

LM2940QML-SP Neutron Displacement Damage (NDD) Characterization



ABSTRACT

This report presents the effect of neutron displacement damage (NDD) on the LM2940QML-SP device. The devices were irradiated up to 1×10^{13} n/cm² (1-MeV equivalent). A sample size of nine units was exposed to radiation testing per MIL-STD-883(Method 1017 for Neutron Irradiation) and an additional unirradiated sample device was used for correlation. Electrical testing was performed at Texas Instruments before and after neutron irradiation using the production test program for LM2940QML-SP.

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1 Overview

The LM2940QML-SP is a radiation-hardness-assured (RHA), 6-V to 26-V, 1-A, 5-V output linear regulator. The LM2940 positive voltage regulator features the ability to source 1A of output current with a dropout voltage of typically 0.5V and a maximum of 1V over the entire temperature range.

General device information and testing conditions are listed in [Table 1-1](#).

Table 1-1. Overview Information

TI Part Number	LM2940QML-SP
Orderable Number	LM2940GW5.0RLQV
Device Function	Low Dropout Regulator (LDO)
Die Name	GLLM1940F5V2Z1
Package	16-pin CFP (NAC)
Technology	SLM
A/T Lot Number / Date Code	5051703/1506A
Unbiased Quantity Tested	9 + control
Exposure Facility	VPT Rad
Neutron Fluence (1-MeV equivalent)	1.0×10^{12} , 5.0×10^{12} , 1.0×10^{13} n/cm ²
Irradiation Temperature	25°C
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2 Test Procedures

The LM2940QML-SP was electrically pre-tested using the production automated test equipment (ATE) program. General test procedures were IAW MIL-STD-883, Method 1017 for Neutron Irradiation of LM2940QML-SP.

Table 2-1. Neutron Irradiation Conditions

Group	Sample Qty	Neutron Fluence (n/cm ²)	Bias
A	3	1.0×10^{12}	Unbiased
B	3	5.0×10^{12}	Unbiased
C	3	1.0×10^{13}	Unbiased

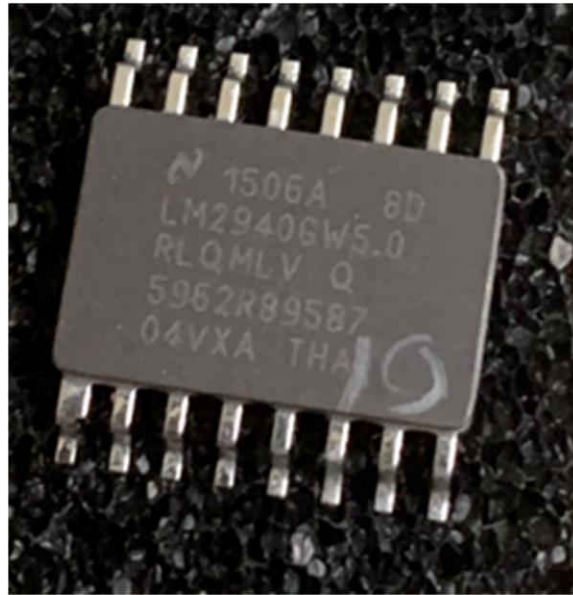


Figure 2-1. LM2940QML-SP Device

The LM2940QML-SP is packaged in a 16-pin dual ceramic flat pack package (NAC) as shown in [Figure 2-1](#).

3 Facility

VPT Rad performs all neutron displacement damage irradiations in a low-enriched, open-pool, water moderated, thermal neutron reactor. It utilizes flat-plate type fuel and has a maximum thermal energy output of up to 1 MW. The Fast Neutron Irradiator (FNI) faces one side of the reactor core. The FNI design produces a geometrical planar *beam* of fast neutrons that is approximately uniform over an area of 12 in × 20 in. Lead and thermal neutron absorbing compounds are combined to filter out both fission gammas and thermal neutrons. The ratio of fast-to-thermal neutrons is approximately 400:1, with a gamma exposure of up to 1401 rad(Si) for a 1E13 n/cm² (1-MeV(Si) equivalent) exposure. The FNI can accommodate a sample or samples with size up to 30 cm in diameter and 15-cm thick including packaging materials. The minimum neutron fluence rate is 1E6 n/cm²-s. The maximum neutron fluence rate is approximately 1.0E11 n/cm²-s (both values are 1-MeV(Si) equivalent).

The neutron fluence rate is determined using the previously-measured neutron radiation field for the FNI, performed in accordance with ASTM standards (ASTM F1190), and correlated to the measured reactor power level. The neutron dose is timed to meet the customer-specified fluence for the irradiation. Neutron dosimetry meeting ASTM standards (ASTM E265) is utilized to track and ensure irradiations meet the required minimum. The facility retains *source-suitability* with the Defense Logistics Agency (DLA) Laboratory Suitability Program for ASTM Test Method 1017. The DUTS are typically irradiation in an unbiased condition as per TM1017. If bias conditions are required, they can be maintained via dry thimbles connected to the irradiation volume.

4 Results

There were no functional failures at the 1.0×10^{12} n/cm² fluence level. All parametric measurements remained well within all data sheet (SNVS389B) limits for the 1.0×10^{12} n/cm² fluence level. At the 5×10^{12} n/cm² fluence level, failures were present in all three devices. At the 1×10^{13} n/cm² fluence level, failures were present in all three devices. The full parameter list and graphs are found in [Appendix A](#).

[Table 4-1](#) lists the LM2940QML-SP specification compliance matrix.

Table 4-1. LM2940QML-SP Specification Compliance Matrix

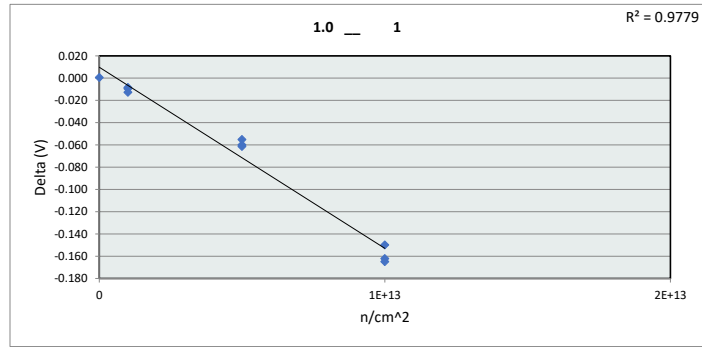
PARAMETER	TEST CONDITION	LM2940QML -SP DATA SHEET (SNVS389B)			ATE TEST #
		MIN	MAX	Unit	
Output Voltage	$V_{IN} = 10V, I_{OUT} = 5mA$	4.85	5.15	V	3.0
	$V_{IN} = 26V, I_{OUT} = 5mA$	4.85	5.15		9.0
	$V_{IN} = 10V, I_{OUT} = 1A$	4.85	5.15		11.0
	$V_{IN} = 6V, I_{OUT} = 1A$	4.85	5.15		13.0
	$V_{IN} = 6V, I_{OUT} = 50mA$	4.85	5.15		15.0
	$V_{IN} = 10V, I_{OUT} = 50mA$	4.85	5.15		16.0
Quiescent Current	$V_{IN} = 26V, I_{OUT} = 5mA$	0.0	15	mA	10.0
	$V_{IN} = 10V, I_{OUT} = 1A$	0.0	50		12.0
Line Regulation	$7V \leq V_{IN} \leq 26V, I_{OUT} \leq 1A$	-40	40	mV	14.0
Load Regulation	$V_{IN} = 10V, 50mA \leq I_{OUT} \leq 1A$	-50	50	mV	17.0
Dropout Voltage	$I_{OUT} = 1A$	0.0	0.7	V	18.0
	$I_{OUT} = 100mA$	0.0	200	mV	19.0
Output Noise Voltage	$V_{IN} = 10V, I_{OUT} = 5mA, 10Hz - 100KHz$	0.0	700	μV_{RMS}	20.0
Output Impedance	$V_{IN} = 10V, f_O = 120Hz, I_{OUT} = 100mA$ DC and 20mA AC		1.0	Ω	21.0
Ripple Rejection	$V_{IN} = 10V, 1V_{RMS}, f = 1KHz, I_{OUT} = 5mA$	60		dB	22.0
Short Circuit Current	$V_{IN} = 10V$	1.5		A	23.0

A Appendix: NDD Test Results

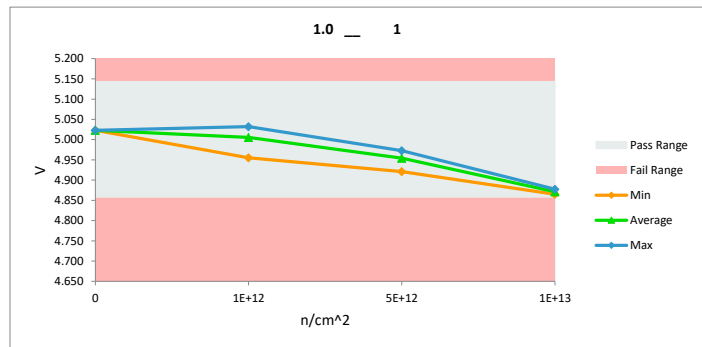
This appendix contains the detailed NDD test results.

