

ADVISORY ON THE USE OF THIS DOCUMENT

The information contained in this document has been developed solely for the purpose of providing general guidance to employees of the Goddard Space Flight Center (GSFC). This document may be distributed outside GSFC only as a courtesy to other government agencies and contractors. Any distribution of this document, or application or use of the information contained herein, is expressly conditioned upon, and is subject to, the following understandings and limitations:

- (a) The information was developed for general guidance only and is subject to change at any time;
- (b) The information was developed under unique GSFC laboratory conditions which may differ substantially from outside conditions;
- (c) GSFC does not warrant the accuracy of the information when applied or used under other than unique GSFC laboratory conditions;
- (d) The information should not be construed as a representation of product performance by either GSFC or the manufacturer;
- (e) Neither the United States government nor any person acting on behalf of the United States government assumes any liability resulting from the application or use of the information.

Interoffice Memorandum

PPM-91-0364

Date June 6, 1991

Location Lanham

Telephone 731-8954

Location Lanham

To W. Beyah
Department Code 300.1From K. Sahu KS

Department 7809

Subject Radiation Report on ISTD
Non-Common Buy Part No. AD571SDG. Krishnan/311
V. Edson
S. Esmacher
D. Krus
R. Woodward
F. Grena/692
K. Ogilvie/692
J. Scudder/692

A radiation evaluation was performed on AD571SD 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 IVb and Figure 1.

The total dose testing was performed using a cobalt-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 steps were 10, 20, 30, 50, 75, and 100 krads. After 100 krads, parts were annealed at 25°C for 24 and 168 hours, and then the irradiation was continued to 200 and 300 krads (cumulative). The dose rate was between 0.5 - 5.0 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 according to the test conditions and the specification limits listed in Table III.

All (8) parts passed initial electrical measurements and continued to stay within the specification limits for all parameters up to 20 krads irradiation. After 30 krads exposure, two parts (SN 17 and SN 18) marginally exceeded the specification limits on zero error 2, but all parts passed all other tests. After 50 krads exposure, all parts were exceeding the specification limits on one or more of the following parameters: zero error 2, gain error 2, and differential linearity (DLin). After 75 and 100 krads, parts continued to exceed the specification limits on all the above parameters. Additionally, at 100 krads, some parts exceeded the specification limits on V_{OL} . No significant recovery was observed on annealing the parts for 24 and 168 hours. On continued exposures to 200 and 300 krads cumulative, the parts became non-functional, and no parametric measurements except for $\pm I_{CC}$ and V_{OH} could be made.

Table IV provides the mean and standard deviation values for each parameter after different radiation exposures and annealing treatments. It also provides a summary of functional test results after each radiation/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.

TABLE I. Part Information

Generic Part Number:	AD571SD
ISTP Non-Common Buy Part Number:	5962-8680202VA
ISTP Non-Common Buy Control Number:	1979
Manufacturer:	Analog Devices, Inc.
Quantity Procured:	22
Lot Date Codes:	8846
Quantity Tested:	10
Serial Numbers of Radiation Samples:	13, 14, 15, 16, 17, 18, 19, 20
Serial Numbers of Control Samples:	11, 12
Part Function:	10 Bit Analog/Digital Converter
Part Technology:	Bipolar
Package Style:	18 Pin Dip

TABLE II. Radiation Schedule

EVENTS	DATE
1) Initial Electrical Measurements	04/17/91
2) 10 krads irradiation @ 556.56 rads/hr	04/18/91
Post 10 krads Electrical Measurements	04/19/91
3) 20 krads irradiation @ 500 rads/hr	04/19/91
Post 20 krads Electrical Measurements	04/20/91
4) 30 krads irradiation @ 499.8 rads/hr	04/21/91
Post 30 krads Electrical Measurements	04/22/91
5) 50 krads irradiation @ 1111.11 rads/hr	04/22/91
Post 50 krads Electrical Measurements	04/23/91
5) 75 krads irradiation @ 1315.7 rads/hr	04/23/91
Post 75 krads Electrical Measurements*	05/06/91
5) 100 krads irradiation @ 1388.9 rads/hr	05/06/91
Post 100 krads Electrical Measurements	05/07/91
6) 24 hour annealing	05/08/91
Post 24 hr Electrical Measurements	05/09/91
7) 168 hour annealing	05/09/91
Post 168 hr Electrical Measurements	04/14/91
8) 200 krads irradiation @ 5263.2 rads/hr	05/14/91
Post 200 krads Electrical Measurements	05/15/91
9) 300 krads irradiation @ 5556 rads/hr	05/15/91
Post 300 krads Electrical Measurements	05/16/91

Notes:

- 1) All parts were radiated under bias at the cobalt-60 gamma ray facility at GSFC.
- 2) All electrical measurements were performed off-site at 25°C.
- 3) Annealing performed at 25°C under bias.

