8755 W. Higgins Road Suite 500
Chicago, Illinois USA 60631

April 17th 2020

RE: LFPCN41347 Littelfuse TPSMB and TPSMC TVS Business Continuous Plan and Capacity Expansion

To our valued customers,

To serve our customers' continuous growth, Littelfuse would like to implement this Business Continuous Plan of TPSMB and TPSMC Automotive TVS products (=<100V Vbr), meanwhile to expand the capacity with improved automation and quality system.

This BCP will introduce the 2nd sources below to build up our robust supply chain, and the new additional capacity will support the long term growth of our automotive customers for the developing electrification.

Change Description

TPSMB (=<100V Vbr)

Change Description	Before	After	Benefits
Manufacturing Line	Existing line	Existing line & New lines	Capacity extension
Lead Frame & Clip Vendor	L/F Vendor: JIH Long Clip vendor: G-Shank	L/F & Clip vendor: 1.JIH Long 2. G-Shank	BCP
Solder Paste	Heraeus F367SN10-90P4	1. Heraeus FS5116 2.Indium 9.32	BCP
EMC	EME-G630AY Vendor: Sumitomo	1.EME-G630AYD Vendor: Sumitomo 2.EME-E500HME Vendor: Sumikon	BCP
Plating Source	1.Bandl (Suzhou) 2. Suyang (Wuxi)	1.Bandl (Suzhou) 2. Suyang (Wuxi) 3. Littelfuse inhouse (Wuxi)	BCP

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TPSMC (=<100V Vbr)

Change Description	Before	After	Benefits
Manufacturing Line	Old line	Old line & New lines	Capacity extension
Lead Frame & Clip Vendor	L/F Vendor: Kenly Clip vendor: G-Shank	L/F & Clip vendor: 1.SDI 2.G-Shank	BCP
Solder Paste	Heraeus F367SN10-90P4	1. Heraeus FS5116 2.Indium 9.32	BCP
EMC	EME-G720C Vendor: Sumitomo	1.EME-G720C Vendor: Sumitomo 2.EME-E500HME Vendor: Sumikon	BCP
Plating Source	1.Bandl (Suzhou) 2. Suyang (Wuxi)	1.Bandl (Suzhou) 2. Suyang (Wuxi) 3. Littelfuse inhouse (Wuxi)	BCP

All the changes have been qualified to AECQ101 with IATF16949 certified production line, and with no FIT/Form/Function change.

We provide in another attachment with the qualification report, also the impacted PNs (Automotive TPSMB and TPSMC, =<100V Vbr) are all listed as appendix in the end of qualification report.

We would implement this PCN by Jan.31 2021. This PCN letter is for your information and acknowledgement. If you require any specific data or product samples to certify this change, please contact Littelfuse® within 90 days of the notification date.

If you have any other questions or concerns, please contact your Littelfuse® local sales.

We value your business and look forward to assisting you whenever possible.

Best Regards,
Charlie Cai
Product Manager Automotive and Hi-Rel TVS

Littelfuse, Wuxi
East 1# Zhen Fa 6 Road
Shuo Fang Industrial Park
Wuxi, Jiangsu 214142

Product Qualification Report

To: Those who may concern

From: Haipeng Xu, Senior Product Engineer, Littelfuse, Wuxi

Jesse Chen, Product Engineer, Littelfuse, Wuxi

Date: Apr 6th, 2020 – Rev.A

Subject: **Qualification test result of TPSMBxx and TPSMCxx BCP and capacity extension**

Purpose:

This report is to inform the successful qualification test results of TPSMBxx and TPSMCxx (Vbr<=100V) Business Continuous Plan and capacity extension.

Conclusion:

According to the qualification result, Littelfuse concluded that TPSMBxx & TPSMCxx BCP and capacity extension qualification has been successfully completed and will be released to mass production according to the schedule announced by our PCN letter.

Best Regards,

Haipeng Xu

Senior Product Engineer
Littelfuse Semiconductor

Littelfuse
Expertise Applied | Answers Delivered

1. Change Description

TPSMB

Change Description	Before	After	Benefits
Manufacturing Line	Existing line	Existing line & New lines	Capacity extension
Lead Frame & Clip Vendor	L/F Vendor: JIH Long Clip vendor: G-Shank	L/F & Clip vendor: 1.JIH Long 2. G-Shank	BCP
Solder Paste	Heraeus F367SN10-90P4	1. Heraeus FS5116 2.Indium 9.32	BCP
EMC	EME-G630AY Vendor: Sumitomo	1.EME-G630AYD Vendor: Sumitomo 2.EME-E500HME Vendor: Sumikon	BCP
Plating Source	1.Bandl (Suzhou) 2. Suyang (Wuxi)	1.Bandl (Suzhou) 2. Suyang (Wuxi) 3. Littelfuse inhouse (Wuxi)	BCP

TPSMC

Change Description	Before	After	Benefits
Manufacturing Line	Existing line	Existing line & New lines	Capacity extension
Lead Frame & Clip Vendor	L/F Vendor: Kenly Clip vendor: G-Shank	L/F & Clip vendor: 1.SDI 2.G-Shank	BCP
Solder Paste	Heraeus F367SN10-90P4	1. Heraeus FS5116 2.Indium 9.32	BCP
EMC	EME-G720C Vendor: Sumitomo	1.EME-G720C Vendor: Sumitomo 2.EME-E500HME Vendor: Sumikon	BCP
Plating Source	1.Bandl (Suzhou) 2. Suyang (Wuxi)	1.Bandl (Suzhou) 2. Suyang (Wuxi) 3. Littelfuse inhouse (Wuxi)	BCP

2. Qualification Test Vehicle

Part Number	Package Type	Lot Size	Internal Reference #
TPSMB7.5A	DO214AA(SMB)	2	125293 & 126178
TPSMB36CA	DO214AA(SMB)	2	133054 & 133056
TPSMC13CA	DO214AB(SMC)	2	129027
TPSMC47CA	DO214AB(SMC)	2	131820

TPSMC62CA	DO214AB(SMC)	2	127455 & 127458
TPSMC91CA	DO214AB(SMC)	2	125467 & 126183

3. Qualification Test Items and Result Summary

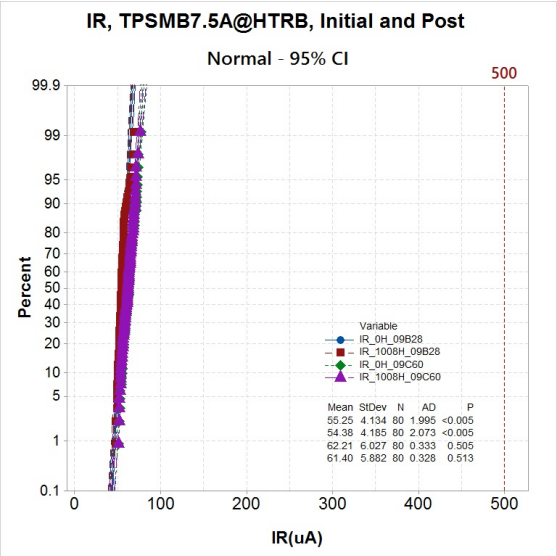
Reliability Test	Part Number	S. S	Test Condition	Ref. Spec	Result Fail/Total
Pre-conditioning	TPSMB7.5A	480	24hr 125˚C bake, 168hrs 85˚C/85% humidity storage, 3 times Reflow	JESD22A-113	0/2880
	TPSMB36CA	480			
	TPSMC13CA	480			
	TPSMC47CA	480			
	TPSMC62CA	480			
	TPSMC91CA	480			
High temperature Reverse Bias (HTRB)	TPSMB7.5A	160	Tj specified in datasheet, 1008hrs, biased at VR	MIL-STD-750-1 M1038 Method A	0/960
	TPSMB36CA	160			
	TPSMC13CA	160			
	TPSMC47CA	160			
	TPSMC62CA	160			
	TPSMC91CA	160			
High Humidity High Temp. Reverse Bias (H3TRB)	TPSMB7.5A	160	TA: 85°C, RH: 85%, 1000hrs, Reverse biased at V_R or max 100V	JESD22-A101	0/960
	TPSMB36CA	160			
	TPSMC13CA	160			
	TPSMC47CA	160			
	TPSMC62CA	160			
	TPSMC91CA	160			
Unbiased Highly Accelerated Stress Test (UHAST)	TPSMB7.5A	160	96 hours at TA=130°C/85%RH.	JESD22-A118	0/960
	TPSMB36CA	160			
	TPSMC13CA	160			
	TPSMC47CA	160			
	TPSMC62CA	160			
	TPSMC91CA	160			
Temperature Cycling (TC)	TPSMB7.5A	160	TA: -55°C to +150°C, dwell time >15mins, 1000 cycle)	JESD22-A104	0/960
	TPSMB36CA	160			
	TPSMC13CA	160			
	TPSMC47CA	160			
	TPSMC62CA	160			
	TPSMC91CA	160			
High temperature Storage Life (HTSL)	TPSMB7.5A	160	TA: 150°C, 1008hours	JESD22-A103	0/960
	TPSMB36CA	160			
	TPSMC13CA	160			
	TPSMC47CA	160			
	TPSMC62CA	160			

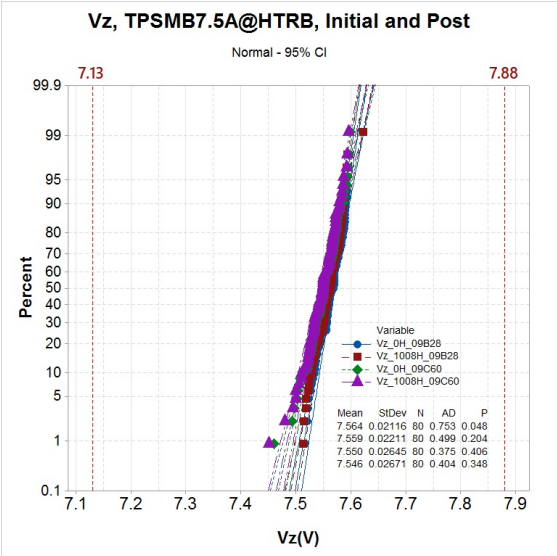
	TPSMC91CA	160			
Resistance to Solder Heat (RSH)	TPSMB7.5A	60	260°C， 10secs	JESD22-A111	0/360
	TPSMB36CA	60			
	TPSMC13CA	60			
	TPSMC47CA	60			
	TPSMC62CA	60			
	TPSMC91CA	60			
Solderability	TPSMB7.5A	20	245°C ± 5°C, 5 ± 0.5s	J-STD002	0/120
	TPSMB36CA	20			
	TPSMC13CA	20			
	TPSMC47CA	20			
	TPSMC62CA	20			
	TPSMC91CA	20			

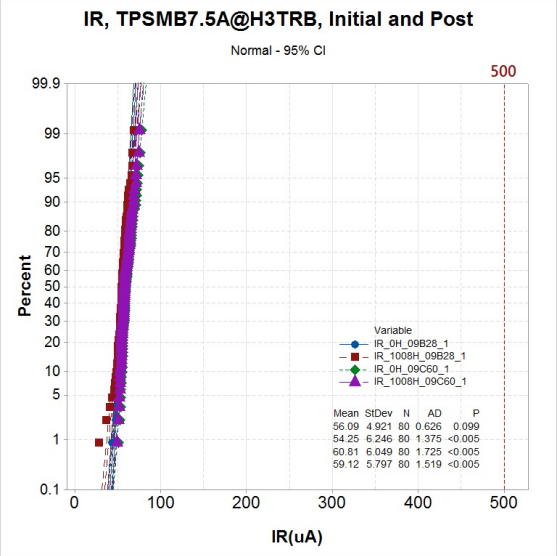
All qual vehicles pass reliability test and meet the drift requirement of AEC-Q101.

