PPM 93-64

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Paramax Systems
Corporation

4700 Boston Way
Lanham MD 20706

Memorandum

PARAMAX
A Unisys Company

PPM-93-064

DATE: June 29, 1993
TO: A. Sharma/311
FROM: K. Sahu/300.1 KS
SUBJECT: Radiation Report on GPEP/PPL/SOI
Part No. HX6464/1KCH-C (HX6464)

cc: Library/311

A radiation evaluation was performed on HX6464 (64Kx1 SRAM) to determine the total dose tolerance of these devices. These are radiation-hardened parts, guaranteed to 1000 krads* by the manufacturer. Five parts were supplied by the manufacturer, Honeywell, for this testing. Two of the five parts had been subjected to 2,500 hours of life test. The remaining three parts had been subjected to 72 hours of burn-in. For more details on the parts, see Table I.

The total dose testing was performed using a cobalt-60 gamma ray source. During the radiation testing, four parts were irradiated under bias (see Figure 1 for bias configuration), and one part was used as a control sample. The total dose radiation levels were 50, 100, 300, 500 and 1000 krads. The dose rate was between 0.72 and 3.57 krads/hour, depending on the total dose level (see Table II for radiation schedule). After 1000 krads, 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. Electrical tests included 64 quiescent leakage current (ICCX) measurements to detect any performance differences between various address locations on the same chip due to process variations, cell structure anomalies and pattern sensitivities. Electrical tests also included seven functional tests. Functional tests #1, 3 and 5 consists of the following automatic pattern generator (APG) tests: ALL_ONES, ALL_ZEROS, CHECKERBOARD and INVERSED CHECKERBOARD. Functional tests #2, 4 and 6 consist of the following APG patterns: "10N" MARCH, ROW_ADDRESS, COL_ADDRESS, SLIDING_DIAGONALLY, PING_PONG, SURROUND, ROW_GALPAT and COL_GALPAT. Functional test #7 is a data retention test @ Vcc = 2.5 V.

No functional failures were observed throughout all irradiation (up to 1000 krads) and subsequent annealing steps. More details of the functional tests are provided in Tables III and IV.

One part (S/N 1194) passed all electrical tests throughout all irradiation and annealing steps. Two parts (S/N 1266 and 1277) passed all electrical tests up to and including the 1000 krad irradiation, but exceeded the specification limits for ICCX and IDR1 after the 168-hour anneal at 25°C. Both parts recovered to within specification limits for all parameters after the 168-hour anneal at 100°C.

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

One part (S/N 1268) exceeded the maximum specification limit for ICCX of 450 μA during initial electrical measurements at all three temperatures, with a reading of 700 μA, and continued to fail this test throughout all subsequent irradiation and annealing steps, with readings reaching a maximum of 18 mA after the final 25°C annealing step. After the 500 krad exposure, the same part also exceeded the maximum specification limit of 450 μA for IDDSB1, with a reading of 474 μA. After the 1000 krad exposure, the part continued to exceed the maximum specification limit for IDDSB1 and also exceeded the maximum specification limit of 30 μA for IDR1, with a reading of 3.9 mA. On annealing the parts at 25°C for 168 hours and at 100°C for 168 hours, failures were observed for ICCX, IDDOPW, IDDOPR, IDDSB1 and IDR1. Table V provides a summary of the failures observed after the 168-hour annealing steps at 25°C and 100°C.

No significant sensitivity to radiation was observed in any other test parameters.

Table VI provides a summary of the functional test results, as well as 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.

