PROTONS TEST REPORT

ESA study: “Survey of Critical Components for 150 kRad Power Systems”

ESTEC Contract N° 22831/09/NL/AF refers

Part Type : HS-4424BRH

Package : FP-16

Description : Dual, Non Inverting Power Mosfet Driver

Manufacturer: Intersil

Alter Technology Group Spain Purchase Order N° ATGSP-TL-09-JC-CO-9 dated 11/27/2009

Alter Technology Group Spain Project Manager Responsible: David NUNEZ

Hirex reference :	HRX/TID/0878	Issue : 01	Date :	June 6th, 2011
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CHANGE RECORD

ISSUE	DATE	PAGE	DESCRIPTION OF CHANGES
01	June 6th, 2011	All	Original Issue

PROTONS TEST REPORT
on
HS-4424BRH
Dual, Non Inverting Power Mosfet Driver

From Intersil

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1 Introduction

In the scope of the ESA study: “Survey of Critical Components for 150 kRad Power Systems”, a protons test of the Intersil HS-4424BRH, Dual, Non Inverting Power Mosfet Driver has been performed up to a total fluence of about 2E11 p/cm^2, in response to Alter Technology Group Spain purchase order reference ATGSP-TL-09-JC-CO-9 that refers to ESTEC contract N° 22831/09/NL/AF.

Displacement damage effects were investigated using 60 MeV protons energy. Devices were irradiated at UCL in Louvain - Belgium.

The purpose of this test was to characterize degradation due to proton displacement damage so a further mission analysis could determine their suitability for flight use. This test was conducted on samples provided by Alter Technology Group Spain.
Test has been performed in accordance with Hirex Engineering Radiation Test Plan HRX/SPE/0233 issue 2 dated 09/08/2010.

A complete set of electrical measurements together with graphical representation of measured parameters with respect to Equivalent Fluence levels received is also provided.

2 Applicable and Reference Documents

2.1 Applicable Documents

- Hirex Engineering Radiation Test Plan: HRX/SPE/0233 issue 2 dated 09/08/2010
- ESCC Basic Specification n° 22900: "Total Dose steady-state irradiation test method"
- Alter Technology Group Proposal: ATGSP-OF-648/2009 Issue 1
- Minutes of Meeting: MM-SRP-ATG-0001 dated 29/10/2009
- Hirex specification: Total Ionizing dose test general procedure.
- SMD detail specification: 5962-99560

2.2 Reference Documents

- Intersil datasheet: 4739.1, June 1999

3 Test Samples

7 samples of the HS-4424BRH devices were tested (6 + 1 control sample).
Allocation of samples used for testing is provided in the following table. Serial numbers were arbitrarily defined by Hirex.

Number serialized by Hirex	Samples Allocation
1	Control sample
2	Biased OFF
4	Biased OFF
5	Biased OFF
6	Biased OFF
7	Biased OFF
14	Biased OFF

Identification of the HS-4424BRH is given below:

Part Number: HS9-4424BRH

Top Marking: logo HS9-4424BRH delta/PROTO

Bottom Marking: -

Date Code: -

4 Experimental Conditions

4.1 Radiation Source Description

The protons exposures were performed at the UCL facility in Louvain-la-Neuve - Belgium.
The Proton Irradiation facility (Light Ion irradiation Facility or LIF) was used for this experiment. The corresponding experimental set-up is shown in Figure 1.

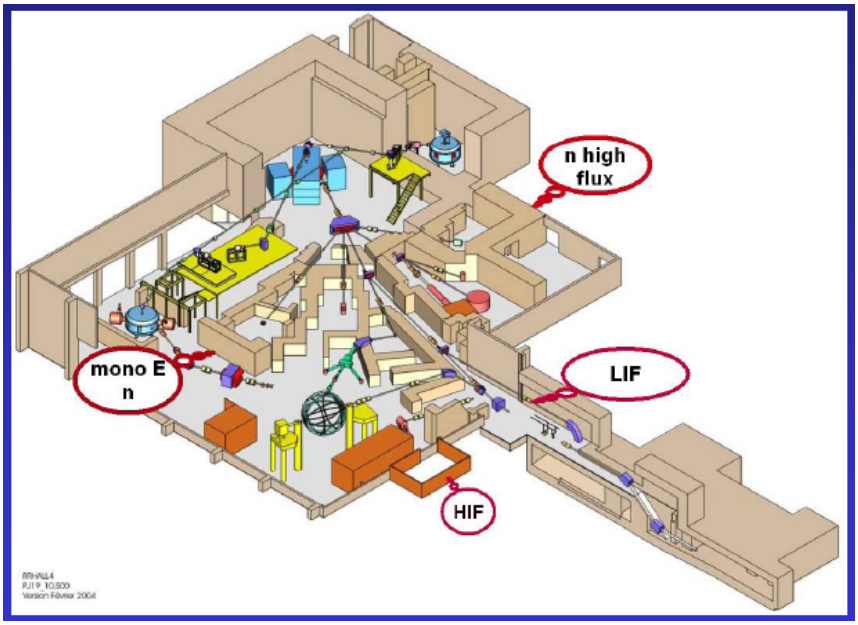


Figure 1 : LIF layout and typical experimental set-up

Light Ion irradiation Facility is characterized by the following beam parameters:
• Initial Proton Energies: 65 MeV;
• Energy Range: 9.3 – 62 MeV using energy degraders (See figure 2)
• Beam Flux at 62 MeV is between 10p/cm2/sec to 5E8 p/cm2/sec
• Irradiation Area: 8 cm diameter maximum

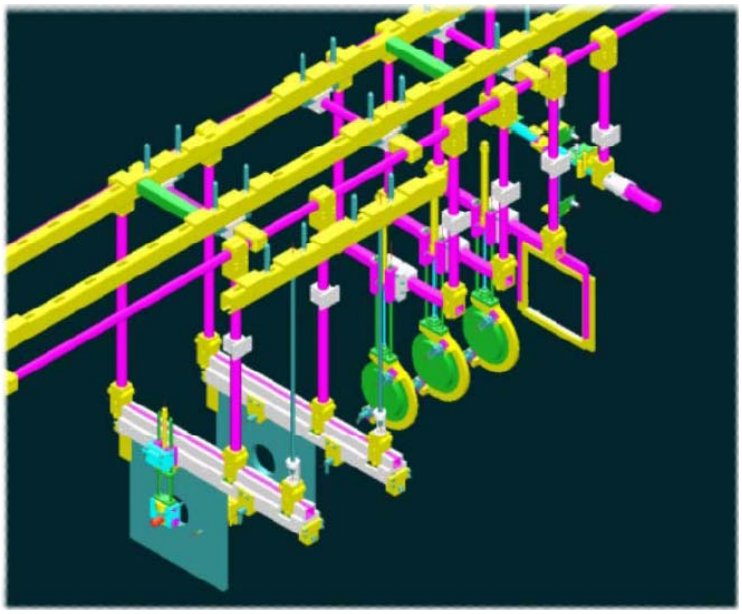


Figure 2: LIF Energy degraders

The irradiation conditions used for this test are provided in the following table:

Fluence Steps	Total Fluence	Flux	Equivalent Total Dose	T
p/cm² @60MeV	p/cm² @60MeV	p/cm²/s	Rad (Si)	°C
0	0		0	
2E+11	2E+11	5.00E+08	27.5E+3	25

4.2 Bias during Dose Exposures and Measurements conditions

4.2.1 Bias conditions

During exposures all samples were biased OFF with all pins connected to ground.

