Total Ionization Dose (TID) Test Results of the RH137K Negative Adjustable Regulator @ Low Dose Rate (LDR)

LDR = 10 mrads(Si)/s

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Acknowledgements

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TID LDR Test Results of the RH137K Negative Adjustable Regulator

Part Type Tested: RH137K Negative Adjustable Regulator

Traceability Information: Fab Lot # W1328052.2; Assembly Lot # 732141.1; Wafer # 3; Date Code: 1345A. See photograph of unit under test in Appendix A.

Quantity of Units: 12 units received, 2 units for control, 5 units for biased irradiation, and 5 units for unbiased irradiation. Serial numbers 242,243, and 245-247had all pins tied to ground during irradiation. Serial numbers 237-241 were biased during irradiation. Serial numbers 235 and 236 were used as control. See Appendix B for the radiation bias connection tables.

Radiation and Electrical Test Increments: Ionizing radiation with the following electrical test increments: 11 Krads(Si), 20 Krads(Si), 53 Krads(Si), 107 Krads(Si).

Radiation dose rate: 10 mrads(Si)/sec.

Radiation Test Standard: MIL-STD-883 TM1019.9 Condition D.

Test Hardware and Software: LTX pre-irradiation test program: EFLR137K.01, and post-irradiation test program EQ2LR137K.01.

Facility and Radiation Source: Defense Micro Electronic Activity (DMEA) and Cobalt-60.

Irradiation and Test Temperature: Room temperature controlled to 24°C±6°C per MIL-STD-883 and MIL-STD-750.

SUMMARY

ALL 12 PARTS PASSED THE ELECTRICAL TEST LIMITS AS SPECIFIED IN THE DATASHEET AFTER EACH IRRADIATION INCREMENT. ADDITIONAL INFORMATION CAN BE PROVIDED PER REQUEST.

1.0 Overview and Background

Among other radiation effects, Total Ionizing Dose (TID) may affect electrical characteristics, causing parametric and/or functional failures in integrated circuits. During gamma-irradiations, TID-induced and transported electron-hole pairs may result in charge trapping in a transistor's dielectrics and interface regions, affecting the device's basic features. Such effects warrant testing and monitoring of circuits to TID, after which annealing and/or Time Dependent Effects (TDE) may take place, depending on the circuit's design and process technology. Hence the requirement per Condition D (for low-dose rates ranging from less than or equal to 10 mrads(Si)/sec) in TM1019, MIL-STD-883 is to not exceed the allowed time of one hour from the end of an incremented irradiation and an electrical test. Additionally, the total time from the end of one incremental irradiation to the start of the next incremental step should be less than two hours.

2.0 Radiation Facility and Test Equipment

The samples were irradiated at Defense Micro-Electronics Activity (DMEA) facility in Sacramento, California. DMEA utilizes J.L. Shepherd model 81-22/484 to provide the dose-rate of 10 mrads(Si)/s. A special design screw-driven automatic cart inside the exposure tunnel positions the Device-Under-Test (DUT) precisely and repeatedly from the source to attain optimal rate verified by ion chamber detectors. See Appendix C for the certificate of dosimetry.

3.0 Test Conditions

The 10 samples were placed in a lead/aluminum container and aligned with the radiation source, Cobalt-60, at DMEA facility in Sacramento, California. During irradiation, five units were biased at +/- 15V and other five had all pads grounded. The devices were irradiated up to 107 Krad(Si) with increments of 11, 20, 53 Krads(Si). After each irradiation, the samples were transported in dry ice to Linear Technology testing facility. Testing was performed on the two control units to confirm the operation of the test system prior to the electrical testing of the 12 units (10 irradiated and 2 control).

The criteria to pass the low dose-rate test is that five samples irradiated under electrical bias must pass the datasheet limits. If any of the tested parameters of these five units do not meet the required limits then a failure-analysis of the part should be conducted and if valid the lot will be scrapped.

4.0 Tested Parameters

The following parameters were measured pre- and post-irradiations:

- V_{REF} (V) @ $|V_{IN} – V_{OUT}| \leq 5V$, $I_{OUT} = 10mA$
- V_{REF} (V) @ $|V_{IN} – V_{OUT}| \leq 5V$, $I_{OUT} \leq 1.5A$
- V_{REF} (V) @ $|V_{IN} – V_{OUT}| \leq 3V$, $I_{OUT} = 10mA$
- V_{REF} (V) @ $|V_{IN} – V_{OUT}| \leq 30V$, $I_{OUT} = 10mA$
- V_{REF} (V) @ $|V_{IN} – V_{OUT}| \leq 30V$, $I_{OUT} = 150mA$
- V_{REF} (V) @ $|V_{IN} – V_{OUT}| \leq 10V$, $I_{OUT} = 10mA$
- V_{REF} (V) @ $|V_{IN} – V_{OUT}| \leq 18V$, $I_{OUT} = 1A$
- Line Regulation (%/V) @ $3V \leq |V_{IN} – V_{OUT}| \leq 30V$
- Load Regulation (mV) @ $V_{OUT} \leq 5V$, $10mA \leq I_{OUT} \leq I_{MAX}$
- Load Regulation (%) @ $V_{OUT} \geq 5V$, $10mA \leq I_{OUT} \leq I_{MAX}$
- Adjust Pin Current (uA)
- Adjust Pin Current Change (uA) @ $10mA \leq I_{OUT} \leq I_{MAX}$
- Adjust Pin Current Change (uA) @ $3V \leq |V_{IN} – V_{OUT}| \leq 30V$
- Minimum Load Current (mA) @ $|V_{IN} – V_{OUT}| = 30V$
- Minimum Load Current (mA) @ $|V_{IN} – V_{OUT}| \leq 10V$
- Current Limit (A) @ $|V_{IN} – V_{OUT}| \leq 15V$
- Current Limit (A) @ $|V_{IN} – V_{OUT}| = 30V$

Appendix D details the test conditions, minimum and maximum values at different accumulated doses.

5.0 Test Results

All ten samples passed the post-irradiation electrical tests. All measurements of the seventeen listed parameters in section 4.0 are within the specification limits.

The used statistics in this report are based on the tolerance limits, which are bounds to gage the quality of the manufactured products. It assumes that if the quality of the items is normally distributed with known mean and known standard deviation, the two-sided tolerance limits can be calculated as follows:

$+K_{TL}$ = mean + (K_{TL}) (standard deviation)

$-K_{TL}$ = mean - (K_{TL}) (standard deviation)

Where $+K_{TL}$ is the upper tolerance limit and $-K_{TL}$ is the lower tolerance limit.
These tolerance limits are defined in a table of inverse normal probability distribution.

However, in most cases, mean and standard deviations are unknown and therefore it is practical to estimate both of them from a sample. Hence the tolerance limit depends greatly on the sample size. The Ps90%/90% K_{TL} factor for a lot quality P of 0.9, confidence C of 0.9 with a sample size of 5, can be found from the tabulated table (MIL-HDBK-814, page 94, table IX-B). The K_{TL} factor in this report is 2.742.

In the plots, the dotted lines with diamond markers are the average of the measured data points of five samples irradiated under electrical bias while the dashed lines with X-markers are the average of measured data points of five units irradiated with all pins tied to ground. The solid lines with triangle markers are the 90%/90% minimum and maximum determined from the calculation of the K_{TL} on the samples irradiated in the biased setup. The solid lines with square symbols are the 90%/90% minimum and maximum determined from the calculation of the K_{TL} on the five samples irradiated with all pins grounded. The orange solid lines with circle markers are the specification limits.

The 11 Krads(Si) test limits are taken from the Linear Technology datasheet's 10 Krads(Si) specification limits. The 53 Krads(Si) test limits are taken from the Linear Technology datasheet's 50 Krads(Si) specification limits. The 107 Krads(Si) test limits are taken from the Linear Technology datasheet's 100 Krads(Si) specification limits.

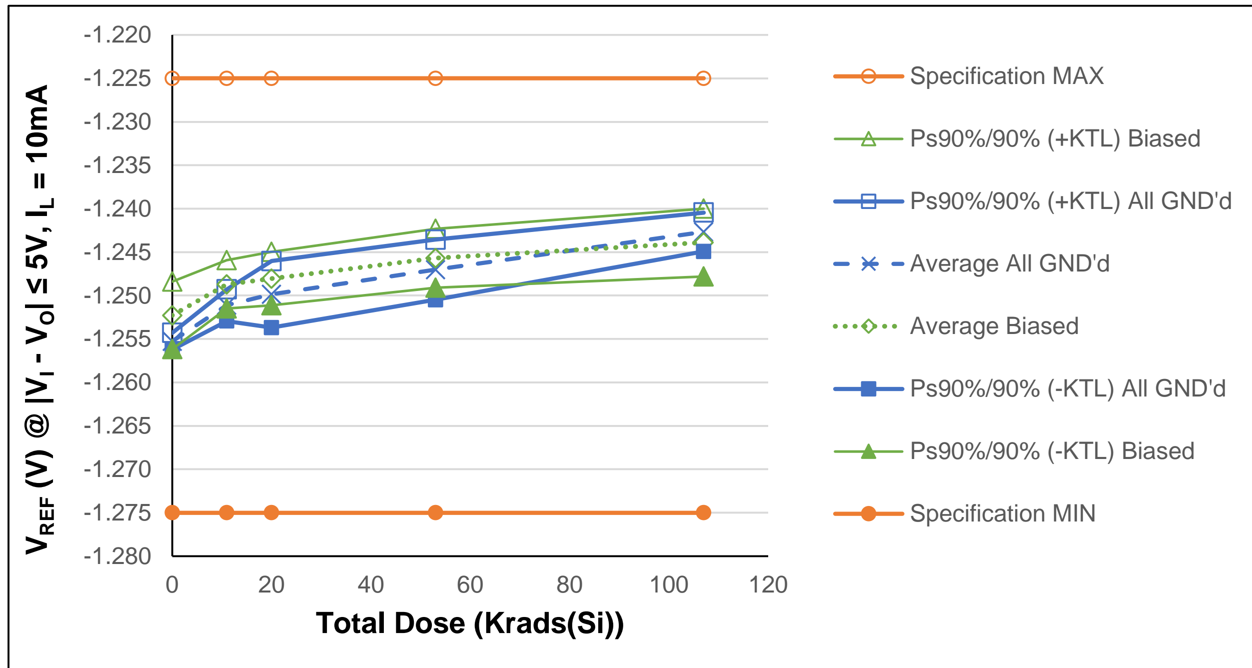

Figure 5.1 Plot of Reference Voltage @ $|V_I - V_O| \leq 5V$ versus Total Dose

Table 5.1: Raw data for reference voltage at $|V_{IN}\text{-}V_{OUT}| \leq 5V$ versus total dose including the statistical calculations, minimum specification, maximum specification, and the status of the test (PASS/FAIL) under the orange headers)

Parameter	V_{REF} @ $\lvert V_I - V_O \rvert = 5V$; I_L =10mA	Total Dose (Krads(Si)) @ 10 mrads/s				
Units	(V)	0	11	20	53	107
242	All GND'd Irradiation	-1.25563	-1.25072	-1.24766	-1.24526	-1.24148
243	All GND'd Irradiation	-1.25469	-1.25043	-1.24959	-1.24661	-1.24293
245	All GND'd Irradiation	-1.25529	-1.25129	-1.25050	-1.24783	-1.24307
246	All GND'd Irradiation	-1.25529	-1.25099	-1.25016	-1.24682	-1.24232
247	All GND'd Irradiation	-1.25545	-1.25216	-1.25140	-1.24858	-1.24361
237	Biased Irradiation	-1.25378	-1.24975	-1.24925	-1.24713	-1.24549
238	Biased Irradiation	-1.25170	-1.24833	-1.24766	-1.24577	-1.24427
239	Biased Irradiation	-1.25384	-1.24984	-1.24925	-1.24663	-1.24435
240	Biased Irradiation	-1.25110	-1.24806	-1.24736	-1.24492	-1.24375
241	Biased Irradiation	-1.25103	-1.24762	-1.24680	-1.24408	-1.24161
235	Control Unit	-1.25406	-1.25153	-1.25133	-1.25095	-1.25128
236	Control Unit	-1.25415	-1.25159	-1.25145	-1.25144	-1.25182
	All GND'd Irradiation Statistics					
	Average All GND'd	-1.25527	-1.25112	-1.24986	-1.24702	-1.24268
	Std Dev All GND'd	0.00035	0.00066	0.00139	0.00126	0.00082
	Ps90%/90% (+KTL) All GND'd	-1.25430	-1.24930	-1.24604	-1.24356	-1.24044
	Ps90%/90% (-KTL) All GND'd	-1.25624	-1.25293	-1.25369	-1.25048	-1.24492
	Biased Irradiation Statistics					
	Average Biased	-1.25229	-1.24872	-1.24806	-1.24571	-1.24389
	Std Dev Biased	0.00141	0.00102	0.00112	0.00124	0.00142
	Ps90%/90% (+KTL) Biased	-1.24842	-1.24594	-1.24498	-1.24231	-1.23999
	Ps90%/90% (-KTL) Biased	-1.25616	-1.25150	-1.25114	-1.24910	-1.24780
	Specification MIN	-1.275	-1.275	-1.275	-1.275	-1.275
	Status (Measurements) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (Measurements) Biased	PASS	PASS	PASS	PASS	PASS
	Specification MAX	-1.225	-1.225	-1.225	-1.225	-1.225
	Status (Measurements) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (Measurements) Biased	PASS	PASS	PASS	PASS	PASS
	Status (-KTL) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (+KTL) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (-KTL) Biased	PASS	PASS	PASS	PASS	PASS
	Status (+KTL) Biased	PASS	PASS	PASS	PASS	PASS

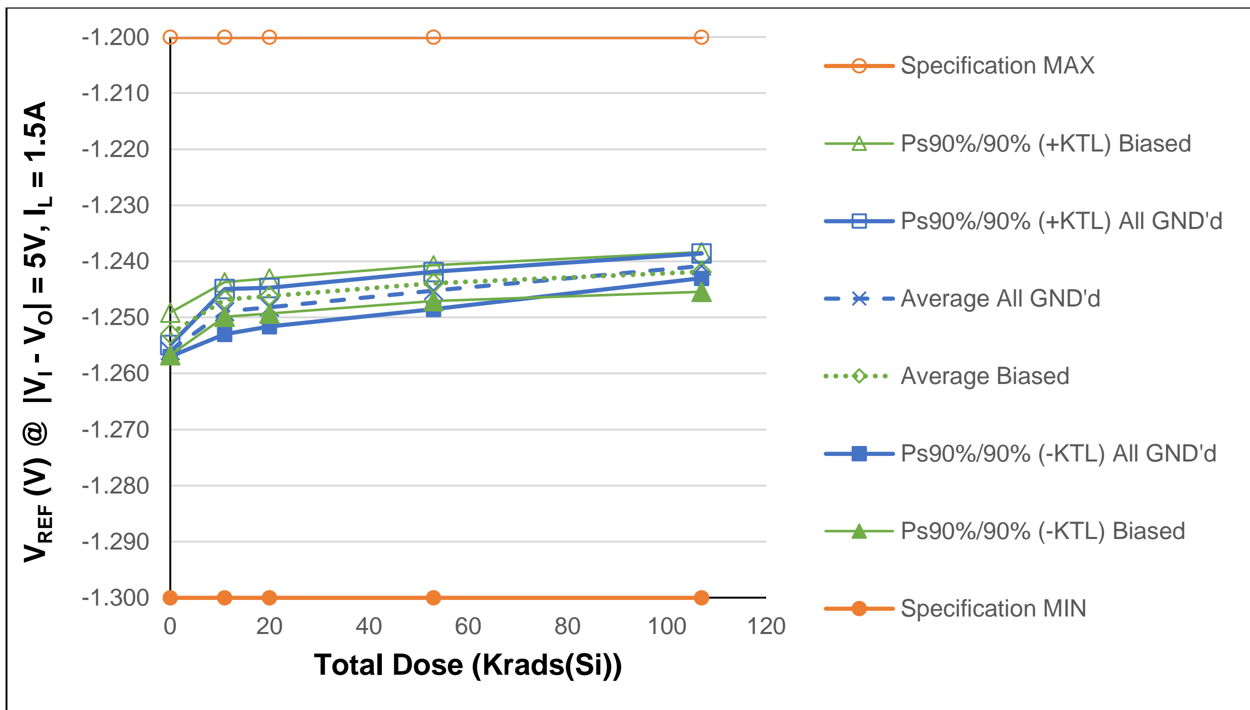

Figure 5.2 Plot of Reference Voltage @ $|V_I - V_O| = 5V$, $I_L = 1.5A$ versus Total Dose

Table 5.2: Raw data for reference voltage at $|V_I – V_O| = 5V$, $I_L = 1.5A$ versus total dose including the statistical calculations, minimum specification, maximum specification, and the status of the test (PASS/FAIL) under the orange headers)

Parameter	V_{REF} @ $\|V_I - V_O\| = 5V$; I_L=1.5A	Total Dose (Krads(Si)) @ 10 mrads/s				
Units	(V)	0	11	20	53	107
242	All GND'd Irradiation	-1.25622	-1.24659	-1.24624	-1.24356	-1.23961
243	All GND'd Irradiation	-1.25529	-1.24873	-1.24784	-1.24462	-1.24101
245	All GND'd Irradiation	-1.25598	-1.24946	-1.24870	-1.24581	-1.24117
246	All GND'd Irradiation	-1.25598	-1.24950	-1.24852	-1.24525	-1.24049
247	All GND'd Irradiation	-1.25618	-1.25053	-1.24962	-1.24679	-1.24175
237	Biased Irradiation	-1.25431	-1.24802	-1.24722	-1.24520	-1.24327
238	Biased Irradiation	-1.25240	-1.24655	-1.24591	-1.24403	-1.24205
239	Biased Irradiation	-1.25450	-1.24793	-1.24746	-1.24478	-1.24242
240	Biased Irradiation	-1.25182	-1.24579	-1.24550	-1.24317	-1.24181
241	Biased Irradiation	-1.25160	-1.24568	-1.24478	-1.24234	-1.23979
235	Control Unit	-1.25469	-1.24971	-1.24944	-1.24938	-1.24972
236	Control Unit	-1.25470	-1.24951	-1.24974	-1.24995	-1.25023
	All GND'd Irradiation Statistics					
	Average All GND'd	-1.25593	-1.24896	-1.24818	-1.24520	-1.24080
	Std Dev All GND'd	0.00037	0.00147	0.00126	0.00122	0.00081
	Ps90%/90% (+KTL) All GND'd	-1.25490	-1.24493	-1.24474	-1.24187	-1.23860
	Ps90%/90% (-KTL) All GND'd	-1.25696	-1.25299	-1.25163	-1.24854	-1.24301
	Biased Irradiation Statistics					
	Average Biased	-1.25293	-1.24679	-1.24617	-1.24390	-1.24187
	Std Dev Biased	0.00138	0.00113	0.00114	0.00117	0.00129
	Ps90%/90% (+KTL) Biased	-1.24914	-1.24370	-1.24304	-1.24071	-1.23834
	Ps90%/90% (-KTL) Biased	-1.25672	-1.24989	-1.24931	-1.24710	-1.24540
	Specification MIN	-1.3	-1.3	-1.3	-1.3	-1.3
	Status (Measurements) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (Measurements) Biased	PASS	PASS	PASS	PASS	PASS
	Specification MAX	-1.2	-1.2	-1.2	-1.2	-1.2
	Status (Measurements) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (Measurements) Biased	PASS	PASS	PASS	PASS	PASS
	Status (-KTL) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (+KTL) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (-KTL) Biased	PASS	PASS	PASS	PASS	PASS
	Status (+KTL) Biased	PASS	PASS	PASS	PASS	PASS

