

TPS8125xEVM

This user's guide describes the characteristics, operation, and use of the TPS8125x evaluation module (EVM). This EVM enables test and evaluation of Texas Instruments' TPS8125x devices, a series of 4.5-MHz, step-up DC-DC converters. This user's guide includes EVM specifications, a schematic diagram, a bill of materials, and board layout images.

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1 Introduction

The TPS8125x device is an ideal power-supply solution for products powered by either a three-cell alkaline, NiCd or NiMH battery, or a single-cell Li-Ion or Li-polymer battery. The wide input voltage range is well-suited for portable power applications such as mobile phones or computer peripherals.

1.1 Requirements

The TPS8125xEVM is designed to produce a fixed output voltage over the full input voltage range. See [Table 1](#) for fixed output voltage version options. A DC power supply capable of delivering 2.50 V to 4.85 V is required to operate this EVM. Please reference the device datasheet for the Recommended Operating Conditions and Absolute Maximum Ratings.

1.2 Applications

- USB Host Supplies from a Single Li-Ion Battery
- USB Dedicated Charging Port Supply
- Li-Ion Applications
- Audio Applications
- RF-PA Buffers

1.3 EVM Features

- 91% Efficiency at 4.5 MHz
- V_{IN} Range from 2.50 V to 4.85 V
- 0.85 μ A Quiescent Current in Shutdown Mode
- 30 μ A Quiescent Current in Normal Operation
- $V_{IN} > V_{OUT}$ operation for V_{in} up to 5.5V

