Radiation Report

ISOS510-SEP Total Ionizing Dose (TID) Report

ABSTRACT

This report covers the radiation characterization results of the ISOS510-SEP, current-driven analog isolator with transistor output. The study was done to determine Total Ionizing Dose (TID) effects under high dose rate (HDR) up to 50krad(Si) as a one time characterization. The results show that all samples passed within the specified limits up to 50krad(Si).

Radiation Lot Acceptance Testing (RLAT) will be performed using five units at a dose level of 50krad(Si) with the enabled bias only for future wafer lots per MIL-STD-883 TM 1019. All future wafer lots will be tested under the same conditions. HDR TID response is the worst case. TID HDR characterization was performed per TM 1019.

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Trademarks

1 Device Information

The ISOS510 radiation-tolerant device is a single-channel, current-driven, analog isolator with transistor output. The device offers significant reliability and performance advantages compared to other current-driven analog isolators, including high bandwidth, low turn-off delay, low power consumption, wider temperature ranges, flat current transfer ratio (CTR), and tight process controls resulting in small part-to-part skew. These performance advantages stay stable across radiation, temperature, and lifetime.

ISOS510 is offered in a small 4-pin SOIC(DFG) package with 2.54mm pin pitch, supporting a 3.75kV_{RMS} isolation rating . The high performance and reliability of ISOS510 enables these devices to be used in aerospace & defense applications such as feedback loops in isolated DC/DC modules, satellite propulsion power processing units, spacecraft battery management systems, and more.

1.1 Device Details

Table 1-1 lists the ISOS510-SEP device information used for TID HDR characterization and qualification.

Table 1-1. Device and Exposure Details

TID HDR Details: Up To 50krad(Si)	
TI Device Number	ISOS510-SEP
VID/SMD Number	V62/26607-01XE
Package	4-pin SOIC (DFG)
Technology	LBC9 / ISOSAX
Die Lot Number	4000946RFB / 4263033MH8
A/T Lot Number	5423730ML5
Lot Trace Code	54AS2LK
Quantity Tested	25 irradiated devices and 5 control devices
Lot Accept or Reject	Devices passed 50krad(Si)
HDR Radiation Facility	Texas Instruments CLAB in Dallas, Texas
HDR Dose Level	Up to 50krad(Si)
HDR Dose Rate	157.54rad(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 ISOS510-SEP samples were irradiated at a high dose rate of 157.54rad(Si)/s up to 50krad(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 datasheet electrical specification limits.

2.2 Test Description and Facilities

The ISOS510-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 157.54rad(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

The ISOS510-SEP device bias schemes were selected to put the device in an enabled state and a disabled state to evaluate the device performance under TID effects. Figure 2-1 and Figure 2-2 show the bias conditions for each pin during irradiation.

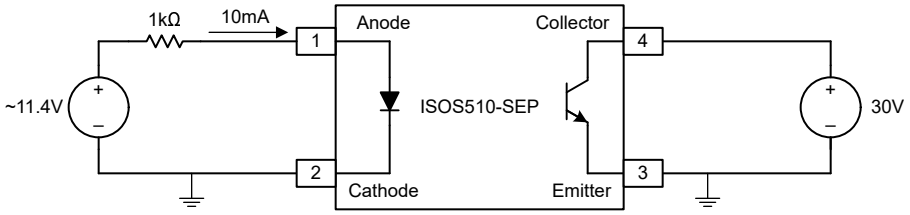


Figure 2-1. ISOS510-SEP Enabled Bias Diagram

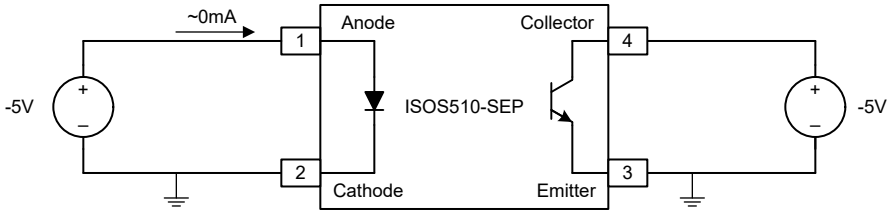


Figure 2-2. ISOS510-SEP Disabled Bias Diagram

2.4 Test Configuration and Condition

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 will be irradiated to 50krad(Si) with the enabled bias (because those units saw the worst drift), and parametrically tested on ATE. Note that the 50krad(Si) disabled bias below is represented as 51krad in Appendix A to differentiate the bias schemes.

Table 2-1 lists the serialized samples used for TID HDR biased characterization.

Table 2-1. HDR Biased Device Information

Control Group	**HDR Dose Rate = 157.54rad(Si)/s**				
Total Samples: 5	**Total Exposed Samples: 25**				
	Exposure Levels				
0krad (Si)	10krad (Si)	20krad(Si)	30krad(Si)	50krad(Si)	50krad(Si)(1)
	Enabled Bias	Enabled Bias	Enabled Bias	Enabled Bias	Disabled Bias(1)
1 - 5	6 - 10	11 - 15	16 - 20	21 - 25	26 - 30

(1) Please note this 50krad(Si) disabled bias is denoted as 51krad in Appendix A.

3 TID Characterization Test Results

3.1 TID Characterization Summary Results

The parametric data for the ISOS510-SEP passes up to 50krad(Si) HDR TID irradiation. The drifts of the electrical parameters through HDR were within the datasheet limits.

Overall, the ISOS510-SEP showed a strong degree of hardness to HDR TID irradiation up to 50krad(Si). The measurements taken post-irradiation for each sample set showed a marginal shift for most parameters at the TID specification level of the device. The parameters that did show a degree of change between pre- and post-irradiation were still within the electrical performance characteristics specified in the datasheet electrical parameters. For the datasheet electrical parameters and associated tests, see *ISOS510-SEP Radiation Tolerant, Current-Driven Analog Isolator With Transistor Output*.

See Appendix A for HDR report up to 50krad(Si).

3.2 Specification Compliance Matrix

Table 3-1. Electrical Parameters Table

Over recommended operating conditions unless otherwise noted; includes RLAT at T_A = 25°C if sub-group number is present for QML RHA and SEP devices

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT	TEST NAME
INPUT							
V_F	Input forward voltage	I_F = 5mA		1.2	1.6	V	VF_5mA
I_R	Input reverse current	V_R = 5V			10	µA	IR
OUTPUT							
$V_{CE(SAT)}$	Collector-emitter saturation voltage	I_F = 10mA, I_C = 1mA			0.3	V	VCE_SAT
I_{C_DARK}	Collector dark current	V_{CE} = 20V, I_F = 0mA			100	nA	IC_DARK
I_{EC}	Reverse current	V_{EC} = 5V, I_F = 0mA			50	µA	IEC
I_{C_OFF}	OFF_state collector current	V_F = 0.7V, V_{CE} = 30V			10	µA	IC_OFF
CTR (1)	Current Transfer Ratio	I_F = 2mA, V_{CE} = 5V	80	130	180	%	CTR_2mA
		I_F = 5mA, V_{CE} = 5V	100	120	155	%	CTR_5mA

(1) CTR (%) = (I_C / I_F) × 100%

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.

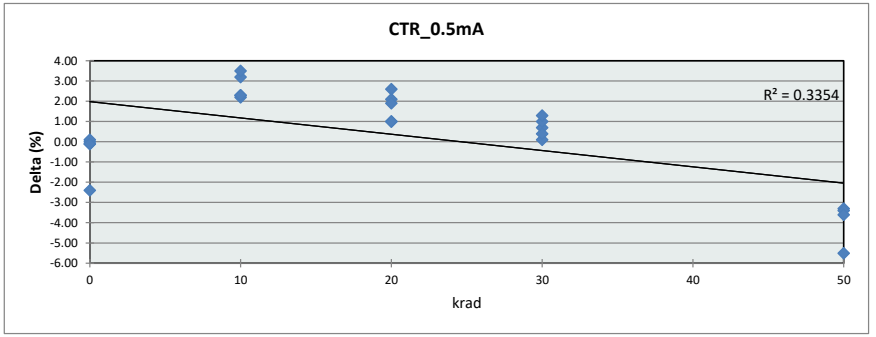
Appendix A: HDR TID Report Data

This appendix provides the ISOS510-SEP TID HDR report. The report shows the variation for each parameter up to 50krad(Si). Please note the 50krad(Si) disabled bias is represented as 51krad in the report data to differentiate the bias schemes.