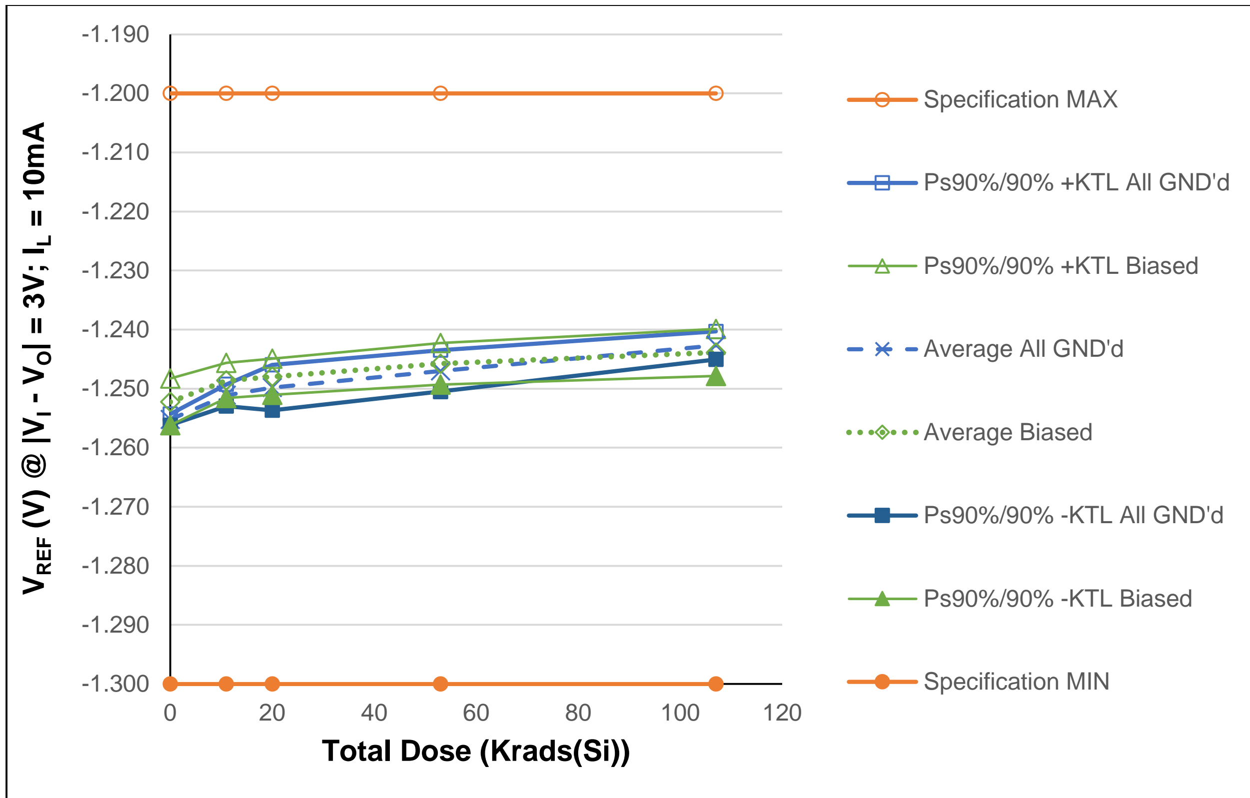

Figure 5.3 Plot of Reference Voltage @ $|V_I - V_O| = 3V$, $I_L = 10$ mA versus Total Dose

Table 5.3: Raw data for reference voltage at $|V_I – V_O| = 3V$, $I_L = 10$ mA versus total dose including the statistical calculations, minimum specification, maximum specification, and the status of the test (PASS/FAIL) under the orange headers)

Parameter	V_{REF} @ $\|V_I - V_O\| = 3V; I_L = 10mA$	Total Dose (Krads(Si)) @ 50r/s				
Units	(V)	0	11	20	53	107
242	All GND'd Irradiation	-1.25559	-1.25065	-1.24761	-1.24517	-1.24144
243	All GND'd Irradiation	-1.25467	-1.25047	-1.24958	-1.24663	-1.24293
245	All GND'd Irradiation	-1.25529	-1.25129	-1.25050	-1.24774	-1.24316
246	All GND'd Irradiation	-1.25526	-1.25095	-1.25001	-1.24682	-1.24222
247	All GND'd Irradiation	-1.25537	-1.25217	-1.25138	-1.24858	-1.24364
237	Biased Irradiation	-1.25377	-1.24981	-1.24912	-1.24733	-1.24558
238	Biased Irradiation	-1.25163	-1.24823	-1.24760	-1.24596	-1.24398
239	Biased Irradiation	-1.25383	-1.24973	-1.24916	-1.24659	-1.24450
240	Biased Irradiation	-1.25106	-1.24782	-1.24726	-1.24496	-1.24368
241	Biased Irradiation	-1.25095	-1.24747	-1.24672	-1.24408	-1.24163
235	Control Unit	-1.25400	-1.25152	-1.25111	-1.25102	-1.25128
236	Control Unit	-1.25407	-1.25152	-1.25138	-1.25140	-1.25182
	All GND'd Irradiation Statistics					
	Average All GND'd	-1.25523	-1.25110	-1.24982	-1.24699	-1.24268
	Std Dev All GND'd	0.00034	0.00067	0.00140	0.00128	0.00086
	Ps90%/90% +KTL All GND'd	-1.25430	-1.24926	-1.24597	-1.24348	-1.24032
	Ps90%/90% -KTL All GND'd	-1.25617	-1.25294	-1.25366	-1.25050	-1.24504
	Biased Irradiation Statistics					
	Average Biased	-1.25225	-1.24861	-1.24797	-1.24578	-1.24387
	Std Dev Biased	0.00144	0.00109	0.00111	0.00129	0.00145
	Ps90%/90% +KTL Biased	-1.24830	-1.24562	-1.24492	-1.24225	-1.23990
	Ps90%/90% -KTL Biased	-1.25620	-1.25160	-1.25102	-1.24932	-1.24785
	Specification MIN	-1.3	-1.3	-1.3	-1.3	-1.3
	Status (Measurements) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (Measurements) Biased	PASS	PASS	PASS	PASS	PASS
	Specification MAX	-1.2	-1.2	-1.2	-1.2	-1.2
	Status (Measurements) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (Measurements) Biased	PASS	PASS	PASS	PASS	PASS
	Status (-KTL) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (+KTL) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (-KTL) Biased	PASS	PASS	PASS	PASS	PASS
	Status (+KTL) Biased	PASS	PASS	PASS	PASS	PASS

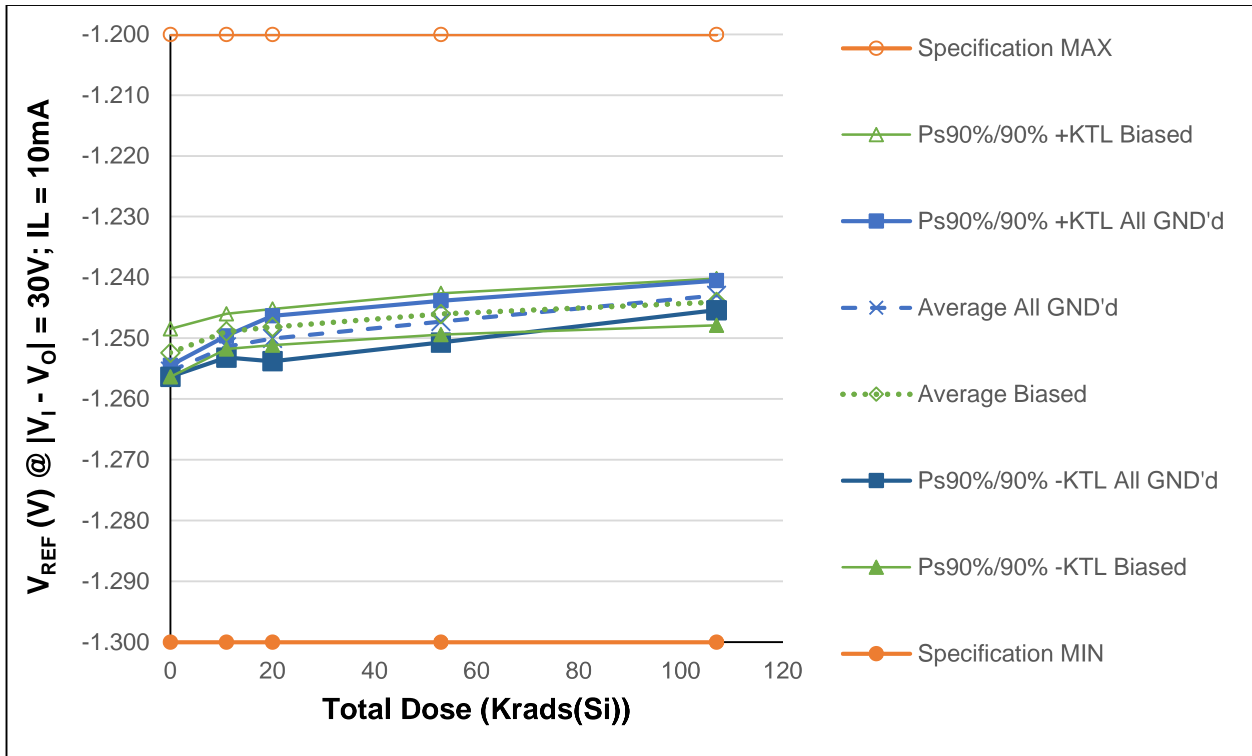

Figure 5.4 Plot of Reference Voltage @ $|V_I - V_O| = 30V$, $I_L = 10$ mA versus Total Dose

Table 5.4: Raw data for reference voltage at $|V_I – V_O|$ = 30V, I_L = 10 mA versus total dose including the statistical calculations, minimum specification, maximum specification, and the status of the test (PASS/FAIL) under the orange headers)

Parameter	V_{REF} @ $\|V_I - V_O\|$ = 30V; I_L = 10mA	Total Dose (Krads(Si)) @ 50r/s				
Units	V	0	11	20	53	107
242	All GND'd Irradiation	-1.25575	-1.25102	-1.24787	-1.24557	-1.24171
243	All GND'd Irradiation	-1.25484	-1.25066	-1.24980	-1.24682	-1.24316
245	All GND'd Irradiation	-1.25548	-1.25145	-1.25072	-1.24797	-1.24344
246	All GND'd Irradiation	-1.25543	-1.25144	-1.25031	-1.24709	-1.24246
247	All GND'd Irradiation	-1.25553	-1.25240	-1.25150	-1.24889	-1.24399
237	Biased Irradiation	-1.25391	-1.24997	-1.24920	-1.24737	-1.24557
238	Biased Irradiation	-1.25179	-1.24858	-1.24775	-1.24601	-1.24450
239	Biased Irradiation	-1.25400	-1.25001	-1.24942	-1.24705	-1.24457
240	Biased Irradiation	-1.25126	-1.24808	-1.24748	-1.24526	-1.24377
241	Biased Irradiation	-1.25104	-1.24778	-1.24698	-1.24439	-1.24181
235	Control Unit	-1.25407	-1.25161	-1.25140	-1.25117	-1.25136
236	Control Unit	-1.25423	-1.25171	-1.25145	-1.25149	-1.25182
	All GND'd Irradiation Statistics					
	Average All GND'd	-1.25541	-1.25139	-1.25004	-1.24727	-1.24295
	Std Dev All GND'd	0.00034	0.00065	0.00136	0.00125	0.00089
	Ps90%/90% +KTL All GND'd	-1.25448	-1.24961	-1.24631	-1.24384	-1.24052
	Ps90%/90% -KTL All GND'd	-1.25633	-1.25317	-1.25377	-1.25070	-1.24538
	Biased Irradiation Statistics					
	Average Biased	-1.25240	-1.24888	-1.24816	-1.24602	-1.24404
	Std Dev Biased	0.00145	0.00105	0.00108	0.00124	0.00140
	Ps90%/90% +KTL Biased	-1.24843	-1.24601	-1.24519	-1.24263	-1.24020
	Ps90%/90% -KTL Biased	-1.25637	-1.25176	-1.25113	-1.24941	-1.24789
	Specification MIN	-1.3	-1.3	-1.3	-1.3	-1.3
	Status (Measurements) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (Measurements) Biased	PASS	PASS	PASS	PASS	PASS
	Specification MAX	-1.2	-1.2	-1.2	-1.2	-1.2
	Status (Measurements) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (Measurements) Biased	PASS	PASS	PASS	PASS	PASS
	Status (-KTL) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (+KTL) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (-KTL) Biased	PASS	PASS	PASS	PASS	PASS
	Status (+KTL) Biased	PASS	PASS	PASS	PASS	PASS

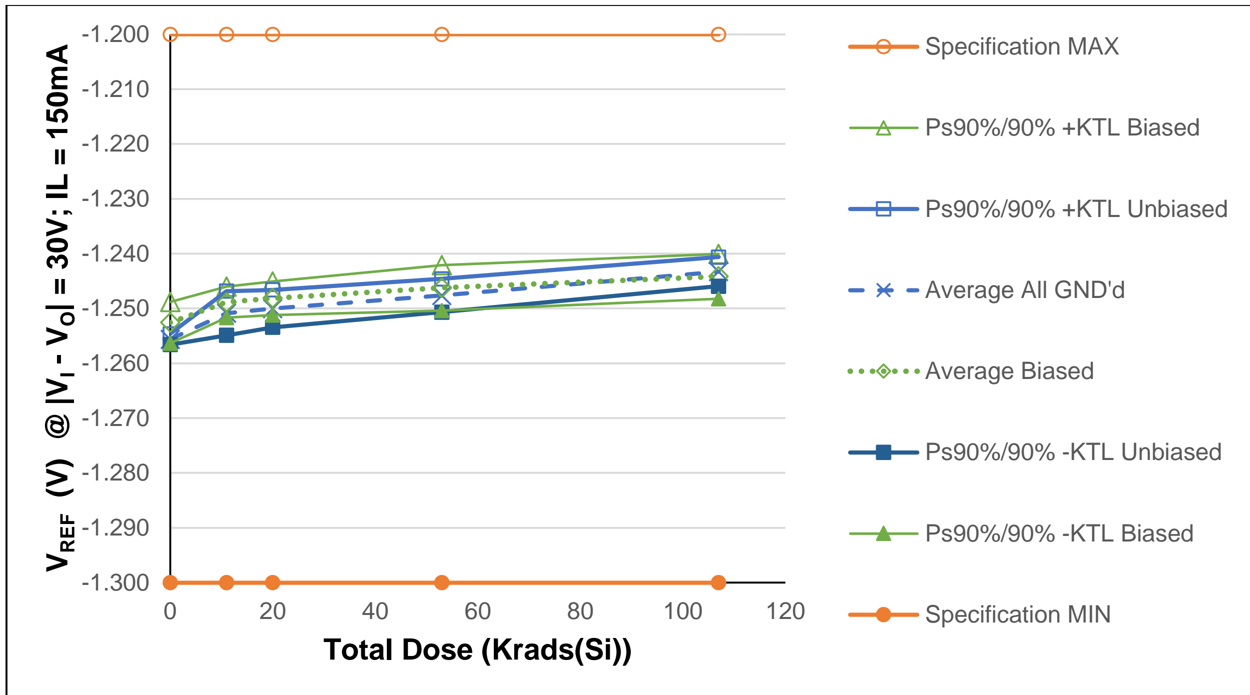

Figure 5.5 Plot of Reference Voltage @ $|V_I – V_O|$ = 30V, I_L = 150 mA versus Total Dose

Table 5.5 Raw data for reference voltage at $|V_I - V_O| = 30V$, $I_L = 150$ mA versus total dose including the statistical calculations, minimum specification, maximum specification, and the status of the test (PASS/FAIL) under the orange headers)

Parameter	V_{REF} @ $|V_I - V_O| = 30V$; $I_L = 150mA$	Total Dose (Krads(Si)) @ 50r/s				
Units	(V)	0	11	20	53	107
242	All GND'd Irradiation	-1.25598	-1.24846	-1.24807	-1.24600	-1.24185
243	All GND'd Irradiation	-1.25502	-1.25072	-1.24974	-1.24733	-1.24361
245	All GND'd Irradiation	-1.25567	-1.25154	-1.25065	-1.24831	-1.24361
246	All GND'd Irradiation	-1.25567	-1.25126	-1.25028	-1.24751	-1.24285
247	All GND'd Irradiation	-1.25572	-1.25236	-1.25138	-1.24892	-1.24443
237	Biased Irradiation	-1.25400	-1.24970	-1.24920	-1.24779	-1.24569
238	Biased Irradiation	-1.25201	-1.24863	-1.24767	-1.24646	-1.24447
239	Biased Irradiation	-1.25407	-1.25011	-1.24942	-1.24748	-1.24488
240	Biased Irradiation	-1.25145	-1.24817	-1.24760	-1.24516	-1.24399
241	Biased Irradiation	-1.25132	-1.24764	-1.24680	-1.24425	-1.24171
235	Control Unit	-1.25435	-1.25126	-1.25150	-1.25099	-1.25106
236	Control Unit	-1.25439	-1.25134	-1.25153	-1.25129	-1.25136
	All GND'd Irradiation Statistics					
	Average All GND'd	-1.25561	-1.25087	-1.25003	-1.24761	-1.24327
	Std Dev All GND'd	0.00035	0.00147	0.00124	0.00111	0.00097
	Ps90%/90% +KTL Unbiased	-1.25464	-1.24684	-1.24661	-1.24458	-1.24061
	Ps90%/90% -KTL Unbiased	-1.25658	-1.25489	-1.25344	-1.25065	-1.24593
	Irradiation Statistics Biased					
	Average Biased	-1.25257	-1.24885	-1.24814	-1.24623	-1.24414
	Std Dev Biased	0.00136	0.00104	0.00112	0.00151	0.00150
	Ps90%/90% +KTL Biased	-1.24883	-1.24601	-1.24505	-1.24209	-1.24004
	Ps90%/90% -KTL Biased	-1.25631	-1.25169	-1.25122	-1.25037	-1.24825
	Specification MIN	-1.3	-1.3	-1.3	-1.3	-1.3
	Status (Measurements) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (Measurements) Biased	PASS	PASS	PASS	PASS	PASS
	Specification MAX	-1.2	-1.2	-1.2	-1.2	-1.2
	Status (Measurements) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (Measurements) Biased	PASS	PASS	PASS	PASS	PASS
	Status (-KTL) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (+KTL) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (-KTL) Biased	PASS	PASS	PASS	PASS	PASS
	Status (+KTL) Biased	PASS	PASS	PASS	PASS	PASS

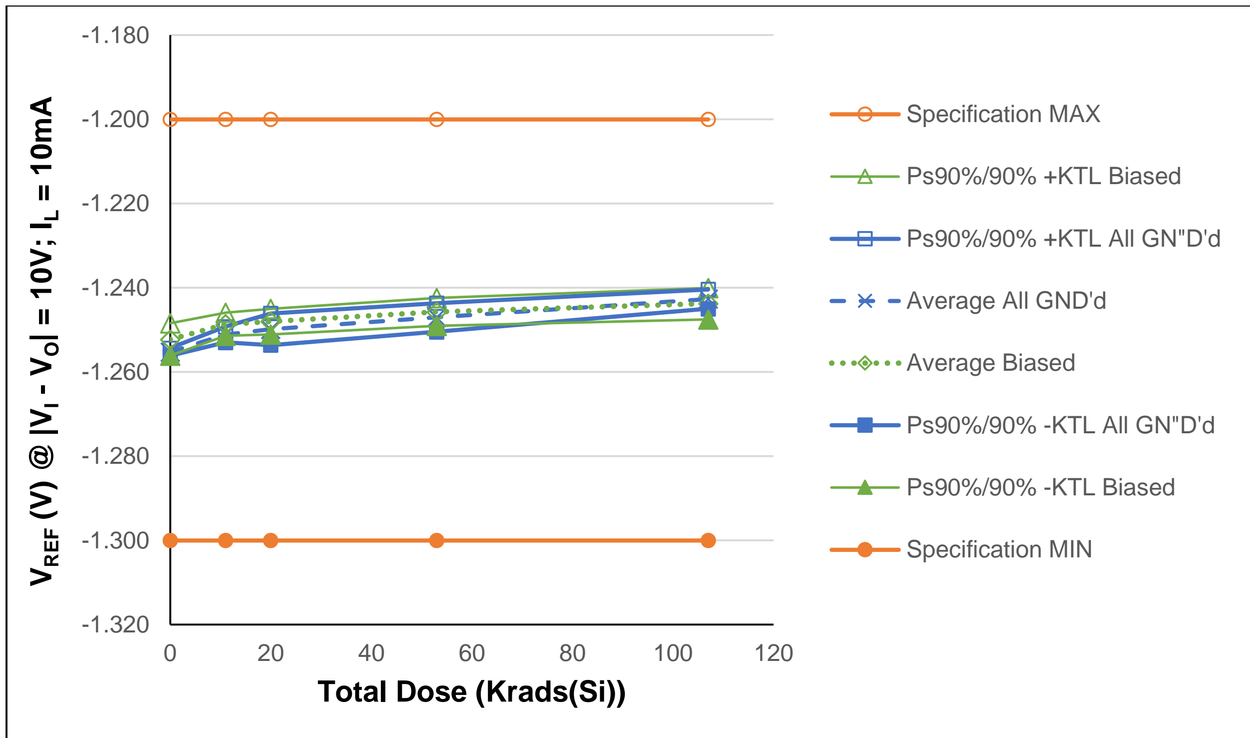

Figure 5.6 Plot of Reference Voltage @ $|V_I - V_O| = 10V$, $I_L = 10$ mA versus Total Dose

