ADVANCE INFORMATION

![Texas Instruments logo]

User's Guide
SLVUBA1 – October 2017

TPS26620-23 Evaluation Module

This user's guide describes the evaluation module (EVM) for the Texas Instruments TPS26620, TPS26621, TPS26622, and TPS26623 devices. This document provides configuration information and test setup details for evaluating the TPS26620-23 devices. The EVM schematic, board layout, and bill of materials (BOM) are included.

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Trademarks

All trademarks are the property of their respective owners.

1   Introduction

The TPS26620-23EVM allows reference circuit evaluation of TI's TPS2662X. The TPS2662X devices are 4.5- to 57-V, 800-mA industrial eFuse with integrated back-to-back FETs, programmable undervoltage, overvoltage, input reverse polarity, overcurrent and inrush current protection features.

1.1 Features

The TPS26620-23EVM features include:
- 4.5- to 57-V input operating voltage range
- 25- to 800-mA programmable current limit
- Reverse input polarity protection up to –57 V
- Programmable input undervoltage lockout (UVLO) and overvoltage protection (OVP) cutoff
- Programmable VOUT slew rate control
- Overcurrent fault response (auto-retry and latch versions available)
- Optional onboard transient protection like input TVS and output Schottky diodes
- Onboard reset switch

1.2 EVM Applications

The TPS26620-23EVM is used in the following applications:
- Control and automation
- Industrial power systems
- Sensors controls
- PLCs

2 Description

The TPS26620-23EVM enables full evaluation of the TPS26620-23 devices. This EVM has two independent channels (CH1 and CH2) where two devices can be evaluated together. CH1 is configured to test OVP cutoff versions TPS26620 and TPS26621 and CH2 is configured to test OV clamp versions TPS26622 and TPS26623. Input power is applied at T1 (CH1) and T3 (CH2) while T2 (CH1) and T4 (CH2) provide the output connections to the load. Refer to the schematic in Figure 1 and EVM test setup in Figure 2. S1 and S2 allow U1 and U2 to be reset or disabled and jumper J4 and J8 allow the current limit setting to be changed.

Table 1. TPS26620-23EVM Options and Setting

Part Number	EVM Function	V_IN Range	UVLO	OVP	Current Limit		Fault Response Versions Available
TPS26620-23EVM	4.5-V to 57-V, 800-mA Industrial eFuse	4.5 V–57 V	15 V	33 V	25 mA	800 mA	Auto-retry and Latch-off

ADVANCE INFORMATION

3   Schematics

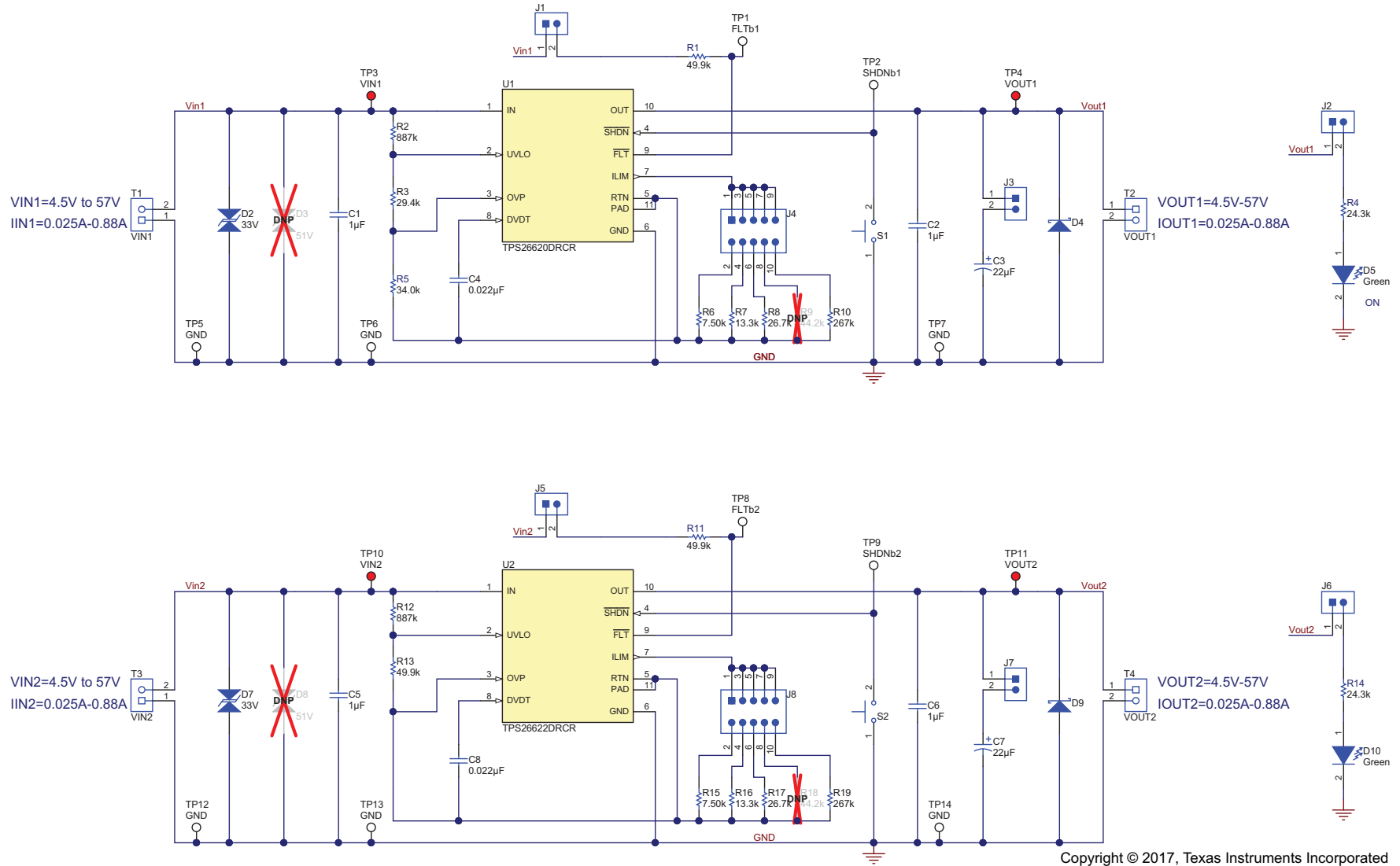Figure 1 illustrates the EVM schematic.

