PPM-91-381

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UNISYS

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Interoffice Memorandum

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Code 300.1
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7809
Subject
Radiation Report on ISTP
Non-Common Buy Part No. LF111H-MIL

PPM-91-381
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July 30, 1991
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A radiation evaluation was performed on LF111H-MIL 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 10, 20, 50, and 100 krads. After 100 krads, parts were annealed at 25°C for 24 and 168 hours (cumulative). The dose rate was between 0.5 - 2.5 krads/hour, depending on the total dose level (see Table II for radiation schedule). After each radiatior exposure and annealing treatment, parts were electrically tested according to the test conditions and the specification limits listed in Table III.

During initial measurements, one part (SN 504) exceeded the maximum specification limit of 50 pA on $I_{b}+$ and $I_{b}-$ (readings were 68 pA and 81pA, respectively) and exceeded the maximum specification limit of 25pA for IOS (reading was 72.7pA). However, all parts passed all other tests and were well within the specification limits for all other parameters.

After 10 krads irradiation, three parts exceeded the specification limits on Vos@50 (readings ranged from 1.9 mV to 15.2 mV against a specification limit of 4 mV). However, all parts passed all other parameters. After 20 krads irradiation, seven parts exceeded the specification limits for Vos@50. After 50 krads irradiation, three parts (SN 503, SN 505, SN 508) showed significant increase in $I_{b}+$, $I_{b}-$, I_{os}, and I_{bias}. The readings for these parts exceeded the test equipment range of 336 pA for all four parameters. Also, all parts exceeded the test equipment range for Vos@50 (15.2mV). However, all parts passed all other parameters.

After 100 krads irradiation, all parts continued to exceed the test equipment range for I_{b+}, I_{b-}, I_{os}, I_{bias}, and V_{os}. Significant recovery was observed upon annealing the parts for 24 hours. Four parts (SNs 502, 504, 507 and 509) recovered to pass Ib+ and Ib-. 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 (301) 731-8954.

TABLE I. Part Information

Generic Part Number:	LF111H-MIL
ISTP Non-Common Buy Part Number:	LF111H-MIL
ISTP Non-Common Buy Control Number:	2093
Charge Number:	C13790
Manufacturer:	National Semiconductor Corp.
Quantity Procured:	45
Lot Date Code:	9015
Quantity Tested:	10
Serial Numbers of Radiation Samples:	502, 503, 504, 505, 506, 507, 508, 509
Serial Numbers of Control Samples:	500, 501
Part Function:	Voltage Comparator
Part Technology:	Bipolar
Package Style:	8-Pin Can

TABLE II. Radiation Schedule

EVENTS	DATE
1) Initial Electrical Measurements	04/12/91
2) 10 krads irradiation @ 500 rads/hr	04/12/91
Post 10 krads Electrical Measurements	04/13/91
3) 20 krads irradiation @ 230 rads/hr	04/13/91
Post 20 krads Electrical Measurements	04/15/91
4) 50 krads irradiation @ 1500 rads/hr	04/15/91
Post 50 krads Electrical Measurements	04/16/91
5) 100 krads irradiation @ 2500 rads/hr	04/16/91
Post 100 krads Electrical Measurements	04/17/91
6) 24 hour annealing	04/17/91
Post 24 hr Electrical Measurements	04/18/91
7) 168 hour annealing	04/17/91
Post 168 hr Electrical Measurements	04/24/91

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.

Table III. Electrical Characteristics of LF111H-MIL

$^{+}V_S$ = +15V, $^{-}V_S$ = -15V,

Test	Conditions	MIN	MAX
$+I_1$	T_A = 25°C		6.0 mA
$-I_1$	T_A = 25°C		5.0 mA
V_{os}@50	T_A = 25°C, R_S 50K ohms		4.0 mV
Gain	T_A = 25°C	40 kV/V	
I_{b^+}			50 pA
I_{b^-}			50 pA
I_{os}	V_S = +/- 15 V, V_{CM} = 0		25 pA
$+I_{BIAS}$	T_A = 25°C, V_{CM} = 0		50 pA
$-I_{BIAS}$	T_A = 25°C, V_{CM} = 0		50 pA
V_{sat}	V_{in} -0.05 mV, I_{out} = 50 mA,		1.5 V

Note:

1. The offset voltages and offset currents given are the maximum values required to drive the output within a volt of either supply with a 1.0 mA load. Thus, these problems define an error band and take into account the worst case effects of voltage gain and input impedance.

TABLE IV: Summary of Electrical Measurements after Total Dose Exposures and Annealing for LF111H-MIL 1/, 2/

Parameters		Spec. Limits min	Spec. Limits max	Initials mean	Initials sd	Total Dose Exposure (krads) 10 mean	10 sd	20 mean	20 sd	50 mean	50 sd	100 mean	100 sd	Annealing 24 hrs mean	24 hrs sd	168 hrs mean	168 hrs sd
+I[illegible]	mA		6	2.3	.1	2.3	.1	2.3	.1	2.3	.1	2.2	.1	2.2	.1	2.3	.1
-I[illegible]	mA		5	1.5	.1	1.5	.1	1.5	.1	1.5	.1	1.5	.1	1.4	.1	1.4	.1
|Vos@50|	mV		4	.9	.2	3.1	1.3	6.7	3	>15.2		>15.2		40	20	**	
Gain*	kV/V	40		Pass		Pass		Pass		Pass		Pass		Pass		Pass	
Ib-	pA		50	14.0	20.5	2.6	1.3	2.4	1.2	>366		>366		50	20	**	
Ib-	pA		50	7.3	3.7	6.2	2.5	5.4	2.6	>366		>366		29	20	**	
Ios	pA		25	12.0	23.0	4.0	2.7	4.6	1.2	>366		>366		72	30	**	
Ibias	pA		50	10.1	8.5	4.2	1.7	3.1	2.5	>366		>366		14	2	**	
Vsat	V		1.5	.27	.02	.28	.01	.28	.01	.28	0	.29	0	.29	.03	.29	.01

Notes:

1/ The mean and standard deviation values were calculated over the eight parts irradiated in this testin The control samples remained constant throughout the testing and are not included in this table.

2/ Post 50 krad and post 100 krad VOS@50 electrical measurements could not be made due to parts exceeding the 15.2mV upper limit of the testing range of the ATE for this parameter. Likewise, Ib+, Ib-, Ios and Ibias values went beyond the 366pA limit of the testing range at these radiation steps.

* Due to Gain measurements exceeding the upper limit of the testing range (2 MV/V) of the ATE, Gain was reported as Pass or Fail.

** indicates that no reliable measurements were made for the parameter after 168 hours of annealing.

Figure 1: Radiation Bias Circuit for LF111H-MIL