

# ***TPS2593XXEVM-521: Evaluation Module for TPS2593XX***

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The TPS2593XXEVM-521 evaluation module (EVM) allows reference circuit evaluation of the TI TPS2593XX 12-V eFuse, with fixed current limit. The TPS2593XX is available with several fixed current limit options with both latching and auto-retry operation. The TPS2593XX is not installed on the EVM to permit selection of any of the device options. This user's guide includes the printed-circuit board (PCB) layouts, schematic, and bill of materials (BOM) for the EVM.

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## 1 Features

- TPS2593XX Features
  - Fixed current limit (X = 2, 3, 4, 5A)
  - Latched-off TPS2593LX
  - Auto-retry TPS2593AX
  - Built-in thermal shutdown
  - Fixed UVLO and overvoltage setting
  - Programmable OUTPUT slew rate
- 8-V to 13.0-V (typical) bus operation
- Push button RESET signal
- Copper pour with vias to the internal ground takes advantage of the power pad package
- On-board transorb is for overvoltage input protection
- Common diode at output prevents negative spike when load is removed while powered on

## 2 Applications

- Server
  - Plug-in circuit boards
  - Redundant array of independent disks (RAID) and disk drive
- Telecom
  - ATCA
  - Micro-ATCA
- General hot plug

## 3 Description

The TPS2593XXEVM-521 enables full evaluation of the TPS2593XX devices. Refer to the schematic shown in [Figure 5](#). Input power is applied at J4/J5 while J3/J5 provide the output connection to the load. D5 and C6 provide input protection for the TPS2593XX (U1) while D4/C1/C2/C4 provide output protection. S1 allows U1 to be RESET or disabled. Circuit faults can be observed with D3 and at TP5.

Turn-on or inrush slew rate control can be enabled by installing C3 (default) and is observed at TP4. The ON and FAULT LEDs (D1 and D3 respectively) can be enabled by installing shunts on J1 and J2. TPS2593XXEVM-521 contains an output overload circuit that can be enabled by applying ~ 5 V between TP1 and TP3.

**Table 1. TPS2593XX Device Options**

Part Number	Vin Range	UVLO/OVP	Current Limit (TYP)	Thermal Fault
TPS2593A2DRC	9 V – 18 V	8.5 V/14 V	2 A	Auto-retry
TPS2593L2DRC	9 V – 18 V	8.5 V/14 V	2 A	Latched
TPS2593A3DRC	9 V – 18 V	8.5 V/14 V	3 A	Auto-retry
TPS2593L3DRC	9 V – 18 V	8.5 V/14 V	3 A	Latched
TPS2593A4DRC	9 V – 18 V	8.5 V/14 V	4 A	Auto-retry
TPS2593L4DRC	9 V – 18 V	8.5 V/14 V	4 A	Latched
TPS2593A5DRC	9 V – 18 V	8.5 V/14 V	5 A	Auto-retry
TPS2593L5DRC	9 V – 18 V	8.5 V/14 V	5 A	Latched

## 4 General Configuration and Description

### 4.1 Physical Access

Table 2 lists the TPS2593XXEVM-521 connector functionality, Table 3 describes the test point availability and Table 4 describes the jumper functionality.

**Table 2. Connector Functionality**

Connector	Label	Description
J4/J5	INPUT/GND	8-V to13-V input to the EVM
J3/J5	OUTPUT/GND	8-V to13-V output from the EVM