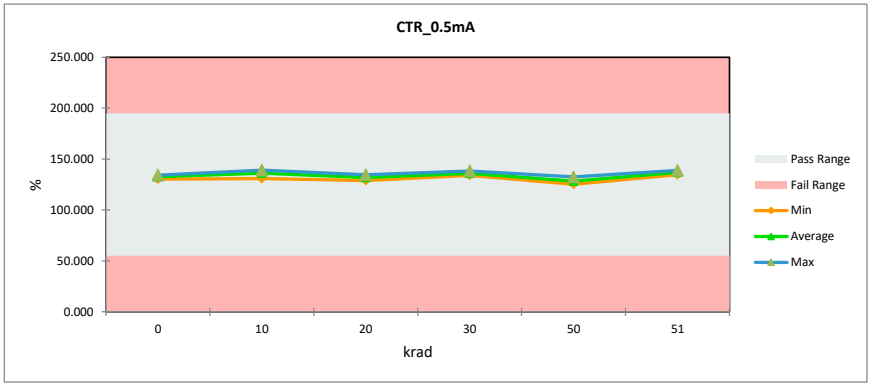
TID Report
ISOS510-SEP

	CTR_0.5mA
Units	%
Max Limit	195
Min Limit	55

krad	Serial #	PreTestHDR	PostTestHDR	Delta	Delta %	% of Limit Range
0	1	131.600	131.500	-0.10	-0.08%	0.07%
0	2	133.400	133.400	0.00	0.00%	0.00%
0	3	134.000	134.100	0.10	0.07%	0.07%
0	4	136.000	133.600	-2.40	-1.76%	1.71%
0	5	130.400	130.300	-0.10	-0.08%	0.07%
10	6	128.500	130.800	2.30	1.79%	1.64%
10	7	134.500	137.700	3.20	2.38%	2.29%
10	8	134.300	136.500	2.20	1.64%	1.57%
10	9	133.900	136.200	2.30	1.72%	1.64%
10	10	135.600	139.100	3.50	2.58%	2.50%
20	11	130.700	131.700	1.00	0.77%	0.71%
20	12	132.400	134.500	2.10	1.59%	1.50%
20	13	126.300	128.900	2.60	2.06%	1.86%
20	14	129.700	131.600	1.90	1.46%	1.36%
20	15	131.700	132.700	1.00	0.76%	0.71%
30	16	134.800	135.500	0.70	0.52%	0.50%
30	17	135.000	135.100	0.10	0.07%	0.07%
30	18	136.500	136.900	0.40	0.29%	0.29%
30	19	137.300	138.300	1.00	0.73%	0.71%
30	20	132.700	134.000	1.30	0.98%	0.93%
50	21	138.000	132.500	-5.50	-3.99%	3.93%
50	22	130.300	127.000	-3.30	-2.53%	2.36%
50	23	128.600	125.200	-3.40	-2.64%	2.43%
50	24	130.500	126.900	-3.60	-2.76%	2.57%
50	25	133.900	130.200	-3.70	-2.76%	2.64%
51	26	134.700	138.900	4.20	3.12%	3.00%
51	27	132.200	137.200	5.00	3.78%	3.57%
51	28	139.200	137.100	-2.10	-1.51%	1.50%
51	29	134.200	136.450	2.25	1.68%	1.61%
51	30	131.900	134.650	2.75	2.08%	1.96%
	Max	138.000	139.100	1.10	2.58%	3.93%
	Average	132.779	133.083	0.30	0.23%	1.31%
	Min	126.300	125.200	-1.10	-3.99%	0.00%
	Std Dev	3.011	3.670	0.66	1.77%	1.04%



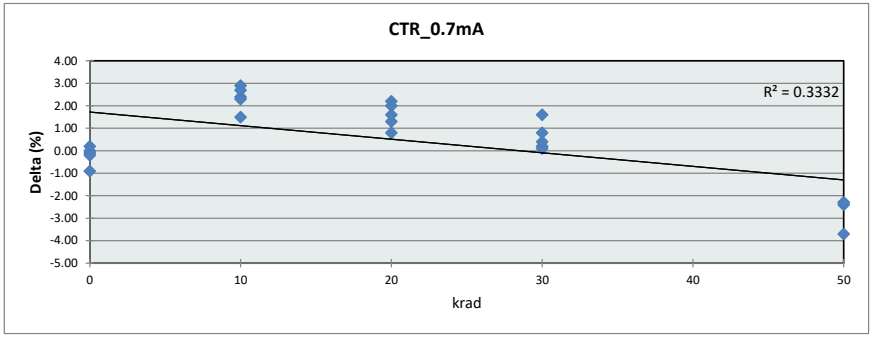
	CTR_0.5mA					
Units	%					
Max Limit	195					
Min Limit	55					
krad	0	10	20	30	50	51
LL	55.000	55.000	55.000	55.000	55.000	55.000
Min	130.300	130.800	128.900	134.000	125.200	134.650
Average	132.580	136.060	131.880	135.960	128.360	136.860
Max	134.100	139.100	134.500	138.300	132.500	138.900
UL	195.000	195.000	195.000	195.000	195.000	195.000



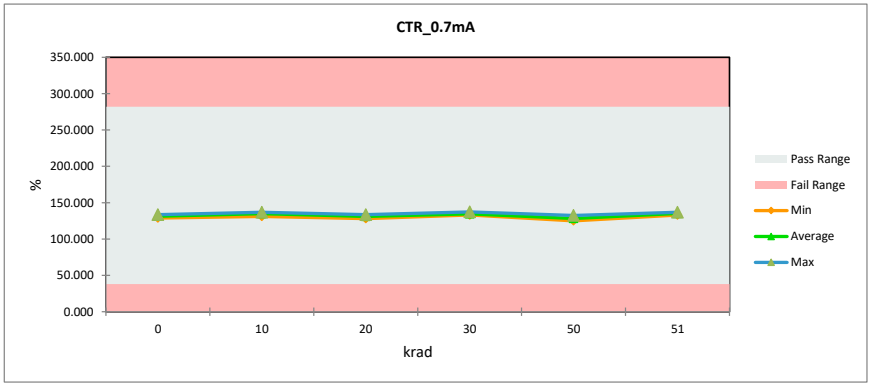
TID Report
ISOS510-SEP

	CTR_0.7mA
Units	%
Max Limit	282
Min Limit	38

krad	Serial #	PreTestHDR	PostTestHDR	Delta	Delta %	% of Limit Range
0	1	130.000	130.200	0.20	0.15%	0.08%
0	2	130.800	130.700	-0.10	-0.08%	0.04%
0	3	133.500	133.500	0.00	0.00%	0.00%
0	4	133.900	133.000	-0.90	-0.67%	0.37%
0	5	129.000	128.800	-0.20	-0.16%	0.08%
10	6	129.700	131.200	1.50	1.16%	0.61%
10	7	133.100	136.000	2.90	2.18%	1.19%
10	8	132.800	135.200	2.40	1.81%	0.98%
10	9	132.900	135.200	2.30	1.73%	0.94%
10	10	134.000	136.700	2.70	2.01%	1.11%
20	11	129.700	131.000	1.30	1.00%	0.53%
20	12	131.400	133.600	2.20	1.67%	0.90%
20	13	126.200	128.200	2.00	1.58%	0.82%
20	14	129.600	131.200	1.60	1.23%	0.66%
20	15	130.500	131.300	0.80	0.61%	0.33%
30	16	132.900	133.100	0.20	0.15%	0.08%
30	17	133.800	133.900	0.10	0.07%	0.04%
30	18	135.500	135.900	0.40	0.30%	0.16%
30	19	135.700	137.300	1.60	1.18%	0.66%
30	20	132.700	133.500	0.80	0.60%	0.33%
50	21	136.100	132.400	-3.70	-2.72%	1.52%
50	22	128.600	126.300	-2.30	-1.79%	0.94%
50	23	127.400	125.000	-2.40	-1.88%	0.98%
50	24	130.200	127.900	-2.30	-1.77%	0.94%
50	25	132.500	129.700	-2.80	-2.11%	1.15%
51	26	133.400	136.900	3.50	2.62%	1.43%
51	27	131.300	135.650	4.35	3.31%	1.78%
51	28	137.600	135.850	-1.75	-1.27%	0.72%
51	29	133.200	134.750	1.55	1.16%	0.64%
51	30	130.800	132.850	2.05	1.57%	0.84%
Max		136.100	137.300	1.20	2.18%	1.52%
Average		131.667	132.129	0.46	0.35%	0.60%
Min		126.200	125.000	-1.20	-2.72%	0.00%
Std Dev		2.639	3.265	0.63	1.34%	0.44%



