JPL PUBLICATION 81-66, VOLUME II

(NASA-CR-168428) TOTAL-DOSE RADIATION EFFECTS DATA FOR SEMICONDUCTOR DEVICES, VOLUME 2 (Jet Propulsion Lab.) 323 p
HC A14/MF A01

N82-17254

CSCL 22B

Unclas
G3/18 08906

Total-Dose Radiation Effects Data for Semiconductor Devices

William E. Price
Keith E. Martin
Donald K. Nichols
Michael K. Gauthier
S. Frederick Brown

December 1, 1981

National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

JPL PUBLICATION 81-66, VOLUME II

Total-Dose Radiation Effects Data for Semiconductor Devices

William E. Price
Keith E. Martin
Donald K. Nichols
Michael K. Gauthier
S. Frederick Brown

December 1, 1981

National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

The research described in this publication was carried out by the Jet Propulsion Laboratory, California Institute of Technology, under contract with the National Aeronautics and Space Administration. This work was sponsored by the Program Assurance Division, Office of Chief Engineer, NASA Headquarters, Washington, D.C. 20546.

ABSTRACT

This document is part two of a three-volume set. Volume I provides total ionizing dose radiation test data on diodes, bipolar transistors, field effect transistors, and miscellaneous discrete solid-state devices. Volume II provides similar data on integrated circuits. Volume III provides a detailed analysis of the data from Volumes I and II. Volume III will be released during 1982.

The data presented here are presented in graphic, tabular, or narrative format, depending on the complexity of the integrated circuit. Most of the tests were done using the JPL or Boeing electron accelerator (Dynamitron) that provides a steady-state 2.5-MeV electron beam. However, some radiation exposures were made with a Cobalt-60 gamma ray source. The results obtained with the Cobalt-60 source should be regarded as only an approximate measure of the radiation damage that would be incurred by an equivalent dose of electrons. All data were generated in support of NASA space programs by the JPL Radiation Effects and Testing Group (514).

INDEX OF DEVICE TYPES

VOLUME II

[a]See Appendix A for Vendor Identification Code.

CONTENTS

SECTION I

INTRODUCTION

The data presented in Volume II of this report describe the results of Total Ionizing Dose (TID) tests of integrated circuits (ICs).[1] The data were obtained by the Jet Propulsion Laboratory (JPL), under contract to NASA, in order to assure the "hardness" (radiation resistance) of components to be used in the Jupiter radiation environment. However, the data is applicable to any ionizing (total dose) radiation environment. Two primary radiation sources types were used: Cobalt-60 gamma ray sources and Dynamitron electron accelerators capable of delivering 2.5-MeV electrons at a steady rate. Irradiations of complex ICs were sent to the Boeing Radiation Effects Laboratory (BREL), Seattle, where the necessary computerized test equipment was available. The work at BREL was subject to JPL specifications and procedures.

Some of the data are presented in a graphic format for various operating conditions as a function of dose. A measure of the statistical variations of each device lot is provided by the tabulated standard deviations at the bottom of each graph. The information on some other ICs is presented in tabular format. For more complex large-scale integrated circuit (LSI) type of devices, the data are given in a narrative form, which gives proper emphasis to the radiation-induced changes in the measured parameters. Where there are irradiations of two or more different lots of a given device type, each lot is treated as an entirely separate test.

---

[1] Volume II contains only integrated circuit data. For data on diodes, bipolar transistors, and miscellaneous semiconductor types, refer to Volume I.

All data taken here substantially meet the specifications of MIL-STD-883B, method 1019.1 (August 1977) for environments where short-term annealing is not a relevant problem. Electrical parameter measurements were usually taken within 20 minutes of the completion of each irradiation. Each test consisted of three or more radiation levels at room temperature. The devices under test were maintained at worst-case bias conditions during the radiation exposure.

SECTION II

DOCUMENT USES AND LIMITATIONS

The purpose of this report is to provide a large amount of test data for integrated circuits exposed to a steady-state total ionizing dose irradiation. As such, it offers a useful comparison of the radiation response of different devices that might be considered in the development (circuit design) of a radiation-hardened system. It also offers a quick method for assisting an engineer to determine the weak links in an existing system and an approximation of the radiation tolerance of the system as a whole.

The data presented here cannot be used as a substitute for a comprehensive testing program of the devices actually used in a given system. It will be clear, on inspecting the data herein, that there are large lot-to-lot or wafer-to-wafer variations in the response of samples of a given device type. The difference in response from functionally identical devices fabricated by different manufacturers is even greater. There was no attempt to remove maverick (outlier) devices from the data plots. Thus, some of the data plots may appear anomalous when compared to other plots for that same device type. It should be noted that a given manufacturer may make a minor adjustment in his processing procedures that will result in a major difference in the device's response to radiation.

SECTION III

RADIATION SOURCES AND DOSIMETRY

A. DYNAMITRON

The Dynamitron electron accelerators at JPL and BREL provide a 2.5-MeV electron beam with a range of beam currents of 10^8 to 10^{10} electrons/ cm^2-sec. All tests described here were irradiated at each fluence level for exposure times between 5 and 45 minutes.

The parts test geometry for the two dynamitron test facilities is essentially the same. The electron beam is brought out of the beam tube into air through a 0.05-mm titanium window, copper and aluminum scattering foils, and 0.9 m of air. Each of these materials scatters the electrons slightly so that the scattered beam has a variation in uniformity of less than 20 percent over the array of parts being tested. The parts test array is confined within a 25-cm diameter circle perpendicular to the direction of the beam. At the center of the circle is the aperture of a vacuum Faraday cup, which is used to measure the flux and fluence of the electron beam. The beam is centered on the Faraday cup with a quadrupole magnet prior to the installation of the test samples. The output from the Faraday cup is a current that is fed into a current integrator, which is calibrated daily against a standard current source. The integrator is set to shut off the electron beam automatically when the desired fluence level is received at the Faraday cup.

B. COBALT-60 SOURCES

The Cobalt-60 gamma ray sources at JPL and BREL were both used. The gamma rays consisted primarily of 1.17 and 1.33 MeV photons with lower energy photons and secondary electrons arising from scattering and absorption. The gamma field was uniform within ±10 percent in the area where parts were exposed. Thermoluminescent dosimetry (TLD), consisting of lithium

fluoride/Teflon microrods, was used for uniformity checks. Calibration of the source was performed with Landsverk ion chambers of ±2 percent accuracy, traceable to the National Bureau of Standards. Bimonthly dose rate computations were performed to account for the radioactive decay of the Cobalt-60 source. Exposure times with the Cobalt-60 sources were typically 5 to 20 minutes for each radiation level. Longer times (up to 4 hours) were required for high-dose applications since the maximum uniform dose rate available was 150 Gy/min [15,000 rad(Si)/min] at JPL.

SECTION IV

TEST SETUP AND PROCEDURES

A. GENERAL REMARKS

The test setup and procedures used here were developed in accord with the specifications of MIL-STD-883B (August 1977), method 1019.1. All tests were done at 25°C ±3°C, using low noise power sources and instrumentation subject to periodic calibration. Some tests were performed *in situ* (without removing the test devices from the radiation area), whereas others required remote testing. In the latter event, a mobile bias fixture was used to maintain bias except during the brief measurement period.

A detailed test plan was written for each test, which included part description, irradiation bias conditions, radiation levels, electrical parameters to be measured, and measurement conditions. The data were processed by hand and by computer, and the calculation of normal standard deviations was made after deletion of clearly erroneous data. Such individual data can be retrieved, if required, by specifying the JPL log number given with each data plot to the Radiation Effects and Testing Group (Section 514) at JPL.

B. *IN SITU* TESTING

A matrix board switching system was built to be used as a master control and switching panel. It was located outside of the irradiation area for all *in situ* tests. The board interfaced the devices under test (DUT) to the power supplies and measurement equipment via a special 15-meter (50-foot), double-shielded cable (see Figure 1). A built-in potentiometer for each DUT could be used to control bias voltages and currents. The matrix board was designed with very high insulation resistance so that very low current measurements (10-50 pA) could be made.

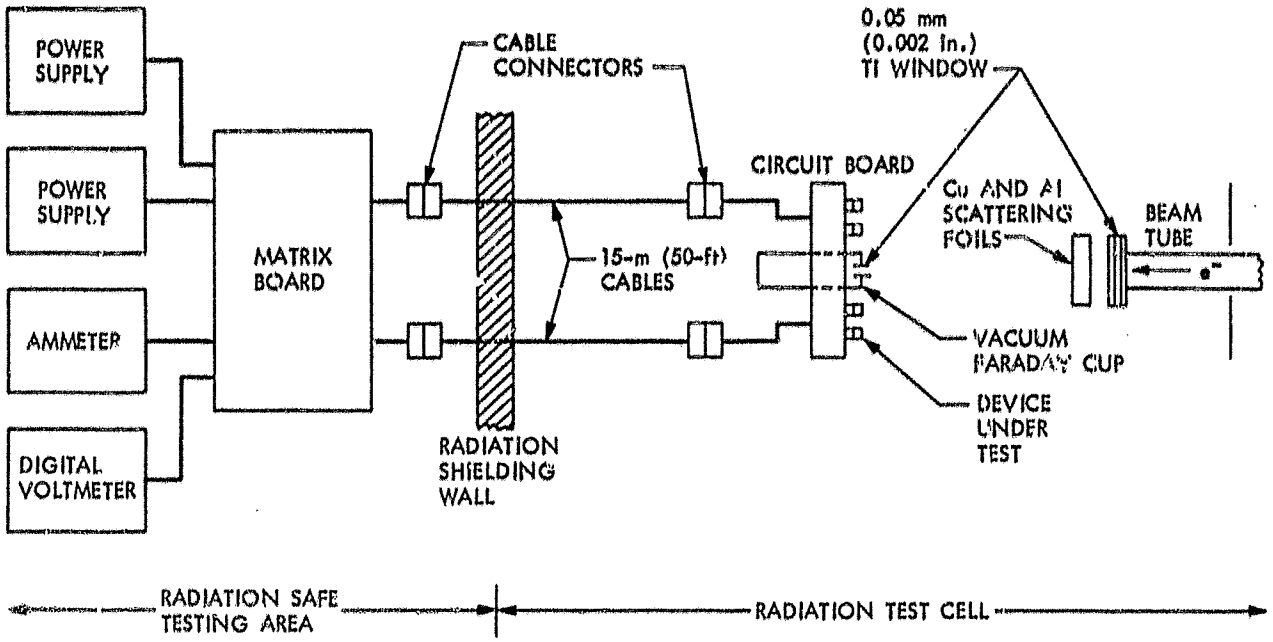


Figure 1. Block Diagram of the Test Setup for in situ Testing With the Electron Accelerator (Dynamitron)

C. NON-IN SITU TESTING

For the remote (non-in situ) tests, the DUTs were removed from the site for approximately 20 minutes between each radiation level. A mobile bias (battery) was applied to the devices at all times except during parameter measurements. Remote measurements were performed using a Tektronix 178/577 curve tracer, a Tektronix 3260 IC tester, or a bench fixture. Occasionally, custom-built test circuits were used to simulate the circuit application of the devices tested.

D. TESTING AT THE BOEING COMPANY

A number of ICs were tested for JPL at the Boeing Radiation Effects Laboratory (BREL). Complex LSI devices--such as A/D converters, memories, and microprocessors--were irradiated with the BREL Dynamitron or Cobalt-60 sources and tested on a Tektronix 3260 computerized IC tester. Most of these tests were non-in situ. The test programs were specified by JPL personnel. The data developed was then sent to JPL for analysis.

SECTION V

DATA PRESENTATION

Some of the data are presented in graphic form and some are summarized in tables. A sample graph, explaining the nomenclature, is shown in Figure 2. Each of the electrical parameter data plots is represented by a single line per graph. Several of the IC parameters are plotted as delta values, which are the radiation-induced changes in a parameter as a function of dose. These include the radiation-induced change in the offset voltage, ΔV_{OS}; the radiation-induced change in the offset current, ΔI_{OS}; and the radiation-induced change in the bias current, ΔI_B. Offset values are always taken as positive, regardless of changes in the algebraic sign that may occur during the course of irradiation. Both the positive and negative open-loop gain, $\pm A_{VOL}$, are presented in decibels (dB) versus total dose. The other parameters for the ICs are plotted directly; that is, not using delta values.

A table at the bottom of each graph lists the test conditions when applicable and the normal standard deviations of each data point at each dose level.[2]

The dose units are in Grays (Gy) where 1 Gray equals 100 rads; for example, 10^{13} 3-MeV electrons/cm^2 = 250,000 rads(Si) = 2500 Gy(Si).

Date codes usually indicate when the device was packaged. For example, 7920 indicates the device was packaged in the twentieth week of 1979. If no date code is available, the space may be used for other identifying numbers such as wafer number or lot number.

---

[2]The log-normal or other types of distributions may provide a better fit for some radiation data than the normal distribution. Hence, caution should be exercised in estimating worst-case conditions based on the limited statistical data presented here.

The word "Fail," shown in some of the tabular data, indicates that the device will not function in its normal mode.

The narrative format is used to describe some of the tests of large-scale ICs (LSIs) because of the complexity of the parameter measurements and resultant difficulty in putting data into a computer for processing into curves.

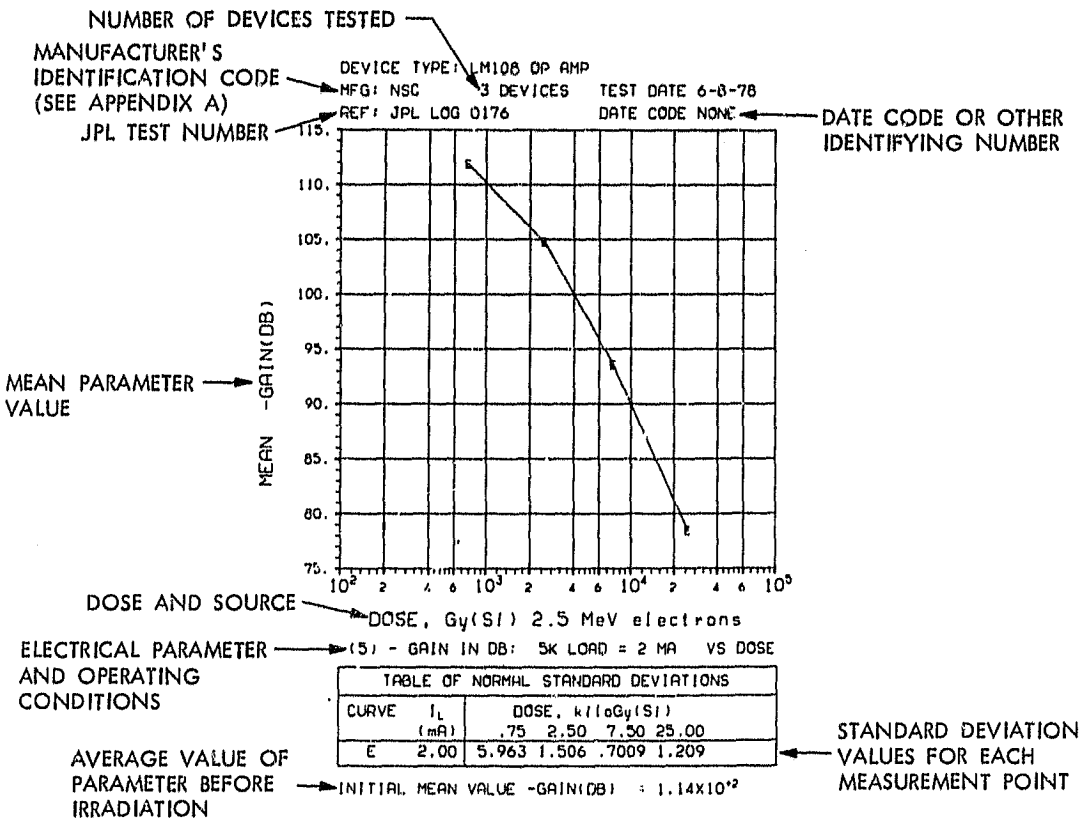


Figure 2. Description of Graph Format

DEVICE: 1802

TYPE: Microprocessor, Rad-Hard CMOS

MANUFACTURER: Sandia

DATE CODE: 8046, Lot B0442A

DEVICES TESTED: 4

TEST DATE: 3-20-80

SOURCE: 1.25 MeV Gamma

LOG NUMBER: 0709 and 0710

RADIATION BIAS CONDITION: (2 devices) V_{CC} = 10 volts
(2 devices) V_{CC} = 7 volts

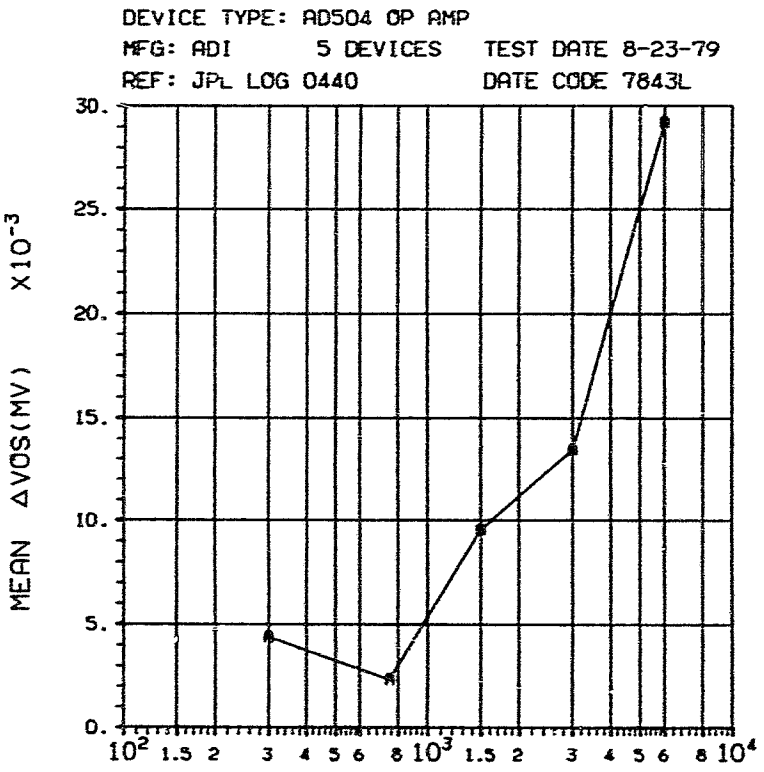
The 10-volt biased devices showed less degradation than the 7-volt biased devices.

A 24-hour annealing test indicated that the parameters had various annealing responses, including some reverse annealing on one device.

The clock-crystal inverter thresholds (V_{TNX} and V_{TPX}) showed significant changes. V_{TPX} is the most sensitive indicator of radiation damage; three of the devices were slightly beyond the preradiation limit at 1500 Gy(Si), and the parts continued to degrade up to 6000 Gy(Si).

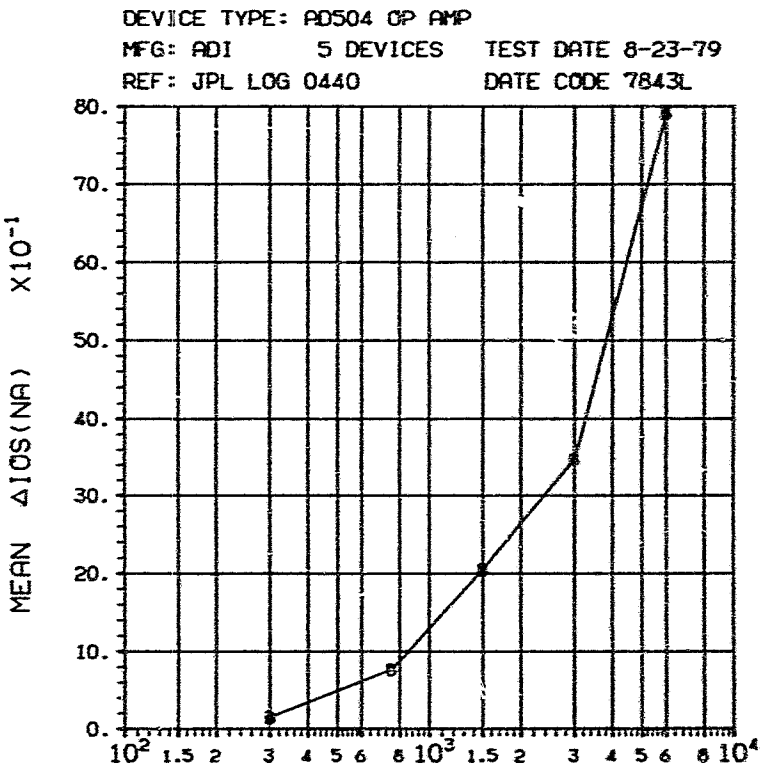
The functional test was performed at 1.2 MHz. All devices passed at both 7 and 10 volts up to 3000 Gy(Si). At 6000 Gy(Si), all devices failed the 7-volt functional test, and one device failed the 10-volt functional test.

The overall results indicate that this lot (B0442A) of devices is acceptable for 10-volt operation after an exposure of 2000 Gy(Si), but considerable caution should be used in lower voltage applications in radiation environments.



(1) VOS IN MV VS DOSE

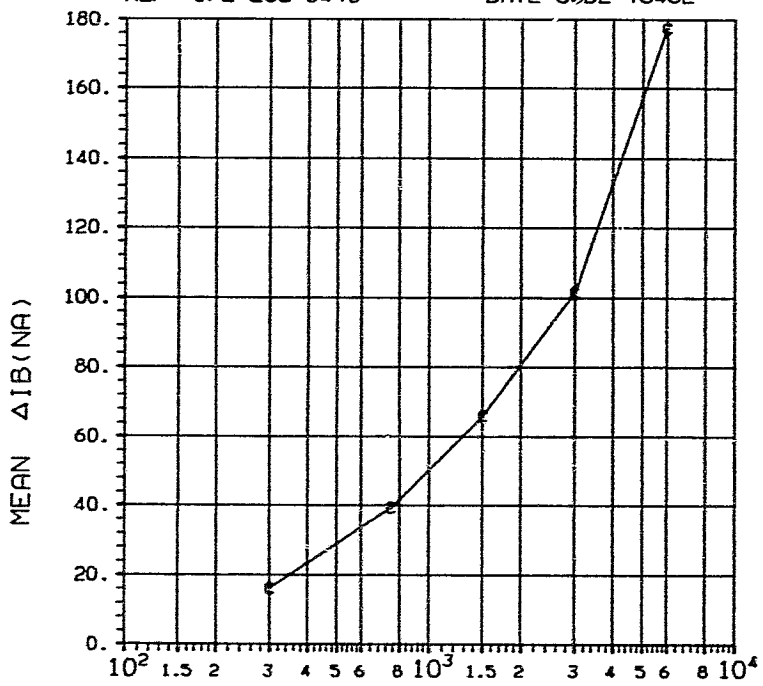
TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.30	.75	1.50	3.00	6.00
A	.0027	.0117	.0233	.0356	.0776



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.30	.75	1.50	3.00	6.00
B	.4338	1.884	4.694	7.830	17.25

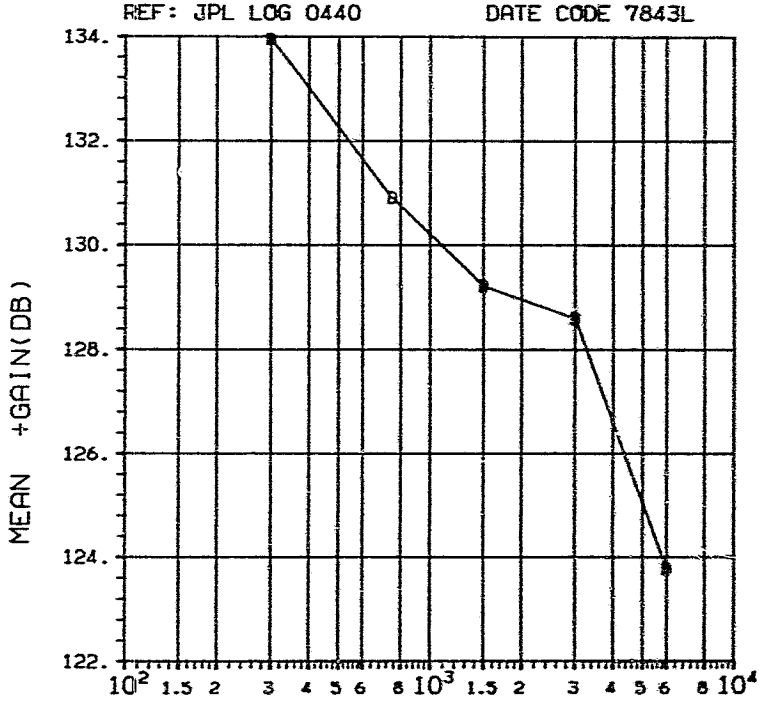
DEVICE TYPE: AD504 OP AMP
MFG: ADI 5 DEVICES TEST DATE 8-23-79
REF: JPL LOG 0440 DATE CODE 7843L



(3) IB IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.30	.75	1.50	3.00	6.00
C	7.187	7.857	17.54	18.07	54.55

DEVICE TYPE: AD504 OP AMP
MFG: ADI 5 DEVICES TEST DATE 8-23-79
REF: JPL LOG 0440 DATE CODE 7843L

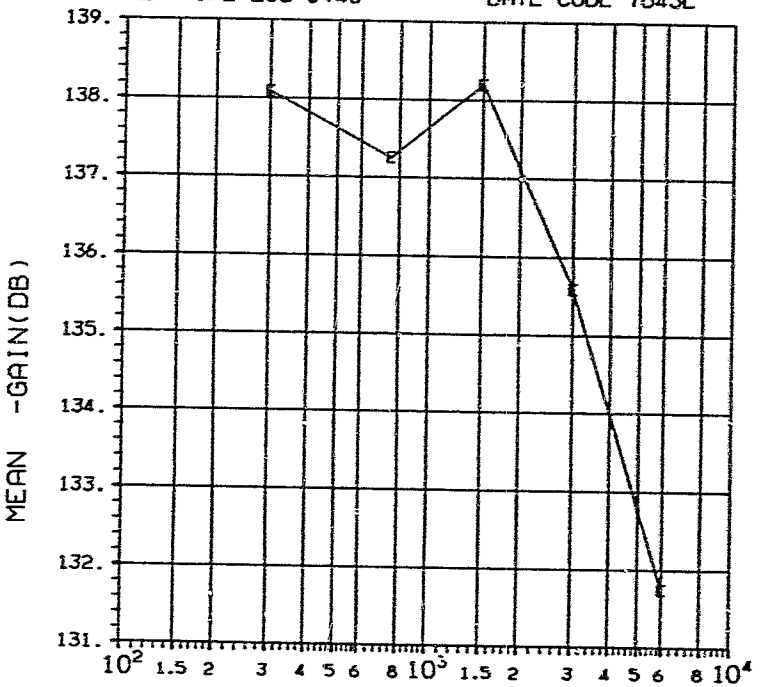


(4) + GAIN IN DB; 2K LOAD=5MA, +10V VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS						
CURVE	I_L (mA)	DOSE, kiloGy(Si)				
		.30	.75	1.50	3.00	6.00
D	5.00	5.209	2.234	3.662	1.227	1.407

INITIAL MEAN VALUE +GAIN(DB) = $1.36 \times 10^{+2}$

DEVICE TYPE: AD504 OP AMP
MFG: ADI 5 DEVICES TEST DATE 8-23-79
REF: JPL LOG 0440 DATE CODE 7843L



(S) - GAIN IN DB; 2K LOAD=5MA, -10V VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS						
CURVE	I_L (mA)	DOSE, kiloGy(Si) .30	.75	1.50	3.00	6.00
E	5.00	3.914	1.979	6.075	8.490	1.949

INITIAL MEAN VALUE -GAIN(DB) = $1.42X10^{+2}$

DEVICE: AD571

TYPE: ADC, 10-Bit

MANUFACTURER: ADI

DATE CODE: 7846N

DEVICES TESTED: 2

TEST DATE: 2-14-79

SOURCE: 2.5 MeV Electrons

LOG NUMBER: 0288

RADIATION BIAS CONDITION: V_{CC} = 15 volts
V_{DD} = -15 volts

RESULTS: Worst-Case Parameter Values, V+ = 5 volts unless otherwise noted in parentheses
V- = -15 volts

Total Dose, Gy(Si)	$I_{CC-BLK}(5)$, mA (Maximum)	$I_{CC-BLK}(15)$, mA (Maximum)	$I_{CC-CONV}(5)$, mA (Maximum)	$I_{CC-CONV}(15)$, mA (Maximum)	$t_{BLANK}(5)$, µs (Maximum)
Initial	1.40	3.60	5.25	9.65	974
300	1.35	3.55	4.40	8.70	969
750	1.35	3.60	4.05	8.23	995
1500	1.40	3.65	3.57	7.75	Fail
3000	1.40	3.65	3.15	7.25	Fail
6000	1.38	3.75	1.90	4.40	Fail

Total Dose, Gy(Si)	$t_{BLANK}(15)$, µs (Maximum)	$t_{CONV}(5)$, µs (Maximum)	$t_{CONV}(15)$, µs (Maximum)	$I_{IH}(5)$, nA (Maximum)	$I_{IH}(15)$, nA (Maximum)
Initial	931	22.7	22.9	15.03	16.72
300	962	24.5	24.6	17.30	19.97
750	1015	28.1	28.2	155.2	233
1500	1075	33.0	31.8	758	1064
3000	Fail	Fail	Fail	1090	1435
6000	Fail	Fail	Fail	816	1026

DEVICE: AD571

LOG NUMBER: 0288

Total Dose, Gy(Si)	$I_{IL}(5)$, µA (Maximum)	$I_{IL}(15)$, µA (Maximum)	$I_{EE-BLK}(5)$, mA (Maximum)	$I_{EE-CONV}$, mA (Maximum)	OFFSET, mV (Maximum)
Initial	3.52	4.33	10.55	11.14	10.07
300	3.40	3.99	10.24	10.79	10.07
750	3.57	4.10	8.32	10.11	9.16
1500	2.90	3.31	7.91	8.70	44.3
3000	2.91	3.32	8.06	8.45	70.8
6000	3.57	4.15	9.77	8.32	Fail

Total Dose, Gy(Si)	OFFERR, LSB (Maximum)	NONLIN, LSB (Maximum)	$I_{OZH}(5)$, nA (Maximum)	$I_{OZH}(15)$, nA (Maximum)	$I_{OZL}(5)$ nA (Maximum)
Initial	1.00	0.57	1.50	9.30	0.120
300	1.00	0.51	10.37	23.5	6.95
750	9.06	0.23	1295	2120	777
1500	4.56	Fail	6380	8800	3930
3000	7.28	Fail	7690	1040	3790
6000	8.03	Fail	3650	5050	978

DEVICE: AD571

LOG NUMBER: 0288

Total Dose, Gy(Si)	$I_{OZL}(15)$, nA (Maximum)	$V_{OH}(5)$, V (Minimum)	$V_{OH}(15)$, V (Minimum)	$I_{OH}(5)$, mA (Minimum)	$I_{OH}(15)$, µA (Minimum)
Initial	111.6	4.92	14.80	14.45	22.8
300	119.0	4.93	14.80	14.10	22.8
750	1491	4.91	14.80	Fail	21.1
1500	7250	4.82	14.70	Fail	14.7
3000	6990	4.80	14.50	Fail	12.8
6000	2160	1.80	5.30	Fail	5.5

Total Dose, Gy(Si)	$V_{OL}(5)$, mV (Maximum)	$V_{OL}(15)$, mV (Maximum)	$I_{OL}(5)$, mA (Minimum)	$I_{OL}(15)$, mA (Minimum)
Initial	16.95	19.4	9.68	12.18
300	23.0	22.0	7.58	10.90
750	48.9	32.8	2.90	7.20
1500	349	157	Fail	1.39
3000	501	506	Fail	Fail
6000	3080	2590	Fail	Fail

DEVICE: AD571

TYPE: ADC, 10-Bit

MANUFACTURER: ADI

DATE CODE: 7846N

DEVICES TESTED: 4

TEST DATE: 4-17-79

SOURCE: 2.5 MeV Electrons

LOG NUMBER: 0342

RADIATION BIAS CONDITION: V_{CC} = 15 volts
V_{DD} = -15 volts

RESULTS: Worst-Case Parameter Values, V_{CC} = 5 volts unless otherwise noted in parentheses
V_{DD} = -15 volts

Total Dose, Gy(Si)	$I_{CC-BLK}(5)$, mA (Maximum)	$I_{CC-BLK}(15)$, mA (Maximum)	$I_{CC-CONV}(5)$, mA (Maximum)	$I_{CC-CONV}(15)$, mA (Maximum)	$t_{BLANK}(5)$, µs (Maximum)
Initial	1.45	3.42	6.75	11.18	1.115
300	1.35	3.27	5.10	9.25	1.080
750	1.30	3.25	4.40	8.45	1.145
1500	1.30	3.20	3.75	7.75	1.185
3000	1.15	3.15	3.15	7.05	Fail
6000	1.20	3.05	2.45	3.45	Fail

Total Dose, Gy(Si)	$t_{BLANK}(15)$, µs (Maximum)	$t_{CONV}(5)$, µs (Maximum)	$t_{CONV}(15)$, µs (Maximum)	$I_{IH}(5)$, nA (Maximum)	$I_{IH}(15)$, nA (Maximum)
Initial	1.040	25.3	25.4	15.42	17.43
300	1.055	27.1	27.8	22.0	28.0
750	1.170	29.4	29.6	813	1190
1500	2.21	32.6	33.0	1060	1450
3000	2.30	Fail	36.0	1820	2160
6000	Fail	Fail	Fail	1830	2060

DEVICE: AD571

LOG NUMBER: 0342

Total Dose, Gy(Si)	$I_{IL}(5)$, µA (Maximum)	$I_{IL}(15)$, µA (Maximum)	$I_{EE-BLK}(5)$, mA (Maximum)	$I_{EE-CONV}$, mA (Maximum)	FFSET, mV (Maximum)
Initial	2.72	3.21	9.31	10.53	6.10
300	3.18	3.61	8.83	10.48	6.10
750	2.56	2.99	10.26	10.67	74.8
1500	2.81	3.28	9.47	10.24	107.1
3000	2.99	3.46	9.52	10.21	120.8
6000	3.46	4.08	8.34	10.23	Fail

Total Dose, Gy(Si)	OFFERR, LSB (Maximum)	NONLIN, LSB (Maximum)	$I_{OZH}(5)$, nA (Maximum)	$I_{OZH}(15)$, nA (Maximum)	$I_{OZL}(5)$, nA (Maximum)
Initial	0.594	0.158	0.81	1.46	0.33
300	0.594	0.332	10.06	21.37	2.79
750	7.69	0.457	1510	1820	911
1500	11.00	1.150	2420	5070	2630
3000	12.41	1.654	2670	6270	1670
6000	Fail	3.07	2080	4500	445

DEVICE: AD571

LOG NUMBER: 0342

Total Dose, Gy(Si)	$I_{OZL}(15)$, nA (Maximum)	$V_{OH}(5)$, V (Minimum)	$V_{OH}(15)$, V (Minimum)	$I_{OH}(5)$, mA (Minimum)	$I_{OH}(15)$, µA (Minimum)
Initial	0.35	4.92	14.85	24.2	23.0
300	10.08	4.92	14.85	23.3	22.9
750	1930	4.91	14.83	20.8	22.6
1500	4580	4.91	14.82	6.57	22.0
3000	3550	4.90	14.82	0.025	19.9
6000	1870	1.27	2.58	Fail	2320

Total Dose, Gy(Si)	$V_{OL}(5)$, mV (Maximum)	$V_{OL}(15)$, mV (Maximum)	$I_{OL}(5)$, mA (Minimum)	$I_{OL}(15)$, mA (Minimum)
Initial	12.8	14.5	9.29	12.07
300	16.4	16.9	8.38	11.16
750	23.3	21.8	6.78	10.08
1500	41.5	2980	2.85	6.77
3000	548	3000	Fail	0.86
6000	2390	2310	Fail	0.008

DEVICE: AD571
TYPE: ADC, 10-Bit
MANUFACTURER: ADI
DATE CODE: 7922N

DEVICES TESTED: 4
TEST DATE: 8-7-79
SOURCE: 2.5 MeV Electrons
LOG NUMBER: 0448

RADIATION BIAS CONDITION: V_{CC} = 15 volts
V_{DD} = -15 volts

RESULTS: Worst-Case Parameter Values, V_{CC} = 5 volts unless otherwise noted in parentheses
V_{DD} = -15 volts

Total Dose, Gy(Si)	$I_{CC-BLK}(5)$, mA (Maximum)	$I_{CC-BLK}(15)$, mA (Maximum)	$I_{CC-CONV}(5)$, mA (Maximum)	$I_{CC-CONV}(15)$, mA (Maximum)	$t_{BLANK}(5)$, µs (Maximum)
Initial	1.350	3.50	5.15	9.45	0.995
300	1.250	3.35	3.91	8.00	1.030
750	0.866	3.30	3.25	7.25	1.040
1500	0.850	3.30	2.75	6.55	Fail
3000	Fail	Fail	Fail	Fail	Fail

Total Dose, Gy(Si)	$t_{BLANK}(15)$, µs (Maximum)	$t_{CONV}(5)$, µs (Maximum)	$t_{CONV}(15)$, µs (Maximum)	$I_{IH}(5)$, nA (Maximum)	$I_{IH}(15)$, nA (Maximum)
Initial	0.965	23.9	23.9	15.46	17.99
300	1.040	28.5	28.6	17.43	20.2
750	1.155	35.7	35.0	58.5	82.3
1500	Fail	Fail	Fail	186	271
3000	Fail	Fail	Fail	Fail	Fail

DEVICE: AD571

LOG NUMBER: 0448

Total Dose, Gy(Si)	$I_{IL}(5)$, µA (Maximum)	$I_{IL}(15)$, µA (Maximum)	$I_{EE-BLK}(5)$, mA (Maximum)	$I_{EE-CONV}(5)$, mA (Maximum)	OFFSET, mV (Maximum)
Initial	2.52	2.90	10.11	11.30	6.10
300	2.21	2.49	9.12	10.03	5.18
750	2.18	2.45	8.25	8.67	4.27
1500	2.11	2.40	8.55	8.68	161
3000	Fail	Fail	Fail	Fail	Fail

Total Dose, Gy(Si)	OFFERR, LSB (Maximum)	NONLIN, LSB (Maximum)	$I_{OZH}(5)$, nA (Maximum)	$I_{OZH}(15)$, nA (Maximum)	$I_{OZL}(5)$, nA (Maximum)
Initial	0.593	1.055	0.551	1.44	0.154
300	0.500	1.082	2.917	5.91	0.504
750	0.406	1.528	118	215	45.2
1500	16.530	3.355	719	204	452
3000	Fail	Fail	Fail	Fail	Fail

Total Dose, Gy(Si)	$I_{OZL}(15)$, nA (Maximum)	$V_{OH}(5)$, V (Minimum)	$V_{OH}(15)$, V (Minimum)	$I_{OH}(5)$, mA (Minimum)	$I_{OH}(15)$, µA (Minimum)
Initial	0.595	4.92	14.85	25.3	22.9
300	2.095	4.93	14.85	21.3	22.8
750	172	4.93	14.85	Fail	22.1
1500	1140	4.92	14.84	Fail	14.9
3000	Fail	Fail	Fail	Fail	Fail

DEVICE: AD571

LOG NUMBER: 0448

Total Dose, Gy(Si)	$V_{OL}(5)$, mV (Maximum)	$V_{OL}(15)$, mV (Maximum)	$I_{OL}(5)$, mA (Minimum)	$I_{OL}(15)$, mA (Minimum)
Initial	13.0	14.6	10.99	14.45
300	23.6	20.9	6.61	9.98
750	302	124	Fail	1.57
1500	496	2670	Fail	Fail
3000	Fail	Fail	Fail	Fail

DEVICE: AD571

TYPE: ADC, 10-Bit

MANUFACTURER: ADI

DATE CODE: 7922N

DEVICES TESTED: 5

TEST DATE: 8-7-79

SOURCE: 2.5 MeV Electrons

LOG NUMBER: 0449

RADIATION BIAS CONDITION: V_{CC} = 15 volts
V_{DD} = -15 volts

RESULTS: Worst-Case Parameter Values, V_{CC} = 5 volts unless otherwise noted in parentheses
V_{DD} = -15 volts

Total Dose, Gy(Si)	$I_{CC-BLK}(5)$, mA (Maximum)	$I_{CC-BLK}(15)$, mA (Maximum)	$I_{CC-CONV}(5)$, mA (Maximum)	$I_{CC-CONV}(15)$, mA (Maximum)	$t_{BLANK}(5)$, µs (Maximum)
Initial	1.40	3.40	5.40	9.70	0.970
300	1.30	3.30	4.15	8.20	1.025
750	1.25	3.25	3.40	7.40	1.020
1500	1.18	3.16	2.70	6.00	Fail
3000	1.10	3.15	1.20	3.15	Fail

Total Dose, Gy(Si)	$t_{BLANK}(15)$, µs (Maximum)	$t_{CONV}(5)$, µs (Maximum)	$t_{CONV}(15)$, µs (Maximum)	$I_{IH}(5)$, nA (Maximum)	$I_{IH}(15)$, nA (Maximum)
Initial	0.940	25.5	25.6	15.43	17.83
300	1.005	27.6	27.7	16.91	19.55
750	1.045	30.5	30.6	42.7	56.4
1500	Fail	Fail	Fail	148	199
3000	Fail	Fail	Fail	309	420

DEVICE: AD571

LOG NUMBER: 0449

Total Dose, Gy(Si)	$I_{IL}(5)$, µA (Maximum)	$I_{IL}(15)$, µA (Maximum)	$I_{EE-BLK}(5)$, mA (Maximum)	$I_{EE-CONV}(5)$, mA (Maximum)	OFFSET, mV (Maximum)
Initial	4.04	5.06	10.19	11.06	6.10
300	3.09	3.56	9.58	10.59	6.10
750	2.61	3.01	9.05	10.11	6.10
1500	2.37	2.68	8.45	8.63	161
3000	2.23	2.59	9.08	9.34	Fail

Total Dose, Gy(Si)	OFFERR, LSB (Maximum)	NONLIN, LSB (Maximum)	$I_{OZH}(5)$, nA (Maximum)	$I_{OZH}(15)$, nA (Maximum)	$I_{OZL}(5)$, nA (Maximum)
Initial	0.59	1.055	1.525	165.4	0.167
300	0.59	1.053	5.49	176.5	0.39
750	0.59	1.496	58.9	235	29.1
1500	16.53	3.06	411	647	243
3000	Fail	3.88	758	1190	309

Total Dose, Gy(Si)	$I_{OZL}(15)$, nA (Maximum)	$V_{OH}(5)$, V (Minimum)	$V_{OH}(15)$, V (Minimum)	$I_{OH}(5)$, mA (Minimum)	$I_{OH}(15)$, µA (Minimum)
Initial	0.58	4.92	14.85	26.4	22.1
300	1.61	4.93	14.85	24.6	22.1
750	57.6	4.93	14.85	Fail	21.7
1500	571	4.92	14.84	Fail	18.27
3000	1050	4.74	13.66	Fail	7.66

DEVICE: AD571

LOG NUMBER: 0449

Total Dose, Gy(Si)	$V_{OL}(5)$, mV (Maximum)	$V_{OL}(15)$, mV (Maximum)	$I_{OL}(5)$, mA (Minimum)	$I_{OL}(15)$, mA (Minimum)
Initial	12.91	14.87	10.49	14.10
300	18.29	18.29	8.18	11.56
750	80.8	34.2	1.585	6.14
1500	502	571	Fail	Fail
3000	Fail	1830	Fail	Fail

DEVICE: AD571

TYPE: ADC, 10-Bit

MANUFACTURER: ADI

DATE CODE: R&D

DEVICES TESTED: 4

TEST DATE: 5-30-80

SOURCE: 2.5 MeV Electrons

LOG NUMBER: 0650

RADIATION BIAS CONDITION: V_{CC} = 15 volts
V_{DD} = -15 volts

RESULTS: Worst-Case Parameter Values, V_{CC} = 5 volts unless noted otherwise in parentheses
V_{DD} = -15 volts

Total Dose, Gy(Si)	$I_{CC-BLK}(5)$, mA (Maximum)	$I_{CC-BLK}(15)$, mA (Maximum)	$I_{CC-CONV}(5)$, mA (Maximum)	$I_{CC-CONV}(15)$, mA (Maximum)	$t_{BLANK}(5)$, µs (Maximum)
Initial	1.50	5.3	5.20	11.68	0.99
300	1.50	5.3	4.95	11.33	1.08
750	1.55	5.4	4.85	11.25	1.17
1500	1.55	5.4	4.45	10.82	2.18
3000	Fail	Fail	Fail	Fail	Fail

Total Dose, Gy(Si)	$t_{BLANK}(15)$, µs (Maximum)	$t_{CONV}(5)$, µs (Maximum)	$t_{CONV}(15)$, µs (Maximum)	$I_{IH}(5)$, nA (Maximum)	$I_{IH}(15)$, nA (Maximum)
Initial	0.96	30.3	30.3	15.78	18.09
300	1.03	31.9	32.0	21.9	28.8
750	1.98	32.9	33.0	445	668
1500	2.32	34.6	34.5	391	563
3000	Fail	Fail	Fail	Fail	Fail

DEVICE: AD571

LOG NUMBER: 0650

Total Dose, Gy(Si)	$I_{IL}(5)$, µA (Maximum)	$I_{IL}(15)$, µA (Maximum)	$I_{EE-BLK}(5)$, mA (Maximum)	$I_{EE-CONV}$, mA (Maximum)	OFFSET, mV (Maximum)
Initial	0.71	0.86	9.70	10.97	1.295
300	1.07	1.25	9.54	10.75	2.24
750	1.12	1.21	9.48	10.6	130
1500	1.19	1.28	9.39	9.9	635
3000	Fail	Fail	Fail	Fail	Fail

Total Dose, Gy(Si)	OFFERR, mLSB (Maximum)	NONLIN, mLSB (Maximum)	$I_{OZH}(5)$, nA (Maximum)	$I_{OZH}(15)$, nA (Maximum)	$I_{OZL}(5)$, nA (Maximum)
Initial	132	153	0.511	1.26	0.098
300	229	263	30.4	57.9	27.1
750	12900	453	1760	2190	1100
1500	Fail	Fail	2560	3210	2990
3000	Fail	Fail	Fail	Fail	Fail

Total Dose, Gy(Si)	$I_{OZL}(15)$, nA (Maximum)	$V_{OH}(5)$, V (Minimum)	$V_{OH}(15)$, V (Minimum)	$I_{OH}(5)$, mA (Maximum)	$I_{OH}(15)$, µA (Minimum)
Initial	0.490	4.93	14.85	26.97	24.8
300	85.6	4.93	14.85	26.53	24.6
750	2700	4.91	14.83	26.14	23.8
1500	6180	4.91	14.83	23.18	23.7
3000	Fail	Fail	Fail	Fail	Fail

DEVICE: AD571

LOG NUMBER: 0650

Total Dose, Gy(Si)	$V_{OL}(5)$, mV (Minimum)	$V_{OL}(15)$, mV (Maximum)	$I_{OL}(5)$, mA (Minimum)	$I_{OL}(15)$, mA (Minimum)
Initial	15.2	19.2	8.57	11.6
300	17.0	20.3	8.18	11.5
750	14.5	21.4	7.85	10.9
1500	26.2	26.1	Fail	Fail
3000	Fail	Fail	Fail	Fail

DEVICE: AD571

TYPE: ADC, 10-Bit

MANUFACTURER: ADI

DATE CODE: 8105 (1)
8107 (2)
8110 (2)

DEVICES TESTED: 5

TEST DATE: 5-26-81

SOURCE: 2.5 MeV Electrons

LOG NUMBER: 0733

RADIATION BIAS CONDITION: V_{CC} = 15 volts
V_{DD} = -15 volts

RESULTS: Worst-Case Parameter Values, V_{CC} = 5 volts unless otherwise noted in parentheses
V_{DD} = -15 volts

Total Dose, Gy(Si)	$I_{CC-BLK}(5)$, mA (Maximum)	$I_{CC-BLK}(15)$, mA (Maximum)	$I_{CC-CONV}(5)$, mA (Maximum)	$I_{CC-CONV}(15)$, mA (Maximum)	$t_{BLANK}(5)$, ns (Maximum)
Initial	1.45	3.50	5.80	9.95	930
300	1.40	3.45	5.03	8.98	920
750	1.52	3.65	4.60	8.60	970
1500	1.65	3.83	4.30	8.35	1030
3000	1.45	3.65	3.80	7.73	960
6000	1.40	3.35	3.10	6.92	Fail

DEVICE: AD571

LOG NUMBER: 0733

Total Dose, Gy(Si)	$t_{BLANK}(15)$, ns (Maximum)	$t_{CONV}(5)$, µs (Maximum)	$t_{CONV}(15)$, µs (Maximum)	$I_{IH}(5)$, nA (Maximum)	$I_{IH}(15)$, nA (Maximum)
Initial	880	20.1	22.0	17.4	19.4
300	905	23.6	23.6	35.0	50.2
750	995	25.4	25.4	1130	1640
1500	1170	28.5	28.6	1390	1950
3000	1100	29.6	32.1	1420	1880
6000	Fail	Fail	Fail	1050	1320

Total Dose, Gy(Si)	$I_{IL}(5)$, µA (Maximum)	$I_{IL}(15)$, µA (Maximum)	$I_{EE-BLK}(5)$, mA (Maximum)	$I_{EE-CONV}$, mA (Maximum)	OFFSET, mV (Maximum)
Initial	3.01	3.48	9.7	11.3	1.60
300	3.59	4.04	9.4	10.7	1.62
750	3.40	3.78	9.4	10.3	109
1500	3.27	3.63	9.3	9.9	242
3000	3.40	3.51	9.2	9.6	198
6000	3.70	4.13	9.0	9.2	104

DEVICE: AD571

LOG NUMBER: 0733

Total Dose, Gy(Si)	OFFERR, LSB (Maximum)	NONLIN, LSB (Maximum)	$I_{OZH}(5)$, nA (Maximum)	$I_{OZH}(15)$, nA (Maximum)	$I_{OZL}(5)$, nA (Maximum)
Initial	0.067	0.18	0.51	5.8	0.053
300	0.165	0.25	215	5.9	0.212
750	11.2	0.41	2350	24600	1910
1500	24.9	0.49	6220	24800	2980
3000	20.4	0.70	3480	11000	2330
6000	10.7	0.76	2370	Fail	Fail

Total Dose, Gy(Si)	$I_{OZL}(15)$, nA (Minimum)	$V_{OH}(5)$, V (Minimum)	$V_{OH}(15)$, V (Minimum)	$I_{OH}(5)$, mA (Minimum)	$I_{OH}(15)$, µA (Minimum)
Initial	10.8	4.87	14.72	28.3	14.8
300	11.4	4.88	14.75	27.7	14.9
750	4510	4.89	14.74	27.2	14.5
1500	16200	4.85	14.74	25.3	13.8
3000	4630	4.87	14.71	Fail	13.2
6000	2110	4.84	14.53	Fail	12.0

DEVICE: AD571

LOG NUMBER: 0733

Total Dose, Gy(Si)	$V_{OL}(5)$, mV (Maximum)	$V_{OL}(15)$, mV (Maximum)	$I_{OL}(5)$, mA (Minimum)	$I_{OL}(15)$, mA (Minimum)
Initial	12.21	15.29	12.0	15.9
300	13.65	16.13	10.8	14.6
750	15.48	17.28	9.7	13.5
1500	23.5	21.5	6.1	10.4
3000	72.6	34.1	1.7	5.8
6000	423	778	Fail	Fail

DEVICE: AD574JD

TYPE: ADC, 12-Bit

MANUFACTURER: ADI

DATE CODE: 7903N

DEVICES TESTED: 2

TEST DATE: 2-6-79

SOURCE: 1.25 MeV Gamma

LOG NUMBER: 0314

RADIATION BIAS CONDITION: V_{CC} = 15 volts
V_{DD} = -15 volts
V_{LOGIC} = 5 volts

RESULTS: Worst-Case Parameter Values, V_{CC} = 15 volts
V_{DD} = -15 volts
V_{LOGIC} = 5 volts

Total Dose, Gy(Si)	V_{REF}, V (Minimum)	I_{REF}, mA (Minimum)	I_{LOGIC}, mA (Maximum)	I_{CC}, mA (Maximum)	I_{DD}, mA (Maximum)
Initial	9.97	1.43	18.90	1.533	13.55
300	9.98	1.20	19.44	1.535	12.06
750	9.98	3.74	26.0	1.535	11.05
1500	9.98	3.93	27.0	1.540	10.85
3000	9.99	3.87	30.4	1.538	11.00
6000	9.99	3.47	26.6	1.539	10.65

DEVICE: AD574JD

LOG NUMBER: 0314

Total Dose, Gy(Si)	t_{CONV}, µs (Maximum)	t_{DSC}, ns (Maximum)	t_{DS}, ns (Maximum)	OFFSET, µV (Maximum)	OFFERR, LSB (Maximum)
Initial	21.00	264	541	2.13	0.75
300	21.35	255	554	4.88	1.87
750	Fail	1024	Fail	Fail	Fail
1500	Fail	1024	Fail	Fail	Fail
3000	Fail	1024	Fail	Fail	Fail
6000	Fail	1024	Fail	Fail	Fail

Total Dose, Gy(Si)	AOL OFF, LSB (Maximum)	AOL ERR, LSB (Maximum)	NONLIN, LSB (Maximum)	I_{OZH}, nA (Maximum)	I_{OZL}, nA (Maximum)
Initial	0.00915	1.121	1.045	3.28	0.0683
300	Fail	Fail	8.55	4.92	1.347
750	Fail	Fail	Fail	6420	Fail
1500	Fail	Fail	Fail	953	Fail
3000	Fail	Fail	Fail	528	Fail
6000	Fail	Fail	Fail	571	Fail

DEVICE: AD574JD

LOG NUMBER: 0314

Total Dose, Gy(Si)	V_{OH}, V (Minimum)	V_{OL}, mV (Maximum)	I_{OH}, mA (Minimum)	I_{OL}, mA (Minimum)	I_{IH}, µA (Maximum)
Initial	4.48	17.27	2.28	7.05	0.891
300	4.07	21.1	0.807	6.68	1.403
750	Fail	549	0.177	0.0072	1.793
1500	Fail	158	0.822	0.758	1.964
3000	Fail	216	0.511	0.482	2.22
6000	Fail	428	0.556	0.527	2.52

Total Dose, Gy(Si)	I_{IL}, nA (Maximum)	t_{DD}, ns (Maximum)	t_{HS}, ns (Maximum)
Initial	14.26	344	32.0
300	14.86	329	19.9
750	16.34	Fail	Fail
1500	21.0	Fail	Fail
3000	32.0	Fail	Fail
6000	55.4	Fail	Fail

DEVICE: AD574JD

TYPE: ADC, 12-Bit

MANUFACTURER: ADI

DATE CODE: 7909N

DEVICES TESTED: 3

TEST DATE: 5-17-79

SOURCE: 1.25 MeV Gamma

LOG NUMBER: 0376

RADIATION BIAS CONDITION: V_{CC} = 15 volts
V_{DD} = -15 volts
V_{LOGIC} = 5 volts

RESULTS: Worst-Case Parameter Values, V_{CC} = 15 volts
V_{DD} = -15 volts
V_{LOGIC} = 5 volts

Total Dose, Gy(Si)	V_{REF}, V (Minimum)	I_{REF}, mA (Minimum)	I_{LOGIC}, mA (Maximum)	I_{CC}, mA (Maximum)	I_{DD}, mA (Maximum)
Initial	9.97	1.545	22.2	1.720	14.50
300	9.98	4.87	26.8	1.725	13.40
750	9.98	5.26	27.4	1.825	12.80

Total Dose, Gy(Si)	t_{CONV}, µs (Maximum)	t_{DSC}, ns (Maximum)	t_{DS}, ns (Maximum)	OFFSET, mV (Maximum)	OFFERR, LSB (Maximum)
Initial	27.7	336	626	2.13	0.75
300	27.9	331	636	1.831	0.75
750	Fail	Fail	Fail	Fail	Fail

DEVICE: AD574JD

LOG NUMBER: 0376

Total Dose, Gy(Si)	AOL OFF, LSB (Maximum)	AOL ERR, LSB (Maximum)	NONLIN, LSB (Maximum)	I_{OZH}, nA (Maximum)	I_{OZL}, nA (Maximum)
Initial	0.01	4.87	0.975	21.2	17.83
300	0.007	2.99	1.357	7.19	6.08
750	Fail	Fail	Fail	Fail	279

Total Dose, Gy(Si)	V_{OH}, V (Minimum)	V_{OL}, mV (Maximum)	I_{OH}, mA (Minimum)	I_{OL}, mA (Minimum)
Initial	4.45	23.5	2.66	8.57
300	3.76	25.6	Fail	7.91
750	Fail	613	Fail	Fail

Total Dose, Gy(Si)	I_{IH}, µA (Maximum)	I_{IL}, nA (Maximum)	t_{DD}, ns (Maximum)	t_{HS}, ns (Maximum)
Initial	1.327	76.4	378	49.7
300	1.565	27.1	384	23.4
750	1.708	49.8	Fail	Fail

DEVICE: AD574JD

TYPE: ADC, 12-Bit

MANUFACTURER: ADI

DATE CODE: 7905N

DEVICES TESTED: 2

TEST DATE: 5-17-79

SOURCE: 1.25 MeV

LOG NUMBER: 0377

RADIATION BIAS CONDITION: V_{CC} = 15 volts
V_{DD} = -15 volts
V_{LOGIC} = 5 volts

RESULTS: Worst-Case Parameter Values, V_{CC} = 15 volts
V_{DD} = -15 volts
V_{LOGIC} = 5 volts

Total Dose, Gy(Si)	V_{REF}, V (Minimum)	I_{REF}, mA (Minimum)	I_{LOGIC}, mA (Maximum)	I_{CC}, mA (Minimum)	I_{DD}, mA (Maximum)
Initial	9.97	1.47	21.0	1.625	13.73
300	9.99	3.92	41.8	1.626	12.60
750	9.99	4.16	31.2	1.670	11.45

Total Dose, Gy(Si)	t_{CONV}, µs (Minimum)	t_{DSC}, ns (Maximum)	t_{DS}, ns (Maximum)	OFFSET, mV (Maximum)	OFFERR, LSB (Maximum)
Initial	21.2	280	626	2.13	0.00
300	20.5	273	636	Fail	Fail
750	Fail	Fail	Fail	Fail	Fail

DEVICE: AD574JD

LOG NUMBER: 0377

Total Dose, Gy(Si)	AOL OFF, LSB (Maximum)	AOL ERR, LSB (Maximum)	NONLIN, LSB (Maximum)	I_{OZH}, nA (Maximum)	I_{OZL}, nA (Maximum)
Initial	10.07	4.12	1.013	0.75	0.099
300	Fail	Fail	Fail	1510	141
750	Fail	Fail	Fail	Fail	Fail

Total Dose, Gy(Si)	V_{OH}, V (Minimum)	V_{OL}, mV (Maximum)	I_{OH}, mA (Minimum)	I_{OL}, mA (Minimum)
Initial	4.44	23.2	2.39	6.77
300	2.13	28.7	0.899	6.59
750	Fail	88.7	0.885	0.831

Total Dose, Gy(Si)	I_{IH}, µA (Maximum)	I_{IL}, nA (Maximum)	t_{DD}, ns (Maximum)	t_{HS}, ns (Maximum)
Initial	1.382	14.50	351	4.58
300	1.828	14.80	329	Fail
750	2.14	28.4	Fail	Fail

DEVICE: AD7521

TYPE: DAC, 12-Bit

MANUFACTURER: ADI

DATE CODE: 7825

DEVICES TESTED: 2

TEST DATE: 9-6-78

SOURCE: 1.25 MeV Gamma

LOG NUMBER: 0376

RADIATION BIAS CONDITION: V_{DD} = 15 volts
V_{REF} = 15 volts

RESULTS: Worst-Case Parameter Values, V_{DD} = 15 volts
V_{REF} = 10 volts

Total Dose, Gy(Si)	$I_{LEAKAGE}$, nA (Maximum)	I_{DD}, µA (Maximum)	NONLIN, % (Maximum)	I_{IH}, nA (Maximum)	V_{THL}, V (Minimum)	V_{THH}, V (Minimum)
Initial	1.715	0.1485	0.01721	2.06	1.790	1.810
30	2.140	0.1320	0.01806	2.01	1.550	1.770
100	1.945	65.40	0.1905	2.02	Fail	Fail
200	327,000	1200	0.1467	2.02	Fail	Fail
300	Fail	Fail	Fail	Fail	Fail	Fail
500	Fail	Fail	Fail	Fail	Fail	Fail

DEVICE: AD7570

TYPE: ADC, 10-Bit

MANUFACTURER: ADI

DATE CODE: 7844

DEVICES TESTED: 2

TEST DATE: 1-24-79

SOURCE: 1.25 MeV Gamma

LOG NUMBER: 0270

RADIATION BIAS CONDITION: V_{DD} = 15 volts
V_{CC} = 5 volts
V_{REF} = - 10 volts

RESULTS: Worst-Case Parameter Values, V_{DD} = 15 volts
V_{CC} = 5 volts
V_{REF} = 10 volts

Total Dose, Gy(Si)	ANALOG OUTPUT LEAKAGE CURRENT, nA (Maximum)	$I_{LEAK_{OH}}$, nA (Maximum)	$I_{LEAK_{OL}}$, nA (Maximum)	I_{IL}, µA (Maximum)	I_{IH}, µA (Maximum)
Initial	0.600	0.600	0.450	0.0010	0.450
30	0.800	0.950	0.500	0.0013	0.500
60	778	2.10	13.7	0.015	0.545
100	786	5.00	42.1	0.076	0.600
150	8350	12.5	77.3	0.235	0.670
200	Fail	Fail	Fail	Fail	Fail

DEVICE: AD7570

LOG NUMBER: 0270

Total Dose, Gy(Si)	RELATIVE ACCURACY, LSB (Maximum)	DIFFERENTIAL NONLIN, LSB (Maximum)	V_{OL}, V (Maximum)	V_{OH}, V (Minimum)	CLOCK F_{MAX}, kHz (Minimum)
Initial	0.495	0.751	0.093	4.930	576.0
30	0.575	0.751	0.092	4.925	620.0
60	1.072	1.751	0.093	4.915	518.0
100	1.030	1.751	0.094	4.895	102.0
150	10.41	15.51	0.099	4.840	126.0
200	Fail	Fail	Fail	Fail	Fail

Total Dose, Gy(Si)	t_{ON} HBE, ns (Maximum)	t_{ON} LBE, ns (Maximum)	t_{OFF} HBE, ns (Maximum)	t_{OFF} LBE, ns (Maximum)
Initial	137.0	147.0	535	528
30	152.5	160.0	542	534
60	187.0	197.5	553	540
100	260.0	287.0	605	568
150	500.0	Fail	Fail	Fail
200	Fail	Fail	Fail	Fail

DEVICE: AD7570

LOG NUMBER: 0270

Total Dose, Gy(Si)	I_{DD}, µA (Maximum)	I_{CC}, µA (Maximum)	I_{SK}, mA (Minimum)	I_{SC}, µA (Minimum)
Initial	0.009	0.046	29.9	1.400
30	1.000	0.144	27.7	1.150
60	70.4	3.11	27.5	0.864
100	625	34.6	27.4	0.545
150	3000	138	26.4	0.180
200	Fail	Fail	Fail	Fail

DEVICE: ADC1210
TYPE: ADC, 12-Bit
MANUFACTURER: NSC
DATE CODE: 840

DEVICES TESTED: 2
TEST DATE: 12-11-78
SOURCE: 1.25 MeV Gamma
LOG NUMBER: 0249

RADIATION BIAS CONDITION: V+ = 10 volts
V- = -10 volts
V_{REF} = 10.000 volts

RESULTS: Worst-Case Parameter Values, V+ = 10 volts
V- = -10 volts
V_{REF} = 10.000 volts

Total Dose, Gy(Si)	I_{NL}, nA (Maximum)	I_{NH}, nA (Maximum)	V_{OH}, V (Minimum)	V_{OL}, V (Maximum)	I_{SK}, mA (Minimum)	I_{SC}, mA (Minimum)
Initial	0.280	0.745	9.97	0.65	8.99	15.10
200	0.615	0.545	Fail	Fail	Fail	Fail

Total Dose, Gy(Si)	I_{CC}, mA (Maximum)	I_{EE}, mA (Maximum)	LINEARITY ERROR, % (Maximum)	FULL-SCALE ERROR, % (Maximum)	ZERO-SCALE ERROR, % (Maximum)	CLOCK FREQ, kHz (Minimum)
Initial	3.77	2.00	0.020	0.055	0.031	200
200	3.76	1.96	Fail	Fail	Fail	Fail

DEVICE: ADC1210 | DEVICES TESTED: 2

TYPE: ADC, 12-Bit | TEST DATE: 12-19-78

MANUFACTURER: NSC | SOURCE: 1.25 MeV Gamma

DATE CODE: 840 | LOG NUMBER: 0272

RADIATION BIAS CONDITION: V+ = 10 volts
V- = -10 volts
V_{REF} = 10.000 volts

RESULTS: Worst-Case Parameter Values, V+ = 10 volts
V- = -15 volts
V_{REF} = 10.000 volts

Total Dose, Gy(Si)	I_{NL}, nA (Maximum)	I_{NH}, nA (Maximum)	V_{OH}, V (Minimum)	V_{OL}, V (Maximum)
Initial	0.195	0.810	9.97	0.700
30	0.370	0.765	9.97	0.900
70	0.325	0.635	9.94	20.0
110	0.340	0.630	9.87	64.5
150	0.370	0.625	9.76	107
200	Fail	Fail	Fail	Fail

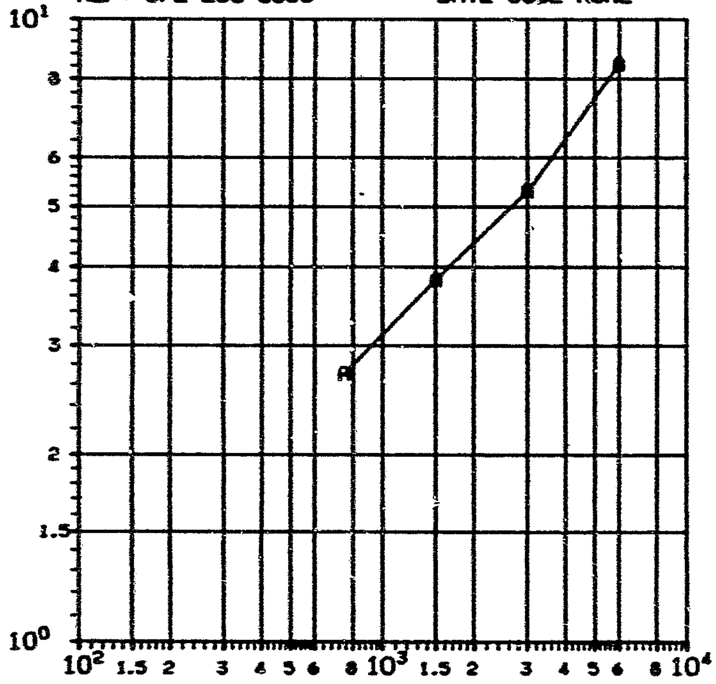
Total Dose, Gy(Si)	I_{SK}, mA (Minimum)	I_{SC}, mA (Minimum)	I_{CC}, mA (Maximum)	I_{EE}, mA (Maximum)
Initial	9.21	14.90	3.87	2.13
30	9.39	14.53	3.91	2.14
70	9.23	14.04	5.23	2.11
110	8.87	13.55	7.57	2.11
150	8.28	12.95	10.54	2.10
200	Fail	Fail	Fail	Fail

DEVICE: ADC1210

LOG NUMBER: 0272

Total Dose, Gy(Si)	LINEARITY ERROR, % (Maximum)	FULL-SCALE ERROR, % (Maximum)	ZERO-SCALE ERROR, % (Maximum)	CLOCK FREQ, kHz (Minimum)
Initial	0.028	0.021	0.131	200
30	0.320	0.240	0.143	200
70	0.125	0.409	0.195	200
110	0.426	1.517	0.348	200
150	1.070	2.83	0.440	200
200	Fail	Fail	Fail	Fail

DEVICE TYPE: CD4013 CMOS
MFG: RCA 3 DEVICES TEST DATE 2-1-80
REF: JPL LOG 0588 DATE CODE NONE

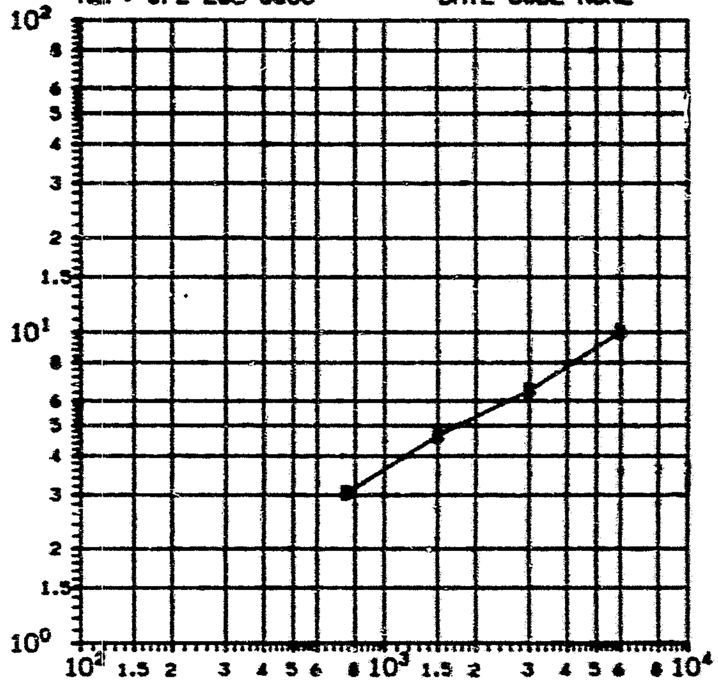


(1) ISS1 IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(SI)			
	.75	1.50	3.00	6.00
A	.1100	.1607	.1500	.1500

INITIAL MEAN VALUE ISS1(NA) = 8.00×10^{-3}

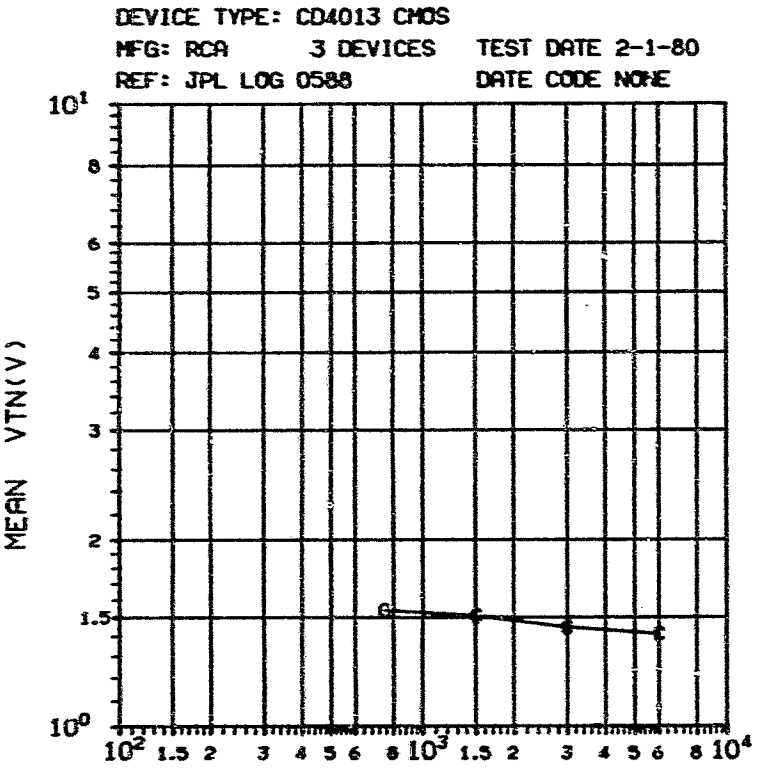
DEVICE TYPE: CD4013 CMOS
MFG: RCA 3 DEVICES TEST DATE 2-1-80
REF: JPL LOG 0588 DATE CODE NONE



(2) ISS2 IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(SI)			
	.75	1.50	3.00	6.00
B	.1300	.2179	.2500	.1803

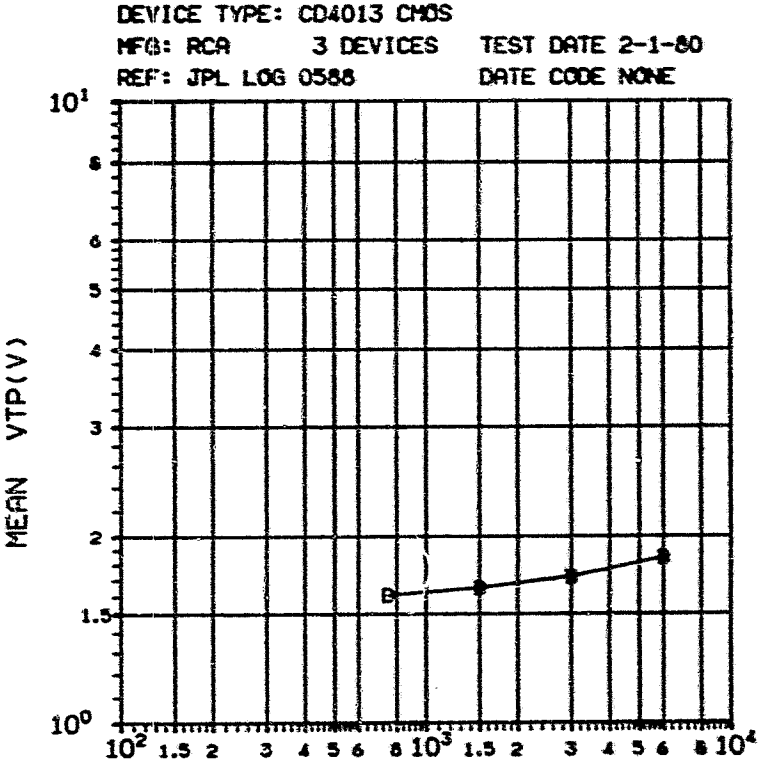
INITIAL MEAN VALUE ISS2(NA) = 1.37×10^{-1}



(3) VTN IN VOLTS VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
C	.0171	.0216	.0303	.0335

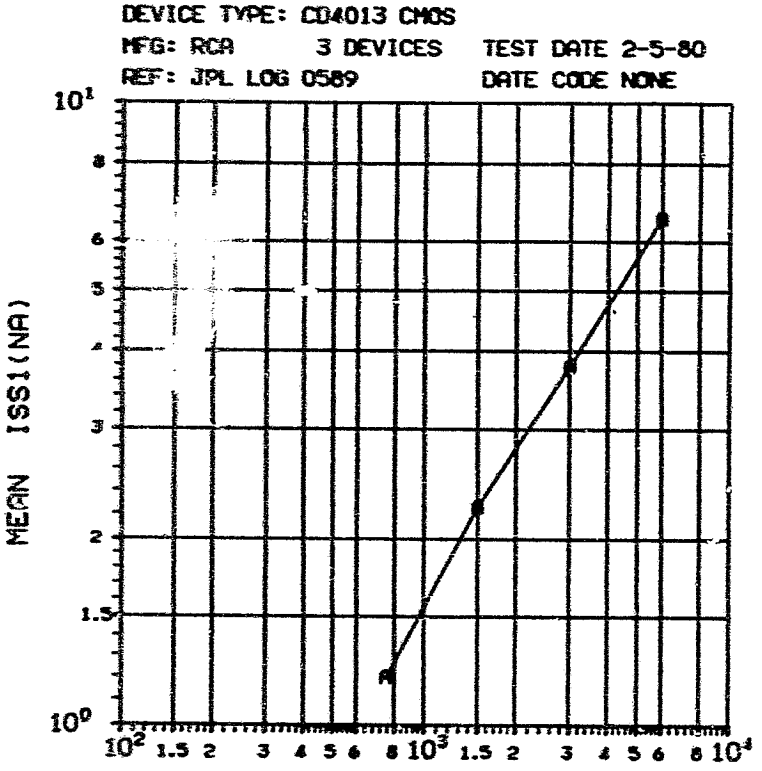
INITIAL MEAN VALUE VTN(V) = $1.64X10^{-0}$



(4) VTP IN VOLTS VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
D	.0061	.0064	.0086	.0133

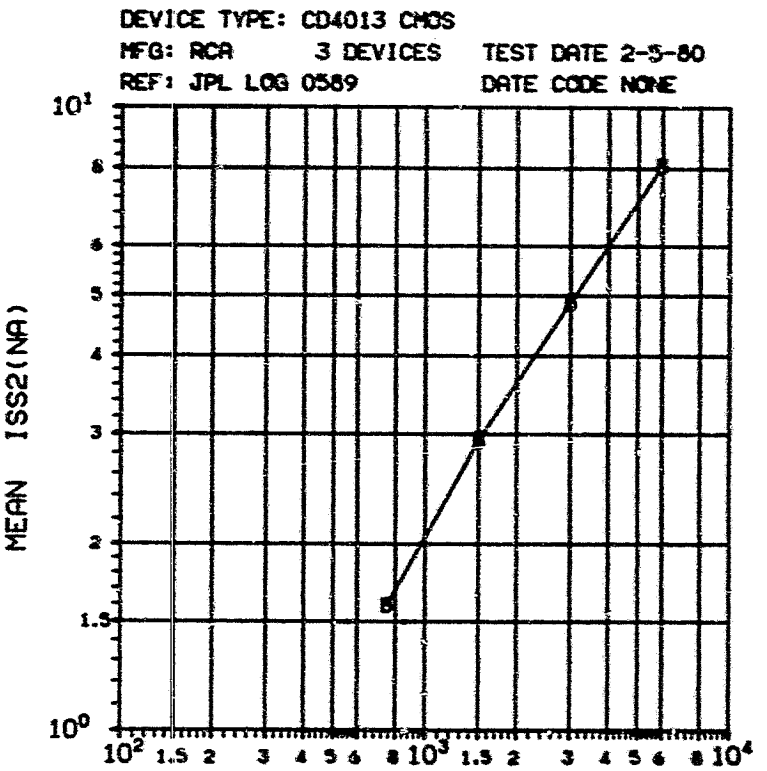
INITIAL MEAN VALUE VTP(V) = $1.51X10^{-0}$



(1) ISS1 IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
A	.0493	.3247	.7286	1.268

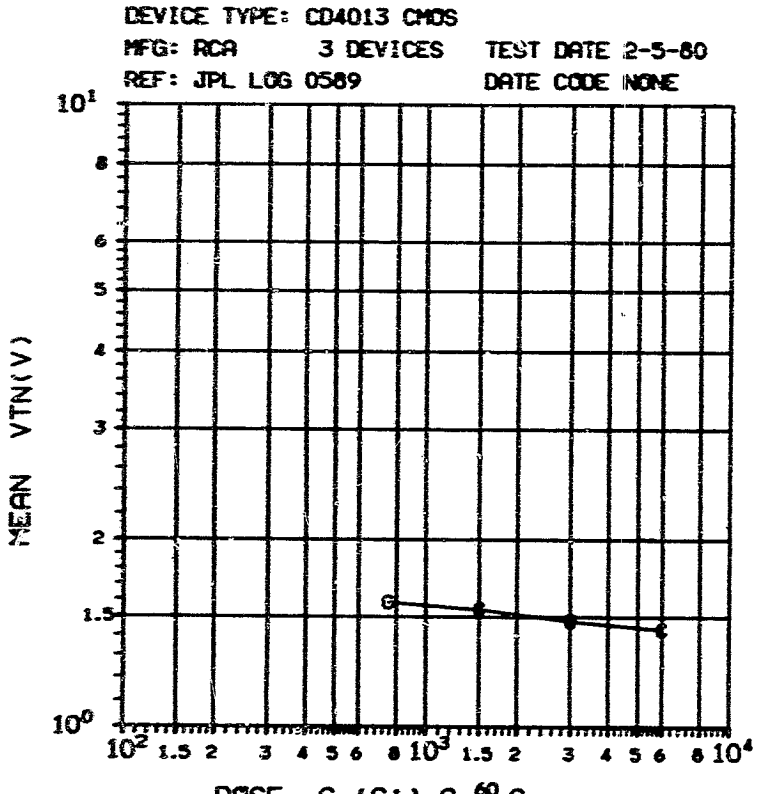
INITIAL MEAN VALUE ISS1(NA) = 2.07×10^{-3}



(2) ISS2 IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
B	.0850	.3523	.8327	1.457

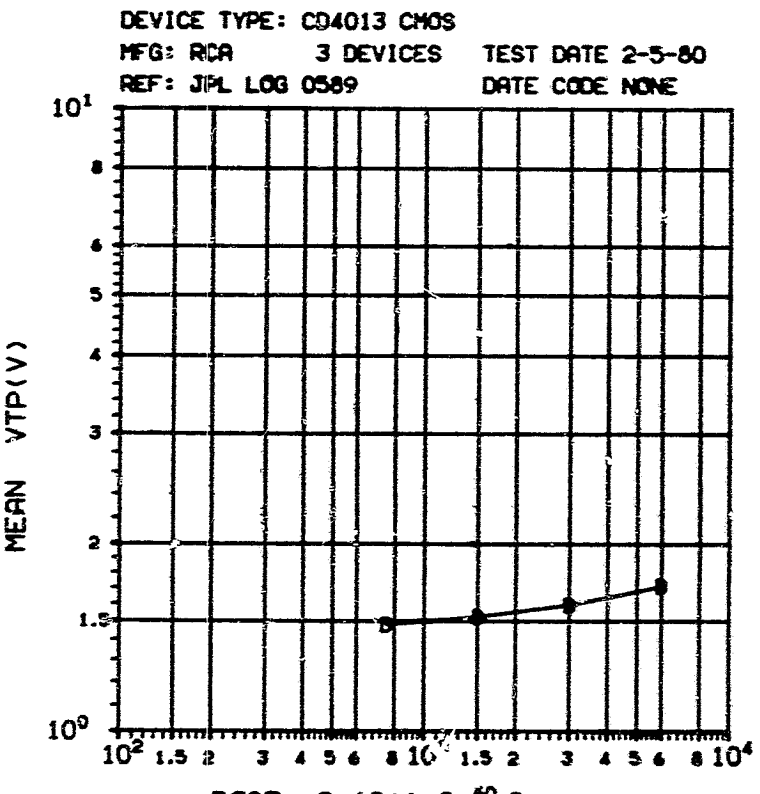
INITIAL MEAN VALUE ISS2(NA) = 2.93×10^{-1}



(3) VTN IN VOLTS VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
C	.0215	.0250	.0332	.0384

INITIAL MEAN VALUE VTN(V) = 1.67×10^{0}



(4) VTP IN VOLTS VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
D	.0070	.0068	.0100	.0172

INITIAL MEAN VALUE VTP(V) = 1.39×10^{0}

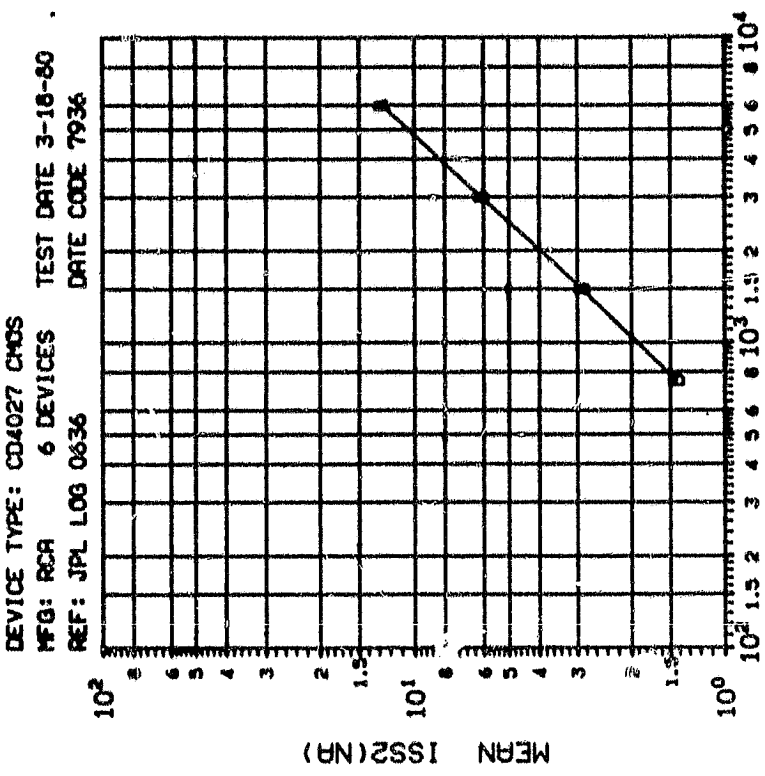


TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
B	.3149	.2058	.8483	3.305

INITIAL MEAN VALUE ISS2(NA) = 2.86×10^{-1}

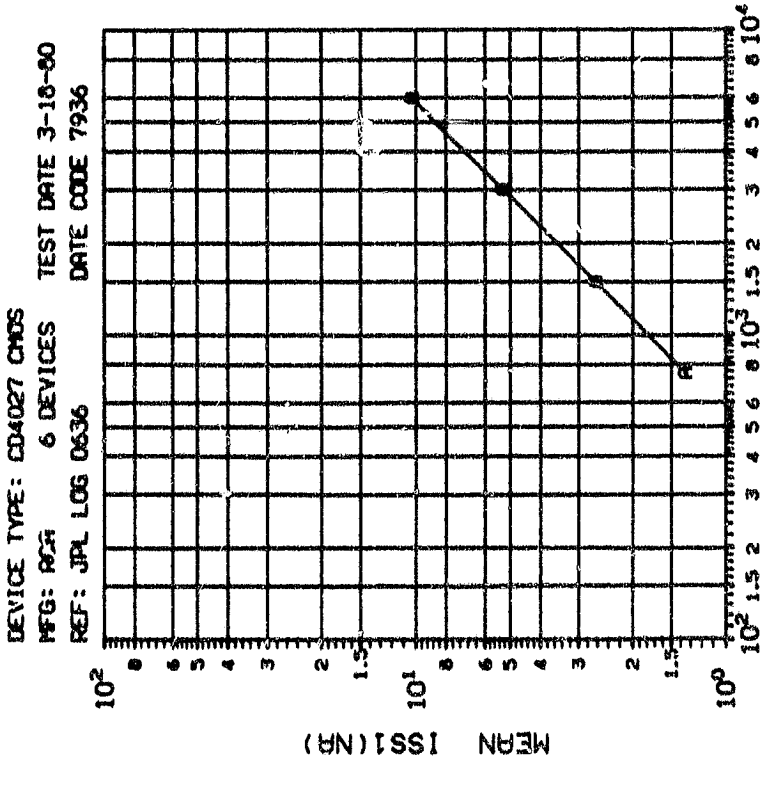
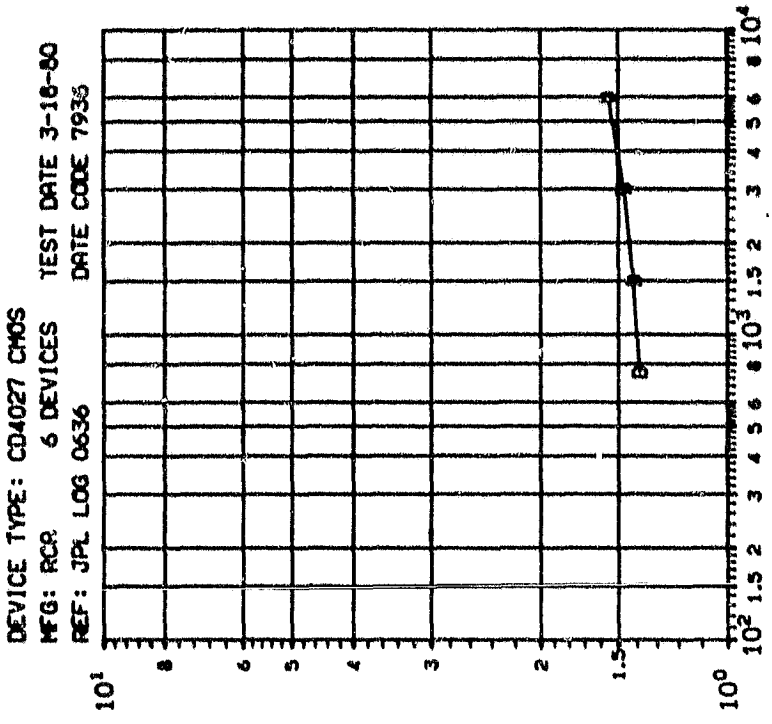


TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
A	.1859	.2971	.8004	2.104

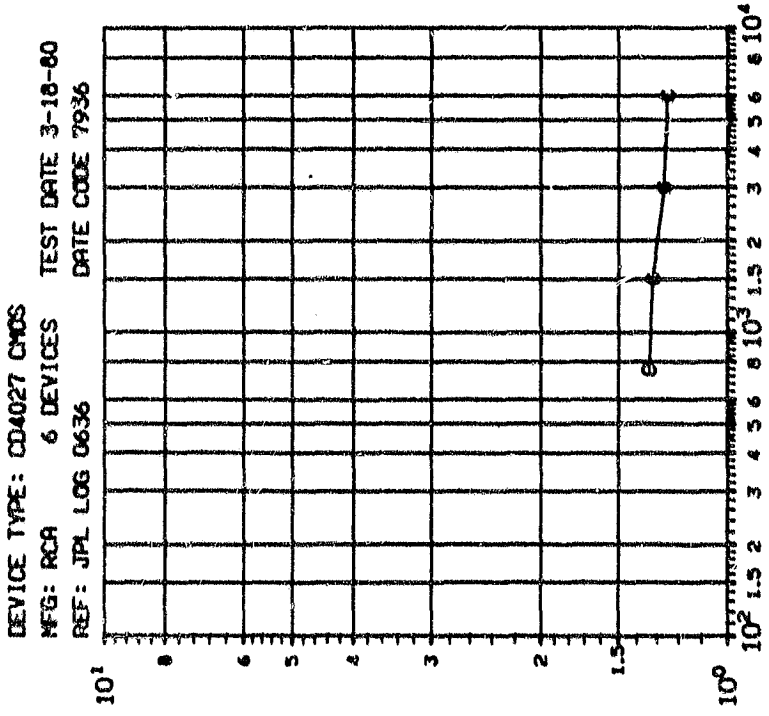
INITIAL MEAN VALUE ISS1(NA) = 2.37×10^{-1}



(4) VTP IN VOLTS VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.75	1.50	3.00	6.00	
D	.6709	.6862	.7109	.7481	

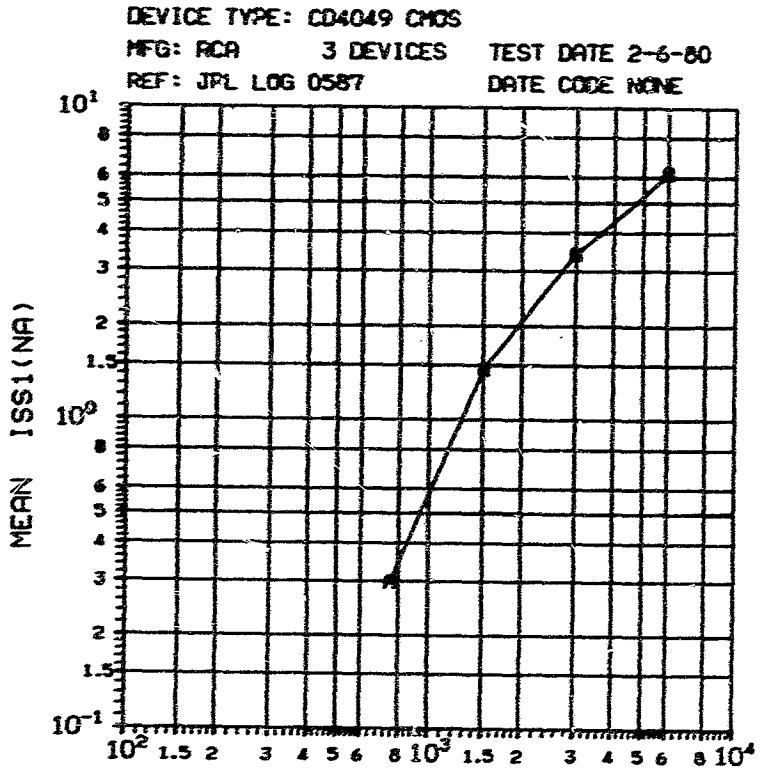
INITIAL MEAN VALUE VTP(V) = 1.84×10^{-0}



(3) VTN IN VOLTS VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.75	1.50	3.00	6.00	
C	.0365	.0139	.0188	.0292	

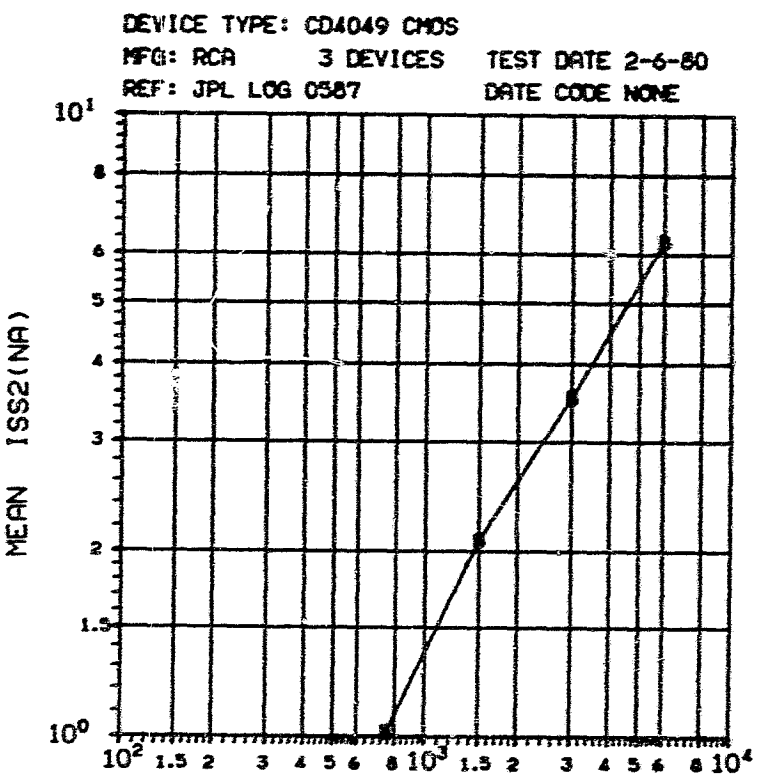
INITIAL MEAN VALUE VTN(V) = 1.44×10^{-0}



(1) ISS1 IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
A	.2362	.6500	.4583	3.700

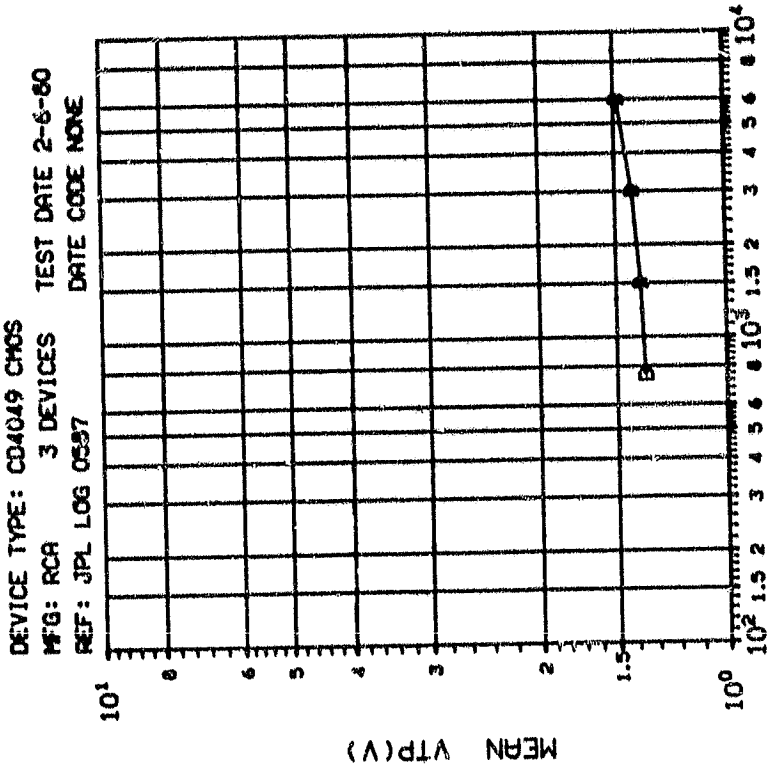
INITIAL MEAN VALUE ISS1(NA) = 2.33×10^{-2}



(2) ISS2 IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
B	.7522	.9385	1.950	3.593

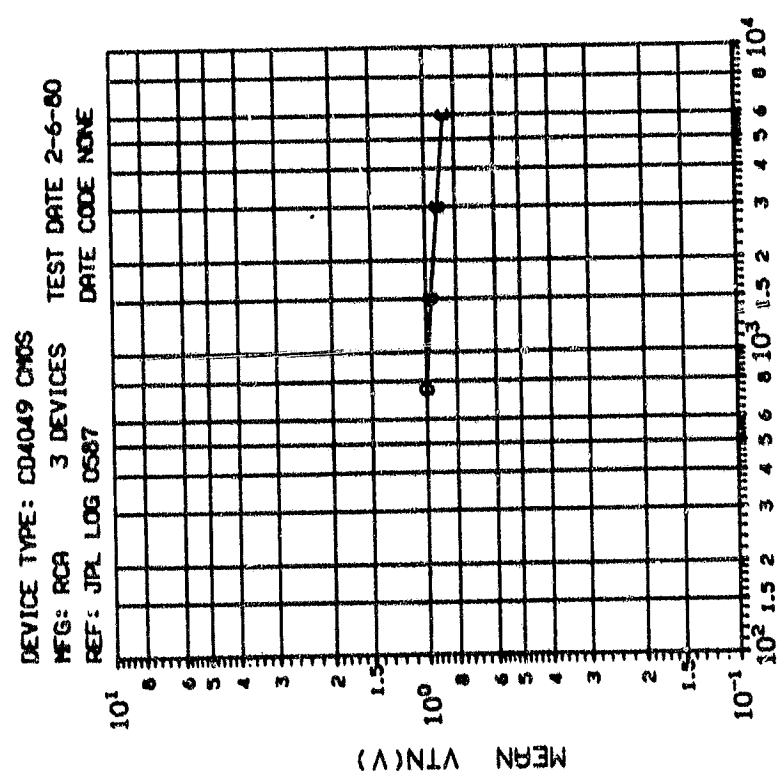
INITIAL MEAN VALUE ISS2(NA) = 2.57×10^{-2}



(4) VTP IN VOLTS VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.75	1.50	3.00	6.00	
D	.0712	.0649	.0741	.0910	

INITIAL MEAN VALUE VTP(V) = 1.28×10^{-9}

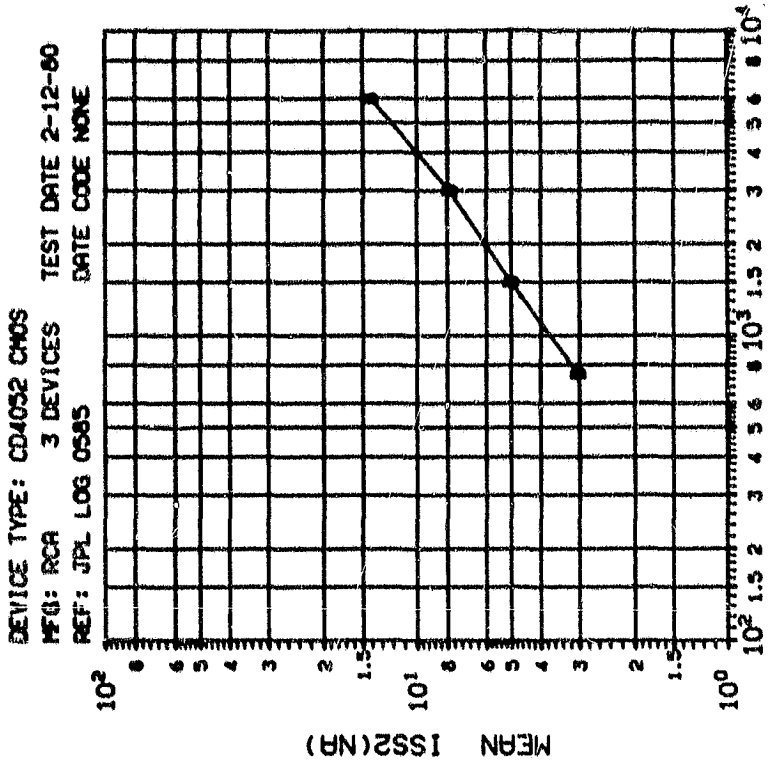


(3) VTN IN VOLTS VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.75	1.50	3.00	6.00	
C	.0566	.0589	.0618	.0696	

INITIAL MEAN VALUE VTN(V) = 1.05×10^{-9}

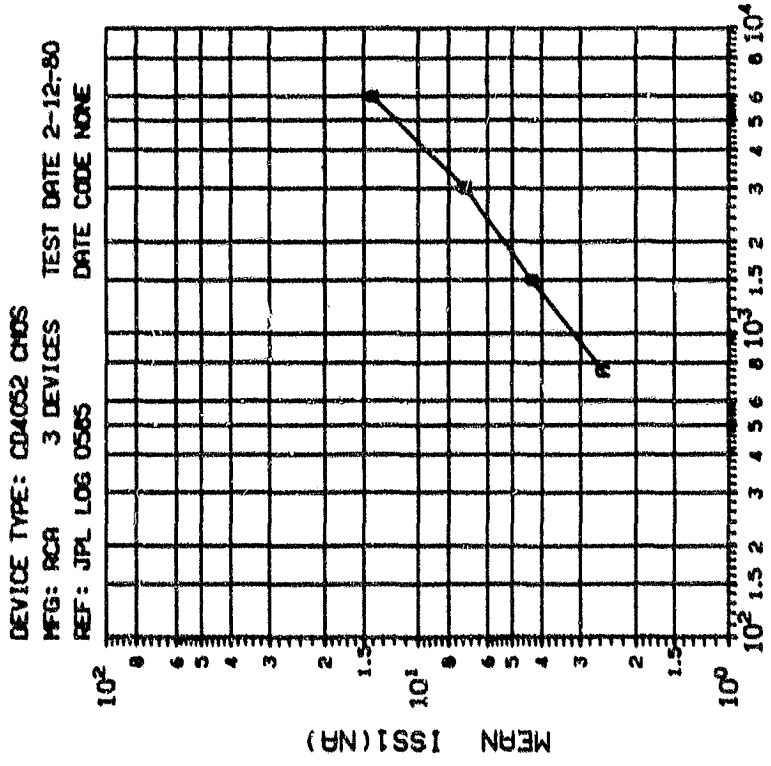
ORIGINAL PAGE IS
OF POOR QUALITY



(2) ISS2 IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00 6.00
B	.5260	.8736	1.224 1.801

INITIAL MEAN VALUE ISS2(NA) = 3.66×10^{-1}

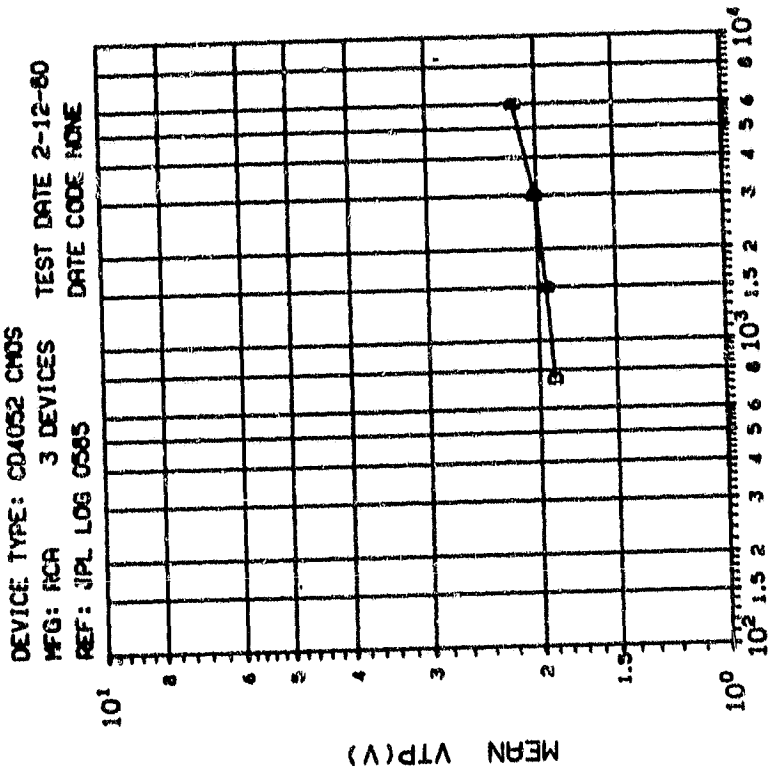


(1) ISS1 IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00 6.00
A	.4652	.7489	1.090 1.721

INITIAL MEAN VALUE ISS1(NA) = 2.72×10^{-1}

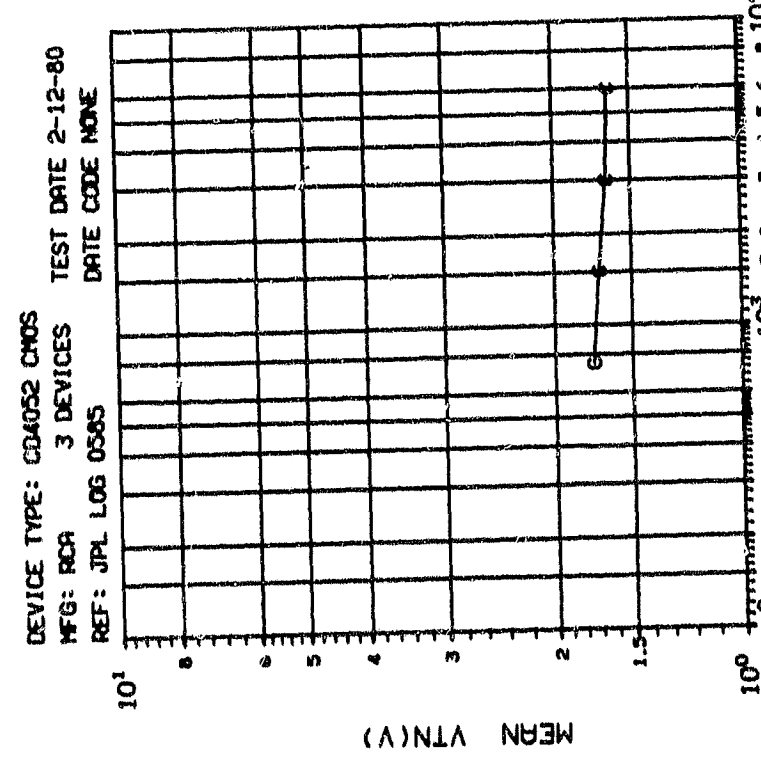
ORIGINAL PAGE IS
OF POOR QUALITY



(4) VTP IN VOLTS VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.75	1.50	3.00	6.00	
D	.0302	.0338	.0374	.0489	

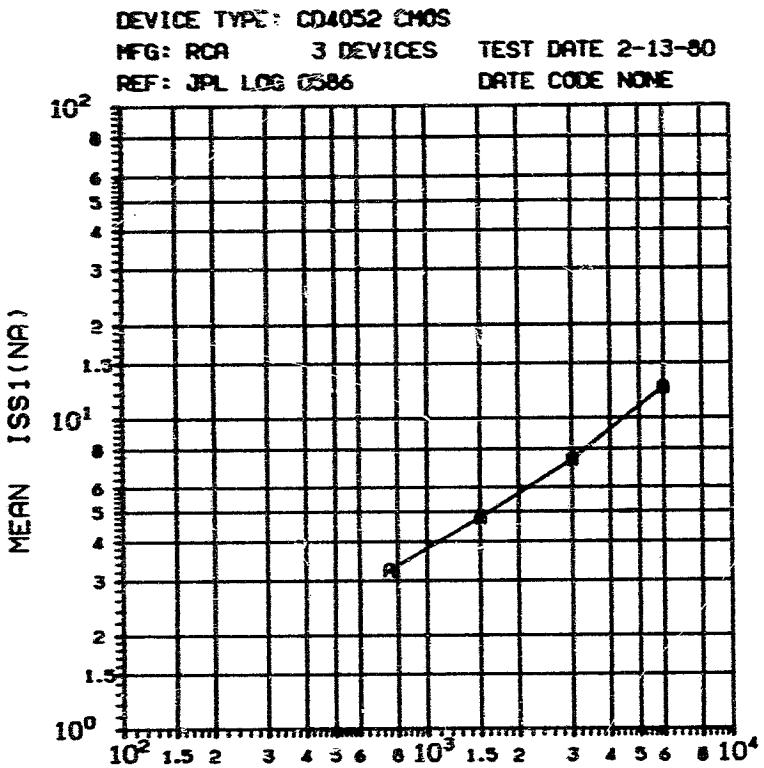
INITIAL MEAN VALUE VTP(V) = 1.80×10^{-9}



(3) VTN IN VOLTS VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.75	1.50	3.00	6.00	
C	.0762	.0713	.0663	.0676	

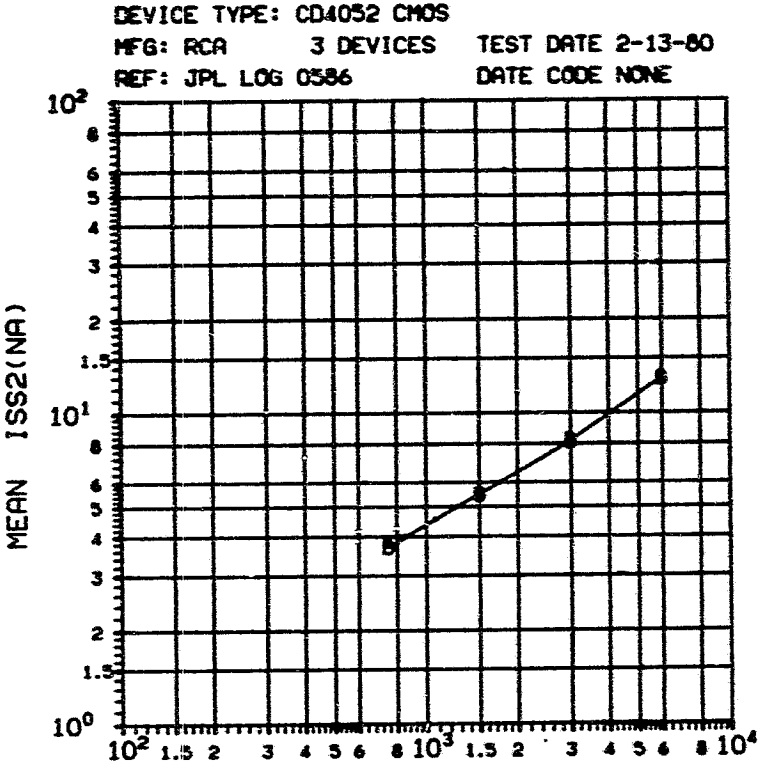
INITIAL MEAN VALUE VTN(V) = 1.81×10^{-9}



(1) ISS1 IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00	6.00
A	.6413	.9168	1.264	2.021

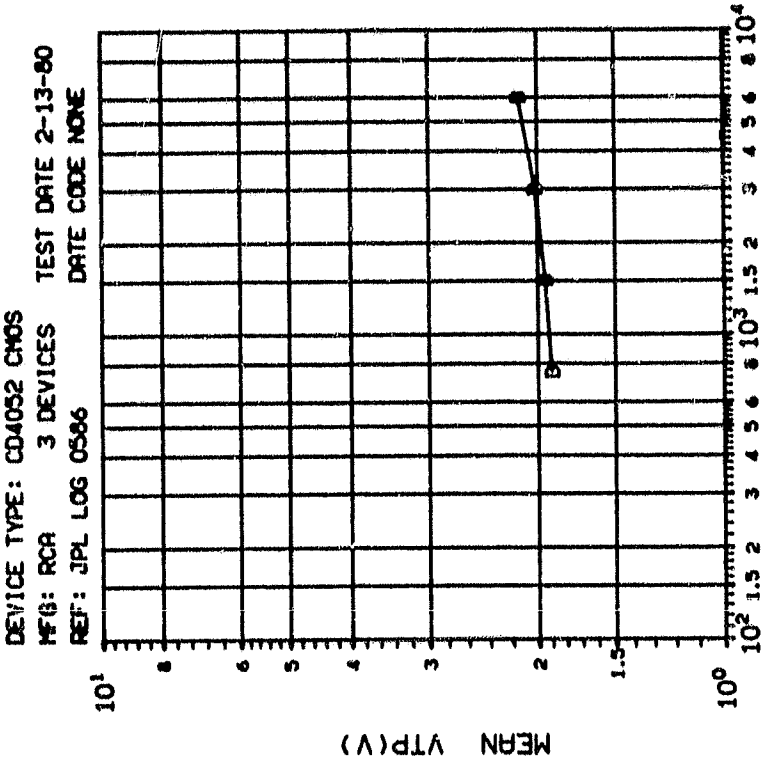
INITIAL MEAN VALUE ISS1(NA) = 3.18×10^{-2}



