

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

HDR = 50 rads(Si)/s

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TID HDR 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: 42 units received, 2 units for control, 20 units for biased irradiation, and 20 units for unbiased irradiation. Serial numbers 726-729, 735-739, 745-749, and 755-759 had all pins tied to ground during irradiation. Serial numbers 730-734, 740-744, 750-754, and 760-764 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: 40 samples were divided into four groups of 10 each. Serial numbers 725-734 of group 1 were irradiated to 10 Krads(Si). Serial numbers 735-744 of group 2 were irradiated to 20 Krads(Si). Serial numbers 745-754 of group 3 were irradiated to 50 Krads(Si). Serial numbers 755-764 of group 4 were irradiated to 100 Krads(Si).

Radiation dose: 50 rads(Si)/sec.

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

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 $24^{\circ}\text{C}\pm 6^{\circ}\text{C}$ per MIL-STD-883 and MIL-STD-750.

SUMMARY

ALL 42 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 A (for high-dose rates ranging from 50 and 300 rads(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 50 rads(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 40 test samples and two control units were electrically tested at 25°C prior to irradiation. The parts were then placed in a lead/aluminum container and aligned with the radiation source, Cobalt-60, at DMEA facility in Sacramento, California. During irradiation, five units of six separate groups were biased at +/- 15V and other five of similar groups had all pads grounded. Ten units of group 1 were irradiated to 10 Krads(Si); group 2 to 20 Krads(Si); group 3 to 50 Krads(Si); and group 4 to 100 Krads(Si). After 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 42 units (40 irradiated and 2 control).

The criteria to pass the high dose-rate test is that five samples in each corresponding dose group irradiated under electrical bias must pass the datasheet limits. If any of the tested parameters of these five units of each group 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) @ $10\text{mA} \leq I_{OUT} \leq I_{MAX}$, $3\text{V} \leq (V_{IN} - V_{OUT}) \leq 40\text{V}$
- Line Regulation (%/V) @ $I_{LOAD} = 10\text{mA}$, $3\text{V} \leq (V_{IN} - V_{OUT}) \leq 40\text{V}$
- Load Regulation (mV) @ $V_{OUT} \leq 5\text{V}$, $10\text{mA} \leq I_{OUT} \leq I_{MAX}$
- Load Regulation (%) @ $V_{OUT} \geq 5\text{V}$, $10\text{mA} \leq I_{OUT} \leq I_{MAX}$
- Adjust Pin Current (μA)
- Adjust Pin Current Change (μA) @ $10\text{mA} \leq I_{OUT} \leq I_{MAX}$
- Adjust Pin Current Change (μA) @ $3\text{V} \leq (V_{IN} - V_{OUT}) \leq 40\text{V}$
- Minimum Load Current (mA) @ $(V_{IN} - V_{OUT}) = 40\text{V}$
- Current Limit (A) @ $(V_{IN} - V_{OUT}) \leq 5\text{V}$
- Current Limit (A) @ $(V_{IN} - V_{OUT}) = 40\text{V}$

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

5.0 Test Results

All 40 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:

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

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

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 $P_{s90\%/90\%}$ 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.

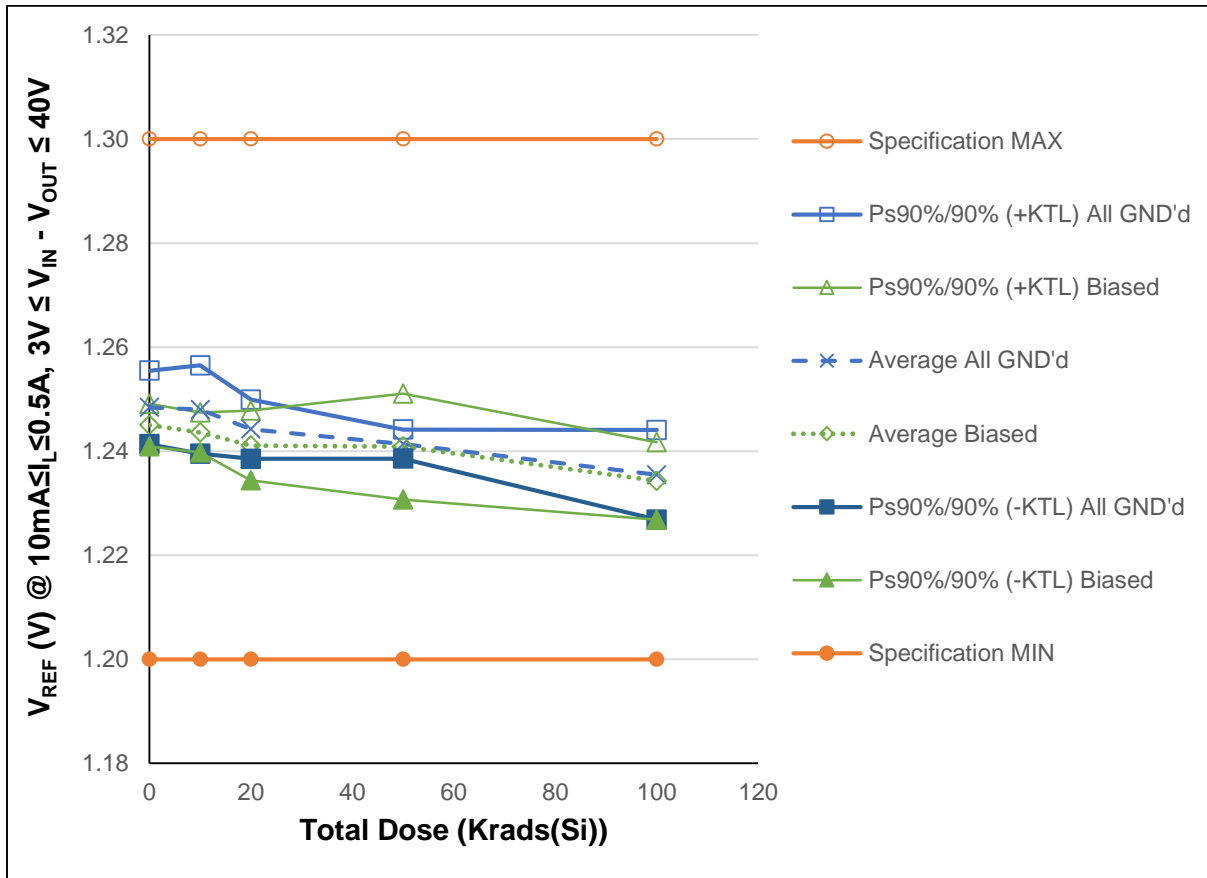


Figure 5.1 Plot of V_{REF} versus Total Dose

Table 5.1: Raw data for reference voltage 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} @ I _L =0.01 to 0.5A, 3V to 40V	Total Dose (Krad(Si)) @ 50rads/sec				
Units	(V)	0	10	20	50	100
725	All GND'd Irradiation	1.25050	1.25030			
726	All GND'd Irradiation	1.24620	1.24495			
727	All GND'd Irradiation	1.24525	1.24431			
728	All GND'd Irradiation	1.25104	1.25070			
729	All GND'd Irradiation	1.24906	1.24969			
730	Biased Irradiation	1.24451	1.24307			
731	Biased Irradiation	1.24272	1.24156			
732	Biased Irradiation	1.24598	1.24495			
733	Biased Irradiation	1.24525	1.24347			
734	Biased Irradiation	1.24658	1.24490			
735	All GND'd Irradiation	1.24573		1.24490		
736	All GND'd Irradiation	1.24608		1.24523		
737	All GND'd Irradiation	1.24672		1.24553		
738	All GND'd Irradiation	1.24231		1.24053		
739	All GND'd Irradiation	1.24449		1.24484		
740	Biased Irradiation	1.24390		1.24156		
741	Biased Irradiation	1.24253		1.23920		
742	Biased Irradiation	1.24560		1.24368		
743	Biased Irradiation	1.23987		1.23798		
744	Biased Irradiation	1.24520		1.24301		
745	All GND'd Irradiation	1.24421			1.24185	
746	All GND'd Irradiation	1.24445			1.24155	
747	All GND'd Irradiation	1.24475			1.24216	
748	All GND'd Irradiation	1.24276			1.23958	
749	All GND'd Irradiation	1.24398			1.24164	
750	Biased Irradiation	1.24983			1.24319	
751	Biased Irradiation	1.24540			1.24116	
752	Biased Irradiation	1.24153			1.23443	
753	Biased Irradiation	1.24727			1.24324	
754	Biased Irradiation	1.24636			1.24248	
755	All GND'd Irradiation	1.24032				1.23065
756	All GND'd Irradiation	1.24571				1.23668
757	All GND'd Irradiation	1.24672				1.23758
758	All GND'd Irradiation	1.24689				1.23834
759	All GND'd Irradiation	1.24336				1.23401
760	Biased Irradiation	1.24374				1.23119
761	Biased Irradiation	1.24266				1.23224
762	Biased Irradiation	1.24764				1.23758
763	Biased Irradiation	1.24414				1.23396
764	Biased Irradiation	1.24672				1.23645
723	Control Unit	1.25226	1.25305	1.25305	1.25305	1.25305
724	Control Unit	1.24825	1.24847	1.24847	1.24847	1.24847
	All GND'd Irradiation Statistics					
	Average All GND'd	1.24841	1.24799	1.24421	1.24135	1.23545
	Std Dev All GND'd	0.00258	0.00310	0.00208	0.00102	0.00314
	Ps90%/90% (+KTL) All GND'd	1.25548	1.25648	1.24990	1.24415	1.24407
	Ps90%/90% (-KTL) All GND'd	1.24134	1.23950	1.23851	1.23856	1.22683
	Biased Irradiation Statistics					
	Average Biased	1.24501	1.24359	1.24109	1.24090	1.23429
	Std Dev Biased	0.00150	0.00141	0.00244	0.00371	0.00271
	Ps90%/90% (+KTL) Biased	1.24911	1.24746	1.24779	1.25108	1.24172
	Ps90%/90% (-KTL) Biased	1.24091	1.23972	1.23439	1.23072	1.22685
	Specification MIN	1.20	1.20	1.20	1.20	1.20
	Status (Measurements) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (Measurements) Biased	PASS	PASS	PASS	PASS	PASS
	Specification MAX	1.30	1.30	1.30	1.30	1.30
	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

