

Total Ionization Dose (TID) Test Results of the RH3083MK Adjustable 2.8A Single Resistor Low Dropout Regulator @ High Dose Rate (HDR)

HDR = 50 rads(Si)/s

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TID HDR Testing of the RH3083MK Adjustable 2.8A Single Resistor Low Dropout Regulator

Part Type Tested: RH3083MK Adjustable 2.8A Single Resistor Low Dropout Regulator

Traceability Information: Fab Lot # HP201682.1; Wafer # 1. See photograph of unit under test in Appendix A.

Quantity of Units: 52 units received, 2 units for control, 25 units for biased irradiation, and 25 units for unbiased irradiation. Serial numbers 6-10, 16-20, 26-30, 36-40, and 46-50, and had all pins tied to ground during irradiation. Serial numbers 1-5, 11-15, 21-25, 31-35, and 41-45 were biased during irradiation. Serial numbers 51 and 52 were used as control. See Appendix B for the radiation bias connection tables.

Radiation and Electrical Test Increments: 50 samples were divided into five groups of 10 each. Serial numbers 1-10 of group 1 were irradiated to 10 Krads(Si). Serial numbers 11-20 of group 2 were irradiated to 20 Krads(Si). Serial numbers 21-30 of group 3 were irradiated to 50 Krads(Si). Serial numbers 31-40 of group 4 were irradiated to 100 Krads(Si). Serial numbers 41-50 of group 5 were irradiated to 200 Krads(Si).

Radiation dose: 50 rads(Si)/sec.

Radiation Test Standard: MIL-STD-883 TM1019.9 Condition A.

Test Hardware and Software: LTX pre-irradiation test program EFR3083R.00; LTX post-irradiation test program EFR3083R.00.

Facility and Radiation Source: Defense Micro Electronic Activity (DMEA) and Cobalt-60.

Irradiation and Test Temperature: Room temperature controlled to 24°C±6°C per MIL-STD-883 and MIL-STD-750.

SUMMARY

ALL 52 PARTS PASSED THE ELECTRICAL TEST LIMITS AS SPECIFIED IN THE DATASHEET AFTER EACH IRRADIATION INCREMENT. ADDITIONAL INFORMATION CAN BE PROVIDED PER REQUEST.

1.0 Overview and Background

Among other radiation effects, Total Ionizing Dose (TID) may affect circuits' electrical characteristics, causing parametric and/or functional failures in integrated circuits. During gamma-irradiations, TID-induced and transported electron-hole pairs may result in charge trapping in the transistors' dielectrics and interface regions, affecting hence the devices' basic features. Such effects warrant testing and monitoring of circuits to TID, after which annealing and/or Time Dependent Effects (TDE) may take place, depending on the circuit's design and process technology. Hence is the requirement per Condition A (for high-dose rates ranging from 50 and 300 rads(Si)/sec) in TM1019, MIL-STD-883 to not exceed the allowed time from the end of an incremented irradiation and an electrical test to more than one hour. Additionally, the total time from the end of one incremental irradiation to the start of the next incremental step should be less than two hours.

2.0 Radiation Facility and Test Equipment

The samples were irradiated at Defense Micro-Electronics Activity (DMEA) facility in Sacramento, California. DMEA utilizes J.L. Shepherd model 81-22/484 to provide the dose-rate of 50 rads(Si)/s. A special design screw-driven automatic cart inside the exposure tunnel positions the Device-Under-Test (DUT) precisely and repeatedly from the source to attain optimal rate verified by ion chamber detectors. See Appendix C for the certificate of dosimetry.

3.0 Test Conditions

The 50 test samples and two control units were electrically tested at 25°C prior to irradiation. The parts were then placed in a lead/aluminum container and aligned with the radiation source, Cobalt-60, at DMEA facility in Sacramento, California. During irradiation, five units of six separate groups were biased at +3V and other five of similar groups had all pads grounded. Ten units of group 1 were irradiated to 10 Krads(Si); group 2 to 20 Krads(Si); group 3 to 50 Krads(Si); group 4 to 100 Krads(Si); and group 5 to 200 Krads(Si). After irradiation, the samples were transported in dry ice to Linear Technology testing facility. Testing was performed on the two control units to confirm the operation of the test system prior to the electrical testing of the 52 units (50 irradiated and 2 control).

The criteria to pass the high dose-rate test is that five samples in each corresponding dose group irradiated under electrical bias must pass the datasheet limits. If any of the tested parameters of these five units do not meet the required limits then a failure-analysis of the part should be conducted and if valid the lot will be scrapped.

4.0 Tested Parameters

The following parameters were measured pre- and post-irradiations:

- SET Pin Current (μA)
- Output Offset Voltage (mV)
- Load Regulation I_{SET} (nA)
- Load Regulation V_{OS} (mV)
- Line Regulation I_{SET} (nA/V)
- Line Regulation V_{OS} (mV/V)
- Minimum Load Current (mA) @ $V_{\text{IN}} = 1\text{V}$, $V_{\text{CONTROL}} = 2\text{V}$
- Minimum Load Current (mA) @ $V_{\text{IN}} = 23\text{V}$, $V_{\text{CONTROL}} = 25\text{V}$
- V_{CONTROL} Dropout Voltage (V) @ $V_{\text{IN}} = 1\text{V}$, $I_{\text{LOAD}} = 0.1\text{A}$
- V_{CONTROL} Dropout Voltage (V) @ $V_{\text{IN}} = 1\text{V}$, $I_{\text{LOAD}} = 1\text{A}$
- V_{CONTROL} Dropout Voltage (V) @ $V_{\text{IN}} = 1\text{V}$, $I_{\text{LOAD}} = 2.8\text{A}$
- V_{IN} Dropout Voltage (V) @ $V_{\text{CONTROL}} = 2\text{V}$, $I_{\text{LOAD}} = 0.1\text{A}$
- V_{IN} Dropout Voltage (V) @ $V_{\text{CONTROL}} = 2\text{V}$, $I_{\text{LOAD}} = 1\text{A}$
- V_{IN} Dropout Voltage (V) @ $V_{\text{CONTROL}} = 2\text{V}$, $I_{\text{LOAD}} = 2.8\text{A}$
- V_{CONTROL} Pin Current (mA) @ $V_{\text{IN}} = 1\text{V}$, $V_{\text{CONTROL}} = 2\text{V}$, $I_{\text{LOAD}} = 0.1\text{A}$
- V_{CONTROL} Pin Current (mA) @ $V_{\text{IN}} = 1\text{V}$, $V_{\text{CONTROL}} = 2\text{V}$, $I_{\text{LOAD}} = 1\text{A}$
- V_{CONTROL} Pin Current (mA) @ $V_{\text{IN}} = 1\text{V}$, $V_{\text{CONTROL}} = 2\text{V}$, $I_{\text{LOAD}} = 2.8\text{A}$
- Current Limit (A) @ $V_{\text{IN}} = 5\text{V}$, $V_{\text{CONTROL}} = 5\text{V}$, $V_{\text{OUT}} = -0.1\text{V}$

Appendix D details the test conditions, minimum and maximum values at different accumulated doses.

5.0 Test Results

All 50 samples passed the post-irradiation electrical tests. All measurements of the 18 listed parameters in section 4.0 are within the specification limits.

The used statistics in this report are based on the tolerance limits, which are bounds to gage the quality of the manufactured products. It assumes that if the quality of the items is normally distributed with known mean and known standard deviation, the two-sided tolerance limits can be calculated by adding to and subtracting from mean the product of standard deviation and the tolerance limit factor K_{TL} where K_{TL} is tabulated from a table of the inverse normal probability distribution. The upper tolerance limit $+K_{TL}$ and the lower tolerance limit $-K_{TL}$ are

$$+K_{TL} = \text{mean} + (K_{TL}) (\text{standard deviation})$$

$$-K_{TL} = \text{mean} - (K_{TL}) (\text{standard deviation})$$

However, in most cases, mean and standard deviations are unknown and therefore it is practical to estimate both of them from a sample. Hence the tolerance limit depends greatly on the sample size. The $P_{s90\%/90\%}$ K_{TL} factor for a lot quality P of 0.9, confidence C of 0.9 with a sample size of 5, can be found from the tabulated table (MIL-HDBK-814, page 94, table IX-B). The K_{TL} factor in this report is 2.742.

In the plots, the dotted lines with diamond markers are the average of the measured data points of five samples irradiated under electrical bias while the dashed lines with X-markers are the average of measured data points of five units irradiated with all pins tied to ground. The solid lines with triangle markers are the average of the data points after the calculation of the K_{TL} statistics on the sample irradiated in the biased setup. The solid lines with square symbols are the average of the measured points after the application of the K_{TL} statistics on the five samples irradiated with all pins grounded. The orange solid lines with circle markers are the specification limits.

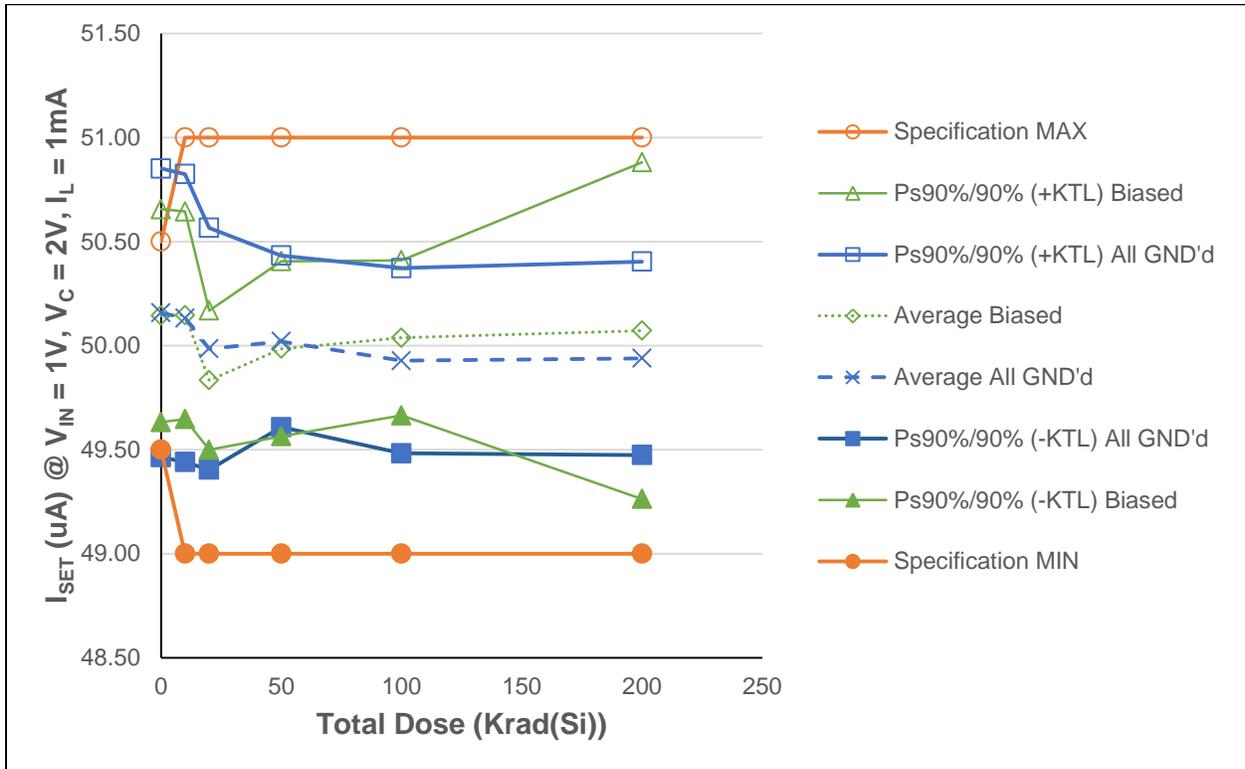


Figure 5.1 Plot of SET Pin Current versus Total Dose

The measured data of five samples of five groups are within datasheet specification limits. Note both pre-irradiation computed KTL data points are slightly out of the limits due to the small 5-piece sample size.

Table 5.1: Raw data for SET Pin current versus total dose including the statistical calculations, minimum specification, maximum specification, and the status of the test (PASS/FAIL) under the orange headers)

Parameter Units	I _{SET} @ V _{IN} =1V, V _C =2V, I _L =1mA (uA)	Total Dose (Krad(Si)) @ 50 rads(Si)/s					
		0	10	20	50	100	200
6	All GND'd Irradiation	50.545	50.561				
7	All GND'd Irradiation	50.071	50.014				
8	All GND'd Irradiation	50.049	50.046				
9	All GND'd Irradiation	49.877	49.910				
10	All GND'd Irradiation	50.246	50.129				
1	Biased Irradiation	50.374	50.380				
2	Biased Irradiation	49.857	49.888				
3	Biased Irradiation	50.122	50.088				
4	Biased Irradiation	50.203	50.233				
5	Biased Irradiation	50.162	50.140				
16	All GND'd Irradiation	50.261		50.321			
17	All GND'd Irradiation	50.053		50.061			
18	All GND'd Irradiation	49.854		49.842			
19	All GND'd Irradiation	49.946		49.913			
20	All GND'd Irradiation	49.697		49.786			
11	Biased Irradiation	49.838		49.820			
12	Biased Irradiation	49.792		49.819			
13	Biased Irradiation	49.786		49.659			
14	Biased Irradiation	49.962		49.999			
15	Biased Irradiation	49.912		49.871			
26	All GND'd Irradiation	50.080			50.118		
27	All GND'd Irradiation	50.005			50.017		
28	All GND'd Irradiation	50.123			50.135		
29	All GND'd Irradiation	49.916			49.764		
30	All GND'd Irradiation	50.088			50.066		
21	Biased Irradiation	50.288			50.256		
22	Biased Irradiation	50.062			49.915		
23	Biased Irradiation	49.952			49.900		
24	Biased Irradiation	49.938			49.898		
25	Biased Irradiation	49.966			49.954		
36	All GND'd Irradiation	50.147				50.153	
37	All GND'd Irradiation	49.758				49.713	
38	All GND'd Irradiation	49.890				49.898	
39	All GND'd Irradiation	50.082				49.997	
40	All GND'd Irradiation	49.866				49.874	
31	Biased Irradiation	49.811				49.835	
32	Biased Irradiation	50.145				50.144	
33	Biased Irradiation	50.189				50.179	
34	Biased Irradiation	50.051				50.026	
35	Biased Irradiation	50.054				50.002	
46	All GND'd Irradiation	50.106					50.117
47	All GND'd Irradiation	49.723					49.689
48	All GND'd Irradiation	49.911					49.912
49	All GND'd Irradiation	50.038					50.075
50	All GND'd Irradiation	49.969					49.899
41	Biased Irradiation	50.036					49.959
42	Biased Irradiation	50.095					50.034
43	Biased Irradiation	50.625					50.568
44	Biased Irradiation	49.826					49.781
45	Biased Irradiation	50.167					50.015
51	Control Unit	50.163	50.163	50.163	50.163	50.163	50.163
52	Control Unit	49.881	49.881	49.881	49.881	49.881	49.881
All GND'd Irradiation Statistics							
Average All GND'd		50.158	50.132	49.985	50.020	49.927	49.938
Std Dev All GND'd		0.253	0.252	0.212	0.150	0.162	0.170
Ps90%/90% (+KTL) All GND'd		50.851	50.824	50.566	50.432	50.372	50.403
Ps90%/90% (-KTL) All GND'd		49.464	49.440	49.403	49.607	49.482	49.473
Biased Irradiation Statistics							
Average Biased		50.144	50.146	49.833	49.984	50.037	50.071
Std Dev Biased		0.187	0.182	0.122	0.153	0.136	0.295
Ps90%/90% (+KTL) Biased		50.655	50.644	50.168	50.405	50.410	50.880
Ps90%/90% (-KTL) Biased		49.632	49.647	49.499	49.564	49.664	49.263
Specification MIN		49.5	49.0	49.0	49.0	49.0	49.0
Status (Measurements) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (Measurements) Biased		PASS	PASS	PASS	PASS	PASS	PASS
Specification MAX		50.5	51.0	51.0	51.0	51.0	51.0
Status (Measurements) All GND'd		FAIL	PASS	PASS	PASS	PASS	PASS
Status (Measurements) Biased		PASS	PASS	PASS	PASS	PASS	PASS
Status (-KTL) All GND'd		FAIL	PASS	PASS	PASS	PASS	PASS
Status (+KTL) All GND'd		FAIL	PASS	PASS	PASS	PASS	PASS
Status (-KTL) Biased		PASS	PASS	PASS	PASS	PASS	PASS
Status (+KTL) Biased		FAIL	PASS	PASS	PASS	PASS	PASS

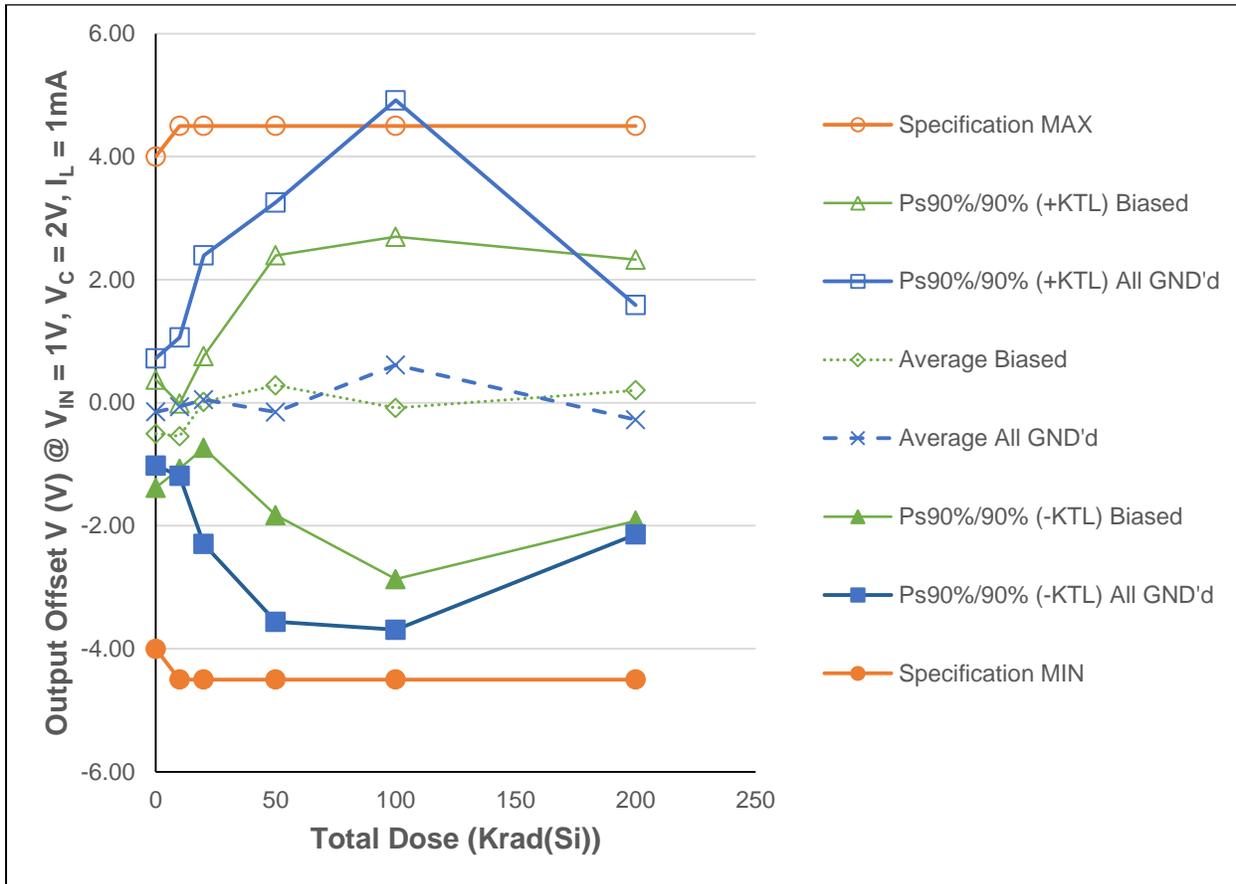


Figure 5.2: Plot of Output Offset Voltage versus Total Dose

All samples passed the Output Offset Voltage parameter test. Note the computed +KTL All GND'd data point at 100 Krad(Si) is outside the maximum limit due to the small 5-piece sample size.

