



**IRUH33P253B1M**

**Total Ionizing Dose Test Report**

**September 2005**

Revision 1

List of devices covered by this report include:

IRUH33P183B1MP  
IRUH33P183B1MK  
IRUH33P183A1MP  
IRUH33P183A1MK  
IRUH33P253B1MP  
IRUH33P253B1MK  
IRUH33P253A1MP  
IRUH33P253A1MK  
IRUH33PA13B1MP  
IRUH33PA13B1MK  
IRUH33PA13A1MP  
IRUH33PA13A1MK  
IRUH50PA23B1MP  
IRUH50PA23B1MK  
IRUH50PA23A1MP  
IRUH50PA23A1MK  
IRUH50P253B1MP  
IRUH50P253B1MK  
IRUH50P253A1MP  
IRUH50P253A1MK  
IRUH50P333B1MP  
IRUH50P333B1MK  
IRUH50P333A1MP  
IRUH50P333A1MK

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## **INTRODUCTION**

This test report covers the total ionizing dose tests performed on the IRUH33P253B1M Ultra Low Dropout linear regulator in a hermetic package. The total ionizing dose test was performed on ten samples of the device from production lot 318855, which had completed MIL-PRF-38534 “K” level assembly, screening and Group A testing May 20, 2004. On September 2<sup>nd</sup>, 2005 International Rectifier tested this device for total ionizing dose hardness at the University of Massachusetts, Nuclear Research Facility using their CO<sup>60</sup> source.

## **SUMMARY OF RESULTS**

All of the test samples passed the post radiation test requirements for total ionizing dose levels up to 750K RAD(Si). The results show a significant degradation in the “OFF” biased samples above 750K RAD(Si) but the devices all passed the post radiation test requirements after a 168hr room temperature anneal. The “ON” biased samples passed the post radiation test requirements for all of the required dose levels.

## **TEST METHOD**

The test method used as a guide in the development of the Test Plan was MIL-STD-883, Method 1019 Ionizing Radiation, Condition A. This method establishes the basic requirements for the performance and execution of the tests.

## **TEST PLAN**

The samples were exposed to CO<sup>60</sup> irradiation in both an “ON” and “OFF” biased state per the requirements of the test plan and the radiation test specification. Post radiation testing of the devices occurred at the UMass facility after each dose step was complete. The devices were tested on September 2<sup>nd</sup>, 2005 for post radiation effects for dose levels up to 1M Rad(Si). The devices were then placed on an extended room temperature anneal for 168hrs.

ON Biased serial numbers: 1677, 1678, 1689, 1693, and 1771  
OFF Biased serial numbers: 1676, 1683, 1749, 1759, and 1762  
Control Samples: 1703 and 1730. 1703 used for this test.

The Radiation Test Specification is included in Appendix B. The testing occurred in the following manner:

### **1.0 Purpose**

The purpose of this test is to characterize and qualify the Total Ionizing Dose effects for International Rectifier’s hybrid ultra low dropout regulator devices. The data resulting from the tests may be incorporated in the IR data sheet for the product.

### **2.0 Test Responsibility**

International Rectifier shall be responsible for conducting the tests, which shall be performed at the University of Massachusetts Research Reactor facility. International Rectifier shall be responsible for the final Test Report.

### **3.0 Test Facility**

#### **3.1 Nuclear Reactor**

The University of Massachusetts Research Reactor shall be used to provide the source for Gamma radiation. UMRR will also provide information on dose rate, total dose, irradiation test times and dosimetry for this evaluation.

#### **3.2 Test Equipment**

The necessary test equipment including interface board, cables, power supplies, measurement system, etc. shall be provided by International Rectifier.

#### **3.3 Sample Size**

Sample size shall be determined based on device type, characterization parameters. As a minimum, the sample size shall meet the requirements of Mil- PRF-38534. Sample size for this TID evaluation equals 12 devices. Five of the samples shall be biased with the worst-case input voltage of 6.8 volts and five samples shall be biased "in-circuit" with the power supply turned off. Two samples shall be maintained as controls of which one shall be tested at each dose step.

### **4.0 Test Devices**

4.1 The following device is planned for Total Ionizing Dose characterization:

- a. IRUH33P253B1M

4.2 All devices shall be subjected to a minimum 168hrs of burn-in and verified for correct electrical performance prior to arrival at UMRR.

4.3 All devices shall be tested after each radiation exposure per T090067G within 1 hour and placed back on to radiation exposure within 2 hours.

### **5.0 Test Method**

MIL-STD-883, Method 1019 Condition A shall be used to establish the procedure for all testing described herein.

### **6.0 Record Keeping**

The Reactor facility shall provide dosimetry data for the CO<sup>60</sup> source. Each exposure run shall be cataloged with the appropriate number in order to maintain correlation to the appropriate data set. IR will be responsible for collecting and compiling the test data.

### **7.0 Test Report**

The Test Report shall include the following information:

- a. Device type(s), serial numbers, wafer lot identification (per active component)
- b. Test dates
- c. Facility, source type
- d. Bias conditions
- e. Comments and observations
- f. Pre and Post Electrical data
- g. Summary descriptive including graphs

## **TEST FACILITY**

The University of Massachusetts, Lowell, Nuclear Research Reactor is a 1 Mega-Watt, Uranium<sup>235</sup> enhanced core reactor. The UMass Lowell Radiation Laboratory provides controlled radiation environments and analytical measurement services to government organizations and industry. The laboratory provides facilities for proton, neutron, and gamma environments. The Gamma Cave is an irradiation room inside this facility having an equi-dimensional volume of 512 cubic feet. A wide range of dose rates, 1Gray (100 rad) per hour to 10,000 Gray (1M Rad) per hour, is available. Several small ports penetrate one shielding wall to provide access for instrumentation cables.

## **Test Results**

The key pre and post radiation test results are shown graphically in Figures 1 thru 14. The raw test data for all the parameters tested is shown in Appendix A. As outlined in the Test Plan, five of the devices exposed to total ionizing dose irradiation were biased "ON" with the maximum input voltage and five samples were placed in the bias circuit with the power supply off or biased "OFF". All of the "ON" bias samples passed the post radiation test requirements up to 1M Rad (Si). The "OFF" bias samples passed the post radiation test requirements up to 750K Rad (Si) and failed for Output Voltage at 1M Rad (Si). However, these samples all recovered after the extended room temperature anneal and passed all of the post radiation test requirements. The parameters affected the most by the ionizing radiation were Output Voltage, Ripple Rejection, and Shutdown Threshold Voltage with the worst-case condition being the "OFF" bias.

### **Output Voltage – Figures 1 thru 10**

The "ON" bias sample shows a worst-case shift in output voltage of +3.8% at 500K Rad (Si) but it recovers by 1.0% at 1M Rad (Si). The "OFF" bias samples show an output voltage shift as much as +4.8% at 750K Rad (Si) and drop out of regulation at 1M Rad (Si). The shifts are most pronounced with the minimum load of 50mA.

