Unisys

DATE: November 30, 1999 PPM-99-037
TO: R. Reed/562
FROM: K. Sahu/S. Kniffin/300.1
SUBJECT: Radiation Report on **54ABT245A (National Semiconductor) (LDC 9736)**
PROJECT: GLAS

cc: G. Henegar/564.9, R. Hardesty/550.0, A. Sharma/562, OFA Library/300.1

A radiation evaluation was performed on **54ABT245A (5962-9214802QSA) Octal Bidirectional Transceiver with TRI-STATE Outputs (National Semiconductor)** to determine the total dose tolerance of these parts. The total dose testing was performed using a Co^{60} gamma ray source. During the radiation testing, one part was irradiated under bias to determine the initial degradation level. Seven parts were then irradiated under bias (see Figure 1 for bias configuration) and two parts were used as control samples. The total dose radiation levels were 10.0, 17.5, 25.0, and 50.0kRads.[1] The average dose rate was 0.17kRads/hour (0.05Rads/s). See Table II for the radiation schedule and average dose rate calculation. After the 50.0kRad irradiation, the parts were annealed under bias at 25°C for 168 hours.[2] After each radiation exposure and annealing step, parts were electrically tested according to the test conditions and the specification limits[3] listed in Table III. An executive summary of the test results is provided below in bold, followed by a detailed summary of the test results after each radiation level and annealing step. See Figure 2 for more details.

All parts passed all functional tests up to 50kRads and all parametric tests up to 17.5kRads. After the 25kRad irradiation, four parts marginally exceeded the specification limit for ICCH_B_to_A. After the 50kRad irradiation, all parts exceeded the specification limit for ICCH_B_to_A. After annealing the parts at 25°C for 168 hours, the parts showed some recovery in ICCH_B_to_A.

Initial electrical measurements were made on 10 samples. One part was used to determine the initial degradation level (SN 7). Seven samples (SN's 9, 10, 11, 12, 13, 14, and 15) were used as radiation samples while SN's 6 and 8 were used as control samples. All parts passed all tests during initial electrical measurements.

All parts passed all tests up to 17.5kRads.

After the 25kRad irradiation, four parts marginally exceeded the specification limit of 250µA for ICCH_B_to_A with readings in the range of 254 to 291µA. **All parts passed all other tests.**

After the 50kRad irradiation, all parts exceeded the specification limit for ICCH_B_to_A with readings in the range of 406 to 700µA. **All parts passed all other tests.**

After annealing the parts for 168 hours at 25°C, the parts showed some recovery in ICCH_B_to_A with five parts exceeding the specification limit with readings in the range of 254 to 323µA.

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

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

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[1] The term Rads, as used in this document, means Rads (silicon). All radiation levels cited are cumulative.
[2] The temperature 25°C as used in this document implies room temperature.
[3] These are manufacturer's pre-irradiation data specification limits. The manufacturer provided no post-irradiation limits at the time these tests were performed.

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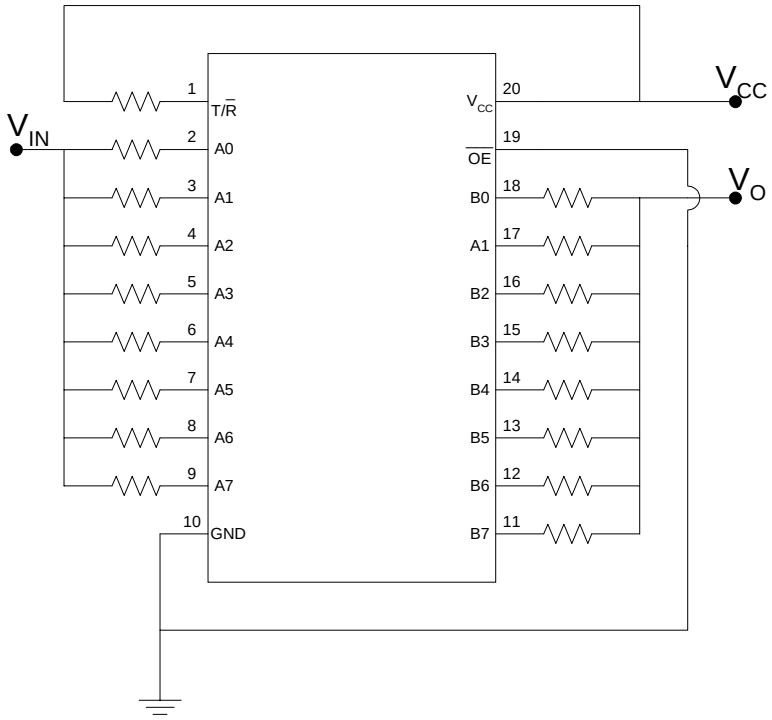
Figure 1. Radiation Bias Circuit for 54ABT245A



