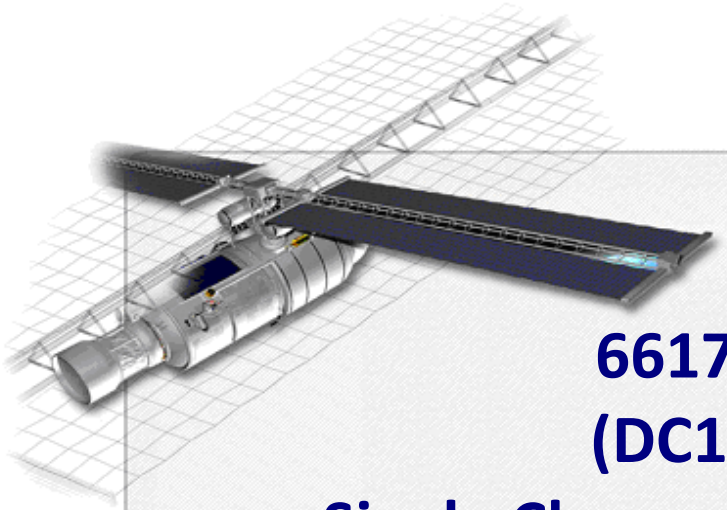
TOTAL IONIZING DOSE TEST REPORT



66179-002
(DC1124)
Single Channel Optocoupler
From
MICROPAC

TRAD/TE/66179/XXX1/ESA/YP/1104		Labège, April 19th, 2012
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Issue : 0		
To: Marc POIZAT	Project/Program :	ESA Contract N°4000102571/10/NL/AF-Radiation Characterization of Laplace RH optocouplers, sensors and detectors

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1 INTRODUCTION

This report includes the test results of 66179-002, a Single Channel Optocoupler from MICROPAC to evaluate Total Ionizing Dose (TID) effects under Co60 irradiation. Between November 2011 and February 2012, TRAD characterized this device for TID sensitivity at the UCL Facility, Belgium using their Gamma irradiation Facility.
The objectives of the test are:

- to detect and measure the degradation of device parameters as a function of TID,
- to determine if device parameters are within specified limits after exposure to final TID level.

2 DOCUMENTS

2.1 Applicable Documents

AD	1.	ESA contract	N°4000102571/10/NL/AF-Radiation Characterization of Laplace RH optocouplers, sensors and detectors
AD	2.	Irradiation Test Plan	ITP-TE-66179-MIC-ESA-1115-2, Iss.2, 16/06/11

2.2 Reference Documents

RD	1.	Datasheet 66179 by MICROPAC	GULL WING HERMETICALLY SEALED, SINGLE CHANNEL OPTOCOUPLER (Electrical Equivalent To 66099) dated 23/01/2007
RD	2.	MICROPAC certificate of traceability and conformance dated 25/07/2011	

3 DEVICE INFORMATION

3.1 Device description

This part is a Single channel radiation tolerant hermetic optocoupler. It is hermetically sealed into a 10 Pin Gull Wing package. The 66179 optocoupler contains a proton tolerant 660nm GaAlAs LED optically coupled to a silicon planar NPN Output phototransistor.

Type	66179-002
Manufacturer	MICROPAC
Function	Optocoupler
Package	10 Pin Gull Wing
Date Code	1124
Sample size	16 parts (15 test parts + 1 control sample)

3.2 Procurement information

75 parts reference 66179-002 were procured by TRAD and delivered by MICROPAC through its French distributor ISOTOPE ELECTRONICS.
Their quality level defined by the 002 extension number corresponds to a commercial standard operating in the temperature range of -55° to +100°C and temperature tested (hot & cold temperature) by the manufacturer prior delivery.
Parts were delivered separated in two lots (25 pcs and 50 pcs) from same date-code 1124 and together with a Certificate of Conformance [RD2].

3.3 External view

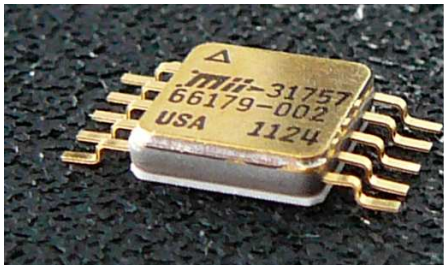


Figure 1: package marking

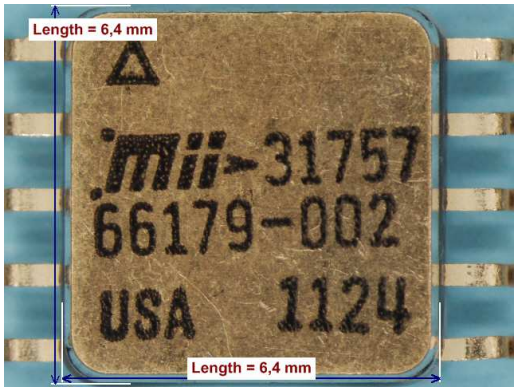


Figure 2: package marking

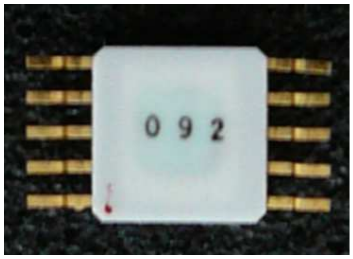


Figure 3: package back marking

3.4 Internal view

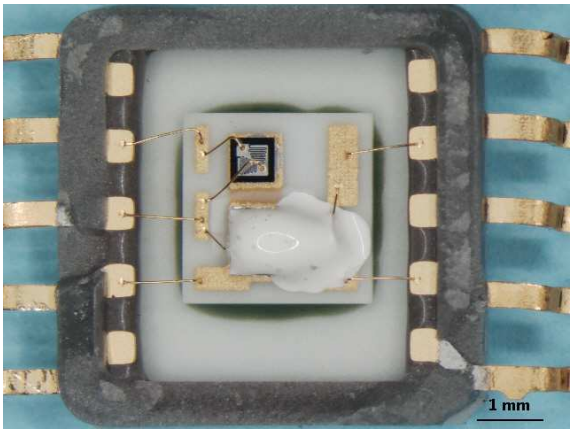


Figure 4: Internal view

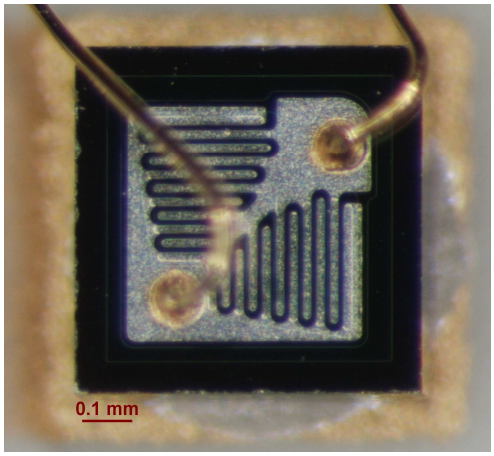


Figure 5: transistor die view

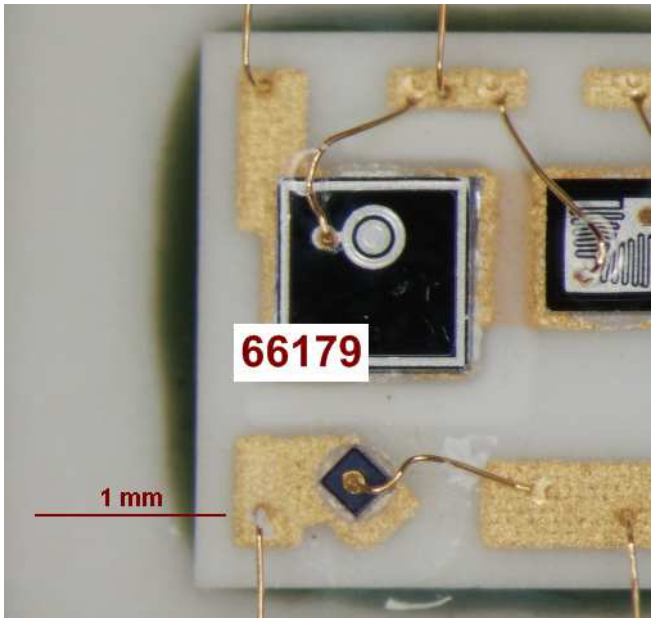


Figure 6: photodetector and LED view

3.5 Serialization

Each part is serialized to enable pre and post test identification and comparison.

Serial Number	Control sample	Test samples													
Serialization	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	Ref	Bias 1	Bias 1	Bias 1	Bias 1	Bias 1	Bias 2	Bias 2	Bias 2	Bias 2	Bias 2	OFF	OFF	OFF	OFF	OFF

Manufacturer device's package back marking (see external view) correspondence is kept as traceability information.

4 IRRADIATION MEANS AND CONDITIONS

4.1 UCL irradiation facility (Belgium)

Gamma irradiations are performed with Cobalt 60 source.
Gamma emitted radiation energies are 1.17 and 1.33 MeV.
Dose rates is equal 15 kRad(Si) / h at the source centre .
Moreover the irradiation chamber is a cylindrical room with a radius of 2m.
Then dose rate usable vary from 1.8 kRad(Si) / h to 80 Rad(Si) / h for normal irradiation positions and direct field.

4.2 Dose measurement

Alanine dosimeters are used for each test set up to control Total Ionizing Dose.

4.3 Experimental conditions

An Accumulated dose of 200 krad(Si) of Co60 is required [AD2] for this TID (Total Ionizing Dose) evaluation test.
Seven steps are defined to determine the component degradation under Co60 irradiation.
The test devices have been exposed to the following Dose rate:

	Step1	Step2	Step3	Step4	Step5	Step6	Step7	Step8
Accumulated dose krad(Si)	10	20	50	74	102	123	152	203
Dose rate (Si)/h	36	36	36	36	310	310	310	310

Parts have been then submitted to the following annealing sequence:

Duration (h)	24	168
Temperature (°C)	25	100

5 ELECTRICAL TESTS

Electrical parameters to be measured in pre and post exposure tests are described in the following table. Electrical tests are performed on each part using the test set-up hereunder. All required data are recorded for each device. Test conditions and limits are given in the applicable irradiation test plan [AD2] and shown hereafter.

5.1 Test set-up

TEST BOARD	TRAD/CT1/E/OPTO/ZIP14/BR/1108
TEST PROGRAM	66179_TE_XXX1_B1_V10.llb

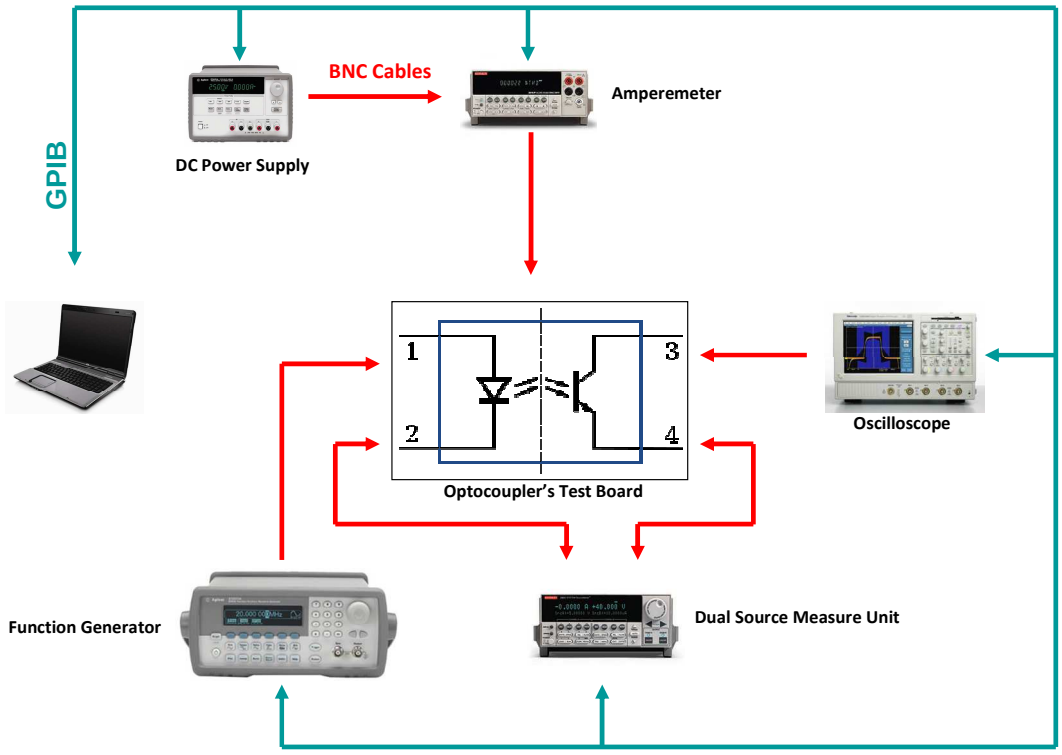


Figure 7: test principle

5.2 Test configuration

Samples were exposed to irradiation in three different modes - two on-modes (Figure 8 and Figure 9) and one in off-mode (all terminal leads short-circuited).

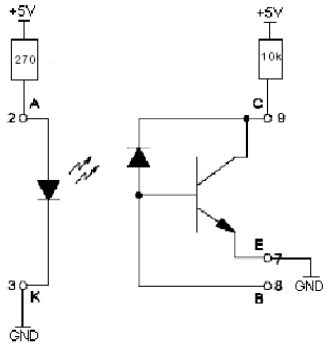


Figure 8: ON bias1

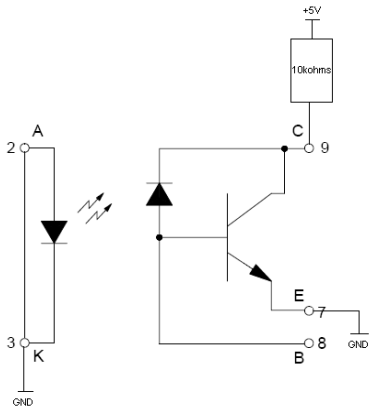


Figure 9: ON bias2

5.3 Electrical parameters

PARAMETER	SYMBOL	TEST CONDITION	MIN	MAX	UNIT
Input Diode Static Reverse Current	I_R	V_R = 2V		100	µA
Input Diode Static Forward Voltage	V_F	I_F = 10mA	0,8	2	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	I_C = 100µA, I_F = 0	40		V
Collector-EmitterBreakdown Voltage	$V_{(BR)CEO}$	I_C = 1mA, I_B = 0, I_F = 0	40		V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	I_C = 0mA, I_E = 100µA, I_F = 0	4		V
Collector-Emitter Cutoff Current	I_{CEO}	V_{CE} = 20V		100	nA
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	I_F = 20mA, I_C = 10mA		0,3	V
Rise Time	tr	V_{CC}=10V,I_F=10mA, R_L=100Ω		20	µs
Fall Time	tf	V_{CC}=10V,I_F=10mA, R_L=100Ω		20	µs
Current Transfer Ratio	CTR1	V_{CE} = 5V, I_F = 1mA			%
Current Transfer Ratio	CTR2	V_{CE} = 5V, I_F = 2mA			%
Current Transfer Ratio	CTR3	V_{CE} = 5V, I_F = 10mA			%
Current Transfer Ratio	CTR4	V_{CE} = 5V, I_F = 20mA			%
Current Transfer Ratio	CTR5	V_{CE} = 20V, I_F = 10mA			%

Min/ Max values are those specified in the reference data-sheet [RD1].

Test measurements are performed at 25°C ± 10°C.

6 TEST HISTORY

Initially, 7 steps were planned for this test sequence, as described hereunder.

	Step1	Step2	Step3	Step4	Step5	Step6	Step7
Accumulated dose krad(Si)	10	20	50	100	120	150	200
Dose rate (Si)/h	36	36	36	36	310	310	310

Due to irradiation facility maintenance, between Step 3 and Step 4, the irradiation was stopped for 48 hours. Total Ionizing Dose at this step was 74 krad(Si).
During this time period, parts were electrically measured and then stocked in a cold chamber at a temperature of -30°C.

7 SUMMARY RESULTS

Only parameters with applicable test limits are shown hereunder.

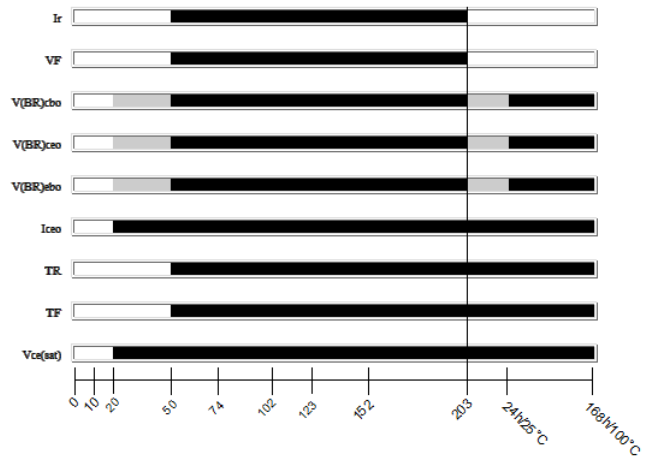


Figure 10: ON Bias 1

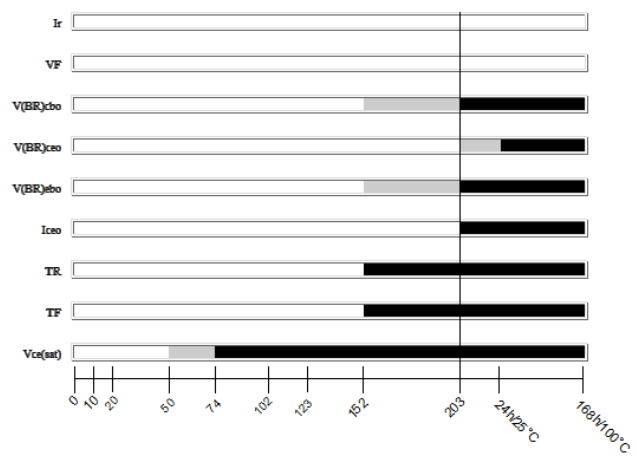


Figure 11: ON Bias 2

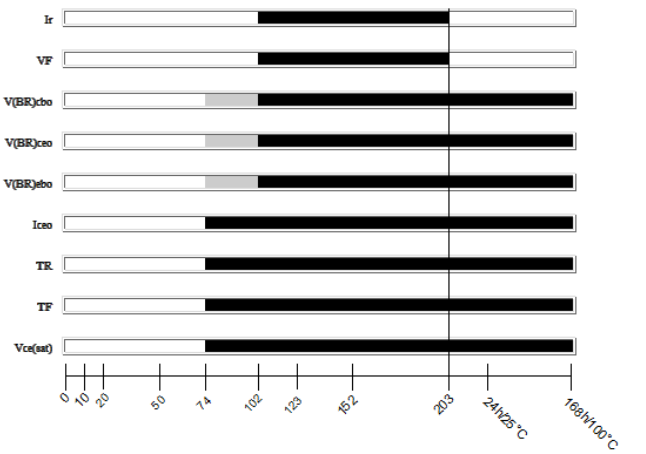
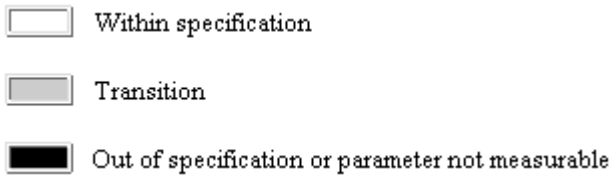


Figure 12: OFF mode



With ON Bias 1 condition:

- Ir, VF, TR and TF are not measurable at step 74.0 krad(Si)
- Iceo and Vce(sat) are not measurable at step 50.0 krad(Si)
- V(BR)ebo is out of specification at 33.5 krad(Si) by interpolation.
- V(BR)ceo is out of specification at 42.2 krad(Si) by interpolation.
- V(BR)cbo is out of specification at 42.7 krad(Si) by interpolation.

With ON Bias 2 condition:

- Iceo is not measurable after 24 hours of annealing at 25°C.
- TR and TF are not measurable at step 203.0 krad(Si)
- Vce(sat) is out of specification at 61.3 krad(Si) by interpolation.
- V(BR)ebo is out of specification at 175.3 krad(Si) by interpolation.
- V(BR)cbo is out of specification at 189.7 krad(Si) by interpolation.
- V(BR)ceo is out of specification at 218.6 krad(Si) by interpolation.

With OFF mode:

- Ir and VF are not measurable at step 123.0 krad(Si)
- Iceo, TR, TF and Vce(sat) are not measurable at step 102.0 krad(Si)
- V(BR)ebo is out of specification at 86.5 krad(Si) by interpolation.
- V(BR)ceo is out of specification at 94.8 krad(Si) by interpolation.
- V(BR)cbo is out of specification at 95.2 krad(Si) by interpolation

Parameters without applicable test limits and which are not measurable are shown hereunder:

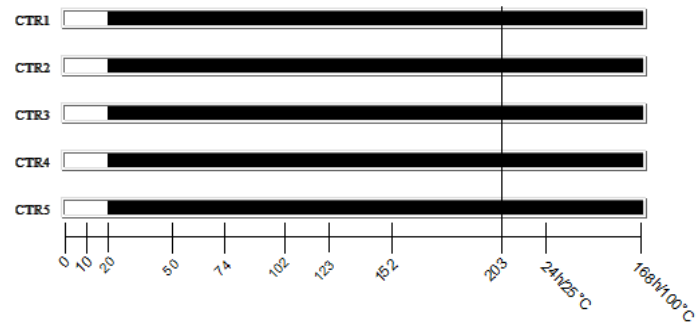


Figure 13: ON Bias 1

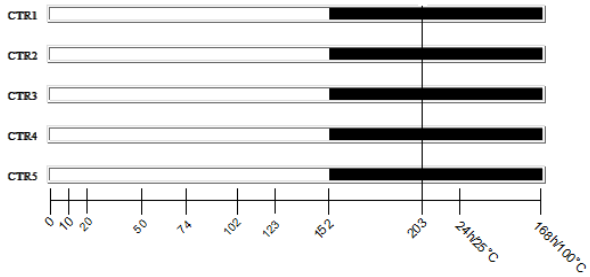


Figure 14: ON Bias 2

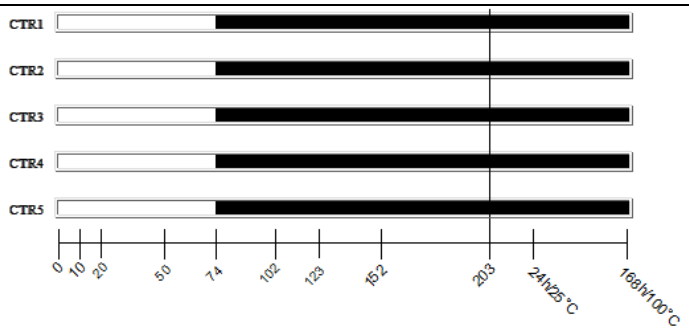
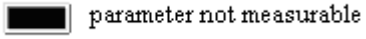


Figure 15: OFF mode



ON Bias 1: CTR1, CTR2, CTR3, CTR4 and CTR5 are not measurable at step 50 krad(Si).

ON Bias 2: CTR1, CTR2, CTR3, CTR4 and CTR5 are not measurable at step 203 krad(Si).

OFF mode: CTR1, CTR2, CTR3, CTR4 and CTR5 are not measurable at step 102 krad(Si).

8 CONCLUSION

Total Ionizing Dose steady-state irradiation test using Gamma ray has been applied on 66179-002, a Single Channel Optocoupler from MICROPAC up to 200krad(Si).

The results indicate that applying:

- ON Bias 1 mode, devices are functional up to 20 krad(Si)
- ON Bias 2 mode, devices are functional up to 50 krad(Si)
- OFF mode, devices are functional up to 74 krad(Si).

Average drift current transfer ratio are described in next Figure, function of the applied Bias mode and CTR configuration.
On devices tested in OFF mode, CTRs are not measurable at 203krad(Si) and after annealing, average drift of CTR are shown at 203krad(Si) (Figure 16) and at 152 krad(Si) (Figure 17).

