

TOTAL DOSE RADIATION TEST REPORT

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|--|
| Part Type : BI06 |
| Package : TO-39 |
| Description : Transistors - Low power PNP |
| Manufacturer : STMicroelectronics |
| Date Code: 30945A |

Alter Italy Purchase Order N° 5503571 dated 03/26/2010

Alter Italy Technical Responsible: Alessandro Cavagnoli

| | | | | |
|--------------------------|--------------|-------------------|---------------|-------------------------------|
| Hirex reference : | HRX/TID/0771 | Issue : 01 | Date : | March 29 th , 2010 |
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|-------------------|----------------------------------|--------------------|--------|--------------|
| Hirex Engineering | Total Dose Radiation Test Report | | Ref.: | HRX/TID/0771 |
| | BI06 | STMicroelectronics | Issue: | 01 |

**TOTAL DOSE RADIATION TEST REPORT
on BI06
STMicroelectronics
Transistors - Low power PNP**

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1 Introduction

A total dose radiation verification test of the STMicroelectronics BI06, Transistors - Low power PNP has been performed with an accumulated dose of about 107 Krad(Si) at a dose rate of 275 rad(Si)/hour, in response to Alter Italy purchase order reference 5503571.

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 Italy.

Test has been performed in accordance with Hirex Engineering proposal reference HRX/PRO/2906 Issue 01 dated 12/09/2009.

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 proposal: HRX/PRO/2906 Issue 01 dated 12/09/2009
- Alter Italy specification: TPR/PL/STM/1151 issue 01 dated 12/17/2009.

2.2 Reference Documents

- NA

3 Test Samples

6 samples of the BI06 device were tested (5 ON + 1 control sample).

Samples were allocated into the bias conditions during exposures and annealing as provided in the following table.

| Serial Number | Allocation |
|---------------|------------|
| 1 | Control |
| 2 | Biased ON |
| 3 | Biased ON |
| 4 | Biased ON |
| 5 | Biased ON |
| 6 | Biased ON |

Identification of the BI06 is given below:

Part Number: BI06

Top Marking: BI06 logo 30945A FR serial

Diffusion Lot:

Date Code: 30945A

4 Experimental Conditions

4.1 Radiation Source Dose Rate and Annealing

The dose exposures were performed at ENEA in the Calliope plant located at the CASACCIA research centre in ROME (Italy).

The γ irradiation plant is a pool-type irradiation facility equipped with a ^{60}Co gamma source in a large shielded panoramic room. The storage water pool, that houses the source, has dimensions of 2x4.4x8 m³.

The emitted radiation has two photons of 1.173 and 1.332 MeV working in coincidence with a mean photon's energy of 1.25 MeV.

It is possible to vary the dose rate by simply adjusting the distance of devices under test to the source in a range of a few rad/H up to 2 Mrad/H.

The main Calliope features are reported in the table and Figure 1 below.

| | |
|------------------------|--|
| Source: | ^{60}Co |
| Geometry: | Cylindrical rack with radioisotope pencils placed on two levels of external rack surface |
| Emitted radiation: | 2 γ photons emitted in coincidence |
| Photons Energy: | 1.173 and 1.332 MeV (average 1.25 MeV) |
| Max licensed activity: | 3.7×10^{15} Bq (100 kCi) |
| Dose rate range: | Few rad/h up to 2 Mrad/h |

Table 1 : Calliope main features

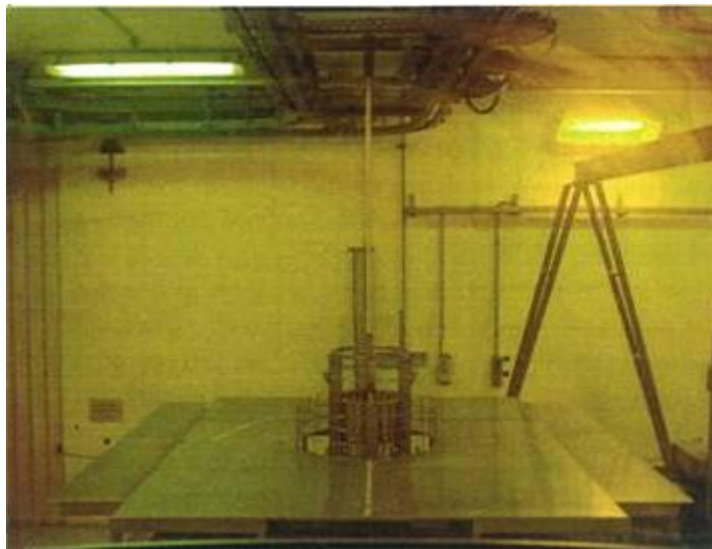


Figure 1 : View of the ^{60}Co γ source through the yellow lead window of the control room

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

| Irradiation Steps | Dose rate | Annealing steps | Temperature |
|-------------------|-----------|-----------------|-------------|
| krads | krads/h | Hours | °C |
| 0 | | | |
| 25.9 | 0.275 | | Room |
| 51.7 | 0.275 | | Room |
| 77.5 | 0.275 | | Room |
| 107.9 | 0.275 | | Room |
| | | 24 | Room |
| | | 168 | 100 |

4.2 Bias during Dose Exposures and Measurements conditions

4.2.1 Bias conditions

During exposures test board allowed to bias 5 samples in accordance with the electrical circuit provided in Figure 1.

During annealing steps the same stress conditions were applied at 25°C and 100°C temperatures.

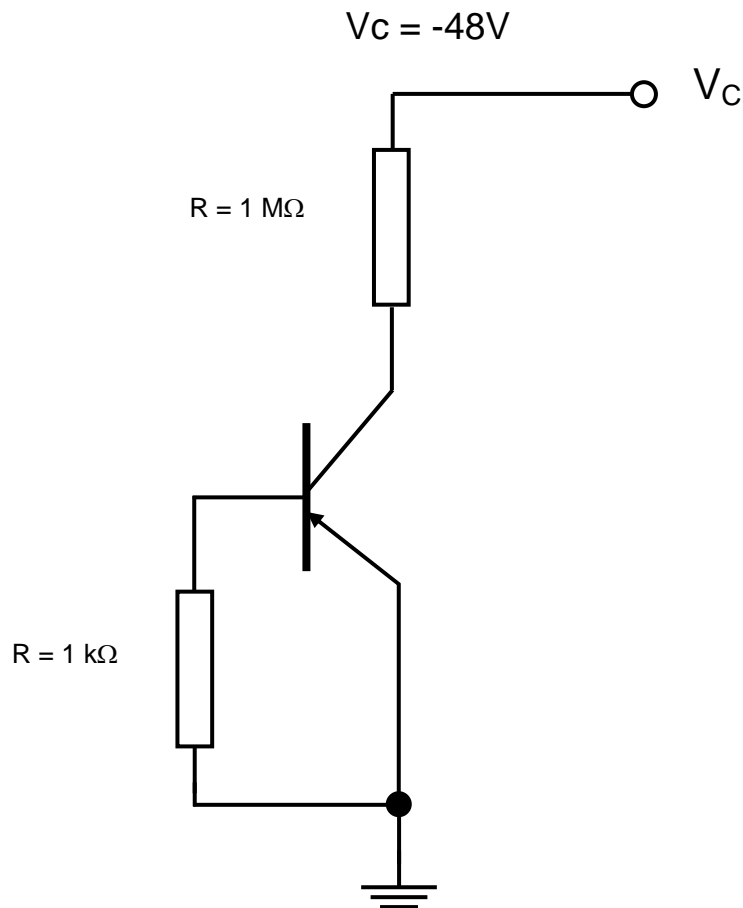


Figure 2 : Bias Conditions during Irradiation Exposures and Annealing

| | | | | |
|-------------------|----------------------------------|--------------------|--------|--------------|
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4.2.2 Electrical Measurements

Electrical parameters test program principle for BI06 is provided in Figure 2.

One HP4142 DC tester was 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.

Test results were automatically loaded in an Excel worksheet and compared in real time to specification limits.

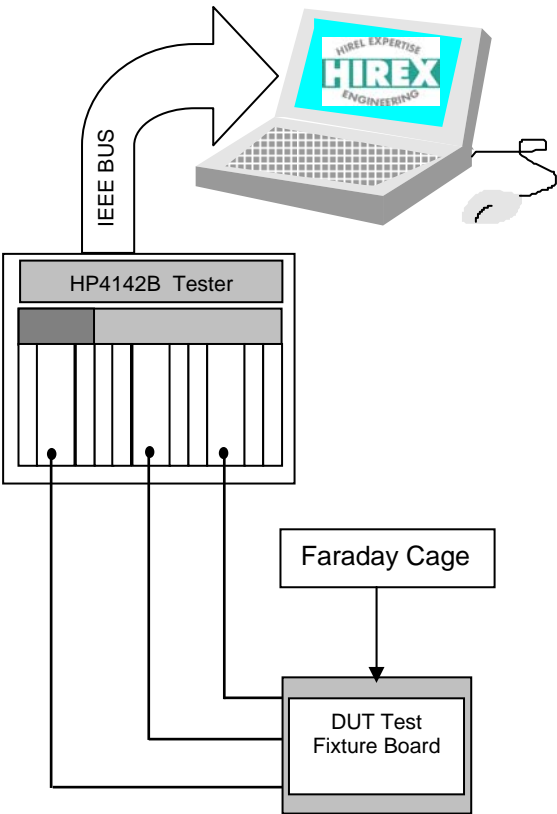


Figure 3 : BI06 test program principle

Electrical parameters test conditions and limits used for performing this test are given in the following table.

| PARAMETERS | SYMBOLS | TEST CONDITIONS | MIN | MAX | UNITS |
|--------------------------------------|---------------------------|-------------------------|------------|--------|-------|
| Collector emitter voltage base open | V(BR)CEO | Ic = -100mA | | -60.0 | V |
| Collector base cut off current | ICBO | Vcb = -60V | -100.0E-09 | | A |
| Emitter base cut off current | IEBO | Veb = -6V | -100.0E-09 | | A |
| Forward current transfer ratio 1 | HFE1 | Vce = -2V ; Ic = -100nA | 10.00 | | - |
| Forward current transfer ratio 2 | HFE2 | Vce = -2V ; Ic = -1µA | 10.00 | | - |
| Forward current transfer ratio 3 | HFE3 | Vce = -2V ; Ic = -100µA | 10.00 | | - |
| Forward current transfer ratio 4 | HFE4 | Vce = -2V ; Ic = -1mA | 10.00 | | - |
| Forward current transfer ratio 5 | HFE5 | Vce = -2V ; Ic = -10mA | 10.00 | | - |
| Forward current transfer ratio 6 | HFE6 | Vce = -2V ; Ic = -100mA | 80.00 | | - |
| Forward current transfer ratio 7 | HFE7 | Vce = -2V ; Ic = -500mA | 10.00 | | - |
| Forward current transfer ratio 8 | HFE8 | Vce = -2V ; Ic = -1A | 160.00 | 400.00 | - |
| Forward current transfer ratio 9 | HFE9 | Vce = -2V ; Ic = -2A | 10.00 | | - |
| Collector emitter saturation voltage | VCE(SAT)1 | Ic = -2A ; Ib = -100mA | -400.0E-03 | | V |
| Collector emitter saturation voltage | VCE(SAT)2 | Ic = -3A ; Ib = -150mA | -600.0E-03 | | V |
| Base emitter saturation voltage | VBE(SAT) | Ic = -2A ; Ib = -100mA | -1.2 | | V |
| Base emitter voltage | VBE1 | Vce = -2V ; Ic = -100nA | -1.5 | | V |
| Base emitter voltage | VBE2 | Vce = -2V ; Ic = -1µA | -1.5 | | V |
| Base emitter voltage | VBE3 | Vce = -2V ; Ic = -100µA | -1.5 | | V |
| Base emitter voltage | VBE4 | Vce = -2V ; Ic = -1mA | -1.5 | | V |
| Base emitter voltage | VBE5 | Ic = -100mA | | -60.0 | V |
| Base emitter voltage | VBE6 | Vcb = -60V | -100.0E-09 | | V |
| Base emitter voltage | VBE7 | Veb = -6V | -100.0E-09 | | V |
| Base emitter voltage | VBE8 | Vce = -2V ; Ic = -100nA | 10.00 | | V |
| Base emitter voltage | VBE9 | Vce = -2V ; Ic = -1µA | 10.00 | | V |

Table 2 : Measured electrical parameters

| | | | | |
|-------------------|----------------------------------|--------------------|--------|--------------|
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5 Conclusion

A Total Ionizing Dose verification test was carried out by Hirex Engineering under Alter Italy contract on the STMicroelectronics BI06 Transistors - Low power PNP in TO-39 package. 5 samples plus one control sample were used during testing. They were exposed to radiation using a dose rate of 275 rad(Si)/hour at room temperature.

A summary of the failure levels for each concerned parameter is provided in the following table. The behavior of each parameter is recorded for bias On samples. Parameters not listed remained within specification limits all along testing. Detail test results are presented in the following section.

| Parameters | Failure Level between : | | Annealing Recovery [Note 1] | | | | | Comments |
|----------------------|-------------------------|-----------------------|-----------------------------|----|---------|----------|---------|----------|
| | | | NA | No | Partial | Complete | Rebound | |
| HFE1 | ON samples | 51.7 & 77.5 kRad(Si) | | | | X | | |
| HFE2 | ON samples | 77.5 & 107.9 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 3 : Summary of parameters failure levels

Notes:

[1]: Complete recovery for HFE1 and HFE2 means that samples have been found within specification limits, but initial values obtained at initial readings have not been recovered.

[2]: SN 6 was send back to Alter Italy on his demand after 107 kRad(Si) exposure step. Consequently, there is no data on this sample after 24h and 168h annealing steps.

| | | | | |
|-------------------|----------------------------------|--------------------|--------|--------------|
| Hirex Engineering | Total Dose Radiation Test Report | | Ref.: | HRX/TID/0771 |
| | B106 | STMicroelectronics | Issue: | 01 |

6 Test Results

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

Failed values with respect to specified limits are highlighted in bold red font in the tables.

Post irradiation values are calculated using 3σ approach.

- For positive variation $(X)_{LOT+} = \text{mean}(X) + 3 \times \sigma(X)$
- For negative variation $(X)_{LOT-} = \text{mean}(X) - 3 \times \sigma(X)$
- $(X)_{LOT \text{ WORST CASE}} = \text{Worstcase}((X)_{LOT+}, (X)_{LOT-})$

Post irradiation parameters drifts (noted ΔX) are defined as follows:

$$\Delta X = X_{\text{post rad}} - X_{\text{initial}}$$

Where $X_{\text{post rad}}$ stands for the value of X after irradiation (at 50krads (Si), 70krads (Si) or 100krads (Si)) and X_{initial} stands for the pre-irradiation value of X.

Post irradiation drift values are calculated using 3σ approach.

- For positive variation $\Delta(X)_{LOT+} = \text{mean}(\Delta X) + 3 \times \sigma(\Delta X)$
- For negative variation $\Delta(X)_{LOT-} = \text{mean}(\Delta X) - 3 \times \sigma(\Delta X)$
- $\Delta(X)_{LOT \text{ WORST CASE}} = \text{Worstcase}(\Delta(X)_{LOT+}, \Delta(X)_{LOT-})$

For bipolar transistors, drifts on forward current transfer ratio are calculated as follows:

$$\Delta\left(\frac{1}{h_{FE}}\right)_{LOT} = \text{mean}\left(\Delta\frac{1}{h_{FE}}\right) + 3 \times \sigma\left(\Delta\frac{1}{h_{FE}}\right)$$

$$[h_{FE}]_{\text{POST RAD}} = \frac{1}{\Delta\left(\frac{1}{h_{FE}}\right)_{LOT} + \frac{1}{h_{FE(\text{min})}}}$$

Where σ stands for standard deviation and $h_{FE(\text{min})}$ stands for the pre-irradiation spec minimum h_{FE} limit available in table 2.

Test conditions : TID

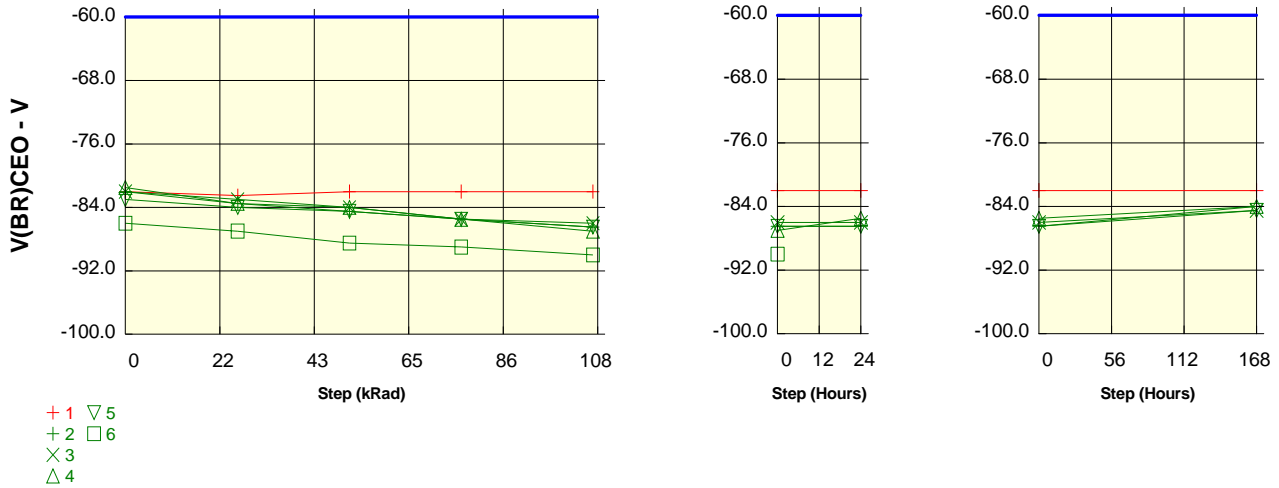
Parameter : Collector to Emitter Breakdown Voltage : V(BR)CEO

Ic = -100mA

Unit : V

Spec Limit Max : -60.0

Spec limits are represented in bold lines on the graphic.



