

UNISYS

DATE: May 17, 1996
TO: P. Gagne
FROM: K. Sahu/300.1 *KS*
SUBJECT: Radiation Report on: 54S20
Project: MASUNI040896 (non-NASA job)
Control #: 15147
Job #: HAFF112
Project part #: 54S20

PPM-96-007

cc: D. Krus/300.1
OFA Library/300.1

A radiation evaluation was performed on 54S20 (Dual 4-input Positive NAND) 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 Co⁶⁰ gamma ray source. The parts were tested in general accordance with MIL-STD-883, Method 1019. During the radiation testing, four parts were irradiated under bias (see Figure 1 for bias configuration). One part was used as a control sample. The total dose radiation levels were 50 and 100 krad*. The dose rate was 0.55 krad/hour for the first 50 krad irradiation and 1.19 krad/hour for the second 50 krad (100 krad cumulative) irradiation (see Table II for radiation schedule). After each radiation exposure, parts were electrically tested according to the test conditions and the specification limits** listed in Table III. The electrical measurements included two functional tests at 1.0 MHz: one with Vcc = 4.5 V, Vil = 0.0 V and Vih = 4.5 V and one with Vcc = 5.5 V, Vil = 0.0 V and Vih = 5.5 V.

All parts passed all functional and parametric electrical tests initially and throughout both irradiation steps.

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

Based on the results of this test, the total-dose radiation characteristics of these parts are acceptable for a total-mission-dose space radiation environment of up to 100 krad.

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 consecutive annealing times at the same temperature and 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.

ADVISORY ON THE USE OF THIS DOCUMENT

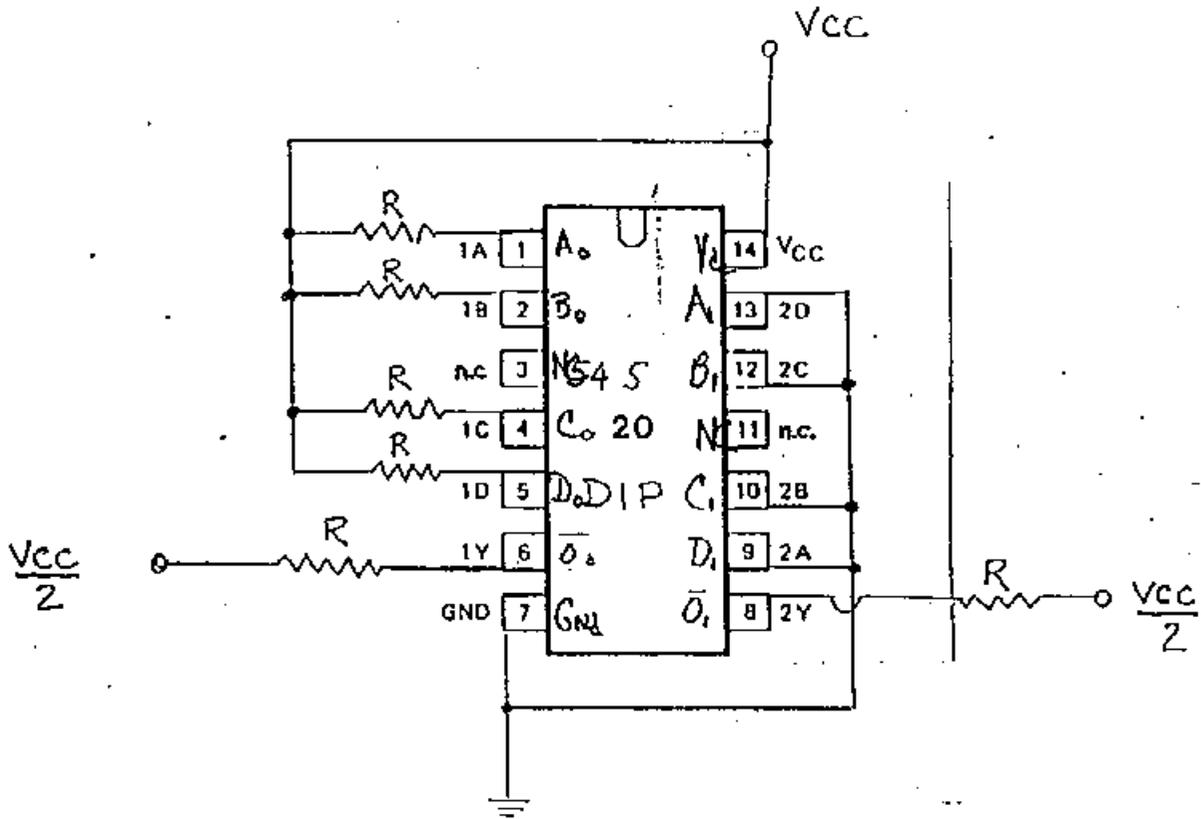
The information contained in this document has been developed solely for the purpose of providing radiation characteristics under total dose irradiation from a Co⁶⁰ gamma-ray source. The parts were tested in general accordance with MIL-STD-883, Method 1019. A lower dose rate than 50 rads(Si)/sec was used in this testing to better simulate the space radiation environment. This information is applicable to the space radiation environment, but not to a nuclear radiation environment.

