

**Total Dose Radiation Test Report**

**MSK 5950 RH**

**RAD Hard Ultra Low Voltage  
Adjustable Positive Linear Regulator**

November 25, 2008 (1st Test)  
December 21, 2009 (2<sup>nd</sup> Test)

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**I. Introduction:**

The total dose radiation test plan for the MSK 5950 RH series was developed to qualify the devices as RAD Hard to 300 KRADS(Si). The testing was performed beyond 300 KRADS(Si) to show trends in device performance as a function of total dose. The test does not classify maximum radiation tolerance of the device, but simply offers designers insight to the critical parameter-shifts up to the specified total dose level.

MIL-STD-883 Method 1019.7 and ASTM F1892-06 were used as guidelines in the development and implementation of the total dose test plan for the MSK 5950RH.

**II. Radiation Source:**

Total dose was performed at the University of Massachusetts, Lowell, using a cobalt 60 radiation source. The dose rate was determined to be 155 Rads(Si)/sec. The total dose schedule can be found in Table I.

**III. Test Setup:**

All test samples were subjected to Group A Electrical Test at 25°C in accordance with the device data sheet. In addition, all devices received 320 hours of burn-in per MIL-STD-883 Method 1015. For test platform verification, one control device was tested at 25°C. Ten devices were then tested at 25°C, prior to irradiation, and were found to be within acceptable test limits.

The devices were vertically aligned with the radiation source and enclosed in a lead/aluminum container during irradiation. Five devices were kept under bias during irradiation. Maximum recommended operating voltage of +7.5V was used for the bias condition. Five devices had all leads grounded during irradiation for the unbiased condition.

After each irradiation the device leads were shorted together and transported to the MSK automatic electrical test platform and tested IAW MSK device data sheet. Testing was performed on irradiated devices, as well as the control device, at each total dose level. Electrical tests were completed within one hour of irradiation. Devices were subjected to subsequent radiation doses within two hours of removal from the radiation field.

**IV. Data:**

All performance curves are averaged from the test results of the biased and unbiased devices, respectively. If required, full test data can be obtained by contacting M.S. Kennedy Corporation.

**V. Summary:**

Based on the test data recorded during radiation testing, the MSK5950RH qualified as a 300 Krad(Si) radiation hardened device. The test results were similar to the November 25, 2008 testing results. Feedback Voltage, Shutdown Threshold and Output Current Limit exhibited the most significant shift due to irradiation, however all performance curves stayed within specification up to 450 Krad(Si) TID.

MSK 5950RH Biased/Unbiased Dose Rate  
Schedule

Dosimetry Equipment  
Bruker Biospin # 0141

Irradiation Date  
12/18/09

Exposure Length (min:sec)	Incremental Dose rads(Si)	Cumulative Dose rads(Si)
5:32	51,460	51,460
5:32	51,460	102,920
5:32	51,460	154,380
5:32	51,460	205,840
11:05	103,075	308,915
16:37	154,535	463,450

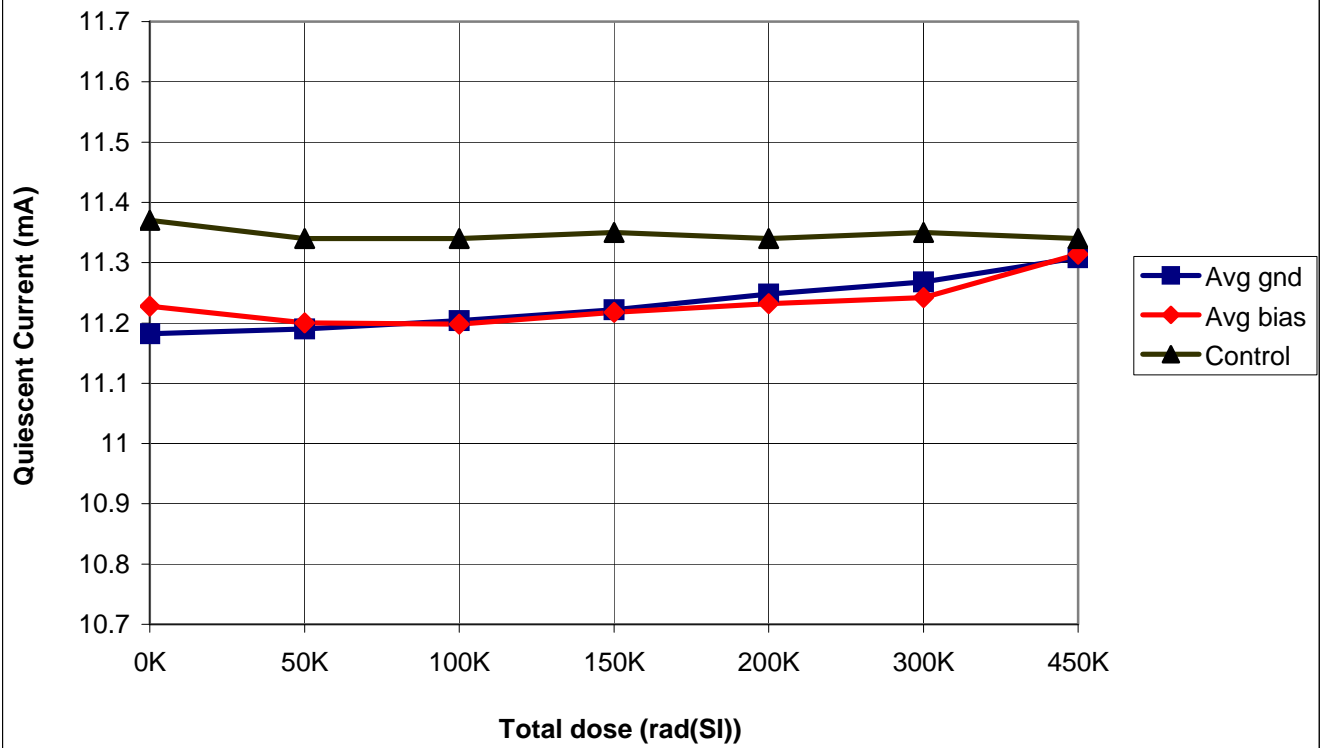
Biased S/N – 0062, 0063, 0064, 0065, 0066

