This user’s guide describes the characteristics, operation, and use of the evaluation module (EVM) for the PGA281. This document also includes the schematic, printed circuit board (PCB) layout, and a bill of materials (BOM). Throughout this document the terms evaluation board, evaluation module, and EVM are synonymous with the PGA281EVM.

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1 Introduction

1.1 PGA281
The PGA281 is a high-precision instrumentation amplifier with pin-programmable gain, attenuation, and error detection. The PGA281 offers low offset voltage, near zero drift, and very low 1/f noise for high-resolution, precision measurement. The high supply voltage and excellent common-mode rejection comply with the requirements for universal industrial signal front-ends.

1.2 PGA281EVM
The PGA281EVM provides basic functional evaluation of the PGA281, along with the following features:
- Onboard power management circuitry generates all required power-supply rails from one split-supply input
- DIP switch allows easy setting of pin-programmable gain
- Error flag LED provides visual feedback of any detected error condition
- Easy access to pertinent nodes with test points, BNC connectors, and banana jacks
- Component footprints allow multiple filtering configurations

A picture of the PGA281EVM is shown in Figure 1.

Figure 1. PGA281EVM
2 PGA281EVM Hardware
This section discusses the PGA281EVM hardware schematics and PCB layout.

2.1 Schematic
The schematic of the PGA281EVM is shown in Figure 2.

![PGA281EVM Schematic](image)

Figure 2. PGA281EVM Schematic
2.2 Jumper Settings

The PGA281EVM jumper settings are given in Table 1. The default settings are shown in Figure 3.

![Figure 3. PGA281EVM Default Jumper Settings](image)

### Table 1. PGA281EVM Jumper Settings

<table>
<thead>
<tr>
<th>Jumper</th>
<th>Position</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>JMP1</td>
<td>INT (default)</td>
<td>VSOP provided by onboard low dropout (LDO) regulator</td>
</tr>
<tr>
<td></td>
<td>EXT</td>
<td>VSOP provided externally at J6</td>
</tr>
<tr>
<td>JMP2</td>
<td>VSOP (default)</td>
<td>VDD connected to VSOP</td>
</tr>
<tr>
<td></td>
<td>EXT</td>
<td>VDD provided externally at J8</td>
</tr>
</tbody>
</table>
2.3 Power Supply Connections

Power is applied through banana connectors J5, J6, J7, J8, J9, and J10. The PGA281 requires three supply voltages: the high-voltage analog input stage supply, the low-voltage analog output stage supply, and the digital supply.

2.3.1 Analog Input Stage Power (VSP, VSN)

Power for the analog input stage is applied at J5 (VSP), J10 (GND), and J9 (VSN). The specified range for these supplies is given in Table 2.

<table>
<thead>
<tr>
<th>Name</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VSP</td>
<td>+5 V</td>
<td>+18 V</td>
<td>Positive supply for analog input stage</td>
</tr>
<tr>
<td>GND</td>
<td>0 V</td>
<td>0 V</td>
<td>Ground reference voltage for analog input stage</td>
</tr>
<tr>
<td>VSN</td>
<td>–5 V</td>
<td>–18 V</td>
<td>Negative supply voltage for analog input stage</td>
</tr>
</tbody>
</table>

2.3.2 Analog Output Stage Power (VSOP, VSON)

Power for the analog output stage is applied at J6 (VSOP) and J7 (VSON). The specified range for these supplies is given in Table 3. On the PGA281EVM, VSON is always connected to GND.

<table>
<thead>
<tr>
<th>NAME</th>
<th>MINIMUM</th>
<th>Maximum</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VSOP</td>
<td>+2.7 V</td>
<td>+5.5 V</td>
<td>Positive supply for analog output stage</td>
</tr>
<tr>
<td>VSON</td>
<td>0 V</td>
<td>0 V</td>
<td>Negative voltage/ground reference for analog output stage</td>
</tr>
</tbody>
</table>

2.3.3 Digital Logic Power (VDD)

Power for the digital core is applied at J8 (VDD). The specified range for VDD is the same as VSOP (+2.7 V to +5.5 V). VSON is used as the digital core ground reference.

