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Interoffice Memorandum

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Date

April 15, 1991

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Radiation Report on LM160, ISTP  
Non-Common Buy Part No. 5962-8767401CA

A radiation evaluation was performed on LM160 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 cobalt-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 steps were 50 and 100 krads. After 100 krads, parts were annealed at 25°C for 24 and 168 hours, and then the irradiation was continued to 200 and 263 krads (cumulative). The dose rate was between 2.5 - 5.0 krads/hour, depending on the total dose level (see Table II for radiation schedule). 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 (8) parts passed all tests on irradiation up to 263 krads. Also, all parameters stayed well within the specification limits up to 263 krads except for IOS. The mean value of IOS over the eight irradiated parts had deteriorated from an initial 0.2 uA to -2.5 uA at 263 krads (the maximum specification limit for IOS is  $\pm 3.0$  uA). Table IV provides the mean and standard deviation values for each parameter after different radiation exposures and annealing treatments.

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

TABLE I. Part Information

Generic Part Number:	IM160
ISTP Non-Common Buy Part Number:	5962-8767401CA
ISTP Non-Common Buy Control Number:	1986
Manufacturer:	National Semiconductor Corp.
Quantity Procured:	18
Lot Date Code:	8918
Quantity Tested:	10
Serial Numbers of Radiation Samples:	54, 55, 57, 58 60, 62, 65, 67
Serial Numbers of Control Samples:	50, 52
Part Function:	Voltage Comparator
Part Technology:	Bipolar
Package Style:	14-Pin DIP

TABLE II. Radiation Schedule

EVENTS	DATE
1) Initial Electrical Measurements	03/11/91
2) 50 krads irradiation @ 2500 rads/hr Post 50 krads Electrical Measurements	03/12/91 03/13/91
3) 100 krads irradiation @ 2500 rads/hr Post 100 krads Electrical Measurements	03/13/91 03/14/91
4) 24 hrs annealing Post 24 hr Electrical Measurements	03/14/91 03/15/91
5) 168 hrs annealing Post 168 hr Electrical Measurements	03/15/91 03/21/91
6) 200 krads irradiation @ 5000 rads/hr Post 200 krads Electrical Measurements	03/21/91 03/22/91
7) 263* krads irradiation @ 5000 rads/hr Post 263 krads Electrical Measurements	03/22/91 03/23/91

Notes:

- All parts were radiated under bias at the cobalt-60 gamma ray facility at GSFC.
- All electrical measurements were performed off-site at 25°C.
- Annealing performed at 25°C under bias.

\* The final accumulated dose was scheduled to be 300 krads; however, a power failure at the radiation facility caused the final accumulated dose to be 262.5 krads.

Table III. Electrical Characteristics of LM160

Test	Conditions	Limit		Units
		Min	Max	
+I <sub>1</sub>	+VCC=6.5V -VCC=-6.5V	-	32	mA
-I <sub>1</sub>	+VCC=6.5V -VCC=-6.5V	-16	-	mA
VOS @ 50 OHMS	+VCC=5V -VCC=-5V	-5	5	mV
VSAT	VCC = ±4.5V I <sub>out</sub> = 6.4mA	-	0.4	V
+VOUT	VCC = ±4.5V I <sub>out</sub> =320uA	2.4	-	V
I <sub>OS</sub>	+VCC=5V -VCC=-5V	-3	3	uA
I <sub>B+/-</sub>	+VCC=5V -VCC=-5V	-20	20	uA
I <sub>BIAS</sub>	+VCC=5V -VCC=-5V	-20	20	uA