Table 5.2: Raw data for output offset voltage versus total dose including the statistical calculations, maximum specification, and the status of the test (PASS/FAIL under the second orange header)

Parameter	V _{OS} @ V _{IN} =1V, V _C = 2V, I _L = 1mA	Total Dose (Krad(Si)) @ 50 rads(Si)/s					
		0	10	20	50	100	200
Units	(V)						
6	All GND'd Irradiation	0.094	0.080				
7	All GND'd Irradiation	-0.079	-0.043				
8	All GND'd Irradiation	-0.444	-0.562				
9	All GND'd Irradiation	-0.516	-0.316				
10	All GND'd Irradiation	0.195	0.519				
1	Biased Irradiation	-0.196	-0.394				
2	Biased Irradiation	-0.144	-0.341				
3	Biased Irradiation	-0.736	-0.742				
4	Biased Irradiation	-0.856	-0.753				
5	Biased Irradiation	-0.590	-0.493				
16	All GND'd Irradiation	0.497		0.493			
17	All GND'd Irradiation	-1.270		-1.205			
18	All GND'd Irradiation	-0.541		-0.252			
19	All GND'd Irradiation	0.464		0.549			
20	All GND'd Irradiation	0.749		0.662			
11	Biased Irradiation	0.316		0.066			
12	Biased Irradiation	0.101		0.056			
13	Biased Irradiation	-0.208		-0.190			
14	Biased Irradiation	-0.190		-0.287			
15	Biased Irradiation	0.174		0.413			
26	All GND'd Irradiation	1.590			1.707		
27	All GND'd Irradiation	-1.257			-1.315		
28	All GND'd Irradiation	-1.241			-0.994		
29	All GND'd Irradiation	-0.969			-0.651		
30	All GND'd Irradiation	0.306			0.493		
21	Biased Irradiation	-0.519			-0.157		
22	Biased Irradiation	-0.335			0.135		
23	Biased Irradiation	0.065			0.171		
24	Biased Irradiation	-0.543			-0.340		
25	Biased Irradiation	1.699			1.608		
36	All GND'd Irradiation	-0.117				-0.050	
37	All GND'd Irradiation	0.989				0.730	
38	All GND'd Irradiation	0.613				0.770	
39	All GND'd Irradiation	2.753				2.964	
40	All GND'd Irradiation	-1.475				-1.348	
31	Biased Irradiation	1.305				1.260	
32	Biased Irradiation	-0.871				-0.791	
33	Biased Irradiation	-1.629				-1.323	
34	Biased Irradiation	0.390				0.437	
35	Biased Irradiation	0.022				-0.007	
46	All GND'd Irradiation	-0.166					0.202
47	All GND'd Irradiation	-1.251					-1.002
48	All GND'd Irradiation	-0.363					0.155
49	All GND'd Irradiation	-1.089					-1.036
50	All GND'd Irradiation	0.064					0.300
41	Biased Irradiation	-1.202					-0.652
42	Biased Irradiation	0.363					0.698
43	Biased Irradiation	1.149					1.214
44	Biased Irradiation	-0.738					-0.429
45	Biased Irradiation	-0.143					0.182
51	Control Unit	-0.168	-0.168	-0.168	-0.168	-0.168	-0.168
52	Control Unit	0.146	0.146	0.146	0.146	0.146	0.146
All GND'd Irradiation Statistics							
Average All GND'd		-0.150	-0.064	0.049	-0.152	0.613	-0.276
Std Dev All GND'd		0.318	0.410	0.855	1.243	1.569	0.680
Ps90%/90% (+KTL) All GND'd		0.722	1.061	2.395	3.257	4.916	1.589
Ps90%/90% (-KTL) All GND'd		-1.021	-1.189	-2.296	-3.561	-3.690	-2.141
Biased Irradiation Statistics							
Average Biased		-0.504	-0.545	0.012	0.283	-0.085	0.203
Std Dev Biased		0.320	0.193	0.272	0.770	1.015	0.774
Ps90%/90% (+KTL) Biased		0.374	-0.015	0.757	2.394	2.697	2.325
Ps90%/90% (-KTL) Biased		-1.382	-1.074	-0.734	-1.828	-2.867	-1.920
Specification MIN		-4.0	-4.5	-4.5	-4.5	-4.5	-4.5
Status (Measurements) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (Measurements) Biased		PASS	PASS	PASS	PASS	PASS	PASS
Specification MAX		4.0	4.5	4.5	4.5	4.5	4.5
Status (Measurements) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (Measurements) Biased		PASS	PASS	PASS	PASS	PASS	PASS
Status (-KTL) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (+KTL) All GND'd		PASS	PASS	PASS	PASS	FAIL	PASS
Status (-KTL) Biased		PASS	PASS	PASS	PASS	PASS	PASS
Status (+KTL) Biased		PASS	PASS	PASS	PASS	PASS	PASS

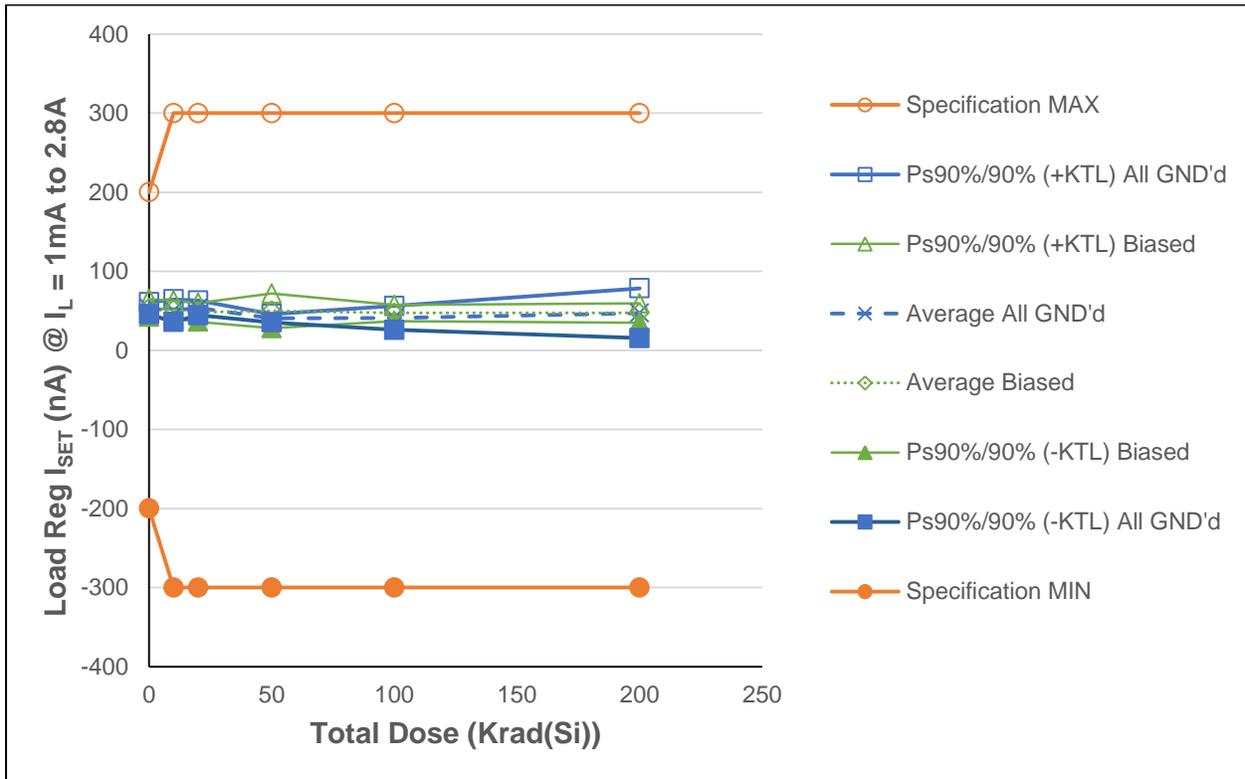


Figure 5.3: Plot of Load Regulation I_{SET} versus Total Dose

All measured post-irradiation data points are within the datasheet specification limits.

Table 5.3: Raw data for Load Regulation I_{SET} versus total dose including the statistical calculations, minimum specification, maximum specification, and the status of the test (PASS/FAIL).

Parameter Units	Load Reg I _{SET} @ I _L = 1mA to 2.8A (nA)	Total Dose (Krad(Si)) @ 50 rads(Si)/s					
		0	10	20	50	100	200
6	All GND'd Irradiation	52.867	57.567				
7	All GND'd Irradiation	57.611	49.986				
8	All GND'd Irradiation	51.441	49.797				
9	All GND'd Irradiation	53.333	50.029				
10	All GND'd Irradiation	50.451	42.826				
1	Biased Irradiation	49.840	50.990				
2	Biased Irradiation	53.318	50.670				
3	Biased Irradiation	59.226	48.298				
4	Biased Irradiation	49.768	49.244				
5	Biased Irradiation	55.908	58.644				
16	All GND'd Irradiation	54.162		44.063			
17	All GND'd Irradiation	54.162		47.716			
18	All GND'd Irradiation	59.415		53.202			
19	All GND'd Irradiation	61.671		66.182			
20	All GND'd Irradiation	55.719		57.466			
11	Biased Irradiation	58.833		55.312			
12	Biased Irradiation	50.160		44.034			
13	Biased Irradiation	50.568		46.479			
14	Biased Irradiation	59.998		46.173			
15	Biased Irradiation	42.754		48.472			
26	All GND'd Irradiation	54.832			40.367		
27	All GND'd Irradiation	57.014			41.488		
28	All GND'd Irradiation	54.890			42.812		
29	All GND'd Irradiation	53.362			40.964		
30	All GND'd Irradiation	56.389			37.689		
21	Biased Irradiation	56.025			62.544		
22	Biased Irradiation	42.142			45.664		
23	Biased Irradiation	56.476			42.332		
24	Biased Irradiation	50.786			52.372		
25	Biased Irradiation	53.667			46.057		
36	All GND'd Irradiation	58.266				47.075	
37	All GND'd Irradiation	55.341				40.891	
38	All GND'd Irradiation	54.453				40.789	
39	All GND'd Irradiation	53.740				43.961	
40	All GND'd Irradiation	50.597				32.393	
31	Biased Irradiation	58.659				48.763	
32	Biased Irradiation	55.195				44.456	
33	Biased Irradiation	57.596				51.892	
34	Biased Irradiation	48.574				42.608	
35	Biased Irradiation	49.171				48.298	
46	All GND'd Irradiation	53.071					43.045
47	All GND'd Irradiation	56.389					58.921
48	All GND'd Irradiation	55.894					53.333
49	All GND'd Irradiation	32.960					29.118
50	All GND'd Irradiation	54.279					50.422
41	Biased Irradiation	58.440					54.308
42	Biased Irradiation	53.813					44.645
43	Biased Irradiation	57.698					45.417
44	Biased Irradiation	59.692					43.161
45	Biased Irradiation	54.468					48.574
51	Control Unit	57.291	57.291	57.291	57.291	57.291	57.291
52	Control Unit	49.680	49.680	49.680	49.680	49.680	49.680
All GND'd Irradiation Statistics							
Average All GND'd		53.141	50.041	53.726	40.664	41.022	46.968
Std Dev All GND'd		2.748	5.214	3.369	1.892	5.473	11.503
Ps90%/90% (+KTL) All GND'd		60.677	64.339	62.963	45.851	56.029	78.510
Ps90%/90% (-KTL) All GND'd		45.604	35.743	44.488	35.476	26.014	15.425
Biased Irradiation Statistics							
Average Biased		53.612	51.569	48.094	49.794	47.204	47.221
Std Dev Biased		4.059	4.102	4.331	7.999	3.684	4.428
Ps90%/90% (+KTL) Biased		64.741	62.817	59.969	71.727	57.304	59.362
Ps90%/90% (-KTL) Biased		42.484	40.321	36.219	27.861	37.103	35.079
Specification MIN		-200	-300	-300	-300	-300	-300
Status (Measurements) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (Measurements) Biased		PASS	PASS	PASS	PASS	PASS	PASS
Specification MAX		200	300	300	300	300	300
Status (Measurements) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (Measurements) Biased		PASS	PASS	PASS	PASS	PASS	PASS
Status (-KTL) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (+KTL) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (-KTL) Biased		PASS	PASS	PASS	PASS	PASS	PASS
Status (+KTL) Biased		PASS	PASS	PASS	PASS	PASS	PASS

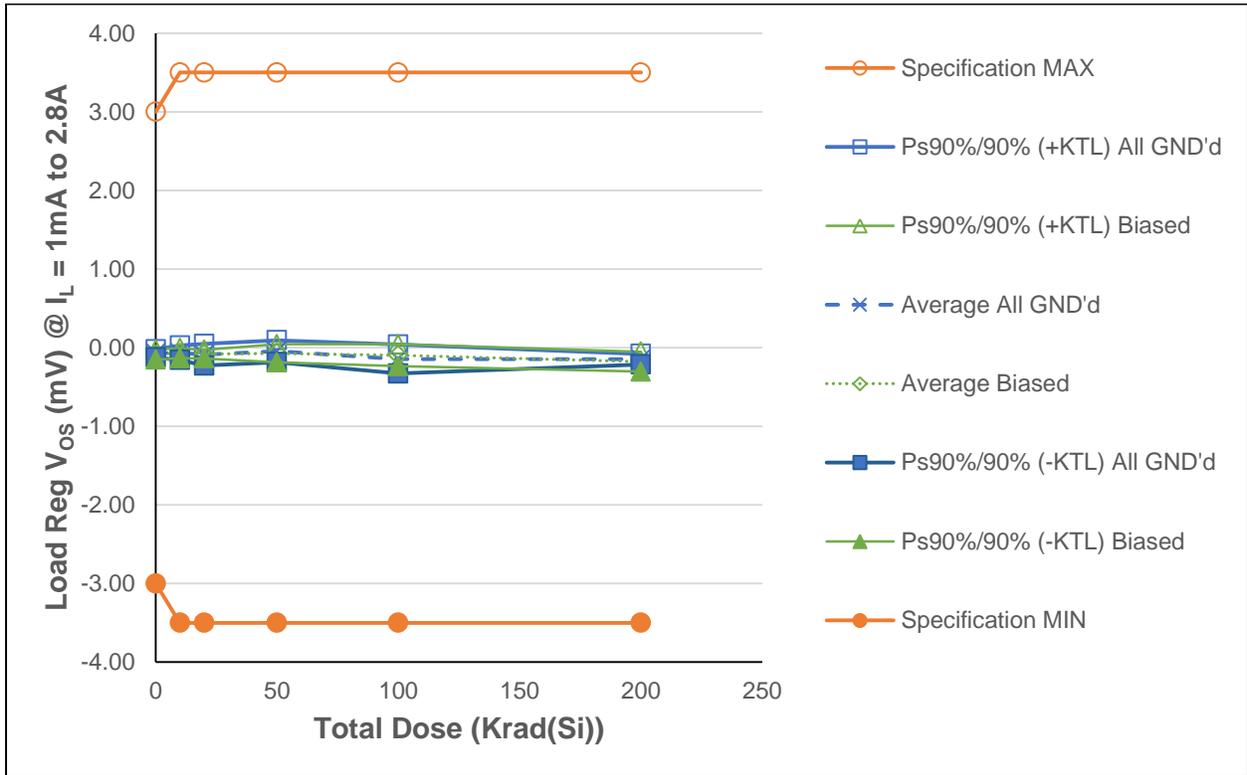


Figure 5.4: Plot of Load Regulation V_{os} versus Total Dose

All measured data points are within datasheet specification limits.

Table 5.4: Raw data for load regulation V_{OS} versus total dose including the statistical calculations, minimum specification, maximum specification, and the status of the test (PASS/FAIL).

Parameter Units	Load Reg V_{OS} @ $I_L=1mA$ to 2.8A (mV)	Total Dose (Krad(Si)) @ 50 rads(Si)/s					
		0	10	20	50	100	200
6	All GND'd Irradiation	-0.1036	-0.1077				
7	All GND'd Irradiation	-0.0665	-0.0802				
8	All GND'd Irradiation	-0.0785	-0.0777				
9	All GND'd Irradiation	-0.0573	-0.0326				
10	All GND'd Irradiation	-0.0599	-0.0288				
1	Biased Irradiation	-0.1066	-0.0915				
2	Biased Irradiation	-0.1201	-0.0994				
3	Biased Irradiation	-0.0659	-0.0599				
4	Biased Irradiation	-0.0693	-0.0464				
5	Biased Irradiation	-0.0881	-0.0585				
16	All GND'd Irradiation	-0.0852		-0.0956			
17	All GND'd Irradiation	-0.0564		-0.0542			
18	All GND'd Irradiation	-0.0499		-0.0432			
19	All GND'd Irradiation	-0.1553		-0.1199			
20	All GND'd Irradiation	-0.1492		-0.1420			
11	Biased Irradiation	-0.1294		-0.1133			
12	Biased Irradiation	-0.0924		-0.0883			
13	Biased Irradiation	-0.0867		-0.0796			
14	Biased Irradiation	-0.0740		-0.0589			
15	Biased Irradiation	-0.0913		-0.0762			
26	All GND'd Irradiation	-0.1197			-0.0974		
27	All GND'd Irradiation	-0.0604			-0.0466		
28	All GND'd Irradiation	-0.0006			0.0153		
29	All GND'd Irradiation	-0.0024			-0.0067		
30	All GND'd Irradiation	-0.0939			-0.0954		
21	Biased Irradiation	-0.0268			-0.0323		
22	Biased Irradiation	-0.0511			-0.0690		
23	Biased Irradiation	-0.0739			-0.0583		
24	Biased Irradiation	-0.0669			-0.0575		
25	Biased Irradiation	-0.1548			-0.1435		
36	All GND'd Irradiation	-0.0662				-0.0882	
37	All GND'd Irradiation	-0.1141				-0.1160	
38	All GND'd Irradiation	-0.1560				-0.1739	
39	All GND'd Irradiation	-0.2106				-0.2491	
40	All GND'd Irradiation	-0.0644				-0.0973	
31	Biased Irradiation	-0.1249				-0.1308	
32	Biased Irradiation	-0.0769				-0.0912	
33	Biased Irradiation	0.0030				-0.0100	
34	Biased Irradiation	-0.0851				-0.1294	
35	Biased Irradiation	-0.0732				-0.1200	
46	All GND'd Irradiation	-0.0674					-0.1280
47	All GND'd Irradiation	-0.0843					-0.1360
48	All GND'd Irradiation	-0.0719					-0.1438
49	All GND'd Irradiation	-0.0503					-0.1382
50	All GND'd Irradiation	-0.1330					-0.1894
41	Biased Irradiation	-0.0421					-0.1208
42	Biased Irradiation	-0.1234					-0.2045
43	Biased Irradiation	-0.1627					-0.2421
44	Biased Irradiation	-0.0842					-0.1624
45	Biased Irradiation	-0.0929					-0.1641
51	Control Unit	-0.1151	-0.1151	-0.1151	-0.1151	-0.1151	-0.1151
52	Control Unit	-0.0756	-0.0756	-0.0756	-0.0756	-0.0756	-0.0756
All GND'd Irradiation Statistics							
Average All GND'd		-0.0732	-0.0654	-0.0910	-0.0462	-0.1449	-0.1471
Std Dev All GND'd		0.0189	0.0338	0.0503	0.0509	0.0671	0.0243
Ps90%/90% (+KTL) All GND'd		-0.0214	0.0273	0.0468	0.0935	0.0391	-0.0803
Ps90%/90% (-KTL) All GND'd		-0.1250	-0.1581	-0.2288	-0.1858	-0.3289	-0.2138
Biased Irradiation Statistics							
Average Biased		-0.0900	-0.0712	-0.0832	-0.0721	-0.0963	-0.1788
Std Dev Biased		0.0234	0.0230	0.0199	0.0421	0.0508	0.0461
Ps90%/90% (+KTL) Biased		-0.0258	-0.0081	-0.0287	0.0433	0.0430	-0.0523
Ps90%/90% (-KTL) Biased		-0.1542	-0.1342	-0.1378	-0.1876	-0.2356	-0.3053
Specification MIN		-3.0	-3.5	-3.5	-3.5	-3.5	-3.5
Status (Measurements) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (Measurements) Biased		PASS	PASS	PASS	PASS	PASS	PASS
Specification MAX		3.0	3.5	3.5	3.5	3.5	3.5
Status (Measurements) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (Measurements) Biased		PASS	PASS	PASS	PASS	PASS	PASS
Status (-KTL) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (+KTL) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (-KTL) Biased		PASS	PASS	PASS	PASS	PASS	PASS
Status (+KTL) Biased		PASS	PASS	PASS	PASS	PASS	PASS

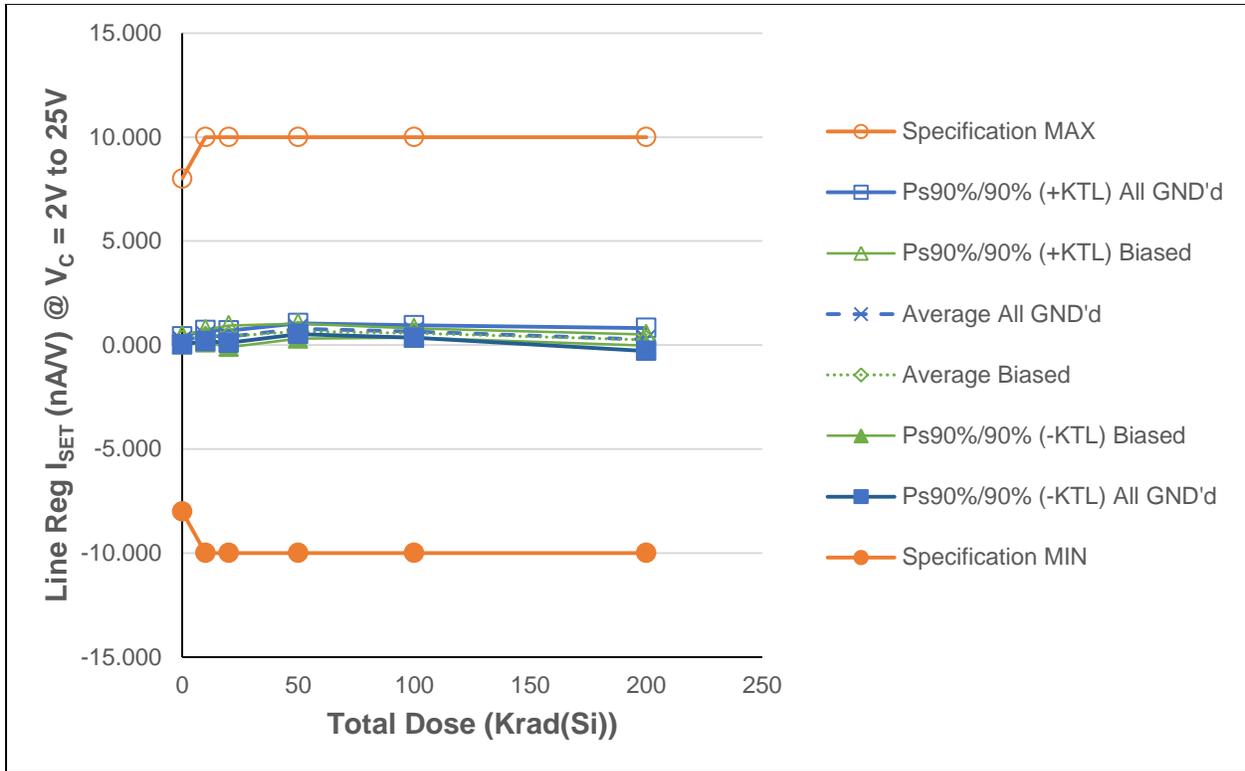


Figure 5.5: Plot of Line Regulation I_{SET} versus Total Dose

The measured post-irradiation average data points are within datasheet specification limits.