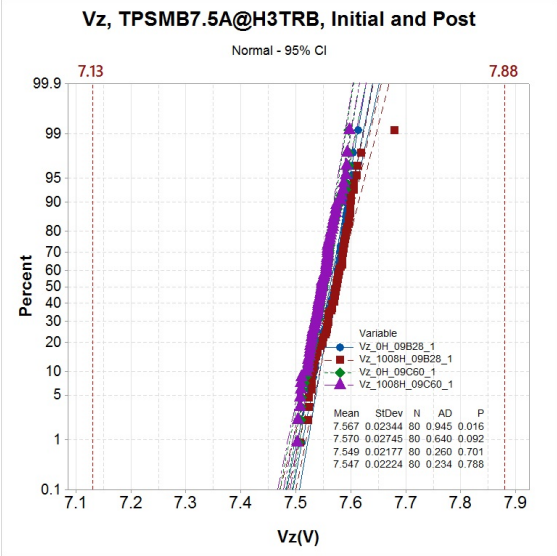
Appendix 1: Parameter drift and distribution in AEC-Q101 stress tests

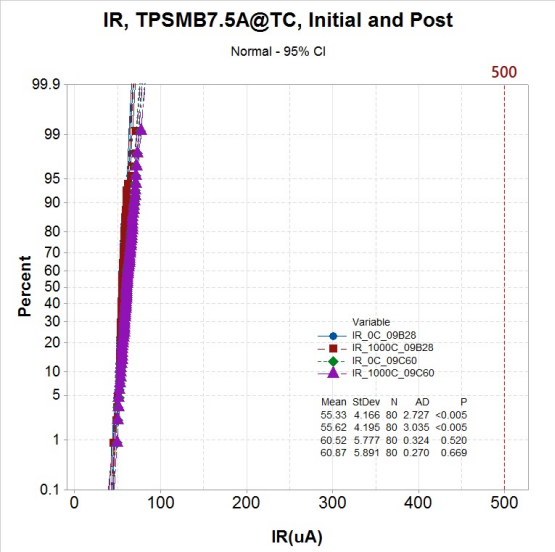
Note: The reference line is equal to or tighten than the specification defined in datasheet.

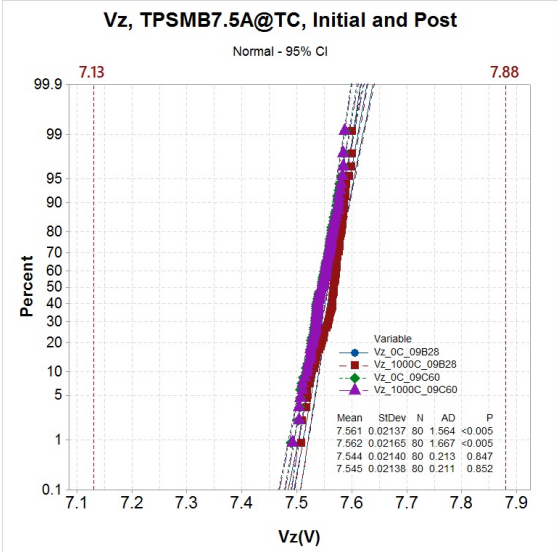


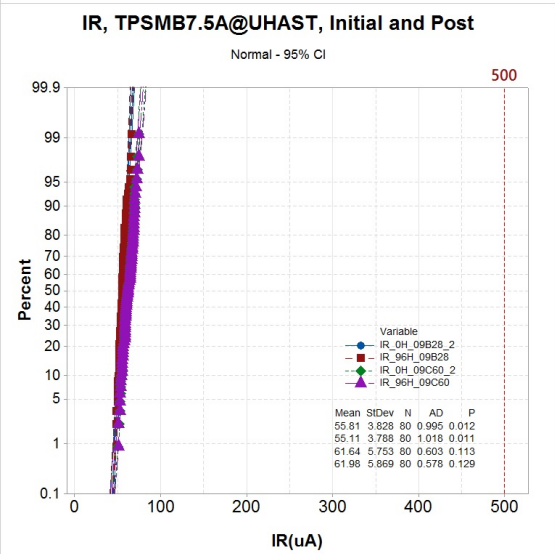


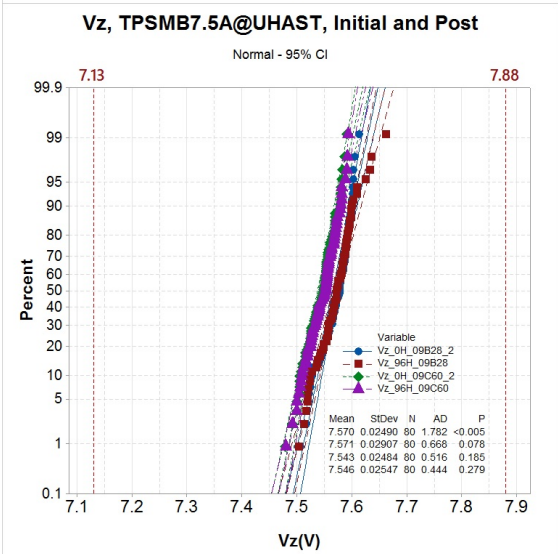


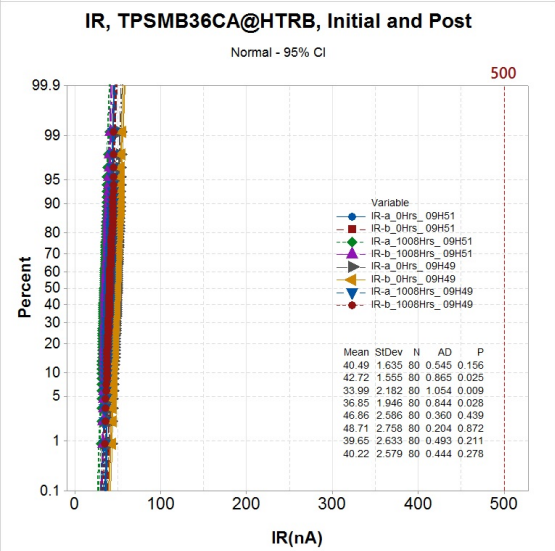


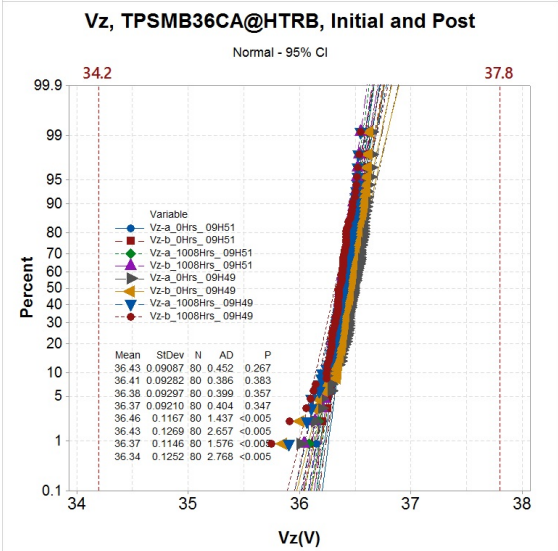

IR, TPSMB7.5A@TC, Initial and Post
Normal - 95% CI
500
Percent
IR(uA)
Variable
IR_0C_09B28
IR_1000C_09B28
IR_0C_09C60
IR_1000C_09C60
Mean StDev N AD P
55.33 4.166 80 2.727 <0.005
55.62 4.195 80 3.035 <0.005
60.52 5.777 80 0.324 0.520
60.87 5.891 80 0.270 0.669

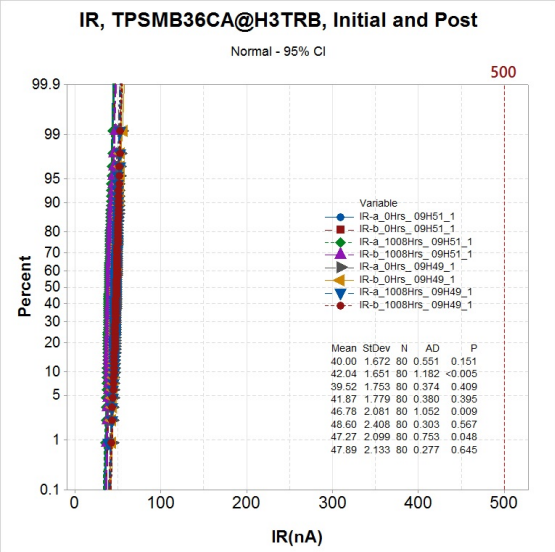

Vz, TPSMB7.5A@TC, Initial and Post
Normal - 95% CI
7.13
7.88
Percent
Vz(V)
Variable
Vz_0C_09B28
Vz_1000C_09B28
Vz_0C_09C60
Vz_1000C_09C60
Mean StDev N AD P
7.561 0.02137 80 1.564 <0.005
7.562 0.02165 80 1.667 <0.005
7.544 0.02140 80 0.213 0.847
7.545 0.02138 80 0.211 0.852

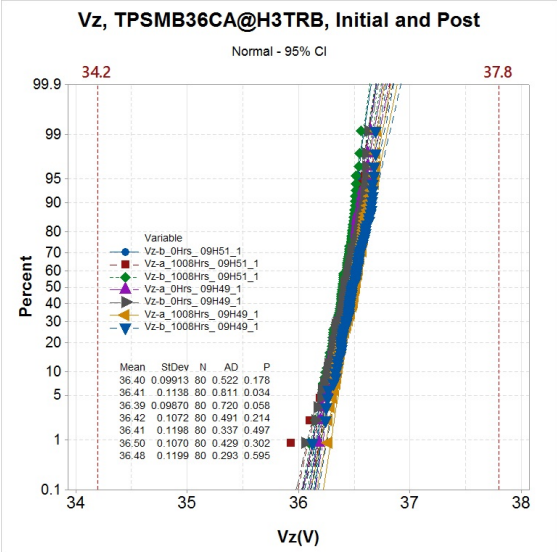

IR, TPSMB7.5A@UHAST, Initial and Post
Normal - 95% CI
500
Percent
IR(uA)
Variable
IR_0H_09B28_2
IR_96H_09B28
IR_0H_09C60_2
IR_96H_09C60
Mean StDev N AD P
55.81 3.828 80 0.995 0.012
55.11 3.788 80 1.018 0.011
61.64 5.753 80 0.603 0.113
61.98 5.869 80 0.578 0.129

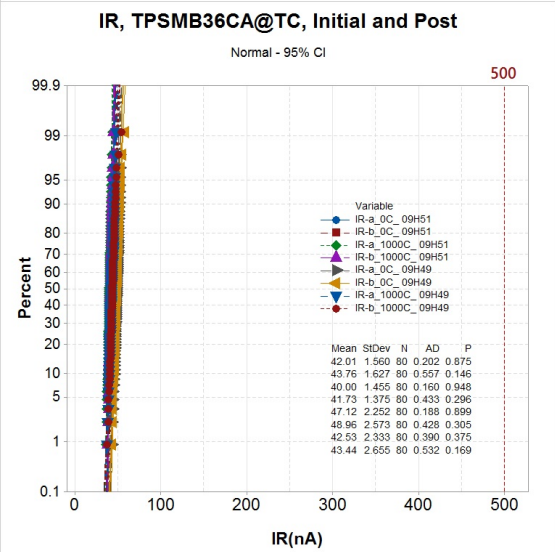

Vz, TPSMB7.5A@UHAST, Initial and Post
Normal - 95% CI
7.13
7.88
Percent
Vz(V)
Variable
Vz_0H_09B28_2
Vz_96H_09B28
Vz_0H_09C60_2
Vz_96H_09C60
Mean StDev N AD P
7.570 0.02490 80 1.782 <0.005
7.571 0.02907 80 0.668 0.078
7.543 0.02484 80 0.516 0.185
7.546 0.02547 80 0.444 0.279

