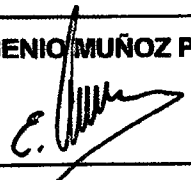


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SCC Component No N.A.		Component Designation: 2N7236	Irradiation Spec. No.: SCC22900 Iss.4
Gen. Spec.: MIL-PRF-19500 Det. Spec.: MIL-S-19500/595 Amend.: N.A.		Evaluation: - Acceptance Diffusion: - Acceptance Lot: X	Project/Programme: RO
Family/Group: 1/2/6	Techology: HEXFET	Functional Assignment: P-CHANNEL FET.	Package: TO-254AA
Manuf. Name: INTER. RECTIFIER Address: USA		Test House: TECNOLOGICA Address: MADRID (SPAIN)	Orig.house: TECNOLOGICA Address: SEVILLA (SPAIN)
Radiation Test Plan No.: RO-TLG-RP-0006		Sample Size: 6 Irradiation Devices: 5 Control Devices: 1	Date Code: 9728 Diffusion LOT: -- Wafer No.: --
Radiation Source: Cobalt-60 Facility Name: CIEMAT Address: MADRID (SPAIN)		Energy: 1.33/1.17 MeV Dose Rate: 10,64 K rad(Si)/h	Date of Test: 01/10/99
Irradiation Conditions: Biased: X Unbiased: - Test Circuit: Figure 1		Irradiation Measurements Interval: Remote test: - In situ Test: X	Annealing Tests: 24h/25°C 168h/100°C Biased: X Unbiased: - Test Circuit: Figure 1

Electrical Measurements. Parameters Tested:

$V_{(BR)DSS}$, $V_{GS(TH)}$, I_{GSS} , I_{DSS} , $R_{DS(ON)1}$, $R_{DS(ON)2}$, V_{SD}

Prepared by.: EUGENIO MUÑOZ PLAZA
 Date: 6/10/99
 Signature: 

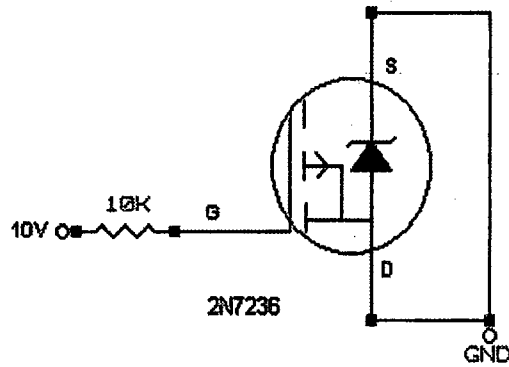
Approved by : JOSE M^a. VALVERDE PORRAS
 Date: 6/10/99
 Signature: 

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FIGURE 1.-TEST CIRCUIT



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SUMMARY

Total dose steady-state irradiation test has been carried out on a P-CHANNEL FET from INTERNATIONAL RECTIFIER with date code 9728. The irradiated parts were labelled as follows: R1, S/N 408 as control device, R2 s/n 410, R3 s/n 413, R4 s/n 415, R5 s/n 417 and R6 s/n 418.

RESULTS

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

	0 KRAD	5 KRAD	10 KRAD	20 KRAD	30 KRAD	ANN 24	ANN 168
$V_{GS(th)}$	PASS	PASS	PASS	PASS	PASS	PASS	PASS
$V_{GS(th)}$	PASS	PASS	FAIL5	FAIL 5	FAIL 5	FAIL 5	FAIL 5
$I_{GSS R1}$	PASS	PASS	PASS	PASS	PASS	PASS	PASS
$I_{GSS P1}$	PASS	PASS	PASS	PASS	PASS	PASS	PASS
I_{DSS}	PASS	PASS	PASS	PASS	PASS	PASS	PASS
$R_{DS(on)1}$	PASS	PASS	PASS	PASS	FAIL5	FAIL 5	FAIL 5
$R_{DS(on)2}$	PASS	PASS	PASS	FAIL 3	FAIL 5	FAIL 5	FAIL 5
V_{SD}	PASS	PASS	PASS	PASS	PASS	PASS	PASS

CONCLUSION

The gate to source voltage (theshold) fail at 10 krad. The RDS(on)1 fail at 30 Krad, and the RDS(on)2 fail in three devices at 20 Krad and over all devices at 30 Krad.

