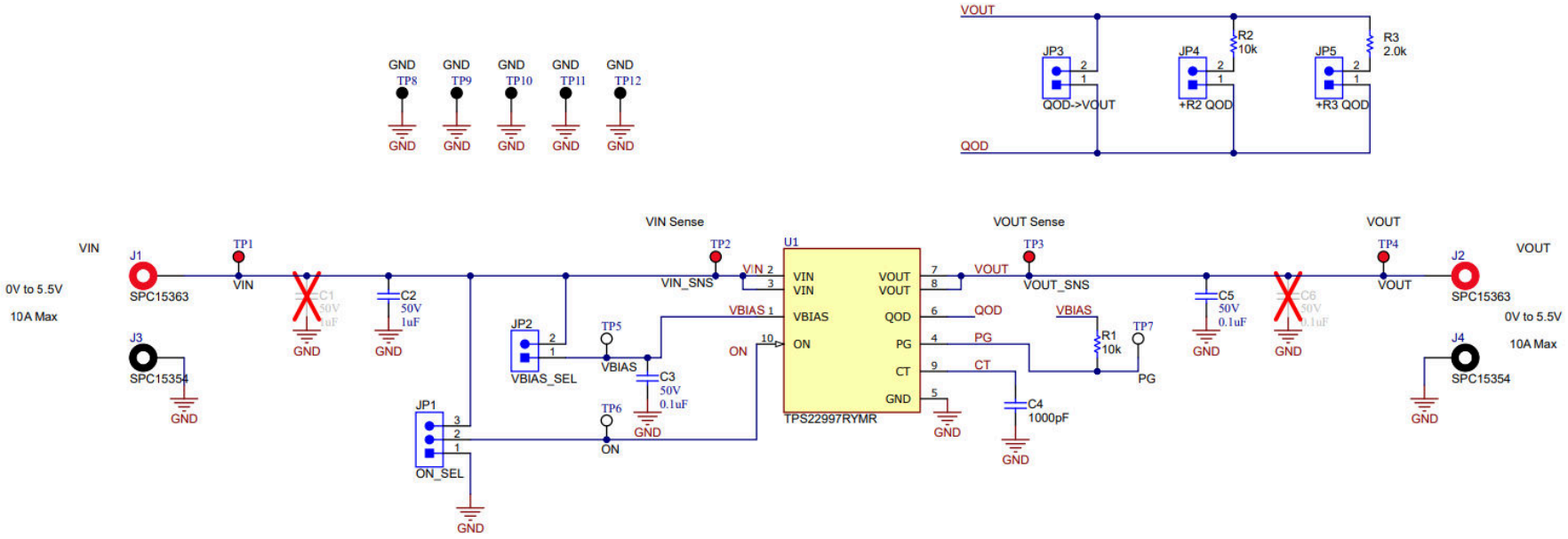

Figure 3-1. TPS22997EVM Schematic

4 PCB Layout

Figure 2 and Figure3 show the PCB layout images.

