TPS26600-02EVM: Evaluation Module for TPS2660x

This user's guide describes the evaluation module (EVM) for the Texas instruments TPS26600, TPS26601, and TPS26602 devices. The document provides configuration information and test setup details for working with the EVM. The EVM schematic, board layout and bill of materials (BOM) are also included.

NOTE: The TPS26602 can be evaluated on this EVM by replacing the TPS26600PWP (U1) or TPS26600RHF (U2) with the TPS26602PWP or TPS26602RHF, on respective channels. Instructions for evaluation are listed in Section 4.4.7. The TPS26601 can be evaluated on this EVM by replacing the TPS26600RHF (U2) with the TPS26601RHF. Instructions for evaluation are listed in Section 4.4.8.

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Trademarks

1 Introduction

The TPS26600-02EVM allows reference circuit evaluation of TI's TPS2660x devices. The TPS2660x are compact 4.2-V to 55-V, 2.23-A industrial eFuses with integrated back-to-back FETs, programmable undervoltage, overvoltage, reverse-polarity, overcurrent, inrush current protection, and output current monitoring features.

1.1 EVM Features

The TPS26600-02EVM features include:

- 4.2-V to 55-V input operating voltage range
- 0.2-A to 2.23-A jumper-programmable current limit
- Reverse polarity protection up to –55 V
- Programmable input UVLO
- Selectable overload fault response (auto-retry, latch and circuit breaker)
- Programmable input overvoltage protection (OVP) cut off
- Programmable V_{OUT} slew rate control
- Load current monitor output with 1.5 V / A
- Optional on-board transient protection devices like input TVS and output Schottky diodes
- On-board reset switch and fault indicators

1.2 EVM Applications

- Control and automation
- PLCs
- Industrial power systems
- Sensors and controls

2 Description

The TPS26600-02EVM enables full evaluation of the TPS2660x devices. The EVM supports HTSOP and QFN versions of the devices on two channels (CH1 and CH2, respectively). Input power is applied at T1 (CH1) and T3 (CH2) while T2 (CH1) and T4 (CH2) provide an output connection to the load. Refer to the schematic in Figure 1 and the test setup in Figure 2.

S1 and S2 allows U1 and U2 to RESET. A fault (FLTb) indicator is provided by D1 and D7 for CH1 and CH2, respectively. Scaled current for each can channel be monitored at TP5 and TP14 with a scaling factor of 1.5 V / A.

Table 1. TPS26600-02EVM Options and Setting

Part Number	EVM Function	V_{IN} Range	UVLO		OVP		Current Limit		Selectable Fault Response
			CH1	CH2	CH1	CH2	Minimum Setting	Maximum Setting	
TPS26600-02EVM	4.2-V to 55-V, 2.23-A Industrial eFuse	4.2 V–55 V	10 V	15 V	40 V	33 V	0.2 A[1]	2.23 A	Auto retry Latch off Circuit Breaker

(1) Minimum programmable current limit can be changed to 0.1 A by changing the R12 and R24 values to 120 kΩ on CH1 and CH2 respectively.

3 Schematics

Figure 1 illustrates the EVM schematic.