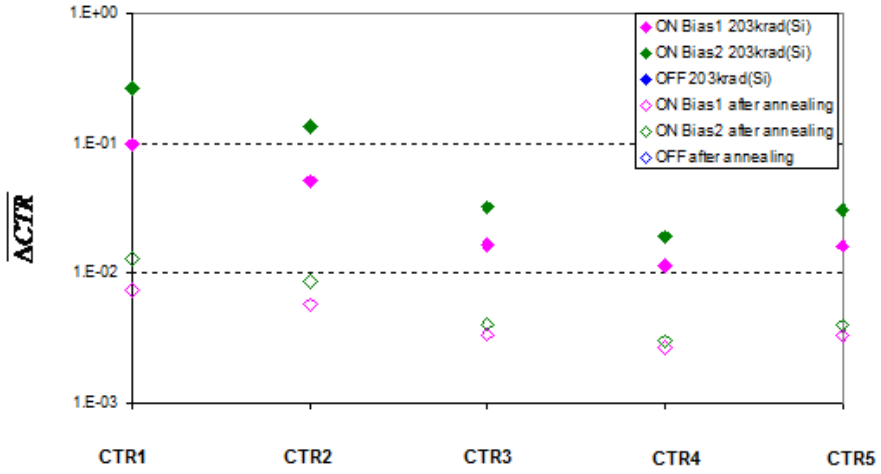


Figure 16: average drift CTR at 203krad(Si) and after annealing

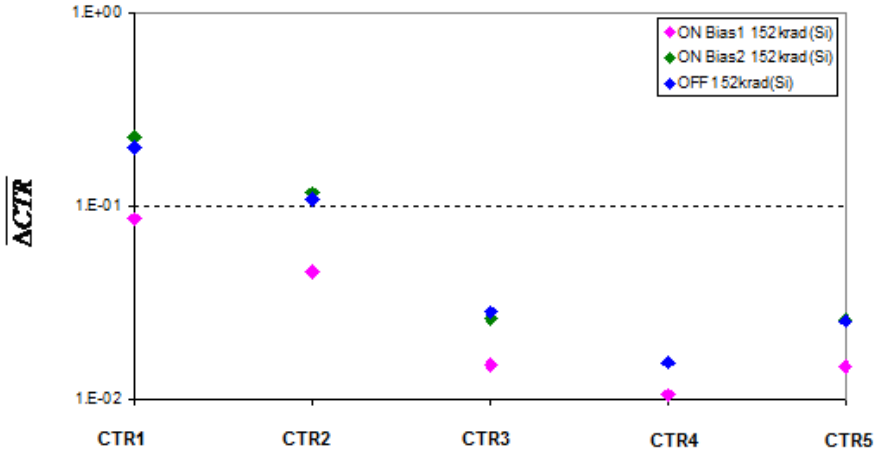


Figure 17:average drift CTR at 152krad(Si)

The least sensitive configuration up to a total dose of 203 krad(Si) and at 152 krad(Si) is CTR4 configuration (Vce = 5V; If = 20 mA)
CRT1 configuration (Vce = 5V; If = 1 mA) exhibits the greatest parameter degradation at all steps.
ON Bias1 mode is the least sensitive configuration for all CTR configuration.
ON Bias2 mode is the most sensitive configuration at 152 krad(Si), except for CTR3 configuration.

As shown in Figure 16, after annealing, average drift Current Transfer Ratio decrease.

9 DETAILED TESTS RESULTS

The pre and post radiation test results are shown graphically in the following pages (9-2 to 9-29). The data is displayed in the following tables and graphs.

These graphs show parameter's shifts observed during the total ionizing dose sequence. The Control sample results are shown on each graph (black curve).

When available in the device data-sheet/specification, the maximum/minimum/typical values are also shown (red dotted line).

The tables include drift calculation between each measurement step and the "0" kRad(Si) step.

For CTR values, the formula used is:

$$\text{Drift} = \frac{1}{\text{measurement } (X \text{ kRad(Si)})} - \frac{1}{\text{measurement } (0 \text{ kRad(Si)})}$$

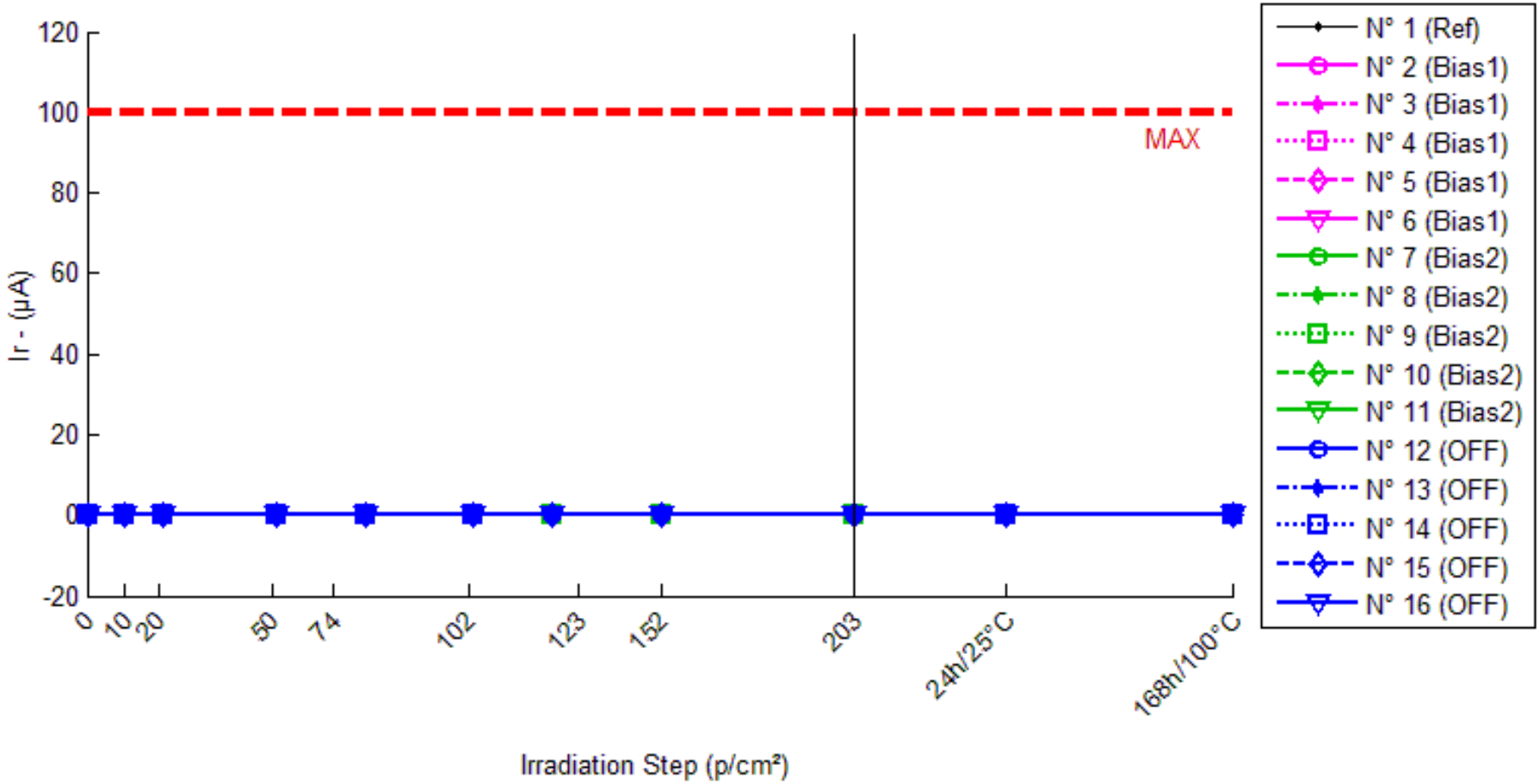
For other parameters, the formula used is:

Drift value= measurement (X kRad(Si)) - measurement (0 kRad(Si))

CONTENTS

1. Ir

Ta=25°C; VR = 2 V



Ir . (µA) **Max = 100.0**

	0krad(Si)	10krad(Si)	20krad(Si)	50krad(Si)	74krad(Si)	102krad(Si)	123krad(Si)	152krad(Si)	203krad(Si)	24h/25°C	168h/100°C
N° 1 (Ref)	2.595E-4	2.406E-4	4.447E-4	8.652E-5	7.282E-5	5.586E-5	9.218E-5	8.506E-5	1.022E-4	7.670E-5	5.120E-5
N° 2 (Bias1)	1.873E-4	3.386E-4	4.556E-4	9.020E-5	8.935E-5	8.053E-5	9.092E-5	7.427E-5	1.261E-4	7.242E-5	4.951E-5
N° 3 (Bias1)	2.185E-4	1.807E-4	4.135E-4	7.785E-5	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable*	7.517E-5	4.583E-5
N° 4 (Bias1)	2.090E-4	3.030E-4	4.699E-4	7.425E-5	8.918E-5	7.849E-5	9.304E-5	8.404E-5	1.168E-4	7.390E-5	5.399E-5
N° 5 (Bias1)	1.897E-4	2.587E-4	2.906E-4	8.258E-5	7.151E-5	8.069E-5	8.775E-5	8.302E-5	9.672E-5	7.884E-5	4.499E-5
N° 6 (Bias1)	1.964E-4	1.834E-4	2.992E-4	9.146E-5	7.650E-5	8.365E-5	9.439E-5	8.530E-5	1.046E-4	7.588E-5	4.854E-5
N° 7 (Bias2)	1.872E-4	1.906E-4	2.905E-4	7.231E-5	6.850E-5	8.107E-5	8.056E-5	8.543E-5	1.036E-4	7.634E-5	4.968E-5
N° 8 (Bias2)	1.504E-4	1.897E-4	2.701E-4	6.922E-5	7.468E-5	8.272E-5	9.295E-5	7.820E-5	9.401E-5	7.947E-5	8.224E-5
N° 9 (Bias2)	1.912E-4	1.712E-4	4.243E-4	7.184E-5	6.317E-5	8.297E-5	8.923E-5	1.240E-4	8.521E-5	7.596E-5	7.958E-5
N° 10 (Bias2)	7.157E-4	7.273E-4	9.804E-4	7.213E-4	6.220E-4	6.129E-4	6.055E-4	2.034E-4	1.931E-4	2.104E-2	1.535E-2
N° 11 (Bias2)	2.331E-4	5.254E-4	7.009E-4	4.574E-4	2.851E-4	4.266E-4	1.164E-3	9.001E-4	1.269E-4	7.841E-5	4.807E-5
N° 12 (OFF1)	1.859E-4	2.480E-4	2.923E-4	7.281E-5	7.307E-5	8.225E-5	9.274E-5	8.813E-5	9.363E-5	7.469E-5	4.609E-5
N° 13 (OFF1)	1.868E-4	1.991E-4	3.828E-4	7.074E-5	6.630E-5	8.268E-5	1.023E-4	8.800E-5	8.441E-5	7.452E-5	5.154E-5
N° 14 (OFF1)	1.729E-4	1.876E-4	3.982E-4	7.632E-5	7.552E-5	7.891E-5	Not Measurable*	Not Measurable*	Not Measurable*	7.536E-5	4.820E-5
N° 15 (OFF1)	1.741E-4	1.444E-4	4.282E-4	7.624E-5	6.656E-5	8.010E-5	9.358E-5	1.116E-4	1.131E-4	7.532E-5	4.799E-5
N° 16 (OFF1)	1.781E-4	1.886E-4	4.979E-4	7.303E-5	7.218E-5	7.752E-5	8.293E-5	9.020E-5	8.441E-5	7.651E-5	6.930E-5

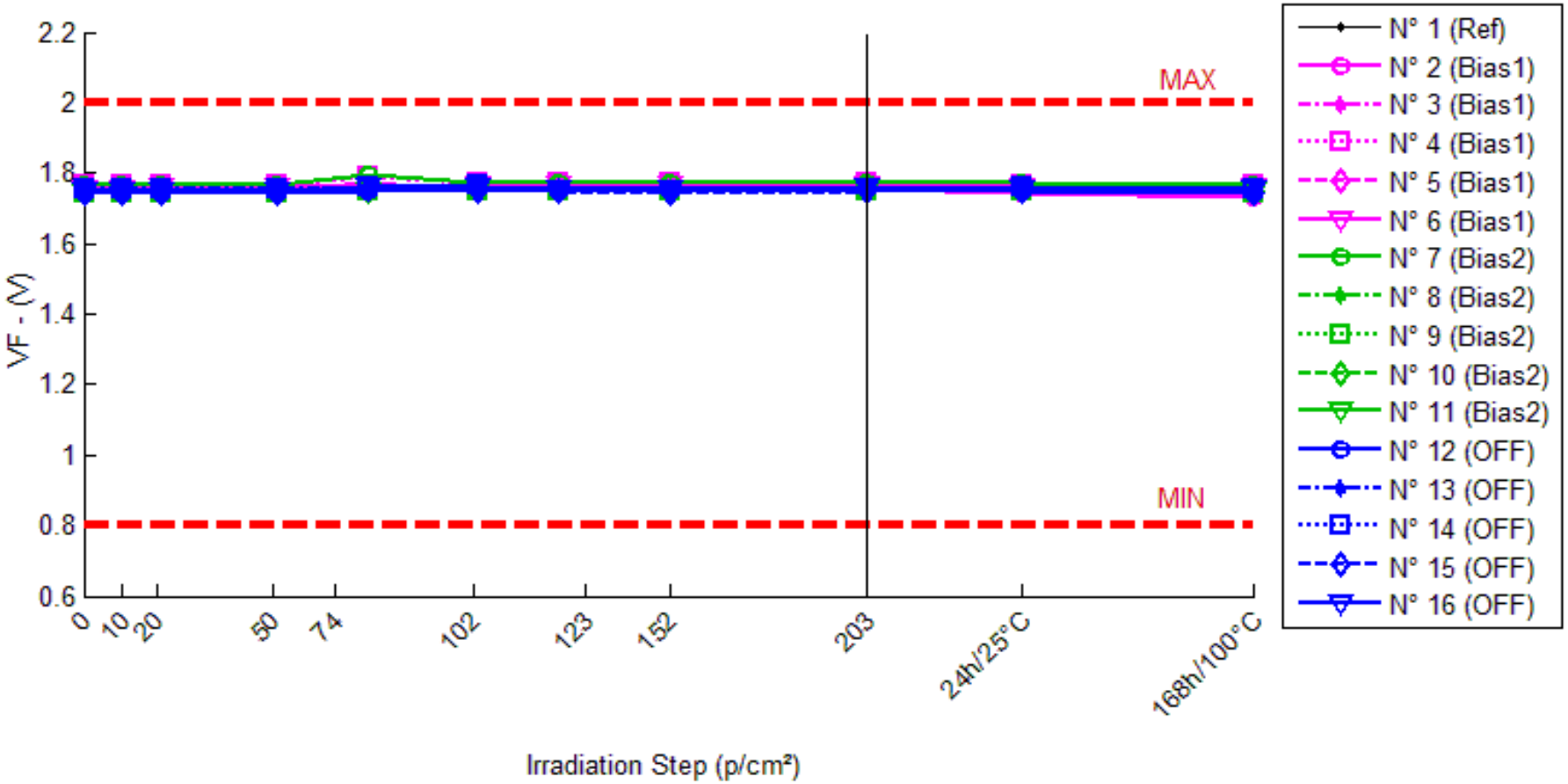
* Device not irradiated

Delta [Ir]

	0krad(Si)	10krad(Si)	20krad(Si)	50krad(Si)	74krad(Si)	102krad(Si)	123krad(Si)	152krad(Si)	203krad(Si)	24h/25°C	168h/100°C
N° 1 (Ref)	---	-1.889E-5	1.852E-4	-1.729E-4	-1.866E-4	-2.036E-4	-1.673E-4	-1.744E-4	-1.572E-4	-1.828E-4	-2.082E-4
N° 2 (Bias1)	---	1.513E-4	2.684E-4	-9.705E-5	-9.790E-5	-1.067E-4	-9.633E-5	-1.130E-4	-6.114E-5	-1.148E-4	-1.377E-4
N° 3 (Bias1)	---	-3.777E-5	1.951E-4	-1.406E-4	NaN	NaN	NaN	NaN	NaN	-1.433E-4	-1.726E-4
N° 4 (Bias1)	---	9.398E-5	2.609E-4	-1.348E-4	-1.199E-4	-1.305E-4	-1.160E-4	-1.250E-4	-9.219E-5	-1.351E-4	-1.550E-4
N° 5 (Bias1)	---	6.905E-5	1.009E-4	-1.071E-4	-1.182E-4	-1.090E-4	-1.019E-4	-1.066E-4	-9.294E-5	-1.108E-4	-1.447E-4
N° 6 (Bias1)	---	-1.302E-5	1.028E-4	-1.050E-4	-1.199E-4	-1.128E-4	-1.020E-4	-1.111E-4	-9.183E-5	-1.205E-4	-1.479E-4
N° 7 (Bias2)	---	3.415E-6	1.033E-4	-1.149E-4	-1.187E-4	-1.061E-4	-1.067E-4	-1.018E-4	-8.360E-5	-1.109E-4	-1.375E-4
N° 8 (Bias2)	---	3.935E-5	1.197E-4	-8.117E-5	-7.571E-5	-6.767E-5	-5.744E-5	-7.219E-5	-5.638E-5	-7.092E-5	-6.815E-5
N° 9 (Bias2)	---	-1.996E-5	2.332E-4	-1.193E-4	-1.280E-4	-1.082E-4	-1.019E-4	-6.718E-5	-1.060E-4	-1.152E-4	-1.116E-4
N° 10 (Bias2)	---	1.162E-5	2.647E-4	5.583E-6	-9.375E-5	-1.028E-4	-1.102E-4	-5.123E-4	-5.226E-4	2.033E-2	1.464E-2
N° 11 (Bias2)	---	2.923E-4	4.678E-4	2.243E-4	5.199E-5	1.935E-4	9.313E-4	6.670E-4	-1.062E-4	-1.547E-4	-1.850E-4
N° 12 (OFF1)	---	6.211E-5	1.063E-4	-1.131E-4	-1.129E-4	-1.037E-4	-9.321E-5	-9.781E-5	-9.231E-5	-1.113E-4	-1.399E-4
N° 13 (OFF1)	---	1.229E-5	1.960E-4	-1.161E-4	-1.205E-4	-1.042E-4	-8.458E-5	-9.882E-5	-1.024E-4	-1.123E-4	-1.353E-4
N° 14 (OFF1)	---	1.473E-5	2.253E-4	-9.657E-5	-9.737E-5	-9.398E-5	NaN	NaN	NaN	-9.753E-5	-1.247E-4
N° 15 (OFF1)	---	-2.972E-5	2.541E-4	-9.788E-5	-1.076E-4	-9.402E-5	-8.054E-5	-6.248E-5	-6.104E-5	-9.880E-5	-1.261E-4
N° 16 (OFF1)	---	1.050E-5	3.198E-4	-1.051E-4	-1.059E-4	-1.006E-4	-9.516E-5	-8.789E-5	-9.368E-5	-1.016E-4	-1.088E-4
Average (OFF1)	---	5.272E-5	1.856E-4	-1.169E-4	-1.140E-4	-1.147E-4	-1.041E-4	-1.139E-4	-8.452E-5	-1.249E-4	-1.516E-4
σ (OFF1)	---	7.779E-5	8.160E-5	1.946E-5	1.074E-5	1.082E-5	8.389E-6	7.845E-6	1.560E-5	1.380E-5	1.330E-5
Average+3σ (OFF1)	---	2.861E-4	4.304E-4	-5.851E-5	-8.175E-5	-8.229E-5	-7.890E-5	-9.040E-5	-3.773E-5	-8.352E-5	-1.117E-4
Average-3σ (OFF1)	---	-1.806E-4	-5.918E-5	-1.753E-4	-1.462E-4	-1.472E-4	-1.292E-4	-1.375E-4	-1.313E-4	-1.663E-4	-1.915E-4
Average (Bias1)	---	6.534E-5	2.377E-4	-1.710E-5	-7.284E-5	-3.826E-5	1.110E-4	-1.729E-5	-1.749E-4	3.975E-3	2.827E-3
σ (Bias1)	---	1.286E-4	1.464E-4	1.440E-4	7.276E-5	1.306E-4	4.590E-4	4.260E-4	1.954E-4	9.141E-3	6.602E-3
Average+3σ (Bias1)	---	4.512E-4	6.768E-4	4.148E-4	1.454E-4	3.536E-4	1.488E-3	1.261E-3	4.113E-4	3.140E-2	2.263E-2
Average-3σ (Bias1)	---	-3.206E-4	-2.013E-4	-4.490E-4	-2.911E-4	-4.301E-4	-1.266E-3	-1.295E-3	-7.612E-4	-2.345E-2	-1.698E-2
Average (Bias2)	---	1.398E-5	2.203E-4	-1.057E-4	-1.088E-4	-9.928E-5	-8.837E-5	-8.675E-5	-8.736E-5	-1.043E-4	-1.270E-4
σ (Bias2)	---	3.256E-5	7.849E-5	8.774E-6	8.581E-6	5.013E-6	6.958E-6	1.692E-5	1.811E-5	6.999E-6	1.196E-5
Average+3σ (Bias2)	---	1.117E-4	4.558E-4	-7.942E-5	-8.311E-5	-8.424E-5	-6.750E-5	-3.600E-5	-3.303E-5	-8.330E-5	-9.109E-5
Average-3σ (Bias2)	---	-8.370E-5	-1.517E-5	-1.321E-4	-1.346E-4	-1.143E-4	-1.092E-4	-1.375E-4	-1.417E-4	-1.253E-4	-1.628E-4

2. VF

Ta=25°C; If = 10 mA



VF . (V) **Min = 0.8 Max = 2.0**

	0krad(Si)	10krad(Si)	20krad(Si)	50krad(Si)	74krad(Si)	102krad(Si)	123krad(Si)	152krad(Si)	203krad(Si)	24h/25°C	168h/100°C
N° 1 (Ref)	1.747	1.747	1.751	1.751	1.755	1.750	1.754	1.754	1.755	1.753	1.748
N° 2 (Bias1)	1.747	1.746	1.750	1.749	1.770	1.751	1.755	1.753	1.754	1.745	1.730
N° 3 (Bias1)	1.745	1.744	1.747	1.745	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable*	1.746	1.742
N° 4 (Bias1)	1.765	1.764	1.768	1.765	1.789	1.771	1.773	1.773	1.773	1.768	1.765
N° 5 (Bias1)	1.757	1.755	1.759	1.759	1.762	1.764	1.765	1.765	1.766	1.761	1.758
N° 6 (Bias1)	1.757	1.755	1.759	1.758	1.761	1.764	1.764	1.764	1.765	1.761	1.759
N° 7 (Bias2)	1.766	1.765	1.769	1.767	1.794	1.773	1.772	1.772	1.774	1.770	1.767
N° 8 (Bias2)	1.747	1.746	1.749	1.748	1.758	1.754	1.752	1.753	1.755	1.751	1.748
N° 9 (Bias2)	1.743	1.742	1.745	1.744	1.751	1.750	1.749	1.749	1.749	1.747	1.745
N° 10 (Bias2)	1.746	1.745	1.747	1.746	1.748	1.752	1.751	1.748	1.753	1.750	1.747
N° 11 (Bias2)	1.745	1.744	1.747	1.746	1.748	1.752	1.750	1.751	1.753	1.750	1.747
N° 12 (OFF1)	1.745	1.744	1.746	1.745	1.747	1.752	1.750	1.749	1.752	1.749	1.746
N° 13 (OFF1)	1.751	1.751	1.752	1.752	1.755	1.758	1.756	1.755	1.758	1.756	1.753
N° 14 (OFF1)	1.756	1.756	1.757	1.757	1.760	1.764	Not Measurable*	Not Measurable*	Not Measurable*	1.761	1.757
N° 15 (OFF1)	1.742	1.742	1.744	1.743	1.754	1.750	1.748	1.746	1.750	1.747	1.744
N° 16 (OFF1)	1.751	1.750	1.751	1.751	1.761	1.758	1.756	1.754	1.758	1.755	1.753

