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Interoffice Memorandum

PPM-91-755

To: T. Miccolis

Department: Code 300.1

From: K. Sahu KS

Department: 7809

Subject: Radiation Report on 54AC151LMQB
SMEX Common Buy Part No. 5962-87691012A
Control No. 1395

Date: Dec. 20, 1991

Location: Lanham

Telephone: 731-8954

Location: Lanham

cc: B. Fafaul/311
A. Sharma/311
D. Krus
J. Stubblefield
A. Moor
Library/311

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A radiation evaluation was performed on 54AC151LMQB 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 10, 20, 30, 50, 75, and 100 krads*. After 100 krads, parts were annealed at 25°C for 168 hours with measurements taken at 24 and 168 hours, and then irradiation was continued to 200 and 300 krads (cumulative). Finally, parts were annealed under bias at 100°C for 168 hours. The dose rate was between 0.45 and 5.3 krads/hour, depending on the total dose level (see Table II for radiation schedule). After each radiation exposure and annealing treatment, 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 1MHz.

All eight parts passed the two functional tests as well as all parametric tests throughout the testing up to 300 krads, and after the subsequent annealing for 168 hours at 100 °C. Table IV provides 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.

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

TABLE I. Part Information

Generic Part Number:	54ΛC151LMQB
SMEX Common Buy Part Number:	5962-87691012A
SMEX Common Buy Control Number:	1395
Charge Number:	C90348
Manufacturer:	National Semiconductor
Lot Date Code:	9022A
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:	8-Input Multiplexer
Part Technology:	CMOS
Package Style:	20 pin LCC
Test Engineer:	K. Kim

TABLE II. Radiation Schedule for 54AC151LMQB

EVENTS	DATE
1) Initial (Pre-Irradiation) Electrical Measurements	07/25/91
2) 10-KRAD IRRADIATION (500 rads/hour)	11/13/91
POST 10-KRAD ELECTRICAL MEASUREMENT	11/14/91
3) 20-KRAD IRRADIATION (550 rads/hour)	11/14/91
POST 20-KRAD ELECTRICAL MEASUREMENT	11/15/91
4) 30-KRAD IRRADIATION (500 rads/hour)	11/15/91
POST 30-KRAD ELECTRICAL MEASUREMENT	11/16/91
5) 50-KRAD IRRADIATION (450 rads/hour)	11/16/91
POST 50-KRAD ELECTRICAL MEASUREMENT	11/18/91
6) 75-KRAD IRRADIATION (1250 rads/hour)	11/18/91
POST 75-KRAD ELECTRICAL MEASUREMENT	11/19/91
7) 100-KRAD IRRADIATION (1250 rads/hour)	11/19/91
POST 100-KRAD ELECTRICAL MEASUREMENT	11/20/91
8) 24 HOURS ANNEALING AT +25°C	11/20/91
POST 24-HOURS ELECTRICAL MEASUREMENT	11/21/91
9) 168 HOURS ANNEALING AT +25°C	11/20/91
POST 168-HOURS ELECTRICAL MEASUREMENT	11/27/91
10) 200-KRAD IRRADIATION (2270 rads/hour)	11/27/91
POST 200-KRAD ELECTRICAL MEASUREMENTS	11/29/91
11) 300-KRAD IRRADIATION (5260 rads/hour)	11/29/91
POST 300-KRAD ELECTRICAL MEASUREMENTS	11/30/91
12) 168 HOURS ANNEALING AT +100°C UNDER BIAS	11/30/91
POST 168 HOURS AT +100°C ELECTRICAL MEASUREMENTS	12/07/91

All electrical measurements performed at +25°C.

Table III. Electrical Characteristics of 54AC151LMQB

FUNCTIONAL TESTS PERFORMED

PARAMETER	VCC	VIL	VIH	CONDITIONS	PINS	LIMITS AT -55C TO +125C
FUNCT 1	3.0V	0.0V	3.0V	FREQ=1.000MHz	ALL I/O	VOL<1.5V / VOH>1.5V
FUNCT 2	5.5V	0.0V	5.5V	FREQ=1.000MHz	ALL I/O	VOL<1.5V / VOH>1.5V
				STD Load <= (IOH =-4.0mA		
				(VREF= 1.5V		
				(IOL = 4.0mA		

