

Unisys

DATE: September 10, 1998 PPM-98-025
TO: J. Dafnis/303
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SUBJECT: Radiation Report on **DS7830J (National Semiconductor) (LDC 9749)**
PROJECT: GOES (ITT)

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A radiation evaluation was performed on **DS7830 Dual Differential Line Driver (National Semiconductor)** to determine the total dose tolerance of these parts. The total dose testing was performed using a Co⁶⁰ 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 levels were 20.0, 40.0, 60.0, 80.0, 100.0, 150.0, and 200.0 kRads.¹ The dose rate was 1.200 kRads/hour (0.33 Rads/s). See Table II for the radiation schedule and effective dose rate calculation. After the 200.0 kRad irradiation, the parts were annealed under bias at 25°C and tested after 24 and 168 hours.² After each radiation exposure and annealing treatment, parts were electrically tested according to the test conditions and the specification limits³ 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. For detailed information, refer to Tables I through IV and Figure 1.

All parts passed all tests up to 200kRads with no significant degradation in any parameter. The parts showed no change after any annealing step at 25°C.

Initial electrical measurements were made on 10 samples. Eight samples (SN's 257, 258, 259, 260, 261, 262, 264, and 265) were used as radiation samples while SN's 255 and 256 were used as control samples. All parts passed all tests during initial electrical measurements.

All parts passed all tests up to 200.0 kRads with no significant degradation in any parameter.

After annealing the parts for 24 hours at 25°C, the parts showed no significant change in any parameter.

After annealing the parts for 168 hours at 25°C, the parts showed no significant change in any parameter.

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.

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.

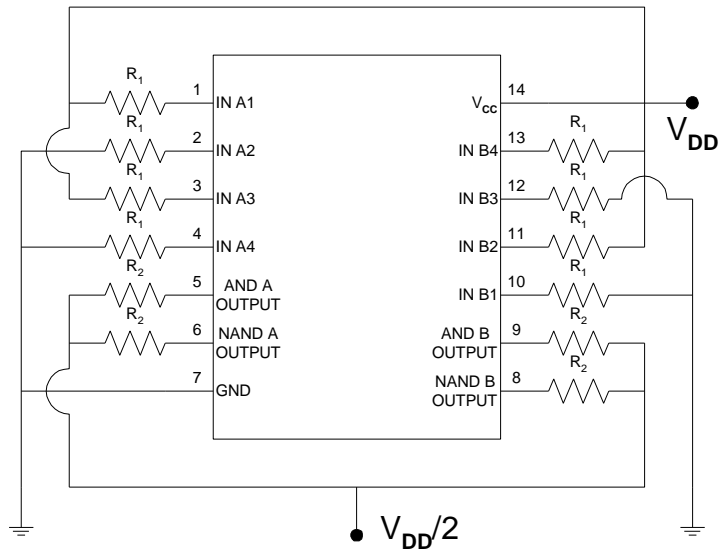
³ These are manufacturer's pre-irradiation data specification limits. The manufacturer provided no post-irradiation limits at the time these tests were performed.

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Figure 1. Radiation Bias Circuit for DS7830



Notes:

1. $V_{DD} = 5.0V \pm 0.5V$.
2. $V_{DD}/2 = 2.5V \pm 0.5V$.
3. $R_1 = 2.0k\Omega \pm 5\%$, $\frac{1}{4}W$.
4. $R_2 = 4.7k\Omega \pm 5\%$, $\frac{1}{4}W$.

