TPS22967EVM-023 Single 4A Load Switch

The TPS22967EVM-023 evaluation module contains a single channel, ultra low ON resistance, 4-A load switch with controlled turn-on and adjustable rise time

Contents

1 Description

The TPS22967 is a small, ultra-low ON-resistance (R_{ON}) single channel load switch with controlled turn on. The device contains a low $Rds_{(ON)}$ N-channel MOSFET that can operate over an input voltage range of 0.8 V to 5.5 V and can support a maximum continuous current of up to 4-A. The switch is controlled by an active high on/off input (ON), which is capable of interfacing directly with low-voltage GPIO control signals.

In the TPS22967, a 225-Ω on-chip load resistor is added for quick output discharge (QOD). When the switch is turned off, the output of the switch is discharged to ground through the 225-Ω load resistor. The rise time of the device is internally controlled in order to avoid in-rush current and can be adjusted using an external ceramic capacitor on the CT pin.

The TPS22967 is available in a small, space-saving 2mm x 2mm 8-pin SON package with integrated thermal pad allowing for high power dissipation.

1.1 *Typical Applications*

- Ultrabooks™
- Notebooks/Netbooks
- Tablet PC
- Consumer Electronics
- Set-top Boxes/Residential Gateways
- Industrial Systems
- Telecom Systems
- Solid State Drivers (SSD)

1.2 *Features*

- Integrated single channel load switch
- Input voltage range: 0.8V to 5.5V
- Ultra-low on-resistance (22 mΩ typical)
- 4A maximum continuous switch current
- Low threshold control input
- Adjustable slew-rate control
- Quick Output Discharge transistor
- SON 8-pin package with thermal pad

2   Electrical Performance Specifications

ELECTRICAL CHARACTERISTICS

Unless otherwise noted, the specification in the following table applies over the operating ambient temperature **–40°C ≤ T$_A$ ≤ 85°C** (Full) and **V$_{BIAS}$ = 5.0 V**. Typical values are for T$_A$ = 25°C.

PARAMETER		TEST CONDITIONS		T$_A$	MIN	TYP	MAX	UNIT
POWER SUPPLIES AND CURRENTS								
I$_{IN(VBIAS-ON)}$	V$_{BIAS}$ quiescent current	I$_{OUT}$ = 0, V$_{IN}$ = V$_{ON}$ = V$_{BIAS}$ = 5.0 V		Full		50	75	µA
I$_{IN(VBIAS-OFF)}$	V$_{BIAS}$ shutdown current	V$_{ON}$ = GND, V$_{OUT}$ = 0 V		Full			2	µA
I$_{IN(VIN-OFF)}$	V$_{IN}$ off-state supply current	V$_{ON}$ = GND, V$_{OUT}$ = 0 V	V$_{IN}$ = 5.0 V	Full		0.2		µA
			V$_{IN}$ = 3.3 V			0.02		
			V$_{IN}$ =1.8 V			0.01		
			V$_{IN}$ = 0.8 V			0.005		
I$_{ON}$	ON pin input leakage current	V$_{ON}$ = 5.5 V		Full			0.5	µA
RESISTANCE CHARACTERISTICS								
R$_{ON}$	ON-state resistance	I$_{OUT}$ = –200 mA, V$_{BIAS}$ = 5.0 V	V$_{IN}$ = 5.0 V	25°C		22	33	mΩ
				Full			35	
			V$_{IN}$ = 3.3 V	25°C		22	33	mΩ
				Full			35	
			V$_{IN}$ = 1.8 V	25°C		22	33	mΩ
				Full			35	
			V$_{IN}$ = 1.5 V	25°C		22	33	mΩ
				Full			35	
			V$_{IN}$ = 1.2 V	25°C		22	33	mΩ
				Full			35	
			V$_{IN}$ = 0.8 V	25°C		22	33	mΩ
				Full			35	
R$_{PD}$	Output pulldown resistance	V$_{IN}$ = 5.0 V, V$_{ON}$ = 0 V, I$_{OUT}$ = 15 mA		Full		225	300	Ω

Users may refer to Datasheet Document SLVSC42 for additional Electrical Specifications.

