



ABSTRACT

This report covers the radiation characterization results of the SN55LVRA4-SEP, radiation tolerant high-speed differential line receiver. The study was done to determine Total Ionizing Dose (TID) effects under high dose rate (HDR) up to 30krad(Si) as a one time characterization. The results show that all samples passed within the specified limits up to 30krad(Si). The data shows that HDR produces the worst-case parametric shifts and therefore will be used for Radiation Lot Acceptance Testing (RLAT). RLAT will be performed using 5 units at a dose level of 30krad(Si) for future wafer lots per MIL-STD-883 TM 1019. All future wafer lots will be tested under the same conditions. TID HDR characterization was performed per TM 1019.

The SN55LVRA4-SEP LIN3B process technology contains Bipolar and CMOS components. In addition to an HDR TID, an ELDRS characterization was performed on technology process node (LIN3B) that is used by this product. Results showed that worst case values post-irradiation were still within pre-radiation specification limits for both HDR and LDR, hence no ELDRS effects were exhibited. Thus, HDR will be performed on each wafer lot for future RLAT testing.

The SN55LVRA4-SEP is packaged in a space enhanced plastic package for low outgassing characteristics and is Single Event Latch-Up (SEL) immune up to 50MeV-cm²/mg, which makes the device an option for low Earth orbit space applications. Single Event Transient (SET) data is also provided in the Single Event Effects Radiation Report.

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1 Device Information

The SN55LVRA4-SEP is a radiation tolerant quad channel differential receiver that implements the electrical characteristics of low-voltage differential signaling (LVDS) with a 3.3V supply. The intended application and signaling technique of these devices is point-to-point baseband data transmission over controlled impedance media of approximately 100Ω.

1.1 Device Details

[Table 1-1](#) lists the device information used for TID HDR characterization and qualification.

Table 1-1. Device and Exposure Details

TID HDR Details: Up To 30krad(Si)	
TI Device Number	SN55LVRA4-SEP
VID Number	V62/25606
Package	16-pin D(SOIC)
Technology	LIN3B
Die Lot Number	4045684FFB
A/T Lot Number and Date Code	4892755ML4 / 4CC3EDK
Quantity Tested	15 irradiated devices + 2 control
Lot Accept or Reject	Devices passed 30krad(Si)
HDR Radiation Facility	Texas Instruments CLAB in Dallas, Texas
HDR Dose Level	10krad(Si), 20krad(Si), 30krad(Si)
HDR Dose Rate	169.21rad(Si)/s ionizing radiation
HDR Radiation Source	Gammacell 220 Excel (GC-220E) Co-60
Irradiation Temperature	Ambient, room temperature

2 Total Dose Test Setup

2.1 Test Overview

The SN55LVRA4-SEP samples were irradiated at a high dose rate of 169.21rad(Si)/s up to 30krad(Si) and then put through full electrical parametric testing on the production Automated Test Equipment (ATE). The samples were functional and passed all electrical parametric tests with readings within data sheet electrical specification limits.

The SN55LVRA4-SEP LIN3B process technology contains Bipolar and CMOS components. In addition to an HDR TID, an ELDRS characterization was performed on technology process node (LIN3B) that is used by this product. Results showed that worst case values post-irradiation were still within pre-radiation specification limits for both HDR and LDR, hence no ELDRS effects were exhibited. Thus, HDR will be performed on each wafer lot for future RLAT testing.

2.2 Test Description and Facilities

The SN55LVRA4-SEP HDR exposure was performed on biased devices in a Co-60 gamma cell at TI facility in Dallas, Texas. The un-attenuated dose rate of this cell is 169.21rads(Si)/s. After exposure, the devices were packed in dry ice (per MIL-STD-883 Method 1019.9 section 3.10) and full post radiation electrical evaluation using Texas Instruments ATE was conducted. ATE test limits are set per data sheet electrical limits based on qualification and characterization data. Post radiation measurements were taken within 30 minutes of removing the devices from the dry ice container. The devices were allowed to reach room temperature prior to electrical post radiation measurements.

2.3 Test Setup Details

The devices were tested in biased conditions as described in the following sections.

2.3.1 Bias Diagram

Figure 2-1 shows the bias conditions for each pin during irradiation.

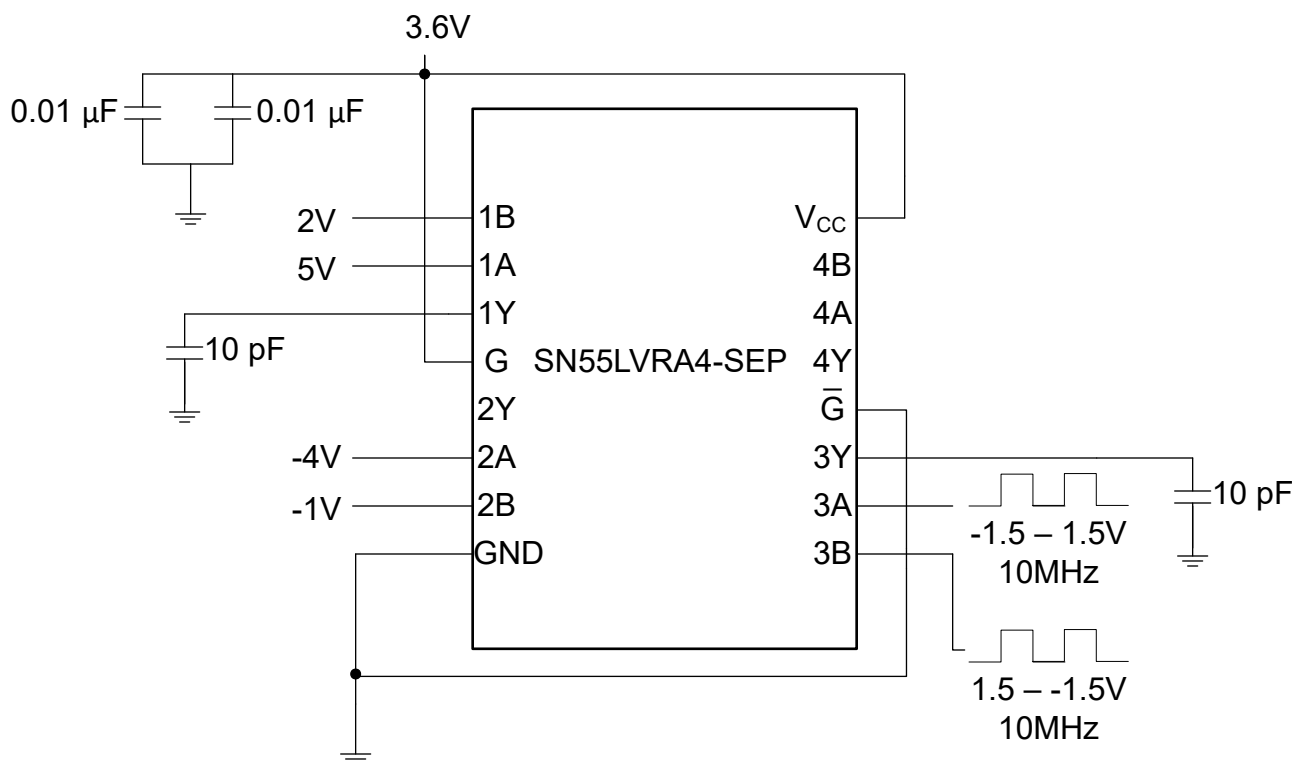


Figure 2-1. SN55LVRA4-SEP Bias Diagram

2.4 Test Configuration and Condition

A step stress (10k, 20k, and 30k) test method was used to determine the TID hardness level. That is, after a predetermined TID level was reached, an electrical test was performed on a given sample of parts to verify that the units are within specified data sheet electrical test limits. The HDR RLAT units were irradiated to 30krad(Si), and parametrically tested on ATE. The units that were irradiated to 30krad(Si) and the data is shown in [Appendix A](#).

[Table 2-1](#) and [Table 2-1](#) list the serialized samples used for TID characterization.

Table 2-1. HDR Device Information

Control Group	HDR Dose Rate = 169.21rad(Si)/s		
Total Samples: 2	Total Samples: 15 Biased		
	Exposure Levels		
0krad (Si)	10krad (Si)	20krad(Si)	30krad(Si)
Biased	Biased	Biased	Biased
1 - 2	3 - 7	8 - 12	13- 17

3 TID Characterization Test Results

3.1 TID Characterization Summary Results

The parametric data for the SN55LVRA4-SEP passes up to 30krad(Si) HDR TID irradiation. The drifts of the electrical parameters through HDR were within the data sheet limits.

Overall, the SN55LVRA4-SEP showed a strong degree of hardness to HDR TID irradiation up to 30krad(Si). The measurements taken post-irradiation for each sample set showed a marginal shift for most parameters at each dose level. The parameters that did show a greater degree of change between pre- and post-irradiation were still within the electrical performance characteristics specified in the data sheet electrical parameters. For the data sheet electrical parameters and associated tests, see [SN55LVRA4-SEP Radiation Tolerant Quad Channel High-Speed Differential Line Receiver](#).

The SN55LVRA4-SEP LIN3B process technology contains Bipolar and CMOS components. In addition to an HDR TID, an ELDRS characterization was performed on technology process node (LIN3B) that is used by this product. Results showed that worst case values post-irradiation were still within pre-radiation specification limits for both HDR and LDR, hence no ELDRS effects were exhibited. Thus, HDR will be performed on each wafer lot for future RLAT testing.

See [Appendix A](#) for HDR report up to 30krad(Si).

