DP159RGZ Evaluation Module

This document describes how to use and configure the DP159RGZEVVM along with recommendations for system hardware implementation. These recommendations are only guidelines and it is the designer’s responsibility to consider all system characteristics and requirements. Engineers should refer to the datasheet for technical details such as device operation, terminal description, and so forth.

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1 Overview

1.1 What is the DP159?

The DP159 is a Dual-Mode DisplayPort to Transition Minimized Differential Signal (TMDS) retimer supporting Digital Video Interface (DVI) 1.0 and High Definition Multimedia Interface (HDMI) 1.4b and 2.0 output signals. The DP159 supports the Dual-Mode Standard version 1.1 type 1 and type 2 through the DDC link. The DP159 supports data rates up to 6 Gbps per data lane to support UltraHD (4K x 2K / 60 Hz) 8 bits per color high resolution video and HDTV with 16-bit color depth at 1080p (1920 x 1080 / 60 Hz). The DP159 can automatically configure itself as a redriver at data rates < 1.0 Gbps or as a retimer above this data rate.

1.2 What is the DP159RGZEVM?

The DP159RGZEVM is a PCB created to help customers evaluate the DP159 device for video applications. This EVM can also be used as a hardware reference design for implementation of the DP159 in the RSB package. PCB design/layout files can be provided upon request to provide PCB design illustrations of the routing/placement rules.

Note that the EVM design supports both the standard DP159 application and a DP159-thru-HDMI application, so it contains many components that would not be needed by a typical DP159 application. A separate reference design specific to the DP159 is available for customers.

1.3 What is Included in the DP159RGZEVM?

The major components of the EVM are as follows:

- DP159RGZ
- Standard DP sink connector (connects to source)
- Standard HDMI source connector (connects to sink)
- DC power regulators
- I²C™ programming interface for external I²C host connection
- USB interface (I²C utility available)
1.4 DP159RGZEVM Board

Figure 1 illustrates the DP159RGZEVM board.

2 Hardware Description

Figure 2 shows the DP159RGZEVM block diagram.

100-Ω differential impedance for HDMI differential pairs.

Figure 2. DP159RGZEVM Block Diagram
2.1 Video Connectors for DP159 Ports

The EVM has a DP connection for the source and a HDMI connection for the sink. J2 is a standard DP connector (Molex 47272-0001). P2 is a standard HDMI connector (Molex 4715-10001). There is a third video connection on the board for a HDMI source (P1), this function is not installed on the DP159RGZEVM.

2.2 Enable/Reset

There are three device enable/reset options to use with the EVM:

A. Supervisor circuitry option
   This is the default configuration on the DP159RGZEVM. The enable (EN) signal is held low until the power good (PG) from the 3.3-V voltage regulator reaches a stable high-voltage level then released high.

B. RC timing option
   C26 external capacitor and internal resistor are used to control the EN ramp time after the device is powered on. C26 is a Do Not Install (DNI option) by default. C26 needs to be installed and R77 needs to be uninstalled to enable this option.

C. External control option
   A push button (SW1) is provided for manual control of the DP159’s EN/OE input.

2.3 Power

A DC power jack (J9) to accept a 5-V wall power adapter is provided on the EVM. The DC power jack (CUI Inc. PJ-202AH) has an inner diameter of 2.1 mm and an outer diameter of 5.5 mm. The tip of the +5-V power supply must be positive. A +5-V power supply of at least 1.5 A that meets the given requirements can be used to power the DP159RGZEVM. Power is provided to the EVM from the 5-V wall power adapter when SW2 is set to position 1.

CAUTION

Care should be taken to not plug in any power source higher than the configured voltage (5 V).

Alternately, it is possible to power the EVM by connecting a USB Micro cable from J13 to a USB host and setting SW2 to position 3.
## 2.4 Jumper Configuration

Jumpers are provided to operate the device/EVM in different configurations. Table 1 lists the jumper settings.

