

Unisys

DATE: December 10, 1999 PPM-99-040
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SUBJECT: Radiation Report on **AD783SQ/883B (Analog Devices) (LDC 9702)**
PROJECT: HST/COS

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A radiation evaluation was performed on **AD783SQ/883B Complete Very High Speed Sample and Hold Amplifier (Analog Devices)** to determine the total dose tolerance of these parts. 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 2.5, 5.0, 10.0, 20.0, 30.0, and 50.0kRads.¹ The average dose rate was 0.16kRads/hour (0.04Rads/s). See Table II for the radiation schedule and average dose rate calculation. After the 10kRad irradiation, the facility experienced a power failure, resulting in ~72 hours of unbiased annealing. After the 50.0kRad irradiation, the parts were annealed under bias at 25°C for 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.

All parts passed all tests up to 50kRads. After annealing the parts at 25°C for 168 hours, the parts showed no significant change in any parameter.

Initial electrical measurements were made on 10 samples. Eight samples (SN's 166, 167, 168, 169, 170, 171, 172, and 173) were used as radiation samples while SN's 164 and 165 were used as control samples. All parts passed all tests during initial electrical measurements.

All parts passed all tests up to 50.0kRads.

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.

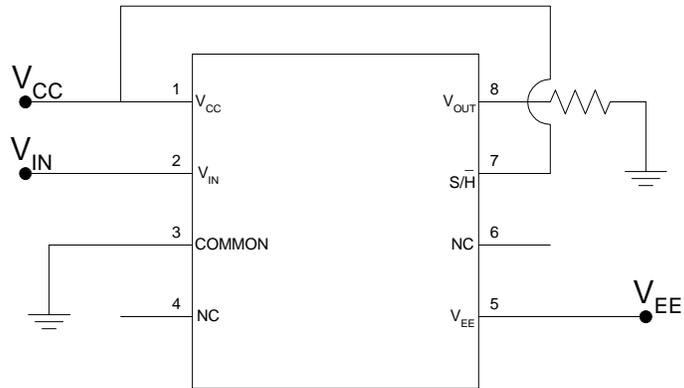
³ These are manufacturer's pre-irradiation data specification limits. The manufacturer provided no post-irradiation limits at the time these tests were performed.

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Figure 1. Radiation Bias Circuit for AD783SQ/883B



Notes:

1. $V_{CC} = +5.0V \pm 0.5V$.
2. $V_{EE} = -5.0V \pm 0.5V$.
3. $V_{IN} = +2.0V \pm 0.2V$.
4. $R = 2k\Omega, 10\%, \frac{1}{2}W$.
5. V_{OUT} should measure about 2.0V.

TABLE I. Part Information

Generic Part Number:	AD783
HST/COS Part Number	AD783SQ/883B
HST/COS TID Requirement	10kRads (RDM = 5)
Charge Number:	C00168
Manufacturer:	Analog Devices
Lot Date Code (LDC):	9702
Quantity Tested:	10
Serial Numbers of Control Samples:	164, 165
Serial Numbers of Radiation Samples:	166, 167, 168, 169, 170, 171, 172, 173
Part Function:	Complete Very High Speed Sample-and-Hold Amplifier
Part Technology:	CMOS
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 AD783SQ/883B

