

UNISYS

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TO: J. Lohr/311.1

FROM: K. Sahu/300.1

SUBJECT: Radiation Report on CASSINI/CIRS
Part No. LT119A
Control No. 11696

cc: A. Sharma/311.0
B. Poscy/300.1
OFA Library/300.1

A radiation evaluation was performed on LT119A (Dual Comparator) to determine the total dose tolerance of these parts. A brief summary of the test results is provided below. For detailed information, refer to Tables I through IV and Figure 1.

The total dose testing was performed using a Co^{60} gamma ray source. During the radiation testing, eight parts were irradiated under bias (see Figure 1 for bias configuration), and two parts were used as control samples. The total dose radiation levels were 5, 10, 15, 20, 30 and 50 krad*. The dose rate was between 0.29 and 1.17 krad/hour, depending on the total dose level (see Table II for radiation schedule). After each radiation exposure parts were electrically tested according to the test conditions and the specification limits** listed in Table III.

All parts passed initial electrical measurements. After the 5 krad irradiation, all irradiated parts exceeded the maximum specification limit of ± 40 nA for ii01, ii02, and ii03 with readings ranging from -74.3 nA to -140.7 nA. After the 10 krad irradiation, all parts continued to exceed the maximum specification limit for ii01, ii02 and ii03 with readings ranging from -272 nA to -357 nA. In addition all irradiated parts except S/N 73 exceeded the maximum specification limit of 500 nA for -ibias1 with readings ranging from 508 nA to 599 nA. All irradiated parts continued to pass all other electrical tests.

After the 15 krad irradiation, all parts continued to exceed the maximum specification limit for ii01, ii02, ii03 and -ibias1 with readings ranging from -349 nA to -1050 nA, and 612 nA to 909 nA. In addition S/N 74, 76, 77 and 79 exceeded the maximum specification limit of 750 nA for -ibias3 with readings ranging from 810 nA to 833 nA. All irradiated parts continued to pass all other electrical tests.

After the 20 krad irradiation, all parts continued to exceed the maximum specification limit for ii01, ii02, ii03 and -ibias1 with readings ranging from -394 nA to -549 nA, and 687 nA to 827 nA. All irradiated parts exceeded the maximum specification limit for -ibias3 with readings ranging from 776 nA to 910 nA. In addition S/N 74, 77 and 79 exceeded the maximum specification limit of 750 nA for -ibias2 with readings ranging from 752 nA to 764 nA. All irradiated parts continued to pass all other electrical tests.

After annealing for 168 hours at 25°C, all irradiated parts continued to exceed the maximum specification limit for ii01, ii02, ii03 and -ibias1 with readings ranging from -370 nA to -511 nA, and 653 nA to 782 nA. In addition all irradiated parts except S/N 73 exceeded the maximum specification limit for -ibias3 with readings ranging from 766 nA to 865 nA. All irradiated parts continued to pass all other electrical tests.

*The term rads, as used in this document, means rads(silicon). All radiation levels cited are cumulative.

**These are manufacturer's pre-irradiation data specification limits. No post-irradiation limits were provided by the manufacturer at the time these tests were performed.

After the 30 krad irradiation, all parts continued to exceed the maximum specification limit for ii01, ii02, ii03 and -ibias1 with readings ranging from -521 nA to -724 nA, and 873 nA to 1036 nA. All irradiated parts exceeded the maximum specification limit for -ibias3 with readings ranging from 981 nA to 1137 nA. In addition all parts exceeded the maximum specification limit of 750 nA for -ibias2 with readings ranging from 788 nA to 961 nA. All irradiated parts continued to pass all other electrical tests.

After the 50 krad irradiation, all parts continued to exceed the maximum specification limit for ii01, ii02, ii03 and -ibias1, -ibias2, -ibias3 with readings ranging from -514 nA to -903 nA, and 898 nA to 1447 nA. All irradiated parts continued to pass all other electrical tests.

Table IV provides a summary of the mean and standard deviation values for each parameter after different irradiation exposures and annealing step.

