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Memorandum

PPM-93-047

DATE: Mar. 26, 1993
TO: J. Lohr/311.1
FROM: K. Sahu/300.1 *KS*
SUBJECT: Radiation Report on ISTP/WAVES
Part No. M38510/19008BEA (HI-509)
Control No. 2111A

cc: A. Sharma/311
Library/300.1 ✓

A radiation evaluation was performed on HI-509 (4-channel Differential Multiplexer) 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 2.5, 5, 10, 15, 20 and 30 krads*. The dose rate was between 0.04 and 0.26 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 at 25°C according to the test conditions and the specification limits** listed in Table III. These tests included one functional test at 10 kHz.

All ten parts passed initial (pre-rad) electrical tests and all eight irradiated parts passed all electrical tests throughout all subsequent irradiation and annealing steps. No significant sensitivity to radiation was observed in any test parameter.

After the 30-krad irradiation, the parts were annealed at 100°C for 168 hours to observe rebound effects. No rebound effects were observed.

Table IV provides a summary of the mean and standard deviation values for each parameter after different irradiation exposures and annealing steps.

*The term rads, as used in this document, means rads(silicon).

**These are manufacturers' non-irradiated data sheet specification limits. No post-irradiation limits were provided by the manufacturer at the time these tests were performed.

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

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TABLE I. Part Information

Generic Part Number:	HI-509
Part Number:	M38510/19008BEA*
ISTP/WAVES Control Number:	2111A
Charge Number:	C33262
Manufacturer:	Harris
Lot Date Code:	9132B
Quantity Tested:	10
Serial Numbers of Radiation Samples:	62, 63, 64, 65, 66, 67, 68, 69
Serial Numbers of Control Samples:	60, 61
Part Function:	4-channel Differential Multiplexer
Part Technology:	CMOS
Package Style:	16-lead DIP package
Test Equipment:	3260
Test Engineer:	T. Mondy

* No radiation tolerance/hardness was guaranteed by the manufacturer for this part.

TABLE II. Radiation Schedule for HI-509

EVENT	DATE
1) INITIAL ELECTRICAL MEASUREMENTS	02/23/93
2) 2.5 KRAD IRRADIATION (0.04 KRADS/HOUR) POST-2.5 KRAD ELECTRICAL MEASUREMENT	02/26/93 03/01/93
3) 5 KRAD IRRADIATION (0.15 KRADS/HOUR) POST-5 KRAD ELECTRICAL MEASUREMENTS	03/01/93 03/03/93
4) 10 KRAD IRRADIATION (0.26 KRADS/HOUR) POST-10 KRAD ELECTRICAL MEASUREMENTS	03/02/93 03/03/93
5) 15 KRAD IRRADIATION (0.26 KRADS/HOUR) POST-15 KRAD ELECTRICAL MEASUREMENTS	03/03/93 02/04/93
6) 20 KRAD IRRADIATION (0.25 KRADS/HOUR) POST-20 KRAD ELECTRICAL MEASUREMENTS	03/04/93 03/05/93
7) 168-HOUR ANNEALING @25°C POST-168 HOUR ANNEAL ELECTRICAL MEASUREMENTS	03/05/93 03/12/93
8) 30 KRAD IRRADIATION (0.15 KRADS/HOUR) POST-30 KRAD ELECTRICAL MEASUREMENTS	03/12/93 03/15/93
9) 168-HOUR ANNEALING @100°C POST-168 HOUR ANNEAL ELECTRICAL MEASUREMENTS	03/15/93 03/22/93

ALL ELECTRICAL MEASUREMENTS WERE PERFORMED AT 25°C.

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

Table III. Electrical Characteristics of HI-509

Test	Units	Specification Limits		Conditions
		Min	Max	
FUNC	P/F			Vcc = ± 15 DC, f = 10 kHz
IIH	uA	-.1	1	Vil = 0, Vih = 4.5 V
IIL	uA	-.1	1	Vih = 5.0 V, Vil = 0.8 V
Isoff1	nA	-10	10	Ven = 0.8 V, VinA = 10 V
Idoff1	nA	-10	10	Ven = 0.8 V, VoutA = -10V
IdonA1	nA	-10	10	Ven = 4 V, VoutA = VinA = 10 V
ICCP	mA	0	12	Vaddr = 0 V, Ven = 5.0 V
ICCSN	mA	0	3.5	Vaddr = 0 V, Ven = 0 V
ICCN	mA	-12	0	Vaddr = 0 V, Ven = 5.0 V
ICCSN	mA	-3.5	0.	Vaddr = 0 V, Ven = 0 V
Ron1A	ohms	0	400	Ven=4.5V, VinA=10V, IoutA=1mA
Ron2A	ohms	0	400	Ven=4.5V, VinA=-10V, IoutA=-1mA
Ron3A	ohms	0	1000	Ven=4.5V, VinA=7.5V, IoutA=1mA
Ron4A	ohms	0	1000	Ven=4.5V, VinA=-7.5V, IoutA=-1mA