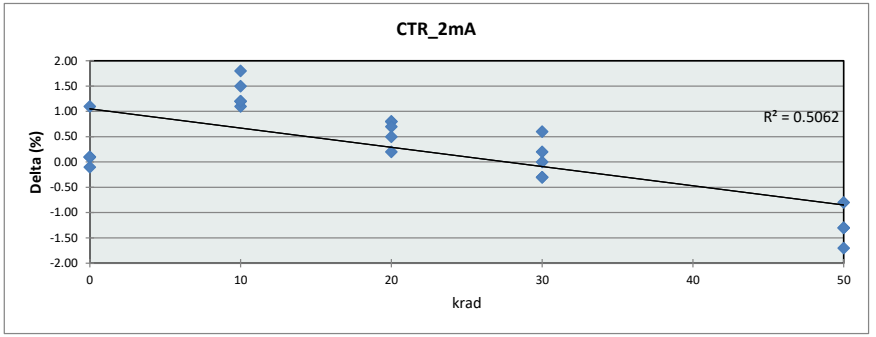
	CTR_0.7mA					
Units	%					
Max Limit	282					
Min Limit	38					
krad	0	10	20	30	50	51
LL	38.000	38.000	38.000	38.000	38.000	38.000
Min	128.800	131.200	128.200	133.100	125.000	132.850
Average	131.240	134.860	131.060	134.740	128.260	135.200
Max	133.500	136.700	133.600	137.300	132.400	136.900
UL	282.000	282.000	282.000	282.000	282.000	282.000



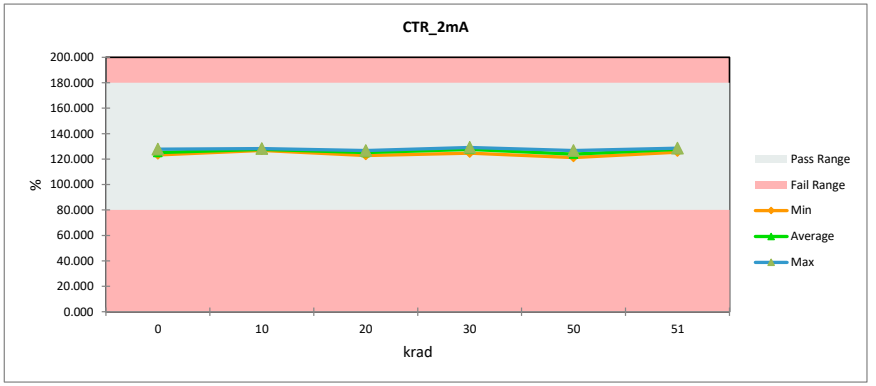
TID Report
ISOS510-SEP

	CTR_2mA
Units	%
Max Limit	180
Min Limit	80

krad	Serial #	PreTestHDR	PostTestHDR	Delta	Delta %	% of Limit Range
0	1	124.400	124.500	0.10	0.08%	0.10%
0	2	123.400	123.500	0.10	0.08%	0.10%
0	3	127.200	127.100	-0.10	-0.08%	0.10%
0	4	126.600	127.700	1.10	0.87%	1.10%
0	5	123.100	123.200	0.10	0.08%	0.10%
10	6	125.700	126.800	1.10	0.88%	1.10%
10	7	126.200	128.000	1.80	1.43%	1.80%
10	8	127.000	128.200	1.20	0.94%	1.20%
10	9	126.400	127.600	1.20	0.95%	1.20%
10	10	126.200	127.700	1.50	1.19%	1.50%
20	11	124.800	125.600	0.80	0.64%	0.80%
20	12	125.900	126.700	0.80	0.64%	0.80%
20	13	122.100	122.800	0.70	0.57%	0.70%
20	14	125.200	125.700	0.50	0.40%	0.50%
20	15	124.600	124.800	0.20	0.16%	0.20%
30	16	125.000	124.700	-0.30	-0.24%	0.30%
30	17	127.900	127.600	-0.30	-0.23%	0.30%
30	18	129.000	129.000	0.00	0.00%	0.00%
30	19	128.500	129.100	0.60	0.47%	0.60%
30	20	127.400	127.600	0.20	0.16%	0.20%
50	21	128.400	126.700	-1.70	-1.32%	1.70%
50	22	123.200	121.900	-1.30	-1.06%	1.30%
50	23	122.500	121.200	-1.30	-1.06%	1.30%
50	24	125.600	124.800	-0.80	-0.64%	0.80%
50	25	126.100	124.800	-1.30	-1.03%	1.30%
51	26	126.700	128.550	1.85	1.46%	1.85%
51	27	125.800	128.150	2.35	1.87%	2.35%
51	28	129.800	128.600	-1.20	-0.92%	1.20%
51	29	127.800	127.050	-0.75	-0.59%	0.75%
51	30	124.700	125.450	0.75	0.60%	0.75%
Max		129.000	129.100	0.10	1.43%	1.80%
Average		125.679	125.938	0.26	0.20%	0.74%
Min		122.100	121.200	-0.90	-1.32%	0.00%
Std Dev		1.928	2.235	0.31	0.72%	0.56%



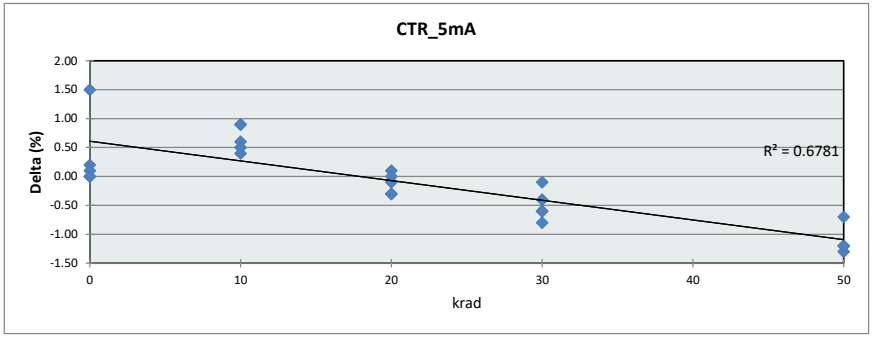
	CTR_2mA					
Units	%					
Max Limit	180					
Min Limit	80					
krad	0	10	20	30	50	51
LL	80.000	80.000	80.000	80.000	80.000	80.000
Min	123.200	126.800	122.800	124.700	121.200	125.450
Average	125.200	127.660	125.120	127.600	123.880	127.560
Max	127.700	128.200	126.700	129.100	126.700	128.600
UL	180.000	180.000	180.000	180.000	180.000	180.000