Any further details about this evaluation can be obtained upon request. If you have any questions, please call me at (301) 731-8954.

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TABLE I. Part Information

Generic Part Number:	LT119A
CASSINI/CIRS Part Number:	M38510/10307SIA
CASSINI/CIRS Control Number:	11696
Charge Number:	EE56049
Manufacturer:	Linear Technology
Lot Date Code:	9103
Quantity Tested:	10
Serial Number of Control Samples:	70, 71
Serial Numbers of Radiation Samples:	72, 73, 74, 75, 76, 77, 78, 79
Part Function:	Comparator
Part Technology:	CMOS
Package Style:	TO-5 10 Pin
Test Equipment:	A540
Test Engineer:	P. Srioudom

* No radiation tolerance/hardness was guaranteed by the manufacturer for this part.

TABLE II. Radiation Schedule for LT119A

EVENTS	DATE
1) INITIAL ELECTRICAL MEASUREMENTS	06/27/95
2) 5 KRAD IRRADIATION (0.312 KRADS/HOUR) POST-5 KRAD ELECTRICAL MEASUREMENT	06/27/95 06/28/95
3) 10 KRAD IRRADIATION (0.294 KRADS/HOUR) POST-10 KRAD ELECTRICAL MEASUREMENT	06/28/95 06/29/95
4) 15 KRAD IRRADIATION (0.294 KRADS/HOUR) POST-15 KRAD ELECTRICAL MEASUREMENT	06/29/95 06/30/95
5) 20 KRAD IRRADIATION (0.076 KRADS/HOUR) POST-20 KRAD ELECTRICAL MEASUREMENT	06/30/95 07/03/95
6) 168-HOUR ANNEALING @25°C POST-168 HOUR ANNEAL ELECTRICAL MEASUREMENT	07/11/95 07/18/95
7) 30 KRAD IRRADIATION (0.588 KRADS/HOUR) POST-30 KRAD ELECTRICAL MEASUREMENT	07/20/95 07/21/95
8) 50 KRAD IRRADIATION (1.176 KRADS/HOUR) POST-50 KRAD ELECTRICAL MEASUREMENT	07/31/95 08/01/95

PARTS WERE IRRADIATED AND ANNEALED UNDER BIAS; SEE FIGURE 1.