Measurements

| V(BR)CEO | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|---------------------|--------|-----------|-----------|-----------|------------|----------|-----------|
| 1_REF | -82.0 | -82.5 | -82.0 | -82.0 | -82.0 | -82.0 | -82.0 |
| ON samples | | | | | | | |
| 2 | -82.0 | -83.5 | -84.5 | -85.5 | -86.5 | -86.5 | -84.0 |
| 3 | -82.0 | -83.0 | -84.0 | -85.5 | -86.0 | -86.0 | -84.5 |
| 4 | -81.5 | -83.5 | -84.0 | -85.5 | -87.0 | -85.5 | -84.0 |
| 5 | -83.0 | -84.0 | -84.5 | -85.5 | -86.5 | -86.5 | -84.5 |
| 6 | -86.0 | -87.0 | -88.5 | -89.0 | -90.0 | | |
| Statistics | | | | | | | |
| Min | -86.0 | -87.0 | -88.5 | -89.0 | -90.0 | -86.5 | -84.5 |
| Max | -81.5 | -83.0 | -84.0 | -85.5 | -86.0 | -85.5 | -84.0 |
| Average | -82.9 | -84.2 | -85.1 | -86.2 | -87.2 | -86.1 | -84.3 |
| Sigma | 1.6 | 1.4 | 1.7 | 1.4 | 1.4 | 0.4 | 0.3 |
| (V(B) Lot WorstCase | -78.0 | -79.9 | -80.0 | -82.0 | -82.9 | -84.9 | -83.5 |

Drift Calculation

| V(BR)CEO | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|----------------------|--------|-------------|------------|------------|------------|------------|-------------|
| ON samples | | | | | | | |
| 2 | - | -1.50E+00 | -2.50E+00 | -3.50E+00 | -4.50E+00 | -4.50E+00 | -2.00E+00 |
| 3 | - | -1.00E+00 | -2.00E+00 | -3.50E+00 | -4.00E+00 | -4.00E+00 | -2.50E+00 |
| 4 | - | -2.00E+00 | -2.50E+00 | -4.00E+00 | -5.50E+00 | -4.00E+00 | -2.50E+00 |
| 5 | - | -1.00E+00 | -1.50E+00 | -2.50E+00 | -3.50E+00 | -3.50E+00 | -1.50E+00 |
| 6 | - | -1.00E+00 | -2.50E+00 | -3.00E+00 | -4.00E+00 | | |
| Average | - | -1.30E+00 | -2.20E+00 | -3.30E+00 | -4.30E+00 | -4.00E+00 | -2.13E+00 |
| Sigma | - | 400.00E-03 | 400.00E-03 | 509.90E-03 | 678.23E-03 | 353.55E-03 | 414.58E-03 |
| d(V(B) Lot WorstCase | - | -100.00E-03 | -1.00E+00 | -1.77E+00 | -2.27E+00 | -2.94E+00 | -881.27E-03 |

Test conditions : TID

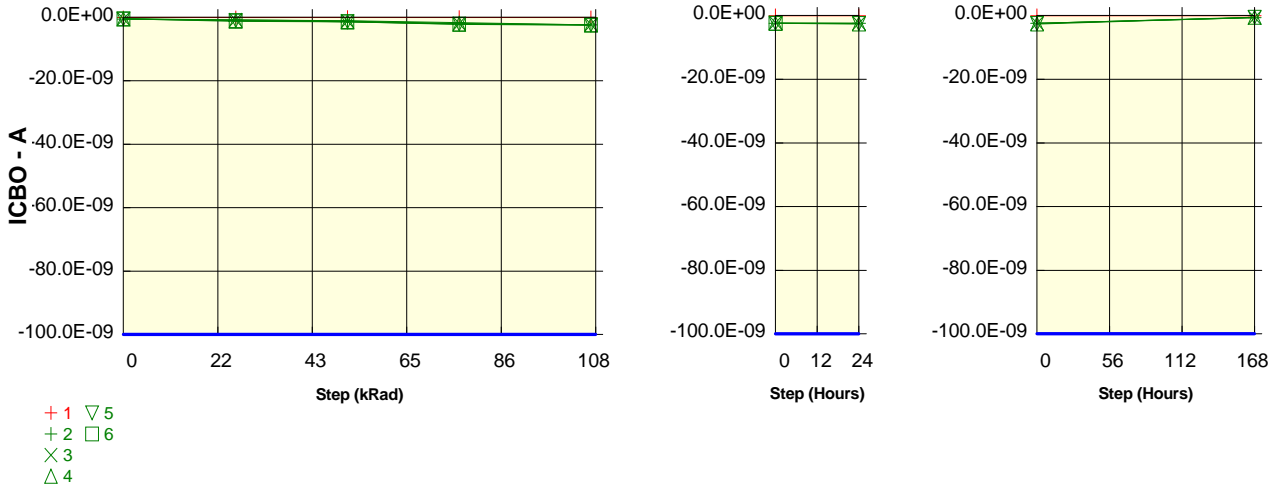
Parameter : Collector Base cut-off current : ICBO

Vcb = -60V

Unit : A

Spec Limit Min : -100.0E-09

Spec limits are represented in bold lines on the graphic.



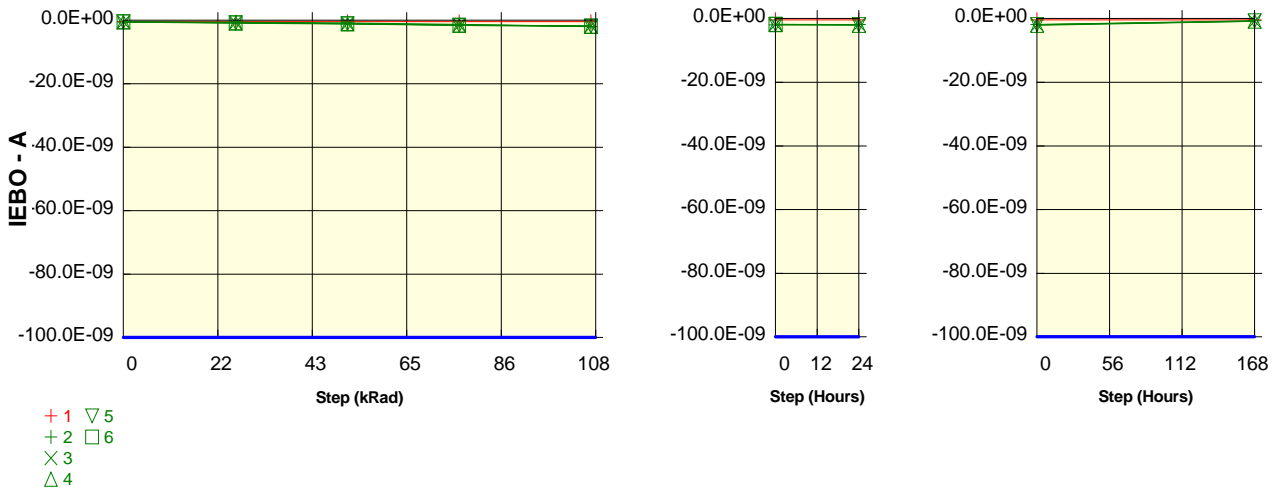
Measurements

| ICBO | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|----------------------|------------|------------|-----------|-----------|------------|-----------|------------|
| 1 REF | -36.6E-12 | -69.9E-12 | -34.1E-12 | -28.4E-12 | -36.5E-12 | -37.3E-12 | -39.8E-12 |
| ON samples | | | | | | | |
| 2 | -584.4E-12 | -815.3E-12 | -1.1E-09 | -1.7E-09 | -2.4E-09 | -2.4E-09 | -632.6E-12 |
| 3 | -479.6E-12 | -855.3E-12 | -1.2E-09 | -2.0E-09 | -2.3E-09 | -2.4E-09 | -678.4E-12 |
| 4 | -532.5E-12 | -1.1E-09 | -1.4E-09 | -2.1E-09 | -2.4E-09 | -2.6E-09 | -550.7E-12 |
| 5 | -572.3E-12 | -1.0E-09 | -1.4E-09 | -2.1E-09 | -2.4E-09 | -2.5E-09 | -522.1E-12 |
| 6 | -500.1E-12 | -1.2E-09 | -1.5E-09 | -2.2E-09 | -2.5E-09 | | |
| Statistics | | | | | | | |
| Min | -584.4E-12 | -1.2E-09 | -1.5E-09 | -2.2E-09 | -2.5E-09 | -2.6E-09 | -678.4E-12 |
| Max | -479.6E-12 | -815.3E-12 | -1.1E-09 | -1.7E-09 | -2.3E-09 | -2.4E-09 | -522.1E-12 |
| Average | -533.8E-12 | -1.0E-09 | -1.3E-09 | -2.0E-09 | -2.4E-09 | -2.5E-09 | -595.9E-12 |
| Sigma | 40.3E-12 | 156.1E-12 | 140.3E-12 | 187.9E-12 | 68.2E-12 | 90.8E-12 | 62.5E-12 |
| d(ICB) Lot WorstCase | -654.6E-12 | -1.5E-09 | -1.7E-09 | -2.6E-09 | -2.6E-09 | -2.8E-09 | -783.5E-12 |

Drift Calculation

| ICBO | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|----------------------|--------|-------------|-------------|------------|------------|-----------|-------------|
| ON samples | | | | | | | |
| 2 | - | -230.98E-12 | -515.24E-12 | -1.11E-09 | -1.84E-09 | -1.83E-09 | -48.20E-12 |
| 3 | - | -375.70E-12 | -723.00E-12 | -1.51E-09 | -1.81E-09 | -1.92E-09 | -198.76E-12 |
| 4 | - | -574.30E-12 | -824.10E-12 | -1.56E-09 | -1.88E-09 | -2.09E-09 | -18.16E-12 |
| 5 | - | -429.90E-12 | -840.90E-12 | -1.57E-09 | -1.82E-09 | -1.96E-09 | 50.18E-12 |
| 6 | - | -735.50E-12 | -982.70E-12 | -1.75E-09 | -2.00E-09 | | |
| Average | - | -469.28E-12 | -777.19E-12 | -1.50E-09 | -1.87E-09 | -1.95E-09 | -53.74E-12 |
| Sigma | - | 172.63E-12 | 154.95E-12 | 209.69E-12 | 69.16E-12 | 92.25E-12 | 91.00E-12 |
| d(ICB) Lot WorstCase | - | -987.15E-12 | -1.24E-09 | -2.13E-09 | -2.08E-09 | -2.23E-09 | -326.75E-12 |

Test conditions : TID
Parameter : Emitter Base cut-off current : IEBO
Veb = -6V
 Unit : A
 Spec Limit Min : -100.0E-09
 Spec limits are represented in bold lines on the graphic.



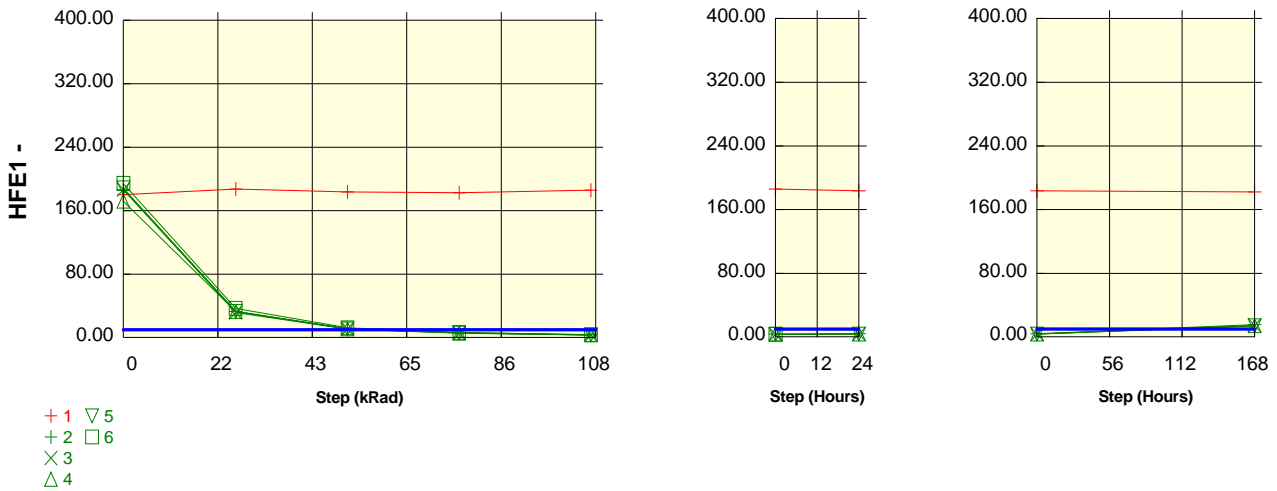
Measurements

| IEBO | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|----------------------------|------------|------------|------------|------------|------------|------------|------------|
| 1_REF | -387.2E-12 | -389.1E-12 | -372.6E-12 | -366.6E-12 | -382.0E-12 | -371.6E-12 | -375.6E-12 |
| ON samples | | | | | | | |
| 2 | -561.5E-12 | -612.5E-12 | -877.2E-12 | -1.3E-09 | -2.0E-09 | -1.9E-09 | -701.6E-12 |
| 3 | -561.7E-12 | -709.3E-12 | -1.0E-09 | -1.5E-09 | -1.8E-09 | -1.9E-09 | -805.6E-12 |
| 4 | -591.5E-12 | -933.3E-12 | -1.2E-09 | -1.6E-09 | -1.9E-09 | -2.1E-09 | -852.2E-12 |
| 5 | -543.7E-12 | -785.7E-12 | -1.1E-09 | -1.6E-09 | -1.8E-09 | -1.9E-09 | -717.9E-12 |
| 6 | -445.6E-12 | -811.2E-12 | -1.1E-09 | -1.5E-09 | -1.8E-09 | | |
| Statistics | | | | | | | |
| Min | -591.5E-12 | -933.3E-12 | -1.2E-09 | -1.6E-09 | -2.0E-09 | -2.1E-09 | -852.2E-12 |
| Max | -445.6E-12 | -612.5E-12 | -877.2E-12 | -1.3E-09 | -1.8E-09 | -1.9E-09 | -701.6E-12 |
| Average | -540.8E-12 | -770.4E-12 | -1.1E-09 | -1.5E-09 | -1.9E-09 | -2.0E-09 | -769.3E-12 |
| Sigma | 50.0E-12 | 106.9E-12 | 106.7E-12 | 119.4E-12 | 70.3E-12 | 87.8E-12 | 62.1E-12 |
| (IEB) Lot WorstCase | -690.9E-12 | -1.1E-09 | -1.4E-09 | -1.9E-09 | -2.1E-09 | -2.2E-09 | -955.6E-12 |

Drift Calculation

| IEBO | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|-----------------------------|--------|-------------|-------------|-------------|------------|-----------|-------------|
| ON samples | | | | | | | |
| 2 | - | -51.02E-12 | -315.72E-12 | -715.28E-12 | -1.39E-09 | -1.31E-09 | -140.08E-12 |
| 3 | - | -147.54E-12 | -464.68E-12 | -915.68E-12 | -1.21E-09 | -1.35E-09 | -243.92E-12 |
| 4 | - | -341.88E-12 | -605.74E-12 | -1.03E-09 | -1.35E-09 | -1.51E-09 | -260.76E-12 |
| 5 | - | -241.94E-12 | -571.46E-12 | -1.01E-09 | -1.29E-09 | -1.39E-09 | -174.14E-12 |
| 6 | - | -365.66E-12 | -636.44E-12 | -1.10E-09 | -1.39E-09 | | |
| Average | - | -229.61E-12 | -518.81E-12 | -955.20E-12 | -1.33E-09 | -1.39E-09 | -204.72E-12 |
| Sigma | - | 118.23E-12 | 116.91E-12 | 133.21E-12 | 69.31E-12 | 75.30E-12 | 49.47E-12 |
| d(IEB) Lot WorstCase | - | -584.31E-12 | -869.54E-12 | -1.35E-09 | -1.53E-09 | -1.62E-09 | -353.15E-12 |

Test conditions : TID
Parameter : Forward current transfer ratio 1 : HFE1
Vce = -2V ; Ic = -100nA
 Unit :
 Spec Limit Min : 10.00
 Spec limits are represented in bold lines on the graphic.