NDD Report LM2940GW5.0RLQV

		1.0	1	
Test Site				
Tester				
Test Number				
Unit		V	V	
Max Limit		5.1436	5.1436	
Min Limit		4.8564	4.8564	
n/cm ²	Serial #	PRE	POST	Delta
1E+12	1.1	5.041	5.032	-0.008
1E+12	2.1	4.965	4.955	-0.009
1E+12	3.1	5.042	5.029	-0.013
5E+12	4.1	5.028	4.973	-0.055
5E+12	5.1	5.030	4.969	-0.061
5E+12	6.1	4.981	4.921	-0.060
1E+13	7.1	5.027	4.865	-0.162
1E+13	8.1	5.027	4.878	-0.150
1E+13	9.1	5.036	4.871	-0.165
0	10.1	5.023	5.023	0.000
Max		5.042	5.032	0.000
Average		5.020	4.952	-0.068
Min		4.965	4.865	-0.165
Std Dev		0.026	0.066	0.067

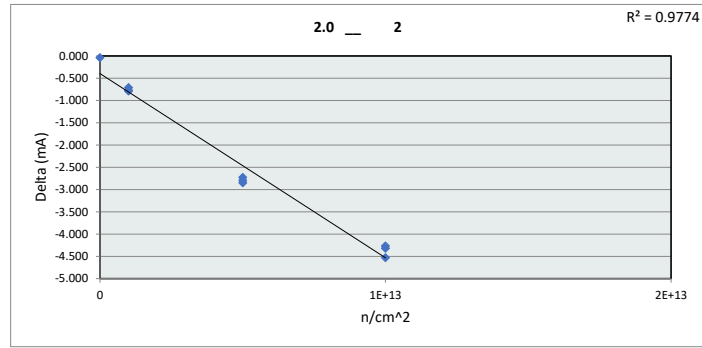


		1.0	1	
Test Site				
Tester				
Test Number				
Max Limit		5.1436	V	
Min Limit		4.8564	V	
n/cm ²	0	1E+12	5E+12	1E+13
LL	4.856	4.856	4.856	4.856
Min	5.023	4.955	4.921	4.865
Average	5.023	5.005	4.954	4.871
Max	5.023	5.032	4.973	4.878
UL	5.144	5.144	5.144	5.144

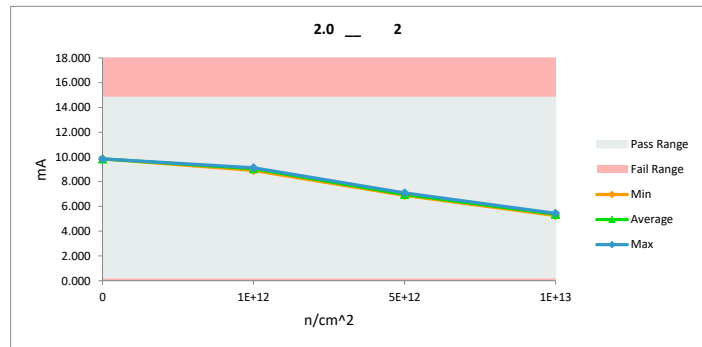


NDD Report
LM2940GW5.0RLQV

		2.0 _ 2		
Test Site				
Tester				
Test Number				
Unit		mA	mA	
Max Limit		14.82	14.82	
Min Limit		0.18	0.18	
n/cm^2	Serial #	PRE	POST	Delta
1E+12	1.1	9.840	9.130	-0.710
1E+12	2.1	9.900	9.110	-0.790
1E+12	3.1	9.680	8.910	-0.770
5E+12	4.1	9.820	7.090	-2.730
5E+12	5.1	9.740	6.890	-2.850
5E+12	6.1	9.730	6.930	-2.800
1E+13	7.1	9.710	5.440	-4.270
1E+13	8.1	9.710	5.390	-4.320
1E+13	9.1	9.790	5.260	-4.530
0	10.1	9.880	9.840	-0.040
Max		9.900	9.840	-0.040
Average		9.780	7.399	-2.381
Min		9.680	5.260	-4.530
Std Dev		0.077	1.738	1.695

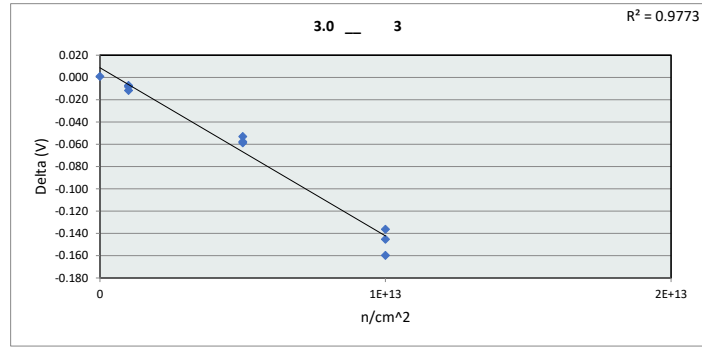


		2.0 _ 2		
Test Site				
Tester				
Test Number				
Max Limit		14.82	mA	
Min Limit		0.18	mA	
n/cm^2	0	1E+12	5E+12	1E+13
LL	0.180	0.180	0.180	0.180
Min	9.840	8.910	6.890	5.260
Average	9.840	9.050	6.970	5.363
Max	9.840	9.130	7.090	5.440
UL	14.820	14.820	14.820	14.820

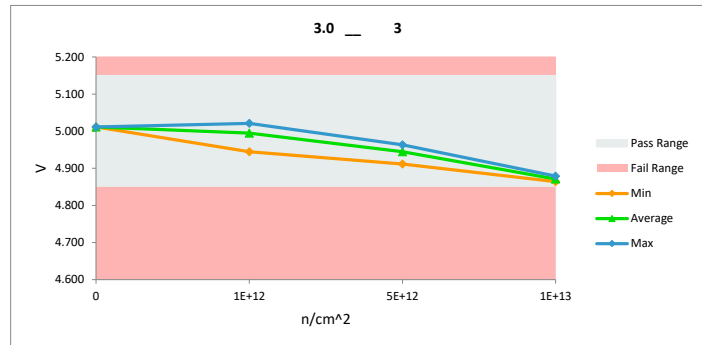


NDD Report LM2940GW5.0RLQV

		3.0	3	
Test Site				
Tester				
Test Number				
Unit		V	V	
Max Limit		5.15	5.15	
Min Limit		4.85	4.85	
n/cm^2	Serial #	PRE	POST	Delta
1E+12	1.1	5.028	5.021	-0.007
1E+12	2.1	4.953	4.945	-0.008
1E+12	3.1	5.030	5.018	-0.012
5E+12	4.1	5.016	4.963	-0.053
5E+12	5.1	5.019	4.960	-0.059
5E+12	6.1	4.969	4.911	-0.058
1E+13	7.1	5.015	4.879	-0.136
1E+13	8.1	5.016	4.870	-0.145
1E+13	9.1	5.024	4.864	-0.160
0	10.1	5.011	5.011	0.001
Max		5.030	5.021	0.001
Average		5.008	4.944	-0.064
Min		4.953	4.864	-0.160
Std Dev		0.026	0.061	0.062

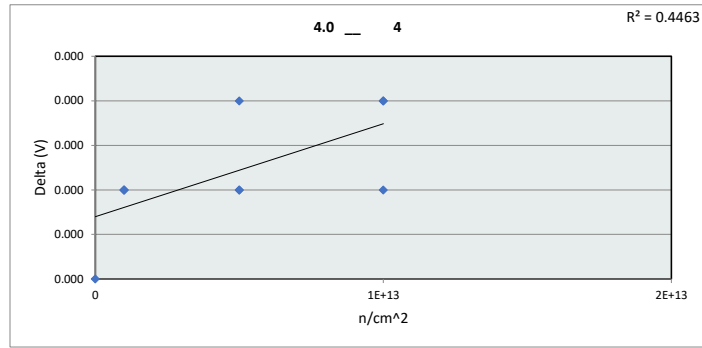


		3.0	3	
Test Site				
Tester				
Test Number				
Max Limit		5.15	V	
Min Limit		4.85	V	
n/cm^2	0	1E+12	5E+12	1E+13
LL	4.850	4.850	4.850	4.850
Min	5.011	4.945	4.911	4.864
Average	5.011	4.995	4.945	4.871
Max	5.011	5.021	4.963	4.879
UL	5.150	5.150	5.150	5.150

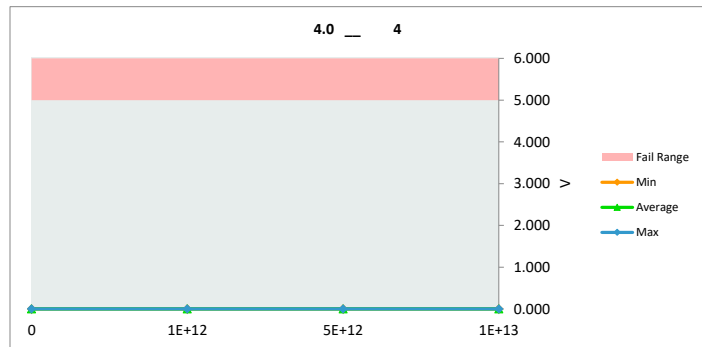


NDD Report LM2940GW5.0RLQV

		4.0	4	
Test Site				
Tester				
Test Number				
Unit		V	V	
Max Limit		4.9982	4.9982	
Min Limit				
n/cm ²	Serial #	PRE	POST	Delta
1E+12	1.1	0.002	0.002	0.000
1E+12	2.1	0.002	0.002	0.000
1E+12	3.1	0.002	0.002	0.000
5E+12	4.1	0.002	0.002	0.000
5E+12	5.1	0.002	0.002	0.000
5E+12	6.1	0.002	0.002	0.000
1E+13	7.1	0.002	0.002	0.000
1E+13	8.1	0.002	0.002	0.000
1E+13	9.1	0.002	0.002	0.000
0	10.1	0.002	0.002	0.000
Max		0.002	0.002	0.000
Average		0.002	0.002	0.000
Min		0.002	0.002	0.000
Std Dev		0.000	0.000	0.000

