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AD8065 Voltage Feedback Amplifier's Total Ionizing Dose Characterization Report

Megan Casey and Anthony Phan

October 2020

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AD8065 Voltage Feedback Amplifier's Total Ionizing Dose Characterization Report

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Test Date: March 19, 2020
Report Date: September 24, 2020

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Code 561.4, Radiation Effects and Analysis Group
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1. Purpose

The purpose of this testing was to characterize Analog Devices' AD8065 FastFET amplifier for low-dose rate (LDR) total ionizing dose (TID) response based on the Lucy project requirements and will be used on the L'ORRI instrument being built by Johns Hopkins University Applied Physics Lab.

The AD8065 is a voltage feedback amplifier with FET inputs developed with the proprietary eXtra Fast Complementary Bipolar (XFCB) process. The amplifier boasts low noise operation and very high input impedance with a wide supply voltage range.

2. Test Samples

Ten parts each of AD8065s from two flight lots were provided by Lucy to Code 561 for TID testing. Two of the ten from each lot were used as controls. More information can be found in Table 1.

Table 1: Part Identification Information

Qty	Flight Part Number	Generic Part Number	Lot Date Code	Package
10	AD8065ARZ	AD8065	1838	SOIC-8
10	AD8065ARZ	AD8065	1128	SOIC-8

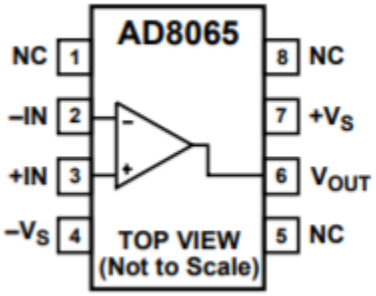

Figure 1: Pin out for AD8065

3. General

Radiation testing was conducted by exposing the parts to gamma radiation at a dose rate of 10 mrad(Si)/s. Ten parts from each lot were tested – eight exposed to radiation and the two remaining were used as controls. Prior to the first radiation dose, all parts were electrically tested. After each exposure level, the parts (including the controls) were tested again. Parts were subjected to multiple levels of total dose as shown in Table 2.

Table 2: Device Grouping and Step-Stress Instructions

Group	LDC	Qty	Bias	Sample #	Dose Rate	Test Levels (krad(Si))
1	1838	4	Biased	1, 2, 3, 4	10 mrad(Si)/s	0, 1, 5, 10, 13, 15, 20, 30
2	1838	4	Unbiased	5, 6, 7, 8	10 mrad(Si)/s	0, 1, 5, 10, 13, 15, 20, 30
3	1838	2	Controls	C1, C2	N/A	N/A
4	1128	4	Biased	11, 12, 13, 14	10 mrad(Si)/s	0, 1, 5, 10, 13, 15, 20, 30
5	1128	4	Unbiased	15, 16, 17, 18	10 mrad(Si)/s	0, 1, 5, 10, 13, 15, 20, 30
6	1128	2	Controls	C11, C12	N/A	N/A

After the 13 krad(Si) dose point, an unavoidable power shutdown occurred in Building 22 at NASA GSFC, which affected the Radiation Effects Facility. The parts were put in the freezer to limit annealing for 96 hours until power was restored. The electrical parameters were measured before and after the power shutdown, and there were no discernable changes, so the test resumed as planned.

4. Electrical Tests

Electrical tests were performed in accordance with the datasheet revL. The electrical parameters listed in Table 3 were tested:

Table 3: List of Parameters Measured

Parameter	Symbol	Conditions V_s= ±5 V R_L = 1 kΩ	Specifications			
			Min	Typical	Max	Unit
Input Offset Voltage	V_{IO}	V_{CM} = 0V SOIC package only		0.4	1.5	mV
Input Bias Current	I_B	SOIC package		2	6	pA
Input Offset Current	I_O			1	10	pA
Open-Loop Gain	G	V_O = ±3V, R_L = 1 kΩ	100	113		dB
Output Voltage Swing	V_{out}	R_L = 1 kΩ	-4.88 to +4.90	-4.94 to +4.95		V
Quiescent Current	I_Q			6.4	7.2	mA
Slew Rate	SR	G = +2, V_O = 4 V step	130	180		V/µs
Power Supply Rejection Ration	PSRR		-85	-100		dB

In addition to the parameters and conditions shown above in Table 3, the same parameters were also measured for the application-specific supply voltage of +12 V. The parameters measured with ±5 V are labeled as “dual supply” in the subsequent sections and results, while the results of the parameters measured with +12 V are labeled as “single supply”. There are no datasheet specified minimums and maximums for the single 12-V supply voltage, so no specification is included in those tables and graphs.

5. Failure Criteria

The parameter limits were defined as those listed in the datasheet revL for the ±5 V supply. Accurate parameter measurements were maintained beyond the specified limits when parameter drift was observed. Functional failure was not observed during this test.

6. Source Requirements

The total dose source was the gamma source in the Radiation Effects Facility, which is compliant with MIL-STD-883, Method 1019. Dosimetry is NIST traceable.

7. Bias Conditions and Fixtures

The unbiased parts had all leads grounded, while the biased part configuration was connected in the following way:

Table 4: Applied Voltages for Biased Irradiations

Pin Name	Pin Number	Connection
NC	1	n/a
-IN	2	
+IN	3	
-Vs	4	GND with bypass capacitors, 4.7uF and 0.1uF, in parallel
NC	5	n/a
Vout	6	
+Vs	7	+12 V with bypass capacitors, 4.7uF and 0.1uF, in parallel
NC	8	n/a

8. Procedure

General test procedures were in accordance with MIL-STD-883, Method 1019, Condition D. Parts were serialized, with controls marked prominently to distinguish them from test samples. Exposures were performed at ambient laboratory temperature. Approximate cumulative test levels were provided by the values in Table 2.

9. Traceability

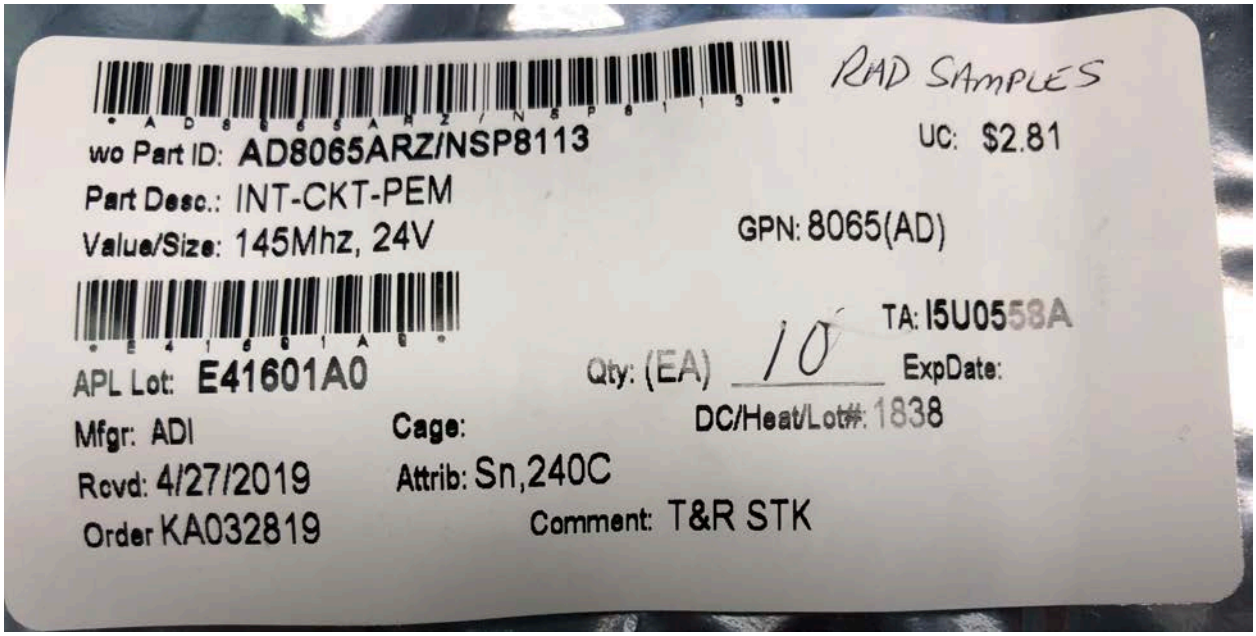

Figure 2. AD8065ARZ – Lot date code: 1838

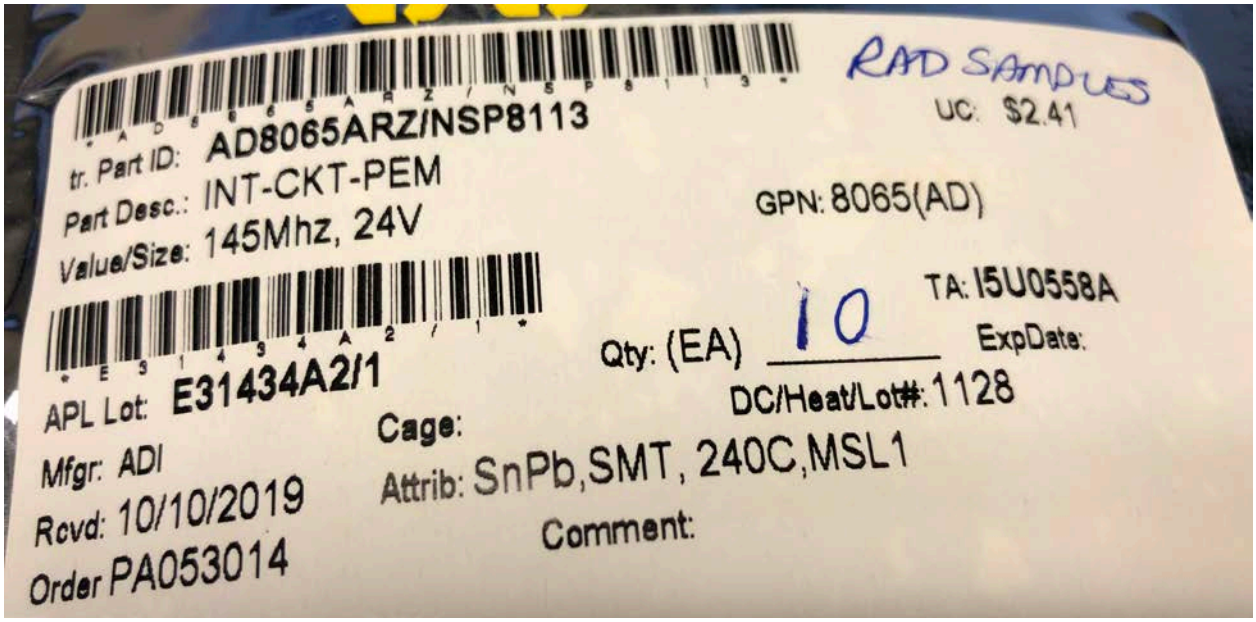

Figure 3. AD8065ARZ – Lot date code: 1128

10. Results

Input Offset Voltage

Dual Supply

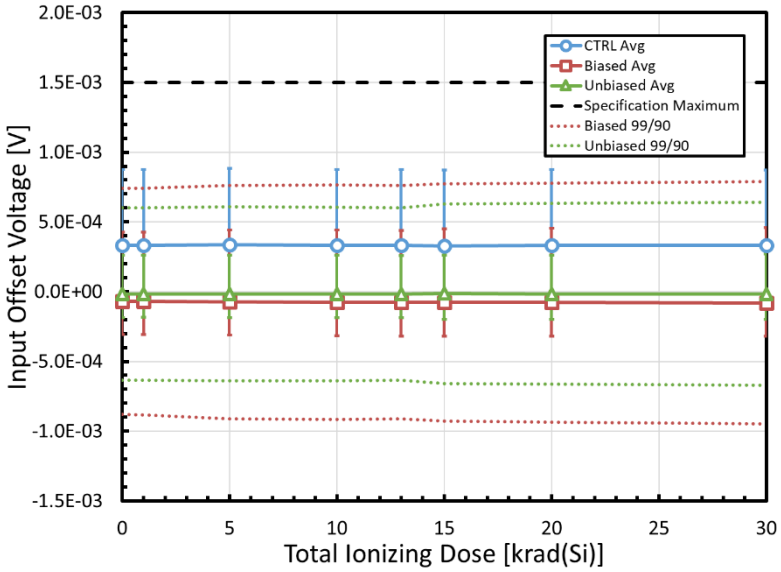

Figure 4. Input offset voltage as a function of total ionizing dose with ±5 V supply voltages.

Table 5: Input offset voltage values with ±5 V supply voltages

Input Offset Voltage		Total Ionizing Dose								
		Pre-Rad	1 krad(Si)	5 krad(Si)	10 krad(Si)	13 krad(Si)	96-hr Freeze	15 krad(Si)	20 krad(Si)	30 krad(Si)
LDC1858	Control (C1)	1.89E-04	1.91E-04	1.92E-04	1.94E-04	1.92E-04	1.92E-04	1.91E-04	1.94E-04	1.92E-04
	Control (C2)	-4.33E-04	-4.33E-04	-4.31E-04	-4.34E-04	-4.32E-04	-4.29E-04	-4.29E-04	-4.29E-04	-4.28E-04
	DUT1	-1.77E-04	-1.82E-04	-1.81E-04	-1.83E-04	-1.82E-04	-1.90E-04	-1.86E-04	-1.85E-04	-1.90E-04
	DUT2	-3.09E-04	-3.06E-04	-3.12E-04	-3.14E-04	-3.17E-04	-3.16E-04	-3.20E-04	-3.20E-04	-3.21E-04
	DUT3	-7.52E-05	-7.87E-05	-8.40E-05	-8.68E-05	-8.56E-05	-9.74E-05	-9.74E-05	-9.49E-05	-9.64E-05
	DUT4	-1.90E-04	-1.94E-04	-1.98E-04	-1.98E-04	-1.99E-04	-2.02E-04	-1.99E-04	-2.05E-04	-2.04E-04
	DUT5	-7.66E-05	-7.49E-05	-7.48E-05	-7.47E-05	-6.88E-05	-7.15E-05	-7.44E-05	-7.58E-05	-8.01E-05
	DUT6	2.62E-04	2.62E-04	2.63E-04	2.62E-04	2.60E-04	2.62E-04	2.62E-04	2.59E-04	2.58E-04
	DUT7	2.29E-04	2.29E-04	2.35E-04	2.34E-04	2.29E-04	2.56E-04	2.56E-04	2.60E-04	2.69E-04
	DUT8	-1.25E-04	-1.26E-04	-1.26E-04	-1.25E-04	-1.25E-04	-1.25E-04	-1.28E-04	-1.30E-04	-1.32E-04
LDC1128	Control (C11)	-4.60E-04	-4.55E-04	-4.61E-04	-4.53E-04	-4.55E-04	-4.53E-04	-4.50E-04	-4.57E-04	-4.58E-04
	Control (C12)	-7.15E-04	-7.09E-04	-7.21E-04	-7.10E-04	-7.09E-04	-7.07E-04	-7.08E-04	-7.04E-04	-7.07E-04
	DUT11	6.41E-05	6.65E-05	6.60E-05	6.59E-05	6.57E-05	6.26E-05	6.02E-05	6.08E-05	6.10E-05
	DUT12	-2.06E-04	-2.06E-04	-2.17E-04	-2.18E-04	-2.18E-04	-2.17E-04	-2.19E-04	-2.21E-04	-2.30E-04
	DUT13	-8.89E-05	-8.93E-05	-1.05E-04	-1.08E-04	-1.08E-04	-1.08E-04	-1.06E-04	-1.11E-04	-1.14E-04
	DUT14	4.27E-04	4.27E-04	4.42E-04	4.43E-04	4.38E-04	4.52E-04	4.51E-04	4.54E-04	4.60E-04
	DUT15	-6.92E-05	-6.67E-05	-6.87E-05	-7.02E-05	-7.18E-05	-7.33E-05	-7.07E-05	-7.21E-05	-6.55E-05
	DUT16	-1.88E-04	-1.83E-04	-1.87E-04	-1.88E-04	-1.86E-04	-1.78E-04	-1.81E-04	-1.84E-04	-1.89E-04
	DUT17	-1.83E-04	-1.83E-04	-1.84E-04	-1.85E-04	-1.85E-04	-1.99E-04	-2.00E-04	-1.99E-04	-1.99E-04
	DUT18	1.64E-05	1.52E-05	1.46E-05	1.20E-05	1.54E-05	1.88E-05	1.95E-05	2.09E-05	2.28E-05
Specification Maximum		1.50E-03	1.50E-03	1.50E-03	1.50E-03	1.50E-03	1.50E-03	1.50E-03	1.50E-03	1.50E-03
Control	CTRL Avg	-3.55E-04	-3.52E-04	-3.55E-04	-3.51E-04	-3.51E-04	-3.49E-04	-3.49E-04	-3.49E-04	-3.50E-04
	CTRL Std Dev	3.33E-04	3.32E-04	3.36E-04	3.33E-04	3.32E-04	3.31E-04	3.30E-04	3.31E-04	3.31E-04
	CTRL +99/90	1.45E-03	1.45E-03	1.47E-03	1.46E-03	1.45E-03	1.45E-03	1.45E-03	1.45E-03	1.45E-03
	CTRL -99/90	-2.16E-03	-2.15E-03	-2.18E-03	-2.16E-03	-2.16E-03	-2.15E-03	-2.15E-03	-2.15E-03	-2.15E-03
	+CTRL Error Bar	5.44E-04	5.43E-04	5.47E-04	5.45E-04	5.43E-04	5.41E-04	5.40E-04	5.43E-04	5.42E-04
	-CTRL Error Bar	3.60E-04	3.58E-04	3.66E-04	3.59E-04	3.58E-04	3.57E-04	3.59E-04	3.55E-04	3.57E-04
Biased	Biased Avg	-6.93E-05	-7.04E-05	-7.35E-05	-7.49E-05	-7.57E-05	-7.69E-05	-7.70E-05	-7.77E-05	-7.92E-05
	Biased Std Dev	2.14E-04	2.14E-04	2.21E-04	2.22E-04	2.21E-04	2.25E-04	2.25E-04	2.26E-04	2.29E-04
	Biased +99/90	7.41E-04	7.41E-04	7.63E-04	7.65E-04	7.60E-04	7.75E-04	7.74E-04	7.79E-04	7.88E-04
	Biased -99/90	-8.79E-04	-8.82E-04	-9.10E-04	-9.15E-04	-9.11E-04	-9.29E-04	-9.28E-04	-9.34E-04	-9.46E-04
	+Biased Error Bar	4.97E-04	4.97E-04	5.16E-04	5.18E-04	5.14E-04	5.29E-04	5.28E-04	5.32E-04	5.39E-04
	-Biased Error Bar	2.39E-04	2.36E-04	2.39E-04	2.40E-04	2.42E-04	2.39E-04	2.43E-04	2.42E-04	2.42E-04
Unbiased	Unbiased Avg	-1.69E-05	-1.59E-05	-1.60E-05	-1.68E-05	-1.65E-05	-1.37E-05	-1.44E-05	-1.49E-05	-1.46E-05
	Unbiased Std Dev	1.64E-04	1.63E-04	1.65E-04	1.65E-04	1.63E-04	1.70E-04	1.71E-04	1.71E-04	1.74E-04
	Unbiased +99/90	6.02E-04	6.01E-04	6.07E-04	6.06E-04	6.00E-04	6.29E-04	6.31E-04	6.33E-04	6.42E-04
	Unbiased -99/90	-6.36E-04	-6.32E-04	-6.40E-04	-6.40E-04	-6.33E-04	-6.56E-04	-6.60E-04	-6.63E-04	-6.71E-04
	+Unbiased Error Bar	2.79E-04	2.78E-04	2.79E-04	2.79E-04	2.77E-04	2.76E-04	2.77E-04	2.75E-04	2.83E-04
	-Unbiased Error Bar	1.71E-04	1.68E-04	1.71E-04	1.71E-04	1.70E-04	1.86E-04	1.85E-04	1.84E-04	1.84E-04

