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To

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7809
Subject

Radiation Report on AD713TQ/883B
ISTP/PA GGS/POLAR/UVI Control No. 5522

PPM-92-0079
Date

March 2, 1992
Location

Lanham
Telephone

731-8954
Location

Lanham

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A radiation evaluation was performed on the AD713TQ/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, eight parts were irradiated under bias (see Figure 1 for bias configuration), and two parts were used as control samples. The total dose radiation steps were 10, 20, 30, 50, 75 and 100 krads*. After 100 krads, the parts were annealed at +25°C for 168 hours. After this annealing, the parts were irradiated to 200 and 300 krads (cumulative). The dose rate was between 160 and 5000 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 eight radiation samples and both control samples passed all of the initial parametric tests. However, after 10 krads of exposure, six parts marginally exceeded the maximum specification limit of 500 uV for Vos. Two of these six parts also marginally exceeded the specification limit of 75 pA for Ib-. After 20 krads of exposure, all eight parts exceeded the specification limits for at least one of the following parameters: Vos, Ibias, Ib+, Ib-, Ios, CMRR and -PSRR. All eight parts continued to degrade for these same parameters throughout the testing to 100 krads. After 100 krads of exposure, the parts passed the CMRR test. The parts recovered slightly after 168 hours of annealing at 25°C, however, all eight parts were still exceeding the specification limits for at least one parameter. Upon further irradiation to 200 and 300 krads, all eight parts exceeded the specification limits for Vos, Ibias, Ib+, Ib- and Ios. The Vos readings were as high as 8 mV, the Ibias parameters approached 800 pA and Ios reached 200 pA while the specification limit is 35 pA maximum. After 300 krads three parts were marginally below the minimum specification limit for the Open Loop Gain test (Aol). However, all eight parts passed the -PSRR test.

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:	AD713
ISTP/PA GGS/POLAR/UVI Part Number:	AD713TQ/883B
Control Number:	5522
Charge Number:	C23354
Manufacturer:	Analog Devices
Lot Date Code:	9024C
Quantity Tested:	8
Serial Numbers of Radiation Samples:	83, 84, 85, 86, 87, 88, 89, 90
Serial Numbers of Control Sample:	80, 81
Part Function:	Quad Operational Amplifier
Part Technology:	BiFET
Package Style:	14-pin DTP

TABLE II. Radiation Schedule for AD713TQ/883B

EVENTS	DATE
1) Initial (Pre-Irradiation) Electrical Measurements	12/24/91
2) 10 KRAD IRRADIATION (0.51 krads/hour)	12/26/91
POST 10 KRAD ELECTRICAL MEASUREMENT	12/27/91
3) 20 KRAD IRRADIATION (0.16 krads/hour)	12/27/91
POST 20 KRAD ELECTRICAL MEASUREMENT	12/30/91
3) 30 KRAD IRRADIATION (0.50 krads/hour)	12/30/91
POST 30 KRAD ELECTRICAL MEASUREMENT	12/31/91
4) 50 KRAD IRRADIATION (0.45 krads/hour)	12/31/91
POST 50 KRAD ELECTRICAL MEASUREMENT	01/02/92
5) 75 KRAD IRRADIATION (1.25 krads/hour)	01/02/92
POST 75 KRAD ELECTRICAL MEASUREMENT	01/03/92
6) 100 KRAD IRRADIATION (0.37 krads/hour)	01/03/92
POST 100 KRAD ELECTRICAL MEASUREMENT	01/06/92
7) 168 HOURS ANNEALING AT 25°C	01/06/92
POST 168 HOURS ELECTRICAL MEASUREMENT	01/13/92
8) 200 KRAD IRRADIATION (5.00 krads/hour)	01/13/92
POST 200 KRAD ELECTRICAL MEASUREMENT	01/14/92
9) 300 KRAD IRRADIATION (4.88 krads/hour)	01/14/92
POST 300 KRAD ELECTRICAL MEASUREMENT	01/15/92

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 AD713TQ/883B

PARAMETER	CONDITIONS	LIMITS	
+I _{cc}	V _s = +/-15 V	12 mA	max.
-I _{cc}	V _s = +/-15 V	12 mA	max.
V _{os}	V _s = +/-15 V	500 μ V	max.
I _{os}	V _{cm} = 0	35 pA	max.
I _{b+}	V _{cm} = 0	75 pA	max.
I _{b+}	V _{cm} = 10 V	120 pA	max.
I _{b-}	V _{cm} = 0	75 pA	max.
I _{b-}	V _{cm} = 10 V	120 pA	max.
I _{bias}	V _{cm} = 0	75 pA	max.
I _{bias}	V _{cm} = 10 V	120 pA	max.
A _{ol}	V _o = +/-10 V, R _l > 2k	200 kV/V	min.
CMRR	V _{cm} = +/-10 V	84 dB	min.
CMRR	V _{cm} = +/-11 V	78 dB	min.
+PSRR	V _s = +/-15 V	84 dB	min.
-PSRR	V _s = +/-15 V	84 dB	min.
+V _o	R _l > 2k	13 V	min.
-V _o	R _l > 2k	12.5 V	min.

