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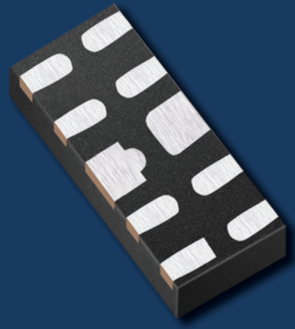
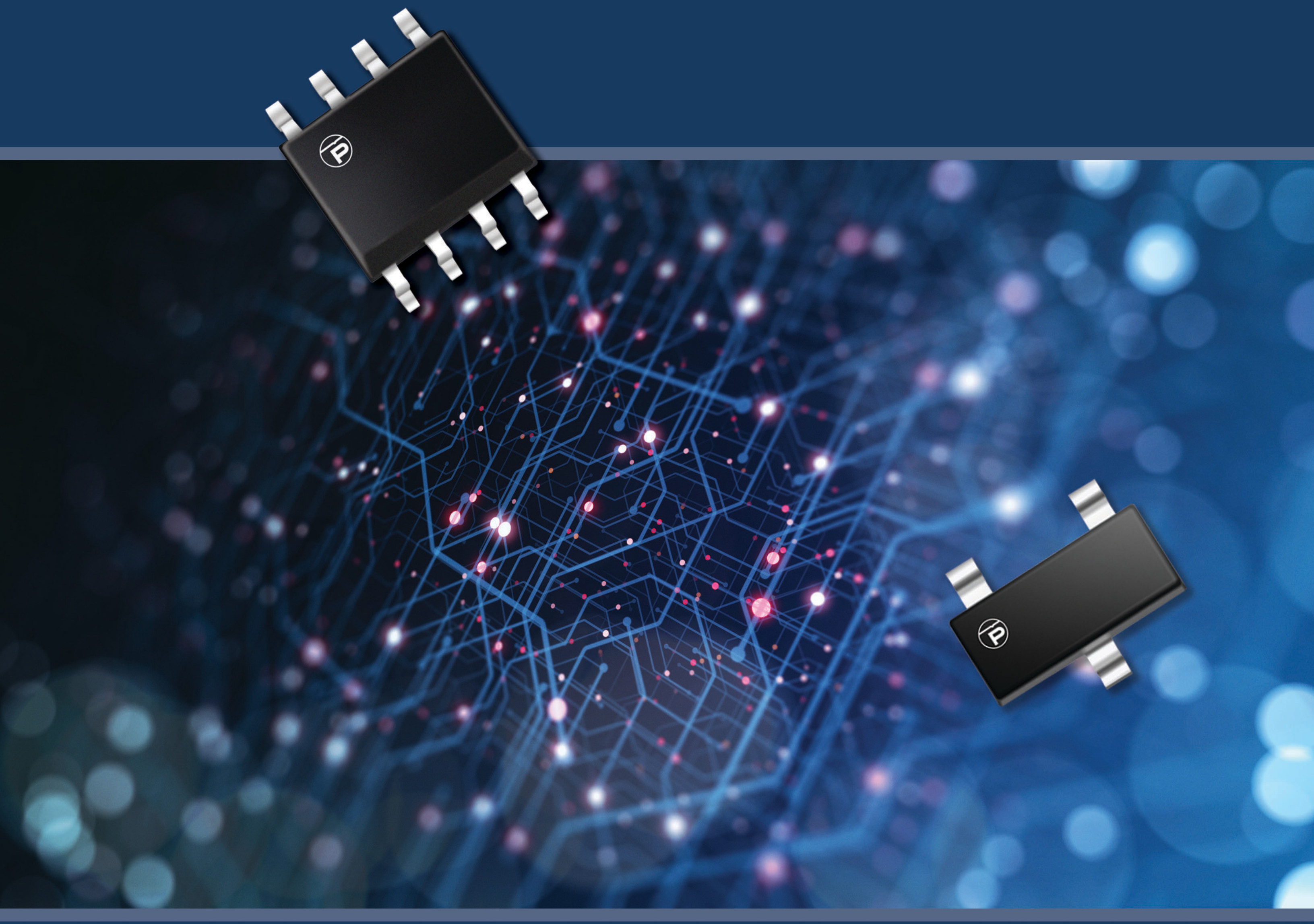


TVS Peak Pulse Power, Pulse Duration & Temperature

By Ivan G. Lawson



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) = $V_C \times I_{PP}$
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.

