

Unisys

DATE: April 10, 1998
TO: S. Hull/562
FROM: K. Sahu/S. Kniffin/300.1
SUBJECT: Radiation Report on: **AD585 (Analog Devices) (LDC 9648)**
Project: MAP Subsystems
Job #: C80720
Project part #: AD585 (5962-8754001CA)

PPM-98-006

cc: M. Delmont/303
A. Reyes/790.2
A. Sharma/562
K. Label/562
OFA Library/300.1

A radiation evaluation was performed on **AD585 (5962-8754001CA) High Speed Precision Sample and Hold Amplifier (Analog Devices)** 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 one part was used as a control sample. The total dose radiation levels were 5.0, 10.0, 15.0, 20.0, 30.0, 50.0, 75.0, and 100.0 kRads.* The dose rate was between 0.125 and 0.625 Rads/hour (0.035 to 0.174 Rads/s). See Table II for the radiation schedule and effective dose rate calculation. The effective dose rate over all testing was 0.064 Rads/sec. After the 100.0 kRad irradiation, 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 9 samples. Eight samples (SN's 261, 262, 263, 264, 265, 266, 267, and 268) were used as radiation samples while SN 260 was used as a control sample. All parts passed all tests during initial electrical measurements.

All parts passed all tests up to 30.0 kRads.

After the 50.0 kRad irradiation, SN 267 fell marginally below the specification limit of 80dB for CMRR with a reading of 75dB and SN 261 marginally exceeded the specification limit of 1000µV/msec for droop rate with a reading of 1250µV/msec. **All parts passed all other tests.**

After the 75.0 kRad irradiation, two parts marginally exceeded the specification limit of 3.0mV for V_Offset with readings of 3.5 and 3.25mV. Three parts fell marginally below the specification limit for CMRR with readings of 74dB for all. Five parts exceeded the specification limit for droop rate with readings in the range of 1100 to 1400µV/msec. **All parts passed all other tests.**

After the 100.0 kRad irradiation, three parts marginally exceeded the specification limit of 3.0mV for V_Offset with readings of 3.3, 3.3 and 4.3mV. Five parts fell marginally below the specification limit for CMRR with readings of 75dB for all. Seven parts exceeded the specification limit for droop rate with readings in the range of 1100 to 1600µV/msec. **All parts passed all other tests.**

* 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.

After annealing the parts for 168 hours at 25°C, the parts showed some recovery, with only four parts marginally exceeding the specification limit for CMRR with readings of 74dB and all parts passed the droop rate test. However, five parts marginally exceeded the specification limit for V_Offset with readings of 3.2mV for all.

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.

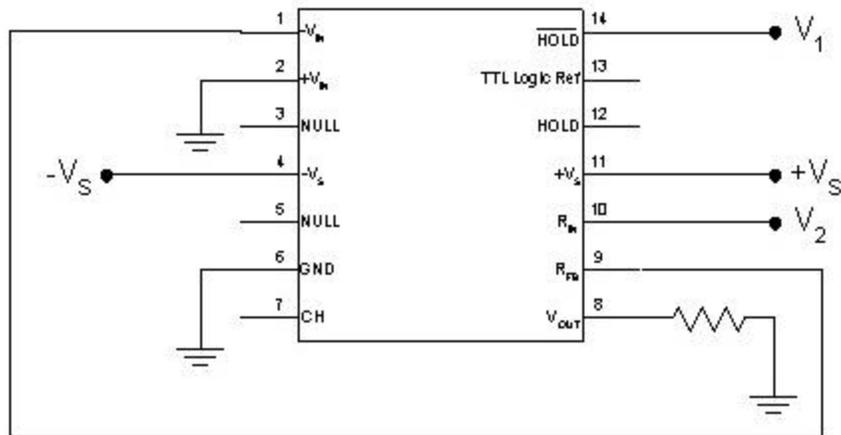
Any further details about this evaluation can be obtained upon request. If you have any questions, please call me at (301) 731-8954.