(2) ISS2 IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00	6.00
B	.7566	1.081	1.395	1.922

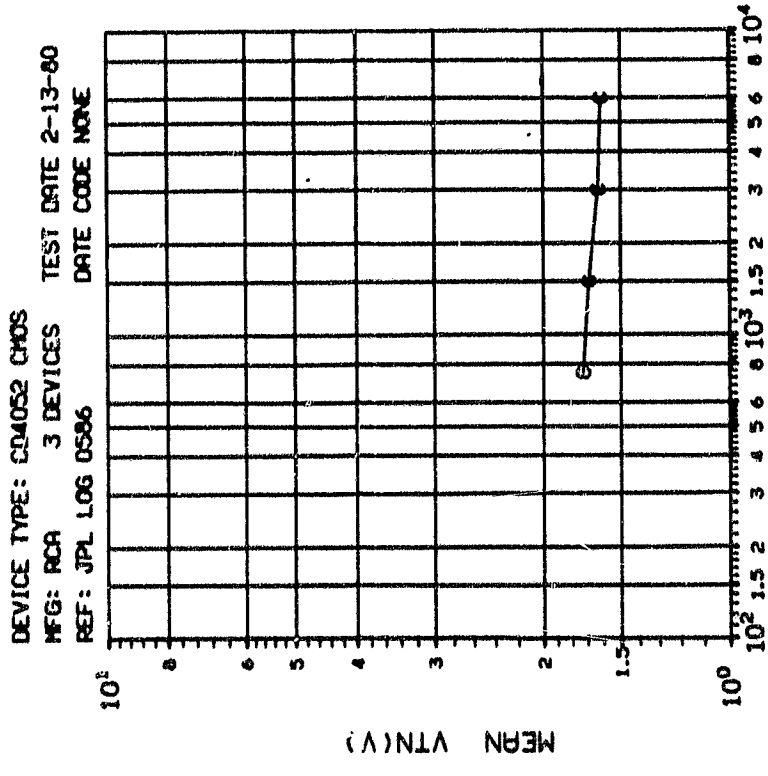
INITIAL MEAN VALUE ISS2(NA) = 4.02×10^{-2}



(4) VTP IN VOLTS VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00 6.00
D	.0346	.0367	.0429 .0542

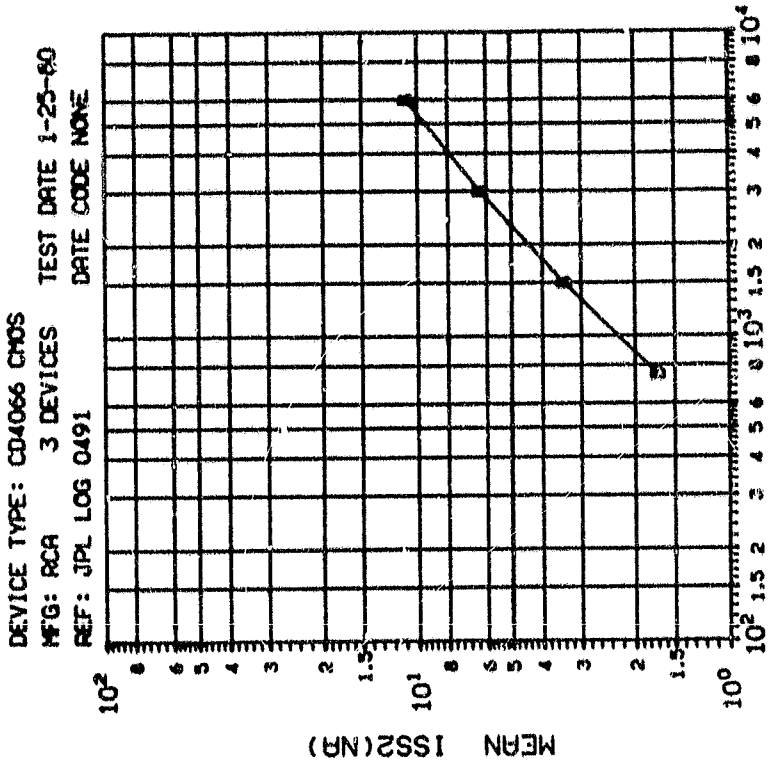
INITIAL MEAN VALUE VTP(V) = 1.80×10^{0}



(3) VTN IN VOLTS VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00 6.00
C	.0465	.0452	.0427 .0453

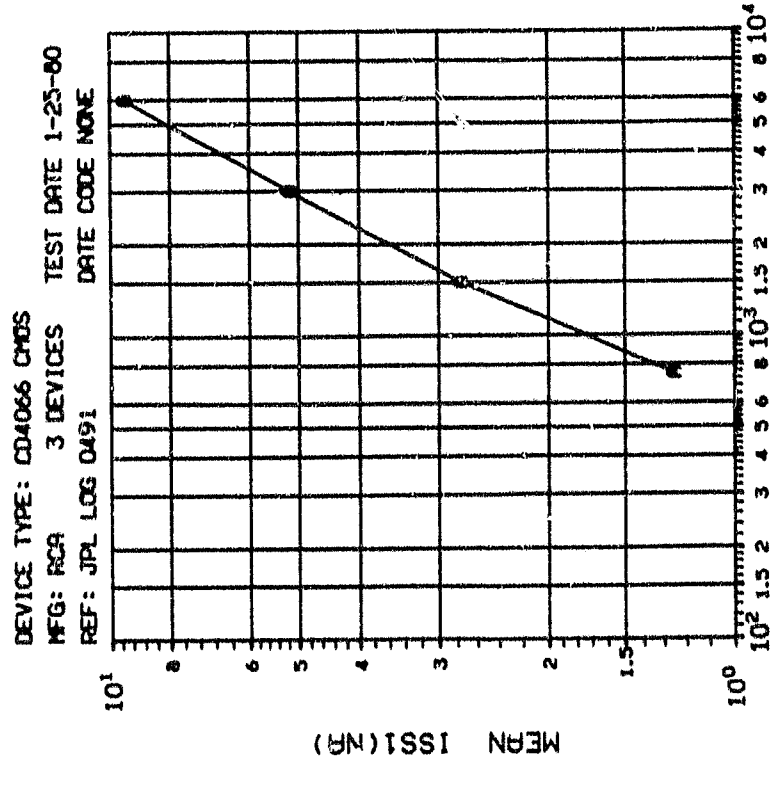
INITIAL MEAN VALUE VTN(V) = 1.80×10^{0}



(2) ISS2 IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00 6.00
B	.1411	.2930	.3969 .1155

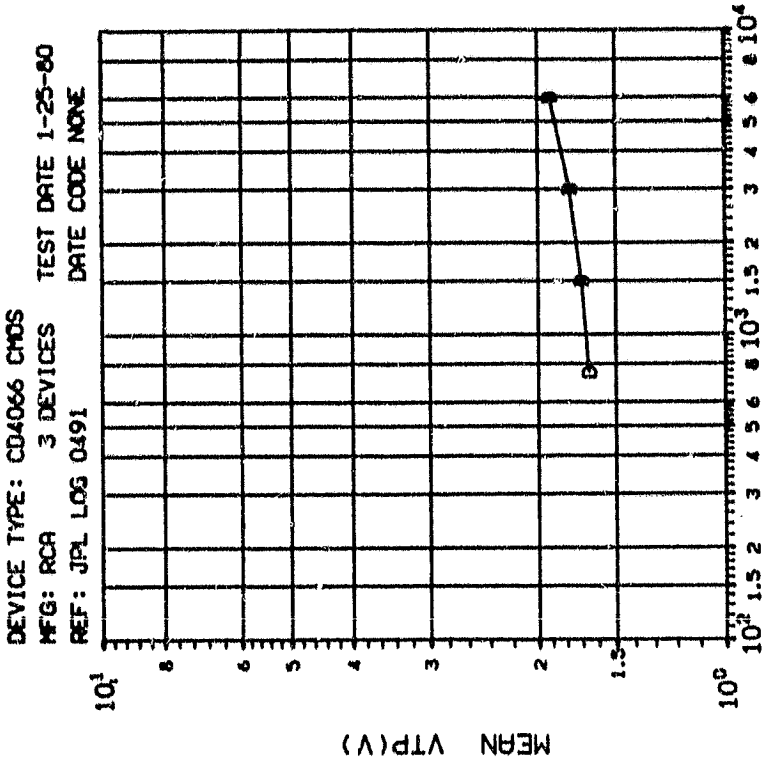
INITIAL MEAN VALUE ISS2(NA) = 2.27×10^{-1}



(1) ISS1 IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00 6.00
A	.0252	.0624	.2804 .3786

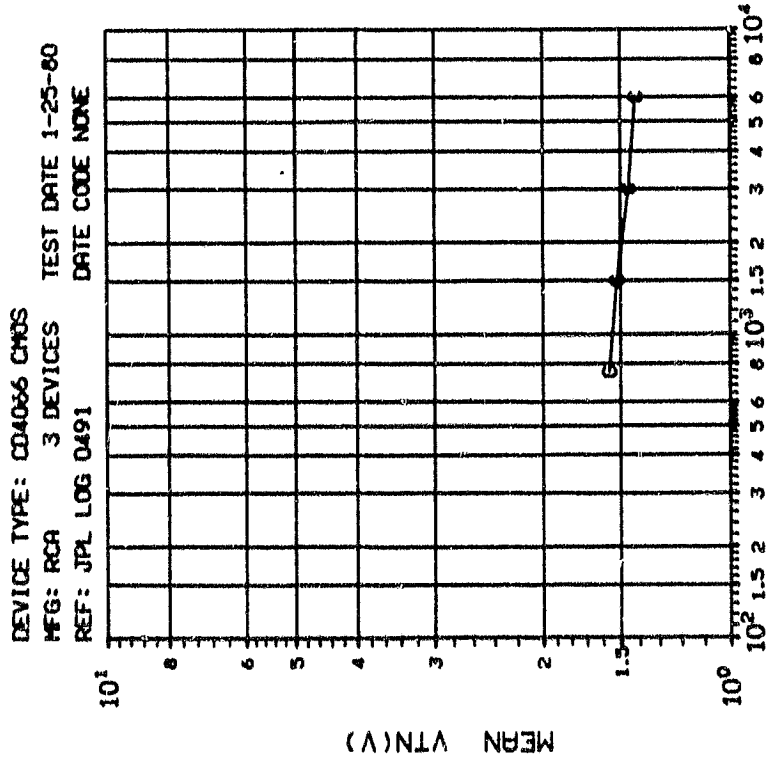
INITIAL MEAN VALUE ISS1(NA) = 1.97×10^{-1}



(4) VTP IN VOLTS VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.75	1.50	3.00	6.00	
D	.0232	.0251	.0218	.0208	

INITIAL MEAN VALUE VTP(V) = 1.56×10^{-0}

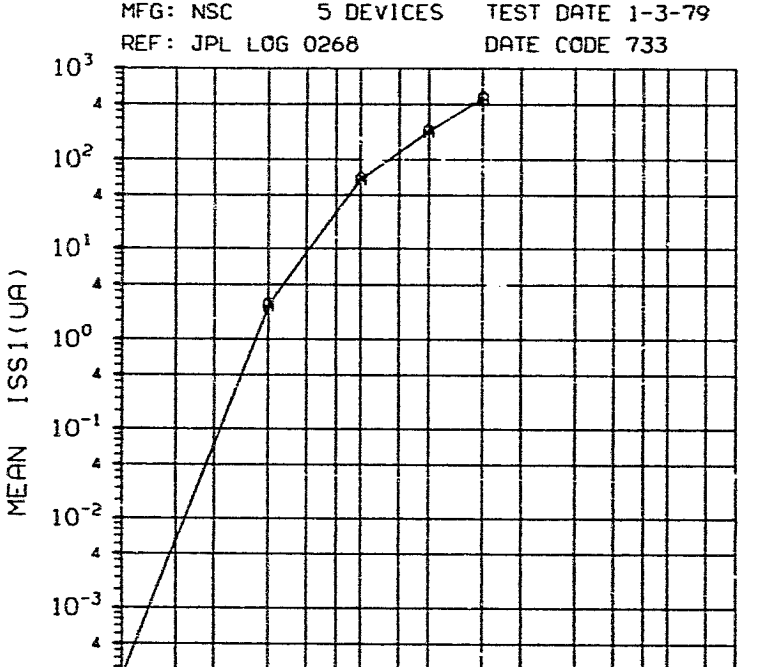


(3) VTN IN VOLTS VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.75	1.50	3.00	6.00	
C	.0040	.0067	.0150	.0173	

INITIAL MEAN VALUE VTN(V) = 1.65×10^{-0}

DEVICE TYPE: CD4081 CMOS
MFG: NSC 5 DEVICES TEST DATE 1-3-79
REF: JPL LOG 0268 DATE CODE 733

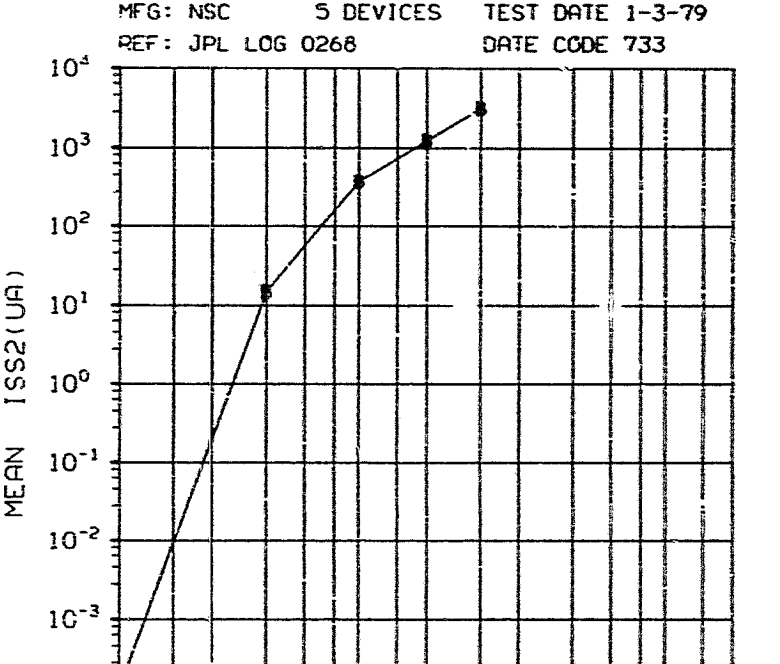


(1) ISS1 IN UA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.01	.03	.06	.10	.15
A	.0001	.4926	4.834	14.59	33.07

INITIAL MEAN VALUE ISS1(UA) = 1.51×10^{-4}

DEVICE TYPE: CD4081 CMOS
MFG: NSC 5 DEVICES TEST DATE 1-3-79
REF: JPL LOG 0268 DATE CODE 733

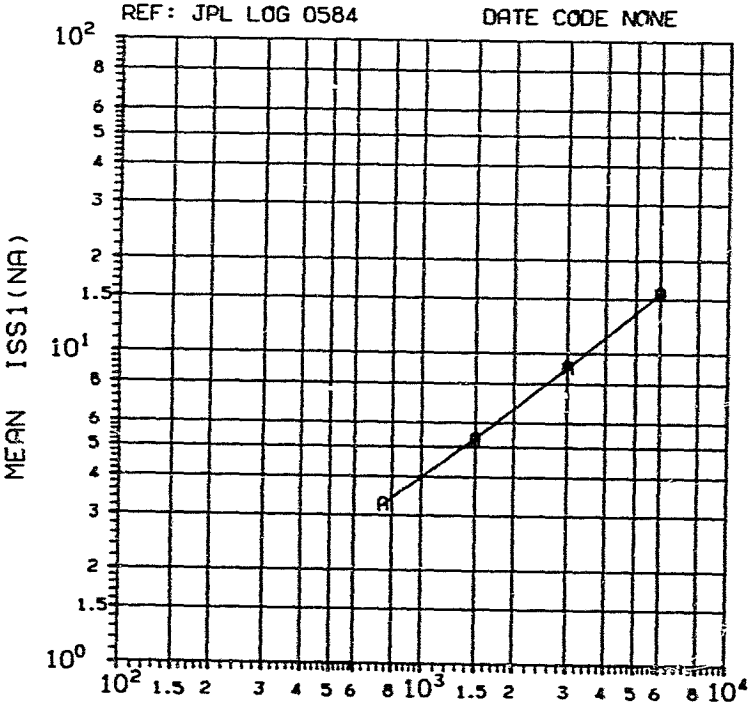


(2) ISS2 IN UA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.01	.03	.06	.10	.15
B	.0001	3.364	37.25	125.9	257.0

INITIAL MEAN VALUE ISS2(UA) = 1.34×10^{-4}

DEVICE TYPE: CD4099 CMOS
MFG: RCA 3 DEVICES TEST DATE 1-31-80
REF: JPL LOG 0584 DATE CODE NONE

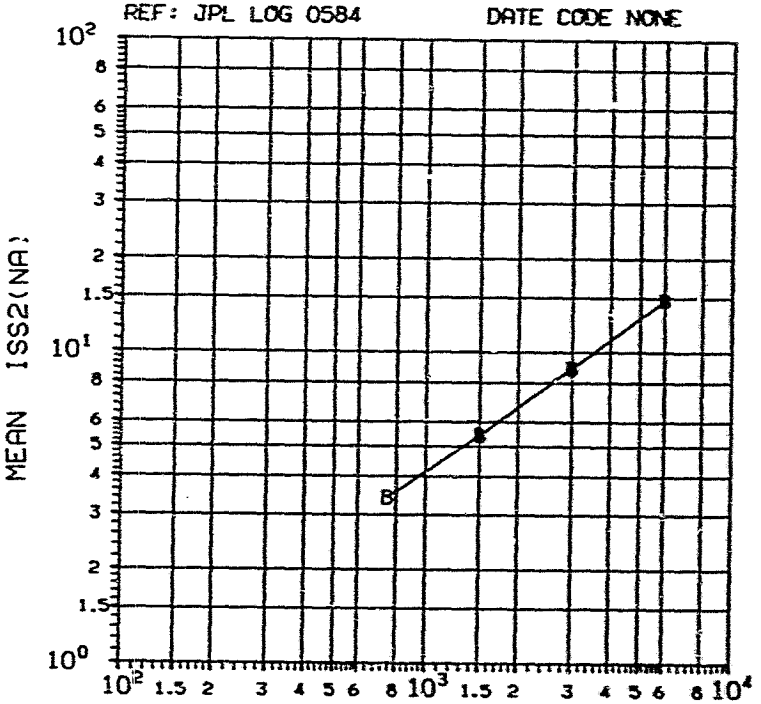


(1) ISS1 IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
A	.4366	.7286	1.127	1.358

INITIAL MEAN VALUE = 6.30×10^{-1}

DEVICE TYPE: CD4099 CMOS
MFG: RCA 3 DEVICES TEST DATE 1-31-80
REF: JPL LOG 0584 DATE CODE NONE

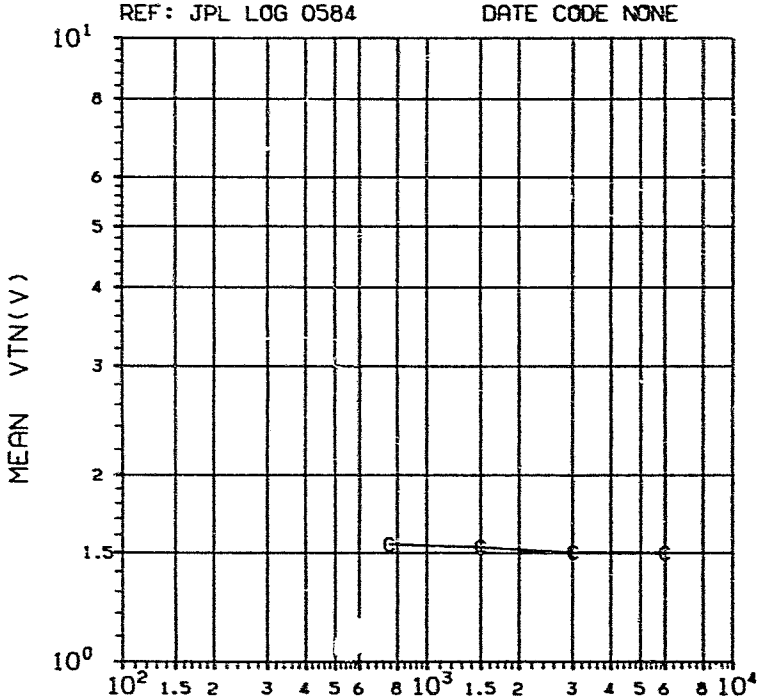


(2) ISS2 IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
B	.3894	.5965	.9042	1.150

INITIAL MEAN VALUE = 6.33×10^{-1}

DEVICE TYPE: CD4099 CMOS
MFG: RCA 3 DEVICES TEST DATE 1-31-80
REF: JPL LOG 0584 DATE CODE NONE

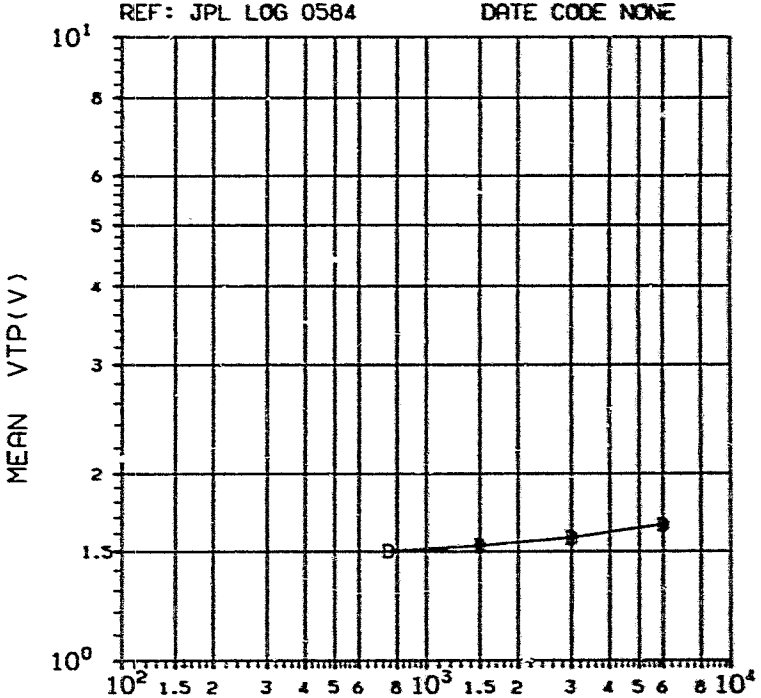


(3) VTN IN VOLTS VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
C	.0076	.0064	.0086	.0076

INITIAL MEAN VALUE = $1.59X10^{-0}$

DEVICE TYPE: CD4099 CMOS
MFG: RCA 3 DEVICES TEST DATE 1-31-80
REF: JPL LOG 0584 DATE CODE NONE



(4) VTP IN VOLTS VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
D	.0716	.0728	.0747	.0793

INITIAL MEAN VALUE = $1.44X10^{-0}$

DEVICE: DAC08
TYPE: DAC, 8-Bit
MANUFACTURER: AMD
DATE CODE: 825

DEVICES TESTED: 2
TEST DATE: 11-6-78
SOURCE: 2.5 MeV Electrons
LOG NUMBER: 223

RADIATION BIAS CONDITION: V_{CC} = 15 volts
V_{EE} = -15 volts

RESULTS: Worst-Case Parameter Values, V_{CC} = 15 volts
V_{EE} = -15 volts
V_{REF}+ = 10.000 volts

Total Dose, Gy(Si)	NONLIN, % (Maximum)	I_{FS}, mA (Minimum)	I_{EE}, mA (Maximum)	I_{CC}, mA (Maximum)	I_{IH}, nA (Maximum)
Initial	0.160	1.994	6.31	2.44	0.400
750	0.345	1.982	7.09	3.20	7100
1500	10.30	1.941	7.74	3.92	12100
3000	6.03	1.913	7.41	3.61	15000

Total Dose, Gy(Si)	I_{IL}, µA (Maximum)	I_{AMP-IN}, µA (Maximum)	I_{ZERO}, µA (Maximum)	I_{SYM}, µA (Maximum)
Initial	1.09	0.49	0.500	0.0
750	3.59	1.50	0.693	6.0
1500	4.95	1.40	19.3	17.0
3000	10.10	0.68	80.1	35.2

DEVICE: DAC08

TYPE: DAC, 8-Bit

MANUFACTURER: NSC

DATE CODE: 825

DEVICES TESTED: 2

TEST DATE: 11-6-78

SOURCE: 2.5 MeV Electrons

LOG NUMBER: 222

RADIATION BIAS CONDITION: V_{CC} = 15 volts
V_{EE} = -15 volts

RESULTS: Worst-Case Parameter Values, V_{CC} = 15 volts
V_{EE} = -15 volts
V_{REF}^{+} = 10.000 volts

Total Dose, Gy(Si)	NONLIN, % (Maximum)	I_{FS}, mA (Minimum)	I_{EE}, mA (Maximum)	I_{CC}, mA (Maximum)	I_{IH}, nA (Maximum)
Initial	0.167	1.981	6.36	2.48	0.35
750	0.325	1.975	8.38	4.54	93
1500	0.570	1.940	8.14	4.33	876
3000	2.37	1.809	7.44	3.66	1140

Total Dose, Gy(Si)	I_{IL}, µA (Maximum)	I_{AMP-IN}, µA (Maximum)	I_{ZERO}, µA (Maximum)	I_{SYM}, µA (Maximum)
Initial	5.51	0.80	0.080	1.0
750	13.8	3.5	2.50	3.0
1500	19.9	5.6	20.4	10.0
3000	25.1	7.1	92.2	50.2

DEVICE: DAC08

TYPE: DAC, 8-Bit

MANUFACTURER: PMI

DATE CODE: 825

DEVICES TESTED: 2

TEST DATE: 11-6-78

SOURCE: 2.5 MeV Electrons

LOG NUMBER: 224

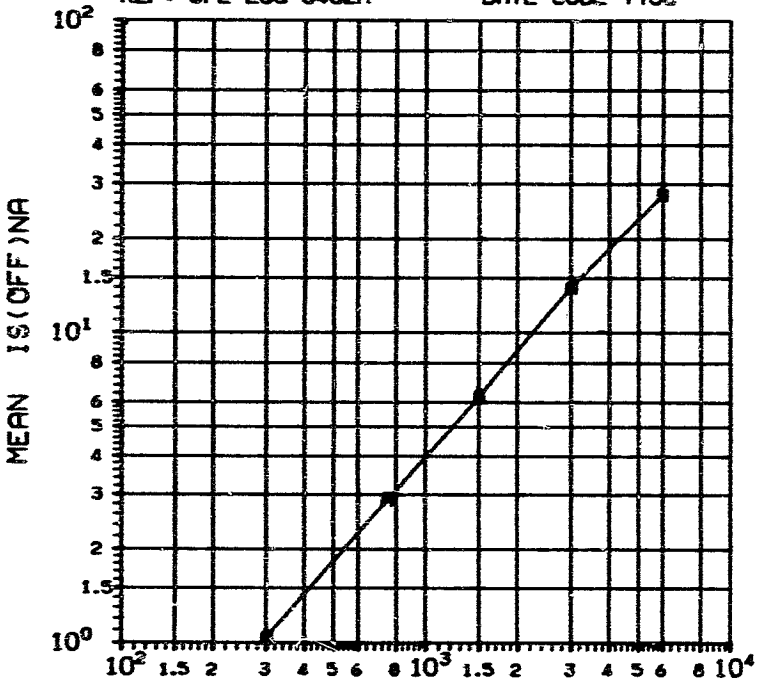
RADIATION BIAS CONDITION: V_{CC} = 15 volts
V_{EE} = -15 volts

RESULTS: Worst-Case Parameter Values, V_{CC} = 15 volts
V_{EE} = -15 volts
V_{REF^+} = 10.000 volts

Total Dose, Gy(Si)	NONLIN, % (Maximum)	I_{FS}, mA (Minimum)	I_{EE}, mA (Maximum)	I_{CC}, mA (Maximum)	I_{IH}, µA (Maximum)
Initial	0.190	1.987	6.24	2.37	0.300
750	0.131	1.982	6.26	2.41	0.900
1500	0.156	1.980	6.26	2.43	2.10
3000	0.150	1.979	6.26	2.45	4.70

Total Dose, Gy(Si)	I_{IL}, µA (Maximum)	I_{AMP-IN}, µA (Maximum)	I_{ZERO}, µA (Maximum)	I_{SYM}, µA (Maximum)
Initial	1.71	0.69	0.050	1.0
750	8.43	3.6	0.070	1.0
1500	12.8	4.3	0.120	2.0
3000	14.3	4.4	0.090	2.0

DEVICE TYPE: DG129 FET SWITCH
MFG: SIL 6 DEVICES TEST DATE 7-5-79
REF: JPL LOG 0402A DATE CODE 7738

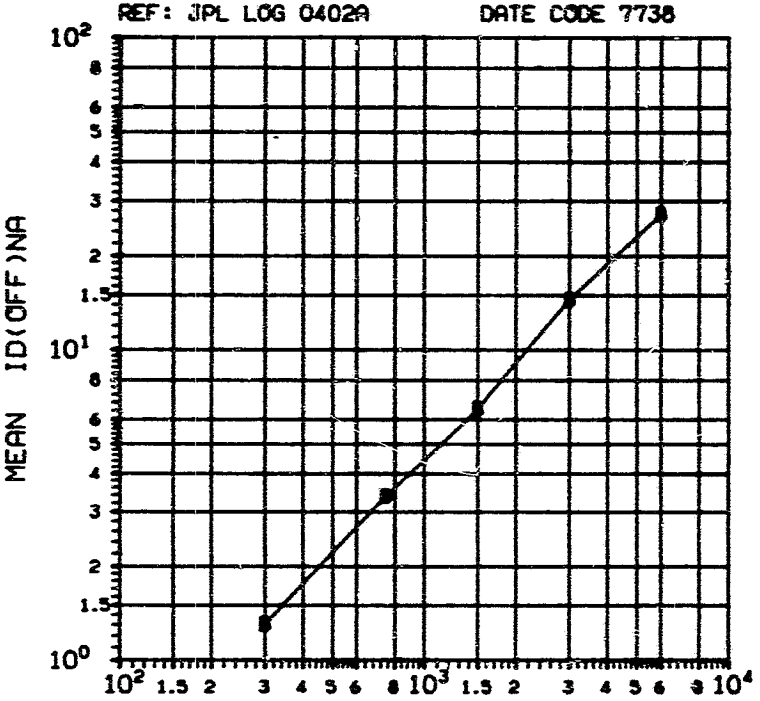


(1) IS(OFF) IN NA; VS=10V, VD=-10V VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.30	.75	1.50	3.00	6.00
A	.3665	.5382	.6314	1.478	6.676

INITIAL MEAN VALUE IS(OFF)NA = 4.98×10^{-1}

DEVICE TYPE: DG129 FET SWITCH
MFG: SIL 6 DEVICES TEST DATE 7-5-79
REF: JPL LOG 0402A DATE CODE 7738

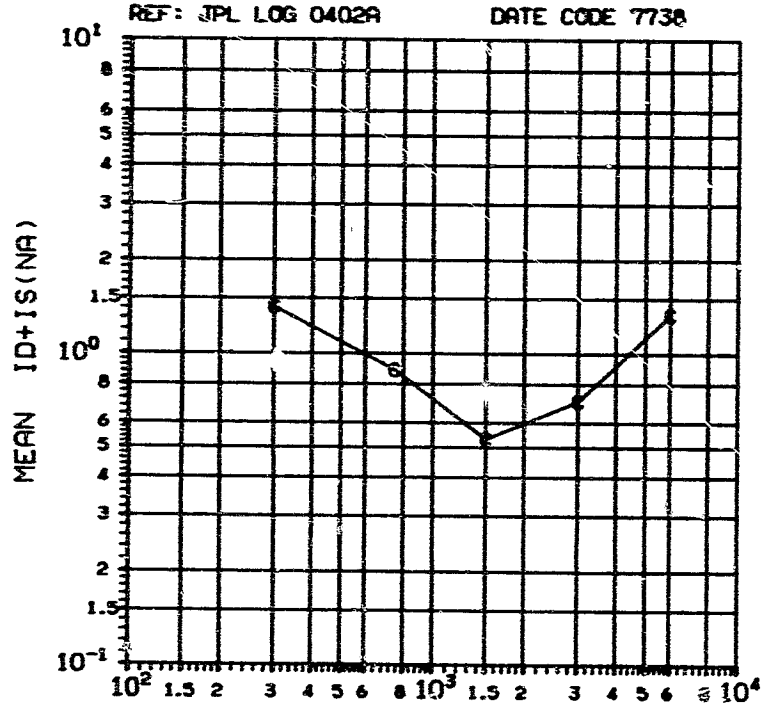


(2) ID(OFF) IN NA; VD=10V, VS=-10V VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.30	.75	1.50	3.00	6.00
B	.5986	1.038	1.365	2.028	5.870

INITIAL MEAN VALUE ID(OFF)NA = 6.53×10^{-1}

DEVICE TYPE: DG129 FET SWITCH
MFG: SIL 6 DEVICES TEST DATE 7-5-79
REF: JPL LOG 0402A DATE CODE 7738

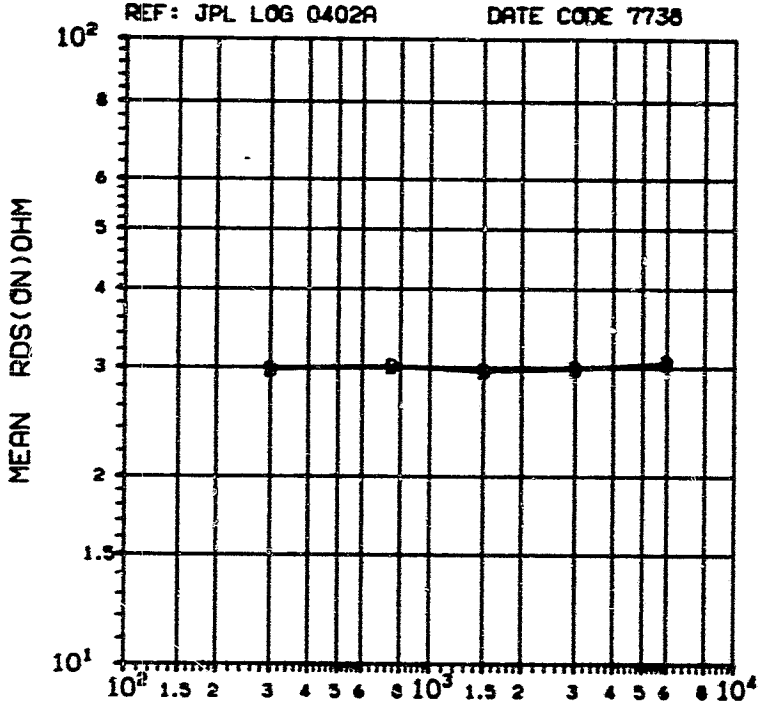


(3) ID(ON)+IS(ON) IN NA; VD=VS=-10V VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.30	.75	1.50	3.00	6.00
C	.4479	1.086	.2202	.6112	.2694

INITIAL MEAN VALUE ID+IS(NA) = 1.02×10^{-0}

DEVICE TYPE: DG129 FET SWITCH
MFG: SIL 6 DEVICES TEST DATE 7-5-79
REF: JPL LOG 0402A DATE CODE 7738

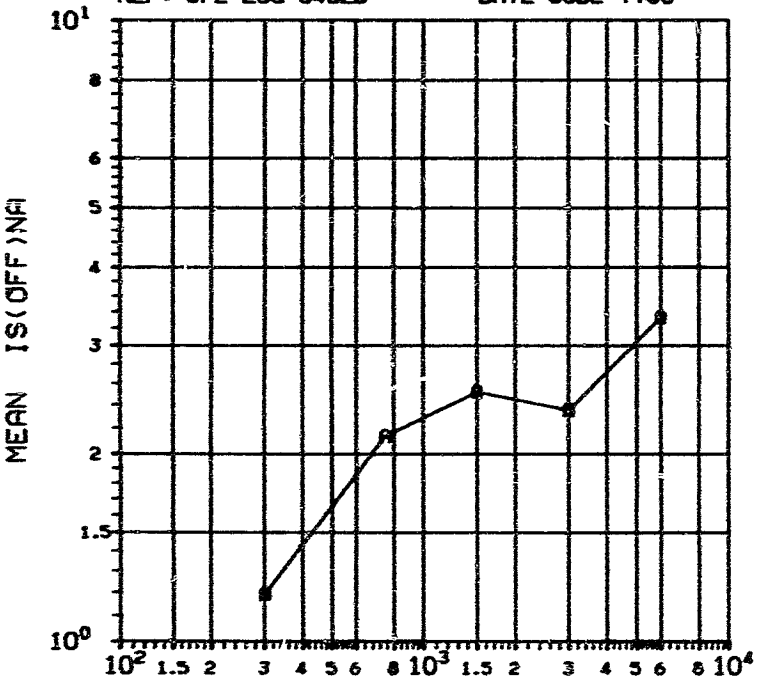


(4) RDS(ON) IN OHMS; VD=10V VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.30	.75	1.50	3.00	6.00
D	1.724	1.818	1.944	2.064	1.835

INITIAL MEAN VALUE RDS(ON)OHM = $2.83 \times 10^{+1}$

DEVICE TYPE: DG129 FET SWITCH
MFG: SIL 6 DEVICES TEST DATE 7-5-79
REF: JPL LOG 0402B DATE CODE 7738

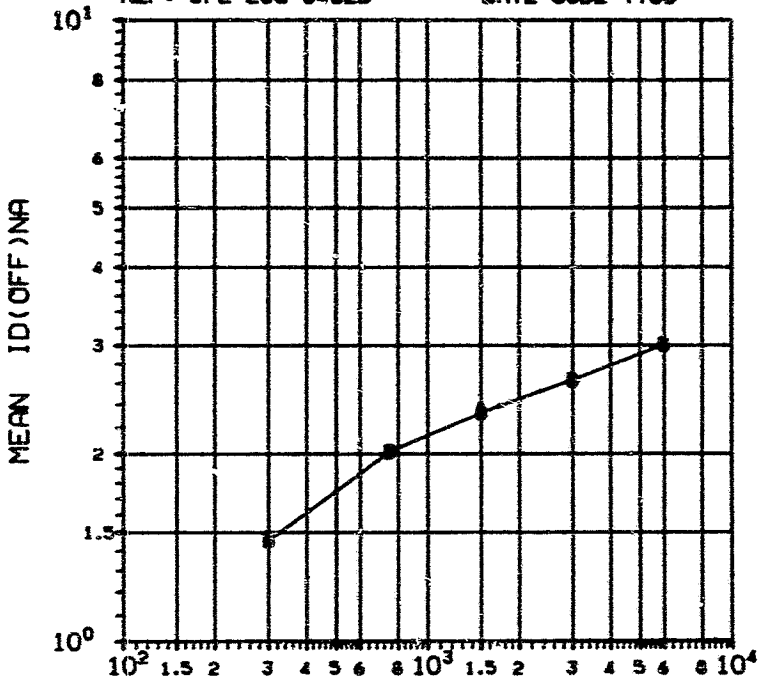


(1) IS(OFF) IN NA; VS=10V, VD=-10V VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.30	.75	1.50	3.00	6.00
A	.9714	1.136	.8886	.9138	.8430

INITIAL MEAN VALUE IS(OFF)NA = $8.77X10^{-1}$

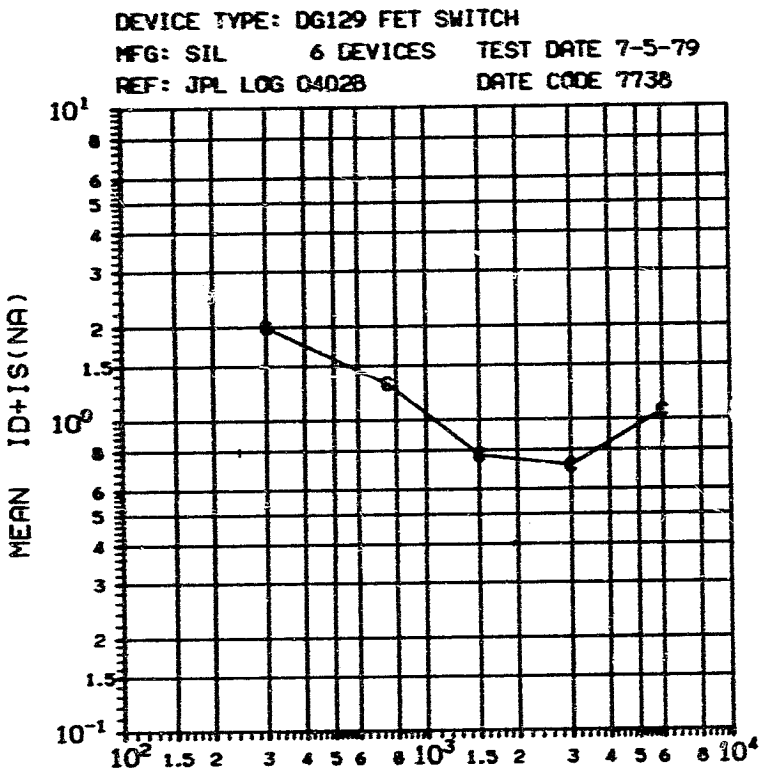
DEVICE TYPE: DG129 FET SWITCH
MFG: SIL 6 DEVICES TEST DATE 7-5-79
REF: JPL LOG 0402B DATE CODE 7738



(2) ID(OFF) IN NA; VD=10V, VS=-10V VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.30	.75	1.50	3.00	6.00
B	1.354	.9579	.8589	1.021	.5970

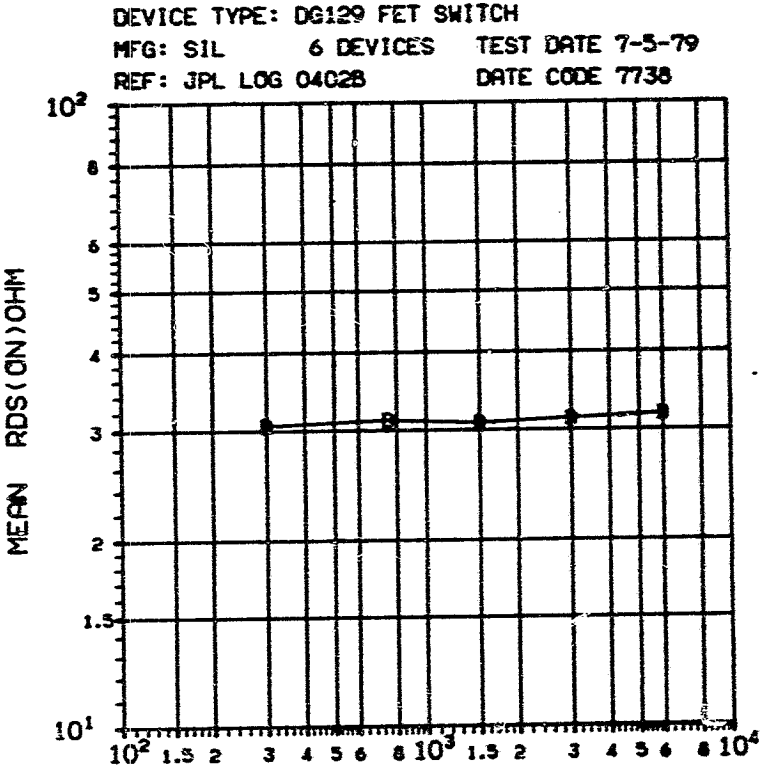
INITIAL MEAN VALUE ID(OFF)NA = $9.43X10^{-1}$



(3) ID(ON)+IS(ON) IN NA; VD=VS=-10V VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.30	.75	1.50	3.00	6.00
C	1.387	1.449	.5913	.3800	.2832

INITIAL MEAN VALUE ID+IS(NA) = 1.10×10^{-0}



(4) RDS(ON) IN OHMS; VD=10V VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.30	.75	1.50	3.00	6.00
D	2.111	1.970	1.808	1.874	1.996

INITIAL MEAN VALUE RDS(ON)OHM = $2.82 \times 10^{+1}$

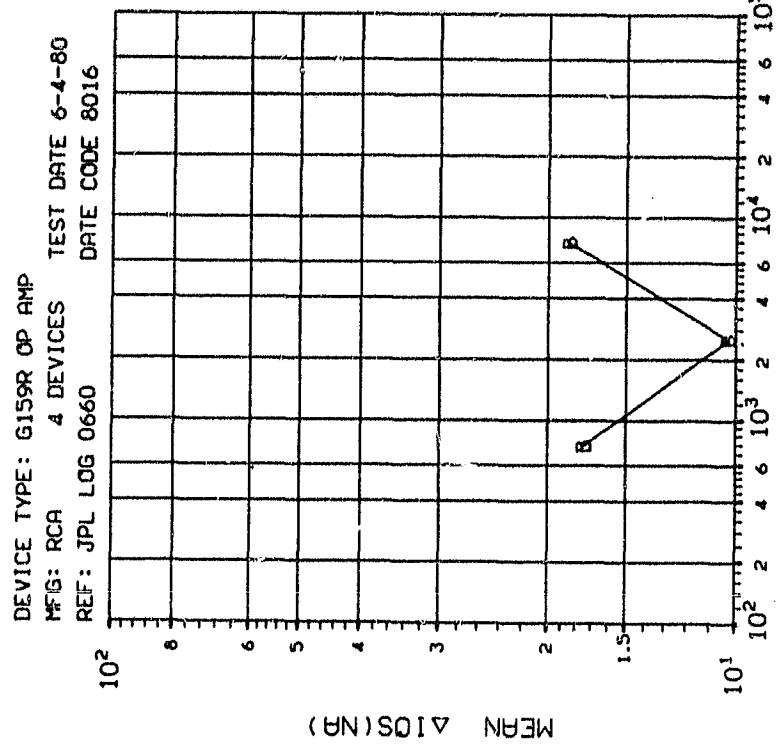


TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si) .75	2.50	7.50	25.00	
B	9.574	13.00	14.82	FAIL	

INITIAL MEAN VALUE ¬IOS(NA) = 1.45X10⁺¹

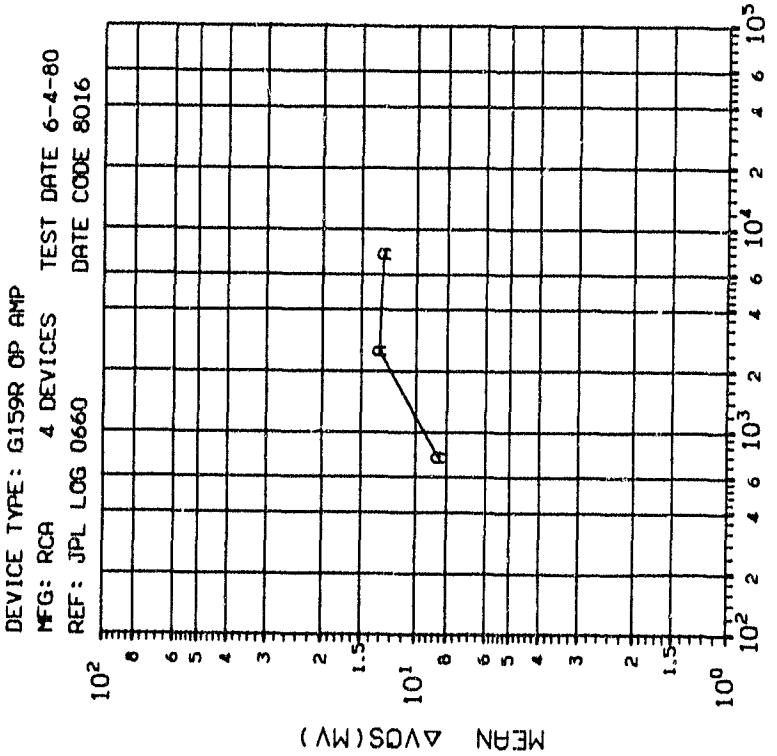


TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si) .75	2.50	7.50	25.00	
A	6.042	9.781	9.430	FAIL	

INITIAL MEAN VALUE ¬VOS(MV) = 2.50X10⁺⁰

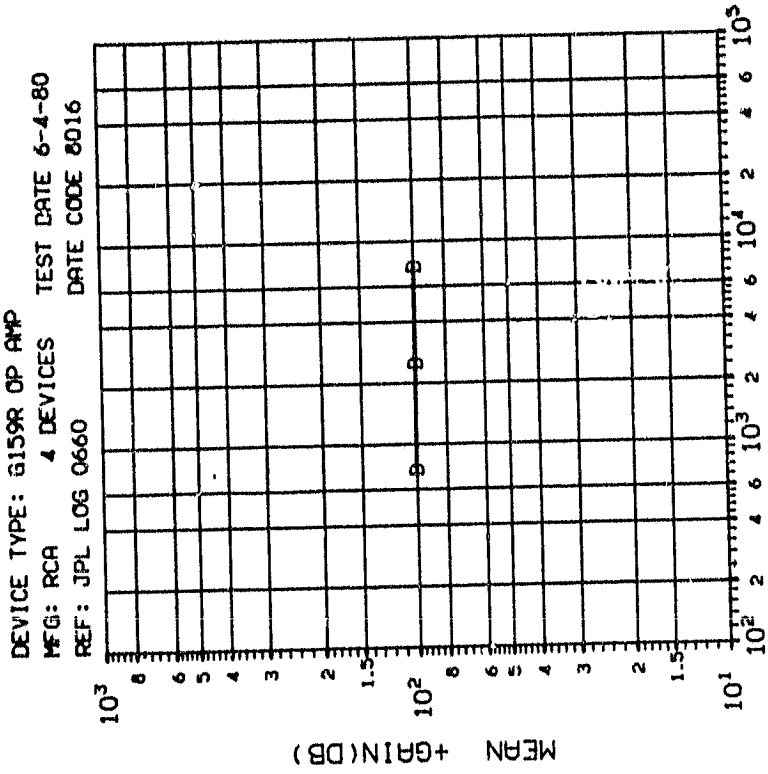


TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.75	2.50	7.50	25.00	
D	1.323	2.861	2.401	FAIL	

INITIAL MEAN VALUE +GAIN(DB) = $1.01 \times 10^{+2}$

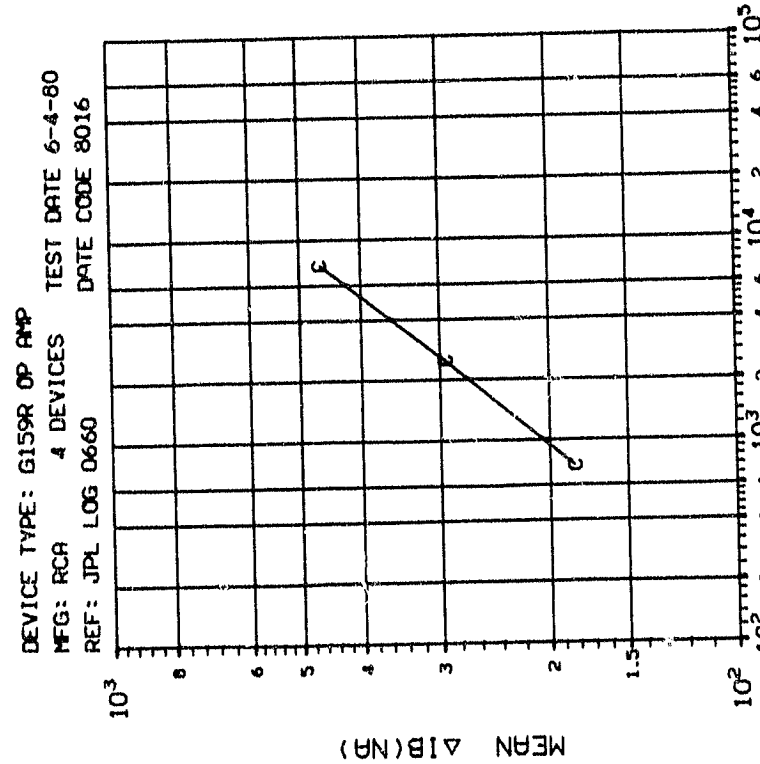


TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.75	2.50	7.50	25.00	
C	79.32	108.0	197.4	FAIL	

INITIAL MEAN VALUE -IB(NA) = $1.17 \times 10^{+2}$

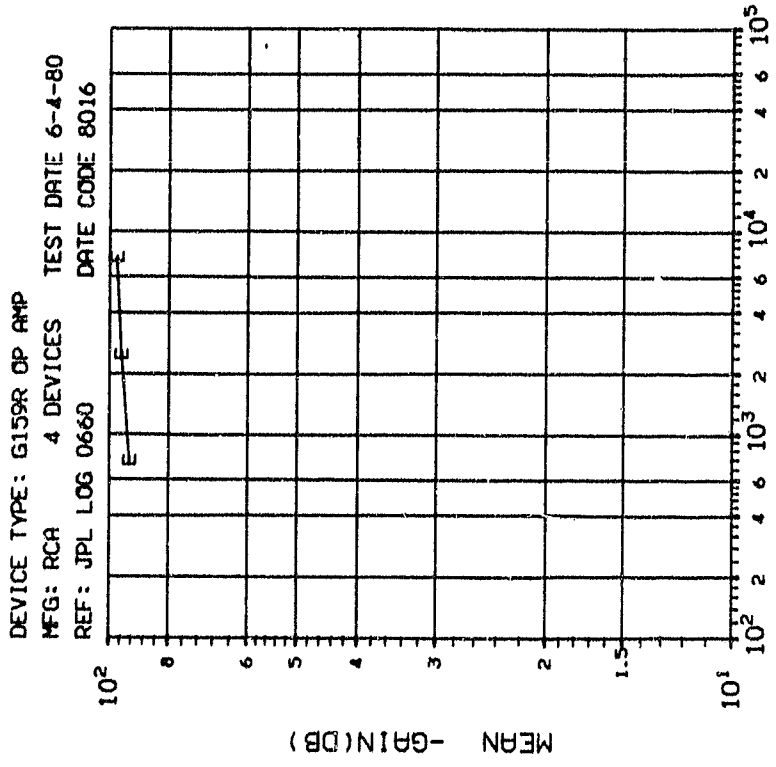
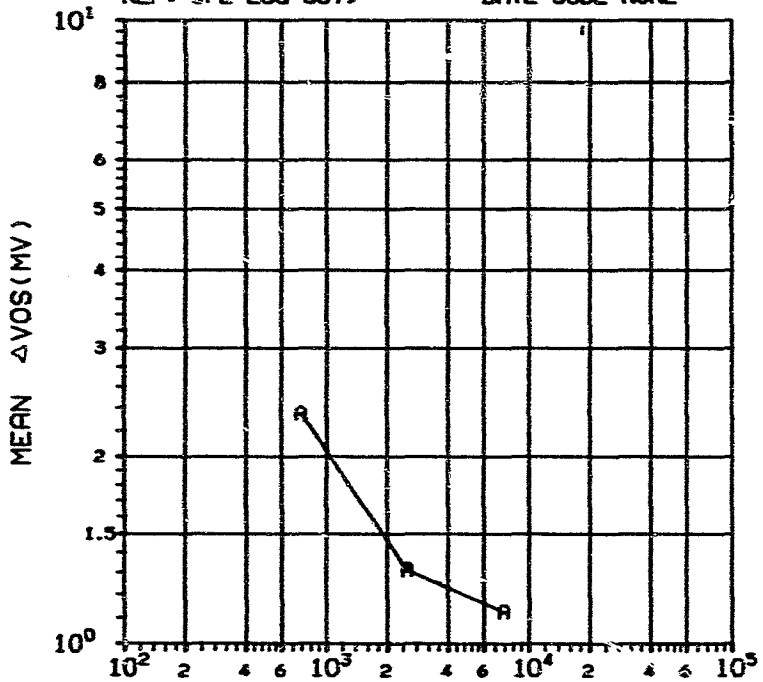


TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.75	2.50	7.50	25.00	
E	12.71	3.879	9.870	FAIL	

INITIAL MEAN VALUE -GAIN(DB) = $1.02 \times 10^{+2}$

DEVICE TYPE: G159R OP AMP
MFG: RCA 4 DEVICES TEST DATE 8-15-80
REF: JPL LOG 0679 DATE CODE NONE

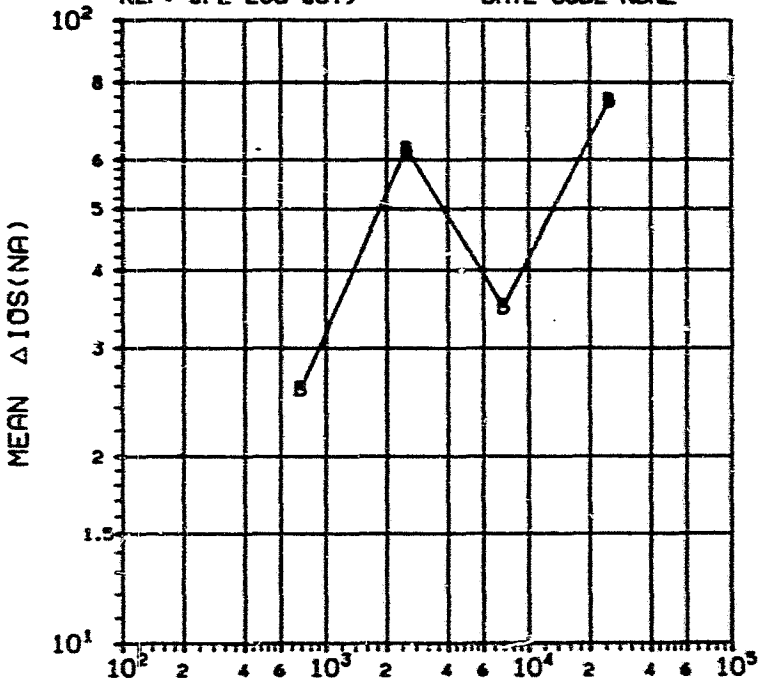


(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS	
CURVE	DOSE, kiloGy(Si) .75 2.50 7.50 25.00
A	.3979 1.245 1.704 FAIL

INITIAL MEAN VALUE ¬VOS(MV) = $2.44X10^{00}$

DEVICE TYPE: G159R OP AMP
MFG: RCA 4 DEVICES TEST DATE 8-15-80
REF: JPL LOG 0679 DATE CODE NONE

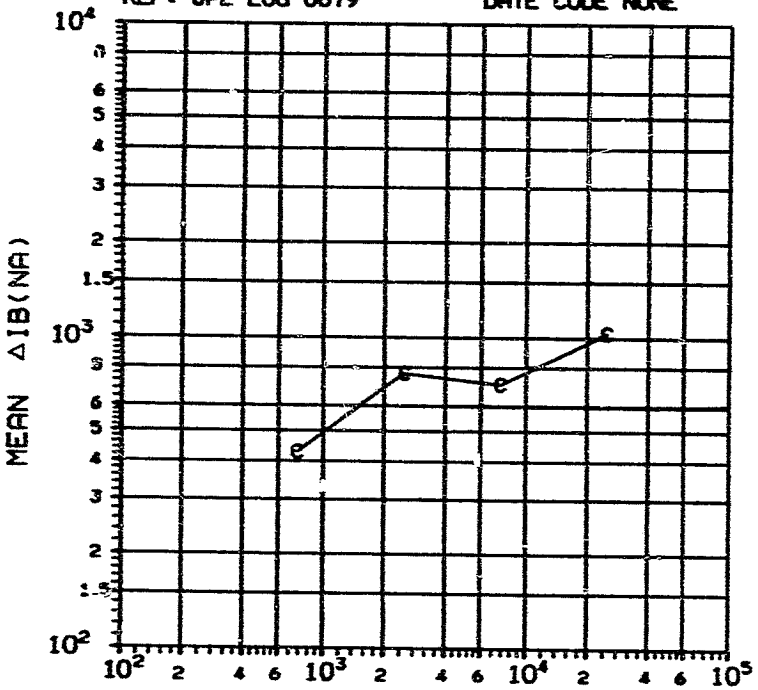


(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS	
CURVE	DOSE, kiloGy(Si) .75 2.50 7.50 25.00
B	17.86 92.51 29.72 86.60

INITIAL MEAN VALUE ¬IOS(NA) = $8.76X10^{+1}$

DEVICE TYPE: G159R OP AMP
MFG: RCA 4 DEVICES TEST DATE 8-15-80
REF: JPL LOG 0679 DATE CODE NONE

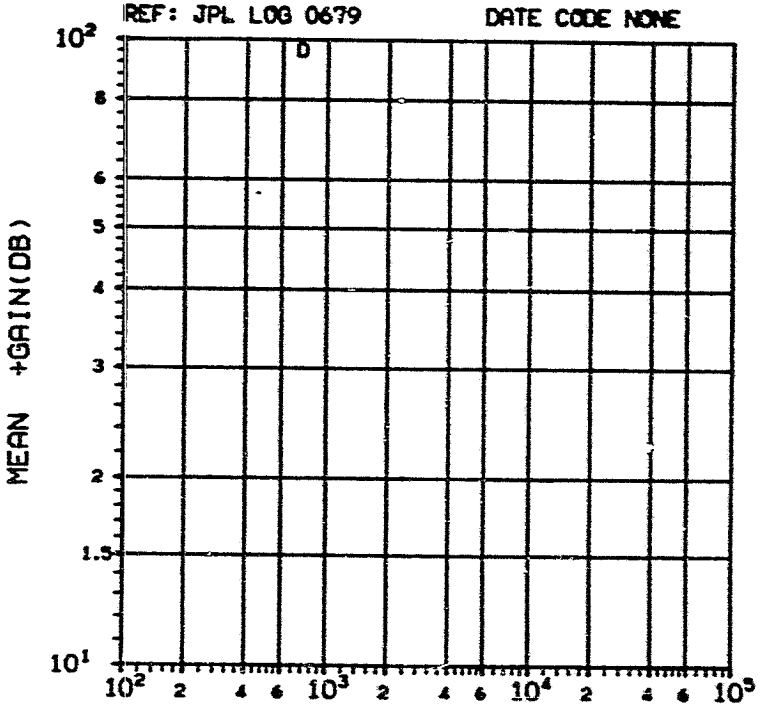


(3) IB IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS	
CURVE	DOSE, kiloGy(Si) .75 2.50 7.50 25.00
C	119.7 573.9 186.6 225.8

INITIAL MEAN VALUE IB(NA) = $3.46 \times 10^{+2}$

DEVICE TYPE: G159R OP AMP
MFG: RCA 4 DEVICES TEST DATE 8-15-80
REF: JPL LOG 0679 DATE CODE NONE



(4A) +AVOL IN DB; 2K LOAD=100PF VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS	
CURVE	DOSE, kiloGy(Si) .75 2.50 7.50 25.00
D	5.890 FAIL FAIL FAIL

INITIAL MEAN VALUE +GAIN(DB) = $2.65 \times 10^{+1}$

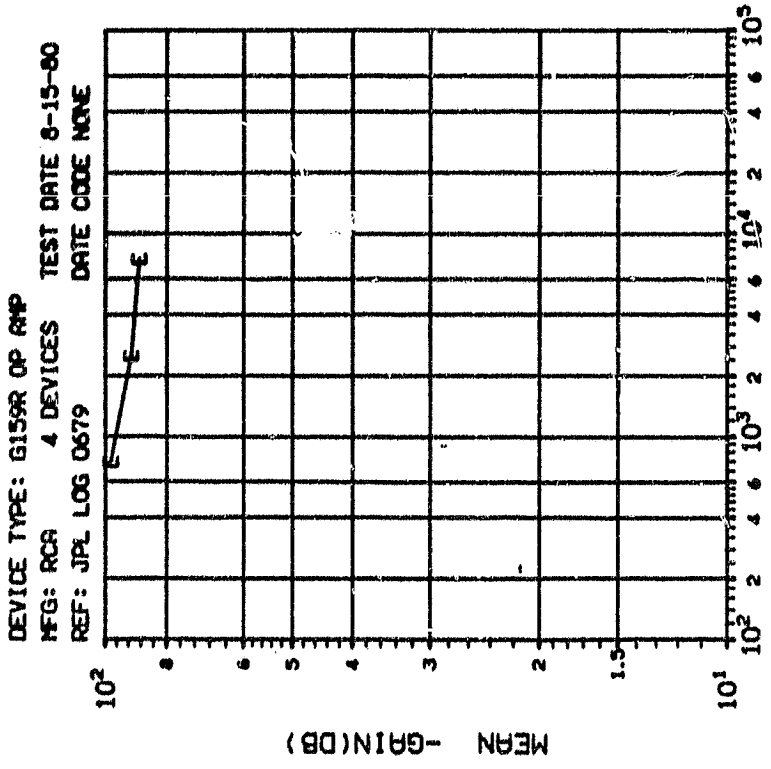
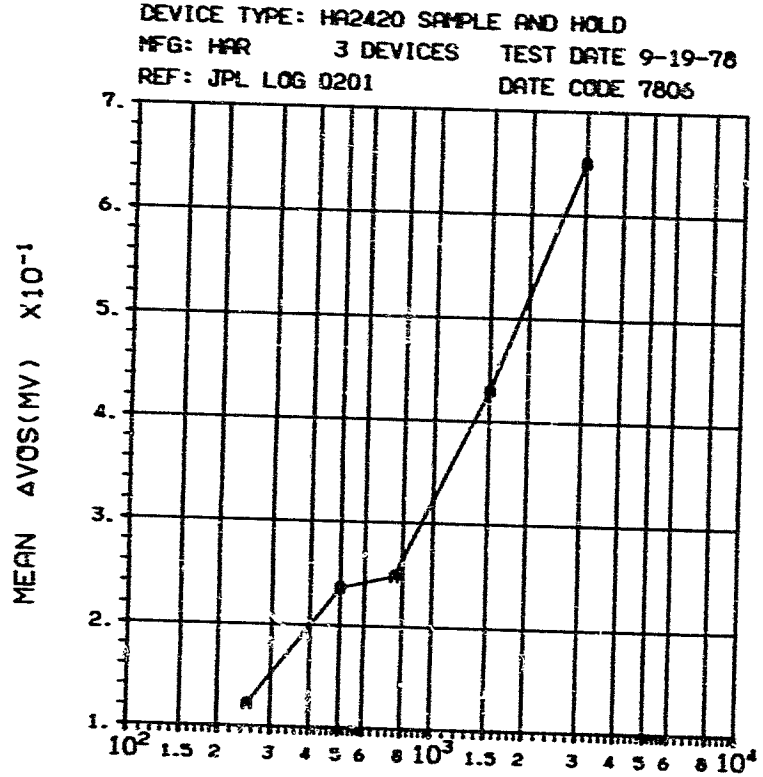


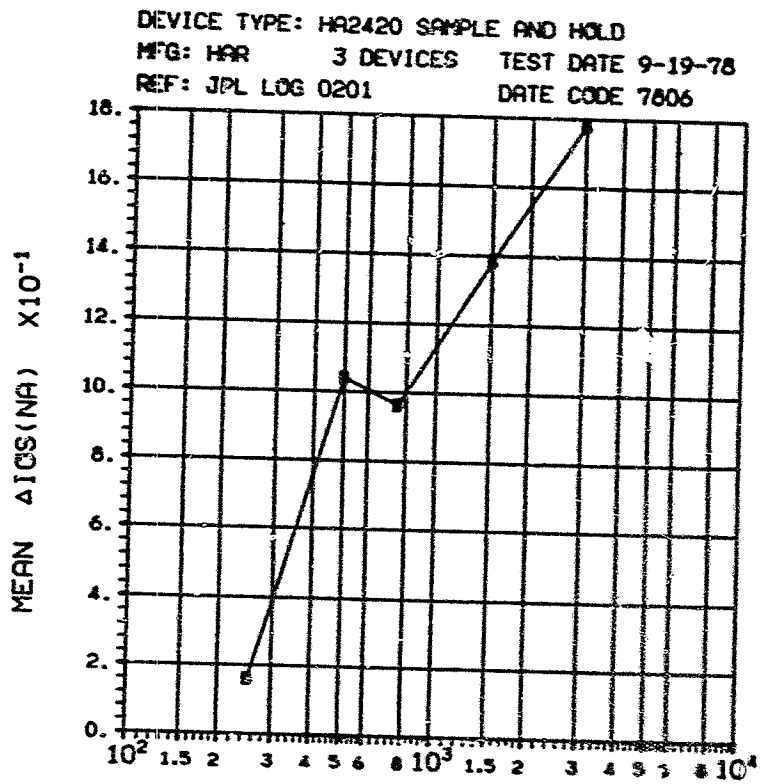
TABLE OF NOMINAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	2.50	7.50	25.00
E	1.618	4.499	1.250	FAIL

INITIAL MEAN VALUE -GAIN(DB) = $1.02 \times 10^{+2}$



(1)VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.25	.50	.75	1.50	3.00
A	.1121	.1925	.2853	.3793	.4680



(2)ICS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.25	.50	.75	1.50	3.00
B	.4468	.3236	.1436	.5559	1.004

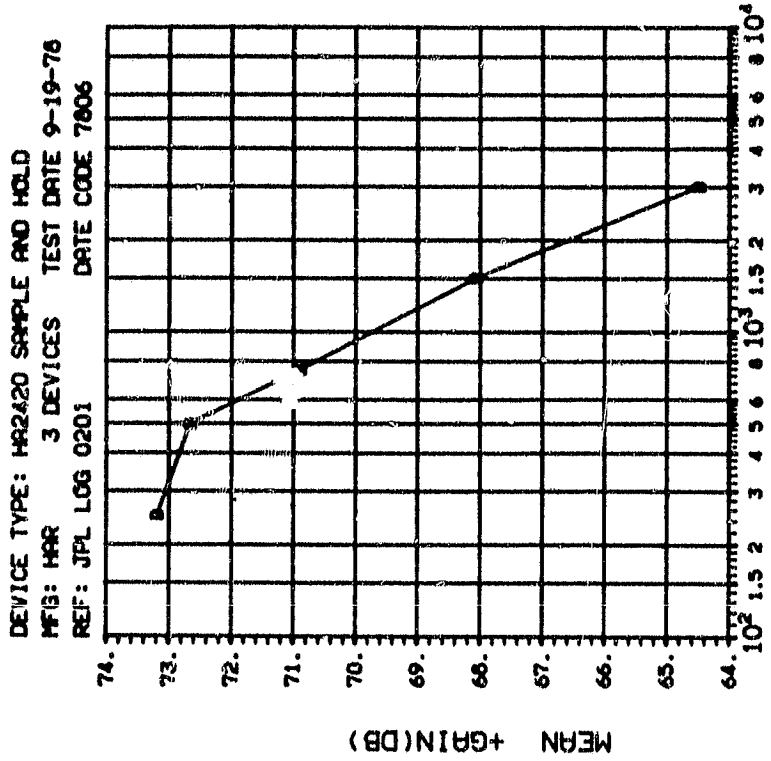


TABLE OF NORMAL STANDARD DEVIATIONS						
CURVE	I_L (mA)	DOSE, kiloGy(Si) .25	.50	.75	1.50	3.00
D	.200	1.696	1.242	1.113	1.789	1.209

INITIAL MEAN VALUE +GAIN(DB) = 7.72×10^{3}

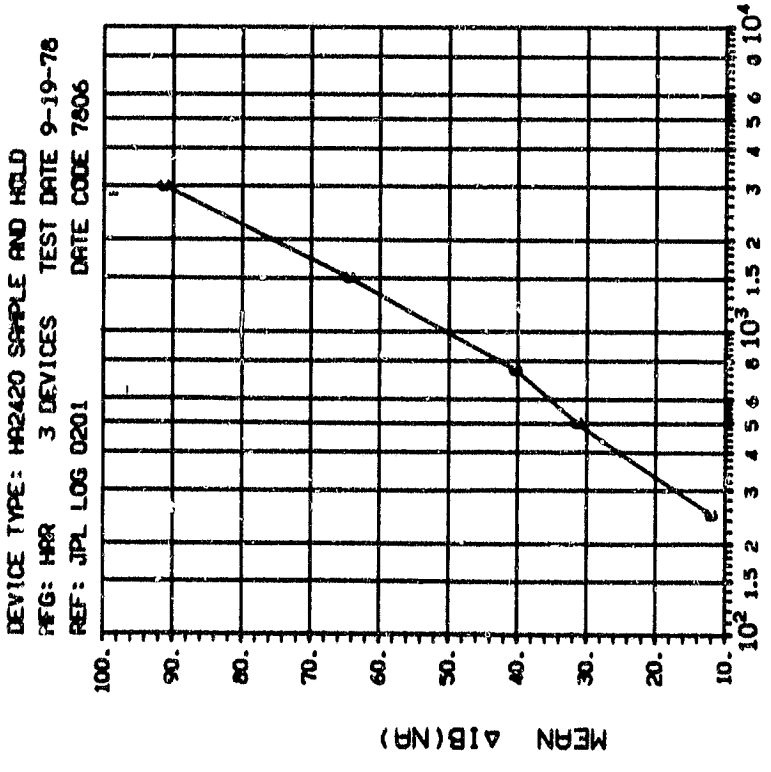
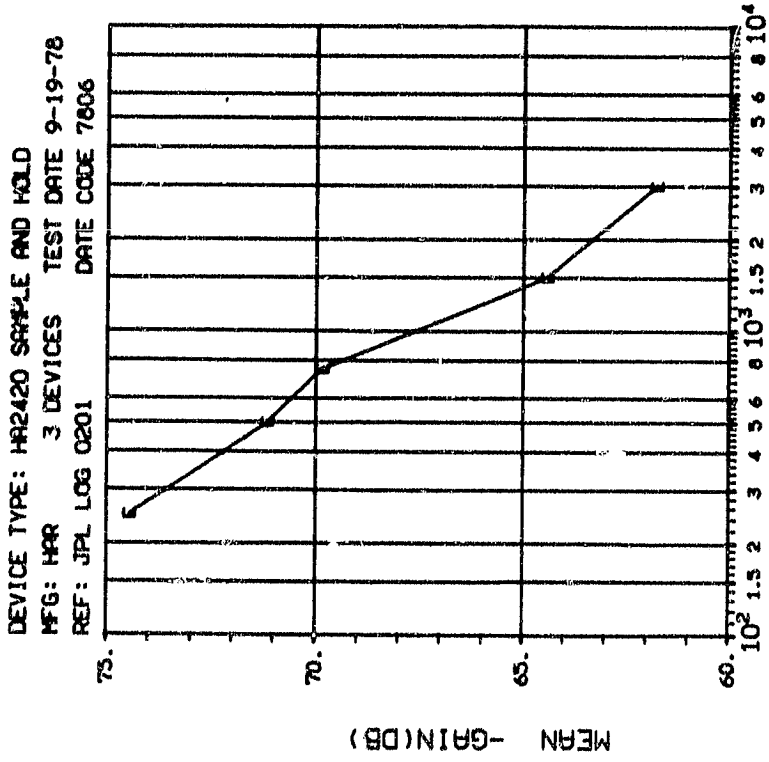


TABLE OF NORMAL STANDARD DEVIATIONS						
CURVE	DOSE, kiloGy(Si) .25	.50	.75	1.50	3.00	
C	4.413	3.959	2.777	3.209	7.740	

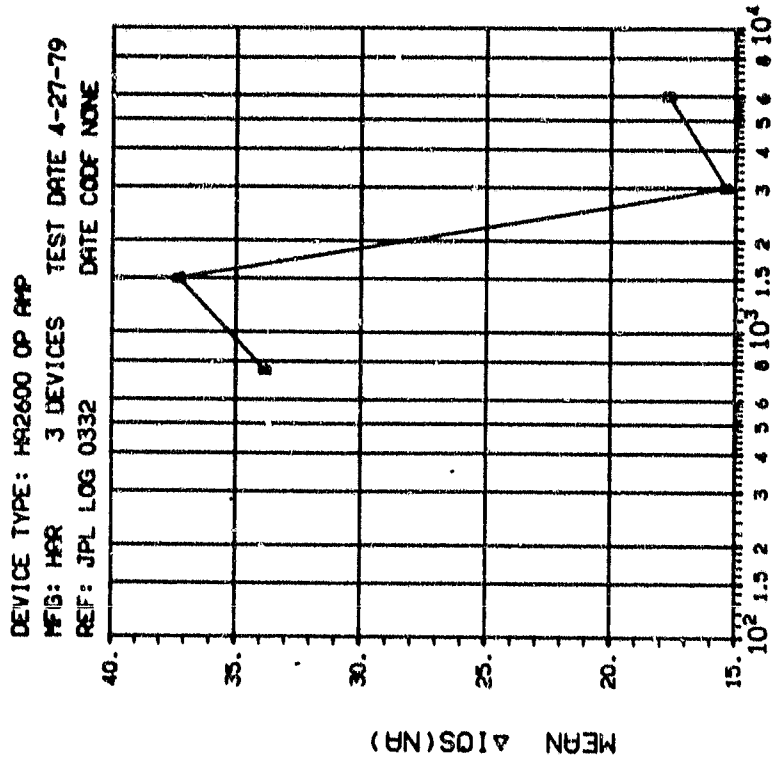
ORIGINAL PAGE IS
OF POOR QUALITY



(5)- GAIN IN DB: 50K LOAD = 2MA VS DOSE

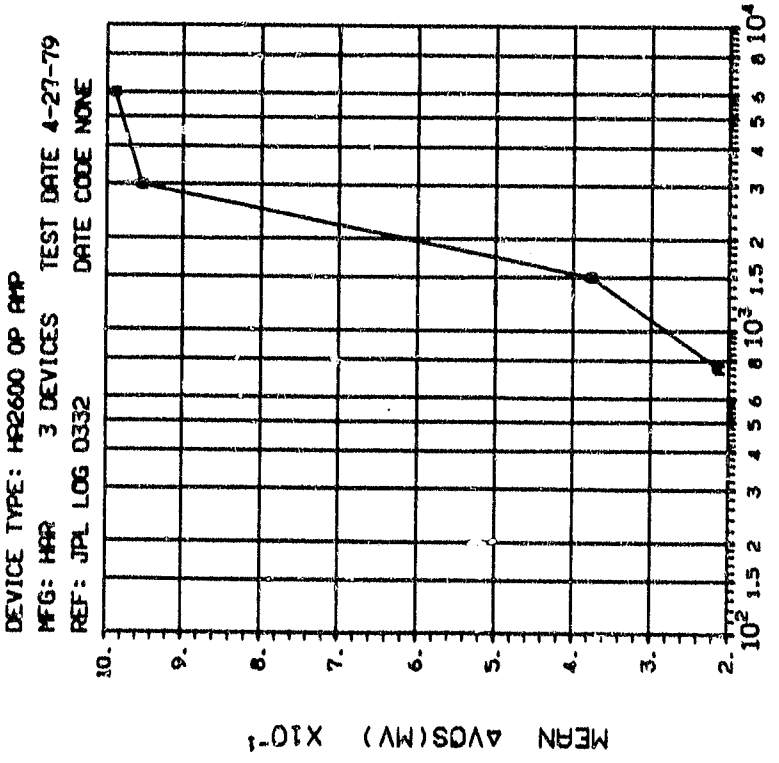
TABLE OF NORMAL STANDARD DEVIATIONS						
CURVE	i_L (mA)	DOSE, kiloGy(Si) .25	.50	.75	1.50	3.00
E	.200	.8150	1.542	2.823	1.480	1.789

INITIAL MEAN VALUE -GAIN(DB) = $7.65X10^{+1}$



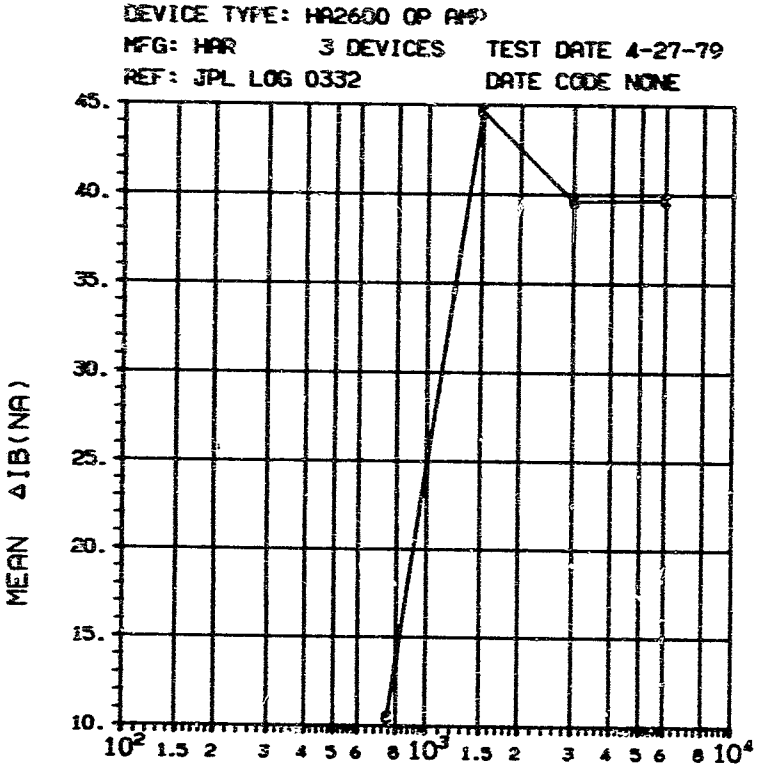
(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00 6.00
A	.1071	.2152	.6684 .7891



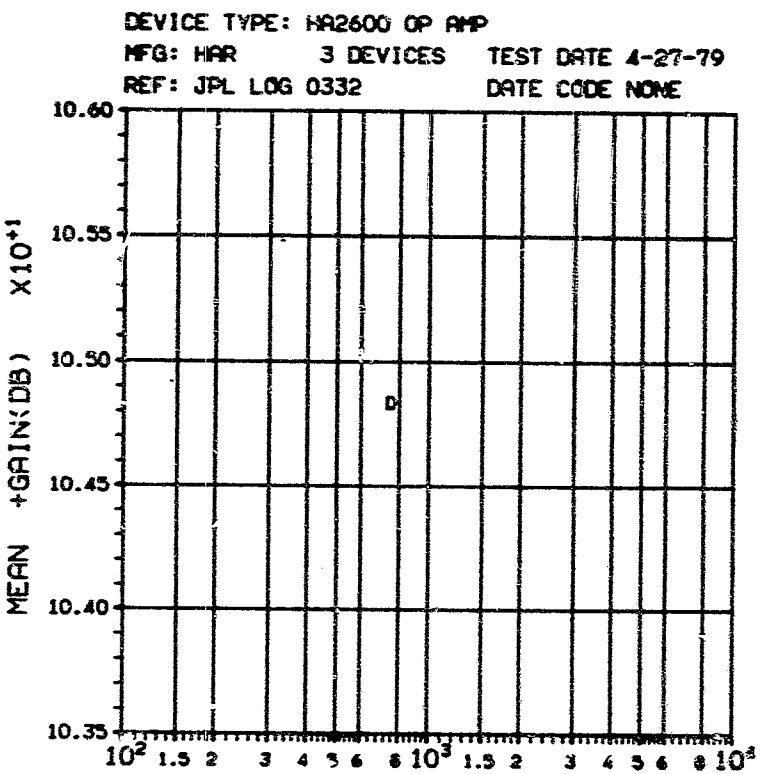
(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00 6.00
B	13.89	49.57	40.90 44.07



(3) IB IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
C	13.37	22.15	38.11	38.29

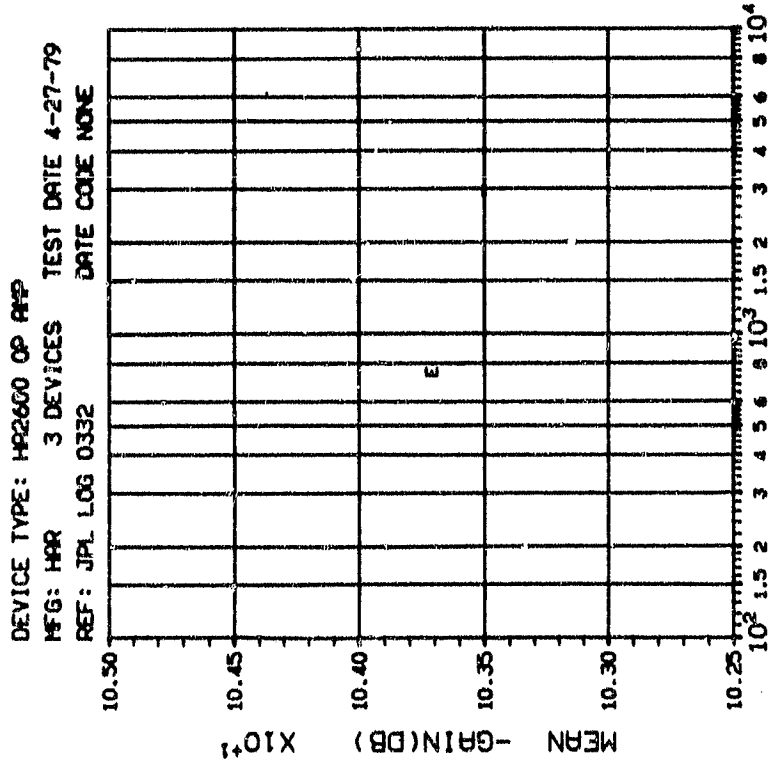


(4) + GAIN IN DB 5K LOAD=2MA, +10V VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	I_L (mA)	DOSE, kiloGy(Si)			
		.75	1.50	3.00	6.00
D	2.00	.3460	FAIL	FAIL	FAIL

INITIAL MEAN VALUE +GAIN(DB) = $1.07X10^{+2}$

ORIGINAL PAGE IS
OF POOR QUALITY



(5) - GAIN IN DB 3K LOAD=2MA, -10V VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	I_L (mA)	DOSE, kiloGy(Si) .75	1.50	3.00 6.00
E	2.00	.6277	FAIL	FAIL FAIL

INITIAL MEAN VALUE -GAIN(DB) = $1.04 \times 10^{+2}$

DEVICE: IM6508

TYPE: RAM, 1k x 1

MANUFACTURER: INL

DATE CODE: 7529

DEVICES TESTED: 3

TEST DATE: 3-30-77

SOURCE: 1.25 MeV Gamma

LOG NUMBER: 051

RADIATION BIAS CONDITION: V_{CC} = 5 volts

RESULTS: Worst-Case Parameter Values, V_{CC} = 5 volts

Total Dose, Gy(Si)	I_{CC}, μA (Maximum)	March	R/W Ping Pong
Initial	0.0020	Pass	Pass
3	0.0036	Pass	Pass
10	480	Pass	Pass
30	27,000	Fail	Fail

DEVICE: IM6508

TYPE: RAM, 1k x 1

MANUFACTURER: INL

DATE CODE: None

DEVICES TESTED: 3

TEST DATE: 4-06-78

SOURCE: 1.25 MeV Gamma

LOG NUMBER: 0168

RADIATION BIAS CONDITION: V_{CC} = 5 volts

RESULTS: Worst-Case Parameter Values, V_{CC} = 5 volts

Total Dose, Gy(Si)	I_{CC}, μA (Maximum)	March	Galpat
Initial	0.045	Pass	Pass
3	0.024	Pass	Pass
10	2100	Pass	Pass
30	11000	Fail	Fail

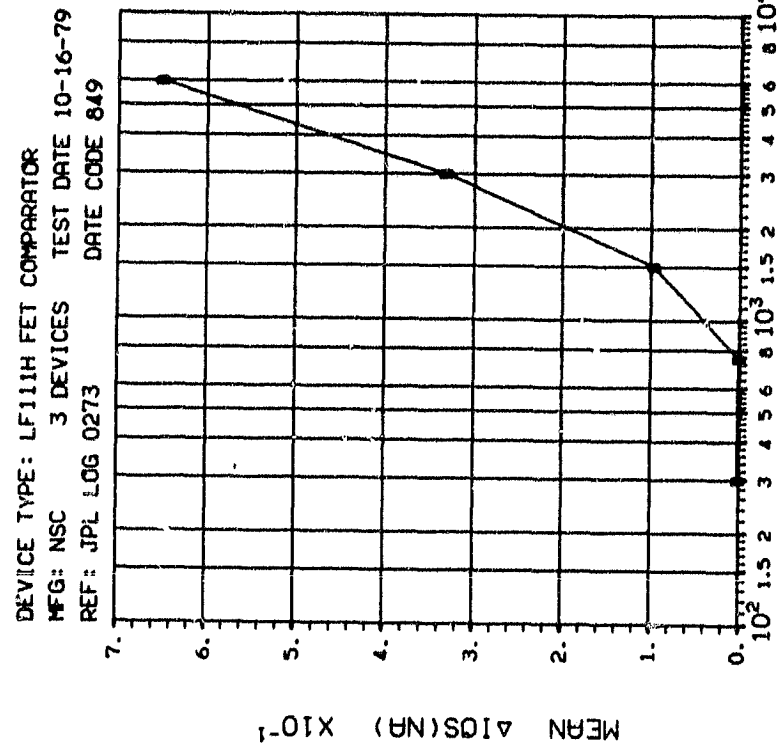


TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.30	.75	1.50	3.00	6.00
B	.5555	1.040	27.94	144.2	396.7

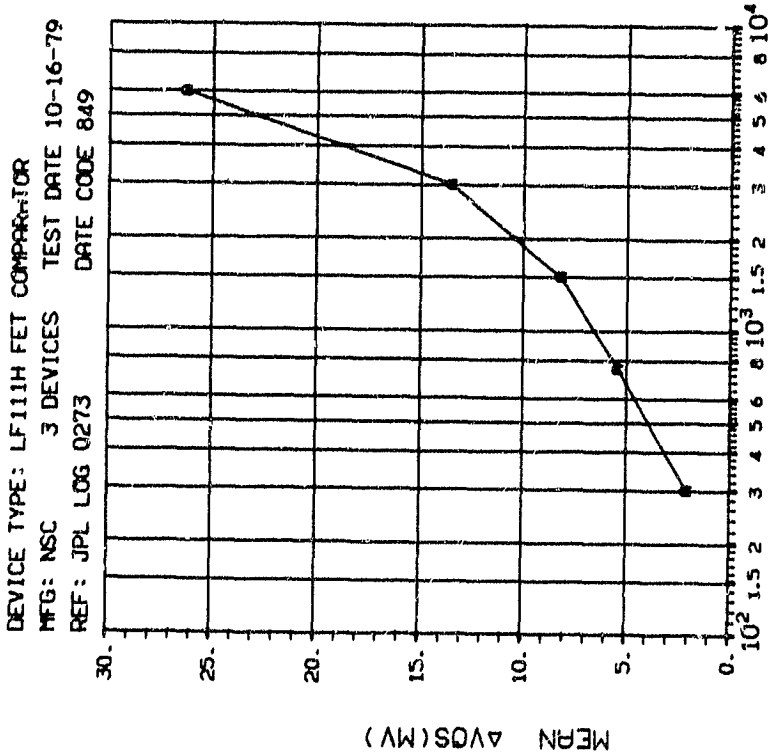


TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.30	.75	1.50	3.00	6.00
A	1.510	2.851	5.018	6.863	16.87

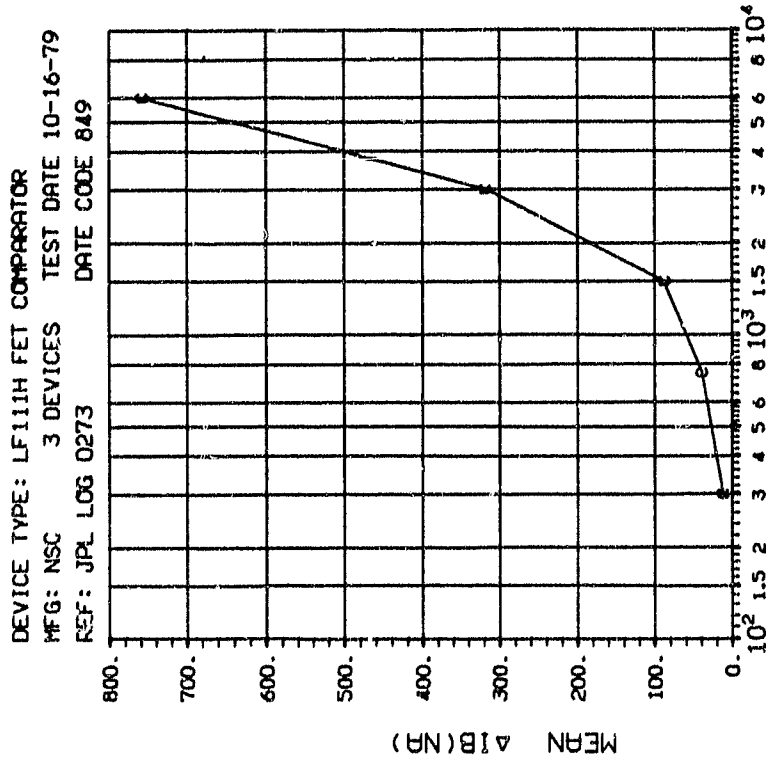
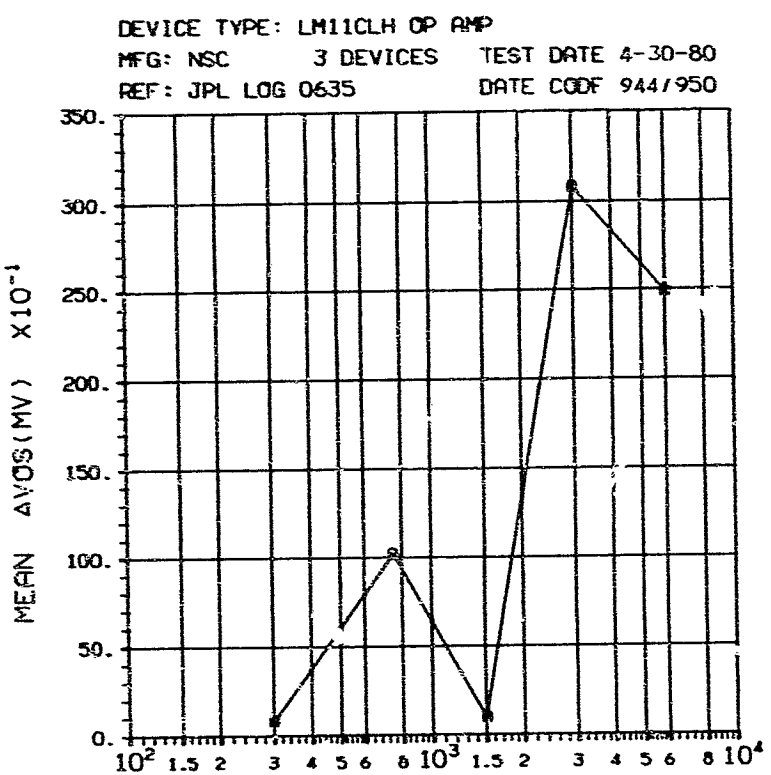
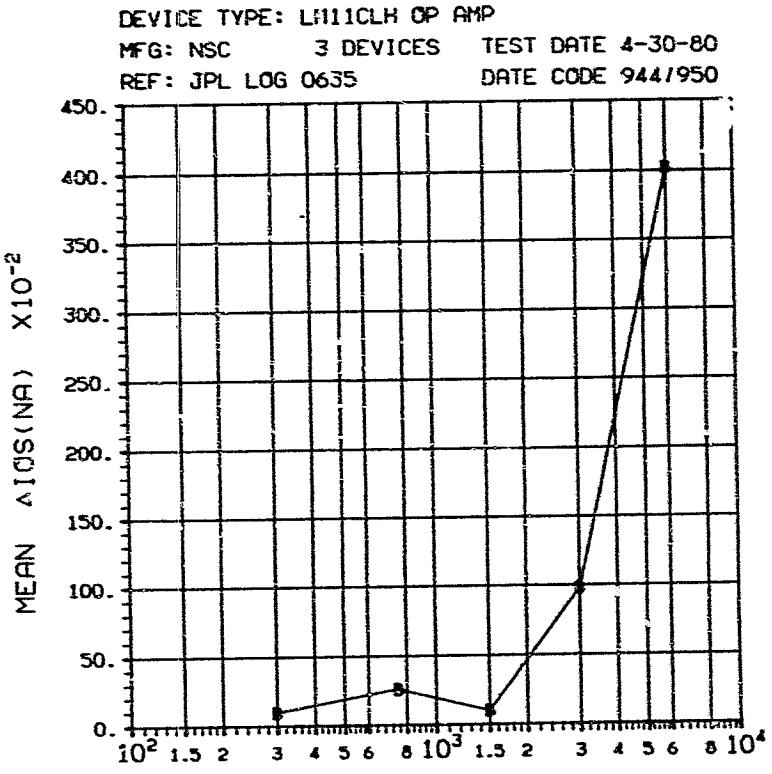


TABLE OF NORMAL STANDARD DEVIATIONS						
CURVE	DOSE, kiloGy(Si)					
	.30	.75	1.50	3.00	6.00	
C	27.36	48.55	9.406	63.25	140.5	



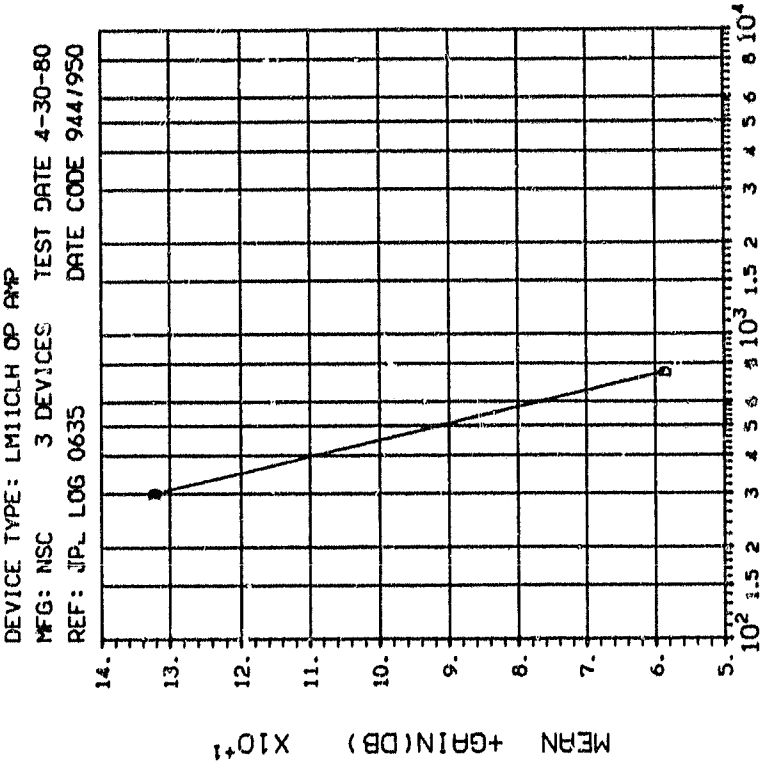
(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.30	.75	1.50	3.00	6.00
A	.5472	7.883	5.895	4.302	3.134



(2) IOS IN NA VS DOSE

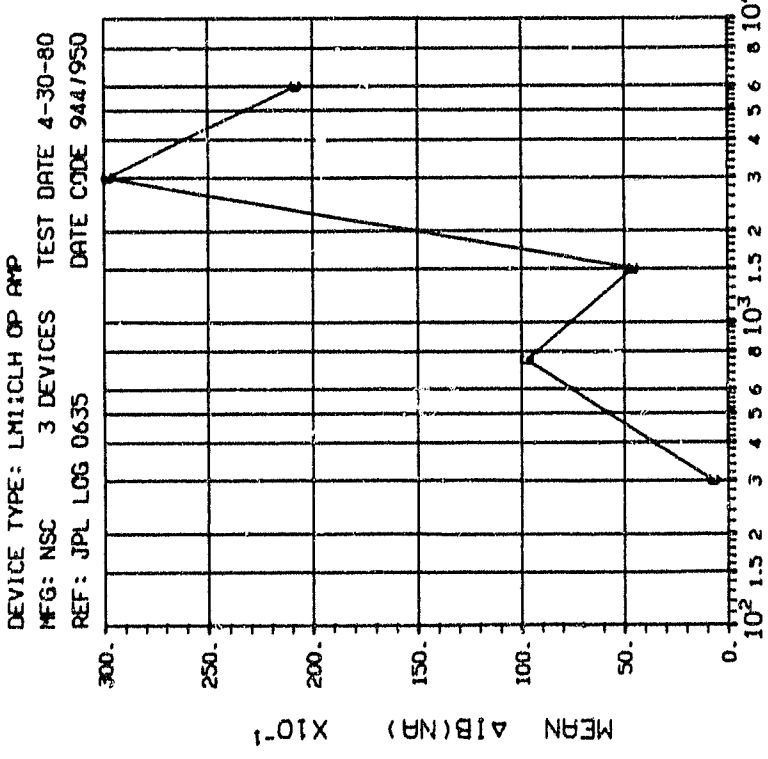
TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.30	.75	1.50	3.00	6.00
B	.0888	.3825	.1615	.6441	5.391



(4A) AVOL (+) IN DB; 5K LOAD=2MA VS DOSE

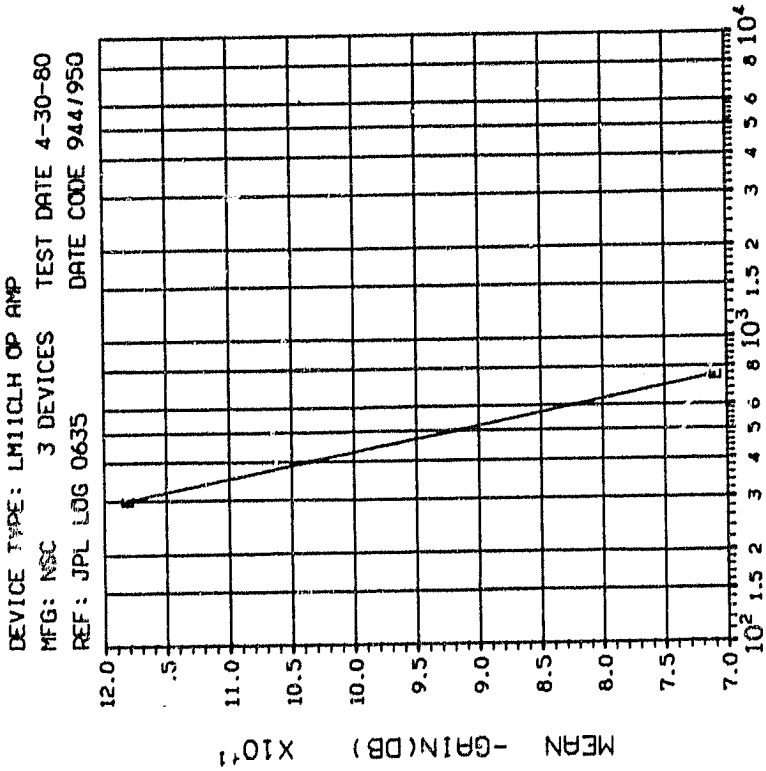
TABLE OF NORMAL STANDARD DEVIATIONS						
CURVE	I_L (mA)	DOSE, kiloGy(Si) .30	.75	1.50	3.00	6.00
D	2.00	13.41	1.313	FAIL	FAIL	FAIL

INITIAL MEAN VALUE +GAIN(DB) = $1.27 \times 10^{+2}$



(3) IB IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS						
CURVE	DOSE, kiloGy(Si) .30	.75	1.50	3.00	6.00	
C	.7063	7.681	1.481	4.801	6.556	



DOSE, Gy(Si) 2.5 MeV electrons

(4B) AVOL (-) IN DB; 5K LOAD=2MA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS						
CURVE	I_L (mA)	DOSE, kiloGy(Si) .30	.75	1.50	3.00	6.00
E	2.00	2.833	.9143	FAIL	FAIL	FAIL

INITIAL MEAN VALUE -GAIN(DB) = $1.23 \times 10^{+2}$

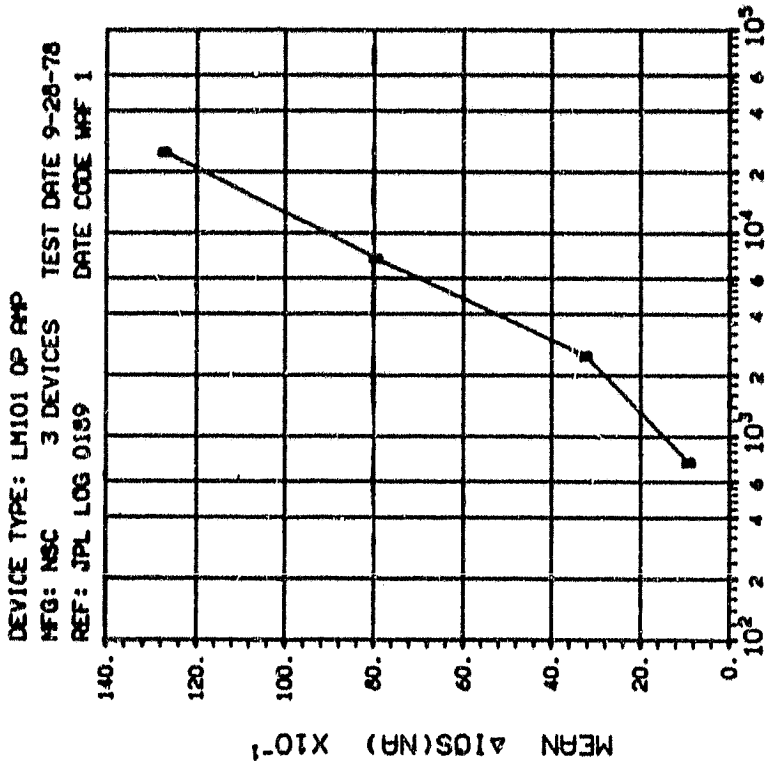


TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(SI)				
	.75	2.50	7.50	25.00	
B	.6429	2.258	5.272	7.378	

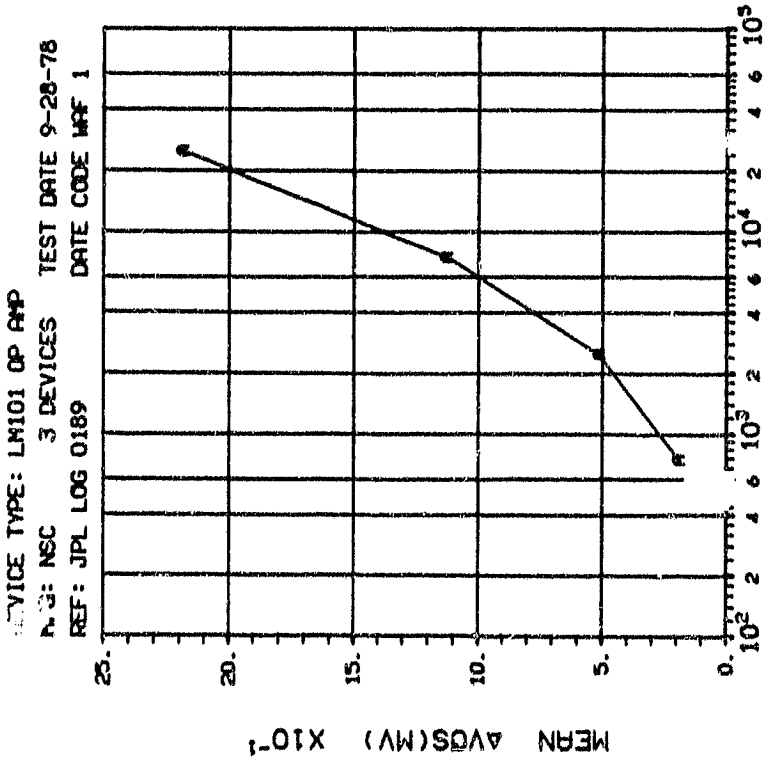
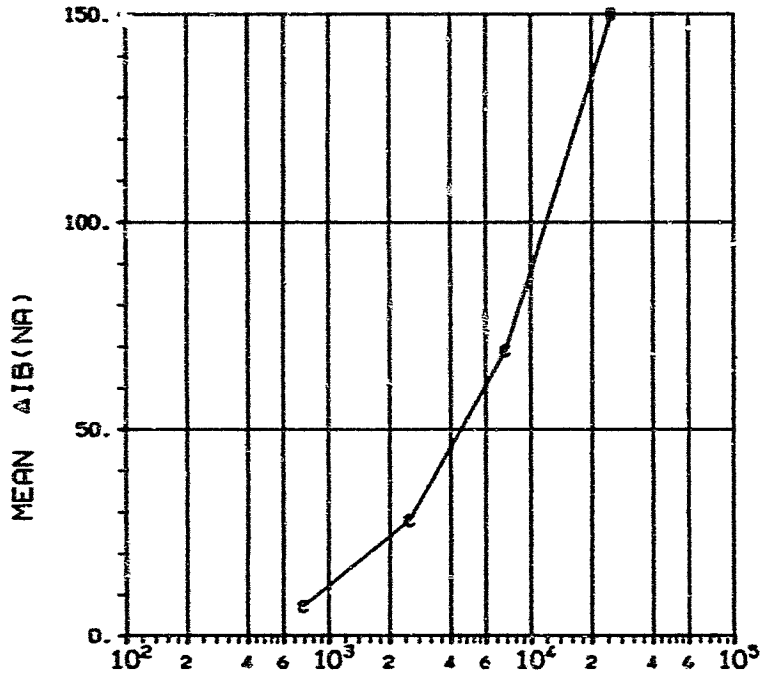


TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(SI)				
	.75	2.50	7.50	25.00	
A	.1555	.4039	.7390	1.150	

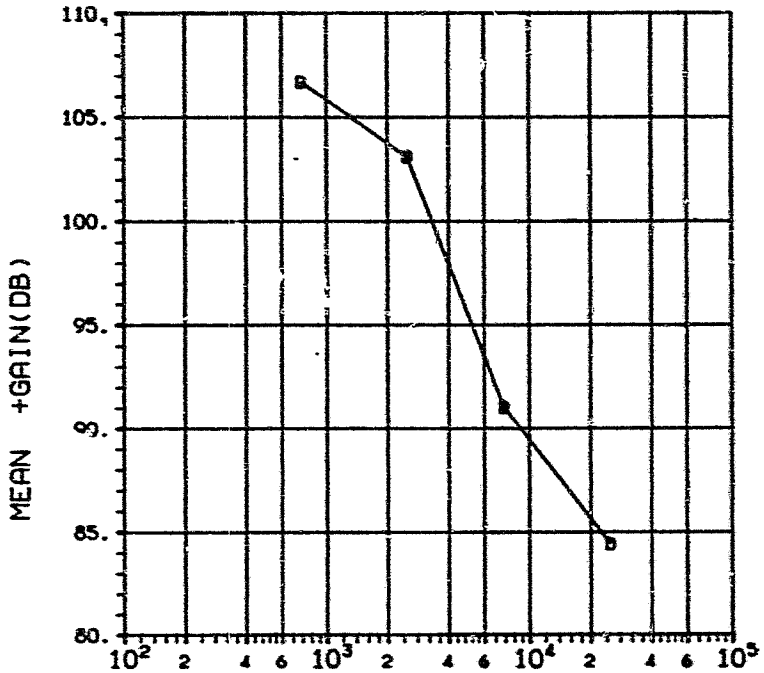
DEVICE TYPE: LM101 OP AMP
MFG: NSC 3 DEVICES TEST DATE 9-28-78
REF: JPL LOG 0189 DATE CODE WAF 1



(3) IB IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	2.50	7.50	25.00
C	1.132	.3150	6.260	26.92

DEVICE TYPE: LM101 OP AMP
MFG: NSC 3 DEVICES TEST DATE 9-28-78
REF: JPL LOG 0189 DATE CODE WAF 1



(4) +GAIN IN DB 2K LOAD = 5MA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	I_L (mA)	DOSE, kiloGy(Si)			
		.75	2.50	7.50	25.00
D	5.00	5.586	7.596	4.772	3.853