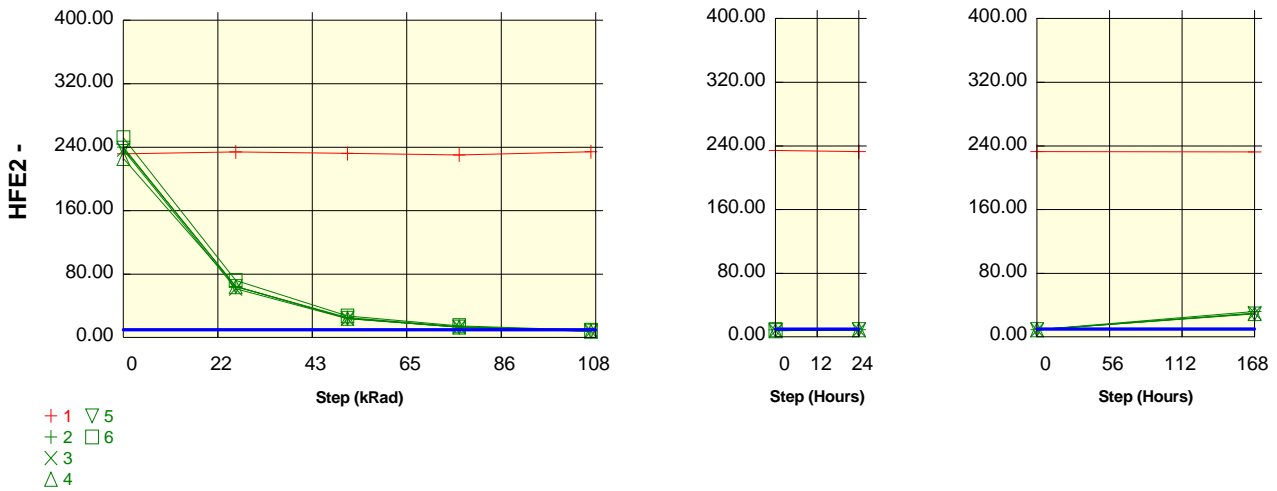
Measurements

| HFE1 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|---------------------|--------|-----------|-----------|-------------|-------------|-------------|-----------|
| 1 REF | 180.08 | 187.28 | 183.59 | 182.65 | 185.59 | 183.56 | 182.17 |
| ON samples | | | | | | | |
| 2 | 186.39 | 32.64 | 11.19 | 6.19 | 3.60 | 3.83 | 15.52 |
| 3 | 186.66 | 31.46 | 10.66 | 5.52 | 3.19 | 3.57 | 14.53 |
| 4 | 171.82 | 32.78 | 10.87 | 5.57 | 3.23 | 3.72 | 13.97 |
| 5 | 188.62 | 32.98 | 10.90 | 5.58 | 3.24 | 3.70 | 13.80 |
| 6 | 194.22 | 36.72 | 12.37 | 6.35 | 3.69 | | |
| Statistics | | | | | | | |
| Min | 171.82 | 31.46 | 10.66 | 5.52 | 3.19 | 3.57 | 13.80 |
| Max | 194.22 | 36.72 | 12.37 | 6.35 | 3.69 | 3.83 | 15.52 |
| Average | 185.54 | 33.32 | 11.20 | 5.84 | 3.39 | 3.70 | 14.45 |
| Sigma | 7.42 | 1.78 | 0.61 | 0.35 | 0.21 | 0.09 | 0.67 |
| (HFE) Lot WorstCase | 163.30 | 27.96 | 9.37 | 4.78 | 2.76 | 3.43 | 12.44 |

Drift Calculation

| HFE1 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|------------------------|--------|-----------|-----------|------------|------------|------------|-----------|
| ON samples | | | | | | | |
| 2 | - | 25.27E-03 | 83.99E-03 | 156.11E-03 | 272.38E-03 | 255.87E-03 | 59.09E-03 |
| 3 | - | 26.43E-03 | 88.47E-03 | 175.71E-03 | 307.86E-03 | 274.50E-03 | 63.49E-03 |
| 4 | - | 24.69E-03 | 86.17E-03 | 173.61E-03 | 303.61E-03 | 263.35E-03 | 65.77E-03 |
| 5 | - | 25.02E-03 | 86.41E-03 | 174.03E-03 | 303.82E-03 | 264.79E-03 | 67.18E-03 |
| 6 | - | 22.08E-03 | 75.68E-03 | 152.40E-03 | 265.77E-03 | | |
| Average | - | 24.70E-03 | 84.14E-03 | 166.37E-03 | 290.69E-03 | 264.63E-03 | 63.88E-03 |
| Sigma | - | 1.43E-03 | 4.46E-03 | 9.99E-03 | 17.83E-03 | 6.63E-03 | 3.07E-03 |
| d(1/HFE) Lot WorstCase | - | 29.00E-03 | 97.54E-03 | 196.34E-03 | 344.19E-03 | 284.51E-03 | 73.08E-03 |

Test conditions : TID
Parameter : Forward current transfer ratio 2 : HFE2
Vce = -2V ; Ic = -1µA
 Unit :
 Spec Limit Min : 10.00
 Spec limits are represented in bold lines on the graphic.



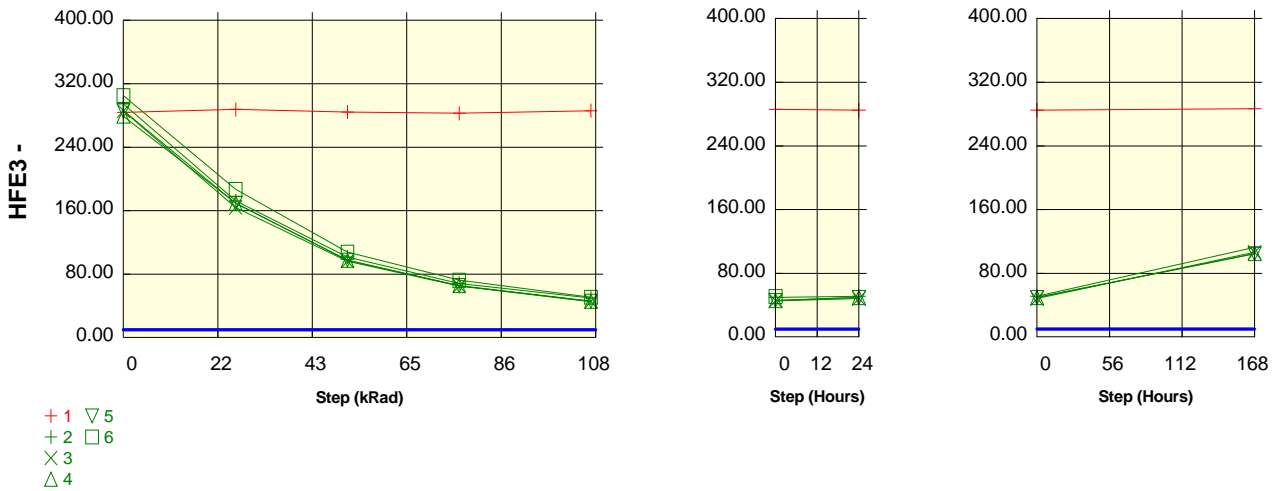
Measurements

| HFE2 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|---------------------|--------|-----------|-----------|-----------|------------|----------|-----------|
| 1 REF | 231.58 | 233.96 | 232.11 | 230.19 | 234.25 | 232.80 | 232.39 |
| ON samples | | | | | | | |
| 2 | 240.20 | 64.44 | 25.08 | 13.64 | 8.77 | 9.27 | 32.03 |
| 3 | 236.81 | 61.68 | 23.78 | 13.06 | 7.92 | 8.69 | 30.06 |
| 4 | 225.82 | 64.16 | 24.16 | 13.16 | 7.93 | 9.01 | 29.26 |
| 5 | 238.68 | 64.39 | 24.19 | 13.15 | 8.01 | 9.00 | 29.04 |
| 6 | 251.97 | 71.88 | 27.27 | 14.82 | 9.06 | | |
| Statistics | | | | | | | |
| Min | 225.82 | 61.68 | 23.78 | 13.06 | 7.92 | 8.69 | 29.04 |
| Max | 251.97 | 71.88 | 27.27 | 14.82 | 9.06 | 9.27 | 32.03 |
| Average | 238.70 | 65.31 | 24.90 | 13.57 | 8.34 | 8.99 | 30.10 |
| Sigma | 8.34 | 3.44 | 1.26 | 0.66 | 0.48 | 0.20 | 1.18 |
| (HFE) Lot WorstCase | 213.68 | 54.98 | 21.11 | 11.59 | 6.90 | 8.38 | 26.56 |

Drift Calculation

| HFE2 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|------------------------|--------|------------|-----------|-----------|------------|------------|-----------|
| ON samples | | | | | | | |
| 2 | - | 11.36E-03 | 35.71E-03 | 69.14E-03 | 109.83E-03 | 103.74E-03 | 27.06E-03 |
| 3 | - | 11.99E-03 | 37.83E-03 | 72.35E-03 | 122.08E-03 | 110.82E-03 | 29.05E-03 |
| 4 | - | 11.16E-03 | 36.97E-03 | 71.57E-03 | 121.68E-03 | 106.53E-03 | 29.74E-03 |
| 5 | - | 11.34E-03 | 37.16E-03 | 71.86E-03 | 120.58E-03 | 106.93E-03 | 30.25E-03 |
| 6 | - | 9.94E-03 | 32.70E-03 | 63.52E-03 | 106.44E-03 | | |
| Average | - | 11.16E-03 | 36.07E-03 | 69.69E-03 | 116.12E-03 | 107.01E-03 | 29.03E-03 |
| Sigma | - | 669.64E-06 | 1.82E-03 | 3.28E-03 | 6.63E-03 | 2.52E-03 | 1.21E-03 |
| d(1/HFE) Lot WorstCase | - | 13.17E-03 | 41.53E-03 | 79.52E-03 | 136.00E-03 | 114.57E-03 | 32.66E-03 |

Test conditions : TID
Parameter : Forward current transfer ratio 3 : HFE3
Vce = -2V ; Ic = -100µA
 Unit :
 Spec Limit Min : 10.00
 Spec limits are represented in bold lines on the graphic.



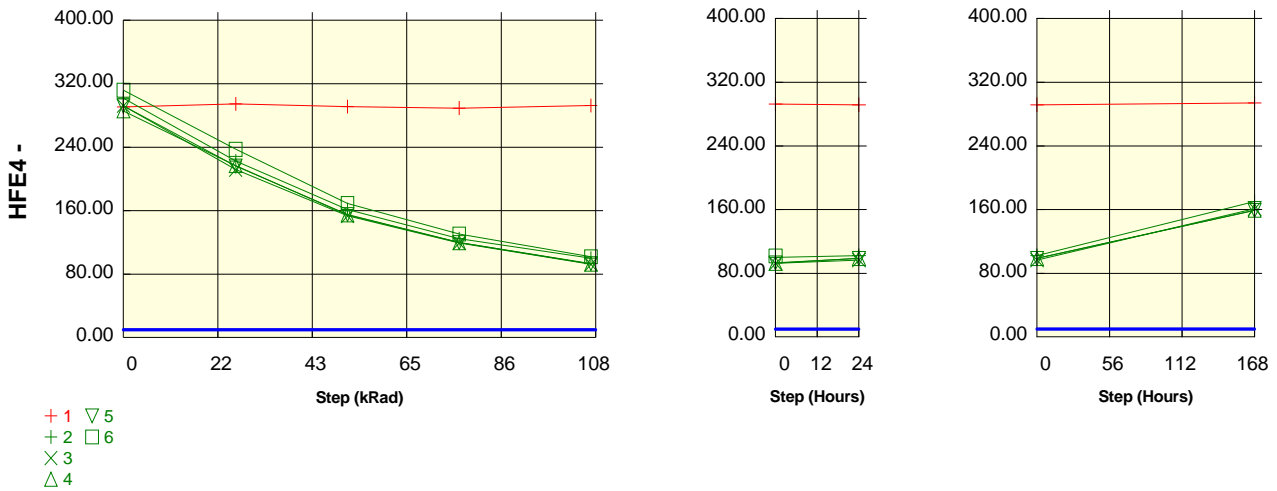
Measurements

| HFE3 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|---------------------|--------|-----------|-----------|-----------|------------|----------|-----------|
| 1 REF | 284.06 | 287.55 | 284.37 | 282.70 | 286.10 | 284.86 | 286.57 |
| ON samples | | | | | | | |
| 2 | 294.69 | 172.30 | 101.57 | 68.24 | 49.79 | 51.11 | 112.54 |
| 3 | 285.81 | 163.98 | 96.35 | 65.11 | 45.38 | 48.22 | 106.23 |
| 4 | 279.22 | 169.28 | 97.31 | 65.47 | 45.74 | 49.59 | 104.73 |
| 5 | 286.19 | 169.15 | 97.53 | 65.47 | 45.85 | 49.61 | 104.51 |
| 6 | 305.02 | 186.73 | 107.54 | 72.18 | 50.73 | | |
| Statistics | | | | | | | |
| Min | 279.22 | 163.98 | 96.35 | 65.11 | 45.38 | 48.22 | 104.51 |
| Max | 305.02 | 186.73 | 107.54 | 72.18 | 50.73 | 51.11 | 112.54 |
| Average | 290.19 | 172.29 | 100.06 | 67.29 | 47.50 | 49.63 | 107.00 |
| Sigma | 8.90 | 7.70 | 4.15 | 2.69 | 2.28 | 1.02 | 3.27 |
| (HFE) Lot WorstCase | 263.50 | 149.19 | 87.62 | 59.22 | 40.65 | 46.56 | 97.20 |

Drift Calculation

| HFE3 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|------------------------|--------|------------|------------|------------|------------|------------|------------|
| ON samples | | | | | | | |
| 2 | - | 2.41E-03 | 6.45E-03 | 11.26E-03 | 16.69E-03 | 16.17E-03 | 5.49E-03 |
| 3 | - | 2.60E-03 | 6.88E-03 | 11.86E-03 | 18.54E-03 | 17.24E-03 | 5.91E-03 |
| 4 | - | 2.33E-03 | 6.69E-03 | 11.69E-03 | 18.28E-03 | 16.58E-03 | 5.97E-03 |
| 5 | - | 2.42E-03 | 6.76E-03 | 11.78E-03 | 18.32E-03 | 16.66E-03 | 6.07E-03 |
| 6 | - | 2.08E-03 | 6.02E-03 | 10.58E-03 | 16.43E-03 | | |
| Average | - | 2.37E-03 | 6.56E-03 | 11.43E-03 | 17.65E-03 | 16.66E-03 | 5.86E-03 |
| Sigma | - | 169.86E-06 | 304.32E-06 | 476.79E-06 | 898.31E-06 | 381.14E-06 | 221.24E-06 |
| d(1/HFE) Lot WorstCase | - | 2.88E-03 | 7.47E-03 | 12.86E-03 | 20.35E-03 | 17.81E-03 | 6.53E-03 |

Test conditions : TID
Parameter : Forward current transfer ratio 4 : HFE4
Vce = -2V ; Ic = -1mA
 Unit :
 Spec Limit Min : 10.00
 Spec limits are represented in bold lines on the graphic.



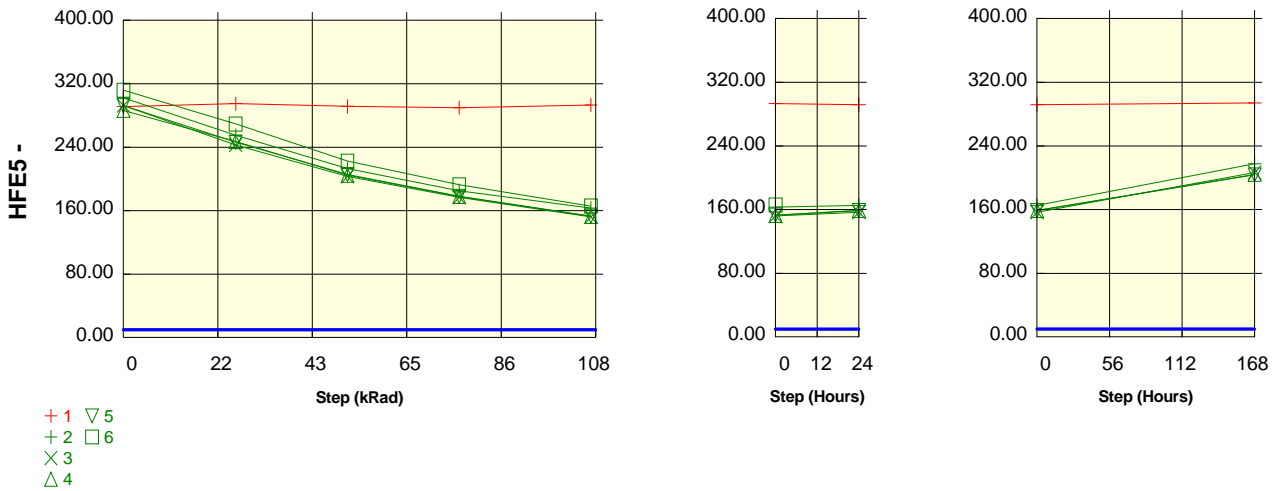
Measurements

| HFE4 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|---------------------|--------|-----------|-----------|-----------|------------|----------|-----------|
| 1 REF | 290.82 | 294.65 | 291.13 | 289.20 | 292.62 | 291.70 | 293.82 |
| ON samples | | | | | | | |
| 2 | 301.91 | 222.58 | 161.33 | 124.70 | 100.08 | 102.08 | 170.11 |
| 3 | 292.29 | 211.61 | 153.34 | 119.04 | 92.31 | 96.53 | 161.04 |
| 4 | 285.78 | 216.75 | 154.64 | 119.70 | 92.67 | 98.57 | 159.10 |
| 5 | 292.24 | 216.21 | 155.20 | 119.82 | 93.12 | 98.67 | 158.89 |
| 6 | 311.86 | 237.30 | 169.16 | 130.53 | 101.80 | | |
| Statistics | | | | | | | |
| Min | 285.78 | 211.61 | 153.34 | 119.04 | 92.31 | 96.53 | 158.89 |
| Max | 311.86 | 237.30 | 169.16 | 130.53 | 101.80 | 102.08 | 170.11 |
| Average | 296.82 | 220.89 | 158.73 | 122.76 | 96.00 | 98.96 | 162.29 |
| Sigma | 9.11 | 8.91 | 5.90 | 4.38 | 4.08 | 1.99 | 4.60 |
| (HFE) Lot WorstCase | 269.47 | 194.15 | 141.04 | 109.62 | 83.75 | 92.99 | 148.50 |

Drift Calculation

| HFE4 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|------------------------|--------|-----------|------------|------------|------------|------------|------------|
| ON samples | | | | | | | |
| 2 | - | 1.18E-03 | 2.89E-03 | 4.71E-03 | 6.68E-03 | 6.48E-03 | 2.57E-03 |
| 3 | - | 1.30E-03 | 3.10E-03 | 4.98E-03 | 7.41E-03 | 6.94E-03 | 2.79E-03 |
| 4 | - | 1.11E-03 | 2.97E-03 | 4.86E-03 | 7.29E-03 | 6.65E-03 | 2.79E-03 |
| 5 | - | 1.20E-03 | 3.02E-03 | 4.92E-03 | 7.32E-03 | 6.71E-03 | 2.87E-03 |
| 6 | - | 1.01E-03 | 2.70E-03 | 4.45E-03 | 6.62E-03 | | |
| Average | - | 1.16E-03 | 2.94E-03 | 4.78E-03 | 7.06E-03 | 6.70E-03 | 2.75E-03 |
| Sigma | - | 98.42E-06 | 135.04E-06 | 188.20E-06 | 341.90E-06 | 163.14E-06 | 113.37E-06 |
| d(1/HFE) Lot WorstCase | - | 1.46E-03 | 3.34E-03 | 5.35E-03 | 8.09E-03 | 7.18E-03 | 3.09E-03 |

Test conditions : TID
Parameter : Forward current transfer ratio 5 : HFE5
Vce = -2V ; Ic = -10mA
 Unit :
 Spec Limit Min : 10.00
 Spec limits are represented in bold lines on the graphic.



