

TOTAL DOSE RADIATION TEST REPORT

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

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




Contract extension up to 400 kRad as per CCN: ATGSP-CN-0004 IS. 3

Final Report

<p>Part Type : SOC2222A</p> <p>Package : CCP-3</p> <p>Description : NPN Small Signal Transistors</p> <p>Manufacturer : STMicroelectronics</p>

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

Alter Technology Project Manager: David NUNEZ

Hirex reference :	HRX/TID/1023	Issue : 01	Date :	January 10 th , 2012
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Hirex Engineering	Total Dose Radiation Test Report		Ref.:	HRX/TID/1023
	SOC2222A	STMICROELECTRONICS	Issue:	01

CHANGE RECORD

ISSUE	DATE	PAGE	DESCRIPTION OF CHANGES
01	January 10th, 2012	All	Original Issue

Hirex Engineering	Total Dose Radiation Test Report		Ref.:	HRX/TID/1023
	SOC2222A	STMicroelectronics	Issue:	01

TOTAL DOSE RADIATION TEST REPORT
on
STMicroelectronics
SOC2222A
NPN Small Signal Transistors

TABLE OF CONTENTS

1 INTRODUCTION.....4

2 APPLICABLE AND REFERENCE DOCUMENTS4

2.1 APPLICABLE DOCUMENTS4

2.2 REFERENCE DOCUMENTS4

3 TEST SAMPLES4

4 EXPERIMENTAL CONDITIONS.....6

4.1 RADIATION SOURCE DOSE RATE AND ANNEALING.....6

4.2 BIAS DURING DOSE EXPOSURES AND MEASUREMENTS CONDITIONS.....7

4.2.1 Bias conditions7

4.2.2 Electrical Measurements7

5 CONCLUSION.....9

6 TEST RESULTS.....10

LIST OF FIGURES:

Figure 1 : Samples bias flow diagram.....4

Figure 2 : Bias Conditions during Irradiation Exposures7

Figure 3 : SOC2222A test program principle.....7

LIST OF TABLES:

Table 1 : Measured electrical parameters8

Table 2 : Summary of parameters failure levels9

LIST OF APPENDICES:

Appendix 1 : Temperature Measurements37

Hirex Engineering	Total Dose Radiation Test Report		Ref.:	HRX/TID/1023
	SOC2222A	STMicroelectronics	Issue:	01

1 Introduction

In the scope of the ESA study: “Survey of Critical Components for 400 kRad Power Systems”, a total dose characterization test of the STMicroelectronics SOC2222A, NPN Small Signal Transistors has been performed with an accumulated dose of about 386.1Krad(Si) at different dose rates of 36 & 100 rad(Si)/hour, in response to Alter Technology purchase order reference ATGSP-TL-09-JC-CO-9.

An Interim report, HRX/TID/0941 Issue 01, corresponding to the irradiation up to 148.5krad(Si) step has been already provided.

The purpose of this test was to evaluate total dose withstanding of this component, to investigate its suitability for being used in space applications. This test was conducted on samples provided by Alter Technology.

Test has been performed in accordance with Hirex Engineering Radiation Test Plan HRX/SPE/0225 issue 2 dated 08/09/2010.

A complete set of electrical measurements together with graphical representation of measured parameters with respect to total dose received, are provided for all samples.

2 Applicable and Reference Documents

2.1 Applicable Documents

- Hirex Engineering Radiation Test Plan: HRX/SPE/0225 issue 2 dated 08/09/2010
- Alter Technology Group Proposal: ATGSP-OF-648/2009 Issue 1
- Minutes of Meeting: MM-SRP-ATG-0001 dated 29/10/2009
- Hirex internal specification: Total Ionizing dose test general procedure.
- ESCC detail specification: 5201-002

2.2 Reference Documents

- STMicroelectronics datasheet: Doc ID 16558 Rev 1, October 2009

3 Test Samples

13 samples of the SOC2222A device were tested (6 ON + 6 OFF + 1 control sample).

12 samples (including the 6 samples already submitted to protons test: see report HRX/TID/0940) have been biased according to the flow diagram given in Figure 1.

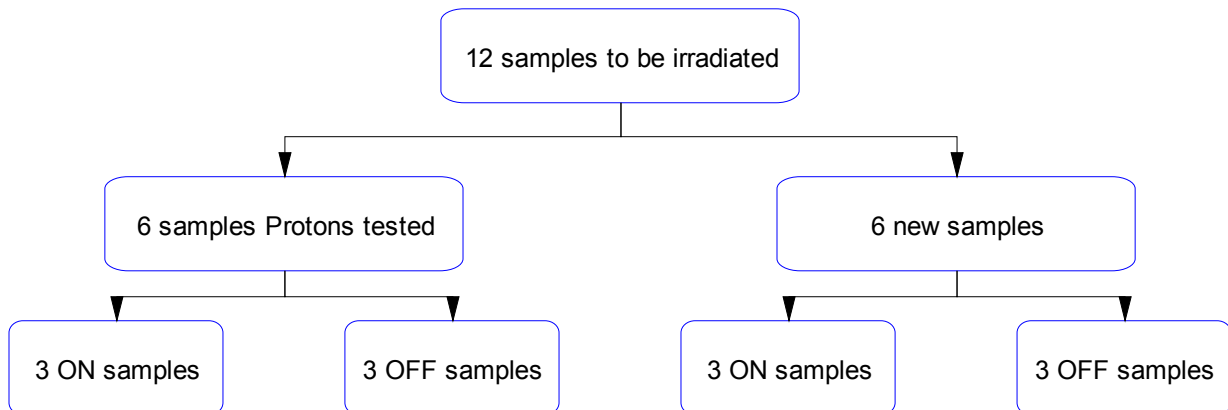


Figure 1 : Samples bias flow diagram

Hirex Engineering	Total Dose Radiation Test Report		Ref.:	HRX/TID/1023
	SOC2222A	STMicroelectronics	Issue:	01

Samples were allocated into the bias conditions during exposures and annealing as provided in the following table. The different samples groups are also identified for an easier plots reading.

SN attributed by Hirex	Samples Allocation	Samples Group Naming
1	Control sample	REF
2	Biased ON	ON_PROTON
3	Biased ON	ON_PROTON
4	Biased ON	ON_PROTON
5	Biased OFF	OFF_PROTON
6	Biased OFF	OFF_PROTON
7	Biased OFF	OFF_PROTON
8	Biased ON	ON_TID
9	Biased ON	ON_TID
10	Biased ON	ON_TID
11	Biased OFF	OFF_TID
12	Biased OFF	OFF_TID
13	Biased OFF	OFF_TID

Identification of the SOC2222A is given below:

Part Number: SOC2222ASW

Top Marking: -

Inspection Lot: DOC01283

Date Code: -

Hirex Engineering	Total Dose Radiation Test Report		Ref.:	HRX/TID/1023
	SOC2222A	STMicroelectronics	Issue:	01

4 Experimental Conditions

4.1 Radiation Source Dose Rate and Annealing

The dose exposures were performed at UCL in Louvain (Belgium). In this irradiation facility, a Cobalt 60 source is used with the possibility to vary the dose rate by simply adjusting the distance to the source. During the dose exposures, devices under test have been irradiated in an ambient temperature of 24°C ±6°C.

The dose received by the devices has been controlled by the measurement of one Alanine pellet dosimeter placed onto the bias board.

Resulting test conditions are provided below.

Irradiation Steps requested	Pellet dosimetry data	Dose rate	Annealing steps	Temperature
kRad	kRad	Rad/h	Hours	°C
0	0			
10	10.8	36		Room
20	25.2	36		Room
50	48.6	36		Room
100	91.8	36		Room
150	148.5	100 [1]		Room
200	196.2	300 [1]		Room
250	240.3	300 [1]		Room
300	283.5	300 [1]		Room
350	324.9	300 [1]		Room
400	386.1	300 [1]		Room
				Room
				100°C

Note [1]: Due to the maintenance period planned at UCL at the end of December and in order to perform subsequent requested exposures steps up to 400 Krad(Si), the dose rate of several steps have been changed, with ESA agreement, from 36 rad(Si)/h to 100 rad(Si)/h and from 100 rad(Si)/h to 300 rad(Si)/h as indicated.

Hirex Engineering	Total Dose Radiation Test Report		Ref.:	HRX/TID/1023
	SOC2222A	STMicroelectronics	Issue:	01

4.2 Bias during Dose Exposures and Measurements conditions

4.2.1 Bias conditions

During exposures test board allowed to bias 6 samples in accordance with the electrical circuit provided in Figure 2. 6 other samples were biased OFF with all pins connected to ground.

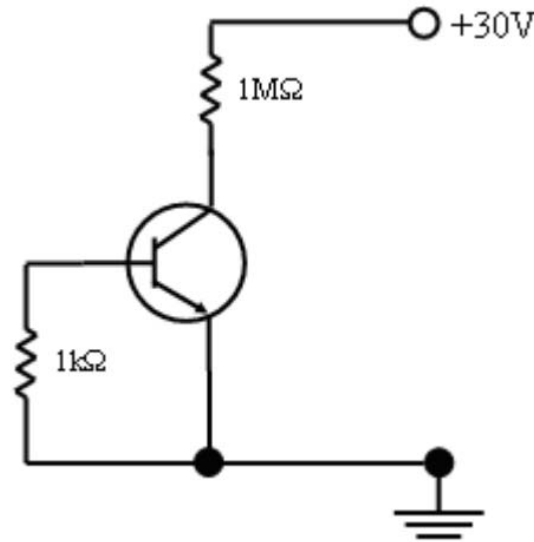


Figure 2 : Bias Conditions during Irradiation Exposures

4.2.2 Electrical Measurements

Electrical parameters test program principle for SOC2222A is provided in Figure 3.

A HP4142 DC tester and a network analyzer HP8714ES were used to perform required measurements.

A dedicated test fixture was designed to ensure proper measurement conditions. In addition a faraday cage was used to ensure optimum conditions for low level measurements.

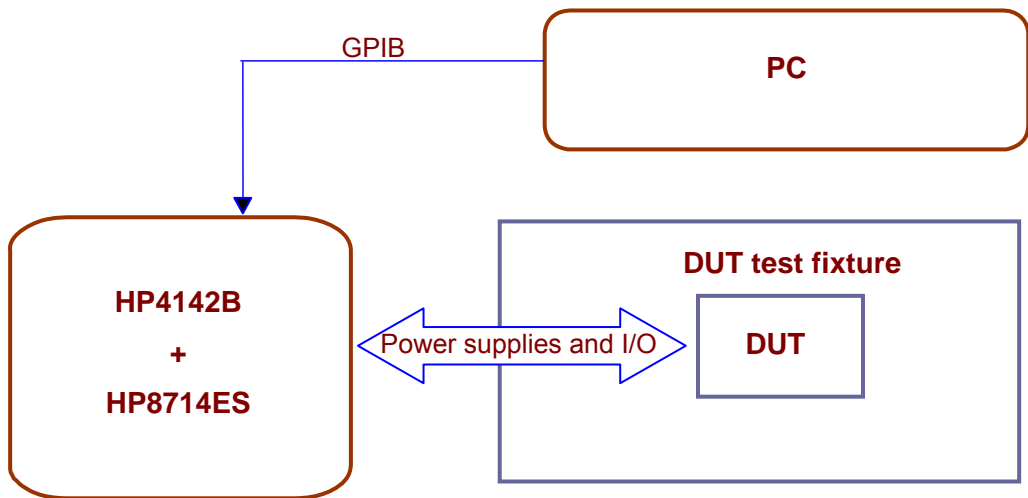


Figure 3 : SOC2222A test program principle

Hirex Engineering	Total Dose Radiation Test Report		Ref.:	HRX/TID/1023
	SOC2222A	STMicroelectronics	Issue:	01

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

N°	Symbols	Characteristics	Test Conditions	Limits		Units
				Min	Max	
1	I_{CBO}	Collector-Base Cut-off Current	$V_{CB} = 60V$	-	10	nA
2	I_{EBO}	Emitter-Base Cut-off Current	$V_{EB} = 3V$	-	10	nA
3	I_{CEO}	Collector-Emitter Cut-off Current	$V_{CE} = 40V$, Note 2		10	nA
4	$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	$I_C = 100\mu A$	75	-	V
5	$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	$I_C = 30mA$, Note 1	40	-	V
6	$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	$I_E = 100\mu A$	6	-	V
7	$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage	$I_C = 150mA$, $I_B = 15mA$ Note 1	-	0.3	V
8	$V_{BE(SAT)}$	Base-Emitter Saturation Voltage	$I_C = 150mA$, $I_B = 15mA$ Note 1	-	1.2	V
9	H_{FE1}	Forward-Current Transfer Ratio	$I_C = 100\mu A$, $V_{CE} = 10V$ Note 1	35	-	
10	H_{FE2}	Forward-Current Transfer Ratio	$I_C = 1mA$, $V_{CE} = 10V$ Note 1	50	-	
11	H_{FE3}	Forward-Current Transfer Ratio	$I_C = 10mA$, $V_{CE} = 10V$ Note 1	75		
12	H_{FE4}	Forward-Current Transfer Ratio	$I_C = 150mA$, $V_{CE} = 10V$ Note 1	100	300	
13	F_T	Gain Bandwidth Product	$V_{CE}=20V$, $I_C=20mA$	300	1000	MHz

Note 1: Pulse measurement: Pulse Width $\leq 300\mu s$, duty cycle 1%.

Note 2: This parameter has been measured at Room temperature at all steps of testing, and also at 110°C at initial step and after Annealing. No limit applicable at 110°C.

Table 1 : Measured electrical parameters

Hirex Engineering	Total Dose Radiation Test Report		Ref.:	HRX/TID/1023
	SOC2222A	STMicroelectronics	Issue:	01

5 Conclusion

A Total Ionizing Dose characterization test was carried out by Hirex Engineering under Alter Technology contract on the STMicroelectronics SOC2222A NPN Small Signal Transistors in CCP-3 package.

12 samples plus one control sample were used during testing. They were exposed to radiation using different dose rates of 36, 100 & 300 rad(Si)/hour at room temperature.

I_{CE0} parameter has been measured at high temperature before and after testing. Corresponding results are provided in Appendix 1.

A summary of the failed parameters is provided in the following table. The behavior of each parameter is recorded for both biased On and biased Off samples of each group. Parameters not listed remained within specification limits all along testing or had no limits specified. Detail test results are presented in next section.

Parameters	Failure Level between :		Annealing Recovery [Note 1]					Comments
			NA	No	Partial	Complete	Rebound	
HFE1	ON_PROTON samples	283.5 & 324.9 kRad(Si)				X		
	ON_TID samples	283.5 & 324.9 kRad(Si)				X		
	OFF_PROTON samples	283.5 & 324.9 kRad(Si)				X		
	OFF_TID samples	283.5 & 324.9 kRad(Si)				X		

[Note 1]: **NA** = Not applicable, **No**: means no sample has recovered, **Partial**: means at least one sample has recovered, **Complete**: means all samples have recovered, **Rebound**: means rebound has been observed on at least one sample.

Table 2 : Summary of parameters failure levels

Hirex Engineering	Total Dose Radiation Test Report		Ref.:	HRX/TID/1023
	SOC2222A	STMicroelectronics	Issue:	01

6 Test Results

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

Statistics are provided separately for biased ON & biased OFF samples of each group.

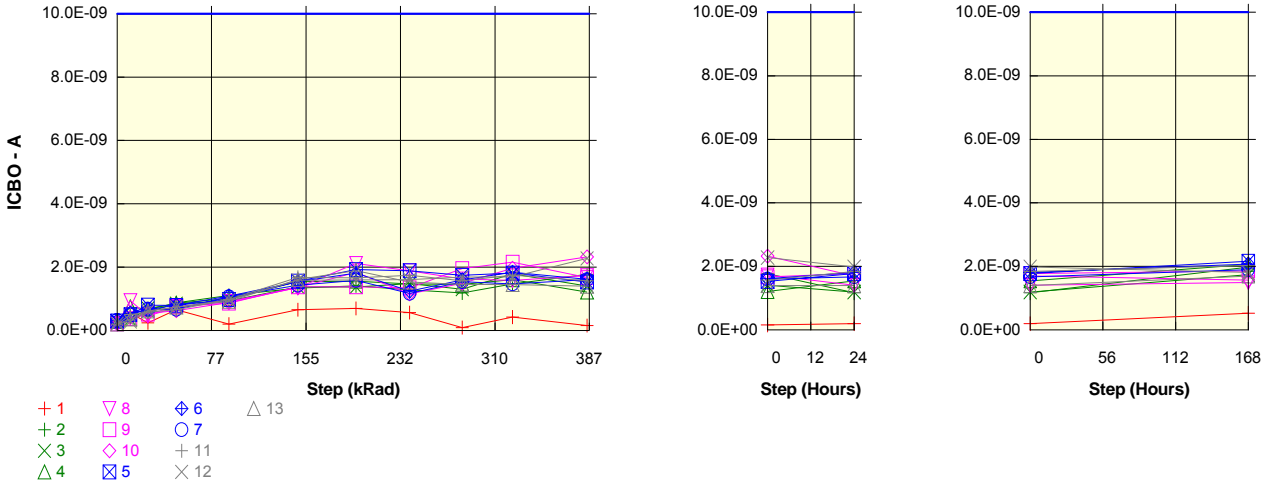
For each parameter, a drift calculation table is provided computing the drift between a given exposure step with respect to initial readings:

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

For the particular case of transistors, drift calculation table for Hfe parameters will refer to 1/Hfe:

$$\Delta(1/hFE) = (1/hFE_{\text{POSTRAD}}) - (1/hFE_{\text{PRERAD}})$$

Parameter : Collector-Base cut-off current : ICBO
 Test conditions : Vcb = 60V
 Unit : A
 Spec Limit Max : 10.0E-09
 Spec limits are represented in bold lines on the graphic.



Measurements

ICBO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	197.1E-12	550.8E-12	243.6E-12	654.4E-12	202.4E-12	654.5E-12	696.0E-12	564.4E-12	93.8E-12	423.0E-12	155.8E-12	196.0E-12	526.0E-12
ON PROTON samples													
2	280.5E-12	387.6E-12	559.9E-12	873.4E-12	1.1E-09	1.3E-09	1.4E-09	1.3E-09	1.2E-09	1.5E-09	1.8E-09	1.2E-09	2.0E-09
3	287.2E-12	345.4E-12	694.0E-12	847.2E-12	931.6E-12	1.4E-09	1.4E-09	1.5E-09	1.3E-09	1.8E-09	1.4E-09	1.2E-09	1.7E-09
4	287.7E-12	748.4E-12	667.5E-12	864.4E-12	1.0E-09	1.5E-09	1.6E-09	1.5E-09	1.5E-09	1.6E-09	1.2E-09	1.5E-09	2.1E-09
Statistics													
Min	280.5E-12	345.4E-12	559.9E-12	847.2E-12	931.6E-12	1.3E-09	1.4E-09	1.3E-09	1.2E-09	1.5E-09	1.2E-09	1.2E-09	1.7E-09
Max	287.7E-12	748.4E-12	694.0E-12	873.4E-12	1.1E-09	1.5E-09	1.6E-09	1.5E-09	1.5E-09	1.8E-09	1.8E-09	1.5E-09	2.1E-09
Average	285.1E-12	493.8E-12	640.5E-12	861.7E-12	1.0E-09	1.4E-09	1.4E-09	1.4E-09	1.3E-09	1.6E-09	1.5E-09	1.3E-09	1.9E-09
Sigma	3.3E-12	180.9E-12	58.0E-12	10.9E-12	69.7E-12	87.9E-12	79.1E-12	90.4E-12	111.1E-12	128.0E-12	230.8E-12	172.0E-12	137.1E-12

Drift Calculation

ICBO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
ON PROTON samples													
2	-	107.1E-12	279.5E-12	592.9E-12	821.9E-12	1.1E-09	1.1E-09	999.9E-12	904.0E-12	1.2E-09	1.5E-09	891.9E-12	1.7E-09
3	-	58.2E-12	406.8E-12	560.0E-12	644.4E-12	1.1E-09	1.1E-09	1.2E-09	1.0E-09	1.5E-09	1.1E-09	904.0E-12	1.5E-09
4	-	460.7E-12	379.8E-12	576.7E-12	725.9E-12	1.3E-09	1.3E-09	1.2E-09	1.2E-09	1.3E-09	925.7E-12	1.3E-09	1.8E-09
Average	-	208.7E-12	355.4E-12	576.5E-12	730.7E-12	1.1E-09	1.2E-09	1.1E-09	1.0E-09	1.3E-09	1.2E-09	1.0E-09	1.6E-09
Sigma	-	179.3E-12	54.8E-12	13.4E-12	72.6E-12	85.7E-12	77.9E-12	87.1E-12	108.3E-12	125.4E-12	234.0E-12	170.1E-12	137.8E-12

Measurements

ICBO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	197.1E-12	550.8E-12	243.6E-12	654.4E-12	202.4E-12	654.5E-12	696.0E-12	564.4E-12	93.8E-12	423.0E-12	155.8E-12	196.0E-12	526.0E-12
ON TID samples													
8	210.0E-12	942.0E-12	462.7E-12	725.2E-12	918.8E-12	1.3E-09	2.1E-09	1.9E-09	1.6E-09	1.6E-09	1.7E-09	1.4E-09	1.5E-09
9	206.7E-12	374.0E-12	519.3E-12	756.8E-12	865.0E-12	1.4E-09	1.4E-09	1.3E-09	2.0E-09	2.2E-09	1.7E-09	1.8E-09	1.9E-09
10	213.0E-12	400.4E-12	541.9E-12	628.5E-12	882.6E-12	1.4E-09	1.8E-09	1.2E-09	1.5E-09	2.0E-09	2.3E-09	1.7E-09	1.6E-09
Statistics													
Min	206.7E-12	374.0E-12	462.7E-12	628.5E-12	865.0E-12	1.3E-09	1.4E-09	1.2E-09	1.5E-09	1.6E-09	1.7E-09	1.4E-09	1.5E-09
Max	213.0E-12	942.0E-12	541.9E-12	756.8E-12	918.8E-12	1.4E-09	2.1E-09	1.9E-09	2.0E-09	2.2E-09	2.3E-09	1.8E-09	1.9E-09
Average	209.9E-12	572.1E-12	508.0E-12	703.5E-12	888.8E-12	1.4E-09	1.8E-09	1.5E-09	1.7E-09	1.9E-09	1.9E-09	1.6E-09	1.6E-09
Sigma	2.6E-12	261.8E-12	33.3E-12	54.6E-12	22.4E-12	12.5E-12	303.8E-12	308.6E-12	195.0E-12	240.4E-12	293.4E-12	160.0E-12	156.5E-12