3.2 Specification Compliance Matrix

Table 3-1. Electrical Parameters Table

Parameter	Test Conditions	V _{CC}	T _A = -55°C to +125°C			Unit	Test Name
			MIN	TYP	MAX		
V _{IT1}	Positive-going differential input voltage threshold, V _{IB} = 0V, 1.2 or 5V, Tested at V _{IT1} = 80mV	3.0V - 3.6V			85	mV	V _{IT1}
V _{IT2}	Negative-going differential input voltage threshold, V _{IB} = 0V, 1.2 or 5V, Tested at V _{IT2} = -80mV	3.0V - 3.6V	-85			mV	V _{IT2}
V _{OH}	High-level output voltage	3.0V - 3.6V	2.4			V	V _{OH}
V _{OL}	Low-level output voltage	3.0V - 3.6V			0.8	V	V _{OL}
I _{I(OFF)}	Output current with power off, V _O = 0 or 2.4V	0V	-25		25	μA	I _{OFF_2}
I _{I(OFF)}	Output current with power off, V _O = 5V or -4V	0V	-70		70		I _{OFF_1}
I _I	Input current (A or B inputs) V _I = 0V, other input open	3.0V - 3.6V	-25		25	μA	I _{I_0V}
I _I	Input Current (A or B inputs) V _I = 2.4V, other input open	3.0V - 3.6V	-25		25	μA	I _{I_2p4V}
I _I	Input Currents (A or B inputs) V _I = -4V, other input open	3.0V - 3.6V	-80		80	μA	I _{I_N4p0V}
I _I	Input Currents (A or B inputs) V _I = 5V, other input open	3.0V - 3.6V	-45		45	μA	I _{I_5p0V}
I _{ID}	Differential input current (I _{IA} – I _{IB})	3.0V - 3.6V	-5		5	μA	I _{IO}
I _{OZ}	High impedance state output current, V _O = 0 or 2.4V, G = 0.8V and $\bar{G}$ = 2V	3.0V - 3.6V	-12		12	μA	I _{OZ}
V _{IH}	High level input voltage (G, $\bar{G}$, A)	3.0V - 3.6V	2			V	V _{IH}
V _{IL}	Low level input voltage (G, $\bar{G}$, A)	3.0V - 3.6V			0.8	V	V _{IL}
I _{IH}	High level input (G, $\bar{G}$, A), V _{IH} = 3.6V	3.0V - 3.6V			15	μA	I _{IH}
I _{IL}	Low level input (G, $\bar{G}$, A), V _{IL} = 0V	3.0V - 3.6V			15	μA	I _{IL}
I _{CC}	Supply current, No load, enabled	3.0V - 3.6V		16	25	mA	I _{CC_Enabled}
I _{CC}	Supply current, disabled and in deep sleep, G at GND for >100μS	3.0V - 3.6V		1.1	6	mA	I _{CC_Disabled}

4 Reference Documents

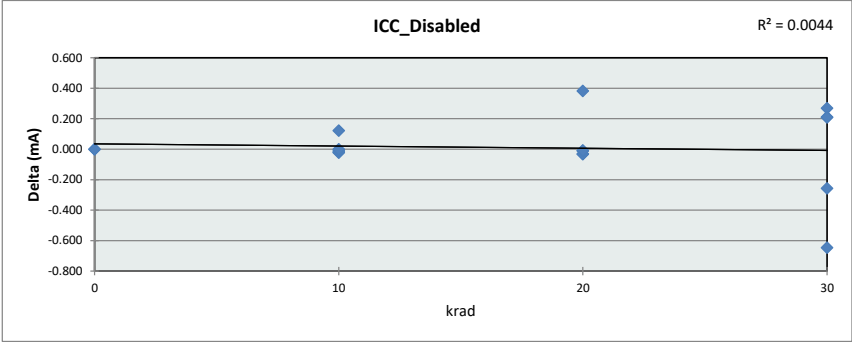
Texas Instruments total ionizing dose radiation (total dose) test procedure follows the standards put forth in MIL-STD-883 TM 1019. The document can be found at the DLA website.

Appendix A: HDR TID Report Data

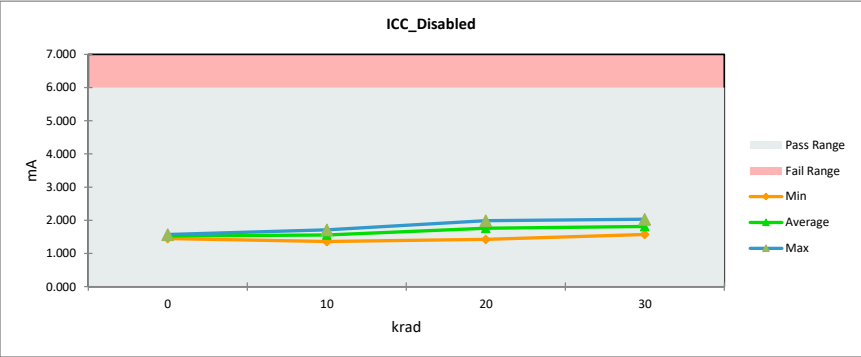
This appendix provides the SN55LVRA4-SEP TID HDR report. The report shows the variation for each parameter up to 30krad(Si).

TID Report
SN55LVRA4-SEP

ICC_Disabled						
Units		mA				
Max Limit		6				
Min Limit		0.01				
krad	Serial #	PreTestHDR	PostTestHDR	Delta	Delta %	% of Limit Range
0	1	1.537	1.537	0.000	0.00%	0.00%
0	2	1.448	1.448	0.000	0.00%	0.00%
10	3	1.588	1.570	-0.018	-1.13%	0.30%
10	4	1.571	1.549	-0.022	-1.40%	0.37%
10	5	1.474	1.463	-0.011	-0.75%	0.18%
10	6	1.500	1.623	0.123	8.20%	2.05%
10	7	1.360	1.360	0.000	0.00%	0.00%
20	8	1.740	1.709	-0.031	-1.78%	0.52%
20	9	1.668	1.637	-0.031	-1.86%	0.52%
20	10	1.436	1.425	-0.011	-0.77%	0.18%
20	11	1.684	1.676	-0.008	-0.48%	0.13%
20	12	1.463	1.846	0.383	26.18%	6.39%
30	13	1.778	1.989	0.211	11.87%	3.52%
30	14	2.112	1.856	-0.256	-12.12%	4.27%
30	15	2.217	1.571	-0.646	-29.14%	10.78%
30	16	1.566	1.836	0.270	17.24%	4.51%
30	17	1.822	2.031	0.209	11.47%	3.49%
Max		2.217	2.031	-0.186	26.18%	10.78%
Average		1.645	1.654	0.010	1.50%	2.19%
Min		1.360	1.360	0.000	-29.14%	0.00%
Std Dev		0.234	0.198	-0.037	11.97%	3.00%

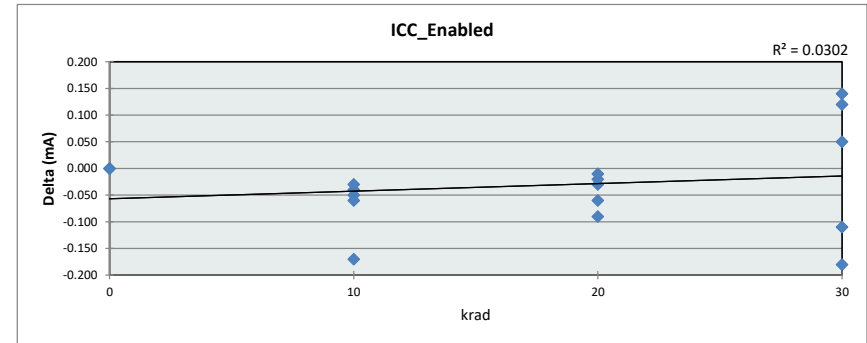


ICC_Disabled				
Units	mA			
Max Limit	6			
Min Limit	0.01			
krad	0	10	20	30
LL	0.010	0.010	0.010	0.010
Min	1.448	1.360	1.425	1.571
Average	1.526	1.558	1.758	1.813
Max	1.570	1.709	1.989	2.031
UL	6.000	6.000	6.000	6.000

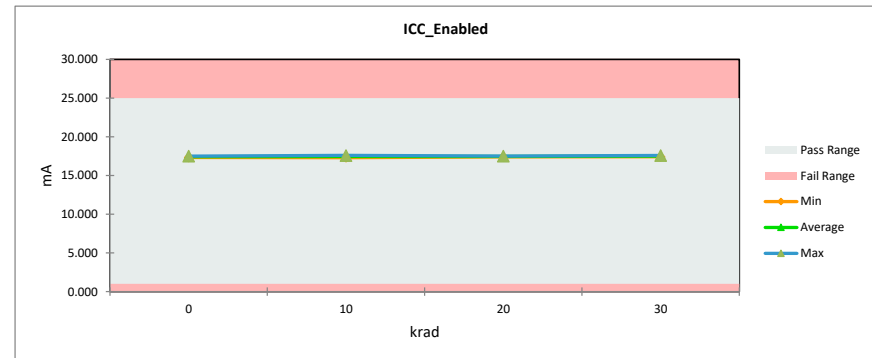


TID Report SN55LVRA4-SEP

		ICC_Enabled				
Units		mA				
Max Limit		25				
Min Limit		1				
krad	Serial #	PreTestHDR	PostTestHDR	Delta	Delta %	% of Limit Range
0	1	17.340	17.340	0.000	0.00%	0.00%
0	2	17.420	17.420	0.000	0.00%	0.00%
10	3	17.510	17.460	-0.050	-0.29%	0.21%
10	4	17.560	17.500	-0.060	-0.34%	0.25%
10	5	17.580	17.540	-0.040	-0.23%	0.17%
10	6	17.770	17.600	-0.170	-0.96%	0.71%
10	7	17.440	17.410	-0.030	-0.17%	0.13%
20	8	17.390	17.300	-0.090	-0.52%	0.37%
20	9	17.520	17.460	-0.060	-0.34%	0.25%
20	10	17.460	17.430	-0.030	-0.17%	0.13%
20	11	17.480	17.460	-0.020	-0.11%	0.08%
20	12	17.420	17.410	-0.010	-0.06%	0.04%
30	13	17.380	17.520	0.140	0.81%	0.58%
30	14	17.530	17.420	-0.110	-0.63%	0.46%
30	15	17.460	17.580	0.120	0.69%	0.50%
30	16	17.600	17.420	-0.180	-1.02%	0.75%
30	17	17.450	17.500	0.050	0.29%	0.21%
Max		17.770	17.600	-0.170	0.81%	0.75%
Average		17.489	17.457	-0.032	-0.18%	0.28%
Min		17.340	17.300	-0.040	-1.02%	0.00%
Std Dev		0.102	0.078	-0.024	0.48%	0.24%

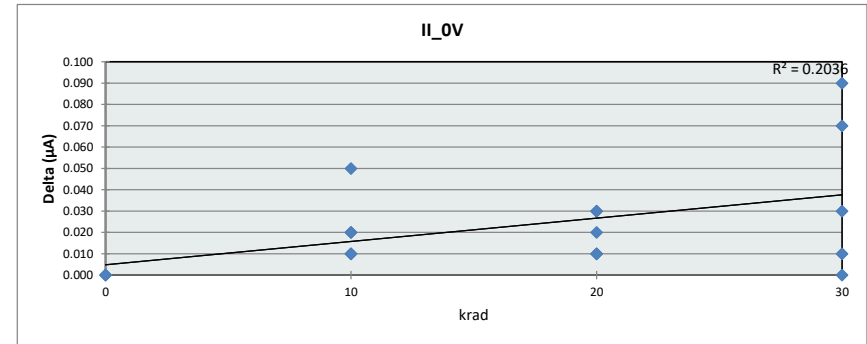


		ICC_Enabled			
Units		mA			
Max Limit		25			
Min Limit		1			
krad		0	10	20	30
LL		1.000	1.000	1.000	1.000
Min		17.340	17.300	17.410	17.420
Average		17.430	17.462	17.448	17.500
Max		17.500	17.600	17.520	17.580
UL		25.000	25.000	25.000	25.000

