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Memorandum

PPM-92-160

DATE: June 10, 1992
TO: J. Lohr/311
FROM: K. Sahu/7809
SUBJECT: Radiation Report GGS/WIND/3D PLASMA Project
Part No. DAC8408AT/883B (Control No. 6304)

cc: L. Rabb/406
A. Sharma/311
Library/30001

A radiation evaluation was performed on the DAC8408AT/883B 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, four parts were irradiated under bias (see Figure 1 for bias configuration), and one part was used as a control sample. The total dose radiation steps were 5, 10, 15, and 20 krads*. After 20 krads, the parts were annealed at 25°C for 168 hours. The dose rate was between 54 and 144 rads/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 at 25°C according to the test conditions and the specification limits listed in Table III.

All five parts were electrically tested prior to irradiation. Serial number 51 marginally failed Linearity and was selected as the control sample. All four irradiated parts passed all parametric testing through 5 krads of exposure. Upon further irradiation to 10 krads all four parts exceeded the specification limits for Gain Error, Linearity, Differential Nonlinearity and PSRR. Gain Error readings approached -1.2% of full scale with a maximum specified limit of -0.39%. The Linearity and Differential Nonlinearity readings reached -0.25% and -0.45% of full scale with maximum specified limits of -0.0975% and -0.195% respectively. PSRR readings as high as 0.11% were recorded with a maximum specified limit of 0.01% for a 10% change in the power supply voltage. After an accumulated dose of 15 krads the parts showed continued degradation in these same parameters as well as for the Icc parameter. Readings of 2.5 mA were recorded for Icc with a maximum specified limit of 1.0 mA. The parts no longer functioned properly after accumulating 20 krads of radiation. The data acquired after this step is invalid because the parts no longer functioned. No sign of recovery was observed after 168 hours of annealing at 25°C.

Table IV provides the mean and standard deviation values for each parameter after each radiation exposure and annealing treatment. 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:	DAC8408
GGG/WIND/3D PLASMA Part Number:	DAC8408AT/883B
Control Number:	6304
Charge Number:	C23773
Manufacturer:	Analog Devices Inc.
Lot Date Code:	8821
Quantity Tested:	5
Serial Numbers of Radiation Samples:	52, 53, 54, 55
Serial Number of Control Sample:	51
Part Function:	Quad 8-Bit Digital to Analog Converter
Part Technology:	CMOS
Package Style:	28 pin DIP
Test Engineer:	C. Nguyen

TABLE II. Radiation Schedule for DAC8408AT/883B

EVENTS	DATE
1) INITIAL (PRE-IRRADIATION) ELECTRICAL MEASUREMENT	04/24/92
2) 5 KRAD IRRADIATION (54.6 rads/hour) POST 5 KRAD ELECTRICAL MEASUREMENT	05/07/92 05/11/92
3) 10 KRAD IRRADIATION (113 - 144 rads/hour)* POST 10 KRAD ELECTRICAL MEASUREMENT	05/11/92 05/13/92
4) 15 KRAD IRRADIATION (113.6 rads/hour) POST 15 KRAD ELECTRICAL MEASUREMENT	05/13/92 05/15/92
5) 20 KRAD IRRADIATION (72 - 90 rads/hour)* POST 20 KRAD ELECTRICAL MEASUREMENT	05/15/92 05/18/92
6) 168 HOURS ANNEALING AT 25°C POST 168 HOURS ELECTRICAL MEASUREMENT	05/19/92 05/26/92

* Anomalous Event: The irradiation test was interrupted at 10 krad and at 20 krad due to power failures. The dose rate was adjusted to meet the original schedule.

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.
- All annealing steps were performed under bias.

Table III. Electrical Characteristics of DAC8408AT/883B

Test #	Test Name	Test Conditions	Min	Max	Unit
1	I _{cc}	V ₊ = 5 V	-	1.0	mA
2	Gain Error		-390	390	m%FS
3	Linearity		-	97.5	m%FS
4	Differential Nonlinearity		-	195	m%FS
5	PSRR	4.5 V to 5.5 V	-	10	m%

Exceptions:

A - Tests not performed are : Input Resistance, Output Leakage Current, Propagation Delays, AC feedthrough, and Switching Characteristics.

B - All tests are performed with V_{cc} = +5 V and V_{ref} = +10 V.

Notes:

1 - V_{IH}, V_{IL}, I_{IH}, and I_{IL} were tested Go/No Go during parametric testing. These parameters were set at their specification limits and used as test conditions during parametric testing.