2.3.4 Onboard LDO Regulator

The PGA281EVM contains an onboard LDO regulator (U2) that is used to generate VSOP and VDD from VSP. This configuration greatly simplifies the power connections to the PGA281EVM, because then only VSP, VSN, and GND must be provided. The LDO regulator output voltage can be adjusted by replacing resistor R20. When using the LDO regulator in this manner, set jumpers JMP1 and JMP2 to INT and VSOP, respectively.

<table>
<thead>
<tr>
<th>R20 Resistance</th>
<th>Output Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>33.2 kΩ</td>
<td>5 V</td>
</tr>
<tr>
<td>18.2 kΩ</td>
<td>3.3 V</td>
</tr>
</tbody>
</table>
2.4 **Input/Output Connections**

The PGA281 is a differential input, differential output amplifier. The input signal is applied at BNC connectors J1 (IN+) and J3 (IN–), while the output signal is measured at BNC connectors J2 (OUT+) and J4 (OUT–).

2.5 **VOCM**

VOCM controls the output stage common-mode voltage. On the PGA281EVM, a resistive voltage divider created by R3 and R4 sets VOCM equal to \( \frac{V_{SOP}}{2} \).

2.6 **Gain Select**

Switch S1 controls the PGA281 gain. Each switch channel sets the logic level at the corresponding gain set pin. When the switch channel is on (up position), \( G_n = 1 \). When the switch channel is off (down position), \( G_n = 0 \). See Table 5 for all possible gain settings.

<table>
<thead>
<tr>
<th>G3:G0</th>
<th>G4 = 0</th>
<th>G4 = 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000</td>
<td>0.125</td>
<td>0.172</td>
</tr>
<tr>
<td>0001</td>
<td>0.25</td>
<td>0.344</td>
</tr>
<tr>
<td>0010</td>
<td>0.5</td>
<td>0.688</td>
</tr>
<tr>
<td>0011</td>
<td>1</td>
<td>1.375</td>
</tr>
<tr>
<td>0100</td>
<td>2</td>
<td>2.75</td>
</tr>
<tr>
<td>0101</td>
<td>4</td>
<td>5.5</td>
</tr>
<tr>
<td>0110</td>
<td>8</td>
<td>11</td>
</tr>
<tr>
<td>0111</td>
<td>16</td>
<td>22</td>
</tr>
<tr>
<td>1000</td>
<td>32</td>
<td>44</td>
</tr>
<tr>
<td>1001</td>
<td>64</td>
<td>88</td>
</tr>
<tr>
<td>1010</td>
<td>128</td>
<td>176</td>
</tr>
<tr>
<td>1011*</td>
<td>0.125</td>
<td>0.172</td>
</tr>
<tr>
<td>1100*</td>
<td>0.125</td>
<td>0.172</td>
</tr>
<tr>
<td>1101*</td>
<td>0.125</td>
<td>0.172</td>
</tr>
<tr>
<td>1110*</td>
<td>0.125</td>
<td>0.172</td>
</tr>
<tr>
<td>1111*</td>
<td>0.125</td>
<td>0.172</td>
</tr>
</tbody>
</table>

2.7 **Error Flag**

The PGA281 contains circuitry that monitors the integrity of the analog signal at several of the internal nodes. When signal conditions are outside the linear range, the error flag pin goes active (sets to \( V_D \)). In an error condition, LED1 on the PGA281EVM turns on.

Error conditions include:
- Input common-mode range exceeded
- Input clamp active
- Input stage at supply rail
- Input-stage current limit exceeded
- Output stage at supply rail
- Output-stage current limit exceeded
2.8 PGA281EVM PCB Layout

Figure 4, Figure 5, Figure 6, and Figure 7 depict the four layers of the PGA281EVM PCB layout.

NOTE: Board layouts are not to scale. These figures are intended to show how the board is laid out; they are not intended to be used for manufacturing PGA281EVM PCBs.
Figure 4. Top Layer (Signal and Ground)
Figure 5. Layer 2 (Power)
Figure 6. Layer 3 (Power)
Table 6 gives the bill of materials (BOM) used for the PGA281EVM. It also lists examples of optional components.