3 Schematic
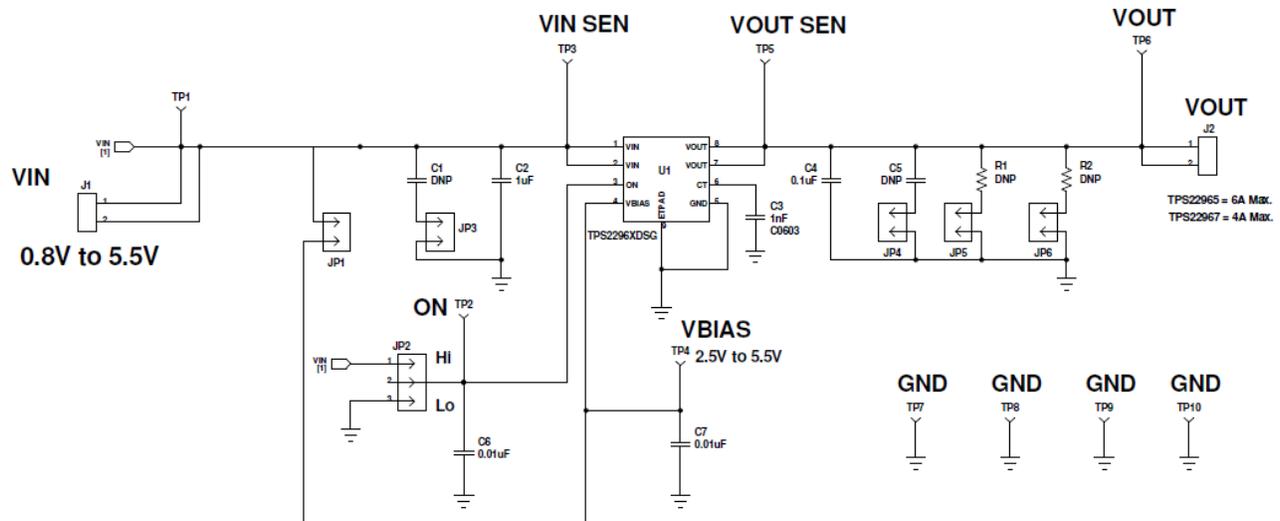
Figure 1. TPS22967EVM-023 Schematic

4 List of Test Points

Table 1. The Functions of Each Test Points

Test Points	Name	Description
J1	VIN	DC Input to VIN
J2	VOUT	VOUT Connection
JP1	VBIAS	Connects VBIAS to VIN
JP2	ON	Connects ON to VIN or GND
JP3	C1	Connects C1 to VIN
JP4	C5	Connects C5 to VOUT
JP5	R1	Connects R1 to VOUT
JP6	R2	Connects R2 to VOUT
TP1	VIN	VIN of TPS22967
TP2	ON	ON of TPS22967
TP3	VIN SEN	Sense connect to VIN of TPS22967
TP4	VBIAS	VBIAS of TPS22967
TP5	VOUT SEN	Sense connect to VOUT of TPS22967
TP6	VOUT	VOUT of TPS22967
TP7	GND	Ground Connection
TP8	GND	Ground Connection
TP9	GND	Ground Connection
TP10	GND	Ground Connection