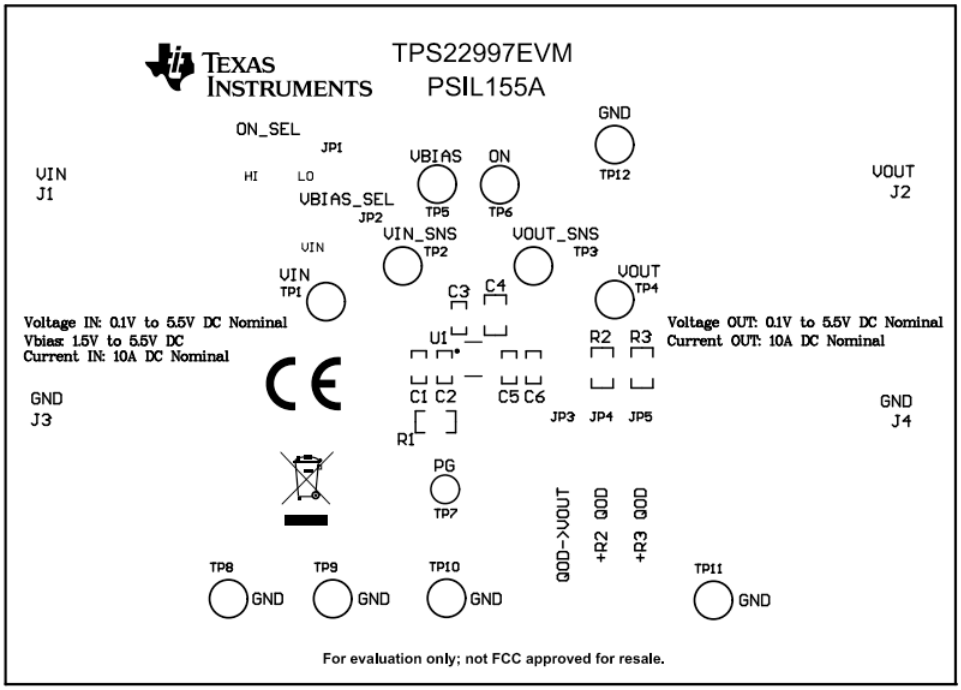

Figure 4-1. TPS22997EVM Top Layout

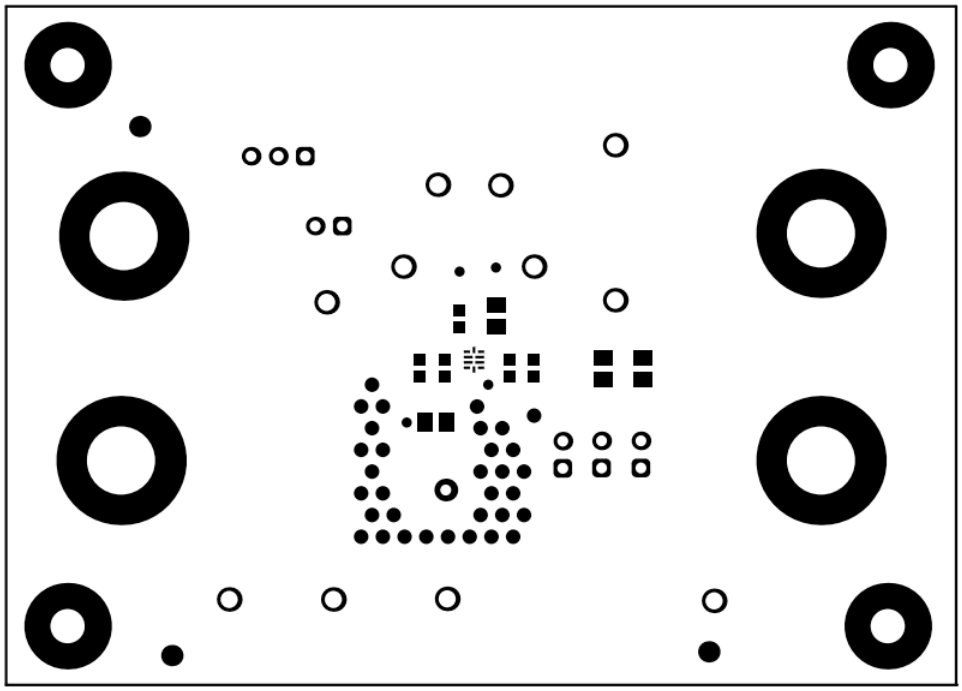

Figure 4-2. TPS22997EVM Bottom Layout

4.1 Setup

This section describes the jumpers and connectors on the EVM as well as how to properly connect, set up and use the EVM. Table 1 describes the input and output connectors and jumpers. Table 2 describes the different test points and functionality. Table 3 describes the jumper functionality and configurations.

Table 4-1. TPS22997EVM Input and Output Connector Functionality

Input	Connector and Test Point	Label	Description
VIN	J1	J1	Input banana connector for VIN
	TP1	VIN	Input test point for VIN
	TP2	VIN_SNS	Sense test point for VIN
VOUT	J2	J2	Output banana connector for VOUT
	TP4	VOUT	Output test point for VOUT
	TP3	VOUT_SNS	Sense test point for VOUT
GND	TP8, TP9, TP10, TP11, TP12	GND	Test point for GND
	J3, J4	J3, J4	Banana connector for GND

Table 4-2. TPS22997EVM Test Point Description

Pin	Test Point	Label	Description
ON	TP6	ON	Enable signal test point
VBIAS	TP5	VBIAS	Bias Voltage test point
PG	TP7	PG	Power good signal test point