### Table 1. Jumper Settings

<table>
<thead>
<tr>
<th>Jumper</th>
<th>Signal Name</th>
<th>Description</th>
<th>Default Config</th>
</tr>
</thead>
</table>
| J1     | HPD_SRC          | JP 1-2 for DP159 thru HDMI  
                       | JP 2-3 for NOT USED  
                       | NC for DP159                                                             | NC                              |
| J3     | I2_EN_PIN        | JP 1-2 for I²C ENABLE  
                       | JP 2-3 for PIN STRAP  
                       | NC – PIN STRAP (internal pulldown)                                         | NC: Enables device configuration from I²C or pin straps. |
| J4     | SCL              | JP 1-2 for USB IF TO I²C  
                       | JP 2-3 for EXT IF TO I²C  
                       | NC – N/A                                                                 | JP 1-2: USB I²C Interface       |
| J6     | SDA              | JP 1-2 for USB IF TO I²C  
                       | JP 2-3 for EXT IF TO I²C  
                       | NC – N/A                                                                 | JP 1-2: USB I²C Interface       |
| J7     | HDMI_SEL_TEST_A1 | JP 1-2 for:  
                       | • I²C Addr bit A1 = 1, when I2C_EN = H  
                       | • DVI mode, when I2C_EN = L  
                       | JP 2-3 for:  
                       | • I²C Addr bit A1 = 0, when I2C_EN = H  
                       | • Normal mode, when I2C_EN = L  
                       | NC for weak internal pulldown (HDMI mode)                                | NC                              |
| J8     | VSADJ            | JP 1-2 for 7.0 kΩ  
                       | JP 2-3 for adjustable resistance  
                       | NC – N/A                                                                 | JP 1-2: Default of 7.0 kΩ       |
| J10    | SLEW_CTL         | JP 1-2 for fastest data rate  
                       | JP 2-3 for 20 ps slow  
                       | NC for 40 ps slow                                                       | NC                              |
| J11    | SIG_EN           | JP 1-2 for Signal Detect Enabled  
                       | JP 2-3 for Signal Detect Disabled                                         | NC                              |
|        |                  | NC for weak internal pullup (Detect Disabled)                              |                                 |
| J12    | EQ_SEL_A0        | JP 1-2 for:  
                       | • I²C Addr bit A0 = 1, when I2C_EN = H  
                       | • Fixed EQ at 14 dB, when I2C_EN = L  
                       | JP 2-3 for:  
                       | • I²C Addr bit A0 = 0, when I2C_EN = H  
                       | • Fixed EQ at 7.5 dB, when I2C_EN = L  
                       | NC for adaptive EQ                                                        | NC                              |
| J14    | TX_TERM_CTL      | JP 1-2 for No TX termination  
                       | JP 2-3 for TX termination 75–100 Ω  
                       | NC for auto termination set                                               | NC                              |
| J15    | PRE_SEL          | JP 1-2 for −5 dB  
                       | JP 2-3 for −2.5 dB  
                       | NC for 0 dB                                                             | NC                              |
Table 1. Jumper Settings (continued)

<table>
<thead>
<tr>
<th>Jumper</th>
<th>Signal Name</th>
<th>Description</th>
<th>Default Config</th>
</tr>
</thead>
<tbody>
<tr>
<td>J16</td>
<td>CEC_EN</td>
<td>JP 1-2 for DP159 thru HDMI</td>
<td>NC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JP 2-3 for NOT USED</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>NC for DP159</td>
<td></td>
</tr>
<tr>
<td>J17</td>
<td>SWAP/POL</td>
<td>JP 1-2 for Polarity Swap</td>
<td>NC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JP 2-3 for Lane Swap</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>NC for No Swap</td>
<td></td>
</tr>
</tbody>
</table>

2.5 Component Population Configuration

To allow the DP159RGZEV to support both the default DP input as well as a HDMI test input, there are many components that need to be removed, placed, or modified depending on the board configuration. Here’s a summary of the default component configuration for the DP159RGZEV. In addition, the unused HDMI receptacle is depopulated.