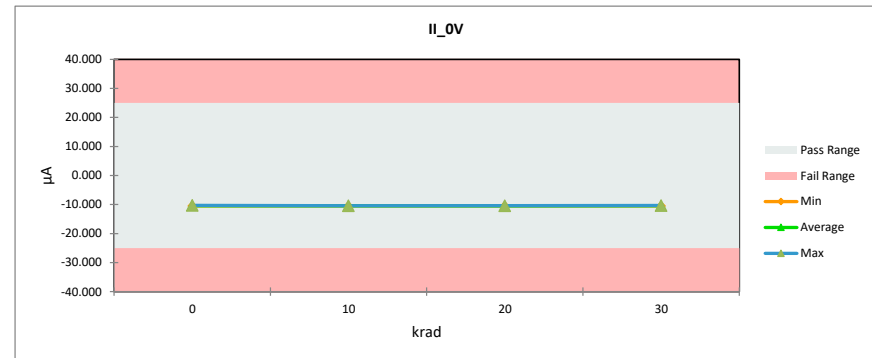


TID Report SN55LVRA4-SEP

II_OV						
Units		μA				
Max Limit		25				
Min Limit		-25				
krad	Serial #	PreTestHDR	PostTestHDR	Delta	Delta %	% of Limit Range
0	1	-10.290	-10.290	0.000	0.00%	0.00%
0	2	-10.440	-10.440	0.000	0.00%	0.00%
10	3	-10.470	-10.450	0.020	-0.19%	0.04%
10	4	-10.480	-10.460	0.020	-0.19%	0.04%
10	5	-10.430	-10.420	0.010	-0.10%	0.02%
10	6	-10.500	-10.450	0.050	-0.48%	0.10%
10	7	-10.460	-10.450	0.010	-0.10%	0.02%
20	8	-10.490	-10.460	0.030	-0.29%	0.06%
20	9	-10.470	-10.440	0.030	-0.29%	0.06%
20	10	-10.450	-10.440	0.010	-0.10%	0.02%
20	11	-10.410	-10.390	0.020	-0.19%	0.04%
20	12	-10.460	-10.450	0.010	-0.10%	0.02%
30	13	-10.470	-10.440	0.030	-0.29%	0.06%
30	14	-10.460	-10.460	0.000	0.00%	0.00%
30	15	-10.490	-10.480	0.010	-0.10%	0.02%
30	16	-10.490	-10.400	0.090	-0.86%	0.18%
30	17	-10.420	-10.350	0.070	-0.67%	0.14%
Max		-10.290	-10.290	0.000	0.00%	0.18%
Average		-10.452	-10.428	0.024	-0.23%	0.05%
Min		-10.500	-10.480	0.020	-0.86%	0.00%
Std Dev		0.049	0.047	-0.002	0.24%	0.05%

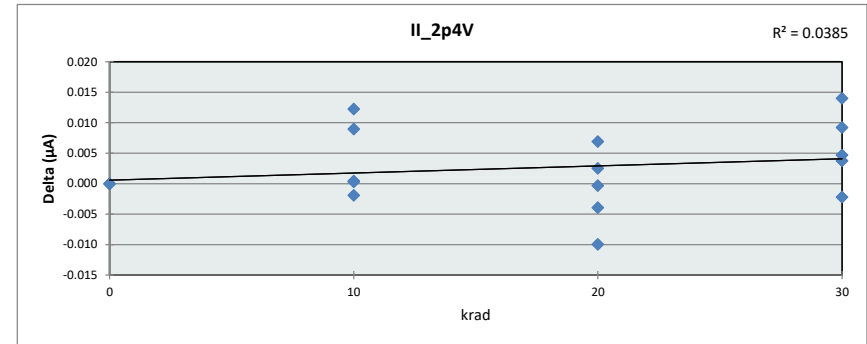


II_OV				
Units		μA		
Max Limit		25		
Min Limit		-25		
krad	0	10	20	30
LL	-25.000	-25.000	-25.000	-25.000
Min	-10.460	-10.460	-10.460	-10.480
Average	-10.410	-10.444	-10.436	-10.410
Max	-10.290	-10.420	-10.390	-10.350
UL	25.000	25.000	25.000	25.000

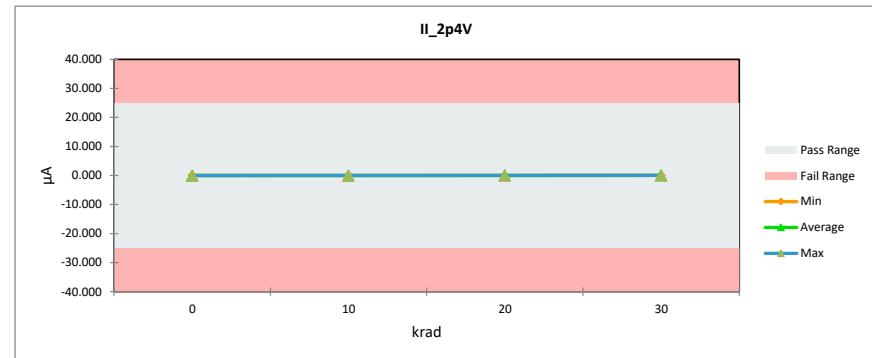


TID Report SN55LVRA4-SEP

II_2p4V						
Units		μA				
Max Limit		25				
Min Limit		-25				
krad	Serial #	PreTestHDR	PostTestHDR	Delta	Delta %	% of Limit Range
0	1	0.015	0.015	0.000	0.00%	0.00%
0	2	0.028	0.028	0.000	0.00%	0.00%
10	3	0.014	0.012	-0.002	-13.36%	0.00%
10	4	0.009	0.009	0.000	4.76%	0.00%
10	5	0.008	0.020	0.012	162.70%	0.02%
10	6	0.019	0.028	0.009	47.54%	0.02%
10	7	0.016	0.016	0.000	2.04%	0.00%
20	8	0.024	0.027	0.003	10.36%	0.01%
20	9	0.028	0.024	-0.004	-14.01%	0.01%
20	10	0.018	0.018	0.000	-1.75%	0.00%
20	11	0.030	0.037	0.007	23.16%	0.01%
20	12	0.025	0.015	-0.010	-39.77%	0.02%
30	13	0.010	0.008	-0.002	-21.48%	0.00%
30	14	0.010	0.019	0.009	93.97%	0.02%
30	15	0.027	0.032	0.005	17.45%	0.01%
30	16	0.019	0.033	0.014	74.19%	0.03%
30	17	0.021	0.024	0.004	18.28%	0.01%
Max		0.030	0.037	0.007	162.70%	0.03%
Average		0.019	0.021	0.003	21.42%	0.01%
Min		0.008	0.008	0.001	-39.77%	0.00%
Std Dev		0.007	0.008	0.001	49.37%	0.01%

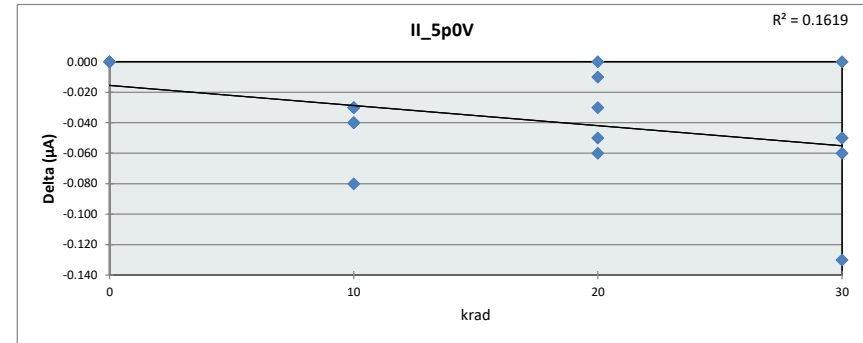


II_2p4V				
Units	μA			
Max Limit	25			
Min Limit	-25			
krad	0	10	20	30
LL	-25.000	-25.000	-25.000	-25.000
Min	0.009	0.016	0.008	0.024
Average	0.016	0.023	0.019	0.030
Max	0.028	0.028	0.037	0.033
UL	25.000	25.000	25.000	25.000

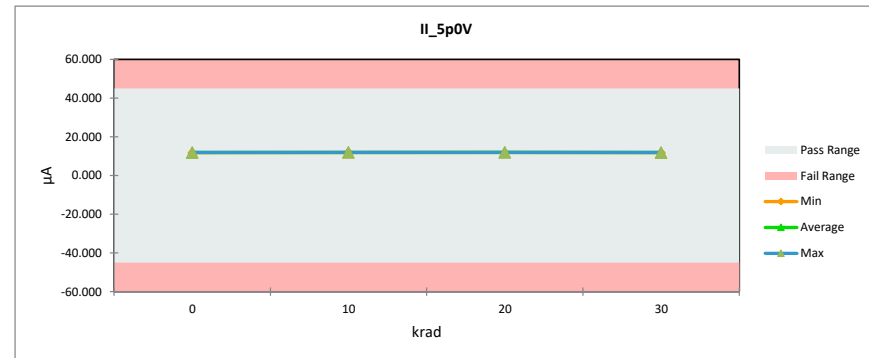


TID Report SN55LVRA4-SEP

II_5p0V						
Units		μA				
Max Limit		45				
Min Limit		-45				
krad	Serial #	PreTestHDR	PostTestHDR	Delta	Delta %	% of Limit Range
0	1	11.830	11.830	0.000	0.00%	0.00%
0	2	11.930	11.930	0.000	0.00%	0.00%
10	3	11.930	11.890	-0.040	-0.34%	0.04%
10	4	11.940	11.900	-0.040	-0.34%	0.04%
10	5	11.900	11.870	-0.030	-0.25%	0.03%
10	6	12.020	11.940	-0.080	-0.67%	0.09%
10	7	11.980	11.950	-0.030	-0.25%	0.03%
20	8	11.970	11.910	-0.060	-0.50%	0.07%
20	9	11.980	11.930	-0.050	-0.42%	0.06%
20	10	11.930	11.920	-0.010	-0.08%	0.01%
20	11	11.950	11.950	0.000	0.00%	0.00%
20	12	11.960	11.930	-0.030	-0.25%	0.03%
30	13	11.960	11.900	-0.060	-0.50%	0.07%
30	14	11.940	11.940	0.000	0.00%	0.00%
30	15	11.980	11.930	-0.050	-0.42%	0.06%
30	16	11.960	11.910	-0.050	-0.42%	0.06%
30	17	11.940	11.810	-0.130	-1.09%	0.14%
Max		12.020	11.950	-0.070	0.00%	0.14%
Average		11.947	11.908	-0.039	-0.32%	0.04%
Min		11.830	11.810	-0.020	-1.09%	0.00%
Std Dev		0.041	0.040	-0.001	0.28%	0.04%