Notes:
1. V_{CC} = +5.0V±0.5V.
2. V_O = +2.5V ±0.25V.
3. V_{IN} = +2.0V±0.2V.
4. R = 1kΩ ±5%, ¼W.

TABLE I. Part Information

Generic Part Number:	54ABT245A
GLAS Part Number	5962-9214802QSA
GLAS TID Requirement	25kRads (RDM = 5)
Charge Number:	M90432
Manufacturer:	National Semiconductor
Lot Date Code (LDC):	9736
Quantity Tested:	10
Serial Numbers of Control Samples:	6, 8
Serial Number of Initial Degradation Sample:	7
Serial Numbers of Radiation Samples:	9, 10, 11, 12, 13, 14, 15
Part Function:	Octal Bidirectional Transceiver
Part Technology:	
Package Style:	20 Pin Flatpack
Test Equipment:	A540
Test Engineer:	S. Archer-Davies

- The manufacturer for this part guaranteed no radiation tolerance/hardness.

TABLE II. Radiation Schedule for 54ABT245A

EVENT	DATE
1) INITIAL ELECTRICAL MEASUREMENTS	10/01/99
One Part Test Runs	
2) 8 KRAD IRRADIATION (0.127 KRADS/HOUR)	10/01/99
POST-8 KRAD ELECTRICAL MEASUREMENT	10/04/99
3) 16.0 KRAD IRRADIATION (0.177 KRADS/HOUR)	10/04/99
POST-16.0 KRAD ELECTRICAL MEASUREMENT	10/06/99
4) 24.0 KRAD IRRADIATION (0.181 KRADS/HOUR)	10/06/99
POST-24.0 KRAD ELECTRICAL MEASUREMENT	10/08/99
All Remaining Parts	
5) 10.0 KRAD IRRADIATION (0.150 KRADS/HOUR)	10/15/99
POST 10.0 KRAD ELECTRICAL MEASUREMENT	10/18/99
6) 17.5 KRAD IRRADIATION (0.179 KRADS/HOUR)	10/18/99
POST-17.5 KRAD ELECTRICAL MEASUREMENT	10/20/99
7) 25.0 KRAD IRRADIATION (0.166 KRADS/HOUR)	10/20/99
POST-25.0 KRAD ELECTRICAL MEASUREMENT	10/22/99
8) 50.0 KRAD IRRADIATION (0.180 KRADS/HOUR)	10/22/99
POST-50.0 KRAD ELECTRICAL MEASUREMENT	10/28/99
9) 168 HOUR ANNEALING @25°C	10/28/99
POST-168 HOUR ANNEAL ELECTRICAL MEASUREMENT	11/04/99

Average Dose Rate = 50,000 RADS/289 HOURS=173.0 RADS/HOUR=0.05RADS/SEC

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

Table III. Electrical Characteristics 54ABT245A (1)

