Radiation Report

LM117HVQML-SP NDD (Neutron Displacement Damage) Characterization

ABSTRACT

This report presents the effect of neutron displacement damage (NDD) on the LM117HVQML-SP device. The results show that all devices were fully functional and within production test limits after having been irradiated up to 1 × 10^{12} n/cm^2. A sample size of three units were exposed to radiation testing per (MIL-STD-883, Method 1017 for Neutron Irradiation). Electrical testing was performed at Texas Instruments before and after neutron irradiation using the production test program for LM117HVQML-SP.

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1 Overview

The LM117HVQML-SP are adjustable 3-terminal positive voltage regulators capable of supplying 0.5 A with up to a 60V input. They are exceptionally easy to use and require only two external resistors to set the output voltage. Further, both line and load regulation are better than standard fixed regulators.

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General device information and testing conditions are listed in Table 1-1.

Table 1-1. Overview Information

TI PART NUMBER	LM117HVQML-SP
Device Function	Linear regulator
Die Name	GLLM117HVHGJKL
Technology	BIPOLAR
A/T Lot Number / Date Code	7268577EM7 / 1721A
Biased Quantity Tested	0
Unbiased Quantity Tested	3
Exposure Facility	VPT Rad
Neutron Fluence (1-MeV equivalent)	1.0×10^{12} n/cm^2
Irradiation Temperature	25°C
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2 Test Procedures

The LM117HVQML-SP was electrically pre-tested using the production automated test equipment program. General test procedures were IAW MIL-STD-883, Method 1017 for Neutron Irradiation of the LM117HVQML-SP as modified in Table 2-1.

Table 2-1. Neutron Irradiation Conditions

GROUP	SAMPLE QTY	NEUTRON FLUENCE (n/cm^2)	BIAS
A	3	1.0×10^{12}	Unbiased

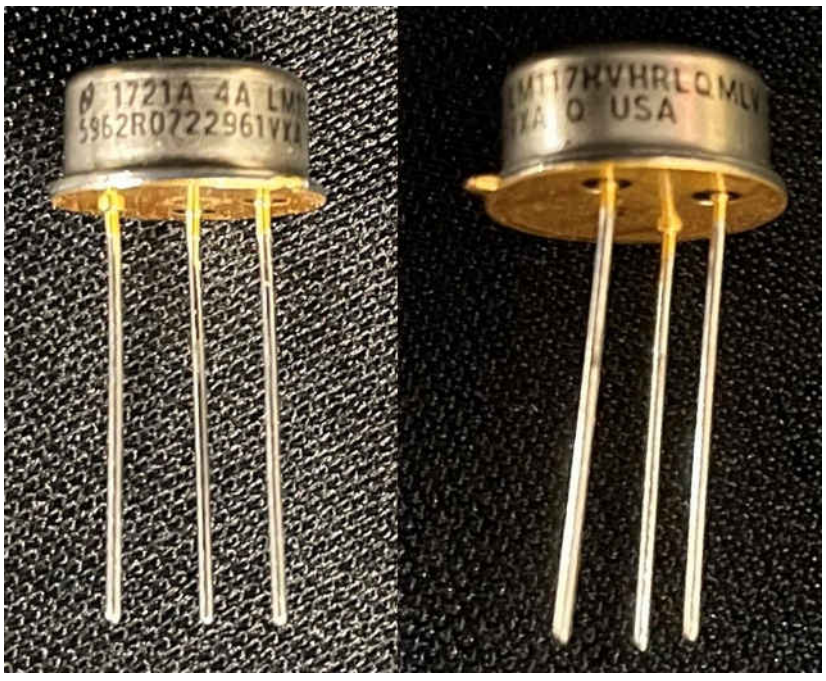

Figure 2-1. LM117HVQML-SP Device

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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 having a maximum thermal energy output of up to 1 MW. The fast neutron irradiator (FNI) faces one side of the reactor core and the 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 less than 150 rad(Si) for a 1E12 n/cm^2 (1-MeV 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/cm^2-s. The maximum neutron fluence rate is approximately 1.0E11 n/cm^2-s (both values are 1-MeV 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

The device passed all parametric measurements well within all data sheet limits for the exposure level 1.0×10^{12} n/cm^2. An overview of the largest drifts seen post-test is discussed later in this section. The data sheet parameters that were tested pre- and post-neutron radiation and their corresponding test names are included in Appendix A. Appendix B contains graphs showing the drift between pre- and post-neutron radiation for these parameters.

The ripple rejection parameter was reduced after neutron exposure. This parameter is measured with test number 101. This parameter drifted downwards from an average value of 80.860 dB to an average value of 66.090 dB.

The line regulation parameter increased after neutron exposure. This parameter is measured with test number 11. This parameter drifted upwards from an average value of 2.117 mV to an average value of 7.253 mV.

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A Test Results

Table A-1 provides the list of tested parameters.

Table A-1. Test List

Post-radiation data sheet limits are used where applicable.

PARAMETERS		TEST CONDITIONS	LM117HVQML-SP DATA SHEET (SNVS357D–MARCH 2006–REVISED APRIL 2013)			TEST NO. OR NAME
SYMBOL	DESCRIPTION		MIN	MAX	UNIT	
I_{Adj}	Adjust pin current	V_{Diff} = 3 V	–10	10	µA	1
		V_{Diff} = 40 V	–10	10	µA	2
I_Q	Minimum load current	V_{Diff} = 3 V, V_O = 1.7 V		5	mA	6
		V_{Diff} = 40 V, V_O = 1.7 V		5	mA	7
		V_I = 60 V, V_O = 1.7 V		5	mA	8
V_{Ref}	Reference voltage	V_{Diff} = 3 V, I_L = 8 mA	1.2	1.45	V	9
		V_{Diff} = 40 V, I_L = 8 mA	1.2	1.45	V	10, 18
V_{RLine}	Line regulation	3 V ≤ V_{Diff} ≤ 40 V, I_L = 8 mA	–40	40	mV	11
		40 V ≤ V_{Diff} ≤ 60 V, I_L = 8 mA	–25	–25	mV	12
V_{RLoad}	Load regulation	V_{Diff} = 3 V, 10 mA ≤ I_L ≤ 0.5 A	–27	27	mV	13
		V_{Diff} = 40 V, 10 mA ≤ I_L ≤ 150 mA	–15	15	mV	14
ΔI_{Adj}/ Load	Adjustment pin current change	V_{Diff} = 3 V, 10 mA ≤ I_L ≤ 0.5 A	–5	5	µA	4
		V_{Diff} = 40 V, 10 mA ≤ I_L ≤ 150 mA	–5	5	µA	5
ΔI_{Adj}/ Line	Adjustment pin current change	3 V ≤ V_{Diff} ≤ 40 V, I_L = 8 mA	–5	5	µA	3
I_{OS}	Short circuit current	V_{IN} = 4.25 V	0.5	1.8	A	16
		V_{IN} = 60 V	0	0.4	A	17
θ_R	Thermal regulation	V_{Diff} = 40 V, I_L = 150 mA, T = 20 mS	–6	6	mV	15
RR	Ripple rejection	120 Hz, 1-V RMS	55		dB	101

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B Test Data

Appendix B shows the detailed test results.