TABLE I. Part Information

Generic Part Number:	DS7830
GOES (ITT) Part Number	DS7830J
Charge Number:	C80709/C80825
Manufacturer:	National Semiconductor
Lot Date Code (LDC):	9749
Quantity Tested:	10
Serial Number of Control Samples:	255, 256
Serial Numbers of Radiation Samples:	257, 258, 259, 260, 261, 262, 264, and 265
Part Function:	Dual Differential Line Driver
Part Technology:	Bipolar
Package Style:	14 Pin DIP
Test Equipment:	A540
Test Engineer:	S. Archer-Davies

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

TABLE II. Radiation Schedule for DS7830

EVENT.....	DATE
1) INITIAL ELECTRICAL MEASUREMENTS	08/17/98
2) 20.0 KRAD IRRADIATION (1.200 KRADS/HOUR)	08/17/98
POST-20.0 KRAD ELECTRICAL MEASUREMENT	08/18/98
3) 40.0 KRAD IRRADIATION (1.200 KRADS/HOUR)	08/18/98
POST-40.0 KRAD ELECTRICAL MEASUREMENT	08/19/98
4) 60.0 KRAD IRRADIATION (1.200 KRADS/HOUR)	08/19/98
POST-60.0 KRAD ELECTRICAL MEASUREMENT	08/20/98
5) 80.0 KRAD IRRADIATION (1.200 KRADS/HOUR)	08/20/98
POST-80.0 KRAD ELECTRICAL MEASUREMENT	08/21/98
6) 72 HOUR ANNEALING @25°C *	08/21/98
POST-72 HOUR ANNEAL ELECTRICAL MEASUREMENT.....	08/24/98
7) 100.0 KRAD IRRADIATION (1.200 KRADS/HOUR).....	08/24/98
POST-100.0 KRAD ELECTRICAL MEASUREMENT	08/25/98
8) 150.0 KRAD IRRADIATION (1.200 KRADS/HOUR).....	08/25/98
POST-150.0 KRAD ELECTRICAL MEASUREMENT	08/27/98
9) 200.0 KRAD IRRADIATION (0.450 KRADS/HOUR).....	08/27/98
POST-200.0 KRAD ELECTRICAL MEASUREMENT	08/31/98
10) 24 HOUR ANNEALING @25°C	08/31/98
POST-24 HOUR ANNEAL ELECTRICAL MEASUREMENT.....	09/01/98
11) 168 HOUR ANNEALING @25°C	08/31/98
POST-168 HOUR ANNEAL ELECTRICAL MEASUREMENT.....	09/03/98

Effective Dose Rate = 200,000 RADS/14 DAYS=595.2 RADS/HOUR=0.16 RADS/SEC

The effective dose rate is lower than that of the individual radiation steps as it takes into account the weekend and the extended step.

* The annealing step was included due to the weekend.

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

Table III. Electrical Characteristics of DS7830 /1

Test #	Parameter	Units	Test Conditions /2	Spec. min	Lim. max
100	Gross Functional				
200-203	Ih1_InA	mA	V_{IN} = 2.4V (Logic 1)	0	120
204-207	Ih1_InB	mA	V_{IN} = 2.4V (Logic 1)	0	120
250-253	Ih2_InA	mA	V_{IN} = 5.5V (Logic 1)	0	2000
254-257	Ih2_InB	mA	V_{IN} = 5.5V (Logic 1)	0	2000
300-303	Iil_InA	mA	V_{IN} = 0.4V (Logic 0)	-4.80	0
304-307	Iil_InB	mA	V_{IN} = 0.4V (Logic 0)	-4.80	0
400-403	VOH1	V	V_{IN} = 0.8V, I_{OUT} = -0.8mA	2.400	
450-453	VOH2	V	V_{IN} = 0.8V, I_{OUT} = 0.8mA	1.800	
500-503	VOL1	mV	V_{IN} = 0.8V, I_{OUT} = 0.8mA	0	400
550-553	VOL2	mV	V_{IN} = 0.8V, I_{OUT} = 0.8mA	0	500
600-603	IOS	mA	V_{CC} = 5.0V	-120	40
700-703	VIC_In1	V	V_{CC} = Min, I_{IN} = -12mA	-1.50	0
704-707	VIC_In2	V	V_{CC} = Min, I_{IN} = -12mA	-1.50	0
800	ICC	mA	V_{IN} = 5.0V	0	36
900-903	TPD	ns	R_L = 400Ω, C_L = 15pF	0	18

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.