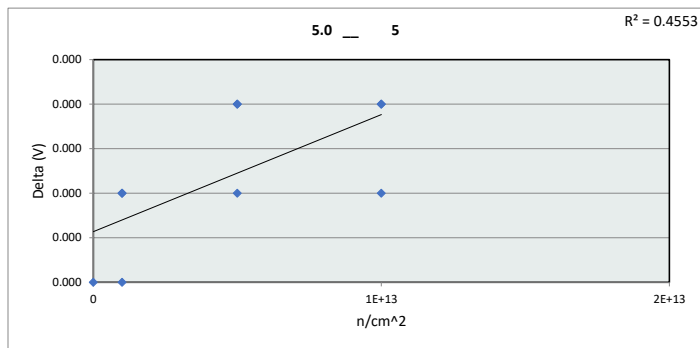


		4.0	4		
Test Site					
Tester					
Test Number					
Max Limit		4.9982	V		
Min Limit			V		
n/cm ²		0	1E+12	5E+12	1E+13
LL					
Min		0.002	0.002	0.002	0.002
Average		0.002	0.002	0.002	0.002
Max		0.002	0.002	0.002	0.002
UL		4.998	4.998	4.998	4.998

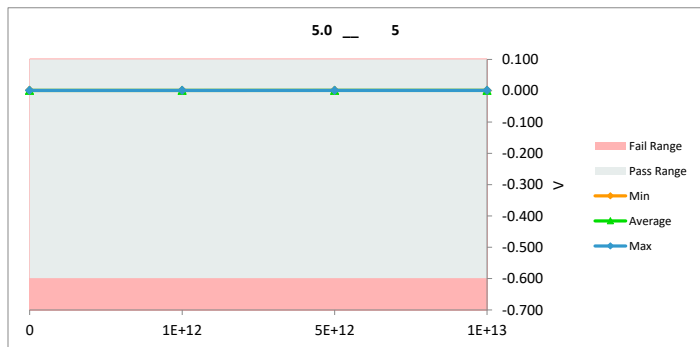


NDD Report LM2940GW5.0RLQV

		5.0	5	
Test Site				
Tester				
Test Number				
Unit		V	V	
Max Limit				
Min Limit		-0.5986	-0.5986	
n/cm ²	Serial #	PRE	POST	Delta
1E+12	1.1	0.001	0.001	0.000
1E+12	2.1	0.001	0.001	0.000
1E+12	3.1	0.001	0.001	0.000
5E+12	4.1	0.001	0.001	0.000
5E+12	5.1	0.001	0.001	0.000
5E+12	6.1	0.001	0.001	0.000
1E+13	7.1	0.001	0.001	0.000
1E+13	8.1	0.001	0.001	0.000
1E+13	9.1	0.001	0.001	0.000
0	10.1	0.001	0.001	0.000
Max		0.001	0.001	0.000
Average		0.001	0.001	0.000
Min		0.001	0.001	0.000
Std Dev		0.000	0.000	0.000

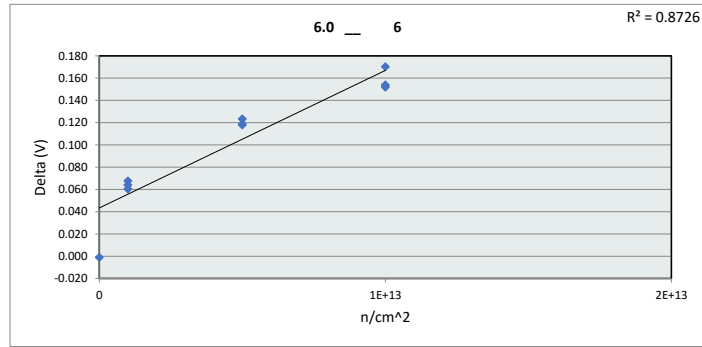


		5.0	5	
Test Site				
Tester				
Test Number				
Max Limit			V	
Min Limit		-0.5986	V	
n/cm ²	0	1E+12	5E+12	1E+13
LL	-0.599	-0.599	-0.599	-0.599
Min	0.001	0.001	0.001	0.001
Average	0.001	0.001	0.001	0.001
Max	0.001	0.001	0.001	0.001
UL				

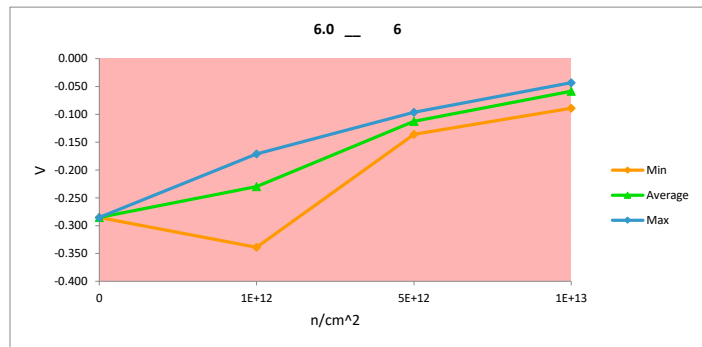


NDD Report LM2940GW5.0RLQV

		6.0 _ 6		
Test Site				
Tester				
Test Number				
Unit		V	V	
Max Limit				
Min Limit				
n/cm^2	Serial #	PRE	POST	Delta
1E+12	1.1	-0.240	-0.180	0.060
1E+12	2.1	-0.407	-0.339	0.068
1E+12	3.1	-0.235	-0.171	0.064
5E+12	4.1	-0.259	-0.136	0.123
5E+12	5.1	-0.225	-0.106	0.119
5E+12	6.1	-0.214	-0.096	0.118
1E+13	7.1	-0.195	-0.043	0.152
1E+13	8.1	-0.259	-0.089	0.170
1E+13	9.1	-0.197	-0.043	0.154
0	10.1	-0.284	-0.285	-0.001
	Max	-0.195	-0.043	0.170
	Average	-0.252	-0.149	0.103
	Min	-0.407	-0.339	-0.001
	Std Dev	0.061	0.098	0.054

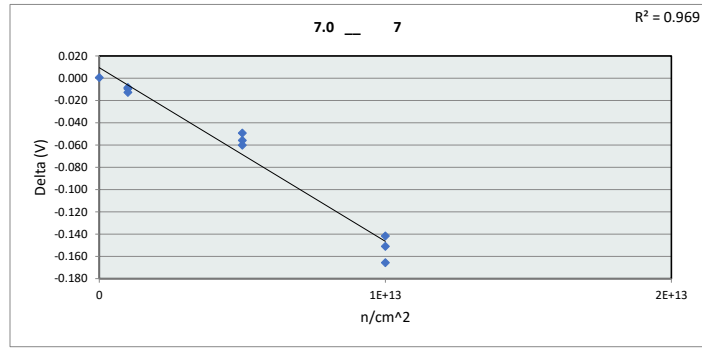


		6.0 _ 6		
Test Site				
Tester				
Test Number				
Max Limit		V	V	
Min Limit		V	V	
n/cm^2	0	1E+12	5E+12	1E+13
LL				
Min	-0.285	-0.339	-0.136	-0.089
Average	-0.285	-0.230	-0.113	-0.059
Max	-0.285	-0.171	-0.096	-0.043
UL				

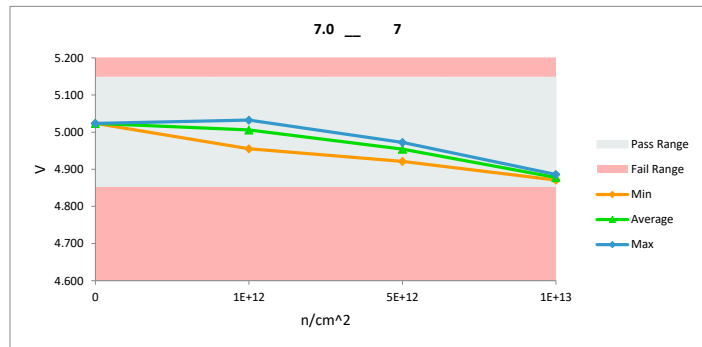


NDD Report LM2940GW5.0RLQV

		7.0 _ 7		
Test Site				
Tester				
Test Number				
Unit		V	V	
Max Limit		5.1474	5.1474	
Min Limit		4.8526	4.8526	
n/cm^2	Serial #	PRE	POST	Delta
1E+12	1.1	5.041	5.032	-0.009
1E+12	2.1	4.965	4.955	-0.010
1E+12	3.1	5.042	5.030	-0.013
5E+12	4.1	5.028	4.972	-0.056
5E+12	5.1	5.019	4.969	-0.049
5E+12	6.1	4.981	4.921	-0.060
1E+13	7.1	5.028	4.886	-0.142
1E+13	8.1	5.028	4.877	-0.151
1E+13	9.1	5.037	4.871	-0.166
0	10.1	5.023	5.024	0.001
	Max	5.042	5.032	0.001
	Average	5.019	4.954	-0.065
	Min	4.965	4.871	-0.166
	Std Dev	0.026	0.063	0.064

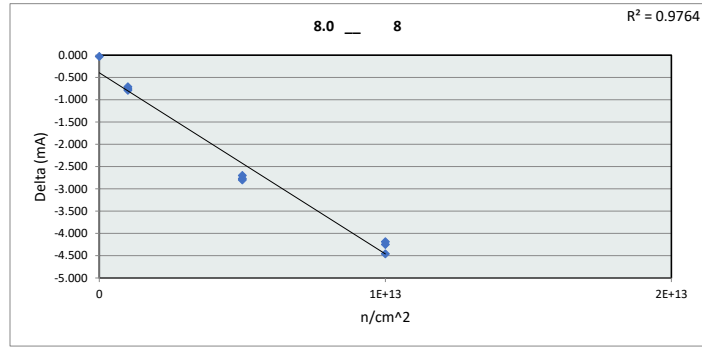


		7.0 _ 7			
Test Site					
Tester					
Test Number					
Max Limit		5.1474	V		
Min Limit		4.8526	V		
n/cm^2		0	1E+12	5E+12	1E+13
LL		4.853	4.853	4.853	4.853
Min		5.024	4.955	4.921	4.871
Average		5.024	5.006	4.954	4.878
Max		5.024	5.033	4.972	4.886
UL		5.147	5.147	5.147	5.147

