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Interoffice Memorandum

PPM-91-0375

Date  
June 4, 1991Location  
LanhamTelephone  
731-8954Location  
LanhamTo  
W. Beyah  
Department  
Code: 300.1From  
K. Sahu KSDepartment  
7809Subject  
Radiation Report on ISTR  
Non-Common Buy Part No. OPA2107SMcc  
G. Krishnan/311  
V. Edson  
S. Esmacher  
D. Krus  
R. Woodward  
B. Fridovich/661  
T. Von Rosenvinge/661

A radiation evaluation was performed on OPA2107SM 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. 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 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 the initial electrical measurements. After 10 krads, two parts (SN 252 and SN 260) failed marginally to meet the specification limits on  $V_{OS}$ . However, all other devices stayed well within the specification limits for all parameters. After 20 krads, all parts exceeded the specification limits of +/- 1.0 mV for  $V_{OS}$  (parts were reading more than 3.8 mV for this parameter). All parts were, however, within the specified limits for all other areas.

After 50 krads, all parts continued to exceed the specification limits on  $V_{OS}$ , but passed all other tests. After 100 krads, all parts exceeded the specification limits on  $I_{bias}$  and  $I_{b-}$ . No significant recovery was observed on annealing the parts for 24 and 168 hours. 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:	OPA2107SM
ISTP Non-Common Buy Part Number:	OPA2107SM
ISTP Non-Common Buy Control Number:	2123A
Manufacturer:	Burr-Brown
Quantity Procured:	15
Lot Date Codes:	8917
Quantity Tested:	10
Serial Numbers of Radiation Samples:	252, 253, 255, 256, 257, 258, 259, 260
Serial Numbers of Control Samples:	250, 251
Part Function:	Operation Amplifier
Part Technology:	Bipolar
Package Style:	TO-99 (8 pin can)

TABLE II. Radiation Schedule

EVENTS	DATE
1) Initial Electrical Measurements	04/09/91
2) 10 krads irradiation @ 500 rads/hr	04/10/91
Post 10 krads Electrical Measurements	04/10/91
3) 20 krads irradiation @ 500 rads/hr	04/11/91
Post 20 krads Electrical Measurements	04/11/91
4) 50 krads irradiation @ 1.6667 krads/hr	04/12/91
Post 50 krads Electrical Measurements	04/12/91
5) 100 krads irradiation @ 2500 rads/hr	04/13/91
Post 100 krads Electrical Measurements	04/13/91
6) 24 hour annealing	04/14/91
Post 24 hr Electrical Measurements	04/14/91
7) 168 hour annealing	04/16/91
Post 168 hr Electrical Measurements	04/20/91

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 OPA2107SM

Conditions

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

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

<u>Test</u>	<u>CONDITIONS</u>	<u>MIN</u>	<u>MAX</u>
+I <sub>CC</sub>	No Load		5 mA
-I <sub>CC</sub>	No Load		5 mA
V <sub>OS</sub>	V <sub>CM</sub> = 0V		1 mV
I <sub>OS</sub>	V <sub>CM</sub> = 0V		8 pA
+I <sub>BIAS</sub>	(Note 1) Either input		10 pA
-I <sub>BIAS</sub>	(Note 1) Either input		10 pA
+I <sub>b</sub>	V <sub>CM</sub> = 0V		10 pA
-I <sub>b</sub>	V <sub>CM</sub> = 0V		10 pA
+PSRR	V <sub>S</sub> = 10 V to 18 V	80 dB	
-PSRR	V <sub>S</sub> = -10 V to -18 V	80 dB	
CMRR	V <sub>CM</sub> = +/- 10 V	80 dB	
DC Voltage GAIN	R <sub>L</sub> = 2 KOhms, V <sub>O</sub> = +/- 10 V	12.6 kV/V	
+V <sub>O</sub>	R <sub>L</sub> = 2 kOhms	11 V	
-V <sub>O</sub>	R <sub>L</sub> = 2 kOhms	11 V	

Notes:

1. I<sub>b</sub> and I<sub>OS</sub> 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 OPA2107SM

1/, 2/

Parameters	Units	Spec. Limits		Initials	Total Dose Exposure (krads)								Annealing				
					10		20		50		100		24 hrs		168 hrs		
					min	max	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean
+Icc	mA		5	4.15	.64	4.45	.03	4.42	.14	4.12	.04	3.95	.03	4	.04	4.04	.03
-Icc	mA		5	4.54	.03	4.45	.03	4.43	.14	4.12	.04	3.95	.04	4.01	.04	4.05	.03
Vos@50	mV		1	.04	.01	.73	.19	>3.8		>3.8		>3.8		>3.8		>3.8	
Ios	pA		8	2.85	.15	1.18	.03	1.08	.12	1.95	.12	2.19	.15	2.26	.18	1.92	.08
Ib+	pA		10	.01	.004	4.19	.22	5.28	.8	8.7	.5	11.4	.9	11.9	.9	9.42	0.48
Ib-	pA		10	2.90	.21	3.2	.13	4.21	.77	6.7	.4	9.1	.8	9.67	.7	7.52	.43
Ibias	pA		10	1.42	.08	3.66	.16	4.81	.74	7.73	.48	10.3	.8	10.8	.8	8.4	.41
AoL	kV/V	12.6		222.9	50.8	212.2	50.5	194.9	43.9	151.4	30.0	115.5	18.9	122.5	20.7	131.4	23.7
CMRR	dB	80		85.7	3.4	86.28	3.13	88.5	3.3	89.9	5.2	90.1	5.7	90.5	6.7	89.8	6.5
+PSRR	dB	80		110.3	6.9	112.7	6.7	111.7	7.7	102.8	3.4	108.4	7.9	108.	8.1	110.4	9.2
-PSRR	dB	80		107.9	5.5	109.8	6.2	106.	4.8	105.7	7.4	109.1	5.3	106.9	4.5	109.7	6.2
+Vo	V	11		13.75	.02	13.7	.01	13.7	.01	13.66	.01	13.60	.01	13.66	.02	13.69	.01
-Vo	V	11		12.8	.005	12.85	.02	12.9	.01	12.86	.01	12.85	.01	12.85	.01	12.81	.04

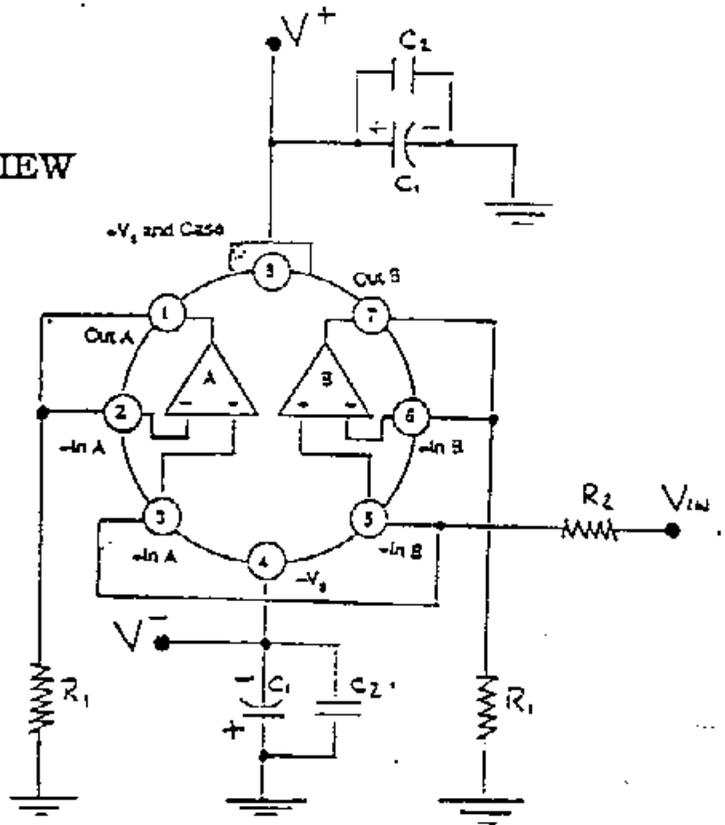
Notes:

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 maximum range of the test equipment for Vos was 3.8 mV.

Figure 1. Radiation Bias Circuit for OPA2107SM

TOP VIEW



Duration shall be 160 hours minimum.  
 $T_A = 125^\circ\text{C} \pm 8^\circ\text{C} / -0^\circ\text{C}$

$V_{IN} = 6.0\text{ V} \pm 0.2\text{ V}; 1\text{ KHz} \pm 0.1\text{ KHz}$  Square Wave; Duty Cycle =  $50 \pm 15\%$



$+V_S = +12\text{ V}$      $-V_S = -12\text{ V}$

$R_1 = 3.4\text{ K}\Omega \pm 5\%$ , 1/2 W

$R_2 = 1.0\text{ K}\Omega \pm 5\%$ , 1/2 W

$C_1 = 1\text{ }\mu\text{F}$

$C_2 = 0.01\text{ }\mu\text{F}$  (Ceramic)