

Unisys

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SUBJECT: Radiation Report on **OM3914NTM (Omnirel) (LDC 9909)**
PROJECT: HST/COS

PPM-99-028

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A radiation evaluation was performed on **OM3914NTM (5962-8774101UA) Three Terminal, Negative Adjustable Voltage Regulator (Omnirel)** 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, 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, 20.0, 30.0, and 50.0kRads.¹ The average dose rate was 0.20kRads/hour (0.05 Rads/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 10kRads. After the 20kRad to 50kRad irradiations, all parts showed some degradation in Reference Voltage with a lowest reading of -1.208V with a specification limit of -1.238V. After the 30 and 50kRad irradiations, parts showed very minor degradation in Load Regulation. After annealing the parts at 25°C for 168 hours, the parts showed some recovery in both radiation sensitive parameters.

Initial electrical measurements were made on 10 samples. Eight samples (SN's 82, 83, 84, 85, 86, 87, 88, and 89) were used as radiation samples while SN's 80 and 81 were used as control samples. All parts passed all tests during initial electrical measurements.

All parts passed all tests up to 10.0kRads.

After the 20kRad irradiation, four parts marginally exceeded the specification limit of -1.238V for Reference Voltage with readings in the range of -1.237 to -1.235V. **All parts passed all other tests.**

After the 30kRad irradiation, six parts marginally exceeded the specification limit for Reference Voltage with readings in the range of -1.230 to -1.222V. One part fell marginally below the specification limit of -1.00% for Load Reg with a reading of -1.04%. **All parts passed all other tests.**

After the 50kRad irradiation, all parts fell marginally below the specification limit for Reference Voltage with readings in the range of -1.219 to -1.208V. Six parts fell marginally below the specification limit for Load Regulation with readings in the range of -1.02 to -1.55%. **All parts passed all other tests.**

After annealing the parts for 168 hours at 25°C, the parts showed some recovery in both radiation sensitive parameters, however most parts remained marginally outside their respective specification limits.

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.

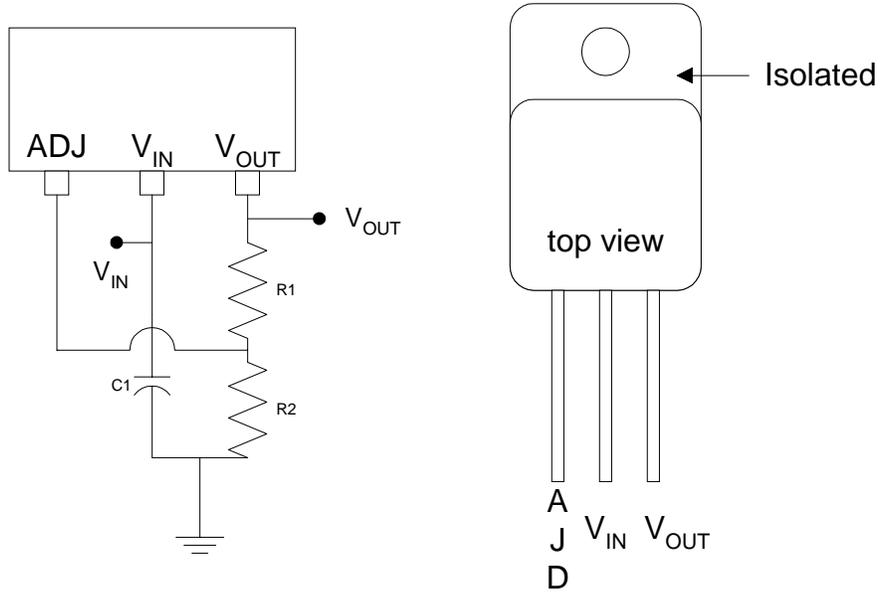
Any further details about this evaluation can be obtained upon request. If you have any questions, please call us at (301) 731-8954.

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Figure 1. Radiation Bias Circuit for OM3914NTM



Notes:

1. $R1 = 250\Omega \pm 5\%$, $\frac{1}{4}W$.
2. $R2 = 1750\Omega \pm 5\%$, $\frac{1}{4}W$.
3. $C1 = 5\mu F$, 50V.
4. $I_O = 5mA$, $I_{ADJ} = 2\mu A$, $V_O = 10V$.