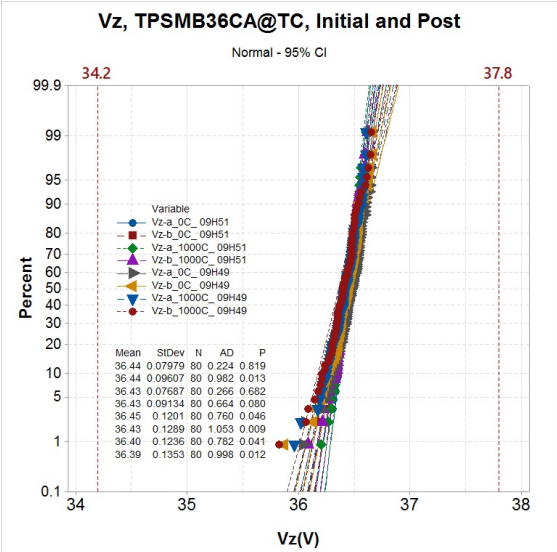

IR, TPSMB36CA@HTRB, Initial and Post
Normal - 95% CI
500
Percent
IR(nA)
Variable
IR-a_0Hrs_ 09H51
IR-b_0Hrs_ 09H51
IR-a_1008Hrs_ 09H51
IR-b_1008Hrs_ 09H51
IR-a_0Hrs_ 09H49
IR-b_0Hrs_ 09H49
IR-a_1008Hrs_ 09H49
IR-b_1008Hrs_ 09H49
Mean StDev N AD P
40.49 1.635 80 0.545 0.156
42.72 1.555 80 0.865 0.025
33.99 2.182 80 1.054 0.009
36.85 1.946 80 0.844 0.028
46.86 2.586 80 0.360 0.439
48.71 2.758 80 0.204 0.872
39.65 2.633 80 0.493 0.211
40.22 2.579 80 0.444 0.278

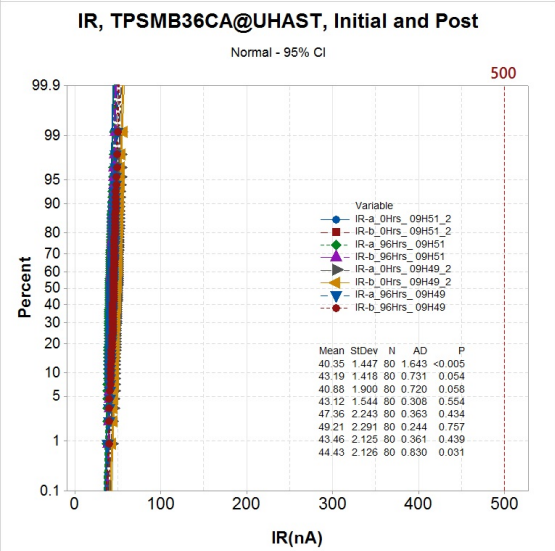

Vz, TPSMB36CA@HTRB, Initial and Post
Normal - 95% CI
34.2
37.8
Percent
Vz(V)
Variable
Vz-a_0Hrs_ 09H51
Vz-b_0Hrs_ 09H51
Vz-a_1008Hrs_ 09H51
Vz-b_1008Hrs_ 09H51
Vz-a_0Hrs_ 09H49
Vz-b_0Hrs_ 09H49
Vz-a_1008Hrs_ 09H49
Vz-b_1008Hrs_ 09H49
Mean StDev N AD P
36.43 0.09087 80 0.452 0.267
36.41 0.09282 80 0.386 0.383
36.38 0.09297 80 0.399 0.357
36.37 0.09210 80 0.404 0.347
36.46 0.1167 80 1.437 <0.005
36.43 0.1269 80 2.657 <0.005
36.37 0.1146 80 1.576 <0.005
36.34 0.1252 80 2.768 <0.005

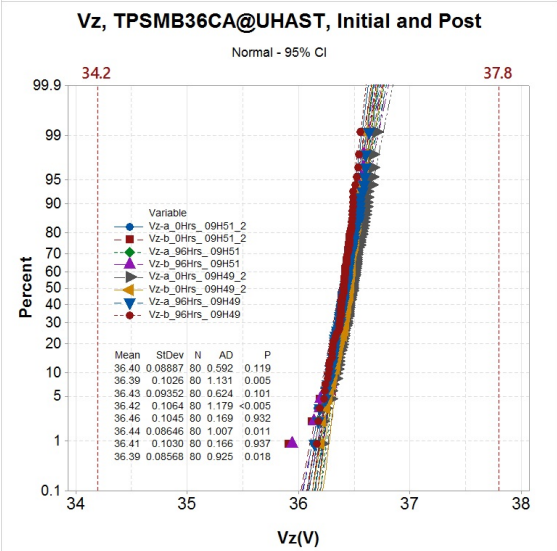

IR, TPSMB36CA@H3TRB, Initial and Post
Normal - 95% CI
500
Percent
IR(nA)
Variable
IR-a_0Hrs_ 09H51_1
IR-b_0Hrs_ 09H51_1
IR-a_1008Hrs_ 09H51_1
IR-b_1008Hrs_ 09H51_1
IR-a_0Hrs_ 09H49_1
IR-b_0Hrs_ 09H49_1
IR-a_1008Hrs_ 09H49_1
IR-b_1008Hrs_ 09H49_1
Mean StDev N AD P
40.00 1.672 80 0.551 0.151
42.04 1.651 80 1.182 <0.005
39.52 1.753 80 0.374 0.409
41.87 1.779 80 0.380 0.395
46.78 2.081 80 1.052 0.009
48.60 2.408 80 0.303 0.567
47.27 2.099 80 0.753 0.048
47.89 2.133 80 0.277 0.645

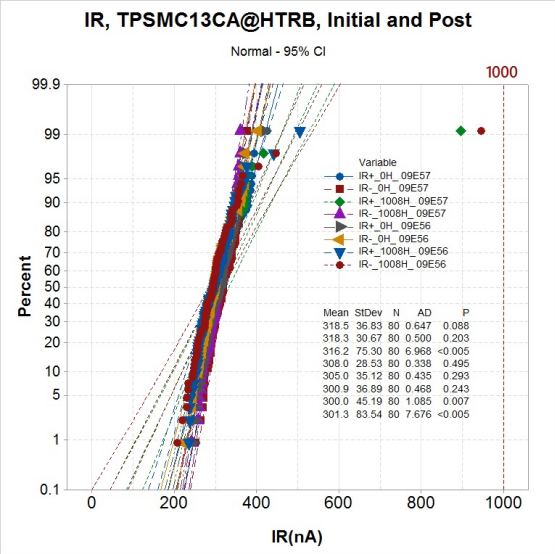

Vz, TPSMB36CA@H3TRB, Initial and Post
Normal - 95% CI
34.2
37.8
Percent
Vz(V)
Variable
Vz-b_0Hrs_ 09H51_1
Vz-a_1008Hrs_ 09H51_1
Vz-b_1008Hrs_ 09H51_1
Vz-a_0Hrs_ 09H49_1
Vz-b_0Hrs_ 09H49_1
Vz-a_1008Hrs_ 09H49_1
Vz-b_1008Hrs_ 09H49_1
Mean StDev N AD P
36.40 0.09913 80 0.522 0.178
36.41 0.1138 80 0.811 0.034
36.39 0.09870 80 0.720 0.058
36.42 0.1072 80 0.491 0.214
36.41 0.1198 80 0.337 0.497
36.50 0.1070 80 0.429 0.302
36.48 0.1199 80 0.293 0.595

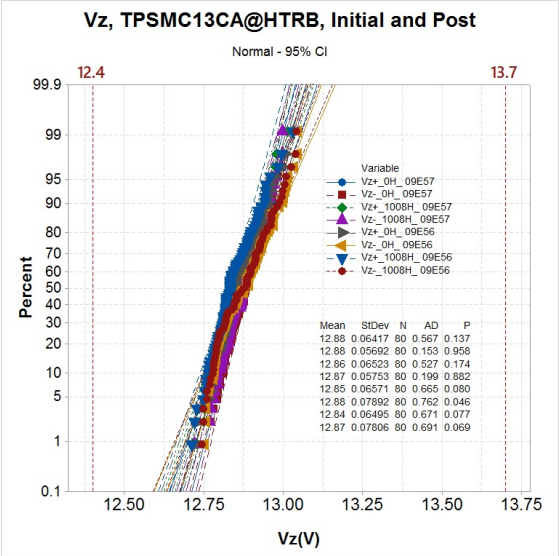

IR, TPSMB36CA@TC, Initial and Post
Normal - 95% CI
500
Percent
IR(nA)
Variable
IR-a_0C_ 09H51
IR-b_0C_ 09H51
IR-a_1000C_ 09H51
IR-b_1000C_ 09H51
IR-a_0C_ 09H49
IR-b_0C_ 09H49
IR-a_1000C_ 09H49
IR-b_1000C_ 09H49
Mean StDev N AD P
42.01 1.560 80 0.202 0.875
43.76 1.627 80 0.557 0.146
40.00 1.455 80 0.160 0.948
41.73 1.375 80 0.433 0.296
47.12 2.252 80 0.188 0.899
48.96 2.573 80 0.428 0.305
42.53 2.333 80 0.390 0.375
43.44 2.655 80 0.532 0.169

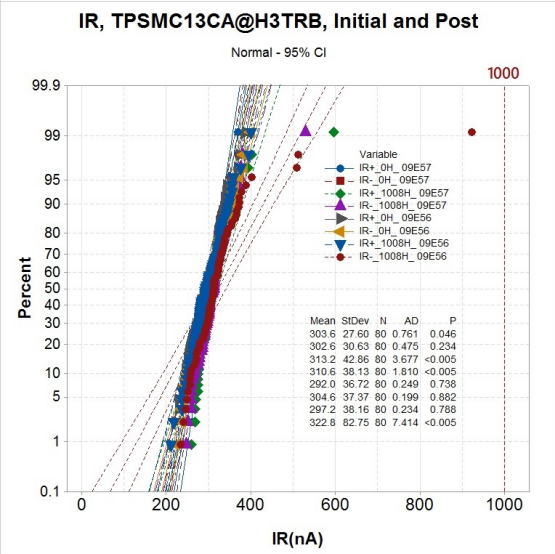

Vz, TPSMB36CA@TC, Initial and Post
Normal - 95% CI
34.2
37.8
Percent
Vz(V)
Variable
Vz-a_0C_ 09H51
Vz-b_0C_ 09H51
Vz-a_1000C_ 09H51
Vz-b_1000C_ 09H51
Vz-a_0C_ 09H49
Vz-b_0C_ 09H49
Vz-a_1000C_ 09H49
Vz-b_1000C_ 09H49
Mean StDev N AD P
36.44 0.07979 80 0.224 0.819
36.44 0.09607 80 0.982 0.013
36.43 0.07687 80 0.266 0.682
36.43 0.09134 80 0.664 0.080
36.45 0.1201 80 0.760 0.046
36.43 0.1289 80 1.053 0.009
36.40 0.1236 80 0.782 0.041
36.39 0.1353 80 0.998 0.012