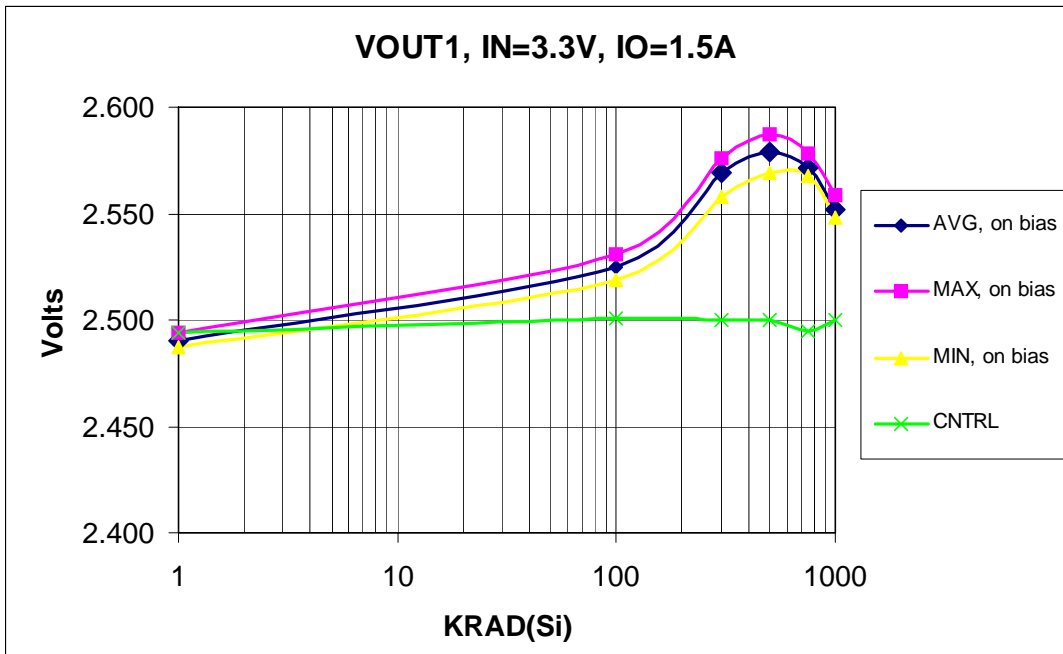


Figure 1 "ON" Biased Samples, VOUT1

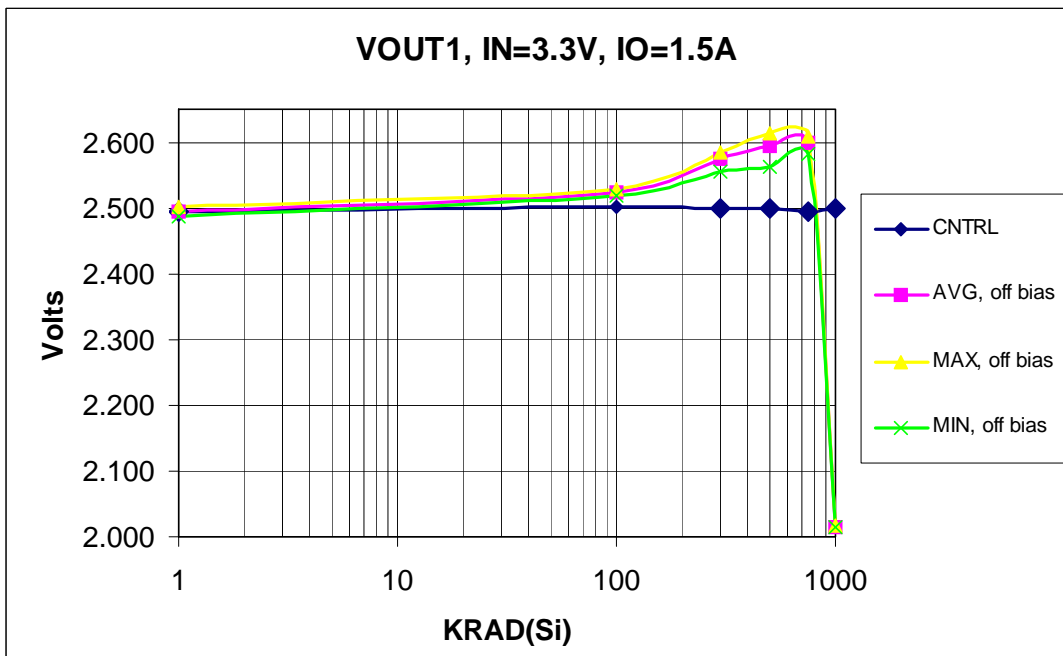


Figure 2 "OFF" Biased Samples, VOUT1

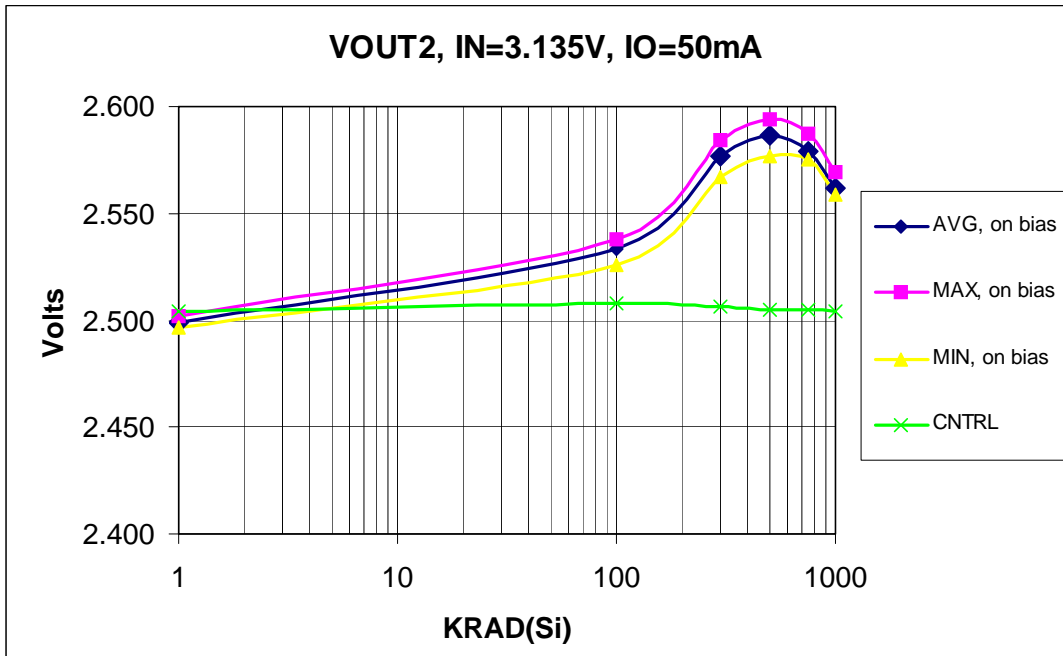


Figure 3 "ON" Biased Samples, VOUT2

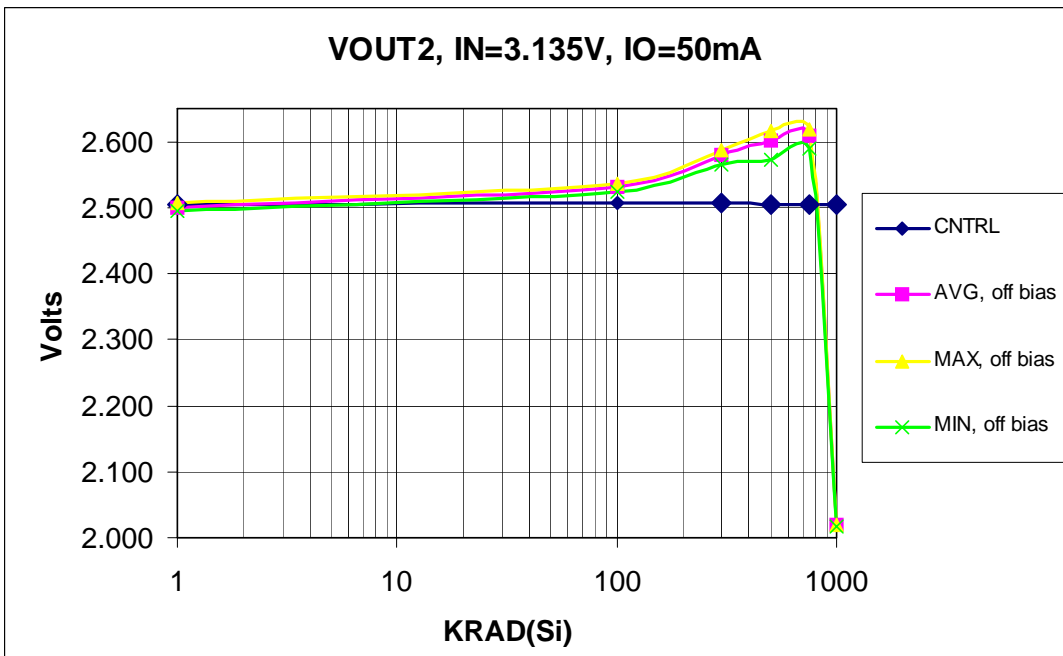


Figure 4 "OFF" Biased Samples, VOUT2



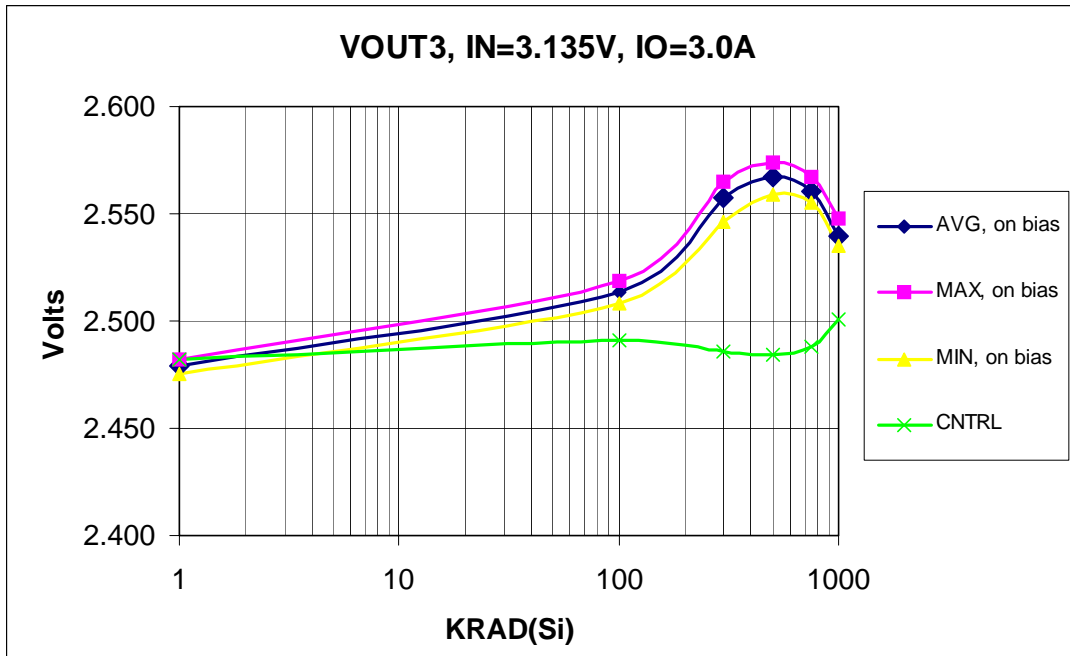


Figure 5 "ON" Biased Samples, VOUT3