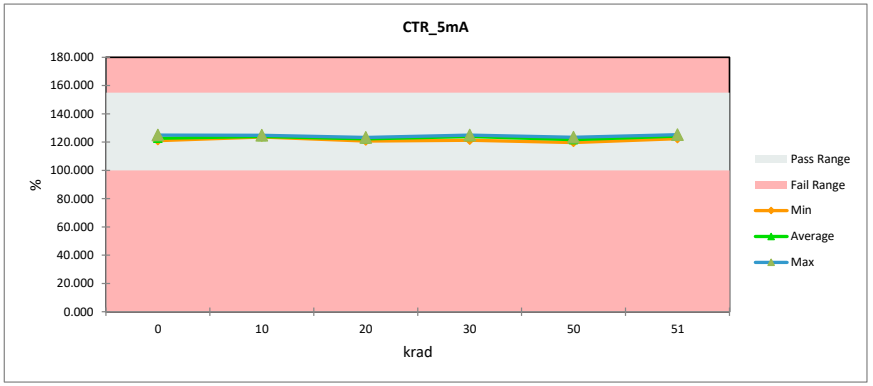
TID Report
ISOS510-SEP

	CTR_5mA
Units	%
Max Limit	155
Min Limit	100

krad	Serial #	PreTestHDR	PostTestHDR	Delta	Delta %	% of Limit Range
0	1	122.300	122.500	0.20	0.16%	0.36%
0	2	120.900	121.000	0.10	0.08%	0.18%
0	3	124.200	124.200	0.00	0.00%	0.00%
0	4	123.400	124.900	1.50	1.22%	2.73%
0	5	121.100	121.100	0.00	0.00%	0.00%
10	6	123.300	123.700	0.40	0.32%	0.73%
10	7	123.200	124.100	0.90	0.73%	1.64%
10	8	124.200	124.800	0.60	0.48%	1.09%
10	9	123.500	124.000	0.50	0.40%	0.91%
10	10	122.700	123.600	0.90	0.73%	1.64%
20	11	123.200	123.300	0.10	0.08%	0.18%
20	12	123.100	123.100	0.00	0.00%	0.00%
20	13	120.800	120.700	-0.10	-0.08%	0.18%
20	14	123.100	122.800	-0.30	-0.24%	0.55%
20	15	122.000	121.700	-0.30	-0.25%	0.55%
30	16	121.900	121.300	-0.60	-0.49%	1.09%
30	17	125.200	124.400	-0.80	-0.64%	1.45%
30	18	125.600	125.000	-0.60	-0.48%	1.09%
30	19	125.000	124.900	-0.10	-0.08%	0.18%
30	20	124.500	124.100	-0.40	-0.32%	0.73%
50	21	124.700	123.400	-1.30	-1.04%	2.36%
50	22	121.600	120.400	-1.20	-0.99%	2.18%
50	23	120.900	119.700	-1.20	-0.99%	2.18%
50	24	123.700	123.000	-0.70	-0.57%	1.27%
50	25	123.200	122.200	-1.00	-0.81%	1.82%
51	26	123.400	124.700	1.30	1.05%	2.36%
51	27	123.600	124.950	1.35	1.09%	2.45%
51	28	126.100	125.250	-0.85	-0.67%	1.55%
51	29	125.300	123.700	-1.60	-1.28%	2.91%
51	30	122.200	122.500	0.30	0.25%	0.55%
Max		125.600	125.000	-0.60	1.22%	2.73%
Average		123.088	122.988	-0.10	-0.08%	0.97%
Min		120.800	119.700	-1.10	-1.04%	0.00%
Std Dev		1.423	1.585	0.16	0.57%	0.82%



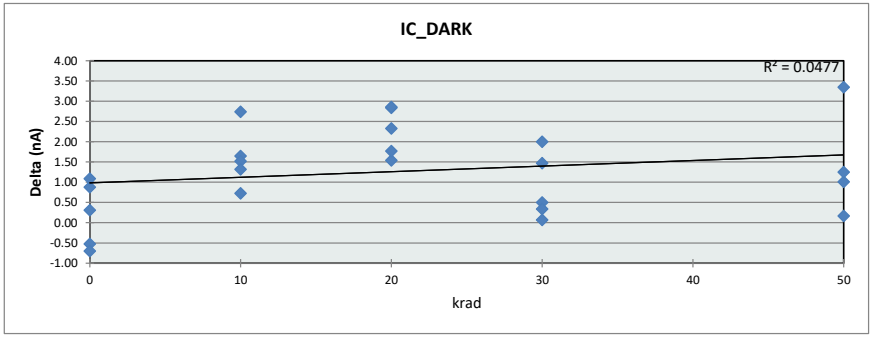
	CTR_5mA					
Units	%					
Max Limit	155					
Min Limit	100					
krad	0	10	20	30	50	51
LL	100.000	100.000	100.000	100.000	100.000	100.000
Min	121.000	123.600	120.700	121.300	119.700	122.500
Average	122.740	124.040	122.320	123.940	121.740	124.220
Max	124.900	124.800	123.300	125.000	123.400	125.250
UL	155.000	155.000	155.000	155.000	155.000	155.000



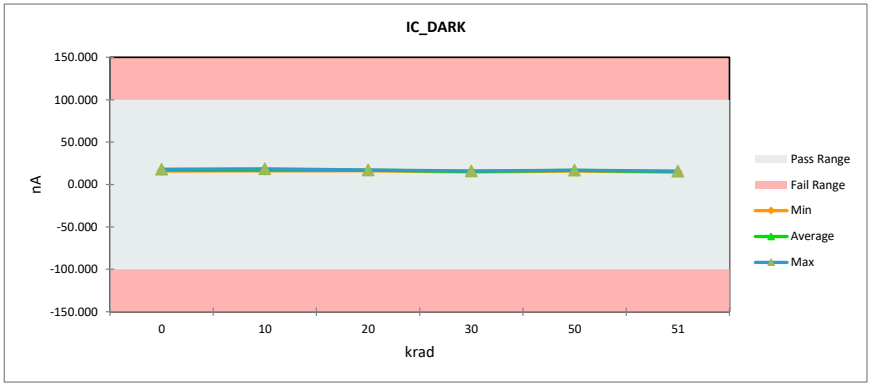
TID Report
ISOS510-SEP

	IC_DARK
Units	nA
Max Limit	100
Min Limit	-100

krad	Serial #	PreTestHDR	PostTestHDR	Delta	Delta %	% of Limit Range
0	1	18.580	18.060	-0.52	-2.80%	0.26%
0	2	17.000	16.300	-0.70	-4.12%	0.35%
0	3	16.770	17.080	0.31	1.85%	0.16%
0	4	15.150	16.030	0.88	5.81%	0.44%
0	5	15.500	16.590	1.09	7.03%	0.55%
10	6	15.740	18.480	2.74	17.41%	1.37%
10	7	14.870	16.520	1.65	11.10%	0.82%
10	8	15.690	16.420	0.73	4.65%	0.37%
10	9	15.000	16.520	1.52	10.13%	0.76%
10	10	14.830	16.150	1.32	8.90%	0.66%
20	11	14.620	16.950	2.33	15.94%	1.17%
20	12	15.480	17.020	1.54	9.95%	0.77%
20	13	14.240	17.080	2.84	19.94%	1.42%
20	14	14.690	16.460	1.77	12.05%	0.89%
20	15	13.380	16.240	2.86	21.38%	1.43%
30	16	14.670	15.170	0.50	3.41%	0.25%
30	17	15.770	15.840	0.07	0.44%	0.04%
30	18	13.690	15.690	2.00	14.61%	1.00%
30	19	14.270	15.740	1.47	10.30%	0.74%
30	20	14.520	14.860	0.34	2.34%	0.17%
50	21	16.680	16.850	0.17	1.02%	0.08%
50	22	15.320	16.330	1.01	6.59%	0.51%
50	23	14.640	15.890	1.25	8.54%	0.62%
50	24	13.450	16.800	3.35	24.91%	1.68%
50	25	15.410	16.740	1.33	8.63%	0.66%
51	26	13.160	15.250	2.09	15.88%	1.05%
51	27	14.730	15.685	0.95	6.48%	0.48%
51	28	16.100	15.695	-0.40	-2.52%	0.20%
51	29	13.840	15.145	1.31	9.43%	0.65%
51	30	13.180	14.575	1.40	10.58%	0.70%
Max		18.580	18.480	-0.10	24.91%	1.68%
Average		15.190	16.461	1.27	8.81%	0.69%
Min		13.380	14.860	1.48	-4.12%	0.04%
Std Dev		1.193	0.799	-0.39	7.54%	0.47%



