User's Guide

TPS25961EVM: Evaluation Module for TPS25961 eFuse

ABSTRACT

This user's guide describes the evaluation module (EVM) for the TPS25961 eFuse. The TPS25961 device is a 2.7-V to 19-V, 2-A eFuse with overcurrent protection, inrush current protection, programmable undervoltage and overvoltage protection.

	Caution	Caution Hot surface. Contact may cause burns. Do not touch!

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Trademarks

1 Introduction

The *TPS25961EVM eFuse Evaluation Board* allows reference circuit evaluation of the Texas Instruments (TI) TPS25961 eFuse. The TPS25961 device is a 2.7-V to 19-V, 2-A eFuse with overcurrent protection, inrush current protection, programmable undervoltage and overvoltage protection.

1.1 EVM Features

General TPS25961EVM eFuse evaluation board features include:

- 2.7-V to 19-V (typical) operation
- 0.1-A to 2-A programmable current limit using onboard jumpers
- Programmable current limit
- TVS diode for input transient protection
- Onboard Schottky diode at output prevents negative spike during overcurrent faults

1.2 EVM Applications

This EVM can be used on the following applications:

- Adapter Input Protection
- Set-top boxes
- Smart speakers
- Wireless earphones
- Video surveillance
- Energy Meters

2 Description

The TPS25961EVM eFuse Evaluation Board has one channel and enables evaluation of the TPS25961 eFuse. Channel 1 is standalone channel and provides programmable OVLO and ILM settings. The input power is applied at connector J1 while J5 provides the output connection. Refer to the schematic in Figure 3-1 and EVM test setup in Figure 5-1. TVS diode D1 provides input protection from transient overvoltages, while Schottky diode D3 provides output protection for the TPS25961 eFuse.

S1 allows U1 to be RESET or disabled.

Table 2-1. TPS25961EVM eFuse Evaluation Board Options and Setting

EVM Function	Channel	Vin UVLO Threshold	Vin OVLO Threshold	Current Limit	
				Low Setting	Hi Setting
2.7-V to 19-V, 2-A eFuse	CH1	10.84 V	Selectable OVLO –fixed 5.9 V, programmable 13.76 V Note: UVLO must be less than OVLO threshold.	0.1 A	2 A

3 Schematic

Figure 3-1 illustrates the EVM schematic.

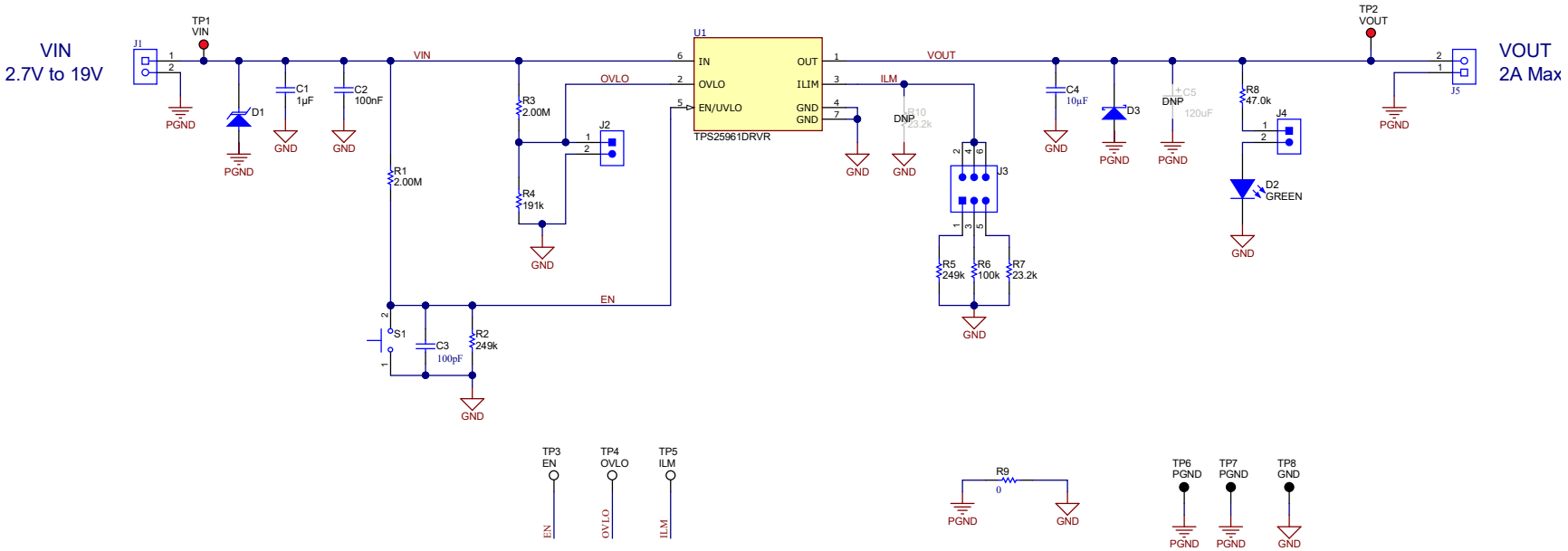

Figure 3-1. TPS25961EVM eFuse Evaluation Board Schematic

4 General Configurations

4.1 Physical Access

Table 4-1 lists the TPS25961EVM eFuse Evaluation Board input and output connector functionality. Table 4-2 and Table 4-3 describe the test point availability and the jumper functionality. Table 4-4 describes the function of signal LEDs.

