

Total Ionizing Dose Radiation Test Report
MSK5063RH,
RAD HARD High Voltage Synchronous Switching Regulator

June 13, 2014 (TID, IC WAFER LOT: WD005797WF#9
MOSFET WAFER LOT: HP201244W#3)

B. Horton
K. Conroy

M.S. Kennedy Corporation

I. Introduction:

The Total Ionizing Dose radiation test plan for the MSK5063RH was developed to qualify the devices as RAD Hard to 300 Krad(Si). Testing was performed beyond 300 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 MSK5063RH.

II. Radiation Source:

Total ionizing dose testing was performed at the University of Massachusetts, Lowell, using a Cobalt 60 radiation source. The dose rate was determined to be 120 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 240 hours of burn-in per MIL-STD-883 Method 1015 and were fully screened IAW MIL-PRF-38535 Class K. 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. 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 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. Post 300 Krad(Si) limits have also been plotted for reference. Device serial number 0010 and the Control device were both partially damaged by operator error, disabling some test functionality. These devices were removed from the applicable parameter analyses and performance curves. 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 and statistical analysis, the MSK5063RH qualifies as 300 Krad(Si) radiation hardened devices. Error Amplifier Reference Voltage, Vin UVLO Threshold (falling), Operating Frequency, and Current Limit Sense Voltage exhibited the most significant shifts with irradiation. These parameters stayed within specified post irradiation limits at 100 Krad(Si) and 300 Krad(Si). "Programmable Frequency Range" exhibited a net change with dose correlating with the change measured directly by the "Operating Frequency" parameter. "Programmable Frequency Range" is a functional test and performed with fixed value FSET resistors. The upper end of the tested range shifted down and out of tolerance at 300 Krad(Si). It is believed at this time that selecting a lower value FSET resistor for test will ensure compliance with the existing limits. This parameter met specifications post 300 Krad(Si) when previously tested on the controller IC (RH3845) in the MSK5055RH. All other parameters stayed within specification up to or beyond 300 Krad(Si).

