Neutron Irradiation Test Results of the RH1086MK 1.5A Low Dropout Positive Adjustable Regulator

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Acknowledgements

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Neutron Radiation Testing of the RH1086MK 1.5A Low Dropout Positive Adjustable Regulator

Part Type Tested: RH1086MK 1.5A Low Dropout Positive Adjustable Regulator

Traceability Information: Fab Lot# W10913024.1; Wafer # 17; Assembly Lot # 540912.1; Date Code 0941A. See photograph of unit under test in Appendix A.

Quantity of Units: 7 units received, 2 units for control, and 5 units for unbiased irradiation. Leads of devices, serial numbers 54-56, 64, and 66 were shorted together using anti-static foam during irradiation. Serial numbers 69 and 70 were used as control. See Appendix B for the radiation bias connection tables.

Radiation Dose: Total fluence of 1E12 neutron/cm^2.

Radiation Test Standard: MIL-STD-883 TM1017 and Linear Technology RH1086MK SPEC No. 05-08-5021.

Test Hardware and Software: LTX test program EFCR1086.05

Facility and Radiation Source: University of Massachusetts, Lowell and Reactor Facility-FNI.

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

SUMMARY

ALL FIVE PARTS PASSED THE ELECTRICAL TEST LIMITS AS SPECIFIED IN THE DATASHEET AFTER IRRADIATION TO 1E12 N/cm^2. ADDITIONAL INFORMATION CAN BE PROVIDED PER REQUEST.

1.0 Overview and Background

Neutron particles incident on semiconductor materials lose energy along their paths. The energy loss produces electron-hole pairs (ionization) and displaces atoms in the material lattice (displacement damage defects or DDD). DDD induces a mixture of isolated and clustered defects or broken bonds. Such defects elevate the energy level of the material and consequently change material and electrical properties. The altering energy level creates the combination of any of the following processes, thermal generation of electron-hole pairs, recombination, trapping, compensation, tunneling, affecting hence the devices' basic features. We run the electrical tests after we had made sure that the parts are not radioactive anymore to be shipped to LTC.

Bipolar technology is susceptible to neutron displacement damage around a fluence level of 1E12 neutron/cm^2. The neutron radiation test for the RH1086MK determines the change in device performance as a function of neutrons' fluence.

2.0 Radiation Facility:

Five samples were irradiated unbiased at the University of Massachusetts, Lowell, using the Reactor Facility-FNI. The neutron flux was determined by system S/P-32, method ASTM E-265, to be 4.05E9 N/cm^2-s (1MeV equivalent) for each irradiation step. Refer to Appendix C for the certificate of dosimetry.

3.0 Test Conditions

Five samples and two control units were electrically tested at 25°C prior to irradiation. The testing was performed on the two control units to confirm the operation of the test system prior to the electrical testing of the 7 units (5 irradiated and 2 control). During irradiation, devices leads were shorted together using anti-static foam and devices then were placed into an anti-static bag. Devices were then vertically aligned with the radiation source.

The criteria to pass the neutron displacement damage test is that five irradiated samples 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 in accordance with method 5004, MIL-STD-883, and if valid the lot will be scrapped.

4.0 Tested Parameters

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

- Reference Voltage (V) @ I_{OUT} = 10mA, (V_{IN} – V_{OUT}) = 3V
- Reference Voltage (V) @ 10mA ≤ I_{OUT} ≤ 1.5A, 1.5V ≤ (V_{IN} – V_{OUT}) ≤ 15V
- Line Regulation (%) @ I_{OUT} = 10mA, 1.5V ≤ (V_{IN} – V_{OUT}) ≤ 15V
- Load Regulation (%) @ (V_{IN} – V_{OUT}) = 3V, 10mA ≤ I_{OUT} ≤ 1.5A
- Dropout Voltage (V) @ ΔV_{REF} = 1%, I_{OUT} = 1.5A
- Current Limit (A) @ (V_{IN} – V_{OUT}) = 5V
- Current Limit (A) @ (V_{IN} – V_{OUT}) = 25V
- Minimum Load Current (mA) @ (V_{IN} – V_{OUT}) = 25V
- Adjust Pin Current (uA)
- Adjust Pin Current Change (uA) @10mA ≤ I_{OUT} ≤ 1.5A, 1.5V ≤ (V_{IN} – V_{OUT}) ≤ 15V

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

5.0 Test Results

All five 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 dashed lines with X-markers are the measured data points of five post-irradiated samples. The solid lines with square symbols are the computed KTL values of five post-irradiated samples with the application of the K_{TL} statistics. The orange solid lines with circle markers are the datasheet specification limits.

The post-irradiation test limits are using Linear Technology datasheets 100 Krads(Si) specification limits.

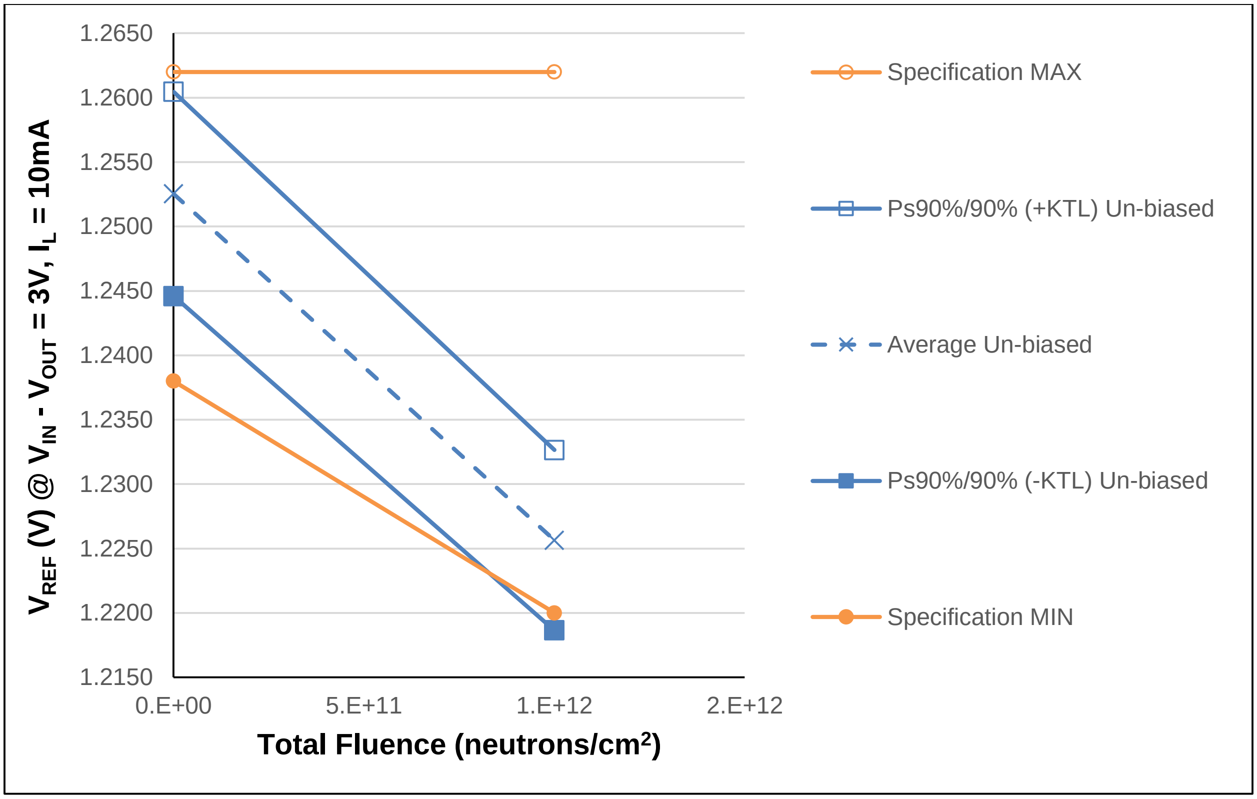

Figure 5.1 Plot Reference Voltage @ I_{OUT} = 10mA, (V_{IN} – V_{OUT}) = 3V versus Total Fluence

