TPS22976 Evaluation Module

The TPS22976EVM evaluation module (EVM) features the TPS22976 load switch. The evaluation module allows the user to connect power to and control the 14-pin DPU package load switch. Parameters such as the on-resistance, rise time, and output pull-down resistance can be easily and accurately evaluated. Table 1 lists a short description of the TPS22976 load switch performance specifications; for additional details on load switch performance, application notes, and the data sheet, see www.ti.com/loadswitch.

Table 1. TPS22976 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
HVL151	TPS22976	Adjustable	0.6 to 5.7	6	Active High	Y

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1 Introduction

1.1 Description

The TPS22976EVM is a two-layer PCB containing the TPS22976 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 5.7 V
- Access to the VIN, VOUT, CT, VBIAS, GND, and ON pins of the TPS22976 load switch device
- Onboard C_{IN}, C_{OUT}, and CT capacitors
- 6-A maximum continuous current operation

2 Electrical Performance

Refer to the TPS22976 data sheet (SLVSDE7) for detailed electrical characteristics of the TPS22976.

3 Schematic

Figure 1 illustrates the TPS22976EVM schematic.

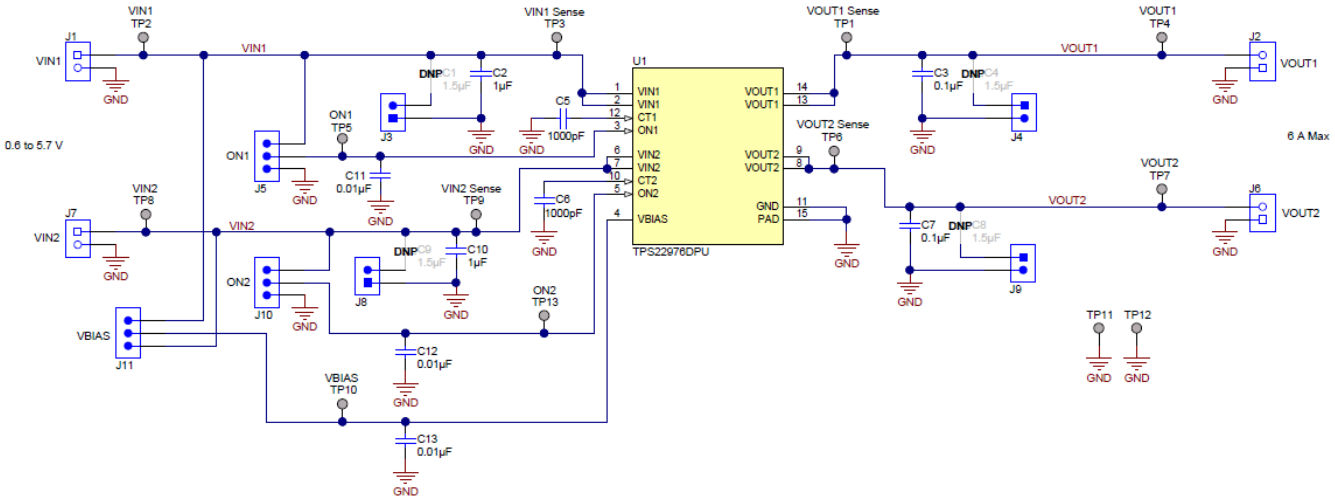


Figure 1. TPS22976EVM Schematic

4 Layout

Figure 2 and Figure 3 show the TPS22976EVM PCB layout images.