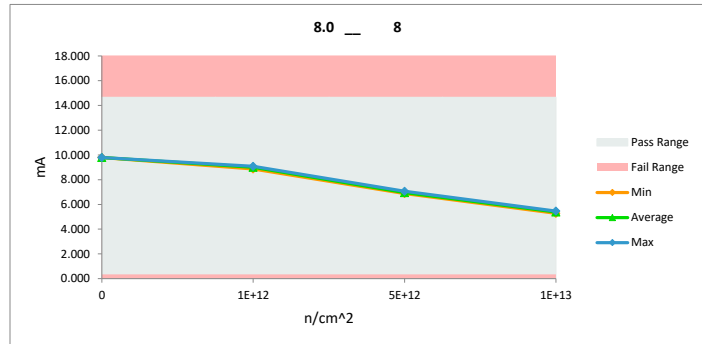


NDD Report
LM2940GW5.0RLQV

		8.0	8	
Test Site				
Tester				
Test Number				
Unit		mA	mA	
Max Limit		14.66	14.66	
Min Limit		0.34	0.34	
n/cm ²	Serial #	PRE	POST	Delta
1E+12	1.1	9.790	9.080	-0.710
1E+12	2.1	9.840	9.050	-0.790
1E+12	3.1	9.620	8.860	-0.760
5E+12	4.1	9.760	7.060	-2.700
5E+12	5.1	9.680	6.880	-2.800
5E+12	6.1	9.680	6.910	-2.770
1E+13	7.1	9.650	5.460	-4.190
1E+13	8.1	9.660	5.410	-4.250
1E+13	9.1	9.740	5.280	-4.460
0	10.1	9.820	9.790	-0.030
Max		9.840	9.790	-0.030
Average		9.724	7.378	-2.346
Min		9.620	5.280	-4.460
Std Dev		0.077	1.707	1.666

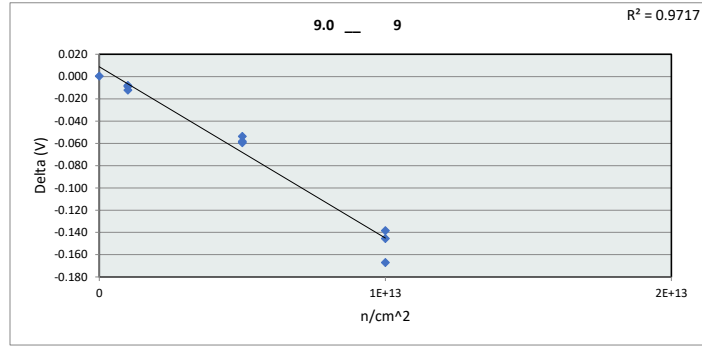


		8.0	8	
Test Site				
Tester				
Test Number				
Max Limit		14.66	mA	
Min Limit		0.34	mA	
n/cm ²	0	1E+12	5E+12	1E+13
LL	0.340	0.340	0.340	0.340
Min	9.790	8.860	6.880	5.280
Average	9.790	8.997	6.950	5.383
Max	9.790	9.080	7.060	5.460
UL	14.660	14.660	14.660	14.660

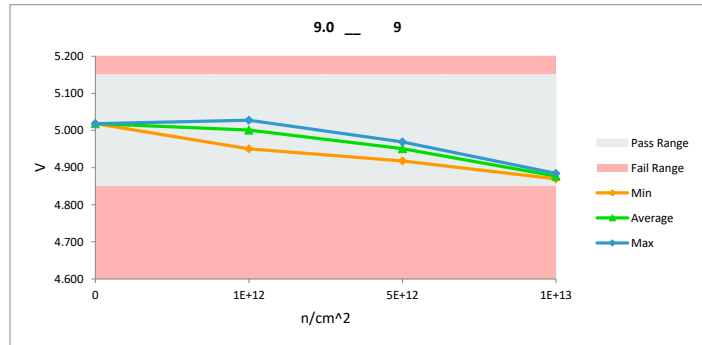


NDD Report LM2940GW5.0RLQV

		9.0	9	
Test Site				
Tester				
Test Number				
Unit		V	V	
Max Limit		5.15	5.15	
Min Limit		4.85	4.85	
n/cm ²	Serial #	PRE	POST	Delta
1E+12	1.1	5.036	5.028	-0.008
1E+12	2.1	4.959	4.951	-0.009
1E+12	3.1	5.037	5.025	-0.012
5E+12	4.1	5.023	4.969	-0.054
5E+12	5.1	5.026	4.966	-0.059
5E+12	6.1	4.976	4.918	-0.058
1E+13	7.1	5.023	4.885	-0.138
1E+13	8.1	5.022	4.877	-0.145
1E+13	9.1	5.037	4.870	-0.167
0	10.1	5.018	5.018	0.001
Max		5.037	5.028	0.001
Average		5.016	4.951	-0.065
Min		4.959	4.870	-0.167
Std Dev		0.026	0.062	0.063

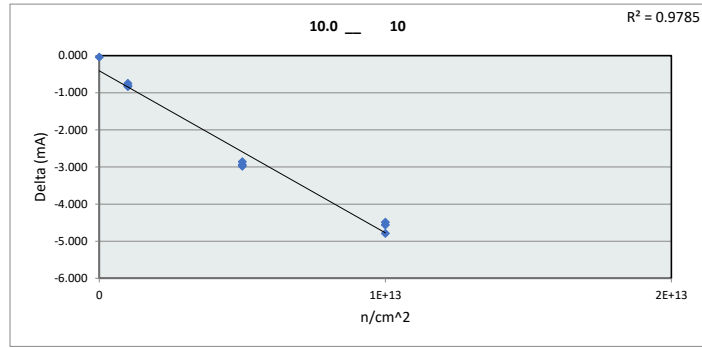


		9.0	9	
Test Site				
Tester				
Test Number				
Max Limit		5.15	V	
Min Limit		4.85	V	
n/cm ²	0	1E+12	5E+12	1E+13
LL	4.850	4.850	4.850	4.850
Min	5.018	4.951	4.918	4.870
Average	5.018	5.001	4.951	4.877
Max	5.018	5.028	4.969	4.885
UL	5.150	5.150	5.150	5.150

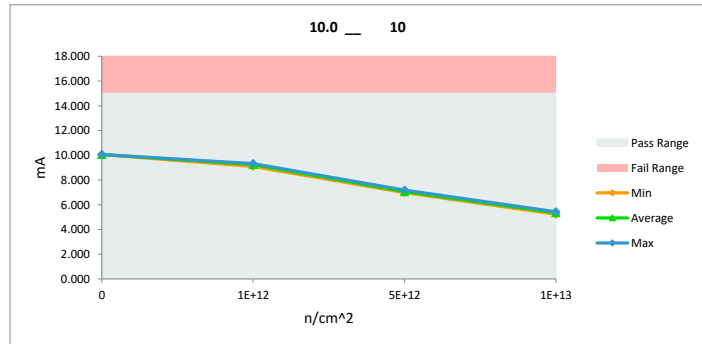


NDD Report LM2940GW5.0RLQV

		10.0	10	
Test Site				
Tester				
Test Number				
Unit		mA	mA	
Max Limit		15	15	
Min Limit		0	0	
n/cm ²	Serial #	PRE	POST	Delta
1E+12	1.1	10.080	9.330	-0.750
1E+12	2.1	10.130	9.300	-0.830
1E+12	3.1	9.900	9.090	-0.810
5E+12	4.1	10.050	7.190	-2.860
5E+12	5.1	9.960	6.980	-2.980
5E+12	6.1	9.950	7.010	-2.940
1E+13	7.1	9.920	5.430	-4.490
1E+13	8.1	9.940	5.380	-4.560
1E+13	9.1	10.020	5.230	-4.790
0	10.1	10.100	10.060	-0.040
Max		10.130	10.060	-0.040
Average		10.005	7.500	-2.505
Min		9.900	5.230	-4.790
Std Dev		0.082	1.832	1.788

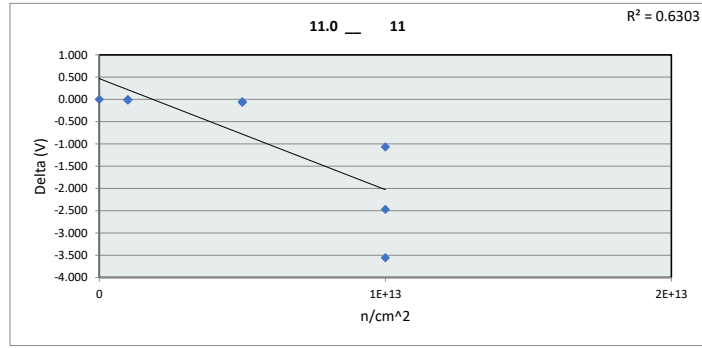


		10.0	10	
Test Site				
Tester				
Test Number				
Max Limit		15	mA	
Min Limit		0	mA	
n/cm ²	0	1E+12	5E+12	1E+13
LL	0.000	0.000	0.000	0.000
Min	10.060	9.090	6.980	5.230
Average	10.060	9.240	7.060	5.347
Max	10.060	9.330	7.190	5.430
UL	15.000	15.000	15.000	15.000

