

ESA study


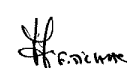
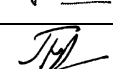
“Test Methods, Requirements, and Guidelines for Evaluation of Radiation Sensitivity of Analog to Digital Converters (ADC), Digital to Analog Converters (DAC) and Vertical Power MOSFETs”

TOTAL IONIZING DOSE TEST REPORT

<p>Part Type : DAC5675AHFG</p> <p>Package : CQFP-52</p> <p>Description : 14-BIT, 400-MSPS WITH LVDS, DIGITAL-TO-ANALOG CONVERTER</p> <p>Manufacturer : Texas Instruments</p> <p>Date Code: 1233A</p>

ESTEC Contract N° 4000105495/12/NL/SFe dated February 27th, 2012

ESTEC Technical Responsible: Christian Poivey

Hirex reference:	HRX/TID/1206	Issue: 01	Date:	December 23 rd , 2014
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Hirex Engineering	TOTAL IONIZING DOSE TEST REPORT		Ref.:	HRX/TID/1206
	DAC5675AHFG	Texas Instruments	Issue:	01

TOTAL DOSE RADIATION TEST REPORT
on
Texas Instruments
DAC5675AHFG
14-BIT, 400-MSPS WITH LVDS, DIGITAL-TO-ANALOG CONVERTER

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1 Introduction

In the scope of the ESA study: "Test Methods, Requirements, and Guidelines for Evaluation of Radiation Sensitivity of Analog to Digital Converters (ADC), Digital to Analog Converters (DAC) and Vertical Power MOSFETs", a total dose radiation evaluation test of the Texas Instruments DAC5675AHFG, 14-BIT, 400-MSPS WITH LVDS, DIGITAL-TO-ANALOG CONVERTER has been performed with an accumulated dose of about 102 krad(Si) at a dose rate of 310 rad(Si)/hour, in response to ESTEC purchase order reference 4000105495/12/NL/SFe.

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 ESTEC. Test has been performed in accordance with Hirex Engineering proposal reference HRX/PRO/3624 Issue 01 dated 10/12/2012.

A complete set of electrical parameter measurements, with their graphical representation, versus total dose received, are provided for all samples.

2 Applicable and Reference Documents

2.1 Applicable Documents

- Hirex Engineering proposal: HRX/PRO/3624 Issue 01 dated 10/12/2012
- Hirex Engineering irradiation test plan for DAC5675AHFG: HRX/SPE/0280 Issue 01 dated 02/13/2014.
- Hirex Engineering Detail Design Document for DAC5675AHFG: HRX/DDD/1874 Issue 01
- Hirex Engineering Test Conditions for DAC5675AHFG: HRX/TC/0966 Issue 01
- ESCC Basic Specification No. 22900 issue 04.

2.2 Reference Documents

- Texas Instruments DAC5675AHFG datasheet: REF SGLS387A, April 2013.

3 Device architecture, functional diagram and technology summary

The DAC5675A is a 14-bit resolution high-speed digital-to-analog converter (DAC). The DAC5675A is designed for high-speed digital data transmission in wired and wireless communication systems, high-frequency direct digital synthesis (DDS), and waveform reconstruction in test and measurement applications. The DAC5675A has excellent spurious-free dynamic range (SFDR) at high intermediate frequencies, which makes it well suited for multicarrier transmission in TDMA and CDMA based cellular base transceiver stations (BTSs)

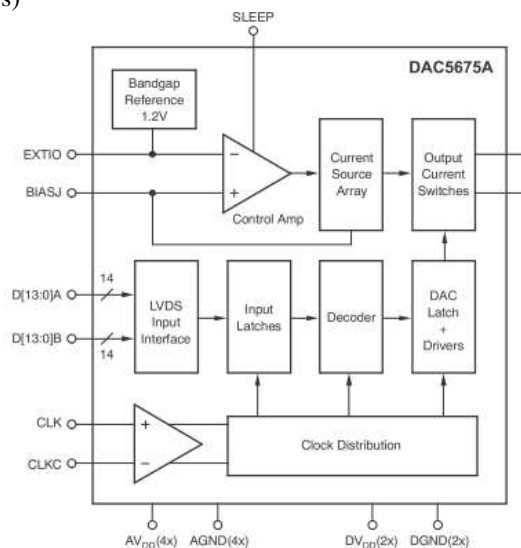


Figure 1: DAC5675AHFG Block Diagram

Identification of the main blocks of the device is shown on Figure 2 (see below).

