Total Ionization Dose (TID) Test Results of the RH117H Positive Adjustable Regulator @ Low Dose Rate (LDR)

LDR = 10 mrads(Si)/s

18 December 2014

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Acknowledgements

The authors would like to thank the Product Engineering and Design S-Power groups from Linear Technology for their help with the board design and assembly as well as the data collection pre- and post-irradiations. Special thanks are also for Thomas Shepherd from Defense Microelectronics Activity (DMEA) for the extensive work for board setup and continuous dosimetry monitoring throughout the ELDRS tests.

TID LDR Testing of the RH117H Positive Adjustable Regulator

Part Type Tested: RH117H Positive Adjustable Regulator

Traceability Information: Fab Lot # W10905063.1; Assembly Lot # 755614; Wafer # 10. 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 770-774 had all pins tied to ground during irradiation. Serial numbers 765-769 were biased during irradiation. Serial numbers 723 and 724 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), 22 Krads(Si), 31 Krads(Si), 50 Krads(Si).

Radiation dose: 10 mrads(Si)/sec.

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

Test Hardware and Software: LTX pre- and post-irradiation test program EQ2CR117H.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 50 Krad(Si) with increments of 10, 22, 31 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) @ 10mA ≤ I_{OUT} ≤ I_{MAX}, 3V ≤ (V_{IN} – V_{OUT}) ≤ 40V
- Line Regulation (%/V) @ I_{LOAD} = 10mA, 3V ≤ (V_{IN} – V_{OUT}) ≤ 40V
- Load Regulation (mV) @ V_{OUT} ≤ 5V, 10mA ≤ I_{OUT} ≤ I_{MAX}
- Load Regulation (%) @ V_{OUT} ≥ 5V, 10mA ≤ I_{OUT} ≤ I_{MAX}
- Adjust Pin Current (uA)
- Adjust Pin Current Change (uA) @ 10mA ≤ I_{OUT} ≤ I_{MAX}
- Adjust Pin Current Change (uA) @ 3V ≤ (V_{IN} – V_{OUT}) ≤ 40V
- Minimum Load Current (mA) @ (V_{IN} – V_{OUT}) = 40V
- Current Limit (A) @ (V_{IN} – V_{OUT}) ≤ 5V
- Current Limit (A) @ (V_{IN} – V_{OUT}) = 40V

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 ten 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 22 Krads(Si) test limits are taken from the Linear Technology datasheet's 20 Krads(Si) specification limits.

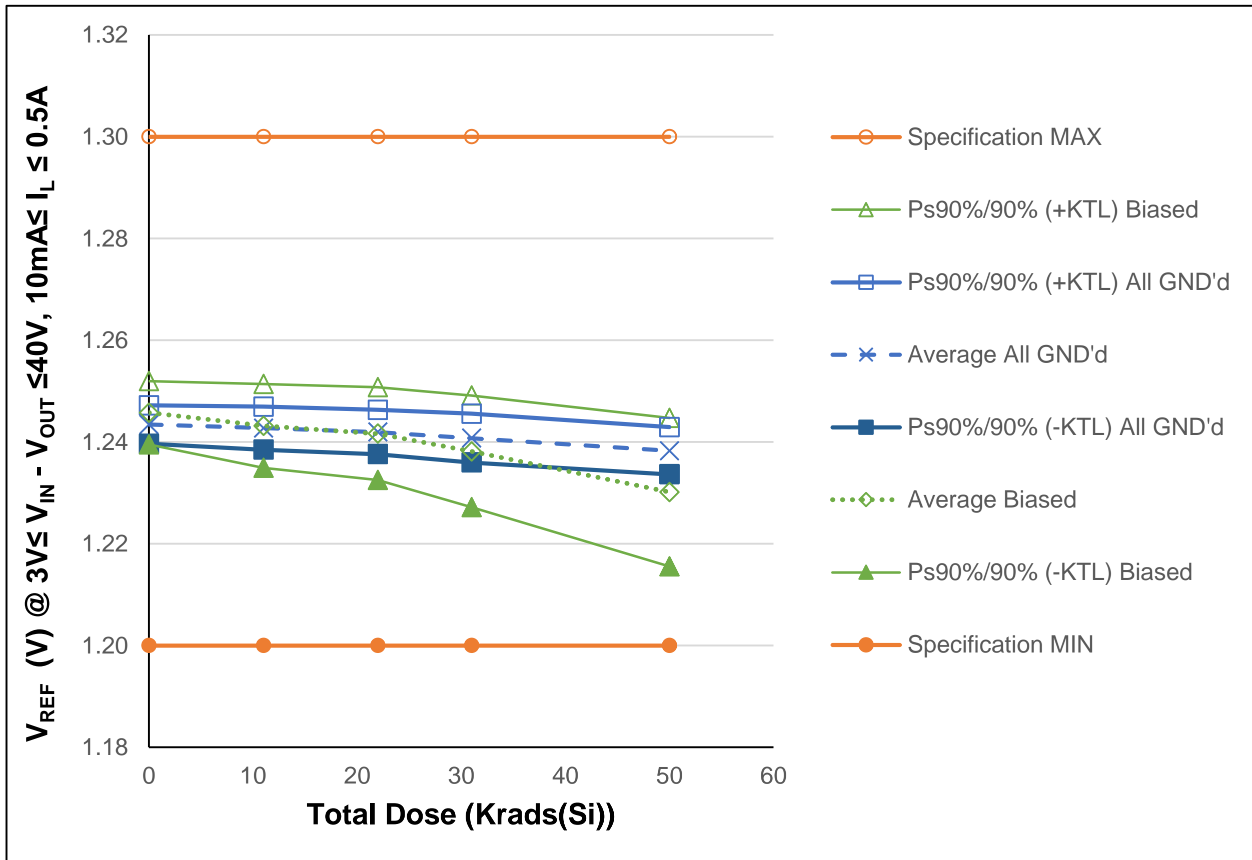

Figure 5.1 Plot of Reference Voltage versus Total Dose

Table 5.1: Raw data for reference voltage at full load 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} @ $3V \le V_I - V_O \le 40V, 10mA \le I_L \le 0.5A$	Total Dose (Krads(Si)) @ 10 mrads/s				
Units	(V)	0	11	22	31	50
770	All GND'd Irradiation	1.24362	1.24211	1.24137	1.24009	1.23767
771	All GND'd Irradiation	1.24113	1.24065	1.23968	1.23827	1.23588
772	All GND'd Irradiation	1.24475	1.24463	1.24373	1.24261	1.24024
773	All GND'd Irradiation	1.24414	1.24379	1.24315	1.24222	1.23951
774	All GND'd Irradiation	1.24348	1.24249	1.24187	1.24062	1.23813
765	Biased Irradiation	1.24666	1.24440	1.24359	1.24123	1.23416
766	Biased Irradiation	1.24505	1.24220	1.24121	1.23713	1.22869
767	Biased Irradiation	1.24316	1.24004	1.23840	1.23483	1.22645
768	Biased Irradiation	1.24479	1.24149	1.23871	1.23422	1.22438
769	Biased Irradiation	1.24916	1.24776	1.24625	1.24336	1.23707
723	Control Unit	1.25226	1.25333	1.25312	1.25284	1.25331
724	Control Unit	1.24825	1.24865	1.24943	1.24945	1.24909
	All GND'd Irradiation Statistics					
	Average All GND'd	1.24343	1.24273	1.24196	1.24076	1.23828
	Std Dev All GND'd	0.00138	0.00154	0.00159	0.00175	0.00170
	Ps90%/90% (+KTL) All GND'd	1.24720	1.24696	1.24632	1.24555	1.24293
	Ps90%/90% (-KTL) All GND'd	1.23965	1.23850	1.23760	1.23597	1.23363
	Biased Irradiation Statistics					
	Average Biased	1.24576	1.24318	1.24163	1.23815	1.23015
	Std Dev Biased	0.00227	0.00301	0.00333	0.00400	0.00532
	Ps90%/90% (+KTL) Biased	1.25199	1.25142	1.25076	1.24913	1.24472
	Ps90%/90% (-KTL) Biased	1.23954	1.23493	1.23250	1.22717	1.21558
	Specification MIN	1.20	1.20	1.20		1.20
	Status (Measurements) All GND'd	PASS	PASS	PASS		PASS
	Status (Measurements) Biased	PASS	PASS	PASS		PASS
	Specification MAX	1.30	1.30	1.30		1.30
	Status (Measurements) All GND'd	PASS	PASS	PASS		PASS
	Status (Measurements) Biased	PASS	PASS	PASS		PASS
	Status (-KTL) All GND'd	PASS	PASS	PASS		PASS
	Status (+KTL) All GND'd	PASS	PASS	PASS		PASS
	Status (-KTL) Biased	PASS	PASS	PASS		PASS
	Status (+KTL) Biased	PASS	PASS	PASS		PASS

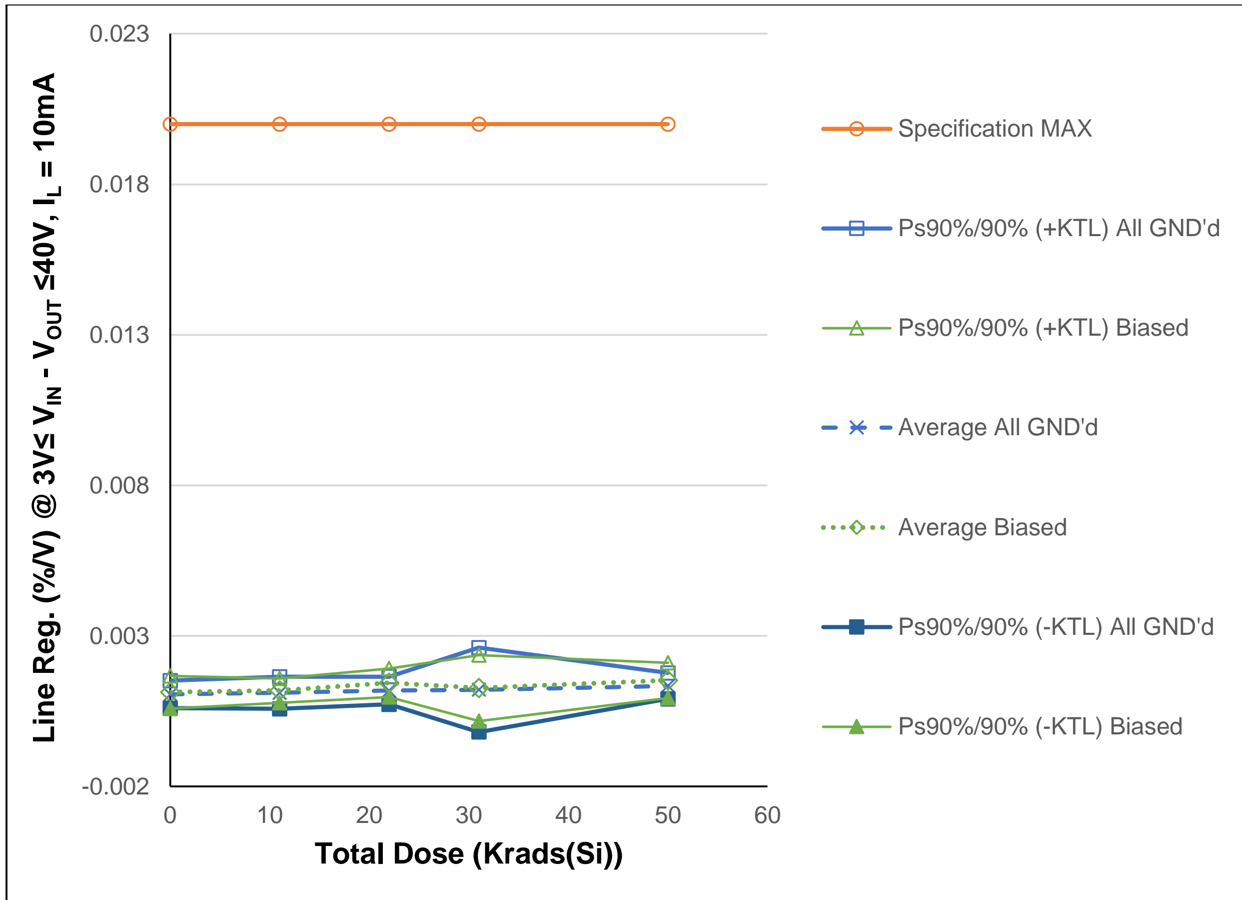

Figure 5.2: Plot of Line Regulation versus Total Dose

Table 5.2: 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. @ $3V \le V_I - V_O \le 40V, I_L = 10mA$	Total Dose (Krads(Si)) @ 10 mrads/s				
Units	(%/V)	0	11	22	31	50
770	All GND'd Irradiation	0.001013	0.000937	0.001136	0.001411	0.001518
771	All GND'd Irradiation	0.001265	0.001325	0.001412	0.001597	0.001292
772	All GND'd Irradiation	0.000953	0.000914	0.001095	0.000325	0.001245
773	All GND'd Irradiation	0.000868	0.001083	0.000995	0.001263	0.001164
774	All GND'd Irradiation	0.001197	0.001299	0.001306	0.001471	0.001496
765	Biased Irradiation	0.000824	0.001123	0.001219	0.001325	0.001251
766	Biased Irradiation	0.001258	0.001020	0.001326	0.001436	0.001530
767	Biased Irradiation	0.001239	0.001240	0.001536	0.001455	0.001511
768	Biased Irradiation	0.001058	0.001147	0.001656	0.001564	0.001850
769	Biased Irradiation	0.001301	0.001410	0.001467	0.000574	0.001499
723	Control Unit	0.001150	0.001406	0.001316	0.001312	0.001092
724	Control Unit	0.000967	0.001284	0.001132	0.001274	0.001010
	All GND'd Irradiation Statistics					
	Average All GND'd	0.001059	0.001112	0.001189	0.001213	0.001343
	Std Dev All GND'd	0.000167	0.000194	0.000168	0.000511	0.000157
	Ps90%/90% (+KTL) All GND'd	0.001517	0.001644	0.001650	0.002614	0.001773
	Ps90%/90% (-KTL) All GND'd	0.000601	0.000579	0.000728	-0.000187	0.000912
	Biased Irradiation Statistics					
	Average Biased	0.001136	0.001188	0.001441	0.001271	0.001528
	Std Dev Biased	0.000198	0.000147	0.000172	0.000399	0.000213
	Ps90%/90% (+KTL) Biased	0.001678	0.001590	0.001913	0.002364	0.002112
	Ps90%/90% (-KTL) Biased	0.000594	0.000786	0.000969	0.000177	0.000944
	Specification MIN					
	Status (Measurements) All GND'd					
	Status (Measurements) Biased					
	Specification MAX	0.02	0.02	0.02		0.02
	Status (Measurements) All GND'd	PASS	PASS	PASS		PASS
	Status (Measurements) Biased	PASS	PASS	PASS		PASS
	Status (-KTL) All GND'd					
	Status (+KTL) All GND'd	PASS	PASS	PASS		PASS
	Status (-KTL) Biased					
	Status (+KTL) Biased	PASS	PASS	PASS		PASS

