

BUF634ADRB and BUF634ADDA Evaluation Modules



ABSTRACT

The BUF634ADRBEVM and BUF634ADDAEVM are evaluation modules (EVMs) for the BUF634A high-speed buffer in the DRB (8-pin SON) and DDA (8-pin SO PowerPAD) packages. Each EVM features two BUF634A devices and are designed to quickly demonstrate the functionality and versatility of the buffer. Optionally, the buffers can be configured as outputs for a dual SOIC amplifier in a composite loop. Each EVM is ready to connect to power, signal sources, and test instruments by using onboard connectors. The default configuration uses split supplies and subminiature version A (SMA) input and output connectors with a 50-Ω output impedance for standard test equipment. The EVMs can be easily configured for other connections and single-supply operation. Dual-channel path configuration is also available for the RCA™ audio input jacks and a 3.5-mm output jack.

Throughout this document, the terms *EVM* and *evaluation module* are synonymous with the BUF634ADRBEVM and BUF634ADDAEVM.

Section 8 lists the related documentation available through the Texas Instruments web site at www.ti.com.

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1 Trademarks

RCA™ is a trademark of Technicolor SA.

All trademarks are the property of their respective owners.

2 Overview

This section provides a general description of the BUF634ADRBEVM and BUF634ADDAEVM. [Table 2-1](#) lists the input and output limits for these EVMs in the default configuration. [Table 2-2](#) lists the input and output limits when the BUF634A EVMs are used in a composite loop configuration with the OPA2810 device.

Table 2-1. EVM Input and Output Limits (Default Configuration)

PARAMETERS	MIN	TYP	MAX	UNIT
Split-supply voltage range (VS+ – VS–)	±2.25	±15	±18	V
Single-supply voltage range (VS– = ground)	4.5	30	36	V
Supply current, I _S with BW = VS–		17	24	mA
Input voltage, V _I		(VS+) - 2 to (VS–) + 2		V
Output drive, I _O with ±12-V or 24-V supply		±250		mA

Table 2-2. EVM Input and Output Limits (Dual Composite Loop Configuration Without OPA2810)

PARAMETERS	MIN	TYP	MAX	UNIT
Split-supply voltage range (VS+ – VS–)	±2.375	±12	±13.5	V
Single-supply voltage range (VS– = ground)	4.75	24	27	V
Supply current, I _S with BW = V–		24.4	32.2	mA
Input voltage, V _I		(VS+) + 0.3 to (VS–) – 0.3		V
Output drive, I _O with ±12-V or 24-V supply		±250		mA

3 Power Connections

The BUF634ADRBEVM and BUF634ADDAEVM are equipped with banana jacks to easily connect to power. The positive supply input is labeled V+, the negative supply input is labeled V–, and ground is labeled GND.

3.1 Split-Supply Operation

To operate in split supply, apply the positive supply voltage to V+, the negative supply voltage to V–, and the ground reference from supply to GND.

3.2 Single-Supply Operation

To operate in single supply, apply jumper V– to GND and apply the positive supply voltage to V+. Inputs and outputs must be biased per data sheet specifications for proper operation.

4 Input and Output Connections

The BUF634ADRBEVM and BUF634ADDAEVM are equipped with SMA connectors to easily connect to the benchtop signal generators and analysis equipment. Additionally, the EVM also includes RCA input jacks and a 3.5-mm output jack that can be used with the two BUF634A devices in a differential audio buffer configuration. The connections to the SMA outputs include 50-Ω termination resistors to easily connect to 50-Ω impedance test equipment. The inputs are high impedance, but can be easily terminated to 50 Ω as well by populating resistors R1 and R4. Route the outputs to the test equipment using cables with a 50-Ω characteristic impedance, and connect the inputs to the signal source with as short of cables as possible for best results in the default configuration.

4.1 Use With a Dual SOIC Amplifier in a Composite Loop

The BUF634ADRBEVM and BUF634ADDAEVM feature the option to configure the BUF634A devices in two composite amplifier loops using a dual SOIC package amplifier, such as the OPA2810. The BUF634A forms an output driving stage for the chosen input amplifier in the composite loop and forms a differential composite amplifier useful for applications (such as audio amplification) with the dual paths on the EVM. Populate the device U1; resistors R2, R3, R4, and R5; capacitors C2 and C4; and remove resistors R11 and R16 when configuring the EVM to use the composite loop.