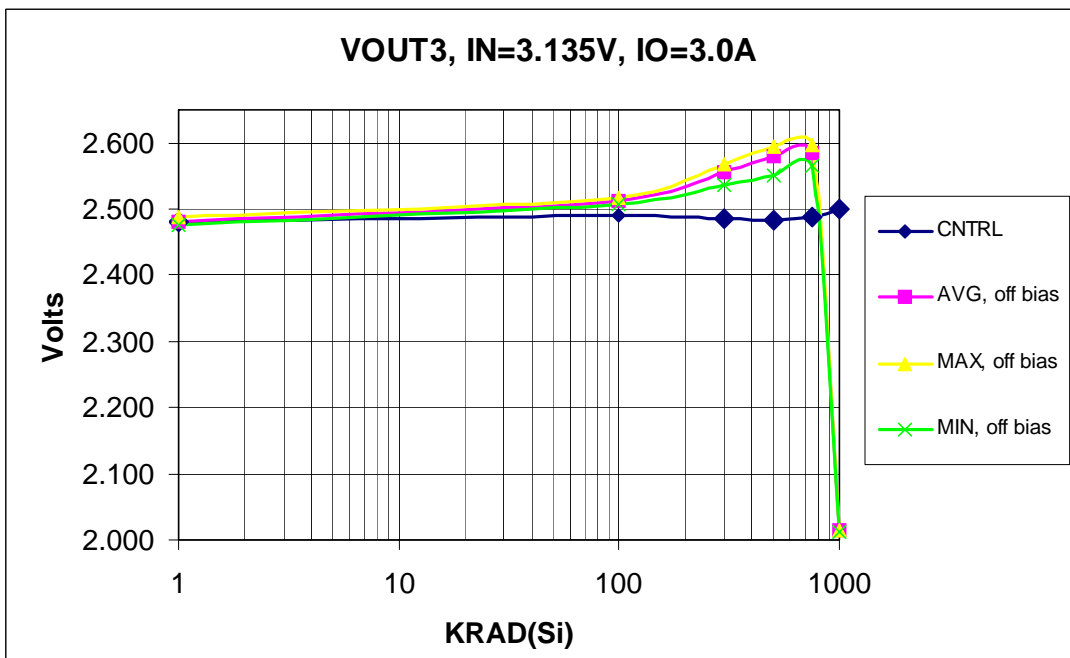


Figure 6 "OFF" Biased Samples, VOUT3

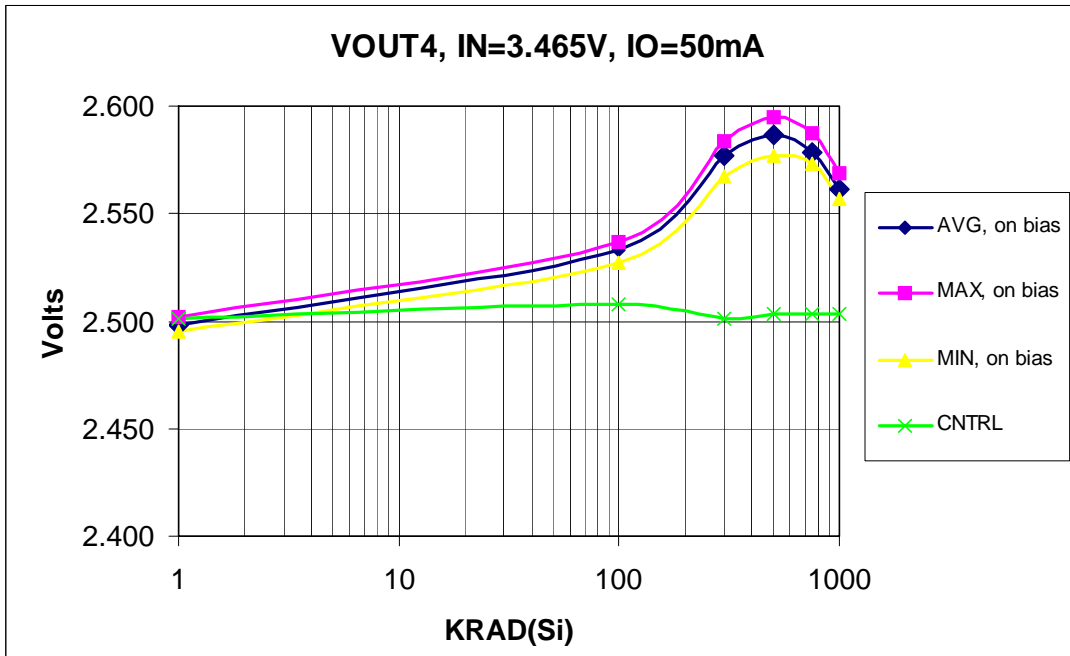


Figure 7 "ON" Biased Samples, VOUT4

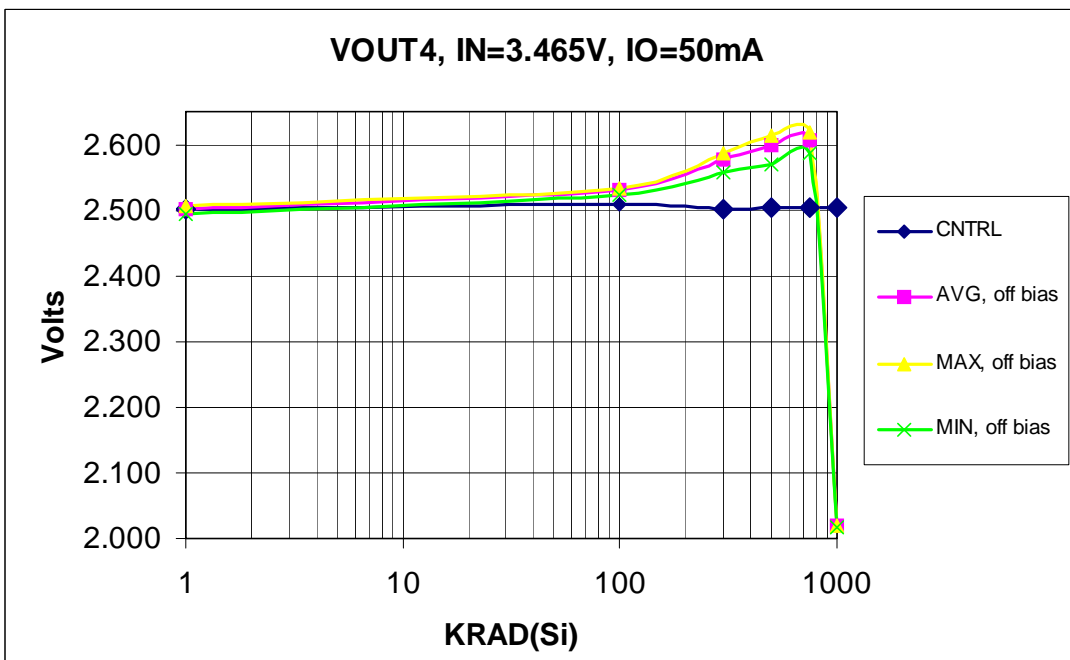


Figure 8 "OFF" Biased Samples, VOUT4

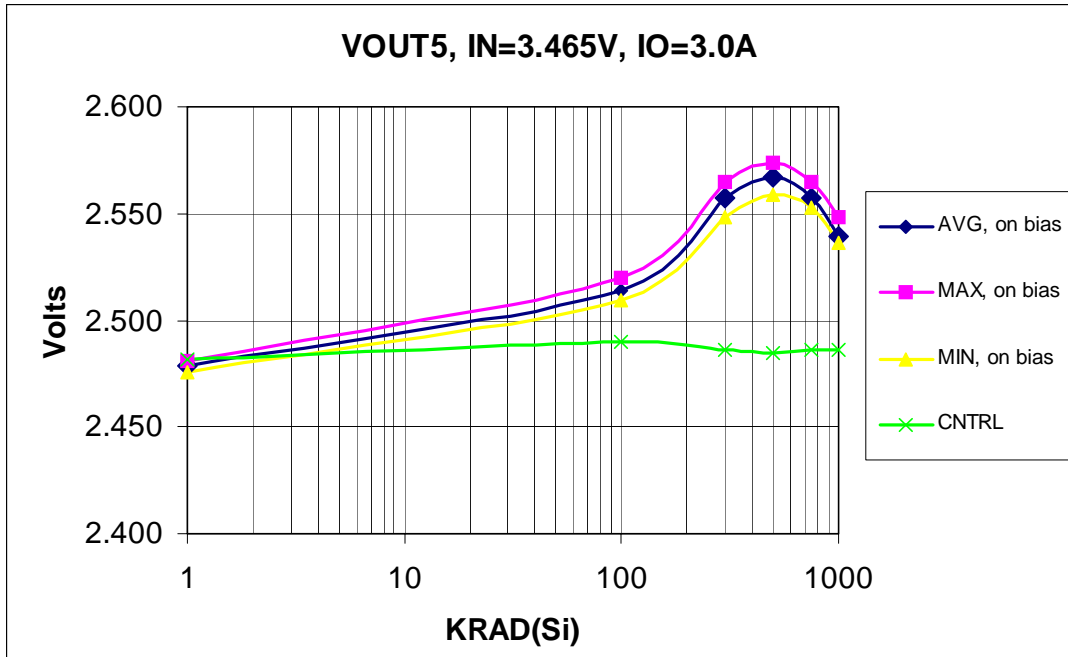


Figure 9 "ON" Biased Samples, VOUT5

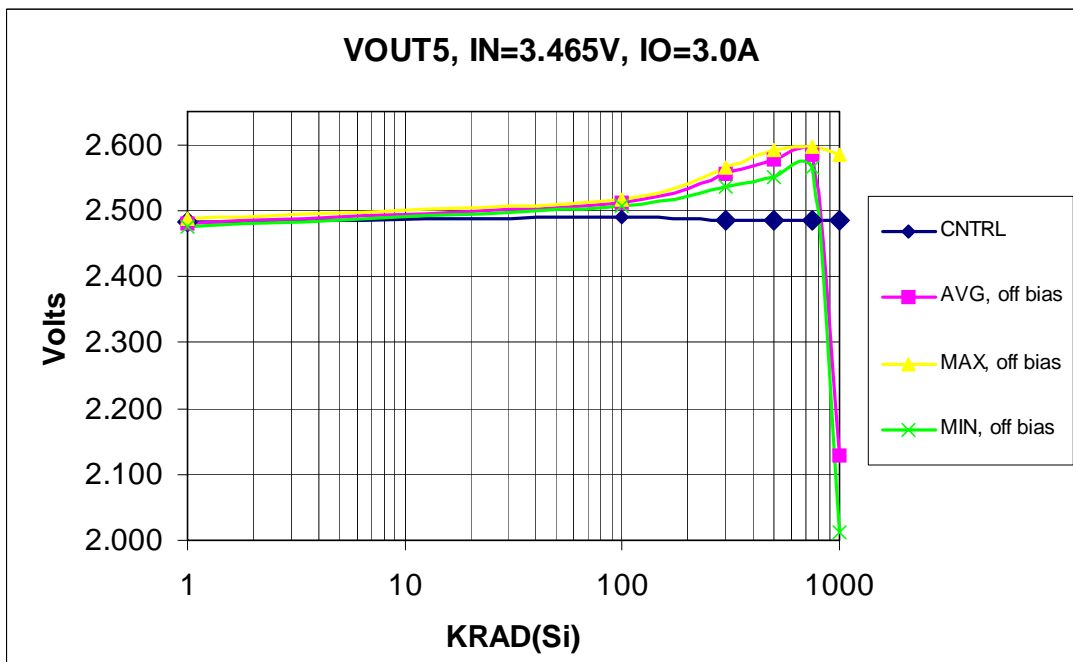


Figure 10 "OFF" Biased Samples, VOUT5

**Ripple Rejection – Figures 11 and 12**

The "ON" bias samples show a downward shift in signal attenuation of 35dB lower at 1M Rad (Si) but the parameter is stable up to 100K Rad (Si). The "OFF" bias samples show a downward shift

in signal attenuation of 40dB lower at 1M Rad (Si) and like the "ON" bias samples the parameter is stable up to 100K Rad (Si).