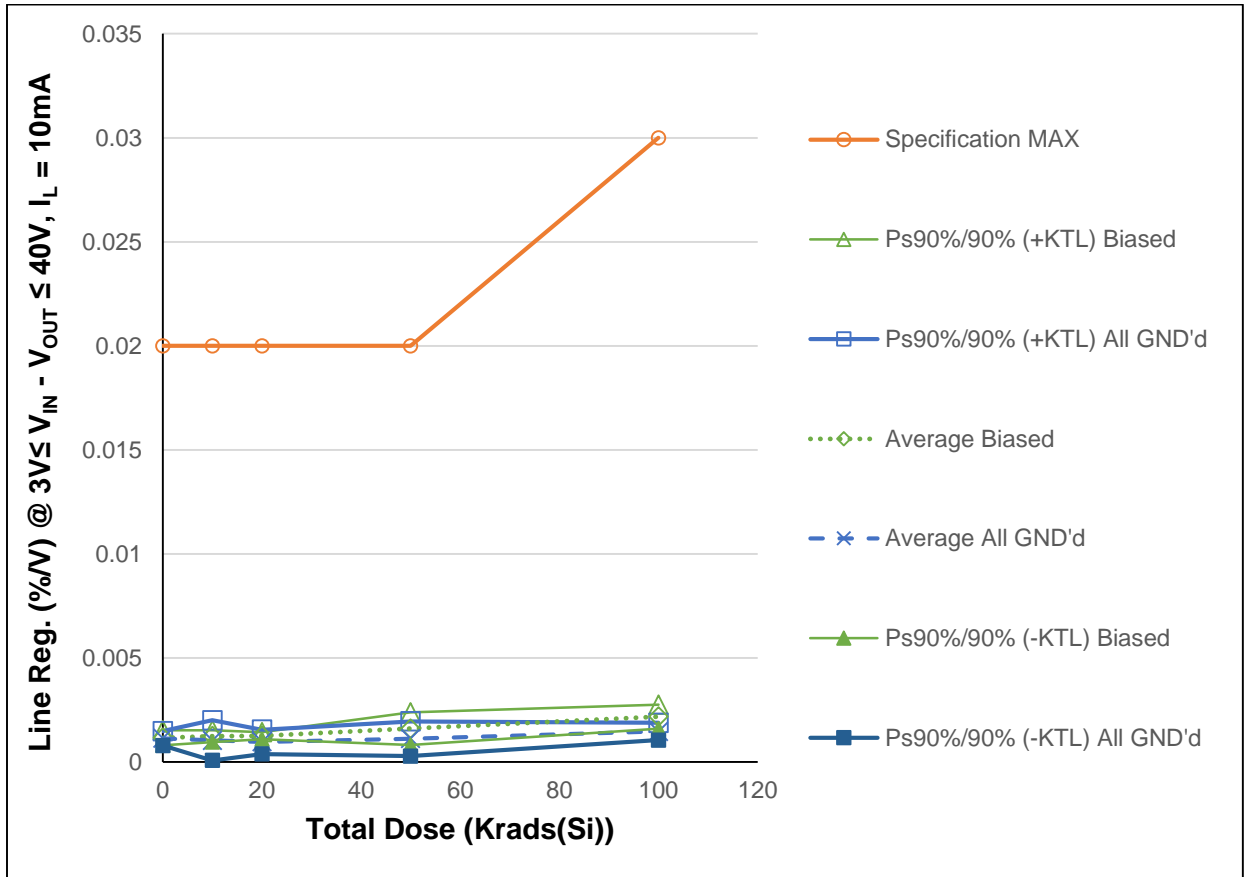


Figure 5.2: Plot of Line Regulation versus Total Dose

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 Units	Line Reg @ $3V \leq V_I - V_O \leq 40V, I_L = 10mA$ (%/V)	Total Dose (Krad(Si)) @ 50rads/sec				
		0	10	20	50	100
725	All GND'd Irradiation	0.001073	0.000863			
726	All GND'd Irradiation	0.001181	0.001553			
727	All GND'd Irradiation	0.001094	0.000912			
728	All GND'd Irradiation	0.001338	0.001233			
729	All GND'd Irradiation	0.001012	0.000658			
730	Biased Irradiation	0.001054	0.001327			
731	Biased Irradiation	0.001219	0.001287			
732	Biased Irradiation	0.001011	0.001073			
733	Biased Irradiation	0.001325	0.001307			
734	Biased Irradiation	0.001236	0.001243			
735	All GND'd Irradiation	0.000969		0.000867		
736	All GND'd Irradiation	0.000932		0.000830		
737	All GND'd Irradiation	0.001072		0.000868		
738	All GND'd Irradiation	0.001226		0.001347		
739	All GND'd Irradiation	0.001136		0.000950		
740	Biased Irradiation	0.001095		0.001205		
741	Biased Irradiation	0.001016		0.001330		
742	Biased Irradiation	0.001160		0.001199		
743	Biased Irradiation	0.000675		0.001291		
744	Biased Irradiation	0.000912		0.001307		
745	All GND'd Irradiation	0.001265			0.000998	
746	All GND'd Irradiation	0.000809			0.000703	
747	All GND'd Irradiation	0.001097			0.001099	
748	All GND'd Irradiation	0.000972			0.001494	
749	All GND'd Irradiation	0.001072			0.001326	
750	Biased Irradiation	0.001317			0.001760	
751	Biased Irradiation	0.000949			0.001327	
752	Biased Irradiation	0.001141			0.001980	
753	Biased Irradiation	0.001092			0.001654	
754	Biased Irradiation	0.001097			0.001324	
755	All GND'd Irradiation	0.000994				0.001550
756	All GND'd Irradiation	0.001011				0.001667
757	All GND'd Irradiation	0.001070				0.001496
758	All GND'd Irradiation	0.000969				0.001287
759	All GND'd Irradiation	0.000914				0.001357
760	Biased Irradiation	0.000934				0.002337
761	Biased Irradiation	0.000972				0.002132
762	Biased Irradiation	0.001173				0.001997
763	Biased Irradiation	0.001095				0.002466
764	Biased Irradiation	0.001035				0.001995
723	Control Unit	0.001150	0.000763	0.000763	0.000763	0.000763
724	Control Unit	0.000967	0.001320	0.001320	0.001320	0.001320
	All GND'd Irradiation Statistics					
	Average All GND'd	0.001140	0.001044	0.000972	0.001124	0.001471
	Std Dev All GND'd	0.000126	0.000351	0.000214	0.000305	0.000152
	Ps90%/90% (+KTL) All GND'd	0.001485	0.002007	0.001560	0.001959	0.001888
	Ps90%/90% (-KTL) All GND'd	0.000794	0.000080	0.000385	0.000288	0.001054
	Biased Irradiation Statistics					
	Average Biased	0.001169	0.001247	0.001266	0.001609	0.002185
	Std Dev Biased	0.000132	0.000102	0.000061	0.000284	0.000210
	Ps90%/90% (+KTL) Biased	0.001530	0.001527	0.001432	0.002389	0.002761
	Ps90%/90% (-KTL) Biased	0.000807	0.000968	0.001100	0.000830	0.001610
	Specification MIN					
	Status (Measurements) All GND'd					
	Status (Measurements) Biased					
	Specification MAX	0.02	0.02	0.02	0.02	0.03
	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

