Total Dose Radiation Test Report

MSK5986RH

RAD Hard Positive Adjustable Voltage Regulator

January 11, 2018 (TID, 1st Test, Wafer Lot: HP201682.1W2)

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I. Introduction:

The total dose radiation test plan for the MSK5986RH was developed to qualify the devices as RAD Hard to 100 KRAD(Si). The testing was performed beyond 100 KRAD(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 MSK5986RH.

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 126.7 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 in accordance with the device data sheet. In addition, all devices received 160 hours minimum of burn-in per MIL-STD-883 Method 1015. For test platform verification, two control devices were 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. An operating voltage of +23V 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 the devices were transported to the MSK electrical test platform. Testing was performed in accordance with the MSK device data sheet. Testing was performed on irradiated devices, as well as the control devices, 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.

III. 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 MSK Products – Anaren Inc.

V. Summary:

Based on the test data recorded during radiation testing and statistical analysis, the MSK5986RH qualified as a 100 Krad(Si) radiation hardened device. The Set Pin Currents exhibited the most significant change with irradiation, however all performance curves stayed within specification up to 450 Krad(Si) TID.

MSK5986RH Biased/Unbiased Dose Rate Schedule

Dosimetry Equipment
Bruker Biospin # 0162

Irradiation Date
1/11/18

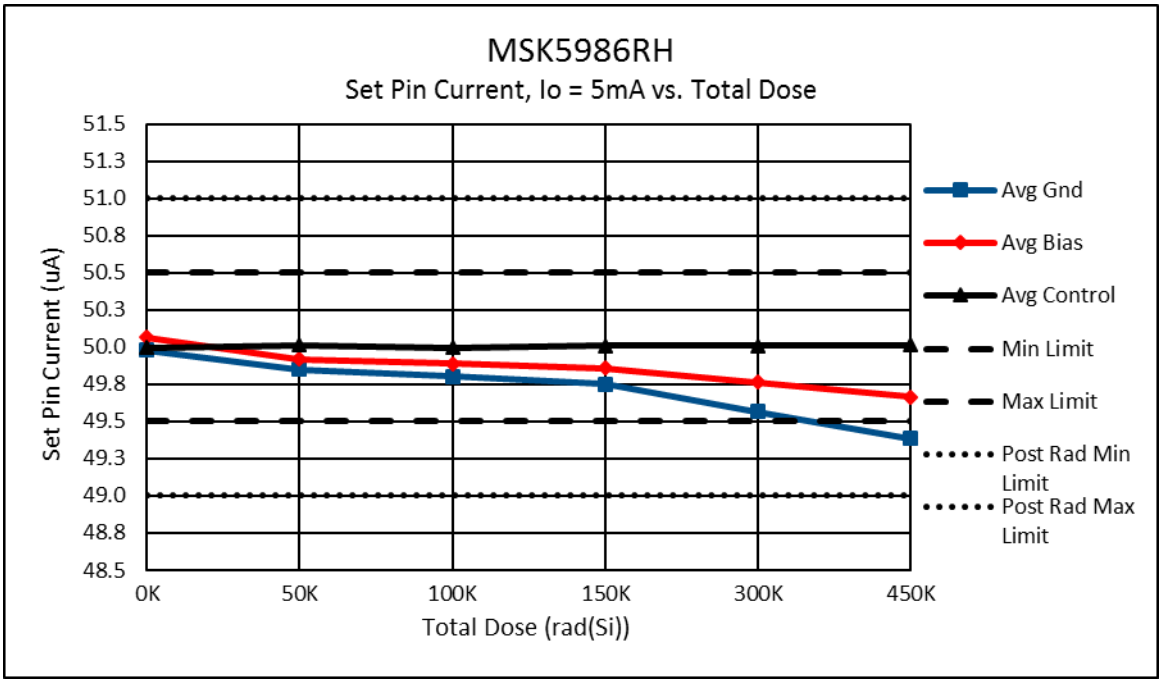
Exposure Length (min:sec)	Incremental Dose rads(Si)	Cumulative Dose rads(Si)
6:46	51,500	51,500
6:46	51,500	103,000
6:46	51,500	154,500
20:19	154,500	309,000
20:19	154,500	463,500