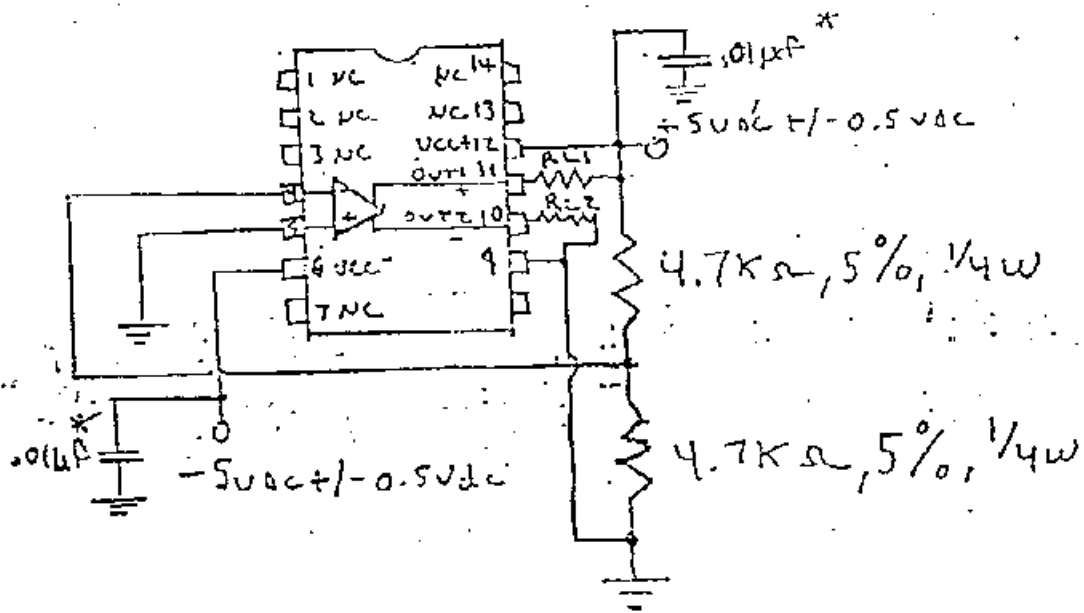
TABLE IV: Summary of Electrical Measurements after  
Total Dose Exposures and Annealing for LM160 1/

Parameters		Spec. Limits		Initials		Total Dose (krads)		Annealing at 25°C				Total Dose (krads)					
		min	max	mean	sd	50		100		24 hrs.		168 hrs.		200		263	
						mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
+I1	mA	-	32	18.7	1.0	18.6	0.7	18.5	0.5	18.5	0.5	18.4	0.5	18.4	0.6	18.4	0.5
-I1	mA	-16	-	-6.9	0.1	-6.8	0.1	-6.8	0.3	-6.9	0.2	-6.8	0.2	-6.7	0.2	-6.8	0.3
VOS	mV	-5	5	0.8	0.3	0.9	1.0	0.8	1.0	0.9	0.5	0.9	0.5	1.3	0.4	1.1	0.4
IB+	uA	-20	20	4.6	0.2	5.0	0.1	5.4	0.1	5.6	0.2	5.7	0.2	6.6	0.2	7.1	0.3
IB-	uA	-20	20	4.3	0.2	5.4	0.2	6.4	0.2	6.5	0.2	7.4	0.3	8.8	0.4	9.6	0.5
IOS	uA	-3	3	0.2	0.1	-0.4	0.1	-0.8	0.2	-0.8	0.2	-1.6	0.2	-2.2	0.4	-2.5	0.3
IBIAS	uA	-	20	4.4	0.2	5.3	0.1	5.9	0.2	6.1	0.2	5.4	0.3	7.7	0.3	8.4	0.3
+VOUT	V	2.4	-	2.8	0	2.8	0	2.8	0	2.8	0	2.7	0.1	2.7	0.1	2.8	0.1
VSAT	mV	-	400	235	15	230	10	235	12	233	12	240	10	236	8	248	10

Note:

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.

Figure 1. Radiation Bias Circuit for LM160



NOTES

$$R_{L1} = 820\Omega \quad 5\% \quad 1/4W$$

$$R_{L2} = 7.5K\Omega \quad 5\% \quad 1/4W$$

\* 1 set of capacitors for each position