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PPM-91-267

To T. Miccolis
Department
Code 300.1
From K. Sahu KS
Department
7809
Subject
Radiation Report on 54AC138DMQB
SMEX Common Buy Part No. 5962-8761501CA

Date April 15, 1991
Location Lanham
Telephone 731-8954
Location Lanham
cc
B. Fafaul/311
J. Denis/311
V. Edson
S. Esmacher
A. Casasnovas
M. Fowler
A. Moor

A radiation evaluation was performed on 54AC138DMQB 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 I.

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, 15, 20, 30, 50, 75 and 100 krads. After 100 krads, parts were annealed at 25°C for 24 and 168 hours, and then irradiation was continued to 200 and 300 krads (cumulative). The dose rate was between 0.25 to 5.0 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 according to the test conditions and the specification limits listed in Table III. These tests included a total of three functional tests (at 1 MHz) after each radiation and annealing step.

All of the parts passed all tests on irradiation up to 100 krads and after subsequent annealing for 24 and 168 hours without any significant degradation in any of the electrical parameters. On continued irradiation to 200 and 300 krads, one part (SN 10) exceeded specification limits on ICCH and ICCL (readings were 400uA against the specification limit of 160uA). However, all other parts passed all tests on irradiation up to 300 krads. Table IV provides the mean and standard deviation values for each parameter after different radiation exposures and annealing treatments. It also provides a summary of 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 731-8954.

TABLE I. Part Information

Generic Part Number:	54AC138DMQB
SMEX Common Buy Part Number:	5962-8762201EA
SMEX Common Buy Control Number:	1652
Manufacturer:	National Semiconductor Corporation
Quantity Procured:	102
Lot Date Code:	9037A
Quantity Tested:	10
Serial Numbers of Radiation Samples:	3, 4, 5, 6, 7, 8, 9, 10
Serial Numbers of Control Samples:	1,2
Part Function:	Decoder/Demultiplexer
Part Technology:	CMOS
Package Style:	16-PIN DIP

TABLE II. Radiation Schedule

EVENTS	DATE
1) Initial Electrical Measurements	02/15/91
2) 5 krad irradiation @ 250 rads/hr	02/25/91
Post 5 krad Electrical Measurements	02/26/91
3) 10 krad irradiation @ 250 rads/hr	02/26/91
Post 10 krad Electrical Measurements	02/27/91
4) 15 krad irradiation @ 250 rads/hr	02/27/91
Post 15 krad Electrical Measurements	02/28/91
5) 20 krad irradiation @ 250 rads/hr	02/28/91
Post 20 krad Electrical Measurements	03/01/91
6) 30 krad irradiation @ 500 rads/hr	03/01/91
Post 30 krad Electrical Measurements	03/02/91
7) 50 krad irradiation @ 1000 rads/hr	03/02/91
Post 50 krad Electrical Measurements	03/03/91
8) 75 krad irradiation @ 1250 rads/hr	03/03/91
Post 75 krad Electrical Measurements	03/04/91
9) 100 krad irradiation @ 1250 rads/hr	03/04/91
Post 100 krad Electrical Measurements	03/05/91
10) 24 hrs annealing	03/05/91
Post 24 hr Electrical Measurements	03/06/91
11) 168 hrs annealing	03/06/91
Post 168 hr Electrical Measurements	03/12/91
12) 200 krad irradiation @ 5000 rads/hr	03/13/91
Post 200 krad Electrical Measurements	03/14/91
13) 300 krad irradiation @ 5000 rads/hr	03/14/91
Post 300 krad Electrical Measurements	03/15/91

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.
- Annealing was performed at 25°C under bias.

