ESD122DMX/DMY Evaluation Module

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Introduction

The ESD122DMX/DMY user guide is used to describe the characteristics, operation, and use of the ESD122 2-Channel ESD Protection Diode evaluation module (EVM). The ESD122 is a bidirectional TVS ESD protection diode array for USB Type-C and HDMI 2.0 circuit protection. The ESD122 is rated to dissipate contact ESD strikes at the maximum level specified in the IEC 61000-4-2 international standard (12-kV Contact, 15-kV Air-gap). This device features a low IO capacitance per channel making it ideal for protecting high-speed interfaces up to 10 Gbps such as USB 3.1 Gen2 and HDMI 2.0. The low dynamic resistance and low clamping voltage ensure system level protection against transient events.

1.1 EVM Features

- IEC61000-4-2 Compliance Testing (SS Lines, SBU Lines, D± Lines, CC Lines)
- IEC61000-4-4 EFT Testing
- IEC61000-4-5 Surge Testing
- USB Type-C Passthrough Functionality

1.2 Description

Texas Instrument's ESD122DMX/DMY evaluation module helps designers evaluate the operation and performance of the ESD122 device. The ESD122 is a bidirectional TVS ESD protection diode array for USB Type-C and HDMI 2.0 circuit protection. This device is rated to dissipate contact ESD strikes at the maximum level specified in the IEC 61000-4-2 international standard (18-kV Contact, 18-kV Air-gap). This EVM also includes the TPD4E02B04 4-Channel ESD Protection Diode for the D± lines of the Type-C port, and the TPD1E05U06 single channel ESD protection diode for the CC lines of the Type-C connector. More information on these devices can be found on the TPD4E02B04 and TPD1E05U06 product pages.

2 EVM Test Setup and Results

The ESD122DMX/DMY-EVM is designed as a passthrough board to allow customers to test the EVM devices in their own system. Section 2.1 outlines the ESD testing setup for the EVM in addition to an example of expected results.

2.1 ESD Testing Setup

The ESD122DMX/DMY-EVM requires the use of external sources of ESD, that is: Type-C breakout boards. The board is designed in this manner to reduce the parasitics on the board that are associated with these extra components, thereby allowing the Type-C super-speed lines to have maximum bandwidth. The EVM is attached to 2-breakout boards, 1-male and 1-female connector types. This allows the user to test any line with ESD protection they wish while observing the resulting waveform on the other end. The EVM comes with a GND pin for easy probe grounding. Figure 1 shows the ESD122DMX/DMY-EVM circuit board.
2.2 **ESD Testing Results**

The ESD122 is rated for 18-kV contact with respect to the IEC61000-4-2 standard. Figure 2 shows the resultant waveform after initiating a 18-kV ESD strike on the SS lines of the EVM. As can be seen from the waveform, the voltage clamps at approximately 42.5 V at the 30-ns mark, and approximately 26 V after reaching 60 ns. The ESD122 device is capable of clamping the voltage to 8.3 V ($I_{pp} = 5$ A).

![Figure 2. ESD122DMX/DMY 18-kV Contact ESD Strike Waveform](image)

2.3 **EFT and Surge Testing**

The ESD122DMX/DMY-EVM can also be used to test EFT and Surge for the ESD122 devices. More information on IEC testing setups and recommendations can be found in *IEC 61000-4-x Tests for TI's Protection Devices* application report.
NOTE: Ensure that the device under test (DUT) is capable of handling the target ESD event. The ESD122 device is only located on the SS lines of the EVM; other lines may have more or less protection depending on the ESD protection device used on that particular line. For more information on the additional devices used in this EVM, consult the following device datasheets:

- TPD4E02B04 Device Datasheet
- TPD1E05U06 Device Datasheet
3 Board Layout

Figure 3. ESD122DMX/DMY-EVM Top Layer

Figure 4. ESD122DMX/DMY-EVM GND1 Layer

Figure 5. ESD122DMX/DMY-EVM Signal Layer 1

Figure 6. ESD122DMX/DMY-EVM GND2 Layer
Figure 11. ESD122DMX/DMY Schematic

5 Bill of Materials

Table 1. Bill of Materials

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# Revision History

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

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<th>Changes from Original (May 2017) to A Revision</th>
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<td>• Added DMX package to the User's Guide</td>
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Changes from Original (May 2017) to A Revision

• Added DMX package to the User's Guide

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**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.
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- 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.

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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.

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http://www.tij.co.jp/lds/ti_ja/general/eStore/notice_01.page

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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):

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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
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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.

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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.

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