INITIAL MEAN VALUE +GAIN(DB) = $1.17X10^{+2}$

ORIGINAL PAGE IS
OF POOR QUALITY

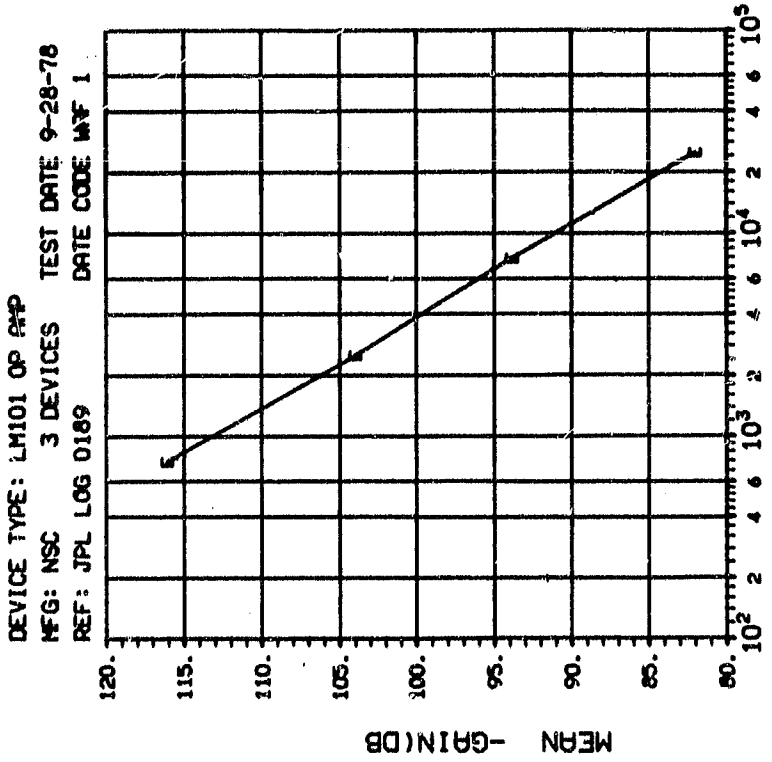
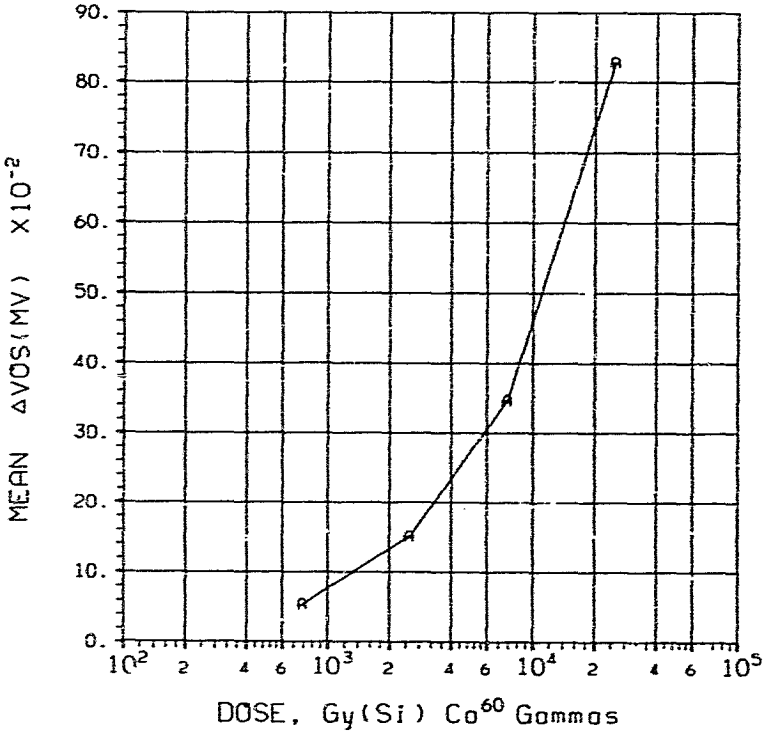


TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	I_L (mA)	DOSE, kiloGy(Si)			
		.75	2.50	7.50	25.00
E	5.00	12.63	5.452	6.609	3.476

INITIAL MEAN VALUE -GAIN(DB = $1.115X10^{+2}$

C-2

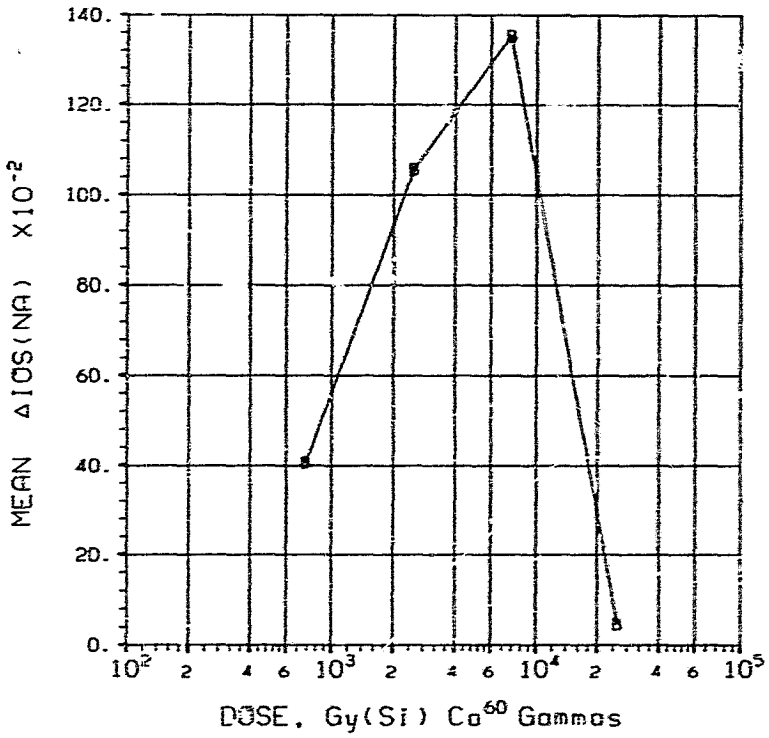
DEVICE TYPE: LM101 OP AMP
MFG: NSC 3 DEVICES TEST DATE 9-29-78
REF: JPL LOG 0190 DATE CODE WAF 4



(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	2.50	7.50	25.00
A	.0100	.0351	.0849	.1071

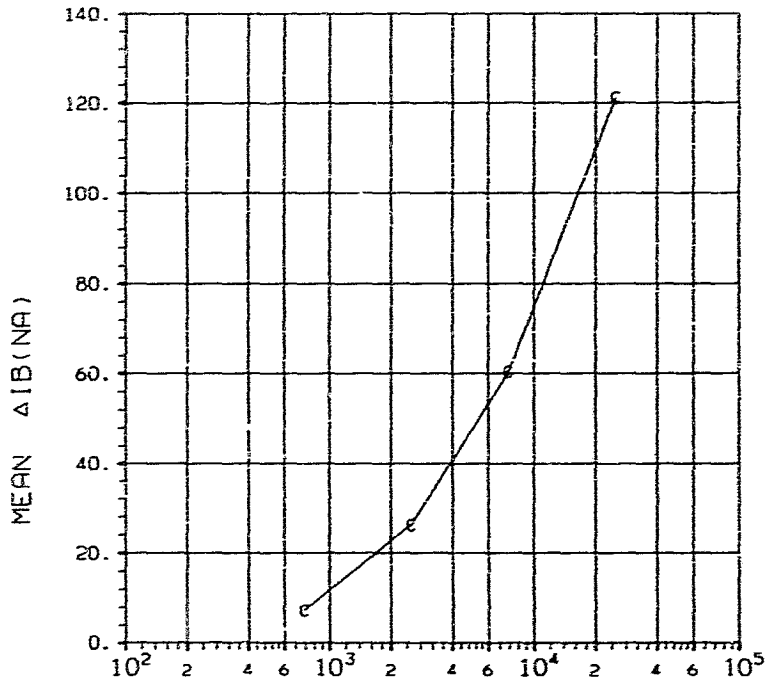
DEVICE TYPE: LM101 OP AMP
MFG: NSC 3 DEVICES TEST DATE 9-29-78
REF: JPL LOG 0190 DATE CODE WAF 4



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	2.50	7.50	25.00
B	.8640	2.222	4.399	8.695

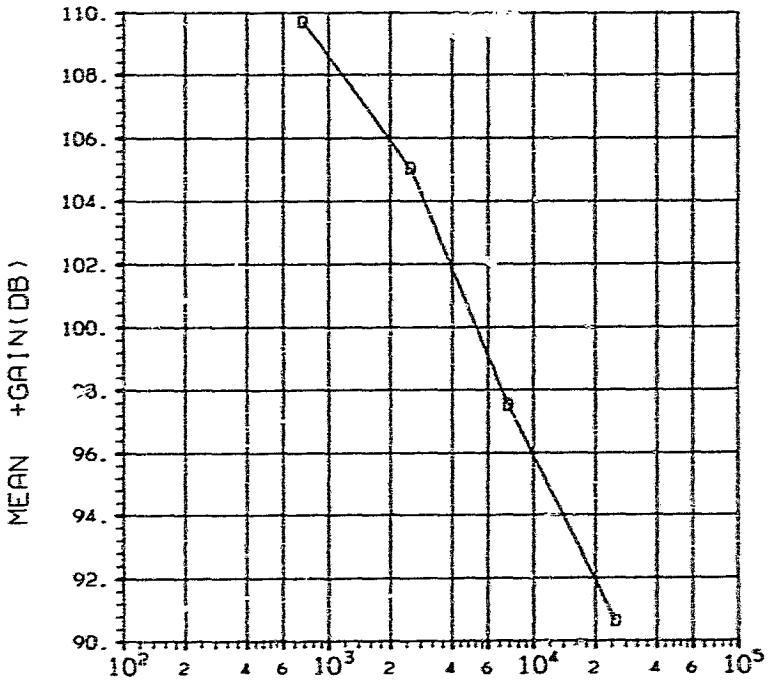
DEVICE TYPE: LM101 OP AMP
MFG: NSC 3 DEVICES TEST DATE 9-29-78
REF: JPL LOG 0190 DATE CODE WAF 4



(3) IB IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	2.50	7.50	25.00
C	.2093	1.179	3.389	3.648

DEVICE TYPE: LM101 OP AMP
MFG: NSC 3 DEVICES TEST DATE 9-29-78
REF: JPL LOG 0190 DATE CODE WAF 4



(4) + GAIN IN DB 2K LOAD = 5MA VS DOSE

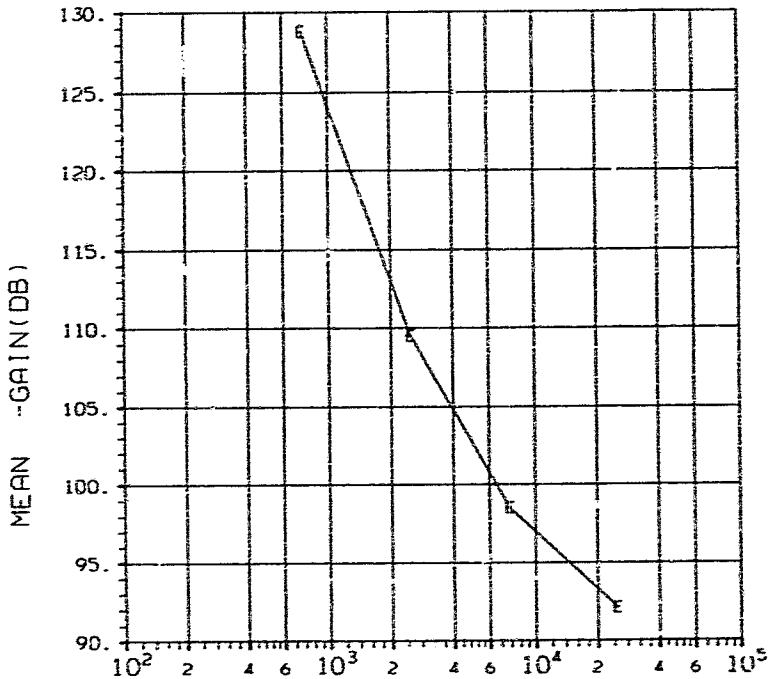
TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	I_L (mA)	DOSE, kiloGy(Si)			
		.75	2.50	7.50	25.00
D	5.00	1.535	.8300	.9819	1.648

INITIAL MEAN VALUE +GAIN(DB) = $1.23X10^{+2}$

DEVICE TYPE: LM101 OP AMP

MFG: NSC 3 DEVICES TEST DATE 9-29-78

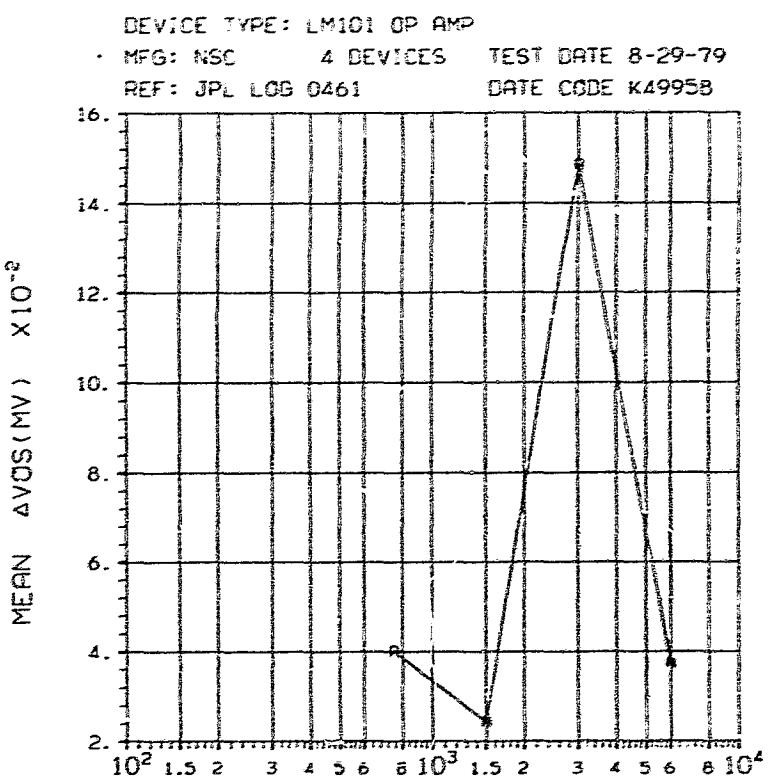
REF: JPL LOG 0190 DATE CODE WAF 4



(5) - GAIN IN DB 2K LOAD = 5MA VS DOSE

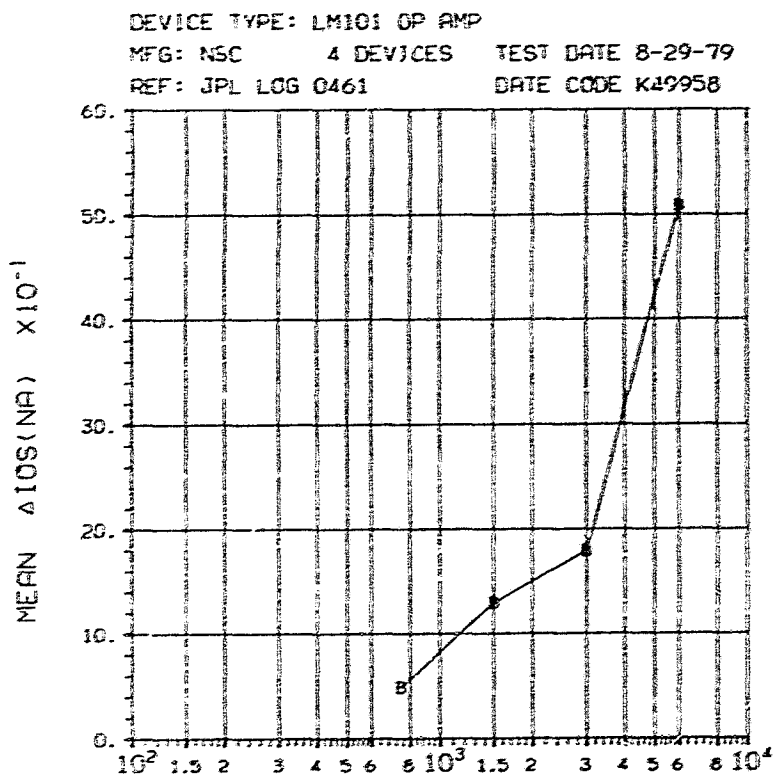
TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	I_L (mA)	DOSE, kiloGy(Si) .75	2.50	7.50	25.00
E	5.00	9.787	2.554	1.417	.9372

INITIAL MEAN VALUE -GAIN(DB = $1.11X10^{+2}$



(1) VOS IN MV VS DOSE

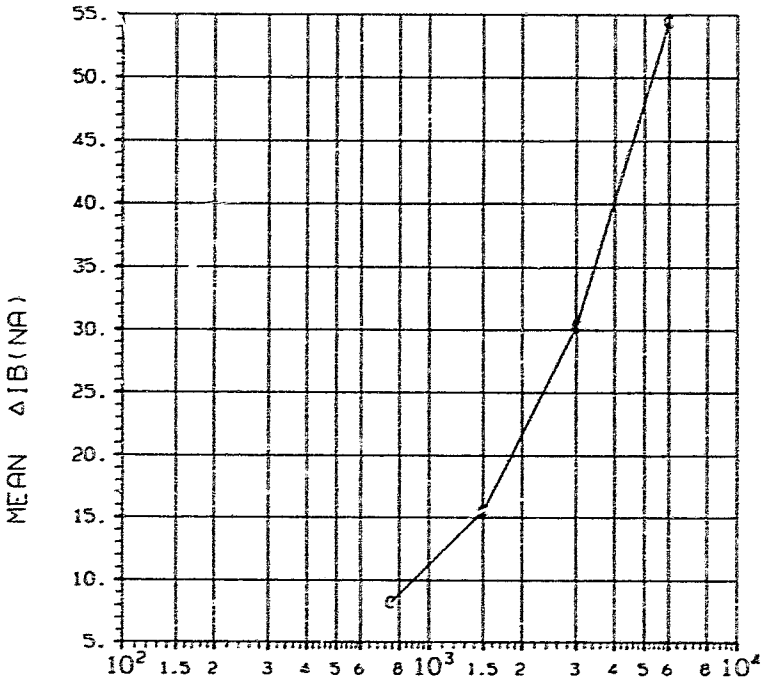
TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
A	.1173	.2351	.2883	.4727



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
B	.2961	.7837	2.925	3.878

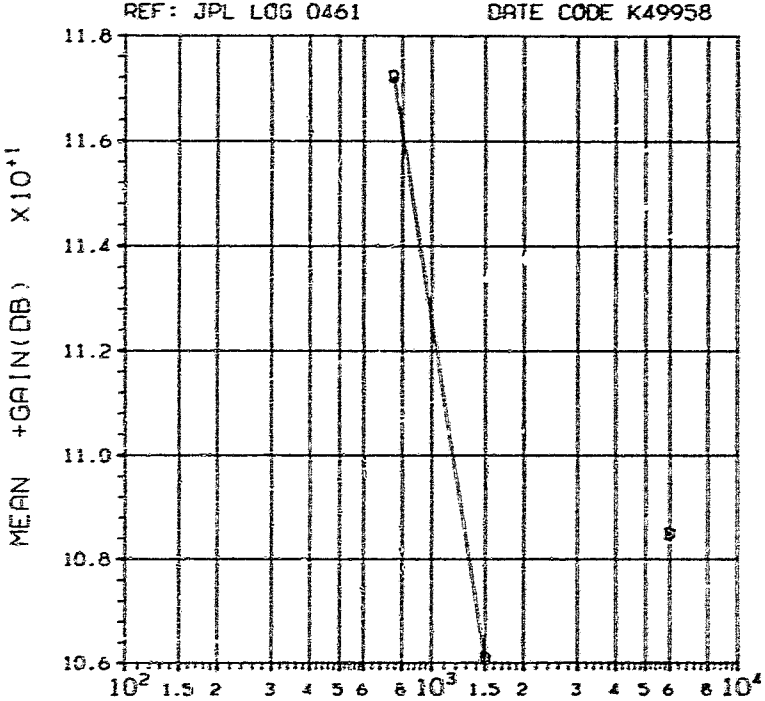
DEVICE TYPE: LM101 OP AMP
MFG: NSC 4 DEVICES TEST DATE 8-29-79
REF: JPL LOG 0461 DATE CODE K49958



(3) IB IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
C	1.181	2.180	3.560	7.615

DEVICE TYPE: LM101 OP AMP
MFG: NSC 4 DEVICES TEST DATE 8-29-79
REF: JPL LOG 0461 DATE CODE K49958



(4) + GAIN IN DB; 2K LOAD=5MA, +10V VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	I_L (mA)	DOSE, kiloGy(Si)			
		.75	1.50	3.00	6.00
D	5.00	7.122	1.348	FAIL	2.251

INITIAL MEAN VALUE +GAIN(DB) = $1.17X10^{+2}$

ORIGINAL PAGE IS
OF POOR QUALITY

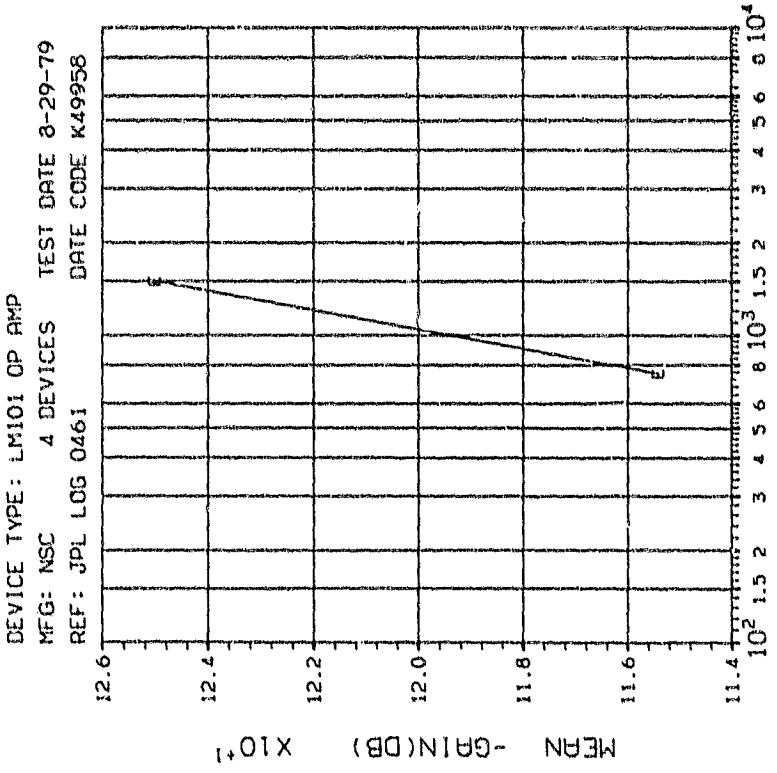


TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	I_L (mA)	DOSE, kiloGy(Si) .75	1.50	3.00 6.00
E	5.00	4.059	4.659	FAIL FAIL

INITIAL MEAN VALUE -GAIN(DB) = $1.09 \times 10^{+2}$

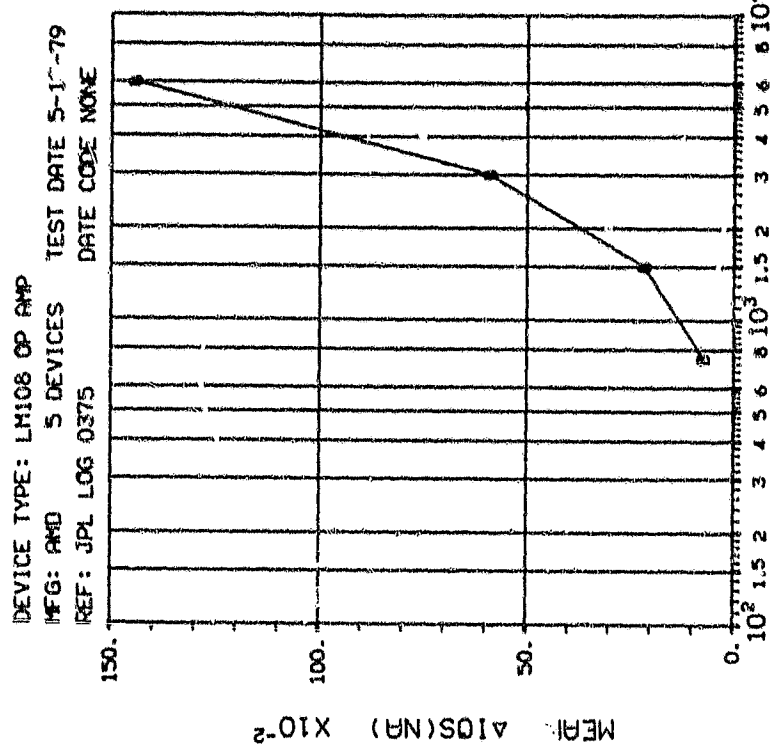


TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00 6.00
B	.0235	.0856	.1862 .3601

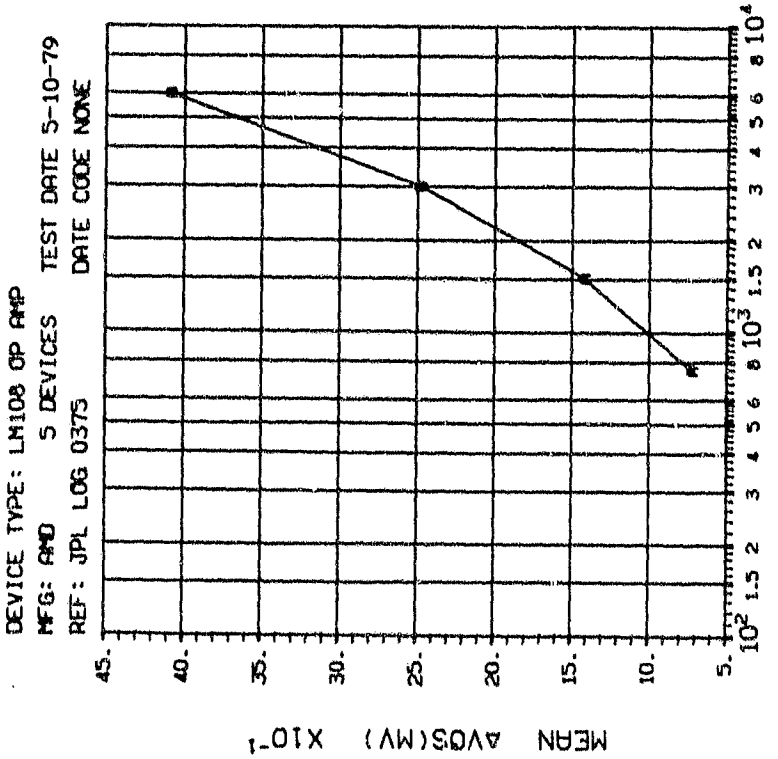
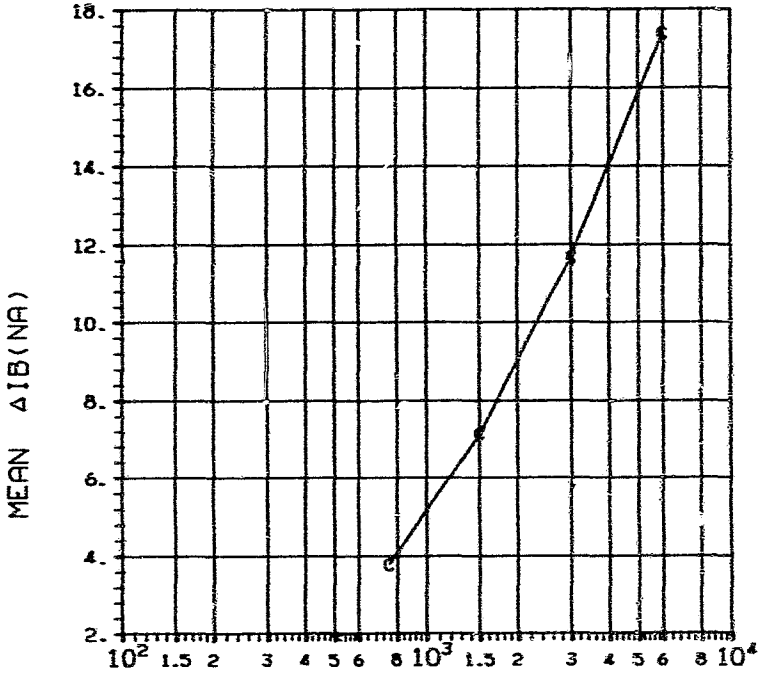


TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00 6.00
A	.1802	.4153	.6489 .8650

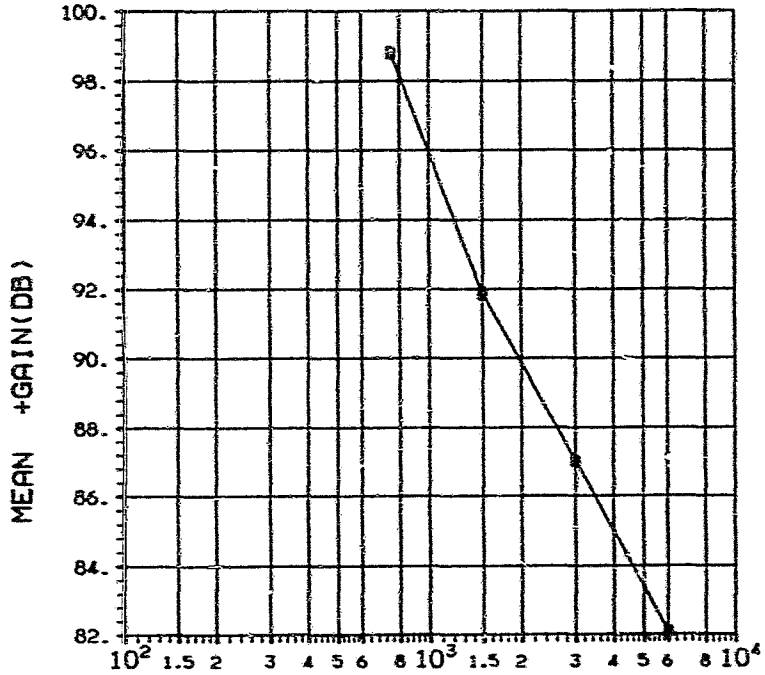
DEVICE TYPE: LM108 OP AMP
MFG: AMD 5 DEVICES TEST DATE 5-10-79
REF: JPL LOG 0375 DATE CODE NONE



(3) IB IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
C	.6661	1.006	1.346	1.648

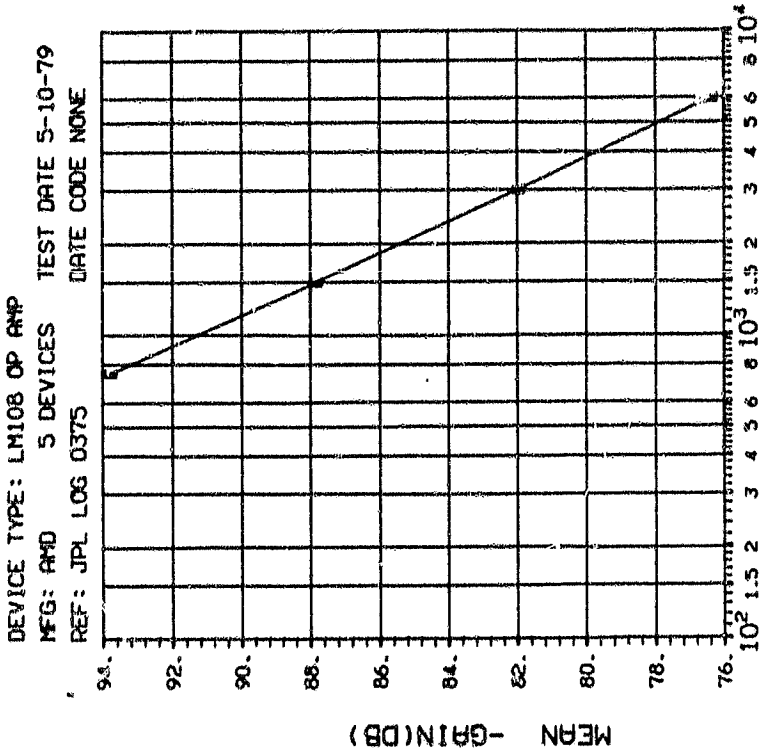
DEVICE TYPE: LM108 OP AMP
MFG: AMD 5 DEVICES TEST DATE 5-10-79
REF: JPL LOG 0375 DATE CODE NONE



(4) + GAIN IN DB 5K LOAD = 2MA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	I_L (mA)	DOSE, kiloGy(Si)			
		.75	1.50	3.00	6.00
D	2.00	1.039	1.500	1.848	1.022

INITIAL MEAN VALUE = $1.11X10^{+2}$

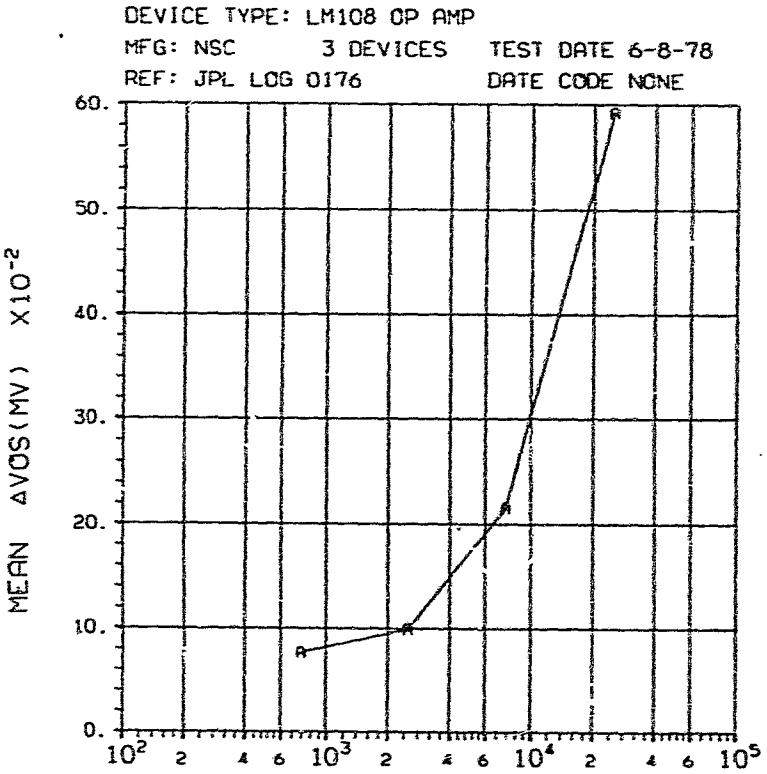


DOSE, Gy(Si) 2.5 MeV electrons

(5) - GAIN IN DB 5K LOAD = 2MA VS DOSE

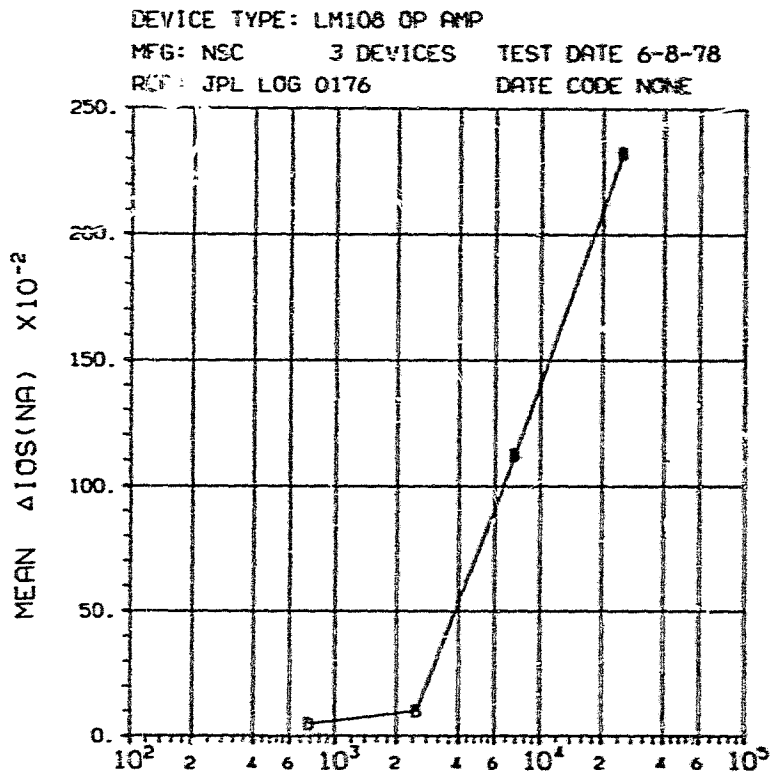
TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	I_L (mA)	DOSE, kiloGy(Si) .75	1.50	3.00 6.00
E	2.00	1.047	1.243	2.008 1.655

INITIAL MEAN VALUE = $1.12 \times 10^{+2}$



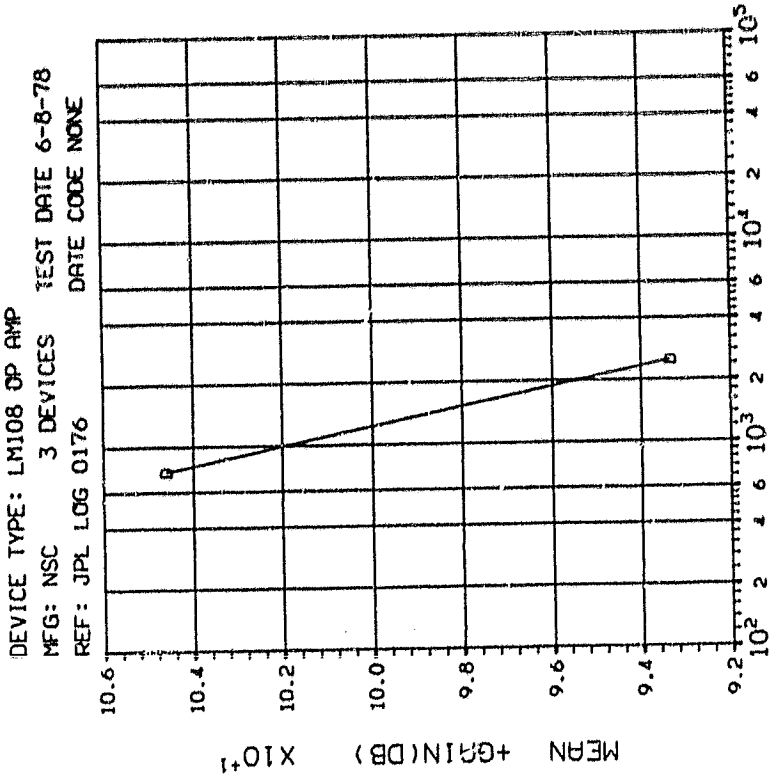
(1) VOS IN MV VS DOSE.

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	2.50	7.50	25.00
A	.0140	.2271	.0407	.2729



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	2.50	7.50	25.00
B	.1661	.2856	.5836	1.495

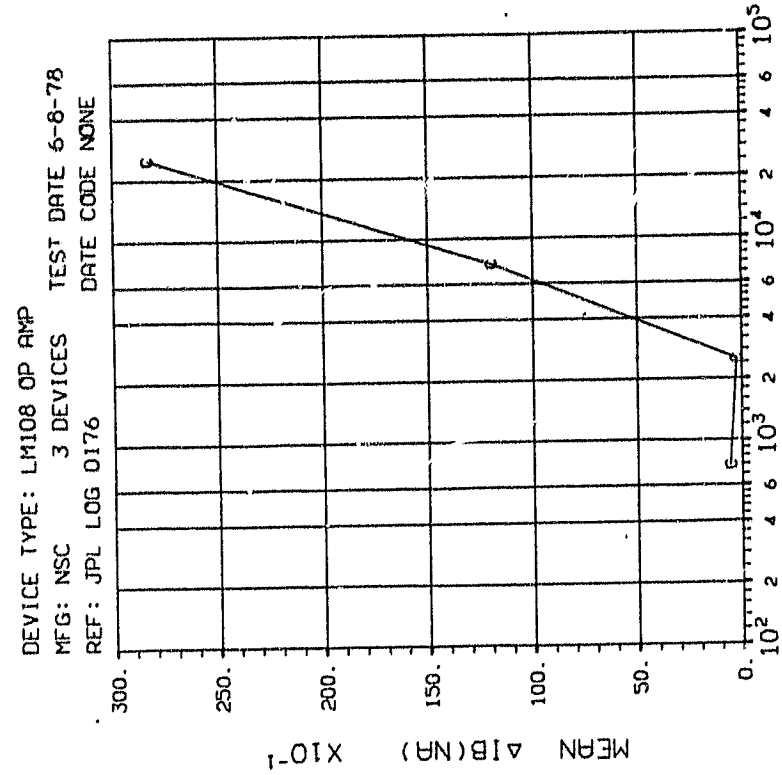


DOSE, Gy(Si) 2.5 MeV electrons

(4) + GAIN IN DB: 5K LOAD = 2 MA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS		
CURVE	I_L (mA)	DOSE, kiloGy(Si) .75 2.50 7.50 25.00
D	2.00	1.344 1.349 FAIL FAIL

INITIAL MEAN VALUE +GAIN(DB) = $1.10X10^{+2}$



DOSE, Gy(Si) 2.5 MeV electrons

(3) IB IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS	
CURVE	DOSE, kiloGy(Si) .75 2.50 7.50 25.00
C	.0778 .0601 .4680 1.034

ORIGINAL PAGE IS
OF POOR QUALITY

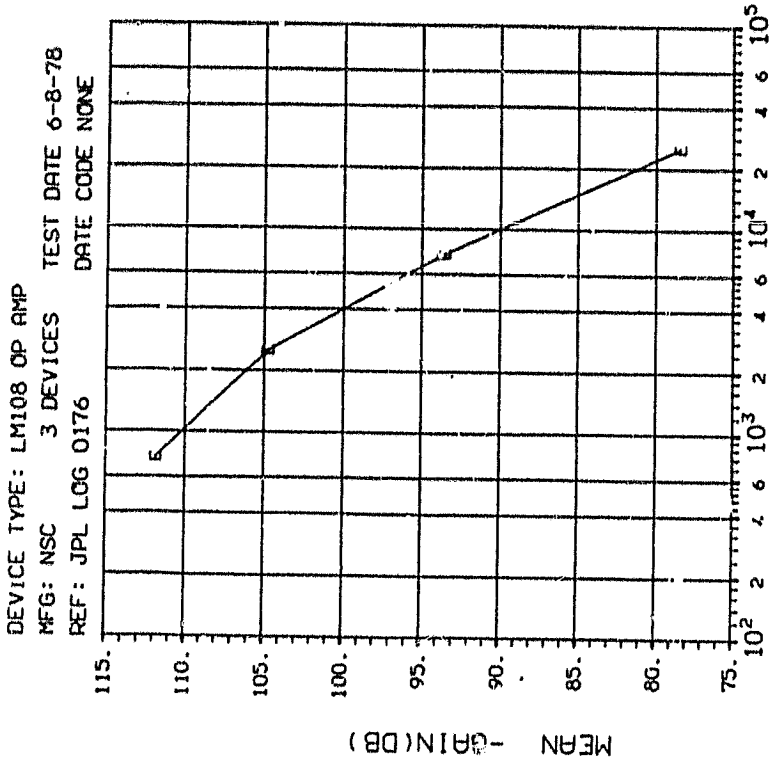
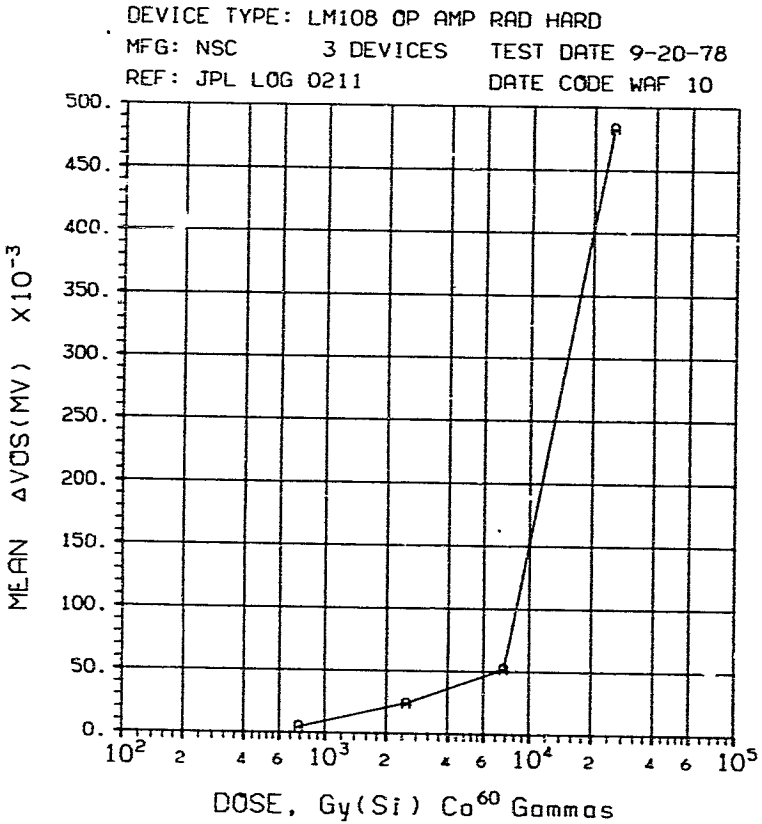


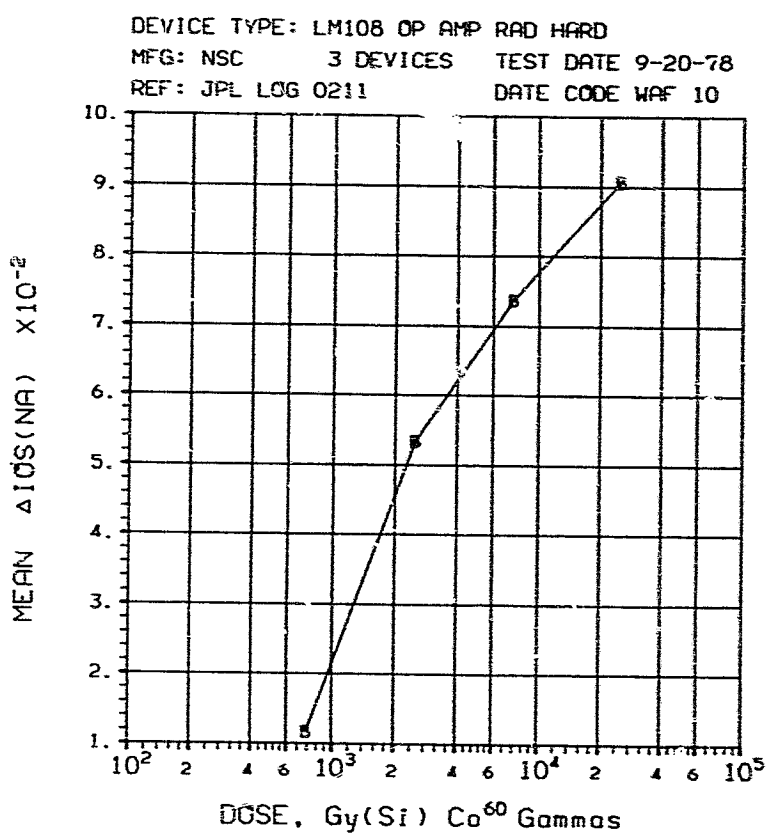
TABLE OF NORMAL STANDARD DEVIATIONS		
CURVE	I_L (mA)	DOSE, kiloGy(Si) .75 2.50 7.50 25.00
E	2.00	5.963 1.506 .7009 1.209

INITIAL MEAN VALUE -GAIN(DB) = 1.14×10^{-2}



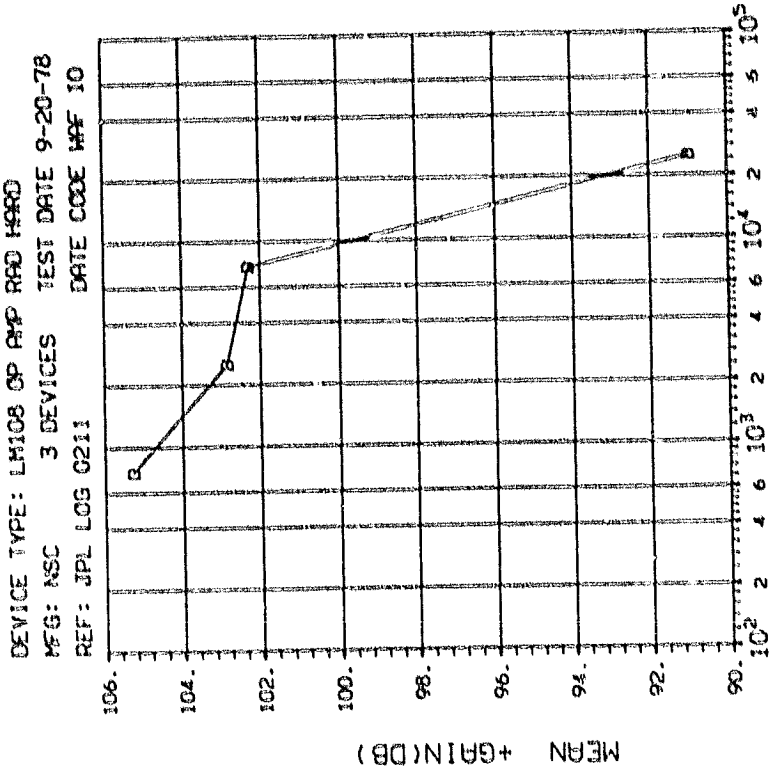
(1) VOS ON MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	2.50	7.50	25.00
A	.0200	.0755	.1330	.2343



(2) IOS IN NA VS DOSE

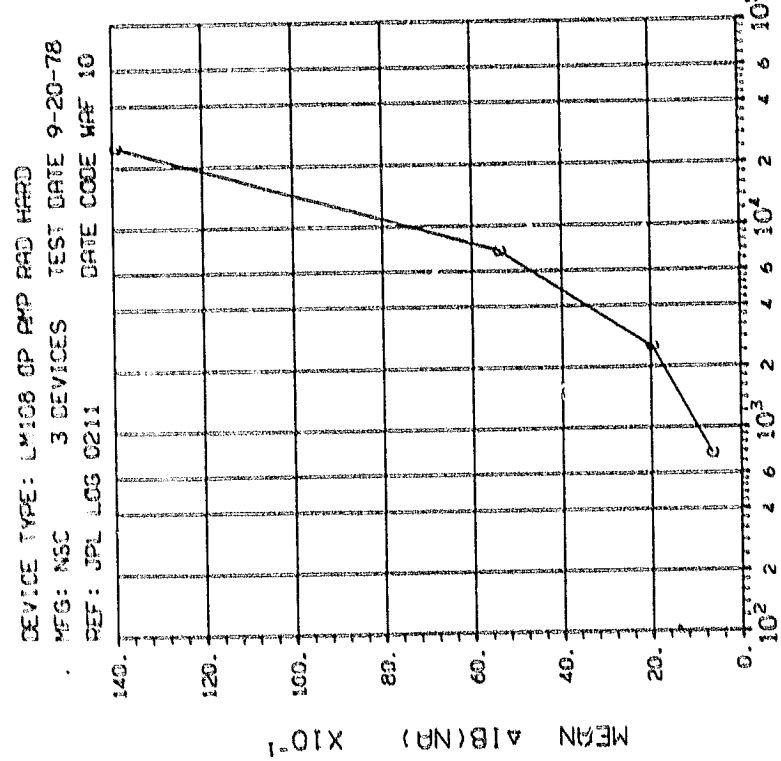
TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	2.50	7.50	25.00
B	.0536	.0555	.0986	.4185



(4) +GAIN IN DB: 5K LOAD = 2 MA VS DOSE

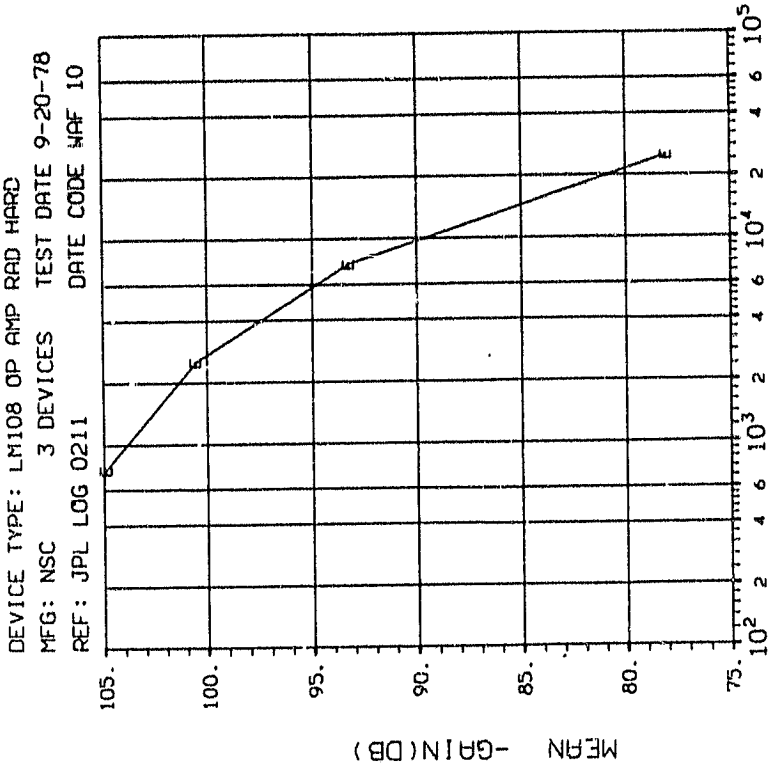
TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	I_L (mA)	DOSE, kiloGy(Si)			
		.75	2.50	7.50	25.00
D	2.00	3.806	2.132	7.271	.9143

INITIAL MEAN VALUE +GAIN(DB) = $1.04 \times 10^{+2}$



(3) IB IN NA VS DOSE

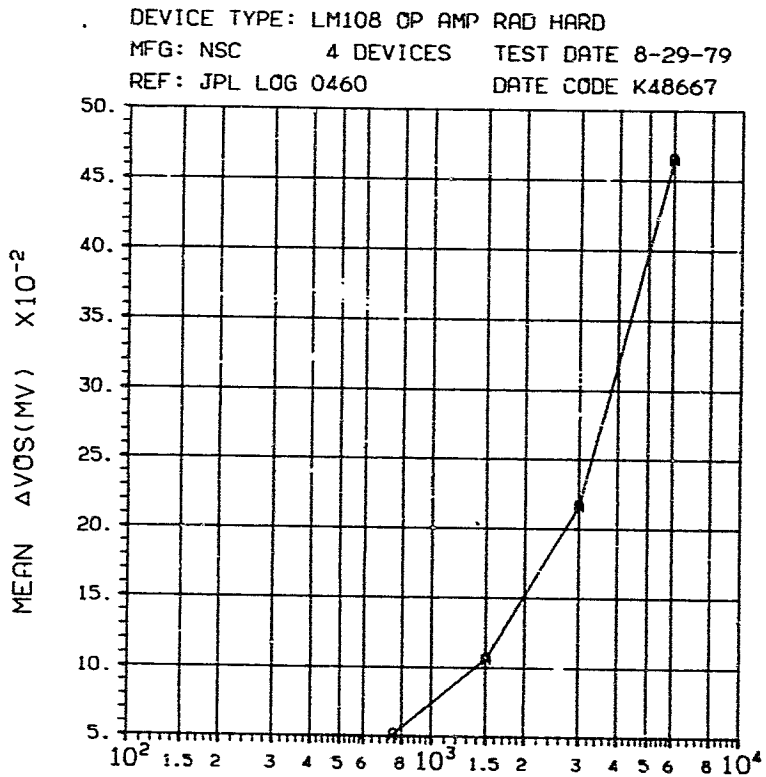
TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	2.50	7.50	25.00
C	.0608	.1351	.6722	1.354



(5) -GAIN IN DB: 5K LOAD = 2 MA VS DOSE

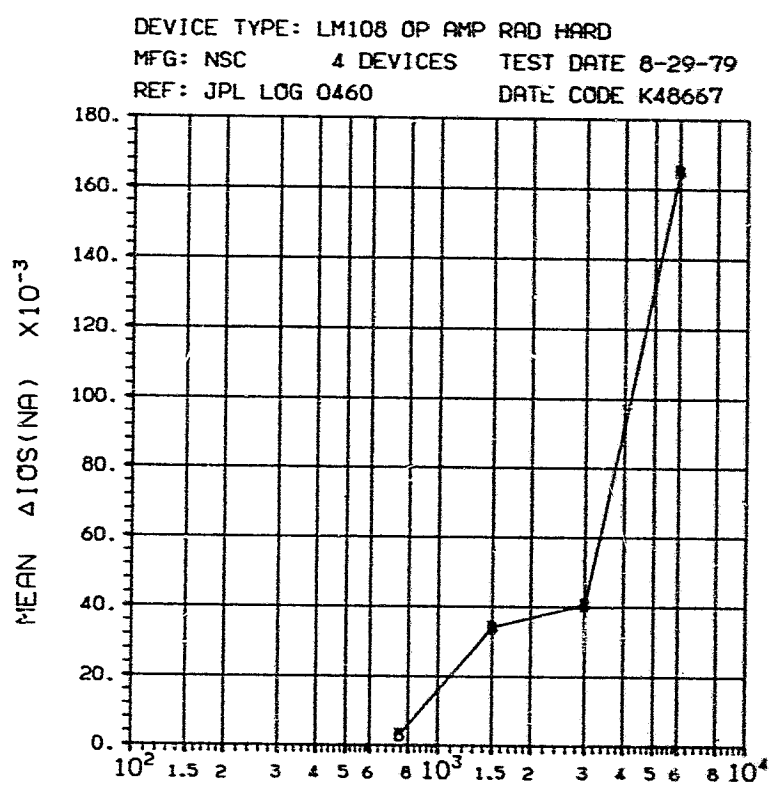
TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	I_L (mA)	DOSE, kiloGy(Si) .75	2.50	7.50 25.00
E	2.00	3.391	2.815	2.182 1.687

INITIAL MEAN VALUE -GAIN(DB) = $1.07X10^{+2}$



(1) VOS IN MV VS DOSE

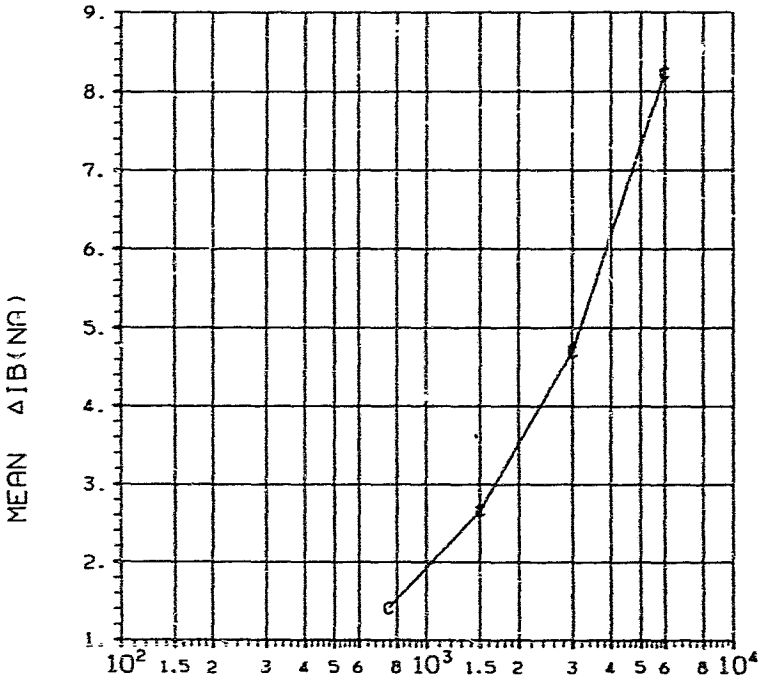
TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
A	.0228	.0358	.0497	.0917



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
B	.0507	.0378	.1169	.2116

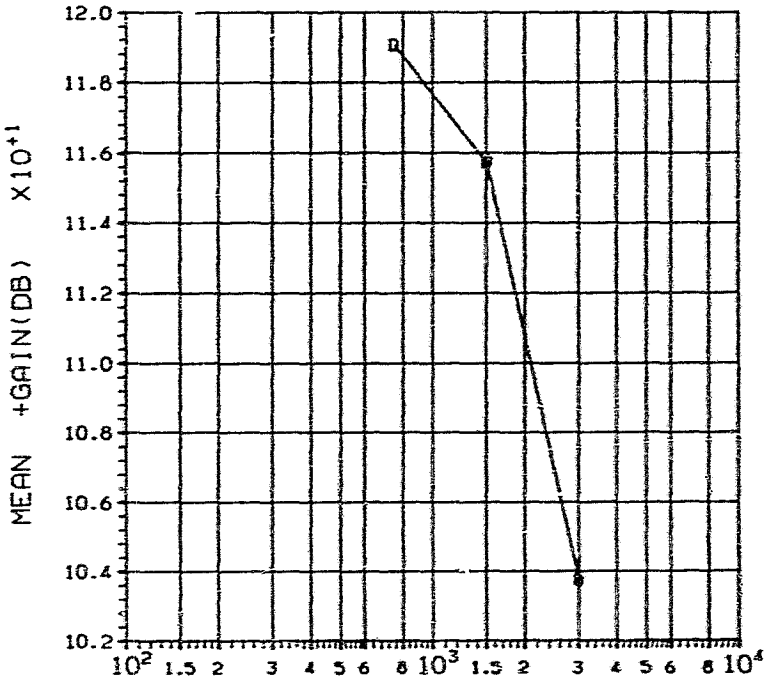
DEVICE TYPE: LM108 OP AMP RAD HARD
MFG: NSC 4 DEVICES TEST DATE 8-29-79
REF: JPL LOG 0460 DATE CODE K48667



(3) IB IN NA VS DOSE .

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
C	.1336	.1767	.2809	.4705

DEVICE TYPE: LM108 OP AMP RAD HARD
MFG: NSC 4 DEVICES TEST DATE 8-29-79
REF: JPL LOG 0460 DATE CODE K48667

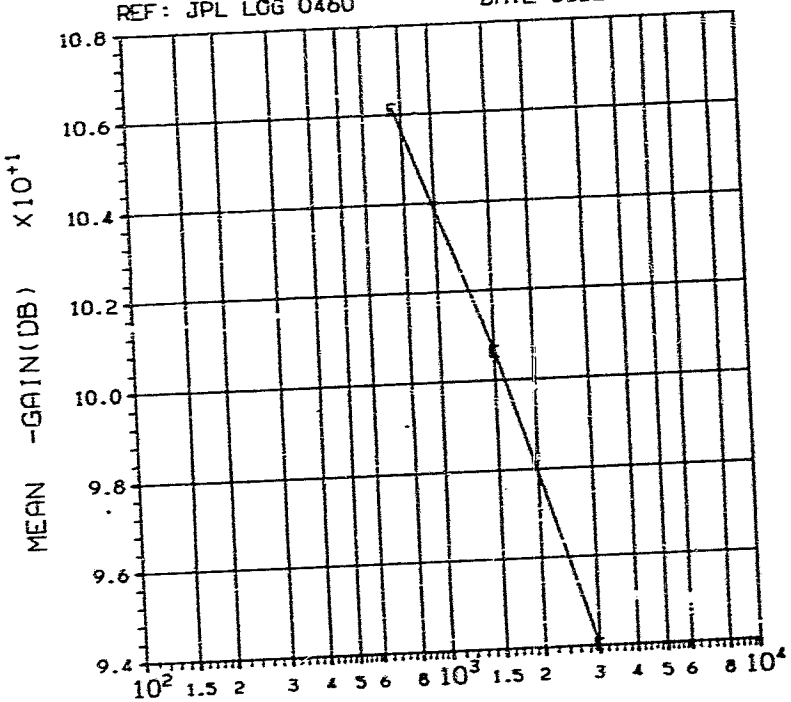


(4) + GAIN IN DB; 5K LOAD=2MA, +10V VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	I_L (mA)	DOSE, kiloGy(Si)			
		.75	1.50	3.00	6.00
D	2.00	18.11	11.63	3.275	FAIL

INITIAL MEAN VALUE +GAIN(DB) = $1.14X10^{+2}$

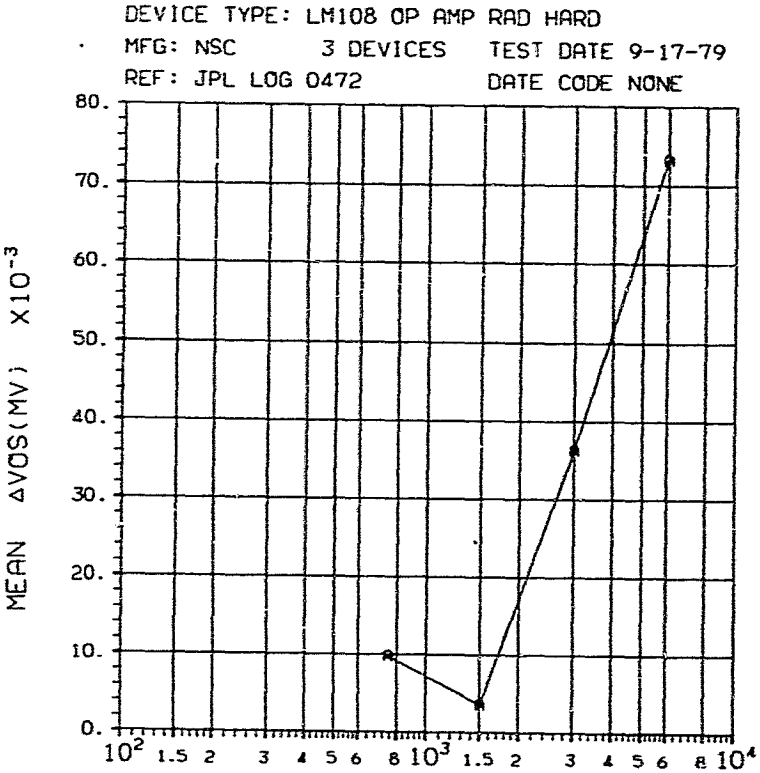
DEVICE TYPE: LM108 OP AMP RAD HARD
MFG: NSC 4 DEVICES TEST DATE 8-29-79
REF: JPL LOG 0460 DATE CODE K48667



(5) - GAIN IN DB; 5K LOAD=2MA, -10V VS DOSE

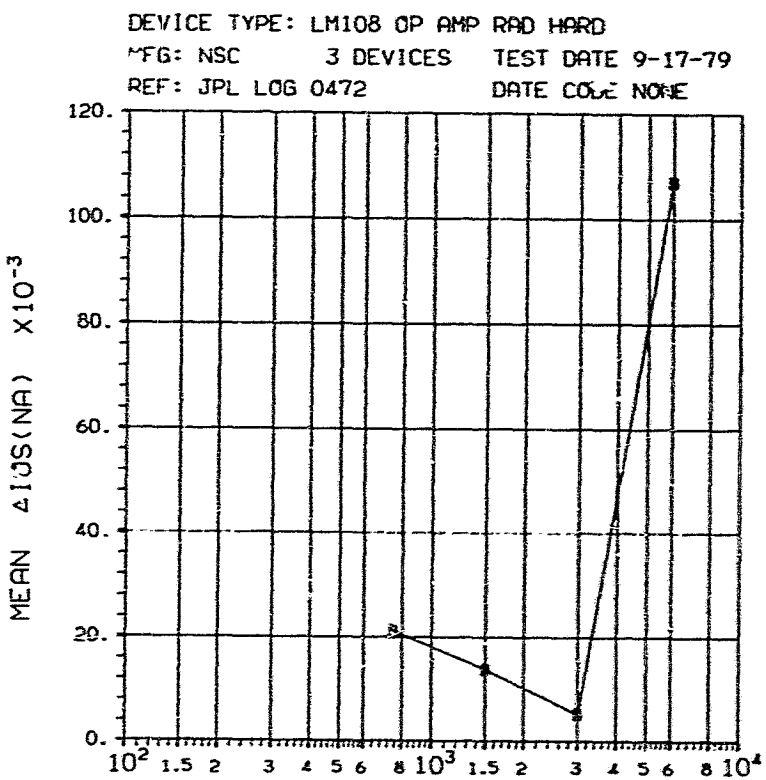
TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	I_L (mA)	DOSE, kiloGy(Si) .75	1.50	3.00	6.00
E	2.00	3.013	1.425	1.052	FAIL

INITIAL MEAN VALUE -GAIN(DB) = $1.21X10^{+2}$



(1) VOS IN MV VS DOSE

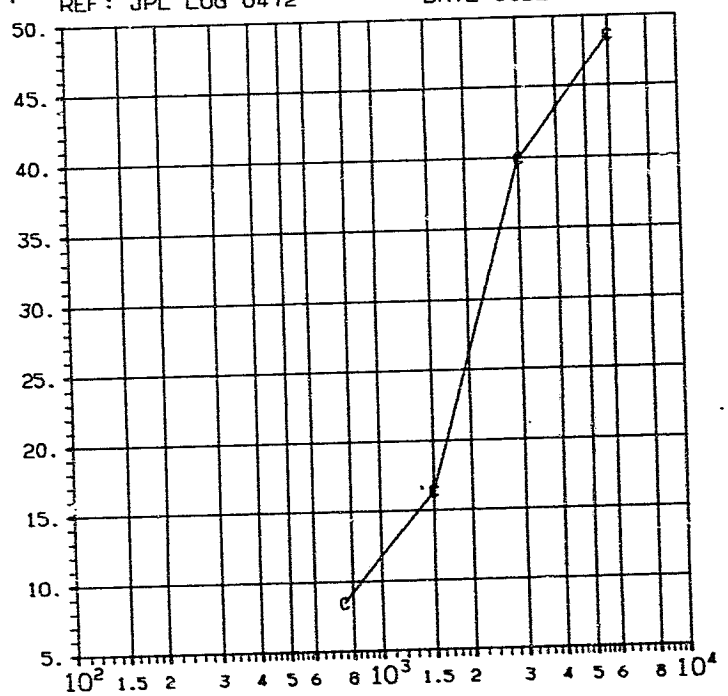
TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
A	.0198	.0239	.0749	.0787



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
B	.0283	.0364	.0515	.1303

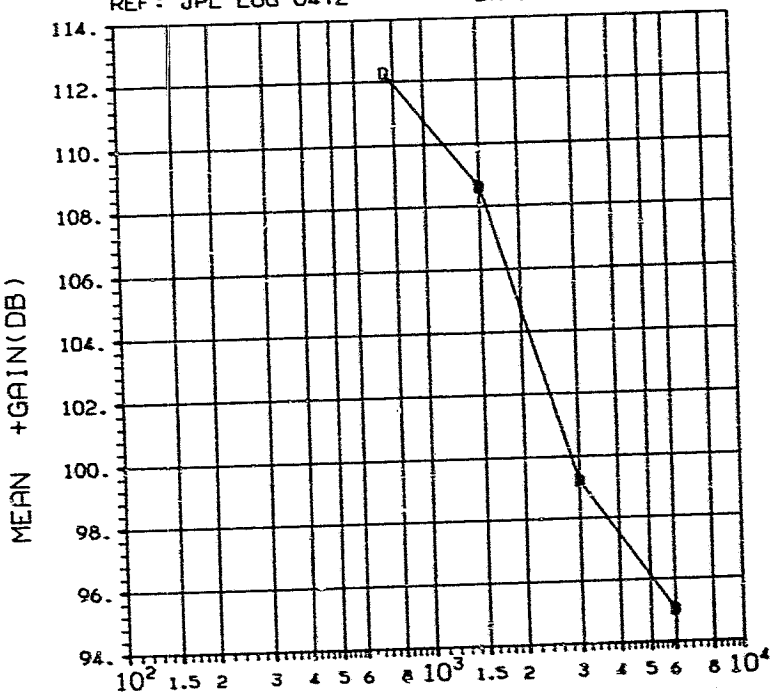
DEVICE TYPE: LM108 OP AMP RAD HARD
MFG: NSC 3 DEVICES TEST DATE 9-17-79
REF: JPL LOG 0472 DATE CODE NONE



(3) IB IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
C	.0459	.0849	.1641	.2442

DEVICE TYPE: LM108 OP AMP RAD HARD
MFG: NSC 3 DEVICES TEST DATE 9-17-79
REF: JPL LOG 0472 DATE CODE NONE

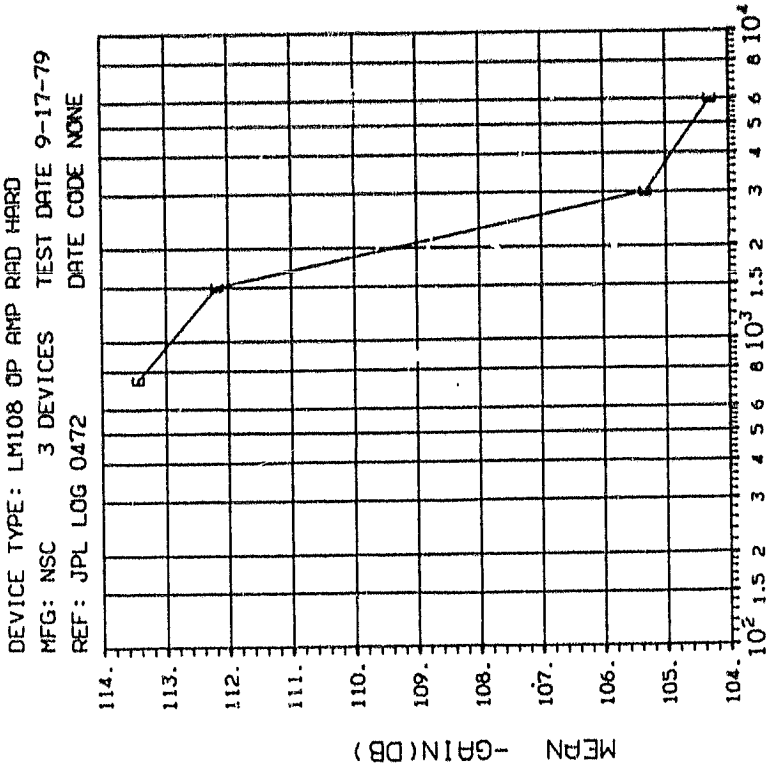


(4) + GAIN IN DB 10K LOAD=1MA, +10V VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	I_L (mA)	DOSE, kiloGy(Si)			
		.75	1.50	3.00	6.00
D	1.00	2.083	1.838	1.081	.6658

INITIAL MEAN VALUE +GAIN(DB) = $1.17X10^{+2}$

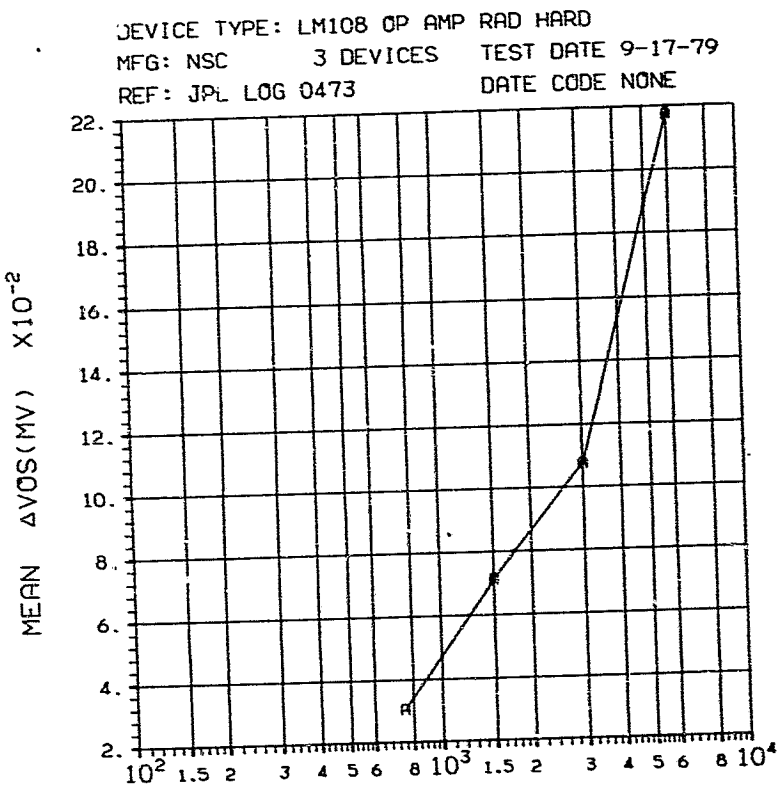
ORIGINAL PAGE IS
OF POOR QUALITY



(5) - GAIN IN DB 10K LOAC-1MA. -10V VS DOSE

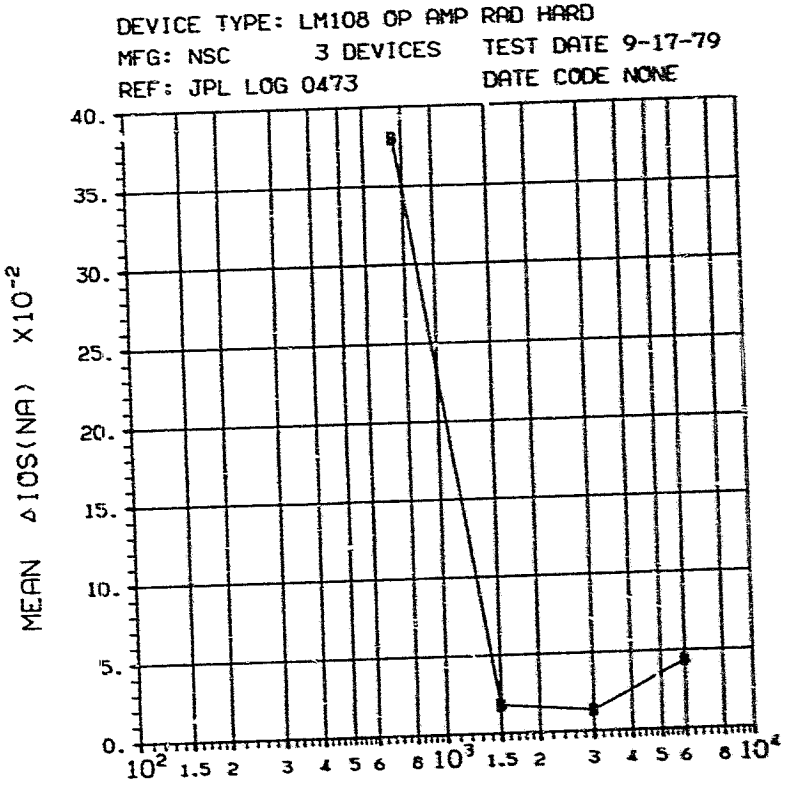
TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	I_L (mA)	DOSE, kiloGy(Si) .75	1.50	3.00	6.00
E	1.00	4.376	6.005	1.820	2.811

INITIAL MEAN VALUE -GAIN(DB) = 1.14×10^2



(1) VOS IN MV VS DOSE.

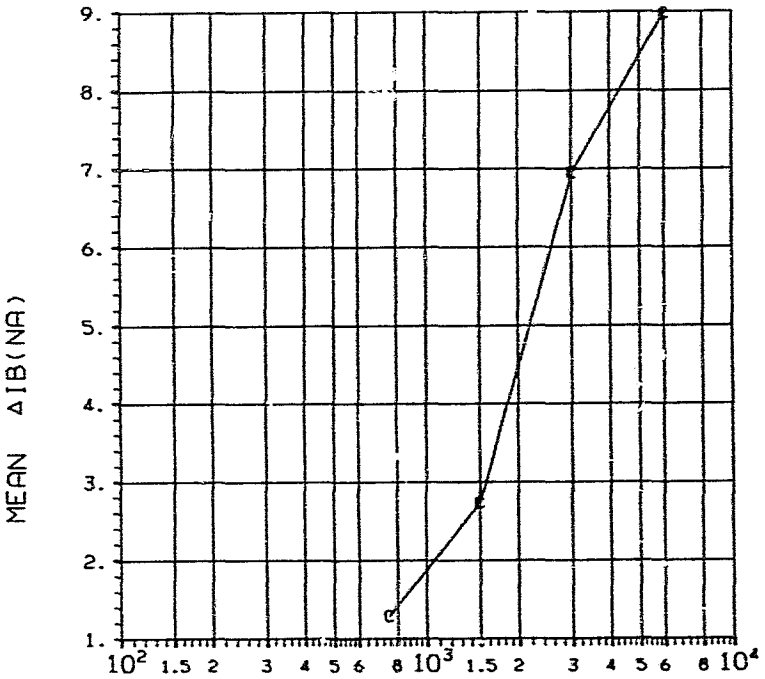
TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
A	.0098	.0158	.0632	.0594



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
B	.4640	.1531	.2401	.2578

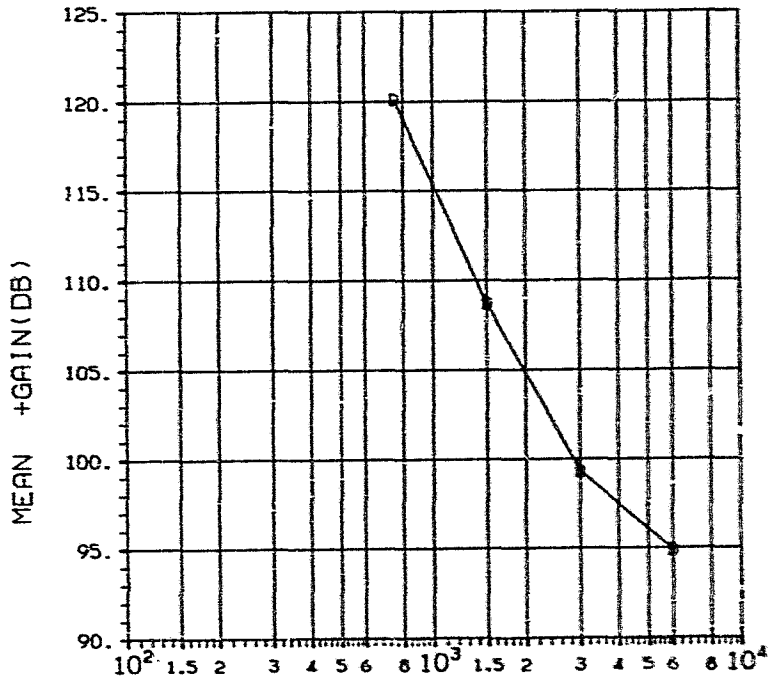
DEVICE TYPE: LM108 OP AMP RAD HARD
MFG: NSC 3 DEVICES TEST DATE 9-17-79
REF: JPL LOG 0473 DATE CODE NONE



(3) IB IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
C	.1180	.0696	.4272	.4206

DEVICE TYPE: LM108 OP AMP RAD HARD
MFG: NSC 3 DEVICES TEST DATE 9-17-79
REF: JPL LOG 0473 DATE CODE NONE

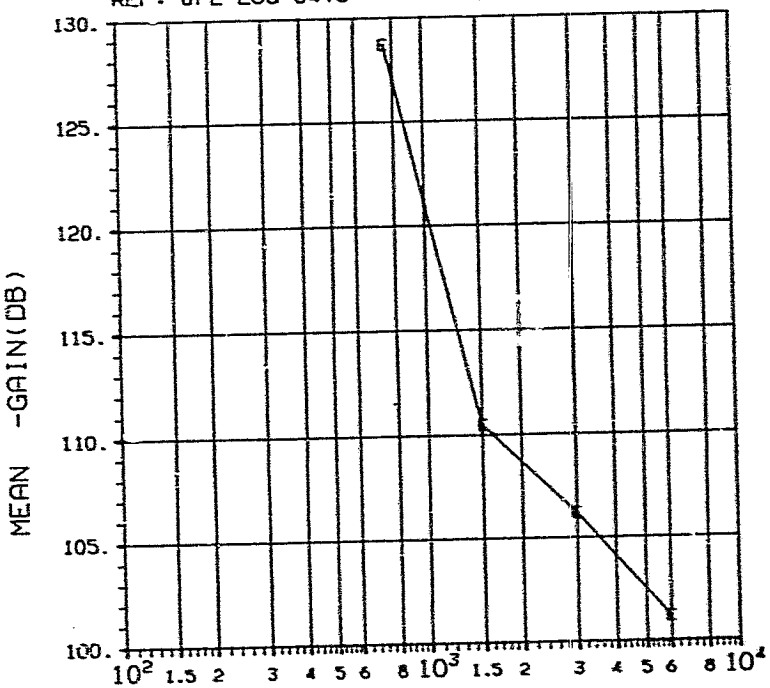


(4) + GAIN IN DB 10K LOAD=1MA, +10V VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	I_L (mA)	DOSE, kiloGy(Si)			
		.75	1.50	3.00	6.00
D	1.00	2.376	.6673	.6202	.4266

INITIAL MEAN VALUE +GAIN(DB) = $1.27X10^{+2}$

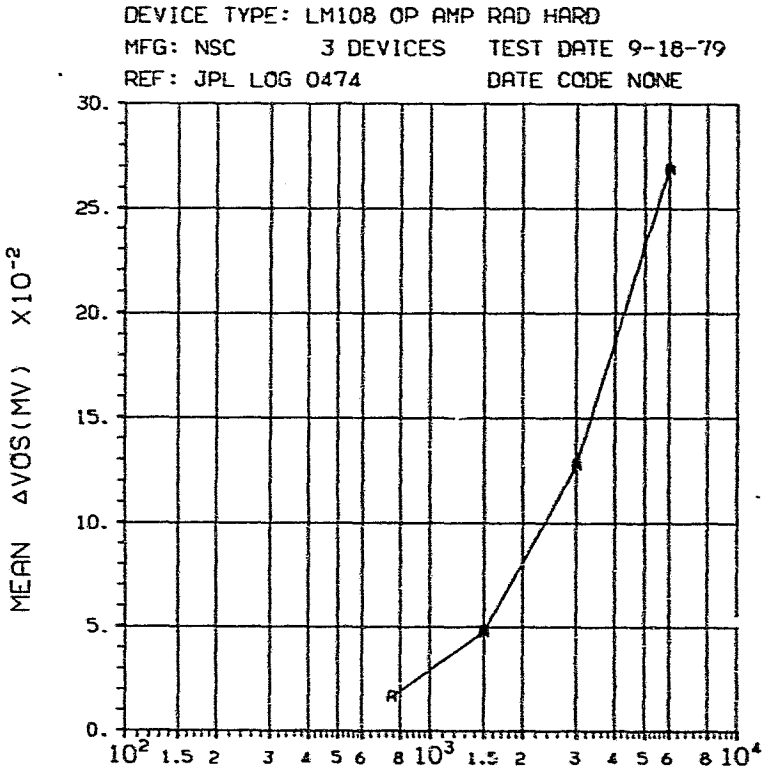
DEVICE TYPE: LM108 OP AMP RAD HARD
MFG: NSC 3 DEVICES TEST DATE 9-17-79
REF: JPL LOG 0473 DATE CODE NONE



(5) - GAIN IN DB 10K LOAD=1MA, -10V VS DOSE

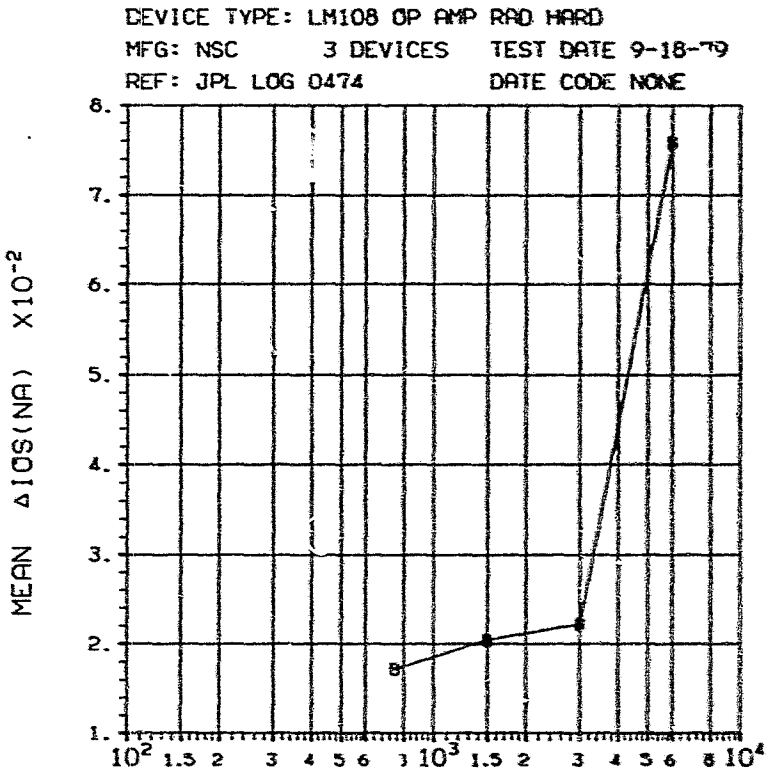
TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	I_L (mA)	DOSE, kiloGy(Si) .75	1.50	3.00	6.00
E	1.00	4.233	.6447	.3040	.3168

INITIAL MEAN VALUE -GAIN(DB) = $1.22X10^{+2}$



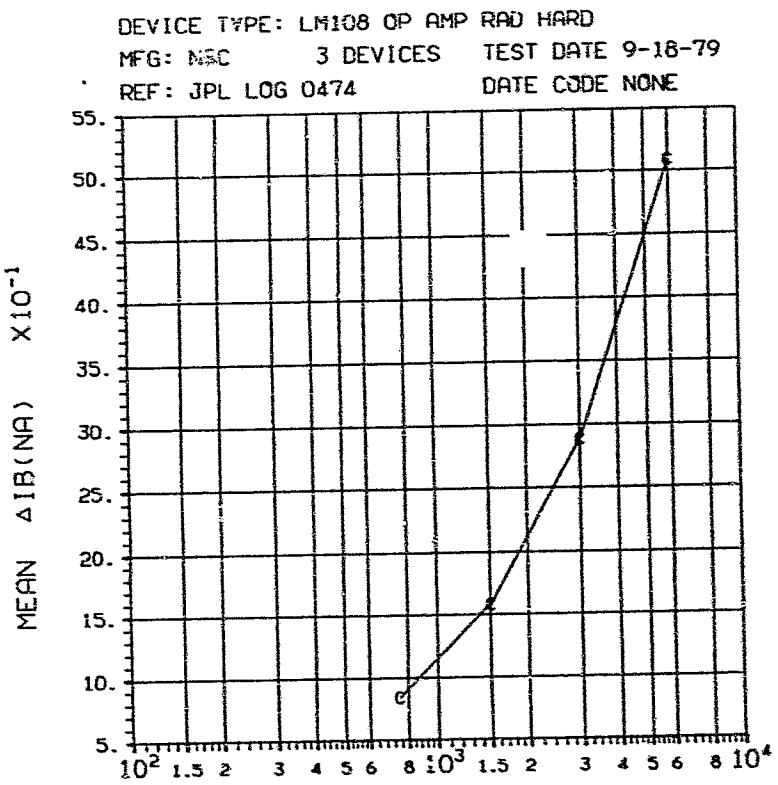
(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
A	.0157	.0271	.0519	.0896



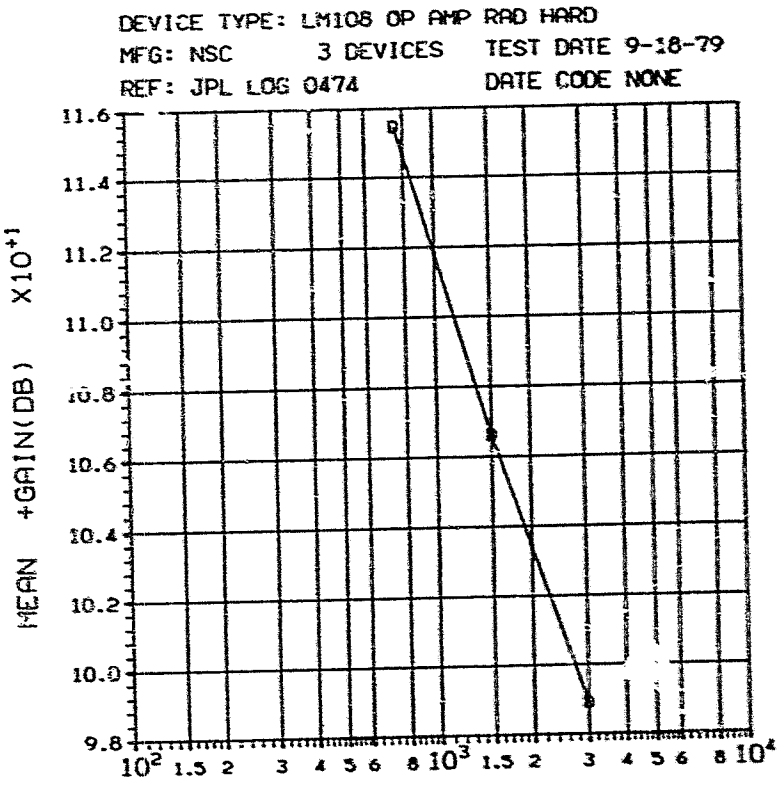
(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
B	.0101	.0090	.0731	.0286



(3) IB IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
C	.1026	.1921	.3369	.5514

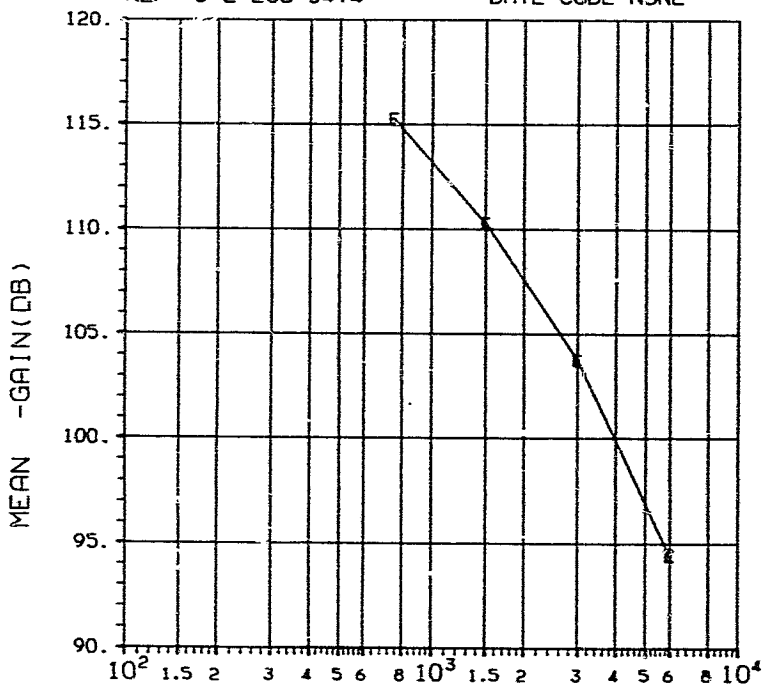


(4) + GAIN IN DB 10K LOAD=1MA, +10V VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	I_L (mA)	DOSE, kiloGy(Si)			
		.75	1.50	3.00	6.00
D	1.00	3.427	.4363	.4363	FAIL

INITIAL MEAN VALUE +GAIN(DB) = $1.40X10^{+2}$

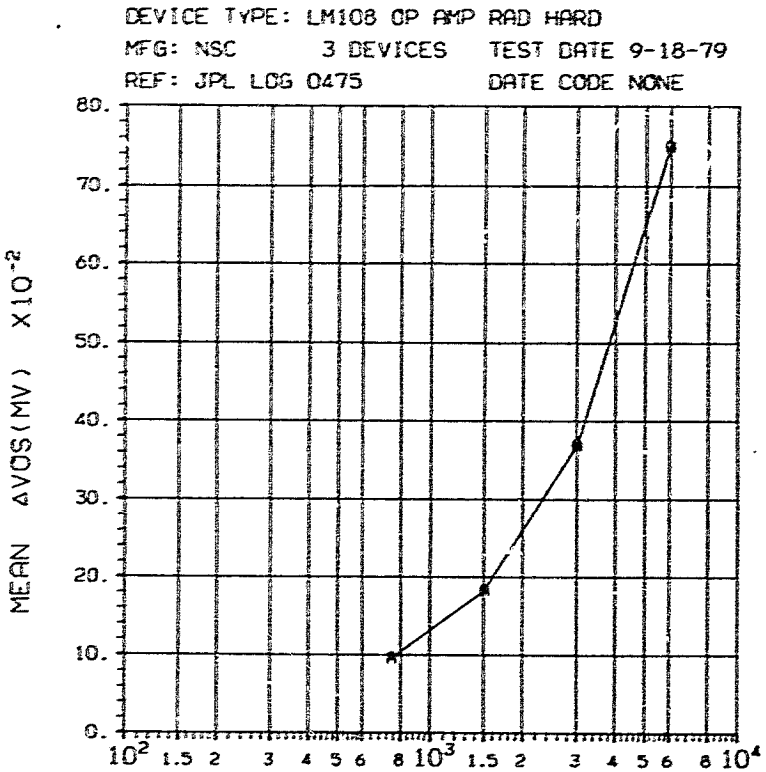
DEVICE TYPE: LM108 OP AMP RAD HARD
MFG: NSC 3 DEVICES TEST DATE 9-18-79
REF: JPL LOG 0474 DATE CODE NONE



(5) - GAIN IN DB 10K LOAD=1MA, -10V VS DOSE

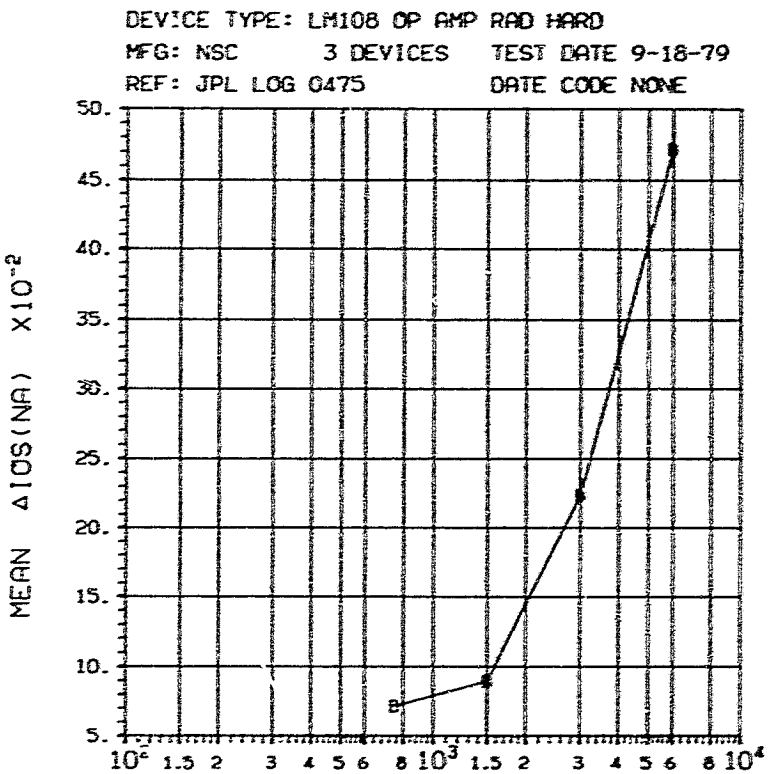
TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	I_L (mA)	DOSE, kiloGy(Si) .75	1.50	3.00	6.00
E	1.00	2.306	.6696	.6696	.4576

INITIAL MEAN VALUE -GAIN(DB) = $1.20X10^{+2}$



(1) VOS IN MV VS DOSE

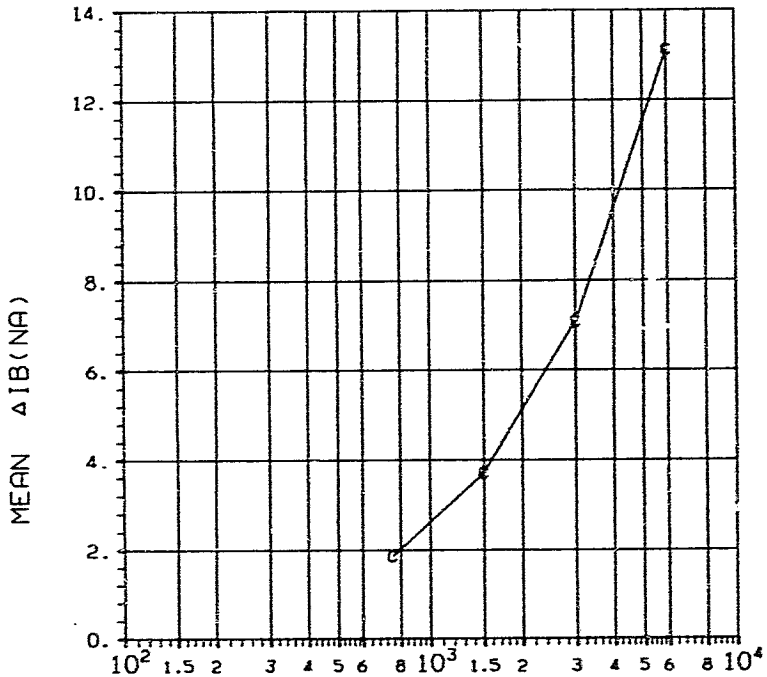
TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
A	.0044	.0094	.0186	.0293



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
B	.0216	.0468	.0198	.0652

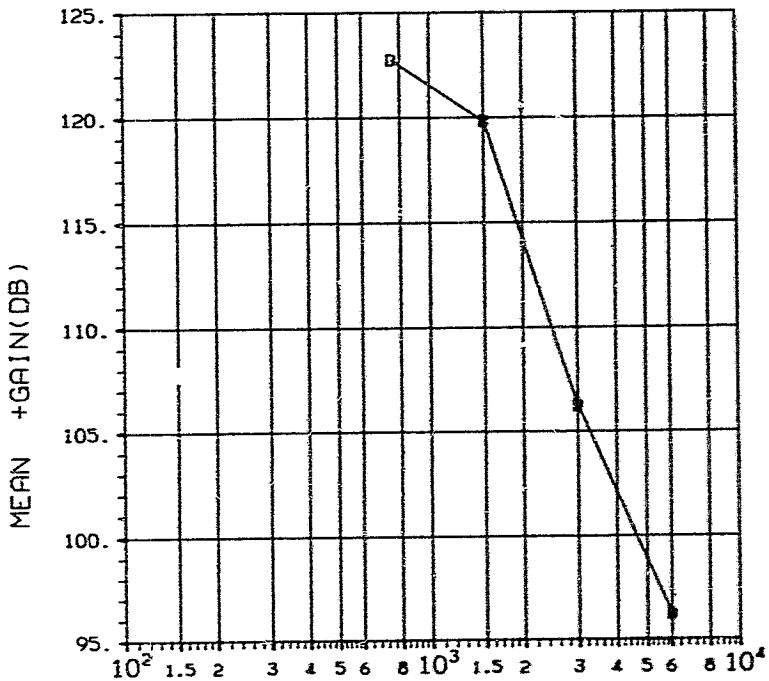
DEVICE TYPE: LM108 OP AMP RAD HARD
MFG: NSC 3 DEVICES TEST DATE 9-18-79
REF: JPL LOG 0475 DATE CODE NONE



(3) IB IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
C	.1558	.2775	.4668	.7558

DEVICE TYPE: LM108 OP AMP RAD HARD
MFG: NSC 3 DEVICES TEST DATE 9-18-79
REF: JPL LOG 0475 DATE CODE NONE



(4) + GAIN IN DB 10K LOAD=1MA, +10V VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	I_L (mA)	DOSE, kiloGy(Si)			
		.75	1.50	3.00	6.00
D	1.00	4.825	12.25	3.792	1.906

INITIAL MEAN VALUE +GAIN(DB) = $1.22X10^{+2}$

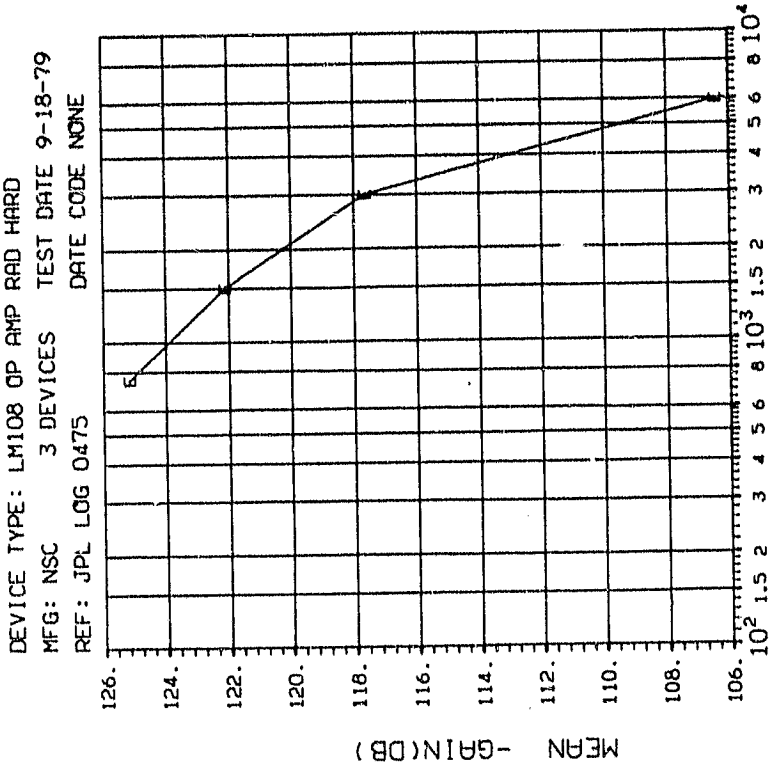


TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	I_L (mA)	DOSE, kiloGy(Si) .75	1.50	3.00	6.00
E	1.00	8.474	10.95	2.033	3.476

INITIAL MEAN VALUE -GAIN(DB) = $1.20X10^{+2}$

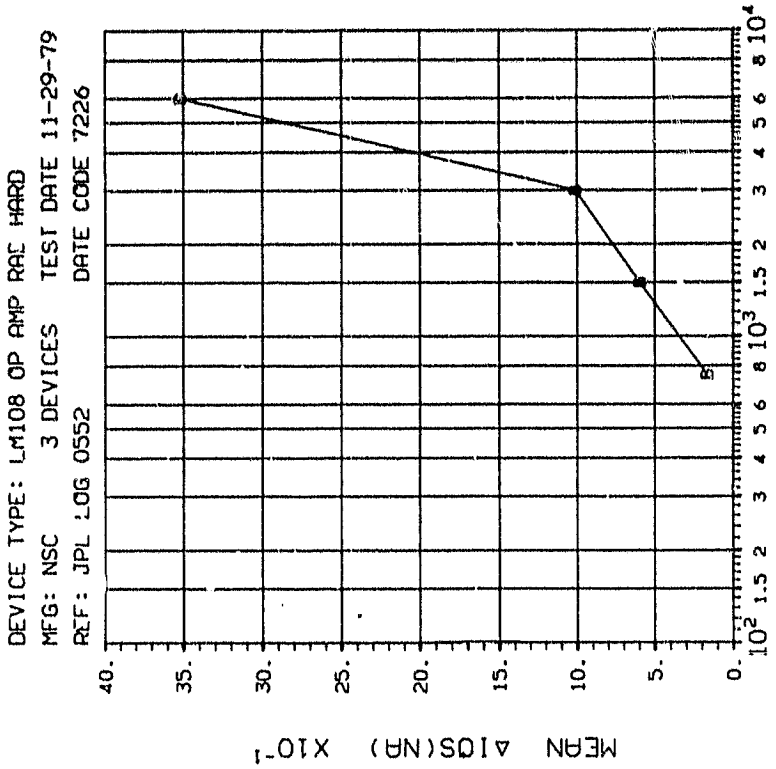


TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.75	1.50	3.00	6.00	
B	.1980	.4993	1.004	.8586	

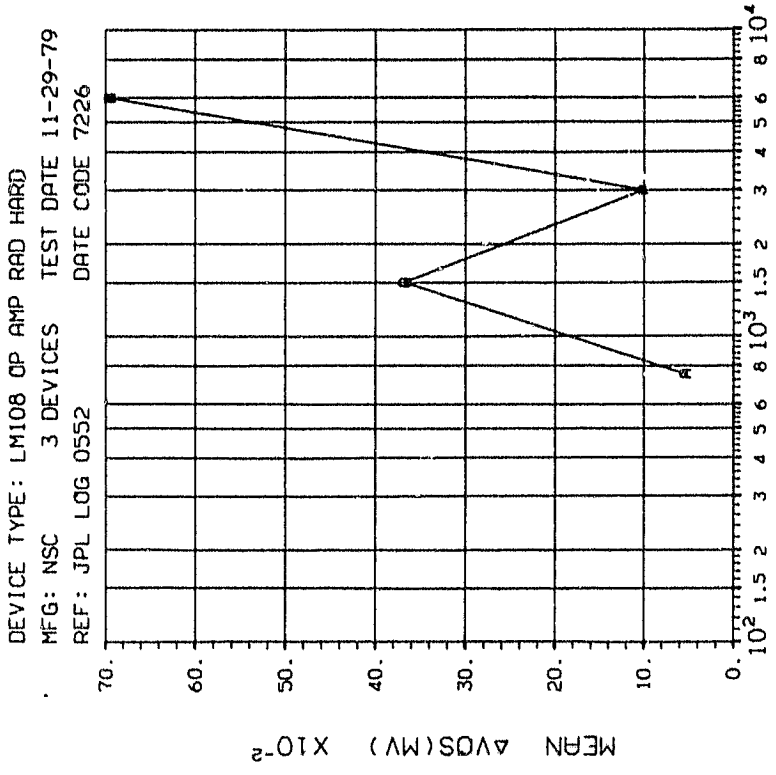
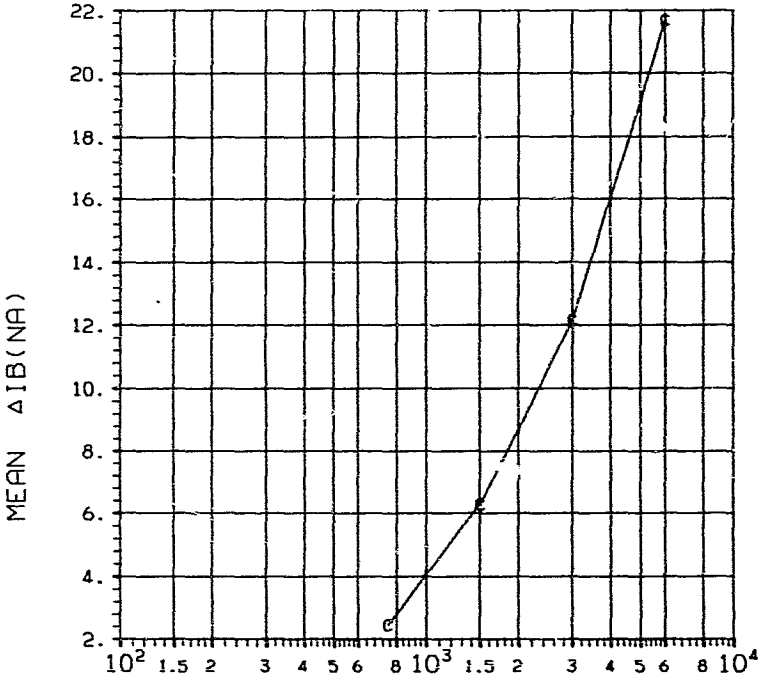


TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.75	1.50	3.00	6.00	
A	.0245	.0987	.2152	.5069	

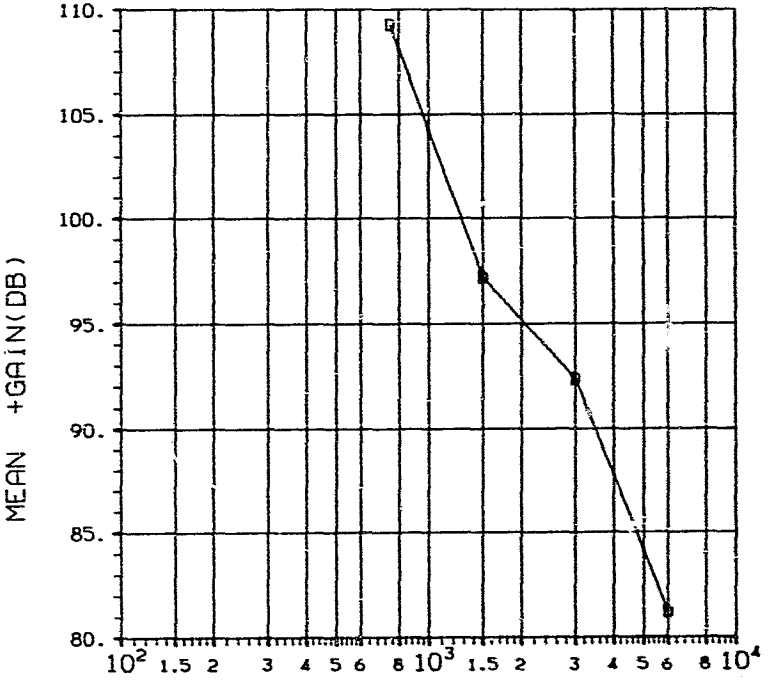
DEVICE TYPE: LM108 OP AMP RAD HARD
MFG: NSC 3 DEVICES TEST DATE 11-29-79
REF: JPL LOG 0552 DATE CODE 7226



(3) IB IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00	6.00
C	.1604	.0646	.1514	.5727