5 Layout
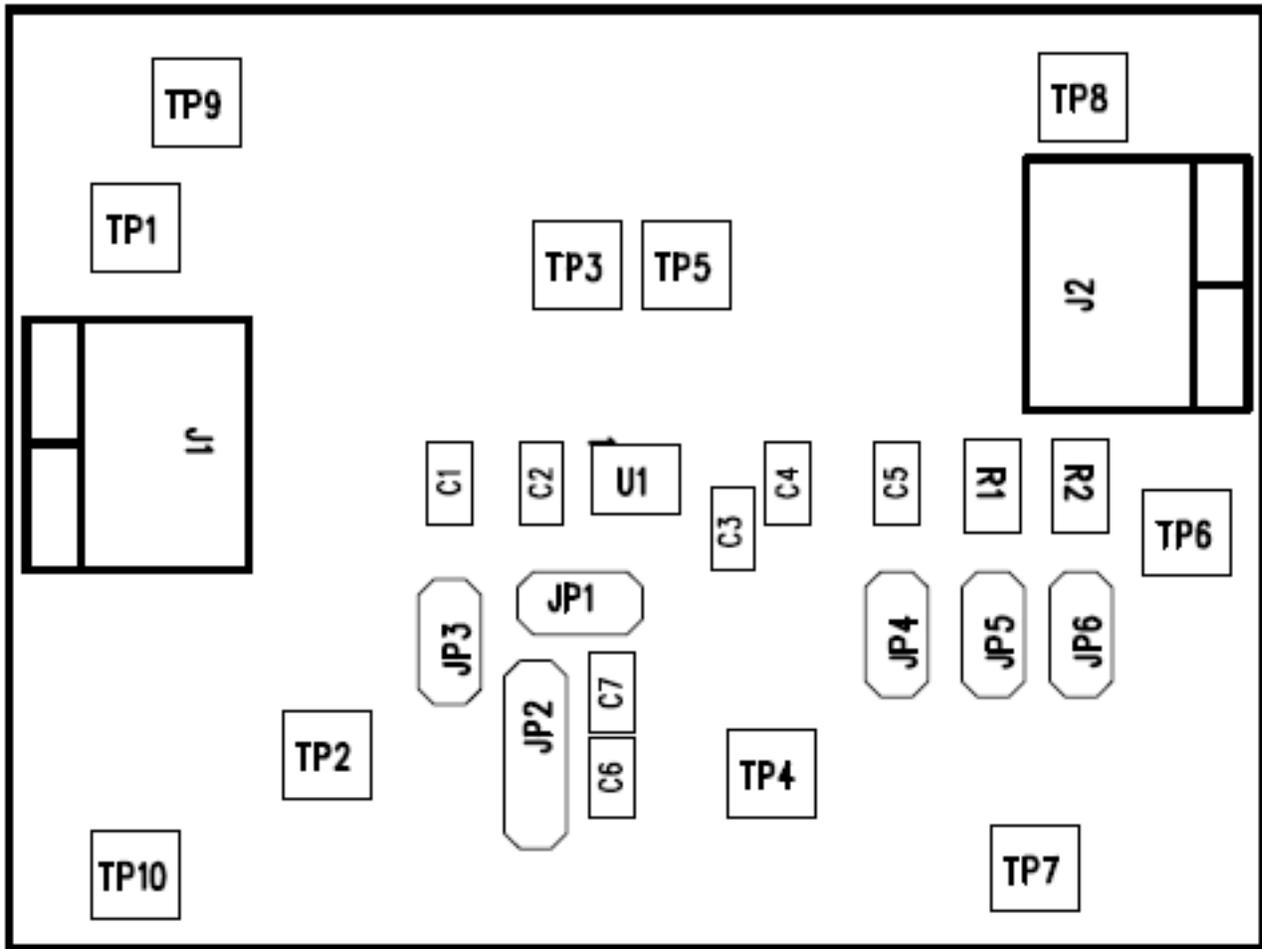
Figure 2. TPS22967EVM-023 Top Assembly
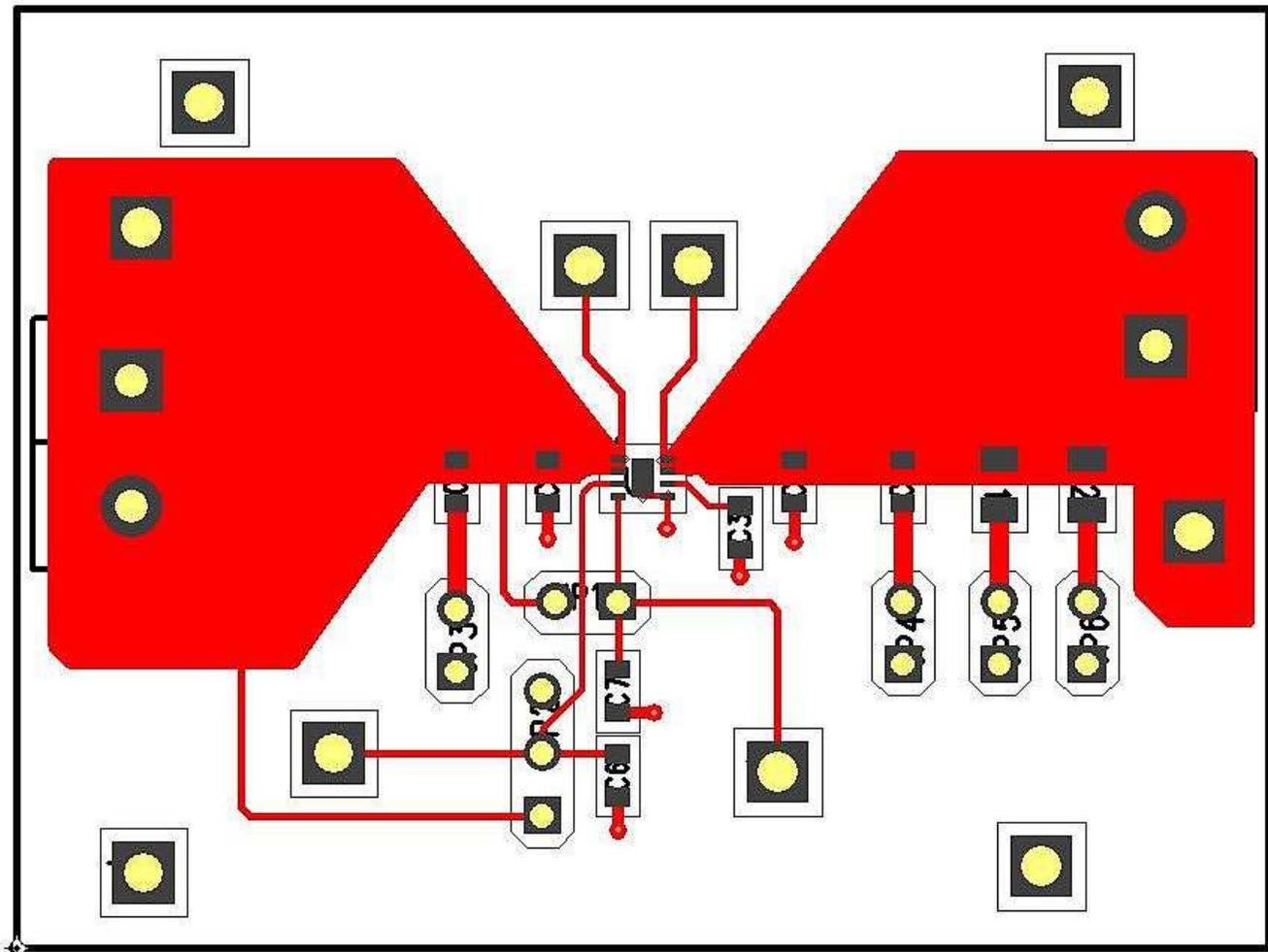