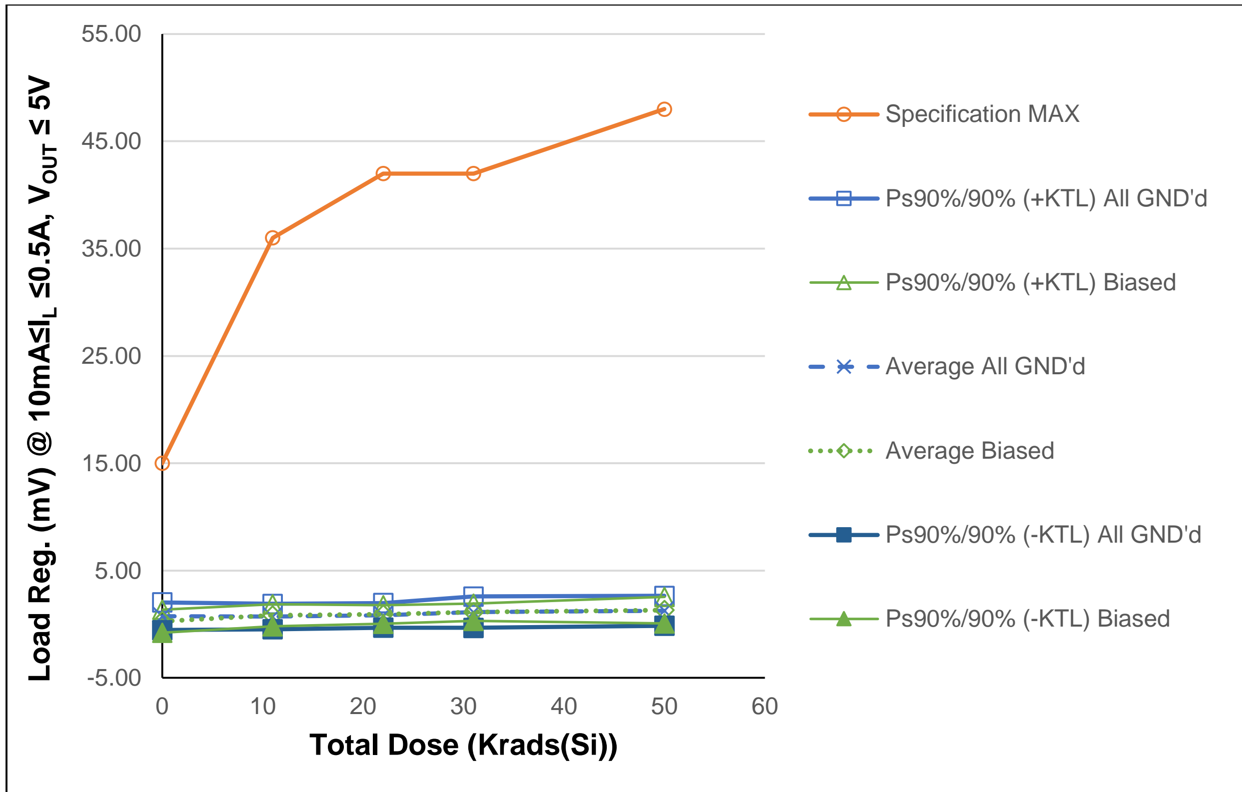

Figure 5.3: Plot of Load Regulation (V_{OUT} ≤ 5V) versus Total Dose

Table 5.3: Raw data for load regulation ($V_{OUT} \leq 5V$) versus total dose including the statistical calculations, maximum specification, and the status of the test (PASS/FAIL).

Parameter	Load Reg @ 10mA≤I_L≤0.5A,V_O ≤ 5V	Total Dose (Krads(Si)) @ 10 mrads/s				
Units	(mV)	0	11	22	31	50
770	All GND'd Irradiation	0.29278	0.92793	1.13964	1.40762	1.32656
771	All GND'd Irradiation	0.99945	0.40722	0.69332	1.16730	0.95463
772	All GND'd Irradiation	1.24645	0.84782	0.95177	1.50108	1.81294
773	All GND'd Irradiation	0.19741	0.15354	0.16022	0.19741	0.55408
774	All GND'd Irradiation	0.98991	1.24455	1.18637	1.36852	1.63174
765	Biased Irradiation	0.79727	1.46484	1.23787	1.49250	1.91784
766	Biased Irradiation	0.05341	0.67902	0.69141	1.06335	0.98419
767	Biased Irradiation	0.11063	0.64278	1.06525	1.13964	1.53732
768	Biased Irradiation	-0.14496	0.85735	1.09386	1.25504	1.39427
769	Biased Irradiation	0.58746	0.52547	0.47779	0.69237	0.77343
723	Control Unit	0.49019	-0.08106	0.09441	0.39101	-0.20885
724	Control Unit	0.96989	1.09196	0.43011	0.37766	0.73624
	All GND'd Irradiation Statistics					
	Average All GND'd	0.74520	0.71621	0.82626	1.12839	1.25599
	Std Dev All GND'd	0.46919	0.43398	0.41980	0.53450	0.50986
	Ps90%/90% (+KTL) All GND'd	2.03171	1.90618	1.97735	2.59399	2.65404
	Ps90%/90% (-KTL) All GND'd	-0.54131	-0.47376	-0.32483	-0.33722	-0.14206
	Biased Irradiation Statistics					
	Average Biased	0.28076	0.83389	0.91324	1.12858	1.32141
	Std Dev Biased	0.39456	0.37225	0.31620	0.29287	0.45323
	Ps90%/90% (+KTL) Biased	1.36266	1.85461	1.78027	1.93162	2.56416
	Ps90%/90% (-KTL) Biased	-0.80113	-0.18682	0.04621	0.32553	0.07867
	Specification MIN					
	Status (Measurements) All GND'd					
	Status (Measurements) Biased					
	Specification MAX	15	36	42		48
	Status (Measurements) All GND'd	PASS	PASS	PASS		PASS
	Status (Measurements) Biased	PASS	PASS	PASS		PASS
	Status (-KTL) All GND'd					
	Status (+KTL) All GND'd	PASS	PASS	PASS		PASS
	Status (-KTL) Biased					
	Status (+KTL) Biased	PASS	PASS	PASS		PASS

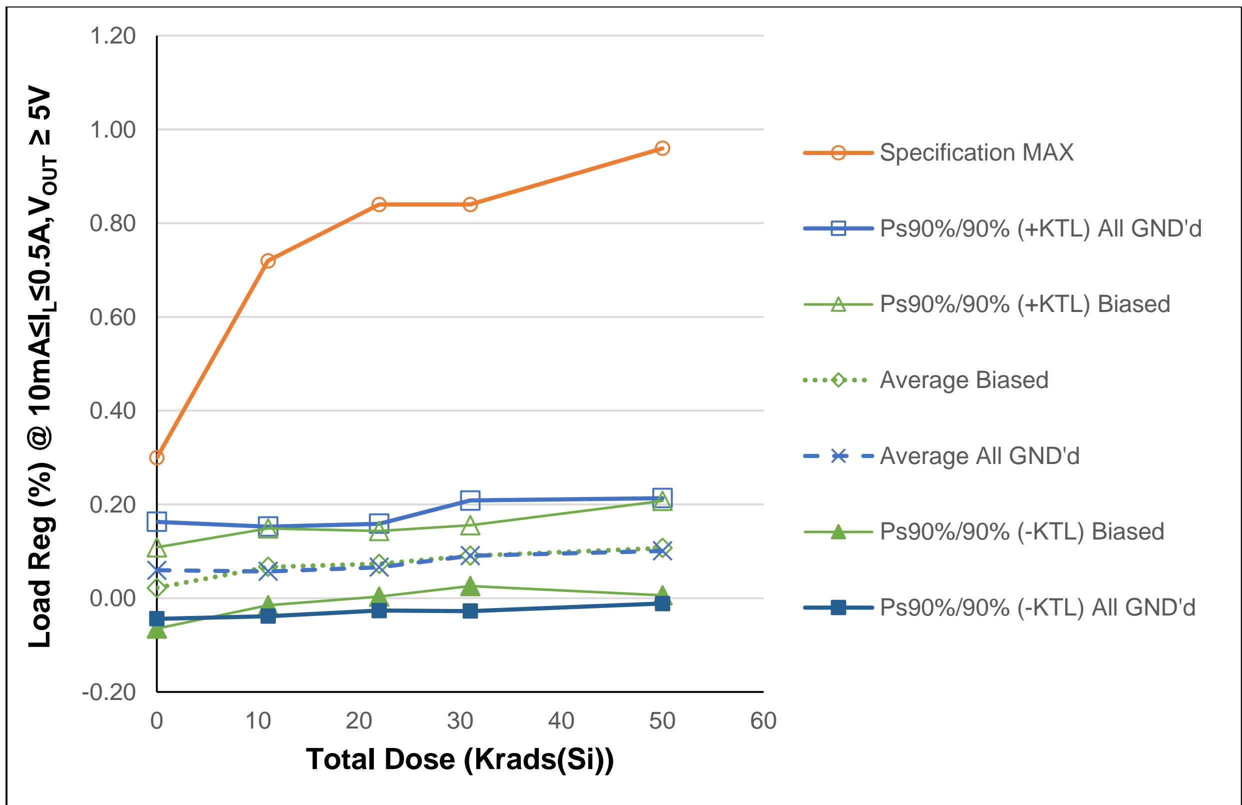

Figure 5.4: Plot of Load Regulation (V_{OUT} ≥ 5V) versus Total Dose

Table 5.4: 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≤0.5A, V_O≥5V	Total Dose (Krads(Si)) @ 10 mrads/s				
Units	(%)	0	11	22	31	50
770	All GND'd Irradiation	0.02354	0.07465	0.09172	0.11338	0.10707
771	All GND'd Irradiation	0.08046	0.03281	0.05590	0.09418	0.07718
772	All GND'd Irradiation	0.10004	0.06807	0.07647	0.12066	0.14596
773	All GND'd Irradiation	0.01586	0.01234	0.01289	0.01589	0.04468
774	All GND'd Irradiation	0.07954	0.10007	0.09544	0.11019	0.13162
765	Biased Irradiation	0.06391	0.11758	0.09944	0.12010	0.15516
766	Biased Irradiation	0.00429	0.05463	0.05567	0.08588	0.08004
767	Biased Irradiation	0.00890	0.05181	0.08594	0.09221	0.12519
768	Biased Irradiation	-0.01165	0.06901	0.08823	0.10158	0.11375
769	Biased Irradiation	0.04701	0.04210	0.03832	0.05565	0.06248
723	Control Unit	0.03913	-0.00647	0.00753	0.03120	-0.01667
724	Control Unit	0.07764	0.08737	0.03441	0.03022	0.05891
	All GND'd Irradiation Statistics					
	Average All GND'd	0.05989	0.05759	0.06648	0.09086	0.10130
	Std Dev All GND'd	0.03769	0.03488	0.03376	0.04301	0.04103
	Ps90%/90% (+KTL) All GND'd	0.16323	0.15323	0.15906	0.20880	0.21381
	Ps90%/90% (-KTL) All GND'd	-0.04345	-0.03805	-0.02610	-0.02708	-0.01121
	Biased Irradiation Statistics					
	Average Biased	0.02249	0.06702	0.07352	0.09108	0.10732
	Std Dev Biased	0.03162	0.02986	0.02549	0.02364	0.03675
	Ps90%/90% (+KTL) Biased	0.10918	0.14889	0.14343	0.15591	0.20810
	Ps90%/90% (-KTL) Biased	-0.06420	-0.01485	0.00362	0.02626	0.00654
	Specification MIN					
	Status (Measurements) All GND'd					
	Status (Measurements) Biased					
	Specification MAX	0.30	0.72	0.84		0.96
	Status (Measurements) All GND'd	PASS	PASS	PASS		PASS
	Status (Measurements) Biased	PASS	PASS	PASS		PASS
	Status (-KTL) All GND'd					
	Status (+KTL) All GND'd	PASS	PASS	PASS		PASS
	Status (-KTL) Biased					
	Status (+KTL) Biased	PASS	PASS	PASS		PASS