NDD Report - Parametric Drift Graphs

LM117HVQML-SP

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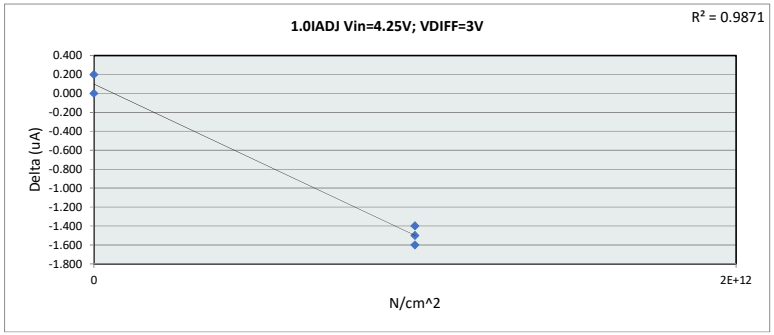
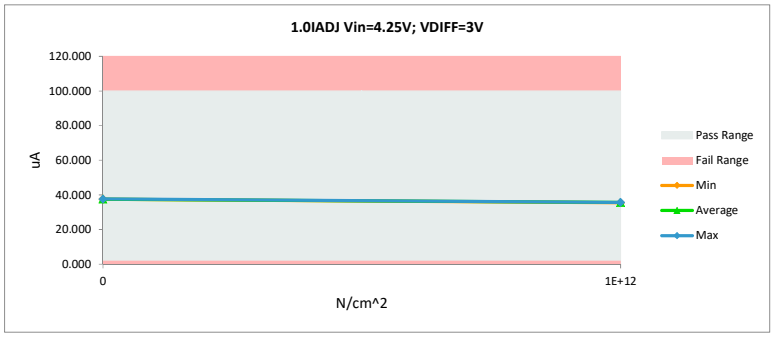
NDD Report - Parametric drift graphs
LM117HVQML-SP

	1.0IADJ Vin=4.25V; VDIFF=3V		
Test Site	SVA	SVA	
Tester	LTX	LTX	
Test Number	RH117HVHYC	RH117HVHYC	
Unit	uA	uA	
Max Limit	100	100	
Min Limit	2	2	
N/cm^2	Serial #	Pre	Post	Delta
1E+12	335	37.300	35.700	-1.600
1E+12	336	36.900	35.400	-1.500
1E+12	337	37.000	35.600	-1.400
0	41	37.300	37.500	0.200
0	42	37.600	37.600	0.000
	Max	37.600	37.600	0.200
	Average	37.220	36.360	-0.860
	Min	36.900	35.400	-1.600
	Std Dev	0.277	1.092	0.882

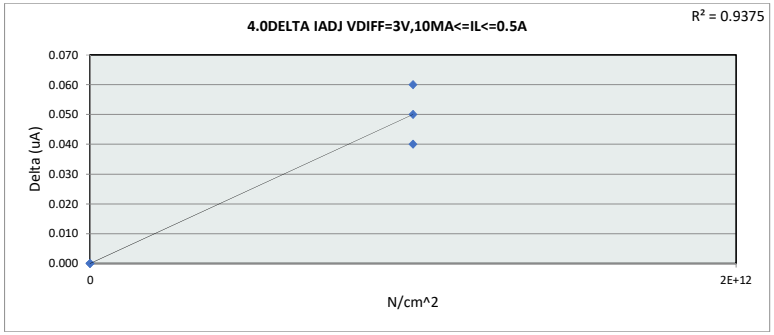


	1.0IADJ Vin=4.25V; VDIFF=3V	
Test Site	SVA	
Tester	LTX	
Test Number	RH117HVHYC	
Max Limit	100	uA
Min Limit	2	uA
N/cm^2	0	1E+12
LL	2.000	2.000
Min	37.500	35.400
Average	37.550	35.567
Max	37.600	35.700
UL	100.000	100.000

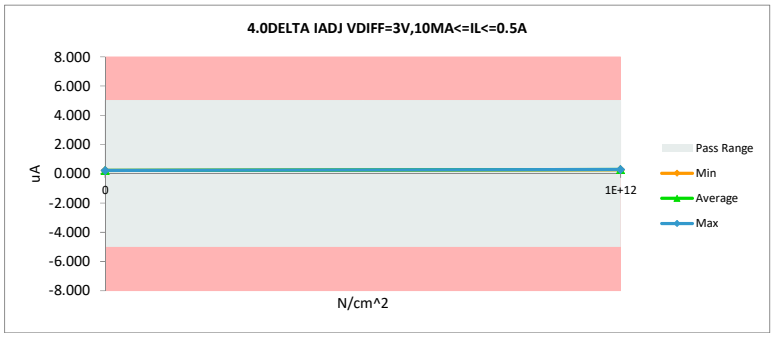


NDD Report - Parametric drift graphs
LM117HVQML-SP

	4.0DELTA IADJ VDIFF=3V,10MA<=IL<=0.5A		
Test Site	SVA	SVA	
Tester	LTX	LTX	
Test Number	RH117HVHYC	RH117HVHYC	
Unit	uA	uA	
Max Limit	5	5	
Min Limit	-5	-5	
N/cm^2	Serial #	Pre	Post	Delta
1E+12	335	0.240	0.280	0.040
1E+12	336	0.240	0.290	0.050
1E+12	337	0.230	0.290	0.060
0	41	0.230	0.230	0.000
0	42	0.230	0.230	0.000
	Max	0.240	0.290	0.060
	Average	0.234	0.264	0.030
	Min	0.230	0.230	0.000
	Std Dev	0.005	0.031	0.028

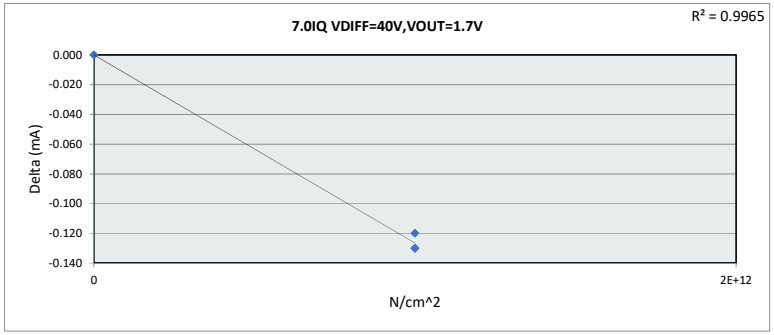


	4.0DELTA IADJ VDIFF=3V,10MA<=IL<=0.5A	
Test Site	SVA	
Tester	LTX	
Test Number	RH117HVHYC	
Max Limit	5	uA
Min Limit	-5	uA
N/cm^2	0	1E+12
LL	-5.000	-5.000
Min	0.230	0.280
Average	0.230	0.287
Max	0.230	0.290
UL	5.000	5.000

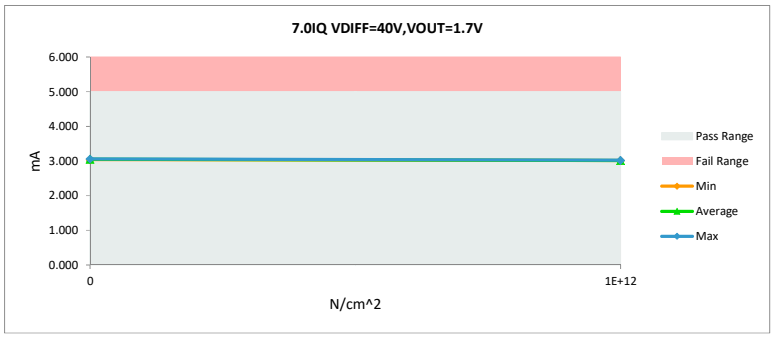


NDD Report - Parametric drift graphs
LM117HVQML-SP

	7.0IQ VDIFF=40V,VOUT=1.7V		
Test Site	SVA	SVA	
Tester	LTX	LTX	
Test Number	RH117HVHYC	RH117HVHYC	
Unit	mA	mA	
Max Limit	5	5	
Min Limit			
N/cm^2	Serial #	Pre	Post	Delta
1E+12	335	3.150	3.020	-0.130
1E+12	336	3.140	3.010	-0.130
1E+12	337	3.130	3.010	-0.120
0	41	3.060	3.060	0.000
0	42	3.040	3.040	0.000
Max		3.150	3.060	0.000
Average		3.104	3.028	-0.076
Min		3.040	3.010	-0.130
Std Dev		0.050	0.022	0.069

