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RADIATION TEST REPORT FOR LP2953A

PROJECT COROT

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Test Report Number	ESA_QCA0410T_I
Project	COROT
SCC Component no.	
Component Designation	Adjustable Micropower Low-Dropout Voltage Regulator
Irradiation Spec. no.	
Family	Integrated Circuits
Group	Silicon Monolithic
Package	Plastic DIP/SO and Ceramic DIP
Component Specification	5962-9233601mEA
Test House Name	ESA / ESTEC
Irradiation Test Plan Number	
Manufacturer name	
Application type of Acceptance	
Serial Number of samples	Three (3) samples serialised as A, B and C
Manufacturing Date Code	H6D0029A
Irradiation Measurement Interval: Biased Unbiased: Circuit Reference: Supply Voltage: Temp ^{o}C: Duration:	 Yes No +3.3V Room temperature 20 ± 3
Electrical Measurement Parameters	
Facility Source: Energy: Dose Rate: Absorbed Material: Thickness: Temperature ^{o}C:	 ^{60}Co 0.005Gy(Si)/min and 0.016Gy(Si)/min N/A N/A 20 ± 3
Dosimetry / Calibration method.	A calibrated NE2571, 0.66cc air ionisation chamber read by a calibrated Farmer 2670 dosimeter.
Anneal Test Biased Unbiased Bias Circuit Reference Supply Voltage Duration	 No No N/A N/A

1 INTRODUCTION

The following document contains the TID Radiation Test Report for LP2953A Voltage Regulator for the COROT project.

2 APPLICABLE DOCUMENTS

AD1- ESA/SCC 22900 “Total Dose Steady-State Irradiation Test Method”

3 TEST DESCRIPTION

Two (2) LP2953A, Flight Lot, and One LP2953A Commercial Device were selected for TID irradiation testing at the ESTEC ^{60}Co facility. Irradiations were performed at a dose rate of 5E-3 Gy(Si)/min and 1.6E-2Gy(Si)/min.

The three devices selected for irradiation testing were serialised (A, B and C). Devices A and B were ceramic DIP packages and device C was a plastic DIP package. An irradiation test board capable of biasing five (5) devices at the same time was employed. An additional interface board provided power distribution and multiplexing for in-situ measurements. After each exposure-step the devices were removed from the irradiation board and parametric measurements performed. In addition regular in-situ measurements were performed. The schematic diagram of the irradiation test board is illustrated in figure 1. Irradiation board, interface board, cables, biasing scheme and test samples were provided by the COROT project. The device operating conditions, temperature conditions and applied dose rates are listed in table1.