Unbiased S/N – 0067, 0068, 0069, 0070, 0071

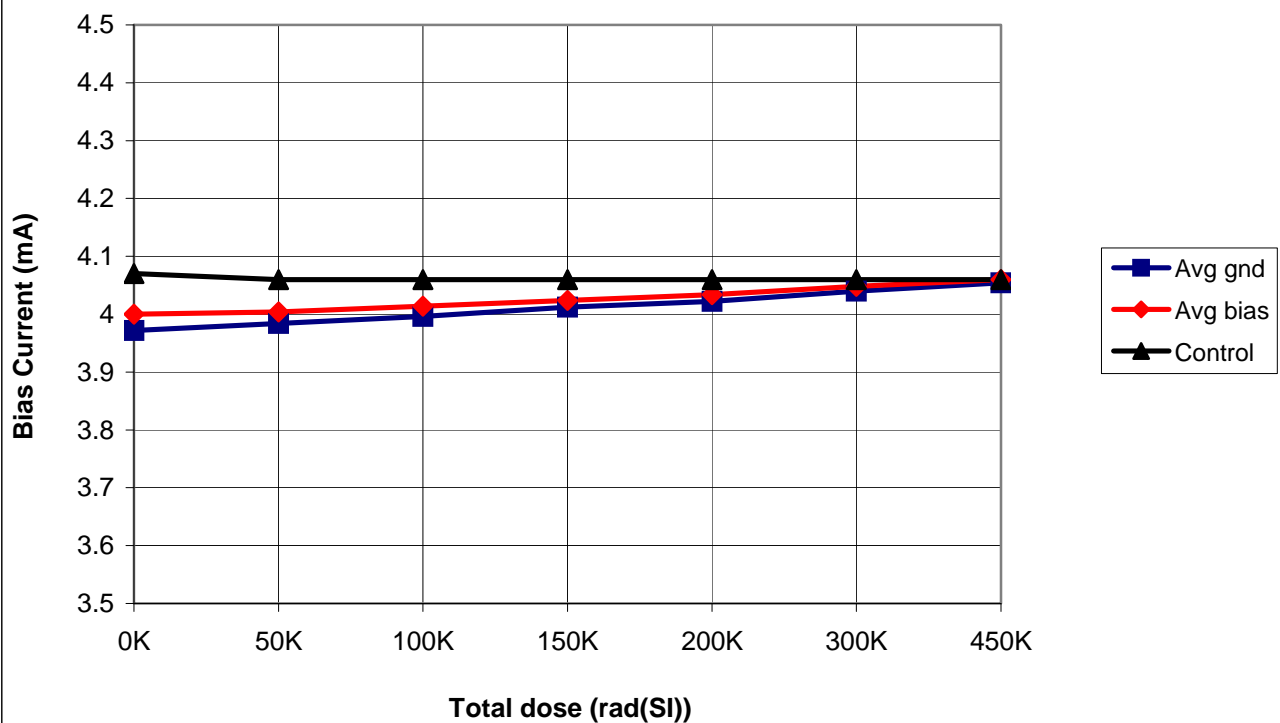
Table 1

**Dose Time, Incremental Dose and Total Cumulative Dose**

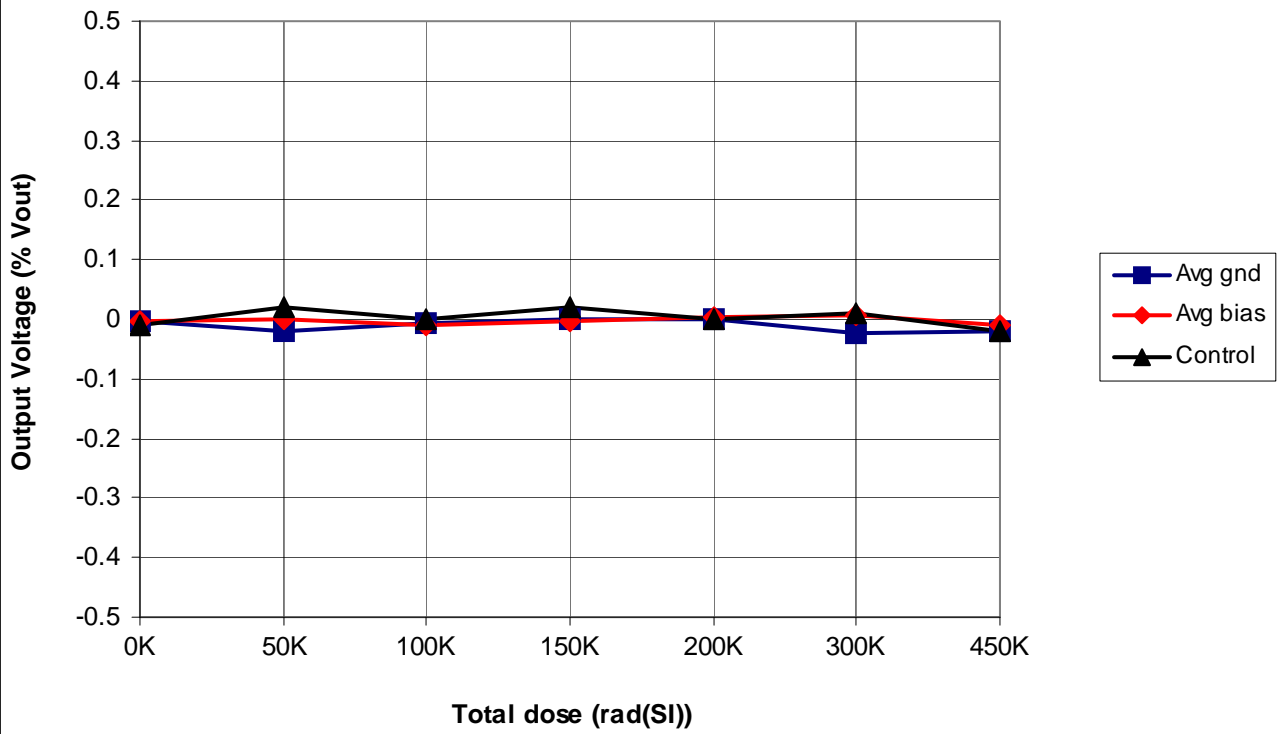
### MSK5950RH Quiescent Current vs. Total Dose



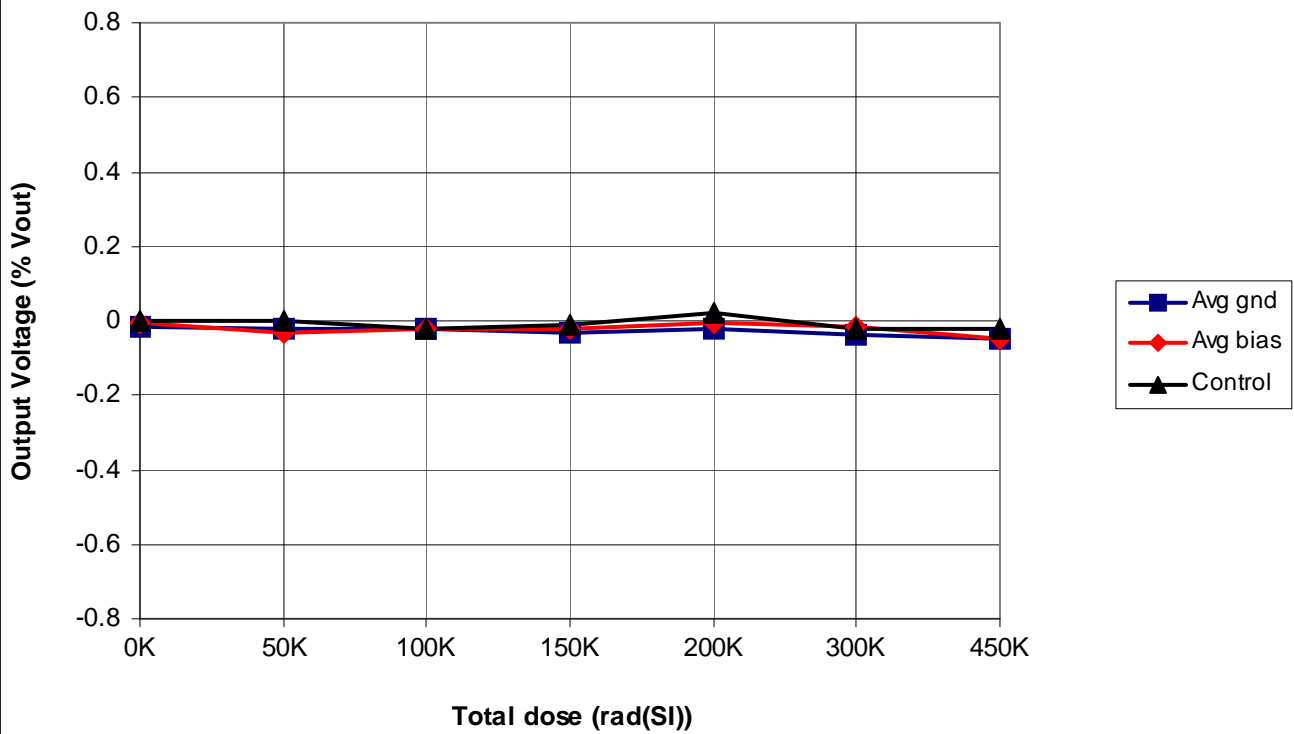
### MSK5950RH Bias Current vs. Total Dose



