Test Waveform Comparison

Various Test waveforms are used to test TVS diodes and also evaluate products that are protected by TVS devices.

The typical waveforms used are described and shown here. Also, the approximate energy can be determined of each so that waveforms of one Pulse type can be compared to another. It is not always possible or convenient to test a TVS component when trying to apply them to a particular application but having some data and guidance can permit a designer to make a better selection.

It can also be estimated for one application by having test data and calculations of energy so the choice and decision can be more exact or have a better chance of success.

The typical waves used for products are 8/20 and 10/1000. The first term is the rise time in ***µsec*** from zero to the wave peak and the second term is the fall time from zero to half value in ***µsec.*** Other wave forms are used but 8/20 and 10/1000 are the usual.

So, in order to compare the typical values to a required value two things must be considered, the peak current and the estimated energy. The peak current is given but the estimated energy must be calculated.

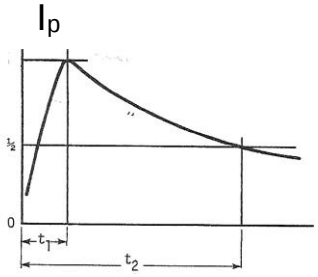
More than 20 years ago this means of estimation was developed in conjunction with USF and was used successfully in fabrication of surge generators and developing products.

The equations are as follows, now the results are approximate but are useful in comparing products and tests.

Area under the curve (estimated)

$= I_p^2[\, t_1/3 + Y/2\,]$ Where $Y = (t_2 - t_1)/.693$

I_p = Peak of Current t_1 = time to peak current and t_2 time to ½ value



This equation is the result of simplifying a complex equation used in the approximation of the energy.

The result is:

8/20	Ip for 12 usec	i^2 x 12x10^{-6}
10/1000	Ip for 1433 usec	i^2 x 1433x10^{-6}
6.4/69	Ip for 94 usec	i^2 x 94x10^{-6}
40/120	Ip for 155 usec	i^2 x 155x10^{-6}
10/350	Ip for 248 usec	i^2 x 248x10^{-6}

The waves 6.4/69 and 40/120 are used when certifying to DO-160

Also, when comparing waves it is important to note a pulse may have a smaller i^2t but the peak pulse that is used to test may be smaller than the required device or chosen device.

An example is to compare an 8/20 and 10/1000. The 8/20 has an Ip of 1000 so the i^2t would be 12. Then another device at 10/1000 has an ip of 200 so the i^2t would be 57. In this case as long as the peak current has enough margin the 10/100 may be the unit to use as it will have greater thermal capacity.

In any case the peak current of the application must always be less than the peak current of selected device.

Always review the need and the peak wave at test to ensure the best device is chosen