Table 5.1: Raw data table for Reference Voltage @ I_{OUT} = 10mA, (V_{IN} – V_{OUT}) = 3V of pre- and post-irradiation (1E12 N/cm^2)

Parameter	V_{REF} @ V_{IN} -V_{OUT} =3V; I_L=10mA	Total Fluence (neutrons/cm^2)	
Units	(V)	0	1.E+12
54	Un-biased Irradiation	1.25186	1.22590
55	Un-biased Irradiation	1.25504	1.22670
56	Un-biased Irradiation	1.25605	1.22924
64	Un-biased Irradiation	1.24980	1.22300
66	Un-biased Irradiation	1.24991	1.22341
69	Control Unit	1.24868	1.24845
70	Control Unit	1.25692	1.25681
	Un-biased Irradiation Statistics		
	Average Un-biased	1.25253	1.22565
	Std-Dev Un-biased	0.00289	0.00255
	Ps90%/90% (+KTL) Un-biased	1.26046	1.23265
	Ps90%/90% (-KTL) Un-biased	1.24460	1.21865
	Specification MIN	1.238	1.220
	Status (Measurements)	PASS	PASS
	Specification MAX	1.262	1.262
	Status (Measurements)	PASS	PASS
	Status (-KTL) Un-biased	PASS	FAIL
	Status (+KTL) Un-biased	PASS	PASS

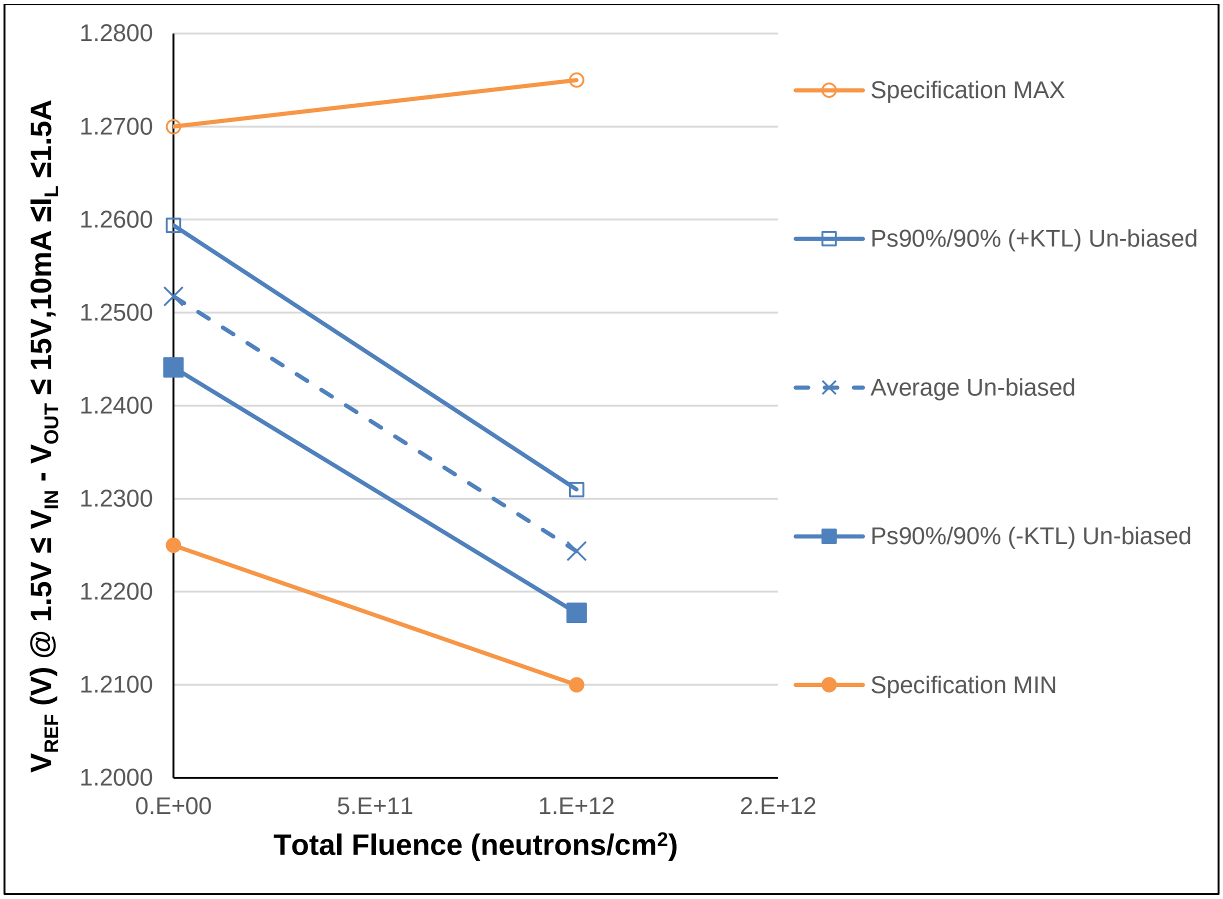

Figure 5.2: Plot of versus Reference Voltage @ 10mA ≤ I_{OUT} ≤ 1.5A, 1.5V ≤ (V_{IN} – V_{OUT}) ≤ 15V versus Total Fluence

Table 5.2: Raw data table for Reference Voltage @ 10mA ≤ I_{OUT} ≤ 1.5A, 1.5V ≤ (V_{IN} – V_{OUT}) ≤ 15V of pre- and post-irradiation (1E12 N/cm^2)

Parameter	V_{REF}. @ 1.5V to 15V;10mA ≤ I_L ≤1.5A	Total Fluence (neutrons/cm^2)	
Units	(V)	0	1.E+12
54	Un-biased Irradiation	1.25121	1.22473
55	Un-biased Irradiation	1.25414	1.22526
56	Un-biased Irradiation	1.25513	1.22778
64	Un-biased Irradiation	1.24906	1.22188
66	Un-biased Irradiation	1.24922	1.22221
69	Control Unit	1.24785	1.24768
70	Control Unit	1.25590	1.25593
	Un-biased Irradiation Statistics		
	Average Un-biased	1.25175	1.22437
	Std-Dev Un-biased	0.00279	0.00242
	Ps90%/90% (+KTL) Un-biased	1.25939	1.23100
	Ps90%/90% (-KTL) Un-biased	1.24411	1.21774
	Specification MIN	1.225	1.210
	Status (Measurements)	PASS	PASS
	Specification MAX	1.270	1.275
	Status (Measurements)	PASS	PASS
	Status (-KTL) Un-biased	PASS	PASS
	Status (+KTL) Un-biased	PASS	PASS