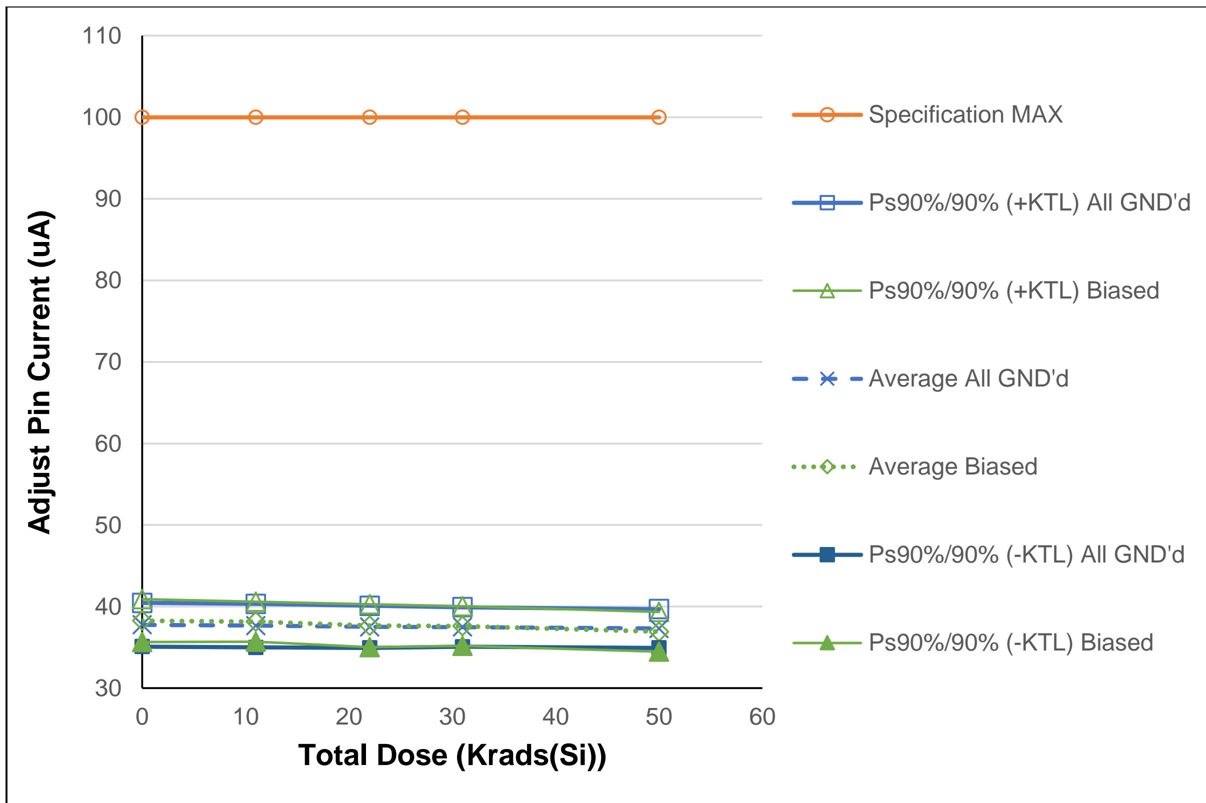

Figure 5.5: Plot of Adjust Pin Current versus Total Dose

Table 5.5: Raw data for adjust pin current versus total dose including the statistical calculations, minimum specification, and the status of the test (PASS/FAIL)

Parameter	Adjust Pin Current	Total Dose (Krads(Si)) @ 10 mrads/s				
Units	(uA)	0	11	22	31	50
770	All GND'd Irradiation	37.08567	36.99123	36.84251	36.90289	36.85178
771	All GND'd Irradiation	38.93988	38.76894	38.66531	38.50042	38.41770
772	All GND'd Irradiation	37.16185	37.07067	36.85321	36.94807	36.73279
773	All GND'd Irradiation	36.91572	36.80050	36.78321	36.69865	36.48647
774	All GND'd Irradiation	38.71296	38.67036	38.40386	38.40662	38.06429
765	Biased Irradiation	36.79207	36.75817	36.29581	36.14735	35.55716
766	Biased Irradiation	38.10320	38.18554	37.15717	37.48630	36.62807
767	Biased Irradiation	39.12902	39.10086	38.43596	38.30571	37.76563
768	Biased Irradiation	39.13496	38.72780	38.61774	38.29262	37.60857
769	Biased Irradiation	38.20905	37.94770	37.76065	37.81404	37.05524
723	Control Unit	38.21854	38.24239	37.84626	38.16810	37.84653
724	Control Unit	37.95937	37.92437	37.37463	37.79620	37.47648
	All GND'd Irradiation Statistics					
	Average All GND'd	37.76322	37.66034	37.50962	37.49133	37.31061
	Std Dev All GND'd	0.97795	0.97261	0.94059	0.88399	0.86852
	Ps90%/90% (+KTL) All GND'd	40.44474	40.32724	40.08873	39.91523	39.69208
	Ps90%/90% (-KTL) All GND'd	35.08169	34.99344	34.93051	35.06743	34.92913
	Biased Irradiation Statistics					
	Average Biased	38.27366	38.14401	37.65347	37.60920	36.92293
	Std Dev Biased	0.96201	0.89683	0.95435	0.88688	0.88742
	Ps90%/90% (+KTL) Biased	40.91148	40.60311	40.27030	40.04104	39.35623
	Ps90%/90% (-KTL) Biased	35.63584	35.68492	35.03663	35.17737	34.48964
	Specification MIN					
	Status (Measurements) All GND'd					
	Status (Measurements) Biased					
	Specification MAX	100	100	100		100
	Status (Measurements) All GND'd	PASS	PASS	PASS		PASS
	Status (Measurements) Biased	PASS	PASS	PASS		PASS
	Status (-KTL) All GND'd					
	Status (+KTL) All GND'd	PASS	PASS	PASS		PASS
	Status (-KTL) Biased					
	Status (+KTL) Biased	PASS	PASS	PASS		PASS

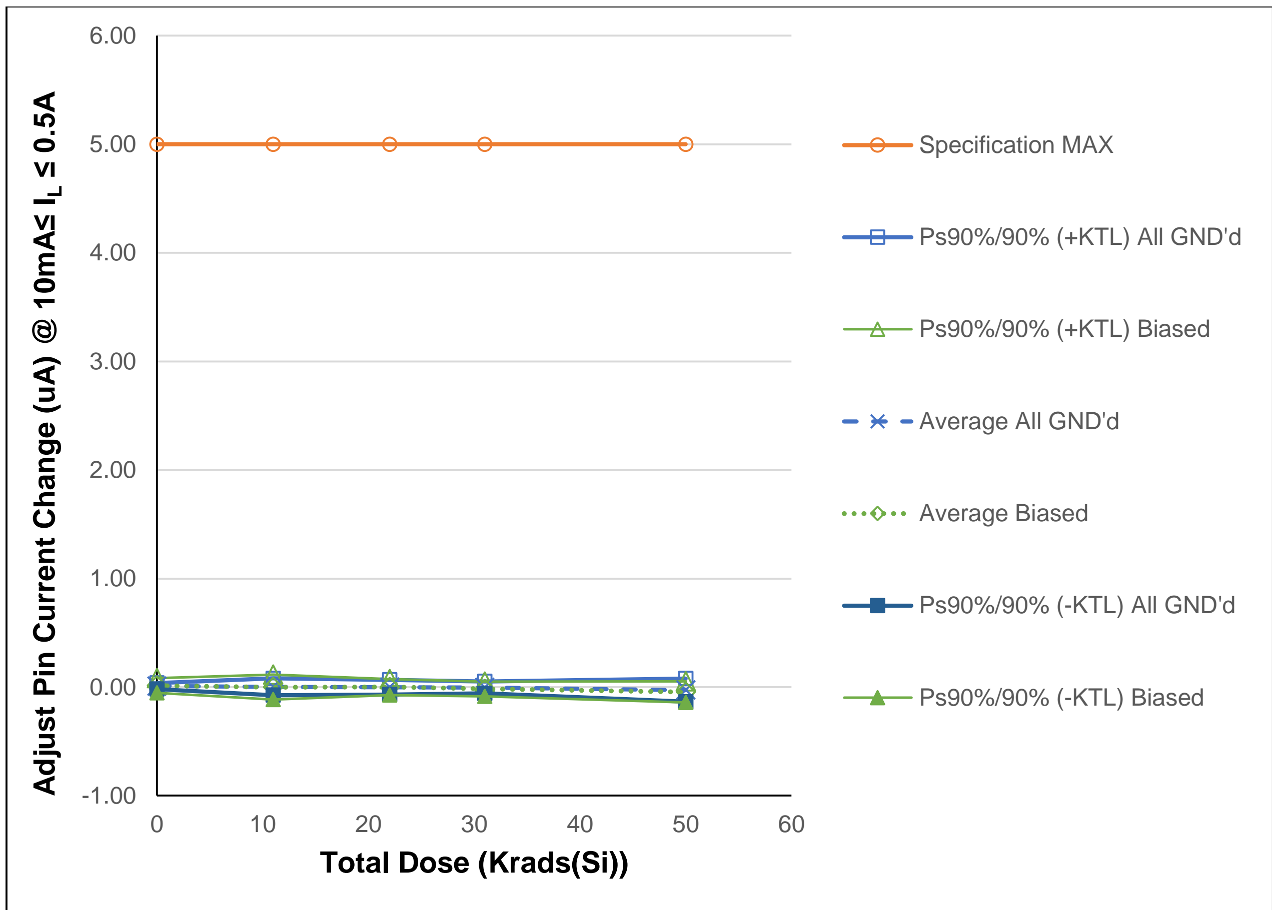

Figure 5.6: Plot of Adjust Pin Current Change @ 10mA ≤ I_L ≤ 0.5A versus Total Dose

Table 5.6: Raw data for adjust pin current change @ 10mA ≤ I_L ≤ 0.5A versus total dose including the statistical calculations, minimum specification, and the status of the test (PASS/FAIL)

Parameter	Adj. Pin I Change @ 10mA ≤ I_L ≤0.5A	Total Dose (Krads(Si)) @ 10 mrads/s				
Units	(uA)	0	11	22	31	50
770	All GND'd Irradiation	0.00000	-0.00359	-0.01190	-0.00476	-0.00237
771	All GND'd Irradiation	0.01780	-0.01839	-0.02379	-0.01071	0.00000
772	All GND'd Irradiation	0.00712	0.02273	-0.01887	0.00000	-0.08686
773	All GND'd Irradiation	0.02375	-0.02679	0.01665	0.02855	0.00000
774	All GND'd Irradiation	0.00237	0.04069	0.03329	-0.02734	-0.04879
765	Biased Irradiation	0.00000	0.05073	-0.03686	-0.02379	-0.06187
766	Biased Irradiation	0.04866	-0.03516	0.00357	-0.05351	-0.06783
767	Biased Irradiation	0.00119	-0.02392	-0.01308	0.00000	-0.05592
768	Biased Irradiation	0.03204	0.03829	0.02973	0.01071	0.01786
769	Biased Irradiation	-0.00972	-0.03351	0.02023	-0.01665	-0.05474
723	Control Unit	0.03820	0.02394	0.01071	-0.01784	0.01308
724	Control Unit	0.01781	0.04069	-0.03210	-0.00119	-0.02618
	All GND'd Irradiation Statistics					
	Average All GND'd	0.01021	0.00293	-0.00093	-0.00285	-0.02760
	Std Dev All GND'd	0.01020	0.02828	0.02473	0.02037	0.03912
	Ps90%/90% (+KTL) All GND'd	0.03817	0.08046	0.06687	0.05300	0.07966
	Ps90%/90% (-KTL) All GND'd	-0.01776	-0.07461	-0.06872	-0.05870	-0.13487
	Biased Irradiation Statistics					
	Average Biased	0.01444	-0.00072	0.00072	-0.01665	-0.04450
	Std Dev Biased	0.02474	0.04174	0.02661	0.02467	0.03525
	Ps90%/90% (+KTL) Biased	0.08228	0.11373	0.07369	0.05101	0.05215
	Ps90%/90% (-KTL) Biased	-0.05341	-0.11516	-0.07226	-0.08430	-0.14115
	Specification MIN					
	Status (Measurements) All GND'd					
	Status (Measurements) Biased					
	Specification MAX	5	5	5		5
	Status (Measurements) All GND'd	PASS	PASS	PASS		PASS
	Status (Measurements) Biased	PASS	PASS	PASS		PASS
	Status (-KTL) All GND'd					
	Status (+KTL) All GND'd	PASS	PASS	PASS		PASS
	Status (-KTL) Biased					
	Status (+KTL) Biased	PASS	PASS	PASS		PASS

