TPS22990 Load Switch Evaluation Module

The TPS22990 evaluation module (EVM) allows the user to connect power to and control the 10-pin WSON package load switch. Parameters such as the on-resistance, rise time, and output pull-down resistance are easily and accurately evaluated. Table 1 lists a short description of the TPS22990 and TPS22990N load switch performance specifications; for additional details on load switch performance, application notes, and the data sheet, see www.ti.com/loadswitch.

Table 1. TPS22990 Rise Time, Output Current Rating, Enable, and Output Discharge Characteristics

EVM	Device	Rise Time Typical (µs)	V_{IN} (V)	Maximum Continuous Current (A)	Enable (ON Pin)	Quick Output Discharge
HVL152-001	TPS22990	Adjustable	0.6 to 5.5	10	Active High	Yes
HVL152-002	TPS22990N	Adjustable	0.6 to 5.5	10	Active High	No

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1 Introduction

1.1 Description

The TPS22990EVM is a two-layer PCB containing the TPS22990 load switch device, and the TPS22990NEVM is a two-layer PCB containing the TPS22990N 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.

1.2 Features

This EVM has the following features:

- V_{IN} input voltage range: 0.6 V to 5.5 V
- 10-A maximum continuous current operation
- Connection points to VIN, VOUT, VBIAS, ON, PG pins as well as SENSE connections for accurate measurement of VIN and VOUT voltages
- Onboard C_{IN}, C_{OUT}, and CT capacitors
- *Power Good* (PG) signal can be monitored via test point

2 Electrical Performance

Refer to the data sheet SLVSDK1 for detailed electrical characteristics of the TPS22990.

3 Schematic

Figure 1 illustrates the EVM schematic.

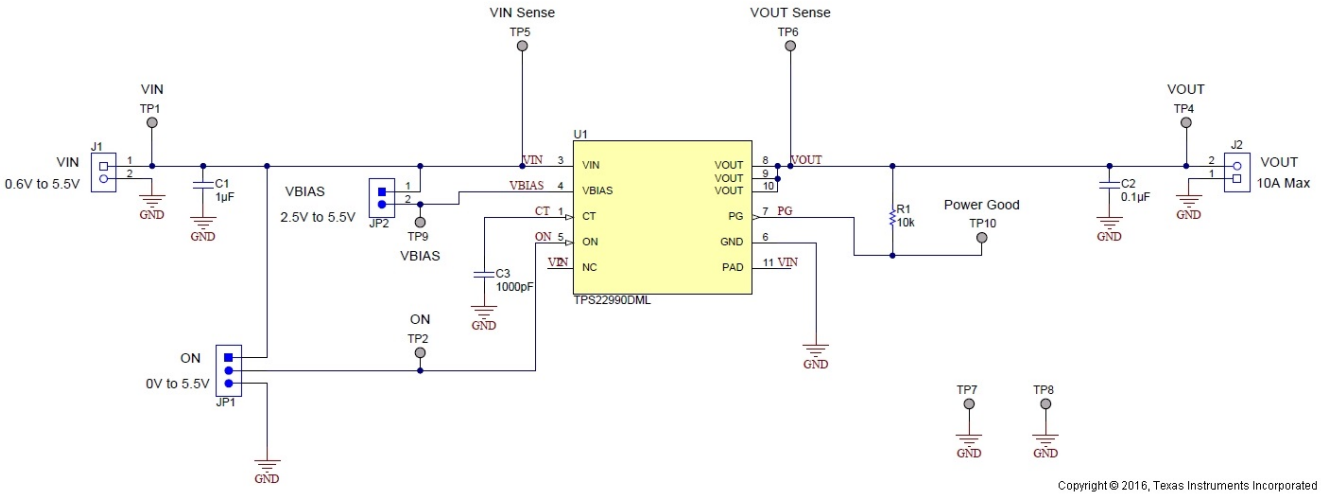

Figure 1. TPS22990 EVM Schematic

4 Layout

Figure 2 and Figure 3 show the PCB layout images.