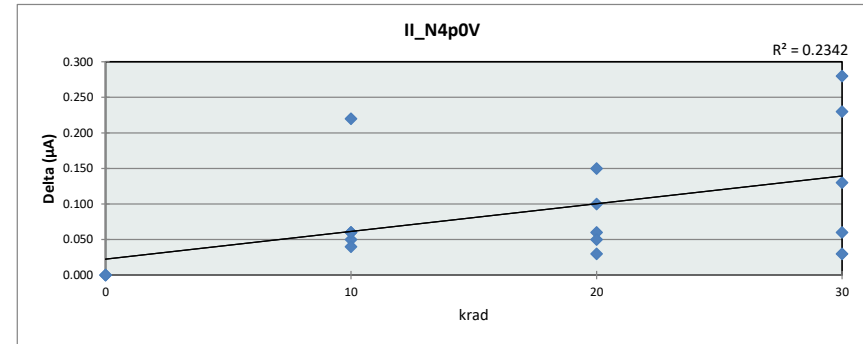


II_5p0V				
Units		μA		
Max Limit		45		
Min Limit		-45		
krad	0	10	20	30
LL	-45.000	-45.000	-45.000	-45.000
Min	11.830	11.870	11.900	11.810
Average	11.888	11.920	11.928	11.883
Max	11.930	11.950	11.950	11.930
UL	45.000	45.000	45.000	45.000

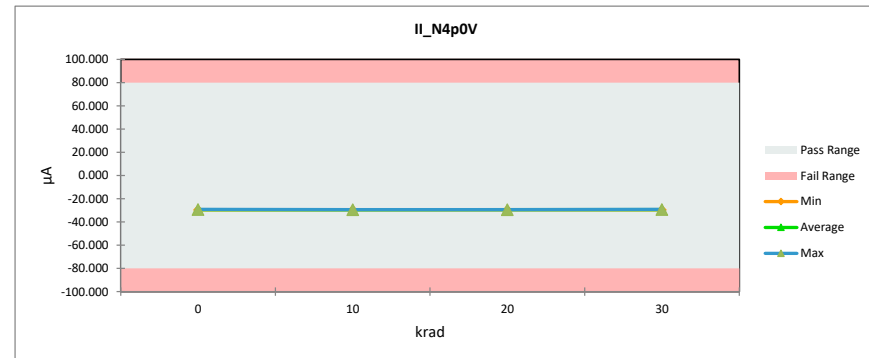


TID Report SN55LVRA4-SEP

II_N4p0V						
Units		μA				
Max Limit		80				
Min Limit		-80				
krad	Serial #	PreTestHDR	PostTestHDR	Delta	Delta %	% of Limit Range
0	1	-29.180	-29.180	0.000	0.00%	0.00%
0	2	-29.510	-29.510	0.000	0.00%	0.00%
10	3	-29.530	-29.470	0.060	-0.20%	0.04%
10	4	-29.560	-29.510	0.050	-0.17%	0.03%
10	5	-29.440	-29.400	0.040	-0.14%	0.02%
10	6	-29.720	-29.500	0.220	-0.74%	0.14%
10	7	-29.560	-29.500	0.060	-0.20%	0.04%
20	8	-29.610	-29.460	0.150	-0.51%	0.09%
20	9	-29.570	-29.470	0.100	-0.34%	0.06%
20	10	-29.510	-29.450	0.060	-0.20%	0.04%
20	11	-29.400	-29.350	0.050	-0.17%	0.03%
20	12	-29.530	-29.500	0.030	-0.10%	0.02%
30	13	-29.580	-29.450	0.130	-0.44%	0.08%
30	14	-29.540	-29.480	0.060	-0.20%	0.04%
30	15	-29.580	-29.550	0.030	-0.10%	0.02%
30	16	-29.620	-29.390	0.230	-0.78%	0.14%
30	17	-29.460	-29.180	0.280	-0.95%	0.18%
Max		-29.180	-29.180	0.000	0.00%	0.18%
Average		-29.524	-29.432	0.091	-0.31%	0.06%
Min		-29.720	-29.550	0.170	-0.95%	0.00%
Std Dev		0.115	0.107	-0.008	0.28%	0.05%

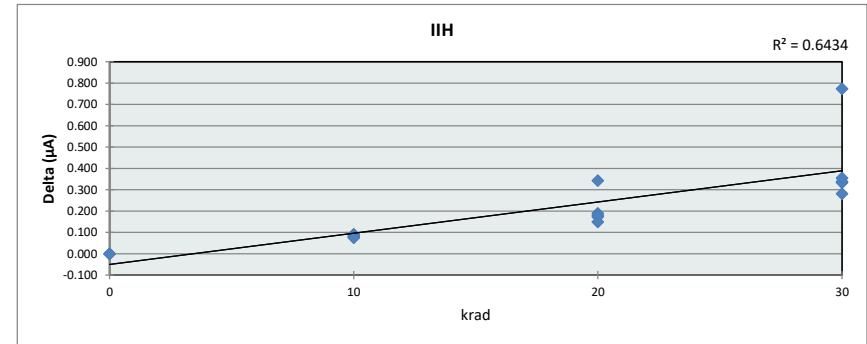


II_N4p0V				
Units	μA			
Max Limit	80			
Min Limit	-80			
krad	0	10	20	30
LL	-80.000	-80.000	-80.000	-80.000
Min	-29.510	-29.500	-29.500	-29.550
Average	-29.418	-29.466	-29.446	-29.373
Max	-29.180	-29.400	-29.350	-29.180
UL	80.000	80.000	80.000	80.000

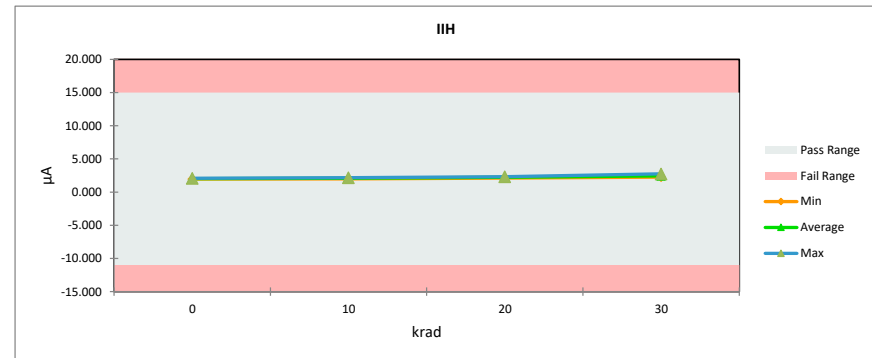


TID Report SN55LVRA4-SEP

IIH						
Units		μA				
Max Limit		15				
Min Limit		-11				
krad	Serial #	PreTestHDR	PostTestHDR	Delta	Delta %	% of Limit Range
0	1	2.009	2.009	0.000	0.00%	0.00%
0	2	1.965	1.965	0.000	0.00%	0.00%
10	3	1.989	2.080	0.091	4.58%	0.35%
10	4	1.973	2.052	0.079	4.00%	0.30%
10	5	1.964	2.048	0.084	4.28%	0.32%
10	6	1.914	2.004	0.090	4.70%	0.35%
10	7	1.939	2.014	0.075	3.87%	0.29%
20	8	1.929	2.119	0.190	9.85%	0.73%
20	9	1.980	2.160	0.180	9.09%	0.69%
20	10	1.966	2.140	0.174	8.85%	0.67%
20	11	1.958	2.108	0.150	7.66%	0.58%
20	12	1.966	2.309	0.343	17.45%	1.32%
30	13	1.962	2.296	0.334	17.02%	1.28%
30	14	1.965	2.303	0.338	17.20%	1.30%
30	15	1.971	2.253	0.282	14.31%	1.08%
30	16	1.952	2.307	0.355	18.19%	1.37%
30	17	1.978	2.752	0.774	39.13%	2.98%
Max		2.009	2.752	0.743	39.13%	2.98%
Average		1.964	2.172	0.208	10.60%	0.80%
Min		1.914	1.965	0.051	0.00%	0.00%
Std Dev		0.022	0.191	0.169	9.54%	0.72%

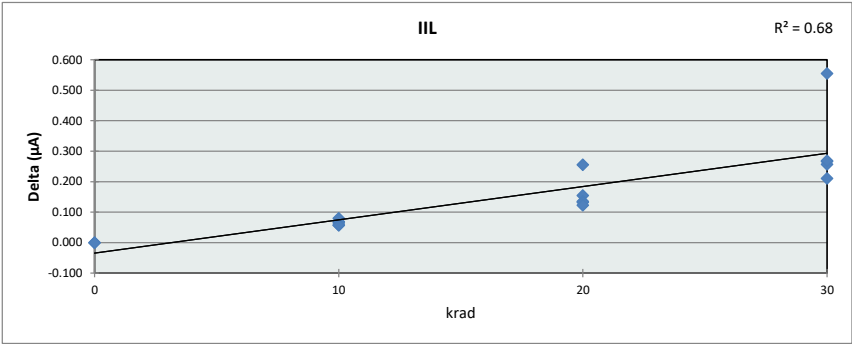


IIH				
Units	μA			
Max Limit	15			
Min Limit	-11			
krad	0	10	20	30
LL	-11.000	-11.000	-11.000	-11.000
Min	1.965	2.004	2.108	2.253
Average	2.027	2.069	2.231	2.437
Max	2.080	2.160	2.309	2.752
UL	15.000	15.000	15.000	15.000