Table 5.5: Raw data for line regulation I_{SET} versus total dose including the statistical calculations, minimum specification, maximum specification, and the status of the test (PASS/FAIL)

Parameter	Line Reg I_{SET} @ $V_C = 2V$ to $25V$	Total Dose (Krad(Si)) @ 50 rads(Si)/s					
		Units (nA/V)					
		0	10	20	50	100	200
6	All GND'd Irradiation	0.268	0.500				
7	All GND'd Irradiation	0.150	0.283				
8	All GND'd Irradiation	0.239	0.459				
9	All GND'd Irradiation	0.135	0.497				
10	All GND'd Irradiation	0.285	0.521				
1	Biased Irradiation	0.245	0.371				
2	Biased Irradiation	0.111	0.443				
3	Biased Irradiation	0.270	0.493				
4	Biased Irradiation	0.279	0.570				
5	Biased Irradiation	0.308	0.273				
16	All GND'd Irradiation	0.061		0.379			
17	All GND'd Irradiation	0.251		0.552			
18	All GND'd Irradiation	0.198		0.455			
19	All GND'd Irradiation	0.355		0.264			
20	All GND'd Irradiation	0.185		0.344			
11	Biased Irradiation	0.227		0.335			
12	Biased Irradiation	0.150		0.341			
13	Biased Irradiation	0.164		0.495			
14	Biased Irradiation	0.268		0.704			
15	Biased Irradiation	0.190		0.209			
26	All GND'd Irradiation	0.251			0.891		
27	All GND'd Irradiation	0.330			0.867		
28	All GND'd Irradiation	0.178			0.740		
29	All GND'd Irradiation	0.283			0.774		
30	All GND'd Irradiation	0.269			0.662		
21	Biased Irradiation	0.283			0.514		
22	Biased Irradiation	0.302			0.863		
23	Biased Irradiation	0.241			0.722		
24	Biased Irradiation	0.292			0.609		
25	Biased Irradiation	0.382			0.632		
36	All GND'd Irradiation	0.271				0.642	
37	All GND'd Irradiation	0.150				0.509	
38	All GND'd Irradiation	0.283				0.599	
39	All GND'd Irradiation	0.232				0.681	
40	All GND'd Irradiation	0.195				0.805	
31	Biased Irradiation	0.171				0.448	
32	Biased Irradiation	0.301				0.574	
33	Biased Irradiation	0.357				0.677	
34	Biased Irradiation	0.227				0.583	
35	Biased Irradiation	0.281				0.588	
46	All GND'd Irradiation	0.185					0.613
47	All GND'd Irradiation	0.238					0.164
48	All GND'd Irradiation	0.251					0.200
49	All GND'd Irradiation	0.267					0.105
50	All GND'd Irradiation	0.302					0.260
41	Biased Irradiation	0.330					0.320
42	Biased Irradiation	0.265					0.123
43	Biased Irradiation	0.338					0.188
44	Biased Irradiation	0.178					0.361
45	Biased Irradiation	0.356					0.229
51	Control Unit	0.296	0.296	0.296	0.296	0.296	0.296
52	Control Unit	0.226	0.226	0.226	0.226	0.226	0.226
All GND'd Irradiation Statistics							
Average All GND'd		0.216	0.452	0.399	0.787	0.647	0.269
Std Dev All GND'd		0.069	0.097	0.107	0.094	0.109	0.201
Ps90%/90% (+KTL) All GND'd		0.404	0.718	0.691	1.045	0.947	0.819
Ps90%/90% (-KTL) All GND'd		0.027	0.186	0.106	0.529	0.348	-0.282
Biased Irradiation Statistics							
Average Biased		0.243	0.430	0.417	0.668	0.574	0.244
Std Dev Biased		0.077	0.114	0.190	0.132	0.082	0.097
Ps90%/90% (+KTL) Biased		0.454	0.742	0.938	1.029	0.798	0.510
Ps90%/90% (-KTL) Biased		0.031	0.118	-0.104	0.306	0.350	-0.022
Specification MIN		-8	-10	-10	-10	-10	-10
Status (Measurements) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (Measurements) Biased		PASS	PASS	PASS	PASS	PASS	PASS
Specification MAX		8	10	10	10	10	10
Status (Measurements) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (Measurements) Biased		PASS	PASS	PASS	PASS	PASS	PASS
Status (-KTL) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (+KTL) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (-KTL) Biased		PASS	PASS	PASS	PASS	PASS	PASS
Status (+KTL) Biased		PASS	PASS	PASS	PASS	PASS	PASS

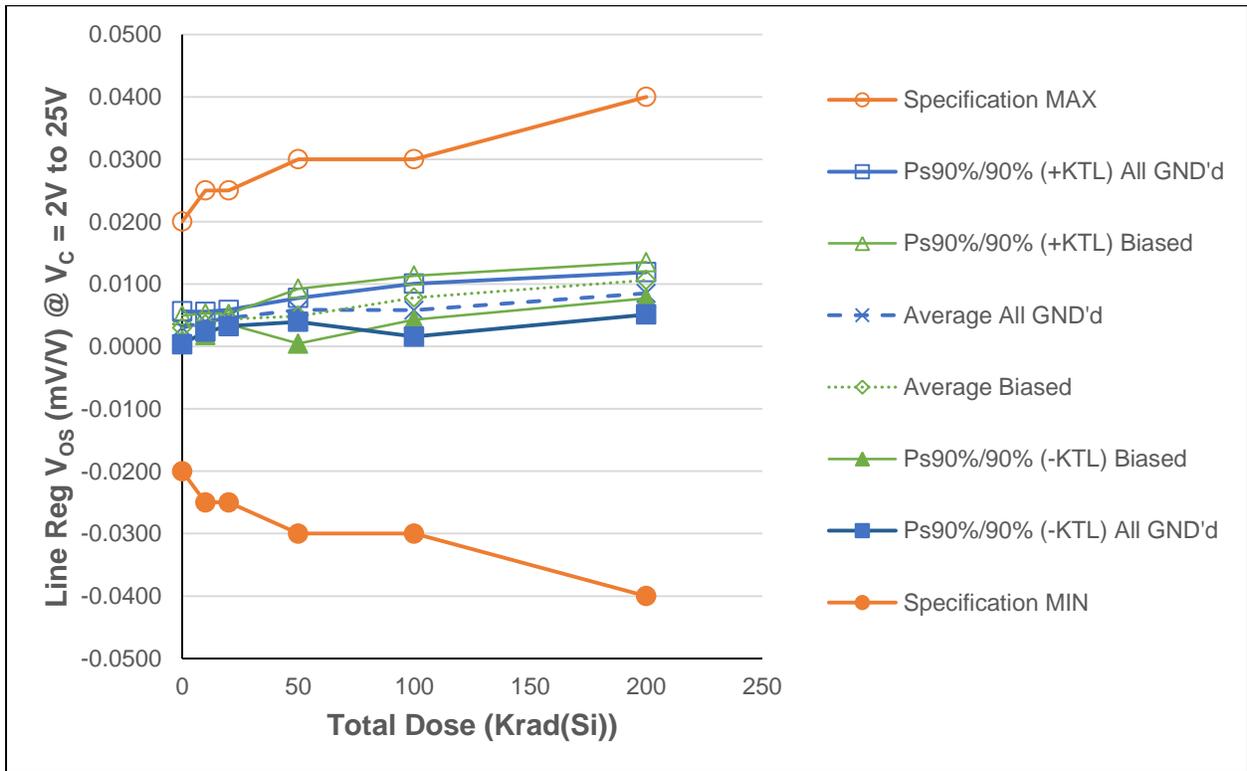


Figure 5.6: Plot of Line Regulation V_{OS} versus Total Dose

All measured average data points are within datasheet specification limits.

Table 5.6: Raw data for line regulation V_{OS} versus total dose including the statistical calculations, minimum specification, maximum specification, and the status of the test (PASS/FAIL)

Parameter Units	Line Reg V_{OS} @ $V_C = 2V$ to $25V$ (mV)	Total Dose (Krad(Si)) @ 50 rads(Si)/s					
		0	10	20	50	100	200
6	All GND'd Irradiation	0.0018	0.0030				
7	All GND'd Irradiation	0.0026	0.0039				
8	All GND'd Irradiation	0.0027	0.0041				
9	All GND'd Irradiation	0.0043	0.0046				
10	All GND'd Irradiation	0.0036	0.0042				
1	Biased Irradiation	0.0039	0.0044				
2	Biased Irradiation	0.0019	0.0029				
3	Biased Irradiation	0.0028	0.0040				
4	Biased Irradiation	0.0032	0.0030				
5	Biased Irradiation	0.0031	0.0035				
16	All GND'd Irradiation	0.0025		0.0058			
17	All GND'd Irradiation	0.0029		0.0046			
18	All GND'd Irradiation	0.0026		0.0045			
19	All GND'd Irradiation	0.0036		0.0049			
20	All GND'd Irradiation	0.0024		0.0030			
11	Biased Irradiation	0.0027		0.0046			
12	Biased Irradiation	0.0027		0.0043			
13	Biased Irradiation	0.0028		0.0040			
14	Biased Irradiation	0.0030		0.0045			
15	Biased Irradiation	0.0034		0.0047			
26	All GND'd Irradiation	0.0027			0.0048		
27	All GND'd Irradiation	0.0040			0.0057		
28	All GND'd Irradiation	0.0047			0.0061		
29	All GND'd Irradiation	0.0032			0.0067		
30	All GND'd Irradiation	0.0029			0.0060		
21	Biased Irradiation	0.0039			0.0067		
22	Biased Irradiation	0.0027			0.0033		
23	Biased Irradiation	0.0026			0.0050		
24	Biased Irradiation	0.0040			0.0061		
25	Biased Irradiation	0.0019			0.0032		
36	All GND'd Irradiation	0.0021				0.0064	
37	All GND'd Irradiation	0.0025				0.0058	
38	All GND'd Irradiation	0.0020				0.0064	
39	All GND'd Irradiation	0.0018				0.0032	
40	All GND'd Irradiation	0.0036				0.0073	
31	Biased Irradiation	0.0028				0.0063	
32	Biased Irradiation	0.0031				0.0074	
33	Biased Irradiation	0.0045				0.0094	
34	Biased Irradiation	0.0036				0.0071	
35	Biased Irradiation	0.0026				0.0089	
46	All GND'd Irradiation	0.0034					0.0092
47	All GND'd Irradiation	0.0034					0.0080
48	All GND'd Irradiation	0.0027					0.0103
49	All GND'd Irradiation	0.0017					0.0081
50	All GND'd Irradiation	0.0019					0.0071
41	Biased Irradiation	0.0039					0.0116
42	Biased Irradiation	0.0032					0.0115
43	Biased Irradiation	0.0015					0.0089
44	Biased Irradiation	0.0034					0.0106
45	Biased Irradiation	0.0029					0.0105
51	Control Unit	0.0032	0.0032	0.0032	0.0032	0.0032	0.0032
52	Control Unit	0.0033	0.0033	0.0033	0.0033	0.0033	0.0033
All GND'd Irradiation Statistics							
Average All GND'd		0.0030	0.0040	0.0046	0.0058	0.0058	0.0085
Std Dev All GND'd		0.0010	0.0006	0.0005	0.0007	0.0016	0.0012
Ps90%/90% (+KTL) All GND'd		0.0056	0.0056	0.0059	0.0078	0.0101	0.0119
Ps90%/90% (-KTL) All GND'd		0.0003	0.0024	0.0033	0.0039	0.0016	0.0051
Biased Irradiation Statistics							
Average Biased		0.0030	0.0036	0.0044	0.0049	0.0078	0.0106
Std Dev Biased		0.0007	0.0006	0.0003	0.0016	0.0013	0.0011
Ps90%/90% (+KTL) Biased		0.0050	0.0053	0.0052	0.0093	0.0113	0.0135
Ps90%/90% (-KTL) Biased		0.0010	0.0018	0.0036	0.0004	0.0043	0.0077
Specification MIN		-0.020	-0.025	-0.025	-0.025	-0.030	-0.040
Status (Measurements) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (Measurements) Biased		PASS	PASS	PASS	PASS	PASS	PASS
Specification MAX		0.020	0.025	0.025	0.025	0.030	0.040
Status (Measurements) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (Measurements) Biased		PASS	PASS	PASS	PASS	PASS	PASS
Status (-KTL) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (+KTL) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (-KTL) Biased		PASS	PASS	PASS	PASS	PASS	PASS
Status (+KTL) Biased		PASS	PASS	PASS	PASS	PASS	PASS

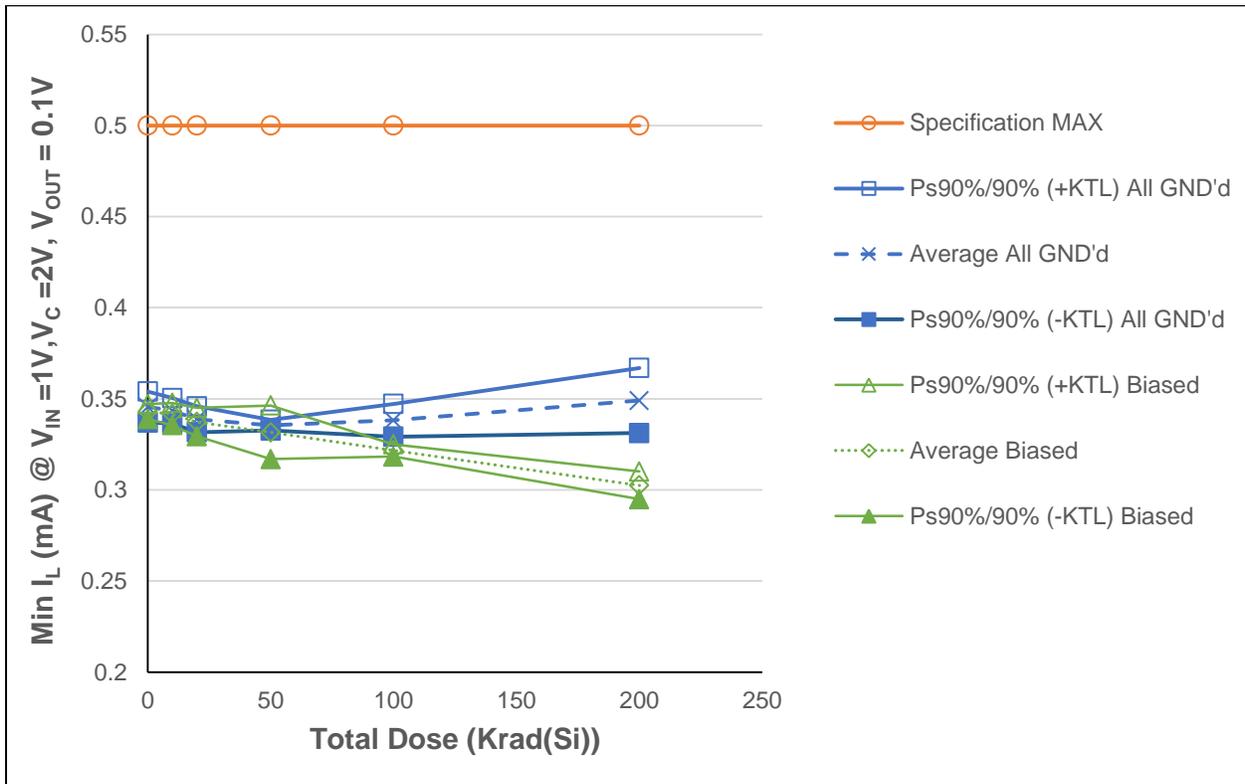


Figure 5.7: Plot of Minimum Load Current (@ $V_{IN} = 1V$) versus Total Dose

The average measured values of all samples pass the datasheet specification maximum limit.

Table 5.7: Raw data table for minimum load current (@ $V_{IN} = 1V$) versus total dose including the statistical calculations, maximum specification, and the status of the test (PASS/FAIL)

Parameter Units	Min I_L @ $V_{IN}=1V, V_C=2V, V_{OUT}=0.1V$ (mA)	Total Dose (Krad(Si)) @ 50 rads(Si)/s					
		0	10	20	50	100	200
6	All GND'd Irradiation	0.347	0.346				
7	All GND'd Irradiation	0.343	0.341				
8	All GND'd Irradiation	0.347	0.344				
9	All GND'd Irradiation	0.341	0.340				
10	All GND'd Irradiation	0.349	0.345				
1	Biased Irradiation	0.343	0.343				
2	Biased Irradiation	0.341	0.339				
3	Biased Irradiation	0.343	0.342				
4	Biased Irradiation	0.344	0.344				
5	Biased Irradiation	0.344	0.340				
16	All GND'd Irradiation	0.343		0.342			
17	All GND'd Irradiation	0.342		0.341			
18	All GND'd Irradiation	0.341		0.337			
19	All GND'd Irradiation	0.344		0.339			
20	All GND'd Irradiation	0.337		0.334			
11	Biased Irradiation	-0.343		0.339			
12	Biased Irradiation	0.341		0.336			
13	Biased Irradiation	0.339		0.333			
14	Biased Irradiation	0.346		0.341			
15	Biased Irradiation	0.342		0.337			
26	All GND'd Irradiation	0.341			0.337		
27	All GND'd Irradiation	0.341			0.335		
28	All GND'd Irradiation	0.339			0.334		
29	All GND'd Irradiation	0.340			0.335		
30	All GND'd Irradiation	0.342			0.336		
21	Biased Irradiation	0.342			0.332		
22	Biased Irradiation	0.340			0.341		
23	Biased Irradiation	0.341			0.329		
24	Biased Irradiation	0.339			0.329		
25	Biased Irradiation	0.340			0.327		
36	All GND'd Irradiation	0.341				0.336	
37	All GND'd Irradiation	0.340				0.334	
38	All GND'd Irradiation	0.344				0.340	
39	All GND'd Irradiation	0.347				0.343	
40	All GND'd Irradiation	0.341				0.338	
31	Biased Irradiation	0.339				0.320	
32	Biased Irradiation	0.345				0.323	
33	Biased Irradiation	0.341				0.321	
34	Biased Irradiation	0.340				0.322	
35	Biased Irradiation	0.344				0.323	
46	All GND'd Irradiation	0.349					0.359
47	All GND'd Irradiation	0.341					0.344
48	All GND'd Irradiation	0.339					0.348
49	All GND'd Irradiation	0.346					0.351
50	All GND'd Irradiation	0.346					0.343
41	Biased Irradiation	0.343					0.300
42	Biased Irradiation	0.348					0.306
43	Biased Irradiation	0.347					0.305
44	Biased Irradiation	0.343					0.302
45	Biased Irradiation	0.345					0.300
51	Control Unit	0.348	0.348	0.348	0.348	0.348	0.348
52	Control Unit	0.341	0.341	0.341	0.341	0.341	0.341
	All GND'd Irradiation Statistics						
	Average All GND'd	0.346	0.343	0.339	0.336	0.338	0.349
	Std Dev All GND'd	0.003	0.003	0.003	0.001	0.003	0.007
	Ps90%/90% (+KTL) All GND'd	0.354	0.350	0.346	0.338	0.347	0.367
	Ps90%/90% (-KTL) All GND'd	0.337	0.336	0.332	0.333	0.329	0.331
	Biased Irradiation Statistics						
	Average Biased	0.343	0.342	0.337	0.332	0.322	0.302
	Std Dev Biased	0.001	0.002	0.003	0.005	0.001	0.003
	Ps90%/90% (+KTL) Biased	0.347	0.348	0.345	0.346	0.325	0.310
	Ps90%/90% (-KTL) Biased	0.339	0.336	0.330	0.317	0.318	0.295
	Specification MIN						
	Status (Measurements) All GND'd						
	Status (Measurements) Biased						
	Specification MAX	0.5	0.5	0.5	0.5	0.5	0.5
	Status (Measurements) All GND'd	PASS	PASS	PASS	PASS	PASS	PASS
	Status (Measurements) Biased	PASS	PASS	PASS	PASS	PASS	PASS
	Status (-KTL) All GND'd						
	Status (+KTL) All GND'd	PASS	PASS	PASS	PASS	PASS	PASS
	Status (-KTL) Biased						
	Status (+KTL) Biased	PASS	PASS	PASS	PASS	PASS	PASS

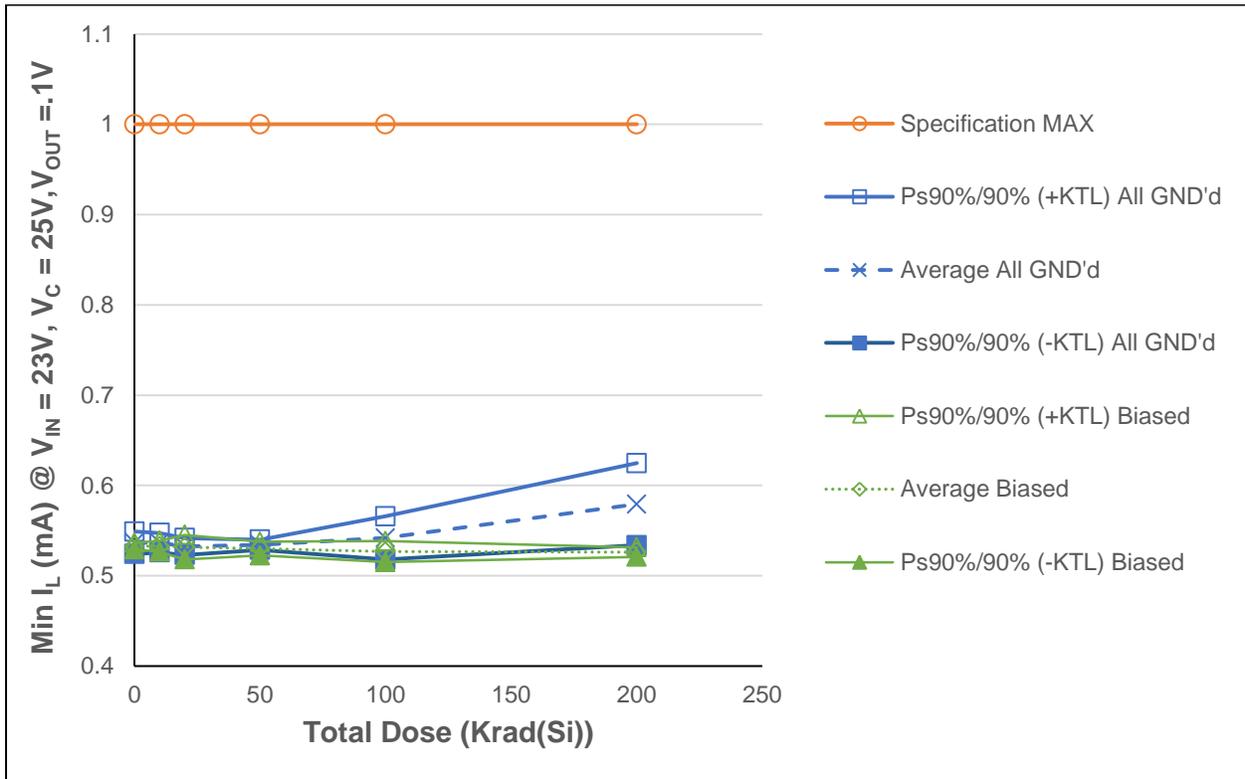


Figure 5.8: Plot of Minimum Load Current (@ $V_{IN} = 23V$) versus Total Dose

The average measured values of samples are within the datasheet maximum limit.

