PPM-91-394

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UNISYS

Interoffice Memorandum

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Code 300.1
From
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7809
Subject
Radiation Report on ISTP
Non-Common Buy Part No. AD847SQ/883B

PPM-91-394
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July 8, 1991
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A radiation evaluation was performed on AD847SQ/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, five 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 5, 10, 20, 30, 50, 75, and 100 krads. After 100 krads, parts were annealed at 25°C for 48 and 168 hours (cumulative). The dose rate was between 0.25 - 1.25 krads/hour, depending on the total dose level (see Table II for radiation schedule). After each radiation exposure and annealing treatment, parts were electrically tested according to the test conditions and the specification limits listed in Table III.

All (5) parts passed initial electrical measurements. However, after the first radiation exposure of 5 krads, parts failed to meet the minimum specification limit of 75dB for -PSRR. One part (SN 11) failed the same specification limit for +PSRR also. However, all parts passed all other tests. After the next radiation step of 10 krads, and all of the following radiation steps, no measurements on + PSRR could be made due to the limited range of the test equipment for this parameter (see Table IV for more details). Also, two parts (SN 9 & SN 11) showed significant degradation in Vos@50. However, all parts continued to pass all other parameters on irradiation to 10 krads.

After 20 krads, all parts showed significant degradation in Vos@50 (readings were >15.2 mV against the initial average reading of 1.1mV). Additionally, two parts (SN 6 & SN 11) exceeded the maximum specification limit of 300nA on I_{OS} and three parts (SN 6, SN 8, & SN 9) failed to meet the maximum specification limit of 1 mV for VosRS. After 30 krads, parts

continued to show degradation in VosRS, Vos@50, and I_{OS}. Also, one part (SN 8) failed to meet the minimum specification limit of 80dB on CMRR. Another part (SN 10) marginally exceeded the maximum specification limit on IOS. However, all parts continued to pass all other parameters.

After 50 krads irradiation, parts continued to show the same failures as after 30 krads. After 100 krads irradiation, parts showed slight recovery in Vos@50, but were still exceeding the specification limits. Also, all parts exceeded the specification limits for I_{bias} and VosRs. Three parts failed CMRR. Also, two parts marginally exceeded the maximum specification limit on Ib+.

After 48 and 168 hours of annealing, parts recovered to pass all tests except -PSRR. Table IV provides the mean and standard deviation values for each parameter after different radiation exposures and annealing treatments. It also provides a summary of functional test results after each radiation/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.

TABLE I: Part Information

Generic Part Number:	AD847SQ/883B
ISTP Non-Common Buy Part Number:	AD847SQ/883B
ISTP Non-Common Buy Control Number:	1993
Charge Number:	C03876
Manufacturer:	Analog Devices
Quantity Procured:	42
Lot Date Code:	8964G
Quantity Tested:	6
Serial Numbers of Radiation Samples:	6, 8, 9, 10, 11
Serial Number of Control Sample:	4
Part Function:	High Speed, Low-Power Operational Amplifier
Part Technology:	Bipolar
Package Style:	8 Pin DIP

TABLE II: Radiation Schedule

EVENTS	DATE
1) Initial Electrical Measurements	03/21/91
2) 5 krads irradiation @ 250 rads/hr	03/23/91
Post 5 krads Electrical Measurements	03/24/91
3) 10 krads irradiation @ 250 rads/hr	03/24/91
Post 10 krads Electrical Measurements	03/25/91
4) 20 krads irradiation @ 500 rads/hr	03/25/91
Post 20 krads Electrical Measurements	03/26/91
5) 30 krads irradiation @ 500 rads/hr	03/26/91
Post 30 krads Electrical Measurements	03/27/91
6) 50 krads irradiation @ 1000 rads/hr	03/27/91
Post 50 krads Electrical Measurements	03/28/91
7) 75 krads irradiation @ 1250 rads/hr	03/28/91
Post 75 krads Electrical Measurements	03/29/91
8) 100 krads irradiation @ 1250 rads/hr	03/29/91
Post 100 krads Electrical Measurements	03/30/91
9) 48 hour annealing	03/30/91
Post 48 hr Electrical Measurements	04/01/91
10) 168 hour annealing	03/30/91
Post 168 hr Electrical Measurements	04/06/91

Notes:

1) All parts were radiated under bias at the cobalt-60 gamma ray facility at GSFC.

2) All electrical measurements were performed off-site at 25°C.

3) Annealing performed at 25°C under bias.