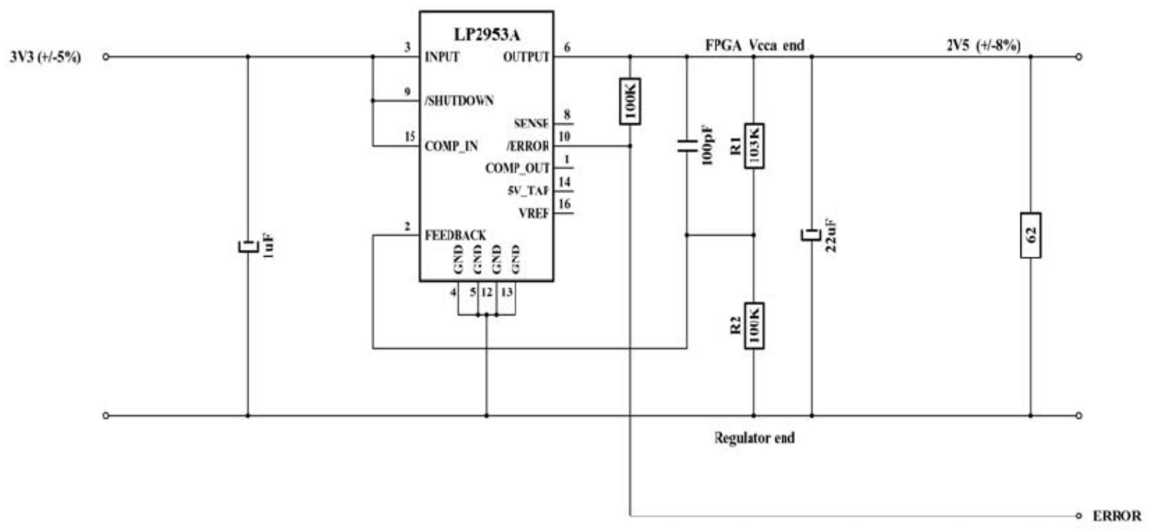

Figure 1 Schematic diagram of irradiation biasing scheme.

Parameter	Dev A	Dev B	Dev C
Bias During Irradiation	+3.3V	+3.3V	+3.3V
Dose Rate	0.005Gy(Si)/min and 0.016Gy(Si)/min	0.005Gy(Si)/min and 0.016Gy(Si)/min	0.005Gy(Si)/min and 0.016Gy(Si)/min
Irradiation Temperature	20 ± 3 ^{o}C	20 ± 3 ^{o}C	20 ± 3 ^{o}C

Table 1 Irradiation Test Conditions

3.1 Measurement set-up

Two sets of measurements were performed one set of in-situ measurements during the irradiation runs and one set of parametric measurement at regular intervals between irradiation steps. In-Situ measurements were performed employing calibrated power supplies, ammeters and digital voltmeters.

- HP 6632A System DC Power Supply
- HP 3478A digital multimeter
- 2 x Fluke 8050A digital multimeter

Measurement	Unit
1) Total current consumption	mA
2) Individual current consumption	mA
3) Output Voltage	V
4) Error Voltage	V

Table 2 In-Situ measurements for each device during irradiation.

For in-situ measurement the LP2953A was programmed for 2.5V output with a 62O load resistor in the test circuit.

Parametric measurements were performed employing an Agilent semiconductor parameter analyser:

- Agilent 4156C

Three specific measurement programmes were employed to perform the required parametric measurements. These were:

Programme 1) Sweep input voltage from 0V to 5V. Measure Ground current and Output current at an input voltage of 3V.

Programme 2) Sweep input voltage from 0V to 3.3V. Measure input voltage for when output regulation is activated, measure feedback and output voltage at an input voltage of 3V.

Programme 3) Sweep output from –2V to 12V with ground = 0V. Measure GND current and Output voltage at an output current of 36mA.

The time between irradiation stop, performing parametric measurements and starting irradiation for all irradiation steps were less than 60min. 4 irradiation steps were performed and parametric measurements performed after each step. Pre-irradiation measurements were performed on all devices. Table 3 illustrates the irradiation and measurement history.

Irradiation steps (total accumulated dose indicated)	Dev A	Dev B	Dev C
Pre-rad. Par. measurements	Yes	Yes	Yes
22Gy(Si) at 0.005Gy(Si)/min			
par. measurements	Yes	Yes	Yes
64Gy(Si) at 0.016Gy(Si)/min			
par. measurements	Yes	Yes	Yes
113Gy(Si) at 0.016Gy(Si)/min			
Par. Measurements	Yes	Yes	Yes
177Gy(Si) at 0.016Gy(Si)/min			
Par Measurements	Yes	Yes	Yes

Table 3 Irradiation and measurement history

3.2 Thermal conditions

All irradiations and measurements were performed at room temperature (20 ± 3 ^{o}C).

3.3 Dosimetry

A calibrated NE2571, 0.66cc air ionisation chamber read by a calibrated Farmer 2670 dosimeter was used to measure the Total Ionising Dose.

3.4 Test Results

Figures 2 to 5 illustrate the in-situ measurements while figures 5 to 9 illustrate the parametric measurements.