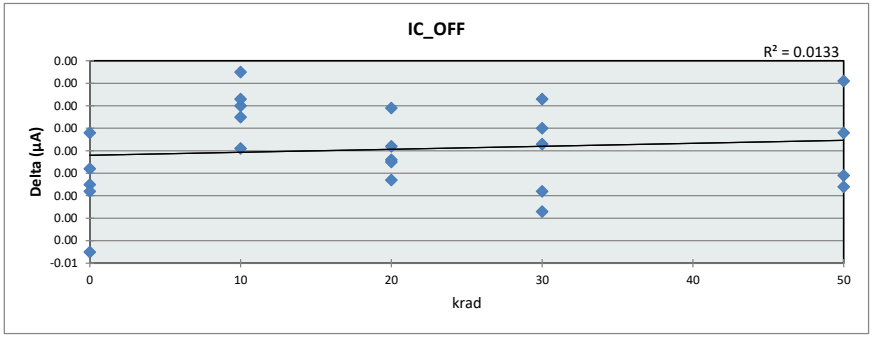
	IC_DARK					
Units	nA					
Max Limit	100					
Min Limit	-100					
krad	0	10	20	30	50	51
LL	-100.000	-100.000	-100.000	-100.000	-100.000	-100.000
Min	16.030	16.150	16.240	14.860	15.890	14.575
Average	16.812	16.818	16.750	15.460	16.522	15.270
Max	18.060	18.480	17.080	15.840	16.850	15.695
UL	100.000	100.000	100.000	100.000	100.000	100.000



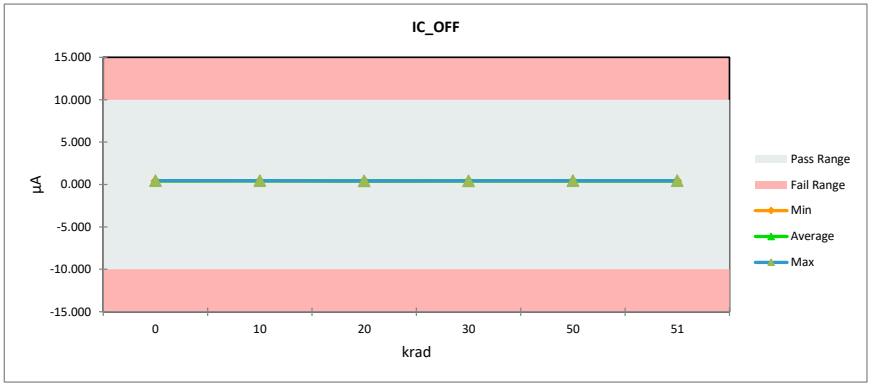
TID Report
ISOS510-SEP

	IC_OFF
Units	µA
Max Limit	10
Min Limit	-10

krad	Serial #	PreTestHDR	PostTestHDR	Delta	Delta %	% of Limit Range
0	1	0.458	0.453	0.00	-0.98%	0.02%
0	2	0.438	0.438	0.00	-0.18%	0.00%
0	3	0.434	0.433	0.00	-0.35%	0.01%
0	4	0.432	0.433	0.00	0.19%	0.00%
0	5	0.434	0.433	0.00	-0.41%	0.01%
10	6	0.438	0.441	0.00	0.80%	0.02%
10	7	0.434	0.435	0.00	0.35%	0.01%
10	8	0.434	0.436	0.00	0.46%	0.01%
10	9	0.432	0.434	0.00	0.53%	0.01%
10	10	0.433	0.433	0.00	0.02%	0.00%
20	11	0.433	0.433	0.00	-0.09%	0.00%
20	12	0.434	0.432	0.00	-0.30%	0.01%
20	13	0.431	0.433	0.00	0.44%	0.01%
20	14	0.434	0.434	0.00	0.05%	0.00%
20	15	0.434	0.433	0.00	-0.12%	0.00%
30	16	0.434	0.431	0.00	-0.62%	0.01%
30	17	0.434	0.433	0.00	-0.41%	0.01%
30	18	0.432	0.432	0.00	0.07%	0.00%
30	19	0.431	0.433	0.00	0.53%	0.01%
30	20	0.433	0.434	0.00	0.23%	0.01%
50	21	0.436	0.435	0.00	-0.37%	0.01%
50	22	0.435	0.434	0.00	-0.25%	0.01%
50	23	0.431	0.434	0.00	0.72%	0.02%
50	24	0.431	0.432	0.00	0.19%	0.00%
50	25	0.434	0.435	0.00	0.12%	0.00%
51	26	0.431	0.434	0.00	0.79%	0.02%
51	27	0.434	0.434	0.00	0.17%	0.00%
51	28	0.435	0.434	0.00	-0.31%	0.01%
51	29	0.433	0.434	0.00	0.09%	0.00%
51	30	0.431	0.432	0.00	0.16%	0.00%
Max		0.458	0.453	0.00	0.80%	0.02%
Average		0.435	0.435	0.00	0.02%	0.01%
Min		0.431	0.431	0.00	-0.98%	0.00%
Std Dev		0.005	0.004	0.00	0.44%	0.01%



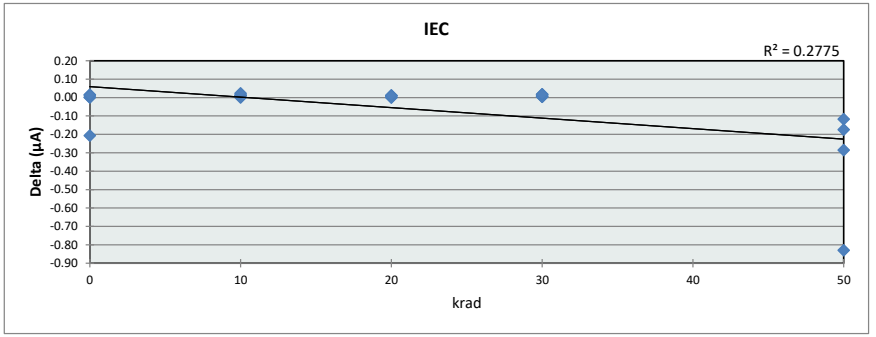
	IC_OFF					
Units	µA					
Max Limit	10					
Min Limit	-10					
krad	0	10	20	30	50	51
LL	-10.000	-10.000	-10.000	-10.000	-10.000	-10.000
Min	0.433	0.433	0.432	0.431	0.432	0.432
Average	0.438	0.436	0.433	0.433	0.434	0.434
Max	0.453	0.441	0.434	0.434	0.435	0.434
UL	10.000	10.000	10.000	10.000	10.000	10.000



