

# Unisys

DATE: August 23, 1999  
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SUBJECT: Radiation Report on **OM1850 (Omnirel) (LDC 9912)**  
PROJECT: HST/COS

PPM-99-024

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A radiation evaluation was performed on **OM1850STM3 (5962-8864601UA) Three Terminal, Positive Adjustable Low Dropout Voltage Regulator (Omnirel)** to determine the total dose tolerance of these parts. The total dose testing was performed using a Co<sup>60</sup> 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.<sup>1</sup> The effective dose rate was 0.14kRads/hour (0.04 Rads/s). See Table II for the radiation schedule and effective dose rate calculation. After the 50.0kRad irradiation, the parts were annealed under bias at 25°C for 168 hours.<sup>2</sup> After each radiation exposure and annealing treatment, parts were electrically tested according to the test conditions and the specification limits<sup>3</sup> 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 1.188V with a specification limit of 1.238V. After the 30 to 50kRad irradiations, parts showed very minor degradation in Load Regulation and Dropout Voltage. After the 50kRad irradiation, some parts showed very minor degradation in Line Regulation. After annealing the parts at 25°C for 168 hours, the parts showed some recovery in all radiation sensitive parameters.**

Initial electrical measurements were made on 10 samples. Eight samples (SN's 52, 53, 54, 55, 56, 57, 58, and 59) were used as radiation samples while SN's 50 and 51 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, all parts fell marginally below the specification limit of 1.238V for Reference Voltage with readings in the range of 1.237 to 1.228V. **All parts passed all other tests.**

After the 30kRad irradiation, all parts fell marginally below the specification limit for Reference Voltage with readings in the range of 1.226 to 1.217V. Three parts fell marginally below the specification limit of -0.80% for Load Regulation with readings in the range of -0.81 to -0.85%. All parts marginally exceeded the specification limit of 1.50V for Dropout Voltage with readings in the range of 1.51 to 1.52V. **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 1.201 to 1.188V. Two parts marginally exceeded the specification limit of 0.2% for Line Regulation with reading of 0.22 and 0.21%. Six parts fell marginally below the specification limit for Load Regulation with readings in the range of -0.81 to -0.83%. All parts marginally exceeded the specification limit for Dropout Voltage with readings in the range of 1.54 to 1.55V. **All parts passed all other tests.**

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<sup>1</sup> The term Rads, as used in this document, means Rads (silicon). All radiation levels cited are cumulative.

<sup>2</sup> The temperature 25°C as used in this document implies room temperature.

<sup>3</sup> 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, the parts showed some recovery in all radiation sensitive parameters, however most parts remained 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.

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

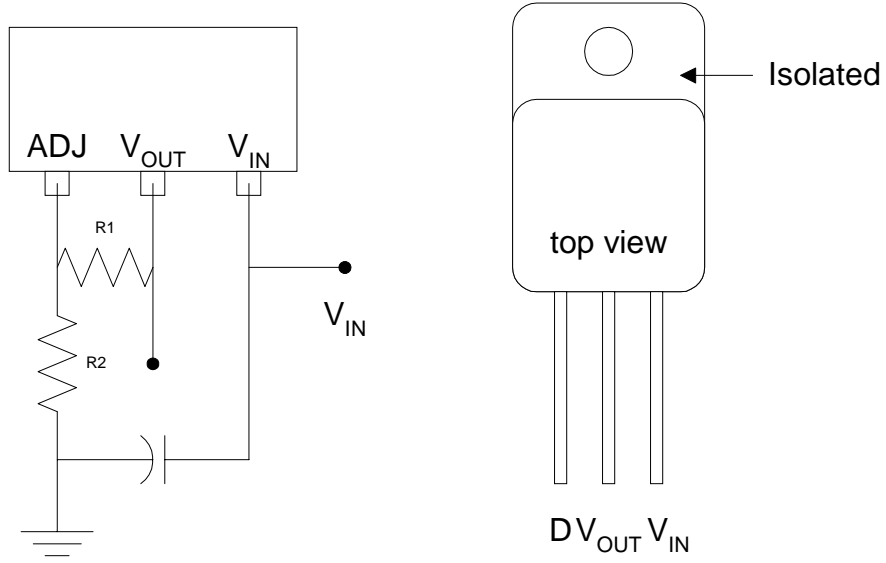
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Figure 1. Radiation Bias Circuit for OM1850STM3



Notes:

1. R1 = 200Ω ±5%, ¼W.
2. R2 = 2kΩ ±5%, ¼W.
3. Adjust V<sub>IN</sub> until V<sub>OUT</sub> = 14V and record V<sub>IN</sub>.