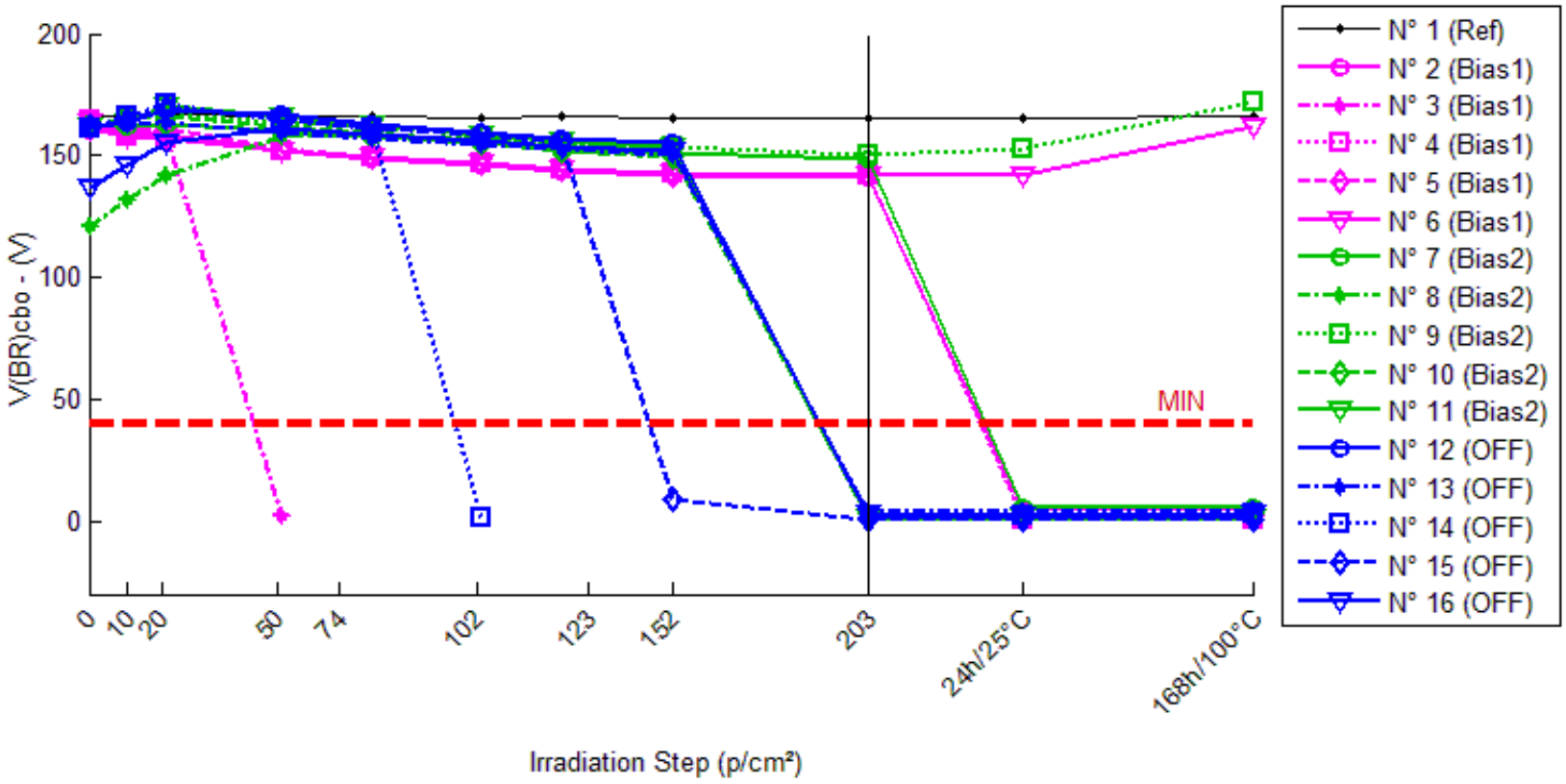
* Device not irradiated

Delta [VF]

	0krad(Si)	10krad(Si)	20krad(Si)	50krad(Si)	74krad(Si)	102krad(Si)	123krad(Si)	152krad(Si)	203krad(Si)	24h/25°C	168h/100°C
N° 1 (Ref)	---	-3.950E-4	3.984E-3	3.820E-3	8.022E-3	3.353E-3	6.861E-3	6.546E-3	7.638E-3	5.553E-3	6.370E-4
N° 2 (Bias1)	---	-8.590E-4	2.870E-3	2.090E-3	2.304E-2	3.940E-3	7.839E-3	6.627E-3	7.270E-3	-1.479E-3	-1.679E-2
N° 3 (Bias1)	---	-6.400E-4	2.507E-3	4.470E-4	NaN	NaN	NaN	NaN	NaN	1.142E-3	-2.748E-3
N° 4 (Bias1)	---	-7.920E-4	2.955E-3	6.310E-4	2.464E-2	6.481E-3	7.968E-3	7.929E-3	8.835E-3	3.069E-3	3.500E-5
N° 5 (Bias1)	---	-1.786E-3	2.066E-3	1.649E-3	4.786E-3	6.636E-3	7.556E-3	7.380E-3	8.653E-3	3.685E-3	4.780E-4
N° 6 (Bias1)	---	-1.215E-3	2.565E-3	1.715E-3	4.207E-3	7.105E-3	7.104E-3	7.604E-3	8.829E-3	4.761E-3	1.937E-3
N° 7 (Bias2)	---	-1.362E-3	2.488E-3	1.086E-3	2.784E-2	7.043E-3	6.101E-3	6.111E-3	8.120E-3	3.752E-3	1.230E-3
N° 8 (Bias2)	---	-1.383E-3	2.158E-3	9.920E-4	1.143E-2	6.879E-3	5.471E-3	5.801E-3	7.648E-3	3.828E-3	1.446E-3
N° 9 (Bias2)	---	-1.040E-3	2.123E-3	9.650E-4	7.514E-3	6.801E-3	5.514E-3	5.363E-3	5.863E-3	3.952E-3	1.666E-3
N° 10 (Bias2)	---	-9.840E-4	1.902E-3	-3.000E-6	2.617E-3	6.076E-3	5.333E-3	2.593E-3	7.013E-3	3.972E-3	9.920E-4
N° 11 (Bias2)	---	-1.495E-3	1.559E-3	4.650E-4	2.522E-3	6.728E-3	4.851E-3	5.268E-3	7.075E-3	4.187E-3	1.633E-3
N° 12 (OFF1)	---	-1.290E-3	7.600E-4	6.730E-4	1.796E-3	7.043E-3	4.766E-3	4.450E-3	6.905E-3	3.749E-3	1.671E-3
N° 13 (OFF1)	---	-1.030E-4	1.005E-3	1.500E-3	4.070E-3	7.466E-3	5.619E-3	4.021E-3	7.737E-3	5.030E-3	2.648E-3
N° 14 (OFF1)	---	-3.160E-4	3.530E-4	1.044E-3	3.418E-3	7.717E-3	NaN	NaN	NaN	4.536E-3	2.230E-4
N° 15 (OFF1)	---	-2.060E-4	1.399E-3	7.980E-4	1.224E-2	7.976E-3	5.372E-3	3.791E-3	7.800E-3	4.735E-3	2.035E-3
N° 16 (OFF1)	---	-1.373E-3	2.760E-4	5.200E-5	1.034E-2	6.792E-3	4.631E-3	3.496E-3	7.224E-3	4.148E-3	1.642E-3
Average (OFF1)	---	-1.058E-3	2.593E-3	1.306E-3	1.417E-2	6.040E-3	7.617E-3	7.385E-3	8.397E-3	2.236E-3	-3.417E-3
σ (OFF1)	---	4.582E-4	3.513E-4	7.234E-4	1.119E-2	1.425E-3	3.827E-4	5.533E-4	7.559E-4	2.458E-3	7.665E-3
Average+3σ (OFF1)	---	3.161E-4	3.647E-3	3.477E-3	4.774E-2	1.032E-2	8.765E-3	9.045E-3	1.066E-2	9.610E-3	1.958E-2
Average-3σ (OFF1)	---	-2.433E-3	1.539E-3	-8.637E-4	-1.940E-2	1.765E-3	6.469E-3	5.725E-3	6.129E-3	-5.138E-3	-2.641E-2
Average (Bias1)	---	-1.253E-3	2.046E-3	7.010E-4	1.038E-2	6.705E-3	5.454E-3	5.027E-3	7.144E-3	3.938E-3	1.393E-3
σ (Bias1)	---	2.264E-4	3.434E-4	4.620E-4	1.044E-2	3.708E-4	4.474E-4	1.403E-3	8.470E-4	1.659E-4	2.839E-4
Average+3σ (Bias1)	---	-5.735E-4	3.076E-3	2.087E-3	4.171E-2	7.818E-3	6.796E-3	9.235E-3	9.685E-3	4.436E-3	2.245E-3
Average-3σ (Bias1)	---	-1.932E-3	1.016E-3	-6.851E-4	-2.094E-2	5.593E-3	4.112E-3	8.193E-4	4.603E-3	3.441E-3	5.418E-4
Average (Bias2)	---	-6.576E-4	7.586E-4	8.134E-4	6.372E-3	7.399E-3	5.097E-3	3.940E-3	7.416E-3	4.440E-3	1.644E-3
σ (Bias2)	---	6.205E-4	4.659E-4	5.302E-4	4.613E-3	4.831E-4	4.743E-4	4.025E-4	4.276E-4	5.018E-4	8.917E-4
Average+3σ (Bias2)	---	1.204E-3	2.156E-3	2.404E-3	2.021E-2	8.848E-3	6.520E-3	5.147E-3	8.699E-3	5.945E-3	4.319E-3
Average-3σ (Bias2)	---	-2.519E-3	-6.391E-4	-7.771E-4	-7.466E-3	5.949E-3	3.674E-3	2.732E-3	6.134E-3	2.934E-3	-1.031E-3

3. V(BR)cbo

Ta=25°C; Ic = 100 µA; If = 0



V(BR)cbo . (V) **Min = 40.0**

	0krad(Si)	10krad(Si)	20krad(Si)	50krad(Si)	74krad(Si)	102krad(Si)	123krad(Si)	152krad(Si)	203krad(Si)	24h/25°C	168h/100°C
N° 1 (Ref)	166.12	165.99	166.58	165.86	165.94	165.44	165.74	165.70	165.52	165.63	165.80
N° 2 (Bias1)	160.27	158.70	158.74	151.54	148.87	146.24	143.84	142.14	140.88	4.54	4.67
N° 3 (Bias1)	163.04	157.76	157.44	2.17	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable*	2.26	2.24
N° 4 (Bias1)	164.10	157.58	157.09	151.75	149.42	146.86	144.44	142.61	141.84	0.52	0.50
N° 5 (Bias1)	161.47	160.34	160.75	152.81	149.76	147.07	144.22	142.29	141.76	1.92	1.96
N° 6 (Bias1)	163.65	157.62	157.04	151.70	149.58	146.98	144.40	142.57	141.85	141.69	162.14
N° 7 (Bias2)	163.19	162.21	162.60	160.62	157.96	154.89	152.27	150.66	148.30	5.55	5.36
N° 8 (Bias2)	120.88	131.54	141.70	157.35	158.04	156.80	154.69	152.84	0.36	0.38	0.34
N° 9 (Bias2)	161.31	164.81	167.10	163.77	162.04	157.62	155.13	153.41	150.57	152.91	171.71
N° 10 (Bias2)	161.71	164.89	165.92	162.33	159.17	155.64	151.83	149.70	1.65	0.77	0.73
N° 11 (Bias2)	161.57	163.53	170.24	166.39	162.66	158.47	155.72	153.69	1.39	1.45	1.75
N° 12 (OFF)	160.75	163.77	168.93	166.82	162.94	159.49	157.05	155.35	1.22	1.00	0.99
N° 13 (OFF)	162.89	163.03	163.52	159.56	156.88	154.79	152.45	150.47	4.17	3.71	4.62
N° 14 (OFF)	160.76	166.42	171.11	164.53	161.03	1.39	Not Measurable*	Not Measurable*	Not Measurable*	2.46	2.87
N° 15 (OFF)	162.00	164.38	169.55	165.41	161.31	158.49	155.26	8.57	0.74	0.75	0.76
N° 16 (OFF)	136.72	146.25	154.90	161.30	158.86	156.26	153.25	151.68	3.03	2.27	2.62

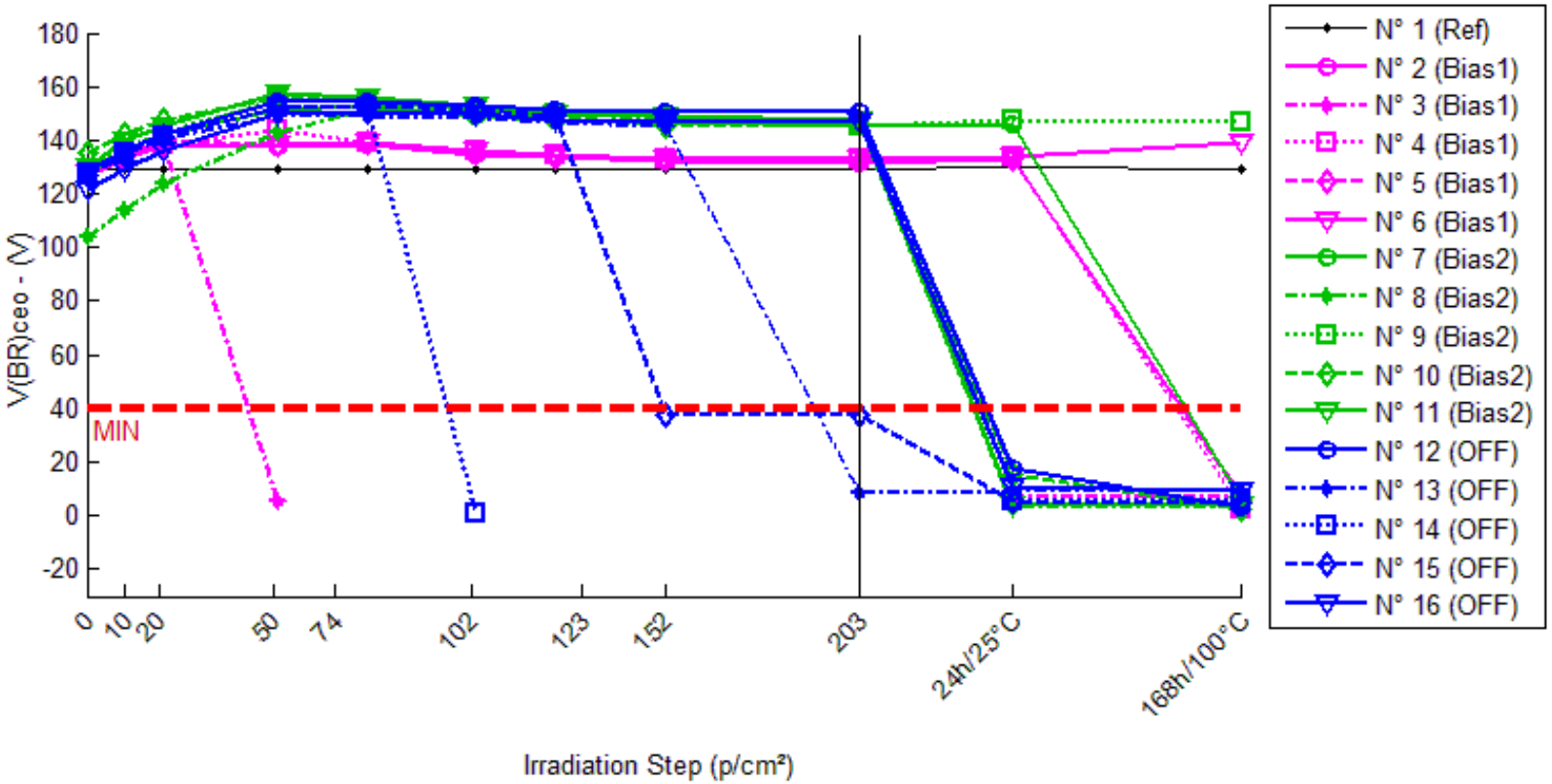
* Device not irradiated

Delta [V(BR)cbo]

	0krad(Si)	10krad(Si)	20krad(Si)	50krad(Si)	74krad(Si)	102krad(Si)	123krad(Si)	152krad(Si)	203krad(Si)	24h/25°C	168h/100°C
N° 1 (Ref)	---	-1.333E-1	4.574E-1	-2.582E-1	-1.795E-1	-6.820E-1	-3.789E-1	-4.186E-1	-6.063E-1	-4.939E-1	-3.228E-1
N° 2 (Bias1)	---	-1.567E+0	-1.527E+0	-8.726E+0	-1.140E+1	-1.403E+1	-1.643E+1	-1.813E+1	-1.939E+1	-1.557E+2	-1.556E+2
N° 3 (Bias1)	---	-5.281E+0	-5.599E+0	-1.609E+2	NaN	NaN	NaN	NaN	NaN	-1.608E+2	-1.608E+2
N° 4 (Bias1)	---	-6.518E+0	-7.004E+0	-1.235E+1	-1.468E+1	-1.724E+1	-1.966E+1	-2.149E+1	-2.225E+1	-1.636E+2	-1.636E+2
N° 5 (Bias1)	---	-1.127E+0	-7.174E-1	-8.661E+0	-1.171E+1	-1.439E+1	-1.725E+1	-1.917E+1	-1.971E+1	-1.596E+2	-1.595E+2
N° 6 (Bias1)	---	-6.022E+0	-6.606E+0	-1.195E+1	-1.407E+1	-1.667E+1	-1.924E+1	-2.107E+1	-2.179E+1	-2.195E+1	-1.504E+0
N° 7 (Bias2)	---	-9.748E-1	-5.841E-1	-2.564E+0	-5.228E+0	-8.299E+0	-1.091E+1	-1.252E+1	-1.489E+1	-1.576E+2	-1.578E+2
N° 8 (Bias2)	---	1.067E+1	2.082E+1	3.648E+1	3.717E+1	3.592E+1	3.382E+1	3.196E+1	-1.205E+2	-1.205E+2	-1.205E+2
N° 9 (Bias2)	---	3.505E+0	5.791E+0	2.463E+0	7.268E-1	-3.690E+0	-6.180E+0	-7.900E+0	-1.074E+1	-8.398E+0	1.040E+1
N° 10 (Bias2)	---	3.183E+0	4.204E+0	6.197E-1	-2.541E+0	-6.073E+0	-9.881E+0	-1.202E+1	-1.601E+2	-1.609E+2	-1.610E+2
N° 11 (Bias2)	---	1.967E+0	8.673E+0	4.822E+0	1.098E+0	-3.096E+0	-5.849E+0	-7.873E+0	-1.602E+2	-1.601E+2	-1.598E+2
N° 12 (OFF1)	---	3.018E+0	8.173E+0	6.067E+0	2.185E+0	-1.260E+0	-3.702E+0	-5.405E+0	-1.595E+2	-1.598E+2	-1.598E+2
N° 13 (OFF1)	---	1.373E-1	6.295E-1	-3.338E+0	-6.015E+0	-8.106E+0	-1.044E+1	-1.243E+1	-1.587E+2	-1.592E+2	-1.583E+2
N° 14 (OFF1)	---	5.653E+0	1.035E+1	3.767E+0	2.689E-1	-1.594E+2	NaN	NaN	NaN	-1.583E+2	-1.579E+2
N° 15 (OFF1)	---	2.375E+0	7.549E+0	3.408E+0	-6.931E-1	-3.510E+0	-6.746E+0	-1.534E+2	-1.613E+2	-1.612E+2	-1.612E+2
N° 16 (OFF1)	---	9.527E+0	1.818E+1	2.458E+1	2.214E+1	1.954E+1	1.653E+1	1.496E+1	-1.337E+2	-1.345E+2	-1.341E+2
Average (OFF1)	---	-4.103E+0	-4.290E+0	-4.051E+1	-1.296E+1	-1.558E+1	-1.815E+1	-1.997E+1	-2.079E+1	-1.323E+2	-1.282E+2
σ (OFF1)	---	2.559E+0	2.951E+0	6.731E+1	1.650E+0	1.606E+0	1.555E+0	1.586E+0	1.445E+0	6.176E+1	7.089E+1
Average+3σ (OFF1)	---	3.573E+0	4.563E+0	1.614E+2	-8.013E+0	-1.076E+1	-1.348E+1	-1.521E+1	-1.645E+1	5.297E+1	8.445E+1
Average-3σ (OFF1)	---	-1.178E+1	-1.314E+1	-2.424E+2	-1.791E+1	-2.040E+1	-2.281E+1	-2.473E+1	-2.512E+1	-3.176E+2	-3.409E+2
Average (Bias1)	---	3.669E+0	7.782E+0	8.364E+0	6.244E+0	2.953E+0	1.988E-1	-1.670E+0	-9.327E+1	-1.215E+2	-1.178E+2
σ (Bias1)	---	4.292E+0	8.025E+0	1.595E+1	1.748E+1	1.855E+1	1.893E+1	1.893E+1	7.522E+1	6.547E+1	7.361E+1
Average+3σ (Bias1)	---	1.655E+1	3.186E+1	5.620E+1	5.868E+1	5.859E+1	5.697E+1	5.512E+1	1.324E+2	7.489E+1	1.031E+2
Average-3σ (Bias1)	---	-9.207E+0	-1.629E+1	-3.948E+1	-4.619E+1	-5.269E+1	-5.658E+1	-5.846E+1	-3.189E+2	-3.179E+2	-3.386E+2
Average (Bias2)	---	4.142E+0	8.977E+0	6.897E+0	3.578E+0	-3.054E+1	-1.092E+0	-3.908E+1	-1.533E+2	-1.546E+2	-1.543E+2
σ (Bias2)	---	3.595E+0	6.304E+0	1.049E+1	1.082E+1	7.280E+1	1.206E+1	7.712E+1	1.312E+1	1.131E+1	1.134E+1
Average+3σ (Bias2)	---	1.493E+1	2.789E+1	3.837E+1	3.602E+1	1.879E+2	3.510E+1	1.923E+2	-1.140E+2	-1.207E+2	-1.202E+2
Average-3σ (Bias2)	---	-6.644E+0	-9.936E+0	-2.458E+1	-2.887E+1	-2.489E+2	-3.729E+1	-2.704E+2	-1.926E+2	-1.885E+2	-1.883E+2

4. V(BR)ceo

Ta=25°C; Ic = 1 mA; Ib = 0; If = 0



V(BR)ceo . (V) **Min = 40.0**

	0krad(Si)	10krad(Si)	20krad(Si)	50krad(Si)	74krad(Si)	102krad(Si)	123krad(Si)	152krad(Si)	203krad(Si)	24h/25°C	168h/100°C
N° 1 (Ref)	129.87	129.54	129.34	129.42	129.46	129.49	129.47	129.43	129.39	129.93	129.58
N° 2 (Bias1)	127.11	133.19	138.12	137.70	138.65	134.66	133.66	132.33	131.80	132.75	8.18
N° 3 (Bias1)	127.14	133.49	138.46	5.61	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable*	7.41	7.47
N° 4 (Bias1)	128.99	135.28	138.38	144.05	139.40	135.78	134.63	133.31	132.88	133.61	2.80
N° 5 (Bias1)	128.34	134.69	139.90	138.59	139.15	135.48	134.16	132.74	132.25	133.33	6.14
N° 6 (Bias1)	127.87	133.48	137.87	138.51	139.52	135.96	134.65	133.28	132.82	133.89	138.84
N° 7 (Bias2)	127.61	136.12	142.04	151.39	152.69	149.40	147.26	146.49	145.08	145.94	6.32
N° 8 (Bias2)	104.15	113.93	123.86	142.90	151.59	151.83	149.55	148.15	147.08	3.32	3.50
N° 9 (Bias2)	128.72	136.95	143.01	155.49	154.13	151.66	149.61	148.40	145.09	147.31	146.51
N° 10 (Bias2)	135.07	142.15	147.84	155.87	154.48	151.64	149.04	145.44	146.28	15.59	2.81
N° 11 (Bias2)	129.95	139.81	145.23	157.77	155.75	152.94	150.21	148.73	147.52	3.80	3.76
N° 12 (OFF1)	128.80	136.23	142.01	154.34	154.46	153.04	151.11	150.35	150.30	17.92	3.05
N° 13 (OFF1)	127.99	135.02	140.30	148.87	149.22	148.00	146.79	144.95	8.50	9.24	9.53
N° 14 (OFF1)	128.06	135.54	141.30	152.41	151.95	0.92	Not Measurable*	Not Measurable*	Not Measurable*	5.26	5.24
N° 15 (OFF1)	127.14	134.37	141.12	152.10	152.99	151.64	149.44	37.83	37.94	5.13	5.05
N° 16 (OFF1)	121.58	129.31	136.07	149.89	150.81	149.55	147.71	146.95	147.05	10.57	9.41

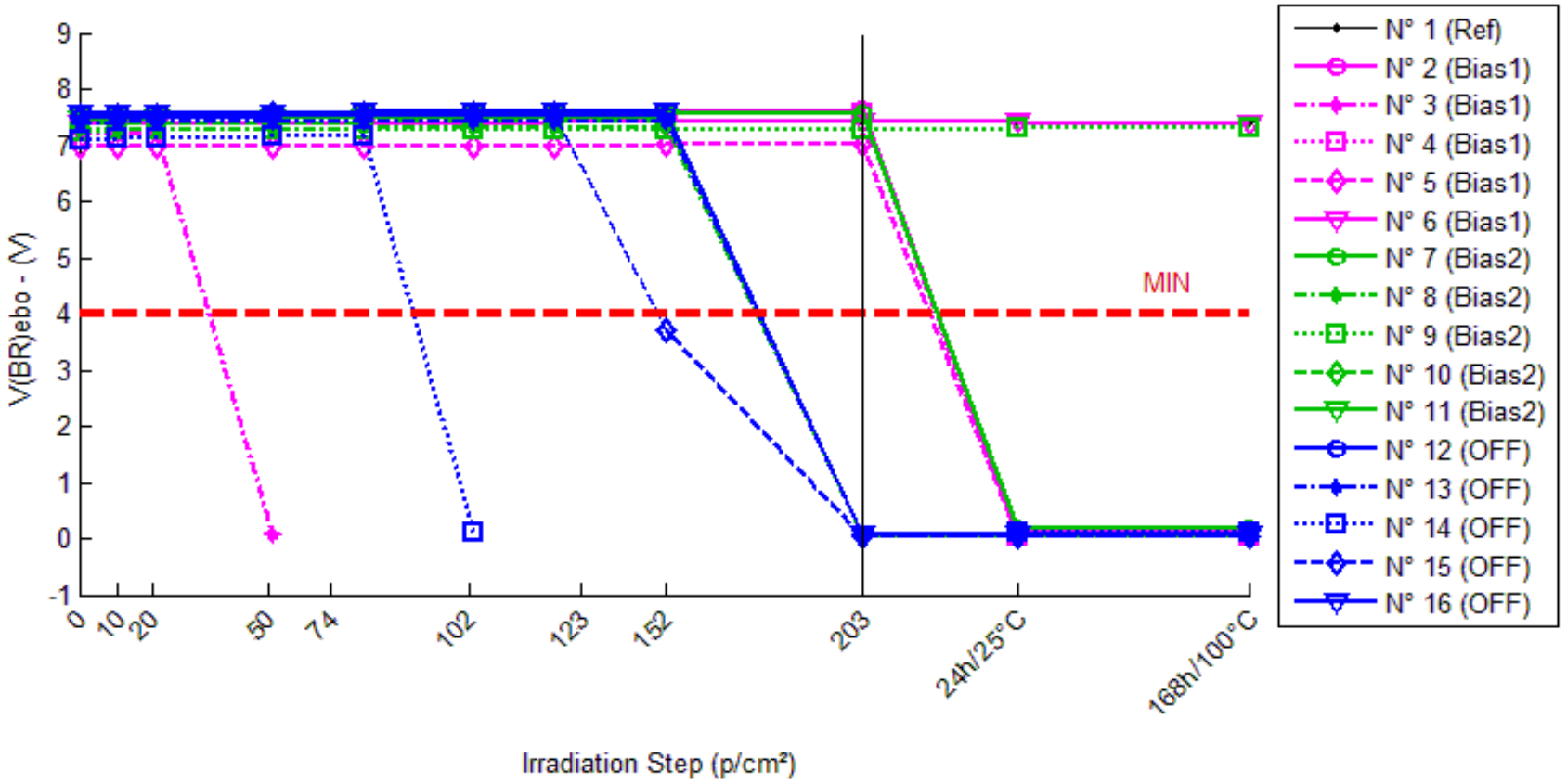
* Device not irradiated

Delta [V(BR)ceo]

