MetOp	TOTAL DOSE RADIATION TEST REPORT No. MO-RR-TLG-PM-0008	Issue: 1 Rev.: Date: 04/10/99 Page: 1/5

SCC Component No IRFY9140CSCS		Component Designation: IRFY9140	Irradiation Spec. No.: MIL-STD-883 1019.4
Gen. Spec.: MIL-PRF-19500 Det. Spec.: 81-0253 Amend.: --		Evaluation: - Acceptance Diffusion: - Acceptance Lot: X	Project/Programme: METOP
Family: 12	Group: 06	Functional Assignment: HEXFET P-CHANNEL	Package: TO-257
MFR. Name: INTER. RECTIFIER Address: USA		Test House: TECNOLOGICA Address: MADRID (SPAIN)	Orig. house: TECNOLOGICA Address: SEVILLA (SPAIN)
Radiation Test Plan No.: MO-RP-TLG-PM-0008		Sample Size: 6 Irradiation Devices: 5 Control Devices: 1	Date Code: 9913 Diffusion LOT: -- Wafer No.: --
Radiation Source: Cobalt-60 Facility Name: CIEMAT Address: MADRID (SPAIN)		Energy: 1.33/1.17 MeV Dose Rate: 280 rad(Si)/h	Date of Test: 27/09/99
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(BR)DSS, -VGS(TH)1, -IGSSR1, -IGSSF1, -IDSS1, RDS(ON) 1, RDS(ON) 2, -VSD.

Prepared by.: Sergio Fenoy González Date: 05/10/99 Signature:	Approved by : Jose Maria Valverde Date: 07/10/99 Signature:

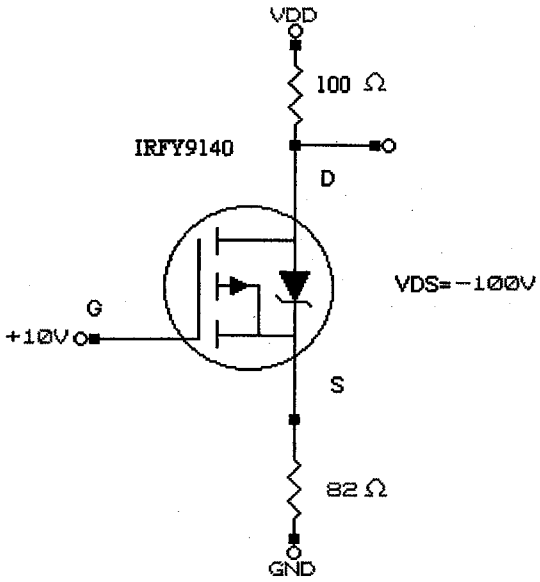


FIGURE 1.-TEST CIRCUIT

SUMMARY

Total dose steady-state irradiation test has been carried out on a WIDEBAND P-CHANNEL HEXFET from INTERNATIONAL RECTIFIER with date code 9913. The irradiated parts were labelled as follows: irradiated devices R2,..,R6= S/N 216,..,220 and R1= S/N 215 as control device.

DEVIATION TO PLAN

- The third and fourth irradiation steps at 15 and 20 Krad have been changed to 17.5 and 23.5 Krad.

RESULTS

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

	0 KRAD	6 KRAD	12 KRAD	17.5 KRAD	23.5 KRAD	ANN
V(BR)DSS	PASS	PASS	PASS	PASS	PASS	PASS
VGS(TH)	PASS	FAIL 3	FAIL	FAIL	FAIL 4	FAIL 4
IGSSR1	PASS	PASS	PASS	PASS	PASS	PASS
IGSSF1	PASS	PASS	PASS	PASS	PASS	PASS
IDSS1	PASS	PASS	PASS	PASS	PASS	PASS
RDS(ON) 1	PASS	PASS	PASS	FAIL	FAIL	FAIL
RDS(ON) 2	PASS	PASS	PASS	FAIL	FAIL	FAIL
VSD	PASS	PASS	PASS	PASS	PASS	PASS

CONCLUSION

The results indicate that:

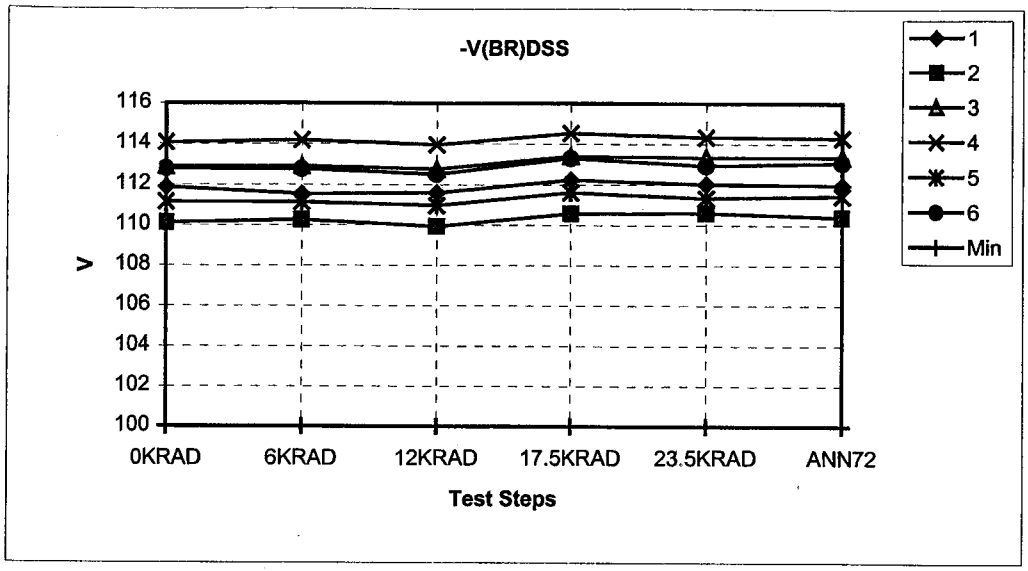
- The Gate to Source Thershold Voltage (VGSth) failed at 6 Krad in 3 of the 5 samples and at 12 Krad in all the samples (sample N° 3 recovers during the irradiation).
- The Drain to Source ON Resistance (RDSON 1,2) failed at 17.5 Krad in all the samples
- After annealing both parameters failed according to specification.

SCHEDULE

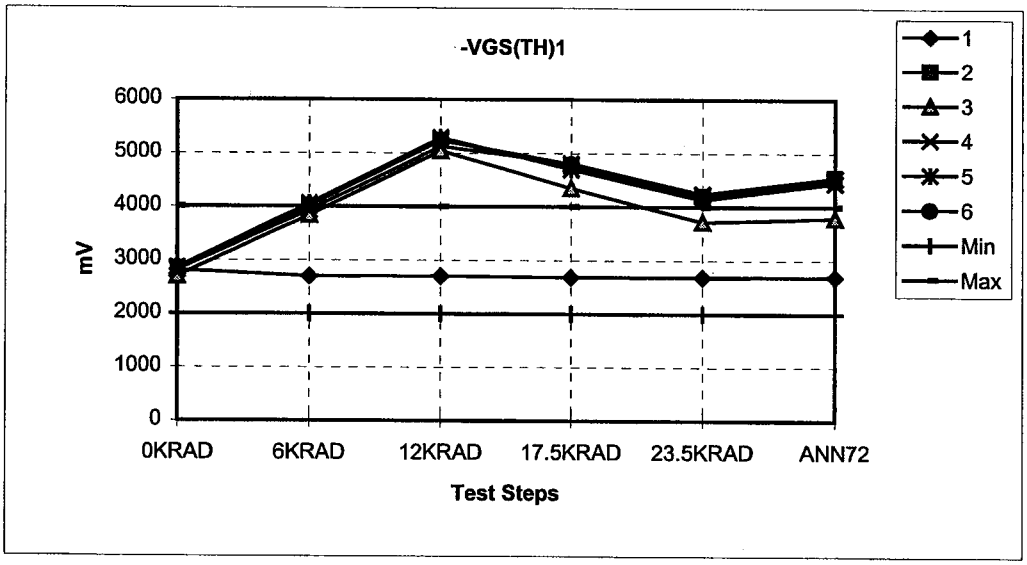
Test Step	Description	Result or Actual Test Condition	Time In	Time Out	Exposure
1	Samples serialization	CONTROL R1 IRR. DEVICES R2,.., R6.			
2	Initial Electrical Measurements	See 0 krad(Si) values in respective Parameter Data Tables	14:30 27/09	14:55 27/09	25 min.
3	Set-up of Test	Bias circuit verified according to Fig. 1			
4	Irradiation Exposure	Total Dose: 6.0 Krad(Si) Cumulative Dose: 6.0 Krad(Si) Dose Rate: 280 Rad(Si)/h Temperature: 25.3◦C (average)	15:01 27/09	12:27 28/09	21h26'
5	Intermediate Electrical Measurements	See 6 Krad(Si) values in respective Parameter Data Tables	12:27 28/09	12:50 28/09	23 min.
6	Set-up of Test	Bias circuit verified according to Fig. 1			
7	Irradiation Exposure	Total Dose: 6.0 Krad(Si) Cumulative Dose: 12.0 Krad(Si) Dose Rate: 280 rad(Si)/h Temperature: 25.6◦C (average)	12:57 28/09	10:23 29/09	21h26'
8	Intermediate Electrical Measurements	See 12 krad(Si) values in respective Parameter Data Tables	10:23 29/09	10:55 29/09	32 min.
9	Set-up of Test	Bias circuit verified according to Fig. 1			
10	Irradiation Exposure	Total Dose: 5.5 krad(Si) Cumulative Dose: 17.5 Krad(Si) Dose Rate: 280 rad(Si)/h Temperature: 25.5◦C (average)	12:23 29/09	08:01 30/09	19h38'
11	Intermediate Electrical Measurements	See 17.5 krad(Si) values in respective Parameter Data Tables	08:01 30/09	08:35 30/09	34 min
12	Set-up of Test	Bias circuit verified according to Fig. 1			

