MetOp	TOTAL DOSE RADIATION TEST REPORT No. MO-RR-TLG-PM-006	Issue: 1 Rev.: Date: 16/03/2000 Page: 1/5

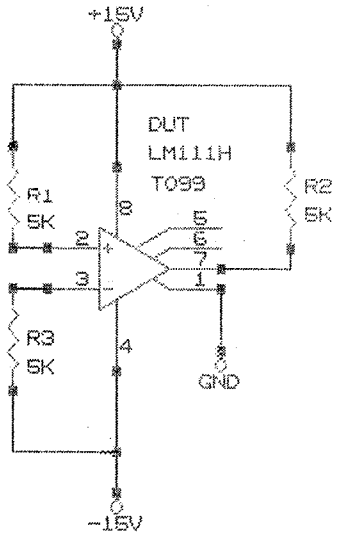
SCC Component No M385310/10304SGA	**Component Designation:** **LM111H**	**Irradiation Spec. No.:** **MIL-STD-883 1019.4**
Gen. Spec.: MIL-PRF-38535 **Det. Spec.: MIL-M-38510/103** **Amend.: --**	**Evaluation: -** **Acceptance Diffusion: -** **Acceptance Lot: X**	**Project/Programme:** **METOP**
Family: 08 **Group:** 06	**Functional Assignment:** **VOLTAGE COMPARATOR**	**Package:** **TO-99**
MFR. Name: NATIONAL SEMICONDUCTOR **Address:** USA	**Test House: TECNOLOGICA** **Address: MADRID (SPAIN)**	**Orig. house: TECNOLOGICA** **Address: SEVILLA (SPAIN)**
Radiation Test Plan No.: **MO-RP-TLG-PM-006**	**Sample Size: 6** **Irradiation Devices: 5** **Control Devices: 1**	**Date Code: T7B9935A** **Diffusion LOT: --** **Wafer No.: --**
Radiation Source: Cobalt-60 **Facility Name: CIEMAT** **Address: MADRID (SPAIN)**	**Energy: 1.33/1.17 MeV** **Dose Rate: 310 rad(Si)/h**	**Date of Test:** **15/02/2000**
Irradiation Conditions: **Biased: X** **Unbiased: --** **Test Circuit: Figure 1**	**Irradiation Measurements Interval:** **Remote test: --** **In situ Test: X**	**Annealing Tests: 72h/25ºC** **Biased: X** **Unbiased: -** **Test Circuit: Figure 1**

Electrical Measurements. Parameters Tested:

V_{IO} , $V_{IO(R)}$, I_{IO} , I_{IB} , I_{CC} , CMRR

Prepared by.: José M. Valverde **Date:** 16/03/2000 **Signature:**	**Approved by :** **Date:** 16/03/2000 **Signature:**

FIGURE 1.-TEST CIRCUIT



SUMMARY

Total dose steady-state irradiation test has been carried out on a VOLTAGE COMPARATOR from NSC with date code T7B9935A. The irradiated parts were labelled as follows: irradiated devices R2,..,R6= S/N 133 to 137 and R1= S/N 132 as control device.

DEVIATION TO PLAN

Not included parameter: IIO(R).

RESULTS

The next table shows a results resume of the irradiation test:

	0 KRAD	6 KRAD	12 KRAD	15 KRAD	20 KRAD	ANN
VIO	PASS	PASS	FAIL 3	FAIL 4	FAIL 5	FAIL 5
IIO	PASS	FAIL 5	FAIL 5	FAIL 5	FAIL 5	FAIL 5
IIB+	PASS	PASS	PASS	PASS	FAIL 1	FAIL 5
IIB-	PASS	PASS	FAIL 5	FAIL 5	FAIL 5	FAIL 5
CMRR	PASS	PASS	PASS	PASS	PASS	PASS
ICC+	PASS	PASS	PASS	PASS	PASS	PASS
VIO(R)	PASS	PASS	PASS	PASS	FAIL 1	FAIL 1

CONCLUSION

The results indicate that:

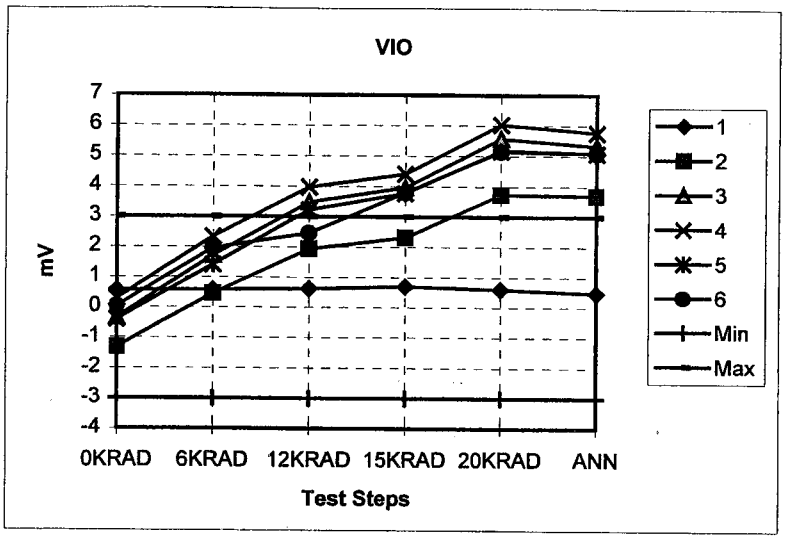
The tested lot is sensitive at radiation and the most afected parameters are: the offset input voltages (VIO, VIO(R)) and the input bias and offset currents (IIB±, IIO). The first faillures appear at 6Krad.

SCHEDULE

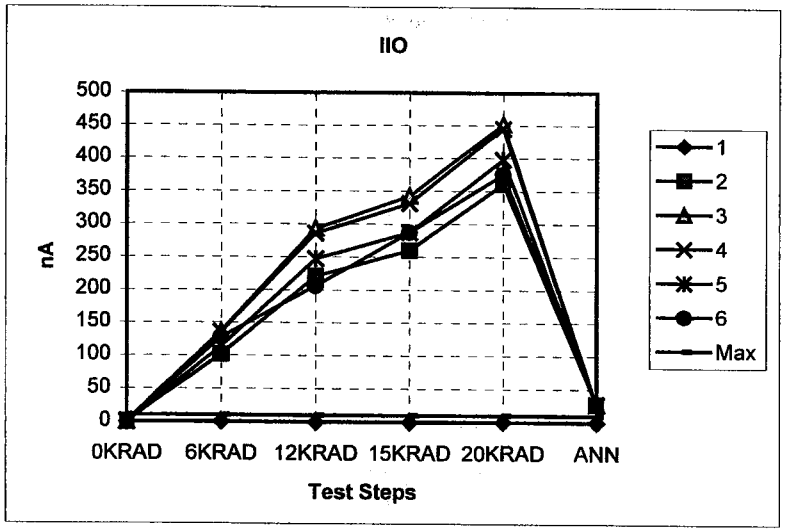
Test Step	Description	Result or Actual Test Condition	Time In	Time Out	Exposure
1	Sample serialization	CONTROL R1 IRR. DEVICES R2 to R6			
2	Initial Electrical Measurements	See 0 krad(Si) values in respective Parameter Data Tables	13:00 15/02	13:30 15/02	30m
3	Set-up of Test	Bias circuit verified according to Fig. 1			
4	Irradiation Exposure	Total Dose: 6 Krad(Si) Cumulative Dose: 6 Krad(Si) Dose Rate: 310 Rad(Si)/h	14:20 15/02	09:48 16/02	19h-28m
5	Intermediate Electrical Measurements	See 6 krad(Si) values in respective Parameter Data Tables	10:00 16/02	11:00 16/02	60min.
6	Set-up of Test	Bias circuit verified according to Fig. 1			
7	Irradiation Exposure	Total Dose: 6 Krad(Si) Cumulative Dose: 12 Krad(Si) Dose Rate: 310 Rad(Si)/h	11:42 16/02	07:30 17/02	19h 48m
8	Intermediate Electrical Measurements	See 12 krad(Si) values in respective Parameter Data Tables	07:45 17/02	08:15 17/02	30m
9	Set-up of Test	Bias circuit verified according to Fig. 1			
10	Irradiation Exposure	Total Dose: 2 Krad(Si) Cumulative Dose: 14 Krad(Si) Dose Rate: 310 Rad(Si)/h	08:30 17/02	14:52 17/02	6h-22m
11	Intermediate Electrical Measurements	See 14 krad(Si) values in respective Parameter Data Tables	15:00 17/02	15:30 17/02	30m
12	Set-up of Test	Bias circuit verified according to Fig. 1			
13	Irradiation Exposure	Total Dose: 6 Krad(Si) Cumulative Dose: 20 Krad(Si) Dose Rate: 310 Rad(Si)/h	15:40 17/02	10:42 18/02	19h- 2m
14	Intermediate Electrical Measurements	See 20 krad(Si) values in respective Parameter Data Tables	11:00 18/02	11:30 18/02	30min.