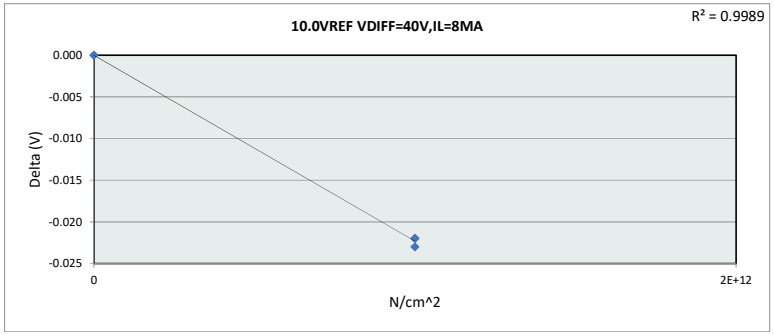


	7.0IQ VDIFF=40V,VOUT=1.7V	
Test Site	SVA	
Tester	LTX	
Test Number	RH117HVHYC	
Max Limit	5	mA
Min Limit		mA
N/cm^2	0	1E+12
LL		
Min	3.040	3.010
Average	3.050	3.013
Max	3.060	3.020
UL	5.000	5.000

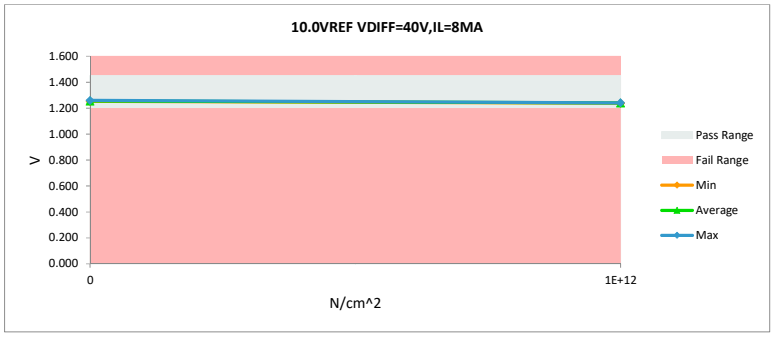


NDD Report - Parametric drift graphs
LM117HVQML-SP

	10.0VREF VDIFF=40V,IL=8MA		
Test Site	SVA	SVA	
Tester	LTX	LTX	
Test Number	RH117HVHYC	RH117HVHYC	
Unit	V	V	
Max Limit	1.45	1.45	
Min Limit	1.2	1.2	
N/cm^2	Serial #	Pre	Post	Delta
1E+12	335	1.262	1.240	-0.022
1E+12	336	1.260	1.237	-0.023
1E+12	337	1.263	1.241	-0.022
0	41	1.251	1.251	0.000
0	42	1.259	1.259	0.000
	Max	1.263	1.259	0.000
	Average	1.259	1.246	-0.013
	Min	1.251	1.237	-0.023
	Std Dev	0.005	0.009	0.012

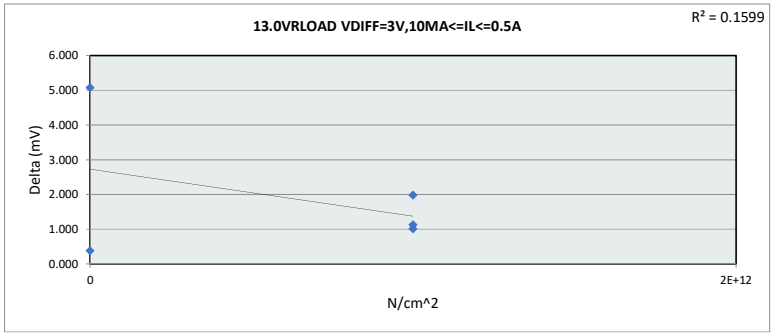


	10.0VREF VDIFF=40V,IL=8MA	
Test Site	SVA	
Tester	LTX	
Test Number	RH117HVHYC	
Max Limit	1.45	V
Min Limit	1.2	V
N/cm^2	0	1E+12
LL	1.200	1.200
Min	1.251	1.237
Average	1.255	1.239
Max	1.259	1.241
UL	1.450	1.450

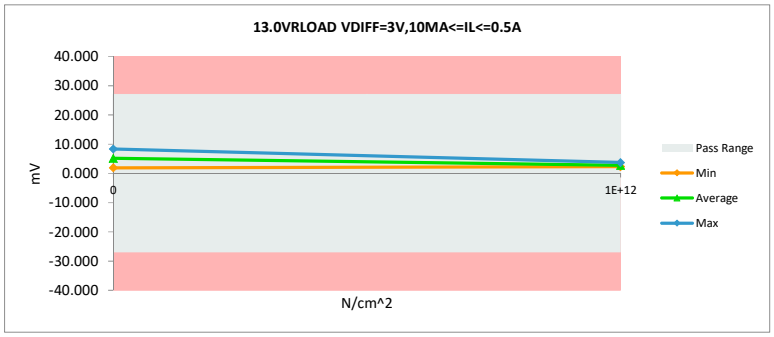


NDD Report - Parametric drift graphs
LM117HVQML-SP

	13.0VRLOAD VDIFF=3V,10MA<=IL<=0.5A		
Test Site	SVA	SVA	
Tester	LTX	LTX	
Test Number	RH117HVHYC	RH117HVHYC	
Unit	mV	mV	
Max Limit	27	27	
Min Limit	-27	-27	
N/cm^2	Serial #	Pre	Post	Delta
1E+12	335	1.190	2.320	1.130
1E+12	336	1.730	3.710	1.980
1E+12	337	1.340	2.350	1.010
0	41	3.300	8.380	5.080
0	42	1.560	1.940	0.380
	Max	3.300	8.380	5.080
	Average	1.824	3.740	1.916
	Min	1.190	1.940	0.380
	Std Dev	0.850	2.680	1.858

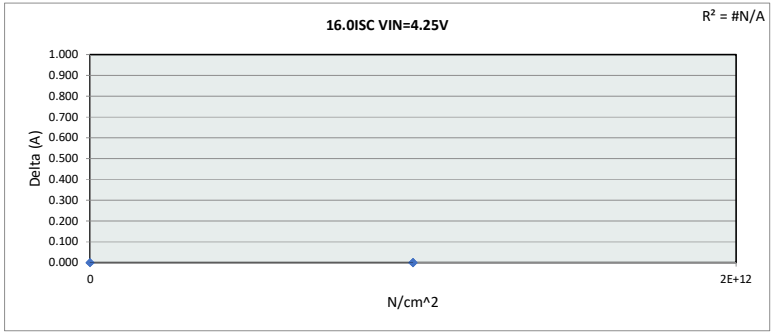


	13.0VRLOAD VDIFF=3V,10MA<=IL<=0.5A	
Test Site	SVA	
Tester	LTX	
Test Number	RH117HVHYC	
Max Limit	27	mV
Min Limit	-27	mV
N/cm^2	0	1E+12
LL	-27.000	-27.000
Min	1.940	2.320
Average	5.160	2.793
Max	8.380	3.710
UL	27.000	27.000