DC PARAMETRIC TESTS PERFORMED

PARAMETER	VCC	VIL	VIH	CONDITIONS	PINS	LIMITS AT -55C TO +125C
VOH1	3.0V	0.9V	2.1V	LOAD=-50.0UA	OUTS	>+2.9V / <+6.0V
VOH2	4.5V	1.35V	3.15V	LOAD=-50.0UA	OUTS	>+4.4V / <+6.0V
VOH3	5.5V	1.65V	3.85V	LOAD=-50.0UA	OUTS	>+5.4V / <+6.0V
VOH4	3.0V	0.9V	2.1V	LOAD=-4.0MA	OUTS	>+2.4V / <+6.0V
VOH5	4.5V	1.35V	3.15V	LOAD=-24.0MA	OUTS	>+3.7V / <+6.0V
VOH6	5.5V	1.65V	3.85V	LOAD=-24.0MA	OUTS	>+4.7V / <+6.0V
VOH7	5.5V	1.65V	3.85V	LOAD=-50.0MA	OUTS	>+3.85V / <+6.0V

PARAMETER	VCC	VIL	VIH	CONDITIONS	PINS	LIMITS AT -55C TO +125C
VOL1	3.0V	0.9V	2.1V	LOAD=+50.0UA	OUTS	>+0.0V / <+0.1V
VOL2	4.5V	1.35V	3.15V	LOAD=+50.0UA	OUTS	>+0.0V / <+0.1V
VOL3	5.5V	1.65V	3.85V	LOAD=+50.0UA	OUTS	>+0.0V / <+0.1V
VOL4	3.0V	0.9V	2.1V	LOAD=+12.0MA	OUTS	>+0.0V / <+0.5V
VOL5	4.5V	1.35V	3.15V	LOAD=+24.0MA	OUTS	>+0.0V / <+0.5V
VOL6	5.5V	1.65V	3.15V	LOAD=+24.0MA	OUTS	>+0.0V / <+0.5V
VOL7	5.5V	1.65V	3.15V	LOAD=+50.0MA	OUTS	>+0.0V / <+1.65V

PARAMETER	VCC	VIL	VIH	CONDITIONS	PINS	LIMITS AT -55C TO +125C
IIH	5.5V	0.0V	5.5V	VIN = 5.5V	INS	>+0.00UA / <+1.00UA
IIL	5.5V	0.0V	5.5V	VIN = 0.0V	INS	>-1.00UA / <+0.00UA

PARAMETER	VCC	VIL	VIH	CONDITIONS	PINS	LIMITS AT -55C TO +125C
ICCH	5.5V	0.0V	5.5V	VIN = 5.5V	VCC	>+0.0A / <+160UA
ICCL	5.5V	0.0V	5.5V	VIN = 0.0V	VCC	>+0.0A / <+160UA

AC PARAMETRIC TESTS PERFORMED

PARAMETER	VCC	VIL	VIH	FREQUENCY	PINS	LIMITS AT +25C ONLY
TPLH1	4.5V	0.0V	4.5V	1.0 MHz	In TO OUTS	> 1.0nS / < 10.0nS
TPHL1	4.5V	0.0V	4.5V	1.0 MHz	In TO OUTS	> 1.0nS / < 11.0nS
TPLH2	4.5V	0.0V	4.5V	1.0 MHz	Sn TO OUTS	> 1.0nS / < 13.0nS
TPHL2	4.5V	0.0V	4.5V	1.0 MHz	Sn TO OUTS	> 1.0nS / < 15.0nS
TPLH3	4.5V	0.0V	4.5V	1.0 MHz	E_ TO OUTS	> 1.0nS / < 10.0nS
TPHL3	4.5V	0.0V	4.5V	1.0 MHz	E_ TO OUTS	> 1.0nS / < 10.0nS

PARAMETER	VCC	VIL	VIH	FREQUENCY	PINS	LIMITS AT -55C TO +125C
TPLH1	4.5V	0.0V	4.5V	1.0 MHz	In TO OUTS	> 1.0nS / < 12.0nS
TPHL1	4.5V	0.0V	4.5V	1.0 MHz	In TO OUTS	> 1.0nS / < 13.0nS
TPLH2	4.5V	0.0V	4.5V	1.0 MHz	Sn TO OUTS	> 1.0nS / < 15.5nS
TPHL2	4.5V	0.0V	4.5V	1.0 MHz	Sn TO OUTS	> 1.0nS / < 15.5nS
TPLH3	4.5V	0.0V	4.5V	1.0 MHz	E_ TO OUTS	> 1.0nS / < 12.0nS
TPHL3	4.5V	0.0V	4.5V	1.0 MHz	E_ TO OUTS	> 1.0nS / < 12.0nS

COMMENTS/EXCEPTIONS

(1) VIL & VIH were tested during VOL & VOH tests as Go/NoGo.

(2) Cin and Cpd tests are not performed.