2 - One LSB = 390m%FS

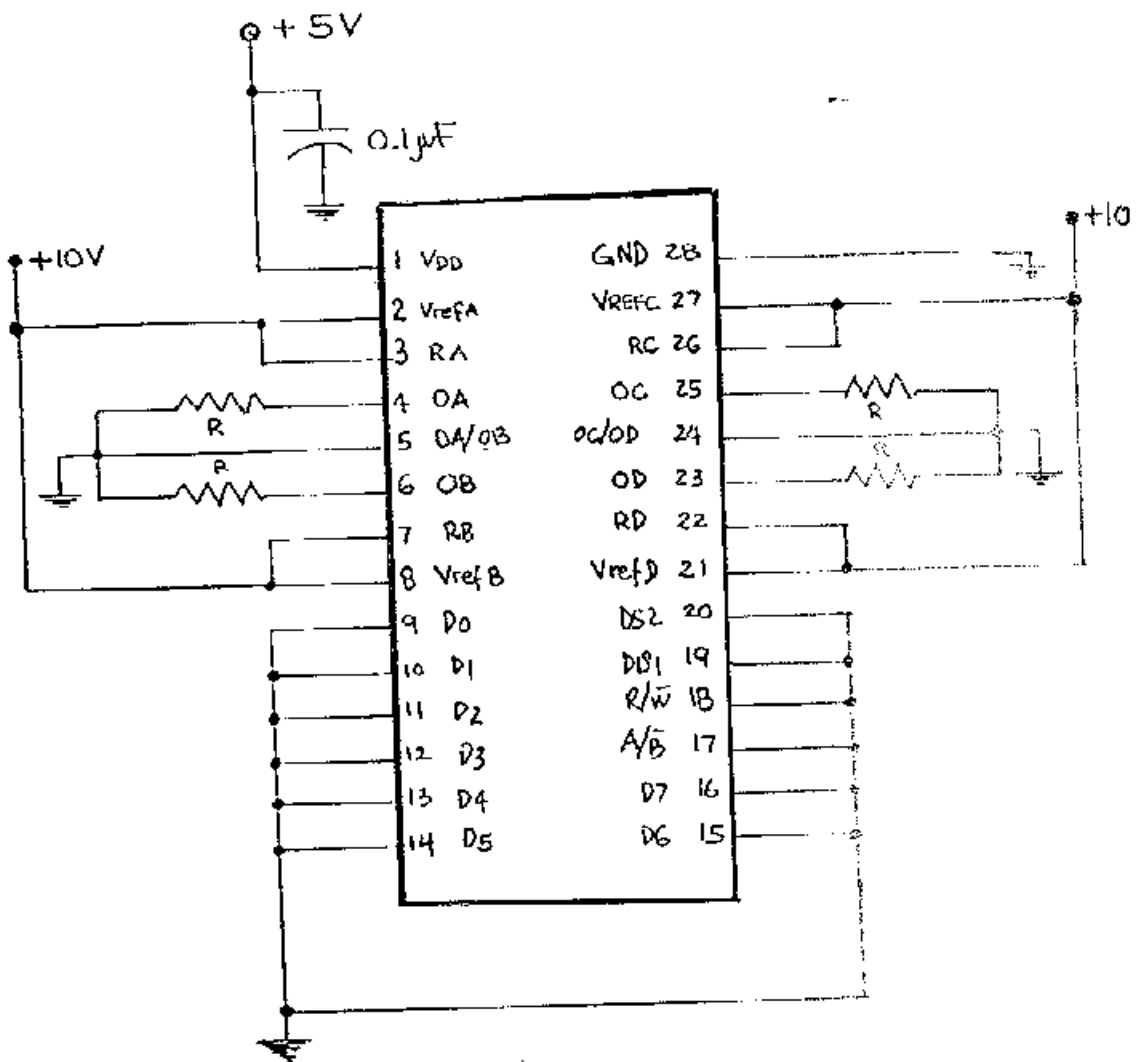
TABLE IV: Summary of Electrical Measurements After
Total Dose Exposures and Annealing for DAC8408AT/883 1/, 2/

Parameters	Units	Spec Limits @ 25°C min max		Total Dose Exposure (TDE) (krads)										Anneal	
				0 (Pre-Rad)		5		10		15		20		168 hour	
				mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
ICC	mA	0.0	1.0	0.01	0.01	0.01	0.01	0.20	0.28	1.57	0.86	3.59	1.83	3.44	1.79
GAIN ERR	m%FS	-390.0	390.0	57.47	25.91	71.88	30.99	981.50	141.71	6341.6	773.92	****	****	****	****
LINEARITY	m%FS	0.0	97.5	18.63	8.01	21.31	8.80	201.20	24.85	725.00	36.56	****	****	****	****
DIF. NONLIN	m%FS	0.0	195.0	15.08	16.01	16.99	16.49	261.19	88.50	823.31	48.10	****	****	****	****
PSRR	m%	0.0	4.0	2.00	1.39	1.47	1.23	100.64	7.24	13616	21064	****	****	****	****

1/ These statistics do not include the control samples which remained constant throughout testing.