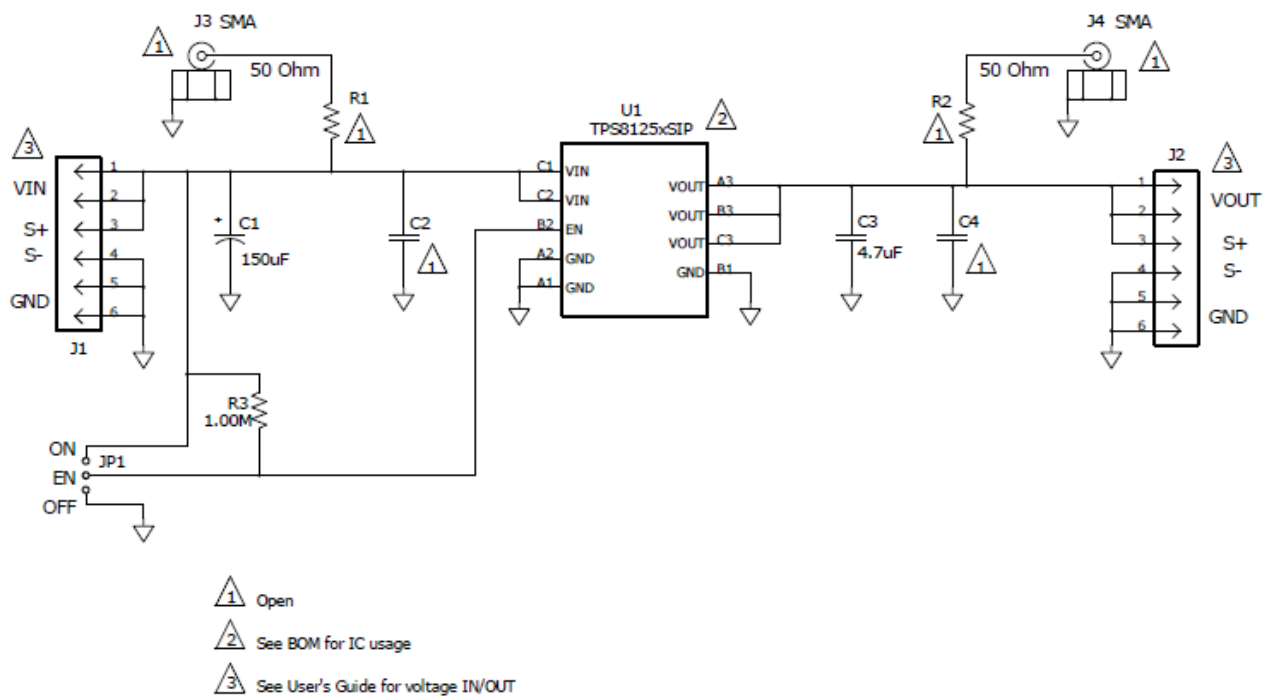
1.4 EVM Ordering Options

[Table 1](#) provides the ordering Information for the various EVM options.

Table 1. TPS8125x Output Voltage Options and Ordering Information

Orderable EVM Number	Device Part Number	Output Voltage
PWR121-001	TPS81256	5 V

2 TPS8125xEVM Schematic



For reference only; see [Table 2](#) for specific values.

Figure 1. TPS8125xEVM Schematic

3 Connector and Test Point Descriptions

3.1 Connectors

3.1.1 J1: V_{IN} Header

This header is the connection for the input power supply and ground. Connect the input power supply to Pin 1 or 2 and the GND return to Pin 5 or 6. Twist the leads to the power supply and keep them as short as possible. The input voltage must be between 2.50 V and 4.85 V.

The input Sense connections (Pins 3 and 4) allow access to the input voltage directly at the TPS8125x input capacitors; therefore, a four-wire power and sense supply can be connected. These connections allow for accurate voltage measurement by avoiding the I x R voltage drop across the PCB traces. Twist the leads to the sensing connectors if they are used.

3.1.2 J2: V_{OUT} Header

This header is the connection for the output voltage and return. Connect the load between Pin 1 or 2 and Pin 5 or 6 (GND). The output Sense connections (Pins 3 and 4) allow access to the voltage directly at the TPS8125x output capacitors. These connections allow for accurate voltage measurement by avoiding the I x R voltage drop across the PCB traces.

3.2 Other Connectors

3.2.1 J3: SMA Input Connector

This SMA connector is connected to the input voltage node of the converter and can be terminated with a 49.9 ohm resistor. It can be used to easily analyze the noise spectrum of the output voltage with a spectrum analyzer. By default, J3 is not assembled on the EVM.

3.2.2 J4: SMA Output Connector

This SMA connector is connected to the output voltage node of the converter and can be terminated with a 49.9 ohm resistor. It can be used to easily analyze the noise spectrum of the output voltage with a spectrum analyzer. By default, J4 is not assembled on the EVM.

3.3 Jumpers

3.3.1 JP1: Enable Jumper

Placing a jumper across pins EN and ON ties the EN pin to VIN, which enables the device. Placing a jumper across pins EN and OFF ties the EN pin to GND, which disables the device.

4 TPS8125xEVM Printed Circuit Board Layout

Figure 2 through Figure 6 show the design of the TPS8125xEVM-121 printed circuit board (PCB). The EVM has been designed using a four-layer PCB with all components on the top side of the board. Moving components to both sides of the PCB can offer additional size reduction for space-constrained systems. All the following images are viewed from the top of the PCB.