Figure 3. TPS22967EVM-023 Topside
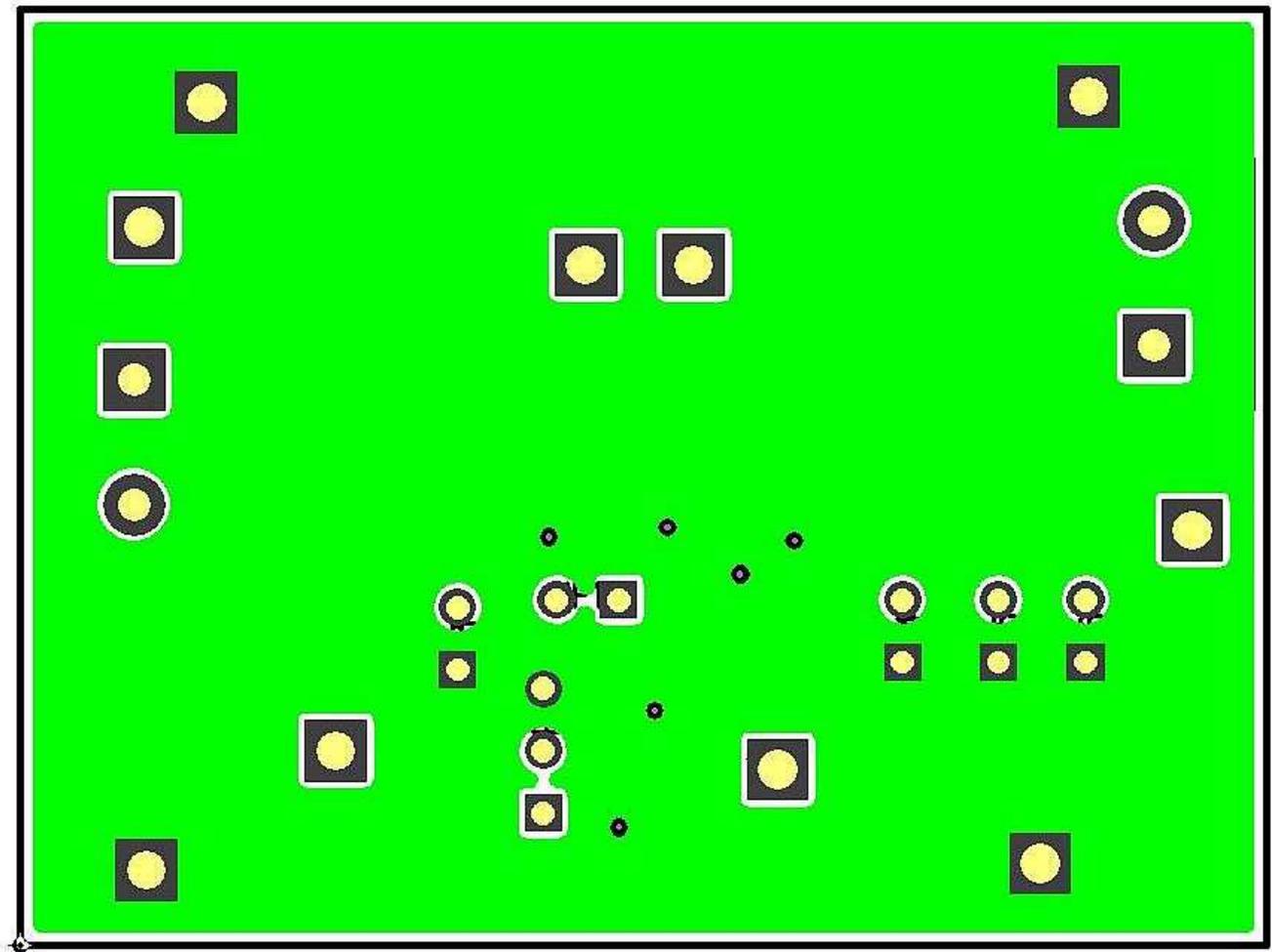
Figure 4. TPS22967EVM-023 Bottomside