Table 5.8: Raw data table for minimum I_L (@ $V_{IN} = 23V$) versus total dose including the statistical calculations, maximum specification, and the status of the test (PASS/FAIL)

Parameter	Min I_L @ $V_{IN}=23V, V_C=25V, V_{OUT}=1V$	Total Dose (Krad(Si)) @ 50 rads(Si)/s					
Units	(mA)	0	10	20	50	100	200
6	All GND'd Irradiation	0.537	0.536				
7	All GND'd Irradiation	0.532	0.533				
8	All GND'd Irradiation	0.537	0.536				
9	All GND'd Irradiation	0.533	0.535				
10	All GND'd Irradiation	0.543	0.543				
1	Biased Irradiation	0.532	0.533				
2	Biased Irradiation	0.532	0.531				
3	Biased Irradiation	0.533	0.532				
4	Biased Irradiation	0.535	0.536				
5	Biased Irradiation	0.533	0.532				
16	All GND'd Irradiation	0.536		0.538			
17	All GND'd Irradiation	0.531		0.531			
18	All GND'd Irradiation	0.531		0.531			
19	All GND'd Irradiation	0.533		0.533			
20	All GND'd Irradiation	0.527		0.528			
11	Biased Irradiation	0.535		0.535			
12	Biased Irradiation	0.533		0.532			
13	Biased Irradiation	0.528		0.525			
14	Biased Irradiation	0.539		0.537			
15	Biased Irradiation	0.530		0.528			
26	All GND'd Irradiation	0.535			0.535		
27	All GND'd Irradiation	0.531			0.533		
28	All GND'd Irradiation	0.530			0.533		
29	All GND'd Irradiation	0.536			0.538		
30	All GND'd Irradiation	0.531			0.533		
21	Biased Irradiation	0.534			0.530		
22	Biased Irradiation	0.530			0.534		
23	Biased Irradiation	0.534			0.530		
24	Biased Irradiation	0.530			0.526		
25	Biased Irradiation	0.531			0.530		
36	All GND'd Irradiation	0.530				0.536	
37	All GND'd Irradiation	0.527				0.531	
38	All GND'd Irradiation	0.541				0.550	
39	All GND'd Irradiation	0.540				0.550	
40	All GND'd Irradiation	0.534				0.543	
31	Biased Irradiation	0.527				0.520	
32	Biased Irradiation	0.537				0.532	
33	Biased Irradiation	0.534				0.528	
34	Biased Irradiation	0.534				0.527	
35	Biased Irradiation	0.533				0.526	
46	All GND'd Irradiation	0.545					0.601
47	All GND'd Irradiation	0.535					0.565
48	All GND'd Irradiation	0.536					0.582
49	All GND'd Irradiation	0.541					0.587
50	All GND'd Irradiation	0.537					0.560
41	Biased Irradiation	0.540					0.526
42	Biased Irradiation	0.543					0.528
43	Biased Irradiation	0.542					0.527
44	Biased Irradiation	0.537					0.523
45	Biased Irradiation	0.541					0.526
51	Control Unit	0.540	0.540	0.540	0.540	0.540	0.540
52	Control Unit	0.534	0.534	0.534	0.534	0.534	0.534
All GND'd Irradiation Statistics							
Average All GND'd		0.536	0.537	0.532	0.534	0.542	0.579
Std Dev All GND'd		0.005	0.004	0.003	0.002	0.009	0.017
Ps90%/90% (+KTL) All GND'd		0.549	0.547	0.542	0.540	0.566	0.625
Ps90%/90% (-KTL) All GND'd		0.524	0.526	0.523	0.529	0.518	0.534
Biased Irradiation Statistics							
Average Biased		0.533	0.533	0.532	0.530	0.527	0.526
Std Dev Biased		0.001	0.002	0.005	0.003	0.004	0.002
Ps90%/90% (+KTL) Biased		0.536	0.539	0.545	0.538	0.538	0.531
Ps90%/90% (-KTL) Biased		0.529	0.526	0.518	0.522	0.515	0.521
Specification MIN							
Status (Measurements) All GND'd							
Status (Measurements) Biased							
Specification MAX							
Status (Measurements) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (Measurements) Biased		PASS	PASS	PASS	PASS	PASS	PASS
Status (-KTL) All GND'd							
Status (+KTL) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (-KTL) Biased							
Status (+KTL) Biased		PASS	PASS	PASS	PASS	PASS	PASS

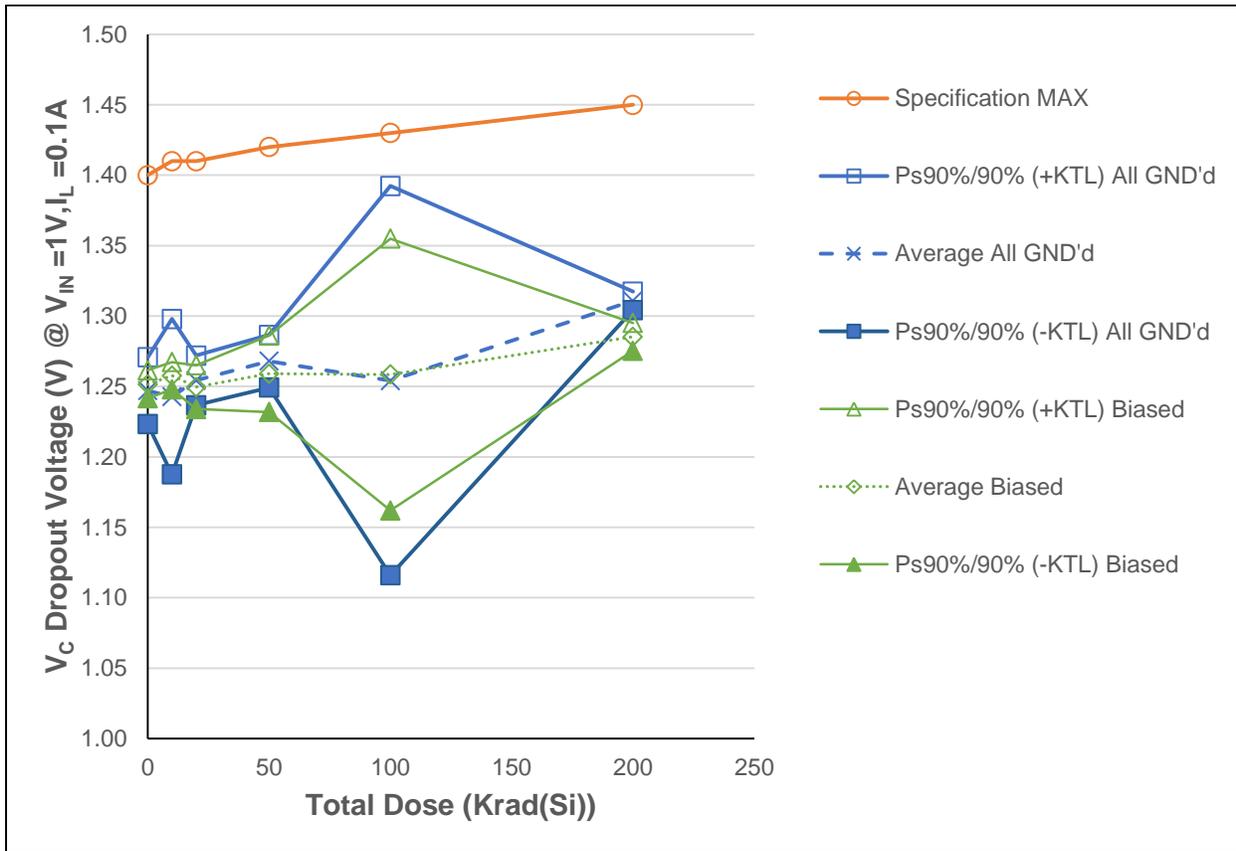


Figure 5.9: Plot of $V_{CONTROL}$ Dropout Voltage (@ $I_L = 0.1A$) versus Total Dose

The average measured values are within datasheet specification maximum limit.

Table 5.9: Raw data table for $V_{CONTROL}$ dropout voltage ($I_L = 0.1A$) versus total dose including the statistical calculations, maximum specification, and the status of the test (PASS/FAIL)

Parameter	V_C Dropout (V) @ $V_{IN} = 1V, I_L = 0.1A$	Total Dose (Krad(Si)) @ 50 rads(Si)/s					
Units	(V)	0	10	20	50	100	200
6	All GND'd Irradiation	1.255	1.259				
7	All GND'd Irradiation	1.251	1.211				
8	All GND'd Irradiation	1.253	1.260				
9	All GND'd Irradiation	1.241	1.245				
10	All GND'd Irradiation	1.235	1.239				
1	Biased Irradiation	1.254	1.259				
2	Biased Irradiation	1.246	1.254				
3	Biased Irradiation	1.251	1.257				
4	Biased Irradiation	1.255	1.263				
5	Biased Irradiation	1.251	1.256				
16	All GND'd Irradiation	1.237		1.250			
17	All GND'd Irradiation	1.253		1.263			
18	All GND'd Irradiation	1.237		1.248			
19	All GND'd Irradiation	1.246		1.259			
20	All GND'd Irradiation	1.244		1.252			
11	Biased Irradiation	1.235		1.246			
12	Biased Irradiation	1.232		1.243			
13	Biased Irradiation	1.247		1.256			
14	Biased Irradiation	1.236		1.247			
15	Biased Irradiation	1.248		1.256			
26	All GND'd Irradiation	1.238			1.268		
27	All GND'd Irradiation	1.251			1.272		
28	All GND'd Irradiation	1.247			1.272		
29	All GND'd Irradiation	1.232			1.256		
30	All GND'd Irradiation	1.246			1.272		
21	Biased Irradiation	1.237			1.266		
22	Biased Irradiation	1.243			1.243		
23	Biased Irradiation	1.238			1.262		
24	Biased Irradiation	1.241			1.266		
25	Biased Irradiation	1.232			1.258		
36	All GND'd Irradiation	1.248				1.290	
37	All GND'd Irradiation	1.246				1.294	
38	All GND'd Irradiation	1.240				1.289	
39	All GND'd Irradiation	1.246				1.197	
40	All GND'd Irradiation	1.245				1.201	
31	Biased Irradiation	1.245				1.275	
32	Biased Irradiation	1.239				1.272	
33	Biased Irradiation	1.236				1.268	
34	Biased Irradiation	1.242				1.196	
35	Biased Irradiation	1.249				1.282	
46	All GND'd Irradiation	1.237					1.309
47	All GND'd Irradiation	1.236					1.310
48	All GND'd Irradiation	1.228					1.310
49	All GND'd Irradiation	1.233					1.311
50	All GND'd Irradiation	1.245					1.315
41	Biased Irradiation	1.234					1.280
42	Biased Irradiation	1.242					1.288
43	Biased Irradiation	1.243					1.288
44	Biased Irradiation	1.237					1.283
45	Biased Irradiation	1.238					1.287
51	Control Unit	1.245	1.245	1.245	1.245	1.245	1.245
52	Control Unit	1.235	1.235	1.235	1.235	1.235	1.235
All GND'd Irradiation Statistics							
Average All GND'd		1.247	1.243	1.254	1.268	1.254	1.311
Std Dev All GND'd		0.009	0.020	0.006	0.007	0.050	0.002
Ps90%/90% (+KTL) All GND'd		1.271	1.298	1.272	1.287	1.392	1.317
Ps90%/90% (-KTL) All GND'd		1.223	1.188	1.237	1.249	1.116	1.304
Biased Irradiation Statistics							
Average Biased		1.252	1.258	1.250	1.259	1.258	1.285
Std Dev Biased		0.004	0.004	0.006	0.010	0.035	0.004
Ps90%/90% (+KTL) Biased		1.262	1.267	1.265	1.286	1.355	1.295
Ps90%/90% (-KTL) Biased		1.242	1.248	1.234	1.232	1.162	1.275
Specification MIN							
Status (Measurements) All GND'd							
Status (Measurements) Biased							
Specification MAX							
Status (Measurements) All GND'd		1.40	1.41	1.41	1.42	1.43	1.45
Status (Measurements) Biased		PASS	PASS	PASS	PASS	PASS	PASS
Status (-KTL) All GND'd							
Status (+KTL) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (-KTL) Biased							
Status (+KTL) Biased		PASS	PASS	PASS	PASS	PASS	PASS

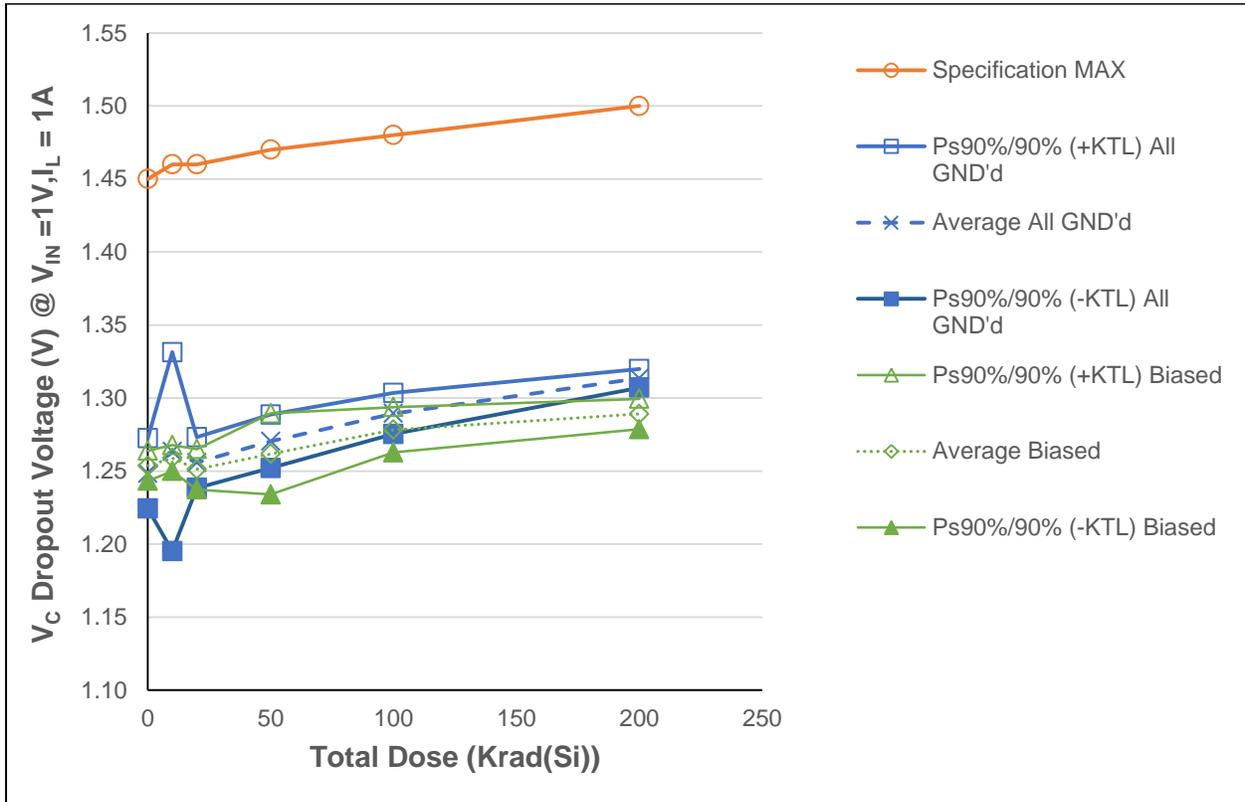


Figure 5.10: Plot of $V_{CONTROL}$ Dropout Voltage (@ $I_L = 1A$) versus Total Dose

The average measured values of samples are within datasheet limits.

Table 5.10: Raw data table for $V_{CONTROL}$ dropout voltage ($I_L = 1A$) versus total dose including the statistical calculations, maximum specification, and the status of the test (PASS/FAIL)

Parameter Units	V_C Dropout (V) @ $V_{IN} = 1V, I_L = 1A$ (V)	Total Dose (Krad(Si)) @ 50 rads(Si)/s					
		0	10	20	50	100	200
6	All GND'd Irradiation	1.2555	1.2619				
7	All GND'd Irradiation	1.2534	1.3046				
8	All GND'd Irradiation	1.2550	1.2618				
9	All GND'd Irradiation	1.2413	1.2471				
10	All GND'd Irradiation	1.2367	1.2410				
1	Biased Irradiation	1.2565	1.2601				
2	Biased Irradiation	1.2478	1.2559				
3	Biased Irradiation	1.2533	1.2573				
4	Biased Irradiation	1.2574	1.2640				
5	Biased Irradiation	1.2527	1.2572				
16	All GND'd Irradiation	1.2394		1.2513			
17	All GND'd Irradiation	1.2546		1.2649			
18	All GND'd Irradiation	1.2392		1.2501			
19	All GND'd Irradiation	1.2466		1.2596			
20	All GND'd Irradiation	1.2451		1.2532			
11	Biased Irradiation	1.2373		1.2487			
12	Biased Irradiation	1.2333		1.2455			
13	Biased Irradiation	1.2488		1.2566			
14	Biased Irradiation	1.2376		1.2485			
15	Biased Irradiation	1.2490		1.2564			
26	All GND'd Irradiation	1.2406			1.2703		
27	All GND'd Irradiation	1.2513			1.2746		
28	All GND'd Irradiation	1.2473			1.2741		
29	All GND'd Irradiation	1.2345			1.2588		
30	All GND'd Irradiation	1.2466			1.2740		
21	Biased Irradiation	1.2396			1.2689		
22	Biased Irradiation	1.2449			1.2447		
23	Biased Irradiation	1.2387			1.2652		
24	Biased Irradiation	1.2417			1.2691		
25	Biased Irradiation	1.2339			1.2609		
36	All GND'd Irradiation	1.2500				1.2923	
37	All GND'd Irradiation	1.2481				1.2950	
38	All GND'd Irradiation	1.2411				1.2904	
39	All GND'd Irradiation	1.2479				1.2815	
40	All GND'd Irradiation	1.2451				1.2880	
31	Biased Irradiation	1.2467				1.2784	
32	Biased Irradiation	1.2413				1.2747	
33	Biased Irradiation	1.2367				1.2709	
34	Biased Irradiation	1.2443				1.2825	
35	Biased Irradiation	1.2498				1.2849	
46	All GND'd Irradiation	1.2375					1.3112
47	All GND'd Irradiation	1.2370					1.3125
48	All GND'd Irradiation	1.2303					1.3129
49	All GND'd Irradiation	1.2350					1.3135
50	All GND'd Irradiation	1.2467					1.3174
41	Biased Irradiation	1.2364					1.2841
42	Biased Irradiation	1.2439					1.2928
43	Biased Irradiation	1.2456					1.2923
44	Biased Irradiation	1.2390					1.2863
45	Biased Irradiation	1.2399					1.2897
51	Control Unit	1.2460	1.2460	1.2460	1.2460	1.2460	1.2460
52	Control Unit	1.2370	1.2370	1.2370	1.2370	1.2370	1.2370
All GND'd Irradiation Statistics							
Average All GND'd		1.2484	1.2633	1.2558	1.2704	1.2894	1.3135
Std Dev All GND'd		0.0088	0.0248	0.0063	0.0067	0.0051	0.0023
Ps90%/90% (+KTL) All GND'd		1.2724	1.3314	1.2731	1.2887	1.3035	1.3199
Ps90%/90% (-KTL) All GND'd		1.2244	1.1952	1.2385	1.2521	1.2754	1.3071
Biased Irradiation Statistics							
Average Biased		1.2535	1.2589	1.2512	1.2618	1.2783	1.2891
Std Dev Biased		0.0038	0.0032	0.0050	0.0101	0.0057	0.0038
Ps90%/90% (+KTL) Biased		1.2639	1.2678	1.2650	1.2895	1.2938	1.2995
Ps90%/90% (-KTL) Biased		1.2432	1.2500	1.2373	1.2340	1.2627	1.2786
Specification MIN							
Status (Measurements) All GND'd							
Status (Measurements) Biased							
Specification MAX		1.45	1.46	1.46	1.47	1.48	1.50
Status (Measurements) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (Measurements) Biased		PASS	PASS	PASS	PASS	PASS	PASS
Status (-KTL) All GND'd							
Status (+KTL) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (-KTL) Biased							
Status (+KTL) Biased		PASS	PASS	PASS	PASS	PASS	PASS

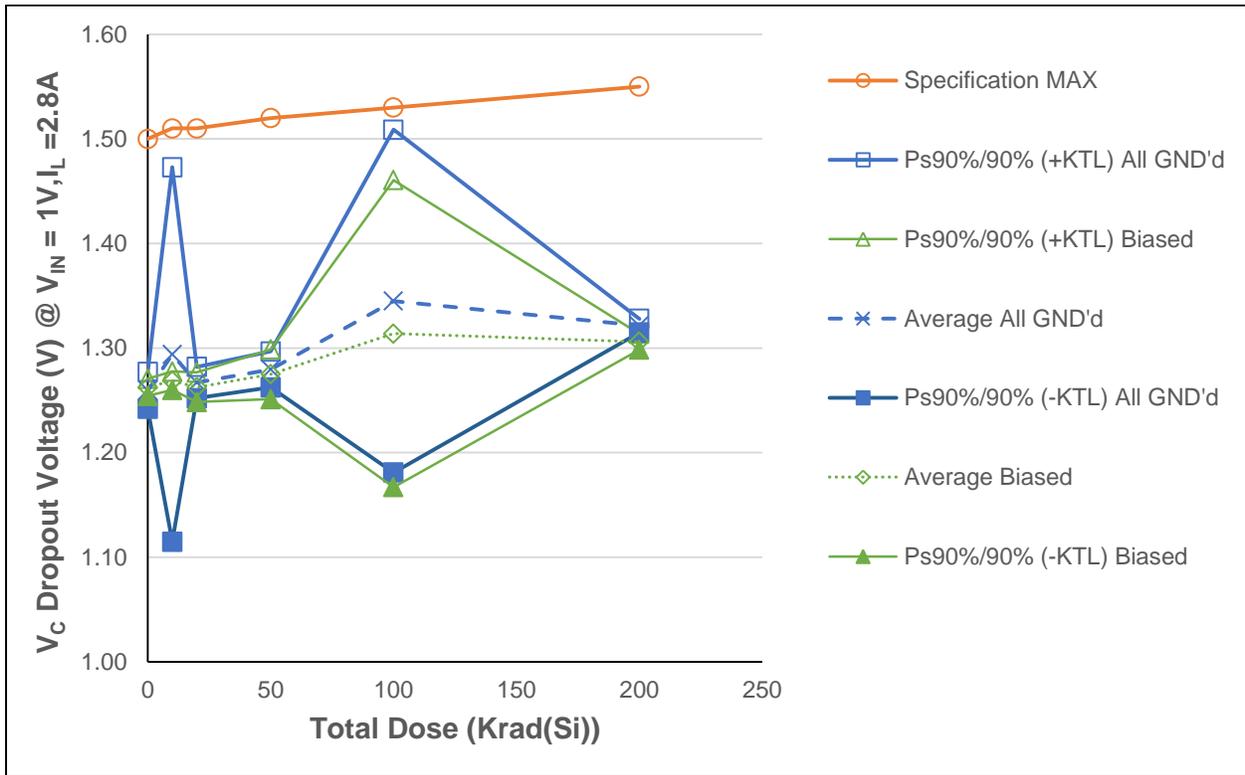


Figure 5.11: Plot of $V_{CONTROL}$ Dropout Voltage (@ $I_L = 2.8A$) versus Total Dose

The average measured values of samples are within datasheet limits.