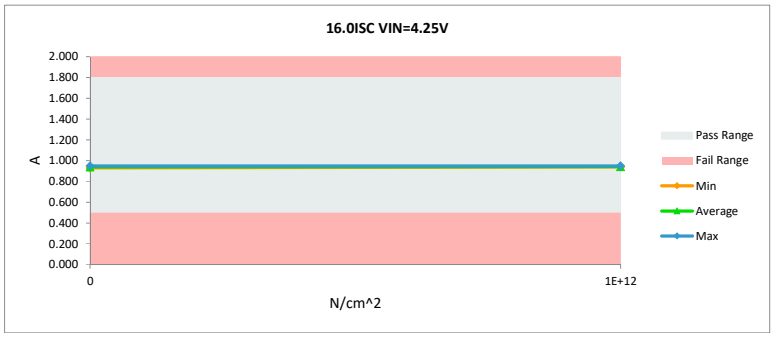


NDD Report - Parametric drift graphs
LM117HVQML-SP

	16.0ISC VIN=4.25V		
Test Site	SVA	SVA	
Tester	LTX	LTX	
Test Number	RH117HVHYC	RH117HVHYC	
Unit	A	A	
Max Limit	1.8	1.8	
Min Limit	0.5	0.5	
N/cm^2	Serial #	Pre	Post	Delta
1E+12	335	0.940	0.940	0.000
1E+12	336	0.940	0.940	0.000
1E+12	337	0.950	0.950	0.000
0	41	0.950	0.950	0.000
0	42	0.930	0.930	0.000
	Max	0.950	0.950	0.000
	Average	0.942	0.942	0.000
	Min	0.930	0.930	0.000
	Std Dev	0.008	0.008	0.000

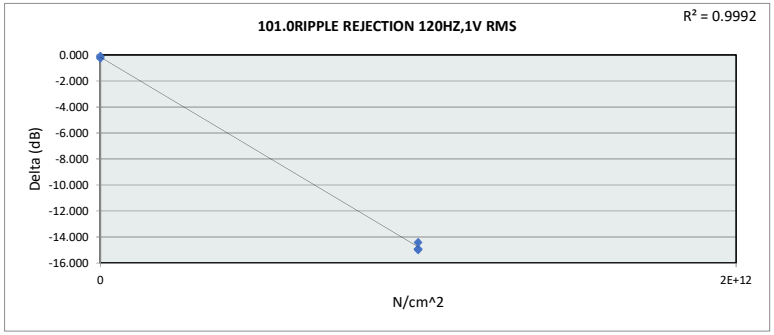


	16.0ISC VIN=4.25V	
Test Site	SVA	
Tester	LTX	
Test Number	RH117HVHYC	
Max Limit	1.8	A
Min Limit	0.5	A
N/cm^2	0	1E+12
LL	0.500	0.500
Min	0.930	0.940
Average	0.940	0.943
Max	0.950	0.950
UL	1.800	1.800

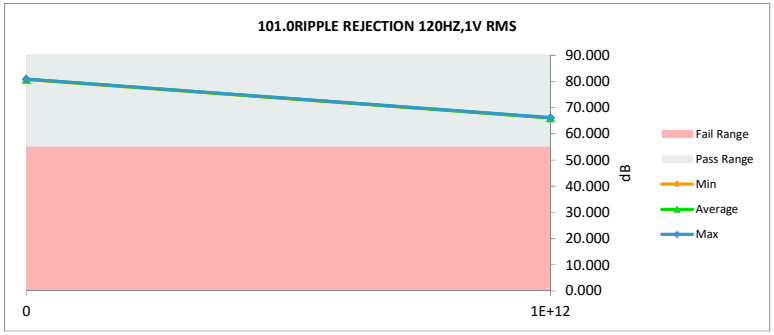


NDD Report - Parametric drift graphs
LM117HVQML-SP

	101.0RIPPLE REJECTION 120HZ,1V RMS		
Test Site	SVA	SVA	
Tester	LTX	LTX	
Test Number	RH117HVHYC	RH117HVHYC	
Unit	dB	dB	
Max Limit			
Min Limit	55	55	
N/cm^2	Serial #	Pre	Post	Delta
1E+12	335	81.060	66.150	-14.910
1E+12	336	81.060	66.080	-14.980
1E+12	337	80.460	66.040	-14.420
0	41	81.170	80.930	-0.240
0	42	80.870	80.770	-0.100
	Max	81.170	80.930	-0.100
	Average	80.924	71.994	-8.930
	Min	80.460	66.040	-14.980
	Std Dev	0.281	8.085	8.000

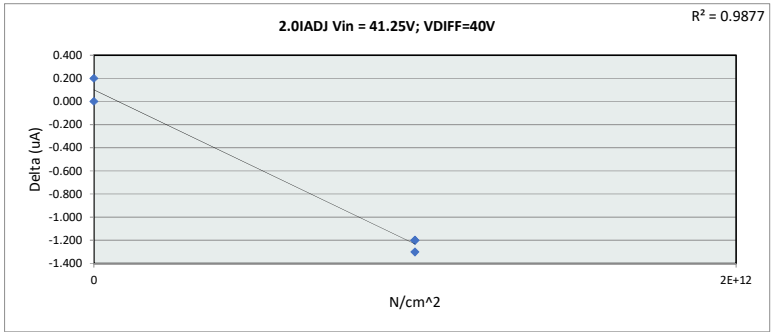


	101.0RIPPLE REJECTION 120HZ,1V RMS	
Test Site	SVA	
Tester	LTX	
Test Number	RH117HVHYC	
Max Limit		dB
Min Limit	55	dB
N/cm^2	0	1E+12
LL	55.000	55.000
Min	80.770	66.040
Average	80.850	66.090
Max	80.930	66.150
UL		

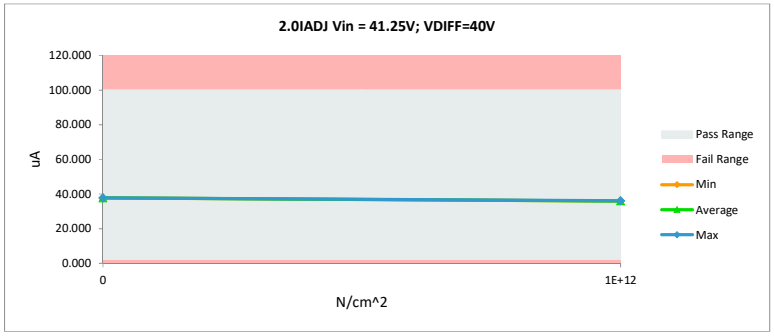


NDD Report - Parametric drift graphs
LM117HVQML-SP

	2.0IADJ Vin = 41.25V; VDIFF=40V		
Test Site	SVA	SVA	
Tester	LTX	LTX	
Test Number	RH117HVHYC	RH117HVHYC	
Unit	uA	uA	
Max Limit	100	100	
Min Limit	2	2	
N/cm^2	Serial #	Pre	Post	Delta
1E+12	335	37.400	36.100	-1.300
1E+12	336	37.100	35.900	-1.200
1E+12	337	37.200	36.000	-1.200
0	41	37.500	37.700	0.200
0	42	37.800	37.800	0.000
	Max	37.800	37.800	0.200
	Average	37.400	36.700	-0.700
	Min	37.100	35.900	-1.300
	Std Dev	0.274	0.962	0.735

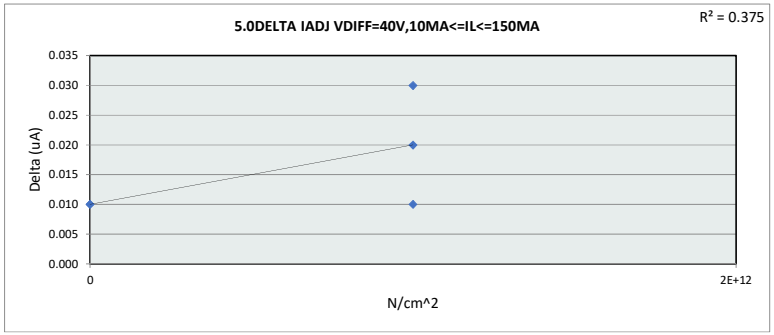


	2.0IADJ Vin = 41.25V; VDIFF=40V	
Test Site	SVA	
Tester	LTX	
Test Number	RH117HVHYC	
Max Limit	100	uA
Min Limit	2	uA
N/cm^2	0	1E+12
LL	2.000	2.000
Min	37.700	35.900
Average	37.750	36.000
Max	37.800	36.100
UL	100.000	100.000