5.1 Typical Test Setups
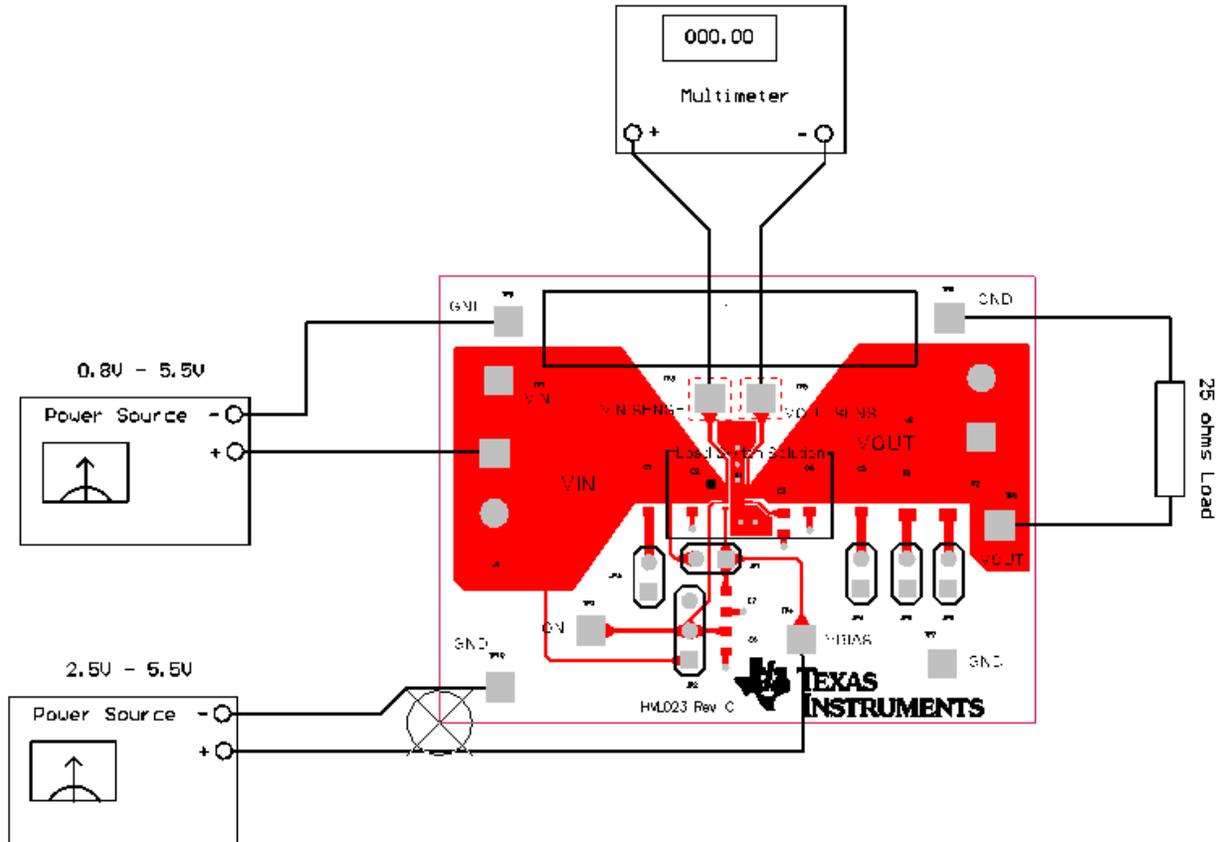
Figure 5. TPS22967EVM-023 Recommended Ron Test Set Up
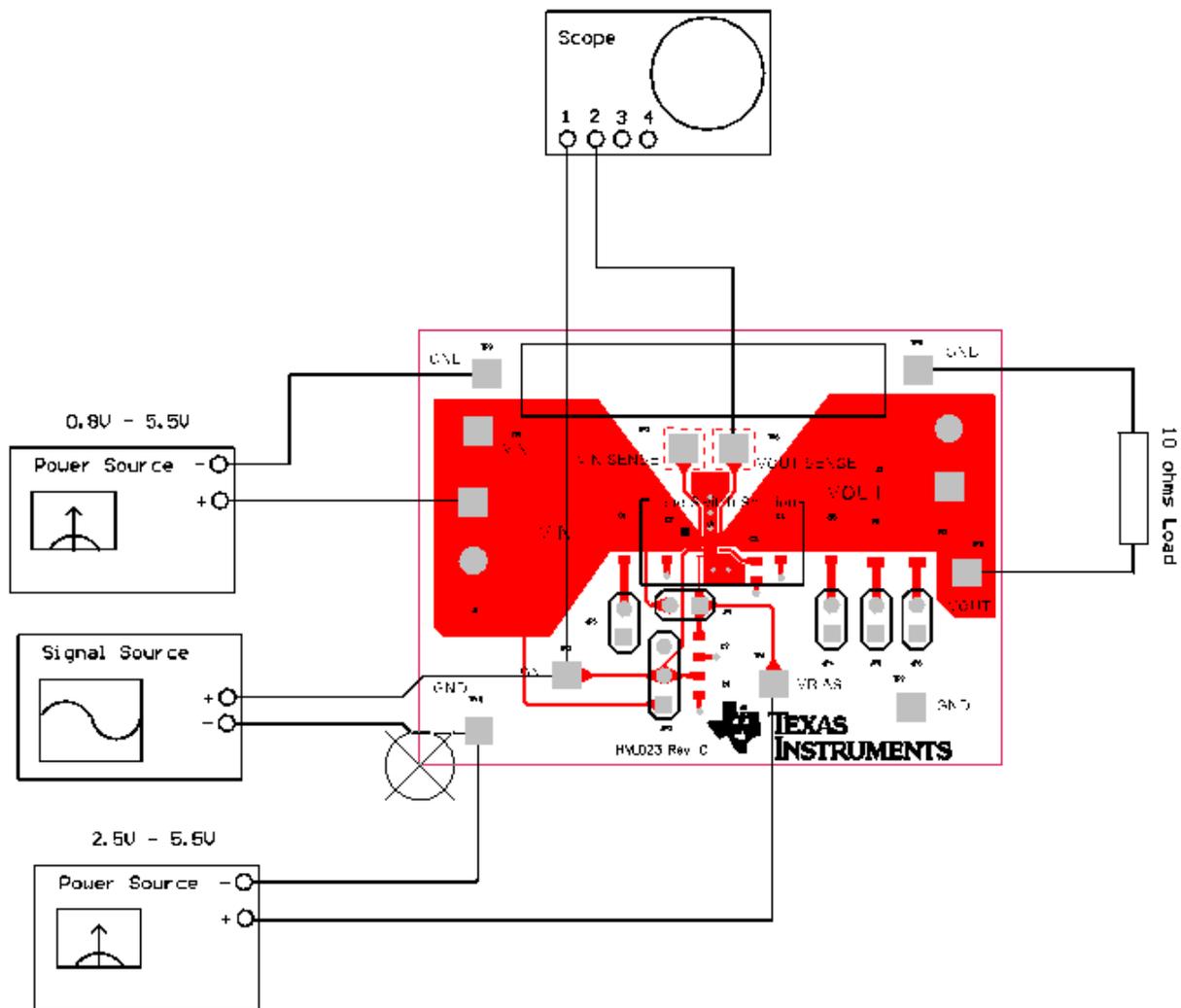
Figure 6. TPS22967EVM-023 Recommended Rise Time Test Set Up

