

Unisys

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SUBJECT: Radiation Report on **HI506 (Harris Semiconductor) (LDC 9745)**
PROJECT: IRAC

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A radiation evaluation was performed on **HI506 (M38510/19001BXA) Single 16 Channel Multiplexer (Harris Semiconductor)** to determine the total dose tolerance of these parts. The total dose testing was performed using a Co⁶⁰ 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 levels were 2.5, 5.0, 10.0, 15.0, 20.0, 30.0, and 50.0kRads.¹ The dose rate was 0.130kRads/hour (0.04 Rads/s). See Table II for the radiation schedule and effective dose rate calculation. After the 50.0kRad irradiation, the parts were annealed under bias at 25°C and tested after and 168 hours.² After each radiation exposure and annealing treatment, parts were electrically tested according to the test conditions and the specification limits³ listed in Table III.

An executive summary of the test results is provided below in bold, followed by a detailed summary of the test results after each radiation level and annealing step. For detailed information, refer to Tables I through IV and Figure 1.

All parts passed all tests up to 50kRads with no significant degradation observed in any parameter.

Initial electrical measurements were made on 10 samples. Eight samples (SN's 41, 42, 43, 44, 45, 46, 47, and 48) were used as radiation samples while SN's 49 and 50 were used as control samples. All parts passed all tests during initial electrical measurements.

All parts passed all tests up to 50.0 kRads.

After annealing the parts for 168 hours at 25°C, the parts showed no significant change in any parameter.

Table IV provides a summary of the test results with the mean and standard deviation values for each parameter after each irradiation exposure and annealing step.

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

¹ The term Rads, as used in this document, means Rads (silicon). All radiation levels cited are cumulative.

² The temperature 25°C as used in this document implies room temperature.

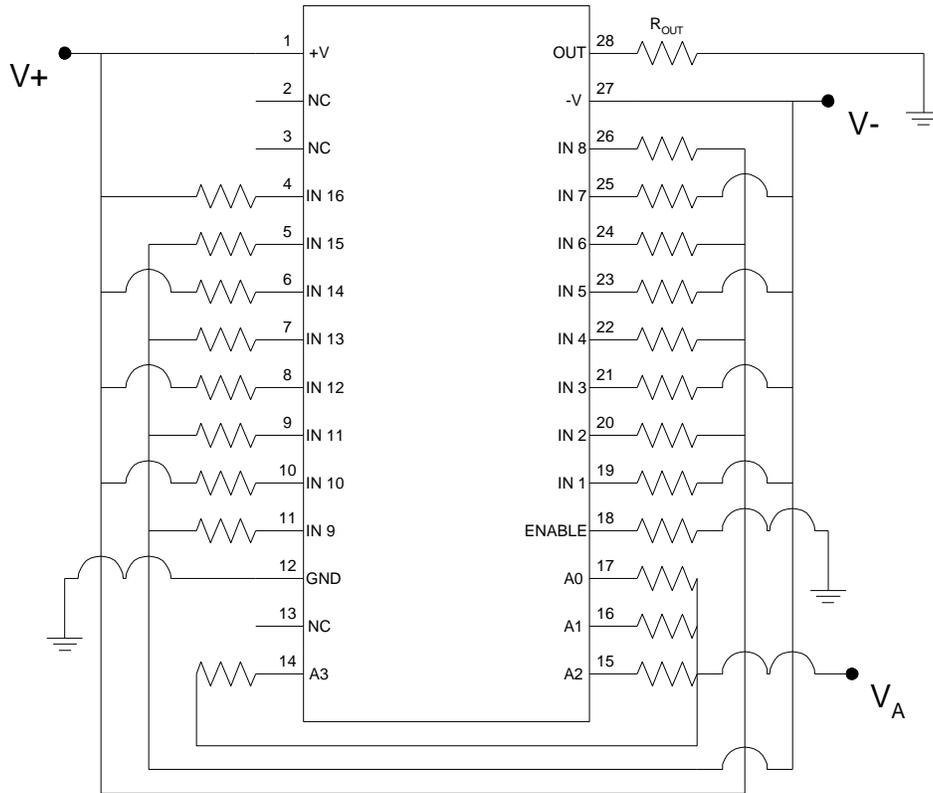
³ These are manufacturer's pre-irradiation data specification limits. The manufacturer provided no post-irradiation limits at the time these tests were performed.

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Figure 1. Radiation Bias Circuit for HI506



Notes:

1. $V+ = 15V \pm 0.5V$, $V- = -15V \pm 0.5V$. $V_A = 5V \pm 0.5V$.
2. $R_{OUT} = 10k\Omega \pm 10\%$, $\frac{1}{4}W$.
3. All other $R = 2k\Omega \pm 10\%$, $\frac{1}{4}W$.