The rest of parameters pass according to radiation plan during the irradiation test.

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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	10:15 23/09	10:45 23/09	30 min.
3	Set-up of Test	Bias circuit verified according to Fig. 1			
4	Irradiation Exposure	Total Dose: 4.96 Krad(Si) Cumulative Dose: 4.96 Krad(Si) Dose Rate: 10.64 KRad(Si)/h Temperature: 23.6 °C (average)	11:06 23/09	11:34 23/09	28 min
5	Intermediate Electrical Measurements	See 5 Krad(Si) values in respective Parameter Data Tables	11:40 23/09	12:00 23/09	20 min.
6	Set-up of Test	Bias circuit verified according to Fig. 1			
7	Irradiation Exposure	Total Dose: 4.61 Krad(Si) Cumulative Dose: 9.57 Krad(Si) Dose Rate: 10.64Krad(Si)/h Temperature: 24.6°C (average)	12:06 23/09	12:32 23/09	26 min
8	Intermediate Electrical Measurements	See 10 krad(Si) values in respective Parameter Data Tables	12:40 23/09	12:55 23/09	15 min.
9	Set-up of Test	Bias circuit verified according to Fig. 1			
10	Irradiation Exposure	Total Dose: 9.93 krad(Si) Cumulative Dose: 19.5 Krad(Si) Dose Rate: 10.64 Krad(Si)/h Temperature: 25.7°C (average)	13:02 23/09	13:59 23/06	56 min.
11	Intermediate Electrical Measurements	See 20 krad(Si) values in respective Parameter Data Tables	14:05 23/09	14:20 23/09	20 min
12	Set-up of Test	Bias circuit verified according to Fig. 1			

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Test Step	Description	Result or Actual Test Condition	Time In	Time Out	Exposure
13	Irradiation Exposure	Total Dose: 9.93 Krad(Si) Cumulative Dose: 29.4 Krad(Si) Dose Rate: 10.64 Krad(Si)/h Temperature: 26.7°C (average)	14:26 23/09	15:22 23/09	56 min
14	Intermediate Electrical Measurements	See 30 krad(Si) values in respective Parameter Data Tables	15:30 23/09	15:50 23/09	40 min.
15	Annealing 24h	Bias circuit verified according to Fig. 1 Temperature: 25 °C (average)	16:00 23/09	16:00 24/09	24 H
16	Electrical Measurements	See ANN24h values in respective parameter Data Tables	16:10 24/09	16:30 24/09	20 min.
17	Annealing 168h	Bias circuit verified according to Fig. 1 Temperature: 100°C	16:45 24/09	16:45 01/10	168 H
18	Final Electrical Measurements	See ANN168h values in respective parameter Data Tables	16:50 01/10	17:20 01/10	30 min.

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ELECTRICAL MEASUREMENT CONDITIONS