Figure 1. TPS26620-23EVM Schematic

4 General Configurations

4.1 Physical Access

Table 2 lists the TPS26620-23EVM 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
T1	CH2	VIN2(+), GND(–)	CH2 input power supply to the EVM
T2		VOUT2(+), GND(–)	CH2 output from the EVM

Table 3. Test Points Description

Test Points	Label	Description
TP1, TP8	FLTb1, FLTb2	Fault indicator
TP2, TP9	SHDNb1, SHDNb2	Shutdown signal
TP3, TP10	VIN1, VIN2	Power supply input
TP4, TP11	VOUT1, VOUT2	eFuse output
TP5, TP12		
TP6, TP13	GND	GND
TP7, TP14		

Table 4. Jumper and LED Descriptions

Jumper	Label	Description
J1, J5	J1, J5	FLTb pullup to VIN1,VIN2
J2, J6	J2, J6	Output power indicator for VOUT1, VOUT2
J3, J7	J3, J6	Connects bulk capacitor to VOUT1, VOUT2
J4, J8	ILIM	1-2 position sets 880 mA 3-4 position sets 500 mA 5-6 position sets 250 mA 7-8 position sets 150 mA 9-10 position sets 25 mA

4.2 Test Equipment and Set Up

4.2.1 Power Supplies

One adjustable power supply 0-V to 60-V output, 0-A to 5-A output current limit.

4.2.2 Meters

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

4.2.3 Oscilloscope

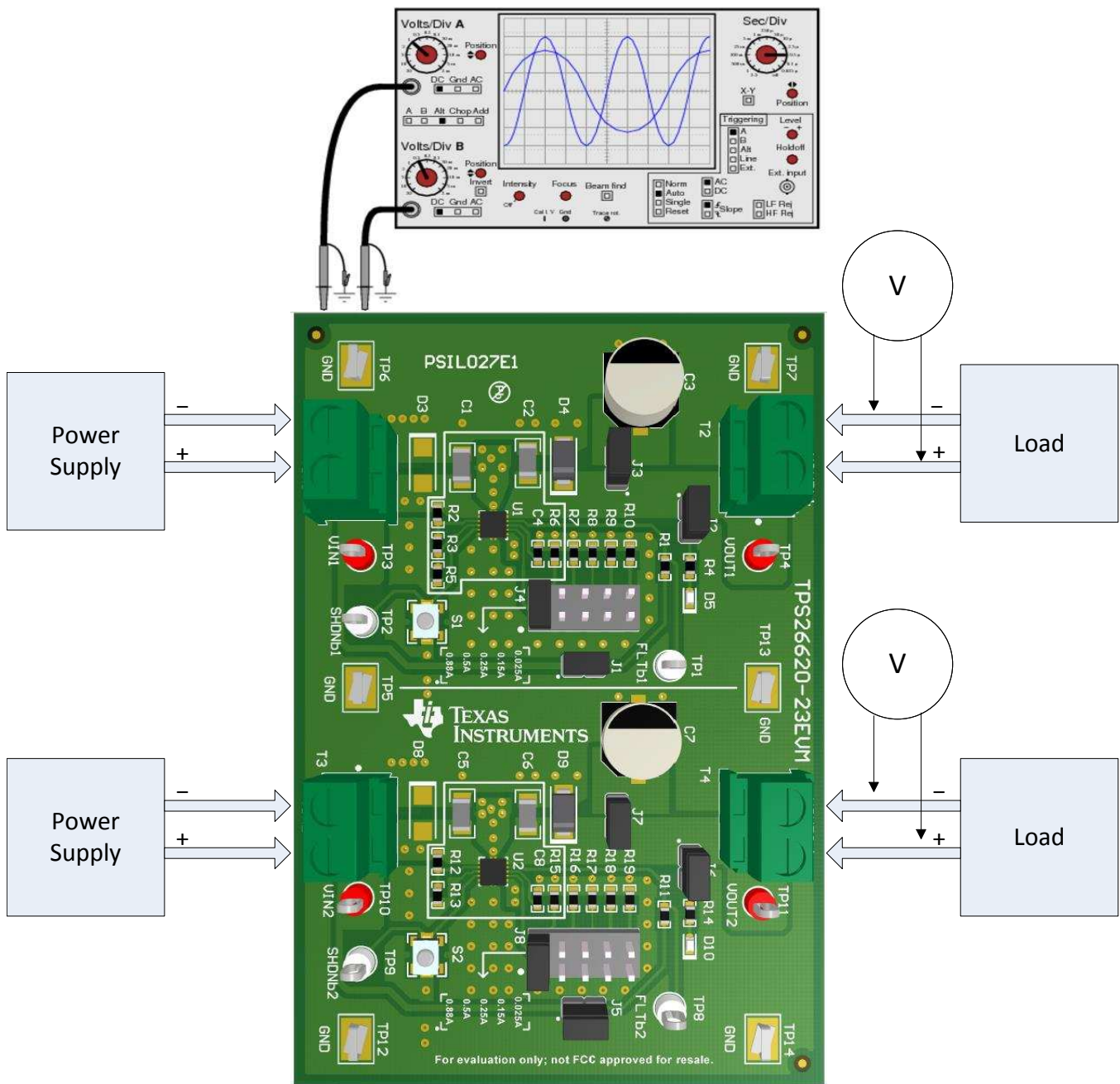A DPO2024 or equivalent, three 10× voltage probes and a DC current probe.