5 Schematic

Figure 5-1 shows a schematic for the BUF634ADRBEVM.

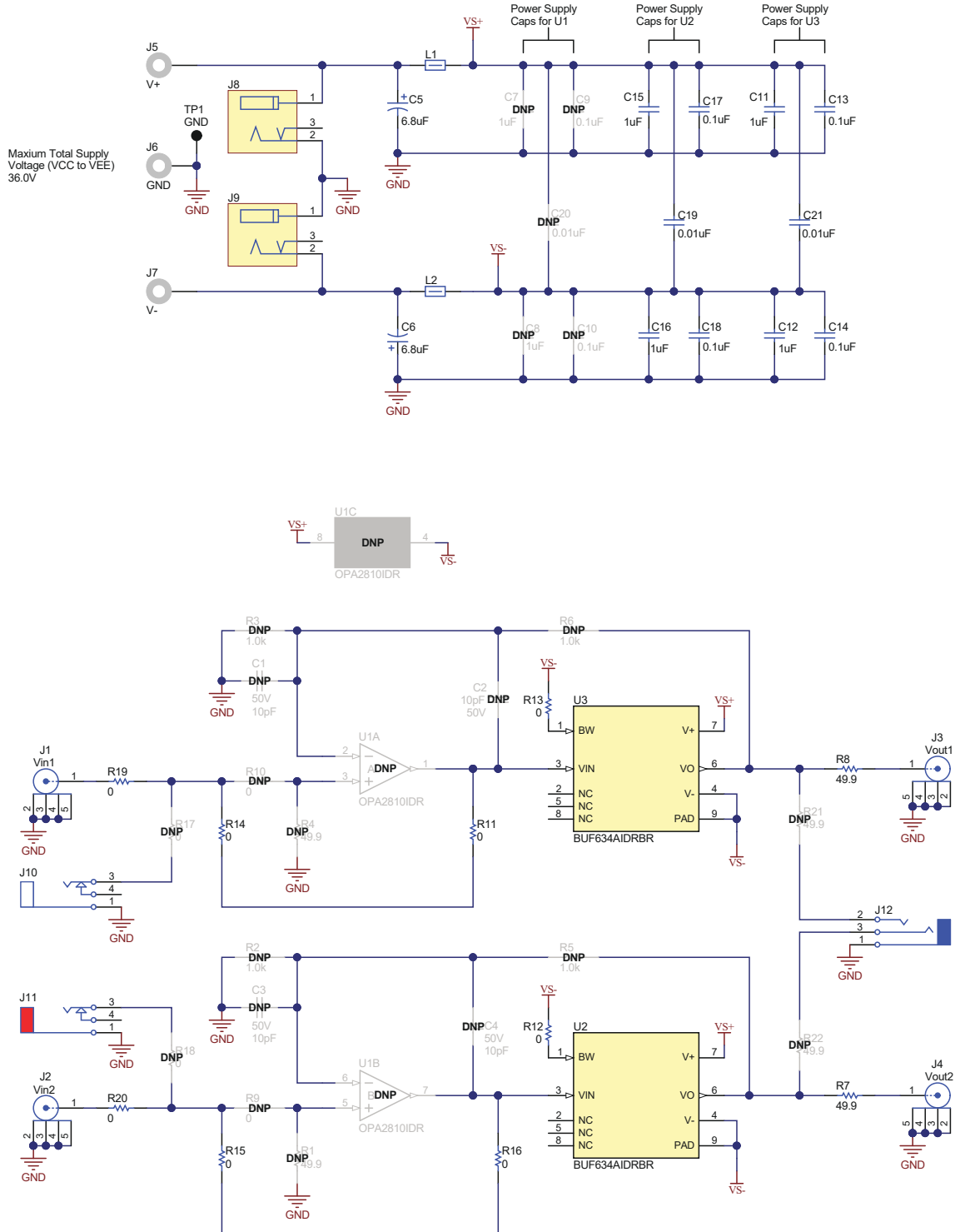


Figure 5-1. BUF634ADRBEVM Schematic

Figure 5-2 shows a schematic for the BUF634ADDAEVM.