**Table 3. Test Points**

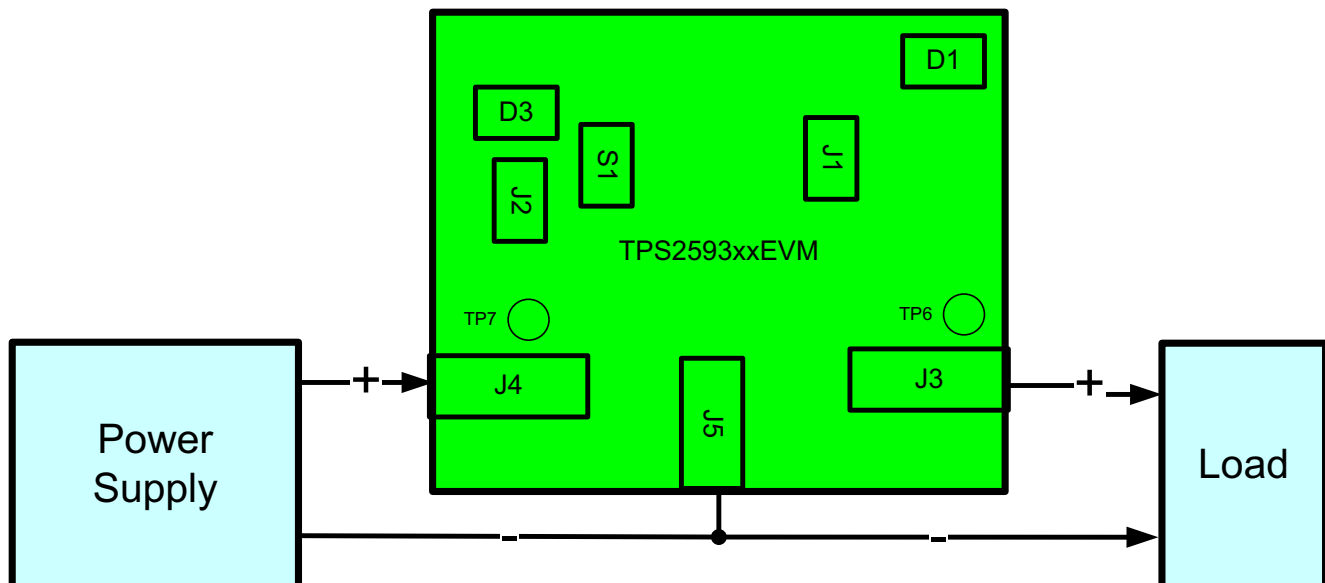
Test Point	Color	Label	Description
TP7/TP8/TP9	RED/BLK/SM	INPUT/GND	8-V to13-V input to the EVM
TP6/TP10	RED/SM	OUTPUT/GND	8-V to13-V output from the EVM
TP5	WHT	EN/FLT	Active high enable input/active low fault output
TP4	WHT	RAMP	GATE output for slew rate control
TP1	WHT	LDEN	Output load enable. Apply 5 V between TP1 and TP3 to enable U1 overload.
TP3	BLK	GND	Ground for load circuit
TP2	ORG	ILD	Output current monitor. Load current = 10 x voltage on TP2 when the overload circuit is enabled at TP1.

**Table 4. Jumper Functionality**

Jumper	Label	Description
J1	J1	Install between pins 1 and 2 to enable D1
J2	J2	Install between pins 1 and 2 to enable D3

### 4.2 Test Setup

Figure 1 shows a typical test setup for the TPS2593XXEVM-521. Connect J4/J5 to the power supply and J3/J5 to the load.



**Figure 1. Typical TPS2593XXEVM-521 Test Setup**

5 EVM Assembly Drawings and Layout Guidelines

5.1 PCB Drawings

Figure 2 to Figure 4 show component placement and layout of the EVM.

