TVS3300YZF 33-V Precision Surge Protection Clamp Evaluation Module

This user guide describes the characteristics, operation, and use of the TVS3300YZF Precision Surge Protection Diode Evaluation Module (EVM). The TVS3300YZF is a precision clamp that keeps ultra-low and flat clamping voltage during transient over-voltage events like surge. This user guide includes setup instructions, schematic diagrams, a bill of materials, and printed-circuit board layout drawings for the EVM.

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1 Introduction

Texas Instrument's TVS3300YZF evaluation module helps designers evaluate the operation and performance of the TVS3300YZF device. The TVS3300YZF is a precision clamp that keeps ultra-low and flat clamping voltage during transient over-voltage events like surge. With TI's precision surge technology, the TVS3300YZF's clamping voltage barely changes no matter how high the surge current. The TVS3300YZF 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

This TVS3300YZF EVM board includes two sets of screw terminal headers for general purpose inline testing of various connector configurations. There are also two banana plug input ports for easy testing along with 4-50 Ω SMA connectors for convenient connection to an oscilloscope for testing. Figure 1 shows the basic setup of the EVM along with important connector locations.

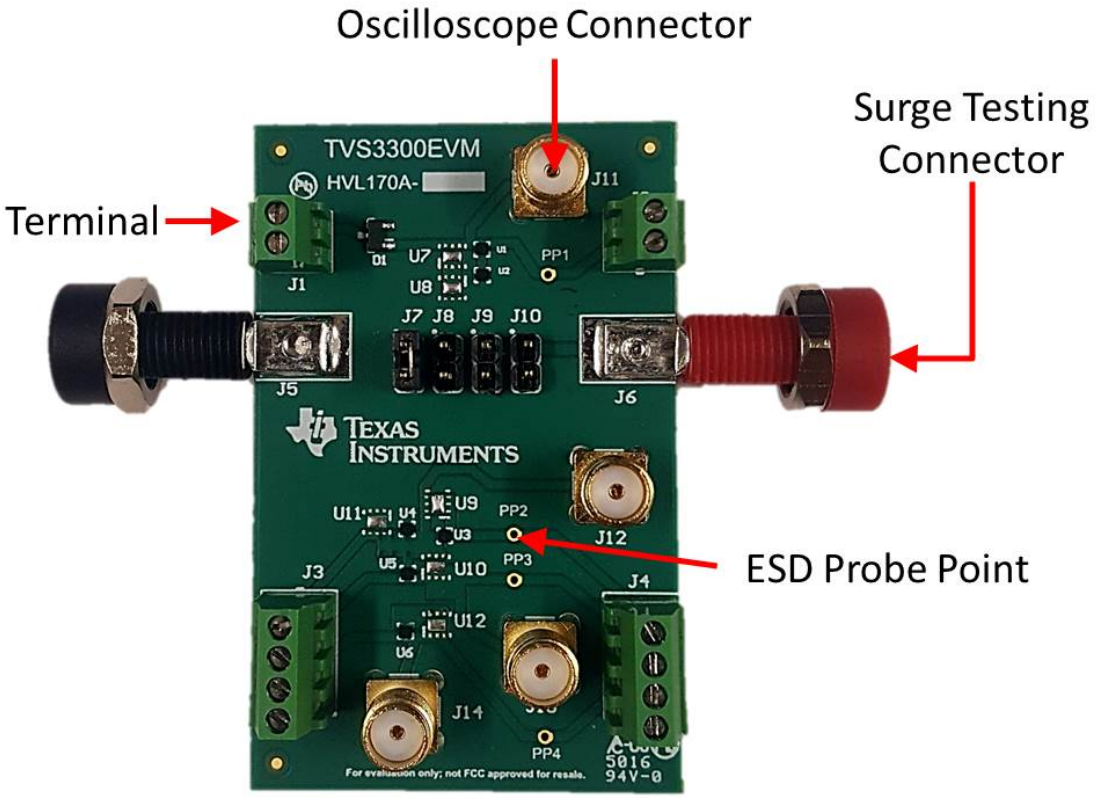

Figure 1. TVS3300YZF EVM Circuit Board Setup

3 Testing

Section 3.1 and Section 3.2 outline the testing procedures for the TVS3300YZF EVM circuit board along with their respective results. Care must be taken when testing any EVM in order to avoid potential damage to the board.