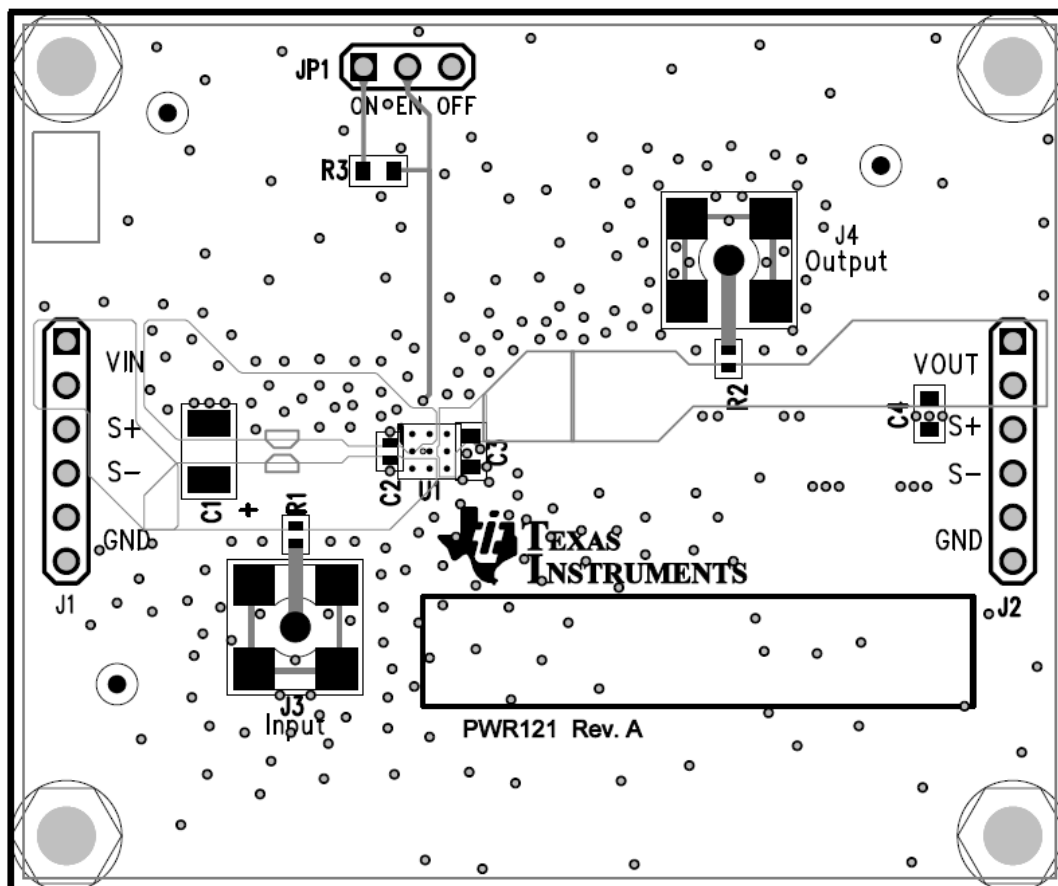


Figure 2. TPS8125xEVM Component Placement

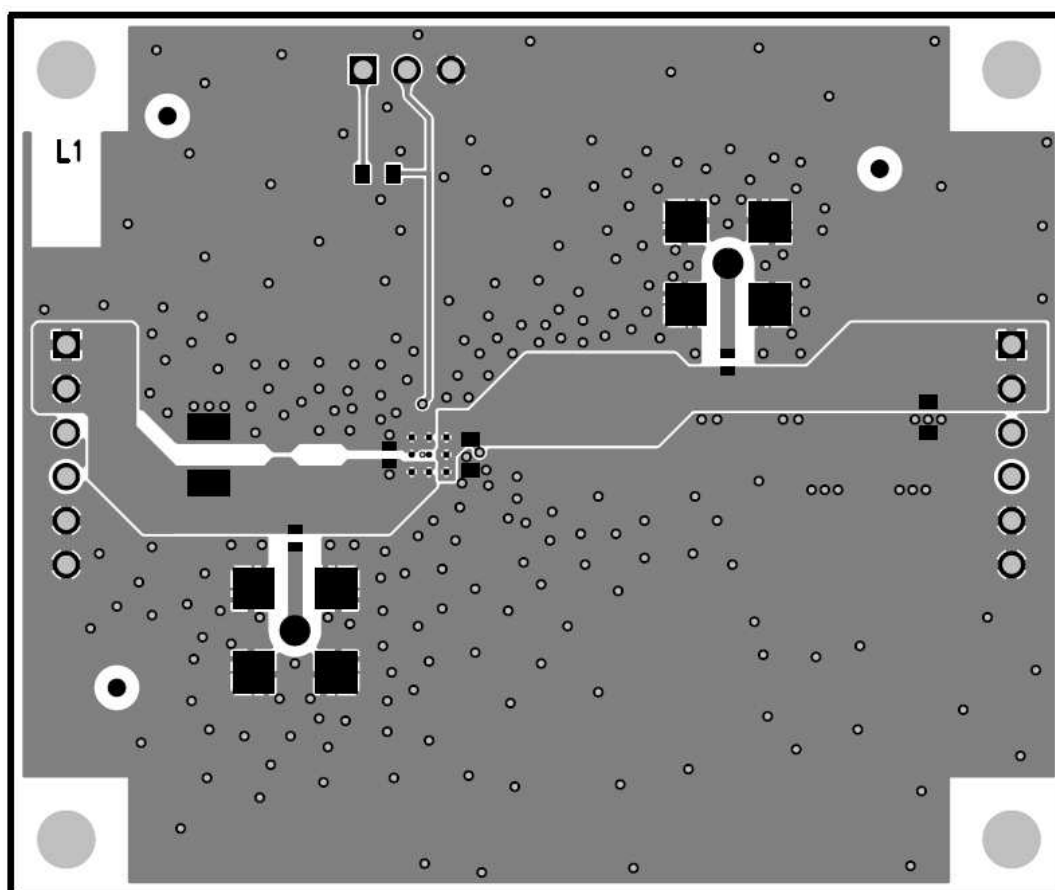