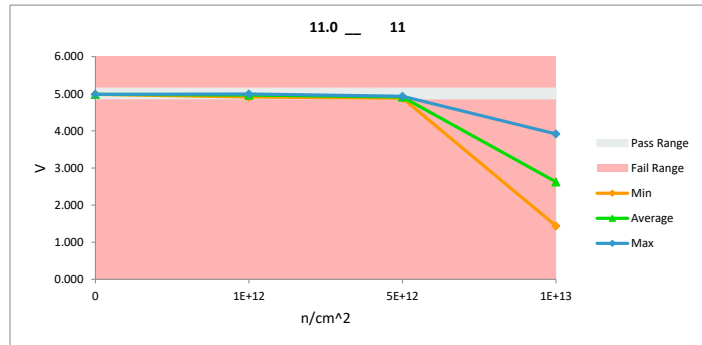


NDD Report
LM2940GW5.0RLQV

		11.0	11	
Test Site				
Tester				
Test Number				
Unit		V	V	
Max Limit		5.15	5.15	
Min Limit		4.85	4.85	
n/cm^2	Serial #	PRE	POST	Delta
1E+12	1.1	5.003	4.993	-0.010
1E+12	2.1	4.923	4.913	-0.010
1E+12	3.1	5.003	4.989	-0.013
5E+12	4.1	4.988	4.932	-0.056
5E+12	5.1	4.990	4.929	-0.062
5E+12	6.1	4.939	4.880	-0.059
1E+13	7.1	4.987	3.917	-1.070
1E+13	8.1	4.989	2.518	-2.471
1E+13	9.1	4.998	1.442	-3.556
0	10.1	4.984	4.984	0.000
	Max	5.003	4.993	0.000
	Average	4.980	4.250	-0.731
	Min	4.923	1.442	-3.556
	Std Dev	0.027	1.265	1.272

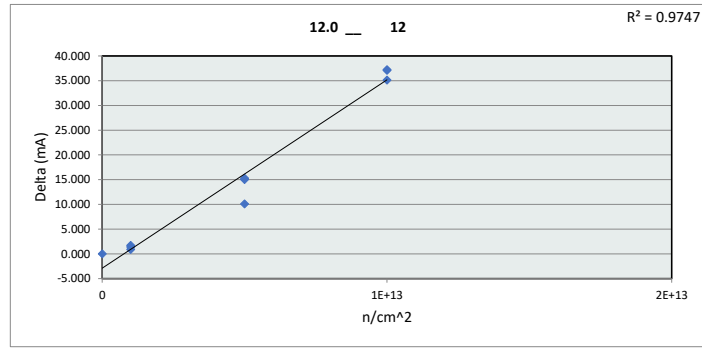


		11.0	11	
Test Site				
Tester				
Test Number				
Max Limit		5.15	V	
Min Limit		4.85	V	
n/cm^2	0	1E+12	5E+12	1E+13
LL	4.850	4.850	4.850	4.850
Min	4.984	4.913	4.880	1.442
Average	4.984	4.965	4.914	2.626
Max	4.984	4.993	4.933	3.917
UL	5.150	5.150	5.150	5.150

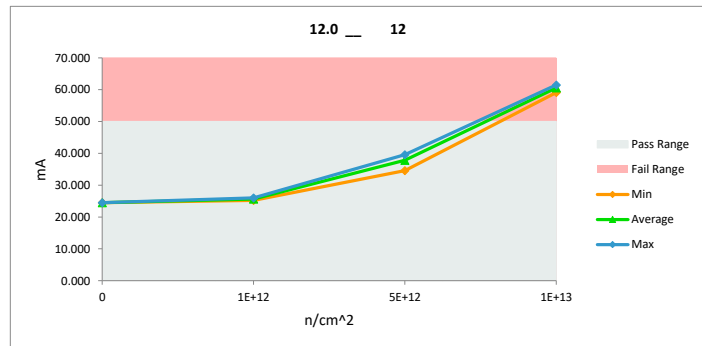


NDD Report
LM2940GW5.0RLQV

		12.0 _ 12		
Test Site				
Tester				
Test Number				
Unit		mA	mA	
Max Limit		50	50	
Min Limit		0	0	
n/cm^2	Serial #	PRE	POST	Delta
1E+12	1.1	24.300	25.200	0.900
1E+12	2.1	24.300	26.000	1.700
1E+12	3.1	24.300	25.700	1.400
5E+12	4.1	24.500	34.600	10.100
5E+12	5.1	24.300	39.300	15.000
5E+12	6.1	24.300	39.600	15.300
1E+13	7.1	24.000	61.100	37.100
1E+13	8.1	24.300	61.500	37.200
1E+13	9.1	24.000	59.100	35.100
0	10.1	24.500	24.500	0.000
	Max	24.500	61.500	37.200
	Average	24.280	39.660	15.380
	Min	24.000	24.500	0.000
	Std Dev	0.169	15.494	15.612

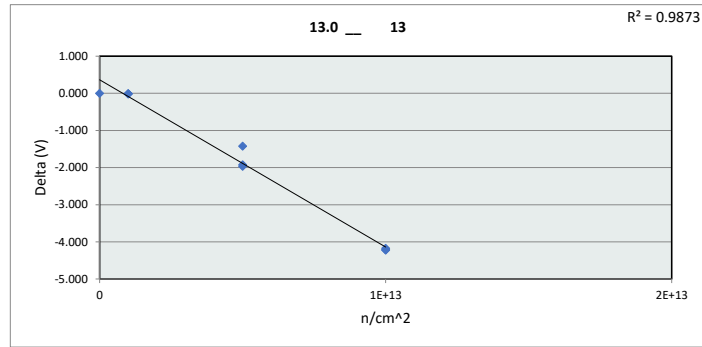


		12.0 _ 12		
Test Site				
Tester				
Test Number				
Max Limit		50	mA	
Min Limit		0	mA	
n/cm^2	0	1E+12	5E+12	1E+13
LL	0.000	0.000	0.000	0.000
Min	24.500	25.200	34.600	59.100
Average	24.500	25.633	37.833	60.567
Max	24.500	26.000	39.600	61.500
UL	50.000	50.000	50.000	50.000

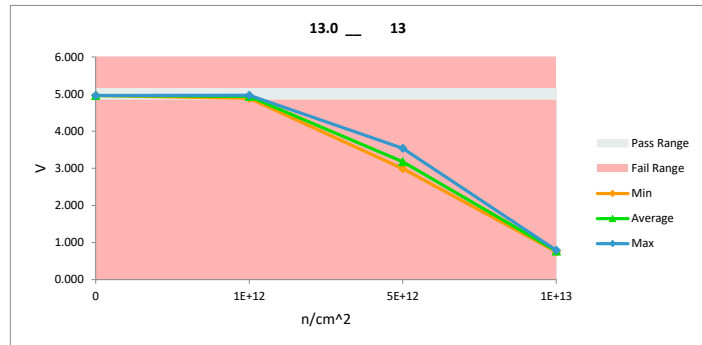


NDD Report LM2940GW5.0RLQV

		13.0 _ 13		
Test Site				
Tester				
Test Number				
Unit		V	V	
Max Limit		5.15	5.15	
Min Limit		4.85	4.85	
n/cm^2	Serial #	PRE	POST	Delta
1E+12	1.1	4.980	4.969	-0.011
1E+12	2.1	4.899	4.884	-0.015
1E+12	3.1	4.979	4.963	-0.016
5E+12	4.1	4.965	3.541	-1.424
5E+12	5.1	4.967	3.001	-1.966
5E+12	6.1	4.916	2.990	-1.926
1E+13	7.1	4.966	0.793	-4.173
1E+13	8.1	4.989	0.772	-4.217
1E+13	9.1	4.974	0.753	-4.221
0	10.1	4.962	4.962	0.000
Max		4.989	4.969	0.000
Average		4.960	3.163	-1.797
Min		4.899	0.753	-4.221
Std Dev		0.029	1.827	1.836

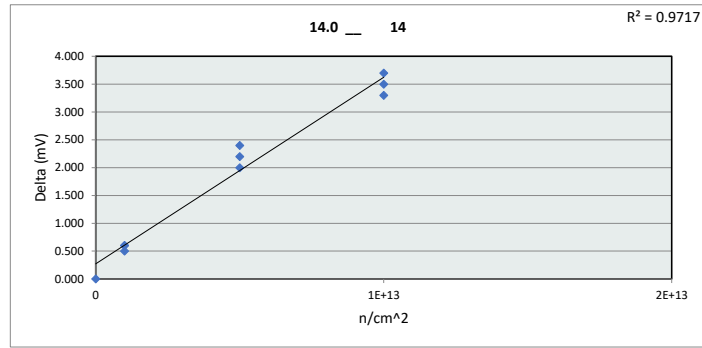


		13.0 _ 13		
Test Site				
Tester				
Test Number				
Max Limit		5.15	V	
Min Limit		4.85	V	
n/cm^2	0	1E+12	5E+12	1E+13
LL	4.850	4.850	4.850	4.850
Min	4.962	4.884	2.990	0.753
Average	4.962	4.938	3.177	0.773
Max	4.962	4.969	3.541	0.793
UL	5.150	5.150	5.150	5.150

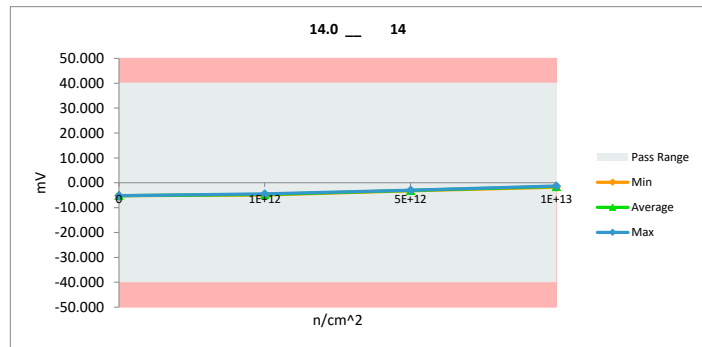


NDD Report LM2940GW5.0RLQV

		14.0 _ 14		
Test Site				
Tester				
Test Number				
Unit		mV	mV	
Max Limit		40	40	
Min Limit		-40	-40	
n/cm^2	Serial #	PRE	POST	Delta
1E+12	1.1	-5.400	-4.900	0.500
1E+12	2.1	-5.300	-4.700	0.600
1E+12	3.1	-5.100	-4.500	0.600
5E+12	4.1	-5.400	-3.200	2.200
5E+12	5.1	-5.400	-3.000	2.400
5E+12	6.1	-5.000	-3.000	2.000
1E+13	7.1	-4.700	-1.400	3.300
1E+13	8.1	-5.500	-1.800	3.700
1E+13	9.1	-4.800	-1.300	3.500
0	10.1	-5.200	-5.200	0.000
	Max	-4.700	-1.300	3.700
	Average	-5.180	-3.300	1.880
	Min	-5.500	-5.200	0.000
	Std Dev	0.274	1.476	1.377