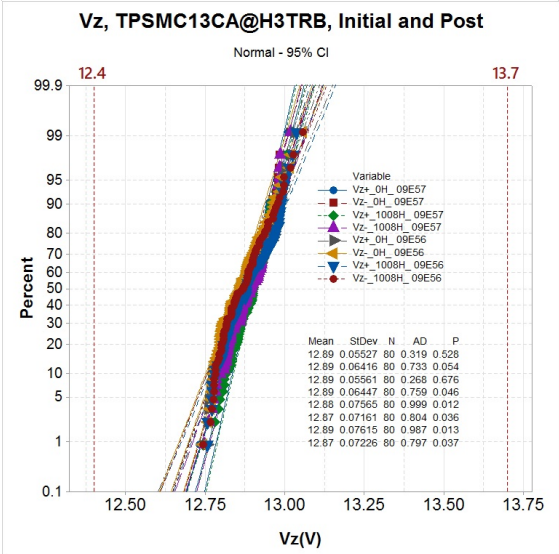

IR, TPSMB36CA@UHAST, Initial and Post
Normal - 95% CI
500
Percent
IR(nA)
Variable
IR-a_0Hrs_ 09H51_2
IR-b_0Hrs_ 09H51_2
IR-a_96Hrs_ 09H51
IR-b_96Hrs_ 09H51
IR-a_0Hrs_ 09H49_2
IR-b_0Hrs_ 09H49_2
IR-a_96Hrs_ 09H49
IR-b_96Hrs_ 09H49
Mean StDev N AD P
40.35 1.447 80 1.643 <0.005
43.19 1.418 80 0.731 0.054
40.88 1.900 80 0.720 0.058
43.12 1.544 80 0.308 0.554
47.36 2.243 80 0.363 0.434
49.21 2.291 80 0.244 0.757
43.46 2.125 80 0.361 0.439
44.43 2.126 80 0.830 0.031

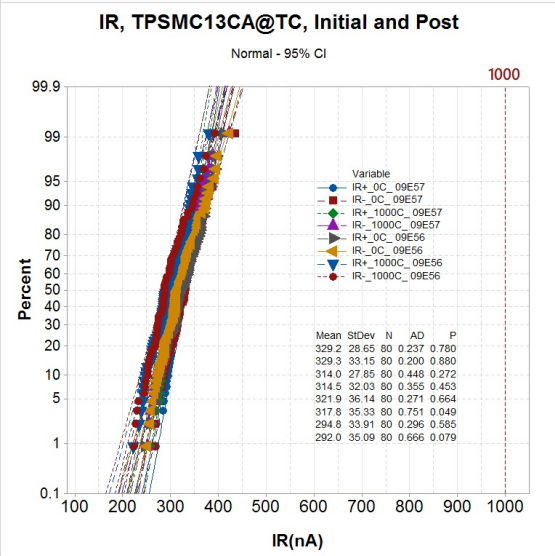

Vz, TPSMB36CA@UHAST, Initial and Post
Normal - 95% CI
34.2
37.8
Percent
Vz(V)
Variable
Vz-a_0Hrs_ 09H51_2
Vz-b_0Hrs_ 09H51_2
Vz-a_96Hrs_ 09H51
Vz-b_96Hrs_ 09H51
Vz-a_0Hrs_ 09H49_2
Vz-b_0Hrs_ 09H49_2
Vz-a_96Hrs_ 09H49
Vz-b_96Hrs_ 09H49
Mean StDev N AD P
36.40 0.08887 80 0.592 0.119
36.39 0.1026 80 1.131 0.005
36.43 0.09352 80 0.624 0.101
36.42 0.1064 80 1.179 <0.005
36.46 0.1045 80 0.169 0.932
36.44 0.08646 80 1.007 0.011
36.41 0.1030 80 0.166 0.937
36.39 0.08568 80 0.925 0.018

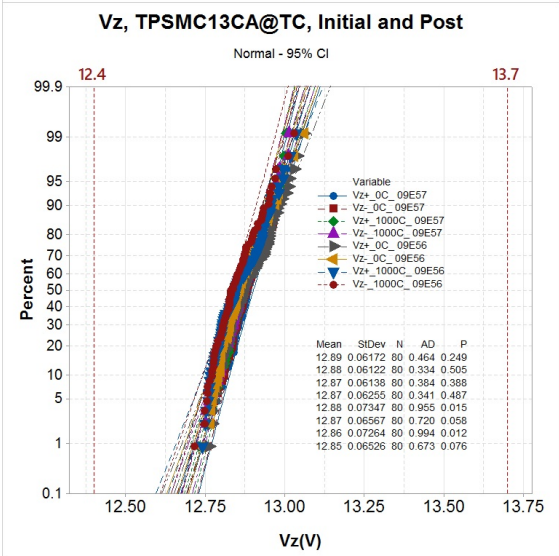

IR, TPSMC13CA@HTRB, Initial and Post
Normal - 95% CI
1000
Percent
IR(nA)
Variable
IR+_0H_09E57
IR-_0H_09E57
IR+_1008H_09E57
IR-_1008H_09E57
IR+_0H_09E56
IR-_0H_09E56
IR+_1008H_09E56
IR-_1008H_09E56
Mean StDev N AD P
318.5 36.83 80 0.647 0.088
318.3 30.67 80 0.500 0.203
316.2 75.30 80 6.968 <0.005
308.0 28.53 80 0.338 0.495
305.0 35.12 80 0.435 0.293
300.9 36.89 80 0.468 0.243
300.0 45.19 80 1.085 0.007
301.3 83.54 80 7.676 <0.005

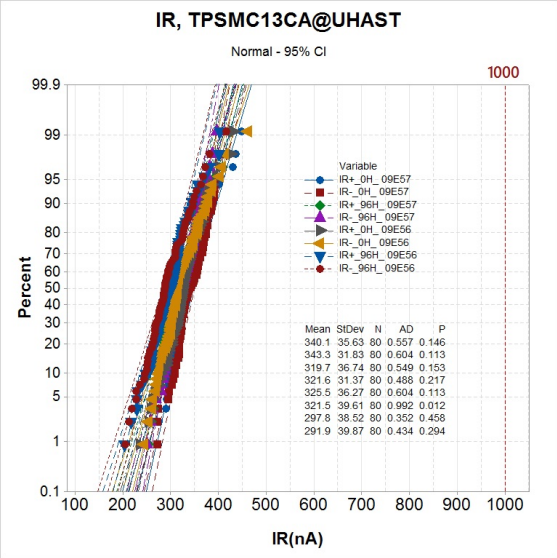

Vz, TPSMC13CA@HTRB, Initial and Post
Normal - 95% CI
12.4
13.7
Percent
Vz(V)
Variable
Vz+_0H_09E57
Vz-_0H_09E57
Vz+_1008H_09E57
Vz-_1008H_09E57
Vz+_0H_09E56
Vz-_0H_09E56
Vz+_1008H_09E56
Vz-_1008H_09E56
Mean StDev N AD P
12.88 0.06417 80 0.567 0.137
12.88 0.05692 80 0.153 0.958
12.86 0.06523 80 0.527 0.174
12.87 0.05753 80 0.199 0.882
12.85 0.06571 80 0.665 0.080
12.88 0.07892 80 0.762 0.046
12.84 0.06495 80 0.671 0.077
12.87 0.07806 80 0.691 0.069

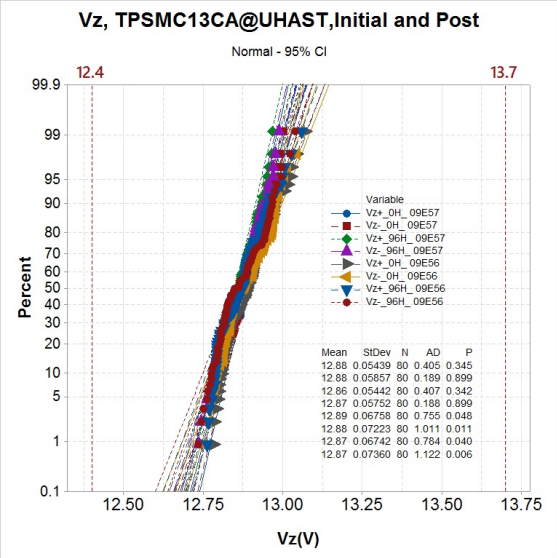

IR, TPSMC13CA@H3TRB, Initial and Post
Normal - 95% CI
1000
Percent
IR(nA)
Variable
IR+_0H_09E57
IR-_0H_09E57
IR+_1008H_09E57
IR-_1008H_09E57
IR+_0H_09E56
IR-_0H_09E56
IR+_1008H_09E56
IR-_1008H_09E56
Mean StDev N AD P
303.6 27.60 80 0.761 0.046
302.6 30.63 80 0.475 0.234
313.2 42.86 80 3.677 <0.005
310.6 38.13 80 1.810 <0.005
292.0 36.72 80 0.249 0.738
304.6 37.37 80 0.199 0.882
297.2 38.16 80 0.234 0.788
322.8 82.75 80 7.414 <0.005

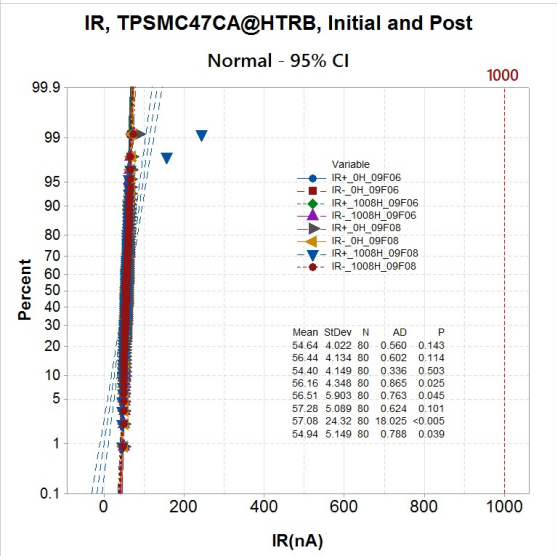

Vz, TPSMC13CA@H3TRB, Initial and Post
Normal - 95% CI
12.4
13.7
Percent
Vz(V)
Variable
Vz+_0H_09E57
Vz-_0H_09E57
Vz+_1008H_09E57
Vz-_1008H_09E57
Vz+_0H_09E56
Vz-_0H_09E56
Vz+_1008H_09E56
Vz-_1008H_09E56
Mean StDev N AD P
12.89 0.05527 80 0.319 0.528
12.89 0.06416 80 0.733 0.054
12.89 0.05561 80 0.268 0.676
12.89 0.06447 80 0.759 0.046
12.88 0.07565 80 0.999 0.012
12.87 0.07161 80 0.804 0.036
12.89 0.07615 80 0.987 0.013
12.87 0.07226 80 0.797 0.037

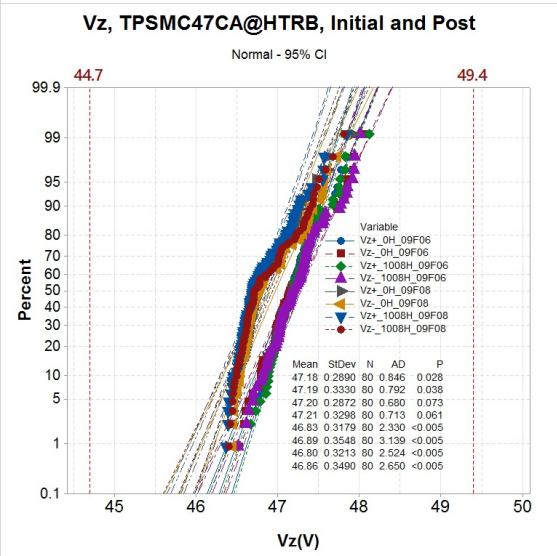

IR, TPSMC13CA@TC, Initial and Post
Normal - 95% CI
1000
Percent
IR(nA)
Variable
IR+_0C_09E57
IR-_0C_09E57
IR+_1000C_09E57
IR-_1000C_09E57
IR+_0C_09E56
IR-_0C_09E56
IR+_1000C_09E56
IR-_1000C_09E56
Mean StDev N AD P
329.2 28.65 80 0.237 0.780
329.3 33.15 80 0.200 0.880
314.0 27.85 80 0.448 0.272
314.5 32.03 80 0.355 0.453
321.9 36.14 80 0.271 0.664
317.8 35.33 80 0.751 0.049
294.8 33.91 80 0.296 0.585
292.0 35.09 80 0.666 0.079

