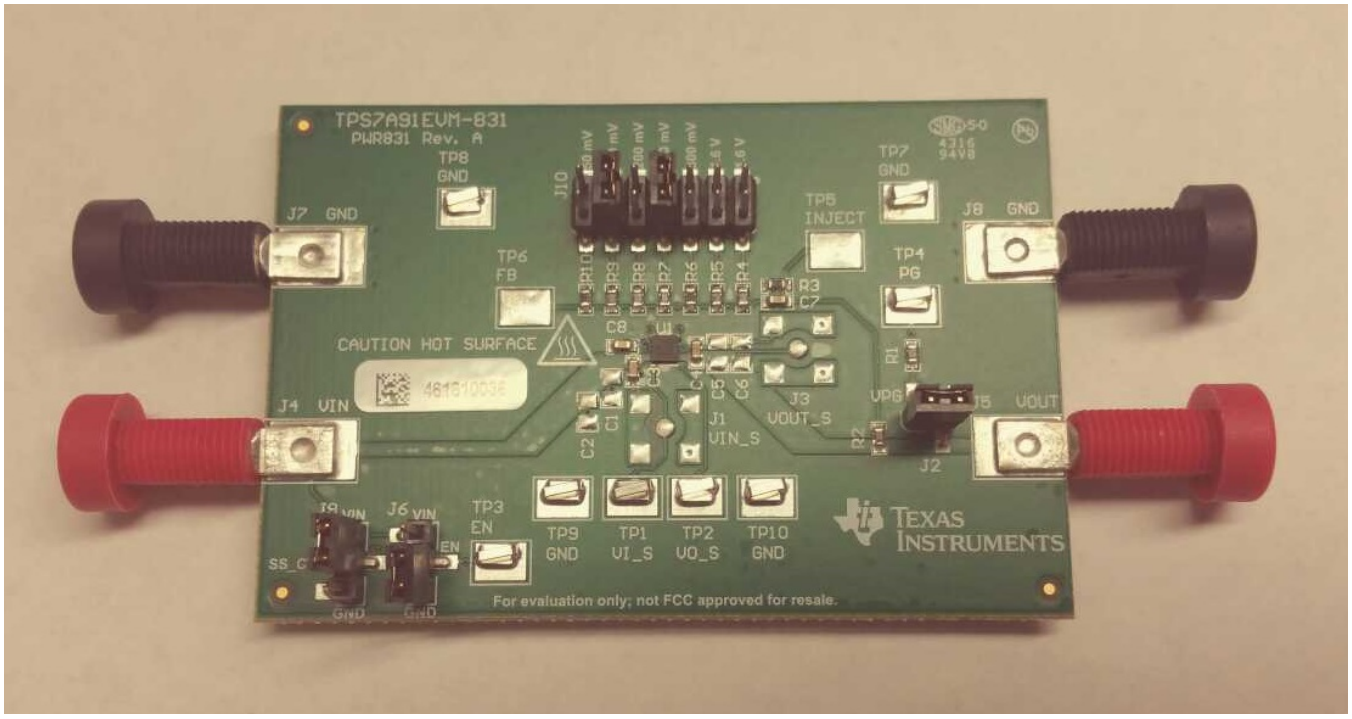
TPS7A91EVM-831 Evaluation Module



This user's guide describes the operational use of the TPS7A91EVM-831 evaluation module (EVM) as a reference design for engineering demonstration and evaluation of the TPS7A9101DSK, low-dropout linear regulator (LDO). Included in this user's guide are setup and operating instructions, thermal and layout guidelines, a printed-circuit-board (PCB) layout, a schematic diagram, and a bill of materials (BOM).

Throughout this document, the terms demonstration kit, evaluation board, evaluation module are synonymous with the TPS7A91EVM-831.

The following related documents are available through the Texas Instruments web site at http://www.ti.com.