Single Supply

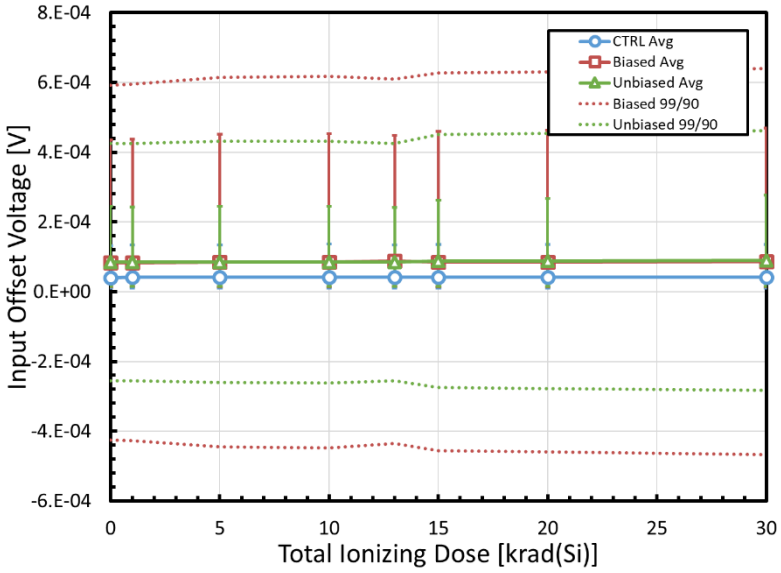

Figure 5. Input offset voltage as a function of total ionizing dose with 12 V supply voltage.

Table 6: Input offset voltage values with 12 V supply voltage

Input Offset Voltage		Total Ionizing Dose							
		Pre-Rad	1 krad(Si)	5 krad(Si)	10 krad(Si)	13 krad(Si)	15 krad(Si)	20 krad(Si)	30 krad(Si)
LDC1839	Control (C1)	1.33E-04	1.34E-04	1.35E-04	1.37E-04	1.34E-04	1.35E-04	1.36E-04	1.35E-04
	Control (C2)	1.00E-05	1.01E-05	1.00E-05	9.99E-06	1.00E-05	1.01E-05	1.01E-05	1.02E-05
	DUT1	2.20E-05	2.18E-05	2.19E-05	2.15E-05	2.16E-05	2.12E-05	2.13E-05	2.09E-05
	DUT2	1.42E-05	1.43E-05	1.41E-05	1.40E-05	3.87E-05	1.38E-05	1.38E-05	1.38E-05
	DUT3	4.18E-05	4.08E-05	3.94E-05	3.84E-05	3.88E-05	3.60E-05	3.64E-05	3.65E-05
	DUT4	1.97E-05	1.95E-05	1.91E-05	1.89E-05	1.90E-05	1.89E-05	1.85E-05	1.84E-05
	DUT5	3.75E-05	3.74E-05	3.76E-05	3.74E-05	3.83E-05	3.75E-05	3.72E-05	3.60E-05
	DUT6	2.44E-04	2.43E-04	2.45E-04	2.44E-04	2.41E-04	2.43E-04	2.41E-04	2.40E-04
	DUT7	2.35E-04	2.36E-04	2.42E-04	2.42E-04	2.37E-04	2.63E-04	2.67E-04	2.76E-04
	DUT8	3.60E-05	3.57E-05	3.54E-05	3.56E-05	3.60E-05	3.58E-05	3.46E-05	3.45E-05
LDC1128	Control (C11)	9.87E-06	9.91E-06	9.85E-06	9.92E-06	9.91E-06	9.99E-06	9.90E-06	9.89E-06
	Control (C12)	9.59E-06	9.61E-06	9.58E-06	9.58E-06	9.58E-06	9.99E-06	9.60E-06	9.60E-06
	DUT11	8.25E-05	8.30E-05	8.29E-05	8.37E-05	8.34E-05	8.06E-05	8.12E-05	8.09E-05
	DUT12	1.61E-05	1.62E-05	1.55E-05	1.54E-05	1.55E-05	1.54E-05	1.53E-05	1.49E-05
	DUT13	3.86E-05	3.88E-05	3.46E-05	3.42E-05	3.40E-05	3.46E-05	3.32E-05	3.23E-05
	DUT14	4.35E-04	4.37E-04	4.51E-04	4.53E-04	4.49E-04	4.60E-04	4.62E-04	4.69E-04
	DUT15	3.75E-05	3.71E-05	3.72E-05	3.65E-05	3.63E-05	3.65E-05	3.62E-05	3.80E-05
	DUT16	1.52E-05	1.55E-05	1.53E-05	1.53E-05	1.52E-05	1.57E-05	1.56E-05	1.51E-05
	DUT17	2.19E-05	2.19E-05	2.19E-05	2.18E-05	2.16E-05	2.02E-05	2.04E-05	2.02E-05
	DUT18	5.18E-05	5.15E-05	5.09E-05	5.06E-05	5.17E-05	5.31E-05	5.35E-05	5.47E-05
Control	CTRL Avg	4.05E-05	4.09E-05	4.10E-05	4.16E-05	4.10E-05	4.13E-05	4.14E-05	4.11E-05
	CTRL Std Dev	5.32E-05	5.38E-05	5.40E-05	5.49E-05	5.40E-05	5.41E-05	5.46E-05	5.41E-05
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	CTRL -99/90	-2.49E-04	-2.52E-04	-2.53E-04	-2.57E-04	-2.52E-04	-2.53E-04	-2.56E-04	-2.53E-04
	+CTRL Error Bar	9.21E-05	9.32E-05	9.35E-05	9.52E-05	9.35E-05	9.38E-05	9.46E-05	9.38E-05
	-CTRL Error Bar	3.09E-05	3.13E-05	3.14E-05	3.20E-05	3.14E-05	3.13E-05	3.18E-05	3.15E-05
Biased	Biased Avg	8.38E-05	8.39E-05	8.48E-05	8.48E-05	8.75E-05	8.50E-05	8.52E-05	8.59E-05
	Biased Std Dev	1.34E-04	1.35E-04	1.40E-04	1.41E-04	1.38E-04	1.43E-04	1.44E-04	1.46E-04
	Biased +99/90	5.92E-04	5.95E-04	6.14E-04	6.17E-04	6.10E-04	6.26E-04	6.30E-04	6.39E-04
	Biased -99/90	-4.25E-04	-4.27E-04	-4.45E-04	-4.47E-04	-4.35E-04	-4.56E-04	-4.59E-04	-4.68E-04
	+Biased Error Bar	3.51E-04	3.53E-04	3.66E-04	3.68E-04	3.61E-04	3.75E-04	3.77E-04	3.83E-04
	-Biased Error Bar	6.96E-05	6.96E-05	7.07E-05	7.09E-05	7.20E-05	7.13E-05	7.14E-05	7.21E-05
Unbiased	Unbiased Avg	8.49E-05	8.48E-05	8.56E-05	8.54E-05	8.47E-05	8.81E-05	8.82E-05	8.93E-05
	Unbiased Std Dev	9.00E-05	9.00E-05	9.16E-05	9.16E-05	8.98E-05	9.59E-05	9.66E-05	9.85E-05
	Unbiased +99/90	4.25E-04	4.25E-04	4.32E-04	4.32E-04	4.24E-04	4.51E-04	4.54E-04	4.62E-04
	Unbiased -99/90	-2.56E-04	-2.56E-04	-2.61E-04	-2.61E-04	-2.55E-04	-2.75E-04	-2.77E-04	-2.83E-04
	+Unbiased Error Bar	1.60E-04	1.59E-04	1.59E-04	1.58E-04	1.56E-04	1.75E-04	1.79E-04	1.87E-04
	-Unbiased Error Bar	6.97E-05	6.93E-05	7.03E-05	7.02E-05	6.94E-05	7.24E-05	7.26E-05	7.42E-05

Input Bias Current
Dual Supply

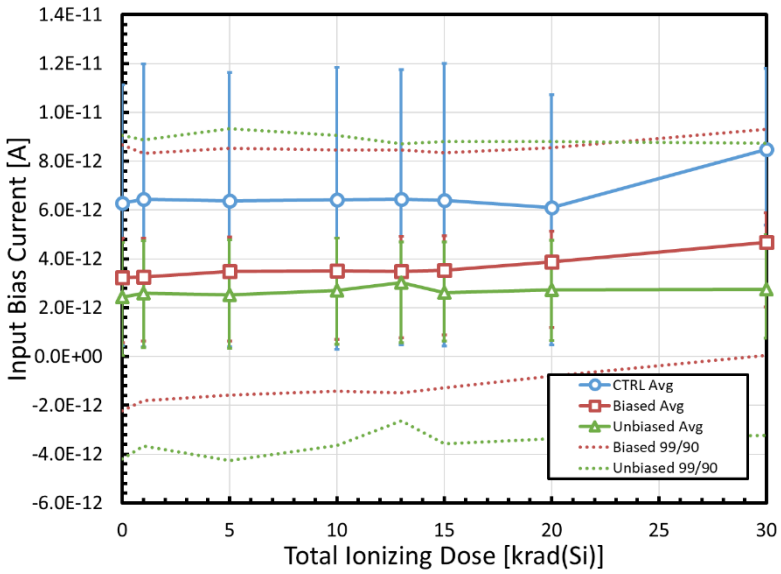

Figure 6. Input bias current as a function of total ionizing dose with ±5 V supply voltages.

Table 7: Input bias current values with ±5 V supply voltages

Input Bias Current		Total Ionizing Dose								
		Pre-Rad	1 krad(Si)	5 krad(Si)	10 krad(Si)	13 krad(Si)	96-hr Freeze	15 krad(Si)	20 krad(Si)	30 krad(Si)
LDC1838	Control (C1)	4.60E-13	3.98E-13	4.00E-13	2.95E-13	4.74E-13	-3.93E-13	4.30E-13	4.61E-13	8.97E-12
	Control (C2)	5.66E-12	5.62E-12	5.60E-12	5.60E-12	5.65E-12	-5.42E-12	5.53E-12	5.58E-12	5.38E-12
	DUT1	2.18E-12	3.06E-12	2.98E-12	2.92E-12	3.01E-12	-2.70E-12	3.08E-12	3.29E-12	3.90E-12
	DUT2	4.57E-12	4.41E-12	4.65E-12	4.70E-12	4.74E-12	-4.64E-12	4.74E-12	4.93E-12	5.53E-12
	DUT3	4.63E-12	4.49E-12	4.50E-12	4.45E-12	4.45E-12	-3.95E-12	4.38E-12	4.40E-12	4.97E-12
	DUT4	4.85E-12	4.85E-12	4.90E-12	4.85E-12	4.92E-12	-4.81E-12	4.94E-12	5.12E-12	5.78E-12
	DUT5	4.66E-12	4.74E-12	4.78E-12	4.83E-12	4.67E-12	-4.66E-12	4.70E-12	4.75E-12	4.66E-12
	DUT6	4.64E-12	4.66E-12	4.78E-12	4.84E-12	4.70E-12	-4.82E-12	4.60E-12	4.62E-12	4.99E-12
	DUT7	6.09E-13	6.08E-13	6.33E-13	6.35E-13	-----	-7.08E-13	7.38E-13	7.66E-13	8.30E-13
	DUT8	2.26E-12	2.22E-12	2.26E-12	2.29E-12	2.21E-12	-2.16E-12	2.18E-12	2.32E-12	2.28E-12
LDC1128	Control (C11)	7.93E-12	7.80E-12	7.82E-12	7.93E-12	7.90E-12	-7.86E-12	7.67E-12	7.68E-12	7.80E-12
	Control (C12)	1.11E-11	1.20E-11	1.16E-11	1.18E-11	1.18E-11	-1.11E-11	1.20E-11	1.07E-11	1.18E-11
	DUT11	5.61E-13	6.29E-13	6.25E-13	7.01E-13	7.73E-13	-7.61E-13	8.95E-13	1.17E-12	2.04E-12
	DUT12	4.09E-12	3.88E-12	4.15E-12	4.33E-12	4.38E-12	-4.47E-12	4.34E-12	4.96E-12	5.88E-12
	DUT13	2.23E-12	2.11E-12	2.47E-12	2.70E-12	2.75E-12	-2.57E-12	2.56E-12	3.22E-12	3.97E-12
	DUT14	2.75E-12	2.69E-12	3.56E-12	3.50E-12	2.92E-12	-3.89E-12	3.35E-12	3.91E-12	5.34E-12
	DUT15	6.32E-13	1.15E-12	3.56E-13	1.25E-12	1.55E-12	3.53E-13	9.06E-13	1.23E-12	2.80E-12
	DUT16	2.70E-12	3.20E-12	3.10E-12	3.36E-12	3.47E-12	-3.17E-12	3.07E-12	3.18E-12	1.53E-12
	DUT17	3.96E-12	3.86E-12	4.04E-12	3.98E-12	4.07E-12	-4.46E-12	4.14E-12	4.24E-12	4.15E-12
	DUT18	2.60E-14	3.57E-13	3.41E-13	4.98E-13	5.54E-13	-5.48E-13	6.33E-13	6.50E-13	7.56E-13
Specification Maximum		6.00E-12	6.00E-12	6.00E-12	6.00E-12	6.00E-12	6.00E-12	6.00E-12	6.00E-12	6.00E-12
Control	CTRL Avg	6.29E-12	6.45E-12	6.36E-12	6.42E-12	6.45E-12	-6.20E-12	6.41E-12	6.11E-12	8.49E-12
	CTRL Std Dev	3.89E-12	4.18E-12	4.06E-12	4.18E-12	4.08E-12	3.92E-12	4.16E-12	3.73E-12	2.31E-12
	CTRL +99/90	2.74E-11	2.92E-11	2.85E-11	2.91E-11	2.86E-11	1.51E-11	2.90E-11	2.64E-11	2.10E-11
	CTRL -99/90	-1.49E-11	-1.63E-11	-1.57E-11	-1.63E-11	-1.57E-11	-2.75E-11	-1.62E-11	-1.42E-11	-4.07E-12
	+CTRL Error Bar	4.84E-12	5.54E-12	5.27E-12	5.42E-12	5.31E-12	5.81E-12	5.59E-12	4.60E-12	3.31E-12
	-CTRL Error Bar	5.83E-12	6.05E-12	5.96E-12	6.12E-12	5.97E-12	4.94E-12	5.98E-12	5.65E-12	3.11E-12
Biased	Biased Avg	3.23E-12	3.26E-12	3.48E-12	3.52E-12	3.49E-12	-3.47E-12	3.53E-12	3.88E-12	4.68E-12
	Biased Std Dev	1.44E-12	1.34E-12	1.34E-12	1.31E-12	1.31E-12	1.29E-12	1.27E-12	1.24E-12	1.22E-12
	Biased +99/90	8.68E-12	8.33E-12	8.54E-12	8.46E-12	8.47E-12	1.41E-12	8.35E-12	8.55E-12	9.31E-12
	Biased -99/90	-2.21E-12	-1.80E-12	-1.58E-12	-1.43E-12	-1.48E-12	-8.35E-12	-1.28E-12	-7.98E-13	4.24E-14
	+Biased Error Bar	1.62E-12	1.59E-12	1.42E-12	1.33E-12	1.43E-12	2.71E-12	1.41E-12	1.25E-12	1.20E-12
	-Biased Error Bar	2.67E-12	2.64E-12	2.85E-12	2.82E-12	2.72E-12	1.34E-12	2.64E-12	2.70E-12	2.64E-12
Unbiased	Unbiased Avg	2.43E-12	2.60E-12	2.53E-12	2.71E-12	3.03E-12	-2.52E-12	2.62E-12	2.72E-12	2.75E-12
	Unbiased Std Dev	1.75E-12	1.66E-12	1.80E-12	1.68E-12	1.50E-12	1.92E-12	1.63E-12	1.61E-12	1.58E-12
	Unbiased +99/90	9.07E-12	8.87E-12	9.34E-12	9.07E-12	8.71E-12	4.76E-12	8.81E-12	8.81E-12	8.73E-12
	Unbiased -99/90	-4.20E-12	-3.67E-12	-4.27E-12	-3.64E-12	-2.64E-12	-9.80E-12	-3.56E-12	-3.37E-12	-3.23E-12
	+Unbiased Error Bar	2.22E-12	2.14E-12	2.24E-12	2.13E-12	1.67E-12	2.87E-12	2.08E-12	2.03E-12	2.24E-12
	-Unbiased Error Bar	2.41E-12	2.24E-12	2.19E-12	2.21E-12	2.48E-12	2.30E-12	1.99E-12	2.07E-12	1.99E-12