* Post 75 krad EMs were scheduled for 04/24/91; however, due to a malfunction with the testing board, actual post 75 krad electrical measurements were performed on 05/06/91.

Table III. Electrical Characteristics of AD571SD

Conditions

$+V_{CC} = +15V$, $-V_{EE} = -15V$
 $T_A = 25^\circ C$ (unless otherwise noted)

<u>Test</u>	<u>Other Conditions</u>	<u>MIN</u>	<u>MAX</u>
+I _{CC}		0.2 mA	10.0 mA
-I _{CC}		-15.0 mA	-0.9 mA
Zero1		-200 m%FS	200 m%FS
Gain1		-400 m%FS	400 m%FS
Zero2		-200 m%FS	200 m%FS
Gain2		-200 m%FS	200 m%FS
Lin		-98 m%FS	98 m%FS
DLin		-98 m%FS	98 m%FS
dFS1+	$V_{EE} = -15V$ $4.5V \leq V_{CC} \leq 5.5V$	-195 m%	195 m%
dFS1-	$V_{CC} = 5V$ $-16.0V \leq V_{EE} \leq -13.5V$	-195 m%	195 m%
V _{OL}	$I_{OL} = 3.2 mA$		400 mV
V _{OH}	$I_{OH} = -.05 mA$	2.4 V	

TABLE IV: Summary of Electrical Measurements after
Total Dose Exposures and Annealing for AD571SD 1/

Parameters	Spec. Limits min max	Initials		Total Dose Exposure (krads)												Annealing					
				10		20		30		50		75		100		24 hrs		168 hrs			
		mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd		
+Icc	mA	10		5.73	.25	5.28	.26	4.74	.21	4.32	.23	3.79	.25	3.70	.21	3.29	.25	3.37	.23	3.50	.24
-Icc	mA	15		10.41	.41	10.02	.48	9.62	.52	9.36	.52	8.89	.5	6.87	1.73	8.53	.44	8.55	.47	8.73	.45
Zero1	m%F	-200	200	107	4	110	5	107	6	112	5	119	6	102	5	105	5	99	6	103	6
Gain1	m%F	-400	400	53	13	84	15	115	18	130	29	281	51	213	40	272	60	274	55	170	57
Zero2	m%F	-200	200	59	6	77	22	94	27	127	42	195	76	132	45	204	73	207	48	127	42
Gain2	m%F	-200	200	51	8	71	16	104	16	122	29	185	48	248	41	272	60	249	76	173	55
Lin	m%F	-98	98	12	3	14	3	26	2	35	3	55	2	39	4	84	4	81	3	73	5
DLin	m%F	-98	98	18	1	33	3	53	3	75	5	151	69	140	9	170	9	171	8	147	8
DFS1+	m%	-195	195	2	2	1	1	5	2	4	2	1	1	3	2	5	2	4	2	7	4
DFS1-	m%	-195	195	50	5	52	5	55	4	55	5	63	7	65	7	73	5	68	7	74	10
VOL	mV		400	134	4	140	4	148	4	157	5	181	11	201	18	342	100	329	87	249	41
VCH	V	2.4		3.63	.01	3.59	.01	3.59	0.00	3.62	.01	3.58	.01	3.55	.03	3.17	.43	2.74	.63	2.89	.63

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.