Test Step	Description	Result or Actual Test Condition	Time In	Time Out	Exposure
12	Set-up of Test	Bias circuit verified according to Fig. 1			
17	Annealing 72h	Bias circuit verified according to Fig. 1. Temperature: 25 °C	11:30 18/02	11:30 21/02	72h
18	Electrical Measurements	See ANN values in respective parameter Data Tables	11:30 21/02	12:00 21/02	30min

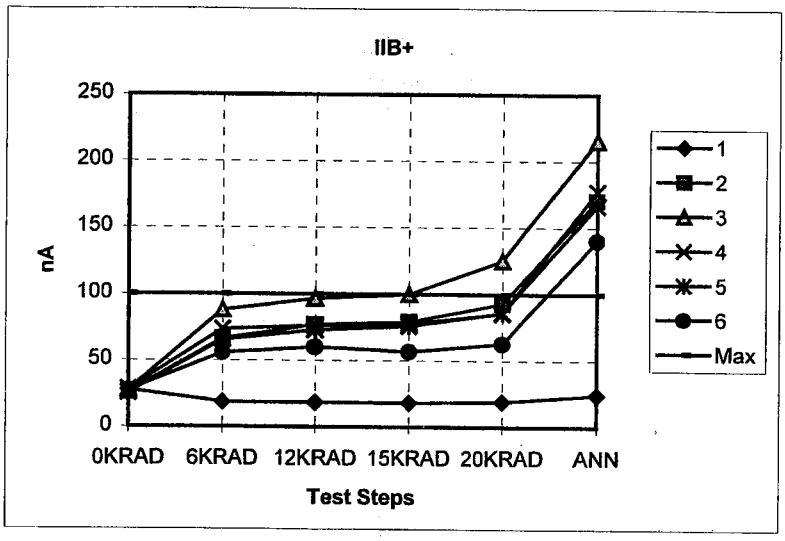
ELECTRICAL MEASUREMENT RESULTS



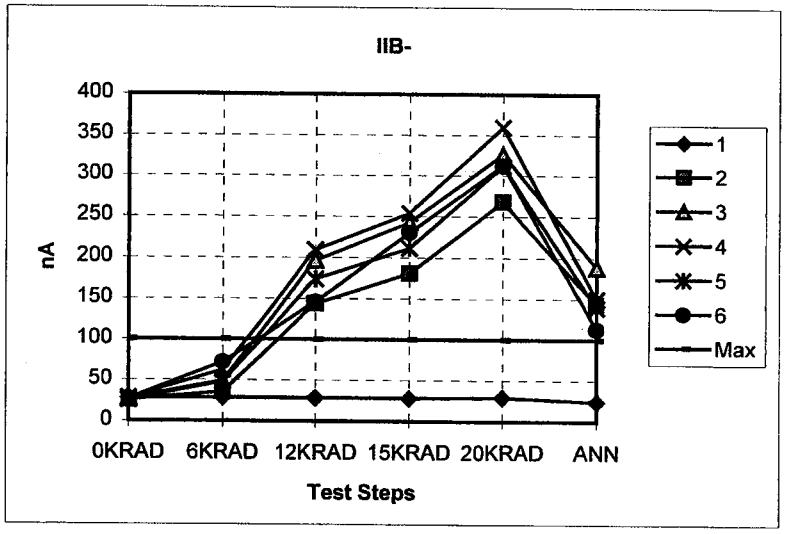
VIO	0KRAD	6KRAD	12KRAD	15KRAD	20KRAD	ANN
1	0.57	0.58	0.63	0.70	0.61	0.48
2	-1.33	0.46	1.94	2.31	3.73	3.69
3	-0.34	1.72	3.48	3.96	5.58	5.31
4	0.29	2.34	3.97	4.41	6.04	5.76
5	-0.40	1.41	3.23	3.77	5.18	5.09
6	0.04	1.95	2.47	3.79	5.15	5.09
Min	-3	-3	-3	-3	-3	-3
Max	3	3	3	3	3	3
Unit	mV	mV	mV	mV	mV	mV



