

Unisys

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SUBJECT: Radiation Report on **MTR2805F (Interpoint) (LDC 9828)**
PROJECT: TOMS

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A radiation evaluation was performed on **MTR2805F (M5962/9306801HCZ) 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 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. For detailed information, refer to Tables I through IV and Figure 1.

All parts passed all tests up to 50kRads. After 100kRads, all parts showed significant degradation in Vout, Efficiency, Load Reg., Line Reg., and Output Ripple. After annealing the parts for 168 hours at 25°C, the parts showed such a steep increase in Iin (30mA to 2.0A) that the readings for several parameters became unreliable.

Initial electrical measurements were made on 4 samples. Three samples (SN's 1367, 1368 and 1369) were used as radiation samples while SN 1371 was used as a control sample. All parts passed all tests during initial electrical measurements.

All parts passed all tests up to 50kRads, no significant degradation was noted in any test parameter.

After the 100kRad irradiation, all parts fell below the specification limit of 4.95V for Vout with readings in the range of 588 to 679mV. All parts fell below the specification limit of 76.0% for Efficiency with readings in the range of 33.4% to 37.8%. All parts exceeded the specification limit of 50.0mV for Load Reg. with readings in the range of 4.3 to 4.4V. One part exceeded the specification limit of 50.0mV for Line Reg. with a reading of 61.4mV. All parts exceeded the specification limit of 50.0mVp-p for Output Ripple with readings in the range of 424 to 524mVp-p.

After annealing the parts for 168 hours at 25°, all parts exceeded the specification limit of 120.0mA for Iin with readings of 2.0A. These readings represent the maximum current for the device. As a result, the readings for Vout, Efficiency and Line Reg. became unreliable. All parts showed significant recovery in Load Reg. and Output Ripple.

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.

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.

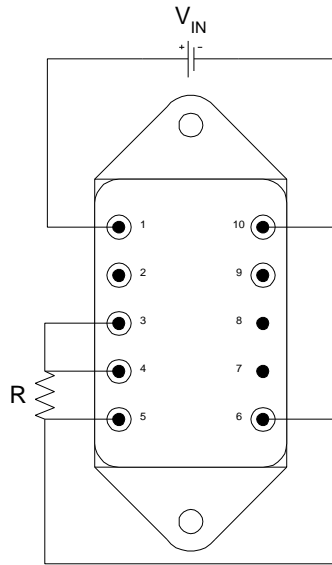
Any further details about this evaluation can be obtained upon request. If you have any questions, please call us at (301) 731-8954.

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Figure 1. Radiation Bias Circuit for MTR2805F



Notes:

1. $V_{IN} = 28.0V \pm 0.5V$.
2. $R = 50\Omega \pm 5\%$, 5W.
3. Check $I_L \approx 0.1A$, $V_L \approx 5.0V$.

Pinout:

- | | |
|--------------------|-------------------|
| 1. Positive Input | 6. Positive Sense |
| 2. Inhibit | 7. Case Ground |
| 3. Sense Return | 8. Case Ground |
| 4. Output Common | 9. Sync |
| 5. Positive Output | 10. Input Common |

TABLE I. Part Information

Generic Part Number:	MTR2805F
TOMS Part Number:	M5962/9306801HCZ
Charge Number:	M90404
Manufacturer:	Interpoint
Lot Date Code (LDC):	9828
Quantity Tested:	4
Serial Number of Control Samples:	1371
Serial Numbers of Radiation Samples:	1367, 1368 and 1369
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 MTR2805F

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 MTR2805F /1

Test #	Parameter	Units	Test Conditions /2	Spec. Lim.	
				min	max
1	V _{OUT}	V	Full Load	4.95	5.05
2	Efficiency	%	Full Load	76.00	
3	I _{IN}	mA	No Load		120
4	Load Reg	mV	No Load to Full		50
5	Line Reg	mV	Full Load, V _{IN} = 16 to 40VDC		50
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 MTR2805F /1

Test #	Parameters	Units	Spec. Lim. /2		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	
					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	4.95	5.05	4.98	0	4.97	0	4.98	0	4.98	0.01	4.98	0.01	4.98	0	4.99	0.01	4.99	0.01	4.99	0.01	0.7	0.05	*	*
2	Efficiency	%	76.00		77.45	0.27	77.56	0.27	77.60	0.26	77.52	0.36	77.52	0.35	77.60	0.27	77.51	0.28	77.48	0.37	77.51	0.27	35.97	1.86	*	*
3	IIN	mA		120	31.1	0.6	31.5	0.3	31.6	0.2	31.4	0.7	31.4	0.7	31.3	0.6	31.3	0.6	31.1	0.6	30.9	0.7	30.4	0.1	2000	0
4	Load Reg	mV		50	1.6	0.1	1.7	0.05	1.7	0	0.6	0.1	0.9	0.05	0.9	0.1	0.9	0.1	1.2	0.1	1.3	0.1	4341	33	3.7	0.3
5	Line Reg	mV		50	0.2	0.2	0.5	0.5	0.2	0.2	1.1	0.2	0.9	0.2	0.9	0.2	0.6	0.1	0.6	0.1	0.4	0	33.5	24.1	*	*
6	Output Ripple	mVp-p		50	0.8	0.05	0.8	0.05	0.8	0	0.9	0.05	0.9	0.05	0.9	0.05	0.9	0.05	1.0	0	1.0	0.05	486	43	0.6	0.4

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, Line Reg, Output Ripple.