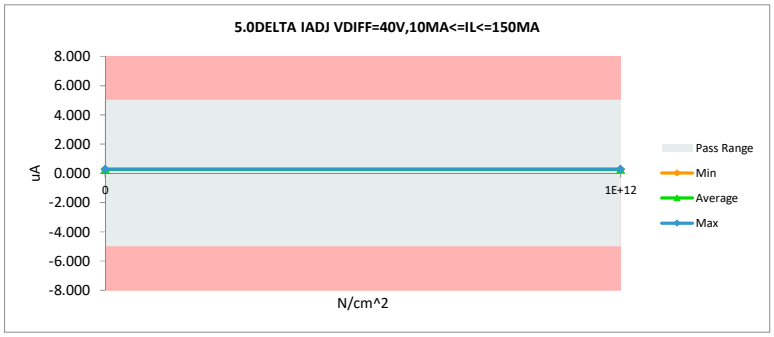


NDD Report - Parametric drift graphs
LM117HVQML-SP

	5.0DELTA IADJ VDIFF=40V,10MA<=IL<=15		
Test Site	SVA	SVA	
Tester	LTX	LTX	
Test Number	RH117HVHYC	RH117HVHYC	
Unit	uA	uA	
Max Limit	5	5	
Min Limit	-5	-5	
N/cm^2	Serial #	Pre	Post	Delta
1E+12	335	0.260	0.270	0.010
1E+12	336	0.250	0.280	0.030
1E+12	337	0.240	0.260	0.020
0	41	0.260	0.270	0.010
0	42	0.270	0.280	0.010
	Max	0.270	0.280	0.030
	Average	0.256	0.272	0.016
	Min	0.240	0.260	0.010
	Std Dev	0.011	0.008	0.009

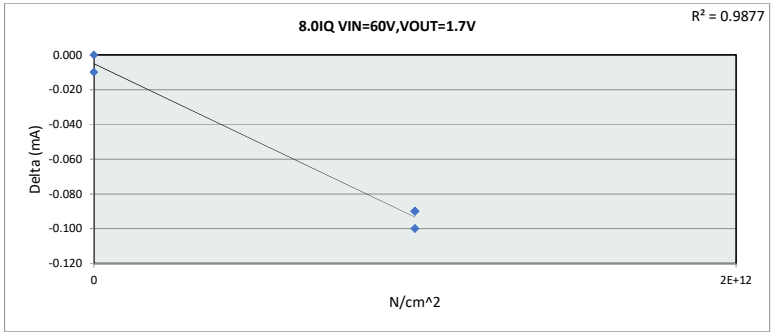


	5.0DELTA IADJ VDIFF=40V,10MA<=IL<=150MA	
Test Site	SVA	
Tester	LTX	
Test Number	RH117HVHYC	
Max Limit	5	uA
Min Limit	-5	uA
N/cm^2	0	1E+12
LL	-5.000	-5.000
Min	0.270	0.260
Average	0.275	0.270
Max	0.280	0.280
UL	5.000	5.000

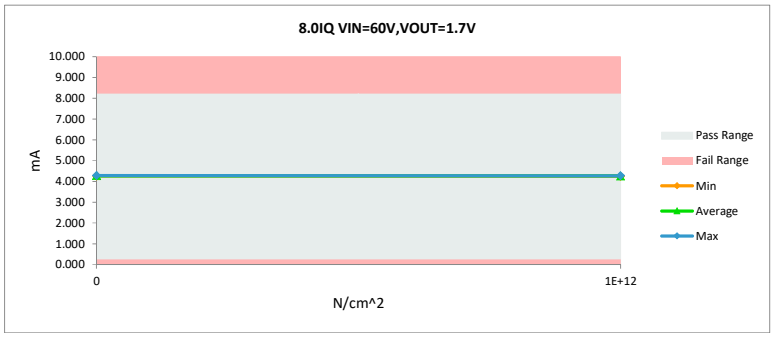


NDD Report - Parametric drift graphs
LM117HVQML-SP

	8.0IQ VIN=60V,VOUT=1.7V		
Test Site	SVA	SVA	
Tester	LTX	LTX	
Test Number	RH117HVHYC	RH117HVHYC	
Unit	mA	mA	
Max Limit	8.2	8.2	
Min Limit	0.25	0.25	
N/cm^2	Serial #	Pre	Post	Delta
1E+12	335	4.370	4.270	-0.100
1E+12	336	4.350	4.260	-0.090
1E+12	337	4.340	4.250	-0.090
0	41	4.290	4.280	-0.010
0	42	4.260	4.260	0.000
	Max	4.370	4.280	0.000
	Average	4.322	4.264	-0.058
	Min	4.260	4.250	-0.100
	Std Dev	0.045	0.011	0.049

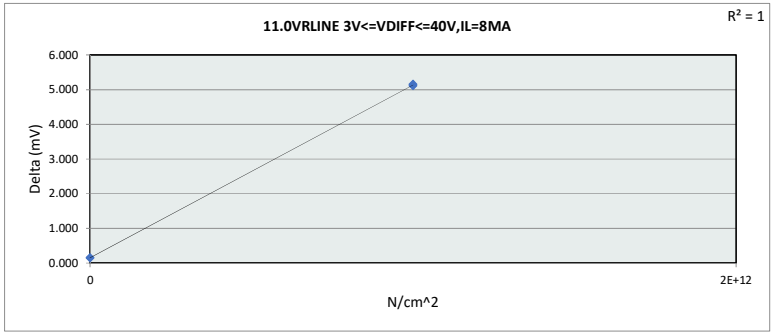


	8.0IQ VIN=60V,VOUT=1.7V	
Test Site	SVA	
Tester	LTX	
Test Number	RH117HVHYC	
Max Limit	8.2	mA
Min Limit	0.25	mA
N/cm^2	0	1E+12
LL	0.250	0.250
Min	4.260	4.250
Average	4.270	4.260
Max	4.280	4.270
UL	8.200	8.200

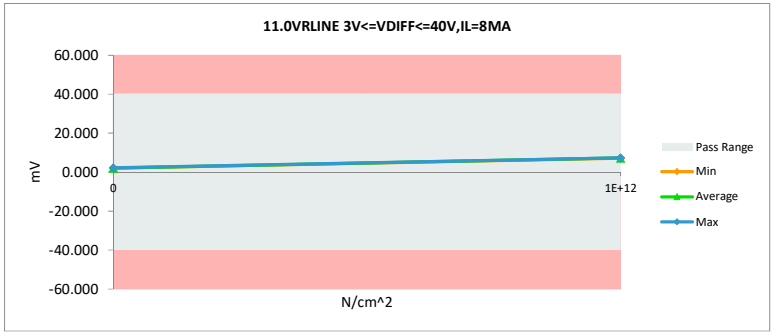


NDD Report - Parametric drift graphs
LM117HVQML-SP

	11.0VRLINE 3V<=VDIFF<=40V,IL=8MA		
Test Site	SVA	SVA	
Tester	LTX	LTX	
Test Number	RH117HVHYC	RH117HVHYC	
Unit	mV	mV	
Max Limit	40	40	
Min Limit	-40	-40	
N/cm^2	Serial #	Pre	Post	Delta
1E+12	335	2.090	7.230	5.140
1E+12	336	2.220	7.330	5.110
1E+12	337	2.040	7.200	5.160
0	41	2.100	2.240	0.140
0	42	1.900	2.060	0.160
	Max	2.220	7.330	5.160
	Average	2.070	5.212	3.142
	Min	1.900	2.060	0.140
	Std Dev	0.116	2.796	2.731