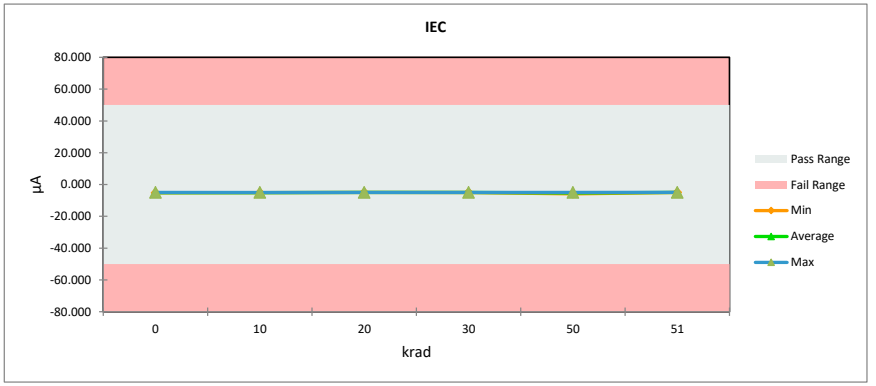
TID Report
ISOS510-SEP

	IEC
Units	µA
Max Limit	50
Min Limit	-50

krad	Serial #	PreTestHDR	PostTestHDR	Delta	Delta %	% of Limit Range
0	1	-5.008	-5.005	0.00	-0.06%	0.00%
0	2	-5.061	-5.060	0.00	-0.02%	0.00%
0	3	-5.042	-5.026	0.02	-0.32%	0.02%
0	4	-5.025	-5.231	-0.21	4.10%	0.21%
0	5	-5.056	-5.042	0.01	-0.28%	0.01%
10	6	-5.118	-5.106	0.01	-0.23%	0.01%
10	7	-5.053	-5.039	0.01	-0.28%	0.01%
10	8	-5.090	-5.079	0.01	-0.22%	0.01%
10	9	-5.044	-5.043	0.00	-0.02%	0.00%
10	10	-5.056	-5.033	0.02	-0.45%	0.02%
20	11	-4.973	-4.972	0.00	-0.02%	0.00%
20	12	-5.011	-5.000	0.01	-0.22%	0.01%
20	13	-4.989	-4.980	0.01	-0.18%	0.01%
20	14	-5.045	-5.043	0.00	-0.04%	0.00%
20	15	-5.019	-5.007	0.01	-0.24%	0.01%
30	16	-5.030	-5.025	0.00	-0.10%	0.00%
30	17	-4.934	-4.929	0.00	-0.10%	0.00%
30	18	-4.998	-4.988	0.01	-0.20%	0.01%
30	19	-5.021	-5.003	0.02	-0.36%	0.02%
30	20	-5.042	-5.024	0.02	-0.36%	0.02%
50	21	-5.059	-5.888	-0.83	16.39%	0.83%
50	22	-4.959	-5.244	-0.28	5.75%	0.28%
50	23	-5.036	-5.153	-0.12	2.32%	0.12%
50	24	-5.054	-5.228	-0.17	3.44%	0.17%
50	25	-4.950	-5.003	-0.05	1.07%	0.05%
51	26	-4.903	-4.923	-0.02	0.41%	0.02%
51	27	-4.977	-4.968	0.01	-0.19%	0.01%
51	28	-4.967	-5.000	-0.03	0.65%	0.03%
51	29	-5.065	-5.045	0.02	-0.40%	0.02%
51	30	-5.055	-5.039	0.02	-0.33%	0.02%
Max		-4.934	-4.929	0.00	16.39%	0.83%
Average		-5.030	-5.090	-0.06	1.18%	0.07%
Min		-5.118	-5.888	-0.77	-0.45%	0.00%
Std Dev		0.040	0.189	0.15	3.63%	0.18%



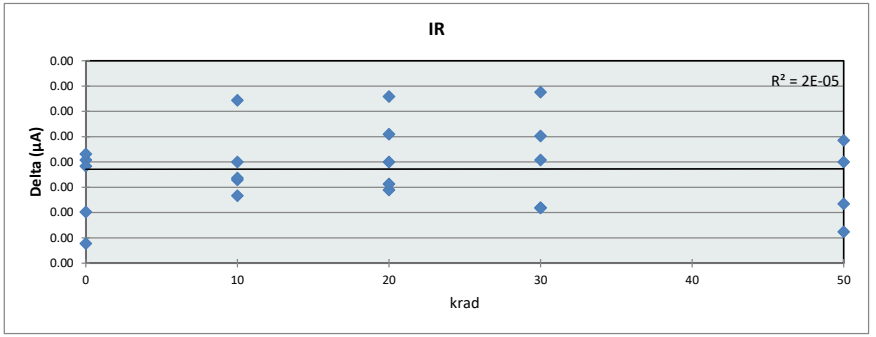
	IEC					
Units	µA					
Max Limit	50					
Min Limit	-50					
krad	0	10	20	30	50	51
LL	-50.000	-50.000	-50.000	-50.000	-50.000	-50.000
Min	-5.231	-5.106	-5.043	-5.025	-5.888	-5.045
Average	-5.073	-5.060	-5.000	-4.994	-5.303	-4.995
Max	-5.005	-5.033	-4.972	-4.929	-5.003	-4.923
UL	50.000	50.000	50.000	50.000	50.000	50.000



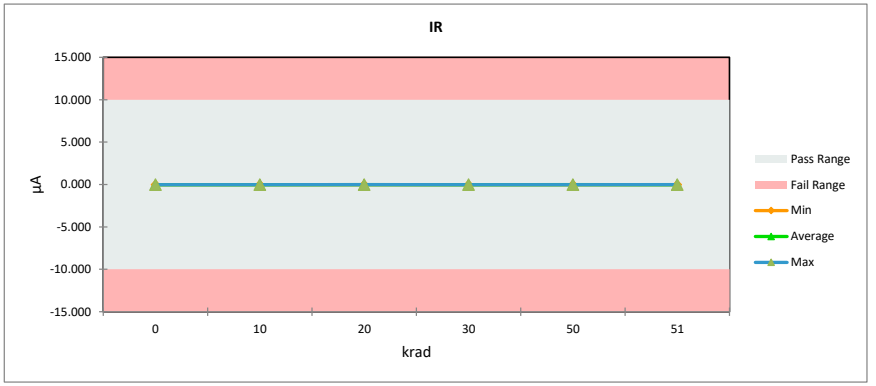
TID Report
ISOS510-SEP

	IR
Units	µA
Max Limit	10
Min Limit	-10

krad	Serial #	PreTestHDR	PostTestHDR	Delta	Delta %	% of Limit Range
0	1	-0.013	-0.013	0.00	-0.60%	0.00%
0	2	-0.013	-0.013	0.00	1.20%	0.00%
0	3	-0.012	-0.016	0.00	25.99%	0.02%
0	4	-0.012	-0.014	0.00	16.11%	0.01%
0	5	-0.013	-0.013	0.00	-2.49%	0.00%
10	6	-0.015	-0.012	0.00	-16.72%	0.01%
10	7	-0.012	-0.013	0.00	5.65%	0.00%
10	8	-0.014	-0.015	0.00	4.49%	0.00%
10	9	-0.013	-0.013	0.00	0.00%	0.00%
10	10	-0.013	-0.015	0.00	9.86%	0.01%
20	11	-0.012	-0.012	0.00	0.00%	0.00%
20	12	-0.014	-0.015	0.00	8.06%	0.01%
20	13	-0.012	-0.013	0.00	7.16%	0.00%
20	14	-0.013	-0.012	0.00	-8.20%	0.01%
20	15	-0.014	-0.011	0.00	-18.66%	0.01%
30	16	-0.014	-0.014	0.00	-0.59%	0.00%
30	17	-0.015	-0.013	0.00	-18.04%	0.01%
30	18	-0.013	-0.015	0.00	14.16%	0.01%
30	19	-0.013	-0.015	0.00	13.99%	0.01%
30	20	-0.014	-0.013	0.00	-7.29%	0.01%
50	21	-0.012	-0.015	0.00	23.17%	0.01%
50	22	-0.012	-0.012	0.00	0.00%	0.00%
50	23	-0.013	-0.015	0.00	12.67%	0.01%
50	24	-0.016	-0.015	0.00	-5.54%	0.00%
50	25	-0.011	-0.013	0.00	15.93%	0.01%
51	26	-0.013	-0.013	0.00	0.16%	0.00%
51	27	-0.015	-0.014	0.00	-5.71%	0.00%
51	28	-0.011	-0.013	0.00	18.22%	0.01%
51	29	-0.014	-0.013	0.00	-7.73%	0.01%
51	30	-0.013	-0.013	0.00	2.51%	0.00%
Max		-0.012	-0.011	0.00	25.99%	0.02%
Average		-0.013	-0.014	0.00	2.68%	0.01%
Min		-0.016	-0.016	0.00	-18.66%	0.00%
Std Dev		0.001	0.001	0.00	11.86%	0.01%