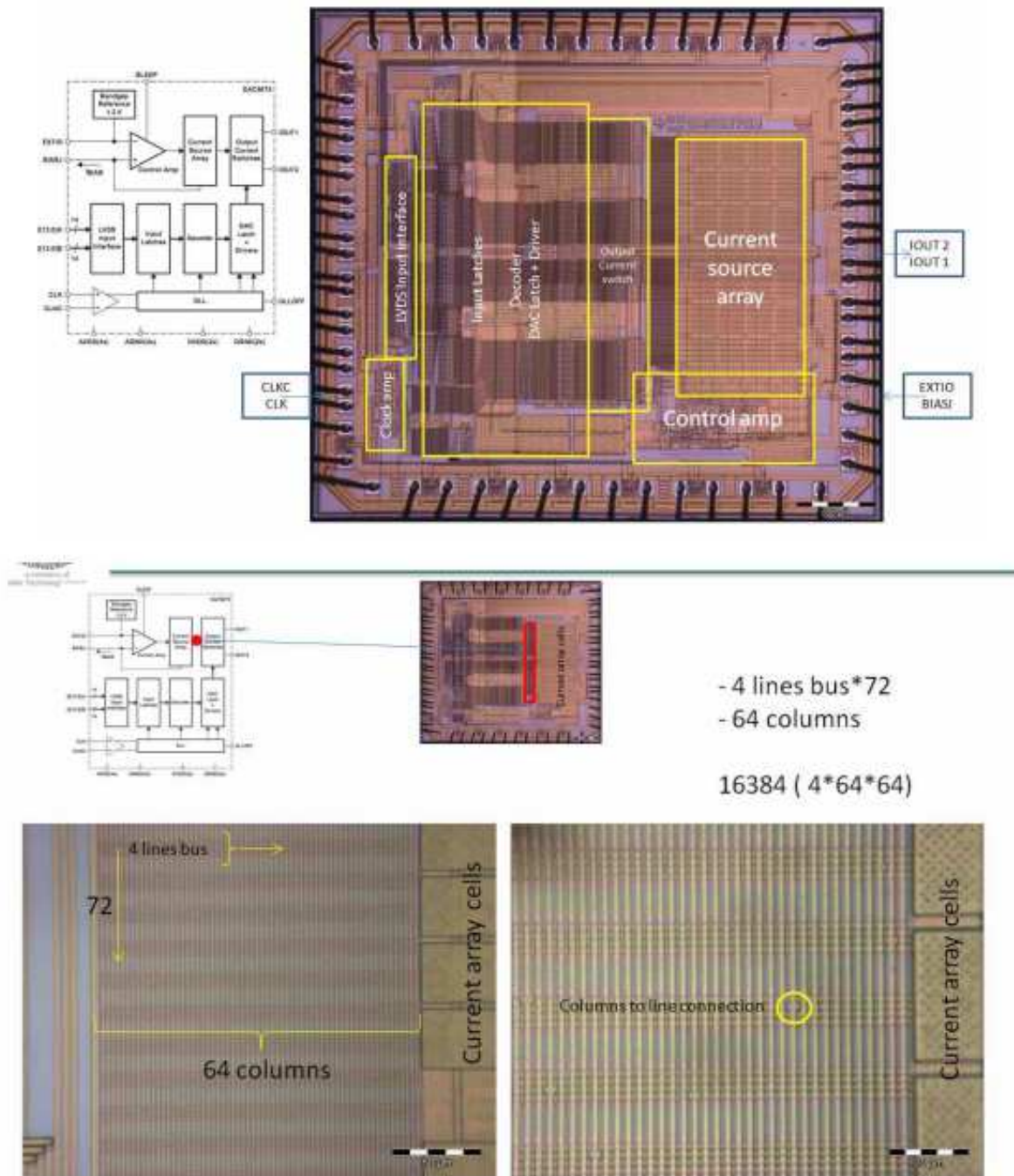


Figure 2: DAC5675AHFG Die Floorplan

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4 Test Samples

11 samples of the DAC5675AHFG device have been tested (5 ON + 5 OFF + 1 control sample).

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

Serial Number (serialized by Hirex)	Allocation
1	Control
2	Biased ON
3	Biased ON
4	Biased ON
5	Biased ON
6	Biased ON
7	Biased OFF
8	Biased OFF
9	Biased OFF
10	Biased OFF
11	Biased OFF

Identification of the DAC5675AHFG is provided below:

Part Type:	DAC5675AHFG	Part Number:	DAC5675AHFG
Top Marking:	logo DAC5675AHFG/EM EVAL ONLY THA 7ACR 1233A	Bottom Marking:	-
Date Code:	1233A	Lot Number:	2016803

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The complete tested devices traceability is provided on the following photos as well as the die marking.



Photo 1 – Top Device Marking

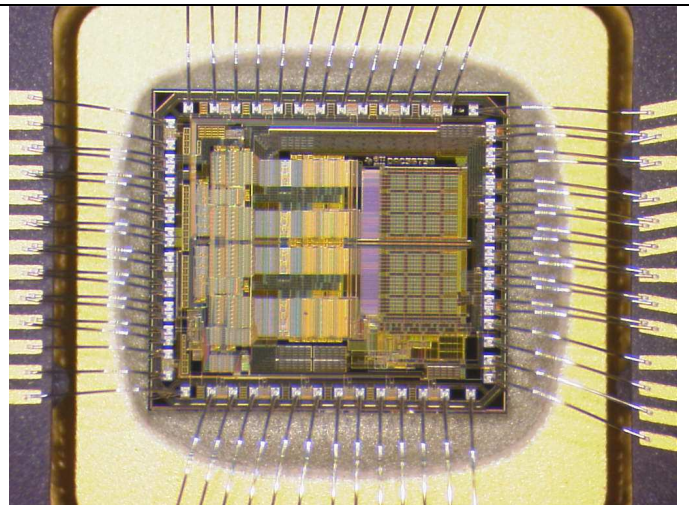


Photo 2 – Die View

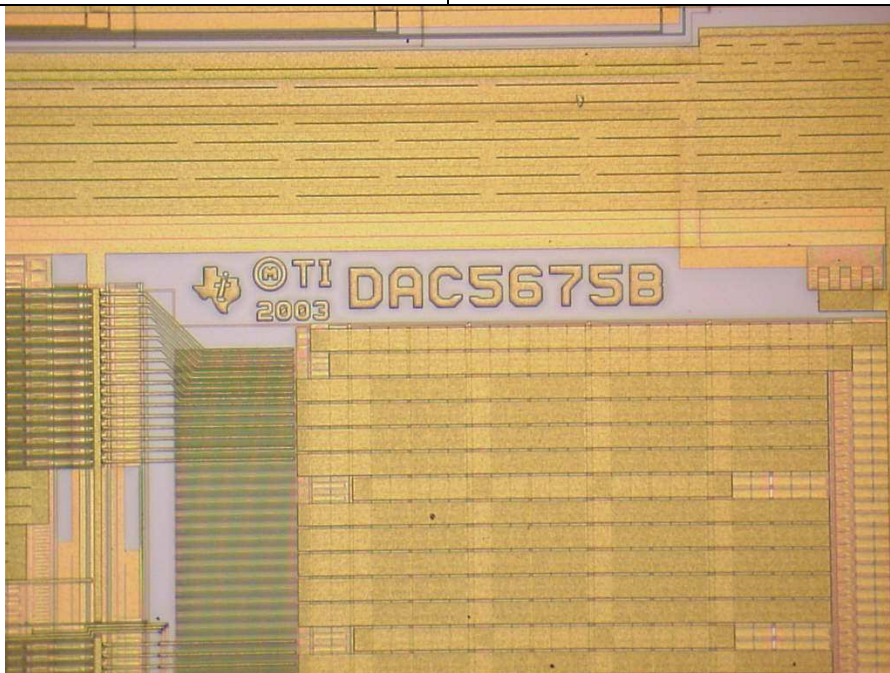


Photo 3 – Die Marking

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5 Experimental Conditions

5.1 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.

Prior to the test campaign the dose rate at board location is controlled using the Hirex calibrated dosimeter reference: Radcal Accu-Dose.