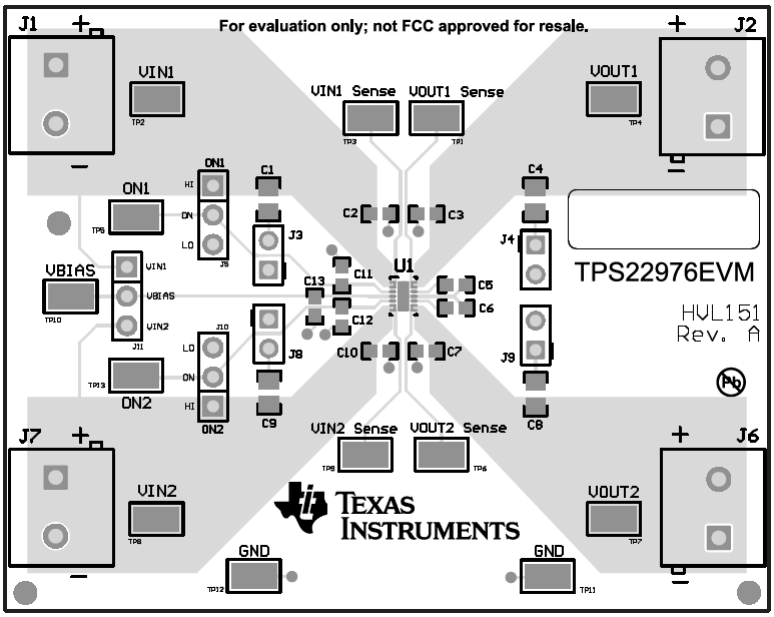


Figure 2. TPS22976EVM Top Layer

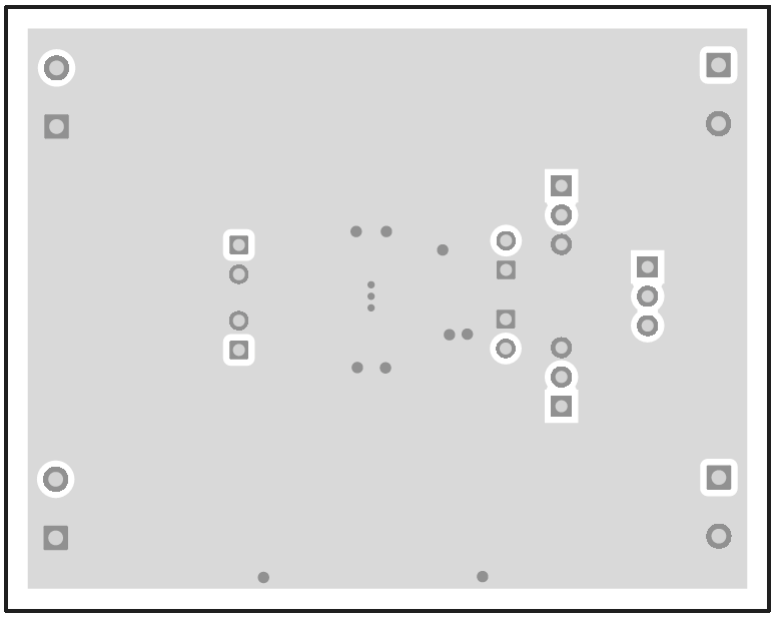


Figure 3. TPS22976EVM Bottom Layer

4.1 Setup (Channel 1 / Channel 2)

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, TP2 / J7, TP8 – Input Connections

These are the connections 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 / J6, TP7 – Output Connections

These are the connections 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 J5, TP5 / J10, TP13 – ON

This is the enable input for the device. A shorting jumper can be installed on J5/J10 in either the high or low position. The TPS22976 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 TP5/TP13. Refer to the TPS22976 data sheet (SLVSDE7) for proper ON and OFF voltage level settings. A switching signal may also be used and connected at this point.

4.1.4 TP3/TP9 - VIN Sense, TP1/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.

4.1.5 J11, TP10 – VBIAS

This is the VBIAS input for the device. A shorting jumper can be connected across J11 to connect the VIN of either channel to VBIAS. An external source can be applied to VBIAS by removing the jumper and connecting a supply to TP10. Please refer to the TPS22976 data sheet (SLVSDE7) for proper VBIAS voltage level settings.

4.1.6 J4 / J9 – Output capacitor (Optional)

A shorting jumper can be placed across J4/J9 to enable the use of optional output capacitor C4/C8 (not provided).

4.1.7 TP11, TP12 – GND

These are connections to GND.

5 Operation

Connect the VIN power supply to the J1/J7 terminal (VIN). Connect the negative lead of the power supply to TP11/TP12 (GND). The input voltage range of the TPS22976EVM is 0.6 V to 5.7 V.

External output loads can be applied to the switch by using the J2/J6 terminal (VOUT). The TPS22976EVM is rated for a maximum continuous current of 6 A. When the ON pin is asserted high, the output of the TPS22976 is enabled.

6 Test Configurations

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

Figure 4 shows the typical setup for measuring on-resistance. Connect the desired VBIAS to the the VBIAS test point. It is recommended that VBIAS is greater than VIN for best on-resistance performance. 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.

