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UNISYS

Interoffice Memorandum

To  
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 Department  
 Code 300.1  
 From  
 K. Sahu *KS*  
 Department  
 7809  
 Subject  
 Radiation Report on SMEX  
 Common Buy Part No. MN91204

PPM-91-522  
 Date  
 September 10, 1991  
 Location  
 Lanham  
 Telephone  
 731-8954  
 Location  
 Lanham  
 cc  
 B. Fafaul/311  
 D. Krus  
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A radiation evaluation was performed on MN91204 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 5, 10, 20, 30, 50, 75 and 100 krads. After 100 krads, parts were annealed at 25°C for 24 and 168 hours, and then irradiation was continued to 200 and 300 krads (cumulative). The dose rate was between 250 - 5000 rads/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 20 krads. However, two parts were damaged during test measurements after 20 krads, and were excluded from further testing. After 30 krads, one part (SN 43) exceeded the maximum specification limit of 16.1m%FS for LIN with a reading of 19.0m%FS. However, all other parts passed all tests to 30 krads. After 50 krads, all parts except one exceeded the maximum specification limit for LIN (failed readings ranging from 16.5-33.0 m%FS), and no dFS1± readings were obtained for the parts exceeding the maximum specification limit for LIN. Parts also showed significant degradation in GAIN1, although all parts were still within the specification limits for this parameter. After 75 and 100 krads, all parts failed LIN and all parts except SN 43 failed to meet the minimum specification limit of -200m%FS for GAIN1. No dFS1± readings were obtained for the failing parts. No recovery was observed upon annealing the parts for 24 hours, although three parts (SNs 42, 45 and 48) recovered to pass GAIN1 after 168 hours of annealing.

On continued irradiation to 200 and 300 krads, all parts failed GAIN1 and LIN, and significant degradation was observed in ZERO1. 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:	MN370B/H
SMEX Common Buy Part Number:	MN91204
SMEX Common Buy Control Number:	1688
Charge Number:	C90211
Manufacturer:	Micro Networks
Quantity Procured:	110
Lot Date Code:	9038
Quantity Tested:	10
Serial Numbers of Radiation Samples:	42, 43, 44, 45, 46, 47, 48, 49
Serial Numbers of Control Samples:	40, 41
Part Function:	12-Bit D/A Converter
Part Technology:	Bipolar
Package Style:	18-Pin DIP
Test Engineer:	C. Nguyen

TABLE II. Radiation Schedule

EVENTS	DATE
1) Initial Electrical Measurements	06/26/91
2) 5 krads irradiation @ 250 rads/hr	07/01/91
Post 5 krads Electrical Measurements	07/02/91
3) 10 krads irradiation @ 250 rads/hr*	07/03/91
Post 10 krads Electrical Measurements	07/03/91
4) 20 krads irradiation @ 500 rads/hr	07/03/91
Post 20 krads Electrical Measurements	07/05/91
5) 30 krads irradiation @ 500 rads/hr	07/05/91
Post 30 krads Electrical Measurements	07/08/91
6) 50 krads irradiation @ 1000 rads/hr	07/08/91
Post 50 krads Electrical Measurements	07/09/91
7) 75 krads irradiation @ 1250 rads/hr	07/09/91
Post 75 krads Electrical Measurements	07/10/91
8) 100 krads irradiation @ 1250 rads/hr	07/10/91
Post 100 krads Electrical Measurements	07/11/91
9) 24 hrs annealing	07/11/91
Post 24 hr Electrical Measurements	07/12/91
10) 168 hrs annealing	07/11/91
Post 168 hr Electrical Measurements	07/18/91
11) 200 krads irradiation @ 5000 rads/hr	07/18/91
Post 200 krads Electrical Measurements	07/19/91
12) 300 krads irradiation @ 5000 rads/hr	07/19/91
Post 300 krads Electrical Measurements	07/22/91

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 was performed at 25°C under bias.