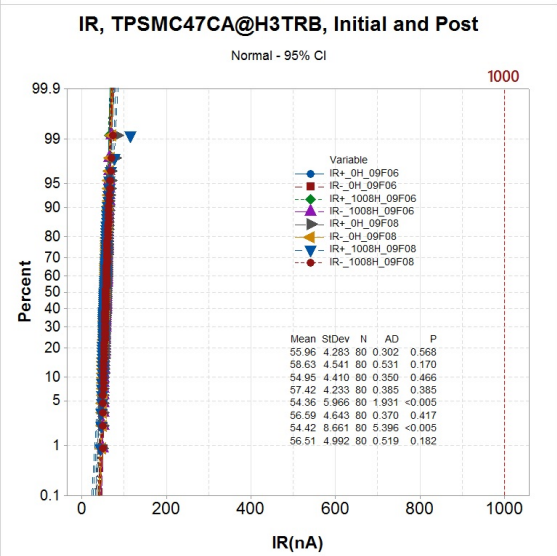

Vz, TPSMC13CA@TC, Initial and Post
Normal - 95% CI
12.4
13.7
Percent
Vz(V)
Variable
Vz+_0C_09E57
Vz-_0C_09E57
Vz+_1000C_09E57
Vz-_1000C_09E57
Vz+_0C_09E56
Vz-_0C_09E56
Vz+_1000C_09E56
Vz-_1000C_09E56
Mean StDev N AD P
12.89 0.06172 80 0.464 0.249
12.88 0.06122 80 0.334 0.505
12.87 0.06138 80 0.384 0.388
12.87 0.06255 80 0.341 0.487
12.88 0.07347 80 0.955 0.015
12.87 0.06567 80 0.720 0.058
12.86 0.07264 80 0.994 0.012
12.85 0.06526 80 0.673 0.076

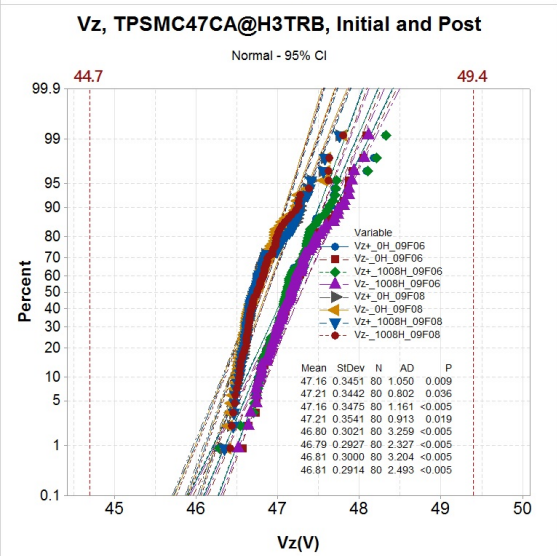

IR, TPSMC13CA@UHAST
Normal - 95% CI
1000
Percent
IR(nA)
Variable
IR+_0H_ 09E57
IR-_0H_ 09E57
IR+_96H_ 09E57
IR-_96H_ 09E57
IR+_0H_ 09E56
IR-_0H_ 09E56
IR+_96H_ 09E56
IR-_96H_ 09E56
Mean StDev N AD P
340.1 35.63 80 0.557 0.146
343.3 31.83 80 0.604 0.113
319.7 36.74 80 0.549 0.153
321.6 31.37 80 0.488 0.217
325.5 36.27 80 0.604 0.113
321.5 39.61 80 0.992 0.012
297.8 38.52 80 0.352 0.458
291.9 39.87 80 0.434 0.294

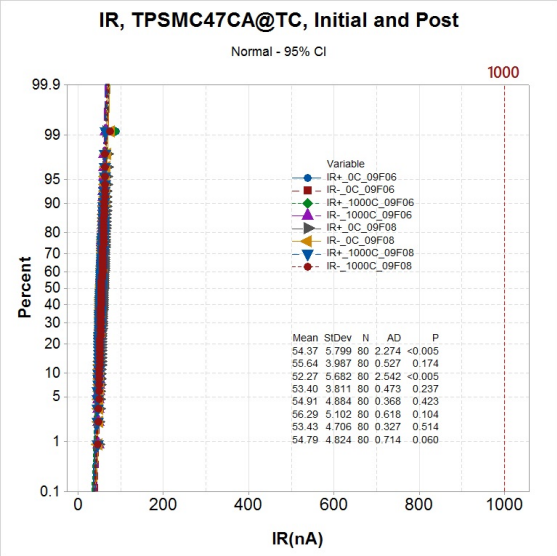

Vz, TPSMC13CA@UHAST,Initial and Post
Normal - 95% CI
12.4
13.7
Percent
Vz(V)
Variable
Vz+_0H_ 09E57
Vz-_0H_ 09E57
Vz+_96H_ 09E57
Vz-_96H_ 09E57
Vz+_0H_ 09E56
Vz-_0H_ 09E56
Vz+_96H_ 09E56
Vz-_96H_ 09E56
Mean StDev N AD P
12.88 0.05439 80 0.405 0.345
12.88 0.05857 80 0.189 0.899
12.86 0.05442 80 0.407 0.342
12.87 0.05752 80 0.188 0.899
12.89 0.06758 80 0.755 0.048
12.88 0.07223 80 1.011 0.011
12.87 0.06742 80 0.784 0.040
12.87 0.07360 80 1.122 0.006

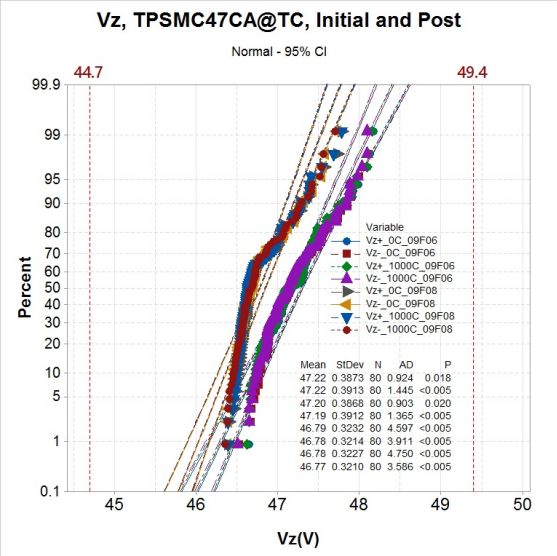

IR, TPSMC47CA@HTRB, Initial and Post
Normal - 95% CI
1000
Percent
IR(nA)
Variable
IR+_0H_09F06
IR-_0H_09F06
IR+_1008H_09F06
IR-_1008H_09F06
IR+_0H_09F08
IR-_0H_09F08
IR+_1008H_09F08
IR-_1008H_09F08
Mean StDev N AD P
54.64 4.022 80 0.560 0.143
56.44 4.134 80 0.602 0.114
54.40 4.149 80 0.336 0.503
56.16 4.348 80 0.865 0.025
56.51 5.903 80 0.763 0.045
57.28 5.089 80 0.624 0.101
57.08 24.32 80 18.025 <0.005
54.94 5.149 80 0.788 0.039

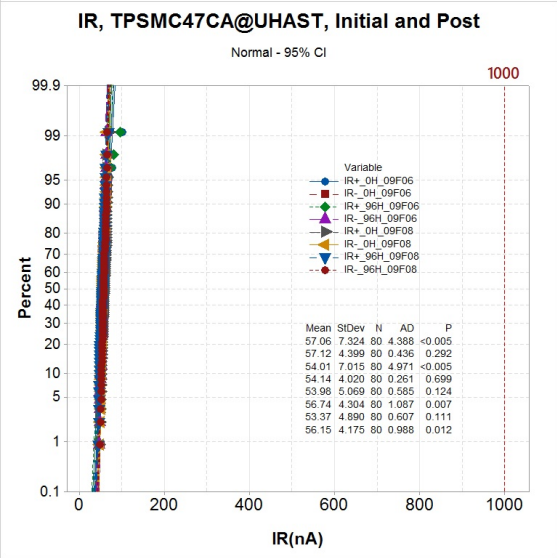

Vz, TPSMC47CA@HTRB, Initial and Post
Normal - 95% CI
44.7
49.4
Percent
Vz(V)
Variable
Vz+_0H_09F06
Vz-_0H_09F06
Vz+_1008H_09F06
Vz-_1008H_09F06
Vz+_0H_09F08
Vz-_0H_09F08
Vz+_1008H_09F08
Vz-_1008H_09F08
Mean StDev N AD P
47.18 0.2890 80 0.846 0.028
47.19 0.3330 80 0.792 0.038
47.20 0.2872 80 0.680 0.073
47.21 0.3298 80 0.713 0.061
46.83 0.3179 80 2.330 <0.005
46.89 0.3548 80 3.139 <0.005
46.80 0.3213 80 2.524 <0.005
46.86 0.3490 80 2.650 <0.005

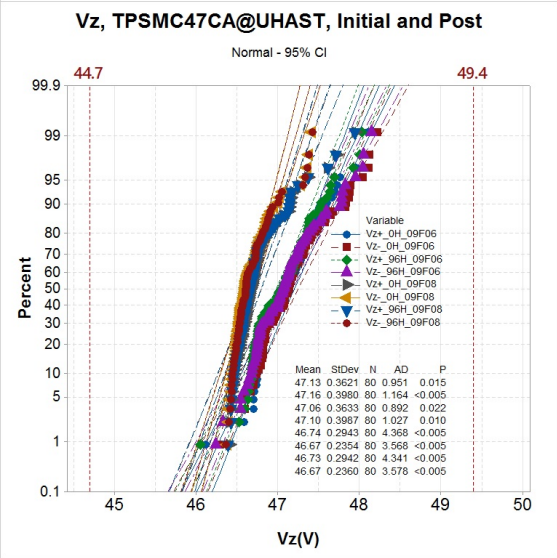

IR, TPSMC47CA@H3TRB, Initial and Post
Normal - 95% CI
1000
Percent
IR(nA)
Variable
IR+_0H_09F06
IR-_0H_09F06
IR+_1008H_09F06
IR-_1008H_09F06
IR+_0H_09F08
IR-_0H_09F08
IR+_1008H_09F08
IR-_1008H_09F08
Mean StDev N AD P
55.96 4.283 80 0.302 0.568
58.63 4.541 80 0.531 0.170
54.95 4.410 80 0.350 0.466
57.42 4.233 80 0.385 0.385
54.36 5.966 80 1.931 <0.005
56.59 4.643 80 0.370 0.417
54.42 8.661 80 5.396 <0.005
56.51 4.992 80 0.519 0.182