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Figure 1. Radiation Bias Circuit for AD585



Notes:

1. Resistor is $2\text{k}\Omega \pm 5\%$, $\frac{1}{2}\text{W}$.
2. $V_1, V_2 = 5.0\text{V} \pm 0.1\text{V}$.
3. $+V_S = +15\text{V} \pm 0.1\text{V}$, $-V_S = -15\text{V} \pm 0.1\text{V}$

TABLE I. Part Information

Generic Part Number:	AD585
MAP Subsystem Part Number	AD585 (5962-8754001CA)
Charge Number:	C80720
Manufacturer:	Analog Devices
Lot Date Code (LDC):	9648
Quantity Tested:	9
Serial Number of Control Samples:	260
Serial Numbers of Radiation Samples:	261, 262, 263, 264, 265, 266, 267, and 268
Part Function:	High Speed Precision Sample and Hold Amplifier
Part Technology:	Bipolar
Package Style:	14 Pin DIP
Test Equipment:	A540
Test Engineer:	S. Archer-Davies

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

TABLE II. Radiation Schedule for AD585

EVENT.....	DATE
1) INITIAL ELECTRICAL MEASUREMENTS	03/04/98
2) 5.0 KRAD IRRADIATION (0.125 KRADS/HOUR)	03/16/98
POST-30.0 KRAD ELECTRICAL MEASUREMENT	03/18/98
3) 10.0 KRAD IRRADIATION (0.125 KRADS/HOUR)	03/18/98
POST-30.0 KRAD ELECTRICAL MEASUREMENT	03/20/98
4) 15.0 KRAD IRRADIATION (0.125 KRADS/HOUR)	03/20/98
POST-30.0 KRAD ELECTRICAL MEASUREMENT	03/23/98
5) 20.0 KRAD IRRADIATION (0.125 KRADS/HOUR)	03/23/98
POST-30.0 KRAD ELECTRICAL MEASUREMENT	03/25/98
6) 30.0 KRAD IRRADIATION (0.250 KRADS/HOUR)	03/25/98
POST-30.0 KRAD ELECTRICAL MEASUREMENT	03/27/98
7) 50.0 KRAD IRRADIATION (0.500 KRADS/HOUR)	03/27/98
POST-50.0 KRAD ELECTRICAL MEASUREMENT	03/30/98
8) 75.0 KRAD IRRADIATION (0.625 KRADS/HOUR)	03/30/98
POST-75.0 KRAD ELECTRICAL MEASUREMENT	04/01/98
9) 100.0 KRAD IRRADIATION (0.625 KRADS/HOUR).....	04/01/98
POST-100.0 KRAD ELECTRICAL MEASUREMENT	04/03/98
10) 168 HOUR ANNEALING @25°C	04/03/98
POST-168 HOUR ANNEAL ELECTRICAL MEASUREMENT	04/10/98

Effective Dose Rate = 100,000 RADS/18 DAYS=231.5 RADS/HOUR=0.064 RADS/SEC

The effective dose rate is lower than that of the individual radiation steps as it takes into account the interim-annealing step.

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

Table III. Electrical Characteristics of AD585 /1 /2 /3

Test #	Parameter	Units	Test Conditions	Spec. min	Lim. max
1	Plus_Icc	mA	$R_L = 8$	0	10.0
2	Minus_Icc	mA	$R_L = 8$	-10.0	0
3	Iin_Logic	mA	$V_S = \pm 18V$		50
4	Ibias	nA	$V_{IN} = 0V$	-2.0	2.0
5	logic_ref	V	50mA Load	1.200	1.600
6	output_curr	mA	$R_L = 100W$	12.0	
7	v_offset	mV	$V_{OUT} = 0V$	-3.0	3.0
8	CMRR	dB	$V_{CM} = \pm 10V$	80	
9	DRM	%			0.3
10	acquisition_time	ms	10V step to 0.01%		3.0
11	droop rate	mV/ms	$V_{IN} = 0V$		1000
12	PSRR +	dB	$+V_S = +5$ to $+18V$, $V_{IN} = V_{OUT} = 0V$	70	
12	PSRR -	dB	$-V_S = -12$ to $-18V$, $V_{IN} = V_{OUT} = 0V$		-70

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/ $V_S = \pm 15V$, $C_H = \text{Internal}$, $R_L = \text{infinite}$, $A = +1$, Hold active, sample mode unless otherwise noted.

