PROTECTION PRODUCTS

Application Note

SI96-01
Surging Ideas
TVS Diode Application Note

Error! Reference source not found.

What Are TVS Diodes?

TVS diodes are solid state pn junction devices specifically designed to protect sensitive semiconductors from the damaging effects of transient voltages. TVS diode schematic symbols are shown in Figure 1. The electrical characteristics of the device are determined by factors such as junction area, doping concentration and substrate resistivity. The surge power and surge current capability of the TVS diode are proportional to the junction area. TVS diodes are constructed with large cross sectional area junctions for absorbing high transient currents. While the VI characteristic curve of the TVS diode is similar to that of a zener diode, TVS diodes are specifically designed, characterized and tested for transient voltage suppression. By contrast, zener diodes are designed and specified for voltage regulation.

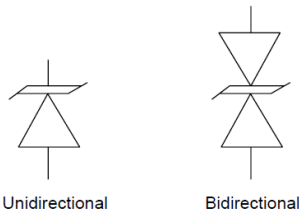

Figure 1 - TVS Diode Schematic Symbols

TVS diodes serve as parallel protection elements (Figure 2). Under normal operating conditions, the TVS diode presents a high impedance to the protected circuit. Ideally, the device appears as an open circuit, although a small amount of leakage current is present.

When the normal operating voltage of the protected circuit is exceeded, the TVS diode junction avalanches providing a low impedance path for the transient current. As a result, the transient current is diverted away from the protected components and shunted through the TVS diode. The voltage across the protected circuit is limited to the clamping voltage of the TVS diode. The device returns to a high impedance state after the transient threat passes. TVS diodes will not wear out nor will there be any degradation of the electrical parameters as long as the device is operated within specified limits.

A primary attribute of the TVS diode is its reaction time. Avalanche breakdown theoretically occurs in picoseconds. This is very difficult to measure however. Therefore, TVS diodes are often specified as responding “almost instantaneously”. The fast response time of the TVS diode means that any voltage overshoot is primarily due to lead inductance and PC board traces.

TVS diodes are available in a wide range of operating voltages. Traditional device voltages range from 5V to 440V for discrete devices. Recent innovations in TVS technology have yielded devices, such as Semtech’s SLV series, which operate at 2.8 and 3.3V.

The TVS diodes fast response time and low clamping voltages make them ideal for use as board level protectors for semiconductors and other sensitive components. Applications include data and signal lines, microprocessors & MOS memory, AC power lines and telecommunication equipment.

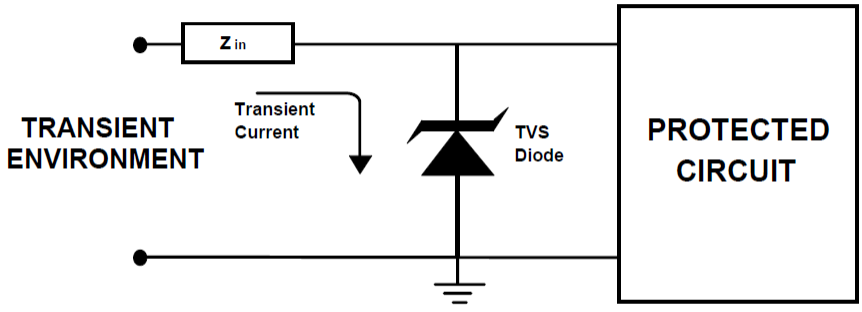

Figure 2 - TVS Diode Operation

Important Notice

Information relating to this product and the application or design described herein is believed to be reliable, however such information is provided as a guide only and Semtech assumes no liability for any errors in this document, or for the application or design described herein. Semtech reserves the right to make changes to the product or this document at any time without notice. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. Semtech warrants performance of its products to the specifications applicable at the time of sale, and all sales are made in accordance with Semtech's standard terms and conditions of sale.

SEMTECH PRODUCTS ARE NOT DESIGNED, INTENDED, AUTHORIZED OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT APPLICATIONS, DEVICES OR SYSTEMS, OR IN NUCLEAR APPLICATIONS IN WHICH THE FAILURE COULD BE REASONABLY EXPECTED TO RESULT IN PERSONAL INJURY, LOSS OF LIFE OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE. INCLUSION OF SEMTECH PRODUCTS IN SUCH APPLICATIONS IS UNDERSTOOD TO BE UNDERTAKEN SOLELY AT THE CUSTOMER'S OWN RISK. Should a customer purchase or use Semtech products for any such unauthorized application, the customer shall indemnify and hold Semtech and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs damages and attorney fees which could arise.

Contact Information

Semtech Corporation
200 Flynn Road, Camarillo, CA 93012
Phone: (805) 498-2111, Fax: (805) 498-3804
www.semtech.com