

UNISYS

DATE: June 10, 1997
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 SUBJECT: Radiation Report on: OP271A
 Project: SMEX/LITE
 Job #: EV78042
 Project part #: OP271A

PPM-97-022

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A radiation evaluation was performed on OP271A (5962-88721022A) 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 IV and Figure 1.

The total dose testing was performed using a Co^{60} 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, 15.0, 20.0 30.0 and 50.0 kRads.* The dose rate was between 0.06 and 0.50 kRads/hour (see Table II for radiation schedule). After the 50.0 kRad exposure, the parts were annealed for 168 hours at 25°C. After each radiation exposure and annealing treatment, parts were electrically tested according to the test conditions and the specification limits** listed in Table III, except for slew rate. See the note for slew rate test in tables III and IV.

Initial electrical measurements were made on 10 samples. Eight samples (SN's 103, 104, 105, 106, 107, 108, 109, and 110) were used as radiation samples while SN's 101 and 102 were used as control samples. All parts passed all tests during initial electrical measurements.

All parts passed all tests to 5.0 kRads. No significant degradation was noted in any parameter.

After the 10.0 kRad irradiation, all parts except SN 110 exceeded the specification limits for Ios_A and Ios_B . Readings for each parameter were within the range of 10.2 to 15.1nA, against a specification limit of 10.0nA. All parts passed all other tests.

After the 15.0 kRad irradiation, SN's 103 and 105 exceeded the limit for $+\text{Ib}_A$ with readings of 35.0 and 42.4nA respectively, against a specification limit of 20.0nA. All parts except SN 110 exceeded the limits for $-\text{Ib}_A$ and $+\text{Ib}_B$ with readings within the range of 18.5 to 35.2nA, against a specification limit of 20.0nA. SN's 103 and 105 exceeded the limit for $-\text{Ib}_B$ with readings of 20.5 and 21.7nA respectively, against a specification limit of 20.0nA. All parts exceeded the specification limits for Ios_A and Ios_B . Readings for both parameters were within the range of 18.3 to 35.4nA. All parts passed all other tests.

After the 20.0 kRad irradiation, all parts exceeded the specification limits for $+\text{Ib}_A$, $-\text{Ib}_A$, $+\text{Ib}_B$, $-\text{Ib}_B$, Ios_A , and Ios_B . Readings were within the range of 22 to 59nA for all of these parameters. All parts passed all other tests.

After the 30.0 kRad irradiation, all parts showed further degradation in $+\text{Ib}_A$, $-\text{Ib}_A$, $+\text{Ib}_B$, $-\text{Ib}_B$, Ios_A , and Ios_B . Readings were within the ranges 45 to 95nA for all of these parameters. SN's 103, 104 and 108 fell

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

** These are manufacturer's pre-irradiation data specification limits. The manufacturer provided no post-irradiation limits at the time these tests were performed.

marginally below the limit for N_PSRR_A, with readings of 107, 105 and 106dB respectively. **All parts passed all other tests.**

After the 50.0 kRad irradiation, all parts continued to show further degradation in +Ib_A, -Ib_A, +Ib_B, -Ib_B, Ios_A, and Ios_B. Readings were within the range of 37 to 144nA for all of these parameters. All parts fell marginally below the limit for N_PSRR_A with readings within the range of 104 to 108dB. **All parts passed all other tests.**

After annealing the parts for 168 hours at 25°C, parts showed no significant recovery in any parameter.

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.