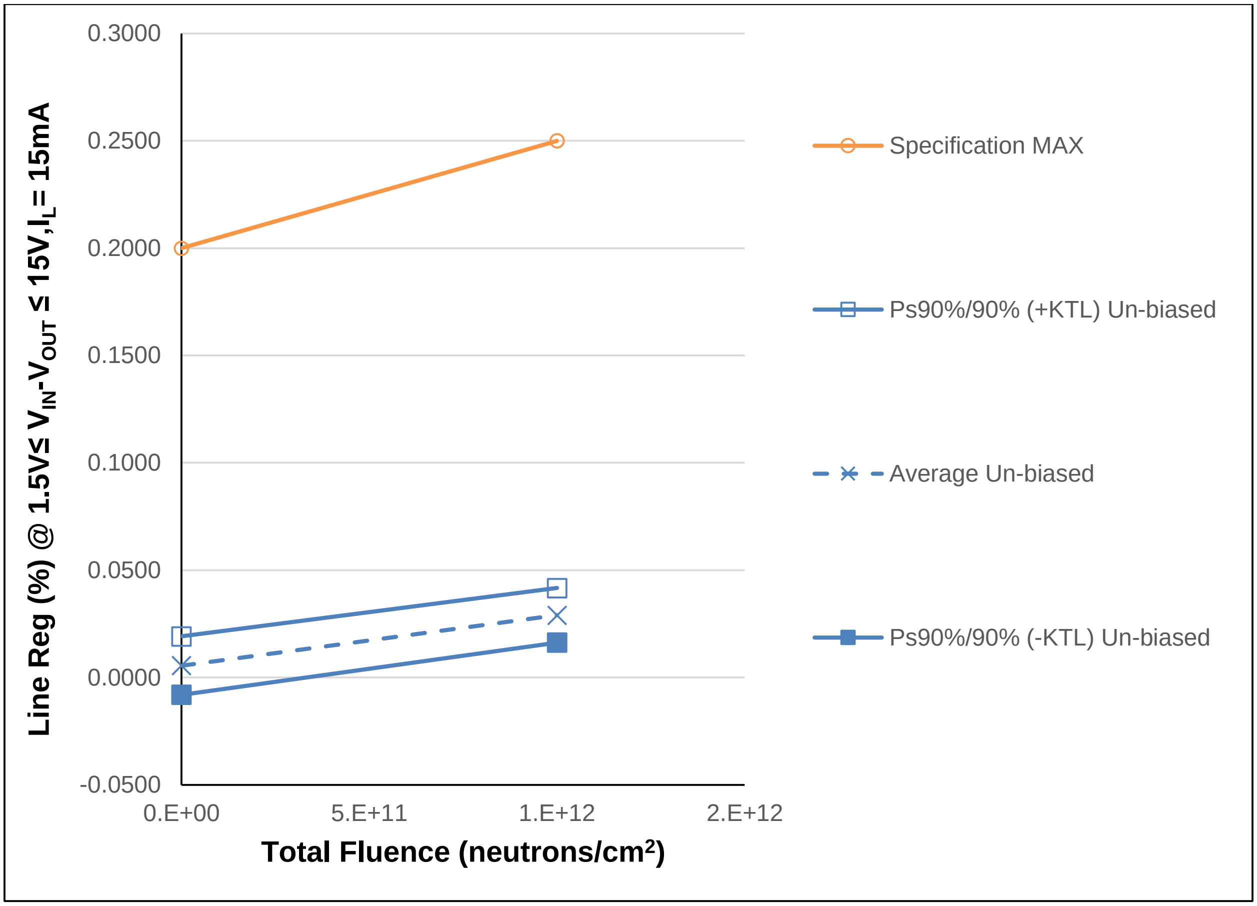

Figure 5.3: Plot of Line Regulation @ I_{OUT} = 10mA, 1.5V ≤ (V_{IN} – V_{OUT}) ≤ 15V versus Total Fluence

Table 5.3: Raw data table for Line Regulation @ I_{OUT} = 10mA, 1.5V ≤ (V_{IN} – V_{OUT}) ≤ 15V of pre- and post-irradiation (1E12 N/cm^2)

Parameter	Line Reg @ 1.5V TO 15V; I_L =10mA	Total Fluence (neutrons/cm^2)	
Units	(%)	0	1.E+12
54	Un-biased Irradiation	0.00000	0.03120
55	Un-biased Irradiation	0.01147	0.02333
56	Un-biased Irradiation	0.00076	0.03096
64	Un-biased Irradiation	0.00771	0.03432
66	Un-biased Irradiation	0.00771	0.02495
69	Control Unit	0.01344	-0.00153
70	Control Unit	0.00038	0.00000
	Un-biased Irradiation Statistics		
	Average Un-biased	0.00553	0.02895
	Std-Dev Un-biased	0.00495	0.00462
	Ps90%/90% (+KTL) Un-biased	0.01911	0.04163
	Ps90%/90% (-KTL) Un-biased	-0.00805	0.01627
	Specification MIN		
	Status (Measurements)		
	Specification MAX	0.2	0.25
	Status (Measurements)	PASS	PASS
	Status (-KTL) Un-biased		
	Status (+KTL) Un-biased	PASS	PASS

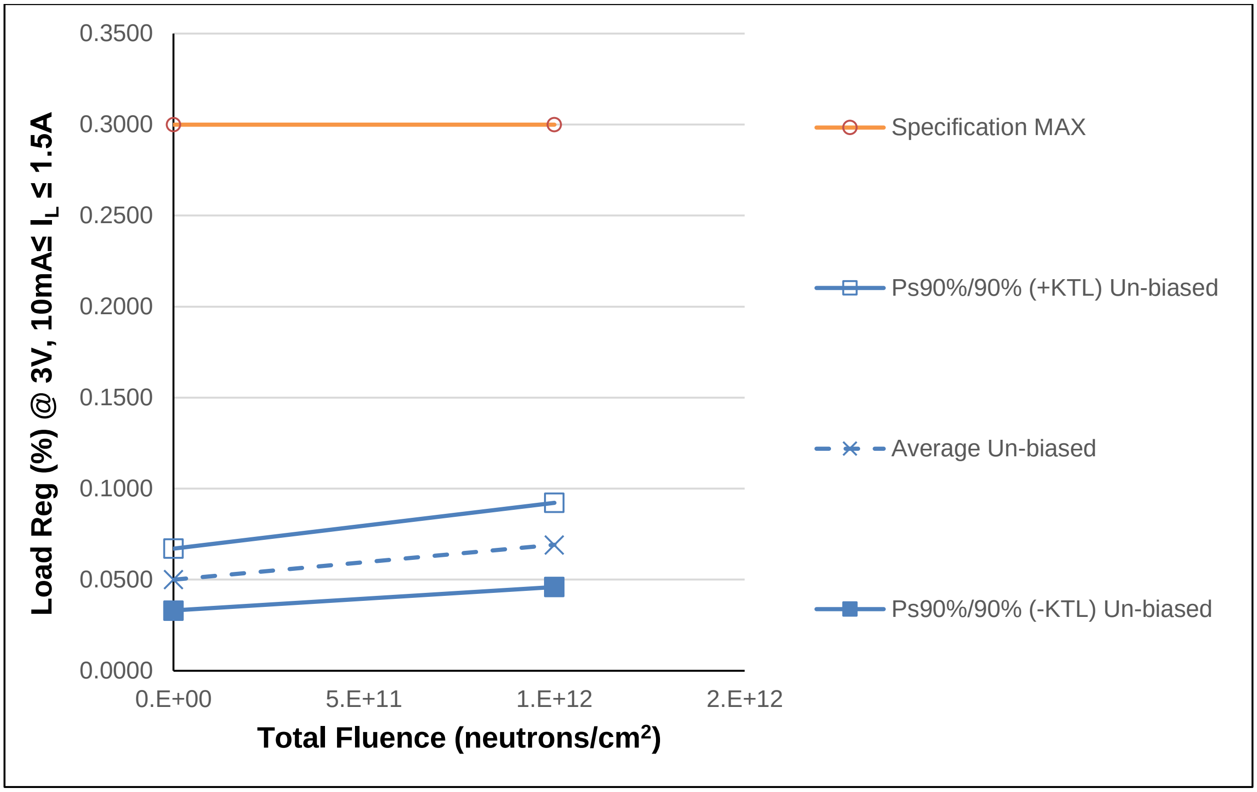

Figure 5.4: Plot of Load Regulation @ (V_{IN} – V_{OUT}) = 3V, 10mA ≤ I_{OUT} ≤ 1.5A versus Total Fluence

