This user's guide describes the characteristics, operation, and use of the TVSxx0x Precision Surge Protection Diode Adaptor Board Evaluation Module (EVM). The TVSxx0x family of devices are precision clamps that keep ultra-low and flat clamping voltages during transient overvoltage events like surge for both bidirectional and unidirectional signals. These adaptor boards place the small DRV package size of the TVSxx00 device and the small DRB package size of the TVSxx01 device into a larger footprint that is designed to fit into industry standard SMA and SMB package types and allow users to test performance in their own systems. This user's guide includes setup instructions, schematic diagrams, a bill of materials, and printed-circuit board layout drawings for the EVM.

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Trademarks

All trademarks are the property of their respective owners.
1 Introduction

Texas Instruments' TVSxx0x evaluation module helps designers evaluate the operation and performance of the TVSxx0x family of devices. The TVSxx0x family is a precision clamp that keeps ultra-low and flat clamping voltage during transient overvoltage events like surge. With TI's precision surge technology, the TVSxx0x's clamping voltage barely changes up to its maximum surge current. The TVSxx0x also responds fast to the surge to limit overshoot voltage during clamping. Used in the system, its superior voltage suppression performance ensures a safe environment for downstream protected circuits.

2 Board Setup

The Flat Clamp Adaptor Board EVM is designed to allow the user to evaluate the protection performance of the TVSxx0x in their own system without having to make any changes to their existing schematic or layout. The EVM serves as an adaptor board to allow the small size of the QFN chip to be placed pin for pin in the industry standard SMA and SMB surge protector footprints. Users can easily replace their existing surge solution chip with the TVS3300 EVM to evaluate the component.

This EVM kit contains 36 adapter boards with 6 boards for each of the TVSxx0x voltage levels. 3 adapter boards per voltage level are in unidirectional configuration and 3 adapter boards per voltage level are in bidirectional configuration. Based on their system, the user must use the unidirectional configuration if the signal on the protected line stays above 0 V. Otherwise, it is recommended to use the bidirectional configuration, which can protect the system if the signal contains both positive and negative voltages.

The unidirectional adapter boards are all 105mil x 200mil (2.6mm x 5mm) and the bidirectional adapter boards are 145mil by 200mil (3.7mm x 5mm). The solderable pad underneath each adapter board is 85mil x 55mil for the unidirectional and 145mil x 50mil for the bidirectional. This can be seen in the figures below.

![Figure 1. Unidirectional Adapter Board](image1)

![Figure 2. Bidirectional Adapter Board](image2)
To install the EVM, remove the existing surge protection solution, cut out the adapter board needed for your applications and place the adaptor board in the existing footprint. If there is no existing surge protection solution in the system, the EVM can still be tested by soldering the bottom plates of the adaptor board over the protected line and a ground plane. In the unidirectional configuration, pin 1 of the adapter board must be installed pointing towards ground, pin 1 can be seen by the silkscreen bar on one side of the unidirectional adaptor boards. In the bidirectional configuration either pin can be connected to ground or input signal. Each adapter board has solder pads on the bottom extending to the edge allowing the board to be soldered down.

2.1 Surge Testing

The adaptor provides an easy way to test the TVSxx0x surge protection as defined in IEC 61000-4-5. Evaluate the TVSxx0x surge protection by exposing the protected line to a surge event. The event must be created by a combinational waveform generator (CWG) in series with a 40-Ω coupling resistor as shown in Figure 3. Test at different surge current levels and observe that the voltage on the line is clamped to a safe level for the protected system. After the surge event, post-test the system to ensure that no damage or shift in leakage currents occurred.

Figure 3. Surge Test Setup Unidirectional Configuration

The waveform in Figure 4 shows the response of the TVSxx0x Unidirectional adaptor board to a 30-A surge waveform created by a similar setup as in Figure 3. Despite the 35 A of current over a IEC 61000-4-5 surge waveform, the TVS3300 holds the voltage on the line to a maximum of 37 V, robustly protecting the downstream components.

Figure 4. TVS3300 35-A Surge Clamping Waveforms

This is just one of the 6 different voltage level devices on the adapter board with all of them having superior clamping for their node.
2.2 ESD Testing

The TVS\textsubscript{xx0x} devices also provide ESD protection above ±8-kV contact and ±15-kV air gap according to the IEC 61000-4-2 standard. After installing the adaptor board into the system, evaluate the ESD protection provided by the TVS\textsubscript{xx0x} by using an ESD simulator to create an ESD event on your protected line. For specific information on ESD testing procedures, see the application report, *IEC 61000-4-x Tests for TI's Protection Devices*.

Figure 5 shows all the adapter boards that come in one evaluation module.

![Figure 5. FLAT-CLAMP-TVS-EVM Board](image-url)
3 Schematic

Figure 6 through Figure 12 display the EVM schematics with each voltage node.

Figure 6. TVS0500 Schematic

Figure 7. TVS0701 Schematic
Figure 8. TVS140X Schematic  
Figure 9. TVS180X Schematic
Figure 10. TVS220X Schematic

Figure 11. TVS270X Schematic
Figure 12. TVS330X Schematic
4 Layout

Figure 13 and Figure 14 illustrate the PCB layout images.

Figure 13. Evaluation Module Top Layer

Figure 14. Evaluation Module Bottom Layer
### Table 1. Evaluation Module Bill of Materials

<table>
<thead>
<tr>
<th>Designator</th>
<th>Qty</th>
<th>Value</th>
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<td>DRV</td>
<td>TVS0500DRV</td>
<td>Texas Instruments</td>
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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.

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