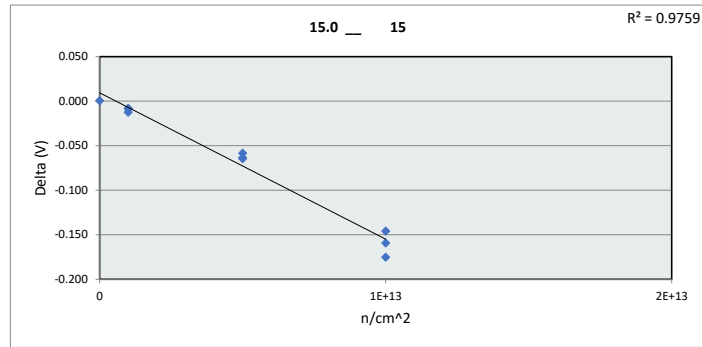


		14.0 _ 14		
Test Site				
Tester				
Test Number				
Max Limit		40	mV	
Min Limit		-40	mV	
n/cm^2	0	1E+12	5E+12	1E+13
LL	-40.000	-40.000	-40.000	-40.000
Min	-5.200	-4.900	-3.200	-1.800
Average	-5.200	-4.700	-3.067	-1.500
Max	-5.200	-4.500	-3.000	-1.300
UL	40.000	40.000	40.000	40.000

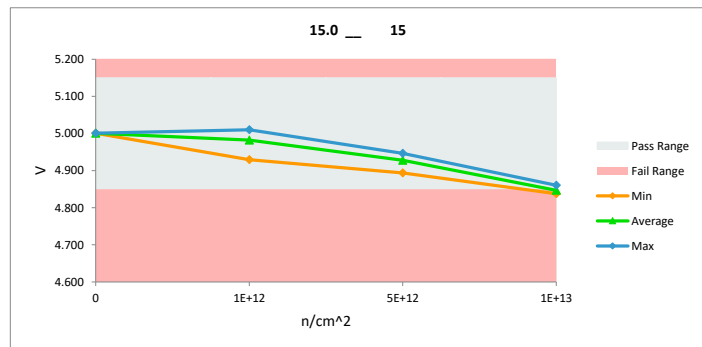


NDD Report LM2940GW5.0RLQV

		15.0	15	
Test Site				
Tester				
Test Number				
Unit		V	V	
Max Limit		5.15	5.15	
Min Limit		4.85	4.85	
n/cm ²	Serial #	PRE	POST	Delta
1E+12	1.1	5.018	5.010	-0.008
1E+12	2.1	4.938	4.930	-0.009
1E+12	3.1	5.019	5.007	-0.012
5E+12	4.1	5.005	4.947	-0.058
5E+12	5.1	5.008	4.943	-0.065
5E+12	6.1	4.957	4.893	-0.063
1E+13	7.1	5.006	4.860	-0.146
1E+13	8.1	5.002	4.843	-0.159
1E+13	9.1	5.013	4.838	-0.175
0	10.1	5.000	5.001	0.001
Max		5.019	5.010	0.001
Average		4.997	4.927	-0.069
Min		4.938	4.838	-0.175
Std Dev		0.027	0.067	0.067

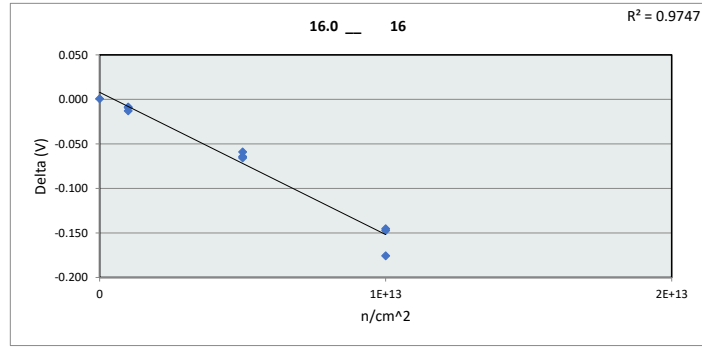


		15.0	15	
Test Site				
Tester				
Test Number				
Max Limit		5.15	V	
Min Limit		4.85	V	
n/cm ²	0	1E+12	5E+12	1E+13
LL	4.850	4.850	4.850	4.850
Min	5.001	4.930	4.894	4.838
Average	5.001	4.982	4.928	4.847
Max	5.001	5.010	4.947	4.861
UL	5.150	5.150	5.150	5.150

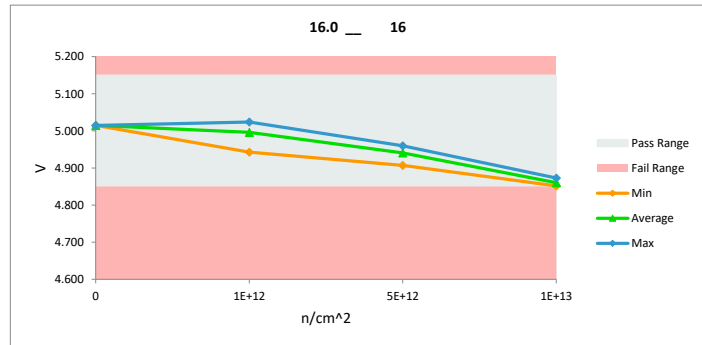


NDD Report
LM2940GW5.0RLQV

		16.0 _ 16		
Test Site				
Tester				
Test Number				
Unit		V	V	
Max Limit		5.15	5.15	
Min Limit		4.85	4.85	
n/cm^2	Serial #	PRE	POST	Delta
1E+12	1.1	5.032	5.024	-0.009
1E+12	2.1	4.952	4.943	-0.009
1E+12	3.1	5.034	5.021	-0.013
5E+12	4.1	5.019	4.960	-0.059
5E+12	5.1	5.022	4.956	-0.066
5E+12	6.1	4.971	4.907	-0.064
1E+13	7.1	5.020	4.873	-0.147
1E+13	8.1	5.002	4.856	-0.145
1E+13	9.1	5.028	4.852	-0.176
0	10.1	5.014	5.015	0.001
Max		5.034	5.024	0.001
Average		5.009	4.941	-0.069
Min		4.952	4.852	-0.176
Std Dev		0.027	0.067	0.066

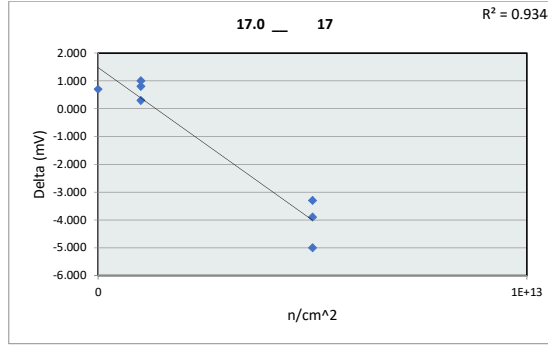


		16.0 _ 16		
Test Site				
Tester				
Test Number				
Max Limit		5.15	V	
Min Limit		4.85	V	
n/cm^2	0	1E+12	5E+12	1E+13
LL	4.850	4.850	4.850	4.850
Min	5.015	4.943	4.907	4.852
Average	5.015	4.996	4.941	4.860
Max	5.015	5.024	4.960	4.873
UL	5.150	5.150	5.150	5.150

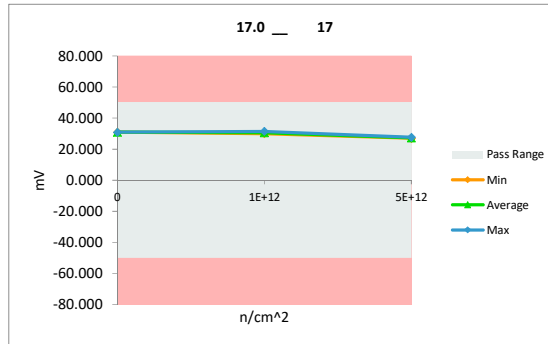


NDD Report
LM2940GW5.0RLQV

		17.0	17	
Test Site				
Tester				
Test Number				
Unit		mV	mV	
Max Limit		50	50	
Min Limit		-50	-50	
n/cm ²	Serial #	PRE	POST	Delta
1E+12	1.1	29.600	30.600	1.000
1E+12	2.1	29.200	30.000	0.800
1E+12	3.1	31.200	31.500	0.300
5E+12	4.1	30.500	27.200	-3.300
5E+12	5.1	31.600	27.700	-3.900
5E+12	6.1	32.000	27.000	-5.000
0	10.1	30.200	30.900	0.700
	Max	32.000	31.500	1.000
	Average	30.614	29.271	-1.343
	Min	29.200	27.000	-5.000
	Std Dev	1.037	1.908	2.604

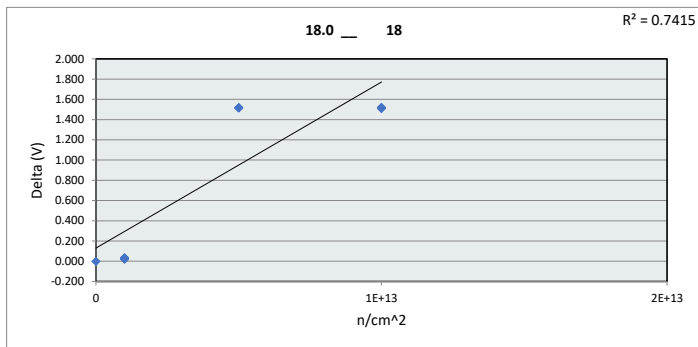


		17.0	17
Test Site			
Tester			
Test Number			
Max Limit		50	mV
Min Limit		-50	mV
n/cm ²	0	1E+12	5E+12
LL	-50.000	-50.000	-50.000
Min	30.900	30.000	27.000
Average	30.900	30.700	27.300
Max	30.900	31.500	27.700
UL	50.000	50.000	50.000

