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Memorandum

PARAMAX
A Unisys Company

PPM-93-031

DATE: Feb. 10, 1993
TO: B. Fafaul/311
FROM: K. Sahu/300.1
SUBJECT: Radiation Report on FAST/MUE
Part No. OPA111VM/883B
Control No. 6308

cc: R. Kolecki/740.4
T. Miccolis/300.1
A. Sharma/311
Library/300.1 ✓
L. Cusick/740.4
SMEX, PPM File

A radiation evaluation was performed on OPA111VM (Op Amp) 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, 40 and 60 krads*. After 60 krads, parts were annealed at +25°C for 168 hours. The irradiation was then continued to 100 krads (cumulative). The dose rate was between 0.25 and 2 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 at 25°C according to the test conditions and the specification limits** listed in Table III.

All ten parts passed initial (pre-rad) electrical tests. After the 5-krad exposure, one part (SN 223) exceeded the maximum specification limits of 2.00 pA for both +Ibias and -Ibias with readings of 9.15 pA and 8.43 pA, respectively. All eight irradiated parts passed all electrical tests at the 10-krad exposure level. After the 20-krad irradiation, SN 223 again failed +Ibias and -Ibias, with readings of 4.55 pA and 4.99 pA, respectively. After the 40-krad irradiation, five parts (SN 218,

*The term rads, as used in this document, means rads(silicon).
**These are manufacturers' non-irradiated data sheet specification limits. No post-irradiation limits were provided by the manufacturer at the time these tests were performed.

220, 221, 222 and 223 exceeded the maximum specification limit for +Ibias, with readings ranging from 2.01 to 6.23 pA and four parts (SN 218, 221, 222 and 223) exceeded the maximum specification limit for -Ibias, with readings ranging from 2.22 to 6.48 pA. After the 60-krad irradiation, all eight irradiated parts failed +Ibias and -Ibias, with readings ranging from 2.33 to 6.54 pA and 2.47 to 4.56 pA, respectively. In addition, two parts (SN 216, and 223) exceeded the maximum specification limit of 500 uV for Vio, with readings of 724 and 855 uV, one part (SN 217) exceeded the minimum specification limit of -500 uV for Vio, with a reading of -708 uV and one part (SN 223) exceeded the maximum specification limit of 1.50 pA for Iio, with a reading of 1.74 pA.

After annealing for 168 hours at 25°C, SN 216 and 223 continued to fail Vio, with readings of 851 and 1084 uV and three parts (SN 216, 217 and 223) continued to fail +Ibias and -Ibias, with readings ranging from 2.07 to 3.15 pA for +Ibias and 2.04 to 2.57 pA for -Ibias.

After continued irradiation to 100 krads (cumulative), SN 216 and 223 continued to exceed the maximum specification limit of 500 uV for Vio with readings of 908 and 1073 uV, and SN 217 exceeded the minimum specification limit of -500 uV for Vio with a reading of -917 uV. All eight irradiated parts failed +Ibias and -Ibias, with readings ranging from 2.25 to 4.99 pA and 2.38 to 3.43 pA, respectively.

After a final annealing for 168 hours at 100°C no rebound effects were observed.

Table IV provides a summary of the mean and standard deviation values for each parameter after different irradiation exposures and annealing steps.

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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TABLE I. Part Information

Generic Part Number:	OPA111VM
Part Number:	OPA111VM/883B
FAST/MUE Control Number:	6308
Charge Number:	C33027
Manufacturer:	Burr-Brown
Lot Date Code:	9237
Quantity Tested:	10
Serial Numbers of Radiation Samples:	216, 217, 218, 219, 220, 221, 222, 223
Serial Numbers of Control Samples:	214, 215
Part Function:	Op Amp
Part Technology:	FET
Package Style:	8-lead TOX Can
Test Engineer:	C. Nguyen