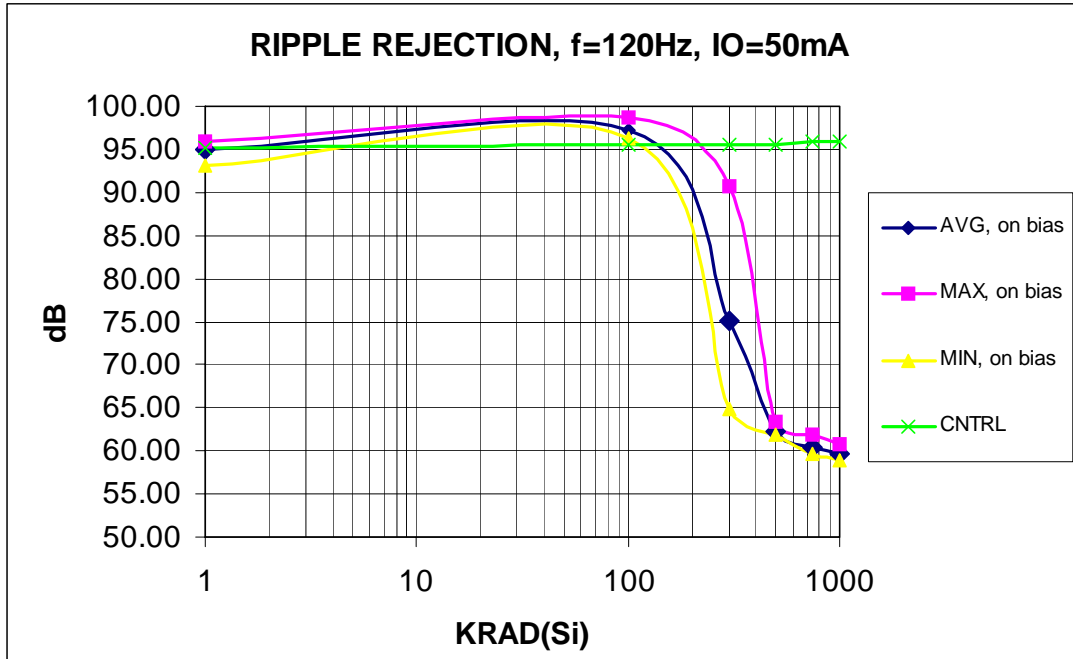


Figure 11 "ON" Biased Samples, RIPPLE REJECTION

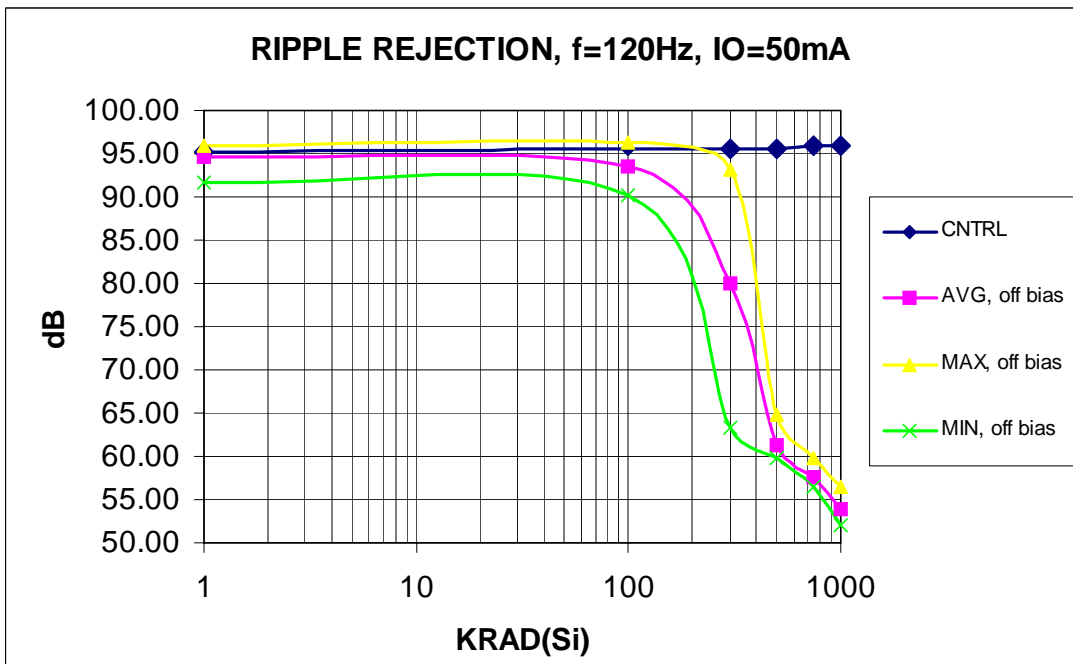


Figure 12 "OFF" Biased Samples, RIPPLE REJECTION

**Shutdown Threshold Voltage – Figures 13 and 14 (not specified over radiation)**

The “ON” bias samples show an overall shift in threshold voltage of +295mV at 500K Rad (Si) but the parameter does start to recover at 1M Rad (Si). The “OFF” bias samples show an overall shift in threshold voltage of +339mV at 1M Rad (Si). Data is shown here on this parameter for information purposes only.

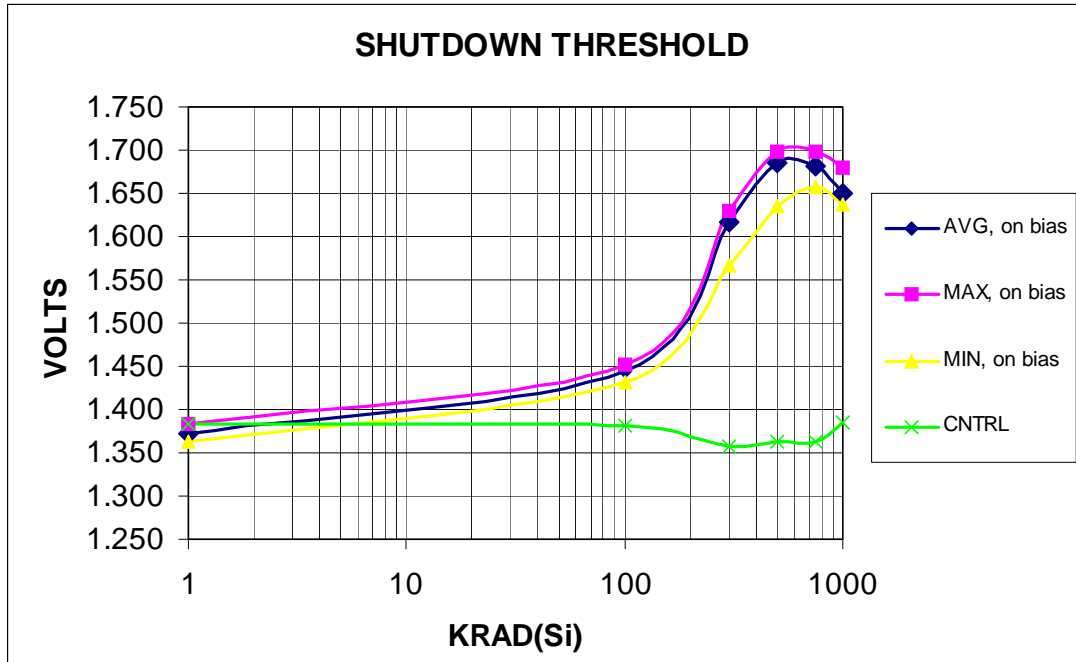


Figure 13 “ON” Biased Samples, SHUTDOWN THRESHOLD

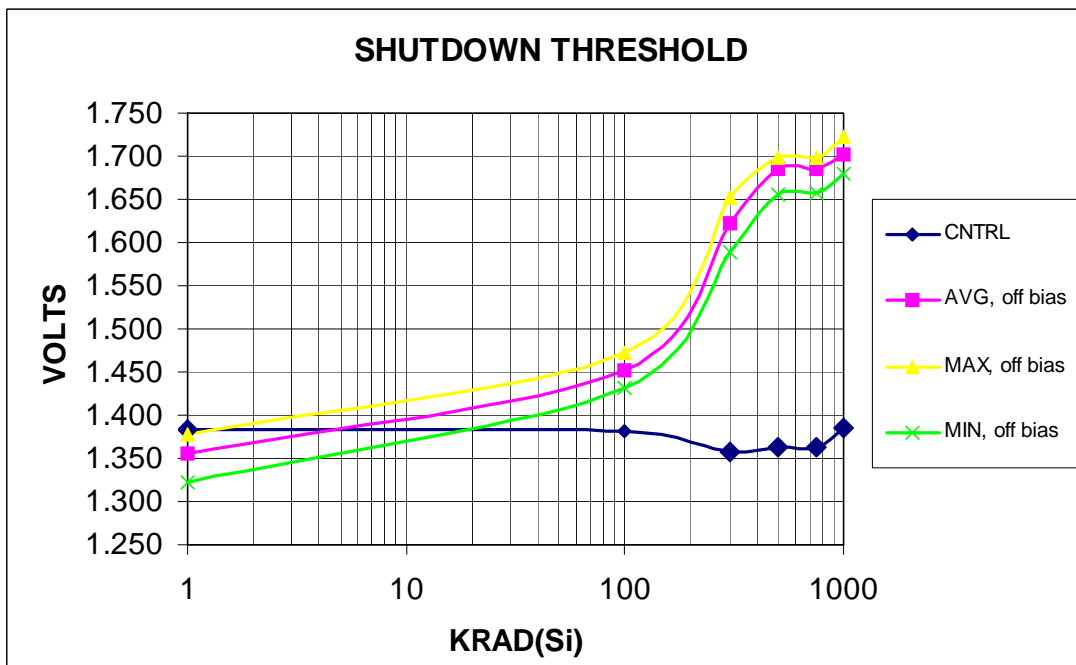


Figure 14 “OFF” Biased Samples, SHUTDOWN THRESHOLD

## **CONCLUSION**

The IRUH33P253B1M has demonstrated hardness to ionizing dose radiation exposure to 1M Rad (Si) with no affect on its performance when the device is in the “ON” bias condition and the results show it to meet all the post radiation test requirements. The results of this testing also show that when this device is in the “OFF” bias condition it meets all post radiation test requirements up to 750K Rad (Si) and can be accepted as a 1M Rad (Si) device based on the results of the extended room temperature anneal per MIL-STD-883, Method 1019. It should also be noted that all of the “OFF” bias samples regulated properly within several seconds after the anneal bias was applied to them.

