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Memorandum

PARAMAX
A Unisys Company

PPM-92-305

DATE: Dec. 14, 1992
TO: B. Fafaul
FROM: K. Sahu ~~FS~~
SUBJECT: Radiation Report on FAST/HCI
Part No. M38510/10201BCA (LM723)
Control No. 7345

cc: L. Shiflett/745.1
A. Sharma/311
Library/300.1 ✓
L. Cusick/740.4
SMEX, PPM File

A radiation evaluation was performed on LM723 (Adjustable Regulator) 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 Cobalt-60 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 steps were 5, 10, 20, 30 and 40 krads*. After 40 krads, parts were annealed at +25°C for 168 hours. The irradiation was then continued to 60 krads (cumulative). The dose rate was between 0.08 and 1.0 krads/hour, depending on the total dose level (see Table II for radiation schedule). After each radiation exposure and annealing treatment, parts were electrically tested at 25°C according to the test conditions and the specification limits** listed in Table III.

All ten parts passed initial (pre-rad) electrical tests. All eight irradiated parts passed all electrical tests throughout all irradiation and annealing steps.

After a final annealing at 100°C, no rebound effects were observed.

Table IV provides a summary of the functional test results, as well as the mean and standard deviation values for each parameter

*The term rads, as used in this document, means rads(silicon).
**These are manufacturers' non-irradiated data sheet specification limits. No post-irradiation limits were provided by the manufacturer at the time these tests were performed.

after different irradiation exposures and annealing steps.

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

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TABLE I. Part Information

Generic Part Number:	LM723
Part Number:	M38510/10201BCA
FAST/HCI Control Number:	7352
Charge Number:	C33114
Manufacturer:	Silicon General
Lot Date Code:	9228
Quantity Tested:	10
Serial Numbers of Radiation Samples:	91, 93, 94, 95, 96, 97, 98, 99
Serial Numbers of Control Samples:	89, 90
Part Function:	Adjustable Voltage Regulator
Part Technology:	Bipolar
Package Style:	14-pin DIP
Test Engineer:	A. Phung

TABLE II. Radiation Schedule for LM723

EVENTS	DATE
1) Initial Electrical Measurements	10/30/92
2) 5 KRAD IRRADIATION (0.80 krads/hour)	11/06/92
POST-5 KRAD ELECTRICAL MEASUREMENT	11/09/92
3) 10 KRAD IRRADIATION (0.25 krads/hour)	11/09/92
POST-10 KRAD ELECTRICAL MEASUREMENT	11/10/92
4) 20 KRAD IRRADIATION (0.23 krads/hour)	11/10/92
POST-20 KRAD ELECTRICAL MEASUREMENT	11/12/92
5) 30 KRAD IRRADIATION (0.51 KRADS/HOUR)	11/12/92
POST-30 KRAD ELECTRICAL MEASUREMENT	11/13/92
6) 40 KRAD IRRADIATION (0.15 KRADS/HOUR)	11/13/92
POST-40 KRAD ELECTRICAL MEASUREMENT	11/16/92
7) 168 HOUR ANNEALING @25°C	11/16/92
POST-168 HOUR ANNEAL ELECTRICAL MEASUREMENT	11/23/92
8) 60 KRAD IRRADIATION (1.0 KRADS/HOUR)	11/23/92
POST-60 KRAD ELECTRICAL MEASUREMENT	11/24/92
9) 168 HOUR ANNEALING @100°C*	11/24/92
POST-168 HOUR ANNEAL ELECTRICAL MEASUREMENT	12/01/92

ALL ELECTRICAL MEASUREMENTS WERE PERFORMED AT 25°C.

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

*High temperature annealing is performed to accelerate long term time dependent effects (TDE), namely, the "rebound" effect due to the growth of interface states after the radiation exposure. For more information on the need to perform this test, refer to MIL-STD-883D, Method 1019, Para. 3.10.1.

Table III. Electrical Characteristics of LM723

Test	Conditions	Min.	Max.	Units
Iq+	Vin=30V		3	mA
Vref	Iref=1mA, Vin=12V	6.95	7.35	V
REG/ld1	VO=5V, VI=12V, IL=1 - 50mA		7.5	mV
REG/ln1	VO=5V, VI=12 - 15V		5.0	mV
REG/ld2	VO=37V, VI=40V, IL=1 - 10mA		185	mV
REG/ln2	VO=5V, VI=9.5 - 40V		15	mV
REG/ld3	VO=7.5V, VI=10V, IL=6 - 12mA		15	mV
REG/ln3	VO=2V, VI=12 - 40V, IL=1mA		4	mV

