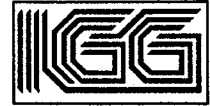

RADIATION TEST SUMMARY

PART TYPE : AD571SD

DESCRIPTION : 10 BIT A/D CONVERTER

REPORT NO. : RD 217

PARAMETERS PLOTTED :
VOH

NOTE : The following failures were also recorded but not plotted:

S/No 113 (unbiased) failed DNL (unipolar) @ 30 Krad and full scale error (bipolar) and DNL (bipolar) @ 50 Krad.
S/No 101 (biased) failed INL go/nogo (unipolar) @ 100 Krad.
S/No 103 (biased) failed INL go/nogo (unipolar) @ 75 Krad and DNL (bipolar), INL (bipolar) and min,max DNL @ 100 Krad.
S/No 105 (biased) failed DNL (unipolar) and INL go/nogo (unipolar) @ 75 Krad.

The results for the remaining parameters showed no significant change and hence plots were not considered necessary.

RIR IN:- 73641

RIR OUT:- 73641

- PARTS HISTORY LOG

Radiation Testing

PROGRAMME:- XMM

PART TYPE:- AD571SD

RADIATION REPORT:- RD 217

IGG TASK NUMBER:- 1500

SUMMARY OF TEST RESULTS

This part was tested biased and also unbiased. For the unbiased test one sample (SN 113) failed DNL (unipolar) at 30KRad(Si) and Full Scale Error (bipolar) and DNL (bipolar) at 50KRad(Si). As this sample passed these parameters at 100KRad(Si) this failure can be considered spurious. The V_{OH} for the unbiased test failed between 20 and 30KRads(Si) and between 30 and 50KRads(Si) for the biased test. This parameter showed a change with irradiation and was plotted. No other parameter showed any significant change. Various other failures were recorded for the biased test at 75 and 100KRad(Si).

Radiation Report Number:- RD 217

Project:- XMM

Part Type:- Ad571SD | Date Code:- 9525A

Manufacturer:- AD/U | IGG Task No:- 1500

Project Approval of Lot Traveller:-

Signed.......................... Date............

Position........................

Serial Number Range:-

099 through 119 (not inclusive)

I certify that the subject component has been tested in accordance with the following radiation specifications:-

Test Method - ESA/SCC22900 ISSUE- 4 DATE- Jan '95

Irradiation Test Plan- XM-PL-IGG-0040 ISSUE- 2 DATE- Nov '96

Closed/Approved NCR No:- N N/A

Approved Waiver No:- WAR N/A

Signed...P.A. Russell........... Date.24/2/97.

Upscreening Engineer

Signed............. Date.26/2/97..

Upscreening Manager

RADIATION REPORT NUMBER:- RD 217 DATE:- 19.2.97

PROJECT:- XMM RIR IN:- 73641

PART NUMBER:- AD571SD MANUFACTURER:- AD/U

PROCUREMENT LEVEL:- IGG-132-653 DATE CODE:- 9525A

TEST METHOD:- ESA/SCC22900 ISSUE- 4 DATE- Jan '95

TEST PLAN:- XM-PL-IGG-0040 ISSUE- 2 DATE- Nov '96

START QUANTITY:- 11

No.	Test (Sample Size)	XM-PL-IGG-0040 Test Method and Conditions		Date in	Qty in	Date out	Qty out	SIGNED Op/QA
1	Serialisation and Selection of Control Sample (100%)	Control Sample= SN 99		13/1/97	11	13/1/97	10 + CONTROL SAMPLE	P.A.R. IGG 16 CT
2	Initial Electrical Measurements (100% read and record)	Table A Testing at IGG		13/1/97	10	13/1/97	10	P.A.R. IGG 16 CT
3	Initial Electrical Measurements (100% read and record)	Table A Testing at ERA UB=Unbiased B=Biased	UB	14/1/97	5	14/1/97	5	P.A.R. IGG 16 CT
			B	14/1/97	5	14/1/97	5	P.A.R. IGG 16 CT
4	Set-up and apply Bias per Figure 1	Verify Bias Circuit and conditions (in-situ) for the 5 biased test samples	UB	14/1/97	5	14/1/97	5	P.A.R. IGG 16 CT
			B	15/1/97	5	15/1/97	5	P.A.R. IGG 16 CT
5	Irradiation 1 (10 samples)	Dose=10kRADSi Rate= 10RADSi per second Time= 1000sec	UB	14/1/97	5	14/1/97	5	P.A.R. IGG 16 CT
			B	15/1/97	5	15/1/97	5	P.A.R.
6	Interim 1 Electrical Measurements (100% read and record)	Table A. Bias to be maintained until testing is performed. Tdwell=10mins maximum	UB	14/1/97	5	14/1/97	5	P.A.R.
			B	15/1/97	5	15/1/97	5	P.A.R.

