

UNISYS

DATE: January 26, 1995 PPM-95-123

TO: B. Fafaul/311

FROM: K. Sahu/300.1 *KS*

SUBJECT: Radiation Report on HST/BASE
Part No. MD82C59A
Control No. 10619

cc: A. Sharma/311.0
R. Williams/300.1
OFA Library/300.1

A radiation evaluation was performed on MD82C59A (Priority Interrupt Controller) 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 ^{60}Co 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, 7.5, 10, 15, 20 and 30 krads*. The dose rate was between 0.04 and 0.59 krads/hour, depending on the total dose level (see Table II for radiation schedule). After the 30 krad irradiation, parts were annealed at 25°C for 168 hours, after which the parts were annealed at 100°C for 168 hours. After each radiation exposure and annealing treatment, parts were electrically tested according to the test conditions and the specification limits** listed in Table III. These tests included four functional tests, two at 1.0MHz and two at 1.36MHz.

All parts passed initial electrical measurements. All irradiated parts passed all electrical and functional tests up to and including the 30 krad level.

After annealing for 168 hours at 25°C, all parts passed all electrical and functional tests.

After annealing for 168 hours at 100°C, no rebound effects were observed in the parts.

Table IV provides a summary of 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.

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

**These are manufacturer's pre-irradiation data specification limits. No post-irradiation limits were provided by the manufacturer at the time these tests were performed.

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TABLE I. Part Information

Generic Part Number:	MD82C59A
HST/BASE Part Number:	5962-8501602YA
HST/BASE Control Number:	10619
Charge Number:	EI56075
Manufacturer:	Harris Corp
Lot Date Code:	9431
Quantity Tested:	10
Serial Number of Control Samples:	41, 42
Serial Numbers of Radiation Samples:	43, 44, 45, 46, 47, 48, 49, 50
Part Function:	Priority Interrupt Controller
Part Technology:	CMOS
Package Style:	28-pin DIP
Test Equipment:	S-50
Test Engineer:	T. Scharer

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

TABLE II. Radiation Schedule for MD82C59A

EVENTS	DATE
1) INITIAL ELECTRICAL MEASUREMENTS	12/13/94
2) 2.5 KRAD IRRADIATION (0.04 KRADS/HOUR)	12/16/94
POST-2.5 KRAD ELECTRICAL MEASUREMENT	12/19/94
3) 5 KRAD IRRADIATION (0.15 KRADS/HOUR)	12/19/94
POST-5 KRAD ELECTRICAL MEASUREMENT	12/20/94
4) 7.5 KRAD IRRADIATION (0.15 KRADS/HOUR)	12/20/94
POST-7.5 KRAD ELECTRICAL MEASUREMENT	12/21/94
5) 10 KRAD IRRADIATION (0.15 KRADS/HOUR)	12/21/94
POST-10 KRAD ELECTRICAL MEASUREMENT	12/22/94
6) 15 KRAD IRRADIATION (0.31 KRADS/HOUR)	12/22/94
POST-15 KRAD ELECTRICAL MEASUREMENT	12/23/94
7) 20 KRAD IRRADIATION (0.06 KRADS/HOUR)	12/23/94
POST-20 KRAD ELECTRICAL MEASUREMENT	12/27/94
8) 30 KRAD IRRADIATION (0.59 KRADS/HOUR)	12/27/94
POST-30 KRAD ELECTRICAL MEASUREMENT	12/28/94
9) 168-HOUR ANNEALING @25°C	12/29/94
POST-168 HOUR ANNEAL ELECTRICAL MEASUREMENT	01/10/95
(The test equipment was down until 01/10/95)	
10) 168-HOUR ANNEALING @100°C*	01/10/95
POST-168 HOUR ANNEAL ELECTRICAL MEASUREMENT	01/17/94

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

*High temperature annealing is performed to accelerate long term time dependent effects (TDE), namely, the "rebound" effect due to the growth of interface states after the radiation exposure. For more information on the need to perform this test, refer to MIL-STD-883D, Method 1019, Para. 3.10.1.