Test Step	Description	Result or Actual Test Condition	Time In	Time Out	Exposure
13	Irradiation Exposure	Total Dose: 6 Krad(Si) Cumulative Dose: 23.5 Krad(Si) Dose Rate: 280 rad(Si)/h Temperature: 25.7◦C (average)	10:01 30/09	07:27 01/10	21h26'
14	Intermediate Electrical Measurements	See 23.5 krad(Si) values in respective Parameter Data Tables	07:27 01/10	08:00 01/10	33 min.
15	Annealing 72h	Bias circuit verified according to Fig. 1 Temperature: 25 ◦C (average)	09:00 01/10	09:00 04/10	72 H
16	Electrical Measurements	See ANN72h values in respective parameter Data Tables	09:00 04/10	09:30 04/10	30 min.

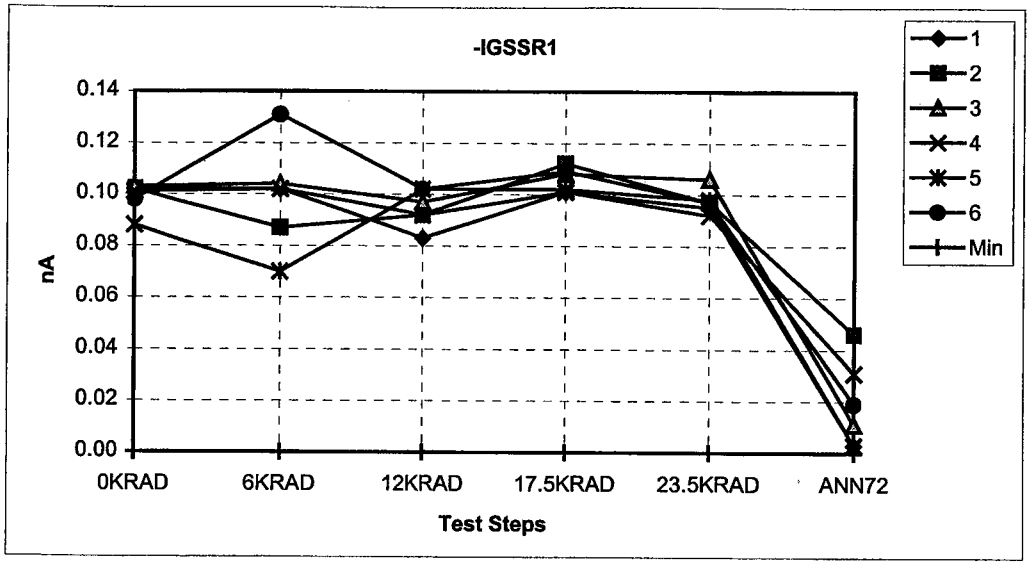
ELECTRICAL MEASUREMENT RESULTS



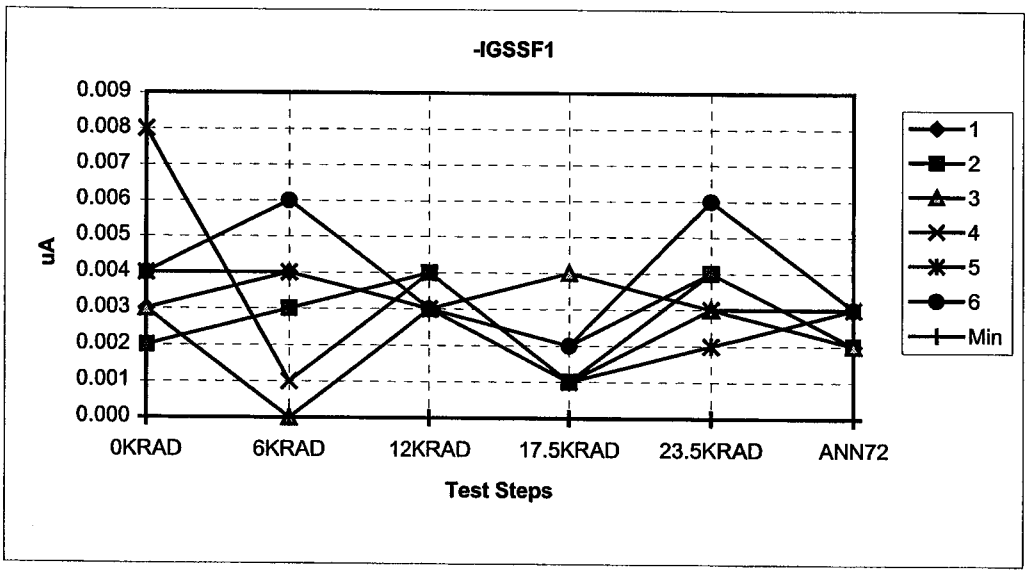
-V(BR)DSS	0KRAD	6KRAD	12KRAD	17.5KRAD	23.5KRAD	ANN72
1	111.89	111.53	111.59	112.23	112.02	111.96
