This is the user’s guide for the DP-EXPANSION-EVM for use with the TPS6598x Booster Packs supporting
the expansion board connector. The DP-EXPANSION-EVM is not intended to be used alone and requires
the TPS6598x BoosterPack for operation.

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About this Manual

The DP-EXPANSION-EVM user’s guide contains an introduction, setup instructions, the EVM schematic, top and bottom board layouts and component views, layout, and a bill of materials (BOM).

2 Information About Cautions and Warnings

ATTENTION
STATIC SENSITIVE DEVICES
HANDLE ONLY AT
STATIC SAFE WORK STATIONS
3 Items Required for Operation

The following items are required to use the DP-EXPANSION-EVM:

- TPS65986 data sheet (SLVSD13)
- TPS65986EVM
  - TPS65986EVM user’s guide
  - Barrel jack adapter or DC power supply
- Mini DisplayPort to DisplayPort, HDMI, VGA, or other cable
- DisplayPort-to-DisplayPort cable
- USB3.0 Type-A to Type-B
- USB Type-C cable
- USB Type-C to Type-A
- USB Type-A to Type-C
- Notebook with DisplayPort and USB
- Monitor with DisplayPort, HDMI, or VGA input

4 Introduction

The DP-EXPANSION-EVM adds to the capabilities of the TPS6598x BoosterPack supporting the expansion board connector by allowing the user to evaluate the USB Type-C and power-delivery (PD) capabilities of the TPS6598x USB Type-C and PD devices from the power and data perspective.

The TPS6598x USB Type-C and PD controller provides cable plug and orientation detection at the USB Type-C connector. Upon cable detection, the TPS6598x device communicates on the CC wire using the USB PD protocol. When cable detection and USB PD negotiation are complete, the TPS6598x device enables the appropriate power path and configures alternate mode settings for internal and (optional) external multiplexers.

This user guide describes the TPS65986EVM and the capabilities of this EVM with the DP-EXPANSION-EVM.

5 Setup and Connectors, Test Point, and LED Description

5.1 J1 Type-A USB Receptacle

The J1 jumper is used to connect a USB device to the DP-EXPANSION-EVM and TPS6598x BoosterPack. This connection provides the USB host data to a device when appropriately connected.

5.2 J2 Mini DisplayPort Receptacle

The J2 jumper is used to connect to a monitor either through a Mini DisplayPort cable to standard DisplayPort, VGA, HDMI, or other cable.

5.3 J3 Type-B USB Receptacle

The J3 jumper is used to connect to a USB source from a notebook. The USB signals are routed to the Type-C connector when a connection is available on the Type-C connector on the TPS6598x BoosterPack.
5.4 **J4 Expansion Board Connector**

The J4 jumper connects the DP-EXPANSION-EVM to the TPS6598x BoosterPack. The super-speed signals are connected from the USB and DisplayPort connectors to the Type-C connector through J4. This jumper also includes certain GPIO control, I²C communication, and power from the TPS6598x BoosterPack.

5.5 **J5 DisplayPort Receptacle**

The J5 jumper is used to connect a DisplayPort source from a notebook. The DisplayPort signals are routed to the Type-C connector when a DisplayPort device is connected on the Type-C connector on the TPS6598x BoosterPack.

5.6 **TP2: 3.3-V TPS6598x BoosterPack Supply**

This test point is used to access the 3.3-V supply from the connected TPS6598x BoosterPack. Considering the J4 connector, the maximum current draw should be 1 A. This supply is used to supply power to the DisplayPort connector.

5.7 **TP3: 5-V TPS6598x BoosterPack Supply**

This test point is used to access the 5-V (high-current) supply from the connected TPS6598x BoosterPack. Although the TPS6598x BoosterPacks can provide 3 A from the main 5-V supply, TI recommends to draw a maximum of 1 A because of the J4 connector.

5.8 **TP4: 5-V USB TPS6598x BoosterPack Supply**

This test point is used to access the 5-V USB supply from the connected TPS6598x BoosterPack. This supply powers VBUS on the Type-A receptacle on the DisplayPort Sink Board. This test point is not intended to draw current when a USB device is connected to J1. A maximum of 1 A can be drawn from the test point when J1 is not connected.

5.9 **TP5: PP_HV TPS6598x BoosterPack Main Supply**

This test point is used to access the PP_HV supply from the connected TPS6598x BoosterPack and can vary from 5 V (low-voltage bus-powered operation) to 20 V (self-powered or high-voltage bus-powered operation). A maximum of 3 A can be drawn from this test point.