5.2 Test Setup Equipment List

- **Voltage Source:**
  - 1 Power Source capable of 10V 10A.
- **Multimeters:**
  - 2 voltmeters
- **Output Loads:**
  - Electronic Load or Resistor(If testing 4A operation of the switch at 5.5V a 22W power rated resistor is needed)
- **Oscilloscope:**
  - 2 channel 100MHz
- **Signal Generator:**
  - Dual Channel Preferred
- **Recommended Wire Gauge:** 18 AWG

5.3 Test Procedure (Standalone Setup)

Figure 5 shows a typical setup for R_{ON} testing of the EVM. VBIAS voltage must be present for the device to function. Place a shunt across JP1 to connect VBIAS to VIN voltage source, if VIN supply is used below 2.5V remove the shunt and connect VBIAS voltage to a voltage source greater or equal to 2.5V.

5.4 R_{ON} Test Procedure

1. Setup the EVM per Figure 5.
2. Set SOURCE1 level to 5.0V.
3. Place a shunt on JP2 shorting pins 1 to 2. This connects ON to VIN voltage, ON voltage must be between 1.2V and 5.5V for a valid ON state. (When testing R_{ON} it is desired to have the switch operating in the always ON condition.)
4. Place a load on VOUT.
5. Turn on SOURCE1.
6. Record the voltage reading from Meter1, record the input current reading from Source1. Calculate R_{ON} by dividing Meter1 voltage level by the current reading from Source1. The results will be the R_{ON} value for the Switch.
7. Turn off Source1.

5.5 Trise/Ton Tfall/Toff Test Procedure

1. Set up the EVM per Figure 6.
2. Set SOURCE1 level to 5.0V VBIAS is operational between 2.5V and 5.25V, Datasheet limits are specified with VBIAS set at 5.0V.
3. Remove shunt from JP2.
4. Place a load on VOUT1 (a 10Ω 3.25W resistor is recommended for this test).
5. Set signal generator outputs to 0-2Vpp levels, 10–100Hz, and 25% duty cycle. Connect signal generator output to TP2.
6. Turn on SOURCE1.
7. Turn ON the signal generator output.
8. Trise and Ton can be observed from the oscilloscope channel2. A detailed description of t_R, t_{ON}, t_F, and t_{OFF} are listed in the TPS22967 Datasheet under the Switching Characteristics Section.
9. Turn off Source1, and the signal generator output.

6 Performance Data and Typical Characteristic Curves

Figure 7 through Figure 8 present typical performance curves for TPS22967EVM-023.