DEVICE TYPE: LM108 OP AMP RAD HARD
MFG: NSC 3 DEVICES TEST DATE 11-29-79
REF: JPL LOG 0552 DATE CODE 7226

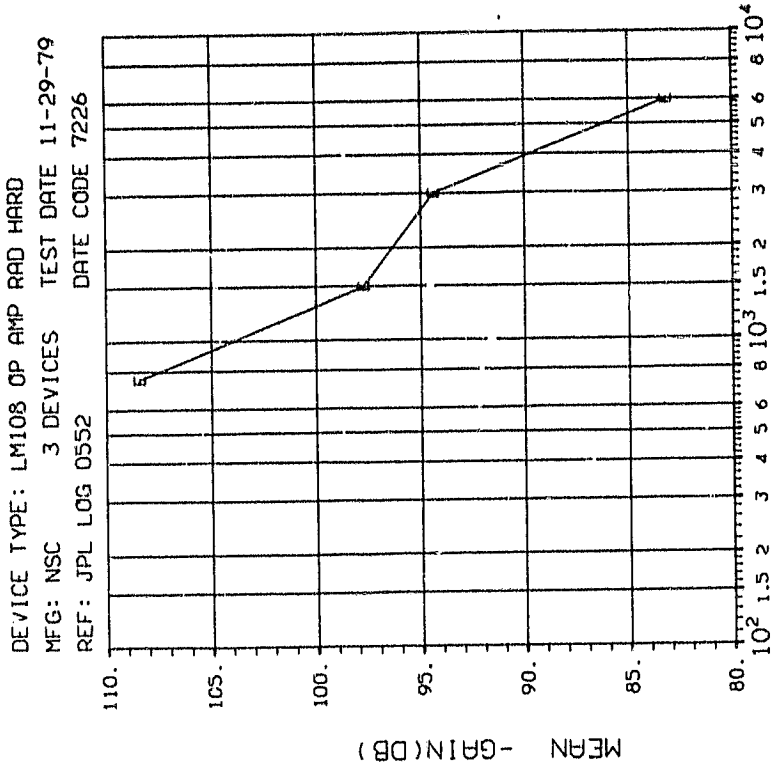


(4) + GAIN IN DB 10K LOAD=1MA, +10V VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	I_L (mA)	DOSE, kiloGy(Si) .75	1.50	3.00	6.00
D	1.00	3.361	1.119	2.639	1.121

INITIAL MEAN VALUE +GAIN(DB) = $1.14X10^{+2}$

ORIGINAL PAGE IS
OF POOR QUALITY



(5) - GAIN IN DB 10K LOAD=1MA, -10V VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	I_L (mA)	DOSE, kiloGy(Si) .75	1.50	3.00 6.00
E	1.00	4.128	1.461	3.583 2.903

INITIAL MEAN VALUE -GAIN(DB) = $1.15X10^{+2}$

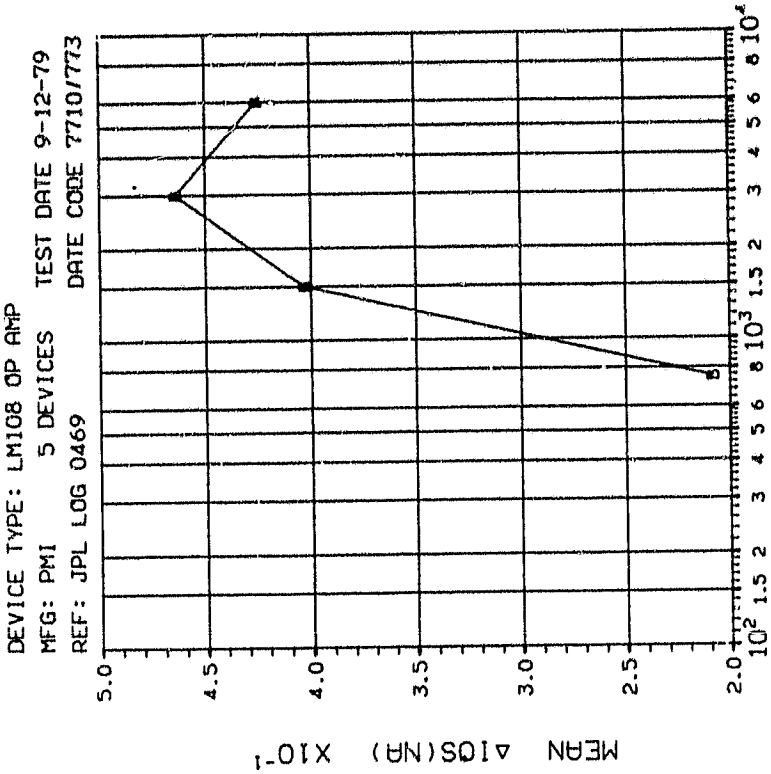


TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.75	1.50	3.00	6.00	
B	.2216	.2485	.3216	.3472	

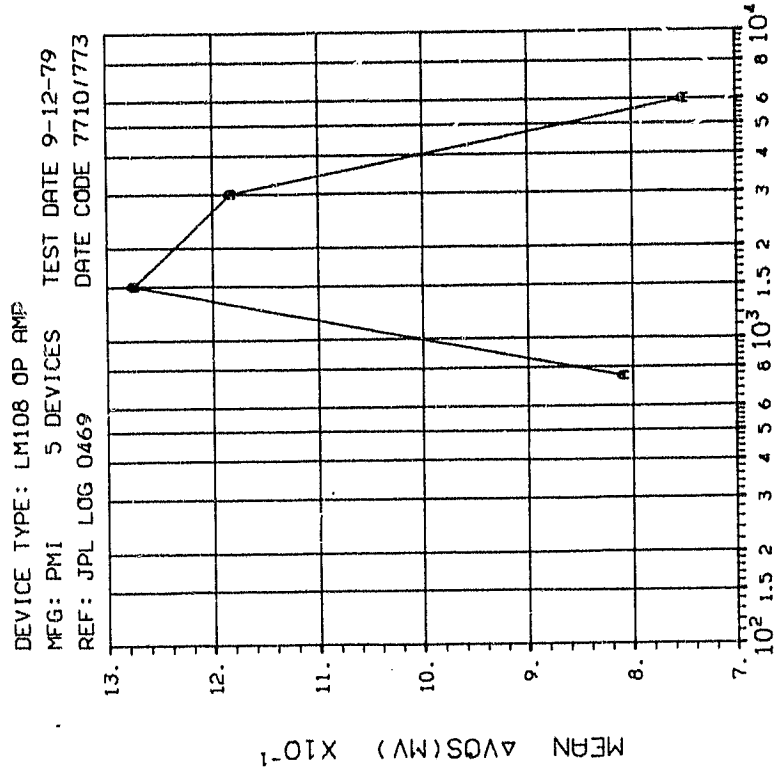
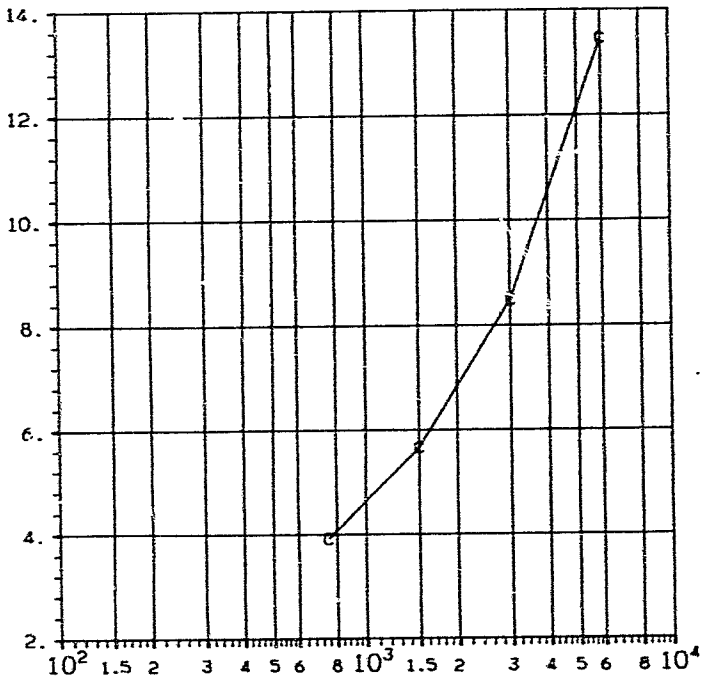


TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.75	1.50	3.00	6.00	
A	.6401	.9653	.9291	.7276	

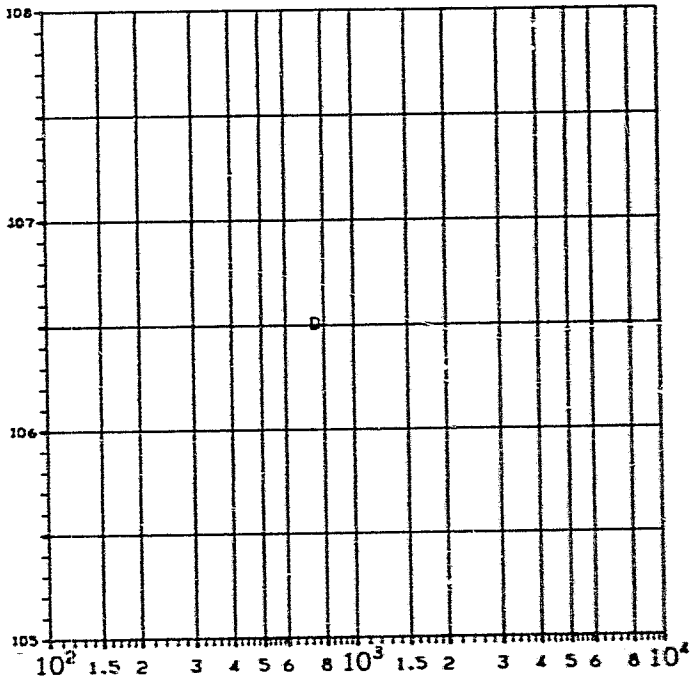
DEVICE TYPE: LM108 OP AMP
MFG: PMI 5 DEVICES TEST DATE 9-12-79
REF: JPL LOG 0469 DATE CODE 7710/773



(3) IB IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
C	1.979	2.717	3.700	5.575

DEVICE TYPE: LM108 OP AMP
MFG: PMI 5 DEVICES TEST DATE 9-12-79
REF: JPL LOG 0469 DATE CODE 7710/773



(4) + GAIN IN DB 5K LOAD = 2mA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	I_L (mA)	DOSE, kiloGy(Si)			
		.75	1.50	3.00	6.00
D	2.00	10.17	FAIL	FAIL	FAIL

INITIAL MEAN VALUE +GAIN(DB) = $1.18 \times 10^{+2}$

ORIGINAL PAGE IS
OF POOR QUALITY

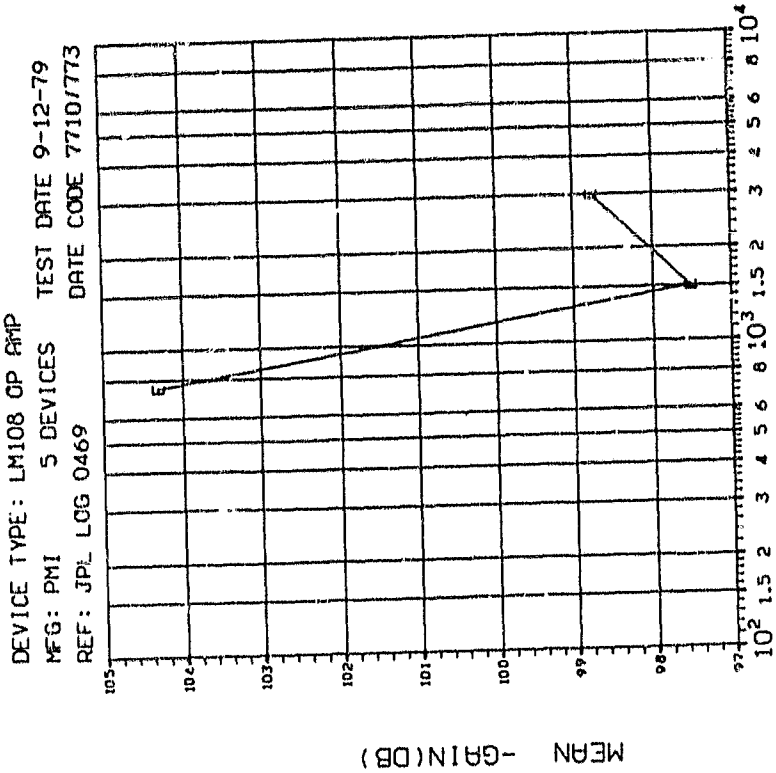
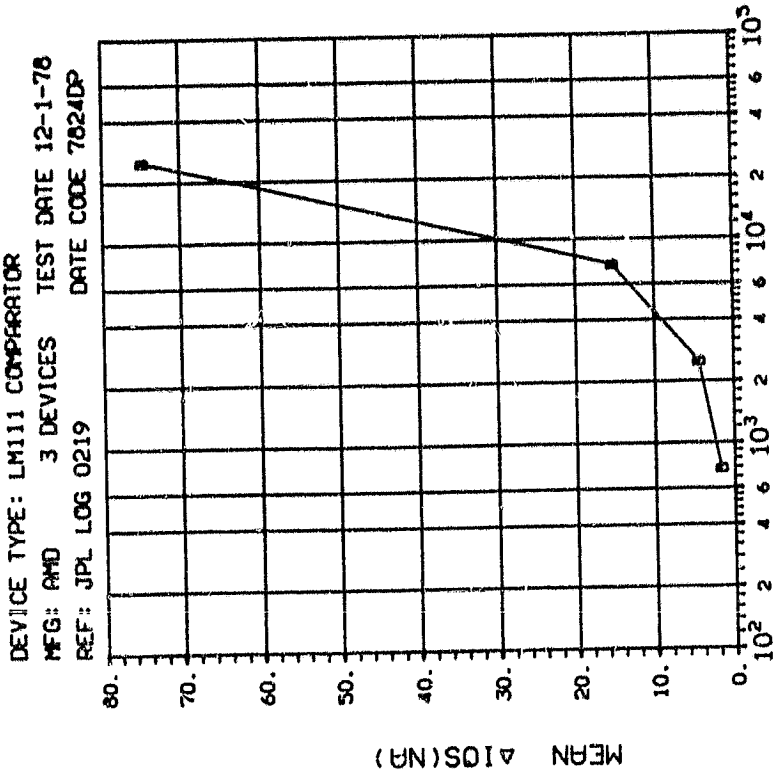


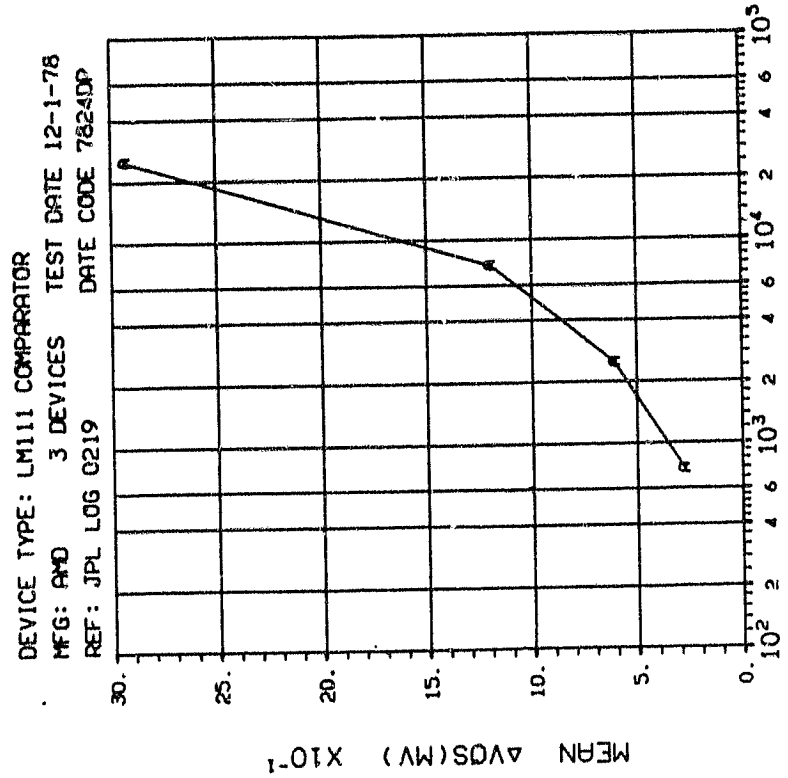
TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	I_L (mA)	DOSE, kiloGy(Si) .75	1.50	3.00	6.00
E	2.00	8.049	3.850	4.147	FAIL

INITIAL MEAN VALUE -GAIN(DB) = $1.24 \times 10^{+2}$



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	2.50	7.50	25.00
B	.8581	.7663	.5554	1.589



(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	2.50	7.50	25.00
A	.0939	.0837	.2061	.2861

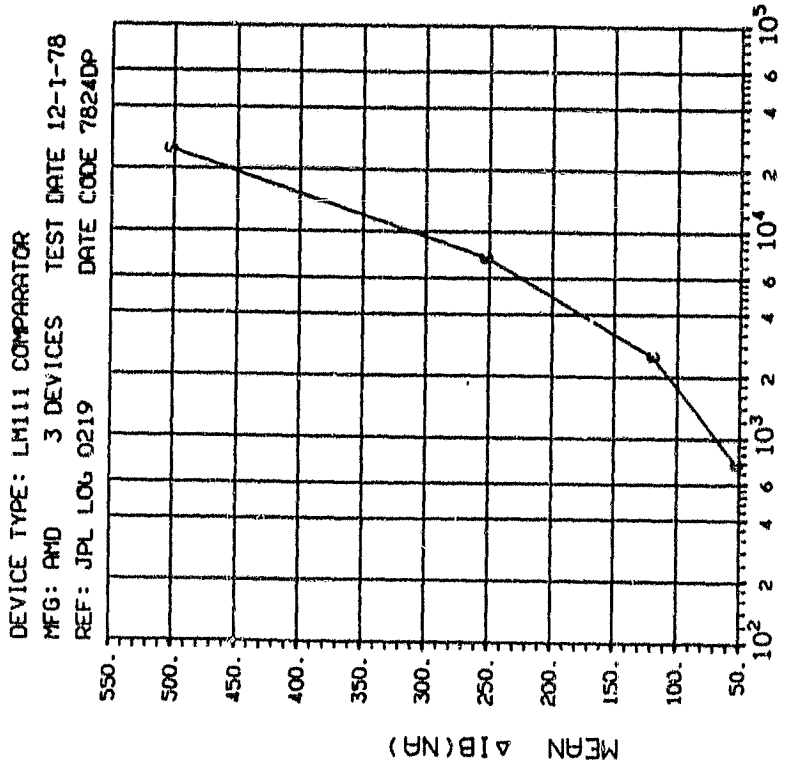
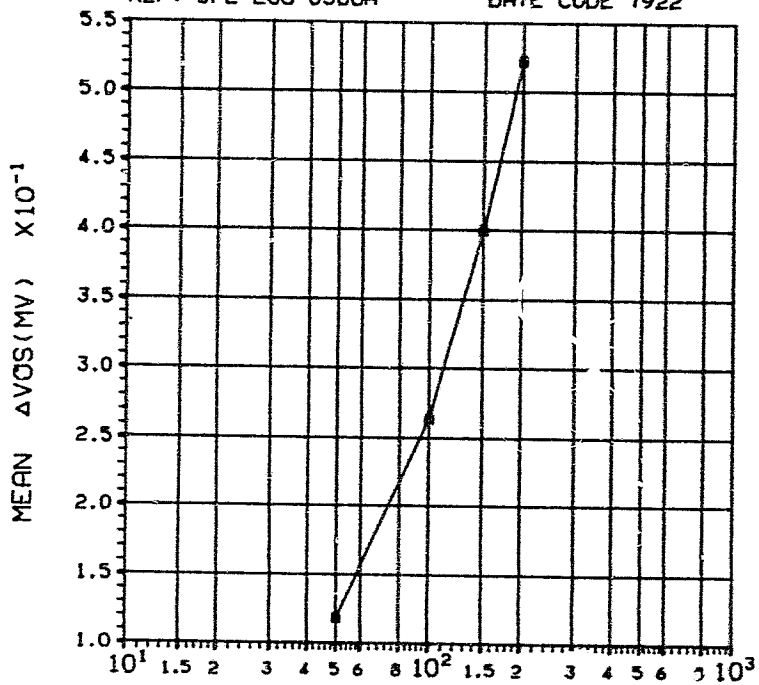


TABLE OF NORMAL STANDARD DEVIATIONS		
CURVE	DOSE, kiloGy(Si)	
	.75 2.50 7.50 25.00	
C	2.857 5.864 12.07 27.11	

DEVICE TYPE: LM111 COMPARATOR
MFG: AMD 8 DEVICES TEST DATE 10-16-79
REF: JPL LOG 0500A DATE CODE 7922

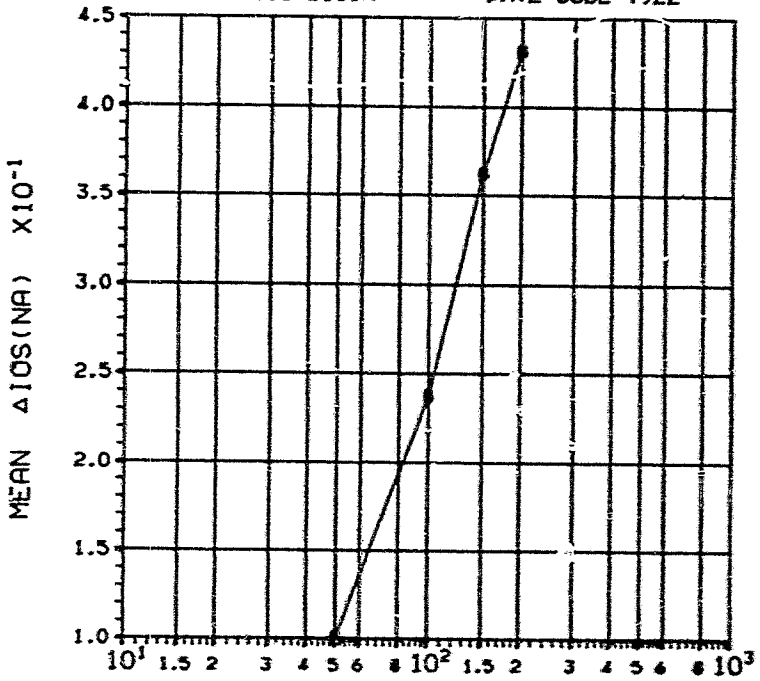


DOSE, Gy(Si) 2.5 MeV electrons

(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.05	.10	.15	.20
A	.0483	.0833	.1113	.1331

DEVICE TYPE: LM111 COMPARATOR
MFG: AMD 8 DEVICES TEST DATE 10-16-79
REF: JPL LOG 0500A DATE CODE 7922



DOSE, Gy(Si) 2.5 MeV electrons

(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.05	.10	.15	.20
B	.3350	.5668	1.068	1.678

ORIGINAL PAGE IS
OF POOR QUALITY

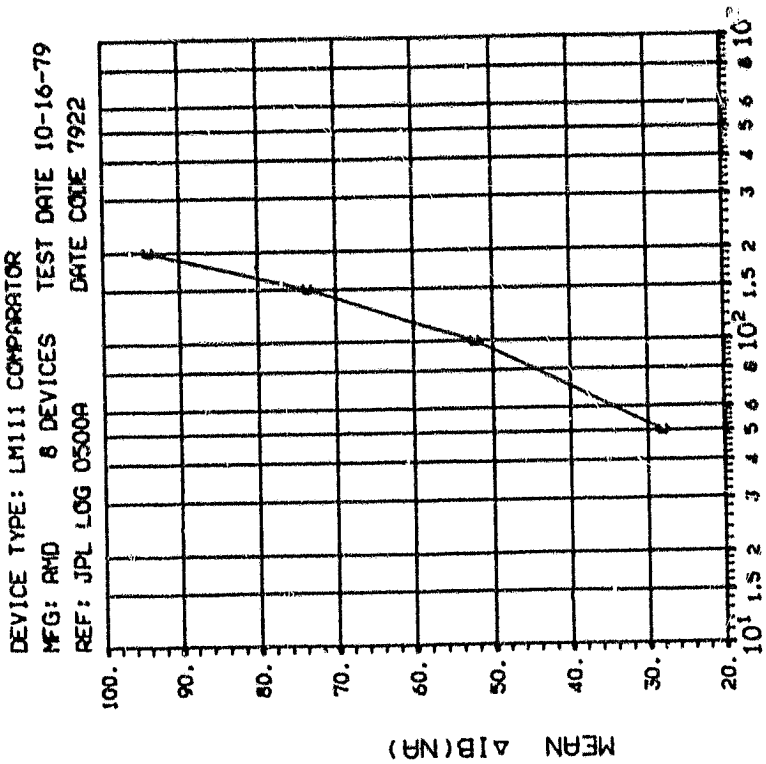
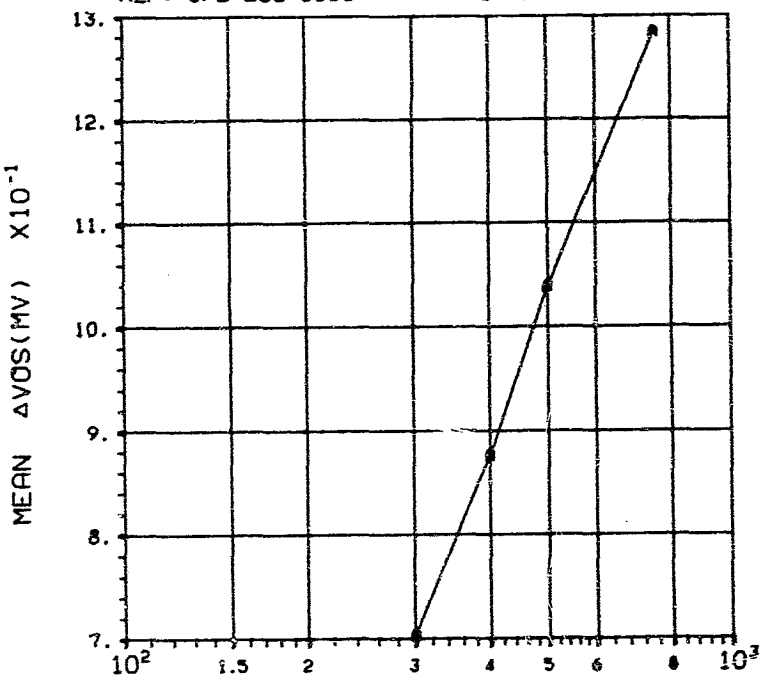


TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.05	.10	.15	.20	
C	9.860	22.51	36.09	49.79	

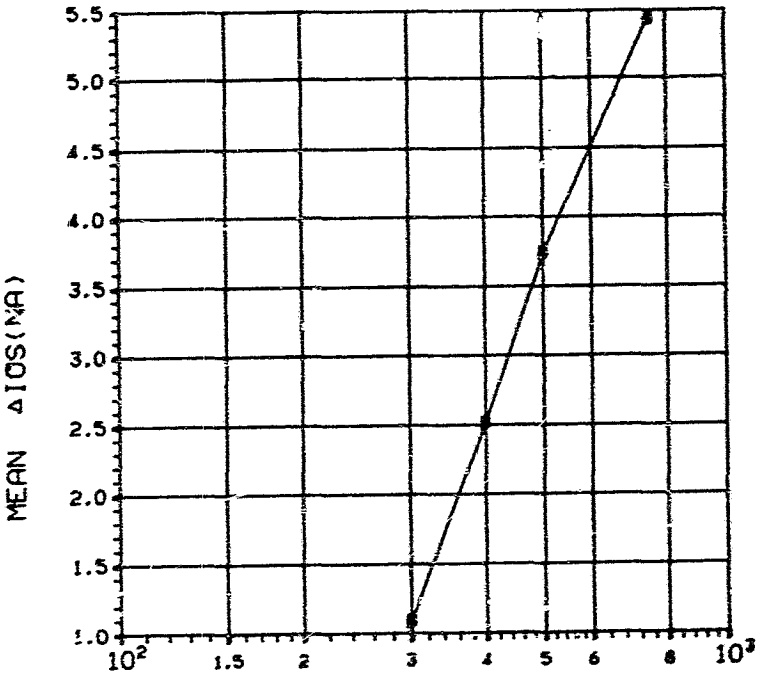
DEVICE TYPE: LM111 COMPARATOR
MFG: AMD 8 DEVICES TEST DATE 10-16-79
REF: JPL LOG 0500A DATE CODE 7922



(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.30	.40	.50	.75
A	.1712	.1988	.2544	.3143

DEVICE TYPE: LM111 COMPARATOR
MFG: AMD 8 DEVICES TEST DATE 10-16-79
REF: JPL LOG 0500A DATE CODE 7922



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.30	.40	.50	.75
B	3.240	4.068	4.727	4.476

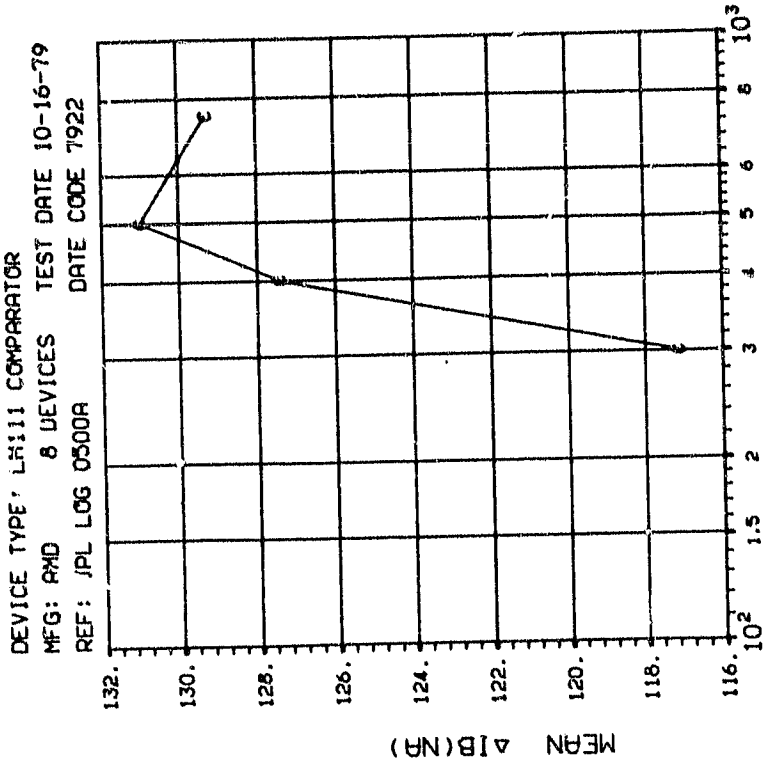
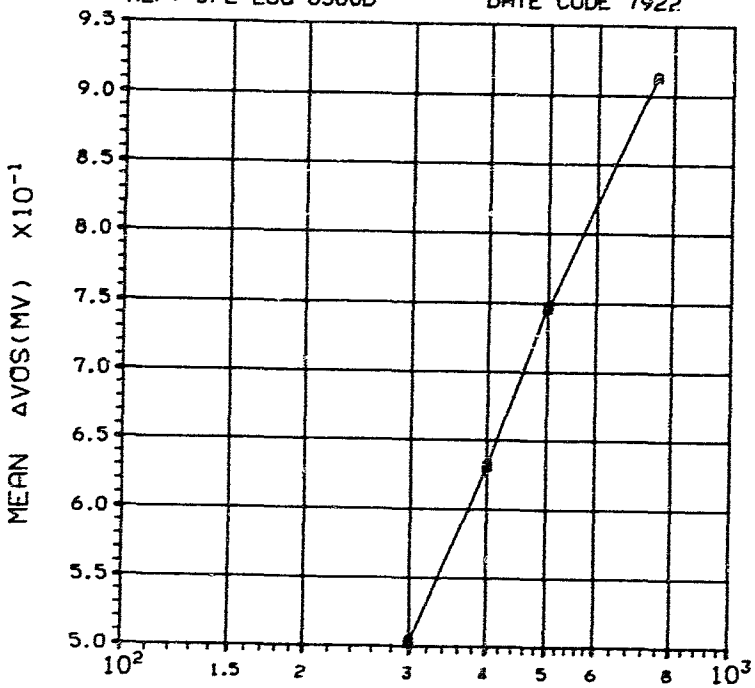


TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si) .30	.40	.50	.75	
C	64.48	69.78	69.90	76.59	

DEVICE TYPE: LM111 COMPARATOR
MFG: AMD 8 DEVICES TEST DATE 10-16-79
REF: JPL LOG 0500B DATE CODE 7922

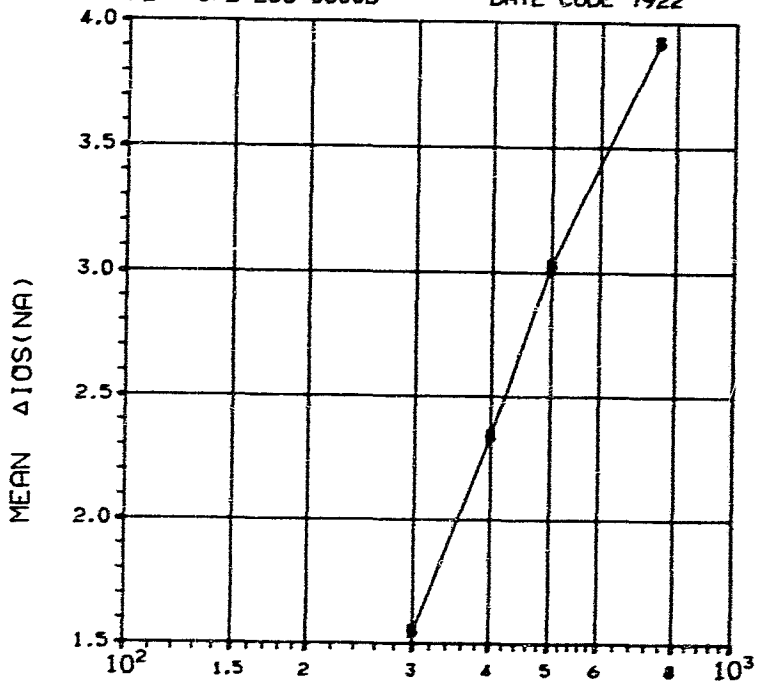


DOSE, Gy(Si) 2.5 MeV electrons

(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.30	.40	.50	.75
A	.2738	.3384	.4014	.4638

DEVICE TYPE: LM111 COMPARATOR
MFG: AMD 8 DEVICES TEST DATE 10-16-79
REF: JPL LOG 0500B DATE CODE 7922

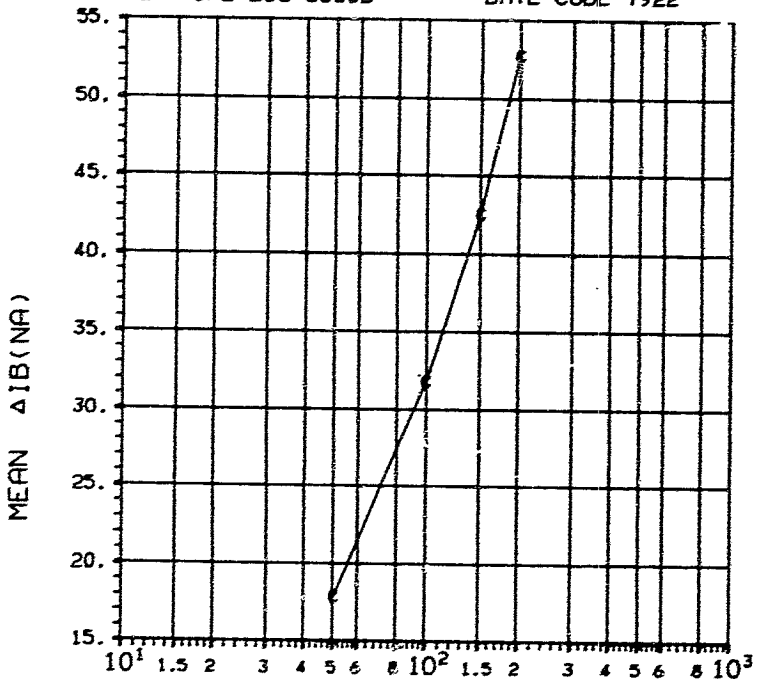


DOSE, Gy(Si) 2.5 MeV electrons

(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.30	.40	.50	.75
B	1.657	2.418	3.234	3.817

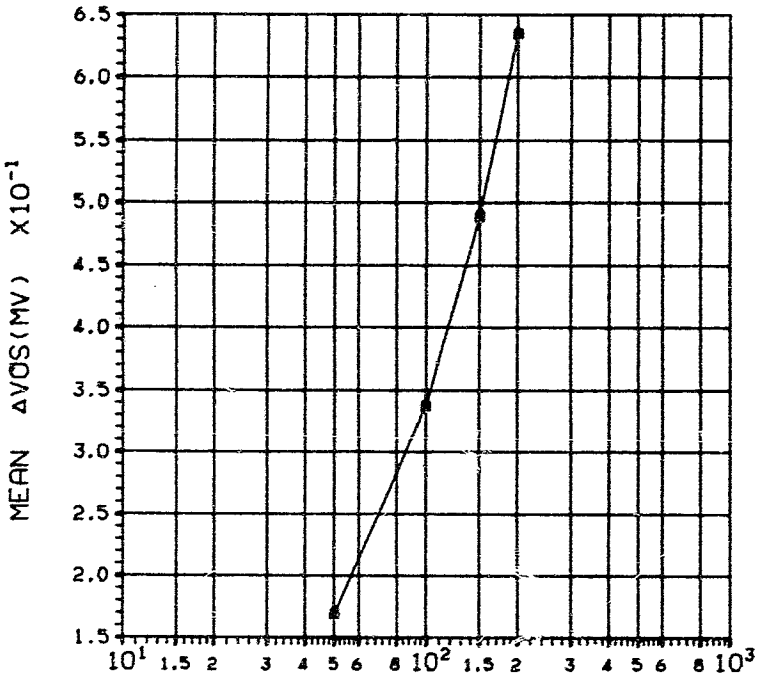
DEVICE TYPE: LM111 COMPARATOR
MFG: AMD 8 DEVICES TEST DATE 10-16-79
REF: JPL LOG 0500B DATE CODE 7922



(3) IB IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.05	.10	.15	.20
C	13.38	23.64	33.34	44.13

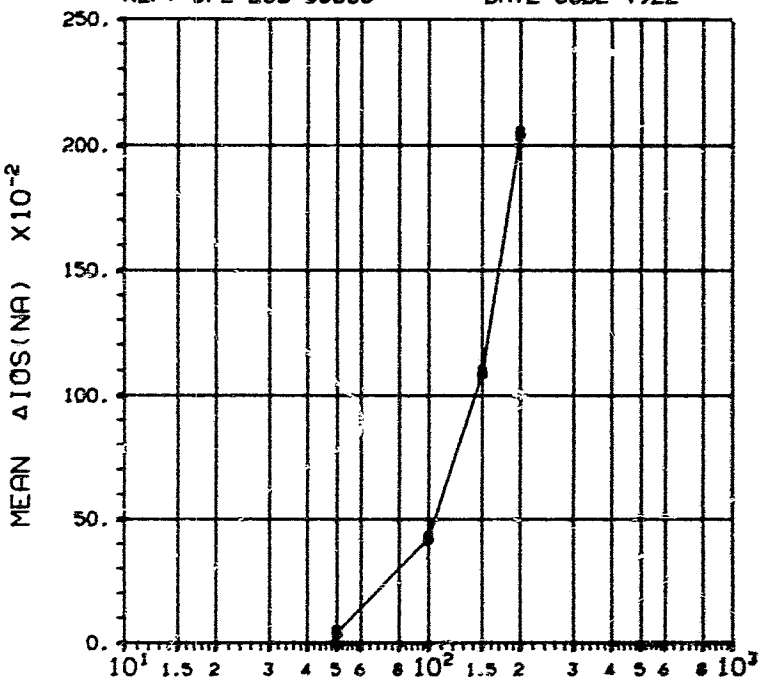
DEVICE TYPE: LM111 COMPARATOR
MFG: AMD 8 DEVICES TEST DATE 10-16-79
REF: JPL LOG 0500C DATE CODE 7922



(1) VOS IN MV VS DOSE

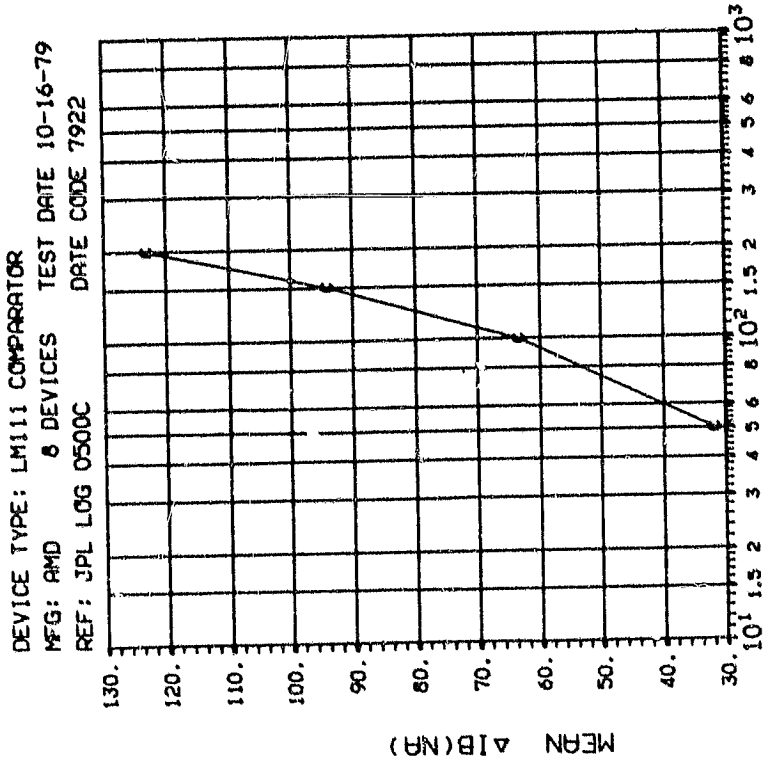
TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.05	.10	.15	.20
A	.0584	.1128	.1589	.2093

DEVICE TYPE: LM111 COMPARATOR
MFG: AMD 8 DEVICES TEST DATE 10-16-79
REF: JPL LOG 0500C DATE CODE 7922



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.05	.10	.15	.20
B	.4422	.6551	1.153	1.726

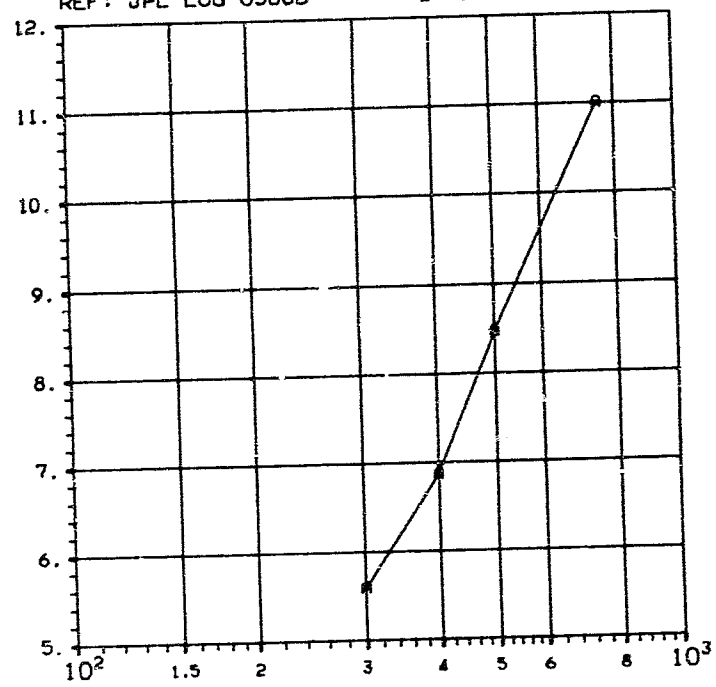


DOSE, Gy(Si) 2.5 MeV electrons

(3) IB IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, 4.11oGy(Si) .05	.10	.15	.20
C	12.67	25.53	37.80	49.22

DEVICE TYPE: LM111 COMPARATOR
MFG: AMD 8 DEVICES TEST DATE 10-16-79
REF: JPL LOG 0500D DATE CODE 7922

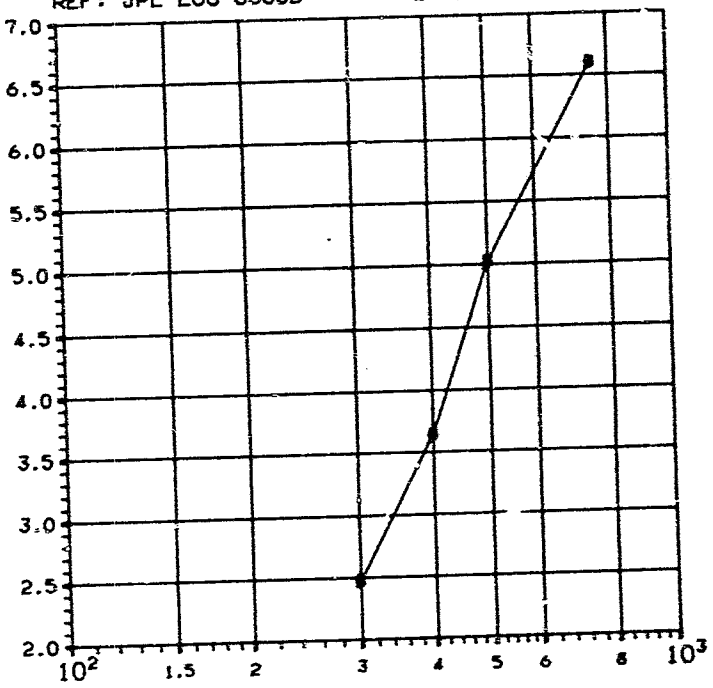


DOSE, Gy(Si) 2.5 MeV electrons

(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.30	.40	.50	.75
A	.3121	.3905	.4767	.6199

DEVICE TYPE: LM111 COMPARATOR
MFG: AMD 8 DEVICES TEST DATE 10-16-79
REF: JPL LOG 0500D DATE CODE 7922



DOSE, Gy(Si) 2.5 MeV electrons

(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.30	.40	.50	.75
B	3.208	4.673	6.230	7.801

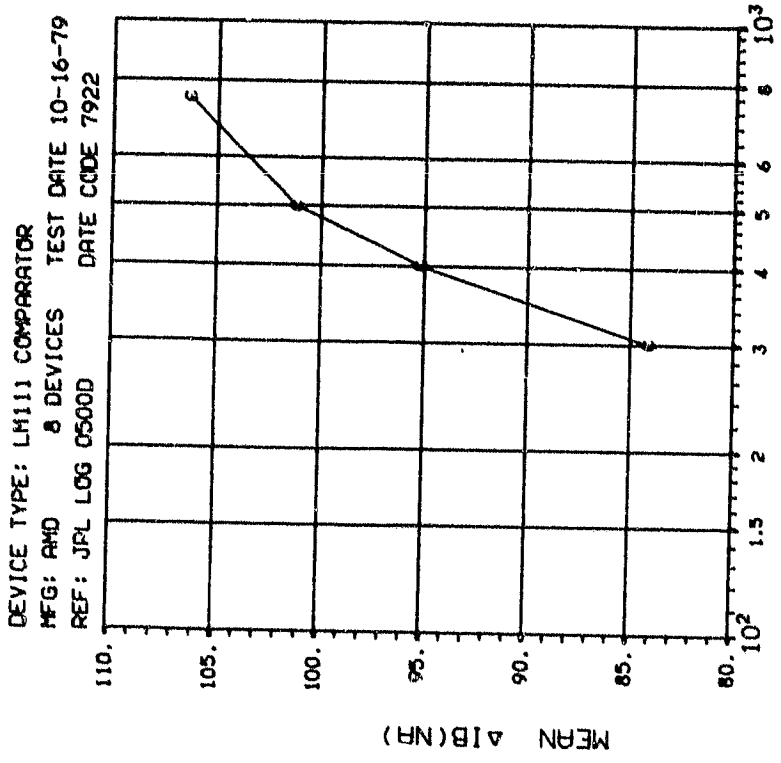


TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.30	.40	.50	.75	
C	81.98	88.45	84.83	78.87	

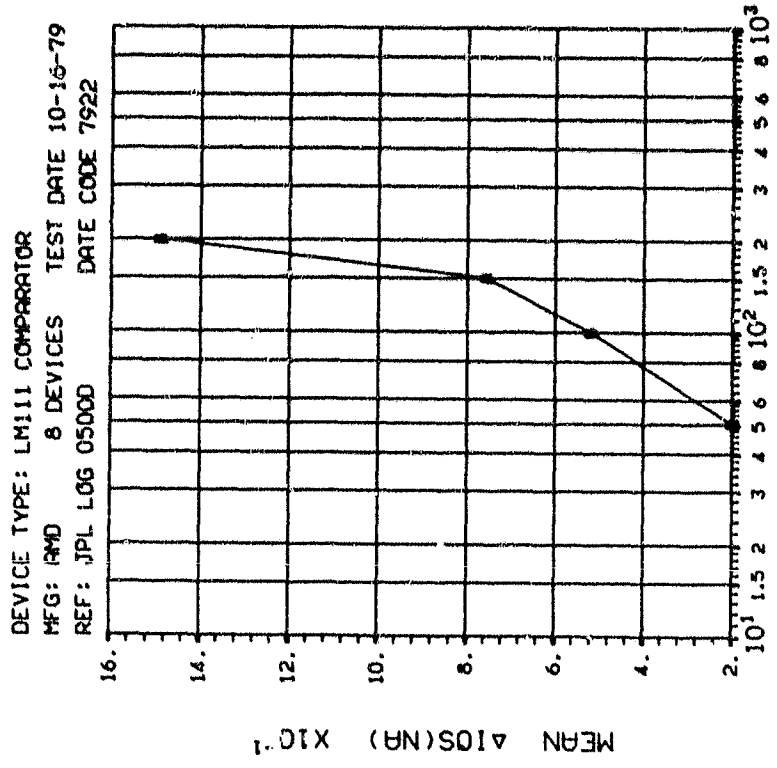


TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.05	.10	.15	.20
B	.2891	.4748	1.083	1.769

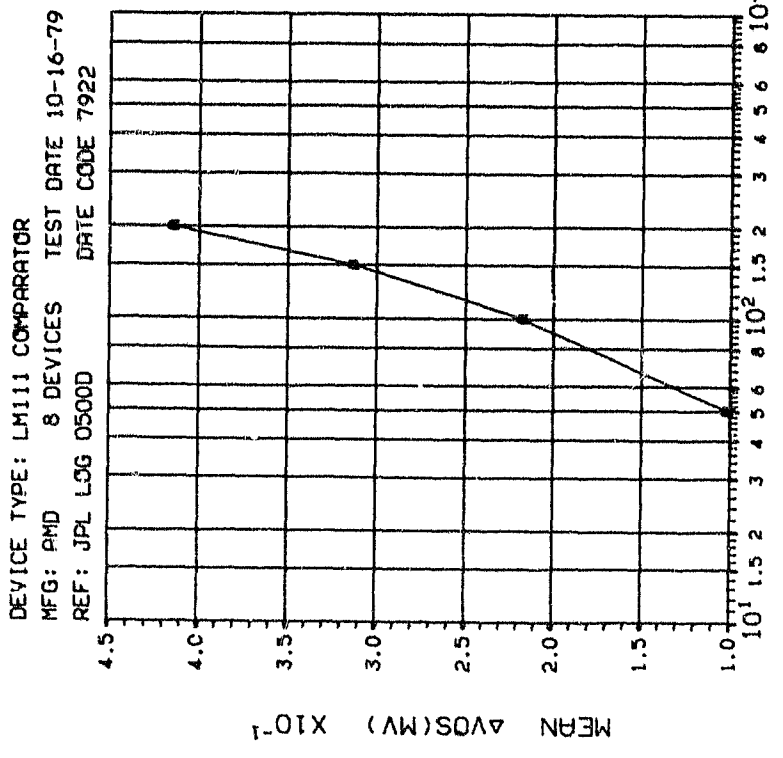


TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.05	.10	.15	.20
A	.0766	.1381	.1829	.2353

ORIGINAL PAGE IS
OF POOR QUALITY

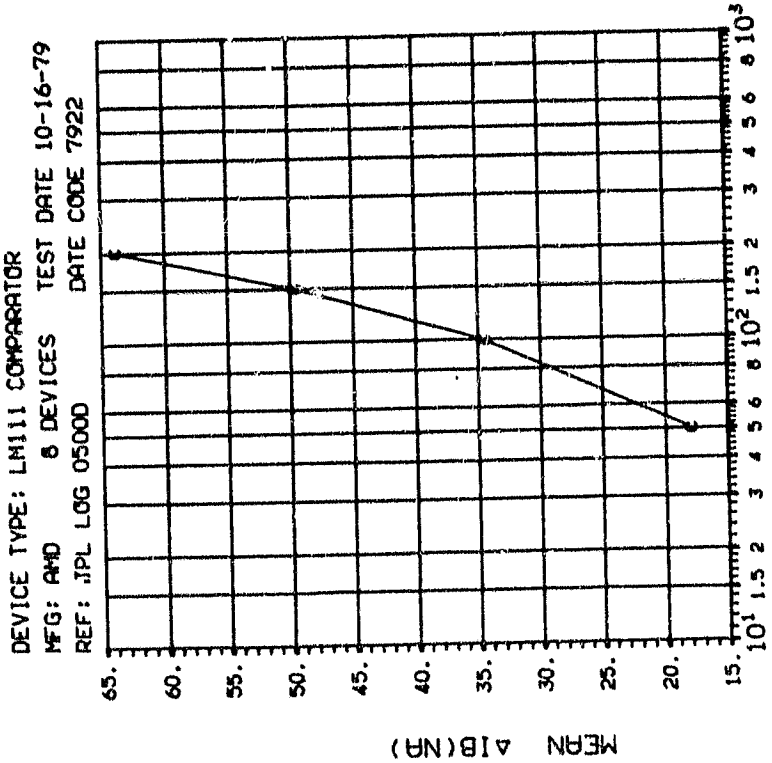
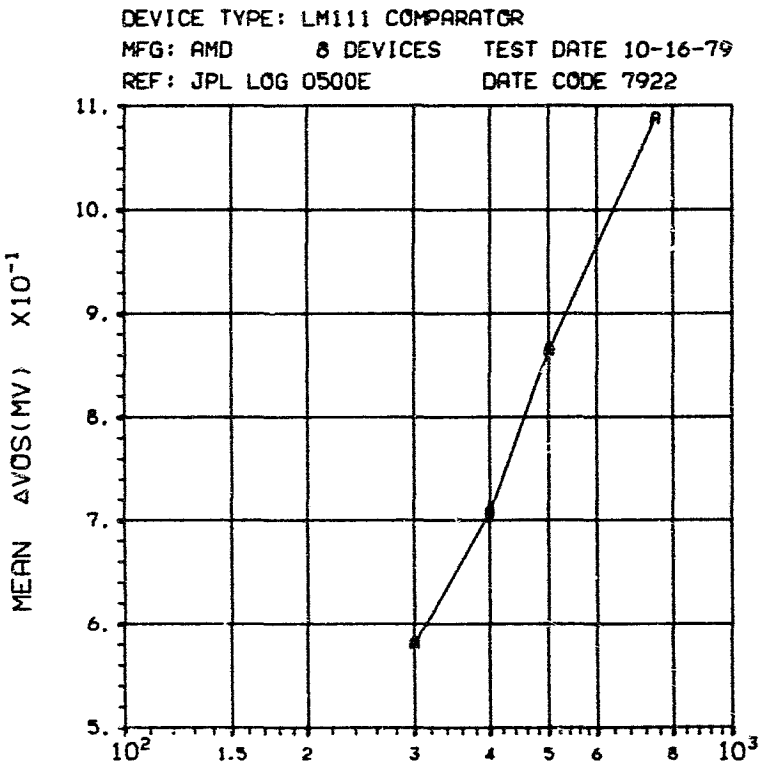
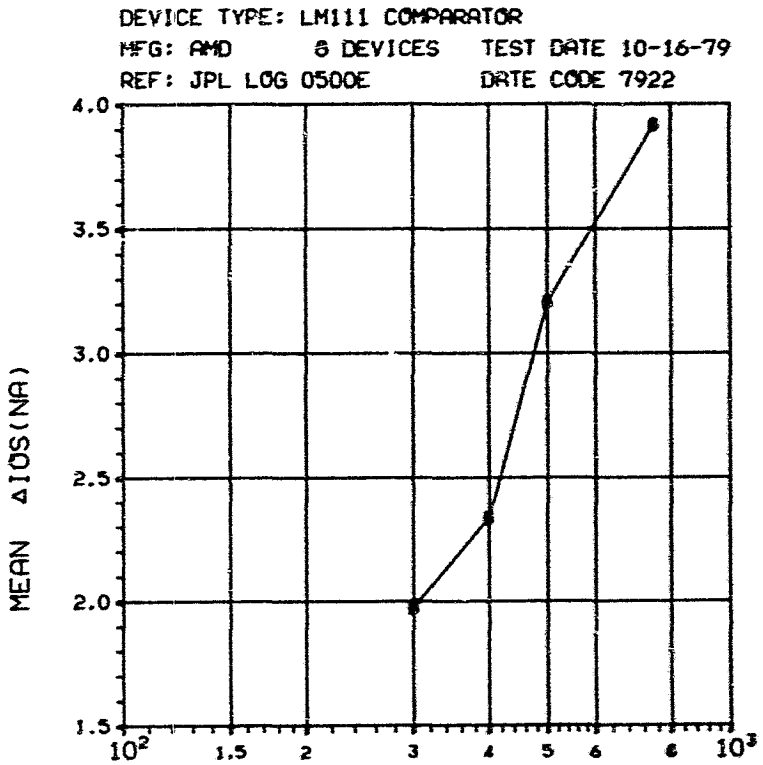


TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.05	.10	.15	.20
C	14.83	30.30	46.12	61.30



(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si) .30	.40	.50	.75
A	.3629	.4338	.5222	.6424



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si) .30	.40	.50	.75
B	1.515	1.814	2.079	2.835

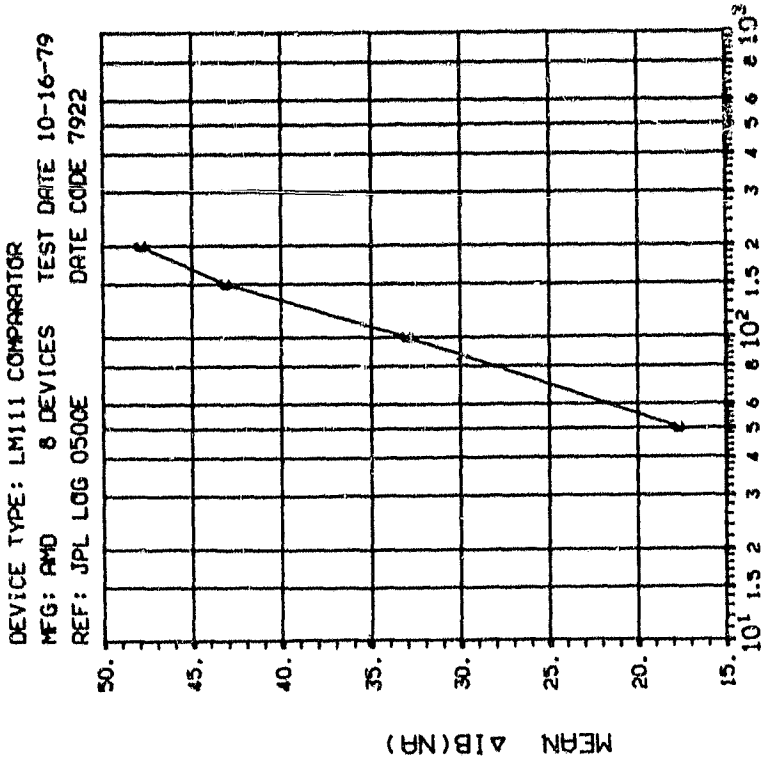


TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.05	.10	.15	.20
C	13.37	24.91	32.50	34.67

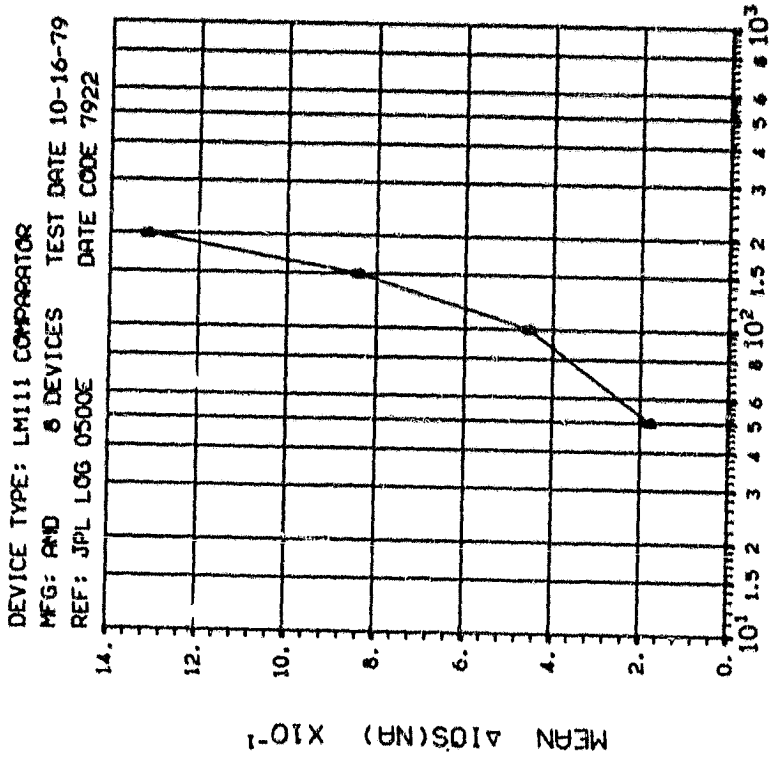


TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.05	.10	.15	.20
A	.0911	.1617	.2312	.2896

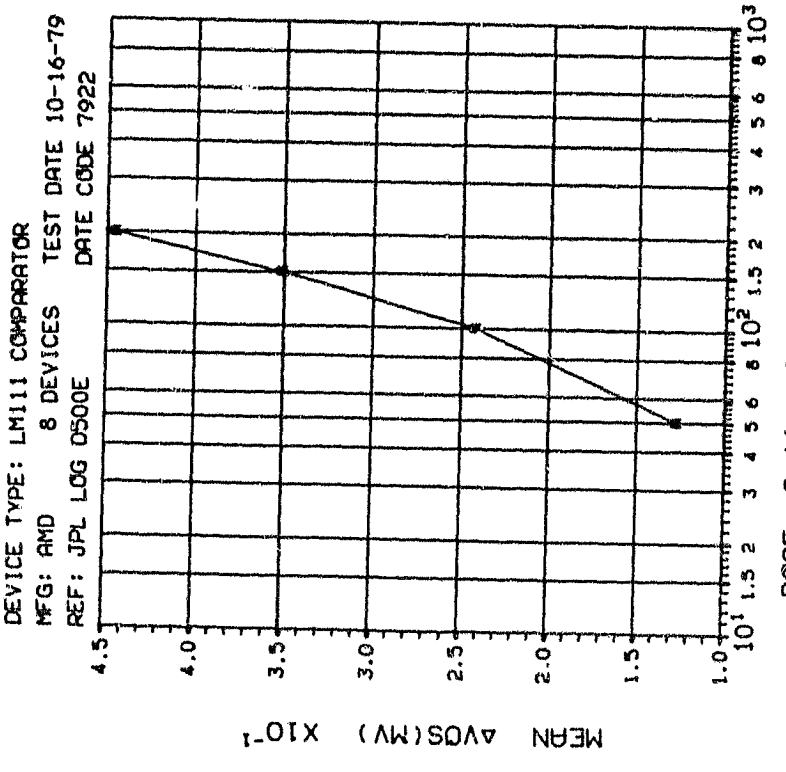


TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.05	.10	.15	.20
B	.3221	.6459	.7986	1.088

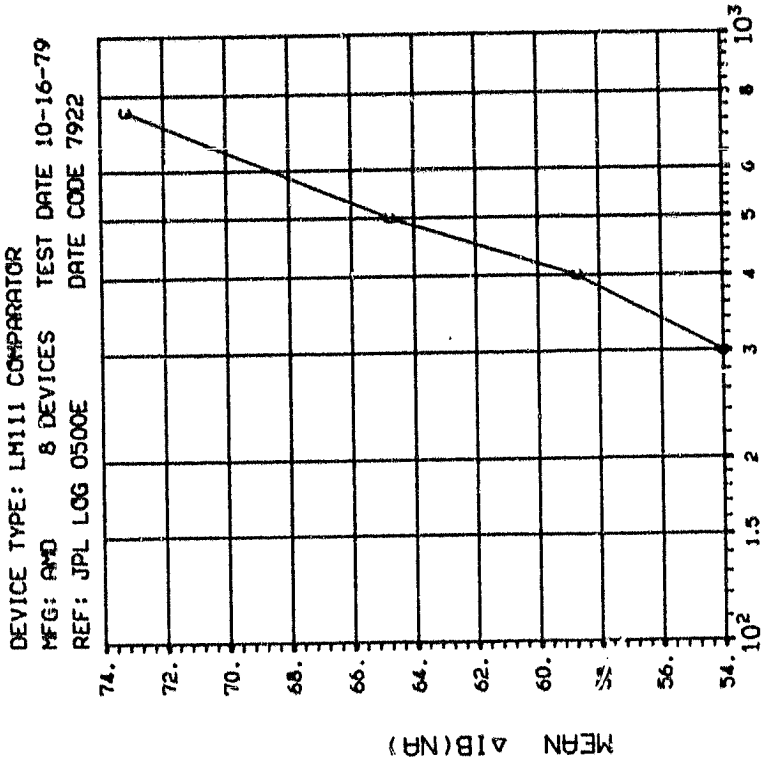


TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si) .30	.40	.50	.75
C	33.60	32.20	30.82	27.19

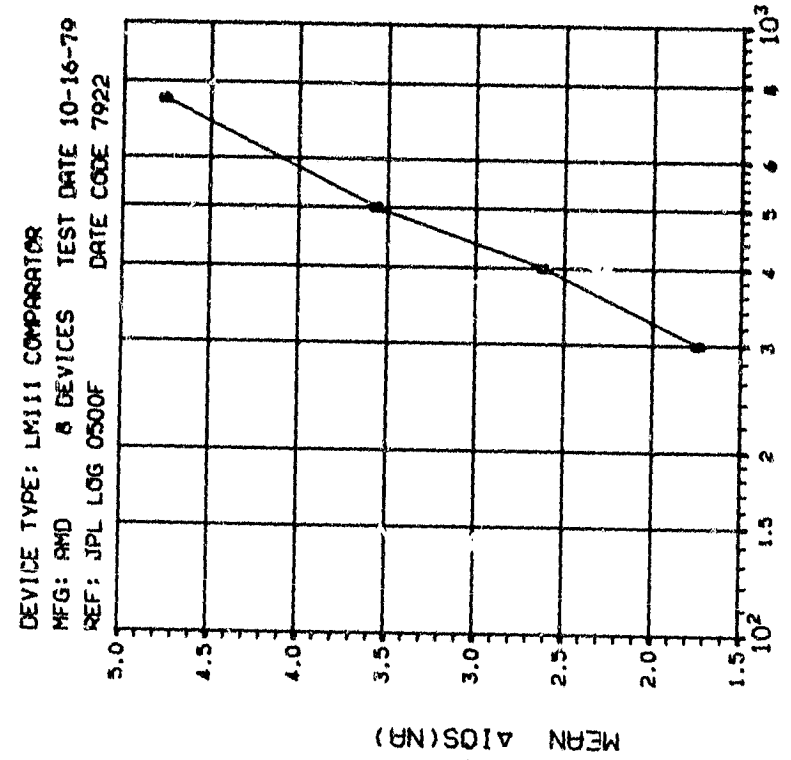


TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(SI)			
	.30	.40	.50	.75
B	1.497	2.750	3.708	4.851

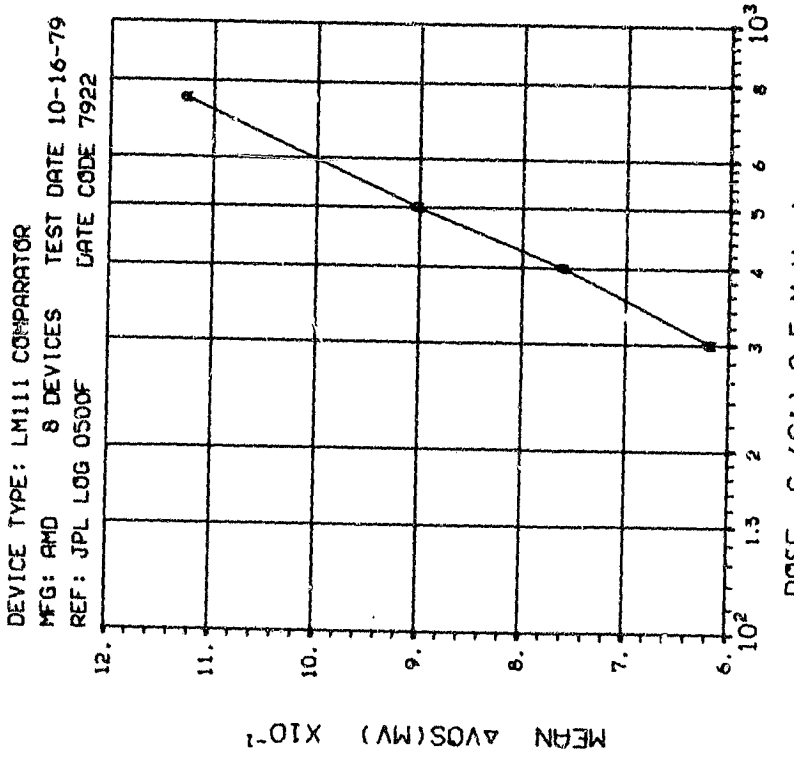


TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(SI)			
	.30	.40	.50	.75
A	.2936	.3627	.4309	.5291

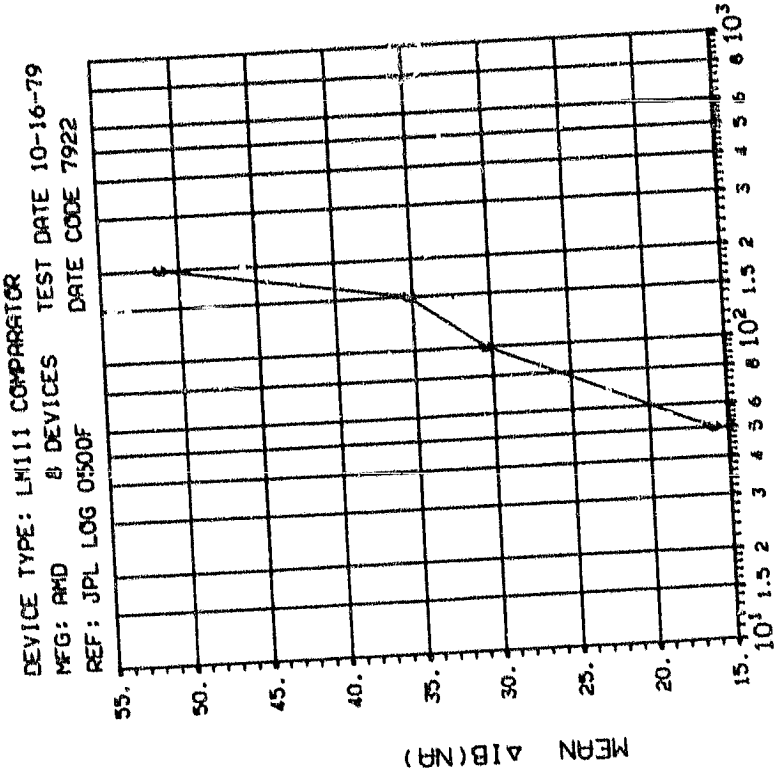
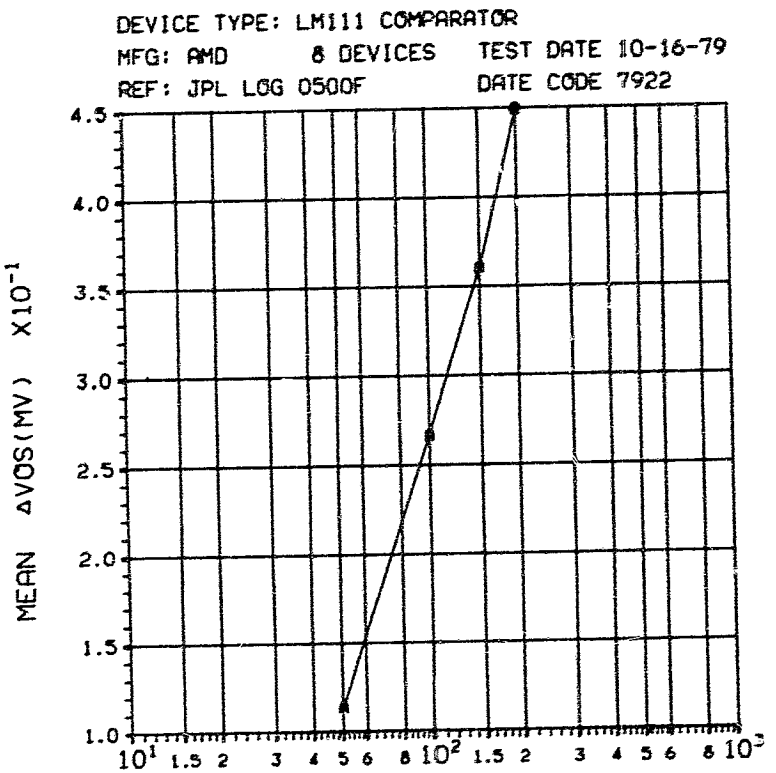
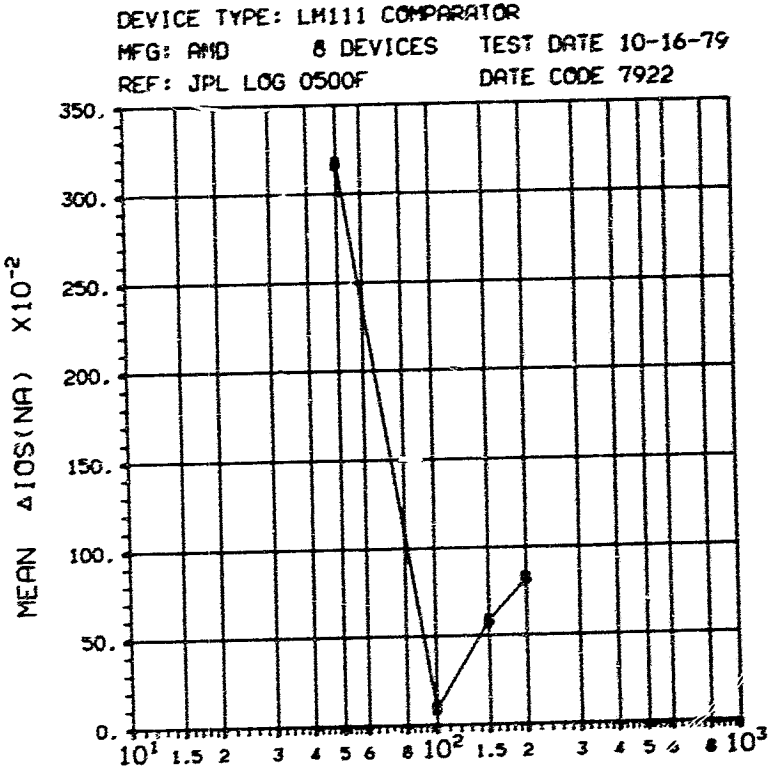


TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.05	.10	.15	.20
C	9.174	22.12	25.16	44.41



(1) VOS IN MV VS DOSE

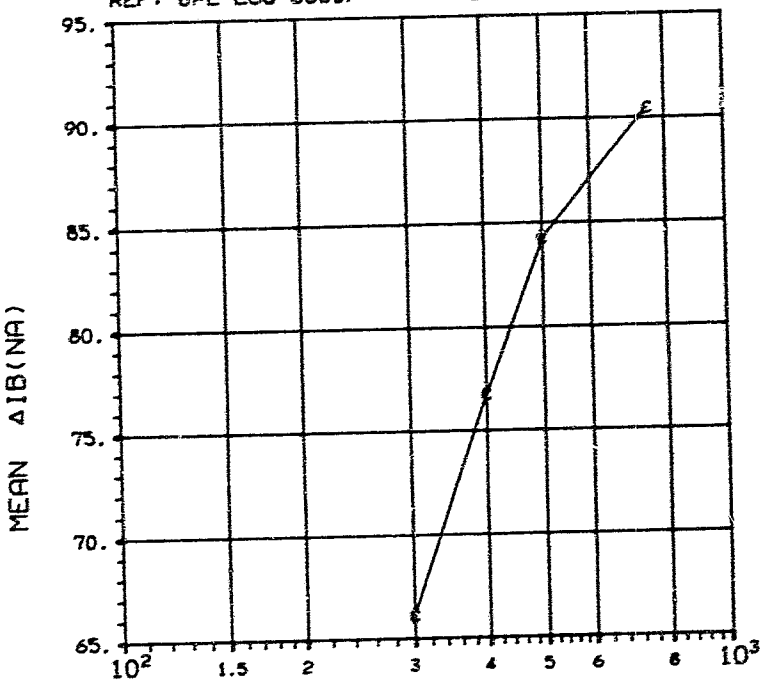
TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.05	.10	.15	.20
A	.0697	.1374	.1829	.2231



(2) IOS IN NA VS DOSE

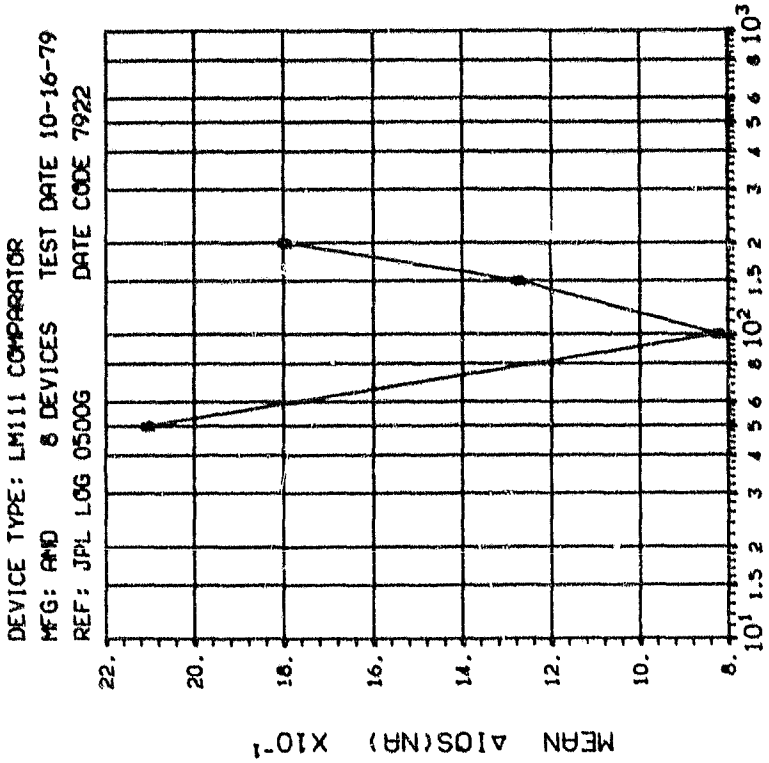
TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.05	.10	.15	.20
B	12.49	1.199	.5942	.7954

DEVICE TYPE: LM111 COMPARATOR
MFG: AMD 8 DEVICES TEST DATE 10-16-79
REF: JPL LOG 0500F DATE CODE 7922



(3) IB IN NA VS DOSE

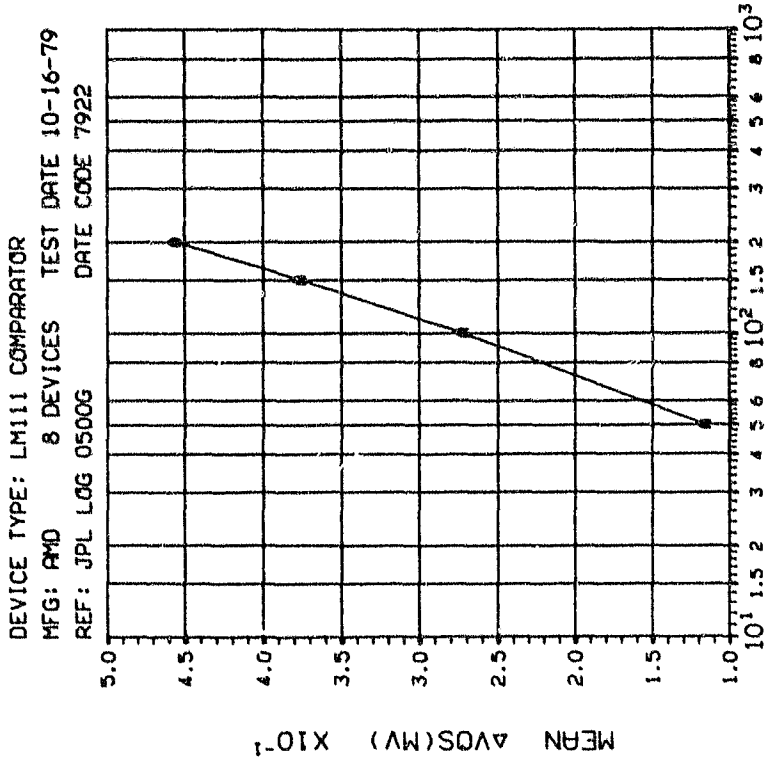
TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(SI)			
	.30	.40	.50	.75
C	61.64	72.63	76.31	71.56



DOSE, Gy(Si) 2.5 MeV electrons

(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.05	.10	.15	.20
B	6.357	.7796	1.292	1.929

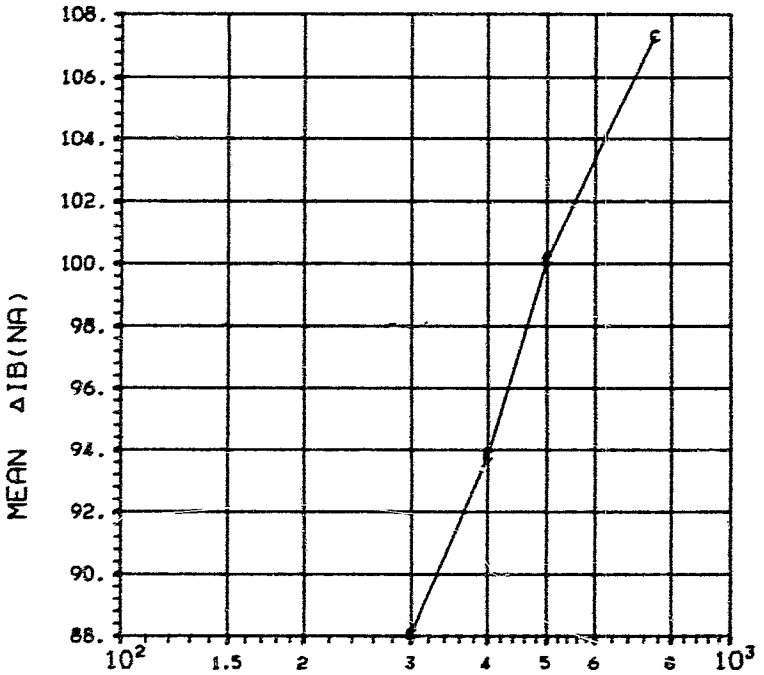


DOSE, Gy(Si) 2.5 MeV electrons

(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.05	.10	.15	.20
A	.0585	.1048	.1477	.1764

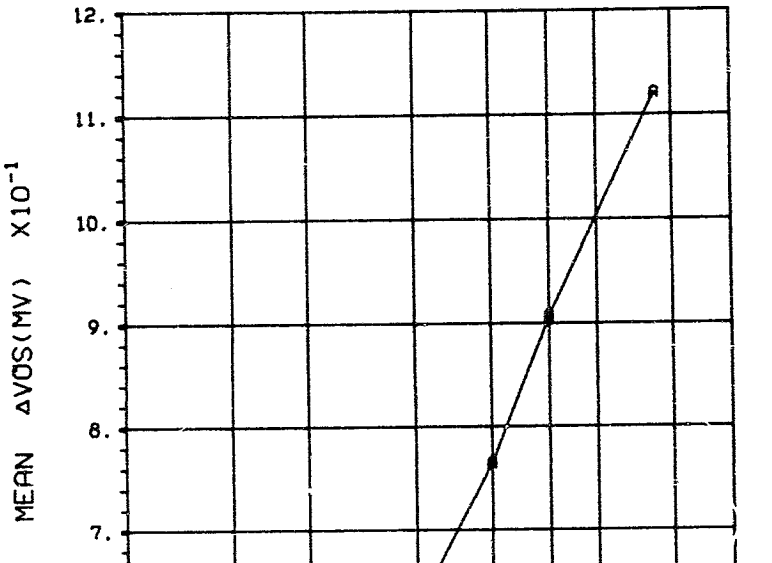
DEVICE TYPE: LM111 COMPARATOR
MFG: AMD 8 DEVICES TEST DATE 10-16-79
REF: JPL LOG 0500G DATE CODE 7922



(3) IB IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.30	.40	.50	.75
C	70.10	70.25	69.45	63.52

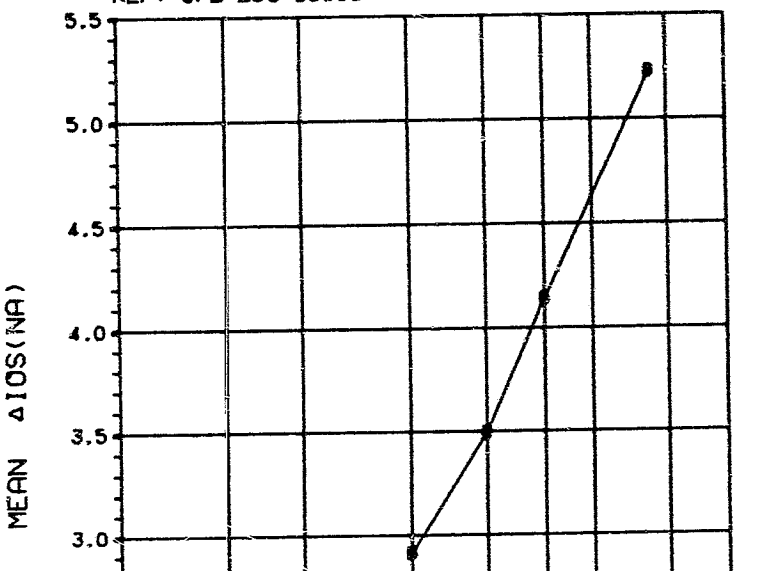
DEVICE TYPE: LM111 COMPARATOR
MFG: AMD 8 DEVICES TEST DATE 10-16-79
REF: JPL LOG 0500G DATE CODE 7922



(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.30	.40	.50	.75
A	.2390	.2969	.3614	.4618

DEVICE TYPE: LM111 COMPARATOR
MFG: AMD 8 DEVICES TEST DATE 10-16-79
REF: JPL LOG 0500G DATE CODE 7922



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.30	.40	.50	.75
B	2.834	3.533	4.107	5.396

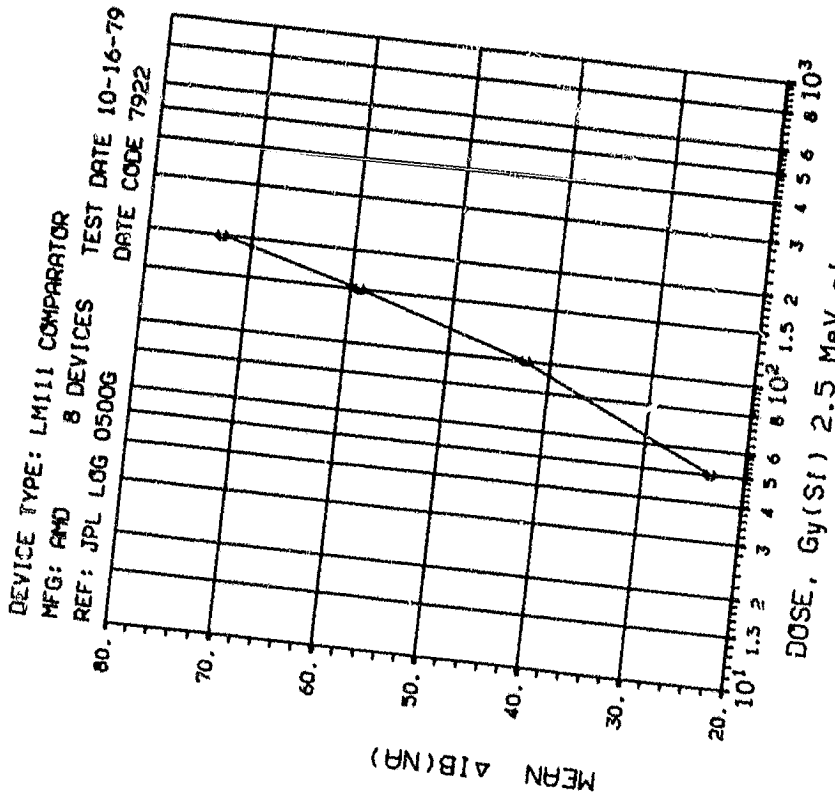
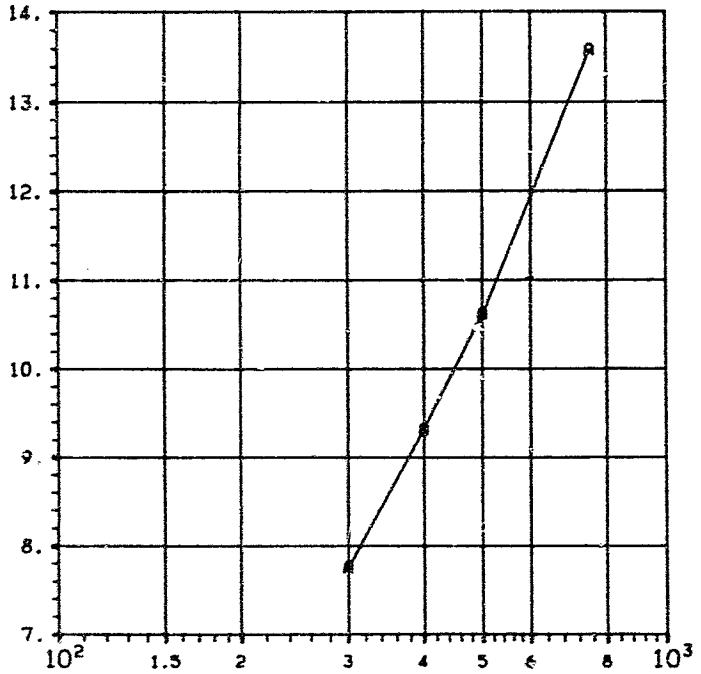


TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.05	.10	.15	.20
C	12.64	27.43	43.09	56.86

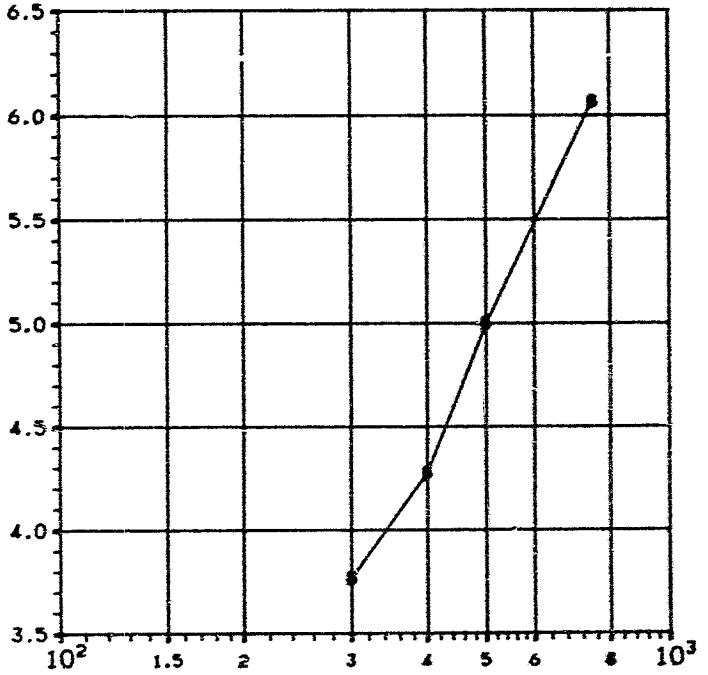
DEVICE TYPE: LM111 COMPARATOR
MFG: AMD 7 DEVICES TEST DATE 10-16-79
REF: JPL LOG 05001 DATE CODE 7922



(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.30	.40	.50	.75
A	.4216	.5049	.5420	.7032

DEVICE TYPE: LM111 COMPARATOR
MFG: AMD 7 DEVICES TEST DATE 10-16-79
REF: JPL LOG 05001 DATE CODE 7922



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.30	.40	.50	.75
B	4.946	5.246	5.846	6.675

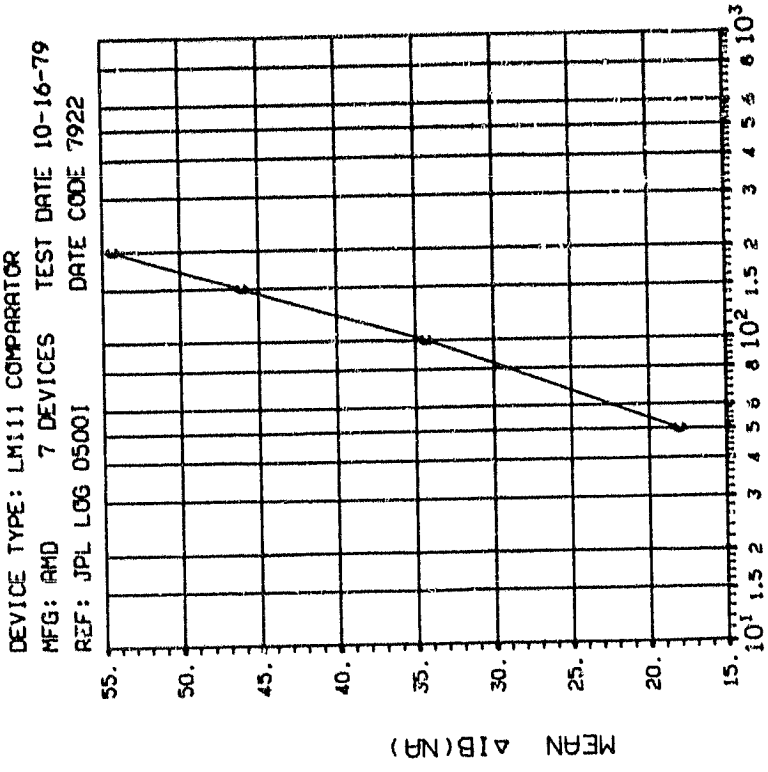
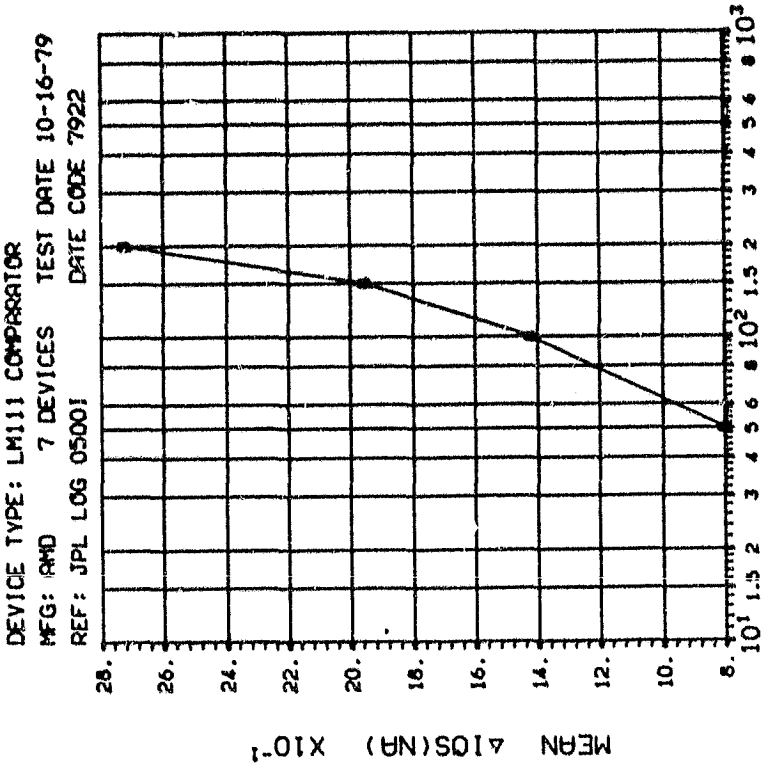


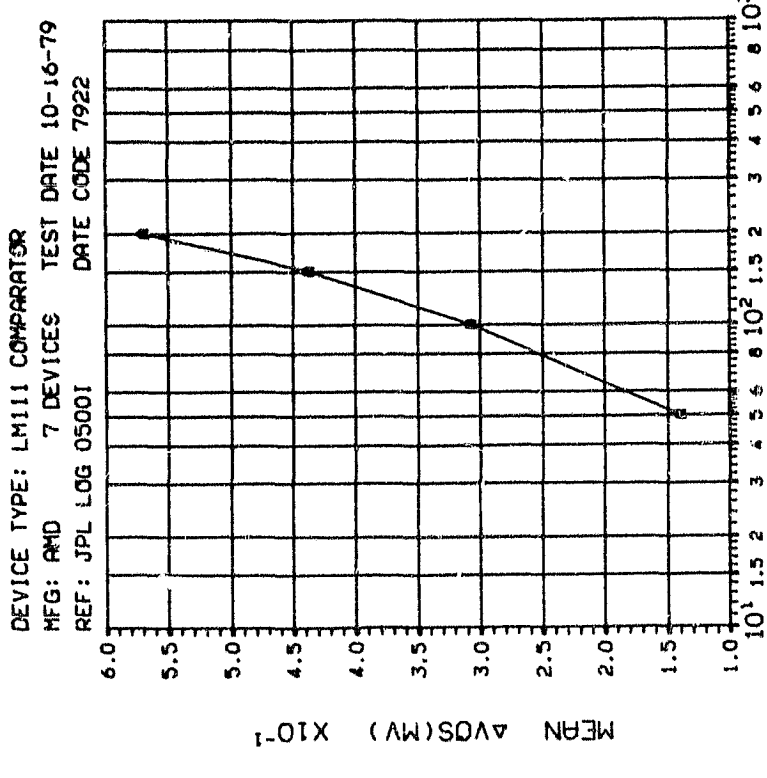
TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, μGy(Si)			
	.05	.10	.15	.20
C	13.47	26.31	36.06	44.40



DOSE, Gy(Si) 2.5 MeV electrons

(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.05	.10	.15	.20
B	2.255	2.716	3.038	3.727



DOSE, Gy(Si) 2.5 MeV electrons

(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.05	.10	.15	.20
A	.0981	.1781	.2339	.3150

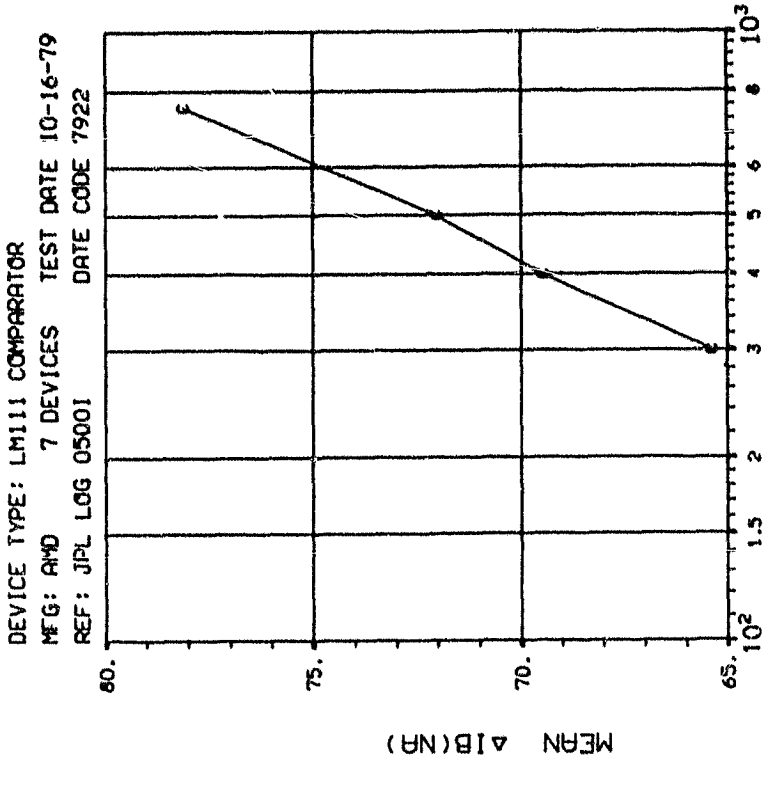
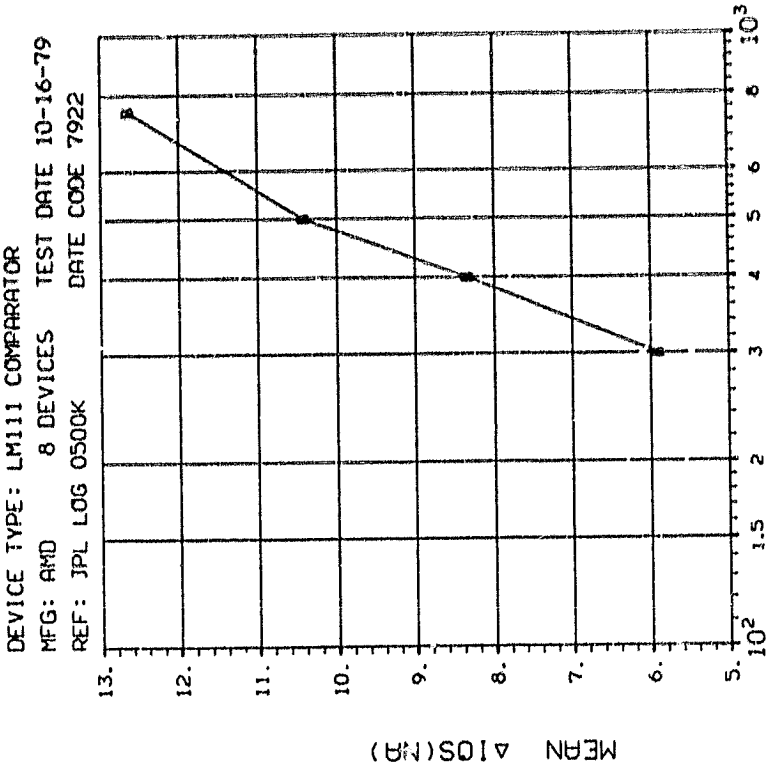


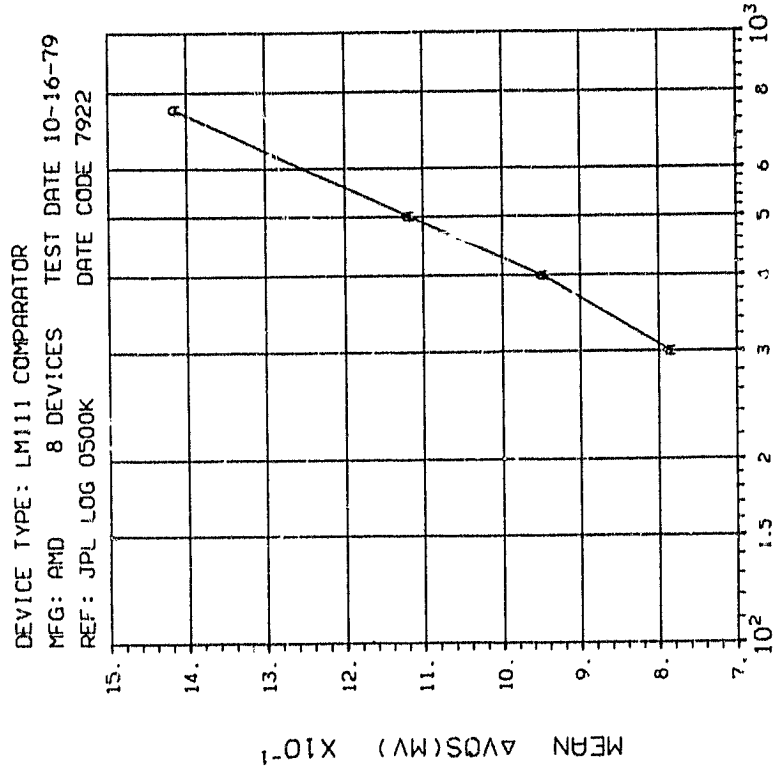
TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.30	.40	.50	.75	
C	54.59	54.42	52.83	49.57	



DOSE, Gy(Si) 2.5 MeV electrons

(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.30	.40	.50	.75
B	4.847	6.431	8.005	9.165



DOSE, Gy(Si) 2.5 MeV electrons

(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.30	.40	.50	.75
A	.3618	.4296	.5164	.6632

ORIGINAL PAGE IS
OF POOR QUALITY

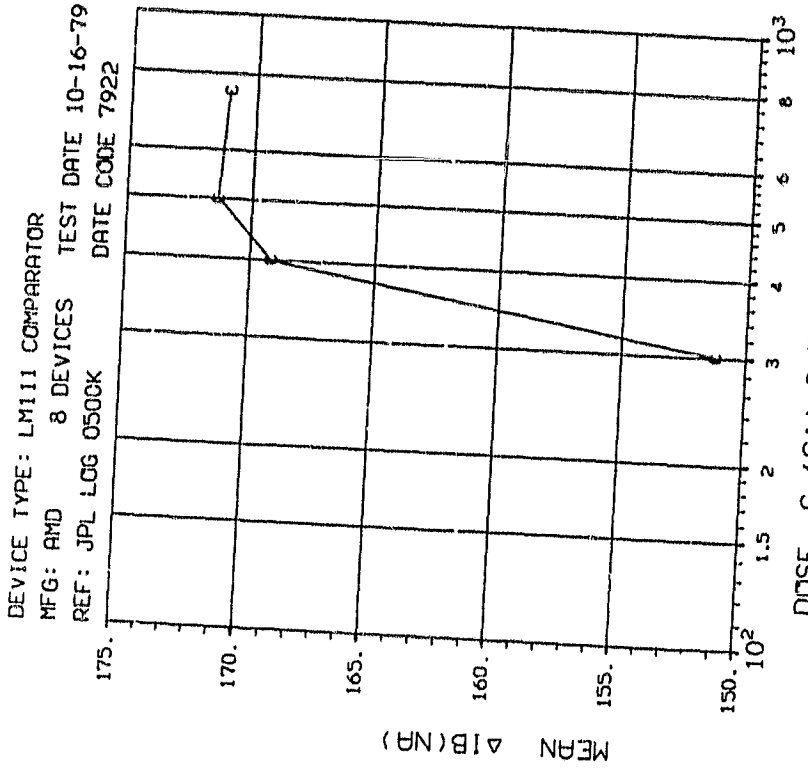
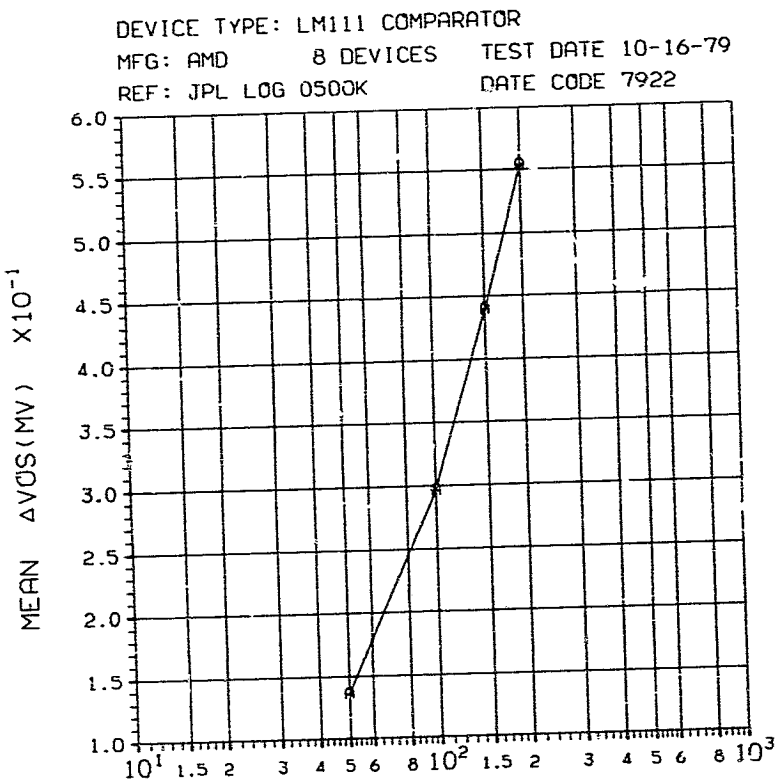
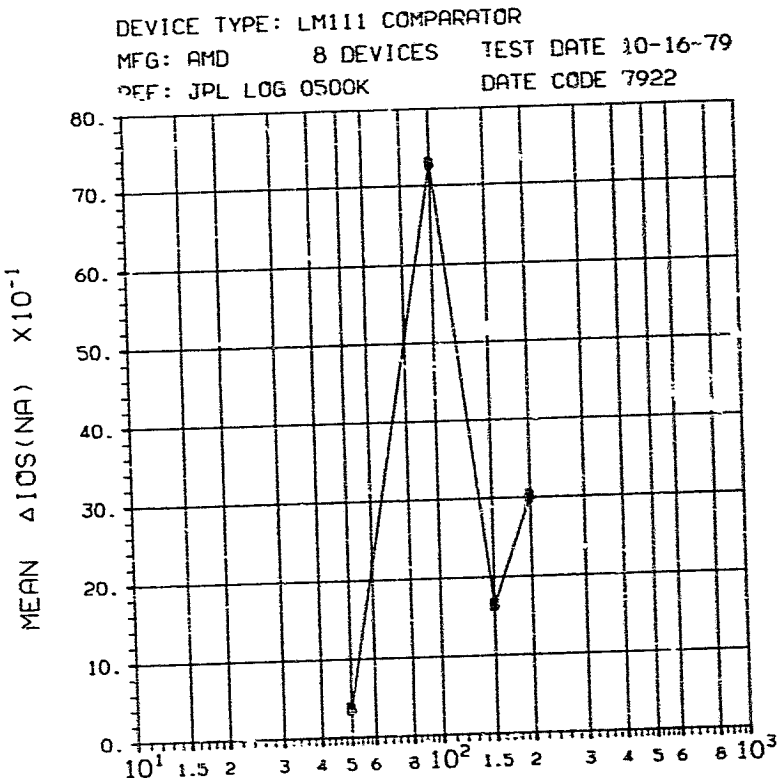


TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.30	.40	.50	.75
C	87.58	98.34	96.67	87.01



(1) VOS IN MV VS DOSE

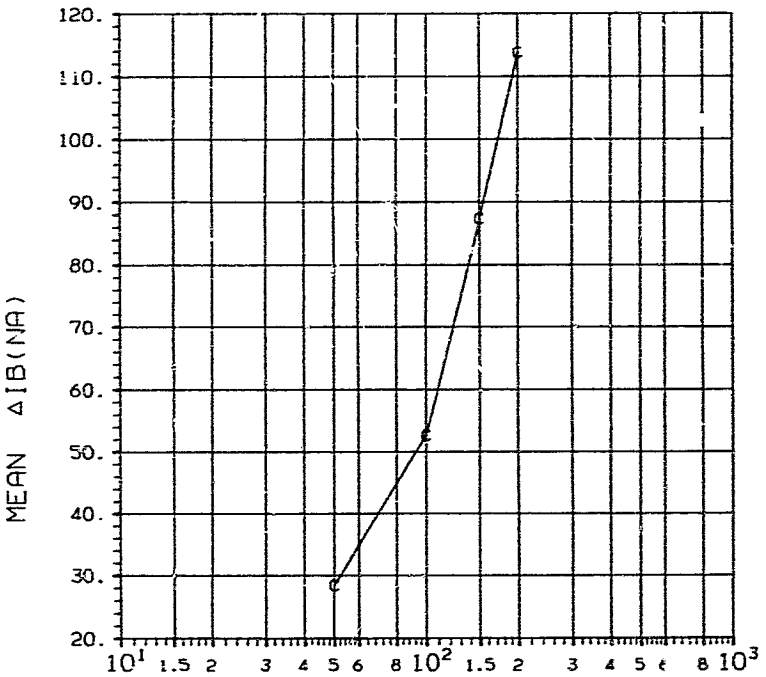
TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.05	.10	.15	.20
A	.0699	.1514	.2104	.2656



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.05	.10	.15	.20
B	.7014	14.10	2.330	3.042