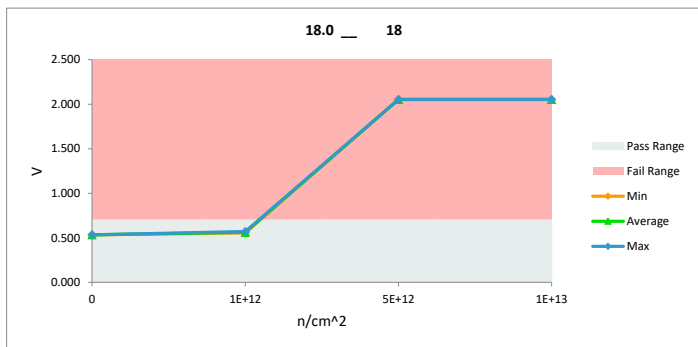


NDD Report LM2940GW5.0RLQV

		18.0 _ 18		
Test Site				
Tester				
Test Number				
Unit		V	V	
Max Limit		0.7	0.7	
Min Limit		0	0	
n/cm^2	Serial #	PRE	POST	Delta
1E+12	1.1	0.535	0.554	0.019
1E+12	2.1	0.532	0.563	0.031
1E+12	3.1	0.534	0.569	0.035
5E+12	4.1	0.536	2.053	1.517
5E+12	5.1	0.536	2.053	1.517
5E+12	6.1	0.538	2.053	1.515
1E+13	7.1	0.533	2.053	1.520
1E+13	8.1	0.543	2.053	1.510
1E+13	9.1	0.538	2.053	1.515
0	10.1	0.534	0.533	-0.001
Max		0.543	2.053	1.520
Average		0.536	1.454	0.918
Min		0.532	0.533	-0.001
Std Dev		0.003	0.774	0.772

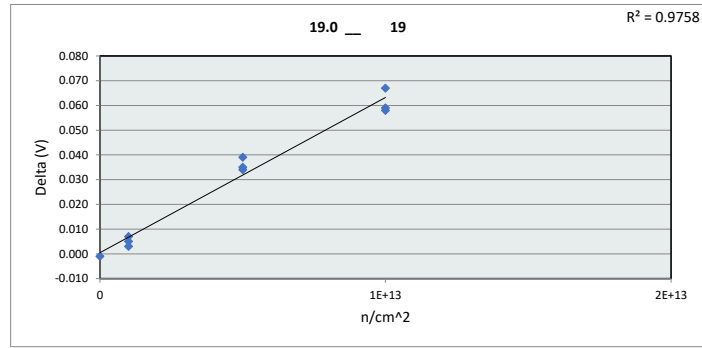


		18.0 _ 18		
Test Site				
Tester				
Test Number				
Max Limit		0.7	V	
Min Limit		0	V	
n/cm^2	0	1E+12	5E+12	1E+13
LL	0.000	0.000	0.000	0.000
Min	0.533	0.554	2.053	2.053
Average	0.533	0.562	2.053	2.053
Max	0.533	0.569	2.053	2.053
UL	0.700	0.700	0.700	0.700

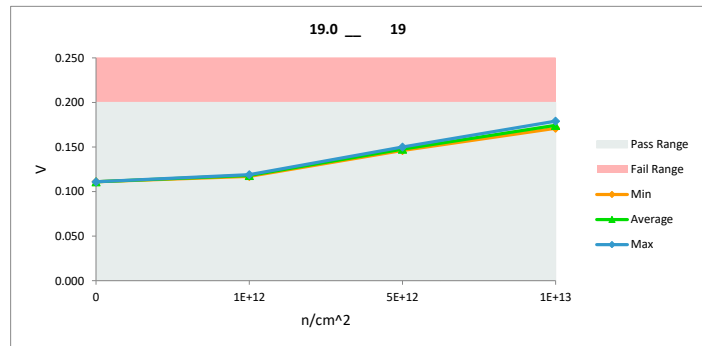


NDD Report LM2940GW5.0RLQV

		19.0 __ 19		
Test Site				
Tester				
Test Number				
Unit		V	V	
Max Limit		0.2	0.2	
Min Limit		0	0	
n/cm^2	Serial #	PRE	POST	Delta
1E+12	1.1	0.112	0.119	0.007
1E+12	2.1	0.114	0.117	0.003
1E+12	3.1	0.113	0.118	0.005
5E+12	4.1	0.111	0.150	0.039
5E+12	5.1	0.112	0.146	0.034
5E+12	6.1	0.112	0.147	0.035
1E+13	7.1	0.112	0.171	0.059
1E+13	8.1	0.115	0.173	0.058
1E+13	9.1	0.112	0.179	0.067
0	10.1	0.112	0.111	-0.001
Max		0.115	0.179	0.067
Average		0.113	0.143	0.031
Min		0.111	0.111	-0.001
Std Dev		0.001	0.026	0.026

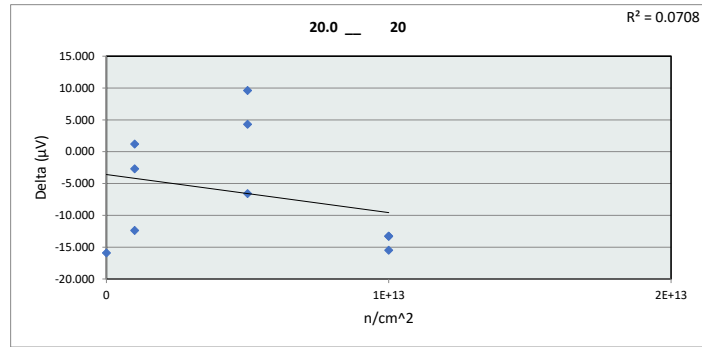


		19.0 __ 19		
Test Site				
Tester				
Test Number				
Max Limit		0.2	V	
Min Limit		0	V	
n/cm^2	0	1E+12	5E+12	1E+13
LL	0.000	0.000	0.000	0.000
Min	0.111	0.117	0.146	0.171
Average	0.111	0.118	0.148	0.174
Max	0.111	0.119	0.150	0.179
UL	0.200	0.200	0.200	0.200

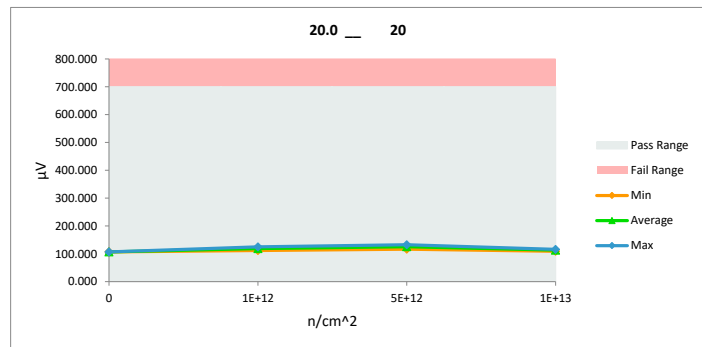


NDD Report LM2940GW5.0RLQV

		20.0	20	
Test Site				
Tester				
Test Number				
Unit		µV	µV	
Max Limit		700	700	
Min Limit		0	0	
n/cm ²	Serial #	PRE	POST	Delta
1E+12	1.1	123.400	124.600	1.200
1E+12	2.1	122.100	119.400	-2.700
1E+12	3.1	124.500	112.100	-12.400
5E+12	4.1	122.900	132.500	9.600
5E+12	5.1	123.100	116.500	-6.600
5E+12	6.1	123.000	127.300	4.300
1E+13	7.1	127.100	113.800	-13.300
1E+13	8.1	122.500	109.200	-13.300
1E+13	9.1	131.700	116.200	-15.500
0	10.1	122.700	106.800	-15.900
	Max	131.700	132.500	9.600
	Average	124.300	117.840	-6.460
	Min	122.100	106.800	-15.900
	Std Dev	2.966	8.184	9.106

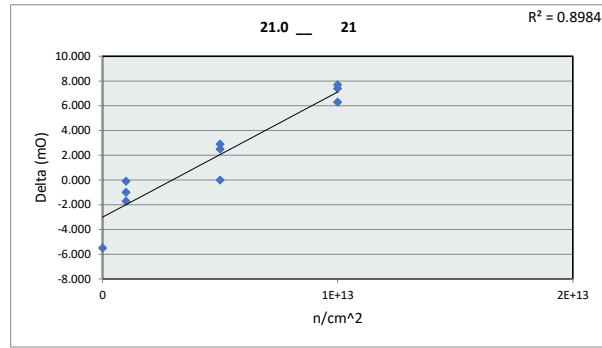


		20.0	20	
Test Site				
Tester				
Test Number				
Max Limit		700	µV	
Min Limit		0	µV	
n/cm ²	0	1E+12	5E+12	1E+13
LL	0.000	0.000	0.000	0.000
Min	106.800	112.100	116.500	109.200
Average	106.800	118.700	125.433	113.067
Max	106.800	124.600	132.500	116.200
UL	700.000	700.000	700.000	700.000