Single Supply

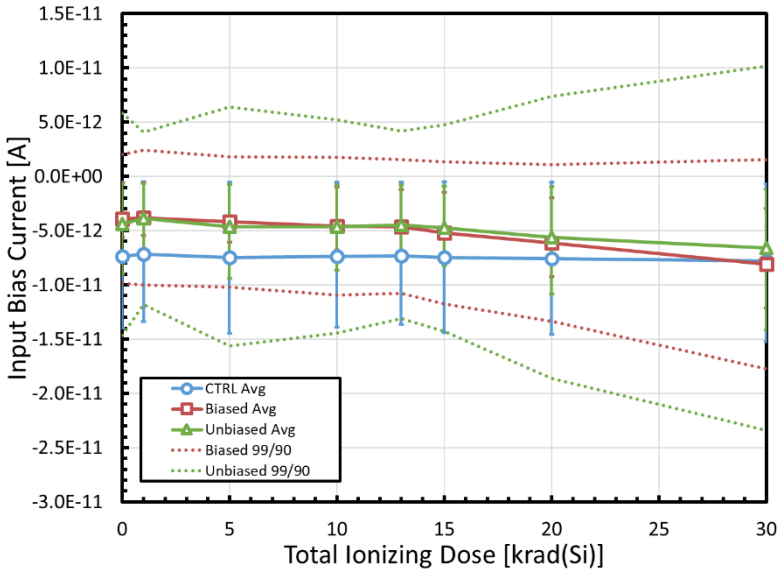

Figure 7. Input bias current as a function of total ionizing dose with 12 V supply voltage.

Table 8: Input bias current values with 12 V supply voltage

Input Bias Current		Total Ionizing Dose							
		Pre-Rad	1 krad(Si)	5 krad(Si)	10 krad(Si)	13 krad(Si)	15 krad(Si)	20 krad(Si)	30 krad(Si)
LDC1939	Control (C1)	-5.30E-13	-5.02E-13	-5.34E-13	-5.26E-13	-5.22E-13	-5.01E-13	-5.18E-13	-6.67E-13
	Control (C2)	-5.69E-12	-5.75E-12	-5.72E-12	-5.80E-12	-5.75E-12	-5.73E-12	-5.79E-12	-5.94E-12
	DUT1	-3.59E-12	-3.70E-12	-3.74E-12	-4.12E-12	-4.42E-12	-4.75E-12	-5.79E-12	-8.19E-12
	DUT2	-5.14E-12	-5.18E-12	-5.32E-12	-5.74E-12	-5.27E-12	-6.44E-12	-7.26E-12	-9.51E-12
	DUT3	-4.81E-12	-5.00E-12	-5.03E-12	-5.74E-12	-5.31E-12	-5.57E-12	-5.96E-12	-6.37E-12
	DUT4	-5.17E-12	-5.28E-12	-5.32E-12	-5.44E-12	-5.61E-12	-5.98E-12	-6.39E-12	-7.15E-12
	DUT5	-5.02E-12	-5.01E-12	-5.03E-12	-5.25E-12	-5.31E-12	-5.65E-12	-5.62E-12	-5.89E-12
	DUT6	-4.96E-12	-5.11E-12	-5.40E-12	-5.76E-12	-5.68E-12	-5.90E-12	-6.04E-12	-6.48E-12
	DUT7	-6.56E-13	-6.52E-13	-7.16E-13	-7.90E-13	-8.08E-13	-9.08E-13	-9.66E-13	-1.18E-12
	DUT8	-2.09E-12	-2.10E-12	-2.16E-12	-2.40E-12	-2.40E-12	-2.53E-12	-2.87E-12	-3.27E-12
LDC1128	Control (C11)	-9.29E-12	-9.03E-12	-9.12E-12	-9.31E-12	-9.27E-12	-9.14E-12	-9.37E-12	-9.39E-12
	Control (C12)	-1.40E-11	-1.34E-11	-1.44E-11	-1.39E-11	-1.36E-11	-1.44E-11	-1.45E-11	-1.52E-11
	DUT11	-5.95E-13	-6.09E-13	-7.21E-13	-9.77E-13	-1.18E-12	-1.46E-12	-1.96E-12	-2.98E-12
	DUT12	-5.60E-12	-5.44E-12	-6.05E-12	-6.79E-12	-7.16E-12	-7.85E-12	-9.23E-12	-1.21E-11
	DUT13	-2.58E-12	-2.25E-12	-3.03E-12	-3.92E-12	-4.33E-12	-4.80E-12	-6.76E-12	-1.00E-11
	DUT14	-3.70E-12	-2.90E-12	-4.33E-12	-3.92E-12	-3.67E-12	-4.68E-12	-5.73E-12	-8.34E-12
	DUT15	-3.80E-12	-3.47E-12	-3.80E-12	-4.10E-12	-4.26E-12	-4.45E-12	-5.39E-12	-6.09E-12
	DUT16	-8.97E-12	-7.01E-12	-9.41E-12	-8.61E-12	-7.44E-12	-8.22E-12	-1.08E-11	-1.32E-11
	DUT17	-7.73E-12	-5.92E-12	-8.49E-12	-7.87E-12	-7.44E-12	-8.05E-12	-1.09E-11	-1.42E-11
	DUT18	-1.90E-12	-1.68E-12	-1.94E-12	-2.15E-12	-2.44E-12	-2.31E-12	-2.38E-12	-2.65E-12
Control	CTRL Avg	-7.37E-12	-7.16E-12	-7.45E-12	-7.38E-12	-7.29E-12	-7.45E-12	-7.56E-12	-7.80E-12
	CTRL Std Dev	4.92E-12	4.70E-12	5.06E-12	4.89E-12	4.80E-12	5.07E-12	5.12E-12	5.29E-12
	CTRL +99/90	1.94E-11	1.84E-11	2.01E-11	1.92E-11	1.88E-11	2.01E-11	2.03E-11	2.10E-11
	CTRL -99/90	-3.41E-11	-3.27E-11	-3.50E-11	-3.39E-11	-3.34E-11	-3.50E-11	-3.54E-11	-3.66E-11
	+CTRL Error Bar	6.84E-12	6.66E-12	6.92E-12	6.85E-12	6.77E-12	6.95E-12	7.04E-12	7.14E-12
	-CTRL Error Bar	6.60E-12	6.21E-12	6.99E-12	6.50E-12	6.34E-12	6.97E-12	6.99E-12	7.41E-12
Biased	Biased Avg	-3.90E-12	-3.79E-12	-4.19E-12	-4.58E-12	-4.62E-12	-5.19E-12	-6.13E-12	-8.08E-12
	Biased Std Dev	1.57E-12	1.64E-12	1.59E-12	1.67E-12	1.63E-12	1.73E-12	1.91E-12	2.55E-12
	Biased +99/90	2.03E-12	2.43E-12	1.84E-12	1.74E-12	1.54E-12	1.35E-12	1.08E-12	1.56E-12
	Biased -99/90	-9.83E-12	-1.00E-11	-1.02E-11	-1.09E-11	-1.08E-11	-1.17E-11	-1.33E-11	-1.77E-11
	+Biased Error Bar	3.30E-12	3.19E-12	3.47E-12	3.61E-12	3.44E-12	3.73E-12	4.18E-12	5.10E-12
	-Biased Error Bar	1.70E-12	1.64E-12	1.86E-12	2.21E-12	2.54E-12	2.65E-12	3.10E-12	4.04E-12
Unbiased	Unbiased Avg	-4.39E-12	-3.87E-12	-4.62E-12	-4.62E-12	-4.47E-12	-4.75E-12	-5.62E-12	-6.61E-12
	Unbiased Std Dev	2.71E-12	2.10E-12	2.91E-12	2.60E-12	2.28E-12	2.52E-12	3.43E-12	4.43E-12
	Unbiased +99/90	5.85E-12	4.09E-12	6.41E-12	5.22E-12	4.16E-12	4.78E-12	7.38E-12	1.02E-11
	Unbiased -99/90	-1.46E-11	-1.18E-11	-1.56E-11	-1.45E-11	-1.31E-11	-1.43E-11	-1.86E-11	-2.34E-11
	+Unbiased Error Bar	3.73E-12	3.22E-12	3.90E-12	3.83E-12	3.66E-12	3.84E-12	4.65E-12	5.43E-12
	-Unbiased Error Bar	4.58E-12	3.15E-12	4.79E-12	3.99E-12	2.97E-12	3.47E-12	5.25E-12	7.54E-12

Input Offset Current
Dual Supply

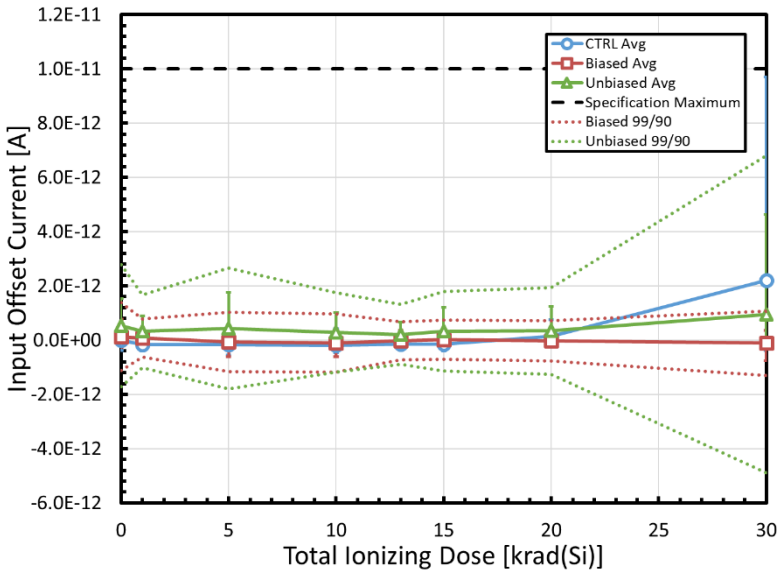

Figure 8. Input offset current as a function of total ionizing dose with ±5 V supply voltages.

Table 9: Input offset current values with ±5 V supply voltages

Input Offset Current		Total Ionizing Dose								
		Pre-Rad	1 krad(Si)	5 krad(Si)	10 krad(Si)	13 krad(Si)	96-hr Freeze	15 krad(Si)	20 krad(Si)	30 krad(Si)
LDC1838	Control (C1)	2.68E-13	3.05E-13	3.47E-13	4.19E-13	2.50E-13	3.30E-13	3.07E-13	2.65E-13	9.70E-12
	Control (C2)	-3.19E-13	-2.26E-13	-2.61E-13	-3.84E-13	-2.94E-13	-1.63E-13	-2.39E-13	-2.53E-13	-1.55E-13
	DUT1	7.77E-13	1.33E-13	6.87E-14	5.89E-14	8.33E-14	4.09E-13	6.44E-14	5.97E-14	1.70E-13
	DUT2	-9.28E-14	1.49E-13	-1.17E-13	-2.89E-13	-1.26E-13	3.35E-14	-1.21E-13	-1.62E-13	-1.48E-13
	DUT3	-2.50E-13	-1.56E-13	-1.87E-13	-1.90E-13	-1.74E-13	4.22E-13	-1.12E-14	4.19E-14	-1.41E-13
	DUT4	-2.56E-13	-2.56E-13	-2.84E-13	-3.16E-13	-3.08E-13	-1.77E-13	-2.61E-13	-2.63E-13	-2.92E-13
	DUT5	-2.24E-13	-2.41E-13	-2.89E-13	-3.39E-13	-2.61E-13	-2.58E-14	-1.82E-13	-2.65E-13	-1.57E-13
	DUT6	1.70E-14	2.59E-14	3.82E-14	7.00E-14	4.36E-14	1.96E-13	1.46E-13	1.66E-13	7.38E-14
	DUT7	2.84E-13	2.88E-13	2.63E-13	2.59E-13	-----	2.86E-13	2.41E-13	2.26E-13	2.15E-13
	DUT8	1.95E-13	2.09E-13	1.57E-13	1.19E-13	1.45E-13	2.30E-13	2.18E-13	1.42E-13	1.45E-13
Specification Maximum		1.00E-11	1.00E-11	1.00E-11	1.00E-11	1.00E-11	1.00E-11	1.00E-11	1.00E-11	1.00E-11
LDC1128	Control (C11)	-3.78E-13	-3.68E-13	-5.46E-13	-4.65E-13	-3.44E-13	-2.43E-13	-2.13E-13	-2.32E-13	-3.14E-13
	Control (C12)	3.98E-13	-4.07E-13	-2.21E-13	-3.38E-13	-2.04E-13	3.62E-13	-4.08E-13	7.58E-13	-3.88E-13
	DUT11	4.48E-13	3.85E-13	3.96E-13	3.54E-13	3.52E-13	4.00E-13	3.78E-13	3.66E-13	3.64E-13
	DUT12	1.40E-13	1.41E-13	7.61E-14	1.11E-14	-5.13E-14	4.72E-14	9.33E-15	-4.32E-14	3.83E-14
	DUT13	1.29E-13	1.66E-13	1.81E-13	1.03E-13	8.58E-14	8.22E-14	2.21E-13	9.77E-14	-1.07E-13
	DUT14	1.55E-13	9.92E-14	-6.12E-13	-6.17E-13	6.82E-15	7.81E-13	-1.27E-13	-2.65E-13	-7.63E-13
	DUT15	1.54E-12	9.01E-13	1.76E-12	1.02E-12	6.81E-13	2.53E-12	1.20E-12	1.25E-12	4.63E-12
	DUT16	1.11E-12	4.66E-13	7.00E-13	3.88E-13	3.16E-13	5.99E-13	4.28E-13	6.04E-13	2.18E-12
	DUT17	2.27E-13	1.73E-13	1.59E-13	9.15E-14	6.75E-14	2.04E-13	6.54E-14	1.03E-13	1.23E-13
	DUT18	1.12E-12	7.77E-13	7.22E-13	6.56E-13	5.03E-13	5.96E-13	5.31E-13	5.22E-13	4.47E-13
Control	CTRL Avg	-7.75E-15	-1.74E-13	-1.70E-13	-1.92E-13	-1.48E-13	7.16E-14	-1.38E-13	1.35E-13	2.21E-12
	CTRL Std Dev	3.44E-13	2.84E-13	3.24E-13	3.56E-13	2.35E-13	2.76E-13	2.68E-13	4.15E-13	4.32E-12
	CTRL +99/90	1.86E-12	1.37E-12	1.59E-12	1.74E-12	1.13E-12	1.57E-12	1.32E-12	2.39E-12	2.57E-11
	CTRL -99/90	-1.88E-12	-1.72E-12	-1.93E-12	-2.13E-12	-1.43E-12	-1.43E-12	-1.59E-12	-2.12E-12	-2.13E-11
	+CTRL Error Bar	4.06E-13	4.79E-13	5.17E-13	6.11E-13	3.98E-13	2.90E-13	4.45E-13	6.23E-13	7.49E-12
	-CTRL Error Bar	3.70E-13	2.33E-13	3.76E-13	2.73E-13	1.96E-13	3.14E-13	2.69E-13	3.87E-13	2.60E-12
Biased	Biased Avg	1.31E-13	8.24E-14	-5.97E-14	-1.11E-13	-1.63E-14	2.50E-13	1.91E-14	-2.09E-14	-1.10E-13
	Biased Std Dev	3.29E-13	1.87E-13	2.90E-13	2.83E-13	1.87E-13	2.87E-13	1.91E-13	1.98E-13	3.14E-13
	Biased +99/90	1.37E-12	7.91E-13	1.04E-12	9.61E-13	6.91E-13	1.34E-12	7.42E-13	7.28E-13	1.08E-12
	Biased -99/90	-1.11E-12	-6.26E-13	-1.16E-12	-1.18E-12	-7.24E-13	-8.36E-13	-7.04E-13	-7.69E-13	-1.30E-12
	+Biased Error Bar	6.46E-13	3.02E-13	4.55E-13	4.64E-13	3.68E-13	5.31E-13	3.59E-13	3.87E-13	4.73E-13
	-Biased Error Bar	3.87E-13	3.39E-13	5.52E-13	5.06E-13	2.92E-13	4.27E-13	2.80E-13	2.44E-13	6.53E-13
Unbiased	Unbiased Avg	5.34E-13	3.25E-13	4.39E-13	2.83E-13	2.14E-13	5.77E-13	3.31E-13	3.43E-13	9.57E-13
	Unbiased Std Dev	5.92E-13	3.54E-13	5.89E-13	3.86E-13	2.91E-13	7.63E-13	3.87E-13	4.23E-13	1.55E-12
	Unbiased +99/90	2.78E-12	1.66E-12	2.67E-12	1.74E-12	1.31E-12	3.46E-12	1.80E-12	1.94E-12	6.81E-12
	Unbiased -99/90	-1.71E-12	-1.02E-12	-1.79E-12	-1.18E-12	-8.87E-13	-2.31E-12	-1.13E-12	-1.26E-12	-4.90E-12
	+Unbiased Error Bar	1.01E-12	5.77E-13	1.32E-12	7.39E-13	4.67E-13	1.95E-12	8.72E-13	9.03E-13	3.67E-12
	-Unbiased Error Bar	7.58E-13	5.66E-13	7.28E-13	6.22E-13	4.74E-13	6.02E-13	5.14E-13	6.08E-13	1.11E-12

