PROTONS TEST REPORT

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

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

Part Type : RHF43BK-01V

Package : FP-08

Description : Precision Bipolar Single Operational Amplifier Radiation Hardened

Manufacturer: STMicroelectronics

Date Code: 0810

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

Alter Technology Group Spain Project Responsible: David NUNEZ

Hirex reference :	HRX/TID/0938	Issue : 01	Date :	June 8th, 2011
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Authorized by:	J.F. PASCAL	Technical Manager		

CHANGE RECORD

ISSUE	DATE	PAGE	DESCRIPTION OF CHANGES
01	June 8th, 2011	All	Original Issue

PROTONS TEST REPORT
on
RHF43BK-01V
Precision Bipolar Single Operational Amplifier Radiation Hardened

From STMicroelectronics

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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 STMicroelectronics RHF43BK-01V, Precision Bipolar Single Operational Amplifier Radiation Hardened 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/0238 issue 2 dated 09/13/2010.

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

2 Applicable and Reference Documents

2.1 Applicable Documents

- Hirex Engineering Radiation Test Plan: HRX/SPE/0238 issue 2 dated 09/13/2010
- 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: 5962F06237

2.2 Reference Documents

- STMicroelectronics datasheet: Rev 1, November 2009

3 Test Samples

7 samples of the RHF43BK-01V devices were tested (6 + 1 control sample).
Allocation of samples used for testing is provided in the following table.

Serial Number	Date Code	Samples Allocation
255	0810A	Control sample
275	0810B	Biased OFF
276	0810B	Biased OFF
277	0810B	Biased OFF
279	0810B	Biased OFF
280	0810B	Biased OFF
290	0810B	Biased OFF

Identification of the RHF43BK-01V is given below:

Part Type: RHF43BK-01V

Part Number: 5962F0623701VXC

Top Marking: logo 0810A F0623701 VXC Q FR & logo 0810B F0623701 VXC Q FR

Bottom Marking: -

Date Code: 0810

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.

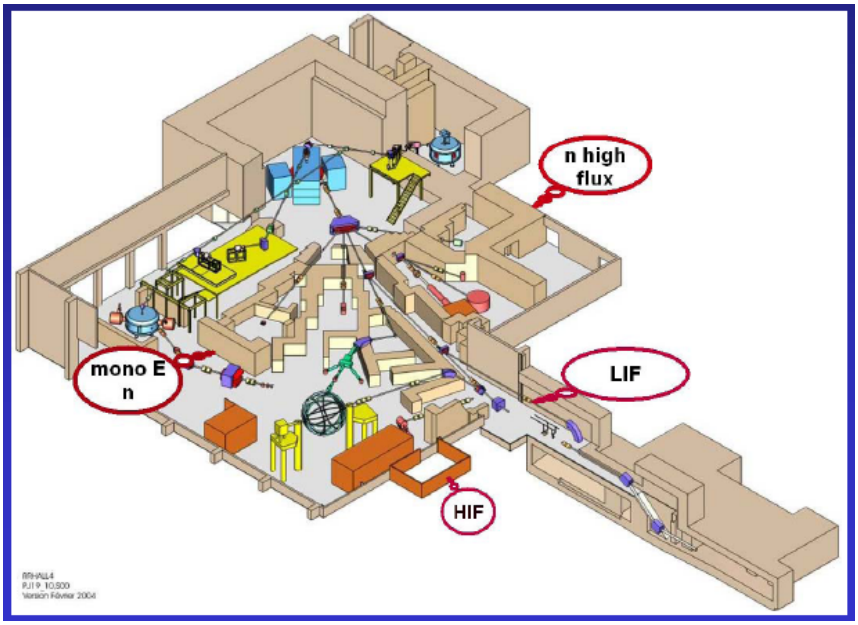


Figure 1 : LIF layout and typical experimental set-up

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

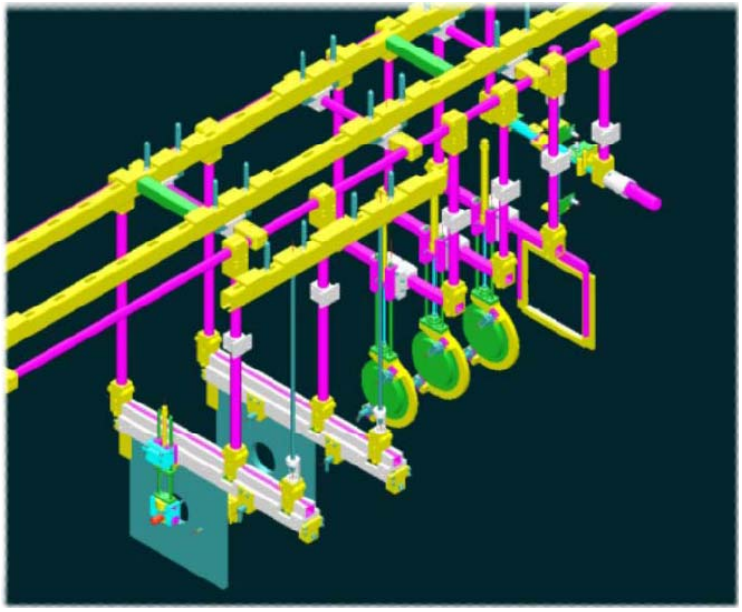


Figure 2: LIF Energy degraders

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

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 RHF43BK-01V is provided in Figure 3.

A HP4142 DC tester was used to perform required measurements.