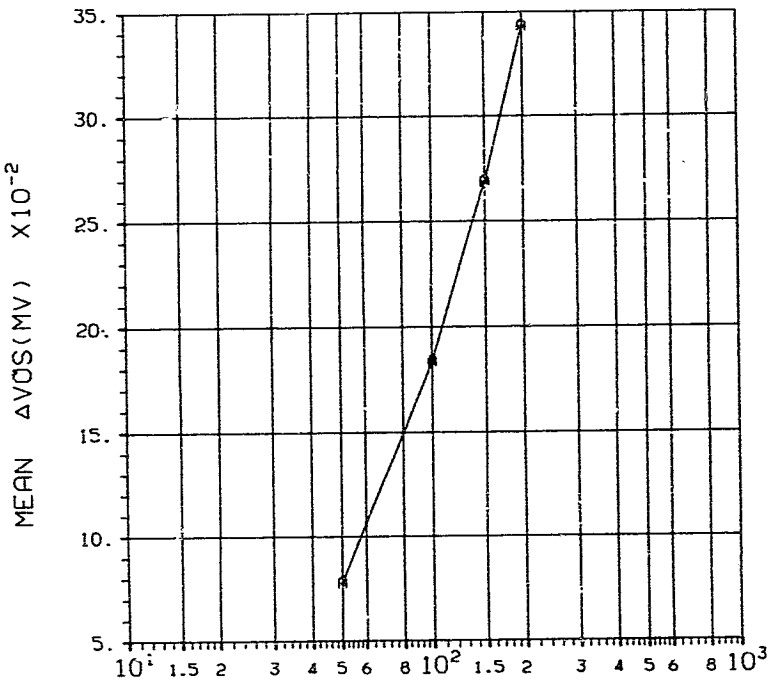
DEVICE TYPE: LM111 COMPARATOR
MFG: AMD 8 DEVICES TEST DATE 10-16-79
REF: JPL LOG 0500K DATE CODE 7922



(3) IB IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.05	.10	.15	.20
C	14.39	36.15	47.31	62.95

DEVICE TYPE: LM111 COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 10-16-79
REF: JPL LOG 0500M DATE CODE 7922

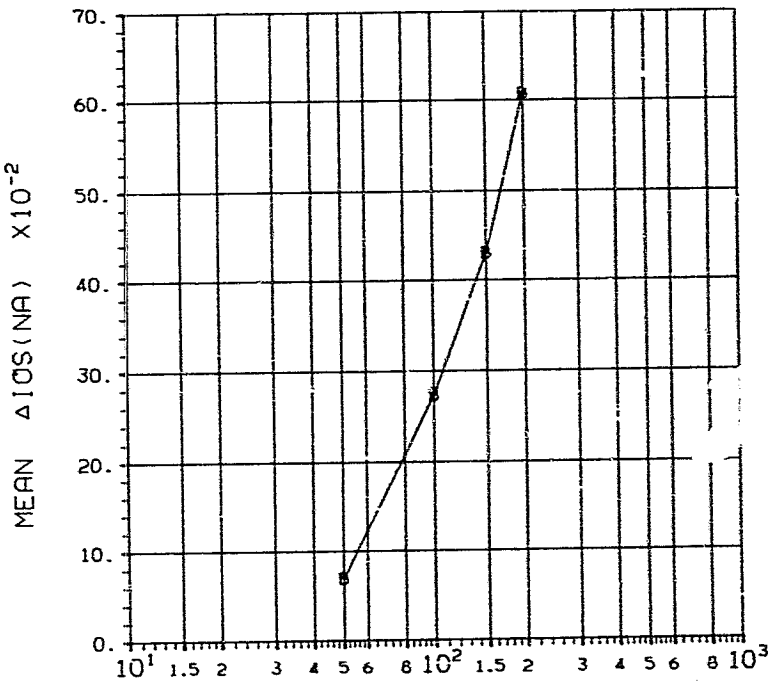


DOSE, Gy(Si) 2.5 MeV electrons

(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.05	.10	.15	.20
A	.0499	.1059	.1555	.1962

DEVICE TYPE: LM111 COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 10-16-79
REF: JPL LOG 0500M DATE CODE 7922



DOSE, Gy(Si) 2.5 MeV electrons

(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.05	.10	.15	.20
B	.3447	.4681	.6277	.8241

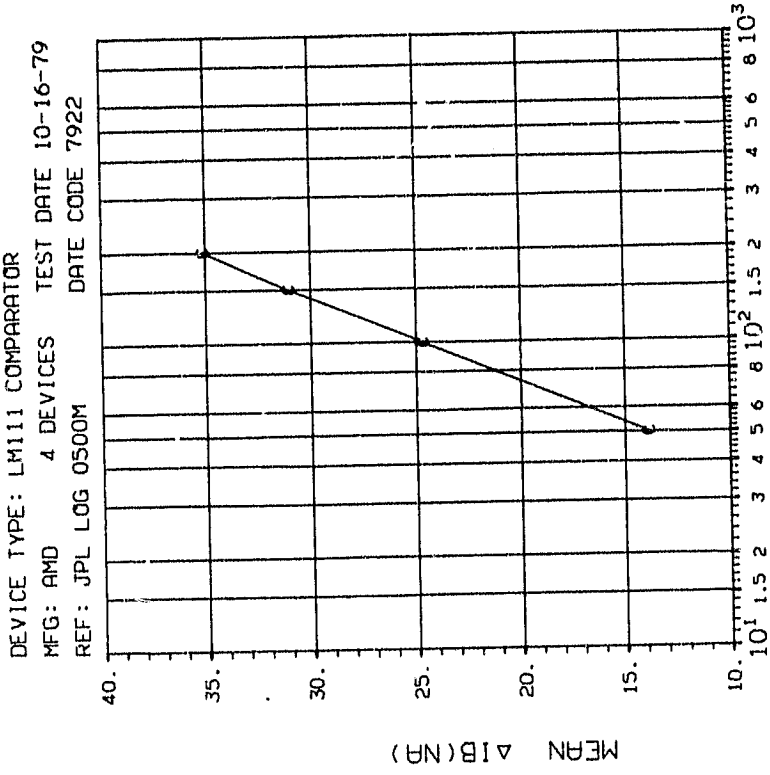
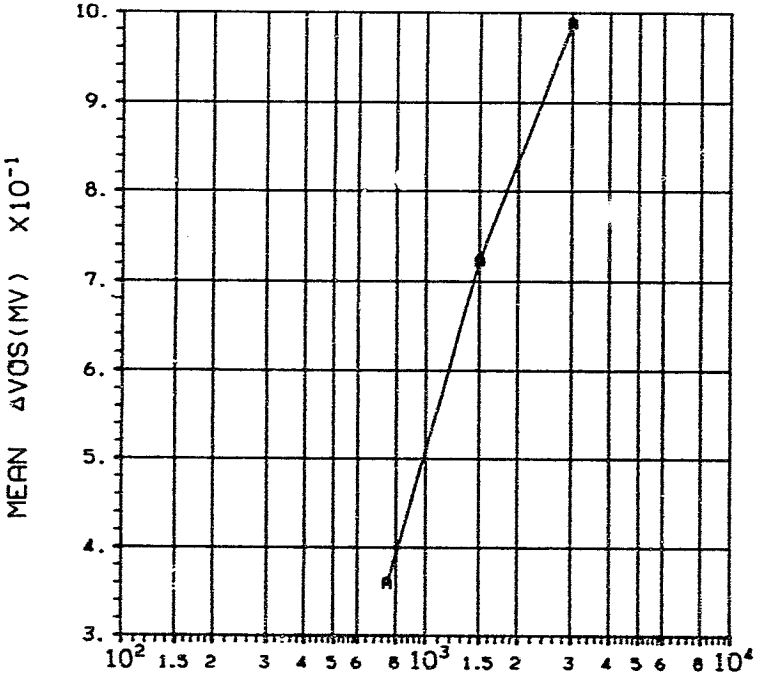


TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.05	.10	.15	.20
C	10.96	19.27	22.62	22.97

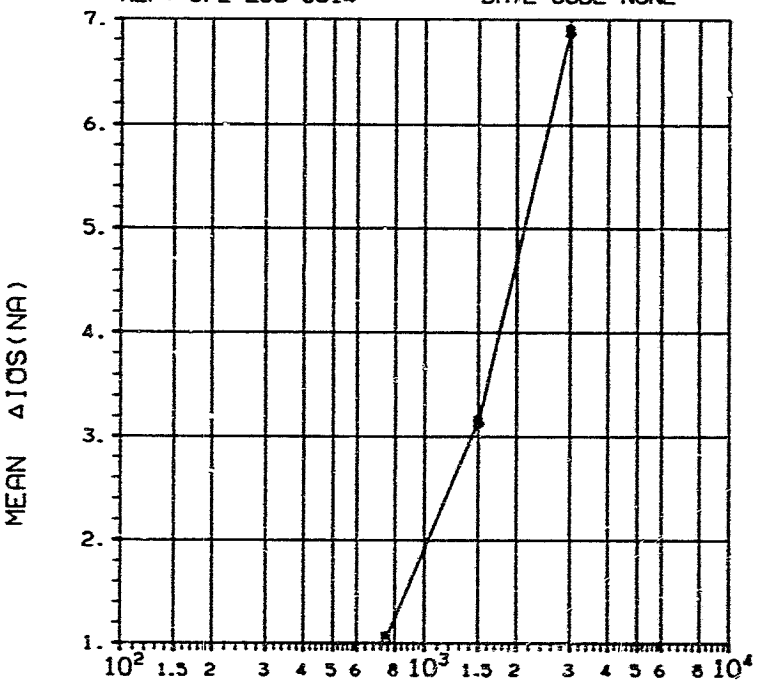
DEVICE TYPE: LM111 COMPARATOR
MFG: AMD 9 DEVICES TEST DATE 10-29-79
REF: JPL LOG 0514 DATE CODE NONE



(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00
A	.0474	.1430	.3596

DEVICE TYPE: LM111 COMPARATOR
MFG: AMD 9 DEVICES TEST DATE 10-29-79
REF: JPL LOG 0514 DATE CODE NONE



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00
B	.8986	1.725	3.811

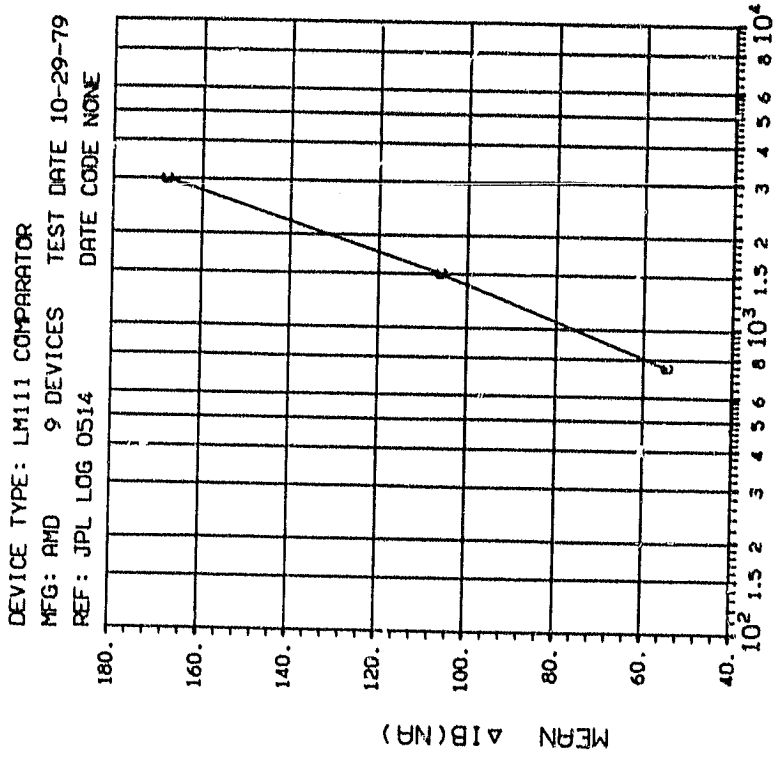


TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	
C	21.76	4.270	4.832	

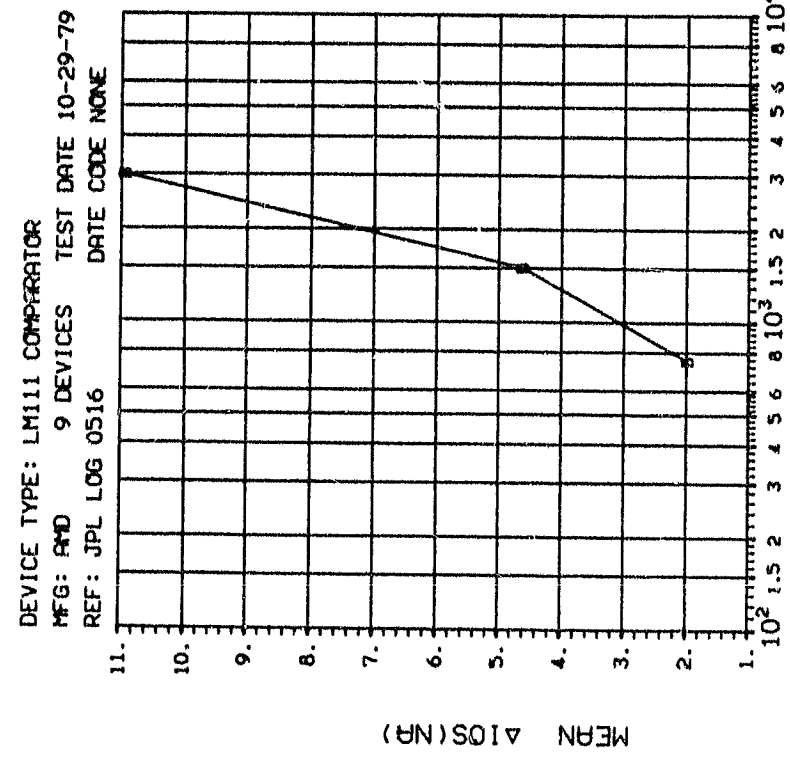


TABLE OF NORMAL STANDARD DEVIATIONS		
CURVE	DOSE, kiloGy(Si) .75 1.50 3.00	
B	.4121 .9645 1.728	

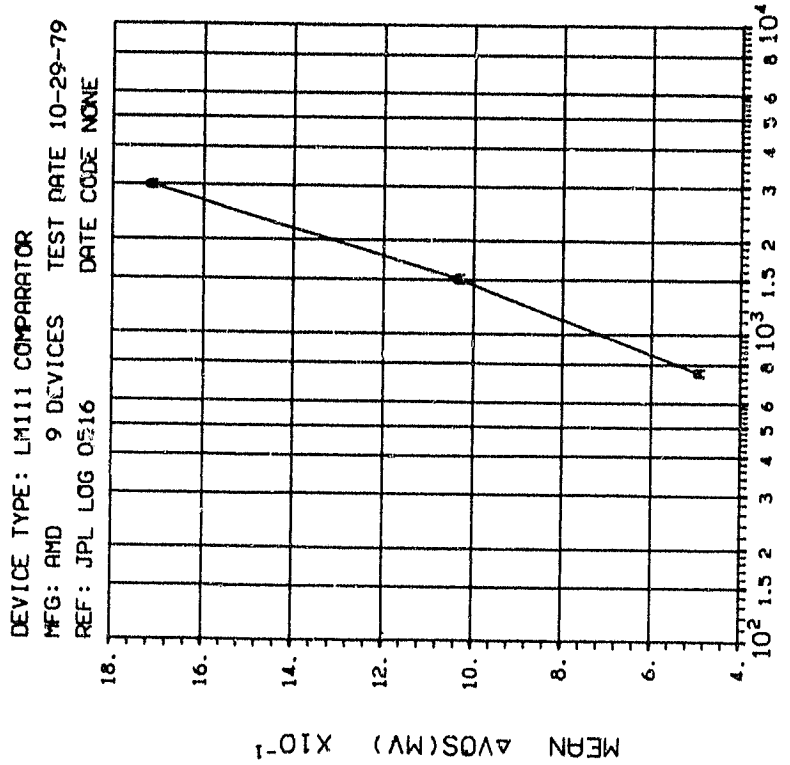


TABLE OF NORMAL STANDARD DEVIATIONS		
CURVE	DOSE, kiloGy(Si) .75 1.50 3.00	
A	.0467 .1289 .2180	

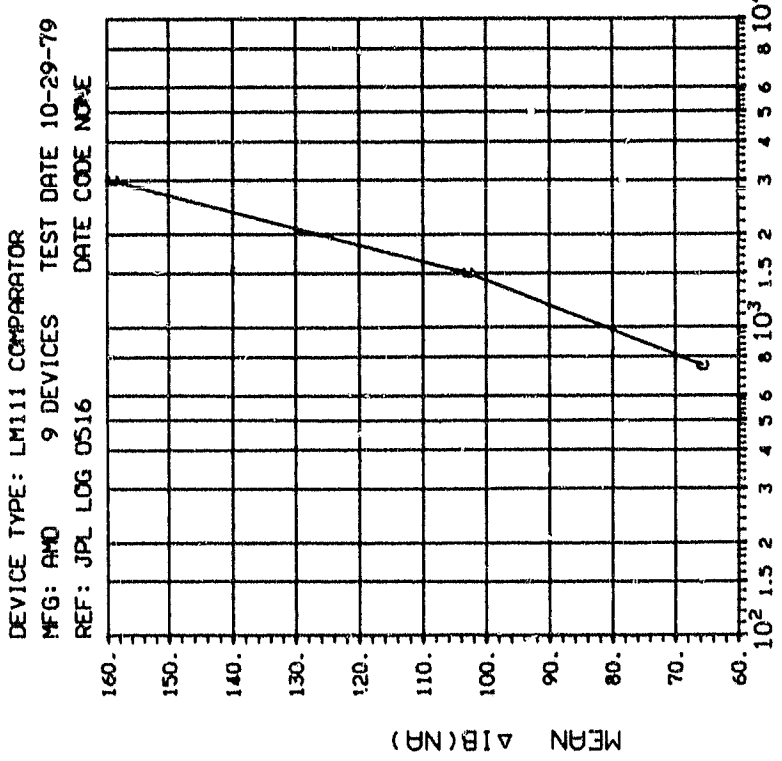


TABLE OF NORMAL STANDARD DEVIATIONS	
CURVE	DOSE, kiloGy(Si) .75 1.50 3.00
C	5.270 6.196 8.227

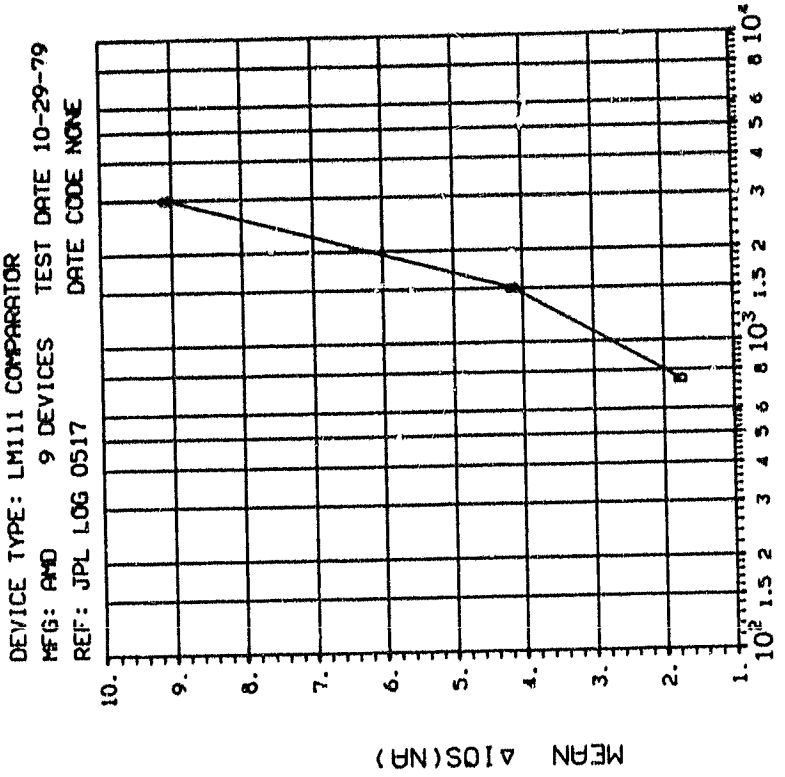


TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
B	.7050	1.519	3.108

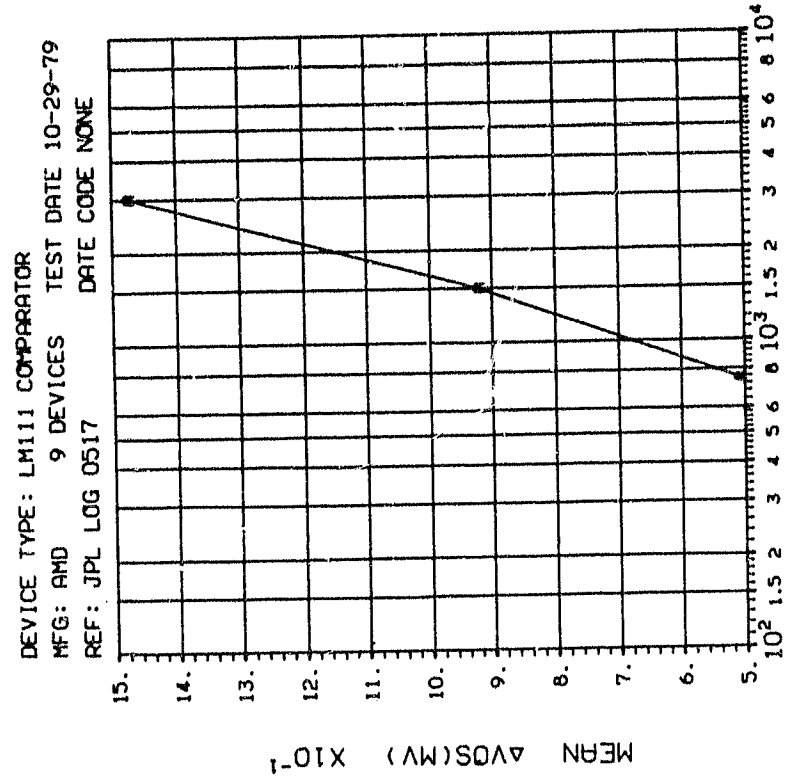


TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
A	.0992	.2240	.3313

ORIGINAL PAGE IS
OF POOR QUALITY

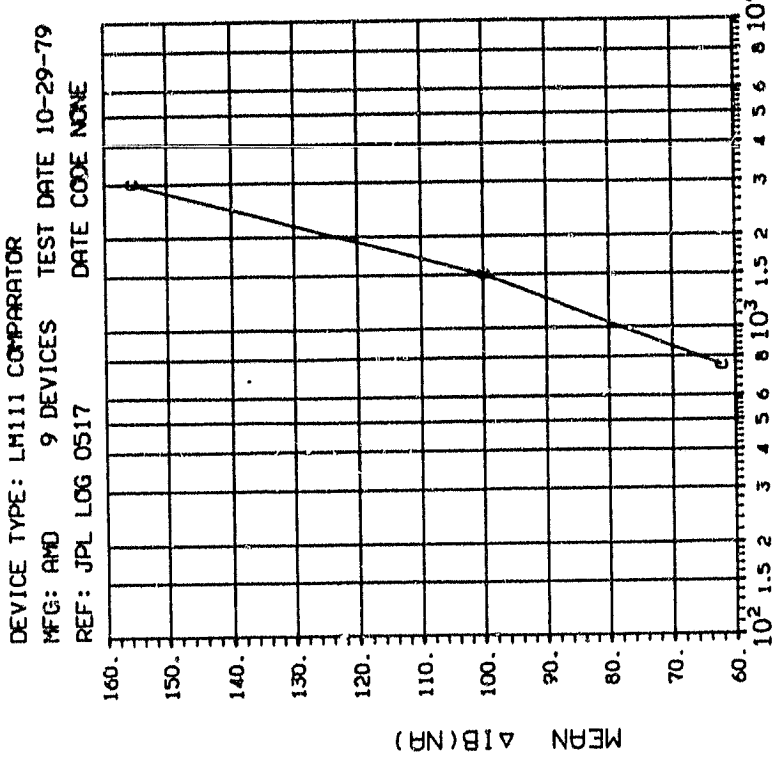


TABLE OF NORMAL STANDARD DEVIATIONS	
CURVE	DOSE, kiloGy(Si) .75 1.50 3.00
C	4.800 5.128 6.141

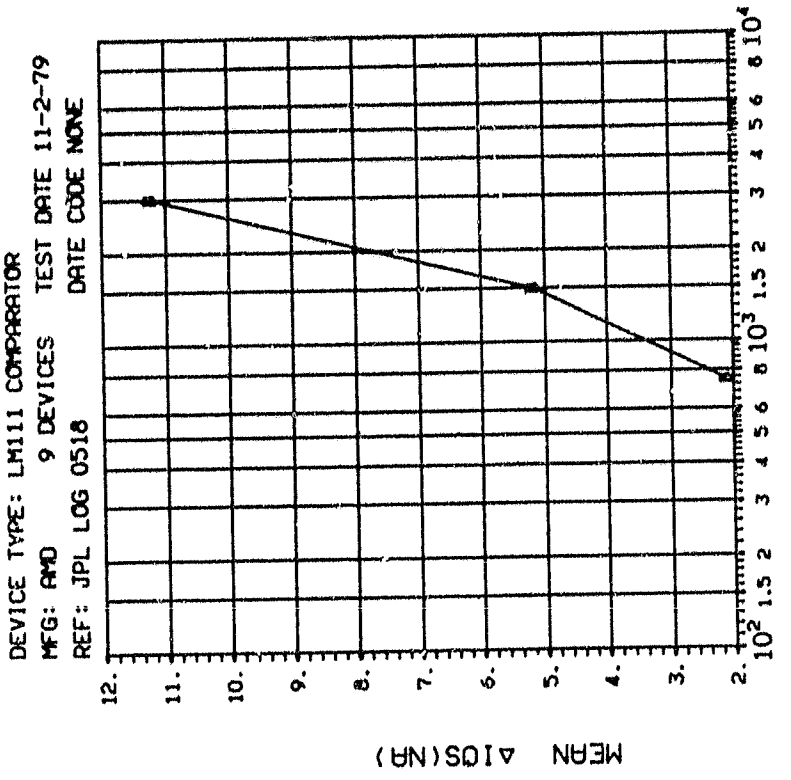


TABLE OF NORMAL STANDARD DEVIATIONS		
CURVE	DOSE, kiloGy(Si) .75 1.50 3.00	
B	1.240 2.313 4.455	

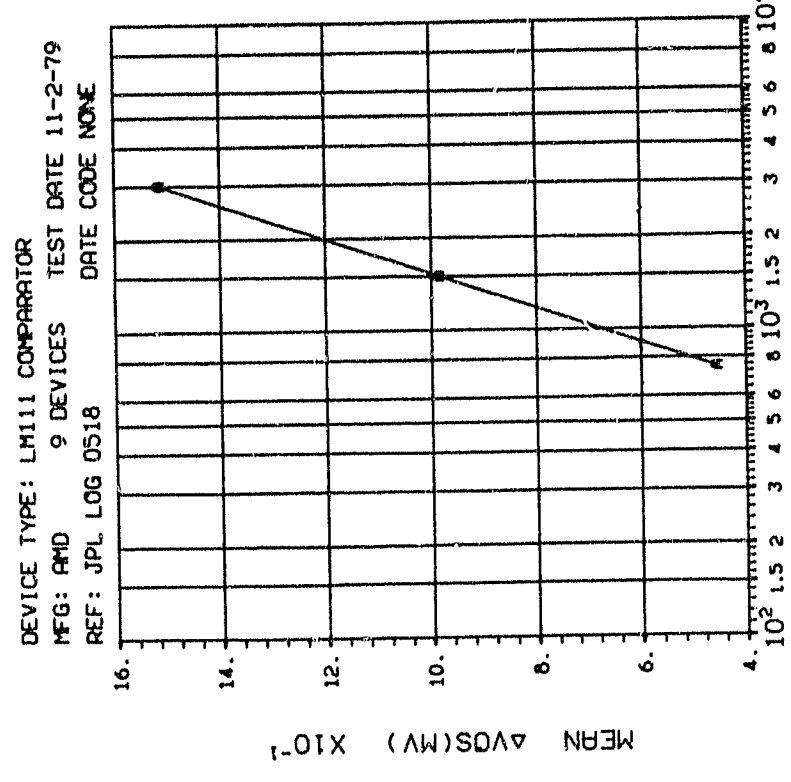


TABLE OF NORMAL STANDARD DEVIATIONS		
CURVE	DOSE, kiloGy(Si) .75 1.50 3.00	
A	.1216 .2775 .4773	

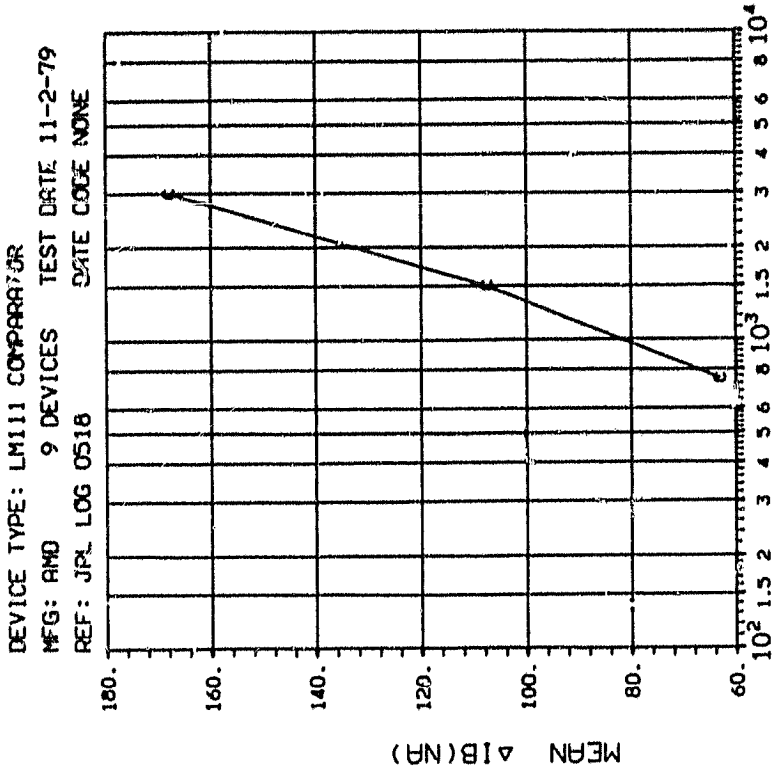


TABLE OF NORMAL STANDARD DEVIATIONS	
CURVE	DOSE, kiloGy(Si) .75 1.50 3.00
C	16.12 11.78 11.98

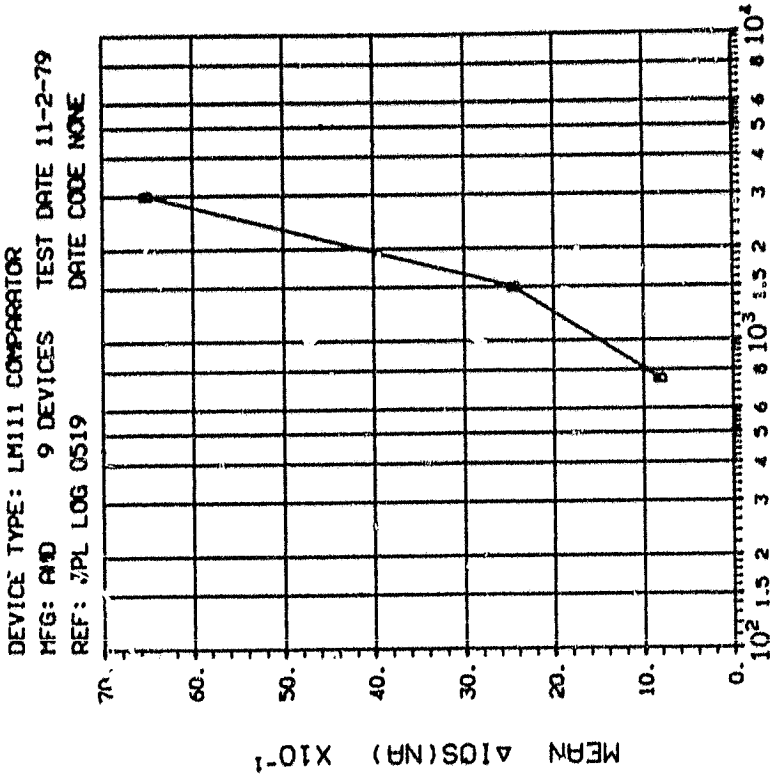


TABLE OF NORMAL STANDARD DEVIATIONS	
CURVE	DOSE, kiloGy(Si) .75 1.50 3.00
B	.8675 1.473 2.655

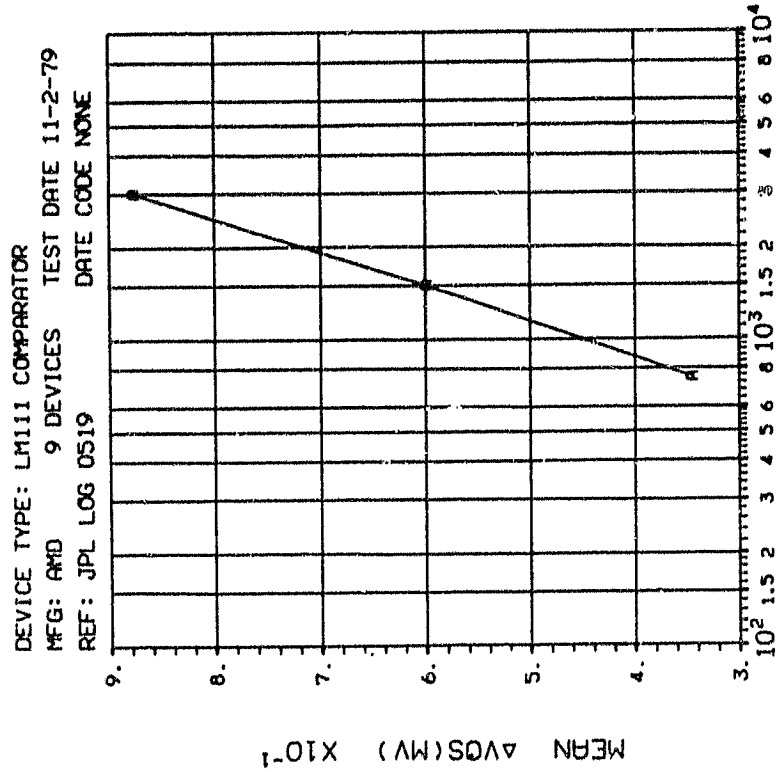


TABLE OF NORMAL STANDARD DEVIATIONS	
CURVE	DOSE, kiloGy(Si) .75 1.50 3.00
A	.0495 .1024 .1738

ORIGINAL PAGE IS
OF POOR QUALITY

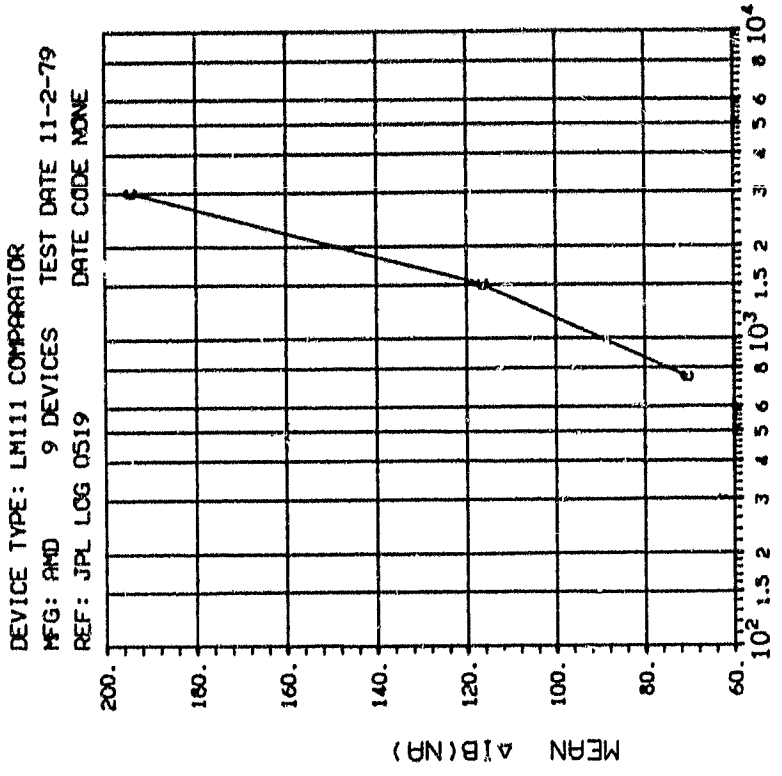
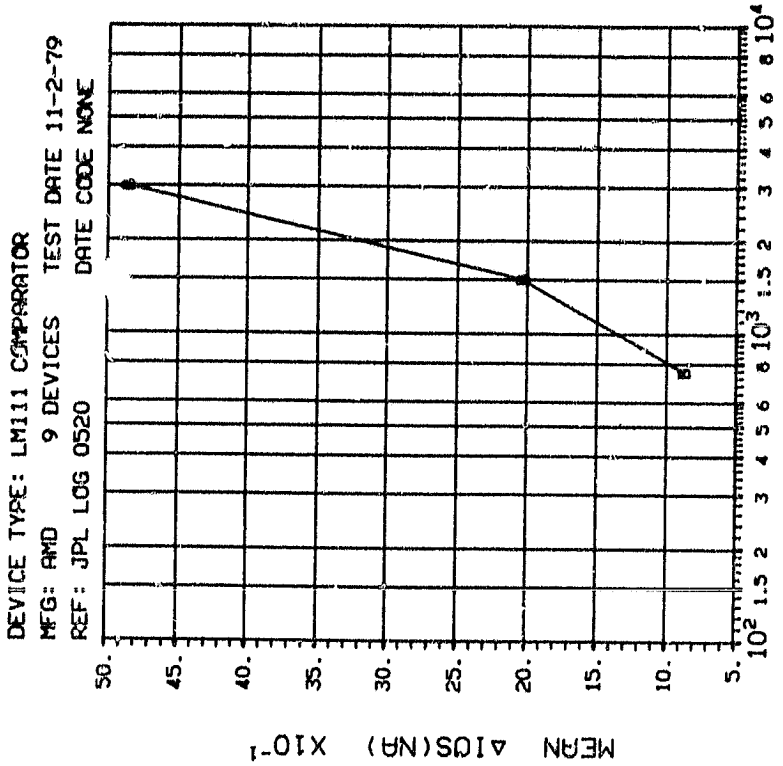


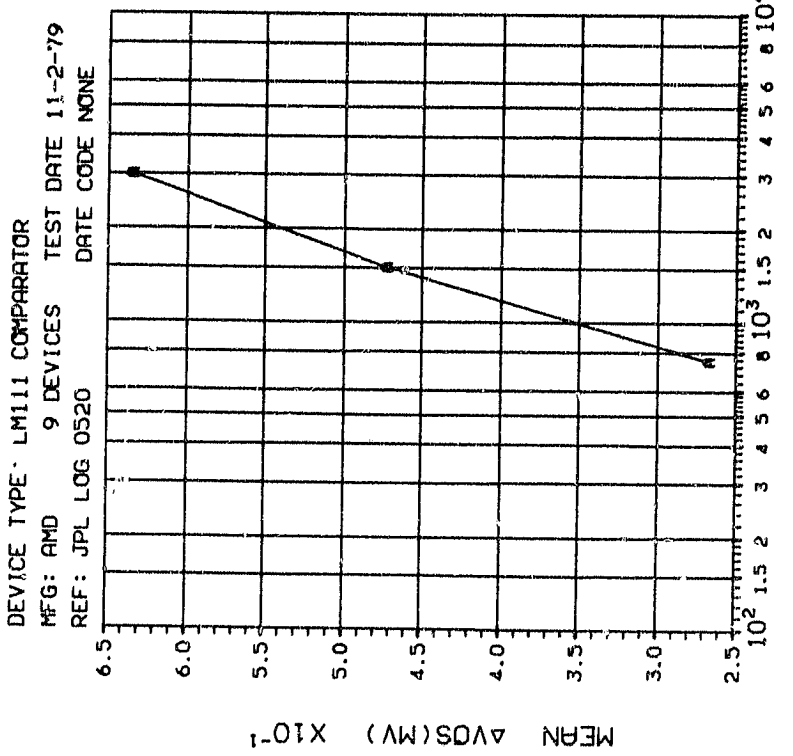
TABLE OF NORMAL STANDARD DEVIATIONS		
CURVE	DOSE, kiloGy(Si) .75 1.50 3.00	
C	8.192	9.306 15.65



DOSE, Gy(Si) 2.5 MeV electrons

(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
B	.6484	.9466	1.432



DOSE, Gy(Si) 2.5 MeV electrons

(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
A	.0259	.0464	.0955

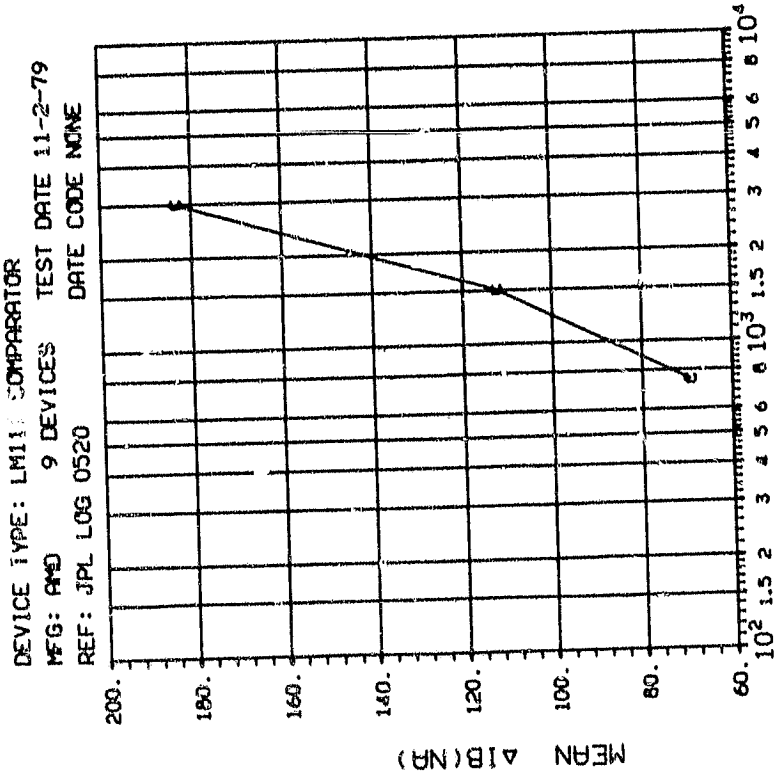
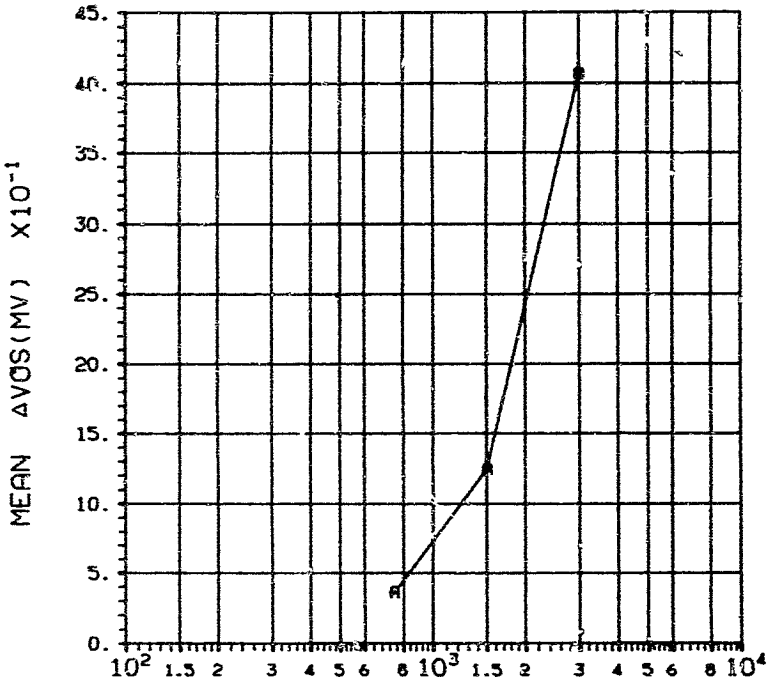


TABLE OF NORMAL STANDARD DEVIATIONS	
CURVE	DOSE, kiloGy(Si) .75 1.50 3.00
C	5.620 7.630 11.24

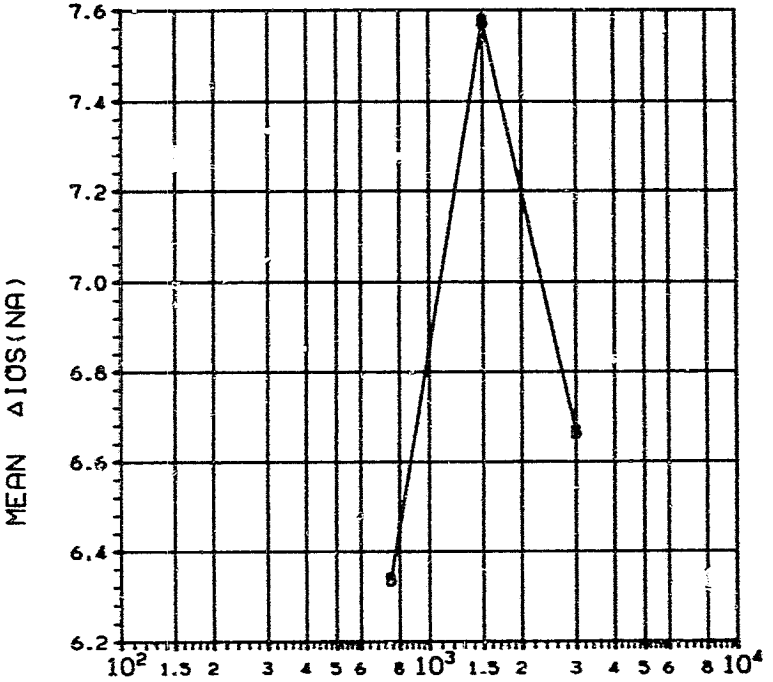
DEVICE TYPE: LM111 COMPARATOR
MFG: AMD 9 DEVICES TEST DATE 11-2-79
REF: JPL LOG 0521 DATE CODE NONE



(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
A	.8198	.5372	6.549

DEVICE TYPE: LM111 COMPARATOR
MFG: AMD 9 DEVICES TEST DATE 11-2-79
REF: JPL LOG 0521 DATE CODE NONE



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
B	8.865	4.967	64.77

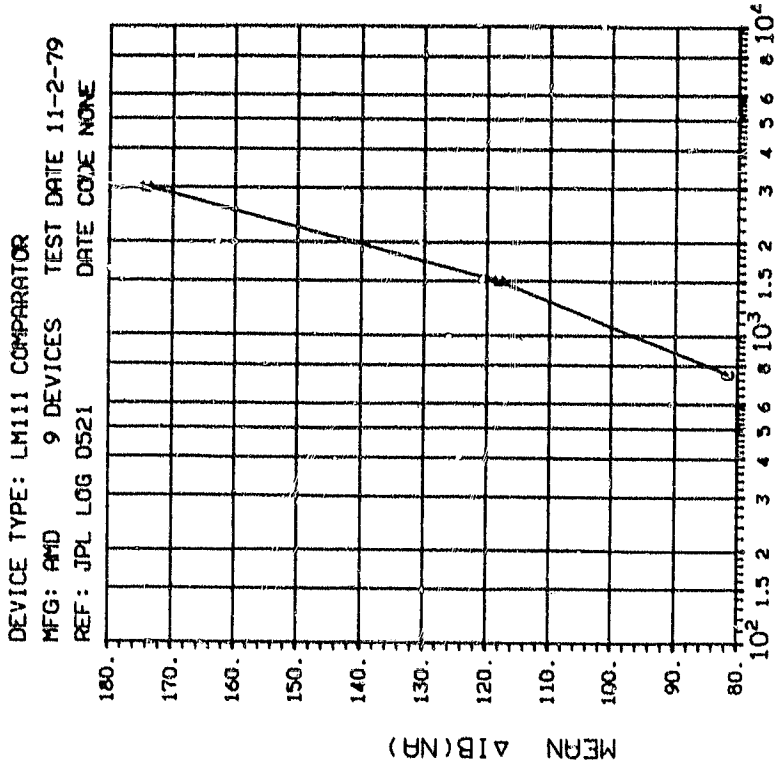
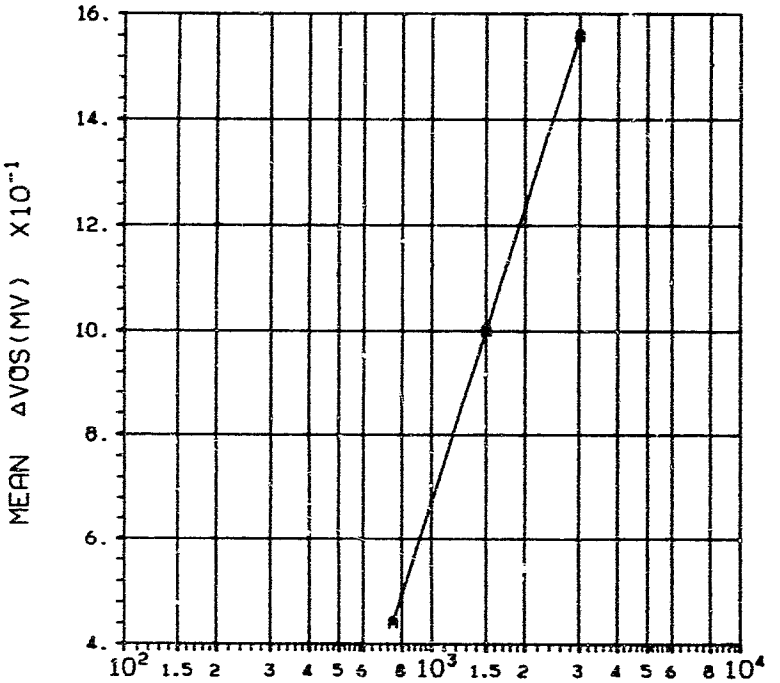


TABLE OF NORMAL STANDARD DEVIATIONS	
CURVE	DOSE, kiloGy(Si) .75 1.50 3.00
C	31.43 31.37 28.57

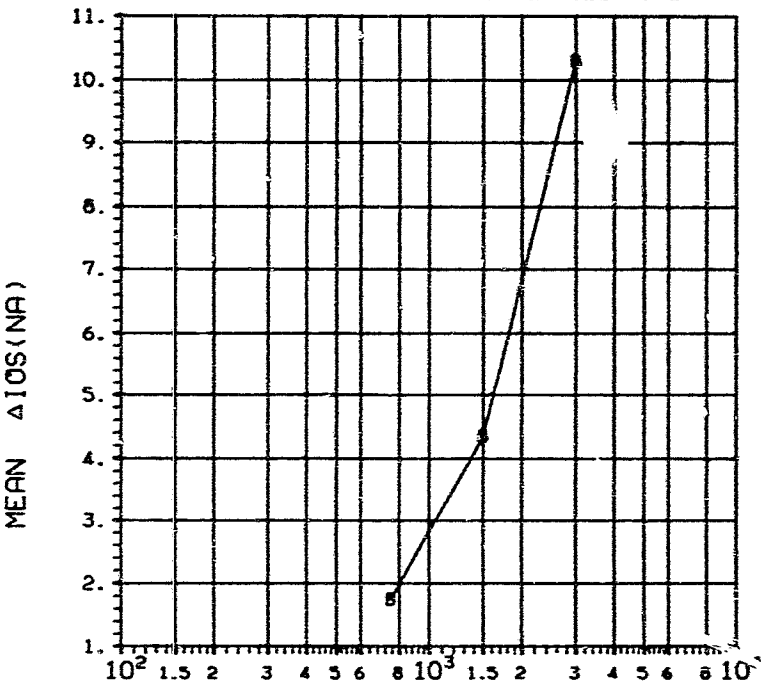
DEVICE TYPE: LM111 COMPARATOR
MFG: AMD 9 DEVICES TEST DATE 11-2-79
REF: JPL LOG 0522 DATE CODE NONE



(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
A	.0531	.1103	.1796

DEVICE TYPE: LM111 COMPARATOR
MFG: AMD 9 DEVICES TEST DATE 11-2-79
REF: JPL LOG 0522 DATE CODE NONE



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
B	.7225	1.209	2.216

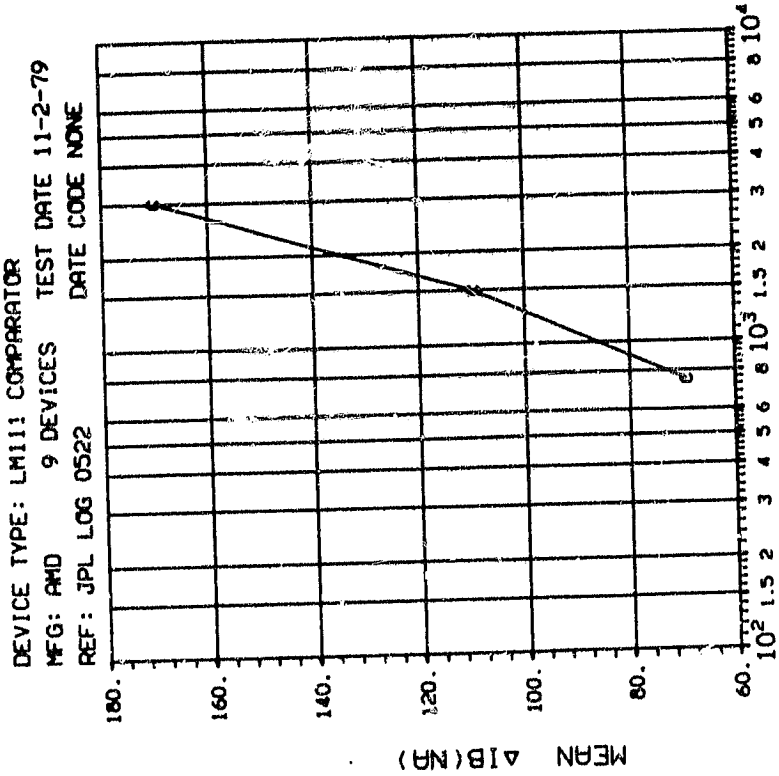
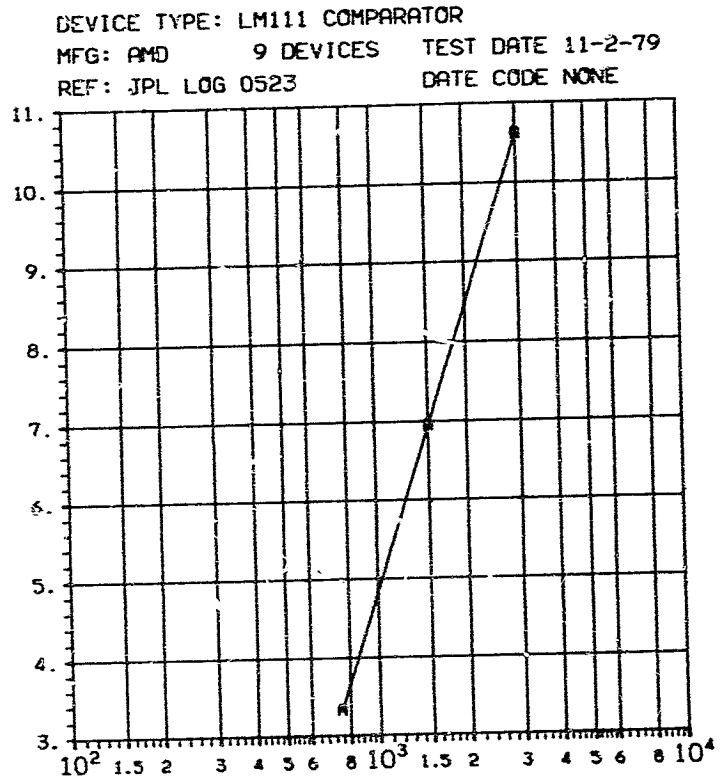
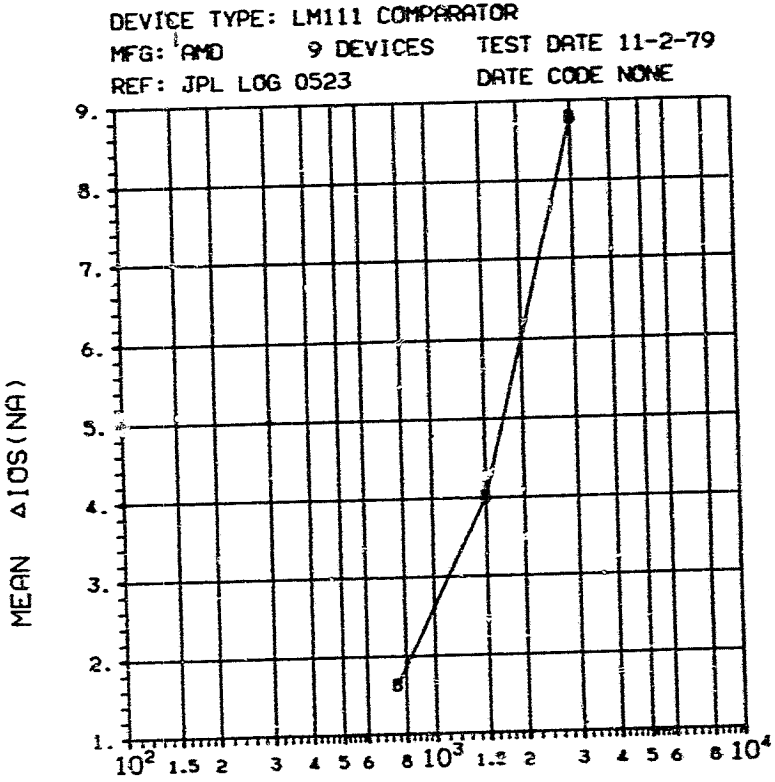


TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00
C	3.896	4.709	6.446



(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
A	.0358	.0688	.0962



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
B	.5578	1.166	1.393

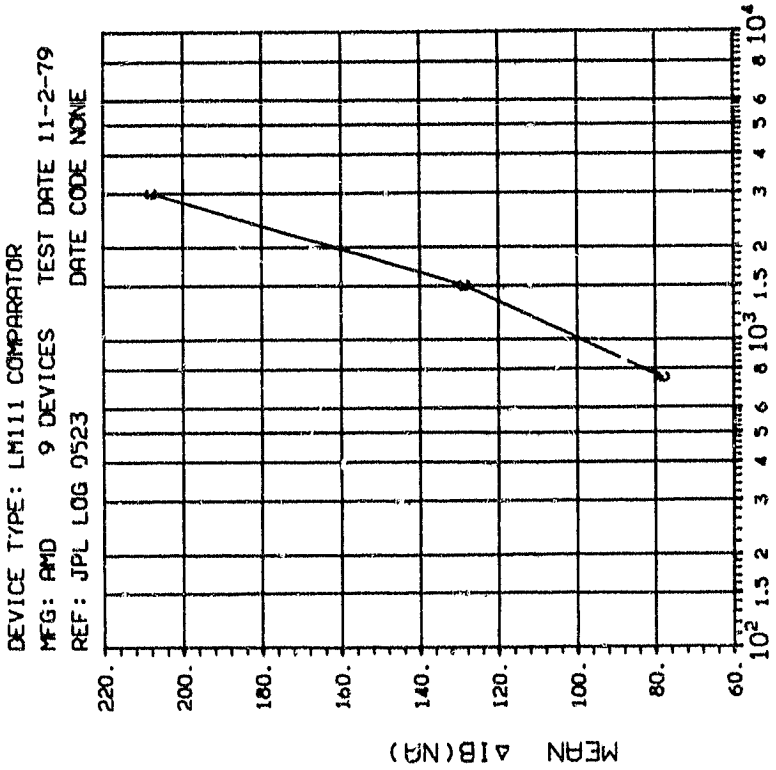
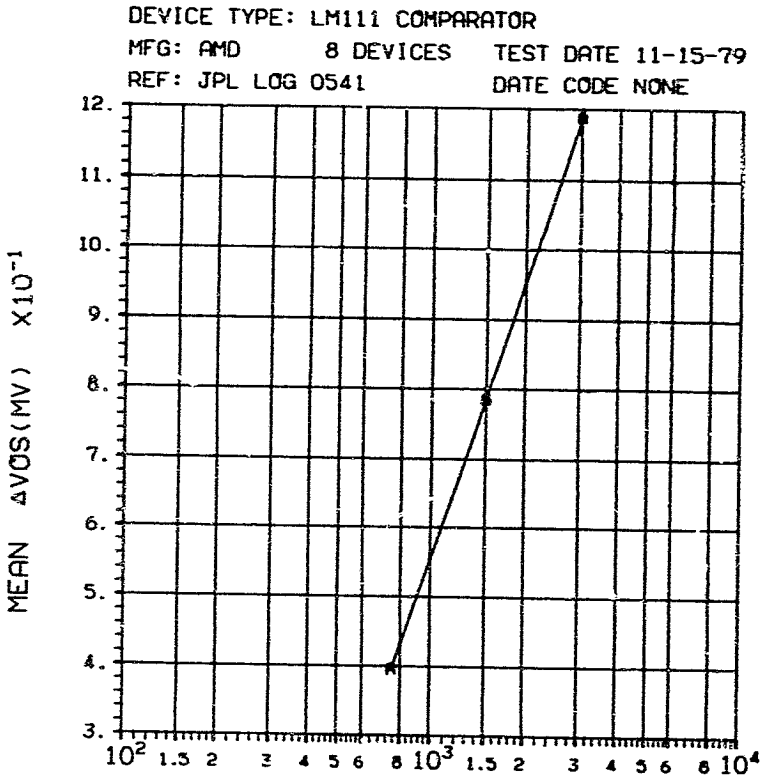
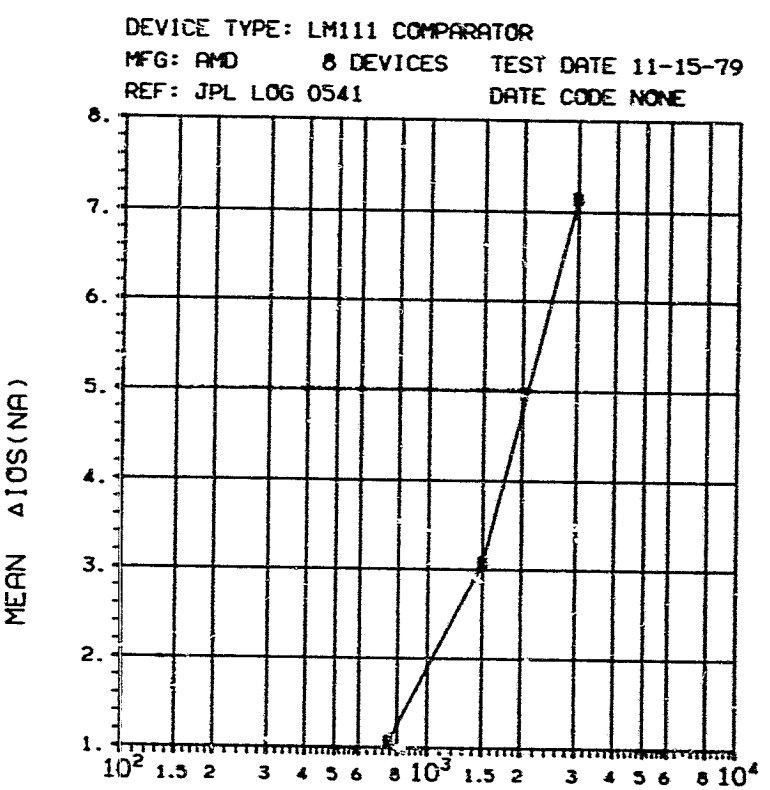


TABLE OF NORMAL STANDARD DEVIATIONS	
CURVE	DOSE, kiloGy(Si) .75 1.50 3.00
C	4.702 7.474 12.32



(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
A	.0766	.1720	.2701



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURV	DOSE, kiloGy(Si)		
	.75	1.50	3.00
B	.7616	1.529	2.667

ORIGINAL PAGE IS
OF POOR QUALITY

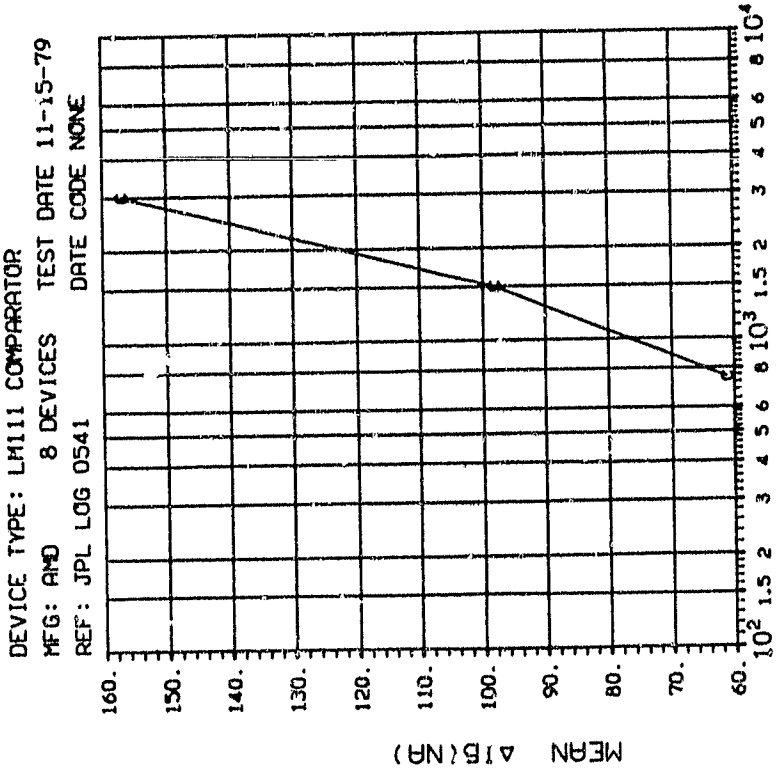
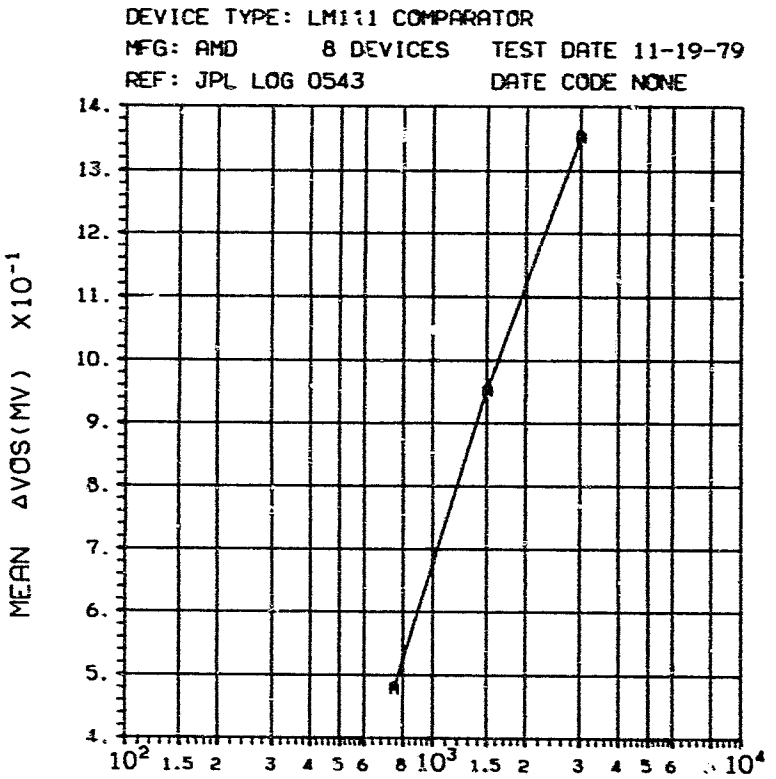
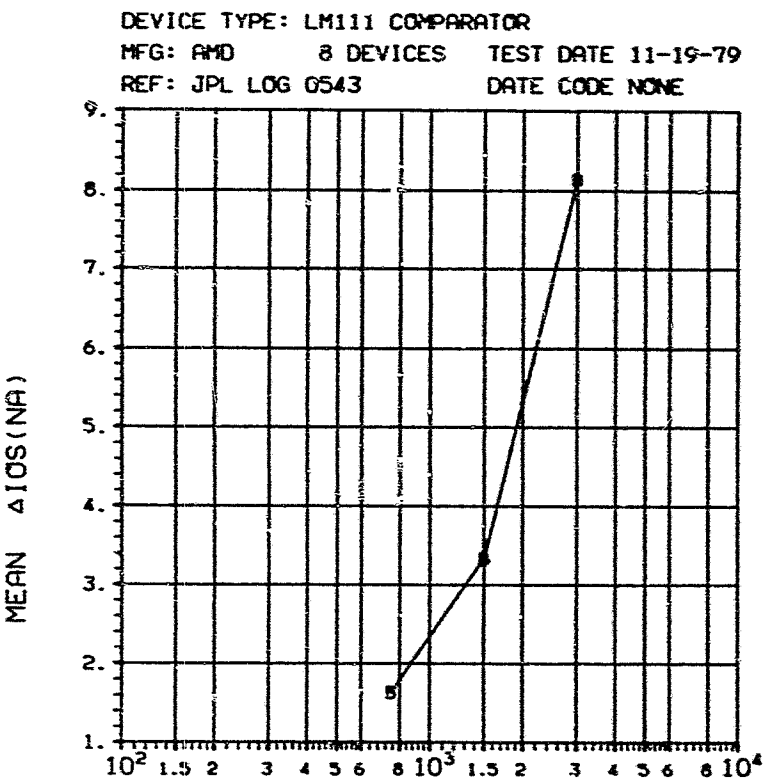


TABLE OF NORMAL STANDARD DEVIATIONS	
CURVE	DOSE, kiloGy(Si) .75 1.50 3.00
C	4.288 4.478 5.426



(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
A	.0630	.1807	.5208



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
B	.8525	1.782	3.189

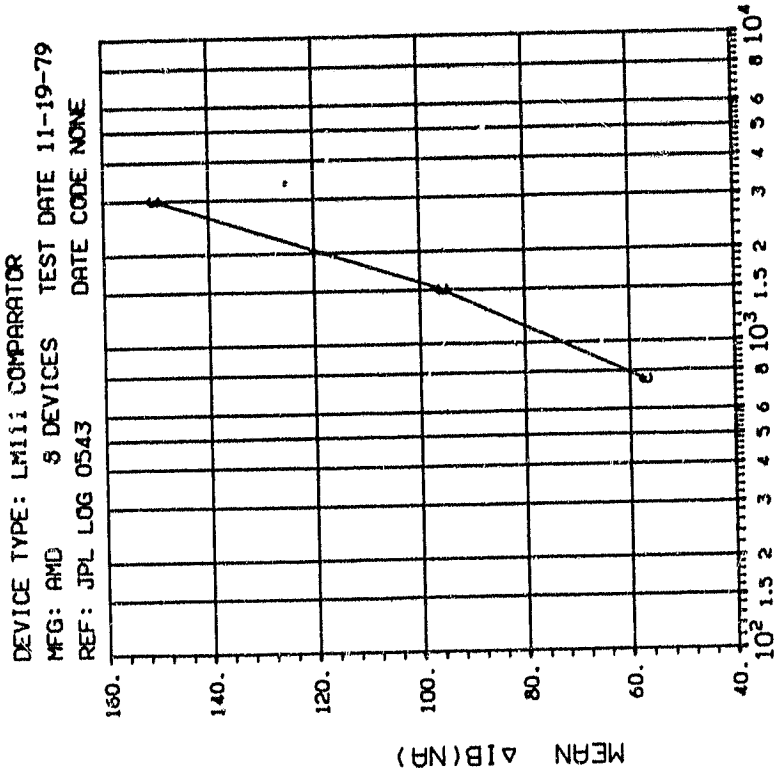
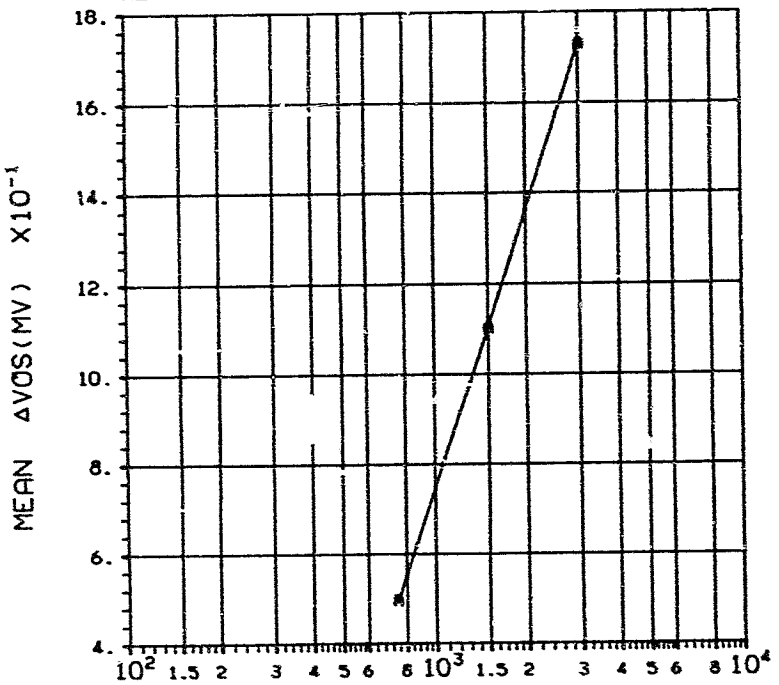


TABLE OF NORMAL STANDARD DEVIATIONS		
CURVE	DOSE, kiloGy(Si) .75 1.50 3.00	
C	2.714	4.448 5.313

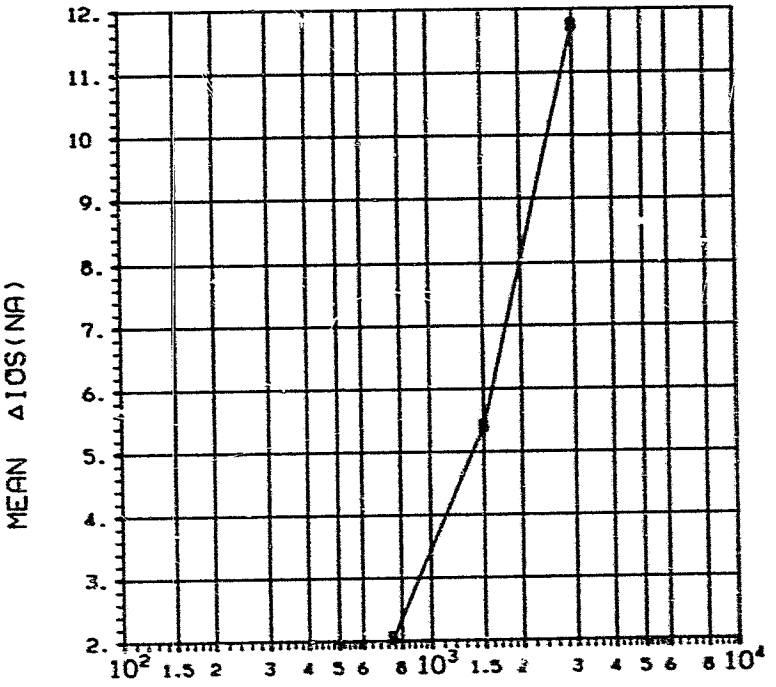
DEVICE TYPE: LM111 COMPARATOR
MFG: AMD 8 DEVICES TEST DATE 11-19-79
REF: JPL LOG 0544 DATE CODE NONE



(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS		
CURVE	DOSE, kiloGy(Si)	
	.75	1.50 3.00
A	.0961	.2214 .3693

DEVICE TYPE: LM111 COMPARATOR
MFG: AMD 8 DEVICES TEST DATE 11-19-79
REF: JPL LOG 0544 DATE CODE NONE



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS		
CURVE	DOSE, kiloGy(Si)	
	.75	1.50 3.00
B	.6741	1.101 2.674

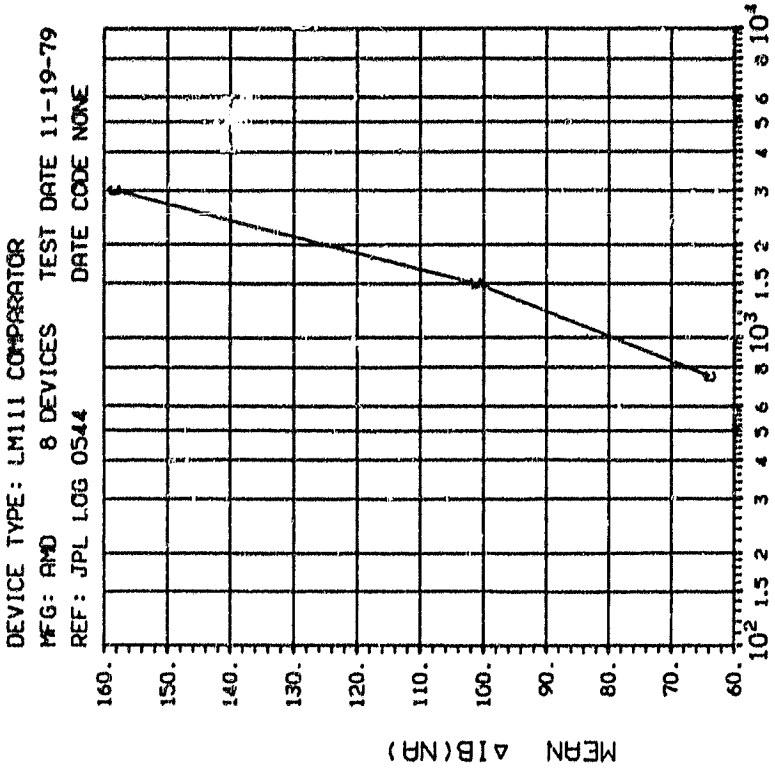
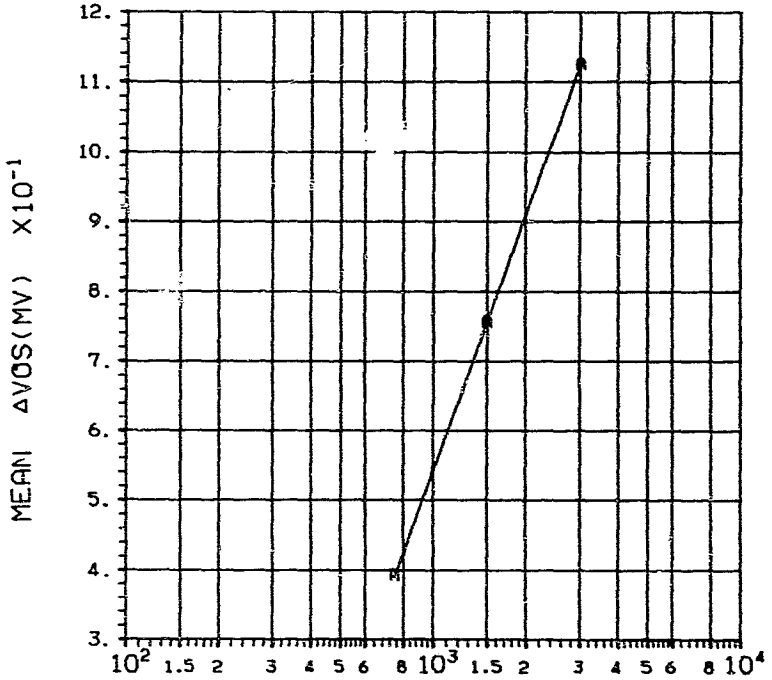


TABLE OF NORMAL STANDARD DEVIATIONS	
CURVE	DOSE, kiloGy(Si) .75 1.50 3.00
C	5.869 7.015 8.447

C-3

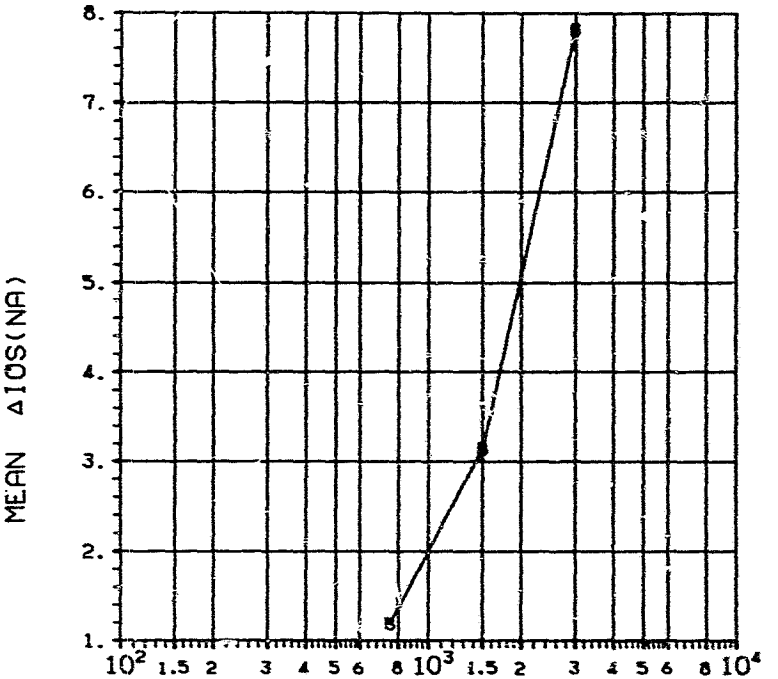
DEVICE TYPE: LM111 COMPARATOR
MFG: AMD 9 DEVICES TEST DATE 11-19-79
REF: JPL LOG 0545 DATE CODE NONE



(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS	
CURVE	DOSE, kiloGy(Si) .75 1.50 3.00
A	.0389 .0882 .1390

DEVICE TYPE: LM111 COMPARATOR
MFG: AMD 9 DEVICES TEST DATE 11-19-79
REF: JPL LOG 0545 DATE CODE NONE



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS	
CURVE	DOSE, kiloGy(Si) .75 1.50 3.00
B	.6962 .8941 1.759

ORIGINAL PAGE IS
OF POOR QUALITY

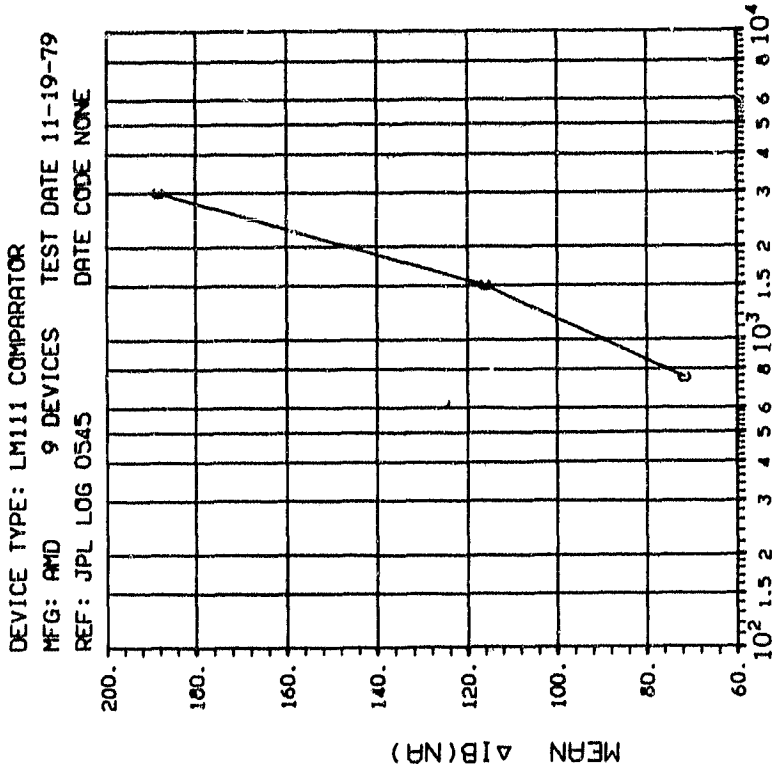


TABLE OF NORMAL STANDARD DEVIATIONS	
CURVE	DOSE, kiloGy(Si) .75 1.50 3.00
C	6.586 8.553 11.14

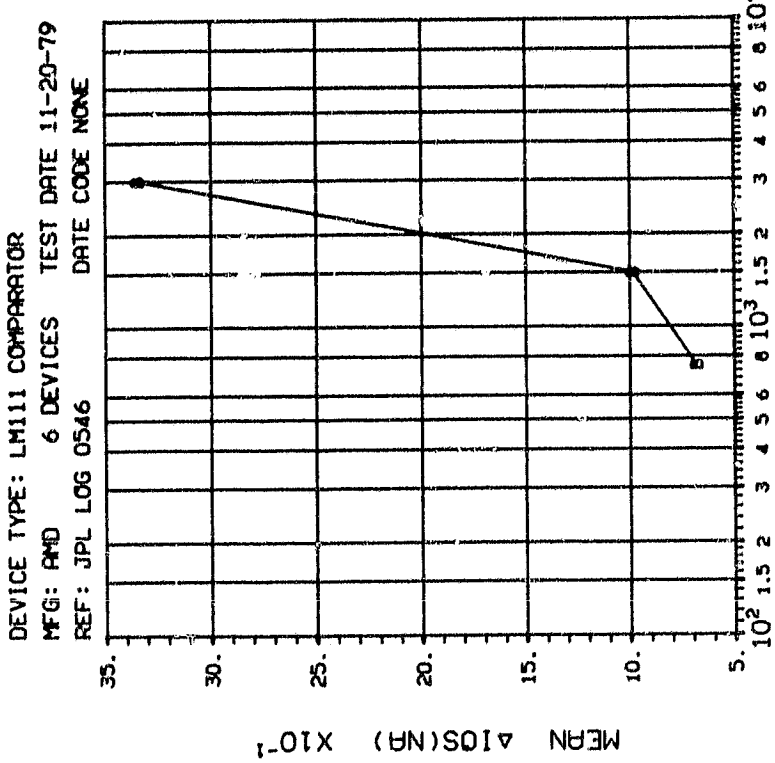


TABLE OF NORMAL STANDARD DEVIATIONS	
CURVE	DOSE, kiloGy(Si) .75 1.50 3.00
B	.6679 1.088 1.731

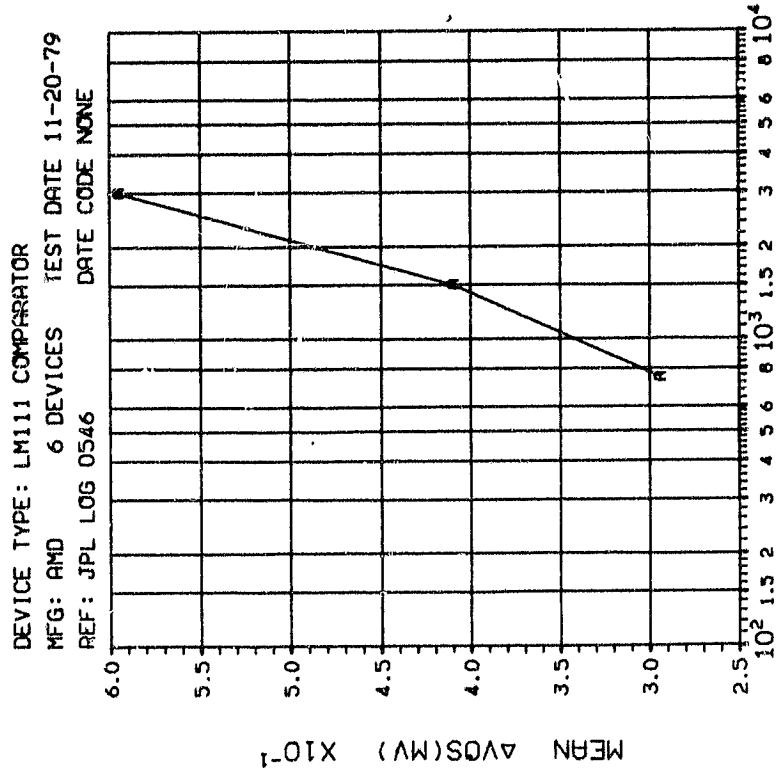


TABLE OF NORMAL STANDARD DEVIATIONS	
CURVE	DOSE, kiloGy(Si) .75 1.50 3.00
A	.0659 .0718 .1318

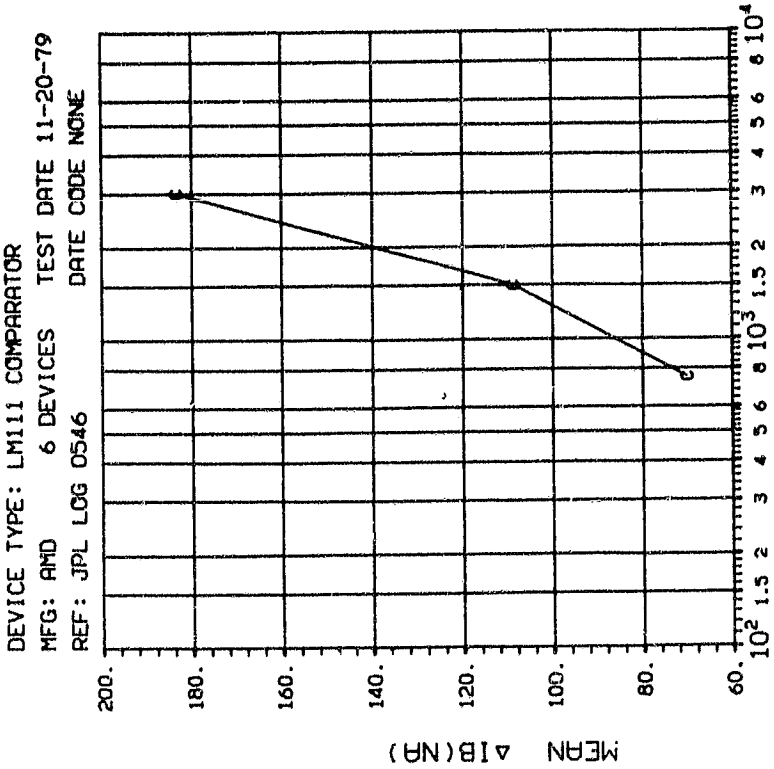
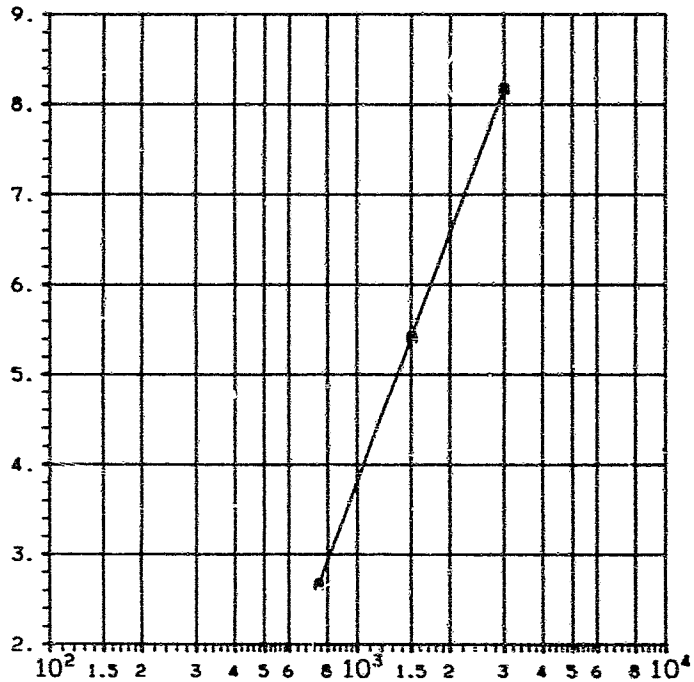


TABLE OF NORMAL STANDARD DEVIATIONS		
CURVE	DOSE, kiloGy(Si) .75 1.50 3.00	
C	4.489	5.576 9.369

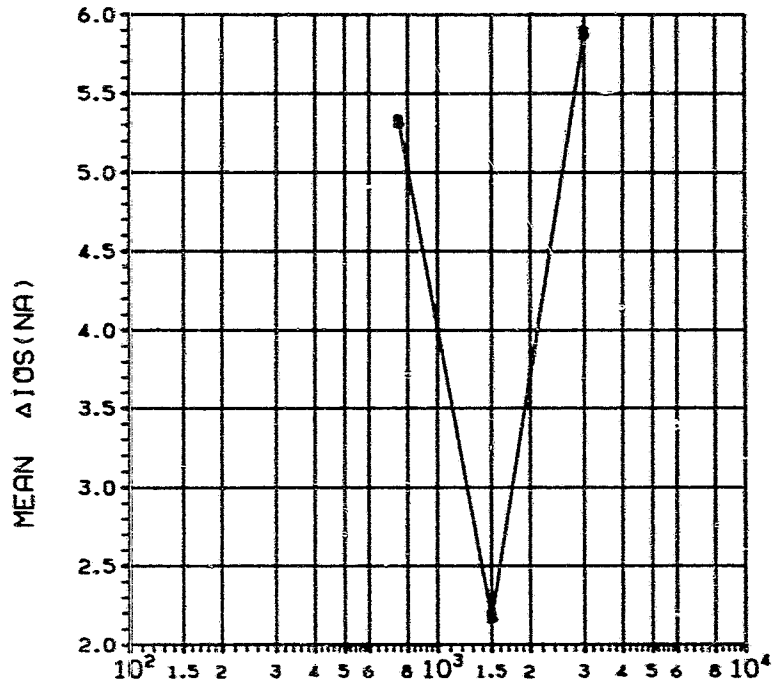
DEVICE TYPE: LM111 COMPARATOR
MFG: AMD 7 DEVICES TEST DATE 11-21-79
REF: JPL LOG 0547 DATE CODE NONE



(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00
A	.0625	.1357	.1810

DEVICE TYPE: LM111 COMPARATOR
MFG: AMD 7 DEVICES TEST DATE 11-21-79
REF: JPL LOG 0547 DATE CODE NONE



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00
B	5.655	1.429	2.062

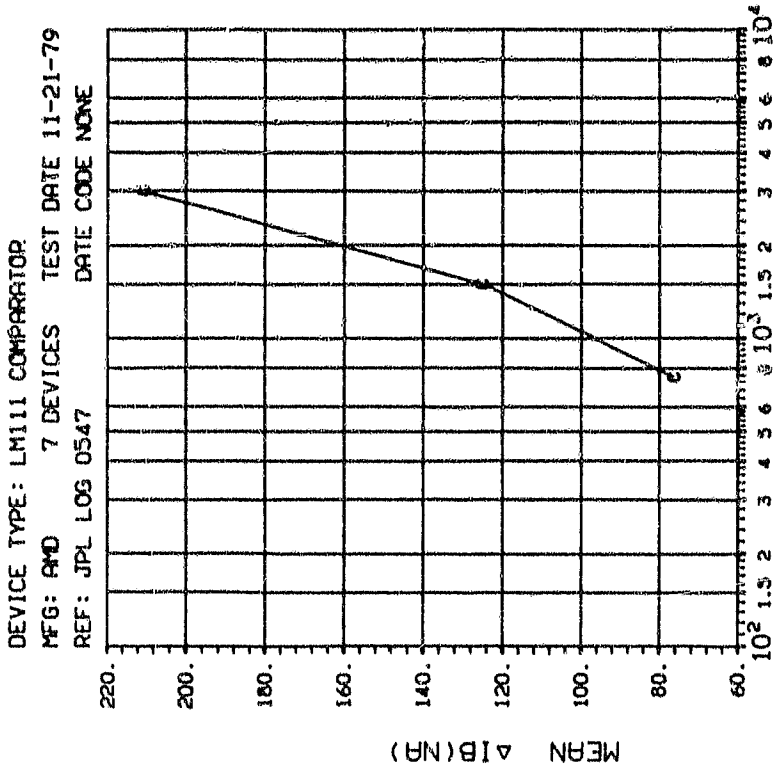
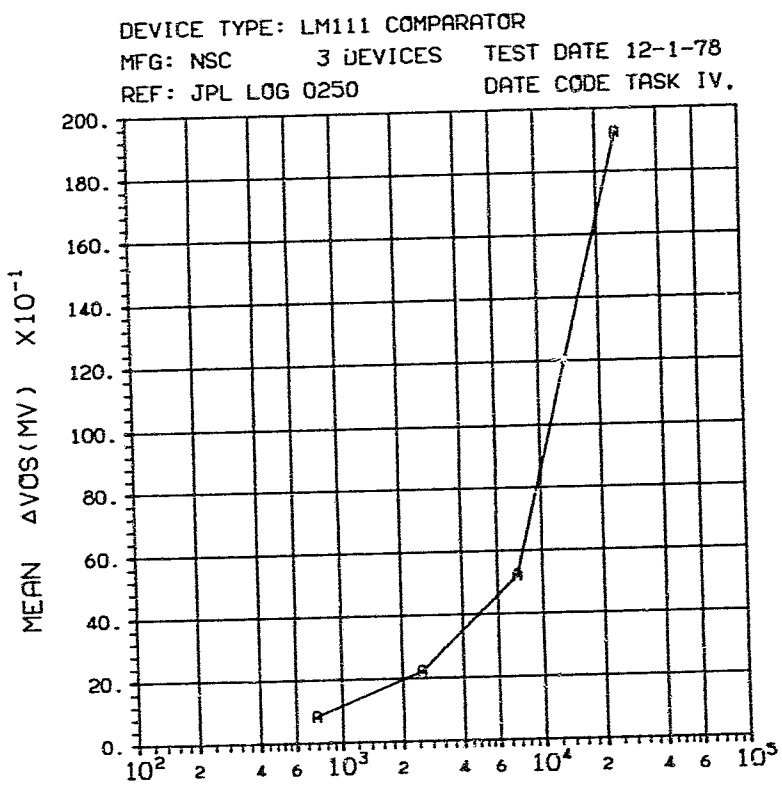
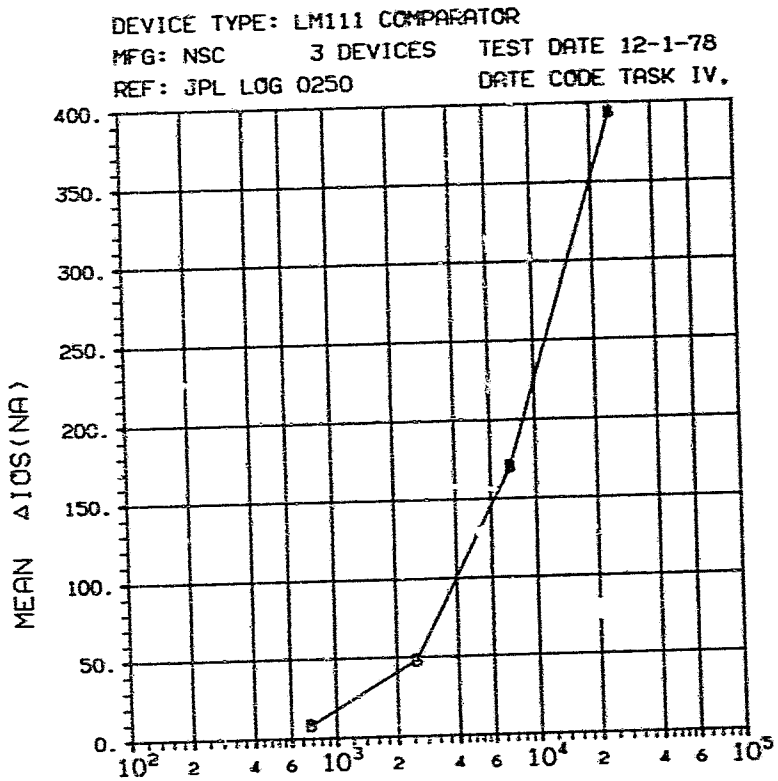


TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
C	3.800	5.005	8.716



(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	2.50	7.50	25.00
A	.2208	.6421	1.792	11.82



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	2.50	7.50	25.00
B	5.251	18.49	46.65	90.24

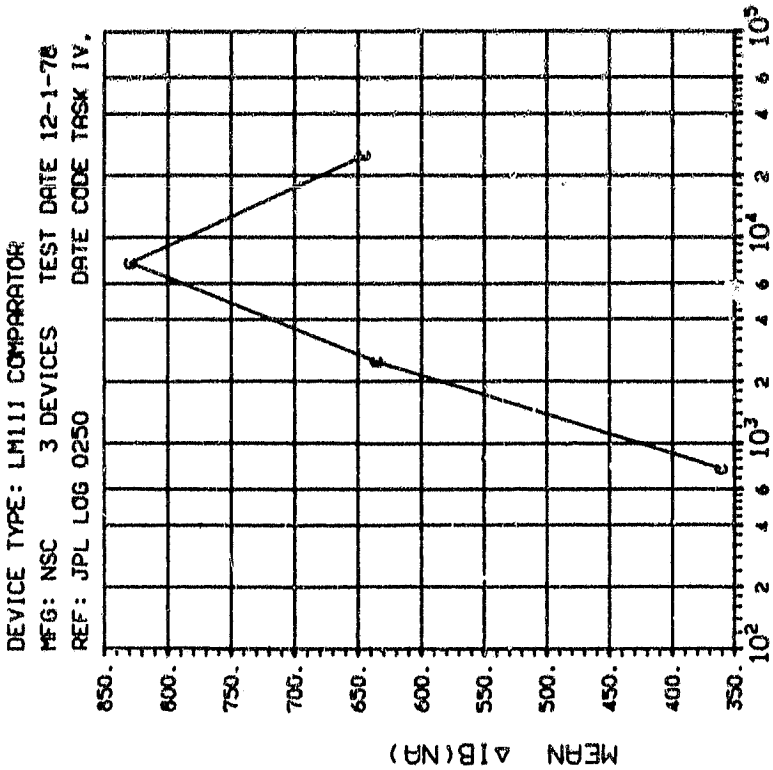


TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.75	2.50	7.50	25.00	
C	17.24	14.06	25.76	77.98	

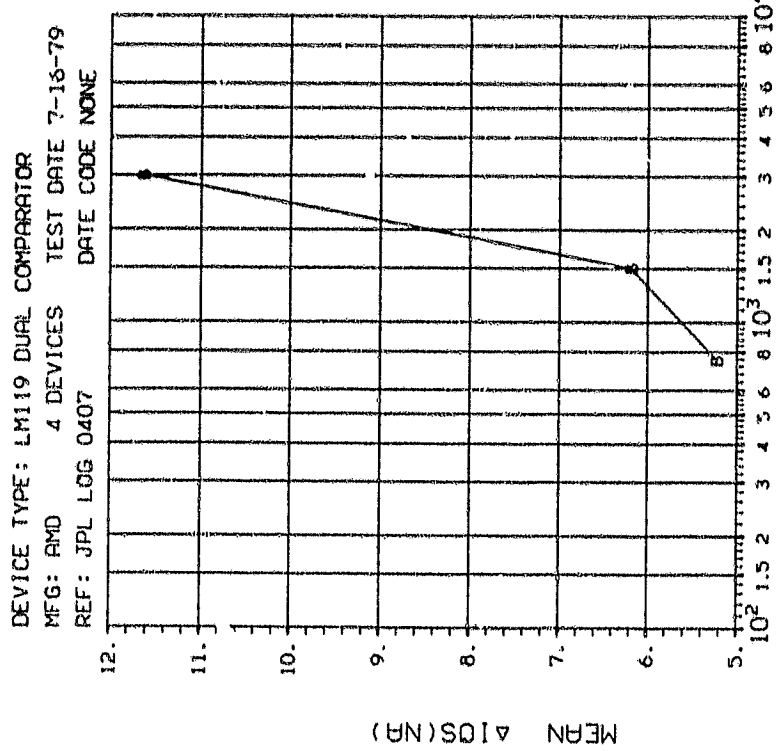


TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
B	4.254	7.368	4.792

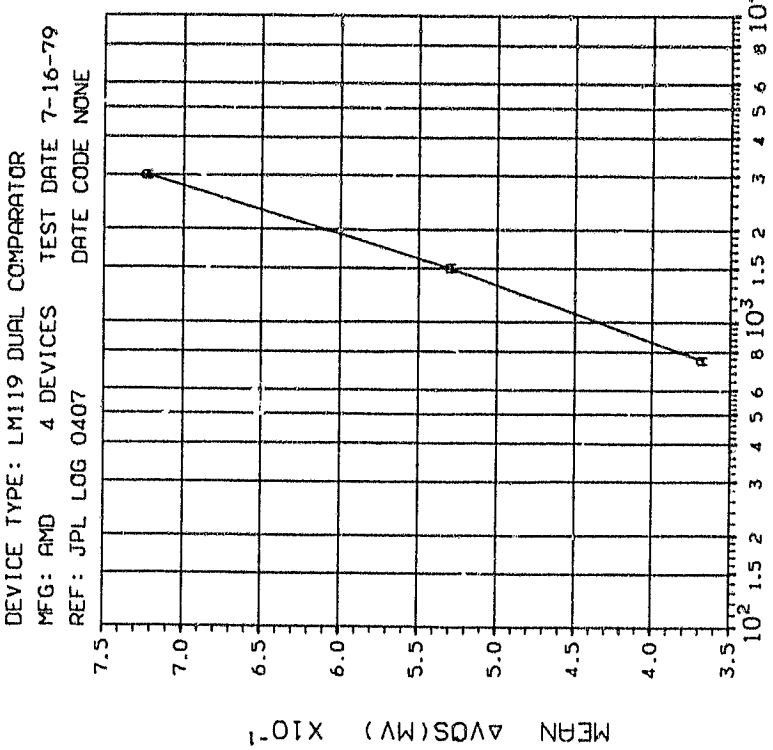
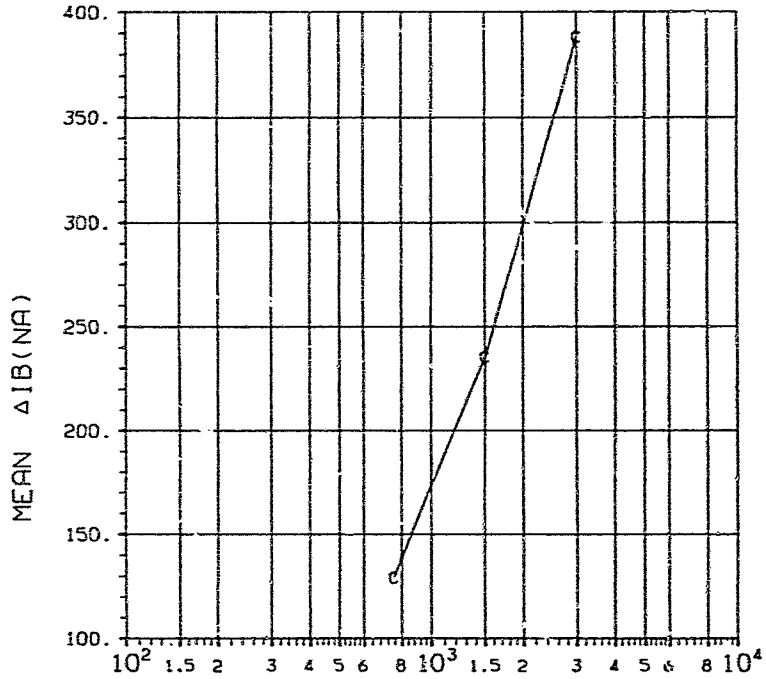


TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
A	.2220	.3286	.4484

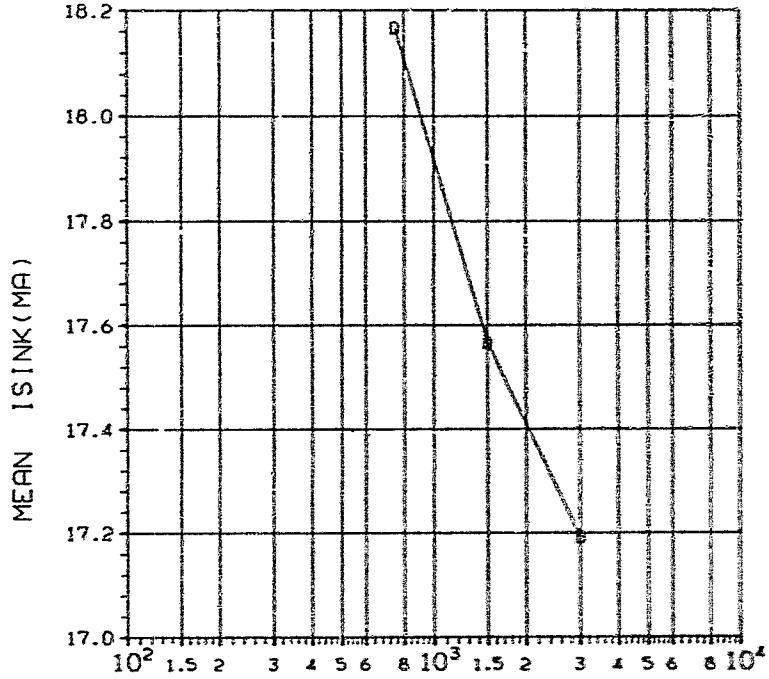
DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-16-79
REF: JPL LOG 0407 DATE CODE NONE



(3) IB (NON INVERTING INPUT) IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00
C	6.127	12.22	16.86

DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-16-79
REF: JPL LOG 0407 DATE CODE NONE

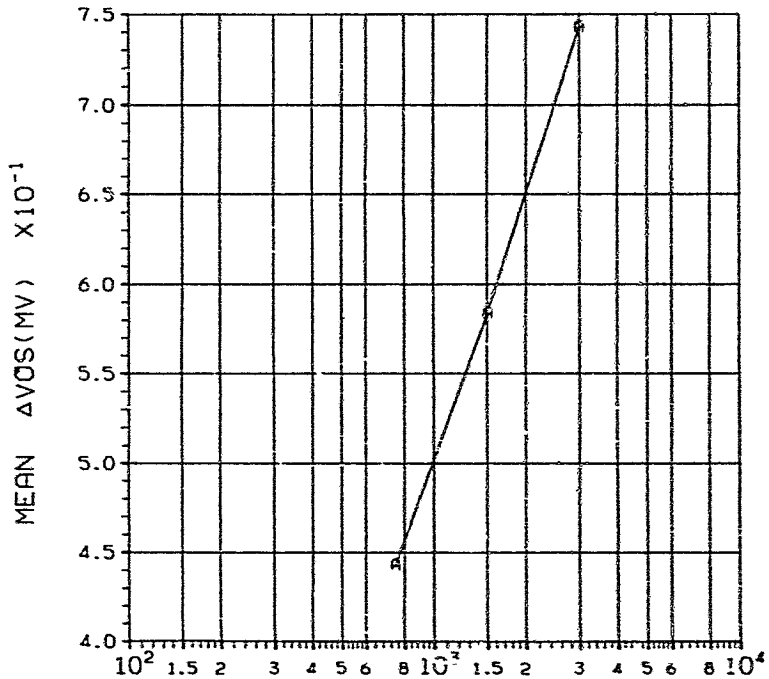


(4) I SINK IN MA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00
D	.4041	.4203	.3948

INITIAL MEAN VALUE ISINK(MA) = $1.94X10^{+1}$

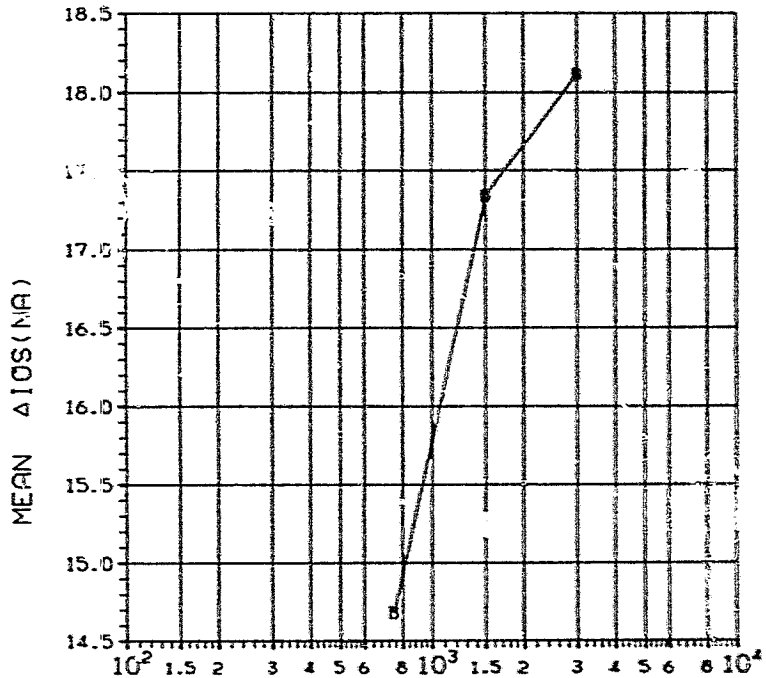
DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-16-79
REF: JPL LOG 0408 DATE CODE NONE