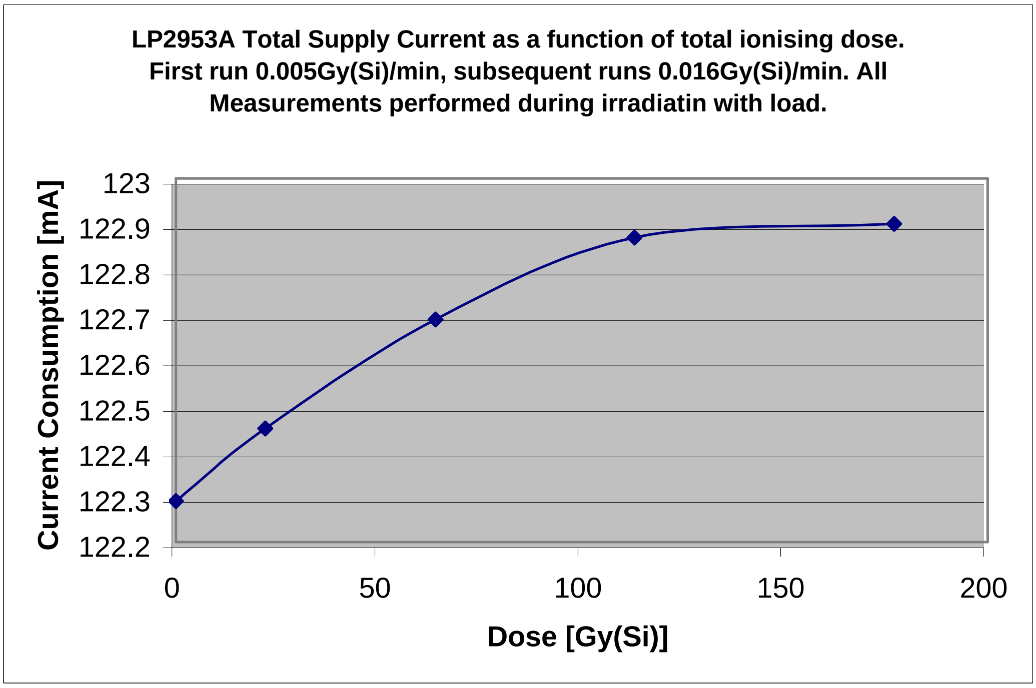

Figure 2 LP2953A Total Supply Current as a function of total ionising dose. First run 0.005Gy(Si)/min, subsequent runs 0.016Gy(Si)/min.

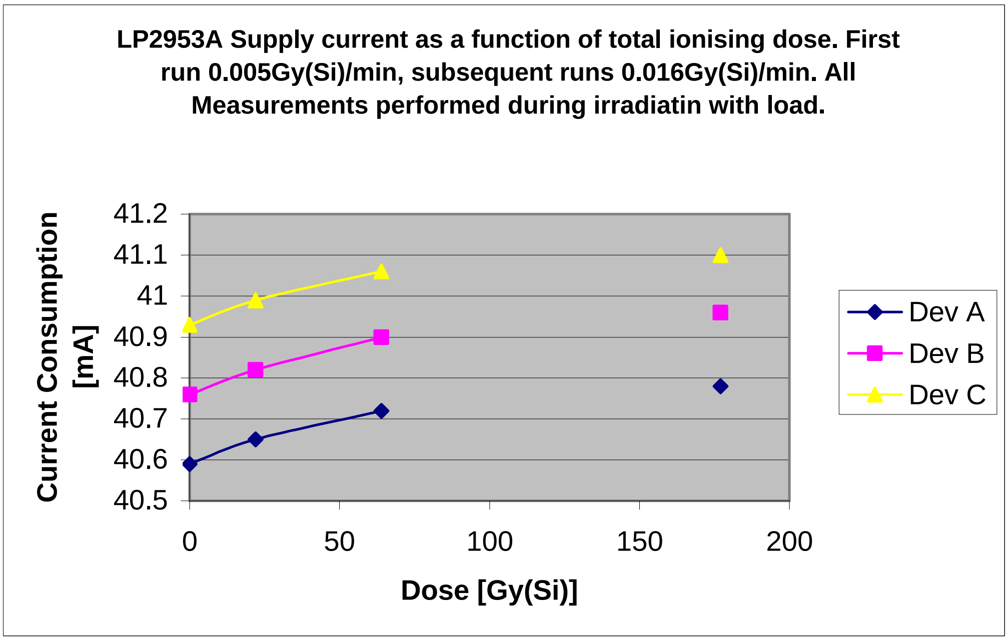

Figure 3 LP2953A Supply Current as a function of total ionising dose. First run 0.005Gy(Si)/min, subsequent runs 0.016Gy(Si)/min.

