

UNISYS

DATE: May 15, 1997
TO: J.Lohr/311
FROM: K. Sahu/300.1 *KS*
SUBJECT: Radiation Report on: AD570
Project: MIDEX/MAP POWER
Job #: EE71415
Project part #: AD570 (5962-8680201VA)

PPM-97-018

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A radiation evaluation was performed on AD570 (5962-8680201VA) 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 Co⁶⁰ 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 levels were 5.0, 10.0, 15.0, 20.0, 30.0, and 50.0 kRads.* The dose rate was between 0.125 and 0.50 kRads/hour (see Table II for radiation schedule). After the 50.0 kRad exposure, the parts were annealed for 168 hours at 25°C. After each radiation exposure and annealing treatment, parts were electrically tested according to the test conditions and the specification limits** listed in Table III.

Initial electrical measurements were made on 7 samples. Six samples (SN's 51, 52, 53, 54, 55, and 56) were used as radiation samples while SN 50 was used as the control sample. All parts passed all tests during initial electrical measurements.

All parts passed all tests upon irradiation to 50.0 kRads. No significant degradation was observed in any test parameter.

After annealing the parts for 168 hours at 25°C, the parts showed no significant change in any parameter. All parts passed all tests.

Table IV provides a summary of the test results with the mean and standard deviation values for each parameter after each irradiation exposure and 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.

* The term Rads, as used in this document, means Rads(silicon). All radiation levels cited are cumulative.

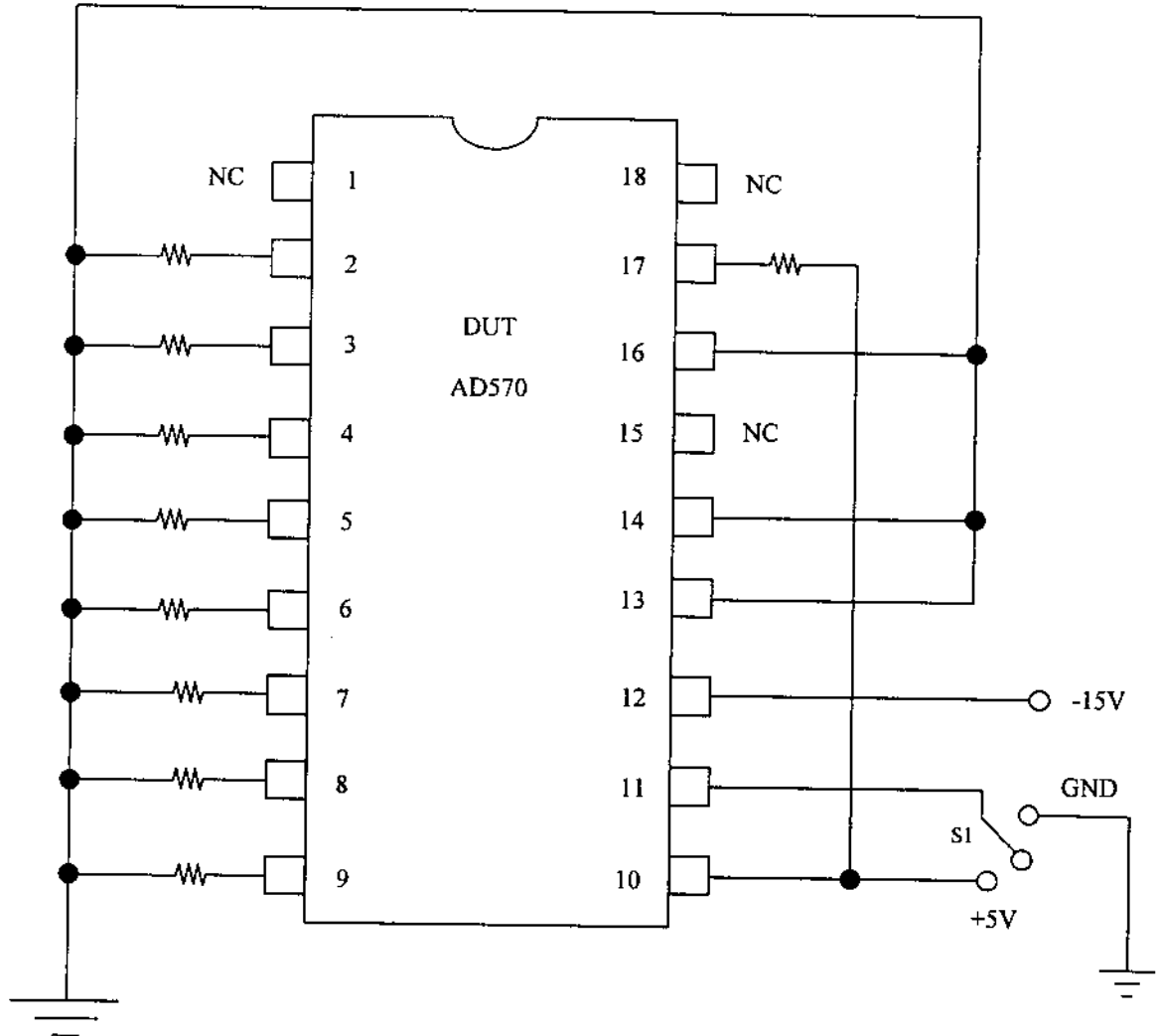
** These are manufacturer's pre-irradiation data specification limits. The manufacturer provided no post-irradiation limits at the time these tests were performed.