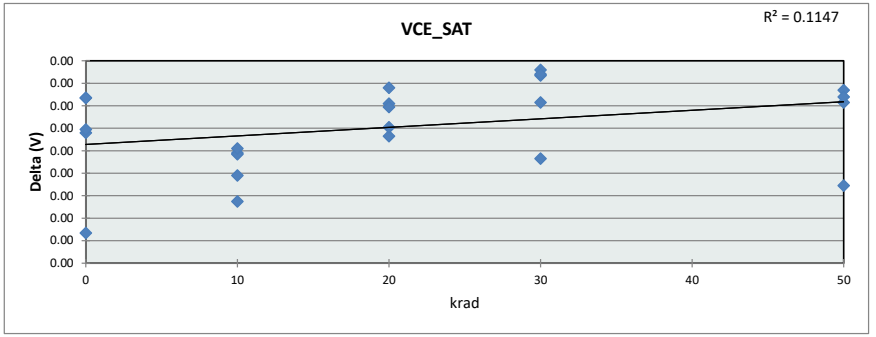
	IR					
Units	µA					
Max Limit	10					
Min Limit	-10					
krad	0	10	20	30	50	51
LL	-10.000	-10.000	-10.000	-10.000	-10.000	-10.000
Min	-0.016	-0.015	-0.015	-0.015	-0.015	-0.014
Average	-0.014	-0.014	-0.013	-0.014	-0.014	-0.013
Max	-0.013	-0.012	-0.011	-0.013	-0.012	-0.013
UL	10.000	10.000	10.000	10.000	10.000	10.000



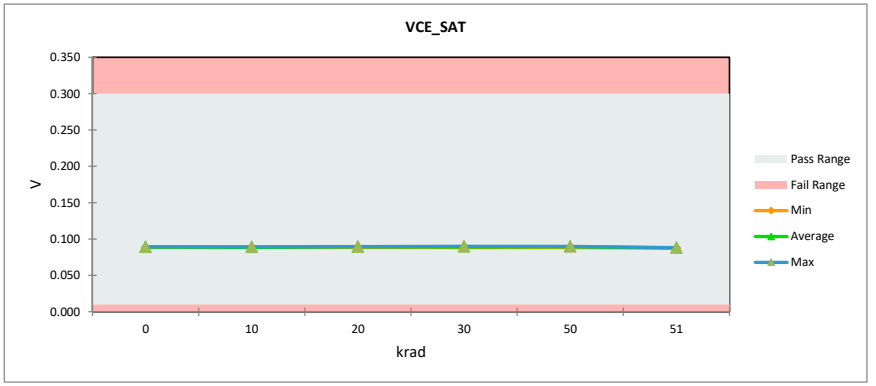
TID Report
ISOS510-SEP

	VCE_SAT
Units	V
Max Limit	0.3
Min Limit	0.01

krad	Serial #	PreTestHDR	PostTestHDR	Delta	Delta %	% of Limit Range
0	1	0.089	0.089	0.00	-0.05%	0.01%
0	2	0.089	0.089	0.00	0.30%	0.09%
0	3	0.089	0.089	0.00	0.30%	0.09%
0	4	0.089	0.088	0.00	-1.04%	0.32%
0	5	0.089	0.089	0.00	-0.01%	0.00%
10	6	0.089	0.088	0.00	-0.47%	0.14%
10	7	0.089	0.089	0.00	-0.73%	0.22%
10	8	0.088	0.088	0.00	-0.25%	0.08%
10	9	0.089	0.089	0.00	-0.26%	0.08%
10	10	0.089	0.089	0.00	-0.20%	0.06%
20	11	0.089	0.089	0.00	-0.08%	0.02%
20	12	0.089	0.089	0.00	0.01%	0.00%
20	13	0.089	0.089	0.00	0.25%	0.08%
20	14	0.089	0.090	0.00	0.21%	0.07%
20	15	0.089	0.090	0.00	0.40%	0.12%
30	16	0.089	0.090	0.00	0.58%	0.18%
30	17	0.089	0.089	0.00	0.53%	0.16%
30	18	0.088	0.089	0.00	0.26%	0.08%
30	19	0.089	0.088	0.00	-0.30%	0.09%
30	20	0.089	0.090	0.00	0.54%	0.17%
50	21	0.089	0.088	0.00	-0.57%	0.18%
50	22	0.089	0.090	0.00	0.26%	0.08%
50	23	0.089	0.090	0.00	0.38%	0.12%
50	24	0.089	0.089	0.00	0.31%	0.10%
50	25	0.089	0.090	0.00	0.36%	0.11%
51	26	0.089	0.088	0.00	-1.75%	0.54%
51	27	0.089	0.088	0.00	-1.88%	0.58%
51	28	0.088	0.087	0.00	-1.24%	0.38%
51	29	0.089	0.088	0.00	-1.32%	0.41%
51	30	0.090	0.088	0.00	-1.58%	0.49%
Max		0.089	0.090	0.00	0.58%	0.32%
Average		0.089	0.089	0.00	0.02%	0.11%
Min		0.088	0.088	0.00	-1.04%	0.00%
Std Dev		0.000	0.001	0.00	0.43%	0.07%



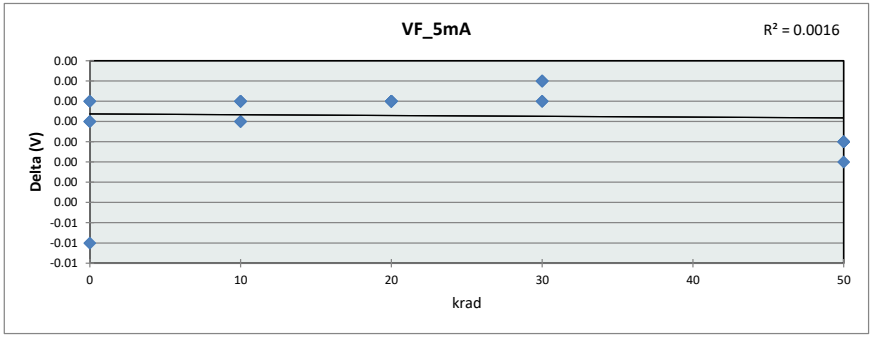
	VCE_SAT					
Units	V					
Max Limit	0.3					
Min Limit	0.01					
krad	0	10	20	30	50	51
LL	0.010	0.010	0.010	0.010	0.010	0.010
Min	0.088	0.088	0.089	0.088	0.088	0.087
Average	0.089	0.089	0.089	0.089	0.089	0.088
Max	0.089	0.089	0.090	0.090	0.090	0.088
UL	0.300	0.300	0.300	0.300	0.300	0.300