# Appendix A

## Electrical Data

**Electrical Test Data (Pre-radiation)**

Wednesday, August 24, 2005, 5:42 PM

TEST	Vout1	Vout2	Vout3	Vout4	Vout5	Vdrop	Ilatch	Ripple Rej	SHDN Thresh	Vout@ SHDN	Ishdn*
Max Limit	2.525	2.625	2.625	2.625	2.625	0.400	----	200	1.6	100	----
Min Limit	2.475	2.375	2.375	2.375	2.375	----	3	65	1.0	-100	----
Serial #	(V)	(V)	(V)	(V)	(V)	(V)	(A)	(dB)	(V)	(mV)	(uA)
1703	2.494	2.504	2.48	2.501	2.482	0.209	10.13	95.16	1.384	-1.18	149.58
1676	2.488	2.497	2.478	2.495	2.476	0.201	10.17	93.18	1.363	0.18	155.39
1677	2.487	2.497	2.475	2.495	2.477	0.205	10.22	95.12	1.384	-2.41	152.92
1678	2.489	2.497	2.479	2.498	2.478	0.209	10.22	94.81	1.363	-1.32	149.11
1683	2.493	2.500	2.481	2.499	2.481	0.197	10.13	95.57	1.363	-2.01	145.16
1689	2.494	2.502	2.482	2.502	2.480	0.205	9.85	95.88	1.384	-2.07	147.06
1693	2.489	2.497	2.476	2.497	2.476	0.197	10.58	95.12	1.322	-1.68	146.25
1749	2.501	2.507	2.489	2.507	2.488	0.208	10.52	95.47	1.336	-1.09	147.15
1759	2.492	2.499	2.478	2.499	2.479	0.212	10.06	91.63	1.378	-1.14	158.07
1762	2.498	2.506	2.486	2.505	2.485	0.197	10.56	94.79	1.378	-4.94	153.07
1771	2.488	2.494	2.477	2.495	2.478	0.205	10.13	95.88	1.363	-1.60	144.69

\* Data collected for information purposes only parameter not specified for pre-radiation.

**Electrical Test Data (Post radiation – 100K Rad (Si))**

Friday, September 02, 2005, 10:06 AM

TEST	Vout1	Vout2	Vout3	Vout4	Vout5	Vdrop*	Ilatch	Ripple Rej	SHDN Thresh	Vout@ SHDN	Ishdn*
Max Limit	2.625	2.625	2.625	2.625	2.625	----	----	200	----	100	----
Min Limit	2.375	2.375	2.375	2.375	2.375	----	3	40	----	-100	----
Serial #	(V)	(V)	(V)	(V)	(V)	(V)	(A)	(dB)	(V)	(mV)	(uA)
1703	2.501	2.508	2.491	2.508	2.490	0.220	10.07	95.51	1.382	-2.19	149.78
1676	2.521	2.528	2.509	2.526	2.511	0.244	9.93	92.88	1.452	-1.45	148.20
1677	2.523	2.531	2.512	2.532	2.512	0.233	10.11	96.26	1.452	-0.19	141.49
1678	2.519	2.526	2.508	2.527	2.509	0.233	9.89	96.26	1.431	-2.27	144.62
1683	2.526	2.533	2.513	2.533	2.513	0.236	10.07	96.26	1.452	-0.94	137.91
1689	2.531	2.537	2.519	2.537	2.520	0.244	10.02	98.18	1.452	-1.15	137.80
1693	2.525	2.534	2.511	2.534	2.512	0.225	10.43	97.13	1.431	-1.18	134.70
1749	2.528	2.535	2.518	2.534	2.517	0.225	10.48	93.46	1.431	-1.61	140.53
1759	2.518	2.525	2.507	2.524	2.507	0.233	9.98	90.24	1.473	-1.14	151.57
1762	2.525	2.536	2.513	2.534	2.515	0.221	10.52	95.10	1.452	-1.14	143.10
1771	2.526	2.538	2.517	2.534	2.517	0.233	10.07	98.62	1.452	-0.89	134.49

\* Data collected for information purposes only parameter not specified for post radiation.



**Electrical Test Data (Post radiation – 300K Rad (Si))**

Friday, September 02, 2005, 11:26 AM

TEST	Vout1	Vout2	Vout3	Vout4	Vout5	Vdrop*	Ilatch	Ripple Rej	SHDN* Thresh	Vout@ SHDN	Ishdn*
Max Limit	2.625	2.625	2.625	2.625	2.625	----	----	200	----	100	----
Min Limit	2.375	2.375	2.375	2.375	2.375	----	3	65	----	-100	----
Serial #	(V)	(V)	(V)	(V)	(V)	(V)	(A)	(dB)	(V)	(mV)	(uA)
1703	2.500	2.506	2.486	2.501	2.486	0.225	10.16	95.52	1.358	-2.43	151.68
1676	2.566	2.571	2.551	2.568	2.548	0.225	9.84	90.72	1.630	-0.51	-5.54
1677	2.567	2.573	2.556	2.574	2.554	0.225	9.39	90.29	1.630	-1.04	133.39
1678	2.558	2.567	2.546	2.567	2.548	0.228	9.57	90.72	1.567	-0.74	130.28
1683	2.584	2.588	2.567	2.586	2.565	0.228	10.21	63.25	1.630	-0.82	128.88
1689	2.576	2.582	2.565	2.584	2.565	0.228	10.12	64.87	1.630	-0.85	127.56
1693	2.570	2.579	2.557	2.577	2.557	0.217	10.57	64.92	1.630	-0.45	127.47
1749	2.582	2.586	2.564	2.584	2.563	0.217	10.39	64.87	1.588	-0.15	132.74
1759	2.554	2.564	2.536	2.557	2.535	0.225	9.89	93.17	1.609	-1.09	144.03
1762	2.584	2.586	2.565	2.585	2.564	0.217	10.52	87.64	1.651	-0.43	132.23
1771	2.576	2.584	2.564	2.582	2.564	0.228	10.07	64.87	1.630	-1.05	124.57

\* Data collected for information purposes only parameter not specified for pre-radiation.

