

These Are Not Your Grandfather's TVS Diodes



Kim Devlin-Allen

Conventional transient voltage suppression (TVS) diodes have been essential building blocks in system designs for decades. They protect against transient surge events, and many designers rely on TVS diodes to provide an adequate level of surge immunity to protect sensitive electronics at the heart of their systems.

Many end applications, from industrial sensors and programmable logic controller (PLC) input/output (I/O) modules to appliances and medical equipment, must comply with international standards for surge immunity such as International Electrotechnical Commission (IEC) 61000-4-5.

Although conventional TVS diodes have been the safe option to ensure robust and reliable surge immunity, they are far from perfect. In fact, most designs exposed to harsh environments that require surge immunity are likely to be over-designed due to inefficient clamping and the inherent performance variability of conventional TVS protection diodes across temperature. You must settle for solutions with larger package sizes, excessive line capacitance and higher static leakage current. And you must carefully select downstream components to ensure the residual voltage and current from a surge event doesn't damage downstream components and lead to system failure.

Because TVS diode technology hasn't changed in decades, many designers simply reuse their TVS protection schemes from generation to generation. But, it's time to pull out your schematics and look for a better surge protection alternative. TI's flat clamps are changing the game, providing improved surge protection with more flexibility so that you can optimize for cost, size and performance.

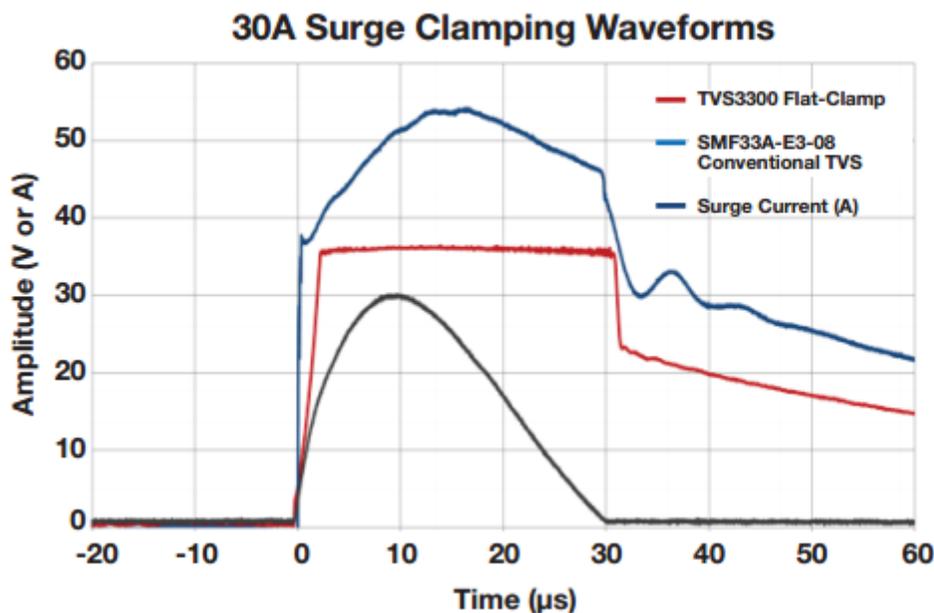


Figure 1. Clamping Comparison between Flat-clamp Technology and Traditional TVS Diodes

Would a robust surge protection solution – with as much as a 90% smaller package footprint (as shown in [Figure 2](#)), 50% lower static leakage current and significantly lower capacitance – get you to evaluate your TVS

protection scheme? What if the clamping voltage was more precise, clamping at a consistent, flat voltage across the duration of the surge event and saving you the cost of high-voltage-tolerant downstream components?

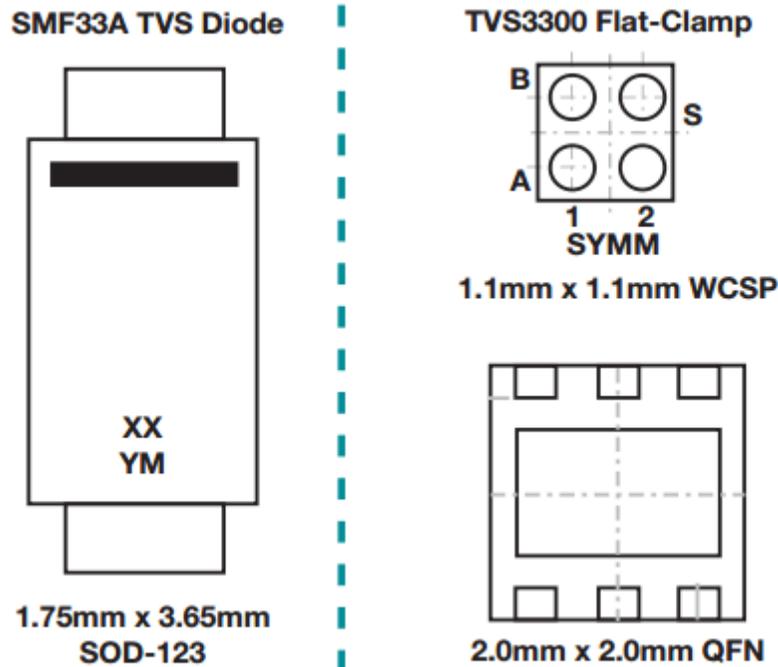


Figure 2. Flat-clamp Packages Can Have a 90% Area Reduction on the Printed Circuit Board

It's easy to ignore TVS diodes when redesigning your system and reuse a conventional TVS in your next-generation design. However, robust surge protection can't be ignored, and it's time to reconsider that portion of the schematic. There is a better alternative with improved clamping performance that also saves board space and downstream system costs.

Additional Resources

- Read TI's whitepaper describing the [new flat-clamp surge-protection technology](#).
- Start designing now with the [TVS3300 evaluation module](#).

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATA SHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to [TI's Terms of Sale](#) or other applicable terms available either on [ti.com](https://www.ti.com) or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products.

TI objects to and rejects any additional or different terms you may have proposed.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2023, Texas Instruments Incorporated