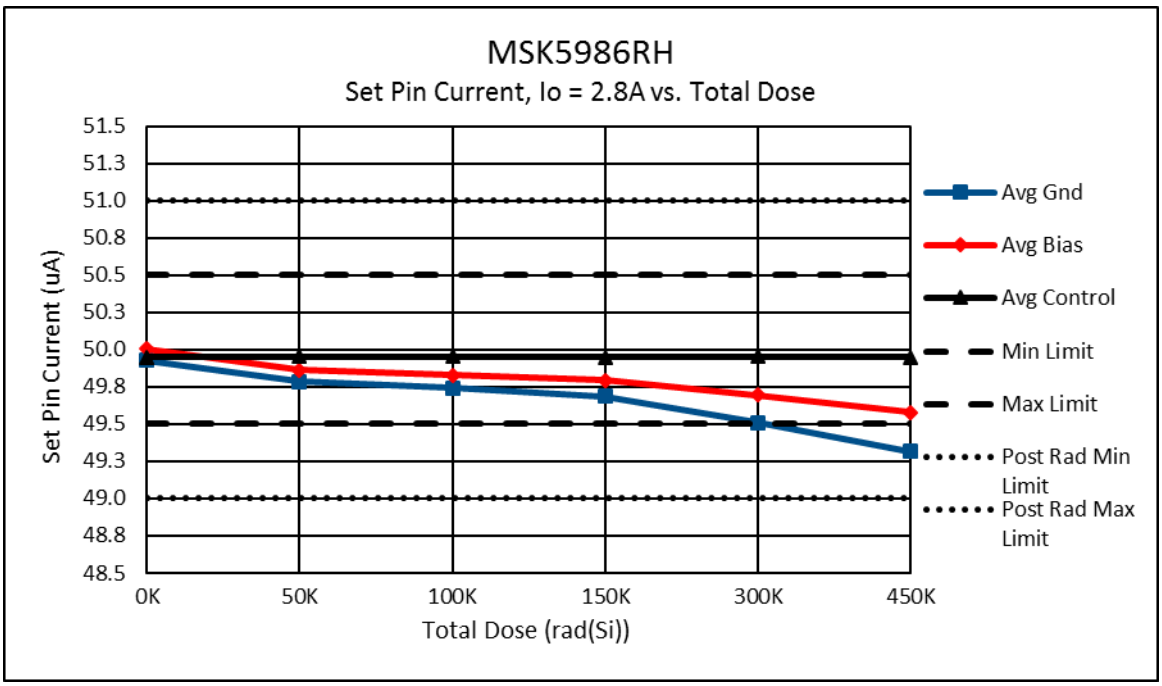
Biased S/N – 0032, 0033, 0034, 0035, 0036

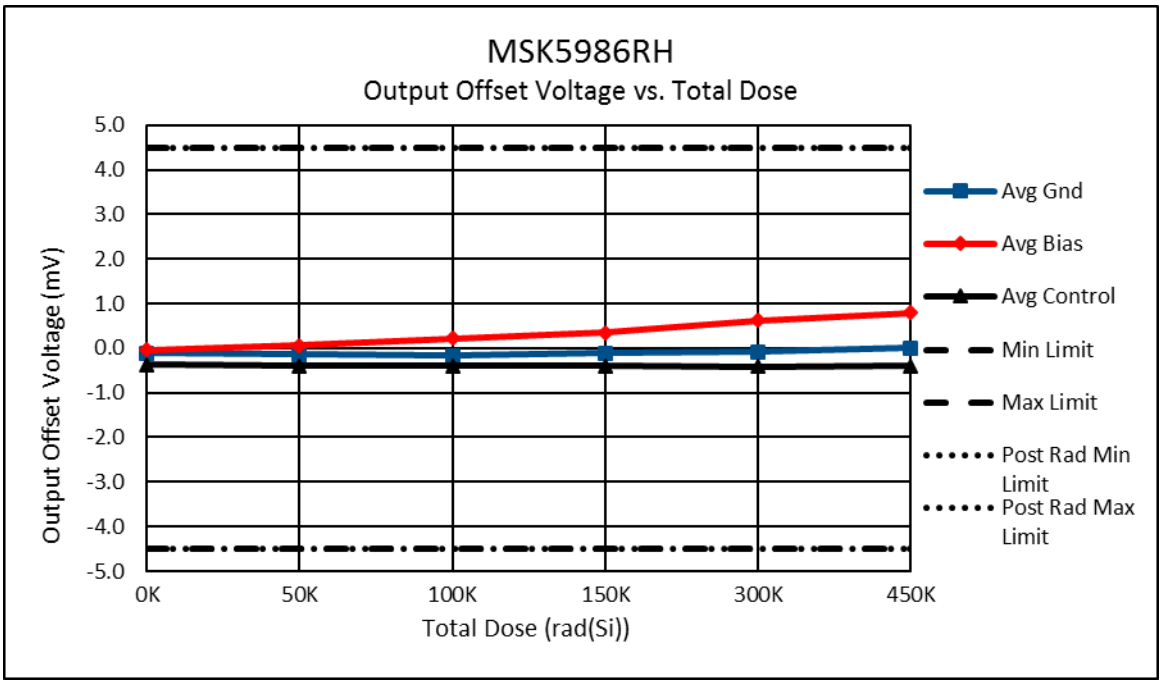
Unbiased S/N – 0037, 0038, 0039, 0040, 0041