Table III. Electrical Characteristics of MD82C59A

PARAMETER	VCC	VIL	VIH	CONDITIONS	PINS	LIMITS AT +25C	-55C	+125C
FUNCT 1	4.5V	0.4V	2.6V	FREQ = 1.35MHZ	ALL I/O	VOL < 1.5V	VOL < 1.5V	VOH > 1.5V
FUNCT 2	4.5V	0.4V	2.6V	FREQ = 1.00MHZ	ALL I/O	VOL < 1.5V	VOL < 1.5V	VOH > 1.5V
FUNCT 3	5.5V	0.4V	2.6V	FREQ = 1.35MHZ	ALL I/O	VOL < 1.5V	VOL < 1.5V	VOH > 1.5V
FUNCT 4	5.5V	0.4V	2.6V	FREQ = 1.00MHZ	ALL I/O	VOL < 1.5V	VOL < 1.5V	VOH > 1.5V
LOADS USED FOR ALL FUNCTIONAL TESTS ARE +/- 2.5MA								
PARAMETER	VCC	VIL	VIH	CONDITIONS	PINS	LIMITS AT +25C	-55C	+125C
VOH1	4.5V	0.4V	2.6V	LOAD = -2.5MA	OUTS	> +3.0V	> +3.0V	< +4.5V
VOH2	4.5V	0.4V	2.6V	LOAD = -100UA	OUTS	> +4.1V	> +4.1V	< +4.5V
VOL	4.5V	0.4V	2.6V	LOAD = +2.5MA	OUTS	> +0.0V	> +0.0V	< +0.4V
IIL	5.5V	0.0V	5.5V	VTST = 5.5V	INS	> -0.90A	> -0.90A	< +1.00A
IIL - IR	5.5V	0.0V	5.5V	VTST = 5.5V	IR 1NS	> -0.20A	> -0.20A	< +1.00A
IIL	5.5V	0.0V	5.5V	VTST = 0.0V	INS	> -1.00A	> -1.00A	< +0.00A
IIL - IR	5.5V	0.0V	5.5V	VTST = 0.0V	IR 1NS	> -500UA	> -500UA	< +0.00A
IOZR	5.5V	0.0V	5.5V	VOUT = 5.5V	OUTS	> -10UA	> -10UA	< +10UA
IOZL	5.5V	0.0V	5.5V	VOUT = 0.0V	OUTS	> -10UA	> -10UA	< +10UA
ICCSRH	5.5V	0.0V	5.5V	VIN = 5.5V	VCC	> +0.0A	> +0.0A	< +10UA
ICCSRL	5.5V	0.0V	5.5V	VIN = 0.0V	VCC	> +0.0A	> +0.0A	< +10UA
ICCSOP	5.0V	0.0V	5.0V	FREQ = 5.0MHZ	VCC	> +0.0A	> +0.0A	< +8MA
PARAMETER	VCC	VIL	VIH	CONDITIONS	PINS	LIMITS AT +25C	-55C	+125C
TRLDVH 1	4.5V	0.4V	2.6V	VCOMP = 1.5V	INTA -> VD	> 0.0NS	> 0.0NS	< 120.0NS
TRLDVL 1	4.5V	0.4V	2.6V	VCOMP = 1.5V	INTA -> VD	> 0.0NS	> 0.0NS	< 120.0NS
TRHDL 1	4.5V	0.4V	2.6V	VCOMP = VOL + .5V	INTA -> VD	> 10.0NS	> 10.0NS	< 85.0NS
TRHDH 1	4.5V	0.4V	2.6V	VCOMP = VOH - .5V	INTA -> VD	> 10.0NS	> 10.0NS	< 85.0NS
TJHIH 1	4.5V	0.4V	2.6V	VCOMP = 1.5V	IR -> INT	> 0.0NS	> 0.0NS	< 300.0NS