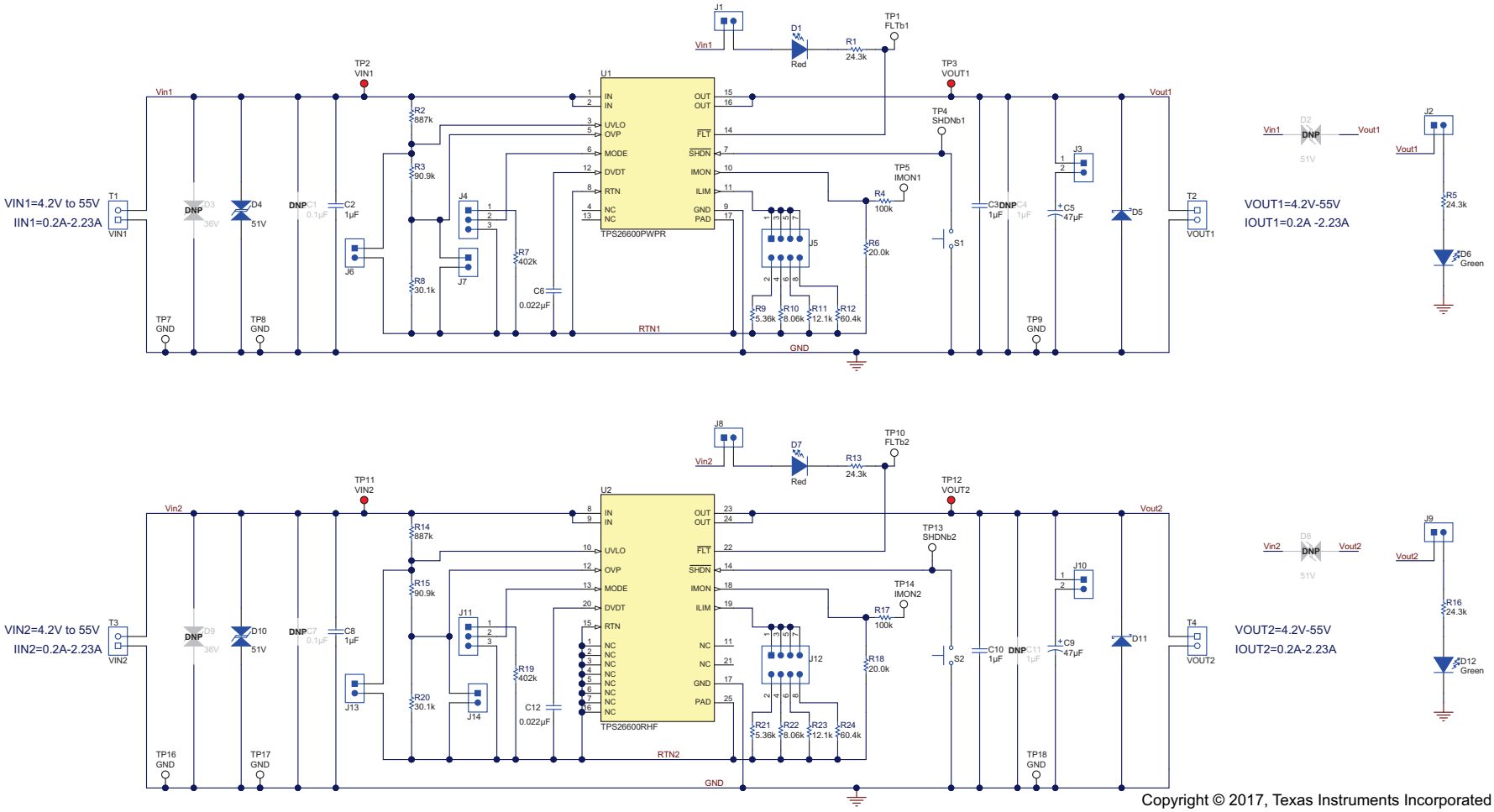

Figure 1. TPS26600-02EVM Schematic

4 General Configurations

4.1 Physical Access

Table 2 lists the TPS26600-02EVM input and output connector functionality, Table 3 describes the test point availability, and Table 4 describes the jumper functionality.

Table 2. Input and Output Connector Functionality

Connector		Label	Description
T1	CH1	VIN1(+), GND(–)	CH1 input power supply to the EVM
T2		VOUT1(+), GND(–)	CH1 output from the EVM
T3	CH2	VIN2(+), GND(–)	CH2 input power supply to the EVM
T4		VOUT2(+), GND(–)	CH2 output from the EVM

Table 3. Test Points Description

Channel	Test Points	Label	Description
CH1	TP1	FLTb1	CH1 fault indicator
	TP2	VIN1	CH1 power supply input
	TP3	VOUT1	CH1 output voltage
	TP4	SHDNb1	CH1 shutdown input
	TP5	IMON1	CH1 output current monitor
	TP7, TP8, TP9	GND	GND
CH2	TP10	FLTb2	CH2 fault indicator
	TP11	VIN2	CH2 power supply input
	TP12	VOUT2	CH2 output voltage
	TP13	SHDNb2	CH2 shutdown input
	TP14	IMON2	CH2 output current monitor
	TP16, TP17, TP18	GND	GND

Table 4. Jumper and LED Descriptions

Jumper	Label	Description
J1	J1	CH1 fault LED pulled to VIN1, if installed
J2	J2	CH1 output power indicator LED pulled to VOUT1, if installed
J3	J3	CH1 bulk output capacitor connects to VOUT1, if installed
J4	MODE	CH1 MODE selection 1-2 position sets latch-off mode 2-3 position sets auto-retry mode Open position sets circuit breaker with auto-retry mode
J5	ILIM	CH1 current limit setting 1-2 position sets 2.23 A 3-4 position sets 1.5 A 5-6 position sets 1 A 7-8 position sets 0.2 A
J6	UVLO	CH1 UVLO setting Sets internal UVLO (15 V), if installed
J7	OVP	CH1 OVP setting Sets internal OVP (33 V), if installed
J8	J8	CH2 fault LED pulled to VIN2, if installed
J9	J9	CH2 output power indicator LED pulled to VOUT2, if installed
J10	J10	CH2 bulk output capacitor connects to VOUT1, if installed

Table 4. Jumper and LED Descriptions (continued)

Jumper	Label	Description
J11	MODE	CH2 MODE selection 1-2 position sets latch-off mode 2-3 position sets auto-retry mode Open position sets circuit breaker with auto-retry mode
J12	ILIM	CH2 current limit setting 1-2 position sets 2.23 A 3-4 position sets 1.5 A 5-6 position sets 1 A 7-8 position sets 0.2A
J13	UVLO	CH2 UVLO setting Sets internal UVLO (15 V), if installed
J14	OVP	CH2 OVP setting Sets internal OVP (33 V), if installed
D1, D7 (RED-LED)	Fault LED	CH1, CH2 fault indicators, respectively. LED turns on when the internal MOSFET is disabled due to any fault condition such as undervoltage, overvoltage, overload, short circuit, reverse current, and thermal shutdown.
D6, D12 (GREEN-LED)	Output power indicator	CH1, CH2 output power indicators, respectively. LED turns on whenever the output voltage is available.

4.2 Test Equipment

4.2.1 Power Supplies

One adjustable power supply: 0-V to 60-V output, 0-A to 3-A output current limit.

4.2.2 Meters

One DMM minimum needed and may require more if simultaneous measurements are required.

4.2.3 Oscilloscope

A DPO2024, or equivalent. Three 10x voltage probes and one DC current probe.

4.2.4 Loads

One resistive load which can tolerate up to 3-A DC load at 24 V.

NOTE: A resistive load is recommended for testing. If an electronic load is used, ensure that the output load is set in the constant resistance (CR) mode, not in the constant current (CC) mode.

4.3 Test Setup

Figure 2 shows the typical test setup for the TPS26600-02EVM. Connect T1/T3 to the power supply and T2/T4 to the load.

