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## Product Qualification Report

To: Those who may concern  
 From: Connie Li, Product Engineer, Littelfuse, WX  
 Date: Dec 26, 2017 - Rev 0.1  
 Subject: **Qualification Test Result for Littelfuse TVS SLD8S12A to 17A with N substrate**

### Purpose:

This report is to inform the successful AEC-Q101 qualification test results associated with TVS SLD8S12A to SLD8S17A with N substrate

### 1. Qualification Types (Test Vehicle)

Product Series	Representative Test Sample Part Numbers	Package (Assembly Location)
SLD8S	SLD8S12A	SMTO263(Wuxi)
	SLD8S12A	
	SLD8S14A	
	SLD8S14A	
	SLD8S15A	

### 2. Qualification Test Items and Result Summary:

Test Category	Description	Sample P/N	Sample Qty	Littelfuse test Ref#	Contents/Conditions	Result Summary
Parametric	Electrical Parameters	SLD8S12A	308	104190	VBR, IR	100% meet published spec.
		SLD8S12A	308			
		SLD8S14A	308	96042		
		SLD8S14A	308			
		SLD8S15A	308			
Load dump test	ISO7637	SLD8S12A	10	104192	ISO7637 5a	Meet datasheet
		SLD8S12A	10			
		SLD8S14A	10	96043		
		SLD8S14A	10			
		SLD8S15A	10			

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Reliability Test	Pre-condition (PC)	SLD8S12A	231	104190	SMD qualification parts for TC, AC, H3TRB	0% failure at MSL Level 1
		SLD8S12A	231			
		SLD8S14A	231	96042		
		SLD8S14A	231			
		SLD8S15A	231			
	DC Blocking (HTRB)	SLD8S12A	77	104190	150°C, VR	0% failure at 1008 hours
		SLD8S12A	77			
		SLD8S14A	77	96042		
		SLD8S14A	77			
		SLD8S15A	77			
	Biased Temp & Humidity (H3TRB)	SLD8S12A	77	104190	VR@85C,85%RH	0% failure at 1008 hours
		SLD8S12A	77			
		SLD8S14A	77	96042		
		SLD8S14A	77			
		SLD8S15A	77			
	UFAST	SLD8S12A	77	104190	96 hours at TA=130°C/85%RH.	0% failure at 96 hours
		SLD8S12A	77			
		SLD8S14A	77	96042		
		SLD8S14A	77			
		SLD8S15A	77			
	Temp Cycle	SLD8S12A	77	104190	-55°C&150°C (air to air)	0% failure at 1000 cycles
		SLD8S12A	77			
		SLD8S14A	77	96042		
		SLD8S14A	77			
SLD8S15A		77				
Resistance to Solder Heat (RSH)	SLD8S14A	30	96042	260°C, 10 seconds	0% failure after RSH	

### 3. Conclusion

According to above qualification test results, Littelfuse concluded that SLD8S12A to 17A with N substrate passed all the AEC-Q101 Reliability Test at WTC Lab, which is ready to start mass production.

Below is the SLD8SSeries Part Number list covered by this report:

PN	Package
SLD8S12A	SMTO263
SLD8S13A	SMTO263
SLD8S14A	SMTO263
SLD8S15A	SMTO263
SLD8S16A	SMTO263
SLD8S17A	SMTO263

## 4. MTBF Calculation

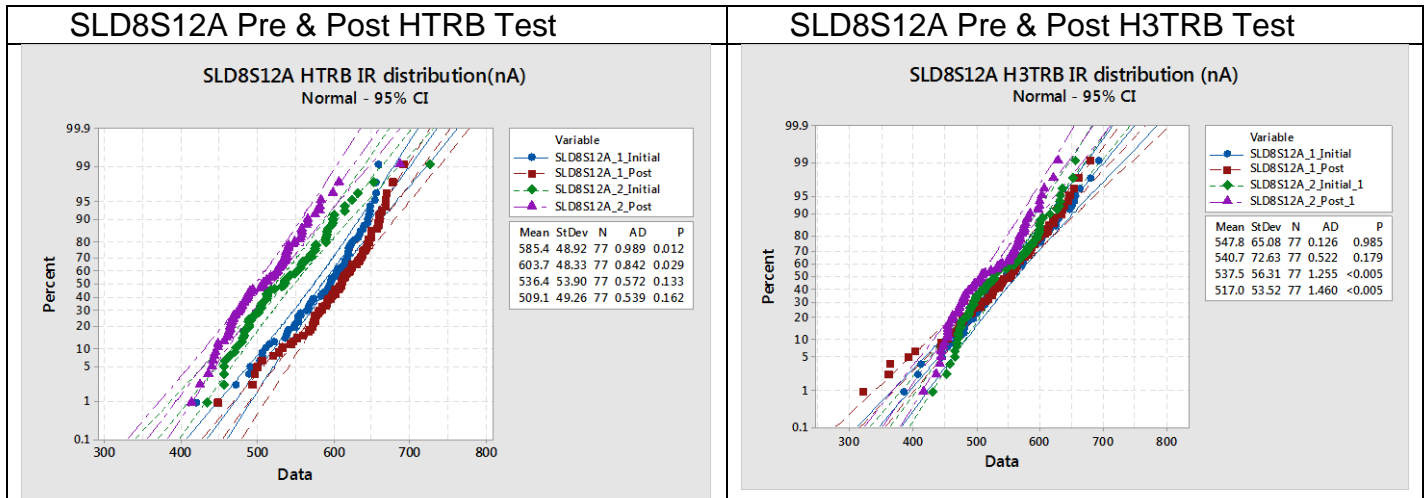
Estimate of Failure Rate, MTBF, FITS for a Given Operation Temperature (See note)