Drift Calculation

ICBO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
ON TID samples													
8	-	732.0E-12	252.7E-12	515.2E-12	708.8E-12	1.1E-09	1.9E-09	1.7E-09	1.4E-09	1.4E-09	1.5E-09	1.2E-09	1.3E-09
9	-	167.3E-12	312.6E-12	550.1E-12	658.3E-12	1.2E-09	1.2E-09	1.1E-09	1.7E-09	2.0E-09	1.5E-09	1.6E-09	1.6E-09
10	-	187.4E-12	328.9E-12	415.6E-12	669.6E-12	1.1E-09	1.6E-09	943.4E-12	1.3E-09	1.8E-09	2.1E-09	1.5E-09	1.4E-09
Average	-	362.2E-12	298.1E-12	493.6E-12	678.9E-12	1.2E-09	1.6E-09	1.3E-09	1.5E-09	1.7E-09	1.7E-09	1.4E-09	1.4E-09
Sigma	-	261.6E-12	32.8E-12	57.0E-12	21.6E-12	14.4E-12	302.2E-12	309.1E-12	197.5E-12	241.4E-12	291.2E-12	160.6E-12	158.4E-12

Measurements

Hirex Engineering	Total Dose Radiation Test Report										Ref.:	HRX/TID/1023
	SOC2222A					STMicroelectronics					Issue:	01

ICBO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	197.1E-12	550.8E-12	243.6E-12	654.4E-12	202.4E-12	654.5E-12	696.0E-12	564.4E-12	93.8E-12	423.0E-12	155.8E-12	196.0E-12	526.0E-12
OFF PROTON samples													
5	298.1E-12	502.0E-12	799.6E-12	791.0E-12	976.6E-12	1.6E-09	1.9E-09	1.9E-09	1.7E-09	1.8E-09	1.5E-09	1.8E-09	2.2E-09
6	317.1E-12	546.4E-12	659.4E-12	801.0E-12	1.1E-09	1.5E-09	1.8E-09	1.2E-09	1.6E-09	1.8E-09	1.6E-09	1.8E-09	2.1E-09
7	314.4E-12	493.2E-12	671.6E-12	664.6E-12	1.1E-09	1.4E-09	1.6E-09	1.2E-09	1.5E-09	1.5E-09	1.6E-09	1.7E-09	1.9E-09
Statistics													
Min	298.1E-12	493.2E-12	659.4E-12	664.6E-12	976.6E-12	1.4E-09	1.6E-09	1.2E-09	1.5E-09	1.5E-09	1.5E-09	1.7E-09	1.9E-09
Max	317.1E-12	546.4E-12	799.6E-12	801.0E-12	1.1E-09	1.6E-09	1.9E-09	1.9E-09	1.7E-09	1.8E-09	1.6E-09	1.8E-09	2.2E-09
Average	309.9E-12	513.9E-12	710.2E-12	752.2E-12	1.0E-09	1.5E-09	1.8E-09	1.4E-09	1.6E-09	1.7E-09	1.6E-09	1.8E-09	2.0E-09
Sigma	8.4E-12	23.3E-12	63.4E-12	62.1E-12	47.3E-12	56.0E-12	143.4E-12	321.2E-12	83.4E-12	165.8E-12	37.9E-12	58.3E-12	109.8E-12

Drift Calculation

ICBO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
OFF PROTON samples													
5	-	203.9E-12	501.5E-12	492.9E-12	678.5E-12	1.3E-09	1.6E-09	1.6E-09	1.4E-09	1.5E-09	1.2E-09	1.5E-09	1.9E-09
6	-	229.3E-12	342.3E-12	483.9E-12	769.9E-12	1.2E-09	1.5E-09	921.9E-12	1.3E-09	1.5E-09	1.3E-09	1.5E-09	1.8E-09
7	-	178.8E-12	357.2E-12	350.2E-12	747.8E-12	1.1E-09	1.3E-09	860.0E-12	1.2E-09	1.2E-09	1.3E-09	1.4E-09	1.6E-09
Average	-	204.0E-12	400.3E-12	442.3E-12	732.1E-12	1.2E-09	1.5E-09	1.1E-09	1.3E-09	1.4E-09	1.3E-09	1.4E-09	1.7E-09
Sigma	-	20.6E-12	71.8E-12	65.2E-12	38.9E-12	60.5E-12	149.1E-12	329.4E-12	91.1E-12	168.7E-12	29.5E-12	60.0E-12	115.5E-12

Measurements

ICBO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	197.1E-12	550.8E-12	243.6E-12	654.4E-12	202.4E-12	654.5E-12	696.0E-12	564.4E-12	93.8E-12	423.0E-12	155.8E-12	196.0E-12	526.0E-12
OFF TID samples													
11	197.8E-12	504.6E-12	579.0E-12	657.2E-12	975.6E-12	1.7E-09	1.7E-09	1.7E-09	1.6E-09	1.7E-09	1.6E-09	1.8E-09	2.0E-09
12	213.4E-12	282.2E-12	611.2E-12	743.2E-12	965.2E-12	1.6E-09	1.6E-09	1.6E-09	1.7E-09	1.7E-09	2.3E-09	2.0E-09	1.8E-09
13	203.6E-12	362.8E-12	612.9E-12	734.2E-12	920.2E-12	1.6E-09	1.9E-09	1.5E-09	1.5E-09	1.4E-09	1.4E-09	1.4E-09	1.7E-09
Statistics													
Min	197.8E-12	282.2E-12	579.0E-12	657.2E-12	920.2E-12	1.6E-09	1.6E-09	1.5E-09	1.5E-09	1.4E-09	1.4E-09	1.4E-09	1.7E-09
Max	213.4E-12	504.6E-12	612.9E-12	743.2E-12	975.6E-12	1.7E-09	1.9E-09	1.7E-09	1.7E-09	1.7E-09	2.3E-09	2.0E-09	2.0E-09
Average	205.0E-12	383.2E-12	601.0E-12	711.5E-12	953.7E-12	1.6E-09	1.7E-09	1.6E-09	1.6E-09	1.6E-09	1.7E-09	1.7E-09	1.8E-09
Sigma	6.4E-12	91.9E-12	15.6E-12	38.6E-12	24.0E-12	39.7E-12	127.7E-12	87.8E-12	95.4E-12	130.2E-12	380.6E-12	251.7E-12	140.4E-12

Drift Calculation

ICBO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
OFF TID samples													
11	-	306.8E-12	381.1E-12	459.4E-12	777.8E-12	1.5E-09	1.5E-09	1.5E-09	1.4E-09	1.6E-09	1.4E-09	1.6E-09	1.8E-09
12	-	68.8E-12	397.7E-12	529.8E-12	751.8E-12	1.4E-09	1.4E-09	1.4E-09	1.5E-09	1.5E-09	2.1E-09	1.8E-09	1.6E-09
13	-	159.2E-12	409.2E-12	530.6E-12	716.6E-12	1.4E-09	1.7E-09	1.3E-09	1.2E-09	1.2E-09	1.2E-09	1.2E-09	1.5E-09
Average	-	178.2E-12	396.0E-12	506.6E-12	748.7E-12	1.4E-09	1.5E-09	1.4E-09	1.4E-09	1.4E-09	1.5E-09	1.5E-09	1.6E-09
Sigma	-	98.1E-12	11.5E-12	33.4E-12	25.1E-12	45.6E-12	130.1E-12	91.3E-12	91.5E-12	130.5E-12	375.2E-12	249.4E-12	143.9E-12

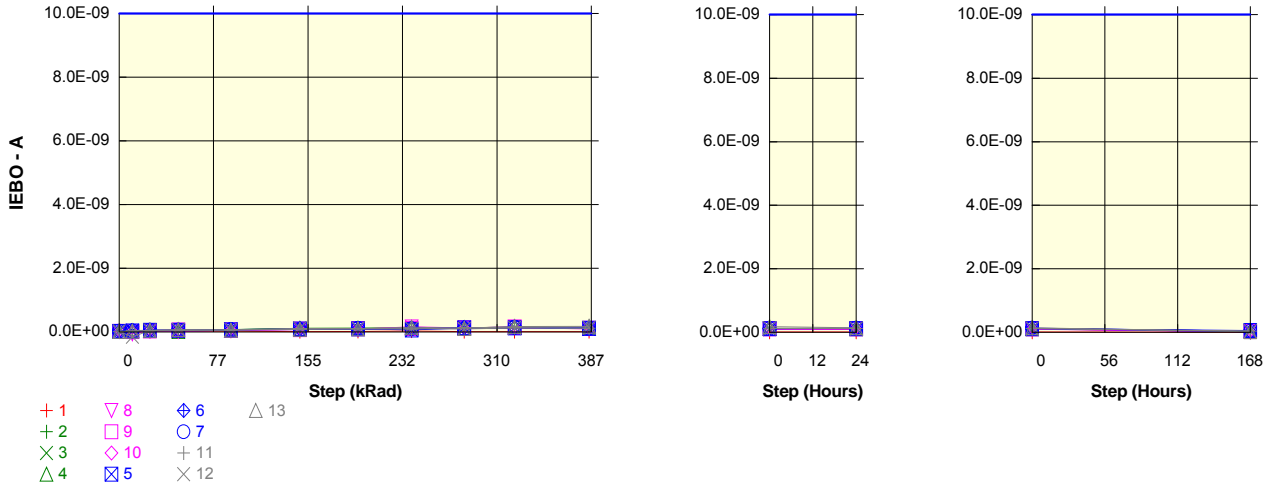
Parameter : Emitter-Base cut-off current : IEBO

Test conditions : Veb = 3V

Unit : A

Spec Limit Max : 10.0E-09

Spec limits are represented in bold lines on the graphic.



Measurements

IEBO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	16.3E-12	12.7E-12	15.0E-12	21.7E-12	24.0E-12	14.3E-12	17.3E-12	27.6E-12	14.5E-12	13.2E-12	11.7E-12	11.5E-12	3.0E-12
ON PROTON samples													
2	24.5E-12	24.7E-12	40.9E-12	26.9E-12	73.3E-12	104.6E-12	99.2E-12	102.6E-12	110.9E-12	120.3E-12	124.8E-12	105.1E-12	26.5E-12
3	23.1E-12	22.6E-12	40.8E-12	32.5E-12	58.3E-12	106.0E-12	103.2E-12	127.1E-12	112.5E-12	140.4E-12	112.0E-12	108.6E-12	28.9E-12
4	18.3E-12	42.3E-12	38.6E-12	15.7E-12	71.1E-12	113.4E-12	120.6E-12	131.1E-12	132.8E-12	152.8E-12	124.5E-12	114.0E-12	32.8E-12
Statistics													
Min	18.3E-12	22.6E-12	38.6E-12	15.7E-12	58.3E-12	104.6E-12	99.2E-12	102.6E-12	110.9E-12	120.3E-12	112.0E-12	105.1E-12	26.5E-12
Max	24.5E-12	42.3E-12	40.9E-12	32.5E-12	73.3E-12	113.4E-12	120.6E-12	131.1E-12	132.8E-12	152.8E-12	124.8E-12	114.0E-12	32.8E-12
Average	22.0E-12	29.9E-12	40.1E-12	25.0E-12	67.5E-12	108.0E-12	107.7E-12	120.3E-12	118.7E-12	137.8E-12	120.4E-12	109.2E-12	29.4E-12
Sigma	2.6E-12	8.8E-12	1.0E-12	7.0E-12	6.6E-12	3.9E-12	9.3E-12	12.6E-12	10.0E-12	13.4E-12	6.0E-12	3.7E-12	2.6E-12

Drift Calculation

IEBO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
ON PROTON samples													
2	-	180.0E-15	16.4E-12	2.4E-12	48.8E-12	80.1E-12	74.7E-12	78.2E-12	86.4E-12	95.8E-12	100.3E-12	80.6E-12	2.0E-12
3	-	-480.0E-15	17.7E-12	9.4E-12	35.2E-12	82.8E-12	80.1E-12	104.0E-12	89.3E-12	117.3E-12	88.9E-12	85.5E-12	5.8E-12
4	-	23.9E-12	20.3E-12	-2.7E-12	52.7E-12	95.0E-12	102.3E-12	112.7E-12	114.5E-12	134.5E-12	106.2E-12	95.7E-12	14.5E-12
Average	-	7.9E-12	18.1E-12	3.0E-12	45.6E-12	86.0E-12	85.7E-12	98.3E-12	96.8E-12	115.8E-12	98.5E-12	87.3E-12	7.4E-12
Sigma	-	11.3E-12	1.6E-12	4.9E-12	7.5E-12	6.5E-12	11.9E-12	14.7E-12	12.6E-12	15.8E-12	7.2E-12	6.3E-12	5.2E-12

Measurements

IEBO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	16.3E-12	12.7E-12	15.0E-12	21.7E-12	24.0E-12	14.3E-12	17.3E-12	27.6E-12	14.5E-12	13.2E-12	11.7E-12	11.5E-12	3.0E-12
ON TID samples													
8	15.5E-12	-57.0E-12	32.5E-12	17.1E-12	59.6E-12	86.6E-12	92.3E-12	159.2E-12	125.8E-12	163.3E-12	112.1E-12	108.4E-12	26.8E-12
9	17.5E-12	14.1E-12	32.6E-12	62.3E-12	54.6E-12	75.5E-12	101.4E-12	108.5E-12	122.8E-12	137.8E-12	112.2E-12	111.8E-12	36.8E-12
10	15.3E-12	13.4E-12	42.4E-12	24.8E-12	49.8E-12	78.3E-12	80.0E-12	118.7E-12	126.7E-12	140.8E-12	100.8E-12	101.8E-12	20.1E-12
Statistics													
Min	15.3E-12	-57.0E-12	32.5E-12	17.1E-12	49.8E-12	75.5E-12	80.0E-12	108.5E-12	122.8E-12	137.8E-12	100.8E-12	101.8E-12	20.1E-12
Max	17.5E-12	14.1E-12	42.4E-12	62.3E-12	59.6E-12	86.6E-12	101.4E-12	159.2E-12	126.7E-12	163.3E-12	112.2E-12	111.8E-12	36.8E-12
Average	16.1E-12	-9.8E-12	35.8E-12	34.7E-12	54.7E-12	80.1E-12	91.3E-12	128.8E-12	125.1E-12	147.3E-12	108.4E-12	107.3E-12	27.9E-12
Sigma	989.3E-15	33.3E-12	4.6E-12	19.8E-12	4.0E-12	4.7E-12	8.8E-12	21.9E-12	1.7E-12	11.4E-12	5.4E-12	4.2E-12	6.9E-12

Drift Calculation

IEBO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
ON TID samples													
8	-	-72.5E-12	16.9E-12	1.6E-12	44.1E-12	71.0E-12	76.8E-12	143.7E-12	110.3E-12	147.8E-12	96.6E-12	92.8E-12	11.2E-12
9	-	-3.4E-12	15.1E-12	44.8E-12	37.1E-12	58.0E-12	83.9E-12	91.0E-12	105.3E-12	120.2E-12	94.7E-12	94.3E-12	19.3E-12
10	-	-1.9E-12	27.1E-12	9.5E-12	34.5E-12	63.0E-12	64.7E-12	103.3E-12	111.4E-12	125.4E-12	85.5E-12	86.4E-12	4.7E-12
Average	-	-25.9E-12	19.7E-12	18.6E-12	38.6E-12	64.0E-12	75.1E-12	112.7E-12	109.0E-12	131.1E-12	92.2E-12	91.2E-12	11.7E-12
Sigma	-	32.9E-12	5.3E-12	18.8E-12	4.0E-12	5.4E-12	7.9E-12	22.5E-12	2.7E-12	11.9E-12	4.8E-12	3.4E-12	5.9E-12

Hirex Engineering	Total Dose Radiation Test Report										Ref.:	HRX/TID/1023
	SOC2222A					STMicroelectronics					Issue:	01

Measurements

IEBO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	16.3E-12	12.7E-12	15.0E-12	21.7E-12	24.0E-12	14.3E-12	17.3E-12	27.6E-12	14.5E-12	13.2E-12	11.7E-12	11.5E-12	3.0E-12
OFF PROTON samples													
5	19.9E-12	36.1E-12	53.9E-12	54.0E-12	66.2E-12	92.8E-12	95.5E-12	66.3E-12	128.6E-12	127.6E-12	117.9E-12	118.2E-12	57.7E-12
6	21.8E-12	41.3E-12	55.4E-12	60.0E-12	76.1E-12	97.0E-12	99.6E-12	122.2E-12	135.9E-12	145.7E-12	119.0E-12	122.5E-12	20.1E-12
7	22.3E-12	29.0E-12	53.0E-12	57.4E-12	69.6E-12	74.3E-12	106.7E-12	102.8E-12	106.2E-12	150.5E-12	116.1E-12	132.6E-12	35.9E-12
Statistics													
Min	19.9E-12	29.0E-12	53.0E-12	54.0E-12	66.2E-12	74.3E-12	95.5E-12	66.3E-12	106.2E-12	127.6E-12	116.1E-12	118.2E-12	20.1E-12
Max	22.3E-12	41.3E-12	55.4E-12	60.0E-12	76.1E-12	97.0E-12	106.7E-12	122.2E-12	135.9E-12	150.5E-12	119.0E-12	132.6E-12	57.7E-12
Average	21.3E-12	35.4E-12	54.1E-12	57.1E-12	70.6E-12	88.0E-12	100.6E-12	97.1E-12	123.6E-12	141.3E-12	117.7E-12	124.4E-12	37.9E-12
Sigma	1.0E-12	5.0E-12	957.6E-15	2.4E-12	4.1E-12	9.8E-12	4.6E-12	23.1E-12	12.6E-12	9.9E-12	1.2E-12	6.0E-12	15.4E-12

Drift Calculation

IEBO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
OFF PROTON samples													
5	-	16.2E-12	34.0E-12	34.1E-12	46.3E-12	72.9E-12	75.6E-12	46.4E-12	108.7E-12	107.7E-12	98.0E-12	98.3E-12	37.8E-12
6	-	19.4E-12	33.5E-12	38.1E-12	54.3E-12	75.1E-12	77.8E-12	100.3E-12	114.1E-12	123.8E-12	97.2E-12	100.6E-12	-1.7E-12
7	-	6.7E-12	30.8E-12	35.1E-12	47.3E-12	52.1E-12	84.4E-12	80.5E-12	83.9E-12	128.2E-12	93.9E-12	110.3E-12	13.6E-12
Average	-	14.1E-12	32.8E-12	35.8E-12	49.3E-12	66.7E-12	79.3E-12	75.8E-12	102.2E-12	119.9E-12	96.4E-12	103.1E-12	16.6E-12
Sigma	-	5.4E-12	1.4E-12	1.7E-12	3.5E-12	10.4E-12	3.8E-12	22.3E-12	13.1E-12	8.8E-12	1.8E-12	5.2E-12	16.3E-12

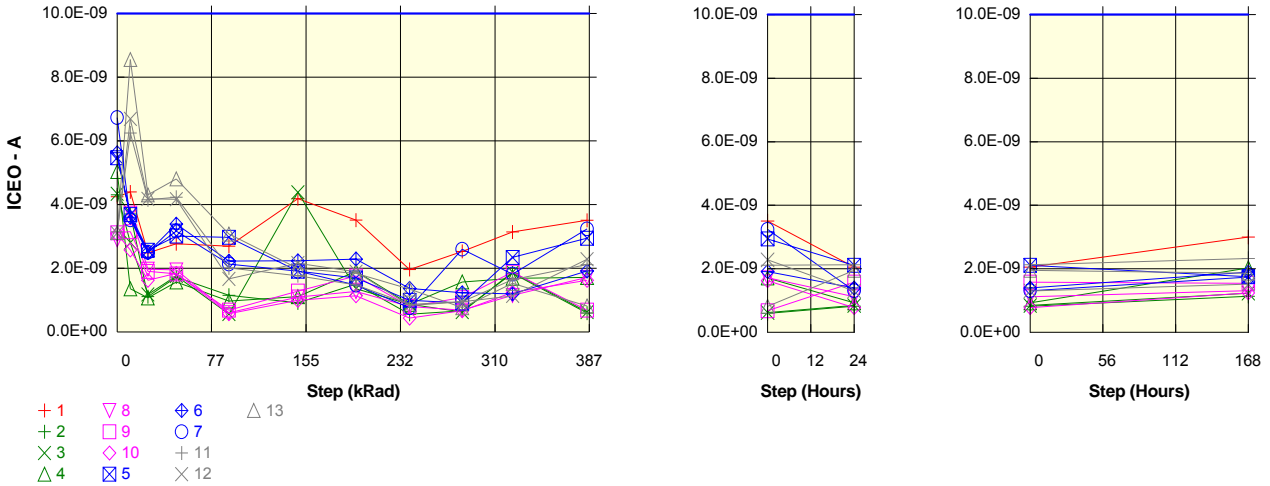
Measurements

IEBO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	16.3E-12	12.7E-12	15.0E-12	21.7E-12	24.0E-12	14.3E-12	17.3E-12	27.6E-12	14.5E-12	13.2E-12	11.7E-12	11.5E-12	3.0E-12
OFF TID samples													
11	12.4E-12	29.9E-12	36.9E-12	41.1E-12	61.9E-12	106.2E-12	98.6E-12	93.2E-12	140.1E-12	139.0E-12	117.5E-12	123.0E-12	37.4E-12
12	14.6E-12	-149.8E-12	46.0E-12	65.0E-12	63.0E-12	101.3E-12	105.3E-12	102.0E-12	97.9E-12	128.8E-12	128.5E-12	114.6E-12	42.7E-12
13	15.1E-12	29.9E-12	50.0E-12	75.2E-12	58.9E-12	81.0E-12	98.2E-12	149.1E-12	114.4E-12	172.6E-12	178.0E-12	144.0E-12	16.9E-12
Statistics													
Min	12.4E-12	-149.8E-12	36.9E-12	41.1E-12	58.9E-12	81.0E-12	98.2E-12	93.2E-12	97.9E-12	128.8E-12	117.5E-12	114.6E-12	16.9E-12
Max	15.1E-12	29.9E-12	50.0E-12	75.2E-12	63.0E-12	106.2E-12	105.3E-12	149.1E-12	140.1E-12	172.6E-12	178.0E-12	144.0E-12	42.7E-12
Average	14.0E-12	-30.0E-12	44.3E-12	60.4E-12	61.3E-12	96.2E-12	100.7E-12	114.7E-12	117.5E-12	146.8E-12	141.3E-12	127.2E-12	32.3E-12
Sigma	1.2E-12	84.7E-12	5.5E-12	14.3E-12	1.8E-12	10.9E-12	3.3E-12	24.5E-12	17.4E-12	18.7E-12	26.3E-12	12.4E-12	11.2E-12

Drift Calculation

IEBO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
OFF TID samples													
11	-	17.5E-12	24.5E-12	28.7E-12	49.5E-12	93.8E-12	86.1E-12	80.8E-12	127.7E-12	126.6E-12	105.1E-12	110.6E-12	24.9E-12
12	-	-164.4E-12	31.4E-12	50.5E-12	48.5E-12	86.7E-12	90.8E-12	87.4E-12	83.3E-12	114.3E-12	113.9E-12	100.0E-12	28.2E-12
13	-	14.8E-12	34.9E-12	60.0E-12	43.7E-12	65.9E-12	83.1E-12	134.0E-12	99.3E-12	157.5E-12	162.9E-12	128.9E-12	1.7E-12
Average	-	-44.0E-12	30.3E-12	46.4E-12	47.2E-12	82.1E-12	86.7E-12	100.7E-12	103.4E-12	132.8E-12	127.3E-12	113.2E-12	18.3E-12
Sigma	-	85.1E-12	4.3E-12	13.1E-12	2.5E-12	11.8E-12	3.1E-12	23.7E-12	18.3E-12	18.2E-12	25.4E-12	11.9E-12	11.8E-12

Parameter : Collector-Emitter cut-off current : ICEO
 Test conditions : Vce = 40V
 Unit : A
 Spec Limit Max : 10.0E-09
 Spec limits are represented in bold lines on the graphic.