Table 5.6 Raw data for reference voltage at $|V_I – V_O|$ = 10V, I_L = 10 mA versus total dose including the statistical calculations, minimum specification, maximum specification, and the status of the test (PASS/FAIL) under the orange headers)

Parameter	V_{REF} @ $\|V_I - V_O\|$ = 10V; I_L=10mA	Total Dose (Krads(Si)) @ 10mr/s				
Units	V	0	11	20	53	107
242	All GND'd Irradiation	-1.25561	-1.25067	-1.24767	-1.24530	-1.24147
243	All GND'd Irradiation	-1.25472	-1.25038	-1.24958	-1.24668	-1.24288
245	All GND'd Irradiation	-1.25529	-1.25134	-1.25053	-1.24785	-1.24319
246	All GND'd Irradiation	-1.25529	-1.25110	-1.25019	-1.24691	-1.24227
247	All GND'd Irradiation	-1.25545	-1.25215	-1.25133	-1.24858	-1.24361
237	Biased Irradiation	-1.25378	-1.24969	-1.24920	-1.24713	-1.24534
238	Biased Irradiation	-1.25167	-1.24839	-1.24757	-1.24577	-1.24406
239	Biased Irradiation	-1.25380	-1.24974	-1.24928	-1.24663	-1.24429
240	Biased Irradiation	-1.25110	-1.24788	-1.24737	-1.24500	-1.24361
241	Biased Irradiation	-1.25104	-1.24762	-1.24684	-1.24417	-1.24162
235	Control Unit	-1.25407	-1.25152	-1.25114	-1.25096	-1.25121
236	Control Unit	-1.25411	-1.25145	-1.25141	-1.25146	-1.25182
	All GND'd Irradiation Statistics					
	Average All GND'd	-1.25527	-1.25113	-1.24986	-1.24707	-1.24268
	Std Dev All GND'd	0.00034	0.00068	0.00138	0.00124	0.00084
	Ps90%/90% +KTL All GN"D'd	-1.25435	-1.24926	-1.24608	-1.24365	-1.24039
	Ps90%/90% -KTL All GN"D'd	-1.25619	-1.25299	-1.25364	-1.25048	-1.24498
	Biased Irradiation Statistics					
	Average Biased	-1.25228	-1.24867	-1.24805	-1.24574	-1.24379
	Std Dev Biased	0.00140	0.00100	0.00112	0.00120	0.00137
	Ps90%/90% +KTL Biased	-1.24843	-1.24593	-1.24498	-1.24245	-1.24004
	Ps90%/90% -KTL Biased	-1.25613	-1.25140	-1.25112	-1.24903	-1.24753
	Specification MIN	-1.3	-1.3	-1.3	-1.3	-1.3
	Status (Measurements) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (Measurements) Biased	PASS	PASS	PASS	PASS	PASS
	Specification MAX	-1.2	-1.2	-1.2	-1.2	-1.2
	Status (Measurements) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (Measurements) Biased	PASS	PASS	PASS	PASS	PASS
	Status -KTL All GND'd	PASS	PASS	PASS	PASS	PASS
	Status +KTL All GND'd	PASS	PASS	PASS	PASS	PASS
	Status -KTL Biased	PASS	PASS	PASS	PASS	PASS
	Status +KTL Biased	PASS	PASS	PASS	PASS	PASS

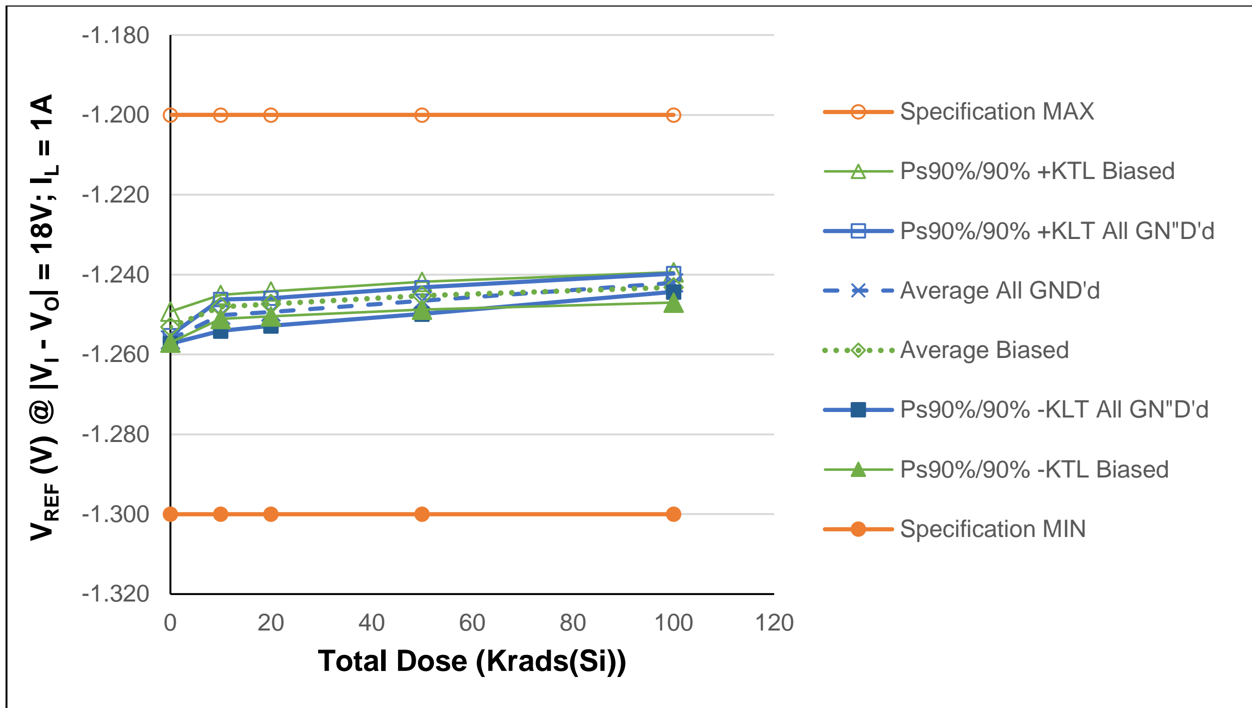

Figure 5.7 Plot of Reference Voltage @ $|V_I - V_O| = 18V$, $I_L = 1A$ versus Total Dose

Table 5.7 Raw data for reference voltage at $|V_I - V_O| = 18V$, $I_L = 1A$ versus total dose including the statistical calculations, minimum specification, maximum specification, and the status of the test (PASS/FAIL) under the orange headers)

Parameter	V_{REF} @ $\lvert V_I - V_O \rvert = 18V$; I_L=1A	Total Dose (Krads(Si)) @ 10mr/s				
Units	V	0	10	20	50	100
242	All GND'd Irradiation	-1.25659	-1.24785	-1.24741	-1.24486	-1.24086
243	All GND'd Irradiation	-1.25563	-1.24984	-1.24905	-1.24601	-1.24223
245	All GND'd Irradiation	-1.25633	-1.25080	-1.24992	-1.24722	-1.24242
246	All GND'd Irradiation	-1.25636	-1.25073	-1.24966	-1.24663	-1.24164
247	All GND'd Irradiation	-1.25644	-1.25163	-1.25080	-1.24805	-1.24307
237	Biased Irradiation	-1.25453	-1.24917	-1.24836	-1.24677	-1.24492
238	Biased Irradiation	-1.25262	-1.24770	-1.24705	-1.24526	-1.24345
239	Biased Irradiation	-1.25476	-1.24934	-1.24870	-1.24622	-1.24354
240	Biased Irradiation	-1.25201	-1.24732	-1.24668	-1.24446	-1.24293
241	Biased Irradiation	-1.25179	-1.24691	-1.24600	-1.24364	-1.24110
235	Control Unit	-1.25498	-1.25087	-1.25072	-1.25048	-1.25075
236	Control Unit	-1.25498	-1.25075	-1.25096	-1.25103	-1.25123
	All GND'd Irradiation Statistics					
	Average All GND'd	-1.25627	-1.25017	-1.24937	-1.24655	-1.24204
	Std Dev All GND'd	0.00037	0.00144	0.00126	0.00121	0.00084
	Ps90%/90% +KLT All GN"D'd	-1.25526	-1.24621	-1.24591	-1.24323	-1.23975
	Ps90%/90% -KLT All GN"D'd	-1.25728	-1.25413	-1.25283	-1.24987	-1.24434
	Biased Irradiation Statistics					
	Average Biased	-1.25314	-1.24809	-1.24736	-1.24527	-1.24319
	Std Dev Biased	0.00141	0.00110	0.00114	0.00127	0.00138
	Ps90%/90% +KTL Biased	-1.24928	-1.24506	-1.24423	-1.24178	-1.23940
	Ps90%/90% -KTL Biased	-1.25700	-1.25111	-1.25048	-1.24875	-1.24698
	Specification MIN	-1.3	-1.3	-1.3	-1.3	-1.3
	Status (Measurements) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (Measurements) Biased	PASS	PASS	PASS	PASS	PASS
	Specification MAX	-1.2	-1.2	-1.2	-1.2	-1.2
	Status (Measurements) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (Measurements) Biased	PASS	PASS	PASS	PASS	PASS
	Status -KTL All GND'd	PASS	PASS	PASS	PASS	PASS
	Status +KTL All GND'd	PASS	PASS	PASS	PASS	PASS
	Status -KTL Biased	PASS	PASS	PASS	PASS	PASS
	Status +KTL Biased	PASS	PASS	PASS	PASS	PASS

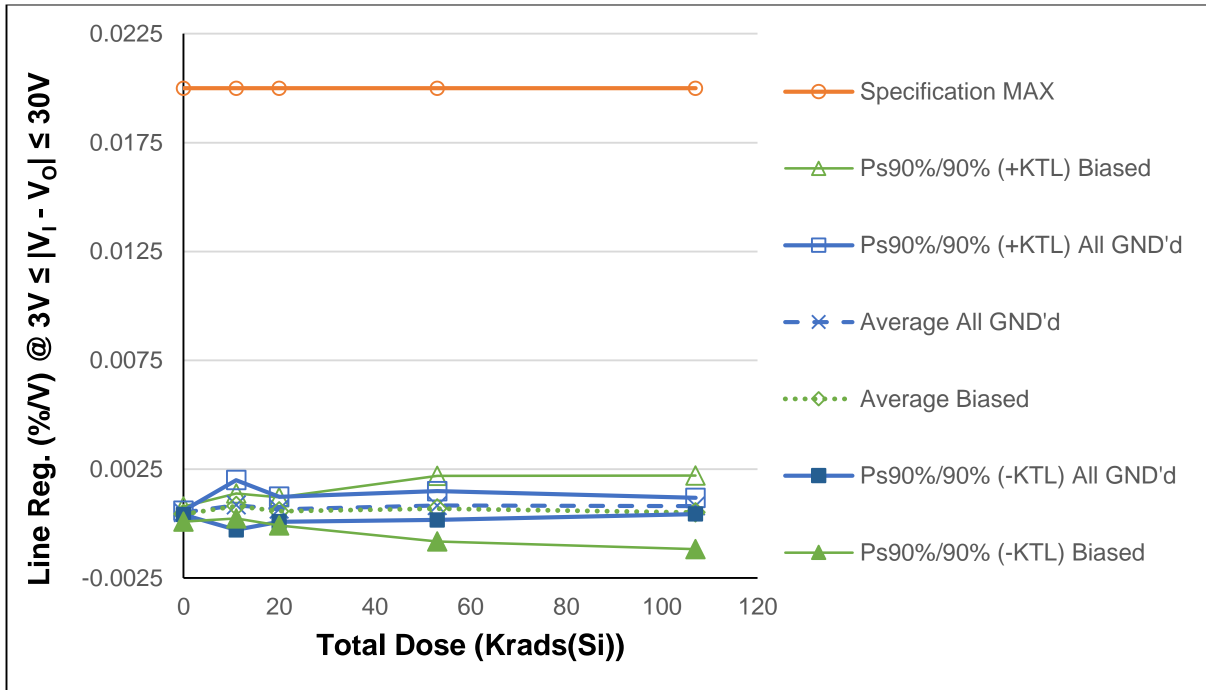

Figure 5.8: Plot of Line Regulation versus Total Dose

Table 5.8: Raw data for line regulation versus total dose including the statistical calculations, maximum specification, and the status of the test (PASS/FAIL under the second orange header)

Parameter	Line Reg @ 3V ≤ $\|V_I - V_O\|$ ≤ 30V	Total Dose (Krads(Si)) @ 10 mrads/s				
Units	(%/V)	0	11	20	53	107
242	All GND'd Irradiation	0.00048	0.00110	0.00076	0.00119	0.00080
243	All GND'd Irradiation	0.00051	0.00056	0.00065	0.00057	0.00068
245	All GND'd Irradiation	0.00056	0.00047	0.00065	0.00068	0.00085
246	All GND'd Irradiation	0.00051	0.00147	0.00090	0.00079	0.00071
247	All GND'd Irradiation	0.00048	0.00068	0.00034	0.00093	0.00102
237	Biased Irradiation	0.00039	0.00048	0.00023	0.00011	0.00003
238	Biased Irradiation	0.00048	0.00102	0.00042	0.00014	0.00157
239	Biased Irradiation	0.00051	0.00085	0.00076	0.00139	0.00020
240	Biased Irradiation	0.00058	0.00076	0.00065	0.00091	0.00026
241	Biased Irradiation	0.00025	0.00094	0.00077	0.00091	0.00054
235	Control Unit	0.00020	0.00029	0.00085	0.00042	0.00023
236	Control Unit	0.00048	0.00057	0.00020	0.00028	0.00000
	All GND'd Irradiation Statistics					
	Average All GND'd	0.00051	0.00086	0.00066	0.00083	0.00081
	Std Dev All GND'd	0.00003	0.00042	0.00021	0.00024	0.00014
	Ps90%/90% (+KTL) All GND'd	0.00060	0.00200	0.00123	0.00150	0.00118
	Ps90%/90% (-KTL) All GND'd	0.00041	-0.00028	0.00009	0.00017	0.00044
	Biased Irradiation Statistics					
	Average Biased	0.00044	0.00081	0.00057	0.00069	0.00052
	Std Dev Biased	0.00013	0.00021	0.00024	0.00055	0.00061
	Ps90%/90% (+KTL) Biased	0.00079	0.00138	0.00121	0.00220	0.00220
	Ps90%/90% (-KTL) Biased	0.00010	0.00024	-0.00008	-0.00082	-0.00117
	Specification MIN					
	Status (Measurements) All GND'd					
	Status (Measurements) Biased					
	Specification MAX	0.02	0.02	0.02	0.02	0.02
	Status (Measurements) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (Measurements) Biased	PASS	PASS	PASS	PASS	PASS
	Status (-KTL) All GND'd					
	Status (+KTL) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (-KTL) Biased					
	Status (+KTL) Biased	PASS	PASS	PASS	PASS	PASS

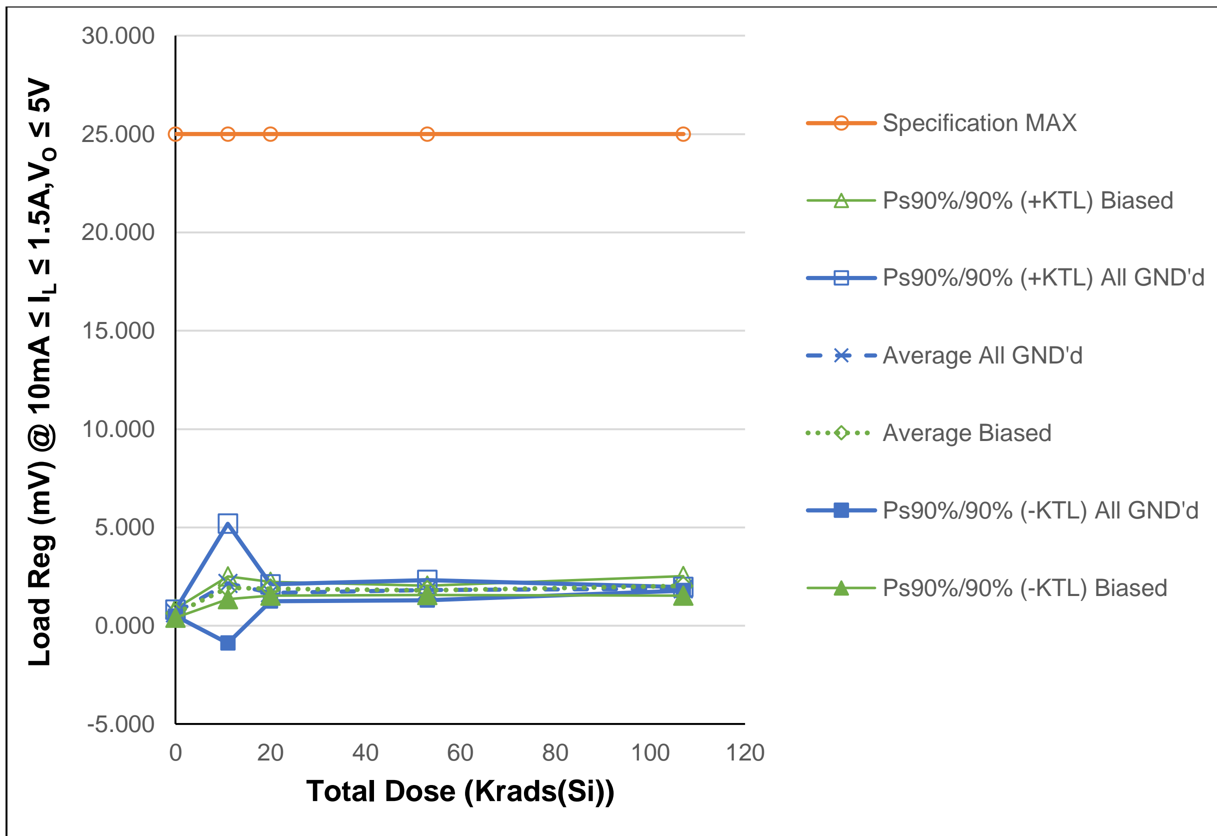

Figure 5.9: Plot of Load Regulation (V_O ≤ 5V) versus Total Dose

Table 5.9: Raw data for load regulation (V_{OUT} ≤ 5V) versus total dose including the statistical calculations, maximum specification, and the status of the test (PASS/FAIL).

