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TVS Peak Pulse Power, Pulse Duration & Temperature
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The peak pulse power rating (P_{pp}) of a TVS diode is defined as the instantaneous power dissipated for a given pulse duration. The rating is calculated by the following:

P_{pp}(given in Watts) = V_C x I_{pp}
V_C = Clamping Voltage
I_{pp} = Peak Pulse Current

Peak pulse power ratings are normally given for an 8/20µs or 10/1000µs double exponential waveform. For example, Figure 1 shows a 400 Watt 8/20µs rated curve. As the surge pulse width decreases the peak pulse power increases logarithmically. For shorter pulse widths, the TVS can handle higher peak pulse currents.
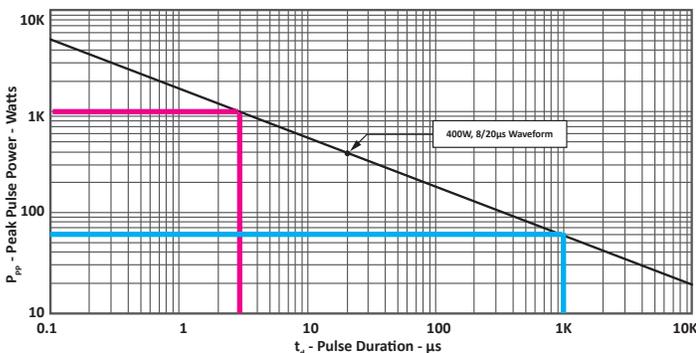
Figure 1. Peak Pulse Power vs Pulse Time

A 3µs surge will have a peak pulse power of approximately 1kW. When the surge pulse is increased, as in the 10/1000µs curve, the peak pulse power will decrease to 60 Watts.

A pulse duration (t_d) is defined as the front time plus fall time. Front time is characterized by the length of time needed for the peak pulse current (I_{pp}) to reach its peak value, as shown in Figure 2. The fall time is characterized as the length of time needed for the pulse to reach 50% of its peak value.
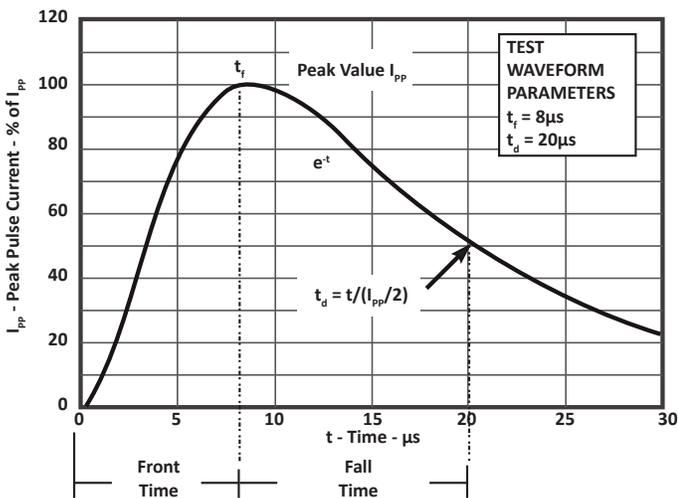
The maximum peak pulse current rating (I_{pp}) of a TVS device parallels the peak pulse power curve. The maximum peak pulse power (P_{pp}) is equal to the maximum clamping voltage (V_C) multiplied by the maximum peak pulse current (I_{pp}), where the maximum clamping voltage is considered a constant independent of time. Typically, the maximum clamping voltage is called a failure threshold voltage for a given silicon P/N junction diode. Considering this voltage a constant over time, then the power curve represents the current rating over time.

During surge conditions, the TVS dissipates the transient power and is limited by junction temperature. The peak pulse power decreases linearly from 25°C to T_{MAX}. For example in Figure 3, a 400 Watt TVS operating at 100°C is capable of dissipating 40% of the rated peak pulse current.
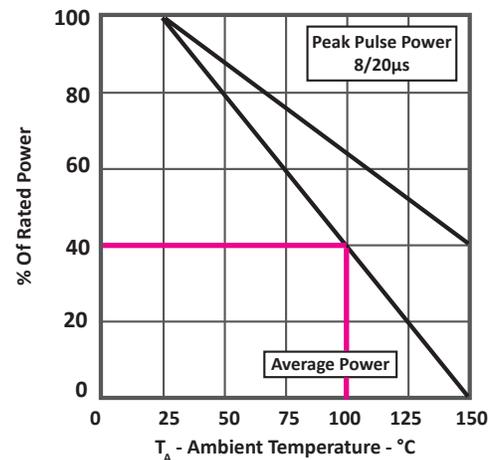
Figure 3. Power Derating Curve

To determine the capability of a device with a square wave, derate the device to 66% of the peak exponential value. For a half sine wave, derate to 75% of the peak exponential value.

Figure 2. 8/20µs Pulse Waveshape

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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