2	110.12	110.25	109.94	110.58	110.60	110.39
3	112.89	112.91	112.76	113.40	113.34	113.33
4	114.06	114.18	113.95	114.54	114.34	114.29
5	111.15	111.13	110.98	111.61	111.34	111.44
6	112.79	112.75	112.50	113.31	112.93	113.06
Min	100	100	100	100	100	100
Max	700	700	700	700	700	700
Unit	V	V	V	V	V	V



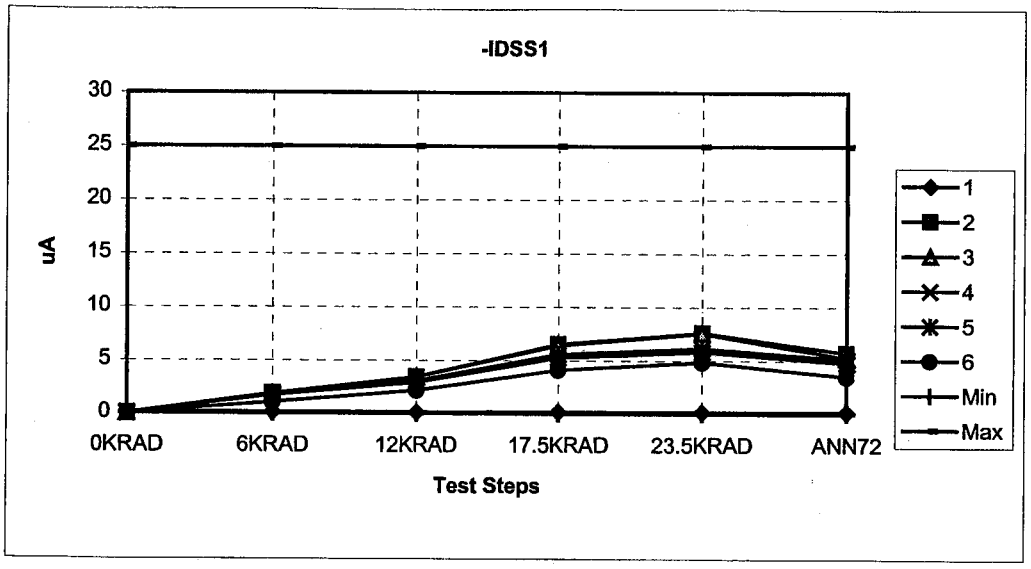
-VGS(TH)1	0KRAD	6KRAD	12KRAD	17.5KRAD	23.5KRAD	ANN72
1	2815.88	2700.75	2703.31	2686.25	2685.81	2695.63
2	2824.38	4008.06	5237.19	4762.00	4202.63	4547.44
3	2698.31	3840.50	5038.19	4343.44	3719.56	3791.25
4	2812.25	3931.94	5121.75	4803.38	4240.13	4541.31
5	2856.63	4056.31	5287.44	4699.25	4134.63	4445.31
6	2855.81	4023.75	5234.94	4796.31	4145.00	4488.50
Min	2000	2000	2000	2000	2000	2000
Max	4000	4000	4000	4000	4000	4000
Unit	mV	mV	mV	mV	mV	mV



