The manual describes the ISO5851 Evaluation Module (EVM). The ISO5851 EVM allows designers to evaluate device AC and DC performance with a pre-populated 1-nF load or with a user-installed IGBT in either of the standard TO-247 or TO-220 packages.

Warning: Note that although these devices provide galvanic isolation of up to 5700-V, the EVM cannot be used for isolation voltage testing. Voltage exceeding the EVM's ratings ($V_{CC1} > 5.5$-V, $V_{CC2} - V_{EE2} > 30$-V, or IGBT Collector-Emitter Voltage $V_{CE} > 50$-V) can damage the EVM resulting in personal injury.

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1 Overview

The ISO5851 is a 5.7-kV<sub>RMS</sub>, reinforced isolated, IGBT gate driver with 2.5-A source and 5-A sink currents. The primary side operates from a single 3-V to 5.5-V supply. The output side allows for a supply range from minimum 15-V to maximum 30-V. Two complementary CMOS inputs control the output state of the gate driver. The short propagation time assures accurate control of the output stage.

An internal desaturation detection recognizes when the IGBT is in an overload condition. Upon a desaturation detect, the gate driver output is driven low to $V_{\text{EE2}}$ potential, turning the IGBT immediately off.

When desaturation is active, a fault signal is sent across the isolation barrier pulling the FLT output at the primary side low and blocking the isolator input. The FLT output condition is latched and can be reset through a low-active pulse at the RST input.

When the IGBT is turned off during normal operation with bipolar output supply, the output is hard clamp to $V_{\text{EE2}}$. If the output supply is unipolar, an active Miller clamp can be used, allowing Miller current to sink across a low impedance path preventing IGBT to dynamically turned on during high voltage transient conditions.

The readiness for the gate driver to be operated is under the control of two undervoltage-lockout circuits monitoring the primary and secondary supplies. If either side have insufficient supply, the RDY output goes low, otherwise the output is high.
## 2 EVM Setup and Precautions

### 2.1 Power Supply Connections

Figure 1 illustrates the EVM power supply schematic.

The primary side of the EVM (\( V_{CC1} \)) operates from a single 3-V to 5.5-V power supply and connected via TB3. Test point (TP8) is available for monitoring the primary power supply.

The EVM provides connections for evaluating the output side (\( V_{CC2}, V_{EE2} \)) with either a bipolar or unipolar power supply, from a minimum 15-V to maximum 30-V. For unipolar operation, connect \( V_{EE2} \) to GND2 through a wire-bridge between pin 2 and pin 3 of TB2, as shown in Figure 2. \( V_{CC2} \) and \( V_{EE2} \) can be monitored via TP17 and TP19, respectively.

Figure 1. ISO5851 EVM Power Supply Schematic

Figure 2. Output Power Supply for Unipolar (Left) or Bipolar (Right) Operation
2.2 Signal Connections

Figure 3 illustrates the ISO5851 EVM signal path schematic.

2.2.1 I/O Connections

Figure 3 shows the signal path schematic of the EVM. JMP1 allows for stimulus or monitoring of the device I/O pins IN+, IN-, RDY, FLT, and RST. Test points 1, 2, 3, 4, and 5 provide additional access to the I/O pins. The EVM comes populated with 10-kΩ pullup resistors (R1, R2) on the RDY and FLT pins, as well as 220-pF capacitors (C4, C5) to GND1 for noise filtering.

2.2.2 Output and Loading

The EVM comes populated with a 1-nF load (C12) on the output side. The output can be monitored directly via TP12. A 10:1 resistor-divider network is provided for monitoring the output with a low-voltage probe via TP20. The divider circuit can be disconnected from the output by removing the shunt on JMP5. 10-Ω gate resistors (R3, R12) control the rise and fall times of the output. These resistors can be modified by the user to alter the turn-on and turn-off characteristics of the output.

The EVM also allows for evaluation of the device with an IGBT load in either of the standard TO-247 or TO-220 footprints. During evaluation with an IGBT load, the pre-installed capacitive load (C12) can be disconnected from the output by removing the shunt on JMP2.