6.1 Trise/Tfall Curves
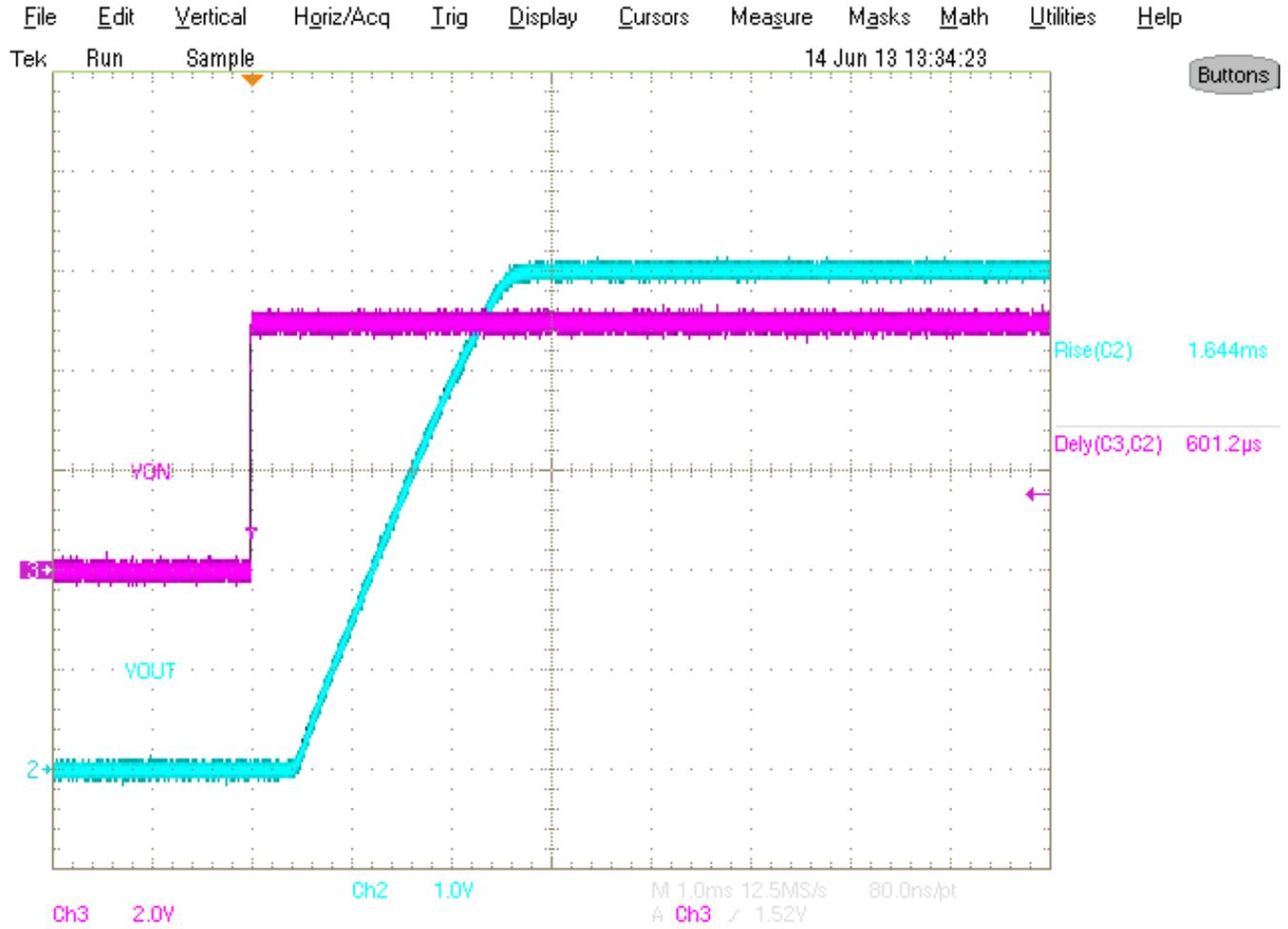
**Figure 7. TPS22967EVM-023 Trise/Ton VIN=5V VBIAS=5V ct=1nF Load =10Ω.**
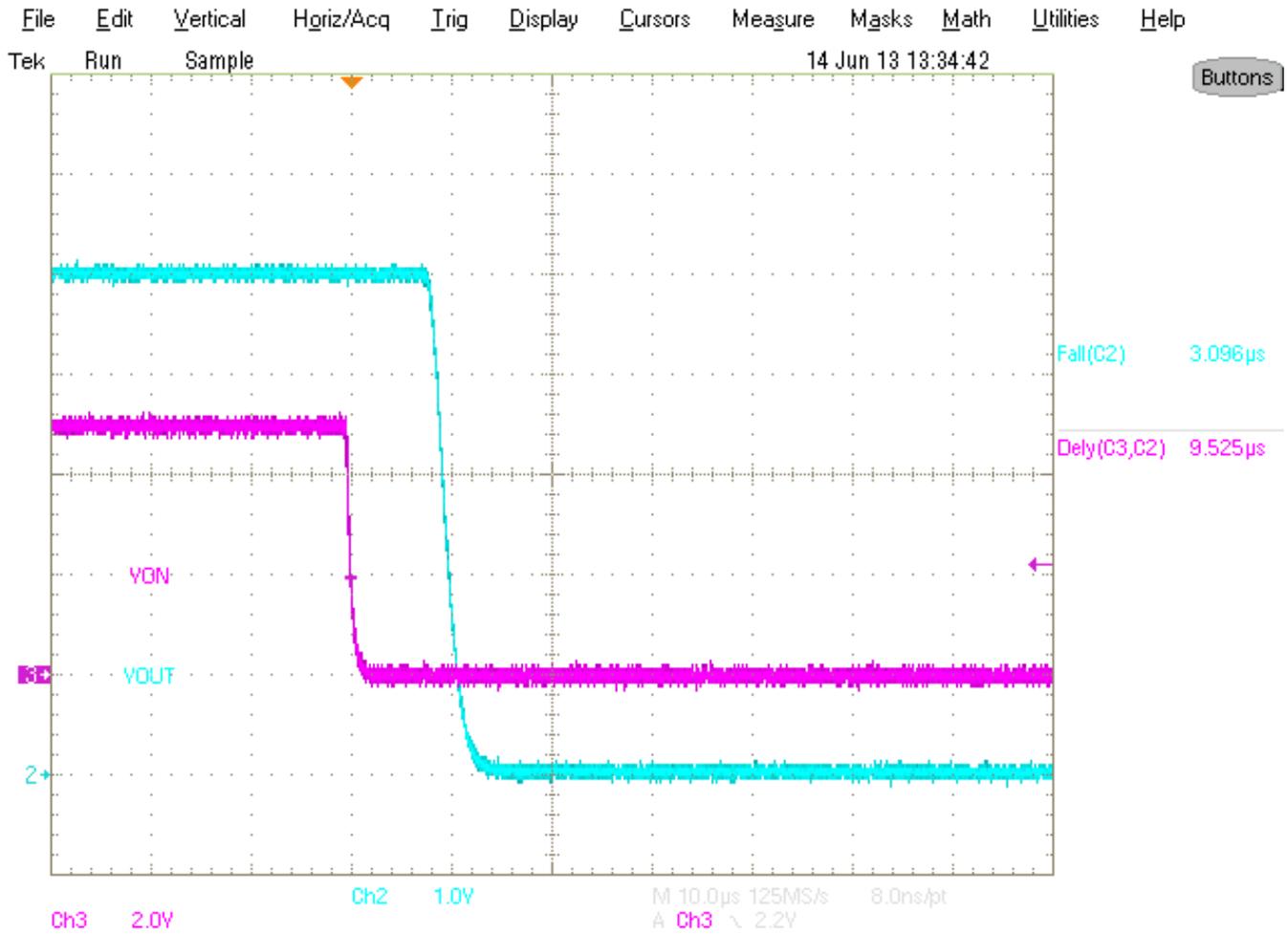
Figure 8. TPS22967EVM-023 Tfall/Toff VIN=5V VBIAS=5V ct=1nF Load =10Ω.