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

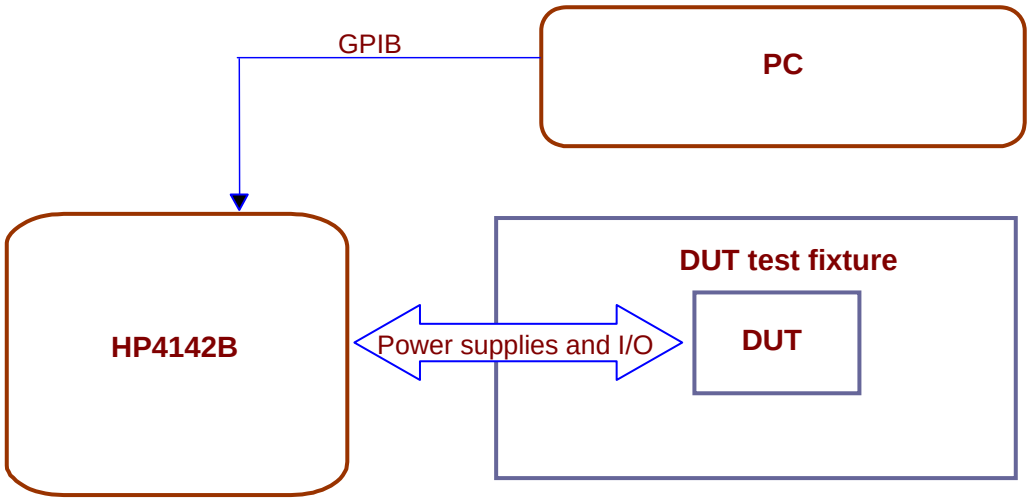


Figure 3 : RHF43BK-01V test program principle

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

Parameter	Description	Conditions	Spec		Unit
			Min	Max	
VIO	Input Offset Voltage	+Vcc=+1.5V, Vdd=-1.5V, VICM=0	-300	300	µV
		+Vcc=+8V, Vdd=-8V, VICM=0	-300	300	µV
IIO	Input Offset Current	+Vcc=+2V, Vdd=-2V, VICM=0	-15	15	nA
IIB+	Input Bias Current	+Vcc=+2V, Vdd=-2V, VICM=0	-60	60	nA
		+Vcc=+8V, Vdd=-8V, VICM=0	-60	60	nA
IIB-	Input Bias Current	+Vcc=+2V, Vdd=-2V, VICM=0	-60	60	nA
		+Vcc=+8V, Vdd=-8V, VICM=0	-60	60	nA
SVR	Supply Rejection Ratio	+3V < +Vcc < 16V	90	-	dB
CMRR	Common Mode Rejection Ratio	Vdd<VICM<Vcc Vcc=+1.5V, Vdd=-1.5V	72	-	dB
		Vdd<VICM<Vcc Vcc=+8V, Vdd=-8V	72	-	dB
ICC	Power Supply Current	+Vcc=+1.5V, VICM=0	-	2.6	mA
		Vdd=-1.5V, VICM=0	-2.6	0	mA
		+Vcc=+8V, VICM=0	-	2.9	mA
		Vdd=-8V, VICM=0	-2.9	-	mA
AVD	Voltage Gain	+Vcc=+1.5V, Vdd=-1.5V, VICM=0V, RL=1K, Vdd+0.5<Vout<Vcc-0.5	74	-	dB
		+Vcc=+8V, Vdd=-8V, VICM=0V, RL=1K, Vdd+0.5<Vout<Vcc-0.5	74	-	dB

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 STMicroelectronics RHF43BK-01V Precision Bipolar Single Operational Amplifier Radiation Hardened in FP-08 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

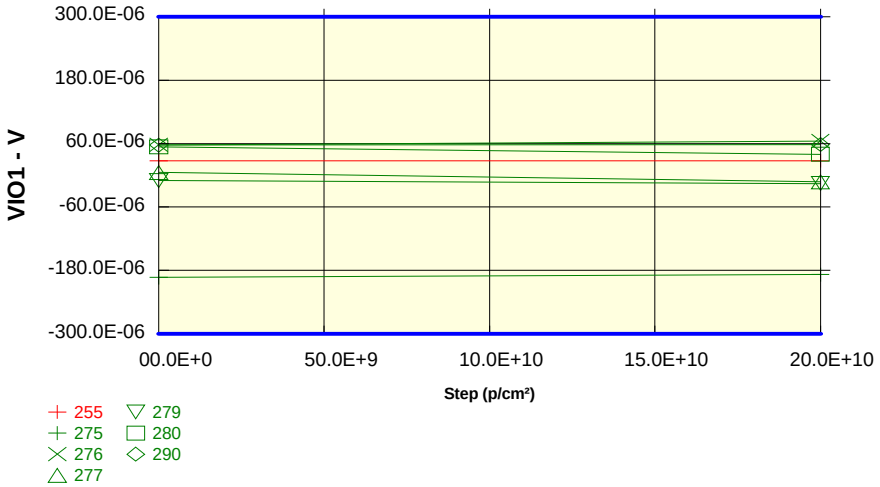
Test results including tables and graphics are provided in this section for each measured parameter.

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 : Input Offset Voltage : VIO1
+Vcc=+1.5V. Vdd=-1.5V. VICM=0
Unit : V
Spec Limit Min : -300.0E-06
Spec Limit Max : 300.0E-06
Spec limits are represented in bold lines on the graphic.



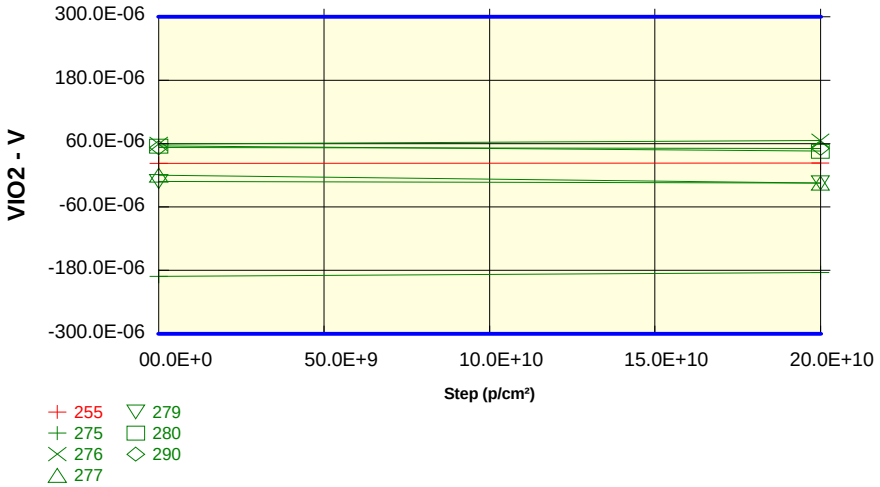
Measurements

VIO1	0 p/cm²	2E+11 p/cm²
255_REF	27.4E-06	27.5E-06
OFF samples		
275	-193.4E-06	-188.0E-06
276	57.4E-06	64.8E-06
277	5.4E-06	-12.3E-06
279	-9.8E-06	-15.6E-06
280	53.9E-06	39.7E-06
290	57.2E-06	58.2E-06
Statistics		
Min	-193.4E-06	-188.0E-06
Max	57.4E-06	64.8E-06
Average	-4.9E-06	-8.9E-06
Sigma	88.4E-06	86.1E-06
(VIO) Lot WorstCase	-270.0E-06	-267.0E-06

Drift Calculation

VIO1	0 p/cm²	2E+11 p/cm²
OFF samples		
275	-	5.40E-06
276	-	7.40E-06
277	-	-17.72E-06
279	-	-5.72E-06
280	-	-14.20E-06
290	-	960.00E-09
Average	-	-3.98E-06
Sigma	-	9.47E-06
d(VIO) Lot WorstCase	-	24.43E-06

Test conditions : Protons
Parameter : Input Offset Voltage : VIO2
+Vcc=+8V. Vdd=-8V. VICM=0
Unit : V
Spec Limit Min : -300.0E-06
Spec Limit Max : 300.0E-06
Spec limits are represented in bold lines on the graphic.



