

DATE: April 23, 1997
TO: J.Lohr/311
FROM: K. Sahu/300.1
SUBJECT: Radiation Report on: TL7770-5
Project: SMEX-LITE
Job #: EE71379
Project part #: TL7770-5

PPM-97-015

cc: T. Miccolis/311
A. Sharma/311
OFA Library/300.1

A radiation evaluation was performed on TL7770-5 (5962-9093201M2A) 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 III.

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 2.5, 5.0, 10.0, 15.0, 20.0, 30.0, and 50.0 kRads.* The dose rate was between 0.06 and 0.50 kRads/hour (see Table II for radiation schedule). Between the 10.0 and 15.0 kRad exposures, the parts were annealed for 936 hours at 25°C. After the 50.0 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**.

Initial electrical measurements were made on 10 samples. Eight samples (SN's 92, 93, 94, 95, 96, 97, 98, and 99) were used as radiation samples while SN's 90 and 91 were used as control samples. All parts passed all tests during initial electrical measurements.

After the 2.5 kRad irradiation, all parts passed all tests.

After 5.0 kRads, all parts passed all tests.

After 10.0 kRads, all parts passed all tests.

After annealing the parts for 936 hours at 25°C, the parts showed no significant recovery.

After 15.0 kRads, all parts

After 20.0 kRads, all parts

After 30.0 kRads, all parts

After 50.0 kRads, the parts

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

Table III provides a summary of the test results with the mean and standard deviation values for each parameter after each irradiation exposure and annealing step.

* 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.

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:	TL7770-5
SMEX/LITE Part Number	5962-9093201M2A
Charge Number:	EE71379
Manufacturer:	Texas Instruments
Lot Date Code (LDC):	9602-A
Quantity Tested:	10
Serial Number of Control Samples:	90, 91
Serial Numbers of Radiation Samples:	92, 93, 94, 95, 96, 97, 98, 99
Part Function:	Dual Power Supply Supervisor
Part Technology:	Bipolar
Package Style:	20 Pin LCC
Test Equipment:	A540
Test Engineer:	A. Naji

- No radiation tolerance/hardness was guaranteed by the manufacturer for this part.

TABLE II. Radiation Schedule for TL7770-5

EVENT	DATE
1) INITIAL ELECTRICAL MEASUREMENTS.....	01/27/97
2) 2.5 KRAD IRRADIATION (0.062 KRADS/HOUR)	01/29/97
POST-2.5 KRAD ELECTRICAL MEASUREMENT.....	01/31/97
3) 5.0 KRAD IRRADIATION (0.062 KRADS/HOUR)	01/31/97
POST-5.0 KRAD ELECTRICAL MEASUREMENT.....	02/03/97
4) 10.0 KRAD IRRADIATION (0.125 KRADS/HOUR)	02/03/97
POST-10.0 KRAD ELECTRICAL MEASUREMENT.....	02/05/97
5) 936 HOUR ANNEALING @25°C	02/05/97
POST-936 HOUR ANNEAL ELECTRICAL MEASUREMENT	03/24/97
6) 15.0 KRAD IRRADIATION (0.125 KRADS/HOUR)	03/24/97
POST-15.0 KRAD ELECTRICAL MEASUREMENT.....	03/26/97
7) 20.0 KRAD IRRADIATION (0.125 KRADS/HOUR)	03/26/97
POST-20.0 KRAD ELECTRICAL MEASUREMENT.....	03/28/97
8) 30.0 KRAD IRRADIATION (0.250 KRADS/HOUR)	03/28/97
POST-30.0 KRAD ELECTRICAL MEASUREMENT.....	03/31/97
9) 50.0 KRAD IRRADIATION (0.500 KRADS/HOUR)	03/31/97
POST-50.0 KRAD ELECTRICAL MEASUREMENT.....	04/02/97
10) 168 HOUR ANNEALING @25°C	04/00/97
POST-168 HOUR ANNEAL ELECTRICAL MEASUREMENT	04/00/97

