

Determining Clamping Voltage Levels for a Broad Range of Pulse Currents

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In Transient Voltage Suppressor (TVS) data sheets, all clamping voltage (V_C) levels are specified at maximum rated peak pulse current (I_{PP}). How do you interpolate the V_C levels for transient currents (I_P) other than the rated maximum?

This figure is easily calculated using the parameters on the data sheet with the formula:

$$V_C = (I_P/I_{PP})(V_C \text{ max.} - V_{BR} \text{ max.}) + V_{BR} \text{ max.}$$

Where: I_P = test pulse current
 I_{PP} = max rated pulse current
 $V_C \text{ max.}$ = maximum specified clamping voltage
 $V_{BR} \text{ max.}$ = upper limit of breakdown voltage

This calculation assumes a linear increase in V_C between V_{BR} and $V_C \text{ max.}$, which is realistic. Figure 1 illustrates the DVC vs DIP relationship for two voltage levels, 10 V and 64 V, in the SMB 600 W series between V_{BR} and V_C as determined by this formula. Results are linear as expected. $V_{BR} \text{ max.}$ is used in this calculation as it is the upper limit of specified breakdown voltage.

In those instances where $V_{BR} \text{ max.}$ is not given on the data sheet, it can be closely approximated. For "A" suffix parts, multiply the minimum V_{BR} by 1.11 and for non-suffix parts, multiply by 1.22 to obtain the maximum V_{BR} . The curves derived from measured data are compared with calculated values in Figure 1. Surge tests were performed for a 30 piece sample at 25 °C ambient with a 10/1000 μs waveform.

Note that the curves based on actual surge data have a more shallow slope than those from the calculation, indicating that the devices are conservatively rated and that the formula shown provides a sufficient level of confidence for worst-case design.

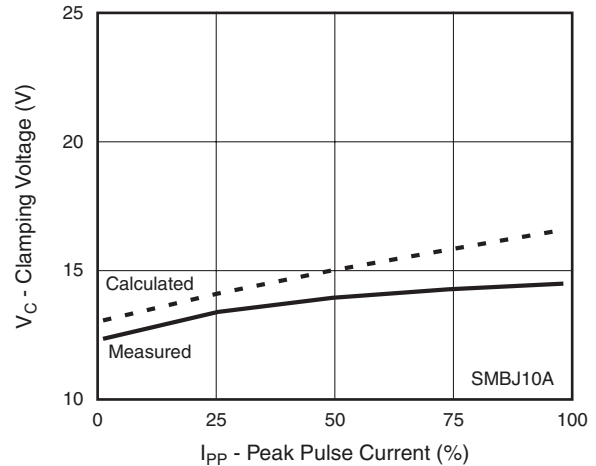


Figure 1. V_C vs IPP for SMBJ10A Calculated and Measured

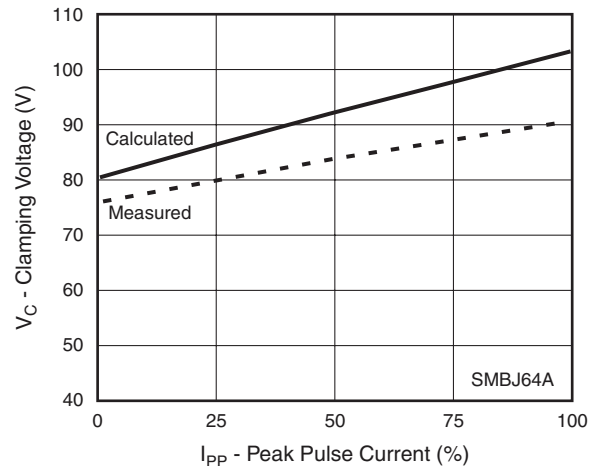


Figure 2. V_C vs IPP for SMBJ64A Calculated and Measured