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Interoffice Memorandum

PPM-91-363

Date May 29, 1991

Location Lanham

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Location Lanham

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Radiation Report on ISTD
Non-Common Buy Part No. OP43AJ/883cc
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A radiation evaluation was performed on OP43AJ/883 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, and then the irradiation was continued to 200 and 300 krads (cumulative). The dose rate was between 0.5 - 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 parts passed the initial electrical measurements. After 10 krads irradiation, all parts failed to meet the specification limits of +/-0.5 mV for V_{OS} (readings ranged from -1.4 mV to -2.8 mV). After 20 krads, all parts exceeded the specification limits on $I_{b+/-}$ and I_{bias} , and the average V_{OS} reading had degraded to approximately 5 mV. After 50 krads irradiation, further significant degrading in V_{OS} , I_b , and I_{bias} was observed. V_{OS} readings were beyond the range measurement of the test equipment (indicated by >30.4 in table IV). One device failed CMRR and PSRR. After 100 krads, parts showed increased degradation in I_b and I_{bias} and continued failures in the V_{OS} test. Additionally, SN 204 marginally exceeded the specifications limits on I_{CC} , and SN 205 also was not functional. Three parts failed to meet the minimum specification limit for $-V_o$.

Upon annealing for 24 and 168 hours, slight recovery was observed in $I_{b+/-}$ and I_{bias} , but average readings were still approximately

twice the maximum specification limit. In addition, SN 205 became functional but continued to fail I_{CC} . After 200 krads, six parts failed $-V_o$ while SN 204 and SN 205 continued to fail I_{CC} (SN 205 was no longer functional). I_{OS} , I_b , I_{bias} , and A_{OL} readings were above the range of the test equipment. After 300 krads all parts failed $-V_o$. Table IV provides the mean and standard deviation values for each parameter after different radiation exposures and annealing treatments. It also provides a summary of functional test results after each radiation/annealing step.

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:	OP43AJ/883
ISTP Non-Common Buy Part Number:	OP43AJ/883
ISTP Non-Common Buy Control Number:	2122
Manufacturer:	PMI
Quantity Procured:	60
Lot Date Codes:	9023
Quantity Tested:	10
Serial Numbers of Radiation Samples:	202, 204, 205, 242, 211, 215, 220, 181
Serial Numbers of Control Samples:	183, 227
Part Function:	Operation Amplifier
Part Technology:	Bipolar
Package Style:	TO-99 (8 pin can)

TABLE II. Radiation Schedule

EVENTS	DATE
1) Initial Electrical Measurements	04/01/91
2) 10 krad irradiation @ 500 rads/hr	04/04/91
Post 10 krad Electrical Measurements	04/05/91
3) 20 krad irradiation @ 500 rads/hr	04/08/91
Post 20 krad Electrical Measurements	04/09/91
4) 50 krad irradiation @ 1500 rads/hr	04/09/91
Post 50 krad Electrical Measurements	04/10/91
5) 100 krad irradiation @ 2500 rads/hr	04/10/91
Post 100 krad Electrical Measurements	04/11/91
6) 24 hour annealing	04/11/91
Post 24 hr Electrical Measurements	04/12/91
7) 168 hour annealing	04/12/91
Post 144 hr Electrical Measurements	04/18/91
8) 200 krad irradiation @ 5000 rads/hr	04/19/91
Post 100 krad Electrical Measurements	04/20/91
9) 300 krad irradiation @ 5000 rads/hr	04/20/91
Post 300 krad Electrical Measurements	04/21/91

Notes:

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

Table III. Electrical Characteristics of OP43AJ/883

Conditions

$$+V_S = +15V, -V_S = -15V, T_A = +25^\circ C$$

$$V_{CM} = 0V, R_S = 50 \text{ Ohm}$$

<u>Test</u>	<u>Other Conditions</u>	<u>MIN</u>	<u>MAX</u>
+I _{CC}	No Load		1.0 mA
-I _{CC}	No Load		1.0 mA
V _{OS}		-0.5 mV	0.5 mV
I _{OS}	(Note 1,2)		3.5 pA
+I _{BIAS}	(Note 1) Either input		5.0 pA
-I _{BIAS}	(Note 1) Either input		5.0 pA
I _O			5.0 pA
-I _O			5.0 pA
+PSRR	V _S = 10V to 18V	92 dB	
-PSRR	V _S = -10V to -18V	92 dB	
CMRR	+/- 11 V	100 dB	
DC Voltage GAIN	R _L = 2KOhm, V _O = +/- 10 V	1.0 MV/V	
+V _O	R _L = 2 KOhm	12.3 V	
-V _O	R _L = 2 KOhm	12.3 V	

Notes:

1. I_b and I_{OS} are tested at +25°C ambient and devices warmed up.
2. Tested at 3.5 pA (Max) due to current ATE capability and per requester approval.

TABLE IV: Summary of Electrical Measurements after
Total Dose Exposures and Annealing for OP43AJ/883

1/, 2/

Parameters	Units	Spec. Limits		Initials		Total Dose Exposure (krads)								Annealing				Total Dose (krads)			
						10		20		50		100		24 hrs		168 hrs		200		300	
						mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
+Icc	mA		1	.9	.07	.9	.07	.9	.07	.95	.06	.96	.08	.95	.02	1	.17	.91	.02	.9	.02
-Icc	mA		1	.9	.07	.9	.07	.9	.07	.96	.1	.96	.04	.96	.02	1	.17	.92	.02	.9	.02
Vos@50	mV		0.5	.1	.1	2.3	.4	5.2	2.8	>30.4		>30.4		>30.4		>30.4		>30.4		>30.4	
Ios	pA		3.5	1	.2	.4	.1	.6	.1	1.3	.2	1.2	.8	1.08	.9	2.7	3.4	>30.4		>30.4	
Ib+	pA		5	4.2	.2	2.9	.2	.6	2	16.7	1	33	3	25.5	1.4	11.8	.35	>30.4		>30.4	
Ib-	pA		5	3.4	.5	2.6	.2	5.5	.7	15.6	1.3	33	3	24.4	1.8	10.5	1.5	>30.4		>30.4	
Ibias	pA		5	3.8	.3	2.8	.3	5.9	.4	15.9	1.7	31	3.4	24.9	1.5	10.7	1.9	>30.4		>30.4	
AoL	MV/V		1	>160		>160		>160		>160		>160		>160		>160		>160		>160	
CMRR	dB	100		125	14	122	4	120	6	122	17	123	3.2	121	7	120	5	*		*	
+PSRR	dB	92		115	8	117	14	*		114	8	109	6.2	115	6.8	*		*		*	
-PSRR	dB	92		114	7	127	16	113	5	114	12	111	8.7	112	7.2	*		*		*	
+Vo	V	12.3		12.8	.1	12.9	.1	12.9	.06	12.8	.01	12.7	.09	12.8	.02	12.8	.04	12.8	.01	12.8	.01
-Vo	V	12.3		12.8	.01	12.8	.01	12.9	.1	12.7	.07	12.1	.4	12.2	.34	12.4	.3	11	.76	9.5	1.12

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/ The range of the test equipment was limited to ≤ 30.4 mV for Vos, 30.4 pA for Ios, Ib+, Ib-, and Ibias, and ≥ 160 for AoL

* No reliable measurements would be made for these parameters at the noted radiation/annealing step.

Figure 1. Radiation Bias Circuit for OP43AJ/883

TOP VIEW