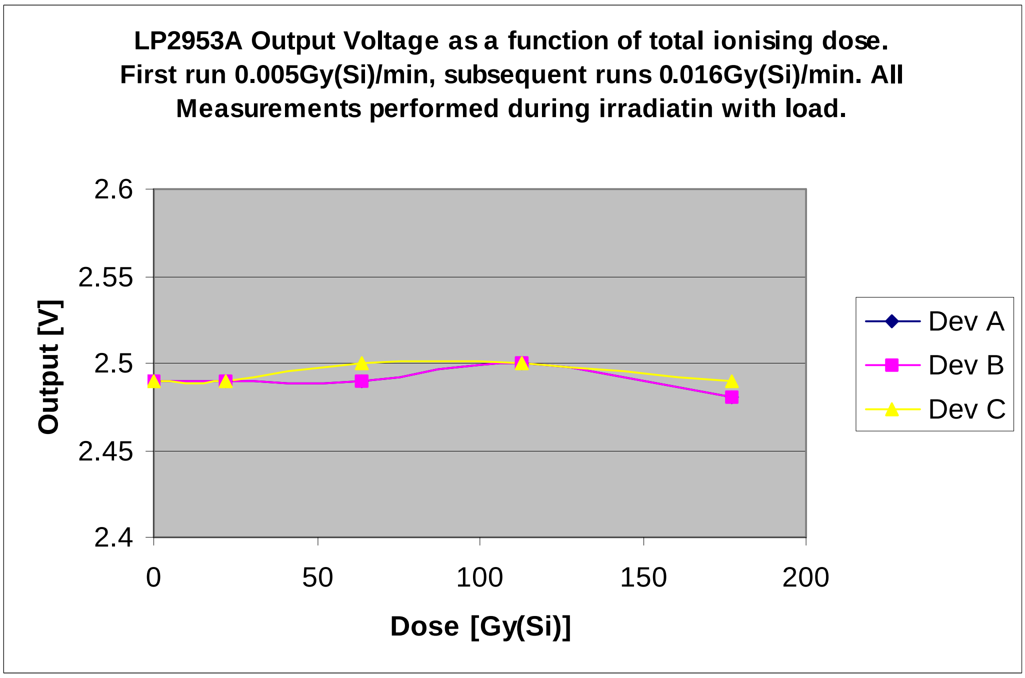

Figure 4 LP2953A Output voltage as a function of total ionising dose. First run 0.005Gy(Si)/min, subsequent runs 0.016Gy(Si)/min.