Single Supply

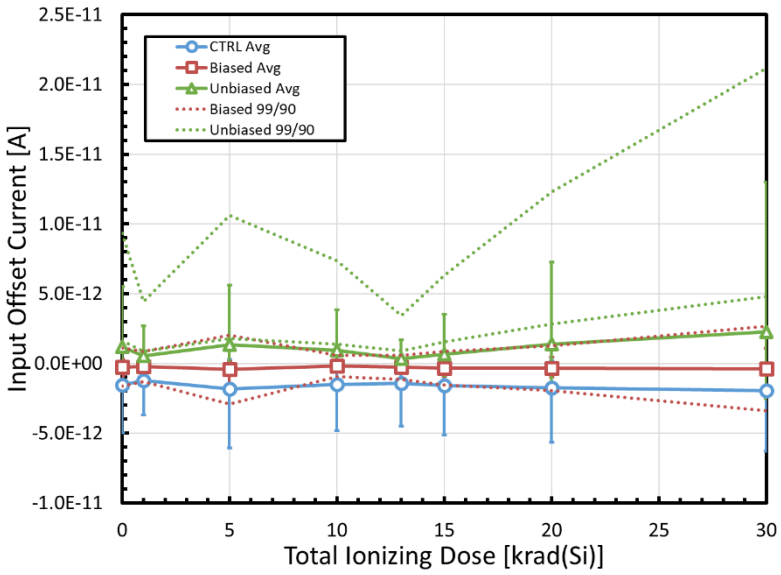

Figure 9. Input offset current as a function of total ionizing dose with 12 V supply voltage.

Table 10: Input offset current values with 12 V supply voltage

Input Offset Current		Total Ionizing Dose							
		Pre-Rad	1 krad(Si)	5 krad(Si)	10 krad(Si)	13 krad(Si)	15 krad(Si)	20 krad(Si)	30 krad(Si)
LDC1839	Control (C1)	2.82E-13	2.64E-13	2.70E-13	2.69E-13	2.72E-13	1.95E-13	1.91E-13	-2.52E-14
	Control (C2)	-5.77E-13	-5.77E-13	-5.74E-13	-7.00E-13	-6.04E-13	-5.79E-13	-6.00E-13	-6.10E-13
	DUT1	-2.42E-13	-2.27E-13	-2.36E-13	-2.79E-13	-3.09E-13	-2.97E-13	-6.00E-13	-2.83E-13
	DUT2	-3.92E-13	-4.15E-13	-3.53E-13	-3.55E-13	-2.09E-13	-5.27E-13	-5.63E-13	-5.36E-13
	DUT3	-2.32E-13	-2.36E-13	-1.73E-13	-3.55E-13	-2.06E-13	-1.70E-13	-1.34E-13	-2.74E-13
	DUT4	-3.26E-13	-3.13E-13	-3.10E-13	-3.08E-13	-3.03E-13	-2.02E-13	-2.24E-13	-3.10E-13
	DUT5	-3.64E-13	-3.04E-13	-3.04E-13	-1.46E-13	-4.16E-13	-4.61E-13	-4.42E-13	-4.63E-13
	DUT6	-2.05E-13	-1.51E-13	-1.36E-13	-1.02E-13	-3.70E-14	1.11E-13	3.52E-13	2.34E-13
	DUT7	2.30E-13	2.32E-13	2.36E-13	2.25E-13	1.99E-13	1.62E-13	1.66E-13	1.34E-13
	DUT8	1.21E-13	1.32E-13	9.65E-14	9.84E-15	-2.86E-14	-6.04E-14	-1.35E-13	-2.09E-13
LDC1128	Control (C11)	-9.18E-13	-8.62E-13	-8.76E-13	-7.52E-13	-8.80E-13	-8.74E-13	-9.28E-13	-9.07E-13
	Control (C12)	-4.97E-12	-3.67E-12	-6.05E-12	-4.80E-12	-4.50E-12	-5.14E-12	-5.64E-12	-6.29E-12
	DUT11	2.07E-13	1.86E-13	1.09E-13	5.67E-14	5.55E-14	-8.76E-15	-1.87E-14	-1.12E-13
	DUT12	-4.57E-13	-4.04E-13	-4.43E-13	-3.98E-13	-5.54E-13	-6.22E-13	-6.74E-13	-4.18E-13
	DUT13	3.21E-13	2.64E-13	3.43E-14	7.53E-14	1.52E-14	1.13E-13	4.55E-13	1.10E-12
	DUT14	-9.10E-13	-6.46E-13	-2.10E-12	7.53E-14	-6.34E-13	-9.25E-13	-9.67E-13	-2.06E-12
	DUT15	-4.40E-13	-3.38E-13	-4.30E-13	-4.42E-13	-5.66E-13	-8.62E-13	-1.45E-12	-2.53E-12
	DUT16	5.54E-12	2.70E-12	5.63E-12	3.87E-12	1.70E-12	2.82E-12	5.19E-12	8.04E-12
	DUT17	4.11E-12	1.75E-12	5.54E-12	3.84E-12	1.70E-12	3.53E-12	7.25E-12	1.30E-11
	DUT18	4.25E-13	2.84E-13	2.04E-13	2.62E-13	1.07E-13	7.94E-14	5.44E-14	-2.83E-14
Control	CTRL Avg	-1.55E-12	-1.21E-12	-1.81E-12	-1.50E-12	-1.43E-12	-1.60E-12	-1.74E-12	-1.96E-12
	CTRL Std Dev	2.02E-12	1.48E-12	2.48E-12	1.95E-12	1.82E-12	2.08E-12	2.29E-12	2.52E-12
	CTRL +99/90	9.46E-12	6.84E-12	1.17E-11	9.11E-12	8.49E-12	9.71E-12	1.07E-11	1.18E-11
	CTRL -99/90	-1.26E-11	-9.26E-12	-1.53E-11	-1.21E-11	-1.13E-11	-1.29E-11	-1.42E-11	-1.57E-11
	+CTRL Error Bar	1.83E-12	1.48E-12	2.08E-12	1.76E-12	1.70E-12	1.79E-12	1.93E-12	1.93E-12
	-CTRL Error Bar	3.42E-12	2.46E-12	4.24E-12	3.30E-12	3.07E-12	3.54E-12	3.89E-12	4.33E-12
Biased	Biased Avg	-2.54E-13	-2.24E-13	-4.35E-13	-1.86E-13	-2.68E-13	-3.30E-13	-3.41E-13	-3.62E-13
	Biased Std Dev	3.60E-13	2.87E-13	6.55E-13	2.00E-13	2.27E-13	3.20E-13	4.20E-13	8.02E-13
	Biased +99/90	1.11E-12	8.63E-13	2.04E-12	5.72E-13	5.89E-13	8.82E-13	1.25E-12	2.67E-12
	Biased -99/90	-1.62E-12	-1.31E-12	-2.91E-12	-9.44E-13	-1.13E-12	-1.54E-12	-1.93E-12	-3.40E-12
	+Biased Error Bar	5.75E-13	4.88E-13	5.43E-13	2.61E-13	3.23E-13	4.43E-13	7.96E-13	1.46E-12
	-Biased Error Bar	6.56E-13	4.22E-13	1.67E-12	2.12E-13	3.66E-13	5.96E-13	6.27E-13	1.70E-12
Unbiased	Unbiased Avg	1.18E-12	5.38E-13	1.35E-12	9.40E-13	3.31E-13	6.65E-13	1.37E-12	2.27E-12
	Unbiased Std Dev	2.15E-12	1.03E-12	2.45E-12	1.70E-12	8.23E-13	1.50E-12	2.89E-12	4.99E-12
	Unbiased +99/90	9.32E-12	4.42E-12	1.06E-11	7.36E-12	3.45E-12	6.32E-12	1.23E-11	2.12E-11
	Unbiased -99/90	-6.97E-12	-3.34E-12	-7.92E-12	-5.48E-12	-2.78E-12	-4.99E-12	-9.57E-12	-1.66E-11
	+Unbiased Error Bar	4.36E-12	2.16E-12	4.28E-12	2.93E-12	1.36E-12	2.86E-12	5.88E-12	1.07E-11
	-Unbiased Error Bar	1.62E-12	8.76E-13	1.78E-12	1.38E-12	8.97E-13	1.53E-12	2.83E-12	4.80E-12

Open-Loop Gain
Dual Supply

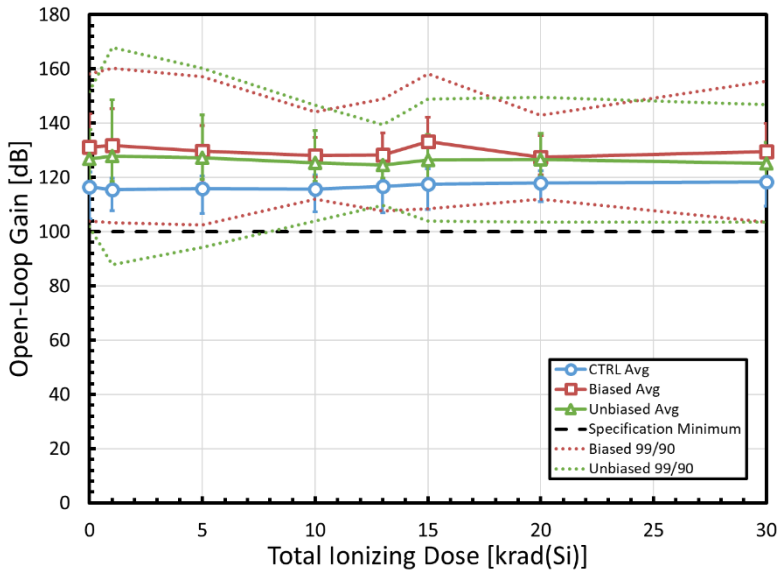

Figure 10. Open-loop gain as a function of total ionizing dose with ±5 V supply voltages.

Table 11: Open-loop gain values with ±5 V supply voltages

Open-Loop Gain		Total Ionizing Dose								
		Pre-Rad	1 krad(Si)	5 krad(Si)	10 krad(Si)	13 krad(Si)	96-hr Freeze	15 krad(Si)	20 krad(Si)	30 krad(Si)
LDC1838	Control (C1)	121.91	116.86	119.20	120.86	123.52	121.30	123.23	122.39	126.27
	Control (C2)	118.43	117.61	117.06	115.16	116.91	117.65	119.32	118.82	116.29
	DUT1	124.04	132.21	128.90	127.11	124.77	129.75	131.25	124.94	124.47
	DUT2	143.37	130.06	125.71	132.33	127.10	132.58	130.84	125.74	132.06
	DUT3	135.30	132.96	139.20	130.63	130.88	135.40	142.23	135.35	137.67
	DUT4	131.17	145.21	139.13	127.37	129.00	123.82	133.35	128.12	129.53
	DUT5	121.52	120.43	119.34	118.45	119.77	121.21	119.57	120.94	118.59
	DUT6	122.36	119.91	119.59	123.24	121.11	123.46	123.53	120.40	118.39
	DUT7	118.73	119.76	119.80	119.45	120.93	119.32	120.73	121.16	118.99
	DUT8	133.86	138.68	136.66	137.31	129.39	139.78	130.84	130.98	131.40
LDC1128	Control (C11)	121.22	119.62	120.48	119.69	119.84	122.50	119.89	119.57	121.79
	Control (C12)	104.66	107.81	106.81	107.29	106.96	107.81	108.07	111.04	109.41
	DUT11	127.31	127.35	123.77	125.36	136.39	119.22	137.79	128.74	125.67
	DUT12	136.28	131.22	131.58	126.25	131.96	131.08	137.89	130.83	129.58
	DUT13	132.68	137.85	133.22	134.84	129.36	133.21	134.61	124.88	139.84
	DUT14	118.82	117.27	116.61	120.22	116.67	120.31	118.68	120.98	116.90
	DUT15	123.92	118.53	124.07	123.98	121.38	119.73	124.97	123.35	129.29
	DUT16	122.86	122.63	121.56	125.45	125.42	123.98	122.03	124.80	123.14
	DUT17	133.32	148.67	142.98	130.06	129.52	122.98	134.63	136.13	128.67
	DUT18	137.59	134.64	134.55	124.93	128.74	131.68	135.71	135.11	132.95
Specification Minimum		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Control	CTRL Avg	116.56	115.48	115.89	115.75	116.81	117.31	117.63	117.95	118.44
	CTRL Std Dev	6.99	4.54	5.38	5.33	6.15	5.77	5.72	4.21	6.30
	CTRL +99/90	154.55	140.15	145.13	144.73	150.25	148.69	148.71	140.85	152.70
	CTRL -99/90	78.56	90.80	86.64	86.77	83.37	85.94	86.54	95.06	84.19
	+CTRL Error Bar	5.36	4.15	4.59	5.11	6.71	5.19	5.60	4.43	7.83
	-CTRL Error Bar	11.89	7.66	9.07	8.46	9.85	9.50	9.56	6.92	9.03
Biased	Biased Avg	131.12	131.77	129.77	128.01	128.26	128.17	133.33	127.45	129.46
	Biased Std Dev	7.18	7.52	7.23	4.25	5.43	5.80	6.58	4.09	6.88
	Biased +99/90	158.29	160.21	157.11	144.08	148.82	150.11	158.24	142.90	155.50
	Biased -99/90	103.96	103.33	102.42	111.95	107.71	106.23	108.42	111.99	103.43
	+Biased Error Bar	12.25	13.44	9.43	6.83	8.12	7.23	8.90	7.90	10.37
	-Biased Error Bar	12.30	14.50	13.15	7.79	11.59	8.95	14.65	6.47	12.56
Unbiased	Unbiased Avg	126.77	127.90	127.32	125.36	124.53	125.27	126.50	126.61	125.18
	Unbiased Std Dev	6.57	10.57	8.72	5.64	3.94	6.56	5.94	6.09	5.70
	Unbiased +99/90	151.62	167.90	160.30	146.68	139.44	150.08	148.97	149.63	146.75
	Unbiased -99/90	101.92	87.91	94.33	104.04	109.63	100.45	104.03	103.58	103.60
	+Unbiased Error Bar	10.82	20.76	15.66	11.95	4.99	14.51	9.21	9.52	7.77
	-Unbiased Error Bar	8.04	9.37	7.97	6.91	4.76	5.95	6.93	6.21	6.79

Single Supply

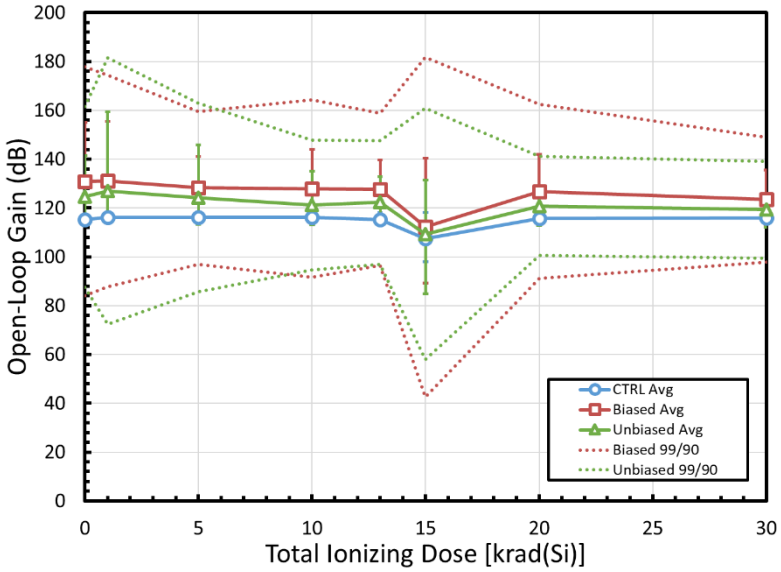

Figure 11. Open-loop gain as a function of total ionizing dose with 12 V supply voltage.