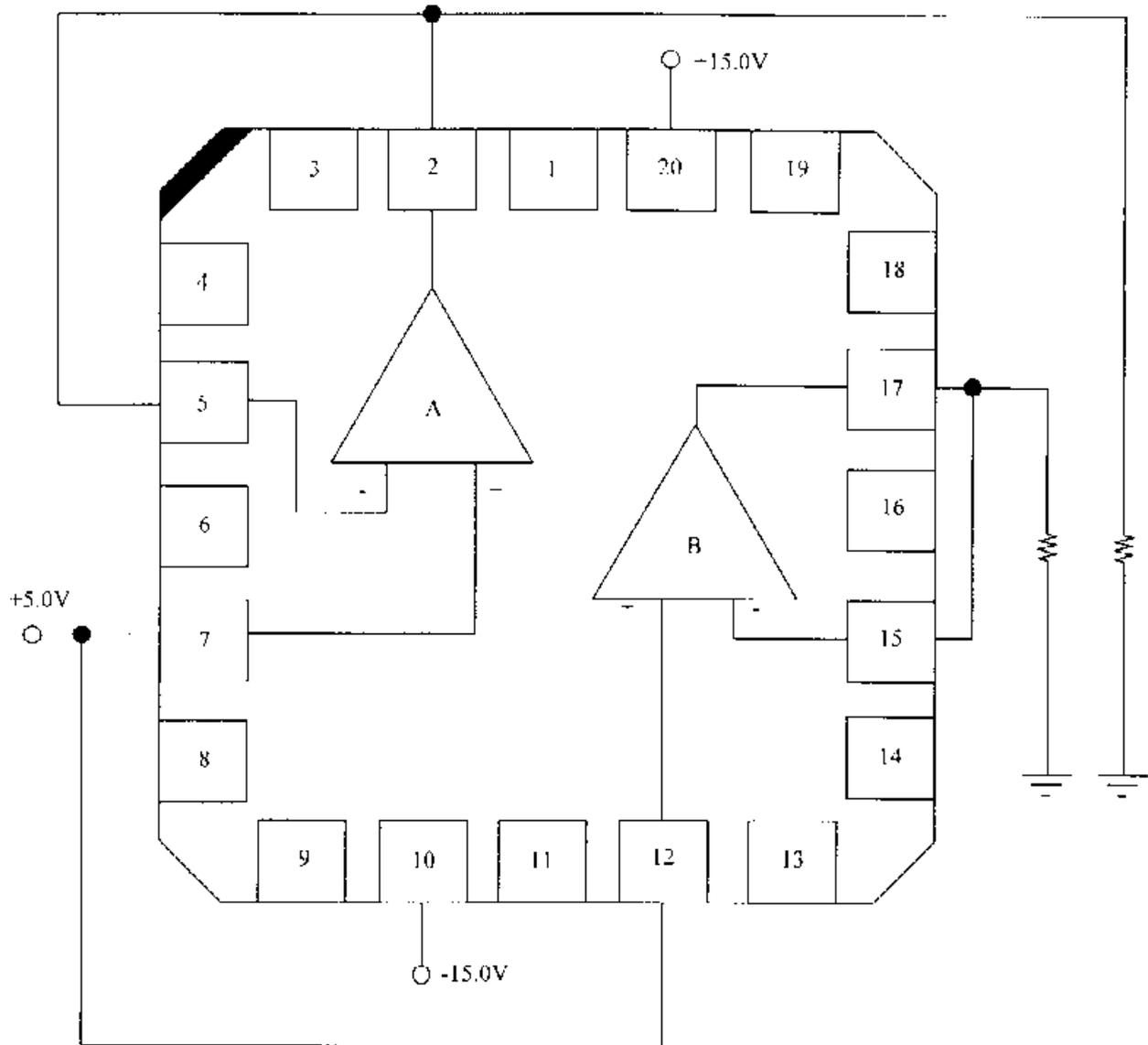
Any further details about this evaluation can be obtained upon request. If you have any questions, please call me at (301) 731-8954.

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Figure 1. Radiation Bias Circuit for OP271A



Pin connection list:

1: NC 2: OUT A 3: NC 4: NC 5: -IN A 6: NC 7: +IN A 8: NC 9: NC 10: -V
 11: NC 12: +IN B 13: NC 14: NC 15: -IN B 16: NC 17: OUT B 18: NC 19: NC 20: +V

Resistors are $300\Omega + 5\%$, $\frac{1}{4}$ W

Use 20 pin LCC to 8 pin DIP adapters.