Table III: Electrical Characteristics of AD847SQ/883B 1/,2/

V_{CC} = +/- 15 V, T_A = 25°C,
R_S = 100 ohms
(unless otherwise specified)

Test	Conditions	MIN	MAX
$+I_{CC}$			6.3 mA
$-I_{CC}$			6.3 mA
$^*V_{OS}$@50	R_S = 50 Ohms	-5.0 mV	5.0 mV
I_{OS}		-300 nA	300 nA
I_b+	V_O = 0V	-5.0 µA	5.0 µA
I_b-	V_O = 0V	-5.0 µA	5.0 µA
I_{bias}	V_{IN} = 0V	-5.0 µA	5.0 µA
A_{OL}	V_O = +/-10V, R_L = 1 kohms	3.0 kV/V	
CMRR	R_S = 100 ohm, V_C = +/- 12V	80 dB	
+PSRR	V_S = 5V to 15V	75 dB	
-PSRR	V_S = -5V to -15V	75 dB	
$+V_O$	R_L = 1 kohms	12 V	
$-V_O$	R_L = 500 ohms		-12 V
|VosRs|	R_S = 100 ohms, V_{CC} = +/- 5V		1.0 mV

Notes:

1/ Table III lists the conditions and limits for tests performed in BIN#1 only, except for VOSRs which was performed in BIN#2.

2/ Additional tests were performed in Bin#2, with VCC = ±5V. The test data from Bin#1 is summarized in Table IV, and is representative of the test data from both bins. Data from Bin#2 is available and can be obtained upon request.

* V_{OS}@50 measurements are made for informational purposes only. The manufacturer does not specify V_{OS} with ±15V supplies. The test limit was determined from the ±5V and PSRR specifications.

TABLE IV: Summary of Electrical Measurements after Total Dose Exposures and Annealing for AD847SQ/883B

1/, 2/, 3/, 4/

		Spec. Limits		Initials		Total Dose Exposure (krads)												Annealing	
						5		10		20		30		50		100		168 hrs	
Parameters		min	max	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
+Icc	mA		6.3	4.9	.3	4.8	.2	4.9	.3	4.8	.05	4.7	.1	4.7	.1	4.6	.1	4.6	.03
-Icc	mA		6.3	4.9	.2	4.8	.2	4.8	.3	4.8	.04	4.7	.15	4.7	.1	4.6	.08	4.7	.04
|Vos@50|	mV		5.0	1.1	.1	2.5	1.0	6.2	10	>15.2		>15.2		>15.2		13.7	.45	3.5	.07
Ios	nA		300	12.3	13	18	9	61	50	222	85	227	73	220	30	201	30	74	23
Ib+	µA		5.0	2.4	.1	2.6	.1	2.9	.1	3.5	.1	3.9	.1	4.1	.2	5.1	.2	4.6	.2
Ib-	µA		5.0	2.4	.1	2.6	.1	3.0	.1	3.2	.2	3.7	.2	3.9	.1	4.9	.1	4.5	.05
Ibias	µA		5.0	2.5	.1	2.6	.1	3.0	.1	3.3	.1	3.8	.2	4.0	.1	5.0	.1	4.4	.07
AOL	kV/V	3.0		6.8	.5	6.4	.7	7.6	3.3	4.4	.8	3.8	.4	3.4	.2	3.1	.07	4.0	.05
CMRR	dB	80		95	.4	94	.9	94	2	90.2	2.2	*	-	*	-	*	-	88.3	3.4
+PSRR**	dB	75		89	1	<74	-	<74	-	<74	-	<74	-	<74	-	<74	-	79	3
-PSRR**	dB	75		78	.3	<74	-	<74	-	<74	-	<74	-	<74	-	<74	-	<74	-
+Vc	V	12		13.9	.02	13.9	.01	13.8	.04	13.8	.03	10.1	2	13.9	.01	13.8	.01	13.8	.01
-Vc	V	12		13.7	.02	13.6	.01	13.8	.1	13.6	.01	10.6	3.2	13.6	.01	13.6	.01	13.7	.01
|VosRs	mV		1.0	.45	.09	*		.36	.25	1.1	1.0	1.9	1.0	1.7	.1	1.45	.1	.75	.1

Notes:

1/ Due to catastrophic oscillatory failure, SN 11 was removed from the group of test samples after 20 krads.
2/ The mean and standard deviation values were calculated over the five parts irradiated in this testing (except where noted above). The control sample remained constant throughout the testing and is not included in this table.
3/ This data was calculated from the measurements from Bin #1 only (except for |VosRS| which is from Bin #2). The data from Bin#2 was very similar to Bin #1, and is available upon request.
4/ Data after 75 krads irradiation and 24 hours annealing is not included in Table IV, but is available on request.

* No reliable measurements were made for these parameters at the noted radiation steps.

** PSRR measurement range on the tester was limited to 74 dB. Therefore, no accurate data can be provided for the noted radiation steps. However, based on other measurements (VOS at 5V and 15V), PSRR is expected to between 50dB to 75dB at these radiation steps.

Figure 1: radiation Bias Circuit for AD847SQ/883