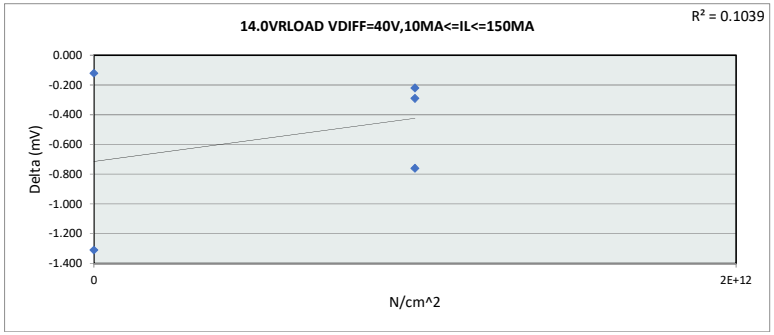


	11.0VRLINE 3V<=VDIFF<=40V,IL=8MA	
Test Site	SVA	
Tester	LTX	
Test Number	RH117HVHYC	
Max Limit	40	mV
Min Limit	-40	mV
N/cm^2	0	1E+12
LL	-40.000	-40.000
Min	2.060	7.200
Average	2.150	7.253
Max	2.240	7.330
UL	40.000	40.000

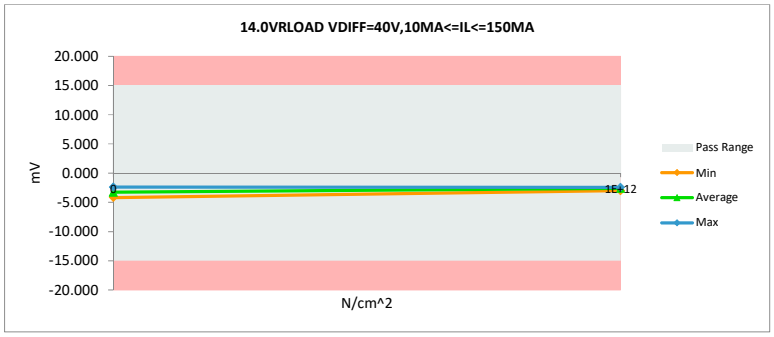


NDD Report - Parametric drift graphs
LM117HVQML-SP

	14.0VRLOAD VDIFF=40V,10MA<=IL<=150M		
Test Site	SVA	SVA	
Tester	LTX	LTX	
Test Number	RH117HVHYC	RH117HVHYC	
Unit	mV	mV	
Max Limit	15	15	
Min Limit	-15	-15	
N/cm^2	Serial #	Pre	Post	Delta
1E+12	335	-2.210	-2.430	-0.220
1E+12	336	-2.250	-3.010	-0.760
1E+12	337	-2.150	-2.440	-0.290
0	41	-2.860	-4.170	-1.310
0	42	-2.270	-2.390	-0.120
	Max	-2.150	-2.390	-0.120
	Average	-2.348	-2.888	-0.540
	Min	-2.860	-4.170	-1.310
	Std Dev	0.290	0.761	0.496

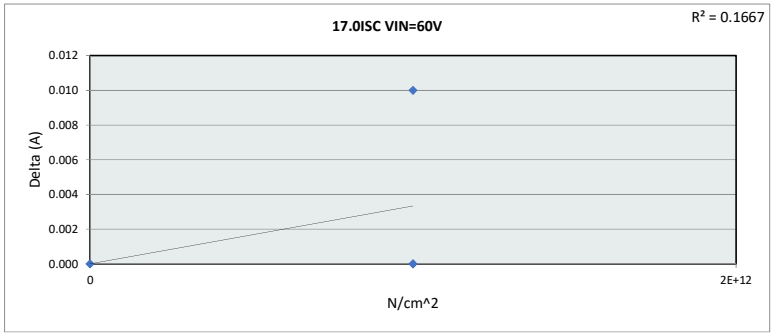


	14.0VRLOAD VDIFF=40V,10MA<=IL<=150MA	
Test Site	SVA	
Tester	LTX	
Test Number	RH117HVHYC	
Max Limit	15	mV
Min Limit	-15	mV
N/cm^2	0	1E+12
LL	-15.000	-15.000
Min	-4.170	-3.010
Average	-3.280	-2.627
Max	-2.390	-2.430
UL	15.000	15.000

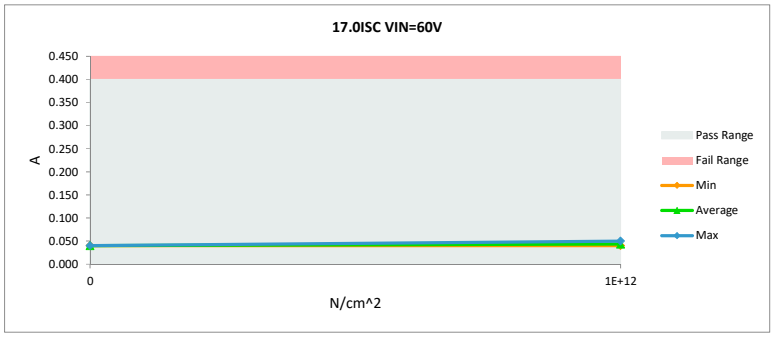


NDD Report - Parametric drift graphs
LM117HVQML-SP

	17.0ISC VIN=60V		
Test Site	SVA	SVA	
Tester	LTX	LTX	
Test Number	RH117HVHYC	RH117HVHYC	
Unit	A	A	
Max Limit	0.4	0.4	
Min Limit	0	0	
N/cm^2	Serial #	Pre	Post	Delta
1E+12	335	0.040	0.040	0.000
1E+12	336	0.040	0.040	0.000
1E+12	337	0.040	0.050	0.010
0	41	0.040	0.040	0.000
0	42	0.040	0.040	0.000
	Max	0.040	0.050	0.010
	Average	0.040	0.042	0.002
	Min	0.040	0.040	0.000
	Std Dev	0.000	0.004	0.004

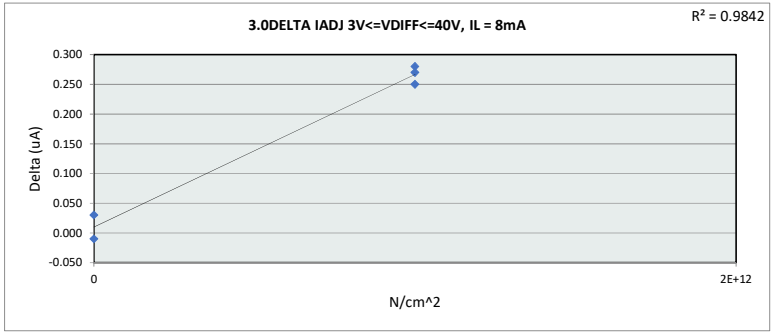


	17.0ISC VIN=60V	
Test Site	SVA	
Tester	LTX	
Test Number	RH117HVHYC	
Max Limit	0.4	A
Min Limit	0	A
N/cm^2	0	1E+12
LL	0.000	0.000
Min	0.040	0.040
Average	0.040	0.043
Max	0.040	0.050
UL	0.400	0.400

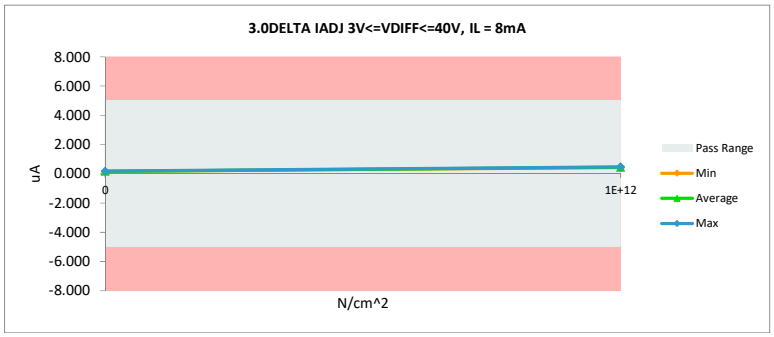


NDD Report - Parametric drift graphs
LM117HVQML-SP

	3.0DELTA IADJ 3V<=VDIFF<=40V, IL = 8mA		
Test Site	SVA	SVA	
Tester	LTX	LTX	
Test Number	RH117HVHYC	RH117HVHYC	
Unit	uA	uA	
Max Limit	5	5	
Min Limit	-5	-5	
N/cm^2	Serial #	Pre	Post	Delta
1E+12	335	0.190	0.470	0.280
1E+12	336	0.180	0.450	0.270
1E+12	337	0.170	0.420	0.250
0	41	0.150	0.180	0.030
0	42	0.170	0.160	-0.010
	Max	0.190	0.470	0.280
	Average	0.172	0.336	0.164
	Min	0.150	0.160	-0.010
	Std Dev	0.015	0.153	0.142