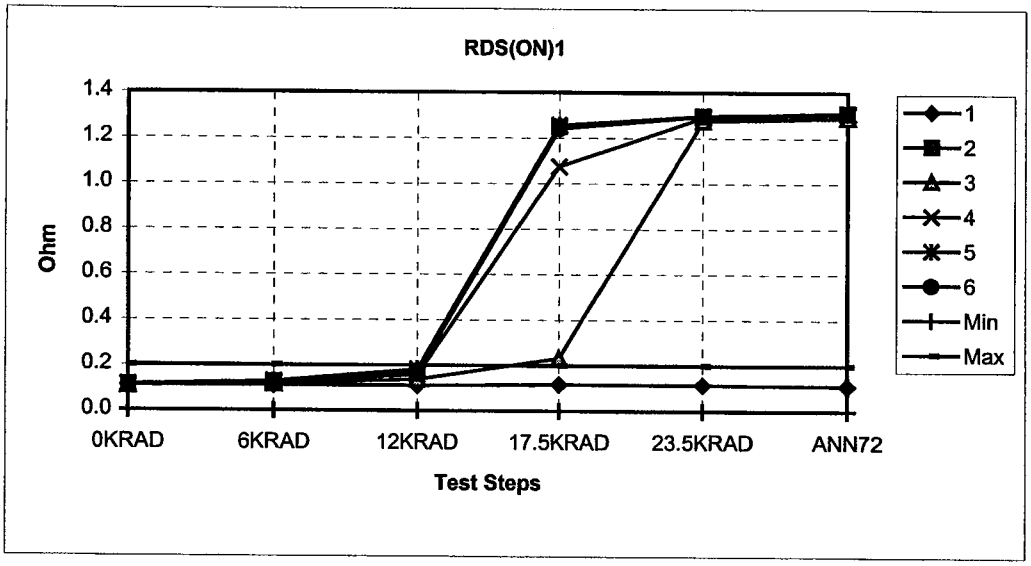
-IGSSR1	0KRAD	6KRAD	12KRAD	17.5KRAD	23.5KRAD	ANN72
1	0.102	0.102	0.083	0.101	0.095	0.003
2	0.102	0.087	0.092	0.112	0.097	0.046
3	0.103	0.104	0.097	0.108	0.106	0.011
4	0.101	0.102	0.092	0.101	0.092	0.031
5	0.088	0.070	0.102	0.102	0.098	0.003
6	0.098	0.131	0.102	0.109	0.097	0.019
Min	0	0	0	0	0	0
Max	100	100	100	100	100	100
Unit	nA	nA	nA	nA	nA	nA



