

Components Division
 Laboratory Support Group

RADIATION ANALYSIS
 REPORT NUMBER

RA 0103

Part Type	Microcircuit
Type Number	54ACT74
Manufacturer	NSC, USA
Project	XMM

ANALYST	P.ELLEN/QCL		25/11/97
APPROVED	L.ADAMS/QCA		25/11/97

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Introduction

As a consequence of Total Dose radiation testing by National Semiconductor (NSC) and IGG, five samples of 54ACT74 devices, manufactured by NSC, were sent to the ESTEC, QC Division Components Laboratory Support Group for detailed radiation testing in the region up to 10 Krads. NSC reported out of specification results for I_{cc} , (Standby Leakage Current), at 30 Krads, having made interim measurements at 10 Krads only. IGG also made their first interim measurement at 10 Krads at which stage out of specification results for I_{cc} were obtained. It was requested that the testing at ESTEC be carried out at a much lower dose rate compared to NSC (69.808 rads/sec), and IGG (10 rads/sec).

Component Information

The components were identified as FACT, CMOS Dual D-Type flip flops, type number 54ACT74FM-RH, manufactured by National Semiconductor Corporation. The following information was taken from the marking on the components and the accompanying documentation:

Component Type	CMOS Dual D-Type flip flops
Type Number	54ACT74FM-RH
Procurement Level	5962R8752501 SDA
Date Code	9610A
Package	14 lead ceramic flat pack
Serial Numbers	105,151 - 154

Test Description

The irradiation was carried out using the ESTEC Co 60 source, with the test samples, serial numbers 151 to 154 under bias with $V_{inH} = 5.0$ Volts, positioned to attain a dose rate of 100 rads/hour, (1.67 rads/min). Sample serial number 105, also biased in the same way as the irradiated samples, was maintained as the control sample. The bias circuit is shown in figure 1 .

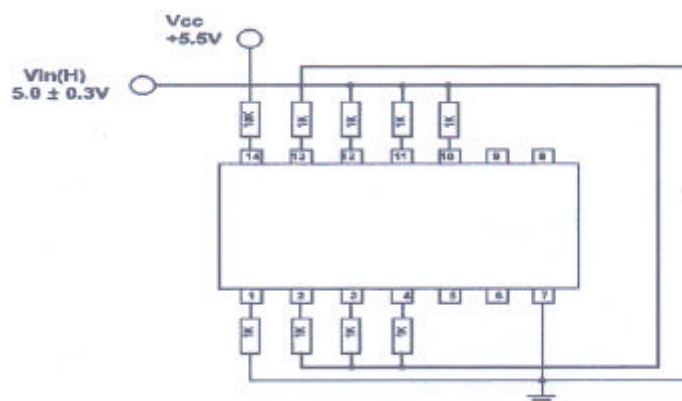


Figure 1 Radiation Bias Circuit

Test Description (contd.)

Initially it was planned to record interim measurements at steps of 2.5 Krads, but as a noticeable increases in Icc values were recorded between 5 Krads and 7 Krads measurements were taken more frequently up to 12 Krads. The irradiation was concluded at 19 Krads as the results were the same as already obtained by NSC and IGG.

Dose Rate Monitoring

The dosimetry system used a 0.6cc air ionisation chamber (type 2571, serial number 2698) connected to an NE Ionex Dosemaster 2590 system with an overall accuracy of $\pm 5\%$.

Results

The results are presented graphically in figures 2 and 3. The results for IccH and IccL are given as these were the only parameters that showed any significant variation. The results for IccH and IccL are also given in Tables 1 and 2.