TABLE I. Part Information

Generic Part Number:	OM3914nTM
HST/COS Part Number	5962-8774101UA
HST/COS TID Requirement	10kRads (RDM = 5)
Charge Number:	M90430
Manufacturer:	Omnirel
Lot Date Code (LDC):	9909
Quantity Tested:	10
Serial Numbers of Control Samples:	80, 81
Serial Numbers of Radiation Samples:	82, 83, 84, 85, 86, 87, 88, 89
Part Function:	3 Amp Negative Adjustable Voltage Regulator
Part Technology:	Bipolar
Package Style:	TO-257AA
Test Equipment:	Bench
Test Engineer:	S. Norris

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

TABLE II. Radiation Schedule for OM1850STM3

EVENT	DATE
1) INITIAL ELECTRICAL MEASUREMENTS	08/10/99
2) 2.5 KRAD IRRADIATION (0.139 KRADS/HOUR).....	08/17/99
POST-2.5 KRAD ELECTRICAL MEASUREMENT	08/18/99
3) 5.0 KRAD IRRADIATION (0.147 KRADS/HOUR).....	08/18/99
POST-5.0 KRAD ELECTRICAL MEASUREMENT	08/19/99
4) 10.0 KRAD IRRADIATION (0.294 KRADS/HOUR).....	08/19/99
POST-10.0 KRAD ELECTRICAL MEASUREMENT	08/20/99
5) 20.0 KRAD IRRADIATION (0.143 KRADS/HOUR).....	08/20/99
POST-20.0 KRAD ELECTRICAL MEASUREMENT	08/23/99
6) 30.0 KRAD IRRADIATION (0.244 KRADS/HOUR).....	08/23/99
POST-30.0 KRAD ELECTRICAL MEASUREMENT	08/25/99
7) 50.0 KRAD IRRADIATION (0.215 KRADS/HOUR).....	08/26/99
POST-50.0 KRAD ELECTRICAL MEASUREMENT	08/30/99
8) 168 HOUR ANNEALING @25°C.....	08/30/99
POST-168 HOUR ANNEAL ELECTRICAL MEASUREMENT.....	09/07/99

Average Dose Rate = 50,000 RADS/256 HOURS=195.3 RADS/HOUR=0.05RADS/SEC

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

Table III. Electrical Characteristics OM3914NTM (1)

Test #	Parameter	Units	Spec. Limit		Test Conditions
			min	max	
1	Ref Voltage	V	-1.238	-1.262	$V_{IN} = 3.0V, I_{OUT} = 10mA$
2	Line Reg.	%		0.48% =0.015%/V	$V_{IN} = -4.25$ to $-36.25, V_{OUT} = 1.25V$
3	Load Reg.	%	-1.0	1.0	$V_{IN} - V_{OUT} = 3.0V, 10mA \leq I_{OUT} \leq 2.0A$
4	Adj. Pin Current	μA		100	$V_{IN} - V_{OUT} = 25V, 10mA \leq I_{OUT} \leq 2.0A$
5	Ripple Rejection	dB	60		$f = 120Hz, C_{ADJ} = 0\mu F, V_{OUT} = -1.25V$

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 OM3914 STM (

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	
					mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
1	Ref. Voltage	V	-1.238	-1.262	-1.248	0.005	-1.247	0.001	-1.245	0.001	-1.243	0.001	-1.238	0.001	-1.226	0.003	-1.214	0.004	-1.218	0.003
2	Line Reg.	%		0.48	0.02	0.008	0.02	0.008	0.02	0.004	0.03	0.005	0.03	0.007	0.06	0.007	0.11	0.015	0.09	0.021
3	Load Reg.	%	-1.0	1.0	-0.64	0.02	-0.78	0.06	-0.77	0.03	-0.84	0.06	-0.78	0.04	-0.93	0.07	-1.10	0.20	-1.03	0.09
4	Adj. Pin Current	mA		100	-75	4.8	-63	4.7	-69	3.3	-68	4.3	-71	6.0	-71	3.3	-70	5.0	-48	4.3
5	Ripple Rejection	dB	56		90	0.4	91	0.4	91	0.5	91	0.7	86	0.8	91	0.5	91	0.5	91	0.5

Notes:

- (1) The mean and standard deviation values were calculated over the eight parts irradiated in this testing. The control samples remained constant throughout testing and are not
- (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.

Radiation sensitive parameters: Ref. Voltage, Load Reg.