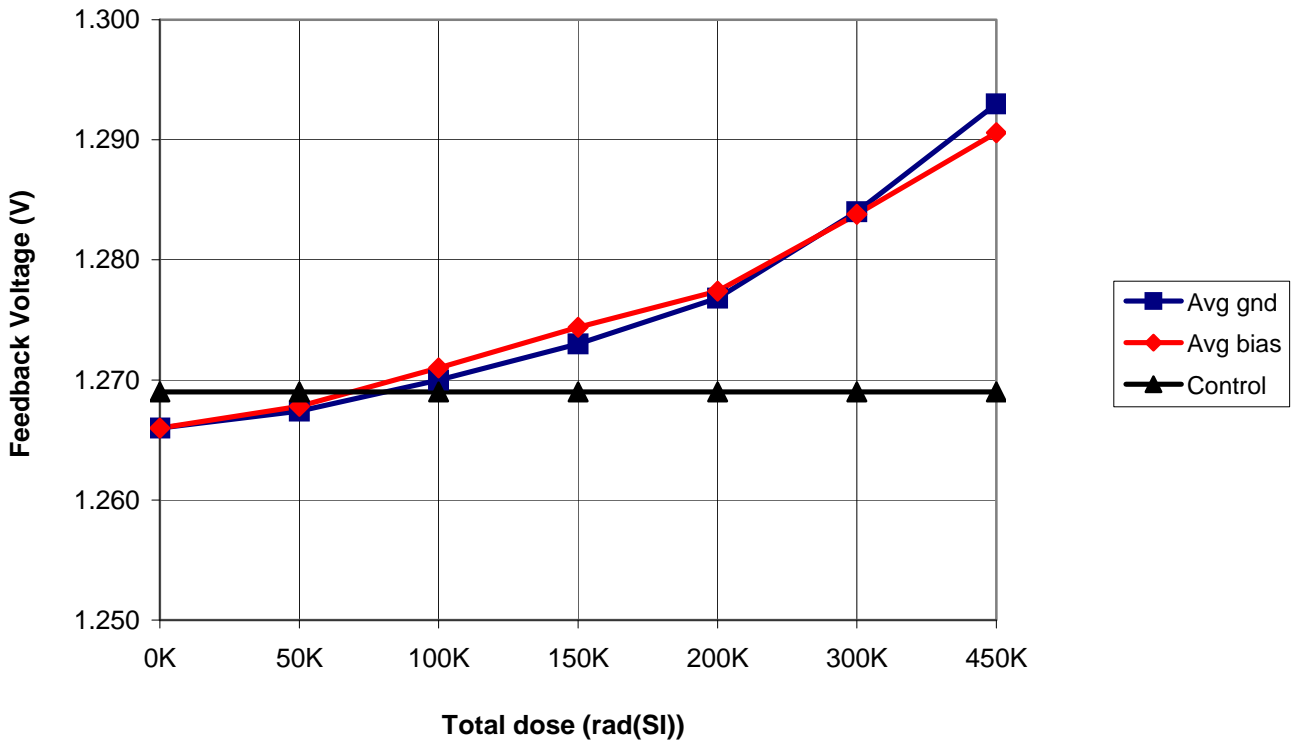
### MSK5950RH Line Regulation vs. Total Dose



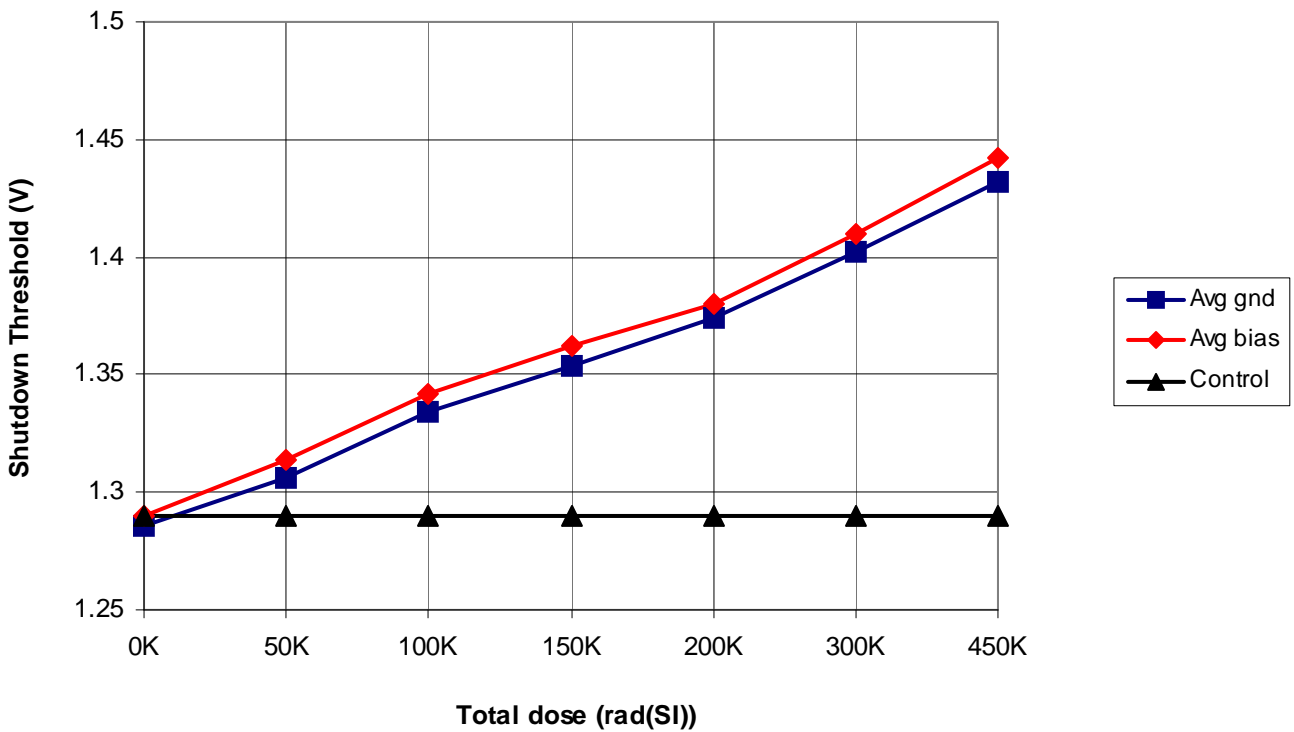
### MSK5950RH Load Regulation vs. Total Dose



