

Unisys

DATE: November 20, 1998 PPM-99-011
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SUBJECT: Radiation Report on **AD780 (Analog Devices) (LDC 9728)**
PROJECT: IRAC

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A radiation evaluation was performed on **AD780 (5962-9463601MPA) 2.5V/3.0V High Precision Reference (Analog Devices)** to determine the total ionizing dose (TID) tolerance of these parts. The TID 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 TID radiation levels were 2.5, 5.0, 10.0, 15.0, 20.0, 30.0, 50.0, and 100.0kRads.¹ The dose rate was 0.259kRads/hour (0.08Rads/s). See Table II for the radiation schedule and effective dose rate calculation. After the 100.0kRad irradiation, the parts were annealed under bias at 25°C and tested after 168 hours.² After each radiation exposure and annealing treatment, parts were electrically tested according to the test conditions and the specification limits³ listed in Table III.

An executive summary of the test results is provided below in bold, followed by a detailed summary of the test results after each radiation level and annealing step. For detailed information, refer to Tables I through IV and Figure 1.

All parts passed all tests initially and upon irradiation to 100kRads. After annealing the parts for 168 hours at 25°C, no significant change was noted in any parameter.

Initial electrical measurements were made on 10 samples. Eight samples (SN's 52, 53, 54, 55, 56, 57, 58, and 59) were used as radiation samples while SN's 50 and 51 were used as control samples. All parts passed all tests during initial electrical measurements.

All parts passed all tests up to 100kRads.

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

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 us at (301) 731-8954.

¹ The term Rads, as used in this document, means Rads (silicon). All radiation levels cited are cumulative.

² The temperature 25°C as used in this document implies room temperature.

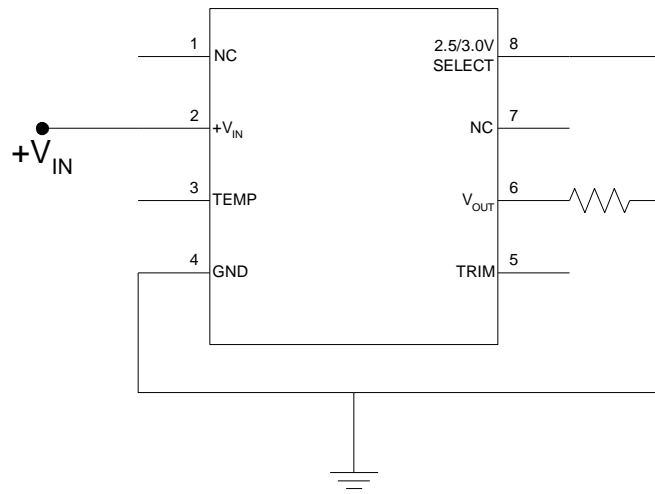
³ These are manufacturer's pre-irradiation data specification limits. The manufacturer provided no post-irradiation limits at the time these tests were performed.

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Figure 1. Radiation Bias Circuit for AD780



Notes:

1. $V_{IN} = +15V \pm 0.5V$.
2. $R = 560\Omega \pm 5\%$, $\frac{1}{4}W$ (Check $I_R \approx 5.3mA @ 3.0V$).

TABLE I. Part Information

Generic Part Number:	AD780
IRAC Part Number:	AD780SQ (5962-9463601MPA)
Charge Number:	M88536
Manufacturer:	Analog Devices
Lot Date Code (LDC):	9728
Quantity Tested:	10
Serial Number of Control Samples:	50, 51
Serial Numbers of Radiation Samples:	52, 53, 54, 55, 56, 57, 58, and 59
Part Function:	2.5V/3.0V High Precision Reference
Part Technology:	Bipolar
Package Style:	8 Pin DIP
Test Equipment:	A540
Test Engineer:	S. Norris

- The manufacturer for this part guaranteed no radiation tolerance/hardness.