3/ Due to limitations in the automatic test equipment, ΔRM , acquisition time, droop rate, and PSRR were measured using bench tests.

TABLE IV: Summary of Electrical Measurements after Total Dose Exposures and Annealing for AD585 /1

Test #	Parameters	Units	Spec. Lim. /2 min max		Total Dose Exposure (kRads Si)																		Annealing			
					Initial		5.0		10.0		15.0		20.0		30.0		50.0		75.0		100.0		168 hours @25°C			
					mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
1	Plus_Icc	mA	0	10.0	4.5	0.1	4.5	0.1	4.5	0.1	4.5	0.1	4.5	0.1	4.1	0.1	4.4	0.1	4.4	0.1	4.4	0.1	4.4	0.1	4.4	0.1
2	Minus_Icc	mA	-10.0	0	-4.3	0.1	-4.3	0.1	-4.3	0.1	-4.3	0.1	-4.2	0.1	-4.2	0.1	-4.2	0.1	-4.2	0.1	-4.2	0.1	-4.2	0.1	-4.2	0.1
3	Iin_Logic	mA		50	-6	0.7	-6	0.5	-6	0.3	-6	0.3	-6	0.3	-6	0.4	-7	0.5	-7	0.3	-8	0.6	-8	0.6		
4	Ibias	nA	-2.0	2.0	-0.53	0.84	-0.66	0.64	-0.48	0.79	-0.52	0.84	0.28	0.35	0.23	0.61	0.13	0.81	0.03	0.57	-0.20	0.58	0.25	0.98		
5	logic_ref	V	1.200	1.600	1.359	0.003	1.359	0.003	1.359	0.003	1.359	0.003	1.359	0.003	1.356	0.003	1.350	0.004	1.365	0.004	1.370	0.004	1.367	0.003		
6	output_curr	mA	12.0		15	0	15	0	15	0	15	0	15	0	15	0	15	0	15	0	15	0	15	0	15	0
7	v_offset	mV	-3.0	3.0	0.4	0.6	0.3	0.6	0.2	0.6	0.1	0.6	0.0	0.5	2.5	0.3	2.4	0.4	2.7	0.6	3.1	0.5	2.9	0.4		
8	CMRR	dB	80		85	4.2	85	2.6	86	1.7	91	2.0	90	0	90	0	86	3.9	78	4.0	78	3.7	78	4.0		
9	DRM	%		0.3	0.05	0.03	0.05	0.03	0.05	0.03	0.05	0.03	0.04	0.03	0.05	0.03	0.06	0.03	0.05	0.03	0.04	0.03	0.05	0.03		
10	acquisition_time	ms		3.0	1.3	0	1.3	0	1.3	0.1	1.3	0.1	1.4	0.1	1.3	0.1	1.2	0.1	1.4	0.1	1.4	0.1	1.3	0.1		
11	droop_rate	mV/ms		1000	165	9	174	7	172	11	186	15	196	19	391	64	773	196	1056	254	1306	253	838	160		
12	PSRR +	dB	70		87	6	87	3	91	7	93	5	92	5	85	4	89	5	90	6	87	5.9	87	5.6		
13	PSRR -	dB		-70	3/		-91	4	-89	4	-89	5	-88	3	-86	3	-84	3	-85	2	-87	4	-88	3		

- 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.
 - 3/ PSRR- was added after the 5kRad irradiation.

Radiation sensitive parameters: v_offset, CMRR, droop rate.