

Unisys

DATE: June 22, 1998
TO: R. Koehler/303
FROM: K. Sahu/S. Kniffin/300.1
SUBJECT: Radiation Report on **CLC502 (LDC Not Marked)**
PROJECT: Integral Spectrometer

PPM-98-019

cc: F. Duttweiler/UCSD, R. Reed/562, A. Sharma/562, OFA Library/300.1

A radiation evaluation was performed on **CLC502AJP Low-Gain Op Amp with Fast 14-bit Settling (Comlinear/National Semi.)** 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, five 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 5.0, 10.0, 15.0, 20.0, 30.0, 50.0, 75.0, and 100.0 kRads.¹ The dose rate was between 0.125 and 0.625 kRads/hour (0.035 to 0.174 Rads/s). See Table II for the radiation schedule and effective dose rate calculation. After the 100.0 kRad irradiation, the parts were annealed under bias at 25°C and tested after 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. A summary of the test results is provided below, for detailed information, refer to Tables I through IV and Figure 1.

Initial electrical measurements were made on 6 samples. Five samples (SN's 305, 306, 307, 308, and 309) were used as radiation samples while SN 314 was used as a control sample. All parts passed all tests during initial electrical measurements.

All parts passed all tests up to 100.0 kRads. No significant degradation was noted in any parameter.

After annealing the parts for 168 hours at 25°C, parts showed no significant change 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 us at (301) 731-8954.

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.

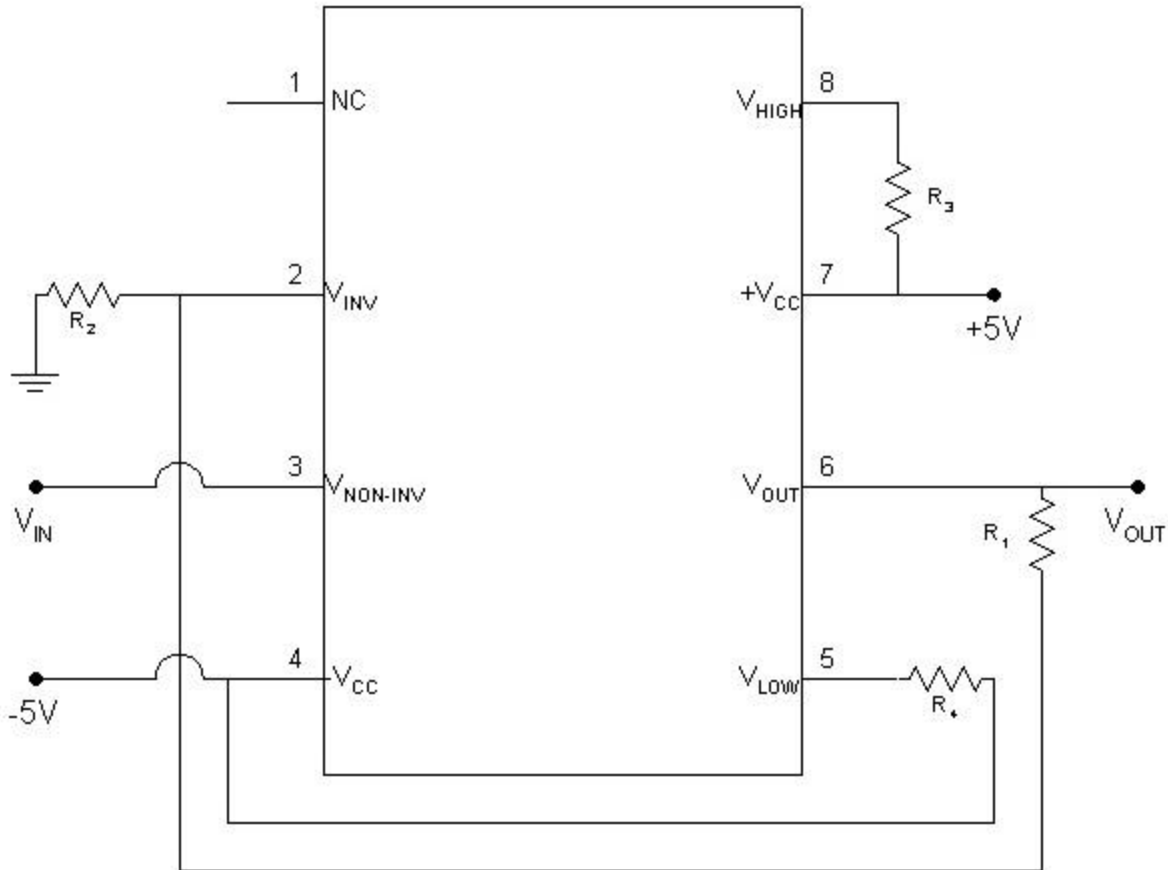
³ These are manufacturer's pre-irradiation data specification limits. The manufacturer provided no post-irradiation limits at the time these tests were performed.

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Figure 1. Radiation Bias Circuit for CLC502



Notes:

1. R_1 & $R_2 = 250\Omega \pm 5\%$, $\frac{1}{4}W$.
2. R_3 & $R_4 = 1k\Omega \pm 5\%$, $\frac{1}{4}W$.
3. $V_{IN} = V_{OUT} = 3.0V \pm 10\%$.

