



Vishay Thin Film Engineering Test Report

PTN CHIP RESISTOR - SURGE IMMUNITY TESTING

1. Background

Surge immunity or electromagnetic compatibility can be defined as the ability of a system or device to withstand continuous or pulsed/transient energy from external sources without having an adverse effect on its performance. In this document we report the results of transient surge immunity testing on the Vishay Thin Film PTN product line over a range of voltage pulse levels.

2. Experimental Equipment and Methods

Surge immunity testing for this study was conducted according to IEC standard 60115-1, paragraph 4.27 using the 1.2/50 μ s waveform. Samples for the testing were selected from three different case sizes and values as detailed in table below.

SAMPLE DETAILS			
CASE SIZE	RESISTANCE VALUE		
	Low	Critical	High
0603	10 Ω	25.2 k Ω	150 k Ω
1206	10 Ω	40.2 k Ω	1 M Ω
2512	10 Ω	40.2 k Ω	1 M Ω

To facilitate the application of voltage pulses to the device under test (DUT), samples were mounted to FR-4 test cards and inserted into a testing fixture as shown in Figure 1 below.

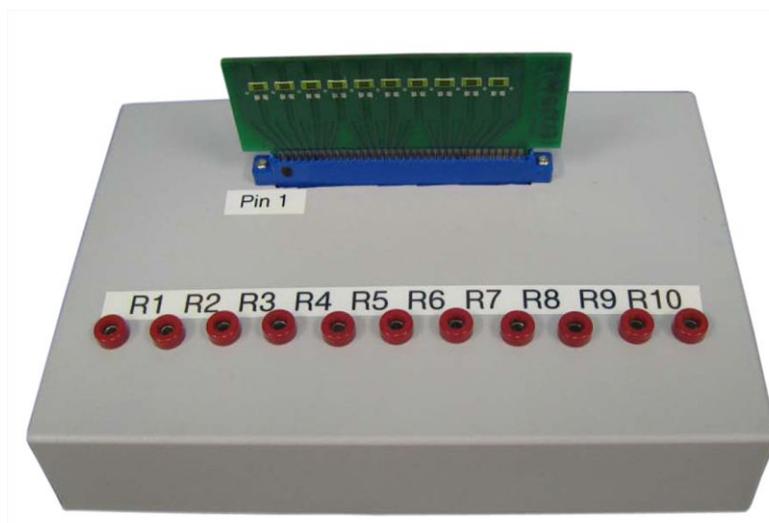


Fig. 1 - Test Fixture

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Voltage pulses, following the 1.2/50 μ s waveform, were generated using a Schaffner NSG650 High Energy Pulse Generator. Prior to conducting the testing, the voltage waveform was verified using a Tektronix TDS3034B oscilloscope. This measured waveform is shown in Figure 2 below.