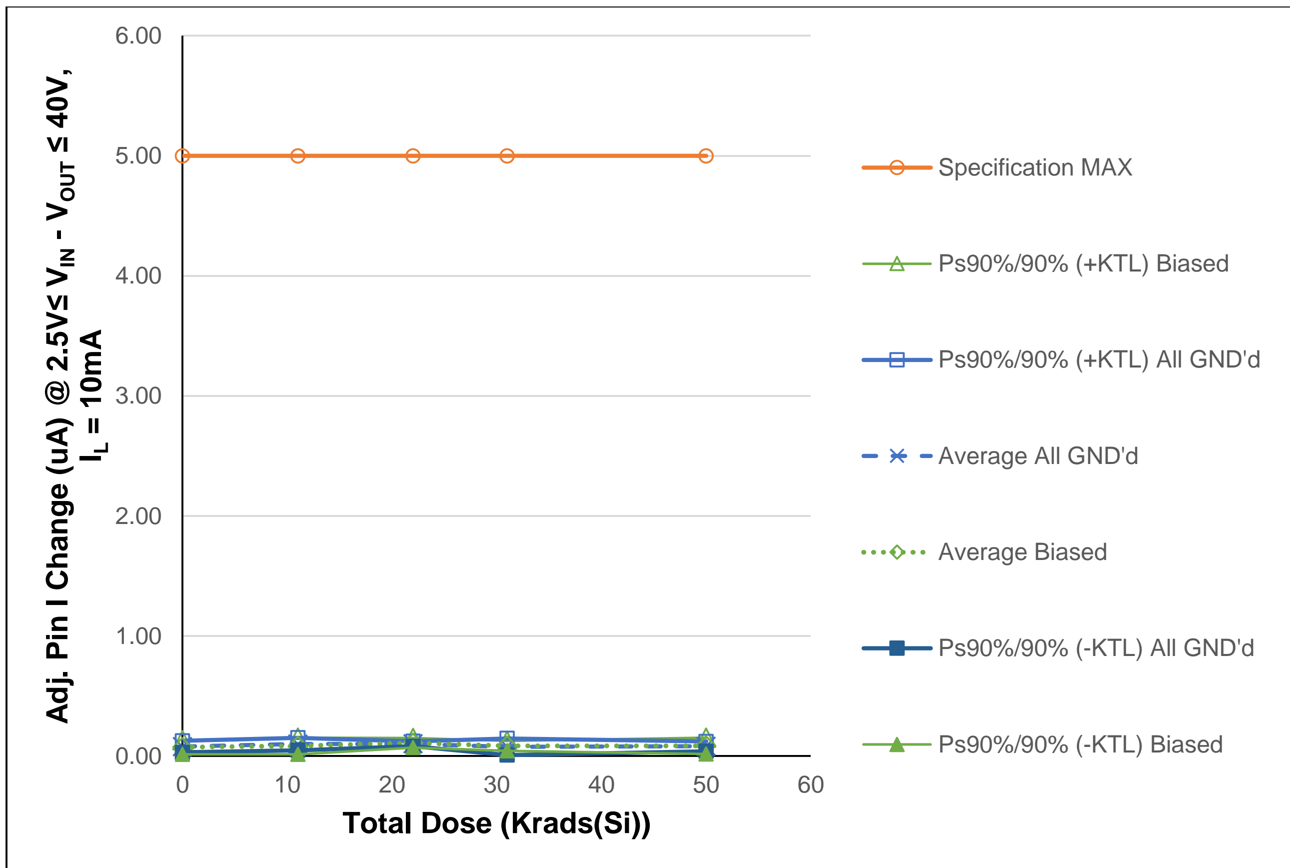

Figure 5.7: Plot of Adjust Pin Current Change @ 2.5V ≤ V_{IN} – V_{OUT} ≤ 40V versus Total Dose

Table 5.7: Raw data table for adjust pin current change @ 2.5V ≤ $V_{IN} – V_{OUT}$ ≤ 40V versus total dose including the statistical calculations, maximum specification, and the status of the test (PASS/FAIL)

Parameter	Delta Adj. I @ 2.5V≤V_I-V_O≤40V,I_L=10mA	Total Dose (Krads(Si)) @ 10 mrads/s				
Units	(uA)	0	11	22	31	50
770	All GND'd Irradiation	0.07618	0.09978	0.09974	0.04756	0.10114
771	All GND'd Irradiation	0.08686	0.13043	0.10448	0.10582	0.07139
772	All GND'd Irradiation	0.05816	0.07778	0.09974	0.05827	0.08567
773	All GND'd Irradiation	0.07004	0.10052	0.09379	0.07611	0.08568
774	All GND'd Irradiation	0.10467	0.09619	0.11400	0.09974	0.06307
765	Biased Irradiation	0.07381	0.05550	0.13423	0.07015	0.06783
766	Biased Irradiation	0.06765	0.08616	0.10926	0.09022	0.08686
767	Biased Irradiation	0.06885	0.06627	0.09498	0.10924	0.09163
768	Biased Irradiation	0.10920	0.09738	0.10584	0.08070	0.12375
769	Biased Irradiation	0.05103	0.11892	0.10464	0.07611	0.05950
723	Control Unit	0.06647	0.08063	0.14731	0.09751	0.06783
724	Control Unit	0.07240	0.05146	0.13794	0.08443	0.08567
	All GND'd Irradiation Statistics					
	Average All GND'd	0.07918	0.10094	0.10235	0.07750	0.08139
	Std Dev All GND'd	0.01763	0.01891	0.00754	0.02532	0.01468
	Ps90%/90% (+KTL) All GND'd	0.12752	0.15279	0.12302	0.14694	0.12165
	Ps90%/90% (-KTL) All GND'd	0.03085	0.04909	0.08168	0.00806	0.04113
	Biased Irradiation Statistics					
	Average Biased	0.07411	0.08485	0.10979	0.08529	0.08591
	Std Dev Biased	0.02141	0.02513	0.01465	0.01527	0.02495
	Ps90%/90% (+KTL) Biased	0.13281	0.15375	0.14997	0.12715	0.15433
	Ps90%/90% (-KTL) Biased	0.01541	0.01594	0.06961	0.04342	0.01750
	Specification MIN					
	Status (Measurements) All GND'd					
	Status (Measurements) Biased					
	Specification MAX	5	5	5		5
	Status (Measurements) All GND'd	PASS	PASS	PASS		PASS
	Status (Measurements) Biased	PASS	PASS	PASS		PASS
	Status (-KTL) All GND'd					
	Status (+KTL) All GND'd	PASS	PASS	PASS		PASS
	Status (-KTL) Biased					
	Status (+KTL) Biased	PASS	PASS	PASS		PASS

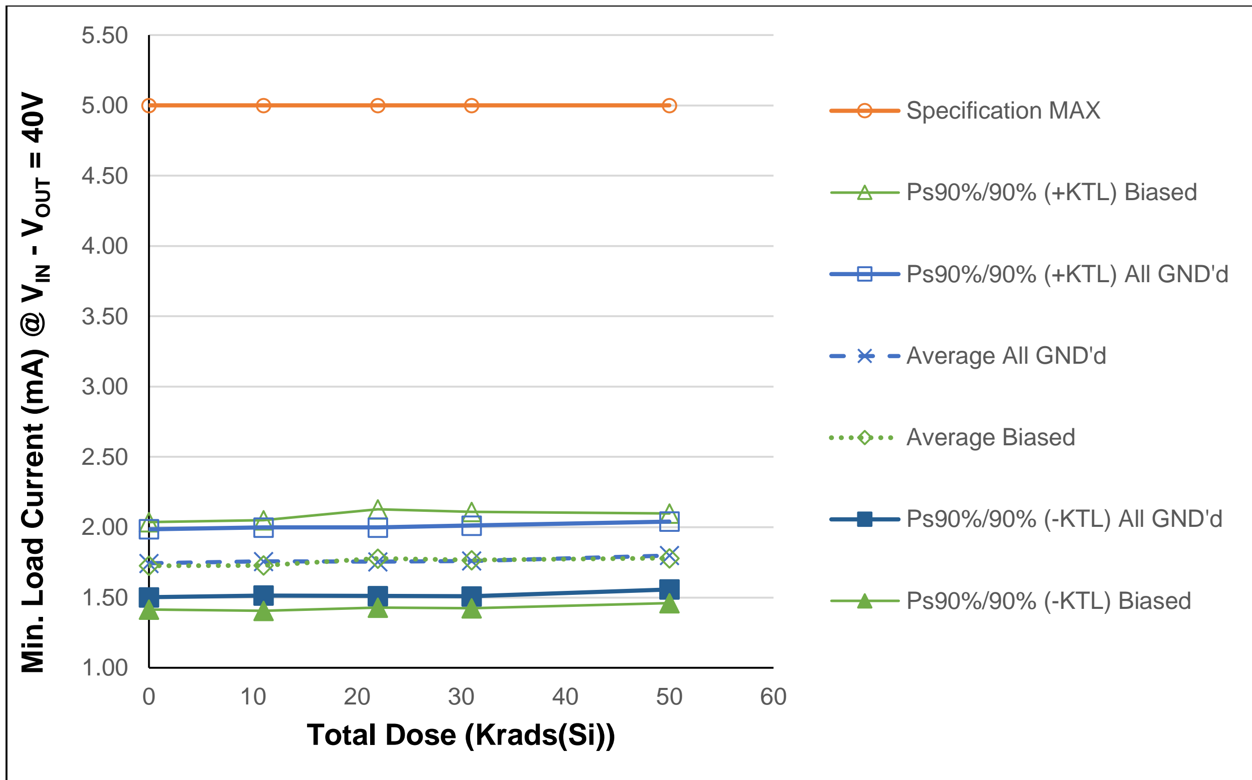

Figure 5.8: Plot of Minimum Load Current versus Total Dose

Table 5.8: Raw data table for minimum load current versus total dose including the statistical calculations, maximum specification, and the status of the test (PASS/FAIL)

Parameter	Min. Load Current @ V_I - V_O = 40V	Total Dose (Krads(Si)) @ 10 mrads/s				
Units	(mA)	0	11	22	31	50
770	All GND'd Irradiation	1.72664	1.74779	1.74851	1.75266	1.78722
771	All GND'd Irradiation	1.87605	1.89191	1.88427	1.89643	1.91652
772	All GND'd Irradiation	1.66874	1.68207	1.68821	1.68689	1.73774
773	All GND'd Irradiation	1.66432	1.67637	1.66064	1.66808	1.69741
774	All GND'd Irradiation	1.78264	1.78494	1.79360	1.79570	1.85362
765	Biased Irradiation	1.58402	1.59762	1.64130	1.64494	1.65791
766	Biased Irradiation	1.81258	1.79877	1.90818	1.86582	1.88541
767	Biased Irradiation	1.76009	1.73304	1.80517	1.79631	1.79697
768	Biased Irradiation	1.84115	1.88176	1.88495	1.89643	1.89517
769	Biased Irradiation	1.63019	1.62930	1.64639	1.62460	1.66081
723	Control Unit	1.91924	1.92592	1.95288	1.92650	1.95182
724	Control Unit	1.61023	1.62165	1.66574	1.62460	1.64815
	All GND'd Irradiation Statistics					
	Average All GND'd	1.74368	1.75661	1.75504	1.75995	1.79850
	Std Dev All GND'd	0.08838	0.08829	0.08889	0.09184	0.08804
	Ps90%/90% (+KTL) All GND'd	1.98601	1.99871	1.99878	2.01177	2.03991
	Ps90%/90% (-KTL) All GND'd	1.50134	1.51452	1.51131	1.50813	1.55708
	Biased Irradiation Statistics					
	Average Biased	1.72560	1.72810	1.77720	1.76562	1.77926
	Std Dev Biased	0.11320	0.11770	0.12760	0.12505	0.11594
	Ps90%/90% (+KTL) Biased	2.03600	2.05084	2.12708	2.10850	2.09718
	Ps90%/90% (-KTL) Biased	1.41521	1.40536	1.42732	1.42274	1.46134
	Specification MIN					
	Status (Measurements) All GND'd					
	Status (Measurements) Biased					
	Specification MAX	5	5	5		5
	Status (Measurements) All GND'd	PASS	PASS	PASS		PASS
	Status (Measurements) Biased	PASS	PASS	PASS		PASS
	Status (-KTL) All GND'd					
	Status (+KTL) All GND'd	PASS	PASS	PASS		PASS
	Status (-KTL) Biased					
	Status (+KTL) Biased	PASS	PASS	PASS		PASS