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Figure 1. Radiation Bias Circuit for AD570



Notes:

1. All Resistors 3.0k Ω , 1/4 W, 1%, HF.
2. I_{CC} (+5V) ~ 1Amp/100 devices. I_{EE} (-15V) ~ 2Amp/100 devices.
3. 10 μ f caps – one per supply.
4. Connect S_1 to GND.
5. Apply +V and -V.
6. Toggle S_1 to +5V, then set to GND.
7. Repeat steps 4, 5 and 6 before each radiation exposure and the annealing step.

TABLE I. Part Information

Generic Part Number:	AD570
MAP/POWER Part Number	5962-8680201VA
Charge Number:	EE71415
Manufacturer:	Analog Devices
Lot Date Code (LDC):	9617
Quantity Tested:	7
Serial Number of Control Sample:	50
Serial Numbers of Radiation Samples:	51, 52, 53, 54, 55, 56
Part Function:	8-bit A/D Converter
Part Technology:	Bipolar
Package Style:	18 Pin DIP
Test Equipment:	A540
Test Engineer:	A. Naji

- No radiation tolerance/hardness was guaranteed by the manufacturer for this part.

TABLE II. Radiation Schedule for AD570

EVENT	DATE
1) INITIAL ELECTRICAL MEASUREMENTS	04/16/97
2) 5.0 KRAD IRRADIATION (0.062 KRADS/HOUR)	04/18/97
POST-5.0 KRAD ELECTRICAL MEASUREMENT	04/21/97
3) 10.0 KRAD IRRADIATION (0.125 KRADS/HOUR)	04/21/97
POST-10.0 KRAD ELECTRICAL MEASUREMENT	04/23/97
4) 15.0 KRAD IRRADIATION (0.125 KRADS/HOUR)	04/23/97
POST-15.0 KRAD ELECTRICAL MEASUREMENT	04/25/97
5) 20.0 KRAD IRRADIATION (0.125 KRADS/HOUR)	04/25/97
POST-20.0 KRAD ELECTRICAL MEASUREMENT	04/28/97
6) 30.0 KRAD IRRADIATION (0.250 KRADS/HOUR)	04/28/97
POST-30.0 KRAD ELECTRICAL MEASUREMENT	04/30/97
7) 50.0 KRAD IRRADIATION (0.500 KRADS/HOUR)	04/30/97
POST-50.0 KRAD ELECTRICAL MEASUREMENT	05/02/97
8) 168 HOUR ANNEALING @25°C	05/02/97
POST-168 HOUR ANNEAL ELECTRICAL MEASUREMENT	05/09/97

Effective Dose Rate = 50,000 RADS/26 DAYS = 80.1 RADS/HOUR=0.022 RADS/SEC.

PARTS WERE IRRADIATED AND ANNEALED UNDER BIAS, SEE FIGURE 1.

