Government Systems Group

C:\REPORTS\231.DOC

Unisys Corporation
4700 Boston Way
Lanham MD 20706

Telephone
301 731 8600

UNISYS

DATE: November 15, 1994

PPM-95-101

TO: B. Fafaul/311.1
FROM: K. Sahu/300.1
SUBJECT: Radiation Report on
Part No. IDT7204
Control No. 11007

cc: A. Sharma/311
Library/300.1

A radiation evaluation was performed on IDT7204 (2K x 9-Bit Parallel FIFO) 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, seven 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, 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 six functional tests, four at 1 MHz and two at 20 MHz.

All parts passed initial electrical measurements. All irradiated parts passed all electrical and functional tests up to and including the 30 krad irradiation 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 on all parts except one. This part (S/N 57) exceeded the maximum specification limit of 4 mA for ICC3, with a reading of 10.65 mA.

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 non-irradiation data specification limits. No post-irradiation limits were provided by the manufacturer at the time these tests were performed.

ADVISORY ON THE USE OF THIS DOCUMENT

The information contained in this document has been developed solely for the purpose of providing general guidance to employees of the Goddard Space Flight Center (GSFC). This document may be distributed outside GSFC only as a courtesy to other government agencies and contractors. Any distribution of this document, or application or use of the information contained herein, is expressly conditional upon, and is subject to, the following understandings and limitations:

(a) The information was developed for general guidance only and is subject to change at any time;

(b) The information was developed under unique GSFC laboratory conditions which may differ substantially from outside conditions;

(c) GSFC does not warrant the accuracy of the information when applied or used under other than unique GSFC laboratory conditions;

(d) The information should not be construed as a representation of product performance by either GSFC or the manufacturer;

(e) Neither the United States government nor any person acting on behalf of the United States government assumes any liability resulting from the application or use of the information.

TABLE I. Part Information

Generic Part Number:	IDT7204
HST/BASE Part Number:	IDT7204L40DB
HST/BASE Control Number:	11007
Charge Number:	C44617
Manufacturer:	Integrated Device Technology Inc
Lot Date Code:	9410, 9405
Quantity Tested:	9
Serial Number of Control Samples:	50, 51
Serial Numbers of Radiation Sample:	52, 53, 54, 55, 56, 57, 58
Part Function:	CMOS Asynchonous FIFO
Part Technology:	CMOS
Package Style:	28 PIN DIP
Test Equipment:	Sentry S-50
Test Engineer:	P. Srioudom

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

TABLE II. Radiation Schedule for IDT7204

EVENTS	DATE
1) INITIAL ELECTRICAL MEASUREMENTS	09/29/94
2) 2.5 KRAD IRRADIATION (0.15 KRADS/HOUR)	09/29/94
POST-2.5 KRAD ELECTRICAL MEASUREMENT	09/30/94
3) 5 RAD IRRADIATION (0.04 KRADS/HOUR)	09/30/94
POST-5 KRAD ELECTRICAL MEASUREMENT	10/03/94
(S-50 was down for repair on 10/03/94. Parts annealed 24 hours at 25°C prior to testing on 10/04/94)	
4) 10 KRAD IRRADIATION (0.29 KRADS/HOUR)	10/04/94
POST-10 KRAD ELECTRICAL MEASUREMENT	10/05/94
(S-50 was down for repair on 10/04/94. Parts annealed 24 hours at 25°C prior to testing on 10/05/94)	
5) 15 KRAD IRRADIATION (0.25 KRADS/HOUR)	10/06/94
POST-15 KRAD ELECTRICAL MEASUREMENT	10/07/94
6) 20 KRAD IRRADIATION (0.06 KRADS/HOUR)	10/07/94
POST-20 KRAD ELECTRICAL MEASUREMENT	10/11/94
7) 30 KRAD IRRADIATION (0.59 KRADS/HOUR)	10/11/94
POST-30 KRAD ELECTRICAL MEASUREMENT	10/12/94
8) 168-HOUR ANNEALING @25°C	10/13/94
POST-168 HOUR ANNEAL ELECTRICAL MEASUREMENT	10/19/94
9) 168-HOUR ANNEALING @100°C*	10/19/94
POST-168 HOUR ANNEAL ELECTRICAL MEASUREMENT	10/27/94

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 IDT7204

TESTS PERFORMED

PARAMETER	VCC	VIL	VIH	CONDITIONS	PINS	LIMITS AT +25C/-55C/+125C
FUNCT 1	4.5V	0.0V	4.5V	FREQ= 1 MHZ	ALL I/O	VOL<2.25V / VOH>2.25V
FUNCT 2	5.5V	0.0V	5.5V	FREQ= 1 MHZ	ALL I/O	VOL<2.75V / VOH>2.75V
FUNCT 3	4.5V	0.0V	3.0V	FREQ= 1 MHZ	ALL I/O	VOL<1.50V / VOH>1.50V
FUNCT 4	5.5V	0.0V	3.0V	FREQ= 1 MHZ	ALL I/O	VOL<1.50V / VOH>1.50V
FUNCT 5	4.5V	0.0V	3.0V	FREQ= 20 MHZ	ALL I/O	VOL<1.50V / VOH>1.50V
FUNCT 6	5.5V	0.0V	3.0V	FREQ= 20 MHZ	ALL I/O	VOL<1.50V / VOH>1.50V