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TABLE I. Part Information

Generic Part Number:	HX6464
Part Number:	HX6464/1KCH-C[1], [4]
Control Number:	7950
Charge Number:	C35008
Manufacturer:	Honeywell
Lot Date Code:	9213, 9243
Quantity Tested:	5
Serial Numbers of Radiation Samples:	1194[2], 1266[3], 1268[3], 1277[3]
Serial Numbers of Control Sample:	1187[2]
Part Function:	64Kx1 SRAM
Part Technology:	SOI
Package Style:	24-pin Flat Pack
Test Equipment:	Sentry S-50
Test Engineer:	K. Kim

[1]These are radiation-hardened parts, guaranteed to 1000 krads by the manufacturer. Parts for testing were supplied by the manufacturer.
[2]These two parts received 2,500 hours of life test at Honeywell before shipment to Paramax.
[3]These three parts were recently assembled, tested and burned-in for 72 hours at Honeywell before shipment to Paramax.
[4]According to the manufacturer's test data, these sample parts exhibit slightly higher than normal standby currents and may not meet the data sheet limit. All parts were screened and measured to less than 600 μA standby current at 25°C.

TABLE II. Radiation Schedule for HX6464

EVENTS	DATE
1) INITIAL ELECTRICAL MEASUREMENTS	04/16/93
2) 50 KRAD IRRADIATION (1.14 KRADS/HOUR)	04/21/93
POST-50 KRAD ELECTRICAL MEASUREMENT	04/23/93
3) 100 KRAD IRRADIATION (0.72 KRADS/HOUR)	04/23/93
POST-100 KRAD ELECTRICAL MEASUREMENT	04/26/93
4) 300 KRAD IRRADIATION (2.25 KRADS/HOUR)	04/26/93
POST-300 KRAD ELECTRICAL MEASUREMENT	04/30/93
5) 500 KRAD IRRADIATION (3.03 KRADS/HOUR)	04/30/93
POST-500 KRAD ELECTRICAL MEASUREMENT	05/04/93
6) 1000 KRAD IRRADIATION (3.57 KRADS/HOUR)	05/04/93
POST-1000 KRAD ELECTRICAL MEASUREMENT	05/11/93
7) 168 HOUR ANNEALING @25°C	05/11/93
POST-168 HOUR ANNEAL ELECTRICAL MEASUREMENT	05/18/93
8) 168 HOUR ANNEALING @100°C*	05/18/93
POST-168 HOUR ANNEAL ELECTRICAL MEASUREMENT	05/25/93

ELECTRICAL MEASUREMENTS WERE PERFORMED AT 25°C, -55°C and +125°C FOR INITIAL AND FINAL (168-HOUR ANNEALING AT 25°C AND 100°C) STEPS. ELECTRICAL MEASUREMENTS WERE PERFORMED AT 25°C AT ALL OTHER STEPS.

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 HX6464

PART NO : HX6464/1KCH-C	PART TYPE : (64K x 1) Bits RAD-HARDENED CMOS Static RAM.	PCN : SI10623A
LOCATION	TEST SPECIFICATIONS	
DIRECTORY : DUA0:[LIBRARY.623]	HONEYWELL DATA SHEET (10/91)	

FUNCTIONAL TESTS

PARAMETER	VCC	VIL	VIH	CONDITIONS	PINS	LIMITS @ -55C TO +125C
FUNCT # 1	5.0V	0.0V	5.0V	FREQ =18.18MHz	ALL I/O	VOL<2.5V , VOH>2.5V
FUNCT # 2	5.0V	0.0V	5.0V	FREQ =18.18MHz	ALL I/O	VOL<2.5V , VOH>2.5V
FUNCT # 3	5.0V	0.0V	5.0V	FREQ =10.00MHz	ALL I/O	VOL<2.5V , VOH>2.5V
FUNCT # 4	5.0V	0.0V	5.0V	FREQ =10.00MHz	ALL I/O	VOL<2.5V , VOH>2.5V
FUNCT # 5	5.0V	0.0V	5.0V	FREQ = 2.00MHz	ALL I/O	VOL<2.5V , VOH>2.5V
FUNCT # 6	5.0V	0.0V	5.0V	FREQ = 2.00MHz	ALL I/O	VOL<2.5V , VOH>2.5V
FUNCT # 7	5.0V	0.0V	5.0V	FREQ = 2.00MHz	ALL I/O	VOL<2.5V , VOH>2.5V