In addition, the dose received by the devices is verified by the measurement of one Alanine pellet dosimeter placed on the biasing board.

Resulting test conditions are provided below.

Irradiation Steps Requested	Pellet Dosimetry data	Dose rate	Annealing steps	Temperature
krad (Si)	krad (Si)	rad(Si)/h	Hours	°C
0	0	-	-	Room
10	8.2	310	-	Room
20	22.3	310	-	Room
30	28.7	310	-	Room
50	54.1	310	-	Room
100	106.7	310	-	Room
-	-	-	24h	Room
-	-	-	144h	Room
-	-	-	168h	100°C

5.2 Bias during Dose Exposures and Measurements conditions

5.2.1 Bias conditions

During exposures test board allowed to bias 5 samples in accordance with the electrical circuit provided in Figure 3. 5 other samples were biased OFF with all pins connected to ground. During annealing steps the same stress conditions have been applied at room and 100°C temperatures.

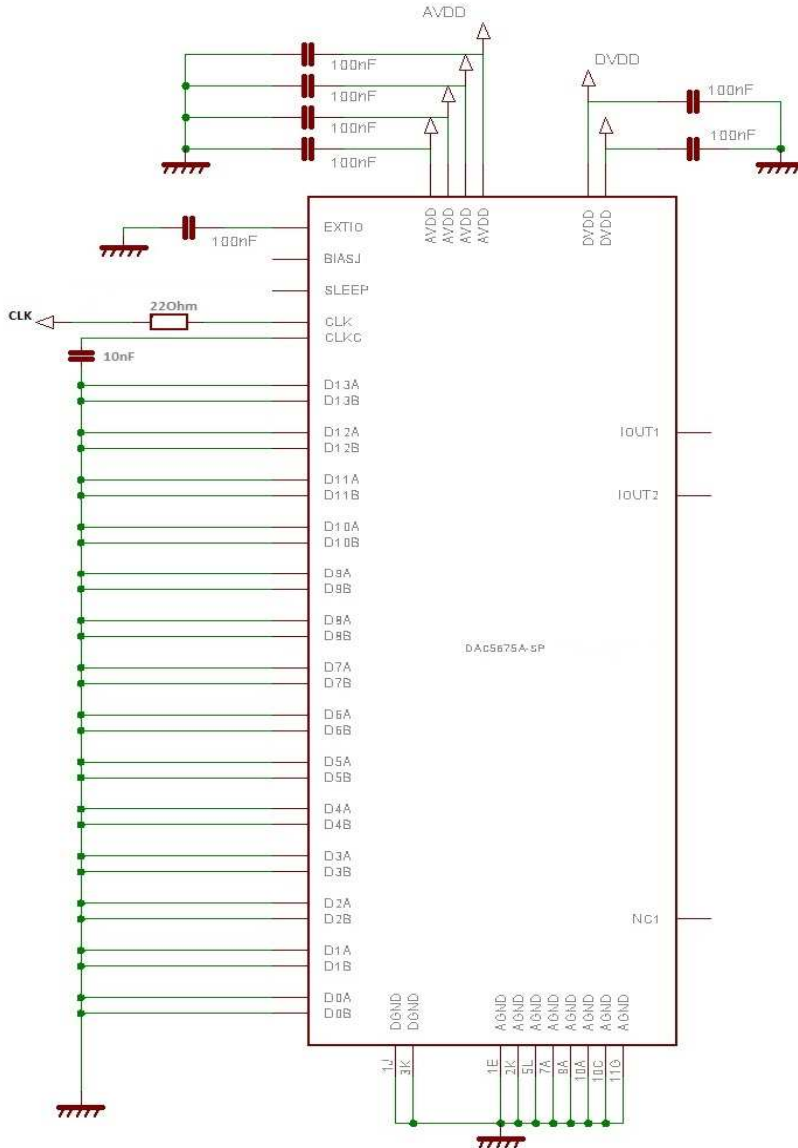


Figure 3: Bias Conditions during Irradiation Exposures and Annealing

5.2.2 Electrical Measurements

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

PARAMETERS	SYMBOLS	TEST CONDITIONS	Limits		UNITS
			MIN	MAX	
Linear Electrical specifications (Dvdd=Avdd=3.3V, 50 MSPS, I_{O(FS)}= 20 mA unless otherwise specified)					
Integral Non Linearity Positive	INL+	EXTIO Intern	-4	4.6	LSB
Integral Non Linearity Negative	INL-	EXTIO Intern	-4	4.6	LSB
Differential Non Linearity Positive	DNL+	EXTIO Intern	-2	2.2	LSB
Differential Non Linearity Negative	DNL-	EXTIO Intern	-2	2.2	LSB
Gain Error	Eg	EXTIO Extern	-10	10	%FSR
AC Electrical specifications (Dvdd=Avdd=3.3V, I_{O(FS)}= 20 mA, 50MSPS)					
Total harmonic distortion	THD	EXTIO Intern			dBc
Spurious free dynamic range	SFDR	EXTIO Intern			dBc
Signal to noise ratio	SNR	EXTIO Intern			dBc
DC Electrical specifications (Dvdd=Avdd=3.3V, 50 MSPS, I_{O(FS)}= 20 mA unless otherwise specified)					
Analog Supply Current	I _{avdd}	EXTIO Intern, Square @1Mhz		148	mA
Digital Supply Current	I _{dvdd}	EXTIO Intern, Square @1Mhz		130	mA
Reference Voltage	V _{EXTIO}	EXTIO Intern, Square @1Mhz	1.17	1.3	V
Digital specifications (Dvdd=Avdd=3.3V unless otherwise specified)					
High-level input current	I _{IH}	Sleep input	-100	100	μA
Low-level input current	I _{IL}	Sleep input	-10	10	μA

Table 1: Room Temperatures Electrical Measurements

5.2.2.1 Electrical test setup description

Electrical parameters test setup for DAC5675AHFG is provided in Figure 4.

A test bench including one converters tester and a HP4142 DC tester have been used to perform the required electrical measurements.

A dedicated test fixture was designed to ensure proper measurement conditions.



Figure 4: DAC5675AHFG test program principle

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Main Test Parameters are:

- Linear Electrical parameters
 - Offset Error,
 - Gain Error,
 - DNL (differential non-linearity),
 - INL (integral non-linearity).

