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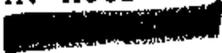
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From Code 300.1
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Subject 7809

Date PPM-92-044
Location Jan. 28, 1992
Telephone GSFC
Location 731-8954
cc Lanham

Radiation Report on 54ACT373LMQB
SMEX Part No. 5962-87556012A
Control No. 1423

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A radiation evaluation was performed on 54ACT373LMQB 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 cobalt-60 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 steps were 5, 10, 20, 30, 50, 75 and 100 krad*. After 100 krad, parts were annealed under bias at +25°C for 168 hours. After this annealing, the parts were irradiated to 200 and 300 krad (cumulative). Finally, the parts were annealed under bias for 240 hours at 100°C. The dose rate was between 250 and 5,200 rads/hour, depending on the total dose level (see Table II for radiation schedule). After each radiation exposure and annealing treatment, the parts were electrically tested at +25°C according to the test conditions and the specification limits listed in Table III. These tests included two functional tests at 1 MHz after each radiation and annealing step.

All parts passed both functional tests on irradiation up to 300 krad and on subsequent high temperature annealing for 240 hours. Also, no significant degradation was observed in any of the electrical parameters throughout this evaluation. Table IV provides the mean and standard deviation values for each parameter after each radiation exposure and annealing treatment. It also provides a summary of the functional test results after each radiation/annealing step.

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

*In this report, the term rads is used as an abbreviation for rads (Si).

TABLE I. Part Information

Generic Part Number:	54ACT373LMQB
SMEX Common Buy Part Number:	5962-87556012A
SMEX Common Buy Control Number:	1423
Charge Number:	C90295
Manufacturer:	National Semiconductor Corp.
Lot Date Code:	9010D
Quantity Tested:	10
Serial Numbers of Radiation Samples:	32, 33, 34, 35, 36, 37, 38, 39
Serial Number of Control Samples:	30, 31
Part Function:	Octal Transparent Latch with Tri-State Outputs
Part Technology:	CMOS
Package Style:	20-Pin LCC
Test Engineer:	C. Nguyen

TABLE II. Radiation Schedule for 54ACT373LMQB

EVENTS	DATE
1) Initial (Pre-Irradiation) Electrical Measurements	09/13/91
2) 5 krads irradiation @ 250 rads/hour	12/06/91
Post 5 krads Electrical Measurements	12/09/91
Note: Post 5 krads EM delayed by S-50 problems	
3) 10 krads irradiation @ 240 rads/hour	12/09/91
Post 10 krads Electrical Measurements	12/10/91
4) 20 krads irradiation @ 490 rads/hour	12/10/91
Post 20 krads Electrical Measurements	12/11/91
5) 30 krads irradiation @ 500 rads/hour	12/11/91
Post 30 krads Electrical Measurements	12/12/91
6) 50 krads irradiation @ 1,000 rads/hour	12/12/91
Post 50 krads Electrical Measurements	12/13/91
7) 75 krads irradiation @ 370 rads/hour	12/13/91
Post 75 krads Electrical Measurements	12/16/91
8) 100 krads irradiation @ 1,250 rads/hour	12/16/91
Post 100 krads Electrical Measurements	12/17/91
9) 24 hours annealing @ +25°C under bias	12/17/91
Post 24 hours Electrical Measurements	12/18/91
10) 168 hours annealing @ +25°C under bias	12/17/91
Post 168 hours Electrical Measurements	12/24/91
11) 200 krads irradiation @ 2,220 rads/hour	12/24/91
Post 200 krads Electrical Measurements	12/25/91
12) 300 krads irradiation @ 5,130 rads/hour	12/26/91
Post 300 krads Electrical Measurements	12/27/91
13) 240 hours annealing @ +100°C under bias	12/27/91
Post 240 hours Electrical Measurements	01/06/92
Annealing time increased due to S-50 problems	

Notes:

- All parts were radiated under bias at the cobalt-60 gamma ray facility at GSFC.
- All electrical measurements were performed off-site at 25°C, unless otherwise noted.
- The parts were annealed under bias at 25°C.