<table>
<thead>
<tr>
<th>Function</th>
<th>Reference Designator</th>
<th>DP159RGZEV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Differential Pair - IN</td>
<td>C11, C12, C13, C14, C15, C16, C24, C25</td>
<td>populated with 0.1 µF</td>
</tr>
<tr>
<td>Differential Pair - HDMI IN</td>
<td>R14, R15, R18, R19, R20, R21, R22, R23</td>
<td>not populated</td>
</tr>
<tr>
<td>SDA / SCL - HDMI</td>
<td>R16, R17, R24, R25, R123, R124</td>
<td>not populated</td>
</tr>
<tr>
<td>Differential Pair - DP IN</td>
<td>R112, R109, R111, R108, R110, R107, R106, R105</td>
<td>populated with 0 Ω</td>
</tr>
<tr>
<td>SDA / SCL / HPD - DP</td>
<td>R33, R31, R32 (R126, R135, R132, R133 - snoop)</td>
<td>populated with 0 Ω</td>
</tr>
<tr>
<td>Pullup Differential Pair HDMI IN</td>
<td>R1, R2, R3, R4, R6, R7, R8, R9</td>
<td>populated, but not connected</td>
</tr>
</tbody>
</table>

2.5.1 HPD Snoop Option

To accommodate systems that do not properly resend DDC commands after HPD goes low, we have implemented a HPD snoop mode on the DP159RGZEV. This mode allows the HPD line to be routed around the DP159, but remain connected to the DP159 on the sink side to allow the DP159 to snoop its state. This snoop mode is disabled by default on the DP159RGZEVs.

- Pop R131, no pop R129, R130, R139 for HPD on
- No pop R131, pop R129, R130, R139 for HPD snoop only

2.5.2 DDC Snoop Option – not Available for DP159RGZ REV B

To accommodate systems that do not properly support clock stretching on the DDC lines, we have implemented a snoop mode on the DP159RGZEV. This mode allows the DDC lines to be routed around the DP159RGZ, but remain connected to the DP159RGZ on the sink side to allow the DP159RGZ to snoop the DDC traffic. This snoop mode is enabled by default on the DP159RGZ REV B1 EVMs.

- Pop R126, R125, R132, R133. No pop R31, R32 – DP159RGZ, DDC snoop only
- Pop R31, R32. No pop R126, R125, R132, R133 – DP159RGZ, DDC on
2.6 Local I^2C Access Through J5

Access to DP159’s local I^2C signals is provided via the J5 input connector. Note that I^2C signal levels should be at 3.3 V when I^2C interface is accessed through the connector.

A standalone external I^2C host can be connected via J5 for debug and control purposes. An example of an external I^2C Host controller is the Total Phase Aardvark I^2C/SPI Host Adapter (Total Phase Part#: TP240141). Sample scripts for this I^2C Host controller are provided by request.

<table>
<thead>
<tr>
<th>J5 pin #</th>
<th>Description</th>
<th>J5 pin #</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SCL_CTL</td>
<td>2</td>
<td>GND</td>
</tr>
<tr>
<td>3</td>
<td>SDA_CTL</td>
<td>4</td>
<td>NC</td>
</tr>
<tr>
<td>5</td>
<td>NC</td>
<td>6</td>
<td>NC</td>
</tr>
<tr>
<td>7</td>
<td>NC</td>
<td>8</td>
<td>NC</td>
</tr>
<tr>
<td>9</td>
<td>NC</td>
<td>10</td>
<td>GND</td>
</tr>
</tbody>
</table>

Table 2. Aardvark I^2C (J5) Pin-Out

Table 3. DP159 Target I^2C Address(1)

<table>
<thead>
<tr>
<th>DP159 I^2C Target Address</th>
<th>Bit 7 (MSB)</th>
<th>Bit 6</th>
<th>Bit 5</th>
<th>Bit 4</th>
<th>Bit 3</th>
<th>Bit 2</th>
<th>Bit 1</th>
<th>Bit 0 (W/R)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A6</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0/1</td>
</tr>
</tbody>
</table>

(1) The target I^2C address for DP159 can be modified by the EVM jumper settings.

2.7 Local I^2C Access Through USB Interface via TUSB3410

Access to DP159’s local I^2C signals is also provided through the TUSB3410 on the DP159RGZEVM using a USB TI Utility called Eye Scan. To use the utility:

• Install the Eye Scan software from Texas Instruments
• J6 must be set to SDA – SDA_USB
• J4 must be set to SCL – SCL_USB
• Attach USB micro cable to J13 and to the host computer

NOTE: The USB connection should be made prior to installing any DP or HDMI cables.

• Start the Eye Scan software
Figure 3 shows the Register Status / Control tab.

Confirm that the SN65DP149/159/TMDS171/181 Interface is present and selected at the top. If it is not, check the USB connection and confirm that the driver is loaded in Device Manager. It may take a moment for the USB driver to load, if the DP159RGZ does not appear, hit the Refresh button. This tab can be used to read and write the status and control registers of the device.
Figure 4 shows the Eye Scan tab.