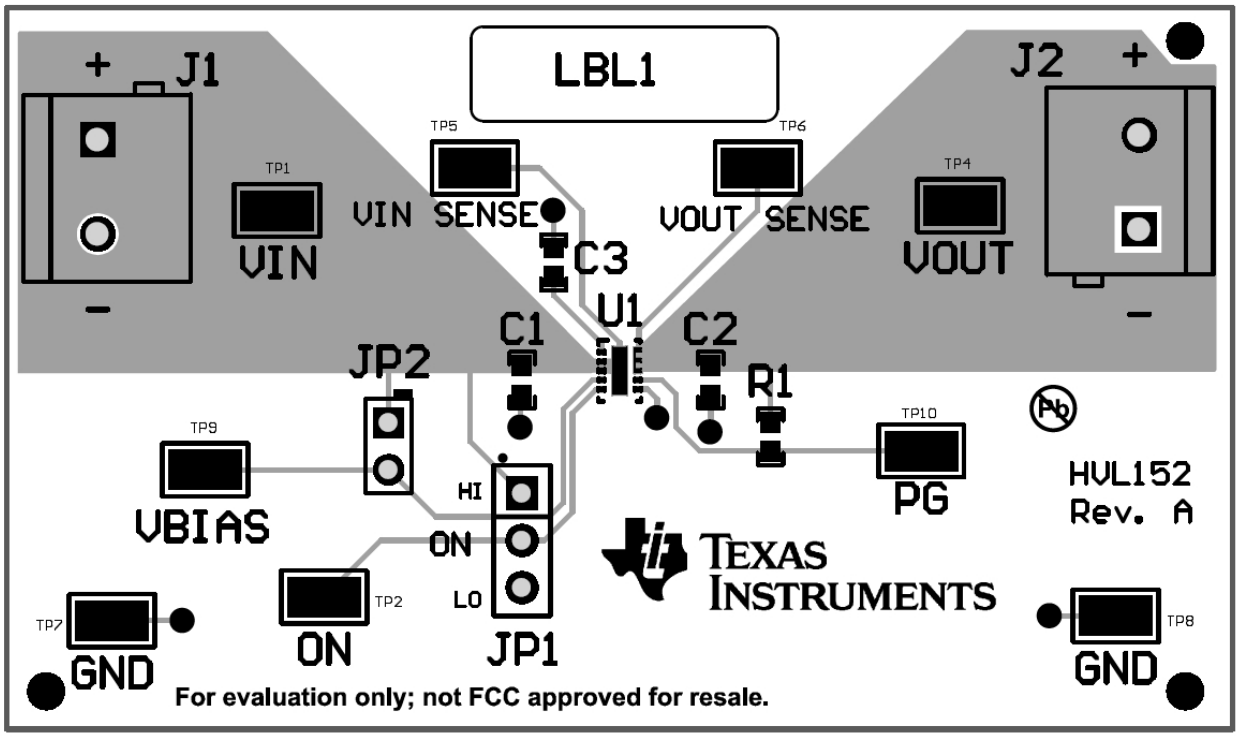

Figure 2. TPS22990 EVM Top Layout

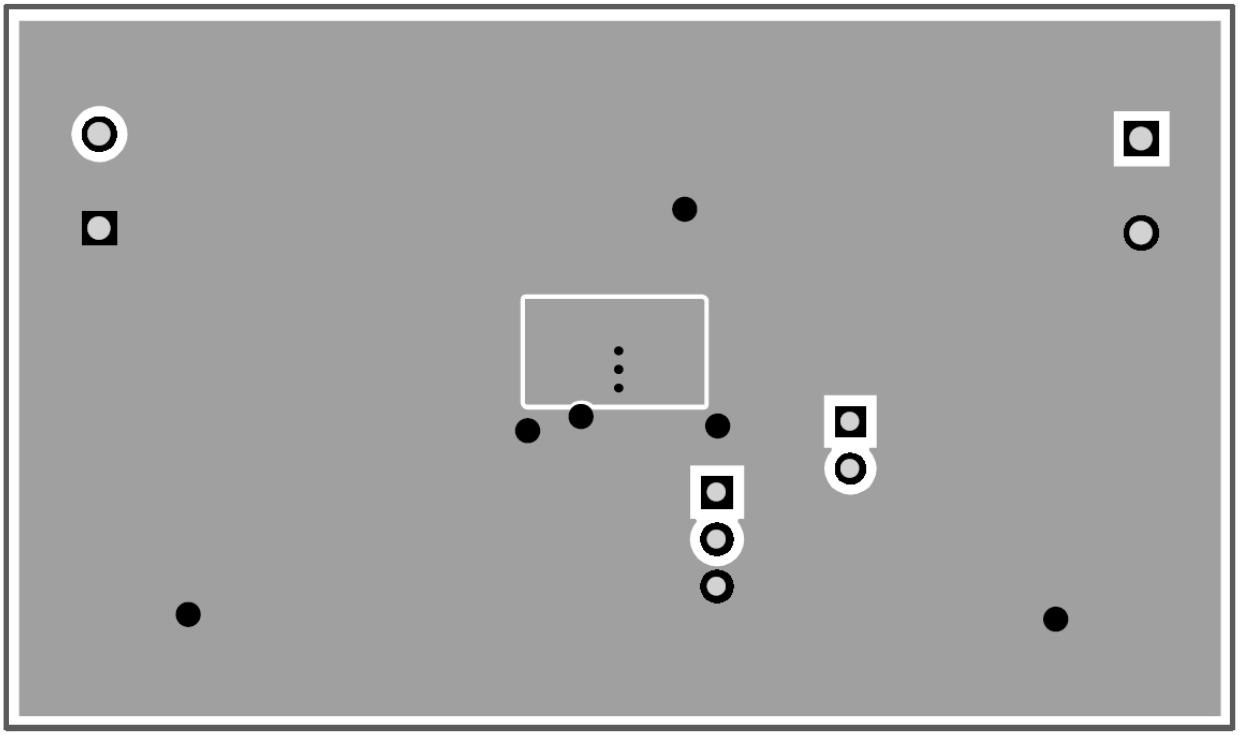

Figure 3. TPS22990 EVM Bottom Layout

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.

4.1.1 J1, TP1 – Input Connection

This is the connection for the leads from the input source. Connect the positive lead to the + terminal (VIN) and the negative lead to the – terminal (GND).

4.1.2 J2, TP4 – Output Connection

This is the connection for the output of the EVM. Connect the positive lead to the + terminal (VOUT) and the negative lead to the – terminal (GND).

4.1.3 JP1, TP2 – ON

This is the enable input for the device. A shorting jumper must be installed on JP1 in either the high or low position. The TPS22990 is active high, and ON must not be left floating. An external enable source can be applied to the EVM by removing the shunt and connecting a signal to TP2. Refer to the data sheet for proper ON and OFF voltage level settings. A switching signal may also be used and connected at this point.

4.1.4 JP2, TP9 – VBIAS Power

This jumper connects VBIAS to the VIN voltage source. VBIAS must be maintained between 2.5 V–5.5 V for proper operation on the TPS22990 device. If testing conditions involve taking the VIN voltage below 2.5 V, remove the shunt across JP2 and connect VBIAS voltage at TP9.

4.1.5 TP10 – Power Good (PG)

This test point is used to monitor the PG pin voltage which is tied to VOUT through a 10-kΩ resistor.

4.1.6 TP5 - VIN Sense, TP6 - VOUT Sense

These two connections are used when very accurate measurements of the input or output are required. Make R_{ON} measurements using these sense connections when measuring the voltage drop from VIN to VOUT.

4.1.7 TP7, TP8 – GND

These are connections to GND.

5 Operation

Connect the V_{IN} power supply to the J1 terminal (VIN). The input voltage range of the TPS22990 EVM is 0.6 V to 5.5 V.

External output loads can be applied to the switch by using the J2 terminal (VOUT). The TPS22990 EVM is rated for a maximum continuous current of 10 A. A shunt on JP1 must be installed for proper operation. When the ON pin is asserted high, the output of the TPS22990 is enabled.

