

UNISYS

DATE: November 8, 1994
TO: J. Lohr/311.1
FROM: K. Sahu/300.1 *KS*
SUBJECT: Radiation Report on CASSINI/CIRS
Part No. LM139
Control No. 11422

PPM-94-038

cc: A. Sharma/311.2
Library/300.1

A radiation evaluation was performed on LM139 (Quad Voltage Comparator) 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 V and Figure 1.

The total dose testing was performed using a cobalt-60 gamma ray source. During the radiation testing, ten parts were irradiated under bias (see Table V for bias configuration), ten parts were irradiated unbiased and three parts were used as control samples. The total dose radiation levels were 5, 10, 15, 20, 30, 50, 75 and 100 krad*. The dose rates were between 0.08 and 1.47 krad/hour (see Table II for radiation schedule). After the 100 krad irradiation, the parts were annealed for 168 hours at 25°C, after which the parts were annealed for 168 hours at 100°C. After each radiation exposure and annealing step, the parts were electrically tested according to the test conditions and the specification limits** listed in Table III.

All parts passed initial electrical measurements. All irradiated parts passed all electrical tests throughout all irradiation steps up to and including the 100 krad level.

After annealing for 168 hours at 25°C, all irradiated parts continued to pass all electrical tests.

After annealing for 168 hours at 100°C, no rebound effects were observed.

Table IV provides the mean and standard deviation values for each parameter after different irradiation exposures and annealing steps.

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

*The term rads, as used in this document, means rads(silicon). All radiation levels cited are cumulative.

**These are manufacturer's non-irradiated data specification limits. No post-irradiation limits were provided by the manufacturer at the time these tests were performed.

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TABLE I. Part Information

Generic Part Number:	LM139
CASSINI/CIRS Part Number:	5962-9773901CA
CASSINI/CIRS Control Number:	11422
Charge Number:	C44543
Manufacturer:	National
Lot Date Code:	9108, 9228
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:	Quad Voltage Comparator
Part Technology:	Bipolar
Package Style:	14-pin DIP
Test Equipment:	A540
Test Engineer:	T. Mandy

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

TABLE II. Radiation Schedule for LM139

EVENTS	DATE
1) INITIAL ELECTRICAL MEASUREMENTS	09/06/94
2) 5 KRAD IRRADIATION (0.29 KRADS/HOUR) POST-5 KRAD ELECTRICAL MEASUREMENTS	09/07/94 09/08/94
3) 10 KRAD IRRADIATION (0.29 KRADS/HOUR) POST-10 KRAD ELECTRICAL MEASUREMENTS	09/08/94 09/09/94
4) 15 KRAD IRRADIATION (0.77 KRADS/HOUR) POST-15 KRAD ELECTRICAL MEASUREMENTS	09/09/94 09/12/94
5) 20 KRAD IRRADIATION (0.25 KRADS/HOUR) POST-20 KRAD ELECTRICAL MEASUREMENTS	09/12/94 09/13/94
6) 30 KRAD IRRADIATION (0.53 KRADS/HOUR) POST-30 KRAD ELECTRICAL MEASUREMENTS	09/13/94 09/14/94
7) 50 KRAD IRRADIATION (1.11 KRADS/HOUR) POST-50 KRAD ELECTRICAL MEASUREMENTS	09/14/94 09/15/94
8) 75 KRAD IRRADIATION (1.47 KRADS/HOUR) POST-75 KRAD ELECTRICAL MEASUREMENTS	09/15/94 09/16/94
9) 100 KRAD IRRADIATION (0.38 KRADS/HOUR) POST-100 KRAD ELECTRICAL MEASUREMENTS	09/16/94 09/19/94
10) 168-HOUR ANNEALING @25°C POST-336 HOUR ANNEAL ELECTRICAL MEASUREMENTS	09/19/94 09/26/94
11) 168-HOUR ANNEALING @100°C* POST-168 HOUR ANNEAL ELECTRICAL MEASUREMENTS	09/26/94 10/03/94

*High temperature annealing is performed to accelerate long term time dependent effects (TDE), namely, the "rebound" effect, due to the growth of interface states after the radiation exposure. For more information on the need to perform this test, refer to MIL-STD-8830, Method 1019, Para. 3.10.1.

