

DATE: February 9, 1997
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 SUBJECT: Radiation Report on: LMC6062
 Project: SMEX/WIRE
 Control #: 15606
 Job #: EE71396
 Project part #: LMC6062

PPM-97-008

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A radiation evaluation was performed on LMC6062 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 Co⁶⁰ gamma ray source. During the radiation testing, two parts SN# 2 and 3 were irradiated under bias (see Figure 1 for bias configuration). The total dose radiation levels for SN# 2 were 10 and 20 Krads* and the average dose rate was 0.15 krads / hour. The total dose levels for SN#3 were 1, 2, 3, 4, 7, 11 15, 20, 30, 50 and 100 krads The average dose rate up to 20 krads was 0.045 krads / hour The average dose rate for radiation steps above 20 krads was 0.25 krads / hour. (see Table II for radiation schedule). After each radiation exposure, parts were electrically tested to measure the output voltages on channels A and B, and input bias current. The parts were mounted in the bias fixture provided by the SMEX/Wire project during all electrical measurements (see Figure 1).

Table III provides the summary of initial electrical measurements on SN# 2, 3 4, 5 , 6, 7, 8, 9, 11 and 12.

SN#2 showed significant increase in Vout and I_{bias} on irradiation to 10 and 20 krads. The Vout for channel A increased from -0.79 mV to 17.7 mV after 10 krads and to 49 mV after 20 krads. Similar increases were found for channel B. The I_{bias} increased from 0.352 pA to 3.5 pA after 10 krads and to -11.6 pA after 20 krads. This part was not irradiated any further.

SN# 3 also showed gradual increase in Vout A from 0 -59mV to 55mV on irradiation from 1 to 30 krads. Also, Vout B increased from -0.89 mV to 64 mV and I_{bias} increased from 0.257 pA to -12.7 pA on irradiation from 1 to 30 krads. On continued irradiation to 50 krads , Vout A increased exponentially to 5V while Vout B and I_{bias} showed gradual increase to 87 mV and -14.2 pA. On annealing the parts @ 25°C for 68 hours, the part showed significant decrease in Vout A, with a reading of 188 mV. The irradiation of SN# 3 was continued to 100 krads. The part again showed exponential increase in Vout A to -5V and gradual increase in Vout B and I_{bias}. No significant recovery was observed on annealing the parts at @ 25°C for 68 hours after 100krads exposure.

Table IV provides the summary of electrical measurements on SN# 2 and 3 after radiation exposures to different radiation levels.

* The term rads, as used in this document, means rads(silicon). All consecutive annealing times at the same temperature and all radiation levels cited are cumulative.

A comparison of electrical measurements after 20 krads exposure shows that for SN# 2, which was irradiated at higher dose rate of 0.15 krads/hour, compared to SN# 3 which was irradiated at the dose rate of 0.045 krads/hour, the increase in Vout and Ibias is slightly higher. See Table IV for details