Table III. Electrical Characteristics of LT119A

test #	Test name	Min	Max	Conditions
1	I _{dd}	0.0 ma	10.0 ma	V _{ss} = +/- 15v
2	I _{sc}	-5.00 ma	0.00 ma	V _{ss} = +/- 15v
3	v _{io1_1}	-1.000 mv	1.000 mv	V _{ss} =+/-15v, V _{cm} = 0v
4	v _{io1_2}	-1.000 mv	1.000 mv	V _{ss} =+/-15v, V _{cm} = 0v
5	+i _{bias1_1}	-0.1 na	500.0 na	V _{ss} =+/- 15v, V _{cm} = 0v
6	-i _{bias1_1}	-0.1 na	500.0 na	V _{ss} =+/-15v, V _{cm} = 0v
7	+i _{bias1_2}	-0.1 na	500.0 na	V _{ss} =+/-15v, V _{cm} = 0v
8	-i _{bias1_2}	-0.1 na	500.0 na	V _{ss} =+/-15v, V _{cm} = 0v
9	i _{io1_1}	-40.0 na	40.0 na	V _{ss} =+/-15v, V _{cm} = 0v
10	i _{io1_2}	-40.0 na	40.0 na	V _{ss} =+/-15v, V _{cm} = 0v
11	v _{io2_1}	-1.000 mv	1.000 mv	V _{ss} =+27v/-3v, V _{cm} =+12v
12	v _{io2_2}	-1.000 mv	1.000 mv	V _{ss} =+27v/-3v, V _{cm} =+12v
13	+i _{bias2_1}	-0.1 na	750.0 na	V _{ss} =+27v/-3v, V _{cm} =+12v
14	-i _{bias2_1}	-0.1 na	750.0 na	V _{ss} =+27v/-3v, V _{cm} =+12v
15	+i _{bias2_2}	-0.1 na	750.0 na	V _{ss} =+27v/-3v, V _{cm} =+12v
16	-i _{bias2_2}	-0.1 na	750.0 na	V _{ss} =+27v/-3v, V _{cm} =+12v
17	i _{io2_1}	-40.0 na	40.0 na	V _{ss} =+27v/-3v, V _{cm} =+12v
18	i _{io2_2}	-40.0 na	40.0 na	V _{ss} =+27v/-3v, V _{cm} =+12v
19	v _{io3_1}	-1.000 mv	1.000 mv	V _{ss} =+3v/-27v, V _{cm} =-12v
20	v _{io3_2}	-1.000 mv	1.000 mv	V _{ss} =+3v/-27v, V _{cm} =-12v
21	+i _{bias3_1}	-0.1 na	750.0 na	V _{ss} =+3v/-27v, V _{cm} =-12v
22	-i _{bias3_1}	-0.1 na	750.0 na	V _{ss} =+3v/-27v, V _{cm} =-12v
23	+i _{bias3_2}	-0.1 na	750.0 na	V _{ss} =+3v/-27v, V _{cm} =-12v
24	-i _{bias3_2}	-0.1 na	750.0 na	V _{ss} =+3v/-27v, V _{cm} =-12v
25	i _{io3_1}	-40.0 na	40.0 na	V _{ss} =+3v/-27v, V _{cm} =-12v
26	i _{io3_2}	-40.0 na	40.0 na	V _{ss} =+3v/-27v, V _{cm} =-12v
27	v _{io4_1}	-1.000 mv	1.000 mv	V _{ss} =-2.5v/-2.5v, V _{cm} =-2.5v
28	v _{io4_2}	-1.000 mv	1.000 mv	V _{ss} =-2.5v/-2.5v, V _{cm} =-2.5v
29	cm _{rr} 1	90.0 db		V _{ss} =+/-15v, V _{cm} = +/-12v
30	cm _{rr} 2	90.0 db		V _{ss} =+/-15v, V _{cm} = +/-12
31	+A _{vs} 1 (V/mv)	20.00 V/mv		V _{ss} =+/-15v, V _o = +/-10v
32	+A _{vs} 2 (V/mv)	20.00 V/mv		V _{ss} =+/-15v, V _o = +/-10v
33	V _{o11_1}		0.600 v	V _{ss} =3.5v/-1.0v, i _{o1} =3.2ma
34	V _{o11_2}		0.600 v	V _{ss} =3.5v/-1.0v, i _{o1} =3.2ma
35	V _{o12_1}		0.600 v	V _{ss} =2.25v/-2.25v, i _{o1} =3.2ma
36	V _{o12_2}		0.600 v	V _{ss} =2.25v/-2.25v, i _{o1} =3.2ma
37	V _{o13_1}		1.500 v	V _{ss} =+27v/-3v, i _{o1} =25ma
38	V _{o13_2}		1.500 v	V _{ss} =+27v/-3v, i _{o1} =25ma
39	V _{o14_1}		1.500 v	V _{ss} =+3v/-27v, i _{o1} =25ma
40	V _{o14_2}		1.500 v	V _{ss} =+3v/-27v, i _{o1} =25ma

TABLE IV: Summary of Electrical Measurements after Total Dose Exposures and Annealing for LT119A /1