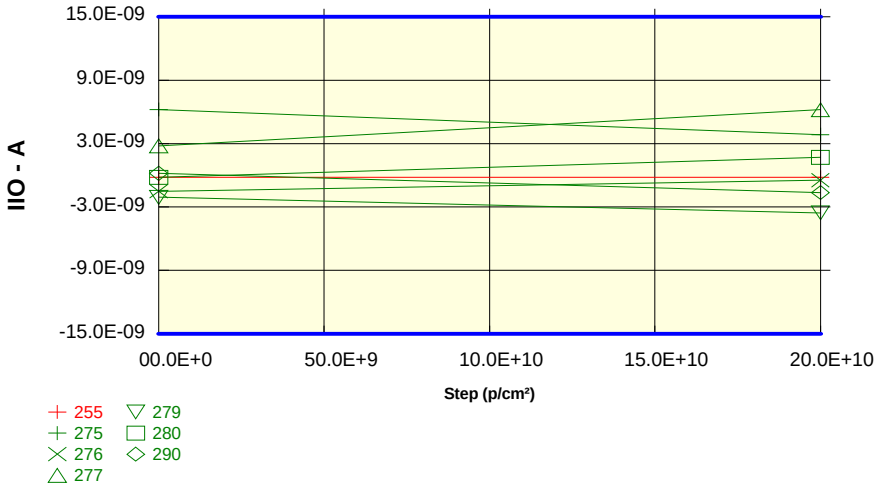
Measurements

VIO2	0 p/cm²	2E+11 p/cm²
255_REF	22.7E-06	23.2E-06
OFF samples		
275	-191.4E-06	-184.3E-06
276	59.2E-06	65.7E-06
277	280.0E-09	-14.7E-06
279	-11.7E-06	-14.6E-06
280	55.2E-06	45.6E-06
290	52.4E-06	50.9E-06
Statistics		
Min	-191.4E-06	-184.3E-06
Max	59.2E-06	65.7E-06
Average	-6.0E-06	-8.6E-06
Sigma	87.4E-06	84.6E-06
(VIO) Lot WorstCase	-268.2E-06	-262.4E-06

Drift Calculation

VIO2	0 p/cm²	2E+11 p/cm²
OFF samples		
275	-	7.04E-06
276	-	6.52E-06
277	-	-15.00E-06
279	-	-2.92E-06
280	-	-9.56E-06
290	-	-1.48E-06
Average	-	-2.57E-06
Sigma	-	7.95E-06
d(VIO) Lot WorstCase	-	21.30E-06

Test conditions : Protons
Parameter : Input Offset Current : IIO
+Vcc=+2V. Vdd=-2V. VICM=0
Unit : A
Spec Limit Min : -15.0E-09
Spec Limit Max : 15.0E-09
Spec limits are represented in bold lines on the graphic.



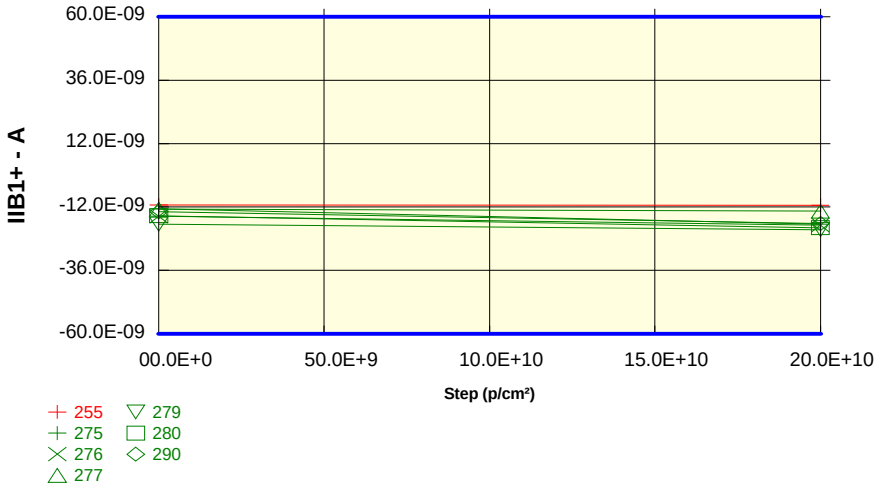
Measurements

IIO	0 p/cm²	2E+11 p/cm²
255_REF	-196.0E-12	-194.0E-12
OFF samples		
275	6.2E-09	3.8E-09
276	-1.5E-09	-464.0E-12
277	2.8E-09	6.2E-09
279	-2.1E-09	-3.6E-09
280	-195.6E-12	1.7E-09
290	183.2E-12	-1.6E-09
Statistics		
Min	-2.1E-09	-3.6E-09
Max	6.2E-09	6.2E-09
Average	897.3E-12	1.0E-09
Sigma	2.8E-09	3.3E-09
(IIO) Lot WorstCase	-7.6E-09	-8.9E-09

Drift Calculation

IIO	0 p/cm²	2E+11 p/cm²
OFF samples		
275	-	-2.38E-09
276	-	1.06E-09
277	-	3.44E-09
279	-	-1.48E-09
280	-	1.89E-09
290	-	-1.82E-09
Average	-	116.93E-12
Sigma	-	2.14E-09
d(IIO) Lot WorstCase	-	-6.32E-09

Test conditions : Protons
Parameter : Plus Input Bias Current : IIB1+
+Vcc=+2V. Vdd=-2V. VICM=0
Unit : A
Spec Limit Min : -60.0E-09
Spec Limit Max : 60.0E-09
Spec limits are represented in bold lines on the graphic.