Measurements

ICEO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	4.2E-09	4.4E-09	2.5E-09	2.8E-09	2.7E-09	4.2E-09	3.5E-09	2.0E-09	2.5E-09	3.1E-09	3.5E-09	2.0E-09	3.0E-09
ON PROTON samples													
2	4.3E-09	3.7E-09	1.1E-09	1.7E-09	1.2E-09	916.0E-12	1.5E-09	560.2E-12	663.0E-12	1.8E-09	593.2E-12	826.6E-12	1.1E-09
3	4.3E-09	2.8E-09	1.2E-09	1.8E-09	562.3E-12	4.4E-09	1.4E-09	867.8E-12	625.4E-12	1.9E-09	625.6E-12	845.2E-12	1.2E-09
4	5.0E-09	1.4E-09	1.1E-09	1.6E-09	971.0E-12	1.1E-09	1.9E-09	869.8E-12	1.6E-09	1.7E-09	1.7E-09	930.6E-12	2.0E-09
Statistics													
Min	4.3E-09	1.4E-09	1.1E-09	1.6E-09	562.3E-12	916.0E-12	1.4E-09	560.2E-12	625.4E-12	1.7E-09	593.2E-12	826.6E-12	1.1E-09
Max	5.0E-09	3.7E-09	1.2E-09	1.8E-09	1.2E-09	4.4E-09	1.9E-09	869.8E-12	1.6E-09	1.9E-09	1.7E-09	930.6E-12	2.0E-09
Average	4.6E-09	2.6E-09	1.1E-09	1.7E-09	895.3E-12	2.1E-09	1.6E-09	765.9E-12	953.3E-12	1.8E-09	976.5E-12	867.5E-12	1.5E-09
Sigma	335.7E-12	965.7E-12	46.8E-12	83.1E-12	246.9E-12	1.6E-09	230.8E-12	145.5E-12	437.4E-12	85.3E-12	519.3E-12	45.3E-12	398.3E-12

Drift Calculation

ICEO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
ON PROTON samples													
2	-	-604.2E-12	-3.2E-09	-2.6E-09	-3.2E-09	-3.4E-09	-2.8E-09	-3.7E-09	-3.6E-09	-2.5E-09	-3.7E-09	-3.5E-09	-3.2E-09
3	-	-1.5E-09	-3.2E-09	-2.6E-09	-3.8E-09	48.8E-12	-3.0E-09	-3.5E-09	-3.7E-09	-2.5E-09	-3.7E-09	-3.5E-09	-3.1E-09
4	-	-3.7E-09	-4.0E-09	-3.5E-09	-4.1E-09	-3.9E-09	-3.1E-09	-4.2E-09	-3.5E-09	-3.3E-09	-3.3E-09	-4.1E-09	-3.0E-09
Average	-	-1.9E-09	-3.4E-09	-2.9E-09	-3.7E-09	-2.4E-09	-3.0E-09	-3.8E-09	-3.6E-09	-2.8E-09	-3.6E-09	-3.7E-09	-3.1E-09
Sigma	-	1.3E-09	372.5E-12	417.2E-12	379.5E-12	1.8E-09	132.3E-12	285.2E-12	105.5E-12	419.7E-12	183.6E-12	290.9E-12	66.6E-12

Measurements

ICEO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	4.2E-09	4.4E-09	2.5E-09	2.8E-09	2.7E-09	4.2E-09	3.5E-09	2.0E-09	2.5E-09	3.1E-09	3.5E-09	2.0E-09	3.0E-09
ON TID samples													
8	2.9E-09	3.7E-09	2.0E-09	1.9E-09	602.4E-12	1.1E-09	1.3E-09	802.0E-12	683.6E-12	1.2E-09	1.7E-09	1.1E-09	1.3E-09
9	3.1E-09	3.2E-09	1.9E-09	1.8E-09	684.5E-12	1.3E-09	1.8E-09	801.8E-12	1.1E-09	1.9E-09	683.4E-12	1.6E-09	1.5E-09
10	3.1E-09	2.6E-09	1.6E-09	1.8E-09	574.2E-12	994.2E-12	1.1E-09	436.4E-12	664.8E-12	1.2E-09	1.6E-09	779.6E-12	1.2E-09
Statistics													
Min	2.9E-09	2.6E-09	1.6E-09	1.8E-09	574.2E-12	994.2E-12	1.1E-09	436.4E-12	664.8E-12	1.2E-09	683.4E-12	779.6E-12	1.2E-09
Max	3.1E-09	3.7E-09	2.0E-09	1.9E-09	684.5E-12	1.3E-09	1.8E-09	802.0E-12	1.1E-09	1.9E-09	1.7E-09	1.6E-09	1.5E-09
Average	3.0E-09	3.2E-09	1.8E-09	1.9E-09	620.4E-12	1.1E-09	1.4E-09	680.1E-12	809.9E-12	1.4E-09	1.3E-09	1.2E-09	1.4E-09
Sigma	96.4E-12	471.9E-12	152.4E-12	55.9E-12	46.8E-12	119.2E-12	266.6E-12	172.3E-12	192.1E-12	325.0E-12	466.5E-12	327.4E-12	128.4E-12

Drift Calculation

ICEO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
ON TID samples													
8	-	836.4E-12	-922.8E-12	-945.4E-12	-2.3E-09	-1.8E-09	-1.6E-09	-2.1E-09	-2.2E-09	-1.7E-09	-1.2E-09	-1.8E-09	-1.6E-09
9	-	34.2E-12	-1.2E-09	-1.3E-09	-2.4E-09	-1.8E-09	-1.4E-09	-2.3E-09	-2.0E-09	-1.2E-09	-2.4E-09	-1.5E-09	-1.6E-09
10	-	-500.2E-12	-1.5E-09	-1.2E-09	-2.5E-09	-2.1E-09	-1.9E-09	-2.6E-09	-2.4E-09	-1.8E-09	-1.5E-09	-2.3E-09	-1.8E-09
Average	-	123.5E-12	-1.2E-09	-1.2E-09	-2.4E-09	-1.9E-09	-1.6E-09	-2.3E-09	-2.2E-09	-1.6E-09	-1.7E-09	-1.9E-09	-1.7E-09
Sigma	-	549.3E-12	217.8E-12	152.4E-12	86.9E-12	126.7E-12	236.2E-12	224.3E-12	153.2E-12	263.3E-12	538.7E-12	316.6E-12	121.6E-12

Hirex Engineering	Total Dose Radiation Test Report										Ref.:	HRX/TID/1023
	SOC2222A					STMicroelectronics					Issue:	01

Measurements

ICEO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	4.2E-09	4.4E-09	2.5E-09	2.8E-09	2.7E-09	4.2E-09	3.5E-09	2.0E-09	2.5E-09	3.1E-09	3.5E-09	2.0E-09	3.0E-09
OFF PROTON samples													
5	5.5E-09	3.7E-09	2.6E-09	3.0E-09	3.0E-09	1.9E-09	1.7E-09	995.6E-12	906.0E-12	2.3E-09	2.9E-09	2.1E-09	1.8E-09
6	5.6E-09	3.6E-09	2.5E-09	3.4E-09	2.2E-09	2.2E-09	2.3E-09	1.4E-09	1.2E-09	1.2E-09	1.9E-09	1.4E-09	1.9E-09
7	6.7E-09	3.5E-09	2.5E-09	3.2E-09	2.1E-09	1.9E-09	1.5E-09	756.8E-12	2.6E-09	1.8E-09	3.2E-09	1.3E-09	1.7E-09
Statistics													
Min	5.5E-09	3.5E-09	2.5E-09	3.0E-09	2.1E-09	1.9E-09	1.5E-09	756.8E-12	906.0E-12	1.2E-09	1.9E-09	1.3E-09	1.7E-09
Max	6.7E-09	3.7E-09	2.6E-09	3.4E-09	3.0E-09	2.2E-09	2.3E-09	1.4E-09	2.6E-09	2.3E-09	3.2E-09	2.1E-09	1.9E-09
Average	5.9E-09	3.6E-09	2.5E-09	3.2E-09	2.4E-09	2.0E-09	1.8E-09	1.0E-09	1.6E-09	1.8E-09	2.7E-09	1.6E-09	1.8E-09
Sigma	559.3E-12	67.0E-12	29.2E-12	153.5E-12	375.6E-12	153.6E-12	345.5E-12	251.3E-12	732.7E-12	467.3E-12	567.1E-12	357.7E-12	71.1E-12

Drift Calculation

ICEO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
OFF PROTON samples													
5	-	-1.8E-09	-2.9E-09	-2.5E-09	-2.5E-09	-3.6E-09	-3.8E-09	-4.5E-09	-4.6E-09	-3.1E-09	-2.5E-09	-3.4E-09	-3.7E-09
6	-	-2.0E-09	-3.1E-09	-2.2E-09	-3.4E-09	-3.4E-09	-3.3E-09	-4.3E-09	-4.4E-09	-4.4E-09	-3.7E-09	-4.2E-09	-3.7E-09
7	-	-3.2E-09	-4.2E-09	-3.6E-09	-4.6E-09	-4.8E-09	-5.3E-09	-6.0E-09	-4.1E-09	-4.9E-09	-3.5E-09	-5.4E-09	-5.0E-09
Average	-	-2.3E-09	-3.4E-09	-2.8E-09	-3.5E-09	-3.9E-09	-4.1E-09	-4.9E-09	-4.4E-09	-4.2E-09	-3.2E-09	-4.3E-09	-4.1E-09
Sigma	-	621.6E-12	575.0E-12	577.6E-12	857.8E-12	637.2E-12	820.8E-12	761.1E-12	178.6E-12	751.9E-12	513.0E-12	841.7E-12	595.4E-12

Measurements

ICEO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	4.2E-09	4.4E-09	2.5E-09	2.8E-09	2.7E-09	4.2E-09	3.5E-09	2.0E-09	2.5E-09	3.1E-09	3.5E-09	2.0E-09	3.0E-09
OFF TID samples													
11	3.1E-09	6.2E-09	4.2E-09	4.2E-09	2.0E-09	1.8E-09	1.5E-09	864.0E-12	947.8E-12	1.6E-09	2.1E-09	2.1E-09	2.3E-09
12	3.1E-09	6.7E-09	4.2E-09	4.2E-09	1.7E-09	2.2E-09	1.9E-09	828.4E-12	946.6E-12	1.1E-09	2.3E-09	1.3E-09	1.5E-09
13	3.1E-09	8.5E-09	4.3E-09	4.8E-09	3.1E-09	2.0E-09	1.8E-09	1.3E-09	762.0E-12	1.5E-09	816.8E-12	2.0E-09	1.9E-09
Statistics													
Min	3.1E-09	6.2E-09	4.2E-09	4.2E-09	1.7E-09	1.8E-09	1.5E-09	828.4E-12	762.0E-12	1.1E-09	816.8E-12	1.3E-09	1.5E-09
Max	3.1E-09	8.5E-09	4.3E-09	4.8E-09	3.1E-09	2.2E-09	1.9E-09	1.3E-09	947.8E-12	1.6E-09	2.3E-09	2.1E-09	2.3E-09
Average	3.1E-09	7.2E-09	4.2E-09	4.4E-09	2.3E-09	2.0E-09	1.7E-09	1.0E-09	885.5E-12	1.4E-09	1.7E-09	1.8E-09	1.9E-09
Sigma	15.1E-12	997.1E-12	66.7E-12	288.1E-12	598.2E-12	160.5E-12	184.9E-12	234.7E-12	87.3E-12	219.9E-12	655.6E-12	354.0E-12	330.0E-12

Drift Calculation

ICEO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
OFF TID samples													
11	-	3.1E-09	1.0E-09	1.1E-09	-1.1E-09	-1.4E-09	-1.7E-09	-2.3E-09	-2.2E-09	-1.5E-09	-1.0E-09	-1.0E-09	-819.6E-12
12	-	3.6E-09	1.1E-09	1.1E-09	-1.4E-09	-948.8E-12	-1.2E-09	-2.3E-09	-2.2E-09	-2.0E-09	-823.0E-12	-1.8E-09	-1.6E-09
13	-	5.4E-09	1.2E-09	1.7E-09	-47.0E-12	-1.1E-09	-1.3E-09	-1.8E-09	-2.4E-09	-1.6E-09	-2.3E-09	-1.2E-09	-1.3E-09
Average	-	4.0E-09	1.1E-09	1.3E-09	-872.7E-12	-1.1E-09	-1.4E-09	-2.1E-09	-2.2E-09	-1.7E-09	-1.4E-09	-1.3E-09	-1.2E-09
Sigma	-	1.0E-09	73.1E-12	289.6E-12	597.2E-12	175.6E-12	199.6E-12	236.7E-12	86.1E-12	206.4E-12	654.9E-12	340.7E-12	314.9E-12

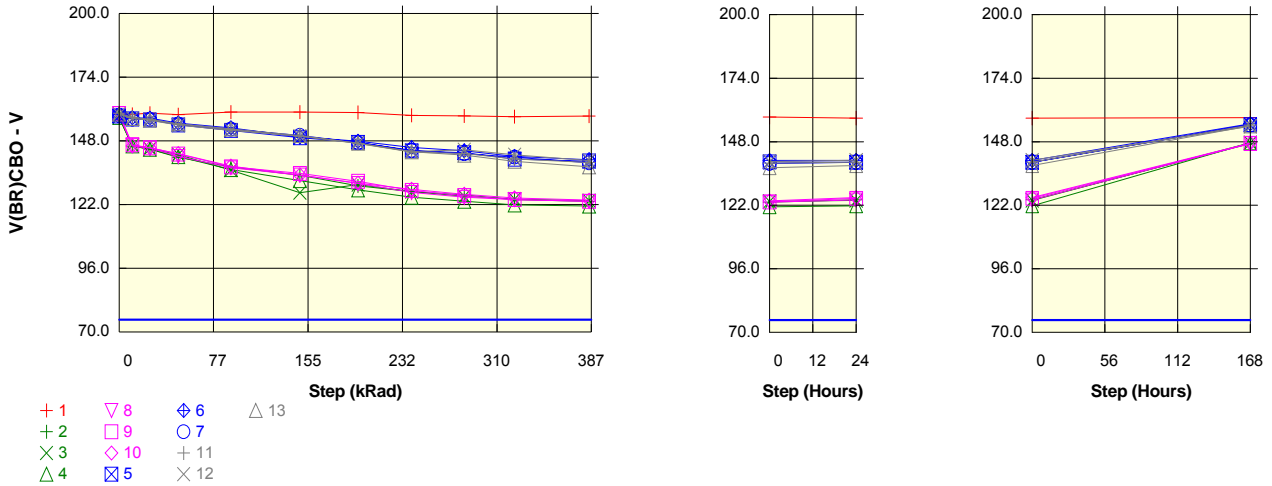
Parameter : Collector-Base breakdown voltage : V(BR)CBO

Test conditions : I_c = 100µA

Unit : V

Spec Limit Min : 75.0

Spec limits are represented in bold lines on the graphic.



Measurements

V(BR)CBO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1 REF	159.1	158.8	159.3	158.7	159.7	159.7	159.6	158.4	158.2	157.9	158.1	157.6	157.9
ON_PROTON samples													
2	157.4	145.8	144.6	141.3	137.3	133.9	129.6	127.3	125.9	124.1	123.3	124.3	147.2
3	157.9	146.1	144.8	142.4	136.0	126.8	130.1	127.3	125.4	124.3	123.6	124.0	147.6
4	157.6	145.9	144.6	141.6	136.3	131.8	128.0	125.0	123.4	121.8	121.4	121.8	147.6
Statistics													
Min	157.4	145.8	144.6	141.3	136.0	126.8	128.0	125.0	123.4	121.8	121.4	121.8	147.2
Max	157.9	146.1	144.8	142.4	137.3	133.9	130.1	127.3	125.9	124.3	123.6	124.3	147.6
Average	157.6	145.9	144.7	141.8	136.6	130.9	129.3	126.5	124.9	123.4	122.8	123.4	147.4
Sigma	0.2	0.1	0.1	0.5	0.6	3.0	0.9	1.1	1.1	1.1	1.0	1.1	0.2

Drift Calculation

V(BR)CBO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
ON_PROTON samples													
2	-	-11.6E+00	-12.8E+00	-16.1E+00	-20.1E+00	-23.5E+00	-27.8E+00	-30.1E+00	-31.5E+00	-33.3E+00	-34.1E+00	-33.1E+00	-10.2E+00
3	-	-11.8E+00	-13.0E+00	-15.5E+00	-21.8E+00	-31.0E+00	-27.7E+00	-30.6E+00	-32.5E+00	-33.6E+00	-34.3E+00	-33.8E+00	-10.3E+00
4	-	-11.6E+00	-13.0E+00	-16.0E+00	-21.3E+00	-25.8E+00	-29.6E+00	-32.6E+00	-34.2E+00	-35.7E+00	-36.1E+00	-35.8E+00	-10.0E+00
Average	-	-11.7E+00	-12.9E+00	-15.8E+00	-21.0E+00	-26.7E+00	-28.3E+00	-31.1E+00	-32.7E+00	-34.2E+00	-34.8E+00	-34.2E+00	-10.2E+00
Sigma	-	88.3E-03	89.6E-03	273.1E-03	720.8E-03	3.2E+00	853.3E-03	1.1E+00	1.1E+00	1.1E+00	918.0E-03	1.1E+00	120.3E-03

Measurements

V(BR)CBO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1 REF	159.1	158.8	159.3	158.7	159.7	159.7	159.6	158.4	158.2	157.9	158.1	157.6	157.9
ON_TID samples													
8	159.1	146.1	145.1	141.7	137.0	134.0	130.6	126.9	125.0	124.0	123.3	124.2	147.3
9	159.1	146.4	145.1	142.6	137.4	134.7	131.5	127.7	125.6	124.1	123.4	124.8	147.2
10	158.6	145.9	145.1	142.8	137.7	134.1	130.8	128.2	126.2	124.7	123.8	125.1	147.4
Statistics													
Min	158.6	145.9	145.1	141.7	137.0	134.0	130.6	126.9	125.0	124.0	123.3	124.2	147.2
Max	159.1	146.4	145.1	142.8	137.7	134.7	131.5	128.2	126.2	124.7	123.8	125.1	147.4
Average	158.9	146.1	145.1	142.4	137.4	134.3	130.9	127.6	125.6	124.3	123.5	124.7	147.3
Sigma	0.3	0.2	0.0	0.5	0.3	0.3	0.4	0.5	0.5	0.3	0.2	0.4	0.1

Drift Calculation

V(BR)CBO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
ON_TID samples													
8	-	-13.1E+00	-14.1E+00	-17.5E+00	-22.1E+00	-25.1E+00	-28.6E+00	-32.2E+00	-34.2E+00	-35.1E+00	-35.9E+00	-35.0E+00	-11.8E+00
9	-	-12.8E+00	-14.0E+00	-16.5E+00	-21.8E+00	-24.5E+00	-27.7E+00	-31.4E+00	-33.5E+00	-35.1E+00	-35.8E+00	-34.3E+00	-11.9E+00
10	-	-12.6E+00	-13.5E+00	-15.8E+00	-20.9E+00	-24.5E+00	-27.8E+00	-30.3E+00	-32.3E+00	-33.8E+00	-34.8E+00	-33.4E+00	-11.1E+00
Average	-	-12.8E+00	-13.9E+00	-16.6E+00	-21.6E+00	-24.7E+00	-28.0E+00	-31.3E+00	-33.3E+00	-34.7E+00	-35.5E+00	-34.2E+00	-11.6E+00
Sigma	-	200.5E-03	280.0E-03	711.6E-03	532.2E-03	315.9E-03	395.3E-03	774.2E-03	761.1E-03	608.3E-03	507.6E-03	630.8E-03	362.5E-03

Hirex Engineering	Total Dose Radiation Test Report										Ref.:	HRX/TID/1023
	SOC2222A					STMicroelectronics					Issue:	01

Measurements

V(BR)CBO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	159.1	158.8	159.3	158.7	159.7	159.7	159.6	158.4	158.2	157.9	158.1	157.6	157.9
OFF PROTON samples													
5	158.2	156.9	156.5	154.5	152.3	149.3	147.4	143.9	143.2	140.6	139.8	139.6	154.9
6	158.8	157.4	157.3	155.3	153.3	149.6	147.8	145.3	144.0	141.7	140.3	140.4	155.3
7	158.4	156.9	156.8	154.8	152.8	150.2	147.3	144.1	142.8	141.3	139.1	139.6	154.8
Statistics													
Min	158.2	156.9	156.5	154.5	152.3	149.3	147.3	143.9	142.8	140.6	139.1	139.6	154.8
Max	158.8	157.4	157.3	155.3	153.3	150.2	147.8	145.3	144.0	141.7	140.3	140.4	155.3
Average	158.5	157.1	156.8	154.9	152.8	149.7	147.5	144.4	143.3	141.2	139.7	139.8	155.0
Sigma	0.2	0.2	0.3	0.3	0.4	0.4	0.2	0.6	0.5	0.5	0.5	0.4	0.2

Drift Calculation

V(BR)CBO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
OFF PROTON samples													
5	-	-1.3E+00	-1.7E+00	-3.7E+00	-5.9E+00	-8.9E+00	-10.8E+00	-14.3E+00	-15.0E+00	-17.6E+00	-18.4E+00	-18.6E+00	-3.3E+00
6	-	-1.3E+00	-1.5E+00	-3.5E+00	-5.4E+00	-9.1E+00	-10.9E+00	-13.5E+00	-14.8E+00	-17.1E+00	-18.4E+00	-18.4E+00	-3.5E+00
7	-	-1.5E+00	-1.7E+00	-3.6E+00	-5.7E+00	-8.2E+00	-11.1E+00	-14.3E+00	-15.6E+00	-17.1E+00	-19.4E+00	-18.9E+00	-3.6E+00
Average	-	-1.4E+00	-1.6E+00	-3.6E+00	-5.7E+00	-8.7E+00	-10.9E+00	-14.0E+00	-15.1E+00	-17.3E+00	-18.7E+00	-18.6E+00	-3.4E+00
Sigma	-	109.9E-03	73.2E-03	81.8E-03	205.0E-03	398.2E-03	147.6E-03	389.1E-03	363.5E-03	256.9E-03	431.4E-03	189.3E-03	132.0E-03

Measurements

V(BR)CBO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	159.1	158.8	159.3	158.7	159.7	159.7	159.6	158.4	158.2	157.9	158.1	157.6	157.9
OFF TID samples													
11	159.3	157.6	156.9	154.9	152.6	149.9	147.0	143.5	142.8	140.6	139.2	139.7	154.8
12	158.9	157.2	156.4	154.4	152.3	150.0	147.1	143.6	144.3	142.4	139.9	140.4	154.3
13	158.9	157.1	156.5	155.0	152.9	150.2	147.0	143.6	142.1	139.6	137.4	138.3	154.5
Statistics													
Min	158.9	157.1	156.4	154.4	152.3	149.9	147.0	143.5	142.1	139.6	137.4	138.3	154.3
Max	159.3	157.6	156.9	155.0	152.9	150.2	147.1	143.6	144.3	142.4	139.9	140.4	154.8
Average	159.0	157.3	156.6	154.8	152.6	150.0	147.0	143.6	143.1	140.9	138.8	139.5	154.5
Sigma	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.1	0.9	1.1	1.1	0.9	0.2