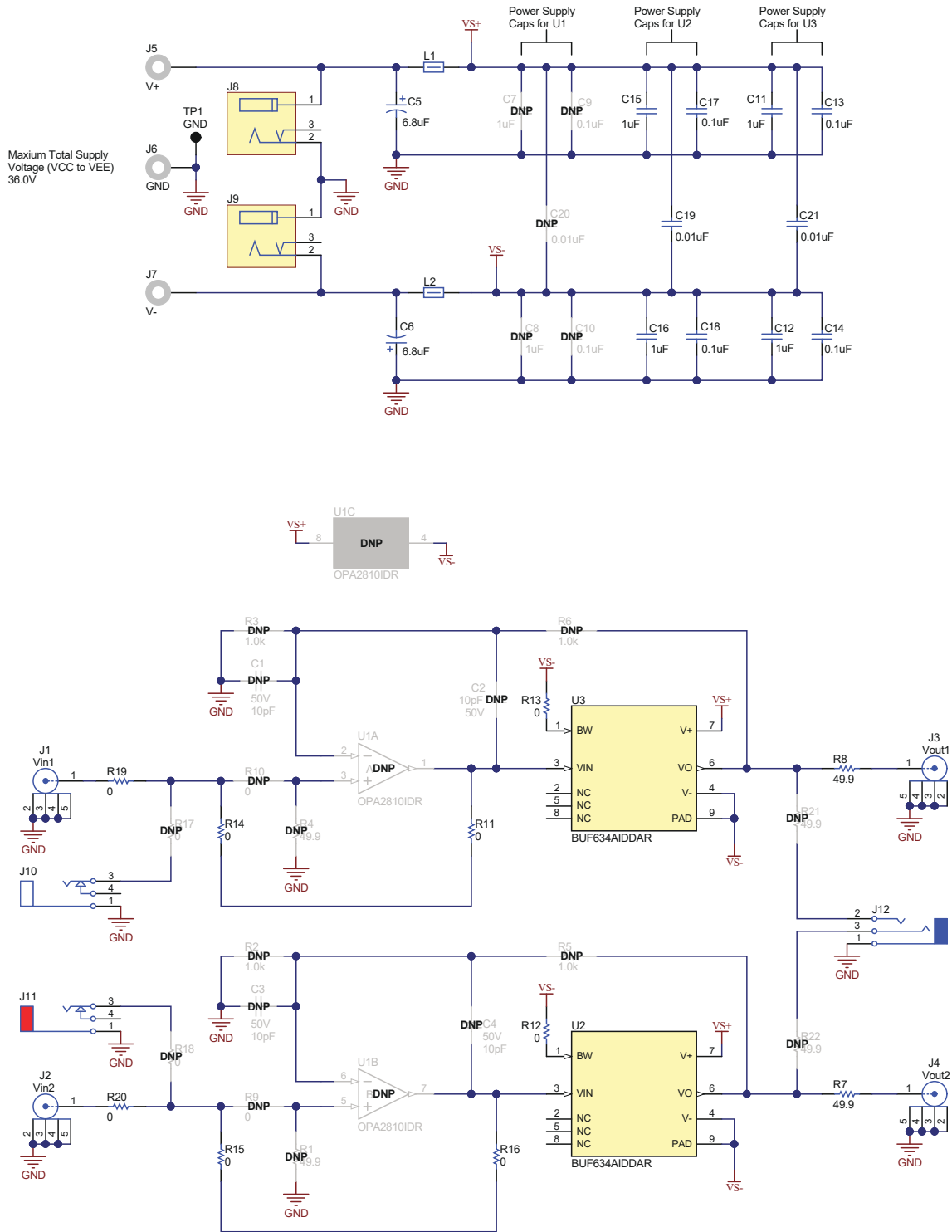


Figure 5-2. BUF634ADDAEVM Schematic

6 Layout

Figure 6-1 and Figure 6-2 illustrate the layers for the BUF634ADRBEVM.