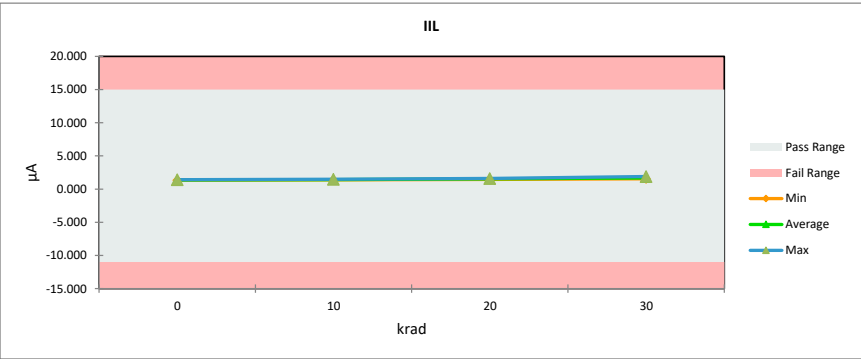


TID Report
SN55LVRA4-SEP

		IIL				
Units		μA				
Max Limit		15				
Min Limit		-11				
krad	Serial #	PreTestHDR	PostTestHDR	Delta	Delta %	% of Limit Range
0	1	1.354	1.354	0.000	0.00%	0.00%
0	2	1.327	1.327	0.000	0.00%	0.00%
10	3	1.343	1.412	0.069	5.14%	0.27%
10	4	1.340	1.405	0.065	4.85%	0.25%
10	5	1.340	1.397	0.057	4.25%	0.22%
10	6	1.302	1.382	0.080	6.14%	0.31%
10	7	1.320	1.378	0.058	4.39%	0.22%
20	8	1.303	1.458	0.155	11.90%	0.60%
20	9	1.338	1.473	0.135	10.09%	0.52%
20	10	1.330	1.463	0.133	10.00%	0.51%
20	11	1.327	1.450	0.123	9.27%	0.47%
20	12	1.330	1.586	0.256	19.25%	0.98%
30	13	1.319	1.586	0.267	20.24%	1.03%
30	14	1.332	1.589	0.257	19.29%	0.99%
30	15	1.338	1.549	0.211	15.77%	0.81%
30	16	1.316	1.585	0.269	20.44%	1.03%
30	17	1.338	1.893	0.555	41.48%	2.13%
Max		1.354	1.893	0.539	41.48%	2.13%
Average		1.329	1.487	0.158	11.91%	0.61%
Min		1.302	1.327	0.025	0.00%	0.00%
Std Dev		0.014	0.136	0.123	10.25%	0.53%

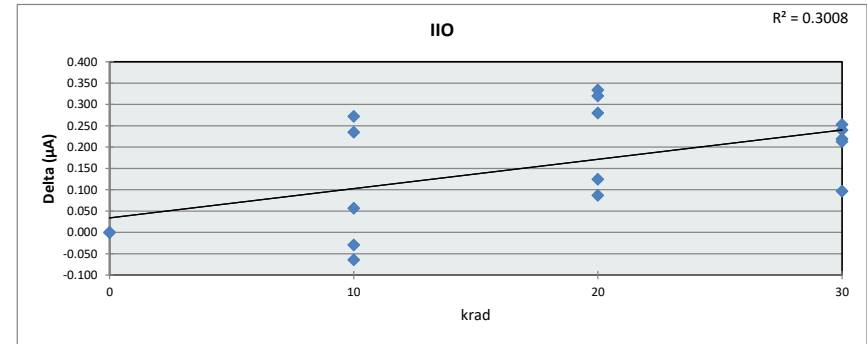


		IIL			
Units		μA			
Max Limit		15			
Min Limit		-11			
krad		0	10	20	30
LL		-11.000	-11.000	-11.000	-11.000
Min		1.327	1.378	1.450	1.549
Average		1.375	1.418	1.535	1.676
Max		1.412	1.473	1.589	1.893
UL		15.000	15.000	15.000	15.000

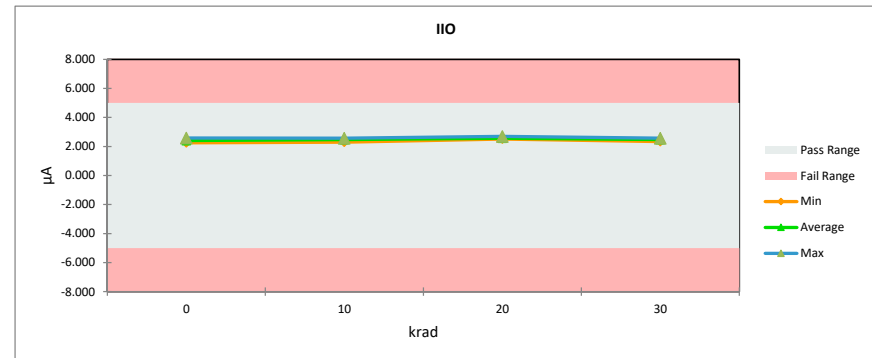


TID Report SN55LVRA4-SEP

IIO						
Units		μA				
Max Limit		5				
Min Limit		-5				
krad	Serial #	PreTestHDR	PostTestHDR	Delta	Delta %	% of Limit Range
0	1	2.252	2.252	0.000	0.00%	0.00%
0	2	2.295	2.295	0.000	0.00%	0.00%
10	3	2.305	2.577	0.272	11.80%	2.72%
10	4	2.450	2.507	0.057	2.33%	0.57%
10	5	2.548	2.484	-0.064	-2.51%	0.64%
10	6	2.532	2.503	-0.029	-1.15%	0.29%
10	7	2.341	2.576	0.235	10.04%	2.35%
20	8	2.415	2.540	0.125	5.18%	1.25%
20	9	2.208	2.295	0.087	3.94%	0.87%
20	10	2.362	2.696	0.334	14.14%	3.34%
20	11	2.231	2.551	0.320	14.34%	3.20%
20	12	2.280	2.560	0.280	12.28%	2.80%
30	13	2.292	2.511	0.219	9.55%	2.19%
30	14	2.284	2.524	0.240	10.51%	2.40%
30	15	2.360	2.573	0.213	9.03%	2.13%
30	16	2.249	2.502	0.253	11.25%	2.53%
30	17	2.243	2.340	0.097	4.32%	0.97%
Max		2.548	2.696	0.148	14.34%	3.34%
Average		2.332	2.487	0.155	6.77%	1.66%
Min		2.208	2.252	0.044	-2.51%	0.00%
Std Dev		0.101	0.121	0.019	5.60%	1.14%

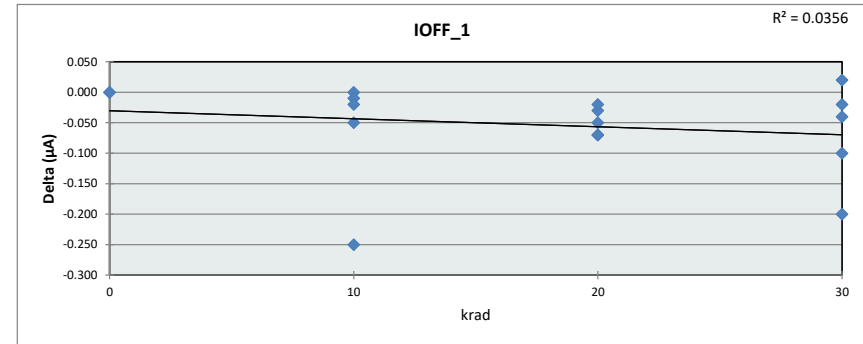


IIO				
Units	μA			
Max Limit	5			
Min Limit	-5			
krad	0	10	20	30
LL	-5.000	-5.000	-5.000	-5.000
Min	2.252	2.295	2.511	2.340
Average	2.408	2.480	2.568	2.472
Max	2.577	2.576	2.696	2.573
UL	5.000	5.000	5.000	5.000

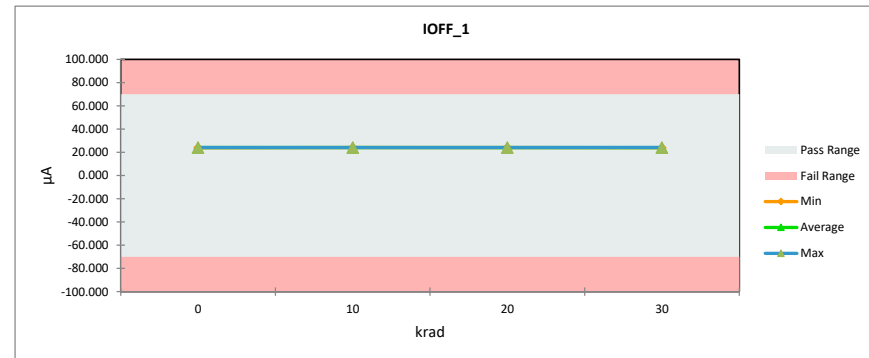


TID Report SN55LVRA4-SEP

		IOFF_1				
		Units				
		Max Limit				
		Min Limit				
krad	Serial #	PreTestHDR	PostTestHDR	Delta	Delta %	% of Limit Range
0	1	23.870	23.870	0.000	0.00%	0.00%
0	2	24.110	24.110	0.000	0.00%	0.00%
10	3	24.050	24.050	0.000	0.00%	0.00%
10	4	24.080	24.070	-0.010	-0.04%	0.01%
10	5	24.050	24.030	-0.020	-0.08%	0.01%
10	6	24.290	24.040	-0.250	-1.03%	0.18%
10	7	24.170	24.120	-0.050	-0.21%	0.04%
20	8	24.140	24.070	-0.070	-0.29%	0.05%
20	9	24.080	24.030	-0.050	-0.21%	0.04%
20	10	24.090	24.060	-0.030	-0.12%	0.02%
20	11	24.080	24.060	-0.020	-0.08%	0.01%
20	12	24.120	24.050	-0.070	-0.29%	0.05%
30	13	24.080	24.060	-0.020	-0.08%	0.01%
30	14	24.110	24.130	0.020	0.08%	0.01%
30	15	24.190	24.150	-0.040	-0.17%	0.03%
30	16	24.170	23.970	-0.200	-0.83%	0.14%
30	17	24.010	23.910	-0.100	-0.42%	0.07%
Max		24.290	24.150	-0.140	0.08%	0.18%
Average		24.099	24.046	-0.054	-0.22%	0.04%
Min		23.870	23.870	0.000	-1.03%	0.00%
Std Dev		0.088	0.073	-0.015	0.30%	0.05%