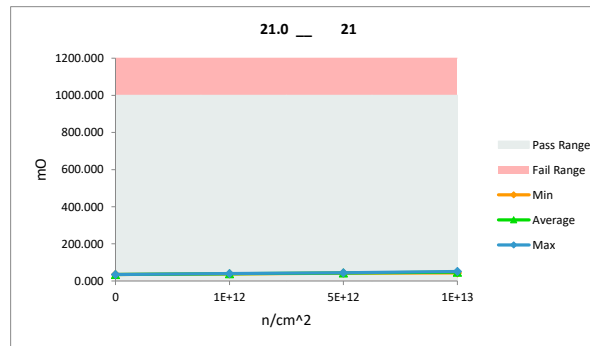


NDD Report LM2940GW5.0RLQV

		21.0	21	
Test Site				
Tester				
Test Number				
Unit		mO	mO	
Max Limit		1000	1000	
Min Limit		1.2	1.2	
n/cm ²	Serial #	PRE	POST	Delta
1E+12	1.1	38.600	38.500	-0.100
1E+12	2.1	39.900	38.900	-1.000
1E+12	3.1	41.300	39.600	-1.700
5E+12	4.1	39.100	42.000	2.900
5E+12	5.1	41.200	43.700	2.500
5E+12	6.1	44.200	44.200	0.000
1E+13	7.1	43.500	51.200	7.700
1E+13	8.1	36.000	43.400	7.400
1E+13	9.1	42.200	48.500	6.300
0	10.1	40.500	35.000	-5.500
	Max	44.200	51.200	7.700
	Average	40.650	42.500	1.850
	Min	36.000	35.000	-5.500
	Std Dev	2.419	4.839	4.325

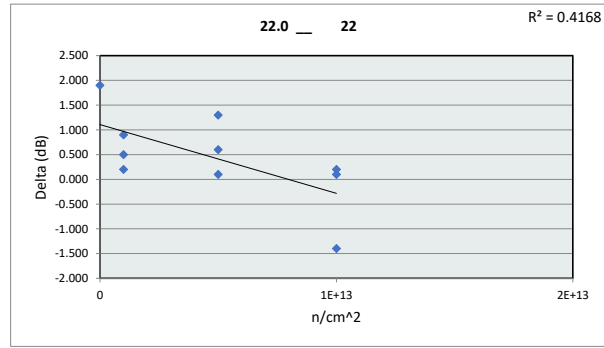


		21.0	21	
Test Site				
Tester				
Test Number				
Max Limit		1000	mO	
Min Limit		1.2	mO	
n/cm ²	0	1E+12	5E+12	1E+13
LL	1.200	1.200	1.200	1.200
Min	35.000	38.500	42.000	43.400
Average	35.000	39.000	43.300	47.700
Max	35.000	39.600	44.200	51.200
UL	1000.000	1000.000	1000.000	1000.000

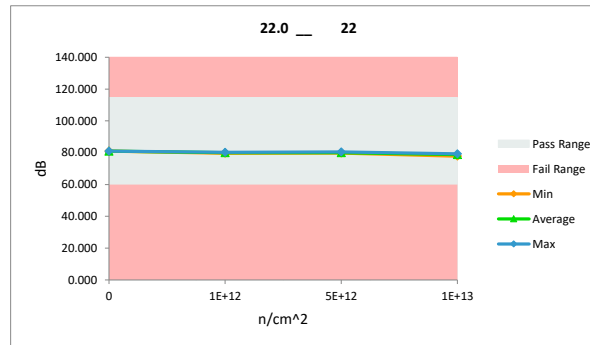


NDD Report
LM2940GW5.0RLQV

		22.0 __ 22		
Test Site				
Tester				
Test Number				
Unit		dB	dB	
Max Limit		114.6	114.6	
Min Limit		60	60	
n/cm^2	Serial #	PRE	POST	Delta
1E+12	1.1	79.300	80.200	0.900
1E+12	2.1	79.200	79.700	0.500
1E+12	3.1	79.800	80.000	0.200
5E+12	4.1	79.700	79.800	0.100
5E+12	5.1	79.200	80.500	1.300
5E+12	6.1	79.200	79.800	0.600
1E+13	7.1	79.200	79.300	0.100
1E+13	8.1	79.100	79.300	0.200
1E+13	9.1	79.200	77.800	-1.400
0	10.1	79.100	81.000	1.900
Max		79.800	81.000	1.900
Average		79.300	79.740	0.440
Min		79.100	77.800	-1.400
Std Dev		0.245	0.857	0.872

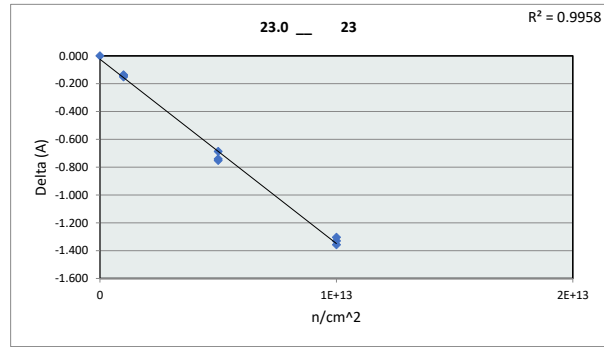


		22.0 __ 22		
Test Site				
Tester				
Test Number				
Max Limit		114.6	dB	
Min Limit		60	dB	
n/cm^2	0	1E+12	5E+12	1E+13
LL	60.000	60.000	60.000	60.000
Min	81.000	79.700	79.800	77.800
Average	81.000	79.967	80.033	78.800
Max	81.000	80.200	80.500	79.300
UL	114.600	114.600	114.600	114.600

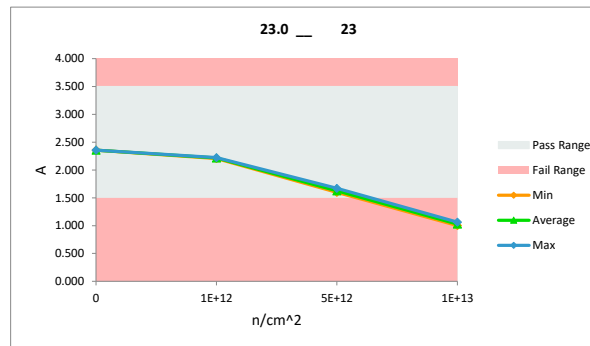


NDD Report LM2940GW5.0RLQV

		23.0	23		
Test Site					
Tester					
Test Number					
Unit		A	A		
Max Limit		3.5	3.5		
Min Limit		1.5	1.5		
n/cm ²	Serial #	PRE	POST	Delta	
1E+12	1.1	2.356	2.220	-0.136	
1E+12	2.1	2.373	2.222	-0.151	
1E+12	3.1	2.348	2.205	-0.143	
5E+12	4.1	2.358	1.671	-0.687	
5E+12	5.1	2.349	1.598	-0.751	
5E+12	6.1	2.354	1.613	-0.741	
1E+13	7.1	2.366	1.063	-1.303	
1E+13	8.1	2.350	1.020	-1.330	
1E+13	9.1	2.359	1.001	-1.358	
0	10.1	2.356	2.356	0.000	
	Max	2.373	2.356	0.000	
	Average	2.357	1.697	-0.660	
	Min	2.348	1.001	-1.358	
	Std Dev	0.008	0.538	0.538	

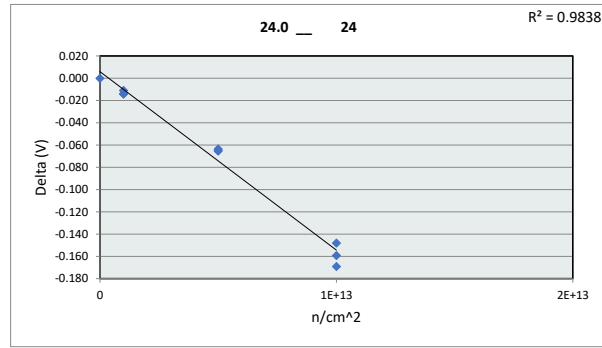


		23.0	23		
Test Site					
Tester					
Test Number					
Max Limit		3.5	A		
Min Limit		1.5	A		
n/cm ²		0	1E+12	5E+12	1E+13
LL		1.500	1.500	1.500	1.500
Min		2.356	2.205	1.598	1.001
Average		2.356	2.216	1.627	1.028
Max		2.356	2.222	1.671	1.063
UL		3.500	3.500	3.500	3.500

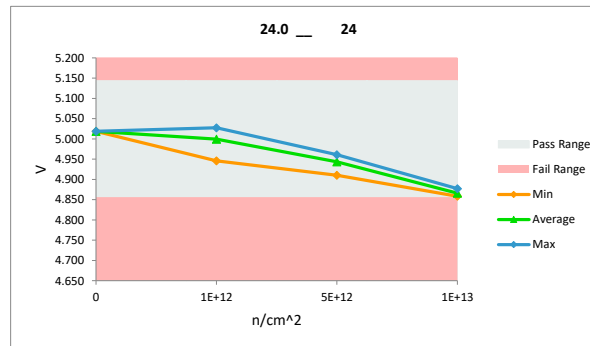


NDD Report
LM2940GW5.0RLQV

		24.0	24	
Test Site				
Tester				
Test Number				
Unit		V	V	
Max Limit		5.1436	5.1436	
Min Limit		4.8564	4.8564	
n/cm^2	Serial #	PRE	POST	Delta
1E+12	1.1	5.042	5.028	-0.014
1E+12	2.1	4.957	4.946	-0.011
1E+12	3.1	5.039	5.025	-0.014
5E+12	4.1	5.023	4.959	-0.064
5E+12	5.1	5.026	4.961	-0.066
5E+12	6.1	4.975	4.910	-0.065
1E+13	7.1	5.025	4.877	-0.148
1E+13	8.1	5.022	4.862	-0.159
1E+13	9.1	5.028	4.858	-0.169
0	10.1	5.019	5.019	0.000
Max		5.042	5.028	0.000
Average		5.016	4.945	-0.071
Min		4.957	4.858	-0.169
Std Dev		0.027	0.066	0.065



		24.0	24	
Test Site				
Tester				
Test Number				
Max Limit		5.1436	V	
Min Limit		4.8564	V	
n/cm^2	0	1E+12	5E+12	1E+13
LL	4.856	4.856	4.856	4.856
Min	5.019	4.946	4.910	4.858
Average	5.019	4.999	4.944	4.866
Max	5.019	5.028	4.961	4.877
UL	5.144	5.144	5.144	5.144



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