TLALCV 1	4.5V	0.4V	2.6V	VCOMP = 1.5V	INTA -> VCCS	> 0.0NS	> 0.0NS	< 300.0NS
TRLELI 1	4.5V	0.4V	2.6V	VCOMP = 1.5V	INTA -> VEN	> 0.0NS	> 0.0NS	< 100.0NS
TRLELR 1	4.5V	0.4V	2.6V	VCOMP = 1.5V	RD -> VEN	> 0.0NS	> 0.0NS	< 100.0NS
TRHEHI 1	4.5V	0.4V	2.6V	VCOMP = 1.5V	RD -> VEN	> 0.0NS	> 0.0NS	< 50.0NS
TRHEHR 1	4.5V	0.4V	2.6V	VCOMP = 1.5V	RD -> VEN	> 0.0NS	> 0.0NS	< 50.0NS
TAHDVH 1	4.5V	0.4V	2.6V	VCOMP = 1.5V	CS -> VD	> 0.0NS	> 0.0NS	< 200.0NS
TAHDVL 1	4.5V	0.4V	2.6V	VCOMP = 1.5V	CS -> VD	> 0.0NS	> 0.0NS	< 200.0NS
TCVDVH 1	4.5V	0.4V	2.6V	VCOMP = 1.5V	CAS -> VD	> 0.0NS	> 0.0NS	< 200.0NS
TCVDVL 1	4.5V	0.4V	2.6V	VCOMP = 1.5V	CAS -> VD	> 0.0NS	> 0.0NS	< 200.0NS
PARAMETER	VCC	VIL	VIH	CONDITIONS	PINS	LIMITS AT +25C	-55C	+125C
TRLDVH 2	4.5V	0.4V	2.6V	VCOMP = 1.5V	INTA -> VD	> 0.0NS	> 0.0NS	< 120.0NS
TRLDVL 2	4.5V	0.4V	2.6V	VCOMP = 1.5V	INTA -> VD	> 0.0NS	> 0.0NS	< 120.0NS
TRHDL 2	4.5V	0.4V	2.6V	VCOMP = VOL + .5V	INTA -> VD	> 10.0NS	> 10.0NS	< 85.0NS
TRHDH 2	4.5V	0.4V	2.6V	VCOMP = VOH - .5V	INTA -> VD	> 10.0NS	> 10.0NS	< 85.0NS
TJHIH 2	4.5V	0.4V	2.6V	VCOMP = 1.5V	IR -> INT	> 0.0NS	> 0.0NS	< 300.0NS
TLALCV 2	4.5V	0.4V	2.6V	VCOMP = 1.5V	INTA -> VCCS	> 0.0NS	> 0.0NS	< 300.0NS
TRLELI 2	4.5V	0.4V	2.6V	VCOMP = 1.5V	INTA -> VEN	> 0.0NS	> 0.0NS	< 100.0NS
TRLELR 2	4.5V	0.4V	2.6V	VCOMP = 1.5V	RD -> VEN	> 0.0NS	> 0.0NS	< 100.0NS
TRHEHI 2	4.5V	0.4V	2.6V	VCOMP = 1.5V	RD -> VEN	> 0.0NS	> 0.0NS	< 50.0NS
TRHEHR 2	4.5V	0.4V	2.6V	VCOMP = 1.5V	RD -> VEN	> 0.0NS	> 0.0NS	< 50.0NS
TAHDVH 2	4.5V	0.4V	2.6V	VCOMP = 1.5V	CS -> VD	> 0.0NS	> 0.0NS	< 200.0NS
TAHDVL 2	4.5V	0.4V	2.6V	VCOMP = 1.5V	CS -> VD	> 0.0NS	> 0.0NS	< 200.0NS
TCVDVH 2	4.5V	0.4V	2.6V	VCOMP = 1.5V	CAS -> VD	> 0.0NS	> 0.0NS	< 200.0NS
TCVDVL 2	4.5V	0.4V	2.6V	VCOMP = 1.5V	CAS -> VD	> 0.0NS	> 0.0NS	< 200.0NS