Related Documentation

Device	Literature Number
TPS7A91	SBVS282

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Trademarks

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1 Introduction

The Texas Instruments TPS7A91EVM-831 EVM helps design engineers evaluate the operation and performance of the TPS7A91 family of linear regulators for possible use in their own circuit application. This particular EVM configuration contains a dual low-noise, high-PSRR linear regulator for high-speed communication systems. The regulator is capable of delivering up to 1 A to the load with low VIN to VOUT dropout voltage. For stability, use a 10-µF input capacitor and 10-µF output capacitor for the TPS7A91.

1.1 Before You Begin

The following warnings and cautions are noted for the safety of anyone using or working close to the TPS7A91EVM-831. Observe all safety precautions.

WARNING

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

CAUTION

The circuit module may be damaged by overtemperature. To avoid damage, monitor the temperature during evaluation and provide cooling, as needed, for your system environment.

CAUTION

Some power supplies can be damaged by application of external voltages. If using more than one power supply, check your equipment requirements and use blocking diodes or other isolation techniques, as needed, to prevent damage to your equipment.

CAUTION

The circuit module is not a finished product or electrical appliance. The module does not contain current or voltage thresholds for circuit protection. It must be used by qualified personnel with additional equipment for evaluation only.

2 EVM Setup

This section describes how to properly connect and setup the TPS7A91EVM-831, including the jumpers and connectors on the EVM board.

2.1 Input/Output Connectors and Jumper Descriptions

2.1.1 J1 – VIN_S

Input power-supply sense voltage connector. Place an SMA connector here to sense the input supply voltage.

2.1.2 J2 – VPG

Pullup voltage selector for PG. This EVM is designed so that PG can be pulled up to either VOUT by shorting J2, or pulled up to another voltage by applying an external voltage to the VPG post.

2.1.3 J3 – VOUT_S

Output power-supply sense voltage connector. Place an SMA connector here to sense the output voltage.

2.1.4 J4 – VIN

Input power-supply voltage connector. Twist together the positive input lead and ground return lead from the input power supply; keep the leads as short as possible to minimize input inductance. Add additional bulk capacitance between J4 and J7 (use the C2 or C1 footprint) if the supply leads are longer than six inches.

2.1.5 J5 – VOUT

Regulated output voltage connector.

2.1.6 J6 – EN

Output enable. To enable the output, connect a jumper to short VIN to EN. To disable the output, connect a jumper to short EN to GND.

2.1.7 J7 – GND

Return connector for the input power supply.

2.1.8 J8 – GND

Output ground return connector.

2.1.9 J9 – SS_CTRL

Soft-start control. Connect a jumper to short VIN1 to SS_CTRL for a fast charge time. Connect a jumper to short SS_CTRL to GND for a slower startup.

2.1.10 J10 – ANYOUT

The output voltage of the TPS7A91 is selectable in accordance with the names given to the output voltage setting pins: 50 mV, 100 mV, 200 mV, 400 mV, 800 mV, 1.6 V, and 1.6 V. For each pin connected to the ground, the output voltage setting increases by the value associated with that pin name, starting from the value of the reference voltage of 0.8 V; floating the pins has no effect on the output voltage.

2.1.11 TP1 – VI_S

Input sense test point.

2.1.12 TP2 – VO_S

Output sense test point.

2.1.13 TP3 – EN

Enable test point.

2.1.14 TP4 – PG

Power-Good test point.

2.1.15 TP5 – INJECT

Injection signal test point. To take open loop measurements, remove resistor R2 and inject a small signal at TP5.

2.1.16 TP6 – FB

Feedback sense test point.

2.1.17 TP7 – GND

Ground.

2.1.18 TP8 – GND

Ground.

2.1.19 TP9 – GND

Ground.

2.1.20 TP10 – GND

Ground.

2.2 Soldering Guidelines

To avoid damaging the integrated circuit (IC), use a hot-air system for any solder rework to modify the EVM for the purpose of repair or other application reasons.