	0krad(Si)	10krad(Si)	20krad(Si)	50krad(Si)	74krad(Si)	102krad(Si)	123krad(Si)	152krad(Si)	203krad(Si)	24h/25°C	168h/100°C
N° 1 (Ref)	---	-3.302E-1	-5.293E-1	-4.564E-1	-4.150E-1	-3.809E-1	-4.012E-1	-4.404E-1	-4.823E-1	5.370E-2	-2.895E-1
N° 2 (Bias1)	---	6.075E+0	1.101E+1	1.058E+1	1.154E+1	7.552E+0	6.547E+0	5.222E+0	4.687E+0	5.633E+0	-1.189E+2
N° 3 (Bias1)	---	6.349E+0	1.131E+1	-1.215E+2	NaN	NaN	NaN	NaN	NaN	-1.197E+2	-1.197E+2
N° 4 (Bias1)	---	6.283E+0	9.381E+0	1.506E+1	1.041E+1	6.785E+0	5.638E+0	4.321E+0	3.886E+0	4.614E+0	-1.262E+2
N° 5 (Bias1)	---	6.353E+0	1.156E+1	1.026E+1	1.081E+1	7.143E+0	5.822E+0	4.406E+0	3.909E+0	4.990E+0	-1.222E+2
N° 6 (Bias1)	---	5.608E+0	1.000E+1	1.064E+1	1.165E+1	8.093E+0	6.783E+0	5.412E+0	4.945E+0	6.014E+0	1.096E+1
N° 7 (Bias2)	---	8.511E+0	1.444E+1	2.378E+1	2.508E+1	2.180E+1	1.965E+1	1.888E+1	1.748E+1	1.833E+1	-1.213E+2
N° 8 (Bias2)	---	9.779E+0	1.971E+1	3.875E+1	4.744E+1	4.767E+1	4.539E+1	4.400E+1	4.293E+1	-1.008E+2	-1.007E+2
N° 9 (Bias2)	---	8.231E+0	1.429E+1	2.677E+1	2.542E+1	2.294E+1	2.089E+1	1.968E+1	1.637E+1	1.859E+1	1.779E+1
N° 10 (Bias2)	---	7.083E+0	1.277E+1	2.080E+1	1.941E+1	1.657E+1	1.397E+1	1.037E+1	1.121E+1	-1.195E+2	-1.323E+2
N° 11 (Bias2)	---	9.862E+0	1.528E+1	2.783E+1	2.580E+1	2.299E+1	2.026E+1	1.878E+1	1.757E+1	-1.262E+2	-1.262E+2
N° 12 (OFF1)	---	7.429E+0	1.321E+1	2.554E+1	2.566E+1	2.424E+1	2.231E+1	2.154E+1	2.150E+1	-1.109E+2	-1.258E+2
N° 13 (OFF1)	---	7.033E+0	1.231E+1	2.089E+1	2.124E+1	2.001E+1	1.880E+1	1.697E+1	-1.195E+2	-1.188E+2	-1.185E+2
N° 14 (OFF1)	---	7.478E+0	1.324E+1	2.434E+1	2.389E+1	-1.271E+2	NaN	NaN	NaN	-1.228E+2	-1.228E+2
N° 15 (OFF1)	---	7.228E+0	1.397E+1	2.496E+1	2.585E+1	2.449E+1	2.230E+1	-8.931E+1	-8.920E+1	-1.220E+2	-1.221E+2
N° 16 (OFF1)	---	7.732E+0	1.449E+1	2.831E+1	2.923E+1	2.797E+1	2.613E+1	2.537E+1	2.547E+1	-1.110E+2	-1.122E+2
Average (OFF1)	---	6.133E+0	1.065E+1	-1.500E+1	1.110E+1	7.393E+0	6.197E+0	4.840E+0	4.357E+0	-1.970E+1	-9.521E+1
σ (OFF1)	---	3.151E-1	9.262E-1	5.959E+1	5.926E-1	5.622E-1	5.538E-1	5.571E-1	5.406E-1	5.592E+1	5.942E+1
Average+3σ (OFF1)	---	7.079E+0	1.343E+1	1.638E+2	1.288E+1	9.080E+0	7.859E+0	6.512E+0	5.978E+0	1.481E+2	8.305E+1
Average-3σ (OFF1)	---	5.188E+0	7.875E+0	-1.938E+2	9.323E+0	5.707E+0	4.536E+0	3.169E+0	2.735E+0	-1.875E+2	-2.735E+2
Average (Bias1)	---	8.693E+0	1.530E+1	2.759E+1	2.863E+1	2.639E+1	2.403E+1	2.234E+1	2.111E+1	-6.191E+1	-9.252E+1
σ (Bias1)	---	1.160E+0	2.628E+0	6.815E+0	1.084E+1	1.219E+1	1.226E+1	1.269E+1	1.247E+1	7.395E+1	6.280E+1
Average+3σ (Bias1)	---	1.217E+1	2.318E+1	4.803E+1	6.114E+1	6.295E+1	6.080E+1	6.041E+1	5.853E+1	1.599E+2	9.588E+1
Average-3σ (Bias1)	---	5.213E+0	7.415E+0	7.141E+0	-3.883E+0	-1.016E+1	-1.274E+1	-1.573E+1	-1.631E+1	-2.838E+2	-2.809E+2
Average (Bias2)	---	7.380E+0	1.344E+1	2.481E+1	2.517E+1	-6.085E+0	2.238E+1	-6.357E+0	-4.043E+1	-1.171E+2	-1.203E+2
σ (Bias2)	---	2.641E-1	8.305E-1	2.667E+0	2.929E+0	6.773E+1	2.992E+0	5.541E+1	7.485E+1	5.813E+0	5.214E+0
Average+3σ (Bias2)	---	8.172E+0	1.594E+1	3.281E+1	3.396E+1	1.971E+2	3.136E+1	1.599E+2	1.841E+2	-9.965E+1	-1.046E+2
Average-3σ (Bias2)	---	6.588E+0	1.095E+1	1.681E+1	1.638E+1	-2.093E+2	1.341E+1	-1.726E+2	-2.650E+2	-1.345E+2	-1.359E+2

5. V(BR)ebo

Ta=25°C; Ic = 0; Ie = 100 µA; If = 0



V(BR)ebo . (V) **Min = 4.0**

	0krad(Si)	10krad(Si)	20krad(Si)	50krad(Si)	74krad(Si)	102krad(Si)	123krad(Si)	152krad(Si)	203krad(Si)	24h/25°C	168h/100°C
N° 1 (Ref)	7.437	7.438	7.436	7.434	7.432	7.423	7.429	7.429	7.424	7.426	7.430
N° 2 (Bias1)	7.548	7.557	7.561	7.575	7.585	7.592	7.603	7.610	7.622	0.102	0.101
N° 3 (Bias1)	7.187	7.194	7.199	0.088	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable*	0.087	0.087
N° 4 (Bias1)	7.504	7.512	7.514	7.525	7.534	7.536	7.548	7.559	7.563	0.031	0.030
N° 5 (Bias1)	6.964	6.970	6.973	6.983	6.988	6.990	6.999	7.004	7.010	0.045	0.045
N° 6 (Bias1)	7.380	7.380	7.381	7.390	7.396	7.396	7.404	7.412	7.421	7.424	7.397
N° 7 (Bias2)	7.527	7.535	7.540	7.551	7.559	7.561	7.569	7.572	7.573	0.198	0.190
N° 8 (Bias2)	7.275	7.278	7.280	7.289	7.294	7.294	7.301	7.304	0.067	0.067	0.066
N° 9 (Bias2)	7.254	7.258	7.261	7.272	7.275	7.276	7.283	7.287	7.287	7.291	7.321
N° 10 (Bias2)	7.380	7.385	7.389	7.399	7.413	7.404	7.413	7.417	0.051	0.050	0.048
N° 11 (Bias2)	7.465	7.471	7.477	7.484	7.487	7.484	7.491	7.495	0.070	0.070	0.070
N° 12 (OFF)	7.497	7.500	7.505	7.513	7.517	7.515	7.524	7.530	0.081	0.070	0.070
N° 13 (OFF)	7.399	7.403	7.406	7.416	7.419	7.418	7.426	7.430	0.023	0.023	0.022
N° 14 (OFF)	7.105	7.119	7.129	7.148	7.156	0.114	Not Measurable*	Not Measurable*	Not Measurable*	0.114	0.107
N° 15 (OFF)	7.529	7.535	7.541	7.551	7.557	7.556	7.565	3.707	0.037	0.037	0.036
N° 16 (OFF)	7.551	7.555	7.562	7.575	7.582	7.583	7.592	7.599	0.057	0.057	0.056

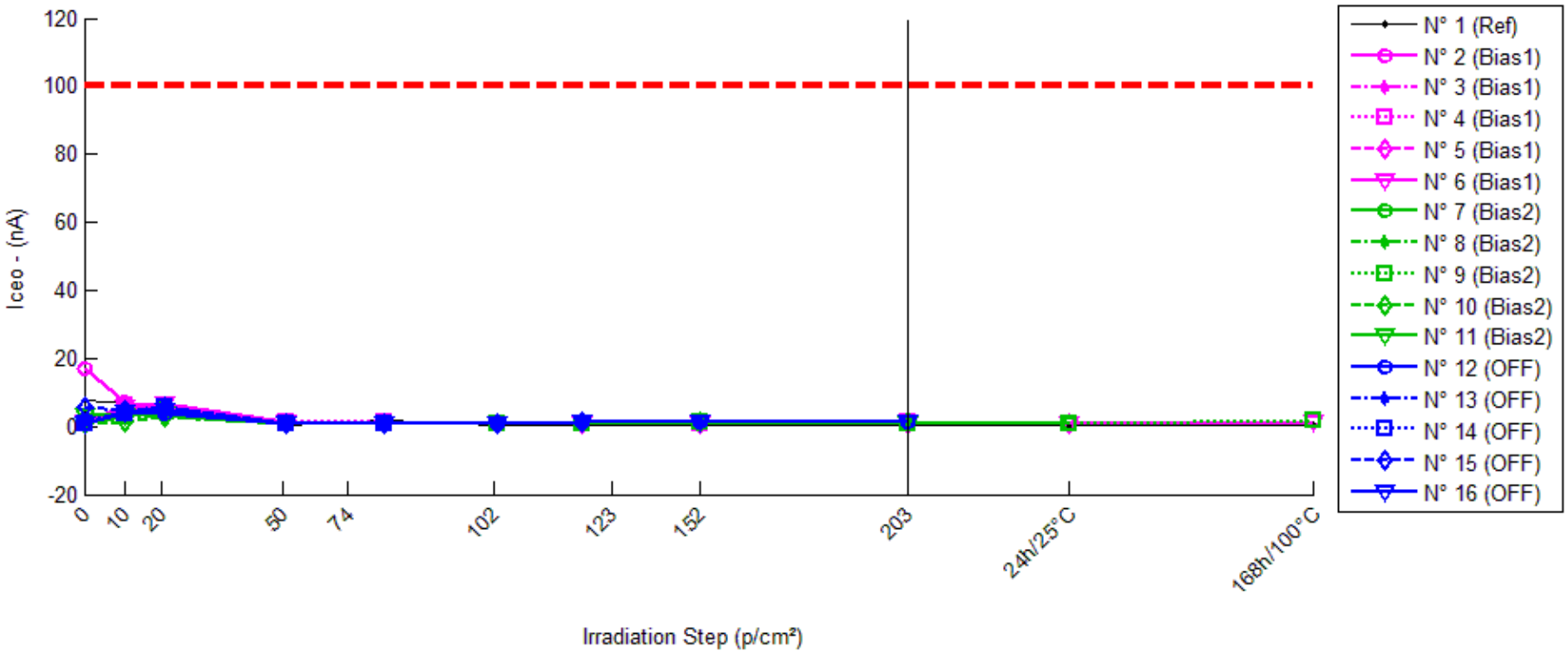
* Device not irradiated

Delta [V(BR)ebo]

	0krad(Si)	10krad(Si)	20krad(Si)	50krad(Si)	74krad(Si)	102krad(Si)	123krad(Si)	152krad(Si)	203krad(Si)	24h/25°C	168h/100°C
N° 1 (Ref)	---	3.400E-4	-1.239E-3	-3.497E-3	-4.724E-3	-1.372E-2	-8.088E-3	-8.301E-3	-1.338E-2	-1.135E-2	-6.987E-3
N° 2 (Bias1)	---	8.330E-3	1.252E-2	2.698E-2	3.602E-2	4.349E-2	5.495E-2	6.191E-2	7.362E-2	-7.446E+0	-7.447E+0
N° 3 (Bias1)	---	7.160E-3	1.197E-2	-7.099E+0	NaN	NaN	NaN	NaN	NaN	-7.101E+0	-7.100E+0
N° 4 (Bias1)	---	8.304E-3	1.060E-2	2.095E-2	2.997E-2	3.233E-2	4.398E-2	5.507E-2	5.954E-2	-7.473E+0	-7.474E+0
N° 5 (Bias1)	---	5.643E-3	8.477E-3	1.843E-2	2.313E-2	2.522E-2	3.404E-2	3.970E-2	4.511E-2	-6.919E+0	-6.919E+0
N° 6 (Bias1)	---	1.910E-4	1.476E-3	9.984E-3	1.583E-2	1.623E-2	2.439E-2	3.270E-2	4.084E-2	4.423E-2	1.752E-2
N° 7 (Bias2)	---	8.009E-3	1.227E-2	2.404E-2	3.187E-2	3.362E-2	4.121E-2	4.447E-2	4.570E-2	-7.329E+0	-7.337E+0
N° 8 (Bias2)	---	2.946E-3	4.798E-3	1.427E-2	1.870E-2	1.831E-2	2.560E-2	2.865E-2	-7.209E+0	-7.208E+0	-7.209E+0
N° 9 (Bias2)	---	4.020E-3	7.787E-3	1.793E-2	2.146E-2	2.243E-2	2.923E-2	3.351E-2	3.337E-2	3.734E-2	6.751E-2
N° 10 (Bias2)	---	5.013E-3	9.235E-3	1.932E-2	3.324E-2	2.403E-2	3.275E-2	3.713E-2	-7.329E+0	-7.330E+0	-7.331E+0
N° 11 (Bias2)	---	5.738E-3	1.233E-2	1.852E-2	2.176E-2	1.907E-2	2.628E-2	2.946E-2	-7.395E+0	-7.395E+0	-7.395E+0
N° 12 (OFF1)	---	2.250E-3	7.566E-3	1.565E-2	1.948E-2	1.720E-2	2.689E-2	3.298E-2	-7.417E+0	-7.427E+0	-7.427E+0
N° 13 (OFF1)	---	3.494E-3	6.687E-3	1.665E-2	1.965E-2	1.864E-2	2.652E-2	3.103E-2	-7.377E+0	-7.377E+0	-7.377E+0
N° 14 (OFF1)	---	1.322E-2	2.377E-2	4.268E-2	5.097E-2	-6.992E+0	NaN	NaN	NaN	-6.992E+0	-6.998E+0
N° 15 (OFF1)	---	5.895E-3	1.152E-2	2.233E-2	2.758E-2	2.712E-2	3.538E-2	-3.822E+0	-7.492E+0	-7.492E+0	-7.493E+0
N° 16 (OFF1)	---	4.343E-3	1.087E-2	2.386E-2	3.143E-2	3.186E-2	4.082E-2	4.762E-2	-7.494E+0	-7.494E+0	-7.495E+0
Average (OFF1)	---	5.926E-3	9.007E-3	-1.404E+0	2.624E-2	2.932E-2	3.934E-2	4.734E-2	5.478E-2	-5.779E+0	-5.785E+0
σ (OFF1)	---	3.388E-3	4.489E-3	3.183E+0	8.709E-3	1.152E-2	1.312E-2	1.347E-2	1.489E-2	3.264E+0	3.252E+0
Average+3σ (OFF1)	---	1.609E-2	2.248E-2	8.145E+0	5.236E-2	6.386E-2	7.871E-2	8.776E-2	9.945E-2	4.012E+0	3.971E+0
Average-3σ (OFF1)	---	-4.240E-3	-4.461E-3	-1.095E+1	1.095E-4	-5.228E-3	-3.319E-5	6.926E-3	1.010E-2	-1.557E+1	-1.554E+1
Average (Bias1)	---	5.145E-3	9.284E-3	1.881E-2	2.541E-2	2.349E-2	3.102E-2	3.464E-2	-4.371E+0	-5.845E+0	-5.841E+0
σ (Bias1)	---	1.915E-3	3.185E-3	3.502E-3	6.655E-3	6.133E-3	6.363E-3	6.457E-3	4.027E+0	3.289E+0	3.304E+0
Average+3σ (Bias1)	---	1.089E-2	1.884E-2	2.932E-2	4.537E-2	4.189E-2	5.011E-2	5.401E-2	7.709E+0	4.022E+0	4.070E+0
Average-3σ (Bias1)	---	-6.006E-4	-2.697E-4	8.309E-3	5.443E-3	5.092E-3	1.193E-2	1.527E-2	-1.645E+1	-1.571E+1	-1.575E+1
Average (Bias2)	---	5.841E-3	1.208E-2	2.423E-2	2.982E-2	-1.379E+0	3.240E-2	-9.277E-1	-7.445E+0	-7.356E+0	-7.358E+0
σ (Bias2)	---	4.333E-3	6.854E-3	1.090E-2	1.290E-2	3.137E+0	6.944E-3	1.930E+0	5.809E-2	2.096E-1	2.072E-1
Average+3σ (Bias2)	---	1.884E-2	3.264E-2	5.693E-2	6.851E-2	8.033E+0	5.323E-2	4.862E+0	-7.271E+0	-6.727E+0	-6.737E+0
Average-3σ (Bias2)	---	-7.160E-3	-8.479E-3	-8.458E-3	-8.872E-3	-1.079E+1	1.157E-2	-6.717E+0	-7.619E+0	-7.985E+0	-7.980E+0

6. Iceo

Ta=25°C; Vce = 20V



Iceo . (nA) **Max = 100.0**

	0krad(Si)	10krad(Si)	20krad(Si)	50krad(Si)	74krad(Si)	102krad(Si)	123krad(Si)	152krad(Si)	203krad(Si)	24h/25°C	168h/100°C
N° 1 (Ref)	7.499	6.481	5.642	0.432	1.624	0.184	0.308	0.252	0.432	0.114	0.157
N° 2 (Bias1)	16.965	6.951	5.278	1.044	0.936	0.647	0.803	0.743	1.265	0.961	Not Measurable**
N° 3 (Bias1)	1.147	4.708	4.478	Not Measurable**	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable**	Not Measurable**
N° 4 (Bias1)	0.990	5.974	5.113	1.085	1.068	0.658	0.850	0.819	1.192	0.875	Not Measurable**
N° 5 (Bias1)	0.582	3.973	3.396	0.926	0.866	0.600	0.785	0.780	0.849	0.802	Not Measurable**
N° 6 (Bias1)	1.168	5.697	6.478	1.156	1.015	0.648	0.927	0.872	0.844	0.828	1.073
N° 7 (Bias2)	1.009	3.165	3.118	0.695	0.846	0.732	0.906	0.969	1.041	1.031	Not Measurable**
N° 8 (Bias2)	0.781	2.650	2.832	0.715	0.894	0.768	1.050	0.994	1.046	Not Measurable**	Not Measurable**
N° 9 (Bias2)	0.906	2.948	5.374	0.786	0.781	0.740	0.998	1.222	0.931	0.913	2.008
N° 10 (Bias2)	0.866	1.410	2.907	0.802	0.856	0.760	1.132	1.395	1.261	Not Measurable**	Not Measurable**
N° 11 (Bias2)	3.233	3.025	3.584	0.831	0.876	0.707	1.111	1.066	0.933	Not Measurable**	Not Measurable**
N° 12 (OFF)	0.728	3.791	3.580	0.763	0.996	0.756	1.167	1.164	1.147	Not Measurable**	Not Measurable**
N° 13 (OFF)	1.213	4.254	5.580	0.904	1.025	0.867	1.303	1.345	Not Measurable**	Not Measurable**	Not Measurable**
N° 14 (OFF)	0.742	3.576	5.671	0.889	1.022	Not Measurable**	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable**	Not Measurable**
N° 15 (OFF)	5.629	4.731	5.541	0.970	1.023	0.835	1.251	Not Measurable**	Not Measurable**	Not Measurable**	Not Measurable**
N° 16 (OFF)	1.014	4.438	4.601	0.896	1.033	0.799	1.083	1.259	1.211	Not Measurable**	Not Measurable**

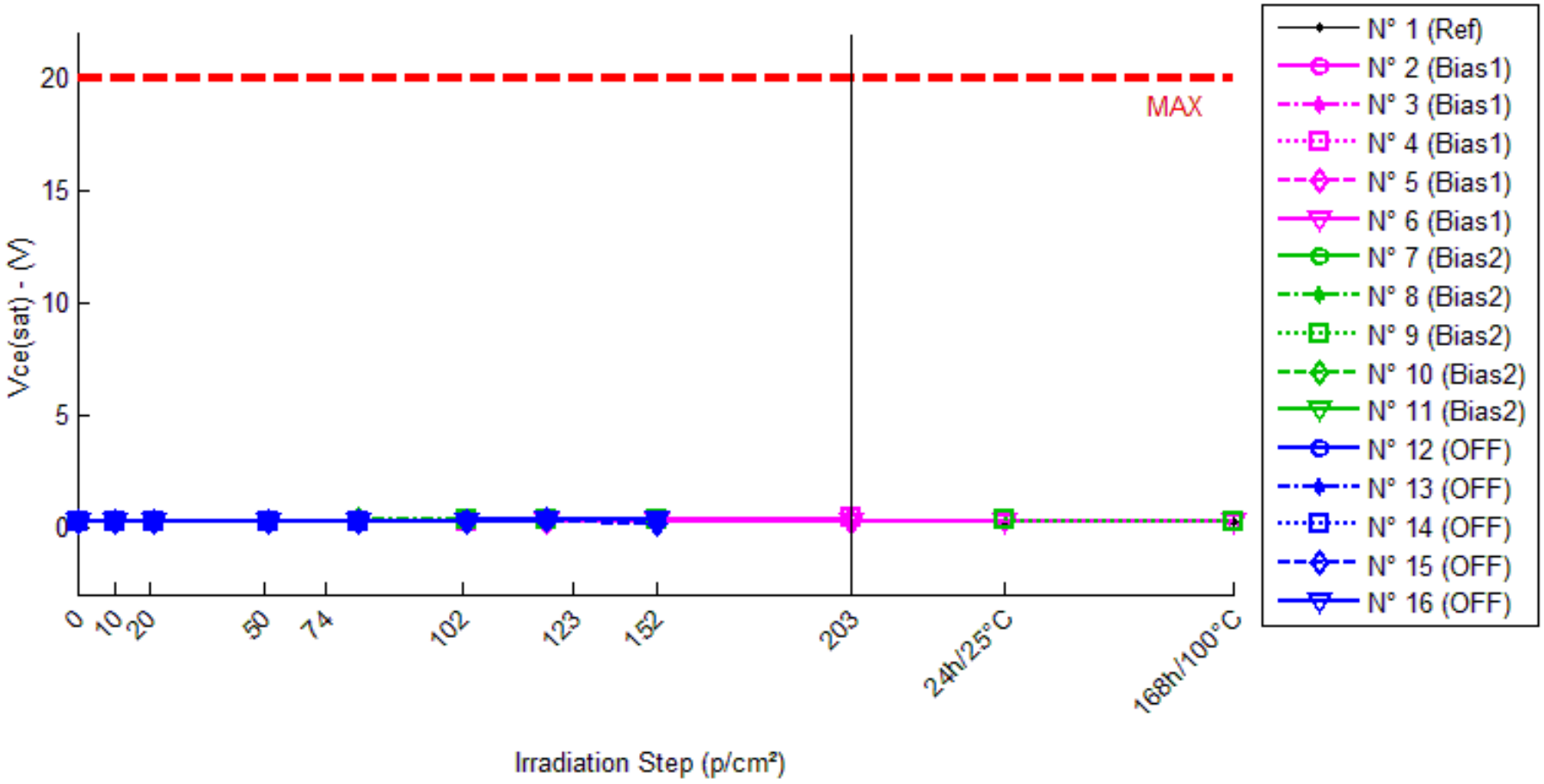
* Device not irradiated
** Test equipment limit, value higher than 10µA