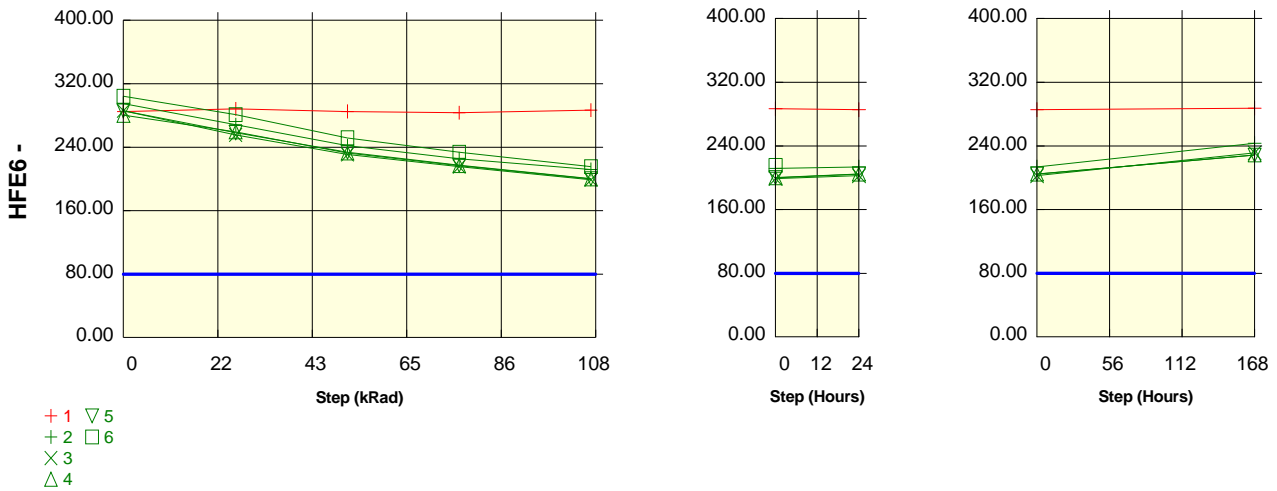
Measurements

| HFE5 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|---------------------|--------|-----------|-----------|-----------|------------|----------|-----------|
| 1 REF | 291.21 | 294.84 | 291.43 | 289.81 | 293.22 | 291.91 | 293.94 |
| ON samples | | | | | | | |
| 2 | 302.13 | 255.14 | 213.15 | 185.16 | 163.22 | 165.34 | 217.58 |
| 3 | 292.55 | 242.66 | 203.09 | 176.84 | 152.01 | 156.56 | 206.47 |
| 4 | 286.38 | 247.16 | 204.69 | 177.78 | 152.63 | 158.73 | 204.08 |
| 5 | 292.54 | 246.32 | 205.50 | 178.13 | 153.16 | 158.87 | 203.78 |
| 6 | 311.88 | 269.23 | 222.38 | 192.51 | 165.76 | | |
| Statistics | | | | | | | |
| Min | 286.38 | 242.66 | 203.09 | 176.84 | 152.01 | 156.56 | 203.78 |
| Max | 311.88 | 269.23 | 222.38 | 192.51 | 165.76 | 165.34 | 217.58 |
| Average | 297.10 | 252.10 | 209.76 | 182.08 | 157.36 | 159.88 | 207.98 |
| Sigma | 8.94 | 9.48 | 7.20 | 6.00 | 5.89 | 3.29 | 5.64 |
| (HFE) Lot WorstCase | 270.26 | 223.65 | 188.17 | 164.09 | 139.69 | 150.02 | 191.06 |

Drift Calculation

| HFE5 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|------------------------|--------|------------|-----------|-----------|------------|-----------|-----------|
| ON samples | | | | | | | |
| 2 | - | 609.67E-06 | 1.38E-03 | 2.09E-03 | 2.82E-03 | 2.74E-03 | 1.29E-03 |
| 3 | - | 702.75E-06 | 1.51E-03 | 2.24E-03 | 3.16E-03 | 2.97E-03 | 1.43E-03 |
| 4 | - | 554.09E-06 | 1.39E-03 | 2.13E-03 | 3.06E-03 | 2.81E-03 | 1.41E-03 |
| 5 | - | 641.51E-06 | 1.45E-03 | 2.20E-03 | 3.11E-03 | 2.88E-03 | 1.49E-03 |
| 6 | - | 507.93E-06 | 1.29E-03 | 1.99E-03 | 2.83E-03 | | |
| Average | - | 603.19E-06 | 1.40E-03 | 2.13E-03 | 2.99E-03 | 2.85E-03 | 1.40E-03 |
| Sigma | - | 67.69E-06 | 71.78E-06 | 86.44E-06 | 144.85E-06 | 85.22E-06 | 73.37E-06 |
| d(1/HFE) Lot WorstCase | - | 806.25E-06 | 1.62E-03 | 2.39E-03 | 3.43E-03 | 3.10E-03 | 1.62E-03 |

Test conditions : TID
Parameter : Forward current transfer ratio 6 : HFE6
Vce = -2V ; Ic = -100mA
 Unit :
 Spec Limit Min : 80.00
 Spec limits are represented in bold lines on the graphic.



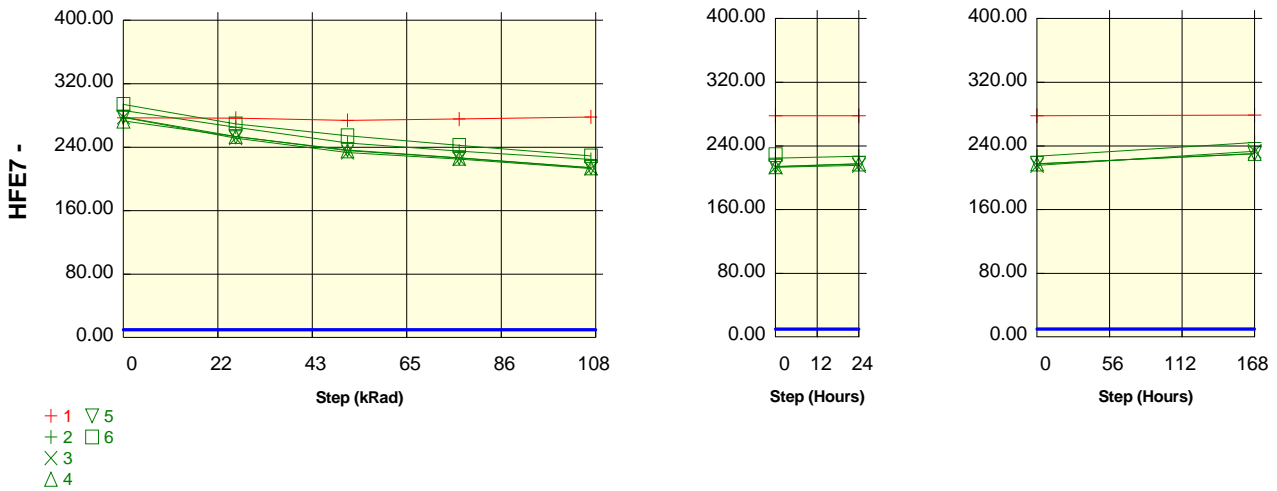
Measurements

| HFE6 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|---------------------|--------|-----------|-----------|-----------|------------|----------|-----------|
| 1 REF | 284.87 | 288.29 | 285.07 | 283.54 | 286.68 | 285.52 | 287.48 |
| ON samples | | | | | | | |
| 2 | 295.16 | 268.37 | 241.88 | 225.42 | 211.88 | 213.54 | 243.37 |
| 3 | 285.91 | 255.48 | 230.88 | 215.54 | 198.96 | 202.63 | 231.32 |
| 4 | 280.29 | 259.40 | 232.71 | 216.67 | 200.01 | 204.52 | 228.83 |
| 5 | 285.92 | 258.39 | 233.58 | 217.24 | 200.33 | 204.71 | 228.32 |
| 6 | 304.22 | 281.19 | 251.76 | 233.63 | 215.51 | | |
| Statistics | | | | | | | |
| Min | 280.29 | 255.48 | 230.88 | 215.54 | 198.96 | 202.63 | 228.32 |
| Max | 304.22 | 281.19 | 251.76 | 233.63 | 215.51 | 213.54 | 243.37 |
| Average | 290.30 | 264.57 | 238.16 | 221.70 | 205.34 | 206.35 | 232.96 |
| Sigma | 8.44 | 9.36 | 7.78 | 6.92 | 6.94 | 4.23 | 6.12 |
| (HFE) Lot WorstCase | 264.98 | 236.48 | 214.83 | 200.94 | 184.53 | 193.66 | 214.61 |

Drift Calculation

| HFE6 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|------------------------|--------|------------|------------|------------|------------|-----------|------------|
| ON samples | | | | | | | |
| 2 | - | 338.26E-06 | 746.32E-06 | 1.05E-03 | 1.33E-03 | 1.29E-03 | 720.94E-06 |
| 3 | - | 416.67E-06 | 833.69E-06 | 1.14E-03 | 1.53E-03 | 1.44E-03 | 825.48E-06 |
| 4 | - | 287.25E-06 | 729.44E-06 | 1.05E-03 | 1.43E-03 | 1.32E-03 | 802.23E-06 |
| 5 | - | 372.64E-06 | 783.70E-06 | 1.11E-03 | 1.49E-03 | 1.39E-03 | 882.34E-06 |
| 6 | - | 269.18E-06 | 684.94E-06 | 993.09E-06 | 1.35E-03 | | |
| Average | - | 336.80E-06 | 755.61E-06 | 1.07E-03 | 1.43E-03 | 1.36E-03 | 807.75E-06 |
| Sigma | - | 54.21E-06 | 50.30E-06 | 51.61E-06 | 76.74E-06 | 55.82E-06 | 57.98E-06 |
| d(1/HFE) Lot WorstCase | - | 499.42E-06 | 906.52E-06 | 1.22E-03 | 1.66E-03 | 1.53E-03 | 981.67E-06 |

Test conditions : TID
Parameter : Forward current transfer ratio 7 : HFE7
Vce = -2V ; Ic = -500mA
 Unit :
 Spec Limit Min : 10.00
 Spec limits are represented in bold lines on the graphic.



+ 1 ▽ 5
 + 2 □ 6
 X 3
 △ 4

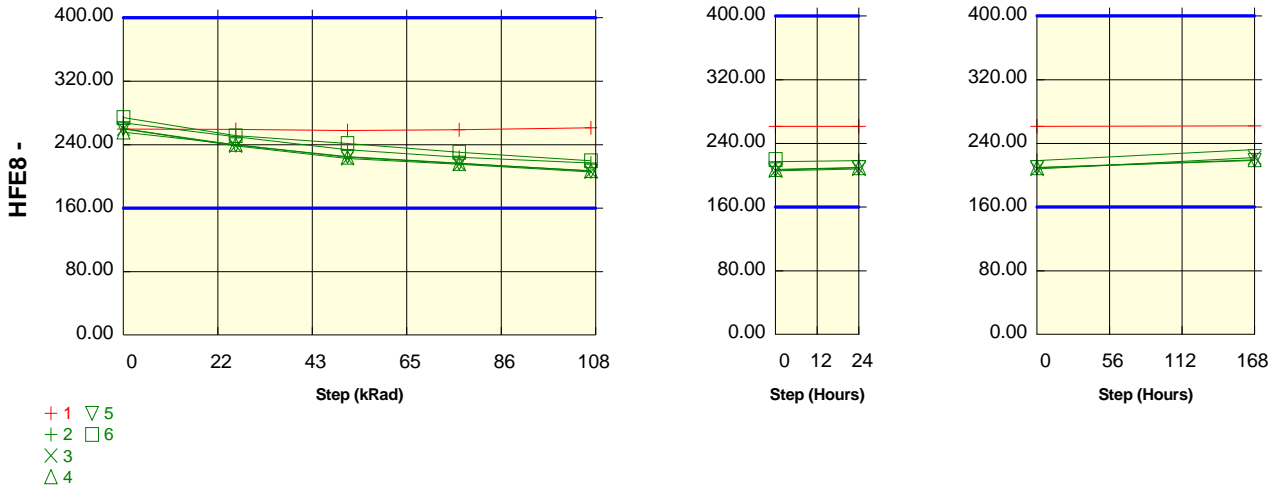
Measurements

| HFE7 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|----------------------------|--------|-----------|-----------|-----------|------------|----------|-----------|
| 1 REF | 277.06 | 276.66 | 273.90 | 275.41 | 278.12 | 277.84 | 278.65 |
| ON samples | | | | | | | |
| 2 | 286.25 | 265.10 | 245.36 | 234.86 | 224.47 | 226.87 | 244.30 |
| 3 | 277.75 | 251.45 | 233.40 | 225.02 | 213.17 | 215.43 | 233.22 |
| 4 | 272.99 | 253.49 | 235.57 | 226.19 | 213.83 | 217.34 | 230.51 |
| 5 | 277.92 | 253.21 | 236.31 | 226.67 | 214.34 | 217.78 | 229.97 |
| 6 | 293.92 | 269.26 | 254.32 | 242.11 | 229.05 | | |
| Statistics | | | | | | | |
| Min | 272.99 | 251.45 | 233.40 | 225.02 | 213.17 | 215.43 | 229.97 |
| Max | 293.92 | 269.26 | 254.32 | 242.11 | 229.05 | 226.87 | 244.30 |
| Average | 281.77 | 258.50 | 240.99 | 230.97 | 218.97 | 219.35 | 234.50 |
| Sigma | 7.43 | 7.24 | 7.82 | 6.57 | 6.53 | 4.43 | 5.79 |
| (HFE) Lot WorstCase | 259.48 | 236.78 | 217.53 | 211.25 | 199.37 | 206.07 | 217.13 |

Drift Calculation

| HFE7 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|-------------------------------|--------|------------|------------|------------|------------|------------|------------|
| ON samples | | | | | | | |
| 2 | - | 278.80E-06 | 582.17E-06 | 764.48E-06 | 961.50E-06 | 914.48E-06 | 599.94E-06 |
| 3 | - | 376.54E-06 | 684.18E-06 | 843.78E-06 | 1.09E-03 | 1.04E-03 | 687.40E-06 |
| 4 | - | 281.68E-06 | 581.77E-06 | 757.96E-06 | 1.01E-03 | 937.80E-06 | 675.08E-06 |
| 5 | - | 351.14E-06 | 633.56E-06 | 813.48E-06 | 1.07E-03 | 993.74E-06 | 750.25E-06 |
| 6 | - | 311.58E-06 | 529.75E-06 | 728.16E-06 | 963.64E-06 | | |
| Average | - | 319.95E-06 | 602.29E-06 | 781.58E-06 | 1.02E-03 | 971.91E-06 | 678.17E-06 |
| Sigma | - | 38.48E-06 | 52.48E-06 | 41.45E-06 | 52.70E-06 | 49.49E-06 | 53.41E-06 |
| d(1/HFE) Lot WorstCase | - | 435.39E-06 | 759.72E-06 | 905.92E-06 | 1.18E-03 | 1.12E-03 | 838.40E-06 |

Test conditions : TID
Parameter : Forward current transfer ratio 8 : HFE8
Vce = -2V ; Ic = -1A
 Unit :
 Spec Limit Min : 160.00
 Spec Limit Max : 400.00
 Spec limits are represented in bold lines on the graphic.



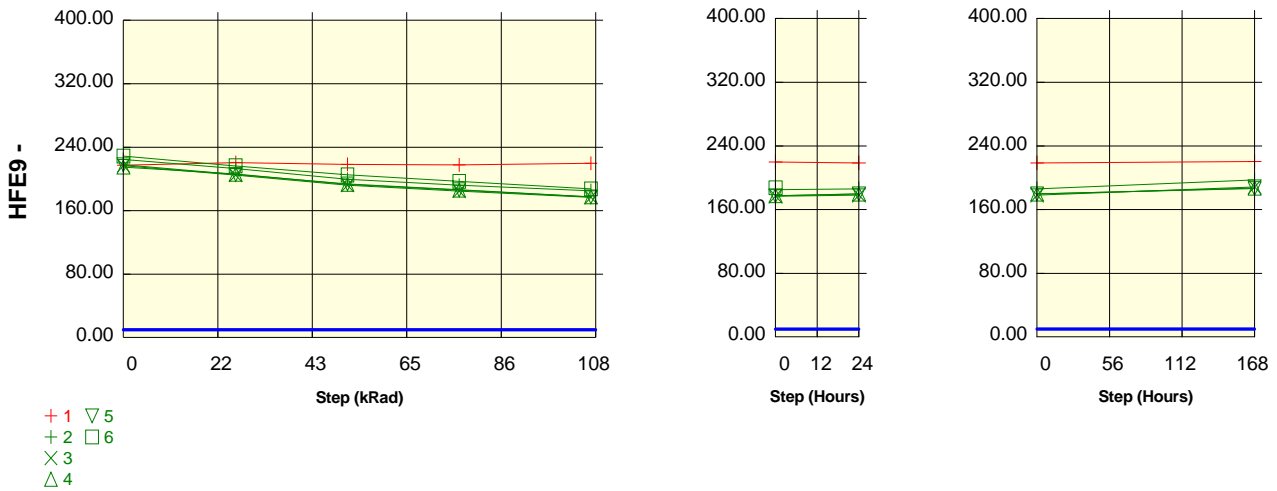
Measurements

| HFE8 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|---------------------|--------|-----------|-----------|-----------|------------|----------|-----------|
| 1_REF | 259.52 | 259.22 | 257.82 | 258.79 | 261.34 | 261.34 | 261.92 |
| ON samples | | | | | | | |
| 2 | 267.65 | 249.75 | 233.49 | 224.31 | 216.97 | 218.29 | 232.05 |
| 3 | 259.94 | 238.40 | 222.53 | 215.27 | 205.60 | 207.89 | 222.19 |
| 4 | 255.79 | 240.32 | 224.25 | 216.37 | 207.22 | 209.56 | 219.54 |
| 5 | 260.21 | 239.67 | 224.85 | 216.71 | 206.65 | 209.44 | 218.73 |
| 6 | 274.18 | 251.29 | 241.61 | 230.49 | 219.76 | | |
| Statistics | | | | | | | |
| Min | 255.79 | 238.40 | 222.53 | 215.27 | 205.60 | 207.89 | 218.73 |
| Max | 274.18 | 251.29 | 241.61 | 230.49 | 219.76 | 218.29 | 232.05 |
| Average | 263.56 | 243.88 | 229.35 | 220.63 | 211.24 | 211.29 | 223.13 |
| Sigma | 6.55 | 5.47 | 7.21 | 5.88 | 5.91 | 4.09 | 5.31 |
| (HFE) Lot WorstCase | 243.92 | 227.47 | 207.71 | 202.98 | 193.52 | 199.02 | 207.20 |

Drift Calculation

| HFE8 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|------------------------|--------|------------|------------|------------|------------|------------|------------|
| ON samples | | | | | | | |
| 2 | - | 267.81E-06 | 546.60E-06 | 721.87E-06 | 872.67E-06 | 844.90E-06 | 573.18E-06 |
| 3 | - | 347.68E-06 | 646.77E-06 | 798.28E-06 | 1.02E-03 | 963.18E-06 | 653.63E-06 |
| 4 | - | 251.60E-06 | 549.84E-06 | 712.23E-06 | 916.25E-06 | 862.44E-06 | 645.59E-06 |
| 5 | - | 329.37E-06 | 604.38E-06 | 771.42E-06 | 996.06E-06 | 931.62E-06 | 728.75E-06 |
| 6 | - | 332.33E-06 | 491.76E-06 | 691.37E-06 | 903.22E-06 | | |
| Average | - | 305.76E-06 | 567.87E-06 | 739.03E-06 | 940.98E-06 | 900.54E-06 | 650.29E-06 |
| Sigma | - | 38.46E-06 | 53.16E-06 | 39.61E-06 | 55.62E-06 | 48.57E-06 | 55.08E-06 |
| d(1/HFE) Lot WorstCase | - | 421.12E-06 | 727.34E-06 | 857.87E-06 | 1.11E-03 | 1.05E-03 | 815.53E-06 |

Test conditions : TID
Parameter : Forward current transfer ratio 9 : HFE9
Vce = -2V ; Ic = -2A
 Unit :
 Spec Limit Min : 10.00
 Spec limits are represented in bold lines on the graphic.