Parameter	Load Reg @ 10mA≤I_L≤1.5A,V_O≤5V	Total Dose (Krads(Si)) @ 10 mrads/s				
Units	(mV)	0	11	20	53	107
242	All GND'd Irradiation	0.59032	4.12464	1.42193	1.70422	1.86920
243	All GND'd Irradiation	0.59986	1.70136	1.74522	1.98746	1.91689
245	All GND'd Irradiation	0.68760	1.83201	1.80244	2.01893	1.89781
246	All GND'd Irradiation	0.68760	1.49822	1.64032	1.57929	1.83106
247	All GND'd Irradiation	0.72384	1.63078	1.78337	1.79195	1.86920
237	Biased Irradiation	0.52547	1.73187	2.02179	1.93214	2.21443
238	Biased Irradiation	0.69809	1.77383	1.75571	1.74332	2.21443
239	Biased Irradiation	0.65994	1.91307	1.78337	1.85490	1.92833
240	Biased Irradiation	0.72384	2.26975	1.86062	1.75095	1.93596
241	Biased Irradiation	0.57030	1.94454	2.02179	1.74141	1.82152
235	Control Unit	0.63038	1.81961	1.89781	1.56879	1.56403
236	Control Unit	0.55408	2.08855	1.70708	1.49345	1.59264
	All GND'd Irradiation Statistics					
	Average All GND'd	0.65784	2.15740	1.67866	1.81637	1.87683
	Std Dev All GND'd	0.05926	1.10632	0.15660	0.18687	0.03262
	Ps90%/90% (+KTL) All GND'd	0.82034	5.19092	2.10806	2.32877	1.96628
	Ps90%/90% (-KTL) All GND'd	0.49535	-0.87612	1.24925	1.30396	1.78739
	Biased Irradiation Statistics					
	Average Biased	0.63553	1.92661	1.88866	1.80454	2.02293
	Std Dev Biased	0.08467	0.21184	0.12747	0.08577	0.18057
	Ps90%/90% (+KTL) Biased	0.86769	2.50749	2.23818	2.03972	2.51806
	Ps90%/90% (-KTL) Biased	0.40336	1.34574	1.53914	1.56937	1.52780
	Specification MIN					
	Status (Measurements) All GND'd					
	Status (Measurements) Biased					
	Specification MAX	25	25	25	25	25
	Status (Measurements) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (Measurements) Biased	PASS	PASS	PASS	PASS	PASS
	Status (-KTL) All GND'd					
	Status (+KTL) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (-KTL) Biased					
	Status (+KTL) Biased	PASS	PASS	PASS	PASS	PASS

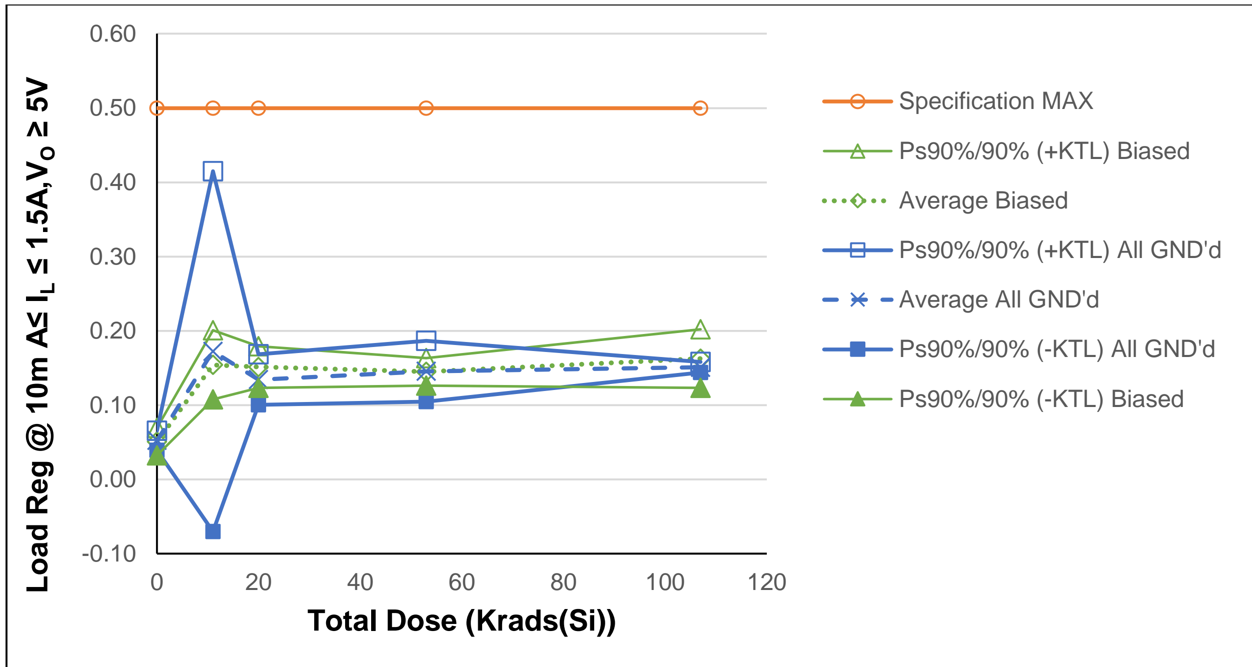

Figure 5.10: Plot of Load Regulation ($V_O \geq 5V$) versus Total Dose

Table 5.10: Raw data for line regulation (V_{OUT} ≥ 5V) versus total dose including the statistical calculations, maximum specification, and the status of the test (PASS/FAIL).

Parameter	Load Reg @ 10mA≤I_L≤1.5A,V_O≥5V	Total Dose (Krads(Si)) @ 10 mrads/s				
Units	(%)	0	11	20	53	107
242	All GND'd Irradiation	0.04701	0.32978	0.11397	0.13686	0.15056
243	All GND'd Irradiation	0.04781	0.13606	0.13966	0.15943	0.15422
245	All GND'd Irradiation	0.05478	0.14641	0.14414	0.16180	0.15267
246	All GND'd Irradiation	0.05478	0.11976	0.13121	0.12666	0.14739
247	All GND'd Irradiation	0.05766	0.13024	0.14251	0.14352	0.15030
237	Biased Irradiation	0.04191	0.13858	0.16184	0.15493	0.17780
238	Biased Irradiation	0.05577	0.14210	0.14072	0.13994	0.17797
239	Biased Irradiation	0.05263	0.15307	0.14276	0.14879	0.15497
240	Biased Irradiation	0.05786	0.18186	0.14917	0.14065	0.15566
241	Biased Irradiation	0.04559	0.15586	0.16216	0.13998	0.14671
235	Control Unit	0.05027	0.14539	0.15166	0.12541	0.12499
236	Control Unit	0.04418	0.16687	0.13641	0.11934	0.12723
	All GND'd Irradiation Statistics					
	Average All GND'd	0.05241	0.17245	0.13430	0.14565	0.15103
	Std Dev All GND'd	0.00472	0.08848	0.01241	0.01494	0.00259
	Ps90%/90% (+KTL) All GND'd	0.06534	0.41506	0.16832	0.18662	0.15814
	Ps90%/90% (-KTL) All GND'd	0.03947	-0.07016	0.10027	0.10469	0.14392
	Biased Irradiation Statistics					
	Average Biased	0.05075	0.15429	0.15133	0.14486	0.16262
	Std Dev Biased	0.00678	0.01703	0.01023	0.00676	0.01437
	Ps90%/90% (+KTL) Biased	0.06935	0.20098	0.17937	0.16338	0.20203
	Ps90%/90% (-KTL) Biased	0.03215	0.10760	0.12328	0.12633	0.12321
	Specification MIN					
	Status (Measurements) All GND'd					
	Status (Measurements) Biased					
	Specification MAX	0.5	0.5	0.5	0.5	0.5
	Status (Measurements) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (Measurements) Biased	PASS	PASS	PASS	PASS	PASS
	Status (-KTL) All GND'd					
	Status (+KTL) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (-KTL) Biased					
	Status (+KTL) Biased	PASS	PASS	PASS	PASS	PASS

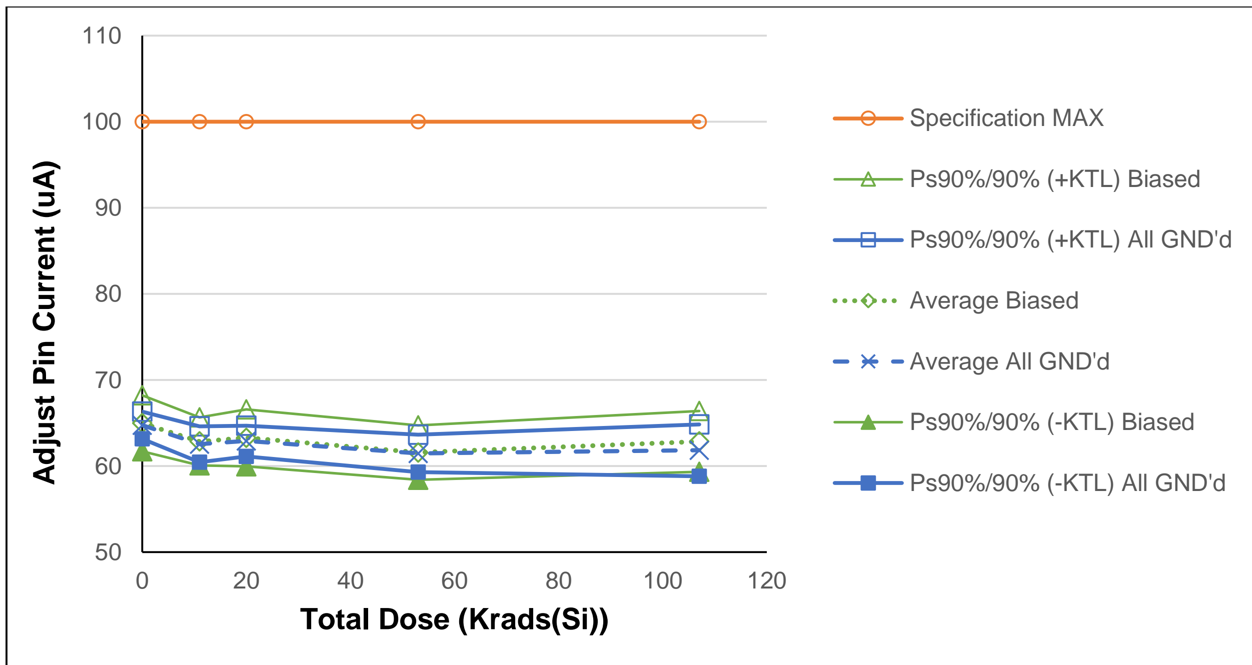

Figure 5.11: Plot of Adjust Pin Current versus Total Dose

Table 5.11: Raw data for adjust pin current versus total dose including the statistical calculations, maximum specification, and the status of the test (PASS/FAIL)

Parameter	Adjust Pin Current	Total Dose (Krads(Si)) @ 10 mrads/s				
Units	(uA)	0	11	20	53	107
242	All GND'd Irradiation	64.93076	61.54178	62.19240	60.44361	61.54811
243	All GND'd Irradiation	64.63711	62.64362	62.98359	61.21208	62.21328
245	All GND'd Irradiation	64.99596	63.16557	63.41309	62.23875	62.59404
246	All GND'd Irradiation	65.32895	63.36773	63.68911	62.30861	62.76778
247	All GND'd Irradiation	63.80703	62.07425	62.34231	61.14697	60.06312
237	Biased Irradiation	64.11142	62.51170	62.42678	60.99849	62.03836
238	Biased Irradiation	66.40501	64.19262	64.80151	63.07486	64.43246
239	Biased Irradiation	64.63949	62.23355	62.88126	61.20732	62.35130
240	Biased Irradiation	66.04498	63.64706	64.31610	62.42380	64.03742
241	Biased Irradiation	63.69298	61.74493	62.01393	60.19299	61.51837
235	Control Unit	63.98783	62.83863	62.42440	62.26223	62.96055
236	Control Unit	64.25407	62.70432	63.03593	63.20789	63.41271
	All GND'd Irradiation Statistics					
	Average All GND'd	64.73996	62.55859	62.92410	61.47000	61.83727
	Std Dev All GND'd	0.57658	0.75810	0.65226	0.79350	1.09672
	Ps90%/90% (+KTL) All GND'd	66.32095	64.63729	64.71259	63.64579	64.84446
	Ps90%/90% (-KTL) All GND'd	63.15897	60.47989	61.13561	59.29422	58.83007
	Biased Irradiation Statistics					
	Average Biased	64.97878	62.86597	63.28792	61.57949	62.87558
	Std Dev Biased	1.19286	1.01886	1.21224	1.15623	1.28370
	Ps90%/90% (+KTL) Biased	68.24959	65.65968	66.61188	64.74987	66.39550
	Ps90%/90% (-KTL) Biased	61.70796	60.07226	59.96396	58.40912	59.35567
	Specification MIN					
	Status (Measurements) All GND'd					
	Status (Measurements) Biased					
	Specification MAX	100	100	100	100	100
	Status (Measurements) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (Measurements) Biased	PASS	PASS	PASS	PASS	PASS
	Status (-KTL) All GND'd					
	Status (+KTL) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (-KTL) Biased					
	Status (+KTL) Biased	PASS	PASS	PASS	PASS	PASS

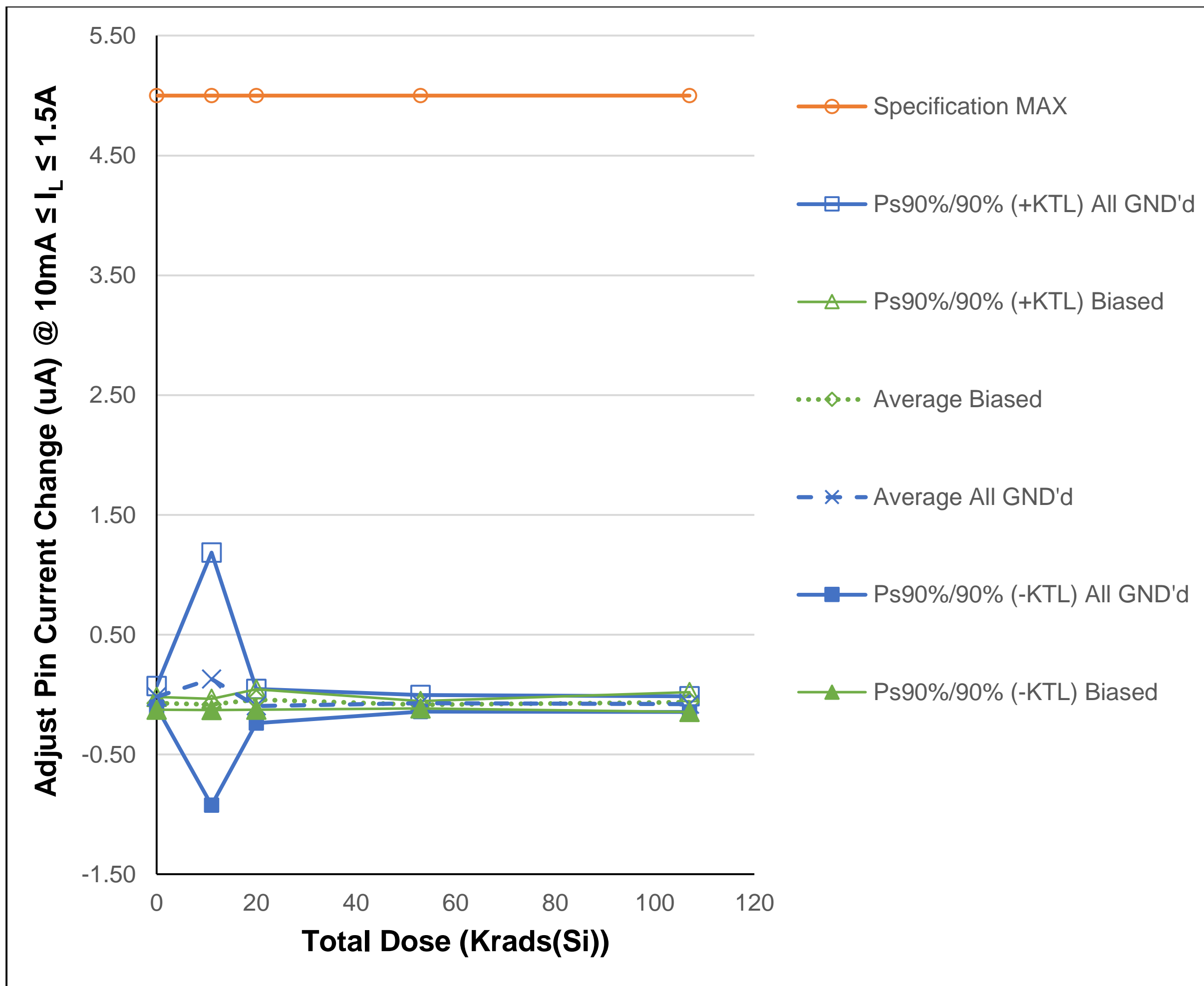

Figure 5.12: Plot of Adjust Pin Current Change @ 10mA ≤ I_L ≤ 1.5A versus Total Dose

Table 5.12: Raw data for adjust pin current change @ 10mA ≤ I_L ≤ 1.5A versus total dose including the statistical calculations, maximum specification, and the status of the test (PASS/FAIL)

Parameter	Δ Adj. Current @ 10mA ≤ I_L ≤ 1.5A	Total Dose (Krads(Si)) @ 10 mrads/s				
Units	(uA)	0	11	20	53	107
242	All GND'd Irradiation	-0.02503	0.81774	-0.16061	-0.09498	-0.08567
243	All GND'd Irradiation	-0.01072	-0.04860	-0.02974	-0.04609	-0.09044
245	All GND'd Irradiation	0.02384	-0.05118	-0.09399	-0.06540	-0.06544
246	All GND'd Irradiation	-0.06519	-0.04047	-0.12849	-0.05084	-0.04879
247	All GND'd Irradiation	-0.00955	-0.02500	-0.06187	-0.10093	-0.11067
237	Biased Irradiation	-0.04613	-0.06885	0.00000	-0.07493	-0.07021
238	Biased Irradiation	-0.07235	-0.06527	-0.08328	-0.10316	-0.05831
239	Biased Irradiation	-0.10010	-0.10217	-0.03568	-0.08532	-0.06187
240	Biased Irradiation	-0.07389	-0.09881	-0.03213	-0.08546	-0.01905
241	Biased Irradiation	-0.06793	-0.07478	-0.05829	-0.07730	-0.10352
235	Control Unit	-0.01788	-0.05119	-0.04165	-0.03181	-0.04165
236	Control Unit	-0.10453	-0.03094	-0.02499	-0.08072	-0.09043
	All GND'd Irradiation Statistics					
	Average All GND'd	-0.01733	0.13050	-0.09494	-0.07165	-0.08020
	Std Dev All GND'd	0.03221	0.38432	0.05192	0.02514	0.02381
	Ps90%/90% (+KTL) All GND'd	0.07098	1.18430	0.04742	-0.00273	-0.01492
	Ps90%/90% (-KTL) All GND'd	-0.10564	-0.92330	-0.23731	-0.14057	-0.14548
	Biased Irradiation Statistics					
	Average Biased	-0.07208	-0.08197	-0.04188	-0.08523	-0.06259
	Std Dev Biased	0.01923	0.01728	0.03111	0.01107	0.03020
	Ps90%/90% (+KTL) Biased	-0.01935	-0.03459	0.04342	-0.05487	0.02022
	Ps90%/90% (-KTL) Biased	-0.12481	-0.12936	-0.12718	-0.11560	-0.14540
	Specification MIN					
	Status (Measurements) All GND'd					
	Status (Measurements) Biased					
	Specification MAX	5	5	5	5	5
	Status (Measurements) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (Measurements) Biased	PASS	PASS	PASS	PASS	PASS
	Status (-KTL) All GND'd					
	Status (+KTL) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (-KTL) Biased					
	Status (+KTL) Biased	PASS	PASS	PASS	PASS	PASS