Test #	Parameters	Unit	Spec. Lim./2	min	max	Total Dose Exposure (krads)														
						Initial		5		10		15		20		Annealing		Total Dose Exposure (krads)		
						mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	
1	Idd	mA	0	10	7.88	0.23	7.79	0.19	7.76	0.22	7.62	0.57	7.70	0.14	7.79	0.14	7.72	0.14	7.70	0.15
2	Iss	mA	-5	0	-3.34	0.09	-3.30	0.08	-3.29	0.08	-3.32	0.06	-3.31	0.07	-3.29	0.06	-3.28	0.06	-3.24	0.07
3	Vio1_1	mV	-1	1	0.83	0	0.83	0	0.83	0	0.83	0	0.83	0	0.83	0	0.83	0	0.83	0
4	Vio1_2	mV	-1	1	0.82	0	0.82	0.09	0.82	0	0.82	0	0.82	0	0.82	0	0.82	0	0.82	0
5	+ibias1_1	nA	-0.1	500	152	0.14	201	17.9	247	23	285	28	291	27.6	285	26.4	336	29.9	483	41.2
6	-ibias1_1	nA	-0.1	500	130	11.6	319	24.7	552	44.7	692	56.3	766	55.5	724	51.3	966	68.3	1000	115
7	+ibias1_2	nA	-0.1	500	158	1.5	213	17.6	252	24.4	292	28.9	298	27.9	291	26.3	343	29.7	490	41.1
8	-ibias1_2	nA	-0.1	500	134	12.9	319	23.1	551	44.5	691	56.8	766	56.4	722	51.2	965	66.9	1000	110
9	ii01_1	nA	-40	40	22.2	26.6	-100	8.56	-300	21.7	-400	28.6	-500	28.1	-400	25.1	-600	38.5	-600	90.5
10	ii01_2	nA	-40	40	23.9	3.1	-100	10.4	-300	20.5	-400	28.7	-468	28.7	-400	25.2	-600	37.7	-700	81.4
11	Vio2_1	mV	-1	1	0.42	0	0.42	0.67	0.42	0.02	0.42	0.02	0.42	0	0.42	0	0.43	23.9	0.43	14.5
12	Vio2_2	mV	-1	1	0.42	0	0.42	0.33	0.42	0.04	0.42	0.04	0.42	0	0.42	0	0.43	43.9	0.43	30.4
13	+ibias2_1	nA	-0.1	750	131	14.1	174	18.2	215	23.8	251	27.9	256	27.1	251	26.1	296	30.1	431	42.1
14	-ibias2_1	nA	-0.1	750	112	11.8	285	25.1	507	45.9	641	57.4	699	56.2	659	52.7	886	70.7	1000	114
15	+ibias2_2	nA	-0.1	750	136	15.3	185	15.9	222	23.9	257	29.3	263	27.8	257	26.5	304	30.6	439	42.1
16	-ibias2_2	nA	-0.1	750	115	12.9	285	24.2	507	45.9	639	58.7	699	57.8	658	52.8	886	69.7	1000	109
17	ii02_1	nA	-40	40	19.3	2.68	-100	84.1	-300	22.2	-400	29.7	-400	29.2	-400	26.8	-600	40.8	-600	87.1
18	ii02_2	nA	-40	40	21.0	3.50	-100	12.1	-300	22.2	-400	29.9	-600	30.3	-400	2.64	-600	39.5	-600	79.3
19	Vio3_1	mV	-1	1	-0.58	0	-0.58	30.7	-0.58	34.3	-0.58	0	-0.58	0	-0.58	0	-0.58	0	-0.58	0
20	Vio3_2	mV	-1	1	-0.58	0	-0.58	34.3	-0.58	33.2	-0.58	0	-0.58	0	-0.58	0	-0.58	0	-0.58	0

Notes:

- 1/ The mean and standard deviation values were calculated over the eight parts irradiated in this testing. The control samples remained constant throughout the testing and are not included in this table.
- 2/ These are manufacturer's pre-irradiation data sheet specification limits. No post-irradiation limits were provided by the manufacturer at the time the tests were performed.

Radiation-sensitive parameters: ii01, ii02, ii03, -ibias1, -ibias2 and -ibias3.