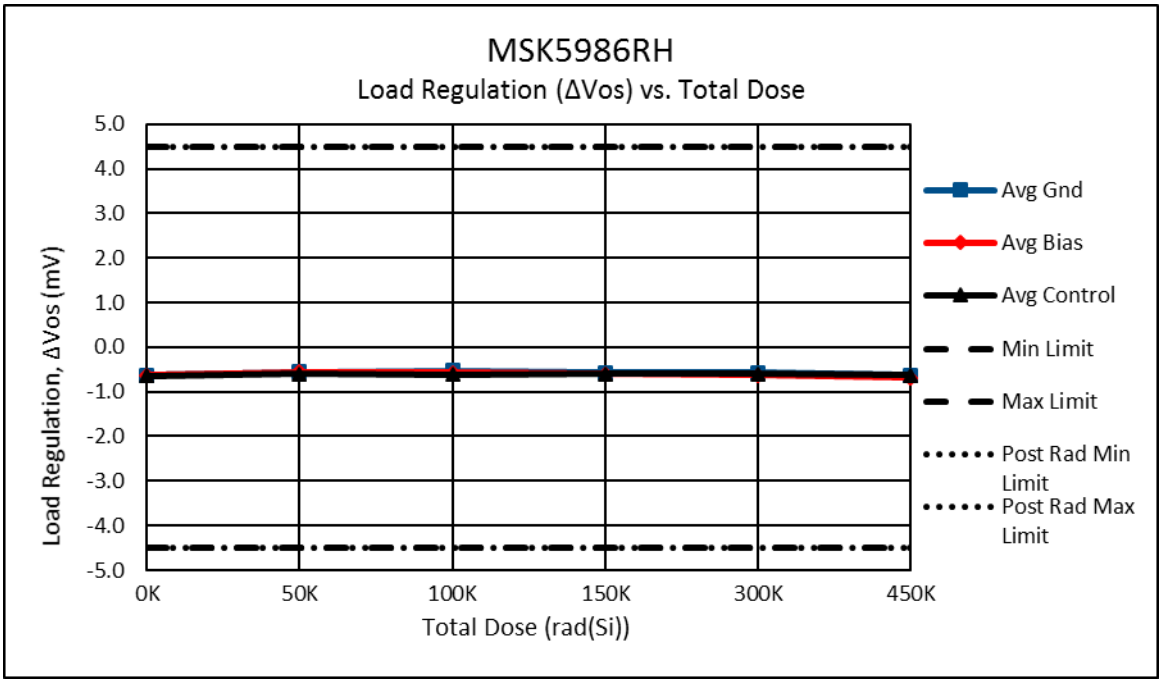
Table 1

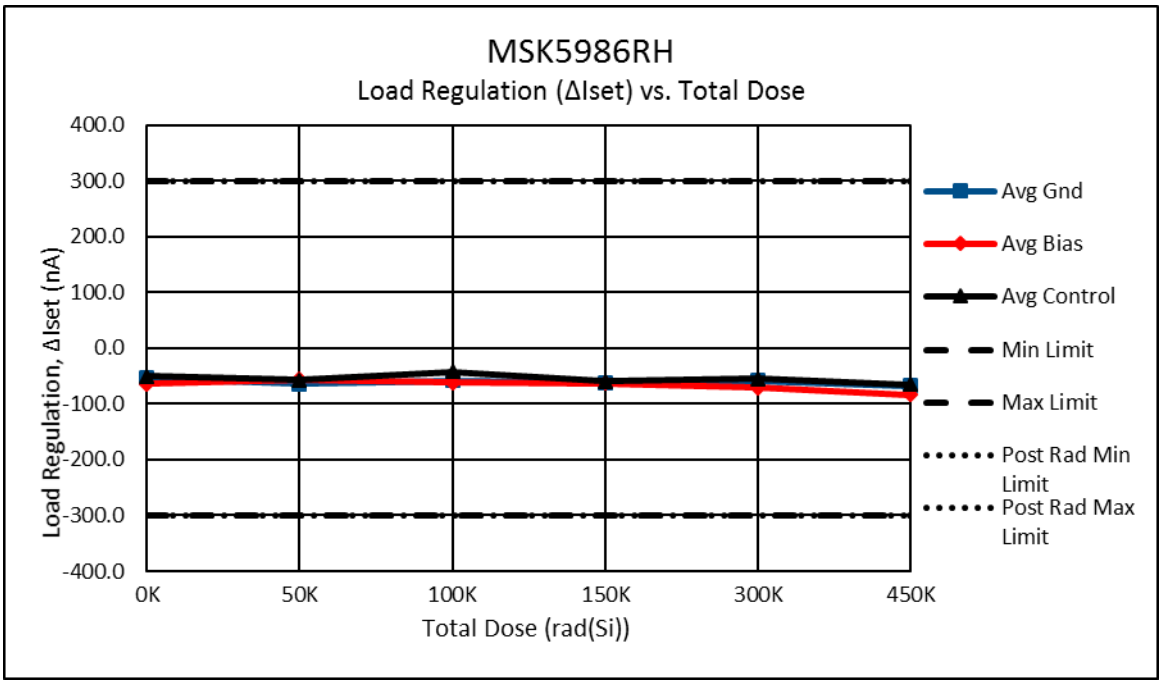
Dose Time, Incremental Dose and Total Cumulative Dose