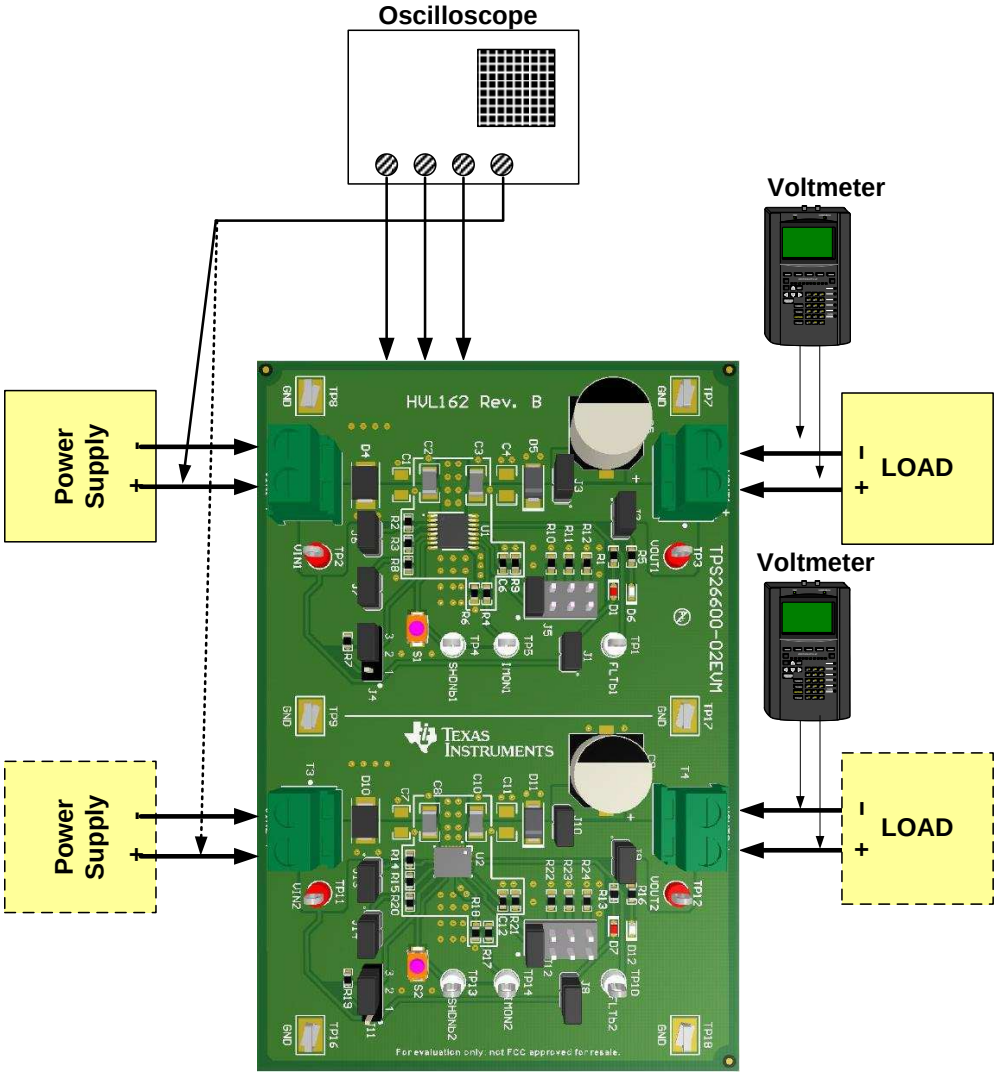

Figure 2. EVM Test Setup

4.4 Test Procedure

NOTE: CH1 and CH2 can be tested one by one with a single power supply and the load.

4.4.1 Preliminary Tests

1. Turn on the power supply and set the output voltage and the current limit according to Table 5.

Table 5. Power Supply Setting for the TPS26600-02EVM

EVM	Channel	Voltage Set Point	Power Supply Current Limit
TPS26600-02EVM	CH1	24 V	3 A
	CH2	24 V	3 A

2. Turn on the load and set the load resistance to 16 Ω ±1 Ω.
3. Disable the power supply, load and hook up the TPS26600-02EVM assembly as shown in Figure 2
4. Make sure the default evaluation board jumper settings are as shown in Table 6.

Table 6. Default Jumper Setting for the TPS26600-02EVM

	J1	J2	J3	J4	J5	J6	J7
CH1	Install	Install	Do not populate	2-3	1-2	Do not populate	Do not populate
	J8	**J9**	**J10**	**J11**	**J12**	**J13**	**J14**
CH2	Install	Install	Do not populate	2-3	1-2	Install	Install

5. Enable the power supply and the load.
6. Connect the negative probe of the DMM to TP7 or TP18 test points, the positive probe to the respective test points, and verify that the voltages shown in Table 7 are obtained.

Table 7. TPS26600-02EVM DMM Readings at Different Test Points

Voltage test on (CH1)	Measured Voltage Reading	Voltage test on (CH2)	Measured Voltage Reading
VIN1 (TP2)	24 V ±1 V DC	VIN2 (TP11)	24 V ±1 V DC
VOUT1 (TP3)	24 V ±1 V DC	VOUT2 (TP12)	24 V ±1 V DC
IMON1 (TP5)	2.3 V ±0.2 V DC	IMON2 (TP14)	2.3 V ±0.2 V DC
FLTb1 (TP1)	22.6 V ±0.5 V DC	FLTb2 (TP10)	22.6 V ±0.5 V DC
SHDNb1 (TP4)	2.7 V ±0.5 V DC	SHDNb2 (TP13)	2.7 V ±0.5 V DC

7. Press the CH1/CH2 shutdown switch S1/S2 and verify the CH1/CH2 output voltage VOUT1/VOUT2 drops to zero. Release the S1/S2 switch and verify the output voltage resumes to nominal 24 V ±1 V.
8. Disable the power supply and the load.

4.4.2 UVLO, OVP Tests

Follow the instructions to verify undervoltage and overvoltage levels of the device:

1. Set the load resistance to 24 Ω ±1 Ω and the power supply voltage to 24 V. Enable the power supply and the load.
2. Increase the CH1 input voltage (VIN1) and monitor the output voltage (VOUT1). Verify that VOUT1 increases as VN1 increases and drops to zero when VIN1 exceeds 40 V ±1 V (CH1 OVP limit).
3. Reduce the CH1 input voltage and verify that the output turns on at 36 V ±1 V.

4. Further reduce the CH1 input voltage and verify that VOUT1 reduces as VN1 reduces and drops to zero when VIN1 falls below 9 V ±0.5 V (CH1 UVLO limit).
5. Increase the CH2 input voltage (VIN2) and monitor the output voltage (VOUT2). Verify that VOUT2 increases as VN2 increases and drops to zero when VIN2 exceeds 33 V ±1 V (CH2 OVP limit).
6. Reduce the CH2 input voltage and verify that the output turns on at 30 V ±1 V.
7. Further reduce the CH2 input voltage and verify that VOUT2 reduces as VN2 reduces and drops to zero when VIN2 falls below 14 V ±0.5 V (CH2 UVLO limit).
8. Verify that CH1 and CH2 FLTb red LEDs (D1/D7) turn on whenever the supply voltage reaches either OVP or UVLO limits of the respective channels.
9. Disable the power supply and the load.

4.4.3 Output Voltage Start-Up Time Test

Follow the instructions to verify the individual channels output voltage start-up time:

1. Set up the oscilloscope as listed in Table 8.
2. Set the load resistance to 16 Ω ±1 Ω and the power supply voltage to 24 V.
3. Enable the load.
4. Enable the power supply and verify that the output voltage startup waveform is as shown in Figure 3.