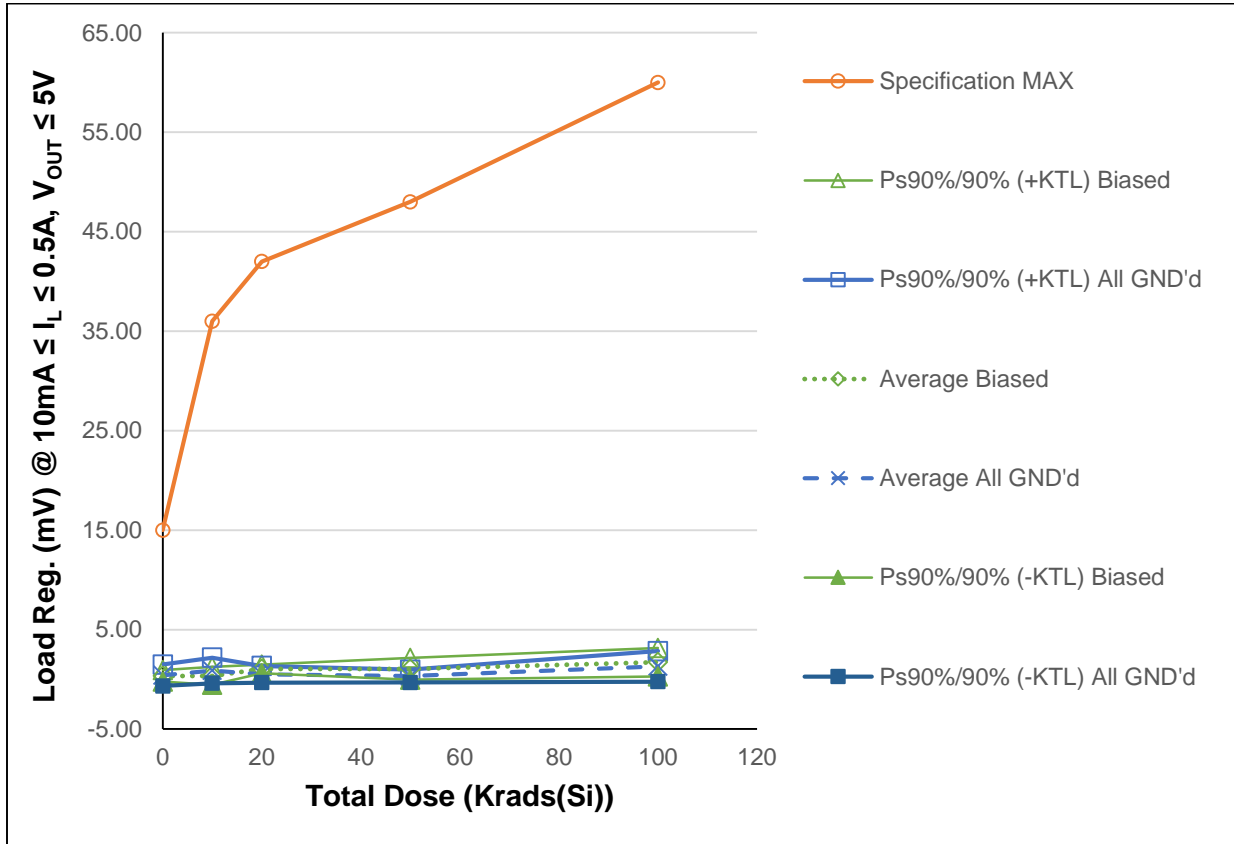


Figure 5.3: Plot of Load Regulation ($V_{OUT} \leq 5V$) versus Total Dose

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 \leq I \leq 0.5A, V \leq 5V	Total Dose (Krad(Si)) @ 50rads/sec				
		0	10	20	50	100
Units	(mV)					
725	All GND'd Irradiation	0.25177	0.54264			
726	All GND'd Irradiation	0.03433	1.25980			
727	All GND'd Irradiation	0.18597	1.07670			
728	All GND'd Irradiation	1.03188	1.35326			
729	All GND'd Irradiation	0.53120	0.27847			
730	Biased Irradiation	0.41294	0.06580			
731	Biased Irradiation	0.14877	0.01049			
732	Biased Irradiation	0.67329	0.82016			
733	Biased Irradiation	0.30804	0.35381			
734	Biased Irradiation	0.18406	0.48733			
735	All GND'd Irradiation	0.76866		0.75340		
736	All GND'd Irradiation	0.15926		0.23746		
737	All GND'd Irradiation	0.73051		0.92316		
738	All GND'd Irradiation	0.07820		0.36144		
739	All GND'd Irradiation	0.69237		0.29564		
740	Biased Irradiation	0.61893		1.13487		
741	Biased Irradiation	0.04387		1.07575		
742	Biased Irradiation	0.54932		0.84877		
743	Biased Irradiation	1.03283		1.25790		
744	Biased Irradiation	0.58746		0.92506		
745	All GND'd Irradiation	0.43583			0.02098	
746	All GND'd Irradiation	0.56839			0.55313	
747	All GND'd Irradiation	0.42629			0.56171	
748	All GND'd Irradiation	0.08965			0.31376	
749	All GND'd Irradiation	0.51212			0.19932	
750	Biased Irradiation	0.60368			0.82874	
751	Biased Irradiation	1.05476			1.13392	
752	Biased Irradiation	0.90218			1.64890	
753	Biased Irradiation	0.86498			1.07575	
754	Biased Irradiation	0.64468			0.58079	
755	All GND'd Irradiation	0.80395				1.27697
756	All GND'd Irradiation	0.53024				1.03951
757	All GND'd Irradiation	0.05341				0.86689
758	All GND'd Irradiation	0.34046				1.09577
759	All GND'd Irradiation	0.29278				2.27928
760	Biased Irradiation	0.18311				1.53446
761	Biased Irradiation	0.22507				1.70612
762	Biased Irradiation	0.01526				2.54536
763	Biased Irradiation	0.02480				1.10626
764	Biased Irradiation	0.38815				1.76334
723	Control Unit	0.49019	0.12302	0.12302	0.12302	0.12302
724	Control Unit	0.96989	1.26839	1.26839	1.26839	1.26839
	All GND'd Irradiation Statistics					
	Average All GND'd	0.40703	0.90218	0.51422	0.32978	1.31168
	Std Dev All GND'd	0.39298	0.46907	0.30502	0.23255	0.56036
	Ps90%/90% (+KTL) All GND'd	1.48458	2.18837	1.35059	0.96743	2.84818
	Ps90%/90% (-KTL) All GND'd	-0.67052	-0.38401	-0.32214	-0.30786	-0.22481
	Biased Irradiation Statistics					
	Average Biased	0.34542	0.34752	1.04847	1.05362	1.73111
	Std Dev Biased	0.21105	0.33012	0.16369	0.39857	0.52292
	Ps90%/90% (+KTL) Biased	0.92411	1.25272	1.49731	2.14650	3.16495
	Ps90%/90% (-KTL) Biased	-0.23327	-0.55768	0.59963	-0.03927	0.29727
	Specification MIN					
	Status (Measurements) All GND'd					
	Status (Measurements) Biased					
	Specification MAX	15	36	42	48	60
	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

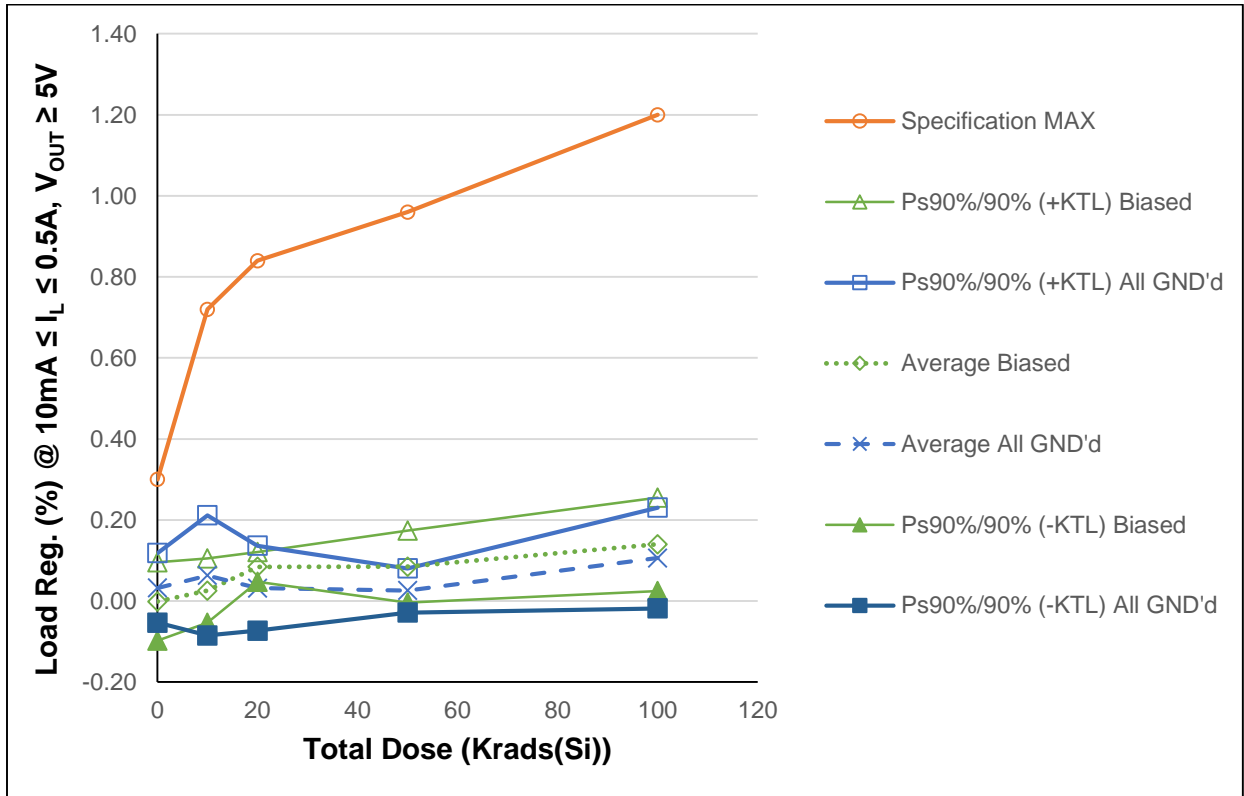


Figure 5.4: Plot of Load Regulation ($V_{OUT} \geq 5V$) versus Total Dose

Table 5.4: Raw data for load regulation ($V_{OUT} \geq 5V$) versus total dose including the statistical calculations, maximum specification, and the status of the test (PASS/FAIL).

Parameter Units	Load Reg @ 10mA≤I _L ≤0.5A,V _O ≥5V (%)	Total Dose (Krad(Si)) @ 50rads/sec				
		0	10	20	50	100
725	All GND'd Irradiation	0.02013	0.04338			
726	All GND'd Irradiation	0.00275	0.10109			
727	All GND'd Irradiation	0.01493	0.08645			
728	All GND'd Irradiation	0.08241	0.10808			
729	All GND'd Irradiation	0.04251	-0.02229			
730	Biased Irradiation	-0.03319	-0.00529			
731	Biased Irradiation	0.01197	0.00084			
732	Biased Irradiation	0.05401	0.06584			
733	Biased Irradiation	-0.02474	0.02845			
734	Biased Irradiation	-0.01477	0.03913			
735	All GND'd Irradiation	0.06167		0.06048		
736	All GND'd Irradiation	0.01278		0.01907		
737	All GND'd Irradiation	0.05856		0.07406		
738	All GND'd Irradiation	-0.00630		0.02913		
739	All GND'd Irradiation	0.05560		-0.02375		
740	Biased Irradiation	0.04973		0.09132		
741	Biased Irradiation	0.00353		0.08673		
742	Biased Irradiation	0.04408		0.06820		
743	Biased Irradiation	0.08323		0.10151		
744	Biased Irradiation	0.04716		0.07437		
745	All GND'd Irradiation	0.03502			-0.00169	
746	All GND'd Irradiation	0.04565			0.04453	
747	All GND'd Irradiation	0.03424			0.04520	
748	All GND'd Irradiation	-0.00721			0.02531	
749	All GND'd Irradiation	0.04115			0.01605	
750	Biased Irradiation	0.04828			0.06662	
751	Biased Irradiation	0.08462			0.09128	
752	Biased Irradiation	0.07261			0.13340	
753	Biased Irradiation	0.06930			0.08645	
754	Biased Irradiation	0.05170			0.04672	
755	All GND'd Irradiation	0.06478				0.10366
756	All GND'd Irradiation	0.04255				0.08399
757	All GND'd Irradiation	0.00428				0.07000
758	All GND'd Irradiation	0.02730				0.08841
759	All GND'd Irradiation	0.02354				0.18436
760	Biased Irradiation	-0.01472				0.12448
761	Biased Irradiation	0.01811				0.13827
762	Biased Irradiation	0.00122				0.20525
763	Biased Irradiation	0.00199				0.08957
764	Biased Irradiation	0.03112				0.14241
723	Control Unit	0.03913	0.00982	0.00982	0.00982	0.00982
724	Control Unit	0.07764	0.10149	0.10149	0.10149	0.10149
	All GND'd Irradiation Statistics					
	Average All GND'd	0.03255	0.06334	0.03180	0.02588	0.10608
	Std Dev All GND'd	0.03138	0.05406	0.03829	0.01986	0.04538
	Ps90%/90% (+KTL) All GND'd	0.11858	0.21159	0.13679	0.08034	0.23051
	Ps90%/90% (-KTL) All GND'd	-0.05349	-0.08490	-0.07319	-0.02859	-0.01834
	Biased Irradiation Statistics					
	Average Biased	-0.00134	0.02579	0.08443	0.08489	0.13999
	Std Dev Biased	0.03530	0.02906	0.01331	0.03235	0.04198
	Ps90%/90% (+KTL) Biased	0.09544	0.10547	0.12093	0.17360	0.25511
	Ps90%/90% (-KTL) Biased	-0.09813	-0.05388	0.04792	-0.00382	0.02488
	Specification MIN					
	Status (Measurements) All GND'd					
	Status (Measurements) Biased					
	Specification MAX	0.3	0.72	0.84	0.96	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					
	Status (+KTL) All GND'd	PASS	PASS	PASS	PASS	PASS
	Status (-KTL) Biased					
	Status (+KTL) Biased	PASS	PASS	PASS	PASS	PASS