Delta [Iceo]

	0krad(Si)	10krad(Si)	20krad(Si)	50krad(Si)	74krad(Si)	102krad(Si)	123krad(Si)	152krad(Si)	203krad(Si)	24h/25°C	168h/100°C
N° 1 (Ref)	---	-1.017E+0	-1.856E+0	-7.067E+0	-5.874E+0	-7.314E+0	-7.191E+0	-7.247E+0	-7.067E+0	-7.384E+0	-7.342E+0
N° 2 (Bias1)	---	-1.001E+1	-1.169E+1	-1.592E+1	-1.603E+1	-1.632E+1	-1.616E+1	-1.622E+1	-1.570E+1	-1.600E+1	NaN
N° 3 (Bias1)	---	3.560E+0	3.331E+0	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
N° 4 (Bias1)	---	4.984E+0	4.122E+0	9.500E-2	7.792E-2	-3.324E-1	-1.409E-1	-1.716E-1	2.012E-1	-1.152E-1	NaN
N° 5 (Bias1)	---	3.392E+0	2.814E+0	3.441E-1	2.844E-1	1.827E-2	2.036E-1	1.980E-1	2.676E-1	2.199E-1	NaN
N° 6 (Bias1)	---	4.528E+0	5.309E+0	-1.276E-2	-1.537E-1	-5.204E-1	-2.410E-1	-2.968E-1	-3.245E-1	-3.407E-1	-9.553E-2
N° 7 (Bias2)	---	2.156E+0	2.109E+0	-3.143E-1	-1.630E-1	-2.773E-1	-1.031E-1	-4.070E-2	3.207E-2	2.125E-2	NaN
N° 8 (Bias2)	---	1.869E+0	2.050E+0	-6.628E-2	1.128E-1	-1.309E-2	2.690E-1	2.128E-1	2.645E-1	NaN	NaN
N° 9 (Bias2)	---	2.042E+0	4.469E+0	-1.196E-1	-1.247E-1	-1.659E-1	9.194E-2	3.164E-1	2.485E-2	7.290E-3	1.102E+0
N° 10 (Bias2)	---	5.443E-1	2.041E+0	-6.421E-2	-1.068E-2	-1.065E-1	2.660E-1	5.286E-1	3.947E-1	NaN	NaN
N° 11 (Bias2)	---	-2.073E-1	3.510E-1	-2.401E+0	-2.356E+0	-2.525E+0	-2.122E+0	-2.167E+0	-2.299E+0	NaN	NaN
N° 12 (OFF1)	---	3.063E+0	2.853E+0	3.550E-2	2.680E-1	2.881E-2	4.395E-1	4.360E-1	4.192E-1	NaN	NaN
N° 13 (OFF1)	---	3.041E+0	4.367E+0	-3.094E-1	-1.878E-1	-3.464E-1	9.042E-2	1.316E-1	NaN	NaN	NaN
N° 14 (OFF1)	---	2.834E+0	4.929E+0	1.475E-1	2.807E-1	NaN	NaN	NaN	NaN	NaN	NaN
N° 15 (OFF1)	---	-8.975E-1	-8.758E-2	-4.659E+0	-4.605E+0	-4.794E+0	-4.378E+0	NaN	NaN	NaN	NaN
N° 16 (OFF1)	---	3.423E+0	3.587E+0	-1.185E-1	1.838E-2	-2.148E-1	6.846E-2	2.446E-1	1.964E-1	NaN	NaN
Average (OFF1)	---	1.290E+0	7.781E-1	-3.874E+0	-3.955E+0	-4.288E+0	-4.085E+0	-4.123E+0	-3.889E+0	-4.060E+0	-9.553E-2
σ (OFF1)	---	6.354E+0	7.031E+0	8.033E+0	8.051E+0	8.023E+0	8.053E+0	8.068E+0	7.879E+0	7.966E+0	NaN
Average+3σ (OFF1)	---	2.035E+1	2.187E+1	2.023E+1	2.020E+1	1.978E+1	2.008E+1	2.008E+1	1.975E+1	1.984E+1	NaN
Average-3σ (OFF1)	---	-1.777E+1	-2.032E+1	-2.797E+1	-2.811E+1	-2.836E+1	-2.825E+1	-2.833E+1	-2.753E+1	-2.796E+1	NaN
Average (Bias1)	---	1.281E+0	2.204E+0	-5.931E-1	-5.083E-1	-6.176E-1	-3.196E-1	-2.300E-1	-3.166E-1	1.427E-2	1.102E+0
σ (Bias1)	---	1.055E+0	1.468E+0	1.016E+0	1.038E+0	1.071E+0	1.019E+0	1.102E+0	1.119E+0	9.868E-3	NaN
Average+3σ (Bias1)	---	4.445E+0	6.608E+0	2.455E+0	2.607E+0	2.595E+0	2.738E+0	3.076E+0	3.042E+0	4.387E-2	NaN
Average-3σ (Bias1)	---	-1.883E+0	-2.200E+0	-3.641E+0	-3.624E+0	-3.830E+0	-3.377E+0	-3.536E+0	-3.675E+0	-1.534E-2	NaN
Average (Bias2)	---	2.293E+0	3.130E+0	-9.807E-1	-8.452E-1	-1.332E+0	-9.449E-1	2.707E-1	3.078E-1	NaN	NaN
σ (Bias2)	---	1.796E+0	1.963E+0	2.063E+0	2.111E+0	2.314E+0	2.295E+0	1.539E-1	1.576E-1	0.000E+0	0.000E+0
Average+3σ (Bias2)	---	7.681E+0	9.017E+0	5.209E+0	5.488E+0	5.609E+0	5.940E+0	7.323E-1	7.805E-1	NaN	NaN
Average-3σ (Bias2)	---	-3.095E+0	-2.758E+0	-7.171E+0	-7.178E+0	-8.272E+0	-7.830E+0	-1.909E-1	-1.650E-1	NaN	NaN

7. Vce(sat)

Ta=25°C; If = 20 mA; Ic = 10 mA



Vce(sat) . (V) **Max = 0.3**

	0krad(Si)	10krad(Si)	20krad(Si)	50krad(Si)	74krad(Si)	102krad(Si)	123krad(Si)	152krad(Si)	203krad(Si)	24h/25°C	168h/100°C
N° 1 (Ref)	0.196	0.200	0.198	0.200	0.198	0.197	0.215	0.198	0.209	0.198	0.197
N° 2 (Bias1)	0.194	0.211	0.222	0.236	0.248	0.260	0.271	0.276	0.287	Not Measurable**	Not Measurable**
N° 3 (Bias1)	0.191	0.208	0.218	Not Measurable**	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable**	Not Measurable**
N° 4 (Bias1)	0.198	0.214	0.225	0.249	0.259	0.270	0.306	0.316	0.371	Not Measurable**	Not Measurable**
N° 5 (Bias1)	0.182	0.196	0.208	0.220	0.227	0.230	0.238	0.240	0.243	Not Measurable**	Not Measurable**
N° 6 (Bias1)	0.187	0.201	0.213	0.225	0.235	0.241	0.250	0.252	0.261	0.259	0.216
N° 7 (Bias2)	0.188	0.203	0.214	0.238	0.258	0.278	0.308	0.368	Not Measurable**	Not Measurable**	Not Measurable**
N° 8 (Bias2)	0.190	0.207	0.221	0.254	0.274	0.322	0.362	Not Measurable	Not Measurable**	Not Measurable**	Not Measurable**
N° 9 (Bias2)	0.190	0.204	0.215	0.241	0.258	0.281	0.330	0.360	Not Measurable**	0.328	0.222
N° 10 (Bias2)	0.196	0.213	0.225	0.272	0.332	Not Measurable**	Not Measurable**	Not Measurable**	Not Measurable**	Not Measurable**	Not Measurable**
N° 11 (Bias2)	0.196	0.209	0.217	0.242	0.258	0.270	0.285	0.292	Not Measurable**	Not Measurable**	Not Measurable**
N° 12 (OFF1)	0.192	0.204	0.213	0.238	0.256	0.273	0.289	0.331	Not Measurable**	Not Measurable**	Not Measurable**
N° 13 (OFF1)	0.188	0.203	0.215	0.239	0.259	0.278	0.299	0.351	Not Measurable**	Not Measurable**	Not Measurable**
N° 14 (OFF1)	0.187	0.199	0.210	0.232	0.252	Not Measurable**	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable**	Not Measurable**
N° 15 (OFF1)	0.188	0.200	0.211	0.233	0.249	0.268	0.293	0.320	Not Measurable**	Not Measurable**	Not Measurable**
N° 16 (OFF1)	0.182	0.196	0.208	0.231	0.250	0.270	0.286	0.345	Not Measurable**	Not Measurable**	Not Measurable**

* device not irradiated

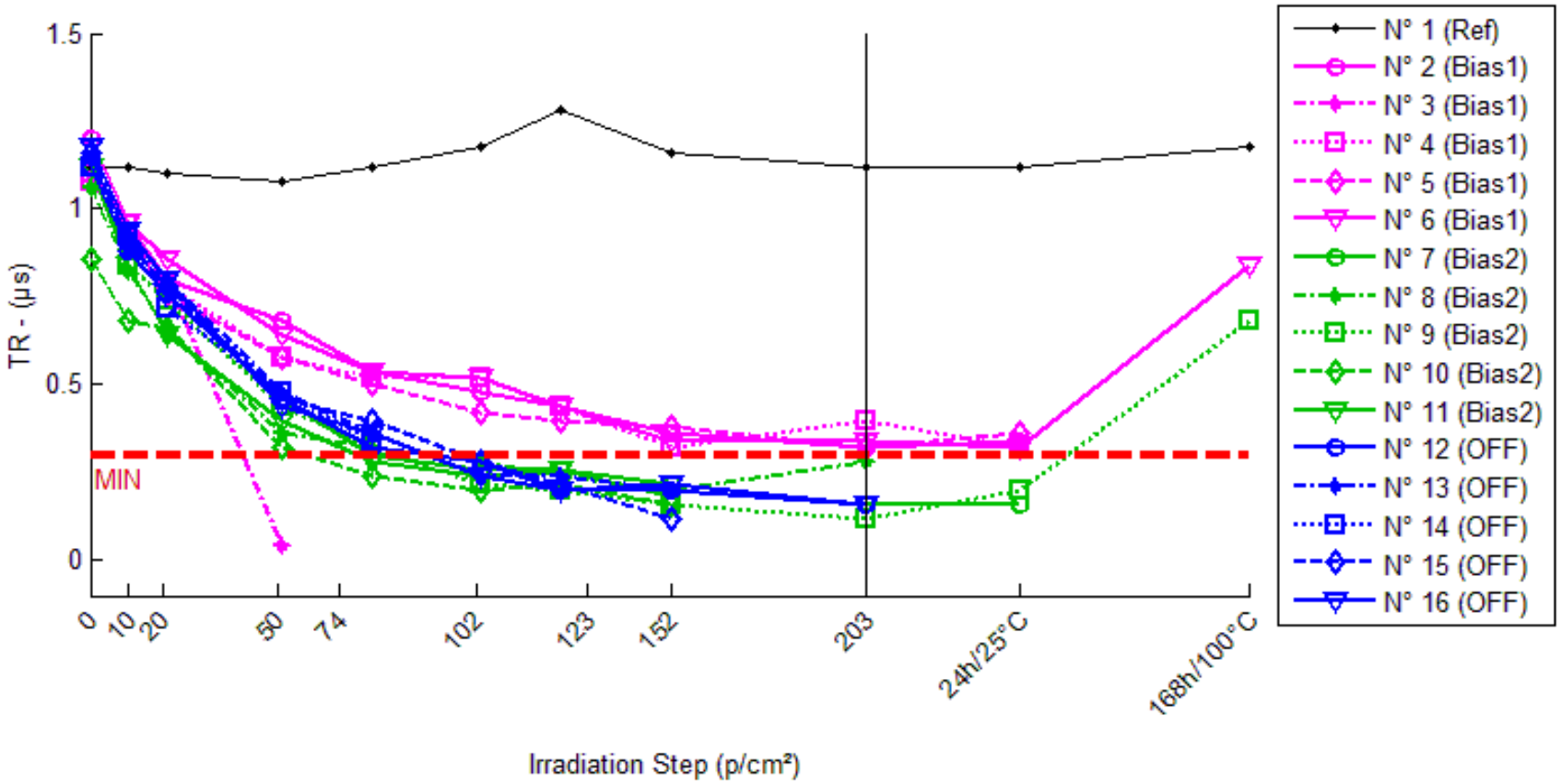
** Not Measurable because of test condition (cf. CTR4) cannot be applied

Delta [Vce(sat)]

	0krad(Si)	10krad(Si)	20krad(Si)	50krad(Si)	74krad(Si)	102krad(Si)	123krad(Si)	152krad(Si)	203krad(Si)	24h/25°C	168h/100°C
N° 1 (Ref)	---	3.547E-3	2.027E-3	3.407E-3	1.801E-3	9.456E-4	1.876E-2	1.292E-3	1.229E-2	1.263E-3	1.015E-3
N° 2 (Bias1)	---	1.761E-2	2.804E-2	4.209E-2	5.430E-2	6.624E-2	7.751E-2	8.225E-2	9.328E-2	NaN	NaN
N° 3 (Bias1)	---	1.786E-2	2.772E-2	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
N° 4 (Bias1)	---	1.589E-2	2.696E-2	5.026E-2	6.070E-2	7.121E-2	1.072E-1	1.176E-1	1.723E-1	NaN	NaN
N° 5 (Bias1)	---	1.400E-2	2.631E-2	3.812E-2	4.491E-2	4.792E-2	5.580E-2	5.821E-2	6.120E-2	NaN	NaN
N° 6 (Bias1)	---	1.448E-2	2.610E-2	3.820E-2	4.830E-2	5.416E-2	6.303E-2	6.537E-2	7.414E-2	7.245E-2	2.900E-2
N° 7 (Bias2)	---	1.539E-2	2.637E-2	5.078E-2	7.025E-2	9.008E-2	1.209E-1	1.806E-1	NaN	NaN	NaN
N° 8 (Bias2)	---	1.650E-2	3.072E-2	6.371E-2	8.415E-2	1.316E-1	1.723E-1	NaN	NaN	NaN	NaN
N° 9 (Bias2)	---	1.409E-2	2.585E-2	5.139E-2	6.829E-2	9.190E-2	1.408E-1	1.702E-1	NaN	1.386E-1	3.263E-2
N° 10 (Bias2)	---	1.745E-2	2.884E-2	7.594E-2	1.360E-1	NaN	NaN	NaN	NaN	NaN	NaN
N° 11 (Bias2)	---	1.345E-2	2.149E-2	4.617E-2	6.154E-2	7.434E-2	8.864E-2	9.631E-2	NaN	NaN	NaN
N° 12 (OFF1)	---	1.162E-2	2.055E-2	4.537E-2	6.372E-2	8.092E-2	9.663E-2	1.384E-1	NaN	NaN	NaN
N° 13 (OFF1)	---	1.517E-2	2.634E-2	5.124E-2	7.101E-2	8.957E-2	1.103E-1	1.623E-1	NaN	NaN	NaN
N° 14 (OFF1)	---	1.206E-2	2.277E-2	4.450E-2	6.457E-2	NaN	NaN	NaN	NaN	NaN	NaN
N° 15 (OFF1)	---	1.190E-2	2.274E-2	4.531E-2	6.112E-2	7.983E-2	1.050E-1	1.319E-1	NaN	NaN	NaN
N° 16 (OFF1)	---	1.392E-2	2.587E-2	4.923E-2	6.804E-2	8.768E-2	1.041E-1	1.625E-1	NaN	NaN	NaN
Average (OFF1)	---	1.597E-2	2.703E-2	4.217E-2	5.205E-2	5.988E-2	7.590E-2	8.086E-2	1.002E-1	7.245E-2	2.900E-2
σ (OFF1)	---	1.760E-3	8.494E-4	5.701E-3	6.949E-3	1.072E-2	2.276E-2	2.649E-2	4.984E-2	NaN	NaN
Average+3σ (OFF1)	---	2.124E-2	2.958E-2	5.927E-2	7.290E-2	9.203E-2	1.442E-1	1.603E-1	2.498E-1	NaN	NaN
Average-3σ (OFF1)	---	1.069E-2	2.448E-2	2.507E-2	3.121E-2	2.773E-2	7.610E-3	1.398E-3	-4.927E-2	NaN	NaN
Average (Bias1)	---	1.538E-2	2.666E-2	5.760E-2	8.405E-2	9.697E-2	1.306E-1	1.490E-1	NaN	1.386E-1	3.263E-2
σ (Bias1)	---	1.653E-3	3.489E-3	1.214E-2	3.020E-2	2.438E-2	3.511E-2	4.595E-2	0.000E+0	NaN	NaN
Average+3σ (Bias1)	---	2.033E-2	3.712E-2	9.401E-2	1.747E-1	1.701E-1	2.360E-1	2.869E-1	NaN	NaN	NaN
Average-3σ (Bias1)	---	1.042E-2	1.619E-2	2.118E-2	-6.552E-3	2.383E-2	2.533E-2	1.118E-2	NaN	NaN	NaN
Average (Bias2)	---	1.293E-2	2.366E-2	4.713E-2	6.569E-2	8.450E-2	1.040E-1	1.488E-1	NaN	NaN	NaN
σ (Bias2)	---	1.545E-3	2.420E-3	2.941E-3	3.868E-3	4.848E-3	5.628E-3	1.596E-2	0.000E+0	0.000E+0	0.000E+0
Average+3σ (Bias2)	---	1.757E-2	3.092E-2	5.595E-2	7.729E-2	9.905E-2	1.209E-1	1.966E-1	NaN	NaN	NaN
Average-3σ (Bias2)	---	8.296E-3	1.640E-2	3.830E-2	5.409E-2	6.996E-2	8.712E-2	1.009E-1	NaN	NaN	NaN

8. TR

Ta=25°C; Vcc = 10 V; If = 10 mA; RL = 100 Ohms



TR . (µs) **Max = 20.0**

	0krad(Si)	10krad(Si)	20krad(Si)	50krad(Si)	74krad(Si)	102krad(Si)	123krad(Si)	152krad(Si)	203krad(Si)	24h/25°C	168h/100°C
N° 1 (Ref)	1.12	1.12	1.10	1.08	1.12	1.18	1.28	1.16	1.12	1.12	1.18
N° 2 (Bias1)	1.20	0.96	0.80	0.68	0.54	0.48	0.44	0.36	0.32	0.34	Not Measurable**
N° 3 (Bias1)	1.08	0.92	0.80	0.04	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable**	Not Measurable**
N° 4 (Bias1)	1.08	0.92	0.78	0.58	0.52	0.52	0.44	0.32	0.40	0.32	Not Measurable**
N° 5 (Bias1)	1.12	0.92	0.76	0.58	0.50	0.42	0.40	0.38	0.32	0.36	Not Measurable**
N° 6 (Bias1)	1.12	0.96	0.86	0.64	0.54	0.52	0.44	0.34	0.34	0.32	0.84
N° 7 (Bias2)	1.12	0.88	0.76	0.46	0.30	0.26	0.26	0.22	0.16	0.16	Not Measurable**
N° 8 (Bias2)	1.06	0.82	0.66	0.36	0.32	0.28	0.24	0.20	0.28	Not Measurable**	Not Measurable**
N° 9 (Bias2)	1.12	0.84	0.74	0.44	0.32	0.22	0.20	0.16	0.12	0.20	0.68
N° 10 (Bias2)	0.86	0.68	0.66	0.32	0.24	0.20	0.22	0.16	Not Measurable**	Not Measurable**	Not Measurable**
N° 11 (Bias2)	1.12	0.84	0.64	0.40	0.28	0.24	0.26	0.18	Not Measurable**	Not Measurable**	Not Measurable**
N° 12 (OFF)	1.12	0.88	0.76	0.46	0.32	0.28	0.20	0.20	0.16	Not Measurable**	Not Measurable**
N° 13 (OFF)	1.14	0.92	0.80	0.48	0.36	0.24	0.24	0.20	Not Measurable**	Not Measurable**	Not Measurable**
N° 14 (OFF)	1.12	0.92	0.72	0.48	0.34	Not Measurable**	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable**	Not Measurable**
N° 15 (OFF)	1.16	0.90	0.78	0.46	0.40	0.28	0.22	0.12	Not Measurable**	Not Measurable**	Not Measurable**
N° 16 (OFF)	1.18	0.94	0.80	0.44	0.36	0.24	0.20	0.22	0.16	Not Measurable**	Not Measurable**

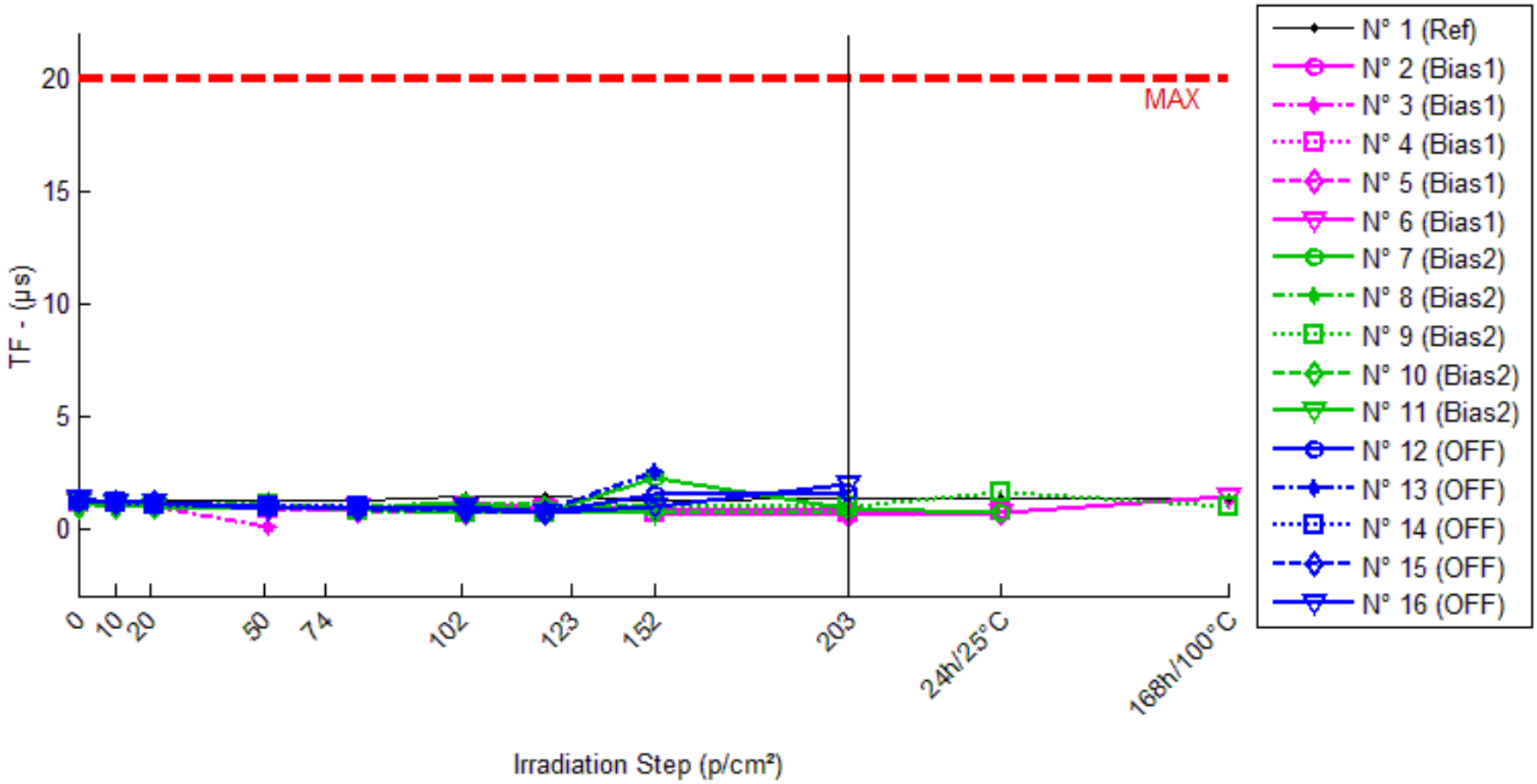
* Device not irradiated
** Test equipment limit