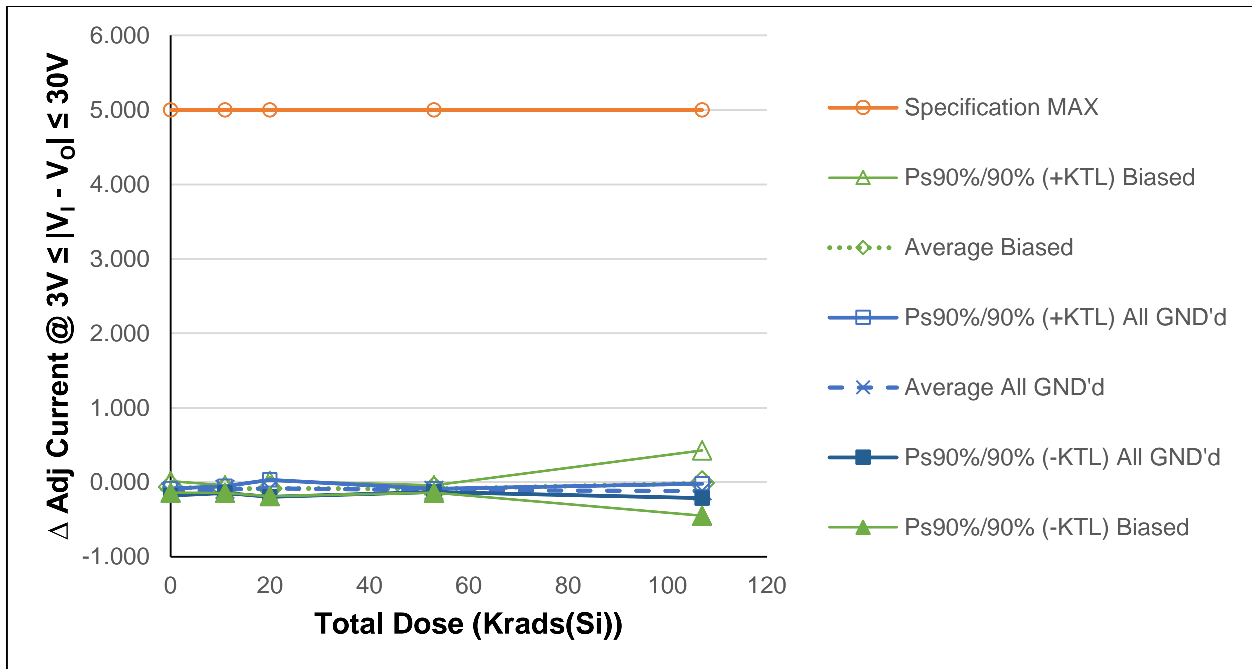

Figure 5.13: Plot of Adjust Pin Current Change @ 3V ≤ $|V_I – V_O|$ ≤ 30V versus Total Dose

Table 5.13: Raw data table for adjust pin current change @ 3V ≤ $|V_I – V_O|$ ≤ 30V versus total dose including the statistical calculations, maximum specification, and the status of the test (PASS/FAIL)

Parameter	∆ Adj Current @ 3V ≤ $|V_I - V_O|$ ≤ 30V	Total Dose (Krads(Si)) @ 10 mrads/s				
Units	(uA)	0	11	20	53	107
242	All GND'd Irradiation	-0.12836	-0.08928	-0.10470	-0.10806	-0.08568
243	All GND'd Irradiation	-0.10572	-0.11407	-0.11422	-0.11385	-0.13446
245	All GND'd Irradiation	-0.13228	-0.09146	-0.01189	-0.11890	-0.11899
246	All GND'd Irradiation	-0.13431	-0.11883	-0.08447	-0.09959	-0.07854
247	All GND'd Irradiation	-0.15457	-0.08073	-0.10351	-0.10330	-0.16540
237	Biased Irradiation	-0.10095	-0.07599	-0.11302	-0.07135	0.27131
238	Biased Irradiation	-0.04409	-0.10456	-0.09517	-0.07104	-0.04641
239	Biased Irradiation	-0.07628	-0.07381	-0.12256	-0.10553	-0.11185
240	Biased Irradiation	-0.02980	-0.09047	-0.04639	-0.10330	-0.09520
241	Biased Irradiation	-0.07270	-0.12002	-0.04283	-0.10345	-0.07734
235	Control Unit	-0.19747	-0.06288	-0.05355	-0.08651	-0.04165
236	Control Unit	-0.05805	-0.11407	-0.12254	-0.13423	-0.11067
	All GND'd Irradiation Statistics					
	Average All GND'd	-0.13105	-0.09887	-0.08376	-0.10874	-0.11661
	Std Dev All GND'd	0.01742	0.01662	0.04160	0.00780	0.03574
	Ps90%/90% (+KTL) All GND'd	-0.08328	-0.05329	0.03031	-0.08737	-0.01860
	Ps90%/90% (-KTL) All GND'd	-0.17882	-0.14446	-0.19782	-0.13012	-0.21462
	Biased Irradiation Statistics					
	Average Biased	-0.06476	-0.09297	-0.08399	-0.09093	-0.01190
	Std Dev Biased	0.02808	0.01954	0.03729	0.01804	0.16016
	Ps90%/90% (+KTL) Biased	0.01224	-0.03938	0.01827	-0.04146	0.42727
	Ps90%/90% (-KTL) Biased	-0.14177	-0.14656	-0.18625	-0.14041	-0.45106
	Specification MIN					
	Status (Measurements) All GND'd					
	Status (Measurements) Biased					
	Specification MAX	5	5	5	5	5
	Status (Measurements) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (Measurements) Biased	PASS	PASS	PASS	PASS	PASS
	Status (-KTL) All GND'd					
	Status (+KTL) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (-KTL) Biased					
	Status (+KTL) Biased	PASS	PASS	PASS	PASS	PASS

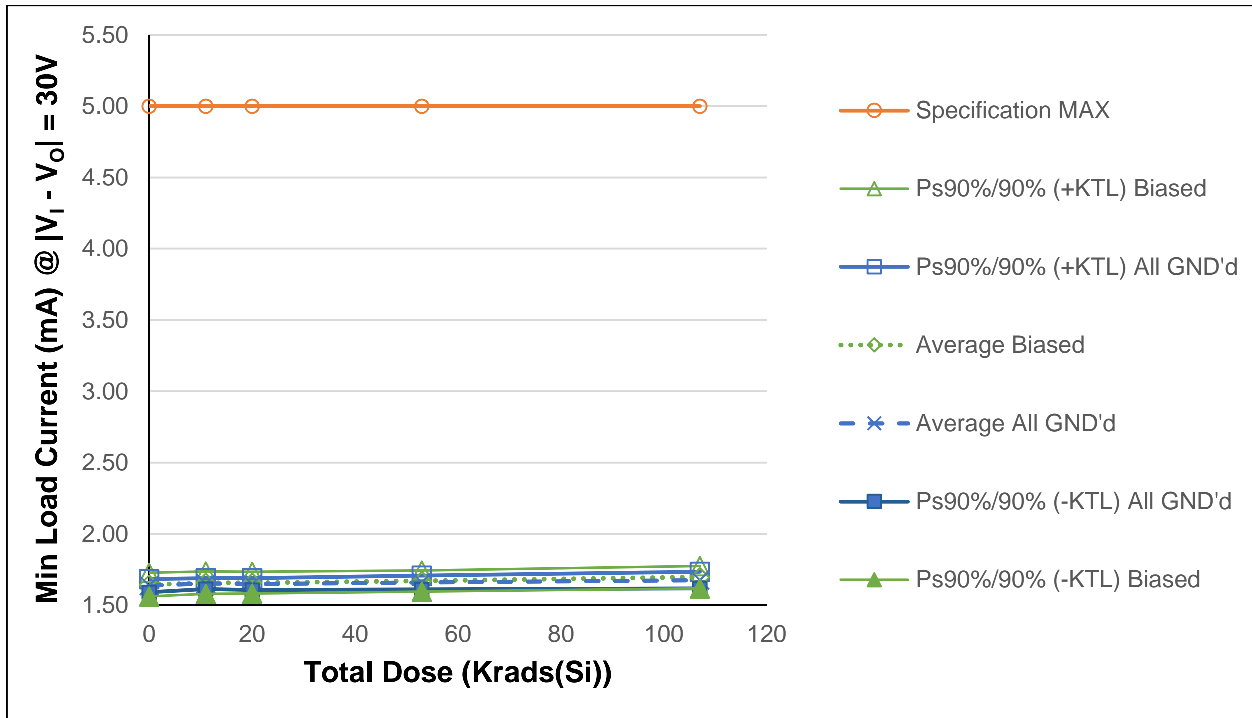

Figure 5.14: Plot of Minimum Load Current @ $|V_I - V_O| = 30V$ versus Total Dose

Table 5.14: Raw data table for minimum load current @ $|V_I - V_O| = 30V$ versus total dose including the statistical calculations, maximum specification, and the status of the test (PASS/FAIL)

Parameter	Min Load Current @ $\lvert V_I - V_O \rvert = 30V$	Total Dose (Krads(Si)) @ 10 mrads/s				
Units	(mA)	0	11	20	53	107
242	All GND'd Irradiation	1.63222	1.64761	1.64501	1.65626	1.67490
243	All GND'd Irradiation	1.63839	1.65302	1.64799	1.65504	1.67947
245	All GND'd Irradiation	1.64328	1.65821	1.65592	1.67332	1.68709
246	All GND'd Irradiation	1.65874	1.66720	1.66507	1.67956	1.69380
247	All GND'd Irradiation	1.61270	1.62971	1.62458	1.63447	1.63906
237	Biased Irradiation	1.62376	1.64128	1.63830	1.65177	1.67863
238	Biased Irradiation	1.67324	1.68503	1.68169	1.69570	1.72369
239	Biased Irradiation	1.63709	1.64769	1.65020	1.66320	1.68900
240	Biased Irradiation	1.67857	1.69083	1.69008	1.69943	1.72918
241	Biased Irradiation	1.60919	1.62407	1.62511	1.63851	1.66346
235	Control Unit	1.63038	1.63794	1.63220	1.63417	1.63769
236	Control Unit	1.61948	1.62894	1.62336	1.62939	1.62679
	All GND'd Irradiation Statistics					
	Average All GND'd	1.63707	1.65115	1.64771	1.65973	1.67486
	Std Dev All GND'd	0.01679	0.01399	0.01509	0.01767	0.02128
	Ps90%/90% (+KTL) All GND'd	1.68310	1.68952	1.68909	1.70819	1.73321
	Ps90%/90% (-KTL) All GND'd	1.59103	1.61278	1.60633	1.61127	1.61652
	Biased Irradiation Statistics					
	Average Biased	1.64437	1.65778	1.65707	1.66972	1.69679
	Std Dev Biased	0.03049	0.02892	0.02791	0.02691	0.02861
	Ps90%/90% (+KTL) Biased	1.72797	1.73707	1.73361	1.74350	1.77524
	Ps90%/90% (-KTL) Biased	1.56076	1.57849	1.58054	1.59594	1.61835
	Specification MIN					
	Status (Measurements) All GND'd					
	Status (Measurements) Biased					
	Specification MAX	5	5	5	5	5
	Status (Measurements) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (Measurements) Biased	PASS	PASS	PASS	PASS	PASS
	Status (-KTL) All GND'd					
	Status (+KTL) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (-KTL) Biased					
	Status (+KTL) Biased	PASS	PASS	PASS	PASS	PASS

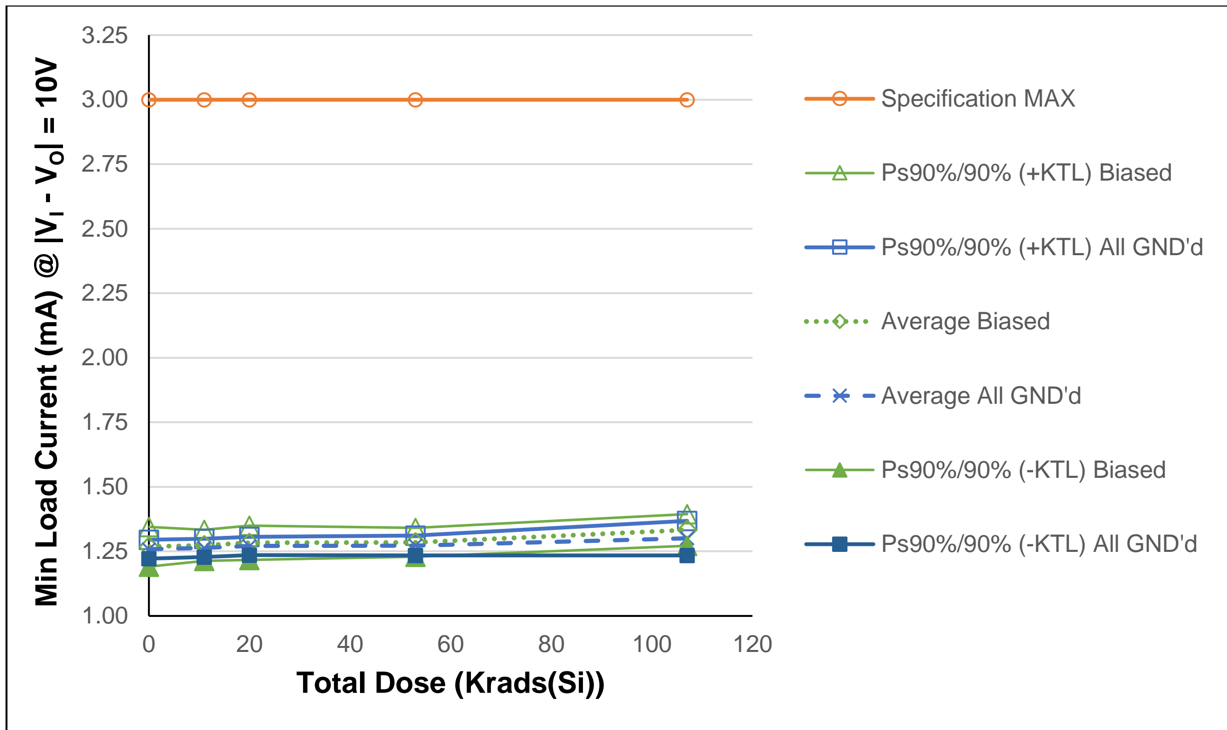

Figure 5.15: Plot of Minimum Load Current @ $|V_I - V_O| = 10V$ versus Total Dose

Table 5.15: Raw data table for minimum load current @ $|V_I - V_O|$ = 10V versus total dose including the statistical calculations, maximum specification, and the status of the test (PASS/FAIL)

Parameter	Min Load Current @ $\lvert V_I - V_O \rvert$ = 10V	Total Dose (Krads(Si)) @ 10 mrads/s				
Units	(mA)	0	11	20	53	107
242	All GND'd Irradiation	1.25469	1.25843	1.26688	1.26511	1.30445
243	All GND'd Irradiation	1.25894	1.26559	1.27077	1.26816	1.30338
245	All GND'd Irradiation	1.26460	1.26963	1.27664	1.28482	1.31626
246	All GND'd Irradiation	1.27413	1.27901	1.28625	1.28848	1.32084
247	All GND'd Irradiation	1.23828	1.24440	1.25178	1.25467	1.25901
237	Biased Irradiation	1.25537	1.27047	1.27230	1.27942	1.32656
238	Biased Irradiation	1.28952	1.28998	1.30211	1.30158	1.34958
239	Biased Irradiation	1.25719	1.26217	1.27115	1.27722	1.31817
240	Biased Irradiation	1.30348	1.29974	1.31278	1.30797	1.36208
241	Biased Irradiation	1.23410	1.24440	1.25422	1.25749	1.30788
235	Control Unit	1.25537	1.25996	1.25224	1.25194	1.26259
236	Control Unit	1.24371	1.24768	1.24637	1.25019	1.25169
	All GND'd Irradiation Statistics					
	Average All GND'd	1.25813	1.26341	1.27047	1.27225	1.30079
	Std Dev All GND'd	0.01327	0.01297	0.01274	0.01413	0.02453
	Ps90%/90% (+KTL) All GND'd	1.29451	1.29897	1.30540	1.31098	1.36805
	Ps90%/90% (-KTL) All GND'd	1.22174	1.22785	1.23553	1.23351	1.23352
	Biased Irradiation Statistics					
	Average Biased	1.26793	1.27335	1.28251	1.28473	1.33285
	Std Dev Biased	0.02805	0.02205	0.02416	0.02032	0.02243
	Ps90%/90% (+KTL) Biased	1.34485	1.33380	1.34875	1.34044	1.39437
	Ps90%/90% (-KTL) Biased	1.19101	1.21290	1.21628	1.22903	1.27134
	Specification MIN					
	Status (Measurements) All GND'd					
	Status (Measurements) Biased					
	Specification MAX	3	3	3	3	3
	Status (Measurements) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (Measurements) Biased	PASS	PASS	PASS	PASS	PASS
	Status (-KTL) All GND'd					
	Status (+KTL) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (-KTL) Biased					
	Status (+KTL) Biased	PASS	PASS	PASS	PASS	PASS

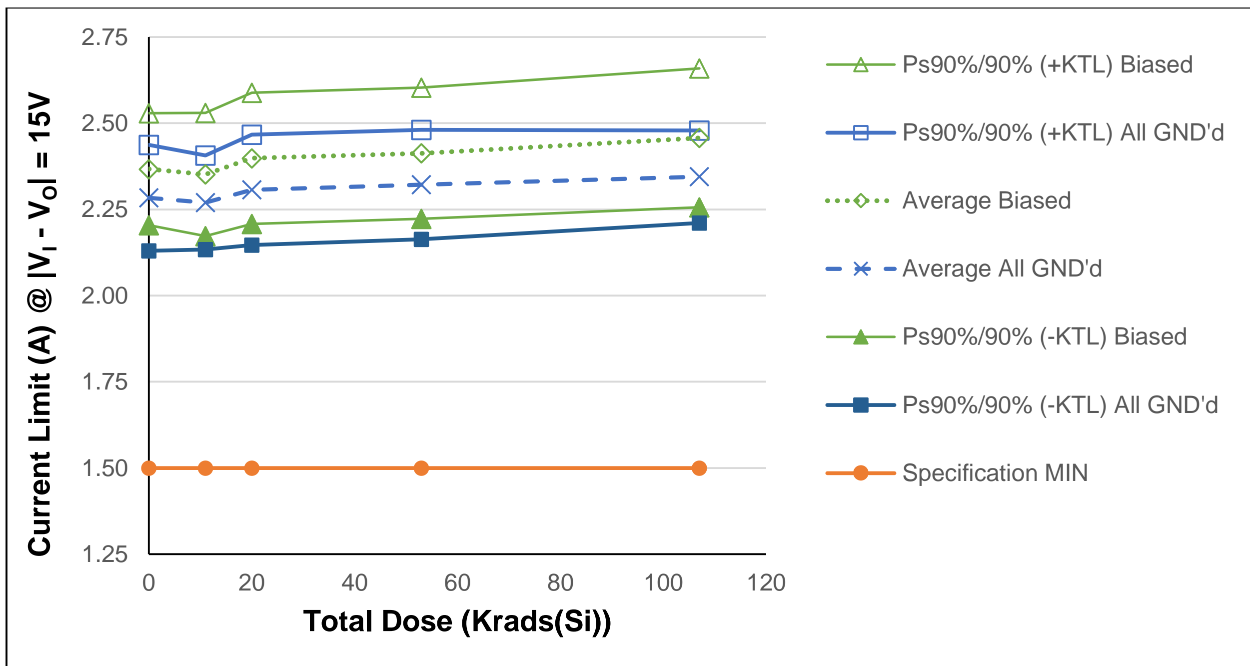

Figure 5.16: Plot of Current Limit @ $|V_I - V_O| = 15V$ versus Total Dose

Table 5.16: Raw data table for current limit @ $|V_I - V_O| = 15V$ versus total dose including the statistical calculations, minimum specification, and the status of the test (PASS/FAIL)