4.2.4 Loads

One resistive load or equivalent which can tolerate up to 2-A DC load at 24 V.

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

4.3   Test Setup and Connections

Figure 2 shows a typical test setup for the TPS26620-23 EVM. Connect T1 to the power supply and T2 to the load.

Figure 2. EVM Setup With Test Equipment

4.4 Test Procedure

4.4.1 Current Limit Test

Use the following instructions to verify the current limit and the latch feature.

1. Table 5 shows how to setup the oscilloscope for CH1.

Table 5. TPS26620-23EVM Oscilloscope Setting for Current Limit Test

Oscilloscope Setting	CH1 Probe Points	CH2 Probe Points
Channel 1 = 20 V/div	VIN1 (TP3)	VIN2 (TP10)
Channel 2 = 20 V/div	VOUT1 (TP4)	VOUT2 (TP11)
Channel 3 = 50 V/div	FLTb1 (TP1)	FLTb2 (TP8)
Channel 4 = 500 mA/div	Input current into T1 + wire	Input current into T3 + wire
Trigger source = Channel 4		
Trigger level = 500 mA ±100 mA		
Trigger polarity = Positive		
Trigger mode = Single sequence		
Time base	800 ms/div	800 ms/div

> **NOTE:** If an electronic load is used, ensure that the output load is set to constant resistance mode and not constant current mode.

> **NOTE:** Measuring *Current Limit* values on the oscilloscope can easily cause 8% error from anticipated values listed in Table 5.

2. The jumper setting for the different current limit test is shown in Table 6.

3. Set the current limit to 880 mA by installing the J4 and J8 jumper in position 1-2.

Table 6. TPS26620-23EVM Jumper Setting for Current Limits

CH1, CH2 Jumper Position (J4, J8)	Load Current Limit
1-2	880 mA
3-4	500 mA
5-6	250 mA
7-8	150 mA
9-10	25 mA

4. Set the power supply on CH1 to 24 V and the output load on CH2 to 120 ±1 Ω and enable the power supply and load on CH1.

5. Set the trigger on the oscilloscope and change the load to 24 ±1 Ω.

6. Verify that input current is limited as per the setting in Table 6 and the device is in latched mode as shown in Figure 3.

7. The level of the current pulse should match with the load current limit setting in Table 6.

8. After the oscilloscope triggers, turn off the load.

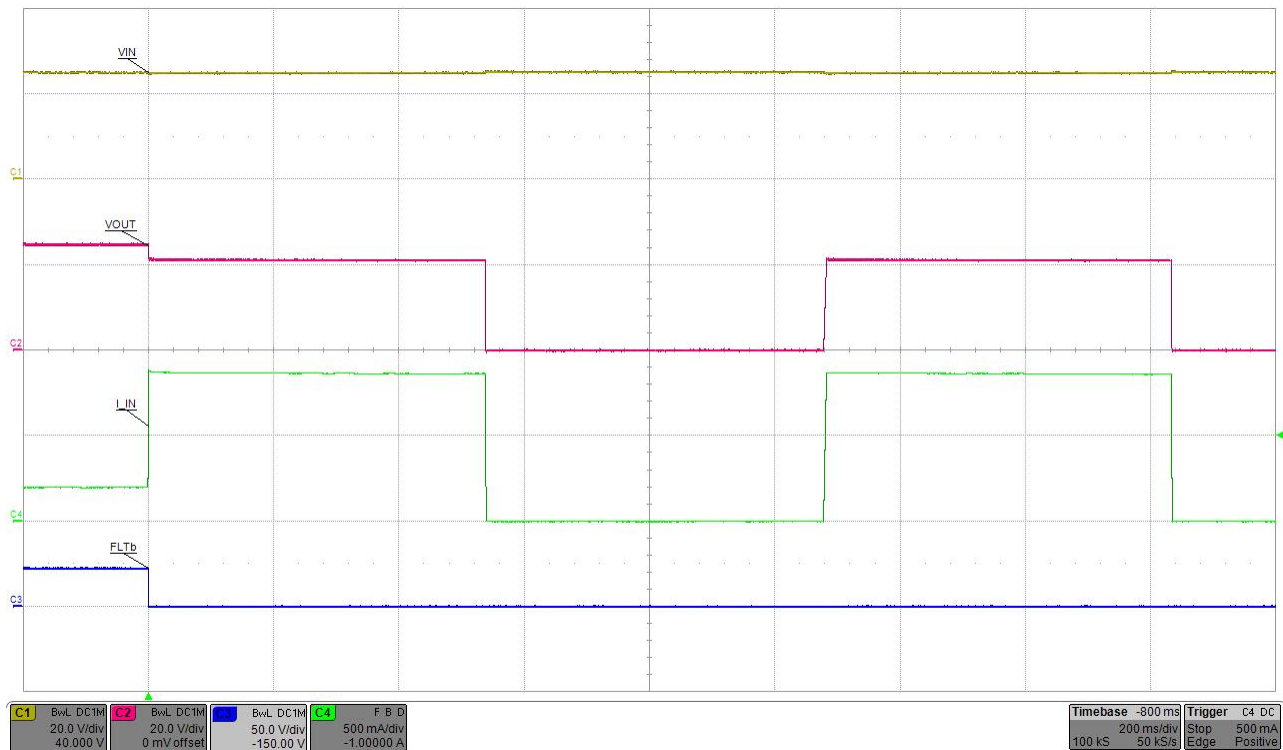9. Connect the oscilloscope to CH2 and verify the same behavior on CH2 by repeating the procedure.