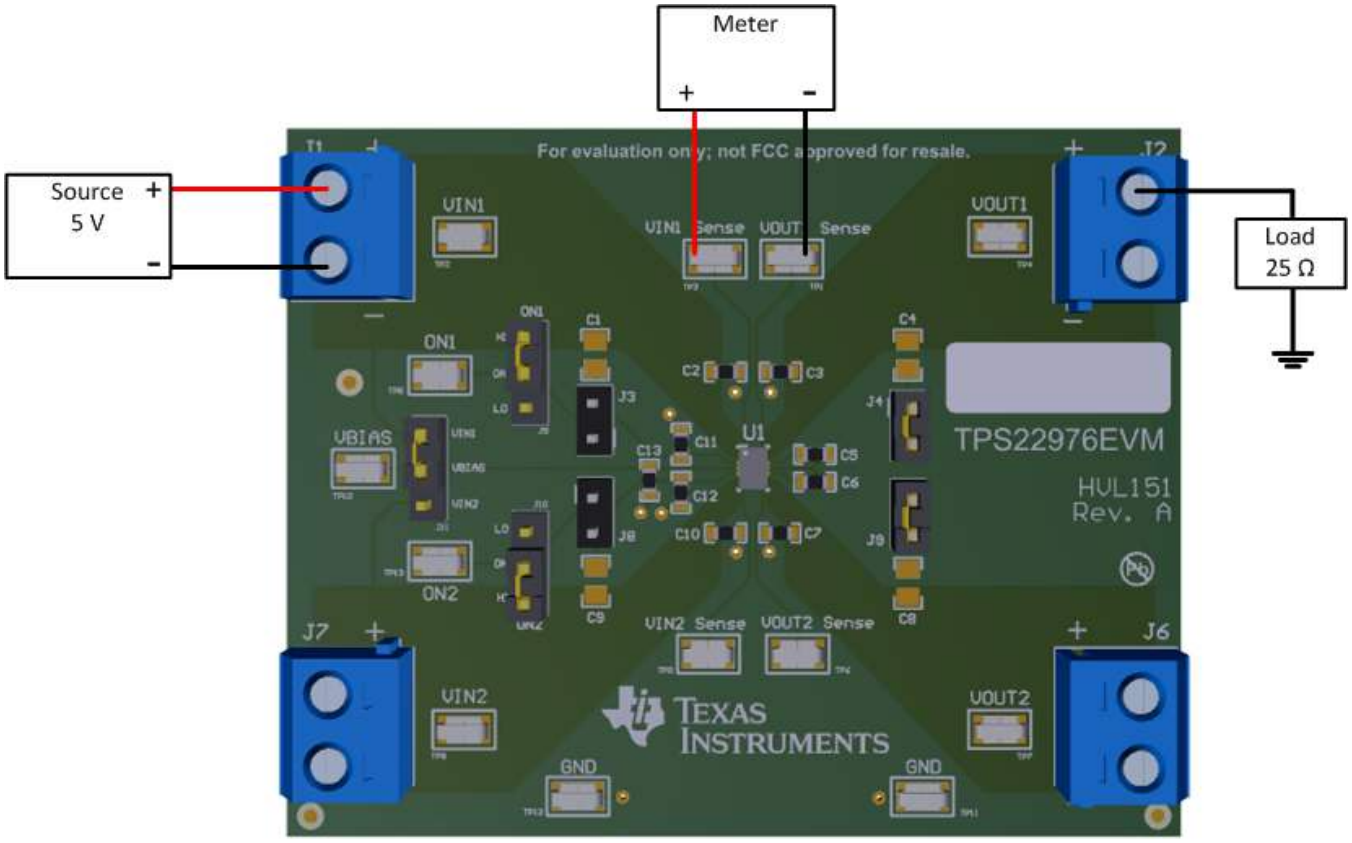


Figure 4. R_{ON} Test Setup

6.2 Rise Time Test Setup

Figure 5 shows the test setup for measuring the rise time of the TPS22976. 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 (TP1/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 capacitors (C5/C6). For more information on the rise time variance with CT capacitor value, refer to the TPS22976 data sheet (SLVSDE7).