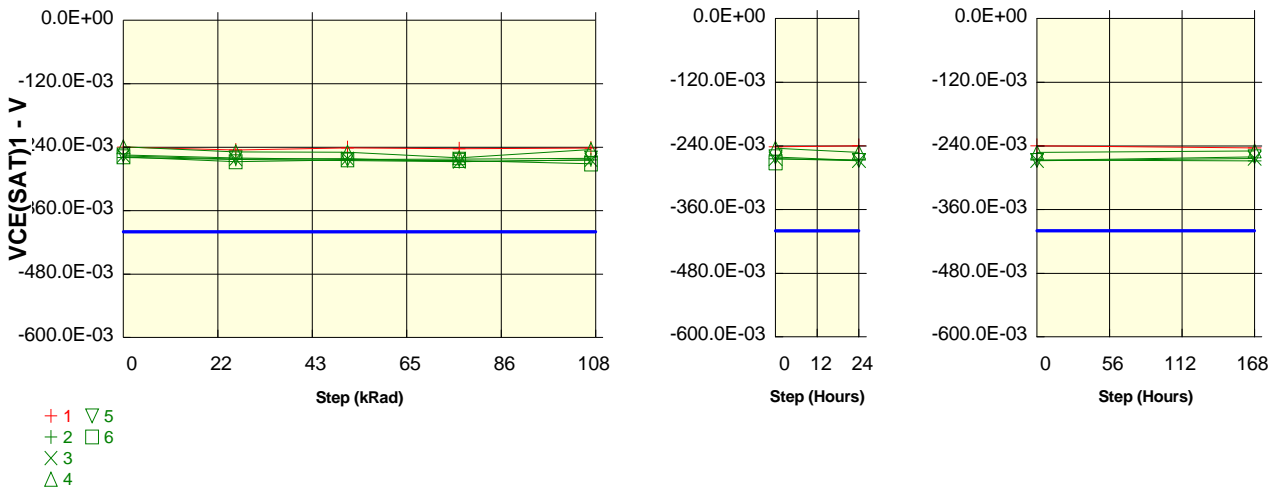
Measurements

| HFE9 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|----------------------------|--------|-----------|-----------|-----------|------------|----------|-----------|
| 1 REF | 217.25 | 220.52 | 218.40 | 217.72 | 219.73 | 218.72 | 220.45 |
| ON samples | | | | | | | |
| 2 | 224.57 | 213.11 | 199.54 | 192.04 | 185.20 | 186.24 | 197.17 |
| 3 | 216.76 | 204.77 | 192.04 | 184.77 | 176.85 | 178.22 | 188.41 |
| 4 | 214.93 | 206.06 | 193.11 | 185.84 | 177.57 | 179.56 | 186.96 |
| 5 | 217.87 | 205.59 | 193.69 | 186.31 | 177.48 | 179.84 | 186.51 |
| 6 | 228.75 | 216.38 | 205.04 | 196.74 | 187.46 | | |
| Statistics | | | | | | | |
| Min | 214.93 | 204.77 | 192.04 | 184.77 | 176.85 | 178.22 | 186.51 |
| Max | 228.75 | 216.38 | 205.04 | 196.74 | 187.46 | 186.24 | 197.17 |
| Average | 220.57 | 209.18 | 196.68 | 189.14 | 180.91 | 180.96 | 189.77 |
| Sigma | 5.22 | 4.68 | 4.93 | 4.56 | 4.49 | 3.11 | 4.33 |
| (HFE) Lot WorstCase | 204.90 | 195.15 | 181.90 | 175.45 | 167.45 | 171.65 | 176.76 |

Drift Calculation

| HFE9 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|-------------------------------|--------|------------|------------|------------|------------|------------|------------|
| ON samples | | | | | | | |
| 2 | - | 239.45E-06 | 558.42E-06 | 754.18E-06 | 946.45E-06 | 916.47E-06 | 618.63E-06 |
| 3 | - | 270.28E-06 | 594.01E-06 | 798.74E-06 | 1.04E-03 | 997.78E-06 | 694.17E-06 |
| 4 | - | 200.23E-06 | 525.79E-06 | 728.32E-06 | 978.87E-06 | 916.54E-06 | 695.94E-06 |
| 5 | - | 274.12E-06 | 572.96E-06 | 777.37E-06 | 1.04E-03 | 970.54E-06 | 771.64E-06 |
| 6 | - | 249.73E-06 | 505.47E-06 | 711.18E-06 | 962.92E-06 | | |
| Average | - | 246.76E-06 | 551.33E-06 | 753.96E-06 | 994.78E-06 | 950.33E-06 | 695.10E-06 |
| Sigma | - | 26.57E-06 | 31.92E-06 | 31.75E-06 | 40.57E-06 | 35.17E-06 | 54.10E-06 |
| d(1/HFE) Lot WorstCase | - | 326.47E-06 | 647.10E-06 | 849.22E-06 | 1.12E-03 | 1.06E-03 | 857.40E-06 |

Test conditions : TID
Parameter : Collector emitter saturation voltage 1 : VCE(SAT)1
Ic = -2A ; Ib = -100mA
 Unit : V
 Spec Limit Min : -400.0E-03
 Spec limits are represented in bold lines on the graphic.



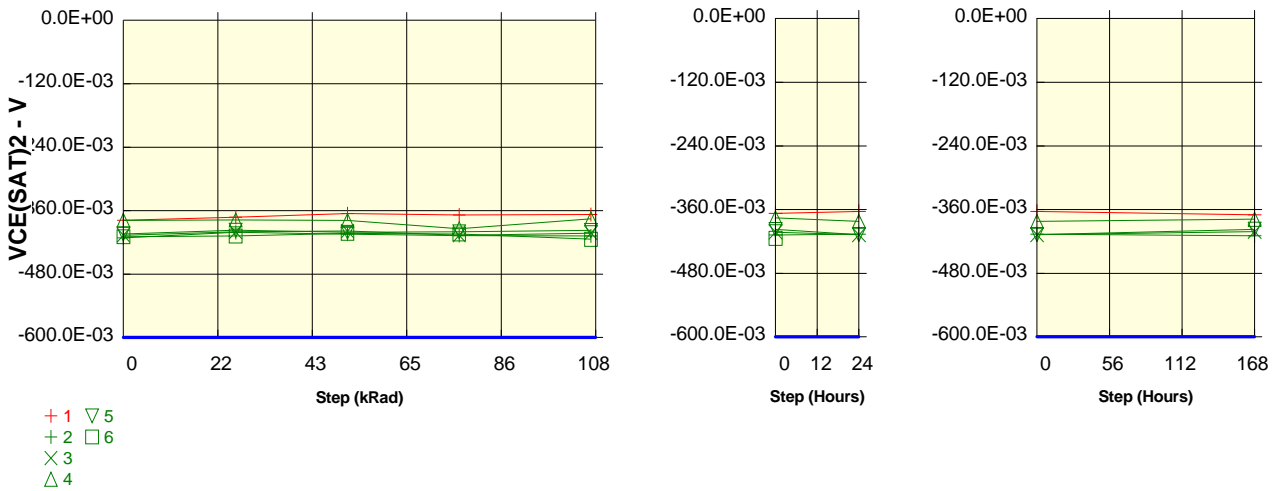
Measurements

| VCE(SAT)1 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|----------------------------|------------|------------|------------|------------|------------|------------|------------|
| 1_REF | -239.5E-03 | -245.6E-03 | -241.1E-03 | -243.0E-03 | -242.0E-03 | -239.9E-03 | -243.8E-03 |
| ON samples | | | | | | | |
| 2 | -259.7E-03 | -263.0E-03 | -265.3E-03 | -267.0E-03 | -264.2E-03 | -266.6E-03 | -268.5E-03 |
| 3 | -256.5E-03 | -262.5E-03 | -261.6E-03 | -267.1E-03 | -264.1E-03 | -267.6E-03 | -263.4E-03 |
| 4 | -239.2E-03 | -248.8E-03 | -249.6E-03 | -260.0E-03 | -244.3E-03 | -252.2E-03 | -249.5E-03 |
| 5 | -254.8E-03 | -260.4E-03 | -263.1E-03 | -262.5E-03 | -260.8E-03 | -267.2E-03 | -260.6E-03 |
| 6 | -258.2E-03 | -267.5E-03 | -264.1E-03 | -265.0E-03 | -271.6E-03 | | |
| Statistics | | | | | | | |
| Min | -259.7E-03 | -267.5E-03 | -265.3E-03 | -267.1E-03 | -271.6E-03 | -267.6E-03 | -268.5E-03 |
| Max | -239.2E-03 | -248.8E-03 | -249.6E-03 | -260.0E-03 | -244.3E-03 | -252.2E-03 | -249.5E-03 |
| Average | -253.7E-03 | -260.4E-03 | -260.7E-03 | -264.3E-03 | -261.0E-03 | -263.4E-03 | -260.5E-03 |
| Sigma | 7.4E-03 | 6.3E-03 | 5.7E-03 | 2.7E-03 | 9.1E-03 | 6.5E-03 | 7.0E-03 |
| (VCE) Lot WorstCase | -276.0E-03 | -279.2E-03 | -277.8E-03 | -272.5E-03 | -288.2E-03 | -282.9E-03 | -281.4E-03 |

Drift Calculation

| VCE(SAT)1 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|-----------------------------|--------|------------|------------|------------|------------|------------|------------|
| ON samples | | | | | | | |
| 2 | - | -3.28E-03 | -5.60E-03 | -7.32E-03 | -4.48E-03 | -6.92E-03 | -8.80E-03 |
| 3 | - | -6.00E-03 | -5.08E-03 | -10.60E-03 | -7.64E-03 | -11.16E-03 | -6.92E-03 |
| 4 | - | -9.68E-03 | -10.44E-03 | -20.88E-03 | -5.16E-03 | -13.00E-03 | -10.32E-03 |
| 5 | - | -5.60E-03 | -8.36E-03 | -7.72E-03 | -6.04E-03 | -12.40E-03 | -5.84E-03 |
| 6 | - | -9.28E-03 | -5.84E-03 | -6.76E-03 | -13.36E-03 | | |
| Average | - | -6.77E-03 | -7.06E-03 | -10.66E-03 | -7.34E-03 | -10.87E-03 | -7.97E-03 |
| Sigma | - | 2.40E-03 | 2.03E-03 | 5.28E-03 | 3.19E-03 | 2.38E-03 | 1.72E-03 |
| d(VCE) Lot WorstCase | - | -13.98E-03 | -13.16E-03 | -26.50E-03 | -16.91E-03 | -18.00E-03 | -13.13E-03 |

Test conditions : TID
Parameter : Collector emitter saturation voltage 2 : VCE(SAT)2
Ic = -3A ; Ib = -150mA
 Unit : V
 Spec Limit Min : -600.0E-03
 Spec limits are represented in bold lines on the graphic.



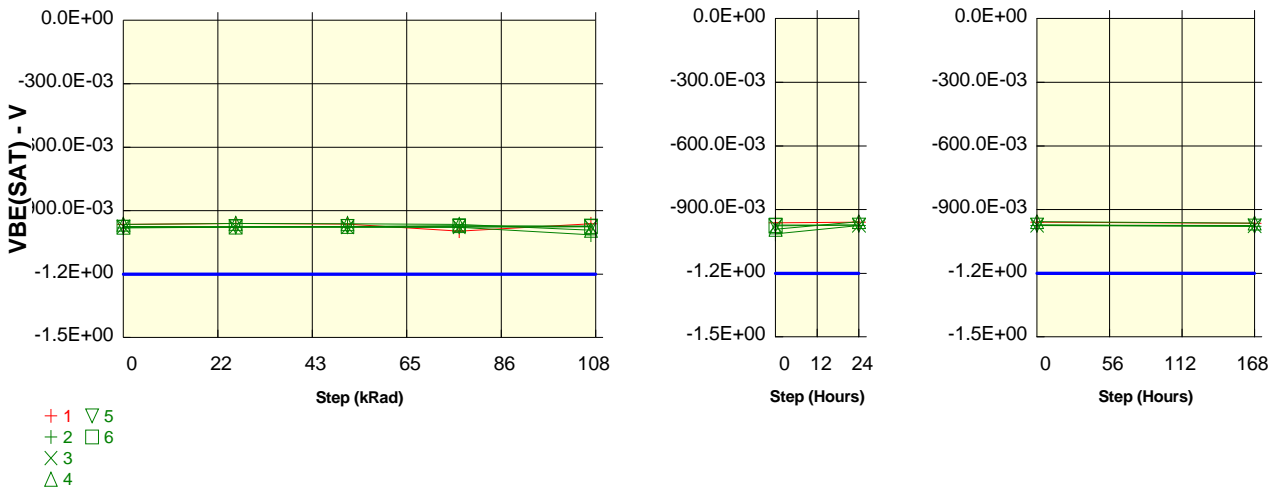
Measurements

| VCE(SAT)2 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|----------------------------|------------|------------|------------|------------|------------|------------|------------|
| 1_REF | -378.1E-03 | -372.6E-03 | -365.7E-03 | -368.5E-03 | -367.1E-03 | -363.7E-03 | -369.6E-03 |
| ON samples | | | | | | | |
| 2 | -411.4E-03 | -401.2E-03 | -404.6E-03 | -407.1E-03 | -407.9E-03 | -406.3E-03 | -409.4E-03 |
| 3 | -406.5E-03 | -400.2E-03 | -398.6E-03 | -406.8E-03 | -402.4E-03 | -407.5E-03 | -401.4E-03 |
| 4 | -378.4E-03 | -377.6E-03 | -378.5E-03 | -394.1E-03 | -375.6E-03 | -382.2E-03 | -378.3E-03 |
| 5 | -403.9E-03 | -397.0E-03 | -400.9E-03 | -399.9E-03 | -397.5E-03 | -407.1E-03 | -397.1E-03 |
| 6 | -409.4E-03 | -408.0E-03 | -402.9E-03 | -404.2E-03 | -414.2E-03 | | |
| Statistics | | | | | | | |
| Min | -411.4E-03 | -408.0E-03 | -404.6E-03 | -407.1E-03 | -414.2E-03 | -407.5E-03 | -409.4E-03 |
| Max | -378.4E-03 | -377.6E-03 | -378.5E-03 | -394.1E-03 | -375.6E-03 | -382.2E-03 | -378.3E-03 |
| Average | -401.9E-03 | -396.8E-03 | -397.1E-03 | -402.4E-03 | -399.5E-03 | -400.8E-03 | -396.6E-03 |
| Sigma | 12.0E-03 | 10.2E-03 | 9.5E-03 | 4.9E-03 | 13.2E-03 | 10.7E-03 | 11.4E-03 |
| (VCE) Lot WorstCase | -438.0E-03 | -427.5E-03 | -425.6E-03 | -417.1E-03 | -439.1E-03 | -432.9E-03 | -430.8E-03 |

Drift Calculation

| VCE(SAT)2 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|-----------------------------|--------|------------|-------------|-------------|------------|-------------|-----------|
| ON samples | | | | | | | |
| 2 | - | 10.24E-03 | 6.84E-03 | 4.28E-03 | 3.52E-03 | 5.08E-03 | 2.00E-03 |
| 3 | - | 6.36E-03 | 7.88E-03 | -240.01E-06 | 4.12E-03 | -960.01E-06 | 5.08E-03 |
| 4 | - | 760.01E-06 | -120.00E-06 | -15.72E-03 | 2.76E-03 | -3.84E-03 | 80.01E-06 |
| 5 | - | 6.88E-03 | 3.00E-03 | 4.04E-03 | 6.40E-03 | -3.16E-03 | 6.80E-03 |
| 6 | - | 1.40E-03 | 6.48E-03 | 5.20E-03 | -4.80E-03 | | |
| Average | - | 5.13E-03 | 4.82E-03 | -487.99E-06 | 2.40E-03 | -719.99E-06 | 3.49E-03 |
| Sigma | - | 3.57E-03 | 2.96E-03 | 7.84E-03 | 3.80E-03 | 3.51E-03 | 2.61E-03 |
| d(VCE) Lot WorstCase | - | -5.58E-03 | -4.07E-03 | -24.02E-03 | -9.00E-03 | -11.26E-03 | -4.35E-03 |

Test conditions : TID
Parameter : Base emitter saturation voltage : VBE(SAT)
Ic = -2A ; Ib = -100mA
 Unit : V
 Spec Limit Min : -1.2E+00
 Spec limits are represented in bold lines on the graphic.