Drift Calculation

V(BR)CBO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
OFF TID samples													
11	-	-1.7E+00	-2.5E+00	-4.4E+00	-6.8E+00	-9.4E+00	-12.3E+00	-15.8E+00	-16.5E+00	-18.7E+00	-20.1E+00	-19.6E+00	-4.5E+00
12	-	-1.7E+00	-2.5E+00	-4.4E+00	-6.6E+00	-8.9E+00	-11.8E+00	-15.2E+00	-14.6E+00	-16.5E+00	-19.0E+00	-18.4E+00	-4.6E+00
13	-	-1.8E+00	-2.3E+00	-3.9E+00	-6.0E+00	-8.7E+00	-11.9E+00	-15.3E+00	-16.7E+00	-19.3E+00	-21.5E+00	-20.6E+00	-4.4E+00
Average	-	-1.7E+00	-2.4E+00	-4.2E+00	-6.4E+00	-9.0E+00	-12.0E+00	-15.5E+00	-15.9E+00	-18.1E+00	-20.2E+00	-19.6E+00	-4.5E+00
Sigma	-	49.0E-03	57.2E-03	226.4E-03	310.5E-03	296.8E-03	242.6E-03	257.8E-03	972.2E-03	1.2E+00	1.0E+00	891.0E-03	62.4E-03

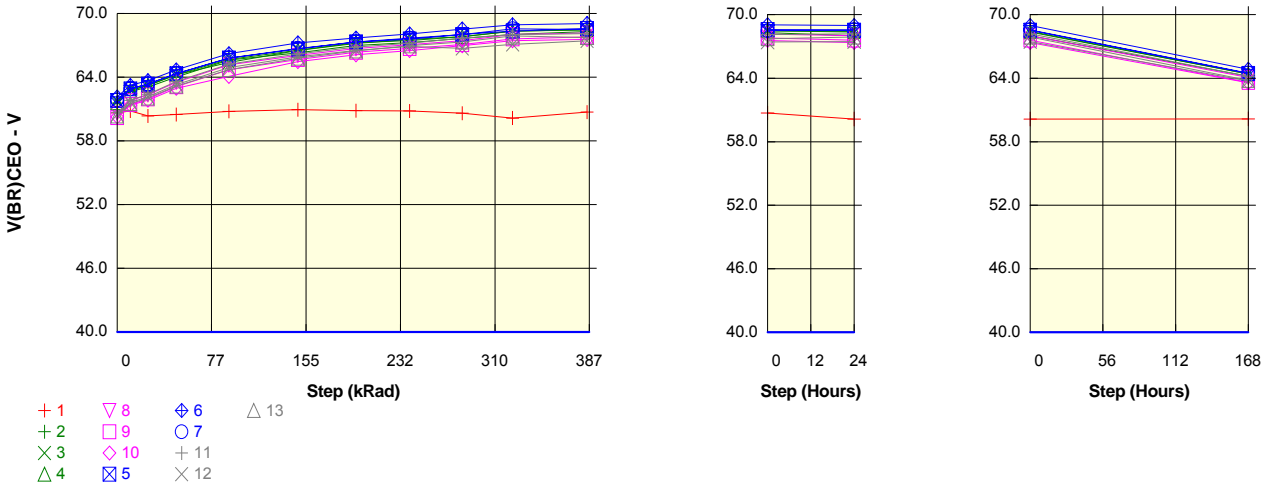
Parameter : Collector-Emitter breakdown voltage : V(BR)CEO

Test conditions : I_c = 30mA (pulse width 300µs)

Unit : V

Spec Limit Min : 40.0

Spec limits are represented in bold lines on the graphic.



Measurements

V(BR)CEO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1 REF	60.6	60.8	60.4	60.5	60.8	60.9	60.8	60.8	60.6	60.1	60.7	60.1	60.2
ON PROTON samples													
2	61.5	62.6	63.1	64.0	65.6	66.3	67.0	67.3	67.6	68.0	68.3	68.0	64.2
3	61.7	62.8	63.2	64.2	65.4	66.5	67.2	67.6	67.8	68.3	68.5	68.4	64.4
4	61.6	62.7	63.2	64.2	65.7	66.5	67.2	67.5	67.8	68.3	68.5	68.4	64.4
Statistics													
Min	61.5	62.6	63.1	64.0	65.4	66.3	67.0	67.3	67.6	68.0	68.3	68.0	64.2
Max	61.7	62.8	63.2	64.2	65.7	66.5	67.2	67.6	67.8	68.3	68.5	68.4	64.4
Average	61.6	62.7	63.2	64.2	65.6	66.5	67.1	67.4	67.8	68.2	68.4	68.3	64.3
Sigma	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.2	0.1

Drift Calculation

V(BR)CEO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
ON PROTON samples													
2	-	1.1E+00	1.5E+00	2.5E+00	4.1E+00	4.8E+00	5.4E+00	5.7E+00	6.1E+00	6.5E+00	6.7E+00	6.5E+00	2.6E+00
3	-	1.1E+00	1.5E+00	2.6E+00	3.7E+00	4.9E+00	5.5E+00	5.9E+00	6.1E+00	6.7E+00	6.8E+00	6.7E+00	2.7E+00
4	-	1.1E+00	1.6E+00	2.6E+00	4.1E+00	4.9E+00	5.6E+00	5.9E+00	6.2E+00	6.7E+00	6.9E+00	6.8E+00	2.8E+00
Average	-	1.1E+00	1.6E+00	2.6E+00	3.9E+00	4.9E+00	5.5E+00	5.8E+00	6.2E+00	6.6E+00	6.8E+00	6.7E+00	2.7E+00
Sigma	-	14.1E-03	51.7E-03	64.8E-03	170.1E-03	77.0E-03	86.2E-03	74.2E-03	53.8E-03	114.5E-03	54.9E-03	149.3E-03	67.8E-03

Measurements

V(BR)CEO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1 REF	60.6	60.8	60.4	60.5	60.8	60.9	60.8	60.8	60.6	60.1	60.7	60.1	60.2
ON TID samples													
8	60.6	61.8	62.3	63.5	65.2	66.1	66.7	67.1	67.4	68.0	68.2	68.0	64.1
9	60.2	61.4	62.0	63.1	64.7	65.7	66.3	66.7	67.1	67.6	67.8	67.6	63.6
10	60.3	61.4	61.8	62.9	64.1	65.5	66.1	66.5	67.0	67.4	67.6	67.4	63.6
Statistics													
Min	60.2	61.4	61.8	62.9	64.1	65.5	66.1	66.5	67.0	67.4	67.6	67.4	63.6
Max	60.6	61.8	62.3	63.5	65.2	66.1	66.7	67.1	67.4	68.0	68.2	68.0	64.1
Average	60.4	61.5	62.0	63.2	64.6	65.7	66.4	66.8	67.2	67.7	67.8	67.7	63.7
Sigma	0.2	0.2	0.2	0.2	0.4	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.2

Drift Calculation

V(BR)CEO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
ON TID samples													
8	-	1.2E+00	1.7E+00	2.9E+00	4.6E+00	5.4E+00	6.1E+00	6.4E+00	6.8E+00	7.4E+00	7.6E+00	7.4E+00	3.4E+00
9	-	1.2E+00	1.8E+00	2.9E+00	4.5E+00	5.5E+00	6.2E+00	6.5E+00	6.9E+00	7.4E+00	7.6E+00	7.4E+00	3.4E+00
10	-	1.1E+00	1.6E+00	2.7E+00	3.8E+00	5.2E+00	5.9E+00	6.2E+00	6.7E+00	7.2E+00	7.3E+00	7.1E+00	3.3E+00
Average	-	1.2E+00	1.7E+00	2.8E+00	4.3E+00	5.4E+00	6.0E+00	6.4E+00	6.8E+00	7.3E+00	7.5E+00	7.3E+00	3.4E+00
Sigma	-	56.0E-03	80.0E-03	105.1E-03	335.6E-03	120.0E-03	128.5E-03	114.4E-03	64.3E-03	110.3E-03	128.5E-03	133.0E-03	57.1E-03

Hirex Engineering	Total Dose Radiation Test Report										Ref.:	HRX/TID/1023
	SOC2222A					STMicroelectronics					Issue:	01

Measurements

V(BR)CEO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	60.6	60.8	60.4	60.5	60.8	60.9	60.8	60.8	60.6	60.1	60.7	60.1	60.2
OFF PROTON samples													
5	61.8	62.9	63.3	64.3	65.8	66.7	67.3	67.6	68.0	68.3	68.6	68.5	64.4
6	62.1	63.2	63.7	64.7	66.2	67.2	67.7	68.1	68.5	68.9	69.0	69.0	64.8
7	61.8	62.9	63.4	64.3	65.8	66.7	67.3	67.7	68.0	68.6	68.5	68.6	64.5
Statistics													
Min	61.8	62.9	63.3	64.3	65.8	66.7	67.3	67.6	68.0	68.3	68.5	68.5	64.4
Max	62.1	63.2	63.7	64.7	66.2	67.2	67.7	68.1	68.5	68.9	69.0	69.0	64.8
Average	61.9	63.0	63.5	64.4	65.9	66.9	67.4	67.8	68.2	68.6	68.7	68.7	64.6
Sigma	0.1	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2

Drift Calculation

V(BR)CEO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
OFF PROTON samples													
5	-	1.1E+00	1.5E+00	2.5E+00	4.0E+00	4.8E+00	5.5E+00	5.8E+00	6.2E+00	6.5E+00	6.8E+00	6.7E+00	2.6E+00
6	-	1.1E+00	1.5E+00	2.6E+00	4.1E+00	5.1E+00	5.6E+00	5.9E+00	6.4E+00	6.8E+00	6.9E+00	6.8E+00	2.7E+00
7	-	1.1E+00	1.5E+00	2.5E+00	4.0E+00	4.9E+00	5.5E+00	5.8E+00	6.2E+00	6.7E+00	6.6E+00	6.7E+00	2.6E+00
Average	-	1.1E+00	1.5E+00	2.5E+00	4.0E+00	4.9E+00	5.5E+00	5.8E+00	6.3E+00	6.7E+00	6.8E+00	6.8E+00	2.7E+00
Sigma	-	19.8E-03	13.0E-03	29.4E-03	48.1E-03	110.9E-03	40.2E-03	66.5E-03	101.7E-03	110.6E-03	112.8E-03	58.0E-03	39.1E-03

Measurements

V(BR)CEO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	60.6	60.8	60.4	60.5	60.8	60.9	60.8	60.8	60.6	60.1	60.7	60.1	60.2
OFF TID samples													
11	60.7	61.8	62.4	63.6	65.2	66.2	66.8	67.2	67.7	68.0	68.1	68.2	64.2
12	60.5	61.6	62.2	63.3	64.9	65.9	66.5	66.9	66.7	67.1	67.4	67.4	63.7
13	60.4	61.5	62.0	63.2	64.7	65.8	66.5	67.0	67.3	67.9	67.7	67.9	63.8
Statistics													
Min	60.4	61.5	62.0	63.2	64.7	65.8	66.5	66.9	66.7	67.1	67.4	67.4	63.7
Max	60.7	61.8	62.4	63.6	65.2	66.2	66.8	67.2	67.7	68.0	68.1	68.2	64.2
Average	60.5	61.6	62.2	63.3	64.9	66.0	66.6	67.0	67.2	67.7	67.8	67.8	63.9
Sigma	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.1	0.4	0.4	0.3	0.3	0.2

Drift Calculation

V(BR)CEO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
OFF TID samples													
11	-	1.1E+00	1.7E+00	2.9E+00	4.6E+00	5.5E+00	6.2E+00	6.5E+00	7.0E+00	7.3E+00	7.5E+00	7.5E+00	3.5E+00
12	-	1.1E+00	1.7E+00	2.8E+00	4.4E+00	5.5E+00	6.1E+00	6.4E+00	6.3E+00	6.6E+00	7.0E+00	7.0E+00	3.3E+00
13	-	1.2E+00	1.7E+00	2.8E+00	4.4E+00	5.4E+00	6.1E+00	6.6E+00	7.0E+00	7.5E+00	7.4E+00	7.5E+00	3.4E+00
Average	-	1.1E+00	1.7E+00	2.9E+00	4.5E+00	5.5E+00	6.1E+00	6.5E+00	6.7E+00	7.2E+00	7.3E+00	7.4E+00	3.4E+00
Sigma	-	9.0E-03	23.2E-03	53.0E-03	83.9E-03	42.2E-03	44.9E-03	69.9E-03	346.8E-03	391.6E-03	220.9E-03	261.2E-03	96.5E-03

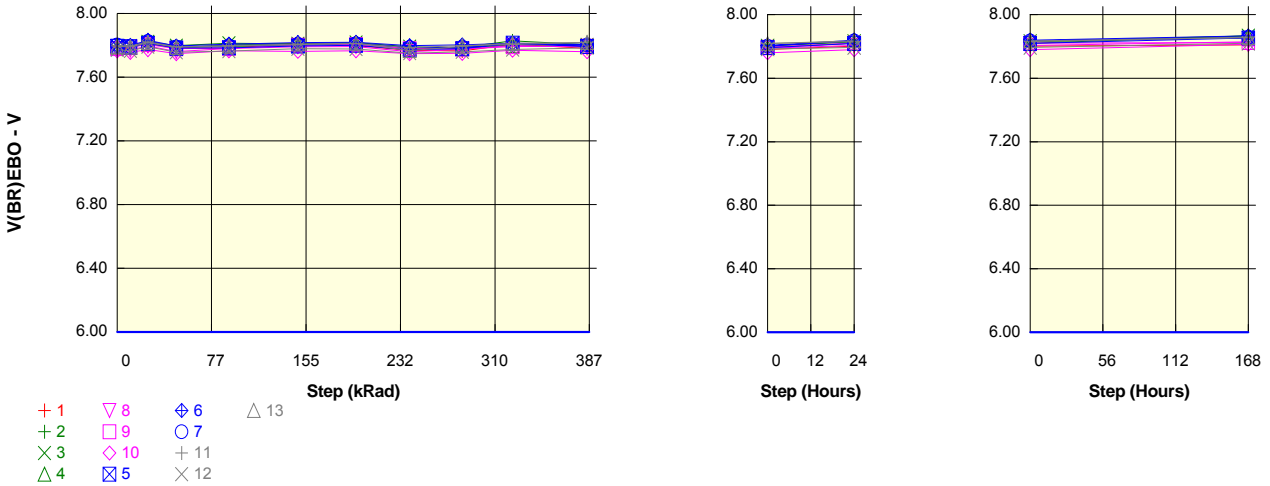
Parameter : Emitter-Base breakdown voltage : V(BR)EBO

Test conditions : Ie = 100µA

Unit : V

Spec Limit Min : 6.00

Spec limits are represented in bold lines on the graphic.



Measurements

V(BR)EBO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1 REF	7.79	7.78	7.83	7.78	7.78	7.82	7.80	7.77	7.76	7.81	7.78	7.80	7.81
ON PROTON samples													
2	7.79	7.79	7.81	7.78	7.80	7.81	7.82	7.78	7.79	7.83	7.80	7.83	7.86
3	7.79	7.80	7.82	7.80	7.81	7.81	7.82	7.79	7.78	7.81	7.80	7.83	7.87
4	7.79	7.79	7.81	7.79	7.79	7.80	7.82	7.78	7.78	7.80	7.79	7.82	7.87
Statistics													
Min	7.79	7.79	7.81	7.78	7.79	7.80	7.82	7.78	7.78	7.80	7.79	7.82	7.86
Max	7.79	7.80	7.82	7.80	7.81	7.81	7.82	7.79	7.79	7.83	7.80	7.83	7.87
Average	7.79	7.79	7.81	7.79	7.80	7.81	7.82	7.78	7.78	7.81	7.80	7.83	7.86
Sigma	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00

Drift Calculation

V(BR)EBO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
ON PROTON samples													
2	-	3.2E-03	20.4E-03	-6.4E-03	12.8E-03	17.6E-03	27.6E-03	-6.8E-03	-3.6E-03	37.6E-03	13.2E-03	40.0E-03	68.8E-03
3	-	2.4E-03	28.8E-03	5.2E-03	20.4E-03	16.4E-03	24.0E-03	-2.0E-03	-10.8E-03	15.2E-03	9.6E-03	36.8E-03	72.8E-03
4	-	799.7E-06	20.0E-03	-1.6E-03	4.4E-03	10.8E-03	27.2E-03	-8.8E-03	-8.8E-03	10.8E-03	5.2E-03	30.8E-03	77.2E-03
Average	-	2.1E-03	23.1E-03	-933.5E-06	12.5E-03	14.9E-03	26.3E-03	-5.9E-03	-7.7E-03	21.2E-03	9.3E-03	35.9E-03	72.9E-03
Sigma	-	997.9E-06	4.1E-03	4.8E-03	6.5E-03	3.0E-03	1.6E-03	2.9E-03	3.0E-03	11.7E-03	3.3E-03	3.8E-03	3.4E-03

Measurements

V(BR)EBO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1 REF	7.79	7.78	7.83	7.78	7.78	7.82	7.80	7.77	7.76	7.81	7.78	7.80	7.81
ON TID samples													
8	7.78	7.77	7.80	7.76	7.78	7.79	7.79	7.76	7.78	7.80	7.79	7.81	7.83
9	7.78	7.79	7.81	7.78	7.78	7.80	7.81	7.78	7.78	7.79	7.79	7.82	7.82
10	7.76	7.76	7.77	7.75	7.77	7.76	7.77	7.75	7.75	7.77	7.76	7.78	7.81
Statistics													
Min	7.76	7.76	7.77	7.75	7.77	7.76	7.77	7.75	7.75	7.77	7.76	7.78	7.81
Max	7.78	7.79	7.81	7.78	7.78	7.80	7.81	7.78	7.78	7.80	7.79	7.82	7.83
Average	7.77	7.77	7.79	7.76	7.78	7.78	7.79	7.76	7.77	7.79	7.78	7.80	7.82
Sigma	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.01	0.02	0.01

Drift Calculation

V(BR)EBO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
ON TID samples													
8	-	-5.2E-03	20.4E-03	-13.6E-03	4.0E-03	16.0E-03	16.8E-03	-15.2E-03	0.0E+00	24.0E-03	13.6E-03	30.4E-03	54.0E-03
9	-	9.6E-03	25.2E-03	-2.0E-03	2.4E-03	19.6E-03	25.2E-03	-1.6E-03	-3.2E-03	11.6E-03	14.0E-03	40.4E-03	44.4E-03
10	-	-9.2E-03	8.4E-03	-17.6E-03	400.1E-06	-2.0E-03	800.1E-06	-17.2E-03	-15.2E-03	4.4E-03	-4.8E-03	14.4E-03	47.6E-03
Average	-	-1.6E-03	18.0E-03	-11.1E-03	2.3E-03	11.2E-03	14.3E-03	-11.3E-03	-6.1E-03	13.3E-03	7.6E-03	28.4E-03	48.7E-03
Sigma	-	8.1E-03	7.1E-03	6.6E-03	1.5E-03	9.4E-03	10.1E-03	6.9E-03	6.5E-03	8.1E-03	8.8E-03	10.7E-03	4.0E-03

Hirex Engineering	Total Dose Radiation Test Report								Ref.:	HRX/TID/1023
	SOC2222A				STMicroelectronics				Issue:	01

Measurements

V(BR)EBO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	7.79	7.78	7.83	7.78	7.78	7.82	7.80	7.77	7.76	7.81	7.78	7.80	7.81
OFF PROTON samples													
5	7.79	7.79	7.81	7.78	7.78	7.80	7.80	7.77	7.78	7.81	7.79	7.82	7.85
6	7.80	7.80	7.83	7.80	7.81	7.82	7.82	7.80	7.80	7.81	7.81	7.84	7.87
7	7.80	7.79	7.82	7.79	7.80	7.81	7.81	7.79	7.79	7.81	7.80	7.84	7.86
Statistics													
Min	7.79	7.79	7.81	7.78	7.78	7.80	7.80	7.77	7.78	7.81	7.79	7.82	7.85
Max	7.80	7.80	7.83	7.80	7.81	7.82	7.82	7.80	7.80	7.81	7.81	7.84	7.87
Average	7.80	7.79	7.82	7.79	7.80	7.81	7.81	7.79	7.79	7.81	7.80	7.83	7.86
Sigma	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01

Drift Calculation

V(BR)EBO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
OFF PROTON samples													
5	-	-3.6E-03	18.8E-03	-11.6E-03	-9.6E-03	1.2E-03	6.4E-03	-22.8E-03	-15.2E-03	20.0E-03	-2.0E-03	24.8E-03	59.2E-03
6	-	0.0E+00	32.4E-03	-3.6E-03	8.0E-03	18.8E-03	19.2E-03	-1.2E-03	3.2E-03	13.6E-03	7.6E-03	40.0E-03	66.8E-03
7	-	-9.2E-03	23.2E-03	-13.2E-03	-4.8E-03	4.8E-03	8.8E-03	-15.2E-03	-14.0E-03	6.4E-03	-400.1E-06	33.6E-03	53.6E-03
Average	-	-4.3E-03	24.8E-03	-9.5E-03	-2.1E-03	8.3E-03	11.5E-03	-13.1E-03	-8.7E-03	13.3E-03	1.7E-03	32.8E-03	59.9E-03
Sigma	-	3.8E-03	5.7E-03	4.2E-03	7.4E-03	7.6E-03	5.6E-03	8.9E-03	8.4E-03	5.6E-03	4.2E-03	6.2E-03	5.4E-03

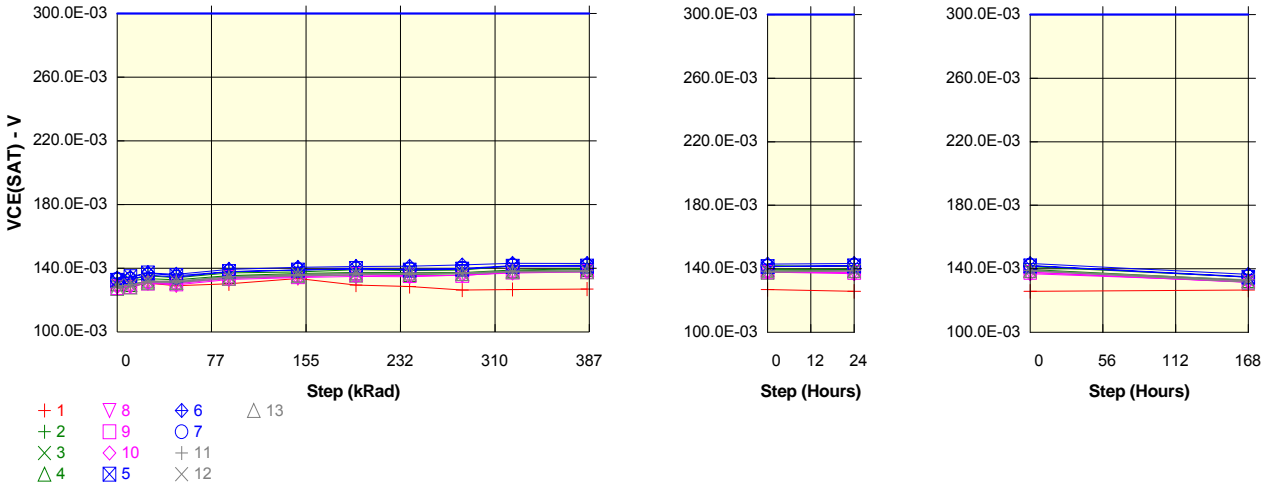
Measurements

V(BR)EBO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	7.79	7.78	7.83	7.78	7.78	7.82	7.80	7.77	7.76	7.81	7.78	7.80	7.81
OFF TID samples													
11	7.80	7.80	7.82	7.79	7.80	7.80	7.81	7.78	7.80	7.81	7.82	7.83	7.86
12	7.77	7.77	7.79	7.76	7.76	7.78	7.78	7.75	7.76	7.77	7.78	7.79	7.82
13	7.79	7.79	7.82	7.79	7.80	7.81	7.81	7.77	7.79	7.81	7.82	7.84	7.85
Statistics													
Min	7.77	7.77	7.79	7.76	7.76	7.78	7.78	7.75	7.76	7.77	7.78	7.79	7.82
Max	7.80	7.80	7.82	7.79	7.80	7.81	7.81	7.78	7.80	7.81	7.82	7.84	7.86
Average	7.79	7.78	7.81	7.78	7.79	7.80	7.80	7.77	7.78	7.80	7.81	7.82	7.84
Sigma	0.01	0.01	0.01	0.02	0.02	0.01	0.02	0.01	0.02	0.02	0.02	0.02	0.02

Drift Calculation

V(BR)EBO	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
OFF TID samples													
11	-	-1.6E-03	24.0E-03	-6.8E-03	0.0E+00	6.4E-03	12.8E-03	-12.4E-03	2.0E-03	8.0E-03	21.2E-03	33.2E-03	60.4E-03
12	-	-6.0E-03	18.8E-03	-15.6E-03	-8.8E-03	6.8E-03	5.6E-03	-21.6E-03	-12.8E-03	1.6E-03	12.0E-03	21.6E-03	47.6E-03
13	-	-3.2E-03	23.2E-03	-6.0E-03	2.0E-03	14.8E-03	20.0E-03	-26.4E-03	0.0E+00	19.6E-03	24.0E-03	42.0E-03	61.6E-03
Average	-	-3.6E-03	22.0E-03	-9.5E-03	-2.3E-03	9.3E-03	12.8E-03	-20.1E-03	-3.6E-03	9.7E-03	19.1E-03	32.3E-03	56.5E-03
Sigma	-	1.8E-03	2.3E-03	4.3E-03	4.7E-03	3.9E-03	5.9E-03	5.8E-03	6.6E-03	7.4E-03	5.1E-03	8.4E-03	6.3E-03

Parameter : Collector-Emitter saturation voltage : VCE(SAT)
 Test conditions : Ic = 150mA ; ib = 15mA (pulse width 300µs)
 Unit : V
 Spec Limit Max : 300.0E-03
 Spec limits are represented in bold lines on the graphic.