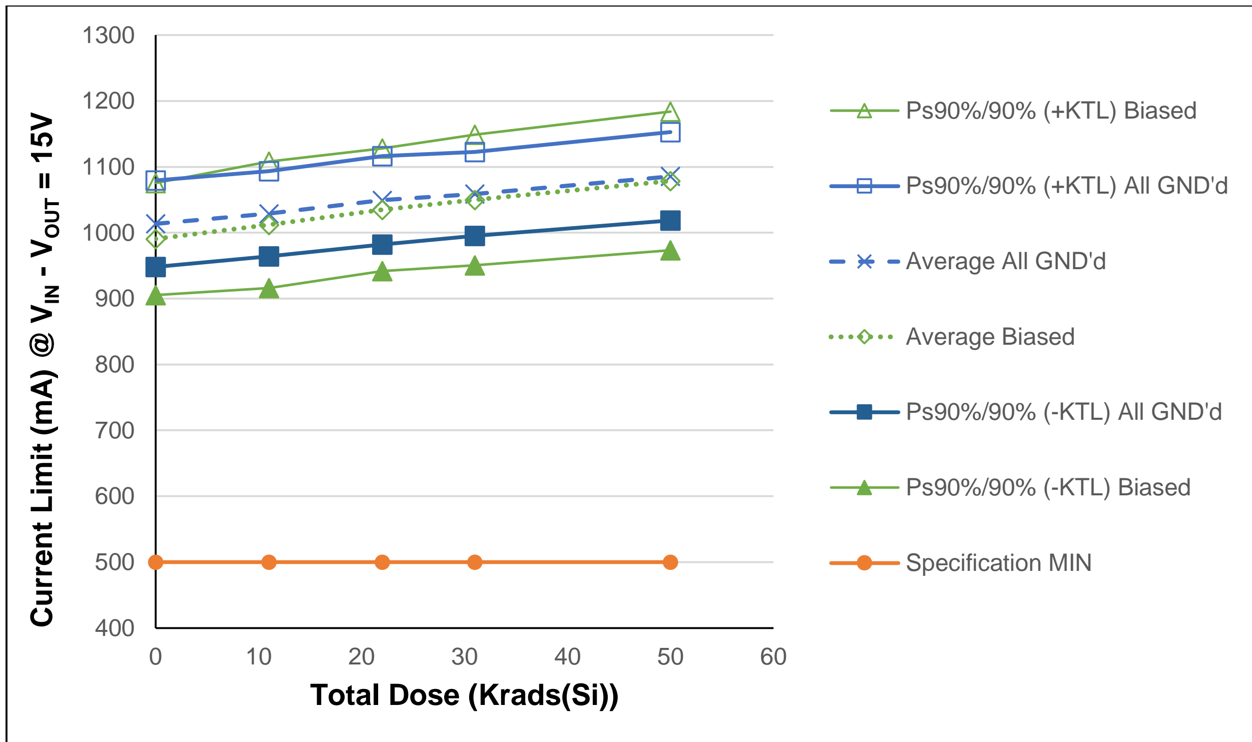

Figure 5.9: Plot of Current Limit @ $V_{IN} – V_{OUT}$ = 15V versus Total Dose

Table 5.9: Raw data table for current limit @ $V_{IN} – V_{OUT} \leq 15V$ versus total dose including the statistical calculations, maximum specification, and the status of the test (PASS/FAIL)

Parameter	Current Limit @ V_{IN} - V_{OUT} = 15V	Total Dose (Krads(Si)) @ 10 mrads/s				
Units	(mA)	0	11	22	31	50
770	All GND'd Irradiation	1013.014	1028.922	1051.368	1062.774	1093.904
771	All GND'd Irradiation	1046.276	1060.274	1082.367	1089.179	1116.890
772	All GND'd Irradiation	979.865	995.167	1014.619	1025.464	1050.642
773	All GND'd Irradiation	1007.659	1022.344	1042.090	1051.096	1075.502
774	All GND'd Irradiation	1021.238	1037.271	1056.048	1065.340	1090.834
765	Biased Irradiation	950.679	969.705	992.947	1006.041	1032.232
766	Biased Irradiation	1035.005	1064.150	1082.638	1102.503	1133.448
767	Biased Irradiation	985.983	1006.035	1027.116	1041.761	1070.479
768	Biased Irradiation	1002.033	1023.570	1051.510	1064.958	1096.445
769	Biased Irradiation	978.490	996.391	1019.332	1033.859	1059.713
723	Control Unit	1064.786	1062.098	1063.190	1065.885	1076.303
724	Control Unit	989.091	987.601	988.392	991.226	999.435
	All GND'd Irradiation Statistics					
	Average All GND'd	1013.610	1028.796	1049.298	1058.771	1085.554
	Std Dev All GND'd	23.978	23.639	24.485	23.195	24.492
	Ps90%/90% (+KTL) All GND'd	1079.357	1093.614	1116.435	1122.372	1152.712
	Ps90%/90% (-KTL) All GND'd	947.864	963.977	982.161	995.169	1018.397
	Biased Irradiation Statistics					
	Average Biased	990.438	1011.970	1034.709	1049.824	1078.463
	Std Dev Biased	31.081	35.077	33.977	36.197	38.403
	Ps90%/90% (+KTL) Biased	1075.661	1108.151	1127.872	1149.077	1183.766
	Ps90%/90% (-KTL) Biased	905.214	915.789	941.545	950.572	973.161
	Specification MIN	500	500	500		500
	Status (Measurements) All GND'd	PASS	PASS	PASS		PASS
	Status (Measurements) Biased	PASS	PASS	PASS		PASS
	Specification MAX					
	Status (Measurements) All GND'd					
	Status (Measurements) Biased					
	Status (-KTL) All GND'd	PASS	PASS	PASS		PASS
	Status (+KTL) All GND'd					
	Status (-KTL) Biased	PASS	PASS	PASS		PASS
	Status (+KTL) Biased					

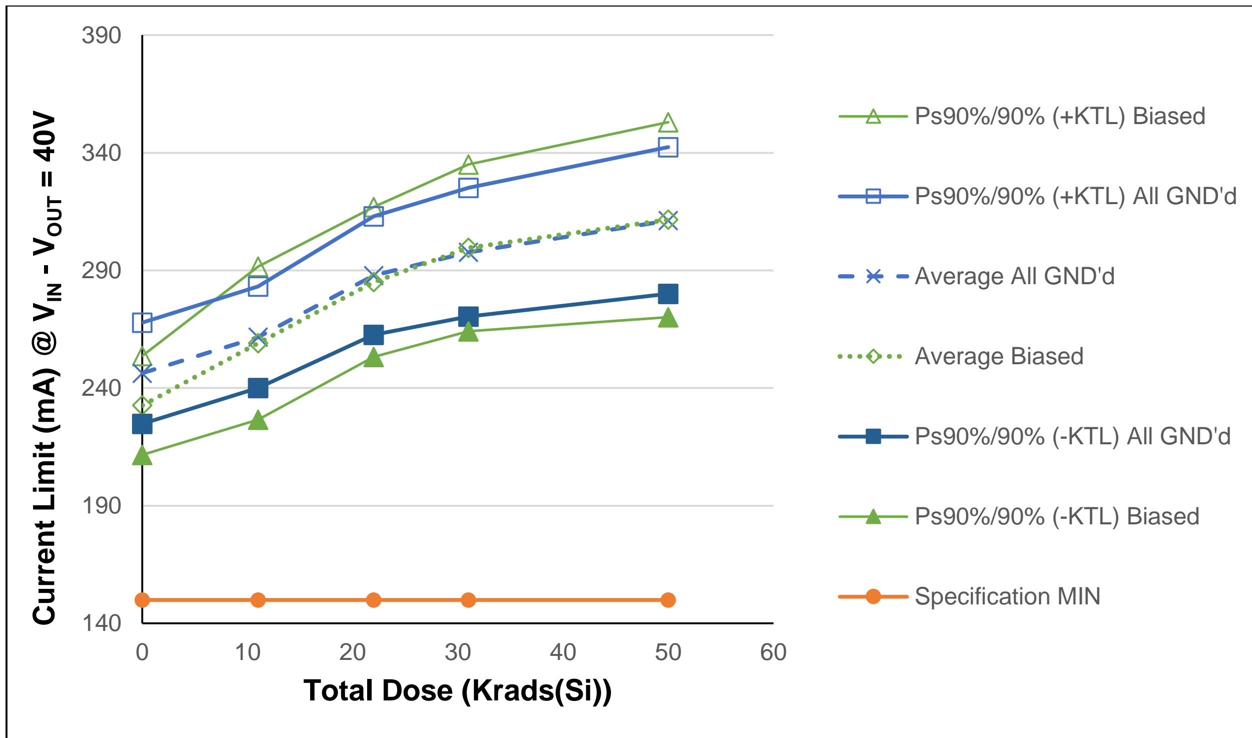

Figure 5.10: Plot of Current Limit @ $V_{IN} - V_{OUT} = 40V$ versus Total Dose

Table 5.10: Raw data table for current limit @ $V_{IN} - V_{OUT}$ = 40V versus total dose including the statistical calculations, maximum specification, and the status of the test (PASS/FAIL)

Parameter	Current Limit @ V_{IN} - V_{OUT} = 40V	Total Dose (Krads(Si)) @ 10 mrads/s				
Units	(mA)	0	11	22	31	50
770	All GND'd Irradiation	254.206	270.295	298.146	310.452	327.904
771	All GND'd Irradiation	250.041	264.817	291.857	300.902	314.118
772	All GND'd Irradiation	235.144	250.307	274.999	284.472	298.346
773	All GND'd Irradiation	250.977	265.612	292.070	301.150	312.279
774	All GND'd Irradiation	241.498	257.305	282.183	291.510	303.295
765	Biased Irradiation	225.145	247.262	273.760	287.155	297.544
766	Biased Irradiation	239.931	274.710	296.587	315.097	328.244
767	Biased Irradiation	235.202	261.588	285.321	299.116	311.661
768	Biased Irradiation	239.132	264.652	296.672	309.913	325.098
769	Biased Irradiation	223.863	247.160	273.094	286.693	295.588
723	Control Unit	248.412	246.006	251.739	255.429	247.790
724	Control Unit	226.792	224.162	229.397	233.226	225.552
	All GND'd Irradiation Statistics					
	Average All GND'd	246.373	261.667	287.851	297.697	311.188
	Std Dev All GND'd	7.840	7.874	9.181	9.976	11.363
	Ps90%/90% (+KTL) All GND'd	267.870	283.258	313.025	325.051	342.345
	Ps90%/90% (-KTL) All GND'd	224.876	240.076	262.677	270.343	280.032
	Biased Irradiation Statistics					
	Average Biased	232.655	259.074	285.087	299.594	311.627
	Std Dev Biased	7.666	11.868	11.604	12.925	15.109
	Ps90%/90% (+KTL) Biased	253.676	291.616	316.906	335.035	353.057
	Ps90%/90% (-KTL) Biased	211.634	226.533	253.268	264.154	270.197
	Specification MIN	150	150	150		150
	Status (Measurements) All GND'd	PASS	PASS	PASS		PASS
	Status (Measurements) Biased	PASS	PASS	PASS		PASS
	Specification MAX					
	Status (Measurements) All GND'd					
	Status (Measurements) Biased					
	Status (-KTL) All GND'd	PASS	PASS	PASS		PASS
	Status (+KTL) All GND'd					
	Status (-KTL) Biased	PASS	PASS	PASS		PASS
	Status (+KTL) Biased					

Appendix A

Figure A1: Top View showing ID and Date Code

Figure A2: Side View showing serial number

Appendix B

Radiation Bias Connection Tables

Table B1: Biased Conditions

PIN	FUNCTION	CONNECTION / BIAS
1	INPUT	+15V,to -15V via 0.1µF
2	ADJUST	To -15V via 2KΩ
3	OUTPUT	To -15V via 61.9Ω

Table B2: All GND'd

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

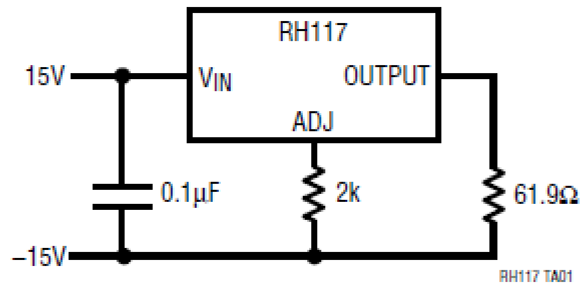

Figure B1: Total Dose Bias Circuit

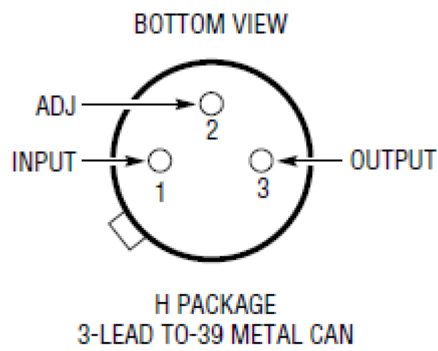

Figure B2: Pin-Out

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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LINEAR TECHNOLOGY

REQUEST FOR AND RESULTS OF TESTS

PAGE NO. 1 | NO. OF PAGES 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)* Same as block 2 CONTRACT NUMBER CRADA CR-08-17	4. MANUFACTURING PLANT NAME AND ADDRESS *(Include ZIP Code)* 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

DD FORM 1222, FEB 63 (EF) REPLACES DD FORM 1222, 1 JUL 59, WHICH IS OBSOLETE

Continuation of DD Form 1222 Experiment #: 2014-NRC-009 Page 15 of 36

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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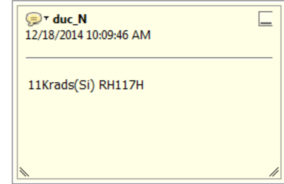
4.