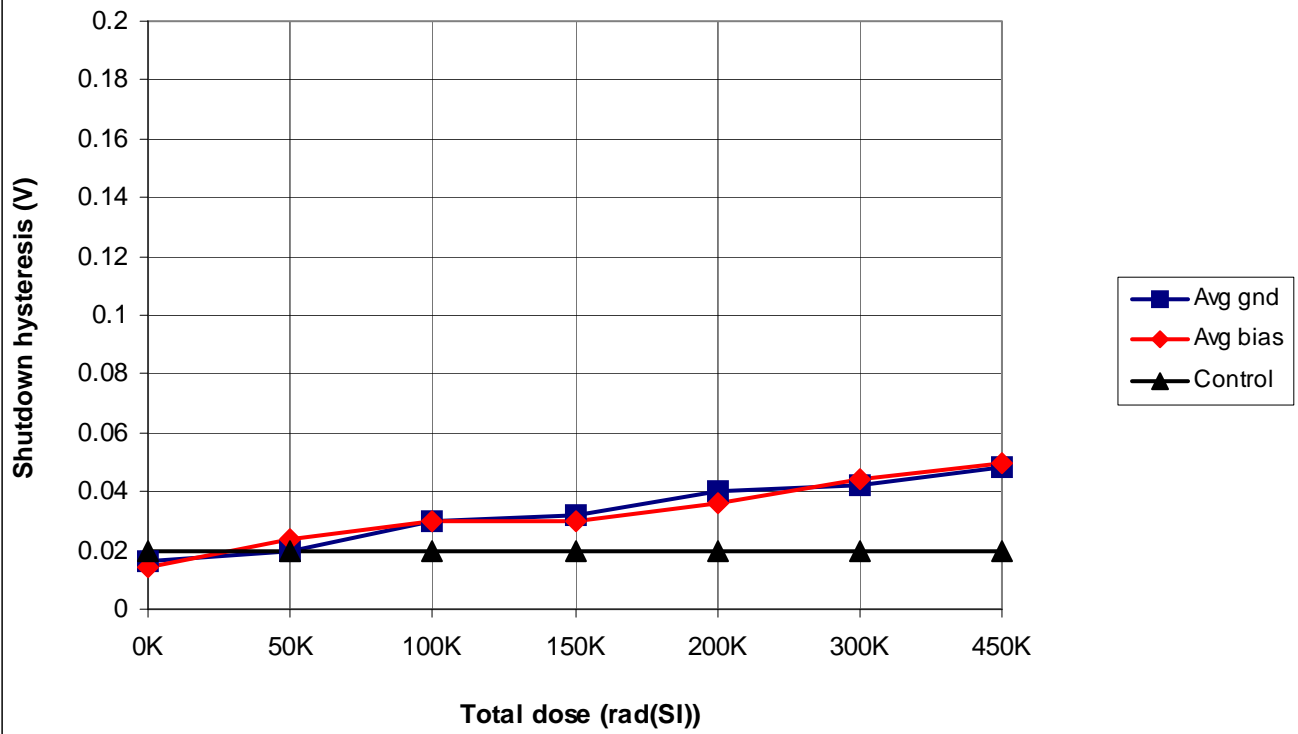
**MSK5950RH**  
**Feedback Voltage vs. Total Dose**



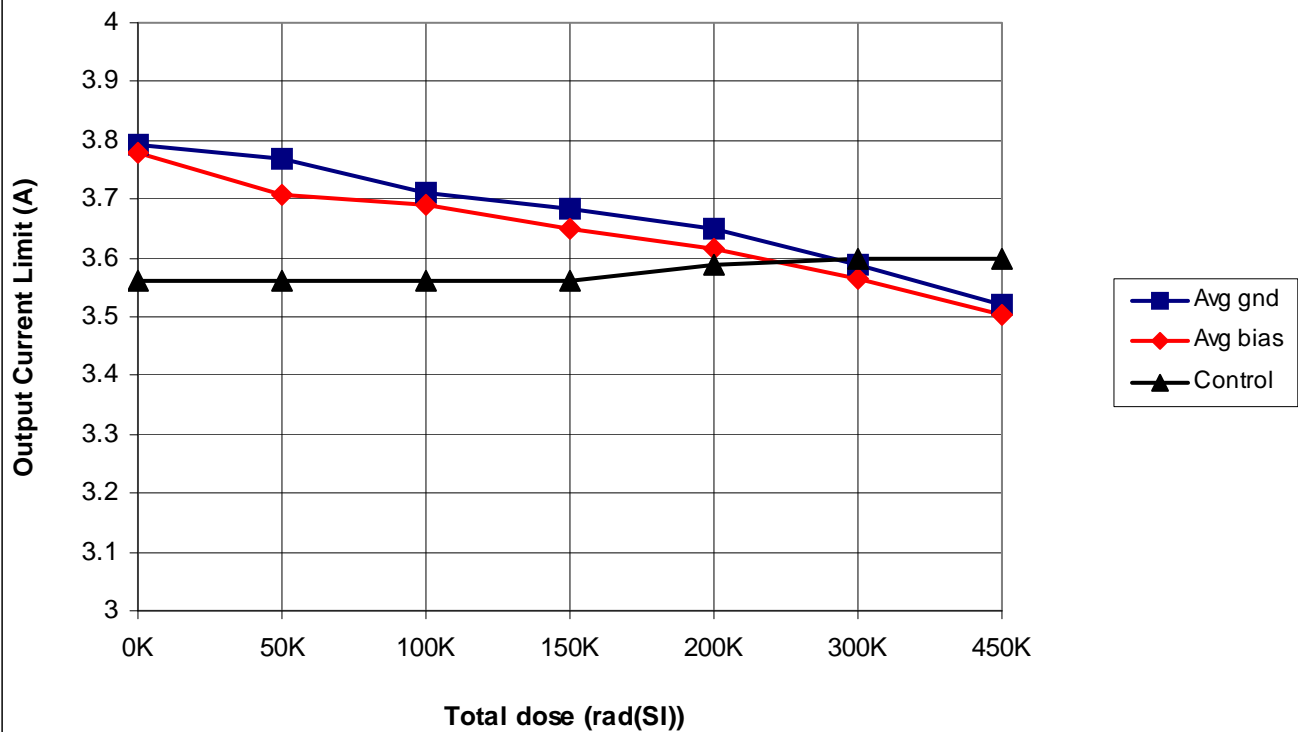
**MSK5950RH**  
**Shutdown Threshold vs. Total Dose**



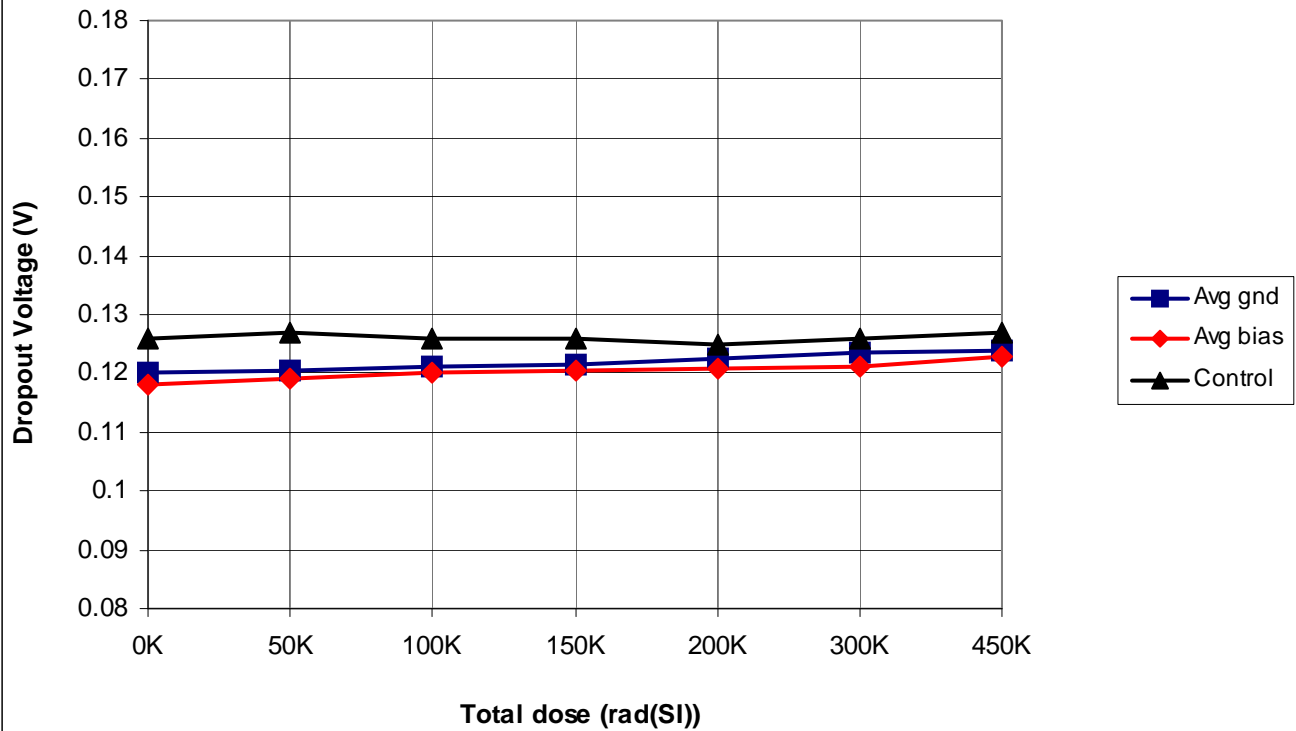
### MSK5950RH Shutdown Hysteresis vs. Total Dose