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.

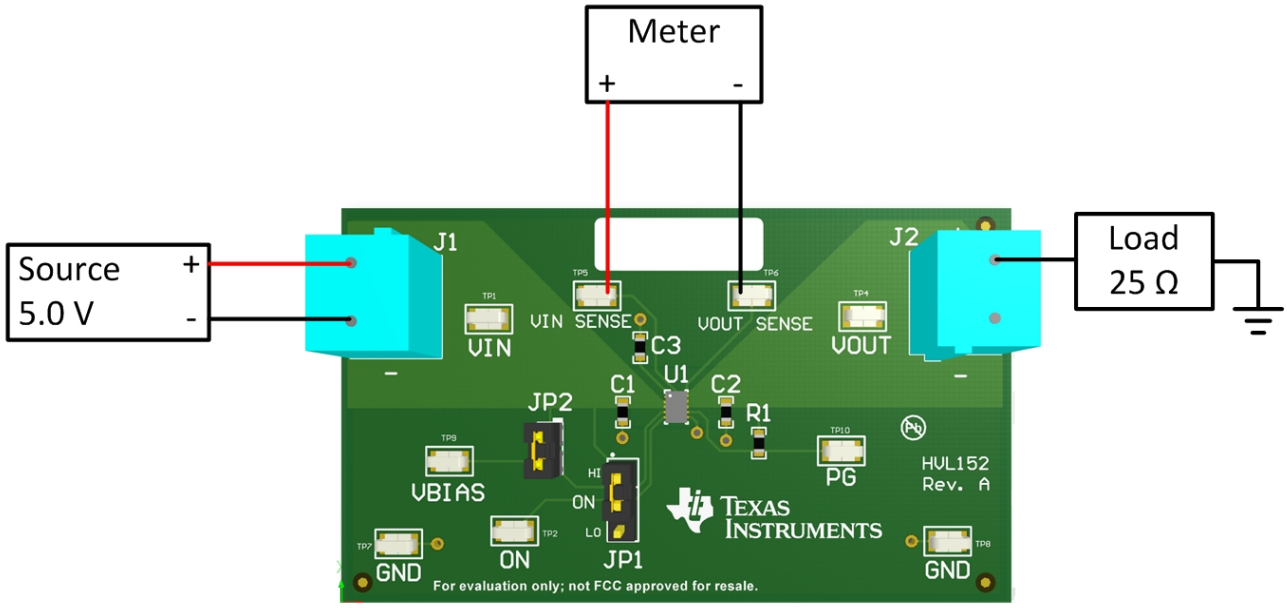

Figure 4. R_{ON} Test Setup

6.2 Rise Time Test Setup

Figure 5 shows the test setup for measuring the rise time of the TPS22990. 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 (TP6) with an oscilloscope to measure the slew rate and rise time of the switch with a given input voltage. To vary the output voltage rise time, change the default 1000-pF CT capacitor (C3). For more information on the rise time variance with CT capacitor value, refer to the TPS22990 data sheet (SLVSDK1).