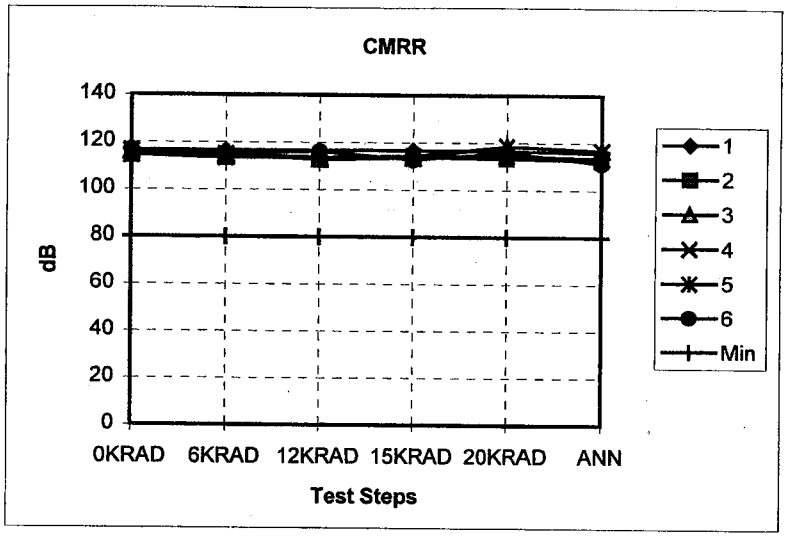
IIO	0KRAD	6KRAD	12KRAD	15KRAD	20KRAD	ANN
1	0.23	0.27	0.20	0.20	0.36	0.21
2	0.68	101.42	220.48	260.07	360.71	27.19
3	0.17	136.46	293.14	342.57	451.39	27.20
4	0.67	135.63	285.57	331.61	445.15	27.19
5	0.12	113.12	246.71	287.41	397.72	27.19
6	0.19	127.14	206.05	287.03	375.23	27.17
Max	10	10	10	10	10	10
Unit	nA	nA	nA	nA	nA	nA



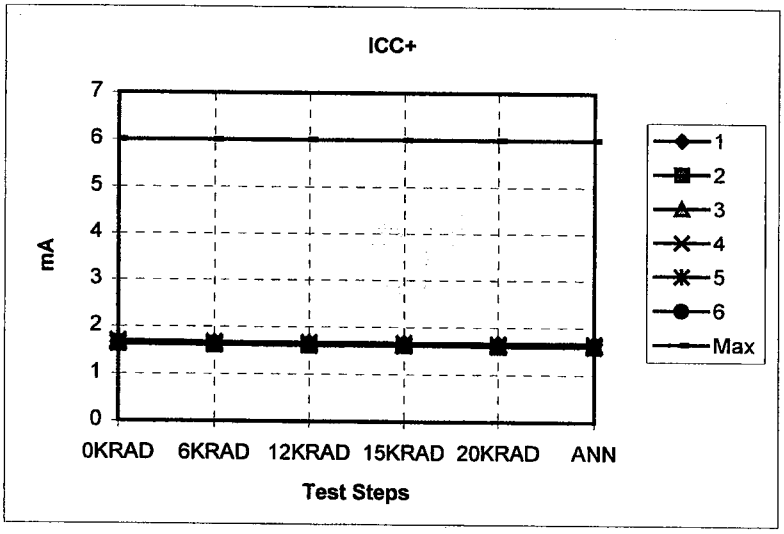
IIB+	0KRAD	6KRAD	12KRAD	15KRAD	20KRAD	ANN
1	27.72	18.67	18.52	18.16	19.32	24.22
2	26.07	66.20	76.74	79.07	92.83	170.49
3	27.68	87.80	96.64	99.89	125.28	215.35
4	28.43	73.48	76.21	77.61	85.47	177.52
5	25.44	65.30	72.88	75.86	86.04	166.76
6	27.35	55.69	60.13	56.64	62.57	140.33
Max	100	100	100	100	100	100
Unit	nA	nA	nA	nA	nA	nA