### Table 6. PGA281EVM Bill of Materials

<table>
<thead>
<tr>
<th>Count</th>
<th>RefDes</th>
<th>Value</th>
<th>Description</th>
<th>Part Number</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>U1</td>
<td>N/A</td>
<td>PGA281, TSSOP-16</td>
<td>PGA281</td>
<td>Texas Instruments</td>
</tr>
<tr>
<td>1</td>
<td>U2</td>
<td>N/A</td>
<td>TPS7A4101, MSOP-8</td>
<td>TPS7A4101</td>
<td>Texas Instruments</td>
</tr>
<tr>
<td>5</td>
<td>C1-C3, C10, C11</td>
<td>10 nF</td>
<td>CAP CER 10000PF 25V 10% X7R 0603</td>
<td>C1608X7R1E103K080AA</td>
<td>TDK Corporation</td>
</tr>
<tr>
<td>2</td>
<td>C5, C9</td>
<td>10 pF</td>
<td>CAP CER 10PF 50V NPO 0603</td>
<td>C1608CG1H100D080AA</td>
<td>Texas Instruments</td>
</tr>
<tr>
<td>1</td>
<td>C7</td>
<td>100 pF</td>
<td>CAP CER 100PF 50V 5% NPO 0603</td>
<td>C1608CG1H101J080AA</td>
<td>Texas Instruments</td>
</tr>
<tr>
<td>1</td>
<td>C12</td>
<td>10 nF</td>
<td>CAP CER 10000PF 25V 5% NPO 0603</td>
<td>C1608CG1E103J080AA</td>
<td>Texas Instruments</td>
</tr>
<tr>
<td>5</td>
<td>C13-C17</td>
<td>10 µF</td>
<td>CAP CER 10UF 25V 10% X7R 1206</td>
<td>C3216X7R1E106K160AB</td>
<td>TDK Corporation</td>
</tr>
<tr>
<td>2</td>
<td>D1, D5</td>
<td>N/A</td>
<td>TVS 6.0 VOLT 600 WATT BI-DIR SMB</td>
<td>SMBJ6.0CA</td>
<td>Littelfuse Inc</td>
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<tr>
<td>2</td>
<td>D2, D3</td>
<td>N/A</td>
<td>TVS 24 VOLT 600 WATT BI-DIR SMB</td>
<td>SMBJ24CA</td>
<td>Littelfuse Inc</td>
</tr>
<tr>
<td>1</td>
<td>D4</td>
<td>N/A</td>
<td>DIODE SCHOTTKY 30V 200MA SOT23</td>
<td>BAT54-V-GS08</td>
<td>Vishay Semiconductor</td>
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<tr>
<td>1</td>
<td>LED1</td>
<td>N/A</td>
<td>LED RED CLEAR 0603 SMD</td>
<td>LTST-C190CKT</td>
<td>Lite-On Inc</td>
</tr>
<tr>
<td>5</td>
<td>R1, R5, R7, R9, R13</td>
<td>1 kΩ</td>
<td>RES 1K OHM 1/10W 1% 0603 SMD</td>
<td>RMCF0603FT1K00</td>
<td>Stackpole Electronics Inc</td>
</tr>
<tr>
<td>7</td>
<td>R2-R4, R6, R8, R10, R14</td>
<td>100 kΩ</td>
<td>RES 100K OHM 1/10W 1% 0603 SMD</td>
<td>RMCF0603FT100K</td>
<td>Stackpole Electronics Inc</td>
</tr>
<tr>
<td>2</td>
<td>R11, R15</td>
<td>0 Ω</td>
<td>RES 0.0 OHM 1/10W JUMP 0603 SMD</td>
<td>ERJ-3GEY0R00V</td>
<td>Panasonic Electronic Components</td>
</tr>
<tr>
<td>2</td>
<td>R12, R16</td>
<td>1.3 kΩ</td>
<td>RES 1.3K OHM 1/16W .5% 0603 SMD</td>
<td>RR08P1.3KDC-ND</td>
<td>Susumu Electronics Inc</td>
</tr>
<tr>
<td>1</td>
<td>R17</td>
<td>221 Ω</td>
<td>RES 221 OHM 1/10W 1% 0603 SMD</td>
<td>RMCF0603FT221R</td>
<td>Stackpole Electronics Inc</td>
</tr>
<tr>
<td>4</td>
<td>R18-R19, R22-R23</td>
<td>22 Ω</td>
<td>RES 22 OHM 1/4W 5% 1206 SMD</td>
<td>RMCF1206JT22R0</td>
<td>Stackpole Electronics Inc</td>
</tr>
<tr>
<td>1</td>
<td>R20</td>
<td>33.2 kΩ</td>
<td>RES 33.2K OHM 1/10W .1% 0603 SMD</td>
<td>ERA-3AB43322V</td>
<td>Panasonic Electronic Components</td>
</tr>
<tr>
<td>1</td>
<td>R21</td>
<td>10 kΩ</td>
<td>RES 10.0K OHM 1/10W .1% 0603 SMD</td>
<td>RG1608P-103-B-T5</td>
<td>Susumu Electronics Inc</td>
</tr>
<tr>
<td>1</td>
<td>Q1</td>
<td>N/A</td>
<td>SWITCH DIP 5POS TOP ACT GULLEAD</td>
<td>A6S-S104-H</td>
<td>Omron Semiconductor</td>
</tr>
<tr>
<td>6</td>
<td>TP1-TP5, TP15</td>
<td>N/A</td>
<td>TEST POINT WHITE</td>
<td>5012</td>