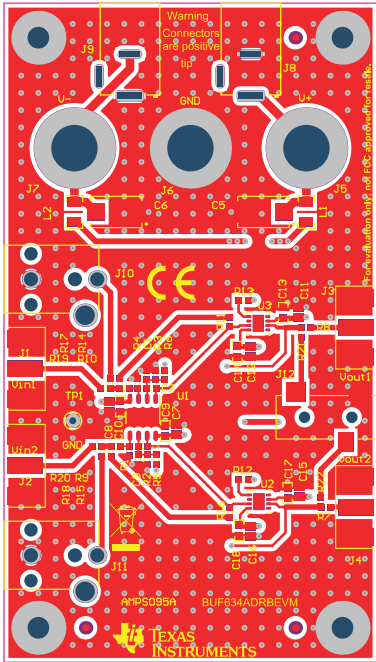


Figure 6-1. BUF634ADRBEVM Top Layer

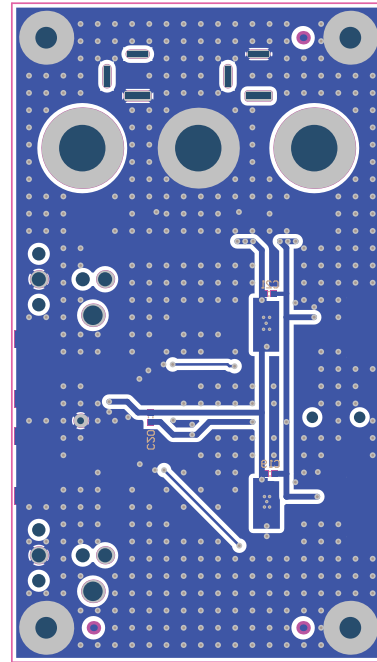


Figure 6-2. BUF634ADDAEVM Bottom Layer

Figure 6-3 through Figure 6-4 illustrate the various layout silk screens for the BUF634ADDAEVM.

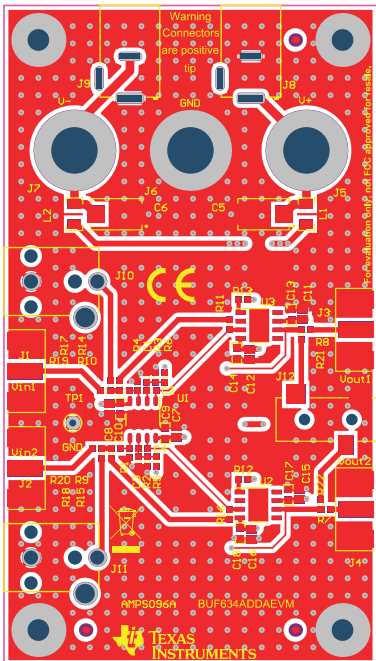


Figure 6-3. BUF634ADRBEVM Top Layer

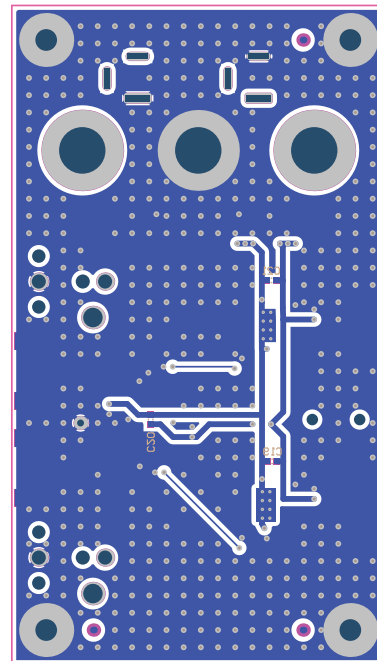


Figure 6-4. BUF634ADDAEVM Bottom Solder

7 Bill of Materials

Table 7-1 lists the bill of materials for the BUF634ADRB and BUF634ADDAEVM. Note: the only difference in the BOM between both boards is the BUF634A package that is used.