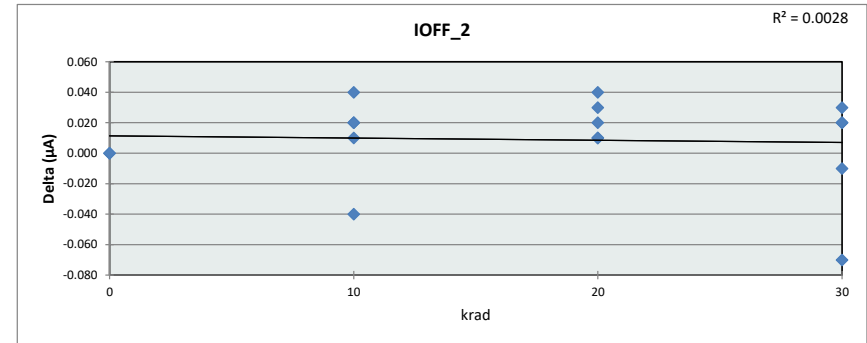


		IOFF_1			
		Units			
		Max Limit			
		Min Limit			
krad		0	10	20	30
LL		-70.000	-70.000	-70.000	-70.000
Min		23.870	24.030	24.050	23.910
Average		24.025	24.058	24.072	24.010
Max		24.110	24.120	24.130	24.150
UL		70.000	70.000	70.000	70.000

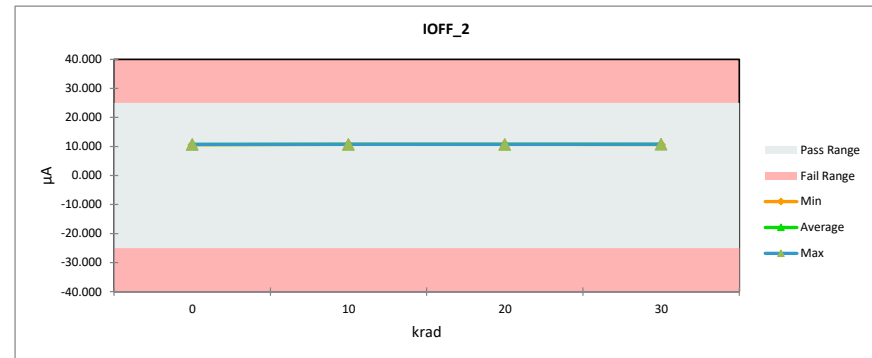


TID Report SN55LVRA4-SEP

IOFF_2						
Units		μA				
Max Limit		25				
Min Limit		-25				
krad	Serial #	PreTestHDR	PostTestHDR	Delta	Delta %	% of Limit Range
0	1	10.590	10.590	0.000	0.00%	0.00%
0	2	10.700	10.700	0.000	0.00%	0.00%
10	3	10.700	10.710	0.010	0.09%	0.02%
10	4	10.710	10.750	0.040	0.37%	0.08%
10	5	10.700	10.720	0.020	0.19%	0.04%
10	6	10.750	10.710	-0.040	-0.37%	0.08%
10	7	10.720	10.740	0.020	0.19%	0.04%
20	8	10.730	10.740	0.010	0.09%	0.02%
20	9	10.690	10.720	0.030	0.28%	0.06%
20	10	10.710	10.730	0.020	0.19%	0.04%
20	11	10.690	10.730	0.040	0.37%	0.08%
20	12	10.710	10.720	0.010	0.09%	0.02%
30	13	10.710	10.730	0.020	0.19%	0.04%
30	14	10.730	10.750	0.020	0.19%	0.04%
30	15	10.740	10.770	0.030	0.28%	0.06%
30	16	10.740	10.670	-0.070	-0.65%	0.14%
30	17	10.670	10.660	-0.010	-0.09%	0.02%
Max		10.750	10.770	0.020	0.37%	0.14%
Average		10.705	10.714	0.009	0.08%	0.05%
Min		10.590	10.590	0.000	-0.65%	0.00%
Std Dev		0.036	0.042	0.006	0.26%	0.04%

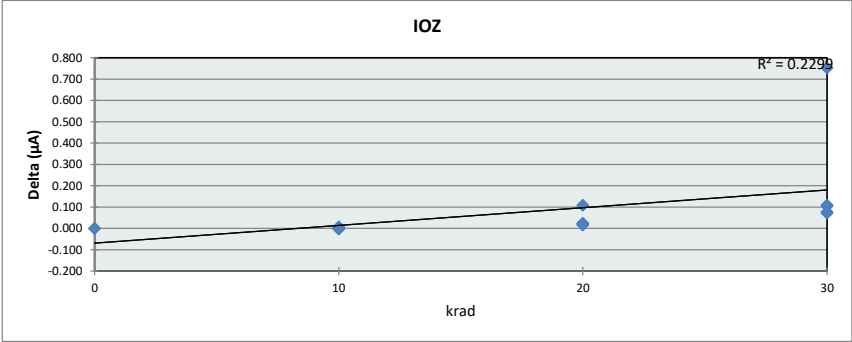


IOFF_2				
Units	μA			
Max Limit	25			
Min Limit	-25			
krad	0	10	20	30
LL	-25.000	-25.000	-25.000	-25.000
Min	10.590	10.710	10.720	10.660
Average	10.688	10.726	10.732	10.700
Max	10.750	10.740	10.750	10.770
UL	25.000	25.000	25.000	25.000

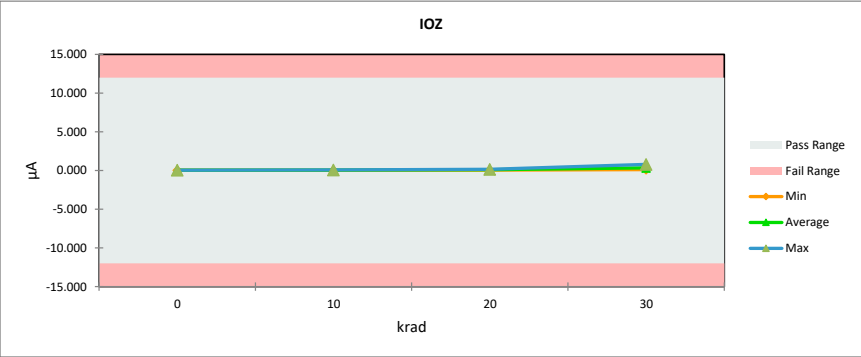


TID Report
SN55LVRA4-SEP

IOZ						
Units		µA				
Max Limit		12				
Min Limit		-12				
krad	Serial #	PreTestHDR	PostTestHDR	Delta	Delta %	% of Limit Range
0	1	0.040	0.040	0.000	0.00%	0.00%
0	2	0.039	0.039	0.000	0.00%	0.00%
10	3	0.038	0.036	-0.002	-5.77%	0.01%
10	4	0.039	0.039	0.001	1.63%	0.00%
10	5	0.033	0.041	0.008	25.00%	0.03%
10	6	0.036	0.040	0.004	10.45%	0.02%
10	7	0.038	0.037	-0.001	-1.67%	0.00%
20	8	0.041	0.066	0.025	60.15%	0.10%
20	9	0.039	0.059	0.021	52.70%	0.09%
20	10	0.038	0.060	0.022	59.48%	0.09%
20	11	0.035	0.052	0.016	46.71%	0.07%
20	12	0.037	0.146	0.109	291.70%	0.45%
30	13	0.037	0.148	0.110	295.72%	0.46%
30	14	0.035	0.139	0.104	298.97%	0.43%
30	15	0.043	0.114	0.072	167.57%	0.30%
30	16	0.040	0.118	0.078	193.50%	0.32%
30	17	0.035	0.787	0.753	2181.00%	3.14%
Max		0.043	0.787	0.745	2181.00%	3.14%
Average		0.038	0.115	0.078	216.30%	0.32%
Min		0.033	0.036	0.003	-5.77%	0.00%
Std Dev		0.003	0.178	0.176	518.51%	0.74%

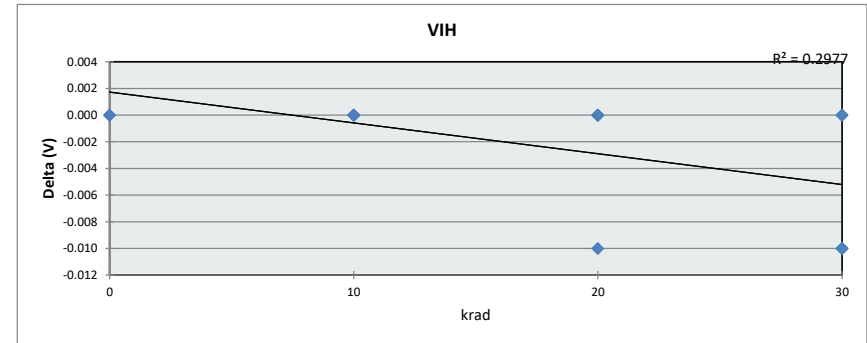


IOZ				
Units	µA			
Max Limit	12			
Min Limit	-12			
krad	0	10	20	30
LL	-12.000	-12.000	-12.000	-12.000
Min	0.036	0.037	0.052	0.114
Average	0.038	0.049	0.109	0.340
Max	0.040	0.066	0.148	0.787
UL	12.000	12.000	12.000	12.000

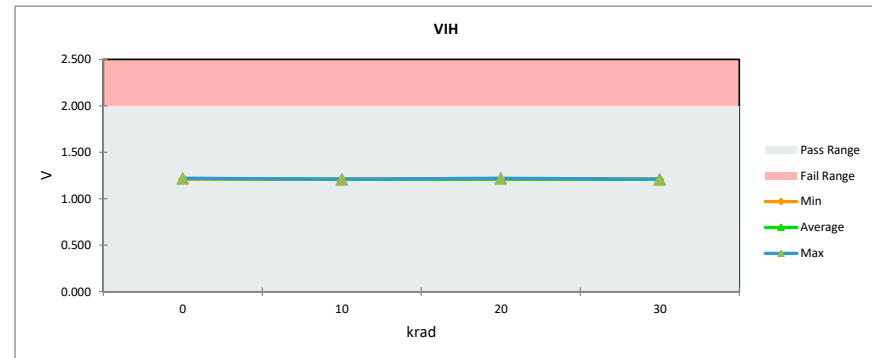


TID Report SN55LVRA4-SEP

		VIH				
Units		V				
Max Limit		2				
Min Limit		0				
krad	Serial #	PreTestHDR	PostTestHDR	Delta	Delta %	% of Limit Range
0	1	1.220	1.220	0.000	0.00%	0.00%
0	2	1.220	1.220	0.000	0.00%	0.00%
10	3	1.220	1.220	0.000	0.00%	0.00%
10	4	1.210	1.210	0.000	0.00%	0.00%
10	5	1.210	1.210	0.000	0.00%	0.00%
10	6	1.210	1.210	0.000	0.00%	0.00%
10	7	1.210	1.210	0.000	0.00%	0.00%
20	8	1.210	1.210	0.000	0.00%	0.00%
20	9	1.210	1.210	0.000	0.00%	0.00%
20	10	1.220	1.210	-0.010	-0.82%	0.50%
20	11	1.210	1.210	0.000	0.00%	0.00%
20	12	1.210	1.210	0.000	0.00%	0.00%
30	13	1.220	1.220	0.000	0.00%	0.00%
30	14	1.220	1.210	-0.010	-0.82%	0.50%
30	15	1.220	1.210	-0.010	-0.82%	0.50%
30	16	1.210	1.210	0.000	0.00%	0.00%
30	17	1.220	1.210	-0.010	-0.82%	0.50%
Max		1.220	1.220	0.000	0.00%	0.50%
Average		1.215	1.212	-0.002	-0.19%	0.12%
Min		1.210	1.210	0.000	-0.82%	0.00%
Std Dev		0.005	0.004	-0.001	0.36%	0.22%