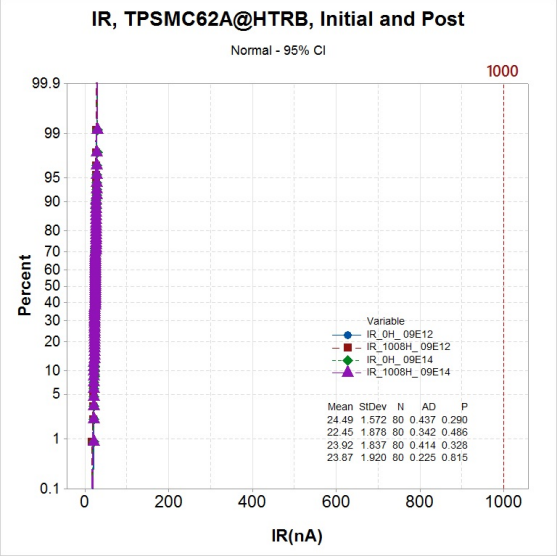

Vz, TPSMC47CA@H3TRB, Initial and Post
Normal - 95% CI
44.7
49.4
Percent
Vz(V)
Variable
Vz+_0H_09F06
Vz-_0H_09F06
Vz+_1008H_09F06
Vz-_1008H_09F06
Vz+_0H_09F08
Vz-_0H_09F08
Vz+_1008H_09F08
Vz-_1008H_09F08
Mean StDev N AD P
47.16 0.3451 80 1.050 0.009
47.21 0.3442 80 0.802 0.036
47.16 0.3475 80 1.161 <0.005
47.21 0.3541 80 0.913 0.019
46.80 0.3021 80 3.259 <0.005
46.79 0.2927 80 2.327 <0.005
46.81 0.3000 80 3.204 <0.005
46.81 0.2914 80 2.493 <0.005

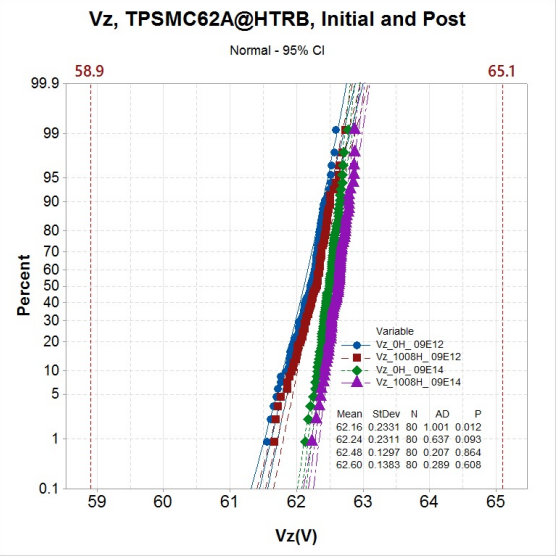

IR, TPSMC47CA@TC, Initial and Post
Normal - 95% CI
1000
Percent
IR(nA)
Variable
IR+_0C_09F06
IR-_0C_09F06
IR+_1000C_09F06
IR-_1000C_09F06
IR+_0C_09F08
IR-_0C_09F08
IR+_1000C_09F08
IR-_1000C_09F08
Mean StDev N AD P
54.37 5.799 80 2.274 <0.005
55.64 3.987 80 0.527 0.174
52.27 5.682 80 2.542 <0.005
53.40 3.811 80 0.473 0.237
54.91 4.884 80 0.368 0.423
56.29 5.102 80 0.618 0.104
53.43 4.706 80 0.327 0.514
54.79 4.824 80 0.714 0.060

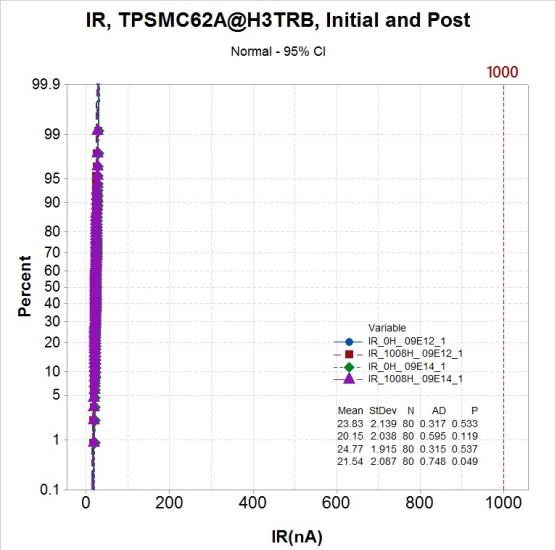

Vz, TPSMC47CA@TC, Initial and Post
Normal - 95% CI
44.7
49.4
Percent
Vz(V)
Variable
Vz+_0C_09F06
Vz-_0C_09F06
Vz+_1000C_09F06
Vz-_1000C_09F06
Vz+_0C_09F08
Vz-_0C_09F08
Vz+_1000C_09F08
Vz-_1000C_09F08
Mean StDev N AD P
47.22 0.3873 80 0.924 0.018
47.22 0.3913 80 1.445 <0.005
47.20 0.3868 80 0.903 0.020
47.19 0.3912 80 1.365 <0.005
46.79 0.3232 80 4.597 <0.005
46.78 0.3214 80 3.911 <0.005
46.78 0.3227 80 4.750 <0.005
46.77 0.3210 80 3.586 <0.005

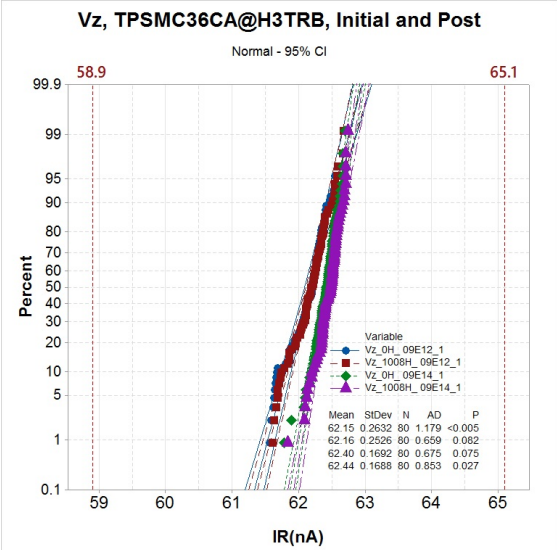

IR, TPSMC47CA@UHAST, Initial and Post
Normal - 95% CI
1000
Percent
IR(nA)
Variable
IR+_0H_09F06
IR-_0H_09F06
IR+_96H_09F06
IR-_96H_09F06
IR+_0H_09F08
IR-_0H_09F08
IR+_96H_09F08
IR-_96H_09F08
Mean StDev N AD P
57.06 7.324 80 4.388 <0.005
57.12 4.399 80 0.436 0.292
54.01 7.015 80 4.971 <0.005
54.14 4.020 80 0.261 0.699
53.98 5.069 80 0.585 0.124
56.74 4.304 80 1.087 0.007
53.37 4.890 80 0.607 0.111
56.15 4.175 80 0.988 0.012

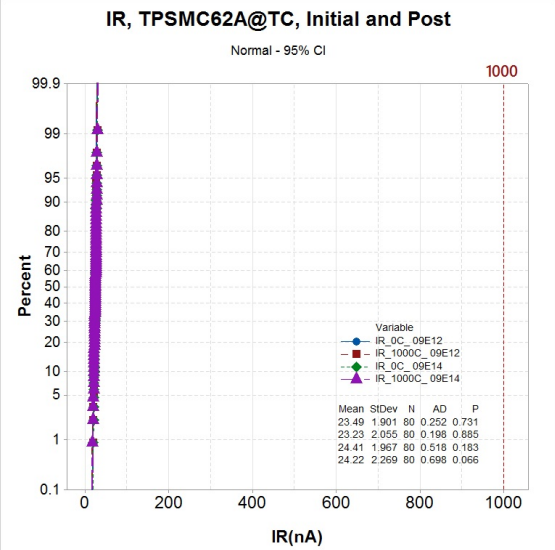

Vz, TPSMC47CA@UHAST, Initial and Post
Normal - 95% CI
44.7
49.4
Percent
Vz(V)
Variable
Vz+_0H_09F06
Vz-_0H_09F06
Vz+_96H_09F06
Vz-_96H_09F06
Vz+_0H_09F08
Vz-_0H_09F08
Vz+_96H_09F08
Vz-_96H_09F08
Mean StDev N AD P
47.13 0.3621 80 0.951 0.015
47.16 0.3980 80 1.164 <0.005
47.06 0.3633 80 0.892 0.022
47.10 0.3987 80 1.027 0.010
46.74 0.2943 80 4.368 <0.005
46.67 0.2354 80 3.568 <0.005
46.73 0.2942 80 4.341 <0.005
46.67 0.2360 80 3.578 <0.005

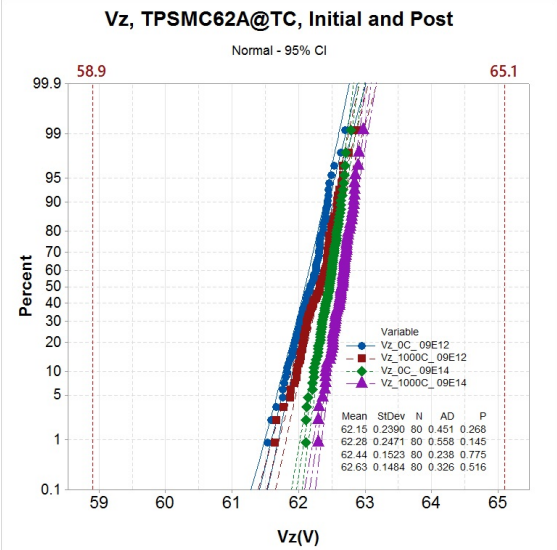

IR, TPSMC62A@HTRB, Initial and Post
Normal - 95% CI
1000
Percent
IR(nA)
Variable
IR_0H_ 09E12
IR_1008H_ 09E12
IR_0H_ 09E14
IR_1008H_ 09E14
Mean StDev N AD P
24.49 1.572 80 0.437 0.290
22.45 1.878 80 0.342 0.486
23.92 1.837 80 0.414 0.328
23.87 1.920 80 0.225 0.815

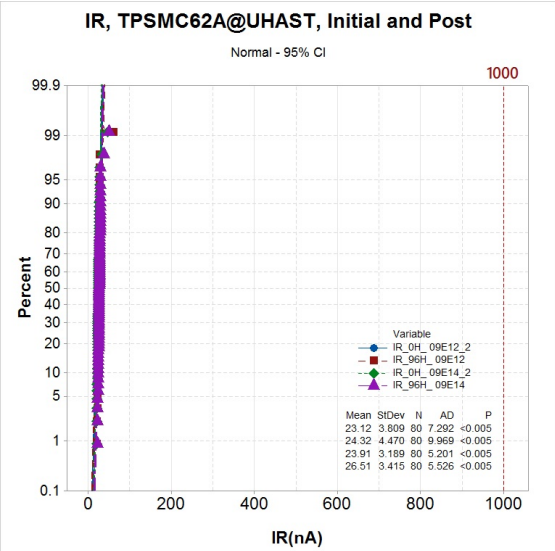

Vz, TPSMC62A@HTRB, Initial and Post
Normal - 95% CI
58.9
65.1
Percent
Vz(V)
Variable
Vz_0H_ 09E12
Vz_1008H_ 09E12
Vz_0H_ 09E14
Vz_1008H_ 09E14
Mean StDev N AD P
62.16 0.2331 80 1.001 0.012
62.24 0.2311 80 0.637 0.093
62.48 0.1297 80 0.207 0.864
62.60 0.1383 80 0.289 0.608