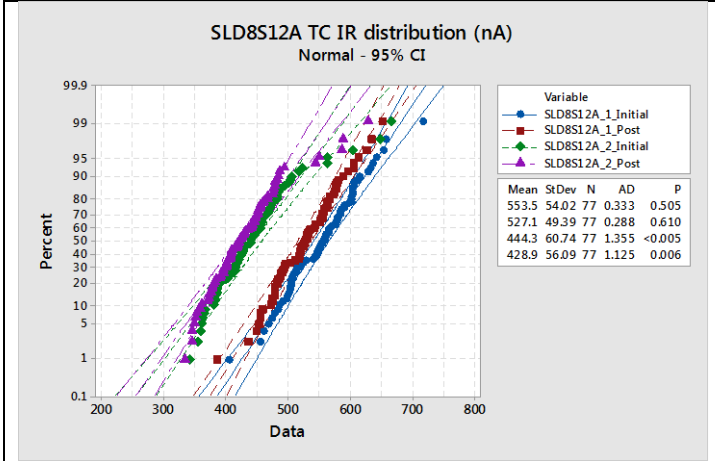
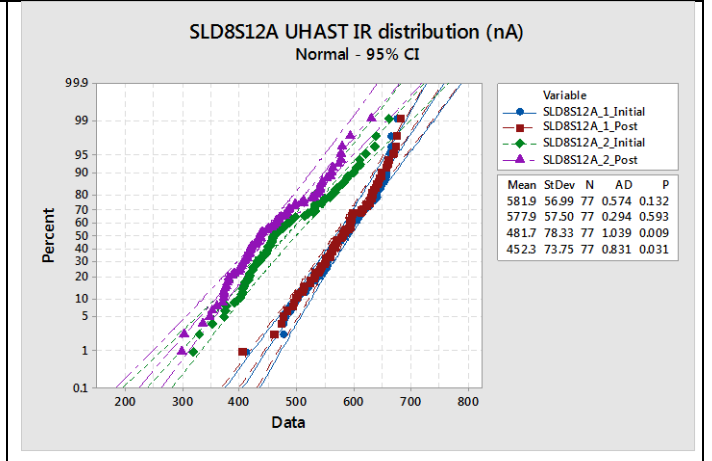
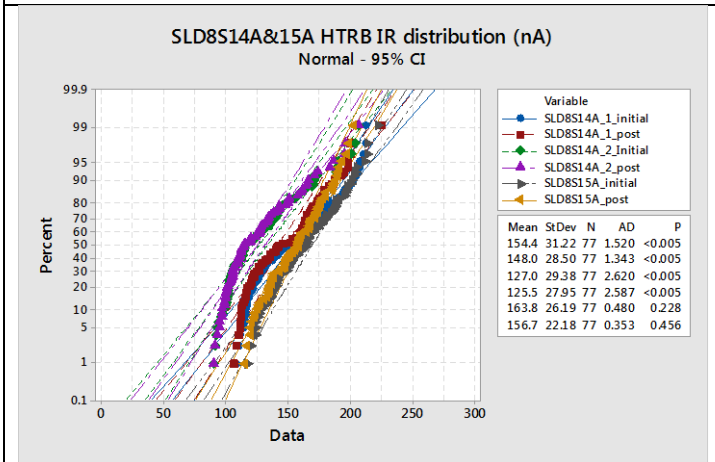
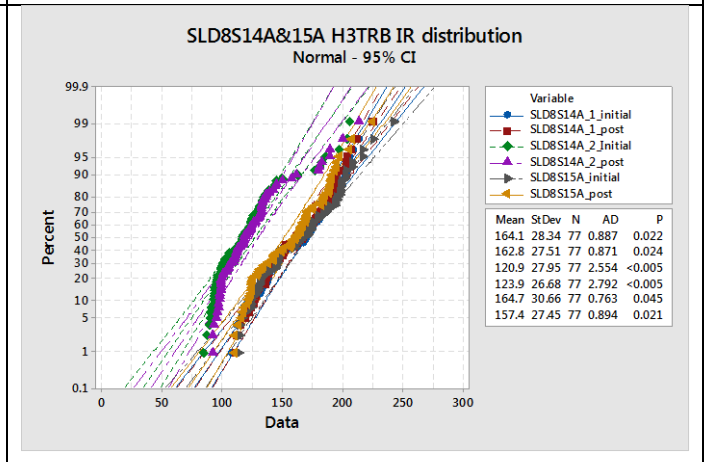
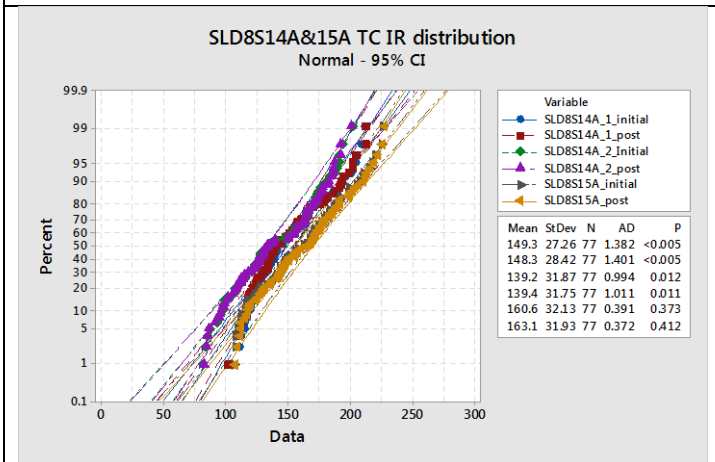
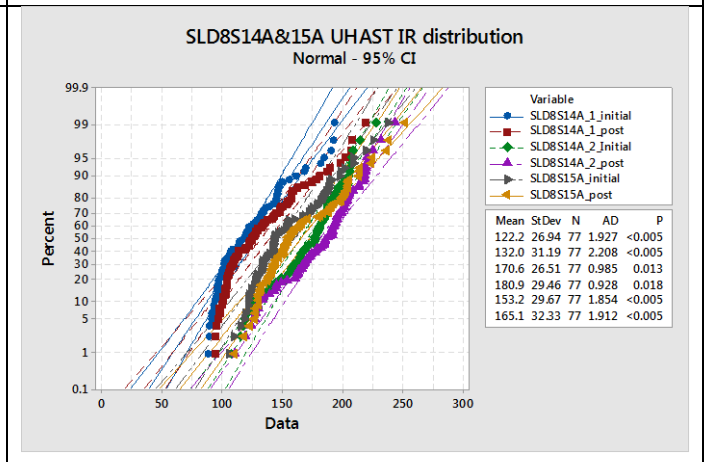
Temp °C	% FR/khrs	MTBF (K)	FITS
30	0.00001	21938436	0.05
55	0.00008	1187766	0.84
85	0.00163	61424	16.3
100	0.00599	16700	59.9
125	0.04220	2370	422
150	0.23611	424	2362