EVENT	DATE
1) INITIAL ELECTRICAL MEASUREMENTS	11/05/99
2) 2.5 KRAD IRRADIATION (0.139 KRADS/HOUR).....	11/15/99
POST-2.5 KRAD ELECTRICAL MEASUREMENT	11/16/99
3) 5.0 KRAD IRRADIATION (0.139 KRADS/HOUR).....	11/16/99
POST-5.0 KRAD ELECTRICAL MEASUREMENT	11/17/99
4) 10.0 KRAD IRRADIATION (0.117 KRADS/HOUR).....	11/17/99
POST-10.0 KRAD ELECTRICAL MEASUREMENT	11/19/99
5) 72 HOUR UNBIASED ANNEALING @25°C.....	11/19/99
POST-72 HOUR UNBIASED ANNEAL ELECTRICAL MEASUREMENT.....	11/22/99
6) 20.0 KRAD IRRADIATION (0.227 KRADS/HOUR).....	11/22/99
POST-20.0 KRAD ELECTRICAL MEASUREMENT	11/24/99
7) 30.0 KRAD IRRADIATION (0.088 KRADS/HOUR).....	11/24/99
POST-30.0 KRAD ELECTRICAL MEASUREMENT	11/29/99
8) 50.0 KRAD IRRADIATION (0.224 KRADS/HOUR).....	11/29/99
POST-50.0 KRAD ELECTRICAL MEASUREMENT	12/03/99
9) 168 HOUR ANNEALING @25°C.....	12/03/99
POST-168 HOUR ANNEAL ELECTRICAL MEASUREMENT.....	12/10/99

Average Dose Rate = 50,000 RADS/310 HOURS=161.0 RADS/HOUR=0.04RADS/SEC

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

Table III. Electrical Characteristics AD783SQ (1)

Test #	Parameter	Units	Spec. Limit		Test Conditions (2)
			min	max	
1	I _{supply}	mA		17	
2	PWR_CON	mW		175	
3	I _{in_high}	μA	-10	10	V _{IN} = 5V
4	I _{bias}	nA	-250	250	
5	+PSRR	dB	45		
6	-PSRR	dB	45		
7	+I _o	mA	-5.0	5.0	
8	-I _o	mA	-5.0	5.0	
9	I _{sink}	mA	-5.0	5.0	
10	Acquisition Time	ns		350	5V Step to 0.1%

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) V_{CC} = +5V, V_{EE} = -5V and C_L = 50pF unless otherwise noted.

TABLE IV: Summary of Electrical Measurements after Total Dose Exposures and Annealing for AD783SQ/883B (1)

Test #	Parameters	Units	Spec. Lim. (2)		Total Dose Exposure (kRads Si)								Annealing		Total Dose Exposure (kRads Si)						Annealing	
					Initial		2.5		5.0		10.0		72 hours unbiased @25°C		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	mean	sd
1	I _{supply}	mA		17	9.2	0.1	9.2	0.1	9.1	0.1	9.2	0.1	9.2	0.1	9.4	1.0	9.7	0.2	10.5	0.2	10.3	0.3
2	PWR_CON	mW		175	92	1	92	1	91	1	92	1	92	1	94	2	97	2	105	2	103	3
3	I _{in_high}	mA	-10	10	0.05	0.01	0.09	0.06	0.07	0.03	0.06	0.05	0.06	0.04	0.1	0.1	0.2	0.2	0.2	0.4	0.08	0.03
4	I _{bias}	nA	-250	250	47	53	44	48	64	62	14	80	-1	109	-56	80	25	73	4	37	-6	109
5	+_PSRR	dB	45		55	0	63	2	56	1	56	1	55	1	64	3	63	2	55	1	55	1
6	-_PSRR	dB	45		51	0	62	2	51	1	51	1	52	1	63	5	62	2	52	1	52	1
7	+I _o	mA	-5.0	5.0	-4.5	0	-4.5	0	-4.5	0	-4.5	0	-4.5	0	-4.5	0	-4.5	0	-4.5	0	-4.5	0
8	-I _o	mA	-5.0	5.0	4.5	0	4.5	0	4.5	0	4.5	0	4.5	0	4.5	0	4.5	0	4.5	0	4.5	0
9	I _{sink}	mA	-5.0	5.0	9.3	0.1	12.5	0	9.3	0.1	9.2	0.1	9.2	0.1	12.5	0	12.5	0	9.2	0.1	9.2	0.1
10	Acquisition Time	ns		350	178	6	181	2	181	2	181	1	170	7	171	4	170	4	179	4	136	16

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 the data.
- (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.