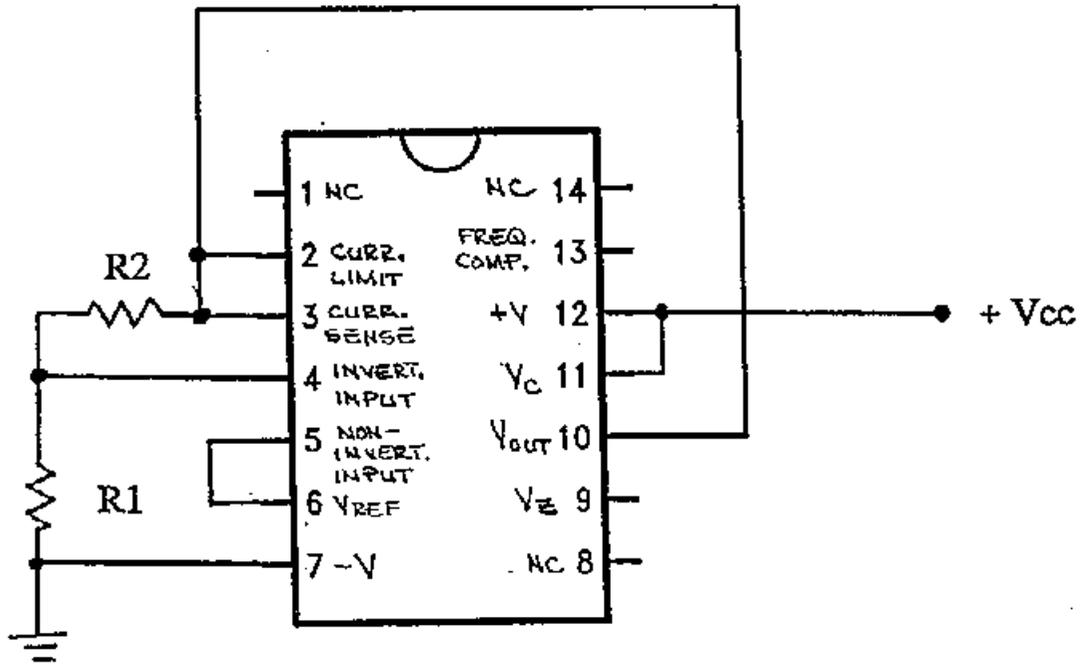
TABLE IV: Summary of Electrical Measurements After Total Dose Exposures and Annealing Steps for LM723 1/

Parameters	Spec.	Lim./2	Total Dose Exposure (TDE) (krads)												Anneal		TDE		Anneal			
			(Pre-Rad.)		0		5		10		20		30		40		168 hrs @25°C		60		168 hrs @+100°C	
			min	max	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd								
Iq+	mA	-	3	1.79	.05	1.79	.05	1.79	.05	1.79	.05	1.78	.06	1.78	.06	1.79	.05	1.79	.05	1.78	.04	
Vref	V	6.95	7.35	7.20	.02	7.21	.02	7.21	.02	7.21	.02	7.21	.02	7.21	.02	7.20	.02	7.19	.07	7.21	.02	
REG/ld1	mV	-	7.5	0.92	1.3	1.16	.76	1.62	.47	1.62	1.0	1.59	.52	2.30	1.2	1.44	.38	1.32	.63	1.37	.62	
REG/ln1	mV	-	5.0	1.08	.34	0.61	1.3	0.84	0.7	1.07	1.2	0.74	.68	1.17	1.2	0.92	.44	1.11	.54	0.84	.56	
REG/ld2	mV	-	185	88.5	1.9	89.7	2.4	89.9	3.2	92.3	3.4	94.9	4.2	93.4	4.8	90.8	2.7	91.4	1.2	98.3	3.2	
REG/ln2	mV	-	15	3.91	0.6	4.08	.42	3.75	.83	3.57	0.8	4.11	0.9	4.01	.64	3.95	.59	4.03	.74	3.79	1.2	
REG/ld3	mV	-	15	0.46	.28	0.55	.24	0.50	.23	0.53	.22	0.43	.15	0.43	.15	0.47	0.2	0.75	0.2	0.61	.18	
REG/ln3	mV	-	4	0.90	.28	0.88	0.3	0.84	0.4	0.59	.38	0.69	.31	0.63	.13	0.69	.24	0.73	.21	0.79	.35	

Notes:

- 1/ The mean and standard deviation values were calculated over the eight parts irradiated in this testing. The control samples remained constant throughout the testing and are not included in this table.
- 2/ These are manufacturers' non-irradiated data sheet specification limits. No post-irradiation limits were provided by the manufacturer at the time the tests were performed.

Figure 1. Radiation Bias Circuit for LM723



$$+V_{cc} = +30 \pm 0.5 \text{ V}$$

$$R1 = R2 = \frac{2.5}{2.4} \text{ Kohm} \pm 5\%, 1/4 \text{ W}$$

$$V_{out} = V_{ref} * (R1 + R2 / R1) = 14.30 \text{ V (APPROX.)}$$