Table 5.11: Raw data table for $V_{CONTROL}$ dropout voltage ($I_L = 2.8A$) versus total dose including the statistical calculations, maximum specification, and the status of the test (PASS/FAIL)

Parameter Units	V_C Dropout @ $V_{IN} = 1V, I_L = 2.8A$ (V)	Total Dose (Krad(Si)) @ 50 rads(Si)/s					
		0	10	20	50	100	200
6	All GND'd Irradiation	1.2678	1.2739				
7	All GND'd Irradiation	1.2612	1.4098				
8	All GND'd Irradiation	1.2624	1.2709				
9	All GND'd Irradiation	1.2544	1.2595				
10	All GND'd Irradiation	1.2519	1.2549				
1	Biased Irradiation	1.2666	1.2708				
2	Biased Irradiation	1.2586	1.2652				
3	Biased Irradiation	1.2608	1.2659				
4	Biased Irradiation	1.2629	1.2727				
5	Biased Irradiation	1.2629	1.2691				
16	All GND'd Irradiation	1.2498		1.2633			
17	All GND'd Irradiation	1.2651		1.2757			
18	All GND'd Irradiation	1.2563		1.2641			
19	All GND'd Irradiation	1.2566		1.2678			
20	All GND'd Irradiation	1.2554		1.2644			
11	Biased Irradiation	1.2473		1.2594			
12	Biased Irradiation	1.2440		1.2574			
13	Biased Irradiation	1.2607		1.2683			
14	Biased Irradiation	1.2464		1.2595			
15	Biased Irradiation	1.2594		1.2679			
26	All GND'd Irradiation	1.2531			1.2792		
27	All GND'd Irradiation	1.2638			1.2836		
28	All GND'd Irradiation	1.2616			1.2825		
29	All GND'd Irradiation	1.2498			1.2689		
30	All GND'd Irradiation	1.2611			1.2839		
21	Biased Irradiation	1.2571			1.2804		
22	Biased Irradiation	1.2594			1.2599		
23	Biased Irradiation	1.2568			1.2770		
24	Biased Irradiation	1.2571			1.2812		
25	Biased Irradiation	1.2572			1.2761		
36	All GND'd Irradiation	1.2601				1.3000	
37	All GND'd Irradiation	1.2594				1.3048	
38	All GND'd Irradiation	1.2489				1.2991	
39	All GND'd Irradiation	1.2656				1.4072	
40	All GND'd Irradiation	1.2541				1.4135	
31	Biased Irradiation	1.2594				1.2908	
32	Biased Irradiation	1.2583				1.2867	
33	Biased Irradiation	1.2520				1.2838	
34	Biased Irradiation	1.2539				1.4090	
35	Biased Irradiation	1.2612				1.2985	
46	All GND'd Irradiation	1.2495					1.3186
47	All GND'd Irradiation	1.2532					1.3214
48	All GND'd Irradiation	1.2441					1.3211
49	All GND'd Irradiation	1.2510					1.3208
50	All GND'd Irradiation	1.2572					1.3252
41	Biased Irradiation	1.2522					1.3019
42	Biased Irradiation	1.2610					1.3076
43	Biased Irradiation	1.2590					1.3093
44	Biased Irradiation	1.2526					1.3052
45	Biased Irradiation	1.2569					1.3061
51	Control Unit	1.2577	1.2577	1.2577	1.2577	1.2577	1.2577
52	Control Unit	1.2510	1.2510	1.2510	1.2510	1.2510	1.2510
All GND'd Irradiation Statistics							
Average All GND'd		1.2595	1.2938	1.2671	1.2796	1.3449	1.3214
Std Dev All GND'd		0.0064	0.0653	0.0055	0.0063	0.0598	0.0024
Ps90%/90% (+KTL) All GND'd		1.2771	1.4729	1.2821	1.2968	1.5089	1.3280
Ps90%/90% (-KTL) All GND'd		1.2420	1.1148	1.2521	1.2624	1.1810	1.3149
Biased Irradiation Statistics							
Average Biased		1.2623	1.2687	1.2625	1.2749	1.3138	1.3060
Std Dev Biased		0.0030	0.0032	0.0052	0.0087	0.0535	0.0028
Ps90%/90% (+KTL) Biased		1.2705	1.2775	1.2767	1.2987	1.4606	1.3137
Ps90%/90% (-KTL) Biased		1.2542	1.2599	1.2483	1.2512	1.1669	1.2984
Specification MIN							
Status (Measurements) All GND'd							
Status (Measurements) Biased							
Specification MAX							
Status (Measurements) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (Measurements) Biased		PASS	PASS	PASS	PASS	PASS	PASS
Status (-KTL) All GND'd							
Status (+KTL) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (-KTL) Biased							
Status (+KTL) Biased		PASS	PASS	PASS	PASS	PASS	PASS

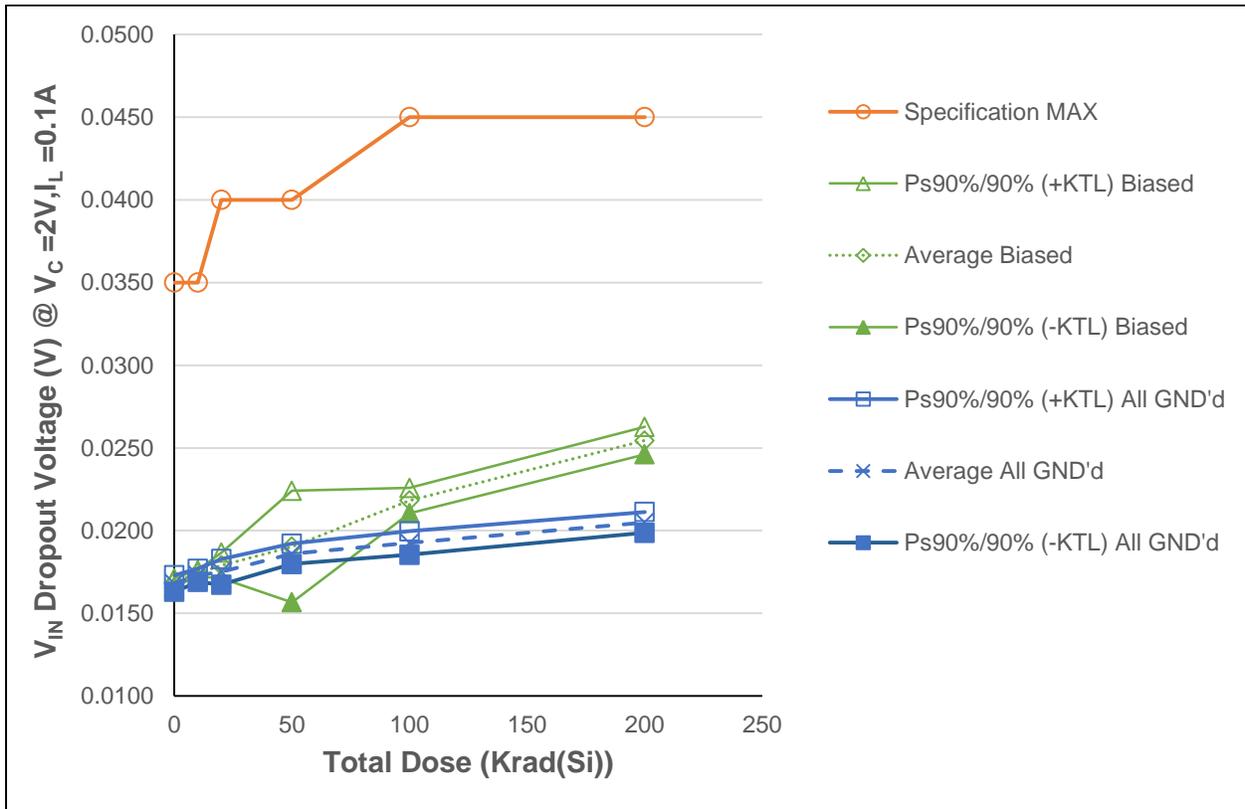


Figure 5.12: Plot of V_{IN} Dropout Voltage (@ $I_L = 0.1A$) versus Total Dose

The measured data points are within datasheet specification maximum limits.

Table 5.12: Raw data table for V_{IN} dropout voltage ($I_L = 0.1A$) versus total dose including the statistical calculations, maximum specification, and the status of the test (PASS/FAIL)

Parameter Units	V_{IN} Dropout @ $V_C = 2V, I_L = 0.1A$ (V)	Total Dose (Krad(Si)) @ 50 rads(Si)/s					
		0	10	20	50	100	200
6	All GND'd Irradiation	0.0167	0.0173				
7	All GND'd Irradiation	0.0170	0.0174				
8	All GND'd Irradiation	0.0169	0.0174				
9	All GND'd Irradiation	0.0168	0.0173				
10	All GND'd Irradiation	0.0166	0.0171				
1	Biased Irradiation	0.0170	0.0174				
2	Biased Irradiation	0.0169	0.0174				
3	Biased Irradiation	0.0168	0.0174				
4	Biased Irradiation	0.0169	0.0175				
5	Biased Irradiation	0.0168	0.0174				
16	All GND'd Irradiation	0.0167		0.0174			
17	All GND'd Irradiation	0.0172		0.0180			
18	All GND'd Irradiation	0.0165		0.0173			
19	All GND'd Irradiation	0.0167		0.0174			
20	All GND'd Irradiation	0.0167		0.0174			
11	Biased Irradiation	0.0169		0.0180			
12	Biased Irradiation	0.0164		0.0174			
13	Biased Irradiation	0.0169		0.0180			
14	Biased Irradiation	0.0168		0.0180			
15	Biased Irradiation	0.0168		0.0180			
26	All GND'd Irradiation	0.0168			0.0186		
27	All GND'd Irradiation	0.0168			0.0186		
28	All GND'd Irradiation	0.0171			0.0189		
29	All GND'd Irradiation	0.0167			0.0184		
30	All GND'd Irradiation	0.0166			0.0184		
21	Biased Irradiation	0.0165			0.0194		
22	Biased Irradiation	0.0170			0.0169		
23	Biased Irradiation	0.0167			0.0195		
24	Biased Irradiation	0.0166			0.0194		
25	Biased Irradiation	0.0168			0.0200		
36	All GND'd Irradiation	0.0168				0.0194	
37	All GND'd Irradiation	0.0168				0.0196	
38	All GND'd Irradiation	0.0164				0.0192	
39	All GND'd Irradiation	0.0166				0.0191	
40	All GND'd Irradiation	0.0164				0.0189	
31	Biased Irradiation	0.0171				0.0219	
32	Biased Irradiation	0.0166				0.0217	
33	Biased Irradiation	0.0167				0.0216	
34	Biased Irradiation	0.0169				0.0217	
35	Biased Irradiation	0.0170				0.0223	
46	All GND'd Irradiation	0.0163					0.0202
47	All GND'd Irradiation	0.0164					0.0205
48	All GND'd Irradiation	0.0164					0.0208
49	All GND'd Irradiation	0.0163					0.0204
50	All GND'd Irradiation	0.0165					0.0206
41	Biased Irradiation	0.0163					0.0251
42	Biased Irradiation	0.0166					0.0259
43	Biased Irradiation	0.0165					0.0253
44	Biased Irradiation	0.0166					0.0253
45	Biased Irradiation	0.0163					0.0255
51	Control Unit	0.0166	0.0166	0.0166	0.0166	0.0166	0.0166
52	Control Unit	0.0166	0.0166	0.0166	0.0166	0.0166	0.0166
All GND'd Irradiation Statistics							
Average All GND'd		0.0168	0.0173	0.0175	0.0186	0.0193	0.0205
Std Dev All GND'd		0.0002	0.0001	0.0003	0.0002	0.0003	0.0002
Ps90%/90% (+KTL) All GND'd		0.0173	0.0177	0.0183	0.0192	0.0200	0.0211
Ps90%/90% (-KTL) All GND'd		0.0163	0.0169	0.0167	0.0180	0.0185	0.0199
Biased Irradiation Statistics							
Average Biased		0.0169	0.0174	0.0179	0.0190	0.0218	0.0254
Std Dev Biased		0.0001	0.0001	0.0003	0.0012	0.0003	0.0003
Ps90%/90% (+KTL) Biased		0.0171	0.0176	0.0187	0.0224	0.0226	0.0263
Ps90%/90% (-KTL) Biased		0.0166	0.0172	0.0171	0.0157	0.0211	0.0246
Specification MIN							
Status (Measurements) All GND'd							
Status (Measurements) Biased							
Specification MAX		0.035	0.035	0.040	0.040	0.045	0.045
Status (Measurements) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (Measurements) Biased		PASS	PASS	PASS	PASS	PASS	PASS
Status (-KTL) All GND'd							
Status (+KTL) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (-KTL) Biased							
Status (+KTL) Biased		PASS	PASS	PASS	PASS	PASS	PASS

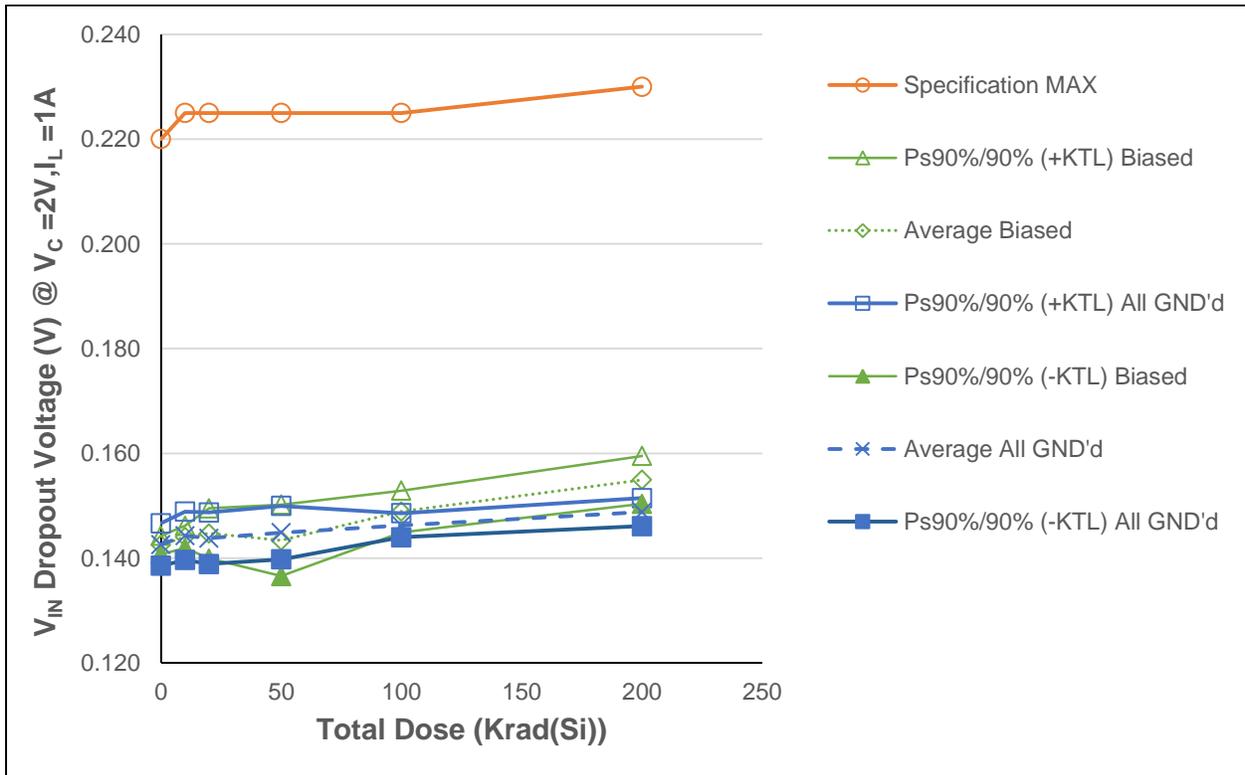


Figure 5.13: Plot of V_{IN} Dropout Voltage (@ $I_L = 1A$) versus Total Dose

The average measured values of samples are within datasheet specification maximum limits.