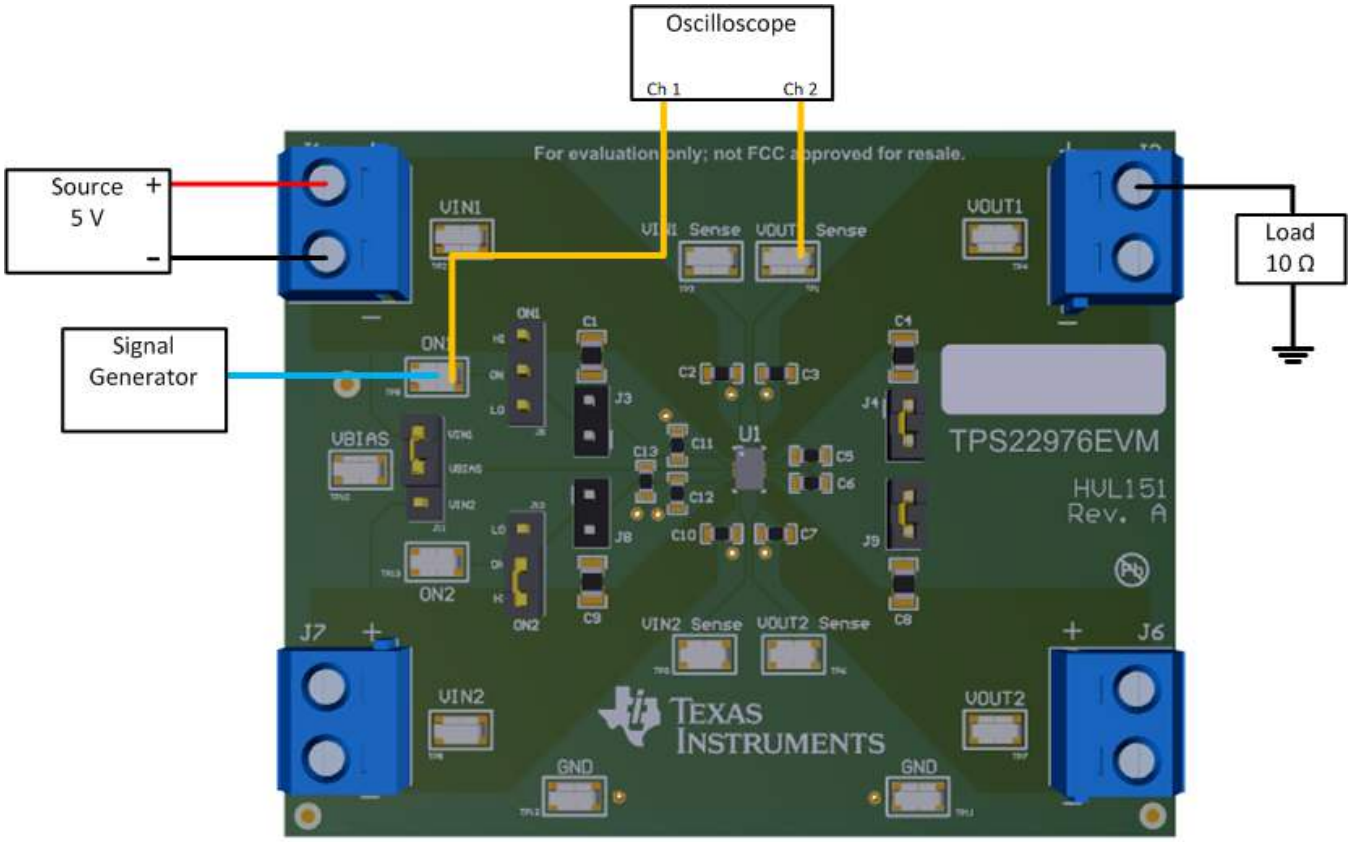
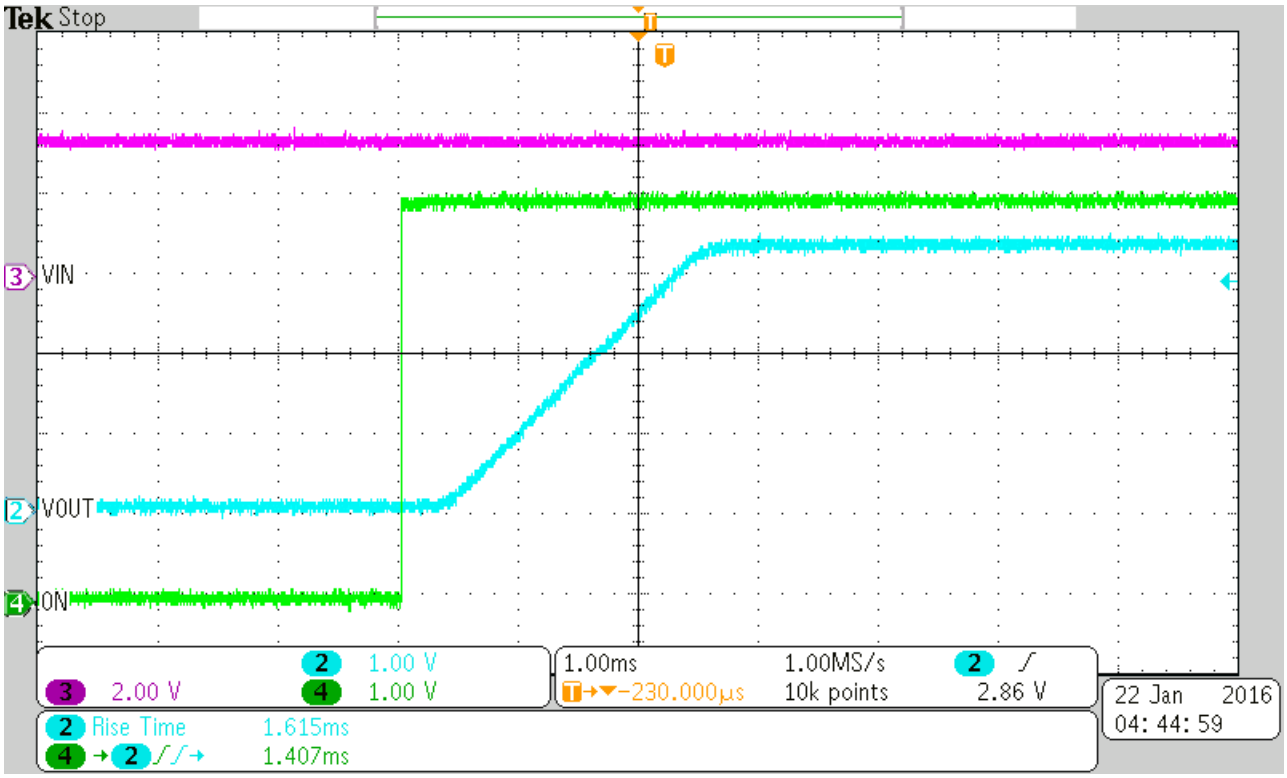