MSK5063RH Biased/Unbiased Dose Rate
Schedule

Dosimetry Equipment
Bruker Biospin # 0371

Irradiation Date
6/13/14

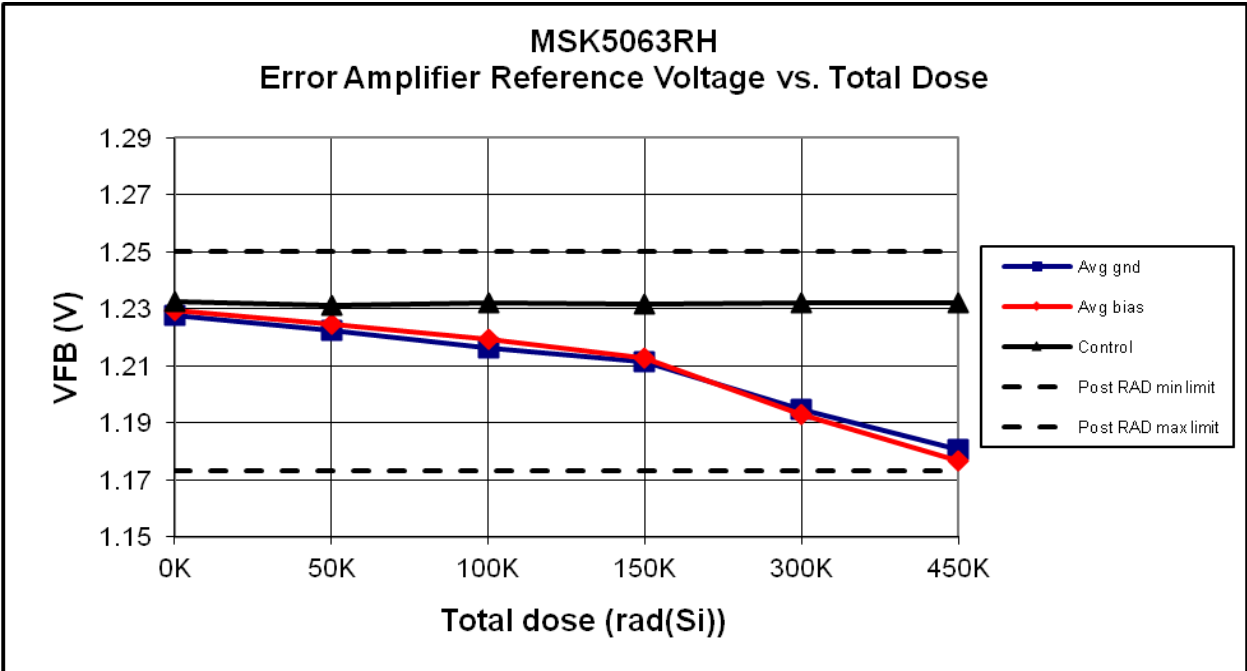
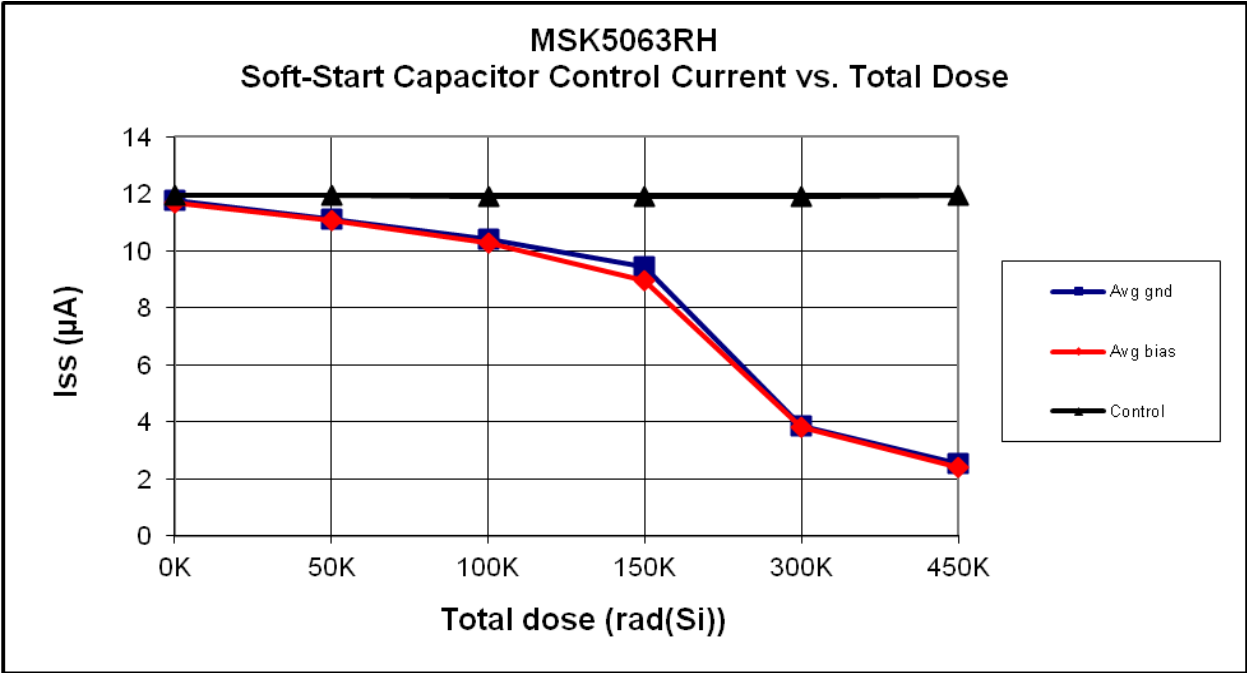
Exposure Length (min:sec)	Incremental Dose rads(Si)	Cumulative Dose rad(Si)
07:09	51,480	51,480
07:09	51,480	102,960
07:09	51,480	154,440
21:28	154,560	309,000
21:28	154,560	463,560