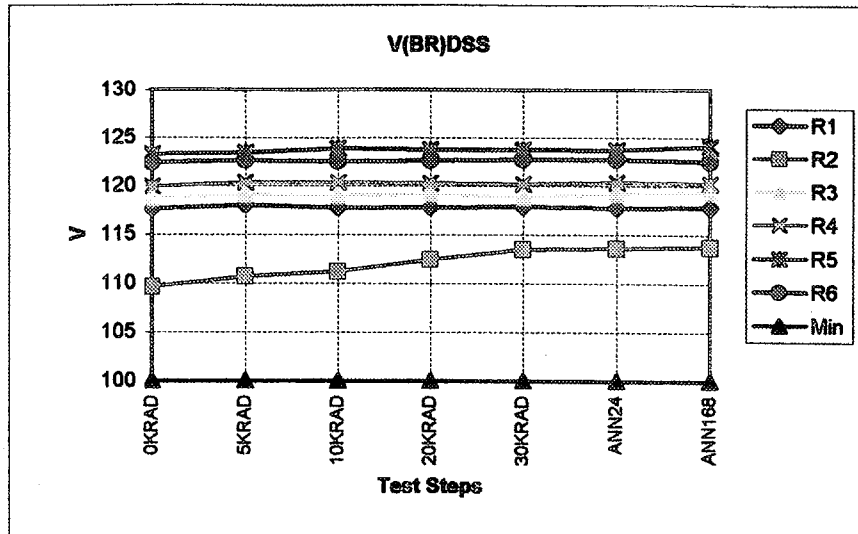
RO	TOTAL DOSE RADIATION TEST REPORT No. RO-TLG-RR-0006	Issue: 1 Rev.: Date: 06/10/99 ANNEX
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**TABLE 1 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE AT INTERMEDIATE POINTS AND
ON COMPLETION OF IRRADIATION AT 25°C**

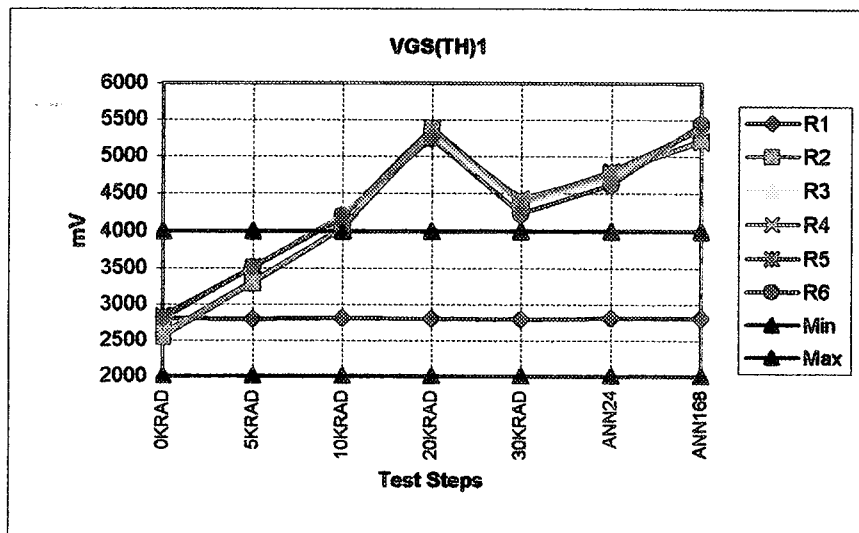
No	CHARACTERISTICS	SYMBOL	TEST CONDITION	LIMITS		UNIT
				MIN	MAX	
1	Breckdown Voltage	$V_{(BR)DSS}$	$I_D = -1mA$	-	-100	V
2	Gate to Source Threshol Voltage	$V_{GS(TH)}$	$V_{DS} = V_{GS}, I_D = -0.25mA$	-4	-2	V
3	Gate Reverse Current	I_{GSS}	$V_{GS} = \pm 20 v$	-	± 100	nA
4	Drain Current	I_{DSS}	$V_{DS} = -80V$	-25	0	uA
5	Static ON Resistance 1	$R_{DS(ON)1}$	$V_{DS} = -10V, I_D = -11A$	-	0.20	Ohm
6	Static ON Resistance 2	$R_{DS(ON)2}$	$V_{DS} = -10V, I_D = -18A$	-	0.22	Ohm
7	Forward Voltage (diode)	V_{SD}	$I_D = -18A$	-4.2	0	V