Note: The Mean-Time-Between-Failure (MTBF) in hours and the percent failure rate per 1000 hours (%FR/khr) are computed at a 60% confidence level using the chi square method and the Arrhenius derating model for various junction operating temperatures. For the calculations, a value of 1 eV was used for the activation energy.

## 5. Appendix A – Pre & Post Test Electrical Performance Distribution

- Based on the qualification lots data, the actual VZ drift is within  $\pm 10\%$  (AEC 20%), IR leakage drift is within  $\pm 50\%$  (AEC 5 times for normal leakage and 10 times for moisture leakage).
- AEC requirement:  
Parts not remaining within  $\pm 20\%$  of the initial reading of each test (with the exception of leakage limits which are not to exceed 10 times the initial value for moisture tests and 5 times leakage the initial value for all others) after completion of environmental testing. Parts exceeding these guidelines must be justified by the supplier and approved by the user. For leakages below 100nA, tester accuracy may prevent a post stress analysis to initial reading



**SLD8S12A Pre & Post TC Test**

**SLD8S12A Pre & Post UHAST Test**

**SLD8S14A&15A Pre & Post HTRB Test**

**SLD8S14A&15A Pre & Post H3TRB Test**

**SLD8S14A&15A Pre & Post TC Test**

**SLD8S14A&15A Pre & Post UHAST Test**


### 6. Appendix B- N substrate has larger safe operation area (SOA)

The SOA chart can be update as below for N substrate

SLD8S12A orange line

SLD8S15A blue line

**Figure 4 - Typical SOA Chart**