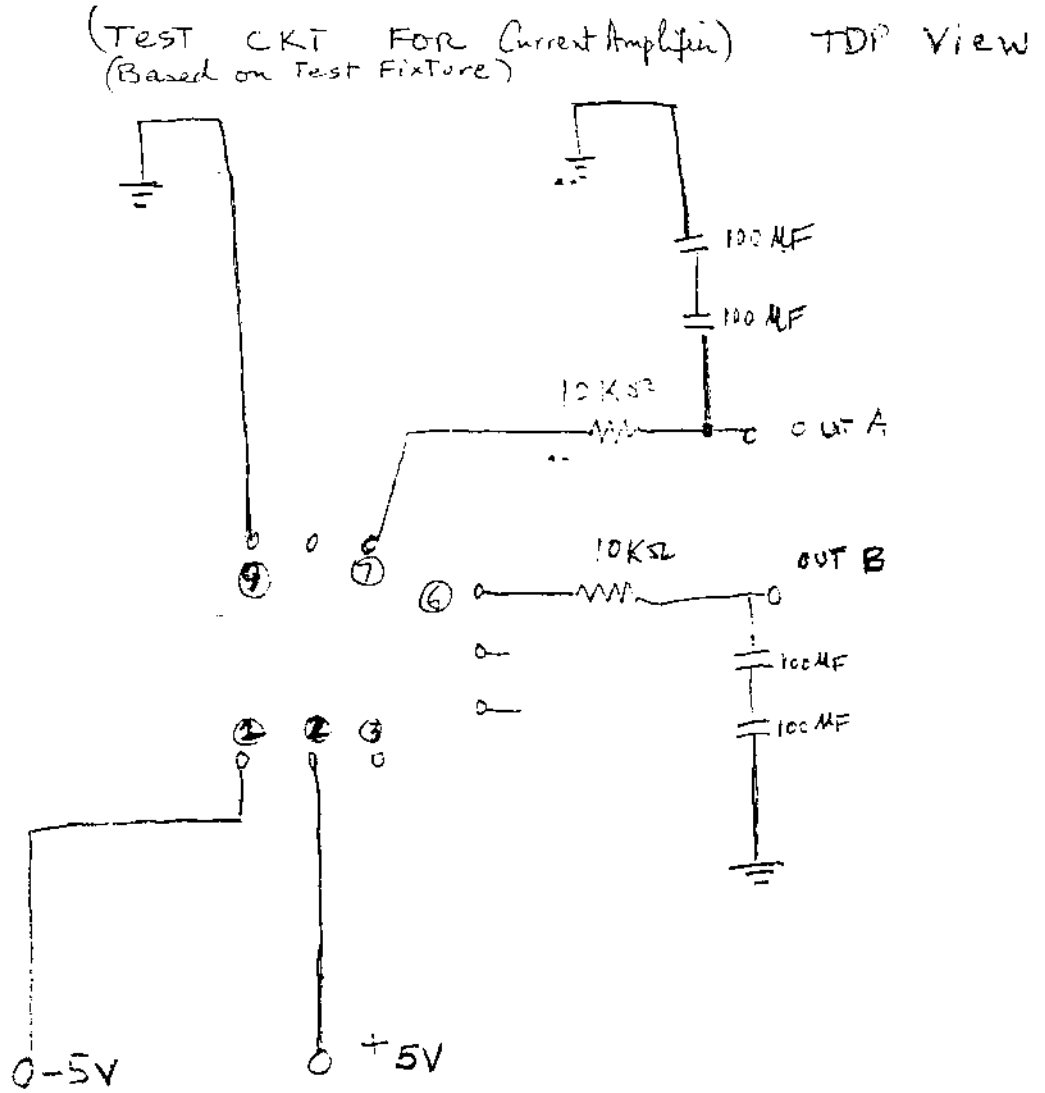
Any further details about this evaluation can be obtained upon request. If you have any questions, please call me at (301) 731-8954.

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Figure 1. Radiation Bias Circuit for LMC6062



Alix
12/19/96

TABLE I. Part Information

Generic Part Number:	LMC6062
Project Part Number	LMC6062
Project Control Number:	15606
Charge Number:	EE71396
Manufacturer:	National
Lot Date Code (LDC):	Not Marked on the Parts
Quantity Tested:	10
Serial Number of Samples:	2,3,4,5,6,7,8,9,11 and 12
Serial Numbers of Radiation Samples:	2,3
Part Function:	Op Amp
Part Technology:	Bipolar
Package Style:	12 pin metal can
Test Equipment:	Bench Test
Engineer:	S.Norris

