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Memorandum

DATE: May 19, 1992 PPM-92-160
TO: J. Lohr/311
FROM: K. Sahu/7809
SUBJECT: Radiation Report on GGS/WIND/3D PLASMA Project
Part No. AD711TQ/883B (control no.6295)

cc: L. Rabb/406
A. Sharma/311
✓Library/300.1

A radiation evaluation was performed on the AD711TQ Op Amp 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, one part* was 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, 15 and 20 krads (the term rad as used here means rad(Si)). After 20 krads, parts were annealed at +25°C for 168 hours. The dose rate was between 0.05 and 0.11 krads/hour, depending on the total dose level (see Table II for radiation schedule). After each radiation exposure and annealing treatment, the part was electrically tested at +25°C according to the test conditions and the specification limits listed in Table III.

The part passed all tests on irradiation up to 5 krads. After the 10-krad irradiation, the part marginally ($\leq 5\%$) exceeded the specification limits for $I_{b+}(0V)$, $I_{b-}(0V)$ and $I_{bias}(0V)$ and exceeded the specification limits for V_{os} by 30%. Upon continued irradiation to 15 krads, the part continued to drift outside of these limits. After 20 krads, the part exceeded the limits for $I_{b+}(0V)$, $I_{b-}(0V)$ and $I_{bias}(0V)$ by 100% and the limits for V_{os} by over 200%.

After annealing for 168 hours at +25°C, some recovery was observed in $I_{b+}(0V)$, $I_{b-}(0V)$ and $I_{bias}(0V)$, but the part still remained outside the specification limits. No recovery was observed in V_{os} .

Table IV gives the mean and standard deviation values for each parameter after different irradiation exposures and annealing steps.

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

*No more parts were available from the requestor.

TABLE I. Part Information

Generic Part Number:	AD711TQ
GGs/WIND/3D PLASMA Part Number:	AD711TQ/883B
Control Number:	6295
Charge Number:	C23764
Manufacturer:	Analog Devices
Lot Date Code:	9011A
Quantity Tested:	2
Serial Number of Radiation Sample:	58
Serial Number of Control Sample:	57
Part Function:	Op Amp
Part Technology:	BiFET
Package Style:	8-pin DIP
Test Engineer:	A. Phung

TABLE II. Radiation Schedule for AD711TQ

EVENTS	DATE
1) INITIAL (PRE-IRRADIATION) ELECTRICAL MEASUREMENT	04/17/92
2) 5- KRAD IRRADIATION (0.11 krads/hour) POST-5-KRAD ELECTRICAL MEASUREMENT	04/21/92 04/23/92
3) 10-KRAD IRRADIATION (0.05 krads/hour) POST-10-KRAD ELECTRICAL MEASUREMENT	04/23/92 04/28/92
4) 15-KRAD IRRADIATION (0.11 krads/hour) POST-15-KRAD ELECTRICAL MEASUREMENT	04/28/92 04/30/92
5) 20-KRAD IRRADIATION (0.05 KRAD/HOUR) POST-20-KRAD ELECTRICAL MEASUREMENT	04/30/92 05/04/92
6) 168 HOURS ANNEALING AT +25°C POST-168-HOUR ELECTRICAL MEASUREMENTS	05/04/92 05/11/92

ALL ELECTRICAL MEASUREMENTS WERE PERFORMED AT +25°C.

PART WAS IRRADIATED AND ANNEALED UNDER BIAS; SEE FIGURE 1.

Table III. Electrical Characteristics of AD711TQ

Unless Otherwise Specified: $T_A = 25^\circ\text{C}$, $V_{CC}=15\text{V}$, $-V_{CC}=-15\text{V}$

TEST	CONDITIONS	LIMIT		UNITS
		Min	Max	
+I _{CC}	V _o = 0V		3	mA
-I _{CC}	V _o = 0V		3	mA
V _{OS50}	R _s = 500ohm	-.5	.5	mV
V _{OS}	R _g = 1000ohm	-.5	.5	mV
I _{OS}		-25	25	pA
I _{b+}	V _{CM} = 0V	-50	50	pA
I _{b-}	V _{CM} = 0V	-50	50	pA
I _{bias}	V _{CM} = 0V	-50	50	pA
I _{b+}	V _{CM} = 10V /1	-100	100	pA
I _{b-}	V _{CM} = 10V /1	-100	100	pA
I _{bias}	V _{CM} = 10V /1	-100	100	pA
A _{OL}	V _o = +/- 10V, R _L =2K Ohm	200		V/mV
CMRR	V _{CM} =+/- 10V	80		dB
CMRR	V _{CM} =+/- 11V	76		dB
+PSRR	+V _{CC} =(15,5)V; -V _{CC} =-15V	80		dB
-PSRR	+V _{CC} =15V; -V _{CC} =(15,5)V	80		dB
+V _o	R _L =2K Ohm	13		V
-V _o	R _L =2K Ohm		-12.5	V

Notes:

1. V_{CM} = 10V is obtained by setting +V_{CC} = 5V and -V_{CC}=-25V.
2. Common Mode Voltage Range Performed GoNoGo in the CMRR test.

TABLE IV: Summary of Electrical Measurements After Total Dose Exposures and Annealing Steps for AD7111TO 1/, 2/

Parameters		Spec. Limits		Total Dose Exposure (krads)					Annealing hours @25°C
		min	max	0 (Pre- Rad)	5	10	15	20	
+Icc	mA	-	3	2.65	2.62	2.58	2.55	2.52	2.52
-Icc	mA	-	3	-2.65	-2.62	-2.58	-2.56	-2.52	-2.52
Vos@50	uV	-500	500	-151	-411	-668.2	-894	-1275	-1279
Vos	uV	-500	500	-151	-411	-668.2	-894	-1275	-1279
Ios	pA	-25	25	-0.943	-1.45	-1.94	-3.43	-5.00	-4.19
Ib+	(0V) pA	-50	50	9.91	26.15	52.36	66.15	101	67.33
Ib-	(0V) pA	-50	50	10.85	27.59	54.29	69.57	105.9	71.51
Ibias	(0V) pA	-50	50	10.38	26.87	53.32	67.86	103.4	69.42
Ib+	(10V) pA	-100	100	14.77	37.18	69.91	87.78	123.9	86.70
Ib-	(10V) pA	-100	100	12.54	38.67	71.83	91.25	128.8	90.80
Ibias	(10V) pA	-100	100	12.24	37.92	70.87	89.51	126.3	88.75
Aol	KV/V	200	-	541.4	592.4	590.3	567.6	548.6	581.9
CMRR(10V)	dB	80	-	93.88	115.1	98.74	92.62	87.30	87.30
CMRR(11V)	dB	76	-	91.96	104.3	104.4	95.50	89.30	89.38
+PSRR	dB	80	-	144.2	OVER	142.7	142.7	138.2	136.6
-PSRR	dB	80	-	89.14	95.88	OVER	95.82	86.82	86.68
+Vo	V	13	-	13.88	13.90	13.89	13.89	13.92	13.91
-Vo	V	-	-12.5	-13.40	-13.40	-13.40	-13.40	-13.40	-13.37

Notes:

1/ Values in this table are based on a single radiation sample.

2/ The control sample remained constant throughout the testing and is not included in this table.

Figure 1. Radiation Bias Circuit for AD711TQ