PARAMETER	VCC	VIL	VIH	CONDITIONS	PINS	LIMITS AT +25C/-55C/+125C
VOL1	4.5V	0.8V	2.2V	LOAD=+8.0MA	OUTS	>+0.0V / <+0.4V
VOL2	5.5V	0.8V	2.2V	LOAD=+8.0MA	OUTS	>+0.0V / <+0.4V
VOH1	4.5V	0.8V	2.2V	LOAD=-2.0MA	OUTS	>+2.4V / <+4.5V
VOH2	5.5V	0.8V	2.2V	LOAD=-2.0MA	OUTS	>+2.4V / <+5.5V
IIH	5.5V	0.4V	5.5V	VTST= 5.5V	INS	>-0.0A / <+10UA
IIL	5.5V	0.4V	5.5V	VTST= 0.4V	INS	>-10UA / <+0.0A
IOZH	5.5V	0.4V	5.5V	VOUT= 5.5V	OUTS	>-0.0A / <+10UA
IOZL	5.5V	0.4V	5.5V	VOUT= 0.4V	OUTS	>-10UA / <+0.0A
ICC1	5.5V	0.8V	2.2V	VIN = 0.0V	VCC	>+0.0A / <+150MA
ICC2	5.5V	0.8V	2.2V	VIN = 0.0V	VCC	>+0.0A / <+25.0MA
ICC3	5.5V	0.0V	5.3V	VIN = 5.3V	VCC	>+0.0A / <+4.0MA

AC PARAMETRIC TESTS

PARAMETER	VCC	VIL	VIH	CONDITIONS	PINS	LIMITS @ +25C
TA_LH	5.5V	0.0V	3.0V	F= 1 MHZ,	OUTPUTS	> 0NS / < 40NS
TRFF	5.5V	0.0V	3.0V	F= 1 MHZ,	OUTPUTS	> 0NS / < 35NS
TRHF	5.5V	0.0V	3.0V	F= 1 MHZ,	OUTPUTS	> 0NS / < 50NS
TA_HL	5.5V	0.0V	3.0V	F= 1 MHZ,	OUTPUTS	> 0NS / < 40NS
TWHF	5.5V	0.0V	3.0V	F= 1 MHZ,	OUTPUTS	> 0NS / < 50NS
TREF	5.5V	0.0V	3.0V	F= 1 MHZ,	OUTPUTS	> 0NS / < 35NS
TWFF	5.5V	0.0V	3.0V	F= 1 MHZ,	OUTPUTS	> 0NS / < 35NS

TABLE IV: Summary of Electrical Measurements after Total Dose Exposures and Annealing for IDT7204 /1

Test #	Parameters	Units	Spec. Lim./2 min	Spec. Lim./2 max	Initials mean	Initials sd	Total Dose Exposure (krads) 2.5 mean	2.5 sd	5 mean	5 sd	10 mean	10 sd	15 mean	15 sd	20 mean	20 sd	30 mean	30 sd	Annealing 168 hrs @25°C mean	168 hrs @25°C sd	168 hrs @100°C mean	168 hrs @100°C sd
1	VOH1	V	2.4	4.5	2.84	.03	2.86	.03	2.83	.02	2.84	.02	2.84	.02	2.85	.02	2.86	.02	2.86	.02	2.88	.02
2	VOH2	V	2.4	5.5	3.70	.38	3.78	.03	3.72	.03	3.74	.02	3.74	.03	3.75	.02	3.75	.02	3.75	.02	3.80	.03
3	VOL1	mV	0	400	181	17	207	23	209	35	212	57	210	40	178	14	182	18	202	34	215	23
4	VOL2	mV	0	400	167	18	175	22	196	36	196	48	204	48	164	14	170	19	193	40	183	22
5	IIH	µA	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	IIL	µA	-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	IOZH	µA	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	IOZL	µA	-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	ICC1	mA	0	150	11.1	4.7	11.3	3.5	16.5	6.6	11.4	2.7	11.5	7.3	12.5	4.0	15.4	6.6	11.1	7.1	10.0	7.6
10	ICC2	mA	0	25	3.30	.33	3.43	.11	3.17	.10	3.15	.10	3.13	.10	3.13	.10	3.50	.18	3.36	.14	4.89	3.9
11	ICC3	mA	0	4	0	.01	.01	.02	0	0	0	0	0	0	0	.01	0.40	.18	0.26	.14	1.52	3.7
12	TA_LH	nS	0	40	10.9	.95	10.5	.29	11.1	.30	13.1	.29	11.3	.29	11.2	.28	11.2	.25	11.1	.28	9.03	.31
13	TRFF	nS	0	35	10.1	0.91	9.77	.21	10.7	.81	12.3	.30	10.3	.31	10.1	.23	10.1	.18	10.1	.25	8.43	.35
14	TRHF	nS	0	50	15.1	1.5	14.6	.44	15.3	.47	17.1	.43	15.2	.45	15.0	.44	15.0	.38	15.0	.46	13.4	.47
15	TA_HL	nS	0	40	15.5	1.4	15.4	1.4	16.0	1.5	17.9	1.4	16.1	1.4	15.8	1.3	15.9	1.4	16.0	1.4	13.6	1.3
16	TWHF	nS	0	50	17.0	1.3	16.5	.37	17.0	.42	18.7	.37	17.0	.38	16.8	.37	16.9	.37	16.9	.39	14.7	.47
17	TREF	nS	0	35	28.0	0.97	27.7	.32	28.1	.30	30.5	.54	28.6	.36	28.2	.27	28.3	.31	28.5	.45	25.7	.29
18	TWEF	nS	0	35	13.2	.87	12.9	.24	13.8	1.3	15.4	.42	13.5	.34	13.3	.26	13.3	.26	13.4	.28	11.3	.47
19	FUNC1,Vcc=4.5V,Vih=4.5V,1MHz/				P		P		P		P		P		P		P		P		P	
20	FUNC2,Vcc=5.5V,Vih=5.5V,1MHz				P		P		P		P		P		P		P		P		P	
21	FUNC3,Vcc=4.5V,Vih=3.0V,1MHz				P		P		P		P		P		P		P		P		P	
22	FUNC4,Vcc=5.5V,Vih=3.0V,1MHz				P		P		P		P		P		P		P		P		P	
23	FUNC5,Vcc=4.5V,Vih=3.0V,20MHz				P		P		P		P		P		P		P		P		P	
24	FUNC6,Vcc=5.5V,Vih=3.0V,20MHz				P		P		P		P		P		P		P		P		P	

