Semicon Champion

Quality | Customer Focus

Product Qualification Report

To: Those who may concern

From: Zexi Hu，Product Engineer，Semicon Champion

Date: Oct 25，2022 -Rev 1

Subject: Qualification Test Result for Semicon Champion TVS TPSMD Product Series

Purpose:

This report is to inform the successful AEC-Q101 qualification test results associated with TVS TPSMB Product Series.

1. Qualification Types (Test Vehicle)

Product Series	Representative Test Sample Part Numbers	Package(Assembly Location)
TPSMD	TPSMD40CA	ShangHai Jinke Semiconductor Equipment Co.，Ltd

2. Qualification Test Items and Result Summary:

Test Category	Description	Sample P/N	Sample Qty	Test Ref#	Contents/Conditions	Result Summary
Parametric	Electrical Parameters	**TPSMD40CA**	370	Datasheet	VBR、IR	100% meet published spec.
Surge IPP test	10X1000us Surge Out	**TPSMD40CA**	5	Datasheet	+/- 1 hit, from rated IPP, 0.1 IPP step	100% passing at 1.2xRated IPP

Reliability Test	Pre-condition (PC)	**TPSMD40CA**	206	JESD22A-113	Performed on surface mount devices (SMDs) prior to TC,AC, H3TRB,HAST & IOL,PTC stresses only.	0% failure at MSL Level 1
	High Temperature Reverse Bias (HTRB)	**TPSMD40CA**	77	JESD22-A108	150℃, 1000hrs	0% failure at 1000 hours
	Temperature Cycling (TC)	**TPSMD40CA**	77	JESD22-A104	-55℃&150℃ (air to air),1000 cycles	0% failure at 1000 cycles
	High-temperature High-humidity Reverse Bias(H3TRB)	**TPSMD40CA**	77	JESD22-A101	85℃, 85%RH, 80%VR,1000 hrs	0% failure at 1000 hours
	Highly Accelerated Stress Test (HAST)	**TPSMD40CA**	77	JESD22-A101	130℃, 85%RH 80%VR, 96hrs	0% failure at 96 hours
	Resistance to solder heat(RSH)	**TPSMD40CA**	30	JESD22-B106 JESD22-A111	260℃(+5,-0),10sec	0% failure after RSH
	Solderability(SD)	**TPSMD40CA**	10	J-STD-002	235℃±5℃, 3sec	0% failure after Solderability
	Moisture Soak Level (MSL)	**TPSMD40CA**	22	JESD020D	85℃, 85%RH,168hRS	0% failure at MSL Level 1
	Destructive Physical Analysis(DPA)	**TPSMD40CA**	2	AEC-Q101-004 Section	Completed H3TRB or HAST, and TC.	100% meet published spec.

3. Conclusion

According to the above qualification test results, Semicon Champion concluded that TPSMB product series passed the all the AEC-Q101 Reliability Test at WTC Lab, which is ready to start mass production.

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

TPSMD10A,TPSMD10CA,TPSMD11A,TPSMD11CA,TPSMD12A,TPSMD12CA,TPSMD13A,TPSMD13CA,TPSMD14A,TPSMD14CA,TPSMD15A,TPSMD15CA,TPSMD16A,TPSMD16CA,TPSMD17A,TPSMD17CA,TPSMD18A,TPSMD18CA,TPSMD20A,TPSMD20CA,TPSMD22A,TPSMD22CA,TPSMD24A,TPSMD24CA,TPSMD26A,TPSMD26CA,TPSMD28A,TPSMD28CA,TPSMD30A,TPSMD30CA,TPSMD33A,TPSMD33CA,TPSMD36A,TPSMD36CA,TPSMD40A,TPSMD40CA,TPSMD43A,TPSMD43CA,TPSMD45A,TPSMD45CA,TPSMD48A,TPSMD48CA,TPSMD51A,TPSMD51CA,TPSMD54A,TPSMD54CA,TPSMD58A,TPSMD58CA,TPSMD60A,TPSMD60CA,TPSMD64A,TPSMD64CA,TPSMD70A,TPSMD70CA,TPSMD75A,TPSMD75CA,TPSMD78A,TPSMD78CA,TPSMD85A,TPSMD85CA.