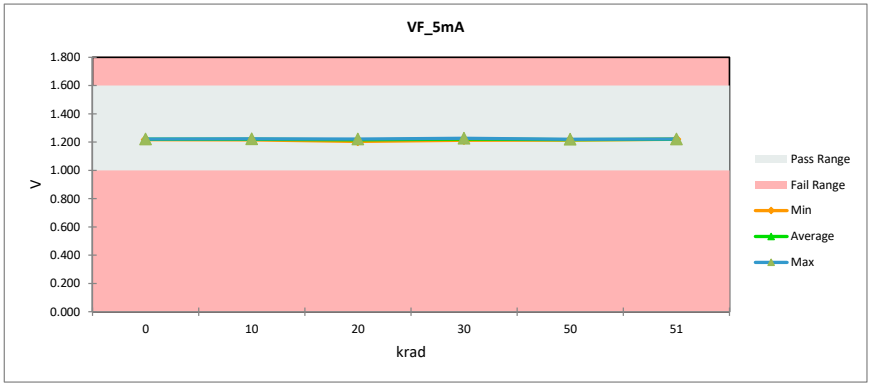
TID Report
ISOS510-SEP

	VF_5mA
Units	V
Max Limit	1.6
Min Limit	1

krad	Serial #	PreTestHDR	PostTestHDR	Delta	Delta %	% of Limit Range
0	1	1.219	1.219	0.00	0.00%	0.00%
0	2	1.218	1.219	0.00	0.08%	0.17%
0	3	1.219	1.220	0.00	0.08%	0.17%
0	4	1.224	1.218	-0.01	-0.49%	1.00%
0	5	1.222	1.222	0.00	0.00%	0.00%
10	6	1.221	1.221	0.00	0.00%	0.00%
10	7	1.221	1.221	0.00	0.00%	0.00%
10	8	1.220	1.221	0.00	0.08%	0.17%
10	9	1.215	1.216	0.00	0.08%	0.17%
10	10	1.222	1.223	0.00	0.08%	0.17%
20	11	1.204	1.205	0.00	0.08%	0.17%
20	12	1.220	1.221	0.00	0.08%	0.17%
20	13	1.217	1.218	0.00	0.08%	0.17%
20	14	1.217	1.218	0.00	0.08%	0.17%
20	15	1.218	1.219	0.00	0.08%	0.17%
30	16	1.221	1.223	0.00	0.16%	0.33%
30	17	1.222	1.223	0.00	0.08%	0.17%
30	18	1.212	1.213	0.00	0.08%	0.17%
30	19	1.225	1.227	0.00	0.16%	0.33%
30	20	1.219	1.221	0.00	0.16%	0.33%
50	21	1.219	1.217	0.00	-0.16%	0.33%
50	22	1.216	1.215	0.00	-0.08%	0.17%
50	23	1.221	1.220	0.00	-0.08%	0.17%
50	24	1.217	1.216	0.00	-0.08%	0.17%
50	25	1.217	1.217	0.00	0.00%	0.00%
51	26	1.221	1.222	0.00	0.04%	0.08%
51	27	1.221	1.221	0.00	-0.04%	0.08%
51	28	1.220	1.221	0.00	0.08%	0.17%
51	29	1.222	1.220	0.00	-0.16%	0.33%
51	30	1.220	1.220	0.00	0.00%	0.00%
Max		1.225	1.227	0.00	0.16%	1.00%
Average		1.219	1.219	0.00	0.02%	0.20%
Min		1.204	1.205	0.00	-0.49%	0.00%
Std Dev		0.004	0.004	0.00	0.14%	0.20%



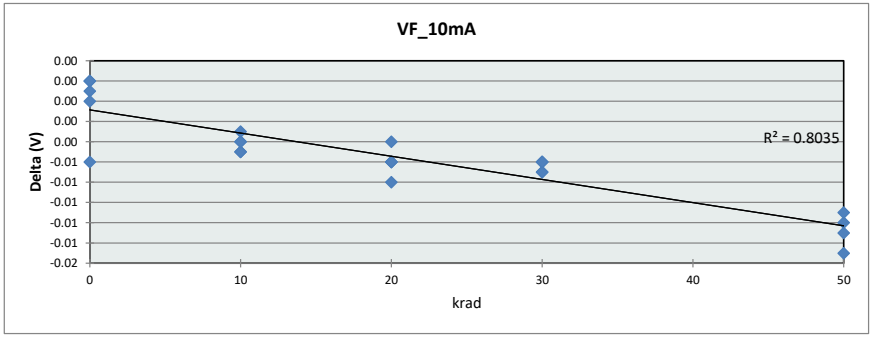
	VF_5mA					
Units	V					
Max Limit	1.6					
Min Limit	1					
krad	0	10	20	30	50	51
LL	1.000	1.000	1.000	1.000	1.000	1.000
Min	1.218	1.216	1.205	1.213	1.215	1.220
Average	1.220	1.220	1.216	1.221	1.217	1.221
Max	1.222	1.223	1.221	1.227	1.220	1.222
UL	1.600	1.600	1.600	1.600	1.600	1.600



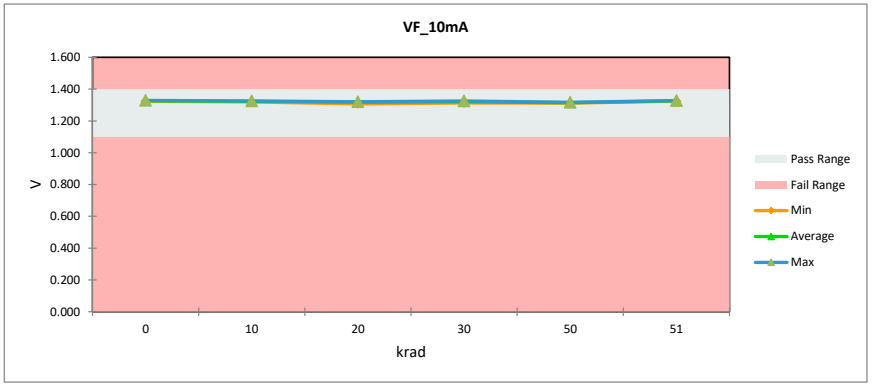
TID Report
ISOS510-SEP

	VF_10mA
Units	V
Max Limit	1.4
Min Limit	1.1

krad	Serial #	PreTestHDR	PostTestHDR	Delta	Delta %	% of Limit Range
0	1	1.325	1.326	0.00	0.08%	0.33%
0	2	1.322	1.324	0.00	0.15%	0.67%
0	3	1.327	1.329	0.00	0.15%	0.67%
0	4	1.330	1.324	-0.01	-0.45%	2.00%
0	5	1.328	1.328	0.00	0.00%	0.00%
10	6	1.328	1.323	-0.01	-0.38%	1.67%
10	7	1.328	1.323	-0.01	-0.38%	1.67%
10	8	1.327	1.323	0.00	-0.30%	1.33%
10	9	1.323	1.319	0.00	-0.30%	1.33%
10	10	1.328	1.325	0.00	-0.23%	1.00%
20	11	1.315	1.307	-0.01	-0.61%	2.67%
20	12	1.327	1.321	-0.01	-0.45%	2.00%
20	13	1.326	1.320	-0.01	-0.45%	2.00%
20	14	1.327	1.321	-0.01	-0.45%	2.00%
20	15	1.325	1.321	0.00	-0.30%	1.33%
30	16	1.328	1.322	-0.01	-0.45%	2.00%
30	17	1.329	1.323	-0.01	-0.45%	2.00%
30	18	1.320	1.313	-0.01	-0.53%	2.33%
30	19	1.332	1.325	-0.01	-0.53%	2.33%
30	20	1.328	1.322	-0.01	-0.45%	2.00%
50	21	1.328	1.313	-0.02	-1.13%	5.00%
50	22	1.325	1.312	-0.01	-0.98%	4.33%
50	23	1.329	1.317	-0.01	-0.90%	4.00%
50	24	1.326	1.315	-0.01	-0.83%	3.67%
50	25	1.326	1.315	-0.01	-0.83%	3.67%
51	26	1.329	1.327	0.00	-0.15%	0.67%
51	27	1.330	1.327	0.00	-0.26%	1.17%
51	28	1.329	1.329	0.00	-0.04%	0.17%
51	29	1.331	1.325	-0.01	-0.49%	2.17%
51	30	1.327	1.326	0.00	-0.11%	0.50%
Max		1.332	1.329	0.00	0.15%	5.00%
Average		1.326	1.321	-0.01	-0.42%	2.01%
Min		1.315	1.307	-0.01	-1.13%	0.00%
Std Dev		0.004	0.005	0.00	0.33%	1.23%



	VF_10mA					
Units	V					
Max Limit	1.4					
Min Limit	1.1					
krad	0	10	20	30	50	51
LL	1.100	1.100	1.100	1.100	1.100	1.100
Min	1.324	1.319	1.307	1.313	1.312	1.325
Average	1.326	1.323	1.318	1.321	1.314	1.326
Max	1.329	1.325	1.321	1.325	1.317	1.329
UL	1.400	1.400	1.400	1.400	1.400	1.400



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Last updated 10/2025