Test #	Parameter	Units	Spec. Limit min	Spec. Limit max	Test Conditions
10	Functional A to B	P/F			V_{IL} = 0.8V, V_{IH} = 2.0V, Verify output V_O
20	Functional B to A	P/F			V_{IL} = 0.8V, V_{IH} = 2.0V, Verify output V_O
100-107, 120-127	Vout_A_and_B	V	2.5	4.5	For all inputs affecting output under test, V_{IN} = 2.0V or 0.8V, I_{OH} = -3mA, V_{CC} = 4.5V
130-137, 140-147	Vout_A_and_B	V	3.0	5.0	For all inputs affecting output under test, V_{IN} = 2.0V or 0.8V, I_{OH} = -3mA, V_{CC} = 5.0V
150-157, 160-167	Vout_A_and_B	V	2.0	5.5	For all inputs affecting output under test, V_{IN} = 2.0V or 0.8V, I_{OH} = -24mA, V_{CC} = 5.5V
200-207, 250-257	Iout_A_and_B	mA	-180	-50	V_{OUT} = 2.5V, V_{CC} = 5.5V
300-307, 350-357	Vout_A_and_B	V	0	0.55	For all inputs affecting output under test, V_{IN} = 2.0V or 0.8V, I_{OH} = 483mA, V_{CC} = 4.5V
400-407, 410-417	IOZL_B_and_A	µA	-10	10	For all control inputs affecting output under test, V_{IN} = V_{IH} or V_{IL}, V_{IH} = 2.0V, V_{IL} = 0.8V, V_{OUT} = 2.7V, V_{CC} = 5.5V
420-427, 430-437	IOZH_A_and_B	µA	-10	10	For all control inputs affecting output under test, V_{IN} = V_{IH} or V_{IL}, V_{IH} = 2.0V, V_{IL} = 0.8V, V_{OUT} = 2.7V, V_{CC} = 5.5V
500-507, 550-557	ICEX_A_and_B	µA	-50	50	For output under test V_{OUT} = 5.5V, Outputs at high logic state, V_{CC} = 5.5V
600-607, 650-657	IOFF_A_and_B	µA	-100	100	For output under test V_{IN} or V_{OUT} = 4.5V, all other pins = 0.0V, V_{CC} = 0.0V
700-708, 750-758	Vic_A_B_TR_OE	V	-1.2	0	For input under test I_{IN} = -18mA, V_{CC} = 4.5V
800	IIH_T_R	µA	-1.0	1.0	For input under test V_{IN} = $V_{CC,}$ V_{CC} = 5.5V
801	IIH_OE_	µA	-1.0	1.0	For input under test V_{IN} = $V_{CC,}$ V_{CC} = 5.5V
810-817, 820-827	IIH_A_and_B	µA	-100	100	For input under test V_{IN} = $V_{CC,}$ V_{CC} = 5.5V
830	IIL_T_R	µA	-1.0	1.0	For input under test V_{IN} = $V_{CC,}$ V_{CC} = 5.5V
831	IIL_OE_	µA	-1.0	1.0	For input under test V_{IN} = $V_{CC,}$ V_{CC} = 5.5V
840-847, 850-857	IIL_A_and_B	µA	-100	100	For input under test V_{IN} = $V_{CC,}$ V_{CC} = 5.5V
900	ICCH_B_to_A	µA	0	250	V_{IN} = V_{CC} or GND, I_{OUT} = 0A, A or B Ports, V_{CC} = 5.5V
910	ICCH_A_to_B	µA	0	250	V_{IN} = V_{CC} or GND, I_{OUT} = 0A, A or B Ports, V_{CC} = 5.5V
920	ICCL_A_to_B	mA	0	30	V_{IN} = V_{CC} or GND, I_{OUT} = 0A, A or B Ports, V_{CC} = 5.5V
930	ICCL_B_to_A	mA	0	30	V_{IN} = V_{CC} or GND, I_{OUT} = 0A, A or B Ports, V_{CC} = 5.5V
940	ICCZH	mA	0	30	V_{IN} = V_{CC} or GND, I_{OUT} = 0A, A or B Ports, V_{CC} = 5.5V
950	ICCZL	mA	0	30	V_{IN} = V_{CC} or GND, I_{OUT} = 0A, A or B Ports, V_{CC} = 5.5V

Notes:

(1) These are the manufacturer's non-irradiated data sheet specification limits. The manufacturer provided no post-irradiation limits at the time the tests were performed.