Figure 3. J4 = 1-2 Position, Current Limit (800 mA) and Auto-Retry

4.4.2 Output Short-Circuit Protection Test

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

1. Set the oscilloscope as shown in Table 7 on CH1.

Table 7. TPS26620-23EVM Oscilloscope Setting for Output Short Circuit Protection

Oscilloscope Setting	CH1 Probe Points	CH2 Probe Points
Channel 1 = 20 V/div	VIN1 (TP3)	VIN2 (TP10)
Channel 2 = 20 V/div	VOUT1 (TP4)	VOUT2 (TP11)
Channel 3 = 20 V/div	FLTb1 (TP1)	FLTb2 (TP8)
Channel 4 = 2 mA/div	Input current into T1 + wire	Input current into T3 + wire
Trigger source = Channel 2		
Trigger level = 10 V		
Trigger polarity = Negative		
Trigger mode = Single sequence		
Time base	2 ms/div	2 ms/div

2. Set the power supply on CH1 to 24 V and the load resistance on CH1 to 120 ±1 Ω.

3. Enable the load and the power supply on CH1.

4. Use either thick wire or a screw driver to short the output to ground and verify the output short-circuit response as shown in Figure 4.
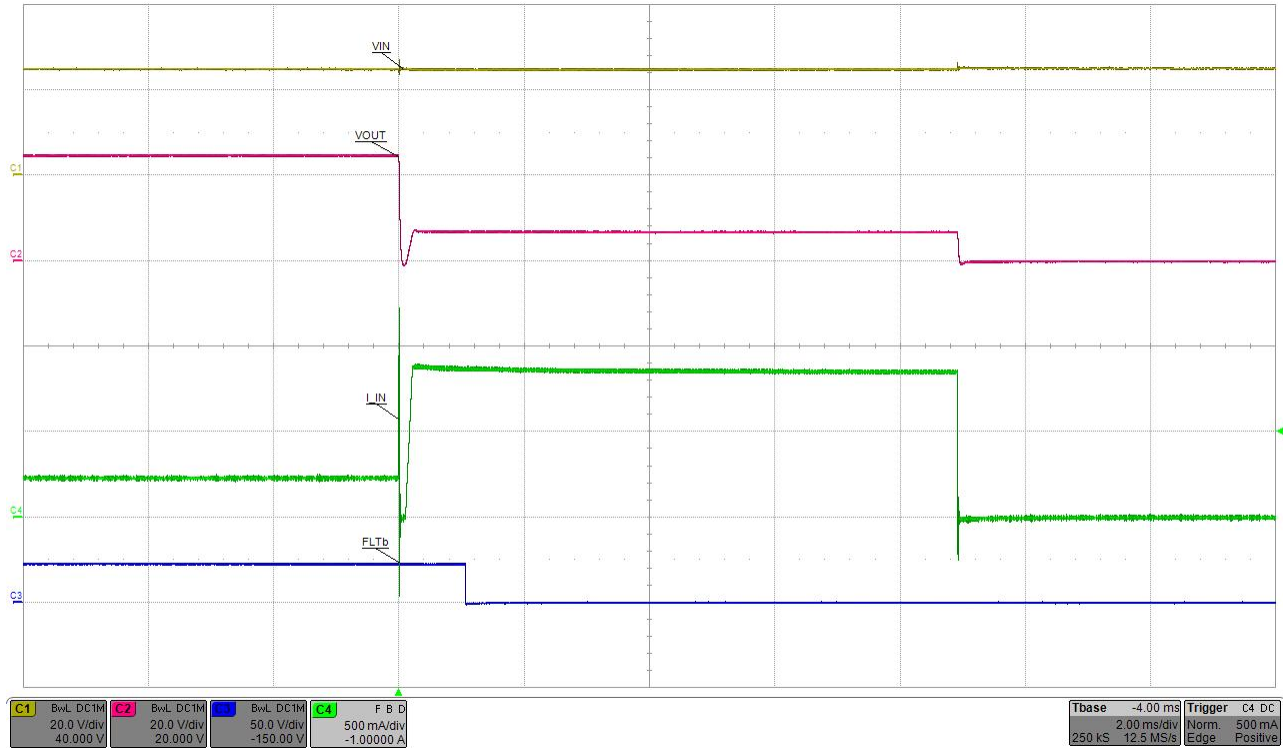