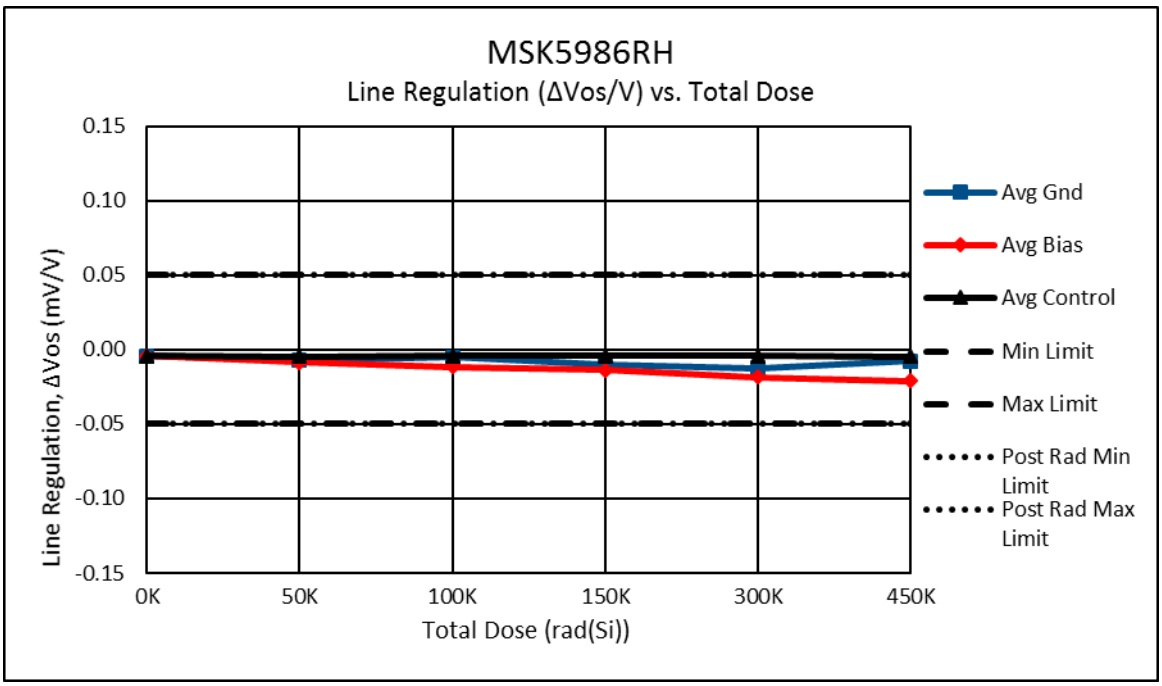

MSK5986RH
Set Pin Current, Io = 5mA vs. Total Dose
Set Pin Current (uA)
51.5
51.3
51.0
50.8
50.5
50.3
50.0
49.8
49.5
49.3
49.0
48.8
48.5
0K
50K
100K
150K
300K
450K
Total Dose (rad(Si))
Avg Gnd
Avg Bias
Avg Control
Min Limit
Max Limit
Post Rad Min Limit
Post Rad Max Limit