Table 4-3. TPS22997EVM Jumper Configuration

Input	Jumper	Label	Description
VIN	JP2	VBIAS_SEL	BIAS voltage pull up to VIN
	JP1	ON_SEL	ON-pin enable signal • Position 1 and 2 sets ON-pin LO • Position 2 and 3 sets ON-pin HI
VOUT	JP3, JP4, JP5	QOD– > VOUT, +R2 QOD, +R3 QOD	Quick output discharge setting • JP3 sets device to use internal QOD • JP4 sets device to use internal QOD + 10 kΩ • JP5 sets device to use internal QOD + 2 kΩ

5 Operation

Connect the VIN power supply to the J1 terminal. The input voltage range of the TPS22997EVM is 0.1 V to 5.5 V. Connect an acceptable bias voltage to TP5 or populate JP2 to use VIN as VBIAS. The bias voltage range of TPS22997EVM is 0.1V to 5.5 V. Note that VIN cannot be greater than VBIAS for correct operation of the device.

To adjust the slew rate of the device you can depopulate the C4 capacitor and change the capacitance. As it is currently, the CT pin has 1000pF of capacitance resulting in a slew rate described further in the TPS22997 datasheet.

External output loads can be applied to the switch by using the J2 terminal. To discharge the output rail when the device is disabled, adjust the quick output discharge on the TPS22997EVM as needed. When the ON pin is asserted high, the output of the TPS22997 is enabled.

The status of the MOSFET being fully turned on can be viewed using the power good, PG, pin. This is an open drain pin that is pulled up to Vbias and asserted high when the output is full load ready.

6 Test Configurations

6.1 On-Resistance (R_{ON}) Test Setup

Figure 4 shows the typical setup for measuring on-resistance. The voltage drop across the switch is measured using the sense connections, and this can be divided by the load current to calculate the R_{ON} resistance.

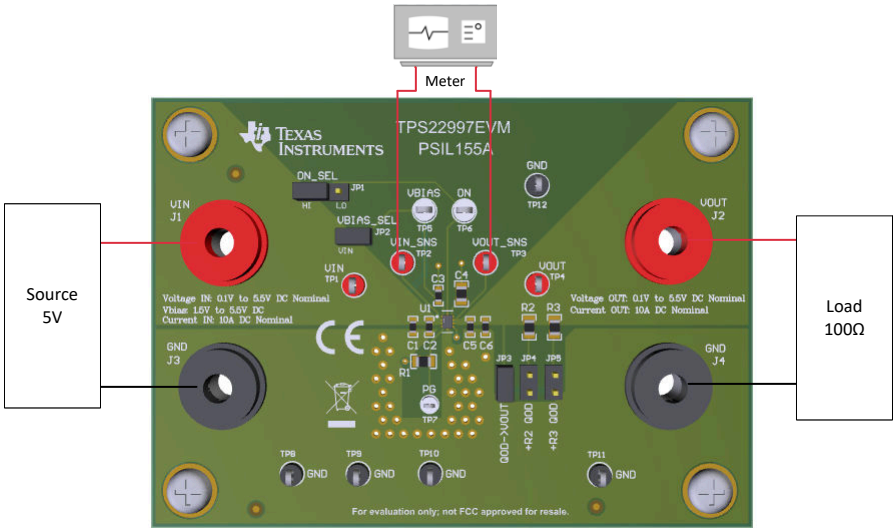

Figure 6-1. R_{ON} Test Setup

6.2 Rise Time Test Setup

Figure 5 shows the test setup for measuring the rise time of the TPS22997. Apply a square wave to the ON pin of the switch using a function generator and apply a voltage to the VIN terminal using a power supply. Observe the waveform at VOUT Sense with an oscilloscope to measure the slew rate and rise time of the switch with a given input voltage.