Table 8. TPS26600-02EVM Oscilloscope Setting for the Output Voltage Start-Up Test

Oscilloscope Setting	CH1 Probe Points	CH2 Probe Points
Channel 1 = 10 V / div	VOUT1 (TP3)	VOUT2 (TP12)
Channel 2 = 10 V / div	VIN1 (TP2)	VIN2 (TP11)
Channel 3 = 20 V / div	FLTb1 (TP1)	FLTb2 (TP10)
Channel 4 = 1 A / div	Input current into T1 +Ve wire	Input current into T3 +Ve wire
Trigger source = Channel 1		
Trigger level = 12 V ±1 V		
Trigger polarity = Rising		
Trigger mode = Single		
Time base	2 ms / div	

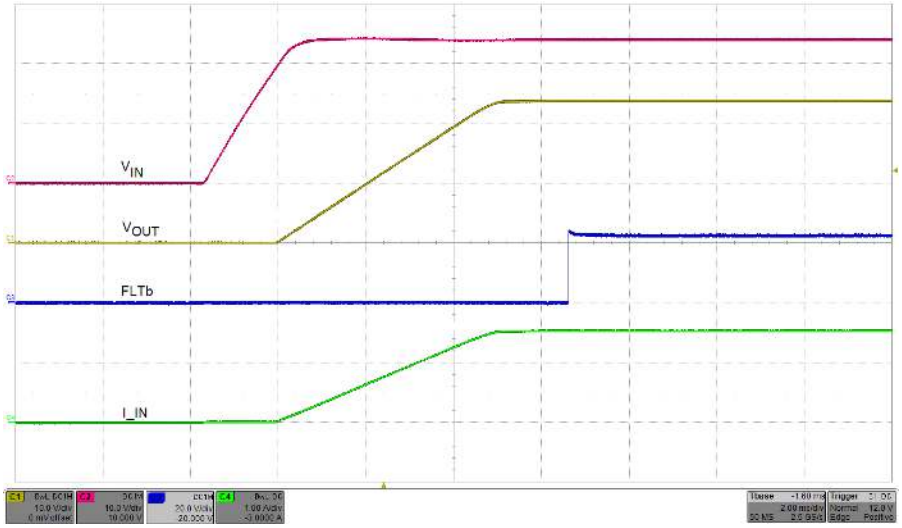

Figure 3. Output Voltage Start-Up Waveform

4.4.4 Current Limit and Fault Responses Test

Follow the instructions to verify the current limit and various fault response modes like auto-retry, latch and circuit breaker with auto-retry:

1. Set up the oscilloscope as listed in Table 9.

Table 9. TPS26600-02EVM Oscilloscope Setting for the Current Limit Test

Oscilloscope Setting	CH1 Probe Points	CH2 Probe Points
Channel 1 = 10V / div	VOUT1 (TP3)	VOUT2 (TP12)
Channel 2 = 10V / div	VIN1 (TP2)	VIN2 (TP11)
Channel 4 = 2 A / div	Input current into T1 +Ve wire	Input current into T3 +Ve wire
Trigger source = Channel 2		
Trigger level = 12 V ±1V		
Trigger polarity = Rising		
Trigger mode = Single		
Time base	100 ms / div	

NOTE: Note : Measuring the current limit value on the oscilloscope can easily cause ±10% error from the typical expected values as listed in Table 10.

2. Set the current limit to 2.23 A by installing the J5/J12 jumper in position 1-2.
3. The jumper setting for different current limits is shown in Table 10.
4. Set the current limit response to auto-retry by installing the J4/J11 jumper in position 2-3.

Table 10. TPS26600-02EVM Jumper Setting for Current Limits

CH1, CH2 Jumper Positions (J5, J12)	Load Current Limit (A)
1-2	2.23
3-4	1.5
5-6	1
7-8	0.2

5. Set the load resistance to 6 Ω ±1 Ω and the power supply voltage to 24 V.
6. Enable the load.
7. Enable the power supply and verify the current limit magnitude and auto-retry fault response waveform as shown in Figure 4.

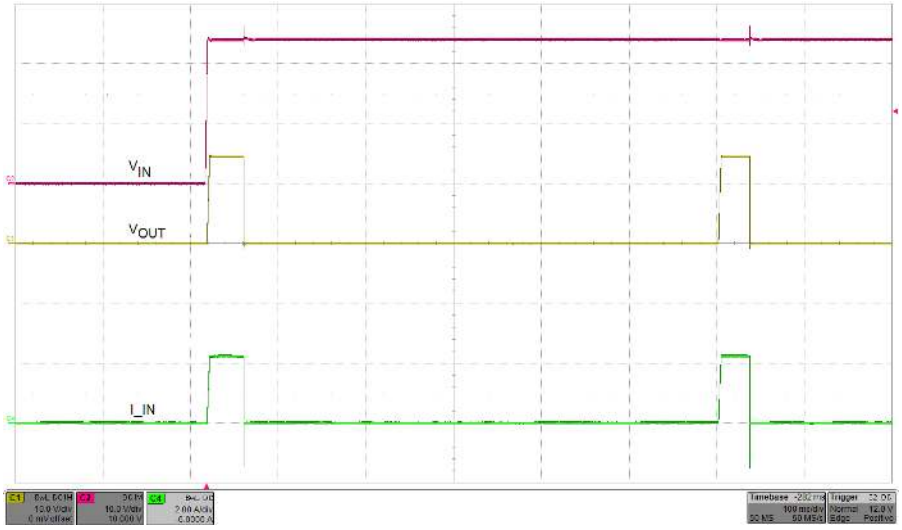

Figure 4. J5/J12 = 2-3 Position, Current Limit (2.23 A), Auto-Retry Mode

8. Disable the power supply.
9. Set the current limit response mode to latch-off by installing the J4/J11 jumper in the position 1-2.
10. Set the load resistance to 6 Ω ±1 Ω and enable the load.
11. Enable the power supply and verify the current limit magnitude the latch-off fault response waveform as shown in the Figure 5.

