PPM 92-092

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UNISYS

Interoffice Memorandum

To
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Department
Code 311
From
K. Sahu
Department
7809
Subject
Radiation Report on AD829SQ/883B
GGS/WIND/WAVES Control No. 5736

PPM-92-0092
Date
March 4, 1992
Location
Lanham
Telephone
731-8954
Location
Lanham
cc
E. Werner/406
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G. Robinson/303
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[redacted]

A radiation evaluation was performed on the AD829SQ/883B 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 cobalt-60 gamma ray source. During the radiation testing, four parts were irradiated under bias (see Figure 1 for bias configuration), and one part was used as a control sample. The total dose radiation steps were 3.2, 10, 15, 20, 30, 40 and 50 krads*. After 50 krads, the parts were annealed at 25°C for 168 hours and at 100°C for 168 hours. The dose rate was between 50 and 225 rads/hour, depending on the total dose level (see Table II for radiation schedule). After each radiation exposure and annealing treatment, the parts were electrically tested at +25°C according to the test conditions and the specification limits listed in Table III.

All parts passed all parametric tests upon irradiation to 3.2 krads. However, upon further irradiation to 10 krads, all four parts were 10 dB to 15 dB below the specification limit of 98 dB for PSRR. Also, two parts exceeded the maximum limit of 500 uV for Vos with readings up to 800 uV. After further irradiation to 30 krads, the Vos parameter showed significant degradation. All four parts were in excess of the specified limit for Vos with a maximum reading of 2.07 mV for one part. The PSRR readings (although still below the limit) remained consistent from 10 krads through 50 krads of exposure. After 40 krads of exposure, one part was marginally below the specified limit of 30 V/mV for the Gain at Vcc=+/-5 V with a reading of 29.94 V/mV. In addition, two parts continued to exceed the limits for Vos and three parts began to exceed the specified limit of 500 nA for Ios with readings up to 700 nA. No significant changes were noticed after further irradiation to 50 krads. The parts showed significant recovery after annealing at 25°C for 168 hours. All four parts recovered to within the specified limits for all parametric tests except for the PSRR test which remained about 10 dB below the limit. The parts continued to recover after annealing at 100°C for 168 hours with two parts less than 5 dB below the limit for PSRR.

Table IV provides the mean and standard deviation values for each parameter after each radiation exposure and annealing treatment. Any further details about this evaluation can be obtained upon request. If you have any questions, please call me at (301)731-8954.

* In this report, the term "rads" is used as an abbreviation for rads (Si).

TABLE I. Part Information

Generic Part Number:	AD829
GGS/WIND/WAVES Part Number:	AD829SQ/883B
Control Number:	5736
Charge Number:	C23421
Manufacturer:	Analog Devices Inc.
Lot Date Code:	9005
Quantity Tested:	4
Serial Numbers of Radiation Samples:	601, 602, 603, 604
Serial Number of Control Sample:	600
Part Function:	High Speed, Low Noise Video Op-Amp
Package Style:	8-pin DIP

TABLE II. Radiation Schedule for AD829SQ/883B

EVENTS	DATE
1) Initial (Pre-Irradiation) Electrical Measurements	01/10/92
2) 3.2 KRAD IRRADIATION * (70 rads/hour)	01/10/92
POST 3.2 KRAD ELECTRICAL MEASUREMENT	01/13/92
3) 10 KRAD IRRADIATION (160 rads/hour)	01/13/92
POST 10 KRAD ELECTRICAL MEASUREMENT	01/15/92
4) 15 KRAD IRRADIATION (120 rads/hour)	01/15/92
POST 15 KRAD ELECTRICAL MEASUREMENT	01/17/92
5) 20 KRAD IRRADIATION (55 rads/hour)	01/17/92
POST 20 KRAD ELECTRICAL MEASUREMENT	01/21/92
6) 30 KRAD IRRADIATION (225 rads/hour)	01/21/92
POST 30 KRAD ELECTRICAL MEASUREMENT	01/23/92
7) 40 KRAD IRRADIATION (110 rads/hour)	01/23/92
POST 40 KRAD ELECTRICAL MEASUREMENT	01/27/92
8) 50 KRAD IRRADIATION (225 rads/hour)	01/27/92
POST 50 KRAD ELECTRICAL MEASUREMENT	01/30/92
9) 168 HOURS ANNEALING AT 25°C	01/30/92
POST 168 HOURS ELECTRICAL MEASUREMENT	02/05/92
10) 168 HOURS ANNEALING AT 100°C	02/05/92
POST 168 HOURS ELECTRICAL MEASUREMENT	02/12/92