Table III. Electrical Characteristics of 54ACT373LMQB

FUNCTIONAL TESTS PERFORMED

PARAMETER	VCC	VIL	VIH	CONDITIONS	PINS	LIMITS OVER TEMP.
FUNCT 1	4.5V	0.0V	4.5V	FREQ=1.00MHz	I/O	VOL<2.25V; VOH>2.25V
FUNCT 2	5.5V	0.0V	5.5V	FREQ=1.00MHz	I/O	VOL<2.75V; VOH>2.75V

LOAD USED <= IOH = -5.0 mA
VREF = 1.5 V
IOL = +5.0 mA

DC PARAMETRIC TESTS PERFORMED

PARAMETER	VCC	VIL	VIH	CONDITIONS	PINS	LIMITS @ 25°C
VOH1	4.5V	0.8V	2.0V	LOAD=-50uA	OUTS	> 4.4V ; <4.5V
VOH2	4.5V	0.8V	2.0V	LOAD=-24mA	OUTS	> 3.7V ; <4.5V
VOH3	5.5V	0.8V	2.0V	LOAD=-50uA	OUTS	> 5.4V ; <5.5V
VOH4	5.5V	0.8V	2.0V	LOAD=-24mA	OUTS	> 4.7V ; <5.5V
VOH5	5.5V	0.8V	2.0V	LOAD=-50mA	OUTS	>3.85V ; <5.5V
VOL1	4.5V	0.8V	2.0V	LOAD=+50uA	OUTS	>0.0V ; < 0.1V
VOL2	4.5V	0.8V	2.0V	LOAD=+24mA	OUTS	>0.0V ; < 0.5V
VOL3	5.5V	0.8V	2.0V	LOAD=+50uA	OUTS	>0.0V ; < 0.1V
VOL4	5.5V	0.8V	2.0V	LOAD=+24mA	OUTS	>0.0V ; < 0.5V
VOL5	5.5V	0.8V	2.0V	LOAD=+50mA	OUTS	>0.0V ; <1.65V
I _{IH}	5.5V	0.0V	5.5V	VIN = 5.5V	INS	> 0.0uA; <1.0uA
I _{IL}	5.5V	0.0V	5.5V	VIN = 0.0V	INS	>-1.0uA; <0.0uA
I _{OZH}	5.5V	0.0V	5.5V	VIN = 5.5V	INS	> 0.0uA; < 10uA
I _{OZL}	5.5V	0.0V	5.5V	VIN = 5.5V	INS	> -10uA; <0.0uA
I _{CCH}	5.5V	0.0V	5.5V	VIN = 5.5V	VCC	>0.0uA ; <160uA
I _{CCL}	5.5V	0.0V	5.5V	VIN = 0.0V	VCC	>0.0uA ; <160uA
I _{CCZ}	5.5V	0.0V	5.5V	VIN = 0.0V	VCC	>0.0uA ; <160uA
DEL_ICC	5.5V	0.0V	5.5V	VIN = 3.4V	VCC	>0.0uA ; <1.6mA