4.2.2 Electrical Measurements

Electrical parameters test program principle for HS-4424BRH is provided in Figure 3.

A HP4142 DC tester and a HP33120 waveform generator were used to perform required measurements.

A dedicated test fixture and a test board were designed to ensure proper measurement conditions.

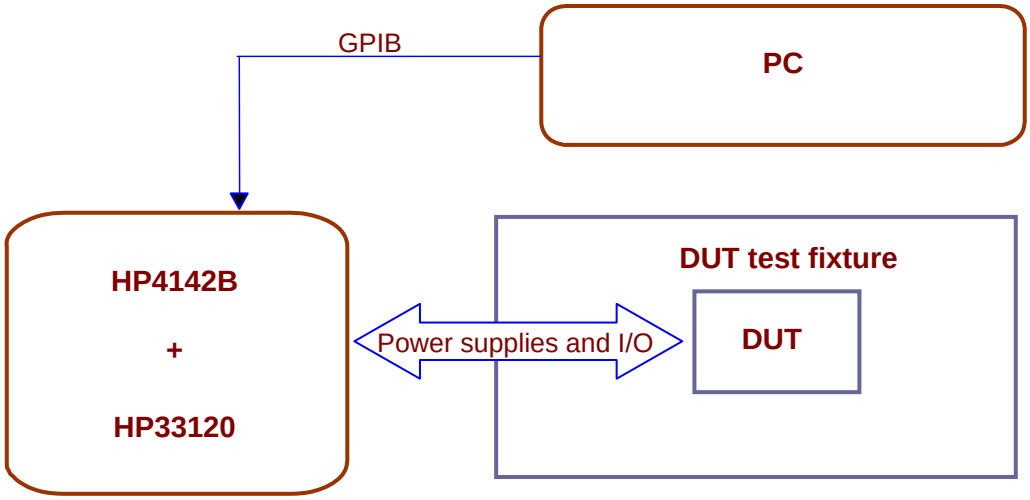


Figure 3 : HS-4424BRH test program principle

Electrical parameters test conditions and limits used for performing this test are given in Table 1.

Parameter	Description	Conditions	Spec		Unit
			Min	Max	
ICCSBL	Power supply current, low	VS = 18V ; VIN = 0V	-	3.5	mA
ICCSBH	Power supply current, high	VS = 18V ; VIN = 18V	-	3.5	mA
IIL_A	Input current, low	VS = 18V	-2	2	µA
IIL_B	Input current, low	VS = 18V	-2	2	µA
IIH_A	Input current, high	VS = 18V	-2	2	µA
IIH_B	Input current, high	VS = 18V	-2	2	µA
VOL_A	Voltage output	VS = 12V	-	0.8	V
VOL_B	Voltage output	VS = 12V	-	0.8	V
VOH_A	Voltage output	VS = 12V	11.25	-	V
VOH_B	Voltage output	VS = 12V	11.25	-	V
TPHL_A	Propagation delay, low	VS = 12V ; CL = 4300 pF	-	250	ns
TPHL_B	Propagation delay, low	VS = 12V ; CL = 4300 pF	-	250	ns
TPLH_A	Propagation delay, high	VS = 12V ; CL = 4300 pF	-	250	ns
TPLH_B	Propagation delay, high	VS = 12V ; CL = 4300 pF	-	250	ns
TR_A	Response time, rise	VS = 12V ; CL = 4300 pF	-	75	ns
TR_B	Response time, rise	VS = 12V ; CL = 4300 pF	-	75	ns
TF_A	Response time, fall	VS = 12V ; CL = 4300 pF	-	75	ns
TF_B	Response time, fall	VS = 12V ; CL = 4300 pF	-	75	ns

Table 1 : Measured electrical parameters

5 Conclusion

A proton displacement damage test was carried out by Hirex Engineering under Alter Technology Group Spain contract on the Intersil HS-4424BRH Dual, Non Inverting Power Mosfet Driver in FP-16 package.

Each device was exposed at room temperature to a protons flux of 60 MeV incident energy up to a total fluence of 2E+11p/cm².

All parameters remained within specification limits all along testing.

6 Test Results

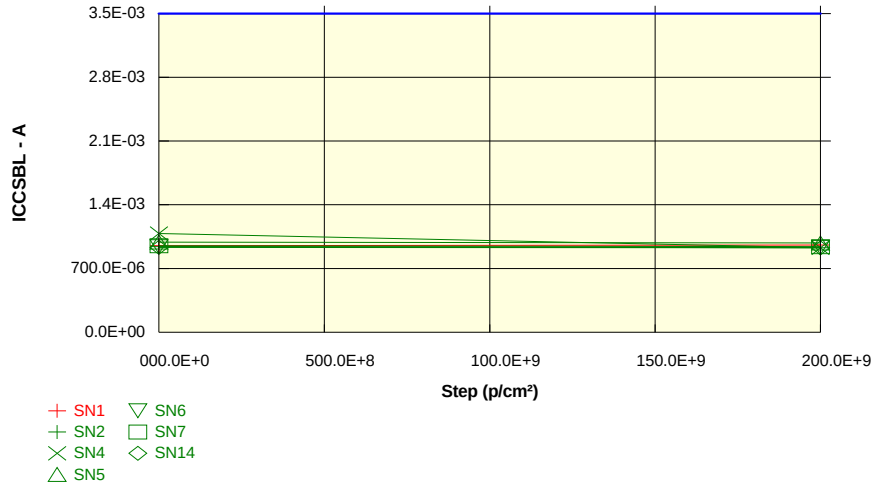
Test results including tables and graphics are provided in this section for each measured parameter.

Parameter measurements values are plotted versus Equivalent Fluence levels for 60 MeV incident energy protons. Fluences are expressed in protons/cm^2 in Silicon.

For each parameter, a drift calculation table is provided computing the drift between a given exposure step with respect to initial readings:

$$\Delta\text{(Parameter value)}=\text{(Parameter value}_{POSTRAD}\text{)} - \text{(Parameter value}_{PRERAD}\text{)}$$

Test conditions : Protons
Parameter : Power Supply Current. Low : ICCSBL
VS=18V. VIN=0V
Unit : A
Spec Limit Max : 3.5E-03
Spec limits are represented in bold lines on the graphic.