Table III. Electrical Characteristics of OPA111VM

Test	Units	Specification Limits		Conditions
		Min	Max	
+I _{dd}	mA	0	3.5	I _o = 0 mA
-I _{dd}	mA	-3.5	0	I _o = 0 mA
+swing	V	11.0	-	R _l = 2 Kohm, V _o = ± 10 VDC
-swing	V	-	-11.0	R _l = 2 Kohm, V _o = ± 10 VDC
V _{io}	µV	-500	500	V _{cc} = ± 10 VDC
+I _{bias}	pA	-2.00	2.00	V _{cm} = 0 VDC
-I _{bias}	pA	-2.00	2.00	V _{cm} = 0 VDC
I _{io}	pA	-1.50	1.50	V _{cm} = 0 VDC
PSRR	dB	90	-	V _{cc} = ± 10 to ± 18 VDC
A _{vo}	dB	114	-	R _l = 2 Kohm, V _{in} = ± 10 VDC
CMRR	dB	90	-	R _l = 2 Kohm, V _{in} = ± 10 VDC
I _{sc}	mA	-	-10	R _l = 2 Kohm, V _{in} = ± 10 VDC
+SR	V/usec	1.0	-	R _l = 2 Kohm, V _o = ± 10 VDC
-SR	V/usec	1.0	-	R _l = 2 Kohm, V _o = ± 10 VDC

TABLE IV: Summary of Electrical Measurements After Total Dose Exposures and Annealing Steps for OPA111VM 1/

Parameters	Spec.	Lim./2	Total Dose Exposure (TDE) (krads)												Anneal		TDE		Anneal		
			0		5		10		20		40		50		168 hrs @25°C		100		168 hrs @+100°C		
			min	max	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	
+I _{dd}	mA	0	3.5	2.5	.09	2.6	.09	2.6	0.1	2.7	.13	2.7	.13	2.7	.14	2.6	.17	2.6	.17	2.6	.14
-I _{dd}	mA	-3.5	0	-2.6	.09	-2.6	.09	-2.6	.09	-2.6	.09	-2.7	0.1	-2.7	.14	-2.6	.17	-2.6	.17	-2.6	.14
+swing	V	11.0	-	13.2	.03	13.2	.02	13.2	.02	13.2	.02	13.2	.02	13.2	.02	13.2	.02	13.2	.02	13.2	.02
-swing	V	-	-11.0	-14.0	.01	-14.0	.01	-14.0	.01	-14.0	.02	-14.0	.02	-14.0	.02	-14.0	.01	-14.0	.01	-14.0	.01
V _{ic}	uV	-500	500	48.4	68	41.8	79	49.4	104	60.4	155	90.0	299	136	490	183	576	158	626	110	419
+I _{bias}	pA	-2.00	2.00	0.63	0.2	1.66	2.2	1.04	0.3	1.57	1.0	2.51	1.4	2.83	1.3	2.04	.49	2.92	.77	1.21	.11
-I _{bias}	pA	-2.00	2.00	0.64	.28	1.46	2.1	0.85	.19	1.57	.92	2.41	1.5	2.60	.56	1.92	.33	2.80	.32	1.04	0.1
I _{io}	pA	-1.50	1.50	-0.1	.25	0.19	.19	0.18	.18	0	.18	0.10	.21	0.23	.62	0.12	0.2	0.12	.49	0.17	.04
PSRR	dB	90	-	119	11	118	9.2	118	8.5	116	6.3	115	7.0	113	8.4	114	9.6	112	10	114	6.6
A _{vo}	dB	114	-	124	1.5	124	1.5	124	2.0	123	2.1	123	1.5	123	1.5	123	1.6	123	1.5	123	1.6
CMRR	dB	90	-	114	6.3	117	7.5	120	10	124	19	123	17	122	18	120	11	121	13	119	9.2
I _{sc}	mA	-	-10	-37.9	1.1	-37.9	1.1	-37.9	1.2	-38.0	1.3	-38.0	1.4	-38.1	1.5	-38.1	1.5	-38.4	1.2	-37.0	1.5
+SR	V/usec	1.0	-	2.3	.13	2.3	.11	2.3	0.1	2.3	.12	2.3	.12	2.4	.11	2.4	.12	2.4	.15	2.3	.12
-SR	V/usec	1.0	-	3.0	.13	3.1	.11	3.1	.14	3.0	.12	3.0	.12	3.0	.09	3.0	0.1	3.0	.08	3.0	.11

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/ These are manufacturers' non-irradiated data sheet specification limits. No post-irradiation limits were provided by the manufacturer at the time the tests were performed.

Figure 1. Radiation Bias Circuit for OPA111VM