TABLE II. Radiation Schedule for AD780

EVENT.....	DATE
1) INITIAL ELECTRICAL MEASUREMENTS	10/22/98
2) 2.5 KRAD IRRADIATION (0.147 KRADS/HOUR)	10/27/98
POST-2.5 KRAD ELECTRICAL MEASUREMENT	10/28/98
3) 5.0 KRAD IRRADIATION (0.147 KRADS/HOUR)	10/28/98
POST-5.0 KRAD ELECTRICAL MEASUREMENT	10/29/98
4) 10.0 KRAD IRRADIATION (0.294 KRADS/HOUR)	10/29/98
POST-10.0 KRAD ELECTRICAL MEASUREMENT	10/30/98
5) 15.0 KRAD IRRADIATION (0.079 KRADS/HOUR)	10/30/98
POST-15.0 KRAD ELECTRICAL MEASUREMENT	11/02/98
6) 20.0 KRAD IRRADIATION (0.125 KRADS/HOUR)	11/02/98
POST-20.0 KRAD ELECTRICAL MEASUREMENT	11/05/98
7) 30.0 KRAD IRRADIATION (0.555 KRADS/HOUR)	11/05/98
POST-30.0 KRAD ELECTRICAL MEASUREMENT	11/06/98
8) 50.0 KRAD IRRADIATION (0.357 KRADS/HOUR)	11/06/98
POST-50.0 KRAD ELECTRICAL MEASUREMENT	11/09/98
9) 100.0 KRAD IRRADIATION (1.220 KRADS/HOUR).....	11/09/98
POST-100.0 KRAD ELECTRICAL MEASUREMENT	11/12/98
10) 168 HOUR ANNEALING @25°C	11/12/98
POST-168 HOUR ANNEAL ELECTRICAL MEASUREMENT	11/19/98

Effective Dose Rate = 100,000 RADS/14 DAYS=258.7 RADS/HOUR=0.08 RADS/SEC

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

Table III. Electrical Characteristics of AD780 /1

Test #	Parameter	Units	Test Conditions /2	Spec. Lim.	
				min	max
1	I _{cc_2.5V}	mA	V _{IN} = 5.0V, I _L = 0mA, V _{OUT} = 2.5V		1.3
2	I _{cc_3.0V}	mA	V _{IN} = 5.0V, I _L = 0mA, V _{OUT} = 3.0V		1.3
3	V_Error_2.5V	V	V _{IN} = 5.0V, I _L = 0mA, V _{OUT} = 2.5V	2.495	2.505
4	V_Error_3.0V	V	V _{IN} = 5.0V, I _L = 0mA, V _{OUT} = 3.0V	2.995	3.005
5	V _{line_2.5V}	mV	V _{OUT} = 2.5V, V _{IN} = 4V to 36V		320
6	V _{load_2.5V}	mV	V _{OUT} = 2.5V, V _{IN} = 5.0V, I _L = 0mA to 10mA		500
7	V_TEMP_PIN	mV	V _{IN} = 5.0V	500	620

Notes:

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

2/ T_A = 25°C unless otherwise noted.

TABLE IV: Summary of Electrical Measurements after Total Dose Exposures and Annealing for LT1010 /1

Test #	Parameters	Units	Spec. Lim. /2		Total Dose Exposure (kRads Si)																				Annealing	
					Initial		2.5		5.0		10.0		15.0		20.0		30.0		50.0		100.0		168 hours @25°C			
			min	max	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
1	Icc_2.5V	mA		1.3	0.7	0	0.7	0	0.7	0	0.7	0	0.7	0	0.7	0	0.7	0	0.7	0	0.7	0	0.7	0	0.7	0
2	Icc_3.0V	mA		1.3	0.8	0	0.8	0	0.8	0	0.8	0	0.8	0	0.8	0	0.8	0	0.8	0	0.8	0	0.8	0	0.8	0
3	V_Error_2.5V	V	2.495	2.505	2.501	0	2.501	0	2.501	0.001	2.501	0	2.501	0	2.502	0	2.502	0.001	2.502	0.000	2.503	0.000	2.503	0.000	2.503	0.000
4	V_Error_3.0V	V	2.995	3.005	3.002	0	3.002	0	3.002	0.001	3.002	0.001	3.002	0	3.002	0	3.002	0	3.002	0.000	3.003	0.000	3.003	0.000	3.003	0.000
5	Vline_2.5V	?V		320	11	2	11	2	11	2	11	3	11	3	11	3	11	3	11	3	11	3	11	2	11	3
6	Vload_2.5V	?V		500	186	3	189	5	195	11	203	18	185	3	189	4	192	5	194	4	194	7	196	5	196	5
7	V_TEMP_PIN	mV	500	620	546	5	541	2	540	3	546	1	538	2	544	3	544	3	544	3	544	3	544	3	541	2

Notes:

- 1/ The mean and standard deviation values were calculated over the eight parts irradiated in this testing. The control samples remained constant throughout 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.

Radiation sensitive parameters: None.