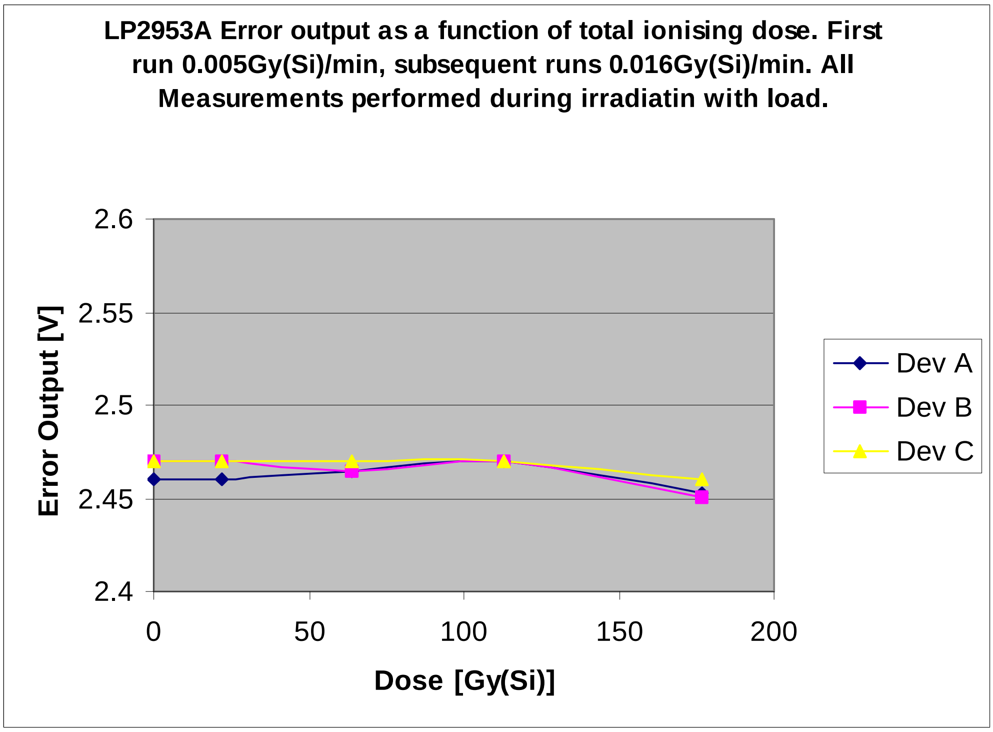

Figure 5 LP2953A Error output as a function of total ionising dose. First run 0.005Gy(Si)/min, subsequent runs 0.016Gy(Si)/min.

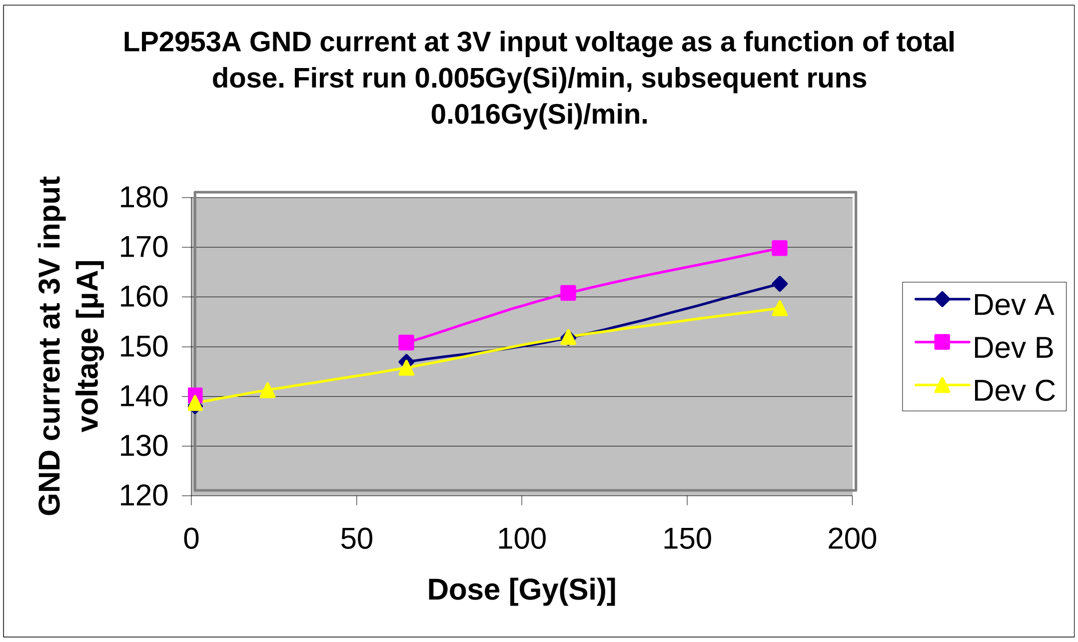

Figure 6 LP2953A GND current at 3V input voltage as a function of total dose. First run 0.005Gy(Si)/min, subsequent runs 0.016Gy(Si)/min.