TABLE I. Part Information

Generic Part Number:	CLC502
Integral Spectrometer Part Number	CLC502AJP
Charge Number:	C80777
Manufacturer:	Comlinear/National Semi.
Lot Date Code (LDC):	LDC Not Marked
Quantity Tested:	6
Serial Number of Control Samples:	314
Serial Numbers of Radiation Samples:	305, 306, 307, 308, and 309
Part Function:	Clamping, Low-Gain Op Amp w/ Fast 14-bit Settling
Part Technology:	Bipolar
Package Style:	8-Pin DIP
Test Equipment:	A540
Test Engineer:	S. Norris

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

TABLE II. Radiation Schedule for CLC502

EVENT	DATE
1) INITIAL ELECTRICAL MEASUREMENTS.....	05/19/98
2) 5.0 KRAD IRRADIATION (0.125 KRADS/HOUR)	05/20/98
POST-5.0 KRAD ELECTRICAL MEASUREMENT	05/22/98
3) 10.0 KRAD IRRADIATION (0.056 KRADS/HOUR)	05/22/98
POST-10.0 KRAD ELECTRICAL MEASUREMENT	05/26/98
4) 15.0 KRAD IRRADIATION (0.125 KRADS/HOUR)	05/26/98
POST-15.0 KRAD ELECTRICAL MEASUREMENT	05/28/98
5) 20.0 KRAD IRRADIATION (0.125 KRADS/HOUR)	05/29/98
POST-20.0 KRAD ELECTRICAL MEASUREMENT	06/01/98
6) 30.0 KRAD IRRADIATION (0.250 KRADS/HOUR)	06/01/98
POST-30.0 KRAD ELECTRICAL MEASUREMENT	06/03/98
7) 50.0 KRAD IRRADIATION (0.500 KRADS/HOUR)	06/03/98
POST-50.0 KRAD ELECTRICAL MEASUREMENT	06/05/98
8) 75.0 KRAD IRRADIATION (0.384 KRADS/HOUR)	06/05/98
POST-75.0 KRAD ELECTRICAL MEASUREMENT	06/08/98
9) 100.0 KRAD IRRADIATION (0.625 KRADS/HOUR)	06/08/98
POST-100.0 KRAD ELECTRICAL MEASUREMENT	06/10/98
10) 168 HOUR ANNEALING @25°C	06/10/98
POST-168 HOUR ANNEAL ELECTRICAL MEASUREMENT	06/17/98

Effective Dose Rate = 100,000 RADS/20 DAYS=208.3 RADS/HOUR=0.06 RADS/SEC

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

Table III. Electrical Characteristics of CLC502 /1

Test #	Parameter /2	Units	Test Conditions /2	Spec. min	Lim. max
1	I _{cc}	mA	No Load		23
2	V _{os}	mV			1.60
3	I _{ib_non_inv}	μA	Non-Inverting	-20	20
4	PSRR	dB		60	
5	PSRR	dB		60	
6	CMRR	dB		60	
7	+ _{swing}	V	0.5V Step	3.20	
8	- _{swing}	V	0.5V Step		-3.20
9	Rise_Time /2	ns	5V Step		8.00
10	Slew Rate	V/μs		500	
11	Large_Sig_BW	MHz	V _{OUT} < 5V _{PP}	40.00	

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/ Due to measurement difficulties with the ATE, the Rise Time was measured with a bench setup after 20kRads. Slew Rate and Large_Sig_BW were then calculated from the Rise Time measurement.

TABLE IV: Summary of Electrical Measurements after Total Dose Exposures and Annealing for CLC502 /1

Test #	Parameters	Units	Spec. Lim. /2		Total Dose Exposure (kRads Si)																				Annealing	
					Initial		5.0		10.0		15.0		20.0		30.0		50.0		75.0		100.0		168 hours @25°C			
			min	max	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
1	Icc	mA		23	18.9	0.3	18.9	0.3	18.9	0.3	18.9	0.3	18.9	0.3	18.9	0.3	18.9	0.3	18.9	0.3	18.9	0.3	18.9	0.3	18.9	0.3
2	Vos	mV		1.60	0.31	0	0.31	0	0.31	0	0.31	0	0.31	0	0.31	0	0.31	0	0.31	0	0.31	0	0.31	0	0.31	0
3	lib_non_inv	?A	-20	20	-1	6	-1	6	-1	6	-1	6	-1	6	-1	5	-1	5	-1	5	-1	5	-1	5	-1	5
4	PSRR	dB	60		95	9	98	5	102	11	105	15	101	8	95	4	105	11	106	11	100	10	101	6		
5	PSRR	dB	60		96	4	103	10	93	3	96	5	100	6	101	10	111	10	103	7	101	14	100	8		
6	CMRR	dB	60		98	4	103	15	102	2	97	2	97	7	103	7	99	7	98	5	98	2	102	7		
7	+_swing	V	3.20		3.39	0	3.39	0	3.39	0	3.39	0	3.39	0	3.39	0	3.39	0	3.39	0	3.39	0	3.39	0	3.39	0
8	-_swing	V		-3.20	-3.26	0	-3.26	0	-3.26	0	-3.26	0	-3.26	0	-3.26	0	-3.26	0	-3.26	0	-3.26	0	-3.26	0	-3.26	0
9	Rise_Time	ns		8.00	4.41	0.46	4.42	0.32	4.43	0.20	4.95	0.16	4.64	0.13	4.70	0.16	4.29	0.53	4.20	0.28	4.15	0.19	5.38	0.16		
10	Slew Rate	V/μs	500		918	103	908	69	904	41	809	27	861	26	852	28	946	118	956	61	965	44	744	22		
11	Large_Sig_BW	MHz	40.00		79.94	8.44	79.49	6.00	79.08	3.60	70.84	2.34	75.33	2.24	74.58	2.48	82.66	10.43	83.20	5.31	84.0	3.90	64.6	2.06		

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 in this
 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: None.