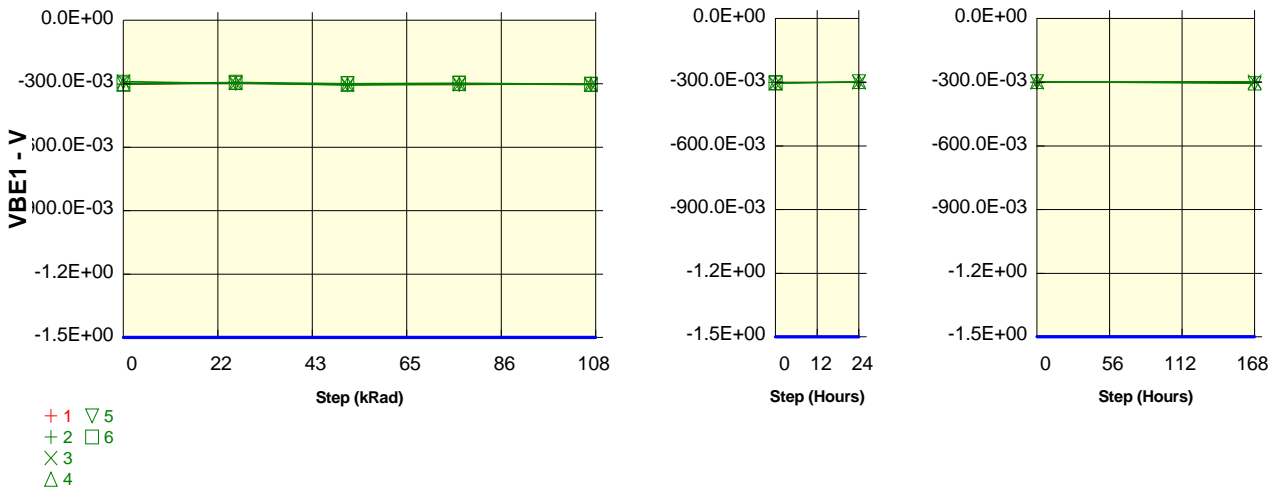
Measurements

| VBE(SAT) | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|----------------------------|------------|------------|------------|------------|------------|------------|------------|
| 1_REF | -964.8E-03 | -961.0E-03 | -963.0E-03 | -997.3E-03 | -962.2E-03 | -960.2E-03 | -964.3E-03 |
| ON samples | | | | | | | |
| 2 | -982.2E-03 | -977.3E-03 | -977.6E-03 | -978.7E-03 | -1.0E+00 | -975.6E-03 | -978.8E-03 |
| 3 | -975.7E-03 | -976.3E-03 | -977.8E-03 | -977.3E-03 | -976.4E-03 | -973.0E-03 | -975.7E-03 |
| 4 | -964.3E-03 | -960.4E-03 | -961.6E-03 | -964.5E-03 | -992.6E-03 | -957.3E-03 | -963.8E-03 |
| 5 | -977.6E-03 | -976.0E-03 | -975.4E-03 | -974.1E-03 | -972.5E-03 | -972.8E-03 | -977.8E-03 |
| 6 | -979.3E-03 | -977.2E-03 | -974.8E-03 | -971.6E-03 | -975.0E-03 | | |
| Statistics | | | | | | | |
| Min | -982.2E-03 | -977.3E-03 | -977.8E-03 | -978.7E-03 | -1.0E+00 | -975.6E-03 | -978.8E-03 |
| Max | -964.3E-03 | -960.4E-03 | -961.6E-03 | -964.5E-03 | -972.5E-03 | -957.3E-03 | -963.8E-03 |
| Average | -975.8E-03 | -973.4E-03 | -973.4E-03 | -973.2E-03 | -986.2E-03 | -969.7E-03 | -974.0E-03 |
| Sigma | 6.2E-03 | 6.5E-03 | 6.1E-03 | 5.0E-03 | 15.9E-03 | 7.2E-03 | 6.0E-03 |
| (VBE) Lot WorstCase | -994.3E-03 | -993.1E-03 | -991.6E-03 | -988.3E-03 | -1.0E+00 | -991.3E-03 | -992.0E-03 |

Drift Calculation

| VBE(SAT) | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|-----------------------------|--------|-------------|-----------|-------------|-------------|-----------|-------------|
| ON samples | | | | | | | |
| 2 | - | 4.96E-03 | 4.64E-03 | 3.52E-03 | -32.36E-03 | 6.68E-03 | 3.48E-03 |
| 3 | - | -640.05E-06 | -2.12E-03 | -1.60E-03 | -720.04E-06 | 2.64E-03 | -19.07E-09 |
| 4 | - | 3.88E-03 | 2.72E-03 | -239.99E-06 | -28.32E-03 | 6.96E-03 | 519.97E-06 |
| 5 | - | 1.56E-03 | 2.20E-03 | 3.48E-03 | 5.08E-03 | 4.76E-03 | -239.99E-06 |
| 6 | - | 2.04E-03 | 4.44E-03 | 7.64E-03 | 4.28E-03 | | |
| Average | - | 2.36E-03 | 2.38E-03 | 2.56E-03 | -10.41E-03 | 5.26E-03 | 939.98E-06 |
| Sigma | - | 1.94E-03 | 2.44E-03 | 3.25E-03 | 16.45E-03 | 1.73E-03 | 1.49E-03 |
| d(VBE) Lot WorstCase | - | -3.46E-03 | -4.94E-03 | -7.18E-03 | -59.74E-03 | 59.35E-06 | -3.54E-03 |

Test conditions : TID
Parameter : Base-Emitter Voltage : VBE1
Vce = -2V ; Ic = -100nA
 Unit : V
 Spec Limit Min : -1.5E+00
 Spec limits are represented in bold lines on the graphic.



Measurements

| VBE1 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|----------------------------|------------|------------|------------|------------|------------|------------|------------|
| 1_REF | -302.7E-03 | -295.6E-03 | -302.3E-03 | -305.5E-03 | -299.5E-03 | -300.9E-03 | -297.2E-03 |
| ON samples | | | | | | | |
| 2 | -301.2E-03 | -297.9E-03 | -307.8E-03 | -304.1E-03 | -301.6E-03 | -298.8E-03 | -298.1E-03 |
| 3 | -288.7E-03 | -297.3E-03 | -305.5E-03 | -301.8E-03 | -305.4E-03 | -299.9E-03 | -297.2E-03 |
| 4 | -302.3E-03 | -294.7E-03 | -302.3E-03 | -300.1E-03 | -303.7E-03 | -297.1E-03 | -303.7E-03 |
| 5 | -291.9E-03 | -297.8E-03 | -300.8E-03 | -298.9E-03 | -303.9E-03 | -298.4E-03 | -306.9E-03 |
| 6 | -300.2E-03 | -292.4E-03 | -299.1E-03 | -296.7E-03 | -301.6E-03 | | |
| Statistics | | | | | | | |
| Min | -302.3E-03 | -297.9E-03 | -307.8E-03 | -304.1E-03 | -305.4E-03 | -299.9E-03 | -306.9E-03 |
| Max | -288.7E-03 | -292.4E-03 | -299.1E-03 | -296.7E-03 | -301.6E-03 | -297.1E-03 | -297.2E-03 |
| Average | -296.9E-03 | -296.0E-03 | -303.1E-03 | -300.3E-03 | -303.2E-03 | -298.6E-03 | -301.5E-03 |
| Sigma | 5.5E-03 | 2.2E-03 | 3.2E-03 | 2.5E-03 | 1.5E-03 | 999.7E-06 | 4.0E-03 |
| (VBE) Lot WorstCase | -313.3E-03 | -302.5E-03 | -312.6E-03 | -307.9E-03 | -307.6E-03 | -301.6E-03 | -313.5E-03 |

Drift Calculation

| VBE1 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|-----------------------------|--------|------------|------------|------------|-------------|------------|------------|
| ON samples | | | | | | | |
| 2 | - | 3.37E-03 | -6.57E-03 | -2.86E-03 | -378.88E-06 | 2.44E-03 | 3.17E-03 |
| 3 | - | -8.53E-03 | -16.78E-03 | -13.11E-03 | -16.68E-03 | -11.19E-03 | -8.46E-03 |
| 4 | - | 7.54E-03 | -26.40E-06 | 2.17E-03 | -1.39E-03 | 5.16E-03 | -1.45E-03 |
| 5 | - | -5.87E-03 | -8.88E-03 | -6.99E-03 | -11.94E-03 | -6.48E-03 | -14.96E-03 |
| 6 | - | 7.84E-03 | 1.06E-03 | 3.51E-03 | -1.37E-03 | | |
| Average | - | 867.50E-06 | -6.24E-03 | -3.46E-03 | -6.35E-03 | -2.52E-03 | -5.42E-03 |
| Sigma | - | 6.83E-03 | 6.48E-03 | 6.10E-03 | 6.68E-03 | 6.60E-03 | 6.89E-03 |
| d(VBE) Lot WorstCase | - | -19.62E-03 | -25.68E-03 | -21.77E-03 | -26.39E-03 | -22.32E-03 | -26.09E-03 |

Test conditions : TID

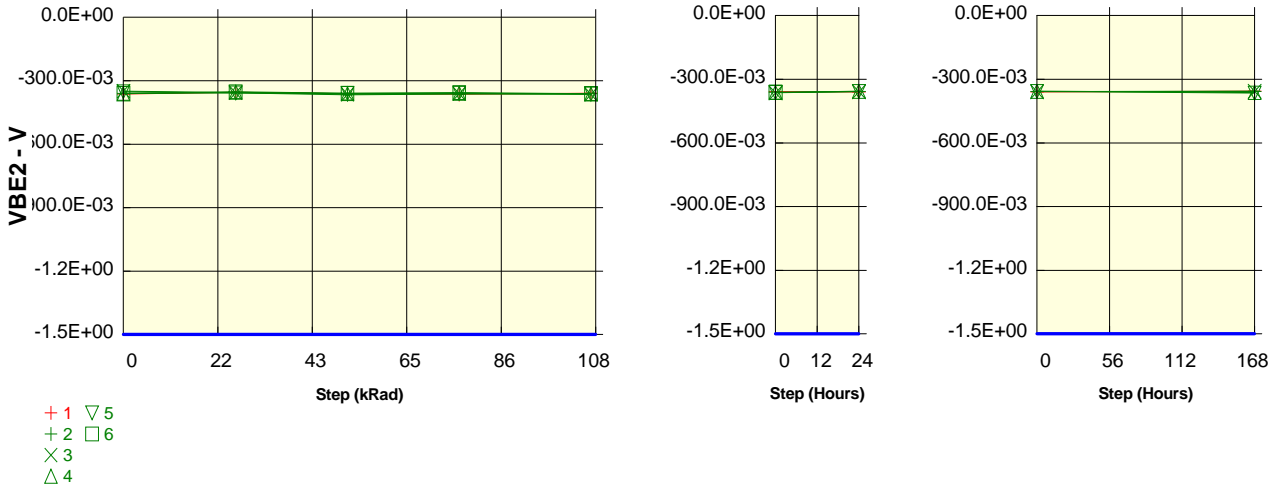
Parameter : Base-Emitter Voltage : VBE2

Vce = -2V ; Ic = -1µA

Unit : V

Spec Limit Min : -1.5E+00

Spec limits are represented in bold lines on the graphic.



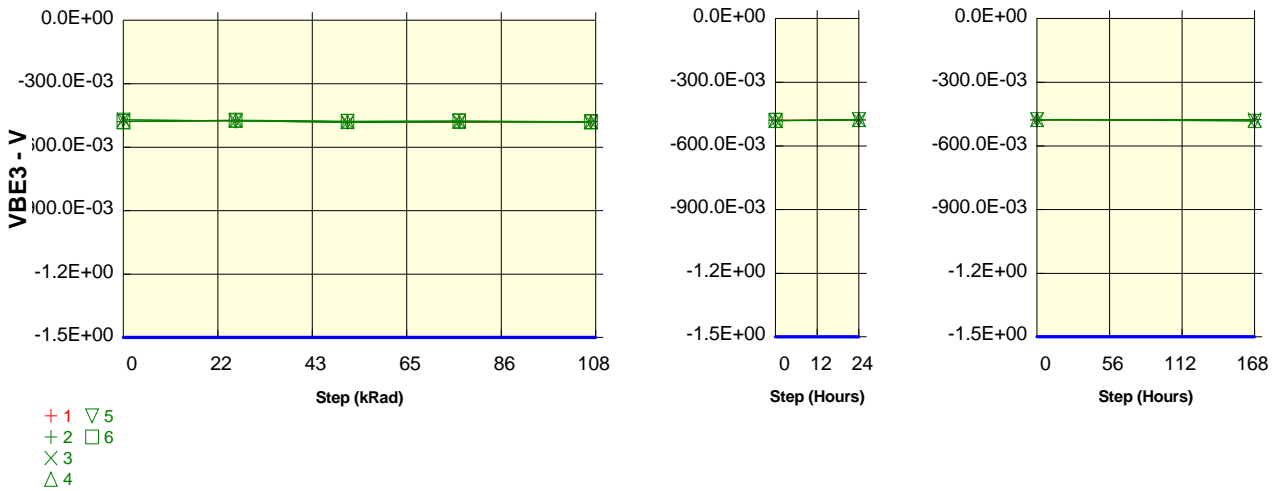
Measurements

| VBE2 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|---------------------|------------|------------|------------|------------|------------|------------|------------|
| 1_REF | -362.0E-03 | -355.0E-03 | -361.5E-03 | -364.4E-03 | -359.0E-03 | -360.0E-03 | -356.5E-03 |
| ON samples | | | | | | | |
| 2 | -360.5E-03 | -357.1E-03 | -366.6E-03 | -363.1E-03 | -360.8E-03 | -357.9E-03 | -357.2E-03 |
| 3 | -349.1E-03 | -356.5E-03 | -364.4E-03 | -361.0E-03 | -364.4E-03 | -359.2E-03 | -356.4E-03 |
| 4 | -361.7E-03 | -354.2E-03 | -361.5E-03 | -359.4E-03 | -362.7E-03 | -356.4E-03 | -362.7E-03 |
| 5 | -352.1E-03 | -357.1E-03 | -360.1E-03 | -358.4E-03 | -363.0E-03 | -357.6E-03 | -365.7E-03 |
| 6 | -359.6E-03 | -352.1E-03 | -358.5E-03 | -356.2E-03 | -360.7E-03 | | |
| Statistics | | | | | | | |
| Min | -361.7E-03 | -357.1E-03 | -366.6E-03 | -363.1E-03 | -364.4E-03 | -359.2E-03 | -365.7E-03 |
| Max | -349.1E-03 | -352.1E-03 | -358.5E-03 | -356.2E-03 | -360.7E-03 | -356.4E-03 | -356.4E-03 |
| Average | -356.6E-03 | -355.4E-03 | -362.2E-03 | -359.6E-03 | -362.3E-03 | -357.8E-03 | -360.5E-03 |
| Sigma | 5.0E-03 | 2.0E-03 | 2.9E-03 | 2.3E-03 | 1.4E-03 | 989.6E-06 | 3.9E-03 |
| (VBE) Lot WorstCase | -371.7E-03 | -361.3E-03 | -371.0E-03 | -366.7E-03 | -366.5E-03 | -360.7E-03 | -372.1E-03 |

Drift Calculation

| VBE2 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|----------------------|--------|------------|------------|------------|-------------|------------|------------|
| ON samples | | | | | | | |
| 2 | - | 3.46E-03 | -6.04E-03 | -2.62E-03 | -295.07E-06 | 2.60E-03 | 3.36E-03 |
| 3 | - | -7.44E-03 | -15.37E-03 | -11.97E-03 | -15.30E-03 | -10.14E-03 | -7.38E-03 |
| 4 | - | 7.46E-03 | 134.05E-06 | 2.25E-03 | -1.08E-03 | 5.23E-03 | -1.08E-03 |
| 5 | - | -5.01E-03 | -8.03E-03 | -6.29E-03 | -10.86E-03 | -5.45E-03 | -13.58E-03 |
| 6 | - | 7.49E-03 | 1.12E-03 | 3.38E-03 | -1.13E-03 | | |
| Average | - | 1.19E-03 | -5.64E-03 | -3.05E-03 | -5.73E-03 | -1.94E-03 | -4.67E-03 |
| Sigma | - | 6.28E-03 | 5.99E-03 | 5.65E-03 | 6.17E-03 | 6.16E-03 | 6.40E-03 |
| d(VBE) Lot WorstCase | - | -17.64E-03 | -23.62E-03 | -20.00E-03 | -24.24E-03 | -20.42E-03 | -23.88E-03 |

Test conditions : TID
Parameter : Base-Emitter Voltage : VBE3
Vce = -2V ; Ic = -100µA
 Unit : V
 Spec Limit Min : -1.5E+00
 Spec limits are represented in bold lines on the graphic.



