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PPM-92-131

DATE: April 10, 1992

TO: J. Lohr/311

PARAMAX

A Unisys Company

FROM: K. Sahu/7809

SUBJECT: Radiation Report on ISTP/PA GGS/POLAR-UVI Project
Part no. AD674AT/883BAD674AT (control no. 5523)

cc: J. Galloway/407
G. Robinson/311
A. Sharma/311
✓Library/311

A radiation evaluation was performed on the AD674AT Analog-to-Digital Converter 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 cobalt-60 gamma-ray source. During the radiation testing, four parts were irradiated under bias (see Figure 1 for bias configuration), and one part was used as a control sample. The total dose radiation steps were 10, 20, 30, 50, 75 and 100 krads*. After 100 krads, parts were annealed at +25°C for 168 hours. After this annealing, the parts were irradiated to 200 and 300 krads total dose. The dose rate was between 0.4 and 5 krads/hour, depending on the total dose level (see Table II for radiation schedule). After each radiation exposure and annealing treatment, parts were electrically tested at +25°C according to the test conditions and the specification limits listed in Table III.

The parts passed all tests on irradiation up to 50 krads. After the 50-krad irradiation, three parts marginally exceeded the specification limits for linearity. Of these, one part also exceeded the specification limits for all three gain parameters and another exceeded the specification limits for differential linearity. Upon continued irradiation to 100 krads, additional failures in various parameters (linearity, differential linearity, all three zero parameters and all three gain parameters) occurred in all four irradiated parts.

After annealing for 168 hours at +25°C, one part (SN 698) showed recovery in zero parameters and one (SN 699) showed complete recovery in all parameters. After additional irradiation to 200 and 300 krads, all parts again showed failure in the same parameters as before annealing, with one (SN698) failing catastrophically with missing code after 300 krads.

Table IV gives 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 rad as used here means rad(Si).

TABLE I. Part Information

Generic Part Number:	AD674AT
ISTP/PA Part Number:	AD674AT/883B
Control Number:	5523
Charge Number:	C23355
Manufacturer:	Analog Devices
Lot Date Code:	8941A
Quantity Tested:	5
Serial Numbers of Radiation Samples:	697, 698, 699, 700
Serial Number of Control Sample:	696
Part Function:	12-bit Analog-to-Digital Converter
Part Technology:	BiMOS (monolithic bipolar/CMOS)
Package Style:	28-pin DIP
Test Engineer:	T. Mondy

TABLE II. Radiation Schedule for AD674AT

EVENTS	DATE
1) Initial (Pre-Irradiation) Electrical Measurements	01/09/92
2) 10- KRAD IRRADIATION (0.5 krads/hour)*	01/22/92
POST-10-KRAD ELECTRICAL MEASUREMENT	02/12/92
3) 20-KRAD IRRADIATION (0.5 krads/hour)	02/12/92
POST-20-KRAD ELECTRICAL MEASUREMENT	02/13/92
4) 30-KRAD IRRADIATION (0.5 krads/hour)	02/13/92
POST-30-KRAD ELECTRICAL MEASUREMENT	02/24/92
5) 50-KRAD IRRADIATION (1 KRAD/HOUR)	02/24/92
POST-50-KRAD ELECTRICAL MEASUREMENT	02/25/92
6) 75-KRAD IRRADIATION (1.25 KRADS/HOUR)	02/27/92
POST-75-KRAD ELECTRICAL MEASUREMENT	02/28/92
7) 100-KRAD IRRADIATION (0.4 KRADS/HOUR)	02/28/92
POST-100-KRAD ELECTRICAL MEASUREMENT	03/02/92
8) 168 HOURS ANNEALING AT +25°C	03/02/92
POST-168-HOUR ELECTRICAL MEASUREMENTS	03/09/92
9) 200-KRAD IRRADIATION (5 KRADS/HOUR)	03/09/92
POST-200-KRAD ELECTRICAL MEASUREMENT	03/10/92
10) 300-KRAD IRRADIATION (5 KRADS/HOUR)	03/10/92
POST-300-KRAD ELECTRICAL MEASUREMENT	03/11/92

ALL ELECTRICAL MEASUREMENTS WERE PERFORMED AT +25°C.

ALL PARTS WERE IRRADIATED AND ANNEALED UNDER BIAS; SEE FIGURE 1.

*Parts were kept under bias for 18 days following the 10 krad exposure while the test equipment was under repair.

Table III. Electrical Characteristics of AD674AT

$T_A=25C, V_{CC}=15V, V_{EE}=-15V, V_{LOGIC}=5V$

TEST	CONDITIONS	LIMIT		UNITS
		Min	Max	
+I _{cc1}	(I _{CC})		5	mA
-I _{cc1}	(I _{EE})		29	mA
I _{cc2}	(I _L)		40	mA
V _{REF}		9.9	10.1	V
ZERO1	VFS = 10.0V Unipolar Mode	-48.8	48.8	m%FS
GAIN1	VFS = 10.0V Unipolar Mode	-250	250	m%FS
ZERO2	VFS = 20.0V Bipolar Mode	-97.7	97.7	m%FS
GAIN2	VFS = 20.0V Bipolar Mode	-250	250	m%FS
ZERO3	VFS = 10.0V Bipolar Mode	-97.7	97.7	m%FS
GAIN3	VFS = 10.0V Bipolar Mode	-250	250	m%FS
* The following tests are performed with both a Unipolar 10V Span and Bipolar 20V Span.				
L _{in}	(INL)			
D L _{in}	(DNL)		12.2	m%FS
			24.4	m%FS

Table III cont. Electrical Characteristics of AD674AT

	Min	Max	
* The following tests are performed			
with both a Unpolar 10V Span and			
Bipolar 20V Span.			
dSF1+ V _{CC} = 16.5V to 13.5V		24.4	m%FS
dSF2- V _{EE} = -16.5V to -13.5V		24.4	m%FS
dSF2+ V _{LOG} = 5.5V to 4.5V		24.4	m%FS

Exceptions:

- 1.) Offset Drift Error Tests are not performed.
- 2.) Full-Scale Drift Tests are not performed.
- 3.) Logic High and Low levels performed Go/NoGo.
- 4.) Logic Input/Output source, sink and leakage current tests are not performed.
- 5.) AC Electrical Tests are not performed.
- 6.) Internal Reference Output Voltage Test performed with NO-LOAD.