Figure 4. Eye Scan Tab

To run an Eye Scan, select the Eye Scan tab, select the relevant lanes, and press scan. Note that Eye Scan cannot be performed when the device is in retimer mode, it does not function in redriver mode.
Note that at HDMI 2.0 speeds there is a bug that causes invalid eyescan results. Results that look like this:

![Figure 5. Sample Eyescan at HDMI2.0 Raw](image)

Should be interpreted as this:

![Figure 6. Sample Eyescan at HDMI2.0 Interpreted](image)
2.8 Rsadj Potentiometer

The default Rsadj value on the DP159RGZEVM is 7.0 kΩ. The optimal value for an application may vary from 4.7 kΩ to 7 kΩ. To allow customers to test the effects of various Rsadj values, there is a potentiometer on the EVM at R76. The Rsadj value can be varied by turning the knob and setting J8 to [2,3].

3 Quick Start Guide

The following steps provide quick start instructions:

1. Connect USB cable from J13 to a USB host, set SW2 to 3. LED D2 should light up.
   Option: Apply 5-V power to J9, set SW2 to 1. LED D2 should light up.
2. If using external I²C adapter instead of pin straps, configure the DP159 at this step using J5 or through the USB interface.
4. Plug in an HDMI video sink device into P2 (standard HDMI connector) using a standard HDMI cable.
5. Video output on HDMI sink should be observed.