Table III. Electrical Characteristics of LM139

Unless Otherwise Specified: $T_A = 25^\circ\text{C}$

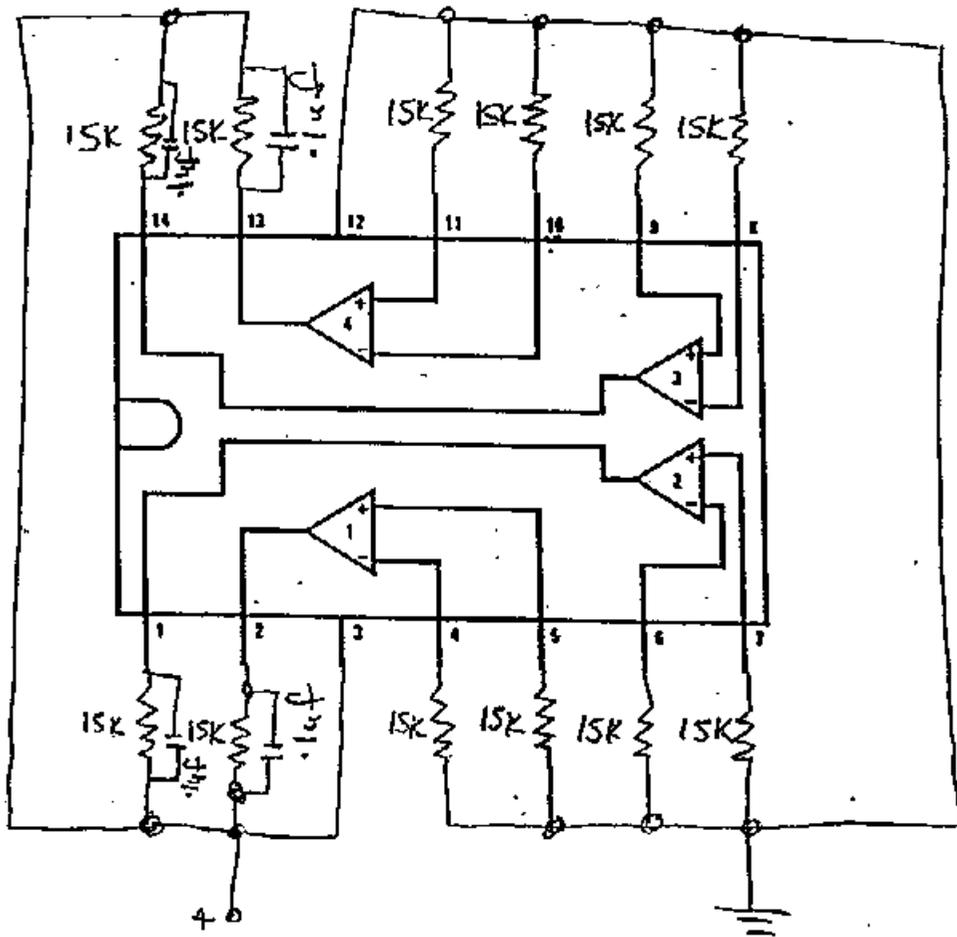
TEST NAME	SYMBOL	CONDITIONS	LIMITS	
			MIN	MAX
SUPPLY CURRENT				
5V	I_{cc}	+Vcc = 5V, $V_{OUT} = 0V$	0.000mA	3.000mA
30V	I_{cc}	+Vcc = 30V, $V_{OUT} = 0V$	0.000mA	3.000mA
INPUT OFFSET TESTS				
VOS_5V	V_{IO}	+Vcc = 5V, $V_{OUT} = 1.4V$	-5.00mV	5.00mV
VOS_30V	V_{IO}	+Vcc = 30V, $V_{OUT} = 15V$ (Note: 1)	-5.00mV	5.00mV
PSRR	PSRR	+Vcc = (5V, 30V), $V_{OUT} = 1.4V$	70dB	
P_IIB_5V	$+I_{IB}$	+Vcc = 5V, $V_{OUT} = 1.4V$ (Note: 1)	-100.00nA	-1.000nA
N_IIB_5V	$-I_{IB}$	+Vcc = 5V, $V_{OUT} = 1.4V$ (Note: 1)	-100.00nA	-1.000nA
IIOS_5V	I_{IO}	+Vcc = 5V, $V_{OUT} = 1.4V$ (Note: 1)	-25.00nA	25.00nA
P_IIB_30V	$+I_{IB}$	+Vcc = 30V, $V_{OUT} = 15V$ (Note: 1)	-100.00nA	-1.000nA
N_IIB_30V	$-I_{IB}$	+Vcc = 30V, $V_{OUT} = 15V$ (Note: 1)	-100.00nA	-1.000nA
IIOS_30V	I_{IO}	+Vcc = 30V, $V_{OUT} = 15V$ (Note: 1)	-25.00nA	25.00nA
AOL		+Vcc = 5V, $V_{OUT} = (11V, 1V)$	50 V/mV	
I_SINK		+Vcc = 5V, $V_{OUT} = 1.5V$ (Note: 2)	6.00mA	
V_SAT		+Vcc = 5V, $I_{OUT} = 4.0mA$ (Note: 2)		400.0mV
I_LEAK		+Vcc = 30V, $V_{OUT} = 30V$		0.500uA

TABLE IV: Summary of Electrical Measurements after Total Dose Exposures and Annealing for LM139 /1