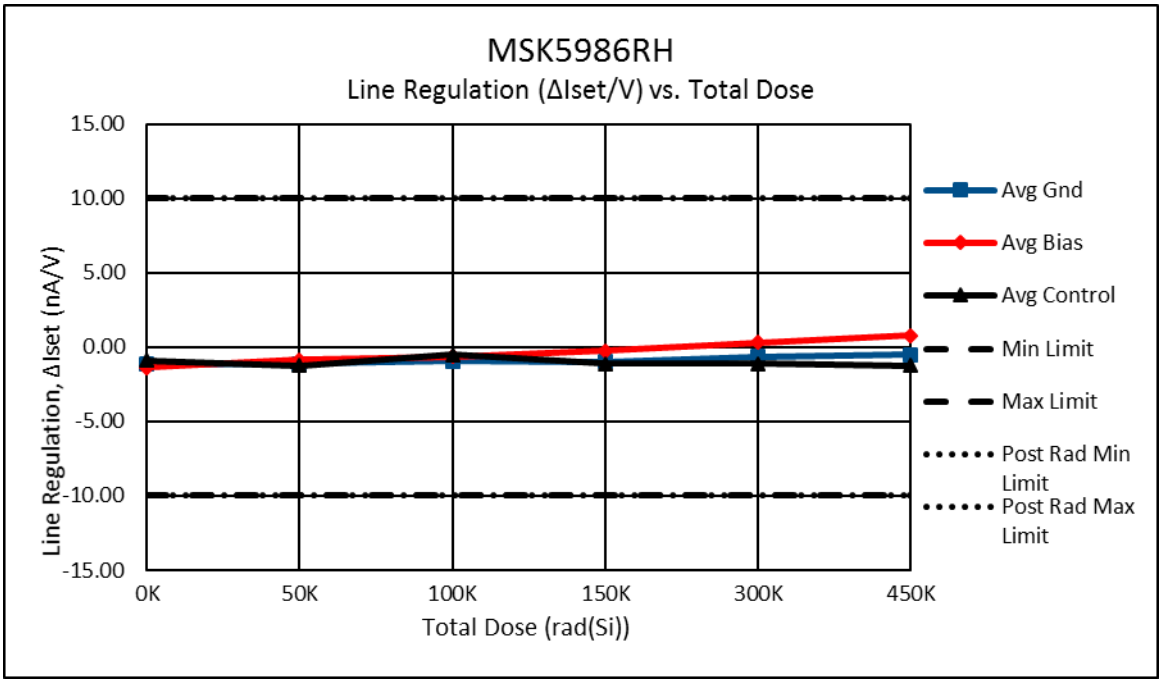

MSK5986RH
Set Pin Current, Io = 2.8A vs. Total Dose
Set Pin Current (uA)
51.5
51.3
51.0
50.8
50.5
50.3
50.0
49.8
49.5
49.3
49.0
48.8
48.5
0K
50K
100K
150K
300K
450K
Total Dose (rad(Si))
Avg Gnd
Avg Bias
Avg Control
Min Limit
Max Limit
Post Rad Min Limit
Post Rad Max Limit