TABLE IV: Summary of Electrical Measurements after Total Dose Exposures and Annealing for 54ABT245A (1)

					Total Dose Exposure (kRads Si)										Annealing	
					Initial		10.0		17.5		25.0		50.0		168 hours @25°C	
Test #	Parameters	Units	Spec. Lim. (2) min	Spec. Lim. (2) max	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
10	Functional A to B (	P/F			P		P		P		P		P		P	
20	Functional B to A (	P/F			P		P		P		P		P		P	
100-107, 120-12	Vout_A_and_B	V	2.5	4.5	3.0	0.1	3.0	0.1	3.0	0.1	3.0	0.1	3.0	0.1	3.0	0.1
130-137, 140-14	Vout_A_and_B	V	3.0	5.0	3.5	0.1	3.5	0.1	3.5	0.1	3.5	0.1	3.5	0.1	3.5	0.1
150-157, 160-16	Vout_A_and_B	V	2.0	5.5	4.0	0.1	4.0	0.1	4.0	0.1	4.0	0.1	4.0	0.1	4.0	0.1
200-207, 250-25	Iout_A_and_B	mA	-180	-50	-108	2	-107	2	-107	1	-106	1	-106	1	-107	1
300-307, 350-35	Vout_A_and_B	V	0	0.55	0.32	0.01	0.32	0.01	0.32	0.01	0.32	0.01	0.32	0.01	0.32	0.01
400-407, 410-41	IOZL_B_and_A	mA	-10	10	0.06	0.02	0.06	0.02	0.06	0.02	0.06	0.02	0.06	0.02	0.06	0.02
420-427, 430-43	IOZH_A_and_B	mA	-10	10	0.05	0.02	0.05	0.02	0.05	0.02	0.05	0.02	0.05	0.02	0.05	0.02
500-507, 550-55	ICEX_A_and_B	mA	-50	50	0.04	0.02	0.04	0.02	0.04	0.02	0.04	0.02	0.04	0.02	0.04	0.02
600-607, 650-65	IOFF_A_and_B	mA	-100	100	0.06	0.02	0.06	0.02	0.06	0.02	0.06	0.02	0.06	0.02	0.06	0.02
700-708, 750-75	Vic_A_B_TR_OE	V	-1.2	0	-0.7	0.05	-0.8	0.05	-0.8	0.05	-0.8	0.05	-0.8	0.05	-0.8	0.05
800	IIH_T_R	mA	-1.0	1.0	0.007	0.001	0.007	0.001	0.007	0.001	0.007	0.001	0.007	0.001	0.007	0.001
801	IIH_OE_	mA	-1.0	1.0	0.003	0.001	0.003	0.001	0.003	0.001	0.003	0.001	0.003	0.001	0.003	0.001
810-817, 820-82	IIH_A_and_B	mA	-100	100	1.0	0.8	1.0	0.5	1.0	0.5	1.0	0.5	1.0	0.5	1.0	0.5
830	IIL_T_R	mA	-1.0	1.0	0.010	0.012	0.010	0.012	0.010	0.012	0.010	0.012	0.010	0.012	0.010	0.012
831	IIL_OE_	mA	-1.0	1.0	0.012	0.018	0.012	0.018	0.012	0.018	0.012	0.018	0.012	0.018	0.012	0.018
840-847, 850-85	IIL_A_and_B	mA	-100	100	0	0	0	0	0	0	0	0	0	0	0	0
900	ICCH_B_to_A	mA	0	250	127	8	124	3	131	3	247	28	549	105	268	39
910	ICCH_A_to_B	mA	0	250	124	5	124	3	125	3	139	6	150	12	134	6
920	ICCL_A_to_B	mA	0	30	22	0.5	22	0.5	22	0.5	22	0.5	22	0.5	22	0.5
930	ICCL_B_to_A	mA	0	30	22	0.5	22	0.5	22	0.5	22	0.5	22	0.5	22	0.5
940	ICCZH	mA	0	30	22	0.5	22	0.5	22	0.5	22	0.5	22	0.5	22	0.5
950	ICCZL	mA	0	30	22	0.5	22	0.5	22	0.5	22	0.5	22	0.5	22	0.5

Notes:

(1) The mean and standard deviation values were calculated over the seven parts irradiated in this testing. The control samples remained constant throughout testing and are not included ir

(2)

(3) A P indicates that all parts passed the functional test at that level.

Radiation sensitive parameters: ICCH_B_to_A.