Table 4-1. Input and Output Connector Functionality

Channel	Connector	Label	Description
CH1	J1	VIN(+), PGND(–)	Input of CH1
	J5	VOUT(+), PGND(–)	Output of CH1

Table 4-2. Test Points Description

Channel	Test Points	Label	Description
CH1	TP1	VIN	CH1 input voltage
	TP2	VOUT	CH1 output voltage
	TP3	EN/UVLO	CH1 EN/UVLO signal
	TP4	OVLO	CH1 OVLO signal
	TP5	ILM	CH1 current limit
	TP8	GND	CH1 IC GND signal
	TP6,TP7	PGND	CH1 power GND signal

Table 4-3. Jumper Descriptions and Default Positions

Channel	Jumper	Label	Description	Default Jumper Position
CH1	J3	ILM	1-2 position sets the current limit to 0.2 A	5-6
			3-4 position sets the current limit to 0.47 A	
			5-6 position sets the current limit to 2 A	
			Open position sets the current limit to 0.1 A	
	J2	OVLO	1-2 position sets input OVLO threshold at fixed 5.9 V	Open
			Open position sets input OVLO threshold at programmable 13.76 V	
	J4	J4	CH1 output power indicator LED pulled to VOUT, if installed	1-2

Table 4-4. LED Descriptions

LED	Description
D2	CH1 output power indicator. LED turns on whenever the output voltage is available.

4.2 Test Equipment and Setup

4.2.1 Power Supplies

One adjustable power supply with 0-V to 19-V output and current limit greater than 2 A.

4.2.2 Meters

One DMM minimum needed.

4.2.3 Oscilloscope

A DPO2024 or equivalent, three 10x voltage probes, and a DC current probe.

4.2.4 Loads

One resistive load or equivalent that can tolerate up to 2-A DC load at 19V and capable of the output short.

5 Test Setup and Procedures

In this user's guide section, the test procedure is described for TPS25961EVM testing.

Make sure the evaluation board has default jumper settings as shown in Table 5-1.