(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
A	.3072	.3534	.3632

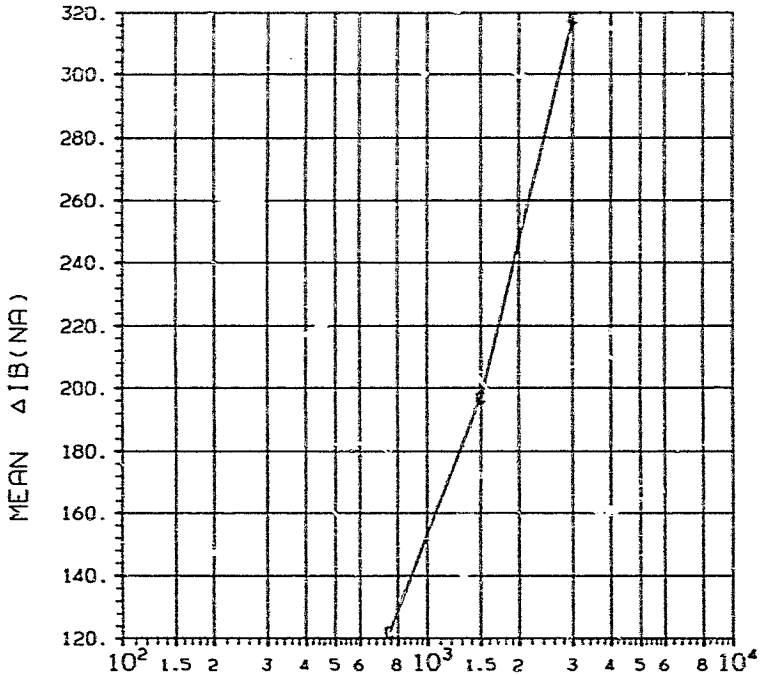
DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-16-79
REF: JPL LOG 0408 DATE CODE NONE



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
B	11.19	12.44	6.115

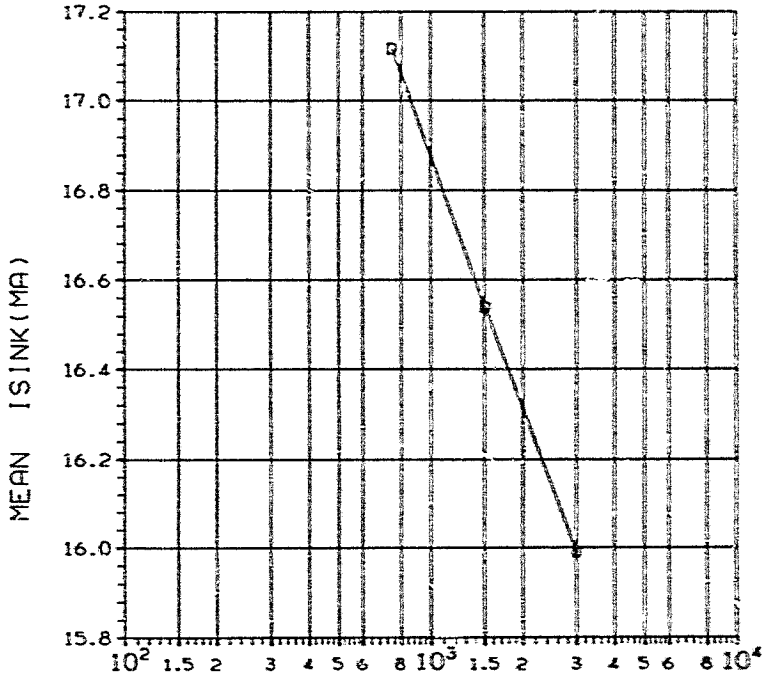
DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-16-79
REF: JPL LOG 0408 DATE CODE NONE



(3) IB (NON INVERTING INPUT) IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00
C	16.41	17.60	28.67

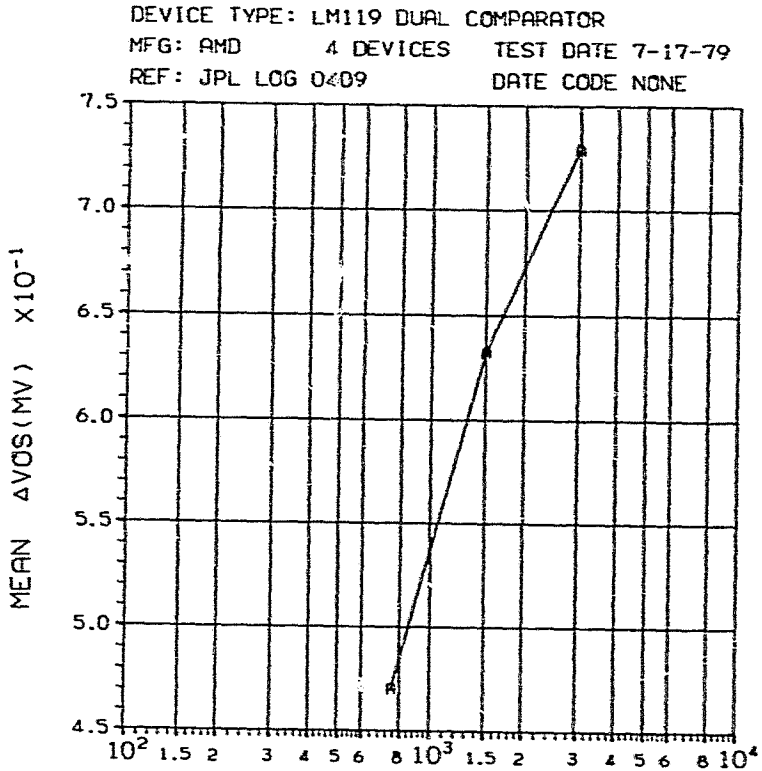
DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-16-79
REF: JPL LOG 0408 DATE CODE NONE



(4) I SINK IN MA VS DOSE

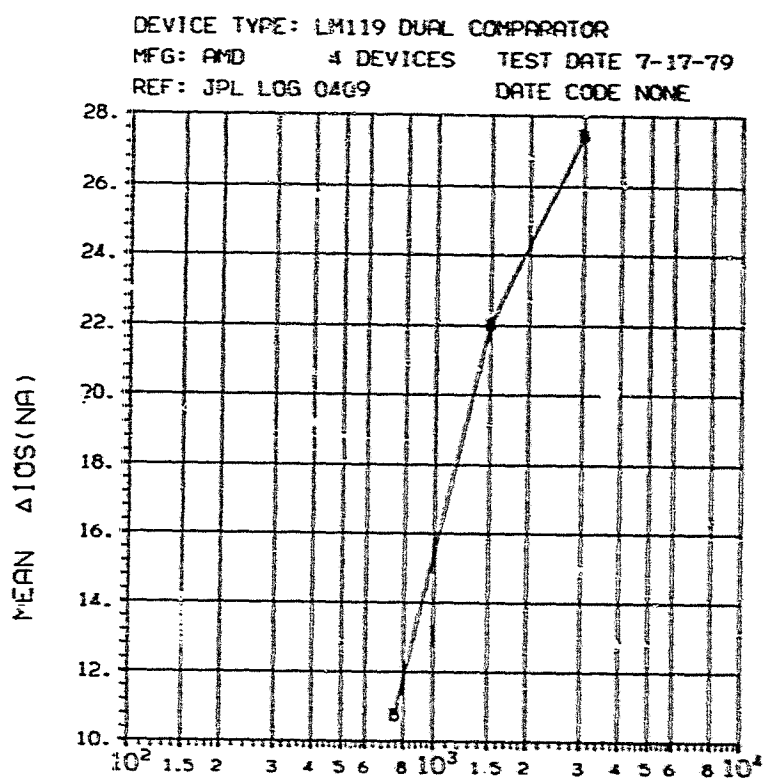
TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00
D	.6377	.5909	.6602

INITIAL MEAN VALUE ISINK(MA) = $1.72 \times 10^{+1}$



(1) VOS IN MV VS DOSE

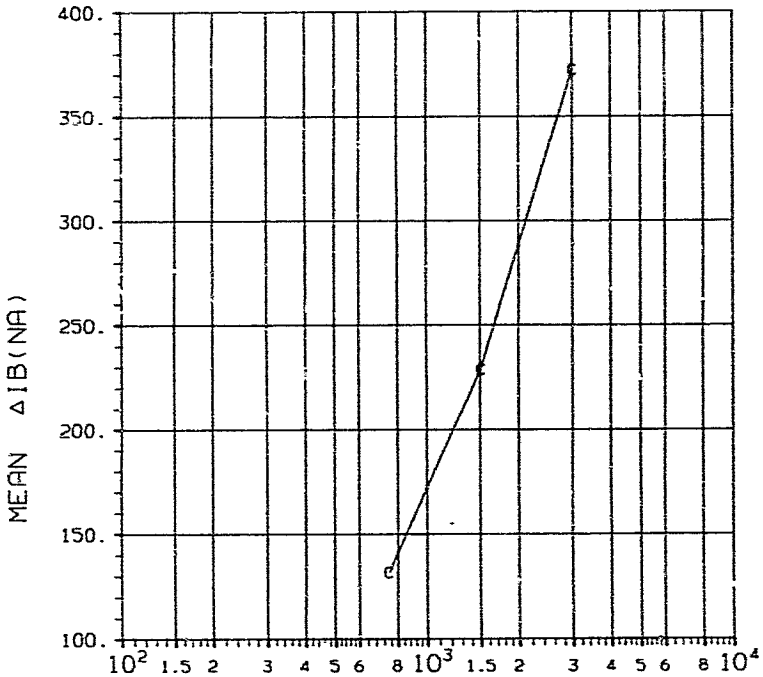
TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00
A	.4672	.6679	.6564



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00
B	7.718	14.32	27.72

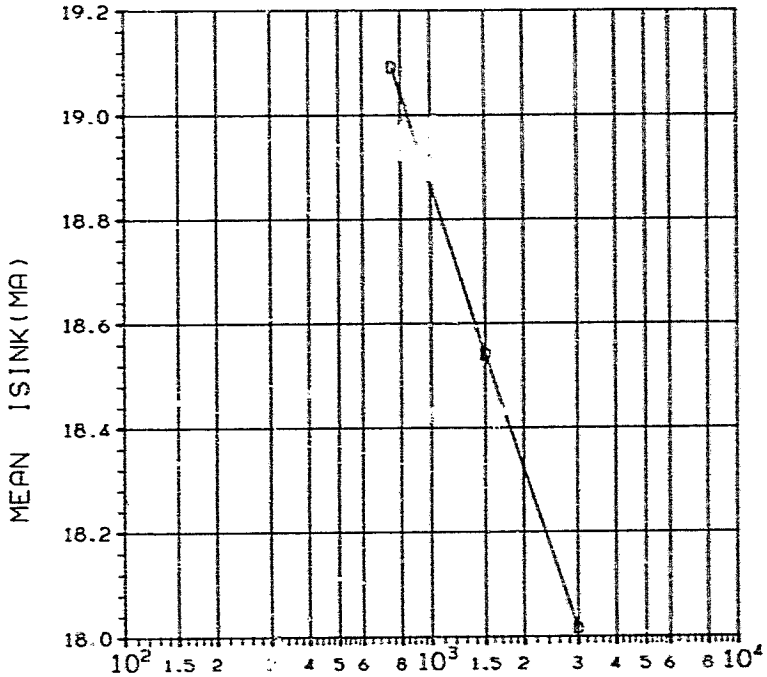
DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-17-79
REF: JPL LOG 0409 DATE CODE NONE



(3) IB (NON INVERTING INPUT) IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS		
CURVE	DOSE, kiloGy(Si)	
	.75	1.50 3.00
C	14.66	22.75 36.57

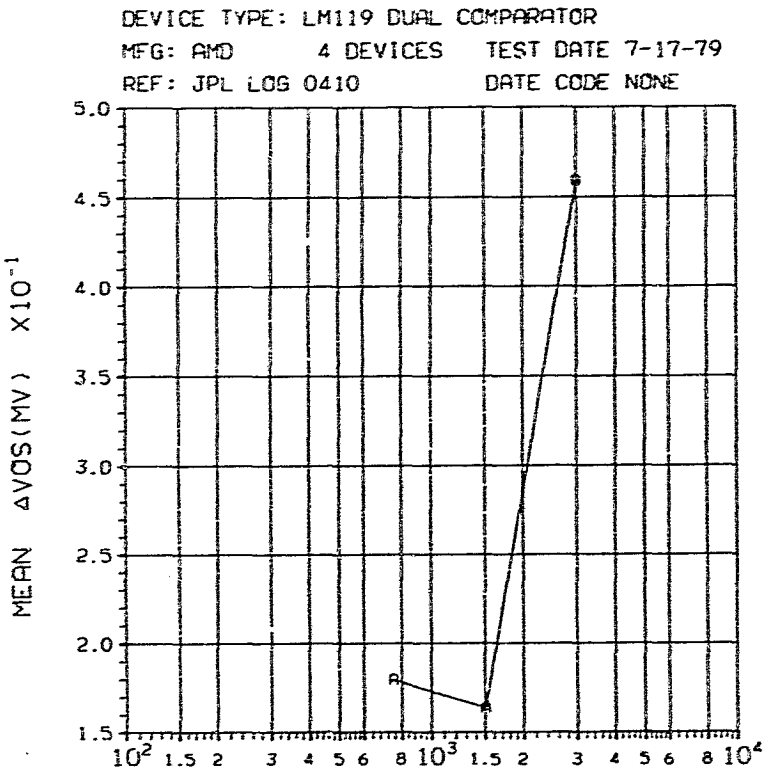
DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-17-79
REF: JPL LOG 0409 DATE CODE NONE



(4) I SINK IN MA VS DOSE

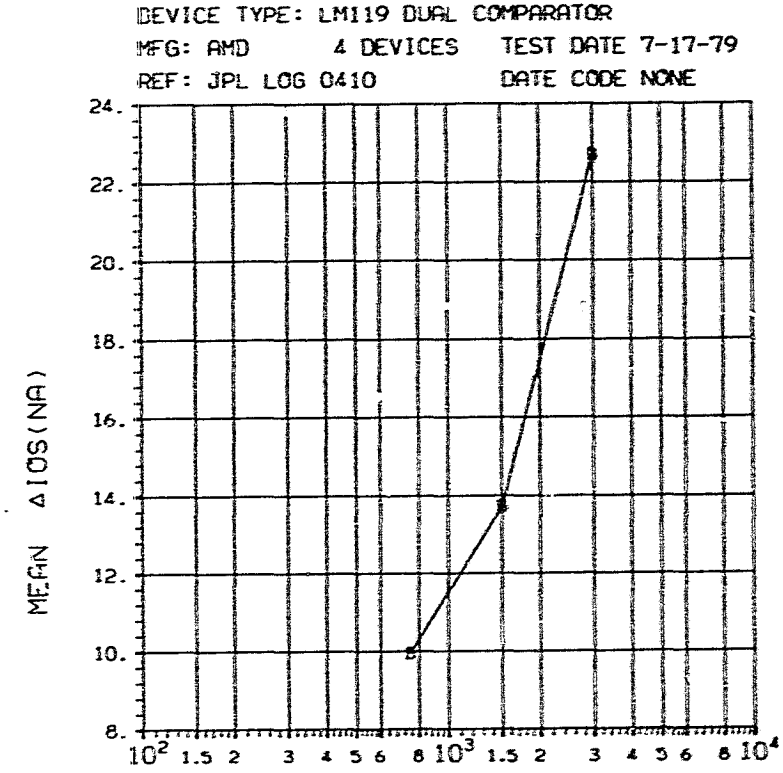
TABLE OF NORMAL STANDARD DEVIATIONS		
CURVE	DOSE, kiloGy(Si)	
	.75	1.50 3.00
D	.6898	.7500 .7703

INITIAL MEAN VALUE ISINK(MA) = $2.00 \times 10^{+1}$



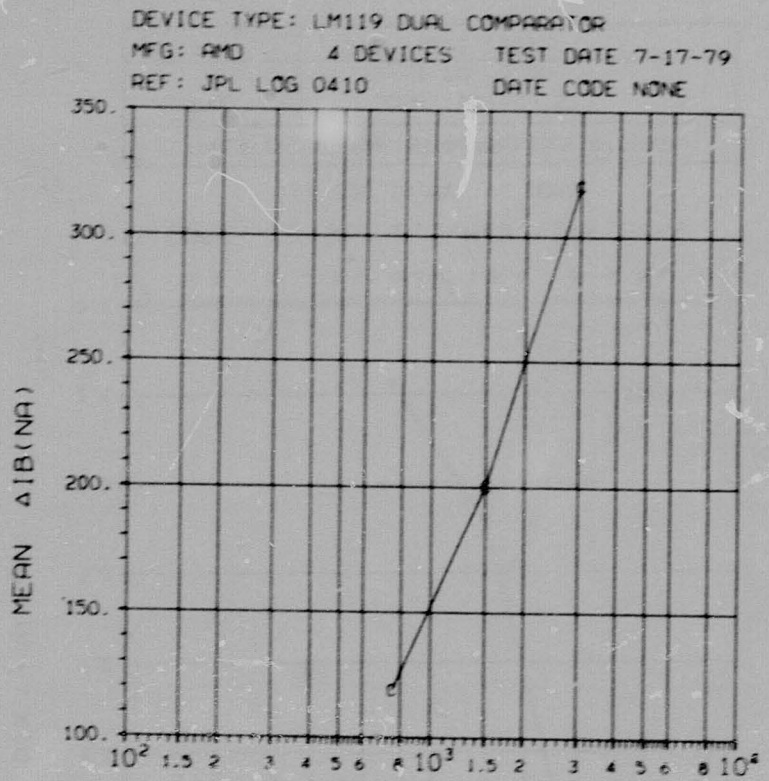
(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
A	.1549	.1240	.1436



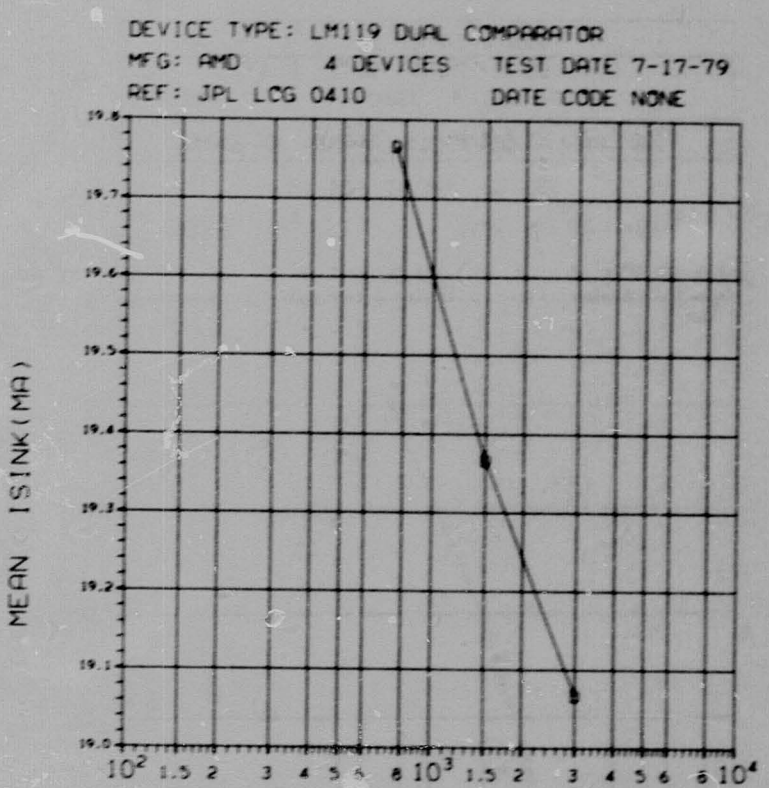
(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
B	8.362	9.180	13.60



(3) IB (NON INVERTING INPUT) IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00
C	13.29	12.65	15.00

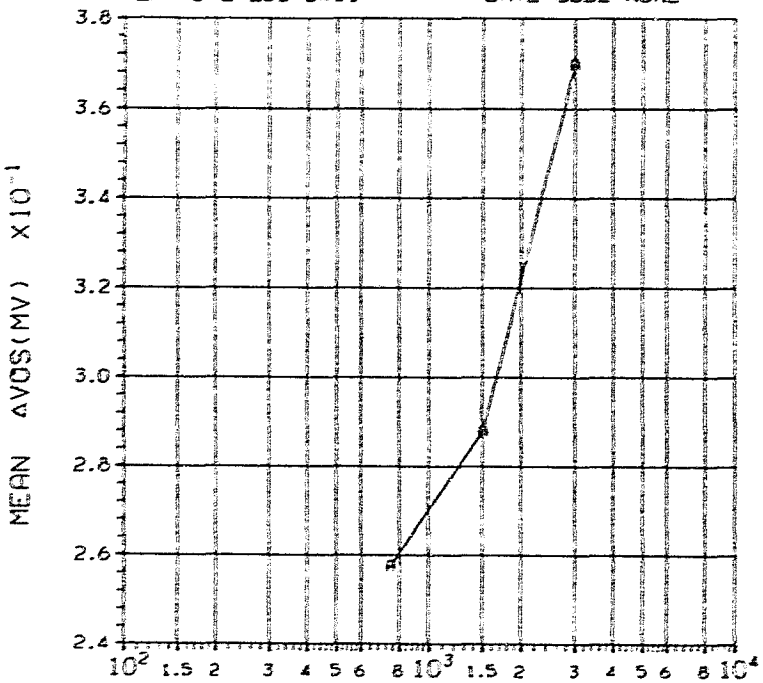


(4) I SINK IN MA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00
D	.7937	.8062	.8266

INITIAL MEAN VALUE ISINK(MA) = $2.02 \times 10^{+1}$

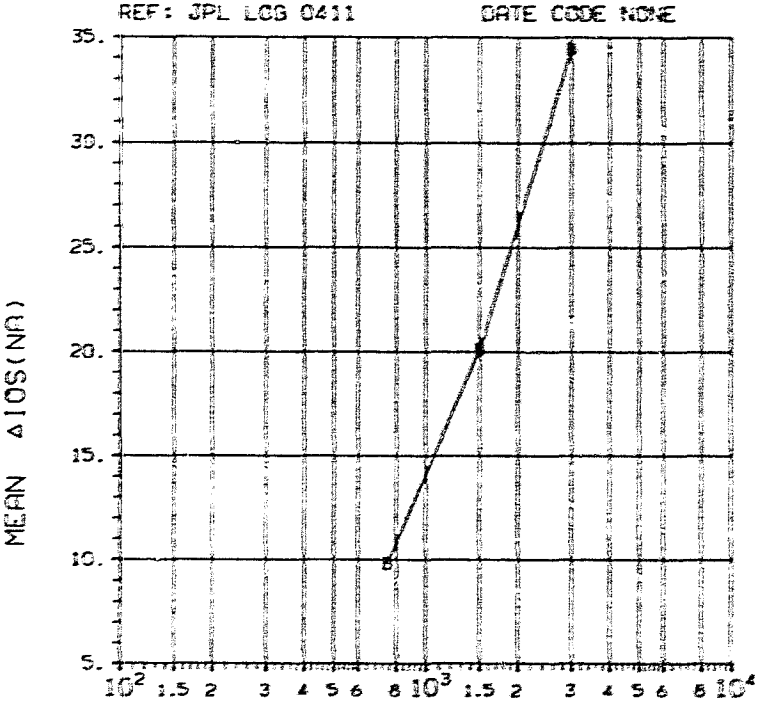
DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-17-79
REF: JPL LOG 0411 DATE CODE NONE



(1) VOS IN MV VS DOSE

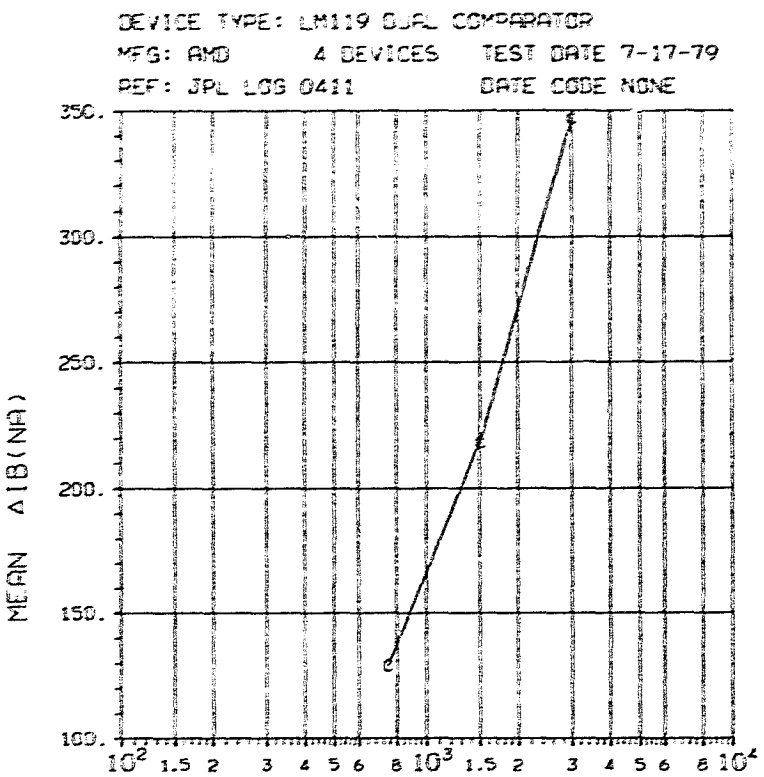
TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
A	.1290	.1821	.3245

DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-17-79
REF: JPL LOG 0411 DATE CODE NONE



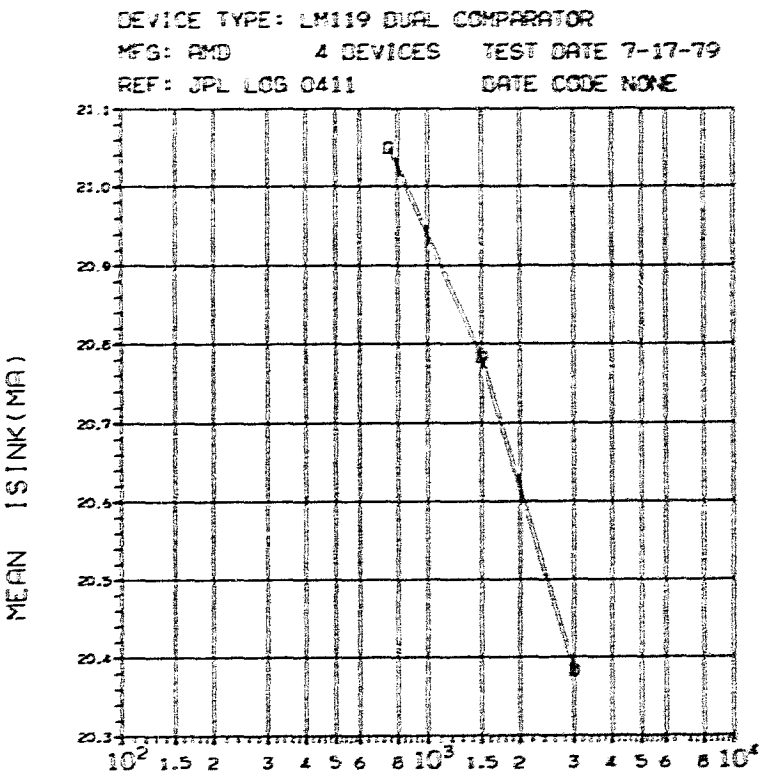
(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
B	8.131	12.03	4.869



(3) IB (NON INVERTING INPUT) IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS	
CURVE	DOSE, kiloGy(Si) .75 1.50 3.00
C	8.608 17.09 28.63

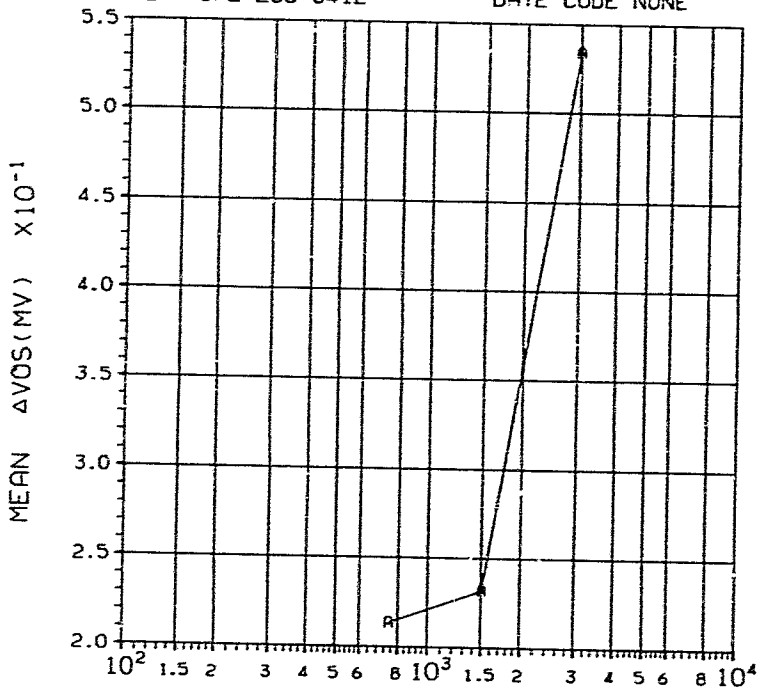


(4) I SINK IN MA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS	
CURVE	DOSE, kiloGy(Si) .75 1.50 3.00
D	1.069 1.102 1.012

INITIAL MEAN VALUE ISINK(MA) = $2.15 \times 10^{+1}$

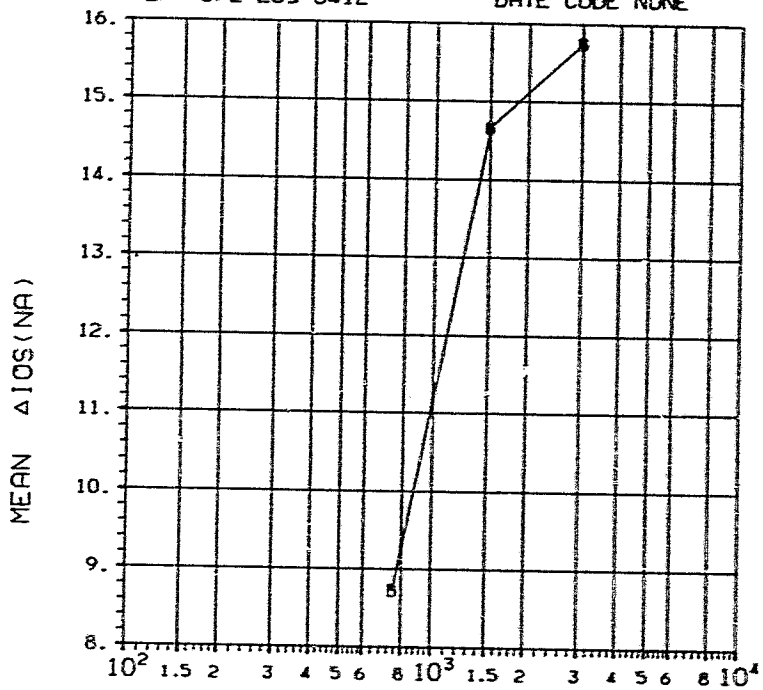
DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-17-79
REF: JPL LOG 0412 DATE CODE NONE



(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00
A	.0658	.1703	.2044

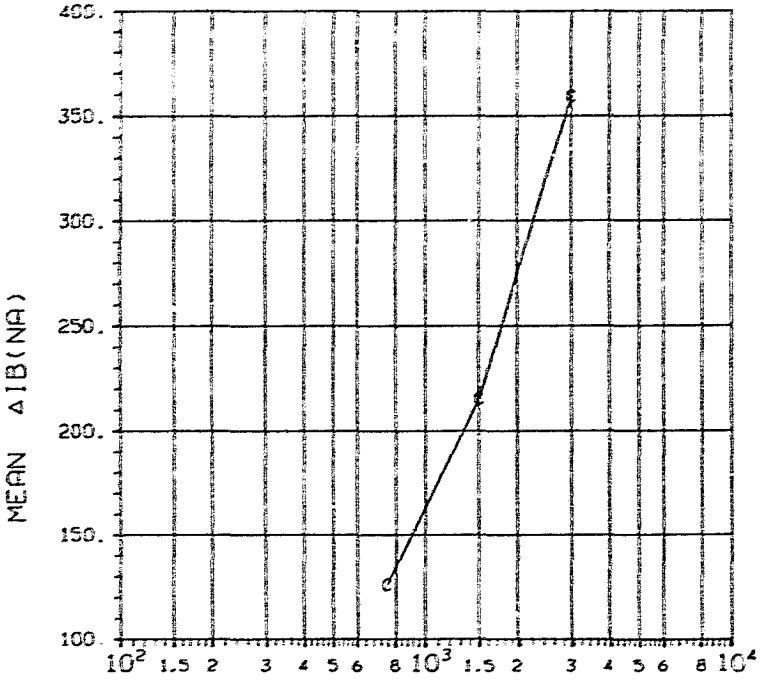
DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-17-79
REF: JPL LOG 0412 DATE CODE NONE



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00
B	4.835	6.962	9.618

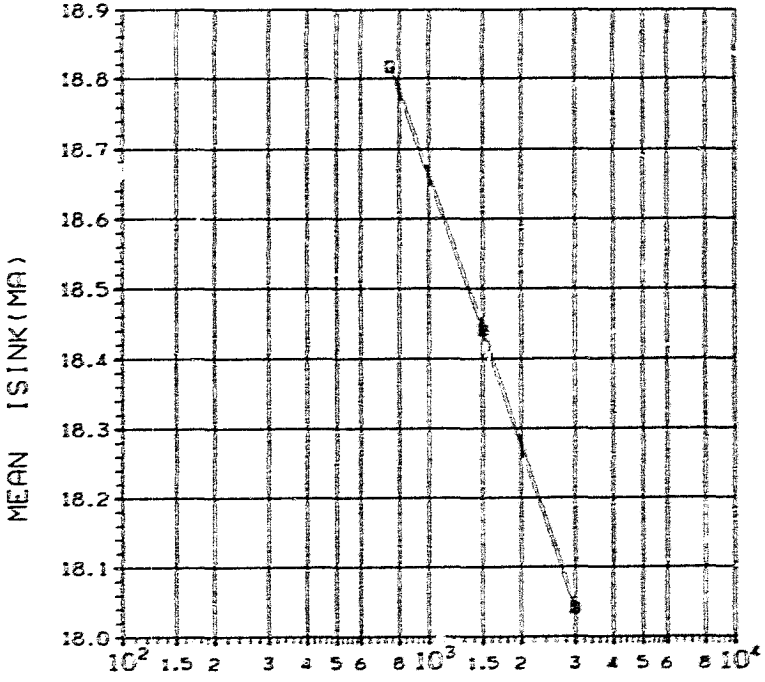
DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-17-79
REF: JPL LOG 0412 DATE CODE NONE



(3) IB (NON INVERTING INPUT) IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
C	6.817	3.930	22.55

DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-17-79
REF: JPL LOG 0412 DATE CODE NONE

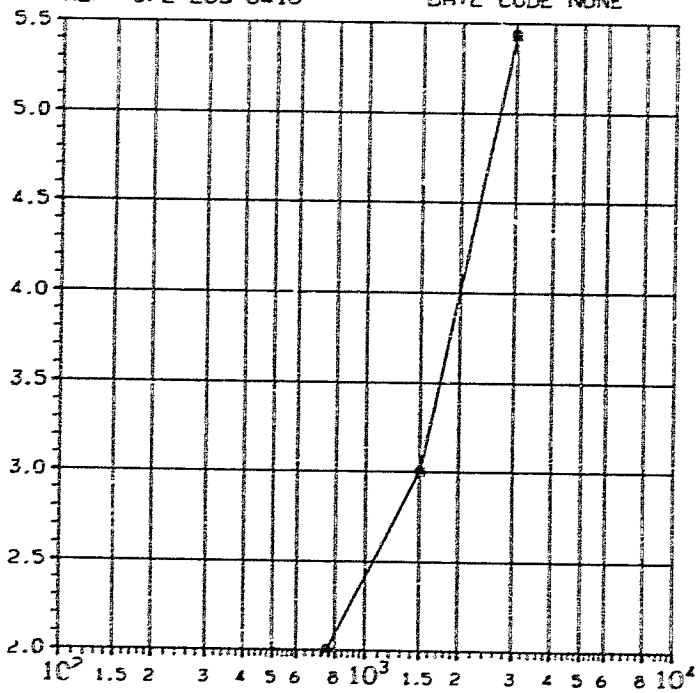


(4) I SINK IN MA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
D	.4690	.4787	.6238

INITIAL MEAN VALUE ISINK(MA) = 1.93X10⁻³

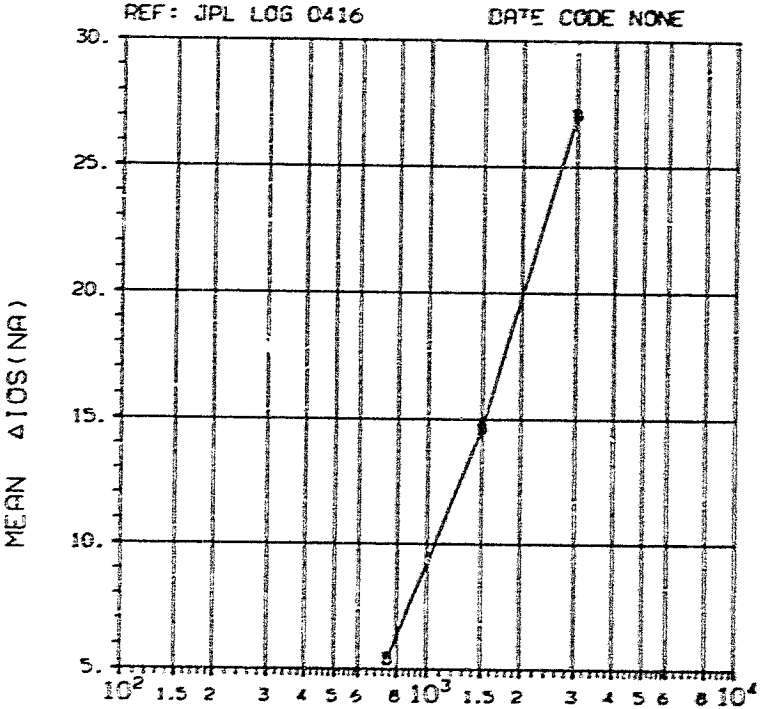
DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-27-79
REF: JPL LOG 0416 DATE CODE NONE



(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
A	.2058	.2895	.4142

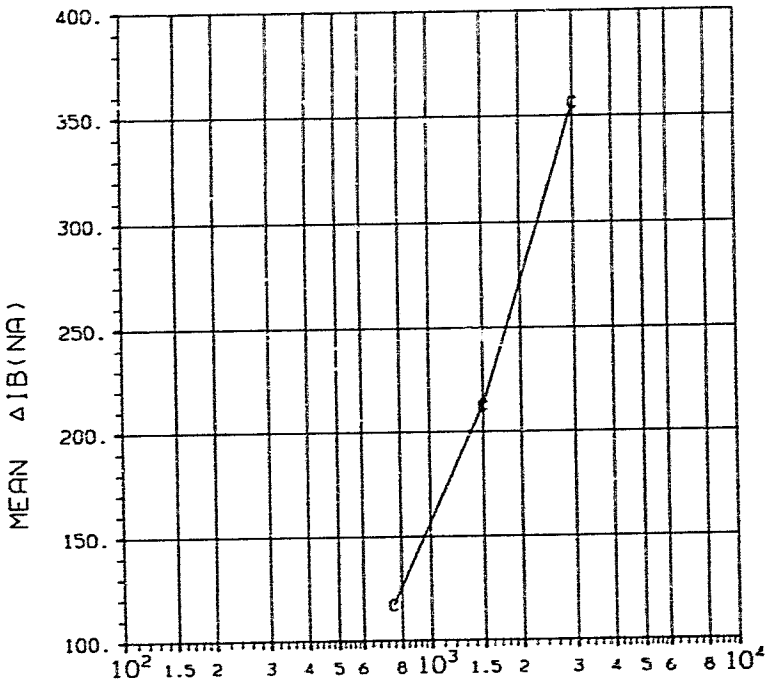
DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-27-79
REF: JPL LOG 0416 DATE CODE NONE



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
B	3.579	9.059	19.57

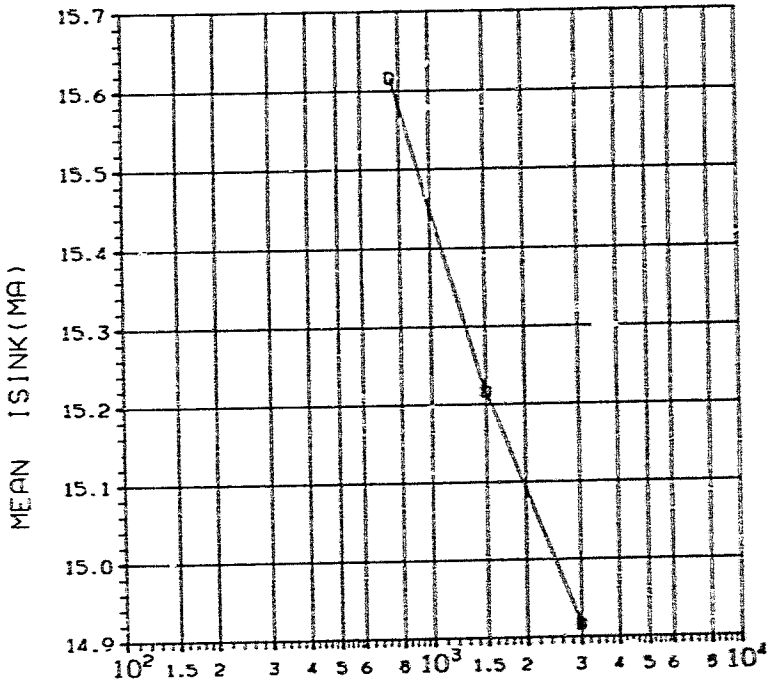
DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-27-79
REF: JPL LOG 0416 DATE CODE NONE



(3) IB (NON INVERTING INPUT) IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
C	19.21	35.27	61.04

DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-27-79
REF: JPL LOG 0416 DATE CODE NONE

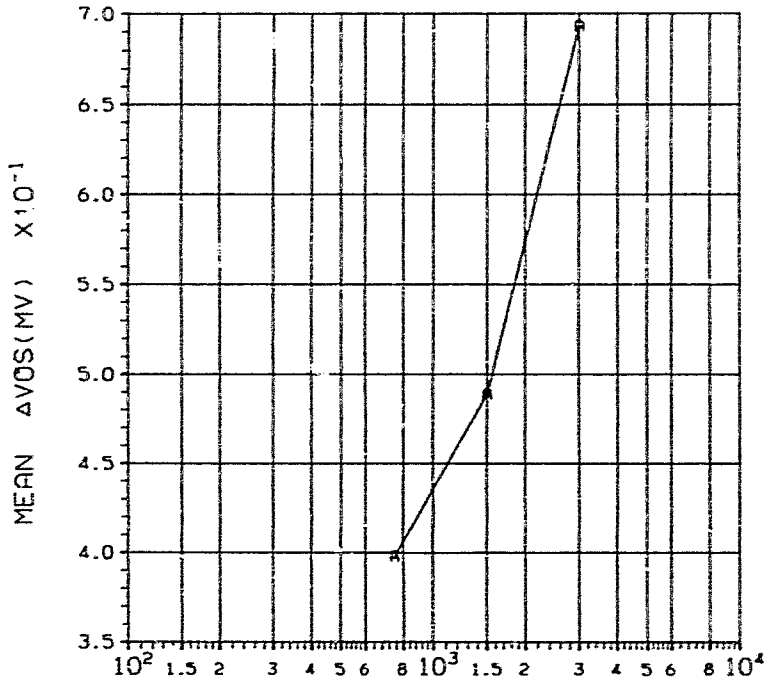


(4) I SINK IN MA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
C	.5228	.5657	.6377

INITIAL MEAN VALUE ISINK(MA) = $1.51 \times 10^{+1}$

DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-27-79
REF: JPL LOG 0417 DATE CODE NONE

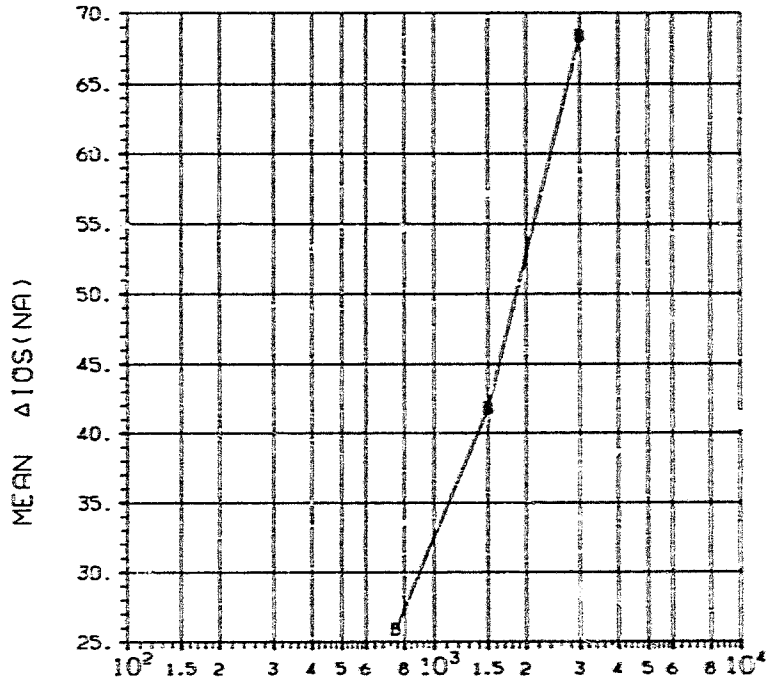


DOSE, Gy(Si) 2.5 MeV electrons

(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
A	.4410	.4832	.3795

DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-27-79
REF: JPL LOG 0417 DATE CODE NONE

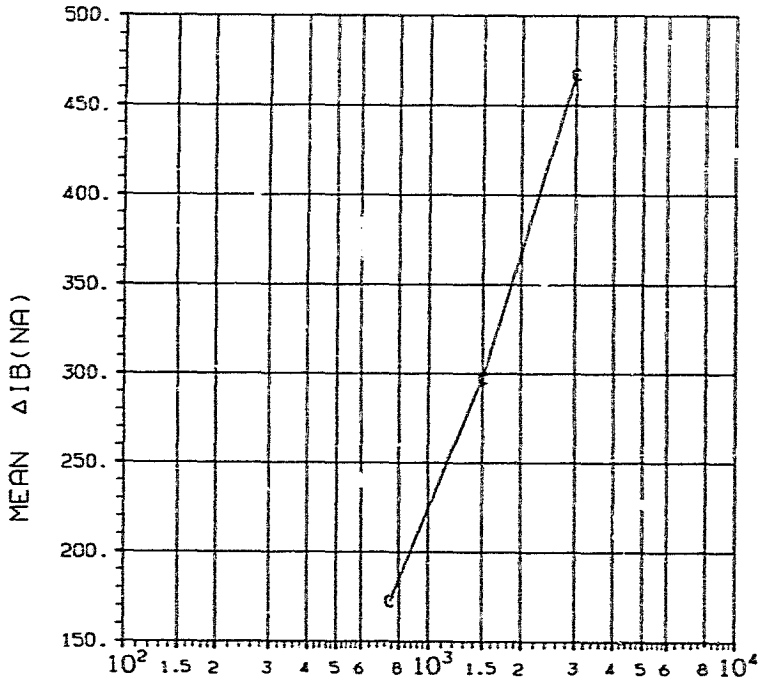


DOSE, Gy(Si) 2.5 MeV electrons

(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
B	14.02	15.15	3.940

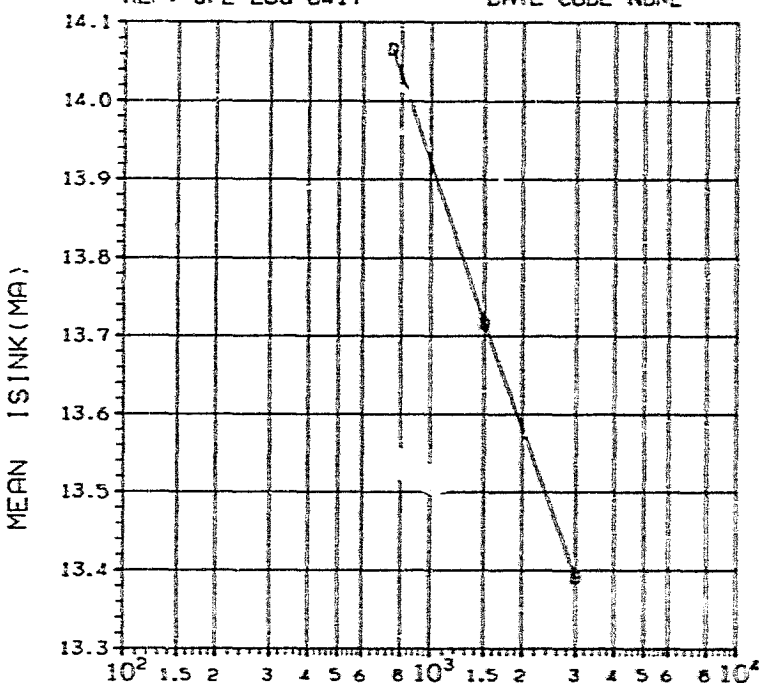
DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-27-79
REF: JPL LOG 0417 DATE CODE NONE



(3) IB (NON INVERTING INPUT) IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
C	30.68	46.93	71.12

DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-27-79
REF: JPL LOG 0417 DATE CODE NONE



(4) I SINK IN MA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
D	.2082	.1826	.1893

INITIAL MEAN VALUE ISINK(MA) = $1.42 \times 10^{+1}$

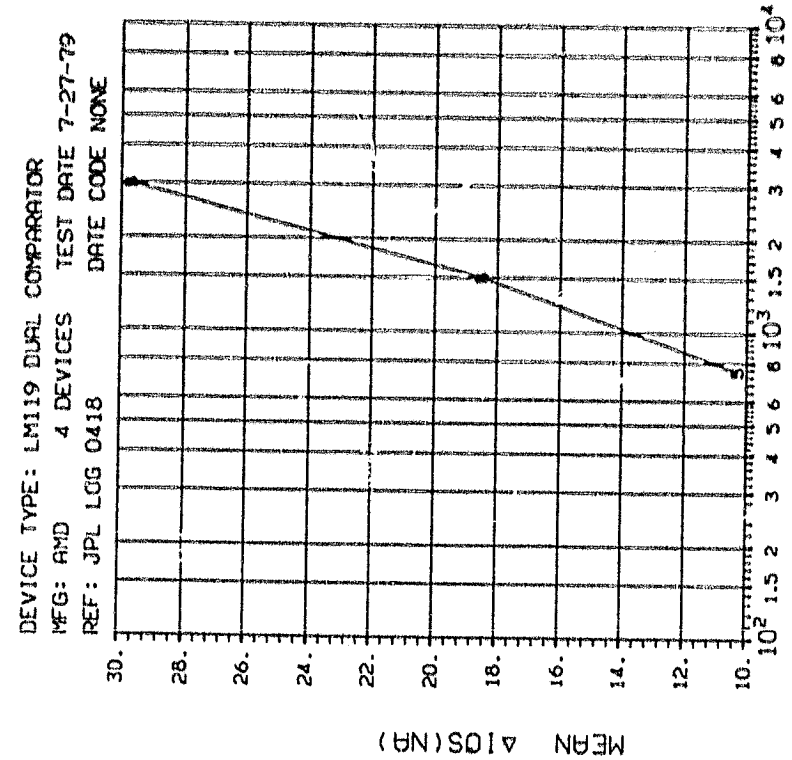


TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
B	6.826	13.56	14.50

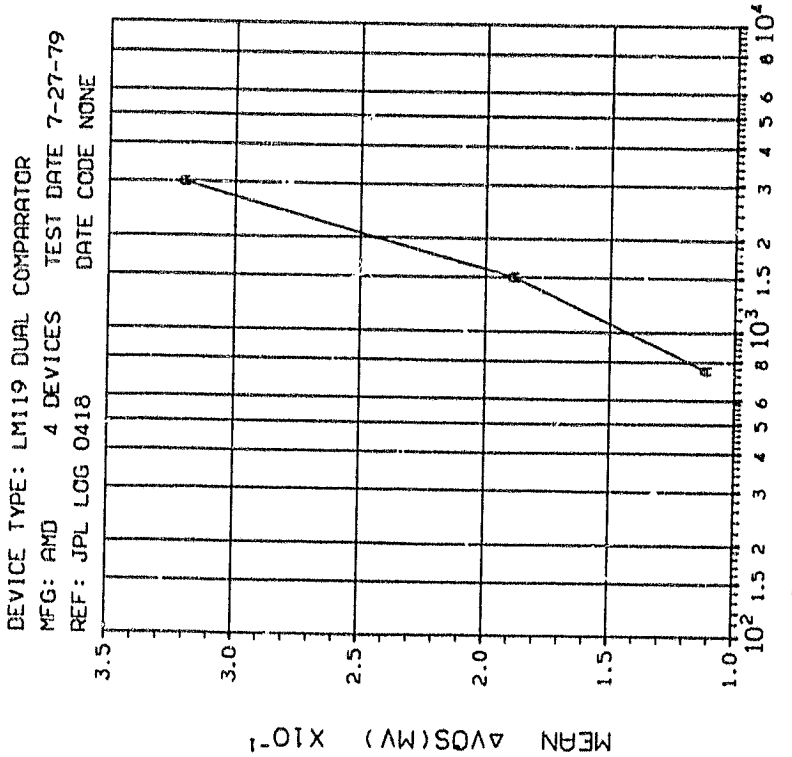
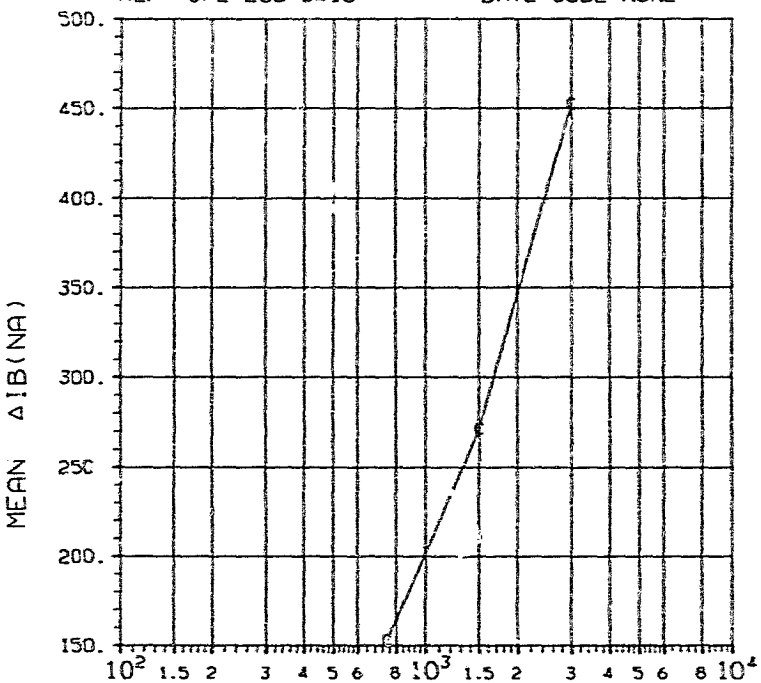


TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
A	.0202	.0762	.1038

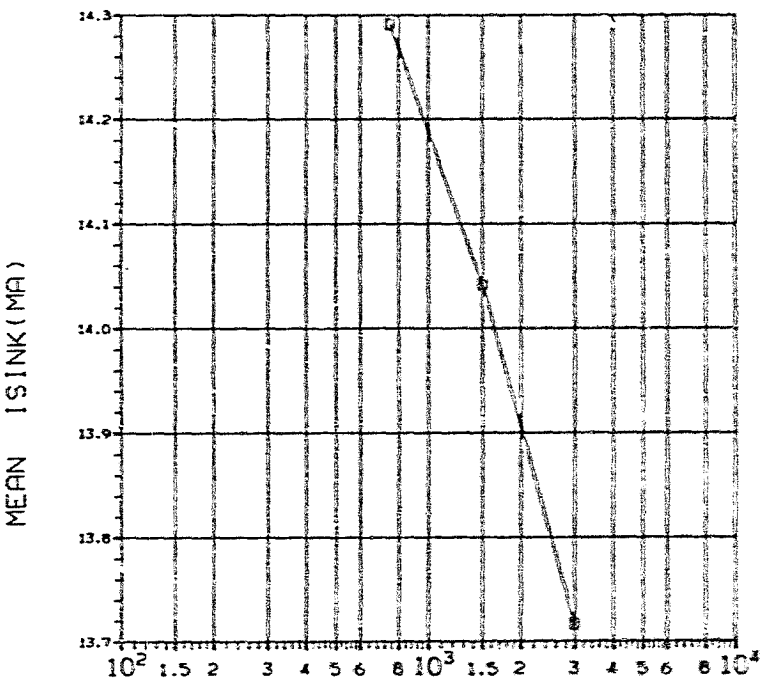
DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-27-79
REF: JPL LOG 0418 DATE CODE NONE



(3) IB (NON INVERTING INPUT) IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
C	12.94	25.95	34.60

DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-27-79
REF: JPL LOG 0418 DATE CODE NONE

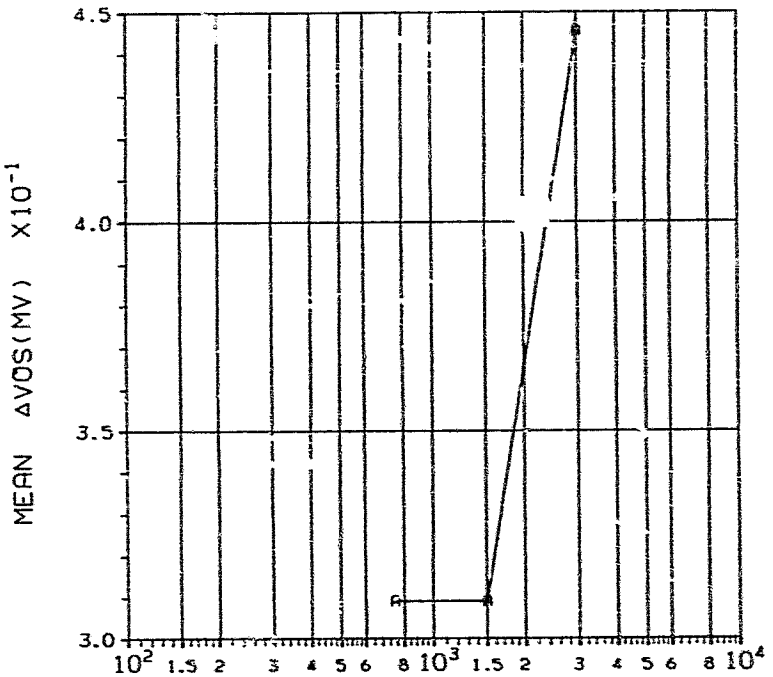


(4) I SINK IN MA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
D	.3096	.3403	.3559

INITIAL MEAN VALUE ISINK(MA) = 1.44×10^{-1}

DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-27-79
REF: JPL LOG 0419 DATE CODE NONE

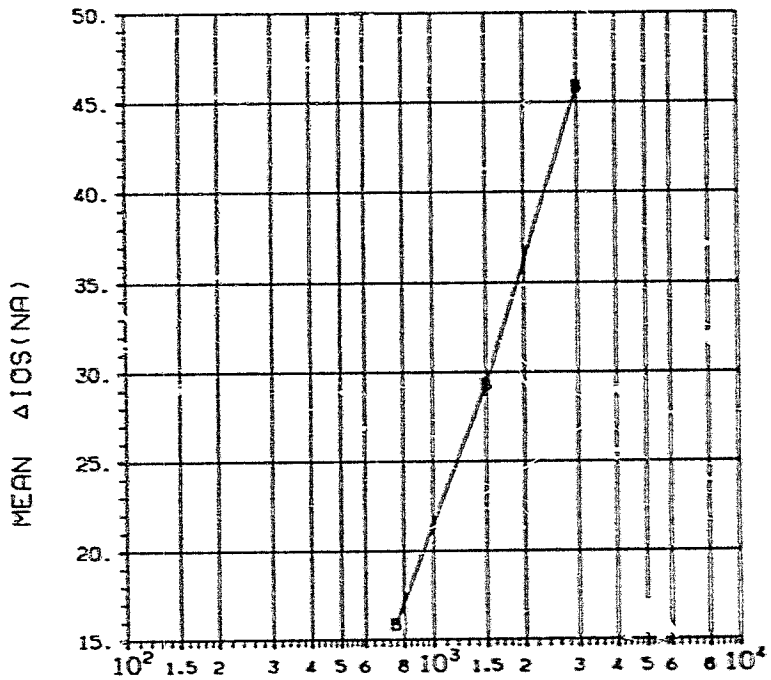


DOSE, Gy(Si) 2.5 MeV electrons

(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00
A	.3242	.3323	.3909

DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-27-79
REF: JPL LOG 0419 DATE CODE NONE

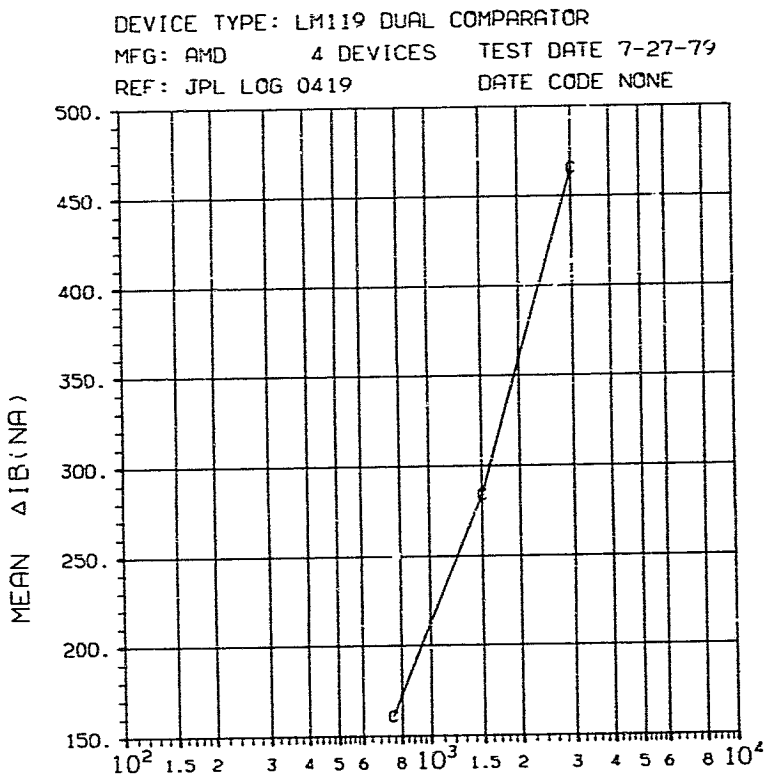


DOSE, Gy(Si) 2.5 MeV electrons

(2) IOS IN NA VS DOSE

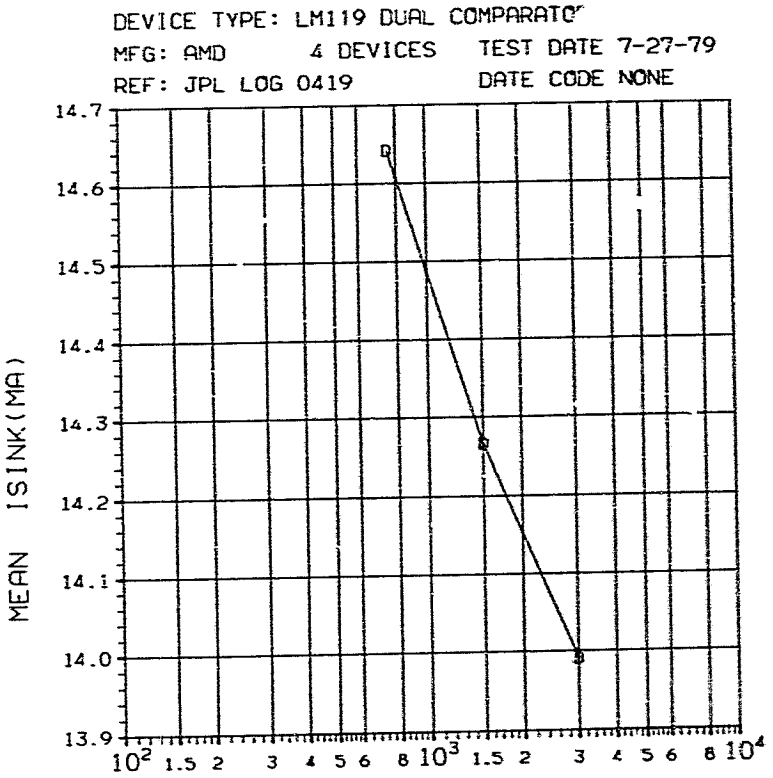
TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00
B	6.758	13.60	28.72

ORIGINAL PAGE IS
OF POOR QUALITY



(3) IB (NON INVERTING INPUT) IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS	
CURVE	DOSE, kiloGy(Si) .75 1.50 3.00
C	13.63 23.92 31.68

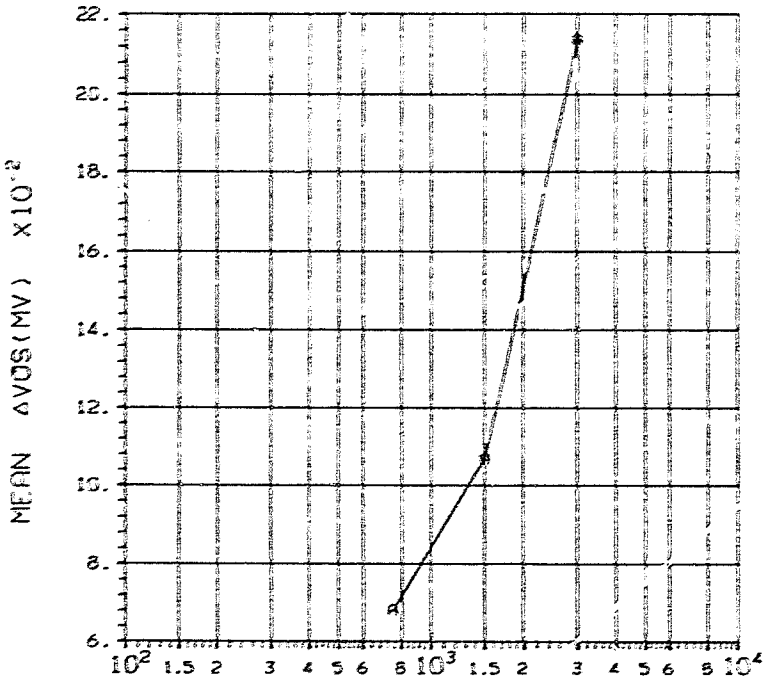


(4) I SINK IN MA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS	
CURVE	DOSE, kiloGy(Si) .75 1.50 3.00
D	.2872 .3000 .2630

INITIAL MEAN VALUE ISINK(MA) = $1.45 \times 10^{+1}$

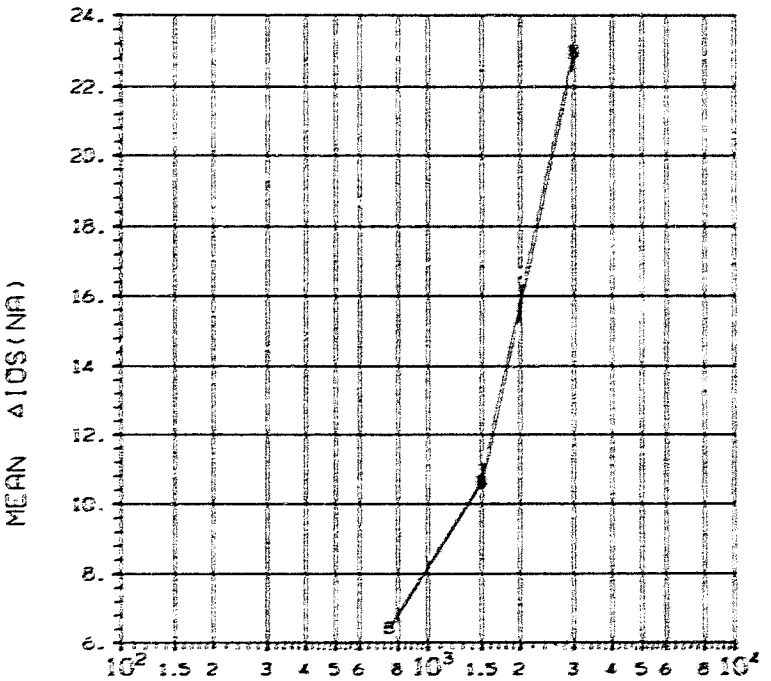
DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-27-79
REF: JPL LOG 0420 DATE CODE NONE



(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
A	.0641	.0710	.1855

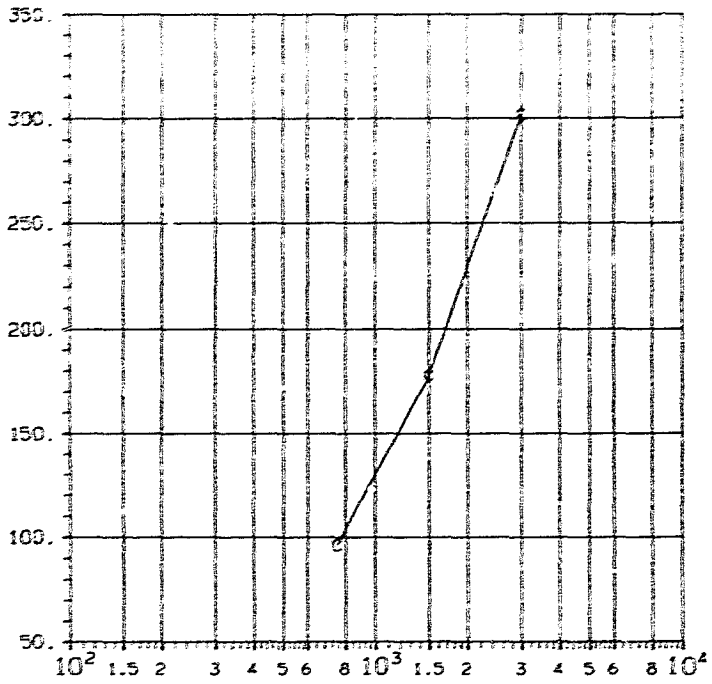
DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-27-79
REF: JPL LOG 0420 DATE CODE NONE



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
B	10.10	14.12	19.65

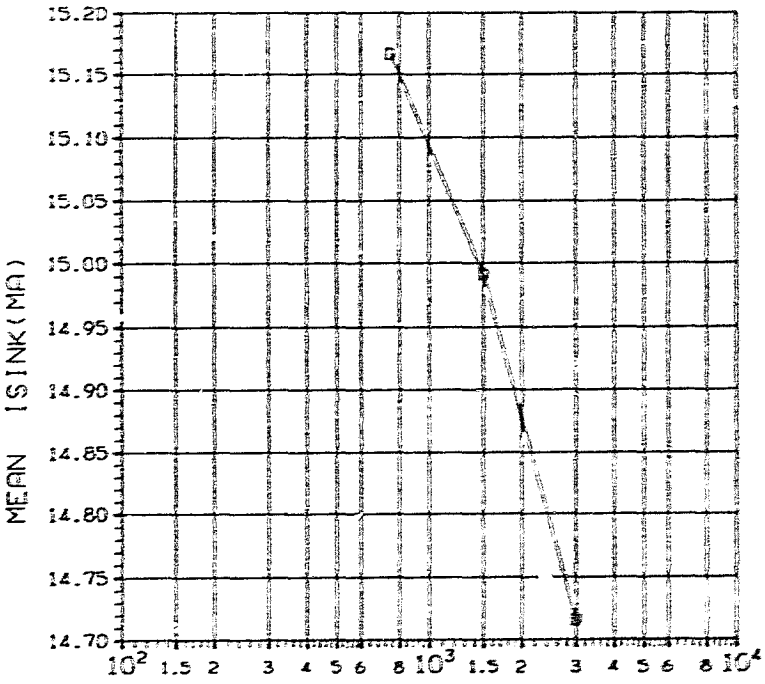
DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-27-79
REF: JPL LOG 0420 DATE CODE NONE



(3) IB (NON INVERTING INPUT) IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
C	7.573	14.56	32.83

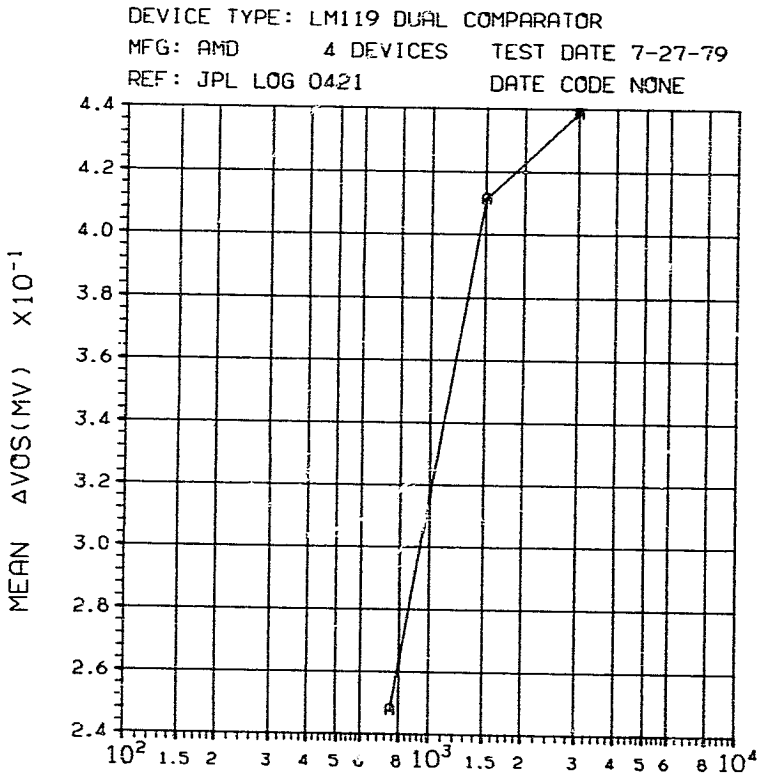
DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-27-79
REF: JPL LOG 0420 DATE CODE NONE



(4) I SINK IN MA VS DOSE

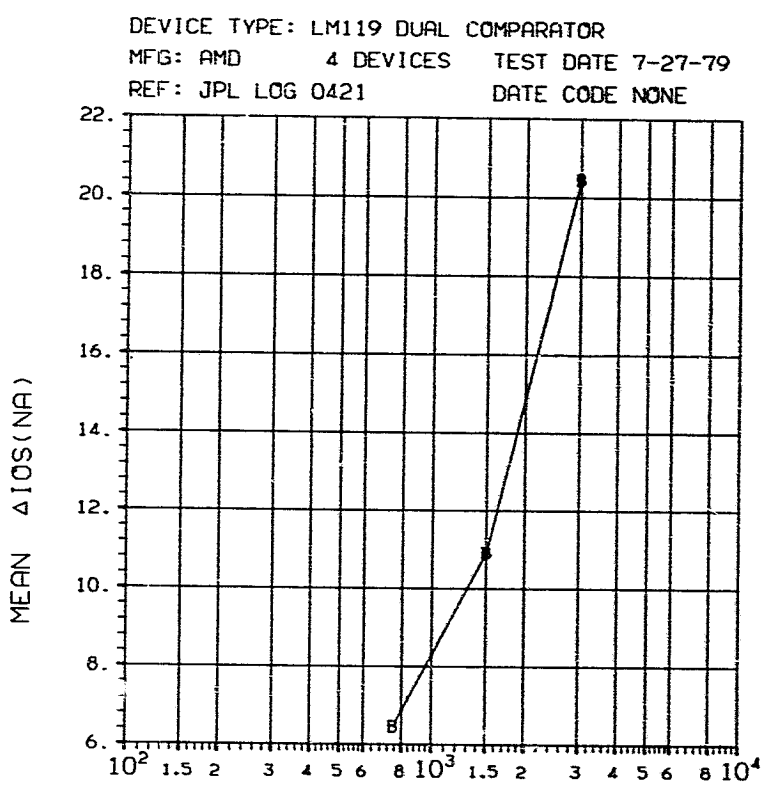
TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
D	1.034	1.024	1.033

INITIAL MEAN VALUE ISINK(MA) = $1.53 \times 10^{+1}$



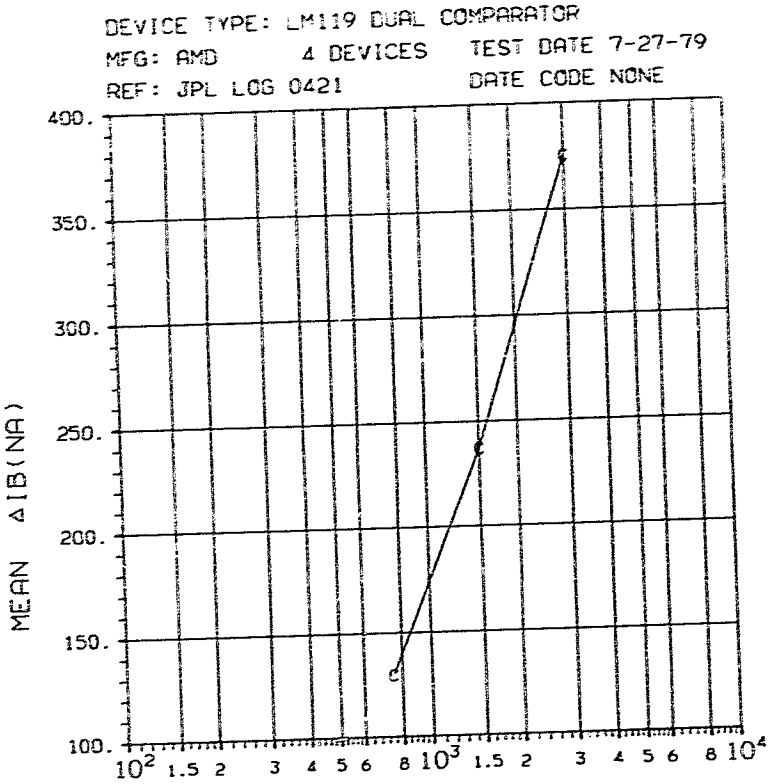
(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
A	.2409	.2974	.3207



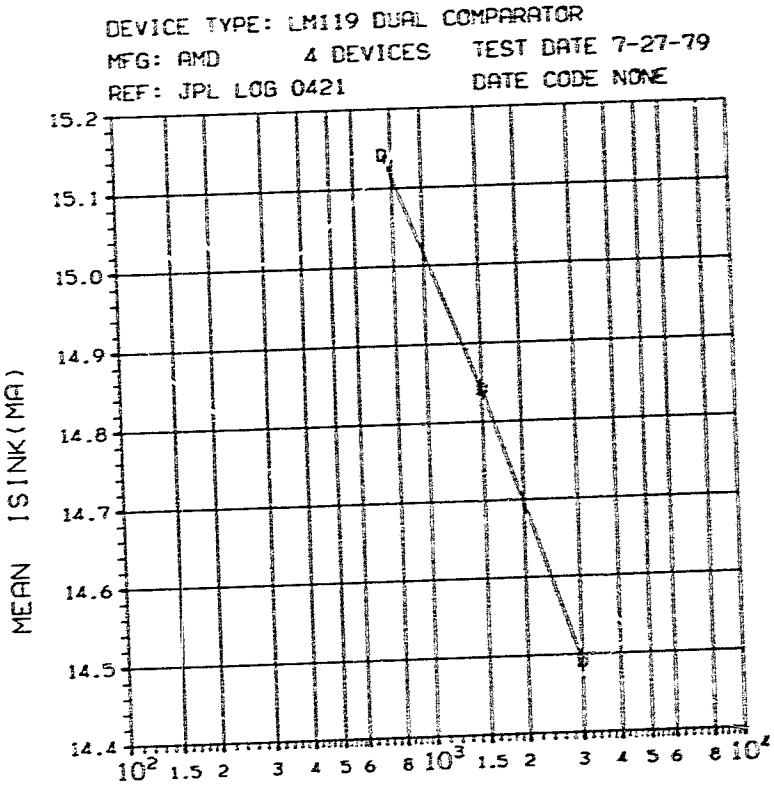
(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
B	7.038	9.462	13.94



(3) IB (NON INVERTING INPUT) IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
C	10.55	21.28	35.04

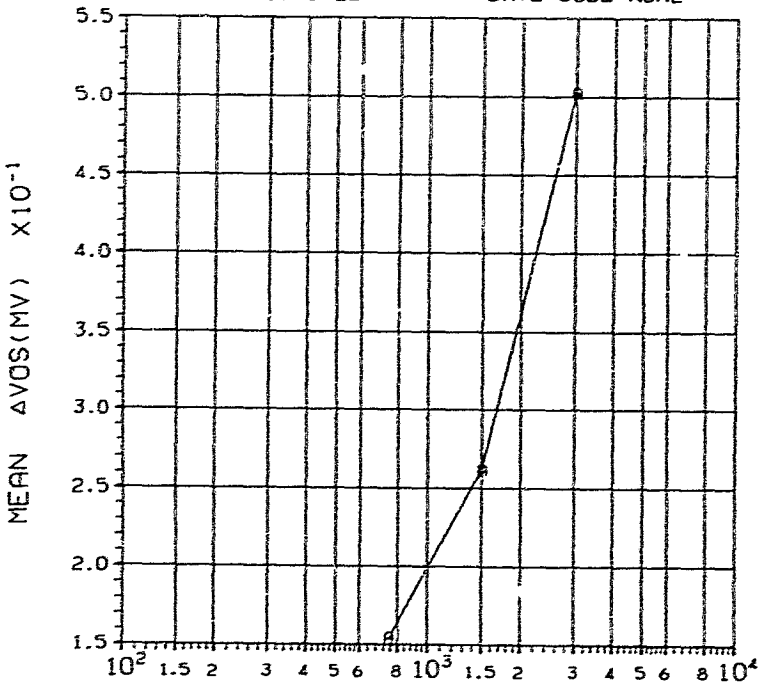


(4) I SINK IN MA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
D	.4856	.4272	.5123

INITIAL MEAN VALUE ISINK(MA) = $1.55 \times 10^{+1}$

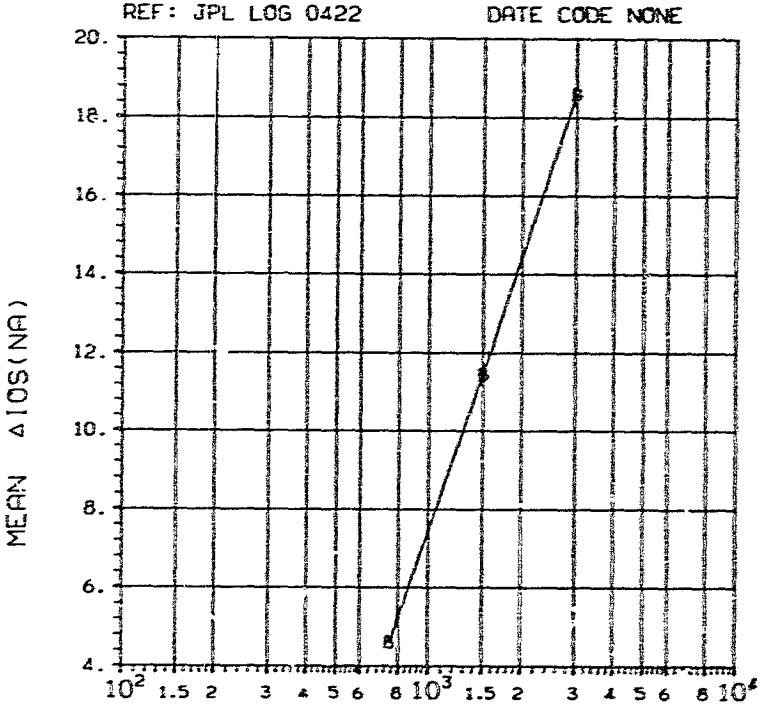
DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-27-79
REF: JPL LOG 0422 DATE CODE NONE



(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
A	.0856	.1079	.0755

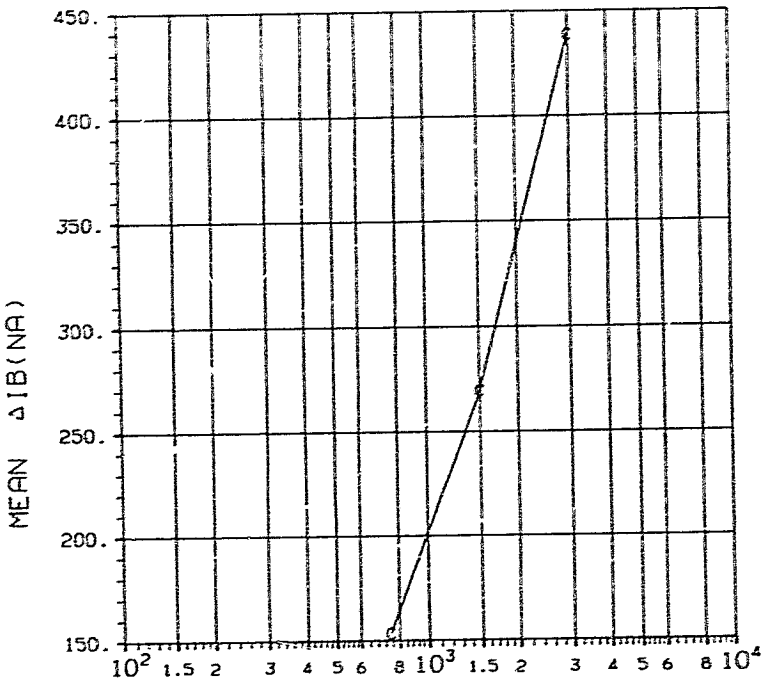
DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-27-79
REF: JPL LOG 0422 DATE CODE NONE



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
B	3.700	8.241	17.10

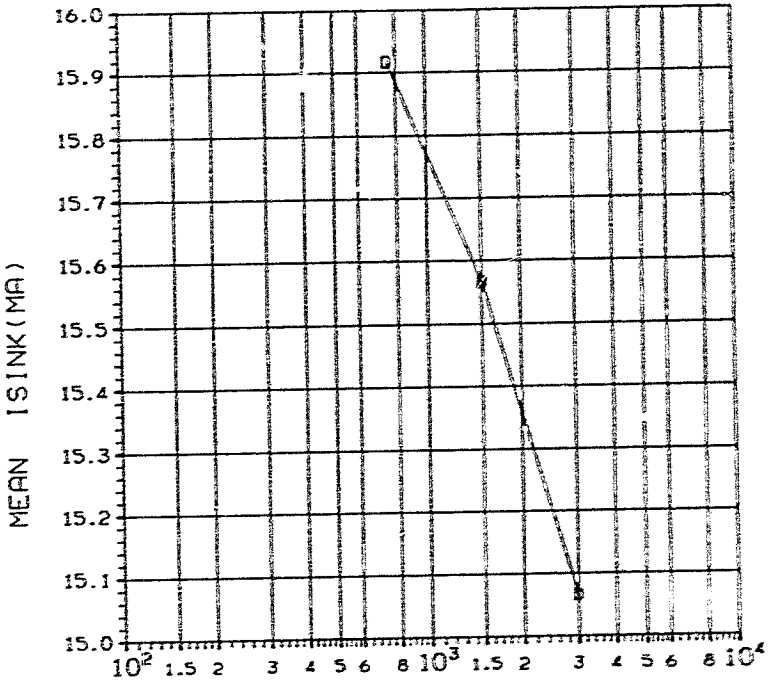
DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-27-79
REF: JPL LOG 0422 DATE CODE NONE



(3) IB (NON INVERTING INPUT) IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
C	10.05	19.66	29.59

DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-27-79
REF: JPL LOG 0422 DATE CODE NONE

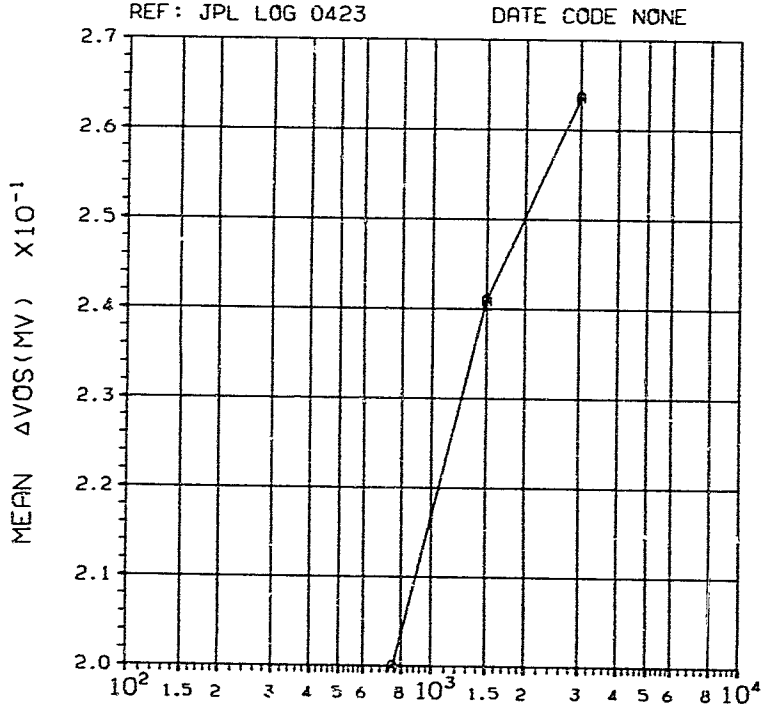


(4) I SINK IN MA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
D	.1826	.1915	.1915

INITIAL MEAN VALUE ISINK(MA) = $1.62 \times 10^{+1}$

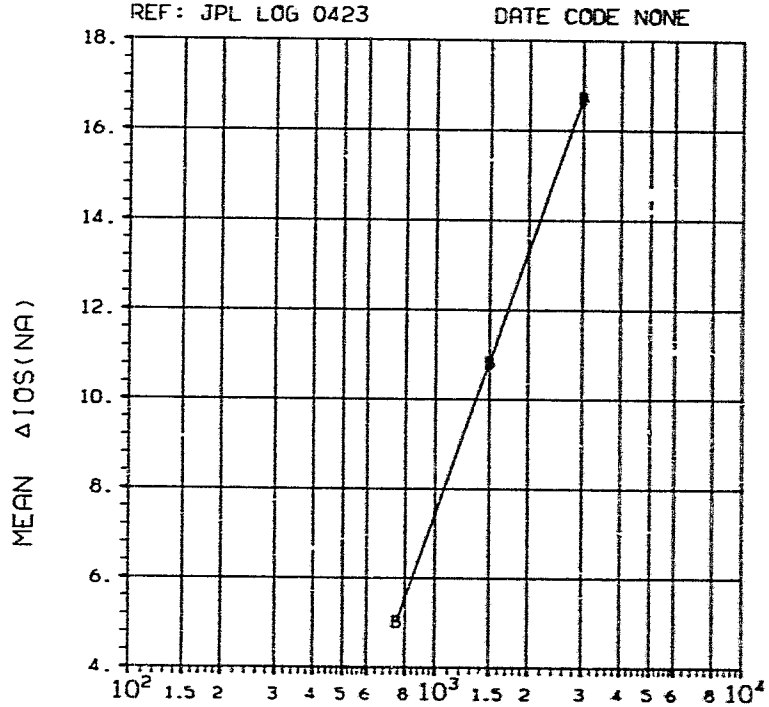
DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-27-79
REF: JPL LOG 0423 DATE CODE NONE



(1) VOS IN MV VS DOSE

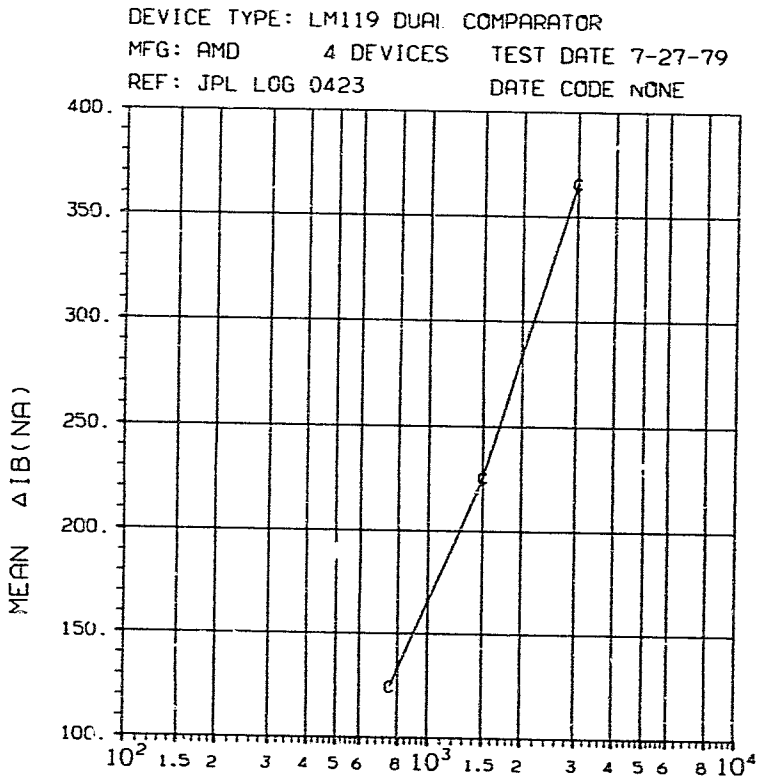
TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
A	.1701	.1856	.1246

DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-27-79
REF: JPL LOG 0423 DATE CODE NONE



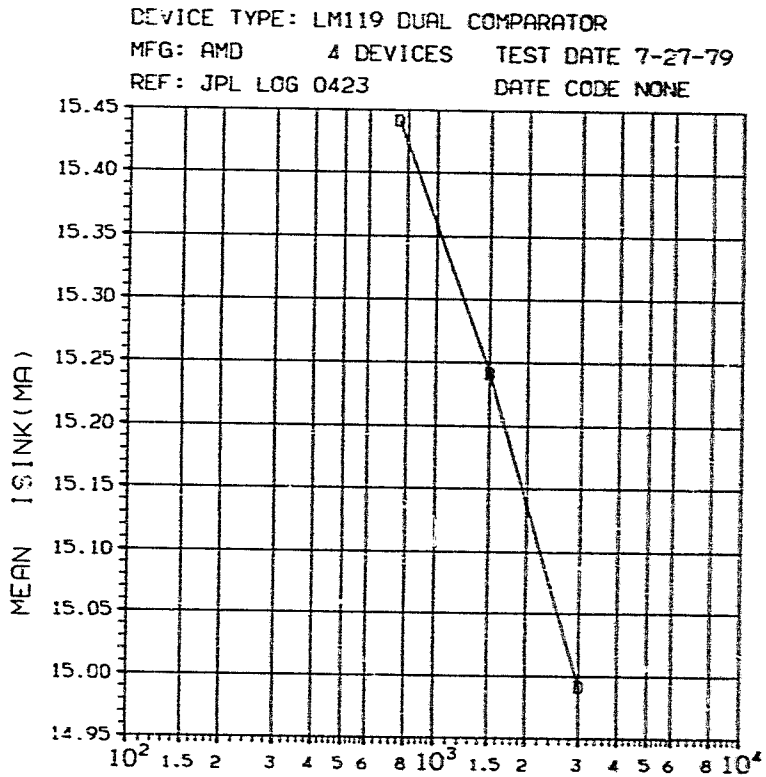
(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
B	3.828	7.925	12.62



(3) IB (NON INVERTING INPUT) IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS		
CURVE	DOSE, kiloGy(Si)	
	.75	1.50 3.00
C	22.48	43.25 49.91

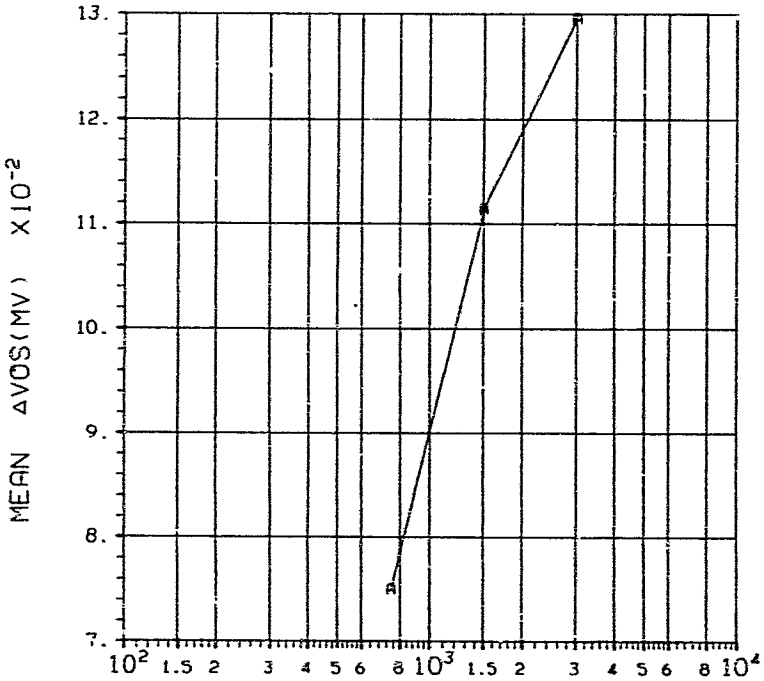


(4) I SINK IN MA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS		
CURVE	DOSE, kiloGy(Si)	
	.75	1.50 3.00
D	.2217	.2217 .1893

INITIAL MEAN VALUE ISINK(MA) = $1.53X10^{+1}$

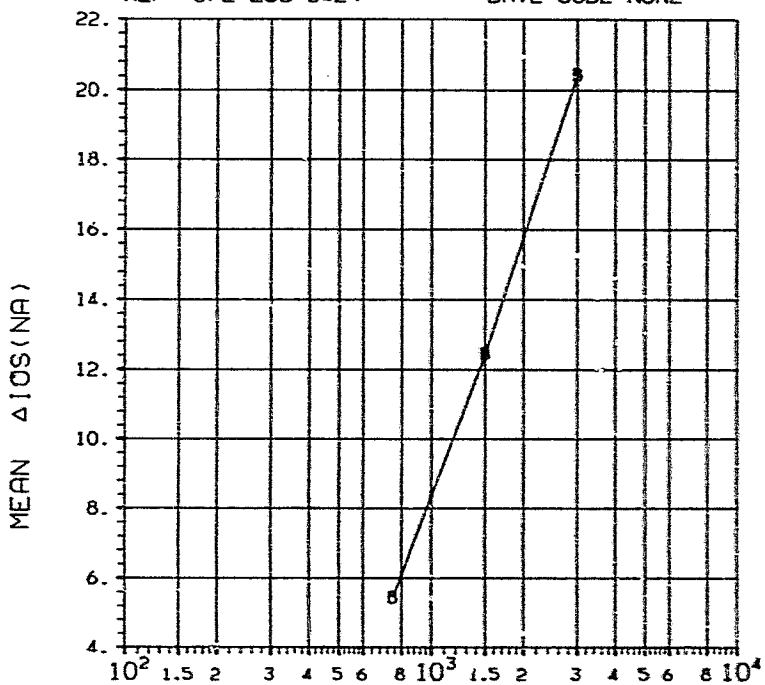
DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-27-79
REF: JPL LOG 0424 DATE CODE NONE



(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDAPD DEVIATIONS		
CURVE	DOSE, kiloGy(Si)	
	.75	1.50 3.00
A	.0818	.1027 .0721

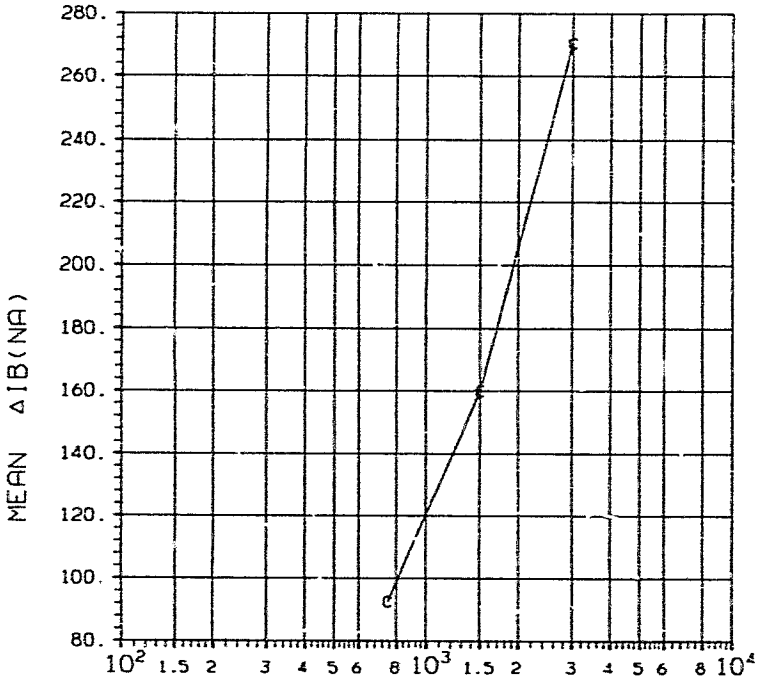
DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-27-79
REF: JPL LOG 0424 DATE CODE NONE



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS		
CURVE	DOSE, kiloGy(Si)	
	.75	1.50 3.00
B	2.231	7.213 22.62

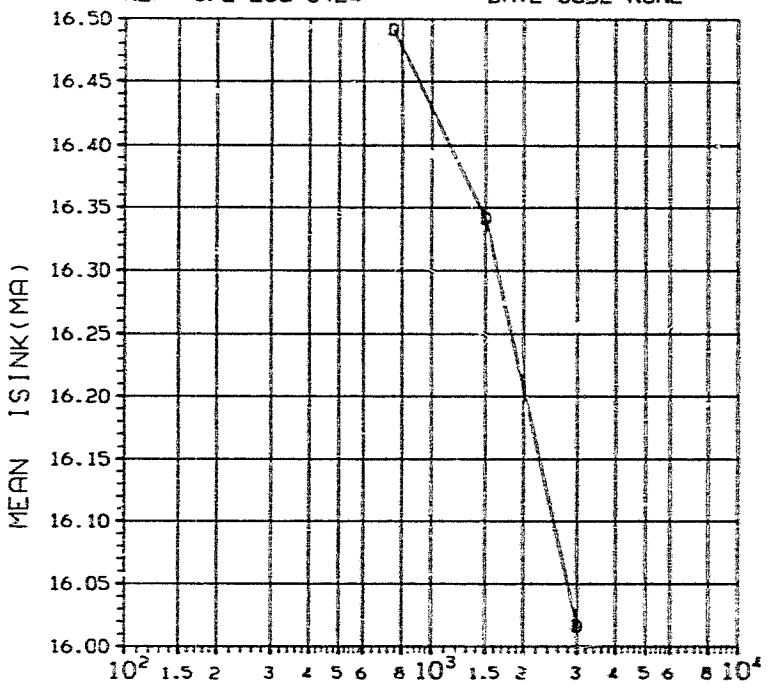
DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-27-79
REF: JPL LOG 0424 DATE CODE NONE



(3) IB (NON INVERTING INPUT) IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00
C	30.19	49.98	88.21

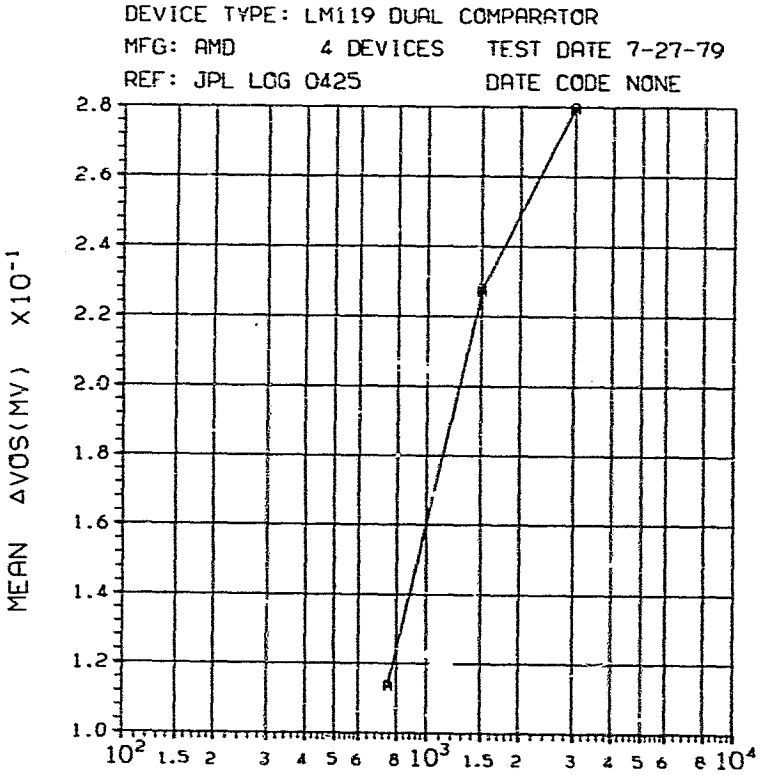
DEVICE TYPE: LM119 DUAL COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 7-27-79
REF: JPL LOG 0424 DATE CODE NONE



(4) I SINK IN MA VS DOSE

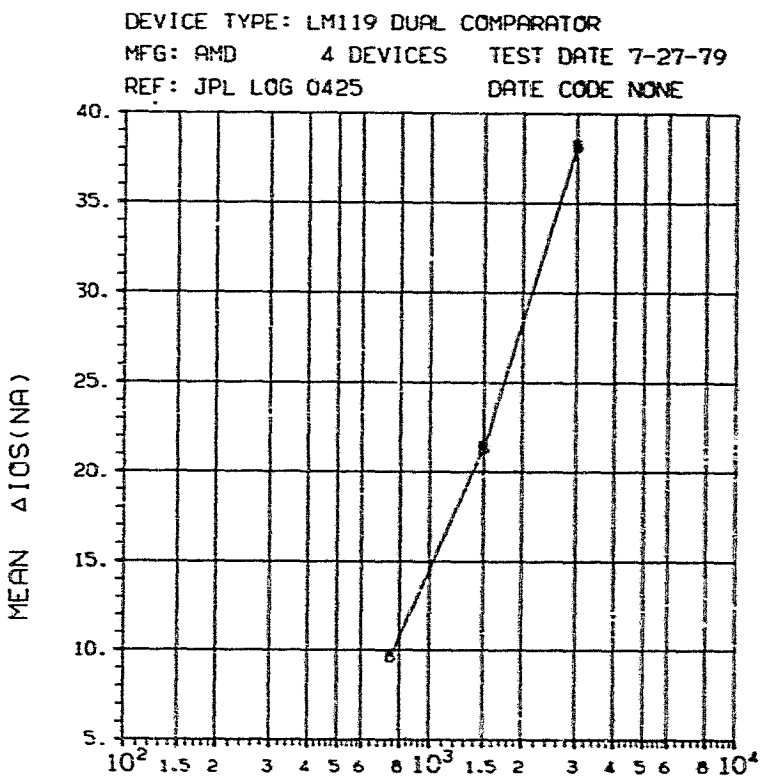
TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00
D	1.124	1.159	1.208

INITIAL MEAN VALUE ISINK(MA) = $1.64X10^{+1}$



(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
A	.1184	.3156	.3572



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00
B	3.728	10.82	21.18

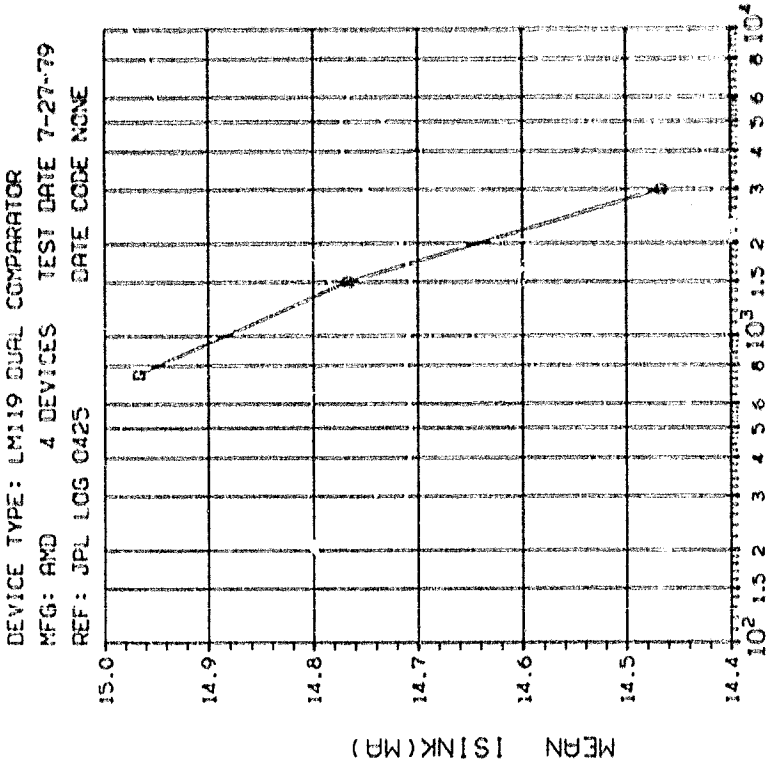


TABLE OF NORMAL STANDARD DEVIATIONS	
CURVE	DOSE, kiloGy(Si) .75 1.50 3.00
B	.5000 .5000 .5000

INITIAL MEAN VALUE ISINK(MA) = 1.51X10^1

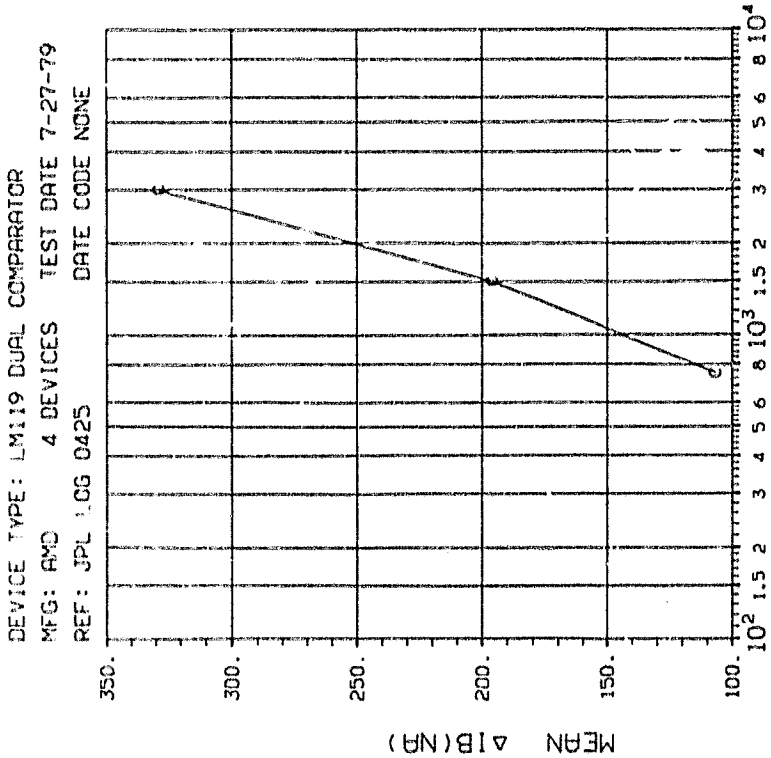
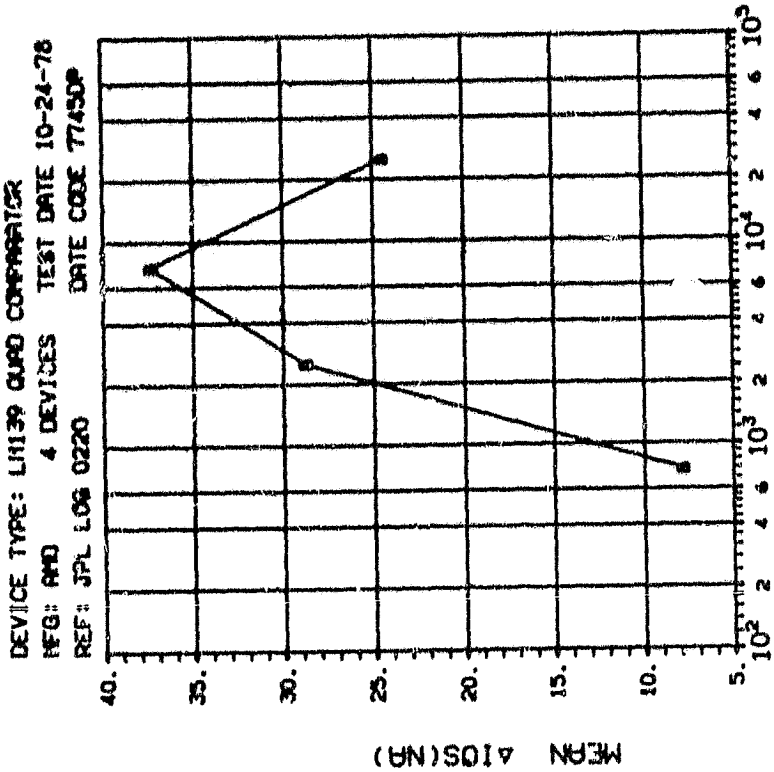
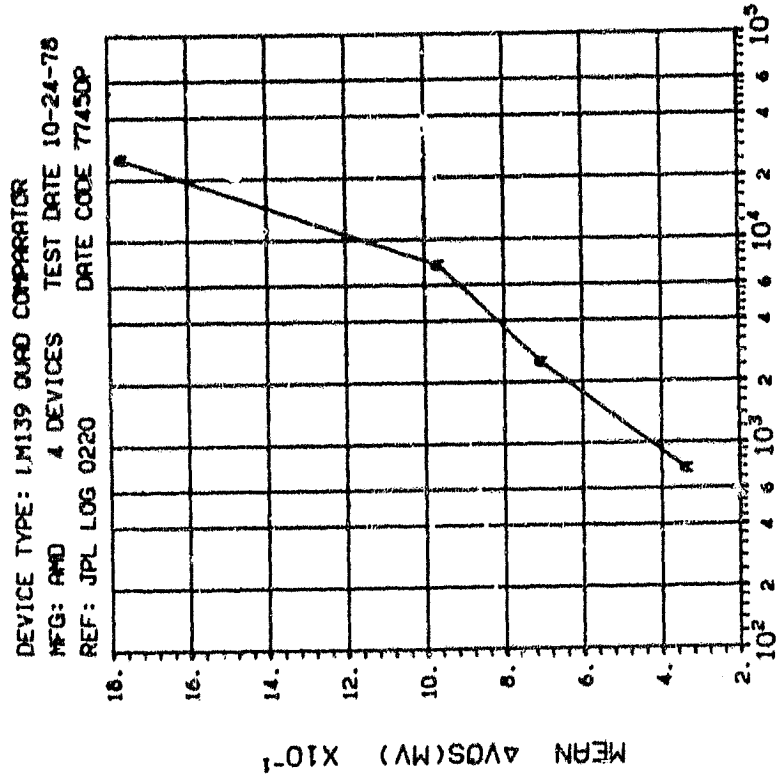