Figure 4. Output Short-Circuit Protection

5   EVM Board Assembly Drawings and Layout Guidelines

5.1   PCB Drawings

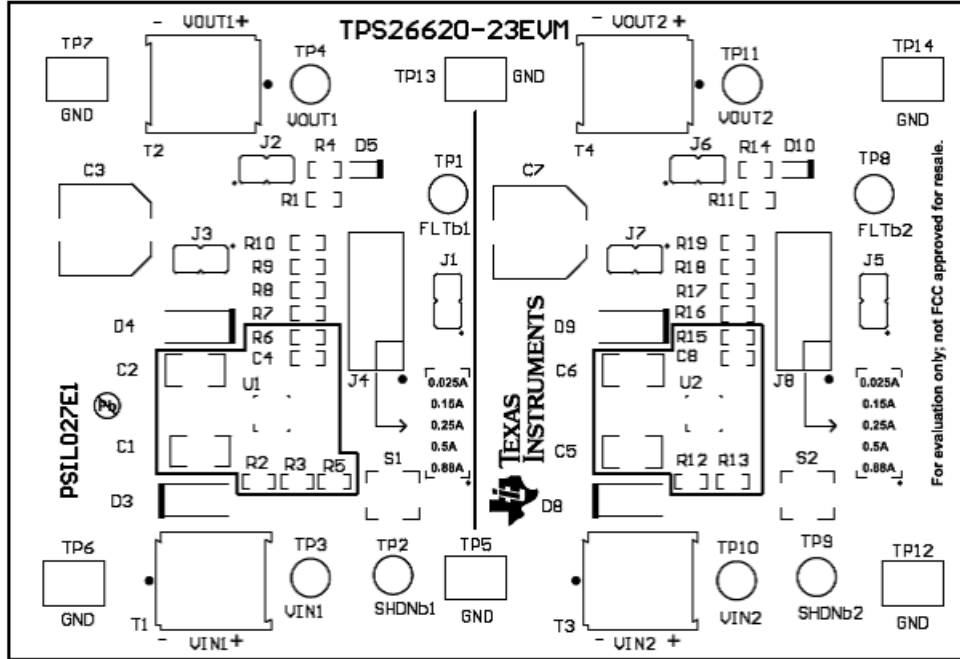Figure 5 through Figure 8 show the component placement and layout of this EVM.

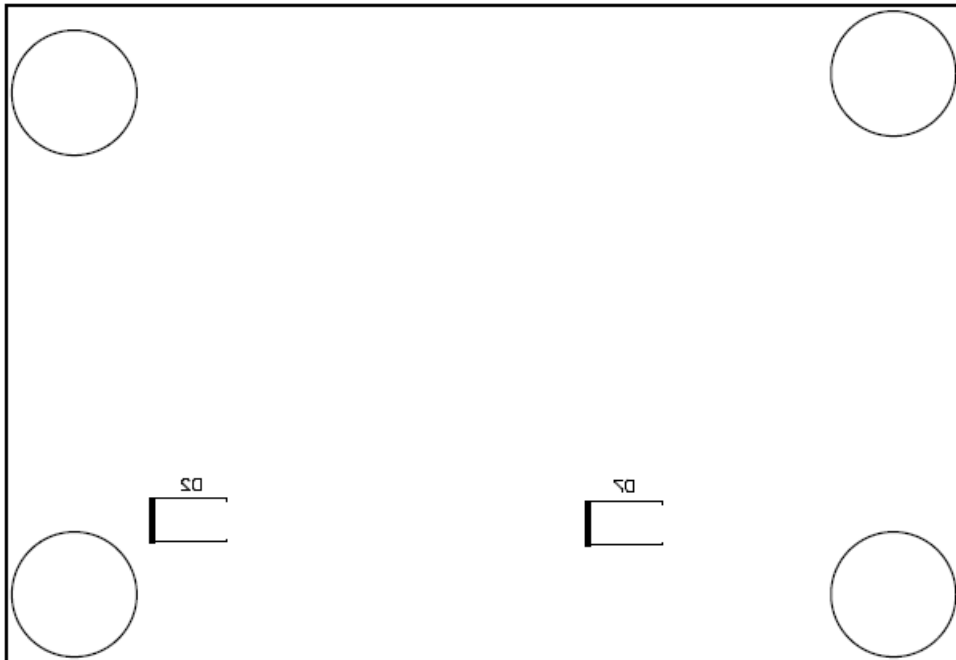**Figure 5. TPS26620-23EVM Top Side Placement**