RO	TOTAL DOSE RADIATION TEST REPORT No. RO-TLG-RR-0006	Issue: 1 Rev.: Date: 06/10/99 ANNEX
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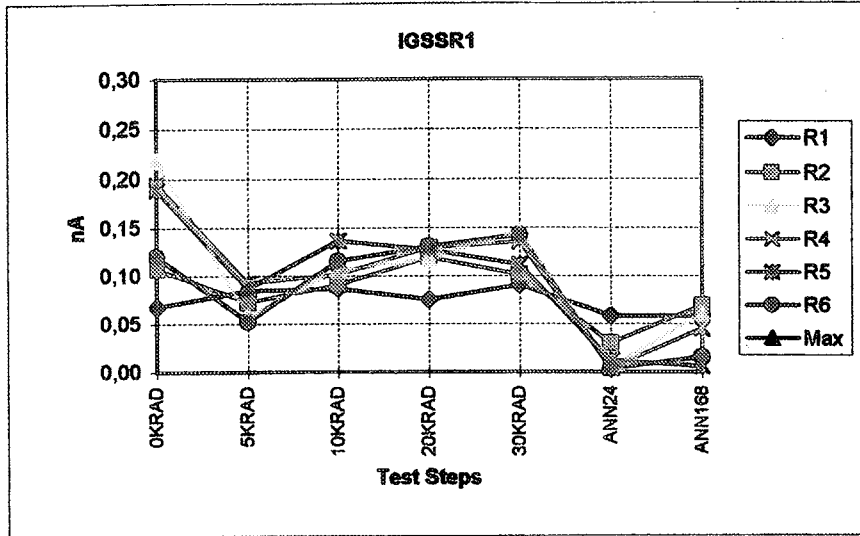
ELECTRICAL MEASUREMENT RESULTS



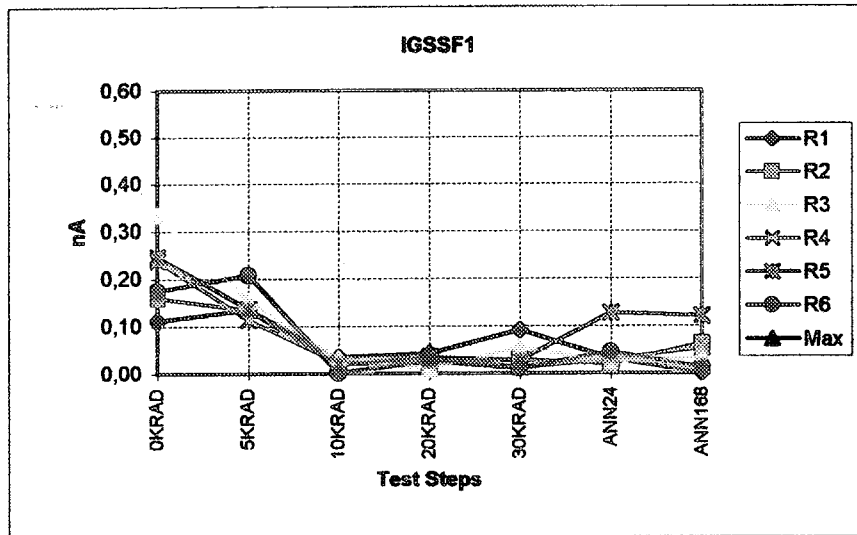
V(BR)DSS	0KRAD	5KRAD	10KRAD	20KRAD	30KRAD	ANN24	ANN168
R1	117,59	117,97	117,68	117,74	117,78	117,71	117,72
R2	109,60	110,70	111,16	112,42	113,43	113,56	113,72
R3	118,65	119,02	118,92	119,13	118,79	119,15	119,38
R4	119,93	120,36	120,33	120,27	120,18	120,35	120,22
R5	123,29	123,45	123,84	123,75	123,78	123,69	124,07
R6	122,38	122,60	122,54	122,61	122,70	122,73	122,54
Min	100	100	100	100	100	100	100
Max	-	-	-	-	-	-	-
Unit	V	V	V	V	V	V	V