The EVM provides an additional connection (P2) for applying an external power supply to the IGBT Collector. The EVM is not intended for high voltage testing and the voltage applied to P2 should be limited to 50-V DC.

When evaluating the device with an IGBT load using P2, the components D1, D2, R7, and C13 should be populated with their default values, specified in Figure 3. Additionally, ensure that the DESAT pin is not connected to GND2 when driving an IGBT load using P2, either by removing R8, or verifying that all jumpers are removed from JMP3.
2.2.3 DESAT

The EVM comes populated with a 220-pF DESAT capacitance. Pin1 on JMP3 can be used to apply a signal directly to the DESAT pin.

For evaluation with the default 1-nF load, when actual IGBT is not connected as load, the desaturation function should be disabled by connecting the DESAT pin to GND2 by shunting pin 1 to pin 2 on JMP3.

2.2.4 CLAMP

By default, the CLAMP pin is connected to the output via a 0-Ω resistor (R6). The CLAMP feature can be disabled by removing R6. CLAMP can be monitored via TP14, and a signal can be applied directly to the CLAMP pin via JMP4.

3 Example Measurements

Figure 4 illustrates measurements performed under the default EVM configuration. For these measurements, $V_{IN}$ is connected to GND1.

![Figure 4. ISO5851 EVM Input and Output With Unipolar Output Supply](image)

Figure 4 shows the input and output of the ISO5851 EVM for a 100-kHz clock with $R_G = 10 \, \Omega$ (R3) and $R_{12} = 10 \, \Omega$ and a unipolar output supply ($V_{CC2} = 15\text{-}V$, $V_{EE2} = \text{GND2}$). The output is measured at TP12.
Figure 5 shows the input and output of the ISO5851 EVM for a 100-kHz clock with $R_G = 10 \, \Omega$ (R3) and $R12 = 10 \, \Omega$ and a bipolar output supply ($V_{CC2} = 15-V, V_{EE2} = -8-V$).

Figure 6 with Unipolar Output Supply and Figure 7 with Bipolar Output Supply, shows the functionality of the DESAT, FLT, and RST pins. IN+ is set to 5-$V_{DC}$, and an 10-µs pulse is applied to RST. On the rising edge of RST, the fault is cleared and the DESAT capacitor begins to charge. As the DESAT pin reaches the DESAT threshold voltage, a fault is triggered on FLT, and the output goes into active turn-off. RST must be toggled low, then high to reset the device, and the cycle begins again.
Figure 7. ISO5851 EVM DESAT and Reset with Bipolar Output Supply
4 Printed-Circuit Board

The ISO5851 is an isolated gate driver with several important features. The printed-circuit board (PCB)/EVM, as shown in Figure 8 ISO5851 EVM, has been designed to support the ISO5851 device and to allow the user to evaluate its basic operation and features. The left side of the PCB contains the interface to the input, control, and status functions of the integrated circuit (IC). The right side of the PCB has been designed to interface to an IGBT. No electrical connections exist between the right and left sides of the PCB.

![ISO5851 EVM](image)

Figure 8. ISO5851 EVM

Refer to the ISO5851EVM schematic shown in Figure 3 and the bill of materials given in Table 2, to become familiar with the PCB components and layout.

The following table pertains to the labels on the EVM board (Figure 8):

<table>
<thead>
<tr>
<th>Given</th>
<th>Read As</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCC1</td>
<td>V_{CC1}</td>
</tr>
<tr>
<td>VCC2</td>
<td>V_{CC2}</td>
</tr>
<tr>
<td>VEE2</td>
<td>V_{EE2}</td>
</tr>
<tr>
<td>VCE</td>
<td>V_{CE}</td>
</tr>
<tr>
<td>VIN+</td>
<td>IN+</td>
</tr>
<tr>
<td>VIN−</td>
<td>IN−</td>
</tr>
<tr>
<td>/FAULT</td>
<td>FLT</td>
</tr>
</tbody>
</table>

4.1 ISO5851 Operation

4.1.1 Left-Side Operation: DC Power, Control, and Status

4.1.1.1 DC Input Power

The left side of the ISO5851 (and therefore the PCB) can be operated using either a +3-V (±10%) to +5.5-V (±10%) dc power supply. As the current requirement is extremely low, the user can choose to operate the ISO5851 EVM by battery. The dc power supply must be connected to the TB3 terminal having $V_{CC1}$ (+5.5-V DC) and GND1 (+5.5-V DC return).
4.1.1.2 Control and Status

The interface to the device is via the JMP1 header. It contains the IN+ and IN− inputs, the device RST, RDY, and FLT indicator output. The JMP1 header allows easy connections to test equipment using standard clip leads. Each of the five signals also has a test point for additional connections. These are test points TP1–TP5.