* Anomalous Event:

Due to a power failure in the radiation lab, the parts received 3.2 krads of exposure instead of the 5 krads as planned.

Notes:

- All parts were radiated under bias at the cobalt-60 gamma ray facility at GSFC.
- All electrical measurements were performed off-site at +25°C.
- All annealing steps were performed under bias.

Table III. Electrical Characteristics of AD829SQ/883B

PARAMETRIC TESTS PERFORMED

PARAMETER	TEST CONDITIONS	LIMIT MIN	LIMIT MAX	UNITS
+Icc	Vcc=+/- 5 V	---	6.5	mA
+Icc	Vcc=+/-15 V	---	6.8	mA
-Icc	Vcc=+/- 5 V	---	6.5	mA
-Icc	Vcc=+/-15 V	---	6.8	mA
Vos	Vcc=+/- 5 V	---	500	uV
Vos	Vcc=+/-15 V	---	500	uV
Ios	Vcc=+/- 5 V	---	500	nA
Ios	Vcc=+/-15 V	---	500	nA
Ib+	Vcc=+/- 5 V	---	7.0	uA
Ib+	Vcc=+/-15 V	---	7.0	uA
Ib-	Vcc=+/- 5 V	---	7.0	uA
Ib-	Vcc=+/-15 V	---	7.0	uA
Ibias	Vcc=+/- 5 V	---	7.0	uA
Ibias	Vcc=+/-15 V	---	7.0	uA
CMRR	Vcm=+/-2.5 V, Vcc=+/- 5 V	100	---	dB
CMRR	Vcm=+/- 24 V, Vcc=+/-15 V	100	---	dB
+PSRR	Vcc+=(+18,+4.5)V, Vcc-=-18 V	98	---	dB
-PSRR	Vcc+=+18 V, Vcc-=(-18,-4.5)V	98	---	dB
Av	Vcc=+/-5 V,Vo=+/-2.5V,Rl=500	30	---	V/mV
Av	Vcc=+/-15 V,Vo=+/-10V,Rl=1k	50	---	V/mV
+Vout	Rl= 500, Vcc=+/- 5 V	3	---	V
+Vout	Rl= 150, Vcc=+/- 5 V	2.5	---	V
+Vout	Rl=1000, Vcc=+/-15 V	12	---	V
+Vout	Rl= 500, Vcc=+/-15 V	10	---	V
-Vout	Rl= 500, Vcc=+/- 5 V	3	---	V
-Vout	Rl= 150, Vcc=+/- 5 V	2.5	---	V
-Vout	Rl=1000, Vcc=+/-15 V	12	---	V
-Vout	Rl= 500, Vcc=+/-15 V	10	---	V