Table 5.13: Raw data table for V_{IN} dropout voltage ($I_L = 1A$) versus total dose including the statistical calculations, maximum specification, and the status of the test (PASS/FAIL)

Parameter	V_{IN} Dropout @ $V_C = 2V, I_L = 1A$	Total Dose (Krad(Si)) @ 50 rads(Si)/s					
Units	(V)	0	10	20	50	100	200
6	All GND'd Irradiation	0.1427	0.1442				
7	All GND'd Irradiation	0.1437	0.1460				
8	All GND'd Irradiation	0.1438	0.1456				
9	All GND'd Irradiation	0.1426	0.1439				
10	All GND'd Irradiation	0.1402	0.1417				
1	Biased Irradiation	0.1418	0.1436				
2	Biased Irradiation	0.1423	0.1435				
3	Biased Irradiation	0.1427	0.1441				
4	Biased Irradiation	0.1435	0.1454				
5	Biased Irradiation	0.1423	0.1438				
16	All GND'd Irradiation	0.1425		0.1445			
17	All GND'd Irradiation	0.1440		0.1458			
18	All GND'd Irradiation	0.1404		0.1423			
19	All GND'd Irradiation	0.1426		0.1443			
20	All GND'd Irradiation	0.1396		0.1421			
11	Biased Irradiation	0.1423		0.1444			
12	Biased Irradiation	0.1397		0.1419			
13	Biased Irradiation	0.1431		0.1455			
14	Biased Irradiation	0.1438		0.1465			
15	Biased Irradiation	0.1429		0.1454			
26	All GND'd Irradiation	0.1402			0.1423		
27	All GND'd Irradiation	0.1425			0.1458		
28	All GND'd Irradiation	0.1440			0.1473		
29	All GND'd Irradiation	0.1418			0.1449		
30	All GND'd Irradiation	0.1413			0.1440		
21	Biased Irradiation	0.1399			0.1428		
22	Biased Irradiation	0.1423			0.1408		
23	Biased Irradiation	0.1400			0.1436		
24	Biased Irradiation	0.1385			0.1423		
25	Biased Irradiation	0.1434			0.1474		
36	All GND'd Irradiation	0.1412				0.1457	
37	All GND'd Irradiation	0.1421				0.1458	
38	All GND'd Irradiation	0.1413				0.1458	
39	All GND'd Irradiation	0.1419				0.1476	
40	All GND'd Irradiation	0.1406				0.1466	
31	Biased Irradiation	0.1415				0.1485	
32	Biased Irradiation	0.1395				0.1471	
33	Biased Irradiation	0.1415				0.1485	
34	Biased Irradiation	0.1423				0.1493	
35	Biased Irradiation	0.1435				0.1511	
46	All GND'd Irradiation	0.1411					0.1488
47	All GND'd Irradiation	0.1400					0.1481
48	All GND'd Irradiation	0.1415					0.1499
49	All GND'd Irradiation	0.1396					0.1476
50	All GND'd Irradiation	0.1414					0.1496
41	Biased Irradiation	0.1395					0.1533
42	Biased Irradiation	0.1429					0.1576
43	Biased Irradiation	0.1420					0.1555
44	Biased Irradiation	0.1409					0.1542
45	Biased Irradiation	0.1403					0.1542
51	Control Unit	0.1422	0.1422	0.1422	0.1422	0.1422	0.1422
52	Control Unit	0.1407	0.1407	0.1407	0.1407	0.1407	0.1407
All GND'd Irradiation Statistics							
Average All GND'd		0.1426	0.1443	0.1438	0.1449	0.1463	0.1488
Std Dev All GND'd		0.0015	0.0017	0.0018	0.0019	0.0008	0.0010
Ps90%/90% (+KTL) All GND'd		0.1467	0.1489	0.1487	0.1500	0.1486	0.1515
Ps90%/90% (-KTL) All GND'd		0.1386	0.1397	0.1389	0.1398	0.1440	0.1461
Biased Irradiation Statistics							
Average Biased		0.1425	0.1441	0.1447	0.1434	0.1489	0.1549
Std Dev Biased		0.0006	0.0008	0.0017	0.0025	0.0015	0.0017
Ps90%/90% (+KTL) Biased		0.1443	0.1462	0.1495	0.1502	0.1529	0.1595
Ps90%/90% (-KTL) Biased		0.1407	0.1420	0.1399	0.1366	0.1449	0.1504
Specification MIN							
Status (Measurements) All GND'd							
Status (Measurements) Biased							
Specification MAX		0.220	0.225	0.225	0.225	0.225	0.230
Status (Measurements) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (Measurements) Biased		PASS	PASS	PASS	PASS	PASS	PASS
Status (-KTL) All GND'd							
Status (+KTL) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (-KTL) Biased							
Status (+KTL) Biased		PASS	PASS	PASS	PASS	PASS	PASS

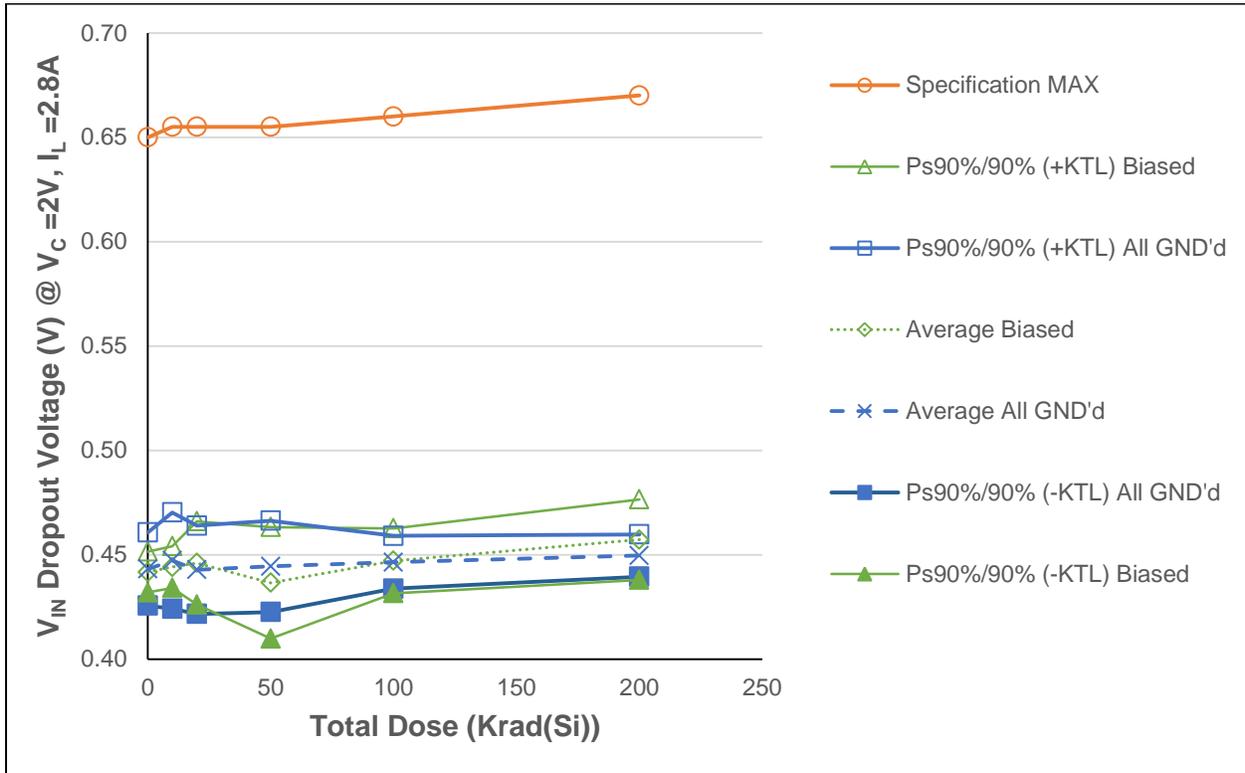


Figure 5.14: Plot of V_{IN} Dropout Voltage (@ $I_L = 2.8A$) versus Total Dose

The average measured values of samples are within datasheet specification maximum limits.

Table 5.14: Raw data table for V_{IN} dropout voltage ($I_L = 2.8A$) versus total dose including the statistical calculations, maximum specification, and the status of the test (PASS/FAIL)

Parameter Units	V_{IN} Dropout @ $V_C = 2V, I_L = 2.8A$ (V)	Total Dose (Krad(Si)) @ 50 rads(Si)/s					
		0	10	20	50	100	200
6	All GND'd Irradiation	0.4433	0.4454				
7	All GND'd Irradiation	0.4477	0.4580				
8	All GND'd Irradiation	0.4490	0.4519				
9	All GND'd Irradiation	0.4431	0.4453				
10	All GND'd Irradiation	0.4327	0.4355				
1	Biased Irradiation	0.4374	0.4410				
2	Biased Irradiation	0.4401	0.4415				
3	Biased Irradiation	0.4423	0.4441				
4	Biased Irradiation	0.4471	0.4502				
5	Biased Irradiation	0.4416	0.4438				
16	All GND'd Irradiation	0.4443		0.4473			
17	All GND'd Irradiation	0.4471		0.4497			
18	All GND'd Irradiation	0.4356		0.4388			
19	All GND'd Irradiation	0.4429		0.4454			
20	All GND'd Irradiation	0.4281		0.4327			
11	Biased Irradiation	0.4418		0.4438			
12	Biased Irradiation	0.4321		0.4347			
13	Biased Irradiation	0.4456		0.4490			
14	Biased Irradiation	0.4500		0.4539			
15	Biased Irradiation	0.4457		0.4489			
26	All GND'd Irradiation	0.4309			0.4323		
27	All GND'd Irradiation	0.4416			0.4484		
28	All GND'd Irradiation	0.4476			0.4533		
29	All GND'd Irradiation	0.4413			0.4467		
30	All GND'd Irradiation	0.4376			0.4416		
21	Biased Irradiation	0.4320			0.4328		
22	Biased Irradiation	0.4410			0.4358		
23	Biased Irradiation	0.4312			0.4346		
24	Biased Irradiation	0.4243			0.4268		
25	Biased Irradiation	0.4486			0.4528		
36	All GND'd Irradiation	0.4358				0.4418	
37	All GND'd Irradiation	0.4405				0.4438	
38	All GND'd Irradiation	0.4390				0.4440	
39	All GND'd Irradiation	0.4405				0.4529	
40	All GND'd Irradiation	0.4364				0.4496	
31	Biased Irradiation	0.4363				0.4447	
32	Biased Irradiation	0.4297				0.4388	
33	Biased Irradiation	0.4406				0.4482	
34	Biased Irradiation	0.4425				0.4501	
35	Biased Irradiation	0.4448				0.4537	
46	All GND'd Irradiation	0.4397					0.4520
47	All GND'd Irradiation	0.4334					0.4468
48	All GND'd Irradiation	0.4394					0.4525
49	All GND'd Irradiation	0.4315					0.4446
50	All GND'd Irradiation	0.4389					0.4523
41	Biased Irradiation	0.4324					0.4506
42	Biased Irradiation	0.4467					0.4683
43	Biased Irradiation	0.4412					0.4597
44	Biased Irradiation	0.4373					0.4547
45	Biased Irradiation	0.4338					0.4528
51	Control Unit	0.4425	0.4425	0.4425	0.4425	0.4425	0.4425
52	Control Unit	0.4358	0.4358	0.4358	0.4358	0.4358	0.4358
All GND'd Irradiation Statistics							
Average All GND'd		0.4432	0.4472	0.4428	0.4445	0.4464	0.4496
Std Dev All GND'd		0.0064	0.0084	0.0077	0.0080	0.0046	0.0037
Ps90%/90% (+KTL) All GND'd		0.4607	0.4703	0.4640	0.4663	0.4591	0.4598
Ps90%/90% (-KTL) All GND'd		0.4256	0.4242	0.4216	0.4226	0.4338	0.4395
Biased Irradiation Statistics							
Average Biased		0.4417	0.4441	0.4461	0.4366	0.4471	0.4572
Std Dev Biased		0.0036	0.0036	0.0073	0.0097	0.0057	0.0070
Ps90%/90% (+KTL) Biased		0.4515	0.4541	0.4660	0.4633	0.4626	0.4765
Ps90%/90% (-KTL) Biased		0.4319	0.4341	0.4261	0.4099	0.4316	0.4379
Specification MIN							
Status (Measurements) All GND'd							
Status (Measurements) Biased							
Specification MAX		0.650	0.655	0.655	0.655	0.660	0.670
Status (Measurements) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (Measurements) Biased		PASS	PASS	PASS	PASS	PASS	PASS
Status (-KTL) All GND'd							
Status (+KTL) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (-KTL) Biased							
Status (+KTL) Biased		PASS	PASS	PASS	PASS	PASS	PASS

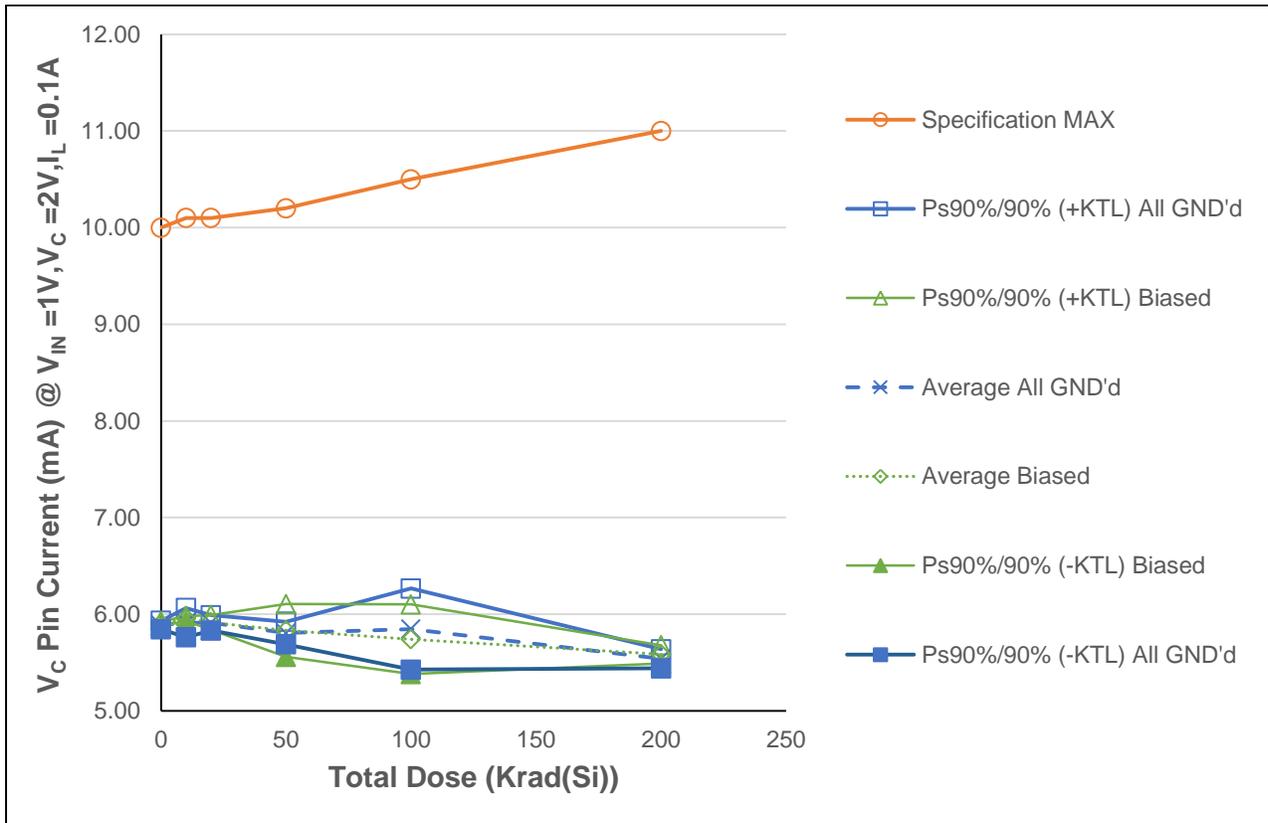


Figure 5.15: Plot of $V_{CONTROL}$ Pin Current (@ $I_L = 0.1A$) versus Total Dose

The average measured values of samples are within datasheet specification maximum limits.

Table 5.15: Raw data table for $V_{CONTROL}$ pin current ($I_L = 0.1A$) versus total dose including the statistical calculations, maximum specification, and the status of the test (PASS/FAIL)

Parameter Units	$I_{CONTROL}$ @ $V_{IN}=1V, V_C=2V, I_L=0.1A$ (mA)	Total Dose (Krad(Si)) @ 50 rads(Si)/s					
		0	10	20	50	100	200
6	All GND'd Irradiation	5.893	5.945				
7	All GND'd Irradiation	5.882	5.817				
8	All GND'd Irradiation	5.912	5.957				
9	All GND'd Irradiation	5.879	5.920				
10	All GND'd Irradiation	5.870	5.918				
1	Biased Irradiation	5.903	5.956				
2	Biased Irradiation	5.886	5.946				
3	Biased Irradiation	5.912	5.968				
4	Biased Irradiation	5.898	5.960				
5	Biased Irradiation	5.896	5.947				
16	All GND'd Irradiation	5.875		5.898			
17	All GND'd Irradiation	5.905		5.923			
18	All GND'd Irradiation	5.855		5.875			
19	All GND'd Irradiation	5.930		5.946			
20	All GND'd Irradiation	5.884		5.907			
11	Biased Irradiation	5.863		5.890			
12	Biased Irradiation	5.870		5.885			
13	Biased Irradiation	5.906		5.937			
14	Biased Irradiation	5.882		5.912			
15	Biased Irradiation	5.925		5.948			
26	All GND'd Irradiation	5.798			5.762		
27	All GND'd Irradiation	5.916			5.852		
28	All GND'd Irradiation	5.865			5.807		
29	All GND'd Irradiation	5.825			5.763		
30	All GND'd Irradiation	5.896			5.841		
21	Biased Irradiation	5.845			5.812		
22	Biased Irradiation	5.823			6.003		
23	Biased Irradiation	5.843			5.804		
24	Biased Irradiation	5.823			5.792		
25	Biased Irradiation	5.800			5.745		
36	All GND'd Irradiation	5.881				5.728	
37	All GND'd Irradiation	5.897				5.732	
38	All GND'd Irradiation	5.924				5.744	
39	All GND'd Irradiation	5.943				6.015	
40	All GND'd Irradiation	5.920				6.013	
31	Biased Irradiation	5.855				5.727	
32	Biased Irradiation	5.808				5.635	
33	Biased Irradiation	5.802				5.674	
34	Biased Irradiation	5.855				5.968	
35	Biased Irradiation	5.847				5.701	
46	All GND'd Irradiation	5.910					5.560
47	All GND'd Irradiation	5.921					5.533
48	All GND'd Irradiation	5.911					5.489
49	All GND'd Irradiation	5.920					5.524
50	All GND'd Irradiation	5.970					5.584
41	Biased Irradiation	5.907					5.581
42	Biased Irradiation	5.931					5.533
43	Biased Irradiation	5.929					5.614
44	Biased Irradiation	5.926					5.618
45	Biased Irradiation	5.921					5.575
51	Control Unit	5.924	5.924	5.924	5.924	5.924	5.924
52	Control Unit	5.898	5.898	5.898	5.898	5.898	5.898
All GND'd Irradiation Statistics							
Average All GND'd		5.887	5.911	5.909	5.805	5.846	5.538
Std Dev All GND'd		0.016	0.055	0.029	0.042	0.153	0.036
Ps90%/90% (+KTL) All GND'd		5.931	6.063	5.988	5.921	6.266	5.637
Ps90%/90% (-KTL) All GND'd		5.844	5.760	5.830	5.689	5.427	5.439
Biased Irradiation Statistics							
Average Biased		5.899	5.955	5.914	5.831	5.741	5.584
Std Dev Biased		0.009	0.009	0.028	0.099	0.132	0.034
Ps90%/90% (+KTL) Biased		5.925	5.981	5.991	6.104	6.102	5.679
Ps90%/90% (-KTL) Biased		5.873	5.930	5.838	5.559	5.380	5.490
Specification MIN							
Status (Measurements) All GND'd							
Status (Measurements) Biased							
Specification MAX		10.0	10.1	10.1	10.2	10.5	11.0
Status (Measurements) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (Measurements) Biased		PASS	PASS	PASS	PASS	PASS	PASS
Status (-KTL) All GND'd							
Status (+KTL) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (-KTL) Biased							
Status (+KTL) Biased		PASS	PASS	PASS	PASS	PASS	PASS

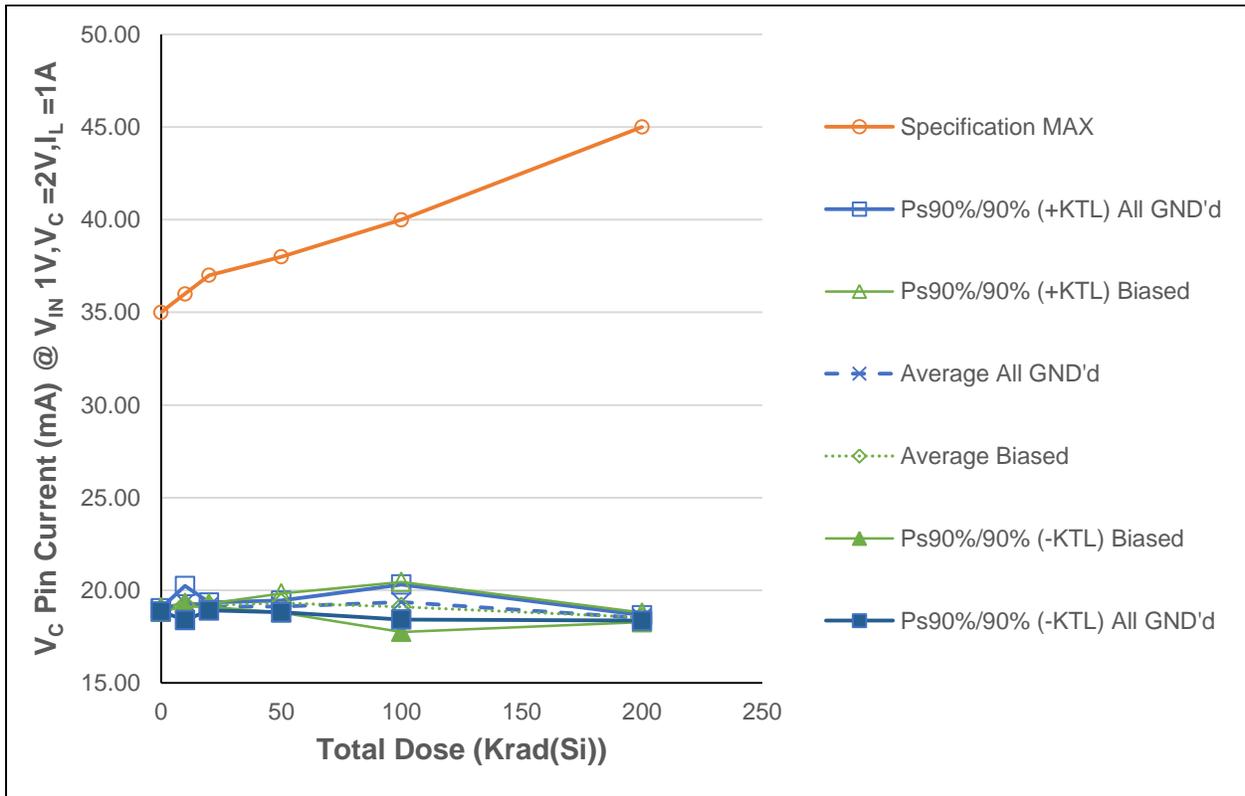


Figure 5.16: Plot of $V_{CONTROL}$ Pin Current (@ $I_L = 1A$) versus Total Dose

The average measured values of samples are within datasheet specification maximum limits.