DC PARAMETRIC TESTS

PARAMETER	VCC	VIL	VIH	CONDITIONS	PINS	LIMITS @ -55C TO +125C
VIH_5.5V	5.5V	1.65V	3.85V	FREQ= 2.0MHZ	INS	>+1.65V , <+3.85V
VIL_4.5V	4.5V	1.35V	3.15V	FREQ= 2.0MHZ	INS	>+1.35V , <+3.15V
VOH1	4.5V	1.35V	3.15V	LOAD= -5.0MA	OUTS	>+4.2V , <+4.5V
VOH2	4.5V	0.0V	4.5V	LOAD= -20.0UA	OUTS	>+4.9V , <+4.5V
VOL1	4.5V	1.35V	3.15V	LOAD= +10.0MA	OUTS	>+0.0V , <+0.4V
VOL2	4.5V	0.0V	4.5V	LOAD= +20.0UA	OUTS	>+0.0V , <+0.1V
IIH	5.5V	0.0V	5.5V	VIN = 5.5V	INS	>-5UA , < +5UA
IIL	5.5V	0.0V	5.5V	VIN = 0.0V	INS	>-5UA , < +5UA
IOZH	5.5V	0.0V	5.5V	VOUT= 5.5V	OUTS	>-10UA , < +10UA
IOZL	5.5V	0.0V	5.5V	VOUT= 0.0V	OUTS	>-10UA , < +10UA
IDR1	2.5V	0.0V	2.5V	DATA RETENTION	VCC	> 0.0A , <+300UA
ICCSB1	5.5V	0.3V	5.2V	ALL INS STABLE	VCC	> 0.0A , <+450UA
ICCOPW	5.5V	0.3V	5.2V	FRQ= 1MHZ,WRITE	VCC	> 0.0A , < +9MA
ICCOPR	5.5V	0.3V	5.2V	FRQ= 1MHZ,READ	VCC	> 0.0A , < +6MA
ICCX*	5.5V	0.3V	5.2V	FRQ= 10MHZ,WRITE	VCC	> 0.0A , <+450UA

AC GO/NO-GO TESTS PERFORMED DURING FUNCTIONAL TEST #1,2

PARAMETER	VCC	VIL	VIH	CONDITIONS	LIMITS @ -55C TO +125C
(WRITE CYCLE)					
TAVAV	5.0V	0.0V	5.0V	F=18.18MHz , VCMP=2.5V	* 55ns (Min.)
TWLWH	5.0V	0.0V	5.0V	F=18.18MHz , VCMP=2.5V	45ns (Min.)
TDVWH	5.0V	0.0V	5.0V	F=18.18MHz , VCMP=2.5V	45ns (Min.)
TAVWH	5.0V	0.0V	5.0V	F=18.18MHz , VCMP=2.5V	45ns (Min.)
TWHDX	5.0V	0.0V	5.0V	F=18.18MHz , VCMP=2.5V	0ns (Min.)
TWHAX	5.0V	0.0V	5.0V	F=18.18MHz , VCMP=2.5V	0ns (Min.)
TWHWL	5.0V	0.0V	5.0V	F=18.18MHz , VCMP=2.5V	10ns (Min.)
(READ CYCLE)					
TAVAV	5.0V	0.0V	5.0V	F=18.18MHz , VCMP=2.5V	50ns (Min.)
TAXQX	5.0V	0.0V	5.0V	F=18.18MHz , VCMP=2.5V	2ns (Min.)
TGLQV	5.0V	0.0V	5.0V	F=18.18MHz , VCMP=2.5V	25ns (Min.)

AC PARAMETRIC TESTS

PARAMETER	VCC	VIL	VIH	CONDITIONS	LIMITS @ -55C TO +125C
TAVQV_LH	4.5V	0.5V	4.0V	F=1.0MHz , VCMP=2.5V	> 0ns , < 50ns
TAVQV_HL	4.5V	0.5V	4.0V	F=1.0MHz , VCMP=2.5V	> 0ns , < 50ns

Table III (cont.). Electrical Characteristics of HX6464

COMMENTS/EXCEPTIONS

(1) FUNCTIONAL TESTS ARE PERFORMED AT VCC=5.0V ONLY.