Parameters /2	Spec. Lim. /3 min max	Total Dose Exposure (TDE)																		Annealing					
		Initial		5 krad		10 krad		15 krad		20 krad		30 krad		50 krad		75 krad		100 krad		168 hrs @25°C		168 hrs @100°C			
		mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd		
Icc_5V	nA	0	3.0	0.89	.02	0.68	.01	0.68	.01	0.67	.01	0.68	.01	0.67	.01	0.66	.01	0.64	.01	0.65	.01	0.65	.01	0.67	0
Icc_30V	nA	0	3.2	1.40	.02	1.40	.02	1.45	.03	1.44	.02	1.44	.03	1.43	.02	1.43	.02	1.40	.02	1.38	.02	1.38	.02	1.35	.41
VOS_5V_CMP1	mV	-5.0	5.0	-0.18	.52	-0.23	.49	-0.23	.49	-0.23	.48	-0.23	.48	-0.23	.45	-0.23	.46	-0.20	.46	-0.20	.46	-0.20	.46	-0.20	.41
VOS_30V_CMP1	mV	-5.0	5.0	-0.24	.68	-0.25	.61	-0.27	.61	-0.27	.59	-0.26	.58	-0.23	.53	-0.23	.54	-0.19	.53	-0.19	.53	-0.19	.53	-0.19	.41
PSRR_CMP1	dB	70	-	59.2	5.2	59.1	4.8	59.2	4.5	59.4	4.2	59.7	5.7	59.3	5.3	59.2	5.4	59.1	5.3	59.1	5.3	59.1	5.3	59.1	.47
P_IIB_5V_CMP1	nA	-100	-1.0	-39.6	1.5	-39.0	1.5	-39.1	1.6	-39.1	1.5	-39.2	1.6	-39.1	1.6	-39.1	1.6	-39.1	1.6	-39.1	1.6	-39.1	1.6	-39.1	1.6
N_IIB_5V_CMP1	nA	-100	-1.0	-39.1	1.6	-39.1	1.6	-39.1	1.6	-39.1	1.6	-39.1	1.6	-39.1	1.6	-39.1	1.6	-39.1	1.6	-39.1	1.6	-39.1	1.6	-39.1	1.6
ILOS_5V_CMP1	nA	-25	25	-0.50	.40	-0.45	.40	-0.43	.40	-0.43	.54	-0.43	.62	-0.43	.68	-0.43	1.4	-0.43	2.0	-0.43	2.4	-0.43	2.5	-0.43	8.5
P_IIB_30V_CMP1	nA	-100	-1.0	-32.8	1.6	-32.8	1.6	-32.8	1.6	-32.8	1.6	-32.8	1.6	-32.8	1.6	-32.8	1.6	-32.8	1.6	-32.8	1.6	-32.8	1.6	-32.8	8.1
N_IIB_30V_CMP1	nA	-100	-1.0	-32.8	1.6	-32.8	1.6	-32.8	1.6	-32.8	1.6	-32.8	1.6	-32.8	1.6	-32.8	1.6	-32.8	1.6	-32.8	1.6	-32.8	1.6	-32.8	1.5
ILOS_30V_CMP1	nA	-25	25	-0.45	.54	-0.43	.45	-0.43	.47	-0.43	.62	-0.43	.66	-0.43	4.4	-0.43	2.2	-0.43	2.5	-0.43	2.5	-0.43	2.8	-0.43	8.2
AOL_CMP1	V/mV	50	-	235	57	236	60	237	71	239	85	239	106	241	91	240	1.4	240	2.1	240	2.1	240	2.3	240	1.6
I_SINK_CMP1	nA	6.0	-	19.3	.62	18.1	.60	18.0	.60	17.8	.59	17.7	.60	17.8	.70	17.2	.58	16.8	.58	16.8	.59	16.8	.59	16.8	.95
V_SAT_CMP1	mV	-	400	232	7.7	233	7.5	233	7.5	234	7.5	234	7.5	234	7.6	234	7.6	234	7.5	234	7.4	234	7.5	234	8.1
I_LEAK_CMP1	nA	-	3.5	0.25	.02	0.13	0.02	0.12	0	0.10	0	0.11	0	0.10	.03	0.10	.03	0.10	.02	0.05	0	0.16	0	0.04	.02

- 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/ Values for all parameters except Icc_5V and Icc_30V are given only for section 1. Values for other sections are available on request.
 - 3/ These are manufacturers' non-irradiated data sheet specification limits. No post-irradiation limits were provided by the manufacturer at the time the tests were performed. Radiation-sensitive parameters were: none.

Table V. Radiation Bias Circuit for LMI39



Vcc = 15 VDC

FY 1997 - OCT 1996 TO SEP 1997
 EOSDIS
 BUDGET: 1.5 MAN YEARS
 TED HAMMER JOB# 310-428-13-01-64