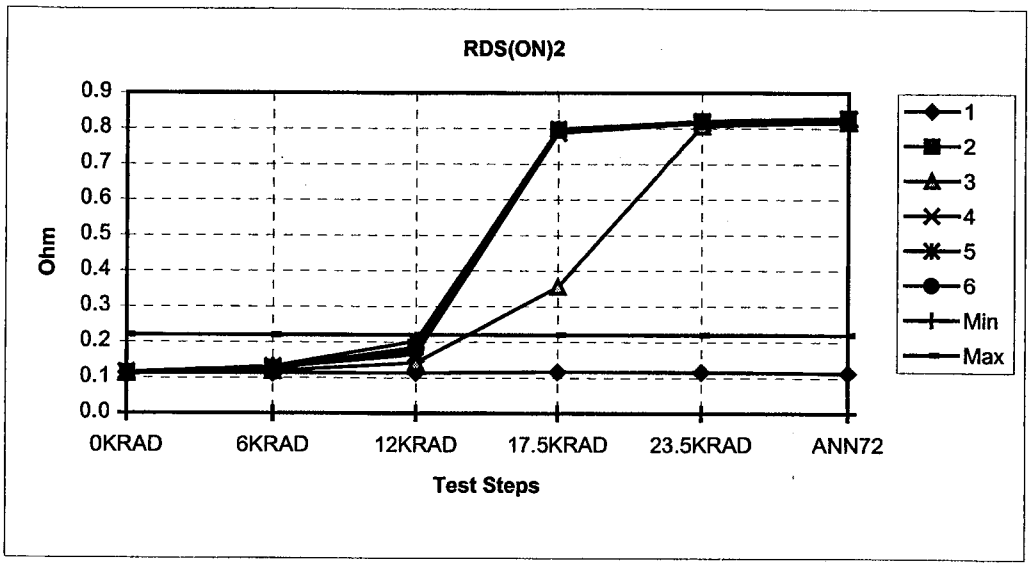
-IGSSF1	0KRAD	6KRAD	12KRAD	17.5KRAD	23.5KRAD	ANN72
1	0.003	0.004	0.003	0.002	0.004	0.002
2	0.002	0.003	0.004	0.001	0.004	0.002
3	0.003	0.000	0.003	0.004	0.003	0.002
4	0.008	0.001	0.004	0.001	0.003	0.003
5	0.004	0.004	0.003	0.001	0.002	0.003
6	0.004	0.006	0.003	0.002	0.006	0.003
Min	0	0	0	0	0	0
Max	100	100	100	100	100	100
Unit	uA	uA	uA	uA	uA	uA



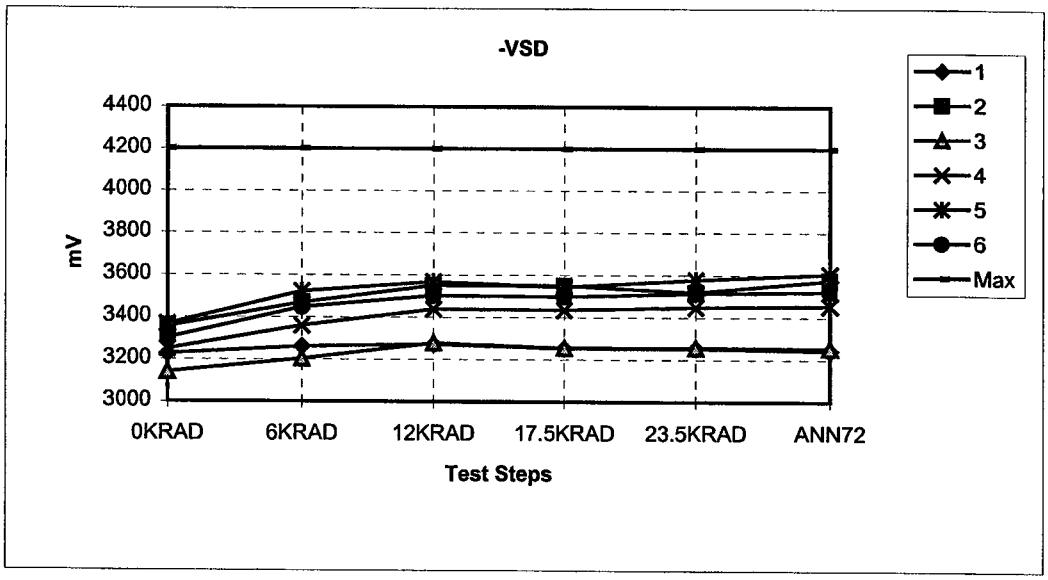
-IDSS1	0KRAD	6KRAD	12KRAD	17.5KRAD	23.5KRAD	ANN72
1	0.146	0.126	0.117	0.182	0.157	0.146
2	0.010	1.872	3.443	6.522	7.604	5.715
3	0.002	1.788	3.456	6.393	7.547	5.247
4	0.007	1.737	2.935	5.258	5.829	4.760
5	0.006	1.749	3.067	5.577	6.150	5.140
6	0.003	1.056	2.171	4.123	4.865	3.517
Min	0	0	0	0	0	0
Max	25	25	25	25	25	25
Unit	uA	uA	uA	uA	uA	uA