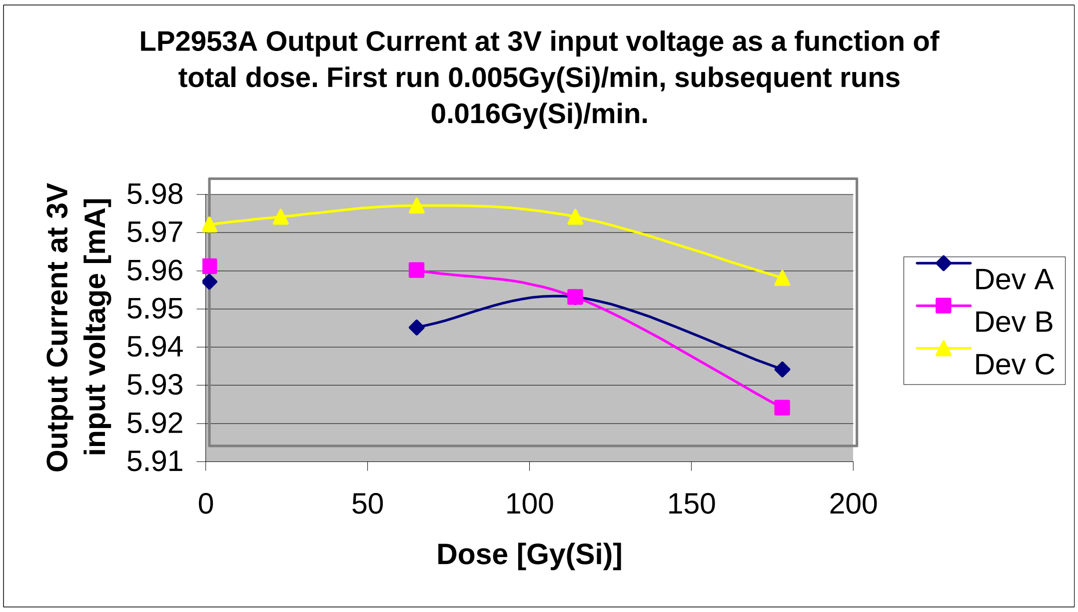

Figure 7 LP2953A Output Current at 3V input voltage as a function of total dose. First run 0.005Gy(Si)/min, subsequent runs 0.016Gy(Si)/min.

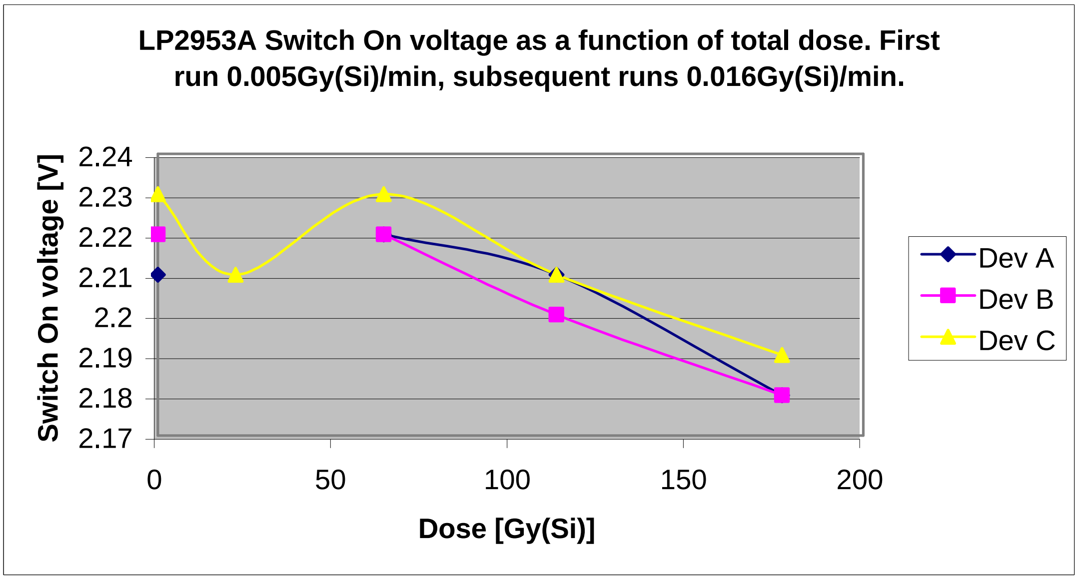

Figure 8 LP2953A Switch On voltage as a function of total dose. First run 0.005Gy(Si)/min, subsequent runs 0.016Gy(Si)/min.