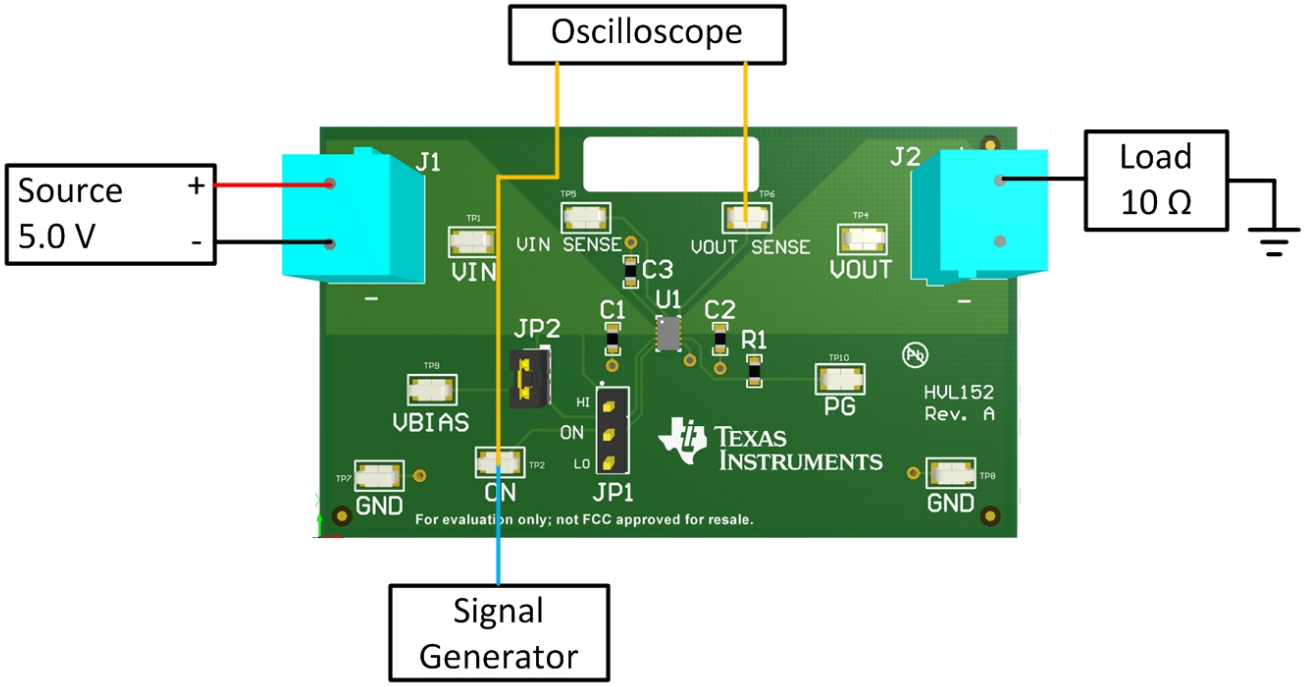

Figure 5. Rise Time Test Setup

6.3 V_{OUT} Rise Time Example

Figure 6 shows an example of a rise time measurement taken on the TPS22990 EVM.