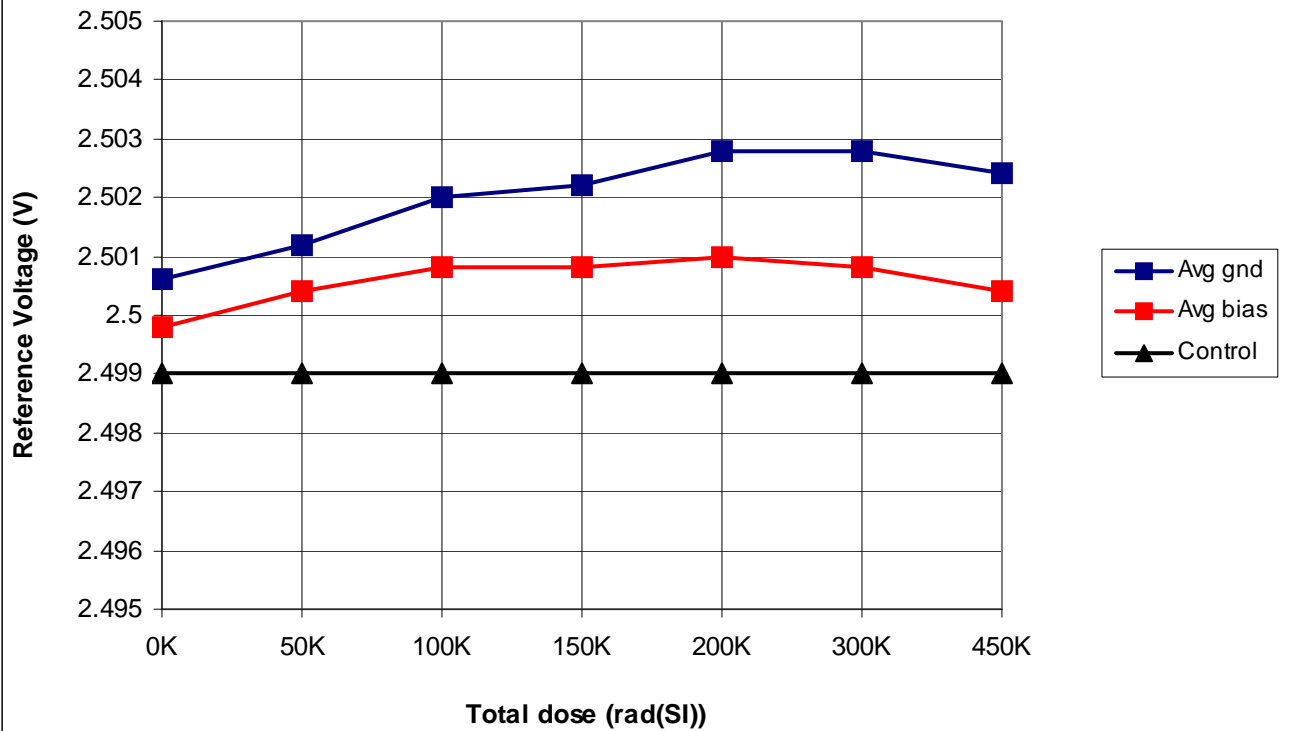
### MSK5950RH Output Current Limit vs. Total Dose



**MSK5950RH**  
**Dropout Voltage vs. Total Dose**



**MSK5950RH**  
**Reference Voltage vs. Total Dose**





**Total Dose Radiation Test Report**  
**MSK 5950 RH**  
**RAD Hard Ultra Low Voltage**  
**Adjustable Positive Linear Regulator**

November 25, 2008

J. Douglas  
F. Freytag

M.S. Kennedy Corporation  
Liverpool, NY

## **I. Introduction:**

The total dose radiation test plan for the MSK 5950 RH series was developed to qualify the devices as RAD Hard to 300 KRADS(Si). The testing was performed beyond 300 KRADS(Si) to show trends in device performance as a function of total dose. The test does not classify maximum radiation tolerance of the device, but simply offers designers insight to the critical parameter-shifts up to the specified total dose level.

MIL-STD-883 Method 1019.7 and ASTM F1892-06 were used as guidelines in the development and implementation of the total dose test plan for the MSK 5950RH.

## **II. Radiation Source:**

Total dose was performed at the University of Massachusetts, Lowell, using a cobalt 60 radiation source. The dose rate was determined to be 192 Rads(Si)/sec. The total dose schedule can be found in Table I.

## **III. Test Setup:**

All test samples were subjected to Group A Electrical Test at 25°C in accordance with the device data sheet. In addition, all devices received 320 hours of burn-in per MIL-STD-883 Method 1015. For test platform verification, one control device was tested at 25°C. Ten devices were then tested at 25°C, prior to irradiation, and were found to be within acceptable test limits.

The devices were vertically aligned with the radiation source and enclosed in a lead/aluminum container during irradiation. Five devices were kept under bias during irradiation. Maximum recommended operating voltage of +7.5V was used for the bias condition. Five devices had all leads grounded during irradiation for the unbiased condition.

After each irradiation the device leads were shorted together and transported to the MSK automatic electrical test platform and tested IAW MSK device data sheet. Testing was performed on irradiated devices, as well as the control device, at each total dose level. Electrical tests were completed within one hour of irradiation. Devices were subjected to subsequent radiation doses within two hours of removal from the radiation field.

## **IV. Data:**

All performance curves are averaged from the test results of the biased and unbiased devices, respectively. If required, full test data can be obtained by contacting M.S. Kennedy Corporation.

## **V. Summary:**

Based on the test data recorded during radiation testing, the MSK5950RH qualified as a 300 Krad(Si) radiation hardened device. Feedback Voltage, Shutdown Threshold and Output Current Limit exhibited the most significant shift due to irradiation, however all performance curves stayed within specification up to 450 Krad(Si) TID.

