

Unisys

DATE: November 30, 1999
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SUBJECT: Radiation Report on **PIC7527 (SM627HRR) (Silicon General) (LDC 9450)**
PROJECT: HST/COS

PPM-99-038

cc: T. Perry/300.1, R. Reed/562, A. Sharma/562, OFA Library/300.1

A radiation evaluation was performed on **PIC7527 (SM627HRR) Switching Regulator (Silicon General)** 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, four 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 2.5, 5.0, 10.0, 20.0, 30.0, and 50.0kRads.¹ The average dose rate was 0.21kRads/hour (0.06Rads/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 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.

All parts passed all tests up to 50kRads. After annealing the parts at 25°C for 168 hours, the parts showed no significant change in any parameter.

Initial electrical measurements were made on 5 samples. Four samples (SN's 154, 155, 156, and 157) were used as radiation samples while SN 153 was used as a control sample. All parts passed all tests during initial electrical measurements.

All parts passed all tests up to 50.0kRads.

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.

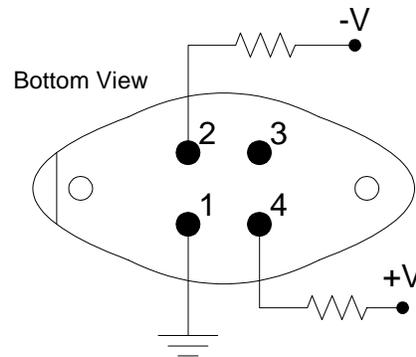
³ These are manufacturer's pre-irradiation data specification limits. The manufacturer provided no post-irradiation limits at the time these tests were performed.

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Figure 1. Radiation Bias Circuit for PIC7527 (SM627HRR)



Notes:

1. $+V = +80.0V \pm 0.5V$.
2. $-V = -80.0V \pm 0.5V$.
3. $R = 10k\Omega, 10\%, \frac{1}{2}W$.

Pin Out:

1. Output
2. Common
3. Drive
4. Input

TABLE I. Part Information

Generic Part Number:	SM627HRR
HST/COS Part Number	PIC7527
HST/COS TID Requirement	10kRads (RDM = 5)
Charge Number:	M90440
Manufacturer:	Silicon General
Lot Date Code (LDC):	9450
Quantity Tested:	5
Serial Number of Control Sample:	153
Serial Numbers of Radiation Samples:	154, 155, 156, 157
Part Function:	Switching Regulator
Part Technology:	Hybrid
Package Style:	4 Pin TO-66 Metal Can
Test Equipment:	Bench
Test Engineer:	S. Norris

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

TABLE II. Radiation Schedule for PIC7527 (SM627HRR)

EVENT	DATE
1) INITIAL ELECTRICAL MEASUREMENTS	09/23/99
2) 2.5 KRAD IRRADIATION (0.156 KRADS/HOUR).....	11/08/99
POST-2.5 KRAD ELECTRICAL MEASUREMENT	11/09/99
3) 5.0 KRAD IRRADIATION (0.116 KRADS/HOUR).....	11/09/99
POST-5.0 KRAD ELECTRICAL MEASUREMENT	11/10/99
4) 10.0 KRAD IRRADIATION (0.109 KRADS/HOUR).....	11/10/99
POST-10.0 KRAD ELECTRICAL MEASUREMENT	11/12/99
5) 20.0 KRAD IRRADIATION (0.152 KRADS/HOUR).....	11/12/99
POST-20.0 KRAD ELECTRICAL MEASUREMENT	11/15/99
6) 30.0 KRAD IRRADIATION (0.217 KRADS/HOUR).....	11/15/99
POST-30.0 KRAD ELECTRICAL MEASUREMENT	11/17/99
7) 50.0 KRAD IRRADIATION (0.465 KRADS/HOUR).....	11/17/99
POST-50.0 KRAD ELECTRICAL MEASUREMENT	11/19/99
8) 168 HOUR ANNEALING @25°C.....	11/19/99
POST-168 HOUR ANNEAL ELECTRICAL MEASUREMENT.....	11/26/99

Average Dose Rate = 50,000 RADS/237 HOURS=211.0 RADS/HOUR=0.06RADS/SEC

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

Table III. Electrical Characteristics PIC7527 (SM627HRR) (1)

Test #	Parameter	Units	Spec. Limit		Test Conditions
			min	max	
1	Von State	V		1.500	$I_4 = 7.0V, I_3 = -30mA$
2	Vf (diode)	V		1.250	$I_2 = 7.0A$
3	Ir (diode)	μA		10.0	$V_1 = \text{Rated Output Voltage}$
4	Iin off State	μA		10.0	$V_4 = \text{Rated Input Voltage}$

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 PIC7225 (SM627HRR) (1)

Test #	Parameters	Units	Spec. Lim. (2)		Total Dose Exposure (kRads Si)														Annealing	
					Initial		2.5		5.0		10.0		20.0		30.0		50.0		168 hours @25°C	
			min	max	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
1	Von State	V		1.500	1.075	0.015	1.080	0.022	1.057	0.024	1.059	0.020	1.063	0.018	1.044	0.018	1.055	0.025	1.064	0.011
2	Vf (diode)	V		1.250	1.033	0.019	1.040	0.017	1.052	0.026	1.038	0.024	1.042	0.028	1.044	0.029	1.046	0.019	1.044	0.018
3	Ir (diode)	mA		10.00	0.42	0.02	0.43	0.05	0.50	0.04	0.45	0.03	0.44	0.02	0.48	0.12	0.48	0.03	0.38	0.06
4	Iin off State (3)	mA		10	<5		<5		<5		<5		<5		<5		<5		<5	

Notes:

- (1) The mean and standard deviation values were calculated over the four parts irradiated in this testing. The control samples remained constant throughout testing and are not i
- (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.
- (3) For this parameter, 5 μ A is the minimum detectable current allowed by the bench setup.

Radiation sensitive parameters: None.