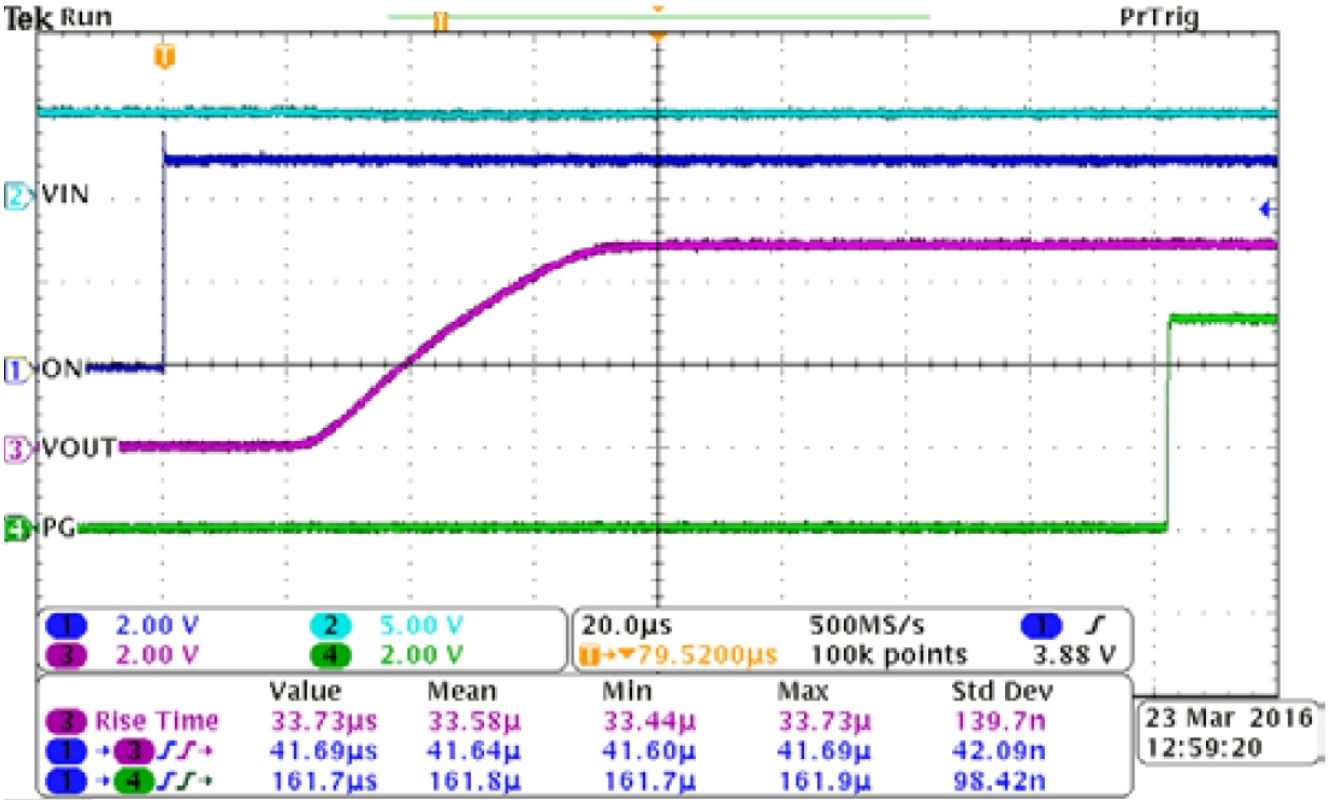

Figure 6. TPS22990 V_{OUT} t_R Example (V_{IN} = 5 V, V_{BIAS} = 5 V, CT = 0 pF, R_L = 10 Ω)

7 Bill of Materials (BOM)

Table 2 lists the EVM BOM.

Table 2. Bill of Materials TPS22990 EVM

Qty	Designator	Value	Description	Package Reference	Manufacturer	Part Number
1	!PCB		Printed Circuit Board		Any	HVL140
1	C1	1uF	CAP, CERM, 1 µF, 16 V, +/- 10%, X5R, 0603	0603	TDK	C1608X5R1C105K
1	C2	0.1uF	CAP, CERM, 0.1 µF, 25 V, +/- 10%, X7R, 0603	0603	TDK	C1608X7R1E104K
1	C3	1000pF	CAP, CERM, 1000 pF, 50 V, +/- 10%, X7R, 0603	0603	Kemet	C0603C102K5RACTU
2	J1, J2	PEC02SAAN	TERMINAL BLOCK 5.08MM VERT 2POS, TH	TERM_BLK, 2pos, 5.08mm	On-Shore Technology	ED120/2DS
1	JP1		Header, 100mil, 3x1, Gold, TH	3x1 Header	Samtec	TSW-103-07-G-S
1	JP2		Header, 100mil, 2x1, Gold, TH	Header, 2.54mm, 2x1, TH	Samtec	HMTSW-102-07-G-S-240
1	R1	10k	RES, 10 k, 5%, 0.1 W, 0603	0603	Vishay-Dale	CRCW0603300RJNEA
1	LBL1		Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	PCB Label 0.650"H x 0.200"W	Brady	THT-14-423-10
2	SH-J1, SH-J2	1x2	Shunt, 100mil, Gold plated, Black	Shunt	3M, Alternate: Samtec	969102-0000-DA, Alternate: SNT-100-BK-G
9	TP1, TP2, TP4, TP5, TP6, TP7, TP8, TP9, TP10		Test Point, Miniature, SMT	Test Point, Miniature, SMT	Keystone	5019
1	U1		5.5 V, 10 A, 4.4 mW On-Resistance Load Switch, DML0010A	DML0010A	Texas Instruments	TPS22990xDML
0	FID1, FID2, FID3		Fiducial mark. There is nothing to buy or mount.	Fiducial	N/A	N/A

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