Figure 6. TPS26620-23EVM Bottom Side Placement
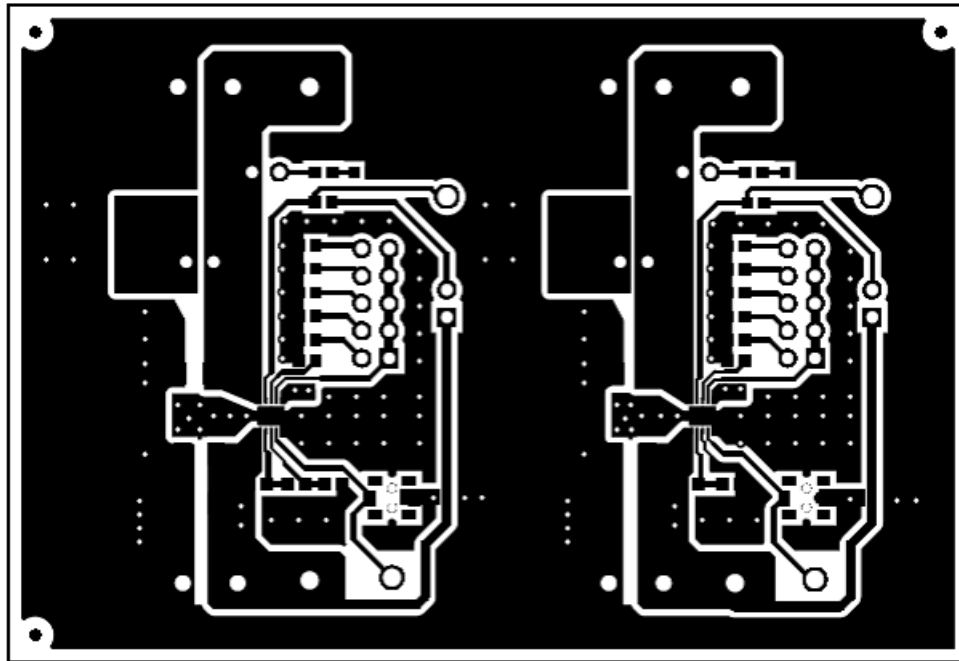
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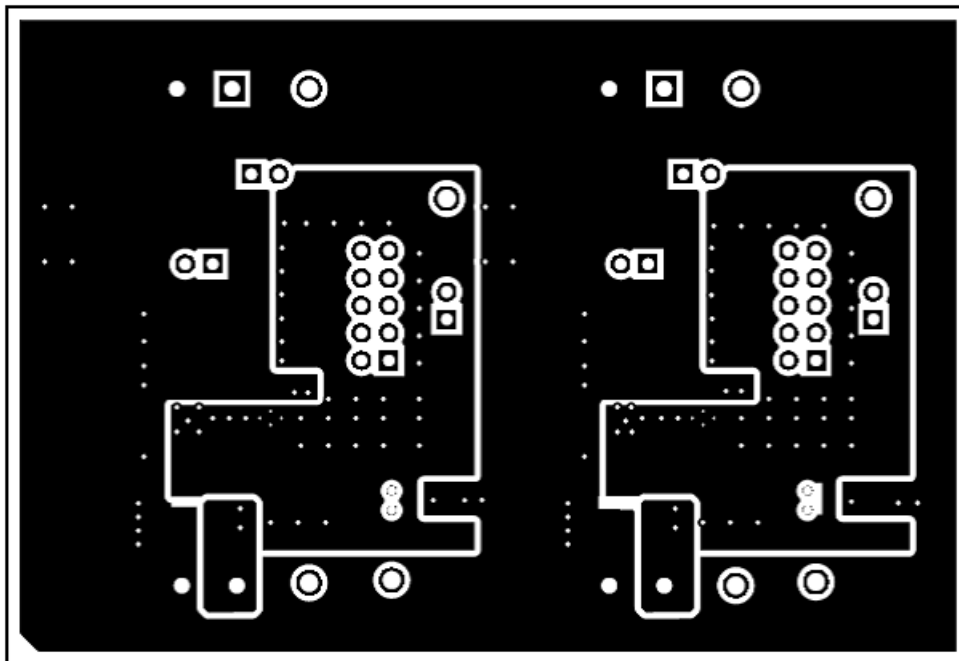**Figure 7. TPS26620-23EVM Top Layer Routing**

Figure 8. TPS26620-23EVM Bottom Layer Routing

6   Bill Of Materials (BOM)

Table 8 lists the EVM BOM.