Figure 5. Rise Time Test Setup

6.3 V_{OUT} Rise Time Example

Figure 6 shows an example of a rise time measurement taken on the TPS22976EVM.



V_{IN} = 3.3 V CT = 1000 pF R_L = 10 Ω

Figure 6. TPS22976 V_{OUT} t_R Example

7 Bill of Materials (BOM)

Table 2 lists the EVM BOM for the TPS22976.

Table 2. Bill of Materials - TPS22976

Qty	Designator	Value	Description	Package Reference	Manufacturer	Part Number
1	!PCB		Printed Circuit Board		Any	HVL151
4	C1, C4, C8, C9	DNP	DNP	0805	Any	N/A
2	C2, C10	1 uF	CAP, CERM, 1 µF, 16 V, ±10%, X7R, 0603	0603	Wurth Electronik	885012206052
2	C3, C7	0.1 uF	CAP, CERM, 0.1 µF, 25 V, ±5%, X7R, 0603	0603	Wurth Electronik	885012206071
2	C5, C6	1000 pF	CAP, CERM, 1000 pF, 50 V, ±10%, X7R, 0603	0603	Kemet	C0603C102J5GAC
4	J1, J2, J6, J7	2×1	Terminal Block, 5.08 mm, 2×1, Brass, TH	2×1 5.08 mm Terminal Block	On-Shore Technology	ED120/2DS
4	J3, J4, J8, J9	2×1	Header, 100 mil, 2×1, Tin, TH	Header, 2 PIN, 100 mil, Tin	Sullins	PEC02SAAN
3	J5, J10, J11	3×1	Header, 100 mil, 3×1, Gold, TH	3×1 Header	Sullins	PBC03SAAN
5	SH-J1, SH-J2, SH-J3, SH-J4, SH-J5	2×1	Shunt, 100 mil, Gold plated, Black	Shunt	3M, Alternate: Samtec	969102-0000-DA, Alternate: SNT-100-BK-G
13	TP1, TP2, TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP11, TP12, TP13		Test Point, Miniature, SMT	Test Point, Miniature, SMT	Keystone	5019
1	U1		5.7-V, 6-A, 16-mΩ On-Resistance Dual-channel Load Switch, DPU0014A	DPU0014A	Texas Instruments	TPS22976DPU
0	FID1, FID2, FID3		Fiducial mark. There is nothing to buy or mount.	Fiducial	N/A	N/A
1	LBL1		Thermal Transfer Printable Labels, 0.650" W × 0.200" H	PCB Label 0.650"H × 0.200"W	Brady	THT-14-423-10

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- *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.*
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