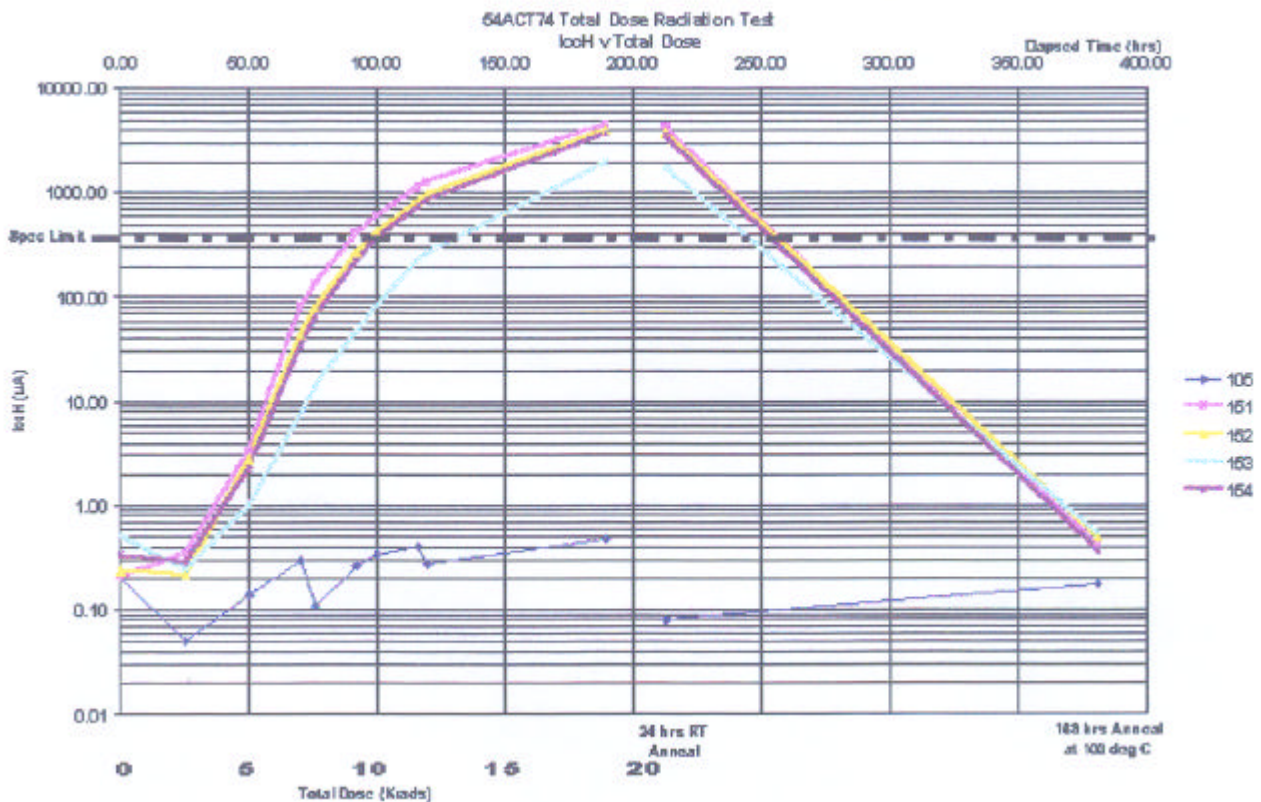


Figure 2

Results (contd.)