Measurements

VCE(SAT)	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	128.6E-03	128.7E-03	130.6E-03	129.0E-03	130.2E-03	133.6E-03	129.5E-03	128.6E-03	126.3E-03	126.7E-03	127.0E-03	125.9E-03	126.6E-03
ON_PROTON samples													
2	132.0E-03	132.9E-03	135.2E-03	134.0E-03	137.2E-03	137.7E-03	139.1E-03	138.7E-03	138.8E-03	141.5E-03	141.9E-03	141.4E-03	134.8E-03
3	131.4E-03	132.1E-03	133.4E-03	132.7E-03	135.4E-03	136.7E-03	137.3E-03	137.3E-03	137.2E-03	138.9E-03	139.7E-03	139.5E-03	132.8E-03
4	130.2E-03	129.8E-03	132.0E-03	131.3E-03	135.0E-03	135.9E-03	137.0E-03	136.1E-03	136.7E-03	138.4E-03	139.2E-03	138.9E-03	132.5E-03
Statistics													
Min	130.2E-03	129.8E-03	132.0E-03	131.3E-03	135.0E-03	135.9E-03	137.0E-03	136.1E-03	136.7E-03	138.4E-03	139.2E-03	138.9E-03	132.5E-03
Max	132.0E-03	132.9E-03	135.2E-03	134.0E-03	137.2E-03	137.7E-03	139.1E-03	138.7E-03	138.8E-03	141.5E-03	141.9E-03	141.4E-03	134.8E-03
Average	131.2E-03	131.6E-03	133.5E-03	132.7E-03	135.9E-03	136.8E-03	137.8E-03	137.4E-03	137.6E-03	139.6E-03	140.3E-03	139.9E-03	133.4E-03
Sigma	734.2E-06	1.3E-03	1.3E-03	1.1E-03	926.3E-06	752.1E-06	921.6E-06	1.0E-03	902.1E-06	1.4E-03	1.2E-03	1.1E-03	1.0E-03

Drift Calculation

VCE(SAT)	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
ON_PROTON samples													
2	-	960.0E-06	3.3E-03	2.1E-03	5.2E-03	5.8E-03	7.2E-03	6.7E-03	6.9E-03	9.6E-03	10.0E-03	9.5E-03	2.9E-03
3	-	720.0E-06	2.0E-03	1.3E-03	4.0E-03	5.3E-03	5.9E-03	5.9E-03	5.8E-03	7.5E-03	8.3E-03	8.1E-03	1.4E-03
4	-	-440.0E-06	1.8E-03	1.1E-03	4.8E-03	5.7E-03	6.8E-03	5.9E-03	6.5E-03	8.2E-03	9.0E-03	8.7E-03	2.3E-03
Average	-	413.3E-06	2.4E-03	1.5E-03	4.7E-03	5.6E-03	6.6E-03	6.2E-03	6.4E-03	8.4E-03	9.1E-03	8.8E-03	2.2E-03
Sigma	-	611.3E-06	660.5E-06	413.5E-06	502.8E-06	191.4E-06	525.6E-06	386.9E-06	431.2E-06	865.9E-06	674.9E-06	558.1E-06	627.7E-06

Measurements

VCE(SAT)	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	128.6E-03	128.7E-03	130.6E-03	129.0E-03	130.2E-03	133.6E-03	129.5E-03	128.6E-03	126.3E-03	126.7E-03	127.0E-03	125.9E-03	126.6E-03
ON_TID samples													
8	128.4E-03	128.8E-03	131.1E-03	130.6E-03	134.2E-03	134.8E-03	135.8E-03	135.3E-03	135.5E-03	137.5E-03	137.8E-03	137.7E-03	131.4E-03
9	128.0E-03	128.6E-03	130.7E-03	130.2E-03	133.7E-03	134.8E-03	136.0E-03	135.4E-03	135.5E-03	137.6E-03	138.2E-03	137.8E-03	131.6E-03
10	128.4E-03	128.8E-03	130.7E-03	129.5E-03	133.0E-03	134.1E-03	134.8E-03	134.7E-03	135.8E-03	137.0E-03	137.9E-03	136.8E-03	131.9E-03
Statistics													
Min	128.0E-03	128.6E-03	130.7E-03	129.5E-03	133.0E-03	134.1E-03	134.8E-03	134.7E-03	135.5E-03	137.0E-03	137.8E-03	136.8E-03	131.4E-03
Max	128.4E-03	128.8E-03	131.1E-03	130.6E-03	134.2E-03	134.8E-03	136.0E-03	135.4E-03	135.8E-03	137.6E-03	138.2E-03	137.8E-03	131.9E-03
Average	128.3E-03	128.7E-03	130.8E-03	130.1E-03	133.6E-03	134.6E-03	135.6E-03	135.1E-03	135.6E-03	137.4E-03	137.9E-03	137.4E-03	131.7E-03
Sigma	179.9E-06	105.0E-06	198.7E-06	463.4E-06	474.4E-06	311.6E-06	543.6E-06	322.2E-06	113.1E-06	255.1E-06	185.7E-06	416.1E-06	196.9E-06

Drift Calculation

VCE(SAT)	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
ON_TID samples													
8	-	440.0E-06	2.7E-03	2.2E-03	5.8E-03	6.4E-03	7.4E-03	6.9E-03	7.1E-03	9.1E-03	9.4E-03	9.3E-03	3.0E-03
9	-	600.0E-06	2.7E-03	2.2E-03	5.7E-03	6.8E-03	8.0E-03	7.4E-03	7.5E-03	9.6E-03	10.2E-03	9.8E-03	3.6E-03
10	-	440.0E-06	2.3E-03	1.2E-03	4.7E-03	5.8E-03	6.4E-03	6.3E-03	7.4E-03	8.6E-03	9.5E-03	8.5E-03	3.6E-03
Average	-	493.3E-06	2.6E-03	1.9E-03	5.4E-03	6.3E-03	7.3E-03	6.9E-03	7.3E-03	9.1E-03	9.7E-03	9.2E-03	3.4E-03
Sigma	-	75.4E-06	188.6E-06	509.1E-06	502.1E-06	413.5E-06	660.0E-06	441.8E-06	167.6E-06	375.7E-06	364.2E-06	528.0E-06	266.0E-06

Hirex Engineering	Total Dose Radiation Test Report									Ref.:	HRX/TID/1023
	SOC2222A			STMicroelectronics			Issue:	01			

Measurements

VCE(SAT)	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	128.6E-03	128.7E-03	130.6E-03	129.0E-03	130.2E-03	133.6E-03	129.5E-03	128.6E-03	126.3E-03	126.7E-03	127.0E-03	125.9E-03	126.6E-03
OFF PROTON samples													
5	132.4E-03	134.7E-03	137.0E-03	135.3E-03	138.0E-03	138.8E-03	139.8E-03	138.8E-03	139.4E-03	141.3E-03	141.4E-03	141.8E-03	134.8E-03
6	133.8E-03	134.4E-03	137.2E-03	136.2E-03	139.3E-03	140.6E-03	141.2E-03	141.2E-03	142.0E-03	143.2E-03	143.0E-03	143.4E-03	136.6E-03
7	133.1E-03	133.0E-03	135.8E-03	134.3E-03	137.8E-03	138.9E-03	139.6E-03	139.5E-03	139.9E-03	141.6E-03	141.5E-03	142.0E-03	135.0E-03
Statistics													
Min	132.4E-03	133.0E-03	135.8E-03	134.3E-03	137.8E-03	138.8E-03	139.6E-03	138.8E-03	139.4E-03	141.3E-03	141.4E-03	141.8E-03	134.8E-03
Max	133.8E-03	134.7E-03	137.2E-03	136.2E-03	139.3E-03	140.6E-03	141.2E-03	141.2E-03	142.0E-03	143.2E-03	143.0E-03	143.4E-03	136.6E-03
Average	133.1E-03	134.0E-03	136.6E-03	135.3E-03	138.4E-03	139.4E-03	140.2E-03	139.9E-03	140.4E-03	142.0E-03	141.9E-03	142.4E-03	135.5E-03
Sigma	588.2E-06	728.3E-06	618.2E-06	784.1E-06	682.0E-06	801.6E-06	697.7E-06	1.0E-03	1.1E-03	802.7E-06	717.3E-06	674.4E-06	816.7E-06

Drift Calculation

VCE(SAT)	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
OFF PROTON samples													
5	-	2.3E-03	4.6E-03	2.9E-03	5.6E-03	6.4E-03	7.4E-03	6.4E-03	7.0E-03	8.9E-03	9.0E-03	9.4E-03	2.4E-03
6	-	520.0E-06	3.3E-03	2.4E-03	5.5E-03	6.7E-03	7.3E-03	7.4E-03	8.2E-03	9.3E-03	9.1E-03	9.5E-03	2.8E-03
7	-	-80.0E-06	2.7E-03	1.2E-03	4.7E-03	5.8E-03	6.5E-03	6.4E-03	6.8E-03	8.6E-03	8.4E-03	9.0E-03	1.9E-03
Average	-	906.7E-06	3.5E-03	2.2E-03	5.3E-03	6.3E-03	7.1E-03	6.7E-03	7.3E-03	8.9E-03	8.8E-03	9.3E-03	2.3E-03
Sigma	-	1.0E-03	780.4E-06	702.2E-06	378.5E-06	385.1E-06	427.1E-06	462.3E-06	618.2E-06	310.4E-06	315.0E-06	247.3E-06	343.1E-06

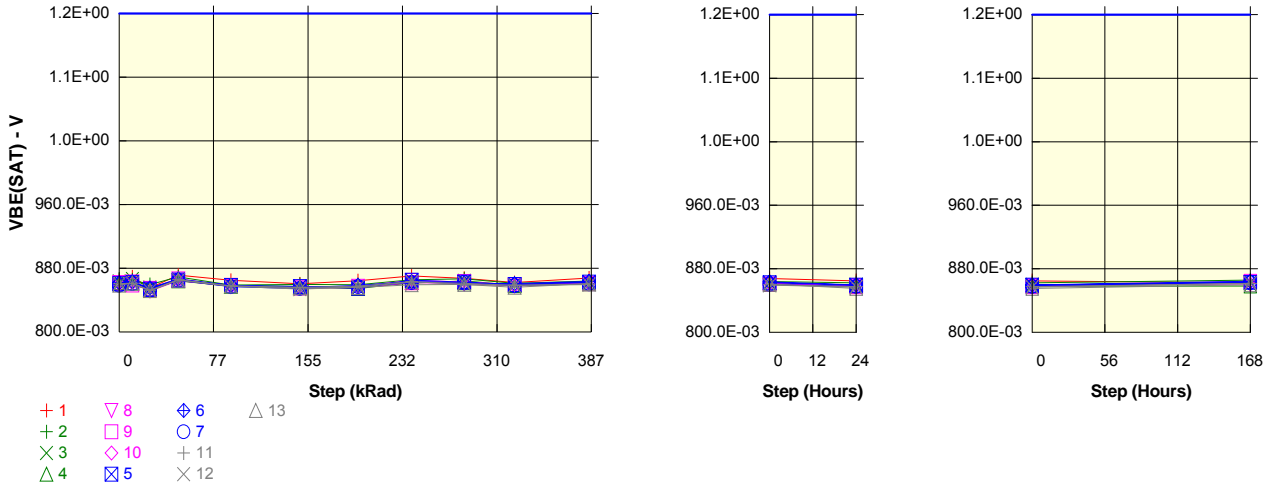
Measurements

VCE(SAT)	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	128.6E-03	128.7E-03	130.6E-03	129.0E-03	130.2E-03	133.6E-03	129.5E-03	128.6E-03	126.3E-03	126.7E-03	127.0E-03	125.9E-03	126.6E-03
OFF TID samples													
11	128.0E-03	129.7E-03	131.9E-03	132.1E-03	134.7E-03	135.8E-03	136.5E-03	136.2E-03	137.2E-03	138.2E-03	138.5E-03	139.0E-03	133.1E-03
12	129.1E-03	129.2E-03	131.9E-03	131.4E-03	134.7E-03	136.2E-03	137.0E-03	136.7E-03	136.4E-03	137.7E-03	138.0E-03	138.7E-03	132.4E-03
13	127.3E-03	128.2E-03	131.0E-03	130.9E-03	133.6E-03	135.3E-03	135.6E-03	137.1E-03	136.7E-03	137.8E-03	137.8E-03	138.7E-03	131.6E-03
Statistics													
Min	127.3E-03	128.2E-03	131.0E-03	130.9E-03	133.6E-03	135.3E-03	135.6E-03	136.2E-03	136.4E-03	137.7E-03	137.8E-03	138.7E-03	131.6E-03
Max	129.1E-03	129.7E-03	131.9E-03	132.1E-03	134.7E-03	136.2E-03	137.0E-03	137.1E-03	137.2E-03	138.2E-03	138.5E-03	139.0E-03	133.1E-03
Average	128.1E-03	129.1E-03	131.6E-03	131.5E-03	134.3E-03	135.8E-03	136.4E-03	136.6E-03	136.8E-03	137.9E-03	138.1E-03	138.8E-03	132.4E-03
Sigma	757.1E-06	634.4E-06	443.4E-06	490.3E-06	500.0E-06	359.3E-06	575.3E-06	376.7E-06	296.4E-06	210.0E-06	313.8E-06	132.0E-06	588.2E-06

Drift Calculation

VCE(SAT)	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
OFF TID samples													
11	-	1.7E-03	3.9E-03	4.1E-03	6.7E-03	7.8E-03	8.5E-03	8.2E-03	9.2E-03	10.2E-03	10.5E-03	11.0E-03	5.1E-03
12	-	120.0E-06	2.8E-03	2.3E-03	5.6E-03	7.1E-03	7.9E-03	7.6E-03	7.3E-03	8.6E-03	8.9E-03	9.6E-03	3.3E-03
13	-	920.0E-06	3.7E-03	3.6E-03	6.4E-03	8.0E-03	8.4E-03	9.8E-03	9.4E-03	10.5E-03	10.5E-03	11.4E-03	4.4E-03
Average	-	920.0E-06	3.5E-03	3.3E-03	6.2E-03	7.6E-03	8.3E-03	8.5E-03	8.6E-03	9.8E-03	10.0E-03	10.6E-03	4.2E-03
Sigma	-	653.2E-06	469.1E-06	742.9E-06	452.9E-06	403.1E-06	240.7E-06	946.8E-06	940.4E-06	839.9E-06	745.0E-06	784.5E-06	739.7E-06

Parameter : Base-Emitter saturation voltage : VBE(SAT)
 Test conditions : Ic = 150mA ; ib = 15mA (pulse width 300µs)
 Unit : V
 Spec Limit Max : 1.2E+00
 Spec limits are represented in bold lines on the graphic.



Measurements

VBE(SAT)	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	865.2E-03	869.2E-03	855.3E-03	871.2E-03	864.9E-03	860.5E-03	864.4E-03	870.3E-03	867.4E-03	862.2E-03	867.8E-03	864.9E-03	862.3E-03
ON_PROTON samples													
2	866.7E-03	865.4E-03	859.6E-03	869.3E-03	858.9E-03	859.8E-03	859.4E-03	865.5E-03	866.7E-03	861.2E-03	863.8E-03	862.4E-03	865.7E-03
3	863.4E-03	866.5E-03	856.0E-03	864.3E-03	858.7E-03	857.1E-03	856.6E-03	861.3E-03	864.2E-03	858.6E-03	861.9E-03	859.6E-03	862.5E-03
4	862.0E-03	861.5E-03	854.0E-03	864.1E-03	857.5E-03	856.6E-03	854.4E-03	862.4E-03	861.8E-03	858.2E-03	860.5E-03	858.2E-03	858.4E-03
Statistics													
Min	862.0E-03	861.5E-03	854.0E-03	864.1E-03	857.5E-03	856.6E-03	854.4E-03	861.3E-03	861.8E-03	858.2E-03	860.5E-03	858.2E-03	858.4E-03
Max	866.7E-03	866.5E-03	859.6E-03	869.3E-03	858.9E-03	859.8E-03	859.4E-03	865.5E-03	866.7E-03	861.2E-03	863.8E-03	862.4E-03	865.7E-03
Average	864.0E-03	864.5E-03	856.5E-03	865.9E-03	858.4E-03	857.8E-03	856.8E-03	863.1E-03	864.2E-03	859.3E-03	862.1E-03	860.1E-03	862.2E-03
Sigma	2.0E-03	2.2E-03	2.4E-03	2.4E-03	636.9E-06	1.4E-03	2.1E-03	1.8E-03	2.0E-03	1.3E-03	1.4E-03	1.7E-03	3.0E-03

Drift Calculation

VBE(SAT)	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
ON_PROTON samples													
2	-	-1.3E-03	-7.1E-03	2.6E-03	-7.8E-03	-6.9E-03	-7.3E-03	-1.2E-03	0.0E+00	-5.6E-03	-2.9E-03	-4.4E-03	-1.0E-03
3	-	3.1E-03	-7.5E-03	840.0E-06	-4.7E-03	-6.3E-03	-6.8E-03	-2.1E-03	720.0E-06	-4.8E-03	-1.6E-03	-3.8E-03	-920.0E-06
4	-	-480.0E-06	-8.0E-03	2.2E-03	-4.5E-03	-5.4E-03	-7.6E-03	400.0E-06	-200.0E-06	-3.8E-03	-1.4E-03	-3.8E-03	-3.6E-03
Average	-	440.0E-06	-7.5E-03	1.9E-03	-5.7E-03	-6.2E-03	-7.2E-03	-973.3E-06	173.4E-06	-4.7E-03	-2.0E-03	-4.0E-03	-1.8E-03
Sigma	-	1.9E-03	376.7E-06	734.9E-06	1.5E-03	610.2E-06	296.4E-06	1.0E-03	395.1E-06	737.8E-06	652.4E-06	273.9E-06	1.2E-03

Measurements

VBE(SAT)	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	865.2E-03	869.2E-03	855.3E-03	871.2E-03	864.9E-03	860.5E-03	864.4E-03	870.3E-03	867.4E-03	862.2E-03	867.8E-03	864.9E-03	862.3E-03
ON_TID samples													
8	862.1E-03	862.8E-03	854.7E-03	866.8E-03	857.5E-03	856.6E-03	857.4E-03	864.7E-03	863.0E-03	857.8E-03	860.9E-03	858.7E-03	862.9E-03
9	861.0E-03	859.1E-03	853.4E-03	864.6E-03	858.7E-03	855.2E-03	855.6E-03	861.9E-03	863.1E-03	859.6E-03	860.8E-03	857.5E-03	864.2E-03
10	860.8E-03	861.9E-03	851.2E-03	864.7E-03	857.5E-03	855.8E-03	857.1E-03	862.0E-03	860.6E-03	858.0E-03	861.7E-03	859.1E-03	860.9E-03
Statistics													
Min	860.8E-03	859.1E-03	851.2E-03	864.6E-03	857.5E-03	855.2E-03	855.6E-03	861.9E-03	860.6E-03	857.8E-03	860.8E-03	857.5E-03	860.9E-03
Max	862.1E-03	862.8E-03	854.7E-03	866.8E-03	858.7E-03	856.6E-03	857.4E-03	864.7E-03	863.1E-03	859.6E-03	861.7E-03	859.1E-03	864.2E-03
Average	861.3E-03	861.3E-03	853.1E-03	865.3E-03	857.9E-03	855.8E-03	856.7E-03	862.9E-03	862.2E-03	858.5E-03	861.1E-03	858.4E-03	862.7E-03
Sigma	543.6E-06	1.6E-03	1.4E-03	1.0E-03	556.5E-06	572.2E-06	821.3E-06	1.3E-03	1.1E-03	816.7E-06	420.0E-06	698.2E-06	1.4E-03