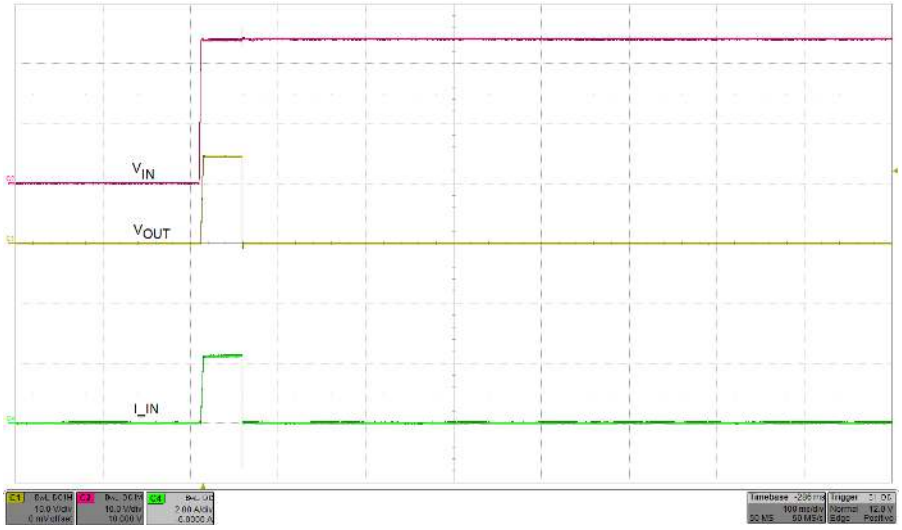

Figure 5. J5/J12 = 1-2 Position, Current Limit (2.23 A), Latch-Off Mode

12. Once the device is latched-off, either the power supply or the SHDNb should be recycled to re-enable it.
13. Change the load resistance to 16 Ω ±1 Ω.
14. Press and release the reset switch (S1/S2) to re-enable the device from latch-off mode and verify the recovery or restart waveform as shown in Figure 6.

Figure 6. Restart From Latch-Off Mode

15. Disable the power supply.
16. Set the current limit response mode to circuit breaker with auto-retry by uninstalling the J4/J11 jumper.
17. Set the load resistance to 6 Ω ±1 Ω and enable the load.
18. Enable the power supply and verify the circuit breaker with auto retry fault response waveform as shown in Figure 7.

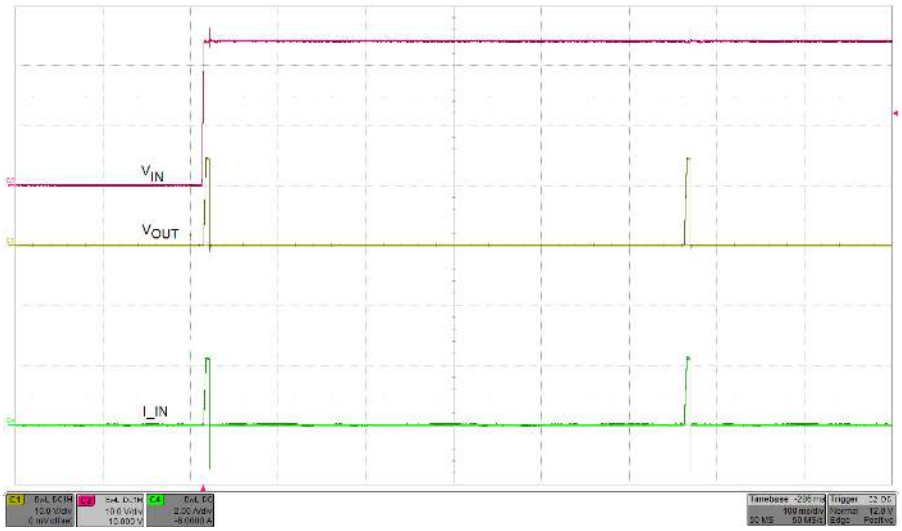

Figure 7. J5/J12 = Floating, Current Limit (2.23 A), Circuit Breaker With Auto-Retry Mode

4.4.5 Output Short-Circuit Protection Test

Follow the instructions to verify the output short-circuit protection feature of the device:

1. Set up the oscilloscope as listed in Table 11.

Table 11. TPS26600-02EVM Output Short-Circuit Protection Test

Oscilloscope Setting	CH1 Probe Points	CH2 Probe Points
Channel 1 = 10 V / div	VOUT1 (TP3)	VOUT2 (TP12)
Channel 2 = 10 V / div	VIN1 (TP2)	VIN2 (TP11)
Channel 3 = 20 V / div	FLTb1 (TP1)	FLTb2 (TP10)
Channel 4 = 2 A / div	Input current into T1 +Ve wire	Input current into T3 +Ve wire
Trigger source = Channel 1		
Trigger level = 12 V ±1 V		
Trigger polarity = Falling		
Trigger mode = Single		
Time base	2 ms / div	

2. Set the load resistance to 16 Ω ±1 Ω and the power supply voltage to 24 V.
3. Enable the load and the power supply.
4. Use either wire or FET to short the output to ground and verify the output short-circuit response waveform as shown in Figure 8.

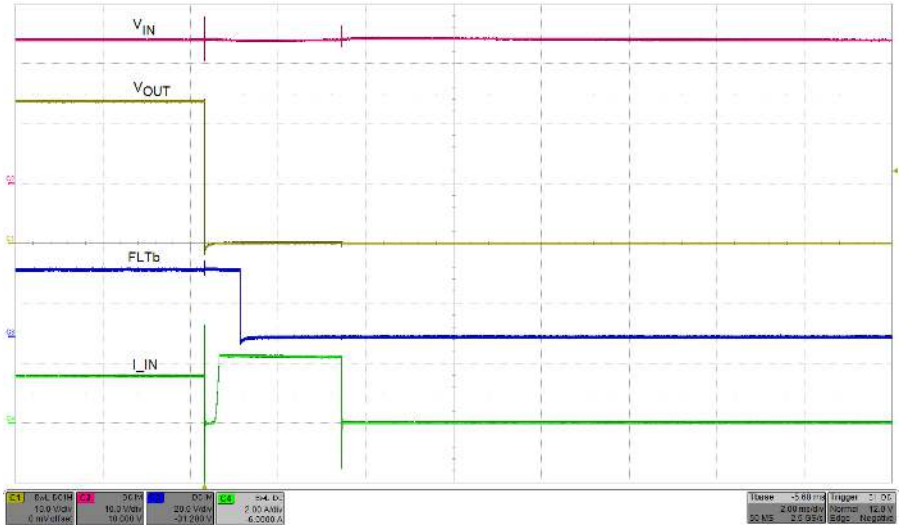

Figure 8. Output Short-Circuit Protection

4.4.6 Reverse Polarity Test

Follow the instructions to verify the reverse polarity protection feature of the device:

1. Set up the oscilloscope as listed in Table 12.

Table 12. TPS26600-02EVM Reverse Polarity Test

Oscilloscope Setting	CH1 Probe Points	CH2 Probe Points
Channel 1 = 10 V / div	VOUT1 (TP3)	VOUT2 (TP12)
Channel 2 = 10 V / div	VIN1 (TP2)	VIN2 (TP11)
Trigger source = Channel 1		
Trigger level = –12 V ±1 V		
Trigger polarity = Falling		
Trigger mode = Single		
Time base	10 ms / div	

2. Set the power supply voltage to 24 V and disable the power supply.
3. Connect +ve terminal of the power supply to either T1/T3 –ve terminal, connect –ve terminal of the power supply to either T1/T3 +ve terminal.
4. Enable the power supply and verify the reverse polarity protection waveform as shown in Figure 9.

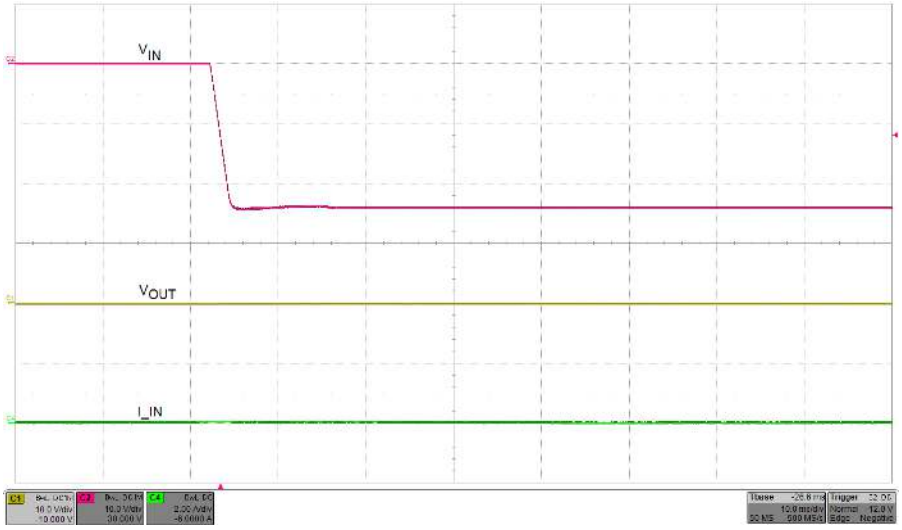

Figure 9. Reverse Polarity Protection

4.4.7 Instructions to Evaluate the TPS26602

1. Replace either U1 or U2 with the TPS26602PWP or the TPS26602RHF on respective channels.
2. Install jumper on J7/J14 to connect the OVP pin to RTN.
3. Follow the similar test procedure as TPS26600 for evaluation.

4.4.8 Instructions to Evaluate the TPS26601

1. Replace U2 with the TPS26601RHF.
2. Make sure all jumpers are set according to default jumper settings.
3. Follow the similar test procedure as TPS26600 for evaluation.

5 EVM Board Assembly Drawings and Layout Guidelines

5.1 PCB Drawings

Figure 10 through Figure 12 show component placement and layout of the EVM.