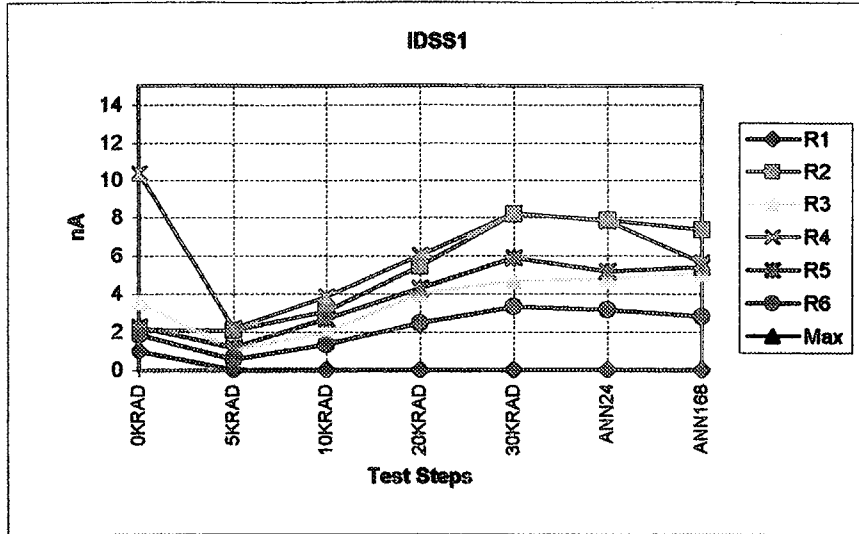
VGS(TH)1	0KRAD	5KRAD	10KRAD	20KRAD	30KRAD	ANN24	ANN168
R1	2802,44	2795,63	2810,75	2803,44	2799,00	2810,38	2813,56
R2	2545,88	3283,81	4026,81	5317,31	4390,56	4763,56	5232,88
R3	2810,69	3510,38	4231,44	5281,31	4360,13	4706,13	5444,06
R4	2599,50	3325,56	4043,88	5340,00	4428,81	4768,63	5194,75
R5	2837,88	3502,00	4167,31	5391,06	4378,69	4801,94	5367,56
R6	2793,25	3503,44	4194,63	5239,13	4224,44	4621,44	5434,63
Min	2000	2000	2000	2000	2000	2000	2000
Max	4000	4000	4000	4000	4000	4000	4000
Unit	mV	mV	mV	mV	mV	mV	mV



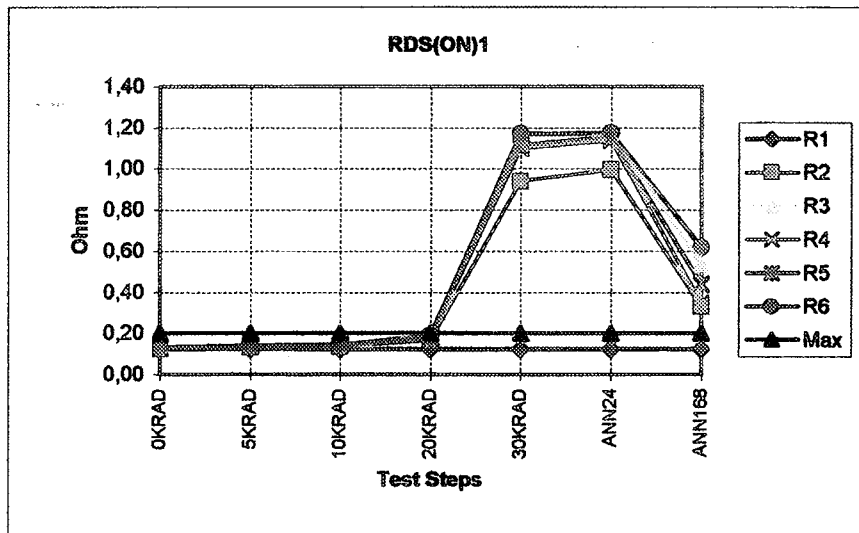
IGSSR1	0KRAD	5KRAD	10KRAD	20KRAD	30KRAD	ANN24	ANN168
R1	0,087	0,084	0,086	0,075	0,090	0,058	0,058
R2	0,107	0,072	0,090	0,119	0,101	0,030	0,069
R3	0,219	0,057	0,105	0,117	0,147	0,005	0,060
R4	0,195	0,092	0,101	0,129	0,135	0,004	0,045
R5	0,189	0,086	0,136	0,127	0,111	0,012	0,006
R6	0,120	0,052	0,115	0,130	0,142	0,003	0,016
Min	0	0	0	0	0	0	0
Max	100	100	100	100	100	100	100
Unit	nA	nA	nA	nA	nA	nA	nA