(3) AC parametrics are performed at VCC = 4.5V only.

TABLE IV: Summary of Elecrical Measurements After Total Dose Exposures and Annealing for 54AC151LMQB 1/, 2/

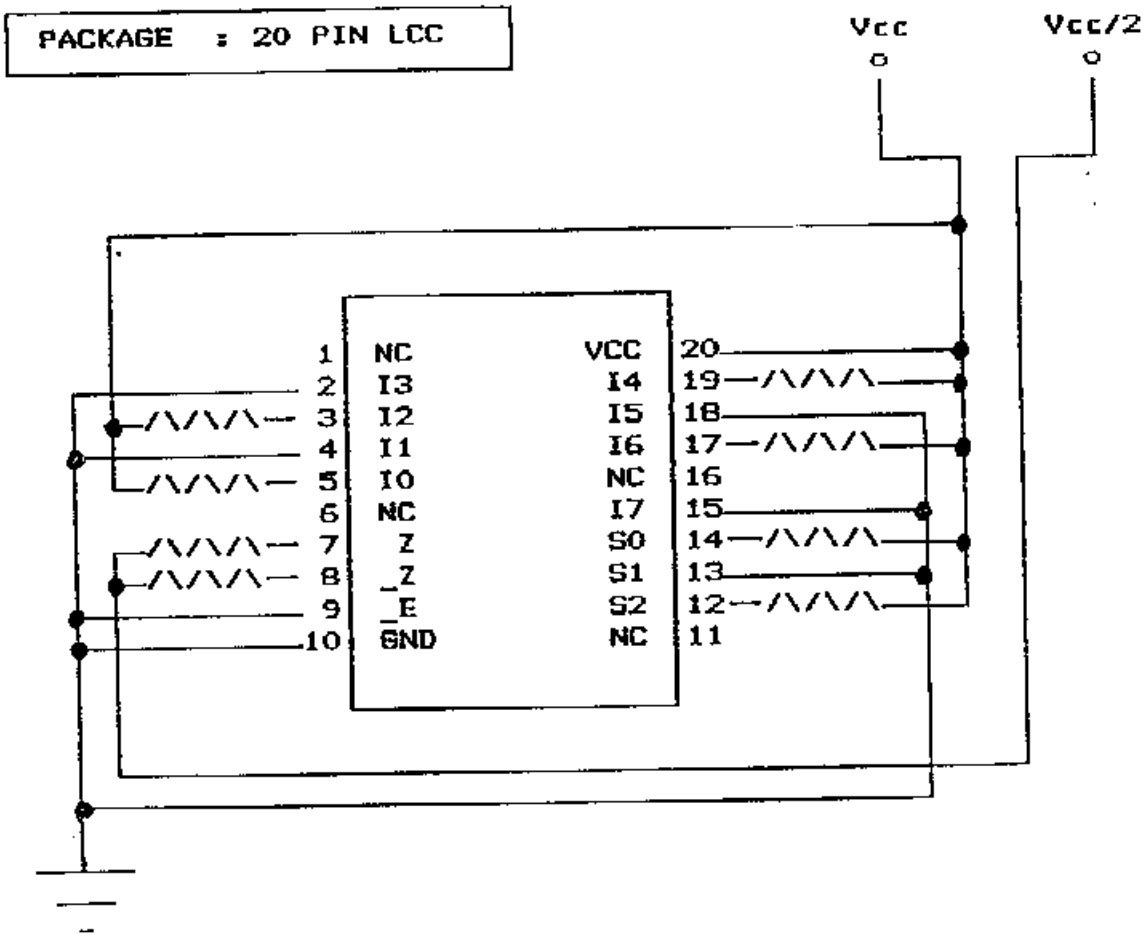
		Spec Limits		Total Dose Exposure (TDE) (krads)												Anneal		Total Dose (krads)				Anneal	
				0 (Pre-Rad)		10		20		30		50		100		168 hrs @25°C		200		300		168 hrs @100°C	
Parameters		min	max	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
FUNC1 @ 1 MHz				P		P		P		P		P		P		P		P		P		P	
FUNC2 @ 1 MHz				P		P		P		P		P		P		P		P		P		P	
VOH1_3.0V	V	2.9	6.0	2.99	0	3.00	0	3.00	0	3.00	0	3.00	0	3.00	0	3.00	0	3.00	0	3.00	0	3.00	0.01
VOH2_4.5V	V	4.4	6.0	4.49	0	4.49	0	4.49	0	4.49	0	4.49	0	4.49	0	4.49	0	4.49	0	4.49	0	4.49	0
VOH3_5.5V	V	5.4	6.0	5.49	-	5.49	-	5.49	-	5.49	0	5.49	-	5.49	-	5.49	-	5.49	-	5.49	-	5.49	0
VOH4_3.0V	V	2.4	6.0	2.93	0	2.93	0	2.92	0.01	2.93	0	2.92	0	2.92	0	2.93	0	2.92	0	2.92	0.01	2.92	0
VOH5_4.5V	V	3.7	6.0	4.18	0.01	4.16	0.02	4.17	0.03	4.17	0.03	4.15	0.01	4.16	0.02	4.17	0.02	4.16	0.02	4.16	0.02	4.15	0.01
VOH6_5.5V	V	4.7	6.0	5.22	0.02	5.19	0.02	5.20	0.03	5.20	0.02	5.18	0.01	5.19	0.01	5.21	0.01	5.20	0.02	5.20	0.02	5.20	0.01
VOH7_5.5V	V	3.85	6.0	4.90	0.04	4.85	0.04	4.86	0.06	4.87	0.05	4.82	0.02	4.85	0.03	4.88	0.03	4.87	0.03	4.86	0.03	4.85	0.02
VOL1_3.0V	mV	0	100	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-
VOL2_4.5V	mV	0	100	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-
VOL3_5.5V	mV	0	100	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-
VOL4_3.0V	mV	0	500	128.8	6.8	138.7	8.0	134.8	12.6	131.5	11.3	141.9	4.8	134.2	6.30	128.2	6.7	124.4	7.7	122.5	6.3	132.4	9.25