Table 5.4: Raw data table for Load Regulation @ (V_{IN} – V_{OUT}) = 3V, 10mA ≤ I_{OUT} ≤ 1.5A of pre- and post-irradiation (1E12 N/cm^2)

Parameter	Load Reg @ 3V;I_L from 10mA to 1.5A	Total Fluence (neutrons/cm^2)	
Units	(%)	0	1.E+12
54	Un-biased Irradiation	0.04380	0.06067
55	Un-biased Irradiation	0.06011	0.07907
56	Un-biased Irradiation	0.04715	0.07712
64	Un-biased Irradiation	0.04800	0.06261
66	Un-biased Irradiation	0.05119	0.06625
69	Control Unit	0.04720	0.04988
70	Control Unit	0.06647	0.06450
	Un-biased Irradiation Statistics		
	Average Un-biased	0.05005	0.06915
	Std-Dev Un-biased	0.00621	0.00844
	Ps90%/90% (+KTL) Un-biased	0.06707	0.09228
	Ps90%/90% (-KTL) Un-biased	0.03303	0.04601
	Specification MIN		
	Status (Measurements)		
	Specification MAX	0.3	0.3
	Status (Measurements)	PASS	PASS
	Status (-KTL) Un-biased		
	Status (+KTL) Un-biased	PASS	PASS

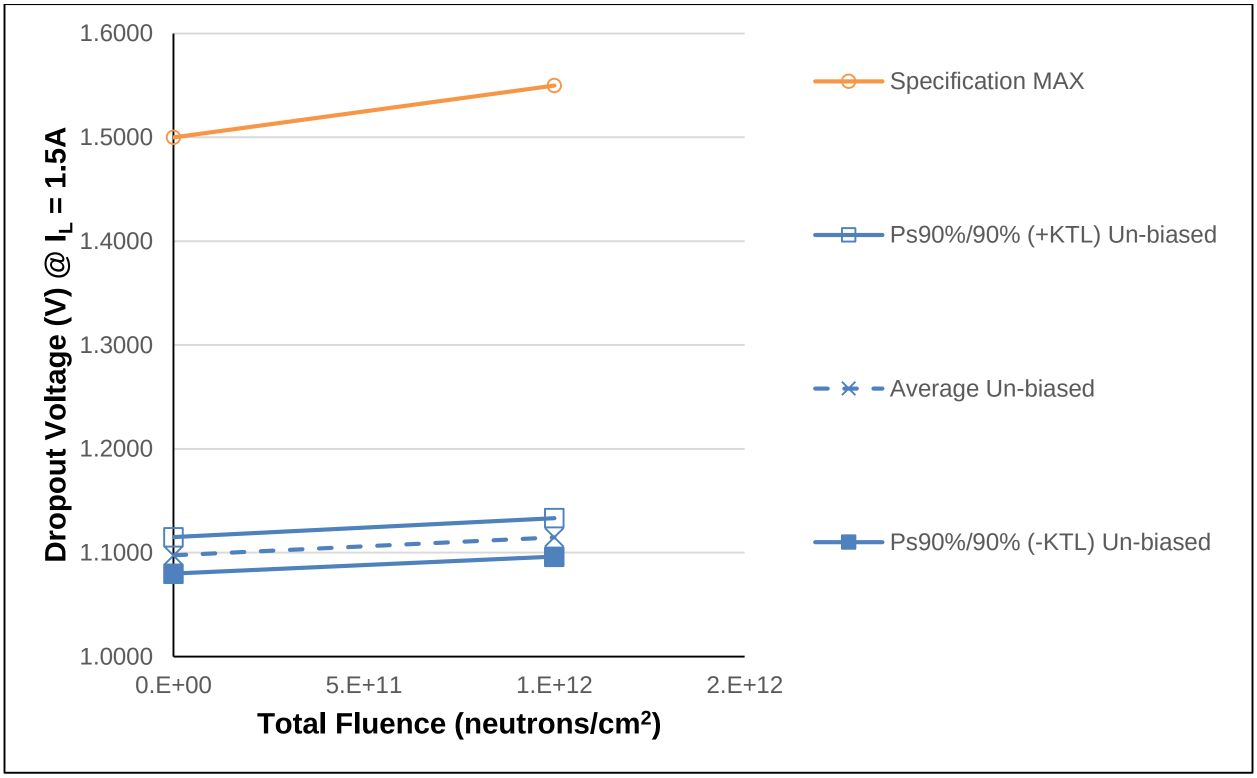

Figure 5.5: Plot of Dropout Voltage @ ΔV_{REF} = 1%, I_{OUT} = 1.5A versus Total Fluence

Table 5.5: Raw data table for Dropout Voltage @ ΔV_{REF} = 1%, I_{OUT} = 1.5A of pre- and post-irradiation (1E12 N/cm^2)

Parameter	Dropout Voltage at 1.5A	Total Fluence (neutrons/cm^2)	
Units	(V)	0	1.E+12
54	Un-biased Irradiation	1.09636	1.11244
55	Un-biased Irradiation	1.10142	1.11887
56	Un-biased Irradiation	1.10550	1.12360
64	Un-biased Irradiation	1.09505	1.11323
66	Un-biased Irradiation	1.08863	1.10577
69	Control Unit	1.09680	1.10008
70	Control Unit	1.10742	1.10998
	Un-biased Irradiation Statistics		
	Average Un-biased	1.09739	1.11478
	Std-Dev Un-biased	0.00643	0.00677
	Ps90%/90% (+KTL) Un-biased	1.11502	1.13335
	Ps90%/90% (-KTL) Un-biased	1.07977	1.09621
	Specification MIN		
	Status (Measurements)		
	Specification MAX	1.50	1.55
	Status (Measurements)	PASS	PASS
	Status (-KTL) Un-biased		
	Status (+KTL) Un-biased	PASS	PASS