MSK 5950RH Biased/Unbiased Dose Rate  
Schedule

Dosimetry Equipment  
Bruker Biospin # 0141

Irradiation Date  
11/18/08

Exposure Length (min:sec)	Incremental Dose rads(Si)	Cumulative Dose rads(Si)
4:28	51,456	51,456
4:28	51,456	102,912
4:28	51,456	154,368
4:28	51,456	205,824
8:57	103,104	308,928
13:25	154,560	463,488

Biased S/N – 0006, 0007, 0009, 0010, 0012

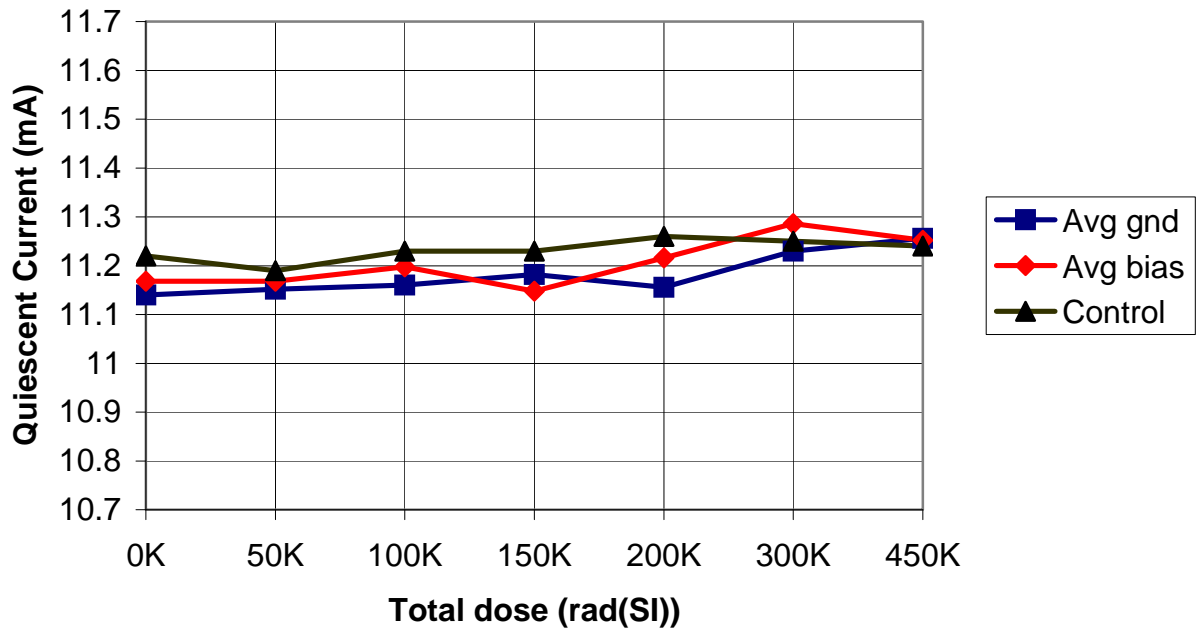
Unbiased S/N – 0016, 0017, 0018, 0019, 0020

Table 1

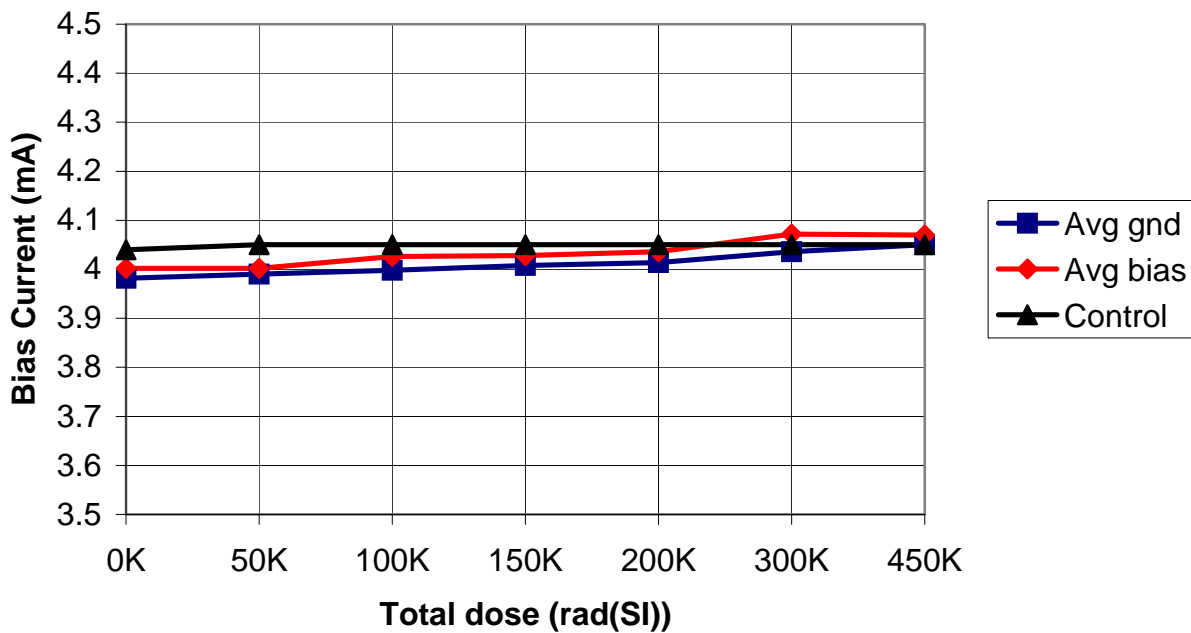
**Dose Time, Incremental Dose and Total Cumulative Dose**

