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Interoffice Memorandum

To
 Department **T. Miccolis**
 Code **300.1**
 From
 Department **K. Sahu KS**
 Subject **7809**
Radiation Report on AD524
SMEX Common Buy Part No. 5962-8853901EA
Control No. 1665

Date **PPM-92-0069**
 Location **Feb. 18, 1992**
 Telephone **Lanham**
 Location **731-8954**
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A radiation evaluation was performed on AD524 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, 25, 50, 75, and 100 krads*. After 100 krads, the parts were annealed at +25°C for 168 hours with measurements taken after 24 hours and 168 hours. The dose rate was between 0.3 and 5.3 krads/hour, depending on the total dose level (see Table II for radiation schedule). After each radiation exposure and annealing treatment, the parts were electrically tested @ +25°C according to the test conditions and the specification limits listed in Table III.

All irradiated parts passed all electrical measurements through 10 krads of exposure with the exception of one part which marginally exceeded the specification limit of 35 nA for the IOS parameter. Upon further irradiation to 25 krads, all of the parts exceeded the specified limits of 50 nA for +Ibias and -Ibias with readings as high as 300 nA. In addition, five parts exceeded the limits for IOS, VosOut and VosIn. These parameters had readings up to 270 nA for IOS, -12 mV for VosOut (limit = -3 mV), and -230 uV for VosIn (limit = 100 uV). Upon further irradiation to 100 krads, these parameters continued to degrade with the most significant degradation for +Ibias and -Ibias. These two parameters had readings up to 800 nA. Some recovery was observed after annealing the parts for 168 hours; however, all of the parts still exceeded the limits for at least one of the previously mentioned parameters. Table IV provides 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.

*In this report, the term "rads" is used as an abbreviation for rads (Si).

TABLE I. Part Information

Generic Part Number:	AD524
SMEX Common Buy Part Number:	5962-8853901EA
SMEX Common Buy Control Number:	1665
Charge Number:	C90105
Manufacturer:	Analog Devices
Lot Date Code:	9004
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:	PRECISION INSTRUMENTATION AMPLIFIER WITH TRI-STATE OUTPUTS
Part Technology:	MONOLITHIC SILICON
Package Style:	16 pin DIP
Test Engineer:	K. Longworth

TABLE II. Radiation Schedule for AD524

EVENTS	DATE
1) Initial (Pre-Irradiation) Electrical Measurements	01/01/92
2) 10-KRAD IRRADIATION (500 rads/hour)	01/13/92
POST 10-KRAD ELECTRICAL MEASUREMENT	01/14/92
3) 25-KRAD IRRADIATION (730 rads/hour)	01/14/92
POST 25-KRAD ELECTRICAL MEASUREMENT	01/15/92
4) 50-KRAD IRRADIATION (1250 rads/hour)	01/15/92
POST 50-KRAD ELECTRICAL MEASUREMENT	01/16/92
5) 75-KRAD IRRADIATION (1250 rads/hour)	01/16/92
POST 75-KRAD ELECTRICAL MEASUREMENT	01/17/92
6) 100-KRAD IRRADIATION (250 rads/hour)	01/17/92
POST 100-KRAD ELECTRICAL MEASUREMENT	01/21/92
7) 24 HOURS ANNEALING AT +25°C	01/21/92
POST 24-HOURS ELECTRICAL MEASUREMENT	01/22/92
8) 168 HOURS ANNEALING AT +25°C	01/21/92
POST 168-HOURS ELECTRICAL MEASUREMENT	01/28/92

- Notes:
- All electrical measurements were performed off-site at +25°C.
 - All parts were radiated under bias at the cobalt-60 gamma ray facility at GSFC.
 - Annealing was performed under bias.