TABLE OF NORMAL STANDARD DEVIATIONS	
CURVE	DOSE, kiloGy(Si) .75 1.50 3.00
C	10.51 15.55 19.94



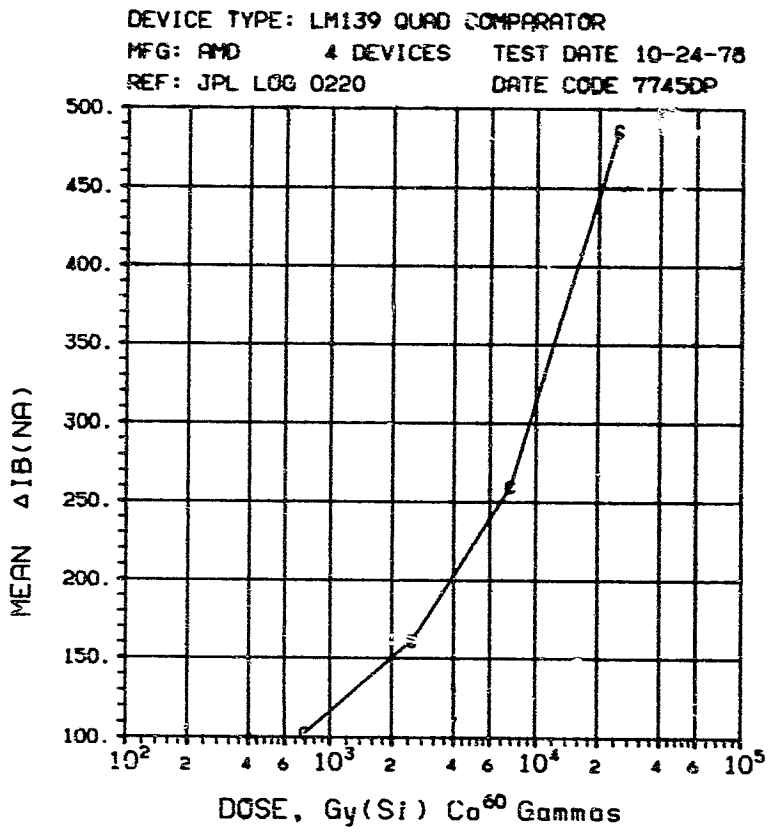
(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.75	2.50	7.50	25.00	
B	2.099	11.67	13.11	26.50	



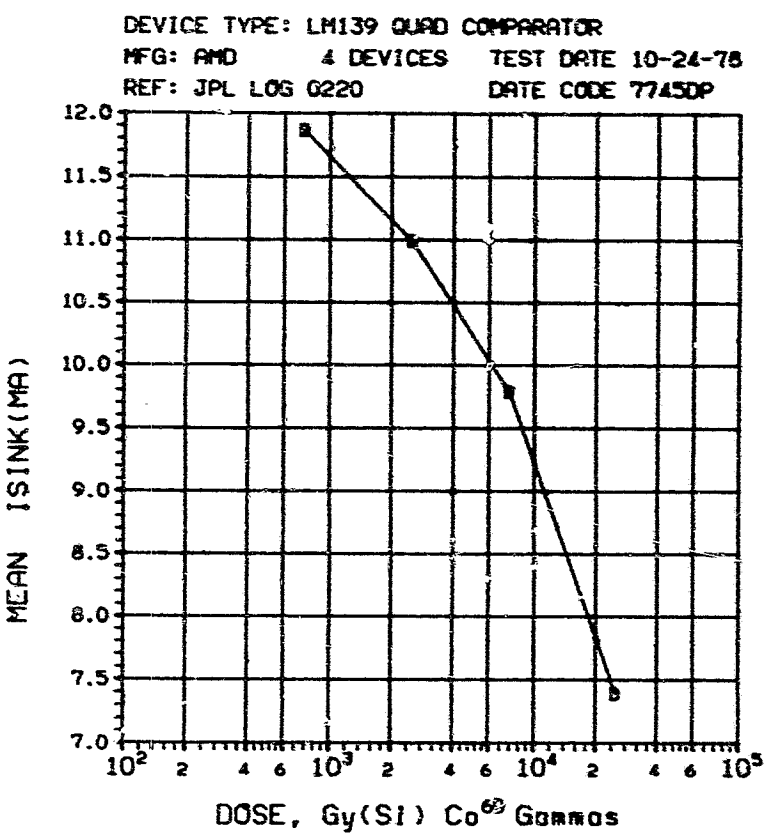
(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.75	2.50	7.50	25.00	
A	.1484	.1731	.5202	1.296	



(3) IB (NON-INVERTING INPUT) IN NA VS DOSE

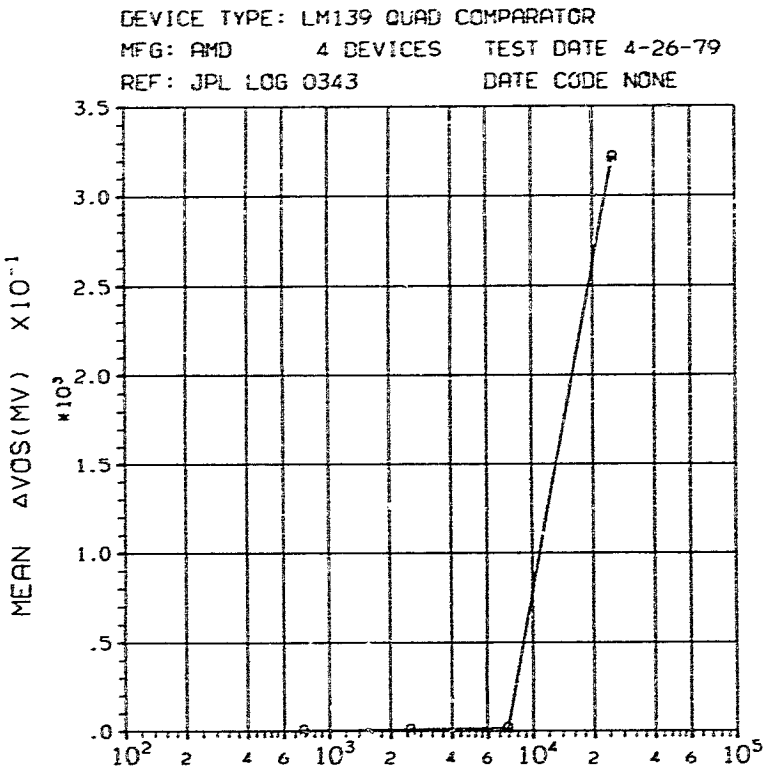
TABLE OF NORMAL STANDARD DEVIATIONS	
CURVE	DOSE, kiloGy(Si) .75 2.50 7.50 25.00
C	37.00 47.55 47.32 48.67



(4) I SINK IN MA VS DOSE

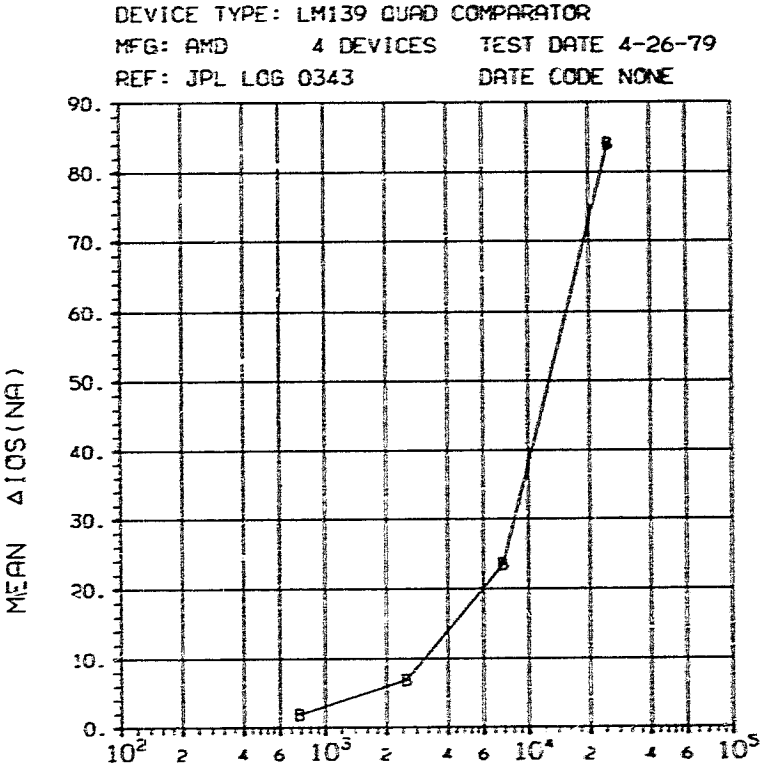
TABLE OF NORMAL STANDARD DEVIATIONS	
CURVE	DOSE, kiloGy(Si) .75 2.50 7.50 25.00
D	.1000 .2062 .6185 1.037

INITIAL MEAN VALUE ISINK(MA) = $1.29X10^{+1}$



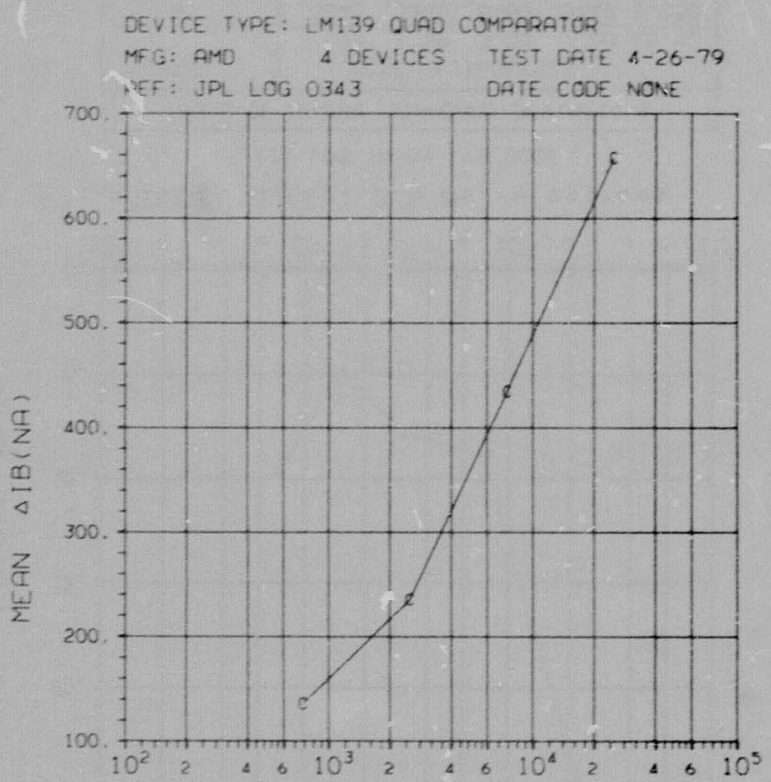
(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS	
CURVE	DOSE, kiloGy(Si) .75 2.50 7.50 25.00
A	.1461 .2842 .4186 637.1



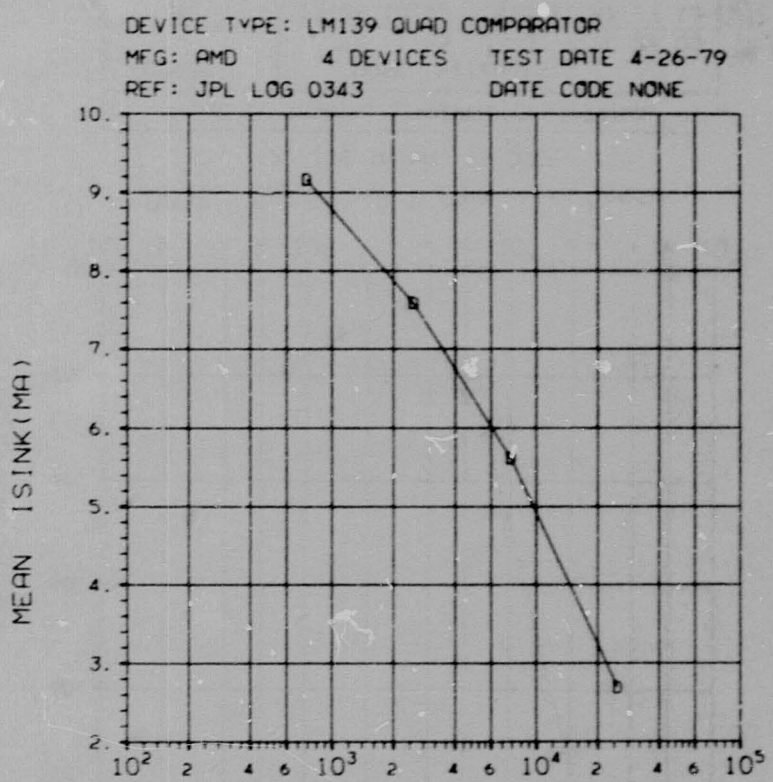
(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS	
CURVE	DOSE, kiloGy(Si) .75 2.50 7.50 25.00
B	2.027 4.204 7.353 55.02



(3) IB (NON INVERTING INPUT) IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	2.50	7.50	25.00
C	13.19	18.47	24.16	473.7

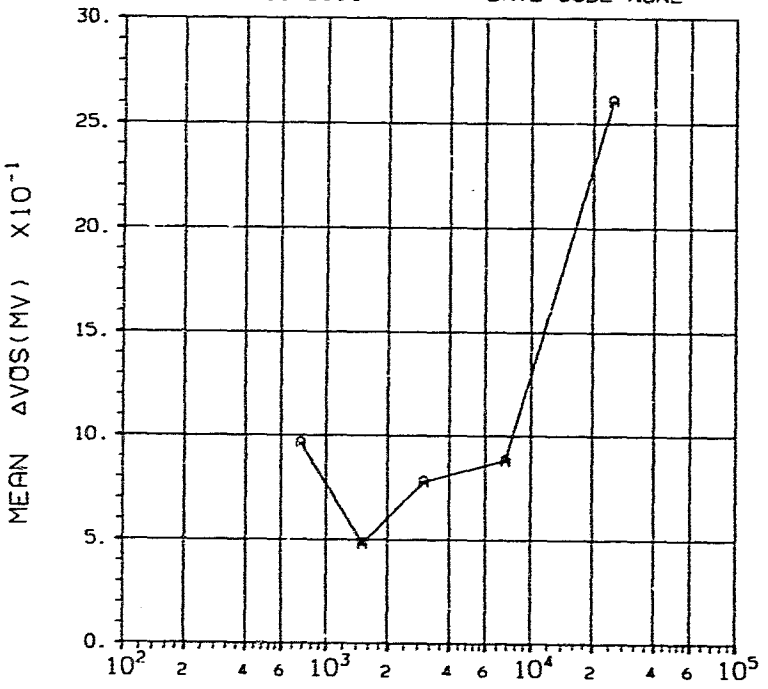


(4) ISINK IN MA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	2.50	7.50	25.00
D	.3512	.2598	.2000	.5694

INITIAL MEAN VALUE ISINK(MA) = $1.20 \times 10^{+1}$

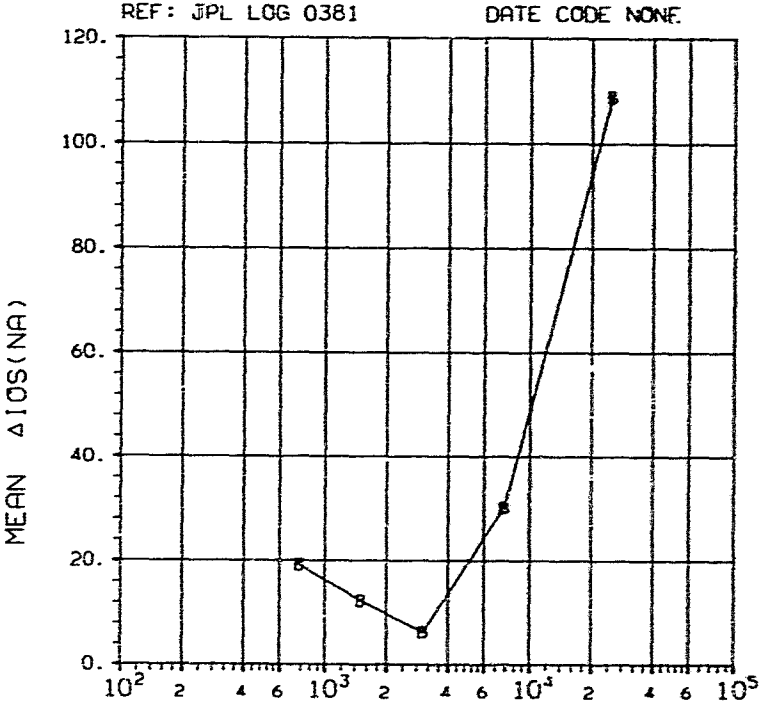
DEVICE TYPE: LM139 QUAD COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 5-30-79
REF: JPL LOG 0381 DATE CODE NONE



(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.75	1.50	3.00	7.50	25.00
A	.1043	.1880	.6469	.8442	1.050

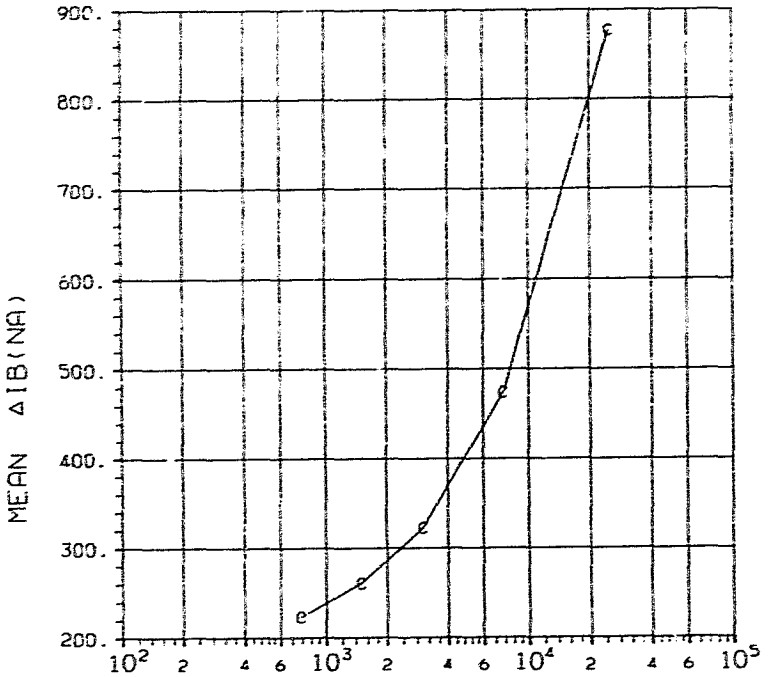
DEVICE TYPE: LM139 QUAD COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 5-30-79
REF: JPL LOG 0381 DATE CODE NONE



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.75	1.50	3.00	7.50	25.00
B	13.26	10.42	7.853	11.45	27.13

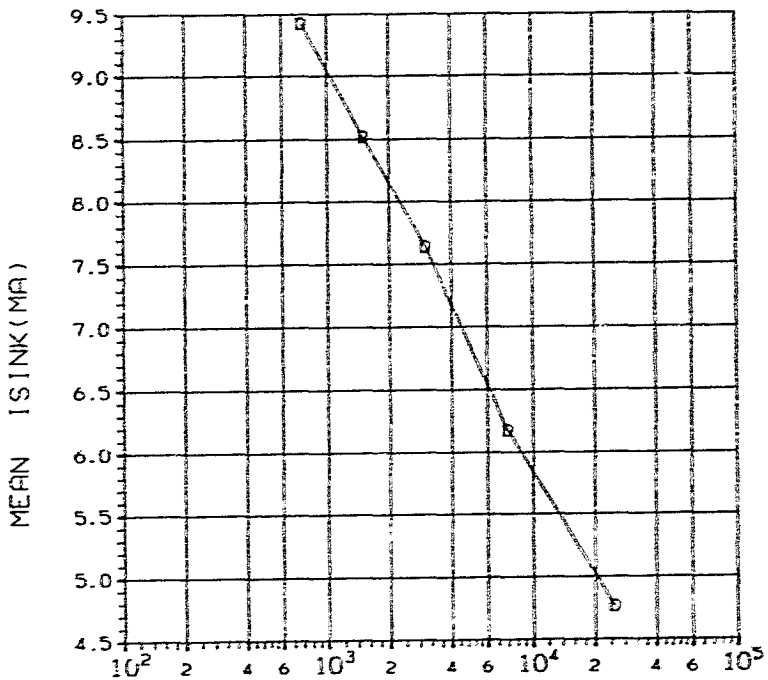
DEVICE TYPE: LM139 QUAD COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 5-30-79
REF: JPL LOG 0381 DATE CODE NONE



(3) IB (NON INVERTING INPUT) IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.75	1.50	3.00	7.50	25.00
C	22.81	33.34	47.41	87.11	182.7

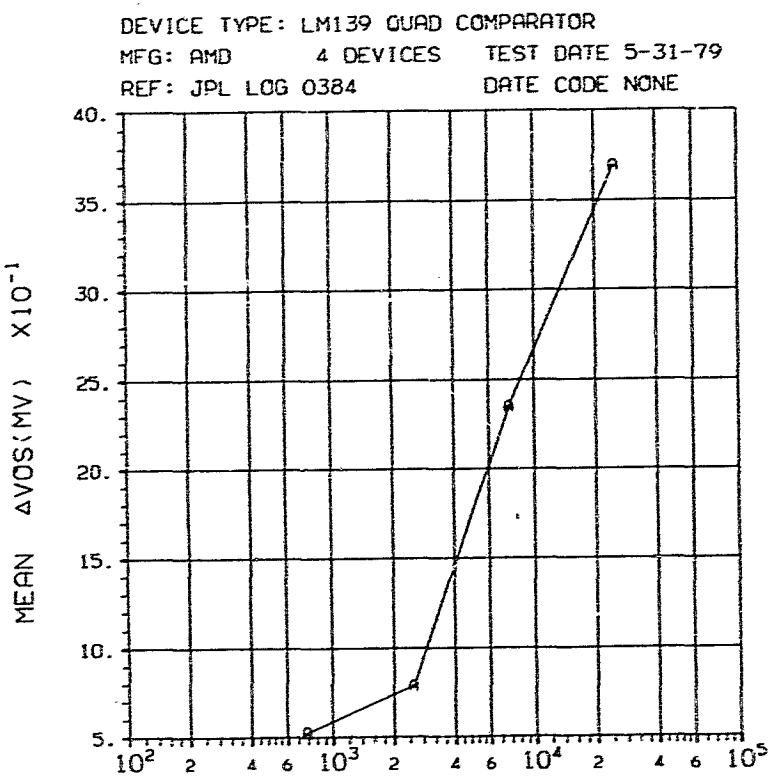
DEVICE TYPE: LM139 QUAD COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 5-30-79
REF: JPL LOG 0381 DATE CODE NONE



(4) : SINK IN MA VS DOSE

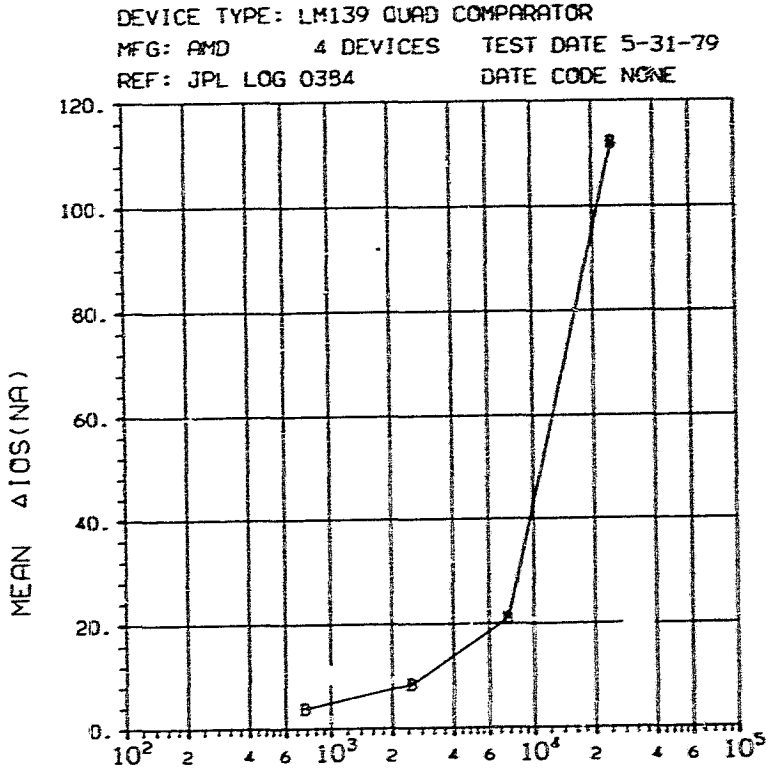
TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.75	1.50	3.00	7.50	25.00
D	.4886	.5809	.6716	.8340	1.532

INITIAL MEAN VALUE ISINK(MA) = $1.27 \times 10^{+1}$



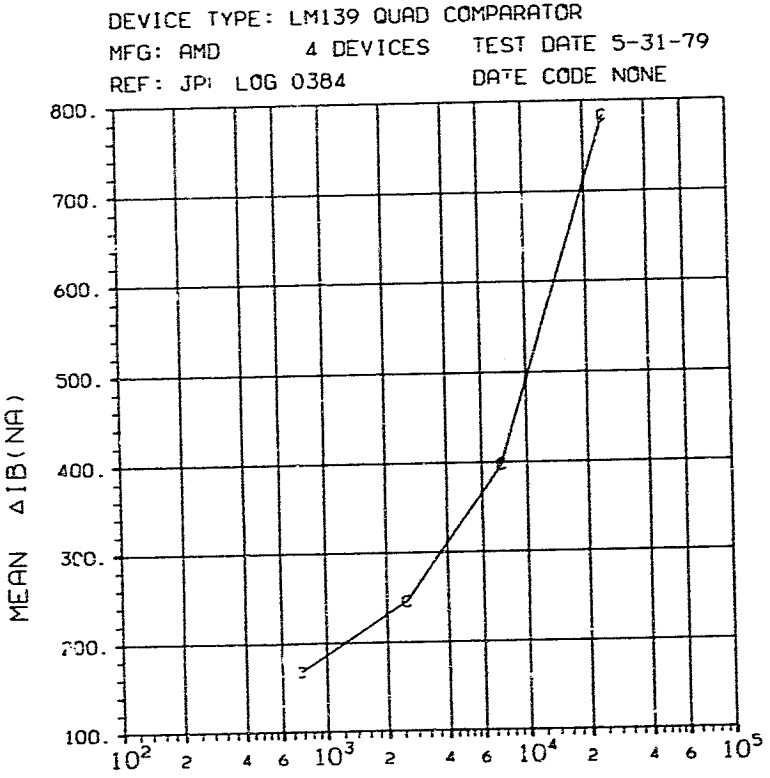
(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si) .75	2.50	7.50	25.00
A	.1104	.1356	.3312	.4987



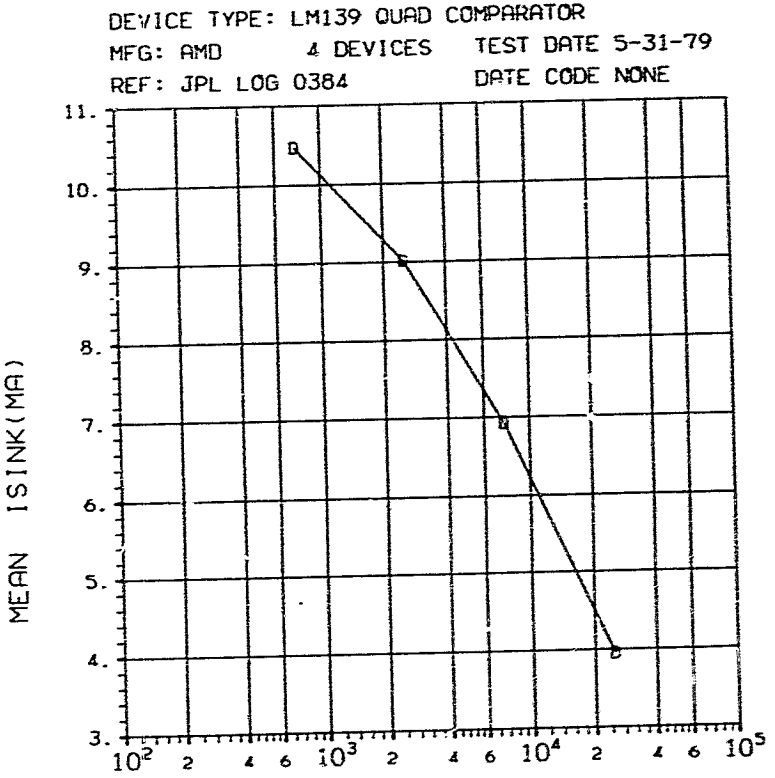
(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si) .75	2.50	7.50	25.00
B	1.153	3.346	10.87	28.89



(3) IB (NON INVERTING INPUT) IN NA VS DOSE

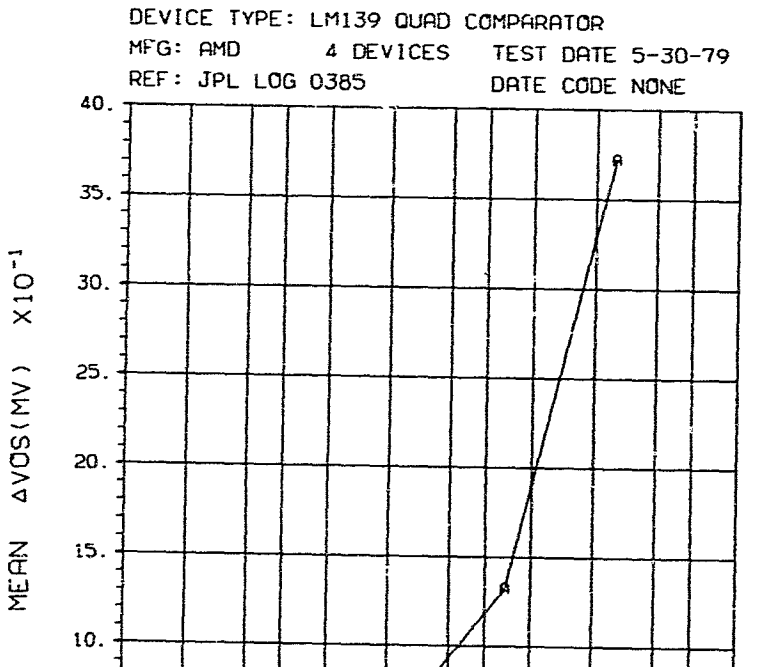
TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	2.50	7.50	25.00
C	38.68	48.46	63.93	128.4



(4) I SINK IN MA VS DOSE

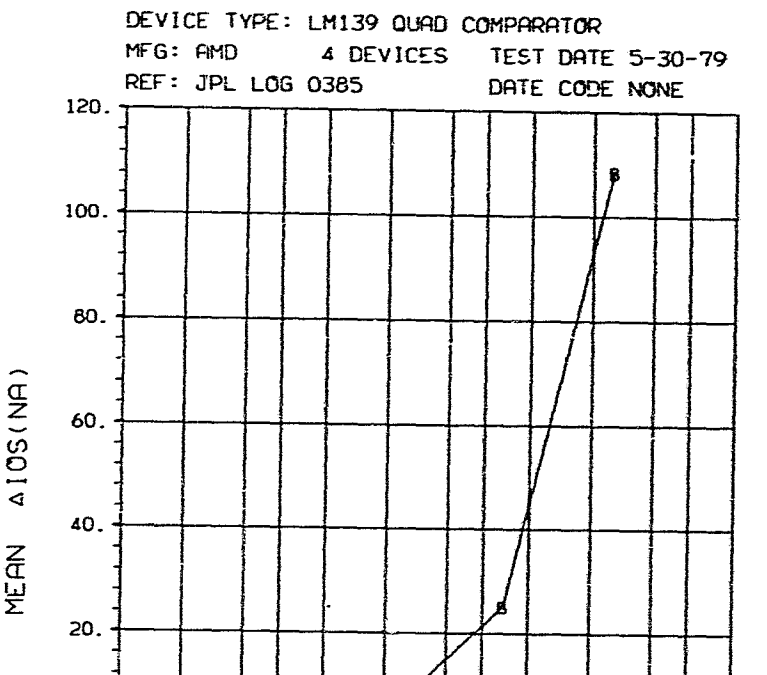
TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	2.50	7.50	25.00
D	.5012	.6177	.6522	.5552

INITIAL MEAN VALUE ISINK(MA) = $1.39X10^{+1}$



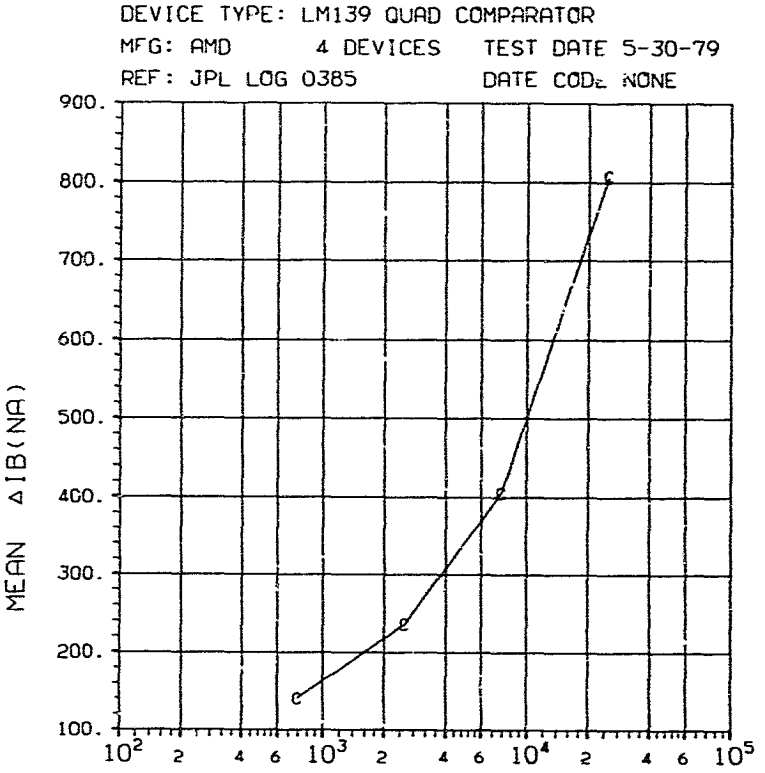
(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	2.50	7.50	25.00
A	.6134	.3796	.6880	.4821



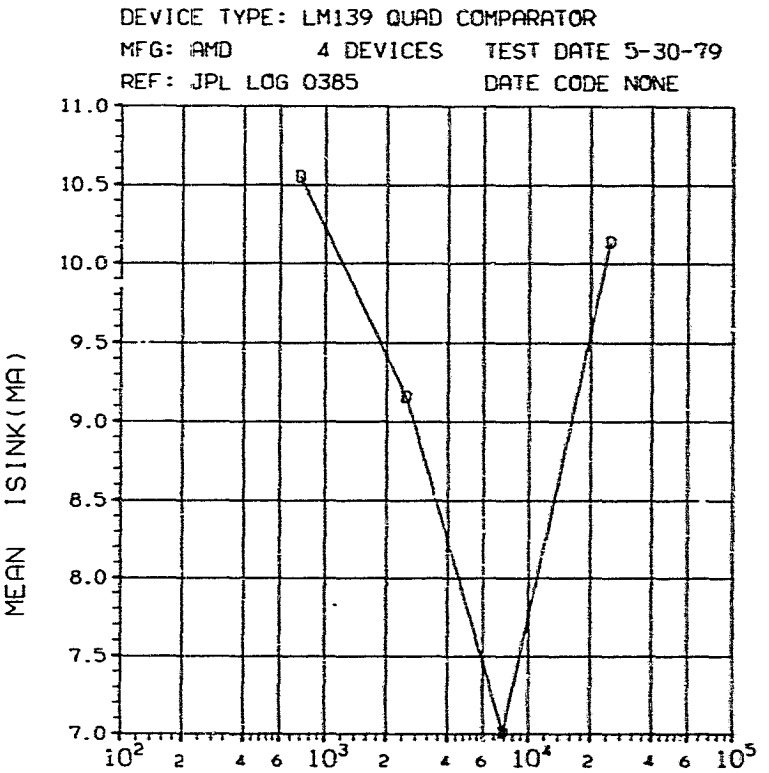
(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	2.50	7.50	25.00
B	6.703	2.045	2.793	13.21



(3) IB (NON INVERTING INPUT) IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	2.50	7.50	25.00
C	30.28	34.89	54.43	114.7

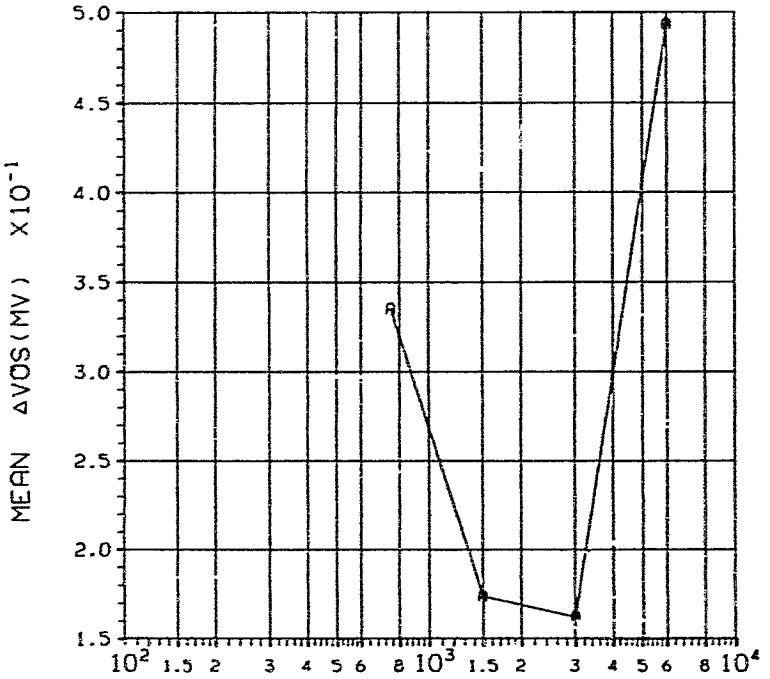


(4) I SINK IN MA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	2.50	7.50	25.00
D	1.520	1.391	.9597	1.297

INITIAL MEAN VALUE ISINK(MA) = $1.32X10^{+1}$

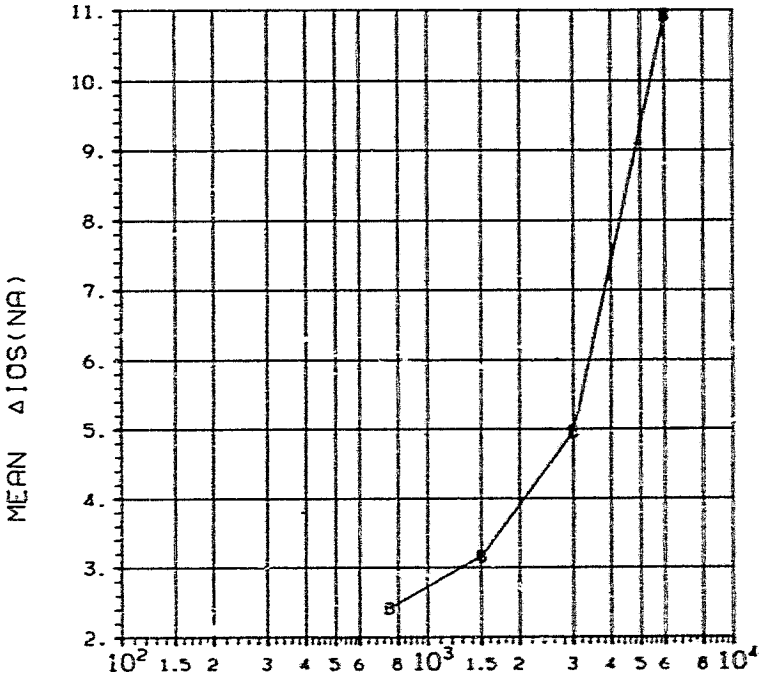
DEVICE TYPE: LM139 QUAD COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 2-29-80
REF: JPL LOG 0612 DATE CODE NONE



1) VOS IN MV VS DOSE

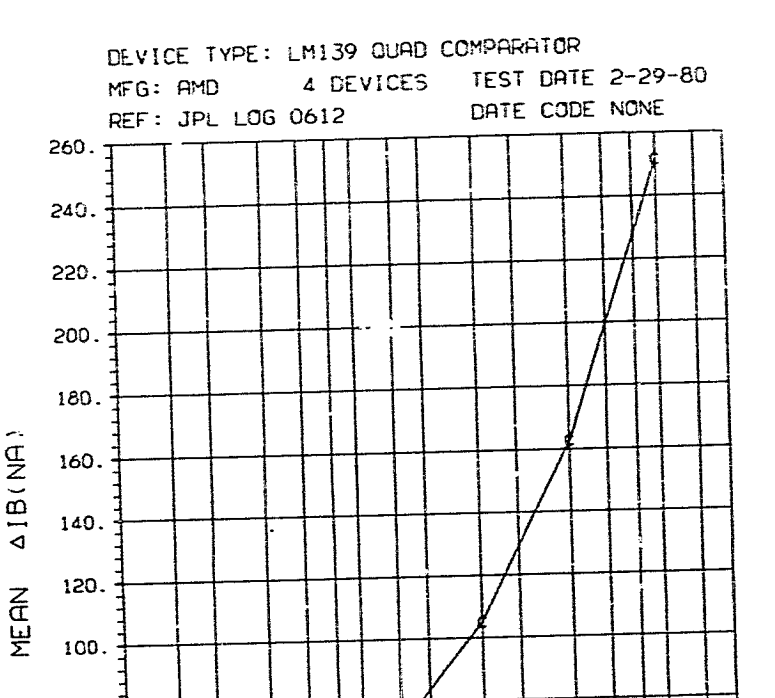
TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
A	.1468	.1178	.1058	.2317

DEVICE TYPE: LM139 QUAD COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 2-29-80
REF: JPL LOG 0612 DATE CODE NONE



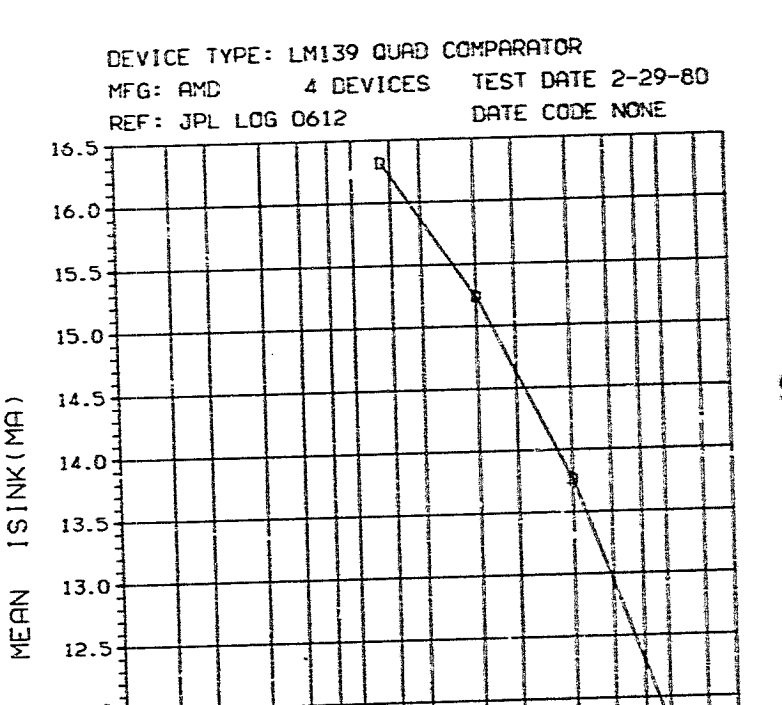
(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
B	1.899	2.069	3.025	3.754



(3) IB (NON INVERTING INPUT) IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00	6.00
C	15.45	14.00	12.52	15.40

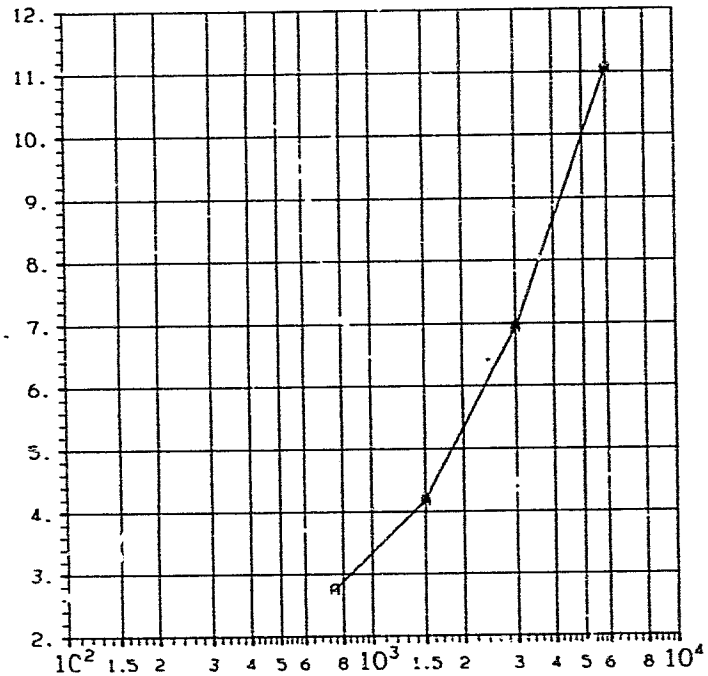


(4) I SINK IN MA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00	6.00
D	.3162	.3500	.6245	.8963

INITIAL MEAN VALUE ISINK(MA) = $1.72 \times 10^{*1}$

DEVICE TYPE: LM139 QUAD COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 2-29-80
REF: JPL LOG 0613 DATE CODE NONE

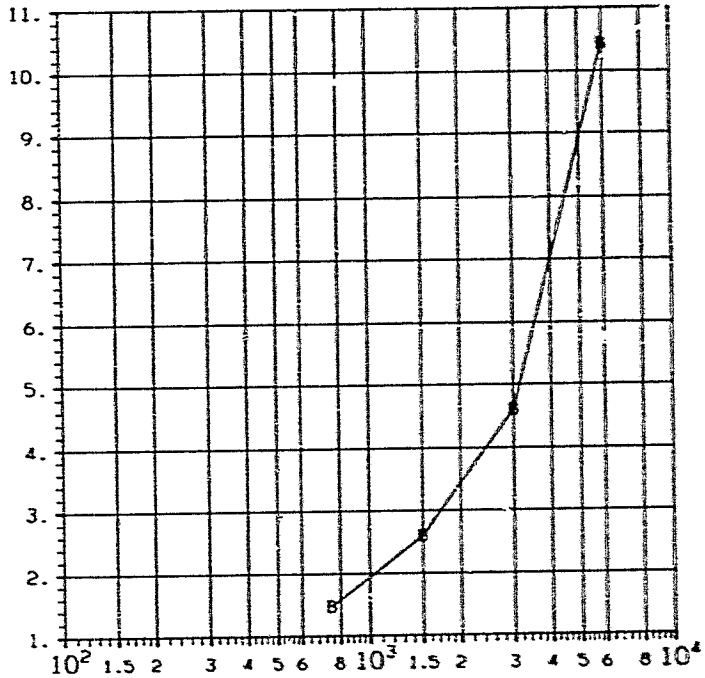


DOSE, Gy(Si) 2.5 MeV electrons

(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
A	0603	.0909	.1645	.2467

DEVICE TYPE: LM139 QUAD COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 2-29-80
REF: JPL LOG 0613 DATE CODE NONE

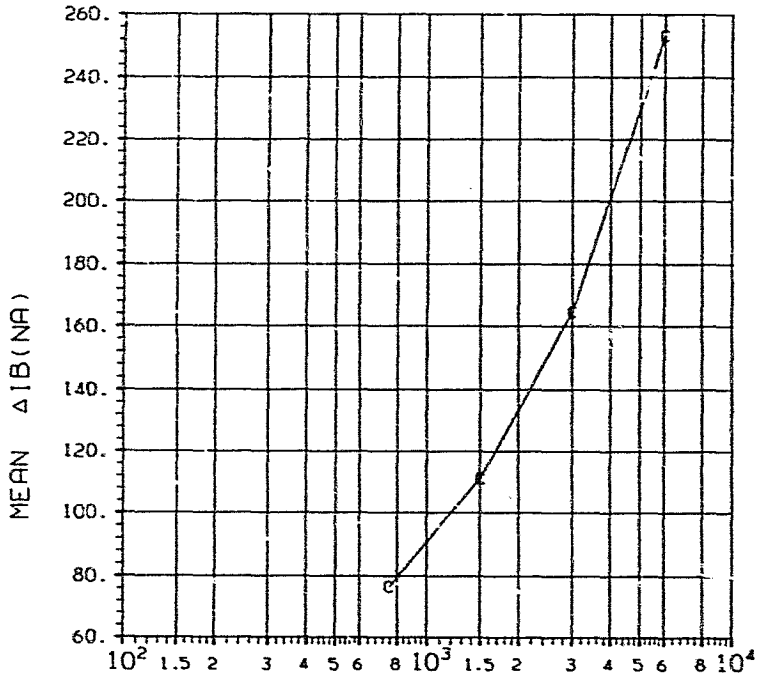


DOSE, Gy(Si) 2.5 MeV electrons

(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
B	.5277	.8614	1.170	2.174

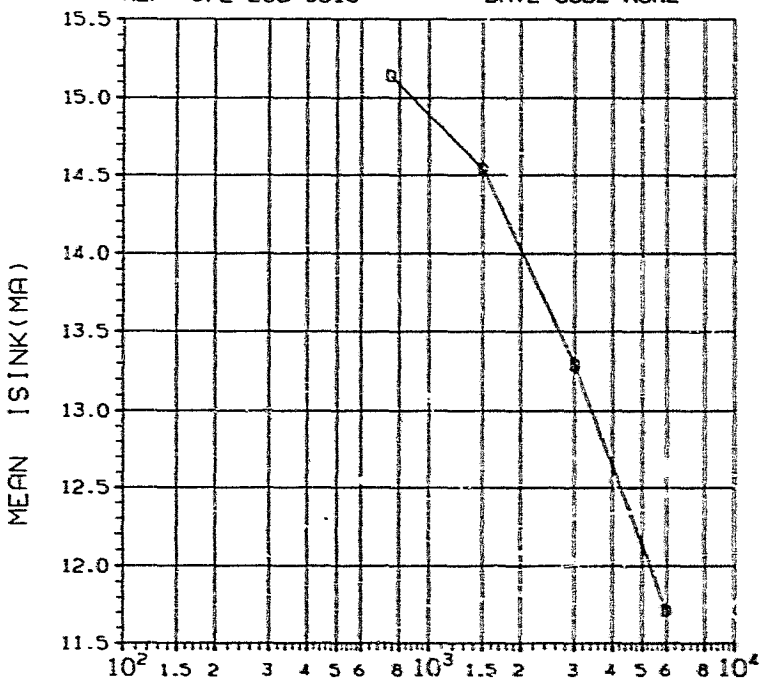
DEVICE TYPE: LM139 QUAD COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 2-29-80
REF: JPL LOG 0613 DATE CODE NONE



(3) IB (NON INVERTING INPUT) IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
C	2.813	6.415	11.40	19.89

DEVICE TYPE: LM139 QUAD COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 2-29-80
REF: JPL LOG 0613 DATE CODE NONE



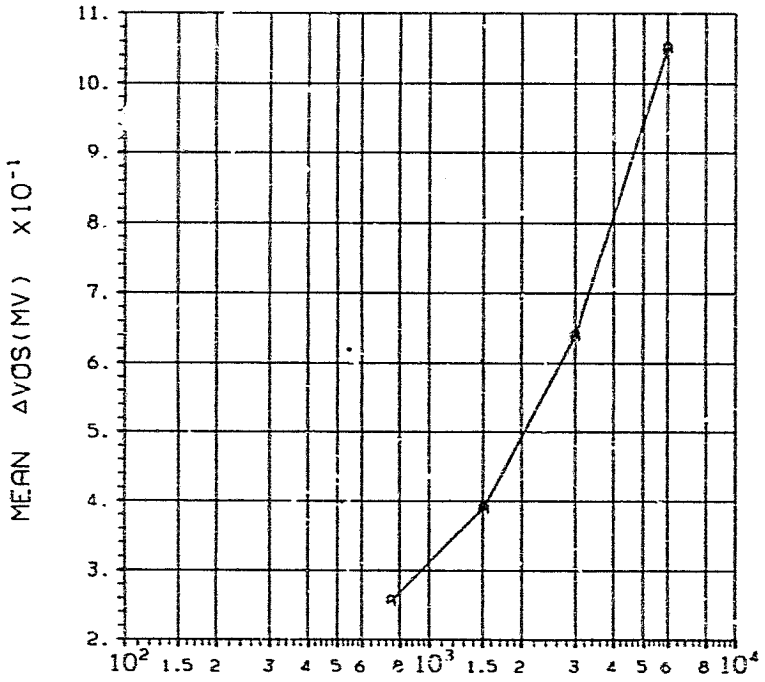
(4) I SINK IN MA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
D	.2630	.3403	.3500	.2944

INITIAL MEAN VALUE ISINK(MA) = $1.67 \times 10^{+1}$

ORIGINAL PAGE IS
OF POOR QUALITY

DEVICE TYPE: LM139 QUAD COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 3-5-80
REF: JPL LOG 0614 DATE CODE NONE

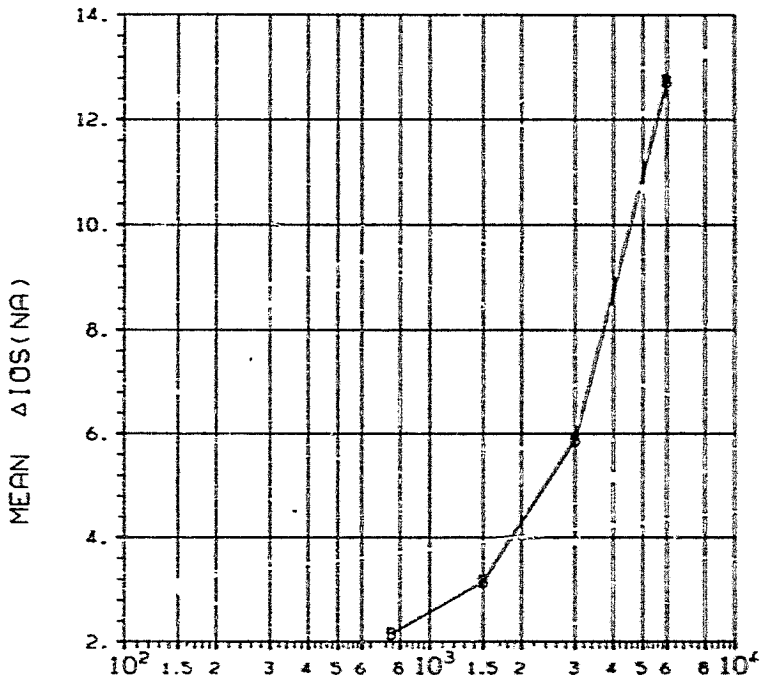


DOSE, Gy(Si) 2.5 MeV electrons

(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
A	.0451	.0635	.0928	.1415

DEVICE TYPE: LM139 QUAD COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 3-5-80
REF: JPL LOG 0614 DATE CODE NONE

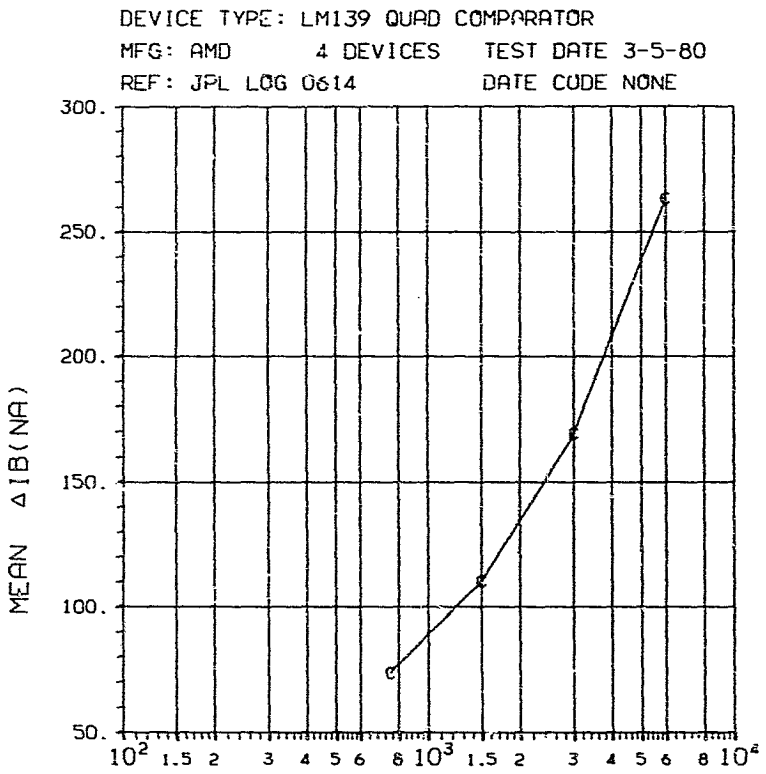


DOSE, Gy(Si) 2.5 MeV electrons

(2) IOS IN NA VS DOSE

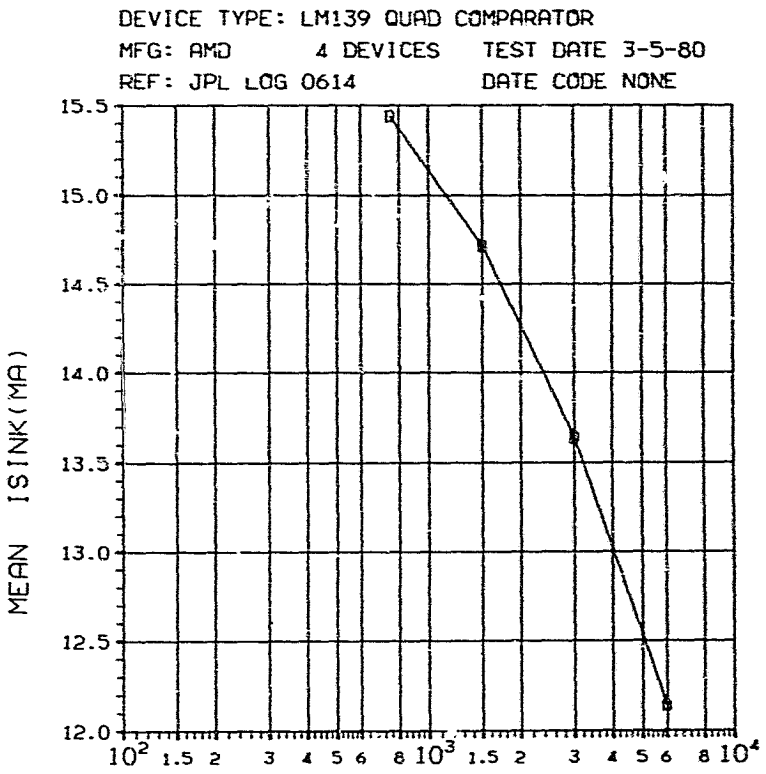
TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
B	.6053	1.176	1.870	2.161

ORIGINAL PAGE IS
OF POOR QUALITY



(3) IB (NON INVERTING INPUT) IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00	6.00
C	5.034	7.456	10.97	16.95

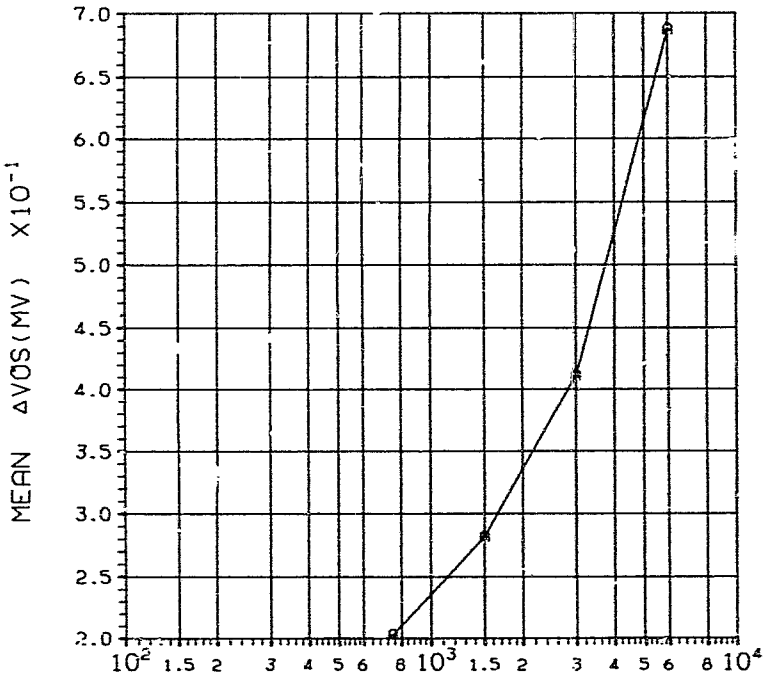


(4) I SINK IN MA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00	6.00
D	.7544	.8756	.6752	.5852

INITIAL MEAN VALUE ISINK(MA) = $1.69X10^{+1}$

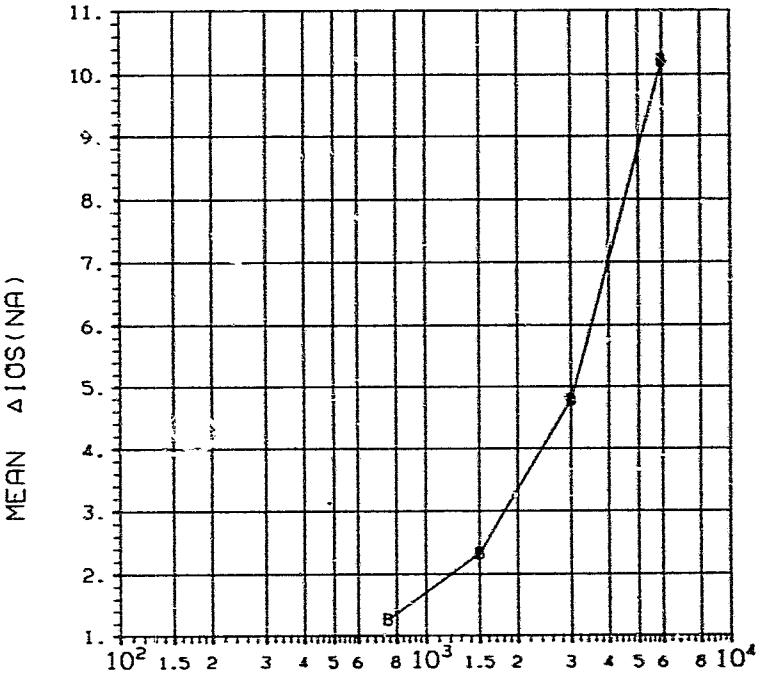
DEVICE TYPE: LM139 QUAD COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 3-5-80
REF: JPL LOG 0615 DATE CODE NONE



(1) VOS IN MV VS DOSE

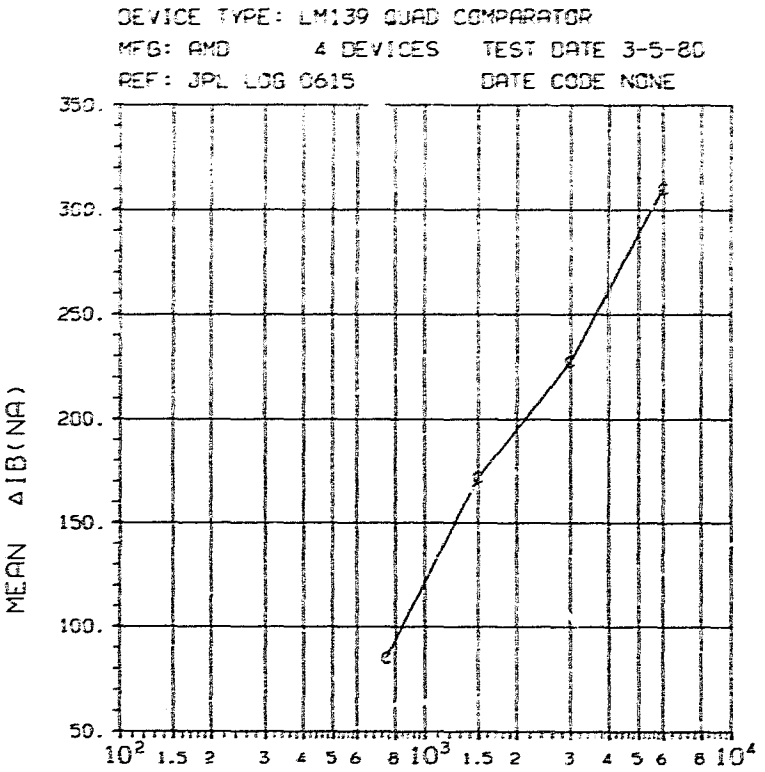
TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
A	.1149	.1553	.2722	.3880

DEVICE TYPE: LM139 QUAD COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 3-5-80
REF: JPL LOG 0615 DATE CODE NONE



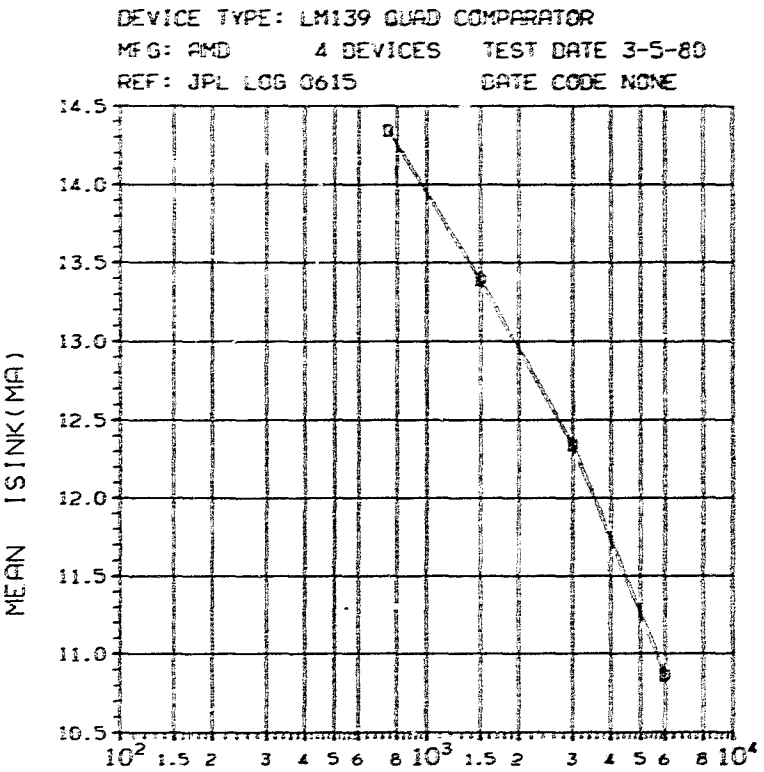
(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
B	.7065	2.036	1.705	3.307



(3) IB (NON INVERTING INPUT) IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
C	77.32	67.26	66.65	63.83

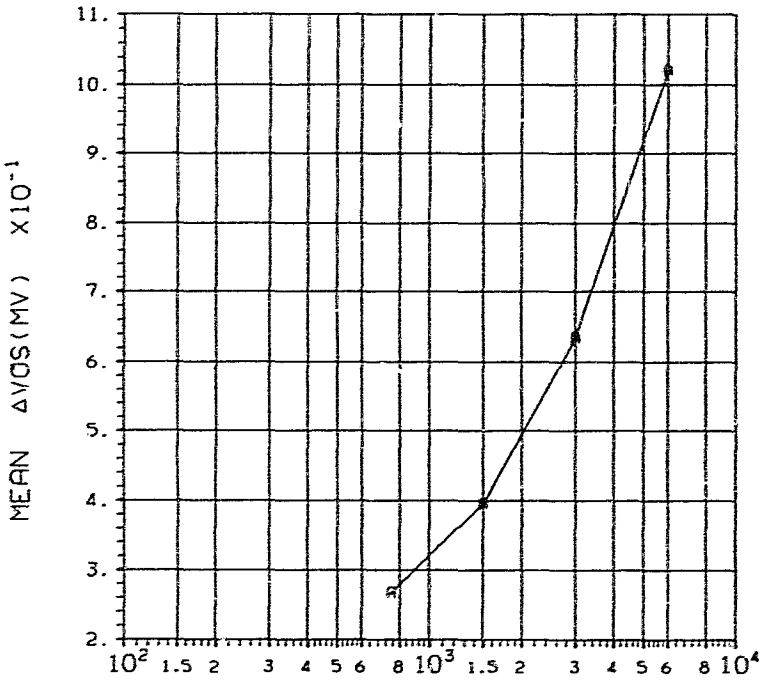


(4) I SINK IN MA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
D	1.135	1.408	1.464	1.415

INITIAL MEAN VALUE ISINK(MA) = $1.66 \times 10^{+1}$

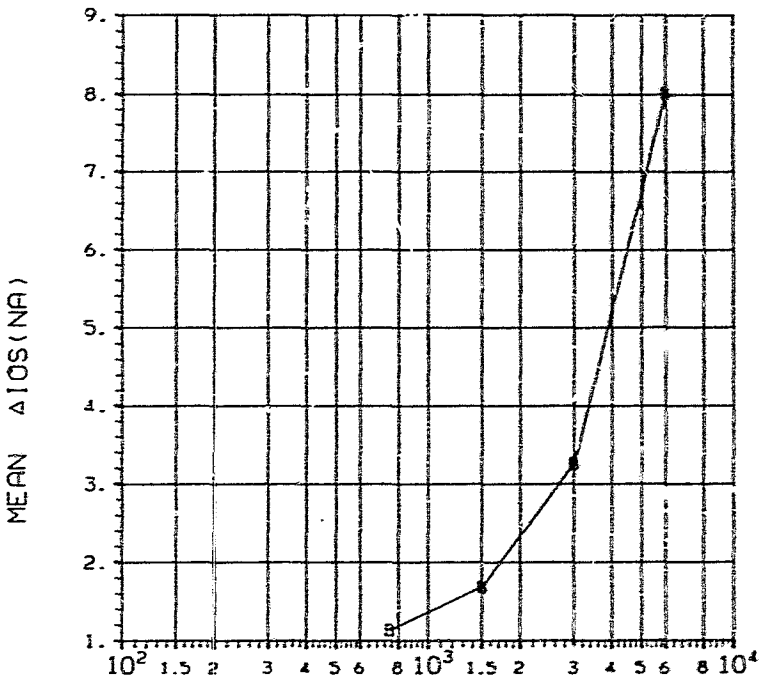
DEVICE TYPE: LM139 QUAD COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 3-6-80
REF: JPL LOG 0616 DATE CODE NONE



(1) VOS IN MV VS DOSE

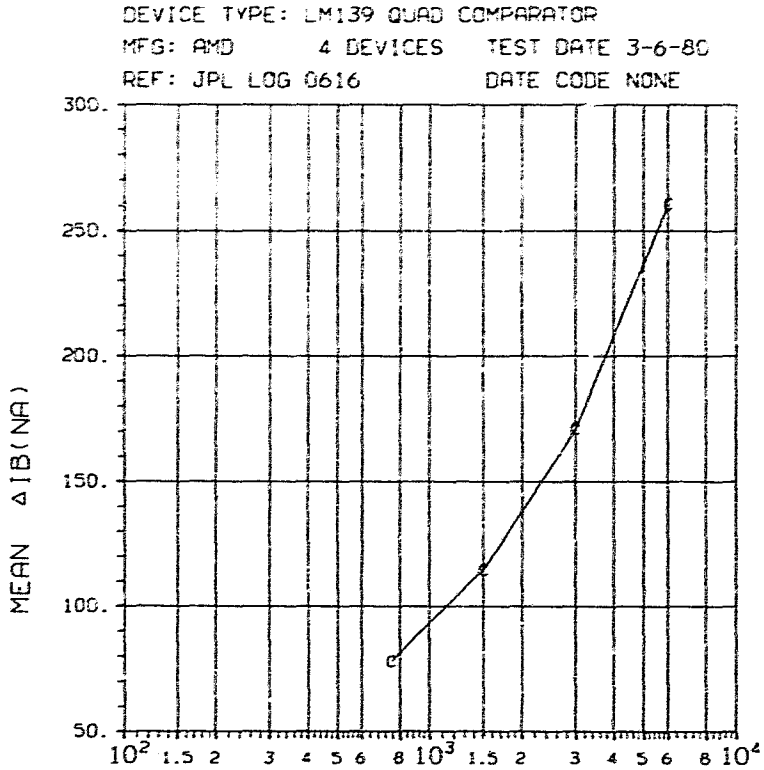
TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00	6.00
A	.0839	.1251	.1677	.2359

DEVICE TYPE: LM139 QUAD COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 3-6-80
REF: JPL LOG 0616 DATE CODE NONE



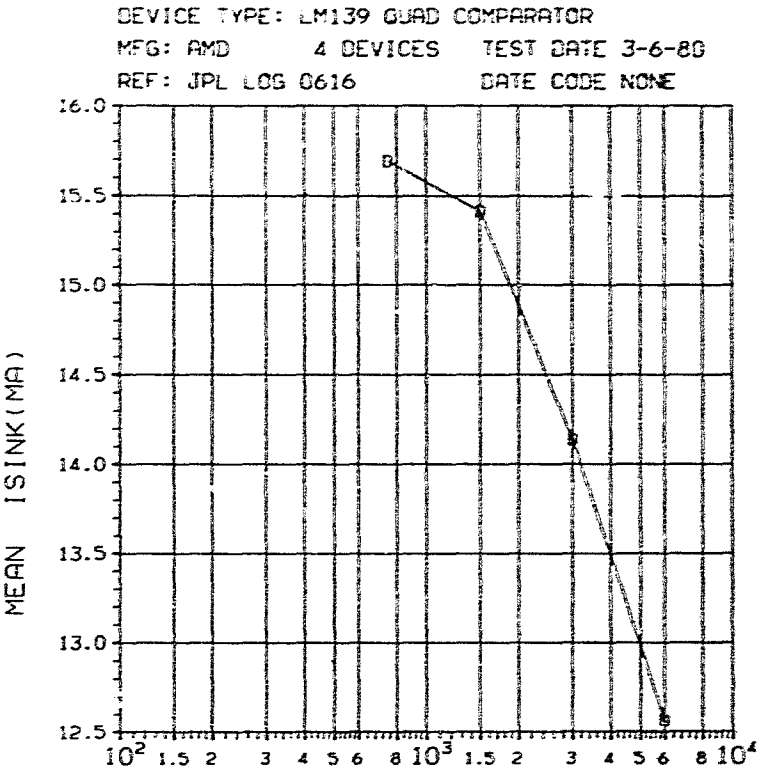
(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00	6.00
B	.5248	.9884	.9095	2.438



(3) IB (NON INVERTING INPUT) IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
C	10.20	13.32	19.07	27.46

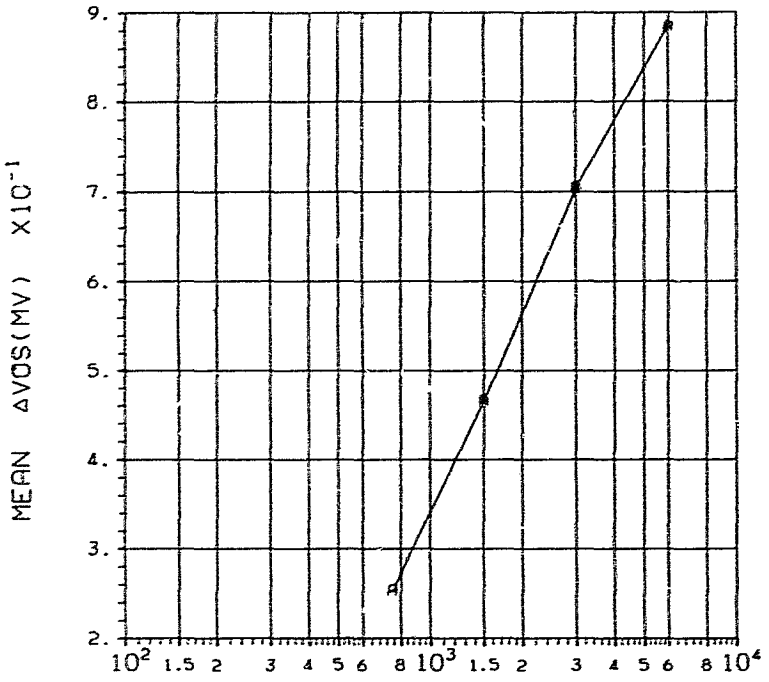


(4) I SINK IN MA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
D	.7274	.9592	.6602	.6245

INITIAL MEAN VALUE ISINK(MA) = $1.72X10^{+1}$

DEVICE TYPE: LM139 QUAD COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 3-6-80
REF: JPL LOG 0617 DATE CODE NONE

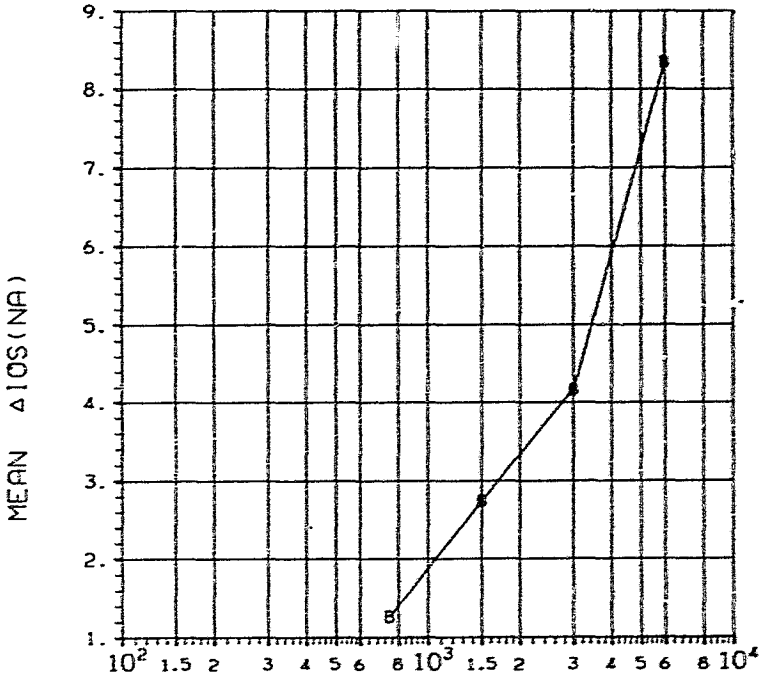


DOSE, Gy(Si) 2.5 MeV electrons

(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00	6.00
A	.1261	.2086	.3171	.2617

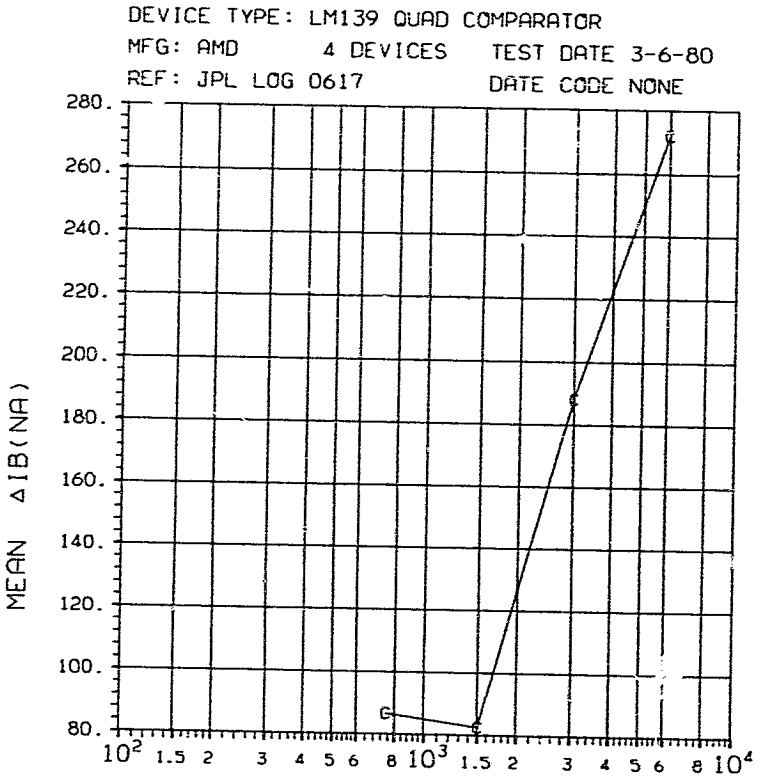
DEVICE TYPE: LM139 QUAD COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 3-6-80
REF: JPL LOG 0617 DATE CODE NONE



DOSE, Gy(Si) 2.5 MeV electrons

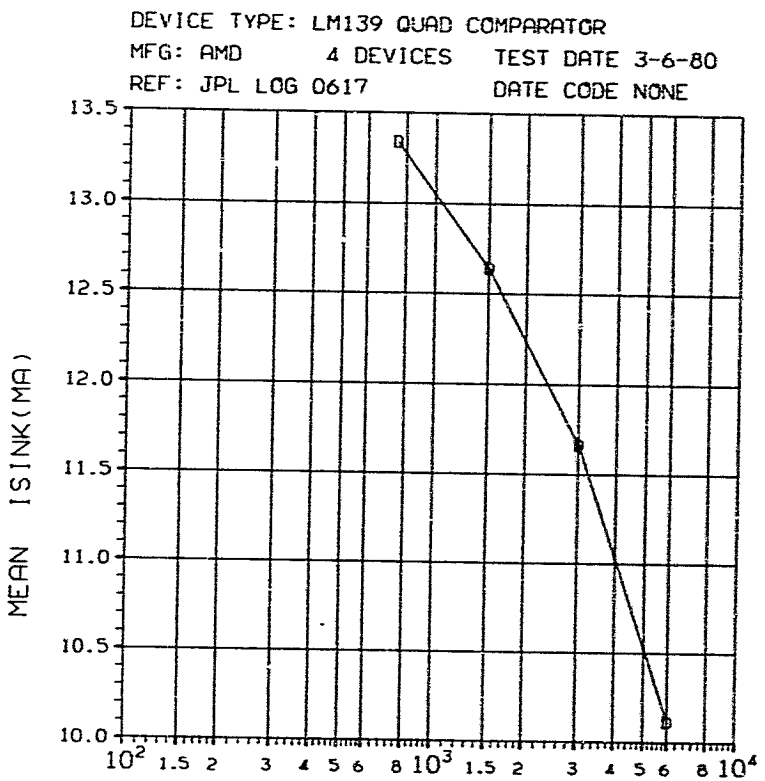
(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00	6.00
B	.8929	.6467	1.730	2.601



(3) IB (NON INVERTING INPUT) IN NA VS DOSE

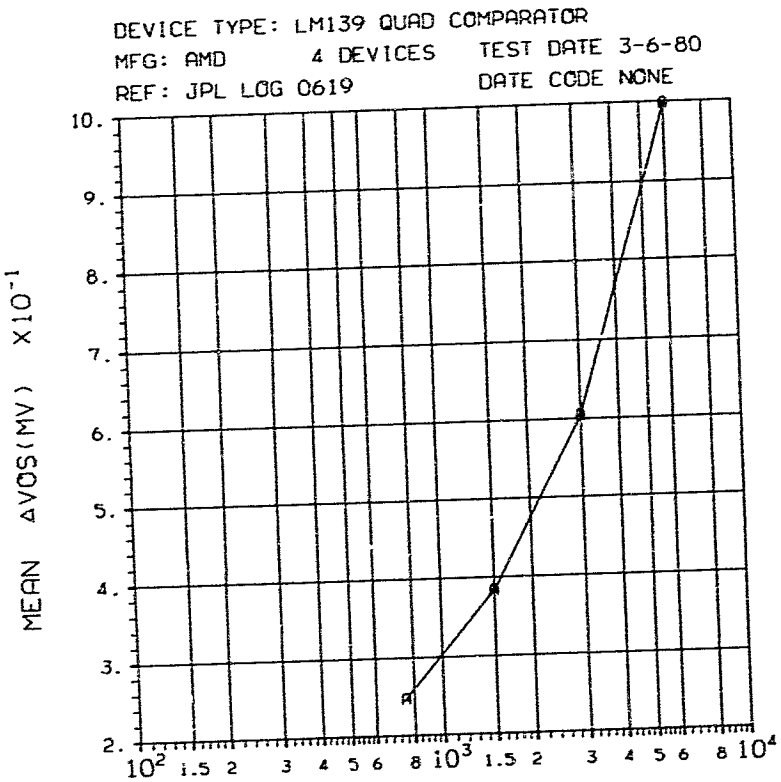
TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
C	25.94	83.78	29.48	20.46



(4) I SINK IN MA VS DOSE

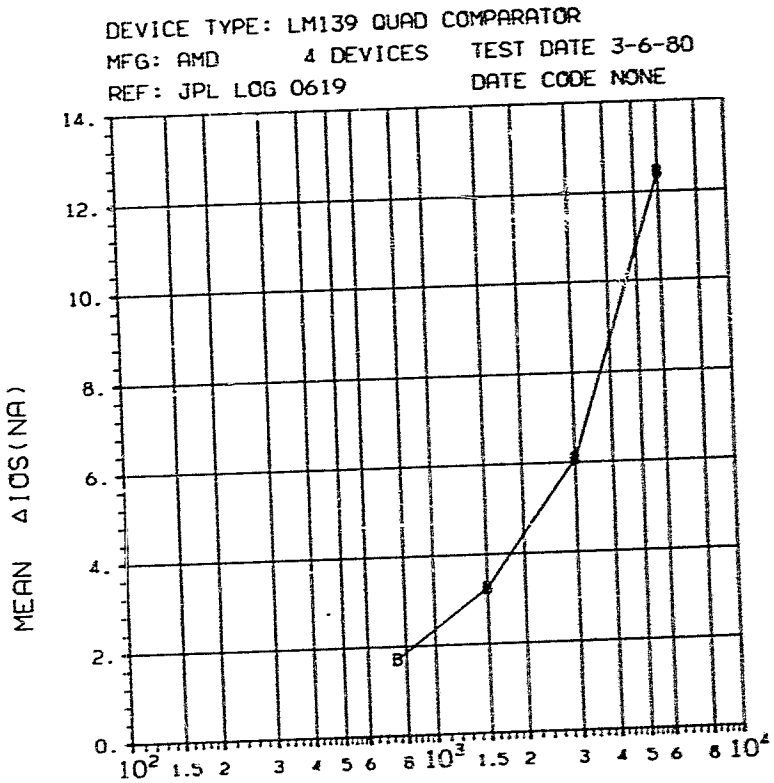
TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
D	.7805	.8221	.8426	.9798

INITIAL MEAN VALUE ISINK(MA) = $1.49X10^{+1}$



(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
A	.0556	.0916	.1468	.2225



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
B	1.067	1.530	2.022	3.847

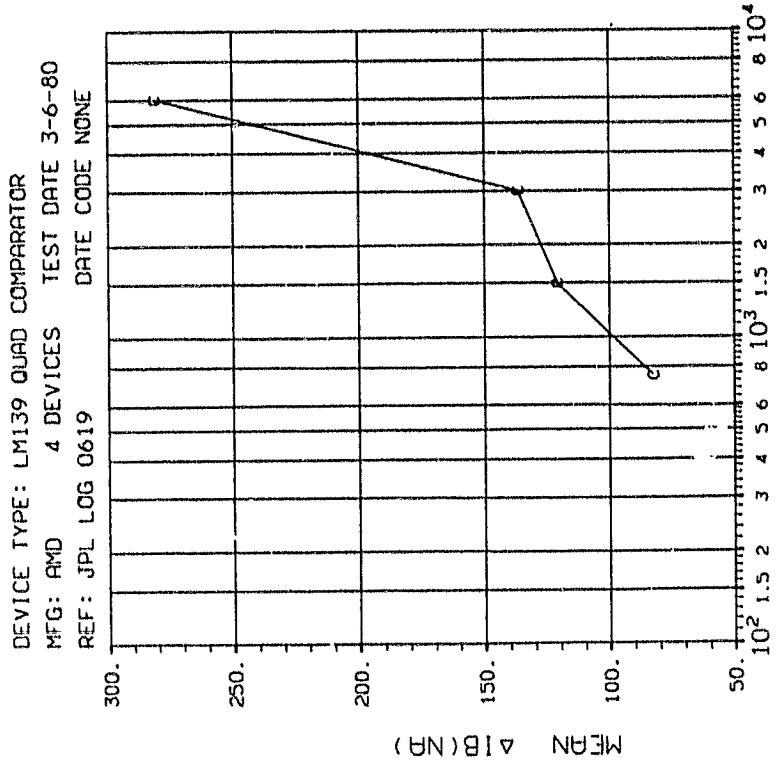
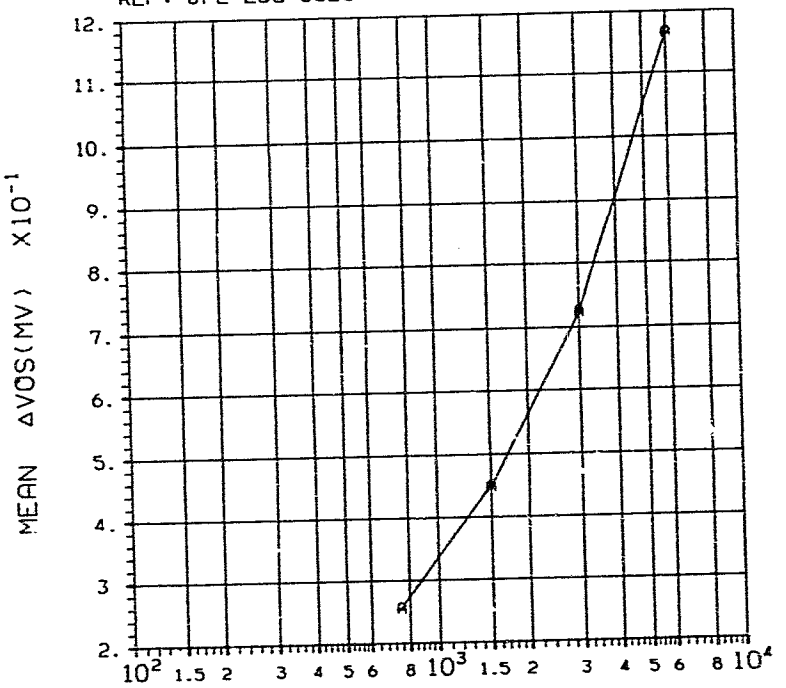


TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	75	1.50	3.00	6.00	
C	15.57	19.53	90.70	34.22	

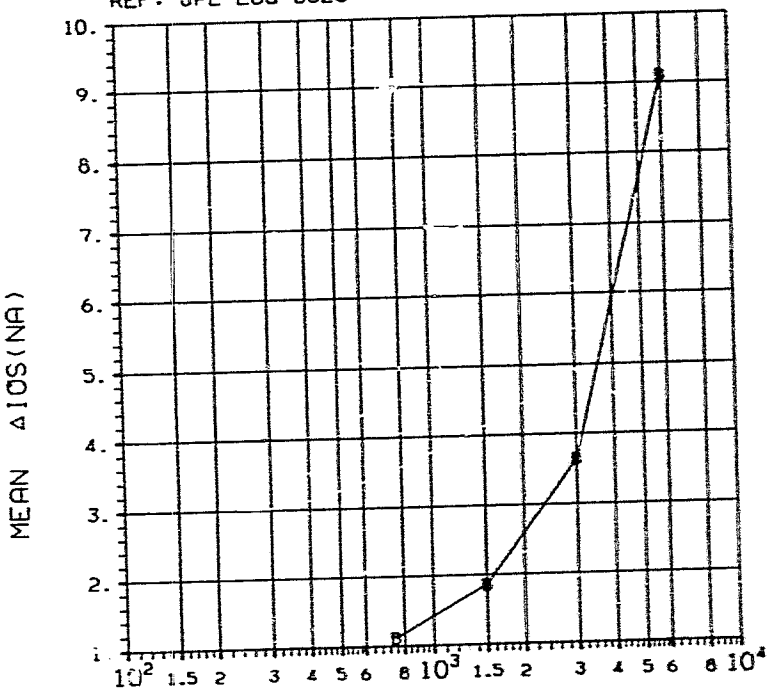
DEVICE TYPE: LM139 QUAD COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 3-7-80
REF: JPL LOG 0623 DATE CODE NONE



(1) VOS IN MV VS DOSE

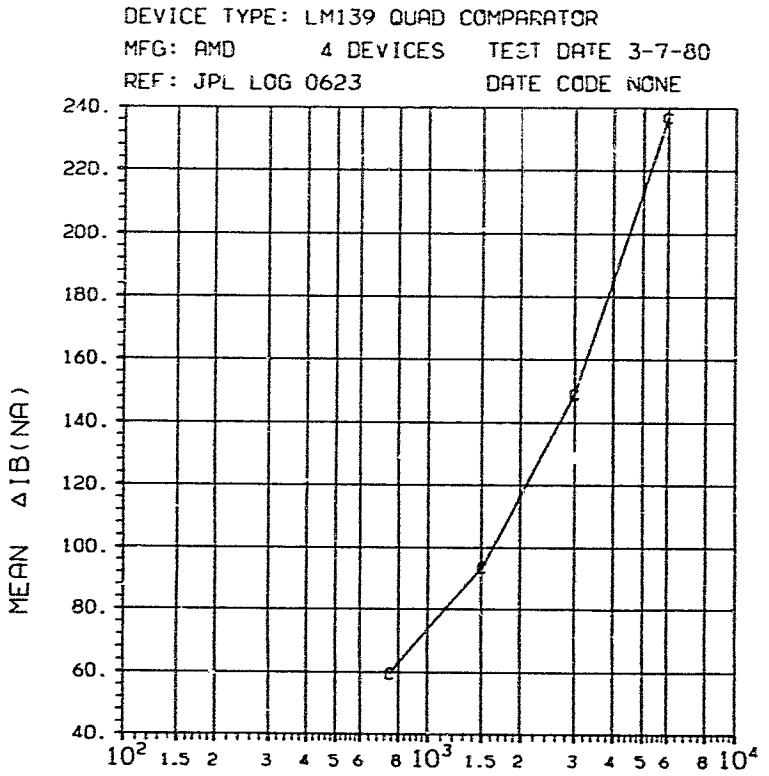
TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
A	.0756	.1345	.2062	.3095

DEVICE TYPE: LM139 QUAD COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 3-7-80
REF: JPL LOG 0623 DATE CODE NONE



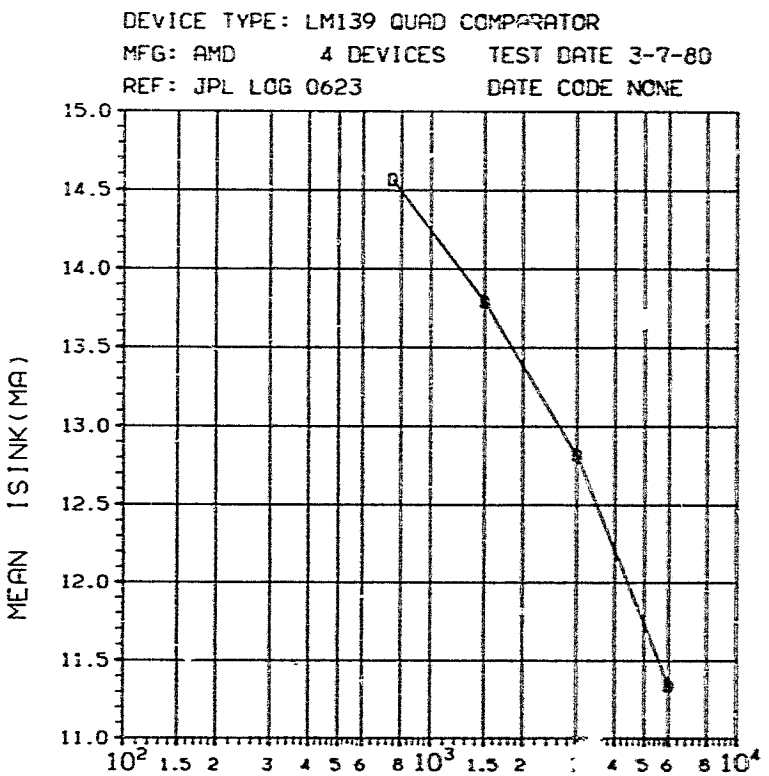
(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
B	.0776	.5242	.6388	.7297



(3) IB (NON INVERTING INPUT) IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00	6.00
C	19.55	23.40	29.30	37.41

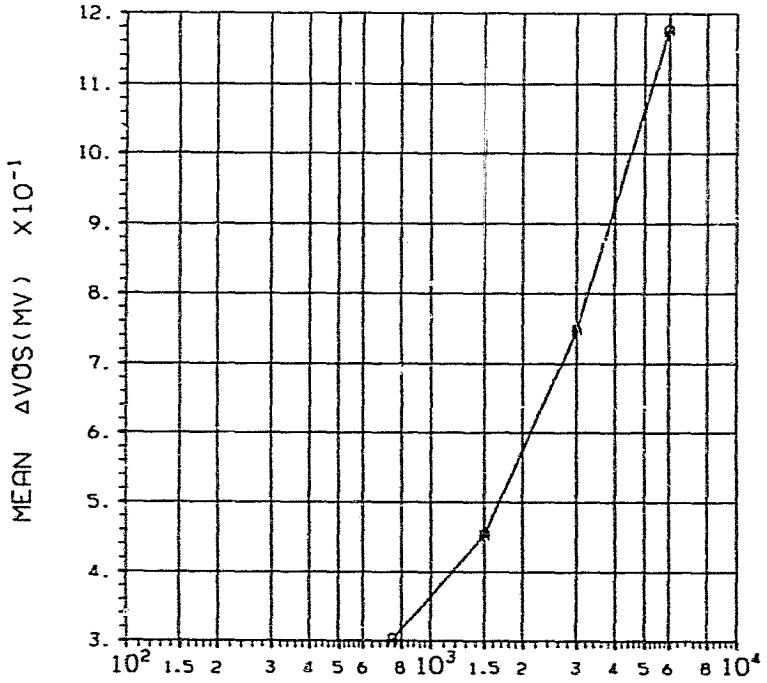


(4) I SINK IN MA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00	6.00
D	1.455	1.367	1.383	1.452

INITIAL MEAN VALUE ISINK(MA) = $1.57X10^{+1}$

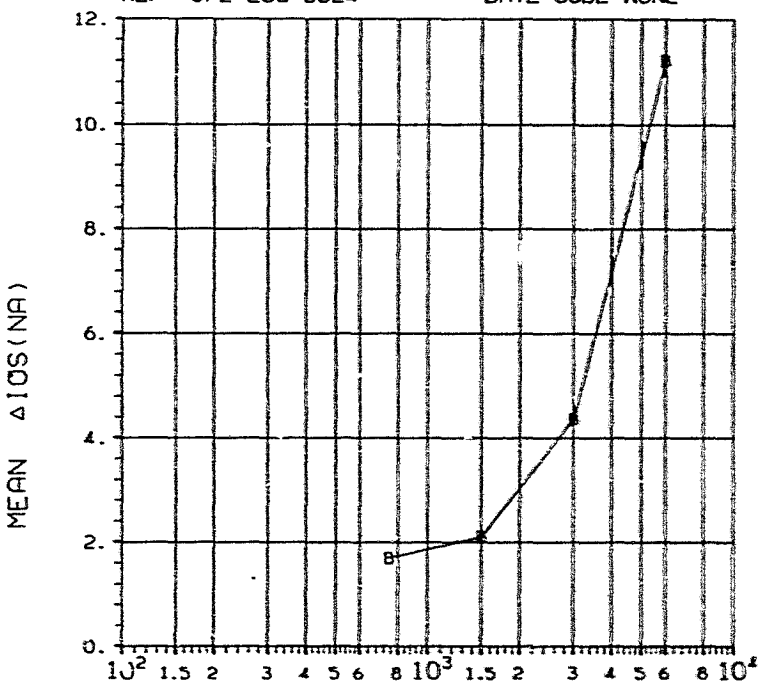
DEVICE TYPE: LM139 QUAD COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 3-7-80
REF: JPL LOG 0624 DATE CODE NONE



(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00	6.00
A	.0418	.0592	.1268	.1839

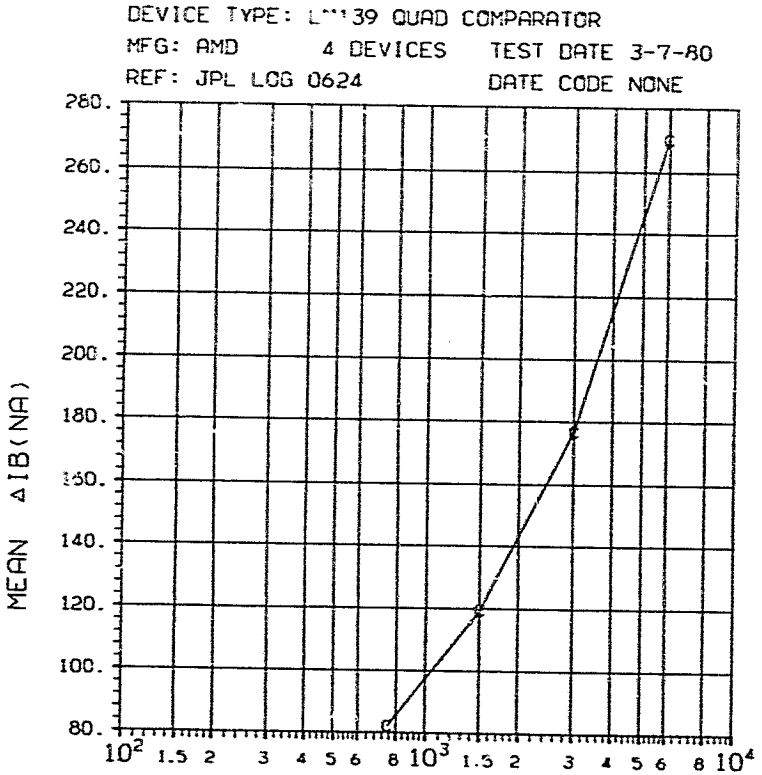
DEVICE TYPE: LM139 QUAD COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 3-7-80
REF: JPL LOG 0624 DATE CODE NONE



(2) IOS IN NA VS DOSE

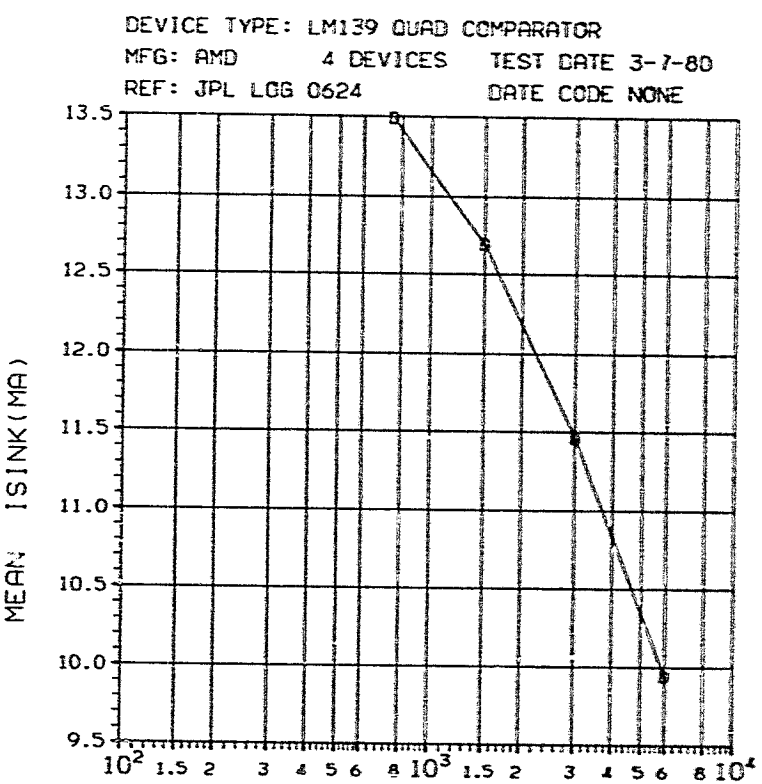
TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00	6.00
B	.0660	.3025	.8179	1.492

ORIGINAL PAGE IS
OF POOR QUALITY



(3) IB (NON INVERTING INPUT) IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
C	10.08	14.98	22.87	33.50

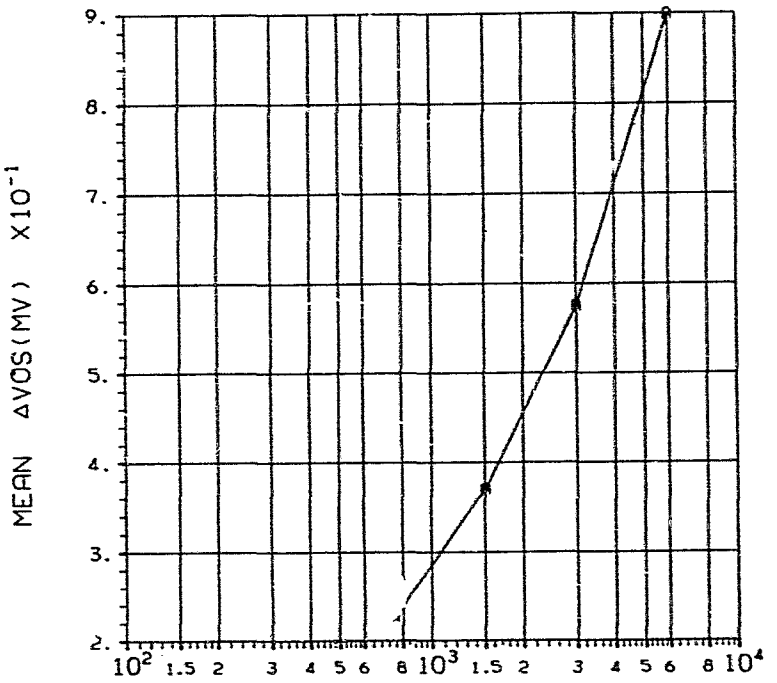


(4) I SINK IN MA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
D	.6652	.5909	.3697	.2062

INITIAL MEAN VALUE ISINK(MA) = $1.52X10^{+1}$

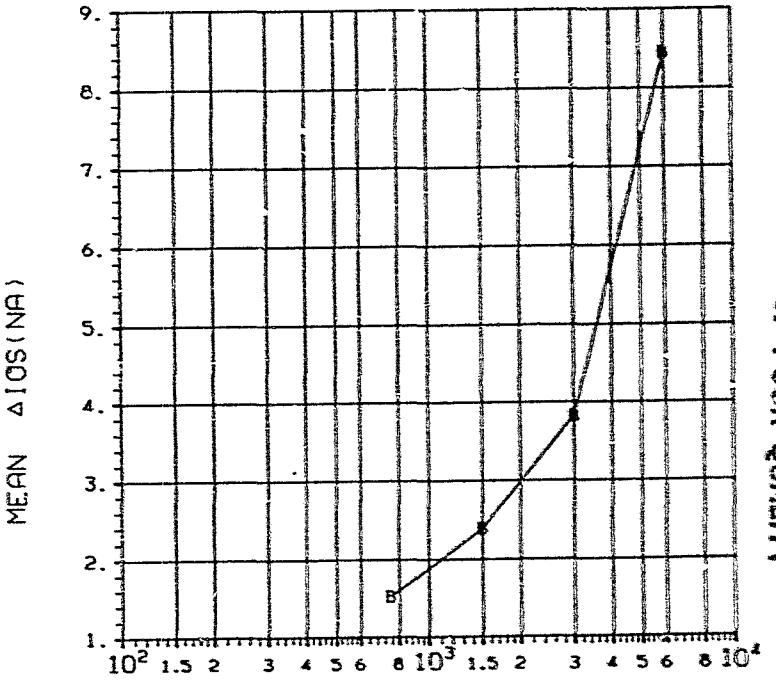
DEVICE TYPE: LM139 QUAD COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 3-10-80
REF: JPL LOG 0625 DATE CODE NONE



(1) VOS IN MV VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00	6.00
A	.0471	.1055	.1848	.2877

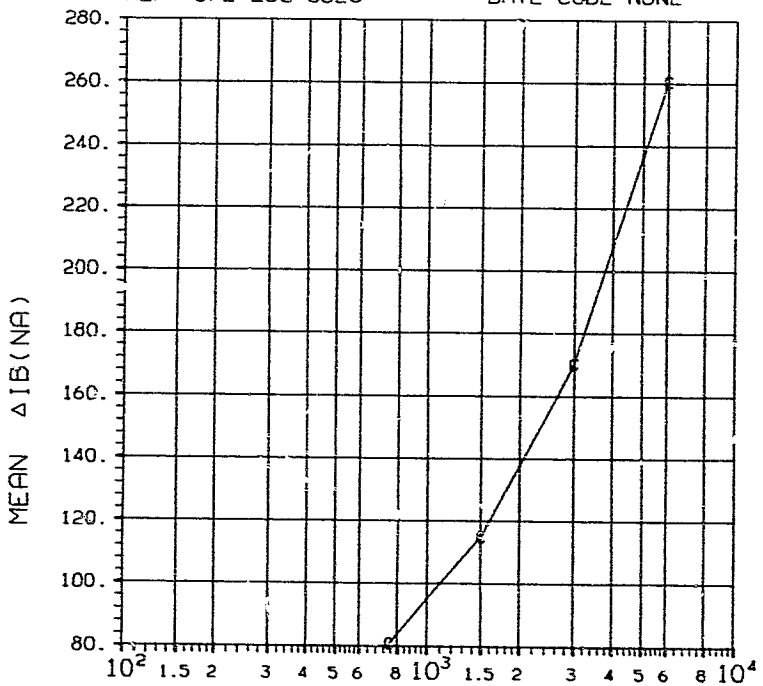
DEVICE TYPE: LM139 QUAD COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 3-10-80
REF: JPL LOG 0625 DATE CODE NONE



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00	6.00
B	.7684	1.225	1.521	2.784

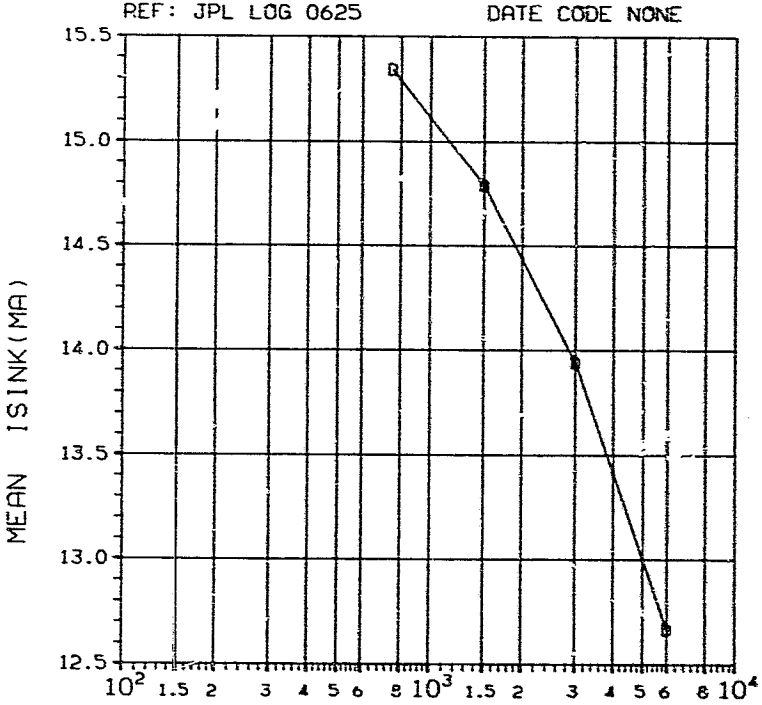
DEVICE TYPE: LM139 QUAD COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 3-10-80
REF: JPL LOG 0625 DATE CODE NONE