TABLE IV (Cont'd): Summary of Electrical Measurements after Total Dose Exposures and Annealing for LT119A /1

Test #	Parameters	Unit	Spec. Lim./2		Total Dose Exposure (krads)												Total Dose Exposure (krads)								
			min	max	Initial			5			10			15			20			168 hrs @25°C		30		50	
					mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	
21	+ibias3_1	nA	-0.1	750	178	13.4	234	17.9	286	22.9	329	28.1	336	26.8	378	26.3	386	29.9	41.2						
22	-ibias3_1	nA	-0.1	750	152	11.8	364	25.3	619	45.3	776	56.4	855	53.8	809	50.3	1000	66.3	114						
23	+ibias3_2	nA	-0.1	750	184	15.2	254	20.8	292	24.4	336	28.4	344	27.6	335	25.9	394	29.6	558						
24	-ibias3_2	nA	-0.1	750	158	12.5	365	23.1	618	44.5	774	56.5	853	53.6	807	49.8	1000	63.7	108						
25	ii03_1	nA	-40	40	25.6	1.89	-100	9.02	-300	22.6	-400	28.6	-519	27.3	-500	24.4	-700	36.5	90.1						
26	ii03_2	nA	-40	40	25.4	3.81	-100	10.7	-300	20.2	-400	28.7	-500	26.6	-500	24.5	-700	34.8	80.9						
27	Vio4_1	mV	-1	1	-0.58	0	-0.58	26.8	31	-0.58	34.3	75.9	-0.58	0	-0.58	28.3	-0.58	0	0						
28	Vio4_2	mV	-1	1	-0.58	0	-0.58	31	-0.58	31.5	-0.58	77.6	-0.58	0	-0.58	28.5	-0.58	0	0						
29	cmrr_1	dB	90	-	133	0.04	133	0.05	133	0.06	133	0.07	133	0.07	133	0.06	133	0.04	133						
30	cmrr2	dB	90	-	134	0.08	133	0.05	134	0.16	133	0.11	133	0.08	133	0.05	133	0.08	133						
31	+Avs_1	V/mv	20	-	37.5	0.16	37.4	0.15	37.5	0	37.5	0.16	37.4	0.15	37.5	0.15	36.7	0.15	36.6						
32	+Avs_2	V/mv	20	-	34.5	0	34.6	0	34.5	0	34.5	0.01	34.5	0	34.6	0	33.8	0	33.9						
33	Voll_1	V	-	0.6	0.12	0	0.12	0	0.13	0	-0.13	0	0.13	0	0.13	0	0.13	0	0.14						
34	Voll_2	V	-	0.6	0.14	0	0.14	0	0.14	0	0.15	0	0.15	0	0.15	0	0.16	0	0.16						
35	Voll2_1	V	-	0.6	0.18	0	0.18	0	0.19	0	0.19	0	0.19	0	0.19	0	0.20	0	0.20						
36	Voll2_2	V	-	0.6	0.20	0	0.20	0	0.21	0	0.21	0	0.21	0	0.21	0	0.22	0	0.21						
37	Voll3_1	V	-	1.5	0.28	0.01	0.28	0.01	0.28	0.01	0.29	0.02	0.29	0.01	0.29	0.01	0.31	0.02	0.32						
38	Voll3_2	V	-	1.5	0.41	0.01	0.41	0.02	0.41	0.01	0.42	0.03	0.42	0.01	0.42	0.01	0.43	0.03	0.45						
39	Voll4_1	V	-	1.5	0.32	0	0.32	0	0.32	0	0.33	0	0.33	0	0.33	0	0.35	0.01	0.37						
40	Voll4_2	V	-	1.5	0.46	0	0.46	0	0.47	0	0.47	0	0.47	0	0.48	0	0.49	0.01	0.51						

Notes:

- 1/ The mean and standard deviation values were calculated over the eight parts irradiated in this testing. The control samples remained constant throughout the testing and are not included in this table.
- 2/ These are manufacturer's pre-irradiation data sheet specification limits. No post-irradiation limits were provided by the manufacturer at the time the tests were performed.

Radiation-sensitive parameters: ii01, ii02, ii03, -ibias1, -ibias2 and -ibias3.

Figure 1. Radiation Bias Circuit for LT119A