(2) FUNCTIONAL TESTS #1, 3 AND 5 CONSISTS OF THE FOLLOWING APG PATTERNS :
1 - ALL_ONES 2 - ALL_ZEROS
3 - CHECKERBOARD 4 - INVERSED CHECKERBOARD

(4) FUNCTIONAL TESTS #2, 4 AND 6 CONSISTS OF THE FOLLOWING APG PATTERNS :
1 - "1ON" MARCH 2 - ROW_ADDRESS
3 - COL_ADDRESS 4 - SLIDING_DIAGONALLY
5 - PING_PONG 6 - SURROUND
7 - ROW_GALPAT 8 - COL_GALPAT

(5) VIL & VIH were tested dynamically (switching) @ 2 MHz and also tested statically as a GO/NO-GO test during VOH1 and VOL1 tests.

(6) DATA RETENTION TEST PERFORMED DURING FUNCTIONAL #7 (FREQ = 2.0MHZ)
- WRITE CHECKERBOARD (ALL ADDRESSES)
- REDUCE VCC TO 2.5V FOR 0.5 SECOND.
- INCREASE VCC BACK TO 5.0V
- READ CHECKERBOARD (ALL ADDRESSES).

(7) ICCX : STAND BY QUIESCENT CURRENT MEASUREMENT FOR EVERY 1024 ADDRESS LOCATIONS. CONSIST OF THE FOLLOWING PROCEDURE :
(a) - WRITE ZEROES (ALL ADDRESSES).
(b) - WRITE ONES TO THE FIRST 1024 ADDRESSES.
(c) - PERFORM AN ICCSB MEASUREMENTS.
(d) - WRITE ZEROES TO THE FIRST 1024 ADDRESSES.
(e) - REPEAT STEPS (b)->(d) FOR THE NEXT 1024 ADDRESSES AND SO ON, FOR A TOTAL OF 64 READINGS (64K ADDRESSES).

(8) TAVAV DURING WRITE CYCLE IS TESTED WITH 55NS LIMIT INSTEAD OF THE 50NS LIMIT SPECIFIED.

(9) TESTS NOT PERFORMED :
- IDDSD2, IDDSE1, IDDSE2, IDDOP2, TSLWH, TEHWH, TSLQV, TSLQX, TSHQZ, TEHQV, TEHQX and TELQZ tests are not perfromed since the "/1" package options do not have CE and NOE.

- TCDR, TR, TELQZ, TGLQX, TGHQZ, TWLQZ, TWHQZ, IDDOP1, Co and Ci are not tested.

Table IV. AUTOMATIC PATTERN GENERATOR (APG)
TEST PATTERNS AND FAILURE DESCRIPTION

PATTERN NAME	TYPE OF FAILURES DETECTED BY PATTERN
ALL ZEROES & ALL ONES	– Opposite Logic State, Minimal Functional testing, Minimal check on Cell interactions.
+CHECKERBOARD & -CHECKERBOARD	– Faulty operation of device address decoders, Minimal Functional testing.
MARCH	– Tests whether each DUT cell (bit) can be accessed and written into with a Zero and One.
ROW ADDRESS & COLUMN ADDRESS	– Faulty Access or Write into a cell. – Faulty Noise Coupling within a Column. – Faulty Noise Coupling within a Row. – Slow Sense–Amplifier Recovery. – Faulty Address Transitions between each Cell and Cells row. – Faulty Address Transitions between each Cell and Cells Column. – Faulty Refresh Sensitivity in Dynamic RAMS.
SLIDE DIAGONAL	– Faulty Internal multiple–address selection. – Destruction of stored data due to noise coupling. – Faulty Sense Amplifiers. – Slow Sense–Amplifier Recovery.
PING PONG	– Unsatisfactory address transitions between each Cell and every other Cell. – Slow Sense–Amplifier Recovery. – Destruction of stored data due to noise coupling between cells within a column. – Destruction of stored data due to noise coupling between cells within a row. – Faulty Refresh Sensitivity in Dynamic RAMS.
SURROUND	– Destruction of stored data within a cell due to opposite state writes to surrounding cells. – Faulty Access or Write into a cell. – Slow Sense–Amplifier Recovery.
ROW GALPAT & COLUMN GALPAT	– Uncovers internal multiple–address selection. – Slow Sense–Amplifier Recovery. – Destruction of stored data due to noise coupling between column and/or rows.