4 References

1. DP159 Data Sheet
### Table 4. DP159RGZEVM Bill of Materials

<table>
<thead>
<tr>
<th>Item</th>
<th>Qty</th>
<th>Reference</th>
<th>Part</th>
<th>PCB Footprint</th>
<th>Manufacturer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>C1,C52</td>
<td>1 uF</td>
<td>603</td>
<td>Taiyo Yuden</td>
<td>LMK107B7105KA-T</td>
</tr>
<tr>
<td>2</td>
<td>12</td>
<td>C9,C10,C17,C18,C19,C21,C23,C29,C40,C46,C59,C60</td>
<td>0.1uF</td>
<td>402</td>
<td>Yageo</td>
<td>CC0402KRX5R6BB104</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>C8,C20,C35,C36,C57</td>
<td>10uF</td>
<td>805</td>
<td>TDK</td>
<td>C2012X5R1A106K125AB</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>C31</td>
<td>10uF</td>
<td>805</td>
<td>TDK</td>
<td>C2012XR1C106K085AC</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>C22,C37,C41,C42,C47</td>
<td>0.01uF</td>
<td>402</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>C26 - DNI</td>
<td>DNI_200nF</td>
<td>402</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>C27</td>
<td>18pF</td>
<td>402</td>
<td>AVX</td>
<td>04025A180JAT2A</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>C28</td>
<td>220pF</td>
<td>402</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>1</td>
<td>C30</td>
<td>220uF</td>
<td>7343</td>
<td>Kemet</td>
<td>T491D227K016AT</td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td>C34</td>
<td>3.3 nF</td>
<td>402</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>1</td>
<td>C32</td>
<td>22uF</td>
<td>805</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>2</td>
<td>C39,C58</td>
<td>2.2uF</td>
<td>805</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>35</td>
<td>C2,C3,C4,C5,C6,C7,C38,R14 ,R15,R16,R17,R18,R19,R20 ,R21,R22,R23,R24,R25,R35 ,R87,R92,R93,R104,R113,R14 ,R120,R123,R124,R125,R126 ,R129,R130,R132 ,R133</td>
<td>DNI</td>
<td>402 / 201</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>2</td>
<td>C45,C49</td>
<td>22pF</td>
<td>402</td>
<td></td>
<td></td>
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<tr>
<td>15</td>
<td>2</td>
<td>C50,C51</td>
<td>33pF</td>
<td>402</td>
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<td></td>
</tr>
<tr>
<td>16</td>
<td>1</td>
<td>D1</td>
<td>Zener 6V</td>
<td>SOT23</td>
<td>Diodes Inc.</td>
<td>MM8Z5233B-FDICT-ND</td>
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<tr>
<td>17</td>
<td>1</td>
<td>D2</td>
<td>LED Green 0805</td>
<td>805</td>
<td>Lite On</td>
<td>LTST-C171GKT</td>
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<tr>
<td>18</td>
<td>1</td>
<td>JP1</td>
<td>JUMPER</td>
<td>HDR_THVT_.1x2_100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>13</td>
<td>J1,J3,J4,J6,J7,J8,J10,J11,J12,J14,J15,J16,J17</td>
<td>HDR3X1 M .1</td>
<td>HDR_THVT_.1x3_100</td>
<td>3M</td>
<td>961103-6404-AR</td>
</tr>
<tr>
<td>20</td>
<td>1</td>
<td>J2</td>
<td>Display_Port_Conne ctor_Sink_0</td>
<td>DISPLAYPORT</td>
<td>Molex</td>
<td>47272-0001</td>
</tr>
<tr>
<td>21</td>
<td>1</td>
<td>J5</td>
<td>Header 5x2 0.1&quot; thru-hole</td>
<td>con_thvt_shrd_2x5_100_m</td>
<td>3M</td>
<td>N2510-6002-RB</td>
</tr>
<tr>
<td>22</td>
<td>1</td>
<td>J9</td>
<td>2.1mm x 5.5mm</td>
<td>PJ-202AH</td>
<td>CUI Inc.</td>
<td>PJ-202AH (PJ-002AH)</td>
</tr>
<tr>
<td>23</td>
<td>1</td>
<td>J13</td>
<td>USB Micro B</td>
<td>USB Micro B</td>
<td>FCI</td>
<td>10103992-0001LF</td>
</tr>
<tr>
<td>24</td>
<td>17</td>
<td>LP1,LP2,LP3,LP4,LP5,LP6,LP7,LP8,LP9,LP10,LP11,LP12 ,LP13,LP14,LP15,LP16,LP17</td>
<td>LP</td>
<td>TESTLOOP</td>
<td>KOBIKONN</td>
<td>151-103-RC</td>
</tr>
<tr>
<td>25</td>
<td>1</td>
<td>L1</td>
<td>2.2 uH</td>
<td>1008</td>
<td>TDK</td>
<td>VLS252010ET-2R2M</td>
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<tr>
<td>26</td>
<td>1</td>
<td>L2</td>
<td>1 uH</td>
<td>1008</td>
<td>TDK</td>
<td>NLCV25T-1R0MF0-V</td>
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<tr>
<td>27</td>
<td>4</td>
<td>L3,L4,L5,L6</td>
<td>CHOKE</td>
<td>805</td>
<td>Murata</td>
<td>DLW21SN900HQ2L</td>
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<td>28</td>
<td>1</td>
<td>P1 - DNI</td>
<td>HDMI_IN</td>
<td>CON_HDMI_RT_.19_0p50mm</td>
<td>Molex</td>
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### Table 4. DP159RGZEVM Bill of Materials (continued)

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Figure 7 through Figure 13 show the DP159RGZEVM schematics.

Figure 7. HDMI Input Connectors
No pop R131, pop R129, R130 for HPD snoop only

Figure 8. DP159RGZ
Pop 2K resistors on R45, R46 for DP159 thru HDMI, DDC snoop only.

Figure 9. HDMI TX Connector
Three place switches - hi, lo, no connect
Sampled at POR

Figure 10. DP159RGZEVM Select Options
Pop C26 and depop R77 if not using the Reset SW.

C26
DNI_200nF
R77
VCC_3P3V
R78
10K
0402
5%

Figure 11. Reset
1.1V LDO REGULATOR

3.3V BUCK REGULATOR - 4V to 17V input

5.0V BOOST

Figure 12. 1.1- and 3.3-V Regulators
Figure 13. TUSB3410
Figure 14 through Figure 19 illustrate the DP159RGZEVM PCB layouts.

Figure 14. Layer 1 (Top)

Figure 15. Layer 2 (GND)
Figure 16. Layer 3 (Power)

Figure 17. Layer 4 (Power)
Figure 18. Layer 5 (GND)

Figure 19. Layer 6 (Bottom)
## Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

<table>
<thead>
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<th>Changes from Original (August 2015) to A Revision</th>
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<td>• Added text and Figure 5 and Figure 6</td>
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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.

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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.

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/lds/it_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/lds/it_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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西新宿三井ビル

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3.4.1 For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive):
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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.

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