Understanding TVS Clamping

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Transient Voltage Suppressors (TVS) limit voltage spikes to an acceptable level through clamping. A clamp device begins conducting when its threshold voltage is exceeded, then restores to a non-conducting mode when the voltage drops below the threshold level. As a result, voltage spikes are “clamped” off to safe levels.

The PSD05C has the following electrical characteristics:

- Rated Stand-Off Voltage ($V_{WM}$): 5.0 Volts
- Minimum Breakdown Voltage ($V_{BR}$): 6.0 Volts
- Clamping Voltage ($V_C$) @ 1A : 9.8 Volts
- Maximum Clamping Voltage (8/20µs) @ 28A: 14.5 Volts
- Maximum Leakage Current ($I_{L}$) @VWM: 10µA

The rated stand-off voltage (Figure 1: $V_{WM}$@IRM) for the PSD05C is 5.0 Volts. Looking at the breakdown region of a TVS, as shown in Figure 1, as the diode starts conducting (clamping) at the minimum breakdown voltage (6V: $V_{BR}@IR$) in a negative direction, there will be an increase in current in the positive direction of the 8/20µs pulse.

When the transient current drawn by the PSD05C is at 1 Amp, the device clamping will be at 9.8 Volts. As the surge current is increased, the diode will continue to conduct (clamp) until it reaches its maximum clamping capability. For a PSD05C, the maximum clamping is 14.5 Volts at 28.0 Amps (for an 8/20µs waveshape), as shown in Figure 2.

The PSD05C is a bidirectional device, so when a negative 8/20µs pulse is applied to the input, the diode will undergo the same clamping characteristics just in the opposite direction. However, the PSD05, the unidirectional equivalent to the PSD05C, will only clamp in one direction as shown in Figure 3.
COMPANY INFORMATION

COMPANY PROFILE

ProTek Devices, based in Tempe, Arizona USA, is a manufacturer of Transient Voltage Suppression (TVS) products designed specifically for the protection of electronic systems from the effects of lightning, Electrostatic Discharge (ESD), Nuclear Electromagnetic Pulse (NEMP), inductive switching and EMI/RFI. With over 25 years of engineering and manufacturing experience, ProTek designs TVS devices that provide application specific protection solutions for all electronic equipment/systems.

ProTek Devices Analog Products Division, also manufactures analog interface, control, RF and power management products.

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