Parameter	Current Limit @ $\|V_I - V_O\| = 15V$	Total Dose (Krads(Si)) @ 10 mrads/s				
Units	(A)	0	11	20	53	107
242	All GND'd Irradiation	2.24928	2.23920	2.27772	2.28615	2.32123
243	All GND'd Irradiation	2.29793	2.27990	2.31844	2.33043	2.35530
245	All GND'd Irradiation	2.23461	2.22831	2.25810	2.28005	2.30223
246	All GND'd Irradiation	2.26244	2.25106	2.27677	2.29386	2.32099
247	All GND'd Irradiation	2.37463	2.35240	2.40354	2.41968	2.42534
237	Biased Irradiation	2.42781	2.42474	2.46529	2.48619	2.53768
238	Biased Irradiation	2.29289	2.27296	2.30851	2.32546	2.36928
239	Biased Irradiation	2.31524	2.29390	2.34091	2.35473	2.39183
240	Biased Irradiation	2.40427	2.37575	2.43112	2.43866	2.48095
241	Biased Irradiation	2.39369	2.39016	2.44627	2.45955	2.50753
235	Control Unit	2.29468	2.27768	2.29914	2.30424	2.30660
236	Control Unit	2.40097	2.37895	2.42135	2.43379	2.42165
	All GND'd Irradiation Statistics					
	Average All GND'd	2.28378	2.27017	2.30691	2.32203	2.34502
	Std Dev All GND'd	0.05594	0.04983	0.05834	0.05799	0.04882
	Ps90%/90% (+KTL) All GND'd	2.43716	2.40681	2.46687	2.48103	2.47887
	Ps90%/90% (-KTL) All GND'd	2.13039	2.13353	2.14695	2.16303	2.21117
	Biased Irradiation Statistics					
	Average Biased	2.36678	2.35150	2.39842	2.41292	2.45745
	Std Dev Biased	0.05910	0.06507	0.06932	0.06935	0.07345
	Ps90%/90% (+KTL) Biased	2.52883	2.52991	2.58850	2.60309	2.65885
	Ps90%/90% (-KTL) Biased	2.20474	2.17309	2.20834	2.22275	2.25606
	Specification MIN	1.5	1.5	1.5	1.5	1.5
	Status (Measurements) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (Measurements) Biased	PASS	PASS	PASS	PASS	PASS
	Specification MAX					
	Status (Measurements) All GND'd					
	Status (Measurements) Biased					
	Status (-KTL) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (+KTL) All GND'd					
	Status (-KTL) Biased	PASS	PASS	PASS	PASS	PASS
	Status (+KTL) Biased					

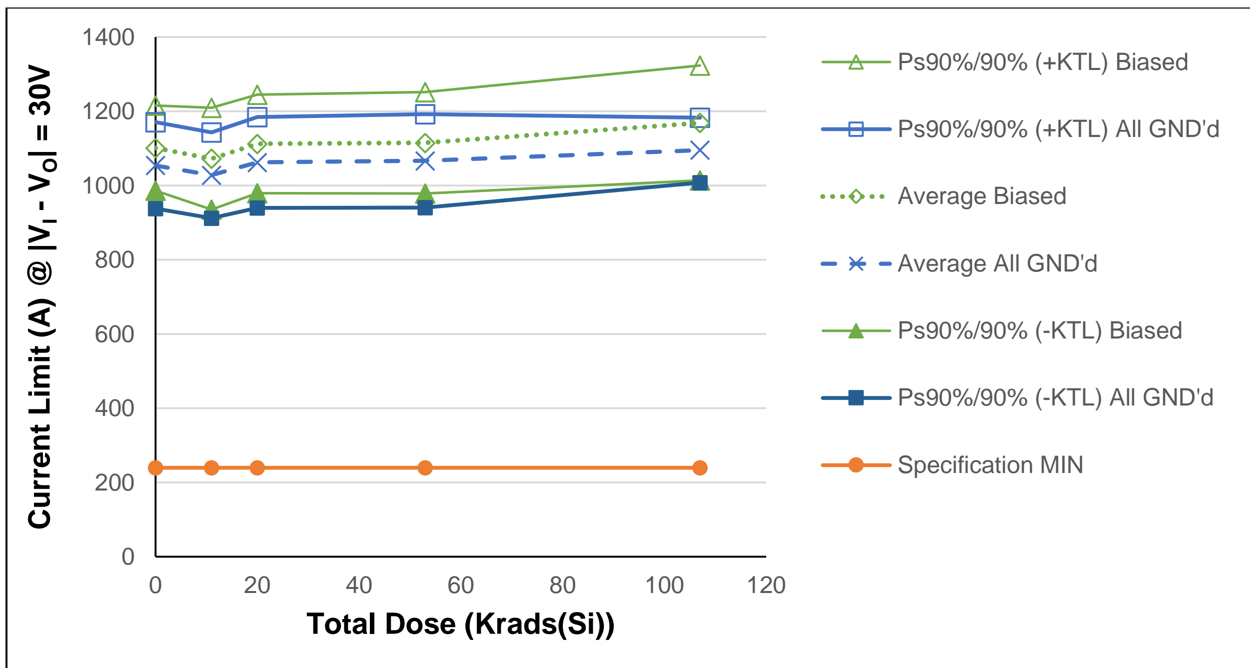

Figure 5.17: Plot of Current Limit @ $|V_I - V_O| = 30V$ versus Total Dose

Table 5.17: Raw data table for current limit @ $|V_I - V_O|$ = 30V versus total dose including the statistical calculations, minimum specification, and the status of the test (PASS/FAIL)

Parameter	Current Limit @ $\|V_I - V_O\|$ = 30V	Total Dose (Krads(Si)) @ 10 mrads/s				
Units	(mA)	0	11	20	53	107
242	All GND'd Irradiation	1039.226	1012.808	1050.692	1048.336	1090.681
243	All GND'd Irradiation	1056.015	1027.891	1063.897	1061.075	1101.195
245	All GND'd Irradiation	1021.894	997.936	1028.650	1039.937	1067.998
246	All GND'd Irradiation	1027.389	1001.463	1031.171	1037.407	1071.602
247	All GND'd Irradiation	1126.300	1100.503	1138.119	1147.238	1147.356
237	Biased Irradiation	1144.373	1129.720	1161.099	1169.971	1229.771
238	Biased Irradiation	1046.537	1014.129	1051.730	1054.049	1101.987
239	Biased Irradiation	1070.831	1033.377	1076.954	1079.557	1124.497
240	Biased Irradiation	1109.104	1070.272	1115.380	1112.900	1168.969
241	Biased Irradiation	1135.365	1114.993	1157.650	1158.752	1219.450
235	Control Unit	1066.573	1041.905	1056.987	1061.302	1065.859
236	Control Unit	1132.580	1100.904	1135.668	1148.509	1139.470
	All GND'd Irradiation Statistics					
	Average All GND'd	1054.165	1028.120	1062.506	1066.799	1095.766
	Std Dev All GND'd	42.392	42.117	44.685	45.906	31.905
	Ps90%/90% (+KTL) All GND'd	1170.404	1143.606	1185.032	1192.674	1183.251
	Ps90%/90% (-KTL) All GND'd	937.925	912.634	939.980	940.924	1008.282
	Biased Irradiation Statistics					
	Average Biased	1101.242	1072.498	1112.563	1115.046	1168.935
	Std Dev Biased	41.845	50.056	48.387	49.779	56.368
	Ps90%/90% (+KTL) Biased	1215.980	1209.753	1245.239	1251.539	1323.497
	Ps90%/90% (-KTL) Biased	986.504	935.244	979.886	978.553	1014.373
	Specification MIN	240	240	240	240	240
	Status (Measurements) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (Measurements) Biased	PASS	PASS	PASS	PASS	PASS
	Specification MAX					
	Status (Measurements) All GND'd					
	Status (Measurements) Biased					
	Status (-KTL) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (+KTL) All GND'd					
	Status (-KTL) Biased	PASS	PASS	PASS	PASS	PASS
	Status (+KTL) Biased					

Appendix A

Figure A1: Top View showing ID and Date Code

Appendix B

Radiation Bias Connection Tables

Table B1: Biased Conditions

PIN	FUNCTION	CONNECTION / BIAS
1	ADJUST	To +15V via 2KΩ
2	OUTPUT	To +15V via 243Ω
3	INPUT	To -15V

Table B2: All GND'd

PIN	FUNCTION	CONNECTION / BIAS
1	ADJUST	Ground
2	OUTPUT	Ground
3	INPUT	Ground

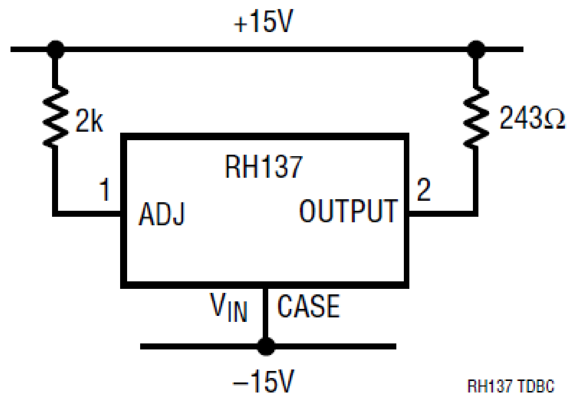

Figure B1: Total Dose Bias Circuit

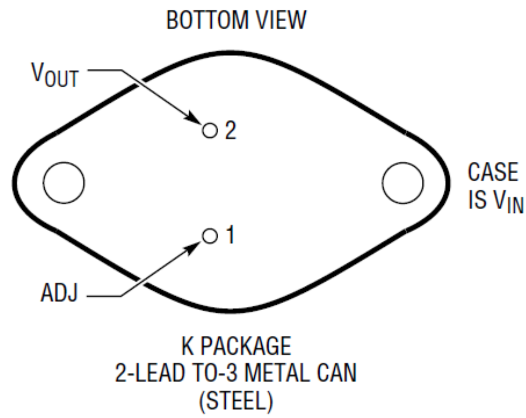

Figure B2: Pin-Out

Figure B3: Bias Board (top view)

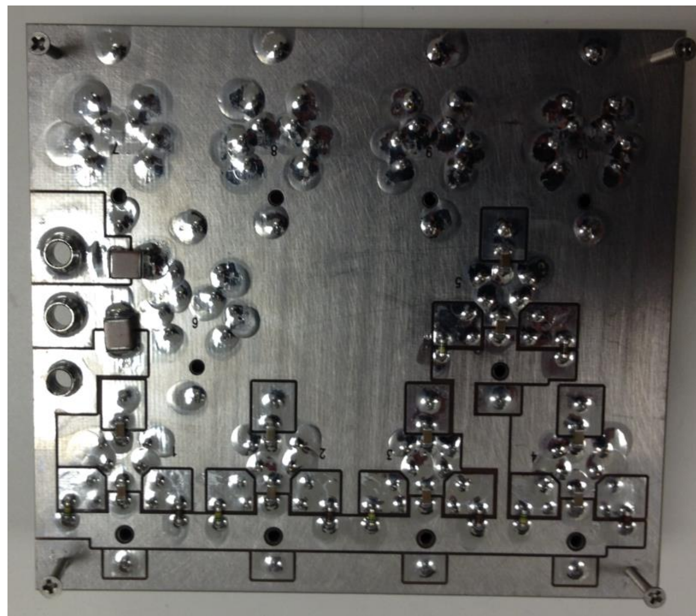

Figure B4: Bias Board (bottom view)

Appendix C

TEST CERTIFICATE

Defense Microelectronics Activity
Science and Engineering Gamma Irradiation Test Facility
DMEA/MEBC
4234 54th Street
McClellan, CA 95652

Testing Certificate Number: 1691.01

This laboratory is accredited by the American Association for Laboratory Accreditation (A2LA) and the dosimetry reported in this test certificate has been determined in accordance with the laboratory's terms of accreditation (exceptions as noted).
The results contained herein relate only to the items tested.
This certificate may not be reproduced, except in full, without the approval of this laboratory.

Date: 2014-12-10 Test Certificate #: 2014-NRC-009 Total Pages (except cover): 36

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REQUEST FOR AND RESULTS OF TESTS

PAGE NO.	NO. OF PAGES
1	36

SECTION A - REQUEST FOR TEST

1. TO: *(Include ZIP Code)*	2. FROM: *(Include ZIP Code)*
Defense Microelectronics Activity Science and Engineering Gamma Irradiation Test Facility 4234 54th Street McClellan, CA 95652-2100	Dr. Sana Rezgui Linear Technology Corp. 1630 McCarthy Blvd. Milpitas, CA 95035 Phone: (408) 432-1900 Email: srezgui@linear.com

3. PRIME CONTRACTOR AND ADDRESS *(Include ZIP Code)*	4. MANUFACTURING PLANT NAME AND ADDRESS *(Include ZIP Code)*
Same as block 2 CONTRACT NUMBER CRADA CR-08-17	Linear Technology Corp. 1630 McCarthy Blvd. Milpitas, CA 95035 P.O. NUMBER TBD

5. END ITEM AND/OR PROJECT	6. SAMPLE NUMBER	7. LOT NO.	8. REASON FOR SUBMITTAL	9. DATE SUBMITTED
N/A	N/A	See below	Total Ionizing Dose (TID) Testing	2013-08-26

10. MATERIAL TO BE TESTED	10a. QUANTITY SUBMITTED	11. QUANTITY REPRESENTED	12. SPEC. & AMEND AND/OR DRAWING NO. & REV. FOR SAMPLE & DATE
Various biased/unbiased devices - see below	See below	N/A	N/A

13. PURCHASED FROM OR SOURCE	14. SHIPMENT METHOD	15. DATE SAMPLED AND SUBMITTED BY
Linear Technology Corp.	Hand carry	2013-10-23 by Tom Shepherd

16. REMARKS AND/OR SPECIAL INSTRUCTIONS AND/OR WAIVERS.

Dose Rate: 10 ±10% mrad(SiO2)/sec | Irradiation Steps: 4 | Type of Test: Customer-Performed

Total Dose: see below ±10% krad(SiO2) | Requested Test Start Date: 2013-10-21 | Dimensions: Various

Security Requirements, Safety or Handling Precautions: Customer to perform pre- and post-irradiation electrical testing. Parts may be packed by customer in dry ice for transport. Irradiation portion of testing to be conducted per MIL-STD-883H, Test Method 1019.8, Condition D. Customer reserves right to modify parameters, devices, etc. to suit test requirements. Some or all of these devices may be irradiated up to 200 krad(SiO2).

Description of parts to be irradiated is as follows:
- MSK5055RH (RH3845MK): fab lot #WD005797.2, ass'y lot #N/A, WFR #9: 10, 30, 50, and 100 krad; 15 pieces; biased
- MSK196RH (6RH6105BK#IB*01): fab lot #WD005624.3, ass'y lot #N/A, WFR #7: 10, 30, 50, and 100 krad; 15 pieces; biased
- RH3080MK-CS: fab lot #HP201494.1, ass'y lot #N/A, WFR #2: 10, 30, 50 and 100 krad; 10 pieces; biased
- RH1086K#7AB-1-CS: fab lot #W1075048.2, ass'y lot #562977.1, WFR #6: 10, 30, 50 and 100 krad; 10 pieces; biased
- RH1084MK-CS: fab lot #9728121.1, ass'y lot #12198.1, WFR #6: 10, 30, 50 and 100 krad; 10 pieces; biased
- RH1185MK-CS: fab lot #WP005088.1, ass'y lot #673016.2, WFR #3: 10, 30, 50 and 100 krad; 10 pieces; biased
- RH1028MW: fab lot #W1117814.1, ass'y lot #675617.1, WFR #5: quantity and dose levels TBD
- Device board: device type, quantity, and dose levels TBD

Experiment #: 2014-NRC-009

DMEA Approval: SHEPHERD.THOMAS.J.1255235946 | SHEPHERD.THOMAS.J.1255235946 | SHEPHERD.THOMAS.J.1255235946 | MELINE.CARY.W.1231854033

17. SEND REPORT OF TEST TO

Individual identified in Block 2

SECTION B - RESULTS OF TEST *(Continue on plain white paper if more space is required)*

1. DATE SAMPLE RECEIVED	2. DATE RESULTS REPORTED	3. LAB REPORT NUMBER
2013-10-21	2014-12-10	N/A

4. TEST PERFORMED	RESULTS OF TEST	SAMPLE RESULT	REQUIREMENTS
	Please see following pages.		

DATE	TYPED NAME AND TITLE OF PERSON CONDUCTING TEST	SIGNATURE
2014-12-10	Thomas J. Shepherd, SEGIT Technical Manager	SHEPHERD.THOMAS.J.1255235946
2014-12-10	Mohammad Arshad, Alt. SEGIT Facility Supervisor	ARSHAD.MOHAMMAD.1231956693

Continuation of DD Form 1222 Experiment #: 2014-NRC-009

4.

Test Performed	Results of Test	Sample Result / Requirements	Step No.
20140729 20:40:00 to 20140804 13:54:49	4.920E+03 rad(SiO2) at 5.975E-01 rad(SiO2)/min	LTC Devices D, F, H, I, WFR #2 - S/Ns D4, F4, H4, I4: 4.92 krad SD, 196.504 krad TD	24
20140729 20:40:00 to 20140804 13:54:49	4.920E+03 rad(SiO2) at 5.975E-01 rad(SiO2)/min	LTC Devices G, E, N, WFR #2 - S/Ns G4, E4, N4: 4.92 krad SD, 185.584 krad TD	24
20140729 20:40:00 to 20140804 13:54:49	4.920E+03 rad(SiO2) at 5.975E-01 rad(SiO2)/min	LTC Devices C, K, L, M, R, S, WFR #2 - S/Ns C4, K4, L4, M4, R4, S4: 4.92 krad SD, 172.284 krad TD	24
20140729 20:40:00 to 20140804 13:54:49	4.920E+03 rad(SiO2) at 5.975E-01 rad(SiO2)/min	BIPC150-RH6016, WFR #10, S/Ns E1, H1, I1: 4.92 krad SD, 93.704 krad TD	24
20140729 20:40:00 to 20140804 13:54:49	4.920E+03 rad(SiO2) at 5.975E-01 rad(SiO2)/min	RH1498MW, WFR #7, S/Ns 821-830: 4.92 krad SD, 61.999 krad TD	24
20140729 20:40:00 to 20140804 13:54:49	4.920E+03 rad(SiO2) at 5.975E-01 rad(SiO2)/min	RH1965MK, WFR #2, S/Ns 1, 3-9, 11-12: 4.92 krad SD, 61.999 krad TD	24
20140729 20:40:00 to 20140804 13:54:49	4.920E+03 rad(SiO2) at 5.975E-01 rad(SiO2)/min	RH1963MK, WFR #11, S/Ns 3-7, 9-11, 13-14: 4.92 krad SD, 61.999 krad TD	24
20140729 20:40:00 to 20140804 13:54:49	4.920E+03 rad(SiO2) at 5.975E-01 rad(SiO2)/min	LT1965, WFR #N/A, S/Ns 21-30: 4.92 krad SD, 63.693 krad TD	24
20140729 20:40:00 to 20140804 13:54:49	4.920E+03 rad(SiO2) at 5.975E-01 rad(SiO2)/min	RH1086MH (6RH1086BHK), WFR #4, S/Ns 662-671: 4.92 krad SD, 61.999 krad TD	24
20140729 20:40:00 to 20140804 13:54:49	4.920E+03 rad(SiO2) at 5.975E-01 rad(SiO2)/min	BIPC150, WFR #6, S/Ns D4LTC & H4LTC: 4.92 krad SD, 30.705 krad TD	24
20140729 20:40:00 to 20140804 13:54:49	4.920E+03 rad(SiO2) at 5.975E-01 rad(SiO2)/min	RH3480-J14, WFR #8, S/Ns 2-8: 4.92 krad SD, 18.209 krad TD	24
20140729 20:40:00 to 20140804 13:54:49	4.920E+03 rad(SiO2) at 5.975E-01 rad(SiO2)/min	RH1084MK-CS, WFR #5, S/Ns 1-6, 8-10: 4.92 krad SD, 110.207 krad TD	24
20140729 20:40:00 to 20140804 13:54:49	4.920E+03 rad(SiO2) at 5.975E-01 rad(SiO2)/min	RH137K (6RH137BKK*12), WFR #3, S/Ns 0237-0243, 0245-0247: 4.92 krad SD, 10.2 krad TD	24
20140729 20:40:00 to 20140804 13:54:49	4.920E+03 rad(SiO2) at 5.975E-01 rad(SiO2)/min	BIPC150 SB Devices, S/Ns H5LTC-GP (WFR #1) & H6LTC-GP (WFR #2): 4.92 krad SD, 10.2 krad TD	24
20140729 20:40:00 to 20140804 13:54:49	4.920E+03 rad(SiO2) at 5.975E-01 rad(SiO2)/min	RH1085MK-CS, WFR #12, S/Ns 1-10: 4.92 krad SD, 4.92 krad TD	24
20140804 15:16:00 to 20140805 13:38:18	8.010E+02 rad(SiO2) at 5.967E-01 rad(SiO2)/min	RH1498MW, WFR #7, S/Ns 821-830: 0.801 krad SD, 62.8 krad TD	25
20140804 15:16:00 to 20140805 13:38:18	8.010E+02 rad(SiO2) at 5.967E-01 rad(SiO2)/min	RH1965MK, WFR #2, S/Ns 1, 3-9, 11-12: 0.801 krad SD, 62.8 krad TD	25
20140804 15:16:00 to 20140805 13:38:18	8.010E+02 rad(SiO2) at 5.967E-01 rad(SiO2)/min	RH1963MK, WFR #11, S/Ns 3-7, 9-11, 13-14: 0.801 krad SD, 62.8 krad TD	25
20140804 15:16:00 to 20140805 13:38:18	8.010E+02 rad(SiO2) at 5.967E-01 rad(SiO2)/min	LT1965, WFR #N/A, S/Ns 21-30: 0.801 krad SD, 64.494 krad TD	25
20140804 15:16:00 to 20140805 13:38:18	8.010E+02 rad(SiO2) at 5.967E-01 rad(SiO2)/min	RH1086MH (6RH1086BHK), WFR #4, S/Ns 662-671: 0.801 krad SD, 62.8 krad TD	25
20140804 15:16:00 to 20140805 13:38:18	8.010E+02 rad(SiO2) at 5.967E-01 rad(SiO2)/min	RH1084MK-CS, WFR #5, S/Ns 1-6, 8-10: 0.801 krad SD, 111.008 krad TD	25
20140804 15:16:00 to 20140805 13:38:18	8.010E+02 rad(SiO2) at 5.967E-01 rad(SiO2)/min	RH137K (6RH137BKK*12), WFR #3, S/Ns 0237-0243, 0245-0247: 0.801 krad SD, 11.001 krad TD	25