2/ For all tests, V_{DD} = 5V, except where otherwise noted.

TABLE IV: Summary of Electrical Measurements after Total Dose Exposures and Annealing for DS7830 /1

Test #	Parameters	Units	Spec. Lim. /2		Total Dose Exposure (kRads Si)																Annealing		Total Dose Exposure (kRads Si)						Annealing			
					Initial		20.0		40.0		60.0		80.0		72 hours @25°C		100.0		150.0		200.0		24 hours @25°C		168 hours @25°C							
					mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd				
100	Gross Functional				0		0		0		0		0		0		0		0		0		0		0							
200-203	Ih1_InA	?A	0	120	17	1	16	1	15	1	14	1	14	1	14	1	14	1	13	1	13	1	13	1	14	1						
204-207	Ih1_InB	?A	0	120	17	1	16	1	15	1	14	1	14	1	14	1	14	1	13	1	13	1	13	1	14	1						
250-253	Ih2_InA	?A	0	2000	23	1	21	1	20	1	19	1	19	1	19	1	19	1	18	1	18	1	18	1	18	1						
254-257	Ih2_InB	?A	0	2000	23	1	21	1	20	1	19	1	19	1	19	1	19	1	18	1	18	1	18	1	18	1						
300-303	Iil_InA	mA	-4.80	0	-2.86	0.01	-2.78	0.06	-2.78	0.06	-2.75	0.06	-2.76	0.06	-2.74	0.06	-2.74	0.06	-2.73	0.06	-2.73	0.06	-2.73	0.06	-2.73	0.06						
304-307	Iil_InB	mA	-4.80	0	-2.86	0.01	-2.77	0.06	-2.77	0.06	-2.75	0.05	-2.76	0.06	-2.74	0.06	-2.74	0.06	-2.73	0.06	-2.73	0.06	-2.73	0.06	-2.73	0.06						
400-403	VOH1	V	2.40		3.02	0	3.02	0.01	3.02	0	3.02	0	3.02	0	3.02	0	3.02	0	3.02	0.01	3.02	0.01	3.02	0.01	3.02	0.01						
450-453	VOH2	V	1.80		2.36	0.01	2.35	0.01	2.34	0.01	2.33	0.01	2.33	0.01	2.33	0.01	2.33	0.01	2.32	0.01	2.32	0.01	2.31	0.01	2.33	0.01						
500-503	VOL1	mV	0	400	217	0	218	2	220	2	219	3	221	3	223	2	222	2	223	3	224	2	225	2	223	5						
550-553	VOL2	mV	0	500	251	1	257	4	257	2	258	2	260	3	258	2	259	2	263	4	264	3	263	3	264	5						
600-603	IOS	mA	-120	40	-82	1	-81	1	-82	1	-82	1	-81	1	-82	1	-81	1	-82	1	-82	1	-82	1	-81	1						
700-703	VIC_In1	V	-1.50	0	-0.85	0	-0.83	0	-0.82	0	-0.85	0	-0.85	0	-0.85	0	-0.85	0	-0.85	0	-0.85	0	-0.85	0	-0.84	0						
704-707	VIC_In2	V	-1.50	0	-0.93	0	-0.92	0	-0.93	0	-0.93	0	-0.93	0	-0.93	0	-0.93	0	-0.93	0	-0.93	0	-0.93	0	-0.93	0						
800	ICC	mA	0	36	18.5	0.1	18.1	0.3	18.1	0.3	18.1	0.3	18.0	0.3	18.0	0.3	18.0	0.3	18.0	0.3	18.0	0.3	18.0	0.3	18.0	0.3						
900-903	TPD	ns	0	18	11.0	0	11.2	0.3	11.1	0.2	11.1	0.2	11.1	0.2	11.2	0.3	11.2	0.3	11.2	0.3	11.2	0.3	11.2	0.3	11.4	0.2						

1/ The mean and standard deviation values were calculated over the eight parts irradiated in this testing. The control samples remained constant throughout testing and are 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.

Radiation sensitive parameters: None.