- Dynamic Electrical parameters
 - THD,
 - SFDR,
 - SNR.

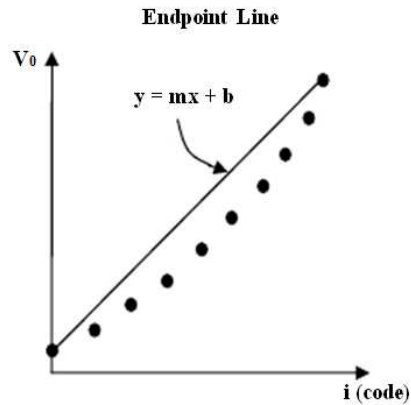
5.2.2.2 Linear electrical parameters description

Offset and Gain Error:

Gain and offset are extracted from a sample set of pair values. Each pair consists of digital code in and analog voltage out. These complete set of pair points constitute the DAC transfer curve (usually a line). The slope of the line is the DAC's inherent gain and the offset is some agreed upon point offset to a zero reference. The general transfer curve of the DAC can be represented

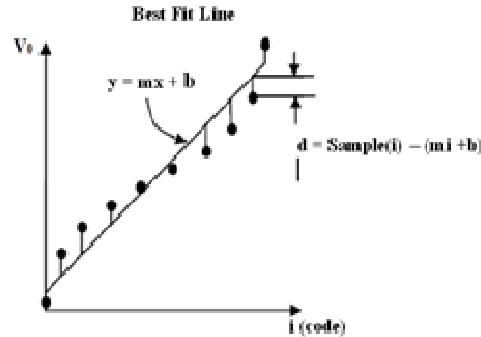
by the familiar equation: $y = mx + b$
 where DAC gain is m and DAC offset is b.

There are 2 main methods for determining gain and offset. First is the endpoint method which sets gain based on the minimum scale and full scale points. Offset is determined from either of the endpoints or a mid point code.



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A preferred technique is the best-fit line, the one that have been used in our case dor the DAC5675 test. Basically the m and the b (gain and offset) parameters are set based on the minimum mean square error (MMSE) distance (from line to sample).



With MMSE the line is based on the total sample set without favoritism to a few points. Squaring the distance has the effect of magnifying large distances and shrinking small distances. There are various techniques for calculating the m and b parameters of the best fit line. A common method minimizes the partial derivatives with respect to slope and offset of the squared distances between the best-fit line and sample seti. The equations derived from this method are:

$$gain = \frac{N K_4 - K_1 K_2}{N K_3 - K_{12}} \quad offset = \frac{K_2}{N} - gain \frac{K_2}{N}$$

Where:

$$K_1 = \sum_{i=0}^{N-1} i \quad K_2 = \sum_{i=0}^{N-1} S(i) \quad K_3 = \sum_{i=0}^{N-1} i^2 \quad K_4 = \sum_{i=0}^{N-1} iS(i)$$

These formulas are native in our ATX7006 and so implemented inside the test program to produce the m and b parameters of the best-fit line. The m parameter is gain in units of volts per quantum step. Gain error is usually reported normalized as a percent:

$$G_{err} = \frac{(m_{bestfit} - m_{target})}{m_{target}} * 100 \quad (\%)$$

Off course target m is the target gain the DAC was designed to. Offset error is usually reported with respect to the DAC zero code. The zero code could occur at Vmin if binary encoded or at Vmid if twos complement encoded. Be sure to pay attention to details of code positions. The zero code of twos complement is actually 1/2 quantum above mid scale. Offset error is usually reported normalized to LSB (quantum) units where Vlsb is the slope (m) of the best-fit line.

$$Off_{Serr} = \frac{((m_{bestfit} \times i_0 + b_{bestfit}) - V_{OffTarget})}{V_{lsb}} \quad (LSB)$$

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DNL:

Differential non-linearity is a metric of uniformity of the individual quanta step sizes. Use the previously collected DAC transfer data points. DNL consists of a set of N-1 data values. Each value is the difference between the actual step size and the LSB (quantum) step size normalized to one quantum:

$$DNL(i) = \frac{(S(i+1) - S(i) - V_{lsb})}{V_{lsb}} \quad (LSB)$$

In order to remove gain from the DNL metric V_{lsb} should be the slope of the best-fit line. Other means of calculating V_{lsb} have varying degrees of effect on DNL (although mostly negligible). The order of methods from most relaxed to most demanding is best-inl line, best-fit line, endpoint and design target. DNL can be reported as the full set of values in ascending code order to correlate with the DAC architecture. DNL can also be reported as the worst case positive and/or negative values of the set to be compared with pass/fail limits.

INL:

Integral non-linearity is a metric of cumulative match of the DAC transfer set to the best-fit line. One could also compare to the endpoint line or target design but these methods would include gain error. INL consists of a set of N data values. Each value is the difference between the sample point and the best-fit line and normalized to one quantum (v_{lsb}):

$$INL(i) = \frac{(S(i) - (m_{bestfit} \times i_0 + b_{bestfit}))}{V_{lsb}} \quad (LSB)$$

INL is the integral of the DNL curve and can also be calculated as the running sum of DNL values:

$$INL(i) = \frac{\sum_{j=0}^{i-1} DNL(j) + S(0) - (m_{bestfit} \times i + b_{bestfit})}{V_{lsb}} \quad (LSB)$$

And conversely, DNL can be calculated by taking the first derivative of the INL curve:

$$DNL(i) = INL(i+1) - INL(i) \quad (LSB)$$

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5.2.2.3 Dynamic electrical parameters description

SNR:

Signal to Noise Ratio (SNR) is the ratio of signal amplitude to noise amplitude expressed in dB. Noise content is computed as the orthogonal vector sum of the FFT noise bins (all excluding dc, fundamental and harmonics).

$$V_{rms\ noise} = \sqrt{\sum_{i=1}^{N/2-1} V_{pki}^2}$$

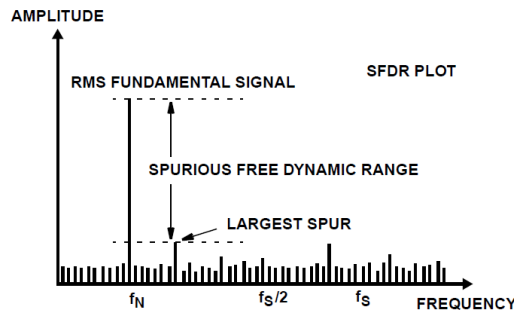
$$SNR = V_{rms_fund} / V_{rms_noise}$$

Other signal to noise and distortion ratios are computed by the same method while excluding appropriate bin(s) magnitudes.