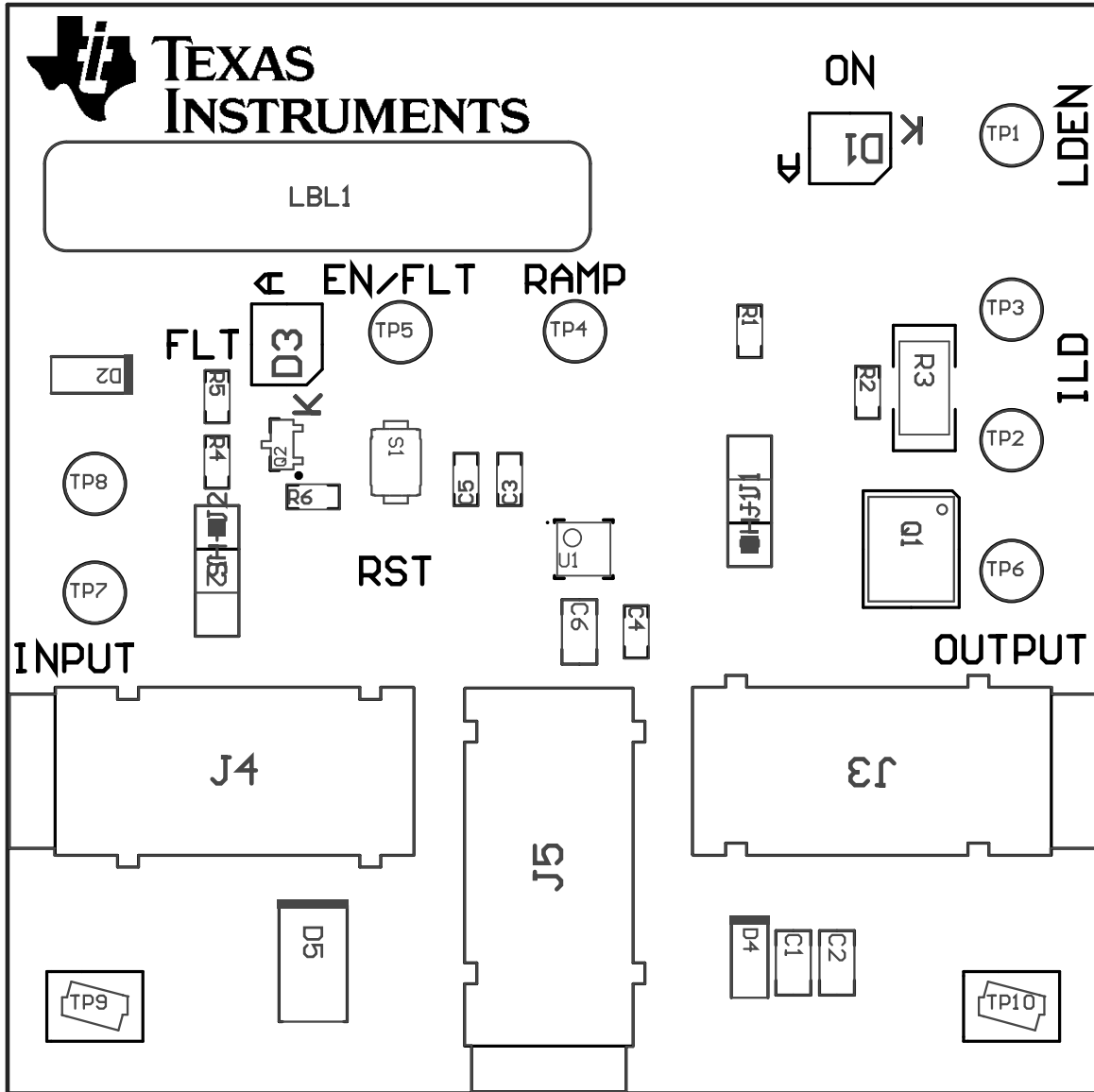


Figure 2. Top Side Placement

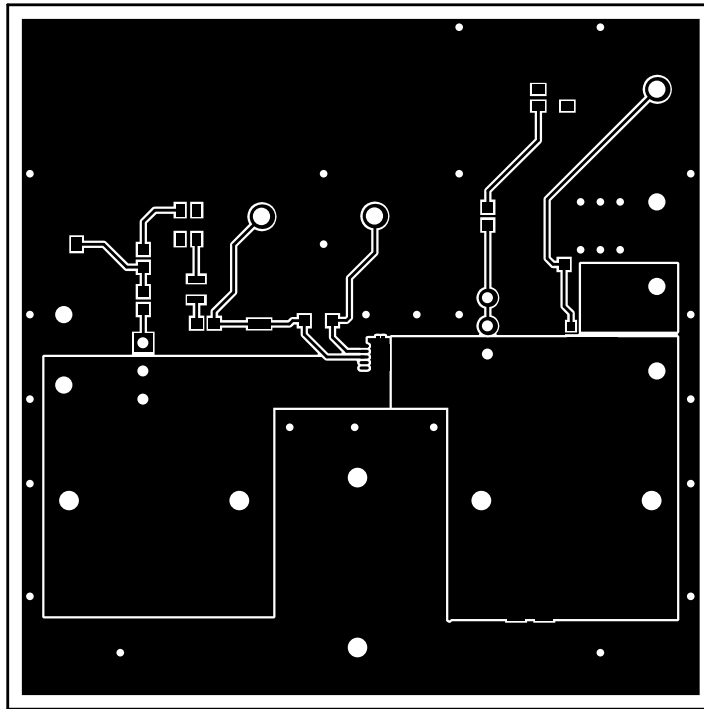


Figure 3. Top Side Routing

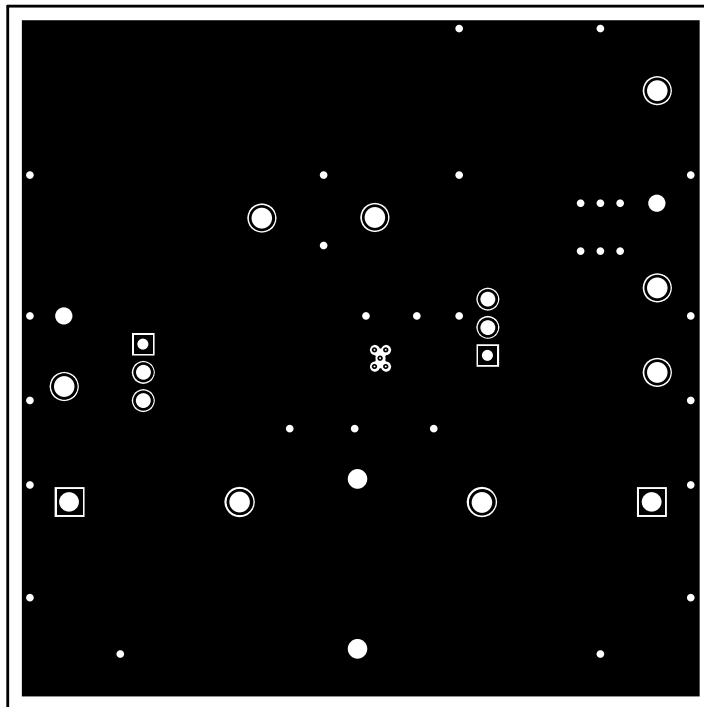


Figure 4. Bottom Side Routing



## 6.2 Bill of Materials

Table 5 is the BOM for the EVM.

**Table 5. TPS2593XXEVM-521 Bill of Materials**

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part No.	Alternate Mfg
!PCB1	1		Printed Circuit Board		PWR521	Any	-	-
C1, C2, C6	3	1uF	CAP, CERM, 1uF, 25V, ±10%, X5R, 0805	0805	08053D105KAT2A	AVX	-	-
C3, C5	2	1000pF	CAP, CERM, 1000pF, 100V, ±20%, X7R, 0603	0603	06031C102MAT2A	AVX	-	-
C4	1	0.1uF	CAP, CERM, 0.1uF, 25V, ±10%, X7R, 0603	0603	06033C104KAT2A	AVX	-	-
D1	1	Green	LED, Green, SMD	Power TOPLED w/lens	LT E63C-CADB-35-L-Z	OSRAM	-	-
D2	1	6.2V	Diode, Zener, 6.2V, 500mW, SOD-123	SOD-123	MMSZ5234B-7-F	Diodes Inc.		
D3	1	Red	LED, Red, SMD	Power TOPLED w/lens	LS E63F-DBFA-1-Z	OSRAM	-	-
D4	1	0.47V	Diode, Schottky, 30V, 1A, SOD-123	SOD-123	MBR130T1G	ON Semiconductor	Equivalent	Any
D5	1	18V	Diode, TVS, Uni, 18V, 600W, SMB	SMB	SMBJ18A-13-F	Diodes Inc.	-	-
J1, J2	2	1x3	Header, TH, 100mil, 1x3, Gold plated, 230 mil above insulator	PBC03SAAN	PBC03SAAN	Sullins Connector Solutions	Equivalent	Any
J3	1	10A	Standard Banana Jack, insulated, 10A, yellow	571-0700	571-0700	DEM Manufacturing	Equivalent	Any
J4	1	10A	Standard Banana Jack, insulated, 10A, red	571-0500	571-0500	DEM Manufacturing	Equivalent	Any