**Electrical Test Data (Post radiation – 500K Rad (Si))**

Friday, September 02, 2005, 12:03 PM

TEST	Vout1	Vout2	Vout3	Vout4	Vout5	Vdrop*	Ilatch	Ripple Rej	SHDN Thresh	Vout@ SHDN	Ishdn*
Max Limit	2.625	2.625	2.625	2.625	2.625	----	----	200	----	100	----
Min Limit	2.375	2.375	2.375	2.375	2.375	----	3	40	----	-100	----
Serial #	(V)	(V)	(V)	(V)	(V)	(V)	(A)	(dB)	(V)	(mV)	(uA)
1703	2.500	2.505	2.484	2.503	2.485	0.218	10.167	95.49	1.363	-2.79	150.08
1676	2.587	2.593	2.571	2.590	2.569	0.237	9.804	61.92	1.698	-1.11	136.29
1677	2.577	2.585	2.565	2.585	2.565	0.237	9.850	61.92	1.698	-1.40	130.48
1678	2.569	2.577	2.559	2.577	2.559	0.241	9.804	63.34	1.635	-0.61	128.25
1683	2.613	2.617	2.594	2.614	2.593	0.237	9.486	59.77	1.698	-2.19	126.21
1689	2.587	2.594	2.573	2.595	2.574	0.237	9.895	61.92	1.698	-0.62	1.60
1693	2.580	2.588	2.566	2.588	2.567	0.229	10.213	61.92	1.698	-0.95	123.56
1749	2.605	2.611	2.591	2.609	2.589	0.229	10.213	59.77	1.677	-0.77	128.57
1759	2.563	2.572	2.552	2.570	2.550	0.244	9.577	64.88	1.656	-0.62	139.68
1762	2.606	2.612	2.590	2.610	2.587	0.222	9.850	59.73	1.698	-1.53	128.40
1771	2.583	2.590	2.574	2.588	2.572	0.241	9.532	61.92	1.698	-1.54	123.06

\* Data collected for information purposes only parameter not specified for post radiation.

**Electrical Test Data (Post radiation – 750K Rad (Si))**

Friday, September 02, 2005, 12:41 PM

TEST	Vout1	Vout2	Vout3	Vout4	Vout5	Vdrop*	Ilatch	Ripple Rej	SHDN* Thresh	Vout@ SHDN	Ishdn*
Max Limit	2.625	2.625	2.625	2.625	2.625	----	----	200	----	100	----
Min Limit	2.375	2.375	2.375	2.375	2.375	----	3	65	----	-100	----
Serial #	(V)	(V)	(V)	(V)	(V)	(V)	(A)	(dB)	(V)	(mV)	(uA)
1703	2.495	2.505	2.488	2.503	2.486	0.208	10.208	95.91	1.363	-2.98	153.02
1676	2.595	2.603	2.578	2.600	2.576	0.245	9.345	57.23	1.698	1.12	135.69
1677	2.569	2.575	2.564	2.575	2.553	0.245	9.436	61.95	1.698	-2.09	129.15
1678	2.568	2.575	2.555	2.573	2.554	0.245	9.209	60.75	1.657	-0.21	127.09
1683	2.609	2.619	2.596	2.619	2.597	0.245	9.890	56.58	1.678	-0.30	124.12
1689	2.578	2.587	2.567	2.587	2.565	0.245	9.209	59.73	1.698	-0.38	120.60
1693	2.569	2.579	2.555	2.578	2.555	0.230	10.072	59.73	1.657	-0.37	120.26
1749	2.606	2.617	2.597	2.615	2.595	0.241	9.572	57.94	1.657	0.12	125.55
1759	2.581	2.590	2.566	2.586	2.564	0.245	9.254	59.73	1.698	-0.15	138.32
1762	2.603	2.612	2.591	2.613	2.591	0.223	10.072	56.53	1.698	1.89	130.15
1771	2.572	2.580	2.561	2.578	2.559	0.245	9.527	59.77	1.698	-1.03	119.68

\* Data collected for information purposes only parameter not specified for pre-radiation.

**Electrical Test Data (Post radiation – 1000K Rad (Si))**

Friday, September 02, 2005, 1:22 PM

TEST	Vout1	Vout2	Vout3	Vout4	Vout5	Vdrop*	Ilatch	Ripple Rej	SHDN Thresh	Vout@ SHDN	Ishdn*
Max Limit	2.625	2.625	2.625	2.625	2.625	----	----	200	----	100	----
Min Limit	2.375	2.375	2.375	2.375	2.375	----	3	40	----	-100	----
Serial #	(V)	(V)	(V)	(V)	(V)	(V)	(A)	(dB)	(V)	(mV)	(uA)
1703	2.500	2.504	2.501	2.503	2.486	0.207	9.782	95.89	1.386	-2.57	152.52
1676	2.016	2.018	2.013	2.018	2.013	2.352	9.146	54.27	1.700	-0.46	179.94
1677	2.548	2.559	2.537	2.557	2.537	0.245	9.509	58.83	1.679	-0.48	126.55
1678	2.551	2.559	2.542	2.559	2.538	0.241	8.919	60.77	1.637	-0.21	125.14
1683	2.016	2.018	2.013	2.018	2.013	2.340	9.419	51.99	1.679	-2.25	165.87
1689	2.559	2.569	2.548	2.569	2.548	0.249	9.101	59.75	1.658	-1.45	123.35
1693	2.550	2.561	2.535	2.560	2.536	0.234	9.464	59.75	1.637	-0.86	120.46
1749	2.015	2.019	2.014	2.019	2.015	2.343	10.024	53.31	1.702	-0.81	168.40
1759	2.015	2.019	2.014	2.019	2.584 <sup>1</sup>	0.257	9.206	56.52	1.702	-0.70	140.49

<sup>1</sup> Device 1759 shows proper regulation for output voltage test five, which is a sign the device has annealed during the test.

1762	2.015	2.019	2.014	2.019	2.015	0.238	9.524	53.66	1.723	-2.58	172.41
1771	2.551	2.560	2.537	2.562	2.537	0.241	8.919	58.83	1.637	-0.61	120.68

\* Data collected for information purposes only parameter not specified for post radiation.

**Electrical Test Data (Post 168hr room temperature anneal)\*\***

Friday, September 09, 2005

TEST	Vout1	Vout2	Vout3	Vout4	Vout5	Vdrop*	Ilatch	Ripple Rej	SHDN Thresh	Vout@ SHDN
Max Limit	2.625	2.625	2.625	2.625	2.625	----	----	200	----	100
Min Limit	2.375	2.375	2.375	2.375	2.375	----	3	40	----	-100
Serial #	(V)	(V)	(V)	(V)	(V)	(V)	(A)	(dB)	(V)	(mV)
1703	2.499	2.506	2.442	2.506	2.495	0.209	8.14	79.0	1.392	6.8
1676	2.520	2.525	2.518	2.525	2.517	0.299	6.82	79.6	1.532	5.3
1677	2.517	2.523	2.514	2.523	2.513	0.283	6.94	80.4	1.548	2.9
1678	2.518	2.523	2.514	2.523	2.513	0.282	7.18	82.1	1.516	3.2
1683	2.533	2.538	2.530	2.539	2.530	0.287	6.94	80.1	1.516	4.1
1689	2.523	2.529	2.519	2.529	2.519	0.287	6.94	81.3	1.528	1.7
1693	2.515	2.523	2.509	2.523	2.509	0.267	7.66	82.8	1.520	3.2
1749	2.536	2.542	2.533	2.542	2.532	0.284	7.18	79.3	1.510	0.2
1759	2.516	2.522	2.513	2.522	2.512	0.294	6.82	79.8	1.540	2.4
1762	2.529	2.536	2.526	2.536	2.525	0.291	7.30	83.2	1.526	1.2
1771	2.514	2.520	2.512	2.520	2.511	0.215	7.06	83.2	1.538	0.7

\* Data collected for information purposes only parameter not specified for post radiation.

\*\* Tested on the Eagle ETS-564 production test system.