Drift Calculation

VBE(SAT)	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
ON_TID samples													
8	-	760.0E-06	-7.4E-03	4.7E-03	-4.6E-03	-5.5E-03	-4.6E-03	2.6E-03	880.0E-06	-4.3E-03	-1.2E-03	-3.4E-03	840.0E-06
9	-	-2.0E-03	-7.6E-03	3.5E-03	-2.4E-03	-5.9E-03	-5.5E-03	880.0E-06	2.0E-03	-1.4E-03	-280.0E-06	-3.6E-03	3.2E-03
10	-	1.0E-03	-9.6E-03	3.9E-03	-3.3E-03	-5.0E-03	-3.7E-03	1.2E-03	-240.0E-06	-2.8E-03	880.0E-06	-1.7E-03	80.0E-06
Average	-	-53.3E-06	-8.2E-03	4.0E-03	-3.4E-03	-5.5E-03	-4.6E-03	1.5E-03	893.3E-06	-2.8E-03	-186.7E-06	-2.9E-03	1.4E-03
Sigma	-	1.4E-03	985.4E-06	484.8E-06	917.6E-06	344.1E-06	718.7E-06	753.6E-06	930.9E-06	1.2E-03	835.4E-06	824.3E-06	1.3E-03

Hirex Engineering	Total Dose Radiation Test Report									Ref.:	HRX/TID/1023	
	SOC2222A			STMicroelectronics						Issue:	01	

Measurements

VBE(SAT)	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	865.2E-03	869.2E-03	855.3E-03	871.2E-03	864.9E-03	860.5E-03	864.4E-03	870.3E-03	867.4E-03	862.2E-03	867.8E-03	864.9E-03	862.3E-03
OFF PROTON samples													
5	860.6E-03	862.0E-03	853.7E-03	865.2E-03	858.4E-03	857.1E-03	854.9E-03	865.0E-03	862.6E-03	859.4E-03	862.5E-03	859.4E-03	863.0E-03
6	862.0E-03	863.0E-03	855.1E-03	866.5E-03	858.4E-03	857.1E-03	858.5E-03	863.3E-03	861.1E-03	860.6E-03	863.6E-03	859.8E-03	864.4E-03
7	858.7E-03	860.7E-03	852.5E-03	864.8E-03	856.8E-03	854.4E-03	857.0E-03	862.0E-03	862.1E-03	858.1E-03	860.4E-03	857.9E-03	862.9E-03
Statistics													
Min	858.7E-03	860.7E-03	852.5E-03	864.8E-03	856.8E-03	854.4E-03	854.9E-03	862.0E-03	861.1E-03	858.1E-03	860.4E-03	857.9E-03	862.9E-03
Max	862.0E-03	863.0E-03	855.1E-03	866.5E-03	858.4E-03	857.1E-03	858.5E-03	865.0E-03	862.6E-03	860.6E-03	863.6E-03	859.8E-03	864.4E-03
Average	860.4E-03	861.9E-03	853.8E-03	865.5E-03	857.8E-03	855.7E-03	856.8E-03	863.4E-03	861.9E-03	859.4E-03	862.2E-03	859.1E-03	863.4E-03
Sigma	1.3E-03	919.3E-06	1.1E-03	747.9E-06	763.8E-06	1.1E-03	1.5E-03	1.2E-03	630.8E-06	1.0E-03	1.3E-03	827.1E-06	717.3E-06

Drift Calculation

VBE(SAT)	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
OFF PROTON samples													
5	-	1.4E-03	-6.9E-03	4.6E-03	-2.2E-03	-3.5E-03	-5.7E-03	4.4E-03	2.0E-03	-1.2E-03	1.9E-03	-1.2E-03	2.4E-03
6	-	1000.0E-06	-6.8E-03	4.6E-03	-3.6E-03	-6.4E-03	-3.5E-03	1.4E-03	-880.0E-06	-1.3E-03	1.6E-03	-2.1E-03	2.5E-03
7	-	2.0E-03	-6.2E-03	6.1E-03	-1.9E-03	-4.2E-03	-1.7E-03	3.4E-03	3.4E-03	-600.0E-06	1.8E-03	-760.0E-06	4.2E-03
Average	-	1.5E-03	-6.6E-03	5.1E-03	-2.6E-03	-4.7E-03	-3.6E-03	3.0E-03	1.5E-03	-1.0E-03	1.8E-03	-1.3E-03	3.0E-03
Sigma	-	426.2E-06	311.5E-06	707.3E-06	734.9E-06	1.2E-03	1.6E-03	1.2E-03	1.8E-03	308.7E-06	130.6E-06	570.7E-06	840.5E-06

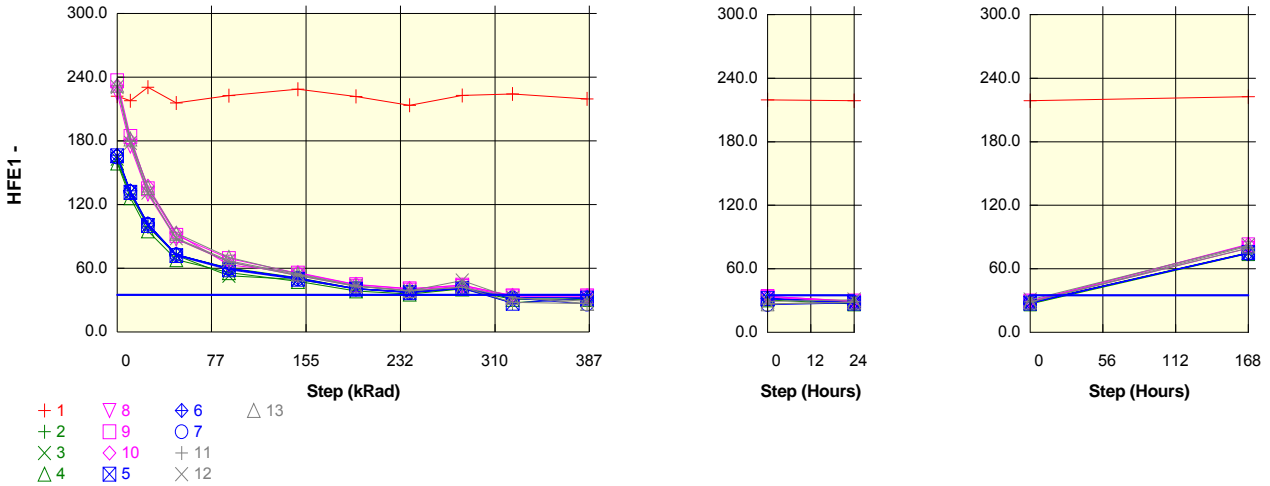
Measurements

VBE(SAT)	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	865.2E-03	869.2E-03	855.3E-03	871.2E-03	864.9E-03	860.5E-03	864.4E-03	870.3E-03	867.4E-03	862.2E-03	867.8E-03	864.9E-03	862.3E-03
OFF TID samples													
11	860.5E-03	861.2E-03	852.4E-03	865.8E-03	858.0E-03	856.1E-03	857.4E-03	863.2E-03	859.2E-03	858.6E-03	859.9E-03	857.5E-03	861.6E-03
12	860.4E-03	860.9E-03	851.9E-03	865.2E-03	857.5E-03	853.8E-03	856.4E-03	862.8E-03	861.2E-03	858.5E-03	859.5E-03	857.0E-03	861.8E-03
13	858.8E-03	861.5E-03	852.1E-03	865.2E-03	857.6E-03	855.4E-03	856.0E-03	859.4E-03	859.9E-03	856.1E-03	860.9E-03	855.2E-03	859.9E-03
Statistics													
Min	858.8E-03	860.9E-03	851.9E-03	865.2E-03	857.5E-03	853.8E-03	856.0E-03	859.4E-03	859.2E-03	856.1E-03	859.5E-03	855.2E-03	859.9E-03
Max	860.5E-03	861.5E-03	852.4E-03	865.8E-03	858.0E-03	856.1E-03	857.4E-03	863.2E-03	861.2E-03	858.6E-03	860.9E-03	857.5E-03	861.8E-03
Average	859.9E-03	861.2E-03	852.1E-03	865.4E-03	857.7E-03	855.1E-03	856.6E-03	861.8E-03	860.1E-03	857.8E-03	860.1E-03	856.6E-03	861.1E-03
Sigma	773.8E-06	246.6E-06	217.5E-06	273.9E-06	185.7E-06	955.7E-06	625.1E-06	1.7E-03	834.0E-06	1.2E-03	570.7E-06	963.0E-06	869.9E-06

Drift Calculation

VBE(SAT)	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
OFF TID samples													
11	-	720.0E-06	-8.1E-03	5.2E-03	-2.6E-03	-4.4E-03	-3.1E-03	2.7E-03	-1.3E-03	-1.9E-03	-600.0E-06	-3.0E-03	1.1E-03
12	-	440.0E-06	-8.5E-03	4.7E-03	-2.9E-03	-6.6E-03	-4.1E-03	2.4E-03	800.0E-06	-1.9E-03	-920.0E-06	-3.4E-03	1.4E-03
13	-	2.6E-03	-6.8E-03	6.4E-03	-1.2E-03	-3.4E-03	-2.9E-03	560.0E-06	1.0E-03	-2.7E-03	2.0E-03	-3.6E-03	1.0E-03
Average	-	1.3E-03	-7.8E-03	5.4E-03	-2.2E-03	-4.8E-03	-3.3E-03	1.9E-03	186.7E-06	-2.2E-03	173.4E-06	-3.4E-03	1.2E-03
Sigma	-	977.8E-06	747.9E-06	684.3E-06	740.7E-06	1.3E-03	524.9E-06	933.1E-06	1.0E-03	386.9E-06	1.3E-03	235.5E-06	136.0E-06

Parameter : Forward-Current Transfer Ratio : HFE1
 Test conditions : Ic = 100µA ; Vce = 10V (pulse width 300µs)
 Unit :
 Spec Limit Min : 35.0
 Spec limits are represented in bold lines on the graphic.



Measurements

HFE1	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	222.1	217.9	230.6	215.8	222.5	228.7	221.8	213.5	222.8	224.1	219.5	218.6	222.4
ON_PROTON samples													
2	160.6	129.9	99.0	72.6	60.4	51.1	40.9	37.7	41.4	27.4	32.1	28.4	75.3
3	163.1	131.5	100.2	72.3	53.0	49.5	40.5	37.3	40.9	32.1	31.9	27.9	74.8
4	159.2	126.5	95.2	68.2	55.9	47.7	38.6	35.8	40.5	30.8	30.7	26.7	74.4
Statistics													
Min	159.2	126.5	95.2	68.2	53.0	47.7	38.6	35.8	40.5	27.4	30.7	26.7	74.4
Max	163.1	131.5	100.2	72.6	60.4	51.1	40.9	37.7	41.4	32.1	32.1	28.4	75.3
Average	161.0	129.3	98.1	71.0	56.4	49.4	40.0	36.9	41.0	30.1	31.6	27.7	74.8
Sigma	1.6	2.1	2.1	2.0	3.0	1.4	1.0	0.8	0.4	2.0	0.6	0.7	0.4

Drift Calculation

HFE1	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
ON_PROTON samples													
2	-	1.5E-03	3.9E-03	7.5E-03	10.3E-03	13.3E-03	18.3E-03	20.3E-03	17.9E-03	30.2E-03	24.9E-03	28.9E-03	7.1E-03
3	-	1.5E-03	3.8E-03	7.7E-03	12.7E-03	14.1E-03	18.5E-03	20.7E-03	18.3E-03	25.0E-03	25.2E-03	29.8E-03	7.2E-03
4	-	1.6E-03	4.2E-03	8.4E-03	11.6E-03	14.7E-03	19.6E-03	21.7E-03	18.4E-03	26.2E-03	26.3E-03	31.1E-03	7.2E-03
Average	-	1.5E-03	4.0E-03	7.9E-03	11.6E-03	14.0E-03	18.8E-03	20.9E-03	18.2E-03	27.1E-03	25.5E-03	29.9E-03	7.2E-03
Sigma	-	72.3E-06	170.6E-06	367.2E-06	982.0E-06	552.1E-06	600.9E-06	580.5E-06	216.1E-06	2.2E-03	592.8E-06	893.8E-06	73.1E-06

Measurements

HFE1	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	222.1	217.9	230.6	215.8	222.5	228.7	221.8	213.5	222.8	224.1	219.5	218.6	222.4
ON_TID samples													
8	225.3	175.0	129.8	87.4	65.9	53.3	43.1	39.4	43.0	33.1	33.0	28.8	79.4
9	236.6	184.2	134.8	91.0	69.2	55.4	44.6	40.6	44.1	34.0	34.0	29.7	82.6
10	231.7	180.4	137.2	92.7	63.1	55.8	44.8	40.8	43.9	34.4	34.2	29.2	83.1
Statistics													
Min	225.3	175.0	129.8	87.4	63.1	53.3	43.1	39.4	43.0	33.1	33.0	28.8	79.4
Max	236.6	184.2	137.2	92.7	69.2	55.8	44.8	40.8	44.1	34.4	34.2	29.7	83.1
Average	231.2	179.8	133.9	90.4	66.0	54.8	44.2	40.3	43.7	33.8	33.7	29.2	81.7
Sigma	4.6	3.8	3.1	2.2	2.5	1.1	0.8	0.6	0.5	0.5	0.5	0.4	1.7

Drift Calculation

HFE1	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
ON_TID samples													
8	-	1.3E-03	3.3E-03	7.0E-03	10.7E-03	14.3E-03	18.8E-03	20.9E-03	18.8E-03	25.8E-03	25.9E-03	30.3E-03	8.2E-03
9	-	1.2E-03	3.2E-03	6.8E-03	10.2E-03	13.8E-03	18.2E-03	20.4E-03	18.4E-03	25.2E-03	25.2E-03	29.5E-03	7.9E-03
10	-	1.2E-03	3.0E-03	6.5E-03	11.5E-03	13.6E-03	18.0E-03	20.2E-03	18.5E-03	24.8E-03	25.0E-03	29.9E-03	7.7E-03
Average	-	1.2E-03	3.1E-03	6.7E-03	10.8E-03	13.9E-03	18.3E-03	20.5E-03	18.6E-03	25.3E-03	25.4E-03	29.9E-03	7.9E-03
Sigma	-	31.0E-06	124.8E-06	220.3E-06	541.7E-06	297.6E-06	328.2E-06	313.4E-06	176.8E-06	422.7E-06	394.0E-06	341.7E-06	183.5E-06

Hirex Engineering	Total Dose Radiation Test Report										Ref.:	HRX/TID/1023
	SOC2222A					STMicroelectronics					Issue:	01

Measurements

HFE1	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	222.1	217.9	230.6	215.8	222.5	228.7	221.8	213.5	222.8	224.1	219.5	218.6	222.4
OFF PROTON samples													
5	165.8	131.5	100.3	71.9	58.6	49.7	40.4	37.1	41.1	27.1	31.9	27.8	75.3
6	166.3	133.0	102.0	73.1	59.7	50.8	40.7	38.0	41.1	32.4	32.2	28.0	74.9
7	164.6	132.0	101.3	72.7	59.9	50.3	40.9	37.3	41.3	32.0	26.2	27.9	74.5
Statistics													
Min	164.6	131.5	100.3	71.9	58.6	49.7	40.4	37.1	41.1	27.1	26.2	27.8	74.5
Max	166.3	133.0	102.0	73.1	59.9	50.8	40.9	38.0	41.3	32.4	32.2	28.0	75.3
Average	165.6	132.1	101.2	72.6	59.4	50.3	40.7	37.5	41.2	30.5	30.1	27.9	74.9
Sigma	0.7	0.6	0.7	0.5	0.6	0.5	0.2	0.4	0.1	2.4	2.8	0.1	0.3

Drift Calculation

HFE1	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
OFF PROTON samples													
5	-	1.6E-03	3.9E-03	7.9E-03	11.0E-03	14.1E-03	18.7E-03	20.9E-03	18.3E-03	30.9E-03	25.4E-03	30.0E-03	7.3E-03
6	-	1.5E-03	3.8E-03	7.7E-03	10.7E-03	13.7E-03	18.5E-03	20.3E-03	18.3E-03	24.8E-03	25.0E-03	29.7E-03	7.3E-03
7	-	1.5E-03	3.8E-03	7.7E-03	10.6E-03	13.8E-03	18.4E-03	20.7E-03	18.2E-03	25.2E-03	32.1E-03	29.8E-03	7.3E-03
Average	-	1.5E-03	3.8E-03	7.7E-03	10.8E-03	13.9E-03	18.6E-03	20.7E-03	18.3E-03	27.0E-03	27.5E-03	29.8E-03	7.3E-03
Sigma	-	32.3E-06	66.9E-06	99.7E-06	167.3E-06	175.0E-06	141.8E-06	259.4E-06	62.6E-06	2.8E-03	3.3E-03	116.3E-06	41.0E-06

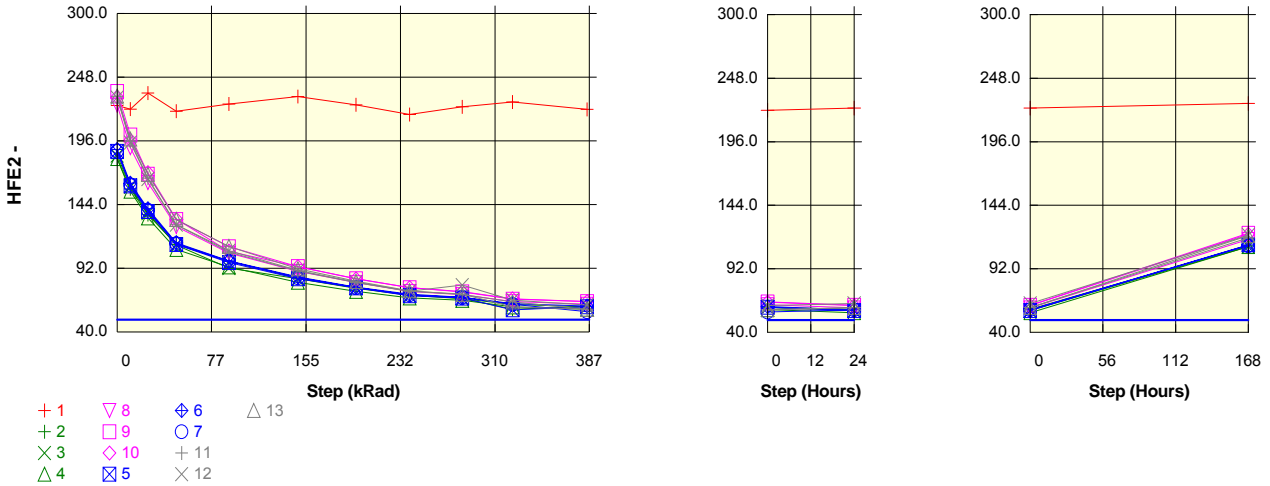
Measurements

HFE1	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	222.1	217.9	230.6	215.8	222.5	228.7	221.8	213.5	222.8	224.1	219.5	218.6	222.4
OFF TID samples													
11	232.0	179.3	132.0	87.7	65.8	53.1	42.9	38.9	42.2	28.0	26.8	28.7	79.5
12	230.7	178.1	131.2	88.4	67.1	53.9	43.2	38.8	48.5	31.9	29.2	30.9	82.3
13	232.5	181.8	136.1	92.9	70.3	54.6	43.5	39.1	42.2	32.6	26.8	28.6	81.4
Statistics													
Min	230.7	178.1	131.2	87.7	65.8	53.1	42.9	38.8	42.2	28.0	26.8	28.6	79.5
Max	232.5	181.8	136.1	92.9	70.3	54.6	43.5	39.1	48.5	32.6	29.2	30.9	82.3
Average	231.7	179.7	133.1	89.7	67.7	53.9	43.2	38.9	44.3	30.8	27.6	29.4	81.1
Sigma	0.8	1.5	2.1	2.3	1.9	0.6	0.2	0.1	3.0	2.0	1.1	1.0	1.2

Drift Calculation

HFE1	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
OFF TID samples													
11	-	1.3E-03	3.3E-03	7.1E-03	10.9E-03	14.5E-03	19.0E-03	21.4E-03	19.4E-03	31.4E-03	33.0E-03	30.5E-03	8.3E-03
12	-	1.3E-03	3.3E-03	7.0E-03	10.6E-03	14.2E-03	18.8E-03	21.4E-03	16.3E-03	27.0E-03	29.9E-03	28.1E-03	7.8E-03
13	-	1.2E-03	3.0E-03	6.5E-03	9.9E-03	14.0E-03	18.7E-03	21.3E-03	19.4E-03	26.3E-03	32.9E-03	30.7E-03	8.0E-03
Average	-	1.2E-03	3.2E-03	6.8E-03	10.5E-03	14.2E-03	18.8E-03	21.4E-03	18.4E-03	28.3E-03	31.9E-03	29.7E-03	8.0E-03
Sigma	-	34.6E-06	107.4E-06	272.2E-06	395.0E-06	214.0E-06	114.9E-06	60.9E-06	1.5E-03	2.2E-03	1.5E-03	1.2E-03	184.6E-06

Parameter : Forward-Current Transfer Ratio : HFE2
 Test conditions : Ic = 1mA ; Vce = 10V (pulse width 300µs)
 Unit :
 Spec Limit Min : 50.0
 Spec limits are represented in bold lines on the graphic.