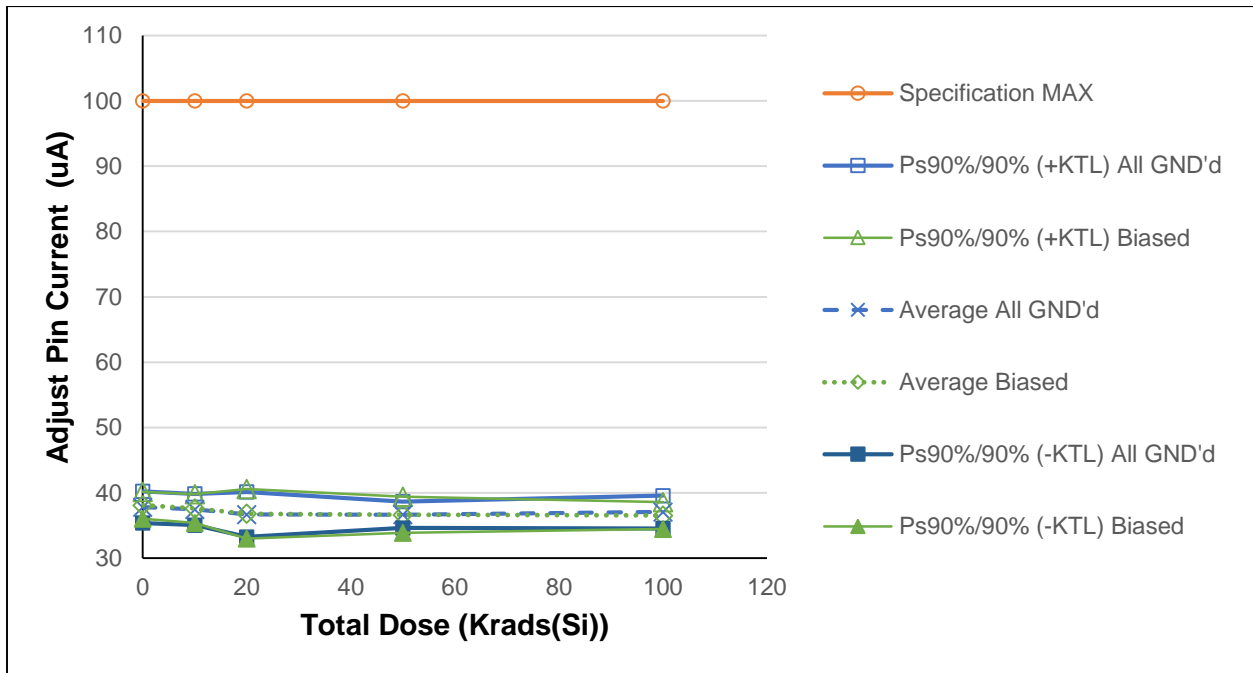


Figure 5.5: Plot of Adjust Pin Current versus Total Dose

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

Parameter Units	Adjust Pin Current (uA)	Total Dose (Krad(Si)) @ 50rad/sec				
		0	10	20	50	100
725	All GND'd Irradiation	37.54211	37.32619			
726	All GND'd Irradiation	37.00259	36.45322			
727	All GND'd Irradiation	39.32508	38.83184			
728	All GND'd Irradiation	37.76212	37.60225			
729	All GND'd Irradiation	37.46139	37.12873			
730	Biased Irradiation	38.99350	38.60344			
731	Biased Irradiation	38.69159	38.27301			
732	Biased Irradiation	37.32824	36.63638			
733	Biased Irradiation	37.40420	37.16922			
734	Biased Irradiation	38.10794	37.47862			
735	All GND'd Irradiation	37.79535		35.92653		
736	All GND'd Irradiation	36.73865		35.31767		
737	All GND'd Irradiation	37.34129		36.17737		
738	All GND'd Irradiation	38.55131		38.05889		
739	All GND'd Irradiation	38.84967		37.99459		
740	Biased Irradiation	37.26274		35.74931		
741	Biased Irradiation	37.43744		36.32005		
742	Biased Irradiation	39.12191		37.96959		
743	Biased Irradiation	39.51522		38.57844		
744	Biased Irradiation	37.82265		35.44489		
745	All GND'd Irradiation	38.20052			37.52606	
746	All GND'd Irradiation	36.89555			36.06564	
747	All GND'd Irradiation	37.52430			35.87294	
748	All GND'd Irradiation	37.19983			36.51036	
749	All GND'd Irradiation	38.87934			37.32143	
750	Biased Irradiation	38.98282			37.98863	
751	Biased Irradiation	36.94541			36.26786	
752	Biased Irradiation	38.33011			36.92891	
753	Biased Irradiation	37.82858			36.85289	
754	Biased Irradiation	36.55329			35.22838	
755	All GND'd Irradiation	38.84136				37.75685
756	All GND'd Irradiation	36.96201				36.22500
757	All GND'd Irradiation	39.16700				38.32520
758	All GND'd Irradiation	37.11417				36.39626
759	All GND'd Irradiation	37.44833				36.70067
760	Biased Irradiation	38.42290				37.41194
761	Biased Irradiation	36.64942				35.56852
762	Biased Irradiation	36.90386				36.00272
763	Biased Irradiation	38.04623				37.01700
764	Biased Irradiation	37.47683				36.68640
723	Control Unit	38.21854	37.96382	37.96382	37.96382	37.96382
724	Control Unit	37.95937	37.58915	37.58915	37.58915	37.58915
	All GND'd Irradiation Statistics					
	Average All GND'd	37.81866	37.46845	36.69501	36.65929	37.08080
	Std Dev All GND'd	0.88637	0.87222	1.25545	0.73869	0.91530
	Ps90%/90% (+KTL) All GND'd	40.24908	39.86007	40.13746	38.68478	39.59054
	Ps90%/90% (-KTL) All GND'd	35.38824	35.07682	33.25256	34.63379	34.57106
	Biased Irradiation Statistics					
	Average Biased	38.10509	37.63213	36.81246	36.65333	36.53732
	Std Dev Biased	0.74633	0.80367	1.38750	1.00969	0.74861
	Ps90%/90% (+KTL) Biased	40.15152	39.83580	40.61698	39.42189	38.59000
	Ps90%/90% (-KTL) Biased	36.05867	35.42847	33.00793	33.88477	34.48464
	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

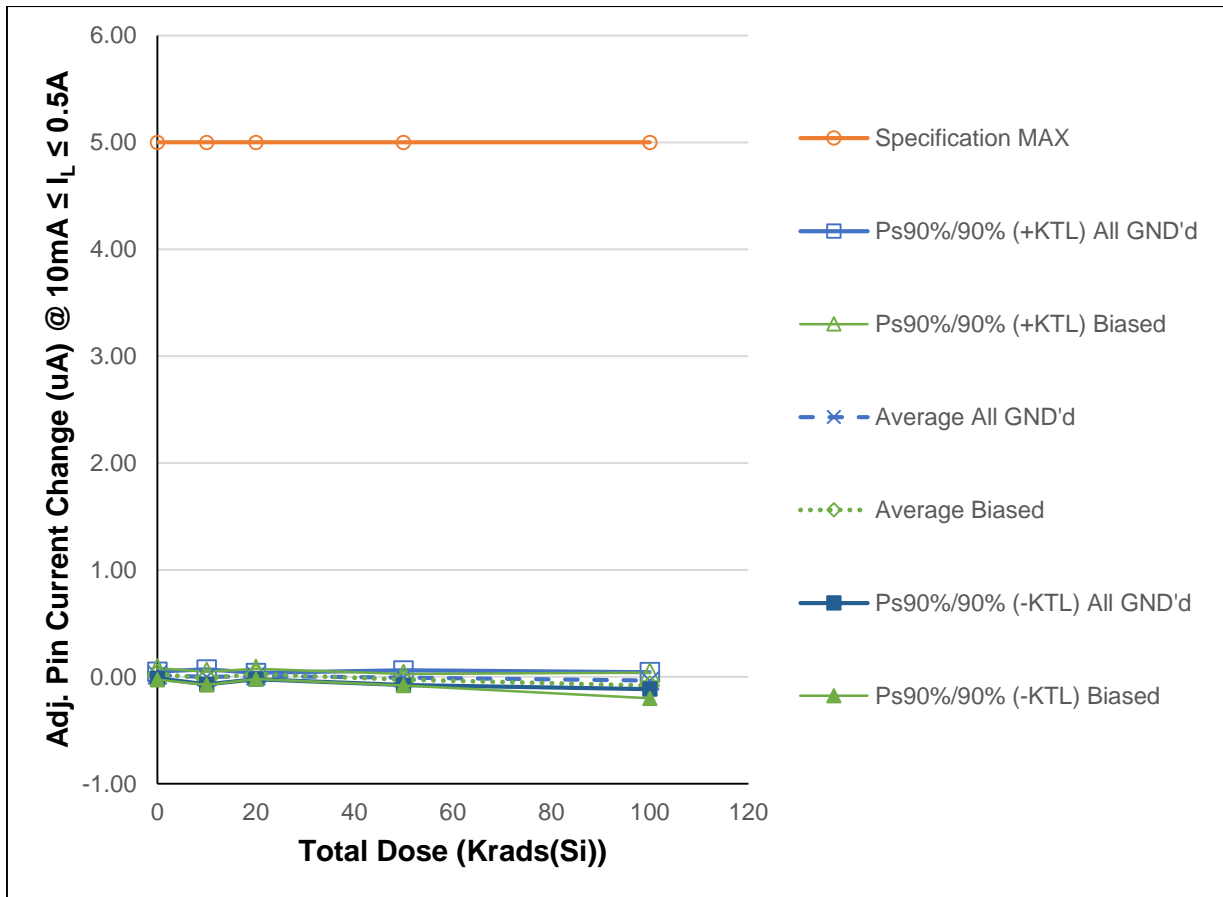


Figure 5.6: Plot of Adjust Pin Current Change @ $10\text{mA} \leq I_L \leq 0.5\text{A}$ versus Total Dose