SFDR:

SFDR is an important parameter for DACs. SFDR is a simple ratio of the fundamental to the largest spur.

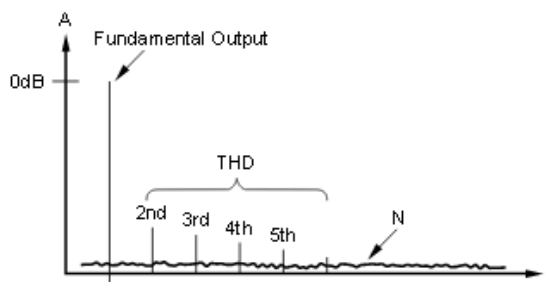
Basically SFDR (Spurious Free Dynamic Range) is the usable dynamic range of a DAC before spurious noise interferes or distorts the fundamental signal. SFDR is the measure of the difference in amplitude between the fundamental and the largest harmonically or non-harmonically related spur from DC to the full Nyquist bandwidth (half the DAC sampling rate, or f_s/2). A spur is any frequency bin on a spectrum analyzer, or from a Fourier transform, of the analog output of the DAC. Figure below shows how SFDR is measured correctly (SFDR is usually specified in dBc).



THD:

Total harmonic distortion plus noise is related to the linearity errors of the DAC, as well as the level of in-band noise.

As shown in figure below, when the signal is reconstructed from the digital source data, harmonic distortion occurs at both even and odd harmonics of the fundamental signal. The sum of these harmonics is defined as the total harmonic distortion, though in practice the sum is limited to seven or nine harmonic terms. For the complete term THD+N, the in-band noise term is included. If the measurement for THD+N is not bandlimited, the out-of-band noise will be included in the THD+N term, and will not be a true measurement of THD+N. Distortion is generally measured against amplitude (signal level) and frequency.



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6 Conclusion

A Total Ionizing Dose evaluation test was carried out by Hirex Engineering under ESTEC contract on the Texas Instruments DAC5675AHFG 14-BIT, 400-MSPS WITH LVDS, DIGITAL-TO-ANALOG CONVERTER in CQFP-52 package.

10 samples plus one control sample were used during testing. They were exposed to radiation using a dose rate of 310 rad(Si)/hour at room temperature.

All parameters remained within specification limits all along testing, and no significant drift was observed on any of them.

Detail test results are presented in next section.

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7 Test Results

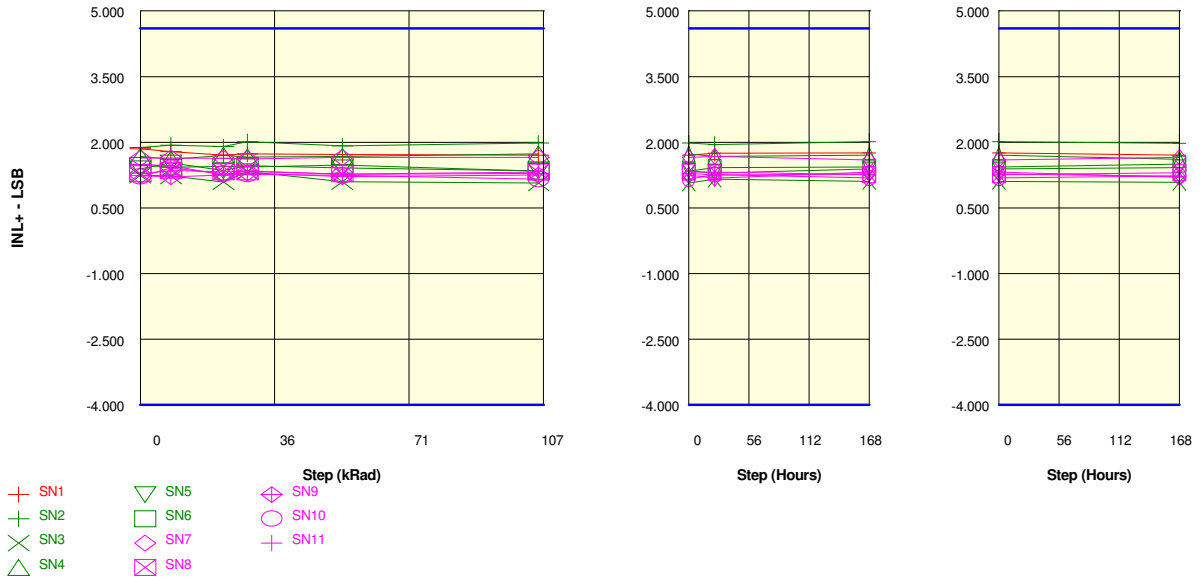
Test results including raw data tables and graphics are provided in this section for each measured parameter.

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

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

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

Parameter : Integral Non Linearity Positive : INL+
Test conditions : Dvdd=Avdd=3.3V. 50 MSPS. IO(FS)= 20 mA. EXTIO Intern
 Unit : LSB
 Spec Limit Min : -4.000
 Spec Limit Max : 4.600
 Spec limits are represented in bold lines on the graphic.



Measurements

INL+	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
SN1_REF	1.854	1.786	1.701	1.729	1.713	1.702	1.749	1.753	1.703
ON samples									
SN2	1.882	1.934	1.900	2.012	1.913	1.980	1.945	2.015	1.972
SN3	1.243	1.227	1.092	1.328	1.096	1.066	1.154	1.103	1.083
SN4	1.675	1.607	1.694	1.662	1.676	1.733	1.675	1.706	1.609
SN5	1.387	1.524	1.351	1.460	1.411	1.345	1.293	1.390	1.415
SN6	1.474	1.427	1.448	1.437	1.477	1.335	1.422	1.432	1.498
Statistics									
Min	1.243	1.227	1.092	1.328	1.096	1.066	1.154	1.103	1.083
Max	1.882	1.934	1.900	2.012	1.913	1.980	1.945	2.015	1.972
Average	1.532	1.544	1.497	1.580	1.515	1.492	1.498	1.529	1.516
Sigma	0.224	0.233	0.279	0.242	0.273	0.324	0.282	0.309	0.288