Table 5-1. Default Jumper Setting for TPS25961EVM eFuse Evaluation Board

J2	J3	J4
Open	5-6	1-2

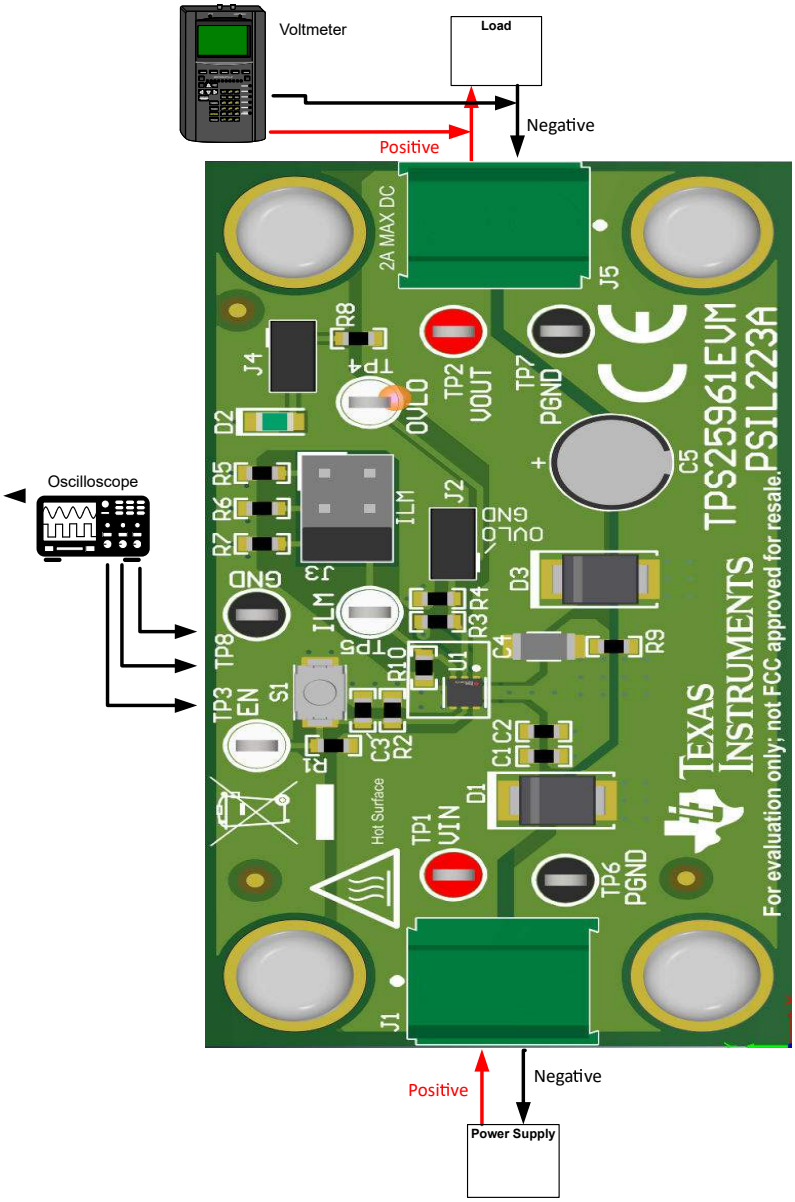

Figure 5-1. TPS25961EVM Setup with Test Equipment

Follow these instructions before starting any test and repeat again before moving to the next test:

- Set the power supply output (VIN) to zero volts.
- Turn ON the power supply and set the power supply output (VIN) to 12 V, current limit = 2 A.
- Turn OFF the power supply.
- Set the jumper setting on EVM to default position as shown in Table 5-1.

5.1 Hot-Plug Test

Use the following instructions to measure the inrush current during the Hot-Plug event on channel 1:

1. Set the input supply voltage VIN to 12 V and current limit of 2 A. Enable the power supply.
2. Hot-plug the supply between VIN and PGND points of connector J1.
3. Observe the waveform at VOUT (TP2) and input current with an oscilloscope to measure the slew rate and rise time of the eFuse with a given input voltage of 12 V.

Figure 5-2 shows an example of inrush current captured on the TPS25961EVM eFuse evaluation board.