3.1 Surge Testing

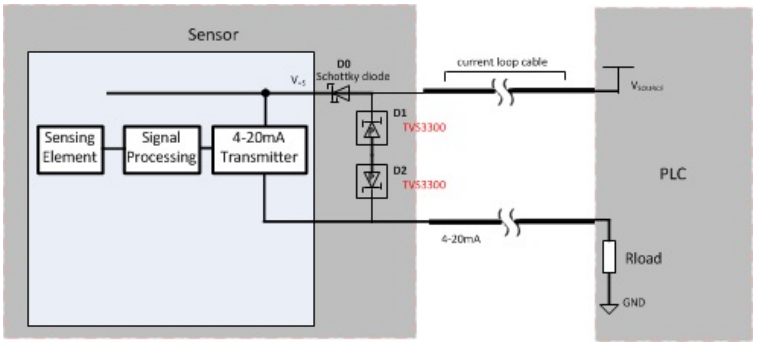

Figure 2. 2-Wire Protection Model

For the surge testing, there are two distinct setups. In Figure 2, two TVS3300YZF's D1 (U1) and D2 (U2) protect the 4-20mA sensor transmitter in a back-to-back configuration by limiting the voltage difference between the two wires connected to the transmitter. In mis-wiring and negative surge situations, Schottky diode D0 (D1 in Figure 3) keeps the current from flowing reversely from the transmitter.

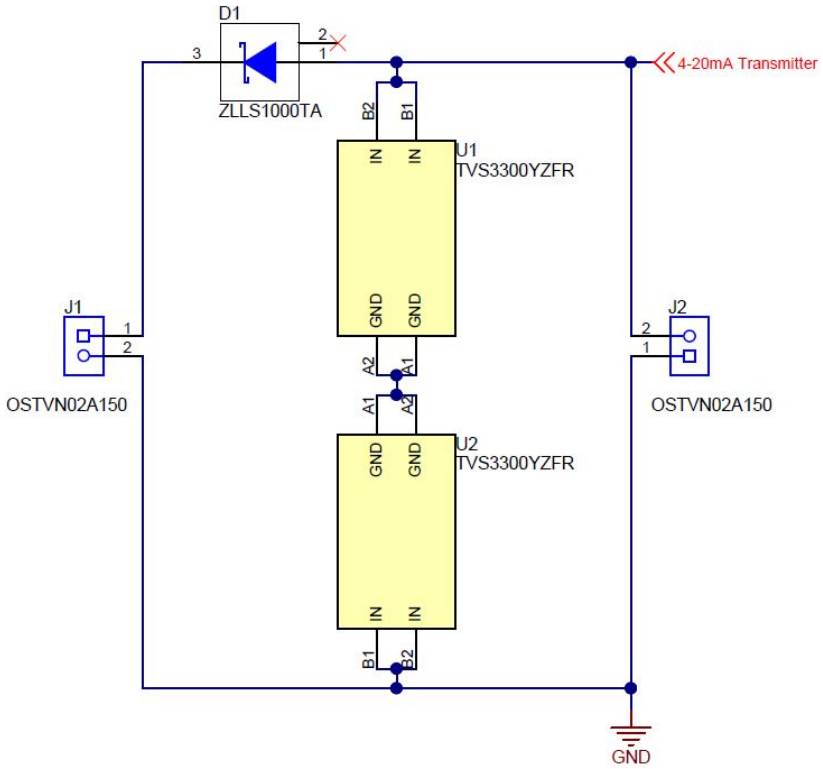

Figure 3. 2-Wire Protection Test Circuit

The next surge test is modeled from Figure 4 with the addition of a second I/O line. The EVM jumpers J7-J10 can be used to select which line is to be tested. Table 1 shows the corresponding SMA connector for each jumper position.