Drift Calculation

INL+	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
ON samples									
SN2	-	52.0E-03	17.6E-03	130.1E-03	30.5E-03	98.0E-03	62.5E-03	133.0E-03	89.5E-03
SN3	-	-16.5E-03	-150.6E-03	85.1E-03	-146.6E-03	-177.5E-03	-88.6E-03	-140.0E-03	-159.9E-03
SN4	-	-67.6E-03	19.8E-03	-12.8E-03	974.0E-06	58.7E-03	-146.0E-06	30.9E-03	-65.7E-03
SN5	-	137.2E-03	-36.1E-03	73.3E-03	24.2E-03	-41.7E-03	-93.9E-03	2.8E-03	28.4E-03
SN6	-	-47.5E-03	-26.1E-03	-37.1E-03	2.8E-03	-139.6E-03	-52.4E-03	-42.7E-03	24.2E-03
Average	-	11.5E-03	-35.1E-03	47.7E-03	-17.6E-03	-40.4E-03	-34.5E-03	-3.2E-03	-16.7E-03
Sigma	-	74.8E-03	62.0E-03	62.8E-03	65.5E-03	107.3E-03	58.9E-03	89.5E-03	87.1E-03

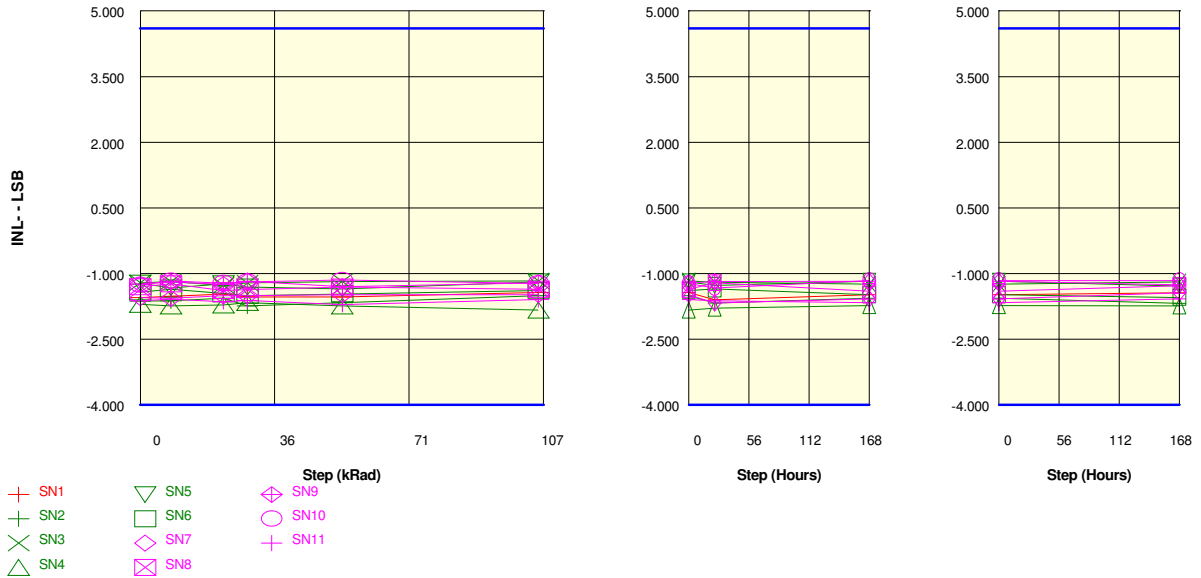
Measurements

INL+	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
SN1_REF	1.854	1.786	1.701	1.729	1.713	1.702	1.749	1.753	1.703
OFF samples									
SN7	1.634	1.641	1.628	1.617	1.647	1.655	1.675	1.595	1.654
SN8	1.276	1.356	1.325	1.327	1.276	1.316	1.314	1.261	1.301
SN9	1.234	1.210	1.253	1.294	1.215	1.245	1.174	1.313	1.199
SN10	1.214	1.413	1.280	1.266	1.240	1.154	1.259	1.179	1.227
SN11	1.494	1.466	1.249	1.348	1.267	1.283	1.250	1.277	1.217
Statistics									
Min	1.214	1.210	1.249	1.266	1.215	1.154	1.174	1.179	1.199
Max	1.634	1.641	1.628	1.617	1.647	1.655	1.675	1.595	1.654
Average	1.370	1.417	1.347	1.371	1.329	1.331	1.334	1.325	1.319
Sigma	0.165	0.141	0.143	0.126	0.160	0.171	0.176	0.142	0.171

Drift Calculation

INL+	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
OFF samples									
SN7	-	7.2E-03	-5.8E-03	-16.9E-03	12.7E-03	21.2E-03	40.9E-03	-38.5E-03	20.0E-03
SN8	-	80.4E-03	48.5E-03	50.9E-03	164.0E-06	39.6E-03	38.1E-03	-15.3E-03	24.5E-03
SN9	-	-24.6E-03	18.3E-03	59.5E-03	-19.3E-03	11.2E-03	-60.3E-03	78.5E-03	-35.5E-03
SN10	-	199.2E-03	66.5E-03	52.7E-03	26.3E-03	-59.8E-03	45.6E-03	-34.5E-03	13.0E-03
SN11	-	-28.0E-03	-244.6E-03	-145.2E-03	-227.0E-03	-210.8E-03	-243.8E-03	-216.9E-03	-277.1E-03
Average	-	46.9E-03	-23.4E-03	213.0E-06	-41.4E-03	-39.7E-03	-35.9E-03	-45.3E-03	-51.0E-03
Sigma	-	85.6E-03	113.4E-03	77.8E-03	94.0E-03	92.0E-03	111.2E-03	95.7E-03	115.1E-03

Parameter : Integral Non Linearity Negative : INL-
 Test conditions : Dvdd=Avdd=3.3V. 50 MSPS. IO(FS)= 20 mA. EXTIO Intern
 Unit : LSB
 Spec Limit Min : -4.000
 Spec Limit Max : 4.600
 Spec limits are represented in bold lines on the graphic.