Table 5.16: Raw data table for $V_{CONTROL}$ pin current ($I_L = 1A$) versus total dose including the statistical calculations, maximum specification, and the status of the test (PASS/FAIL)

Parameter Units	$I_{CONTROL}$ @ $V_{IN}=1V, V_C=2V, I_L=1A$ (mA)	Total Dose (Krad(Si)) @ 50 rads(Si)/s					
		0	10	20	50	100	200
6	All GND'd Irradiation	18.958	19.196				
7	All GND'd Irradiation	18.917	19.910				
8	All GND'd Irradiation	18.992	19.220				
9	All GND'd Irradiation	18.940	19.119				
10	All GND'd Irradiation	18.916	19.124				
1	Biased Irradiation	19.015	19.195				
2	Biased Irradiation	18.910	19.214				
3	Biased Irradiation	19.008	19.254				
4	Biased Irradiation	18.944	19.258				
5	Biased Irradiation	18.952	19.173				
16	All GND'd Irradiation	18.908		19.151			
17	All GND'd Irradiation	18.976		19.178			
18	All GND'd Irradiation	18.798		19.025			
19	All GND'd Irradiation	19.000		19.246			
20	All GND'd Irradiation	18.933		19.024			
11	Biased Irradiation	18.874		19.168			
12	Biased Irradiation	18.917		19.153			
13	Biased Irradiation	18.966		19.190			
14	Biased Irradiation	18.963		19.235			
15	Biased Irradiation	19.023		19.213			
26	All GND'd Irradiation	18.680			19.115		
27	All GND'd Irradiation	19.046			19.143		
28	All GND'd Irradiation	18.924			19.189		
29	All GND'd Irradiation	18.768			18.948		
30	All GND'd Irradiation	18.954			19.257		
21	Biased Irradiation	18.807			19.398		
22	Biased Irradiation	18.756			19.593		
23	Biased Irradiation	18.816			19.257		
24	Biased Irradiation	18.746			19.249		
25	Biased Irradiation	18.691			19.094		
36	All GND'd Irradiation	18.893				18.976	
37	All GND'd Irradiation	18.970				19.210	
38	All GND'd Irradiation	19.055				19.203	
39	All GND'd Irradiation	19.109				19.758	
40	All GND'd Irradiation	19.035				19.707	
31	Biased Irradiation	18.827				18.977	
32	Biased Irradiation	18.725				18.813	
33	Biased Irradiation	18.701				18.839	
34	Biased Irradiation	18.792				19.976	
35	Biased Irradiation	18.824				18.917	
46	All GND'd Irradiation	18.997					18.499
47	All GND'd Irradiation	19.008					18.453
48	All GND'd Irradiation	19.095					18.522
49	All GND'd Irradiation	19.019					18.483
50	All GND'd Irradiation	19.163					18.595
41	Biased Irradiation	19.001					18.505
42	Biased Irradiation	19.049					18.402
43	Biased Irradiation	19.049					18.618
44	Biased Irradiation	19.029					18.631
45	Biased Irradiation	19.029					18.528
51	Control Unit	19.034	19.034	19.034	19.034	19.034	19.034
52	Control Unit	18.987	18.987	18.987	18.987	18.987	18.987
All GND'd Irradiation Statistics							
Average All GND'd		18.944	19.314	19.125	19.130	19.371	18.510
Std Dev All GND'd		0.032	0.336	0.079	0.115	0.344	0.053
Ps90%/90% (+KTL) All GND'd		19.031	20.236	19.341	19.446	20.314	18.657
Ps90%/90% (-KTL) All GND'd		18.858	18.392	18.909	18.814	18.428	18.364
Biased Irradiation Statistics							
Average Biased		18.966	19.219	19.192	19.318	19.104	18.537
Std Dev Biased		0.045	0.037	0.033	0.188	0.492	0.093
Ps90%/90% (+KTL) Biased		19.089	19.321	19.283	19.833	20.452	18.792
Ps90%/90% (-KTL) Biased		18.843	19.117	19.101	18.804	17.757	18.281
Specification MIN							
Status (Measurements) All GND'd							
Status (Measurements) Biased							
Specification MAX		35	36	37	38	40	45
Status (Measurements) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (Measurements) Biased		PASS	PASS	PASS	PASS	PASS	PASS
Status (-KTL) All GND'd							
Status (+KTL) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (-KTL) Biased							
Status (+KTL) Biased		PASS	PASS	PASS	PASS	PASS	PASS

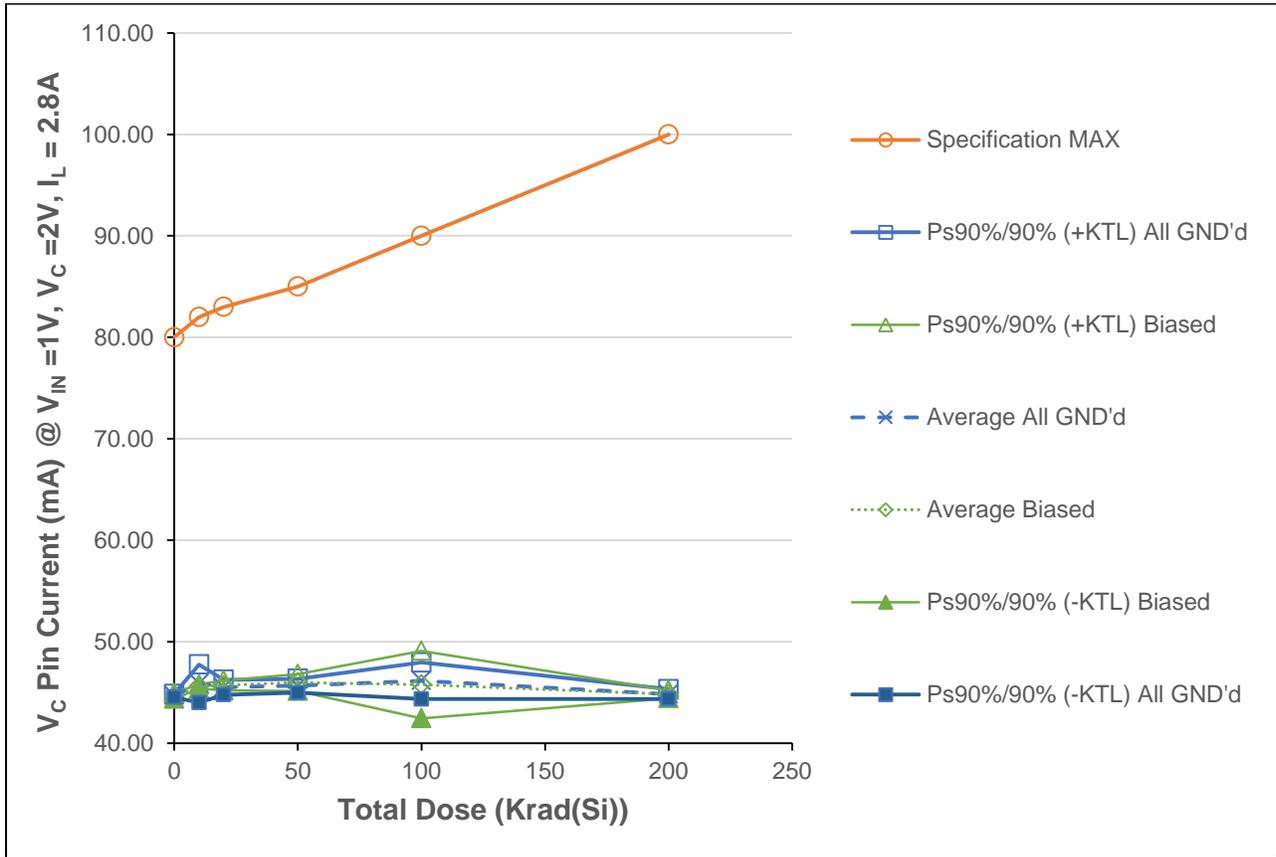


Figure 5.17: Plot of $V_{CONTROL}$ Pin Current (@ $I_L = 2.8A$) versus Total Dose

The average measured values of samples are within datasheet specification maximum limits.

Table 5.17: Raw data table for $V_{CONTROL}$ pin current ($I_L = 2.8A$) versus total dose including the statistical calculations, minimum specification, and the status of the test (PASS/FAIL)

Parameter Units	$I_{CONTROL}$ @ $V_{IN}=1V, V_C=2V, I_L=2.8A$ (mA)	Total Dose (Krad(Si)) @ 50 rads(Si)/s					
		0	10	20	50	100	200
6	All GND'd Irradiation	44.716	45.643				
7	All GND'd Irradiation	44.578	47.099				
8	All GND'd Irradiation	44.733	45.620				
9	All GND'd Irradiation	44.703	45.476				
10	All GND'd Irradiation	44.680	45.552				
1	Biased Irradiation	44.812	45.601				
2	Biased Irradiation	44.544	45.573				
3	Biased Irradiation	44.698	45.601				
4	Biased Irradiation	44.592	45.681				
5	Biased Irradiation	44.607	45.469				
16	All GND'd Irradiation	44.678		45.713			
17	All GND'd Irradiation	44.874		45.755			
18	All GND'd Irradiation	44.183		45.147			
19	All GND'd Irradiation	44.763		45.711			
20	All GND'd Irradiation	44.547		45.215			
11	Biased Irradiation	44.592		45.637			
12	Biased Irradiation	44.537		45.468			
13	Biased Irradiation	44.699		45.624			
14	Biased Irradiation	44.871		45.940			
15	Biased Irradiation	44.897		45.777			
26	All GND'd Irradiation	44.063			45.583		
27	All GND'd Irradiation	44.850			45.689		
28	All GND'd Irradiation	44.695			45.900		
29	All GND'd Irradiation	44.258			45.274		
30	All GND'd Irradiation	44.592			45.853		
21	Biased Irradiation	44.317			46.185		
22	Biased Irradiation	44.240			46.414		
23	Biased Irradiation	44.340			45.836		
24	Biased Irradiation	44.099			45.793		
25	Biased Irradiation	44.250			45.694		
36	All GND'd Irradiation	44.525				45.469	
37	All GND'd Irradiation	44.649				45.970	
38	All GND'd Irradiation	44.793				45.956	
39	All GND'd Irradiation	45.019				46.146	
40	All GND'd Irradiation	44.597				47.243	
31	Biased Irradiation	44.387				45.443	
32	Biased Irradiation	44.115				45.106	
33	Biased Irradiation	44.073				45.126	
34	Biased Irradiation	44.314				47.928	
35	Biased Irradiation	44.321				45.280	
46	All GND'd Irradiation	44.704					44.744
47	All GND'd Irradiation	44.678					44.621
48	All GND'd Irradiation	45.030					45.020
49	All GND'd Irradiation	44.797					44.809
50	All GND'd Irradiation	45.135					45.016
41	Biased Irradiation	44.638					44.659
42	Biased Irradiation	44.983					44.773
43	Biased Irradiation	44.850					44.982
44	Biased Irradiation	44.802					44.963
45	Biased Irradiation	44.740					44.721
51	Control Unit	44.766	44.766	44.766	44.766	44.766	44.766
52	Control Unit	44.685	44.685	44.685	44.685	44.685	44.685
All GND'd Irradiation Statistics							
Average All GND'd		44.682	45.878	45.508	45.660	46.157	44.842
Std Dev All GND'd		0.061	0.685	0.267	0.250	0.657	0.174
Ps90%/90% (+KTL) All GND'd		44.850	47.757	46.239	46.346	47.959	45.320
Ps90%/90% (-KTL) All GND'd		44.513	43.999	44.777	44.973	44.355	44.364
Biased Irradiation Statistics							
Average Biased		44.650	45.585	45.689	45.984	45.777	44.819
Std Dev Biased		0.106	0.076	0.178	0.303	1.210	0.145
Ps90%/90% (+KTL) Biased		44.941	45.795	46.176	46.816	49.096	45.218
Ps90%/90% (-KTL) Biased		44.360	45.375	45.202	45.153	42.458	44.420
Specification MIN							
Status (Measurements) All GND'd							
Status (Measurements) Biased							
Specification MAX		80	82	83	85	90	100
Status (Measurements) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (Measurements) Biased		PASS	PASS	PASS	PASS	PASS	PASS
Status (-KTL) All GND'd							
Status (+KTL) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (-KTL) Biased							
Status (+KTL) Biased		PASS	PASS	PASS	PASS	PASS	PASS

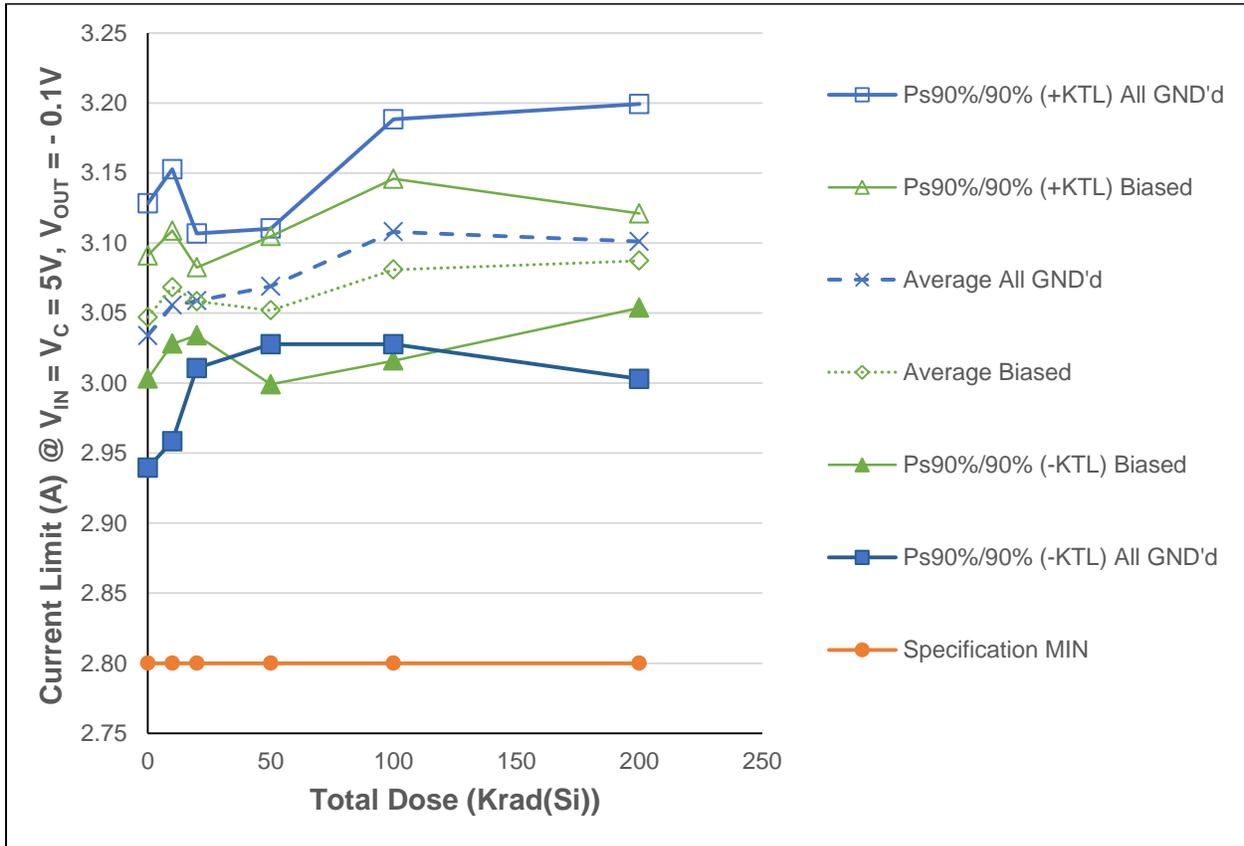


Figure 5.18: Plot of Current Limit versus Total Dose

The average measured values of samples passed datasheet specification minimum limits.

Table 5.18: Raw data table for current limit versus total dose including the statistical calculations, minimum specification, and the status of the test (PASS/FAIL)

Parameter Units	I _{LIMIT} @ V _{IN} =V _C =5V, V _{OUT} =-0.1V (A)	Total Dose (Krad(Si)) @ 50 rads(Si)/s					
		0	10	20	50	100	200
6	All GND'd Irradiation	3.029	3.044				
7	All GND'd Irradiation	3.055	3.078				
8	All GND'd Irradiation	3.078	3.103				
9	All GND'd Irradiation	3.018	3.040				
10	All GND'd Irradiation	2.989	3.012				
1	Biased Irradiation	3.045	3.064				
2	Biased Irradiation	3.031	3.055				
3	Biased Irradiation	3.073	3.093				
4	Biased Irradiation	3.049	3.070				
5	Biased Irradiation	3.037	3.059				
16	All GND'd Irradiation	3.047		3.070			
17	All GND'd Irradiation	3.041		3.064			
18	All GND'd Irradiation	3.005		3.035			
19	All GND'd Irradiation	3.041		3.066			
20	All GND'd Irradiation	3.046		3.059			
11	Biased Irradiation	3.021		3.054			
12	Biased Irradiation	3.034		3.052			
13	Biased Irradiation	3.028		3.050			
14	Biased Irradiation	3.047		3.069			
15	Biased Irradiation	3.042		3.066			
26	All GND'd Irradiation	3.022			3.081		
27	All GND'd Irradiation	3.036			3.085		
28	All GND'd Irradiation	3.005			3.066		
29	All GND'd Irradiation	2.993			3.046		
30	All GND'd Irradiation	3.018			3.067		
21	Biased Irradiation	2.993			3.049		
22	Biased Irradiation	3.011			3.072		
23	Biased Irradiation	2.991			3.043		
24	Biased Irradiation	3.014			3.069		
25	Biased Irradiation	2.972			3.026		
36	All GND'd Irradiation	3.034				3.087	
37	All GND'd Irradiation	3.060				3.114	
38	All GND'd Irradiation	3.069				3.141	
39	All GND'd Irradiation	3.004				3.070	
40	All GND'd Irradiation	3.074				3.129	
31	Biased Irradiation	3.025				3.081	
32	Biased Irradiation	2.997				3.053	
33	Biased Irradiation	3.001				3.063	
34	Biased Irradiation	3.034				3.099	
35	Biased Irradiation	3.054				3.109	
46	All GND'd Irradiation	3.018					3.091
47	All GND'd Irradiation	3.018					3.086
48	All GND'd Irradiation	3.025					3.104
49	All GND'd Irradiation	2.993					3.064
50	All GND'd Irradiation	3.092					3.160
41	Biased Irradiation	3.026					3.094
42	Biased Irradiation	3.006					3.076
43	Biased Irradiation	3.031					3.092
44	Biased Irradiation	3.037					3.101
45	Biased Irradiation	3.006					3.073
51	Control Unit	3.037	3.037	3.037	3.037	3.037	3.037
52	Control Unit	3.030	3.030	3.030	3.030	3.030	3.030
All GND'd Irradiation Statistics							
Average All GND'd		3.034	3.056	3.059	3.069	3.108	3.101
Std Dev All GND'd		0.034	0.035	0.018	0.015	0.029	0.036
Ps90%/90% (+KTL) All GND'd		3.128	3.153	3.107	3.110	3.188	3.199
Ps90%/90% (-KTL) All GND'd		2.939	2.958	3.011	3.028	3.028	3.003
Biased Irradiation Statistics							
Average Biased		3.047	3.068	3.058	3.052	3.081	3.087
Std Dev Biased		0.016	0.015	0.009	0.019	0.024	0.012
Ps90%/90% (+KTL) Biased		3.091	3.109	3.083	3.105	3.146	3.121
Ps90%/90% (-KTL) Biased		3.003	3.028	3.034	2.999	3.016	3.054
Specification MIN		2.8	2.8	2.8	2.8	2.8	2.8
Status (Measurements) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (Measurements) Biased		PASS	PASS	PASS	PASS	PASS	PASS
Specification MAX							
Status (Measurements) All GND'd							
Status (Measurements) Biased							
Status (-KTL) All GND'd		PASS	PASS	PASS	PASS	PASS	PASS
Status (+KTL) All GND'd							
Status (-KTL) Biased		PASS	PASS	PASS	PASS	PASS	PASS
Status (+KTL) Biased							

Appendix A

Picture of one among ten samples used in the test. The part type is in development and identification numbers will be marked on top of future devices.



Figure A1: Top View showing serial number



Figure A2: Bottom View

Appendix B

Radiation Bias Connection Tables

Table B1: Biased Conditions

PIN	FUNCTION	CONNECTION / BIAS
1	NC	NC
2	SET	To ground via 10KΩ resistor
3	$V_{CONTROL}$	To pin 4
4	IN	To +3V To ground via 1uF To pin 3
CASE	OUT	To ground via 100Ω resistor To ground via 10uF capacitor

Table B2: All GND'd

PIN	FUNCTION	CONNECTION / BIAS
1	NC	Ground
2	SET	Ground
3	$V_{CONTROL}$	Ground
4	IN	Ground
CASE	OUT	Ground

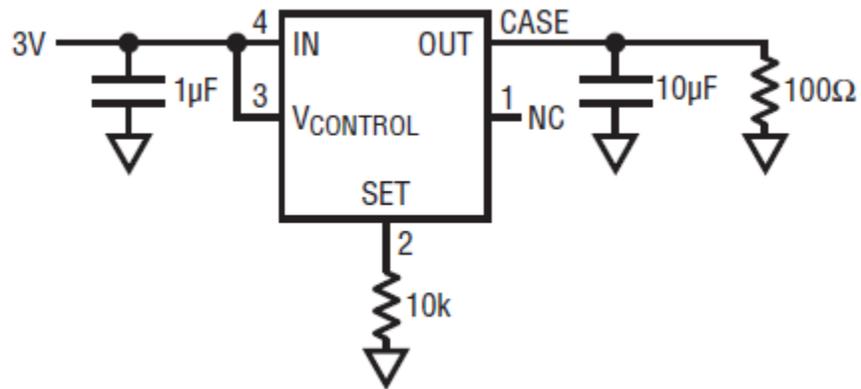


Figure B1: Total Dose Bias Circuit

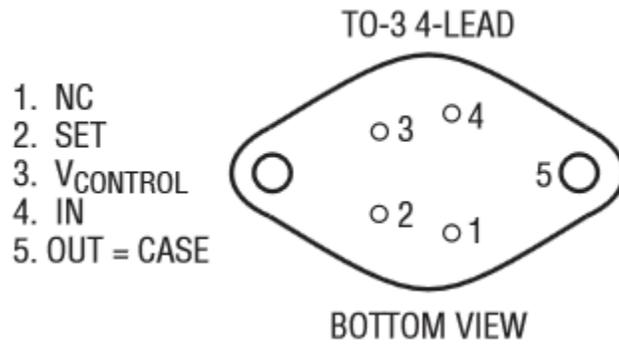


Figure B2: Pin-Out



Figure B3: Bias Board (top view)

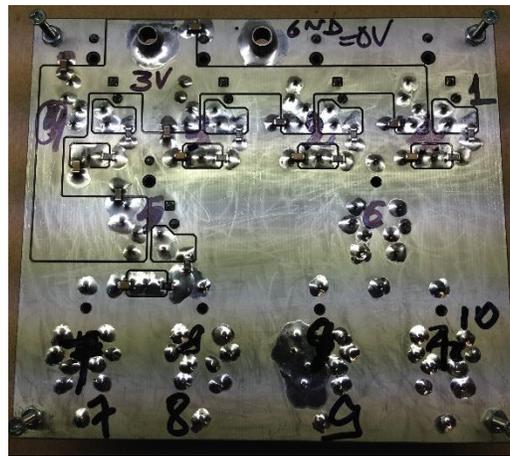


Figure B4: Bias Board (bottom view)

Appendix C

TEST CERTIFICATE

**Defense Microelectronics Activity
Science and Engineering Gamma Irradiation Test Facility
DMEA/MEBC
4234 54th Street
McClellan, CA 95652**



Testing Certificate Number: 1691.01

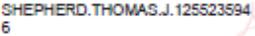
This laboratory is accredited by the American Association for Laboratory Accreditation (A2LA) and the dosimetry reported in this test certificate has been determined in accordance with the laboratory's terms of accreditation. The results contained herein relate only to the items tested. This certificate may not be reproduced, except in full, without the approval of this laboratory.