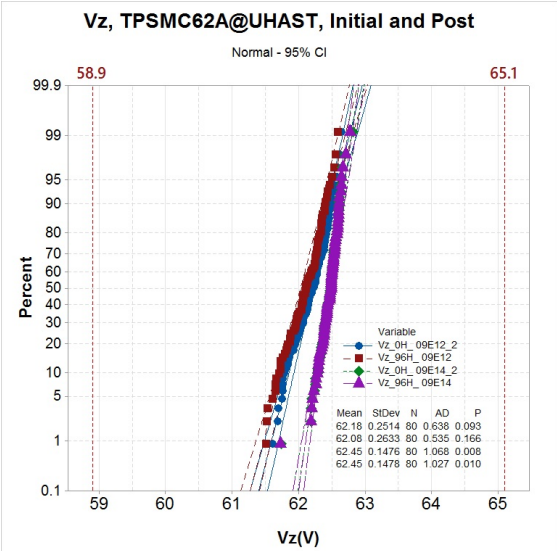

IR, TPSMC62A@H3TRB, Initial and Post
Normal - 95% CI
1000
Percent
IR(nA)
Variable
IR_0H_ 09E12_1
IR_1008H_ 09E12_1
IR_0H_ 09E14_1
IR_1008H_ 09E14_1
Mean StDev N AD P
23.83 2.139 80 0.317 0.533
20.15 2.038 80 0.595 0.119
24.77 1.915 80 0.315 0.537
21.54 2.087 80 0.748 0.049

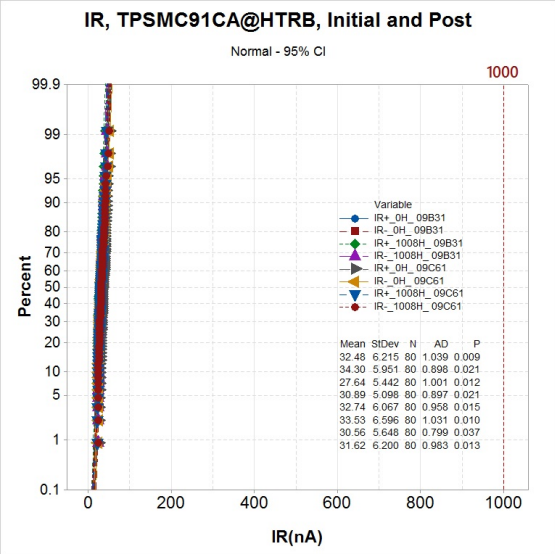

Vz, TPSMC36CA@H3TRB, Initial and Post
Normal - 95% CI
58.9
65.1
Percent
IR(nA)
Variable
Vz_0H_ 09E12_1
Vz_1008H_ 09E12_1
Vz_0H_ 09E14_1
Vz_1008H_ 09E14_1
Mean StDev N AD P
62.15 0.2632 80 1.179 <0.005
62.16 0.2526 80 0.659 0.082
62.40 0.1692 80 0.675 0.075
62.44 0.1688 80 0.853 0.027

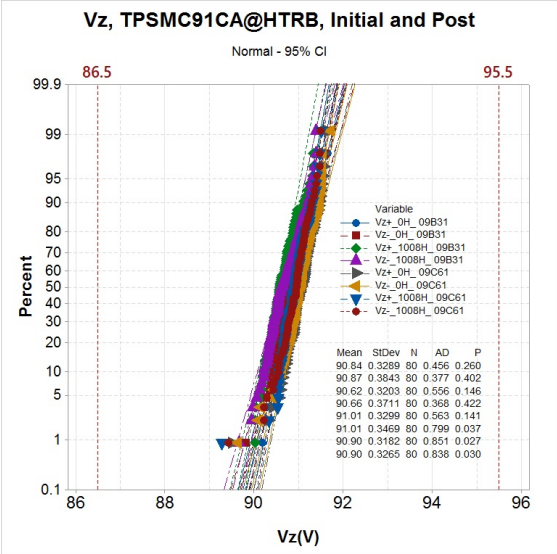

IR, TPSMC62A@TC, Initial and Post
Normal - 95% CI
1000
Percent
IR(nA)
Variable
IR_0C_ 09E12
IR_1000C_ 09E12
IR_0C_ 09E14
IR_1000C_ 09E14
Mean StDev N AD P
23.49 1.901 80 0.252 0.731
23.23 2.055 80 0.198 0.885
24.41 1.967 80 0.518 0.183
24.22 2.269 80 0.698 0.066

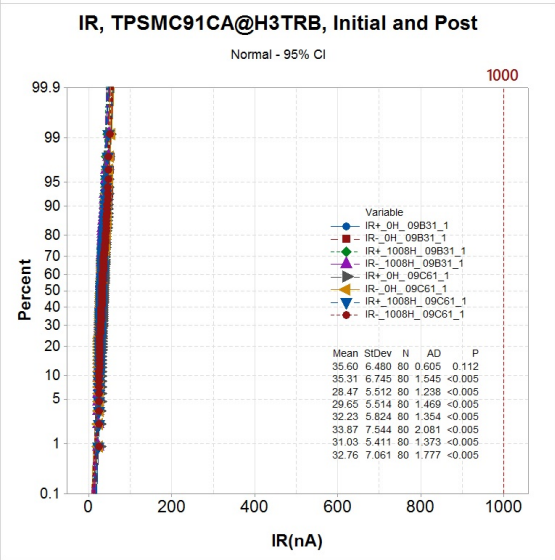

Vz, TPSMC62A@TC, Initial and Post
Normal - 95% CI
58.9
65.1
Percent
Vz(V)
Variable
Vz_0C_ 09E12
Vz_1000C_ 09E12
Vz_0C_ 09E14
Vz_1000C_ 09E14
Mean StDev N AD P
62.15 0.2390 80 0.451 0.268
62.28 0.2471 80 0.558 0.145
62.44 0.1523 80 0.238 0.775
62.63 0.1484 80 0.326 0.516

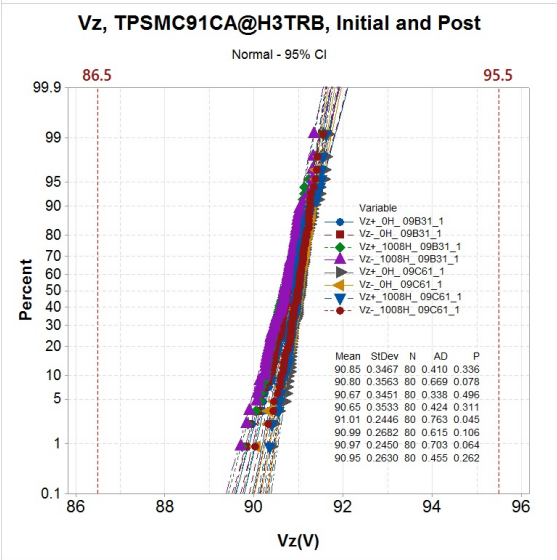

IR, TPSMC62A@UHAST, Initial and Post
Normal - 95% CI
1000
Percent
IR(nA)
Variable
IR_0H_ 09E12_2
IR_96H_ 09E12
IR_0H_ 09E14_2
IR_96H_ 09E14
Mean StDev N AD P
23.12 3.809 80 7.292 <0.005
24.32 4.470 80 9.969 <0.005
23.91 3.189 80 5.201 <0.005
26.51 3.415 80 5.526 <0.005

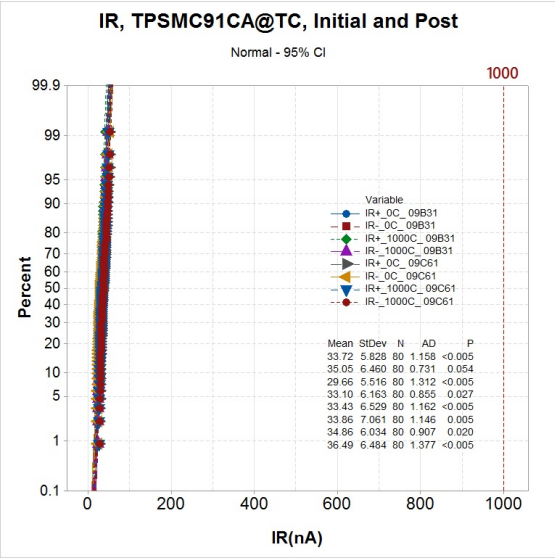

Vz, TPSMC62A@UHAST, Initial and Post
Normal - 95% CI
58.9
65.1
Percent
Vz(V)
Variable
Vz_0H_ 09E12_2
Vz_96H_ 09E12
Vz_0H_ 09E14_2
Vz_96H_ 09E14
Mean StDev N AD P
62.18 0.2514 80 0.638 0.093
62.08 0.2633 80 0.535 0.166
62.45 0.1476 80 1.068 0.008
62.45 0.1478 80 1.027 0.010

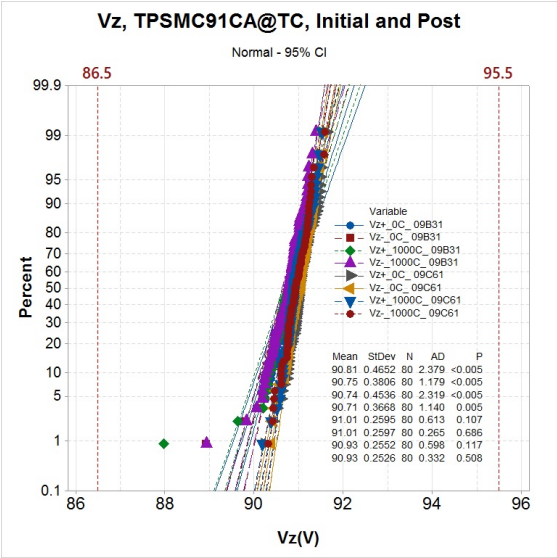

IR, TPSMC91CA@HTRB, Initial and Post
Normal - 95% CI
1000
Percent
IR(nA)
Variable
IR+_0H_ 09B31
IR-_0H_ 09B31
IR+_1008H_ 09B31
IR-_1008H_ 09B31
IR+_0H_ 09C61
IR-_0H_ 09C61
IR+_1008H_ 09C61
IR-_1008H_ 09C61
Mean StDev N AD P
32.48 6.215 80 1.039 0.009
34.30 5.951 80 0.898 0.021
27.64 5.442 80 1.001 0.012
30.89 5.098 80 0.897 0.021
32.74 6.067 80 0.958 0.015
33.53 6.596 80 1.031 0.010
30.56 5.648 80 0.799 0.037
31.62 6.200 80 0.983 0.013

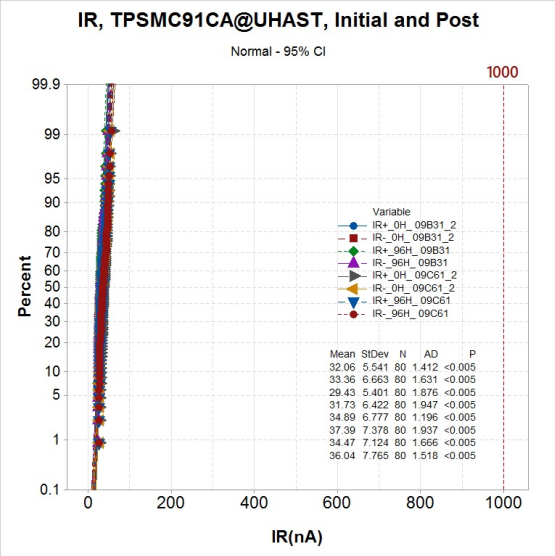

Vz, TPSMC91CA@HTRB, Initial and Post
Normal - 95% CI
86.5
95.5
Percent
Vz(V)
Variable
Vz+_0H_ 09B31
Vz-_0H_ 09B31
Vz+_1008H_ 09B31
Vz-_1008H_ 09B31
Vz+_0H_ 09C61
Vz-_0H_ 09C61
Vz+_1008H_ 09C61
Vz-_1008H_ 09C61
Mean StDev N AD P
90.84 0.3289 80 0.456 0.260
90.87 0.3843 80 0.377 0.402
90.62 0.3203 80 0.556 0.146
90.66 0.3711 80 0.368 0.422
91.01 0.3299 80 0.563 0.141
91.01 0.3469 80 0.799 0.037
90.90 0.3182 80 0.851 0.027
90.90 0.3265 80 0.838 0.030