Total Doses reported are ± 12.76% at 95% confidence (Step No. 24)
12.67% at 95% confidence (Step No. 25)

Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of $k = 2$.

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NOTES:

1. ASTM = American Society for Testing and Materials.
2. DUT = Device Under Test.
3. S/N = Serial Number.
4. SD = Step Dose.
5. TD = Total Dose.
6. WFR = Wafer.
7. Dose rate uniformity across target area: ± 6.88%
8. Both irradiation steps met the requirements of MIL-STD-883H, Test Method 1019.8, Condition D.
9. After the original Test Request (DD Form 1222) was approved, the following changes were made:
   a. The following devices were added to the test lineup:
      RH1085MK-CS, WFR #12
      Latitude to change test parameters to suit customer requirements was included in the original Test Request; no Customer Order Change Request (SEGIT Form QP03-4, Rev. 5) was required/issued.
10. Source information:
    a. Irradiator = J.L. Shepherd & Associates Model 81-22/484 self-contained irradiation facility, S/Ns 7133/50017.
    b. Source selection = Co-60.
11. Dosimeter system:
    a. Radcal Model No. 9010 Radiation Monitor Controller, S/N 90-1313.
    b. Radcal Model No. 90X6-60 Electrometer/Ion Chamber, S/N 96-0362.
    c. This dosimeter system was calibrated per ISO/IEC 17025:2005 by University of Wisconsin Medical Radiation Research Center on 3 Feb 2014 (Report No. ION14427). This calibration is effective for two years.
12. Irradiation geometry: in accordance with section 7.3.2 of ASTM E1249-00 (2005), the DUT's semiconductor chip plane was perpendicular to the incident radiation beam.
13. Filter box: a DMEA Dose Enhancement Chamber (DEC) was used for all testing/dosimetry involved with this experiment.
    The DEC's Pb and Al layers are compliant with section 7.2.2 of ASTM E1249-00 (2005) with respect to thickness and geometry.

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4.

Test Performed			Results of Test				Sample Result / Requirements	Step No.
20140805 14:05:00	to	20140807 14:59:50	1.750E+03	rad(SiO2) at	5.964E-01	rad(SiO2)/min	RH1498MW, WFR #7, S/Ns 821-830: 1.75 krad SD, 64.55 krad TD	26
20140805 14:05:00	to	20140807 14:59:50	1.750E+03	rad(SiO2) at	5.964E-01	rad(SiO2)/min	RH1965MK, WFR #2, S/Ns 1, 3-9, 11-12: 1.75 krad SD, 64.55 krad TD	26
20140805 14:05:00	to	20140807 14:59:50	1.750E+03	rad(SiO2) at	5.964E-01	rad(SiO2)/min	RH1963MK, WFR #11, S/Ns 3-7, 9-11, 13-14: 1.75 krad SD, 64.55 krad TD	26
20140805 14:05:00	to	20140807 14:59:50	1.750E+03	rad(SiO2) at	5.964E-01	rad(SiO2)/min	LT1965, WFR #N/A, S/Ns 21-30: 1.75 krad SD, 66.244 krad TD	26
20140805 14:05:00	to	20140807 14:59:50	1.750E+03	rad(SiO2) at	5.964E-01	rad(SiO2)/min	RH1086MH (6RH1086BHK), WFR #4, S/Ns 662-671: 1.75 krad SD, 64.55 krad TD	26
20140807 16:30:00	to	20140818 10:48:14	9.250E+03	rad(SiO2) at	5.968E-01	rad(SiO2)/min	LTC Devices D, F, H, I, WFR #2 - S/Ns D4, F4, H4, I4: 9.25 krad SD, 205.754 krad TD	27
20140807 16:30:00	to	20140818 10:48:14	9.250E+03	rad(SiO2) at	5.968E-01	rad(SiO2)/min	LTC Devices G, E, N, WFR #2 - S/Ns G4, E4, N4: 9.25 krad SD, 194.834 krad TD	27
20140807 16:30:00	to	20140818 10:48:14	9.250E+03	rad(SiO2) at	5.968E-01	rad(SiO2)/min	LTC Devices C, K, L, M, R, S, WFR #2 - S/Ns C4, K4, L4, M4, R4, S4: 9.25 krad SD, 181.534 krad TD	27
20140807 16:30:00	to	20140818 10:48:14	9.250E+03	rad(SiO2) at	5.968E-01	rad(SiO2)/min	BIPC150-RH6016, WFR #10, S/Ns E1, H1, I1: 9.25 krad SD, 102.954 krad TD	27
20140807 16:30:00	to	20140818 10:48:14	9.250E+03	rad(SiO2) at	5.968E-01	rad(SiO2)/min	BIPC150, WFR #6, S/Ns D4LTC & H4LTC: 9.25 krad SD, 39.955 krad TD	27
20140807 16:30:00	to	20140818 10:48:14	9.250E+03	rad(SiO2) at	5.968E-01	rad(SiO2)/min	RH3480-J14, WFR #8, S/Ns 2-8: 9.25 krad SD, 27.459 krad TD	27
20140807 16:30:00	to	20140818 10:48:14	9.250E+03	rad(SiO2) at	5.968E-01	rad(SiO2)/min	RH1084MK-CS, WFR #5, S/Ns 1-6, 8-10: 9.25 krad SD, 120.258 krad TD	27
20140807 16:30:00	to	20140818 10:48:14	9.250E+03	rad(SiO2) at	5.968E-01	rad(SiO2)/min	RH137K (6RH137BKK*12), WFR #3, S/Ns 0237-0243, 0245-0247: 9.25 krad SD, 20.251 krad TD	27
20140807 16:30:00	to	20140818 10:48:14	9.250E+03	rad(SiO2) at	5.968E-01	rad(SiO2)/min	BIPC150 SB Devices, S/Ns H5LTC-GP (WFR #1) & H6LTC-GP (WFR #2): 9.25 krad SD, 19.45 krad TD	27
20140807 16:30:00	to	20140818 10:48:14	9.250E+03	rad(SiO2) at	5.968E-01	rad(SiO2)/min	RH1085MK-CS, WFR #12, S/Ns 1-10: 9.25 krad SD, 14.17 krad TD	27
20140807 16:30:00	to	20140818 10:48:14	9.250E+03	rad(SiO2) at	5.968E-01	rad(SiO2)/min	RH1498MW, WFR #7, S/Ns 821-830: 9.25 krad SD, 73.8 krad TD	27
20140807 16:30:00	to	20140818 10:48:14	9.250E+03	rad(SiO2) at	5.968E-01	rad(SiO2)/min	RH1965MK, WFR #2, S/Ns 1, 3-9, 11-12: 9.25 krad SD, 73.8 krad TD	27
20140807 16:30:00	to	20140818 10:48:14	9.250E+03	rad(SiO2) at	5.968E-01	rad(SiO2)/min	RH1963MK, WFR #11, S/Ns 3-7, 9-11, 13-14: 9.25 krad SD, 73.8 krad TD	27
20140807 16:30:00	to	20140818 10:48:14	9.250E+03	rad(SiO2) at	5.968E-01	rad(SiO2)/min	LT1965, WFR #N/A, S/Ns 21-30: 9.25 krad SD, 75.494 krad TD	27
20140807 16:30:00	to	20140818 10:48:14	9.250E+03	rad(SiO2) at	5.968E-01	rad(SiO2)/min	RH1086MH (6RH1086BHK), WFR #4, S/Ns 662-671: 9.25 krad SD, 73.8 krad TD	27
20140818 12:06:00	to	20140821 11:45:58	2.560E+03	rad(SiO2) at	5.954E-01	rad(SiO2)/min	LTC Devices D, F, H, I, WFR #2 - S/Ns D4, F4, H4, I4: 2.56 krad SD, 208.314 krad TD	28
20140818 12:06:00	to	20140821 11:45:58	2.560E+03	rad(SiO2) at	5.954E-01	rad(SiO2)/min	LTC Devices G, E, N, WFR #2 - S/Ns G4, E4, N4: 2.56 krad SD, 197.394 krad TD	28
20140818 12:06:00	to	20140821 11:45:58	2.560E+03	rad(SiO2) at	5.954E-01	rad(SiO2)/min	LTC Devices C, K, L, M, R, S, WFR #2 - S/Ns C4, K4, L4, M4, R4, S4: 2.56 krad SD, 184.094 krad TD	28
20140818 12:06:00	to	20140821 11:45:58	2.560E+03	rad(SiO2) at	5.954E-01	rad(SiO2)/min	BIPC150-RH6016, WFR #10, S/Ns E1, H1, I1: 2.56 krad SD, 105.51 krad TD	28
20140818 12:06:00	to	20140821 11:45:58	2.560E+03	rad(SiO2) at	5.954E-01	rad(SiO2)/min	BIPC150, WFR #6, S/Ns D4LTC & H4LTC: 2.56 krad SD, 42.515 krad TD	28
20140818 12:06:00	to	20140821 11:45:58	2.560E+03	rad(SiO2) at	5.954E-01	rad(SiO2)/min	RH1084MK-CS, WFR #5, S/Ns 1-6, 8-10: 2.56 krad SD, 122.818 krad TD	28
20140818 12:06:00	to	20140821 11:45:58	2.560E+03	rad(SiO2) at	5.954E-01	rad(SiO2)/min	BIPC150 SB Devices, S/Ns H5LTC-GP (WFR #1) & H6LTC-GP (WFR #2): 2.56 krad SD, 22.01 krad TD	28

Total Doses reported are ± 12.69% at 95% confidence (Step No. 26)
12.64% at 95% confidence (Step No. 27)
12.50% at 95% confidence (Step No. 28)

Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of $k = 2$.

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NOTES:

1. ASTM = American Society for Testing and Materials.
2. DUT = Device Under Test.
3. S/N = Serial Number.
4. SD = Step Dose.
5. TD = Total Dose.
6. WFR = Wafer.
7. Dose rate uniformity across target area: ± 6.88% (Step No. 26)
   ± 6.67% (Step Nos. 27 & 28)
8. All irradiation steps met the requirements of MIL-STD-883H, Test Method 1019.8, Condition D.
9. Source information:
   a. Irradiator = J.L. Shepherd & Associates Model 81-22/484 self-contained irradiation facility, S/Ns 7133/50017.
   b. Source selection = Co-60.
10. Dosimeter system:
    a. Radcal Model No. 9010 Radiation Monitor Controller, S/N 90-1313.
    b. Radcal Model No. 90X6-60 Electrometer/Ion Chamber, S/N 96-0362.
    c. This dosimeter system was calibrated per ISO/IEC 17025:2005 by University of Wisconsin Medical Radiation Research Center on 3 Feb 2014 (Report No. ION14427). This calibration is effective for two years.
11. Irradiation geometry: in accordance with section 7.3.2 of ASTM E1249-00 (2005), the DUT's semiconductor chip plane was perpendicular to the incident radiation beam.
12. Filter box: a DMEA Dose Enhancement Chamber (DEC) was used for all testing/dosimetry involved with this experiment. The DEC's Pb and Al layers are compliant with section 7.2.2 of ASTM E1249-00 (2005) with respect to thickness and geometry.

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4.

Test Performed	Results of Test	Sample Result / Requirements	Step No.
20140912 15:55:00 to 20140929 09:01:55	1.428E+04 rad(SiO2) at 5.933E-01 rad(SiO2)/min	BIPC150-RH6016, WFR #10, S/Ns E1, H1, I1: 14.28 krad SD, 136.994 krad TD	31
20140912 15:55:00 to 20140929 09:01:55	1.428E+04 rad(SiO2) at 5.933E-01 rad(SiO2)/min	BIPC150, WFR #6, S/Ns D4LTC & H4LTC: 14.28 krad SD, 73.995 krad TD	31
20140912 15:55:00 to 20140929 09:01:55	1.428E+04 rad(SiO2) at 5.933E-01 rad(SiO2)/min	RH3480-J14, WFR #8, S/Ns 2-8: 14.28 krad SD, 58.939 krad TD	31
20140912 15:55:00 to 20140929 09:01:55	1.428E+04 rad(SiO2) at 5.933E-01 rad(SiO2)/min	RH1084MK-CS, WFR #5, S/Ns 1-6, 8-10: 14.28 krad SD, 155.898 krad TD	31
20140912 15:55:00 to 20140929 09:01:55	1.428E+04 rad(SiO2) at 5.933E-01 rad(SiO2)/min	BIPC150 SB Devices, S/Ns H5LTC-GP (WFR #1) & H6LTC-GP (WFR #2): 14.28 krad SD, 53.49 krad TD	31
20140912 15:55:00 to 20140929 09:01:55	1.428E+04 rad(SiO2) at 5.933E-01 rad(SiO2)/min	RH137K (6RH137BKK*12), WFR #3, S/Ns 0237-0243, 0245-0247: 14.28 krad SD, 53.331 krad TD	31
20140912 15:55:00 to 20140929 09:01:55	1.428E+04 rad(SiO2) at 5.933E-01 rad(SiO2)/min	RH1085MK-CS, WFR #12, S/Ns 1-10: 14.28 krad SD, 45.65 krad TD	31
20140912 15:55:00 to 20140929 09:01:55	1.428E+04 rad(SiO2) at 5.933E-01 rad(SiO2)/min	RH1498MW, WFR #7, S/Ns 821-830: 14.28 krad SD, 106.88 krad TD	31
20140912 15:55:00 to 20140929 09:01:55	1.428E+04 rad(SiO2) at 5.933E-01 rad(SiO2)/min	RH1965MK, WFR #2, S/Ns 1, 3-9, 11-12: 14.28 krad SD, 106.88 krad TD	31
20140912 15:55:00 to 20140929 09:01:55	1.428E+04 rad(SiO2) at 5.933E-01 rad(SiO2)/min	RH1963MK, WFR #11, S/Ns 3-7, 9-11, 13-14: 14.28 krad SD, 106.88 3krad TD	31
20140912 15:55:00 to 20140929 09:01:55	1.428E+04 rad(SiO2) at 5.933E-01 rad(SiO2)/min	RH1086MH (6RH1086BHK), WFR #4, S/Ns 662-671: 14.28 krad SD, 106.88 krad TD	31
20140912 15:55:00 to 20140929 09:01:55	1.428E+04 rad(SiO2) at 5.933E-01 rad(SiO2)/min	RH6016MW, WFR #8, S/Ns 1-5: 14.28 krad SD, 31.48 krad TD	31
20140929 10:15:00 to 20141001 11:35:35	1.751E+03 rad(SiO2) at 5.913E-01 rad(SiO2)/min	BIPC150-RH6016, WFR #10, S/Ns E1, H1, I1: 1.751 krad SD, 138.745 krad TD	32
20140929 10:15:00 to 20141001 11:35:35	1.751E+03 rad(SiO2) at 5.913E-01 rad(SiO2)/min	BIPC150, WFR #6, S/Ns D4LTC & H4LTC: 1.751 krad SD, 75.746 krad TD	32
20140929 10:15:00 to 20141001 11:35:35	1.751E+03 rad(SiO2) at 5.913E-01 rad(SiO2)/min	BIPC150 SB Devices, S/Ns H5LTC-GP (WFR #1) & H6LTC-GP (WFR #2): 1.751 krad SD, 55.241 krad TD	32
20141001 18:47:00 to 20141008 10:56:59	5.769E+03 rad(SiO2) at 6.003E-01 rad(SiO2)/min	BIPC150-RH6016, WFR #10, S/Ns E1, H1, I1: 5.769 krad SD, 144.514 krad TD	33
20141001 18:47:00 to 20141008 10:56:59	5.769E+03 rad(SiO2) at 6.003E-01 rad(SiO2)/min	BIPC150, WFR #6, S/Ns D4LTC & H4LTC: 5.769 krad SD, 81.515 krad TD	33
20141001 18:47:00 to 20141008 10:56:59	5.769E+03 rad(SiO2) at 6.003E-01 rad(SiO2)/min	BIPC150 SB Devices, S/Ns H5LTC-GP (WFR #1) & H6LTC-GP (WFR #2): 5.769 krad SD, 61.01 krad TD	33
20141001 18:47:00 to 20141008 10:56:59	5.769E+03 rad(SiO2) at 6.003E-01 rad(SiO2)/min	RH3480-J14, WFR #8, S/Ns 2-8: 5.769 krad SD, 64.708 krad TD	33
20141001 18:47:00 to 20141008 10:56:59	5.769E+03 rad(SiO2) at 6.003E-01 rad(SiO2)/min	RH137K (6RH137BKK*12), WFR #3, S/Ns 0237-0243, 0245-0247: 5.769 krad SD, 59.1 krad TD	33
20141001 18:47:00 to 20141008 10:56:59	5.769E+03 rad(SiO2) at 6.003E-01 rad(SiO2)/min	RH1498MW, WFR #7, S/Ns 821-830: 5.769 krad SD, 112.649 krad TD	33
20141001 18:47:00 to 20141008 10:56:59	5.769E+03 rad(SiO2) at 6.003E-01 rad(SiO2)/min	RH1965MK, WFR #2, S/Ns 1, 3-9, 11-12: 5.769 krad SD, 112.649 krad TD	33
20141001 18:47:00 to 20141008 10:56:59	5.769E+03 rad(SiO2) at 6.003E-01 rad(SiO2)/min	RH6016MW, WFR #8, S/Ns 1-5: 5.769 krad SD, 37.249 krad TD	33
20141001 18:47:00 to 20141008 10:56:59	5.769E+03 rad(SiO2) at 6.003E-01 rad(SiO2)/min	RH1084MK-CS, WFR #5, 4% old, S/Ns 1-8, 11-12: 5.769 krad SD, 5.769 krad TD	33
20141001 18:47:00 to 20141008 10:56:59	5.769E+03 rad(SiO2) at 6.003E-01 rad(SiO2)/min	RH1084MK-CS, WFR #5, 15%, S/Ns 1-2, 5-7, 9, 11-12, 14-15: 5.769 krad SD, 5.769 krad TD	33
20141001 18:47:00 to 20141008 10:56:59	5.769E+03 rad(SiO2) at 6.003E-01 rad(SiO2)/min	RH1084MK-CS, WFR #5, 4% new, S/Ns 1-3, 6, 8-12, 14: 5.769 krad SD, 5.769 krad TD	33
20141001 18:47:00 to 20141008 10:56:59	5.769E+03 rad(SiO2) at 6.003E-01 rad(SiO2)/min	RH117H, WFR #10, S/Ns 0765-0774: 5.769 krad SD, 5.769 krad TD	33
20141001 18:47:00 to 20141008 10:56:59	5.769E+03 rad(SiO2) at 6.003E-01 rad(SiO2)/min	BIPC150-NTK16, WFR #6, S/Ns H8-H9: 5.769 krad SD, 5.769 krad TD	33
20141001 18:47:00 to 20141008 10:56:59	5.769E+03 rad(SiO2) at 6.003E-01 rad(SiO2)/min	BIPC150-NTK52L, WFR #6, S/Ns H10-H11: 5.769 krad SD, 5.769 krad TD	33

Total Doses reported are ± 12.89% at 95% confidence (Step No. 31)
12.63% at 95% confidence (Step No. 32)
13.80% at 95% confidence (Step No. 33)

Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of $k = 2$.