Report No: RD 217	Part Type: AD571SD	Date: 19.2.97

No.	Test (Sample Size)	XM-PL-IGG-0040 Test Method and Conditions		Date in	Qty in	Date out	Qty out	SIGNED Op/QA
7	Irradiation 2 (10 samples)	As Test 5	UB	14/1/97	5	14/1/97	5	[signature] IGG 16 CT
			B	15/1/97	5	15/1/97	5	[signature] IGG 16 CT
8	Interim 2 Electrical Measurements (100% read and record)	As Test 6	UB	14/1/97	5	14/1/97	5	[signature] IGG 16 CT
			B	15/1/97	5	15/1/97	5	[signature] IGG 16 CT
9	Irradiation 3 (10 samples)	As Test 5	UB	14/1/97	5	14/1/97	5	[signature] IGG 16 CT
			B	15/1/97	5	15/1/97	5	[signature] IGG 16 CT
10	Interim 3 Electrical Measurements (100% read and record)	As Test 6	B	15/1/97	5	15/1/97	5	[signature] IGG 16 CT
			UB	14/1/97	5	14/1/97	4	[signature] IGG 16 CT
11	Irradiation 4 (10 samples)	Dose=20kRADSi Rate= 10RADSi per second Time=2000secs	UB	14/1/97	5	14/1/97	5	[signature] IGG 16 CT
			B	15/1/97	5	15/1/97	5	[signature] IGG 16 CT
12	Interim 4 Electrical Measurements (100% read and record)	As Test 6	UB	14/1/97	5	14/1/97	4	[signature] IGG 16 CT
			B	15/1/97	5	15/1/97	4	[signature] IGG 16 CT
13	Irradiation 5 (10 samples)	Dose=25kRADSi Rate= 10RADSi per second Time=2500secs	UB	14/1/97	5	14/1/97	5	[signature] IGG 16 CT
			B	15/1/97	5	15/1/97	5	[signature] IGG 16 CT
14	Interim 5 Electrical Measurements (100% read and record)	As Test 6	UB	14/1/97	5	14/1/97	4	[signature] IGG 16 CT
			B	15/1/97	5	15/1/97	2	[signature] IGG 16 CT

Report No: RD 217		Part Type: AD571SD						Date: 19.2.97
No.	Test (Sample Size)	XM-PL-IGG-0040 Test Method and Conditions		Date in	Qty in	Date out	Qty out	SIGNED Op/QA
15	Irradiation 6 (10 samples)	As Test 13	UB	14/1/97	5	14/1/97	5	[signature] IGG 16 CT
			B	15/1/97	5	15/1/97	5	[signature] IGG 16 CT
16	Final Electrical Measurements (100% read and record)	As Test 6 At ERA	UB	14/1/97	5	14/1/97	4	[signature] IGG 16 CT
			B	15/1/97	5	15/1/97	2	[signature] IGG 16 CT
17	Annealing Test (10 samples)	UB or B-24hr min at +25°C (record exact time)	UB	14/1/97	5	15/1/97	5	[signature] IGG 16 CT
			B	15/1/97	5	16/1/97	5	[signature] IGG 16 CT
18	Post Annealing Electrical Measurements (100% read and record)	Table A	UB	15/1/97	5	15/1/97	4	[signature] IGG 16 CT
			B	16/1/97	5	16/1/97	2	[signature] IGG 16 CT
19	Accelerated Aging under bias (10 samples)	168 hours at +100±5°C unbiased or biased	UB	16/1/97	5	23/1/97	5	[signature] IGG 16 CT
			B	16/1/97	5	23/1/97	5	[signature] IGG 16 CT
20	Post Aging Electrical Measurements (100% read and record)	Table A	UB	23/1/97	5	23/1/97	5	[signature] IGG 16 CT
			B	23/1/97	5	23/1/97	2	[signature] IGG 16 CT
21	Test Report Collation					26/2/97		[signature] IGG 2 CT
22	Test Report Approval					26/2/97		[signature] IGG 2 CT
23	NOTES:-							