Effective Dose Rate = 50,000 RADS/0 DAYS = RADS/HOUR=0.00 RADS/SEC

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

**TABLE III: Summary of Electrical Measurements after
Total Dose Exposures and Annealing for TL7770-5 /1**

Test #	Parameters	Units	Spec. Lim. /2 min max		Total Dose Exposure (kRads)						Rad level		Annealing		Rad level		Rad level		Rad level		Rad level	
					Initial		2.5		5.0		10.0		936 hours @25°C		15.0		20.0		30.0		50.0	
					mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
1	ICC @3.5V	mA	0.0	5.0	2.7	0.05	2.6	0.04	7.8	0.26	5.6	3.0	2.95	1.31	8.2	0.2	8.6	0.1	8.9	0.17	7.6	1.9
2	ICC @18V	mA	0.0	5.0	3.0	0.05	2.9	0.04	3.2	1.24	3.8	1.8	2.8	0	3.6	1.7	4.8	1.8	9.8	0.57	5.8	1.7
3	Iol RS1 @3.5V	uA	-50.0		-0.004	0	-0.006	0.001	-5.0	0	-5.0	0	-0.005	0	-5.0	0	-5.0	0	-5.0	0	-4.4	1.8
4	Iol RS1 @18V	uA	-50.0		-0.005	0	-0.006	0	-0.007	0	-0.007	0	-0.005	0	-0.007	0	-0.007	0	-0.006	0	-5.0	0
5	Voh RS1 @15mA	V	2.0		2.5	0	2.5	0	2.5	0	2.5	0	2.5	0	2.5	0	2.5	0	2.5	0	2.1	0.9
6	Voh RS1 @15mA	V	16.5		17.0	0	17.0	0	17.0	0	17.0	0	17.0	0	17.0	0	17.0	0	17.0	0	17.0	0
7	Iol RS2 @3.5V	uA	-50.0		-0.001	0	-0.01	0	-1.13	2.2	-0.01	0	-0.01	0	-5.0	0	-5.0	0	-5.0	0	-5.0	0
8	Iol RS2 @18V	uA	-50.0		-0.001	0	-0.01	0	-0.01	0	-0.01	0	-0.01	0	-0.01	0	-0.01	0	-0.01	0	-0.01	0
9	Voh RS2 @15mA	V	2.0		2.5	0	2.5	0	2.5	0	2.5	0	2.5	0	2.5	0	2.5	0	2.5	0	2.1	0.9
10	Voh RS2 @15mA	V	16.5		17.0	0	17.0	0	17.0	0	17.0	0	17.0	0	17.0	0	17.0	0	17.0	0	17.0	0
11	Ioh RS1 @3.5V	uA		50.0	-0.009	0	-0.01	0	2.49	2.7	0.61	1.76	-0.009	0	5.0	0.08	5.0	0	5.0	0	5.0	0
12	Ioh RS1 @18V	uA		50.0	0.013	0	0.014	0.001	0.020	0.008	0.019	0.001	0.019	0	0.016	0.02	0.016	0	0.013	0	5.0	0
13&14	Vol RS1 @15mA	V		0.4	0.17	0	0.17	0	0.17	0	0.17	0	0.17	0	0.17	0	0.17	0.01	0.16	0	0.17	0.01
15	Ioh RS2 @3.5V	uA		50.0	-0.002	0	-0.003	0	-0.002	0	-0.002	0	-0.001	0	5.0	0	5.0	0	5.0	0	5.0	0
16	Ioh RS2 @18V	uA		50.0	0.017	0	0.018	0	0.022	0.003	-0.022	0.001	0.026	0	0.021	0.002	0.021	0.002	0.017	0	0.018	0
17&18	Vol RS2 @15mA	V		0.4	0.17	0	0.17	0	0.17	0	0.17	0	0.17	0	0.17	0	0.17	0.01	0.16	0	0.17	0.01
19&21	Voh VSO @20m.	V	2.0		2.7	0	2.7	0	4P/4F		1P/7F		1P/7F	0	4P/4F		3P/5F		8F		8F	
20&22	Voh VSO @20m.	V	16.5		17.2	0	17.2	0	8F		8F		6P/2F	0	8F		8F		8F		8F	
23&25	Voh RST @15m.	V	2.0		2.5	0	2.5	0	2.5	0	2.5	0	2.5	0	2.5	0	2.5	0	2.5	0	2.5	0
24&26	Voh RST @15m.	V		0.4	0.17	0	0.17	0	0.16	0.005	0.17	0.05	0.17	0	0.16	0	0.16	0.001	0.14	0	0.16	0.02
27&29	I_SCR @3.5V	mA		-200.0	-217	10	-77	1.5	-22	14.0	8F		8F		8F		8F		8F		8F	
28&30	I_SCR @18V	mA		-200.0	-214	0	-218	3.9	-11	0	8F		1P/7F		8F		8F		8F		8F	
A /3	I_RES	uA	-10.0		0.0	0.04	-0.4	0.05	-1.6	0.06	-1.74	0.40	-1.44	0.24	-1.83	0.17	-2.23	0.22	-2.21	0.20	-3.12	0.42
B /3	I_VSO	uA		2.0	0.002	0	0.003	0.001	0.26	0.10	0.15	0.15	0.005	0.001	0.15	0.001	0.15	0.01	0.007	0.001	0.021	0.002

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 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/ A combines tests 31, 32, 35, 36, 39, 40, 41, & 42; B combines tests 33, 34, 37 & 38

Radiation-sensitive parameters: ICC, Voh VSO, & I_SCR.