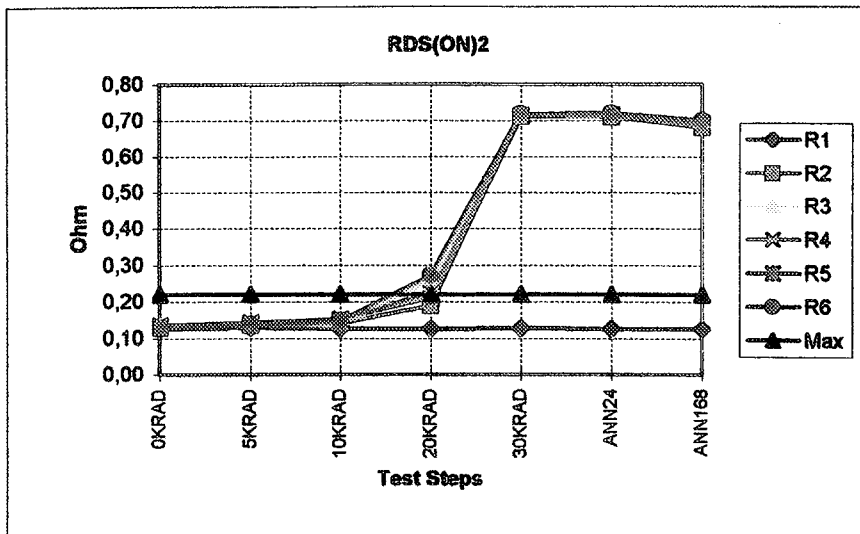
IGSSF1	0KRAD	5KRAD	10KRAD	20KRAD	30KRAD	ANN24	ANN168
R1	0,112	0,135	0,035	0,042	0,092	0,031	0,001
R2	0,160	0,134	0,021	0,022	0,029	0,020	0,063
R3	0,335	0,154	0,033	0,009	0,056	0,024	0,034
R4	0,238	0,114	0,022	0,036	0,012	0,029	0,054
R5	0,246	0,136	0,019	0,034	0,028	0,127	0,120
R6	0,174	0,207	0,001	0,027	0,011	0,045	0,012
Min	0	0	0	0	0	0	0
Max	100	100	100	100	100	100	100
Unit	nA	nA	nA	nA	nA	nA	nA