Report No: RD 217 Part Type: AD571SD Date: 19.2.97

FAILURE LIST AND APPLICABLE NCR

Test No.	Serial Number(s)	Failed Parameter and Failure Mode	Applicable NCR
10	113 (UNBIASED)	FAILED V_{OH} AND DNL (UNIPOLAR).	
12	113 (UNBIASED)	FAILED FULL SCALE ERROR (BIPOLAR) AND DNL (BIPOLAR)	
12	105 (BIASED)	FAILED V_{OH}.	
14	101 (BIASED) 103 (BIASED) 105 (BIASED)	FAILED V_{OH}. FAILED INL GO/NO GO (UNIPOLAR). FAILED INL GO/NO GO (UNIPOLAR) AND DNL (UNIPOLAR)	
16	103 (BIASED) 101 (BIASED)	FAILED V_{OH}, DNL (BIPOLAR) AND MIN, MAX DNL AND INL (BIPOLAR). FAILED INL GO/NO GO (UNIPOLAR).	
20	100, 112 (BIASED)	FAILED INL GO/NO GO (UNIPOLAR).	

Report No: RD 217 Part Type: AD571SD Date: 19.2.97

TEST EQUIPMENT LIST

Item, Type Number and Serial Number	CT Inventory Number	Function	Calibration Due
Item: Radiation Source Type No: Cobalt 60 Serial No: N/A	ERA's Facility	Irradiation	1 / 1 /1998
Item: SZ Type No: M3000 Serial No: 884769	CT 339	ATE	28 / 3 /1997
Item: THURLBY Type No: PL320 Serial No: 26P0623	CT288	PSU	22 / 4 /1997
Item: Type No: Serial No:			/ /199
Item: Type No: Serial No:			/ /199
Item: Type No: Serial No:			/ /199
Item: Type No: Serial No:			/ /199
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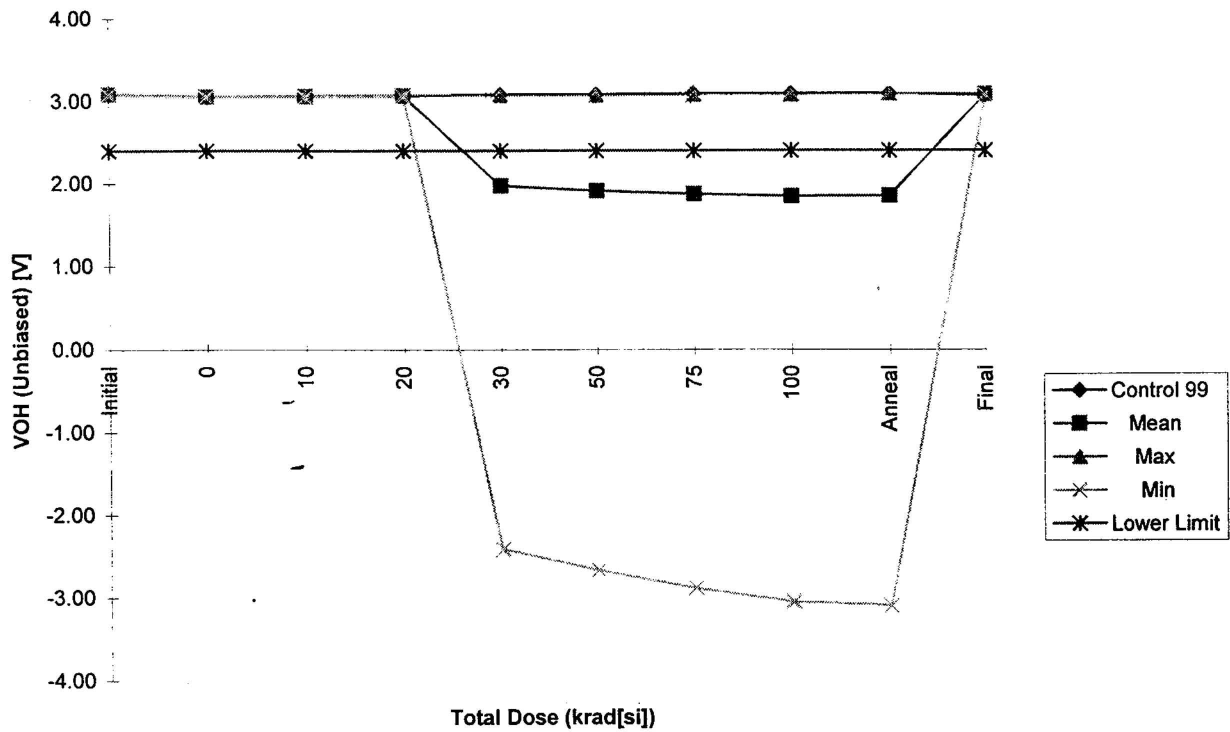
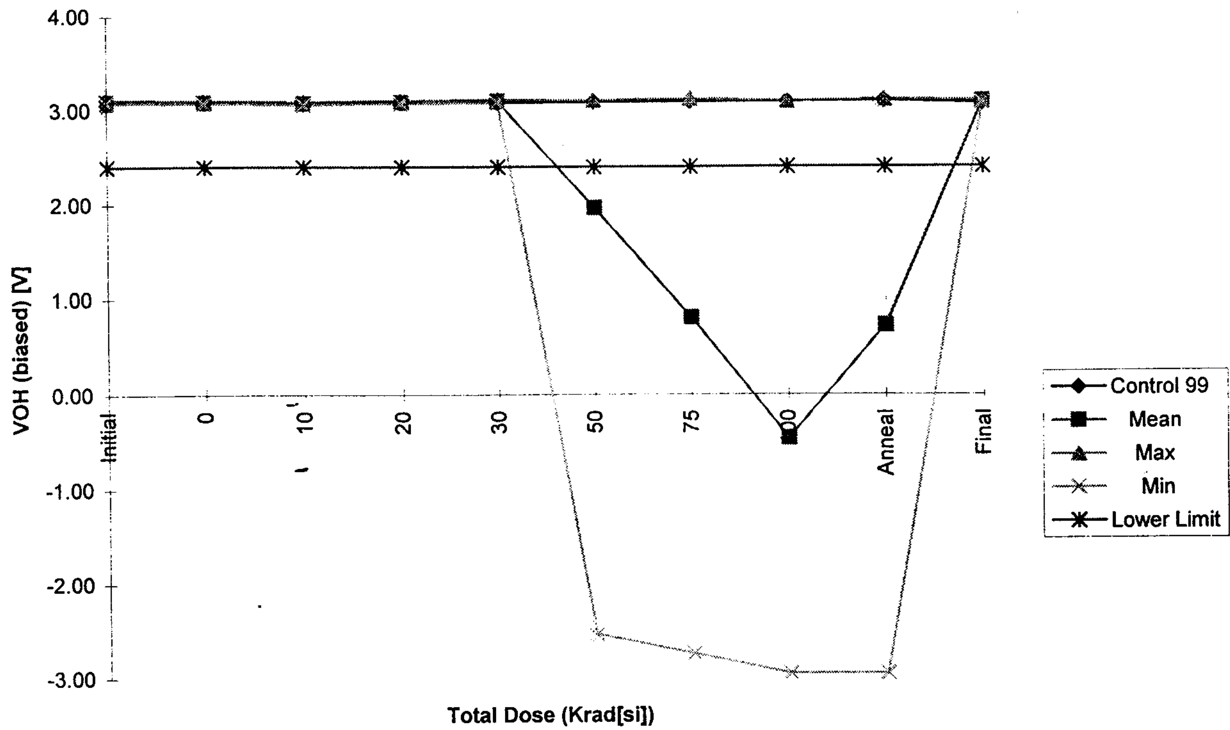