TABLE IV (cont'd): Summary of Electrical Measurements
After Total Dose Exposures and Annealing for AD571SD

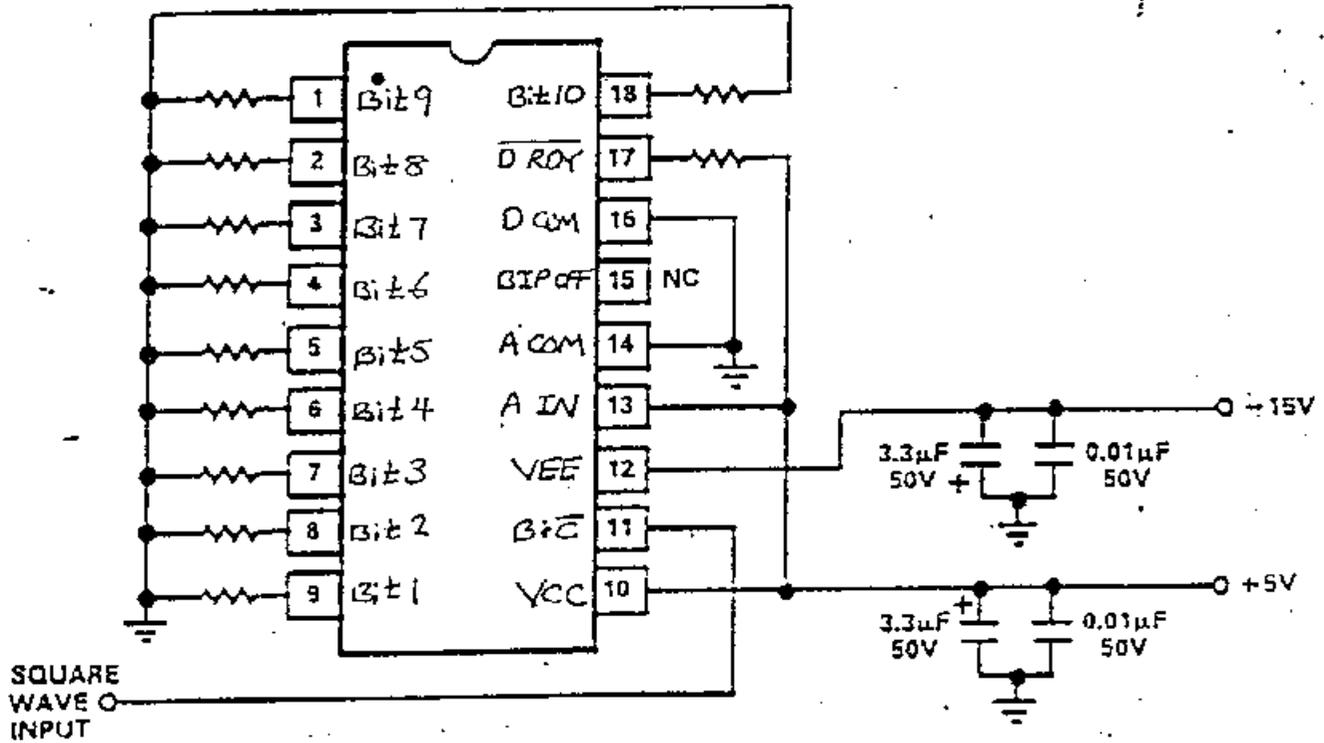
Parameters		Spec. Limits		Initials		Total Dose (krads)			
						200		300	
		min	max	mean	sd	mean	sd	mean	sd
+Icc	mA		10	5.73	.25	22.2	.53	1.67	.41
-Icc	mA		15	10.41	.41	8.18	.48	7.78	.66
Zero1	m%F	-200	200	107	4	*		*	
Gain1	m%F	-400	400	53	13	*		*	
Zero2	m%F	-200	200	59	6	*		*	
Gain2	m%F	-200	200	51	8	*		*	
Lin	m%F	-98	98	12	3	*		*	
DLin	m%F	-98	98	18	1	*		*	
dFS1+	m%	-195	195	2	2	*		*	
dFS1-	m%	-195	195	50	5	*		*	
VOL	mV		400	134	4	*		*	
VOH	V	2.4		3.63	.01	3.64	.25	3.84	.21

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

* The parts were no longer functional, and no reliable measurements would be made for these parameters at the noted radiation/annealing step.

Figure 1. Radiation Bias Circuit for AD571SD



All Resistors shall be 3.0kΩ 1%, 1/4 watt, Metal Film

3.30 µF 50 V Capacitors shall be low leakage tantalum

0.01 µF 50 V Capcitors shall be ceramic. These 0.01 µF capacitors should be kept close to the pins (10 & 12) as possible.