4. MTBF Calculation

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

Temp ℃	% FR/khrs	MTBF (K)	FITS
30	0.0000228	4380864	0.228
55	0.0004225	236700	4.225
85	0.0081844	12218	81.844
100	0.0301256	3319	301.256
125	0.2125123	471	2125.123
150	1.189988	84	11899.880

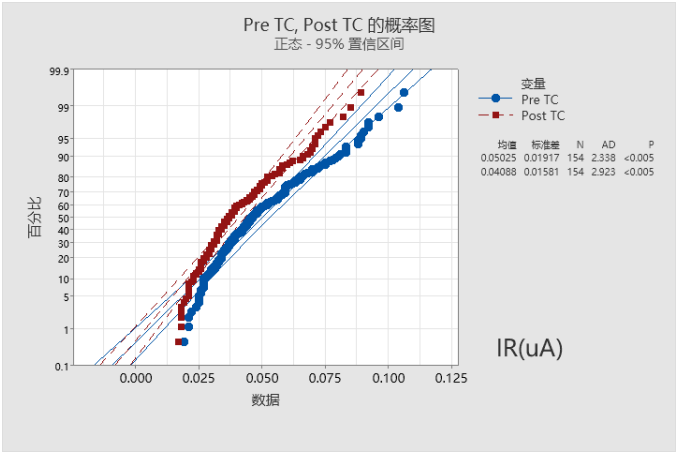
Note： The **M**ean-**T**ime-**B**etween-**F**ailure (MTBF) in hours and the percent failure rate per 1000 hours (%FR/khr) are computed at a 60% confidence level using the chi square method and the Arrhenius derating model for various junction operating temperatures. For the calculations, a value of 1 eV was used for the activation energy.

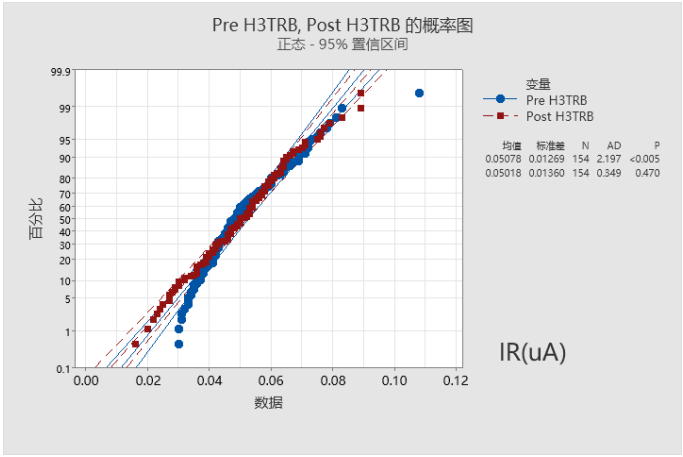
5. Appendix A – Pre & Post Test Electrical Performance Distribution

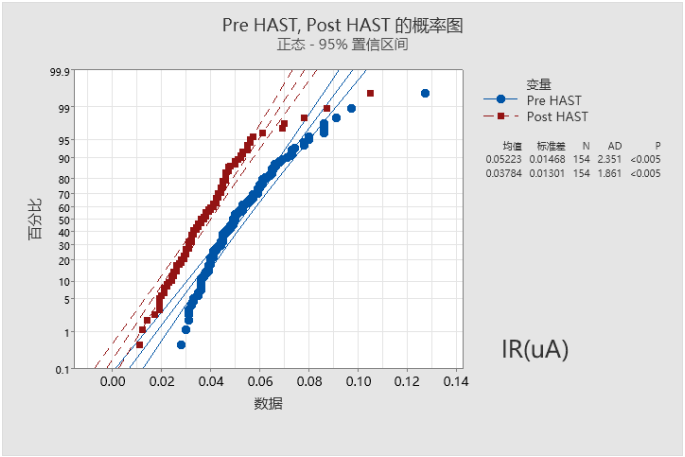
●Based on our 2 qual lots data , our actual VZ drift is within + 10% (AEC 20%), IR leakage drift is within +50% (AEC 5 times for normal leakage and 10 times for moisture leakage).

●AEC required :

Parts not remaining within ± 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

TPSMD40CA Pre&Post HTRB Test	TPSMD40CA Pre&Post H3TRB Test
	
TPSMD40CA Pre&Post TC Test	**TPSMD40CA Pre&Post HAST Test**


Pre H3TRB, Post H3TRB 的概率图
正态 - 95% 置信区间
百分比
数据
变量
Pre H3TRB
Post H3TRB
均值 标准差 N AD P
0.05078 0.01269 154 2.197 <0.005
0.05018 0.01360 154 0.349 0.470
IR(uA)


Pre HAST, Post HAST 的概率图
正态 - 95% 置信区间
百分比
数据
变量
Pre HAST
Post HAST
均值 标准差 N AD P
0.05223 0.01468 154 2.351 <0.005
0.03784 0.01301 154 1.861 <0.005
IR(uA)