Table 12: Open-loop gain values with 12 V supply voltage

Open-Loop Gain		Total Ionizing Dose							
		Pre-Rad	1 krad(Si)	5 krad(Si)	10 krad(Si)	13 krad(Si)	15 krad(Si)	20 krad(Si)	30 krad(Si)
LDC1839	Control (C1)	116.43	117.29	118.40	118.14	118.10	118.14	117.39	116.52
	Control (C2)	113.87	115.02	114.82	114.34	113.66	114.42	114.50	115.00
	DUT1	125.01	125.71	122.45	118.68	121.32	121.29	119.94	118.70
	DUT2	128.49	155.38	136.67	135.76	131.09	134.72	129.57	130.01
	DUT3	155.01	139.61	141.10	143.93	138.95	140.33	142.05	126.40
	DUT4	125.12	123.72	123.00	121.55	122.47	121.46	119.71	119.59
	DUT5	117.38	118.14	119.17	120.55	122.25	119.62	122.29	123.39
	DUT6	115.97	115.91	114.60	113.15	113.58	114.20	113.43	112.06
	DUT7	114.55	114.26	113.31	113.03	113.00	114.49	112.83	112.24
	DUT8	141.52	159.34	133.17	124.90	129.87	131.44	125.31	121.46
LDC1128	Control (C11)	116.47	117.24	117.91	118.68	115.62	98.00	116.95	118.31
	Control (C12)	114.00	114.94	113.37	113.26	113.76	99.49	113.96	113.63
	DUT11	123.08	125.07	121.67	121.42	123.39	99.45	120.48	118.95
	DUT12	146.62	133.09	135.69	135.42	139.56	96.13	130.85	125.23
	DUT13	129.38	131.07	129.66	132.34	130.04	89.20	138.42	135.56
	DUT14	114.72	115.03	116.01	114.69	114.48	95.18	113.37	113.09
	DUT15	120.18	119.81	119.32	116.67	117.83	105.82	117.67	114.92
	DUT16	120.30	120.18	121.10	119.34	123.78	94.44	127.52	125.68
	DUT17	138.79	139.52	145.90	134.99	132.69	84.85	126.84	125.28
	DUT18	128.05	128.06	127.65	127.03	125.02	109.95	121.07	119.58
Control	CTRL Avg	115.19	116.12	116.12	116.10	115.29	107.51	115.70	115.86
	CTRL Std Dev	1.26	1.14	2.10	2.34	1.80	8.88	1.49	1.74
	CTRL +99/90	122.03	122.32	127.55	128.84	125.09	155.79	123.80	125.34
	CTRL -99/90	108.35	109.92	104.70	103.36	105.48	59.23	107.60	106.39
	+CTRL Error Bar	1.28	1.17	2.28	2.57	2.82	10.63	1.69	2.44
	-CTRL Error Bar	1.32	1.18	2.76	2.84	1.62	9.51	1.74	2.24
Biased	Biased Avg	130.93	131.08	128.28	127.97	127.66	112.22	126.80	123.44
	Biased Std Dev	12.39	11.43	8.27	9.60	8.26	18.39	9.42	6.77
	Biased +99/90	177.79	174.31	159.58	164.28	158.90	181.80	162.43	149.06
	Biased -99/90	84.07	87.86	96.98	91.66	96.43	42.64	91.17	97.83
	+Biased Error Bar	24.08	24.30	12.82	15.96	11.90	28.11	15.25	12.12
	-Biased Error Bar	16.21	16.06	12.27	13.28	13.18	23.02	13.43	10.36
Unbiased	Unbiased Avg	124.59	126.90	124.28	121.21	122.25	109.35	120.87	119.33
	Unbiased Std Dev	9.78	14.43	10.20	7.02	6.68	13.60	5.38	5.24
	Unbiased +99/90	161.59	181.49	162.87	147.75	147.54	160.78	141.24	139.13
	Unbiased -99/90	87.59	72.32	85.68	94.66	96.97	57.92	100.50	99.52
	+Unbiased Error Bar	16.92	32.44	21.63	13.79	10.44	22.09	6.65	6.35
	-Unbiased Error Bar	10.05	12.64	10.96	8.18	9.25	24.50	8.04	7.26

Output Voltage Swing
Dual Supply

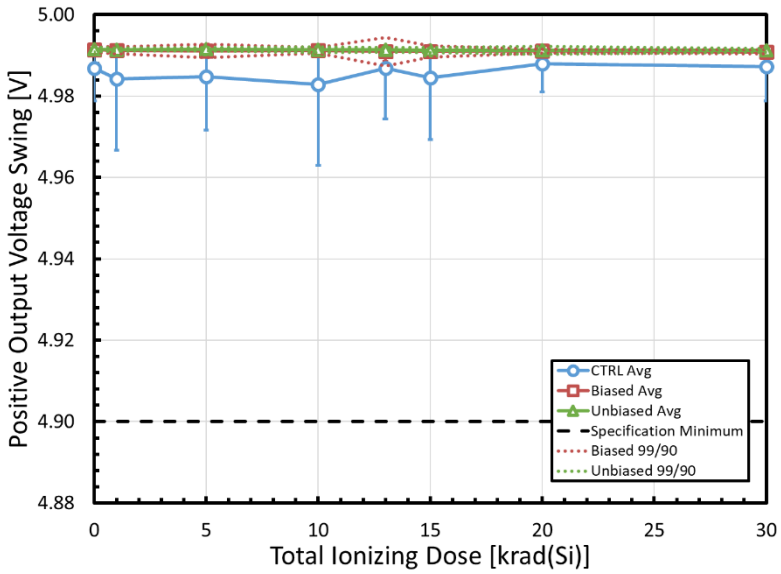

Figure 12. Positive output voltage swing as a function of total ionizing dose with ±5 V supply voltages.

Table 13: Positive output voltage swing values with ±5 V supply voltages

Positive Output Voltage Swing		Total Ionizing Dose								
		Pre-Rad	1 krad(Si)	5 krad(Si)	10 krad(Si)	13 krad(Si)	96-hr Freeze	15 krad(Si)	20 krad(Si)	30 krad(Si)
LDC1838	Control (C1)	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99
	Control (C2)	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99
	DUT1	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99
	DUT2	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99
	DUT3	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99
	DUT4	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99
	DUT5	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99
	DUT6	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99
	DUT7	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99
	DUT8	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99
LDC1128	Control (C11)	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99
	Control (C12)	4.98	4.97	4.97	4.96	4.97	4.96	4.97	4.98	4.98
	DUT11	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99
	DUT12	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99
	DUT13	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99
	DUT14	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99
	DUT15	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99
	DUT16	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99
	DUT17	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99
	DUT18	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99
Specification Minimum		4.90	4.90	4.90	4.90	4.90	4.90	4.90	4.90	4.90
Control	CTRL Avg	4.99	4.98	4.98	4.98	4.99	4.98	4.98	4.99	4.99
	CTRL Std Dev	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00
	CTRL +99/90	5.01	5.04	5.03	5.05	5.03	5.04	5.03	5.01	5.01
	CTRL -99/90	4.96	4.93	4.94	4.92	4.95	4.92	4.94	4.97	4.96
	+CTRL Error Bar	0.00	0.01	0.01	0.01	0.00	0.01	0.01	0.00	0.00
	-CTRL Error Bar	0.01	0.02	0.01	0.02	0.01	0.02	0.02	0.01	0.01
Biased	Biased Avg	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99
	Biased Std Dev	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Biased +99/90	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99
	Biased -99/90	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99
	+Biased Error Bar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	-Biased Error Bar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unbiased	Unbiased Avg	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99
	Unbiased Std Dev	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Unbiased +99/90	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99
	Unbiased -99/90	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99
	+Unbiased Error Bar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	-Unbiased Error Bar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

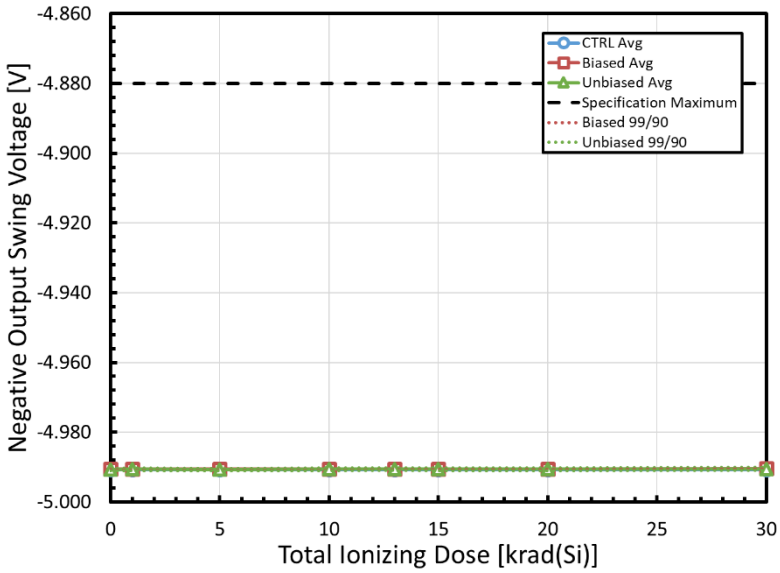

Figure 13. Negative output voltage swing as a function of total ionizing dose with ±5 V supply voltages.

Table 14: Negative output voltage swing values with ±5 V supply voltages

Negative Output Voltage Swing		Total Ionizing Dose								
		Pre-Rad	1 krad(Si)	5 krad(Si)	10 krad(Si)	13 krad(Si)	96-hr Freeze	15 krad(Si)	20 krad(Si)	30 krad(Si)
LDC1838	Control (C1)	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99
	Control (C2)	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99
	DUT1	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99
	DUT2	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99
	DUT3	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99
	DUT4	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99
	DUT5	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99
	DUT6	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99
	DUT7	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99
	DUT8	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99
LDC1128	Control (C11)	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99
	Control (C12)	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99
	DUT11	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99
	DUT12	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99
	DUT13	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99
	DUT14	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99
	DUT15	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99
	DUT16	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99
	DUT17	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99
	DUT18	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99
Specification Maximum		-4.88	-4.88	-4.88	-4.88	-4.88	-4.88	-4.88	-4.88	-4.88
Control	CTRL Avg	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99
	CTRL Std Dev	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	CTRL +99/90	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99
	CTRL -99/90	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99
	+CTRL Error Bar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	-CTRL Error Bar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Biased	Biased Avg	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99
	Biased Std Dev	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Biased +99/90	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99
	Biased -99/90	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99
	+Biased Error Bar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	-Biased Error Bar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unbiased	Unbiased Avg	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99
	Unbiased Std Dev	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Unbiased +99/90	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99
	Unbiased -99/90	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99	-4.99
	+Unbiased Error Bar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	-Unbiased Error Bar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Single Supply

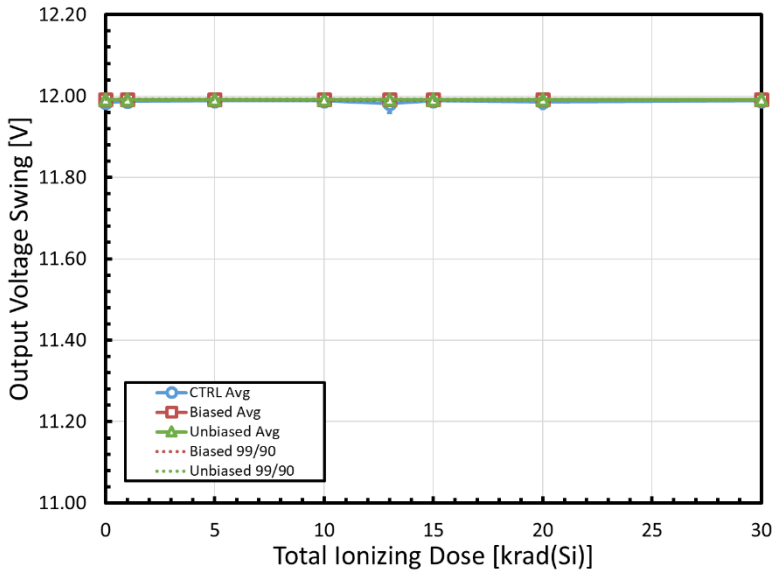

Figure 14. Output voltage swing as a function of total ionizing dose with 12 V supply voltage.

Table 15: Output voltage swing values with 12 V supply voltage

Output Voltage Swing		Total Ionizing Dose							
		Pre-Rad	1 krad(Si)	5 krad(Si)	10 krad(Si)	13 krad(Si)	15 krad(Si)	20 krad(Si)	30 krad(Si)
LDC1839	Control (C1)	-----	11.99	11.99	11.99	11.99	11.99	11.99	11.99
	Control (C2)	11.99	11.99	11.99	11.99	11.99	11.99	11.99	11.99
	DUT1	11.99	11.99	11.99	11.99	11.99	11.99	11.99	11.99
	DUT2	11.99	11.99	11.99	11.99	11.99	11.99	11.99	11.99
	DUT3	11.99	11.99	11.99	11.99	11.99	11.99	11.99	11.99
	DUT4	11.99	11.99	11.99	11.99	11.99	11.99	11.99	11.99
	DUT5	11.99	11.99	11.99	11.99	11.99	11.99	11.99	11.99
	DUT6	11.99	11.99	11.99	11.99	11.99	11.99	11.99	11.99
	DUT7	11.99	11.99	11.99	11.99	11.99	11.99	11.99	11.99
	DUT8	11.99	11.99	11.99	11.99	11.99	11.99	11.99	11.99
LDC1128	Control (C11)	11.99	11.99	11.99	11.99	11.99	11.99	11.99	11.99
	Control (C12)	11.98	11.98	11.98	11.98	11.96	11.99	11.97	11.98
	DUT11	11.99	11.99	11.99	11.99	11.99	11.99	11.99	11.99
	DUT12	11.99	11.99	11.99	11.99	11.99	11.99	11.99	11.99
	DUT13	11.99	11.99	11.99	11.99	11.99	11.99	11.99	11.99
	DUT14	11.99	11.99	11.99	11.99	11.99	11.99	11.99	11.99
	DUT15	11.99	11.99	11.99	11.99	11.99	11.99	11.99	11.99
	DUT16	11.99	11.99	11.99	11.99	11.99	11.99	11.99	11.99
	DUT17	11.99	11.99	11.99	11.99	11.99	11.99	11.99	11.99
	DUT18	11.99	11.99	11.99	11.99	11.99	11.99	11.99	11.99
Control	CTRL Avg	11.99	11.99	11.99	11.99	11.98	11.99	11.99	11.99
	CTRL Std Dev	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.00
	CTRL +99/90	12.01	12.02	12.01	12.01	12.06	12.00	12.04	12.01
	CTRL -99/90	11.96	11.95	11.97	11.96	11.91	11.98	11.93	11.96
	+CTRL Error Bar	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.00
	-CTRL Error Bar	0.01	0.01	0.01	0.01	0.02	0.00	0.02	0.01
Biased	Biased Avg	11.99	11.99	11.99	11.99	11.99	11.99	11.99	11.99
	Biased Std Dev	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Biased +99/90	11.99	11.99	11.99	11.99	11.99	11.99	11.99	11.99
	Biased -99/90	11.99	11.99	11.99	11.99	11.99	11.99	11.99	11.99
	+Biased Error Bar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	-Biased Error Bar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unbiased	Unbiased Avg	11.99	11.99	11.99	11.99	11.99	11.99	11.99	11.99
	Unbiased Std Dev	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Unbiased +99/90	11.99	11.99	11.99	11.99	11.99	11.99	11.99	11.99
	Unbiased -99/90	11.99	11.99	11.99	11.99	11.99	11.99	11.99	11.99
	+Unbiased Error Bar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	-Unbiased Error Bar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Quiescent Current

Dual Supply

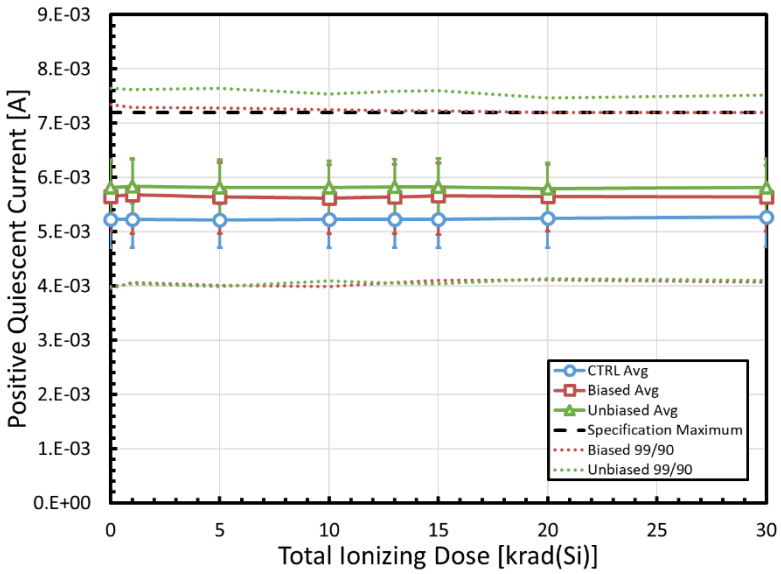

Figure 15. Positive quiescent current as a function of total ionizing dose with ±5 V supply voltages.