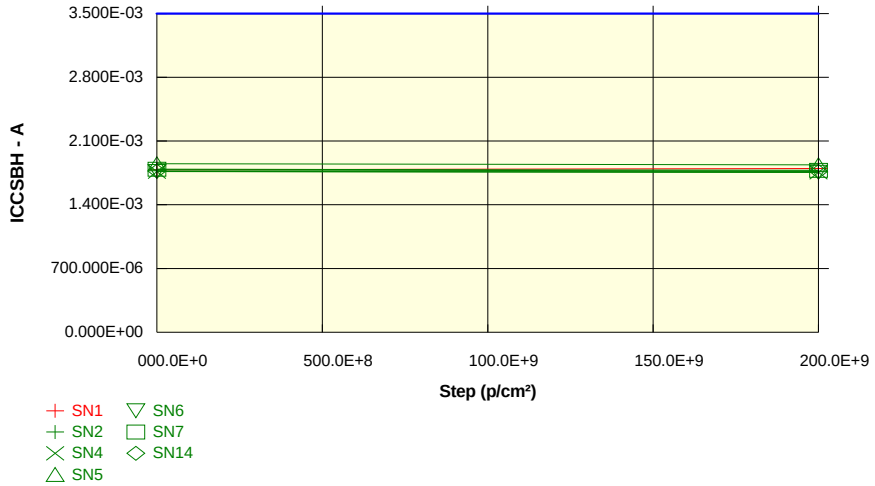
Measurements

ICCSBL	0 p/cm²	2E+11 p/cm²
SN1_REF	951.2E-06	957.8E-06
OFF samples		
SN2	938.7E-06	927.7E-06
SN4	1.1E-03	928.5E-06
SN5	990.6E-06	979.4E-06
SN6	939.5E-06	930.4E-06
SN7	950.3E-06	939.2E-06
SN14	931.6E-06	926.5E-06
Statistics		
Min	931.6E-06	926.5E-06
Max	1.1E-03	979.4E-06
Average	972.4E-06	938.6E-06
Sigma	53.5E-06	18.7E-06

Drift Calculation

ICCSBL	0 p/cm²	2E+11 p/cm²
OFF samples		
SN2	-	-11.06E-06
SN4	-	-155.52E-06
SN5	-	-11.14E-06
SN6	-	-9.10E-06
SN7	-	-11.04E-06
SN14	-	-5.10E-06
Average	-	-33.83E-06
Sigma	-	54.46E-06

Test conditions : Protons
Parameter : Power Supply Current. High : ICCSBH
VS=18V. VIN=18V
Unit : A
Spec Limit Max : 3.500E-03
Spec limits are represented in bold lines on the graphic.



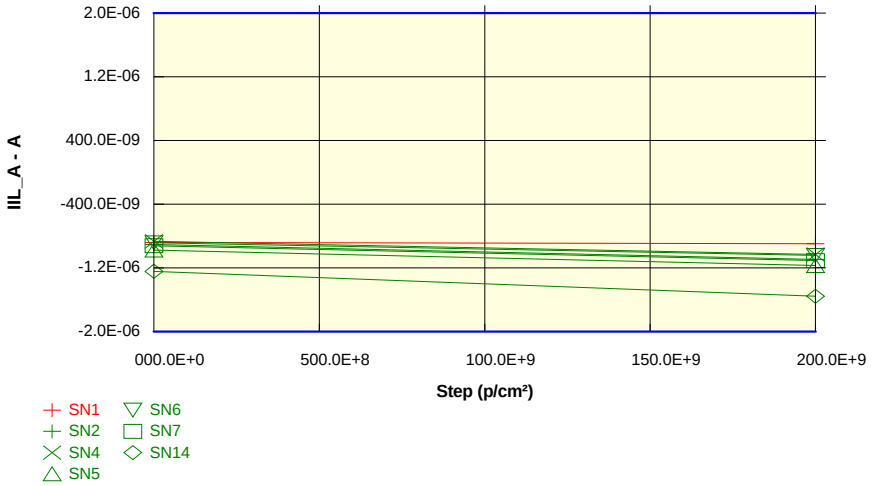
Measurements

ICCSBH	0 p/cm²	2E+11 p/cm²
SN1_REF	1.785E-03	1.799E-03
OFF samples		
SN2	1.785E-03	1.770E-03
SN4	1.763E-03	1.756E-03
SN5	1.851E-03	1.838E-03
SN6	1.766E-03	1.756E-03
SN7	1.790E-03	1.779E-03
SN14	1.770E-03	1.766E-03
Statistics		
Min	1.763E-03	1.756E-03
Max	1.851E-03	1.838E-03
Average	1.788E-03	1.778E-03
Sigma	30.103E-06	28.160E-06

Drift Calculation

ICCSBH	0 p/cm²	2E+11 p/cm²
OFF samples		
SN2	-	-15.00E-06
SN4	-	-7.40E-06
SN5	-	-13.20E-06
SN6	-	-9.60E-06
SN7	-	-11.40E-06
SN14	-	-3.40E-06
Average	-	-10.00E-06
Sigma	-	3.82E-06

Test conditions : Protons
Parameter : Input Current. Low : IIL_A
VS=18V
Unit : A
Spec Limit Min : -2.0E-06
Spec Limit Max : 2.0E-06
Spec limits are represented in bold lines on the graphic.



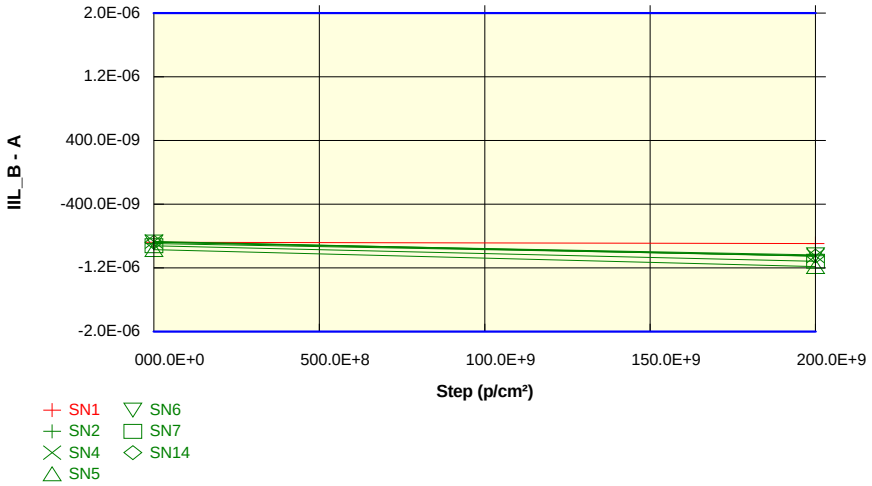
Measurements

IIL_A	0 p/cm²	2E+11 p/cm²
SN1_REF	-881.2E-09	-896.1E-09
OFF samples		
SN2	-905.6E-09	-1.1E-06
SN4	-866.0E-09	-1.0E-06
SN5	-976.9E-09	-1.2E-06
SN6	-885.3E-09	-1.0E-06
SN7	-921.6E-09	-1.1E-06
SN14	-1.2E-06	-1.6E-06
Statistics		
Min	-1.2E-06	-1.6E-06
Max	-866.0E-09	-1.0E-06
Average	-966.3E-09	-1.2E-06
Sigma	128.2E-09	179.3E-09

Drift Calculation

IIL_A	0 p/cm²	2E+11 p/cm²
OFF samples		
SN2	-	-187.60E-09
SN4	-	-167.02E-09
SN5	-	-192.94E-09
SN6	-	-158.86E-09
SN7	-	-186.58E-09
SN14	-	-313.00E-09
Average	-	-201.00E-09
Sigma	-	51.52E-09

Test conditions : Protons
Parameter : Input Current. Low : IIL_B
VS=18V
Unit : A
Spec Limit Min : -2.0E-06
Spec Limit Max : 2.0E-06
Spec limits are represented in bold lines on the graphic.