TABLE I. Part Information

Generic Part Number:	OM1850STM3
HST/COS Part Number	5962-8864601UA
HST/COS TID Requirement	10kRads (RDM = 5)
Charge Number:	M90428
Manufacturer:	Omnirel
Lot Date Code (LDC):	9912
Quantity Tested:	10
Serial Numbers of Control Samples:	50, 51
Serial Numbers of Radiation Samples:	52, 53, 54, 55, 56, 57, 58, 59
Part Function:	3 Amp Low Dropout Positive Adjustable 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 .....	07/23/99
2) 2.5 KRAD IRRADIATION (0.114 KRADS/HOUR).....	07/26/99
POST-2.5 KRAD ELECTRICAL MEASUREMENT .....	07/27/99
3) 5.0 KRAD IRRADIATION (0.114 KRADS/HOUR).....	07/27/99
POST-5.0 KRAD ELECTRICAL MEASUREMENT .....	07/28/99
4) 10.0 KRAD IRRADIATION (0.109 KRADS/HOUR).....	07/28/99
POST-10.0 KRAD ELECTRICAL MEASUREMENT .....	07/30/99
5) 20.0 KRAD IRRADIATION (0.143 KRADS/HOUR).....	07/30/99
POST-20.0 KRAD ELECTRICAL MEASUREMENT .....	08/02/99
6) 30.0 KRAD IRRADIATION (0.143 KRADS/HOUR).....	08/02/99
POST-30.0 KRAD ELECTRICAL MEASUREMENT .....	08/05/99
7) 50.0 KRAD IRRADIATION (0.213 KRADS/HOUR).....	08/05/99
POST-50.0 KRAD ELECTRICAL MEASUREMENT .....	08/10/99
8) 168 HOUR ANNEALING @25°C.....	08/10/99
POST-168 HOUR ANNEAL ELECTRICAL MEASUREMENT.....	08/17/99

Effective Dose Rate = 50,000 RADS/15 DAYS=138.9 RADS/HOUR=0.04 RADS/SEC

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

Table III. Electrical Characteristics OM1850STM3 (1)

Test #	Parameter	Units	Spec. Limit		Test Conditions
			min	max	
1	Ref Voltage	V	1.238	1.262	$V_{IN} - V_{OUT} = 3.0V, I_{OUT} = 10mA$
2	Line Reg.	%	-0.2	0.2	$V_{IN} - V_{OUT} = 15V, I_{OUT} = 10mA$
3	Load Reg.	%	-0.8	0.8	$V_{IN} - V_{OUT} = 3.0V, 10mA \leq I_{OUT} \leq 2.0A$
4	Dropout Voltage	V		1.5	$I_{OUT} = 2.0A, V_{REF} = 1\%$
5	Dropout	%	-1.0	1.0	
6	Adj. Pin Current	$\mu A$		120	$V_{IN} - V_{OUT} = 25V, 10mA \leq I_{OUT} \leq 2.0A$
7	Ripple Rejection	dB	60		$f = 120Hz, C_{ADJ} = 25\mu F, C_{OUT} = 25\mu F, V_{IN} - V_{OUT} = 3.0V, I_{OUT} = 2.0A$

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 OM1850STM3 (**

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	1.249	0.003	1.249	0.003	1.246	0.003	1.242	0.003	1.232	0.003	1.221	0.004	1.194	0.005	1.201	0.005
2	Line Reg.	%	-0.2	0.2	0.02	0.008	0.02	0.007	0.02	0.007	0.02	0.007	0.04	0.01	0.06	0.02	0.17	0.03	0.14	0.03
3	Load Reg.	%	-0.8	0.8	-0.73	0.02	-0.71	0.03	-0.75	0.05	-0.74	0.03	-0.76	0.02	-0.80	0.03	-0.80	0.03	-0.78	0.04
4	Dropout Voltage	V		1.50	1.49	0	1.49	0	1.49	0	1.49	0.007	1.50	0.01	1.52	0.004	1.55	0.005	1.54	0.006
5	Dropout	%	-1.0	1.0	-0.01	0.01	-0.02	0.01	-0.02	0.01	-0.03	0.01	-0.05	0.02	-0.08	0.04	-0.29	0.05	-0.24	0.06
6	Adj. Pin Current	mA		120	44	4.8	40	5.0	41	3.3	45	5.0	48	4.3	43	4.3	43	4.3	29	3.3
7	Ripple Rejection	dB	60		93	0.7	92	0.9	93	1.1	93	1.3	93	1.1	94	1.7	93	1.3	93	0.7

Notes:

- (1) The mean and standard deviation values were calculated over the five parts irradiated in this testing. The control samples remained constant throughout testing and are not included.
- (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, Line Reg., Load Reg., Dropout.**