# MSK5950RH

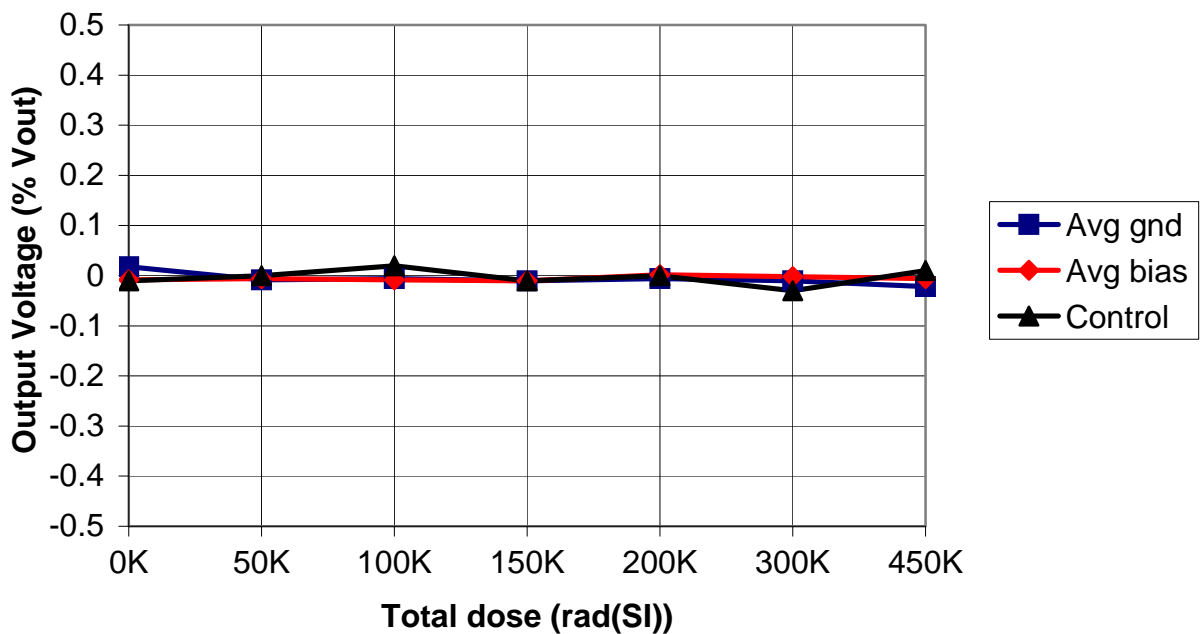
## Quiescent Current vs. Total Dose



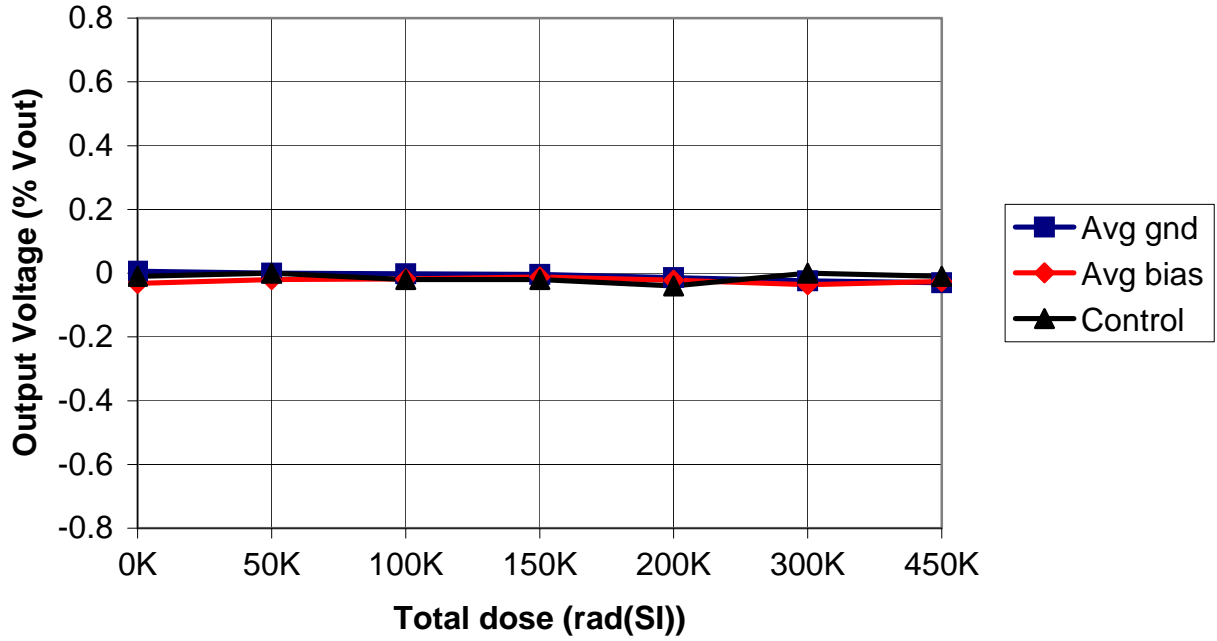
### MSK5950RH Bias Current vs. Total Dose



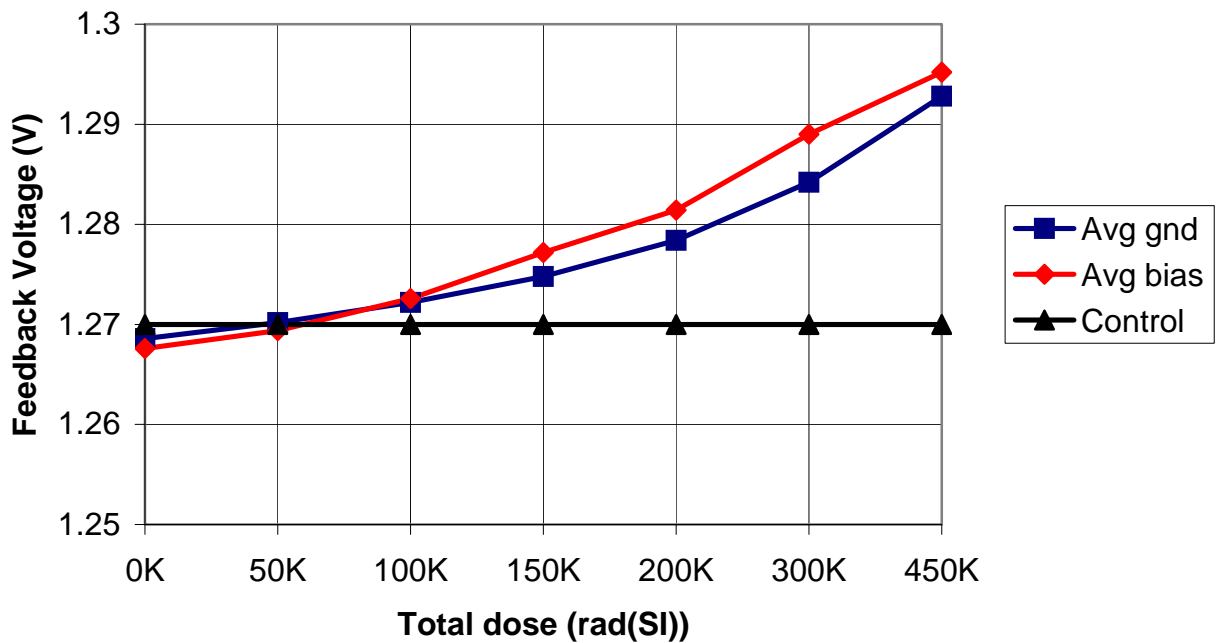
### MSK5950RH Line Regulation vs. Total Dose



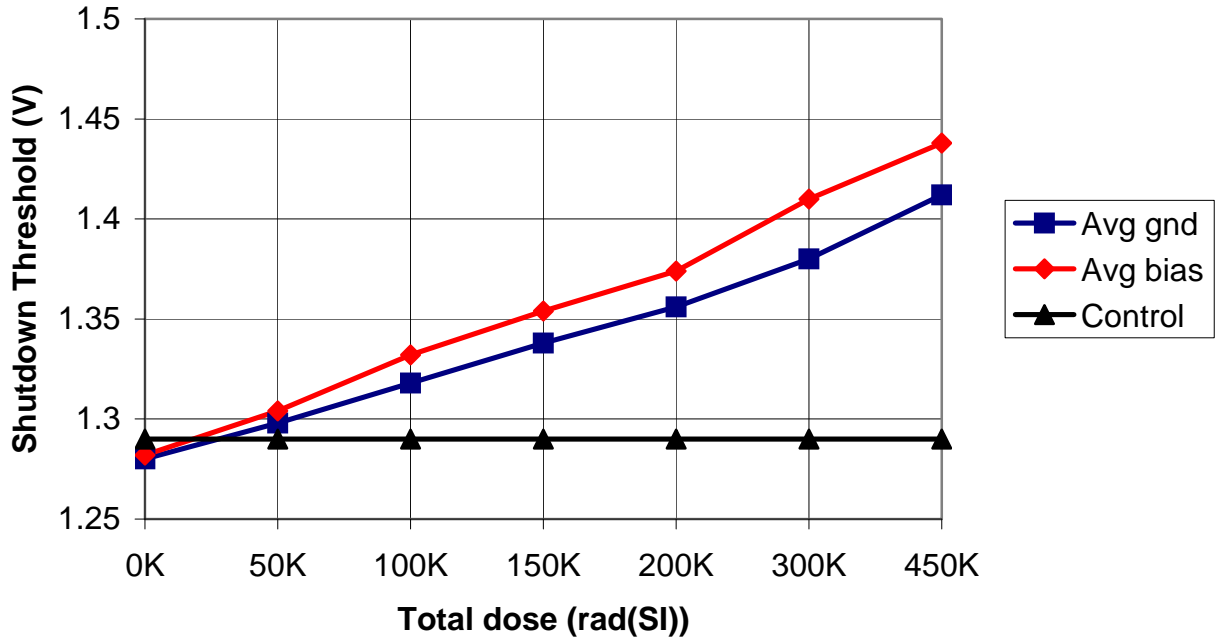
### MSK5950RH Load Regulation vs. Total Dose