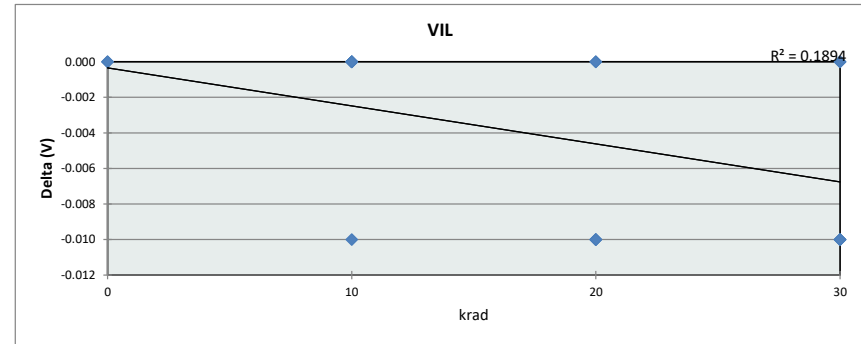


		VIH			
Units		V			
Max Limit		2			
Min Limit		0			
krad		0	10	20	30
LL		0.000	0.000	0.000	0.000
Min		1.210	1.210	1.210	1.210
Average		1.218	1.210	1.212	1.210
Max		1.220	1.210	1.220	1.210
UL		2.000	2.000	2.000	2.000

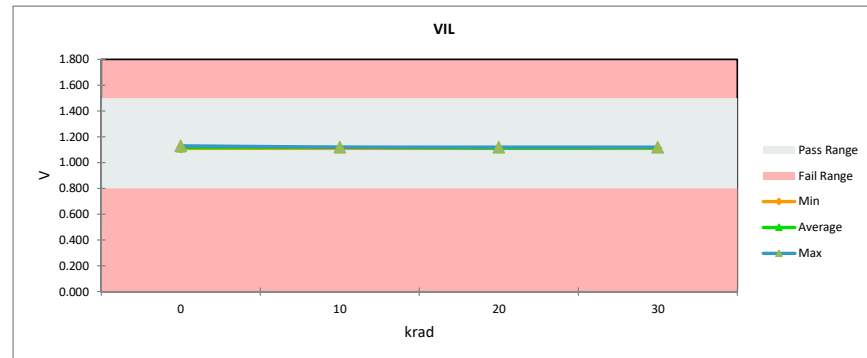


TID Report SN55LVRA4-SEP

		VIL				
Units		V				
Max Limit		1.5				
Min Limit		0.8				
krad	Serial #	PreTestHDR	PostTestHDR	Delta	Delta %	% of Limit Range
0	1	1.130	1.130	0.000	0.00%	0.00%
0	2	1.120	1.120	0.000	0.00%	0.00%
10	3	1.110	1.110	0.000	0.00%	0.00%
10	4	1.110	1.110	0.000	0.00%	0.00%
10	5	1.120	1.120	0.000	0.00%	0.00%
10	6	1.120	1.120	0.000	0.00%	0.00%
10	7	1.120	1.110	-0.010	-0.89%	1.43%
20	8	1.130	1.120	-0.010	-0.88%	1.43%
20	9	1.120	1.120	0.000	0.00%	0.00%
20	10	1.120	1.120	0.000	0.00%	0.00%
20	11	1.120	1.110	-0.010	-0.89%	1.43%
20	12	1.120	1.110	-0.010	-0.89%	1.43%
30	13	1.120	1.110	-0.010	-0.89%	1.43%
30	14	1.110	1.110	0.000	0.00%	0.00%
30	15	1.120	1.110	-0.010	-0.89%	1.43%
30	16	1.120	1.120	0.000	0.00%	0.00%
30	17	1.120	1.110	-0.010	-0.89%	1.43%
Max		1.130	1.130	0.000	0.00%	1.43%
Average		1.119	1.115	-0.004	-0.37%	0.59%
Min		1.110	1.110	0.000	-0.89%	0.00%
Std Dev		0.006	0.006	0.001	0.45%	0.72%

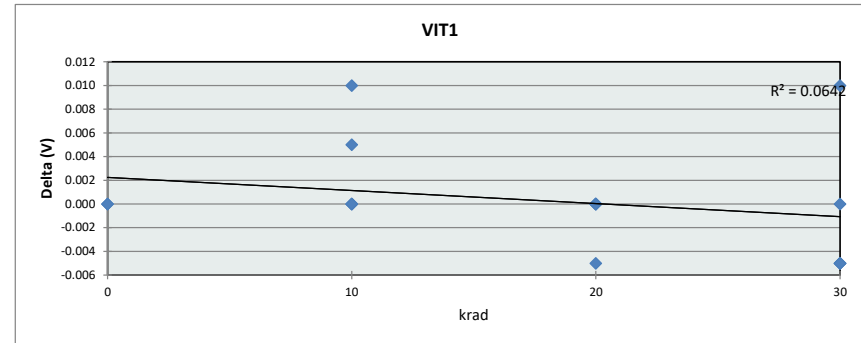


		VIL			
Units		V			
Max Limit		1.5			
Min Limit		0.8			
krad		0	10	20	30
LL		0.800	0.800	0.800	0.800
Min		1.110	1.110	1.110	1.110
Average		1.118	1.118	1.112	1.113
Max		1.130	1.120	1.120	1.120
UL		1.500	1.500	1.500	1.500

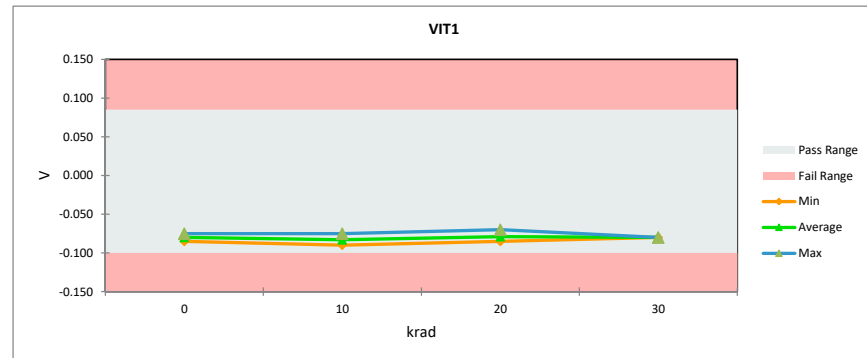


TID Report SN55LVRA4-SEP

		VIT1				
Units		V				
Max Limit		0.085				
Min Limit		-0.1				
krad	Serial #	PreTestHDR	PostTestHDR	Delta	Delta %	% of Limit Range
0	1	-0.080	-0.080	0.000	0.00%	0.00%
0	2	-0.085	-0.085	0.000	0.00%	0.00%
10	3	-0.075	-0.075	0.000	0.00%	0.00%
10	4	-0.080	-0.080	0.000	0.00%	0.00%
10	5	-0.090	-0.090	0.000	0.00%	0.00%
10	6	-0.095	-0.085	0.010	-10.53%	5.41%
10	7	-0.090	-0.085	0.005	-5.56%	2.70%
20	8	-0.075	-0.080	-0.005	6.67%	2.70%
20	9	-0.075	-0.075	0.000	0.00%	0.00%
20	10	-0.070	-0.070	0.000	0.00%	0.00%
20	11	-0.085	-0.085	0.000	0.00%	0.00%
20	12	-0.080	-0.080	0.000	0.00%	0.00%
30	13	-0.080	-0.085	-0.005	6.25%	2.70%
30	14	-0.085	-0.075	0.010	-11.76%	5.41%
30	15	-0.075	-0.080	-0.005	6.67%	2.70%
30	16	-0.075	-0.080	-0.005	6.67%	2.70%
30	17	-0.080	-0.080	0.000	0.00%	0.00%
Max		-0.070	-0.070	0.000	6.67%	5.41%
Average		-0.081	-0.081	0.000	-0.09%	1.43%
Min		-0.095	-0.090	0.005	-11.76%	0.00%
Std Dev		0.007	0.005	-0.002	5.32%	1.94%

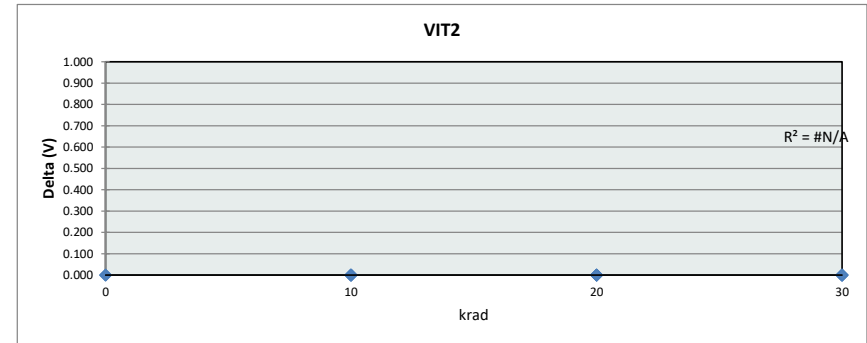


		VIT1			
Units		V			
Max Limit		0.085			
Min Limit		-0.1			
krad		0	10	20	30
LL		-0.100	-0.100	-0.100	-0.100
Min		-0.085	-0.090	-0.085	-0.080
Average		-0.080	-0.083	-0.079	-0.080
Max		-0.075	-0.075	-0.070	-0.080
UL		0.085	0.085	0.085	0.085

