

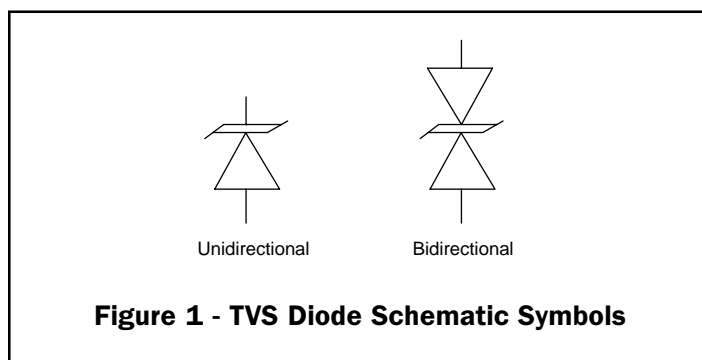
PROTECTION PRODUCTS
What Are TVS Diodes?

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.

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.

