

# Unisys

DATE: November 19, 1999  
TO: R. Reed/562  
FROM: K. Sahu/S. Kniffin/300.1  
SUBJECT: Radiation Report on **DAC08 (Analog Devices) (LDC 9831)**  
PROJECT: GLAS

PPM-99-036

cc: G. Henegar/564.9, R. Hardesty/550.0, A. Sharma/562, OFA Library/300.1

A radiation evaluation was performed on **DAC08 8-Bit High Speed DAC (Analog Devices)** to determine the total dose tolerance of these parts. The total dose testing was performed using a Co<sup>60</sup> gamma ray source. During the radiation testing, one part was irradiated under bias to determine the initial degradation level. Seven parts were then irradiated under bias (see Figure 1 for bias configuration) and two parts were used as control samples. The total dose radiation levels were 10.0, 17.5, 25.0, and 50.0kRads.<sup>1</sup> The average dose rate was 0.17kRads/hour (0.05Rads/s). See Table II for the radiation schedule and average dose rate calculation. After the 50.0kRad irradiation, the parts were annealed under bias at 25°C for 168 hours.<sup>2</sup> After each radiation exposure and annealing step, parts were electrically tested according to the test conditions and the specification limits<sup>3</sup> 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 25kRads. After the 50kRad irradiation, five parts marginally exceeded the specification limit for +PSS\_IFS1 and +PSS\_IFS2. After annealing the parts at 25°C for 168 hours, the parts showed some recovery in +PSS\_IFS1 and +PSS\_IFS2.**

Initial electrical measurements were made on 10 samples. One part was used to determine the initial degradation level (SN 31). Seven samples (SN's 33, 34, 35, 36, 37, 38, and 39) were used as radiation samples while SN's 30 and 32 were used as control samples. All parts passed all tests during initial electrical measurements.

All parts passed all tests up to 25kRads.

After the 50kRad irradiation, five parts marginally exceeded the specification limit of 10.00µA for +PSS\_IFS1 and +PSS\_IFS2 with readings in the range of 10.26 to 15.49µA for both. **All parts passed all other tests.**

After annealing the parts for 168 hours at 25°C, the parts showed some recovery. Four parts exceeded the specification limit for +PSS\_IFS1 and two parts exceeded the specification limit for +PSS\_IFS2.

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.

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

<sup>2</sup> The temperature 25°C as used in this document implies room temperature.

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

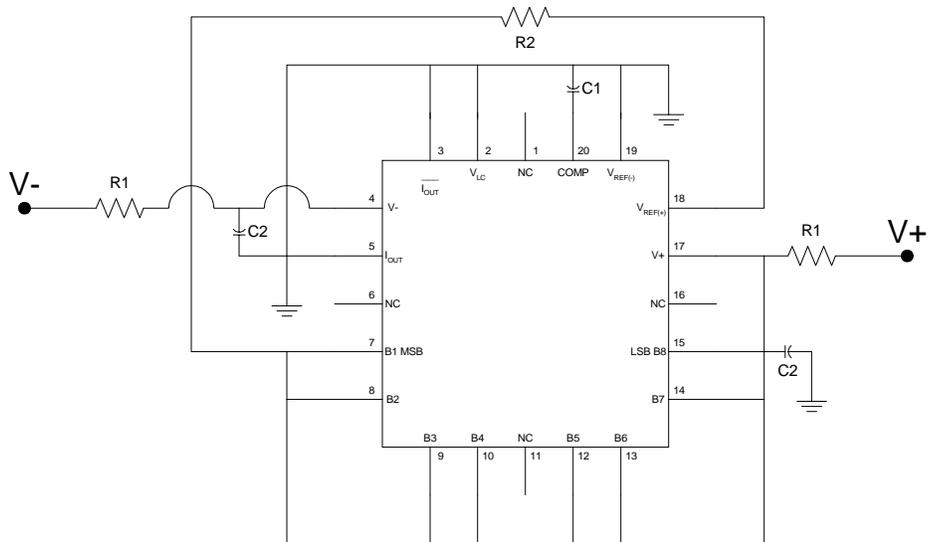
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Figure 1. Radiation Bias Circuit for DAC08



Notes:

1.  $+V = +15V \pm 0.5V$ .
2.  $-V = -15V \pm 0.5V$ .
3.  $R_1 = 10\Omega \pm 5\%$ ,  $\frac{1}{4}W$ .
4.  $R_2 = 7.5k\Omega \pm 5\%$ ,  $\frac{1}{4}W$ .
5.  $C_1 = 0.001\mu F$ , 35V.
6.  $C_2 = 0.1\mu F$ , 35V.