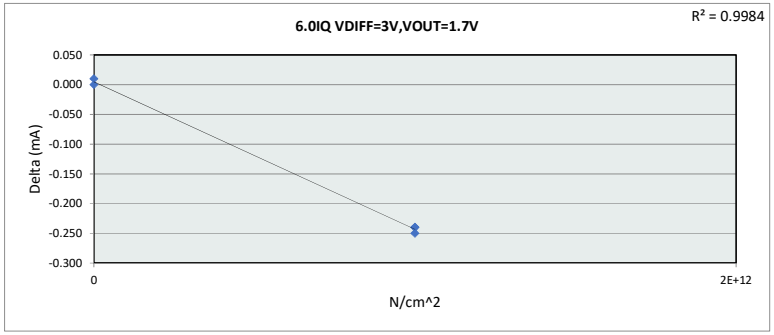


	3.0DELTA IADJ 3V<=VDIFF<=40V, IL = 8mA	
Test Site	SVA	
Tester	LTX	
Test Number	RH117HVHYC	
Max Limit	5	uA
Min Limit	-5	uA
N/cm^2	0	1E+12
LL	-5.000	-5.000
Min	0.160	0.420
Average	0.170	0.447
Max	0.180	0.470
UL	5.000	5.000

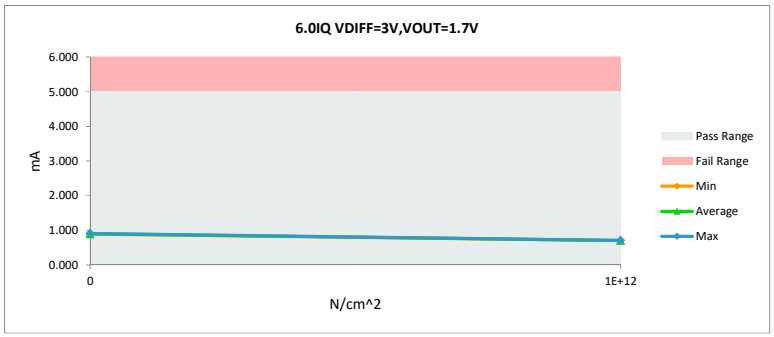


NDD Report - Parametric drift graphs
LM117HVQML-SP

	6.0IQ VDIFF=3V,VOUT=1.7V		
Test Site	SVA	SVA	
Tester	LTX	LTX	
Test Number	RH117HVHYC	RH117HVHYC	
Unit	mA	mA	
Max Limit	5	5	
Min Limit			
N/cm^2	Serial #	Pre	Post	Delta
1E+12	335	0.960	0.710	-0.250
1E+12	336	0.950	0.710	-0.240
1E+12	337	0.950	0.710	-0.240
0	41	0.900	0.910	0.010
0	42	0.890	0.890	0.000
	Max	0.960	0.910	0.010
	Average	0.930	0.786	-0.144
	Min	0.890	0.710	-0.250
	Std Dev	0.032	0.104	0.136

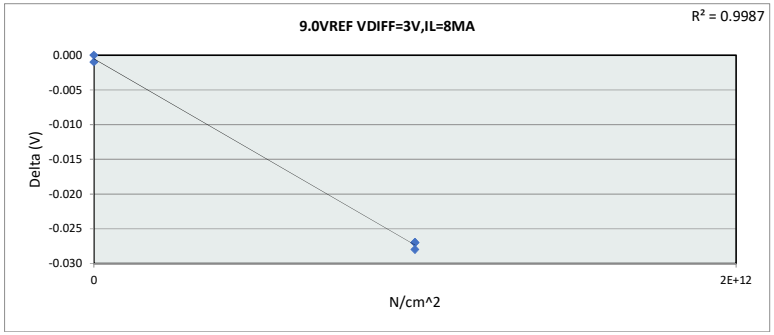


	6.0IQ VDIFF=3V,VOUT=1.7V	
Test Site	SVA	
Tester	LTX	
Test Number	RH117HVHYC	
Max Limit	5	mA
Min Limit		mA
N/cm^2	0	1E+12
LL		
Min	0.890	0.710
Average	0.900	0.710
Max	0.910	0.710
UL	5.000	5.000

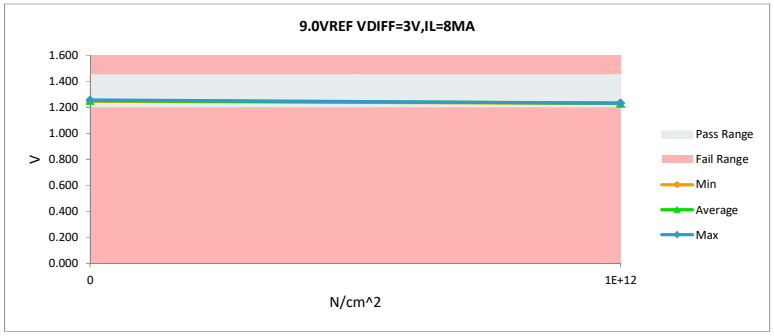


NDD Report - Parametric drift graphs
LM117HVQML-SP

	9.0VREF VDIFF=3V,IL=8MA		
Test Site	SVA	SVA	
Tester	LTX	LTX	
Test Number	RH117HVHYC	RH117HVHYC	
Unit	V	V	
Max Limit	1.45	1.45	
Min Limit	1.2	1.2	
N/cm^2	Serial #	Pre	Post	Delta
1E+12	335	1.259	1.232	-0.027
1E+12	336	1.257	1.230	-0.027
1E+12	337	1.261	1.233	-0.028
0	41	1.249	1.248	-0.001
0	42	1.257	1.257	0.000
	Max	1.261	1.257	0.000
	Average	1.257	1.240	-0.017
	Min	1.249	1.230	-0.028
	Std Dev	0.005	0.012	0.015

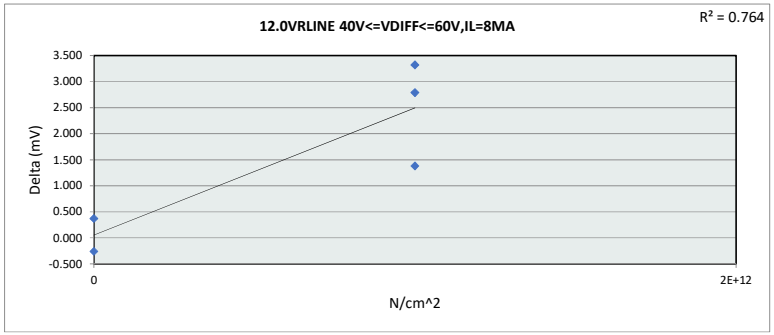


	9.0VREF VDIFF=3V,IL=8MA	
Test Site	SVA	
Tester	LTX	
Test Number	RH117HVHYC	
Max Limit	1.45	V
Min Limit	1.2	V
N/cm^2	0	1E+12
LL	1.200	1.200
Min	1.248	1.230
Average	1.253	1.232
Max	1.257	1.233
UL	1.450	1.450