Table 16: Positive quiescent current values with ±5 V supply voltages

Positive Quiescent Current		Total Ionizing Dose								
		Pre-Rad	1 krad(Si)	5 krad(Si)	10 krad(Si)	13 krad(Si)	96-hr Freeze	15 krad(Si)	20 krad(Si)	30 krad(Si)
LDC1898	Control (C1)	5.51E-03	5.53E-03	5.48E-03	5.51E-03	5.53E-03	5.53E-03	5.50E-03	5.56E-03	5.60E-03
	Control (C2)	5.15E-03	5.14E-03	5.14E-03	5.15E-03	5.15E-03	5.17E-03	5.17E-03	5.17E-03	5.22E-03
	DUT1	5.82E-03	5.80E-03	5.81E-03	5.79E-03	5.80E-03	5.79E-03	5.79E-03	5.78E-03	5.78E-03
	DUT2	5.60E-03	5.60E-03	5.58E-03	5.58E-03	5.56E-03	5.53E-03	5.58E-03	5.57E-03	5.59E-03
	DUT3	5.14E-03	5.35E-03	5.22E-03	5.19E-03	5.25E-03	5.19E-03	5.37E-03	5.29E-03	5.22E-03
	DUT4	5.25E-03	5.31E-03	5.29E-03	5.25E-03	5.32E-03	5.31E-03	5.33E-03	5.31E-03	5.28E-03
	DUT5	5.21E-03	5.23E-03	5.17E-03	5.21E-03	5.21E-03	5.22E-03	5.27E-03	5.27E-03	5.24E-03
	DUT6	5.11E-03	5.14E-03	5.13E-03	5.19E-03	5.16E-03	5.18E-03	5.18E-03	5.17E-03	5.22E-03
	DUT7	5.31E-03	5.33E-03	5.31E-03	5.31E-03	5.32E-03	5.25E-03	5.24E-03	5.27E-03	5.26E-03
	DUT8	6.08E-03	6.09E-03	6.07E-03	6.04E-03	6.08E-03	6.06E-03	6.07E-03	6.06E-03	6.06E-03
LDC1128	Control (C11)	5.53E-03	5.53E-03	5.52E-03	5.52E-03	5.52E-03	5.52E-03	5.55E-03	5.54E-03	5.54E-03
	Control (C12)	4.71E-03	4.71E-03	4.71E-03	4.71E-03	4.71E-03	4.71E-03	4.71E-03	4.71E-03	4.71E-03
	DUT11	6.14E-03	6.10E-03	6.11E-03	6.12E-03	6.13E-03	6.16E-03	6.09E-03	6.15E-03	6.15E-03
	DUT12	5.93E-03	5.95E-03	5.91E-03	5.88E-03	5.90E-03	5.89E-03	5.94E-03	5.89E-03	5.85E-03
	DUT13	6.31E-03	6.34E-03	6.28E-03	6.23E-03	6.24E-03	6.21E-03	6.27E-03	6.24E-03	6.22E-03
	DUT14	5.02E-03	4.97E-03	4.97E-03	4.96E-03	4.97E-03	4.96E-03	4.94E-03	5.01E-03	5.00E-03
	DUT15	6.33E-03	6.35E-03	6.33E-03	6.29E-03	6.30E-03	6.29E-03	6.34E-03	6.27E-03	6.35E-03
	DUT16	6.08E-03	6.10E-03	6.07E-03	6.08E-03	6.08E-03	6.09E-03	6.14E-03	6.07E-03	6.08E-03
	DUT17	6.11E-03	6.14E-03	6.09E-03	6.09E-03	6.09E-03	6.04E-03	6.08E-03	6.06E-03	6.07E-03
	DUT18	6.32E-03	6.29E-03	6.33E-03	6.31E-03	6.34E-03	6.26E-03	6.27E-03	6.22E-03	6.21E-03
Specification Maximum		7.20E-03	7.20E-03	7.20E-03	7.20E-03	7.20E-03	7.20E-03	7.20E-03	7.20E-03	7.20E-03
Control	CTRL Avg	5.22E-03	5.23E-03	5.21E-03	5.22E-03	5.23E-03	5.23E-03	5.23E-03	5.25E-03	5.27E-03
	CTRL Std Dev	3.33E-04	3.39E-04	3.24E-04	3.32E-04	3.35E-04	3.35E-04	3.35E-04	3.46E-04	3.50E-04
	CTRL +99/90	7.03E-03	7.07E-03	6.98E-03	7.03E-03	7.05E-03	7.05E-03	7.05E-03	7.13E-03	7.17E-03
	CTRL -99/90	3.41E-03	3.38E-03	3.45E-03	3.42E-03	3.40E-03	3.41E-03	3.41E-03	3.37E-03	3.37E-03
	+CTRL Error Bar	3.05E-04	3.05E-04	3.02E-04	2.96E-04	3.02E-04	3.03E-04	3.16E-04	3.11E-04	3.30E-04
	-CTRL Error Bar	5.14E-04	5.17E-04	5.02E-04	5.14E-04	5.15E-04	5.21E-04	5.22E-04	5.36E-04	5.53E-04
Biased	Biased Avg	5.65E-03	5.68E-03	5.65E-03	5.62E-03	5.65E-03	5.63E-03	5.66E-03	5.66E-03	5.64E-03
	Biased Std Dev	4.48E-04	4.26E-04	4.31E-04	4.31E-04	4.18E-04	4.27E-04	4.13E-04	4.09E-04	4.13E-04
	Biased +99/90	7.34E-03	7.29E-03	7.28E-03	7.25E-03	7.23E-03	7.25E-03	7.23E-03	7.20E-03	7.20E-03
	Biased -99/90	3.96E-03	4.07E-03	4.01E-03	4.00E-03	4.06E-03	4.02E-03	4.10E-03	4.11E-03	4.07E-03
	+Biased Error Bar	6.58E-04	6.60E-04	6.31E-04	6.08E-04	5.96E-04	5.83E-04	6.04E-04	5.86E-04	5.84E-04
	-Biased Error Bar	6.32E-04	7.07E-04	6.80E-04	6.61E-04	6.78E-04	6.66E-04	7.20E-04	6.46E-04	6.32E-04
Unbiased	Unbiased Avg	5.82E-03	5.83E-03	5.81E-03	5.81E-03	5.82E-03	5.80E-03	5.82E-03	5.80E-03	5.81E-03
	Unbiased Std Dev	4.83E-04	4.73E-04	4.83E-04	4.56E-04	4.69E-04	4.59E-04	4.70E-04	4.41E-04	4.51E-04
	Unbiased +99/90	7.64E-03	7.63E-03	7.64E-03	7.54E-03	7.59E-03	7.53E-03	7.60E-03	7.47E-03	7.52E-03
	Unbiased -99/90	3.99E-03	4.04E-03	3.99E-03	4.09E-03	4.05E-03	4.06E-03	4.05E-03	4.13E-03	4.11E-03
	+Unbiased Error Bar	5.09E-04	5.14E-04	5.15E-04	4.91E-04	5.13E-04	4.91E-04	5.20E-04	4.67E-04	5.37E-04
	-Unbiased Error Bar	7.05E-04	6.90E-04	6.79E-04	6.24E-04	6.60E-04	6.20E-04	6.46E-04	6.26E-04	5.93E-04

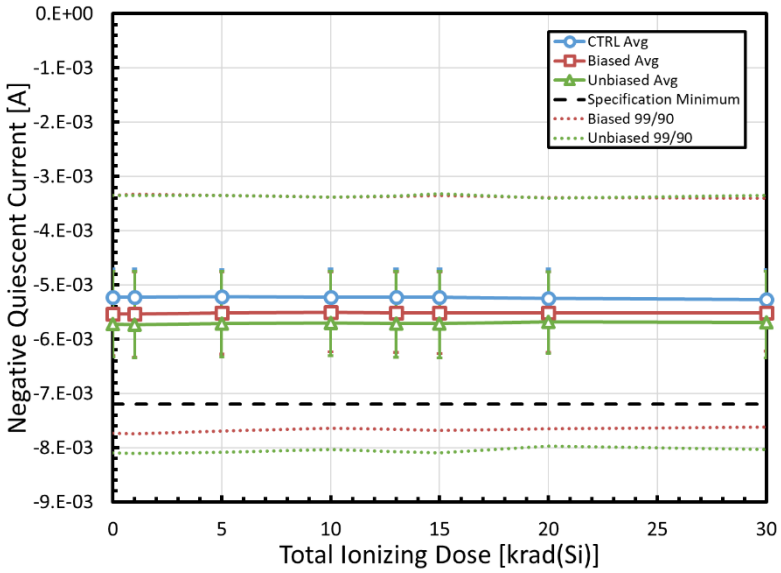

Figure 16. Negative quiescent current as a function of total ionizing dose with ±5 V supply voltages.

Table 17: Negative quiescent current values with ±5 V supply voltages

Negative Quiescent Current		Total Ionizing Dose								
		Pre-Rad	1 krad(Si)	5 krad(Si)	10 krad(Si)	13 krad(Si)	96-hr Freeze	15 krad(Si)	20 krad(Si)	30 krad(Si)
LDC1838	Control (C1)	-5.51E-03	-5.53E-03	-5.48E-03	-5.51E-03	-5.53E-03	-5.53E-03	-5.50E-03	-5.56E-03	-5.60E-03
	Control (C2)	-5.15E-03	-5.14E-03	-5.14E-03	-5.15E-03	-5.15E-03	-5.17E-03	-5.17E-03	-5.17E-03	-5.22E-03
	DUT1	-5.82E-03	-5.80E-03	-5.81E-03	-5.79E-03	-5.80E-03	-5.79E-03	-5.79E-03	-5.78E-03	-5.78E-03
	DUT2	-5.60E-03	-5.60E-03	-5.58E-03	-5.57E-03	-5.56E-03	-5.53E-03	-5.58E-03	-5.57E-03	-5.59E-03
	DUT3	-4.76E-03	-4.76E-03	-4.76E-03	-4.76E-03	-4.76E-03	-4.76E-03	-4.76E-03	-4.76E-03	-4.76E-03
	DUT4	-4.75E-03	-4.76E-03	-4.75E-03	-4.76E-03	-4.76E-03	-4.76E-03	-4.76E-03	-4.76E-03	-4.75E-03
	DUT5	-4.78E-03	-4.78E-03	-4.78E-03	-4.77E-03	-4.78E-03	-4.78E-03	-4.77E-03	-4.77E-03	-4.77E-03
	DUT6	-4.75E-03	-4.75E-03	-4.75E-03	-4.75E-03	-4.75E-03	-4.75E-03	-4.75E-03	-4.75E-03	-4.74E-03
	DUT7	-5.31E-03	-5.33E-03	-5.31E-03	-5.31E-03	-5.32E-03	-5.25E-03	-5.24E-03	-5.27E-03	-5.26E-03
	DUT8	-6.08E-03	-6.09E-03	-6.07E-03	-6.04E-03	-6.08E-03	-6.06E-03	-6.07E-03	-6.06E-03	-6.06E-03
LDC1128	Control (C11)	-5.53E-03	-5.53E-03	-5.51E-03	-5.52E-03	-5.52E-03	-5.51E-03	-5.55E-03	-5.54E-03	-5.54E-03
	Control (C12)	-4.71E-03	-4.71E-03	-4.71E-03	-4.71E-03	-4.71E-03	-4.71E-03	-4.71E-03	-4.71E-03	-4.71E-03
	DUT11	-6.14E-03	-6.09E-03	-6.11E-03	-6.12E-03	-6.12E-03	-6.16E-03	-6.08E-03	-6.15E-03	-6.14E-03
	DUT12	-5.93E-03	-5.95E-03	-5.91E-03	-5.88E-03	-5.89E-03	-5.88E-03	-5.94E-03	-5.89E-03	-5.85E-03
	DUT13	-6.31E-03	-6.34E-03	-6.27E-03	-6.23E-03	-6.24E-03	-6.21E-03	-6.27E-03	-6.24E-03	-6.22E-03
	DUT14	-5.02E-03	-4.97E-03	-4.96E-03	-4.96E-03	-4.97E-03	-4.96E-03	-4.94E-03	-5.01E-03	-5.00E-03
	DUT15	-6.33E-03	-6.35E-03	-6.33E-03	-6.29E-03	-6.30E-03	-6.29E-03	-6.34E-03	-6.26E-03	-6.35E-03
	DUT16	-6.08E-03	-6.10E-03	-6.07E-03	-6.08E-03	-6.08E-03	-6.09E-03	-6.14E-03	-6.07E-03	-6.08E-03
	DUT17	-6.11E-03	-6.14E-03	-6.09E-03	-6.09E-03	-6.09E-03	-6.04E-03	-6.08E-03	-6.06E-03	-6.07E-03
	DUT18	-6.32E-03	-6.29E-03	-6.33E-03	-6.31E-03	-6.33E-03	-6.26E-03	-6.27E-03	-6.22E-03	-6.21E-03
Specification Minimum		-7.20E-03	-7.20E-03	-7.20E-03	-7.20E-03	-7.20E-03	-7.20E-03	-7.20E-03	-7.20E-03	-7.20E-03
Control	CTRL Avg	-5.22E-03	-5.23E-03	-5.21E-03	-5.22E-03	-5.23E-03	-5.23E-03	-5.23E-03	-5.25E-03	-5.27E-03
	CTRL Std Dev	3.33E-04	3.39E-04	3.24E-04	3.32E-04	3.35E-04	3.35E-04	3.35E-04	3.46E-04	3.50E-04
	CTRL +99/90	-3.41E-03	-3.38E-03	-3.45E-03	-3.42E-03	-3.40E-03	-3.41E-03	-3.41E-03	-3.37E-03	-3.36E-03
	CTRL -99/90	-7.03E-03	-7.07E-03	-6.98E-03	-7.03E-03	-7.05E-03	-7.05E-03	-7.05E-03	-7.13E-03	-7.17E-03
	+CTRL Error Bar	5.13E-04	5.17E-04	5.02E-04	5.14E-04	5.15E-04	5.22E-04	5.22E-04	5.36E-04	5.53E-04
	-CTRL Error Bar	3.06E-04	3.06E-04	3.02E-04	2.96E-04	3.02E-04	3.03E-04	3.16E-04	3.11E-04	3.30E-04
Biased	Biased Avg	-5.54E-03	-5.53E-03	-5.52E-03	-5.51E-03	-5.51E-03	-5.51E-03	-5.52E-03	-5.52E-03	-5.51E-03
	Biased Std Dev	5.79E-04	5.83E-04	5.73E-04	5.63E-04	5.67E-04	5.66E-04	5.72E-04	5.63E-04	5.58E-04
	Biased +99/90	-3.35E-03	-3.33E-03	-3.35E-03	-3.38E-03	-3.37E-03	-3.37E-03	-3.35E-03	-3.39E-03	-3.40E-03
	Biased -99/90	-7.73E-03	-7.74E-03	-7.69E-03	-7.64E-03	-7.66E-03	-7.65E-03	-7.68E-03	-7.65E-03	-7.62E-03
	+Biased Error Bar	7.89E-04	7.76E-04	7.67E-04	7.54E-04	7.57E-04	7.50E-04	7.59E-04	7.63E-04	7.60E-04
	-Biased Error Bar	7.68E-04	8.02E-04	7.54E-04	7.22E-04	7.27E-04	7.06E-04	7.50E-04	7.21E-04	7.08E-04
Unbiased	Unbiased Avg	-5.72E-03	-5.73E-03	-5.72E-03	-5.70E-03	-5.72E-03	-5.69E-03	-5.71E-03	-5.68E-03	-5.69E-03
	Unbiased Std Dev	6.27E-04	6.29E-04	6.25E-04	6.16E-04	6.23E-04	6.14E-04	6.32E-04	6.04E-04	6.19E-04
	Unbiased +99/90	-3.35E-03	-3.35E-03	-3.35E-03	-3.38E-03	-3.36E-03	-3.37E-03	-3.32E-03	-3.40E-03	-3.35E-03
	Unbiased -99/90	-8.09E-03	-8.11E-03	-8.08E-03	-8.03E-03	-8.07E-03	-8.01E-03	-8.10E-03	-7.97E-03	-8.04E-03
	+Unbiased Error Bar	9.72E-04	9.80E-04	9.69E-04	9.55E-04	9.68E-04	9.40E-04	9.61E-04	9.32E-04	9.52E-04
	-Unbiased Error Bar	6.08E-04	6.21E-04	6.14E-04	6.02E-04	6.19E-04	6.00E-04	6.35E-04	5.80E-04	6.55E-04