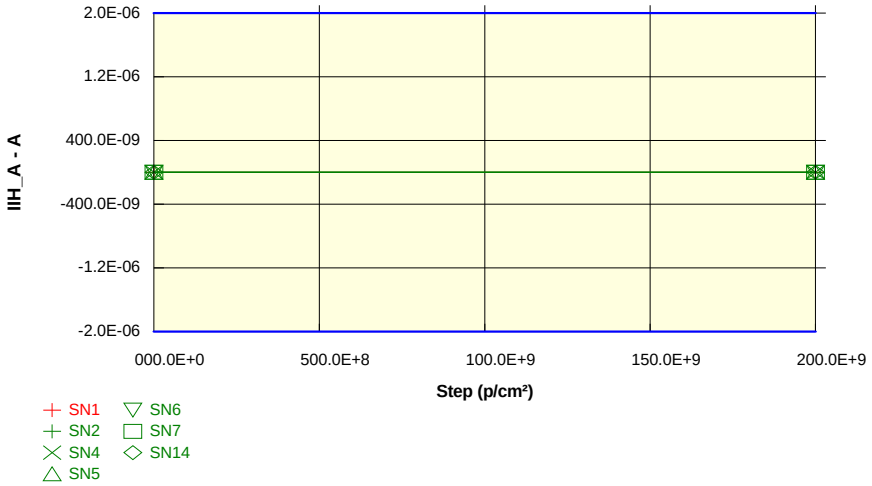
Measurements

IIL_B	0 p/cm²	2E+11 p/cm²
SN1_REF	-878.7E-09	-893.6E-09
OFF samples		
SN2	-894.8E-09	-1.0E-06
SN4	-867.9E-09	-1.1E-06
SN5	-969.7E-09	-1.2E-06
SN6	-875.2E-09	-1.0E-06
SN7	-921.5E-09	-1.1E-06
SN14	-878.6E-09	-1.1E-06
Statistics		
Min	-969.7E-09	-1.2E-06
Max	-867.9E-09	-1.0E-06
Average	-901.3E-09	-1.1E-06
Sigma	35.2E-09	52.8E-09

Drift Calculation

IIL_B	0 p/cm²	2E+11 p/cm²
OFF samples		
SN2	-	-152.42E-09
SN4	-	-182.06E-09
SN5	-	-213.92E-09
SN6	-	-162.40E-09
SN7	-	-196.26E-09
SN14	-	-173.20E-09
Average	-	-180.04E-09
Sigma	-	20.56E-09

Test conditions : Protons
Parameter : Input Current. High : IIH_A
VS=18V
Unit : A
Spec Limit Min : -2.0E-06
Spec Limit Max : 2.0E-06
Spec limits are represented in bold lines on the graphic.



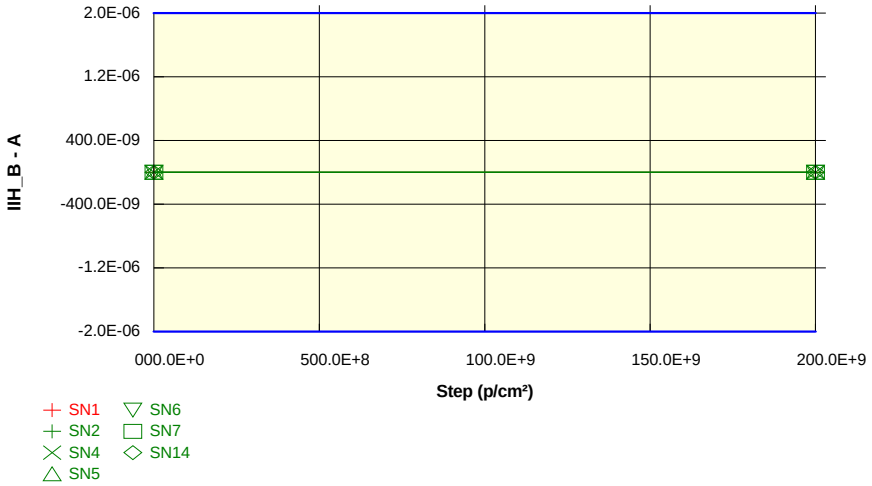
Measurements

IIH_A	0 p/cm²	2E+11 p/cm²
SN1_REF	15.1E-12	15.1E-12
OFF samples		
SN2	16.2E-12	19.0E-12
SN4	17.0E-12	19.9E-12
SN5	16.4E-12	22.0E-12
SN6	14.4E-12	18.1E-12
SN7	13.6E-12	16.3E-12
SN14	38.8E-12	31.2E-12
Statistics		
Min	13.6E-12	16.3E-12
Max	38.8E-12	31.2E-12
Average	19.4E-12	21.1E-12
Sigma	8.8E-12	4.8E-12

Drift Calculation

IIH_A	0 p/cm²	2E+11 p/cm²
OFF samples		
SN2	-	2.78E-12
SN4	-	2.92E-12
SN5	-	5.66E-12
SN6	-	3.72E-12
SN7	-	2.78E-12
SN14	-	-7.60E-12
Average	-	1.71E-12
Sigma	-	4.28E-12

Test conditions : Protons
Parameter : Input Current. High : IIH_B
VS=18V
Unit : A
Spec Limit Min : -2.0E-06
Spec Limit Max : 2.0E-06
Spec limits are represented in bold lines on the graphic.



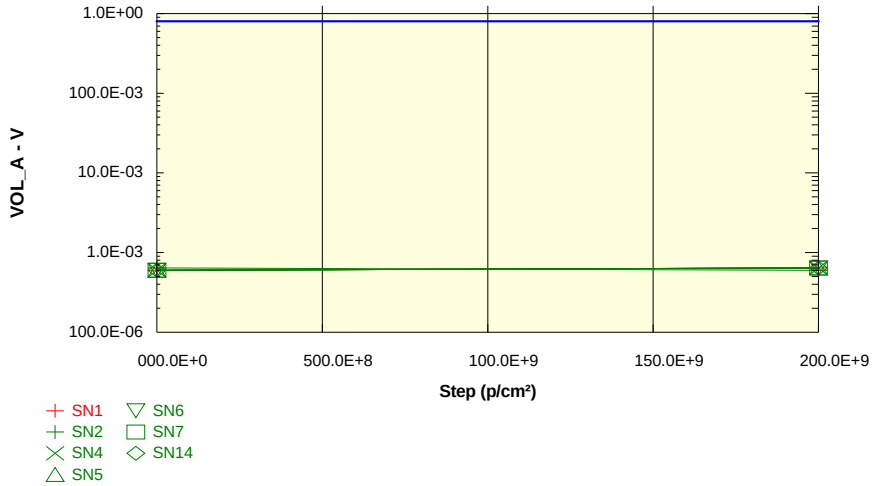
Measurements

IIH_B	0 p/cm²	2E+11 p/cm²
SN1_REF	16.9E-12	18.4E-12
OFF samples		
SN2	18.0E-12	25.9E-12
SN4	17.8E-12	23.0E-12
SN5	18.4E-12	26.2E-12
SN6	15.7E-12	20.5E-12
SN7	16.0E-12	19.6E-12
SN14	16.8E-12	23.0E-12
Statistics		
Min	15.7E-12	19.6E-12
Max	18.4E-12	26.2E-12
Average	17.1E-12	23.1E-12
Sigma	1.0E-12	2.5E-12

Drift Calculation

IIH_B	0 p/cm²	2E+11 p/cm²
OFF samples		
SN2	-	7.90E-12
SN4	-	5.22E-12
SN5	-	7.76E-12
SN6	-	4.84E-12
SN7	-	3.62E-12
SN14	-	6.22E-12
Average	-	5.93E-12
Sigma	-	1.55E-12

Test conditions : Protons
Parameter : Voltage Output : VOL_A
VS=12V
Unit : V
Spec Limit Max : 800.0E-03
Spec limits are represented in bold lines on the graphic.