TABLE I. Part Information

Generic Part Number:	HI506
IRAC Part Number:	M38510/19001BXA
Charge Number:	M88504
Manufacturer:	Harris Semiconductor
Lot Date Code (LDC):	9754
Quantity Tested:	10
Serial Number of Control Samples:	49, 50
Serial Numbers of Radiation Samples:	41, 42, 43, 44, 45, 46, 47, and 48
Part Function:	Single 16 Channel CMOS Analog Multiplexer
Part Technology:	CMOS
Package Style:	28 Pin Dip
Test Equipment:	A540
Test Engineer:	A. Duvalsaint

- The manufacturer for this part guaranteed no radiation tolerance/hardness.

TABLE II. Radiation Schedule for HI506

EVENT.....	DATE
1) INITIAL ELECTRICAL MEASUREMENTS	09/09/98
2) 2.5 KRAD IRRADIATION (0.294 KRADS/HOUR)	09/09/98
POST-2.5 KRAD ELECTRICAL MEASUREMENT	09/11/98
3) 5.0 KRAD IRRADIATION (0.294 KRADS/HOUR)	09/11/98
POST-5.0 KRAD ELECTRICAL MEASUREMENT	09/14/98
4) 10.0 KRAD IRRADIATION (0.294 KRADS/HOUR)	09/14/98
POST-10.0 KRAD ELECTRICAL MEASUREMENT	09/16/98
5) 15.0 KRAD IRRADIATION (0.294 KRADS/HOUR)	09/16/98
POST-15.0 KRAD ELECTRICAL MEASUREMENT	09/18/98
6) 20.0 KRAD IRRADIATION (0.588 KRADS/HOUR)	09/18/98
POST-20.0 KRAD ELECTRICAL MEASUREMENT	09/21/98
7) 30.0 KRAD IRRADIATION (0.294 KRADS/HOUR)	09/21/98
POST-30.0 KRAD ELECTRICAL MEASUREMENT	09/23/98
8) 50.0 KRAD IRRADIATION (1.176 KRADS/HOUR)	09/23/98
POST-50.0 KRAD ELECTRICAL MEASUREMENT	09/25/98
9) 168 HOUR ANNEALING @25°C	09/25/98
POST-168 HOUR ANNEAL ELECTRICAL MEASUREMENT	10/02/98

Effective Dose Rate = 50,000 RADS/16 DAYS=130.2 RADS/HOUR=0.04 RADS/SEC

The effective dose rate is lower than that of the individual radiation steps as it takes into account the time needed to test the parts.

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

Table III. Electrical Characteristics of HI506 /1

Test #	Parameter	Units	Test Conditions /2	Spec. Lim.	
				min	max
1	enable	V	$V_{OH} = 2V, I_{IN} = 100mA$, (Continuity Check)	-1.3	-0.3
2	addr_0	V	$V_{OH} = 2V, I_{IN} = 100mA$, (Continuity Check)	-1.3	-0.3
3	addr_1	V	$V_{OH} = 2V, I_{IN} = 100mA$, (Continuity Check)	-1.3	-0.3
4	addr_2	V	$V_{OH} = 2V, I_{IN} = 100mA$, (Continuity Check)	-1.3	-0.3
5	addr_3	V	$V_{OH} = 2V, I_{IN} = 100mA$, (Continuity Check)	-1.3	-0.3
6	Functional Test	P/F	Part checked against truth table in MIL-SPEC		
23	IDD_vinl	mA	$V_A = 0V, V_{EN} = 5V$	0	14.0
24	IDD_vinh	mA	$V_A = 0V, V_{EN} = 5V$	0	14.0
25	ISS_vinl	mA	$V_A = 0V, V_{EN} = 5V$	-14.0	0
26	ISS_vinh	mA	$V_A = 0V, V_{EN} = 5V$	-14.0	0
27	EN_iih	mA	Measure sequentially, connect all unused address inputs to GND	-0.10	1.00
28-31	A_iih	mA	Measure sequentially, connect all unused address inputs to GND	-0.10	1.00
32	EN_iil	mA	Measure sequentially, connect all unused address inputs to 5V	-1.00	0.10
33-36	A_iil	mA	Measure sequentially, connect all unused address inputs to 5V	-1.00	0.10
37-52	S_ioff_p	nA	$V_S = +10V, V_{EN} = 0.8V$, All unused sources = -10V	-10	10
53-68	S_ioff_n	nA	$V_S = -10V, V_{EN} = 0.8V$, All unused sources = +10V	-10	10
69	IDoff_vih	nA	$V_D = +10V, V_{EN} = 0.8V$, All unused sources = -10V	-20	20
70	IDoff_vil	nA	$V_D = -10V, V_{EN} = 0.8V$, All unused sources = +10V	-20	20
71-86	R1-R16	W	$V_S = +10V, I_O = 1mA$		600
87	IDon_vih	nA	$V_S = +10V, V_D = +10V$, All unused sources = -10V	-20	20
88	IDon_vil	nA	$V_S = +10V, V_D = -10V$, All unused sources = +10V	-20	20

Notes:

1/ These are the manufacturer's non-irradiated data sheet specification limits. The manufacturer provided no post-irradiation limits at the time the tests were performed.