2.3 Equipment Connection

1. Set the input power supply to 6.5 V (max), and turn the power supplies off.
2. Connect the positive voltage lead from input power supply to VIN at the J4 connector of the EVM.
3. Connect the ground lead from input power supply to GND at the J7 connector of the EVM.
4. Connect a 0-A to 1-A load between OUT and GND.
5. Disable the output by shorting EN to GND on J6.

3 Operation

1. Turn on the power supply.
2. Enable the output by shorting the EN pin to VIN on J6.
3. Vary the load and input voltage as necessary for test purposes.

4 PCB Layout

Figure 1 to Figure 3 illustrate the PCB layout for this EVM.

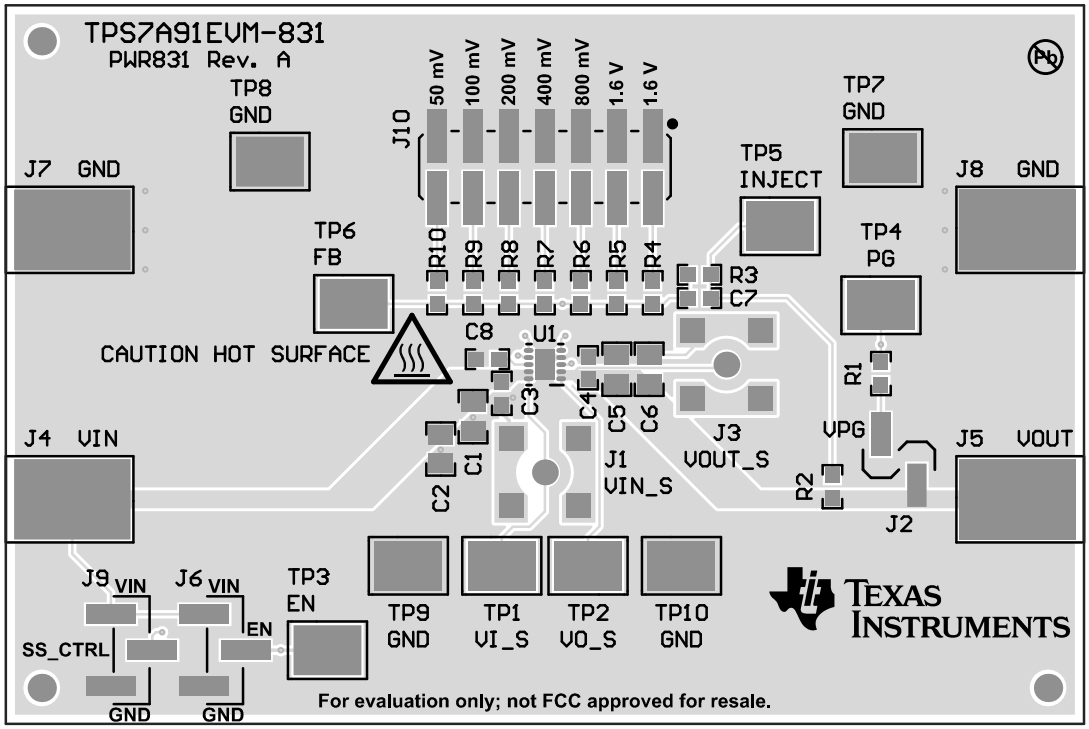

Figure 1. Assembly Layer