4.1.2 Right-Side Operation

4.1.2.1 DC Output Power

Power is provided to \( V_{CC2} \) on the right side of the device at TB2 terminal as shown in Figure 2. The dc supply must be able to provide a bias voltage over the range of +15-V DC to +30-V DC. As the current requirement is extremely low, the user can choose to operate the ISO5851 EVM by battery. If a negative gate drive is required, a dc supply (or battery) must be connected across \( V_{EE2} \) at the TB3 terminal as shown in Figure 2. The voltage range must be between 0-V and 15-V DC.

4.1.2.2 DESAT – JMP3

One of the features of the ISO5851 is the IGBT desaturation protection. JMP3 provides access to the DESAT pin. It is a 3-pin male header, and installing a shorting jumper between pin 1 and pin 2 on JMP3 disables the DESAT function.

4.1.2.3 Load

As shipped, the ISO5851 EVM does not have an IGBT installed. The user can evaluate device operation using a capacitive load of 1nF provided on EVM or capacitive load can be removed and IGBT can be connected onto the board. Most IGBTs are available in the standard TO-247 or TO-220 package. The PCB has provisions to solder an IGBT directly onto the board.

4.1.2.3.1 No IGBT Installed – JMP2

When using the capacitive load, the user must install a jumper short onto JMP2. It connects a 1-nF capacitor (\( C_{12} \)) to the OUT pin. The capacitive consists of the 10-Ω gate resistor (R3) and the 1-nF capacitor (\( C_{12} \)).

4.1.2.3.2 IGBT Installed – REMOVE JMP2

If the user chooses to install an IGBT, JMP2 must be left open with no shorting jumper installed. The PCB has been designed with plated-through holes (or vias) as Q1 and Q2 shown on the schematic for IGBT connections.

4.1.2.4 Turn-on and Turn-off Adjust

The PCB contains 10-Ω gate resistor (R3), D4 diode, and 10-Ω R12 resistor. It allows the user to evaluate device operation with different turn-on and turn-off characteristics. It is shown in Figure 9.

Figure 9. To have different Turn-on and Turn-off
4.1.3 Test Points

Test points have been provided for ready access to signal monitoring and are listed in Table 1.

Table 1. Test Points

<table>
<thead>
<tr>
<th>Test Points</th>
<th>I/O</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>TP1</td>
<td>Input</td>
<td>IN+</td>
</tr>
<tr>
<td>TP2</td>
<td>Input</td>
<td>IN–</td>
</tr>
<tr>
<td>TP3</td>
<td>Output</td>
<td>RDY</td>
</tr>
<tr>
<td>TP4</td>
<td>Output</td>
<td>FLT</td>
</tr>
<tr>
<td>TP5</td>
<td>Input</td>
<td>RST</td>
</tr>
<tr>
<td>TP6</td>
<td>Ground</td>
<td>GND1</td>
</tr>
<tr>
<td>TP7</td>
<td>Ground</td>
<td>GND1</td>
</tr>
<tr>
<td>TP8</td>
<td>Supply</td>
<td>V_CC1</td>
</tr>
<tr>
<td>TP9</td>
<td>Ground</td>
<td>GND1</td>
</tr>
<tr>
<td>TP10</td>
<td>Input</td>
<td>COLLECTOR VOLTAGE</td>
</tr>
<tr>
<td>TP11</td>
<td>Input</td>
<td>EMITTER VOLTAGE</td>
</tr>
<tr>
<td>TP12</td>
<td>Output</td>
<td>GATE VOLTAGE</td>
</tr>
<tr>
<td>TP13</td>
<td>Input</td>
<td>DESAT</td>
</tr>
<tr>
<td>TP14</td>
<td>Input</td>
<td>CLAMP</td>
</tr>
<tr>
<td>TP15</td>
<td>Ground</td>
<td>GND2</td>
</tr>
<tr>
<td>TP16</td>
<td>Ground</td>
<td>GND2</td>
</tr>
<tr>
<td>TP17</td>
<td>Supply</td>
<td>V_CC2</td>
</tr>
<tr>
<td>TP18</td>
<td>Ground</td>
<td>GND2</td>
</tr>
<tr>
<td>TP19</td>
<td>Supply</td>
<td>V_EE2</td>
</tr>
<tr>
<td>TP20</td>
<td>Output</td>
<td>OUT</td>
</tr>
<tr>
<td>P1</td>
<td>Ground</td>
<td>GND2</td>
</tr>
<tr>
<td>P2</td>
<td>Input</td>
<td>COLLECTOR VOLTAGE</td>
</tr>
</tbody>
</table>
## 4.2 ISO5851 EVM Bill of Materials