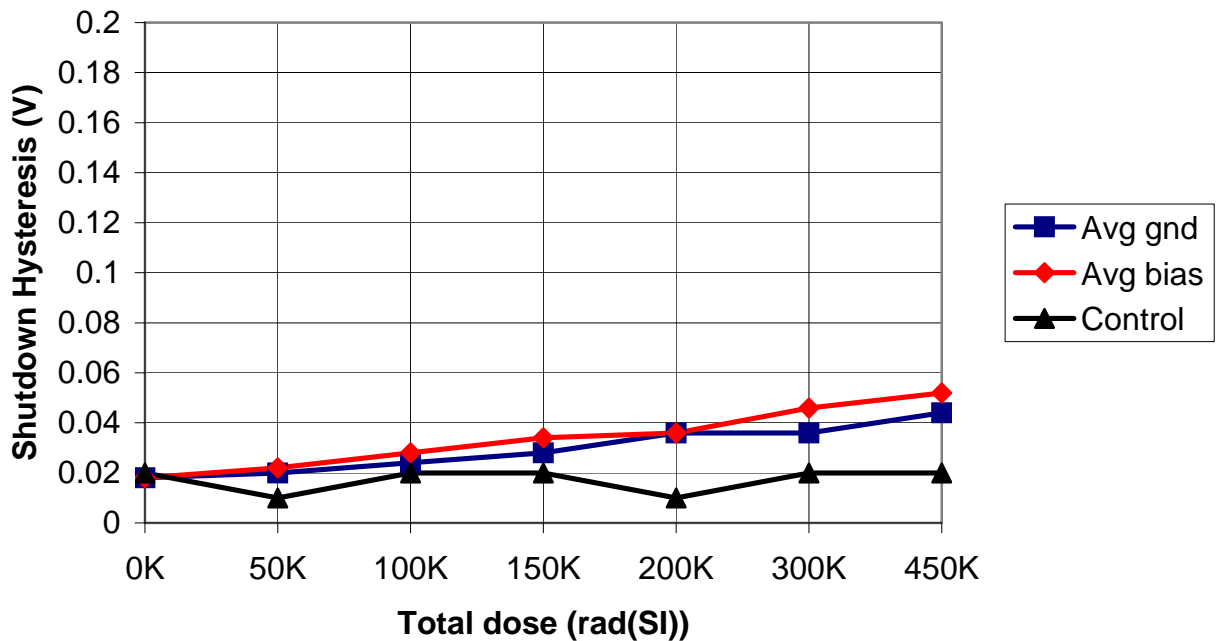
### MSK5950RH Feedback Voltage vs. Total Dose



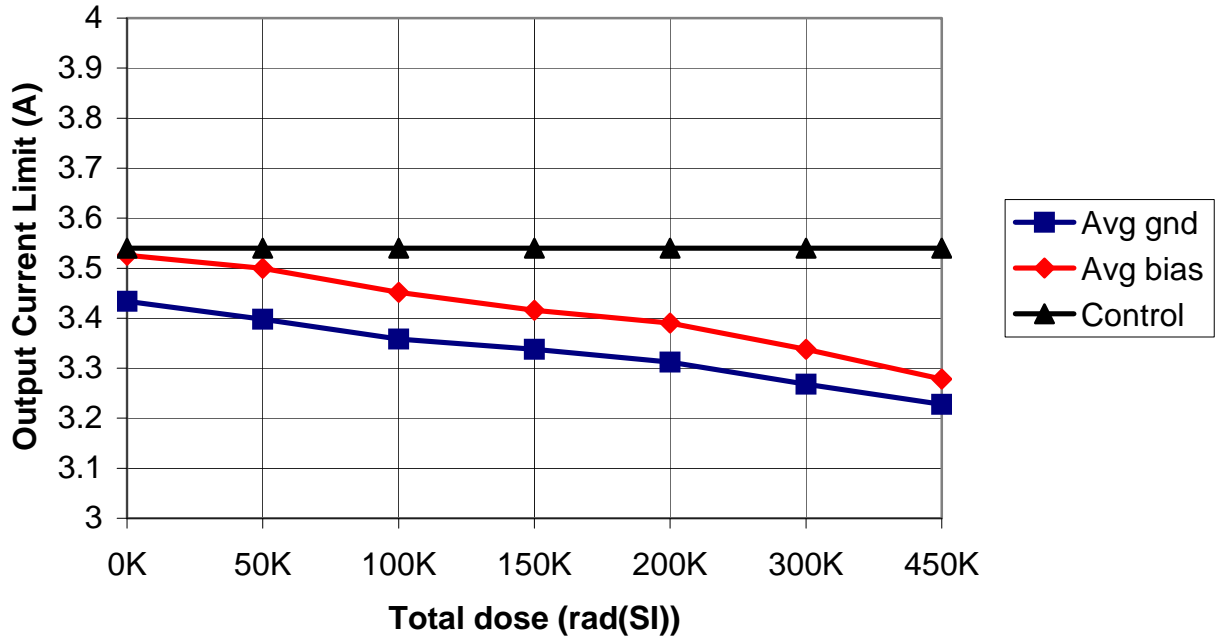
**MSK5950RH**  
**Shutdown Threshold vs. Total Dose**



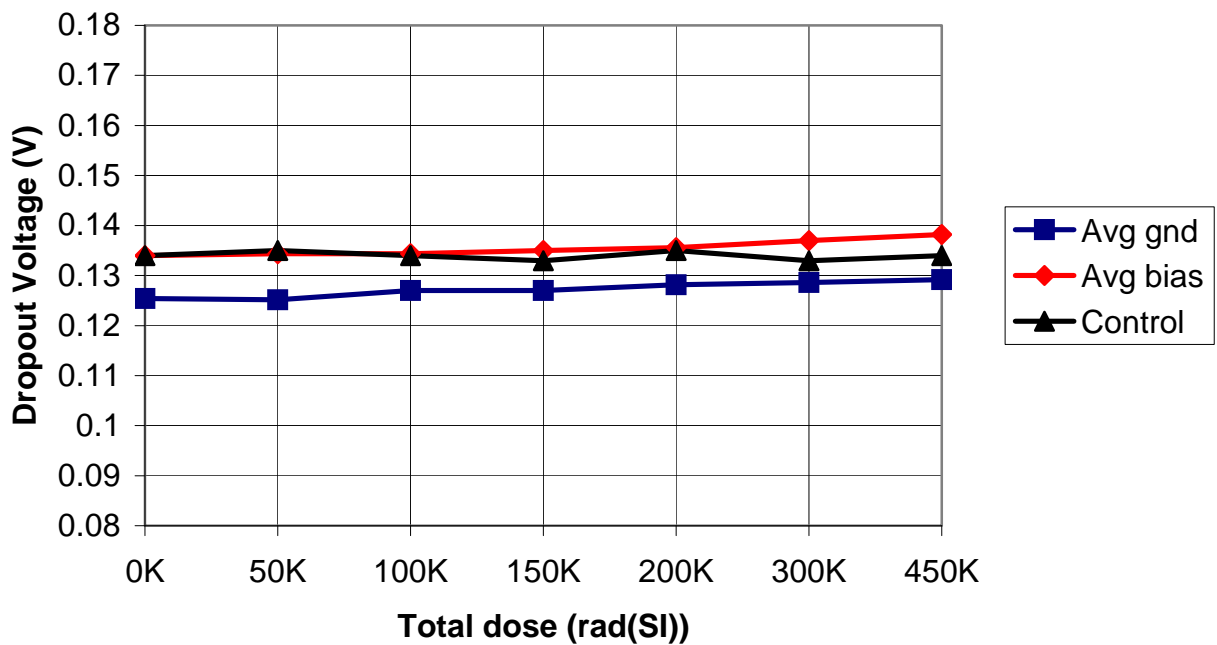
**MSK5950RH**  
**Shutdown Hysteresis vs. Total Dose**



### MSK5950RH Output Current Limit vs. Total Dose



### MSK5950RH Dropout Voltage vs. Total Dose





# MSK5950RH

## Reference Voltage vs. Total Dose

