Unisys

DATE: May 08, 1998 PPM-98-016
TO: R. Koehler/303
FROM: K. Sahu/S. Kniffin/300.1
SUBJECT: Radiation Report on **PE21198 (M83532/02D006BA) (LDC 9740)**
PROJECT: Integral Spectrometer

cc: F. Duttweiler/UCSD, R. Reed/562, A. Sharma/562, OFA Library/300.1

A radiation evaluation was performed on **PE21198 (M83532/02D0006BA) Delay Line (Hytek/Pulse Engineering)** 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, five 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 10.0, 20.0, 30.0, 50.0, 75.0, and 100.0 kRads.[1] The dose rate was between 0.300 and 1.250 kRads/hour (0.08 to 0.35 Rads/s). See Table II for the radiation schedule and effective dose rate calculation. After the 100.0 kRad irradiation, the parts were annealed under bias at 25°C and tested after 168 hours.[2] After each radiation exposure and annealing treatment, parts were electrically tested according to the test conditions and the specification limits[3] listed in Table III. A summary of the test results is provided below, for detailed information, refer to Tables I through IV and Figure 1.

Initial electrical measurements were made on 6 samples. Five samples (SN's 328, 329, 330, 331, and 332) were used as radiation samples while SN 327 was used as a control sample. All parts passed all tests during initial electrical measurements.

All parts passed all tests up to 100.0 kRads. No significant degradation was noted in any parameter.

After annealing the parts for 168 hours at 25°C, 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.

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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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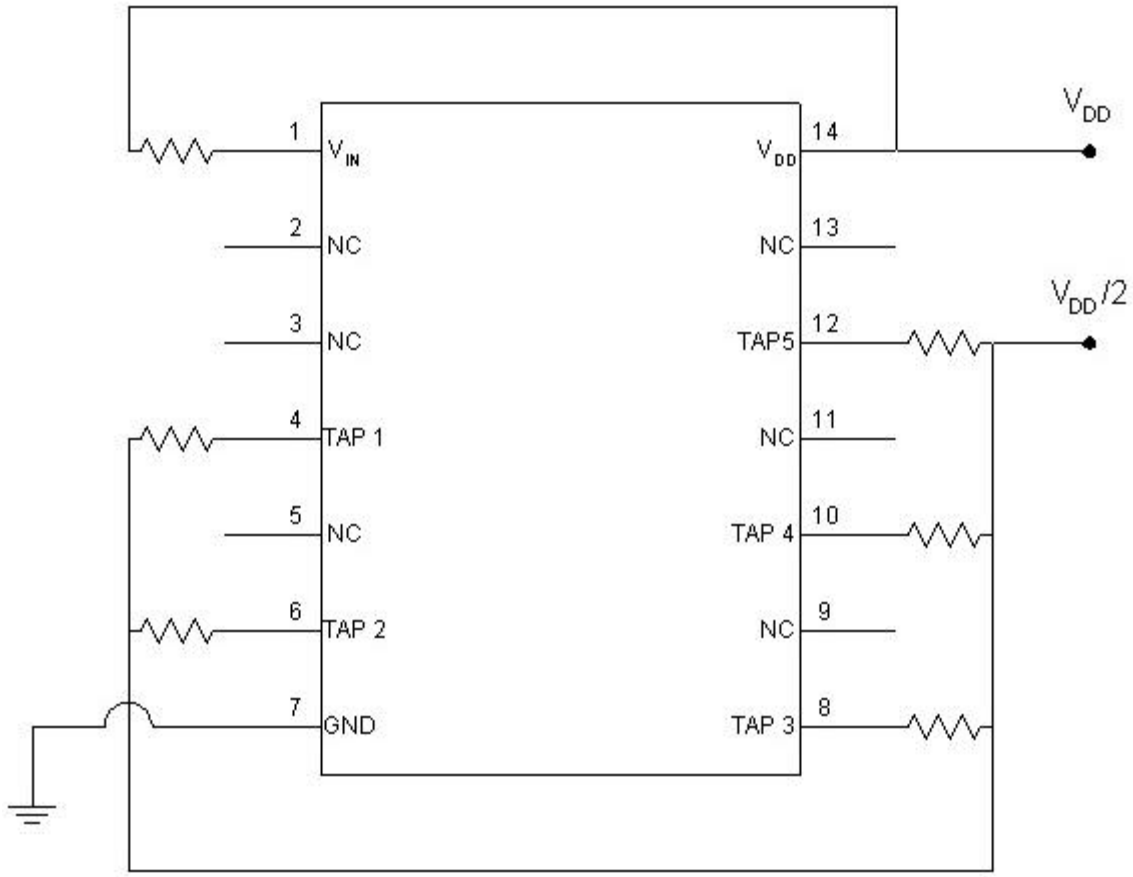
Figure 1. Radiation Bias Circuit for PE21198



Notes:
1. R_L = 2kΩ ±5%, ¼W.
2. V_{DD} = 5V ±0.5V, $V_{DD}/2$ = 2.5V ±0.1V.