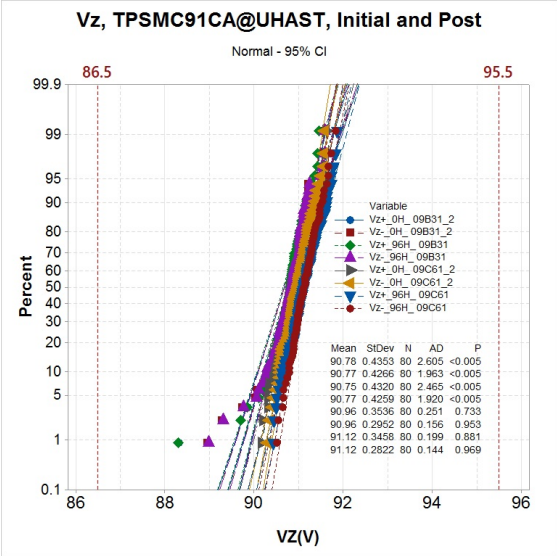

IR, TPSMC91CA@H3TRB, Initial and Post
Normal - 95% CI
1000
Percent
IR(nA)
Variable
IR+_0H_ 09B31_1
IR-_0H_ 09B31_1
IR+_1008H_ 09B31_1
IR-_1008H_ 09B31_1
IR+_0H_ 09C61_1
IR-_0H_ 09C61_1
IR+_1008H_ 09C61_1
IR-_1008H_ 09C61_1
Mean StDev N AD P
35.60 6.480 80 0.605 0.112
35.31 6.745 80 1.545 <0.005
28.47 5.512 80 1.238 <0.005
29.65 5.514 80 1.469 <0.005
32.23 5.824 80 1.354 <0.005
33.87 7.544 80 2.081 <0.005
31.03 5.411 80 1.373 <0.005
32.76 7.061 80 1.777 <0.005


Vz, TPSMC91CA@H3TRB, Initial and Post
Normal - 95% CI
86.5
95.5
Percent
Vz(V)
Variable
Vz+_0H_ 09B31_1
Vz-_0H_ 09B31_1
Vz+_1008H_ 09B31_1
Vz-_1008H_ 09B31_1
Vz+_0H_ 09C61_1
Vz-_0H_ 09C61_1
Vz+_1008H_ 09C61_1
Vz-_1008H_ 09C61_1
Mean StDev N AD P
90.85 0.3467 80 0.410 0.336
90.80 0.3563 80 0.669 0.078
90.67 0.3451 80 0.338 0.496
90.65 0.3533 80 0.424 0.311
91.01 0.2446 80 0.763 0.045
90.99 0.2682 80 0.615 0.106
90.97 0.2450 80 0.703 0.064
90.95 0.2630 80 0.455 0.262


IR, TPSMC91CA@TC, Initial and Post
Normal - 95% CI
1000
Percent
IR(nA)
Variable
IR+_0C_ 09B31
IR-_0C_ 09B31
IR+_1000C_ 09B31
IR-_1000C_ 09B31
IR+_0C_ 09C61
IR-_0C_ 09C61
IR+_1000C_ 09C61
IR-_1000C_ 09C61
Mean StDev N AD P
33.72 5.828 80 1.158 <0.005
35.05 6.460 80 0.731 0.054
29.66 5.516 80 1.312 <0.005
33.10 6.163 80 0.855 0.027
33.43 6.529 80 1.162 <0.005
33.86 7.061 80 1.146 0.005
34.86 6.034 80 0.907 0.020
36.49 6.484 80 1.377 <0.005


Vz, TPSMC91CA@TC, Initial and Post
Normal - 95% CI
86.5
95.5
Percent
Vz(V)
Variable
Vz+_0C_ 09B31
Vz-_0C_ 09B31
Vz+_1000C_ 09B31
Vz-_1000C_ 09B31
Vz+_0C_ 09C61
Vz-_0C_ 09C61
Vz+_1000C_ 09C61
Vz-_1000C_ 09C61
Mean StDev N AD P
90.81 0.4652 80 2.379 <0.005
90.75 0.3806 80 1.179 <0.005
90.74 0.4536 80 2.319 <0.005
90.71 0.3668 80 1.140 0.005
91.01 0.2595 80 0.613 0.107
91.01 0.2597 80 0.265 0.686
90.93 0.2552 80 0.598 0.117
90.93 0.2526 80 0.332 0.508


IR, TPSMC91CA@UHAST, Initial and Post
Normal - 95% CI
1000
Percent
IR(nA)
Variable
IR+_0H_09B31_2
IR-_0H_09B31_2
IR+_96H_09B31
IR-_96H_09B31
IR+_0H_09C61_2
IR-_0H_09C61_2
IR+_96H_09C61
IR-_96H_09C61
Mean StDev N AD P
32.06 5.541 80 1.412 <0.005
33.36 6.663 80 1.631 <0.005
29.43 5.401 80 1.876 <0.005
31.73 6.422 80 1.947 <0.005
34.89 6.777 80 1.196 <0.005
37.39 7.378 80 1.937 <0.005
34.47 7.124 80 1.666 <0.005
36.04 7.765 80 1.518 <0.005


Vz, TPSMC91CA@UHAST, Initial and Post
Normal - 95% CI
86.5
95.5
Percent
VZ(V)
Variable
Vz+_0H_09B31_2
Vz-_0H_09B31_2
Vz+_96H_09B31
Vz-_96H_09B31
Vz+_0H_09C61_2
Vz-_0H_09C61_2
Vz+_96H_09C61
Vz-_96H_09C61
Mean StDev N AD P
90.78 0.4353 80 2.605 <0.005
90.77 0.4266 80 1.963 <0.005
90.75 0.4320 80 2.465 <0.005
90.77 0.4259 80 1.920 <0.005
90.96 0.3536 80 0.251 0.733
90.96 0.2952 80 0.156 0.953
91.12 0.3458 80 0.199 0.881
91.12 0.2822 80 0.144 0.969

Appendix 2: Affected PN list

TPSMB		TPSMB-VR		TPSMC		TPSMC-VR	
TPSMB7.5A	TPSMB56CA	TPSMB6.5A-VR	TPSMB36A-VR	TPSMC12A	TPSMC82A	TPSMC11A-VR	TPSMC51A-VR
TPSMB8.2A	TPSMB58A	TPSMB7.0A-VR	TPSMB36CA-VR	TPSMC12CA	TPSMC82CA	TPSMC11CA-VR	TPSMC51CA-VR
TPSMB9.1A	TPSMB58CA	TPSMB7.5A-VR	TPSMB40A-VR	TPSMC13A	TPSMC91A	TPSMC12A-VR	TPSMC54A-VR
TPSMB10A	TPSMB62A	TPSMB8.0A-VR	TPSMB40CA-VR	TPSMC13CA	TPSMC91CA	TPSMC12CA-VR	TPSMC54CA-VR
TPSMB10CA	TPSMB62CA	TPSMB8.5A-VR	TPSMB43A-VR	TPSMC15A		TPSMC13A-VR	TPSMC58A-VR
TPSMB11A	TPSMB64A	TPSMB8.5CA-VR	TPSMB43CA-VR	TPSMC15CA		TPSMC13CA-VR	TPSMC58CA-VR
TPSMB11CA	TPSMB64CA	TPSMB9.0A-VR	TPSMB45A-VR	TPSMC16A		TPSMC14A-VR	TPSMC60A-VR
TPSMB12A	TPSMB68A	TPSMB9.0CA-VR	TPSMB45CA-VR	TPSMC16CA		TPSMC14CA-VR	TPSMC60CA-VR
TPSMB12CA	TPSMB68CA	TPSMB10A-VR	TPSMB48A-VR	TPSMC18A		TPSMC15A-VR	TPSMC64A-VR
TPSMB13A	TPSMB75A	TPSMB10CA-VR	TPSMB48CA-VR	TPSMC18CA		TPSMC15CA-VR	TPSMC64CA-VR
TPSMB13CA	TPSMB75CA	TPSMB11A-VR	TPSMB51A-VR	TPSMC20A		TPSMC16A-VR	TPSMC70A-VR
TPSMB15A	TPSMB82A	TPSMB11CA-VR	TPSMB51CA-VR	TPSMC20CA		TPSMC16CA-VR	TPSMC70CA-VR
TPSMB15CA	TPSMB82CA	TPSMB12A-VR	TPSMB54A-VR	TPSMC22A		TPSMC17A-VR	TPSMC75A-VR
TPSMB16A	TPSMB91A	TPSMB12CA-VR	TPSMB54CA-VR	TPSMC22CA		TPSMC17CA-VR	TPSMC75CA-VR
TPSMB16CA	TPSMB91CA	TPSMB13A-VR	TPSMB58A-VR	TPSMC24A		TPSMC18A-VR	TPSMC78A-VR
TPSMB18A		TPSMB13CA-VR	TPSMB58CA-VR	TPSMC24CA		TPSMC18CA-VR	TPSMC78CA-VR
TPSMB18CA		TPSMB14A-VR	TPSMB60A-VR	TPSMC27A		TPSMC20A-VR	TPSMC85A-VR
TPSMB20A		TPSMB14CA-VR	TPSMB60CA-VR	TPSMC27CA		TPSMC20CA-VR	TPSMC85CA-VR
TPSMB20CA		TPSMB15A-VR	TPSMB64A-VR	TPSMC30A		TPSMC22A-VR	
TPSMB22A		TPSMB15CA-VR	TPSMB64CA-VR	TPSMC30CA		TPSMC22CA-VR	
TPSMB22CA		TPSMB16A-VR	TPSMB70A-VR	TPSMC33A		TPSMC24A-VR	
TPSMB24A		TPSMB16CA-VR	TPSMB70CA-VR	TPSMC33CA		TPSMC24CA-VR	
TPSMB24CA		TPSMB17A-VR	TPSMB75A-VR	TPSMC36A		TPSMC26A-VR	
TPSMB27A		TPSMB17CA-VR	TPSMB75CA-VR	TPSMC36CA		TPSMC26CA-VR	
TPSMB27CA		TPSMB18A-VR	TPSMB78A-VR	TPSMC39A		TPSMC28A-VR	
TPSMB30A		TPSMB18CA-VR	TPSMB78CA-VR	TPSMC39CA		TPSMC28CA-VR	
TPSMB30CA		TPSMB20A-VR	TPSMB85A-VR	TPSMC43A		TPSMC30A-VR	
TPSMB33A		TPSMB20CA-VR	TPSMB85CA-VR	TPSMC43CA		TPSMC30CA-VR	
TPSMB33CA		TPSMB22A-VR		TPSMC47A		TPSMC33A-VR	
TPSMB36A		TPSMB22CA-VR		TPSMC47CA		TPSMC33CA-VR	
TPSMB36CA		TPSMB24A-VR		TPSMC51A		TPSMC36A-VR	
TPSMB39A		TPSMB24CA-VR		TPSMC51CA		TPSMC36CA-VR	
TPSMB39CA		TPSMB26A-VR		TPSMC56A		TPSMC40A-VR	
TPSMB43A		TPSMB26CA-VR		TPSMC56CA		TPSMC40CA-VR	
TPSMB43CA		TPSMB28A-VR		TPSMC62A		TPSMC43A-VR	
TPSMB47A		TPSMB28CA-VR		TPSMC62CA		TPSMC43CA-VR	
TPSMB47CA		TPSMB30A-VR		TPSMC68A		TPSMC45A-VR	
TPSMB51A		TPSMB30CA-VR		TPSMC68CA		TPSMC45CA-VR	
TPSMB51CA		TPSMB33A-VR		TPSMC75A		TPSMC48A-VR	
TPSMB56A		TPSMB33CA-VR		TPSMC75CA		TPSMC48CA-VR	