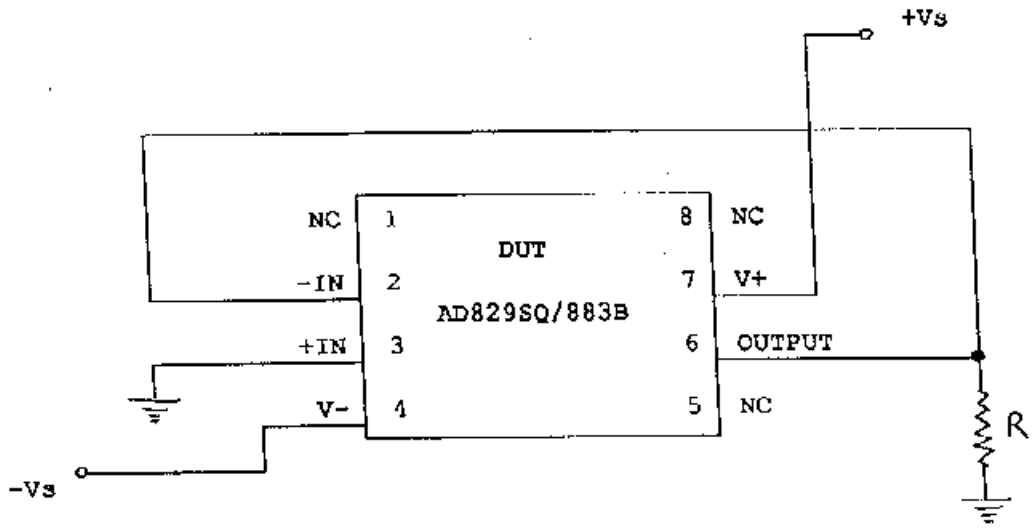
TABLE IV: Summary of Electrical Measurements After Total Dose Exposures and Annealing for AD829SQ/883B 1/, 2/