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NOTES:

1. ASTM = American Society for Testing and Materials.
2. DUT = Device Under Test.
3. S/N = Serial Number.
4. SD = Step Dose.
5. TD = Total Dose.
6. WFR = Wafer.
7. Dose rate uniformity across target area: ± 6.81% (Step Nos. 31-32)
   ± 7.90% (Step No. 33)
8. All irradiation steps met the requirements of MIL-STD-883H, Test Method 1019.8, Condition D. The median dose rate for Step No. 33 was 10.0 mrad(SiO2)/sec, which met the requirements of this condition.
9. After the original Test Request (DD Form 1222) was approved, the following changes were made:
   a. The following devices were added to the test lineup: RH1084MK-CS, WFR #5, 4% old; RH1084MK-CS, WFR #5, 15%; RH1084MK-CS, WFR #5, 4% new; RH117H, WFR #10; BIPC150-NTK16, WFR #6; BIPC150-NTK52L, WFR #6

   Latitude to change test parameters to suit customer requirements was included in the original Test Request; no Customer Order Change Request (SEGIT Form QP03-4, Rev. 5) was required/issued.
10. Source information:
    a. Irradiator = J.L. Shepherd & Associates Model 81-22/484 self-contained irradiation facility, S/Ns 7133/50017.
    b. Source selection = Co-60.
11. Dosimeter system:
    a. Radcal Model No. 9010 Radiation Monitor Controller, S/N 90-1313.
    b. Radcal Model No. 90X6-60 Electrometer/Ion Chamber, S/N 96-0362.
    c. This dosimeter system was calibrated per ISO/IEC 17025:2005 by University of Wisconsin Medical Radiation Research Center on 3 Feb 2014 (Report No. ION14427). This calibration is effective for two years.
12. Irradiation geometry: in accordance with section 7.3.2 of ASTM E1249-00 (2005), the DUT's semiconductor chip plane was perpendicular to the incident radiation beam.
13. Filter box: a DMEA Dose Enhancement Chamber (DEC) was used for all testing/dosimetry involved with this experiment. The DEC's Pb and Al layers are compliant with section 7.2.2 of ASTM E1249-00 (2005) with respect to thickness and geometry.

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4. Test Performed			Results of Test				Sample Result / Requirements	Step No.
20141124 13:55:00	to	20141204 13:48:49	8.500E+03	rad(SiO2) at	5.905E-01	rad(SiO2)/min	BIPC150-RH6016, WFR #10, S/N E1: 8.5 krad SD, 190.585 krad TD	42
20141124 13:55:00	to	20141204 13:48:49	8.500E+03	rad(SiO2) at	5.905E-01	rad(SiO2)/min	BIPC150, WFR #6, S/Ns D4LTC & H4LTC: 8.5 krad SD, 128.136 krad TD	42
20141124 13:55:00	to	20141204 13:48:49	8.500E+03	rad(SiO2) at	5.905E-01	rad(SiO2)/min	RH137K (6RH137BKK*12), WFR #3, S/Ns 0237-0243, 0245-0247: 8.5 krad SD, 107.201 krad TD	42
20141124 13:55:00	to	20141204 13:48:49	8.500E+03	rad(SiO2) at	5.905E-01	rad(SiO2)/min	RH6016MW, WFR #8, S/Ns 1-5: 8.5 krad SD, 84.8 krad TD	42
20141124 13:55:00	to	20141204 13:48:49	8.500E+03	rad(SiO2) at	5.905E-01	rad(SiO2)/min	BIPC150-NTK16, WFR #6, S/Ns H8-H9: 8.5 krad SD, 52.39 krad TD	42
20141124 13:55:00	to	20141204 13:48:49	8.500E+03	rad(SiO2) at	5.905E-01	rad(SiO2)/min	BIPC150-NTK52L, WFR #6, S/Ns H10-H11: 8.5 krad SD, 52.39 krad TD	42
20141124 13:55:00	to	20141204 13:48:49	8.500E+03	rad(SiO2) at	5.905E-01	rad(SiO2)/min	RH3083MLCC20M, WFR #2, S/Ns 1-10: 8.5 krad SD, 40.731 krad TD	42
20141124 13:55:00	to	20141204 13:48:49	8.500E+03	rad(SiO2) at	5.905E-01	rad(SiO2)/min	BIPC150-LCC20M-H1, WFR #8, S/N HLCC1: 8.5 krad SD, 40.731 krad TD	42
20141124 13:55:00	to	20141204 13:48:49	8.500E+03	rad(SiO2) at	5.905E-01	rad(SiO2)/min	BIPC150-RH6016, WFR #10, S/Ns H1, I1: 8.5 krad SD, 191.135 krad TD	42
20141124 13:55:00	to	20141204 13:48:49	8.500E+03	rad(SiO2) at	5.905E-01	rad(SiO2)/min	RH6654-2.5MH, WFR #3, S/Ns 1-10: 8.5 krad SD, 30.25 krad TD	42
20141124 13:55:00	to	20141204 13:48:49	8.500E+03	rad(SiO2) at	5.905E-01	rad(SiO2)/min	RH1084MK-CS, WFR #5, 4% old, S/Ns 1-8, 11-12: 8.5 krad SD, 50.1 krad TD	42
20141124 13:55:00	to	20141204 13:48:49	8.500E+03	rad(SiO2) at	5.905E-01	rad(SiO2)/min	RH1084MK-CS, WFR #5, 15%, S/Ns 1-2, 5-7, 9, 11-12, 14-15: 8.5 krad SD, 50.1 krad TD	42
20141124 13:55:00	to	20141204 13:48:49	8.500E+03	rad(SiO2) at	5.905E-01	rad(SiO2)/min	RH1084MK-CS, WFR #5, 4% new, S/Ns 1-3, 6, 8-12, 14: 8.5 krad SD, 50.1 krad TD	42
20141124 13:55:00	to	20141204 13:48:49	8.500E+03	rad(SiO2) at	5.905E-01	rad(SiO2)/min	RH117H, WFR #10, S/Ns 0765-0774: 8.5 krad SD, 50.1 krad TD	42
20141124 13:55:00	to	20141204 13:48:49	8.500E+03	rad(SiO2) at	5.905E-01	rad(SiO2)/min	RH6016MW, WFR #8, S/Ns 10-13, 16-17, 20, 22, 25-26: 8.5 krad SD, 45.811 krad TD	42
20141124 13:55:00	to	20141204 13:48:49	8.500E+03	rad(SiO2) at	5.905E-01	rad(SiO2)/min	BIPC150-H1NBK & -H2NBK, WFR #6, S/Ns H1NBK & H2NBK: 8.5 krad SD, 28.51 krad TD	42
20141124 13:55:00	to	20141204 13:48:49	8.500E+03	rad(SiO2) at	5.905E-01	rad(SiO2)/min	BIPC150-LCC20M, WFR #8, S/Ns H2LCC & H3LCC: 8.5 krad SD, 28.51 krad TD	42
20141124 13:55:00	to	20141204 13:48:49	8.500E+03	rad(SiO2) at	5.905E-01	rad(SiO2)/min	RH3480-J14-Au1mil, WFR #3, S/Ns 11-14: 8.5 krad SD, 8.5 krad TD	42

Total Doses reported are ± 13.90% at 95% confidence

Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of $k = 2$.

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NOTES:

1. ASTM = American Society for Testing and Materials.
2. DUT = Device Under Test.
3. S/N = Serial Number.
4. SD = Step Dose.
5. TD = Total Dose.
6. WFR = Wafer.
7. Dose rate uniformity across target area: ± 7.93%
8. The irradiation step met the requirements of MIL-STD-883H, Test Method 1019.8, Condition D.
9. After the original Test Request (DD Form 1222) was approved, the following changes were made:
   a. The following devices were added to the test lineup:
      RH3480-J14-Au1mil, WFR #3
      Latitude to change test parameters to suit customer requirements was included in the original Test Request; no Customer Order Change Request (SEGIT Form QP03-4, Rev. 5) was required/issued.
10. Source information:
    a. Irradiator = J.L. Shepherd & Associates Model 81-22/484 self-contained irradiation facility, S/Ns 7133/50017.
    b. Source selection = Co-60.
11. Dosimeter system:
    a. Radcal Model No. 9010 Radiation Monitor Controller, S/N 90-1313.
    b. Radcal Model No. 90X6-60 Electrometer/Ion Chamber, S/N 96-0362.
    c. This dosimeter system was calibrated per ISO/IEC 17025:2005 by University of Wisconsin Medical Radiation Research Center on 3 Feb 2014 (Report No. ION14427). This calibration is effective for two years.
12. Irradiation geometry: in accordance with section 7.3.2 of ASTM E1249-00 (2005), the DUT's semiconductor chip plane was perpendicular to the incident radiation beam.
13. Filter box: a DMEA Dose Enhancement Chamber (DEC) was used for all testing/dosimetry involved with this experiment.
    The DEC's Pb and Al layers are compliant with section 7.2.2 of ASTM E1249-00 (2005) with respect to thickness and geometry.

Step Dose and Cumulative Total Dose Summary #8

Step No.	Device					
	BIPC150, WFR #6, S/Ns D4LTC & H4LTC		RH3480-J14, WFR #8, S/Ns 2-8		RH137K (6RH137BKK*12), WFR #3, S/Ns 0237-0243, 0245-0247	
	SD in krad(SiO2)	Cumulative TD in krad(SiO2)	SD in krad(SiO2)	Cumulative TD in krad(SiO2)	SD in krad(SiO2)	Cumulative TD in krad(SiO2)
18	5.950	5.950	---	---	---	---
19	5.065	11.015	---	---	---	---
20	---	---	---	---	---	---
21	8.009	19.024	8.009	8.009	---	---
22	1.481	20.505	---	---	---	---
23	5.280	25.785	5.280	13.289	5.280	5.280
24	4.920	30.705	4.920	18.209	4.920	10.200
25	---	---	---	---	0.801	11.001
26	---	---	---	---	---	---
27	9.250	39.955	9.250	27.459	9.250	20.251
28	2.560	42.515	---	---	---	---
29	17.200	59.715	17.200	44.659	17.200	37.451
30	---	---	---	---	1.600	39.051
31	14.280	73.995	14.280	58.939	14.280	53.331
32	1.751	75.746	---	---	---	---
33	5.769	81.515	5.769	64.708	5.769	59.100
34	5.340	86.855	5.340	70.048	5.340	64.440
35	---	---	1.480	71.528	1.480	65.920
36	3.321	90.176	3.321	74.849	3.321	69.241
37	7.710	97.886	7.710	82.559	7.710	76.951
38	0.550	98.436	0.550	83.109	0.550	77.501
39	9.360	107.796	9.360	92.469	9.360	86.861
40	1.740	109.536	1.740	94.209	1.740	88.601
41	10.100	119.636	10.100	104.309	10.100	98.701
42	8.500	128.136	---	---	8.500	107.201

NOTES:
1. SD = Step Dose.
2. TD = Total Dose.
3. WFR = Wafer.

Appendix D

Table D1: Pre-Irradiation Electrical Characteristics of Device-Under-Test

SYMBOL	PARAMETER	CONDITIONS	NOTES	$T_A = 25°C$ MIN	$T_A = 25°C$ TYP	$T_A = 25°C$ MAX	SUB-GROUP	$-55°C \le T_A \le 150°C$ MIN	$-55°C \le T_A \le 150°C$ TYP	$-55°C \le T_A \le 150°C$ MAX	SUB-GROUP	UNITS
V_{REF}	Reference Voltage	$\lvert V_{IN} - V_{OUT} \rvert = 5V$, $I_{OUT} = 10mA$		–1.225		–1.275	1					V
		$3V \le \lvert V_{IN} - V_{OUT} \rvert \le 30V$, $10mA \le I_{OUT} \le I_{MAX}$, $P \le P_{MAX}$		–1.200		–1.300	1	–1.200		–1.300	2, 3	V
$\frac{\Delta V_{OUT}}{\Delta V_{IN}}$	Line Regulation	$3V \le \lvert V_{IN} - V_{OUT} \rvert \le 30V$	2			0.02	1			0.05	2, 3	%/V
$\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$	Load Regulation	$10mA \le I_{OUT} \le I_{MAX}$, $\lvert V_{OUT} \rvert \le 5V$ $10mA \le I_{OUT} \le I_{MAX}$, $\lvert V_{OUT} \rvert \ge 5V$	2 2			25 0.5	1 1			50 1	2, 3 2, 3	mV %
	Thermal Regulation	10ms Pulse				0.02	1					%/W
	Ripple Rejection	$V_{OUT} = -10V$, f = 120Hz, $C_{ADJ} = 0$			60							dB
		$V_{OUT} = -10V$, f = 120Hz, $C_{ADJ} = 10\mu F$	3	66				66				dB
I_{ADJ}	Adjust Pin Current					100	1			100	2, 3	µA
ΔI_{ADJ}	Adjust Pin Current Change	$10mA \le I_{OUT} \le I_{MAX}$ $3V \le \lvert V_{IN} - V_{OUT} \rvert \le 30V$				5 5	1 1			5 5	2, 3 2, 3	µA µA
I_{MIN}	Minimum Load Current	$\lvert V_{IN} - V_{OUT} \rvert = 30V$ $\lvert V_{IN} - V_{OUT} \rvert \le 10V$				5 3	1 1			5 3	2, 3 2, 3	mA mA
	Current Limit	$\lvert V_{IN} - V_{OUT} \rvert \le 15V$ H Package K Package	5 5	0.5 1.5			1 1	0.5 1.5			2, 3 2, 3	A A
		$\lvert V_{IN} - V_{OUT} \rvert = 30V$ H Package K Package	5 5	0.15 0.24			1 1					A A
$\frac{\Delta V_{OUT}}{\Delta Temp}$	Temperature Stability	$-55°C \le T_J \le 125°C$	3						0.6			%
$\frac{\Delta V_{OUT}}{\Delta Time}$	Long Term Stability	$T_A = 125°C$	3							1		%
e_n	RMS Output Noise	$10Hz \le f \le 10kHz$			0.003							%
θ_{JC}	Thermal Resistance (Junction to Case)	H Package K Package	3 3			15 3						°C/W °C/W

Table D2: Post-Irradiation Electrical Characteristics of Device-Under-Test

SYMBOL	PARAMETER	CONDITIONS	NOTES	10KRAD(Si) MIN	10KRAD(Si) MAX	20KRAD(Si) MIN	20KRAD(Si) MAX	50KRAD(Si) MIN	50KRAD(Si) MAX	100KRAD(Si) MIN	100KRAD(Si) MAX	200KRAD(Si) MIN	200KRAD(Si) MAX	UNITS
V_{REF}	Reference Voltage	$\lvert V_{IN} - V_{OUT} \rvert \leq 5V$, $I_{OUT} = 10mA$		−1.225	−1.275	−1.225	−1.275	−1.225	−1.275	−1.225	−1.275	−1.22	−1.28	V
		$3V \leq \lvert V_{IN} - V_{OUT} \rvert \leq 30V$, $10mA \leq I_{OUT} \leq I_{MAX}$, $P \leq P_{MAX}$		−1.2	−1.3	−1.2	−1.3	−1.2	−1.3	−1.2	−1.3	−1.2	−1.3	V
$\frac{\Delta V_{OUT}}{\Delta V_{IN}}$	Line Regulation	$3V \leq \lvert V_{IN} - V_{OUT} \rvert \leq 30V$,	2		0.02		0.02		0.02		0.02		0.02	%/V
$\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$	Load Regulation	$10mA \leq I_{OUT} \leq I_{MAX}$, $\lvert V_{OUT} \rvert \leq 5V$	2		25		25		25		25		25	mV
		$10mA \leq I_{OUT} \leq I_{MAX}$, $\lvert V_{OUT} \rvert \geq 5V$	2		0.5		0.5		0.5		0.5		0.5	%
I_{ADJ}	Adjust Pin Current				100		100		100		100		100	μA
ΔI_{ADJ}	Adjust Pin Current Change	$10mA \leq I_{OUT} \leq I_{MAX}$ $3V \leq \lvert V_{IN} - V_{OUT} \rvert \leq 30V$			5 5		5 5		5 5		5 5		5 5	μA μA
I_{MIN}	Minimum Load Current	$\lvert V_{IN} - V_{OUT} \rvert = 30V$ $\lvert V_{IN} - V_{OUT} \rvert \leq 10V$			5 3		5 3		5 3		5 3		5 3	mA mA
	Current Limit H Package	$\lvert V_{IN} - V_{OUT} \rvert \leq 15V$ $\lvert V_{IN} - V_{OUT} \rvert = 30V$		0.5 0.15		0.5 0.15		0.5 0.15		0.5 0.15		0.5 0.15		A A
	K Package	$\lvert V_{IN} - V_{OUT} \rvert \leq 15V$ $\lvert V_{IN} - V_{OUT} \rvert = 30V$		1.5 0.24		1.5 0.24		1.5 0.24		1.5 0.24		1.5 0.24		A A

Note 1: Unless otherwise specified, these specifications apply for $\lvert V_{IN} - V_{OUT} \rvert = 5V$; and $I_{OUT} = 0.1A$ for the H package (TO-39) and $I_{OUT} = 0.5A$ for the K package (TO-3) package. Although power dissipation is internally limited, these specifications are applicable for power dissipations of 2W for the TO-39 and 20W for the TO-3. I_{MAX} is 0.2A for the TO-39 and 1.5A for the TO-3 package.

Note 2: Regulation is measured at a constant junction temperature using pulse testing with a low duty cycle. Changes in output voltage due to heating effects are covered under the specification for thermal regulation.

Note 3: Guaranteed by design, characterization or correlation to other tested parameters.

Note 4: $T_J = 25°C$ unless otherwise noted.

Note 5: I_{SC} is tested at the ambient temperatures of 25°C and −55°C. I_{SC} cannot be tested at the maximum ambient temperature of 150°C due to the high power level required. I_{SC} specification at 150°C ambient is guaranteed by characterization and correlation to 25°C testing.