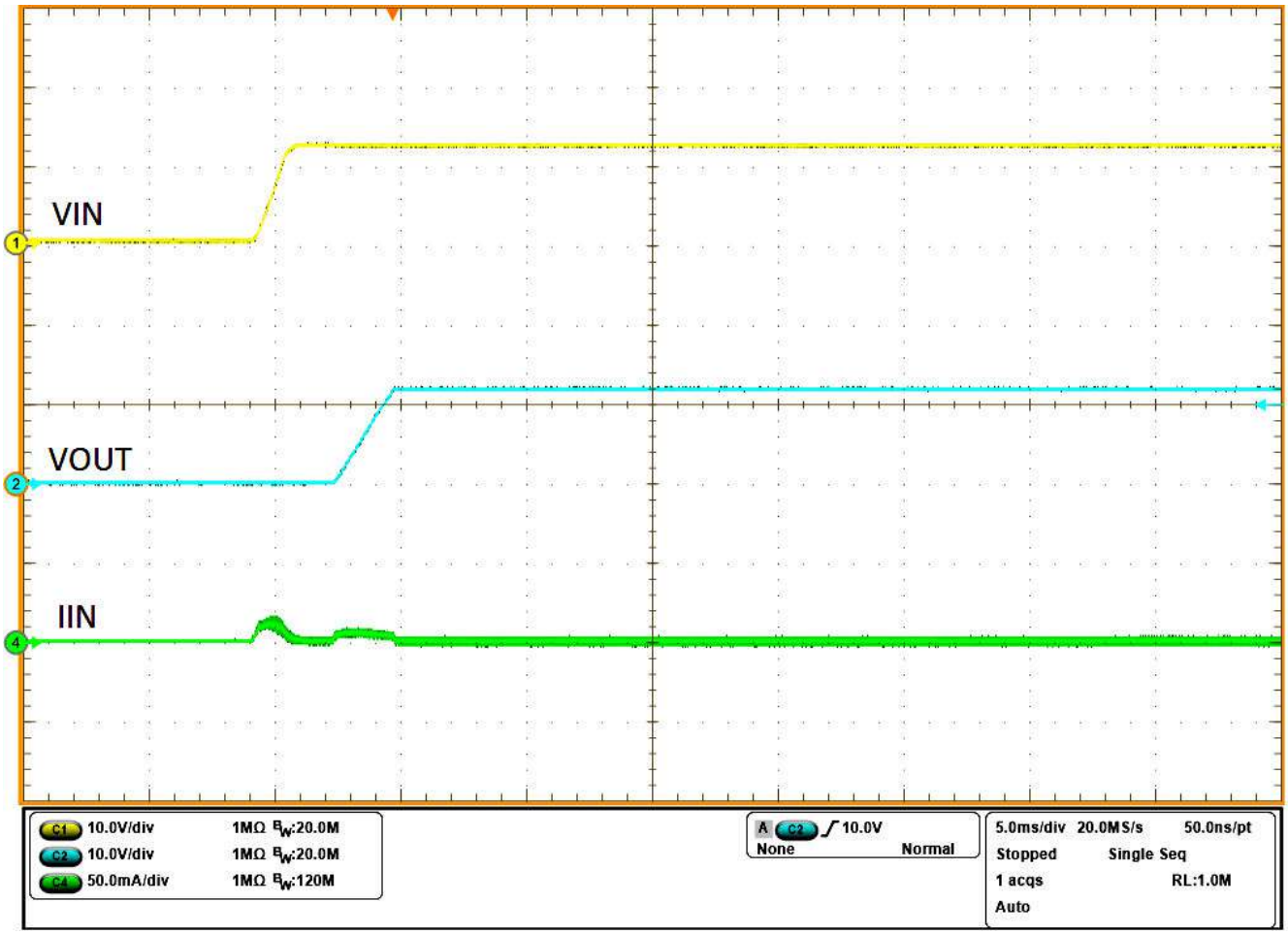

Figure 5-2. TPS25961 Output Rise Profile (VIN = 12 V, Cout = 1uF,R_{ILM} = 23.2kΩ, No Load)

5.2 Overcurrent Test

Use the following instructions to perform the overcurrent test on the TPS25961 eFuse:

1. Set the input supply voltage VIN to 12 V and current limit of 2 A and enable the power supply.
2. Place jumper J3 in suitable position to set the required current limit as per Table 4-3.
3. Apply an overload greater than the set current limit between VOUT and GND. (While testing current limit , use a resistive load to apply over current).

Figure 5-3 shows an example of the overcurrent test on the TPS25961EVM.

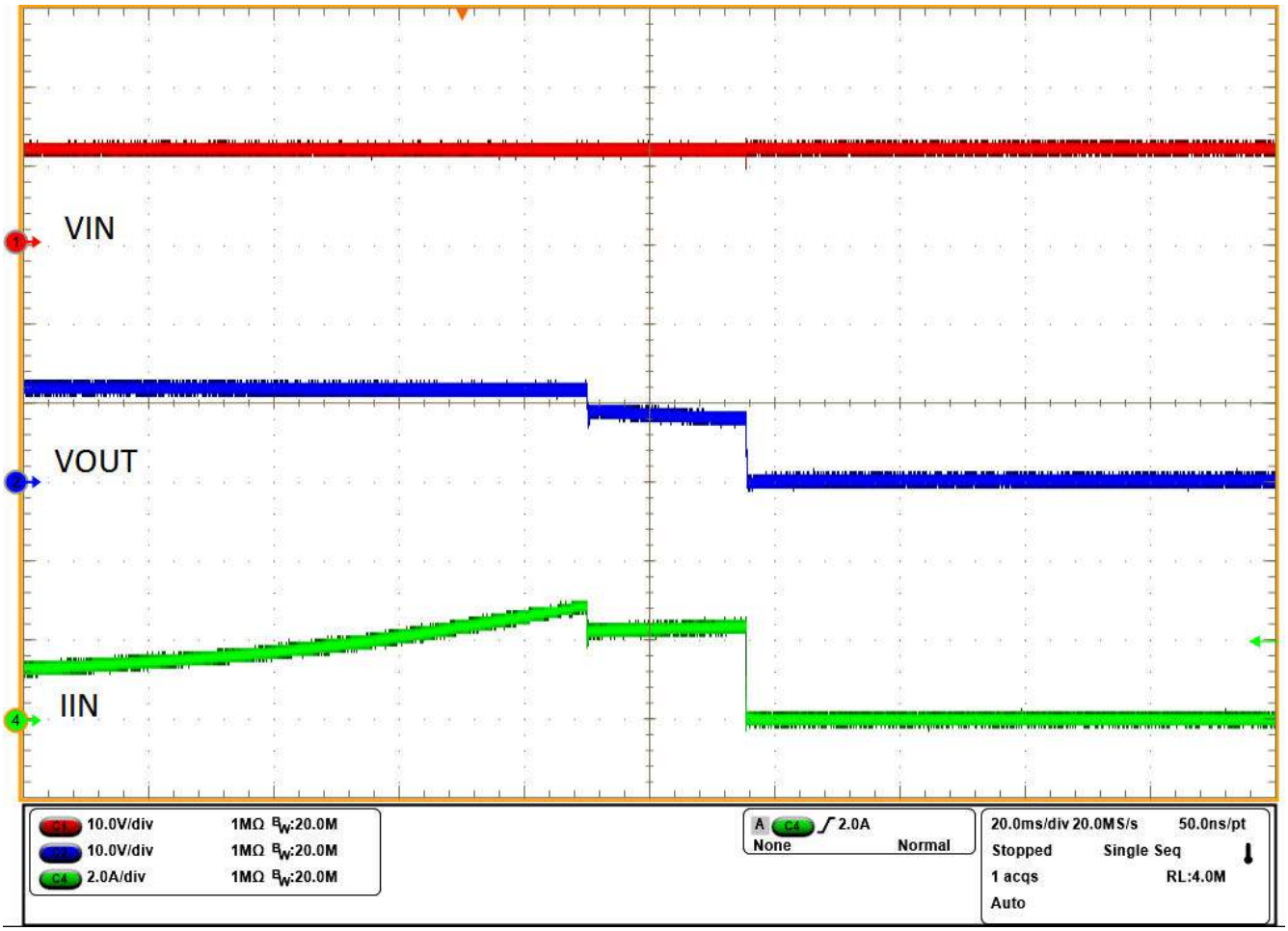

Figure 5-3. Overcurrent Response of TPS25961 for 2-A Current Limit Setting

5.3 Output Hot-Short Test

Use the following instructions to perform the output Hot-Short test:

1. Set the input supply voltage VIN to 12 V and current limit of 2 A. Turn ON the power supply.
2. Short the output of the device,VOUT to GND with a short cable.
3. Observe the waveforms using an oscilloscope.