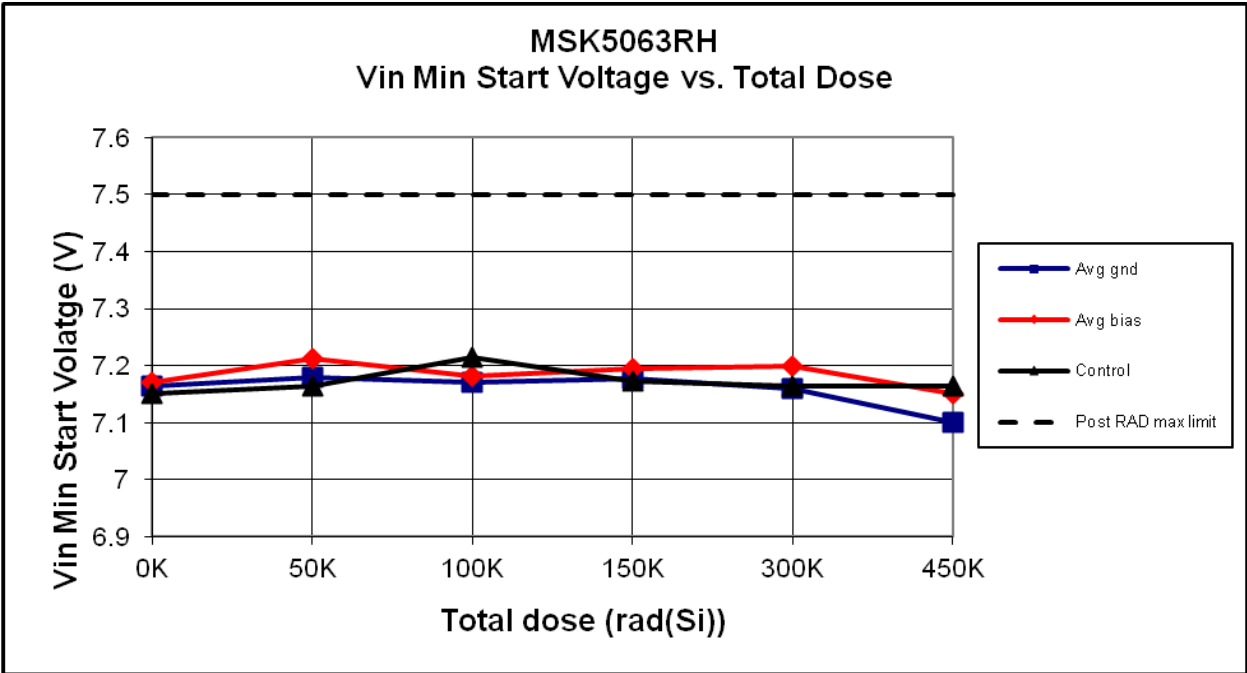
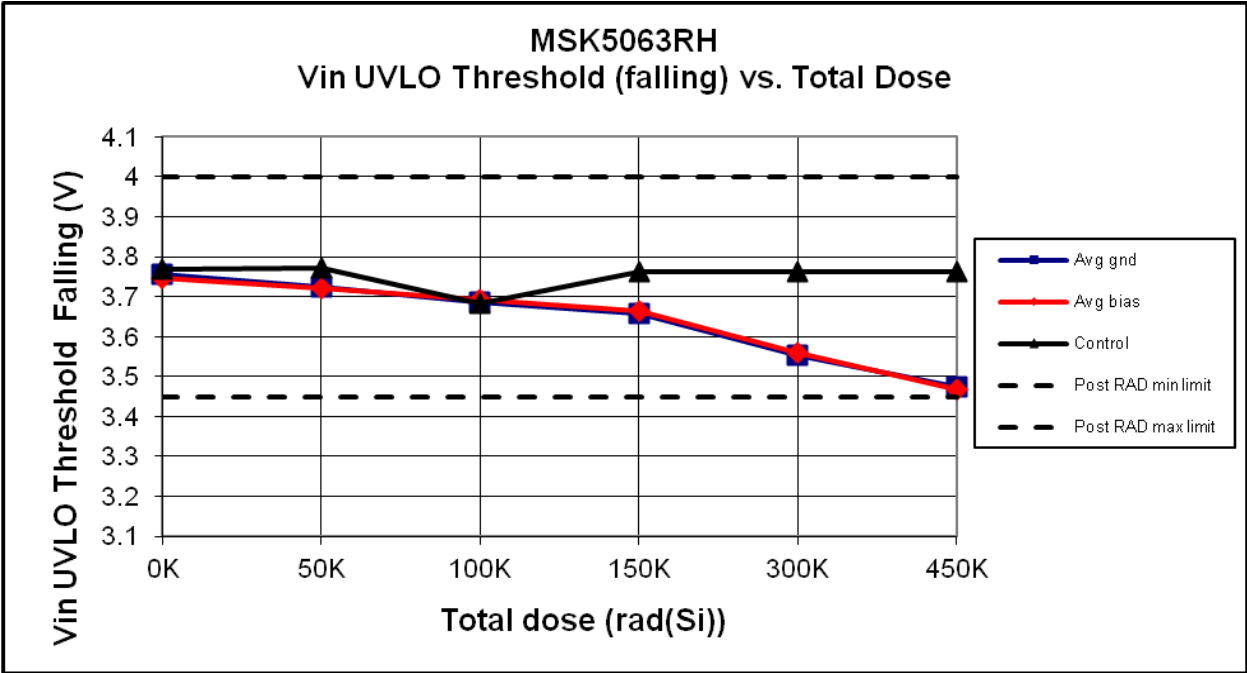
Biased S/N – 0004, 0009, 0010, 0011, 0012