The ISO5851 EVM bill of materials is shown in Table 2.

### Table 2. Bill of Materials

<table>
<thead>
<tr>
<th>Item</th>
<th>QTY</th>
<th>Reference</th>
<th>Part</th>
<th>Manufacturer</th>
<th>Manufacturer Part Number</th>
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<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>C1</td>
<td>DNI</td>
<td>DNI</td>
<td>DNI</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>C2</td>
<td>1 µF</td>
<td>AVX Corporation</td>
<td>TPSA105K020R3000</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>C3</td>
<td>0.1 µF</td>
<td>Kemet Electronic Components</td>
<td>C0805C0104J5RCTU</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>C4,C5</td>
<td>220 pF</td>
<td>Vankel</td>
<td>C0805C0G101-221JNE</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>C6,C9</td>
<td>22 µF</td>
<td>AVX Corporation</td>
<td>TAJV226K050RNJ</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td>C7,C10</td>
<td>4.7 µF</td>
<td>Kemet Electronic Components</td>
<td>CI210X475K5RCTU</td>
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<tr>
<td>7</td>
<td>4</td>
<td>C8,C11,C14,C15</td>
<td>1 µF</td>
<td>Murata Electronics North America</td>
<td>GRM21BR71H105KA12L</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>C12</td>
<td>1 nF</td>
<td>Murata Electronics North America</td>
<td>GRM2195C2A102JA01D</td>
</tr>
<tr>
<td>9</td>
<td>1</td>
<td>C13</td>
<td>220 pF</td>
<td>Venkel</td>
<td>C0805C0G101-221JNE</td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td>D1</td>
<td>UF4007</td>
<td>Fairchild Semiconductor</td>
<td>UF4007</td>
</tr>
<tr>
<td>11</td>
<td>1</td>
<td>D2</td>
<td>BAT165</td>
<td>Infineon Technologies</td>
<td>BAT 165 E6327</td>
</tr>
<tr>
<td>12</td>
<td>1</td>
<td>D3</td>
<td>MURS160T3G</td>
<td>ON Semiconductor</td>
<td>MURS160T3G</td>
</tr>
<tr>
<td>13</td>
<td>1</td>
<td>D4</td>
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<td>Infineon Technologies</td>
<td>BAT 165 E6327</td>
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<tr>
<td>14</td>
<td>1</td>
<td>JMP1</td>
<td>Header 5x2</td>
<td>Samtec Inc</td>
<td>HTSW-105-07-G-D</td>
</tr>
<tr>
<td>15</td>
<td>2</td>
<td>JMP2,JMP5</td>
<td>HDR_THVT_1x2</td>
<td>Samtec Inc</td>
<td>HTSW-102-07-G-S</td>
</tr>
<tr>
<td>16</td>
<td>2</td>
<td>JMP3,JMP4</td>
<td>Header 3x1</td>
<td>Samtec Inc</td>
<td>HTSW-103-07-G-S</td>
</tr>
<tr>
<td>17</td>
<td>1</td>
<td>P1</td>
<td>GND2</td>
<td>Emerson Network Power</td>
<td>108-0740-001</td>
</tr>
<tr>
<td>18</td>
<td>1</td>
<td>P2</td>
<td>COLLECTOR (50-V DC MAX)</td>
<td>Emerson Network Power</td>
<td>108-0740-001</td>
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<tr>
<td>19</td>
<td>2</td>
<td>R1,R2</td>
<td>10 kΩ</td>
<td>Vishay Dale</td>
<td>CRCW080510K0FKEA-</td>
</tr>
<tr>
<td>20</td>
<td>2</td>
<td>R3,R12</td>
<td>10</td>
<td>Vishay Dale</td>
<td>CRCW120610R0FKEA</td>
</tr>
<tr>
<td>21</td>
<td>1</td>
<td>R4</td>
<td>DNI</td>
<td>DNI</td>
<td>DNI</td>
</tr>
<tr>
<td>22</td>
<td>1</td>
<td>R5</td>
<td>10</td>
<td>Vishay/Dale</td>
<td>CRCW120610R0FKEA</td>
</tr>
<tr>
<td>23</td>
<td>3</td>
<td>R6,R8,R9</td>
<td>0</td>
<td>Vishay Dale</td>
<td>CRCW12060000Z0EA-</td>
</tr>
<tr>
<td>24</td>
<td>1</td>
<td>R7</td>
<td>1 kΩ</td>
<td>Panasonic - ECG</td>
<td>ERJ-8ENF1001V</td>
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<tr>
<td>25</td>
<td>1</td>
<td>R10</td>
<td>9 kΩ</td>
<td>Yageo</td>
<td>RC1206FR-079K09L</td>
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<tr>
<td>26</td>
<td>1</td>
<td>R11</td>
<td>1 kΩ</td>
<td>Panasonic - ECG</td>
<td>ERJ-8ENF1001V</td>
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<tr>
<td>27</td>
<td>1</td>
<td>TB2</td>
<td>3PIN TERMINAL BLOCK</td>
<td>TE Connectivity</td>
<td>282834-3</td>
</tr>
<tr>
<td>28</td>
<td>1</td>
<td>TB3</td>
<td>2PIN TERMINAL BLOCK</td>
<td>TE Connectivity</td>
<td>282834-2</td>
</tr>
<tr>
<td>29</td>
<td>1</td>
<td>U1</td>
<td>16 PIN DEVICE</td>
<td>Texas Instruments</td>
<td>ISO5851DW</td>
</tr>
<tr>
<td>30</td>
<td>20</td>
<td>TP1 through TP20</td>
<td>Color: Red for Power, Black for Ground and Blue for Signal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>4</td>
<td>Standoff/spacers</td>
<td>1 inch</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** C6, C7, C8, C9, C10, C11, C12, C13, C14, and C15 are rated for > 50-V