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

Parameter	Adjust I change @ $10\text{mA} \leq I_L \leq 0.5\text{A}$	Total Dose (Krad(Si)) @ 50rads/sec				
		0	10	20	50	100
Units	(uA)					
725	All GND'd Irradiation	0.01186	-0.01190			
726	All GND'd Irradiation	0.01899	0.00239			
727	All GND'd Irradiation	0.00355	0.00477			
728	All GND'd Irradiation	0.03324	-0.03095			
729	All GND'd Irradiation	0.02491	0.03810			
730	Biased Irradiation	0.00474	-0.00595			
731	Biased Irradiation	0.04153	-0.04287			
732	Biased Irradiation	0.01662	0.01905			
733	Biased Irradiation	0.05245	-0.01190			
734	Biased Irradiation	0.01780	-0.01647			
735	All GND'd Irradiation	0.00000		0.00000		
736	All GND'd Irradiation	0.01899		0.00000		
737	All GND'd Irradiation	-0.00357		0.02261		
738	All GND'd Irradiation	0.02730		0.00237		
739	All GND'd Irradiation	0.02018		0.01786		
740	Biased Irradiation	0.00831		0.03810		
741	Biased Irradiation	0.01070		0.03215		
742	Biased Irradiation	0.02515		0.04029		
743	Biased Irradiation	-0.02017		0.02857		
744	Biased Irradiation	0.00000		-0.00239		
745	All GND'd Irradiation	0.01781			-0.03197	
746	All GND'd Irradiation	0.01068			-0.01429	
747	All GND'd Irradiation	0.00950			0.00714	
748	All GND'd Irradiation	0.03442			-0.02619	
749	All GND'd Irradiation	0.01899			0.02859	
750	Biased Irradiation	0.03561			-0.01190	
751	Biased Irradiation	0.04770			-0.05119	
752	Biased Irradiation	0.01899			-0.00239	
753	Biased Irradiation	0.00949			-0.02500	
754	Biased Irradiation	0.03798			-0.03810	
755	All GND'd Irradiation	-0.00119				-0.03810
756	All GND'd Irradiation	-0.00927				-0.01190
757	All GND'd Irradiation	0.03680				-0.03692
758	All GND'd Irradiation	0.02515				-0.07858
759	All GND'd Irradiation	-0.00237				-0.00477
760	Biased Irradiation	0.02849				-0.09527
761	Biased Irradiation	-0.00118				-0.03810
762	Biased Irradiation	0.04155				-0.02858
763	Biased Irradiation	0.01543				-0.11787
764	Biased Irradiation	0.04392				-0.12125
723	Control Unit	0.03820	0.02720	0.02720	0.02720	0.02720
724	Control Unit	0.01781	-0.02858	-0.02858	-0.02858	-0.02858
All GND'd Irradiation Statistics						
Average All GND'd		0.01851	0.00048	0.00857	-0.00734	-0.03405
Std Dev All GND'd		0.01147	0.02539	0.01083	0.02506	0.02896
Ps90%/90% (+KTL) All GND'd		0.04996	0.07010	0.03825	0.06136	0.04536
Ps90%/90% (-KTL) All GND'd		-0.01294	-0.06914	-0.02111	-0.07605	-0.11347
Biased Irradiation Statistics						
Average Biased		0.02663	-0.01163	0.02734	-0.02572	-0.08021
Std Dev Biased		0.01966	0.02221	0.01726	0.01961	0.04407
Ps90%/90% (+KTL) Biased		0.08053	0.04927	0.07467	0.02805	0.04062
Ps90%/90% (-KTL) Biased		-0.02727	-0.07253	-0.01999	-0.07948	-0.20105
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

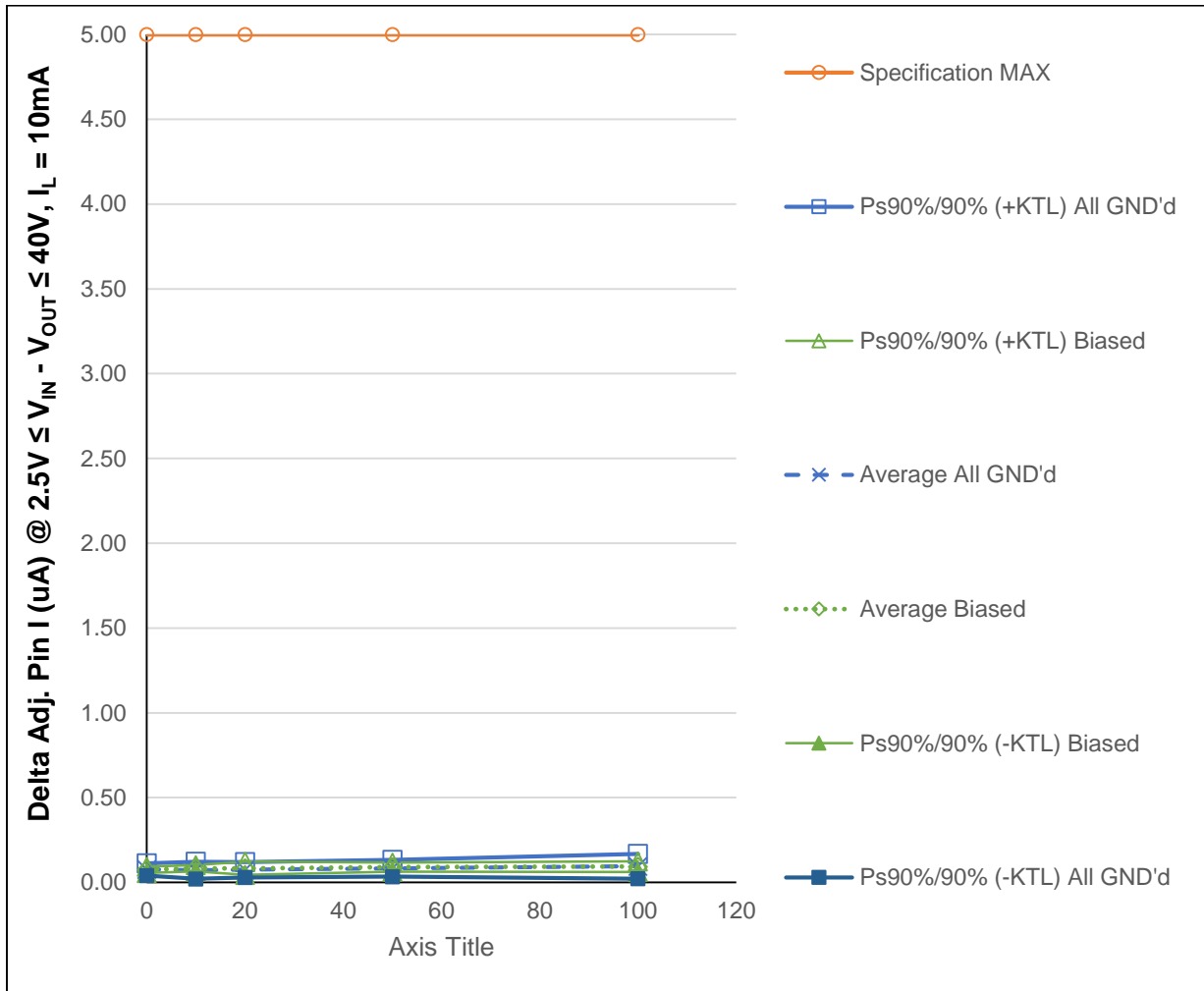


Figure 5.7: Plot of Adjust Pin Current Change @ $2.5V \leq V_{IN} - V_{OUT} \leq 40V$ versus Total Dose

Table 5.7: Raw data table for adjust pin current change @ $2.5V \leq V_{IN} - V_{OUT} \leq 40V$ versus total dose including the statistical calculations, maximum specification, and the status of the test.

Parameter	Delta Adj. I @ $2.5V \leq V_{IN} - V_{OUT} \leq 40V$	Total Dose (Krad(Si)) @ 50rads/sec				
		0	10	20	50	100
Units	(uA)					
725	All GND'd Irradiation	0.08212	0.06671			
726	All GND'd Irradiation	0.09732	0.06906			
727	All GND'd Irradiation	0.07122	0.10221			
728	All GND'd Irradiation	0.07122	0.06887			
729	All GND'd Irradiation	0.06291	0.05240			
730	Biased Irradiation	0.06528	0.07619			
731	Biased Irradiation	0.08190	0.09029			
732	Biased Irradiation	0.07359	0.08931			
733	Biased Irradiation	0.07263	0.07602			
734	Biased Irradiation	0.07953	0.08554			
735	All GND'd Irradiation	0.05103		0.10102		
736	All GND'd Irradiation	0.08094		0.07602		
737	All GND'd Irradiation	0.06885		0.07619		
738	All GND'd Irradiation	0.08427		0.05696		
739	All GND'd Irradiation	0.06171		0.06550		
740	Biased Irradiation	0.07618		0.07619		
741	Biased Irradiation	0.07618		0.08573		
742	Biased Irradiation	0.06171		0.06311		
743	Biased Irradiation	0.06311		0.08929		
744	Biased Irradiation	0.06193		0.10102		
745	All GND'd Irradiation	0.05600			0.07619	
746	All GND'd Irradiation	0.04866			0.07600	
747	All GND'd Irradiation	0.08568			0.07858	
748	All GND'd Irradiation	0.08449			0.07145	
749	All GND'd Irradiation	0.07855			0.11551	
750	Biased Irradiation	0.07240			0.09406	
751	Biased Irradiation	0.06430			0.09029	
752	Biased Irradiation	0.07737			0.07619	
753	Biased Irradiation	0.08925			0.08554	
754	Biased Irradiation	0.06289			0.10239	
755	All GND'd Irradiation	0.06054				0.11768
756	All GND'd Irradiation	0.07263				0.06905
757	All GND'd Irradiation	0.07715				0.12602
758	All GND'd Irradiation	0.07499				0.09505
759	All GND'd Irradiation	0.09377				0.06887
760	Biased Irradiation	0.07953				0.10102
761	Biased Irradiation	0.06669				0.07858
762	Biased Irradiation	0.08784				0.08912
763	Biased Irradiation	0.07240				0.10816
764	Biased Irradiation	0.07596				0.09029
723	Control Unit	0.06647	0.04744	0.04744	0.04744	0.04744
724	Control Unit	0.07240	0.07600	0.07600	0.07600	0.07600
	All GND'd Irradiation Statistics					
	Average All GND'd	0.07696	0.07185	0.07514	0.08355	0.09534
	Std Dev All GND'd	0.01327	0.01832	0.01655	0.01805	0.02661
	Ps90%/90% (+KTL) All GND'd	0.11335	0.12210	0.12051	0.13305	0.16830
	Ps90%/90% (-KTL) All GND'd	0.04056	0.02160	0.02976	0.03404	0.02237
	Biased Irradiation Statistics					
	Average Biased	0.07458	0.08347	0.08307	0.08970	0.09343
	Std Dev Biased	0.00651	0.00695	0.01426	0.00975	0.01144
	Ps90%/90% (+KTL) Biased	0.09242	0.10253	0.12217	0.11642	0.12481
	Ps90%/90% (-KTL) Biased	0.05675	0.06441	0.04396	0.06297	0.06206
	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

