TVS Peak Pulse Power vs. Pulse Duration

The peak pulse power (P_{pp}) rating of a TVS diode is defined as the instantaneous power dissipated by a device for a given pulse condition. The peak pulse power rating is calculated using the following relationship :

$$P_{pp} = V_c \times I_{pp}$$

Where
P_{pp} = Peak pulse power (W)
V_c = Clamping Voltage (V)
I_{pp} = Peak pulse current (A)

Common peak pulse power ratings are normally given for 8/20µs and 10/1000µs double exponential impulse waveforms (see SI96-09 for definition). Many applications specify different surge pulse widths which can range from a few nanoseconds to several milliseconds. To determine the power handling capability of a TVS device for different pulse widths, a peak pulse power vs. pulse width curve is included on device data sheets. An example of a curve for a device rated at 1500W (10/1000µs) is shown in Figure 1. As the surge pulse width decreases, the peak pulse power capability of the device increases logarithmically. Additionally, for shorter pulse widths, the TVS can withstand higher peak pulse currents. For example, for a 1.2/50µs impulse waveform (per IEC 61000-4-5), the peak power handling capability is 6kW, 4x the rating at 1000µs. The peak current handling capability is also increased by approximately a factor of four. Conversely, as the surge pulse width is increases, the peak power and current handling capability of the device decreases.

The curve below is for a non-repetitive double exponential waveform. To determine the capability of the device for a square wave pulse, derate to 66% of the peak exponential value. For a half sine wave pulse, derate to 75%.

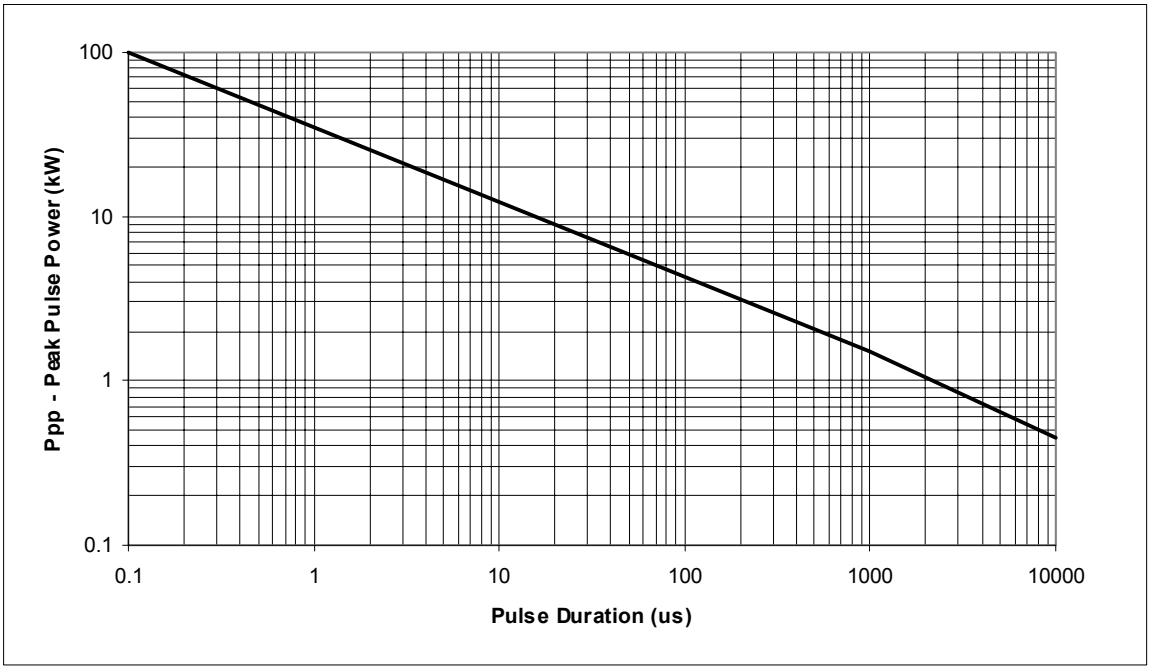

Figure 1 - Peak Pulse Power vs. Pulse Duration for a 1500W TVS Diode