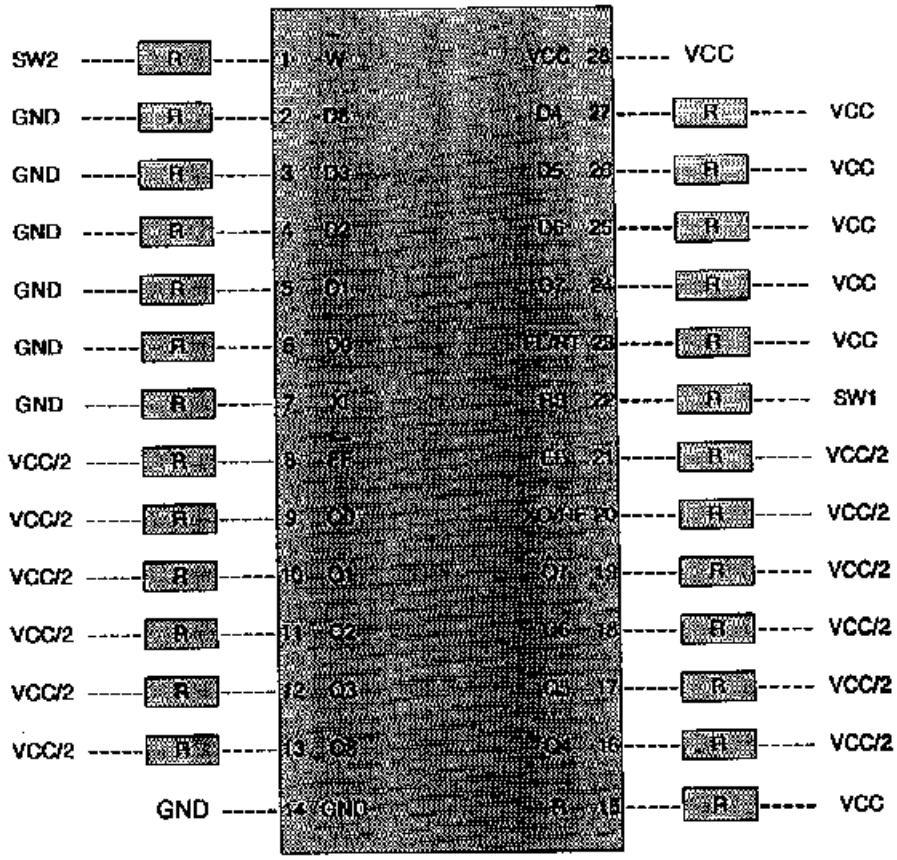
1/ The mean and standard deviation values were calculated over the eight parts irradiated in this testing. The control samples remained constant throughout the testing and is not included in this table.

2/ These are manufacturer's non-irradiated 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 Functional 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.

4/ Radiation-sensitive parameters: none.

Figure 1. Radiation Bias Circuit for IDT7204



NOTES:

VCC = 5.00 V ± 0.5 V.
VCC/2 = 2.50 V ± 0.5 V.
GND = 0.00 V.

R = 2 K ± 10 % (¼ W).