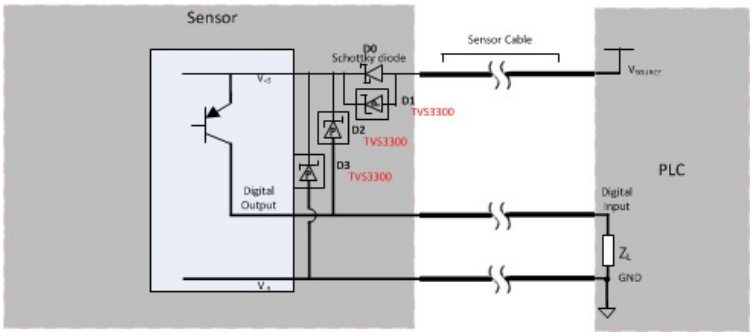

Figure 4. 3-Wire Digital I/O Protection Test Circuit

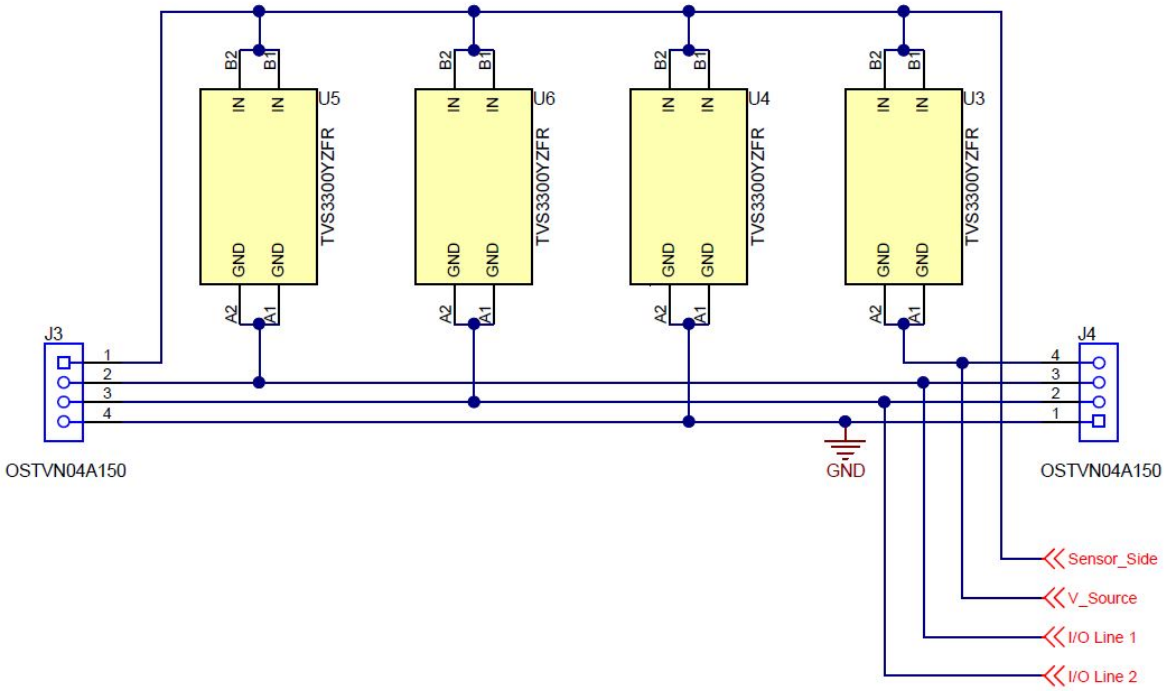

Figure 5. TVS3300YZF 4-Wire Interface Schematic

From Figure 5, four TVS3300YZF's protect the switch output sensor transmitter from surge and mis-wiring conditions. U3 blocks the reverse current when the system is mis-wired and takes most of the current during positive and negative surge. U5 and U6 protects the sensor transmitter by clamping the voltage between power supply and the digital output during surge. U4 protects the sensor transmitter by clamping the voltage between power supply and the ground return during surge. Figure 6 shows a 35-A surge test done on the TVS3300YZF EVM. As can be seen from the waveform, the TVS3300 effectively handles this surge and returns to normal conditions in less than 40 µs.