<td>Keystone Electronics</td>
</tr>
<tr>
<td>5</td>
<td>TP6-TP9, TP14</td>
<td>N/A</td>
<td>TEST POINT BLACK</td>
<td>5011</td>
<td>Keystone Electronics</td>
</tr>
<tr>
<td>3</td>
<td>TP10, TP11, TP13</td>
<td>N/A</td>
<td>TEST POINT RED</td>
<td>5010</td>
<td>Keystone Electronics</td>
</tr>
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<td>1</td>
<td>TP12</td>
<td>N/A</td>
<td>TEST POINT YELLOW</td>
<td>5014</td>
<td>Keystone Electronics</td>
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<td>6</td>
<td>J5-J10</td>
<td>N/A</td>
<td>CONN JACK BANANA UNINS PANEL MOUNT</td>
<td>108-0740-001</td>
<td>Emerson Network Power</td>
</tr>
<tr>
<td>4</td>
<td>J1-J4</td>
<td>N/A</td>
<td>CONN SOCKET BNC R/A 75 OHM PCB</td>
<td>1-1478032-0</td>
<td>TE Connectivity</td>
</tr>
<tr>
<td>2</td>
<td>JMP1, JMP2</td>
<td>N/A</td>
<td>CONN HEADER .100 SNGL 3POS</td>
<td>TSW-103-07-G-S</td>
<td>Samtec</td>
</tr>
<tr>
<td>4</td>
<td>Screws</td>
<td>N/A</td>
<td>SCREW MACHINE PHILLIPS 4-40X3/8</td>
<td>PMS 440 0038 PH</td>
<td>B&amp;F Fastener Supply</td>
</tr>
<tr>
<td>4</td>
<td>Standoffs</td>
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<td>STANDOFF HEX 4-40THR ALUM .500’L</td>
<td>2203</td>
<td>Keystone Electronics</td>
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<tr>
<td>Not Installed</td>
<td>C4, C6, C8</td>
<td>N/A</td>
<td>Capacitor, 0603</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>
4 Related Documentation from Texas Instruments

The following documents provide information regarding Texas Instruments’ integrated circuits and support tools for the PGA281EVM. This user’s guide is available from the TI web site under literature number SBOU130. Any letter appended to the literature number corresponds to the document revision that is current at the time of the writing of this document. Newer revisions may be available from the TI web site, or call the Texas Instruments’ Literature Response Center at (800) 477-8924 or the Product Information Center at (972) 644-5580. When ordering, identify the document by both title and literature number.

<table>
<thead>
<tr>
<th>Document</th>
<th>Literature Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>PGA281 Product Data Sheet</td>
<td>SBO664</td>
</tr>
</tbody>
</table>
EVALUATION BOARD/KIT/MODULE (EVM) ADDITIONAL TERMS

Texas Instruments (TI) provides the enclosed Evaluation Board/Kit/Module (EVM) under the following conditions:

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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REGULATORY COMPLIANCE INFORMATION

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.

Concerning 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 isotope 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.
【Important Notice for Users of this Product in Japan】
This development kit is NOT certified as Confirming to Technical Regulations of Radio Law of Japan

If you use this product in Japan, you are required by Radio Law of Japan to follow the instructions below with respect to this product:

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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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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