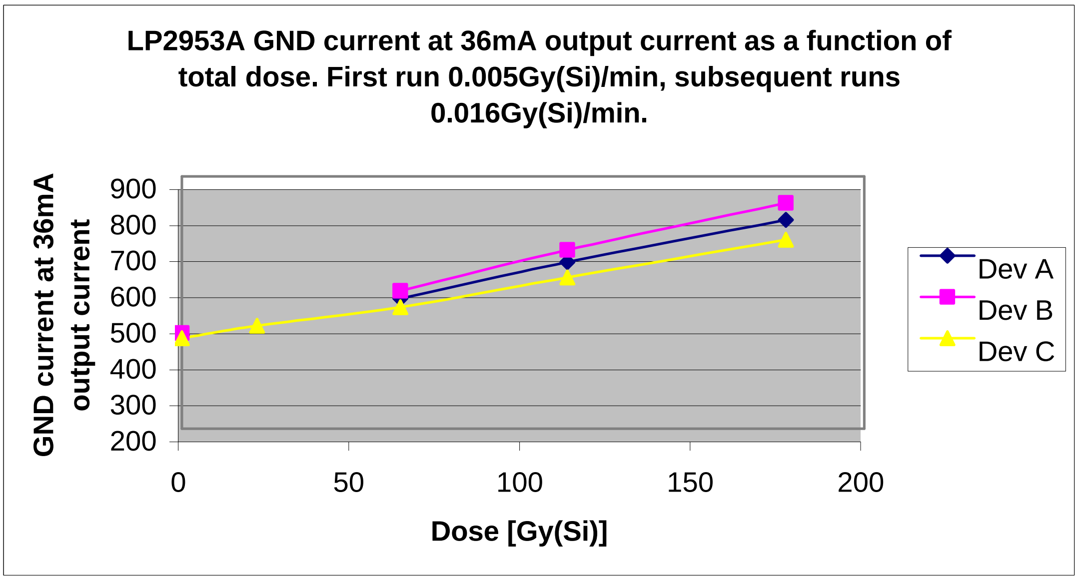

Figure 9 LP2953A GND current at 36mA output current as a function of total dose. First run 0.005Gy(Si)/min, subsequent runs 0.016Gy(Si)/min.

The feedback voltage and output voltage at 3V input voltage and the output voltage at an output current of 36mA did not change significantly and thus their graphs not plotted.

As a final measurement the load resistance of the test circuits were modified to evaluate the performance of the devices at high output currents post – 117Gy(Si) Total Dose exposure. The current consumption, output voltage and Error voltage of the devices were measured. Tables 4, lists the results of these measurements.

Device	Load Resistance [O]	Calculated load current [mA]	Device current consumption [mA]	Vout [V]	Verror [V]
A	9.7	257	270	2.47	1.24
B	9.7	257	269.2	2.45	1.23
C	9.7	257	261.8	2.39	0.103
A	11.7	214	233	2.5	1.257
B	11.7	214	233.4	2.5	1.256
C	11.7	214	230	2.47	1.244
A	15.4	162	169	2.49	1.251
B	15.4	162	169.3	2.49	1.25
C	15.4	162	169.5	2.5	1.256
A	47.6	53	53.4	2.48	1.236
B	47.6	53	53.5	2.48	1.236
C	47.6	53	53.6	2.49	1.242

Table 4 Current Consumption, Vout and Verror measurements as a function of load resistance.

4 CONCLUSION

These tests were performed to complement TID irradiation tests already performed and to investigate possible Enhanced Low Dose Rate Sensitivity (ELDRS). The irradiation tests were performed up to a total dose of 177Gy(Si) sufficient and according to the COROT radiation requirements.