Using the Power vs. Time Curve

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How can the maximum transient power and current capability for silicon Transient Voltage Suppressors (TVS) be derived for conditions other than the 10/1000 µs pulse specified on data sheets?

Most Transient Voltage Suppressors are rated for 10/1000 ms non-repetitive pulse waveforms (10 ms being the front time and 1000 µs being the time from start to decay to one-half of the peak value), which is an early telecom transient waveform. Real world transients will have varying pulse widths depending on the source. Various standards describe other waveforms to reflect these origins. For example, IEC 801 - 5 describes a lightning threat to data lines approximating 1.2/50 ms.

The graph in Figure 1. relates peak pulse power with time for 600 W suppressors; similar curves exist for TVS's rated at other power levels. At 1000 ms the maximum pulse power (P_P) is 600 W, the rating condition of the device. The graph illustrates that at 50 µs, the rating is 2100 W and at 10 000 µs (10 ms), P_P rating is down to approximately 200 W. This applies to all devices in the 600 W series regardless of their operating voltage.

Under shorter pulse widths a TVS will sustain higher pulse currents (I_P). For a width of 50 ms, for example, a TVS will sustain 3.5 times its rated I_P at 1000 ms, 600 W. Thus the peak I_P of an SMBJ12A would increase from 30.2 A at 10/1000 ms to 105.7 A at 1.2/50 ms. The current rating of an SMBJ64A would increase from 5.8 A to 20.3 A.

Increasing the pulse width to 10 000 µs will reduce the I_P rating by a factor of 0.33 since the P_P is reduced to 200 W. An SMBJ12A with an I_P of 30.2 A at 1000 ms would be reduced to an I_P of 9.9 A for a 10 000 ms duration.

This method can be applied to derive the P_P and the I_P of a TVS from any other series (such as 400 W, 500 W, 1.5 kW, 5 kW), using its published power vs pulse time curve.

Most Transient Voltage Suppressors, including the examples shown here, are rated for 10/1000 ms double exponential waveforms. For one-half sine wave pulses, derate to 75 % of the exponential waveform value and for square wave pulses, derate to 66 %.

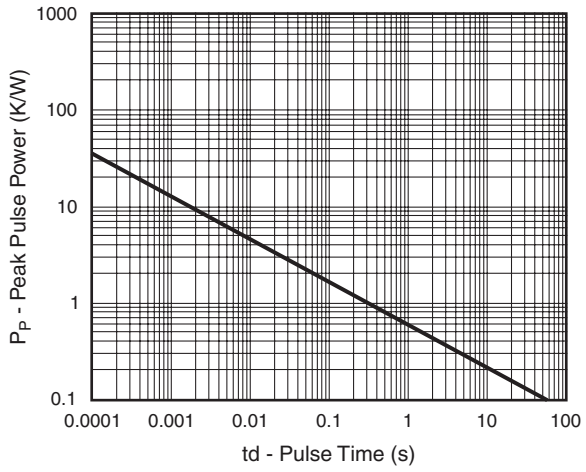

Figure 1. Peak Pulse Power vs. Pulse Time