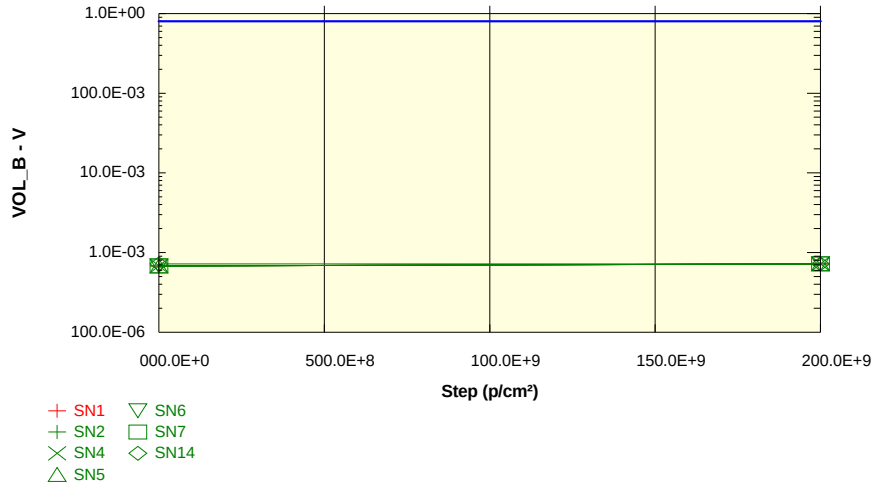
Measurements

VOL_A	0 p/cm²	2E+11 p/cm²
SN1_REF	600.0E-06	640.0E-06
OFF samples		
SN2	640.0E-06	600.0E-06
SN4	600.0E-06	640.0E-06
SN5	600.0E-06	640.0E-06
SN6	600.0E-06	640.0E-06
SN7	600.0E-06	640.0E-06
SN14	600.0E-06	640.0E-06
Statistics		
Min	600.0E-06	600.0E-06
Max	640.0E-06	640.0E-06
Average	606.7E-06	633.3E-06
Sigma	14.9E-06	14.9E-06

Drift Calculation

VOL_A	0 p/cm²	2E+11 p/cm²
OFF samples		
SN2	-	-40.00E-06
SN4	-	40.00E-06
SN5	-	40.00E-06
SN6	-	40.00E-06
SN7	-	40.00E-06
SN14	-	40.00E-06
Average	-	26.67E-06
Sigma	-	29.81E-06

Test conditions : Protons
Parameter : Voltage Output : VOL_B
VS=12V
Unit : V
Spec Limit Max : 800.0E-03
Spec limits are represented in bold lines on the graphic.



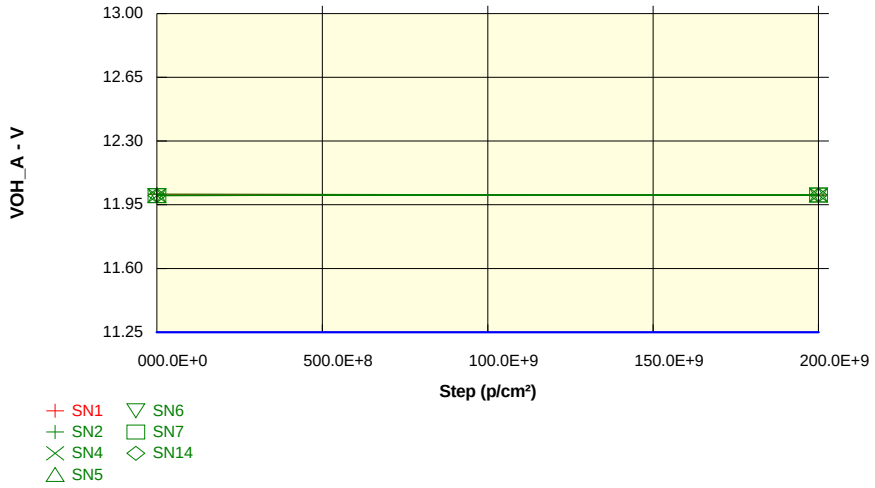
Measurements

VOL_B	0 p/cm²	2E+11 p/cm²
SN1_REF	680.0E-06	720.0E-06
OFF samples		
SN2	680.0E-06	720.0E-06
SN4	680.0E-06	720.0E-06
SN5	680.0E-06	720.0E-06
SN6	680.0E-06	720.0E-06
SN7	680.0E-06	720.0E-06
SN14	720.0E-06	720.0E-06
Statistics		
Min	680.0E-06	720.0E-06
Max	720.0E-06	720.0E-06
Average	686.7E-06	720.0E-06
Sigma	14.9E-06	8.4E-12

Drift Calculation

VOL_B	0 p/cm²	2E+11 p/cm²
OFF samples		
SN2	-	40.00E-06
SN4	-	40.00E-06
SN5	-	40.00E-06
SN6	-	40.00E-06
SN7	-	40.00E-06
SN14	-	0.00E+00
Average	-	33.33E-06
Sigma	-	14.91E-06

Test conditions : Protons
Parameter : Voltage Output : VOH_A
VS=12V
Unit : V
Spec Limit Min : 11.25
Spec limits are represented in bold lines on the graphic.



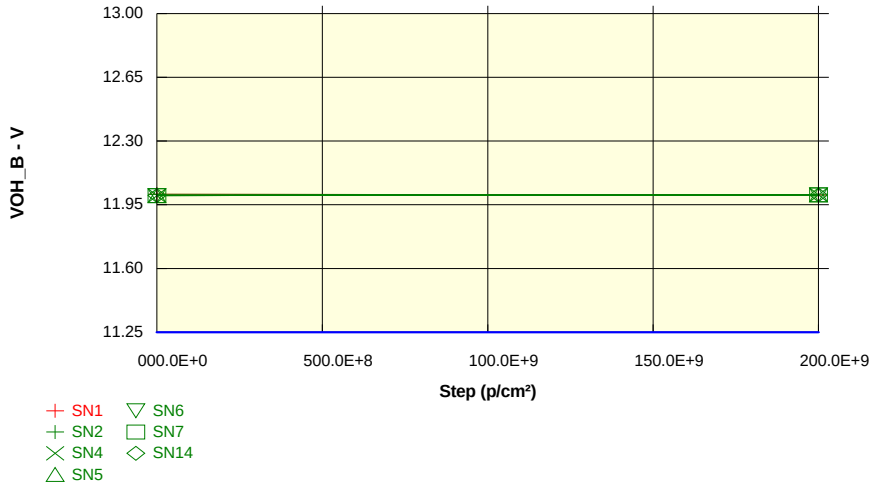
Measurements

VOH_A	0 p/cm²	2E+11 p/cm²
SN1_REF	12.01	12.00
OFF samples		
SN2	12.01	12.00
SN4	12.00	12.00
SN5	12.00	12.00
SN6	12.00	12.00
SN7	12.00	12.00
SN14	12.00	12.00
Statistics		
Min	12.00	12.00
Max	12.01	12.00
Average	12.00	12.00
Sigma	0.00	0.00

Drift Calculation

VOH_A	0 p/cm²	2E+11 p/cm²
OFF samples		
SN2	-	-4.40E-03
SN4	-	3.20E-03
SN5	-	2.80E-03
SN6	-	2.80E-03
SN7	-	3.20E-03
SN14	-	2.80E-03
Average	-	1.73E-03
Sigma	-	2.75E-03

Test conditions : Protons
Parameter : Voltage Output : VOH_B
VS=12V
Unit : V
Spec Limit Min : 11.25
Spec limits are represented in bold lines on the graphic.