TABLE IV: Summary of Electrical Measurements after Total Dose Exposures and Annealing for MD82C59A /1

Test #	Parameters	Units	Spec. Lim./T	Total Dose Exposures (Grads)										Annealing								
				Initial		2.5		5		7.5		10		15		20		30		168 hrs @140°C		
				mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	
1	VOHI	V	4.5	4.3	0.04	4.3	0.04	4.3	0.04	4.3	0.04	4.3	0.04	4.3	0.04	4.3	0.05	4.3	0.04			
2	VOHI	V	4.5	4.5	0.0	4.5	0.0	4.5	0.0	4.5	0.0	4.5	0.0	4.5	0.0	4.5	0.0	4.5	0.0			
3	VOH	mV	408	82.5	8.1	31	9.3	11.4	85.9	10.2	94.8	11.9	93.2	13.4	86.5	10.2	107	48.5	98.1	7.9		
4	IIL	uA	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
5	IIL JR	uA	200	195	7.8	30	9.2	7.9	27	8.5	21	9.7	13.4	24.7	10.9	25.7	11.5	22.9	7.2	18.9	13.9	
6	IIL	uA	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
7	IIL JR	uA	500	32.9	1.9	30	3.8	1.9	30	1.9	78	1.9	77.2	1.9	75.4	1.9	75.1	1.9	75.7	1.9	75.7	1.9
8	IOZLH	uA	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
9	IOZLH	uA	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
10	ICCSBH	uA	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
11	ICCSBH	uA	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
12	ICCOOP	uA	0	22.0	40.9	21.2	41.1	23.7	41.5	21.2	44.9	40.9	24.2	40.2	21.4	44.1	21.3	38.6	24.9	38.4	0.0	0.0
13	TRLDVYL 1	nS	0	14.3	1.9	14.5	1.8	14.6	1.8	14.6	1.9	14.7	1.9	14.8	1.9	15.1	1.9	15.4	2.1	15.9	2.0	2.0
14	TRLDVYL 1	nS	0	15.5	2.4	15.7	2.4	15.8	2.4	15.9	2.5	15.9	2.5	15.9	2.4	16.2	2.5	16.5	2.5	16.5	2.5	2.5
15	TRIDHZ 1	nS	10	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	0.64
16	TRIDHZ 1	nS	10	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	0.64
17	TRIDHZ 1	nS	0	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	0.64
18	TRIDHZ 1	nS	0	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	0.64
19	TRIDHZ 1	nS	0	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	0.64
20	TRIDHZ 1	nS	0	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	0.64
21	TRIDHZ 1	nS	0	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	0.64
22	TRIDHZ 1	nS	0	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	0.64
23	TRIDHZ 1	nS	0	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	0.64
24	TRIDHZ 1	nS	0	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	0.64
25	TRIDHZ 1	nS	0	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	0.64
26	TRIDHZ 1	nS	0	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	0.64
27	TRIDHZ 1	nS	0	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	34.8	0.64	0.64
28	TRIDHZ 2	nS	10	12.9	2.1	13.1	2.1	13.2	2.1	13.3	2.2	13.3	2.2	13.4	2.1	13.4	2.2	13.6	2.4	14.1	2.3	2.3
29	TRIDHZ 2	nS	10	12.9	2.1	13.1	2.1	13.2	2.1	13.3	2.2	13.3	2.2	13.4	2.1	13.4	2.2	13.6	2.4	14.1	2.3	2.3
30	TRIDHZ 2	nS	10	12.9	2.1	13.1	2.1	13.2	2.1	13.3	2.2	13.3	2.2	13.4	2.1	13.4	2.2	13.6	2.4	14.1	2.3	2.3
31	TRIDHZ 2	nS	0	12.9	2.1	13.1	2.1	13.2	2.1	13.3	2.2	13.3	2.2	13.4	2.1	13.4	2.2	13.6	2.4	14.1	2.3	2.3
32	TRIDHZ 2	nS	0	12.9	2.1	13.1	2.1	13.2	2.1	13.3	2.2	13.3	2.2	13.4	2.1	13.4	2.2	13.6	2.4	14.1	2.3	2.3
33	TRIDHZ 2	nS	0	12.9	2.1	13.1	2.1	13.2	2.1	13.3	2.2	13.3	2.2	13.4	2.1	13.4	2.2	13.6	2.4	14.1	2.3	2.3
34	TRIDHZ 2	nS	0	12.9	2.1	13.1	2.1	13.2	2.1	13.3	2.2	13.3	2.2	13.4	2.1	13.4	2.2	13.6	2.4	14.1	2.3	2.3
35	TRIDHZ 2	nS	0	12.9	2.1	13.1	2.1	13.2	2.1	13.3	2.2	13.3	2.2	13.4	2.1	13.4	2.2	13.6	2.4	14.1	2.3	2.3
36	TRIDHZ 2	nS	0	12.9	2.1	13.1	2.1	13.2	2.1	13.3	2.2	13.3	2.2	13.4	2.1	13.4	2.2	13.6	2.4	14.1	2.3	2.3
37	TRIDHZ 2	nS	0	12.9	2.1	13.1	2.1	13.2	2.1	13.3	2.2	13.3	2.2	13.4	2.1	13.4	2.2	13.6	2.4	14.1	2.3	2.3
38	TRIDHZ 2	nS	0	12.9	2.1	13.1	2.1	13.2	2.1	13.3	2.2	13.3	2.2	13.4	2.1	13.4	2.2	13.6	2.4	14.1	2.3	2.3
39	TRIDHZ 2	nS	0	12.9	2.1	13.1	2.1	13.2	2.1	13.3	2.2	13.3	2.2	13.4	2.1	13.4	2.2	13.6	2.4	14.1	2.3	2.3
40	TRIDHZ 2	nS	0	12.9	2.1	13.1	2.1	13.2	2.1	13.3	2.2	13.3	2.2	13.4	2.1	13.4	2.2	13.6	2.4	14.1	2.3	2.3
41	TRIDHZ 2	nS	0	12.9	2.1	13.1	2.1	13.2	2.1	13.3	2.2	13.3	2.2	13.4	2.1	13.4	2.2	13.6	2.4	14.1	2.3	2.3
42	TRIDHZ 2	nS	0	12.9	2.1	13.1	2.1	13.2	2.1	13.3	2.2	13.3	2.2	13.4	2.1	13.4	2.2	13.6	2.4	14.1	2.3	2.3
43	TRIDHZ 2	nS	0	12.9	2.1	13.1	2.1	13.2	2.1	13.3	2.2	13.3	2.2	13.4	2.1	13.4	2.2	13.6	2.4	14.1	2.3	2.3
44	TRIDHZ 2	nS	0	12.9	2.1	13.1	2.1	13.2	2.1	13.3	2.2	13.3	2.2	13.4	2.1	13.4	2.2	13.6	2.4	14.1	2.3	2.3

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 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/ In the functional Tests, "P" means that all parts passed this test at this irradiation or annealing level, "F" means that all parts failed this test at this irradiation or annealing level and "nPmf" means that n parts passed at this level and m parts failed at this level.

Radiation-sensitive parameters: None.

Figure 1. Radiation Bias Circuit for MD82C59A