**Jumpers (default):**

- a. Pins 1 and 2 of JMP2 are connected with a jumper.
- b. Pins 1 and 2 of JMP5 are connected with a jumper.
- c. No jumper on any pins of JMP3 & JMP4.
- d. Pin 3 and 4 of JMP1 are connected with a jumper and rest pins of JMP1 are kept open
STANDARD TERMS AND CONDITIONS FOR EVALUATION MODULES

1. **Delivery:** TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, or documentation (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.

1.1 EVMs are intended solely for product or software developers for use in a research and development setting to facilitate feasibility evaluation, experimentation, or scientific analysis of TI semiconductors products. EVMs have no direct function and are not finished products. EVMs shall not be directly or indirectly assembled as a part or subassembly in any finished product. For clarification, any software or software tools provided with the EVM (“Software”) shall not be subject to the terms and conditions set forth herein but rather shall be subject to the applicable terms and conditions that accompany such Software.

1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.

2 **Limited Warranty and Related Remedies/Disclaimers:**

2.1 These terms and conditions 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 any defects that are 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. Moreover, TI shall not be liable for any defects that result from User's design, specifications or instructions for such EVMs. Testing and other quality control techniques are used to the extent TI deems necessary or as mandated by government requirements. TI does not test all parameters of each EVM.