TABLE I. Part Information

Generic Part Number:	OP271A
SMEX/LITE Part Number	5962-88721022A
Charge Number:	EV78042
Manufacturer:	Analog Devices
Lot Date Code (LDC):	9624
Quantity Tested:	10
Serial Number of Control Samples.	101, 102
Serial Numbers of Radiation Samples:	103, 104, 105, 106, 107, 108, 109, and 110
Part Function:	OP-AMP
Part Technology:	Bipolar
Package Style:	20 Pin LCC
Test Equipment:	A540
Test Engineer:	A. Naji

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

TABLE II. Radiation Schedule for OP271A

EVENT.....	DATE
1) INITIAL ELECTRICAL MEASUREMENTS.....	05/09/97
2) 2.5 KRAD IRRADIATION (0.062 KRADS/HOUR)	05/09/97
POST-2.5 KRAD ELECTRICAL MEASUREMENT	05/12/97
3) 5 KRAD IRRADIATION (0.062 KRADS/HOUR)	05/12/97
POST-5 KRAD ELECTRICAL MEASUREMENT	05/14/97
4) 7.5 KRAD IRRADIATION (0.062 KRADS/HOUR)	05/14/97
POST-7.5 KRAD ELECTRICAL MEASUREMENT	05/16/97
5) 10.0 KRAD IRRADIATION (0.062 KRADS/HOUR)	05/16/97
POST-10.0 KRAD ELECTRICAL MEASUREMENT	05/19/97
6) 15.0 KRAD IRRADIATION (0.125 KRADS/HOUR)	05/19/97
POST-15.0 KRAD ELECTRICAL MEASUREMENT	05/21/97
7) 20.0 KRAD IRRADIATION (0.125 KRADS/HOUR)	05/21/97
POST-20.0 KRAD ELECTRICAL MEASUREMENT	05/23/97
8) 30.0 KRAD IRRADIATION (0.250 KRADS/HOUR)	05/23/97
POST-30.0 KRAD ELECTRICAL MEASUREMENT	05/26/97
9) 50.0 KRAD IRRADIATION (0.250 KRADS/HOUR)	05/26/97
POST-50.0 KRAD ELECTRICAL MEASUREMENT	05/28/97
10) 168 HOUR ANNEALING @25°C	05/28/97
POST-168 HOUR ANNEAL ELECTRICAL MEASUREMENT	06/05/97

Effective Dose Rate = 50,000 RADS/20 DAYS=104.2 RADS/HOUR=0.029 RADS/SEC

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

Table III. Electrical Characteristics of OP271A /1

Test #	Parameter	Units	Test Conditions ^{2/}	Spec. min	Lim. max
1	+I _{CC}	mA	No Load	0.0	6.5
2	+I _{CC}	mA	No Load	-6.5	0.0
3	out_A	μV	V _S = ±15V	-200	200
4	out_B	μV	V _S = ±15V	-200	200
5	+ib_A	nA	V _{CM} = 0V	-20	20
6	-ib_B	nA	V _{CM} = 0V	-20	20
7	+ib_A	nA	V _{CM} = 0V	-20	20
8	-ib_B	nA	V _{CM} = 0V	-20	20
9	ios_A	nA	V _{CM} = 0V	-10	10
10	ios_B	nA	V _{CM} = 0V	-10	10
11	cmrr_A	dB	V _{CM} = ±12V	106	
12	cmrr_B	dB	V _{CM} = ±12V	106	
13	+swing_A	V	R _L = 2kΩ	12.0	
14	-swing_A	V	R _L = 2kΩ		-12.0
15	+swing_B	V	R _L = 2kΩ	12.0	
16	-swing_B	V	R _L = 2kΩ		-12.0
17	open_loop_gain_A	V	R _L = 2kΩ, V _O = ±10V	300	
18	open_loop_gain_B	V	R _L = 2kΩ, V _O = ±10V	300	
19	P_PSRR_A	dB	V _S = +4.5V to +18V	109	
20	P_PSRR_B	dB	V _S = +4.5V to +18V	109	
21	N_PSRR_A	dB	V _S = -4.5V to -18V	109	
22	N_PSRR_B	dB	V _S = -4.5V to -18V	109	

Note:

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

2/ For all tests, V_S = +15V unless otherwise specified.