TABLE I. Part Information

Generic Part Number:	DAC08
GLAS Part Number	5962-89932012A
GLAS TID Requirement	25kRads (RDM = 5)
Charge Number:	M90432
Manufacturer:	Analog Devices
Lot Date Code (LDC):	9831
Quantity Tested:	10
Serial Numbers of Control Samples:	30, 32
Serial Number of Initial Degradation Sample:	31
Serial Numbers of Radiation Samples:	33, 34, 35, 36, 37, 38, 39
Part Function:	8-Bit High Speed Multiplying DAC
Part Technology:	Bipolar
Package Style:	20 Pin LCC
Test Equipment:	A540
Test Engineer:	S. Archer-Davies

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

TABLE II. Radiation Schedule for DAC08

EVENT .....	DATE
1) INITIAL ELECTRICAL MEASUREMENTS .....	10/01/99
One Part Test Runs	
2) 8 KRAD IRRADIATION (0.127 KRADS/HOUR).....	10/01/99
POST-8 KRAD ELECTRICAL MEASUREMENT .....	10/04/99
3) 16.0 KRAD IRRADIATION (0.177 KRADS/HOUR).....	10/04/99
POST-16.0 KRAD ELECTRICAL MEASUREMENT .....	10/06/99
4) 24.0 KRAD IRRADIATION (0.181 KRADS/HOUR).....	10/06/99
POST-24.0 KRAD ELECTRICAL MEASUREMENT .....	10/08/99
All Remaining Parts	
5) 10.0 KRAD IRRADIATION (0.150 KRADS/HOUR).....	10/15/99
POST 10.0 KRAD ELECTRICAL MEASUREMENT .....	10/18/99
6) 17.5 KRAD IRRADIATION (0.179 KRADS/HOUR).....	10/18/99
POST-17.5 KRAD ELECTRICAL MEASUREMENT .....	10/20/99
7) 25.0 KRAD IRRADIATION (0.166 KRADS/HOUR).....	10/20/99
POST-25.0 KRAD ELECTRICAL MEASUREMENT .....	10/22/99
8) 50.0 KRAD IRRADIATION (0.180 KRADS/HOUR).....	10/22/99
POST-50.0 KRAD ELECTRICAL MEASUREMENT .....	10/28/99
9) 168 HOUR ANNEALING @25°C.....	10/28/99
POST-168 HOUR ANNEAL ELECTRICAL MEASUREMENT .....	11/04/99

Average Dose Rate = 50,000 RADS/289 HOURS=173.0 RADS/HOUR=0.05RADS/SEC

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

Table III. Electrical Characteristics DAC08 (1)

Test #	Parameter	Units	Spec. Limit		Test Conditions (2)
			min	max	
10	I <sub>cc_15V</sub>	mA	0	4.0	
11	I <sub>cc_5V</sub>	mA	0	4.0	V <sub>CC</sub> = 5V, V <sub>SS</sub> = -5V, I <sub>REF</sub> = 1mA
12	I <sub>ss_15V</sub>	mA	-8.0	0	
13	I <sub>ss_5V</sub>	mA	-8.0	0	V <sub>CC</sub> = 5V, V <sub>SS</sub> = -5V, I <sub>REF</sub> = 1mA
14	PD_15V	mW	0	174	
15	PD_5V	mW	0	48	V <sub>CC</sub> = 5V, V <sub>SS</sub> = -5V, I <sub>REF</sub> = 1mA
20	+I <sub>f</sub> r	mA	-2.04	-1.92	all inputs = 15V, V <sub>REF</sub> = 10V
21	-I <sub>f</sub> r	mA	-2.04	-1.92	all inputs = 0V, V <sub>REF</sub> = -10V
22	+I <sub>z</sub> s	μA	-2.00	0	all inputs = 0V, V <sub>REF</sub> = 10V
23	-I <sub>z</sub> s	μA	-2.00	0	all inputs = 15V, V <sub>REF</sub> = -10V
24	I <sub>f</sub> r <sub>s</sub>	μA	0	8.00	I <sub>f</sub> r - avg(I <sub>f</sub> r)
30	+PSS_IFS1	μA	-10.0	10.0	V <sub>CC</sub> = 4.5V to 18V, V <sub>SS</sub> = -18V
31	+PSS_IFS2	μA	-10.0	10.0	V <sub>SS</sub> = -4.5V to -18V, V <sub>CC</sub> = 18V
40-47	I <sub>ih</sub> B1-B8	μA	-10.0	10.0	V <sub>IN</sub> = 18V, V <sub>IL</sub> = 0.8V
48-55	I <sub>il</sub> B1-B8	μA	-30.0	30.0	V <sub>IN</sub> = -10V, V <sub>IL</sub> = 2.0V
60	NL+	lsb	0	1.15	all codes, V <sub>REF</sub> = 10V
61	RA+	lsb	0	1.15	all codes, V <sub>REF</sub> = 10V
62	NL-	lsb	0	1.15	all codes, V <sub>REF</sub> = 10V
63	RA-	lsb	0	1.15	all codes, V <sub>REF</sub> = 10V

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<sub>CC</sub> = +15V, V<sub>SS</sub> = -15V, I<sub>REF</sub> = 2mA unless otherwise specified.

**Figure 2: +PSS\_IFS vs. Total Ionizing Dose (kRads Si)**