Delta [TR]

	0krad(Si)	10krad(Si)	20krad(Si)	50krad(Si)	74krad(Si)	102krad(Si)	123krad(Si)	152krad(Si)	203krad(Si)	24h/25°C	168h/100°C
N° 1 (Ref)	---	0.000E+0	-2.000E-2	-4.000E-2	0.000E+0	6.000E-2	1.600E-1	4.000E-2	0.000E+0	0.000E+0	6.000E-2
N° 2 (Bias1)	---	-2.400E-1	-4.000E-1	-5.200E-1	-6.600E-1	-7.200E-1	-7.600E-1	-8.400E-1	-8.800E-1	-8.600E-1	NaN
N° 3 (Bias1)	---	-1.600E-1	-2.800E-1	-1.038E+0	NaN	NaN	NaN	NaN	NaN	NaN	NaN
N° 4 (Bias1)	---	-1.600E-1	-3.000E-1	-5.000E-1	-5.600E-1	-5.600E-1	-6.400E-1	-7.600E-1	-6.800E-1	-7.600E-1	NaN
N° 5 (Bias1)	---	-2.000E-1	-3.600E-1	-5.400E-1	-6.200E-1	-7.000E-1	-7.200E-1	-7.400E-1	-8.000E-1	-7.600E-1	NaN
N° 6 (Bias1)	---	-1.600E-1	-2.600E-1	-4.800E-1	-5.800E-1	-6.000E-1	-6.800E-1	-7.800E-1	-7.800E-1	-8.000E-1	-2.800E-1
N° 7 (Bias2)	---	-2.400E-1	-3.600E-1	-6.600E-1	-8.200E-1	-8.600E-1	-8.600E-1	-9.000E-1	-9.600E-1	-9.600E-1	NaN
N° 8 (Bias2)	---	-2.400E-1	-4.000E-1	-7.000E-1	-7.400E-1	-7.800E-1	-8.200E-1	-8.600E-1	-7.800E-1	NaN	NaN
N° 9 (Bias2)	---	-2.800E-1	-3.800E-1	-6.800E-1	-8.000E-1	-9.000E-1	-9.200E-1	-9.600E-1	-1.000E+0	-9.200E-1	-4.400E-1
N° 10 (Bias2)	---	-1.800E-1	-2.000E-1	-5.400E-1	-6.200E-1	-6.600E-1	-6.400E-1	-7.000E-1	NaN	NaN	NaN
N° 11 (Bias2)	---	-2.800E-1	-4.800E-1	-7.200E-1	-8.400E-1	-8.800E-1	-8.600E-1	-9.400E-1	NaN	NaN	NaN
N° 12 (OFF1)	---	-2.400E-1	-3.600E-1	-6.600E-1	-8.000E-1	-8.400E-1	-9.200E-1	-9.200E-1	-9.600E-1	NaN	NaN
N° 13 (OFF1)	---	-2.200E-1	-3.400E-1	-6.600E-1	-7.800E-1	-9.000E-1	-9.000E-1	-9.400E-1	NaN	NaN	NaN
N° 14 (OFF1)	---	-2.000E-1	-4.000E-1	-6.400E-1	-7.800E-1	NaN	NaN	NaN	NaN	NaN	NaN
N° 15 (OFF1)	---	-2.600E-1	-3.800E-1	-7.000E-1	-7.600E-1	-8.800E-1	-9.400E-1	-1.040E+0	NaN	NaN	NaN
N° 16 (OFF1)	---	-2.400E-1	-3.800E-1	-7.400E-1	-8.200E-1	-9.400E-1	-9.800E-1	-9.600E-1	-1.020E+0	NaN	NaN
Average (OFF1)	---	-1.840E-1	-3.200E-1	-6.156E-1	-6.050E-1	-6.450E-1	-7.000E-1	-7.800E-1	-7.850E-1	-7.950E-1	-2.800E-1
σ (OFF1)	---	3.578E-2	5.831E-2	2.372E-1	4.435E-2	7.724E-2	5.164E-2	4.320E-2	8.226E-2	4.726E-2	NaN
Average+3σ (OFF1)	---	-7.667E-2	-1.451E-1	9.596E-2	-4.720E-1	-4.133E-1	-5.451E-1	-6.504E-1	-5.382E-1	-6.532E-1	NaN
Average-3σ (OFF1)	---	-2.913E-1	-4.949E-1	-1.327E+0	-7.380E-1	-8.767E-1	-8.549E-1	-9.096E-1	-1.032E+0	-9.368E-1	NaN
Average (Bias1)	---	-2.440E-1	-3.640E-1	-6.600E-1	-7.640E-1	-8.160E-1	-8.200E-1	-8.720E-1	-9.133E-1	-9.400E-1	-4.400E-1
σ (Bias1)	---	4.099E-2	1.024E-1	7.071E-2	8.877E-2	9.839E-2	1.068E-1	1.035E-1	1.172E-1	2.828E-2	NaN
Average+3σ (Bias1)	---	-1.210E-1	-5.688E-2	-4.479E-1	-4.977E-1	-5.208E-1	-4.997E-1	-5.614E-1	-5.618E-1	-8.551E-1	NaN
Average-3σ (Bias1)	---	-3.670E-1	-6.711E-1	-8.721E-1	-1.030E+0	-1.111E+0	-1.140E+0	-1.183E+0	-1.265E+0	-1.025E+0	NaN
Average (Bias2)	---	-2.320E-1	-3.720E-1	-6.800E-1	-7.880E-1	-8.900E-1	-9.350E-1	-9.650E-1	-9.900E-1	NaN	NaN
σ (Bias2)	---	2.280E-2	2.280E-2	4.000E-2	2.280E-2	4.163E-2	3.416E-2	5.260E-2	4.243E-2	0.000E+0	0.000E+0
Average+3σ (Bias2)	---	-1.636E-1	-3.036E-1	-5.600E-1	-7.196E-1	-7.651E-1	-8.325E-1	-8.072E-1	-8.627E-1	NaN	NaN
Average-3σ (Bias2)	---	-3.004E-1	-4.404E-1	-8.000E-1	-8.564E-1	-1.015E+0	-1.037E+0	-1.123E+0	-1.117E+0	NaN	NaN

9. TF

Ta=25°C; Vcc = 10 V; If = 10 mA; RL = 100 Ohms



TF . (µs) **Max = 20.0**

	0krad(Si)	10krad(Si)	20krad(Si)	50krad(Si)	74krad(Si)	102krad(Si)	123krad(Si)	152krad(Si)	203krad(Si)	24h/25°C	168h/100°C
N° 1 (Ref)	1.24	1.24	1.20	1.20	1.24	1.44	1.38	1.24	1.28	1.28	1.36
N° 2 (Bias1)	1.24	1.16	1.06	0.96	0.80	1.12	0.82	0.84	0.76	0.68	Not Measurable**
N° 3 (Bias1)	1.16	1.12	1.00	0.08	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable**	Not Measurable**
N° 4 (Bias1)	1.16	1.12	1.04	0.84	0.76	0.96	0.84	0.70	0.68	0.76	Not Measurable**
N° 5 (Bias1)	1.20	1.14	1.04	0.90	0.80	0.72	0.74	0.82	0.60	0.68	Not Measurable**
N° 6 (Bias1)	1.20	1.16	1.10	0.84	0.92	0.84	0.90	0.72	0.60	0.68	1.44
N° 7 (Bias2)	1.22	1.16	1.06	0.92	0.88	1.18	0.68	2.20	0.82	0.72	Not Measurable**
N° 8 (Bias2)	1.18	1.14	1.10	1.08	1.00	1.12	1.04	0.70	0.66	Not Measurable**	Not Measurable**
N° 9 (Bias2)	1.24	1.12	1.02	1.02	0.80	0.72	0.72	0.92	1.00	1.60	1.00
N° 10 (Bias2)	0.92	0.92	0.92	1.08	0.84	1.00	0.86	1.04	Not Measurable**	Not Measurable**	Not Measurable**
N° 11 (Bias2)	1.18	1.08	0.96	0.84	0.82	0.72	0.78	0.68	Not Measurable**	Not Measurable**	Not Measurable**
N° 12 (OFF1)	1.18	1.14	1.12	1.00	0.88	0.88	0.68	1.52	1.60	Not Measurable**	Not Measurable**
N° 13 (OFF1)	1.20	1.14	1.18	0.96	0.88	0.88	0.80	2.54	Not Measurable**	Not Measurable**	Not Measurable**
N° 14 (OFF1)	1.20	1.14	1.02	0.96	0.92	Not Measurable**	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable**	Not Measurable**
N° 15 (OFF1)	1.24	1.12	1.16	0.92	0.90	0.76	0.64	Not Measurable**	Not Measurable**	Not Measurable**	Not Measurable**
N° 16 (OFF1)	1.28	1.18	1.18	0.86	0.88	1.00	0.70	0.92	1.98	Not Measurable**	Not Measurable**

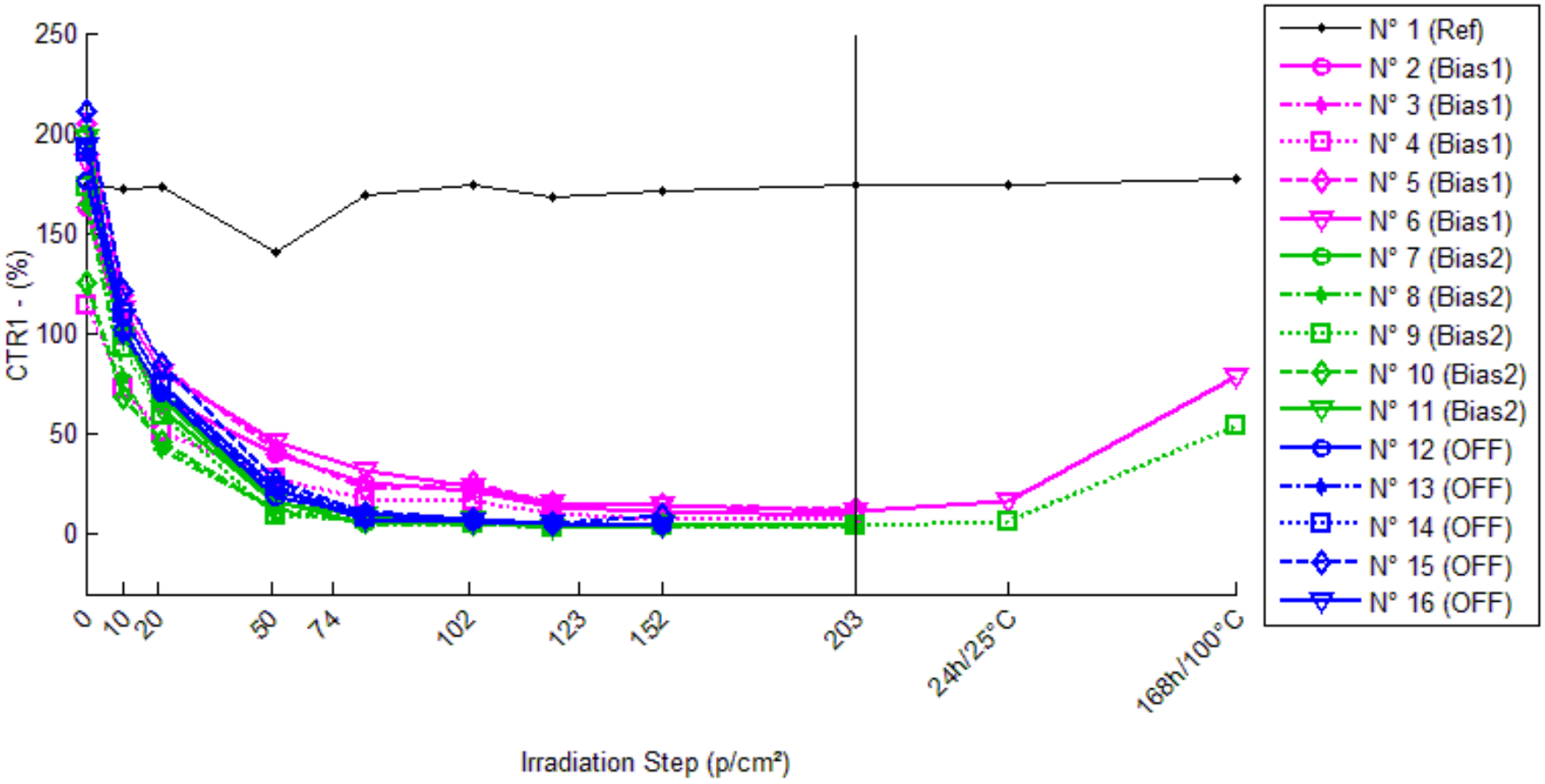
* Device not irradiated
** Test equipment limit

Delta [TF]

	0krad(Si)	10krad(Si)	20krad(Si)	50krad(Si)	74krad(Si)	102krad(Si)	123krad(Si)	152krad(Si)	203krad(Si)	24h/25°C	168h/100°C
N° 1 (Ref)	---	0.000E+0	-4.000E-2	-4.000E-2	0.000E+0	2.000E-1	1.400E-1	0.000E+0	4.000E-2	4.000E-2	1.200E-1
N° 2 (Bias1)	---	-8.000E-2	-1.800E-1	-2.800E-1	-4.400E-1	-1.200E-1	-4.200E-1	-4.000E-1	-4.800E-1	-5.600E-1	NaN
N° 3 (Bias1)	---	-4.000E-2	-1.600E-1	-1.078E+0	NaN	NaN	NaN	NaN	NaN	NaN	NaN
N° 4 (Bias1)	---	-4.000E-2	-1.200E-1	-3.200E-1	-4.000E-1	-2.000E-1	-3.200E-1	-4.600E-1	-4.800E-1	-4.000E-1	NaN
N° 5 (Bias1)	---	-6.000E-2	-1.600E-1	-3.000E-1	-4.000E-1	-4.800E-1	-4.600E-1	-3.800E-1	-6.000E-1	-5.200E-1	NaN
N° 6 (Bias1)	---	-4.000E-2	-1.000E-1	-3.600E-1	-2.800E-1	-3.600E-1	-3.000E-1	-4.800E-1	-6.000E-1	-5.200E-1	2.400E-1
N° 7 (Bias2)	---	-6.000E-2	-1.600E-1	-3.000E-1	-3.400E-1	-4.000E-2	-5.400E-1	9.800E-1	-4.000E-1	-5.000E-1	NaN
N° 8 (Bias2)	---	-4.000E-2	-8.000E-2	-1.000E-1	-1.800E-1	-6.000E-2	-1.400E-1	-4.800E-1	-5.200E-1	NaN	NaN
N° 9 (Bias2)	---	-1.200E-1	-2.200E-1	-2.200E-1	-4.400E-1	-5.200E-1	-5.200E-1	-3.200E-1	-2.400E-1	3.600E-1	-2.400E-1
N° 10 (Bias2)	---	0.000E+0	0.000E+0	1.600E-1	-8.000E-2	8.000E-2	-6.000E-2	1.200E-1	NaN	NaN	NaN
N° 11 (Bias2)	---	-1.000E-1	-2.200E-1	-3.400E-1	-3.600E-1	-4.600E-1	-4.000E-1	-5.000E-1	NaN	NaN	NaN
N° 12 (OFF1)	---	-4.000E-2	-6.000E-2	-1.800E-1	-3.000E-1	-3.000E-1	-5.000E-1	3.400E-1	4.200E-1	NaN	NaN
N° 13 (OFF1)	---	-6.000E-2	-2.000E-2	-2.400E-1	-3.200E-1	-3.200E-1	-4.000E-1	1.340E+0	NaN	NaN	NaN
N° 14 (OFF1)	---	-6.000E-2	-1.800E-1	-2.400E-1	-2.800E-1	NaN	NaN	NaN	NaN	NaN	NaN
N° 15 (OFF1)	---	-1.200E-1	-8.000E-2	-3.200E-1	-3.400E-1	-4.800E-1	-6.000E-1	NaN	NaN	NaN	NaN
N° 16 (OFF1)	---	-1.000E-1	-1.000E-1	-4.200E-1	-4.000E-1	-2.800E-1	-5.800E-1	-3.600E-1	7.000E-1	NaN	NaN
Average (OFF1)	---	-5.200E-2	-1.440E-1	-4.676E-1	-3.800E-1	-2.900E-1	-3.750E-1	-4.300E-1	-5.400E-1	-5.000E-1	2.400E-1
σ (OFF1)	---	1.789E-2	3.286E-2	3.425E-1	6.928E-2	1.612E-1	7.724E-2	4.761E-2	6.928E-2	6.928E-2	NaN
Average+3σ (OFF1)	---	1.666E-3	-4.541E-2	5.599E-1	-1.722E-1	1.937E-1	-1.433E-1	-2.872E-1	-3.322E-1	-2.922E-1	NaN
Average-3σ (OFF1)	---	-1.057E-1	-2.426E-1	-1.495E+0	-5.878E-1	-7.737E-1	-6.067E-1	-5.728E-1	-7.478E-1	-7.078E-1	NaN
Average (Bias1)	---	-6.400E-2	-1.360E-1	-1.600E-1	-2.800E-1	-2.000E-1	-3.320E-1	-4.000E-2	-3.867E-1	-7.000E-2	-2.400E-1
σ (Bias1)	---	4.775E-2	9.529E-2	2.010E-1	1.463E-1	2.709E-1	2.203E-1	6.224E-1	1.405E-1	6.081E-1	NaN
Average+3σ (Bias1)	---	7.925E-2	1.499E-1	4.430E-1	1.589E-1	6.128E-1	3.288E-1	1.827E+0	3.476E-2	1.754E+0	NaN
Average-3σ (Bias1)	---	-2.072E-1	-4.219E-1	-7.630E-1	-7.189E-1	-1.013E+0	-9.928E-1	-1.907E+0	-8.081E-1	-1.894E+0	NaN
Average (Bias2)	---	-7.600E-2	-8.800E-2	-2.800E-1	-3.280E-1	-3.450E-1	-5.200E-1	4.400E-1	5.600E-1	NaN	NaN
σ (Bias2)	---	3.286E-2	5.933E-2	9.274E-2	4.604E-2	9.147E-2	9.092E-2	8.544E-1	1.980E-1	0.000E+0	0.000E+0
Average+3σ (Bias2)	---	2.259E-2	8.999E-2	-1.791E-3	-1.899E-1	-7.059E-2	-2.472E-1	3.003E+0	1.154E+0	NaN	NaN
Average-3σ (Bias2)	---	-1.746E-1	-2.660E-1	-5.582E-1	-4.661E-1	-6.194E-1	-7.928E-1	-2.123E+0	-3.397E-2	NaN	NaN

10.CTR1

Ta=25°C; Vce = 5V; If = 1 mA



CTR1 . (%)

	0krad(Si)	10krad(Si)	20krad(Si)	50krad(Si)	74krad(Si)	102krad(Si)	123krad(Si)	152krad(Si)	203krad(Si)	24h/25°C	168h/100°C
N° 1 (Ref)	174.00	172.55	173.08	170.93	168.69	173.66	168.52	171.25	174.39	174.38	177.15
N° 2 (Bias1)	162.87	98.65	68.32	39.84	25.21	21.62	13.03	11.33	9.68	Not Measurable**	Not Measurable**
N° 3 (Bias1)	169.10	101.67	64.40	Not Measurable**	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable**	Not Measurable**
N° 4 (Bias1)	113.71	72.73	50.75	27.68	17.76	16.51	10.26	7.55	6.71	Not Measurable**	Not Measurable**
N° 5 (Bias1)	204.98	119.54	83.28	41.47	22.11	25.93	15.48	14.26	12.55	Not Measurable**	Not Measurable**
N° 6 (Bias1)	185.57	112.50	80.82	46.05	31.96	23.76	15.56	13.84	11.33	16.28	78.80
N° 7 (Bias2)	199.88	101.08	67.71	16.78	5.36	5.81	3.52	4.07	3.95	Not Measurable**	Not Measurable**
N° 8 (Bias2)	163.56	78.93	41.37	12.62	5.29	4.39	3.85	3.90	3.23	Not Measurable**	Not Measurable**
N° 9 (Bias2)	173.15	92.81	58.91	9.40	7.59	5.18	3.28	4.10	4.05	6.04	53.79
N° 10 (Bias2)	124.99	68.39	45.80	11.28	5.79	4.66	3.68	4.56	Not Measurable**	Not Measurable**	Not Measurable**
N° 11 (Bias2)	197.10	98.70	62.38	15.51	9.65	7.37	3.03	5.20	Not Measurable**	Not Measurable**	Not Measurable**
N° 12 (OFF1)	176.47	101.80	69.82	18.79	10.40	6.44	5.32	4.34	Not Measurable**	Not Measurable**	Not Measurable**
N° 13 (OFF1)	189.83	99.17	70.89	21.78	11.40	7.03	4.89	4.26	Not Measurable**	Not Measurable**	Not Measurable**
N° 14 (OFF1)	190.15	110.46	73.91	23.23	8.02	Not Measurable**	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable**	Not Measurable**
N° 15 (OFF1)	210.66	121.69	84.92	26.84	10.58	7.65	5.63	8.94	Not Measurable**	Not Measurable**	Not Measurable**
N° 16 (OFF1)	193.59	107.70	74.22	21.94	7.31	6.25	5.13	4.13	Not Measurable**	Not Measurable**	Not Measurable**

* device not irradiated

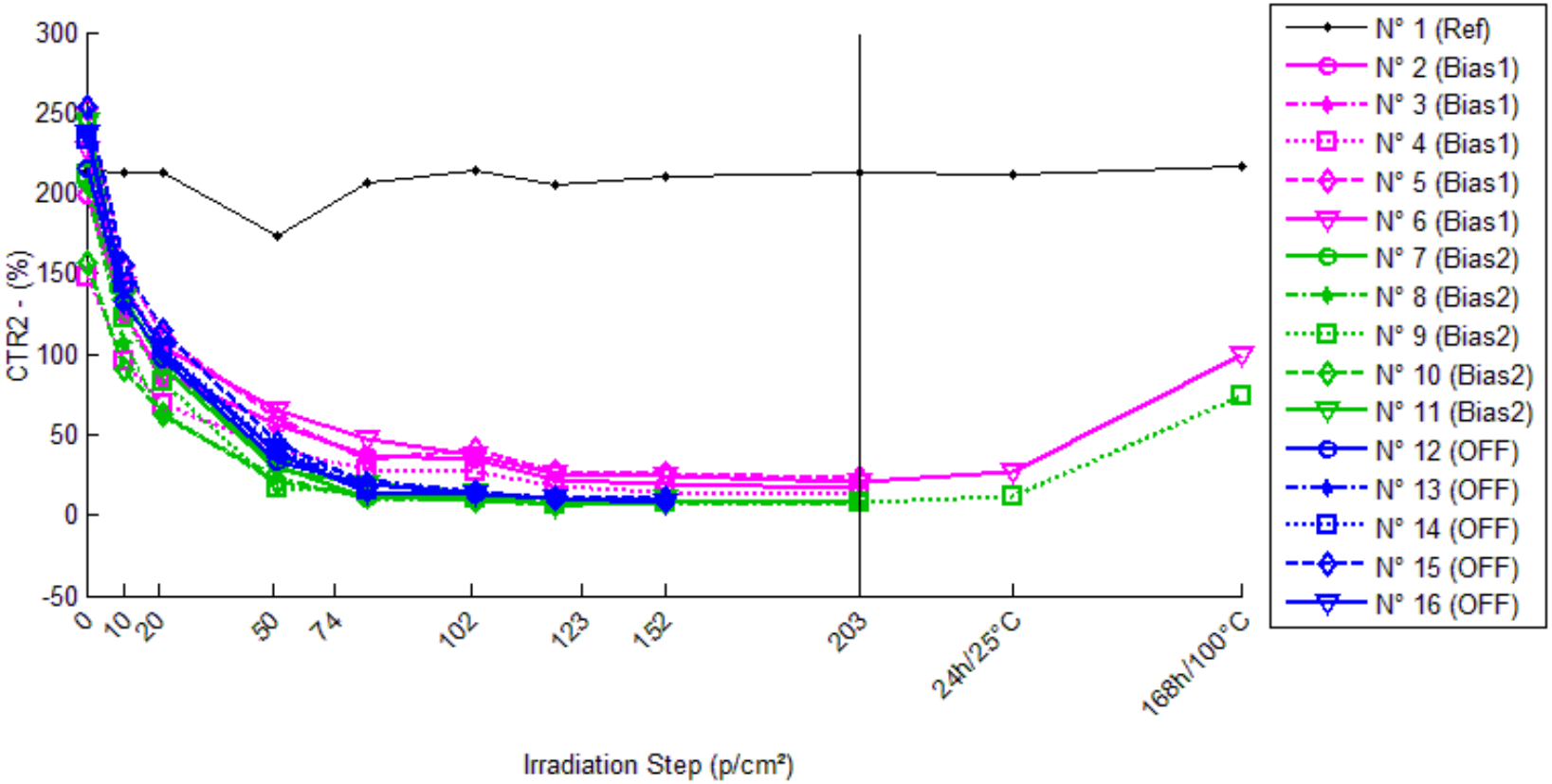
** Not Measurable because of test condition (cf. Vcbo) cannot be applied