The users of this information should be aware that the total dose radiation characteristics of electronic parts can vary significantly with the lot date code, and even within the same lot date code; therefore, an appropriate radiation design margin should be used.

Since radiation testing is considered "destructive testing" under MIL-STD-883, Method 1019, the parts used in this test should not be used in any other application.

Neither Unisys Corporation, nor any person acting on behalf of Unisys Corporation, assumes any liability resulting from the application or use of this information.

Figure 1. Radiation Bias Circuit for 54S20



54S20
14 PIN DIP

$$V_{CC} = 5.0V \pm 10\% , \frac{V_{CC}}{2} = 2.5V \pm 10\%$$

$$R = 1.K \text{ Ohm}, 5\% , \frac{1}{4} W$$

$$T_A = 25^\circ C$$

TABLE I. Part Information

Generic Part Number:	54S20*
Project	MASUNI040896 (non-NASA job)
Project Part Number	54S20
Control Number:	15147
Charge Number:	HAFF112
Manufacturer:	unknown
Lot Date Code (LDC):	Lot # 0131001-35
Quantity Tested:	5
Serial Number of Control Samples:	160
Serial Numbers of Radiation Samples:	161, 162, 163, 164
Part Function:	Dual 4-input Positive NAND
Part Technology:	Schottky
Package Style:	14-pin DIP
Test Equipment:	S-50
Engineer:	A. Duvalsaint

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

TABLE II. Radiation Schedule for 54S20

EVENT.....	DATE
1) INITIAL ELECTRICAL MEASUREMENTS.....	05/02/96
2) 50 KRAD IRRADIATION (0.55 KRADS/HOUR)*.....	05/06/96
POST-50 KRAD ELECTRICAL MEASUREMENT.....	05/08/96
3) 100 KRAD IRRADIATION (1.19 KRADS/HOUR).....	05/09/96
POST-100 KRAD ELECTRICAL MEASUREMENT.....	05/13/96

* The dose rate in the space radiation environment is approximately 100 times smaller than this dose rate; therefore, this low dose rate provides a more accurate simulation of the radiation effects during the actual mission.

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

Table III. Electrical Characteristics of 54S20

TESTS PERFORMED						
PARAMETER	VCC	VIL	VIH	CONDITIONS	PINS	LIMITS @ +25C
FUNCT #1	4.5V	0.0V	4.5V	FREQ = 1MHZ	ALL I/O	VOL < 1.5V ; VOH > 1.5V
FUNCT #2	5.5V	0.0V	5.5V	FREQ = 1MHZ	ALL I/O	VOL < 1.5V ; VOH > 1.5V
PARAMETER	VCC	VIL	VIH	CONDITIONS	PINS	LIMITS @ +25C
VOH	4.5V	0.80V	4.50V	LOAD = -1MA	OUTS	> 2.50V ; < 4.50V
VOL	4.5V	0.00V	2.00V	LOAD = +20MA	OUTS	> 0.00V ; < 0.50V
VIC	4.5V			LOAD = -18MA	INS	> -1.20V ; < 0.00V
PARAMETER	VCC	VIL	VIH	CONDITIONS	PINS	LIMITS @ +25C
I _{IH1}	5.5V	0.00V	2.70V	VIN = 2.7V	INS	> 0.0UA ; < +50.0UA
I _{IH2}	5.5V	0.00V	5.50V	VIN = 5.5V	INS	> 0.0UA ; < +1MA
I _{IL}	5.5V	0.00V	4.50V	VIN = 0.5V	INS	> -10UA ; < -2MA
I _{OS}	5.5V	0.00V	5.50V		INS	> -100MA ; < -40MA
I _{CCH}	5.5V	ALL INPUTS AT 0.00V			VCC	> 0.0UA ; < 8MA
I _{CCL}	5.5V	ALL INPUTS AT 4.50V			VCC	> 0.0UA ; < 18MA

Table IV: Total Dose Exposures and Annealing for 54S20 /1

Test #	Parameters	Units	Spec. Lim./2		Initial		Total Dose Exposure (krads)			
					25°C		50		100	
					mean	sd	mean	sd	mean	sd
1	FUNC1, VCC=4.5V, VIL=0.0V, VIH=4.5V, 1MHz				P		P		P	
2	FUNC2, VCC=5.5V, VIL=0.0V, VIH=5.5V, 1MHz				P		P		P	
3	VOH	V	2.5	4.5	2.90	.03	2.91	0	2.91	0
4	VOL	mV	0	500	441	32	374	15	372	15
5	VIC	mV	-1200	0	-797	64	-744	2.8	-743	2.4
6	I _{H1}	μA	0	50	0.22	.01	0.22	.01	0.22	.01
7	I _{H2}	μA	0	1000	0.39	.01	0.39	.01	0.39	.01
8	I _L	mA	-2	-0.01	-1.44	.01	-1.44	0	-1.44	0
9	I _{OS}	mA	-100	-40	-68.01	2.1	-69.95	.78	-69.96	.79
10	I _{CCH}	mA	0	8	5.82	.02	5.82	.03	5.81	.03
11	I _{CCL}	mA	0	18	11.98	.08	12.06	.01	12.06	.01

Notes:

- 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.
- 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.