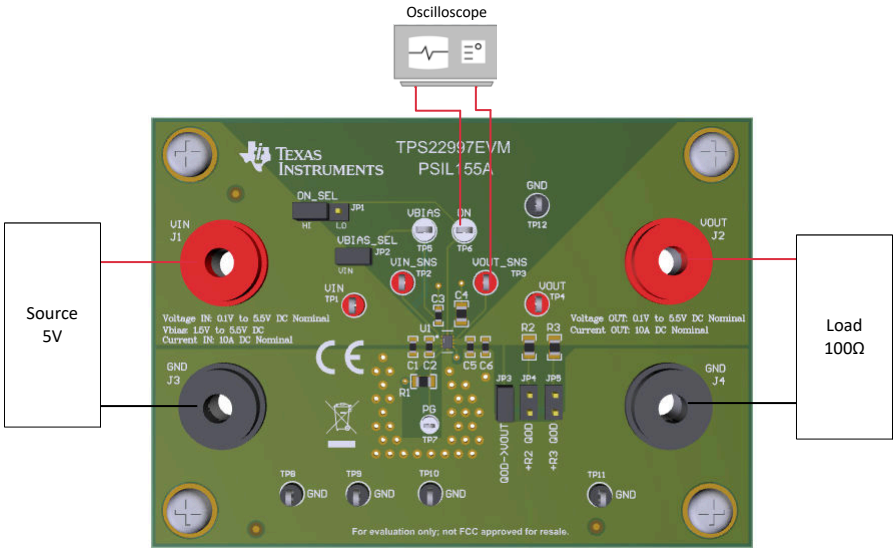

Figure 6-2. Rise Time Test Setup

7 Bill of Materials (BOM)

Table 7-1 lists the TPS22997EVM BOM.

Table 7-1. TPS22997EVM BOM

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
PCB	1		Printed Circuit Board		PSIL155	Any
C2	1	1uF	CAP, CERM, 1 uF, 50 V, +/- 10%, X5R, 0603	0603	C1608X5R1H105K080AB	TDK
C3, C5	2	0.1uF	CAP, CERM, 0.1 uF, 50 V, +/- 10%, X5R, 0603	0603	C1608X5R1H104K080AA	TDK
C4	1	1000pF	CAP, CERM, 1000 pF, 50 V, +/- 5%, X7R, 0805	0805	C0805C102J5RACTU	Kemet
H1, H2, H3, H4	4		Machine Screw, Round, #4-40 x 1/4, Nylon, Philips panhead	Screw	NY PMS 440 0025 PH	B&F Fastener Supply
H5, H6, H7, H8	4		Standoff, Hex, 0.5"L #4-40 Nylon	Standoff	1902C	Keystone
J1, J2	2		BANANA JACK, SOLDER LUG, RED, TH	Red Insulated Banana Jack	SPC15363	Tenma
J3, J4	2		BANANA JACK, SOLDER LUG, BLACK, TH	Black Insulated Banana Jack	SPC15354	Tenma
JP1	1		Header, 100mil, 3x1, Gold, TH	3x1 Header	TSW-103-07-G-S	Samtec
JP2, JP3, JP4, JP5	4		Header, 100mil, 2x1, Gold, TH	2x1 Header	TSW-102-07-G-S	Samtec
R1, R2	2	10k	RES, 10 k, 5%, 0.125 W, 0805	0805	ERJ-6GEYJ103V	Panasonic
R3	1	2.0k	RES, 2.0 k, 5%, 0.125 W, 0805	0805	ERJ-6GEYJ202V	Panasonic
SH-J1, SH-J2, SH-J3	3	1x2	Shunt, 100mil, Flash Gold, Black	Closed Top 100mil Shunt	SPC02SYAN	Sullins Connector Solutions
TP1, TP2, TP3, TP4	4		Test Point, Multipurpose, Red, TH	Red Multipurpose Testpoint	5010	Keystone
TP5, TP6	2		Test Point, Multipurpose, White, TH	White Multipurpose Testpoint	5012	Keystone Electronics

Table 7-1. TPS22997EVM BOM (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
TP7	1		Test Point, Miniature, White, TH	White Miniature Testpoint	5002	Keystone
TP8, TP9, TP10, TP11, TP12	5		Test Point, Multipurpose, Black, TH	Black Multipurpose Testpoint	5011	Keystone
U1	1		5V, 4mΩ, 10A Load Switch with Adjustable Rise Time	WQFN10	TPS22997RYMR	Texas Instruments
C1	0	1uF	CAP, CERM, 1 uF, 50 V, +/- 10%, X5R, 0603	0603	GRM188R61H105KAALD	MuRata
C6	0	0.1uF	CAP, CERM, 0.1 uF, 50 V, +/- 10%, X5R, 0603	0603	C1608X5R1H104K080AA	TDK

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This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

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- *Reorient or relocate the receiving antenna.*
- *Increase the separation between the equipment and receiver.*
- *Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.*
- *Consult the dealer or an experienced radio/TV technician for help.*

3.2 *Canada*

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(1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concernant les EVMs avec appareils radio:

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

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Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

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