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Table V. Post-25°C and 100°C Annealing Failures

S/N	Parameter	Spec.Lim.*	Measurement Temp.	Post 25°C Anneal Reading	Post 100°C Anneal Reading
1268	ICCX	450 μA	-55°C	5 ma	825 μA
1268	ICCX IDR1 IDDOPW IDDOPR IDDSB1	450 μA 30 μA 9 mA 6 mA 450 μA	25°C	18 mA 1 mA 17 mA 12 mA 9 mA	773 μA 0 8 mA 4 mA 239 μA
1266 1268 1277	ICCX ICCX IDR1 IDDOPW IDDOPR IDDSB1 ICCX IDR1	450 μA 450 μA 30 μA 9 mA 6 mA 450 μA 450 μA 30 μA	125°C	529 μA 31 ma 11 mA 32 mA 28 mA 16 mA 740 μA 65 μA	390 μA 31 mA 65 μA 8 mA 4 mA 318 μA 740 μA 0

*According to the manufacturer's test data, these parts exhibit slightly higher than normal standby currents and may not meet the data sheet limit. All parts were screened and measured to less than 600 μA standby current at 25°C.

TABLE VI: Summary of Electrical Measurements After Total Dose Exposures and Annealing for HX6464 1/

Parameters		Spec. Lim. min	Spec. Lim. max	Initial -55°C mean	sd	Initial +25°C mean	sd	Initial +125°C mean	sd	Total Dose Exposure (TDE) (krads) 50 mean	sd	100 mean	sd	300 mean	sd	500 mean	sd	1000 mean	sd
FUNC#1 18.2MHz				PASS		PASS		PASS		PASS		PASS		PASS		PASS		PASS	
FUNC#2 18.2MHz				PASS		PASS		PASS		PASS		PASS		PASS		PASS		PASS	
FUNC#3 10.0MHz				PASS		PASS		PASS		PASS		PASS		PASS		PASS		PASS	
FUNC#4 10.0MHz				PASS		PASS		PASS		PASS		PASS		PASS		PASS		PASS	
FUNC#5 2.0MHz				PASS		PASS		PASS		PASS		PASS		PASS		PASS		PASS	
FUNC#6 2.0MHz				PASS		PASS		PASS		PASS		PASS		PASS		PASS		PASS	
FUNC#7 2.0MHz				PASS		PASS		PASS		PASS		PASS		PASS		PASS		PASS	
VIH	V	1.55	3.35	2.62	.02	2.62	.03	2.64	.02	2.58	.02	2.57	.02	2.53	.03	3.05	.05	2.49	.02
VIL	V	1.35	3.15	2.55	.02	2.07	.02	2.09	.02	2.05	.02	2.06	.05	2.00	.01	1.79	.03	1.96	.01
VOH1	V	4.20	4.50	4.44	0	4.42	0	4.40	0	4.42	0	4.42	0	4.42	0	4.42	0	4.42	0
VOH2	V	4.40	4.50	4.49	0	4.49	0	4.49	0	4.49	0	4.49	0	4.49	0	4.49	0	4.49	0
VOL1	mV	0	400	70.3	1.3	102	2.5	149	3.1	100	2.1	97.8	2.4	97.8	2.4	98.5	2.6	97.8	3.9
VOL2	mV	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IIH	µA	-5.0	5.00	0.07	0.4	0	0	0.08	.26	0	.05	.01	.06	.01	.06	.01	.06	.01	.06
IIL	µA	-5.0	5.00	-.07	.40	0	0	-.03	.19	0	0	0	0	0	0	0	0	0	0
IOZH	µA	-10	10.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IOZL	µA	-10	10.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IDR1	µA	0	30.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	983	1703
IDDSB1	µA	0	450	80.5	111	65.3	90	56.5	71	65.3	90	67.5	94	98.0	146	130	199	4008	6916
IDDOPW	mA	0	9.00	7.63	.17	7.75	.20	8.02	.27	7.75	.18	7.73	.13	7.76	.06	7.94	.36	13.8	10
IDDOPR	mA	0	6.00	3.60	.03	3.55	.04	3.91	.08	3.63	.04	3.64	.05	3.82	.18	3.92	.10	9.56	9.9
ICCX	µA	0	450	333	288	312	260	296	235	314	266	316	259	364	319	4151	6839	7829	13953
TAVQV_LH	ns	0	50.0	16.5	.26	19.3	.40	22.9	.43	19.4	.37	19.4	.37	19.6	.42	21.5	.44	22.6	.47
TAVQV_HL	ns	0	50.0	12.0	.14	14.2	.23	17.2	.31	14.2	.24	14.2	.26	14.2	.30	15.8	.28	15.8	.38