VOL5_4.5V	mV	0	500	193.2	13.3	214.9	16.4	206.9	25.0	201.4	22.4	223.1	9.4	210.1	12.3	196.8	12.4	193.9	14.7	191.3	13.4	200.9	15.0
VOL6_5.5V	mV	0	500	172.7	13.0	193.6	16.0	186.8	24.9	181.6	22.2	203.4	9.5	190.6	12.1	177.2	12.4	175.7	14.7	173.2	13.9	179.9	14.1
VOL7_5.5V	mV	0	1650	367.3	28.3	415.8	37.9	400.8	56.1	389.6	50.7	439.5	22.9	09.4	29.0	377.5	26.4	373.1	30.9	368.3	29.4	383.9	30.4
IIH	uA	0	1.0	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	-
ICCH	uA	0	160.0	0	0	5.13	2.17	10.55	2.10	10.21	2.03	6.04	0.92	5.02	0.58	0.90	0.06	0.11	0.02	2.00	0.15	0.19	0.01
ICCL	uA	0	160.0	0.02	0.03	3.32	1.51	7.60	1.81	6.23	1.87	5.05	0.86	4.31	0.57	0.63	0.18	0.26	0.38	2.44	0.39	0.25	0.18
TPLH1	nS	1.0	10.0	6.10	0.43	6.24	0.53	6.24	0.53	6.23	0.55	6.25	0.58	6.35	0.59	6.39	0.59	6.50	0.74	6.56	0.79	6.81	0.69
TPHL1	nS	1.0	11.0	5.34	0.23	5.86	0.52	5.81	0.49	5.81	0.51	5.80	0.50	5.85	0.47	5.91	0.47	5.82	0.45	5.82	0.45	6.61	0.49
TPLH2	nS	1.0	13.0	7.13	0.28	6.84	0.27	6.85	0.31	6.83	0.31	6.84	0.33	6.89	0.41	6.98	0.39	7.05	0.40	7.16	0.48	8.07	0.20
TPHL2	nS	1.0	13.0	6.00	0.63	6.50	1.02	6.50	1.02	6.47	1.06	6.48	1.11	6.49	1.17	6.56	1.13	6.54	1.20	6.61	1.33	7.47	0.93
TPLH3	nS	1.0	10.0	5.57	0.15	5.49	0.13	5.52	0.15	5.51	0.16	5.52	0.16	5.51	0.23	5.55	0.22	5.71	0.27	5.77	0.28	6.74	0.19
TPHL3	nS	1.0	10.0	4.48	0.86	5.18	0.92	5.20	0.93	5.18	0.95	5.18	1.00	5.15	1.04	5.17	1.03	5.23	1.15	5.23	1.22	6.16	1.18

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/ Post 75 krads and post 24 hour annealing measurements are not included in Table IV. This data is available and can be obtained upon request.

Figure 1. Radiation Bias Circuit for 54AC151LMQB



1. Vcc = 5.0 ± 0.5 Volts
2. Vcc/2 = 2.5 ± 0.25 Volts
3. All Resistors are 1k Ohms, 1/4 watts