Figure 3. TPS8125xEVM Top Copper

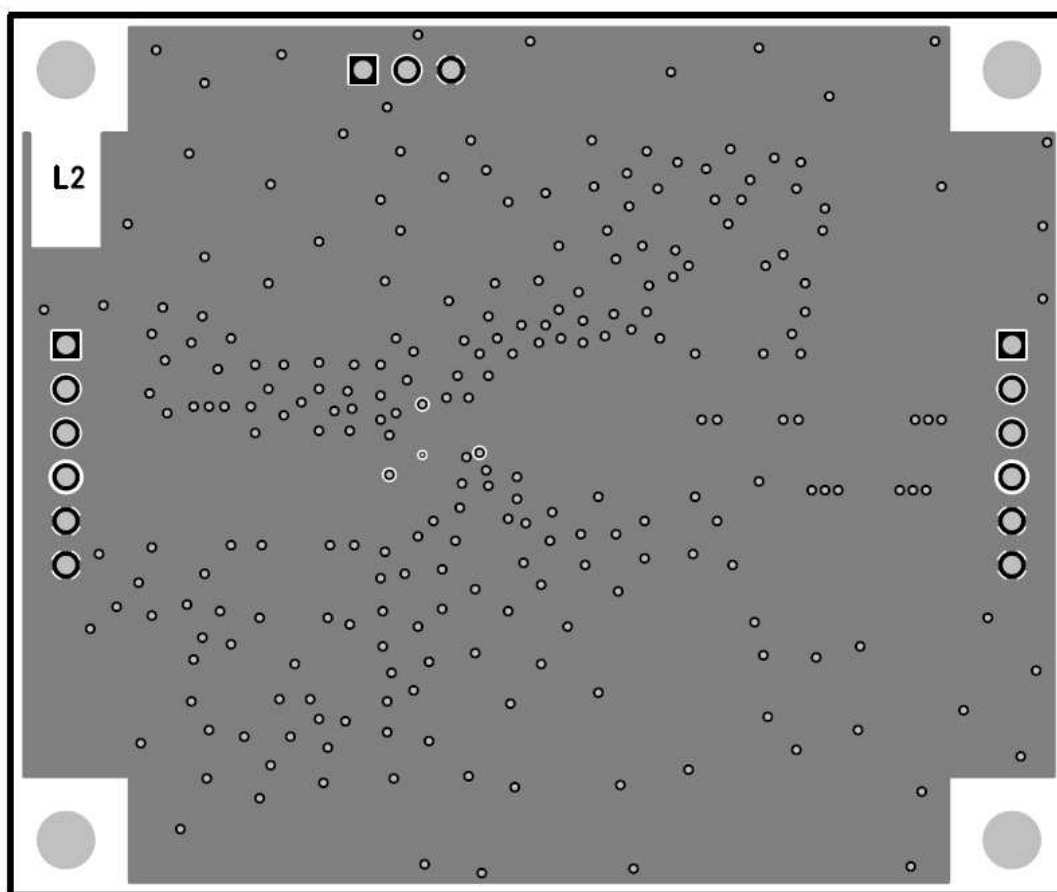


Figure 4. TPS8125xEVM Inner Layer 1