**CAUTION**

The EVM can support up to 60 W of power (20 V at 3 A), use caution when connecting and disconnecting probes on TP5.

5.10 **D1 LED Indicator**

The D1 LED shows the state of the DisplayPort HPD signal on the DisplayPort source and sink board. This LED helps the user to determine the state of HPD when a DisplayPort connection is active.

6 **Getting Started With the DP-EXPANSION-EVM and TPS65986EVM**

6.1 **Separating the Source and Sink Board**

The DP-EXPANSION-EVM is built with the DisplayPort source board and sink board joined together. The boards must be snapped-off from each other and separated by hand. The board should break cleanly because of the perforated connection between the boards.
6.2 TPS65986EVM Firmware Configurations for DP-EXPANSION-EVM
### 6.2.1 TPS65986EVM Configuration ID 0: Self Powered Docking System

#### Table 1. Configuration ID 0

<table>
<thead>
<tr>
<th>CFG ID</th>
<th>Switch S1</th>
<th>Port Type</th>
<th>Type-C Power</th>
<th>PD Source</th>
<th>PD Sink Capabilities</th>
<th>DP Support</th>
<th>PD Control Response</th>
<th>PD Control</th>
<th>Application</th>
<th>FET Paths Used</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Data Power</td>
<td></td>
<td>A</td>
<td>V at A</td>
<td>V at A</td>
<td>V at A</td>
<td>V at A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>■ ← 0</td>
<td>DRP Rp/Rd</td>
<td>3</td>
<td>5 at 3</td>
<td>20 at 3</td>
<td>—</td>
<td>5 at 0</td>
<td>—</td>
<td>UFP_D Config C and D</td>
<td>Initiate DR swap to UFP - Reject DR Swap to DFP - Reject DR Swap to UFP - Accept Source PR Swap to Src - Accept PR Swap to Snk - Reject Initiate PR swap to Src</td>
</tr>
</tbody>
</table>
6.2.1.1 Overview

This configuration represents a docking system connected to an external source of power. This configuration is a DRP product that accepts power-role swaps to source and data-role swaps to UFP. The firmware is also configured to automatically request a power-role swap to source or data-role swap to UFP when appropriate.

6.2.1.2 Power Configurations

This configuration supports sourcing up to 60 W and has two source profiles. This configuration can provide 5 V at 3 A and 20 V at 3 A through the PP_HV path.

This configuration requests only a 5 V at 0-A contract because it is a docking system that is being powered externally.

6.2.1.3 Data Configurations

This configuration is a UFP in terms of data for USB and DisplayPort functionality. When connected to another DisplayPort UFP_D product, the DisplayPort alternate mode is not established because of two connected UFP_D products. The ideal connections are to a DFP_D DisplayPort product or a USB Host. The DP-EXPANSION-EVM DisplayPort sink board can be used to bring out the USB and DisplayPort signals.
### 6.2.2 TPS65986EVM Configuration ID 1: Notebook System

Table 2. Configuration ID 1

<table>
<thead>
<tr>
<th>CFG ID</th>
<th>Switch S1</th>
<th>Port Type</th>
<th>Type-C Power</th>
<th>PD Source</th>
<th>PD Sink Capabilities</th>
<th>DP Support</th>
<th>PD Control Response</th>
<th>PD Control</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Data Power</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1 → ■</td>
<td>DRP Rp/Rd</td>
<td>3</td>
<td>5 at 3</td>
<td>—</td>
<td>DFP_D</td>
<td>DFP DR Swap to DFP - Accept</td>
<td></td>
</tr>
<tr>
<td></td>
<td>■ ← 0</td>
<td></td>
<td></td>
<td>—</td>
<td>5 at 20</td>
<td>Initiated DR/PR Swaps</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>■ ← 0</td>
<td></td>
<td></td>
<td>—</td>
<td>—</td>
<td>SINK PR Swap to Snk - Accept</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>■ ← 0</td>
<td></td>
<td></td>
<td>—</td>
<td>—</td>
<td>Initiate PR swap to Snk</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Source: 5 V at 3-A PP_5V0
Sink: PP_HV
6.2.2.1 Overview

This configuration represents a notebook system that is battery powered. This configuration is a DRP product that accepts power-role swaps to source and sink and data-role swaps to DFP. The firmware is also configured to automatically request a power-role swap to sink or data-role swap to DFP when appropriate. This configuration rejects any data-role swaps to UFP because it is a data host.

6.2.2.2 Power Configurations

This configuration supports sourcing up to 15 W and has one source profile. This configuration can provide 5 V at 3 A.