Date: 2014-04-01

Test Certificate #: 2014-NRC-047

Total Pages (except cover): 2

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REQUEST FOR AND RESULTS OF TESTS					PAGE NO. 1	NO. OF PAGES 2
SECTION A - REQUEST FOR TEST						
1. TO: (Include ZIP Code) Defense Microelectronics Activity Science and Engineering Gamma Irradiation Test Facility 4234 54th Street McClellan, CA 95652-2100				2. FROM: (include ZIP Code) Dr. Sana Rezgui Linear Technology Corp. 1630 McCarthy Blvd. Milpitas, CA 95035 Phone: (408) 432-1900 Email: srezgui@linear.com		
3. PRIME CONTRACTOR AND ADDRESS (include ZIP Code) Same as block 2 CONTRACT NUMBER CRADA CR-08-17				4. MANUFACTURING PLANT NAME AND ADDRESS (include ZIP Code) Linear Technology Corp. 1630 McCarthy Blvd. Milpitas, CA 95035 P.O. NUMBER TBD		
5. END ITEM AND/OR PROJECT N/A		6. SAMPLE NUMBER N/A	7. LOT NO. See below	8. REASON FOR SUBMITTAL Total Ionizing Dose (TID) Testing		9. DATE SUBMITTED 2014-03-31
10. MATERIAL TO BE TESTED Various biased/unbiased devices - see below		10a. QUANTITY SUBMITTED See below	11. QUANTITY REPRESENTED N/A		12. SPEC. & AMEND AND/OR DRAWING NO. & REV. FOR SAMPLE & DATE N/A	
13. PURCHASED FROM OR SOURCE Linear Technology Corp.			14. SHIPMENT METHOD Hand carry	15. DATE SAMPLED AND SUBMITTED BY 2014-03-31 by Tom Shepherd		
16. REMARKS AND/OR SPECIAL INSTRUCTIONS AND/OR WAIVERS. Dose Rate: 3000 ±10% rad(SiO ₂)/min Irradiation Steps: 11 Type of Test: Customer-Performed Total Dose: see below ±10% krad(SiO ₂) Requested Test Start Date: 2014-04-01 Dimensions: various Security Requirements, Safety or Handling Precautions: Customer to perform pre- and post-irradiation electrical testing. Parts may be packed by customer in dry ice for transport. Irradiation portion of testing to be conducted per MIL-STD-883H, Test Method 1019.8, Condition A. Customer reserves right to modify parameters, devices, etc. to suit test requirements. Description of parts to be irradiated is as follows: RH117H, fab lot #10216255.1, assy lot #742778.1, WFR #1: 50 and 200 krad(SiO ₂), 5 devices per dose level, biased RH1963MK, fab lot #WD42342.1, assy lot #N/A, WFR #11: 10, 20, 50, 100 and 200 krad(SiO ₂), 10 devices per dose level, biased RH3083MK, fab lot #HP201682.1, assy lot #N/A, WFR #1: 10, 20, 50, 100 and 200 krad(SiO ₂), 10 devices per dose level, biased RH137K (6RH137BK*12), fab lot #W1328052.1, assy lot #732141.1, WFR #3: 10, 20, 50 and 100 krad(SiO ₂), 10 devices per dose level, biased						
Experiment #: 2014-NRC-047		DMEA Approval:		 <small>Digitally signed by SHEPHERD, THOMAS J. 125523594 DN: cn=SHEPHERD, o=Linear Technology Corporation, ou=SEGIT, email=sj.shepherd@linear.com, c=US</small>	 <small>Digitally signed by ARSHAD, MOHAMMAD 1231956693 DN: cn=ARSHAD, o=Linear Technology Corporation, ou=SEGIT, email=arshad@linear.com, c=US</small>	 <small>Digitally signed by MELINE, CARY 1231854033 DN: cn=MELINE, o=Linear Technology Corporation, ou=SEGIT, email=mcary@linear.com, c=US</small>
17. SEND REPORT OF TEST TO Individual identified in Block 2						
SECTION B - RESULTS OF TEST (Continue on plain white paper if more space is required)						
1. DATE SAMPLE RECEIVED 2014-04-01		2. DATE RESULTS REPORTED 2014-04-01		3. LAB REPORT NUMBER N/A		
4. TEST PERFORMED		RESULTS OF TEST		SAMPLE RESULT		REQUIREMENTS
Please see next page.						
DATE	TYPED NAME AND TITLE OF PERSON CONDUCTING TEST			SIGNATURE		
2014-04-01	Thomas J. Shepherd, SEGIT Technical Manager			 <small>Digitally signed by SHEPHERD, THOMAS J. 125523594 DN: cn=SHEPHERD, o=Linear Technology Corporation, ou=SEGIT, email=sj.shepherd@linear.com, c=US</small>		
2014-04-02	Mohammad Arshad, Alt. SEGIT Facility Supervisor			 <small>Digitally signed by ARSHAD, MOHAMMAD 1231956693 DN: cn=ARSHAD, o=Linear Technology Corporation, ou=SEGIT, email=arshad@linear.com, c=US</small>		

DD FORM 1222, FEB 62 (EF)

REPLACES DD FORM 1222, 1 JUL 58, WHICH IS OBSOLETE.

Continuation of DD Form 1222		Experiment #:		2014-NRC-047		Page 2 of 2	
Test Performed		Results of Test		Sample Result		Requirements	
20140401 10:00:00 to 20140401 10:15:39	5.000E-04 rad(SiO2) at 3.195E+03 rad(SiO2)/min	RH117H, WFR #1, S/Ns 101-103, 121-123, 161-163, 181: 50 krad SD, 50 krad TD				1	
20140401 10:24:30 to 20140401 10:40:09	5.000E-04 rad(SiO2) at 3.195E+03 rad(SiO2)/min	RH117H, WFR #1, S/Ns 123, 161-163, 181: 50 krad SD, 100 krad TD				2	
20140401 11:38:30 to 20140401 11:41:47	1.000E-04 rad(SiO2) at 3.047E+03 rad(SiO2)/min	RH1963MK, WFR #11, S/Ns 1-2, 4-7, 10-12: 10 krad TD				3	
20140401 11:38:30 to 20140401 11:41:47	1.000E-04 rad(SiO2) at 3.047E+03 rad(SiO2)/min	RH3083MK, WFR #1, S/Ns 1-10: 10 krad TD				3	
20140401 11:57:15 to 20140401 12:03:49	2.000E-04 rad(SiO2) at 3.047E+03 rad(SiO2)/min	RH1963MK, WFR #11, S/Ns 14-17, 20-21, 23-24, 26, 30: 20 krad TD				4	
20140401 11:57:15 to 20140401 12:03:49	2.000E-04 rad(SiO2) at 3.047E+03 rad(SiO2)/min	RH3083MK, WFR #1, S/Ns 11-20: 20 krad TD				4	
20140401 12:17:30 to 20140401 12:33:55	5.000E-04 rad(SiO2) at 3.047E+03 rad(SiO2)/min	RH1963MK, WFR #11, S/Ns 33-40, 42-43: 50 krad TD				5	
20140401 12:17:30 to 20140401 12:33:55	5.000E-04 rad(SiO2) at 3.047E+03 rad(SiO2)/min	RH3083MK, WFR #1, S/Ns 21-30: 50 krad TD				5	
20140401 12:47:00 to 20140401 13:19:49	1.000E-05 rad(SiO2) at 3.047E+03 rad(SiO2)/min	RH1963MK, WFR #11, S/Ns 44-47, 49-51, 53-55: 100 krad TD				6	
20140401 12:47:00 to 20140401 13:19:49	1.000E-05 rad(SiO2) at 3.047E+03 rad(SiO2)/min	RH3083MK, WFR #1, S/Ns 31-40: 100 krad TD				6	
20140401 13:31:00 to 20140401 14:36:39	2.000E-05 rad(SiO2) at 3.046E+03 rad(SiO2)/min	RH1963MK, WFR #11, S/Ns 56-57, 59, 61, 63-66, 68-69: 200 krad TD				7	
20140401 13:31:00 to 20140401 14:36:39	2.000E-05 rad(SiO2) at 3.046E+03 rad(SiO2)/min	RH3083MK, WFR #1, S/Ns 41-50: 200 krad TD				7	
20140401 14:57:00 to 20140401 15:00:08	1.000E-04 rad(SiO2) at 3.194E+03 rad(SiO2)/min	RH137K (6RH137BKK*12), WFR #3, S/Ns 191-192, 194, 196-202: 10 krad TD				8	
20140401 15:06:30 to 20140401 15:12:46	2.000E-04 rad(SiO2) at 3.194E+03 rad(SiO2)/min	RH137K (6RH137BKK*12), WFR #3, S/Ns 203-212: 20 krad TD				9	
20140401 15:20:05 to 20140401 15:35:44	5.000E-04 rad(SiO2) at 3.194E+03 rad(SiO2)/min	RH137K (6RH137BKK*12), WFR #3, S/Ns 213, 215-220, 222-224: 50 krad TD				10	
20140401 15:43:00 to 20140401 16:14:18	1.000E-05 rad(SiO2) at 3.194E+03 rad(SiO2)/min	RH137K (6RH137BKK*12), WFR #3, S/Ns 225-234: 100 krad TD				11	

Uncertainty: Total Doses reported are ± 10.94% (Step Nos. 1-2, 8-11)
 16.02% (Step Nos. 3-7)

Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of $k = 2$.

NOTES:

1. ASTM = American Society for Testing and Materials.
2. DUT = Device Under Test.
3. S/N = Serial Number.
4. SD = Step Dose.
5. TD = Total Dose.
6. Dose rate uniformity across target area:
 - ± 4.67% (Step Nos. 1-2, 8-11)
 - ± 9.76% (Step Nos. 3-7)
7. All irradiation steps met the requirements of MIL-STD-883H, Test Method 1019.8, Condition A.
8. After the original Test Request (DD Form 1222) was approved, the following changes were made:
 - a. TDs for the RH117H devices were changed to 50 and 100 krad(SiO2) per customer request.
 - Latitude to change test parameters to suit customer requirements was included in the original Test Request; no Customer Order Change Request (SEGIT Form QP03-4, Rev. 5) was required/issued.
9. Source information:
 - a. Irradiator = J.L. Shepherd & Associates Model 81-22/484 self-contained irradiation facility, S/Ns 7125/50016.
 - b. Source selection = two large Co-60 sources.
10. Dosimeter system:
 - a. Radcal Model No. 9010 Radiation Monitor Controller, S/N 90-1313.
 - b. Radcal Model No. 9025-0.18 Electrometer/Ion Chamber, S/Ns 95-0478/9771.
 - c. This dosimeter system was calibrated per ISO/IEC 17025:2005 by University of Wisconsin Medical Radiation Research Center on 3 Feb 2014 (Report No. ION14426). This calibration is effective for two years.
11. Irradiation geometry: in accordance with section 7.3.2 of ASTM E1249-00 (2005), the DUT's semiconductor chip plane was perpendicular to the incident radiation beam.
12. Filter box: a DMEA Dose Enhancement Chamber (DEC) was used for all testing/dosimetry involved with this experiment.
 - The DEC's Pb and Al layers are compliant with section 7.2.2 of ASTM E1249-00 (2005) with respect to thickness and geometry.

Appendix D

Table D1: Pre-Irradiation Electrical Characteristics of Device-Under-Test

PARAMETER	CONDITIONS	$T_A = 25^\circ\text{C}$		SUB-GROUP	$-55^\circ\text{C} < T_A < 125^\circ\text{C}$		SUB-GROUP	UNITS
		MIN	MAX		MIN	MAX		
SET Pin Current (Note 6)	$V_{IN} = 1\text{V}, V_{CONTROL} = 2\text{V}, I_{LOAD} = 1\text{mA}$	49.5	50.5	1	49	51.5	2, 3	μA
Output Offset Voltage ($V_{OUT} - V_{SET}$)	$V_{IN} = 1\text{V}, V_{CONTROL} = 2\text{V}, I_{LOAD} = 1\text{mA}$	-4	4	1	-6	6	2, 3	mV
Load Regulation, I_{SET}	$I_{LOAD} = 1\text{mA to } 2.8\text{A}$	-200	200	1	-300	300	2, 3	nA
Load Regulation, V_{OS}	$I_{LOAD} = 5\text{mA to } 2.8\text{A}$	-3	3	1	-4	4	2, 3	mV
Line Regulation, I_{SET}	$V_{IN} = 1\text{V to } 23\text{V}, V_{CONTROL} = 2\text{V to } 25\text{V}, I_{LOAD} = 1\text{mA}$ $V_{IN} = 1\text{V to } 23\text{V}, V_{CONTROL} = 2\text{V to } 25\text{V}, I_{LOAD} = 5\text{mA}$	-8	8	1	-10	10	2, 3	nA/V nA/V
Line Regulation, V_{OS}	$V_{IN} = 1\text{V to } 23\text{V}, V_{CONTROL} = 2\text{V to } 25\text{V}, I_{LOAD} = 1\text{mA}$ $V_{IN} = 1\text{V to } 23\text{V}, V_{CONTROL} = 2\text{V to } 25\text{V}, I_{LOAD} = 5\text{mA}$	-0.02	0.02	1	-0.05	0.05	2, 3	mV/V mV/V
Minimum Load Current (Note 3)	$V_{IN} = 1\text{V}, V_{CONTROL} = 2\text{V}$ $V_{IN} = 23\text{V}, V_{CONTROL} = 25\text{V}$		0.5 1	1 1		5 5	2, 3 2, 3	mA mA
$V_{CONTROL}$ Dropout Voltage (Note 4)	$V_{IN} = 1\text{V}, I_{LOAD} = 0.1\text{A}$ $V_{IN} = 1\text{V}, I_{LOAD} = 1\text{A}$ $V_{IN} = 1\text{V}, I_{LOAD} = 2.8\text{A}$		1.4 1.45 1.5	1 1 1		1.55 1.6 1.65	2, 3 2, 3 2, 3	V V V
V_{IN} Dropout Voltage (Note 4)	$V_{CONTROL} = 2\text{V}, I_{LOAD} = 0.1\text{A}$ $V_{CONTROL} = 2\text{V}, I_{LOAD} = 1\text{A}$ $V_{CONTROL} = 2\text{V}, I_{LOAD} = 2.8\text{A}$		35 220 650	1 1 1		35 280 750	2, 3 2, 3 2, 3	mV mV mV
$V_{CONTROL}$ Pin Current (Note 5)	$V_{IN} = 1\text{V}, V_{CONTROL} = 2\text{V}, I_{LOAD} = 0.1\text{A}$ $V_{IN} = 1\text{V}, V_{CONTROL} = 2\text{V}, I_{LOAD} = 1\text{A}$ $V_{IN} = 1\text{V}, V_{CONTROL} = 2\text{V}, I_{LOAD} = 2.8\text{A}$		10 35 80	1 1 1		10 40 90	2, 3 2, 3 2, 3	mA mA mA
Current Limit	$V_{IN} = 5\text{V}, V_{CONTROL} = 5\text{V}, V_{SET} = 0\text{V},$ $V_{OUT} = -0.1\text{V}$		2.8	1		2.8	2, 3	A
Error Amplifier RMS Output Noise (Note 7)	$I_{LOAD} = 500\text{mA}, 10\text{Hz} \leq f \leq 100\text{kHz},$ $C_{OUT} = 10\mu\text{F}, C_{SET} = 0.1\mu\text{F}$		TYP = 40	1				μV_{RMS}
Reference Current RMS Output Noise (Note 7)	$10\text{Hz} \leq f \leq 100\text{kHz}$		TYP = 1	1				nA _{RMS}

Table D2: Post-Irradiation Electrical Characteristics of Device-Under-Test

PARAMETER	CONDITIONS	10KRads(Si)		20KRads(Si)		50KRads(Si)		100KRads(Si)		200KRads(Si)		UNITS
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
SET Pin Current (Note 6)	$V_{IN} = 1V, V_{CONTROL} = 2V, I_{LOAD} = 1mA$	49	51	49	51	49	51	49	51	49	51	μA
Output Offset Voltage ($V_{OUT} - V_{SET}$)	$V_{IN} = 1V, V_{CONTROL} = 2V, I_{LOAD} = 1mA$	-4.5	4.5	-4.5	4.5	-4.5	4.5	-4.5	4.5	-4.5	4.5	mV
Load Regulation, I_{SET}	$I_{LOAD} = 1mA$ to 2.8A	-300	300	-300	300	-300	300	-300	300	-300	300	nA
Load Regulation, V_{OS}	$I_{LOAD} = 5mA$ to 2.8A	-3.5	3.5	-3.5	3.5	-3.5	3.5	-3.5	3.5	-3.5	3.5	mV
Line Regulation, I_{SET}	$V_{IN} = 1V$ to 23V, $V_{CONTROL} = 2V$ to 25V, $I_{LOAD} = 1mA$	-10	10	-10	10	-10	10	-10	10	-10	10	nA/V
Line Regulation, V_{OS}	$V_{IN} = 1V$ to 23V, $V_{CONTROL} = 2V$ to 25V, $I_{LOAD} = 1mA$	-0.025	0.025	-0.025	0.025	-0.025	0.025	-0.03	0.03	-0.04	0.04	mV/V
Minimum Load Current (Note 3)	$V_{IN} = 1V, V_{CONTROL} = 2V$		0.5		0.5		0.5		0.5		0.5	mA
	$V_{IN} = 23V, V_{CONTROL} = 25V$		1		1		1		1		1	mA
$V_{CONTROL}$ Dropout Voltage (Note 4)	$V_{IN} = 1V, I_{LOAD} = 0.1A$		1.41		1.41		1.42		1.43		1.45	V
	$V_{IN} = 1V, I_{LOAD} = 1A$		1.46		1.46		1.47		1.48		1.5	V
	$V_{IN} = 1V, I_{LOAD} = 2.8V$		1.51		1.51		1.52		1.53		1.55	V
V_{IN} Dropout Voltage (Note 4)	$V_{CONTROL} = 2V, I_{LOAD} = 0.1A$		35		40		40		45		45	mV
	$V_{CONTROL} = 2V, I_{LOAD} = 1A$		225		225		225		225		230	mV
	$V_{CONTROL} = 2V, I_{LOAD} = 2.8A$		655		655		655		660		670	mV
$V_{CONTROL}$ Pin Current (Note 5)	$V_{IN} = 1V, V_{CONTROL} = 2V, I_{LOAD} = 0.1A$		10.1		10.1		10.2		10.5		11	mA
	$V_{IN} = 1V, V_{CONTROL} = 2V, I_{LOAD} = 1A$		36		37		38		40		45	mA
	$V_{IN} = 1V, V_{CONTROL} = 2V, I_{LOAD} = 2.8A$		82		83		85		90		100	mA
Current Limit	$V_{IN} = 5V, V_{CONTROL} = 5V, V_{SET} = 0V,$ $V_{OUT} = -0.1V$		2.8		2.8		2.8		2.8		2.8	A
Error Amplifier RMS Output Noise (Note 7)	$I_{LOAD} = 500mA, 10Hz \leq f \leq 100kHz,$ $C_{OUT} = 10\mu F, C_{SET} = 0.1\mu F$		TYP = 40		TYP = 40		TYP = 40		TYP = 40		TYP = 40	μV_{RMS}
Reference Current RMS Output Noise (Note 7)	$10Hz \leq f \leq 100kHz$		TYP = 1		TYP = 1		TYP = 1		TYP = 1		TYP = 1	nA _{RMS}

Note 1: Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.

Note 2: Unless otherwise specified, all voltages are with respect to V_{OUT} . The RH3083MK DICE is tested and specified under pulse load conditions such that $T_J \cong T_A$.

Note 3: Minimum load current is equivalent to the quiescent current of the part. Since all quiescent and drive current is delivered to the output of the part, the minimum load current is the minimum current required to maintain regulation.

Note 4: Dropout results from either of minimum control voltage, $V_{CONTROL}$, or minimum input voltage, V_{IN} , both specified with respect to V_{OUT} . These specifications represent the minimum input-to-output differential voltage required to maintain regulation.

Note 5: The $V_{CONTROL}$ pin current is the drive current required for the output transistor. This current tracks output current with roughly a 1:60 ratio. The minimum value is equal to the quiescent current of the device.

Note 6: The SET pin is clamped to the output with diodes through 1k resistors. These resistors and diodes only carry current under transient overloads.

Note 7: Adding a small capacitor across the reference current resistor lowers output noise. Adding this capacitor bypasses the resistor shot noise and reference current noise; output noise is then equal to error amplifier noise (see LT[®]3083 Data Sheet and Application Note 83).

Note 8: Dice are probe tested at 25°C to the limits shown in Table 1. Except for high current tests, dice are tested under low current conditions which assure full load current specifications when assembled.

Note 9: Dice that are not qualified by Linear Technology with a can sample are guaranteed to meet specifications of Table 1 only. Dice qualified by Linear Technology with a can sample meet specifications in all tables.

Note 10: This IC includes overtemperature protection that is intended to protect the device during momentary overload conditions. Junction temperature exceeds the maximum operating junction temperature when overtemperature protection is active. Continuous operation above the specified maximum operating junction temperature may impair device reliability.

Note 11: Please refer to LT3083 standard product data sheet for Typical Performance Characteristics, Pin Functions, Applications Information, and Typical Applications.