## Appendix B

# Radiation Test Specification

**PRODUCT DESCRIPTION: 2.5V LOW DROPOUT VOLTAGE REGULATOR**

**Automatic Test** **Tester: PXI TEST CONSOLE 04-134-TC**

**Table 1: Pre Radiation Tests, 25C tests only**

Prog. Ref.	Test	Symbol	Test Conditions	Rad Level:	Notes	MIN	MAX	Units
A	Output Voltage	V out	Vin = 3.30 Vdc Iout = 1.5 A	Pre Rad		2.475	2.525	Vdc
A	Output Voltage	V out	Vin = 3.135 Vdc Iout = 50 mA	Pre Rad		2.375	2.625	Vdc
A	Output Voltage	V out	Vin = 3.135 Vdc Iout = 3.0 A	Pre Rad		2.375	2.625	Vdc
A	Output Voltage	V out	Vin = 3.465 Vdc Iout = 50 mA	Pre Rad		2.375	2.625	Vdc
A	Output Voltage	V out	Vin = 3.465 Vdc Iout = 3.0 A	Pre Rad		2.375	2.625	Vdc
A	Dropout Voltage	Vdrop	Iout = 3.0 A	Pre Rad		0	0.40	Vdc
A	Current Limit	I limit	Vin = 3.3 Vdc	Pre Rad		3.0	---	A
A	Ripple Rejection	Rrej	F= 120 Hz Iout = 50 mA	Pre Rad		65	200	dB
A	Shutdown Threshold	Vshutdown	Vin = 5.0 Vdc, Vshutdown ramp from 0.8V to 4.8V, output monitored for 100mV drop	Pre Rad		1.0	1.6	V
A	Output voltage At Shutdown	Vout shdn	Vin = 3.3 Vdc Iout = 50 mA Vshdn = +5 Vdc	Pre Rad		-0.1	+0.1	V
A	Shutdown Pin Current	Ishutdown	Vin = 3.3 Vdc Iout = 50 mA Vshdn = +5 Vdc	Pre Rad	1	---	---	uA

Notes:

1. These tests are performed for information purposes only.

This is proprietary information of International Rectifier Hi-Rel Products and it is understood that this will not be divulged to a third party or used in any way prejudicial to the interest of International Rectifier Hi-Rel Products.

Automatic Test		Tester: PXI TEST CONSOLE 04-134-TC						
Table 2: Post Radiation Tests, 25C tests only								
Prog. Ref.	Test	Symbol	Test Conditions	Rad Level:	Notes	MIN	MAX	Units
B	Output Voltage	V out	Vin = 3.30 Vdc	Post Rad		2.375	2.625	Vdc
			Iout = 1.5 A					
B	Output Voltage	V out	Vin = 3.135 Vdc	Post Rad		2.375	2.625	Vdc
			Iout = 50 mA					
B	Output Voltage	V out	Vin = 3.135 Vdc	Post Rad		2.375	2.625	Vdc
			Iout = 3.0 A					
B	Output Voltage	V out	Vin = 3.465 Vdc	Post Rad		2.375	2.625	Vdc
			Iout = 50 mA					
B	Output Voltage	V out	Vin = 3.465 Vdc	Post Rad		2.375	2.625	Vdc
			Iout = 3.0 A					
B	Dropout Voltage	Vdrop	Iout = 3.0 A	Post Rad	1	---	---	Vdc
B	Current Limit	I limit	Vin = 3.3 Vdc	Post Rad		3.0	---	A
B	Ripple Rejection	Rrej	F= 120 Hz	Post Rad		40	200	dB
			Iout = 50 mA					
B	Shutdown Threshold	Vshutdown	Vin = 5.0 Vdc, Vshutdown ramp from 0.8V to 4.8V, output monitored for 100mV drop	Post Rad	1	---	---	V
B	Output voltage At Shutdown	Vout shdn	Vin = 3.3 Vdc	Post Rad		-0.1	+0.1	V
			Iout = 50 mA					
B	Shutdown Pin Current	Ishutdown	Vin = 3.3 Vdc	Post Rad	1	---	---	uA
			Iout = 50 mA					
			Vshdn = +5 Vdc					

Notes:

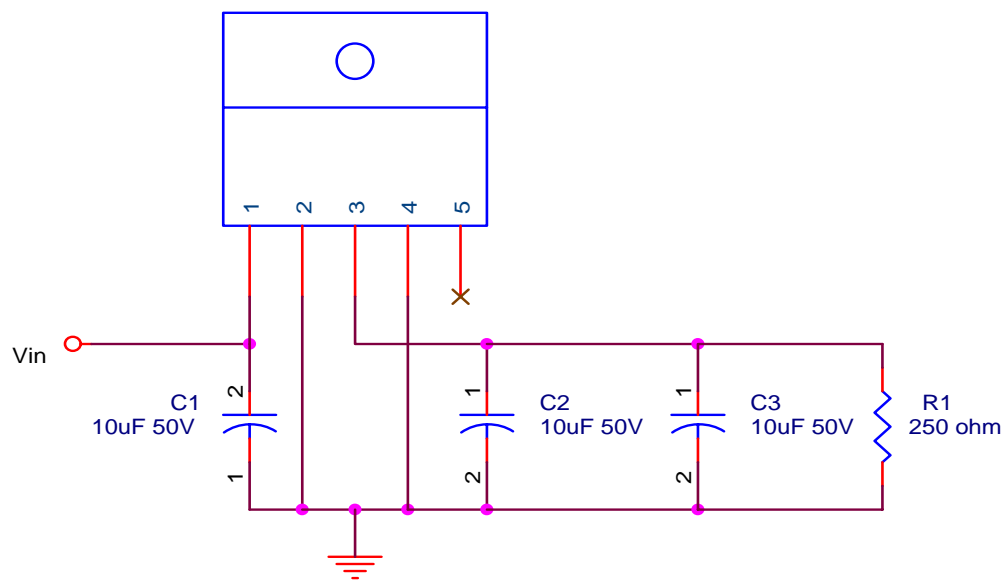
1. These tests are performed for information purposes only.

This is proprietary information of International Rectifier Hi-Rel Products and it is understood that this will not be divulged to a third party or used in any way prejudicial to the interest of International Rectifier Hi-Rel Products.

Table 3: Total Dose Radiation Requirements		
High Dose Rate <sup>2</sup>		
Bias Conditions	Vin = 6.8V, Vout = 2.5V, Io=10mA	Unbiased, in circuit with power supply off
Dose Step Profile	100K, 200K, 200K, 250K, 250K	100K, 200K, 200K, 250K, 250K
Dose Rate Range	50 to 300 Rad(Si)/sec	50 to 300 Rad(Si)/sec
Board Number	TF-02-011	TF-02-011
Program Card Number	TA-02-001	TA-02-001
Chamber	Gamma Cave	Gamma Cave
Test Temperature	25C +/-5C	25C +/-5C

2. Performed at during initial qualification of the device and retested only when specified by Quality Assurance due to a change per MIL-PRF-38534.

**Radiation Circuit**



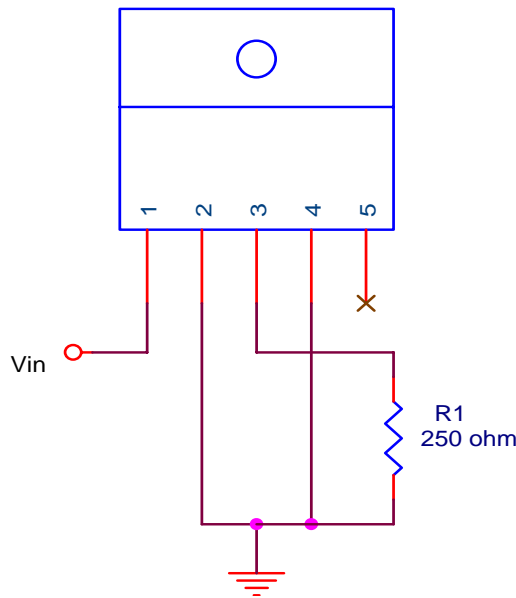
**Table 4: Anneal Test Requirements**

Extended Room Temperature Anneal <sup>3</sup>	
Bias Conditions	Vin = 6.8V, Vout = 2.5V, Io = 10mA
Chamber Temperature	24C +6C, -6C
Duration	168hrs +/- 12hrs
Burn-in Board	BB037
Program Card Number	BP0539

3. The extended room temperature anneal is performed on devices that fail to meet the 1000K dose rating. If the devices pass the post-irradiation testing after this extended room temperature anneal then they shall be considered qualified product.. This test does not apply to products tested at Low Dose rate.

**Anneal Test Circuit**

- Pinout
- 1 - Input
- 2 - Gnd
- 3 - Output
- 4 - Shutdown
- 5 - N/C



**Table 7: Test Hardware**

	Test Fixture	Test System
Pre Radiation Tests	04-135-TF, 04-135-010-TA	PXI 04-134-TC
Post Radiation Tests	04-135-TF, 04-135-010-TA	PXI 04-134-TC