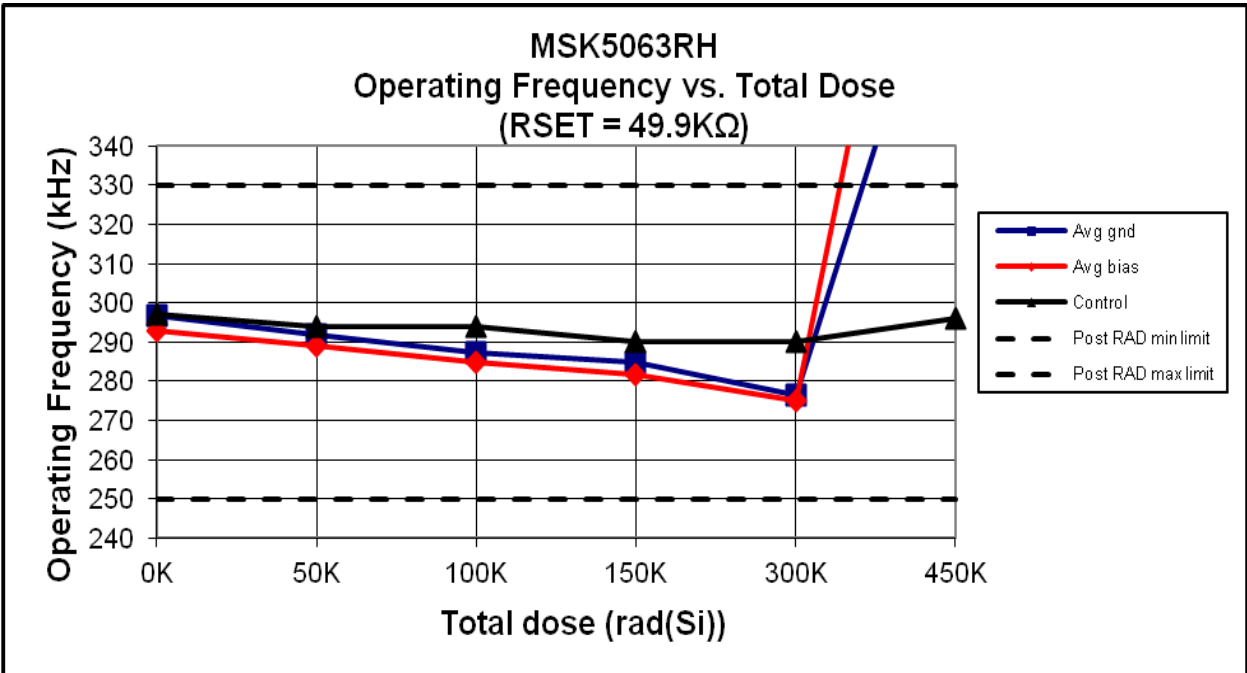
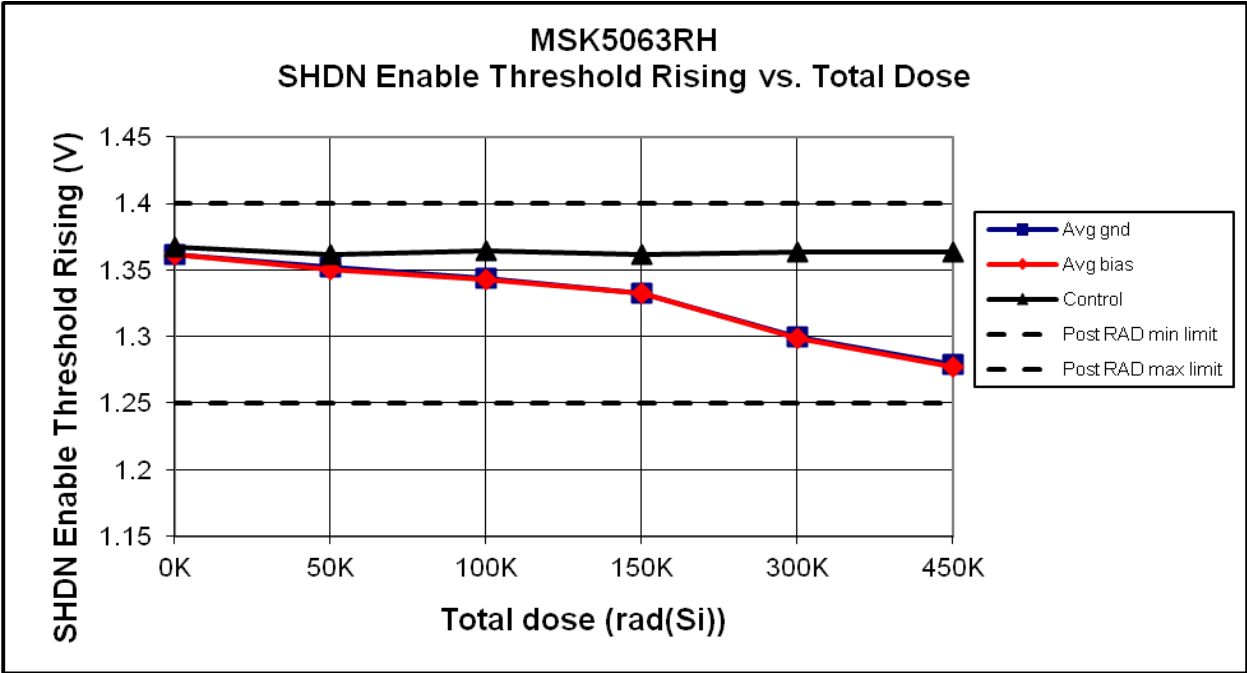
Unbiased S/N – 0013, 0014, 0015, 0017, 0018

