Unisys

DATE: October 20, 1998 PPM-98-031
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SUBJECT: Radiation Report on **MTR2815F (Interpoint) (LDC 9830)**
PROJECT: TOMS

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A radiation evaluation was performed on **MTR2815F (M5962/9307001HCZ) DC/DC Converter (Interpoint)** 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, three 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, 7.5, 10.0, 15.0, 20.0, 30.0, 50.0, and 100.0kRads.[1] The dose rate was 0.320kRads/hour (0.09 Rads/s). See Table II for the radiation schedule and effective dose rate calculation. After the 100.0kRad irradiation, the parts were annealed under bias at 25°C and tested after and 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.

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. For detailed information, refer to Tables I through IV and Figure 1.

All parts showed no significant degradation up to 50kRads. After 15kRads and 30kRads, one part fell marginally below the specification limit of 81% for Efficiency, but passed after the next radiation step. All parts passed all tests after 50kRads. After 100kRads the parts showed such a steep increase in Iin (30mA to 2.0A) that the readings for several parameters became unreliable. After annealing the parts for 168 hours at 25℃, one part passed all tests, one part fell marginally below the specification limit for Efficiency only, and the third part continued to fail Vout, Efficiency and Iin and also failed Load Reg.

Initial electrical measurements were made on 4 samples. Three samples (SN's 106, 108 and 110) were used as radiation samples while SN 105 was used as a control sample. All parts passed all tests during initial electrical measurements.

After the 15kRad irradiation, SN 108 fell marginally below the specification limit of 81% for Efficiency with a reading of 79.5%. However, SN 108 passed the test for Efficiency at 20kRads with a reading of 82.7%. **All parts passed all other tests.**

After the 30kRad irradiation, SN 106 fell marginally below the specification limit of 81% for Efficiency with a reading of 80.4%. However, SN 106 passed the test for Efficiency at 50kRads with a reading of 84.0%. **All parts passed all other tests.**

After the 50.0kRad irradiation, no significant degradation was noted in any parameter. **All parts passed all tests after 50kRads.**

After the 100kRad irradiation, all parts exceeded the specification limit of 35mA for Iin with readings of 2.0A. This is the maximum current for the device. As a result, the readings for Vout, Efficiency and Line Reg. became unreliable. **All parts passed all other tests.**

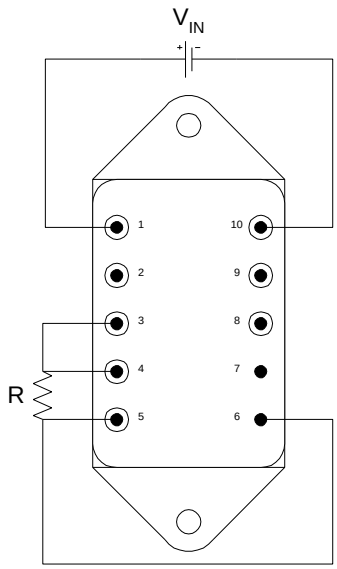
[1] The term Rads, as used in this document, means Rads (silicon). All radiation levels cited are cumulative.
[2] The temperature 25°C as used in this document implies room temperature.
[3] These are manufacturer's pre-irradiation data specification limits. The manufacturer provided no post-irradiation limits at the time these tests were performed.

After annealing the parts for 168 hours at 25°C, SN 108 passed all tests, SN 110 fell below the specification limit for Efficiency with a reading of 77.8% and passed all other tests, and SN 106 continued to give a reading of 2.0A for Iin and gave unreliable readings for Vout, Efficiency and Line Reg. SN 106 also marginally exceeded the specification limit of 30mV for Load Reg. with a reading of 30.5mV.

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.

Figure 1. Radiation Bias Circuit for MTR2815F



Notes:
1. V_{IN} = 28.0V ±0.5V.
2. R = 50Ω ±5%, 5W.
3. Check $I_L \approx 0.3A$, $V_L \approx 15.0V$.