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

TABLE II. Radiation Schedule for LMC6062

SN#2	
EVENT	DATE
1) INITIAL ELECTRICAL MEASUREMENTS.....	12/31/96
2) 10 KRAD IRRADIATION (0.25 KRADS/HOUR)	12/31/96
POST-10 KRAD ELECTRICAL MEASUREMENT.....	01/02/97
3) 20 KRAD IRRADIATION (0.12 KRADS/HOUR)	01/02/97
POST-20 KRAD ELECTRICAL MEASUREMENT.....	01/06/97
SN#3	
EVENT	DATE
1) INITIAL ELECTRICAL MEASUREMENTS.....	01/06/97
2) 1 KRAD IRRADIATION (0.050 KRADS/HOUR)	01/06/97
POST-1 KRAD ELECTRICAL MEASUREMENT.....	01/07/97
3) 2 KRAD IRRADIATION (0.05 KRADS/HOUR)	01/07/97
POST-2 KRAD ELECTRICAL MEASUREMENT.....	01/08/97
4) 3 KRAD IRRADIATION (0.05 KRADS/HOUR)	01/08/97
POST-3 KRAD ELECTRICAL MEASUREMENT.....	01/09/97
5) 4 KRAD IRRADIATION (0.05 KRADS/HOUR)	01/09/97
POST-4 KRAD ELECTRICAL MEASUREMENT.....	01/10/97
6) 7 KRAD IRRADIATION (0.05 KRADS/HOUR)	01/10/97
POST-7 KRAD ELECTRICAL MEASUREMENT.....	01/13/97
7) 11 KRAD IRRADIATION (0.05 KRADS/HOUR)	01/13/97
POST-11 KRAD ELECTRICAL MEASUREMENT.....	01/17/97
8) 15 KRAD IRRADIATION (0.59 KRADS/HOUR)	01/17/97
POST 15 KRAD ELECTRICAL MEASUREMENT.....	01/21/97
9) 20 KRAD IRRADIATION (0.10 KRADS/HOUR)	01/21/97
POST-20 KRAD ELECTRICAL MEASUREMENT.....	01/24/97
13) 30 KRAD IRRADIATION (0.15 KRADS/HOUR)	01/24/97
POST-30 KRAD ELECTRICAL MEASUREMENT.....	01/27/97
14) 50 KRAD IRRADIATION (0.22 KRADS/HOUR)	01/27/97
POST-50 KRAD ELECTRICAL MEASUREMENT.....	01/31/97
15) 68-HOUR ANNEALING @25°C.....	01/31/97
POST-68 HOUR ANNEAL ELECTRICAL MEASUREMENT	02/03/97
14) 100 KRAD IRRADIATION (0.52 KRADS/HOUR)	02/03/97
POST-100 KRAD ELECTRICAL MEASUREMENT.....	02/07/97
16) 68-HOUR ANNEALING @ 100°C	02/07/97
POST-68-HOUR ANNEAL ELECTRICAL MEASUREMENT	02/09/97

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

**TABLE III Summary of Electrical Measurements before Irradiations
For LMC6062**

Electrical	SN#2	SN#3	SN#4	SN#5	SN#6	SN#7	SN#8	SN#9	SN#11	SN#12	
1 Vout, Channel A	mV	-0.786	-0.587	-0.859	-0.745	-0.827	-0.057	-0.568	-0.852	0.936	-0.91
2 Vout, Channel B	mV	-0.972	-0.866	-0.883	-0.786	-0.623	-0.625	-0.436	-0.95	0.746	-0.875
3 Ibias	pA	0.352	0.262	-0.575	0.252	0.242	0.228	0.17	0.271	0.271	0.281

TABLE IV: Summary of Electrical Measurements after Total Dose Exposures and Annealing for LM6062

SN#3

Electrical	TOTAL DOSE (KRADS)														Annual	Total Dose	Annual
	Initial	1.0	2.0	3.0	4.0	7.0	11.0	15	20	30	50	68Hrs.	100	68 Hrs			
1 Vout, Channel A	mV	-0.59	0.82	1.834	3.86	6.37	11.1	24.7	26.8	39	55	5000	188	-4970	-5000		
2 Vout, Channel B	mV	-0.89	0.38	1.849	4.28	7.23	12	29	35.7	48	64	87	60	327	282		
3 Ibias	PA	0.257	0.385	0.208	-0.25	-0.73		-4.5	-5.3	-7.5	-12.7	-14.2	-15.0	-16.0	-11.0		

SN#2

Electrical	#	Parameters	Units	Total dose(KRADS)		
				Initial	20	
1 Vout, Channel A		mV		-0.79	17.7	49
2 Vout, Channel B		mV		-0.97	19.6	56
3 Ibias		PA		0.352	3.5	-11.6