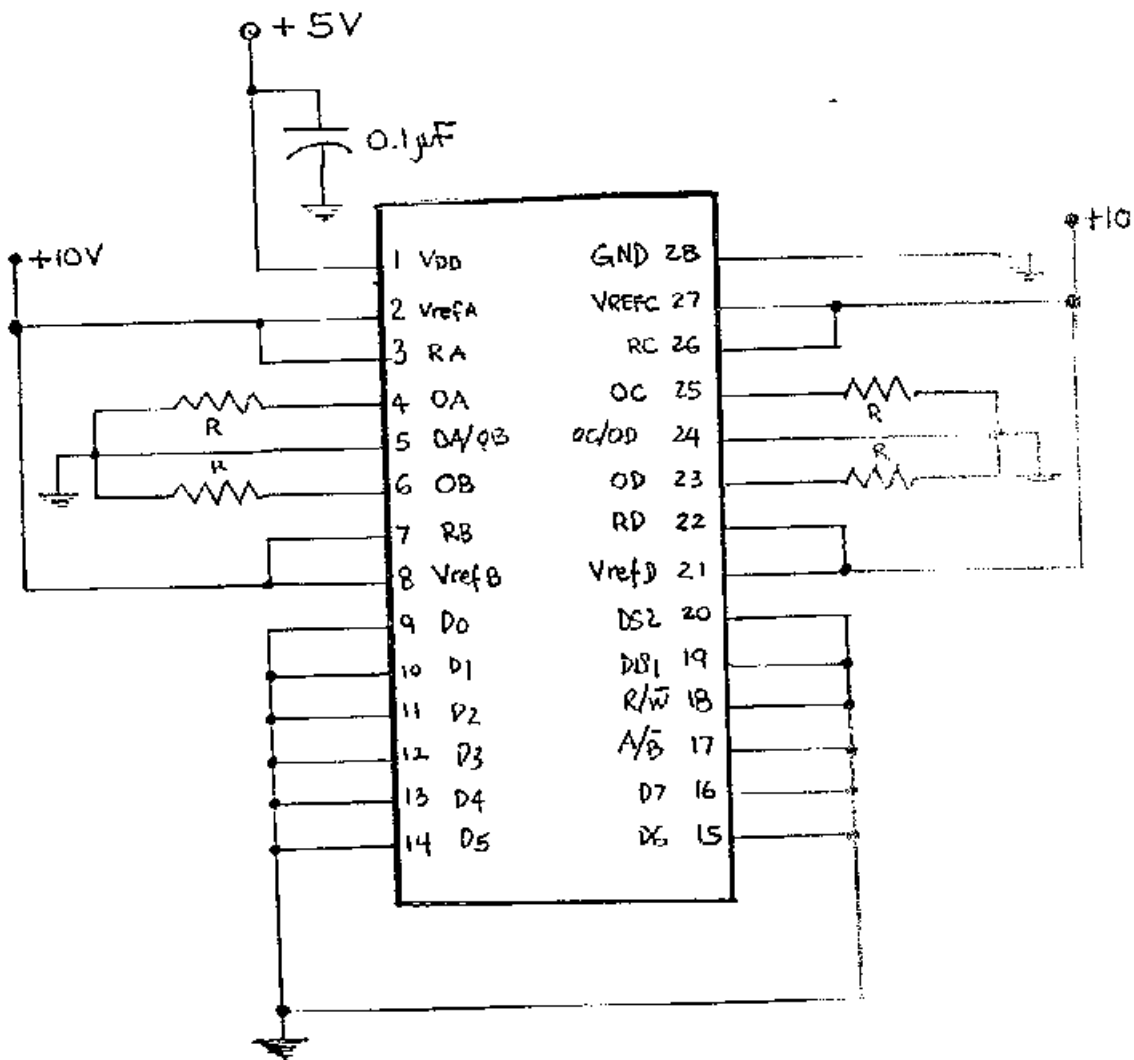
2/ The post 20 krads and post 168 hour annealing statistics are not provided in Table IV. After 20 krads of accumulated exposure, the parts no longer functioned properly making data acquisition impossible.

Figure 1. Radiation Bias Circuit for DAC8408AT/883B



* ALL R = 2K.Ω ¼W 5%.

Figure 1. Radiation Bias Circuit for DAC8408AT/883B



* ALL R = 2KΩ ¼W 5%.