This configuration has two sink profiles through the PP_HV path: 5 V at 0 A and 12 V to 20 V at 2 A. This configuration requests 5 V at 0 A contract because the notebook requires a higher voltage to charge. When an appropriate source capability is advertised it requests a high-voltage contract.

6.2.2.3 Data Configurations

This configuration is a DFP in terms of data for USB and DisplayPort functionality. When connected to another DisplayPort DFP_D product, the DisplayPort alternate mode is not established because of two connected DFP_D products. The ideal connections are to a UFP_D DisplayPort product or a USB device. The DP-EXPANSION-EVM DisplayPort source board can be used to bring out the USB and DisplayPort signals into a legacy notebook.

6.2.3 Connecting the DP-EXPANSION-EVM to TPS65986EVM

Various Type-C cables can be used to connect the EVM to a legacy Type-A host, legacy Type-A device, and Type-C device.

6.2.3.1 Connecting to a Legacy Type-A Device

Using a Type-C to Type-A receptacle cable allows connections to a legacy USB device such as a flash-drive. The TPS65986 device cannot act as a host but can be pass the USB connection to a host by using the DP-EXPANSION-EVM source board. Figure 2 shows how the notebook, DP-EXPANSION-EVM, TPS65986EVM, cable, and flash drive are connected.

![Figure 2. Connecting EVM to Type-A Device](image)

6.2.3.2 Connecting to Type-C devices

Using a Type-C cable allows connections to a Type-C device or host. When two TPS65986EVMs are used with the DP-EXPANSION-EVM source and sink boards, a complete Type-C system can be verified. The source setup must have a DisplayPort source and USB2/3 source connected to provide the data to the sink board. A monitor can be connected to sink board along with a USB device to connect to the source board. Figure 3 shows how the boards are connected.
NOTE: Signal integrity can be a factor in USB and DisplayPort video quality because it must go through multiple connectors and cables.

Figure 3. Connecting EVM to EVM for Type-C System

Figure 4 shows how a source setup can be connected to a Type-C device (DisplayPort, USB, or both) such as a Type-C flash drive, Type-C to DisplayPort dongle, Type-C to HDMI, or Type-C docking system.

Figure 4. Connecting EVM to Type-C Devices

Figure 5 shows how a sink setup can be connected to a Type-C host such as MacBook™ or ChromeBook Pixel™ to enter the DisplayPort alternate mode. The sink allows a DisplayPort and USB connection to the notebooks.

Figure 5. Connecting EVM to Type-C Host
6.2.3.3 Testing DisplayPort Alternate Mode

The DisplayPort alternate mode can be tested with a non-Type-C notebook allowing the user to simulate either a DisplayPort DFP_D (video source) or UFP_D (video sink). Table 3 lists the testing flow used to verify DisplayPort functionality with two TPS65986EVMs and the ACS002 DP-EXPANSION-EVM (DisplayPort source and sink boards).

**CAUTION**
Do not connect the DP-EXPANSION-EVM to the TPS65986EVM when the barrel jack is connected. Connecting the EVM in this way may result in a short when J4 (DP-EXPANSION-EVM) or J5 (TPS65986EVM) expansion board connectors are misaligned.

The required hardware is listed as follows:
- A Windows™ PC with a USB Type-A receptacle and DisplayPort video output
  - USB3.0 Type-A to Type-B cable
  - USB3.0 flash drive
  - USB2.0 Type-A to microUSB
- USB Type-C Cable
- 1080p monitor with DisplayPort input
  - Mini DisplayPort to DisplayPort cable
- ACS003 DP-EXPANSION-EVM (Source and Sink Board)
- Dell laptop power-supply model: DA130PE1-00

Table 3. DisplayPort Testing Table

<table>
<thead>
<tr>
<th>Test Step</th>
<th>Pass Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Left Switch Setting:</strong></td>
<td><img src="image1" alt="Diagram of Switch Setting" /></td>
</tr>
<tr>
<td>B0: ←</td>
<td>USB Type-B (Input from PC)</td>
</tr>
<tr>
<td>B1: →</td>
<td>DisplayPort Receptacle (Input from PC)</td>
</tr>
<tr>
<td>B2: ←</td>
<td>Type-C Cable</td>
</tr>
<tr>
<td><strong>Right Switch Setting:</strong></td>
<td><img src="image2" alt="Diagram of Switch Setting" /></td>
</tr>
<tr>
<td>B0: →</td>
<td>USB Type-A (Output to Flash Drive)</td>
</tr>
<tr>
<td>B1: ←</td>
<td>Mini DisplayPort Receptacle (Output to Monitor)</td>
</tr>
<tr>
<td>B2: ←</td>
<td>DisplayPort Source Board should be connected to the DisplayPort</td>
</tr>
</tbody>
</table>