\* Due to a power outage at the radiation facility on 07/02/91, the second radiation run had to be restarted on 07/03/91 with an increased dose rate of 2 krads per hour.

Table III. Electrical Characteristics of MN91204

VDD = 15V, VEE = -15V, TA = 25°C

Test	Conditions	Limits		Units
		Min	Max	
IIL	VIL = 0V, VIH = 5V	-1	0	uA
IIH	VIL = 0V, VIH = 5V	0	1	uA
IOUT_POS	VIL = 0.8V, VIH = 2V	1	60	mA
IOUT_NEG	VIL = 0.8V, VIH = 2V	-60	-1	mA
IDD	VIL = 0V, VIH = 5V	-	4	mA
IEE	VIL = 0V, VIH = 5V	-4	-	mA
ZERO1		-200	200	m%FS
GAIN1		-200	200	m%FS
LIN		-	16.1	m%FS
dFS1+	VS=14.55 to 15.4VDC	-	120	m%
dFS1-	VS=-15.4 to -14.55VDC	-	360	m%

TABLE IV: Summary of Elec. Measurements after  
Total Dose Exposures and Annealing for MN91204

1/, 2/

Parameters		Spec. Limits		Initials		Total Dose Exposure (krads)											
						5		10		20		30		50		75	
						min	max	mean	sd								
IIL	uA	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
IIH	uA	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
IOUT_POS	mA	1	60	11.1	.3	11.3	.3	12.2	.3	13.1	0.6	13.2	0.7	12.8	0.6	12.3	0.9
IOUT_NEG	-mA	1	60	11.8	0.1	11.8	0.1	11.8	0.1	11.4	0.2	11.4	0.2	10.7	0.2	10.2	0.2
IDD	mA		4	2.0	0.1	2.0	0.1	2.1	0.1	2.0	0.1	1.9	0.1	2.1	0.1	1.8	0.1
IEE	-mA		4	1.7	0.1	1.7	0.1	1.8	0.1	1.7	0.1	1.6	0.1	1.5	0.1	1.6	0.1
ZERO1	m#FS	-200	200	28	5	25	5	15	5	11	8	16	7	23	9	40	12
GAIN1	m#FS	-200	200	-22	4.6	-43	7	-40	8	-64	12	-102	14	-145	23	-212	32
LIN	m#FS		16.1	6.6	1.3	7.2	1.5	7.8	1.3	11	2	13	3	22	6	*	
dFS1+	m#		120	1.4	1.0	1.1	0.7	1.1	0.5	1.0	0.3	1.5	0.3	*		*	
dFS1-	m#		360	76	2	77	2	76	2	77	3	77	2	*		*	

\* implies that no data was recorded for this parameter for some or all parts due to radiation induced degradation.

<Table IV continued on next page>

TABLE IV. (continued)

Parameters		Spec. Limits		Initials		TDE (krads)		Annealing				Total Dose (krads)			
						100		24 hrs.		168 hrs.		200		300	
						mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
IIL	uA	-1	0	0	0	0	0	0	0	0	0	0	0	0	
IIH	uA	0	1	0	0	0	0	0	0	0	0	0	0	0	
IOUT_PCS	mA	1	60	11.1	0.3	12	0.9	12.1	0.8	12.1	0.6	10.7	1	9.8	0.8
IOUT_NEG	-mA	1	60	11.8	0.1	9.8	0.7	9.8	0.7	9.8	0.7	8.0	0.1	6.9	0.2
IDE	mA		4	2.0	0.1	1.8	0.1	2.1	0.1	1.9	0.1	2.1	0.1	1.9	0.1
ISE	-mA		4	1.7	0.1	1.6	0.1	1.6	0.1	1.7	0.1	1.7	0.1	1.5	0.1
ZERO1	m%FS	-200	200	28	5	62	14	50	14	49	13	161	20	262	20
GAIN1	m%FS	-200	200	-22	4.6	-231	43	-240	40	-199	37	*		*	
LIN	m%FS		16.1	6.6	1.3	*		*		*		*		*	
dFS1+	m%		120	1.4	1.0	*		*		*		*		*	
dFS1-	m%		360	76	2	*		*		*		*		*	