Table III. Electrical Characteristics of AD524

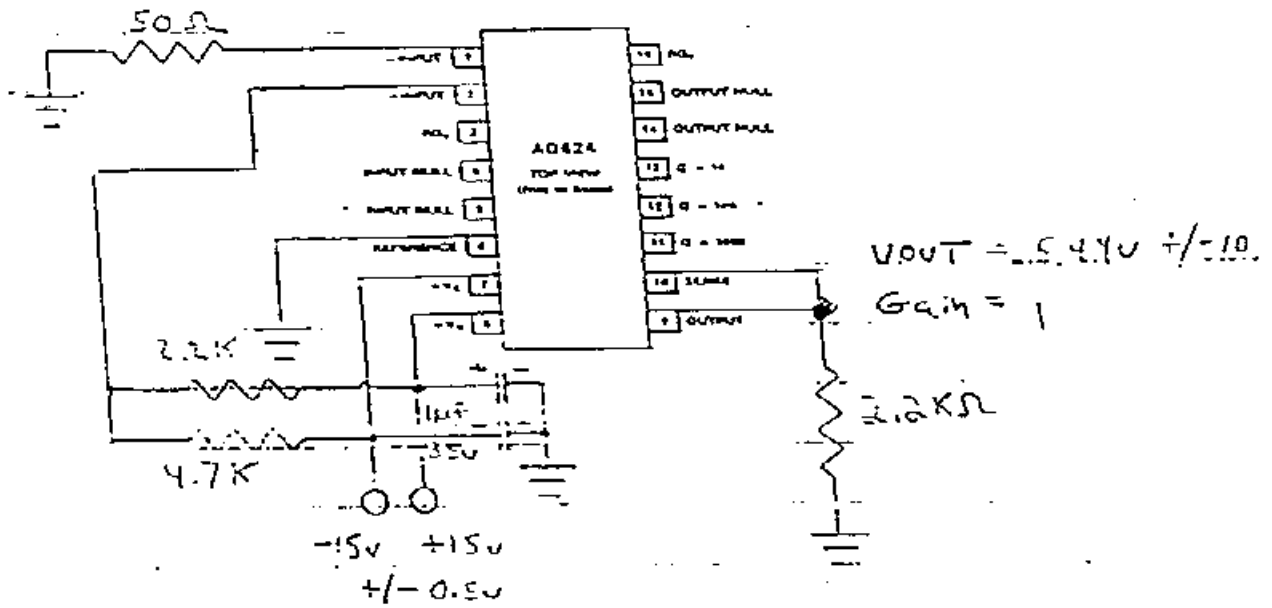
TEST NAME	TEST CONDITIONS	LOWER LIMIT	UPPER LIMIT	UNITS
GE1	G = 1, Vo = ± 10 V	-0.05	+0.05	%
GE10	G = 10, Vo = ± 10 V	-0.25	+0.25	%
GE100	G = 100, Vo = ± 10 V	-0.50	+0.50	%
GE1000	G = 1000, Vo = ± 10 V	-2.00	+2.00	%
VosOut	Vin = 0 V	-3.0	+3.0	mV
VosIn	Vin = 0 V	-100	+100	uV
+PSRR1	G = 1	75	-----	dB
+PSRR10	G = 10	95	-----	dB
+PSRR100	G = 100	105	-----	dB
+PSRR1000	G = 1000	115	-----	dB
-PSRR1	G = 10	75	-----	dB
-PSRR10	G = 10	95	-----	dB
-PSRR100	G = 100	105	-----	dB
-PSRR1000	G = 1000	115	-----	dB
+Ibias	G = 1	-50	+50	nA
-Ibias	G = 1	-50	+50	nA
Ios	Iio = (Ib+) - (Ib-), G=1	-35	+35	nA
CMRR1	G = 1, Vin = 0 to 10 V	70	-----	dB
CMRR10	G = 10, Vin = 0 to 10 V	90	-----	dB
CMRR100	G = 100, Vin = 0 to 10 V	100	-----	dB
CMRR1000	G = 1000, Vin = 0 to 10 V	110	-----	dB
+Iq	G = 1	-----	5.0	mA
-Iq	G = 1	-----	5.0	mA

TABLE IV: Summary of Electrical Measurements After
Total Dose Exposures and Annealing for AD524 1/, 2/, 3/