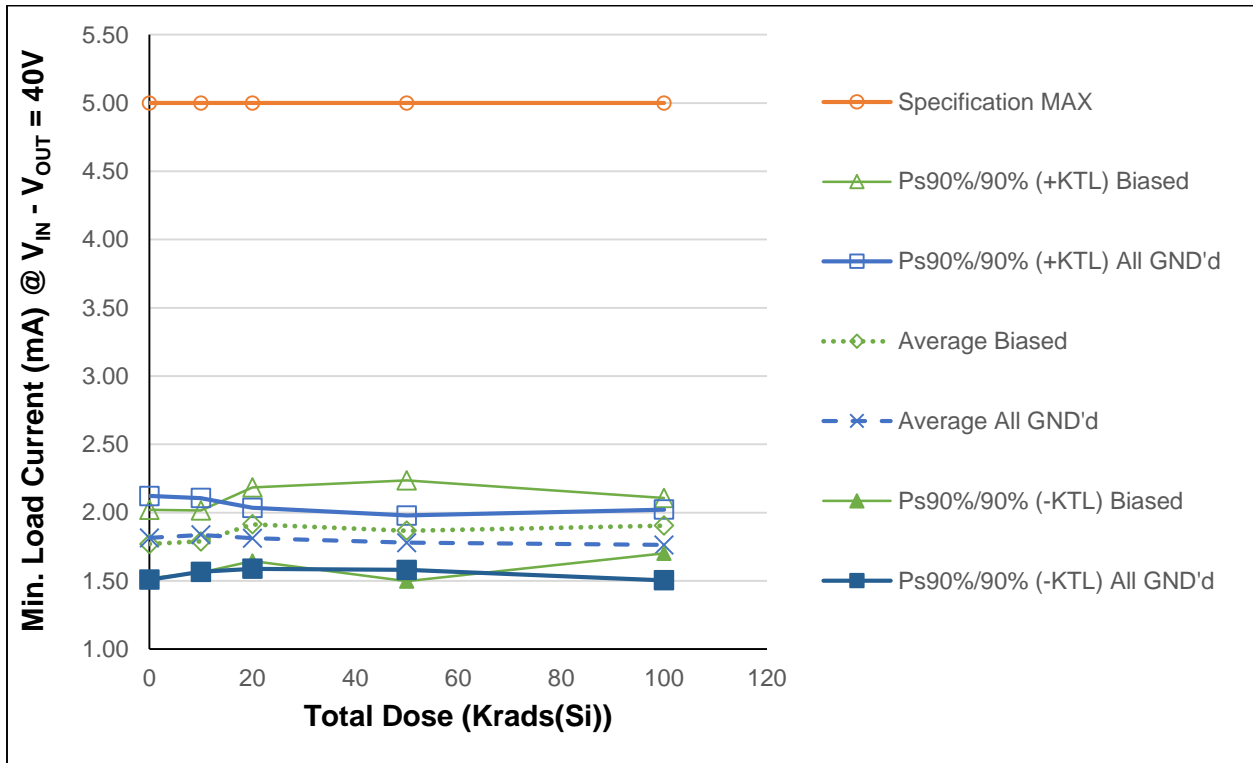


Figure 5.8: Plot of Minimum Load Current versus Total Dose

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 Units	Min. Load I @ $V_{IN} - V_{OUT} = 40V$ (mA)	Total Dose (Krad(Si)) @ 50rads/sec				
		0	10	20	50	100
725	All GND'd Irradiation	1.88504	1.89667			
726	All GND'd Irradiation	1.62425	1.66741			
727	All GND'd Irradiation	1.80678	1.83360			
728	All GND'd Irradiation	1.86683	1.87531			
729	All GND'd Irradiation	1.89265	1.90827			
730	Biased Irradiation	1.87291	1.87562			
731	Biased Irradiation	1.86622	1.87898			
732	Biased Irradiation	1.69738	1.74474			
733	Biased Irradiation	1.70128	1.69853			
734	Biased Irradiation	1.71133	1.74635			
735	All GND'd Irradiation	1.68094		1.82193		
736	All GND'd Irradiation	1.61137		1.72827		
737	All GND'd Irradiation	1.64193		1.73162		
738	All GND'd Irradiation	1.88983		1.91269		
739	All GND'd Irradiation	1.80001		1.86411		
740	Biased Irradiation	1.68908		1.80393		
741	Biased Irradiation	1.86339		1.93275		
742	Biased Irradiation	1.79307		1.87936		
743	Biased Irradiation	1.89333		2.06912		
744	Biased Irradiation	1.69799		1.88523		
745	All GND'd Irradiation	1.68155			1.71301	
746	All GND'd Irradiation	1.67026			1.71911	
747	All GND'd Irradiation	1.65038			1.76915	
748	All GND'd Irradiation	1.76466			1.80613	
749	All GND'd Irradiation	1.78576			1.89027	
750	Biased Irradiation	1.95482			2.03884	
751	Biased Irradiation	1.64954			1.76503	
752	Biased Irradiation	1.88198			1.98301	
753	Biased Irradiation	1.61595			1.74474	
754	Biased Irradiation	1.62173			1.80240	
755	All GND'd Irradiation	1.86134				1.89927
756	All GND'd Irradiation	1.69976				1.72889
757	All GND'd Irradiation	1.79178				1.81492
758	All GND'd Irradiation	1.63400				1.66008
759	All GND'd Irradiation	1.68695				1.71133
760	Biased Irradiation	1.82104				1.97660
761	Biased Irradiation	1.70736				1.88538
762	Biased Irradiation	1.64123				1.83016
763	Biased Irradiation	1.81929				1.98881
764	Biased Irradiation	1.68390				1.84419
723	Control Unit	1.91924	1.93587	1.93587	1.93587	1.93587
724	Control Unit	1.61023	1.63797	1.63797	1.63797	1.63797
	All GND'd Irradiation Statistics					
	Average All GND'd	1.81511	1.83625	1.81173	1.77953	1.76290
	Std Dev All GND'd	0.11188	0.09859	0.08128	0.07272	0.09446
	Ps90%/90% (+KTL) All GND'd	2.12189	2.10658	2.03459	1.97893	2.02190
	Ps90%/90% (-KTL) All GND'd	1.50832	1.56593	1.58887	1.58013	1.50389
	Biased Irradiation Statistics					
	Average Biased	1.76983	1.78884	1.91408	1.86681	1.90503
	Std Dev Biased	0.09122	0.08301	0.09818	0.13463	0.07388
	Ps90%/90% (+KTL) Biased	2.01996	2.01645	2.18329	2.23597	2.10761
	Ps90%/90% (-KTL) Biased	1.51969	1.56124	1.64487	1.49764	1.70245
	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