Figure 5-4 shows test waveform of output Hot-short on the TPS25961EVM eFuse evaluation board.

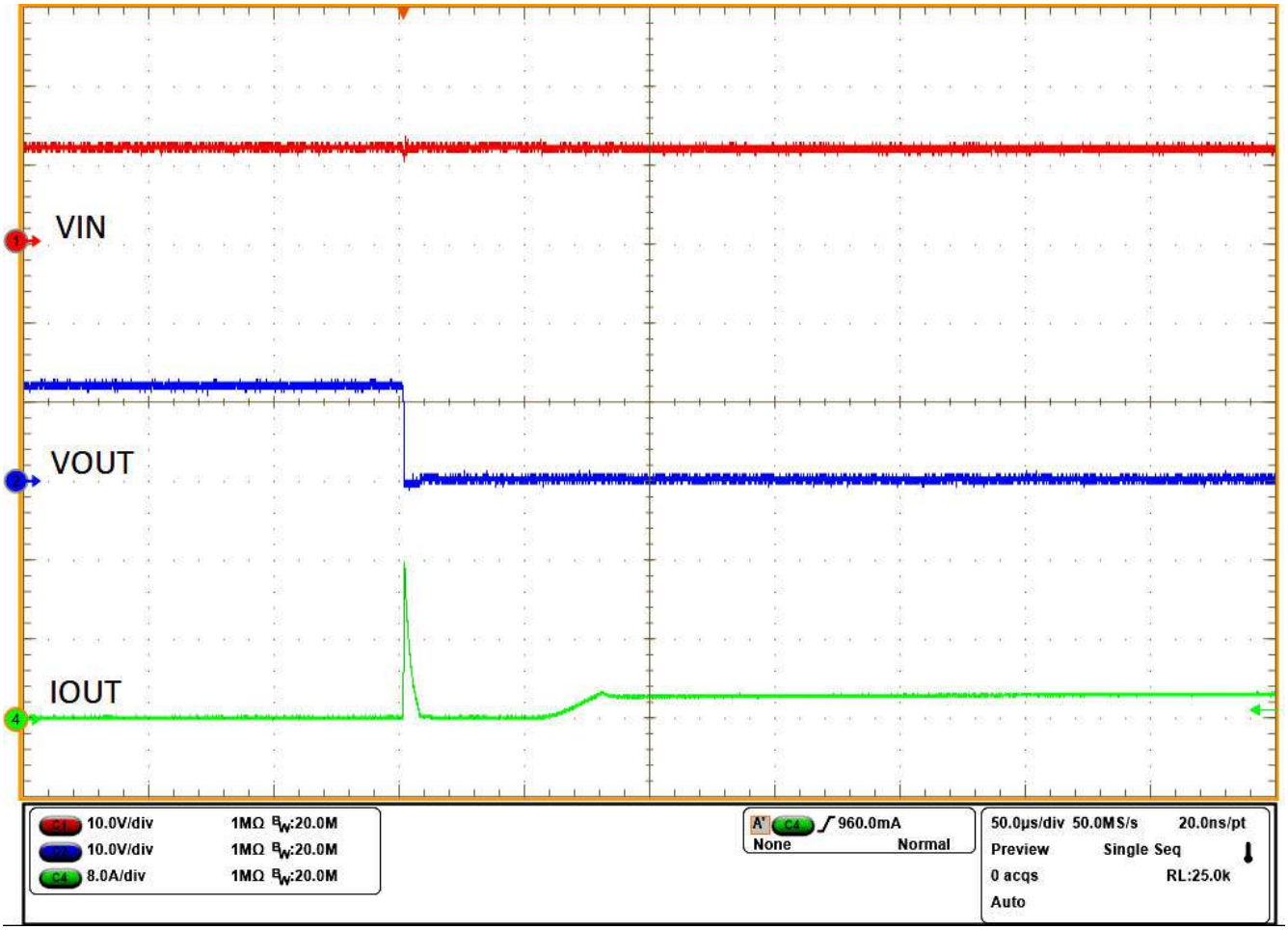

Figure 5-4. Output Hot-Short Response of the TPS25961 Device at Vin = 12 V, Cout = Open, R_{ILM} = 23.2 kΩ

5.4 Wakeup into Short Test

Use the following instructions to perform the wakeup into short test:

1. Set the input supply voltage VIN to 12 V and current limit of 2 A. Turn OFF the power supply.
2. Short the output of the device ,VOUT to GND with a short cable.
3. Turn ON the power supply.