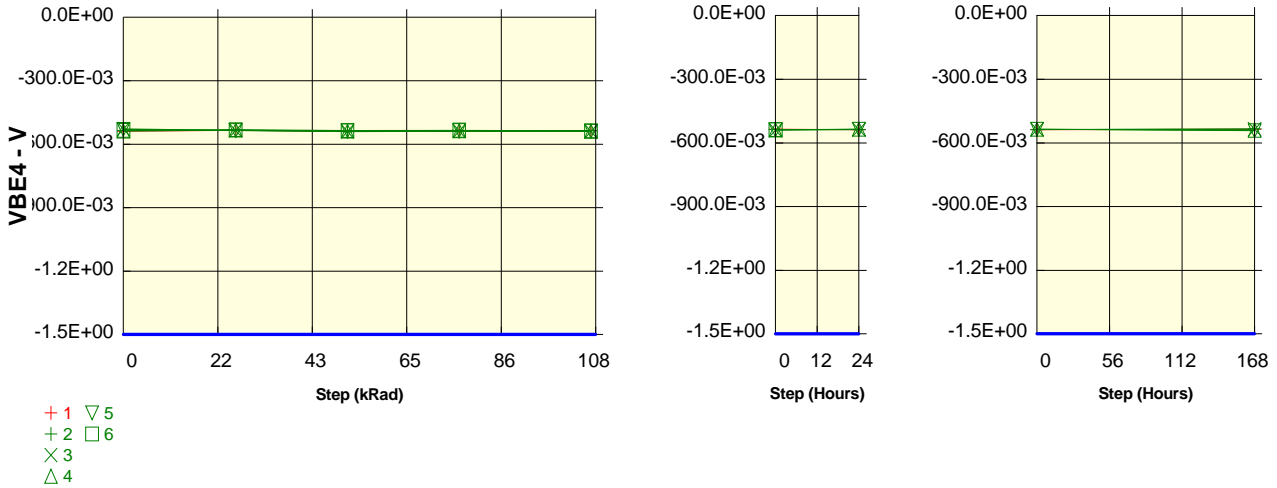
Measurements

| VBE3 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|----------------------------|------------|------------|------------|------------|------------|------------|------------|
| 1_REF | -480.2E-03 | -474.1E-03 | -479.8E-03 | -482.3E-03 | -477.7E-03 | -478.5E-03 | -475.4E-03 |
| ON samples | | | | | | | |
| 2 | -478.9E-03 | -475.7E-03 | -484.0E-03 | -481.1E-03 | -479.2E-03 | -476.6E-03 | -475.7E-03 |
| 3 | -469.3E-03 | -475.4E-03 | -482.3E-03 | -479.5E-03 | -482.4E-03 | -477.7E-03 | -475.4E-03 |
| 4 | -480.0E-03 | -473.4E-03 | -479.8E-03 | -478.1E-03 | -481.0E-03 | -475.4E-03 | -480.8E-03 |
| 5 | -471.8E-03 | -475.9E-03 | -478.6E-03 | -477.2E-03 | -481.2E-03 | -476.3E-03 | -483.3E-03 |
| 6 | -478.0E-03 | -471.5E-03 | -477.0E-03 | -475.1E-03 | -479.0E-03 | | |
| Statistics | | | | | | | |
| Min | -480.0E-03 | -475.9E-03 | -484.0E-03 | -481.1E-03 | -482.4E-03 | -477.7E-03 | -483.3E-03 |
| Max | -469.3E-03 | -471.5E-03 | -477.0E-03 | -475.1E-03 | -479.0E-03 | -475.4E-03 | -475.4E-03 |
| Average | -475.6E-03 | -474.4E-03 | -480.4E-03 | -478.2E-03 | -480.6E-03 | -476.5E-03 | -478.8E-03 |
| Sigma | 4.2E-03 | 1.7E-03 | 2.5E-03 | 2.0E-03 | 1.3E-03 | 827.8E-06 | 3.4E-03 |
| (VBE) Lot WorstCase | -488.3E-03 | -479.5E-03 | -487.9E-03 | -484.4E-03 | -484.4E-03 | -479.0E-03 | -489.0E-03 |

Drift Calculation

| VBE3 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|-----------------------------|--------|------------|------------|------------|-------------|------------|-------------|
| ON samples | | | | | | | |
| 2 | - | 3.19E-03 | -5.08E-03 | -2.23E-03 | -279.49E-06 | 2.36E-03 | 3.19E-03 |
| 3 | - | -6.06E-03 | -13.00E-03 | -10.17E-03 | -13.04E-03 | -8.40E-03 | -6.06E-03 |
| 4 | - | 6.58E-03 | 196.07E-06 | 1.90E-03 | -975.31E-06 | 4.61E-03 | -775.19E-06 |
| 5 | - | -4.10E-03 | -6.79E-03 | -5.36E-03 | -9.37E-03 | -4.47E-03 | -11.50E-03 |
| 6 | - | 6.49E-03 | 1.03E-03 | 2.91E-03 | -987.44E-06 | | |
| Average | - | 1.22E-03 | -4.73E-03 | -2.59E-03 | -4.93E-03 | -1.47E-03 | -3.79E-03 |
| Sigma | - | 5.32E-03 | 5.10E-03 | 4.81E-03 | 5.26E-03 | 5.21E-03 | 5.53E-03 |
| d(VBE) Lot WorstCase | - | -14.75E-03 | -20.03E-03 | -17.02E-03 | -20.70E-03 | -17.10E-03 | -20.39E-03 |

Test conditions : TID
Parameter : Base-Emitter Voltage : VBE4
Vce = -2V ; Ic = -1mA
 Unit : V
 Spec Limit Min : -1.5E+00
 Spec limits are represented in bold lines on the graphic.



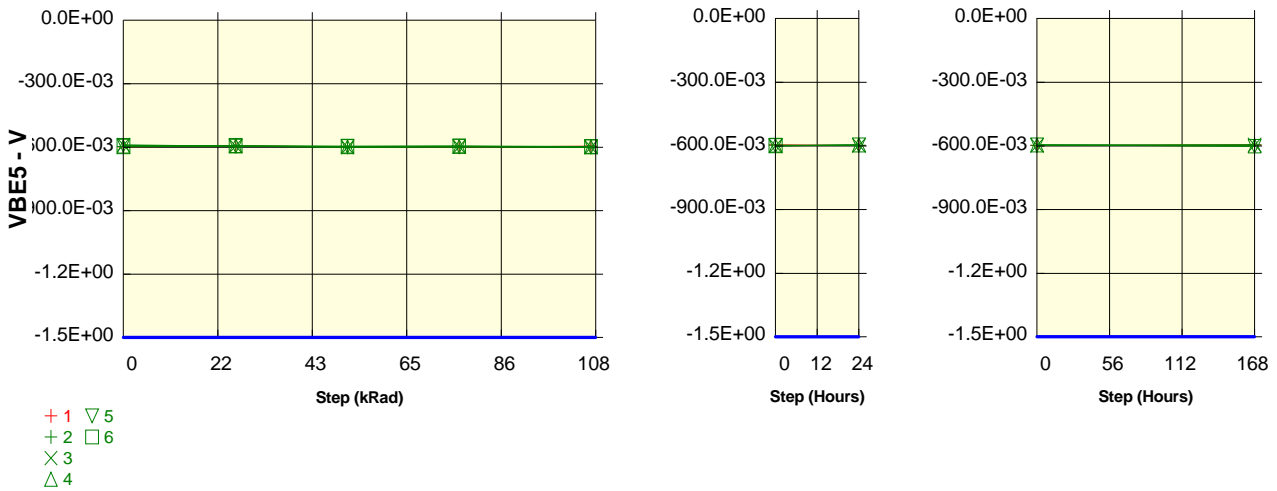
Measurements

| VBE4 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|----------------------------|------------|------------|------------|------------|------------|------------|------------|
| 1_REF | -537.9E-03 | -533.7E-03 | -537.9E-03 | -540.1E-03 | -535.5E-03 | -537.5E-03 | -534.9E-03 |
| ON samples | | | | | | | |
| 2 | -536.1E-03 | -535.0E-03 | -541.3E-03 | -539.0E-03 | -537.2E-03 | -536.8E-03 | -534.7E-03 |
| 3 | -528.2E-03 | -534.6E-03 | -540.0E-03 | -537.6E-03 | -539.9E-03 | -537.2E-03 | -535.3E-03 |
| 4 | -537.5E-03 | -533.1E-03 | -537.9E-03 | -536.3E-03 | -538.7E-03 | -535.3E-03 | -540.3E-03 |
| 5 | -530.0E-03 | -535.4E-03 | -536.7E-03 | -535.7E-03 | -539.0E-03 | -535.7E-03 | -542.3E-03 |
| 6 | -534.4E-03 | -531.4E-03 | -535.2E-03 | -533.8E-03 | -536.9E-03 | | |
| Statistics | | | | | | | |
| Min | -537.5E-03 | -535.4E-03 | -541.3E-03 | -539.0E-03 | -539.9E-03 | -537.2E-03 | -542.3E-03 |
| Max | -528.2E-03 | -531.4E-03 | -535.2E-03 | -533.8E-03 | -536.9E-03 | -535.3E-03 | -534.7E-03 |
| Average | -533.2E-03 | -533.9E-03 | -538.2E-03 | -536.5E-03 | -538.3E-03 | -536.2E-03 | -538.1E-03 |
| Sigma | 3.6E-03 | 1.5E-03 | 2.2E-03 | 1.8E-03 | 1.1E-03 | 759.7E-06 | 3.2E-03 |
| (VBE) Lot WorstCase | -543.9E-03 | -538.4E-03 | -544.8E-03 | -541.8E-03 | -541.8E-03 | -538.5E-03 | -547.9E-03 |

Drift Calculation

| VBE4 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|-----------------------------|--------|-------------|-------------|------------|------------|-------------|------------|
| ON samples | | | | | | | |
| 2 | - | 1.04E-03 | -5.24E-03 | -2.96E-03 | -1.12E-03 | -679.97E-06 | 1.36E-03 |
| 3 | - | -6.44E-03 | -11.84E-03 | -9.44E-03 | -11.72E-03 | -8.96E-03 | -7.08E-03 |
| 4 | - | 4.40E-03 | -400.01E-06 | 1.16E-03 | -1.20E-03 | 2.20E-03 | -2.80E-03 |
| 5 | - | -5.36E-03 | -6.64E-03 | -5.64E-03 | -8.96E-03 | -5.68E-03 | -12.28E-03 |
| 6 | - | 3.04E-03 | -800.01E-06 | 599.98E-06 | -2.44E-03 | | |
| Average | - | -664.01E-06 | -4.98E-03 | -3.26E-03 | -5.09E-03 | -3.28E-03 | -5.20E-03 |
| Sigma | - | 4.42E-03 | 4.20E-03 | 3.96E-03 | 4.40E-03 | 4.32E-03 | 5.06E-03 |
| d(VBE) Lot WorstCase | - | -13.92E-03 | -17.59E-03 | -15.13E-03 | -18.29E-03 | -16.25E-03 | -20.38E-03 |

Test conditions : TID
Parameter : Base-Emitter Voltage : VBE5
Vce = -2V ; Ic = -10mA
 Unit : V
 Spec Limit Min : -1.5E+00
 Spec limits are represented in bold lines on the graphic.



Measurements

| VBE5 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|----------------------------|------------|------------|------------|------------|------------|------------|------------|
| 1_REF | -598.1E-03 | -594.3E-03 | -598.0E-03 | -599.8E-03 | -595.8E-03 | -597.6E-03 | -595.3E-03 |
| ON samples | | | | | | | |
| 2 | -596.8E-03 | -595.2E-03 | -600.8E-03 | -598.7E-03 | -597.2E-03 | -596.8E-03 | -595.0E-03 |
| 3 | -589.4E-03 | -594.9E-03 | -599.7E-03 | -597.6E-03 | -599.8E-03 | -597.2E-03 | -595.5E-03 |
| 4 | -597.7E-03 | -593.5E-03 | -597.6E-03 | -596.4E-03 | -598.6E-03 | -595.4E-03 | -600.1E-03 |
| 5 | -591.2E-03 | -595.7E-03 | -596.7E-03 | -595.8E-03 | -598.8E-03 | -595.9E-03 | -602.0E-03 |
| 6 | -595.7E-03 | -592.3E-03 | -595.2E-03 | -594.1E-03 | -596.8E-03 | | |
| Statistics | | | | | | | |
| Min | -597.7E-03 | -595.7E-03 | -600.8E-03 | -598.7E-03 | -599.8E-03 | -597.2E-03 | -602.0E-03 |
| Max | -589.4E-03 | -592.3E-03 | -595.2E-03 | -594.1E-03 | -596.8E-03 | -595.4E-03 | -595.0E-03 |
| Average | -594.2E-03 | -594.3E-03 | -598.0E-03 | -596.5E-03 | -598.2E-03 | -596.3E-03 | -598.2E-03 |
| Sigma | 3.3E-03 | 1.2E-03 | 2.0E-03 | 1.6E-03 | 1.1E-03 | 708.5E-06 | 3.0E-03 |
| (VBE) Lot WorstCase | -604.0E-03 | -598.0E-03 | -604.0E-03 | -601.2E-03 | -601.5E-03 | -598.5E-03 | -607.0E-03 |

Drift Calculation

| VBE5 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|-----------------------------|--------|-------------|------------|------------|-------------|------------|------------|
| ON samples | | | | | | | |
| 2 | - | 1.60E-03 | -3.96E-03 | -1.92E-03 | -399.95E-06 | 0.00E+00 | 1.76E-03 |
| 3 | - | -5.48E-03 | -10.32E-03 | -8.20E-03 | -10.36E-03 | -7.84E-03 | -6.12E-03 |
| 4 | - | 4.20E-03 | 39.99E-06 | 1.24E-03 | -960.05E-06 | 2.24E-03 | -2.44E-03 |
| 5 | - | -4.52E-03 | -5.56E-03 | -4.64E-03 | -7.64E-03 | -4.76E-03 | -10.80E-03 |
| 6 | - | 3.40E-03 | 480.00E-06 | 1.60E-03 | -1.04E-03 | | |
| Average | - | -160.00E-06 | -3.86E-03 | -2.38E-03 | -4.08E-03 | -2.59E-03 | -4.40E-03 |
| Sigma | - | 4.05E-03 | 3.97E-03 | 3.69E-03 | 4.11E-03 | 3.95E-03 | 4.63E-03 |
| d(VBE) Lot WorstCase | - | -12.32E-03 | -15.76E-03 | -13.46E-03 | -16.42E-03 | -14.43E-03 | -18.29E-03 |

Test conditions : TID

Parameter : Base-Emitter Voltage : VBE6

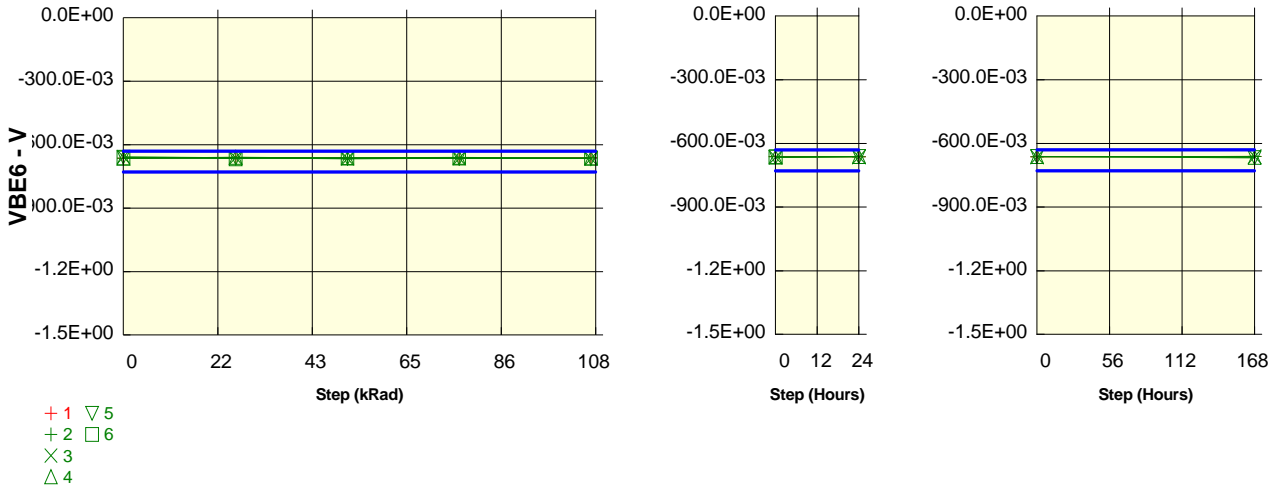
Vce = -2V ; Ic = -100mA

Unit : V

Spec Limit Min : -730.0E-03

Spec Limit Max : -630.0E-03

Spec limits are represented in bold lines on the graphic.