Test Performed			Results of Test				Sample Result / Requirements	Step No.
20141008 11:45:00	to	20141014 16:21:06	5.340E+03	rad(SiO2) at	5.989E-01	rad(SiO2)/min	BIPC150-RH6016, WFR #10, S/Ns E1, H1, I1: 5.34 krad SD, 149.854 krad TD	34
20141008 11:45:00	to	20141014 16:21:06	5.340E+03	rad(SiO2) at	5.989E-01	rad(SiO2)/min	BIPC150, S/Ns D4LTC & H4LTC: 5.34 krad SD, 86.855 krad TD	34
20141008 11:45:00	to	20141014 16:21:06	5.340E+03	rad(SiO2) at	5.989E-01	rad(SiO2)/min	BIPC150 SB Devices, S/Ns H5LTC-GP (WFR #1) & H6LTC-GP (WFR #2): 5.34 krad SD, 66.35 krad TD	34
20141008 11:45:00	to	20141014 16:21:06	5.340E+03	rad(SiO2) at	5.989E-01	rad(SiO2)/min	RH3480-J14, S/Ns 2-8: 5.34 krad SD, 70.048 krad TD	34
20141008 11:45:00	to	20141014 16:21:06	5.340E+03	rad(SiO2) at	5.989E-01	rad(SiO2)/min	RH137K (6RH137BKK*12), WFR #3, S/Ns 0237-0243, 0245-0247: 5.34 krad SD, 64.44 krad TD	34
20141008 11:45:00	to	20141014 16:21:06	5.340E+03	rad(SiO2) at	5.989E-01	rad(SiO2)/min	RH1498MW, WFR #7, S/Ns 821-830: 5.34 krad SD, 117.989 krad TD	34
20141008 11:45:00	to	20141014 16:21:06	5.340E+03	rad(SiO2) at	5.989E-01	rad(SiO2)/min	RH1965MK, WFR #2, S/Ns 1, 3-9, 11-12: 5.34 krad SD, 117.989 krad TD	34
20141008 11:45:00	to	20141014 16:21:06	5.340E+03	rad(SiO2) at	5.989E-01	rad(SiO2)/min	RH6016MW, WFR #8, S/Ns 1-5: 5.34 krad SD, 42.589 krad TD	34
20141008 11:45:00	to	20141014 16:21:06	5.340E+03	rad(SiO2) at	5.989E-01	rad(SiO2)/min	RH1084MK-CS, WFR #5, 4% old, S/Ns 1-8, 11-12: 5.34 krad SD, 11.109 krad TD	34
20141008 11:45:00	to	20141014 16:21:06	5.340E+03	rad(SiO2) at	5.989E-01	rad(SiO2)/min	RH1084MK-CS, WFR #5, 15%, S/Ns 1-2, 5-7, 9, 11-12, 14-15: 5.34 krad SD, 11.109 krad TD	34
20141008 11:45:00	to	20141014 16:21:06	5.340E+03	rad(SiO2) at	5.989E-01	rad(SiO2)/min	RH1084MK-CS, WFR #5, 4% new, S/Ns 1-3, 6, 8-12, 14: 5.34 krad SD, 11.109 krad TD	34
20141008 11:45:00	to	20141014 16:21:06	5.340E+03	rad(SiO2) at	5.989E-01	rad(SiO2)/min	RH117H, WFR #10, S/Ns 0765-0774: 5.34 krad SD, 11.109 krad TD	34
20141008 11:45:00	to	20141014 16:21:06	5.340E+03	rad(SiO2) at	5.989E-01	rad(SiO2)/min	BIPC150-NTK16, WFR #6, S/Ns H8-H9: 5.34 krad SD, 11.109 krad T	34
20141008 11:45:00	to	20141014 16:21:06	5.340E+03	rad(SiO2) at	5.989E-01	rad(SiO2)/min	BIPC150-NTK52L, WFR #6, S/Ns H10-H11: 5.34 krad SD, 11.109 krad TD	34
20141008 11:45:00	to	20141014 16:21:06	5.340E+03	rad(SiO2) at	5.989E-01	rad(SiO2)/min	RH6016MW, WFR #8, S/Ns 10-13, 16-17, 20, 22, 25-26: 5.34 krad SD, 5.34 krad TD	34
20141014 18:48:00	to	20141016 12:02:45	1.480E+03	rad(SiO2) at	5.980E-01	rad(SiO2)/min	RH3480-J14, S/Ns 2-8: 1.48 krad SD, 71.528 krad TD	35
20141014 18:48:00	to	20141016 12:02:45	1.480E+03	rad(SiO2) at	5.980E-01	rad(SiO2)/min	RH137K (6RH137BKK*12), WFR #3, S/Ns 0237-0243, 0245-0247: 1.48 krad SD, 65.92 krad TD	35
20141014 18:48:00	to	20141016 12:02:45	1.480E+03	rad(SiO2) at	5.980E-01	rad(SiO2)/min	RH1498MW, WFR #7, S/Ns 821-830: 1.48 krad SD, 119.469 krad TD	35
20141014 18:48:00	to	20141016 12:02:45	1.480E+03	rad(SiO2) at	5.980E-01	rad(SiO2)/min	RH6016MW, WFR #8, S/Ns 1-5: 1.48 krad SD, 44.069 krad TD	35
20141014 18:48:00	to	20141016 12:02:45	1.480E+03	rad(SiO2) at	5.980E-01	rad(SiO2)/min	RH6016MW, WFR #8, S/Ns 10-13, 16-17, 20, 22, 25-26: 1.48 krad SD, 6.82 krad TD	35

Total Doses reported are ± 13.80% at 95% confidence (Step No. 34)
13.71% at 95% confidence (Step No. 35)



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: ± 7.90%
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: RH6016MW, WFR #8
   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.
20141016 20:05:00 to 20141020 16:44:23	3.321E+03 rad(SiO2) at 5.974E-01 rad(SiO2)/min	BIPC150-RH6016, WFR #10, S/Ns E1, H1, I1: 3.321 krad SD, 153.175 krad TD	36
20141016 20:05:00 to 20141020 16:44:23	3.321E+03 rad(SiO2) at 5.974E-01 rad(SiO2)/min	BIPC150, WFR #6, S/Ns D4LTC & H4LTC: 3.321 krad SD, 90.176 krad TD	36
20141016 20:05:00 to 20141020 16:44:23	3.321E+03 rad(SiO2) at 5.974E-01 rad(SiO2)/min	RH3480-J14, WFR #8, S/Ns 2-8: 3.321 krad SD, 74.849 krad TD	36
20141016 20:05:00 to 20141020 16:44:23	3.321E+03 rad(SiO2) at 5.974E-01 rad(SiO2)/min	RH137K (6RH137BKK*12), WFR #3, S/Ns 0237-0243, 0245-0247: 3.321 krad SD, 69.241 krad TD	36
20141016 20:05:00 to 20141020 16:44:23	3.321E+03 rad(SiO2) at 5.974E-01 rad(SiO2)/min	RH1498MW, WFR #7, S/Ns 821-830: 3.321 krad SD, 122.79 krad TD	36
20141016 20:05:00 to 20141020 16:44:23	3.321E+03 rad(SiO2) at 5.974E-01 rad(SiO2)/min	RH1965MK, WFR #2, S/Ns 1, 3-9, 11-12: 3.321 krad SD, 121.31 krad TD	36
20141016 20:05:00 to 20141020 16:44:23	3.321E+03 rad(SiO2) at 5.974E-01 rad(SiO2)/min	RH6016MW, WFR #8, S/Ns 1-5: 3.321 krad SD, 47.39 krad TD	36
20141016 20:05:00 to 20141020 16:44:23	3.321E+03 rad(SiO2) at 5.974E-01 rad(SiO2)/min	RH1084MK-CS, WFR #5, 4% old, S/Ns 1-8, 11-12: 3.321 krad SD, 14.43 krad TD	36
20141016 20:05:00 to 20141020 16:44:23	3.321E+03 rad(SiO2) at 5.974E-01 rad(SiO2)/min	RH1084MK-CS, WFR #5, 15%, S/Ns 1-2, 5-7, 9, 11-12, 14-15: 3.321 krad SD, 14.43 krad TD	36
20141016 20:05:00 to 20141020 16:44:23	3.321E+03 rad(SiO2) at 5.974E-01 rad(SiO2)/min	RH1084MK-CS, WFR #5, 4% new, S/Ns 1-3, 6, 8-12, 14: 3.321 krad SD, 14.43 krad TD	36
20141016 20:05:00 to 20141020 16:44:23	3.321E+03 rad(SiO2) at 5.974E-01 rad(SiO2)/min	RH117H, WFR #10, S/Ns 0765-0774: 3.321 krad SD, 14.43 krad TD	36
20141016 20:05:00 to 20141020 16:44:23	3.321E+03 rad(SiO2) at 5.974E-01 rad(SiO2)/min	BIPC150-NTK16, WFR #6, S/Ns H8-H9: 3.321 krad SD, 14.43 krad TD	36
20141016 20:05:00 to 20141020 16:44:23	3.321E+03 rad(SiO2) at 5.974E-01 rad(SiO2)/min	BIPC150-NTK52L, WFR #6, S/Ns H10-H11: 3.321 krad SD, 14.43 krad TD	36
20141016 20:05:00 to 20141020 16:44:23	3.321E+03 rad(SiO2) at 5.974E-01 rad(SiO2)/min	RH6016MW, WFR #8, S/Ns 10-13, 16-17, 20, 22, 25-26: 3.321 krad SD, 10.141 krad TD	36
20141016 20:05:00 to 20141020 16:44:23	3.321E+03 rad(SiO2) at 5.974E-01 rad(SiO2)/min	LTC2378IMS-20#PBF*01, WFR #N/A, S/Ns 81-95: 3.321 krad SD, 3.321 krad TD	36
20141016 20:05:00 to 20141020 16:44:23	3.321E+03 rad(SiO2) at 5.974E-01 rad(SiO2)/min	RH3083MLCC20M, WFR #2, S/Ns 1-10: 3.321 krad SD, 3.321 krad TD	36
20141016 20:05:00 to 20141020 16:44:23	3.321E+03 rad(SiO2) at 5.974E-01 rad(SiO2)/min	BIPC150-LCC20M-H1, WFR #8, S/N HLCC1: 3.321 krad SD, 3.321 krad TD	36

Total Doses reported are ± 13.75% 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: ± 7.90%
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:
      LTC2378IMS-20#PBD*01
      RH3083MLCC20M, WFR #2
      BIPC150-LCC20M-H1, WFR #8
      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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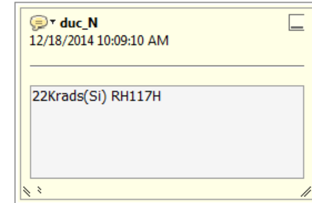
4.