RDS(ON)1	0KRAD	6KRAD	12KRAD	17.5KRAD	23.5KRAD	ANN72
1	0.112	0.112	0.112	0.117	0.115	0.111
2	0.113	0.126	0.173	1.249	1.295	1.308
3	0.109	0.117	0.138	0.233	1.274	1.289
4	0.114	0.126	0.158	1.075	1.290	1.305
5	0.114	0.130	0.183	1.256	1.297	1.310
6	0.109	0.124	0.164	1.241	1.295	1.308
Min	0	0	0	0	0	0
Max	0.2	0.2	0.2	0.2	0.2	0.2
Unit	Ohm	Ohm	Ohm	Ohm	Ohm	Ohm



RDS(ON)2	0KRAD	6KRAD	12KRAD	17.5KRAD	23.5KRAD	ANN72
1	0.113	0.113	0.113	0.117	0.116	0.113
2	0.114	0.128	0.186	0.797	0.820	0.829
3	0.111	0.119	0.142	0.355	0.807	0.818
4	0.116	0.128	0.166	0.788	0.816	0.827
5	0.115	0.132	0.203	0.799	0.821	0.830
6	0.110	0.125	0.176	0.797	0.820	0.828
Min	0	0	0	0	0	0
Max	0.22	0.22	0.22	0.22	0.22	0.22
Unit	Ohm	Ohm	Ohm	Ohm	Ohm	Ohm



-VSD	0KRAD	6KRAD	12KRAD	17.5KRAD	23.5KRAD	ANN72
1	3225.63	3260.13	3272.06	3253.38	3253.75	3241.75
2	3355.94	3468.81	3550.25	3548.38	3518.19	3574.31
3	3140.13	3202.25	3277.00	3254.00	3256.69	3253.00
4	3248.00	3359.69	3437.88	3435.19	3448.25	3453.94
5	3365.44	3521.31	3567.00	3543.63	3578.25	3605.19
6	3299.75	3446.50	3502.13	3497.81	3513.50	3521.31
Min	0	0	0	0	0	0
Max	4200	4200	4200	4200	4200	4200
Unit	mV	mV	mV	mV	mV	mV

DOSIMETRY

User:Tecnológica S.A.
Ref.: Tecnológica
Date: 17/09/99

REQUIREMENTS

Krad(Si)/h	Rad(Si)/min	R/min
0.25	4.17	4.82

CORRECTIONS

Presion (mm)	706
Temperature (°C)	28.1
Probe Position	0.95
Calibration	1.008
Final Equip. reading (R/min)	4.50

FRICKE DOSIMETRY

Irradiation time (h)	48
Spectrometer temp.(°C)	25.7
Coeficiente de ex. Molar	2181
Factor de conversión	27422.62

Dosimeter	Fricke Reading	Rad (Fricke)	Rad (Fricke)/min	R/min	Rad(Si)/ min	Krad(Si)/h
D-1	0.520	14259.76	4.95	5.10	4.41	0.26
D-2	0.529	14506.57	5.04	5.20	4.50	0.27
D-3	0.541	14835.64	5.15	5.31	4.59	0.28
PROBE				5.24	4.53	0.27
D-4	0.554	15192.13	5.28	5.44	4.71	0.28
D-5	0.553	15164.71	5.27	5.43	4.70	0.28
D-6	0.554	15192.13	5.28	5.44	4.71	0.28

DOSE RATE (AVERAGE): D2-D5

Rad(Si)/min	4.61
Rad(Si)/h	280
Non Uniformity (%)	4.56