Measurements

INL-	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
SN1_REF	-1.546	-1.522	-1.472	-1.538	-1.534	-1.436	-1.604	-1.484	-1.441
ON samples									
SN2	-1.627	-1.623	-1.561	-1.739	-1.671	-1.510	-1.675	-1.560	-1.682
SN3	-1.212	-1.185	-1.269	-1.218	-1.182	-1.168	-1.200	-1.247	-1.189
SN4	-1.705	-1.742	-1.717	-1.665	-1.742	-1.835	-1.792	-1.733	-1.742
SN5	-1.224	-1.328	-1.234	-1.310	-1.355	-1.191	-1.272	-1.175	-1.287
SN6	-1.425	-1.360	-1.460	-1.503	-1.466	-1.387	-1.353	-1.483	-1.546
Statistics									
Min	-1.705	-1.742	-1.717	-1.739	-1.742	-1.835	-1.792	-1.733	-1.742
Max	-1.212	-1.185	-1.234	-1.218	-1.182	-1.168	-1.200	-1.175	-1.189
Average	-1.438	-1.448	-1.448	-1.487	-1.483	-1.418	-1.458	-1.439	-1.489
Sigma	0.202	0.204	0.180	0.200	0.205	0.244	0.233	0.205	0.217

Drift Calculation

INL-	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
ON samples									
SN2	-	3.2E-03	65.6E-03	-112.7E-03	-44.6E-03	116.7E-03	-48.2E-03	66.9E-03	-55.5E-03
SN3	-	27.3E-03	-57.3E-03	-5.9E-03	30.1E-03	44.2E-03	12.3E-03	-35.0E-03	23.3E-03
SN4	-	-37.0E-03	-11.7E-03	40.1E-03	-37.3E-03	-129.7E-03	-86.7E-03	-28.4E-03	-36.8E-03
SN5	-	-104.5E-03	-10.1E-03	-85.7E-03	-131.2E-03	32.4E-03	-48.5E-03	49.2E-03	-63.3E-03
SN6	-	65.1E-03	-35.3E-03	-78.1E-03	-41.1E-03	37.9E-03	71.3E-03	-58.0E-03	-120.9E-03
Average	-	-9.2E-03	-9.8E-03	-48.5E-03	-44.8E-03	20.3E-03	-20.0E-03	-1.1E-03	-50.6E-03
Sigma	-	58.1E-03	41.5E-03	56.7E-03	51.3E-03	81.0E-03	55.6E-03	49.6E-03	46.4E-03

Hirex Engineering	TOTAL IONIZING DOSE TEST REPORT						Ref.:	HRX/TID/1206
	DAC5675AHFG			Texas Instruments			Issue:	01

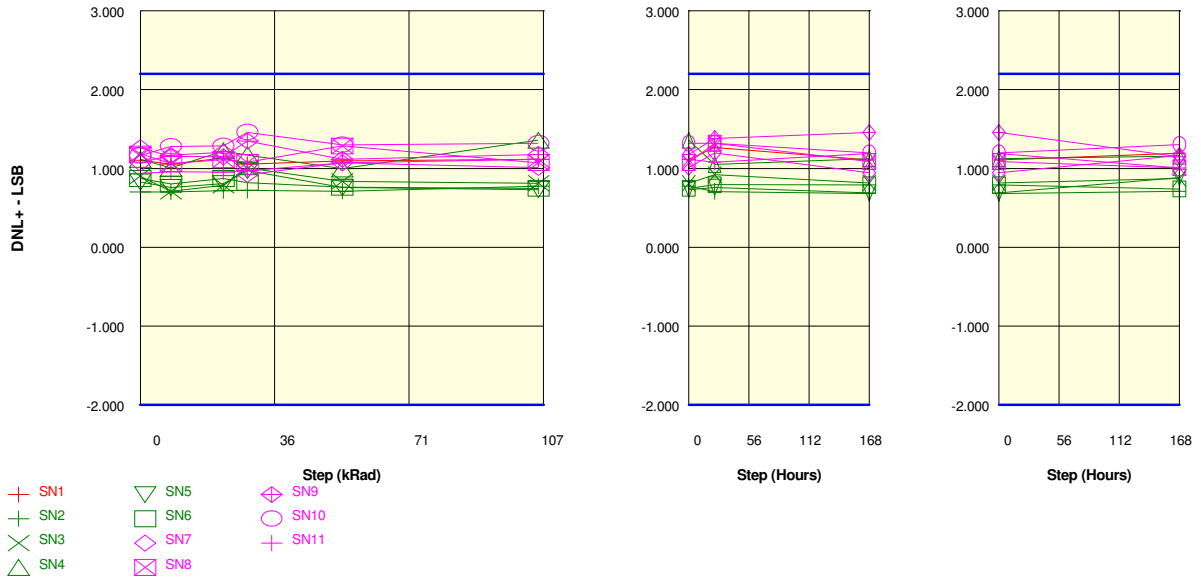
Measurements

INL-	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
SN1_REF	-1.546	-1.522	-1.472	-1.538	-1.534	-1.436	-1.604	-1.484	-1.441
OFF samples									
SN7	-1.549	-1.567	-1.511	-1.506	-1.487	-1.481	-1.677	-1.578	-1.437
SN8	-1.302	-1.237	-1.390	-1.369	-1.310	-1.361	-1.211	-1.408	-1.278
SN9	-1.245	-1.188	-1.252	-1.172	-1.303	-1.213	-1.185	-1.175	-1.257
SN10	-1.259	-1.169	-1.222	-1.191	-1.151	-1.227	-1.330	-1.161	-1.163
SN11	-1.621	-1.589	-1.641	-1.615	-1.707	-1.597	-1.622	-1.667	-1.579
Statistics									
Min	-1.621	-1.589	-1.641	-1.615	-1.707	-1.597	-1.677	-1.667	-1.579
Max	-1.245	-1.169	-1.222	-1.172	-1.151	-1.213	-1.185	-1.161	-1.163
Average	-1.395	-1.350	-1.403	-1.371	-1.392	-1.376	-1.405	-1.398	-1.343
Sigma	0.158	0.188	0.158	0.173	0.190	0.147	0.206	0.205	0.147