Parameters	Spec Limits @ 25°C min max	Total Dose Exposure (TDE) (krads)												Anneal 168 hours			
		0 (Pre-Rad)		10		25		50		75		100		mean	sd		
		mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd				
GainErr X1	%	0	0.05	0.004	0.004	0.004	0.004	0.004	0.003	0.004	0.003	0.004	0.004	0.004	0.003	0.003	
GainErr X10	%	0	0.25	0.013	0.015	0.015	0.020	0.014	0.019	0.013	0.015	0.013	0.015	0.013	0.014	0.014	
GainErr X100	%	0	0.50	0.087	0.051	0.101	0.046	0.104	0.042	0.095	0.043	0.094	0.043	0.105	0.057	0.109	0.039
GainErr X1000	%	0	2.00	0.105	0.079	0.172	0.089	0.156	0.123	0.160	0.108	0.199	0.159	0.229	0.200	0.309	0.276
VosOut	mV	0	3.00	0.17	0.17	0.68	0.84	4.22	5.17	4.14	3.95	4.44	4.08	4.70	4.08	3.13	2.50
VosIn	uV	0	100	14.0	20.8	26.9	29.7	104.8	118.5	97.3	90.2	101.3	97.5	100.7	97.2	65.3	62.7
+PSRR X1	dB	75	-	95.5	18.0	106.0	12.4	106.6	9.8	91.9	14.6	93.9	17.0	94.9	16.9	94.4	17.4
+PSRR X10	dB	95	-	106.2	17.9	124.6	12.1	123.9	11.2	109.2	17.1	114.7	23.7	109.5	19.7	107.2	16.7
+PSRR X100	dB	105	-	127.1	19.8	139.9	11.2	130.7	5.9	124.1	21.1	123.0	22.8	119.9	18.0	120.2	19.1
+PSRR X1000	dB	115	-	126.6	21.9	139.0	8.6	138.5	12.6	122.3	17.9	117.4	16.6	119.1	18.8	116.3	16.4
-PSRR X1	dB	75	-	72.6	10.6	82.7	5.4	83.2	5.2	74.1	11.1	73.9	11.1	74.2	11.4	74.5	11.5
-PSRR X10	dB	95	-	90.3	12.9	102.5	5.4	102.8	5.0	91.7	13.5	91.9	12.5	91.4	13.3	91.8	13.4
-PSRR X100	dB	105	-	106.8	14.9	122.3	6.0	121.4	4.5	109.9	16.1	108.9	15.9	108.9	15.5	109.0	15.6
-PSRR X1000	dB	115	-	118.2	16.9	134.6	5.6	135.1	8.1	119.7	18.1	118.3	15.4	128.9	29.7	116.5	17.3
+Ibias	nA	0	50.0	7.14	3.39	18.6	7.08	186.9	59.3	221.7	82.0	272.2	99.8	435.5	151.8	371.3	113.9
-Ibias	nA	0	50.0	9.62	6.05	15.3	17.0	151.6	118.2	191.6	91.0	235.1	111.0	372.1	190.7	334.5	141.5
Ios	nA	0	35.0	3.59	2.94	14.0	17.7	87.9	110.7	86.4	90.6	92.4	95.0	99.6	105.2	66.3	67.2
CMRR X1	dB	70	-	80.9	12.5	91.0	6.0	90.3	5.5	80.1	11.9	79.8	11.8	79.8	11.6	79.3	11.6
CMRR X10	dB	90	-	98.8	14.6	114.1	6.1	110.4	5.8	97.9	14.1	97.7	14.0	97.7	13.8	97.1	13.8
CMRR X100	dB	100	-	119.3	20.9	133.1	8.8	134.0	10.9	117.7	18.1	118.0	18.1	117.3	17.4	115.5	16.7
CMRR X1000	dB	110	-	130.4	18.1	150.6	14.2	150.6	15.3	130.9	19.6	133.3	22.2	129.9	19.0	131.8	22.3
+Iq	mA	0	5.0	3.16	0.50	3.53	0.26	3.38	0.26	2.98	0.48	2.95	0.48	2.91	0.47	2.94	0.47
-Iq	mA	0	5.0	3.19	0.50	3.55	0.26	3.39	0.27	2.98	0.48	2.96	0.48	2.92	0.47	2.95	0.47

- 1/ These statistics do not include the control samples which remained constant throughout testing.
- 2/ The statistics for the post 24 hour annealing steps are available upon request.
- 3/ During the initial electrical measurements S/N 503 was marginally below the specification limits for -PSRR at Gain = 1X and 10X. These parameters were disregarded for S/N 503 throughout testing.

Figure 1. Radiation Bias Circuit for AD524



NOTE: ALL RESISTORS ARE 10% $\frac{1}{4}$ Watt