J5	1	10A	Standard Banana Jack, insulated, 10A, black	571-0100	571-0100	DEM Manufacturing	Equivalent	Any
LBL1	1		Thermal Transfer Printable Labels, 1.250" W x 0.250" H - 10,000 per roll	PCB Label 1.25"H x 0.250"W	THT-13-457-10	Brady		
Q1	1	30V	MOSFET, N-CH, 30V, 100A, SON 5x6mm	SON 5x6mm	CSD17301Q5A	Texas Instruments	None	None
Q2	1	0.25V	Transistor, PNP, 40V, 0.2A, SOT-23	SOT-23	MMBT3906-7-F	Diodes Inc.	None	None
R1, R5	2	3.32k	RES, 3.32k ohm, 1%, 0.1W, 0603	0603	CRCW06033K32FKEA	Vishay-Dale	Equivalent	Any
R2, R6	2	10.0k	RES, 10.0k ohm, 1%, 0.1W, 0603	0603	CRCW060310K0FKEA	Vishay-Dale	Equivalent	Any
R3	1	0.1	RES, 0.1 ohm, 1%, 0.5W, 2010	2010	WSL2010R1000FEA	Vishay-Dale	Equivalent	Any
R4	1	1.00k	RES, 1.00k ohm, 1%, 0.1W, 0603	0603	CRCW06031K00FKEA	Vishay-Dale	Equivalent	Any
S1	1		Switch, Push Button, SMD	2.9x2x3.9mm SMD	SKRKAEE010	Alps	Equivalent	Any
SH-J1, SH-J2	2	1x2	Shunt, 100mil, Gold plated, Black	Shunt	969102-0000-DA	3M	SNT-100-BK-G	Samtec
TP1, TP4, TP5	3	White	Test Point, TH, Multipurpose, White	Keystone5012	5012	Keystone	Equivalent	Any
TP2	1	Orange	Test Point, TH, Multipurpose, Orange	Keystone5013	5013	Keystone	Equivalent	Any
TP3, TP8	2	Black	Test Point, TH, Multipurpose, Black	Keystone5011	5011	Keystone	Equivalent	Any
TP6, TP7	2	Red	Test Point, TH, Multipurpose, Red	Keystone5010	5010	Keystone	Equivalent	Any
TP9, TP10	2	SMT	Test Point, SMT, Compact	Testpoint_Keystone_Compact	5016	Keystone	Equivalent	Any
U1	0		12V eFuse with Fixed Current Limit, DRC0010A	DRC0010A	TPS2593XXDRC	Texas Instruments		None