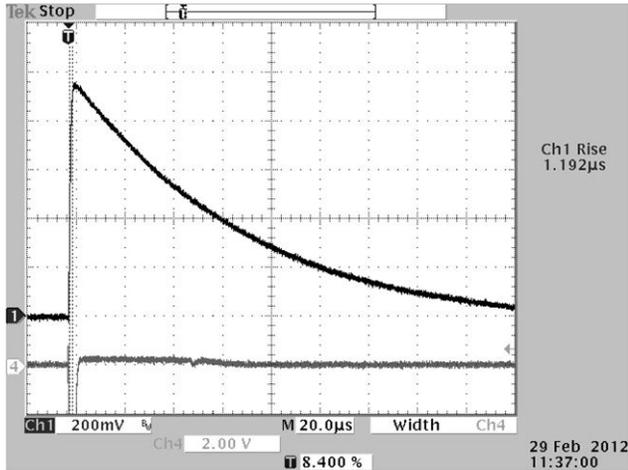


Fig. 2 - 1.2/50 μ s Waveform Verification

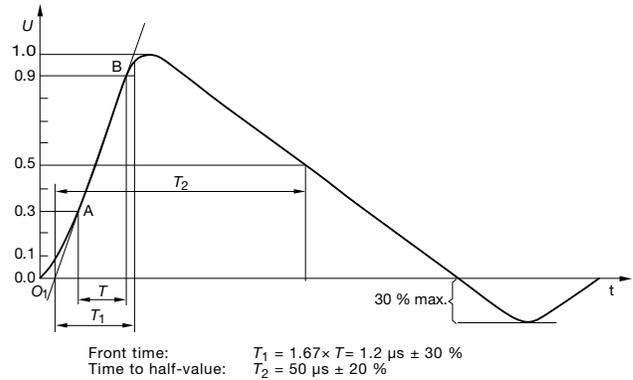


Fig. 3 - Waveform of Open-circuit Voltage (1.2/50 μ s) at the Output of the Generator with no CDN connected (waveform definition according to IEC 60060-1)

Testing was conducted by subjecting sample groups of 10 resistors to incrementally higher voltage pulses, starting with 200 V, until a resistance delta greater than 0.5 % was observed. New samples were used for each voltage pulse level.

Due to the pulse generator lower voltage limit of 200 V, the low-value chips (≤ 1 k Ω) were tested in series instead of individually, as was the case on the higher resistance values. Once again, new groups of samples were used for each voltage pulse level.

3. Results and Discussion

As previously stated, the low-value resistors were tested in series. The resultant voltage drop across the resistors is reflected in the reported pulse test voltage levels in Table 2. As the data shows, Vishay's low-value PTN resistors are minimally affected up to 30 V and 40 V for the larger case sizes and 20 V for the smaller case sizes.

PULSE TEST RESULTS SUMMARY																
SAMPLE DESCRIPTION	DELTA RESULTS	PULSE TEST VOLTAGE LEVEL														
		20	25	30	40	80	120	200	400	600	800	1000	1200	1400	1600	1800
PTN0603 10 Ω	Min.	-0.204	0.131													
	Max.	0.048	0.798													
PTN0603 25.2 k Ω	Min.							-0.002	-0.002	-0.006	-0.037	-0.069	-0.057	-0.156	-0.129	
	Max.							0.000	0.000	-0.001	0.002	0.011	-0.007	0.188	2.275	
PTN0603 150 k Ω	Min.							-0.001	-0.001	0.001	-0.002	-0.029	-0.001	-0.156	-0.016	
	Max.							0.004	0.004	0.006	0.009	0.011	0.005	0.099	0.002	
PTN1206 10 Ω	Min.	-0.002	-0.001	-0.003	-0.003	2.527										
	Max.	0.009	0.006	0.006	0.039	6.894										
PTN1206 40.2 k Ω	Min.							0.000	-0.001	0.000	0.000	0.001	.000	0.000	0.000	-0.005
	Max.							0.004	0.004	0.004	0.003	0.004	0.004	0.006	0.004	0.002
PTN1206 1 M Ω	Min.							-0.001	-0.001	-0.001	0.000	0.000	0.000	0.000	-0.001	0.000
	Max.							0.000	0.001	0.000	0.003	0.000	0.001	0.002	0.002	0.002
PTN2512 10 Ω	Min.	-0.003	0.000	-0.002	-0.009	-0.039	1.653									
	Max.	0.001	0.003	0.004	0.005	0.861	4.362									
PTN2512 40.2 k Ω	Min.							-0.001	0.000	-0.002	0.000	-0.001	-0.001	-0.001	-0.001	-0.001
	Max.							0.001	0.001	0.002	0.002	0.001	0.001	0.001	0.000	0.001
PTN2512 1 M Ω	Min.							-0.005	-0.012	-0.006	-0.012	-0.006	-0.010	-0.007	-0.009	-0.012
	Max.							0.002	0.000	-0.001	0.004	0.002	-0.005	0.002	0.000	0.002

This pulse test data is also presented in graphical format in Figures 4 through 7 of Appendix A.



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4. Conclusion

Based on the results of this work, it can be concluded that Vishay's PTN product line is able to withstand high pulse loads, with minimal effect on performance, when tested in accordance to IEC 60115-1 requirements.