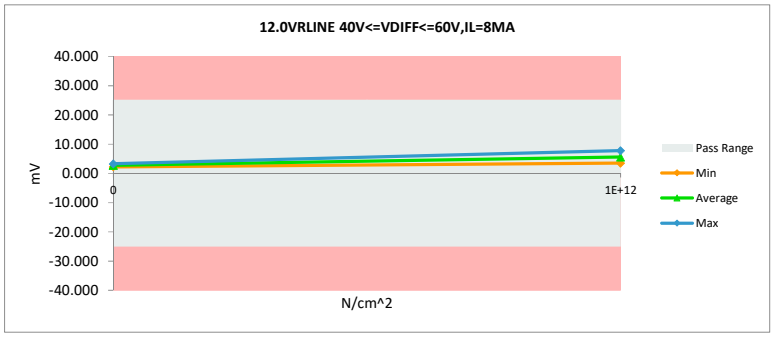


NDD Report - Parametric drift graphs
LM117HVQML-SP

	12.0VRLINE 40V<=VDIFF<=60V,IL=8MA		
Test Site	SVA	SVA	
Tester	LTX	LTX	
Test Number	RH117HVHYC	RH117HVHYC	
Unit	mV	mV	
Max Limit	25	25	
Min Limit	-25	-25	
N/cm^2	Serial #	Pre	Post	Delta
1E+12	335	2.130	3.510	1.380
1E+12	336	2.830	5.620	2.790
1E+12	337	4.440	7.760	3.320
0	41	2.500	2.240	-0.260
0	42	2.900	3.270	0.370
	Max	4.440	7.760	3.320
	Average	2.960	4.480	1.520
	Min	2.130	2.240	-0.260
	Std Dev	0.882	2.207	1.530

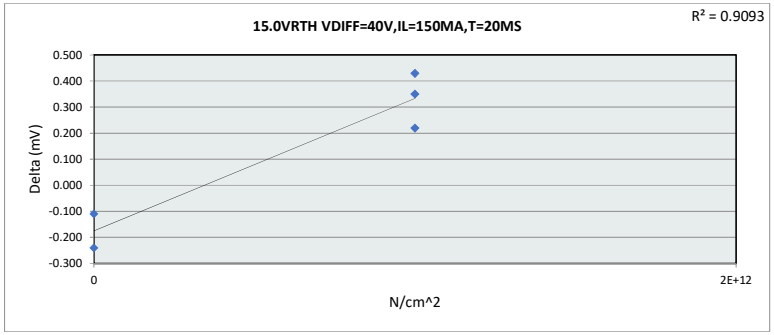


	12.0VRLINE 40V<=VDIFF<=60V,IL=8MA	
Test Site	SVA	
Tester	LTX	
Test Number	RH117HVHYC	
Max Limit	25	mV
Min Limit	-25	mV
N/cm^2	0	1E+12
LL	-25.000	-25.000
Min	2.240	3.510
Average	2.755	5.630
Max	3.270	7.760
UL	25.000	25.000

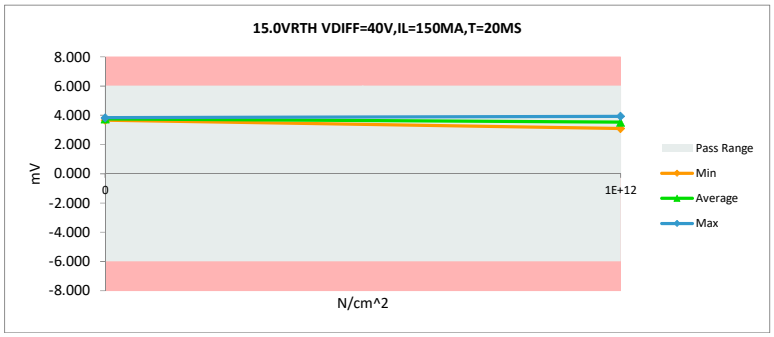


NDD Report - Parametric drift graphs
LM117HVQML-SP

	15.0VRTH VDIFF=40V,IL=150MA,T=20MS		
Test Site	SVA	SVA	
Tester	LTX	LTX	
Test Number	RH117HVHYC	RH117HVHYC	
Unit	mV	mV	
Max Limit	6	6	
Min Limit	-6	-6	
N/cm^2	Serial #	Pre	Post	Delta
1E+12	335	3.500	3.930	0.430
1E+12	336	3.210	3.560	0.350
1E+12	337	2.870	3.090	0.220
0	41	3.900	3.660	-0.240
0	42	3.940	3.830	-0.110
	Max	3.940	3.930	0.430
	Average	3.484	3.614	0.130
	Min	2.870	3.090	-0.240
	Std Dev	0.456	0.326	0.292

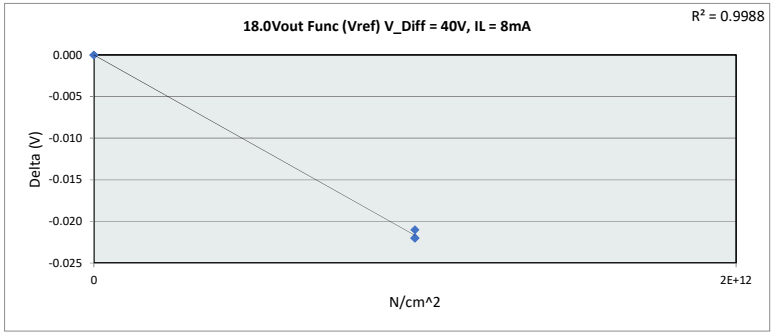


	15.0VRTH VDIFF=40V,IL=150MA,T=20MS	
Test Site	SVA	
Tester	LTX	
Test Number	RH117HVHYC	
Max Limit	6	mV
Min Limit	-6	mV
N/cm^2	0	1E+12
LL	-6.000	-6.000
Min	3.660	3.090
Average	3.745	3.527
Max	3.830	3.930
UL	6.000	6.000

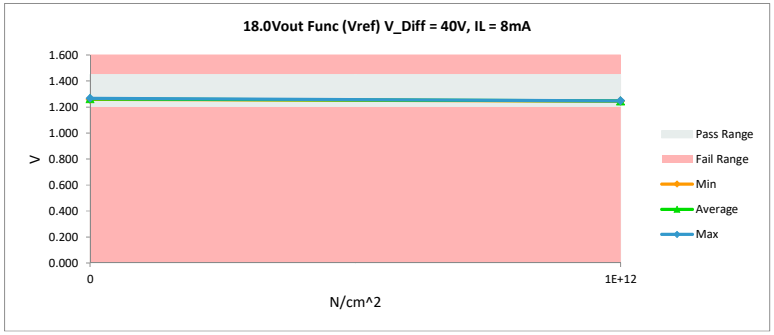


NDD Report - Parametric drift graphs
LM117HVQML-SP

	18.0Vout Func (Vref) V_Diff = 40V, IL = 8mA		
Test Site	SVA	SVA	
Tester	LTX	LTX	
Test Number	RH117HVHYC	RH117HVHYC	
Unit	V	V	
Max Limit	1.45	1.45	
Min Limit	1.2	1.2	
N/cm^2	Serial #	Pre	Post	Delta
1E+12	335	1.269	1.248	-0.021
1E+12	336	1.267	1.245	-0.022
1E+12	337	1.270	1.248	-0.022
0	41	1.259	1.259	0.000
0	42	1.267	1.267	0.000
	Max	1.270	1.267	0.000
	Average	1.266	1.253	-0.013
	Min	1.259	1.245	-0.022
	Std Dev	0.004	0.009	0.012



	18.0Vout Func (Vref) V_Diff = 40V, IL = 8mA	
Test Site	SVA	
Tester	LTX	
Test Number	RH117HVHYC	
Max Limit	1.45	V
Min Limit	1.2	V
N/cm^2	0	1E+12
LL	1.200	1.200
Min	1.259	1.245
Average	1.263	1.247
Max	1.267	1.248
UL	1.450	1.450



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