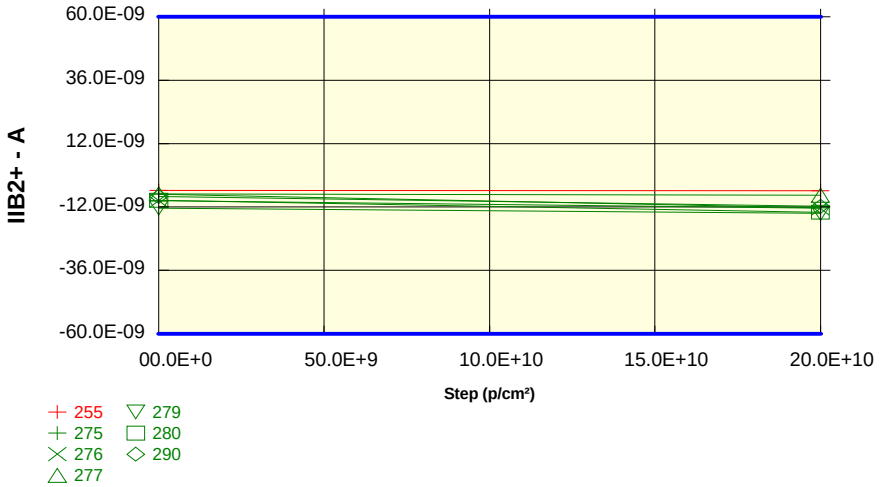
Measurements

IIB1+	0 p/cm²	2E+11 p/cm²
255_REF	-11.3E-09	-11.3E-09
OFF samples		
275	-12.7E-09	-18.6E-09
276	-15.5E-09	-18.9E-09
277	-12.8E-09	-13.6E-09
279	-18.5E-09	-20.6E-09
280	-15.4E-09	-19.9E-09
290	-13.8E-09	-18.2E-09
Statistics		
Min	-18.5E-09	-20.6E-09
Max	-12.7E-09	-13.6E-09
Average	-14.8E-09	-18.3E-09
Sigma	2.0E-09	2.2E-09
(IIB) Lot WorstCase	-20.8E-09	-25.0E-09

Drift Calculation

IIB1+	0 p/cm²	2E+11 p/cm²
OFF samples		
275	-	-5.90E-09
276	-	-3.37E-09
277	-	-745.20E-12
279	-	-2.04E-09
280	-	-4.52E-09
290	-	-4.45E-09
Average	-	-3.50E-09
Sigma	-	1.70E-09
d(IIB) Lot WorstCase	-	1.61E-09

Test conditions : Protons
Parameter : Plus Input Bias Current : IIB2+
+Vcc=+8V. Vdd=-8V. VICM=0
Unit : A
Spec Limit Min : -60.0E-09
Spec Limit Max : 60.0E-09
Spec limits are represented in bold lines on the graphic.



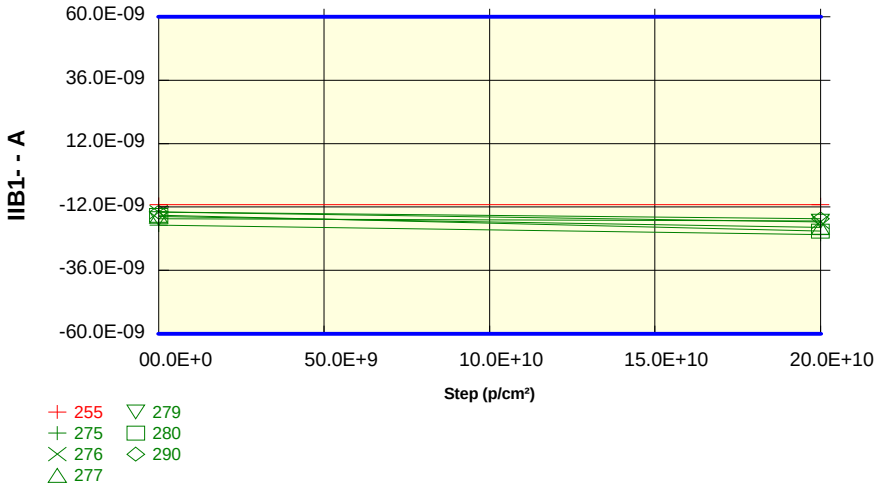
Measurements

IIB2+	0 p/cm²	2E+11 p/cm²
255_REF	-5.8E-09	-5.8E-09
OFF samples		
275	-7.1E-09	-12.3E-09
276	-9.6E-09	-12.5E-09
277	-7.1E-09	-7.6E-09
279	-12.4E-09	-14.5E-09
280	-9.5E-09	-14.0E-09
290	-8.0E-09	-11.7E-09
Statistics		
Min	-12.4E-09	-14.5E-09
Max	-7.1E-09	-7.6E-09
Average	-9.0E-09	-12.1E-09
Sigma	1.8E-09	2.2E-09
(IIB) Lot WorstCase	-14.5E-09	-18.8E-09

Drift Calculation

IIB2+	0 p/cm²	2E+11 p/cm²
OFF samples		
275	-	-5.20E-09
276	-	-2.85E-09
277	-	-494.00E-12
279	-	-2.06E-09
280	-	-4.49E-09
290	-	-3.71E-09
Average	-	-3.14E-09
Sigma	-	1.56E-09
d(IIB) Lot WorstCase	-	1.55E-09

Test conditions : Protons
Parameter : Minus Input Bias Current : IIB1-
+Vcc=+2V. Vdd=-2V. VICM=0
Unit : A
Spec Limit Min : -60.0E-09
Spec Limit Max : 60.0E-09
Spec limits are represented in bold lines on the graphic.



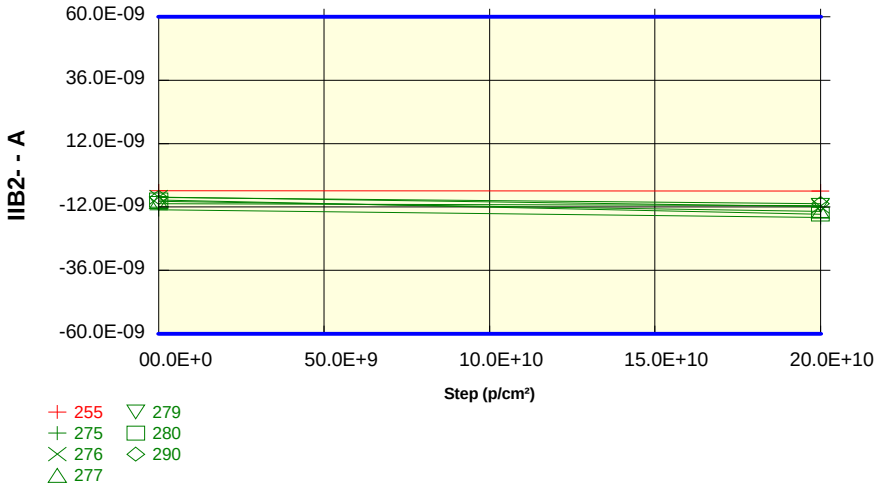
Measurements

IIB1-	0 p/cm²	2E+11 p/cm²
255_REF	-11.1E-09	-11.1E-09
OFF samples		
275	-18.8E-09	-22.4E-09
276	-14.0E-09	-17.7E-09
277	-15.6E-09	-19.7E-09
279	-16.4E-09	-17.4E-09
280	-15.1E-09	-21.1E-09
290	-13.9E-09	-16.5E-09
Statistics		
Min	-18.8E-09	-22.4E-09
Max	-13.9E-09	-16.5E-09
Average	-15.6E-09	-19.1E-09
Sigma	1.7E-09	2.1E-09
(IIB) Lot WorstCase	-20.7E-09	-25.6E-09