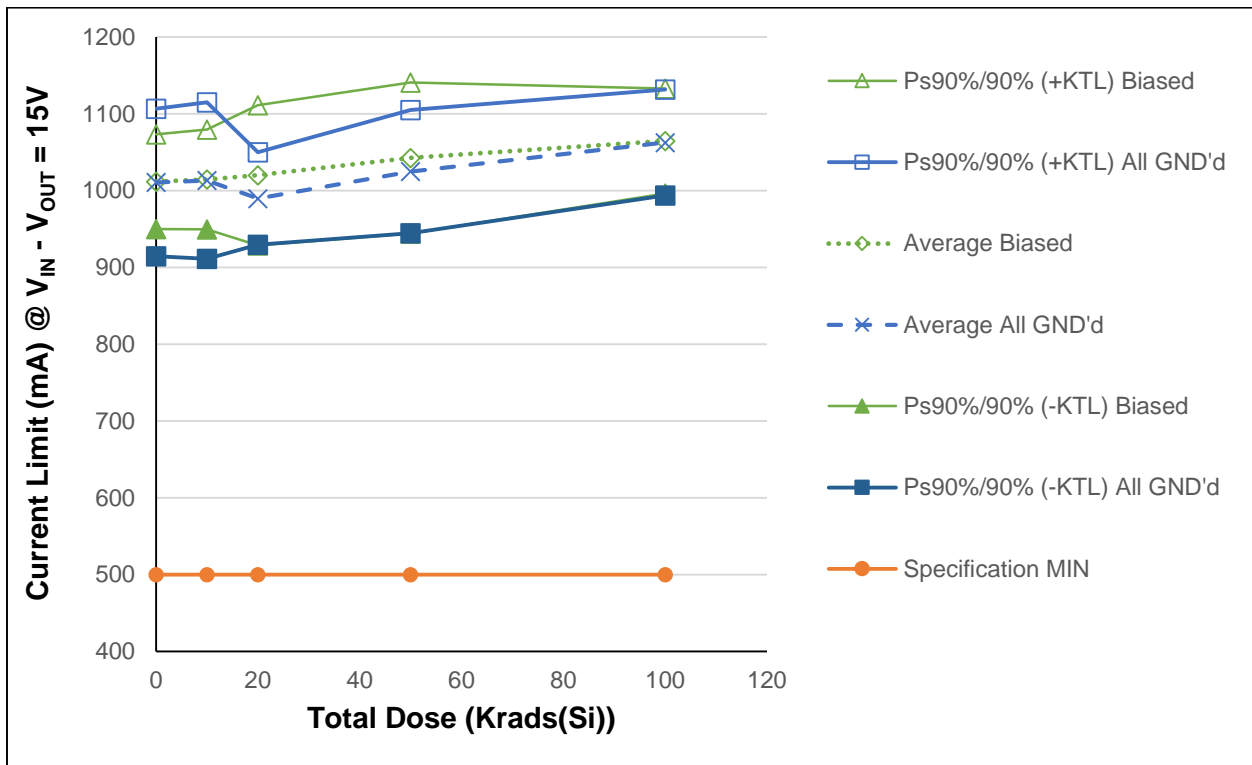


Figure 5.9: Plot of Current Limit @ $V_{IN} - V_{OUT} = 15V$ versus Total Dose

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 Units	Current Limit @ $V_{IN} - V_{OUT} = 15V$ (mA)	Total Dose (Krad(Si)) @ 50rads/sec				
		0	10	20	50	100
725	All GND'd Irradiation	1032.746	1038.372			
726	All GND'd Irradiation	948.552	947.694			
727	All GND'd Irradiation	1021.290	1022.457			
728	All GND'd Irradiation	1028.333	1031.551			
729	All GND'd Irradiation	1022.648	1025.849			
730	Biased Irradiation	1040.608	1044.949			
731	Biased Irradiation	1026.064	1028.665			
732	Biased Irradiation	981.997	982.223			
733	Biased Irradiation	1002.295	1008.319			
734	Biased Irradiation	1007.698	1008.492			
735	All GND'd Irradiation	972.018		976.446		
736	All GND'd Irradiation	951.417		959.095		
737	All GND'd Irradiation	987.605		995.637		
738	All GND'd Irradiation	997.859		1013.923		
739	All GND'd Irradiation	990.225		1003.455		
740	Biased Irradiation	981.781		986.572		
741	Biased Irradiation	1055.027		1068.020		
742	Biased Irradiation	996.953		1005.198		
743	Biased Irradiation	1029.640		1040.093		
744	Biased Irradiation	999.425		1000.243		
745	All GND'd Irradiation	969.599			1003.064	
746	All GND'd Irradiation	1004.508			1044.422	
747	All GND'd Irradiation	957.892			984.410	
748	All GND'd Irradiation	1008.179			1049.651	
749	All GND'd Irradiation	1013.876			1042.725	
750	Biased Irradiation	1042.961			1081.679	
751	Biased Irradiation	993.075			1037.825	
752	Biased Irradiation	1045.514			1077.500	
753	Biased Irradiation	975.324			1007.422	
754	Biased Irradiation	972.372			1008.740	
755	All GND'd Irradiation	1028.600				1088.880
756	All GND'd Irradiation	1015.542				1078.640
757	All GND'd Irradiation	1007.484				1074.110
758	All GND'd Irradiation	975.464				1036.547
759	All GND'd Irradiation	975.078				1034.802
760	Biased Irradiation	1024.091				1088.154
761	Biased Irradiation	993.250				1051.839
762	Biased Irradiation	967.981				1027.136
763	Biased Irradiation	1011.465				1079.129
764	Biased Irradiation	1009.018				1077.132
723	Control Unit	1064.786	1051.057	1051.057	1051.057	1051.057
724	Control Unit	989.091	975.181	975.181	975.181	975.181
	All GND'd Irradiation Statistics					
	Average All GND'd	1010.714	1013.185	989.711	1024.854	1062.596
	Std Dev All GND'd	35.051	37.105	21.929	29.273	25.159
	Ps90%/90% (+KTL) All GND'd	1106.823	1114.926	1049.841	1105.121	1131.582
	Ps90%/90% (-KTL) All GND'd	914.605	911.443	929.581	944.587	993.610
	Biased Irradiation Statistics					
	Average Biased	1011.732	1014.530	1020.025	1042.633	1064.678
	Std Dev Biased	22.521	23.685	33.304	35.889	24.946
	Ps90%/90% (+KTL) Biased	1073.484	1079.473	1111.344	1141.040	1133.081
	Ps90%/90% (-KTL) Biased	949.980	949.586	928.707	944.227	996.275
	Specification MIN	500	500	500	500	500
	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					

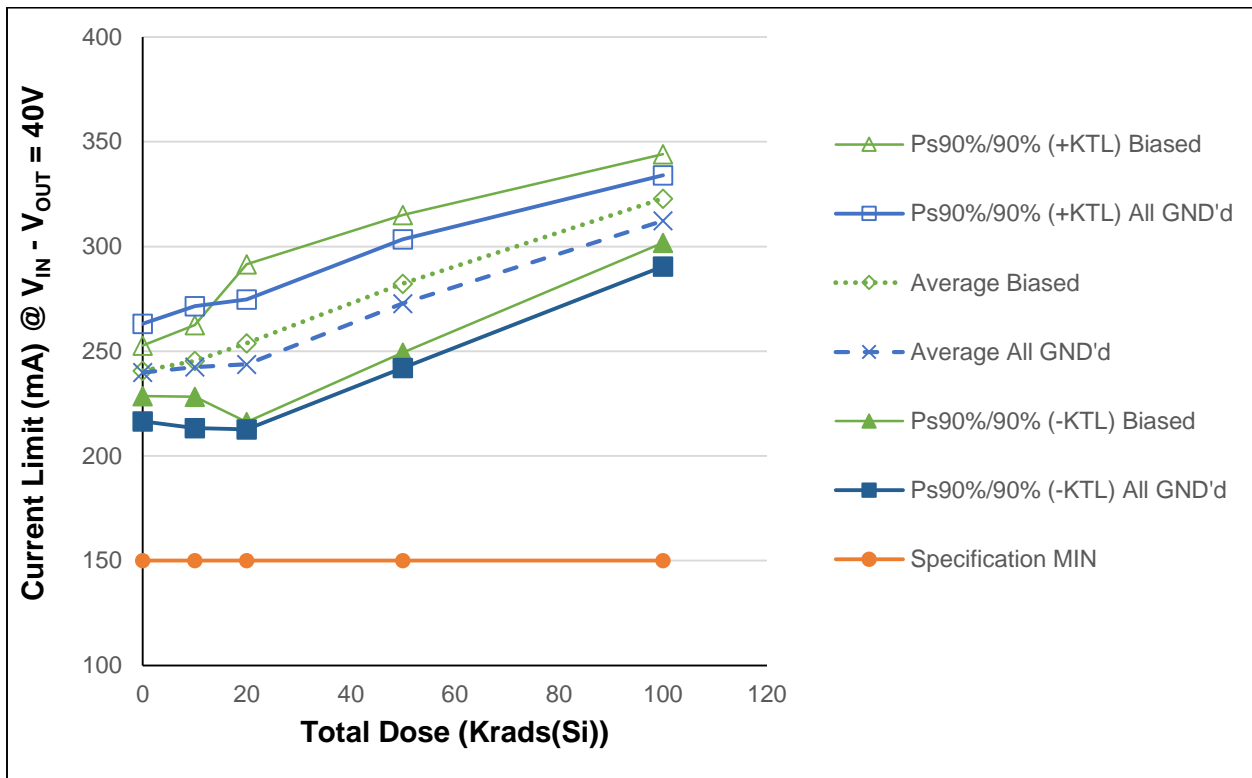


Figure 5.10: Plot of Current Limit @ $V_{IN} - V_{OUT} = 40V$ versus Total Dose

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 Units	Current Limit @ $V_{IN} - V_{OUT} = 40V$ (mA)	Total Dose (Krad(Si)) @ 50rads/sec				
		0	10	20	50	100
725	All GND'd Irradiation	244.211	249.428			
726	All GND'd Irradiation	226.769	225.737			
727	All GND'd Irradiation	243.588	244.228			
728	All GND'd Irradiation	248.295	253.037			
729	All GND'd Irradiation	236.349	239.784			
730	Biased Irradiation	243.693	249.807			
731	Biased Irradiation	239.376	244.926			
732	Biased Irradiation	233.639	235.803			
733	Biased Irradiation	244.481	251.913			
734	Biased Irradiation	242.097	244.315			
735	All GND'd Irradiation	230.695		236.461		
736	All GND'd Irradiation	224.149		232.180		
737	All GND'd Irradiation	231.385		238.435		
738	All GND'd Irradiation	240.915		257.356		
739	All GND'd Irradiation	240.844		254.305		
740	Biased Irradiation	232.644		240.885		
741	Biased Irradiation	245.120		260.867		
742	Biased Irradiation	242.111		253.644		
743	Biased Irradiation	258.790		273.002		
744	Biased Irradiation	236.042		240.809		
745	All GND'd Irradiation	228.208			263.131	
746	All GND'd Irradiation	236.297			277.408	
747	All GND'd Irradiation	233.389			262.579	
748	All GND'd Irradiation	246.476			289.559	
749	All GND'd Irradiation	240.539			271.038	
750	Biased Irradiation	245.419			292.014	
751	Biased Irradiation	241.771			292.745	
752	Biased Irradiation	245.154			286.581	
753	Biased Irradiation	227.185			265.193	
754	Biased Irradiation	231.795			274.578	
755	All GND'd Irradiation	246.065				314.756
756	All GND'd Irradiation	246.817				318.051
757	All GND'd Irradiation	245.332				319.230
758	All GND'd Irradiation	241.551				309.662
759	All GND'd Irradiation	233.663				299.703
760	Biased Irradiation	249.992				330.417
761	Biased Irradiation	241.362				314.694
762	Biased Irradiation	242.099				315.011
763	Biased Irradiation	242.294				324.684
764	Biased Irradiation	246.545				329.797
723	Control Unit	248.412	235.398	235.398	235.398	235.398
724	Control Unit	226.792	212.647	212.647	212.647	212.647
	All GND'd Irradiation Statistics					
	Average All GND'd	239.843	242.443	243.747	272.743	312.281
	Std Dev All GND'd	8.480	10.611	11.311	11.215	7.949
	Ps90%/90% (+KTL) All GND'd	263.096	271.538	274.763	303.496	334.077
	Ps90%/90% (-KTL) All GND'd	216.589	213.348	212.732	241.990	290.484
	Biased Irradiation Statistics					
	Average Biased	240.657	245.353	253.842	282.222	322.921
	Std Dev Biased	4.382	6.232	13.732	11.979	7.694
	Ps90%/90% (+KTL) Biased	252.672	262.440	291.494	315.070	344.019
	Ps90%/90% (-KTL) Biased	228.643	228.266	216.189	249.374	301.822
	Specification MIN	150	150	150	150	150
	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