Measurements

HFE2	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	224.9	221.9	235.0	220.2	226.0	232.2	225.4	217.5	223.8	227.7	221.7	223.5	227.3
ON PROTON samples													
2	181.5	156.8	135.8	111.4	97.7	83.9	76.1	70.4	67.6	58.5	60.6	58.9	110.8
3	184.1	158.5	137.1	111.1	92.2	83.4	75.7	69.9	67.2	62.5	60.4	57.8	110.1
4	181.5	154.9	133.2	107.5	93.1	80.6	73.2	67.8	65.8	60.5	58.6	56.1	110.2
Statistics													
Min	181.5	154.9	133.2	107.5	92.2	80.6	73.2	67.8	65.8	58.5	58.6	56.1	110.1
Max	184.1	158.5	137.1	111.4	97.7	83.9	76.1	70.4	67.6	62.5	60.6	58.9	110.8
Average	182.4	156.7	135.3	110.0	94.4	82.6	75.0	69.4	66.9	60.5	59.9	57.6	110.3
Sigma	1.2	1.4	1.6	1.8	2.4	1.5	1.3	1.1	0.8	1.6	0.9	1.2	0.3

Drift Calculation

HFE2	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
ON PROTON samples													
2	-	867.6E-06	1.9E-03	3.5E-03	4.7E-03	6.4E-03	7.6E-03	8.7E-03	9.3E-03	11.6E-03	11.0E-03	11.5E-03	3.5E-03
3	-	879.5E-06	1.9E-03	3.6E-03	5.4E-03	6.6E-03	7.8E-03	8.9E-03	9.4E-03	10.6E-03	11.1E-03	11.9E-03	3.7E-03
4	-	943.6E-06	2.0E-03	3.8E-03	5.2E-03	6.9E-03	8.1E-03	9.2E-03	9.7E-03	11.0E-03	11.6E-03	12.3E-03	3.6E-03
Average	-	896.9E-06	1.9E-03	3.6E-03	5.1E-03	6.6E-03	7.9E-03	8.9E-03	9.5E-03	11.1E-03	11.2E-03	11.9E-03	3.6E-03
Sigma	-	33.4E-06	65.3E-06	136.7E-06	293.1E-06	208.4E-06	216.3E-06	223.8E-06	163.0E-06	415.3E-06	243.6E-06	348.8E-06	54.7E-06

Measurements

HFE2	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	224.9	221.9	235.0	220.2	226.0	232.2	225.4	217.5	223.8	227.7	221.7	223.5	227.3
ON TID samples													
8	225.2	190.5	162.0	126.1	104.4	89.5	80.3	73.1	70.4	64.7	62.7	60.1	115.9
9	236.3	200.9	168.8	131.7	109.6	93.3	83.5	76.2	72.8	66.8	64.8	62.2	121.0
10	231.8	196.5	170.0	132.0	106.0	93.4	83.3	76.2	72.8	67.0	64.8	61.9	120.4
Statistics													
Min	225.2	190.5	162.0	126.1	104.4	89.5	80.3	73.1	70.4	64.7	62.7	60.1	115.9
Max	236.3	200.9	170.0	132.0	109.6	93.4	83.5	76.2	72.8	67.0	64.8	62.2	121.0
Average	231.1	196.0	166.9	130.0	106.7	92.1	82.4	75.1	72.0	66.2	64.1	61.4	119.1
Sigma	4.5	4.2	3.5	2.7	2.2	1.8	1.5	1.5	1.1	1.0	1.0	0.9	2.3

Drift Calculation

HFE2	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
ON TID samples													
8	-	809.6E-06	1.7E-03	3.5E-03	5.1E-03	6.7E-03	8.0E-03	9.2E-03	9.8E-03	11.0E-03	11.5E-03	12.2E-03	4.2E-03
9	-	747.0E-06	1.7E-03	3.4E-03	4.9E-03	6.5E-03	7.7E-03	8.9E-03	9.5E-03	10.7E-03	11.2E-03	11.8E-03	4.0E-03
10	-	774.6E-06	1.6E-03	3.3E-03	5.1E-03	6.4E-03	7.7E-03	8.8E-03	9.4E-03	10.6E-03	11.1E-03	11.8E-03	4.0E-03
Average	-	777.1E-06	1.7E-03	3.4E-03	5.1E-03	6.5E-03	7.8E-03	9.0E-03	9.6E-03	10.8E-03	11.3E-03	12.0E-03	4.1E-03
Sigma	-	25.6E-06	69.8E-06	93.3E-06	112.0E-06	145.7E-06	143.9E-06	187.3E-06	143.5E-06	167.0E-06	172.8E-06	170.8E-06	83.1E-06

Hirex Engineering	Total Dose Radiation Test Report										Ref.:	HRX/TID/1023
	SOC2222A					STMicroelectronics					Issue:	01

Measurements

HFE2	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	224.9	221.9	235.0	220.2	226.0	232.2	225.4	217.5	223.8	227.7	221.7	223.5	227.3
OFF PROTON samples													
5	187.5	159.3	138.3	111.4	96.6	83.5	76.0	69.6	67.7	58.1	60.6	57.9	111.5
6	188.9	161.4	140.5	112.8	98.0	85.0	76.7	70.8	68.5	63.1	61.2	58.5	111.6
7	187.5	160.0	139.3	112.0	97.7	84.3	76.4	70.2	68.1	62.5	56.6	58.4	111.0
Statistics													
Min	187.5	159.3	138.3	111.4	96.6	83.5	76.0	69.6	67.7	58.1	56.6	57.9	111.0
Max	188.9	161.4	140.5	112.8	98.0	85.0	76.7	70.8	68.5	63.1	61.2	58.5	111.6
Average	188.0	160.3	139.4	112.1	97.4	84.3	76.4	70.2	68.1	61.2	59.5	58.3	111.4
Sigma	0.7	0.9	0.9	0.6	0.6	0.6	0.3	0.5	0.3	2.2	2.0	0.3	0.3

Drift Calculation

HFE2	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
OFF PROTON samples													
5	-	944.0E-06	1.9E-03	3.6E-03	5.0E-03	6.6E-03	7.8E-03	9.0E-03	9.4E-03	11.9E-03	11.2E-03	11.9E-03	3.6E-03
6	-	902.1E-06	1.8E-03	3.6E-03	4.9E-03	6.5E-03	7.7E-03	8.8E-03	9.3E-03	10.6E-03	11.1E-03	11.8E-03	3.7E-03
7	-	914.8E-06	1.8E-03	3.6E-03	4.9E-03	6.5E-03	7.8E-03	8.9E-03	9.4E-03	10.7E-03	12.3E-03	11.8E-03	3.7E-03
Average	-	920.3E-06	1.9E-03	3.6E-03	4.9E-03	6.5E-03	7.8E-03	8.9E-03	9.4E-03	11.0E-03	11.5E-03	11.8E-03	3.7E-03
Sigma	-	17.5E-06	31.2E-06	29.5E-06	54.1E-06	67.9E-06	30.4E-06	84.4E-06	47.4E-06	599.6E-06	572.7E-06	66.7E-06	19.3E-06

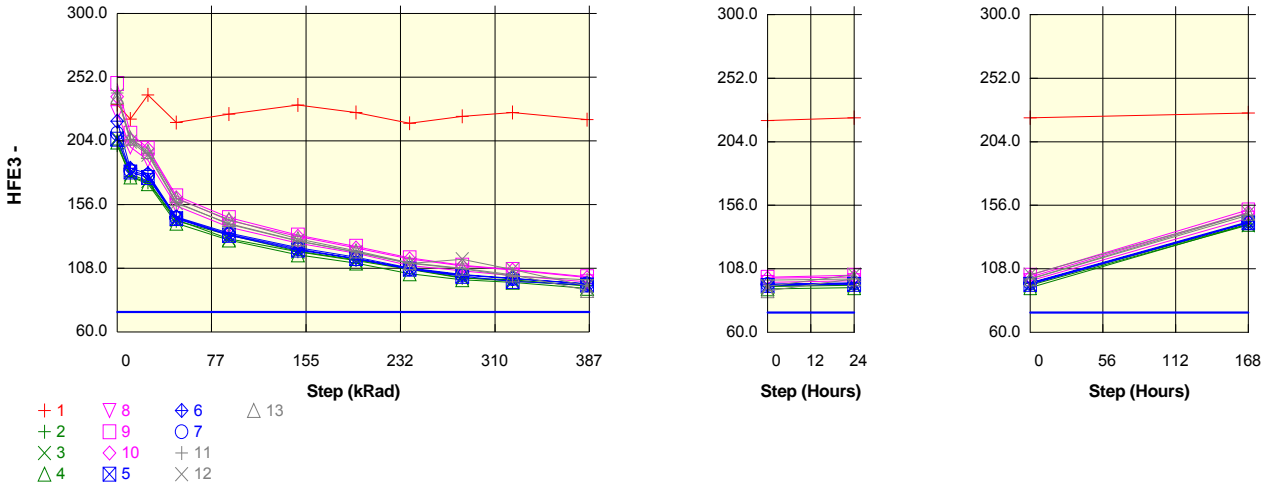
Measurements

HFE2	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	224.9	221.9	235.0	220.2	226.0	232.2	225.4	217.5	223.8	227.7	221.7	223.5	227.3
OFF TID samples													
11	232.3	195.7	165.6	127.6	105.2	89.7	80.4	73.2	70.9	60.4	58.5	60.3	117.3
12	231.2	194.6	164.7	127.6	106.3	90.3	80.7	73.3	78.3	66.1	61.9	63.6	119.6
13	232.7	197.6	168.6	131.8	109.8	91.6	81.3	73.7	70.7	64.6	58.4	60.3	119.1
Statistics													
Min	231.2	194.6	164.7	127.6	105.2	89.7	80.4	73.2	70.7	60.4	58.4	60.3	117.3
Max	232.7	197.6	168.6	131.8	109.8	91.6	81.3	73.7	78.3	66.1	61.9	63.6	119.6
Average	232.0	196.0	166.3	129.0	107.1	90.5	80.8	73.4	73.3	63.7	59.6	61.4	118.6
Sigma	0.6	1.2	1.7	2.0	2.0	0.8	0.4	0.2	3.5	2.4	1.6	1.6	1.0

Drift Calculation

HFE2	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
OFF TID samples													
11	-	804.7E-06	1.7E-03	3.5E-03	5.2E-03	6.8E-03	8.1E-03	9.4E-03	9.8E-03	12.3E-03	12.8E-03	12.3E-03	4.2E-03
12	-	813.1E-06	1.7E-03	3.5E-03	5.1E-03	6.7E-03	8.1E-03	9.3E-03	8.4E-03	10.8E-03	11.8E-03	11.4E-03	4.0E-03
13	-	763.4E-06	1.6E-03	3.3E-03	4.8E-03	6.6E-03	8.0E-03	9.3E-03	9.9E-03	11.2E-03	12.8E-03	12.3E-03	4.1E-03
Average	-	793.7E-06	1.7E-03	3.4E-03	5.0E-03	6.7E-03	8.1E-03	9.3E-03	9.4E-03	11.4E-03	12.5E-03	12.0E-03	4.1E-03
Sigma	-	21.7E-06	51.1E-06	110.3E-06	166.6E-06	92.2E-06	56.8E-06	33.2E-06	650.5E-06	615.0E-06	464.1E-06	417.8E-06	76.6E-06

Parameter : Forward-Current Transfer Ratio : HFE3
 Test conditions : Ic = 10mA ; Vce = 10V (pulse width 300µs)
 Unit :
 Spec Limit Min : 75.0
 Spec limits are represented in bold lines on the graphic.



Measurements

HFE3	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	231.4	220.4	238.7	217.8	224.1	231.1	225.4	217.2	222.5	225.4	220.0	222.1	225.7
ON PROTON samples													
2	200.9	177.3	172.8	143.8	133.1	120.8	114.4	107.6	100.8	98.3	95.0	96.9	141.7
3	206.1	178.8	173.8	144.6	130.3	120.4	113.8	107.1	100.6	99.3	94.6	95.6	141.1
4	203.0	176.9	171.8	141.9	129.2	118.1	111.9	103.8	99.3	97.4	92.9	93.8	141.6
Statistics													
Min	200.9	176.9	171.8	141.9	129.2	118.1	111.9	103.8	99.3	97.4	92.9	93.8	141.1
Max	206.1	178.8	173.8	144.6	133.1	120.8	114.4	107.6	100.8	99.3	95.0	96.9	141.7
Average	203.3	177.6	172.8	143.4	130.9	119.8	113.4	106.2	100.3	98.3	94.2	95.4	141.5
Sigma	2.2	0.8	0.8	1.1	1.6	1.2	1.1	1.7	0.7	0.8	0.9	1.3	0.3

Drift Calculation

HFE3	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
ON PROTON samples													
2	-	662.0E-06	809.3E-06	2.0E-03	2.5E-03	3.3E-03	3.8E-03	4.3E-03	4.9E-03	5.2E-03	5.5E-03	5.3E-03	2.1E-03
3	-	742.9E-06	903.6E-06	2.1E-03	2.8E-03	3.5E-03	3.9E-03	4.5E-03	5.1E-03	5.2E-03	5.7E-03	5.6E-03	2.2E-03
4	-	727.2E-06	894.9E-06	2.1E-03	2.8E-03	3.5E-03	4.0E-03	4.7E-03	5.1E-03	5.3E-03	5.8E-03	5.7E-03	2.1E-03
Average	-	710.7E-06	869.3E-06	2.1E-03	2.7E-03	3.4E-03	3.9E-03	4.5E-03	5.1E-03	5.3E-03	5.7E-03	5.6E-03	2.2E-03
Sigma	-	35.0E-06	42.6E-06	59.8E-06	134.1E-06	98.1E-06	104.1E-06	159.1E-06	85.3E-06	65.6E-06	122.2E-06	162.3E-06	65.7E-06

Measurements

HFE3	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	231.4	220.4	238.7	217.8	224.1	231.1	225.4	217.2	222.5	225.4	220.0	222.1	225.7
ON TID samples													
8	225.2	199.4	189.4	155.0	139.1	126.9	119.4	110.1	106.1	102.5	97.8	99.0	146.1
9	247.2	209.6	198.5	162.6	146.2	132.9	124.5	115.8	110.4	107.0	101.7	103.1	152.6
10	237.2	205.2	197.8	161.1	144.0	132.1	123.3	115.0	109.8	106.7	100.9	101.8	150.6
Statistics													
Min	225.2	199.4	189.4	155.0	139.1	126.9	119.4	110.1	106.1	102.5	97.8	99.0	146.1
Max	247.2	209.6	198.5	162.6	146.2	132.9	124.5	115.8	110.4	107.0	101.7	103.1	152.6
Average	236.6	204.8	195.3	159.6	143.1	130.6	122.4	113.6	108.8	105.4	100.1	101.3	149.7
Sigma	9.0	4.2	4.1	3.3	3.0	2.6	2.2	2.5	1.9	2.1	1.7	1.7	2.7

Drift Calculation

HFE3	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
ON TID samples													
8	-	574.6E-06	838.6E-06	2.0E-03	2.8E-03	3.4E-03	3.9E-03	4.6E-03	5.0E-03	5.3E-03	5.8E-03	5.7E-03	2.4E-03
9	-	724.6E-06	991.4E-06	2.1E-03	2.8E-03	3.5E-03	4.0E-03	4.6E-03	5.0E-03	5.3E-03	5.8E-03	5.7E-03	2.5E-03
10	-	657.5E-06	840.4E-06	2.0E-03	2.7E-03	3.4E-03	3.9E-03	4.5E-03	4.9E-03	5.2E-03	5.7E-03	5.6E-03	2.4E-03
Average	-	652.2E-06	890.1E-06	2.0E-03	2.8E-03	3.4E-03	3.9E-03	4.6E-03	5.0E-03	5.3E-03	5.8E-03	5.6E-03	2.4E-03
Sigma	-	61.3E-06	71.6E-06	48.6E-06	26.7E-06	50.3E-06	38.3E-06	66.7E-06	50.7E-06	70.8E-06	42.5E-06	22.6E-06	45.7E-06

Hirex Engineering	Total Dose Radiation Test Report										Ref.:	HRX/TID/1023
	SOC2222A					STMicroelectronics					Issue:	01

Measurements

HFE3	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	231.4	220.4	238.7	217.8	224.1	231.1	225.4	217.2	222.5	225.4	220.0	222.1	225.7
OFF PROTON samples													
5	205.3	180.6	176.4	145.4	132.9	121.7	115.3	107.3	101.9	98.0	95.4	96.3	142.9
6	218.7	183.3	179.4	146.8	134.5	123.6	116.3	108.3	103.3	100.5	96.4	97.4	143.5
7	209.6	181.5	177.8	145.9	133.5	122.7	115.1	107.6	102.8	100.1	96.1	97.1	142.9
Statistics													
Min	205.3	180.6	176.4	145.4	132.9	121.7	115.1	107.3	101.9	98.0	95.4	96.3	142.9
Max	218.7	183.3	179.4	146.8	134.5	123.6	116.3	108.3	103.3	100.5	96.4	97.4	143.5
Average	211.2	181.8	177.8	146.0	133.6	122.7	115.6	107.7	102.7	99.5	96.0	96.9	143.1
Sigma	5.6	1.1	1.2	0.6	0.7	0.8	0.5	0.4	0.6	1.1	0.4	0.5	0.3

Drift Calculation

HFE3	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
OFF PROTON samples													
5	-	665.9E-06	799.1E-06	2.0E-03	2.7E-03	3.3E-03	3.8E-03	4.5E-03	4.9E-03	5.3E-03	5.6E-03	5.5E-03	2.1E-03
6	-	882.9E-06	1.0E-03	2.2E-03	2.9E-03	3.5E-03	4.0E-03	4.7E-03	5.1E-03	5.4E-03	5.8E-03	5.7E-03	2.4E-03
7	-	740.4E-06	855.0E-06	2.1E-03	2.7E-03	3.4E-03	3.9E-03	4.5E-03	5.0E-03	5.2E-03	5.6E-03	5.5E-03	2.2E-03
Average	-	763.1E-06	885.9E-06	2.1E-03	2.7E-03	3.4E-03	3.9E-03	4.5E-03	5.0E-03	5.3E-03	5.7E-03	5.6E-03	2.3E-03
Sigma	-	90.1E-06	86.3E-06	97.0E-06	87.5E-06	73.1E-06	91.0E-06	87.7E-06	74.6E-06	68.1E-06	87.5E-06	84.5E-06	110.3E-06

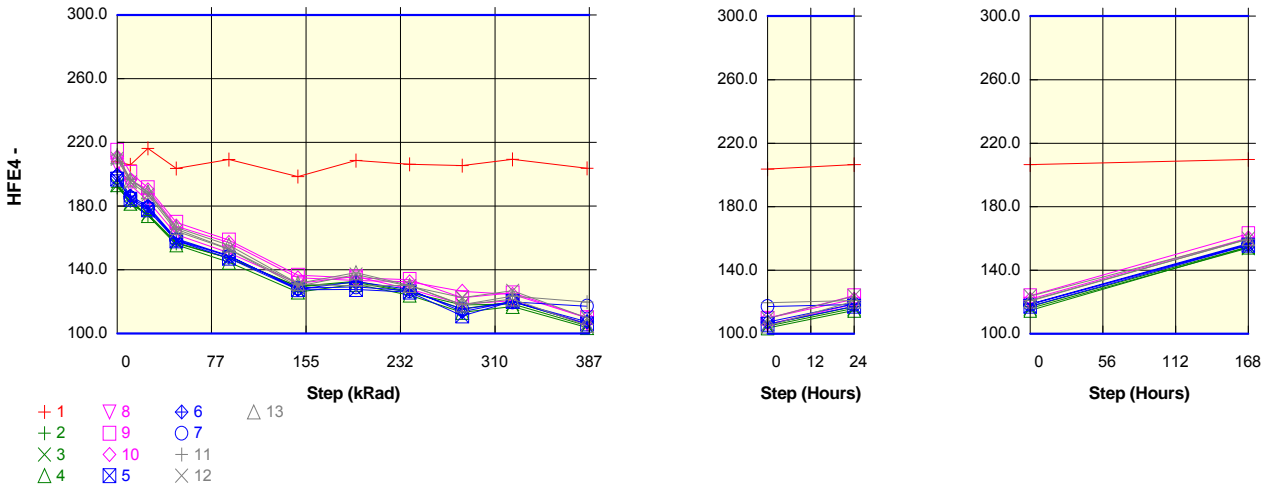
Measurements

HFE3	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	231.4	220.4	238.7	217.8	224.1	231.1	225.4	217.2	222.5	225.4	220.0	222.1	225.7
OFF TID samples													
11	240.1	204.8	194.8	157.6	141.0	128.6	120.3	111.8	107.6	102.0	99.4	100.3	148.5
12	238.3	203.4	193.6	157.2	141.7	128.7	120.1	111.6	114.7	107.1	94.7	103.6	150.1
13	237.2	205.9	196.1	160.5	144.6	130.2	121.1	112.1	108.0	103.0	91.4	100.4	150.0
Statistics													
Min	237.2	203.4	193.6	157.2	141.0	128.6	120.1	111.6	107.6	102.0	91.4	100.3	148.5
Max	240.1	205.9	196.1	160.5	144.6	130.2	121.1	112.1	114.7	107.1	99.4	103.6	150.1
Average	238.5	204.7	194.8	158.4	142.4	129.2	120.5	111.8	110.1	104.0	95.1	101.4	149.5
Sigma	1.2	1.0	1.0	1.5	1.6	0.7	0.4	0.2	3.3	2.2	3.3	1.6	0.7

Drift Calculation

HFE3	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
OFF TID samples													
11	-	716.6E-06	968.0E-06	2.2E-03	2.9E-03	3.6E-03	4.2E-03	4.8E-03	5.1E-03	5.6E-03	5.9E-03	5.8E-03	2.6E-03
12	-	718.6E-06	969.0E-06	2.2E-03	2.9E-03	3.6E-03	4.1E-03	4.8E-03	4.5E-03	5.1E-03	6.4E-03	5.5E-03	2.5E-03
13	-	641.0E-06	884.6E-06	2.0E-03	2.7E-03	3.5E-03	4.0E-03	4.7E-03	5.0E-03	5.5E-03	6.7E-03	5.7E-03	2.5E-03
Average	-	692.1E-06	940.5E-06	2.1E-03	2.8E-03	3.6E-03	4.1E-03	4.8E-03	4.9E-03	5.4E-03	6.3E-03	5.7E-03	2.5E-03
Sigma	-	36.1E-06	39.5E-06	74.2E-06	95.8E-06	62.6E-06	47.1E-06	34.5E-06	269.4E-06	206.2E-06	340.8E-06	154.8E-06	52.5E-06

Parameter : Forward-Current Transfer Ratio : HFE4
 Test conditions : Ic = 150mA ; Vce = 10V (pulse width 300µs)
 Unit :
 Spec Limit Min : 100.0
 Spec Limit Max : 300.0
 Spec limits are represented in bold lines on the graphic.