Drift Calculation

IIB1-	0 p/cm²	2E+11 p/cm²
OFF samples		
275	-	-3.58E-09
276	-	-3.72E-09
277	-	-4.16E-09
279	-	-925.60E-12
280	-	-6.00E-09
290	-	-2.56E-09
Average	-	-3.49E-09
Sigma	-	1.54E-09
d(IIB) Lot WorstCase	-	1.13E-09

Test conditions : Protons
Parameter : Minus Input Bias Current : IIB2-
+Vcc=+8V. Vdd=-8V. VICM=0
Unit : A
Spec Limit Min : -60.0E-09
Spec Limit Max : 60.0E-09
Spec limits are represented in bold lines on the graphic.



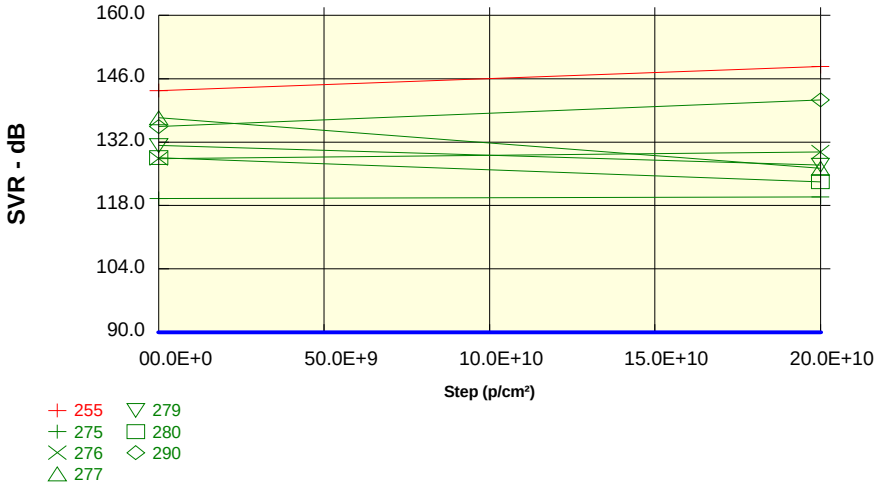
Measurements

IIB2-	0 p/cm²	2E+11 p/cm²
255_REF	-5.9E-09	-5.9E-09
OFF samples		
275	-13.0E-09	-16.0E-09
276	-8.3E-09	-11.8E-09
277	-9.9E-09	-13.6E-09
279	-10.7E-09	-11.4E-09
280	-9.4E-09	-14.7E-09
290	-8.4E-09	-10.7E-09
Statistics		
Min	-13.0E-09	-16.0E-09
Max	-8.3E-09	-10.7E-09
Average	-9.9E-09	-13.0E-09
Sigma	1.6E-09	1.9E-09
(IIB) Lot WorstCase	-14.8E-09	-18.8E-09

Drift Calculation

IIB2-	0 p/cm²	2E+11 p/cm²
OFF samples		
275	-	-2.97E-09
276	-	-3.48E-09
277	-	-3.76E-09
279	-	-718.00E-12
280	-	-5.34E-09
290	-	-2.33E-09
Average	-	-3.10E-09
Sigma	-	1.41E-09
d(IIB) Lot WorstCase	-	1.12E-09

Test conditions : Protons
Parameter : Supply Rejection Ratio : SVR
+3V < +Vcc < 16V
Unit : dB
Spec Limit Min : 90.0
Spec limits are represented in bold lines on the graphic.



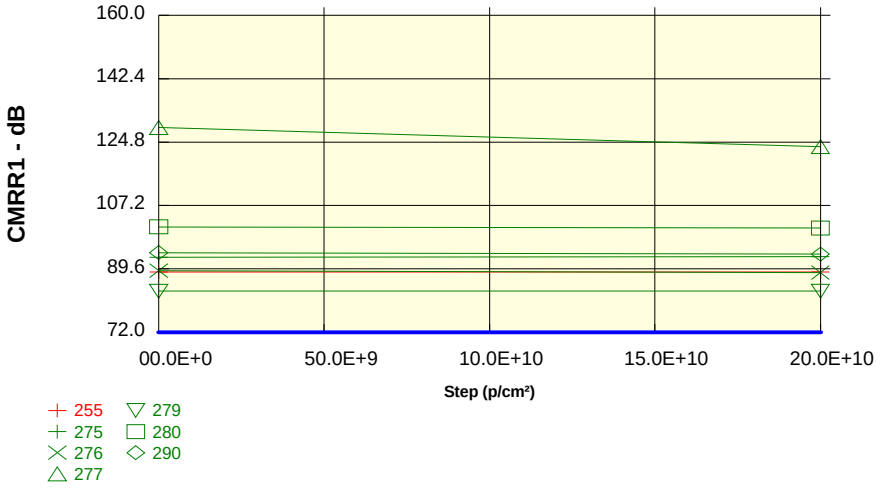
Measurements

SVR	0 p/cm²	2E+11 p/cm²
255_REF	143.4	148.7
OFF samples		
275	119.5	119.9
276	128.4	129.8
277	137.4	126.2
279	131.2	126.9
280	128.6	123.2
290	135.4	141.3
Statistics		
Min	119.5	119.9
Max	137.4	141.3
Average	130.1	127.9
Sigma	5.8	6.7
(SVR) Lot WorstCase	112.8	107.7

Drift Calculation

SVR	0 p/cm²	2E+11 p/cm²
OFF samples		
275	-	361.96E-03
276	-	1.44E+00
277	-	-11.16E+00
279	-	-4.36E+00
280	-	-5.35E+00
290	-	5.86E+00
Average	-	-2.20E+00
Sigma	-	5.47E+00
d(SVR) Lot WorstCase	-	-18.62E+00

Test conditions : Protons
Parameter : Common Mode Rejection Ratio : CMRR1
Vdd<VICM<Vcc. Vcc=+1.5V. Vdd=-1.5V
Unit : dB
Spec Limit Min : 72.0
Spec limits are represented in bold lines on the graphic.