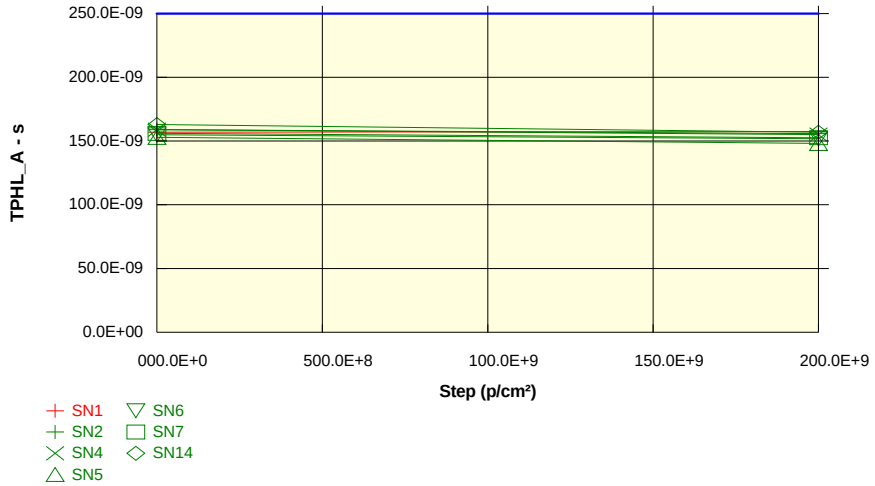
Measurements

VOH_B	0 p/cm²	2E+11 p/cm²
SN1_REF	12.01	12.00
OFF samples		
SN2	12.01	12.00
SN4	12.00	12.00
SN5	12.00	12.00
SN6	12.00	12.00
SN7	12.00	12.00
SN14	12.00	12.00
Statistics		
Min	12.00	12.00
Max	12.01	12.00
Average	12.00	12.00
Sigma	0.00	0.00

Drift Calculation

VOH_B	0 p/cm²	2E+11 p/cm²
OFF samples		
SN2	-	-3.60E-03
SN4	-	3.20E-03
SN5	-	3.20E-03
SN6	-	3.20E-03
SN7	-	3.20E-03
SN14	-	3.20E-03
Average	-	2.07E-03
Sigma	-	2.53E-03

Test conditions : Protons
Parameter : Popagation Delay. Low : TPHL_A
VS=12V. CL=4300pF
Unit : s
Spec Limit Max : 250.0E-09
Spec limits are represented in bold lines on the graphic.



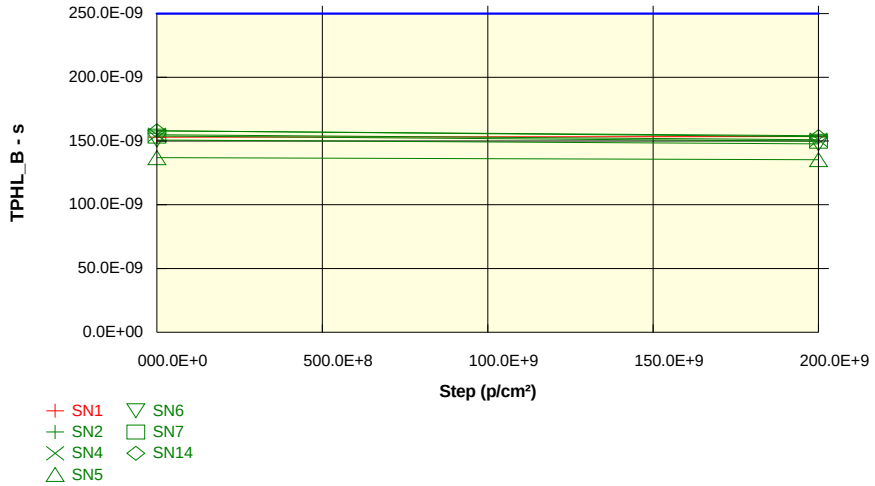
Measurements

TPHL_A	0 p/cm²	2E+11 p/cm²
SN1_REF	156.9E-09	157.5E-09
OFF samples		
SN2	159.0E-09	155.8E-09
SN4	159.0E-09	155.0E-09
SN5	152.8E-09	148.2E-09
SN6	154.8E-09	151.8E-09
SN7	156.1E-09	152.6E-09
SN14	162.9E-09	156.9E-09
Statistics		
Min	152.8E-09	148.2E-09
Max	162.9E-09	156.9E-09
Average	157.4E-09	153.4E-09
Sigma	3.3E-09	2.9E-09

Drift Calculation

TPHL_A	0 p/cm²	2E+11 p/cm²
OFF samples		
SN2	-	-3.19E-09
SN4	-	-3.96E-09
SN5	-	-4.62E-09
SN6	-	-3.05E-09
SN7	-	-3.54E-09
SN14	-	-5.96E-09
Average	-	-4.06E-09
Sigma	-	999.26E-12

Test conditions : Protons
Parameter : Popagation Delay. Low : TPHL_B
VS=12V. CL=4300pF
Unit : s
Spec Limit Max : 250.0E-09
Spec limits are represented in bold lines on the graphic.



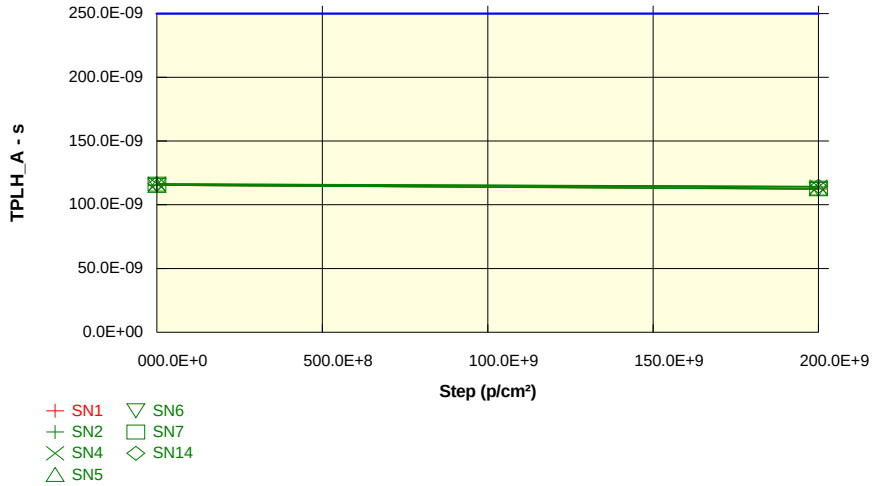
Measurements

TPHL_B	0 p/cm²	2E+11 p/cm²
SN1_REF	153.0E-09	153.6E-09
OFF samples		
SN2	158.0E-09	154.1E-09
SN4	154.9E-09	151.0E-09
SN5	137.0E-09	135.3E-09
SN6	150.8E-09	147.7E-09
SN7	153.9E-09	149.9E-09
SN14	158.1E-09	153.4E-09
Statistics		
Min	137.0E-09	135.3E-09
Max	158.1E-09	154.1E-09
Average	152.1E-09	148.6E-09
Sigma	7.2E-09	6.3E-09

Drift Calculation

TPHL_B	0 p/cm²	2E+11 p/cm²
OFF samples		
SN2	-	-3.85E-09
SN4	-	-3.93E-09
SN5	-	-1.69E-09
SN6	-	-3.06E-09
SN7	-	-4.06E-09
SN14	-	-4.63E-09
Average	-	-3.54E-09
Sigma	-	945.72E-12

Test conditions : Protons
Parameter : Popagation Delay. High : TPLH_A
VS=12V. CL=4300pF
Unit : s
Spec Limit Max : 250.0E-09
Spec limits are represented in bold lines on the graphic.