Test Performed	Results of Test	Sample Result / Requirements	Step No.
20141020 16:50:00 to 20141029 15:40:37	7.710E+03 rad(SiO2) at 5.981E-01 rad(SiO2)/min	BIPC150-RH6016, WFR #10, S/Ns E1, H1, I1: 7.71 krad SD, 160.885 krad TD	37
20141020 16:50:00 to 20141029 15:40:37	7.710E+03 rad(SiO2) at 5.981E-01 rad(SiO2)/min	BIPC150, WFR #6, S/Ns D4LTC & H4LTC: 7.71 krad SD, 97.886 krad TD	37
20141020 16:50:00 to 20141029 15:40:37	7.710E+03 rad(SiO2) at 5.981E-01 rad(SiO2)/min	RH3480-J14, WFR #8, S/Ns 2-8: 7.71 krad SD, 82.559 krad TD	37
20141020 16:50:00 to 20141029 15:40:37	7.710E+03 rad(SiO2) at 5.981E-01 rad(SiO2)/min	RH137K (6RH137BKK*12), WFR #3, S/Ns 0237-0243, 0245-0247: 7.71 krad SD, 76.951 krad TD	37
20141020 16:50:00 to 20141029 15:40:37	7.710E+03 rad(SiO2) at 5.981E-01 rad(SiO2)/min	RH1498MW, WFR #7, S/Ns 821-830: 7.71 krad SD, 130.5 krad TD	37
20141020 16:50:00 to 20141029 15:40:37	7.710E+03 rad(SiO2) at 5.981E-01 rad(SiO2)/min	RH1965MK, WFR #2, S/Ns 1, 3-9, 11-12: 7.71 krad SD, 129.02 krad TD	37
20141020 16:50:00 to 20141029 15:40:37	7.710E+03 rad(SiO2) at 5.981E-01 rad(SiO2)/min	RH6016MW, WFR #8, S/Ns 1-5: 7.71 krad SD, 55.1 krad TD	37
20141020 16:50:00 to 20141029 15:40:37	7.710E+03 rad(SiO2) at 5.981E-01 rad(SiO2)/min	RH1084MK-CS, WFR #5, 4% old, S/Ns 1-8, 11-12: 7.71 krad SD, 22.14 krad TD	37
20141020 16:50:00 to 20141029 15:40:37	7.710E+03 rad(SiO2) at 5.981E-01 rad(SiO2)/min	RH1084MK-CS, WFR #5, 15%, S/Ns 1-2, 5-7, 9, 11-12, 14-15: 7.71 krad SD, 22.14 krad TD	37
20141020 16:50:00 to 20141029 15:40:37	7.710E+03 rad(SiO2) at 5.981E-01 rad(SiO2)/min	RH1084MK-CS, WFR #5, 4% new, S/Ns 1-3, 6, 8-12, 14: 7.71 krad SD, 22.14 krad TD	37
20141020 16:50:00 to 20141029 15:40:37	7.710E+03 rad(SiO2) at 5.981E-01 rad(SiO2)/min	RH117H, WFR #10, S/Ns 0765-0774: 7.71 krad SD, 22.14 krad TD	37
20141020 16:50:00 to 20141029 15:40:37	7.710E+03 rad(SiO2) at 5.981E-01 rad(SiO2)/min	BIPC150-NTK16, WFR #6, S/Ns H8-H9: 7.71 krad SD, 22.14 krad TD	37
20141020 16:50:00 to 20141029 15:40:37	7.710E+03 rad(SiO2) at 5.981E-01 rad(SiO2)/min	BIPC150-NTK52L, WFR #6, S/Ns H10-H11: 7.71 krad SD, 22.14 krad TD	37
20141020 16:50:00 to 20141029 15:40:37	7.710E+03 rad(SiO2) at 5.981E-01 rad(SiO2)/min	RH6016MW, WFR #8, S/Ns 10-13, 16-17, 20, 22, 25-26: 7.71 krad SD, 17.851 krad TD	37
20141020 16:50:00 to 20141029 15:40:37	7.710E+03 rad(SiO2) at 5.981E-01 rad(SiO2)/min	LTC2378IMS-20#PBF*01, WFR #N/A, S/Ns 81-95: 7.71 krad SD, 11.031 krad TD	37
20141020 16:50:00 to 20141029 15:40:37	7.710E+03 rad(SiO2) at 5.981E-01 rad(SiO2)/min	RH3083MLCC20M, WFR #2, S/Ns 1-10: 7.71 krad SD, 11.031 krad TD	37
20141020 16:50:00 to 20141029 15:40:37	7.710E+03 rad(SiO2) at 5.981E-01 rad(SiO2)/min	BIPC150-LCC20M-H1, WFR #8, S/N HLCC1: 7.71 krad SD, 11.031 krad TD	37
20141029 18:00:00 to 20141030 09:21:11	5.500E+02 rad(SiO2) at 5.971E-01 rad(SiO2)/min	BIPC150-RH6016, WFR #10, S/Ns H1, I1: 0.55 krad SD, 161.435 krad TD	38
20141029 18:00:00 to 20141030 09:21:11	5.500E+02 rad(SiO2) at 5.971E-01 rad(SiO2)/min	BIPC150, WFR #6, S/Ns D4LTC & H4LTC: 0.55 krad SD, 98.436 krad TD	38
20141029 18:00:00 to 20141030 09:21:11	5.500E+02 rad(SiO2) at 5.971E-01 rad(SiO2)/min	RH3480-J14, WFR #8, S/Ns 2-8: 0.55 krad SD, 83.109 krad TD	38
20141029 18:00:00 to 20141030 09:21:11	5.500E+02 rad(SiO2) at 5.971E-01 rad(SiO2)/min	RH137K (6RH137BKK*12), WFR #3, S/Ns 0237-0243, 0245-0247: 0.55 krad SD, 77.501 krad TD	38
20141029 18:00:00 to 20141030 09:21:11	5.500E+02 rad(SiO2) at 5.971E-01 rad(SiO2)/min	RH1965MK, WFR #2, S/Ns 1, 3-9, 11-12: 0.55 krad SD, 129.57 krad TD	38
20141029 18:00:00 to 20141030 09:21:11	5.500E+02 rad(SiO2) at 5.971E-01 rad(SiO2)/min	BIPC150-NTK16, WFR #6, S/Ns H8-H9: 0.55 krad SD, 22.69 krad TD	38
20141029 18:00:00 to 20141030 09:21:11	5.500E+02 rad(SiO2) at 5.971E-01 rad(SiO2)/min	BIPC150-NTK52L, WFR #6, S/Ns H10-H11: 0.55 krad SD, 22.69 krad TD	38
20141029 18:00:00 to 20141030 09:21:11	5.500E+02 rad(SiO2) at 5.971E-01 rad(SiO2)/min	LTC2378IMS-20#PBF*01, WFR #N/A, S/Ns 81-95: 0.55 krad SD, 11.581 krad TD	38
20141029 18:00:00 to 20141030 09:21:11	5.500E+02 rad(SiO2) at 5.971E-01 rad(SiO2)/min	BIPC150-H1NBK & -H2NBK, WFR #6, S/Ns H1NBK & H2NBK: 0.55 krad SD, 0.55 krad TD	38
20141029 18:00:00 to 20141030 09:21:11	5.500E+02 rad(SiO2) at 5.971E-01 rad(SiO2)/min	BIPC150-LCC20M, WFR #8, S/Ns H2LCC & H3LCC: 0.55 krad SD, 0.55 krad TD	38
20141029 18:00:00 to 20141030 09:21:11	5.500E+02 rad(SiO2) at 5.971E-01 rad(SiO2)/min	RH6654-2.5MH, WFR #3, S/Ns 1-10: 0.55 krad SD, 0.55 krad TD	38

Total Doses reported are ± 13.88% at 95% confidence (Step No. 37)
13.73% at 95% confidence (Step No. 38)



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. 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:
      BIPC150-H1NBK & -H2NBK, WFR #6
      BIPC150-LCC20M, WFR #8, S/Ns H2LCC & H3LCC
      RH6654-2.5MH, 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.

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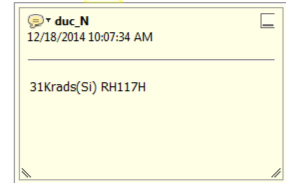
4. Test Performed	Results of Test	Sample Result	Requirements	Step No.
20141030 17:21:00 to 20141110 15:12:26	9.360E+03 rad(SiO2) at 5.957E-01 rad(SiO2)/min	BIPC150-RH6016, WFR #10, S/N E1: 9.36 krad SD, 170.245 krad TD		39
20141030 17:21:00 to 20141110 15:12:26	9.360E+03 rad(SiO2) at 5.957E-01 rad(SiO2)/min	BIPC150, WFR #6, S/Ns D4LTC & H4LTC: 9.36 krad SD, 107.796 krad TD		39
20141030 17:21:00 to 20141110 15:12:26	9.360E+03 rad(SiO2) at 5.957E-01 rad(SiO2)/min	RH3480-J14, WFR #8, S/Ns 2-8: 9.36 krad SD, 92.469 krad TD		39
20141030 17:21:00 to 20141110 15:12:26	9.360E+03 rad(SiO2) at 5.957E-01 rad(SiO2)/min	RH137K (6RH137BKK*12), WFR #3, S/Ns 0237-0243, 0245-0247: 9.36 krad SD, 86.861 krad TD		39
20141030 17:21:00 to 20141110 15:12:26	9.360E+03 rad(SiO2) at 5.957E-01 rad(SiO2)/min	RH1498MW, WFR #7, S/Ns 821-830: 9.36 krad SD, 139.86 krad TD		39
20141030 17:21:00 to 20141110 15:12:26	9.360E+03 rad(SiO2) at 5.957E-01 rad(SiO2)/min	RH1965MK, WFR #2, S/Ns 1, 3-9, 11-12: 9.36 krad SD, 138.93 krad TD		39
20141030 17:21:00 to 20141110 15:12:26	9.360E+03 rad(SiO2) at 5.957E-01 rad(SiO2)/min	RH6016MW, WFR #8, S/Ns 1-5: 9.36 krad SD, 64.46 krad TD		39
20141030 17:21:00 to 20141110 15:12:26	9.360E+03 rad(SiO2) at 5.957E-01 rad(SiO2)/min	RH1084MK-CS, WFR #5, 4% old, S/Ns 1-8, 11-12: 9.36 krad SD, 31.5 krad TD		39
20141030 17:21:00 to 20141110 15:12:26	9.360E+03 rad(SiO2) at 5.957E-01 rad(SiO2)/min	RH1084MK-CS, WFR #5, 15%, S/Ns 1-2, 5-7, 9, 11-12, 14-15: 9.36 krad SD, 31.5 krad TD		39
20141030 17:21:00 to 20141110 15:12:26	9.360E+03 rad(SiO2) at 5.957E-01 rad(SiO2)/min	RH1084MK-CS, WFR #5, 4% new, S/Ns 1-3, 6, 8-12, 14: 9.36 krad SD, 31.5 krad TD		39
20141030 17:21:00 to 20141110 15:12:26	9.360E+03 rad(SiO2) at 5.957E-01 rad(SiO2)/min	RH117H, WFR #10, S/Ns 0765-0774: 9.36 krad SD, 31.5 krad TD		39
20141030 17:21:00 to 20141110 15:12:26	9.360E+03 rad(SiO2) at 5.957E-01 rad(SiO2)/min	BIPC150-NTK16, WFR #6, S/Ns H8-H9: 9.36 krad SD, 32.05 krad TD		39
20141030 17:21:00 to 20141110 15:12:26	9.360E+03 rad(SiO2) at 5.957E-01 rad(SiO2)/min	BIPC150-NTK52L, WFR #6, S/Ns H10-H11: 9.36 krad SD, 32.05 krad TD		39
20141030 17:21:00 to 20141110 15:12:26	9.360E+03 rad(SiO2) at 5.957E-01 rad(SiO2)/min	RH6016MW, WFR #8, S/Ns 10-13, 16-17, 20, 22, 25-26: 9.36 krad SD, 27.211 krad TD		39
20141030 17:21:00 to 20141110 15:12:26	9.360E+03 rad(SiO2) at 5.957E-01 rad(SiO2)/min	LTC2378IMS-20#PBF*01, WFR #N/A, S/Ns 81-95: 9.36 krad SD, 20.941 krad TD		39
20141030 17:21:00 to 20141110 15:12:26	9.360E+03 rad(SiO2) at 5.957E-01 rad(SiO2)/min	RH3083MLCC20M, WFR #2, S/Ns 1-10: 9.36 krad SD, 20.391 krad TD		39
20141030 17:21:00 to 20141110 15:12:26	9.360E+03 rad(SiO2) at 5.957E-01 rad(SiO2)/min	BIPC150-LCC20M-H1, WFR #8, S/N HLCC1: 9.36 krad SD, 20.391 krad TD		39
20141030 17:21:00 to 20141110 15:12:26	9.360E+03 rad(SiO2) at 5.957E-01 rad(SiO2)/min	BIPC150-RH6016, WFR #10, S/Ns H1, I1: 9.36 krad SD, 170.795 krad TD		39
20141030 17:21:00 to 20141110 15:12:26	9.360E+03 rad(SiO2) at 5.957E-01 rad(SiO2)/min	BIPC150-H1NBK & -H2NBK, WFR #6, S/Ns H1NBK & H2NBK: 9.36 krad SD, 9.91 krad TD		39
20141030 17:21:00 to 20141110 15:12:26	9.360E+03 rad(SiO2) at 5.957E-01 rad(SiO2)/min	BIPC150-LCC20M, WFR #8, S/Ns H2LCC & H3LCC: 9.36 krad SD, 9.91 krad TD		39
20141030 17:21:00 to 20141110 15:12:26	9.360E+03 rad(SiO2) at 5.957E-01 rad(SiO2)/min	RH6654-2.5MH, WFR #3, S/Ns 1-10: 9.36 krad SD, 9.91 krad TD		39



Total Doses reported are ± 13.92% 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. 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.
20141110 15:07:00 to 20141112 15:54:32	1.740E+03 rad(SiO2) at 5.944E-01 rad(SiO2)/min	BIPC150-RH6016, WFR #10, S/N E1:	1.74 krad SD, 171.985 krad TD	40
20141110 15:07:00 to 20141112 15:54:32	1.740E+03 rad(SiO2) at 5.944E-01 rad(SiO2)/min	BIPC150, WFR #6, S/Ns D4LTC & H4LTC:	1.74 krad SD, 109.536 krad TD	40
20141110 15:07:00 to 20141112 15:54:32	1.740E+03 rad(SiO2) at 5.944E-01 rad(SiO2)/min	RH3480-J14, WFR #8, S/Ns 2-8:	1.74 krad SD, 94.209 krad TD	40
20141110 15:07:00 to 20141112 15:54:32	1.740E+03 rad(SiO2) at 5.944E-01 rad(SiO2)/min	RH137K (6RH137BKK*12), WFR #3, S/Ns 0237-0243, 0245-0247:	1.74 krad SD, 88.601 krad TD	40
20141110 15:07:00 to 20141112 15:54:32	1.740E+03 rad(SiO2) at 5.944E-01 rad(SiO2)/min	RH1498MW, WFR #7, S/Ns 821-830:	1.74 krad SD, 141.6 krad TD	40
20141110 15:07:00 to 20141112 15:54:32	1.740E+03 rad(SiO2) at 5.944E-01 rad(SiO2)/min	RH1965MK, WFR #2, S/Ns 1, 3-9, 11-12:	1.74 krad SD, 140.67 krad TD	40
20141110 15:07:00 to 20141112 15:54:32	1.740E+03 rad(SiO2) at 5.944E-01 rad(SiO2)/min	RH6016MW, WFR #8, S/Ns 1-5:	1.74 krad SD, 66.2 krad TD	40
20141110 15:07:00 to 20141112 15:54:32	1.740E+03 rad(SiO2) at 5.944E-01 rad(SiO2)/min	BIPC150-NTK16, WFR #6, S/Ns H8-H9:	1.74 krad SD, 33.79 krad TD	40
20141110 15:07:00 to 20141112 15:54:32	1.740E+03 rad(SiO2) at 5.944E-01 rad(SiO2)/min	BIPC150-NTK52L, WFR #6, S/Ns H10-H11:	1.74 krad SD, 33.79 krad TD	40
20141110 15:07:00 to 20141112 15:54:32	1.740E+03 rad(SiO2) at 5.944E-01 rad(SiO2)/min	LTC2378IMS-20#PBF*01, WFR #N/A, S/Ns 86-95:	1.74 krad SD, 22.681 krad TD	40
20141110 15:07:00 to 20141112 15:54:32	1.740E+03 rad(SiO2) at 5.944E-01 rad(SiO2)/min	RH3083MLCC20M, WFR #2, S/Ns 1-10:	1.74 krad SD, 22.131 krad TD	40
20141110 15:07:00 to 20141112 15:54:32	1.740E+03 rad(SiO2) at 5.944E-01 rad(SiO2)/min	BIPC150-LCC20M-H1, WFR #8, S/N HLCC1:	1.74 krad SD, 22.131 krad TD	40
20141110 15:07:00 to 20141112 15:54:32	1.740E+03 rad(SiO2) at 5.944E-01 rad(SiO2)/min	BIPC150-RH6016, WFR #10, S/Ns H1, I1:	1.74 krad SD, 172.535 krad TD	40
20141110 15:07:00 to 20141112 15:54:32	1.740E+03 rad(SiO2) at 5.944E-01 rad(SiO2)/min	RH6654-2.5MH, WFR #3, S/Ns 1-10:	1.74 krad SD, 11.65 krad TD	40

