

## Unisys

DATE: November 20, 1998 PPM-99-010  
TO: S Hull/562  
FROM: K. Sahu/S. Kniffin/300.1  
SUBJECT: Radiation Report on **LT1010MH (Linear Technology) (LDC 9808)**  
PROJECT: IRAC

cc: R. Williams/722.0, R. Reed/562, A. Sharma/562, OFA Library/300.1

A radiation evaluation was performed on **LT1010MH (5962-8856201XA) Fast ±150mA Power Buffer (Linear Technology)** to determine the total ionizing dose (TID) tolerance of these parts. The TID testing was performed using a Co<sup>60</sup> 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 TID radiation levels were 2.5, 5.0, 10.0, 15.0, 20.0, 30.0, 50.0, and 100.0kRads.<sup>1</sup> The dose rate was 0.259kRads/hour (0.08Rads/s). See Table II for the radiation schedule and effective dose rate calculation. After the 100.0kRad irradiation, the parts were annealed under bias at 25°C and tested after 168 hours.<sup>2</sup> After each radiation exposure and annealing treatment, parts were electrically tested according to the test conditions and the specification limits<sup>3</sup> listed in Table III.

An executive summary of the test results is provided below in bold, followed by a detailed summary of the test results after each radiation level and annealing step. For detailed information, refer to Tables I through IV and Figure 1.

**All parts passed all tests initially and upon irradiation to 100kRads. After annealing the parts for 168 hours at 25°C, no significant change was noted in any parameter.**

Initial electrical measurements were made on 10 samples. Eight samples (SN's 79, 80, 81, 82, 83, 84, 85, and 86) were used as radiation samples while SN's 77 and 78 were used as control samples. All parts passed all tests during initial electrical measurements.

All parts passed all tests up to 100kRads.

After annealing the parts for 168 hours at 25°C, the parts showed no significant change in any parameter.

Table IV provides a summary of the test results with the mean and standard deviation values for each parameter after each irradiation exposure and annealing step.

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

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<sup>1</sup> The term Rads, as used in this document, means Rads (silicon). All radiation levels cited are cumulative.

<sup>2</sup> The temperature 25°C as used in this document implies room temperature.

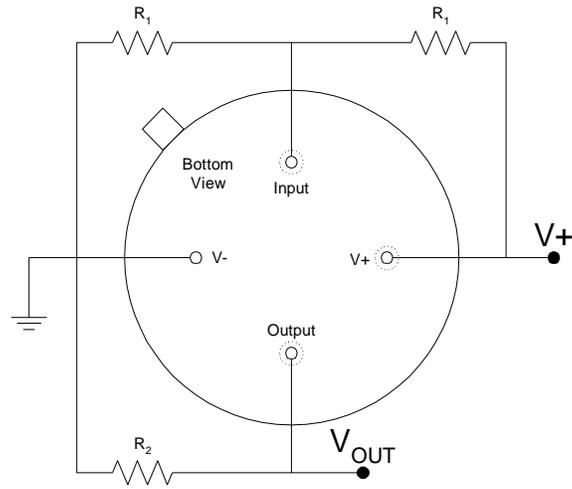
<sup>3</sup> These are manufacturer's pre-irradiation data specification limits. The manufacturer provided no post-irradiation limits at the time these tests were performed.

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Figure 1. Radiation Bias Circuit for LT1010



Notes:

1.  $V+ = +15V \pm 0.5V$ ,  $V_{OUT} = 7.5V \pm 0.25V$  (Check  $I_O \approx 16mA$ ).
2.  $R_1 = 10k\Omega \pm 5\%$ ,  $\frac{1}{4}W$ .
3.  $R_2 = 470\Omega \pm 5\%$ ,  $\frac{1}{4}W$ .

TABLE I. Part Information

Generic Part Number:	LT1010
IRAC Part Number:	LT1010MH (5962-8856201XA)
Charge Number:	M88516
Manufacturer:	Linear Technology
Lot Date Code (LDC):	9808
Quantity Tested:	10
Serial Number of Control Samples:	77, 78
Serial Numbers of Radiation Samples:	79, 80, 81, 82, 83, 84, 85, and 86
Part Function:	Fast $\pm 150\text{mA}$ Power Buffer
Part Technology:	Bipolar
Package Style:	4 Pin TO-39 Can
Test Equipment:	A540
Test Engineer:	S. Norris

- The manufacturer for this part guaranteed no radiation tolerance/hardness.