Table 7-1. Bill of Materials

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer
C5, C6	2	6.8 μ F	CAP, TA, 6.8 μ F, 50 V, \pm 10%, 0.3 Ω , SMD	7343-31	T495D685K050ATE300	Kemet
C11, C12, C15, C16	4	1 μ F	CAP, CERM, 1 μ F, 50 V, \pm 10%, X7R, 0805	0805	08055C105KAT2A	AVX
C13, C14, C17, C18	4	0.1 μ F	CAP, CERM, 0.1 μ F, 50 V, \pm 10%, X5R, 0603	0603	C1608X5R1H104K080A A	TDK
C19, C21	2	0.01 μ F	CAP, CERM, 0.01 μ F, 100 V, \pm 10%, X7R, 0603	0603	06031C103KAT2A	AVX
H1, H2, H3, H4	4		Machine Screw, Round, #4-40 x 1/4, Nylon, Philips panhead	Screw	NY PMS 440 0025 PH	B&F Fastener Supply
H5, H6, H7, H8	4		Standoff, Hex, 0.5"L #4-40 Nylon	Standoff	1902C	Keystone
J1, J2, J3, J4	4		Connector, End launch SMA, 50 Ω , SMT	End Launch SMA	142-0701-801	Cinch Connectivity
J5, J6, J7	3		Standard Banana Jack, Uninsulated	Keystone_6095	6095	Keystone
J8, J9	2		Power Jack, 2.1 \times 5.5 mm, R/A, TH	Power Jack, 2.1 \times 5.5 mm, R/A, TH	EJ508A	Memory Protection Devices
J10	1		RCA Jack, White, R/A, TH	PC Mount Phono Jack-White, TH	970	Keystone
J11	1		RCA Jack, Red, R/A, TH	PC Mount Phono Jack-Red, TH	971	Keystone
J12	1		Audio Jack, 3.5 mm, Stereo, R/A, SMT	Audio Jack SMD	SJ-3523-SMT	CUI Inc.
L1, L2	2	80 Ω	Ferrite Bead, 80 Ω at 100 MHz, 3 A, 1206	1206	HI1206N800R-10	Laird-Signal Integrity Products
R7, R8	2	49.9	RES, 49.9, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW060349R9FKEA	Vishay-Dale
R11, R12, R13, R14, R15, R16, R19, R20	8	0	RES, 0, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW06030000Z0EA	Vishay-Dale
TP1	1		Test Point, Miniature, Black, TH	Black Miniature Testpoint	5001	Keystone
U2, U3	2		36-V, 210-MHz, 250-mA Output, High-Speed Buffer, DRB0008F (VSON-8) or DDA0008B (HSOIC- 8)	DRB0008F or DDA0008B	BUF634AIDRBR or BUF634AIDDA	Texas Instruments
C1, C2, C3, C4	0	10 pF	CAP, CERM, 10 pF, 50 V, \pm 1%, C0G/NP0, 0603	0603	C0603C100F5GAC7867	Kemet
C7, C8	0	1 μ F	CAP, CERM, 1 μ F, 50 V, \pm 10%, X7R, 0805	0805	08055C105KAT2A	AVX
C9, C10	0	0.1 μ F	CAP, CERM, 0.1 μ F, 50 V, \pm 10%, X5R, 0603	0603	C1608X5R1H104K080A A	TDK
C20	0	0.01 μ F	CAP, CERM, 0.01 μ F, 100 V, \pm 10%, X7R, 0603	0603	06031C103KAT2A	AVX
R1, R4, R21, R22	0	49.9	RES, 49.9, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW060349R9FKEA	Vishay-Dale
R2, R3, R5, R6	0	1.0 k	RES, 1.0 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW06031K00JNEA	Vishay-Dale

8 Related Documentation

- Texas Instruments, [BUF634A 36-V, 210-MHz, 250-mA Output, High-Speed Buffer data sheet](#)
- Texas Instruments, [BUF634 250-mA High-Speed Buffer data sheet](#)
- Texas Instruments, [OPA2810 Dual-Channel, 27-V, Rail-to-Rail Input/Output FET-Input Operational Amplifier data sheet](#)

STANDARD TERMS FOR EVALUATION MODULES

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.
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2. *Limited Warranty and Related Remedies/Disclaimers:*
 - 2.1 These terms do not apply to Software. The warranty, if any, for Software is covered in the applicable Software License Agreement.
 - 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.

WARNING

Evaluation Kits 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 shall operate the Evaluation Kit within TI's recommended guidelines and any applicable legal or environmental requirements as well as reasonable and customary safeguards. Failure to set up and/or operate the Evaluation Kit within TI's recommended guidelines may result in personal injury or death or property damage. Proper set up entails following TI's instructions for electrical ratings of interface circuits such as input, output and electrical loads.

NOTE:

EXPOSURE TO ELECTROSTATIC DISCHARGE (ESD) MAY CAUSE DEGRADATION OR FAILURE OF THE EVALUATION KIT; TI RECOMMENDS STORAGE OF THE EVALUATION KIT IN A PROTECTIVE ESD BAG.

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/lstds/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/lstds/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 *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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8. *Limitations on Damages and Liability:*

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