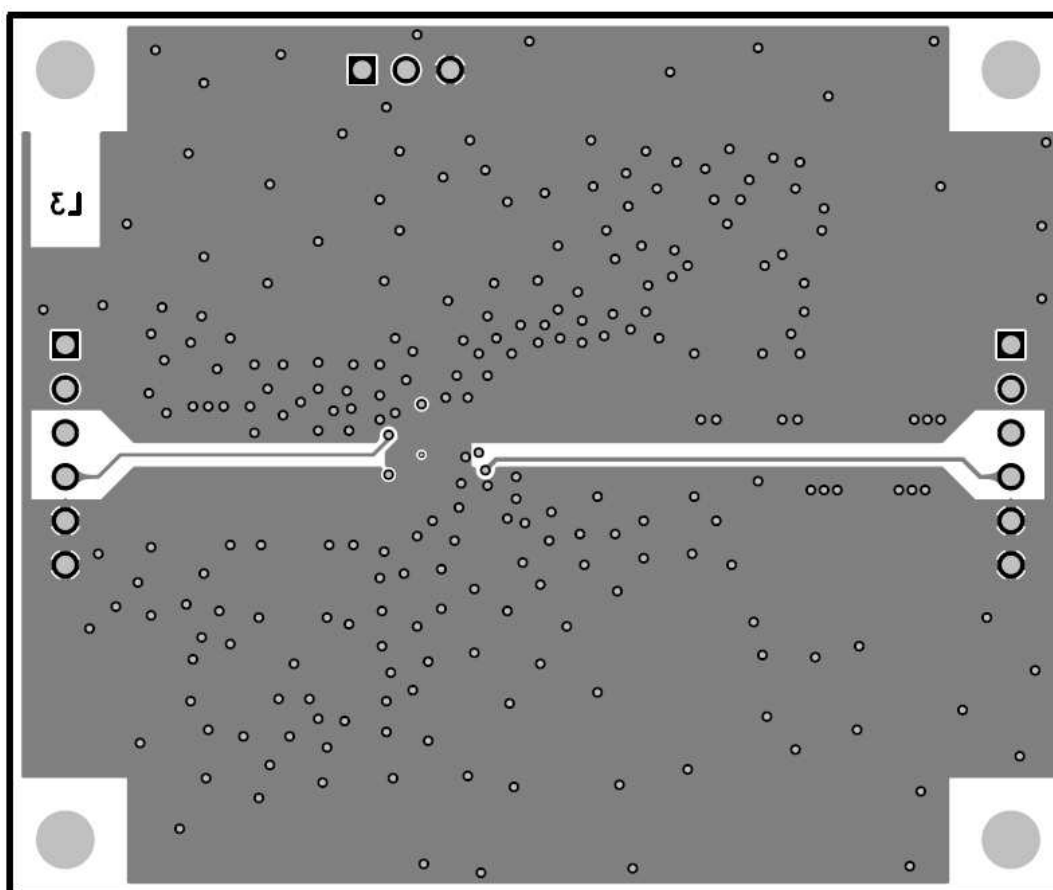


Figure 5. TPS8125xEVM Inner Layer 2

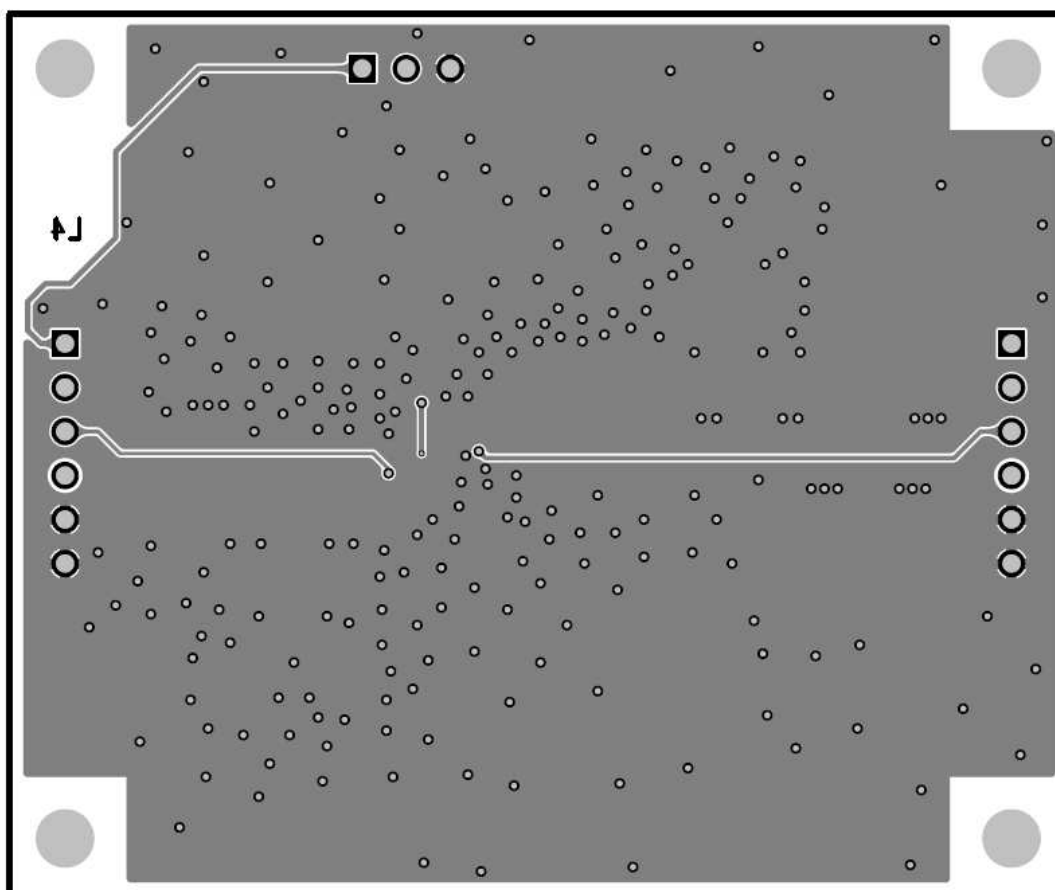


Figure 6. TPS8125xEVM Bottom Copper

5 Bill of Materials

Table 2 lists the EVM components as configured according to the schematic shown in Figure 1.