Appendix A

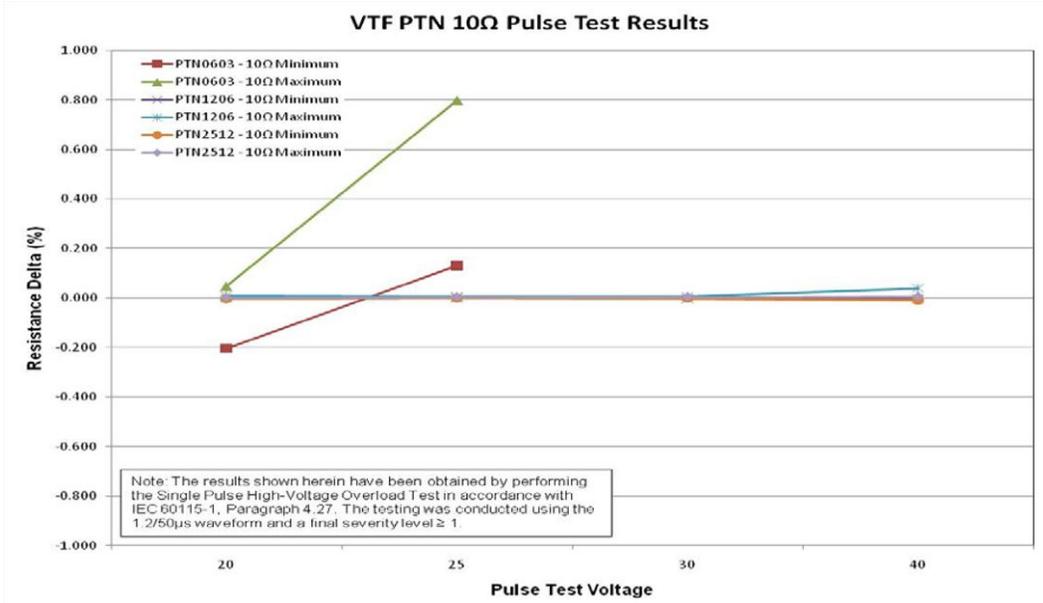


Fig. 4 - Low Value Pulse Test Results

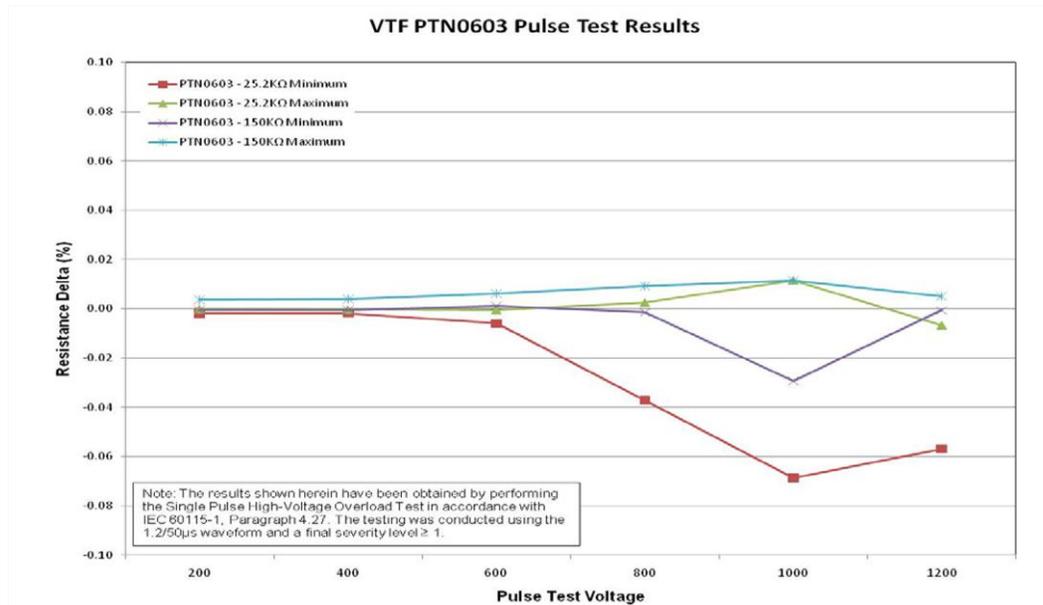


Fig. 5 - 0603 Case Size Pulse Test Results

TECHNICAL NOTE