7   Bill of Materials

Table 2 shows the EVM components list according to the schematic shown in Figure 1.

Table 2. EVM Components List

-002 Count	RefDes	Value	Description	Size	Part Number	MFR
0	C1, C5	DNP	Capacitor, Ceramic, 25V, X7R, 20%	0603	Std	Std
1	C2	1 µF	Capacitor, Ceramic, 25V, Y5R, 20%	0603	GRM188F51E105ZA12D	Murata
1	C3	1 nf	Capacitor, Ceramic, 50V, X7R, 10%	0603	ECJ-1VB1H102K	Panasonic
1	C4	0.1 µF	Capacitor, Ceramic, 50V, Y5R, 20%	0603	GRM188F51H104ZA01D	Murata
2	C6, C7	0.01 µF	Capacitor, Ceramic, 50V, X7R, 10%	0603	0603B103K500BT	Vishay
2	J1, J2	ED120/2DS	Terminal Block 2-pin, 15-A, 5.1mm	0.40 x 0.35 inch	ED120/2DS	OST
5	JP1, JP3, JP4, JP5, JP6	PEC02SAAN	Header, Male 2-pin, 100mil spacing	0.100 inch x 2	PEC02SAAN	Sullins
1	JP2	PEC03SAAN	Header, Male3-pin, 100mil spacing	0.100 inch x 3	PEC03SAAN	Sullins
0	R1, R2	DNP	Resistor, Chip, 1.16W, x%	0805	Std	Std
6	TP1, TP2, TP3, TP4, TP5, TP6	5010	Test Point, Red, Thru Hole Compact Style	0.125 x 0.125 inch	5005	Keystone
4	TP7, TP8, TP9, TP10	5011	Test Point, Black, Thru Hole Compact Style	0.125 x 0.125 inch	5006	Keystone
0	U1	TPS22965DSG	IC, 6-A Load Switch with Controlled Turn-on	SON-8	TPS22965DSG	TI
1	U1	TPS22967DSG	IC, 4-A Load Switch with Controlled Turn-on	SON-8	TPS22967DSG	TI
2			Shunt, Black	100-mil	929950-00	3M
1	—		PCB, 2 In x 1.5 In x 0.062 In		HVL023	Any
1	NA		Label (see Note 5)	1.25 x 0.25 inch	THT-13-457-10	Brady

IMPORTANT NOTICE

Products		Applications	
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Amplifiers	amplifier.ti.com	Communications and Telecom	www.ti.com/communications
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