TABLE IV: Summary of Electrical Measurements After Total Dose Exposures and Annealing Steps for HI-509 1/

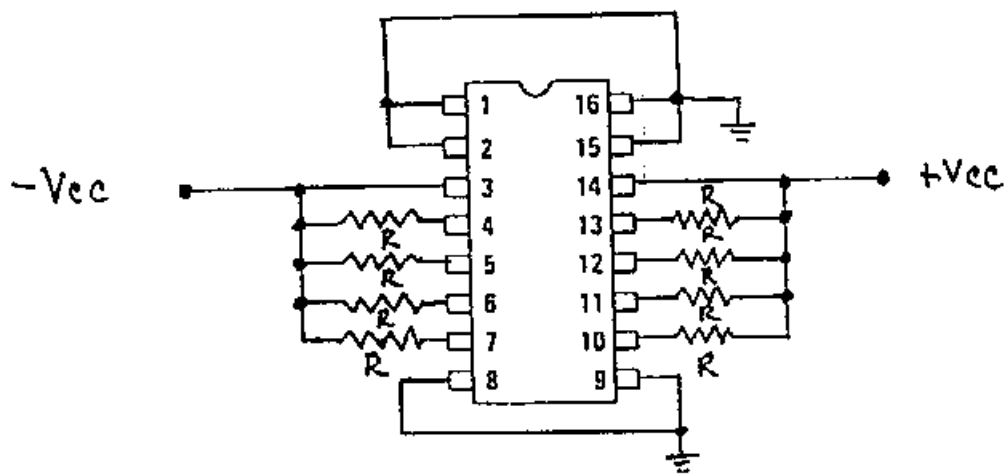
Parameters	10kHz	Spec. Lim./2 min max	PASS/FAIL	Total Dose Exposure (TDE) (krads)												Anneal		TDE		Anneal	
				0		2.5		5		10		15		20		168 hrs @25°C		30 krads		168 hrs @100°C	
				mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
FUNC				PASS		PASS		PASS		PASS		PASS		PASS		PASS		PASS		PASS	
IIH	uA	-0.1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IIL	uA	-0.1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Isoff1	nA	-10	10	-.07	1.8	-.13	1.7	-.14	1.5	-.15	1.7	-.18	1.6	-.16	1.7	-.46	3.1	-.12	2.0	-.11	1.8
Idoff1	rA	-15	10	-.43	2.4	-.22	2.1	-.40	1.8	-.33	2.2	-.02	2.4	-.20	2.2	-.46	3.6	-.91	2.6	-.13	2.2
IdonA1	nA	-10	10	-.32	2.8	-.25	2.6	-.06	2.3	-.22	2.6	-.20	2.7	-.13	2.6	-.08	4.0	-.02	2.7	-.13	2.5
ICCP	mA	0	12	1.35	.06	1.31	.06	1.29	.06	1.26	.06	1.23	.06	1.20	.06	1.22	.06	1.16	.05	1.22	.06
ICCSF	mA	0	3.5	1.36	.06	1.32	.06	1.30	.06	1.27	.06	1.25	.06	1.22	.06	1.24	.06	1.19	.05	1.25	.06
ICCN	mA	-12	0	-.53	.04	-.52	.04	-.51	.04	-.50	.04	-.50	.04	-.49	.04	-.50	.04	-.48	.04	-.53	.04
ICCSN	mA	-3.5	0	-.54	.04	-.53	.04	-.52	.04	-.52	.04	-.51	.04	-.51	.04	-.52	.04	-.51	.04	-.54	.04
Ron1A	ohms	0	400	195	2.9	196	3.6	193	3.3	193	3.1	193	3.4	197	3.8	198	3.8	204	4.1	204	5.6
Ron2A	ohms	0	400	152	2.5	155	3.3	155	3.1	156	2.9	158	3.2	162	3.8	162	4.1	160	4.6	165	4.9
Ron3A	ohms	0	1000	320	5.2	317	6.4	308	6.9	307	6.2	313	9.9	321	9.8	321	8.8	342	16	330	19
Ron4A	ohms	0	1000	213	4.2	215	5.1	214	5.3	215	4.9	216	5.1	223	7.8	223	7.3	236	15	236	15

Notes:

1/ The mean and standard deviation values were calculated over the eight parts irradiated in this testing. The control samples remained constant throughout the testing and are not included in this table.

2/ These are manufacturers' non-irradiated data sheet specification limits. No post-irradiation limits were provided by the manufacturer at the time the tests were performed.

Figure 1. Radiation Bias Circuit for HI-509



$T_a = 25^\circ\text{C}$

$+V_{cc} = 15.0 \text{ VDC} \pm 0.5 \text{ VDC}$

$-V_{cc} = -15.0 \text{ VDC} \pm 0.5 \text{ VDC}$

$R = 3.3 \text{ Kohms}, 1/4\text{W}$