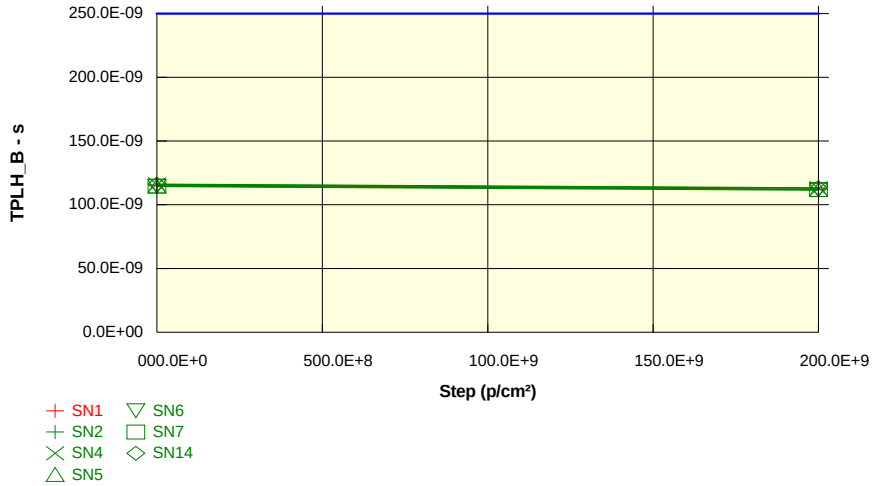
Measurements

TPLH_A	0 p/cm²	2E+11 p/cm²
SN1_REF	115.3E-09	112.4E-09
OFF samples		
SN2	115.6E-09	113.9E-09
SN4	116.3E-09	114.2E-09
SN5	115.2E-09	112.5E-09
SN6	115.3E-09	112.1E-09
SN7	116.2E-09	113.1E-09
SN14	116.6E-09	114.5E-09
Statistics		
Min	115.2E-09	112.1E-09
Max	116.6E-09	114.5E-09
Average	115.9E-09	113.4E-09
Sigma	526.6E-12	896.9E-12

Drift Calculation

TPLH_A	0 p/cm²	2E+11 p/cm²
OFF samples		
SN2	-	-1.63E-09
SN4	-	-2.16E-09
SN5	-	-2.72E-09
SN6	-	-3.22E-09
SN7	-	-3.07E-09
SN14	-	-2.02E-09
Average	-	-2.47E-09
Sigma	-	575.84E-12

Test conditions : Protons
Parameter : Popagation Delay. High : TPLH_B
VS=12V. CL=4300pF
Unit : s
Spec Limit Max : 250.0E-09
Spec limits are represented in bold lines on the graphic.



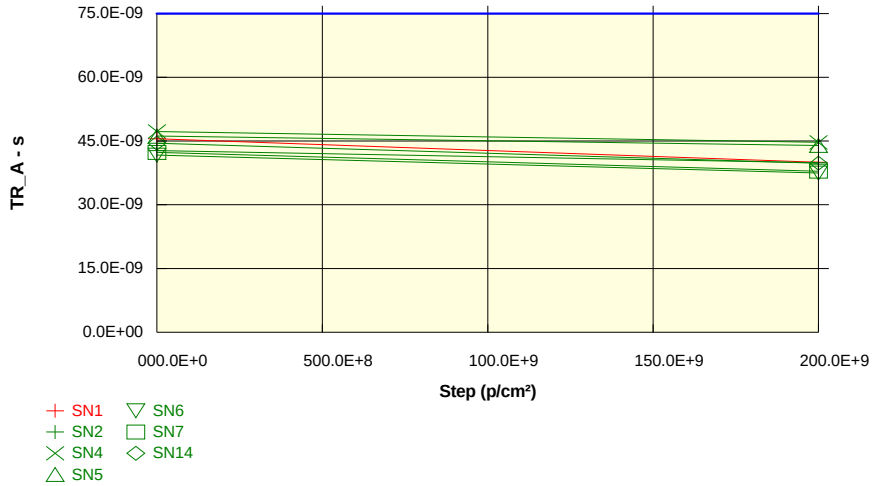
Measurements

TPLH_B	0 p/cm²	2E+11 p/cm²
SN1_REF	115.6E-09	112.1E-09
OFF samples		
SN2	115.5E-09	113.0E-09
SN4	116.0E-09	113.0E-09
SN5	114.6E-09	112.0E-09
SN6	114.2E-09	111.3E-09
SN7	114.6E-09	111.9E-09
SN14	116.2E-09	113.3E-09
Statistics		
Min	114.2E-09	111.3E-09
Max	116.2E-09	113.3E-09
Average	115.2E-09	112.4E-09
Sigma	748.3E-12	719.9E-12

Drift Calculation

TPLH_B	0 p/cm²	2E+11 p/cm²
OFF samples		
SN2	-	-2.44E-09
SN4	-	-2.96E-09
SN5	-	-2.68E-09
SN6	-	-2.85E-09
SN7	-	-2.70E-09
SN14	-	-2.92E-09
Average	-	-2.76E-09
Sigma	-	177.34E-12

Test conditions : Protons
Parameter : Response Time. Rise : TR_A
VS=12V. CL=4300pF
Unit : s
Spec Limit Max : 75.0E-09
Spec limits are represented in bold lines on the graphic.



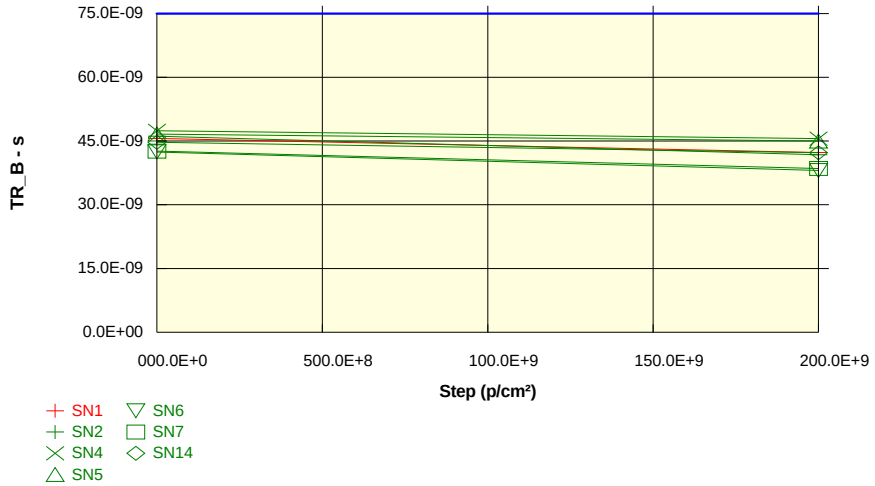
Measurements

TR_A	0 p/cm²	2E+11 p/cm²
SN1_REF	45.5E-09	40.0E-09
OFF samples		
SN2	42.7E-09	39.9E-09
SN4	47.2E-09	44.7E-09
SN5	46.1E-09	44.0E-09
SN6	41.7E-09	37.5E-09
SN7	42.3E-09	37.9E-09
SN14	44.5E-09	39.8E-09
Statistics		
Min	41.7E-09	37.5E-09
Max	47.2E-09	44.7E-09
Average	44.1E-09	40.6E-09
Sigma	2.0E-09	2.8E-09