TABLE I. Part Information

Generic Part Number:	PE21198
Integral Spectrometer Part Number	PE21198 (M83532/02D006BA)
Charge Number:	C80777
Manufacturer:	Hytek/Pulse Engineering
Lot Date Code (LDC):	9740
Quantity Tested:	6
Serial Number of Control Samples:	327
Serial Numbers of Radiation Samples:	328, 329, 330, 331, and 332
Part Function:	Delay Line
Part Technology:	Bipolar
Package Style:	14-Pin DIP (Metal Case)
Test Equipment:	A540
Test Engineer:	S. Archer-Davies

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

TABLE II. Radiation Schedule for PE21198

EVENT	DATE
1) INITIAL ELECTRICAL MEASUREMENTS	04/09/98
2) 10.0 KRAD IRRADIATION (0.500 KRADS/HOUR)	04/21/98
POST-10.0 KRAD ELECTRICAL MEASUREMENT	04/22/98
3) 20.0 KRAD IRRADIATION (0.500 KRADS/HOUR)	04/22/98
POST-20.0 KRAD ELECTRICAL MEASUREMENT	04/23/98
4) 30.0 KRAD IRRADIATION (0.500 KRADS/HOUR)	04/23/98
POST-30.0 KRAD ELECTRICAL MEASUREMENT	04/24/98
5) 50.0 KRAD IRRADIATION (0.300 KRADS/HOUR)	04/24/98
POST-50.0 KRAD ELECTRICAL MEASUREMENT	04/27/98
6) 75.0 KRAD IRRADIATION (1.250 KRADS/HOUR)	04/27/98
POST-75.0 KRAD ELECTRICAL MEASUREMENT	04/28/98
7) 100.0 KRAD IRRADIATION (1.250 KRADS/HOUR)	04/28/98
POST-100.0 KRAD ELECTRICAL MEASUREMENT	04/29/98
8) 168 HOUR ANNEALING @25°C	04/29/98
POST-168 HOUR ANNEAL ELECTRICAL MEASUREMENT	05/06/98

Effective Dose Rate = 100,000 RADS/8 DAYS=520.8 RADS/HOUR=0.14 RADS/SEC
The effective dose rate is lower than that of the individual radiation steps as it takes into account the time needed to test the parts.

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

Table III. Electrical Characteristics of PE21198 /1

Test #	Parameter /2	Units	Test Conditions	Spec. min	Lim. max
1	Icc	mA	V_{CC} = 5.5V, V_I = 0V		75
2	voh_tap1	V	V_{CC} = 4.5V, V_{IH} = 2.0V, I_{OH} = -1mA	2.50	
3	voh_tap2	V	V_{CC} = 4.5V, V_{IH} = 2.0V, I_{OH} = -1mA	2.50	
4	voh_tap3	V	V_{CC} = 4.5V, V_{IH} = 2.0V, I_{OH} = -1mA	2.50	
5	voh_tap4	V	V_{CC} = 4.5V, V_{IH} = 2.0V, I_{OH} = -1mA	2.50	
6	voh_tap5	V	V_{CC} = 4.5V, V_{IH} = 2.0V, I_{OH} = -1mA	2.50	
7	vol_tap1	V	V_{CC} = 4.5V, V_{IH} = 0.8V, I_{OH} = 20mA		0.50
8	vol_tap2	V	V_{CC} = 4.5V, V_{IH} = 0.8V, I_{OH} = 20mA		0.50
9	vol_tap3	V	V_{CC} = 4.5V, V_{IH} = 0.8V, I_{OH} = 20mA		0.50
10	vol_tap4	V	V_{CC} = 4.5V, V_{IH} = 0.8V, I_{OH} = 20mA		0.50
11	vol_tap5	V	V_{CC} = 4.5V, V_{IH} = 0.8V, I_{OH} = 20mA		0.50
12	Iih1	µA	V_{CC} = 5.5V, V_{IH} = 2.7V		50
13	Iih2	mA	V_{CC} = 5.5V, V_{IH} = 5.5V		1.00
14	Iil	mA	V_{CC} = 5.5V, V_{IL} = 0.5V		2.00
15	V_CLAMP	V	V_{CC} = 4.5V, I_I = -18mA, T_C = 25°C	-1.20	
A	Tap 1	ns	V_{CC} = 5V, V_{IN} = 3V (pulse)	8	10
B	Tap 2	ns	V_{CC} = 5V, V_{IN} = 3V (pulse)	18	22
C	Tap 3	ns	V_{CC} = 5V, V_{IN} = 3V (pulse)	28	32
D	Tap 4	ns	V_{CC} = 5V, V_{IN} = 3V (pulse)	38	42
E	Tap 5	ns	V_{CC} = 5V, V_{IN} = 3V (pulse)	47.5	52.5