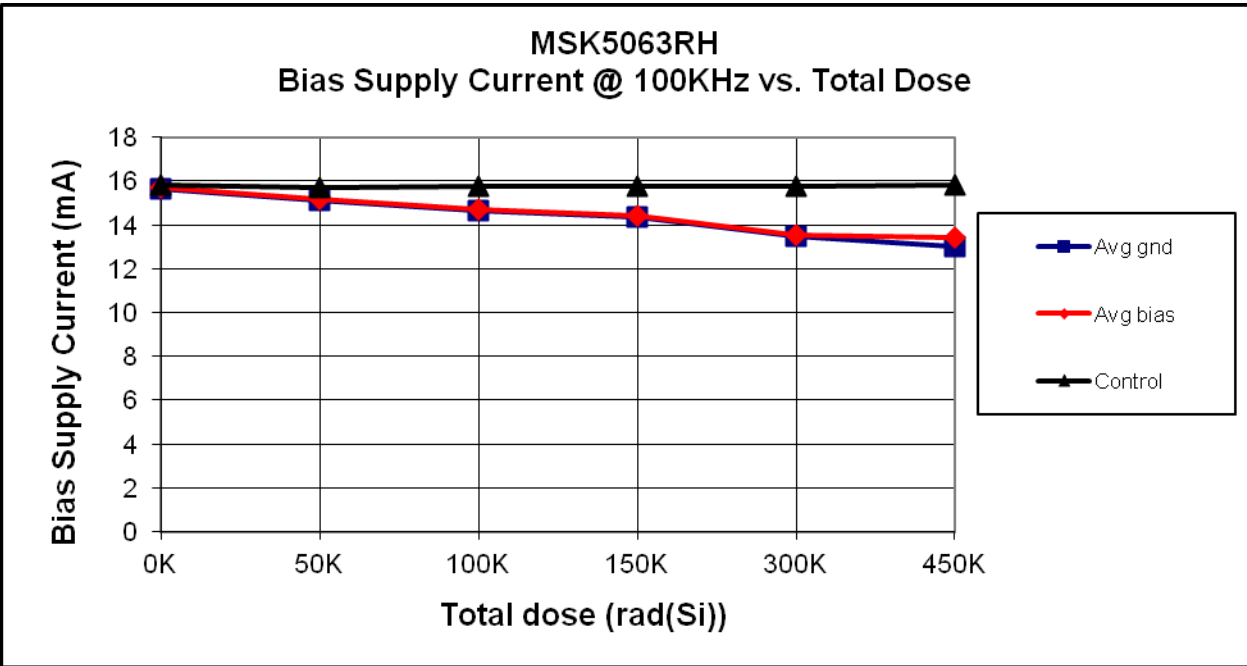
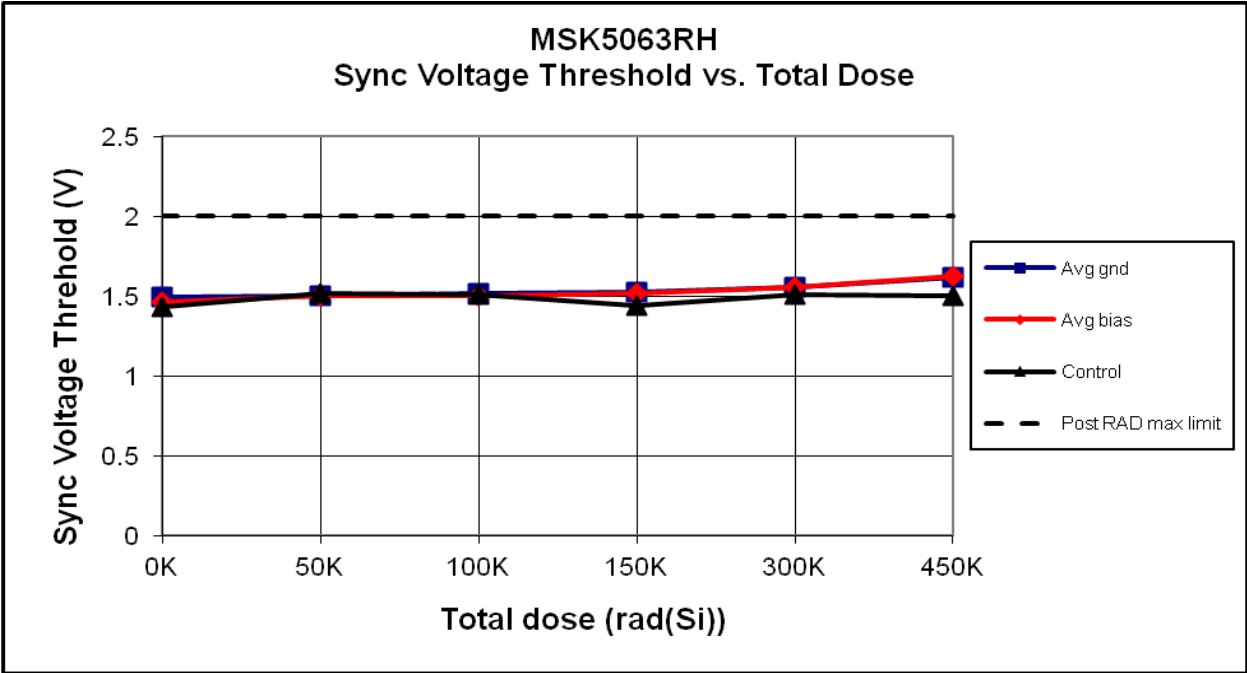
Table 1