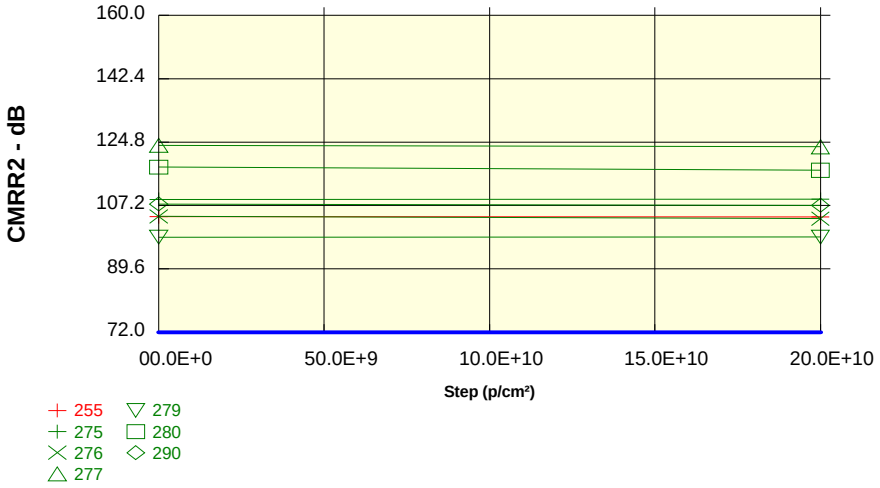
Measurements

CMRR1	0 p/cm²	2E+11 p/cm²
255_REF	88.7	88.7
OFF samples		
275	92.8	93.0
276	89.1	88.6
277	128.9	123.5
279	83.4	83.4
280	101.3	101.0
290	94.1	93.7
Statistics		
Min	83.4	83.4
Max	128.9	123.5
Average	98.3	97.2
Sigma	14.7	12.9
(CMR) Lot WorstCase	54.2	58.5

Drift Calculation

CMRR1	0 p/cm²	2E+11 p/cm²
OFF samples		
275	-	148.48E-03
276	-	-537.05E-03
277	-	-5.35E+00
279	-	24.07E-03
280	-	-302.49E-03
290	-	-385.34E-03
Average	-	-1.07E+00
Sigma	-	1.93E+00
d(CMR) Lot WorstCase	-	-6.86E+00

Test conditions : Protons
Parameter : Common Mode Rejection Ratio : CMRR2
Vdd<VICM<Vcc. Vcc=+8V. Vdd=-8V
Unit : dB
Spec Limit Min : 72.0
Spec limits are represented in bold lines on the graphic.



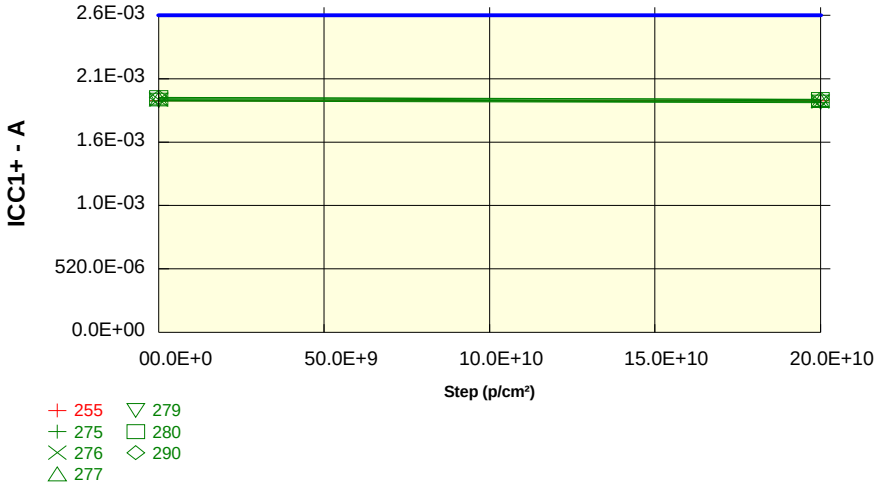
Measurements

CMRR2	0 p/cm²	2E+11 p/cm²
255_REF	104.1	104.0
OFF samples		
275	108.9	108.9
276	104.2	103.6
277	123.9	123.5
279	98.4	98.4
280	117.8	117.0
290	107.6	107.3
Statistics		
Min	98.4	98.4
Max	123.9	123.5
Average	110.1	109.8
Sigma	8.5	8.3
(CMR) Lot WorstCase	84.7	84.8

Drift Calculation

CMRR2	0 p/cm²	2E+11 p/cm²
OFF samples		
275	-	72.53E-03
276	-	-626.62E-03
277	-	-365.43E-03
279	-	43.40E-03
280	-	-853.98E-03
290	-	-368.14E-03
Average	-	-349.71E-03
Sigma	-	332.76E-03
d(CMR) Lot WorstCase	-	-1.35E+00

Test conditions : Protons
Parameter : Power Supply Current : ICC1+
+Vcc=+1.5V. Vdd=-1.5V. VICM=0
Unit : A
Spec Limit Max : 2.6E-03
Spec limits are represented in bold lines on the graphic.



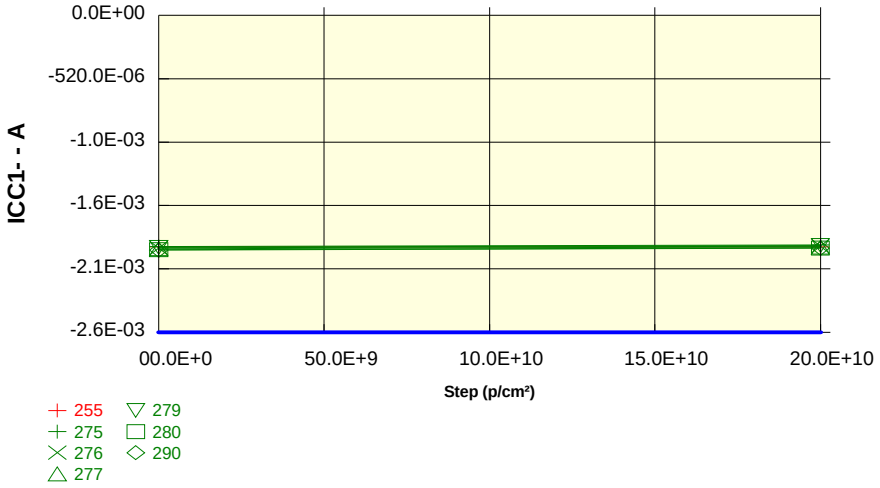
Measurements

ICC1+	0 p/cm²	2E+11 p/cm²
255_REF	1.9E-03	1.9E-03
OFF samples		
275	1.9E-03	1.9E-03
276	1.9E-03	1.9E-03
277	1.9E-03	1.9E-03
279	1.9E-03	1.9E-03
280	1.9E-03	1.9E-03
290	1.9E-03	1.9E-03
Statistics		
Min	1.9E-03	1.9E-03
Max	1.9E-03	1.9E-03
Average	1.9E-03	1.9E-03
Sigma	10.7E-06	10.1E-06
(ICC) Lot WorstCase	1.9E-03	1.9E-03