(3) IB (NON INVERTING INPUT) IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00	6.00
C	13.15	17.70	24.80	36.27

DEVICE TYPE: LM139 QUAD COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 3-10-80
REF: JPL LOG 0625 DATE CODE NONE



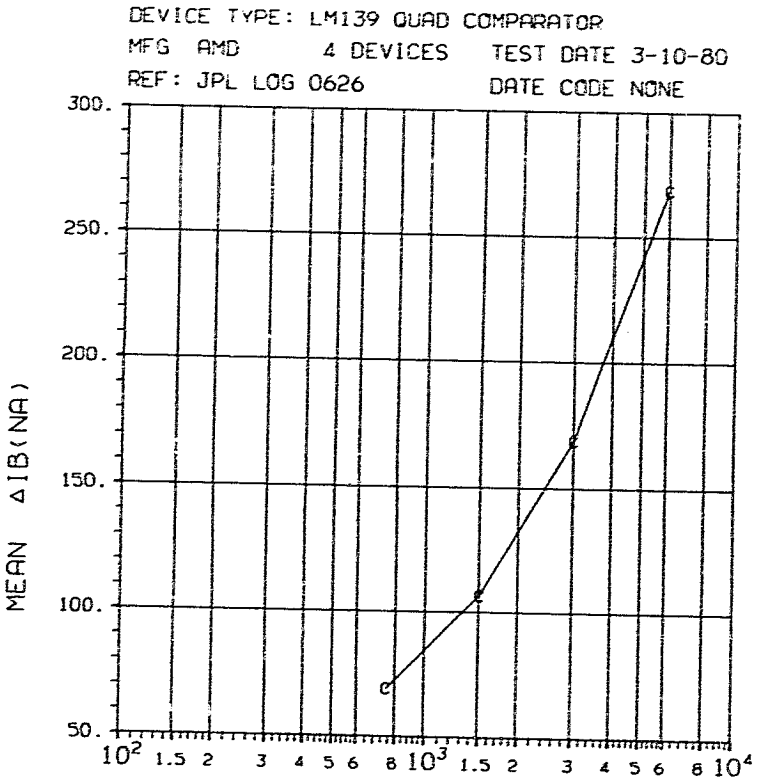
(4) I SINK IN MA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00	6.00
D	.4349	.6131	.7848	.8813

INITIAL MEAN VALUE ISINK(MA) = $1.66X10^{+1}$

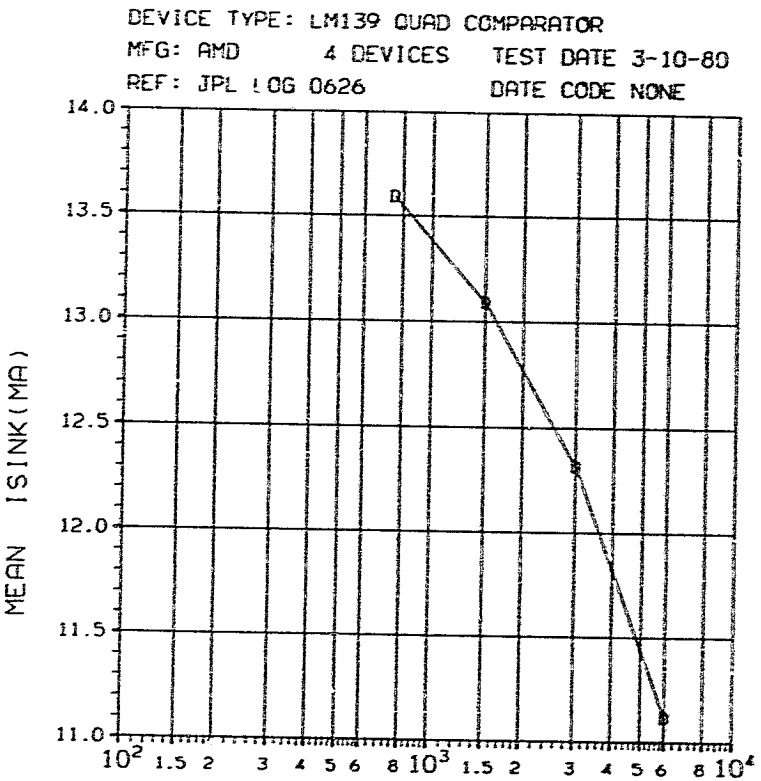
TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00 6.00
A	.1091	.1069	1.473 4.405

TABLE OF NORMAL STANDARD DEVIATIONS			
CURVE	DOSE, kiloGy(Si)		
	.75	1.50	3.00 6.00
B	.3762	.5866	1.267 3.116



(3) IB (NON INVERTING INPUT) IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
C	13.65	18.43	25.13	35.26

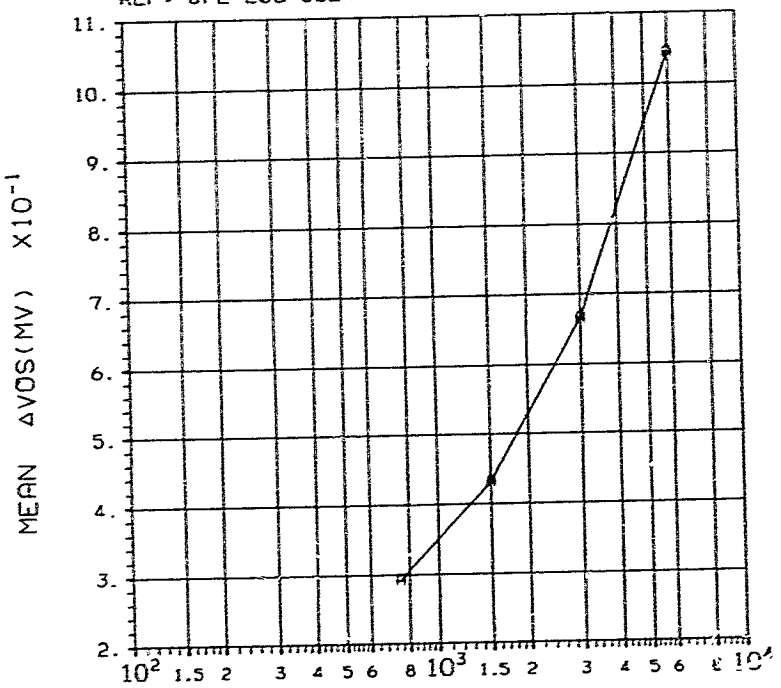


(4) I SINK IN MA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
D	.3594	.2500	.3559	.2828

INITIAL MEAN VALUE ISINK(MA) = $1.45X10^{+1}$

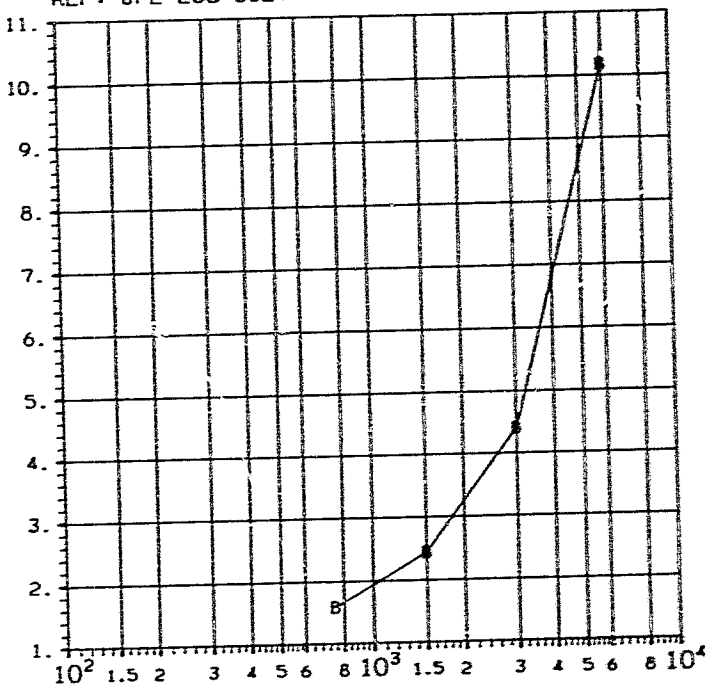
DEVICE TYPE: LM139 QUAD COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 3-10-80
REF: JPL LOG 0627 DATE CODE NONE



(1) VOS IN MV VS DOSE

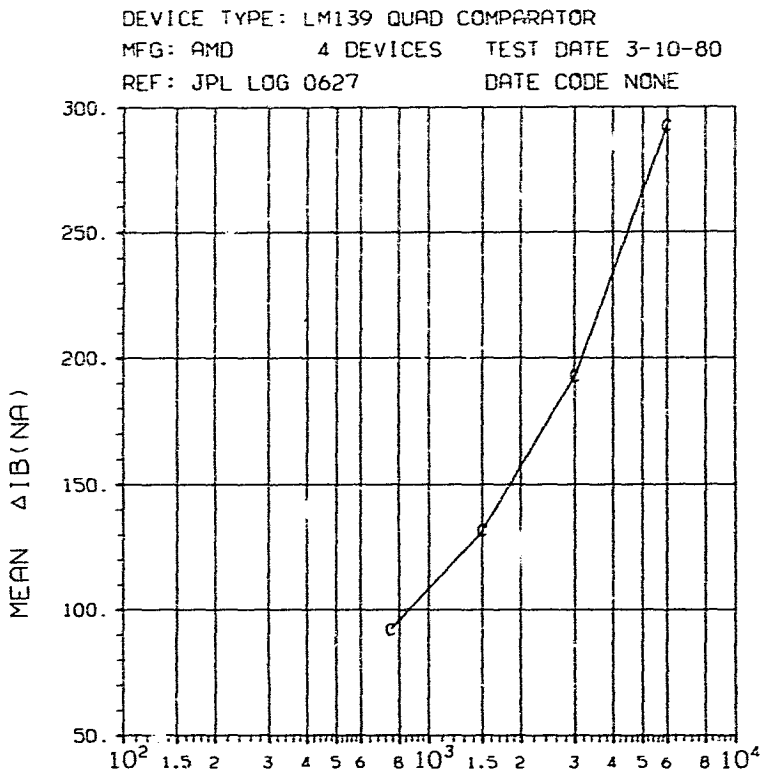
TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
A	.0445	.0926	.1743	.2882

DEVICE TYPE: LM139 QUAD COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 3-10-80
REF: JPL LOG 0627 DATE CODE NONE



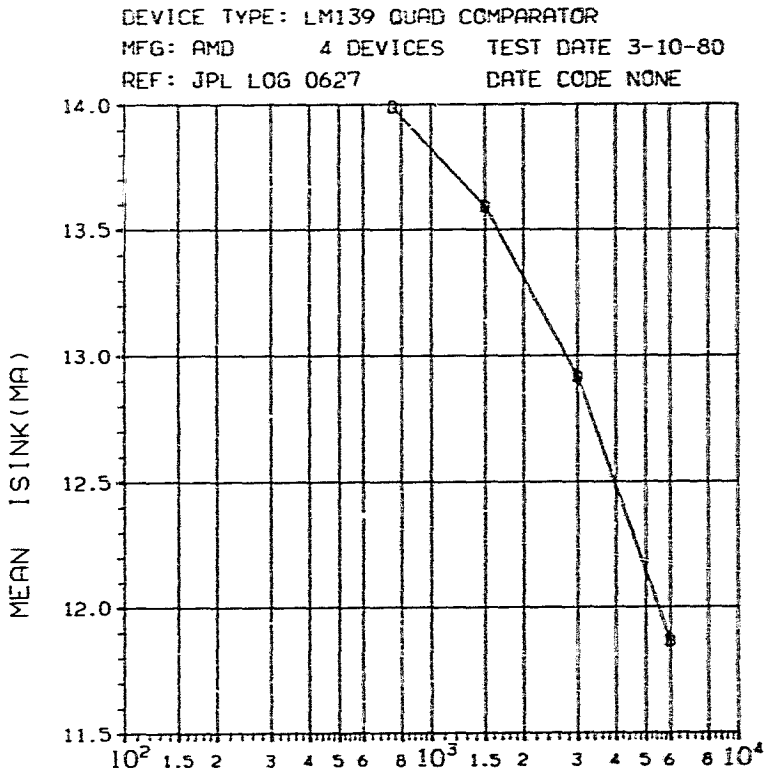
(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
B	1.432	2.721	2.935	4.163



(3) IB (NON INVERTING INPUT) IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
C	5.553	7.461	14.55	24.87



(4) I SINK IN MA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
D	.7632	.6551	.6782	.7047

INITIAL MEAN VALUE ISINK(MA) = $1.50X10^{+1}$

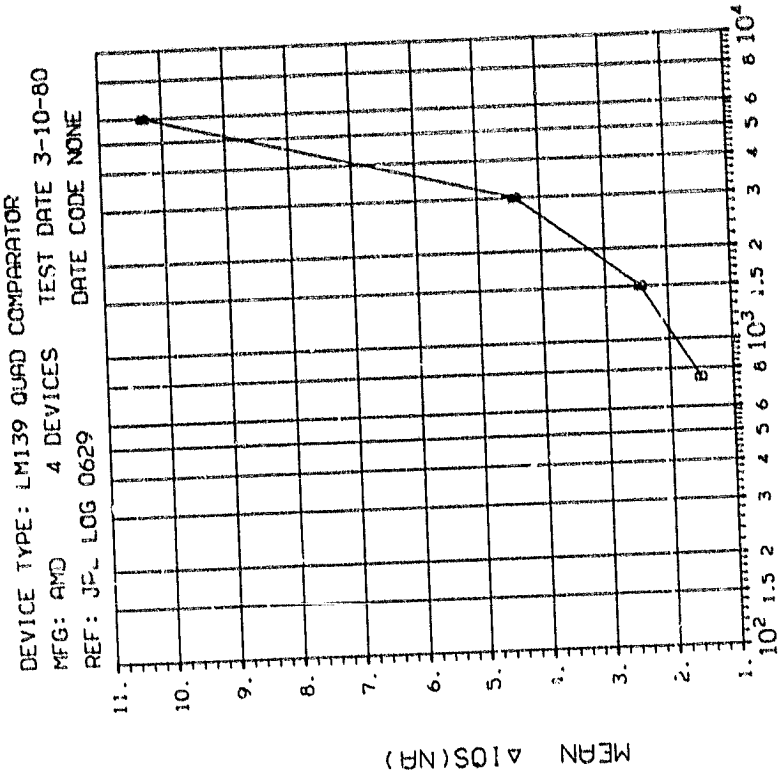


TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.75	1.50	3.00	6.00	
B	.9292	1.064	1.335	2.450	

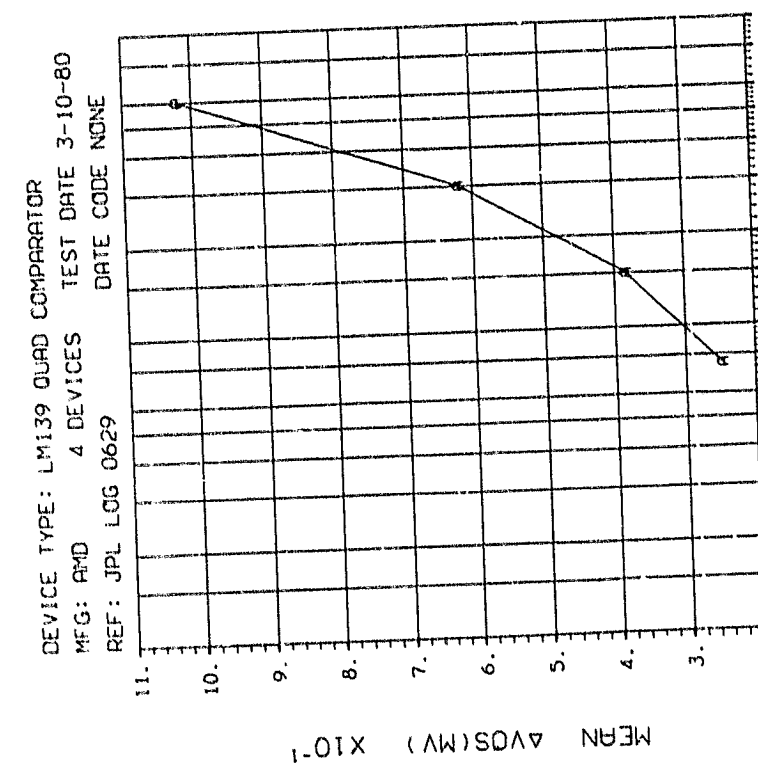
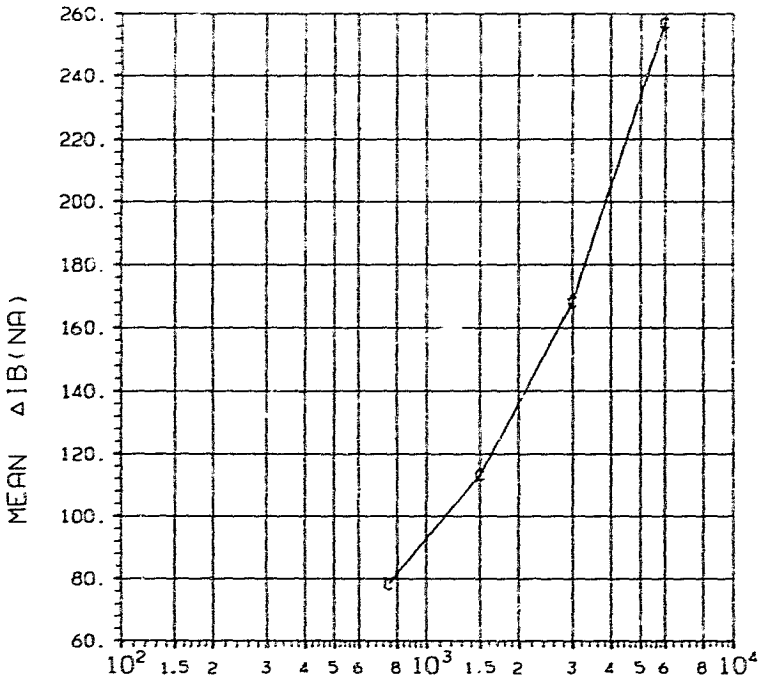


TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.75	1.50	3.00	6.00	
A	.0525	.0848	.1241	.1503	

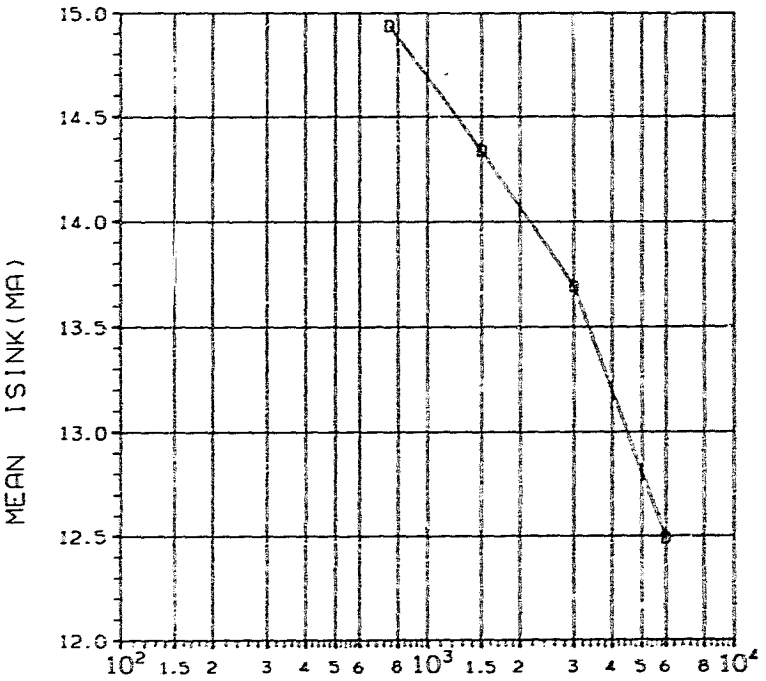
DEVICE TYPE: LM139 QUAD COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 3-10-80
REF: JPL LOG 0629 DATE CODE NONE



(3) IB (NON INVERTING INPUT) IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
C	9.282	9.800	10.39	12.11

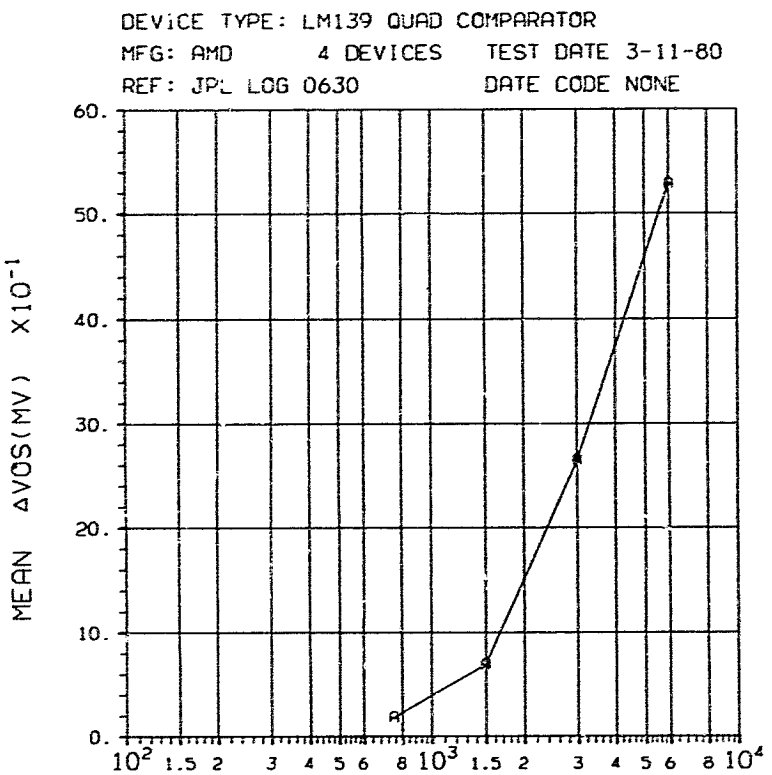
DEVICE TYPE: LM139 QUAD COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 3-10-80
REF: JPL LOG 0629 DATE CODE NONE



(4) I SINK IN MA VS DOSE

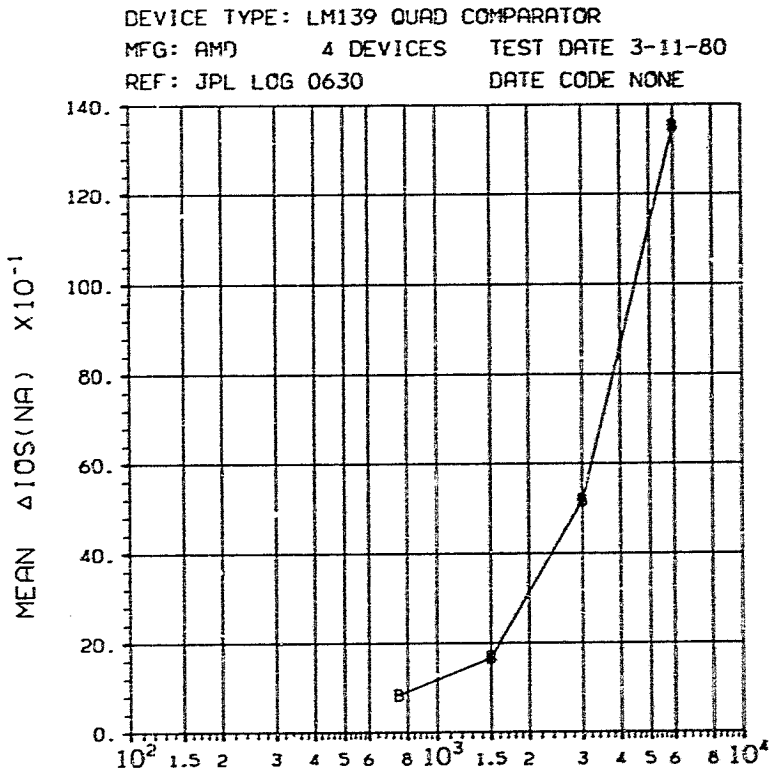
TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
D	1.652	1.821	2.169	2.629

INITIAL MEAN VALUE ISINK(MA) = $1.62X10^{+1}$



(1) VOS IN MV VS DOSE

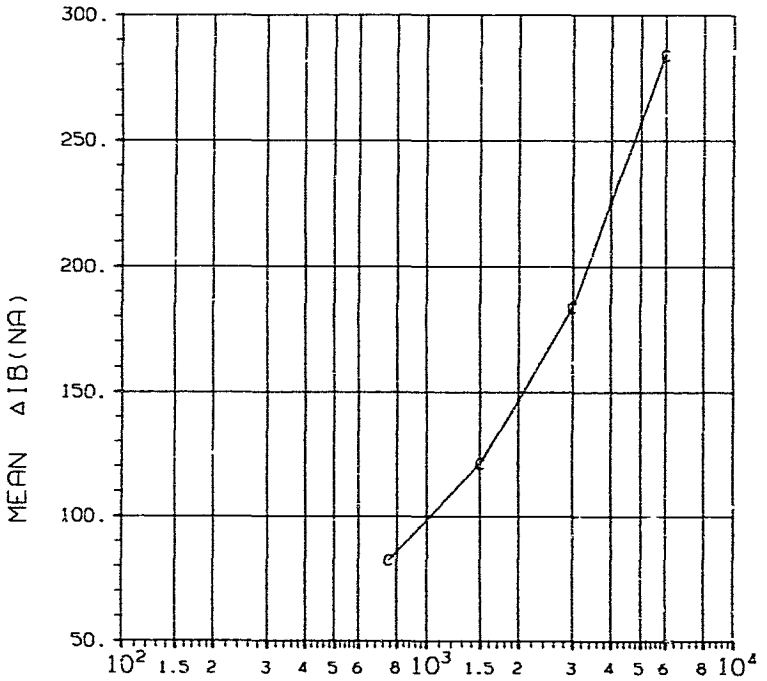
TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00	6.00
A	.0993	.6119	3.974	8.337



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si) .75	1.50	3.00	6.00
B	.6920	1.520	2.434	8.020

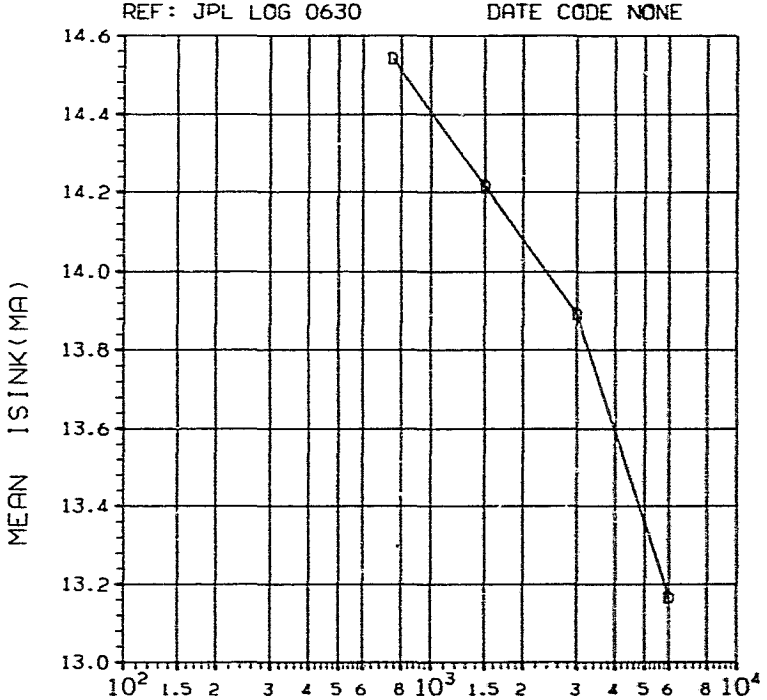
DEVICE TYPE: LM139 QUAD COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 3-11-80
REF: JPL LOG 0630 DATE CODE NONE



(3) IB (NON INVERTING INPUT) IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
C	8.747	12.53	18.42	24.77

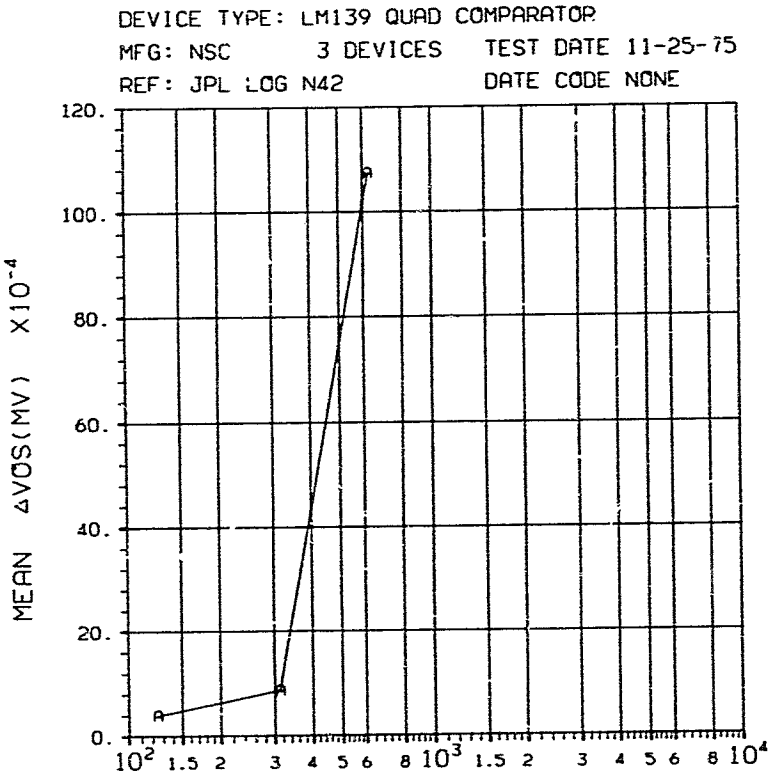
DEVICE TYPE: LM139 QUAD COMPARATOR
MFG: AMD 4 DEVICES TEST DATE 3-11-80
REF: JPL LOG 0630 DATE CODE NONE



(4) I SINK IN MA VS DOSE

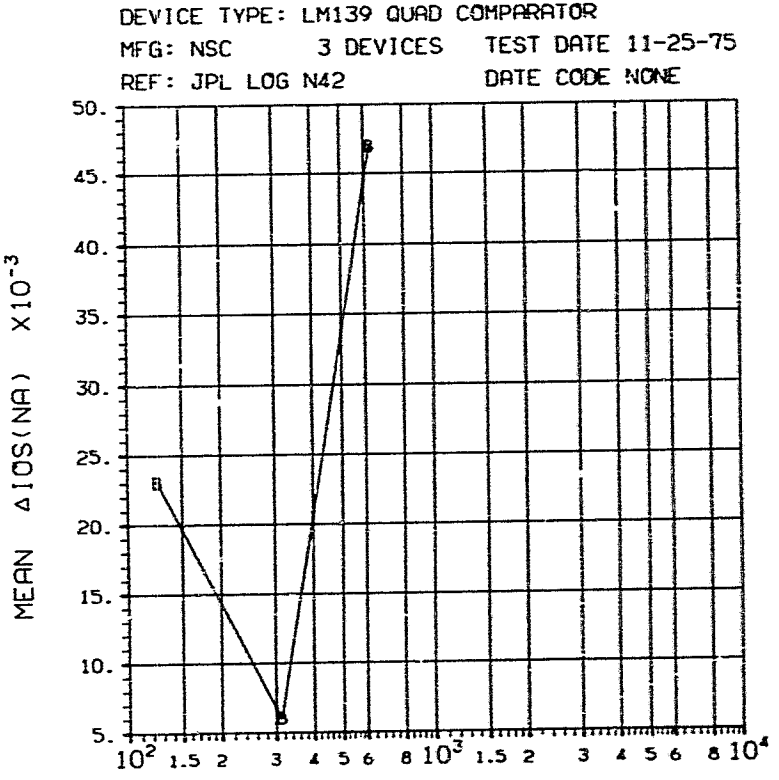
TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
D	1.024	.9832	1.014	.8103

INITIAL MEAN VALUE ISINK(MA) = $1.50X10^{+1}$



(1) VOS IN MV VS DOSE

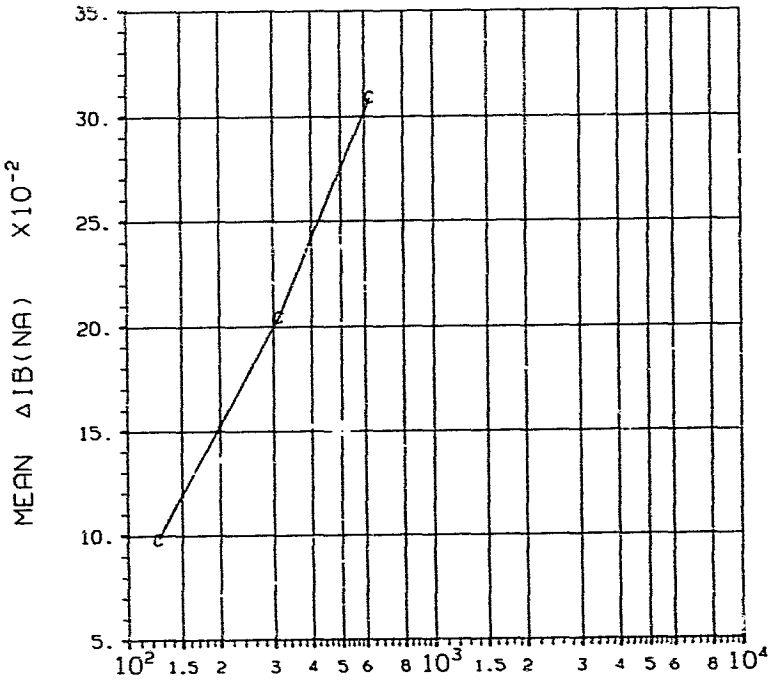
TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si) .12	.31	.62	1.25
A	.0001	.0002	.0079	FAIL



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si) .12	.31	.62	1.25
B	.0055	.0041	.0127	FAIL

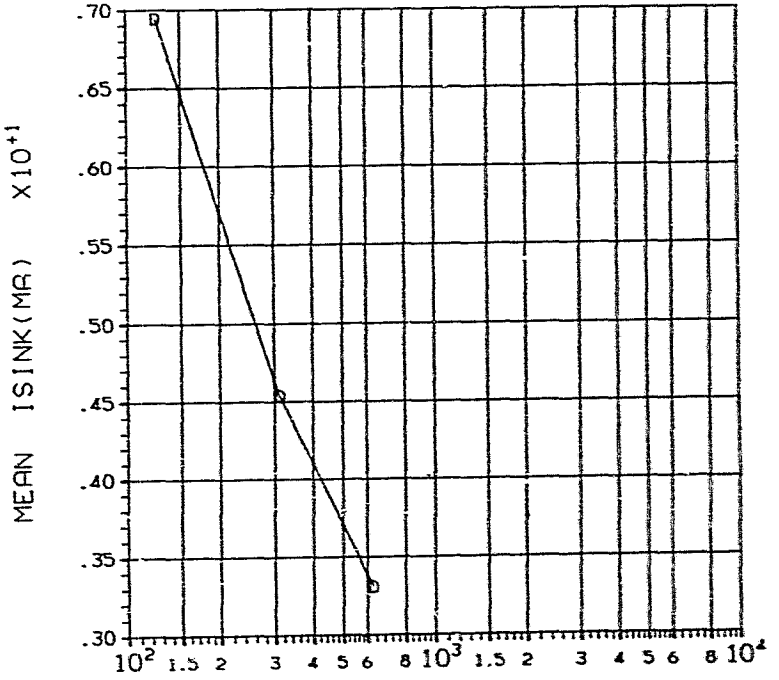
DEVICE TYPE: LM139 QUAD COMPARATOR
MFG: NSC 3 DEVICES TEST DATE 11-25-75
REF: JPL LOG N42 DATE CODE NONE



(3) IB (NON INVERTING INPUT) IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si) .12	.31	.62	1.25
C	.0167	.0371	.0360	FAIL

DEVICE TYPE: LM139 QUAD COMPARATOR
MFG: NSC 3 DEVICES TEST DATE 11-25-75
REF: JPL LOG N42 DATE CODE NONE

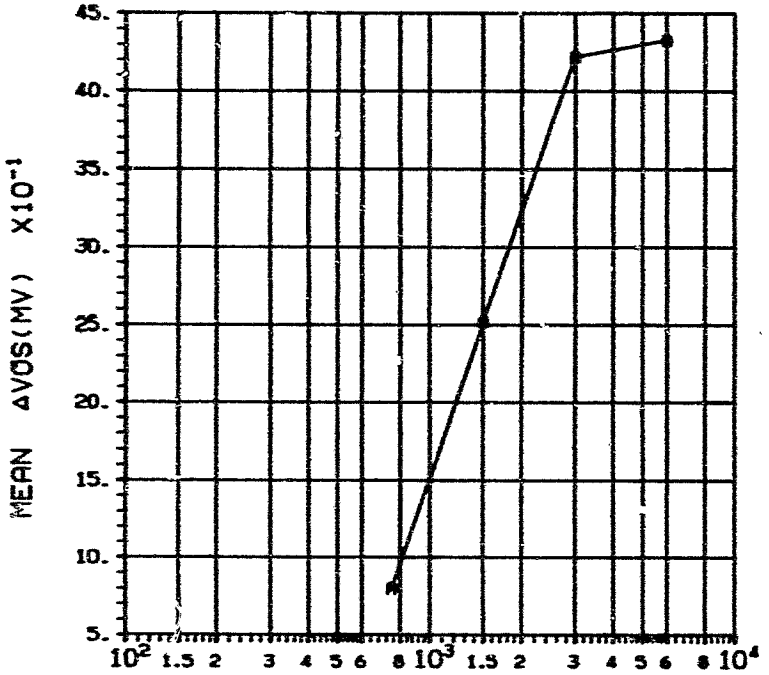


(4) ISINK IN MA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si) .12	.31	.62	1.25
D	.5389	.5196	.4329	FAIL

INITIAL MEAN VALUE ISINK(MA) = $1.14X10^{+1}$

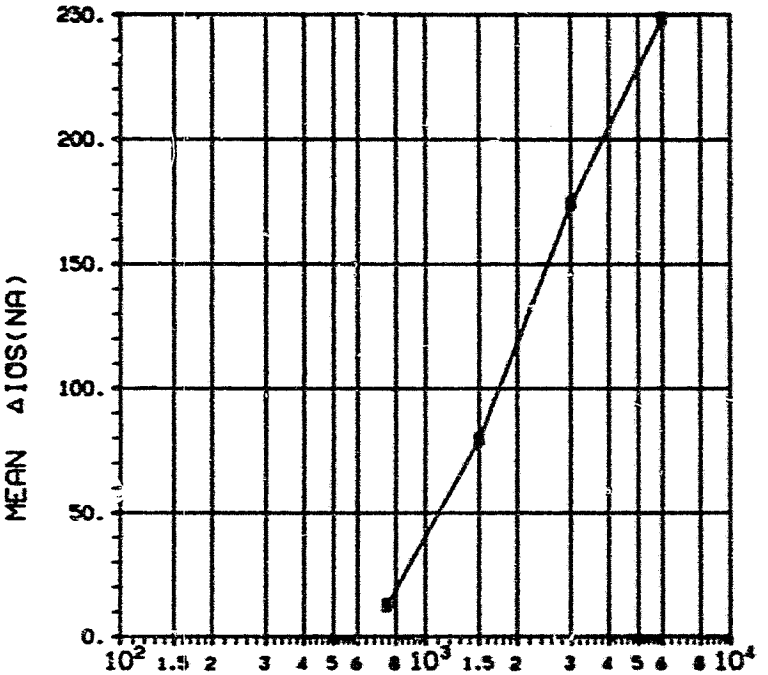
DEVICE TYPE: LM139 QUAD COMPARATOR
MFG: PMI 4 DEVICES TEST DATE 6-5-80
REF: JPL LOG 0661 DATE CODE 7924



(1) VOS IN MV VS DOSE

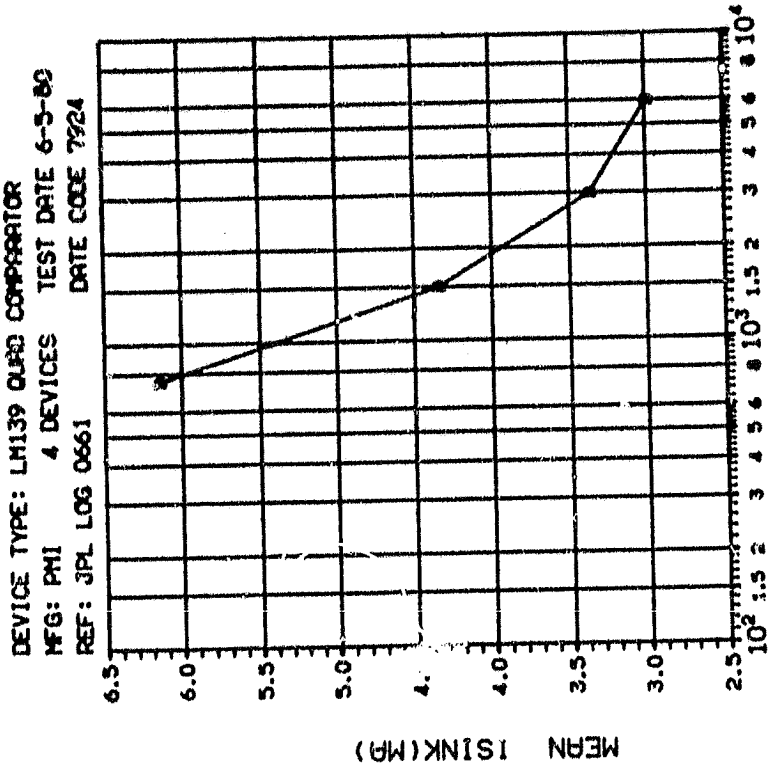
TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
A	.5534	.7262	.9473	1.599

DEVICE TYPE: LM139 QUAD COMPARATOR
MFG: PMI 4 DEVICES TEST DATE 6-5-80
REF: JPL LOG 0661 DATE CODE 7924



(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
B	6.603	47.36	58.23	45.45

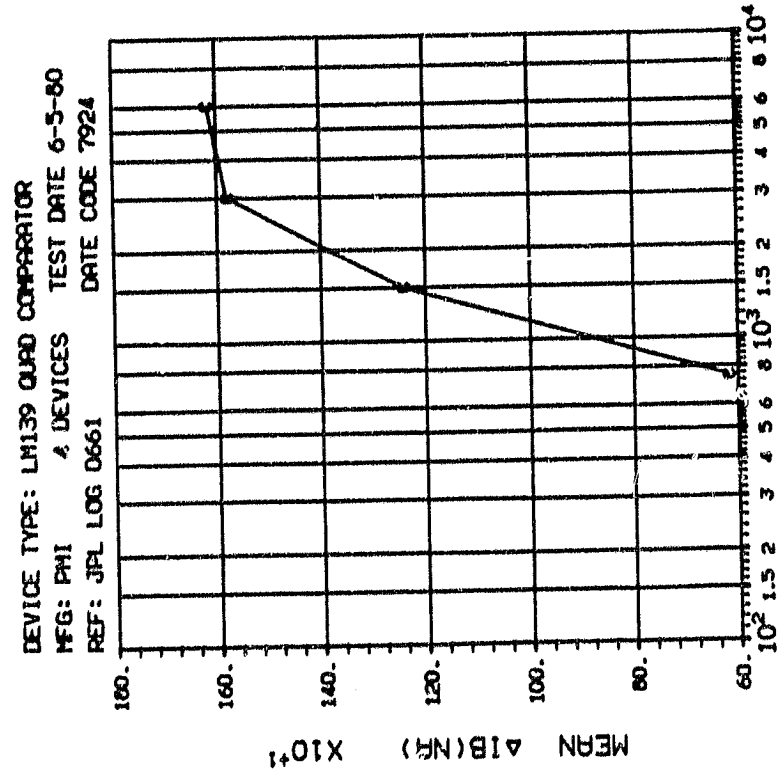


DOSE, Gy(Si) 2.5 MeV electrons

(4) I SINK IN MA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
D	.5560	.5188	.4041	.4717

INITIAL MEAN VALUE ISINK(MA) = 9.97×10^{00}



DOSE, Gy(Si) 2.5 MeV electrons

(3) IB (NON INVERTING INPUT) IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS				
CURVE	DOSE, kiloGy(Si)			
	.75	1.50	3.00	6.00
C	53.00	81.93	66.92	85.47

DEVICE: MCM418
TYPE: Crystal Oscillator
MANUFACTURER: STI
DATE CODE: 0214

DEVICES TESTED: 2
TEST DATE: 10-2-80
SOURCE: 1.25 MeV Gamma
LOG NUMBER: 0214

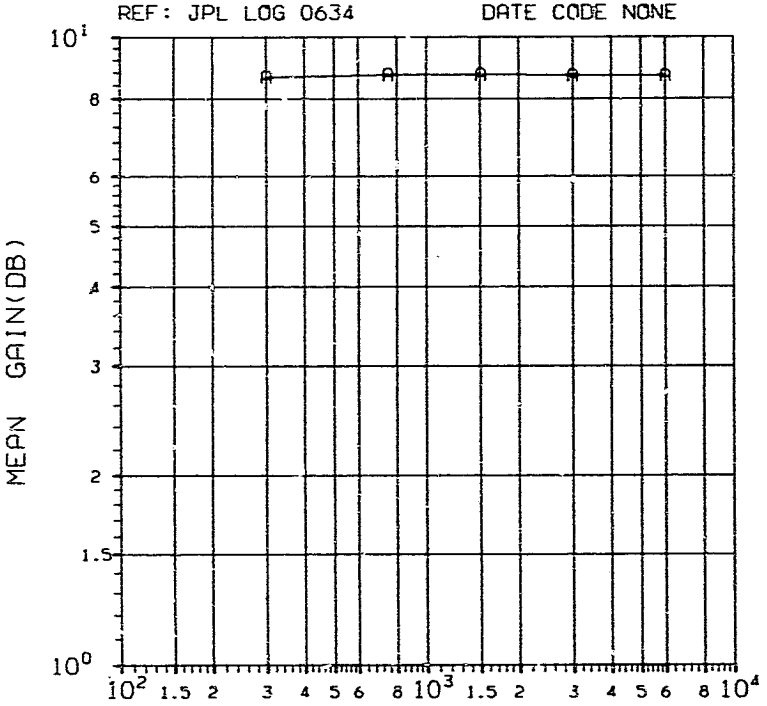
RADIATION BIAS CONDITION: V_{CC} = 5 volts

RESULTS: Worst-Case Parameter Values, V_{CC} = 5 volts

Total Dose, Gy(Si)	OUTPUT FREQUENCY, kHz	
	30[a]	31[a]
Initial	15,999.68	15,999.18
750	16,000.13	15,999.98
1500	16,000.34	16,000.18
3000	16,000.52	16.000.33

[a]There was no change in waveform on any of the six outputs ($\overline{16}$, 8, $\overline{8}$, 4, $\overline{4}$ and $\overline{4}$ MHz) during the test.

DEVICE TYPE: MIC76 RF AMPLIFIER
MFG: MOT 4 DEVICES TEST DATE 5-14-80
REF: JPL LOG 0634 DATE CODE NONE



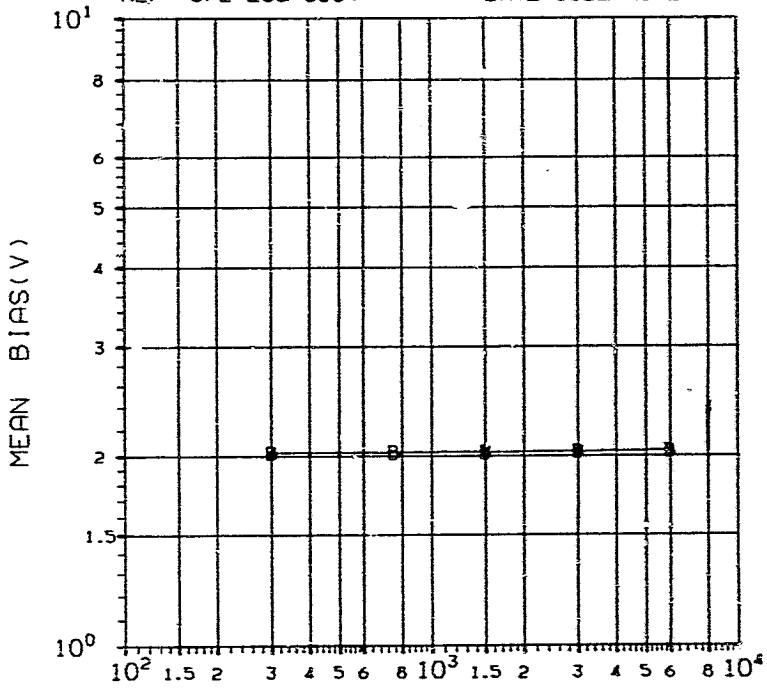
DOSE, Gy(Si) 2.5 MeV electrons

(1A) GAIN IN DBM (MAX. GAIN) VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.30	.75	1.50	3.00	6.00
A	.2380	.2217	.2217	.1826	.1826

INITIAL MEAN VALUE GAIN(DB) = 8.57×10^0

DEVICE TYPE: MIC76 RF AMPLIFIER
MFG: MOT 4 DEVICES TEST DATE 5-14-80
REF: JPL LOG 0634 DATE CODE NONE

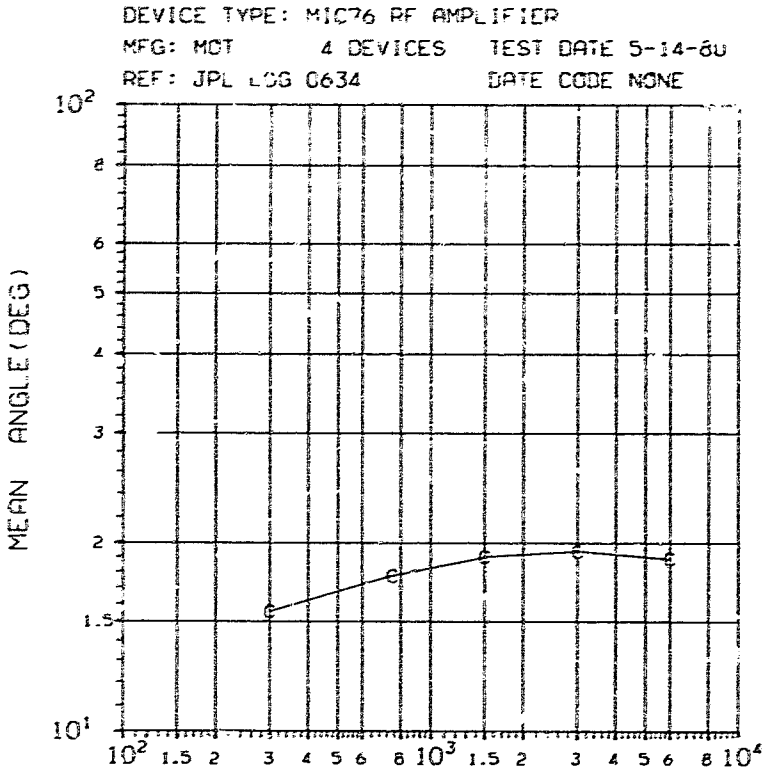


DOSE, Gy(Si) 2.5 MeV electrons

(1B) BIAS VOLTAGE IN VOLTS VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.30	.75	1.50	3.00	6.00
B	.0097	.0096	.0099	.0099	.0068

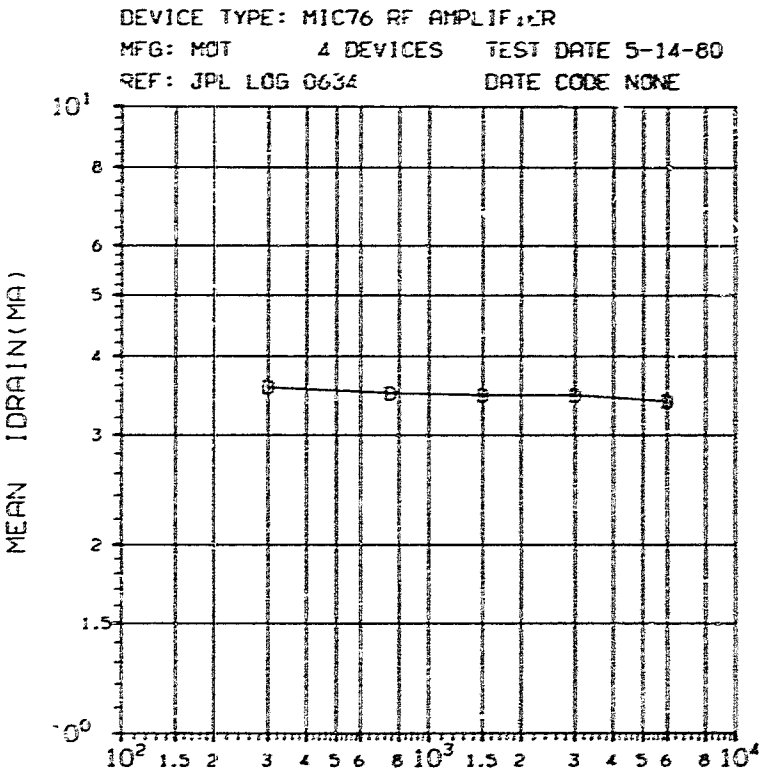
INITIAL MEAN VALUE BIAS(V) = 2.02×10^0



(1C) ANGLE IN DEGREES (MAX. GAIN) VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.30	.75	1.50	3.00	6.00
C	1.994	1.274	1.080	.5228	1.377

INITIAL MEAN VALUE ANGLE(DEG) = $1.65X10^{+1}$

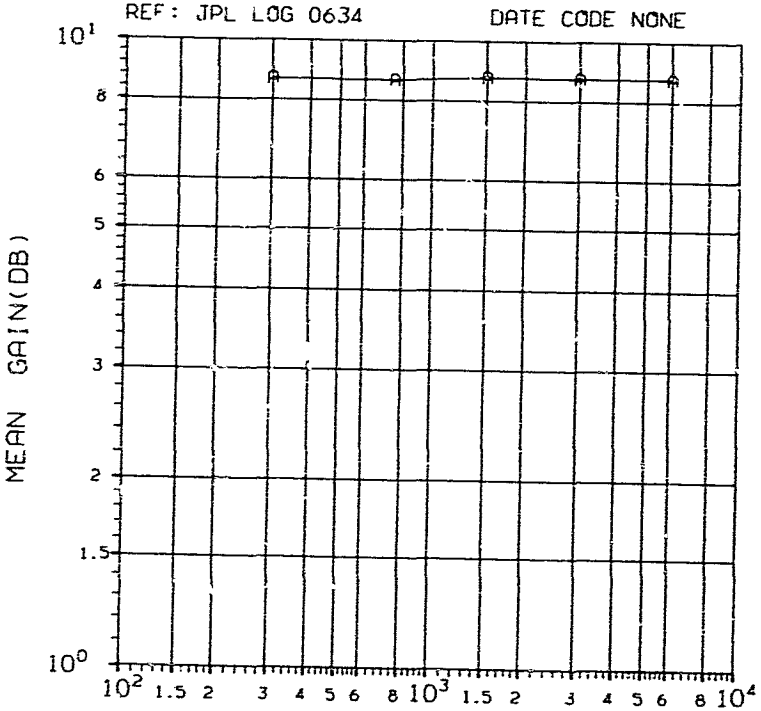


(1D) DC CURRENT DRAIN IN MA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.30	.75	1.50	3.00	6.00
D	.0500	.0816	.0500	.0500	.0816

INITIAL MEAN VALUE IDRAIN(MA) = $3.57X10^{+0}$

DEVICE TYPE: MIC76 RF AMPLIFIER
MFG: MOT 4 DEVICES TEST DATE 5-14-80
REF: JPL LOG 0634 DATE CODE NONE

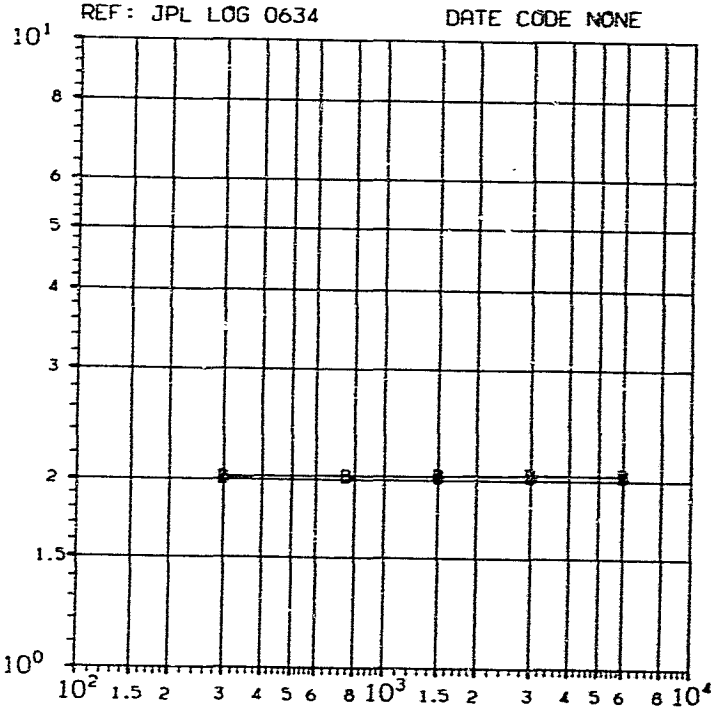


(2A) GAIN IN DBM (AGC POSITION) VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.30	.75	1.50	3.00	6.00
A	.1732	.1258	.2217	.1826	.1826

INITIAL MEAN VALUE GAIN(DB) = $8.57 \times 10^{+0}$

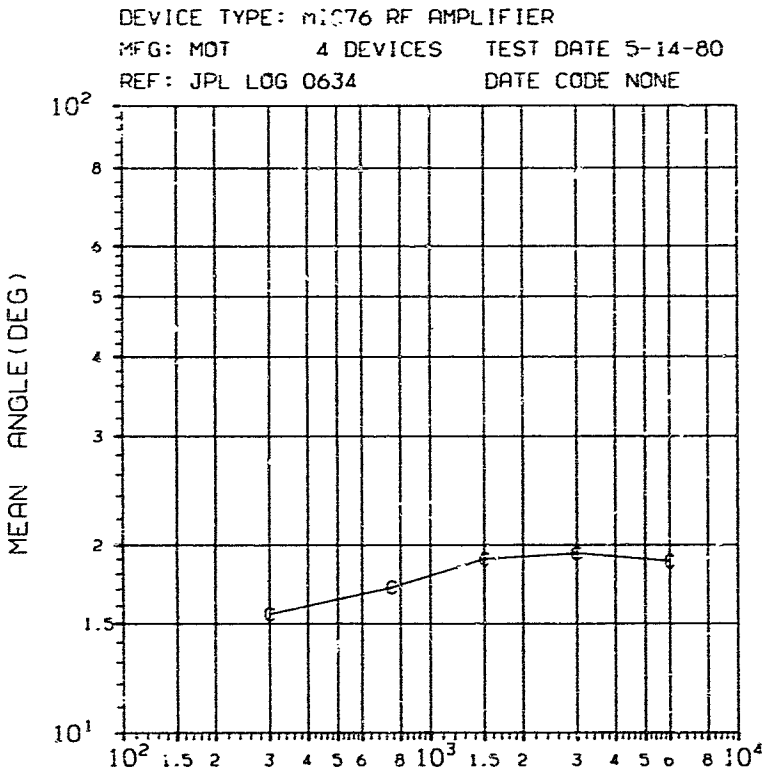
DEVICE TYPE: MIC76 RF AMPLIFIER
MFG: MOT 4 DEVICES TEST DATE 5-14-80
REF: JPL LOG 0634 DATE CODE NONE



(2B) BIAS VOLTAGE IN VOLTS (AGC POSI)VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.30	.75	1.50	3.00	6.00
B	.0101	.0088	.0102	.0105	.0101

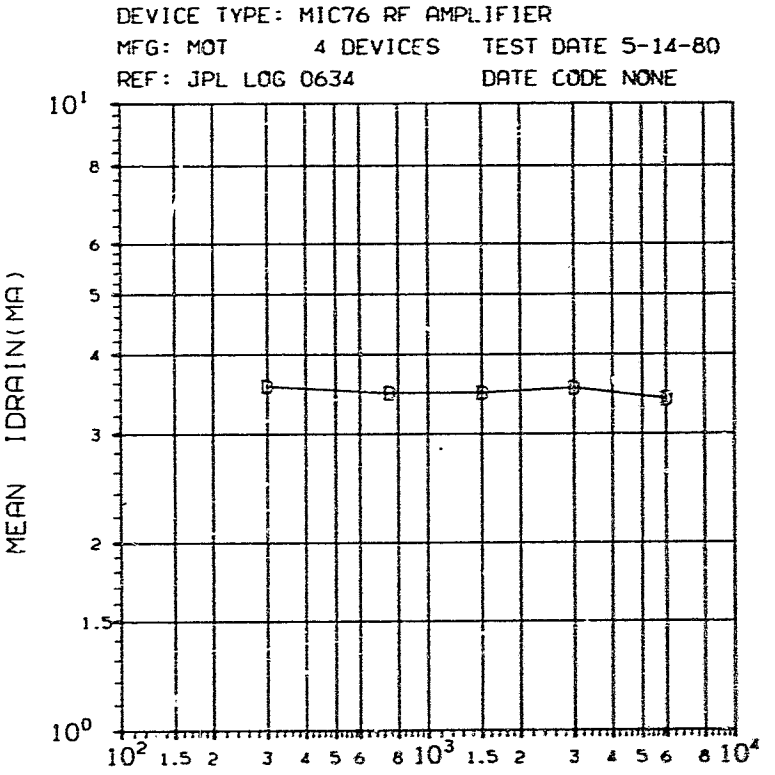
INITIAL MEAN VALUE BIAS(V) = $2.02 \times 10^{+0}$



(2C) ANGLE IN DEGREES (AGC POSITION) VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.30	.75	1.50	3.00	6.00
C	1.664	.3202	1.080	.5228	1.127

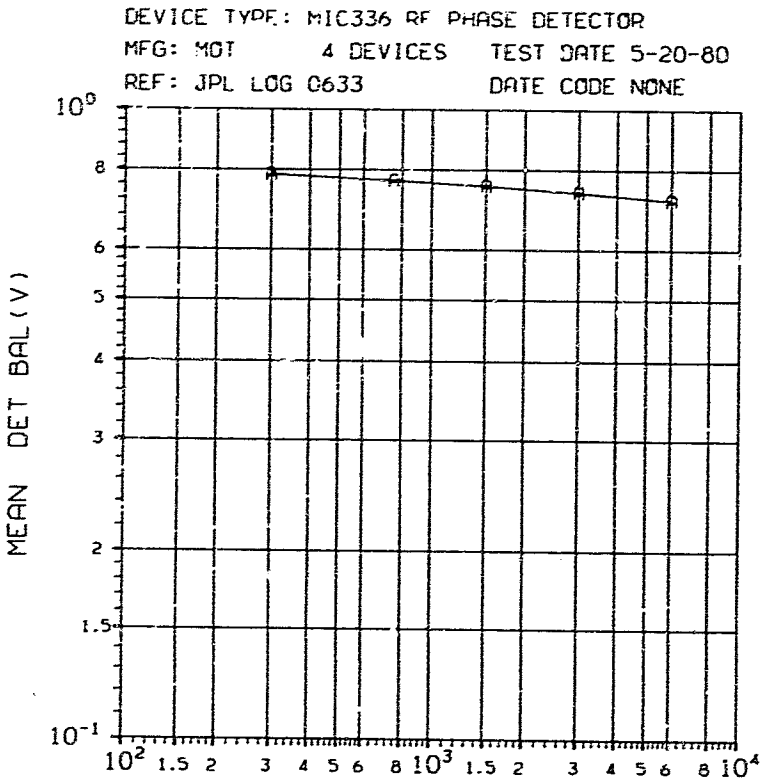
INITIAL MEAN VALUE ANGLE(DEG) = $1.65X10^{+1}$



(2D) DC CURRENT DRAIN IN MA (AGC POS)VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.30	.75	1.50	3.00	6.00
D	.0750	.0500	.0500	.2428	.0816

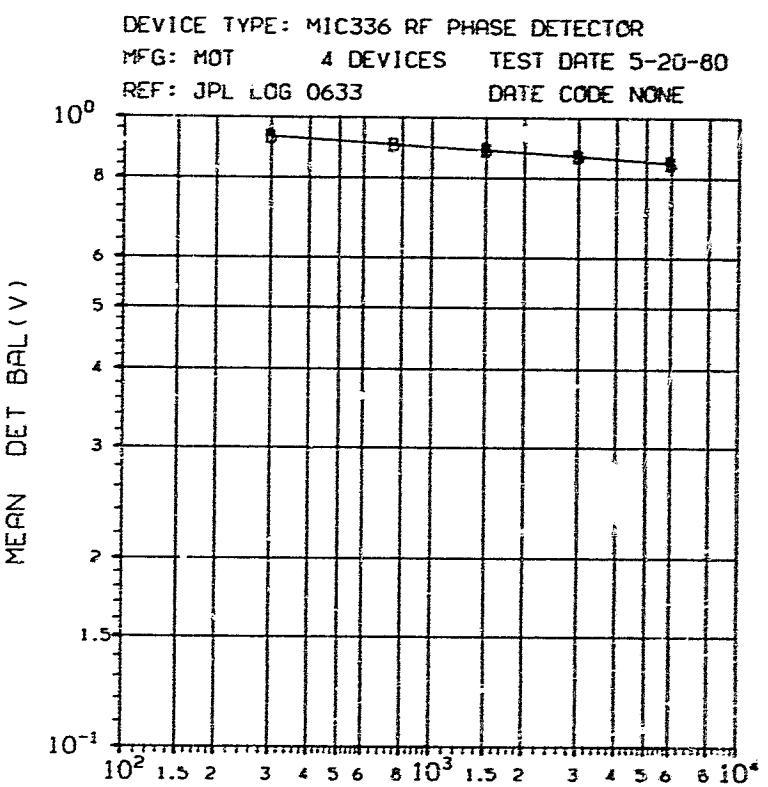
INITIAL MEAN VALUE IDRAIN(MA) = $3.57X10^{+0}$



(1A) 12MHZ PHASE DETECTOR BALANCE VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.30	.75	1.50	3.00	6.00
A	.0133	.0120	.0128	.0115	.0123

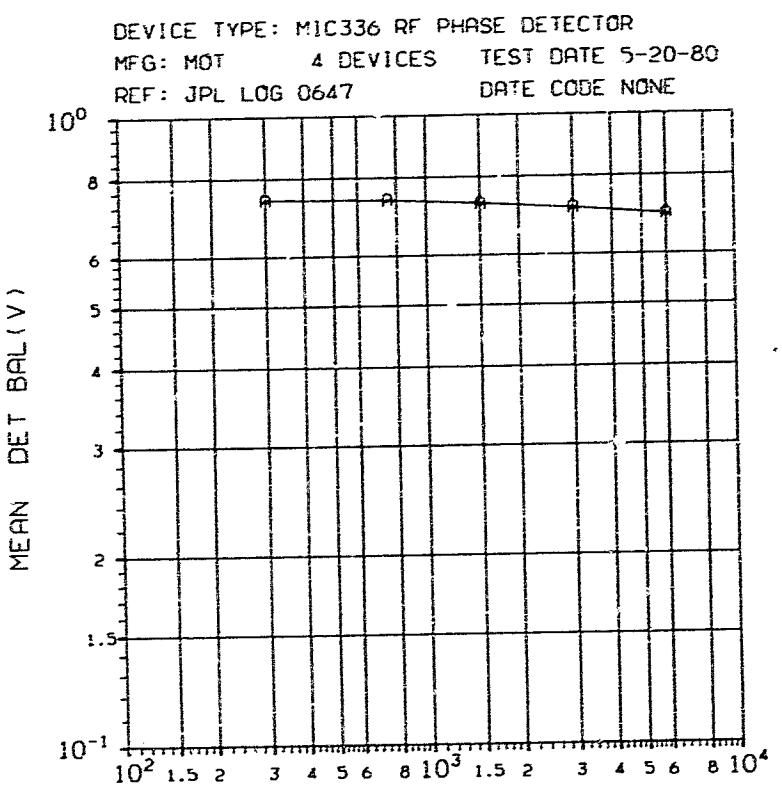
INITIAL MEAN VALUE DET BAL(V) = 7.99×10^{-1}



(1B) 12MHZ PHASE DETECTOR BALANCE VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.30	.75	1.50	3.00	6.00
B	.0363	.0162	.0152	.0135	.0111

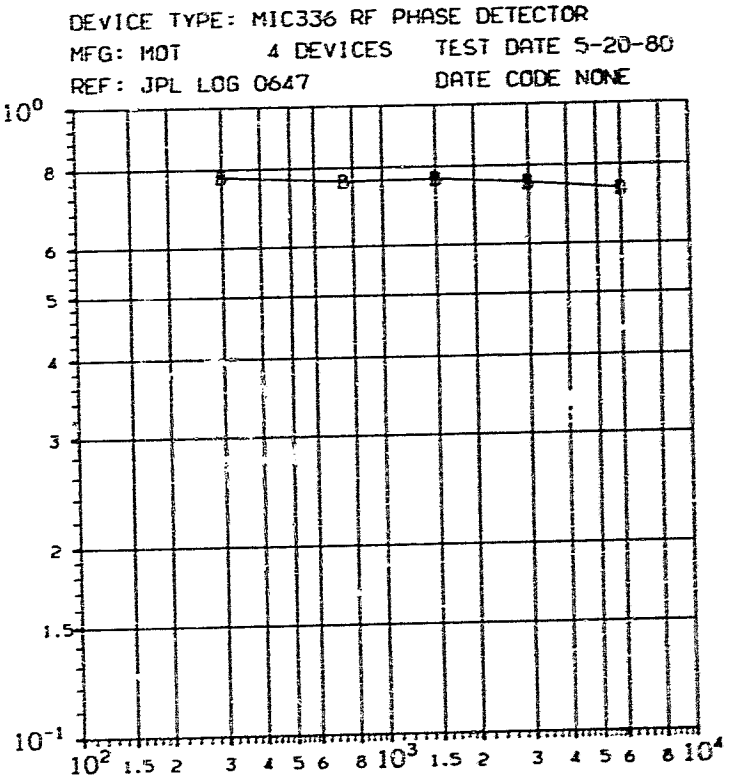
INITIAL MEAN VALUE DET BAL(V) = 9.33×10^{-1}



(1A) 12MHZ PHASE DETECTOR BALANCE VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.30	.75	1.50	3.00	6.00
A	.0317	.0350	.0312	.0296	.0272

INITIAL MEAN VALUE DET BAL(V) = 7.44×10^{-1}



(1B) 12MHZ PHASE DETECTOR BALANCE VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.30	.75	1.50	3.00	6.00
B	.0248	.0217	.0243	.0226	.0207

INITIAL MEAN VALUE DET BAL(V) = 7.32×10^{-1}

DEVICE: MM54C200

TYPE: RAM, 256 x 4

MANUFACTURER: NSC

DATE CODE: None

DEVICES TESTED: 3

TEST DATE: 4-25-77

SOURCE: 1.25 MeV

LOG NUMBER: 052

RADIATION BIAS CONDITION: V_{CC} = 10 volts

RESULTS: Worst-Case Parameter Values, V_{CC} = 10 volts

Total Dose, Gy(Si)	I_{CC}, nA (Maximum)	March	R/W Ping Pong
Initial	1.2	Pass	Pass
3	3.4	Pass	Pass
10	12.0	Pass	Pass
30	38	Pass	Pass
100	84	Pass	Pass
100[a]	170	Pass	Pass
200	125	Pass	Pass
300	145	Pass	Pass

[a]This measurement was taken 5 minutes after the first 100 Gy(Si) measurement.

DEVICE: MM54C905

TYPE: SAR, 12-Bit

MANUFACTURER: NSC

DATE CODE: 817

DEVICES TESTED: 2

TEST DATE: 2-8-79

SOURCE: 1.25 MeV Gamma

LOG NUMBER: 0289

RADIATION BIAS CONDITION: V_{CC} = 10 volts

RESULTS: Worst-Case Parameter Values, V_{CC} = 10 volts unless otherwise noted in parentheses

Total Dose, Gy(Si)	$V_{IH}(5)$, V (Minimum)	$V_{IH}(10)$, V (Minimum)	$V_{IL}(5)$, V (Maximum)	$V_{IL}(10)$, V (Maximum)	$t_{PDE}(5)$, ns (Maximum)
Initial	3.50	7.00	2.60	5.00	140
10	3.30	6.90	2.50	4.90	140
30	3.00	6.60	2.30	4.70	145
60	3.10	5.90	1.70	4.30	201
100	Fail	5.10	Fail	3.70	Fail
150	Fail	Fail	Fail	Fail	Fail
200	Fail	Fail	Fail	Fail	Fail

DEVICE: MM54C905

LOG NUMBER: 0289

Total Dose, Gy(Si)	$t_{PDE}(10)$, ns (Maximum)	$t_{PD-DO}(5)$, ns (Maximum)	$t_{PD-DO}(10)$, ns (Maximum)	CLOCK $F_{MAX}(5)$, MHz (Minimum)	CLOCK $F_{MAX}(10)$, MHz (Minimum)
Initial	58.00	118.0	50.50	2.660	4.032
10	58.00	116.5	50.00	2.778	4.032
30	58.50	115.5	50.00	2.778	4.032
60	62.00	120.0	50.00	2.232	3.906
100	72.00	130.0	51.00	Fail	3.788
150	88.50	175.0	53.00	Fail	Fail
200	119.0	441.0	55.00	Fail	Fail

Total Dose, Gy(Si)	$PWD_{TH}(5)$, ns (Minimum)	$PWD_{TH}(10)$, ns (Minimum)	$I_{CC}(15)$, nA (Maximum)	$V_{OH}(5)$, V (Minimum)	$V_{OL}(5)$, mV (Maximum)
Initial	112.0	32.00	29.03	4.98	2.36
10	104.0	32.00	29.24	4.98	2.23
30	72.0	32.00	0.2421	4.97	2.51
60	Fail	40.00	Fail	4.92	6.97
100	Fail	40.00	Fail	Fail	Fail
150	Fail	Fail	Fail	Fail	Fail
200	Fail	Fail	Fail	Fail	Fail

DEVICE: MM54C905

LOG NUMBER: 0289

Total Dose, Gy(Si)	$I_{SC}(5)$, mA (Minimum)	$I_{SK}(5)$, mA (Minimum)	$V_{OH}(5)$, V (Minimum)	$V_{OL}(10)$, mV (Maximum)	$I_{SC}(10)$, mA (Minimum)
Initial	3.52	3.19	9.98	0.891	15.43
10	3.44	3.41	9.98	0.812	15.35
30	3.27	3.79	9.98	1.175	15.06
60	3.01	4.06	9.93	6.32	14.58
100	1.41	3.16	9.86	16.95	13.96
150	1.20	3.95	Fail	31.1	5.55
200	1.11	4.73	Fail	4980	6.72

Total Dose, Gy(Si)	$I_{SK}(10)$, mA (Minimum)	$t_{PD}(5)$, ns (Maximum)	$t_{PD}(10)$, ns (Maximum)	$I_{IH}(15)$, nA (Maximum)	$I_{IL}(15)$, nA (Maximum)
Initial	15.32	168.7	64.5	0.71	0.185
10	15.71	163.0	63.7	0.72	0.180
30	16.33	153.7	62.6	0.74	0.197
60	16.91	157.0	61.0	0.72	0.197
100	17.31	Fail	60.9	0.74	0.192
150	17.39	Fail	863	0.75	0.20
200	12.04	Fail	Fail	0.95	0.21

DEVICE: MM54C920

TYPE: RAM, 256 x 4

MANUFACTURER: NSC

DATE CODE: 638

DEVICES TESTED: 3

TEST DATE: 3-21-77

SOURCE: 1.25 MeV Gamma

LOG NUMBER: 047

RADIATION BIAS CONDITION: V_{CC} = 5 volts

RESULTS: Worst-Case Parameter Values, V_{CC} = 5 volts

Total Dose, Gy(Si)	I_{CC}, μA (Maximum)	March	R/W Ping Pong
Initial	0.0072	Pass	Pass
3	0.0091	Pass	Pass
10	132	Pass	Pass
30	5900	Fail	Fail

DEVICE: MM54C929

TYPE: RAM, 1k x 1

MANUFACTURER: NSC

DATE CODE: None

DEVICES TESTED: 4

TEST DATE: 6-19-78

SOURCE: 1.25 MeV Gamma

LOG NUMBER: 0200

RADIATION BIAS CONDITION: V_{CC} = 5 volts

RESULTS: Worst-Case Parameter Values, V_{CC} = 5 volts

Total Dose, Gy(Si)	I_{CC}, µA (Maximum)	March	Galpat
Initial	0.056	Pass	Pass
3	0.056	*	*
10	26	*	*
30	7500	Fail	Fail

* No measurements taken at this dosage.

DEVICE: MM54C929

TYPE: RAM, 1k x 1

MANUFACTURER: NSC

DATE CODE: None

DEVICES TESTED: 4

TEST DATE: 7-5-78

SOURCE: 1.25 MeV Gamma

LOG NUMBER: 0202

RADIATION BIAS CONDITION: V+ = 15 volts

RESULTS: Worst-Case Parameter Values, V+ = 15 volts

Total Dose, Gy(Si)	I_{CC}, µA (Maximum)	March	Galpat
Initial	2.5	Pass	Pass
3	3	*	*
10	5	*	*
30	25	*	*
70	4800	Fail	Fail

* No measurements taken at this dosage.

DEVICE: MN371

TYPE: DAC, 12-Bit

MANUFACTURER: MNC

DATE CODE: 7709 and 7711

DEVICES TESTED: 2

TEST DATE: 11-28-79

SOURCE: 2.2 MeV Electrons

LOG NUMBER: 0548

RADIATION BIAS CONDITION: V_{CC} = 15 volts
V_{EE} = -15 volts

RESULTS: Worst-Case Parameter Values, V_{CC} = 15 volts
V_{EE} = -15 volts

Total Dose, Gy(Si)	NONLIN, LSB (Maximum)	ABS ERR, mV (Maximum)	ASBS ACC, % FSR (Maximum)	+SR, mV/s (Minimum)	-SR, mV/s (Minimum)
Initial	0.194	4.97	0.0497	639	686
10	0.420	4.37	0.0437	641	684
30	0.470	4.77	0.0477	634	684
100	0.504	7.17	0.0717	629	682
300	0.476	16.57	0.1658	610	668
750	0.8160	36.4	0.364	567	643
1500	2.17	69.8	0.696	513	627
3000	5.25	112.2	1.122	452	595

DEVICE: MN371

LOG NUMBER: 0548

Total Dose, Gy(Si)	I_{CC-L}, mA (Maximum)	I_{CC-H}, mA (Maximum)	I_{EE-L}, mA (Maximum)	I_{EE-H}, mA (Maximum)	I_{IH}, pA (Maximum)	I_{IL}, µA (Maximum)
Initial	2.30	1.920	2.09	2.12	700	125.9
10	2.30	1.920	2.08	2.12	513	125.9
30	2.30	1.920	2.08	2.12	569	126.1
100	2.30	1.915	2.08	2.12	551	126.1
300	2.29	1.914	2.07	2.11	534	126.1
750	2.28	1.904	2.06	2.11	530	126.0
1500	2.27	1.895	2.06	2.10	557	126.2
3000	2.26	1.885	2.04	2.09	592	126.2

C-4

DEVICE: MN5211
TYPE: ADC, 12-Bit
MANUFACTURER: MNC
DATE CODE: 8102

DEVICES TESTED: 2
TEST DATE: 5-21-81
SOURCE: 2.5 MeV Electrons
LOG NUMBER: 0729

RADIATION BIAS CONDITION: V_{CC} = 5 volts
V_{DD} = 12 volts
V_{EE} = -12 volts

RESULTS: Worst-Case Parameter Values, V_{CC} = 5 volts
V_{DD} = 12 volts
V_{EE} = -12 volts

Total Dose, Gy(Si)	I_{IH}, nA (Maximum)	I_{IL}, µA (Maximum)	ΔV_{REF}, mV (Maximum)	I_{CC}, mA (Maximum)	I_{DD}, mA (Maximum)
Initial	795	332	-	21.9	13.95
300	828	324	2.500	21.6	13.85
750	804	322	3.000	21.5	13.80
1500	793	321	3.500	21.4	13.75
3000	778	320	1.500	21.3	13.80
6000	765	319	5.000	21.1	13.80

Total Dose, Gy(Si)	I_{EE}, mA (Maximum)	OFFSET, mV (Maximum)	OFFERR, LSB (Maximum)	+FSACC, V (Minimum)	-FSACC, V (Minimum)
Inital	8.60	2.01	0.824	4.99	4.99
300	8.55	1.68	0.691	4.99	4.99
750	8.50	2.16	0.887	4.99	4.99
1500	8.50	4.17	1.710	4.99	4.99
3000	8.50	10.36	1.152	5.00	4.98
6000	8.45	16.86	6.90	5.00	4.96

DEVICE: MN5211

LOG NUMBER: 0729

Total Dose, Gy(Si)	NONLIN, LSB (Maximum)	V_{OH}, V (Minimum)	V_{OL}, mV (Maximum)	I_{OH}, mA (Minimum)	I_{OL}, mA (Minimum)
Initial	0.501	4.02	109	4.80	17.69
300	0.532	4.03	112	4.72	15.89
750	0.542	4.03	113	4.70	14.42
1500	0.560	4.04	114	4.68	13.27
3000	0.736	4.03	115	4.65	12.17
6000	1.352	4.04	116	4.63	11.15

DEVICE: MN5214
TYPE: ADC, 12-Bit
MANUFACTURER: MNC
DATE CODE: 8102

DEVICES TESTED: 2
TEST DATE: 5-21-81
SOURCE: 2.5 MeV Electrons
LOG NUMBER: 0730

RADIATION BIAS CONDITION: V_{CC} = 5 volts
V_{DD} = 15 volts
V_{EE} = -15 volts

RESULTS: Worst-Case Parameter Values, V_{CC} = 5 volts
V_{DD} = 15 volts
V_{EE} = -15 volts

Total Dose, Gy(Si)	I_{IH}, nA (Maximum)	I_{IL}, A (Maximum)	ΔV_{REF}, mV (Maximum)	I_{CC}, mA (Maximum)	I_{DD}, mA (Maximum)
Initial	898	304	-	20.4	17.95
300	Fail	Fail	Fail	Fail	Fail
750	Fail	Fail	Fail	Fail	Fail

Total Dose, Gy(Si)	I_{EE}, mA (Maximum)	OFFSET, mV (Maximum)	OFFERR, LSB (Maximum)	+FSACC, V (Minimum)	-FSACC, V (Minimum)
Initial	4.25	1.991	0.815	4.99	4.99
300	Fail	Fail	Fail	Fail	Fail
750	Fail	Fail	Fail	Fail	Fail

DEVICE: MN5214

LOG NUMBER: 0730

Total Dose, Gy(Si)	NONLIN, LSB (Maximum)	V_{OH}, V (Minimum)	V_{OL}, mV (Maximum)	I_{OH}, mA (Minimum)	I_{OL}, mA (Minimum)
Initial	0.443	4.05	117	4.59	18.17
300	Fail	Fail	Fail	Fail	Fail
750	Fail	Fail	Fail	Fail	Fail

DEVICE: MN5216

TYPE: ADC, 12-Bit

MANUFACTURER: MNC

DATE CODES: 7909 (1)
7910 (2)

DEVICES TESTED: 2

TEST DATE: 8-03-79

SOURCE: 2.5 MeV Electrons

LOG NUMBER: 0438

RADIATION BIAS CONDITION: V_{CC} = 5 volts
V_{DD} = 15 volts
V_{EE} = -15 volts

RESULTS: Worst-Case Parameter Values, V_{CC} = 5 volts
V_{DD} = 15 volts
V_{EE} = -15 volts

Total Dose, Gy(Si)	V_{OH}, V (Minimum)	V_{OL}, mV (Maximum)	I_{OH}, mA (Minimum)	I_{OL}, mA (Minimum)	I_{IH}, µA (Maximum)
Initial	3.49	97.5	4.49	15.24	0.818
300	3.52	101	4.38	13.30	0.850
750	3.50	103	4.35	11.25	0.805
1500	4.29	106	4.72	9.73	0.781
3000	4.08	106	4.91	8.19	0.774
6000	4.07	109	4.86	6.84	0.737

Total Dose, Gy(Si)	I_{IL}, µA (Maximum)	V_{REF}, mV (Maximum)	I_{CC}, mA (Maximum)	I_{DD}, mA (Maximum)	I_{EE}, mA (Maximum)
Initial	236	-	16.45	12.40	11.92
300	228	5.00	16.00	12.40	11.90
750	228	7.99	15.95	12.85	11.95
1500	228	6.50	14.56	19.00	11.60
3000	221	9.99	14.25	19.95	11.85
6000	220	16.00	14.11	21.00	12.15

DEVICE: MN5216

LOG NUMBER: 0438

Total Dose, Gy(Si)	OFFSET, mV (Maximum)	OFFERR, LSB (Maximum)	AOL OFF, mV (Maximum)	AOL ERR, LSB (Maximum)	NONLIN, LSB (Maximum)
Initial	2.13	0.750	2.74	1.21	0.919
300	7.62	3.00	7.32	2.99	0.946
750	13.12	5.25	11.90	4.87	0.721
1500	Fail	Fail	11.90	4.91	Fail
3000	Fail	Fail	13.73	5.62	Fail
6000	Fail	Fail	28.3	11.62	Fail

DEVICE: MP7570

TYPE: ADC, 10-Bit

MANUFACTURER: MPI

DATE CODE: 7803

DEVICES TESTED: 2

TEST DATE: 10-16-78

SOURCE: 1.25 MeV Gamma

LOG NUMBER: 0213

RADIATION BIAS CONDITION: V_{CC} = 5 volts
V_{DD} = 15 volts
V_{REF} = -10 volts

RESULTS: Worst-Case Parameter Values, V_{CC} = 5 volts
V_{DD} = 15 volts
V_{REF} = -10 volts

Total Dose, Gy(Si)	ANALOG OUTPUT LEAKAGE CURRENT, nA (Maximum)	I_{OH}, nA (Maximum)	I_{OL}, nA (Maximum)	I_{IL}, µA (Maximum)	I_{IH}, µA (Maximum)
Initial	1.100	0.800	0.555	0.001	0.0009
30	1.200	1.250	1.650	0.002	0.0010
60	0.900	5.80	0.500	0.002	0.0007
100	802	4.00	0.450	0.002	0.0008
200	543	19.55	2.05	0.002	0.0009
300	820,000	33.7	3.10	0.058	0.0007
400	Fail	Fail	Fail	Fail	Fail

DEVICE: MP7570

LOG NUMBER: 0213

Total Dose, Gy(Si)	RELATIVE ACCURACY, LSB (Maximum)	DIFFERENTIAL NONLIN, (Maximum)	V_{OL}, V (Maximum)	V_{OH}, V (Minimum)	CLOCK F_{MAX}, kHz (Minimum)
Initial	0.409	0.751	0.345	4.81	456
30	0.498	0.751	0.341	4.80	829
60	0.569	0.751	0.343	4.79	814
100	0.611	0.751	4.98	4.78	636
200	25.5	1.751	0.351	4.73	100
300	Fail	Fail	4.98	Fail	100
400	Fail	Fail	Fail	Fail	Fail

Total Dose, Gy(Si)	t_{ON} HBE, ns (Maximum)	t_{ON} LBE, ns (Maximum)	t_{OFF} HBE, ns (Maximum)	t_{OFF} LBE, ns (Maximum)
Initial	528	697	310	338
30	590	766	315	325
60	680	873	330	330
100	826	1024	400	356
200	1540	6000	1860	865
300	Fail	Fail	Fail	Fail
400	Fail	Fail	Fail	Fail

DEVICE: MWS5001D

TYPE: RAM, 1k x 1

MANUFACTURER: RCA

DATE CODE: 622

DEVICES TESTED: 3

TEST DATE: 3-29-77

SOURCE: 1.25 MeV Gamma

LOG NUMBER: 050

RADIATION BIAS CONDITION: V_{CC} = 5 volts

RESULTS: Worst-Case Parameter Values, V_{CC} = 5 volts

Total Dose, Gy(Si)	I_{CC}, μA (Maximum)	March	R/W Ping Pong
Initial	11	Pass	Pass
3	14	Pass	Pass
10	54	Pass	Pass
30	220	Pass	Pass
100	880	Fail	Fail

DEVICE: MWS5501
TYPE: RAM, 1k x 1
MANUFACTURER: RCA
DATE CODE: None

DEVICES TESTED: 4
TEST DATE: 4-07-78
SOURCE: 1.25 MeV Gamma
LOG NUMBER: 0169

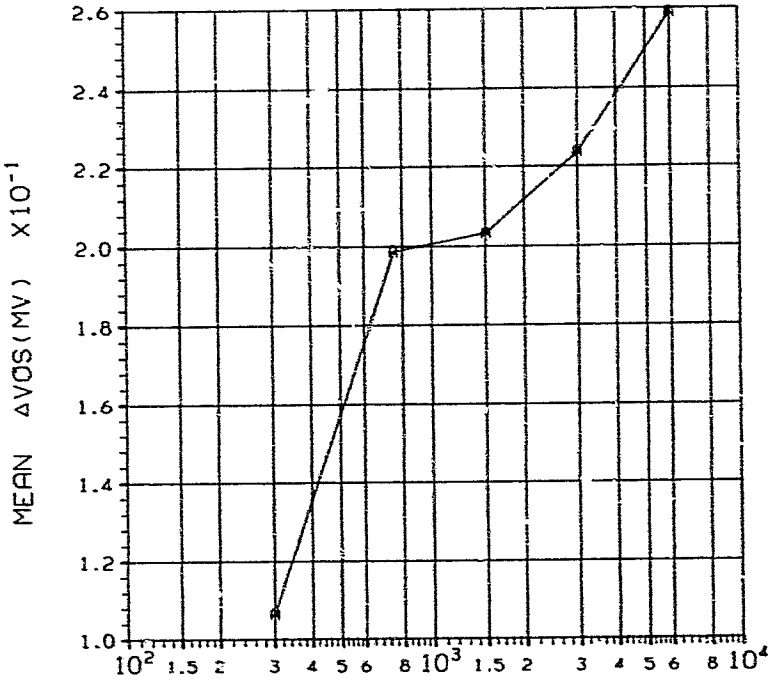
RADIATION BIAS CONDITION: V_{CC} = 10 volts

RESULTS: Worst-Case Parameter Values, V_{CC} = 10 volts

Total Dose, Gy(Si)	I_{CC}, mA (Maximum)	March	Galpat
Initial	0.115	Pass	Pass
3	1.2	*	*
10	4.2	*	*
30	10	Pass	Pass
70	15	Fail	Fail

*No measurements taken at this dosage.

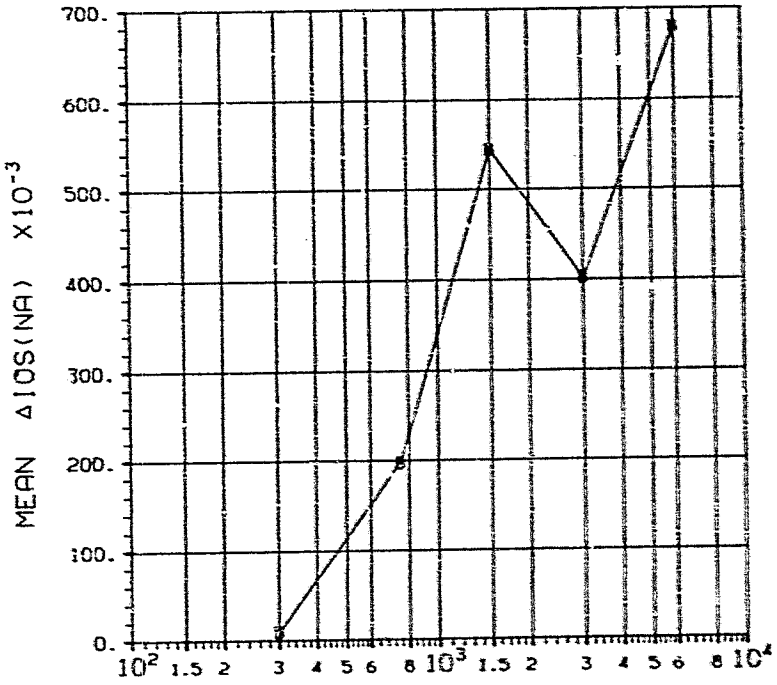
DEVICE TYPE: OP16 OP AMP
MFG: PMI 3 DEVICES TEST DATE 8-27-79
REF: JPL LOG 0459 DATE CODE 7926



(1) VOS IN MV VS DOSE

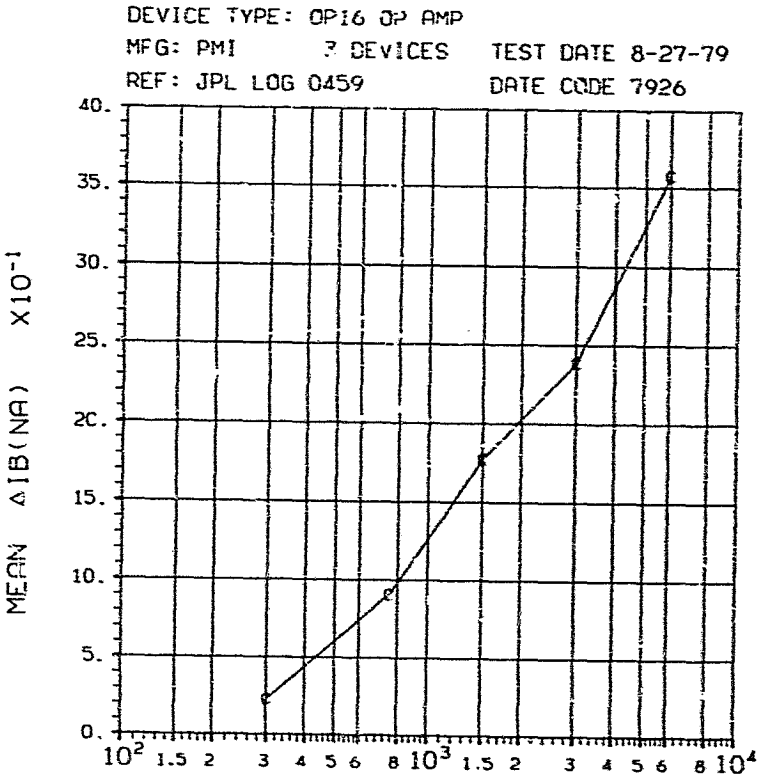
TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.30	.75	1.50	3.00	6.00
A	.1562	.2508	.3251	.2650	.3249

DEVICE TYPE: OP16 OP AMP
MFG: PMI 3 DEVICES TEST DATE 8-27-79
REF: JPL LOG 0459 DATE CODE 7926



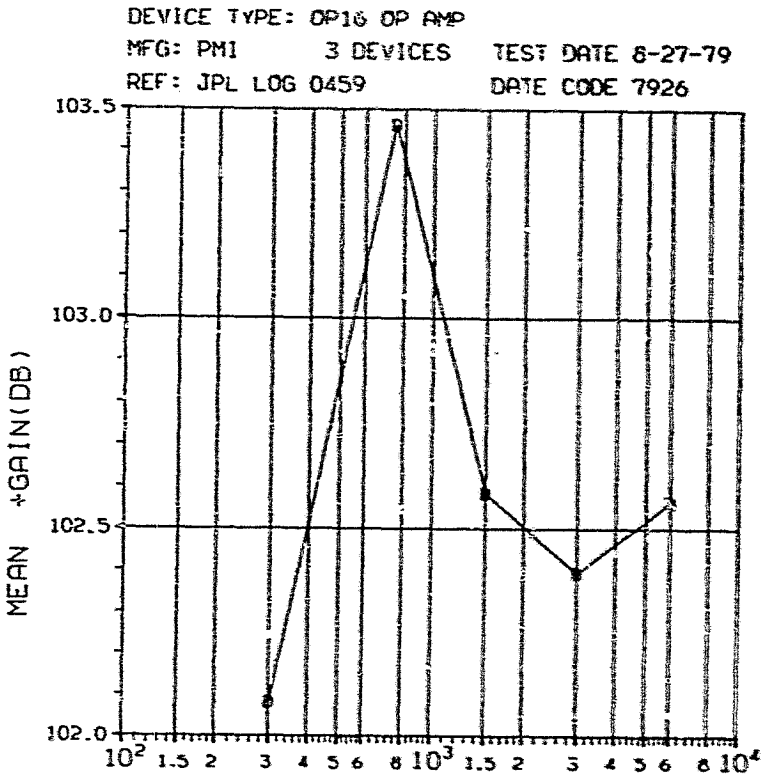
(2) IOS IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.30	.75	1.50	3.00	6.00
B	.1146	.2690	.4450	.3450	.5950



(3) IB IN NA VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS					
CURVE	DOSE, kiloGy(Si)				
	.30	.75	1.50	3.00	6.00
C	.2844	.5350	.7784	1.114	1.758



(4) + GAIN IN DB; 2K LOAD=5MA, +10V VS DOSE

TABLE OF NORMAL STANDARD DEVIATIONS						
CURVE	I_L (mA)	DOSE, kiloGy(Si)				
		.30	.75	1.50	3.00	6.00
D	5.00	3.497	3.738	7.182	6.282	3.917

INITIAL MEAN VALUE +GAIN(DB) = $1.04 \times 10^{+2}$

TABLE OF NORMAL STANDARD DEVIATIONS						
CURVE	I_L (mA)	DOSE, kiloGy(Si) .30	.75	1.50	3.00	6.00
E	5.00	2.511	2.255	3.806	1.565	1.884

INITIAL MEAN VALUE -GAIN(DB) = $9.93 \times 10^{+1}$

DEVICE: SBP9900
TYPE: I^2L 16-Bit Microprocessor
MANUFACTURER: TIX
DATE CODE: None

DEVICES TESTED: 3
TEST DATE: 5-04-77
SOURCE: 2.5 MeV Electrons
LOG NUMBER: None

RADIATION BIAS CONDITION: V_{CC} = 5 volts

RESULTS: Worst-Case Parameter Values, V_{CC} = 5 volts

Total Dose, Gy(Si)	MAXIMUM OPERATING FREQUENCY, kHz	
	Injection Current = 90 mA	Injection Current = 520 mA
Initial	900	2550
100	850	2550
300	800	2[illegible]
1000	700	2350
3000	Failed	Failed

DEVICE: SMP11F

TYPE: Sample and Hold

MANUFACTURER: PMI

DATE CODE: 7920

DEVICES TESTED: 5

TEST DATE: 11-14-79

SOURCE: 2.5 MeV Electrons

LOG NUMBER: 0503

RADIATION BIAS CONDITION: V_{CC} = 12 volts
V_{EE} = -12 volts

RESULTS: Worst-Case Parameter Values, V_{CC} = 12 volts
V_{EE} = -12 volts

Hold Cap = 0.05 mfd. Polystyrene

Total Dose, Gy(Si)	V_{OS}, mV (Maximum)	I_B, uA (Maximum)	+AV(RL=∞), dB (Minimum)	-AV(RL=∞), dB (Minimum)	+AV(RL=2.5kΩ), dB (Minimum)
Initial	7.29	34.3	0.9998	0.9998	0.9997
300	10.04	46.3	0.9996	0.9997	0.9995
750	14.16	60.2	0.9993	0.9995	0.9993
1500	17.10	64.0	0.9992	0.9994	0.9991
3000	15.5	70.0	0.9991	0.9993	0.9990
6000	14.6	80.0	0.9991	0.9992	0.9989

DEVICE: SMP11F

LOG NUMBER: 0503

Total Dose, Gy(Si)	-AV(RL=2.5kΩ), dB (Minimum)	I_{SK}, mA (Minimum)	I_{SC}, mA (Minimum)	+SR(RL=2.5kΩ), V/μs (Minimum)
Initial	0.9997	8.78	-19.5	4.50
300	0.9996	7.33	-19.6	3.44
750	0.9994	6.33	-19.4	2.03
1500	0.9992	5.83	-19.4	1.11
3000	0.9992	5.63	-19.2	0.65
6000	0.9991	5.45	-19.1	0.60

Total Dose, Gy(Si)	-SR(RL=2.5kΩ), V/μs (Minimum)	I_{IH}, nA (Maximum)	I_{IL}, μA (Maximum)	t_{ACQ}(RL=2.5kΩ), μs (Maximum)
Initial	-5.59	0.83	-5.33	3.51
300	-4.51	1.05	-11.1	4.99
750	-3.36	1.43	-15.7	7.18
1500	-2.34	1.82	-17.7	8.92
3000	-1.80	3.00	-17.5	10.88
6000	-1.88	3.13	-17.4	7.68

DEVICE: SMP11F

LOG NUMBER: 0503

Total Dose, Gy(Si)	Q TRANS, pc (Maximum)	I_{CC}, mA (Maximum)	$+I_{DFT}$(V=+5V), nA (Maximum)	$-I_{DFT}$(V=-5V), nA (Maximum)
Initial	583	5.25	1.57	1.56
300	596	5.04	2.44	10.65
750	593	4.93	4.32	10.35
1500	632	4.87	1.79	10.46
3000	637	4.66	2.25	10.33
6000	626	4.79	2.81	9.79

DEVICE: TCC244

TYPE: RAM, 256 x 4

MANUFACTURER: Sandia

DATE CODES: 8024 (1)
8051 (2)
8106 (3)

DEVICES TESTED: 12

TEST DATE: 3-10-81/3-27-81

SOURCE: 1.25 MeV Gamma

LOG NUMBERS: 0711 (1)
0712 (2)
0723 (3)

RADIATION BIAS CONDITION: V_{DD} = 10 volts

RESULTS: Worst-Case Parameter Values, V_{DD} = 10 volts

Total Dose, Gy(Si)	I_{SS}, na (Maximum)	I_{DN}, mA (Maximum)	I_{DP}, mA (Maximum)	V_{DD}, V (Minimum)	t_{AA}, ns (Minimum)	t_{AC}, ns (Minimum)
Initial	<100	5.8	3.2	3.8	150	105
300	100	5.8	3.2	3.8	160	110
750	1500	5.5	3.0	4.9	175	120
1500	18,000	5.4	2.9	8.4	210	140
3000	54,000	4.8	2.6	10.1	260	185
6000	90,000	4.2	2.2	11.8	370	270

Functional Test - At 1500 Gy(Si), all samples failed to function with the 5-V supply voltage but passed with the 10-V supply voltage. At 600 Gy(Si), all samples failed at 10 V.

DEVICE: TDC1001J

TYPE: ADC, 8-Bit

MANUFACTURER: TRW

DATE CODE: 7802C

DEVICES TESTED: 2

TEST DATE: 6-12-78

SOURCE: 1.25 MeV Gamma

LOG NUMBER: 0177

RADIATION BIAS CONDITION: V_{CC} = 5 volts
V_{EE} = -5 volts

RESULTS: Worst-Case Parameter Values, V_{CC} = 5 volts
V_{EE} = -5 volts

Total Dose, Gy(Si)	I_{CC}, mA (Maximum)	I_{REF}, nA (Maximum)	I_{IH}, µA (Maximum)	ΔV_{OS}, mV (Maximum)
Initial	10.1	69	3.1	4.35
750	11.3	165	4.6	3.2
2500	12.5	305	6.4	8.1
7500	10.5	460	9.1	13.5
25000	17.5	560	11.0	23.2

Note: The device remained monotonic throughout the test.

DEVICE: TDC1021J

TYPE: ADC, 4-Bit

MANUFACTURER: TRW

DATE CODE: 7935

DEVICES TESTED: 3

TEST DATE: 11-29-79

SOURCE: 2.5 MeV Electrons

LOG NUMBER: 0506

RADIATION BIAS CONDITION: V_{CC} = 5.25 volts
V_{EE} = -6.25 volts
V_{RB} = -2.0 volts

RESULTS: Worst-Case Parameter Values, V_{CC} = 5.0 volts
V_{EE} = -6.0 volts
V_{RT} = 0.0 volt
V_{RB} = -1 volt

Total Dose, Gy(Si)	I_{CC}, mA (Maximum)	I_{EE}, mA (Maximum)	I_{RB}, mA (Maximum)	ΔR_{AVG}, (Ω) (Maximum)	I_{IH}, (μA) (Maximum)
Initial	10.10	40.2	3.01	-	14.79
300	11.05	37.8	2.97	0.298	16.00
750	9.58	37.5	2.97	0.322	14.74
1500	13.95	36.5	2.97	0.339	13.32
3000	13.80	36.3	2.97	0.363	12.34
6000	13.60	35.8	2.96	0.363	11.75

DEVICE: TDC1021J

LOG NUMBER: 0506

Total Dose, Gy(Si)	I_{IL}, μA (Maximum)	V_{OH}, V (Minimum)	I_{OS}, mA (Maximum)	V_{OL}, mV (Maximum)
Initial	810	2.96	7.84	313
300	782	2.97	7.56	323
750	775	2.95	7.51	324
1500	778	2.94	7.49	330
3000	781	2.91	7.51	341
6000	781	2.91	7.44	348

Total Dose, Gy(Si)	I_{SK}, mA (Minimum)	ACCURACY, % (Maximum)	TOP ERROR, mV (Maximum)	BOTTOM ERROR, mV (Maximum)
Initial	16.01	0.0346	9.00	1.500
300	14.52	0.0336	8.50	0.500
750	12.95	0.0336	8.50	0.500
1500	11.45	0.0351	8.00	0.500
3000	10.10	0.0341	8.00	2.00
6000	9.10	0.0333	8.00	2.50

DEVICE: XR082
TYPE: FET Op Amp, Dual
MANUFACTURER: EXR
DATE CODE: 8024

DEVICES TESTED: 5
TEST DATE: 9-26-80
SOURCE: 2.5 MeV Electrons
LOG NUMBER: 0669

RADIATION BIAS CONDITION: V_{CC} = 15 volts
V_{EE} = -15 volts

RESULTS: Worst-Case Parameter Values, V_{CC} = 15 volts
V_{EE} = -15 volts
R_L = 10 k

Total Dose, Gy(Si)	V_{OS}, mV (Maximum)	I_{OS}, nA (Maximum)	I_B, nA (Maximum)	$+A_{VOL}$, dB (Minimum)	$-A_{VOL}$, dB (Minimum)
Initial	0.129	0.130	0.127	110	108
300	0.129	0.120	0.128	Fail	Fail
750	0.128	0.133	0.127	Fail	Fail
1500	0.128	0.130	0.127	Fail	Fail
3000	0.128	0.128	0.140	Fail	Fail
6000	0.128	0.107	0.143	Fail	Fail

DEVICE: XR215

TYPE: Phase Locked Loop (PLL)

MANUFACTURER: EXR

DATE CODE: 7816

DEVICES TESTED: 3

TEST DATE: 2-16-79

SOURCE: 2.5 MeV Electrons

LOG NUMBER: 0269

RADIATION BIAS CONDITION: V_{CC} = 5 volts
V_{EE} = -5 volts

RESULTS: Worst-Case Parameter Values, V_{CC} = 5 volts
V_{EE} = -5 volts

Total Dose, Gy(Si)	V_{CC}, mA (Maximum)	V_{EE}, mA (Maximum)	Capture Range Low, kHz (Minimum)	Capture Range High, kHz (Maximum)	Lock in Range Low, kHz (Minimum)
Initial	12.16	12.35	383	415	353
300	12.35	12.63	384	413	354
750	12.22	12.45	384	412	355
1500	12.11	12.27	385	412	355
3000	11.97	12.09	384	411	355
6000	11.80	11.88	382	411	356

Total Dose, Gy(Si)	Lock in Range High, kHz (Maximum)	Free Run Freq, MHz (Mean)	X-JITTER, ns (Maximum)	Q2-JITTER, ns (Maximum)	IN-OUT JITTER, ns (Maximum)
Initial	455	4.84	183	310	476
300	449	4.80	178	290	522
750	446	4.80	184	250	534
1500	444	4.79	159	267	645
3000	441	4.77	168	417	523
6000	439	4.76	169	258	513

APPENDIX A

VENDOR IDENTIFICATION CODE LIST

VENDOR IDENTIFICATION CODE LIST

ADI	Analog Devices, Inc.
AMD	Advanced Microdevices Corporation
ATC	Applied Technology Corporation
EXR	Exar Integrated Systems
HAR	Harris Corporation, Semiconductor Division
INL	Intersil, Inc.
MNC	Micro Networks Corporation
MOT	Motorola, Inc., Semiconductor Products Division
MPI	Micro Power Systems, Inc.
NSC	National Semiconductor Corporation
PMI	Precision Monolithics, Inc.
RCA	RCA Corporation, Solid State Division
SIL	Siliconix Devices, Inc.
STI	Spectrum Technology, Inc.
TIX	Texas Instruments, Inc.
TRW	TRW, Inc., Semiconductor Division

APPENDIX B

INTEGRATED CIRCUIT ELECTRICAL PARAMETER SYMBOLS AND ABBREVIATIONS

INTEGRATED CIRCUIT ELECTRICAL PARAMETER SYMBOLS AND ABBREVIATIONS

AOL ERR	Gain error
AOL OFF	Offset gain
+AV	Positive voltage gain
-AV	Negative voltage gain
$+A_{VOL}$	Positive voltage gain under load
$-A_{VOL}$	Negative voltage gain under load
F_{MAX}	Maximum frequency
+FSACC	Positive full-scale accuracy
-FSACC	Negative full-scale accuracy
I_{AMP-IN}	Amplifier input current
I_B	Input bias current
I_{CC}	Power supply current
I_{CC-BLK}	Power supply current (blank mode)
$I_{CC-CONV}$	Power supply current (convert mode)
$I_{CC(H/L)}$	Power supply current (high/low level)
I_{DD}	Drain supply current
$+I_{DFT}$	Positive drift current
$-I_{DFT}$	Negative drift current
I_{DN}	Output drive current (negative)
I_{DP}	Output drive current (positive)
I_{EE}	Emitter power supply current
I_{EE-BLK}	Emitter power supply current (blank mode)
$I_{EE-CONV}$	Emitter power supply current (convert mode)
I_{FS}	Full-scale current
$I_{I(H/L)}$	Input current (high/low level)
$I_{LEAKAGE}$	Leakage current
I_{LOGIC}	Logic power supply current
IN-OUT JITTER	Input-to-output jitter
$I_{O(H/L)}$	Output current (high/low level)
I_{OS}	Offset current
$I_{OZ(H/L)}$	Tri-state output leakage current (high/low level)
I_{RB}	Reference current, bottom

INTEGRATED CIRCUIT ELECTRICAL PARAMETER SYMBOLS AND ABBREVIATIONS (Continuation 1)

I_{REF}	Reference current
I_{SC}	Output source current
I_{SK}	Output sink current
I_{SS}	Leakage current
I_{SYM}	Current symmetry
I_{ZERO}	Zero-scale current
LSB	Least significant bit
NONLIN	Nonlinearity
OFFERR	Offset error
OFFSET	Offset voltage
PWD_{TH}	Pulse width threshold
Q TRANS	Storage transfer
Q2-JITTER	Output jitter measured at Q2 emitter
ΔR_{AVG}	Change in average resistance
+SR	Slew rate positive
-SR	Slew rate negative
t_{AA}	Address access time
t_{AC}	Access time from chip select
t_{ACQ}	Acquisition time
t_{BLANK}	Blank time
t_{CONV}	Conversion time
t_{DS}	Timing specification
t_{DSC}	Timing specification
$t_{OFF/ON\ HBE}$	High bit enable propagation delay
$t_{OFF/ON\ LBE}$	Low bit enable propagation delay
t_{PD}	Propagation delay time
t_{PD-DO}	Propagation delay time from clock input to data output
t_{PDE}	Propagation delay from register enable to output
V_{CC}	Collector voltage
V_{DD}	Drain supply voltage
V_{EE}	Emitter voltage

INTEGRATED CIRCUIT ELECTRICAL PARAMETER SYMBOLS AND ABBREVIATIONS (Continuation 2)

$V_{I(H/L)}$	Input voltage (high/low level)
V_{LOGIC}	Logic voltage
$V_{O(H/L)}$	Output voltage (high/low level)
V_{OS}	Offset voltage
V_{REF}	Reference voltage
$V_{TH(H/L)}$	Threshold voltage (high/low level)
X-JITTER	Phase jitter