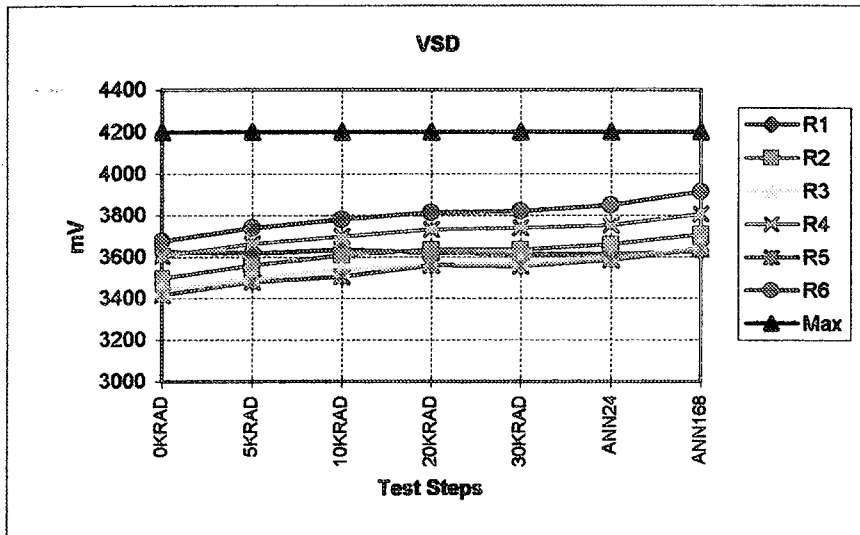
IDSS1	0KRAD	5KRAD	10KRAD	20KRAD	30KRAD	ANN24	ANN168
R1	0,990	0,001	0,000	0,006	0,001	0,002	0,001
R2	2,116	2,083	3,060	5,451	8,187	7,864	7,375
R3	3,585	1,048	1,924	4,037	4,668	4,773	5,088
R4	10,394	2,180	3,836	6,025	8,228	7,818	5,623
R5	2,255	1,173	2,668	4,273	5,871	5,173	5,421
R6	1,858	0,566	1,327	2,455	3,316	3,150	2,814
Min	0	0	0	0	0	0	0
Max	25	25	25	25	25	25	25
Unit	uA	uA	uA	uA	uA	uA	uA



RDS(ON)1	0KRAD	5KRAD	10KRAD	20KRAD	30KRAD	ANN24	ANN168
R1	0,124	0,126	0,124	0,125	0,125	0,124	0,123
R2	0,126	0,133	0,137	0,167	0,939	0,995	0,333
R3	0,132	0,140	0,145	0,194	1,168	1,172	0,540
R4	0,133	0,141	0,147	0,181	1,098	1,137	0,349
R5	0,128	0,136	0,144	0,181	1,115	1,154	0,440
R6	0,128	0,135	0,142	0,189	1,171	1,174	0,620
Min	-	-	-	-	-	-	-
Max	0,2	0,2	0,2	0,2	0,2	0,2	0,2
Unit	Ohm	Ohm	Ohm	Ohm	Ohm	Ohm	Ohm



RDS(ON)2	0KRAD	5KRAD	10KRAD	20KRAD	30KRAD	ANN24	ANN168
R1	0,126	0,128	0,125	0,126	0,127	0,125	0,125
R2	0,128	0,134	0,140	0,189	0,710	0,708	0,681
R3	0,134	0,143	0,149	0,255	0,716	0,718	0,697
R4	0,136	0,143	0,152	0,210	0,712	0,714	0,687
R5	0,130	0,138	0,149	0,225	0,714	0,715	0,691
R6	0,130	0,137	0,146	0,272	0,718	0,719	0,700
Min	0	0	0	0	0	0	0
Max	0,22	0,22	0,22	0,22	0,22	0,22	0,22
Unit	Ohm	Ohm	Ohm	Ohm	Ohm	Ohm	Ohm



VSD	0KRAD	5KRAD	10KRAD	20KRAD	30KRAD	ANN24	ANN168
R1	3626,56	3616,69	3636,38	3620,69	3612,38	3613,44	3628,25
R2	3496,94	3580,44	3608,63	3634,19	3634,69	3661,13	3708,88
R3	3441,00	3495,13	3540,00	3582,88	3574,50	3583,31	3649,19
R4	3605,44	3664,31	3699,44	3732,06	3738,25	3752,44	3804,25
R5	3414,19	3478,88	3504,38	3558,75	3554,06	3584,38	3637,56
R6	3674,81	3738,44	3778,56	3811,94	3820,38	3847,19	3912,69
Min	0	0	0	0	0	0	0
Max	4200	4200	4200	4200	4200	4200	4200
Unit	mV	mV	mV	mV	mV	mV	mV