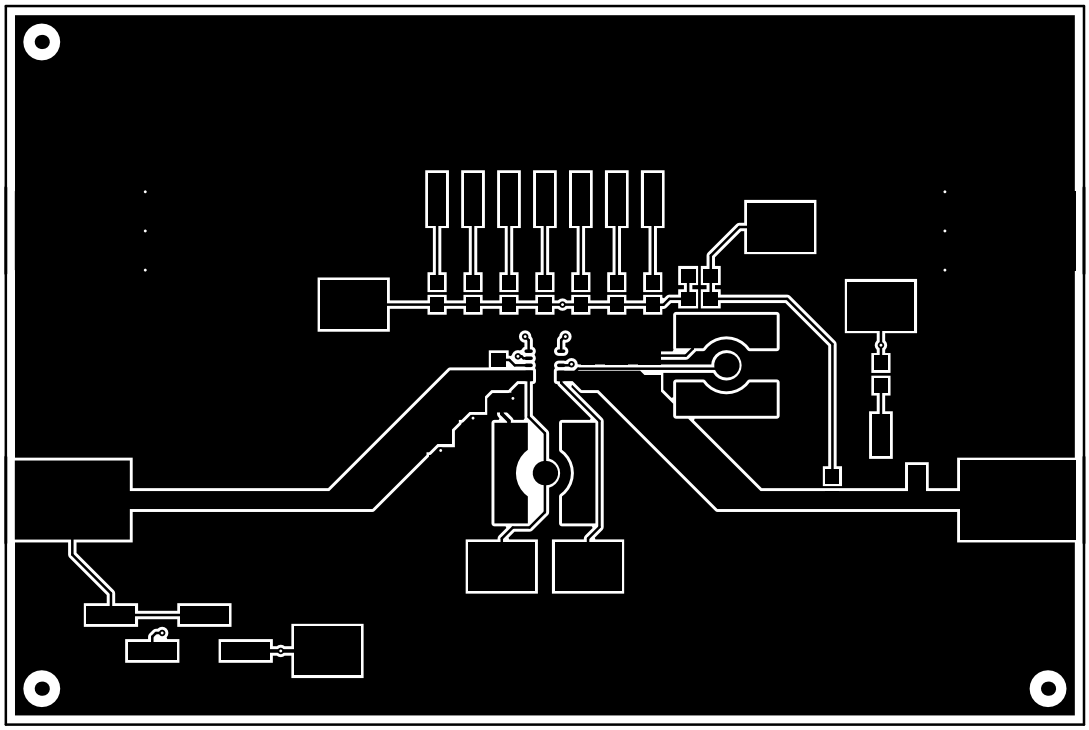

Figure 2. Top Layer Routing

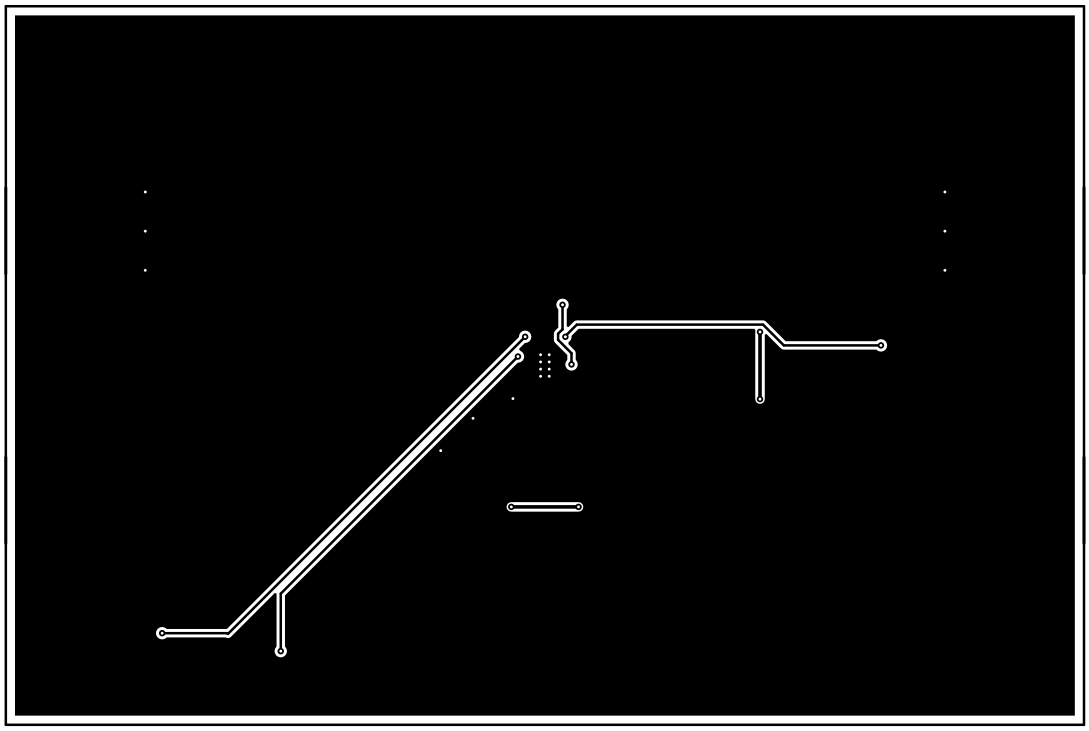

Figure 3. Bottom Layer Routing

5 Schematic

Figure 4 is the schematic for this EVM.

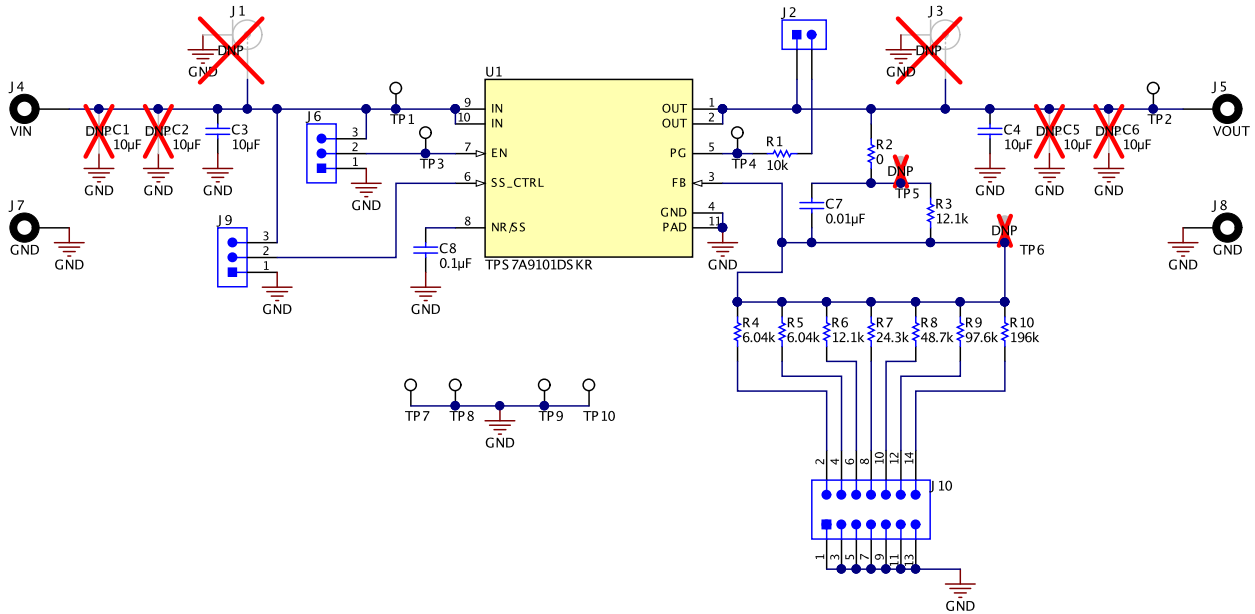

Figure 4. Schematic

6 Bill of Materials

The bill of materials (BOM) for this EVM is shown in Table 1

Table 1. Bill of Materials[1][2]