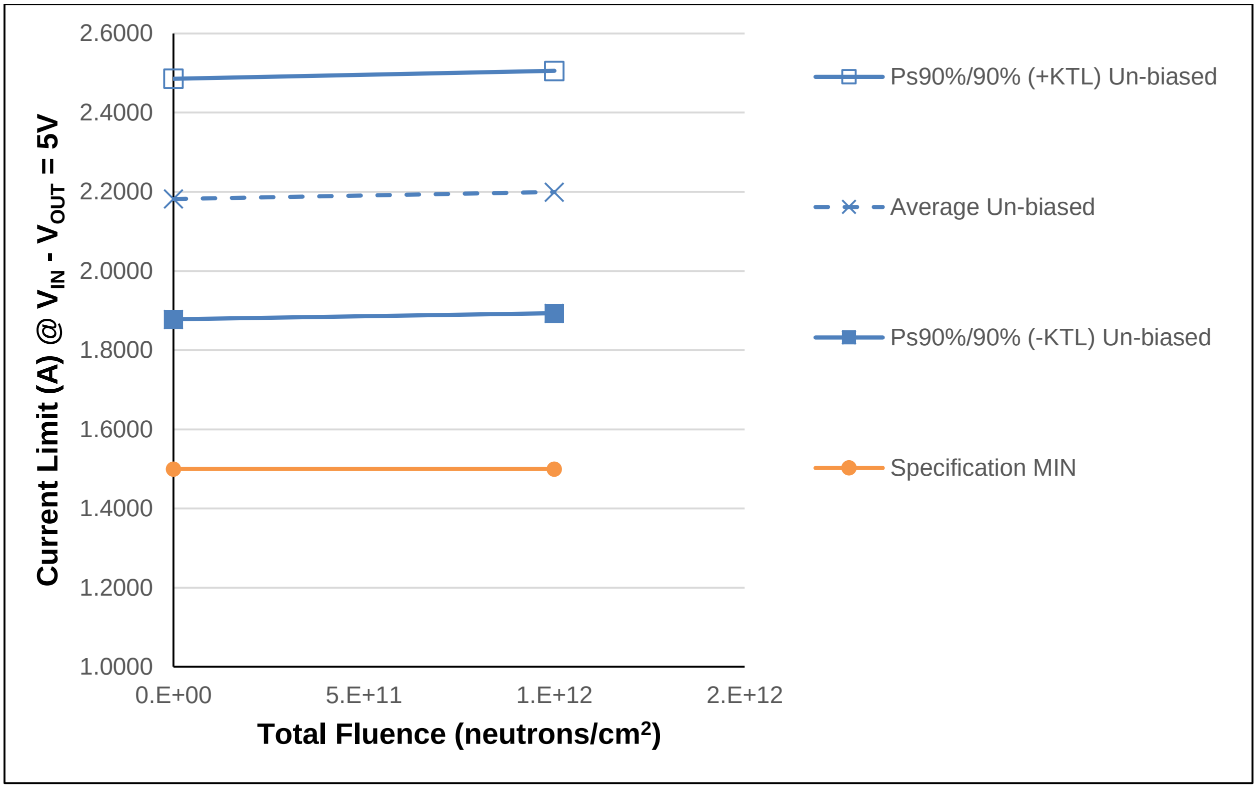

Figure 5.6: Plot of Current Limit @ (V_{IN} – V_{OUT}) = 5V versus Total Fluence

Table 5.6: Raw data table for Current Limit @ (V_{IN} – V_{OUT}) = 5V of pre- and post-irradiation (1E12 N/cm^2)

Parameter	Current Limit @ V_{IN} - V_{OUT} = 5V	Total Fluence (neutrons/cm^2)	
Units	(A)	0	1.E+12
54	Un-biased Irradiation	2.27413	2.28915
55	Un-biased Irradiation	2.07586	2.09228
56	Un-biased Irradiation	2.04867	2.06558
64	Un-biased Irradiation	2.27556	2.29695
66	Un-biased Irradiation	2.23527	2.25298
69	Control Unit	2.24102	2.23374
70	Control Unit	2.04885	2.04079
	Un-biased Irradiation Statistics		
	Average Un-biased	2.18190	2.19939
	Std-Dev Un-biased	0.11082	0.11161
	Ps90%/90% (+KTL) Un-biased	2.48576	2.50542
	Ps90%/90% (-KTL) Un-biased	1.87804	1.89336
	Specification MIN	1.5	1.5
	Status (Measurements)	PASS	PASS
	Specification MAX		
	Status (Measurements)		
	Status (-KTL) Un-biased	PASS	PASS
	Status (+KTL) Un-biased		

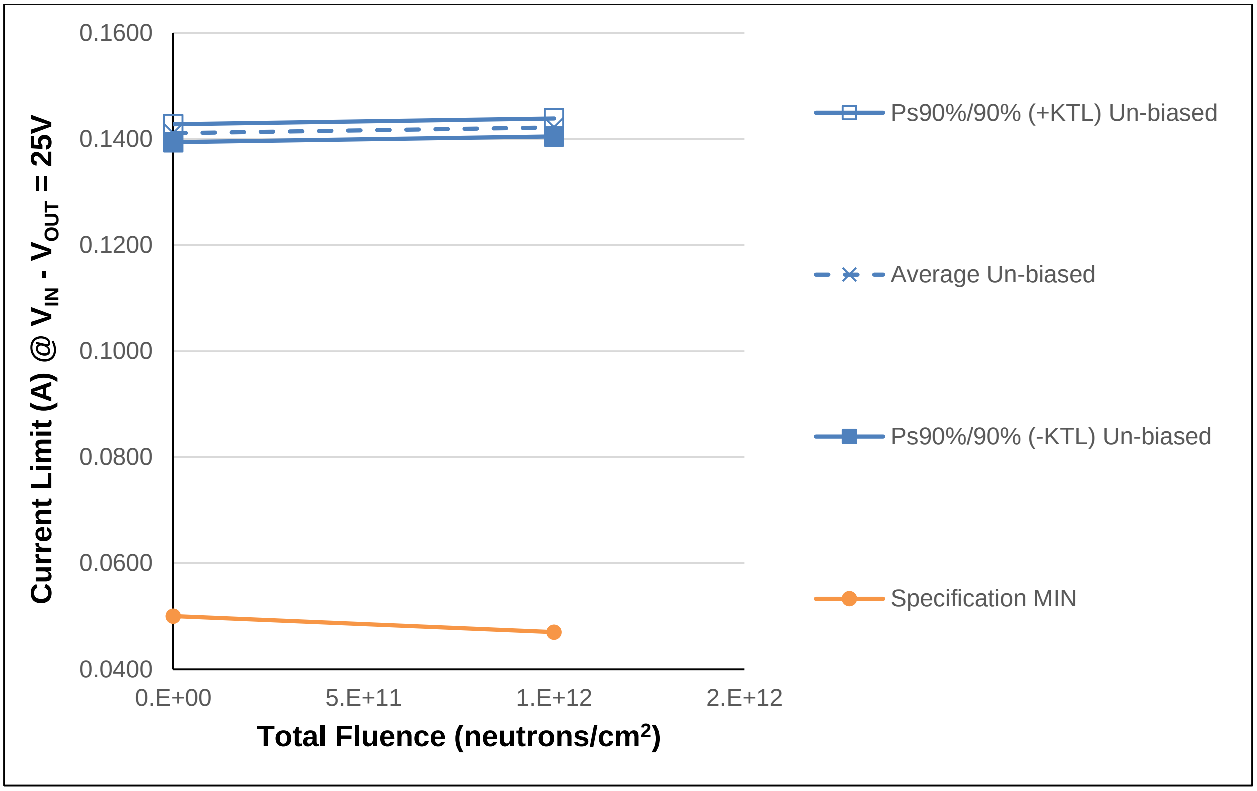

Figure 5.7: Plot of Current Limit @ (V_{IN} – V_{OUT}) = 25V versus Total Fluence

Table 5.7: Raw data table for Current Limit @ ($V_{IN} – V_{OUT}$) = 25V of pre- and post-irradiation (1E12 N/cm^2)

Parameter	Current Limit V_{IN} - V_{OUT} = 25V	Total Fluence (neutrons/cm^2)	
Units	(A)	0	1.E+12
54	Un-biased Irradiation	0.14140	0.14133
55	Un-biased Irradiation	0.14200	0.14241
56	Un-biased Irradiation	0.14098	0.14184
64	Un-biased Irradiation	0.14075	0.14295
66	Un-biased Irradiation	0.14040	0.14245
69	Control Unit	0.14118	0.14348
70	Control Unit	0.14051	0.14229
	Un-biased Irradiation Statistics		
	Average Un-biased	0.14111	0.14220
	Std-Dev Un-biased	0.00062	0.00062
	Ps90%/90% (+KTL) Un-biased	0.14280	0.14391
	Ps90%/90% (-KTL) Un-biased	0.13941	0.14049
	Specification MIN	0.05	0.047
	Status (Measurements)	PASS	PASS
	Specification MAX		
	Status (Measurements)		
	Status (-KTL) Un-biased	PASS	PASS
	Status (+KTL) Un-biased		