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DOSIMETRY

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User: Tecnológica S.A.
Ref.: Tecnológica 3.3.99
Date: 21/09/99

REQUIREMENTS

Krad(Si)/h	Rad(Si)/min	R/min
10.00	166.67	192.68

CORRECTIONS

Presion (mm)	703
Temperature (°C)	25.1
Final Equip. reading (R/min)	173.20

FRICKE DOSIMETRY

Irradiation time (h)	1.25					
Spectrometer temp.(°C)	24.7					
Coefficiente de ex. molar	2181					
Factor de conversión	27613.24					
Dosimeter	Fricke Reading	Rad (Fricke)	Rad (Fricke)/min	R/min	Rad(Si)/min	Krad(Si)/h
D-1	0.472	13033.45	173.78	179.15	154.96	9.30
D-2	0.511	14110.37	188.14	193.96	167.78	10.07
D-3	0.544	15021.60	200.29	206.48	178.61	10.72
PROBE				200.53	173.46	10.41
D-4	0.563	15546.25	207.28	213.69	184.84	11.09
D-5	0.553	15270.12	203.60	209.90	181.56	10.89
D-6	0.524	14469.34	192.92	198.89	172.04	10.32

DOSE RATE (AVERAGE): D2-D5

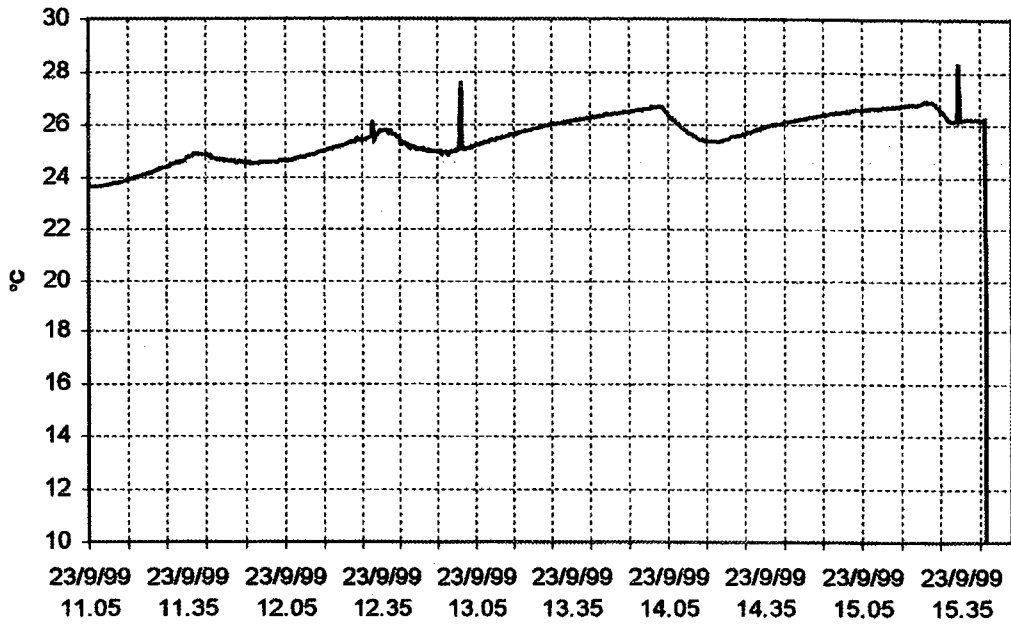
Rad(Si)/min	177.25
Krad(Si)/h	10.64
Non Uniformity (%)	9.62

RO

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TEMPERATURE °C



IRRADIATION DATA