TABLE IV: Summary of Electrical Measurements After Total Dose Exposures and Annealing for AD713TQ/883B 1/, 2/, 3/

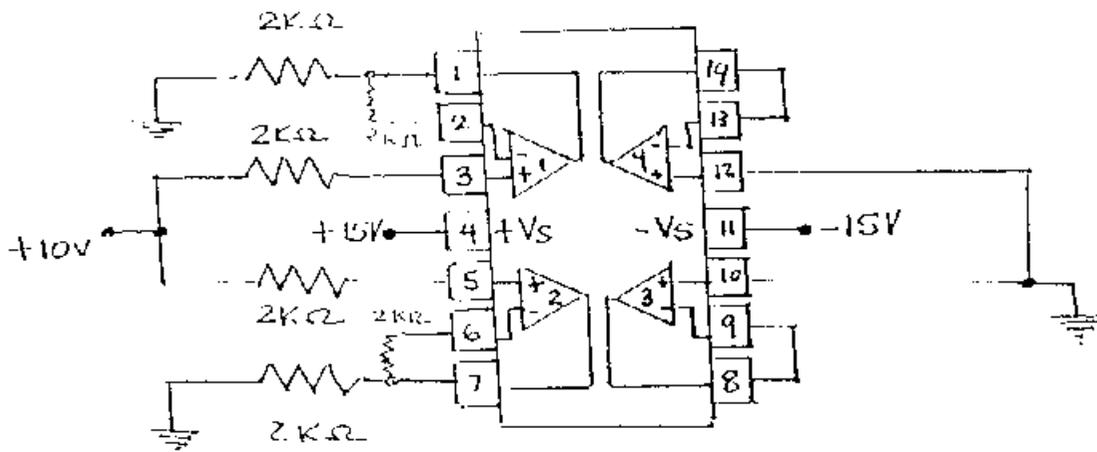
Parameters	Spec limits @ 25°C	Total Dose Exposure (TDE) (krads)												Areal		TDE (krads)			
		0		10		20		30		75		100		168 hours		200		300	
		mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
-Icc mA	C	10.33	0.23	9.83	0.21	9.56	0.21	9.38	0.25	9.06	0.25	8.99	0.20	9.10	0.18	8.9	0.31	8.89	0.30
-Icc mA	C	10.06	0.22	9.85	0.21	9.59	0.22	9.40	0.24	9.05	0.21	9.00	0.22	9.11	0.19	8.9	0.35	8.89	0.30
Vos uV	C	121.7	78.6	344.9	176.8	642.3	231.1	1159	293.9	1833	647.2	1542	531.6	2046	391.4	2337	518.4	2704	565.5
Ios pA	C	4.4	2.1	15.9	5.4	29.8	9.5	51.6	16.4	69.6	18.2	46.0	13.3	47.2	10.0	114.6	22.1	107.9	21.5
Ib+ (Vcm0) pA	C	9.1	2.6	50.0	10.5	92.8	21.6	130.7	14.0	268.9	33.2	291.3	38.4	179.0	32.4	838.4	896.1	472.1	41.5
Ib+ (Vcm10) pA	C	7.4	3.2	48.0	8.8	87.4	9.3	132.5	13.7	267.5	20.6	270.5	24.1	189.1	22.6	495.8	30.1	478.4	29.3
Ib- (Vcm0) pA	C	13.5	0.9	55.0	13.7	121.1	24.7	165.4	15.4	338.4	39.5	337.3	42.5	226.0	38.3	952.6	901.9	526.1	126.9
Ib- (Vcm10) pA	C	12.3	1.6	55.5	13.2	119.0	15.3	173.5	22.1	345.4	32.8	320.4	29.7	241.6	28.0	615.4	44.6	599.4	49.0
Ib-as(0 V) pA	C	11.3	1.7	50.5	21.4	107.1	23.1	147.9	13.3	303.5	35.3	314.3	40.2	202.4	35.4	893.5	598.7	533.0	62.3
Ib-as(10V) pA	C	9.8	2.4	56.8	11.0	103.0	11.7	152.8	16.9	306.4	25.4	295.5	25.9	215.5	24.8	555.5	36.1	538.8	38.3
Ao- KV/V	200	513.9	46.5	498.0	33.9	467.4	38.9	439.0	32.9	332.9	32.3	293.1	26.2	320.9	24.0	212.9	22.6	255.4	141.0
CMRR (10V) dB	84	101.8	10.3	91.3	3.6	85.8	1.9	80.8	1.0	85.0	3.4	88.9	3.8	86.4	3.1	94.0	2.9	96.1	2.7
CMRR (11V) dB	78	101.5	10.4	91.6	3.9	86.1	2.1	81.0	1.2	84.4	3.5	88.9	3.6	85.8	2.6	93.6	3.0	96.0	2.8
+PSRR dB	84	131.1	6.7	129.4	7.3	127.5	5.0	129.1	7.4	128.1	6.1	129.0	7.0	128.0	5.4	126.9	5.7	126.9	5.6
-PSRR dB	84	95.1	10.5	95.1	8.8	94.0	10.2	84.4	3.2	84.1	6.6	96.1	8.3	86.8	6.1	96.5	5.3	97.9	5.7
+Vo V	13	19.7	0.0	13.8	0.1	13.8	0.1	13.8	0.0	13.7	0.0	13.7	0.1	13.8	0.1	13.8	0.0	13.8	0.0
-Vo V	12.5	13.3	0.0	13.3	0.1	13.3	0.0	13.3	0.0	13.3	0.0	13.3	0.0	13.3	0.0	13.3	0.0	13.3	0.0

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

2/ The statistics for the post 50 krads step are available upon request.

3/ The above statistics were calculated using the data for one sector of each Quad Cp-Arp that was used in this evaluation. The data on the other sections were similar and can be obtained upon request.

Figure 1. Radiation Bias Circuit for AD713TQ/883B



NOTE : ALL R = 2KΩ ± 5% 1/4 W .
 OUTPUT 1 & 2 = 10V
 OUTPUT 3 & 4 = 0V