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

Radiation-sensitive parameters were ICCX, IDDSB1, IDR1, IDDOPW and IDDOPR.

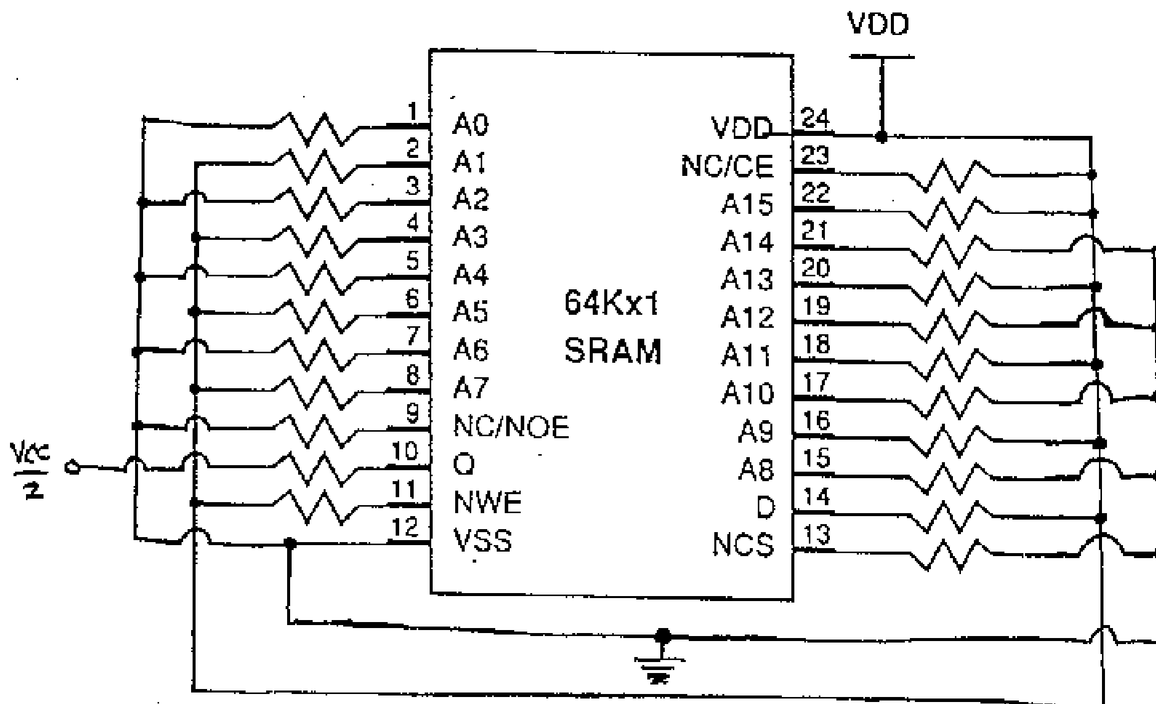
TABLE VI (cont.): Summary of Electrical Measurements After Total Dose Exposures and Annealing for HX6464 1/