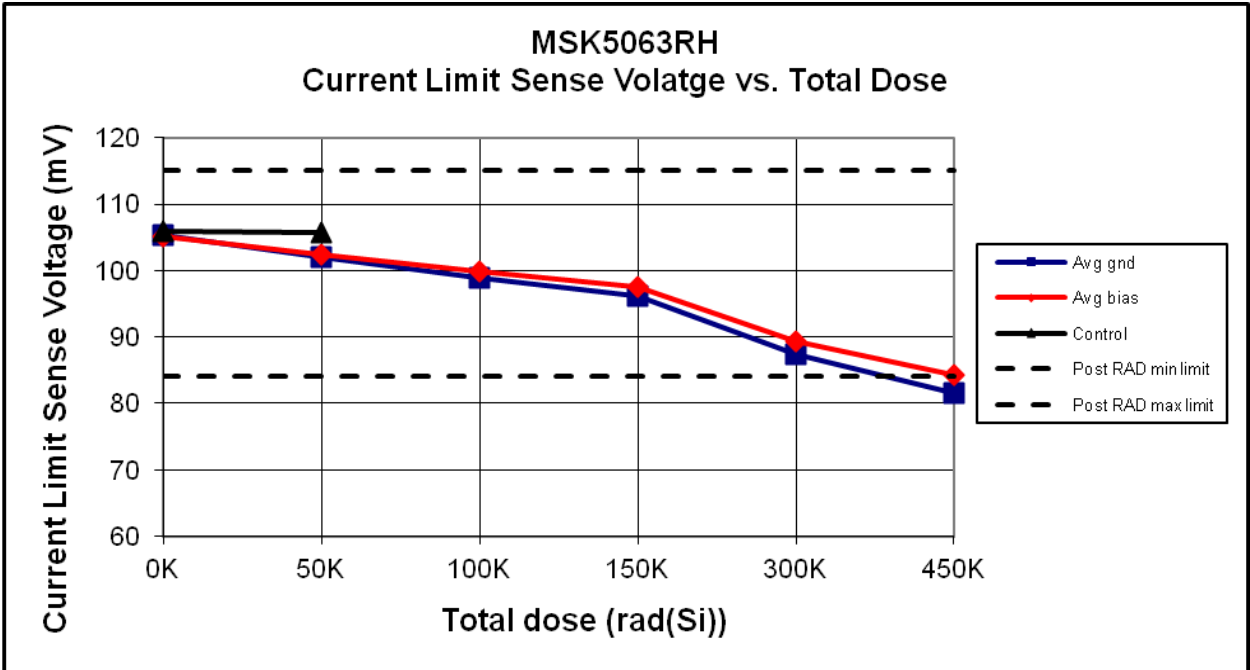
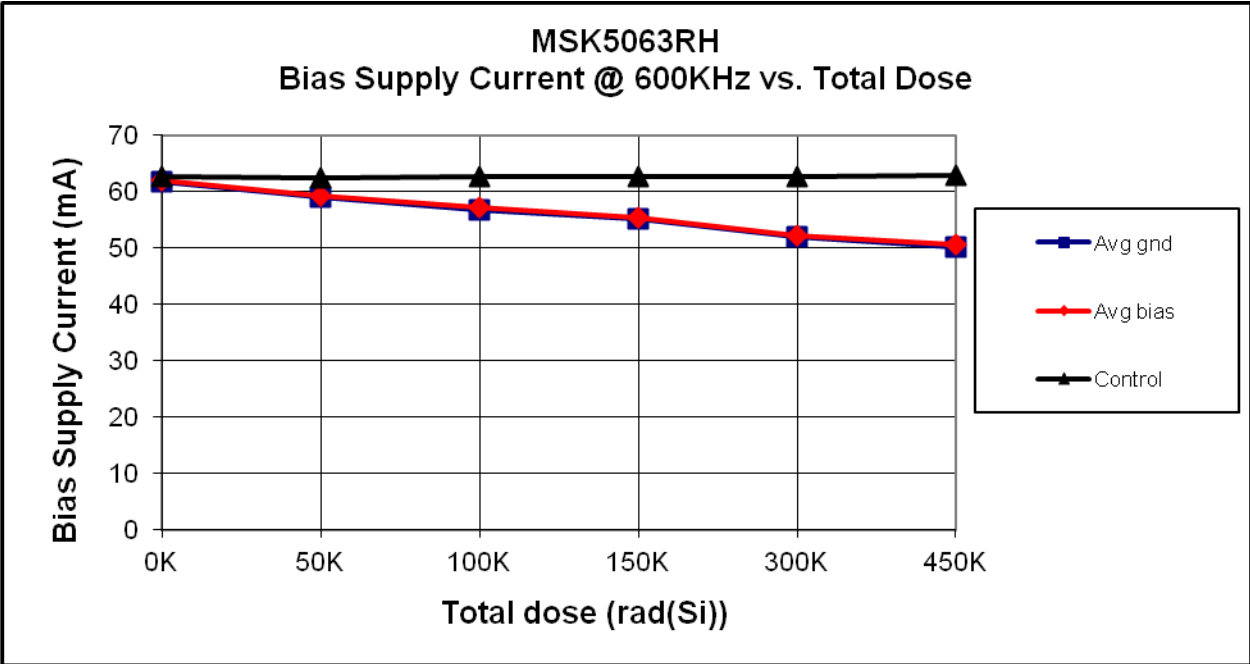
Dose Time, Incremental Dose and Total Cumulative Dose