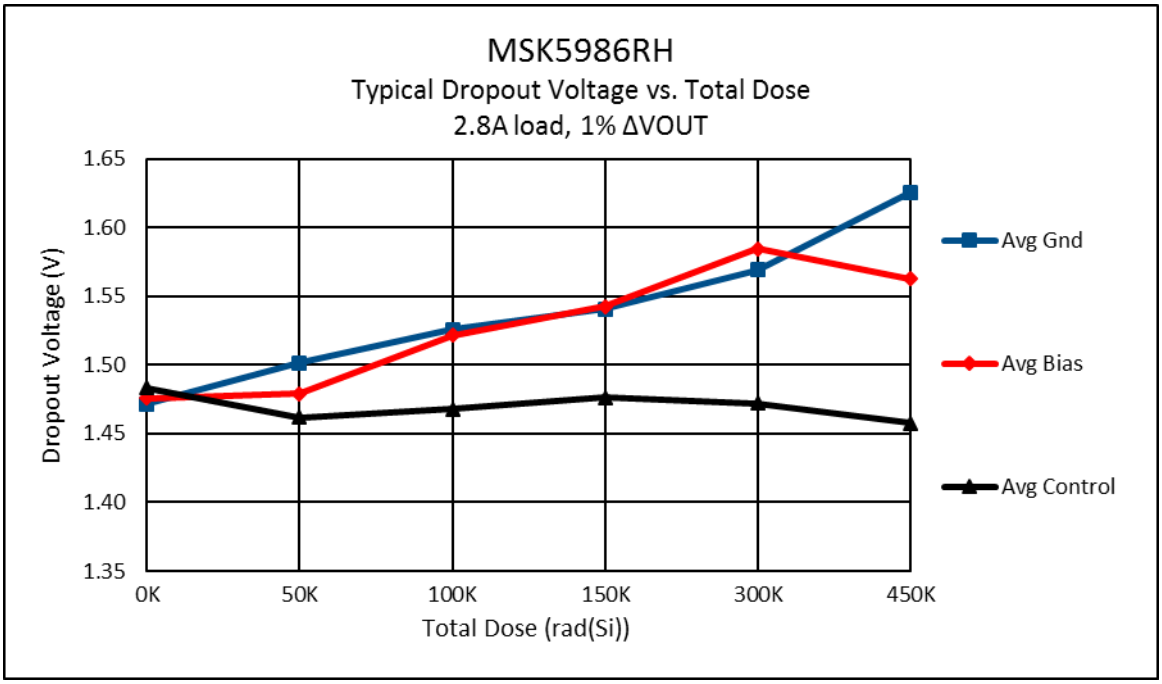

MSK5986RH
Output Offset Voltage vs. Total Dose
Output Offset Voltage (mV)
5.0
4.0
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
-4.0
-5.0
0K
50K
100K
150K
300K
450K
Total Dose (rad(Si))
Avg Gnd
Avg Bias
Avg Control
Min Limit
Max Limit
Post Rad Min Limit
Post Rad Max Limit