Drift Calculation

ICC1+	0 p/cm²	2E+11 p/cm²
OFF samples		
275	-	-14.20E-06
276	-	-15.20E-06
277	-	-15.20E-06
279	-	-14.60E-06
280	-	-15.80E-06
290	-	-16.00E-06
Average	-	-15.17E-06
Sigma	-	626.26E-09
d(ICC) Lot WorstCase	-	-13.29E-06

Test conditions : Protons
Parameter : Power Supply Current : ICC1-
+Vcc=+1.5V. Vdd=-1.5V. VICM=0
Unit : A
Spec Limit Min : -2.6E-03
Spec limits are represented in bold lines on the graphic.



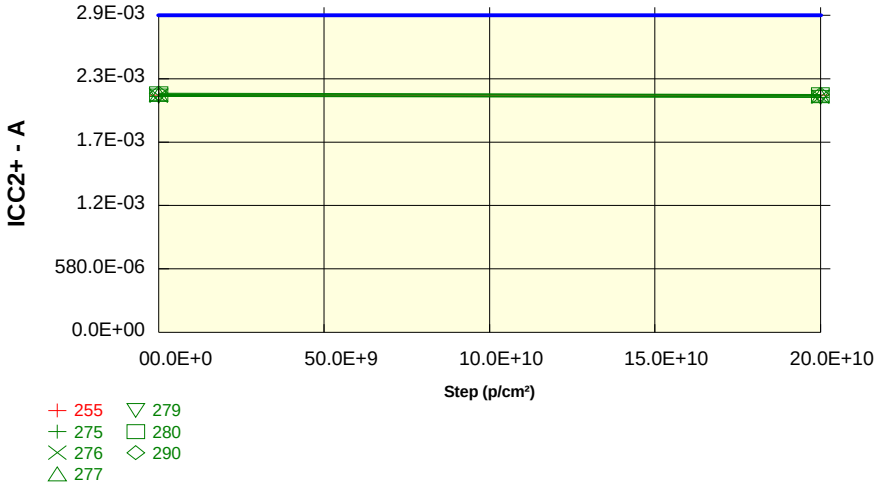
Measurements

ICC1-	0 p/cm²	2E+11 p/cm²
255_REF	-1.9E-03	-1.9E-03
OFF samples		
275	-1.9E-03	-1.9E-03
276	-1.9E-03	-1.9E-03
277	-1.9E-03	-1.9E-03
279	-1.9E-03	-1.9E-03
280	-1.9E-03	-1.9E-03
290	-1.9E-03	-1.9E-03
Statistics		
Min	-1.9E-03	-1.9E-03
Max	-1.9E-03	-1.9E-03
Average	-1.9E-03	-1.9E-03
Sigma	10.7E-06	10.1E-06
(ICC) Lot WorstCase	-1.9E-03	-1.9E-03

Drift Calculation

ICC1-	0 p/cm²	2E+11 p/cm²
OFF samples		
275	-	14.00E-06
276	-	14.80E-06
277	-	14.80E-06
279	-	14.00E-06
280	-	15.20E-06
290	-	15.60E-06
Average	-	14.73E-06
Sigma	-	584.98E-09
d(ICC) Lot WorstCase	-	12.98E-06

Test conditions : Protons
Parameter : Power Supply Current : ICC2+
+Vcc=+8V. Vdd=-8V. VICM=0
Unit : A
Spec Limit Max : 2.9E-03
Spec limits are represented in bold lines on the graphic.



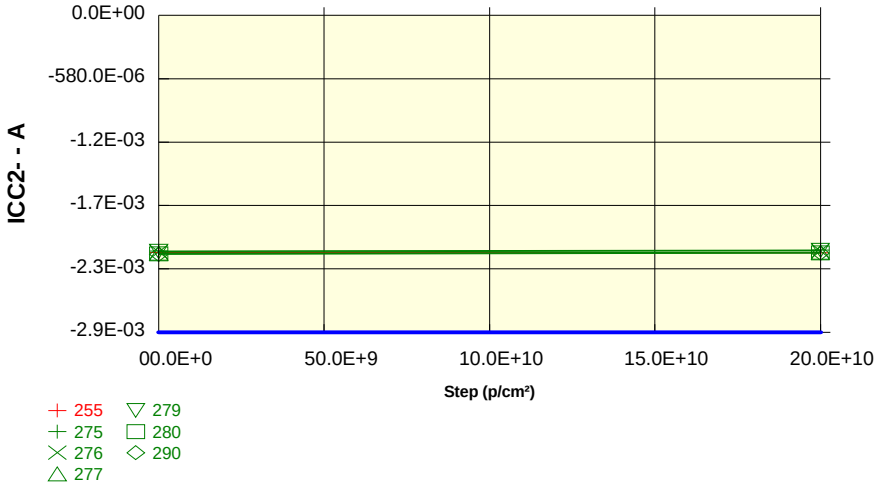
Measurements

ICC2+	0 p/cm²	2E+11 p/cm²
255_REF	2.2E-03	2.2E-03
OFF samples		
275	2.2E-03	2.1E-03
276	2.2E-03	2.2E-03
277	2.2E-03	2.2E-03
279	2.2E-03	2.2E-03
280	2.2E-03	2.2E-03
290	2.2E-03	2.2E-03
Statistics		
Min	2.2E-03	2.1E-03
Max	2.2E-03	2.2E-03
Average	2.2E-03	2.2E-03
Sigma	10.7E-06	10.5E-06
(ICC) Lot WorstCase	2.2E-03	2.2E-03

Drift Calculation

ICC2+	0 p/cm²	2E+11 p/cm²
OFF samples		
275	-	-9.20E-06
276	-	-10.80E-06
277	-	-10.20E-06
279	-	-10.00E-06
280	-	-10.00E-06
290	-	-10.60E-06
Average	-	-10.13E-06
Sigma	-	512.08E-09
d(ICC) Lot WorstCase	-	-8.60E-06

Test conditions : Protons
Parameter : Power Supply Current : ICC2-
+Vcc=+8V. Vdd=-8V. VICM=0
Unit : A
Spec Limit Min : -2.9E-03
Spec limits are represented in bold lines on the graphic.