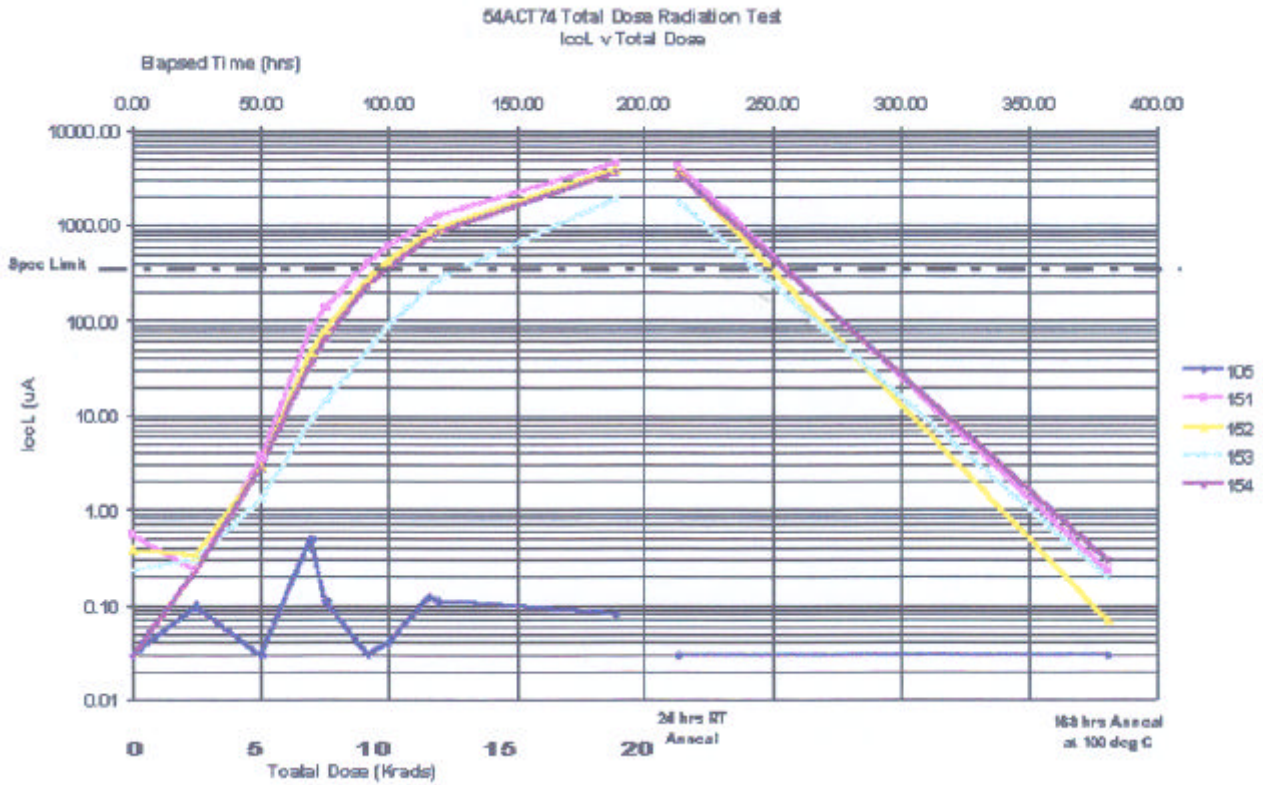


Figure 3

Table 1 IcclH

Total Dose	Time (hrs)	Serial Number					Unit
		105	151	152	153	154	
0	0.00	0.21	0.21	0.24	0.54	0.34	µA
2.5	25.00	0.05	0.35	0.22	0.25	0.29	
5.02	50.00	0.14	3.29	2.79	1.03	2.23	
7.07	70.00	0.30	81.00	44.30	7.67	34.13	
7.59	75.74	0.11	135.55	78.75	14.08	64.25	
9.22	92.00	0.26	415.64	275.41	47.87	232.67	
10	99.80	0.34	609.59	425.19	85.33	364.49	
11.6	115.77	0.41	1123.33	846.86	227.73	749.23	
11.97	119.46	0.28	1258.65	961.89	272.85	857.52	
18.94	189.02	0.49	4550.00	3960.00	1960.00	3710.00	
24 hrs Anneal	213.02	0.08	4360.00	3780.00	1822.22	3530.00	
168 hrs Anneal at 100 deg C	381.02	0.18	0.41	0.51	0.55	0.38	

Results (contd.)

Table 1 IccL

Total Dose	Time (hrs)	Serial Number					Unit
		105	151	152	153	154	
0	0.00	0.03	0.56	0.39	0.23	0.03	μA
2.5	25.00	0.10	0.23	0.33	0.30	0.23	
5.02	50.00	0.03	3.61	2.81	1.34	2.74	
7.07	70.00	0.49	82.28	45.85	8.65	35.61	
7.59	75.74	0.11	135.93	80.13	14.26	64.36	
9.22	92.00	0.03	417.01	276.44	49.81	234.51	
10	99.80	0.04	610.31	426.61	86.31	365.21	
11.6	115.77	0.12	1123.39	848.25	229.35	750.69	
11.97	119.46	0.11	1257.64	961.81	273.47	856.54	
18.94	189.02	0.08	4550.00	3960.00	1950.00	3710.00	
24 hrs Anneal	213.02	0.03	4360.00	3780.00	1824.17	3530.00	
168 hrs Anneal at 100 deg C	381.02	0.03	0.23	0.07	0.20	0.30	

Conclusion

The results of this radiation analysis at a low dose rate generally confirm the results obtained by IGG. Parametric failures of IccH and IccL occur at between 9 and 12.5 Krads, although no functional failures occurred. It would appear that at the lower dose rate the increase in IccH and IccL is less rapid so there would seem to be a dose rate dependence, although this is difficult to state with certainty as IGG have no values below 10 Krads. At the higher total dose levels (>15 Krads) the IGG measurements for IccH and IccL are tester limited, i.e. all identical, so no comparisons can be made.