Figure 5-5 shows test waveform of wakeup into output short on the TPS25961EVM eFuse evaluation board.

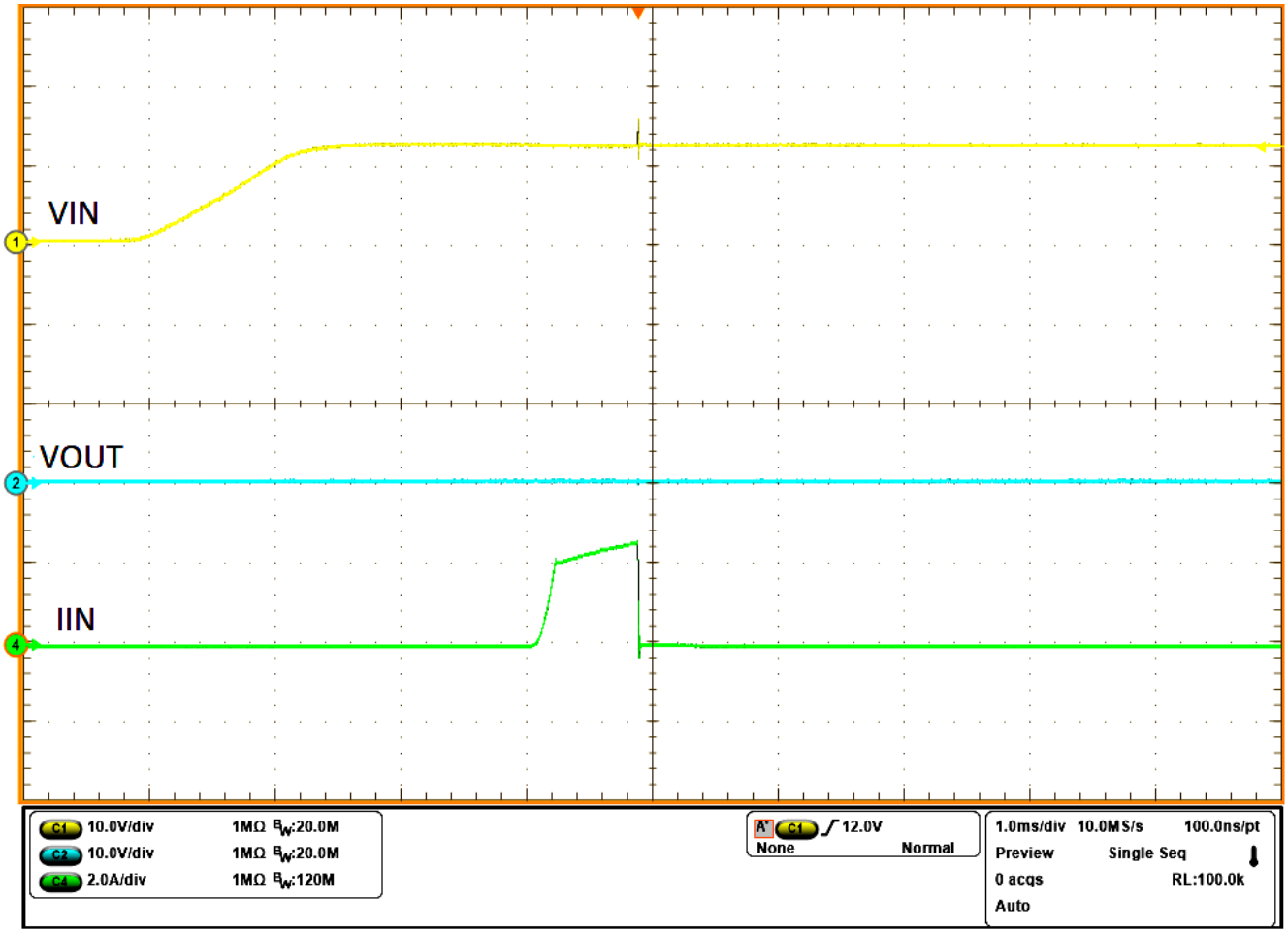

Figure 5-5. Test Waveform of Wakeup into Output Short for the TPS25961 Device at Vin = 12 V, Cout = Open, R_{ILM} = 23.2 kΩ

5.5 Overvoltage Test

Use the following instructions to perform the overvoltage protection test on channel 1:

1. Remove the input TVS diodes.
2. Place jumper J2 in position 1-2 for fixed OVLO threshold of 5.9V or keep jumper open to select programmable threshold of 13.76 V.
3. Set the input supply voltage VIN to 12 V and current limit of 2 A. Apply the supply between VIN and PGND at connector J1 and enable the power supply.
4. Increase the input supply VIN from 12 V to 16 V and observe the waveforms using an oscilloscope.

Figure 5-6 shows overvoltage response of TPS25961 on the TPS25961EVM eFuse evaluation board.