Table 8. TPS26620-23EVM Bill of Materials

Designator	QTY	Value	Description	Package Reference	Part Number	Manufacturer
!PCB1	1		Printed Circuit Board		PSIL027	Any
C1, C2, C5, C6	4	1uF	CAP, CERM, 1 μF, 100 V, ±10%, X7R, 1206	1206	GRM31CR72A105KA01L	Murata
C3, C7	2	22uF	CAP, AL, 22 μF, 63 V, ±20%, 1.2 ohm, AEC-Q200 Grade 2, SMD	SMT Radial E	EEE-FK1J220P	Panasonic
C4, C8	2	0.022uF	CAP, CERM, 0.022 μF, 16 V,±10%, X7R, 0603	0603	GRM188R71C223KA01D	Murata
D2, D7	2	33V	Diode, TVS, Bi, 33 V, SMB	SMB	SMBJ33CA-13-F	Diodes Inc.
D4, D9	2	60V	Diode, Schottky, 60 V, 2 A, SMA	SMA	B260A-13-F	Diodes Inc.
D5, D10	2	Green	LED, Green, SMD	1.6x0.8x0.8mm	LTST-C190GKT	Lite-On
H9, H10, H11, H12	4		Bumpon, Hemisphere, 0.44 X 0.20, Clear	Transparent Bumpon	SJ-5303 (CLEAR)	3M
J1, J2, J3, J5, J6, J7	6		Header, 100mil, 2x1, Gold, TH	Sullins 100mil, 1x2, 230 mil above insulator	PBC02SAAN	Sullins Connector Solutions
J4, J8	2		Header, 100mil, 5x2, Tin, TH	Header, 5x2, 100mil, Tin	PEC05DAAN	Sullins Connector Solutions
R1, R11, R13	3	49.9k	RES, 49.9 k, 1%, 0.1 W, 0603	0603	CRCW060349K9FKEA	Vishay-Dale
R2, R12	2	887k	RES, 887 k, 1%, 0.1 W, 0603	0603	CRCW0603887KFKEA	Vishay-Dale
R3	1	29.4k	RES, 29.4 k, 1%, 0.1 W, 0603	0603	CRCW060329K4FKEA	Vishay-Dale
R4, R14	2	24.3k	RES, 24.3 k, 1%, 0.1 W, 0603	0603	CRCW060324K3FKEA	Vishay-Dale
R5	1	34.0k	RES, 34.0 k, 1%, 0.1 W, 0603	0603	CRCW060334K0FKEA	Vishay-Dale
R6, R15	2	7.50k	RES, 7.50 k, 1%, 0.1 W, 0603	0603	CRCW06037K50FKEA	Vishay-Dale
R7, R16	2	13.3k	RES, 13.3 k, 1%, 0.1 W, 0603	0603	CRCW060313K3FKEA	Vishay-Dale
R8, R17	2	26.7k	RES, 26.7 k, 1%, 0.1 W, 0603	0603	CRCW060326K7FKEA	Vishay-Dale
R10, R19	2	267k	RES, 267 k, 1%, 0.1 W, 0603	0603	CRCW0603267KFKEA	Vishay-Dale
S1, S2	2		Switch, SPST-NO, Off-Mom, 0.05A, 12VDC, SMD	3.9x2.9mm	PTS820 J20M SMTR LFS	C&K Components
SH-J1, SH-J2, SH-J3, SH-J4, SH-J5, SH-J6, SH-J7, SH-J8	8	1x2	Shunt, 100mil, Flash Gold, Black	Closed Top 100mil Shunt	SPC02SYAN	Sullins Connector Solutions
T1, T2, T3, T4	4		Terminal Block, 2x1, 5.08mm, TH	10.16x15.2x9mm	282841-2	TE Connectivity
TP1, TP2, TP8, TP9	4	White	Test Point, TH, Multipurpose, White	Keystone5012	5012	Keystone
TP3, TP4, TP10, TP11	4	Red	Test Point, Multipurpose, Red, TH	Red Multipurpose Testpoint	5010	Keystone
TP5, TP6, TP7, TP12, TP13, TP14	6	SMT	Test Point, SMT, Compact	Testpoint_Keystone_Compact	5016	Keystone
U1	1		7V - 57V, 800mA Industrial eFuse with Integrated Reverse Polarity Protection, DRC0010J (VSON-10)	DRC0010J	TPS26620DRCR	Texas Instruments
U2	1		7V - 57V, 800mA Industrial eFuse with Integrated Reverse Polarity Protection, DRC0010J (VSON-10)	DRC0010J	TPS26622DRCR	Texas Instruments
D3, D8	0	51V	Diode, TVS, Bi, 51 V, SMA	SMA	SMAJ51CA	Littelfuse
FID1, FID2, FID3	0		Fiducial mark. There is nothing to buy or mount.	Fiducial	N/A	N/A
R9, R18	0	44.2k	RES, 44.2 k, 1%, 0.1 W, 0603	0603	CRCW060344K2FKEA	Vishay-Dale

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1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, and/or documentation which may be provided together or separately (collectively, an "EVM" or "EVMs") to the User ("User") in accordance with the terms set forth herein. User's acceptance of the EVM is expressly subject to the following terms.

    1.1 EVMs are intended solely for product or software developers for use in a research and development setting to facilitate feasibility evaluation, experimentation, or scientific analysis of TI semiconductors products. EVMs have no direct function and are not finished products. EVMs shall not be directly or indirectly assembled as a part or subassembly in any finished product. For clarification, any software or software tools provided with the EVM ("Software") shall not be subject to the terms and conditions set forth herein but rather shall be subject to the applicable terms that accompany such Software

    1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.

2. *Limited Warranty and Related Remedies/Disclaimers*:

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    2.2 TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for a nonconforming EVM if (a) the nonconformity was caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI, (b) the nonconformity resulted from User's design, specifications or instructions for such EVMs or improper system design, or (c) User has not paid on time. Testing and other quality control techniques are used to the extent TI deems necessary. TI does not test all parameters of each EVM. User's claims against TI under this Section 2 are void if User fails to notify TI of any apparent defects in the EVMs within ten (10) business days after delivery, or of any hidden defects with ten (10) business days after the defect has been detected.

    2.3 TI's sole liability shall be at its option to repair or replace EVMs that fail to conform to the warranty set forth above, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.

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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2. 実験局の免許を取得後ご使用いただく。
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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.