AC PARAMETRIC TESTS PERFORMED

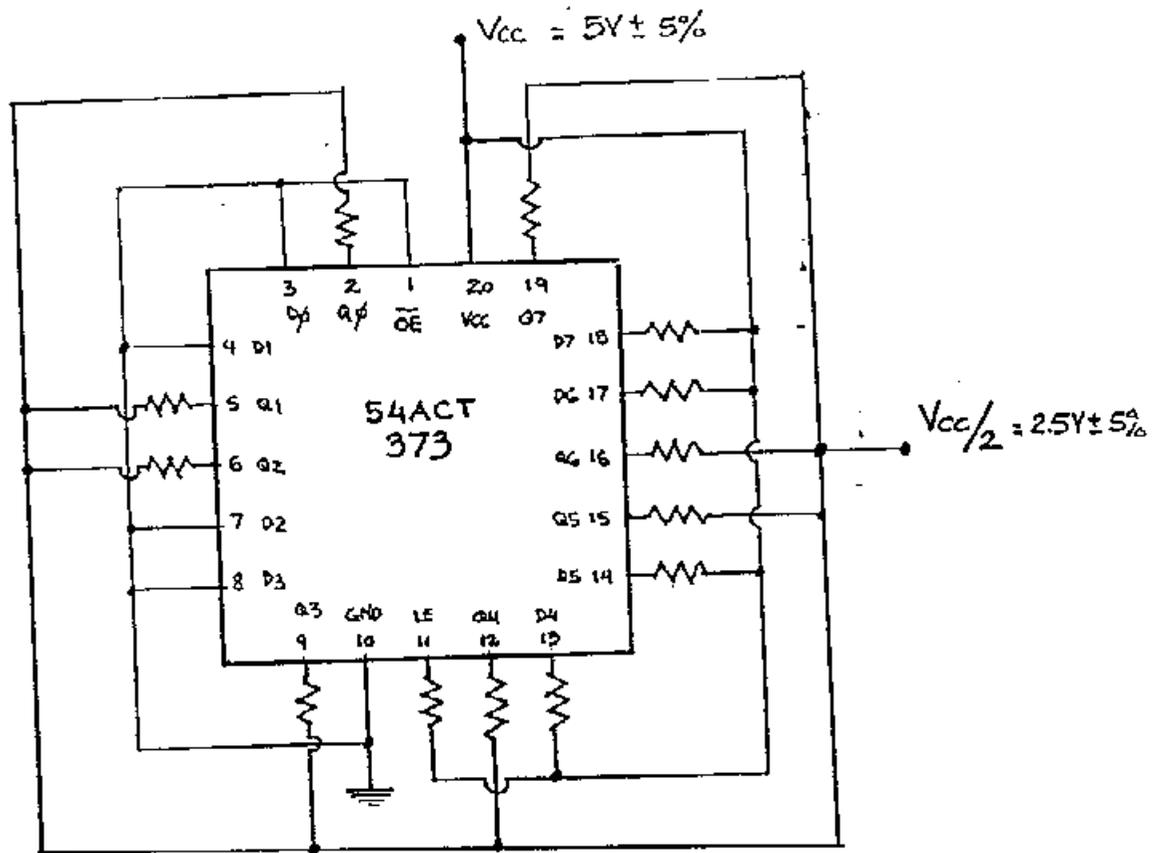
PARAMETER	VCC	VIL	VIH	PINS	LIMITS @ 25°C
TPHL1_DQ	4.5V	0.0V	3.0V	DN TO QN	>1.0nS; <10.5nS
TPLH1_DQ	4.5V	0.0V	3.0V	DN TO QN	>1.0nS; <10.5nS
TPHL2_LQ	4.5V	0.0V	3.0V	LE TO QN	>1.0nS; <10.0nS
TPLH2_LQ	4.5V	0.0V	3.0V	LE TO QN	>1.0nS; <10.5nS
TPHZ_OQ	4.5V	0.0V	3.0V	OE TO QN	>1.0nS; <11.0nS
TPLZ_OQ	4.5V	0.0V	3.0V	OE TO QN	>1.0nS; < 9.0nS
TPZH_OQ	4.5V	0.0V	3.0V	OE TO QN	>1.0nS; < 9.5nS
TPZL_OQ	4.5V	0.0V	3.0V	OE TO QN	>1.0nS; < 9.0nS

TABLE IV: Summary of Electrical Measurements After
Total Dose Exposures and Annealing for 54ACT373LMQB 1/ 2/ 3/