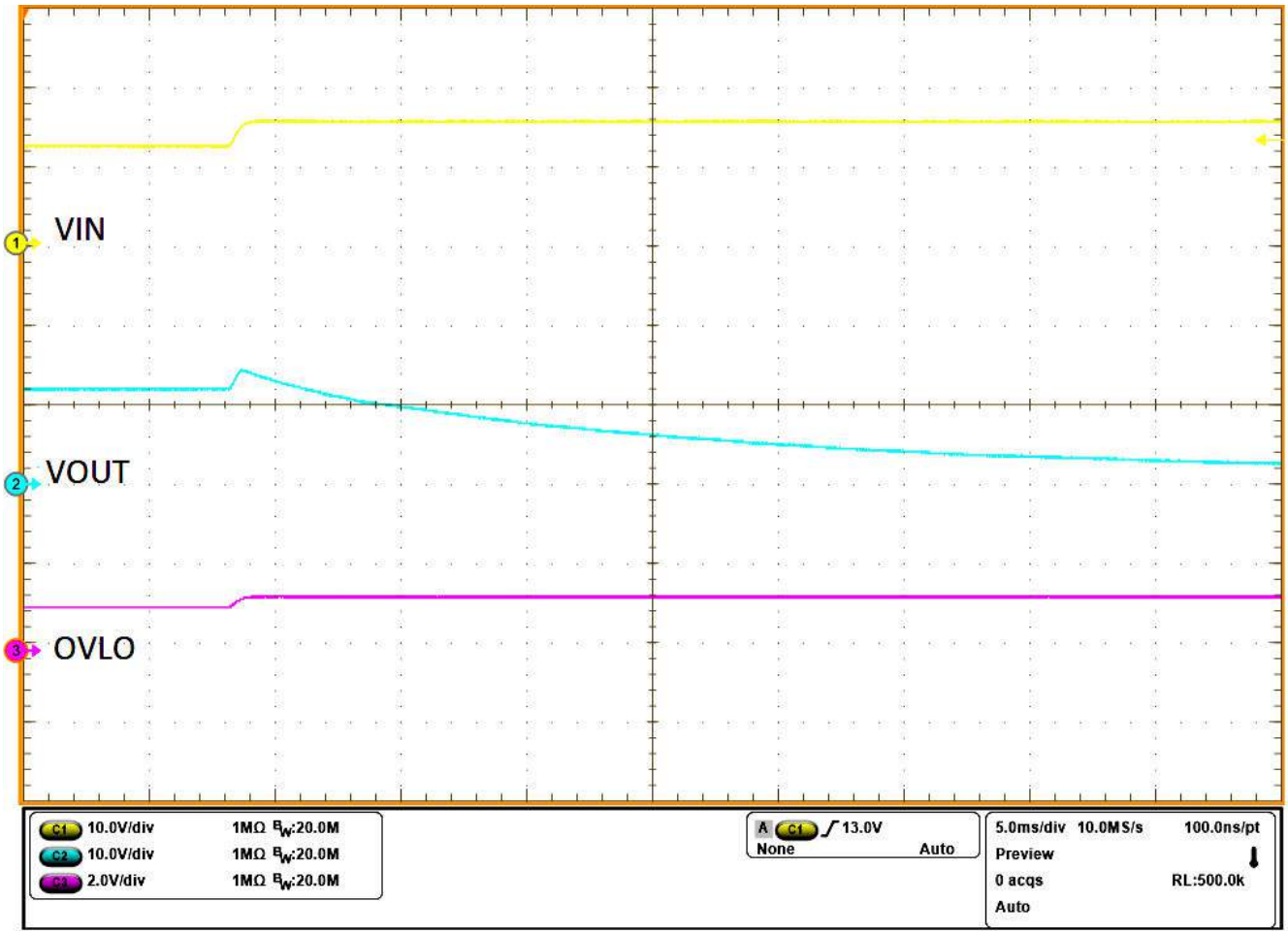

Figure 5-6. Overvoltage Protection Response of the TPS25961 Device for 13.76V OVLO

6 EVAL Board Assembly Drawings and Layout Guidelines

6.1 PCB Drawings

Figure 6-1 shows component placement of the EVAL Board. Figure 6-2 shows PCB layout images.