Dose (kRad)	Control 99	Mean	Max	Min	Lower Limit	Upper Limit	Std.Dev.
	(V)	(V)	(V)	(V)	(V)	(V)	
Initial	3.09	3.08	3.09	3.08	2.4	-	0.01
0	3.06	3.05	3.06	3.05	2.4	-	0.00
10	3.06	3.06	3.07	3.05	2.4	-	0.01
20	3.07	3.07	3.08	3.06	2.4	-	0.01
30	3.08	1.97	3.07	-2.41	2.4	-	2.45
50	3.08	1.91	3.07	-2.67	2.4	-	2.56
75	3.09	1.87	3.08	-2.89	2.4	-	2.66
100	3.09	1.84	3.08	-3.05	2.4	-	2.73
Anneal	3.09	1.85	3.09	-3.09	2.4	-	2.76
Final	3.07	3.08	3.08	3.07	2.4	-	0.00

Note: The results for VOH are the average of the outputs D0-D9.

Lot size for statistics : 5 devices

RD 217 Date code 9525A



Dose (kRad)	Control 99	Mean	Max	Min	Lower Limit	Upper Limit	Std.Dev.
	(V)	(V)	(V)	(V)	(V)	(V)	
Initial	3.09	3.09	3.11	3.08	2.4	-	0.01
0	3.08	3.08	3.10	3.07	2.4	-	0.01
10	3.07	3.08	3.09	3.06	2.4	-	0.01
20	3.08	3.09	3.10	3.07	2.4	-	0.01
30	3.08	3.10	3.11	3.08	2.4	-	0.01
50	3.09	1.96	3.10	-2.53	2.4	-	2.51
75	3.09	0.81	3.12	-2.74	2.4	-	3.15
100	3.09	-0.46	3.09	-2.95	2.4	-	3.24
Anneal	3.10	0.72	3.11	-2.95	2.4	-	3.25
Final	3.07	3.09	3.10	3.07	2.4	-	0.01

Note: The results for VOH are the average of the outputs D0-D9.

Lot size for statistics : 5 devices

RD 217 Date code 9525A

XMM RIR 73641 RD 217	IRRADIATION TEST PLAN NO. XM-PL-IGG-0040 (1)	Issue No. 2 Date: November 1996 Page: 1/4 (2)

Component No. IGG132-65301B (3)	Component Designation: IC, Linear, 10 bit A/D Converter Type AD571SD (4)	Irradiation Spec No. N/A Iss. Rev. (5)

Specification	Acceptance	Electrical Meas.	Project/Programme
Detail IGG-132-653 Iss.B (6)	Evaluation ___ Element Diffusion ___ Lot X (7)	In-situ ___ Remote X (8)	**XMM** (9)

Manufacturer: Analog Devices Address: Santa Clara CA, USA (10)	Test Facility: ERA Address: Leatherhead Surrey ENGLAND (11)	Originator: IGG CT Name: S. Thacker (12)

Radiation Source:	Sample Size: 10 -	Exposure:	Annealing Test:	Radiation Level:
COBALT 60 (13)	Control Devices: 1 (14)	Single ___ Multiple X (15)	YES X NO ___ (16)	10kRAD(Si), 50kRAD(Si) 20kRAD(Si), 75kRAD(Si) 30kRAD(Si), 100kRAD(Si) (17)

Single Exposure:
Dose [kRAD(Si)]
Dose Rate [RAD(Si)/s]
Exposure Time

Not Applicable (18)

Multiple Exposure:

Irradiation Steps	1	2	3	4	5	6
Dose [kRAD(Si)]	10	10	10	20	25	25
Maximum Dose Rate [RAD(Si)/s]	10	10	10	10	10	10
Minimum Exposure Time[s]	1000	1000	1000	2000	2500	2500

(19)

Bias Requirements: During and after Exposure (for remote electrical measurements): YES (for 5 biased test units)

Bias Conditions:
Test Circuits: The Electrical Bias circuit for the 5 biased test units is given in Figure 1 herein. The 5 unbiased test units shall have all leadouts open circuit.