Measurements

HFE4	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	207.8	205.9	216.2	203.6	209.2	198.5	208.6	206.3	205.4	209.3	203.7	206.5	209.7
ON PROTON samples													
2	191.7	183.2	174.2	156.6	147.4	129.6	132.7	126.5	115.6	119.9	106.1	117.2	154.8
3	193.1	181.8	174.9	157.1	147.3	129.3	132.1	125.8	117.9	118.6	104.9	116.1	154.1
4	193.4	181.7	174.0	155.6	144.8	126.0	130.8	124.1	113.2	116.9	103.7	114.8	154.6
Statistics													
Min	191.7	181.7	174.0	155.6	144.8	126.0	130.8	124.1	113.2	116.9	103.7	114.8	154.1
Max	193.4	183.2	174.9	157.1	147.4	129.6	132.7	126.5	117.9	119.9	106.1	117.2	154.8
Average	192.8	182.2	174.4	156.5	146.5	128.3	131.9	125.4	115.6	118.5	104.9	116.0	154.5
Sigma	0.7	0.7	0.4	0.6	1.2	1.6	0.8	1.0	1.9	1.2	1.0	1.0	0.3

Drift Calculation

HFE4	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
ON PROTON samples													
2	-	243.5E-06	525.2E-06	1.2E-03	1.6E-03	2.5E-03	2.3E-03	2.7E-03	3.4E-03	3.1E-03	4.2E-03	3.3E-03	1.2E-03
3	-	322.9E-06	538.7E-06	1.2E-03	1.6E-03	2.6E-03	2.4E-03	2.8E-03	3.3E-03	3.3E-03	4.4E-03	3.4E-03	1.3E-03
4	-	334.3E-06	577.6E-06	1.3E-03	1.7E-03	2.8E-03	2.5E-03	2.9E-03	3.7E-03	3.4E-03	4.5E-03	3.5E-03	1.3E-03
Average	-	300.3E-06	547.1E-06	1.2E-03	1.6E-03	2.6E-03	2.4E-03	2.8E-03	3.5E-03	3.3E-03	4.3E-03	3.4E-03	1.3E-03
Sigma	-	40.4E-06	22.2E-06	37.4E-06	71.2E-06	113.8E-06	65.1E-06	82.1E-06	147.9E-06	106.4E-06	105.8E-06	91.0E-06	28.9E-06

Measurements

HFE4	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	207.8	205.9	216.2	203.6	209.2	198.5	208.6	206.3	205.4	209.3	203.7	206.5	209.7
ON TID samples													
8	205.4	193.2	183.4	162.1	150.7	131.5	135.7	127.8	118.3	120.6	106.0	118.7	156.3
9	215.1	201.1	191.5	169.7	158.7	136.6	134.8	133.9	122.4	125.5	109.9	123.9	163.1
10	210.8	196.3	190.3	167.4	157.1	134.9	133.2	132.4	126.5	124.5	109.8	121.8	160.4
Statistics													
Min	205.4	193.2	183.4	162.1	150.7	131.5	133.2	127.8	118.3	120.6	106.0	118.7	156.3
Max	215.1	201.1	191.5	169.7	158.7	136.6	135.7	133.9	126.5	125.5	109.9	123.9	163.1
Average	210.4	196.9	188.4	166.4	155.5	134.3	134.6	131.4	122.4	123.5	108.6	121.5	159.9
Sigma	4.0	3.2	3.6	3.2	3.5	2.1	1.0	2.6	3.3	2.1	1.8	2.1	2.8

Drift Calculation

HFE4	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
ON TID samples													
8	-	306.4E-06	583.7E-06	1.3E-03	1.8E-03	2.7E-03	2.5E-03	3.0E-03	3.6E-03	3.4E-03	4.6E-03	3.6E-03	1.5E-03
9	-	324.0E-06	572.7E-06	1.2E-03	1.7E-03	2.7E-03	2.8E-03	2.8E-03	3.5E-03	3.3E-03	4.5E-03	3.4E-03	1.5E-03
10	-	350.2E-06	510.7E-06	1.2E-03	1.6E-03	2.7E-03	2.8E-03	2.8E-03	3.2E-03	3.3E-03	4.4E-03	3.5E-03	1.5E-03
Average	-	326.9E-06	555.7E-06	1.3E-03	1.7E-03	2.7E-03	2.7E-03	2.9E-03	3.4E-03	3.3E-03	4.5E-03	3.5E-03	1.5E-03
Sigma	-	18.0E-06	32.1E-06	30.5E-06	63.8E-06	29.8E-06	125.4E-06	66.0E-06	184.8E-06	58.3E-06	82.3E-06	55.4E-06	20.6E-06

Hirex Engineering	Total Dose Radiation Test Report										Ref.:	HRX/TID/1023
	SOC2222A					STMicroelectronics					Issue:	01

Measurements

HFE4	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1 REF	207.8	205.9	216.2	203.6	209.2	198.5	208.6	206.3	205.4	209.3	203.7	206.5	209.7
OFF PROTON samples													
5	196.9	184.2	177.6	158.1	147.3	127.5	127.6	126.0	111.1	120.1	106.0	117.5	155.8
6	199.5	186.4	180.0	159.5	148.9	127.8	132.5	127.5	113.7	120.0	107.4	118.8	156.8
7	197.9	185.2	178.9	158.7	148.4	128.4	129.2	126.8	115.2	119.8	117.2	118.4	156.3
Statistics													
Min	196.9	184.2	177.6	158.1	147.3	127.5	127.6	126.0	111.1	119.8	106.0	117.5	155.8
Max	199.5	186.4	180.0	159.5	148.9	128.4	132.5	127.5	115.2	120.1	117.2	118.8	156.8
Average	198.1	185.3	178.8	158.8	148.2	127.9	129.8	126.8	113.3	120.0	110.2	118.2	156.3
Sigma	1.1	0.9	1.0	0.6	0.7	0.4	2.0	0.6	1.7	0.1	5.0	0.6	0.4

Drift Calculation

HFE4	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
OFF PROTON samples													
5	-	349.3E-06	550.9E-06	1.2E-03	1.7E-03	2.8E-03	2.8E-03	2.9E-03	3.9E-03	3.2E-03	4.4E-03	3.4E-03	1.3E-03
6	-	353.9E-06	543.3E-06	1.3E-03	1.7E-03	2.8E-03	2.5E-03	2.8E-03	3.8E-03	3.3E-03	4.3E-03	3.4E-03	1.4E-03
7	-	345.5E-06	536.4E-06	1.2E-03	1.7E-03	2.7E-03	2.7E-03	2.8E-03	3.6E-03	3.3E-03	3.5E-03	3.4E-03	1.3E-03
Average	-	349.6E-06	543.5E-06	1.2E-03	1.7E-03	2.8E-03	2.7E-03	2.8E-03	3.8E-03	3.3E-03	4.0E-03	3.4E-03	1.3E-03
Sigma	-	3.5E-06	5.9E-06	4.9E-06	10.2E-06	32.8E-06	92.8E-06	12.2E-06	122.3E-06	29.4E-06	399.6E-06	18.0E-06	12.1E-06

Measurements

HFE4	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1 REF	207.8	205.9	216.2	203.6	209.2	198.5	208.6	206.3	205.4	209.3	203.7	206.5	209.7
OFF TID samples													
11	212.1	196.9	188.8	165.6	153.1	131.1	129.9	130.1	118.0	123.5	119.7	121.0	159.5
12	209.7	195.1	187.1	164.3	152.9	129.6	137.0	129.6	122.5	126.7	109.7	123.8	159.9
13	210.9	196.4	188.9	166.6	155.4	131.5	138.2	130.1	117.9	121.6	104.9	120.7	159.8
Statistics													
Min	209.7	195.1	187.1	164.3	152.9	129.6	129.9	129.6	117.9	121.6	104.9	120.7	159.5
Max	212.1	196.9	188.9	166.6	155.4	131.5	138.2	130.1	122.5	126.7	119.7	123.8	159.9
Average	210.9	196.1	188.3	165.5	153.8	130.7	135.0	130.0	119.5	123.9	111.4	121.8	159.7
Sigma	1.0	0.8	0.8	0.9	1.1	0.8	3.6	0.2	2.2	2.1	6.1	1.4	0.1

Drift Calculation

HFE4	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
OFF TID samples													
11	-	364.1E-06	583.4E-06	1.3E-03	1.8E-03	2.9E-03	3.0E-03	3.0E-03	3.8E-03	3.4E-03	3.6E-03	3.5E-03	1.6E-03
12	-	357.1E-06	575.4E-06	1.3E-03	1.8E-03	2.9E-03	2.5E-03	2.9E-03	3.4E-03	3.1E-03	4.3E-03	3.3E-03	1.5E-03
13	-	351.4E-06	553.6E-06	1.3E-03	1.7E-03	2.9E-03	2.5E-03	2.9E-03	3.7E-03	3.5E-03	4.8E-03	3.5E-03	1.5E-03
Average	-	357.5E-06	570.8E-06	1.3E-03	1.8E-03	2.9E-03	2.7E-03	3.0E-03	3.6E-03	3.3E-03	4.3E-03	3.5E-03	1.5E-03
Sigma	-	5.2E-06	12.6E-06	28.0E-06	49.8E-06	32.9E-06	221.2E-06	12.0E-06	168.7E-06	153.6E-06	471.6E-06	111.7E-06	27.3E-06

Parameter : Gain Bandwidth Product : FT

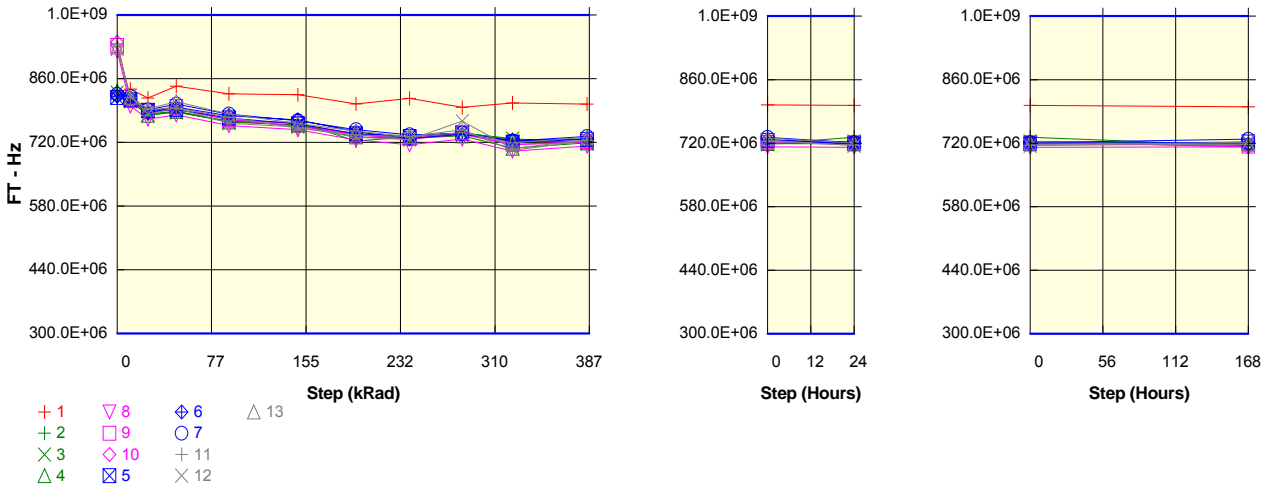
Test conditions : Vce = 20V ; Ic = 20mA

Unit : Hz

Spec Limit Min : 300.0E+06

Spec Limit Max : 1.0E+09

Spec limits are represented in bold lines on the graphic.



Measurements

FT	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1 REF	830.2E+06	837.0E+06	817.5E+06	843.7E+06	826.8E+06	824.7E+06	804.6E+06	816.6E+06	796.7E+06	806.5E+06	804.1E+06	803.4E+06	800.1E+06
ON PROTON samples													
2	827.8E+06	809.7E+06	782.3E+06	788.3E+06	766.3E+06	764.0E+06	722.8E+06	732.1E+06	740.8E+06	726.3E+06	718.5E+06	733.3E+06	714.3E+06
3	829.1E+06	810.2E+06	780.0E+06	786.0E+06	765.8E+06	757.4E+06	738.8E+06	727.3E+06	740.5E+06	728.1E+06	718.1E+06	723.5E+06	718.8E+06
4	832.7E+06	817.3E+06	779.5E+06	788.1E+06	764.9E+06	757.9E+06	732.0E+06	729.5E+06	734.3E+06	707.3E+06	719.0E+06	718.8E+06	718.8E+06
Statistics													
Min	827.8E+06	809.7E+06	779.5E+06	786.0E+06	764.9E+06	757.4E+06	722.8E+06	727.3E+06	734.3E+06	707.3E+06	718.1E+06	718.8E+06	714.3E+06
Max	832.7E+06	817.3E+06	782.3E+06	788.3E+06	766.3E+06	764.0E+06	738.8E+06	732.1E+06	740.8E+06	728.1E+06	719.0E+06	733.3E+06	718.8E+06
Average	829.9E+06	812.4E+06	780.6E+06	787.5E+06	765.7E+06	759.7E+06	731.2E+06	729.6E+06	738.5E+06	720.6E+06	718.5E+06	725.2E+06	717.3E+06
Sigma	2.1E+06	3.5E+06	1.2E+06	1.1E+06	581.7E+03	3.0E+06	6.6E+06	2.0E+06	3.0E+06	9.4E+06	340.0E+03	6.0E+06	2.1E+06

Drift Calculation

FT	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
ON PROTON samples													
2	-	-18.1E+06	-45.4E+06	-39.4E+06	-61.4E+06	-63.7E+06	-105.0E+06	-95.6E+06	-87.0E+06	-101.5E+06	-109.3E+06	-94.4E+06	-113.4E+06
3	-	-18.9E+06	-49.1E+06	-43.1E+06	-63.3E+06	-71.7E+06	-90.3E+06	-101.8E+06	-88.6E+06	-101.0E+06	-111.0E+06	-105.6E+06	-110.3E+06
4	-	-15.4E+06	-53.3E+06	-44.6E+06	-67.8E+06	-74.8E+06	-100.7E+06	-103.3E+06	-98.4E+06	-125.4E+06	-113.8E+06	-113.9E+06	-113.9E+06
Average	-	-17.5E+06	-49.2E+06	-42.4E+06	-64.2E+06	-70.1E+06	-98.7E+06	-100.2E+06	-91.3E+06	-109.3E+06	-111.3E+06	-104.7E+06	-112.6E+06
Sigma	-	1.5E+06	3.2E+06	2.2E+06	2.7E+06	4.7E+06	6.2E+06	3.3E+06	5.0E+06	11.4E+06	1.8E+06	8.0E+06	1.6E+06

Measurements

FT	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1 REF	830.2E+06	837.0E+06	817.5E+06	843.7E+06	826.8E+06	824.7E+06	804.6E+06	816.6E+06	796.7E+06	806.5E+06	804.1E+06	803.4E+06	800.1E+06
ON TID samples													
8	921.1E+06	800.2E+06	771.3E+06	780.5E+06	757.0E+06	747.7E+06	725.3E+06	715.0E+06	727.1E+06	700.8E+06	711.9E+06	711.2E+06	711.9E+06
9	933.0E+06	813.8E+06	789.4E+06	798.4E+06	769.7E+06	761.0E+06	736.5E+06	729.0E+06	739.3E+06	715.8E+06	721.1E+06	721.6E+06	713.5E+06
10	939.9E+06	811.7E+06	784.9E+06	792.3E+06	770.0E+06	755.1E+06	737.4E+06	726.9E+06	737.7E+06	714.7E+06	720.1E+06	723.8E+06	711.5E+06
Statistics													
Min	921.1E+06	800.2E+06	771.3E+06	780.5E+06	757.0E+06	747.7E+06	725.3E+06	715.0E+06	727.1E+06	700.8E+06	711.9E+06	711.2E+06	711.5E+06
Max	939.9E+06	813.8E+06	789.4E+06	798.4E+06	770.0E+06	761.0E+06	737.4E+06	729.0E+06	739.3E+06	715.8E+06	721.1E+06	723.8E+06	713.5E+06
Average	931.4E+06	808.6E+06	781.8E+06	790.4E+06	765.6E+06	754.6E+06	733.1E+06	723.6E+06	734.7E+06	710.4E+06	717.7E+06	718.9E+06	712.3E+06
Sigma	7.8E+06	6.0E+06	7.7E+06	7.4E+06	6.1E+06	5.5E+06	5.5E+06	6.2E+06	5.4E+06	6.8E+06	4.1E+06	5.5E+06	861.3E+03

Drift Calculation

FT	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
ON TID samples													
8	-	-120.9E+06	-149.8E+06	-140.5E+06	-164.1E+06	-173.4E+06	-195.8E+06	-206.1E+06	-194.0E+06	-220.3E+06	-209.2E+06	-209.9E+06	-209.2E+06
9	-	-119.3E+06	-143.6E+06	-134.7E+06	-163.4E+06	-172.0E+06	-196.5E+06	-204.1E+06	-193.8E+06	-217.2E+06	-211.9E+06	-211.4E+06	-219.5E+06
10	-	-128.2E+06	-155.1E+06	-147.6E+06	-169.9E+06	-184.8E+06	-202.5E+06	-213.0E+06	-202.2E+06	-225.3E+06	-219.8E+06	-216.1E+06	-228.4E+06
Average	-	-122.8E+06	-149.5E+06	-140.9E+06	-165.8E+06	-176.8E+06	-198.3E+06	-207.7E+06	-196.7E+06	-220.9E+06	-213.7E+06	-212.5E+06	-219.0E+06
Sigma	-	3.9E+06	4.7E+06	5.3E+06	2.9E+06	5.7E+06	3.0E+06	3.8E+06	3.9E+06	3.3E+06	4.5E+06	2.7E+06	7.8E+06

Hirex Engineering	Total Dose Radiation Test Report									Ref.:	HRX/TID/1023
	SOC2222A				STMicroelectronics				Issue:	01	

Measurements

FT	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	830.2E+06	837.0E+06	817.5E+06	843.7E+06	826.8E+06	824.7E+06	804.6E+06	816.6E+06	796.7E+06	806.5E+06	804.1E+06	803.4E+06	800.1E+06
OFF PROTON samples													
5	818.7E+06	813.2E+06	790.3E+06	792.0E+06	773.4E+06	760.3E+06	738.9E+06	732.3E+06	741.0E+06	720.6E+06	726.4E+06	718.5E+06	722.6E+06
6	821.3E+06	817.9E+06	784.0E+06	797.4E+06	778.6E+06	769.3E+06	743.2E+06	728.6E+06	737.7E+06	723.9E+06	727.8E+06	721.0E+06	718.0E+06
7	825.7E+06	821.1E+06	791.4E+06	804.1E+06	782.0E+06	767.5E+06	747.7E+06	736.4E+06	739.6E+06	722.9E+06	733.0E+06	721.3E+06	729.0E+06
Statistics													
Min	818.7E+06	813.2E+06	784.0E+06	792.0E+06	773.4E+06	760.3E+06	738.9E+06	728.6E+06	737.7E+06	720.6E+06	726.4E+06	718.5E+06	718.0E+06
Max	825.7E+06	821.1E+06	791.4E+06	804.1E+06	782.0E+06	769.3E+06	747.7E+06	736.4E+06	741.0E+06	723.9E+06	733.0E+06	721.3E+06	729.0E+06
Average	821.9E+06	817.4E+06	788.6E+06	797.8E+06	778.0E+06	765.7E+06	743.3E+06	732.4E+06	739.4E+06	722.5E+06	729.1E+06	720.3E+06	723.2E+06
Sigma	2.9E+06	3.2E+06	3.3E+06	5.0E+06	3.5E+06	3.9E+06	3.6E+06	3.2E+06	1.3E+06	1.4E+06	2.8E+06	1.3E+06	4.5E+06

Drift Calculation

FT	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
OFF PROTON samples													
5	-	-5.4E+06	-28.3E+06	-26.7E+06	-45.3E+06	-58.3E+06	-79.7E+06	-86.3E+06	-77.7E+06	-98.0E+06	-92.2E+06	-100.2E+06	-96.0E+06
6	-	-3.4E+06	-37.3E+06	-23.9E+06	-42.7E+06	-52.0E+06	-78.1E+06	-92.7E+06	-83.6E+06	-97.4E+06	-93.5E+06	-100.3E+06	-103.3E+06
7	-	-4.6E+06	-34.3E+06	-21.6E+06	-43.7E+06	-58.1E+06	-78.0E+06	-89.3E+06	-86.1E+06	-102.7E+06	-92.7E+06	-104.4E+06	-96.7E+06
Average	-	-4.5E+06	-33.3E+06	-24.0E+06	-43.9E+06	-56.1E+06	-78.6E+06	-89.4E+06	-82.4E+06	-99.4E+06	-92.8E+06	-101.6E+06	-98.7E+06
Sigma	-	839.5E+03	3.7E+06	2.1E+06	1.0E+06	2.9E+06	789.9E+03	2.6E+06	3.5E+06	2.4E+06	540.7E+03	1.9E+06	3.3E+06

Measurements

FT	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
1_REF	830.2E+06	837.0E+06	817.5E+06	843.7E+06	826.8E+06	824.7E+06	804.6E+06	816.6E+06	796.7E+06	806.5E+06	804.1E+06	803.4E+06	800.1E+06
OFF TID samples													
11	931.1E+06	818.1E+06	792.0E+06	795.8E+06	775.0E+06	750.9E+06	736.2E+06	732.3E+06	747.7E+06	702.4E+06	724.1E+06	715.4E+06	717.5E+06
12	925.3E+06	821.9E+06	782.0E+06	795.6E+06	761.7E+06	753.9E+06	731.1E+06	725.9E+06	766.8E+06	705.8E+06	726.6E+06	714.6E+06	722.4E+06
13	929.2E+06	819.2E+06	793.6E+06	809.5E+06	782.5E+06	761.4E+06	744.4E+06	732.7E+06	741.5E+06	718.8E+06	731.1E+06	720.4E+06	717.6E+06
Statistics													
Min	925.3E+06	818.1E+06	782.0E+06	795.6E+06	761.7E+06	750.9E+06	731.1E+06	725.9E+06	741.5E+06	702.4E+06	724.1E+06	714.6E+06	717.5E+06
Max	931.1E+06	821.9E+06	793.6E+06	809.5E+06	782.5E+06	761.4E+06	744.4E+06	732.7E+06	766.8E+06	718.8E+06	731.1E+06	720.4E+06	722.4E+06
Average	928.5E+06	819.7E+06	789.2E+06	800.3E+06	773.1E+06	755.4E+06	737.2E+06	730.3E+06	752.0E+06	709.0E+06	727.3E+06	716.8E+06	719.2E+06
Sigma	2.4E+06	1.6E+06	5.1E+06	6.5E+06	8.6E+06	4.4E+06	5.5E+06	3.1E+06	10.8E+06	7.0E+06	2.9E+06	2.6E+06	2.3E+06

Drift Calculation

FT	0 kRad	10.8 kRad	25.2 kRad	48.6 kRad	91.8 kRad	148.5 kRad	196.2 kRad	240.3 kRad	283.5 kRad	324.9 kRad	386.1 kRad	24 Hours	168 Hours
OFF TID samples													
11	-	-113.0E+06	-139.2E+06	-135.3E+06	-156.1E+06	-180.2E+06	-194.9E+06	-198.8E+06	-183.5E+06	-228.7E+06	-207.0E+06	-215.7E+06	-213.6E+06
12	-	-103.5E+06	-143.3E+06	-129.7E+06	-163.6E+06	-171.5E+06	-194.2E+06	-199.4E+06	-158.5E+06	-219.5E+06	-198.7E+06	-210.7E+06	-202.9E+06
13	-	-110.0E+06	-135.6E+06	-119.7E+06	-146.7E+06	-167.8E+06	-184.8E+06	-196.5E+06	-187.7E+06	-210.4E+06	-198.0E+06	-208.8E+06	-211.6E+06
Average	-	-108.8E+06	-139.4E+06	-128.3E+06	-155.5E+06	-173.1E+06	-191.3E+06	-198.2E+06	-176.6E+06	-219.5E+06	-201.3E+06	-211.8E+06	-209.4E+06
Sigma	-	4.0E+06	3.2E+06	6.5E+06	6.9E+06	5.2E+06	4.6E+06	1.2E+06	12.9E+06	7.5E+06	4.1E+06	2.9E+06	4.7E+06

Appendix 1 : Temperature Measurements

SN	Temp [°C]	Iceo [A]
spec min	110	-
spec max	110	-
8	110	2.12E-6
9	110	1.60E-6
10	110	1.56E-6
11	110	664.00E-9
12	110	1.14E-6
13	110	996.00E-9

min	664.0E-9
max	2.12E-06
moy	1.35E-06

Table 1 : Initial TID parts measurements at 110°C

SN	Temp [°C]	Iceo [A]
spec min	110	-
spec max	110	-
8	110	7.96E-6
9	110	6.55E-6
10	110	7.72E-6
11	110	7.28E-6
12	110	7.74E-6
13	110	7.59E-6

min	3.26E-6
max	12.00E-6
moy	7.55E-6

Table 2 : Final TID parts measurements at 110°C