Parameters	Spec Limits ● 25°C min max		Total Dose Exposure (TDE) (krads)												Anneal		(TDE) (krads)				Anneal	
			0		5		10		20		50		100		168 hour		200		300		240 hour	
			(Pre-Rad)																			
FUNC1 @ 1 MHz			P		P		P		P		P		P		P		P		P		P	
FUNC2 @ 1 MHz			P		P		P		P		P		P		P		P		P		P	
VOH1 4.5V V	4.4	4.5	4.50	0	4.49	0	4.49	0	4.49	0	4.49	0	4.49	0	4.49	0	4.49	0	4.47	0.01	4.49	0
VOH2 4.5V V	3.7	4.5	4.19	0.01	4.19	0.01	4.19	0.01	4.19	0.01	4.19	0.01	4.17	0.02	4.17	0.01	4.13	0.04	4.09	0.07	4.14	0.03
VOH3 5.5V V	5.4	5.5	5.49	0	5.49	0	5.49	0	5.49	0	5.49	0	5.49	0	5.49	0	5.49	0	5.49	0	5.49	0
VOH4 5.5V V	4.7	5.5	5.24	0.01	5.24	0.01	5.24	0.01	5.24	0.02	5.23	0.01	5.22	0.01	5.23	0.01	5.21	0.02	5.19	0.03	5.21	0.01
VOH5 5.5V V	3.86	5.5	4.94	0.02	4.94	0.02	4.94	0.02	4.93	0.02	4.92	0.02	4.91	0.02	4.91	0.02	4.86	0.04	4.82	0.07	4.87	0.04
VOL1 4.5V V	0	0.10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VOL2 4.5V V	0	0.5	0.14	0	0.14	0	0.14	0	0.14	0	0.14	0	0.14	0	0.14	0	0.14	0.01	0.14	0.01	0.14	0
VOL3 5.5V V	0	0.10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VOL4 5.5V V	0	0.5	0.12	0	0.12	0	0.12	0	0.12	0	0.12	0	0.12	0	0.12	0	0.12	0	0.12	0.01	0.12	0
VOL5 5.5V V	0	1.65	0.26	0.01	0.26	0.01	0.26	0.01	0.26	0.01	0.25	0.01	0.26	0.01	0.26	0.01	0.25	0.01	0.27	0.01	0.26	0.01
IIN uA	0	1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IIL uA	-1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ICZH uA	0	10	0	0	0	0	0	0	0.02	0.04	1.35	1.84	0.93	1.54	0.04	0.07	0.56	1.19	0.84	1.87	0.01	0.04
IOZL uA	-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.25	0	0	0	0
ICCK uA	0	160	0	0	0	0	0.19	0.03	1.90	0.34	14.37	6.69	9.47	6.46	0.95	0.27	6.16	5.18	6.99	8.64	0.90	0.26
ICCL uA	0	160	0	0	0	0	0.12	0.02	1.30	0.20	10.77	4.99	7.30	4.33	0.75	0.22	4.52	3.23	5.92	4.55	1.25	0.26
IC CZ uA	0	160	0	0	0	0	0.07	0.01	0.86	0.17	13.46	5.13	9.32	5.18	0.87	0.28	5.86	4.14	8.16	6.53	0.68	0.16
DELTA ICC mA	0	1.6	0.57	0.05	0.61	0.06	0.59	0.06	0.58	0.05	0.54	0.07	0.42	0.13	0.41	0.10	0.27	0.14	0.21	0.14	0.24	0.16
TPHL1_DQ nS	1.0	10.5	7.01	0.88	7.11	0.59	7.11	0.57	7.08	0.57	7.04	0.56	8.14	0.66	8.10	0.68	8.56	0.65	8.75	0.73	8.34	0.70
TPHL1_QQ nS	1.0	10.5	5.12	0.64	5.70	0.29	5.71	0.28	5.69	0.28	5.71	0.29	6.77	0.39	6.70	0.42	6.62	1.27	6.80	1.09	6.50	1.47
TPHL2_LQ nS	1.0	10.0	7.00	0.90	7.78	0.59	7.77	0.56	7.73	0.57	7.71	0.56	8.73	0.67	8.69	0.67	8.51	0.67	8.70	0.75	8.13	0.71
TPHL2_QQ nS	1.0	10.5	5.11	0.66	5.04	0.28	5.05	0.27	5.03	0.27	5.05	0.28	6.19	0.39	6.12	0.41	6.71	1.29	6.89	1.46	6.55	1.35
TPH2_OQ nS	1.0	11.0	4.13	0.11	4.67	0.14	4.65	0.16	4.54	0.16	4.57	0.15	5.39	0.15	5.29	0.14	4.87	0.18	4.61	0.42	4.54	0.13
TPH2_QQ nS	1.0	9.0	5.03	0.24	5.16	0.14	5.14	0.16	5.15	0.15	5.11	0.15	6.06	0.14	6.01	0.18	6.23	0.15	6.25	0.14	6.16	0.15
TPZH_OQ nS	1.0	9.5	3.35	0.28	3.22	0.25	3.22	0.26	3.26	0.25	3.33	0.25	4.49	0.16	4.44	0.28	5.11	0.27	5.42	0.29	5.11	0.30
TPZL_OQ nS	1.0	9.0	5.83	0.27	6.61	0.17	6.60	0.16	6.58	0.17	6.57	0.16	7.66	0.15	7.62	0.15	7.60	0.14	7.84	0.15	7.21	0.14

- 1/ These statistics do not include the control samples which remained constant throughout testing.
- 2/ The statistics for the post 30 krads, 75 krads, and 24 hour annealing steps are available upon request.
- 3/ The statistical data for TPHZ_OQ at the post 200 krad and post 240 annealing steps were calculated without S/N 34, 36, 38, and 39 due to fluctuations in Automated Test Equipment (ATE).

Figure 1. Radiation Bias Circuit for 54ACT373LMQB



* ALL RESISTORS ARE $2K\Omega \pm 10\%$ $\frac{1}{4}$ -W

$$V_{cc} = 5V \pm 5\%$$

$$\frac{V_{cc}}{2} = 2.5V \pm 5\%$$