TABLE III. Electrical Characteristics of 54AC138

TESTS PERFORMED						
PARAMETER	VCC	VIL	VIH	CONDITIONS	PINS	LIMITS @ +25C
FUNCT #1	2.0V	0.0V	2.0V	FREQ = 1MHz	ALL I/O	VOL<1.0V , VOH>1.0V
FUNCT #2	3.0V	0.0V	3.0V	FREQ = 1MHz	ALL I/O	VOL<1.5V , VOH>1.5V
FUNCT #3	5.5V	0.0V	5.5V	FREQ = 1MHz	ALL I/O	VOL<2.5V , VOH>2.5V
PARAMETER	VCC	VIL	VIH	CONDITIONS	PINS	LIMITS @ +25C
VOH1	3.0V	0.90V	2.10V	LOAD = -50UA	OUTS	>2.90V , <6.00V
VOH2	4.5V	1.35V	3.15V	LOAD = -50UA	OUTS	>4.40V , <6.00V
VOH3	5.5V	1.65V	3.85V	LOAD = -50UA	OUTS	>5.40V , <6.00V
VOH4	3.0V	0.90V	2.10V	LOAD = -4MA	OUTS	>2.40V , <6.00V
VOH5	4.5V	1.35V	3.15V	LOAD = -24MA	OUTS	>3.70V , <6.00V
VOH6	5.5V	1.65V	3.85V	LOAD = -24MA	OUTS	>4.70V , <6.00V
VOH7	5.5V	1.65V	3.85V	LOAD = -50MA	OUTS	>3.85V , <6.00V
PARAMETER	VCC	VIL	VIH	CONDITIONS	PINS	LIMITS @ +25C
VOL1	3.0V	0.90V	2.10V	LOAD = +50UA	OUTS	>0.00V , <0.10V
VOL2	4.5V	1.35V	3.15V	LOAD = +50UA	OUTS	>0.00V , <0.10V
VOL3	5.5V	1.65V	3.85V	LOAD = +50UA	OUTS	>0.00V , <0.10V
VOL4	3.0V	0.90V	2.10V	LOAD = +12MA	OUTS	>0.00V , <0.50V
VOL5	4.5V	1.35V	3.15V	LOAD = +24MA	OUTS	>0.00V , <0.50V
VOL6	5.5V	1.65V	3.85V	LOAD = +24MA	OUTS	>0.00V , <0.50V
VOL7	5.5V	1.65V	3.85V	LOAD = +50MA	OUTS	>0.00V , <1.65V
PARAMETER	VCC	VIL	VIH	CONDITIONS	PINS	LIMITS @ +25C
I _{IH}	5.5V	0.00V	5.50V	VIN = 5.5V	INS	> 0.0UA , <+1.0UA
I _{IL}	5.5V	0.00V	5.50V	VIN = 0.0V	INS	>-1.0UA , < 0.0UA
I _{CCH}	5.5V	0.00V	5.50V	VIN = 5.5V	VCC	> 0.0UA , <160.0UA
I _{CCL}	5.5V	0.00V	5.50V	VIN = 0.0V	VCC	> 0.0UA , <150.0UA
COMMENTS/EXCEPTIONS						
(1) FUNCTIONAL TESTS PERFORMED WITH OUTPUT LOADING OF I _{OH} =-5.0mA, I _{OL} =5.0mA						
(2) VIL & VIH WERE TESTED DURING VOL & VOH TESTS AS GO/NOGO.						
(3) I _{IH} TEST WAS PERFORMED WITH OTHER INPUTS AT VIH. (5.5V) I _{IL} TEST WAS PERFORMED WITH OTHER INPUTS AT VIL. (0.0V)						

TABLE IV: Summary of Electrical Measurements
after Total Dose Exposures and Annealing for 54AC138

1/2/3/

Parameters	Spec. Limits min max	Initials mean sd		Total Dose Exposure (krads)								Anneal		Total Dose (krads)					
				10		20		50		100		168 hrs		200		300			
				mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd		
Func1 @ 1MHz		Pass		Pass		Pass		Pass		Pass		Pass		Pass		Pass		Pass	
Func2 @ 1MHz		Pass		Pass		Pass		Pass		Pass		Pass		Pass		Pass		Pass	
Func3 @ 1MHz		Pass		Pass		Pass		Pass		Pass		Pass		Pass		Pass		Pass	
VCH2 V	4.4 6.0	4.5	0	4.5	0	4.5	0	5.5	0	4.5	0	4.5	0	4.5	0	4.5	0	4.5	0
VCH4 V	2.4 6.0	3.0	0	2.9	0	2.9	0	2.9	0	3.0	0	3.0	0	3.0	0	3.0	0	3.0	0
VOH5 V	3.7 6.0	4.2	0	4.2	.03	4.2	.01	4.2	.02	4.2	.03	4.1	.04	4.2	.04	4.2	.04	4.2	.02
VOH7 V	3.85 6.0	5.0	.02	5.0	.05	5.0	.02	5.0	.04	4.9	.05	4.9	.06	4.9	.05	4.9	.05	4.9	.03
VOL2 V	0 0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VOL4 V	0 0.5	.14	0	.14	.01	.14	0	.14	0	.14	0	.14	0	.15	0	.14	.01	.14	0
VOL5 V	0 0.5	.2	0	.21	.02	.2	.01	.2	.02	.2	.01	.22	.03	.21	.02	.2	.01	.2	.01
VOL7 V	0 1.65	.38	.02	.39	.04	.38	.02	.40	.04	.39	.03	.41	.06	.40	.07	.38	.02	.38	.02
I _{IH} nA	0 1000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I _{IL} nA	-1000 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ICCH uA	0 160	0	0	.88	.3	3.0	1.3	12.2	6.0	16	9.8	2.8	.7	62	134	53	118		
ICCL uA	0 160	0	0	.73	.26	2.5	1.1	10.7	5.5	15	9.1	2.4	.6	59	130	50	114		