**Connect the DP-EXPANSION-EVM**
- DisplayPort source board to the left board output of the PC and USB3.0 output of the PC
- DisplayPort sink board to the right board

**Connect the DP-EXPANSION-EVM**
- DisplayPort Sink Board should be connected to the DisplayPort input of the Monitor and to a USB3.0 Flash Drive
### Table 3. DisplayPort Testing Table (continued)

<table>
<thead>
<tr>
<th>Test Step</th>
<th>Pass Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connect the two EVM setups with a Type-C Cable and connect the barrel</td>
<td>The EVMs should negotiate a high voltage 20 V contract and the DisplayPort alternate mode.</td>
</tr>
<tr>
<td>Check for video on DisplayPort monitor and verify USB flash drive is accessible</td>
<td>Successfully copy and paste a file to and from the USB flash drive. Extend the PC to the DisplayPort Monitor and play video and verify video stream.</td>
</tr>
</tbody>
</table>
This section shows the schematics for the DP-EXPANSION-EVM.
Figure 6. DP-EXPANSION-EVM Source and Sink Board Block Diagram
Figure 7. SS MUX Block Schematic DisplayPort Sink Board

Figure 8. Inter PCB Block Schematic DisplayPort Sink Board
Figure 9. SS MUX Block Schematic DisplayPort Source Board

Figure 10. Inter PCB Block Schematic DisplayPort Source Board
8 TPS65986EVM Board Layout

The following figures contain the PCB layouts of the TPS65986EVM.

Figure 11. DP-EXAPNSION-EVM Super Speed 1

Figure 12. DP-EXAPNSION-EVM Top Layer Component View

Figure 13. DP-EXAPNSION-EVM GND Plane 1

Figure 14. DP-EXAPNSION-EVM High Speed 1

Figure 15. DP-EXAPNSION-EVM GND Plane 2

Figure 16. DP-EXAPNSION-EVM Power 2
9 DP-EXPANSION-EVM Bill of Materials

Table 4 lists the bill of materials (BOM) for the DP-EXPANSION-EVM.

Table 4. BOM

<table>
<thead>
<tr>
<th>Designator</th>
<th>Quantity</th>
<th>Value</th>
<th>Description</th>
<th>PackageReference</th>
<th>PartNumber</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPCB1</td>
<td>1</td>
<td></td>
<td>Printed Circuit Board</td>
<td></td>
<td>ACS002A</td>
<td>Any</td>
</tr>
<tr>
<td>C1 BA, C1 BB, C2 BA, C2 BB, C3 BA, C3 BB, C4 BA, C4 BB, C5 BA, C5 BB, C6 BA, C6 BB, C7, C8, C9</td>
<td>15</td>
<td>0.1uF</td>
<td>CAP, CERM, 0.1 µF, 10 V, +/- 10%, X5R, 0201</td>
<td>0201</td>
<td>CL03A104KP3NNN C</td>
<td>Samsung Electro-Mechanics</td>
</tr>
<tr>
<td>D1 BA, D1 BB, D2</td>
<td>3</td>
<td>White</td>
<td>LED, White, SMD</td>
<td></td>
<td>0402, White</td>
<td>OSRAM</td>
</tr>
<tr>
<td>J1</td>
<td>1</td>
<td></td>
<td>Connector, Receptacle, USB 3.1 Type A, R/A, TH</td>
<td></td>
<td>GSB4111312HR</td>
<td>Amphenol Canada</td>
</tr>
</tbody>
</table>

Figure 17. DP-EXAPNSION-EVM Power 1

Figure 18. DP-EXAPNSION-EVM GND Plane 3

Figure 19. DP-EXAPNSION-EVM Super Speed 2

Figure 20. DP-EXAPNSION-EVM Bottom Layer Component View
### Table 4. BOM (continued)