Drift Calculation

TR_A	0 p/cm²	2E+11 p/cm²
OFF samples		
SN2	-	-2.88E-09
SN4	-	-2.56E-09
SN5	-	-2.19E-09
SN6	-	-4.23E-09
SN7	-	-4.43E-09
SN14	-	-4.71E-09
Average	-	-3.50E-09
Sigma	-	987.16E-12

Test conditions : Protons
Parameter : Response Time. Rise : TR_B
VS=12V. CL=4300pF
Unit : s
Spec Limit Max : 75.0E-09
Spec limits are represented in bold lines on the graphic.



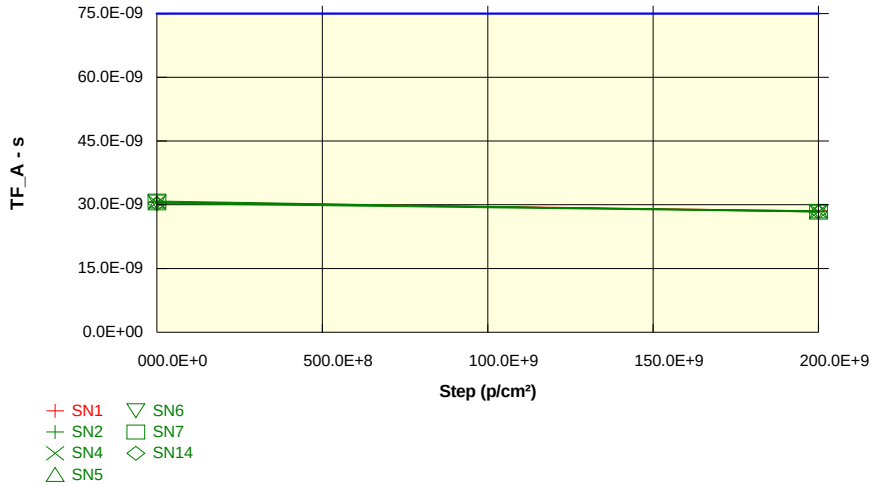
Measurements

TR_B	0 p/cm²	2E+11 p/cm²
SN1_REF	45.6E-09	42.3E-09
OFF samples		
SN2	46.1E-09	41.8E-09
SN4	47.4E-09	45.6E-09
SN5	46.6E-09	45.0E-09
SN6	42.4E-09	38.1E-09
SN7	42.6E-09	38.5E-09
SN14	44.7E-09	42.3E-09
Statistics		
Min	42.4E-09	38.1E-09
Max	47.4E-09	45.6E-09
Average	45.0E-09	41.9E-09
Sigma	1.9E-09	2.9E-09

Drift Calculation

TR_B	0 p/cm²	2E+11 p/cm²
OFF samples		
SN2	-	-4.36E-09
SN4	-	-1.85E-09
SN5	-	-1.62E-09
SN6	-	-4.37E-09
SN7	-	-4.07E-09
SN14	-	-2.45E-09
Average	-	-3.12E-09
Sigma	-	1.18E-09

Test conditions : Protons
Parameter : Response Time. Fall : TF_A
VS=12V. CL=4300pF
Unit : s
Spec Limit Max : 75.0E-09
Spec limits are represented in bold lines on the graphic.



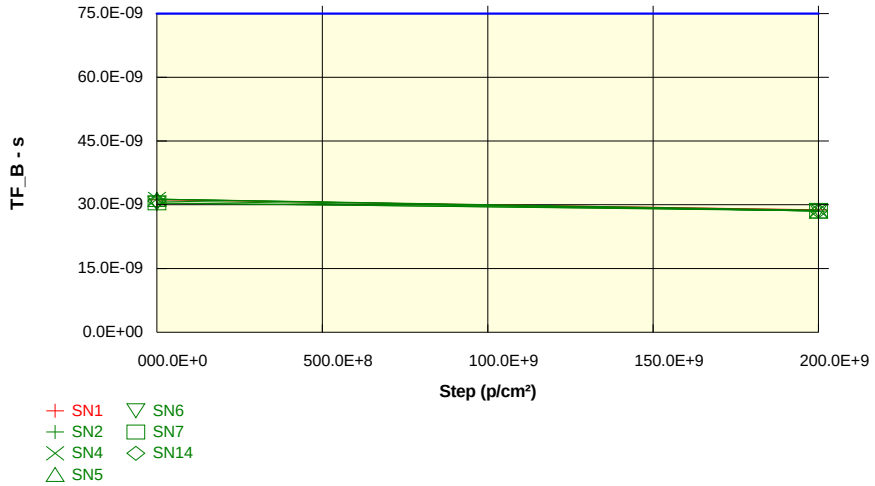
Measurements

TF_A	0 p/cm²	2E+11 p/cm²
SN1_REF	30.7E-09	28.5E-09
OFF samples		
SN2	30.5E-09	28.5E-09
SN4	30.6E-09	28.4E-09
SN5	30.4E-09	28.6E-09
SN6	30.6E-09	28.4E-09
SN7	30.8E-09	28.3E-09
SN14	30.3E-09	28.3E-09
Statistics		
Min	30.3E-09	28.3E-09
Max	30.8E-09	28.6E-09
Average	30.6E-09	28.4E-09
Sigma	179.3E-12	100.7E-12

Drift Calculation

TF_A	0 p/cm²	2E+11 p/cm²
OFF samples		
SN2	-	-2.09E-09
SN4	-	-2.17E-09
SN5	-	-1.84E-09
SN6	-	-2.21E-09
SN7	-	-2.59E-09
SN14	-	-1.93E-09
Average	-	-2.14E-09
Sigma	-	237.62E-12

Test conditions : Protons
Parameter : Response Time. Fall : TF_B
VS=12V. CL=4300pF
Unit : s
Spec Limit Max : 75.0E-09
Spec limits are represented in bold lines on the graphic.



Measurements

TF_B	0 p/cm²	2E+11 p/cm²
SN1_REF	31.2E-09	28.8E-09
OFF samples		
SN2	31.3E-09	28.5E-09
SN4	31.3E-09	28.7E-09
SN5	31.3E-09	28.5E-09
SN6	30.4E-09	28.7E-09
SN7	30.4E-09	28.5E-09
SN14	30.8E-09	28.5E-09
Statistics		
Min	30.4E-09	28.5E-09
Max	31.3E-09	28.7E-09
Average	30.9E-09	28.6E-09
Sigma	403.2E-12	88.8E-12

Drift Calculation

TF_B	0 p/cm²	2E+11 p/cm²
OFF samples		
SN2	-	-2.83E-09
SN4	-	-2.59E-09
SN5	-	-2.77E-09
SN6	-	-1.73E-09
SN7	-	-1.90E-09
SN14	-	-2.32E-09
Average	-	-2.36E-09
Sigma	-	420.74E-12