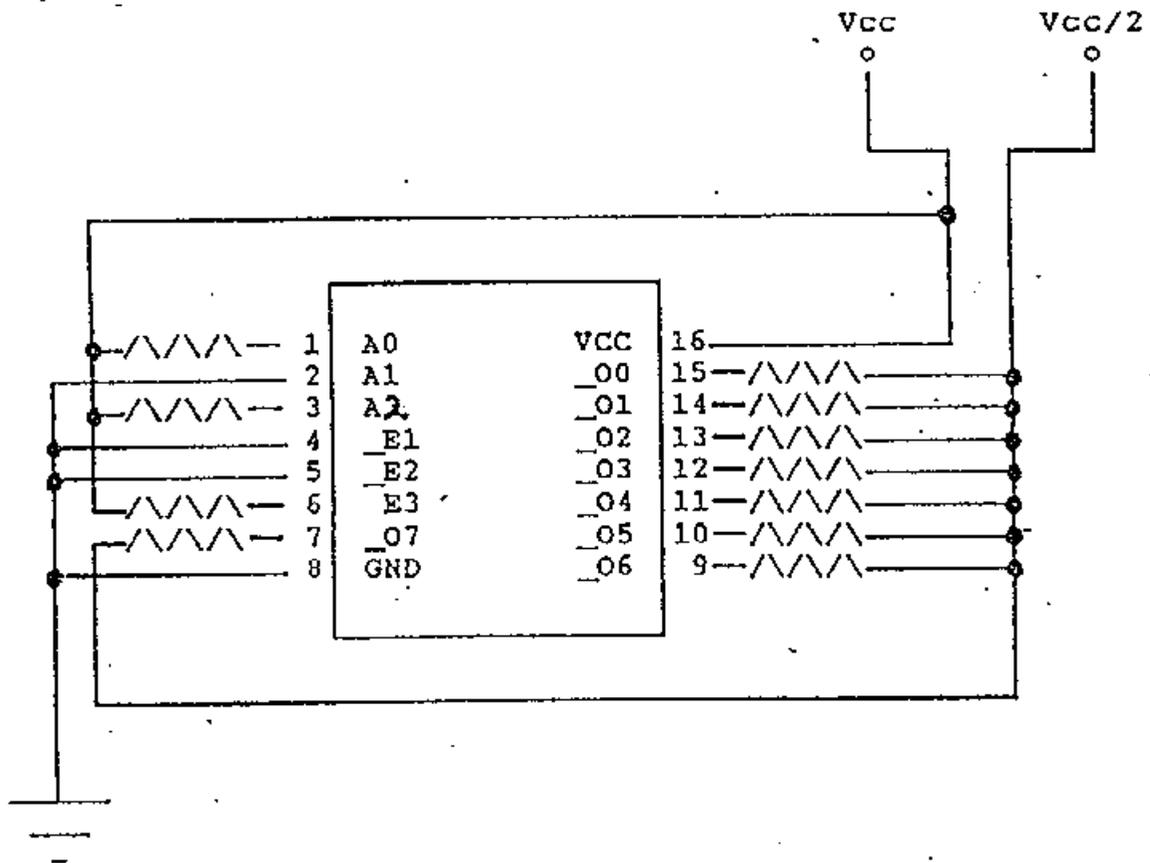
Notes:

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 the table.

2/ Table IV provides radiation characteristics of parts at selected total dose exposures and annealing treatments. The data at other radiation exposures and annealing treatments is available and can be obtained upon request.

3/ The data on VOH1, VOH3, VOL1, and VOL3 tracks similar to VOH2 and VOL2 etc. The values are not included in Table IV but are available on request.

Figure 1. Radiation Bias Circuit for 54AC138



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