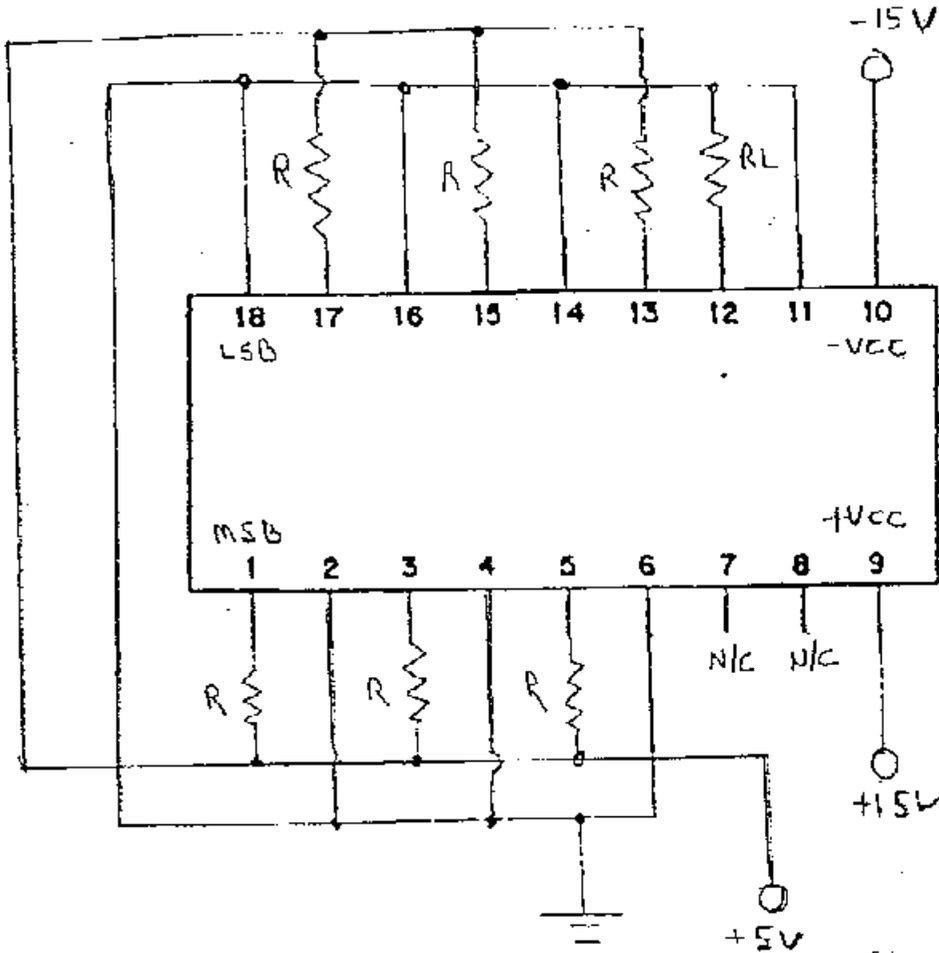
## Notes:

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/ Table IV does not include test data recorded for SNs 44 and 47 after 20 krads, as they were damaged during testing.

\* implies that no data was recorded for this parameter for some or all parts due to radiation induced degradation.

Figure 1. Radiation Bias Circuit for MN91204



+5V Supply shall be +5VDC  $\pm$  .5VDC  
 -15V Supply shall be -15VDC  $\pm$  .5VDC  
 +15V Supply shall be +15VDC  $\pm$  .5VDC  
 RL shall be 10kOhm 10% 1/4W  
 R shall be 1kOhm 10% 1/4W