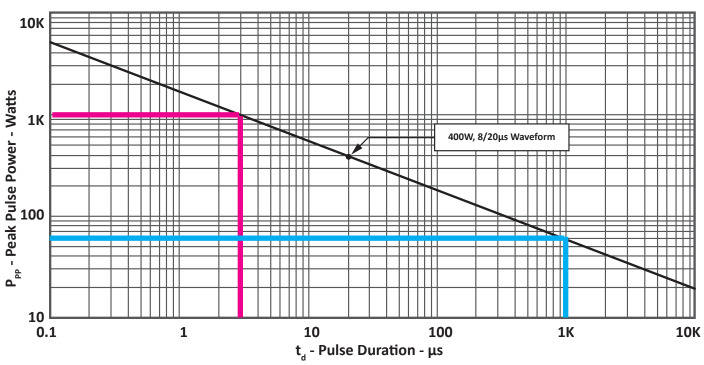


Figure 1. Peak Pulse Power vs Pulse Time

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.

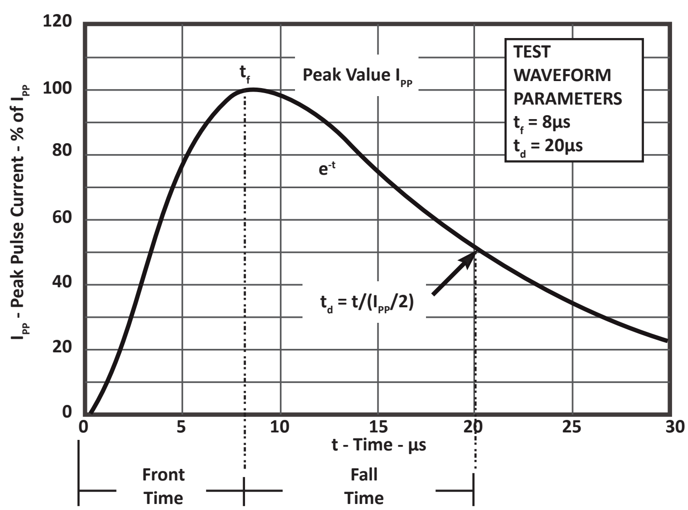


Figure 2. 8/20µs Pulse Waveshape

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.

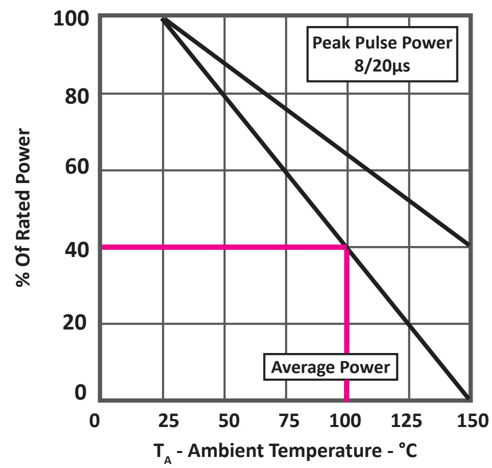


Figure 3. Power Derating Curve

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.

COMPANY PROFILE

In business more than 30 years, ProTek Devices™ is a privately held semiconductor company. The company offers a product line of overvoltage protection components. These include Transient Voltage Suppressor arrays (TVS arrays), Steering Diode/Hybrid arrays, Thyristor Surge Suppressors, EMI Filters, High-Powered Components and Modules as well as Chipscale TVS arrays. These devices deliver circuit protection in electronic systems from numerous overvoltage events. They include lightning; electrostatic discharge (ESD); nuclear electromagnetic pulses (NEMP); inductive switching; and electromagnetic interference (EMI) / radio frequency interference (RFI). ProTek Devices is an ISO 9001 certified company.

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