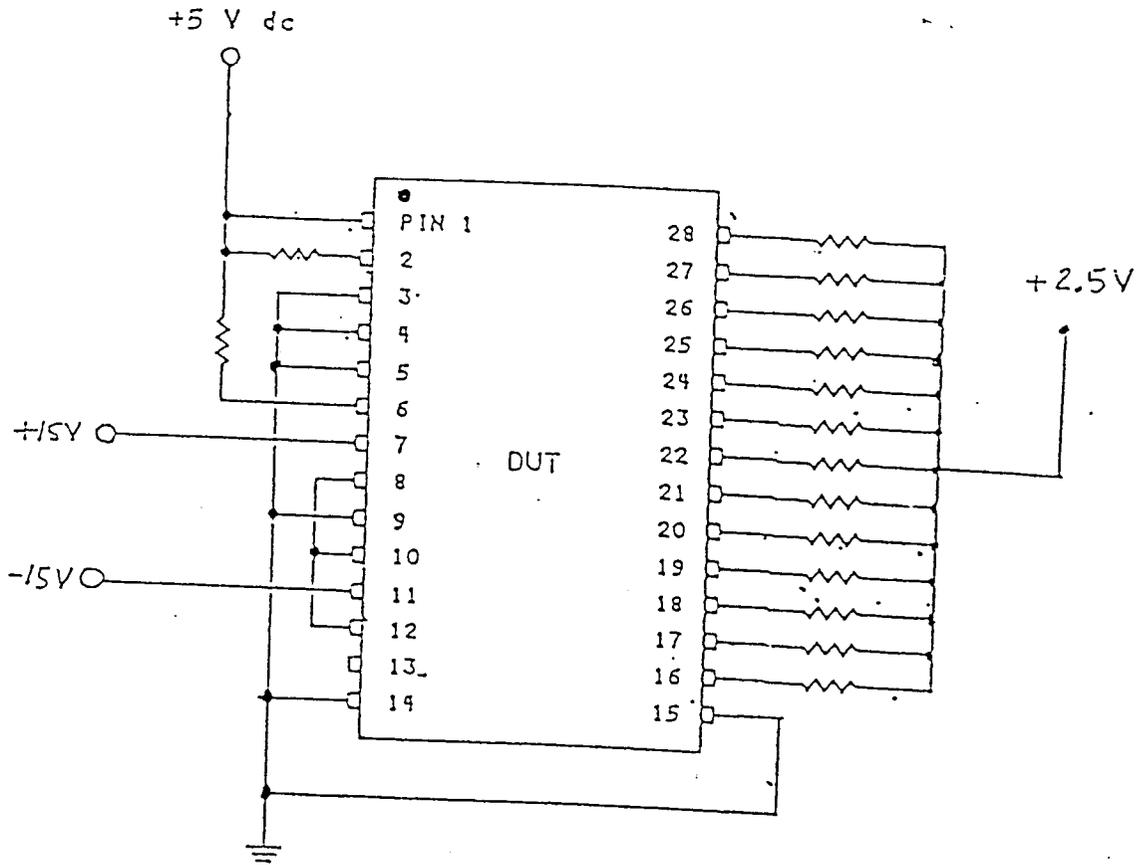
Additional Test Conditions:

- V_{OH} = 2.4V min
- V_{OL} = 4.0mV max
- V_{IH} = 8.0mV
- V_{IL} = 2.0V

* ZERO3 & GAIN3 - Test are supplied as addition information only.
Limits are the same as for the ZERO2 & GAIN2 Tests.

DC TEST PERFORMED				UNLESS OTHERWISE INDICATED.		
TEST	VIN	PINS	TEST CONDITIONS	LIMITS @25C, -55C, +125C		
=====	=====	=====	=====	=====		
CE_1IH	UV	6	VTEST=5.5V	> -100UA	<	+100UA
RC_1IH	UV	5	VTEST=5.5V	> -100UA	<	+100UA
CE_1IL	UV	6	VTEST=0.0V	> -100UA	<	+100UA
RC_1IL	UV	5	VTEST=0.0V	> -100UA	<	+100UA
I2H	10V	OUTS	M2, VTEST=5.5V	> -20UA	<	+20UA
I2L	10V	OUTS	L2, VTEST=0.0V	> -20UA	<	+20UA
V2H	10V	OUTS	ILOAD = -500UA	> +2.4V	<	+5.0V
I2E	10V	11	OUTPUT TRI STATE	> -29.0MA	<	0.0MA
ICC	10V	7	OUTPUT TRI STATE	> 0.0MA	<	5.0MA
ILOGIC	10V	7	OUTPUT TRI STATE	> 0.0MA	<	40.0MA

Figure 1. Radiation Bias Circuit for AD674AT



Notes:

- 1) All resistors 2.0k Ohm, $\pm 10\%$, 1/4 watt.
- 2) One 10 uF, $\pm 20\%$ capacitor shall be connected from each voltage supply line to ground.