Total Doses reported are ± 13.76% 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. 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.
20141112 17:25:00 to 20141124 13:20:59	1.010E+04 rad(SiO2) at	5.929E-01 rad(SiO2)/min	BIPC150-RH6016, WFR #10, S/N E1: 10.1 krad SD, 182.085 krad TD	41
20141112 17:25:00 to 20141124 13:20:59	1.010E+04 rad(SiO2) at	5.929E-01 rad(SiO2)/min	BIPC150, WFR #6, S/Ns D4LTC & H4LTC: 10.1 krad SD, 119.636 krad TD	41
20141112 17:25:00 to 20141124 13:20:59	1.010E+04 rad(SiO2) at	5.929E-01 rad(SiO2)/min	RH3480-J14, WFR #8, S/Ns 2-8: 10.1 krad SD, 104.309 krad TD	41
20141112 17:25:00 to 20141124 13:20:59	1.010E+04 rad(SiO2) at	5.929E-01 rad(SiO2)/min	RH137K (6RH137BKK*12), WFR #3, S/Ns 0237-0243, 0245-0247: 10.1 krad SD, 98.701 krad TD	41
20141112 17:25:00 to 20141124 13:20:59	1.010E+04 rad(SiO2) at	5.929E-01 rad(SiO2)/min	RH1498MW, WFR #7, S/Ns 821-830: 10.1 krad SD, 151.7 krad TD	41
20141112 17:25:00 to 20141124 13:20:59	1.010E+04 rad(SiO2) at	5.929E-01 rad(SiO2)/min	RH1965MK, WFR #2, S/Ns 1, 3-9, 11-12: 10.1 krad SD, 150.77 krad TD	41
20141112 17:25:00 to 20141124 13:20:59	1.010E+04 rad(SiO2) at	5.929E-01 rad(SiO2)/min	RH6016MW, WFR #8, S/Ns 1-5: 10.1 krad SD, 76.3 krad TD	41
20141112 17:25:00 to 20141124 13:20:59	1.010E+04 rad(SiO2) at	5.929E-01 rad(SiO2)/min	BIPC150-NTK16, WFR #6, S/Ns H8-H9: 10.1 krad SD, 43.89 krad TD	41
20141112 17:25:00 to 20141124 13:20:59	1.010E+04 rad(SiO2) at	5.929E-01 rad(SiO2)/min	BIPC150-NTK52L, WFR #6, S/Ns H10-H11: 10.1 krad SD, 43.89 krad TD	41
20141112 17:25:00 to 20141124 13:20:59	1.010E+04 rad(SiO2) at	5.929E-01 rad(SiO2)/min	LTC2378IMS-20#PBF*01, WFR #N/A, S/Ns 86-95: 10.1 krad SD, 32.781 krad TD	41
20141112 17:25:00 to 20141124 13:20:59	1.010E+04 rad(SiO2) at	5.929E-01 rad(SiO2)/min	RH3083MLCC20M, WFR #2, S/Ns 1-10: 10.1 krad SD, 32.231 krad TD	41
20141112 17:25:00 to 20141124 13:20:59	1.010E+04 rad(SiO2) at	5.929E-01 rad(SiO2)/min	BIPC150-LCC20M-H1, WFR #8, S/N HLCC1: 10.1 krad SD, 32.231 krad TD	41
20141112 17:25:00 to 20141124 13:20:59	1.010E+04 rad(SiO2) at	5.929E-01 rad(SiO2)/min	BIPC150-RH6016, WFR #10, S/Ns H1, I1: 10.1 krad SD, 182.635 krad TD	41
20141112 17:25:00 to 20141124 13:20:59	1.010E+04 rad(SiO2) at	5.929E-01 rad(SiO2)/min	RH6654-2.5MH, WFR #3, S/Ns 1-10: 10.1 krad SD, 21.75 krad TD	41
20141112 17:25:00 to 20141124 13:20:59	1.010E+04 rad(SiO2) at	5.929E-01 rad(SiO2)/min	RH1084MK-CS, WFR #5, 4% old, S/Ns 1-8, 11-12: 10.1 krad SD, 41.6 krad TD	41
20141112 17:25:00 to 20141124 13:20:59	1.010E+04 rad(SiO2) at	5.929E-01 rad(SiO2)/min	RH1084MK-CS, WFR #5, 15%, S/Ns 1-2, 5-7, 9, 11-12, 14-15: 10.1 krad SD, 41.6 krad TD	41
20141112 17:25:00 to 20141124 13:20:59	1.010E+04 rad(SiO2) at	5.929E-01 rad(SiO2)/min	RH1084MK-CS, WFR #5, 4% new, S/Ns 1-3, 6, 8-12, 14: 10.1 krad SD, 41.6 krad TD	41
20141112 17:25:00 to 20141124 13:20:59	1.010E+04 rad(SiO2) at	5.929E-01 rad(SiO2)/min	RH117H, WFR #10, S/Ns 0765-0774: 10.1 krad SD, 41.6 krad TD	41
20141112 17:25:00 to 20141124 13:20:59	1.010E+04 rad(SiO2) at	5.929E-01 rad(SiO2)/min	RH6016MW, WFR #8, S/Ns 10-13, 16-17, 20, 22, 25-26: 10.1 krad SD, 37.311 krad TD	41
20141112 17:25:00 to 20141124 13:20:59	1.010E+04 rad(SiO2) at	5.929E-01 rad(SiO2)/min	LTC2378IMS-20#PBF*01, WFR #N/A, S/Ns 81-85: 10.1 krad SD, 31.041 krad TD	41
20141112 17:25:00 to 20141124 13:20:59	1.010E+04 rad(SiO2) at	5.929E-01 rad(SiO2)/min	BIPC150-H1NBK & -H2NBK, WFR #6, S/Ns H1NBK & H2NBK: 10.1 krad SD, 20.01 krad TD	41
20141112 17:25:00 to 20141124 13:20:59	1.010E+04 rad(SiO2) at	5.929E-01 rad(SiO2)/min	BIPC150-LCC20M, WFR #8, S/Ns H2LCC & H3LCC: 10.1 krad SD, 20.01 krad TD	41

Total Doses reported are ± 13.93% 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. 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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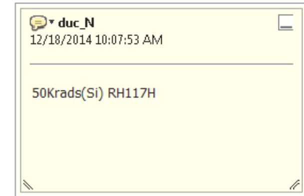
4.

Test Performed	Results of Test	Sample Result / Requirements	Step No.
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 #11

Step No.	Device							
	RH117H, WFR #10, S/Ns 0765-0774		BIPC150-NTK16, WFR #6, S/Ns H8-H9		BIPC150-NTK52L, WFR #6, S/Ns H10-H11		RH6016MW, WFR #8, S/Ns 10-13, 16-17, 20, 22, 25-26	
	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)	SD in krad(SiO2)	Cumulative TD in krad(SiO2)
33	5.769	5.769	5.769	5.769	5.769	5.769	---	---
34	5.340	11.109	5.340	11.109	5.340	11.109	5.340	5.340
35	---	---	---	---	---	---	1.480	6.820
36	3.321	14.430	3.321	14.430	3.321	14.430	3.321	10.141
37	7.710	22.140	7.710	22.140	7.710	22.140	7.710	17.851
38	---	---	0.550	22.690	0.550	22.690	---	---
39	9.360	31.500	9.360	32.050	9.360	32.050	9.360	27.211
40	---	---	1.740	33.790	1.740	33.790	---	---
41	10.100	41.600	10.100	43.890	10.100	43.890	10.100	37.311
42	8.500	50.100	8.500	52.390	8.500	52.390	8.500	45.811

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	$T_J = 25°C$ MIN	TYP	MAX	SUB-GROUP	$-55°C \le T_J \le 150°C$ MIN	TYP	MAX	SUB-GROUP	UNITS
V_{REF}	Reference Voltage	$3V \le (V_{IN} - V_{OUT}) \le 40V$, $10mA \le I_{OUT} \le I_{MAX}$, $P \le P_{MAX}$		1.20		1.30	1	1.20		1.30	2,3	V
$\frac{\Delta V_{OUT}}{\Delta V_{IN}}$	Line Regulation	$3V \le (V_{IN} - V_{OUT}) \le 40V$, $I_{OUT} = 10mA$	2			0.02	1			0.05	2,3	%/V
$\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$	Load Regulation	$10mA \le I_{OUT} \le I_{MAX}$, $V_{OUT} \le 5V$	2			15	1			50	2,3	mV
		$10mA \le I_{OUT} \le I_{MAX}$, $V_{OUT} \ge 5V$	2			0.3	1			1	2,3	%
	Thermal Regulation	20ms Pulse				0.07	1					%/W
	Ripple Rejection	$V_{OUT} = 10V$, f = 120Hz, $C_{ADJ} = 0$			65				65			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	$10mA \le I_{OUT} \le I_{MAX}$				5	1			5	2,3	µA
		$2.5V \le (V_{IN} - V_{OUT}) \le 40V$, $I_{OUT} = 10mA$				5	1			5	2,3	µA
I_{MIN}	Minimum Load Current	$(V_{IN} - V_{OUT}) = 40V$				5	1			5	2,3	mA
	Current Limit	$(V_{IN} - V_{OUT}) \le 15V$ H Package		0.5			1	0.5			2,3	A
		K Package		1.5			1	1.5			2,3	A
		$(V_{IN} - V_{OUT}) = 40V$ H Package		0.15			1					A
		K Package		0.30			1					A
$\frac{\Delta V_{OUT}}{\Delta Temp}$	Temperature Stability	$-55°C \le T_J \le 150°C$							1			%
$\frac{\Delta V_{OUT}}{\Delta Time}$	Long Term Stability	$T_A = 125°C$	3							1		%
e_n	RMS Output Noise	$10Hz \le f \le 10kHz$			0.001							%
θ_{JC}	Thermal Resistance (Junction to Case)	H Package	3			15						°C/W
		K Package	3			3						°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	UNITS
V_{REF}	Reference Voltage	$3V \le (V_{IN} - V_{OUT}) \le 40V$, $10mA \le I_{OUT} \le I_{MAX}$, $P \le P_{MAX}$		1.20	1.30	1.20	1.30	1.20	1.30	1.20	1.30	V
$\frac{\Delta V_{OUT}}{\Delta V_{IN}}$	Line Regulation	$3V \le (V_{IN} - V_{OUT}) \le 40V$, $I_{OUT} = 10mA$	2		0.02		0.02		0.02		0.03	%/V
$\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$	Load Regulation	$10mA \le I_{OUT} \le I_{MAX}$, $V_{OUT} \le 5V$ $10mA \le I_{OUT} \le I_{MAX}$, $V_{OUT} \ge 5V$	2 2		36 0.72		42 0.84		48 0.96		60 1.20	mV %
I_{ADJ}	Adjust Pin Current				100		100		100		100	µA
ΔI_{ADJ}	Adjust Pin Current Change	$10mA \le I_{OUT} \le I_{MAX}$			5		5		5		5	µA
		$3V \le (V_{IN} - V_{OUT}) \le 40V$, $I_{OUT} = 10mA$			5		5		5		5	µA
I_{MIN}	Minimum Load Current	$(V_{IN} - V_{OUT}) = 40V$			5		5		5		5	mA
	Current Limit	$(V_{IN} - V_{OUT}) \le 15V$ H Package K Package		0.5 1.5		0.5 1.5		0.5 1.5		0.5 1.5		A A
		$(V_{IN} - V_{OUT}) = 40V$ H Package K Package		0.15 0.30		0.15 0.30		0.15 0.30		0.15 0.30		A A

Note 1: Unless otherwise specified, these specifications apply for $V_{IN} - V_{OUT} = 5V$; 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 0.5A for the TO-39 and 1.5A for the TO-3.

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.