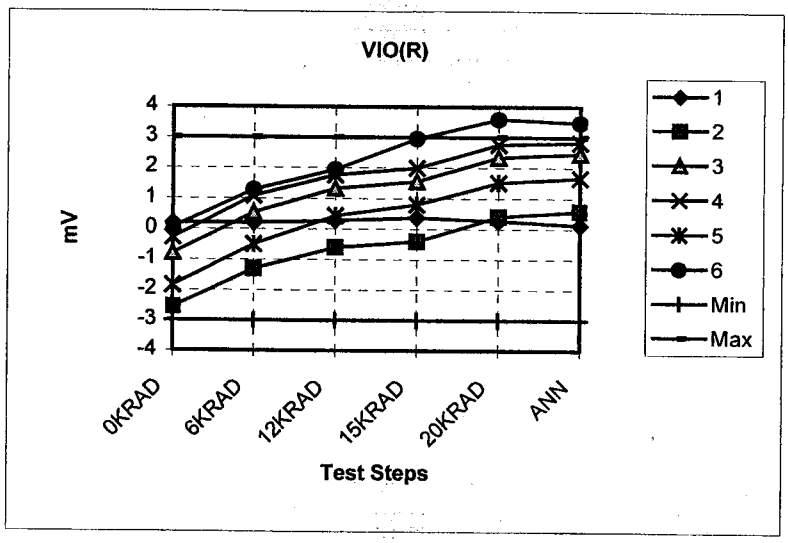
IIB-	0KRAD	6KRAD	12KRAD	15KRAD	20KRAD	ANN
1	27.50	28.41	28.32	27.95	28.96	24.01
2	25.39	35.22	143.75	181.00	267.88	143.30
3	27.51	48.66	196.50	242.68	326.10	188.16
4	27.76	62.15	209.37	254.00	359.68	150.33
5	25.32	47.82	173.84	211.55	311.69	139.58
6	27.17	71.46	145.91	230.40	312.66	113.16
Max	100	100	100	100	100	100
Unit	nA	nA	nA	nA	nA	nA



CMRR	0KRAD	6KRAD	12KRAD	15KRAD	20KRAD	ANN
1	116.5	116.5	116.4	116.6	116.5	115.8
2	114.4	113.5	113.5	113.5	113.4	112.6
3	115.9	114.4	112.7	113.5	118.5	116.8
4	116.4	114.8	113.5	114.3	118.5	116.8
5	114.5	113.5	113.3	113.6	114.2	113.4
6	116.7	115.4	116.1	112.7	115.8	111.4
Min	80	80	80	80	80	80
Unit	dB	dB	dB	dB	dB	dB



ICC+	0KRAD	6KRAD	12KRAD	15KRAD	20KRAD	ANN
1	1.67	1.67	1.67	1.66	1.66	1.68
2	1.63	1.62	1.60	1.61	1.59	1.59
3	1.66	1.65	1.64	1.64	1.63	1.63
4	1.70	1.67	1.67	1.66	1.65	1.65
5	1.64	1.62	1.62	1.61	1.60	1.60
6	1.67	1.64	1.64	1.62	1.61	1.61
Max	6	6	6	6	6	6
Unit	mA	mA	mA	mA	mA	mA



VIO(R)	0KRAD	6KRAD	12KRAD	15KRAD	20KRAD	ANN
1	0.198	0.204	0.272	0.367	0.259	0.123
2	-2.559	-1.310	-0.606	-0.412	0.399	0.580
3	-0.793	0.533	1.321	1.552	2.337	2.464
4	-0.281	1.080	1.764	1.988	2.751	2.830
5	-1.846	-0.503	0.433	0.792	1.511	1.666
6	0.051	1.282	1.936	2.958	3.591	3.477
Min	-3	-3	-3	-3	-3	-3
Max	3	3	3	3	3	3
Unit	mV	mV	mV	mV	mV	mV

DOSIMETRY

User:Tecnológica S.A.
Ref.: Tecnológica
Date: 15/02/00

REQUIREMENTS

Krad(Si)/h	Rad(Si)/min	R/min
0.280	4.67	5.39

CORRECTIONS

Presion (mm)	**714**
Temperature (°C)	**22.2**
Probe Position	**0.95**
Final Equip. reading (R/min)	**4.90**
	4.81

FRICKE DOSIMETRY

Irradiation time (h)	**18**
Spectrometer temp.(°C)	**25.0**
Molar coefficient.	**2181**
Conversion factor.	**27555.78**

Dosimeter	Fricke Reading	Rad (Fricke)	Rad (Fricke)/min	R/min	Rad(Si)/ min	Krad(Si)/h
D-1	**0.228**	**6282.72**	**5.82**	**6.00**	**5.19**	**0.31**
D-2	**0.228**	**6282.72**	**5.82**	**6.00**	**5.19**	**0.31**
D-3	**0.232**	**6392.94**	**5.92**	**6.10**	**5.28**	**0.32**
PROBE				**5.53**	**4.78**	**0.29**
D-4	**0.230**	**6337.83**	**5.87**	**6.05**	**5.23**	**0.31**
D-5	**0.229**	**6310.27**	**5.84**	**6.02**	**5.21**	**0.31**
D-6	**0.228**	**6282.72**	**5.82**	**6.00**	**5.19**	**0.31**

DOSE RATE (AVERAGE): D2-D5

Rad(Si)/min	**5.14**
Rad(Si)/h	**0.31**
Non Uniformity (%)	**9.73**