2/ Supplies = +15V, -15V; V_{AH} (Logic Level High) = +2.4V; V_{AL} (Logic Level Low) = +0.8V unless otherwise specified.

TABLE IV: Summary of Electrical Measurements after Total Dose Exposures and Annealing for HI506 /1

Test #	Parameters	Units	Spec. Lim. /2		Total Dose Exposure (kRads Si)																Annealing	
					Initial		2.5		5.0		10.0		15.0		20.0		30.0		50.0		168 hours @25°C	
					mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
1	enable	V	-1.3	-0.3	-0.8	0	-0.8	0	-0.8	0	-0.7	0	-0.7	0	-0.7	0	-0.7	0	-0.7	0	-0.7	0
2	addr_0	V	-1.3	-0.3	-0.8	0	-0.8	0	-0.8	0	-0.7	0	-0.7	0	-0.7	0	-0.7	0	-0.7	0	-0.7	0
3	addr_1	V	-1.3	-0.3	-0.8	0	-0.8	0	-0.8	0	-0.7	0	-0.7	0	-0.7	0	-0.7	0	-0.7	0	-0.7	0
4	addr_2	V	-1.3	-0.3	-0.8	0	-0.8	0	-0.8	0	-0.8	0	-0.8	0	-0.7	0	-0.7	0	-0.7	0	-0.7	0
5	addr_3	V	-1.3	-0.3	-0.8	0	-0.8	0	-0.8	0	-0.8	0	-0.8	0	-0.7	0	-0.7	0	-0.7	0	-0.7	0
6	Functional Test /3				P		P		P		P		P		P		P		P		P	
23	IDD_vinl	mA	0	14.0	1.5	0	1.4	0	1.4	0	1.4	0	1.3	0	1.3	0	1.3	0	1.2	0	1.3	0
24	IDD_vinh	mA	0	14.0	1.2	0	1.1	0	1.1	0	1.1	0	1.0	0	1.0	0	1.0	0	0.9	0	0.9	0
25	ISS_vinl	mA	-14.0	0	-0.8	0	-0.7	0	-0.7	0	-0.7	0	-0.7	0	-0.7	0	-1.2	0.3	-0.8	0.1	-0.9	0.1
26	ISS_vinH	mA	-14.0	0	-0.5	0	-0.4	0	-0.4	0	-0.4	0	-0.4	0	-0.4	0	-0.3	0	-0.3	0	-0.3	0
27	EN_vinh	?A	-0.10	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28-31	A_iih	?A	-0.10	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	EN_iil	?A	-1.00	0.10	-0.1	0	-0.1	0	-0.1	0	-0.1	0	-0.1	0	-0.1	0	-0.1	0	-0.1	0	-0.1	0
33-36	A_iil	?A	-1.00	0.10	-0.1	0	-0.1	0	-0.1	0	-0.1	0	-0.1	0	-0.1	0	-0.1	0	-0.1	0	-0.1	0
37-52	S_ioff_p	nA	-10	10	3.7	0.1	3.7	0.1	3.8	0.1	3.9	0.1	3.9	0.1	3.9	0.1	3.9	0.1	3.9	0.1	3.7	0.1
53-68	S_ioff_n	nA	-10	10	2.5	0.1	2.5	0.1	2.7	0.1	2.6	0.1	2.6	0.1	2.6	0.1	2.6	0.1	2.6	0.1	2.6	0.1
69	IDoff_vih	nA	-20	20	0.6	0.1	0.8	0.1	0.8	0.1	0.8	0.1	0.9	0	1.0	0	1.0	0.1	1.4	0.1	0.9	0.1
70	IDoff_vil	nA	-20	20	3.0	0.1	3.0	0.1	3.0	0.1	3.0	0.1	3.0	0	3.0	0	3.0	0.1	3.2	0.1	3.0	0
71-86	R1-R16	?		600	148	4	150	4	149	3	151	3	155	2	160	2	168	2	190	3	187	3
87	IDon_vih	nA	-20	20	0.9	0	1.1	0.1	1.1	0.1	1.2	0.1	1.3	0.1	1.4	0	1.3	0	1.7	0.1	1.3	0
88	IDon_vil	nA	-20	20	2.8	0.1	2.8	0.1	2.9	0.1	3.0	0.1	3.0	0	3.2	0.1	3.3	0.1	3.3	0.1	3.2	0.1

Notes:

- 1/ The mean and standard deviation values were calculated over the eight parts irradiated in this testing. The control samples remained constant throughout testing and are not included in this table.
- 2/ These are manufacturer's pre-irradiation data sheet specification limits. No post-irradiation limits were provided by the manufacturer at the time the tests were performed.
- 3/ For this test, P implies that all devices passed this functional test.

Radiation sensitive parameters: None.