

UNISYS

DATE: April 21, 1995

PPM-95-144

TO: J. Lohr/311

FROM: K. Sahn/300.1

SUBJECT: Radiation Report on CASSINI/CIRS
Part No. LT1021-5
Control No. 12095cc: A. Sharma/311.0
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A radiation evaluation was performed on LT1021-5 (Precision Voltage Reference) 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 ⁶⁰Co 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, 50, 75 and 100 krad*. The dose rate was between 0.15 and 1.47 krad/hour, depending on the total dose level (see Table II for radiation schedule). After the 100 krad irradiation, parts were annealed at 25°C for 168 hours, after which the parts were annealed at 100°C for 168 hours. After each radiation exposure and annealing treatment, parts were electrically tested according to the test conditions and the specification limits** listed in Table III.

All parts passed initial electrical measurements. All irradiated parts passed all electrical tests up to and including the 100 krad level.

After annealing for 168 hours at 25°C, all parts passed all electrical tests.

After annealing for 168 hours at 100°C, no rebound effects were observed.

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.

*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.

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TABLE 1. Part Information

Generic Part Number:	LT1021-5
CASSINI/CIRS Part Number:	M38510/12407SGA
CASSINI/CIRS Control Number:	12095
Charge Number:	EE56100
Manufacturer:	Linear Technology Corp
Lot Date Code:	9122
Quantity Tested:	10
Serial Number of Control Samples:	50, 51
Serial Numbers of Radiation Samples:	52, 53, 54, 55, 56, 57, 58, 59
Part Function:	Voltage Reference
Part Technology:	Bipolar
Package Style:	8-pin Metal Can TO-5
Test Equipment:	A540
Test Engineer:	C. Arcila

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

TABLE II. Radiation Schedule for LT1021-5

EVENTS	DATE
1) INITIAL ELECTRICAL MEASUREMENTS	03/13/95
2) 5 KRAD IRRADIATION (0.29 KRADS/HOUR)	03/13/95
POST-5 KRAD ELECTRICAL MEASUREMENT	03/14/95
3) 10 KRAD IRRADIATION (0.29 KRADS/HOUR)	03/14/95
POST-10 KRAD ELECTRICAL MEASUREMENT	03/15/95
4) 15 KRAD IRRADIATION (0.29 KRADS/HOUR)	03/15/95
POST-15 KRAD ELECTRICAL MEASUREMENT	03/16/95
5) 20 KRAD IRRADIATION (0.29 KRADS/HOUR)	03/16/95
POST-20 KRAD ELECTRICAL MEASUREMENT	03/17/95
6) 30 KRAD IRRADIATION (0.15 KRADS/HOUR)	03/17/95
POST-30 KRAD ELECTRICAL MEASUREMENT	03/18/95
7) 50 KRAD IRRADIATION (1.18 KRADS/HOUR)	03/20/95
POST-50 KRAD ELECTRICAL MEASUREMENT	03/21/95
8) 75 KRAD IRRADIATION (0.59 KRADS/HOUR)	03/21/95
POST-75 KRAD ELECTRICAL MEASUREMENT	03/22/95
9) 100 KRAD IRRADIATION (1.47 KRADS/HOUR)	03/22/95
POST-100 KRAD ELECTRICAL MEASUREMENT	03/23/95
10) 168-HOUR ANNEALING @25°C	03/23/95
POST-168 HOUR ANNEAL ELECTRICAL MEASUREMENT	03/30/95
11) 168-HOUR ANNEALING @100°C	03/30/95
POST-168 HOUR ANNEAL ELECTRICAL MEASUREMENT	04/06/95

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

Table III. Electrical Characteristics of LT1021-5

Unless Otherwise Specified: $T_A = 25^\circ\text{C}$

TEST NAME	SYMBOL	CONDITIONS	LIMITS	
			MIN	MAX
I_{CC}	I_{CC}	$V_{IN} = 10\text{V}, I_L = 0\text{mA}$		1.20mA
V_{OUT}	V_{OUT}	$V_{IN} = 10\text{V}, I_L = 0\text{mA}$	4.950V	5.050V
V_{RLINE}	V_{Line1}	$I_L = 0\text{mA}, V_{IN} = (7.2\text{V} \leq V_{IN} \leq 10\text{V})$	-170.00uV	170.00uV
V_{RLINE}	V_{Line2}	$I_L = -100\text{mA}, V_{IN} = (10\text{V} \leq V_{IN} \leq 40\text{V})$	-900.00uV	900.00uV
V_{RLOAD}	V_{Load1}	$V_{IN} = 10\text{V}, (-10\text{mA} \leq I_L \leq 0\text{mA}) 3\text{mS Pulse}$	-1.00mV	1.00mV
V_{RLOAD}	V_{Load2}	$V_{IN} = 10\text{V}, (0\text{mA} \leq I_L \leq 10\text{mA}) 3\text{mS Pulse}$	-5.00mV	5.00mV
V_{TRIM}	V_{TRIM}	$V_{IN} = 10\text{V}, I_L = 0\text{mA}$	3.50V	

TABLE IV: Summary of Electrical Measurements after Total Dose Exposures and Annealing for LT1021-5 /1

Test #	Parameter	Unit	Spec. Lim./2 min max	Total Dose Exposure (krads)												Annealing									
				Initial		5		10		15		20		30		50		75		100		168 hrs @25°C		168 hrs @100°C	
				mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
1	ICC	mA	-	1.2	0.71	0.01	0.70	0.01	0.70	0.01	0.69	0.01	0.69	0.01	0.68	0.01	0.68	0.01	0.67	0.01	0.67	0.01	0.67	0.01	
2	V_Out	V	4.95	5.05	4.99	0.0	5.0	0.0	5.0	0.0	5.0	0.0	5.0	0.0	5.01	0.0	5.01	0.0	5.01	0.0	5.01	0.0	5.01	0.0	
3	V_Line_1	mV	-170	170	48	11	48	14	50	15	33	9	21	18	-13	17	-41	23	-83	20	-88	25	-61	10	
4	V_Line_2	mV	-900	900	-84	17	-76	19	-52	20	-30	21	26	27	111	36	163	41	289	52	265	49	216	36	
5	V_Load_1	mV	-1.0	1.0	-0.77	0.04	-0.78	0.03	-0.81	0.08	-0.79	0.03	-0.82	0.05	-0.84	0.04	-0.84	0.04	-0.87	0.06	-0.85	0.04	-0.86	0.04	
6	V_Load_2	mV	-5.0	5.0	3.64	0.09	3.74	0.11	3.79	0.15	3.85	0.13	3.92	0.12	4.04	0.12	4.2	0.15	4.41	0.22	4.16	0.14	4.24	0.24	
7	V_TRIM	V	3.5	-	4.05	0.0	4.06	0.0	4.05	0.0	4.06	0.0	4.07	0.0	4.07	0.0	4.08	0.0	4.08	0.0	4.09	0.0	4.08	0.0	

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.

Figure 1. Radiation Bias Circuit for LT1021-5