1/Delta [CTR1]

	0krad(Si)	10krad(Si)	20krad(Si)	50krad(Si)	74krad(Si)	102krad(Si)	123krad(Si)	152krad(Si)	203krad(Si)	24h/25°C	168h/100°C
N° 1 (Ref)	---	4.836E-5	3.053E-5	1.032E-4	1.808E-4	1.136E-5	1.869E-4	9.242E-5	-1.303E-5	-1.245E-5	-1.021E-4
N° 2 (Bias1)	---	3.997E-3	8.497E-3	1.896E-2	3.353E-2	4.012E-2	7.061E-2	8.211E-2	9.714E-2	NaN	NaN
N° 3 (Bias1)	---	3.922E-3	9.613E-3	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
N° 4 (Bias1)	---	4.955E-3	1.091E-2	2.733E-2	4.753E-2	5.177E-2	8.870E-2	1.237E-1	1.403E-1	NaN	NaN
N° 5 (Bias1)	---	3.487E-3	7.129E-3	1.923E-2	4.036E-2	3.368E-2	5.971E-2	6.526E-2	7.481E-2	NaN	NaN
N° 6 (Bias1)	---	3.500E-3	6.984E-3	1.633E-2	2.590E-2	3.670E-2	5.889E-2	6.687E-2	8.285E-2	5.604E-2	7.301E-3
N° 7 (Bias2)	---	4.890E-3	9.767E-3	5.461E-2	1.816E-1	1.671E-1	2.788E-1	2.408E-1	2.482E-1	NaN	NaN
N° 8 (Bias2)	---	6.555E-3	1.806E-2	7.313E-2	1.828E-1	2.215E-1	2.535E-1	2.506E-1	3.035E-1	NaN	NaN
N° 9 (Bias2)	---	4.999E-3	1.120E-2	1.006E-1	1.261E-1	1.871E-1	2.995E-1	2.382E-1	2.412E-1	1.598E-1	1.281E-2
N° 10 (Bias2)	---	6.621E-3	1.384E-2	8.067E-2	1.647E-1	2.064E-1	2.635E-1	2.114E-1	NaN	NaN	NaN
N° 11 (Bias2)	---	5.058E-3	1.096E-2	5.939E-2	9.857E-2	1.307E-1	3.247E-1	1.873E-1	NaN	NaN	NaN
N° 12 (OFF1)	---	4.156E-3	8.655E-3	4.755E-2	9.052E-2	1.495E-1	1.823E-1	2.246E-1	NaN	NaN	NaN
N° 13 (OFF1)	---	4.816E-3	8.839E-3	4.064E-2	8.248E-2	1.371E-1	1.992E-1	2.296E-1	NaN	NaN	NaN
N° 14 (OFF1)	---	3.794E-3	8.271E-3	3.780E-2	1.194E-1	NaN	NaN	NaN	NaN	NaN	NaN
N° 15 (OFF1)	---	3.471E-3	7.029E-3	3.251E-2	8.974E-2	1.259E-1	1.728E-1	1.071E-1	NaN	NaN	NaN
N° 16 (OFF1)	---	4.119E-3	8.308E-3	4.041E-2	1.316E-1	1.549E-1	1.897E-1	2.369E-1	NaN	NaN	NaN
Average (OFF1)	---	3.972E-3	8.627E-3	2.046E-2	3.683E-2	4.057E-2	6.948E-2	8.447E-2	9.877E-2	5.604E-2	7.301E-3
σ (OFF1)	---	5.973E-4	1.670E-3	4.763E-3	9.262E-3	7.918E-3	1.388E-2	2.720E-2	2.917E-2	NaN	NaN
Average+3σ (OFF1)	---	5.764E-3	1.364E-2	3.475E-2	6.461E-2	6.432E-2	1.111E-1	1.661E-1	1.863E-1	NaN	NaN
Average-3σ (OFF1)	---	2.180E-3	3.618E-3	6.175E-3	9.044E-3	1.682E-2	2.783E-2	2.874E-3	1.125E-2	NaN	NaN
Average (Bias1)	---	5.625E-3	1.276E-2	7.368E-2	1.507E-1	1.825E-1	2.840E-1	2.257E-1	2.643E-1	1.598E-1	1.281E-2
σ (Bias1)	---	8.819E-4	3.312E-3	1.832E-2	3.710E-2	3.548E-2	2.858E-2	2.590E-2	3.417E-2	NaN	NaN
Average+3σ (Bias1)	---	8.270E-3	2.270E-2	1.287E-1	2.620E-1	2.890E-1	3.697E-1	3.034E-1	3.668E-1	NaN	NaN
Average-3σ (Bias1)	---	2.979E-3	2.827E-3	1.871E-2	3.945E-2	7.609E-2	1.982E-1	1.480E-1	1.618E-1	NaN	NaN
Average (Bias2)	---	4.071E-3	8.220E-3	3.978E-2	1.028E-1	1.419E-1	1.860E-1	1.995E-1	NaN	NaN	NaN
σ (Bias2)	---	5.001E-4	7.075E-4	5.438E-3	2.145E-2	1.298E-2	1.117E-2	6.182E-2	0.000E+0	0.000E+0	0.000E+0
Average+3σ (Bias2)	---	5.572E-3	1.034E-2	5.610E-2	1.671E-1	1.808E-1	2.195E-1	3.850E-1	NaN	NaN	NaN
Average-3σ (Bias2)	---	2.571E-3	6.098E-3	2.347E-2	3.840E-2	1.029E-1	1.525E-1	1.407E-2	NaN	NaN	NaN

11.CTR2

Ta=25°C; Vce = 5V; If = 2 mA



CTR2 . (%)

	0krad(Si)	10krad(Si)	20krad(Si)	50krad(Si)	74krad(Si)	102krad(Si)	123krad(Si)	152krad(Si)	203krad(Si)	24h/25°C	168h/100°C
N° 1 (Ref)	214.70	213.42	212.21	213.00	206.01	213.51	205.52	209.84	213.07	211.47	216.20
N° 2 (Bias1)	198.26	124.81	88.72	56.41	37.43	34.02	21.72	19.86	17.33	Not Measurable**	Not Measurable**
N° 3 (Bias1)	203.80	126.56	81.83	Not Measurable**	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable**	Not Measurable**
N° 4 (Bias1)	148.27	96.08	68.45	41.45	27.86	27.22	18.31	14.13	12.87	Not Measurable**	Not Measurable**
N° 5 (Bias1)	252.80	154.44	111.62	60.68	34.44	41.54	26.93	25.74	23.07	Not Measurable**	Not Measurable**
N° 6 (Bias1)	227.30	142.21	105.06	64.82	47.27	36.84	26.20	24.30	20.36	27.21	99.43
N° 7 (Bias2)	245.46	135.25	97.37	30.89	10.78	11.95	7.15	8.26	7.63	Not Measurable**	Not Measurable**
N° 8 (Bias2)	203.39	107.38	61.63	23.50	10.30	8.75	7.62	7.65	6.22	Not Measurable**	Not Measurable**
N° 9 (Bias2)	211.68	121.93	83.29	16.36	14.55	10.16	6.35	8.16	7.77	11.67	74.50
N° 10 (Bias2)	156.86	90.78	62.80	20.42	11.23	9.11	7.17	7.66	Not Measurable**	Not Measurable**	Not Measurable**
N° 11 (Bias2)	244.48	135.70	92.54	28.42	18.93	14.83	5.97	10.50	Not Measurable**	Not Measurable**	Not Measurable**
N° 12 (OFF1)	214.90	132.91	97.41	32.86	19.82	12.73	10.64	8.62	Not Measurable**	Not Measurable**	Not Measurable**
N° 13 (OFF1)	235.03	130.44	99.73	38.45	22.21	14.29	10.13	8.77	Not Measurable**	Not Measurable**	Not Measurable**
N° 14 (OFF1)	233.70	144.51	103.66	40.93	15.40	Not Measurable**	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable**	Not Measurable**
N° 15 (OFF1)	253.14	155.53	114.81	45.40	19.28	14.77	11.05	10.21	Not Measurable**	Not Measurable**	Not Measurable**
N° 16 (OFF1)	236.57	140.15	102.67	38.24	13.83	12.50	10.50	8.42	Not Measurable**	Not Measurable**	Not Measurable**

* device not irradiated

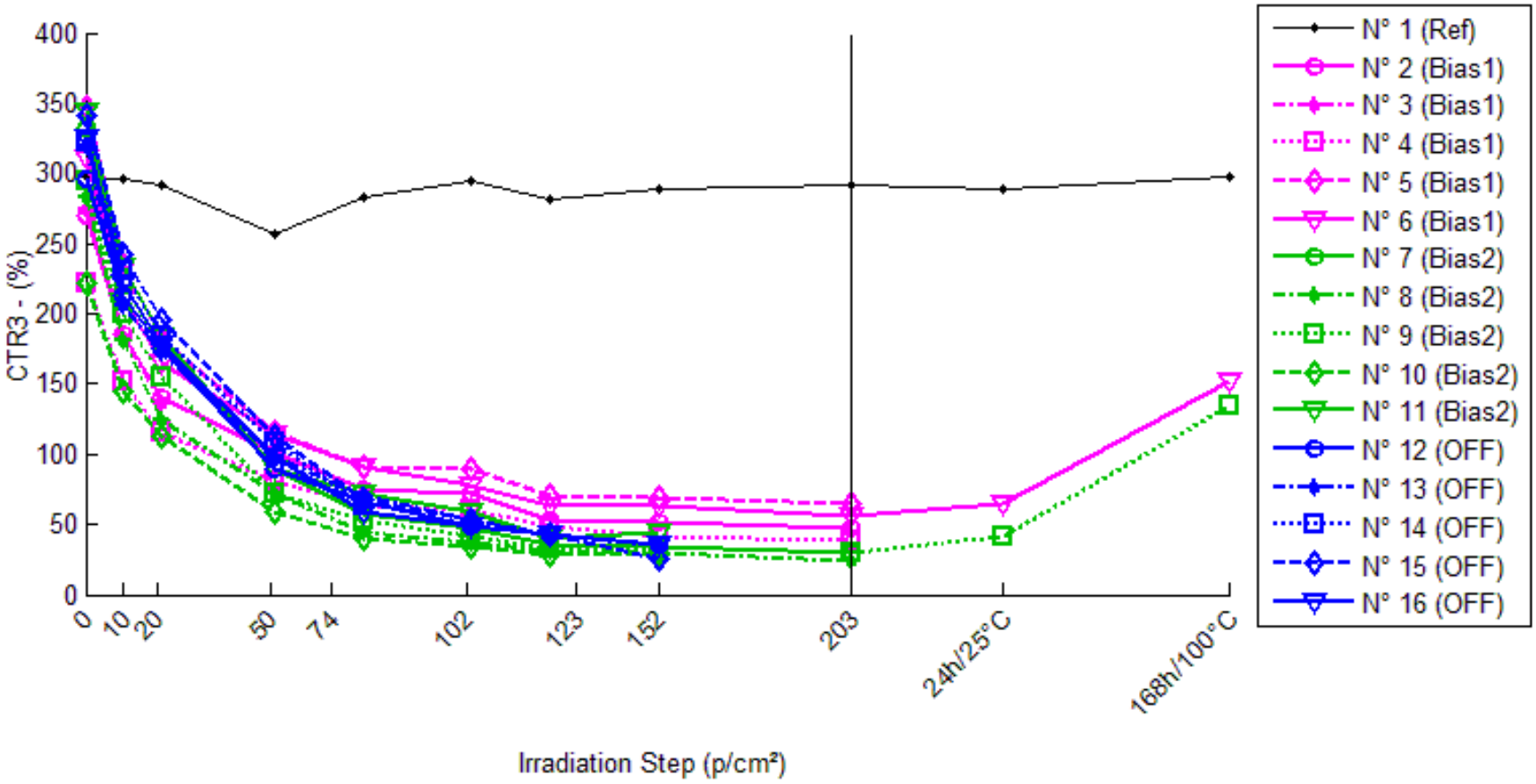
** Not Measurable because of test condition (cf. Vcbo) cannot be applied

1/Delta [CTR2]

	0krad(Si)	10krad(Si)	20krad(Si)	50krad(Si)	74krad(Si)	102krad(Si)	123krad(Si)	152krad(Si)	203krad(Si)	24h/25°C	168h/100°C
N° 1 (Ref)	---	2.797E-5	5.477E-5	3.725E-5	1.965E-4	2.611E-5	2.081E-4	1.079E-4	3.569E-5	7.113E-5	-3.229E-5
N° 2 (Bias1)	---	2.968E-3	6.227E-3	1.268E-2	2.167E-2	2.435E-2	4.099E-2	4.531E-2	5.265E-2	NaN	NaN
N° 3 (Bias1)	---	2.994E-3	7.314E-3	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
N° 4 (Bias1)	---	3.663E-3	7.864E-3	1.738E-2	2.914E-2	2.999E-2	4.787E-2	6.403E-2	7.094E-2	NaN	NaN
N° 5 (Bias1)	---	2.519E-3	5.004E-3	1.252E-2	2.508E-2	2.011E-2	3.318E-2	3.489E-2	3.939E-2	NaN	NaN
N° 6 (Bias1)	---	2.632E-3	5.119E-3	1.103E-2	1.676E-2	2.275E-2	3.376E-2	3.676E-2	4.472E-2	3.234E-2	5.657E-3
N° 7 (Bias2)	---	3.320E-3	6.196E-3	2.830E-2	8.870E-2	7.962E-2	1.359E-1	1.170E-1	1.270E-1	NaN	NaN
N° 8 (Bias2)	---	4.396E-3	1.131E-2	3.764E-2	9.214E-2	1.094E-1	1.263E-1	1.259E-1	1.559E-1	NaN	NaN
N° 9 (Bias2)	---	3.477E-3	7.282E-3	5.639E-2	6.399E-2	9.371E-2	1.529E-1	1.178E-1	1.239E-1	8.099E-2	8.698E-3
N° 10 (Bias2)	---	4.641E-3	9.548E-3	4.261E-2	8.271E-2	1.034E-1	1.330E-1	1.241E-1	NaN	NaN	NaN
N° 11 (Bias2)	---	3.279E-3	6.715E-3	3.110E-2	4.875E-2	6.333E-2	1.633E-1	9.114E-2	NaN	NaN	NaN
N° 12 (OFF1)	---	2.871E-3	5.613E-3	2.578E-2	4.579E-2	7.389E-2	8.931E-2	1.113E-1	NaN	NaN	NaN
N° 13 (OFF1)	---	3.411E-3	5.772E-3	2.176E-2	4.077E-2	6.570E-2	9.447E-2	1.097E-1	NaN	NaN	NaN
N° 14 (OFF1)	---	2.641E-3	5.368E-3	2.015E-2	6.064E-2	NaN	NaN	NaN	NaN	NaN	NaN
N° 15 (OFF1)	---	2.479E-3	4.760E-3	1.808E-2	4.792E-2	6.378E-2	8.658E-2	9.401E-2	NaN	NaN	NaN
N° 16 (OFF1)	---	2.908E-3	5.513E-3	2.192E-2	6.807E-2	7.575E-2	9.104E-2	1.145E-1	NaN	NaN	NaN
Average (OFF1)	---	2.955E-3	6.305E-3	1.340E-2	2.316E-2	2.430E-2	3.895E-2	4.525E-2	5.192E-2	3.234E-2	5.657E-3
σ (OFF1)	---	4.465E-4	1.280E-3	2.755E-3	5.251E-3	4.176E-3	6.928E-3	1.332E-2	1.380E-2	NaN	NaN
Average+3σ (OFF1)	---	4.295E-3	1.015E-2	2.167E-2	3.892E-2	3.683E-2	5.973E-2	8.521E-2	9.332E-2	NaN	NaN
Average-3σ (OFF1)	---	1.616E-3	2.466E-3	5.141E-3	7.408E-3	1.177E-2	1.817E-2	5.289E-3	1.053E-2	NaN	NaN
Average (Bias1)	---	3.823E-3	8.210E-3	3.921E-2	7.526E-2	8.990E-2	1.423E-1	1.152E-1	1.356E-1	8.099E-2	8.698E-3
σ (Bias1)	---	6.454E-4	2.153E-3	1.111E-2	1.838E-2	1.864E-2	1.532E-2	1.398E-2	1.762E-2	NaN	NaN
Average+3σ (Bias1)	---	5.759E-3	1.467E-2	7.255E-2	1.304E-1	1.458E-1	1.882E-1	1.571E-1	1.885E-1	NaN	NaN
Average-3σ (Bias1)	---	1.886E-3	1.751E-3	5.863E-3	2.012E-2	3.398E-2	9.631E-2	7.324E-2	8.275E-2	NaN	NaN
Average (Bias2)	---	2.862E-3	5.405E-3	2.154E-2	5.264E-2	6.978E-2	9.035E-2	1.074E-1	NaN	NaN	NaN
σ (Bias2)	---	3.533E-4	3.896E-4	2.832E-3	1.131E-2	5.921E-3	3.303E-3	9.148E-3	0.000E+0	0.000E+0	0.000E+0
Average+3σ (Bias2)	---	3.922E-3	6.574E-3	3.004E-2	8.658E-2	8.754E-2	1.003E-1	1.348E-1	NaN	NaN	NaN
Average-3σ (Bias2)	---	1.802E-3	4.236E-3	1.304E-2	1.870E-2	5.202E-2	8.044E-2	7.995E-2	NaN	NaN	NaN

12.CTR3

Ta=25°C; Vce = 5V; If = 10 mA



CTR3 . (%)

	0krad(Si)	10krad(Si)	20krad(Si)	50krad(Si)	74krad(Si)	102krad(Si)	123krad(Si)	152krad(Si)	203krad(Si)	24h/25°C	168h/100°C
N° 1 (Ref)	296.75	295.85	292.30	296.58	282.98	294.06	281.76	288.76	292.24	288.95	296.93
N° 2 (Bias1)	269.26	185.22	140.03	101.11	75.01	72.00	53.35	51.94	47.41	Not Measurable**	Not Measurable**
N° 3 (Bias1)	274.31	184.44	136.62	Not Measurable**	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable**	Not Measurable**
N° 4 (Bias1)	221.52	152.58	115.70	80.26	63.50	61.02	48.11	40.93	38.90	Not Measurable**	Not Measurable**
N° 5 (Bias1)	346.49	234.72	181.07	115.47	90.82	89.46	70.13	68.78	64.03	Not Measurable**	Not Measurable**
N° 6 (Bias1)	310.27	211.64	164.66	114.80	91.17	77.35	63.97	62.73	55.33	64.53	152.54
N° 7 (Bias2)	332.37	220.38	178.60	89.86	58.02	47.78	35.41	34.27	30.18	Not Measurable**	Not Measurable**
N° 8 (Bias2)	283.09	180.74	124.71	72.17	44.53	36.52	30.80	30.42	24.45	Not Measurable**	Not Measurable**
N° 9 (Bias2)	294.19	200.63	154.60	72.12	52.76	41.12	32.25	34.09	30.33	40.80	135.26
N° 10 (Bias2)	221.82	145.14	112.81	58.75	40.26	34.62	28.78	29.88	Not Measurable**	Not Measurable**	Not Measurable**
N° 11 (Bias2)	344.10	233.71	183.97	89.72	71.89	59.10	40.22	43.84	Not Measurable**	Not Measurable**	Not Measurable**
N° 12 (OFF1)	296.67	213.73	175.18	89.70	66.62	49.44	43.10	35.96	Not Measurable**	Not Measurable**	Not Measurable**
N° 13 (OFF1)	319.59	205.19	172.42	97.73	70.58	52.51	40.84	35.77	Not Measurable**	Not Measurable**	Not Measurable**
N° 14 (OFF1)	322.48	230.00	184.32	107.98	63.10	Not Measurable**	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable**	Not Measurable**
N° 15 (OFF1)	340.92	242.28	195.21	112.96	67.80	53.77	43.24	24.80	Not Measurable**	Not Measurable**	Not Measurable**
N° 16 (OFF1)	324.60	221.52	177.85	98.42	58.25	48.09	42.32	35.22	Not Measurable**	Not Measurable**	Not Measurable**

* device not irradiated

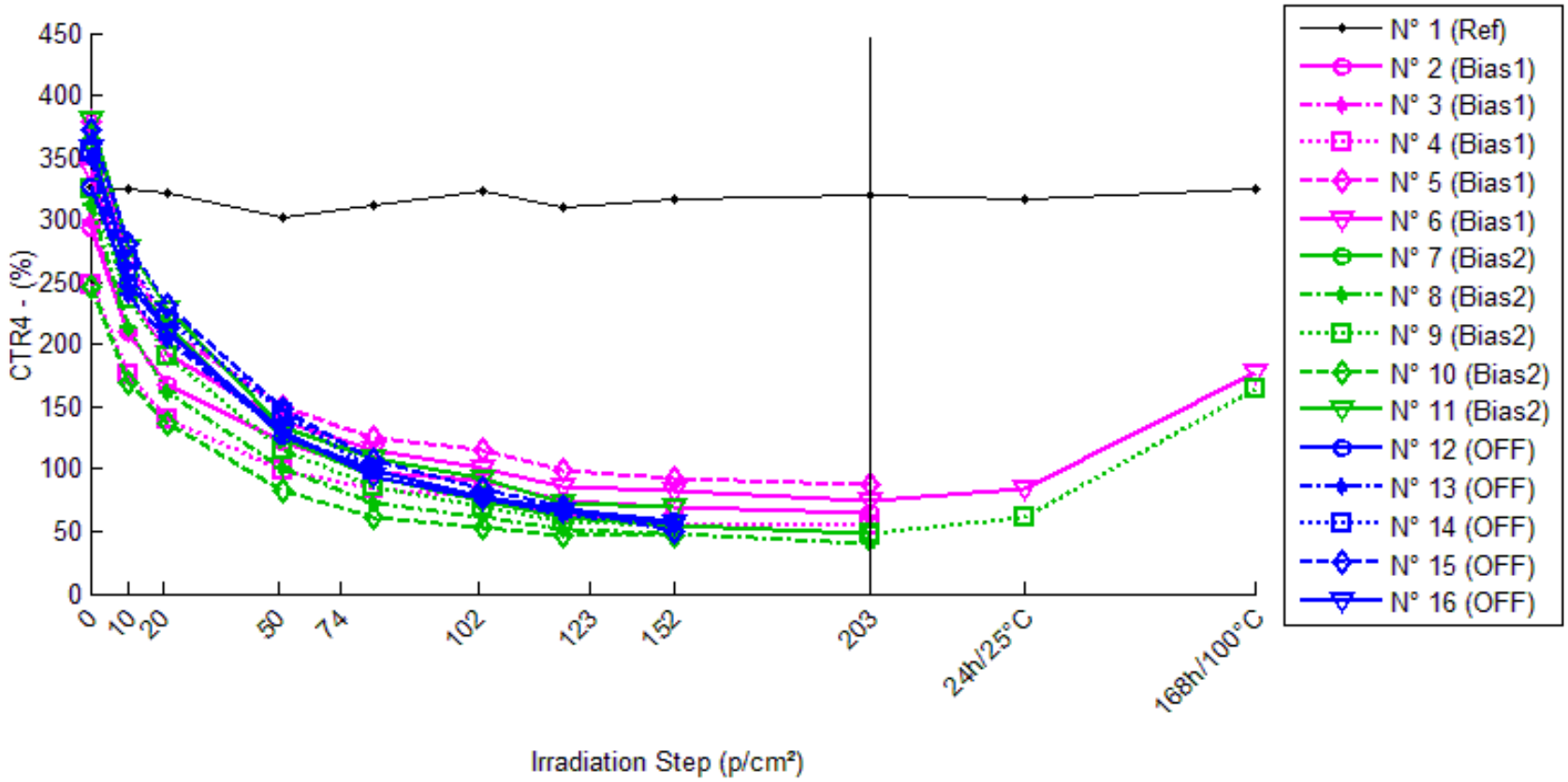
** Not Measurable because of test condition (cf. Vcbo) cannot be applied

1/Delta [CTR3]

