

Unisys

DATE: October 21, 1997
TO: J. Lohr/311
FROM: K. Sahu/300.1
SUBJECT: Radiation Report on: SHD3166
Project: SMEX/LITE
Job #: C78111
Project part #: SHD3166AS

PPM-97-047

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A radiation evaluation was performed on SHD3166AS 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 Co⁶⁰ gamma ray source. During the radiation testing, five parts were irradiated under bias (see Figure 1 for bias configuration) and one part was used as a control sample. The total dose radiation levels were 5.0, 10.0, 15.0, 20.0, 30.0, 50.0, and 100.0 kRads.* The dose rate was between 0.125 and 0.625 kRads/hour (0.035 to 0.174 Rads/s). See Table II for the radiation schedule and effective dose rate calculation. After the 100.0 kRad exposure, the parts were annealed for 168 hours at 25°C. After each radiation exposure and annealing treatment, parts were electrically tested according to the test conditions and the specification limits** listed in Table III.

Initial electrical measurements were made on 6 samples. Five samples (SN's 251, 252, 253, 254, and 255) were used as radiation samples while SN 250 was used as a control sample. All parts passed all tests during initial electrical measurements.

All parts passed all tests up to 100 kRads.

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 me at (301) 731-8954.

* The term Rads, as used in this document, means Rads (silicon). All radiation levels cited are cumulative.

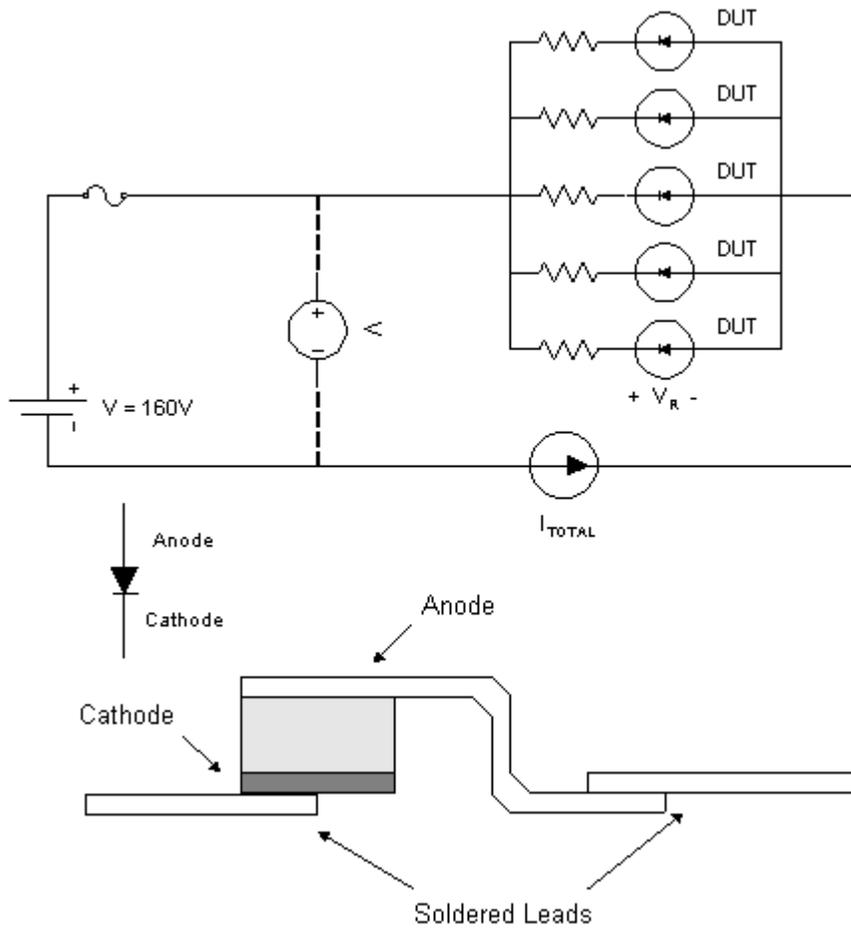
** These are manufacturer's pre-irradiation data specification limits. The manufacturer provided no post-irradiation limits at the time these tests were performed.