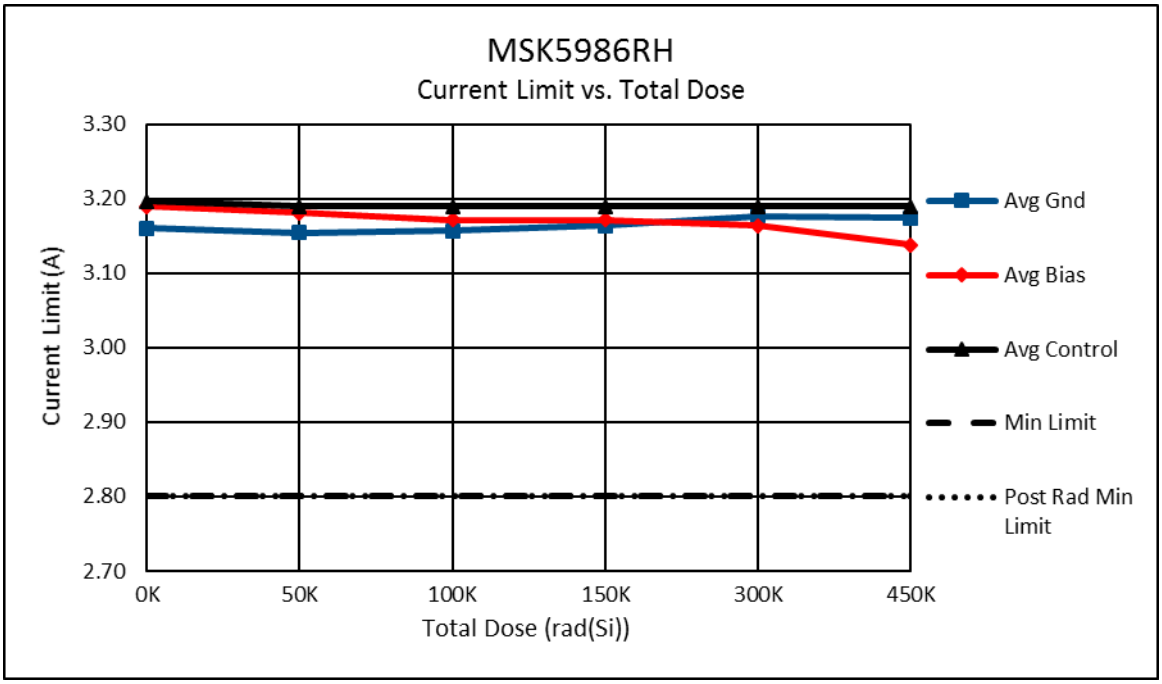

MSK5986RH
Load Regulation (ΔVos) vs. Total Dose
Load Regulation, ΔVos (mV)
5.0
4.0
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
-4.0
-5.0
0K
50K
100K
150K
300K
450K
Total Dose (rad(Si))
Avg Gnd
Avg Bias
Avg Control
Min Limit
Max Limit
Post Rad Min Limit
Post Rad Max Limit


MSK5986RH
Load Regulation (ΔIset) vs. Total Dose
Load Regulation, ΔIset (nA)
400.0
300.0
200.0
100.0
0.0
-100.0
-200.0
-300.0
-400.0
0K
50K
100K
150K
300K
450K
Total Dose (rad(Si))
Avg Gnd
Avg Bias
Avg Control
Min Limit
Max Limit
Post Rad Min Limit
Post Rad Max Limit


MSK5986RH
Line Regulation (ΔVos/V) vs. Total Dose
Line Regulation, ΔVos (mV/V)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0K
50K
100K
150K
300K
450K
Total Dose (rad(Si))
Avg Gnd
Avg Bias
Avg Control
Min Limit
Max Limit
Post Rad Min Limit
Post Rad Max Limit


MSK5986RH
Line Regulation (ΔIset/V) vs. Total Dose
15.00
10.00
5.00
0.00
-5.00
-10.00
-15.00
Line Regulation, ΔIset (nA/V)
0K
50K
100K
150K
300K
450K
Total Dose (rad(Si))
Avg Gnd
Avg Bias
Avg Control
Min Limit
Max Limit
Post Rad Min Limit
Post Rad Max Limit


MSK5986RH
Typical Dropout Voltage vs. Total Dose
2.8A load, 1% ΔVOUT
1.65
1.60
1.55
1.50
1.45
1.40
1.35
Dropout Voltage (V)
0K
50K
100K
150K
300K
450K
Total Dose (rad(Si))
Avg Gnd
Avg Bias
Avg Control


MSK5986RH
Current Limit vs. Total Dose
Current Limit (A)
3.30
3.20
3.10
3.00
2.90
2.80
2.70
0K
50K
100K
150K
300K
450K
Total Dose (rad(Si))
Avg Gnd
Avg Bias
Avg Control
Min Limit
Post Rad Min Limit