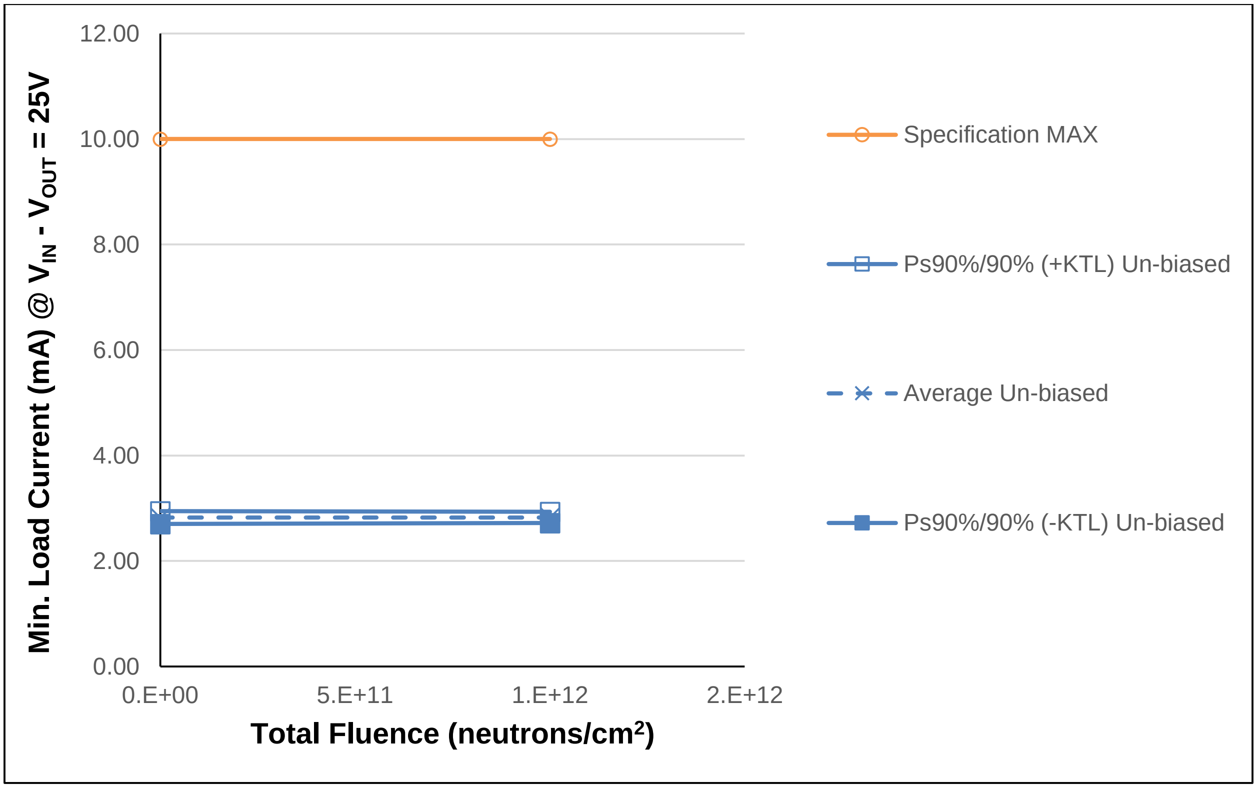

Figure 5.8: Plot of Minimum Load Current @ (V_{IN} – V_{OUT}) = 25V versus Total Fluence

Table 5.8: Raw data table for Minimum Load Current @ (V_{IN} – V_{OUT}) = 25V of pre- and post-irradiation (1E12 N/cm^2)

Parameter	Min. Load Current @ V_{IN}-V_{OUT}= 25V	Total Fluence (neutrons/cm^2)	
Units	(mA)	0	1.E+12
54	Un-biased Irradiation	2.86230	2.87291
55	Un-biased Irradiation	2.78085	2.79063
56	Un-biased Irradiation	2.77740	2.78933
64	Un-biased Irradiation	2.82502	2.82364
66	Un-biased Irradiation	2.87360	2.86131
69	Control Unit	2.75930	2.76370
70	Control Unit	2.77200	2.77476
	Un-biased Irradiation Statistics		
	Average Un-biased	2.82383	2.82756
	Std-Dev Un-biased	0.04461	0.03885
	Ps90%/90% (+KTL) Un-biased	2.94616	2.93408
	Ps90%/90% (-KTL) Un-biased	2.70150	2.72105
	Specification MIN		
	Status (Measurements)		
	Specification MAX	10	10
	Status (Measurements)	PASS	PASS
	Status (-KTL) Un-biased		
	Status (+KTL) Un-biased	PASS	PASS

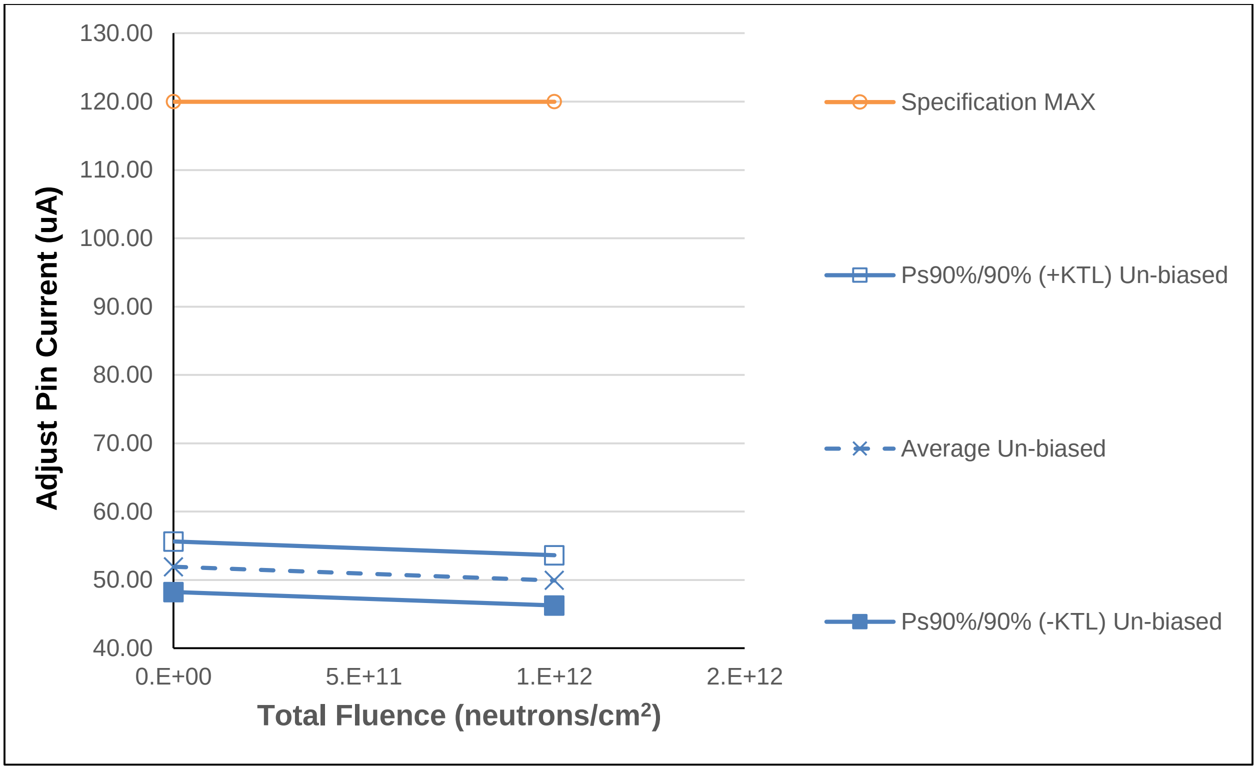

Figure 5.9: Plot of versus Adjust Pin Current versus Total Fluence

Table 5.9: Raw data table for Adjust Pin Current of pre- and post-irradiation (1E12 N/cm^2)

Parameter	Adjust Pin Current	Total Fluence (neutrons/cm^2)	
Units	(uA)	0	1.E+12
54	Un-biased Irradiation	53.16989	51.46558
55	Un-biased Irradiation	50.52086	48.76309
56	Un-biased Irradiation	50.45754	48.43474
64	Un-biased Irradiation	52.34979	49.97215
66	Un-biased Irradiation	53.11135	51.0384
69	Control Unit	50.82547	50.76115
70	Control Unit	50.17204	50.43983
	Un-biased Irradiation Statistics		
	Average Un-biased	51.92189	49.93479
	Std-Dev Un-biased	1.34746	1.34031
	Ps90%/90% (+KTL) Un-biased	55.61663	53.60992
	Ps90%/90% (-KTL) Un-biased	48.22714	46.25967
	Specification MIN		
	Status (Measurements)		
	Specification MAX	120	120
	Status (Measurements)	PASS	PASS
	Status (-KTL) Un-biased		
	Status (+KTL) Un-biased	PASS	PASS