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/lads/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、次のとところをご覧ください。http://www.tij.co.jp/lads/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 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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1. 電波法施行規則第6条第1項第1号に基づく平成18年3月28日総務省告示第173号で定められた電波暗室等の試験設備でご使用いただく。
2. 実験局の免許を取得後ご使用いただく。
3. 技術基準適合証明を取得後ご使用いただく。

なお、本製品は、上記の「ご使用にあたっての注意」を譲渡先、移転先に通知しない限り、譲渡、移転できないものとします。

上記を遵守頂けない場合は、電波法の罰則が適用される可能性があることをご留意ください。

日本テキサス・インスツルメンツ株式会社
東京都新宿区西新宿6丁目24番1号
西新宿三菱ビル

3.3.3 Notice for EVMs for Power Line Communication: Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_02.page

電力線搬送波通信についての開発キットをお使いになる際の注意事項については、次のところをご覧ください。http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_02.page

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.
6. **Disclaimers:**

6.1 EXCEPT AS SET FORTH ABOVE, EVMS AND ANY WRITTEN DESIGN MATERIALS PROVIDED WITH THE EVM (AND THE
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6.2 EXCEPT FOR THE LIMITED RIGHT TO USE THE EVM SET FORTH HEREIN, NOTHING IN THESE TERMS AND
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INVENTION, DISCOVERY OR IMPROVEMENT MADE, CONCEIVED OR ACQUIRED PRIOR TO OR AFTER DELIVERY OF
THE EVM.

7. **USER’S INDEMNITY OBLIGATIONS AND REPRESENTATIONS.** USER WILL DEFEND, INDEMNIFY AND HOLD TI, ITS
LICENSORS AND THEIR REPRESENTATIVES HARMLESS FROM AND AGAINST ANY AND ALL CLAIMS, DAMAGES, LOSSES,
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HANDLING OR USE OF THE EVM THAT IS NOT IN ACCORDANCE WITH THESE TERMS AND CONDITIONS. THIS OBLIGATION
SHALL APPLY WHETHER CLAIMS ARISE UNDER STATUTE, REGULATION, OR THE LAW OF TORT, CONTRACT OR ANY
OTHER LEGAL THEORY, AND EVEN IF THE EVM FAILS TO PERFORM AS DESCRIBED OR EXPECTED.

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

8.1 General Limitations. IN NO EVENT SHALL TI BE LIABLE FOR ANY SPECIAL, COLLATERAL, INDIRECT, PUNITIVE,
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8.2 Specific Limitations. IN NO EVENT SHALL TI’S AGGREGATE LIABILITY FROM ANY WARRANTY OR OTHER OBLIGATION
ARISING OUT OF OR IN CONNECTION WITH THESE TERMS AND CONDITIONS, OR ANY USE OF ANY TI EVM
PROVIDED HEREUNDER, EXCEED THE TOTAL AMOUNT PAID TO TI FOR THE PARTICULAR UNITS SOLD UNDER
THESE TERMS AND CONDITIONS WITH RESPECT TO WHICH LOSSES OR DAMAGES ARE CLAIMED. THE EXISTENCE
OF MORE THAN ONE CLAIM AGAINST THE PARTICULAR UNITS SOLD TO USER UNDER THESE TERMS AND
CONDITIONS SHALL NOT ENLARGE OR EXTEND THIS LIMIT.

9. **Return Policy:** Except as otherwise provided, TI does not offer any refunds, returns, or exchanges. Furthermore, no return of EVM(s)
will be accepted if the package has been opened and no return of the EVM(s) will be accepted if they are damaged or otherwise not in
a resalable condition. If User feels it has been incorrectly charged for the EVM(s) it ordered or that delivery violates the applicable
order, User should contact TI. All refunds will be made in full within thirty (30) working days from the return of the components(s),
excluding any postage or packaging costs.

10. **Governing Law:** These terms and conditions shall be governed by and interpreted in accordance with the laws of the State of Texas,
without reference to conflict-of-laws principles. User agrees that non-exclusive jurisdiction for any dispute arising out of or relating to
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Notwithstanding the foregoing, any judgment may be enforced in any United States or foreign court, and TI may seek injunctive relief
in any United States or foreign court.

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Only those TI components which TI has specifically designated as military grade or “enhanced plastic” are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have not been so designated is solely at the Buyer’s risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

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