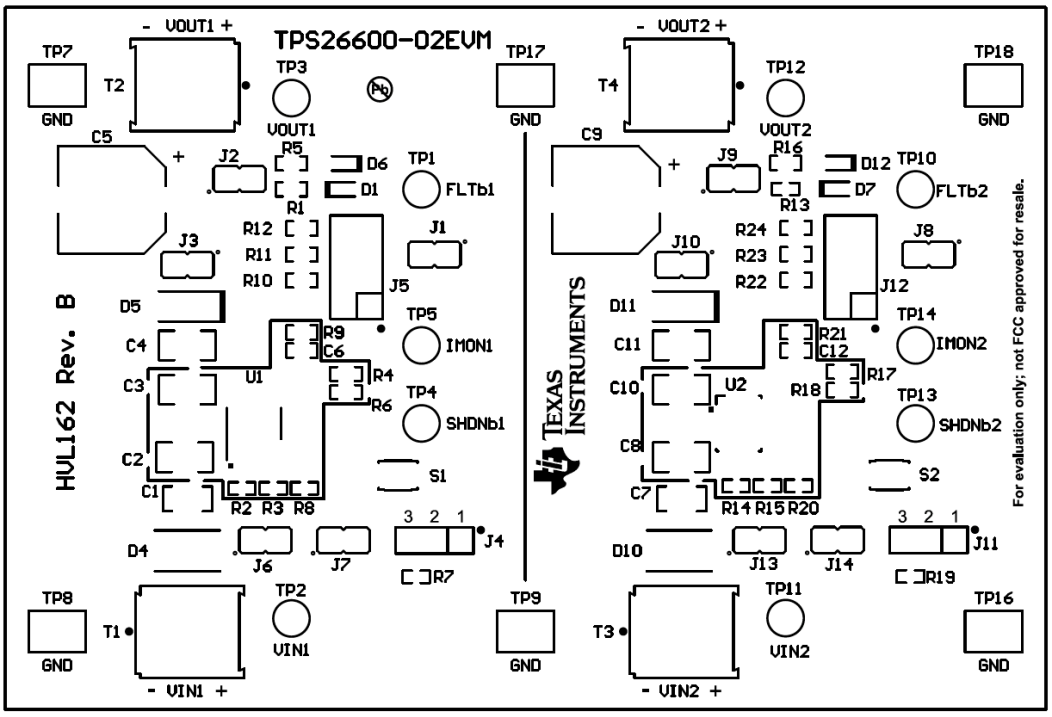

Figure 10. Top Side Placement

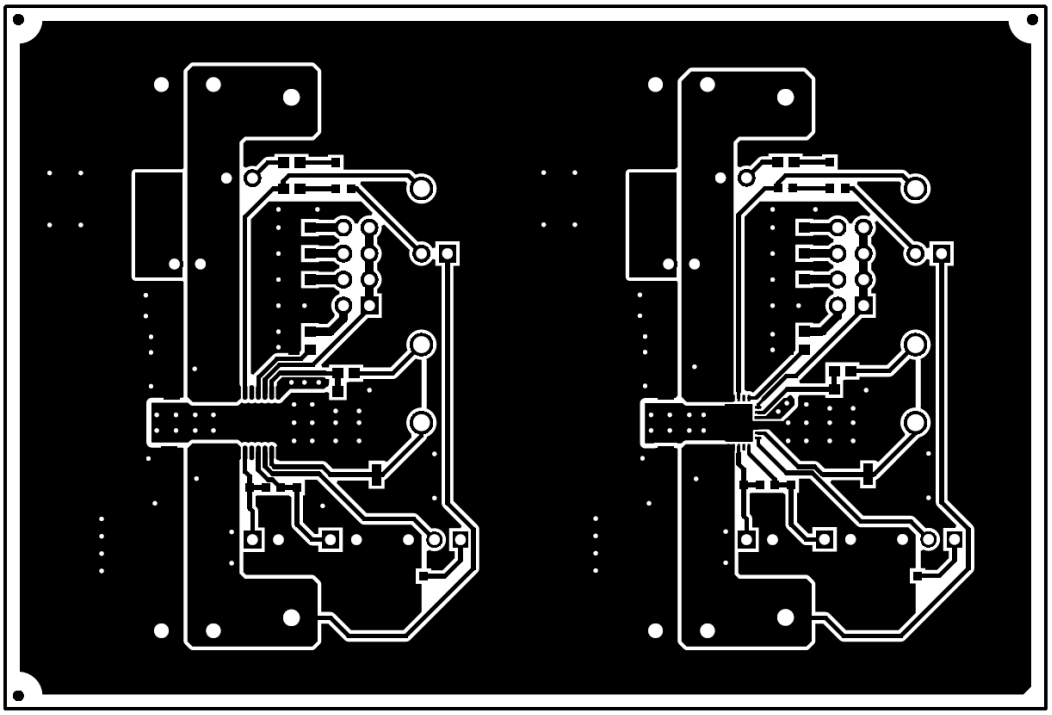

Figure 11. Top Layer

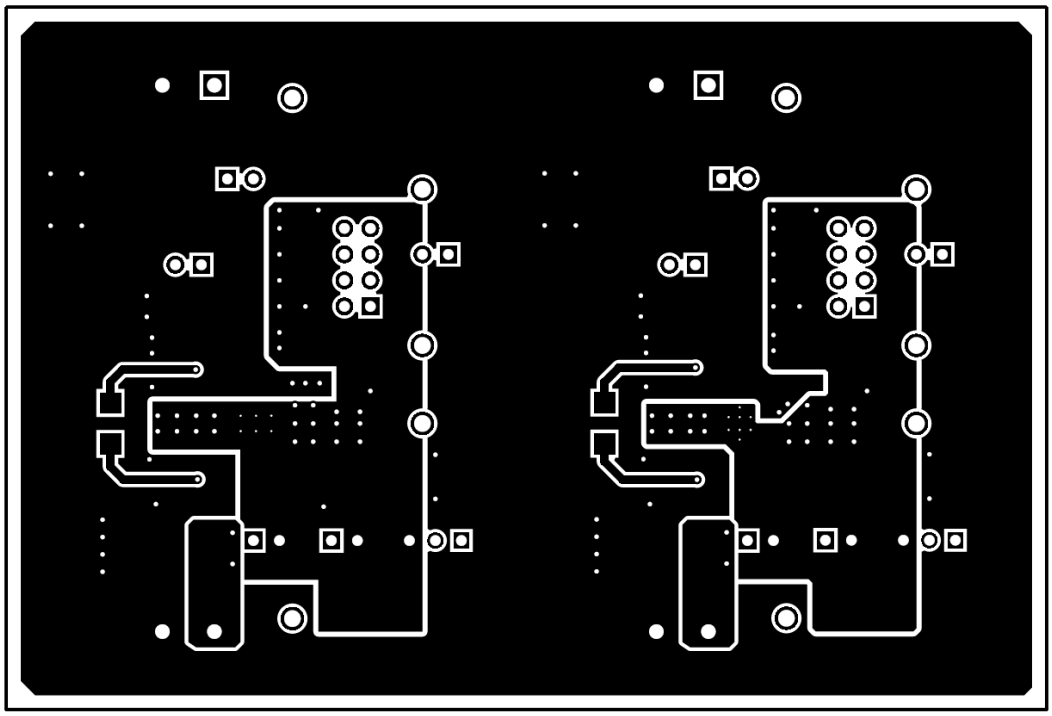

Figure 12. Bottom Layer

6 Bill Of Materials (BOM)

Table 13 displays the EVM BOM.