Single Supply

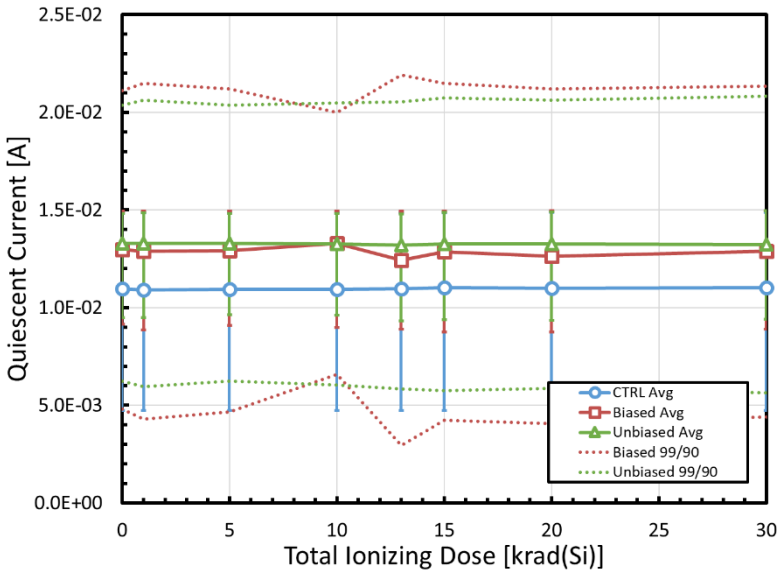

Figure 17. Quiescent current as a function of total ionizing dose with 12 V supply voltage.

Table 18: Quiescent current values with 12 V supply voltage

Quiescent Current		Total Ionizing Dose							
		Pre-Rad	1 krad(Si)	5 krad(Si)	10 krad(Si)	13 krad(Si)	15 krad(Si)	20 krad(Si)	30 krad(Si)
LDC1839	Control (C1)	1.49E-02	1.49E-02	1.49E-02	1.49E-02	1.49E-02	1.49E-02	1.49E-02	1.49E-02
	Control (C2)	1.19E-02	1.16E-02	1.19E-02	1.19E-02	1.19E-02	1.20E-02	1.20E-02	1.21E-02
	DUT1	1.37E-02	1.37E-02	1.37E-02	1.37E-02	1.37E-02	1.37E-02	1.20E-02	1.37E-02
	DUT2	1.30E-02	1.30E-02	1.30E-02	1.30E-02	9.41E-03	1.30E-02	1.30E-02	1.31E-02
	DUT3	9.65E-03	9.39E-03	9.51E-03	1.30E-02	9.45E-03	9.44E-03	9.43E-03	9.44E-03
	DUT4	9.15E-03	8.87E-03	9.10E-03	8.97E-03	8.90E-03	8.75E-03	8.76E-03	8.90E-03
	DUT5	9.49E-03	9.49E-03	9.64E-03	9.60E-03	9.33E-03	9.37E-03	9.35E-03	9.41E-03
	DUT6	1.08E-02	1.05E-02	1.07E-02	1.04E-02	1.06E-02	1.04E-02	1.06E-02	1.03E-02
	DUT7	1.48E-02	1.48E-02	1.48E-02	1.48E-02	1.48E-02	1.48E-02	1.48E-02	1.48E-02
	DUT8	1.44E-02	1.44E-02	1.44E-02	1.44E-02	1.44E-02	1.44E-02	1.44E-02	1.44E-02
LDC1128	Control (C11)	1.23E-02	1.24E-02	1.23E-02	1.23E-02	1.23E-02	1.24E-02	1.24E-02	1.23E-02
	Control (C12)	4.75E-03	4.75E-03	4.75E-03	4.75E-03	4.75E-03	4.75E-03	4.75E-03	4.75E-03
	DUT11	1.49E-02	1.49E-02	1.49E-02	1.49E-02	1.49E-02	1.49E-02	1.50E-02	1.50E-02
	DUT12	1.36E-02	1.37E-02	1.36E-02	1.35E-02	1.35E-02	1.35E-02	1.34E-02	1.35E-02
	DUT13	1.47E-02	1.48E-02	1.46E-02	1.46E-02	1.46E-02	1.47E-02	1.46E-02	1.46E-02
	DUT14	1.49E-02	1.49E-02	1.49E-02	1.46E-02	1.49E-02	1.49E-02	1.49E-02	1.49E-02
	DUT15	1.43E-02	1.44E-02	1.43E-02	1.43E-02	1.43E-02	1.43E-02	1.43E-02	1.44E-02
	DUT16	1.37E-02	1.38E-02	1.37E-02	1.37E-02	1.37E-02	1.38E-02	1.37E-02	1.37E-02
	DUT17	1.40E-02	1.41E-02	1.40E-02	1.40E-02	1.37E-02	1.40E-02	1.40E-02	1.39E-02
	DUT18	1.48E-02	1.49E-02	1.48E-02	1.48E-02	1.48E-02	1.49E-02	1.49E-02	1.50E-02
Control	CTRL Avg	1.10E-02	1.09E-02	1.10E-02	1.09E-02	1.10E-02	1.10E-02	1.10E-02	1.10E-02
	CTRL Std Dev	3.76E-03	3.75E-03	3.76E-03	3.76E-03	3.76E-03	3.78E-03	3.77E-03	3.78E-03
	CTRL +99/90	3.14E-02	3.13E-02	3.14E-02	3.14E-02	3.14E-02	3.16E-02	3.15E-02	3.16E-02
	CTRL -99/90	-9.49E-03	-9.49E-03	-9.48E-03	-9.48E-03	-9.48E-03	-9.53E-03	-9.49E-03	-9.53E-03
	+CTRL Error Bar	3.90E-03	3.96E-03	3.91E-03	3.91E-03	3.90E-03	3.84E-03	3.87E-03	3.86E-03
	-CTRL Error Bar	6.21E-03	6.15E-03	6.21E-03	6.20E-03	6.22E-03	6.27E-03	6.24E-03	6.27E-03
Biased	Biased Avg	1.30E-02	1.29E-02	1.29E-02	1.33E-02	1.24E-02	1.29E-02	1.26E-02	1.29E-02
	Biased Std Dev	2.16E-03	2.27E-03	2.19E-03	1.77E-03	2.51E-03	2.28E-03	2.26E-03	2.24E-03
	Biased +99/90	2.11E-02	2.15E-02	2.12E-02	2.00E-02	2.19E-02	2.15E-02	2.12E-02	2.13E-02
	Biased -99/90	4.80E-03	4.30E-03	4.66E-03	6.59E-03	2.94E-03	4.23E-03	4.08E-03	4.41E-03
	+Biased Error Bar	1.99E-03	2.04E-03	2.02E-03	1.65E-03	2.52E-03	2.08E-03	2.34E-03	2.08E-03
	-Biased Error Bar	3.81E-03	4.03E-03	3.83E-03	4.33E-03	3.52E-03	4.12E-03	3.87E-03	3.98E-03
Unbiased	Unbiased Avg	1.33E-02	1.33E-02	1.33E-02	1.33E-02	1.32E-02	1.33E-02	1.33E-02	1.32E-02
	Unbiased Std Dev	1.87E-03	1.94E-03	1.87E-03	1.91E-03	1.94E-03	1.98E-03	1.95E-03	2.01E-03
	Unbiased +99/90	2.04E-02	2.06E-02	2.04E-02	2.05E-02	2.06E-02	2.07E-02	2.06E-02	2.08E-02
	Unbiased -99/90	6.23E-03	5.95E-03	6.24E-03	6.03E-03	5.85E-03	5.76E-03	5.87E-03	5.65E-03
	+Unbiased Error Bar	1.51E-03	1.56E-03	1.52E-03	1.56E-03	1.58E-03	1.63E-03	1.66E-03	1.72E-03
	-Unbiased Error Bar	3.81E-03	3.80E-03	3.66E-03	3.66E-03	3.87E-03	3.89E-03	3.90E-03	3.84E-03

Slew Rate
Dual Supply

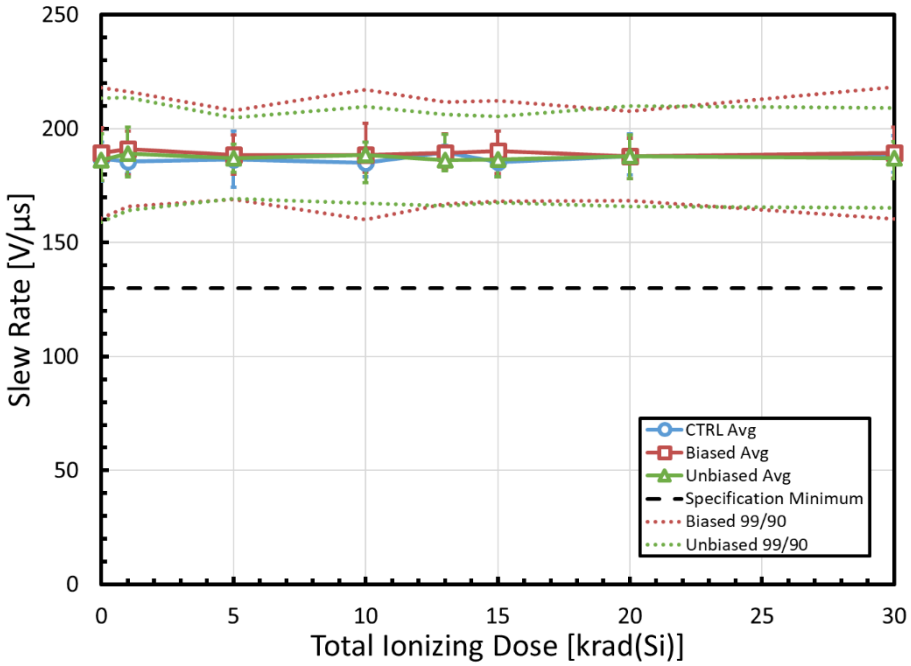

Figure 18. Slew rate as a function of total ionizing dose with ±5 V supply voltages.

Table 19: Slew rate values with ±5 V supply voltages

Slew Rate		Total Ionizing Dose								
		Pre-Rad	1 krad(Si)	5 krad(Si)	10 krad(Si)	13 krad(Si)	96-hr Freeze	15 krad(Si)	20 krad(Si)	30 krad(Si)
LDC1838	Control (C1)	185.16	182.99	187.92	180.00	188.52	185.16	187.11	181.63	180.83
	Control (C2)	176.90	180.35	174.27	178.98	185.16	174.06	178.80	179.83	181.13
	DUT1	177.27	179.83	183.81	180.87	185.71	181.56	180.22	178.10	178.35
	DUT2	189.67	185.16	184.75	182.61	182.72	188.52	187.53	187.53	188.95
	DUT3	182.46	185.16	188.06	182.46	182.46	187.36	184.75	183.94	183.39
	DUT4	182.46	189.95	180.00	180.87	184.75	190.39	187.95	188.80	180.09
	DUT5	177.27	184.34	184.21	187.36	181.56	192.89	188.24	186.13	189.52
	DUT6	179.83	178.80	182.46	184.07	181.40	184.75	178.98	182.59	178.16
	DUT7	179.44	185.16	182.46	189.33	182.72	183.53	179.36	184.89	182.46
	DUT8	181.66	184.34	180.87	176.40	181.66	180.87	182.59	177.97	179.44
LDC1128	Control (C11)	194.19	188.95	199.04	194.09	192.66	197.94	185.58	191.71	196.85
	Control (C12)	190.83	190.39	185.16	186.83	192.22	189.09	189.67	197.94	193.79
	DUT11	196.85	199.04	191.85	202.27	191.93	193.85	192.20	195.92	197.94
	DUT12	189.95	195.92	191.85	193.34	192.22	193.34	194.44	186.94	191.71
	DUT13	200.32	194.09	197.16	190.91	197.80	198.10	198.88	193.85	193.79
	DUT14	195.61	199.04	191.12	195.65	197.47	194.59	195.65	189.09	200.64
	DUT15	191.41	194.09	190.83	192.66	190.76	190.53	190.83	197.34	191.12
	DUT16	194.09	200.64	193.34	190.91	186.27	194.74	189.67	192.44	190.83
	DUT17	197.94	190.83	190.83	193.85	197.49	197.94	192.66	192.59	191.48
	DUT18	187.95	193.34	191.41	194.09	187.53	192.89	189.57	189.09	194.39
Specification Minimum		130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00
Control	CTRL Avg	186.77	185.67	186.60	184.97	189.64	186.56	185.29	187.78	188.15
	CTRL Std Dev	6.55	4.14	8.81	6.07	3.04	8.57	4.02	7.41	7.25
	CTRL +99/90	222.38	208.17	234.51	217.96	206.19	233.18	207.15	228.07	227.56
	CTRL -99/90	151.16	163.16	138.69	151.99	173.09	139.94	163.42	147.49	148.74
	+CTRL Error Bar	7.42	4.72	12.44	9.12	3.02	11.38	4.38	10.16	8.70
	-CTRL Error Bar	9.87	5.32	12.33	6.00	4.48	12.50	6.49	7.95	7.32
Biased	Biased Avg	189.32	191.03	188.57	188.62	189.38	190.96	190.20	188.02	189.36
	Biased Std Dev	7.56	6.68	5.16	7.56	5.89	4.82	5.80	5.18	7.66
	Biased +99/90	217.92	216.30	208.08	217.23	211.68	209.19	212.13	207.61	218.32
	Biased -99/90	160.73	165.75	169.07	160.01	167.08	172.73	168.28	168.43	160.40
	+Biased Error Bar	11.00	8.02	8.58	13.65	8.42	7.13	8.68	7.90	11.29
	-Biased Error Bar	12.05	11.20	8.57	7.75	6.93	9.41	9.99	9.92	11.00
Unbiased	Unbiased Avg	186.20	188.94	187.05	188.58	186.17	189.77	186.49	187.88	187.17
	Unbiased Std Dev	7.22	6.57	4.68	5.60	5.33	5.64	5.02	5.83	5.79
	Unbiased +99/90	213.51	213.81	204.77	209.77	206.35	211.12	205.49	209.95	209.09
	Unbiased -99/90	158.89	164.07	169.33	167.39	166.00	168.42	167.48	165.81	165.26
	+Unbiased Error Bar	11.74	11.70	6.29	5.51	11.32	8.17	6.18	9.46	7.22
	-Unbiased Error Bar	8.93	10.15	6.18	12.19	4.78	8.90	7.51	9.91	9.02

Single Supply

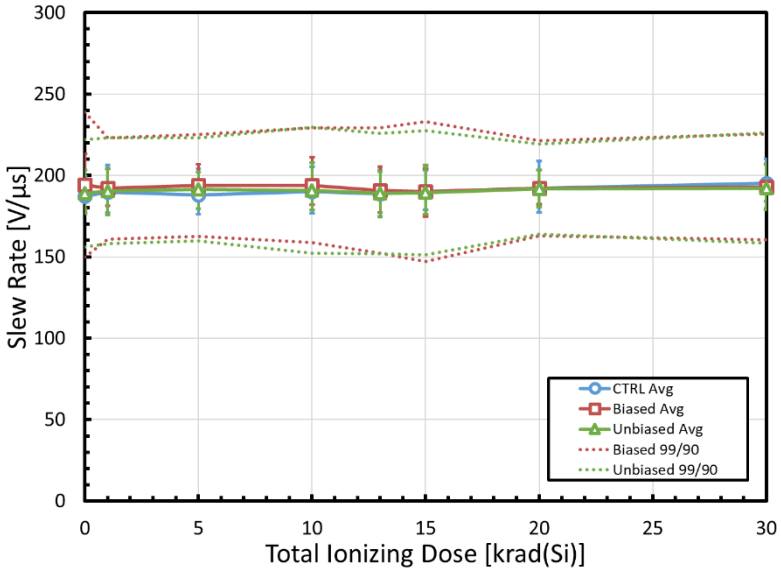

Figure 19. Slew rate as a function of total ionizing dose with 12 V supply voltage.