Shielding: Shielding is required to minimize dose enhancement effects caused by low energy, scattered radiation. The test specimens shall be enclosed in a Pb/Al container of Pb 1.5mm minimum, surrounding an inner shield of Al 0.7 to 1.0mm. (20)

Irradiation Test Sequence (21)

Test Step	Description	Requirements
1	Irradiation Test Samples	Quantity 11 devices shall be selected from the lot delivered to IGG.
2	Serialisation	Serialisation - (if the devices are not serialised). Test units shall be serialised 1 to 5 (unbiased test units), 6 to 10 (biased test units) and the control unit shall be 11.
3	Initial Electrical Measurements (at IGG)	Per Table A herein - (Read and Record) - on all 11 parts at IGG. (See Remarks 1 and 2).
4	Initial Electrical Measurements (at ERA)	Per Table A herein - (Read and Record) - on all 11 parts at ERA. (See Remarks 1 and 2).

S.T. 12.11.96

Irradiation Test Sequence (Cont.) 21

Test Step	Description	Requirements
5	Set-up Test	Verify Bias Circuit and Voltages (In-situ) for 5 biased test units. (See Remark 3).
6	Irradiation Exposure	Verify radiation dose rate and position in the chamber to achieve required dose for all 10 test units. Verify and witness duration of exposure to achieve required dose. (See Remark 4).
7	Intermediate Electrical Measurement (at ERA)	Bias to be maintained until test is performed for 5 biased test units. Test per Table A herein - (Read and Record) - on all 11 parts. Test to be performed immediately upon removal from chamber (less than 10 mins interval). Upon completion of test 5 biased test units shall be replaced in bias circuit and all 10 test units returned to chamber. Maximum interval between two consecutive exposures to be 30 mins. (See Remark 2).
8 to 22	Repeat Set-up/Exposure/Test sequence upto a Final Total Dose of 100kRAD(Si)	Repeat Steps 5, 6, 7 for a total of 6 cycles as per multiple exposure in Box No. 19. (See Remark 5).
23	Annealing	Bias shall be maintained during Annealing for 5 biased test units. Annealing shall be at room temperature for 24 hours. (See Remark 3).
24	Post Annealing Electrical Measurements (at IGG)	Per Table A herein - (Read and Record) - on all 11 parts at IGG. (See Remark 2).
25	Accelerated Aging (under Bias)	Bias shall be maintained during Aging for 5 biased test units. Aging shall be at T_{amb} = $+100 \pm 5°C$ for 168 hours for all 10 test units. (See Remark 3).
26	Final Electrical Measurements (at IGG)	Per Table A herein - (Read and Record) - on all 11 parts at IGG (See Remark 2).
27	Total Dose Irradiation Test Report	ESA/SCC No. 22900.

Remarks 22

1. The initial electrical measurements performed at IGG (Test Step 3) shall be performed within 24 hours of the initial electrical measurements at ERA (Test Step 4).
2. All electrical testing shall be performed on the same set of equipment in order to achieve correlation of results both at IGG and ERA.
3. The control unit and the 5 unbiased test units shall not be biased during testing.
4. The dose rates and exposure times given above, may be adjusted during irradiation testing to achieve convenient test points but shall not exceed the limits specified in Box No. 19. The dose rates and exposure times used during the testing shall be recorded for each test step.
5. The set up/exposure/test sequence shall be stopped for any device that exhibits repeated functional failure.

TABLE A - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE - T_{amb} +25 ±5°C
BEFORE, AT INTERMEDIATE POINTS AND ON COMPLETION OF IRRADIATION