Table III. Electrical Characteristics of AD570 /1

Test #	Parameters	Units	Test Conditions	Spec. Lim.	
				min	max
1	I_{CC_conv}	mA	$T_A = 25^\circ\text{C}$	0.0	10.0
2	I_{CC_blk}	mA	$T_A = 25^\circ\text{C}$	0.0	10.0
3	I_{EE}	mA	$T_A = 25^\circ\text{C}$	-15.0	0.0
4	B/CONVER I_{IL}	μA	$V_{IL} = 0\text{V}$	-100.0	100.0
5	B/CONVER I_{IH}	μA	$V_{IL} = 5\text{V}$	-100.0	100.0
6-13	DB I_{OL}	μA	$V_{OH} = 5\text{V}, V_{OL} = 0\text{V}, \text{bit } 1-8$	-40.0	40.0
14-21	DB I_{OH}	μA		-40.0	40.0
22-29	DB V_{OH}	V	DR, bit 1-8, $I_{OH} = -0.5\text{V}$	2.40	
30	DR V_{OH}	V		2.40	
31-38	DB V_{OL}	mV	DR, bit 1-8, $I_{OL} = +3.2\text{V}$		400
39	DR V_{OL}	mV			400
40	Missing codes				0
41	Differential Nonlinearity /2	$\pm\%$ Full Scale (max)	All codes test unipolar and bipolar.	-0.0978	0.0978
42	Relative Accuracy /2	$\pm\%$ Full Scale (max)	Unipolar and bipolar major transitions ± 3 codes.	-0.0098	0.0098
43	Conv. Time	μs	$T_A = 25^\circ\text{C}$	15	40

Notes:

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

2/ $\pm\%$ Full Scale (max) where 0.098% of Full Scale = 1 LSB. Bits minimum: minimum resolution for which no missing codes are guaranteed.

TABLE IV: Summary of Electrical Measurements after Total Dose Exposures and Annealing for AD570 /1

Test #	Parameters	Units	Spec. Lim. /2		Total Dose (kRads)												Annealing			
			min	max	Initial		5.0		10.0		15.0		20.0		30.0		50.0		168 hours @25°C	
					mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
1	ICC_conv	mA	0.0	10.0	5.09	0.07	5.06	0.19	4.83	0.24	4.83	0.15	4.74	0.21	4.66	0.11	4.24	0.25	4.29	0.16
2	ICC_blk	mA	0.0	10.0	1.41	0.02	1.40	0.02	1.37	0.02	1.37	0.02	1.37	0.01	1.36	0.02	1.32	0.03	1.33	0.02
3	IEE	mA	-15.0	0.0	-8.97	0.11	-8.90	0.13	-8.83	0.14	-8.81	0.13	-8.78	0.13	-8.75	0.12	-8.60	0.13	-8.62	0.13
4	B/CONVER ih	uA	-100.0	100.0	-1.4	0.1	-1.5	0.1	-1.5	0.1	-1.4	0.1	-1.4	0.1	-1.3	0.2	-1.3	0.2	-1.3	0.2
5	B/CONVER iih	uA	-100.0	100.0	-1.4	0.1	-1.5	0.1	-1.5	0.1	-1.4	0.1	-1.4	0.1	-1.3	0.2	-1.3	0.2	-1.3	0.2
6-13	DB ioh /3	uA	-40.0	40.0	0.06	0.02	0.05	0.01	0.05	0.01	0.04	0.01	0.03	0.01	0.03	0.01	0.05	0	0.07	0.02
14-21	DB ioh /3	uA	-40.0	40.0	0.14	0	0.10	0.01	0.13	0.01	0.08	0.01	0.09	0.01	0.09	0.004	0.11	0.02	0.11	0.01
22-29	DB voh	V	2.40		4.92	0	4.92	0.01	4.91	0.01	4.92	0.01	4.92	0.01	4.93	0.01	4.94	0.01	4.92	0.01
30	DR voh	V	2.40		5.00	0.01	4.99	0.01	4.99	0.01	4.99	0.01	4.99	0.01	4.99	0.01	4.99	0.01	4.99	0.01
31-38	DB vol	mV		400	10	0.05	13	3.4	14	4.4	10	2.1	12	3.0	10	4.8	9.8	3.9	17	6.2
39	DR vol	mV		400	39	1.4	35	4.4	35	3.9	41	2.4	40	4.3	44	6.4	46	4.8	45	9.9
40	Missing codes	lin		0	0		0		0		0		0		0		0		0	
41	DNL	lin	-0.0978	0.0978	0.0010	0	0.0010	0	0.0010	0	0.0010	0	0.0010	0	0.0010	0	0.0010	0	0.0010	0
42	RA	lin	-0.0098	0.0098	0.0020	0	0.0020	0	0.0020	0	0.0020	0	0.0020	0	0.0020	0	0.0020	0	0.0020	0
43	Conv. Time	us	15	40	23	0.4	23	0.4	23	0.4	24	0.4	24	0.4	24	0.4	25	0.6	25	0.4

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 manufacturer's pre-irradiation data sheet specification limits. No post-irradiation limits were provided by the manufacturer at the time the tests were performed.
- 3/ The data analysis for these parameters is based on the absolute value of the measurement. This allows a much more meaningful interpretation of the data.

Radiation sensitive parameters: none.