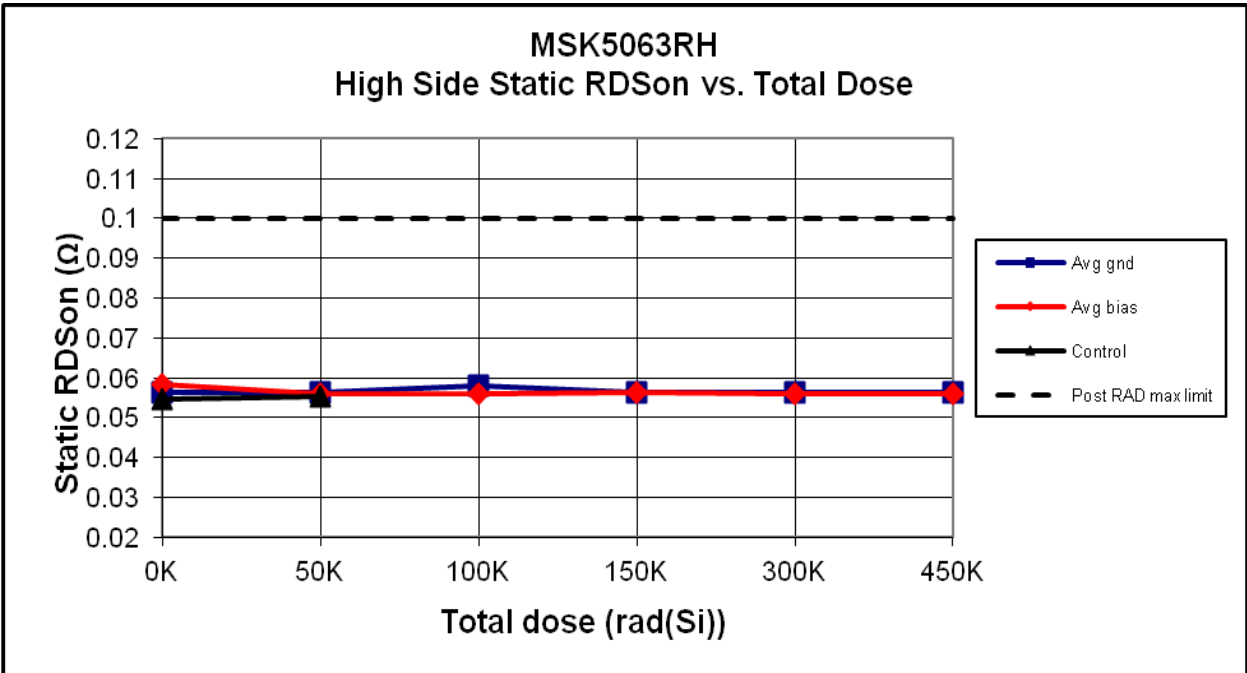
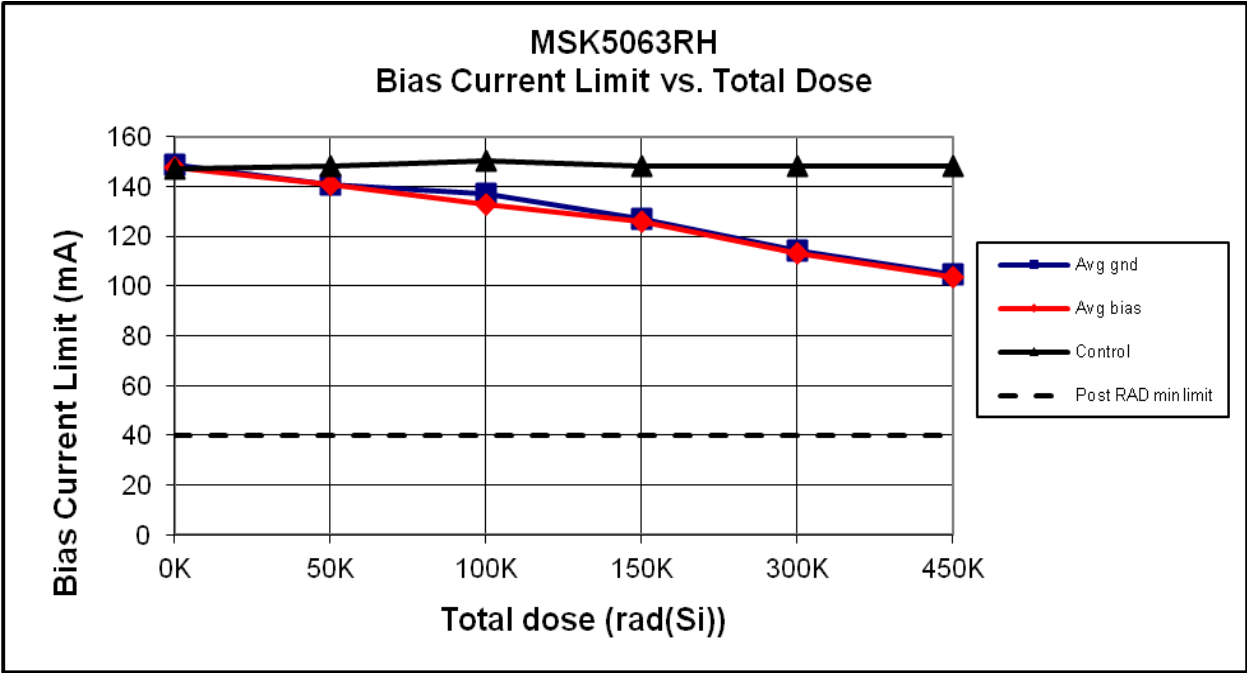












MSK5063RH
Low Side Static RDson vs. Total Dose