NO.	CHARACTERISTICS	SYMBOL	TEST CONDITIONS (SEE NOTE 1)	LIMITS		UNIT
				MIN.	MAX.	
1 to 2	Relative Accuracy	R_A	Unipolar and Bipolar	-	±0.098	% of FS
3	Digital Input Current High	I_{IH}	V_{CC} = 5.5V, V_{IH} = 5.5V	-	±100	μA
4	Digital Input Current Low	I_{IL}	V_{CC} = 4.5V, V_{IL} = 0.4V	-	±100	μA
5	Digital Output Voltage High	V_{OH}	V_{CC} = 4.5V, I_{OH} = -0.5mA	2.4	-	V
6	Digital Output Voltage Low	V_{OL}	V_{CC} = 4.5V, I_{OL} = 3.2 mA	-	0.4	V
7	Three State Leakage Current 1	I_{OLT1}	V_{CC} = 5.5V, V_O = 5.0V	-	±40	μA
8	Three State Leakage Current 2	I_{OLT2}	V_{CC} = 5.5V, V_O = 0V	-	±40	μA
9	Positive Supply Current	I_{CC}	-	-	10	mA
10	Negative Supply Current	I_{EE}	-	-	-15	mA
11	Power Supply Rejection 1	PSRR1	-16.5V ≤ V_{EE} ≤ -13.5V	-	±20	mV
12	Power Supply Rejection 2	PSRR2	4.5V ≤ V_{CC} ≤ 5.5V	-	±20	mV
13	Offset Error (Unipolar)	V_{OS}	First Transition	-	±20	mV
14	Bipolar Zero Error	BPZE	Low Side MSB Transition	-	±20	mV
15	Full Scale Error (Unipolar)	A_{EU}	-	-	±40	mV
16	Full Scale Error (Bipolar)	A_{EB}	-	-	±20	mV
17 to 18	Differential Non-Linearity	DNL	All Codes Test. Unipolar and Bipolar (Note 2)	10	-	BITS
19	Input Resistance	R_{IN}	-	3	7	KΩ
20	Conversion Time	T_C	-	15	40	μs

NOTES:-

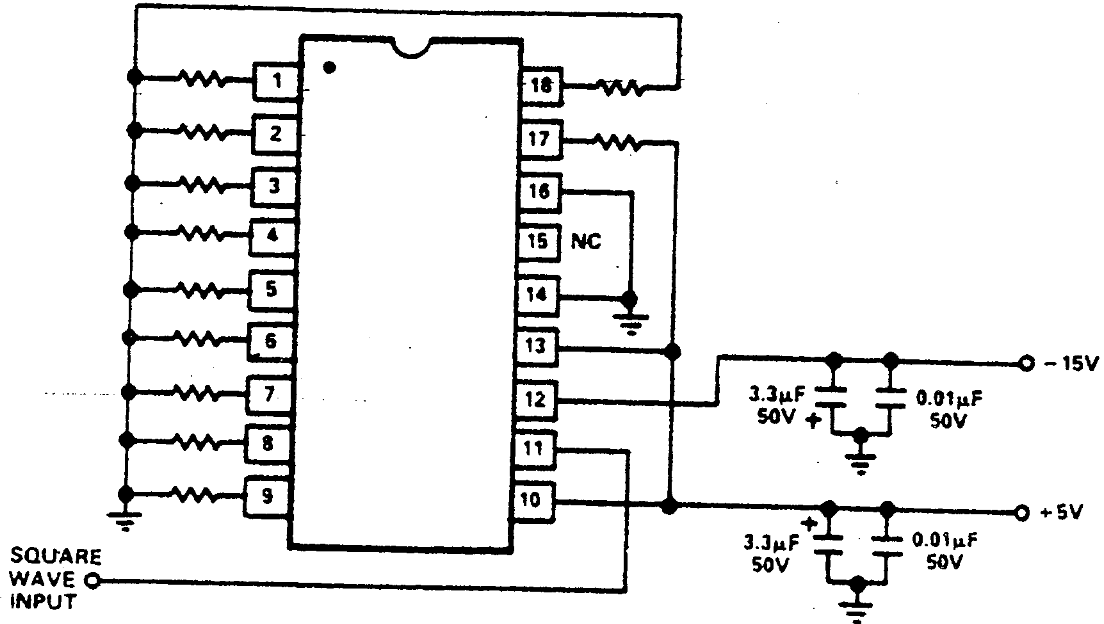
1. Unless otherwise specified:-

   V_{CC} = 5V, V_{EE} = -15V
   V_{IH} = 2.0V, V_{IL} = 0.8V

   Analog input through 15Ω to Pin 13, Unipolar configuration.

2. Minimum resolution for which no missing codes are guaranteed.

FIGURE 1 - ELECTRICAL BIAS CIRCUIT FOR IRRADIATION TESTING



1. ALL RESISTORS 3.0k 1% METAL FILM 1/4W.
2. 0V to 5V SQUARE WAVE WITH FREQUENCY OF 20kHz OR BELOW.