Table 20: Slew rate values with 12 V supply voltage

Slew Rate		Total Ionizing Dose							
		Pre-Rad	1 krad(Si)	5 krad(Si)	10 krad(Si)	13 krad(Si)	15 krad(Si)	20 krad(Si)	30 krad(Si)
LDC1839	Control (C1)	178.80	178.29	182.46	179.83	184.75	180.22	184.34	186.28
	Control (C2)	177.52	177.27	176.27	176.90	174.42	178.80	177.02	183.93
	DUT1	179.44	187.53	184.75	189.95	177.27	174.79	182.46	187.95
	DUT2	182.46	182.46	187.11	182.06	182.46	181.40	185.44	189.14
	DUT3	179.83	188.52	187.95	182.99	179.05	184.57	182.61	179.65
	DUT4	194.39	181.40	188.24	191.75	185.71	177.02	192.30	184.20
	DUT5	184.07	184.75	185.16	180.09	182.72	182.72	187.95	185.02
	DUT6	176.52	175.77	179.44	179.83	174.79	176.27	182.46	186.55
	DUT7	187.95	187.95	193.79	187.53	184.75	185.73	190.39	185.44
	DUT8	177.52	184.48	179.44	178.80	177.27	177.46	180.74	179.00
LDC1128	Control (C11)	193.79	197.31	189.09	197.94	192.59	198.73	198.27	200.97
	Control (C12)	199.52	206.57	203.92	205.21	203.26	203.26	208.70	210.10
	DUT11	202.57	200.00	200.00	203.55	196.85	193.79	190.83	199.03
	DUT12	199.04	190.53	190.83	191.63	195.61	200.64	197.47	195.46
	DUT13	203.92	201.94	205.60	198.73	202.76	203.92	201.92	206.62
	DUT14	213.15	203.92	206.62	211.06	205.26	204.42	203.26	201.30
	DUT15	190.83	192.59	193.25	200.64	196.38	190.19	193.79	197.00
	DUT16	196.85	194.44	197.16	195.61	192.59	196.85	197.16	198.39
	DUT17	203.26	204.42	200.43	207.83	202.27	206.39	203.26	207.07
	DUT18	194.44	199.52	201.94	196.87	200.32	199.52	197.94	199.52
Control	CTRL Avg	187.41	189.86	187.93	189.97	188.76	190.25	192.08	195.32
	CTRL Std Dev	9.48	12.52	10.28	11.93	10.56	10.87	12.26	10.74
	CTRL +99/90	238.93	257.93	243.84	254.85	246.20	249.37	258.73	253.74
	CTRL -99/90	135.88	121.79	132.03	125.09	131.32	131.13	125.44	136.90
	+CTRL Error Bar	12.11	16.71	15.99	15.24	14.50	13.01	16.61	14.78
	-CTRL Error Bar	9.88	12.59	11.66	13.07	14.33	11.45	15.06	11.39
Biased	Biased Avg	194.35	192.04	193.89	193.97	190.62	190.07	192.03	192.92
	Biased Std Dev	11.78	8.24	8.24	9.32	10.17	11.36	7.74	8.61
	Biased +99/90	238.90	223.20	225.05	229.23	229.11	233.05	221.30	225.49
	Biased -99/90	149.80	160.88	162.73	158.70	152.13	147.09	162.77	160.35
	+Biased Error Bar	18.80	11.88	12.74	17.09	14.64	14.35	11.22	13.70
	-Biased Error Bar	14.91	10.64	9.13	11.91	13.35	15.28	9.58	13.27
Unbiased	Unbiased Avg	188.93	190.49	191.33	190.90	188.89	189.39	191.71	192.25
	Unbiased Std Dev	8.74	8.57	8.37	10.23	9.80	10.12	7.31	8.94
	Unbiased +99/90	221.98	222.92	222.97	229.59	225.96	227.69	219.38	226.07
	Unbiased -99/90	155.88	158.07	159.68	152.21	151.81	151.09	164.04	158.43
	+Unbiased Error Bar	14.33	13.93	10.62	16.93	13.38	17.00	11.55	14.82
	-Unbiased Error Bar	12.41	14.72	11.89	12.10	14.10	13.12	10.97	13.25

Power Supply Rejection Ratio

Dual Supply

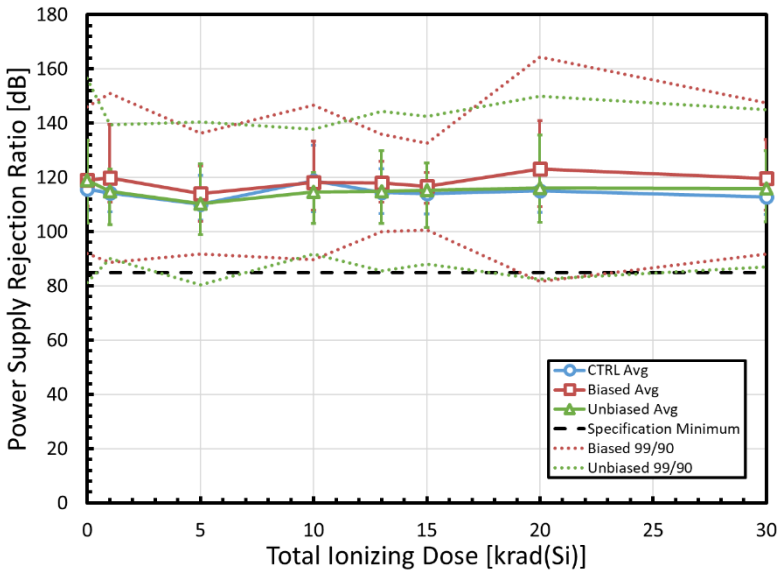

Figure 20. Power supply rejection ratio as a function of total ionizing dose with ±5 V supply voltages.

Table 21: Power supply rejection ratio values with ±5 V supply voltages

Power Supply Rejection Ratio		Total Ionizing Dose								
		Pre-Rad	1 krad(Si)	5 krad(Si)	10 krad(Si)	13 krad(Si)	96-hr Freeze	15 krad(Si)	20 krad(Si)	30 krad(Si)
LDC1898	Control (C1)	116.54	116.39	120.67	116.53	114.83	116.76	117.71	117.33	114.97
	Control (C2)	107.69	107.40	105.97	107.37	106.76	108.79	106.48	107.10	106.28
	DUT1	117.45	118.10	117.19	119.33	118.21	117.20	118.72	115.11	116.09
	DUT2	133.63	121.23	124.36	124.89	122.17	132.57	120.72	141.04	122.43
	DUT3	112.52	114.28	114.13	113.46	113.95	113.88	113.08	115.62	116.84
	DUT4	125.64	139.46	118.52	133.38	122.13	123.44	121.86	138.19	125.19
	DUT5	113.51	114.94	116.67	113.95	110.42	108.96	116.91	116.85	110.99
	DUT6	133.77	121.80	124.99	119.58	120.90	132.83	125.14	118.75	122.48
	DUT7	108.82	107.35	111.25	108.39	107.45	108.16	110.19	107.51	109.75
	DUT8	113.66	114.72	116.07	113.04	117.85	115.33	114.53	115.02	115.17
LDC1128	Control (C11)	120.75	117.89	104.32	131.90	113.26	119.69	114.79	114.71	117.38
	Control (C12)	117.41	115.26	109.34	119.48	123.23	120.20	117.39	120.84	-----
	DUT11	119.82	122.64	114.51	119.49	125.86	120.55	121.40	123.72	133.91
	DUT12	117.79	117.07	103.90	115.81	116.58	115.15	114.37	127.22	120.36
	DUT13	109.40	110.90	109.04	107.97	110.76	109.39	110.48	109.13	107.88
	DUT14	115.94	114.79	110.37	111.71	114.22	115.30	112.61	114.38	114.21
	DUT15	123.84	119.05	105.88	116.82	115.13	111.53	114.30	118.33	120.53
	DUT16	126.16	114.78	98.83	121.73	114.79	117.71	114.54	113.75	115.33
	DUT17	103.19	102.56	105.59	103.04	103.07	102.05	101.60	103.39	103.69
	DUT18	128.31	122.97	104.07	120.90	129.80	132.99	125.30	135.67	129.81
Specification Minimum		85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00
Control	CTRL Avg	115.60	114.24	110.08	118.82	114.52	116.36	114.09	114.99	112.88
	CTRL Std Dev	4.82	4.05	6.38	8.77	5.87	4.56	4.54	5.05	4.77
	CTRL +99/90	141.83	136.28	144.76	166.51	146.42	141.17	138.77	142.45	138.79
	CTRL -99/90	89.36	92.19	75.39	71.13	82.61	91.55	89.42	87.53	86.96
	+CTRL Error Bar	5.15	3.66	10.60	13.08	8.71	3.83	3.62	5.85	4.51
	-CTRL Error Bar	7.90	6.83	5.75	11.45	7.76	7.57	7.61	7.90	6.59
Biased	Biased Avg	119.02	119.81	114.00	118.26	117.99	118.44	116.66	123.05	119.61
	Biased Std Dev	7.13	8.23	5.89	7.53	4.76	6.65	4.23	10.94	7.34
	Biased +99/90	145.98	150.94	136.30	146.73	136.00	143.60	132.65	164.44	147.39
	Biased -99/90	92.06	88.67	91.70	89.78	99.97	93.27	100.67	81.66	91.84
	+Biased Error Bar	14.61	19.65	10.35	15.13	7.88	14.14	5.21	17.99	14.30
	-Biased Error Bar	9.63	8.91	10.10	10.29	7.22	9.05	6.18	13.92	11.74
Unbiased	Unbiased Avg	118.91	114.77	110.42	114.68	114.93	116.19	115.31	116.16	115.97
	Unbiased Std Dev	9.95	6.51	7.93	6.08	7.76	10.61	7.21	8.93	7.66
	Unbiased +99/90	156.54	139.40	140.40	137.67	144.30	156.33	142.57	149.93	144.96
	Unbiased -99/90	81.27	90.14	80.43	91.69	85.56	76.06	88.06	82.39	86.98
	+Unbiased Error Bar	14.87	8.20	14.57	7.05	14.87	16.79	9.98	19.51	13.84
	-Unbiased Error Bar	15.72	12.21	11.59	11.65	11.86	14.15	13.71	12.77	12.28

Single Supply

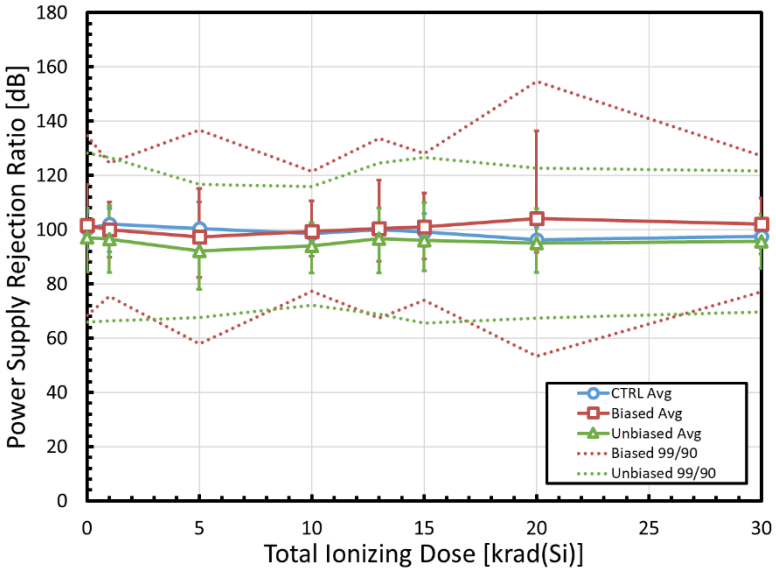

Figure 21. Power supply rejection ratio as a function of total ionizing dose with 12 V supply voltage.

Table 22: Power supply rejection ratio values with 12 V supply voltage

Power Supply Rejection Ratio		Total Ionizing Dose							
		Pre-Rad	1 krad(Si)	5 krad(Si)	10 krad(Si)	13 krad(Si)	15 krad(Si)	20 krad(Si)	30 krad(Si)
LDC1828	Control (C1)	106.76	107.44	110.20	99.41	100.24	105.82	100.69	102.65
	Control (C2)	96.17	91.95	92.65	95.96	96.09	93.73	93.78	92.63
	DUT1	95.06	95.28	97.58	94.98	96.59	105.96	98.67	98.99
	DUT2	105.59	110.25	101.96	104.58	106.42	103.42	136.38	111.12
	DUT3	112.82	106.46	109.25	110.67	118.19	105.51	106.27	111.59
	DUT4	116.55	104.69	115.08	102.09	103.90	113.54	109.86	104.69
	DUT5	90.49	91.31	93.26	90.65	93.04	90.88	90.91	90.99
	DUT6	105.46	104.17	99.59	100.31	102.82	100.97	98.97	104.87
	DUT7	91.92	91.66	89.57	92.99	93.33	90.41	92.00	91.85
	DUT8	91.62	91.93	95.43	91.30	91.35	91.32	90.64	91.58
LDC1128	Control (C11)	105.81	107.72	105.51	97.48	102.42	98.00	95.11	96.86
	Control (C12)	92.95	100.91	93.74	101.73	101.34	99.49	95.98	98.10
	DUT11	97.77	94.87	88.03	97.15	95.44	99.45	98.30	97.59
	DUT12	98.85	102.09	82.28	98.33	102.35	96.13	95.17	104.28
	DUT13	89.06	89.87	95.92	90.30	88.35	89.20	91.64	91.07
	DUT14	96.87	96.72	88.77	97.34	92.82	95.18	96.67	98.17
	DUT15	107.97	108.78	77.95	102.58	108.06	105.82	104.07	105.69
	DUT16	98.67	94.96	96.30	91.47	97.62	94.44	92.07	93.36
	DUT17	84.38	84.16	87.89	83.94	84.09	84.85	84.18	85.67
	DUT18	106.62	105.10	97.43	99.04	104.09	109.95	107.69	101.48
Control	CTRL Avg	100.42	102.00	100.52	98.64	100.02	99.26	96.39	97.56
	CTRL Std Dev	5.98	6.41	7.53	2.16	2.40	4.34	2.60	3.57
	CTRL +99/90	132.94	136.88	141.44	110.39	113.06	122.83	110.55	116.98
	CTRL -99/90	67.91	67.13	59.60	86.90	86.98	75.69	82.23	78.14
	+CTRL Error Bar	6.33	5.71	9.67	3.08	2.39	6.56	4.30	5.09
	-CTRL Error Bar	7.47	10.06	7.88	2.69	3.94	5.53	2.61	4.93
Biased	Biased Avg	101.57	100.03	97.36	99.43	100.51	101.05	104.12	102.19
	Biased Std Dev	8.73	6.47	10.41	5.85	8.74	7.13	13.38	6.61
	Biased +99/90	134.60	124.51	136.74	121.56	133.56	128.04	154.75	127.21
	Biased -99/90	68.54	75.55	57.98	77.30	67.45	74.06	53.49	77.17
	+Biased Error Bar	14.98	10.22	17.72	11.24	17.68	12.49	32.26	9.40
	-Biased Error Bar	12.51	10.16	15.08	9.13	12.16	11.85	12.48	11.12
Unbiased	Unbiased Avg	97.14	96.51	92.18	94.03	96.80	96.08	95.07	95.69
	Unbiased Std Dev	8.24	7.98	6.51	5.77	7.37	8.08	7.33	6.87
	Unbiased +99/90	128.31	126.69	116.80	115.85	124.67	126.63	122.78	121.67
	Unbiased -99/90	65.97	66.33	67.55	72.22	68.93	65.53	67.35	69.70
	+Unbiased Error Bar	10.83	12.27	7.41	8.55	11.25	13.87	12.62	10.01
	-Unbiased Error Bar	12.76	12.35	14.23	10.10	12.71	11.23	10.88	10.01