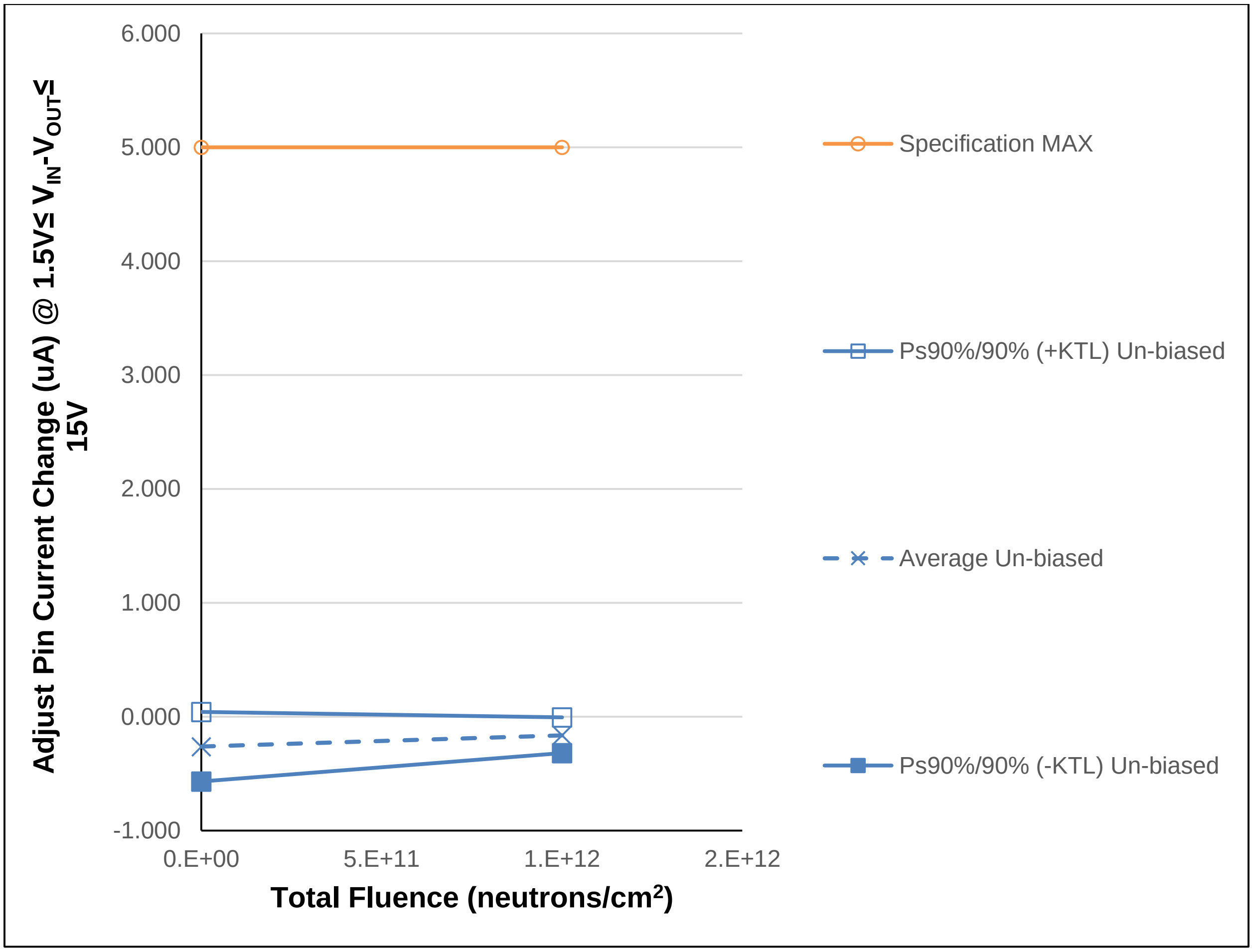

Figure 5.10: Plot of Adjust Pin Current Change @10mA ≤ I_{OUT} ≤ 1.5A, 1.5V ≤ (V_{IN} – V_{OUT}) ≤ 15V versus Total Fluence

Table 5.10: Raw data table for Adjust Pin Current Change @10mA ≤ I_{OUT} ≤ 1.5A, 1.5V ≤ (V_{IN} – V_{OUT}) ≤ 15V of pre- and post-irradiation (1E12 N/cm^2)

Parameter	Delta Adjust Pin I @ I_L=10mA to 1.5A	Total Fluence (neutrons/cm^2)	
Units	(uA)	0	1.E+12
54	Un-biased Irradiation	-0.28730	-0.16185
55	Un-biased Irradiation	-0.41332	-0.25463
56	Un-biased Irradiation	-0.17502	-0.13445
64	Un-biased Irradiation	-0.13319	-0.10111
66	Un-biased Irradiation	-0.30582	-0.16052
69	Control Unit	-0.18696	-0.17245
70	Control Unit	-0.32134	-0.07861
	Un-biased Irradiation Statistics		
	Average Un-biased	-0.26293	-0.16251
	Std-Dev Un-biased	0.11137	0.05711
	Ps90%/90% (+KTL) Un-biased	0.04244	-0.00590
	Ps90%/90% (-KTL) Un-biased	-0.56830	-0.31912
	Specification MIN		
	Status (Measurements)		
	Specification MAX	5	5
	Status (Measurements)	PASS	PASS
	Status (-KTL) Un-biased		
	Status (+KTL) Un-biased	PASS	PASS

Appendix A

Pictures of one among five samples used in the test.

Figure A1: Top View showing date code

Figure A2: Bottom View showing serial number

Appendix B

Radiation Bias Connection Table

Table B1: Unbias condition

Pin	Function	Connection
1	Adjust	Float
2	V_{IN}	Float
3	V_{OUT}	Float

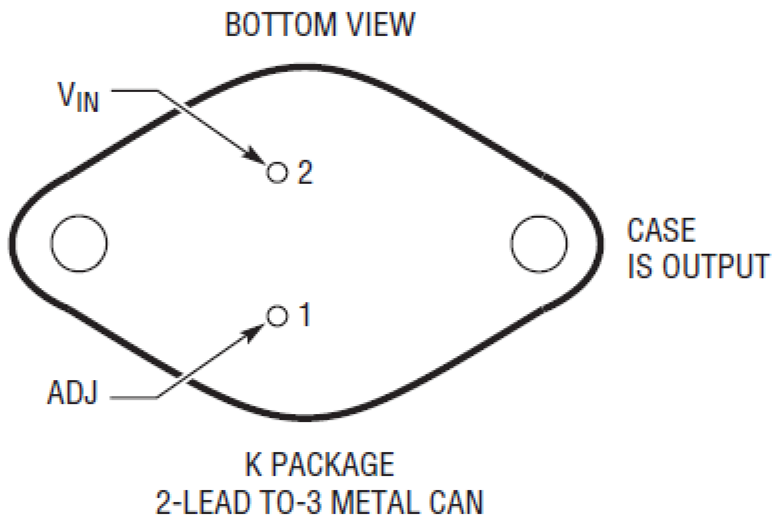

Figure B1: Pin-Out

Appendix C

Pinanski Building
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Thomas Regan
Reactor Engineering

University of Massachusetts
UMASS Lowell

RADIATION LABORATORY

7/2/2012
Linear Technology Corporation
Attention: Sana Rezgui
1530 Buckeye Drive
Milpitas, CA 95035