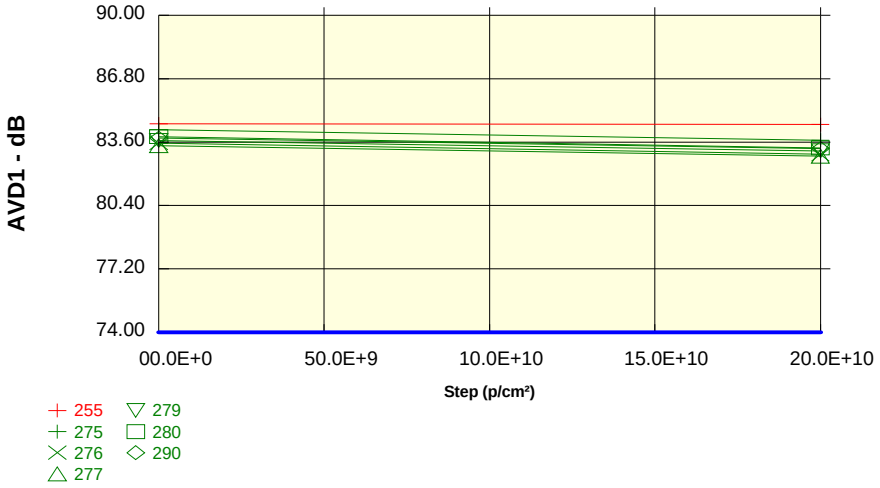
Measurements

ICC2-	0 p/cm²	2E+11 p/cm²
255_REF	-2.2E-03	-2.2E-03
OFF samples		
275	-2.2E-03	-2.1E-03
276	-2.2E-03	-2.2E-03
277	-2.2E-03	-2.2E-03
279	-2.2E-03	-2.2E-03
280	-2.2E-03	-2.2E-03
290	-2.2E-03	-2.2E-03
Statistics		
Min	-2.2E-03	-2.2E-03
Max	-2.2E-03	-2.1E-03
Average	-2.2E-03	-2.2E-03
Sigma	10.8E-06	10.5E-06
(ICC) Lot WorstCase	-2.2E-03	-2.2E-03

Drift Calculation

ICC2-	0 p/cm²	2E+11 p/cm²
OFF samples		
275	-	8.80E-06
276	-	10.20E-06
277	-	9.80E-06
279	-	9.40E-06
280	-	9.60E-06
290	-	10.40E-06
Average	-	9.70E-06
Sigma	-	526.03E-09
d(ICC) Lot WorstCase	-	8.12E-06

Test conditions : Protons
Parameter : Voltage Gain : AVD1
+Vcc=+1.5V. Vdd=-1.5V. VICM=0V.RL=1K. Vdd+0.5<Vout<Vcc-0.5
Unit : dB
Spec Limit Min : 74.00
Spec limits are represented in bold lines on the graphic.



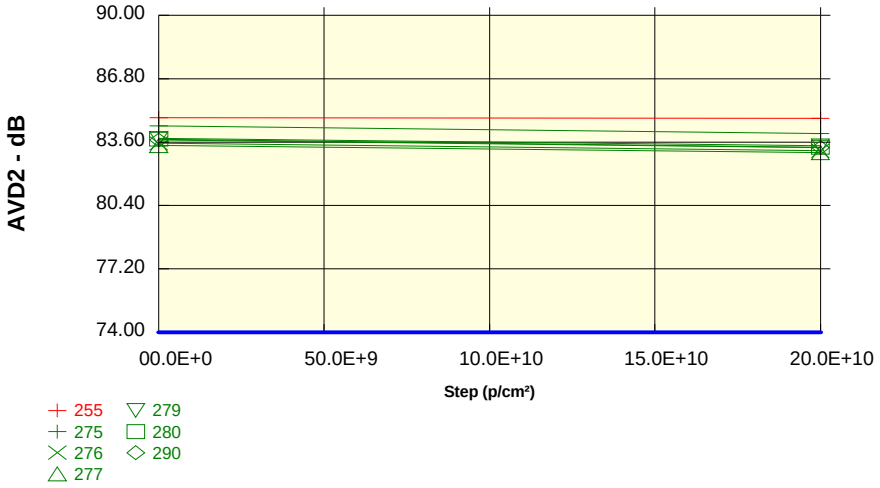
Measurements

AVD1	0 p/cm²	2E+11 p/cm²
255_REF	84.52	84.48
OFF samples		
275	84.23	83.69
276	83.55	82.98
277	83.42	82.89
279	83.68	83.16
280	83.87	83.30
290	83.80	83.28
Statistics		
Min	83.42	82.89
Max	84.23	83.69
Average	83.76	83.22
Sigma	0.26	0.26
(AVD) Lot WorstCase	82.98	82.44

Drift Calculation

AVD1	0 p/cm²	2E+11 p/cm²
OFF samples		
275	-	-540.05E-03
276	-	-566.78E-03
277	-	-534.45E-03
279	-	-522.52E-03
280	-	-572.27E-03
290	-	-527.37E-03
Average	-	-543.91E-03
Sigma	-	18.99E-03
d(AVD) Lot WorstCase	-	-600.87E-03

Test conditions : Protons
Parameter : Voltage Gain : AVD2
+Vcc=+8V. Vdd=-8V. VICM=0V.RL=1K. Vdd+0.5<Vout<Vcc-0.5
Unit : dB
Spec Limit Min : 74.00
Spec limits are represented in bold lines on the graphic.



Measurements

AVD2	0 p/cm²	2E+11 p/cm²
255_REF	84.83	84.79
OFF samples		
275	84.42	84.03
276	83.54	83.17
277	83.43	83.07
279	83.78	83.41
280	83.75	83.34
290	83.70	83.32
Statistics		
Min	83.43	83.07
Max	84.42	84.03
Average	83.77	83.39
Sigma	0.32	0.31
(AVD) Lot WorstCase	82.82	82.46

Drift Calculation

AVD2	0 p/cm²	2E+11 p/cm²
OFF samples		
275	-	-384.33E-03
276	-	-369.76E-03
277	-	-355.16E-03
279	-	-374.95E-03
280	-	-411.55E-03
290	-	-382.66E-03
Average	-	-379.73E-03
Sigma	-	17.17E-03
d(AVD) Lot WorstCase	-	-431.24E-03