Table 13. TPS26600-02EVM Bill of Materials

Item #	Designator	Qty	Value	Part Number	Manufacturer	Description	Package Reference
1	!PCB1	1		HVL162	Any	Printed Circuit Board	
2	C2, C3, C8, C10	4	1uF	GRM31CR72A105KA01L	Murata	CAP, CERM, 1 µF, 100 V, +/- 10%, X7R, 1206	1206
3	C5, C9	2	47uF	EEETG1J470P	Panasonic	CAP, AL, 47 µF, 63 V, +/- 20%, ohm, SMD	SMT Radial G
4	C6, C12	2	0.022uF	GRM188R71C223KA01D	Murata	CAP, CERM, 0.022 µF, 16 V, +/- 10%, X7R, 0603	0603
5	D1, D7	2	Red	LTST-C190CKT	Lite-On	LED, Red, SMD	Red LED, 1.6x0.8x0.8mm
6	D4, D10	2	51V	SMBJ51CA	Bourns	Diode, TVS, Bi, 51 V, 600 W, SMB	SMB
7	D5, D11	2	60V	B260A-13-F	Diodes Inc.	Diode, Schottky, 60 V, 2 A, SMA	SMA
8	D6, D12	2	Green	LTST-C190GKT	Lite-On	LED, Green, SMD	1.6x0.8x0.8mm
9	H1, H2, H3, H4	4		SJ-5303 (CLEAR)	3M	Bumpon, Hemisphere, 0.44 X 0.20, Clear	Transparent Bumpon
10	J1, J2, J3, J6, J7, J8, J9, J10, J13, J14	10		PBC02SAAN	Sullins Connector Solutions	Header, 100mil, 2x1, Gold, TH	Sullins 100mil, 1x2, 230 mil above insulator
11	J4, J11	2		PEC03SAAN	Sullins Connector Solutions	Header, 100mil, 3x1, Tin, TH	Header, 3 PIN, 100mil, Tin
12	J5, J12	2		PEC04DAAN	Sullins Connector Solutions	Header, 100mil, 4x2, Tin, TH	Header, 4x2, 100mil, Tin
13	R1, R5, R13, R16	4	24.3k	CRCW060324K3FKEA	Vishay-Dale	RES, 24.3 k, 1%, 0.1 W, 0603	0603
14	R2, R14	2	887k	CRCW0603887KFKEA	Vishay-Dale	RES, 887 k, 1%, 0.1 W, 0603	0603
15	R3, R15	2	90.9k	CRCW060390K9FKEA	Vishay-Dale	RES, 90.9 k, 1%, 0.1 W, 0603	0603
16	R4, R17	2	100k	CRCW0603100KFKEA	Vishay-Dale	RES, 100 k, 1%, 0.1 W, 0603	0603
17	R6, R18	2	20.0k	CRCW060320K0FKEA	Vishay-Dale	RES, 20.0 k, 1%, 0.1 W, 0603	0603
18	R7, R19	2	402k	CRCW0603402KFKEA	Vishay-Dale	RES, 402 k, 1%, 0.1 W, 0603	0603
19	R8, R20	2	30.1k	CRCW060330K1FKEA	Vishay-Dale	RES, 30.1 k, 1%, 0.1 W, 0603	0603
20	R9, R21	2	5.36k	CRCW06035K36FKEA	Vishay-Dale	RES, 5.36 k, 1%, 0.1 W, 0603	0603
21	R10, R22	2	8.06k	CRCW06038K06FKEA	Vishay-Dale	RES, 8.06 k, 1%, 0.1 W, 0603	0603
22	R11, R23	2	12.1k	CRCW060312K1FKEA	Vishay-Dale	RES, 12.1 k, 1%, 0.1 W, 0603	0603
23	R12, R24	2	60.4k	CRCW060360K4FKEA	Vishay-Dale	RES, 60.4 k, 1%, 0.1 W, 0603	0603
24	S1, S2	2		SKRKAEE010	Alps	Switch, Push Button, SMD	2.9x2x3.9mm SMD
25	SH-J1, SH-J2, SH-J4, SH-J5, SH-J8, SH-J9, SH-J11, SH-J12, SH-J13, SH-J14	10	1x2	SPC02SYAN	Sullins Connector Solutions	Shunt, 100mil, Flash Gold, Black	Closed Top 100mil Shunt
26	T1, T2, T3, T4	4		282841-2	TE Connectivity	Terminal Block, 2x1, 5.08mm, TH	10.16x15.2x9mm
27	TP1, TP4, TP5, TP10, TP13, TP14	6	White	5012	Keystone	Test Point, TH, Multipurpose, White	Keystone5012
28	TP2, TP3, TP11, TP12	4	Red	5010	Keystone	Test Point, Multipurpose, Red, TH	Red Multipurpose Testpoint
29	TP7, TP8, TP9, TP16, TP17, TP18	6	SMT	5016	Keystone	Test Point, SMT, Compact	Testpoint_Keystone_Compact

Table 13. TPS26600-02EVM Bill of Materials (continued)

Item #	Designator	Qty	Value	Part Number	Manufacturer	Description	Package Reference
30	U1	1		TPS26600PWPR	Texas Instruments	4.2V-55V, 2.23A, Industrial eFuse with Integrated Reverse Input Polarity Protection	PWP0016D
31	C1, C7	0	0.1uF	GRM319R72A104KA01D	Murata	CAP, CERM, 0.1 µF, 100 V, +/- 10%, X7R, 1206	1206
32	C4, C11	0	1uF	GRM31CR72A105KA01L	Murata	CAP, CERM, 1 µF, 100 V, +/- 10%, X7R, 1206	1206
33	D2, D8	0	51V	SMAJ51CA	Littelfuse	Diode, TVS, Bi, 51 V, 400 W, SMA	SMA
34	D3, D9	0	36V	SMCJ36CA	Bourns	TVS DIODE 36VWM 58.1VC SMC	SMC
35	FID1, FID2, FID3	0		N/A	N/A	Fiducial mark. There is nothing to buy or mount.	Fiducial
36	SH-J3, SH-J6, SH-J7, SH-J10	0	1x2	SPC02SYAN	Sullins Connector Solutions	Shunt, 100mil, Flash Gold, Black	Closed Top 100mil Shunt
37	U2	1		TPS26600RHF	Texas Instruments	4.2V - 55V, 2.23A Industrial eFuse with Integrated Reverse Input Polarity Protection	RHF0024A

Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Original (August 2016) to A Revision **Page**

- Added TPS26601 device to document. 1
- Changed schematic for board revision B. 3
- Deleted TP6 and TP15 test points from *Test Points Description* table. 4
- Changed *EVM Test Setup* image. 6
- Deleted CH2 *NOTE* from the *Test Procedure* section. 7
- Added *Instructions to Evaluate the TPS26601* section. 13
- Changed all PCB drawings in the *PCB Drawings* section. 14
- Updated BOM for board revision B. 16

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3 *Regulatory Notices:*

   3.1 *United States*

      3.1.1 *Notice applicable to EVMs not FCC-Approved:*

      FCC NOTICE: This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

      3.1.2 *For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:*

      CAUTION

      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.

      FCC Interference Statement for Class A EVM devices

      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.

FCC Interference Statement for Class B EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- *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*

3.2.1 *For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247*

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSSs. Operation is subject to the following two conditions:

(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.

Concerning EVMs Including Detachable Antennas:

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.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur

3.3 *Japan*

3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。
http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page

3.3.2 *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required to follow the instructions set forth by Radio Law of Japan, which includes, but is not limited to, the instructions below with respect to EVMs (which for the avoidance of doubt are stated strictly for convenience and should be verified by User):

1. Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

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3.4 *European Union*

3.4.1 *For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive)*:

This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

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4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.

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4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.

4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.

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