Figure 6. TVS3300YZF Surge Test Waveform

3.2 ESD Testing

The TVS3300YZF also provides ESD protection up to ±8-kV contact and ±15-kV air gap according to IEC 6100-4-2. After connecting to the appropriate test equipment, evaluate the ESD protection provided by the TVS3300YZF by using an ESD simulator on one of the probe points (PP#) to create an ESD event . For specific information on ESD testing procedures, see the application report, *IEC 61000-4-x Tests for TI's Protection Devices*.

Table 1 shows the correlating jumper position for the EVM based on the target probe point to be tested. Further test connection details can be seen in Figure 7.

Table 1. ESD Test Probe Point Required Jumper Connections

ESD Probe Point	Required Jumper Position	Output Waveform SMA Connector
PP1	J7	J11
PP2	J8	J12
PP3	J9	J13
PP4	J10	J14

4 Schematic

Figure 7 shows the circuit schematic for the TVS3300YZF EVM.

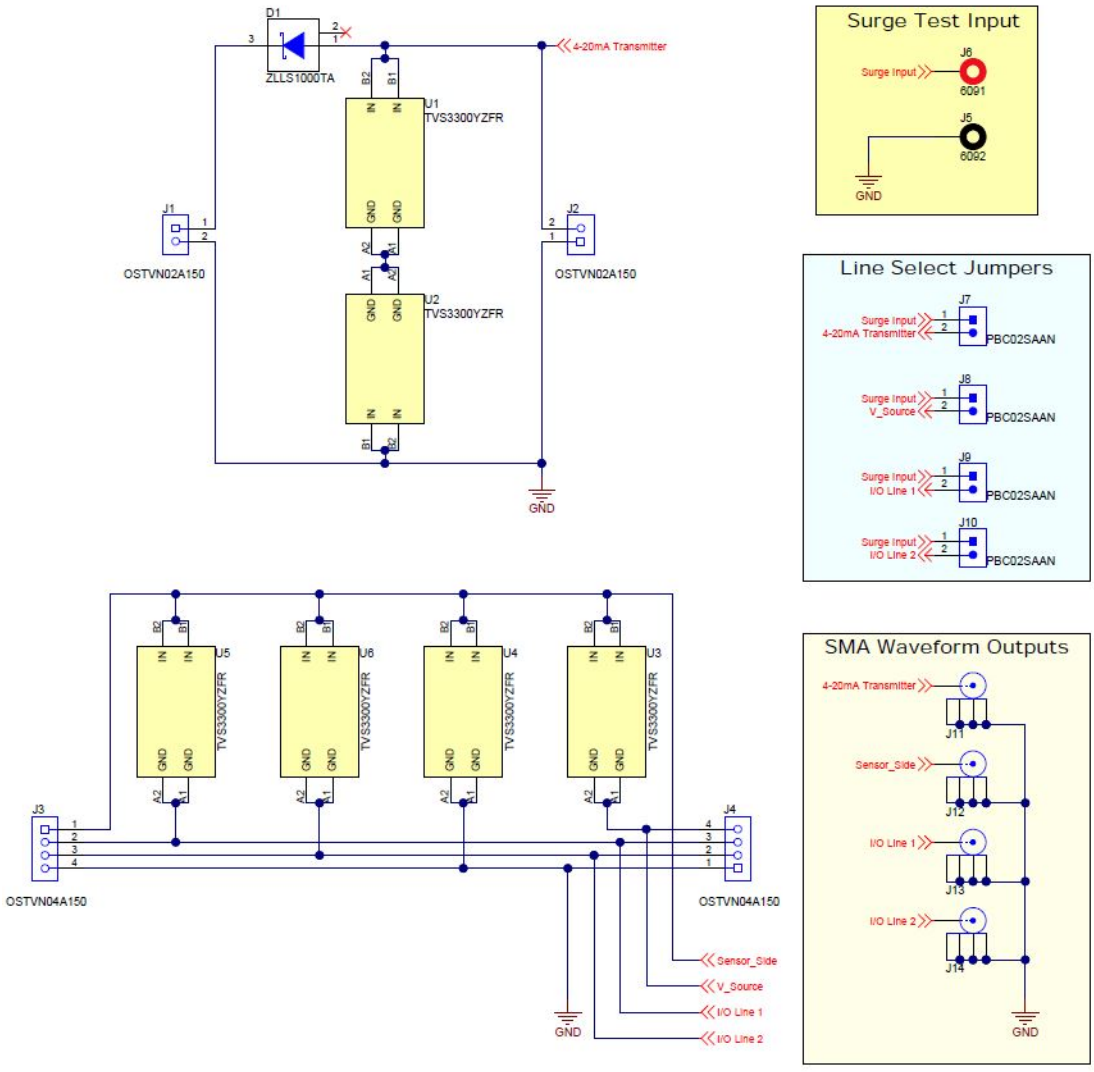

Figure 7. TVS3300YZF EVM Board Schematic

5 Board Layout

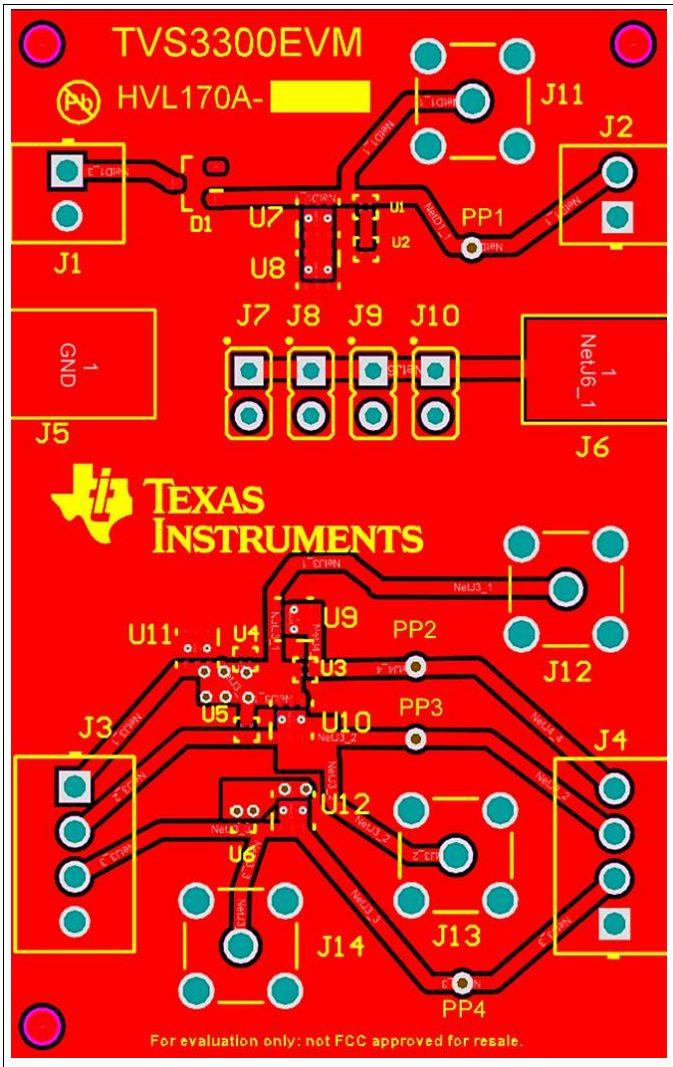

Figure 8. TVS3300YZF EVM Top Layer

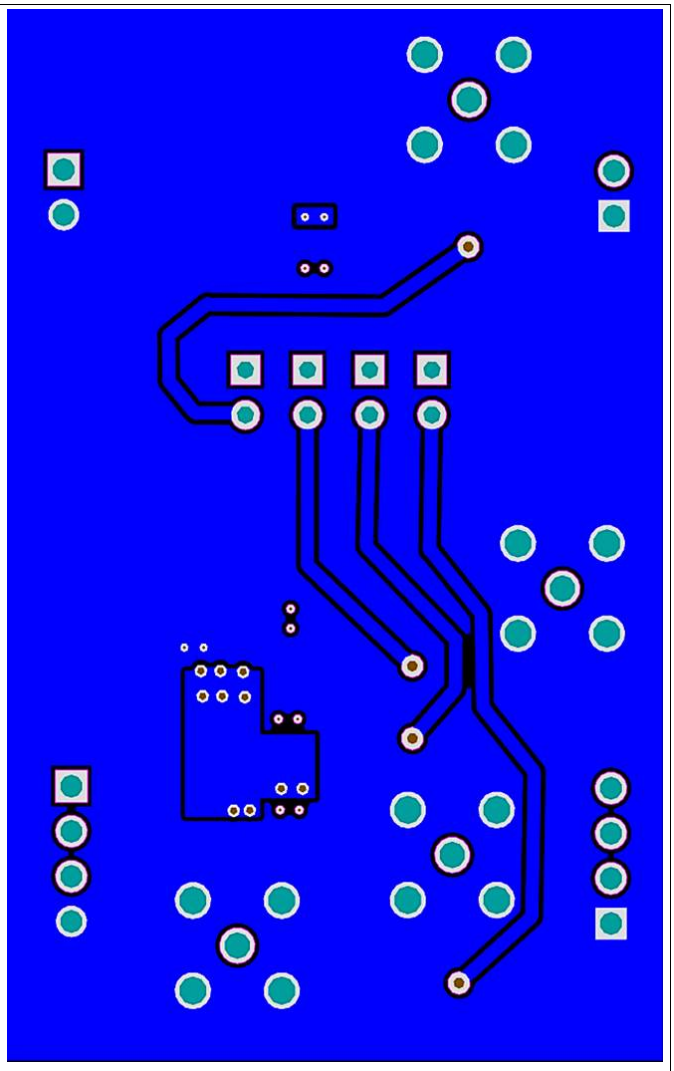

Figure 9. TVS3300YZF EVM Bottom Layer

6 Bill of Materials

Table 2. Bill of Materials

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer
D1	1	—	Diode, Schottky, 40 V, 1.16 A, AEC-Q101, SOT-23	SOT-23	ZLLS1000TA	Zetex
J1, J2	2	—	Terminal Block, 2.54 mm, 2×1, Brass, TH	On-Shore_OSTVN02A150	OSTVN02A150	On Shore Technology
J3, J4	2	—	Terminal Block, 2.54 mm, 4×1, Brass, TH	On-Shore_OSTVN04A150	OSTVN04A150	On Shore Technology
J5	1	—	Standard Banana Jack, Insulated, Black	6092	6092	Keystone
J6	1	—	Standard Banana Jack, Insulated, Red	6091	6091	Keystone
J7, J8, J9, J10	4	—	Header, 100 mil, 2×1, Gold, TH	Sullins_PBC02SAAN	PBC02SAAN	Sullins
J11, J12, J13, J14	4	—	SMA Straight PCB Socket Die Cast, 50 Ω, TH	TE_5-1814832-1	5-1814832-1	TE Connectivity
SH-J5	1	—	Shunt, 2.54 mm, Gold, Black	Wurth_60900213421	60900213421	Wurth Electronics
U1, U2, U3, U4, U5, U6	6	—	33-V Precision Surge Protection Clamp, YZF0004-C01 (DSBGA-4)	YZF0004-C01	TVS3300YZFYZFR	Texas Instruments

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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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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/lsds/ti_ja/general/eStore/notice_01.page

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