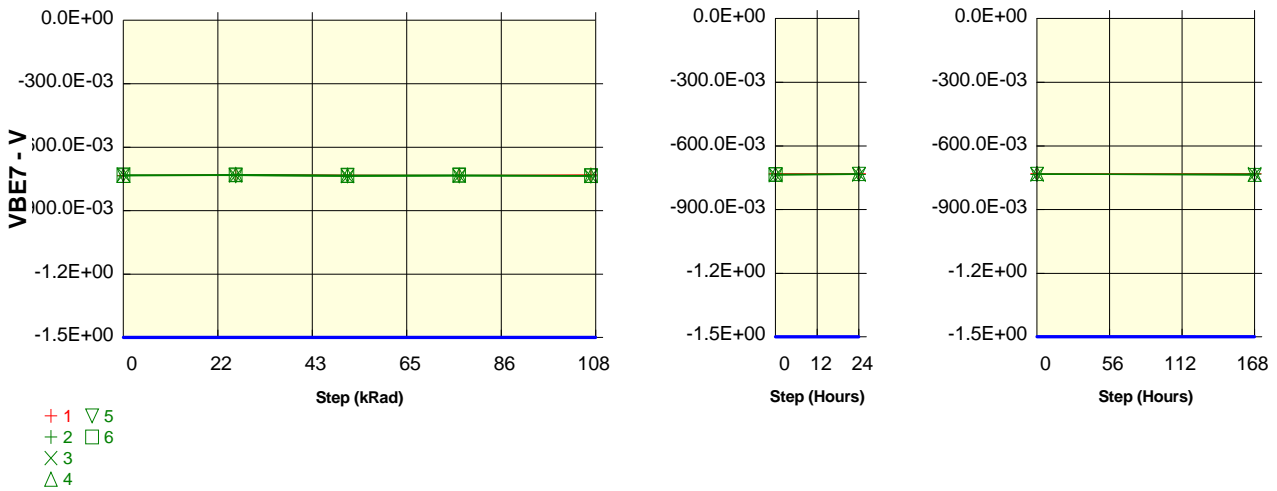
Measurements

| VBE6 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|---------------------|------------|------------|------------|------------|------------|------------|------------|
| 1_REF | -664.7E-03 | -660.2E-03 | -663.6E-03 | -665.4E-03 | -661.7E-03 | -663.1E-03 | -661.3E-03 |
| ON samples | | | | | | | |
| 2 | -664.0E-03 | -661.6E-03 | -666.6E-03 | -664.9E-03 | -663.6E-03 | -663.1E-03 | -661.5E-03 |
| 3 | -657.5E-03 | -661.4E-03 | -665.8E-03 | -664.0E-03 | -665.9E-03 | -663.4E-03 | -662.2E-03 |
| 4 | -664.3E-03 | -659.6E-03 | -663.3E-03 | -662.5E-03 | -664.2E-03 | -661.4E-03 | -665.7E-03 |
| 5 | -659.0E-03 | -662.1E-03 | -663.1E-03 | -662.4E-03 | -665.0E-03 | -662.3E-03 | -667.8E-03 |
| 6 | -662.8E-03 | -666.2E-03 | -661.5E-03 | -660.5E-03 | -663.1E-03 | | |
| Statistics | | | | | | | |
| Min | -664.3E-03 | -666.2E-03 | -666.6E-03 | -664.9E-03 | -665.9E-03 | -663.4E-03 | -667.8E-03 |
| Max | -657.5E-03 | -659.6E-03 | -661.5E-03 | -660.5E-03 | -663.1E-03 | -661.4E-03 | -661.5E-03 |
| Average | -661.5E-03 | -662.2E-03 | -664.1E-03 | -662.9E-03 | -664.4E-03 | -662.6E-03 | -664.3E-03 |
| Sigma | 2.8E-03 | 2.2E-03 | 1.9E-03 | 1.5E-03 | 978.7E-06 | 804.0E-06 | 2.6E-03 |
| (VBE) Lot WorstCase | -669.8E-03 | -668.7E-03 | -669.7E-03 | -667.4E-03 | -667.3E-03 | -665.0E-03 | -672.1E-03 |

Drift Calculation

| VBE6 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|----------------------|--------|-------------|------------|-------------|-------------|------------|------------|
| ON samples | | | | | | | |
| 2 | - | 2.40E-03 | -2.56E-03 | -879.94E-06 | 400.01E-06 | 920.06E-06 | 2.52E-03 |
| 3 | - | -3.96E-03 | -8.36E-03 | -6.56E-03 | -8.40E-03 | -5.96E-03 | -4.68E-03 |
| 4 | - | 4.72E-03 | 999.99E-06 | 1.76E-03 | 39.99E-06 | 2.92E-03 | -1.40E-03 |
| 5 | - | -3.12E-03 | -4.08E-03 | -3.36E-03 | -6.00E-03 | -3.32E-03 | -8.84E-03 |
| 6 | - | -3.32E-03 | 1.36E-03 | 2.36E-03 | -279.96E-06 | | |
| Average | - | -656.00E-06 | -2.53E-03 | -1.34E-03 | -2.85E-03 | -1.36E-03 | -3.10E-03 |
| Sigma | - | 3.53E-03 | 3.58E-03 | 3.31E-03 | 3.64E-03 | 3.48E-03 | 4.18E-03 |
| d(VBE) Lot WorstCase | - | -11.25E-03 | -13.26E-03 | -11.27E-03 | -13.77E-03 | -11.81E-03 | -15.64E-03 |

Test conditions : TID
Parameter : Base-Emitter Voltage : VBE7
Vce = -2V ; Ic = -500mA
 Unit : V
 Spec Limit Min : -1.5E+00
 Spec limits are represented in bold lines on the graphic.



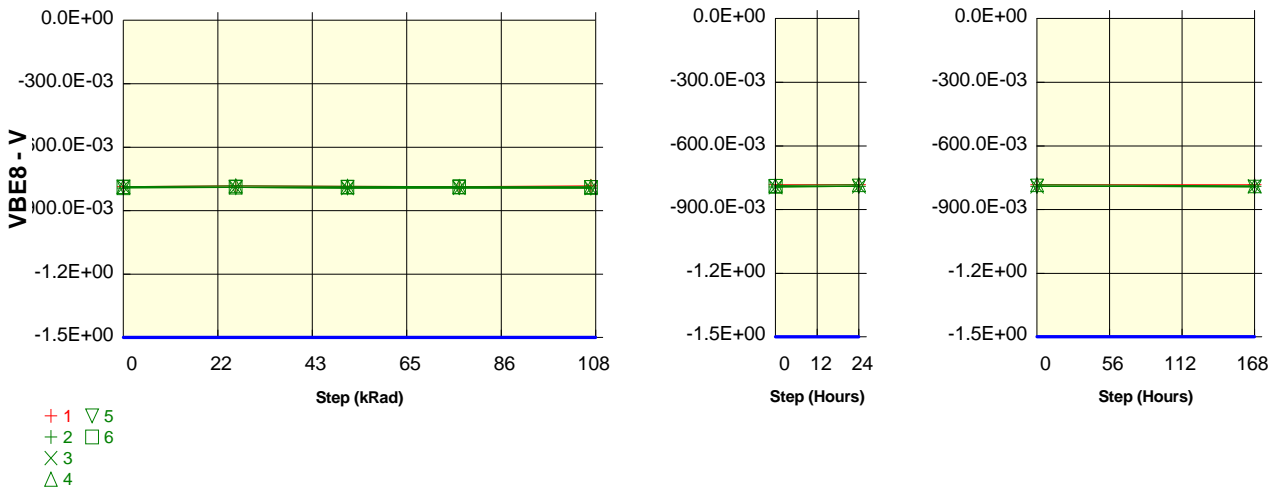
Measurements

| VBE7 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|----------------------------|------------|------------|------------|------------|------------|------------|------------|
| 1_REF | -733.5E-03 | -729.2E-03 | -732.3E-03 | -733.8E-03 | -730.0E-03 | -730.7E-03 | -730.0E-03 |
| ON samples | | | | | | | |
| 2 | -736.2E-03 | -733.6E-03 | -737.4E-03 | -736.3E-03 | -735.9E-03 | -734.3E-03 | -733.5E-03 |
| 3 | -730.2E-03 | -733.8E-03 | -737.3E-03 | -735.7E-03 | -737.1E-03 | -734.4E-03 | -733.7E-03 |
| 4 | -733.3E-03 | -729.6E-03 | -732.4E-03 | -732.2E-03 | -733.1E-03 | -730.0E-03 | -734.5E-03 |
| 5 | -731.5E-03 | -734.2E-03 | -734.6E-03 | -733.7E-03 | -735.7E-03 | -733.4E-03 | -738.6E-03 |
| 6 | -734.5E-03 | -730.9E-03 | -732.8E-03 | -731.4E-03 | -734.3E-03 | | |
| Statistics | | | | | | | |
| Min | -736.2E-03 | -734.2E-03 | -737.4E-03 | -736.3E-03 | -737.1E-03 | -734.4E-03 | -738.6E-03 |
| Max | -730.2E-03 | -729.6E-03 | -732.4E-03 | -731.4E-03 | -733.1E-03 | -730.0E-03 | -733.5E-03 |
| Average | -733.1E-03 | -732.4E-03 | -734.9E-03 | -733.9E-03 | -735.2E-03 | -733.0E-03 | -735.1E-03 |
| Sigma | 2.1E-03 | 1.8E-03 | 2.1E-03 | 1.9E-03 | 1.4E-03 | 1.8E-03 | 2.1E-03 |
| (VBE) Lot WorstCase | -739.5E-03 | -738.0E-03 | -741.3E-03 | -739.5E-03 | -739.3E-03 | -738.4E-03 | -741.3E-03 |

Drift Calculation

| VBE7 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|-----------------------------|--------|------------|------------|-------------|------------|-------------|------------|
| ON samples | | | | | | | |
| 2 | - | 2.52E-03 | -1.20E-03 | -160.04E-06 | 239.96E-06 | 1.88E-03 | 2.68E-03 |
| 3 | - | -3.64E-03 | -7.16E-03 | -5.52E-03 | -6.92E-03 | -4.28E-03 | -3.52E-03 |
| 4 | - | 3.72E-03 | 919.99E-06 | 1.04E-03 | 159.97E-06 | 3.28E-03 | -1.24E-03 |
| 5 | - | -2.68E-03 | -3.12E-03 | -2.16E-03 | -4.16E-03 | -1.88E-03 | -7.08E-03 |
| 6 | - | 3.60E-03 | 1.72E-03 | 3.04E-03 | 160.03E-06 | | |
| Average | - | 704.00E-06 | -1.77E-03 | -752.01E-06 | -2.10E-03 | -250.02E-06 | -2.29E-03 |
| Sigma | - | 3.20E-03 | 3.18E-03 | 2.92E-03 | 2.94E-03 | 3.00E-03 | 3.54E-03 |
| d(VBE) Lot WorstCase | - | -8.89E-03 | -11.31E-03 | -9.51E-03 | -10.92E-03 | -9.24E-03 | -12.92E-03 |

Test conditions : TID
Parameter : Base-Emitter Voltage : VBE8
Vce = -2V ; Ic = -1A
 Unit : V
 Spec Limit Min : -1.5E+00
 Spec limits are represented in bold lines on the graphic.



Measurements

| VBE8 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|----------------------------|------------|------------|------------|------------|------------|------------|------------|
| 1_REF | -786.9E-03 | -782.4E-03 | -785.0E-03 | -786.6E-03 | -782.8E-03 | -782.5E-03 | -783.3E-03 |
| ON samples | | | | | | | |
| 2 | -793.4E-03 | -790.5E-03 | -793.2E-03 | -793.2E-03 | -793.6E-03 | -790.6E-03 | -790.8E-03 |
| 3 | -787.5E-03 | -790.5E-03 | -793.9E-03 | -792.5E-03 | -793.5E-03 | -790.3E-03 | -790.2E-03 |
| 4 | -786.5E-03 | -782.9E-03 | -785.7E-03 | -786.5E-03 | -786.6E-03 | -782.8E-03 | -788.0E-03 |
| 5 | -788.8E-03 | -790.6E-03 | -791.1E-03 | -790.2E-03 | -791.4E-03 | -789.6E-03 | -794.6E-03 |
| 6 | -791.0E-03 | -788.8E-03 | -789.2E-03 | -787.4E-03 | -790.8E-03 | | |
| Statistics | | | | | | | |
| Min | -793.4E-03 | -790.6E-03 | -793.9E-03 | -793.2E-03 | -793.6E-03 | -790.6E-03 | -794.6E-03 |
| Max | -786.5E-03 | -782.9E-03 | -785.7E-03 | -786.5E-03 | -786.6E-03 | -782.8E-03 | -788.0E-03 |
| Average | -789.4E-03 | -788.6E-03 | -790.6E-03 | -790.0E-03 | -791.2E-03 | -788.3E-03 | -790.9E-03 |
| Sigma | 2.5E-03 | 3.0E-03 | 3.0E-03 | 2.6E-03 | 2.6E-03 | 3.2E-03 | 2.4E-03 |
| (VBE) Lot WorstCase | -796.8E-03 | -797.5E-03 | -799.5E-03 | -797.9E-03 | -798.9E-03 | -797.9E-03 | -798.1E-03 |

Drift Calculation

| VBE8 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|-----------------------------|--------|------------|------------|-------------|-------------|-------------|------------|
| ON samples | | | | | | | |
| 2 | - | 2.84E-03 | 119.97E-06 | 199.96E-06 | -280.03E-06 | 2.76E-03 | 2.56E-03 |
| 3 | - | -2.96E-03 | -6.36E-03 | -4.96E-03 | -6.00E-03 | -2.76E-03 | -2.64E-03 |
| 4 | - | 3.60E-03 | 800.00E-06 | -40.00E-06 | -80.00E-06 | 3.68E-03 | -1.48E-03 |
| 5 | - | -1.80E-03 | -2.36E-03 | -1.44E-03 | -2.60E-03 | -840.02E-06 | -5.84E-03 |
| 6 | - | 2.20E-03 | 1.76E-03 | 3.56E-03 | 160.03E-06 | | |
| Average | - | 775.99E-06 | -1.21E-03 | -536.01E-06 | -1.76E-03 | 709.99E-06 | -1.85E-03 |
| Sigma | - | 2.64E-03 | 2.91E-03 | 2.76E-03 | 2.34E-03 | 2.62E-03 | 3.01E-03 |
| d(VBE) Lot WorstCase | - | -7.14E-03 | -9.95E-03 | -8.80E-03 | -8.78E-03 | -7.15E-03 | -10.87E-03 |

Test conditions : TID

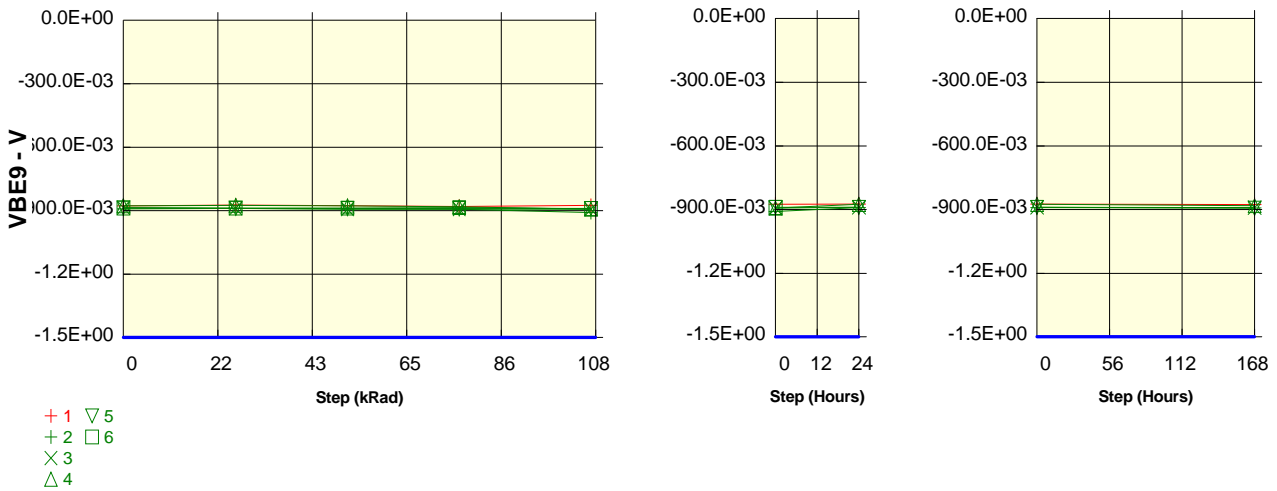
Parameter : Base-Emitter Voltage : VBE9

Vce = -2V ; Ic = -2A

Unit : V

Spec Limit Min : -1.5E+00

Spec limits are represented in bold lines on the graphic.



Measurements

| VBE9 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|---------------------|------------|------------|------------|------------|------------|------------|------------|
| 1_REF | -877.6E-03 | -873.7E-03 | -876.8E-03 | -879.8E-03 | -875.5E-03 | -873.8E-03 | -876.9E-03 |
| ON samples | | | | | | | |
| 2 | -892.4E-03 | -889.5E-03 | -891.7E-03 | -893.6E-03 | -908.6E-03 | -891.2E-03 | -892.5E-03 |
| 3 | -886.3E-03 | -889.2E-03 | -892.8E-03 | -892.8E-03 | -893.6E-03 | -889.6E-03 | -890.8E-03 |
| 4 | -877.2E-03 | -875.2E-03 | -878.0E-03 | -881.6E-03 | -893.0E-03 | -875.7E-03 | -881.8E-03 |
| 5 | -887.3E-03 | -889.0E-03 | -889.7E-03 | -889.4E-03 | -889.4E-03 | -889.1E-03 | -893.8E-03 |
| 6 | -888.4E-03 | -888.3E-03 | -888.1E-03 | -885.4E-03 | -890.2E-03 | | |
| Statistics | | | | | | | |
| Min | -892.4E-03 | -889.5E-03 | -892.8E-03 | -893.6E-03 | -908.6E-03 | -891.2E-03 | -893.8E-03 |
| Max | -877.2E-03 | -875.2E-03 | -878.0E-03 | -881.6E-03 | -889.4E-03 | -875.7E-03 | -881.8E-03 |
| Average | -886.3E-03 | -886.2E-03 | -888.1E-03 | -888.6E-03 | -895.0E-03 | -886.4E-03 | -889.7E-03 |
| Sigma | 5.0E-03 | 5.5E-03 | 5.3E-03 | 4.5E-03 | 7.0E-03 | 6.2E-03 | 4.7E-03 |
| (VBE) Lot WorstCase | -901.3E-03 | -902.8E-03 | -903.9E-03 | -902.1E-03 | -915.9E-03 | -905.1E-03 | -903.8E-03 |

Drift Calculation

| VBE9 | 0 kRad | 25.9 kRad | 51.7 kRad | 77.5 kRad | 107.9 kRad | 24 Hours | 168 Hours |
|----------------------|--------|------------|-------------|------------|------------|-------------|------------|
| ON samples | | | | | | | |
| 2 | - | 2.92E-03 | 720.01E-06 | -1.20E-03 | -16.12E-03 | 1.20E-03 | -40.01E-06 |
| 3 | - | -2.84E-03 | -6.48E-03 | -6.44E-03 | -7.28E-03 | -3.28E-03 | -4.48E-03 |
| 4 | - | 2.08E-03 | -800.03E-06 | -4.40E-03 | -15.72E-03 | 1.56E-03 | -4.56E-03 |
| 5 | - | -1.68E-03 | -2.44E-03 | -2.16E-03 | -2.12E-03 | -1.80E-03 | -6.56E-03 |
| 6 | - | 120.04E-06 | 280.00E-06 | 3.00E-03 | -1.84E-03 | | |
| Average | - | 120.02E-06 | -1.74E-03 | -2.24E-03 | -8.62E-03 | -580.00E-06 | -3.91E-03 |
| Sigma | - | 2.18E-03 | 2.61E-03 | 3.19E-03 | 6.27E-03 | 2.03E-03 | 2.38E-03 |
| d(VBE) Lot WorstCase | - | -6.41E-03 | -9.56E-03 | -11.81E-03 | -27.43E-03 | -6.68E-03 | -11.06E-03 |