NOTE: Unless otherwise noted in the Alternate Part Number and/or Alternate Manufacturer columns, all parts may be substituted with equivalents.

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### General Statement for EVMs including a radio

*User Power/Frequency Use Obligations:* This radio is intended for development/professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability of this EVM and its development application(s) must comply with local laws governing radio spectrum allocation and power limits for this evaluation module. It is the user's sole responsibility to only operate this radio in legally acceptable frequency space and within legally mandated power limitations. Any exceptions to this are strictly prohibited and unauthorized by Texas Instruments unless user has obtained appropriate experimental/development licenses from local regulatory authorities, which is responsibility of user including its acceptable authorization.

### 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

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**

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.

### **For EVMs annotated as IC – INDUSTRY CANADA Compliant**

This Class A or B digital apparatus complies with Canadian ICES-003.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

### **Concerning EVMs including radio transmitters**

This device complies with Industry Canada licence-exempt RSS standard(s). 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.

### **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.

Cet appareil numérique de la classe A ou B est conforme à la norme NMB-003 du Canada.

Les changements ou les modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner l'équipement.

### **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.

### **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.

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1. Use this product 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 this product only after you obtained the license of Test Radio Station as provided in Radio Law of Japan with respect to this product, or
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3. You will employ reasonable safeguards to ensure that your use of the EVM will not result in any property damage, injury or death, even if the EVM should fail to perform as described or expected.
4. You will take care of proper disposal and recycling of the EVM's electronic components and packing materials.

**Certain Instructions.** It is important to operate this EVM within TI's recommended specifications and environmental considerations per the user guidelines. Exceeding the specified EVM ratings (including but not limited to input and output voltage, current, power, and environmental ranges) may cause property damage, personal injury or death. If there are questions concerning these ratings please 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 result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM User's 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, some circuit components may have case temperatures greater than 60°C as long as the input and output are maintained at a normal ambient operating temperature. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors which can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during normal operation, please be aware that these devices may be very warm to the touch. As with all electronic evaluation tools, only qualified personnel knowledgeable in electronic measurement and diagnostics normally found in development environments should use these EVMs.

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Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>
DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
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