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 0.1 μ F
2	ADJUST	To -15V via 2K Ω
3	OUTPUT	To -15V via 61.9 Ω

Table B2: All GND'd

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

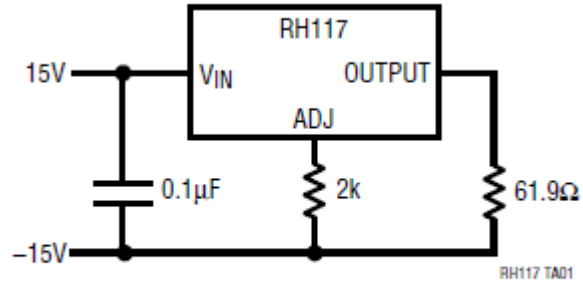


Figure B1: Total Dose Bias Circuit

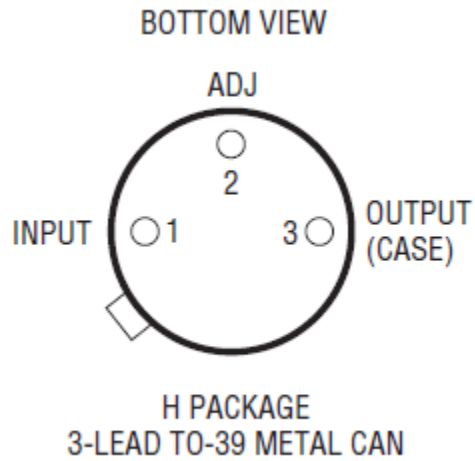


Figure B2: Pin-Out



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. 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: 2014-09-24 Test Certificate #: 2014-NRC-031 Total Pages (except cover): 2

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REQUEST FOR AND RESULTS OF TESTS					PAGE NO. 1	NO. OF PAGES 2
SECTION A - REQUEST FOR TEST						
1. TO: (Include ZIP Code) Defense Microelectronics Activity Science and Engineering Gamma Irradiation Test Facility 4234 54th Street McClellan, CA 95652-2100			2. FROM: (Include ZIP Code) 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			4. MANUFACTURING PLANT NAME AND ADDRESS (Include ZIP Code) Linear Technology Corp. 1630 McCarthy Blvd. Milpitas, CA 95035			
CONTRACT NUMBER CRADA CR-08-17			P.O. NUMBER TBD			
5. END ITEM AND/OR PROJECT N/A		6. SAMPLE NUMBER N/A	7. LOT NO. See below	8. REASON FOR SUBMITTAL Total Ionizing Dose (TID) Testing		9. DATE SUBMITTED 2014-09-23
10. MATERIAL TO BE TESTED Various biased/unbiased devices - see below	10a. QUANTITY SUBMITTED See below	11. QUANTITY REPRESENTED N/A	12. SPEC. & AMEND AND/OR DRAWING NO. & REV. FOR SAMPLE & DATE N/A			
13. PURCHASED FROM OR SOURCE Linear Technology Corp.		14. SHIPMENT METHOD Hand carry	15. DATE SAMPLED AND SUBMITTED BY 2014-09-23 by Tom Shepherd			
16. REMARKS AND/OR SPECIAL INSTRUCTIONS AND/OR WAIVERS. Dose Rate: 3000 ±10% rad(SiO2)/min Irradiation Steps: 10 Type of Test: Customer-Performed Total Dose: see below ±10% krad(SiO2) Requested Test Start Date: 2014-09-24 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 A. Customer reserves right to modify parameters, devices, etc. to suit test requirements. Description of parts to be irradiated is as follows: RH117H, fab lot #W10905063.1, ass'y lot #755614.1, WFR #10: 10, 20, 50 and 100 krad(SiO2), 10 devices per dose level, biased WQRH117MK-CS, fab lot #W0944174.1, ass'y lot #764506.2, WFR #4: 50 and 100 krad(SiO2), 5 devices per dose level, biased WQRH117MK-CS, fab lot #W0944174.1, ass'y lot #764507.2, WFR #11: 50 and 100 krad(SiO2), 5 devices per dose level, biased WQRH117MK-CS, fab lot #W0944174.1, ass'y lot #764508.2, WFR #20: 50 and 100 krad(SiO2), 5 devices per dose level, biased WQRH117MK-CS, fab lot #W0944174.1, ass'y lot #764509.2, WFR #25: 50 and 100 krad(SiO2), 5 devices per dose level, biased WQRH3083MK-CS, fab lot #HP210682.1, ass'y lot #788601.2, WFR #2: 50 and 200 krad(SiO2), 5 devices per dose level, biased WQRH3083MK-CS, fab lot #HP210682.1, ass'y lot #788602.2, WFR #3: 50 and 200 krad(SiO2), 5 devices per dose level, biased						
Experiment #: 2014-NRC-031	DMEA Approval:	SHEPHERD, THOMAS J. 125523594	SHEPHERD, THOMAS J. 125523594	SHEPHERD, THOMAS J. 125523594	MELINE CARY 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 2014-09-24		2. DATE RESULTS REPORTED 2014-09-24		3. LAB REPORT NUMBER N/A		
4. TEST PERFORMED	RESULTS OF TEST	SAMPLE RESULT	REQUIREMENTS			
Please see next page.						
DATE	TYPED NAME AND TITLE OF PERSON CONDUCTING TEST		SIGNATURE			
2014-09-24	Thomas J. Shepherd, SEGIT Technical Manager		SHEPHERD, THOMAS J. 125523594 6			
2014-09-25	Mohammad Arshad, Alt. SEGIT Facility Supervisor		ARSHAD, MOHAMMAD. 1231956693			

DD FORM 1222, FEB 62 (EF)

REPLACES DD FORM 1222, 1 JUL 58, WHICH IS OBSOLETE.

Appendix D

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

SYMBOL	PARAMETER	CONDITIONS	NOTES	$T_J = 25^\circ\text{C}$			$-55^\circ\text{C} \leq T_J \leq 150^\circ\text{C}$			SUB-GROUP	UNITS
				MIN	TYP	MAX	MIN	TYP	MAX		
V_{REF}	Reference Voltage	$3V \leq (V_{IN} - V_{OUT}) \leq 40V$, $10mA \leq I_{OUT} \leq I_{MAX}$, $P \leq P_{MAX}$		1.20	1.30		1.20	1.30	2,3	V	
$\frac{\Delta V_{OUT}}{\Delta V_{IN}}$	Line Regulation	$3V \leq (V_{IN} - V_{OUT}) \leq 40V$, $I_{OUT} = 10mA$	2		0.02			0.05	2,3	%/V	
$\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$	Load Regulation	$10mA \leq I_{OUT} \leq I_{MAX}$, $V_{OUT} \leq 5V$	2		15			50	2,3	mV	
		$10mA \leq I_{OUT} \leq I_{MAX}$, $V_{OUT} \geq 5V$	2		0.3			1	2,3	%	
	Thermal Regulation	20ms Pulse			0.07					%/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			100	2,3	μA	
ΔI_{ADJ}	Adjust Pin Current Change	$10mA \leq I_{OUT} \leq I_{MAX}$			5			5	2,3	μA	
		$2.5V \leq (V_{IN} - V_{OUT}) \leq 40V$, $I_{OUT} = 10mA$			5			5	2,3	μA	
I_{MIN}	Minimum Load Current	$(V_{IN} - V_{OUT}) = 40V$			5			5	2,3	mA	
	Current Limit	$(V_{IN} - V_{OUT}) \leq 15V$ H Package K Package		0.5 1.5		1 1		0.5 1.5	2,3 2,3	A A	
		$(V_{IN} - V_{OUT}) = 40V$ H Package K Package		0.15 0.30		1 1				A A	
$\frac{\Delta V_{OUT}}{\Delta Temp}$	Temperature Stability	$-55^\circ\text{C} \leq T_J \leq 150^\circ\text{C}$						1		%	
$\frac{\Delta V_{OUT}}{\Delta Time}$	Long Term Stability	$T_A = 125^\circ\text{C}$	3					1		%	
e_n	RMS Output Noise	$10Hz \leq f \leq 10kHz$			0.001					%	
θ_{JC}	Thermal Resistance (Junction to Case)	H Package	3		15					$^\circ\text{C}/\text{W}$	
		K Package	3		3					$^\circ\text{C}/\text{W}$	

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

SYMBOL	PARAMETER	CONDITIONS	NOTES	10KRAD(Si)		20KRAD(Si)		50KRAD(Si)		100KRAD(Si)		UNITS
				MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
V_{REF}	Reference Voltage	$3V \leq (V_{IN} - V_{OUT}) \leq 40V$, $10mA \leq I_{OUT} \leq I_{MAX}$, $P \leq P_{MAX}$		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	$3V \leq (V_{IN} - V_{OUT}) \leq 40V$, $I_{OUT} = 10mA$	2		0.02		0.02		0.02		0.03	%/V
$\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$	Load Regulation	$10mA \leq I_{OUT} \leq I_{MAX}$, $V_{OUT} \leq 5V$	2		36		42		48		60	mV
		$10mA \leq I_{OUT} \leq I_{MAX}$, $V_{OUT} \geq 5V$	2		0.72		0.84		0.96		1.20	%
I_{ADJ}	Adjust Pin Current				100		100		100		100	μA
ΔI_{ADJ}	Adjust Pin Current Change	$10mA \leq I_{OUT} \leq I_{MAX}$			5		5		5		5	μA
		$3V \leq (V_{IN} - V_{OUT}) \leq 40V$, $I_{OUT} = 10mA$			5		5		5		5	μA
I_{MIN}	Minimum Load Current	$(V_{IN} - V_{OUT}) = 40V$			5		5		5		5	mA
	Current Limit	$(V_{IN} - V_{OUT}) \leq 15V$	H Package K Package		0.5		0.5		0.5		0.5	A
					1.5		1.5		1.5		1.5	A
		$(V_{IN} - V_{OUT}) = 40V$	H Package K Package		0.15		0.15		0.15		0.15	A
					0.30		0.30		0.30		0.30	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: $T_J = 25^\circ C$ unless otherwise noted.