Pinout:
1. Positive Input
2. +5V DC Output
3. Output Common
4. -Aux Output
5. +Aux Output
6. Case Ground
7. Case Ground
8. Inhibit Input
9. Sync Input
10. Input Common

TABLE I. Part Information

Generic Part Number:	MTR2815F
TOMS Part Number:	M5962/9307001HCZ
Charge Number:	M90404
Manufacturer:	Interpoint
Lot Date Code (LDC):	9828
Quantity Tested:	4
Serial Number of Control Samples:	105
Serial Numbers of Radiation Samples:	106, 108 and 110
Part Function:	DC/DC Converter
Part Technology:	Hybrid (No Optocouplers)
Package Style:	10 Pin Metal Box
Test Equipment:	Bench Test
Test Engineer:	S. Norris

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

TABLE II. Radiation Schedule for MTR2815F

EVENT	DATE
1) INITIAL ELECTRICAL MEASUREMENTS	09/18/98
2) 2.5 KRAD IRRADIATION (0.038 KRADS/HOUR)	09/24/98
POST-2.5 KRAD ELECTRICAL MEASUREMENT	09/25/98
3) 5.0 KRAD IRRADIATION (0.147 KRADS/HOUR)	09/25/98
POST-5.0 KRAD ELECTRICAL MEASUREMENT	09/28/98
4) 7.5 KRAD IRRADIATION (0.038 KRADS/HOUR)	09/28/98
POST-7.5 KRAD ELECTRICAL MEASUREMENT	09/29/98
5) 10.0 KRAD IRRADIATION (0.121 KRADS/HOUR)	09/29/98
POST-10.0 KRAD ELECTRICAL MEASUREMENT	09/30/98
6) 15.0 KRAD IRRADIATION (0.121 KRADS/HOUR)	09/30/98
POST-15.0 KRAD ELECTRICAL MEASUREMENT	10/01/98
7) 20.0 KRAD IRRADIATION (0.077 KRADS/HOUR)	10/01/98
POST-20.0 KRAD ELECTRICAL MEASUREMENT	10/02/98
8) 30.0 KRAD IRRADIATION (0.244 KRADS/HOUR)	10/02/98
POST-30.0 KRAD ELECTRICAL MEASUREMENT	10/05/98
9) 50.0 KRAD IRRADIATION (0.488 KRADS/HOUR)	10/05/98
POST-50.0 KRAD ELECTRICAL MEASUREMENT	10/06/98
10) 100.0 KRAD IRRADIATION (0.488 KRADS/HOUR)	10/06/98
POST-100.0 KRAD ELECTRICAL MEASUREMENT	10/07/98
11) 168 HOUR ANNEALING @25°C	10/07/98
POST-168 HOUR ANNEAL ELECTRICAL MEASUREMENT	10/14/98

Effective Dose Rate = 100,000 RADS/13 DAYS=320.5 RADS/HOUR=0.09 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 MTR2815F /1

Test #	Parameter	Units	Test Conditions /2	Spec. Lim. min	Spec. Lim. max
1	V_{OUT}	V	Full Load	14.85	15.15
2	Efficiency	%	Full Load	81.00	
3	I_{IN}	mA	No Load		35
4	Load Reg	mV	No Load to Full		30
5	Line Reg	mV	Full Load, V_{IN} = 16 to 40VDC		30
6	Output Ripple	mVp-p	Full Load, 10kHz to 2MHz		50

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.

2/ All parameters measured on bench setup.

TABLE IV: Summary of Electrical Measurements after Total Dose Exposures and Annealing for MTR2815F /1

					Total Dose Exposure (kRads Si)																				Annealing	
					Initial		2.5		5.0		7.5		10.0		15.0		20.0		30.0		50.0		100.0		168 hours @25°C	
Test #	Parameters	Units	Spec. Lim. /2 min	Spec. Lim. /2 max	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
1	VOUT	V	14.85	15.15	14.93	0.02	14.93	0.02	14.94	0.02	14.95	0.03	14.95	0.02	14.97	0.02	14.97	0.02	14.97	0.02	14.98	0.02	*	*	10.00	7.07
2	Efficiency	%	81.00		83.45	0.83	82.24	0.67	84.11	1.19	83.39	0.72	83.26	1.19	81.25	1.26	82.58	1.09	81.58	0.92	82.91	0.91	*	*	53.92	38.21
3	IIN	mA		35	34	0.5	33	0.5	33	0.5	33	0.5	33	0.5	33	0	33	0.8	33	0.5	33	0.5	2000	0	688	928
4	Load Reg	mV		30	3	0.5	2	0	3	0.5	4	0	3	0	3	0.5	2	0.5	2	0.5	2	0	28	0.8	12	13
5	Line Reg	mV		30	4	1.5	5	0	9	0.5	11	0	10	0.5	10	0.8	10	0.8	10	0.5	9	0.8	*	*	6	4.4
6	Output Ripple	mVp-p		50	2	0	2	0	3	0.8	3	0.8	4	1.2	3	0.8	4	2.1	4	1.2	4	0.9	1	1.3	2	1.2

Notes:

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

* The parts showed so much degradation in Iin that the readings for these parameters were unreliable.

Radiation sensitive parameters: Vout, Efficiency, Iin, Load Reg.