Subject: **Certificate of Neutron Exposure**

Product: Multiple products see attached table

Irradiation Date: June, 27th, 2012
Irradiation Facility: Reactor Facility- FNI
Dosimetry system: S/P-32, ASTM E-265

Neutron Dosimetry Results:

Irradiation	Requested Fluence (n/cm^2)	Reactor Power (kW)	Time (s)	Fluence Rate (n/cm^2-s)$^{(2,3)}$	Gamma Dose rad (Si) $^{(1)}$	Measured Fluence (n/cm^2)$^{(4)}$	Total Integral Fluence (n/cm^2)
Group 1	1.00E+12	45.0	228	4.05E+09	117	1.03E+12	1.03E+12
Group 2	1.00E+12	45.0	228	4.05E+09	117	9.41E+11	9.41E+11
Group 3	1.00E+13	475	234	4.28E+10	1266	9.22E+12	9.22E+12
Group 4	1.00E+13	90	1235	8.10E+09	1266	9.03E+12	9.03E+12

(1) Based on reactor power at 1,000kW, the gamma dose is 41+/- 5.3% krad(Si)/hr as mapped by TLD-based dosimetry
(2) Dosimetry method: ASTM E-265
(3) The neutron fluence rate is determined from "Initial Testing of the New Ex-Core Fast Neutron Irradiator at UMass Lowell " (6/18/02)
(4) Validated by S-32 flux monitors

The neutron fluence for this irradiation was determined using the previously measured neutron radiation field for this facility, measured with ASTM E-265 "Measuring Reaction Rates and Fast Neutron Fluence by Radioactivation of Sulfur-32" and correlated to the measured reactor power level.

Group 1 **Average Integrated Neutron Fluence (1 MeV Si Eq.) =1.03E12 n/cm^2**
Group 2 **Average Integrated Neutron Fluence (1 MeV Si Eq.) =9.41E11 n/cm^2**
Group 3 **Average Integrated Neutron Fluence (1 MeV Si Eq.) =9.22E12 n/cm^2**
Group 4 **Average Integrated Neutron Fluence (1 MeV Si Eq.) =9.03E12 n/cm^2**

Reviewed by Thomas M Regan
Thomas Regan
Reactor Engineer

Appendix D

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

PARAMETER	CONDITIONS	NOTES	$T_A = 25°C$ MIN	TYP	MAX	SUB-GROUP	$-55°C \le T_A \le 125°C$ MIN	TYP	MAX	SUB-GROUP	UNITS
Reference Voltage	$I_{OUT} = 10mA$, $(V_{IN} - V_{OUT}) = 3V$ (K)		1.238		1.262	1					V
	$10mA \le I_{OUT} \le I_{FULL\ LOAD}$, $1.5V \le (V_{IN} - V_{OUT}) \le 25V$	6	1.225		1.270		1.225		1.270	2,3	V
Line Regulation	$I_{LOAD} = 10mA$, $1.5V \le (V_{IN} - V_{OUT}) \le 15V$	2, 3			0.2	1			0.2	2,3	%
Load Regulation	$(V_{IN} - V_{OUT}) = 3V$, $10mA \le I_{OUT} \le I_{FULL\ LOAD}$	2, 3, 6			0.3	1			0.4	2,3	%
Dropout Voltage	$\Delta V_{REF} = 1\%$, $I_{OUT} = 1.5A$ (K) $\Delta V_{REF} = 1\%$, $I_{OUT} = 0.5A$ (H)	4 4			1.5 1.25	1 1			1.5 1.25	2,3 2,3	V V
Current Limit	$(V_{IN} - V_{OUT}) = 5V$ (K) $(V_{IN} - V_{OUT}) = 5V$ (H) $(V_{IN} - V_{OUT}) = 25V$ (K) $(V_{IN} - V_{OUT}) = 25V$ (H)		1.5 0.5 0.05 0.020			1 1 1 1	1.5 0.5 0.05 0.020			2,3 2,3 2,3 2,3	A A A A
Minimum Load Current	$(V_{IN} - V_{OUT}) = 25V$				10	1			10	2,3	mA
Thermal Regulation	$T_A = 25°C$, 30ms Pulse				0.04	4					%/W
Ripple Rejection	$f = 120Hz$, $C_{ADJ} = 25\mu F$, $C_{OUT} = 25\mu F$ Tantalum, $I_{OUT} = I_{FULL\ LOAD}$, $(V_{IN} - V_{OUT}) = 3V$	6	60			4	60			5,6	dB
Adjust Pin Current	$T_J = 25°C$			55	120	1			120	2,3	μA
Adjust Pin Current Change	$10mA \le I_{OUT} \le I_{FULL\ LOAD}$, $1.5V \le (V_{IN} - V_{OUT}) \le 15V$	6			5	1			5	2,3	μA
Temperature Stability				0.5				0.5			%
Long Term Stability	$T_A = 125°C$, 1000 Hours	5		0.3							%
RMS Output Noise (% of V_{OUT})	$10Hz \le f \le 10kHz$			0.003							%
Thermal Resistance Junction-to-Case	Control Circuitry (K) Control Circuitry (H) Power Transistor (K) Power Transistor (H)	5 5 5 5		1.7 15.0 4.0 20.0							°C/W °C/W °C/W °C/W

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

PARAMETER	CONDITIONS	10KRAD (Si) MIN	10KRAD (Si) MAX	20KRAD (Si) MIN	20KRAD (Si) MAX	50KRAD (Si) MIN	50KRAD (Si) MAX	100KRAD (Si) MIN	100KRAD (Si) MAX	200KRAD (Si) MIN	200KRAD (Si) MAX	UNITS
Reference Voltage (Note 6)	I_{OUT} = 10mA (V_{IN} – V_{OUT}) = 3V (K)	1.234	1.262	1.230	1.262	1.225	1.262	1.220	1.262	1.205	1.262	V
	10mA ≤ I_{OUT} ≤ $I_{FULL\ LOAD}$ 1.5V ≤ (V_{IN} – V_{OUT}) ≤ 15V	1.220	1.275	1.219	1.275	1.215	1.275	1.210	1.275	1.20	1.275	V
Line Regulation (Notes 2, 3)	I_{OUT} = 10mA 1.5V ≤ (V_{IN} – V_{OUT}) ≤ 15V		0.2		0.21		0.23		0.25		0.3	%
Load Regulation (Notes 2, 3, 6)	(V_{IN} – V_{OUT}) = 3V 10mA ≤ I_{OUT} ≤ $I_{FULL\ LOAD}$		0.3		0.3		0.3		0.3		0.3	%
Dropout Voltage (Note 4)	ΔV_{REF} = 1%, I_{OUT} = 1.5A (K) ΔV_{REF} = 1%, I_{OUT} = 0.5A (H)		1.5 1.25		1.51 1.26		1.52 1.27		1.55 1.29		1.575 1.32	V V
Current Limit	(V_{IN} – V_{OUT}) = 5V (K) (V_{IN} – V_{OUT}) = 25V (K) (V_{IN} – V_{OUT}) = 5V (H) (V_{IN} – V_{OUT}) = 25V (H)	1.5 0.05 0.5 0.020		1.5 0.049 0.5 0.019		1.5 0.048 0.5 0.019		1.5 0.047 0.5 0.018		1.5 0.045 0.5 0.017		A A A A
Minimum Load Current	(V_{IN} – V_{OUT}) = 25V		10		10		10		10		10	mA
Adjust Pin Current			120		120		120		120		120	μA
Adjust Pin Current Change (Note 6)	10mA ≤ I_{OUT} ≤ $I_{FULL\ LOAD}$ 1.5V ≤ (V_{IN} – V_{OUT}) ≤ 15V		5		5		5		5		5	μA