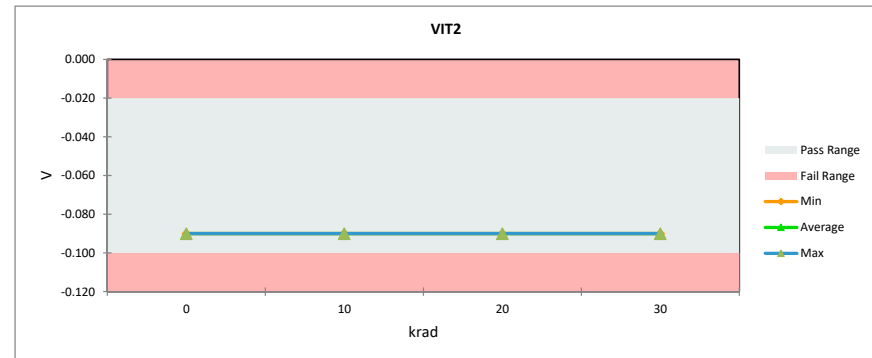


TID Report SN55LVRA4-SEP

VIT2						
Units		V				
Max Limit		-0.02				
Min Limit		-0.1				
krad	Serial #	PreTestHDR	PostTestHDR	Delta	Delta %	% of Limit Range
0	1	-0.090	-0.090	0.000	0.00%	0.00%
0	2	-0.090	-0.090	0.000	0.00%	0.00%
10	3	-0.090	-0.090	0.000	0.00%	0.00%
10	4	-0.090	-0.090	0.000	0.00%	0.00%
10	5	-0.090	-0.090	0.000	0.00%	0.00%
10	6	-0.090	-0.090	0.000	0.00%	0.00%
10	7	-0.090	-0.090	0.000	0.00%	0.00%
20	8	-0.090	-0.090	0.000	0.00%	0.00%
20	9	-0.090	-0.090	0.000	0.00%	0.00%
20	10	-0.090	-0.090	0.000	0.00%	0.00%
20	11	-0.090	-0.090	0.000	0.00%	0.00%
20	12	-0.090	-0.090	0.000	0.00%	0.00%
30	13	-0.090	-0.090	0.000	0.00%	0.00%
30	14	-0.090	-0.090	0.000	0.00%	0.00%
30	15	-0.090	-0.090	0.000	0.00%	0.00%
30	16	-0.090	-0.090	0.000	0.00%	0.00%
30	17	-0.090	-0.090	0.000	0.00%	0.00%
Max		-0.090	-0.090	0.000	0.00%	0.00%
Average		-0.090	-0.090	0.000	0.00%	0.00%
Min		-0.090	-0.090	0.000	0.00%	0.00%
Std Dev		0.000	0.000	0.000	0.00%	0.00%

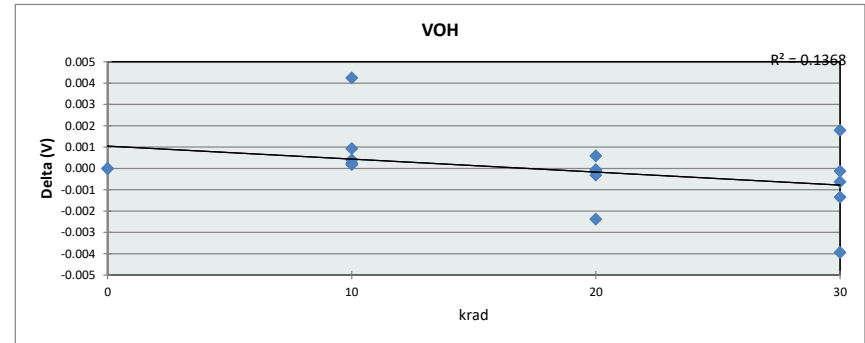


VIT2				
Units	V			
Max Limit	-0.02			
Min Limit	-0.1			
krad	0	10	20	30
LL	-0.100	-0.100	-0.100	-0.100
Min	-0.090	-0.090	-0.090	-0.090
Average	-0.090	-0.090	-0.090	-0.090
Max	-0.090	-0.090	-0.090	-0.090
UL	-0.020	-0.020	-0.020	-0.020

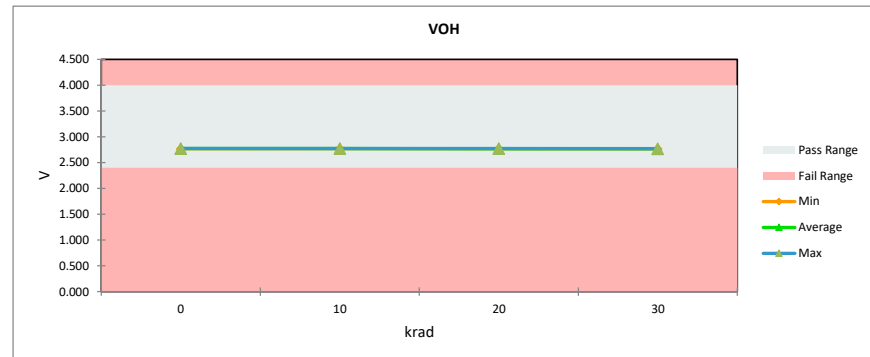


TID Report SN55LVRA4-SEP

		VOH				
		Units				
		Max Limit				
		Min Limit				
krad	Serial #	PreTestHDR	PostTestHDR	Delta	Delta %	% of Limit Range
0	1	2.773	2.773	0.000	0.00%	0.00%
0	2	2.774	2.774	0.000	0.00%	0.00%
10	3	2.769	2.770	0.000	0.01%	0.03%
10	4	2.766	2.767	0.001	0.03%	0.06%
10	5	2.771	2.771	0.000	0.01%	0.02%
10	6	2.769	2.773	0.004	0.15%	0.27%
10	7	2.772	2.772	0.000	0.01%	0.01%
20	8	2.771	2.771	0.000	0.00%	0.01%
20	9	2.773	2.773	0.001	0.02%	0.04%
20	10	2.770	2.770	0.000	0.00%	0.00%
20	11	2.770	2.767	-0.002	-0.09%	0.15%
20	12	2.771	2.771	0.000	-0.01%	0.02%
30	13	2.771	2.770	-0.001	-0.05%	0.08%
30	14	2.772	2.771	-0.001	-0.02%	0.04%
30	15	2.771	2.771	0.000	0.00%	0.01%
30	16	2.771	2.767	-0.004	-0.14%	0.25%
30	17	2.769	2.771	0.002	0.06%	0.11%
Max		2.774	2.774	0.000	0.15%	0.27%
Average		2.771	2.771	0.000	0.00%	0.06%
Min		2.766	2.767	0.000	-0.14%	0.00%
Std Dev		0.002	0.002	0.000	0.06%	0.08%

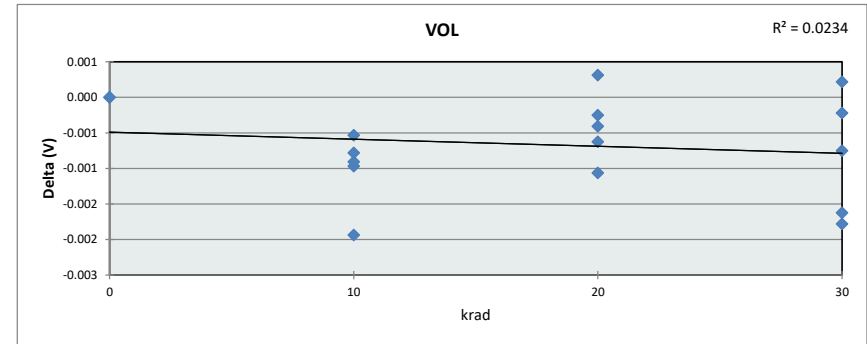


		VOH			
		Units			
		Max Limit			
		Min Limit			
krad		0	10	20	30
LL		2.400	2.400	2.400	2.400
Min		2.767	2.771	2.767	2.767
Average		2.771	2.772	2.770	2.769
Max		2.774	2.773	2.771	2.771
UL		4.000	4.000	4.000	4.000

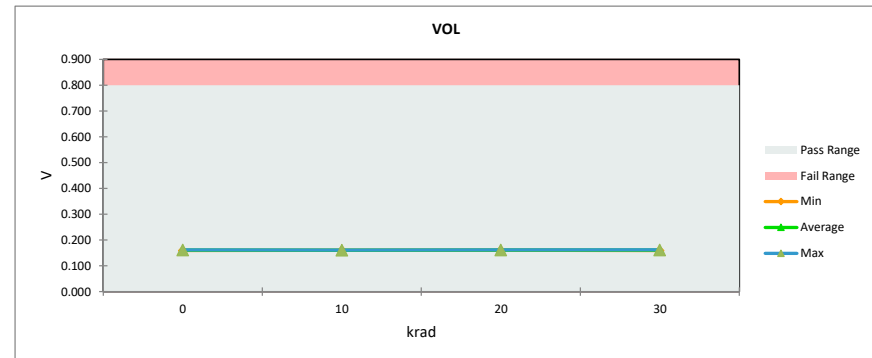


TID Report SN55LVRA4-SEP

VOL						
Units		V				
Max Limit		0.8				
Min Limit		0				
krad	Serial #	PreTestHDR	PostTestHDR	Delta	Delta %	% of Limit Range
0	1	0.159	0.159	0.000	0.00%	0.00%
0	2	0.161	0.161	0.000	0.00%	0.00%
10	3	0.162	0.161	-0.001	-0.60%	0.12%
10	4	0.162	0.161	-0.001	-0.56%	0.11%
10	5	0.161	0.160	-0.001	-0.49%	0.10%
10	6	0.162	0.160	-0.002	-1.19%	0.24%
10	7	0.161	0.161	-0.001	-0.33%	0.07%
20	8	0.162	0.161	-0.001	-0.66%	0.13%
20	9	0.161	0.160	-0.001	-0.39%	0.08%
20	10	0.161	0.160	0.000	-0.25%	0.05%
20	11	0.161	0.161	0.000	-0.15%	0.03%
20	12	0.161	0.161	0.000	0.19%	0.04%
30	13	0.161	0.161	-0.001	-0.46%	0.09%
30	14	0.161	0.161	0.000	-0.14%	0.03%
30	15	0.162	0.162	0.000	0.14%	0.03%
30	16	0.162	0.161	-0.002	-1.10%	0.22%
30	17	0.161	0.159	-0.002	-1.01%	0.20%
Max		0.162	0.162	0.000	0.19%	0.24%
Average		0.161	0.161	-0.001	-0.41%	0.09%
Min		0.159	0.159	0.000	-1.19%	0.00%
Std Dev		0.001	0.001	0.000	0.41%	0.07%



VOL				
Units		V		
Max Limit		0.8		
Min Limit		0		
krad	0	10	20	30
LL	0.000	0.000	0.000	0.000
Min	0.159	0.160	0.160	0.159
Average	0.161	0.160	0.161	0.161
Max	0.161	0.161	0.161	0.162
UL	0.800	0.800	0.800	0.800



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