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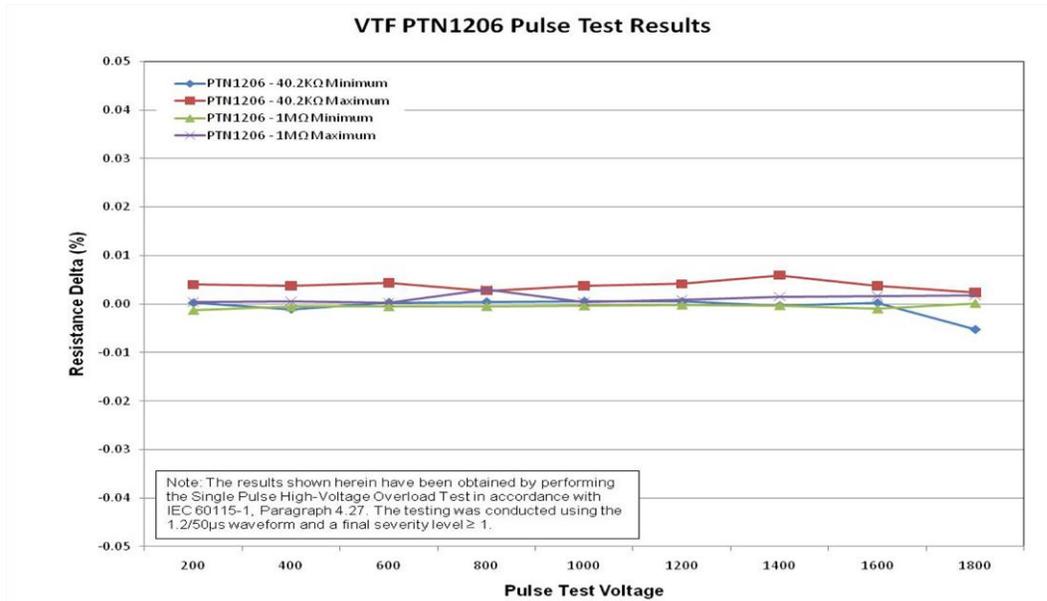


Fig. 6 - 1206 Case Size Pulse Test Results

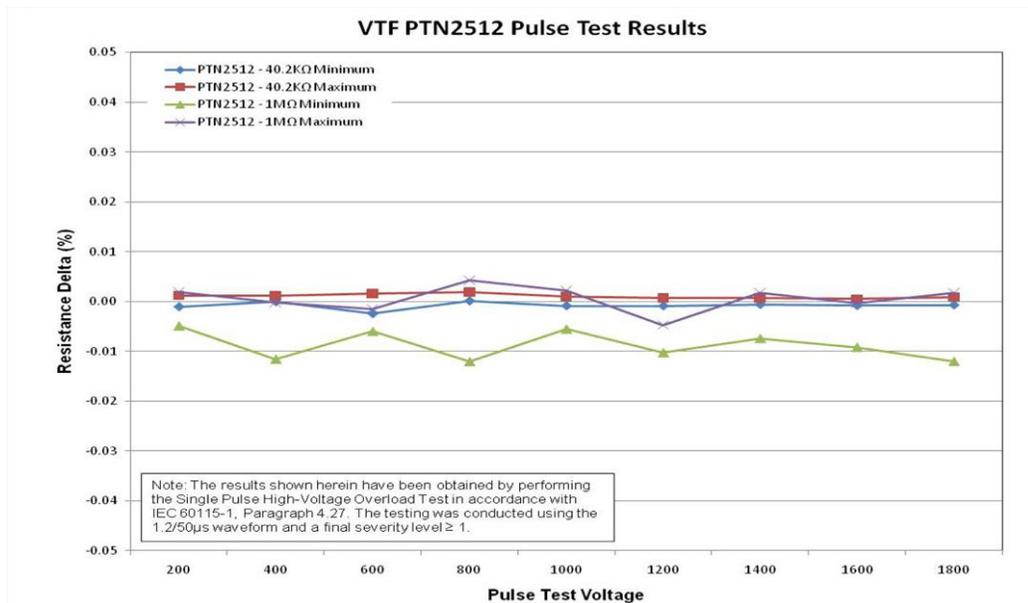


Fig. 7 - 2512 Case Size Pulse Test Results

TECHNICAL NOTE