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
!PCB	1		Printed Circuit Board		PWR831	Any	-	-
C3, C4	2	10uF	CAP, CERM, 10 µF, 16 V, +/- 20%, X5R, 0603	0603	GRM188R61C106MAALD	Murata		
C7	1	0.01uF	CAP, CERM, 0.01 µF, 16 V, +/- 10%, X7R, 0603	0603	GRM188R71C103KA01D	Murata		
C8	1	0.1uF	CAP, CERM, 0.1 µF, 16 V, +/- 10%, X7R, 0603	0603	CL10B104KO8NNNC	Samsung Electro-Mechanics		
J2	1		Header, 2.54 mm, 2x1, Gold, R/A, SMT	Header, 2.54 mm, 2x1, R/A, SMT	87898-0204	Molex		
J4, J5	2		Standard Banana Jack, Insulated, Red	6091	6091	Keystone		
J6, J9	2		Header, 100mil, 3x1, Gold, SMT	Samtec_TSM-103-01-X-SV	TSM-103-01-L-SV	Samtec		
J7, J8	2		Standard Banana Jack, Insulated, Black	6092	6092	Keystone		
J10	1		Header, 100mil, 7x2, SMT	Header, 100 mil, 7x2, SMT	0015912140	Molex		
R1	1	10k	RES, 10 k, 5%, 0.1 W, 0603	0603	CRCW060310K0JNEA	Vishay-Dale		
R2	1	0	RES, 0, 5%, 0.1 W, 0603	0603	CRCW06030000Z0EA	Vishay-Dale		
R3, R6	2	12.1k	RES, 12.1 k, 1%, 0.1 W, 0603	0603	CRCW060312K1FKEA	Vishay-Dale		
R4, R5	2	6.04k	RES, 6.04 k, 1%, 0.1 W, 0603	0603	CRCW06036K04FKEA	Vishay-Dale		
R7	1	24.3k	RES, 24.3 k, 1%, 0.1 W, 0603	0603	CRCW060324K3FKEA	Vishay-Dale		
R8	1	48.7k	RES, 48.7 k, 1%, 0.1 W, 0603	0603	CRCW060348K7FKEA	Vishay-Dale		
R9	1	97.6k	RES, 97.6 k, 1%, 0.1 W, 0603	0603	CRCW060397K6FKEA	Vishay-Dale		
R10	1	196k	RES, 196 k, 1%, 0.1 W, 0603	0603	CRCW0603196KFKEA	Vishay-Dale		
SH-J1, SH-J2, SH-J3, SH-J4, SH-J5	5	1x2	Shunt, 100mil, Gold plated, Black	Shunt	969102-0000-DA	3M	SNT-100-BK-G	Samtec
TP1, TP2, TP3, TP4, TP7, TP8, TP9, TP10	8		Test Point, Compact, SMT	Testpoint_Keystone_Compact	5016	Keystone		
U1	1		High-Accuracy (1%),Low-Noise (3.8-uVRMS), 1-A LDO Voltage Regulator, DSK0010A	DSK0010A	TPS7A9101DSKR	Texas Instruments	TPS7A9101DSKT	Texas Instruments
C1, C2, C5, C6	0	10uF	CAP, CERM, 10 µF, 16 V, +/- 20%, X7R, 0805	0805	EMK212BB7106MG-T	Taiyo Yuden		
FID1, FID2, FID3	0		Fiducial mark. There is nothing to buy or mount.	Fiducial	N/A	N/A		
J1, J3	0		Connector, SMA Jack, Vertical, Gold, SMD	SMA	142-0711-201	Emerson Network Power		
TP5, TP6	0		Test Point, Compact, SMT	Testpoint_Keystone_Compact	5016	Keystone		

(1) These assemblies must comply with workmanship standards IPC-A-610 Class 2.

(2) Unless otherwise noted in the Alternate PartNumber and/or Alternate Manufacturer columns, all parts may be substituted with equivalents.

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1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including 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 and conditions set forth herein. Acceptance of the EVM is expressly subject to the following terms and conditions.

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2 *Limited Warranty and Related Remedies/Disclaimers*:

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   2.3 If any EVM fails to conform to the warranty set forth above, TI's sole liability shall be at its option to repair or replace such EVM, 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:*

      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*

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-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.

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

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If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required by Radio Law of Japan to follow the instructions below with respect to EVMs:

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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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.

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