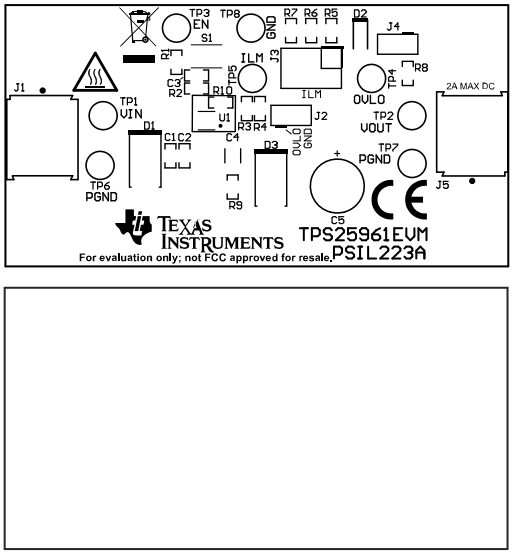

Figure 6-1. TPS25961EVM Board (a) Top Assembly (b) Bottom Assembly

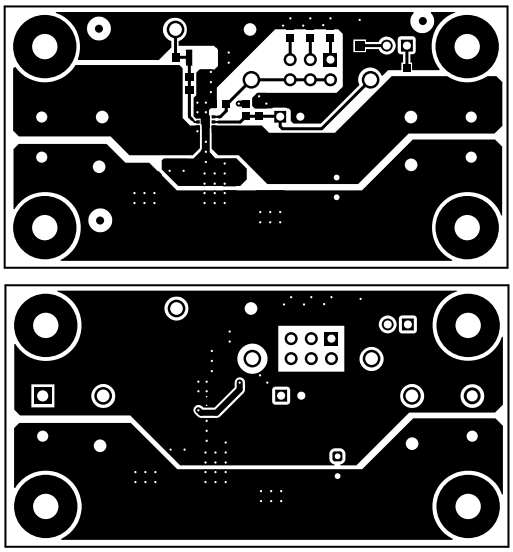

Figure 6-2. TPS25961EVM Board (a) Top Layer (b) Bottom Layer

7 Bill of Materials (BOM)

Table 7-1 lists the EVM BOM.

Table 7-1. Bill of Materials

Designator	Quantity	Description	PartNumber	Manufacturer
!PCB	1	Printed Circuit Board	PSIL223	Any
C1	1	CAP, CERM, 1 uF, 35 V, +/- 10%, X7R, 0603	C1608X7R1V105K080AC	TDK
C2	1	CAP, CERM, 0.1 uF, 50 V, +/- 10%, X7R, 0603	C1608X7R1H104K080AA	TDK
C3	1	CAP, CERM, 100 pF, 50 V, +/- 5%, C0G/NP0, 0603	885012006057	Wurth Elektronik
C4	1	CAP, CERM, 10 µF, 50 V,+/- 10%, X7R, AEC-Q200 Grade 1, 1206	CGA5L1X7R1H106K160AC	TDK
D1	1	Diode, TVS, Uni, 13 V, 21.5 Vc, SMB	SMBJ13A-13-F	Diodes Inc.
D2	1	LED, Green, SMD	LTST-C170KGKT	Lite-On
D3	1	Diode, Schottky, 30 V, 3 A, SMB	B330B-13-F	Diodes Inc.
FID1, FID2, FID3	3	Fiducial mark. There is nothing to buy or mount.	N/A	N/A
H1, H2, H3, H4	4	Machine Screw, Round, #4-40 x 1/4, Nylon, Philips panhead	NY PMS 440 0025 PH	B&F Fastener Supply
H5, H6, H7, H8	4	Standoff, Hex, 0.5"L #4-40 Nylon	1902C	Keystone
J1, J5	2	Terminal Block, 2x1, 5.08mm, TH	282841-2	TE Connectivity
J2, J4	2	Header, 100mil, 2x1, Tin, TH	PEC02SAAN	Sullins Connector Solutions
J3	1	Header, 100mil, 3x2, Tin, TH	PEC03DAAN	Sullins Connector Solutions
R1, R3	2	RES, 2.00 M, 1%, 0.1 W, 0603	RC0603FR-072ML	Yageo
R2, R5	2	RES, 249 k, 1%, 0.1 W, 0603	RC0603FR-07249KL	Yageo
R4	1	RES, 191 k, 1%, 0.1 W, 0603	RC0603FR-07191KL	Yageo
R6	1	RES, 100 k, 1%, 0.1 W, 0603	RC0603FR-07100KL	Yageo
R7	1	RES, 23.2 k, 1%, 0.1 W, 0603	RC0603FR-0723K2L	Yageo
R8	1	RES, 47.0 k, 1%, 0.1 W, 0603	RC0603FR-0747KL	Yageo
R9	1	RES, 0, 5%, 0.1 W, 0603	ERJ-3GEY0R00V	Panasonic
S1	1	Switch, SPST-NO, 0.05 A, 12 VDC, SMT	SKRKAEE020	Alps
SH-J1, SH-J2, SH-J3	3	Shunt, 100mil, Flash Gold, Black	SPC02SYAN	Sullins Connector Solutions
TP1, TP2	2	Test Point, Multipurpose, Red, TH	5010	Keystone
TP3, TP4, TP5	3	Test Point, Multipurpose, White, TH	5012	Keystone
TP6, TP7, TP8	3	Test Point, Multipurpose, Black, TH	5011	Keystone
U1	1	2.7- 19 V, 100 mΩ eFuse with overvoltage, overcurrent and shortcircuit protection	TPS25961DRVR	Texas Instruments
C5	0	CAP, AL, 120 uF, 35 V, +/- 20%, TH	35ZLQ120MEFC6.3X11	Rubycon
R10	0	RES, 23.2 k, 1%, 0.1 W, 0603	RC0603FR-0723K2L	Yageo

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