Parameters		Spec. Lim. min	Spec. Lim. max	Anneal 168 hrs @25°C -55°C mean	sd	25°C mean	sd	+125°C mean	sd	Anneal 168 hrs @100°C -55°C mean	sd	+25°C mean	sd	+125°C mean	sd
FUNC#1 18.2MHz				PASS		PASS		PASS		PASS		PASS		PASS	
FUNC#2 18.2MHz				PASS		PASS		PASS		PASS		PASS		PASS	
FUNC#3 10.0MHz				PASS		PASS		PASS		PASS		PASS		PASS	
FUNC#4 10.0MHz				PASS		PASS		PASS		PASS		PASS		PASS	
FUNC#5 2.0MHz				PASS		PASS		PASS		PASS		PASS		PASS	
FUNC#6 2.0MHz				PASS		PASS		PASS		PASS		PASS		PASS	
FUNC#7 2.0MHz				PASS		PASS		PASS		PASS		PASS		PASS	
VIH	V	1.65	3.85	2.48	.02	2.50	.02	2.52	.02	2.50	.03	2.51	.03	2.54	.02
VIL	V	1.35	3.15	1.95	.01	1.96	.01	1.97	.01	1.97	.02	1.98	.02	1.99	.01
VOH1	V	4.20	4.50	4.44	0	4.42	0	4.40	.01	4.44	.01	4.42	0	4.40	0
VOH2	V	4.40	4.50	4.49	0	4.49	0	4.50	.01	4.50	.01	4.50	.01	4.49	0
VOL1	mV	0	400	66.3	2.3	96.8	3.3	142	7.1	66.8	2.6	99.0	2.7	144	4.1
VOL2	mV	0	100	0	0	0	0	0	0	0	0	0	0	0	0
IIH	uA	-5.0	5.00	0	0	.01	.06	0.04	.14	0	0	0	0	0.04	.10
IIL	uA	-5.0	5.00	0	0	0	0	0	.01	0	0	0	0	0	.01
ICZH	uA	-10	10.0	0	0	0	0	0	0	0	0	0	0	0	0
ICZL	uA	-10	10.0	0	0	0	0	0	0	0	0	0	0	0	0
IDR1	uA	0	30.0	2.50	13	259	448	2821	4820	0	0	0	0	22.5	27
IDDSB1	uA	0	450	124	184	2326	4001	4038	6907	82.5	113	71.5	99	93.5	132
IDDOPW	mA	0	9.00	7.76	.21	10.1	4.1	14.0	10	7.67	.15	7.76	.06	7.98	.08
IDDOPR	mA	0	5.00	3.75	.30	6.02	3.8	9.97	10	3.59	.07	3.83	.24	3.99	.19
ICCX	uA	0	450	1339	2082	4706	7781	8559	1.3E4	547	298	334	280	550	373
TAVQV_LH	ns	0	50.0	19.0	.37	21.7	.42	25.3	.61	19.0	.38	21.7	.42	25.4	.56
TAVQV_HL	ns	0	50.0	13.8	.22	15.9	.33	18.8	.51	13.7	.20	15.9	.28	18.8	.43

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

Radiation-sensitive parameters were ICCX, IDDSB1, IDR1, IDDOPW and IDDOPR.

Figure 1. Radiation Bias Circuit for HX6464



1) Vdd = 5.5 V ± 0.25v

2) Resistors = 2KΩ ±10%, ½W