<table>
<thead>
<tr>
<th>Designator</th>
<th>Quantity</th>
<th>Value</th>
<th>Description</th>
<th>Package/Reference</th>
<th>PartNumber</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>J2</td>
<td>1</td>
<td></td>
<td>Connector, Receptacle, USB 3.1 Type B, R/A, TH eg: 0603, used in PnP report</td>
<td>664-200260S60300</td>
<td>BizLink</td>
<td></td>
</tr>
<tr>
<td>J3</td>
<td>1</td>
<td></td>
<td>Connector, Receptacle, USB 3.1 Type B, R/A, TH</td>
<td>GSB4211311WEU</td>
<td>Amphenol Canada</td>
<td></td>
</tr>
<tr>
<td>J4_BA, J4_BB</td>
<td>2</td>
<td></td>
<td>Socket, 0.8mm, 20x2, Gold, SMT</td>
<td>LSEM-120-03.0-F-DV-A-N-K-TR</td>
<td>Samtec</td>
<td></td>
</tr>
<tr>
<td>J5</td>
<td>1</td>
<td></td>
<td>Socket, 0.8mm, 20x2, Gold, SMT</td>
<td>664-200260S60300</td>
<td>BizLink</td>
<td></td>
</tr>
<tr>
<td>Q1_BA, Q1_BB</td>
<td>2</td>
<td>50 V</td>
<td>Transistor, NPN, 50 V, 0.05 A, SOT-323</td>
<td>GSB4211311WEU</td>
<td>Amphenol Canada</td>
<td></td>
</tr>
<tr>
<td>R1_BA, R1_BB, R6</td>
<td>3</td>
<td>1.00k</td>
<td>RES, 1.00 k, 1%, 0.05 W, 0201</td>
<td>664-200260S60300</td>
<td>BizLink</td>
<td></td>
</tr>
<tr>
<td>TP1_BA, TP1_BB, TP2_BA, TP2_BB, TP3_BA, TP3_BB, TP4_BA, TP4_BB, TP5_BA, TP5_BB</td>
<td>10</td>
<td></td>
<td>Test Point, Miniature, SMT</td>
<td>664-200260S60300</td>
<td>BizLink</td>
<td></td>
</tr>
<tr>
<td>U1_BA, U1_BB</td>
<td>2</td>
<td></td>
<td>4 x 6 Channels USB Type-C™ Alternate Mode MUX, RHR0028A</td>
<td>RHR0028A</td>
<td>Texas Instruments</td>
<td></td>
</tr>
<tr>
<td>FID1, FID2, FID3, FID4, FID5, FID6</td>
<td>0</td>
<td></td>
<td>Fiducial mark. There is nothing to buy or mount.</td>
<td>Fiducial</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>R2_BA, R2_BB, R5_BA, R5_BB</td>
<td>0</td>
<td>1.0Mega</td>
<td>RES, 1.0 M, 5%, 0.05 W, 0201</td>
<td>ERJ-1GEJ105C</td>
<td>Panasonic</td>
<td></td>
</tr>
<tr>
<td>R3_BA, R3_BB, R4_BA, R4_BB</td>
<td>0</td>
<td>100K</td>
<td>RES, 100 k, 1%, 0.05 W, 0201</td>
<td>CRCW0201100KFK</td>
<td>Vishay-Dale</td>
<td></td>
</tr>
<tr>
<td>R7, R8, R11, R12, R13</td>
<td>0</td>
<td>100K</td>
<td>RES, 100 k, 0.5%, 0.063 W, 0402</td>
<td>CRCW0201100KDH</td>
<td>Vishay-Dale</td>
<td></td>
</tr>
<tr>
<td>R9</td>
<td>0</td>
<td>1.00Meg</td>
<td>RES, 1.00 M, 1%, 0.063 W, 0402</td>
<td>CRCW0201100KDF</td>
<td>Vishay-Dale</td>
<td></td>
</tr>
<tr>
<td>R10, R14</td>
<td>0</td>
<td>4.99Meg</td>
<td>RES, 4.99 M, 1%, 0.063 W, 0402</td>
<td>CRCW0201100KDF</td>
<td>Vishay-Dale</td>
<td></td>
</tr>
</tbody>
</table>
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

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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2. 実験局の免許を取得後ご使用いただく。
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西新宿三井ビル

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 DESIGN OF THE EVM ITSELF) ARE PROVIDED "AS IS" AND "WITH ALL FAULTS." TI DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, REGARDING SUCH ITEMS, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF ANY THIRD PARTY PATENTS, COPYRIGHTS, TRADE SECRETS OR OTHER INTELLECTUAL PROPERTY RIGHTS.

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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, EXPENSES, COSTS AND LIABILITIES (COLLECTIVELY, "CLAIMS") ARISING OUT OF OR IN CONNECTION WITH ANY 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:**

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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 these terms and conditions lies within courts located in the State of Texas and consents to venue in Dallas County, Texas. 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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