TABLE II. Radiation Schedule for LT1010

EVENT.....	DATE
1) INITIAL ELECTRICAL MEASUREMENTS .....	10/19/98
2) 2.5 KRAD IRRADIATION (0.147 KRADS/HOUR) .....	10/26/98
POST-2.5 KRAD ELECTRICAL MEASUREMENT .....	10/27/98
3) 5.0 KRAD IRRADIATION (0.147 KRADS/HOUR) .....	10/27/98
POST-5.0 KRAD ELECTRICAL MEASUREMENT .....	10/28/98
4) 10.0 KRAD IRRADIATION (0.121 KRADS/HOUR) .....	10/28/98
POST-10.0 KRAD ELECTRICAL MEASUREMENT .....	10/30/98
5) 15.0 KRAD IRRADIATION (0.079 KRADS/HOUR) .....	10/30/98
POST-15.0 KRAD ELECTRICAL MEASUREMENT .....	11/02/98
6) 20.0 KRAD IRRADIATION (0.125 KRADS/HOUR) .....	11/02/98
POST-20.0 KRAD ELECTRICAL MEASUREMENT .....	11/05/98
7) 30.0 KRAD IRRADIATION (0.555 KRADS/HOUR) .....	10/05/98
POST-30.0 KRAD ELECTRICAL MEASUREMENT .....	10/06/98
8) 50.0 KRAD IRRADIATION (0.357 KRADS/HOUR) .....	10/06/98
POST-50.0 KRAD ELECTRICAL MEASUREMENT .....	11/09/98
9) 100.0 KRAD IRRADIATION (1.220 KRADS/HOUR).....	11/09/98
POST-100.0 KRAD ELECTRICAL MEASUREMENT .....	11/12/98
10) 168 HOUR ANNEALING @25°C .....	11/12/98
POST-168 HOUR ANNEAL ELECTRICAL MEASUREMENT .....	11/19/98

Effective Dose Rate = 100,000 RADS/14 DAYS=258.7 RADS/HOUR=0.08 RADS/SEC

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

Table III. Electrical Characteristics of LT1010 /1

Test #	Parameter	Units	Test Conditions /2	Spec. Lim.	
				min	max
1	I <sub>cc</sub>	mA	I <sub>OUT</sub> = 0mA, I <sub>BIAS</sub> = 0mA		8.0
2	V <sub>os</sub>	mV	I <sub>OUT</sub> = 0mA	20	110
3	+ Gain	V/V	V <sub>OUT</sub> = +10.0V, V <sub>S</sub> = ±20V	0.99500	1.00000
4	- Gain	V/V	V <sub>OUT</sub> = -10.0V, V <sub>S</sub> = ±20V	-1.00000	-0.99500
5	Slew Rate	V/ms	V <sub>S</sub> = ±15V, V <sub>IN</sub> = 20Vp-p, V <sub>OUT</sub> = 10Vp-p, R <sub>L</sub> = 100W	75	
6	I <sub>b</sub>	mA	I <sub>OUT</sub> = 0mA		150

Notes:

1/ These are the manufacturer's non-irradiated data sheet specification limits. The manufacturer provided no post-irradiation limits at the time the tests were performed.

2/  $4.5V \leq V_S \leq 40V$ ,  $V^- + 0.5 \leq V_{IN} \leq V^+ - 1.5V$  and I<sub>OUT</sub> = 0mA unless otherwise noted.

**TABLE IV: Summary of Electrical Measurements after Total Dose Exposures and Annealing for LT1010 /1**

Test #	Parameters	Units	Spec. Lim. /2		Total Dose Exposure (kRads Si)																		Annealing	
					Initial		2.5		5.0		10.0		15.0		20.0		30.0		50.0		100.0		168 hours @25°C	
					mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
1	Icc	mA		8.0	5.8	0.1	5.7	0.1	5.7	0.1	5.6	0.1	5.6	0.1	5.5	0.1	5.4	0.1	5.1	0.1	4.7	0.1	5.0	0.1
2	Vos	mV	20	110	77	3	76	3	73	3	70	3	65	3	62	4	58	4	53	4	42	5	49	4
3	+ Gain	V/V	0.9950	1.0000	0.9997	0.0000	0.9998	0.0000	0.9998	0.0000	0.9998	0.0000	0.9998	0.0000	0.9998	0.0000	0.9999	0.0000	0.9999	0.0000	0.9999	0.0000	0.9999	0.0000
4	- Gain	V/V	-1.0000	-0.9950	-0.9987	0.0000	-0.9987	0.0000	-0.9987	0.0000	-0.9986	0.0000	-0.9986	0.0000	-0.9986	0.0000	-0.9985	0.0000	-0.9984	0.0000	-0.9982	0.0000	-0.9984	0.0000
5	Slew Rate	V/?s	75		589	27	572	28	544	37	492	94	425	102	315	83	259	10	244	11	206	20	234	10
6	Ib	?A		150	0.0	0.8	0.3	0.8	0.1	1.3	0.3	1.0	0.0	0.7	-0.2	1.0	0.0	0.9	0.6	0.5	0.1	0.8	0.1	0.7

Notes:

- 1/ The mean and standard deviation values were calculated over the eight parts irradiated in this testing. The control samples remained constant throughout 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: None.**