4 *EVM Use Restrictions and Warnings:*

4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.

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.

4.3 *Safety-Related Warnings and Restrictions:*

    4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.

    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.

5. *Accuracy of Information:* To the extent TI provides information on the availability and function of EVMs, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.

6. *Disclaimers:*

    6.1 EXCEPT AS SET FORTH ABOVE, EVMS AND ANY MATERIALS PROVIDED WITH THE EVM (INCLUDING, BUT NOT LIMITED TO, REFERENCE DESIGNS AND THE DESIGN OF THE EVM ITSELF) ARE PROVIDED "AS IS" AND "WITH ALL FAULTS." TI DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, REGARDING SUCH ITEMS, INCLUDING BUT NOT LIMITED TO ANY EPIDEMIC FAILURE WARRANTY OR IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF ANY THIRD PARTY PATENTS, COPYRIGHTS, TRADE SECRETS OR OTHER INTELLECTUAL PROPERTY RIGHTS.

    6.2 EXCEPT FOR THE LIMITED RIGHT TO USE THE EVM SET FORTH HEREIN, NOTHING IN THESE TERMS SHALL BE CONSTRUED AS GRANTING OR CONFERRING ANY RIGHTS BY LICENSE, PATENT, OR ANY OTHER INDUSTRIAL OR INTELLECTUAL PROPERTY RIGHT OF TI, ITS SUPPLIERS/LICENSORS OR ANY OTHER THIRD PARTY, TO USE THE EVM IN ANY FINISHED END-USER OR READY-TO-USE FINAL PRODUCT, OR FOR ANY INVENTION, DISCOVERY OR IMPROVEMENT, REGARDLESS OF WHEN MADE, CONCEIVED OR ACQUIRED.

7. *USER'S INDEMNITY OBLIGATIONS AND REPRESENTATIONS.* USER WILL DEFEND, INDEMNIFY AND HOLD TI, ITS LICENSORS AND THEIR REPRESENTATIVES HARMLESS FROM AND AGAINST ANY AND ALL CLAIMS, DAMAGES, LOSSES, EXPENSES, COSTS AND LIABILITIES (COLLECTIVELY, "CLAIMS") ARISING OUT OF OR IN CONNECTION WITH ANY HANDLING OR USE OF THE EVM THAT IS NOT IN ACCORDANCE WITH THESE TERMS. THIS OBLIGATION SHALL APPLY WHETHER CLAIMS ARISE UNDER STATUTE, REGULATION, OR THE LAW OF TORT, CONTRACT OR ANY OTHER LEGAL THEORY, AND EVEN IF THE EVM FAILS TO PERFORM AS DESCRIBED OR EXPECTED.

8. *Limitations on Damages and Liability:*

    8.1 *General Limitations.* IN NO EVENT SHALL TI BE LIABLE FOR ANY SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF THESE TERMS OR THE USE OF THE EVMS , REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. EXCLUDED DAMAGES INCLUDE, BUT ARE NOT LIMITED TO, COST OF REMOVAL OR REINSTALLATION, ANCILLARY COSTS TO THE PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES, RETESTING, OUTSIDE COMPUTER TIME, LABOR COSTS, LOSS OF GOODWILL, LOSS OF PROFITS, LOSS OF SAVINGS, LOSS OF USE, LOSS OF DATA, OR BUSINESS INTERRUPTION. NO CLAIM, SUIT OR ACTION SHALL BE BROUGHT AGAINST TI MORE THAN TWELVE (12) MONTHS AFTER THE EVENT THAT GAVE RISE TO THE CAUSE OF ACTION HAS OCCURRED.

    8.2 *Specific Limitations.* IN NO EVENT SHALL TI'S AGGREGATE LIABILITY FROM ANY USE OF AN EVM PROVIDED HEREUNDER, INCLUDING FROM ANY WARRANTY, INDEMNITY OR OTHER OBLIGATION ARISING OUT OF OR IN CONNECTION WITH THESE TERMS, , EXCEED THE TOTAL AMOUNT PAID TO TI BY USER FOR THE PARTICULAR EVM(S) AT ISSUE DURING THE PRIOR TWELVE (12) MONTHS WITH RESPECT TO WHICH LOSSES OR DAMAGES ARE CLAIMED. THE EXISTENCE OF MORE THAN ONE CLAIM SHALL NOT ENLARGE OR EXTEND THIS LIMIT.

9. *Return Policy.* Except as otherwise provided, TI does not offer any refunds, returns, or exchanges. Furthermore, no return of EVM(s) will be accepted if the package has been opened and no return of the EVM(s) will be accepted if they are damaged or otherwise not in a resalable condition. If User feels it has been incorrectly charged for the EVM(s) it ordered or that delivery violates the applicable order, User should contact TI. All refunds will be made in full within thirty (30) working days from the return of the components(s), excluding any postage or packaging costs.

10. *Governing Law:* These terms and conditions shall be governed by and interpreted in accordance with the laws of the State of Texas, without reference to conflict-of-laws principles. User agrees that non-exclusive jurisdiction for any dispute arising out of or relating to these terms and conditions lies within courts located in the State of Texas and consents to venue in Dallas County, Texas. Notwithstanding the foregoing, any judgment may be enforced in any United States or foreign court, and TI may seek injunctive relief in any United States or foreign court.