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 Anneali

					Total Dose Exposure (kRads Si)														Annealing	
					Initial		10.0		20.0		30.0		50.0		75.0		100.0		168 hours @25°C	
Test #	Parameters	Units	Spec. Lim. /2 min	max	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
1	Icc	mA		75	43	0.1	43	0.1	43	0.1	43	0.1	43	0.1	43	0.1	43	0.1	43	0.1
2	voh_tap1	V	2.50		4.2	0.04	4.2	0.04	4.2	0.05	4.2	0.05	4.2	0.05	4.2	0.04	4.2	0.04	4.2	0.04
3	voh_tap2	V	2.50		4.3	0.04	4.3	0.04	4.3	0.04	4.3	0.05	4.3	0.05	4.3	0.04	4.3	0.05	4.3	0.05
4	voh_tap3	V	2.50		4.3	0.05	4.3	0.05	4.3	0.05	4.3	0.05	4.3	0.05	4.3	0.05	4.3	0.05	4.3	0.05
5	voh_tap4	V	2.50		4.3	0.04	4.3	0.04	4.3	0.05	4.3	0.05	4.3	0.05	4.3	0.06	4.3	0.06	4.3	0.06
6	voh_tap5	V	2.50		4.3	0.04	4.3	0.05	4.3	0.05	4.3	0.05	4.3	0.05	4.3	0.05	4.3	0.05	4.3	0.05
7	vol_tap1	V		0.50	0.13	0	0.13	0	0.13	0	0.13	0	0.13	0	0.13	0	0.13	0	0.13	0
8	vol_tap2	V		0.50	0.13	0	0.13	0	0.13	0	0.13	0	0.13	0	0.13	0	0.13	0	0.13	0
9	vol_tap3	V		0.50	0.13	0	0.13	0	0.13	0	0.13	0	0.13	0	0.13	0	0.13	0	0.13	0
10	vol_tap4	V		0.50	0.13	0	0.13	0	0.13	0	0.13	0	0.13	0	0.13	0	0.13	0	0.13	0
11	vol_tap5	V		0.50	0.13	0	0.13	0	0.13	0	0.13	0	0.13	0	0.13	0	0.13	0	0.13	0
12	Iih1	? A		50	0	1.1	0	1.3	0	1.3	-1	1.1	-1	0	1	2.1	6	4.5	2	1.0
13	Iih2	mA		1.00	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0	0
14	Iil	mA		2.00	-0.07	0	-0.08	0	-0.08	0	-0.08	0	-0.08	0	-0.08	0	-0.08	0	-0.09	0
15	V_CLAMP	V	-1.20		-0.88	0	-0.88	0	-0.88	0	-0.88	0	-0.88	0	-0.88	0	-0.88	0	-0.89	0.01
A	Tap 1 /3	ns	8	10	10.2	0.08													10.4	0.20
B	Tap 2 /3	ns	18	22	20.6	0.14													20.7	0.33
C	Tap 3 /3	ns	28	32	30.4	0.20													30.4	0.31
D	Tap 4 /3	ns	38	42	40.8	0.22													41.1	0.23
E	Tap 5 /3	ns	47.5	52.5	50.7	0.80													50.9	0.87

Notes:

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

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 we

3/ Due to the complexity of the bench setup needed to read the propogation delay, the measurements were only made initially and after final annealing.

Radiation sensitive parameters: None.