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Figure 1. Radiation Bias Circuit for SHD3166AS



Notes:

1. Power supply voltage is 160V max.
2. Resistors are $1k\Omega \pm 5\%$, $\frac{1}{2}$ W.
3. $N = \#$ of DUT in parallel.
4. $I_{MAX} = 25\mu A$ per DUT.
5. $I_{TOTAL} = N * I_{MAX} = 125\mu A$.
6. Fuse = $\frac{1}{4}$ A.

TABLE I. Part Information

Generic Part Number:	SHD3166
SMEX/LITE Part Number	SHD3166AS
Charge Number:	C78111
Manufacturer:	Sensitron Semiconductor
Lot Date Code (LDC):	9706
Quantity Tested:	6
Serial Number of Control Sample:	250
Serial Numbers of Radiation Samples:	251, 252, 253, 254, and 255
Part Function:	Ultra Fast Rectifier
Part Technology:	Bipolar
Package Style:	SHD1
Test Equipment:	Testronics
Test Engineer:	B. Chong

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

TABLE II. Radiation Schedule for SHD3166AS

EVENT.....	DATE
1) INITIAL ELECTRICAL MEASUREMENTS	09/22/97
2) 5.0 KRAD IRRADIATION (0.125 KRADS/HOUR)	09/23/97
POST-5.0 KRAD ELECTRICAL MEASUREMENT	09/25/97
3) 10.0 KRAD IRRADIATION (0.125 KRADS/HOUR)	09/25/97
POST-10.0 KRAD ELECTRICAL MEASUREMENT	09/27/97
4) 15.0 KRAD IRRADIATION (0.125 KRADS/HOUR)	09/27/97
POST-15.0 KRAD ELECTRICAL MEASUREMENT	09/30/97
5) 20.0 KRAD IRRADIATION (0.125 KRADS/HOUR)	10/01/97
POST-20.0 KRAD ELECTRICAL MEASUREMENT	10/03/97
6) 30.0 KRAD IRRADIATION (0.250 KRADS/HOUR)	10/03/97
POST-30.0 KRAD ELECTRICAL MEASUREMENT	10/06/97
7) 50.0 KRAD IRRADIATION (0.500 KRADS/HOUR)	10/06/97
POST-50.0 KRAD ELECTRICAL MEASUREMENT	10/08/97
8) 100.0 KRAD IRRADIATION (0.625 KRADS/HOUR).....	10/08/97
POST-100.0 KRAD ELECTRICAL MEASUREMENT	10/10/97
9) 240 HOUR ANNEALING @25°C	10/10/97
POST-240 HOUR ANNEAL ELECTRICAL MEASUREMENT	10/20/97

Effective Dose Rate = 100,000 RADS/18 DAYS=231.5 RADS/HOUR=0.064 RADS/SEC

The effective dose rate is lower than that of the individual radiation steps as it takes into account the time necessary for testing.

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

Table III. Electrical Characteristics of SHD3166AS /1

Test #	Parameter	Units	Test Conditions /2	Spec. min	Lim. max
01	VF	V	I_F = 20A		0.975
02	IR	mA	V = 200V		25
03	VBR	V	I = 25mA	200	

Note:

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/ $-41.25V < V_{IN} < -4.25V$ unless otherwise noted.

TABLE IV: Summary of Electrical Measurements after Total Dose Exposures and Annealing for SHD3166AS /1

Test #	Parameters	Units	Spec. Lim. /2		Total Dose Exposure (kRads)																Annealing	
					Initial		5.0		10.0		15.0		20.0		30.0		50.0		100.0		168 hours @25°C	
					mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
01	VF	V		0.975	0.923	0.010	0.918	0.009	0.923	0.009	0.925	0.011	0.931	0.010	0.917	0.010	0.922	0.009	0.935	0.005	0.924	0.009
02	IR	mA		25	0.7	0.3	0.7	0.3	0.7	0.3	0.7	0.3	0.7	0.3	0.8	0.3	0.7	0.3	0.7	0.3	0.7	0.3
03	VBR	V	200		200	0	200	0	200	0	200	0	200	0	200	0	200	0	200	0	200	0

Notes:

- 1/ The mean and standard deviation values were calculated over the five 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.