	Spec Limits @ 25°C		Total Dose Exposure (TDE) (krads)														Anneal			
			0 (Pre-Rad)		3.2		10		20		30		40		50		168 hours @ 25°C		168 hours @ 100°C	
Parameters	min	max	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
+Icc (5V) mA	0	6.5	4.95	0.06	4.95	0.06	5.00	0.08	4.95	0.06	4.95	0.06	4.98	0.10	4.88	0.10	4.95	0.06	5.10	0.08
+Icc(15V) mA	0	6.8	5.13	0.05	5.13	0.05	5.15	0.06	5.18	0.10	5.18	0.10	5.18	0.10	5.08	0.10	5.08	0.10	5.25	0.06
-Icc (5V) mA	0	6.5	4.98	0.10	4.98	0.10	5.00	0.08	4.95	0.06	4.95	0.06	4.98	0.10	4.88	0.10	4.95	0.06	5.13	0.10
-Icc(15V) mA	0	6.8	5.13	0.05	5.15	0.06	5.15	0.06	5.18	0.10	5.18	0.10	5.18	0.10	5.10	0.14	5.10	0.12	5.25	0.06
Vos (5V) uV	0	500	53.5	28.7	41.2	33.1	25.4	19.9	95.4	141.9	230.9	308.3	154.2	193.3	161.3	196.9	30.8	26.5	48.8	25.7
Vos(15V) uV	0	500	71.0	34.4	59.9	32.5	496.0	229.2	744.0	457.7	1072	687.9	795.3	628.3	780.3	659.8	257.3	304.2	57.0	23.4
Ios (5V) nA	0	500	17.3	11.0	13.9	13.1	117.5	20.5	212.0	13.4	358.0	36.0	428.8	36.1	483.5	48.6	351.5	54.6	101.3	176.7
Ios(15V) nA	0	500	10.7	10.6	18.9	15.1	191.3	64.4	339.3	66.0	529.5	114.0	566.5	110.8	627.0	123.4	409.3	56.1	18.4	13.2
Ib+ (5V) uA	0	7.0	3.13	0.15	3.30	0.14	3.80	0.14	4.73	0.21	5.30	0.25	5.90	0.24	6.30	0.24	5.75	0.17	4.18	0.15
Ib+(15V) uA	0	7.0	3.05	0.13	3.28	0.13	3.83	0.17	4.68	0.25	5.63	0.26	6.05	0.24	6.48	0.22	5.78	0.13	3.78	0.15
Ib- (5V) uA	0	7.0	3.13	0.15	3.53	0.53	3.68	0.13	4.50	0.24	5.03	0.29	5.48	0.25	5.83	0.29	5.40	0.16	4.18	0.15
Ib-(15V) uA	0	7.0	3.05	0.13	3.25	0.13	3.63	0.17	4.53	0.29	5.10	0.37	5.40	0.30	5.85	0.31	5.35	0.21	3.78	0.15
Ibias(5V) uA	0	7.0	3.13	0.15	3.30	0.14	3.78	0.13	4.63	0.21	5.20	0.24	5.60	0.25	6.08	0.25	5.58	0.21	4.18	0.15
Ibias(15V) uA	0	7.0	3.05	0.13	3.25	0.13	3.75	0.17	4.68	0.25	5.33	0.34	5.78	0.22	6.18	0.22	5.58	0.21	3.78	0.15
Av (5V) kV/V	30	-	45.8	2.1	45.0	2.2	44.7	2.6	39.8	2.1	38.5	1.9	35.5	3.7	33.8	3.9	36.8	2.6	55.0	3.7
Av(15V) kV/V	50	-	91.4	4.6	91.0	5.1	682.0	546.2	836.0	362.5	5119	0.0	141.5	41.4	102.5	31.5	84.8	19.6	101.3	8.9
CMRR (5V) dB	100	-	118.3	4.9	118.0	5.2	116.5	4.5	115.0	4.9	113.8	3.3	114.0	4.2	113.5	3.7	116.8	4.2	117.5	4.8
CMRR(15V) dB	100	-	118.5	4.0	118.0	4.3	113.0	3.2	113.0	2.2	118.3	9.9	116.8	7.1	116.0	5.9	114.5	3.0	117.5	4.2
+PSRR dB	90	-	104.0	0.8	106.5	3.4	87.8	1.7	86.5	2.1	85.0	2.9	87.3	3.9	88.0	4.7	96.3	7.0	113.8	8.5
-PSRR dB	90	-	109.3	0.5	104.5	2.6	85.5	1.3	85.0	2.4	84.3	3.3	84.8	3.4	85.0	3.6	89.8	4.0	97.8	2.6
+Vout1 V	3	-	4.1	0.0	4.1	0.0	4.1	0.0	4.1	0.0	4.0	0.0	4.0	0.0	4.0	0.0	4.0	0.0	4.0	0.0
+Vout2 V	2.5	-	3.7	0.0	3.7	0.0	3.8	0.2	3.7	0.0	3.7	0.0	3.7	0.0	3.6	0.1	3.7	0.0	3.7	0.0
+Vout3 V	12	-	13.8	0.0	13.8	0.0	13.8	0.0	13.8	0.0	13.8	0.0	13.8	0.0	13.7	0.1	13.8	0.1	13.8	0.0
+Vout4 V	10	-	13.6	0.1	13.5	0.0	13.5	0.0	13.5	0.0	13.5	0.0	13.5	0.0	13.5	0.0	13.5	0.0	13.5	0.0
-Vout1 V	3	-	3.9	0.1	3.9	0.0	3.9	0.0	3.8	0.0	3.8	0.0	3.8	0.1	3.8	0.0	3.8	0.0	3.9	0.1
-Vout2 V	2.5	-	3.6	0.1	3.6	0.0	3.6	0.2	3.5	0.1	3.5	0.0	3.5	0.0	3.5	0.0	3.5	0.0	3.5	0.0
-Vout3 V	12	-	13.7	0.0	13.7	0.0	13.7	0.0	13.7	0.1	13.6	0.0	13.6	0.0	13.6	0.0	13.7	0.0	13.7	0.0
-Vout4 V	10	-	13.4	0.0	13.5	0.1	13.4	0.0	13.2	0.1	13.2	0.0	13.2	0.0	13.2	0.0	13.3	0.1	13.3	0.0

1/ These statistics do not include the control sample which remained constant throughout testing.

2/ The statistics for the post 15 krads step are available upon request.

Figure 1. Radiation Bias Circuit for AD829SQ/883B



+Vs =+15.0 +/- 0.5 V.
-Vs =-15.0 +/- 0.5 V.
R = 1K OHM +/- 10%, 1/4 WATT
Ta = 25 Deg. C except during the final annealing step.
During the final annealing step, Ta = 100 Deg. C.