Table 2. TPS8125xEVM Bill of Materials

Count	Ref Des	Value	Description	Size	Part Number	MFR
1	C1	150 μ F	Capacitor, Tantalum, 6.3 V, 70 m Ω , 20%	3528 (B)	T520B157M006ATE070	Kemet
0	C2	Open	Capacitor, Ceramic	0402	Std	Std
1	C3	4.7 μ F	Capacitor, Ceramic, 16 V, X5R, 10%	0603	GRM188R61C475KAAJ	Murata
0	C4	Open	Capacitor, Ceramic	0603	Std	Std
2	J1, J2	PEC06SAAN	Header, Male 6-pin, 100mil spacing	0.100 inch x 6	PEC06SAAN	Sullins
0	J3, J4	Open	Connector, SMT Straight, Jack Receptacle	0.250 SQ	142-0711-201	Johnson
1	JP1	PEC03SAAN	Header, Male 3-pin, 100mil spacing	0.100 inch x 3	PEC03SAAN	Sullins
0	R1, R2	Open	Resistor, Chip, 1/16W, 1%	0402	Std	Std
1	R3	1.00M Ω	Resistor, Chip, 1/16W, 1%	0603	Std	Std
1	U1	TPS81256SIP	IC, High-Efficiency Micro-SiP Boost Converter, 5.0 V	uBGA	TPS81256SIP	TI

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The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies TI from all claims arising from the handling or use of the goods.

Should this evaluation board/kit not meet the specifications indicated in the User's Guide, the board/kit may be returned within 30 days from the date of delivery for a full refund. THE FOREGOING LIMITED WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

Please read the User's Guide and, specifically, the Warnings and Restrictions notice in the User's Guide prior to handling the product. This notice contains important safety information about temperatures and voltages. For additional information on TI's environmental and/or safety programs, please visit www.ti.com/esh or contact TI.

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As noted in the EVM User's Guide and/or EVM itself, this EVM and/or accompanying hardware may or may not be subject to the Federal Communications Commission (FCC) and Industry Canada (IC) rules.

For EVMs **not** subject to the above rules, this evaluation board/kit/module is intended for use for ENGINEERING DEVELOPMENT, DEMONSTRATION OR EVALUATION PURPOSES ONLY and is not considered by TI to be a finished end product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC or ICES-003 rules, which are designed to provide reasonable protection against radio frequency interference. Operation of the equipment may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

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.

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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
3. Use of this product only after you obtained the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to this product. Also, please do not transfer this product, unless you give the same notice above to the transferee. Please note that if you could not follow the instructions above, you will be subject to penalties of Radio Law of Japan.

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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.

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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

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

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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.

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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
3. Use of this product only after you obtained the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to this product. Also, please do not transfer this product, unless you give the same notice above to the transferee. Please note that if you could not follow the instructions above, you will be subject to penalties of Radio Law of Japan.

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EVALUATION BOARD/KIT/MODULE (EVM) WARNINGS, RESTRICTIONS AND DISCLAIMERS

For Feasibility Evaluation Only, in Laboratory/Development Environments. Unless otherwise indicated, this EVM is not a finished electrical equipment and not intended for consumer use. It is intended solely for use for preliminary feasibility evaluation in laboratory/development environments by technically qualified electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems and subsystems. It should not be used as all or part of a finished end product.

Your Sole Responsibility and Risk. You acknowledge, represent and agree that:

1. You have unique knowledge concerning Federal, State and local regulatory requirements (including but not limited to Food and Drug Administration regulations, if applicable) which relate to your products and which relate to your use (and/or that of your employees, affiliates, contractors or designees) of the EVM for evaluation, testing and other purposes.
2. You have full and exclusive responsibility to assure the safety and compliance of your products with all such laws and other applicable regulatory requirements, and also to assure the safety of any activities to be conducted by you and/or your employees, affiliates, contractors or designees, using the EVM. Further, you are responsible to assure 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.
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.

Agreement to Defend, Indemnify and Hold Harmless. You agree to 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 use of the EVM that is not in accordance with the terms of the agreement. This obligation shall apply whether Claims arise under law of tort or contract or any other legal theory, and even if the EVM fails to perform as described or expected.

Safety-Critical or Life-Critical Applications. If you intend to evaluate the components for possible use in safety critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, such as devices which are classified as FDA Class III or similar classification, then you must specifically notify TI of such intent and enter into a separate Assurance and Indemnity Agreement.

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