	0krad(Si)	10krad(Si)	20krad(Si)	50krad(Si)	74krad(Si)	102krad(Si)	123krad(Si)	152krad(Si)	203krad(Si)	24h/25°C	168h/100°C
N° 1 (Ref)	---	1.028E-5	5.135E-5	1.979E-6	1.640E-4	3.088E-5	1.793E-4	9.330E-5	5.201E-5	9.105E-5	-1.972E-6
N° 2 (Bias1)	---	1.685E-3	3.428E-3	6.176E-3	9.618E-3	1.018E-2	1.503E-2	1.554E-2	1.738E-2	NaN	NaN
N° 3 (Bias1)	---	1.776E-3	3.674E-3	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
N° 4 (Bias1)	---	2.040E-3	4.129E-3	7.945E-3	1.123E-2	1.187E-2	1.627E-2	1.992E-2	2.119E-2	NaN	NaN
N° 5 (Bias1)	---	1.374E-3	2.637E-3	5.774E-3	8.125E-3	8.292E-3	1.137E-2	1.165E-2	1.273E-2	NaN	NaN
N° 6 (Bias1)	---	1.502E-3	2.850E-3	5.488E-3	7.745E-3	9.706E-3	1.241E-2	1.272E-2	1.485E-2	1.227E-2	3.333E-3
N° 7 (Bias2)	---	1.529E-3	2.590E-3	8.119E-3	1.423E-2	1.792E-2	2.523E-2	2.617E-2	3.013E-2	NaN	NaN
N° 8 (Bias2)	---	2.000E-3	4.486E-3	1.032E-2	1.892E-2	2.385E-2	2.893E-2	2.935E-2	3.737E-2	NaN	NaN
N° 9 (Bias2)	---	1.585E-3	3.069E-3	1.047E-2	1.556E-2	2.092E-2	2.761E-2	2.594E-2	2.957E-2	2.111E-2	3.994E-3
N° 10 (Bias2)	---	2.382E-3	4.356E-3	1.251E-2	2.033E-2	2.438E-2	3.024E-2	2.896E-2	NaN	NaN	NaN
N° 11 (Bias2)	---	1.373E-3	2.529E-3	8.240E-3	1.100E-2	1.401E-2	2.196E-2	1.990E-2	NaN	NaN	NaN
N° 12 (OFF1)	---	1.308E-3	2.338E-3	7.777E-3	1.164E-2	1.686E-2	1.983E-2	2.444E-2	NaN	NaN	NaN
N° 13 (OFF1)	---	1.744E-3	2.671E-3	7.103E-3	1.104E-2	1.592E-2	2.136E-2	2.482E-2	NaN	NaN	NaN
N° 14 (OFF1)	---	1.247E-3	2.324E-3	6.160E-3	1.275E-2	NaN	NaN	NaN	NaN	NaN	NaN
N° 15 (OFF1)	---	1.194E-3	2.189E-3	5.919E-3	1.182E-2	1.566E-2	2.019E-2	3.738E-2	NaN	NaN	NaN
N° 16 (OFF1)	---	1.434E-3	2.542E-3	7.079E-3	1.409E-2	1.771E-2	2.055E-2	2.531E-2	NaN	NaN	NaN
Average (OFF1)	---	1.675E-3	3.343E-3	6.346E-3	9.180E-3	1.001E-2	1.377E-2	1.496E-2	1.654E-2	1.227E-2	3.333E-3
σ (OFF1)	---	2.568E-4	6.076E-4	1.103E-3	1.589E-3	1.477E-3	2.269E-3	3.692E-3	3.638E-3	NaN	NaN
Average+3σ (OFF1)	---	2.446E-3	5.166E-3	9.654E-3	1.395E-2	1.444E-2	2.058E-2	2.604E-2	2.745E-2	NaN	NaN
Average-3σ (OFF1)	---	9.050E-4	1.521E-3	3.038E-3	4.412E-3	5.581E-3	6.964E-3	3.881E-3	5.624E-3	NaN	NaN
Average (Bias1)	---	1.774E-3	3.406E-3	9.933E-3	1.601E-2	2.022E-2	2.679E-2	2.606E-2	3.236E-2	2.111E-2	3.994E-3
σ (Bias1)	---	4.115E-4	9.509E-4	1.820E-3	3.729E-3	4.323E-3	3.276E-3	3.779E-3	4.349E-3	NaN	NaN
Average+3σ (Bias1)	---	3.008E-3	6.259E-3	1.539E-2	2.720E-2	3.318E-2	3.662E-2	3.740E-2	4.540E-2	NaN	NaN
Average-3σ (Bias1)	---	5.394E-4	5.536E-4	4.473E-3	4.820E-3	7.247E-3	1.697E-2	1.472E-2	1.931E-2	NaN	NaN
Average (Bias2)	---	1.385E-3	2.413E-3	6.808E-3	1.227E-2	1.654E-2	2.048E-2	2.799E-2	NaN	NaN	NaN
σ (Bias2)	---	2.196E-4	1.915E-4	7.600E-4	1.188E-3	9.366E-4	6.529E-4	6.273E-3	0.000E+0	0.000E+0	0.000E+0
Average+3σ (Bias2)	---	2.044E-3	2.987E-3	9.088E-3	1.583E-2	1.935E-2	2.244E-2	4.681E-2	NaN	NaN	NaN
Average-3σ (Bias2)	---	7.265E-4	1.838E-3	4.528E-3	8.702E-3	1.373E-2	1.852E-2	9.171E-3	NaN	NaN	NaN

13.CTR4

Ta=25°C; Vce = 5V; If = 20 mA



CTR4 . (%)

	0krad(Si)	10krad(Si)	20krad(Si)	50krad(Si)	74krad(Si)	102krad(Si)	123krad(Si)	152krad(Si)	203krad(Si)	24h/25°C	168h/100°C
N° 1 (Ref)	325.85	324.85	320.92	322.30	311.49	322.82	310.13	317.38	320.30	317.03	325.49
N° 2 (Bias1)	294.54	210.82	167.63	122.59	96.69	91.07	73.65	69.83	64.57	Not Measurable**	Not Measurable**
N° 3 (Bias1)	299.30	209.23	165.13	Not Measurable**	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable**	Not Measurable**
N° 4 (Bias1)	247.92	176.58	139.64	99.24	84.99	77.56	64.58	56.84	54.21	Not Measurable**	Not Measurable**
N° 5 (Bias1)	378.92	268.22	211.83	149.21	125.63	114.73	98.30	92.08	86.86	Not Measurable**	Not Measurable**
N° 6 (Bias1)	339.82	241.25	192.24	138.36	114.97	100.70	86.22	83.29	74.85	83.81	177.90
N° 7 (Bias2)	362.45	256.73	214.65	124.92	94.75	74.97	62.00	54.86	47.96	Not Measurable**	Not Measurable**
N° 8 (Bias2)	311.78	213.58	160.44	101.18	72.51	61.21	51.28	47.90	40.27	Not Measurable**	Not Measurable**
N° 9 (Bias2)	324.89	236.03	191.04	115.06	85.92	69.74	57.94	54.97	48.43	60.59	164.50
N° 10 (Bias2)	245.60	169.65	135.88	82.05	61.27	53.74	45.97	46.51	Not Measurable**	Not Measurable**	Not Measurable**
N° 11 (Bias2)	380.12	277.53	228.00	133.91	109.13	91.68	72.34	69.88	Not Measurable**	Not Measurable**	Not Measurable**
N° 12 (OFF1)	327.13	249.13	210.71	126.76	99.07	77.94	68.17	58.04	Not Measurable**	Not Measurable**	Not Measurable**
N° 13 (OFF1)	348.63	239.39	203.90	128.28	99.17	77.89	63.60	56.00	Not Measurable**	Not Measurable**	Not Measurable**
N° 14 (OFF1)	354.49	267.01	220.80	144.09	99.64	Not Measurable**	Not Measurable*	Not Measurable*	Not Measurable**	Not Measurable**	Not Measurable**
N° 15 (OFF1)	372.47	280.16	231.01	147.76	107.31	83.99	69.87	50.08	Not Measurable**	Not Measurable**	Not Measurable**
N° 16 (OFF1)	356.89	257.59	211.08	130.10	94.65	76.26	65.85	56.15	Not Measurable**	Not Measurable**	Not Measurable**

* device not irradiated

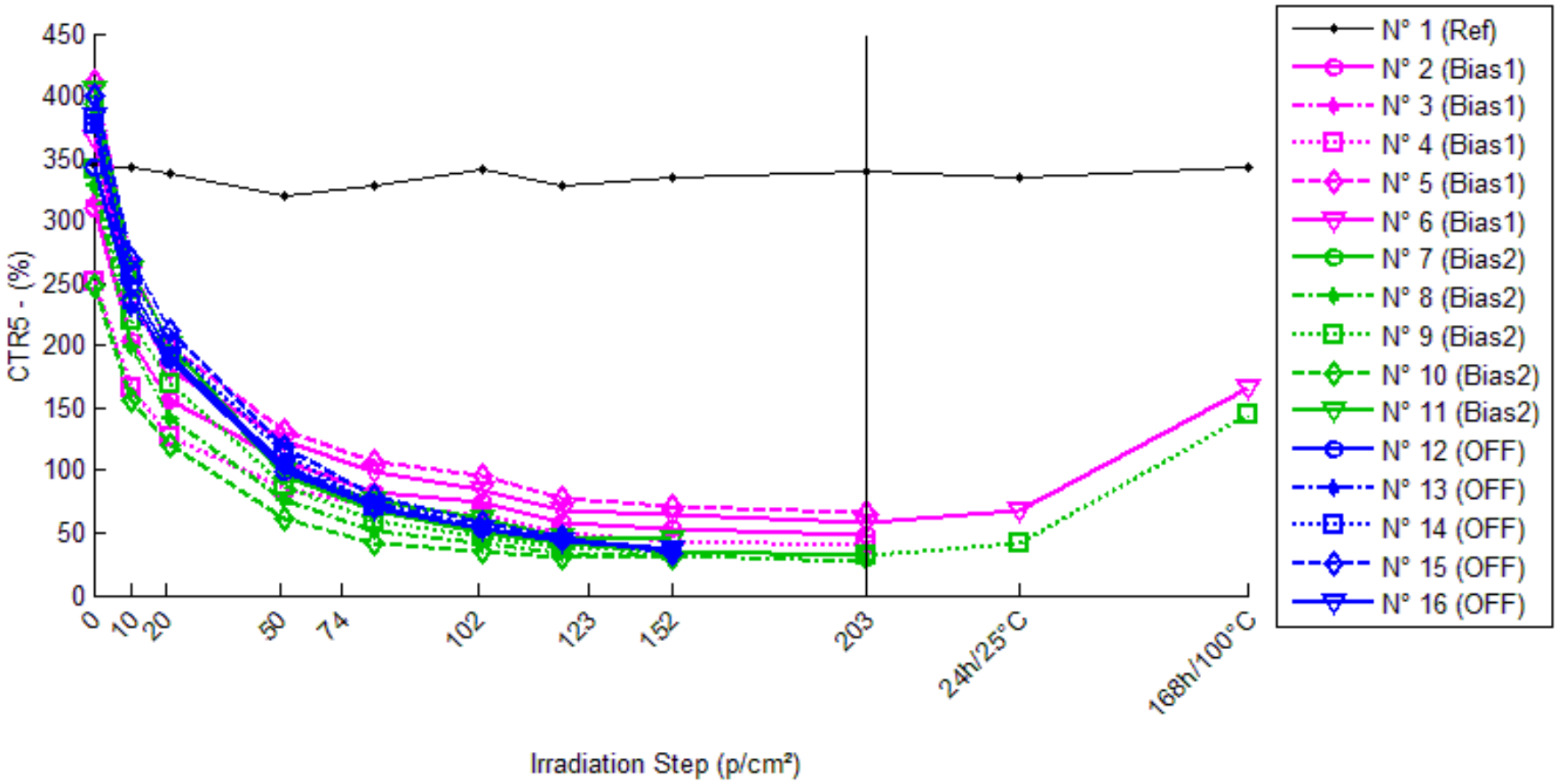
** Not Measurable because of test condition (cf. Vcbo) cannot be applied

1/Delta [CTR4]

	0krad(Si)	10krad(Si)	20krad(Si)	50krad(Si)	74krad(Si)	102krad(Si)	123krad(Si)	152krad(Si)	203krad(Si)	24h/25°C	168h/100°C
N° 1 (Ref)	---	9.405E-6	4.718E-5	3.379E-5	1.415E-4	2.882E-5	1.555E-4	8.187E-5	5.320E-5	8.536E-5	3.391E-6
N° 2 (Bias1)	---	1.348E-3	2.570E-3	4.762E-3	6.948E-3	7.585E-3	1.018E-2	1.092E-2	1.209E-2	NaN	NaN
N° 3 (Bias1)	---	1.438E-3	2.715E-3	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
N° 4 (Bias1)	---	1.630E-3	3.128E-3	6.043E-3	7.732E-3	8.860E-3	1.145E-2	1.356E-2	1.441E-2	NaN	NaN
N° 5 (Bias1)	---	1.089E-3	2.082E-3	4.063E-3	5.321E-3	6.077E-3	7.533E-3	8.221E-3	8.874E-3	NaN	NaN
N° 6 (Bias1)	---	1.202E-3	2.259E-3	4.285E-3	5.755E-3	6.987E-3	8.656E-3	9.064E-3	1.042E-2	8.989E-3	2.678E-3
N° 7 (Bias2)	---	1.136E-3	1.900E-3	5.246E-3	7.795E-3	1.058E-2	1.337E-2	1.547E-2	1.809E-2	NaN	NaN
N° 8 (Bias2)	---	1.475E-3	3.026E-3	6.676E-3	1.058E-2	1.313E-2	1.629E-2	1.767E-2	2.162E-2	NaN	NaN
N° 9 (Bias2)	---	1.159E-3	2.157E-3	5.613E-3	8.561E-3	1.126E-2	1.418E-2	1.511E-2	1.757E-2	1.343E-2	3.001E-3
N° 10 (Bias2)	---	1.823E-3	3.288E-3	8.116E-3	1.225E-2	1.454E-2	1.768E-2	1.743E-2	NaN	NaN	NaN
N° 11 (Bias2)	---	9.725E-4	1.755E-3	4.837E-3	6.533E-3	8.276E-3	1.119E-2	1.168E-2	NaN	NaN	NaN
N° 12 (OFF1)	---	9.570E-4	1.689E-3	4.832E-3	7.037E-3	9.774E-3	1.161E-2	1.417E-2	NaN	NaN	NaN
N° 13 (OFF1)	---	1.309E-3	2.036E-3	4.927E-3	7.215E-3	9.970E-3	1.285E-2	1.499E-2	NaN	NaN	NaN
N° 14 (OFF1)	---	9.243E-4	1.708E-3	4.119E-3	7.215E-3	NaN	NaN	NaN	NaN	NaN	NaN
N° 15 (OFF1)	---	8.846E-4	1.644E-3	4.083E-3	6.634E-3	9.222E-3	1.163E-2	1.729E-2	NaN	NaN	NaN
N° 16 (OFF1)	---	1.080E-3	1.936E-3	4.885E-3	7.763E-3	1.031E-2	1.238E-2	1.501E-2	NaN	NaN	NaN
Average (OFF1)	---	1.341E-3	2.551E-3	4.788E-3	6.439E-3	7.377E-3	9.456E-3	1.044E-2	1.145E-2	8.989E-3	2.678E-3
σ (OFF1)	---	2.094E-4	4.079E-4	8.861E-4	1.103E-3	1.167E-3	1.718E-3	2.365E-3	2.373E-3	NaN	NaN
Average+3σ (OFF1)	---	1.970E-3	3.774E-3	7.447E-3	9.747E-3	1.088E-2	1.461E-2	1.754E-2	1.857E-2	NaN	NaN
Average-3σ (OFF1)	---	7.132E-4	1.327E-3	2.130E-3	3.130E-3	3.878E-3	4.303E-3	3.347E-3	4.329E-3	NaN	NaN
Average (Bias1)	---	1.313E-3	2.425E-3	6.098E-3	9.145E-3	1.156E-2	1.454E-2	1.547E-2	1.910E-2	1.343E-2	3.001E-3
σ (Bias1)	---	3.381E-4	6.896E-4	1.319E-3	2.275E-3	2.406E-3	2.532E-3	2.407E-3	2.205E-3	NaN	NaN
Average+3σ (Bias1)	---	2.327E-3	4.494E-3	1.005E-2	1.597E-2	1.878E-2	2.214E-2	2.269E-2	2.571E-2	NaN	NaN
Average-3σ (Bias1)	---	2.988E-4	3.563E-4	2.141E-3	2.320E-3	4.338E-3	6.947E-3	8.252E-3	1.248E-2	NaN	NaN
Average (Bias2)	---	1.031E-3	1.803E-3	4.569E-3	7.173E-3	9.819E-3	1.212E-2	1.536E-2	NaN	NaN	NaN
σ (Bias2)	---	1.717E-4	1.726E-4	4.288E-4	4.065E-4	4.561E-4	6.084E-4	1.339E-3	0.000E+0	0.000E+0	0.000E+0
Average+3σ (Bias2)	---	1.546E-3	2.320E-3	5.856E-3	8.393E-3	1.119E-2	1.394E-2	1.938E-2	NaN	NaN	NaN
Average-3σ (Bias2)	---	5.158E-4	1.285E-3	3.283E-3	5.953E-3	8.451E-3	1.029E-2	1.135E-2	NaN	NaN	NaN

14.CTR5

Ta=25°C; Vce = 20V; If = 10 mA



CTR5 . (%)

	0krad(Si)	10krad(Si)	20krad(Si)	50krad(Si)	74krad(Si)	102krad(Si)	123krad(Si)	152krad(Si)	203krad(Si)	24h/25°C	168h/100°C
N° 1 (Ref)	343.86	342.40	338.63	339.72	327.51	341.17	328.04	335.10	339.67	334.61	343.45
N° 2 (Bias1)	309.67	203.82	155.63	107.02	82.19	75.23	58.14	53.75	48.98	Not Measurable**	Not Measurable**
N° 3 (Bias1)	314.21	202.36	154.74	Not Measurable**	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable*	Not Measurable	Not Measurable**
N° 4 (Bias1)	251.15	166.69	127.53	85.44	71.68	63.85	50.55	43.35	40.54	Not Measurable**	Not Measurable**
N° 5 (Bias1)	411.38	262.98	199.00	131.21	107.01	95.99	77.78	71.60	66.71	Not Measurable**	Not Measurable**
N° 6 (Bias1)	365.44	236.46	181.30	122.85	99.13	84.61	68.64	65.11	57.41	67.10	166.08
N° 7 (Bias2)	393.52	245.36	194.48	95.97	67.30	50.63	40.91	35.67	31.25	Not Measurable**	Not Measurable**
N° 8 (Bias2)	327.77	198.77	141.16	76.16	50.81	41.51	34.10	31.46	26.54	Not Measurable**	Not Measurable**
N° 9 (Bias2)	340.70	220.38	169.30	87.33	60.31	46.70	37.72	35.24	31.81	42.18	145.07
N° 10 (Bias2)	247.45	156.24	120.20	61.77	42.09	35.91	29.85	30.85	Not Measurable**	Not Measurable**	Not Measurable**
N° 11 (Bias2)	405.35	260.73	201.13	99.56	75.71	61.64	47.02	45.40	Not Measurable**	Not Measurable**	Not Measurable**
N° 12 (OFF1)	343.08	235.92	189.43	98.56	70.98	52.80	44.81	37.33	Not Measurable**	Not Measurable**	Not Measurable**
N° 13 (OFF1)	376.75	230.35	187.78	103.64	73.98	54.82	42.97	37.16	Not Measurable**	Not Measurable**	Not Measurable**
N° 14 (OFF1)	377.48	255.82	200.45	113.91	70.75	Not Measurable**	Not Measurable*	Not Measurable*	Not Measurable**	Not Measurable**	Not Measurable**
N° 15 (OFF1)	399.73	269.25	211.48	118.88	79.79	58.55	46.92	32.79	Not Measurable**	Not Measurable**	Not Measurable**
N° 16 (OFF1)	383.25	245.59	192.49	103.95	69.76	52.93	44.10	36.58	Not Measurable**	Not Measurable**	Not Measurable**

* device not irradiated

** Not Measurable because of test condition (cf. Vcbo) cannot be applied

1/Delta [CTR5]

	0krad(Si)	10krad(Si)	20krad(Si)	50krad(Si)	74krad(Si)	102krad(Si)	123krad(Si)	152krad(Si)	203krad(Si)	24h/25°C	168h/100°C
N° 1 (Ref)	---	1.238E-5	4.491E-5	3.543E-5	1.451E-4	2.290E-5	1.402E-4	7.602E-5	3.583E-5	8.035E-5	3.416E-6
N° 2 (Bias1)	---	1.677E-3	3.196E-3	6.115E-3	8.938E-3	1.006E-2	1.397E-2	1.538E-2	1.719E-2	NaN	NaN
N° 3 (Bias1)	---	1.759E-3	3.280E-3	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
N° 4 (Bias1)	---	2.017E-3	3.860E-3	7.723E-3	9.969E-3	1.168E-2	1.580E-2	1.909E-2	2.068E-2	NaN	NaN
N° 5 (Bias1)	---	1.372E-3	2.594E-3	5.191E-3	6.914E-3	7.987E-3	1.043E-2	1.153E-2	1.256E-2	NaN	NaN
N° 6 (Bias1)	---	1.493E-3	2.779E-3	5.404E-3	7.351E-3	9.083E-3	1.183E-2	1.262E-2	1.468E-2	1.217E-2	3.285E-3
N° 7 (Bias2)	---	1.534E-3	2.601E-3	7.878E-3	1.232E-2	1.721E-2	2.190E-2	2.550E-2	2.945E-2	NaN	NaN
N° 8 (Bias2)	---	1.980E-3	4.033E-3	1.008E-2	1.663E-2	2.104E-2	2.627E-2	2.873E-2	3.462E-2	NaN	NaN
N° 9 (Bias2)	---	1.602E-3	2.972E-3	8.515E-3	1.365E-2	1.848E-2	2.358E-2	2.544E-2	2.850E-2	2.077E-2	3.958E-3
N° 10 (Bias2)	---	2.359E-3	4.278E-3	1.215E-2	1.972E-2	2.380E-2	2.946E-2	2.837E-2	NaN	NaN	NaN
N° 11 (Bias2)	---	1.368E-3	2.505E-3	7.577E-3	1.074E-2	1.376E-2	1.880E-2	1.956E-2	NaN	NaN	NaN
N° 12 (OFF1)	---	1.324E-3	2.364E-3	7.231E-3	1.117E-2	1.603E-2	1.940E-2	2.387E-2	NaN	NaN	NaN
N° 13 (OFF1)	---	1.687E-3	2.671E-3	6.994E-3	1.086E-2	1.559E-2	2.062E-2	2.426E-2	NaN	NaN	NaN
N° 14 (OFF1)	---	1.260E-3	2.340E-3	6.130E-3	1.148E-2	NaN	NaN	NaN	NaN	NaN	NaN
N° 15 (OFF1)	---	1.212E-3	2.227E-3	5.910E-3	1.003E-2	1.458E-2	1.881E-2	2.799E-2	NaN	NaN	NaN
N° 16 (OFF1)	---	1.463E-3	2.586E-3	7.011E-3	1.173E-2	1.628E-2	2.007E-2	2.473E-2	NaN	NaN	NaN
Average (OFF1)	---	1.664E-3	3.142E-3	6.108E-3	8.293E-3	9.703E-3	1.301E-2	1.466E-2	1.628E-2	1.217E-2	3.285E-3
σ (OFF1)	---	2.494E-4	4.920E-4	1.147E-3	1.416E-3	1.568E-3	2.364E-3	3.369E-3	3.493E-3	NaN	NaN
Average+3σ (OFF1)	---	2.412E-3	4.618E-3	9.548E-3	1.254E-2	1.441E-2	2.010E-2	2.476E-2	2.676E-2	NaN	NaN
Average-3σ (OFF1)	---	9.153E-4	1.666E-3	2.668E-3	4.046E-3	5.001E-3	5.914E-3	4.549E-3	5.798E-3	NaN	NaN
Average (Bias1)	---	1.769E-3	3.278E-3	9.239E-3	1.461E-2	1.886E-2	2.400E-2	2.552E-2	3.086E-2	2.077E-2	3.958E-3
σ (Bias1)	---	3.988E-4	8.248E-4	1.891E-3	3.583E-3	3.811E-3	4.079E-3	3.674E-3	3.293E-3	NaN	NaN
Average+3σ (Bias1)	---	2.965E-3	5.752E-3	1.491E-2	2.536E-2	3.029E-2	3.624E-2	3.654E-2	4.074E-2	NaN	NaN
Average-3σ (Bias1)	---	5.726E-4	8.033E-4	3.568E-3	3.863E-3	7.425E-3	1.176E-2	1.450E-2	2.098E-2	NaN	NaN
Average (Bias2)	---	1.389E-3	2.438E-3	6.655E-3	1.106E-2	1.562E-2	1.972E-2	2.521E-2	NaN	NaN	NaN
σ (Bias2)	---	1.912E-4	1.843E-4	5.926E-4	6.584E-4	7.502E-4	7.859E-4	1.886E-3	0.000E+0	0.000E+0	0.000E+0
Average+3σ (Bias2)	---	1.963E-3	2.991E-3	8.433E-3	1.303E-2	1.787E-2	2.208E-2	3.087E-2	NaN	NaN	NaN
Average-3σ (Bias2)	---	8.154E-4	1.885E-3	4.877E-3	9.080E-3	1.337E-2	1.737E-2	1.955E-2	NaN	NaN	NaN