Drift Calculation

INL-	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
OFF samples									
SN7	-	-17.8E-03	37.8E-03	42.7E-03	61.8E-03	68.3E-03	-127.9E-03	-28.6E-03	112.3E-03
SN8	-	65.1E-03	-87.7E-03	-66.5E-03	-7.3E-03	-58.2E-03	91.3E-03	-105.4E-03	24.3E-03
SN9	-	56.7E-03	-6.8E-03	72.6E-03	-58.5E-03	31.9E-03	59.8E-03	69.9E-03	-12.5E-03
SN10	-	90.1E-03	37.4E-03	68.7E-03	108.3E-03	31.9E-03	-70.7E-03	98.6E-03	96.1E-03
SN11	-	31.8E-03	-20.2E-03	6.1E-03	-86.4E-03	24.1E-03	-735.0E-06	-46.1E-03	41.6E-03
Average	-	45.2E-03	-7.9E-03	24.7E-03	3.6E-03	19.6E-03	-9.6E-03	-2.3E-03	52.4E-03
Sigma	-	36.6E-03	46.2E-03	51.4E-03	72.7E-03	41.8E-03	81.0E-03	75.7E-03	46.1E-03

Parameter : Differential Non Linearity Positive : DNL+
 Test conditions : Dvdd=Avdd=3.3V. 50 MSPS. IO(FS)= 20 mA. EXTIO Intern
 Unit : LSB
 Spec Limit Min : -2.000
 Spec Limit Max : 2.200
 Spec limits are represented in bold lines on the graphic.



Measurements

DNL+	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
SN1_REF	1.104	1.053	1.134	1.053	1.093	1.118	1.266	1.106	1.193
ON samples									
SN2	0.701	0.700	0.717	0.722	0.710	0.776	0.708	0.681	0.709
SN3	0.902	0.709	0.785	1.003	0.835	0.810	0.922	0.816	0.871
SN4	1.115	1.004	1.224	1.171	0.995	1.358	1.051	1.124	1.155
SN5	0.828	0.758	0.808	0.973	0.757	0.732	0.760	0.690	0.887
SN6	0.871	0.801	0.873	0.821	0.764	0.748	0.793	0.791	0.739
Statistics									
Min	0.701	0.700	0.717	0.722	0.710	0.732	0.708	0.681	0.709
Max	1.115	1.004	1.224	1.171	0.995	1.358	1.051	1.124	1.155
Average	0.883	0.795	0.881	0.938	0.812	0.885	0.847	0.820	0.872
Sigma	0.135	0.111	0.178	0.155	0.100	0.238	0.124	0.161	0.158

Drift Calculation

DNL+	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
ON samples									
SN2	-	-527.8E-06	16.4E-03	21.2E-03	8.7E-03	75.1E-03	7.4E-03	-19.7E-03	8.2E-03
SN3	-	-192.8E-03	-116.7E-03	101.2E-03	-66.9E-03	-91.6E-03	19.7E-03	-86.2E-03	-31.1E-03
SN4	-	-110.7E-03	108.9E-03	56.1E-03	-119.4E-03	243.3E-03	-63.6E-03	9.2E-03	40.6E-03
SN5	-	-69.4E-03	-19.9E-03	145.3E-03	-70.5E-03	-95.5E-03	-67.4E-03	-137.5E-03	59.4E-03
SN6	-	-69.3E-03	2.0E-03	-50.0E-03	-106.9E-03	-123.0E-03	-77.6E-03	-79.3E-03	-131.3E-03
Average	-	-88.5E-03	-1.9E-03	54.8E-03	-71.0E-03	1.7E-03	-36.3E-03	-62.7E-03	-10.8E-03
Sigma	-	63.0E-03	72.3E-03	67.0E-03	44.7E-03	139.6E-03	41.1E-03	51.9E-03	67.6E-03

Hirex Engineering	TOTAL IONIZING DOSE TEST REPORT						Ref.:	HRX/TID/1206
	DAC5675AHFG			Texas Instruments			Issue:	01

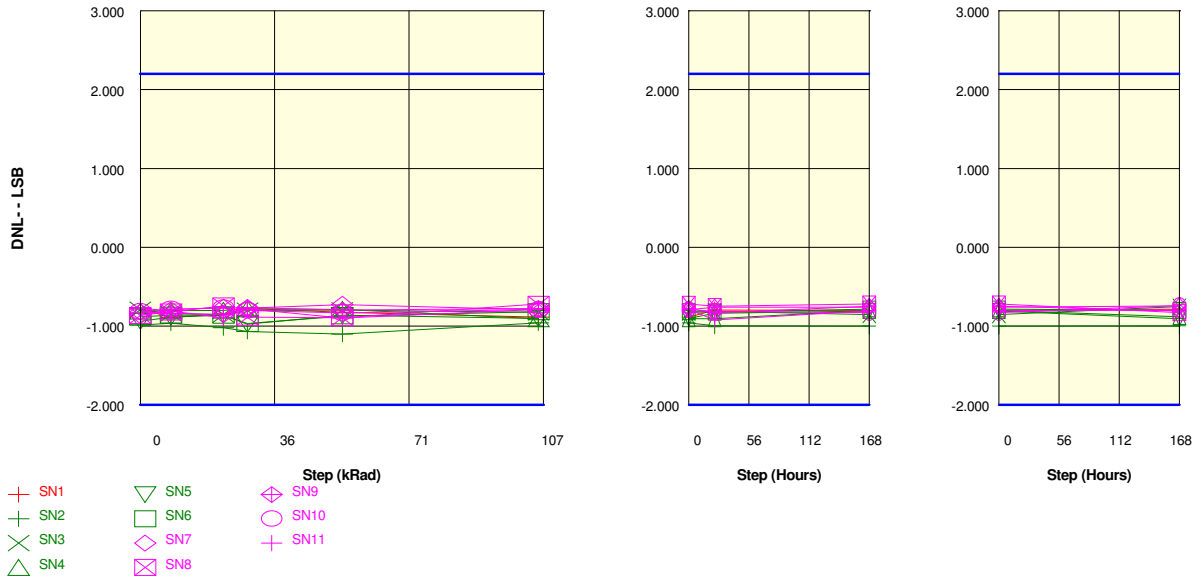
Measurements

DNL+	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
SN1_REF	1.104	1.053	1.134	1.053	1.093	1.118	1.266	1.106	1.193
OFF samples									
SN7	1.069	1.167	1.204	0.924	1.072	1.013	1.196	0.946	1.165
SN8	1.182	1.062	1.112	1.078	1.285	1.074	1.317	1.088	1.008
SN9	1.263	1.151	1.148	1.348	1.116	1.176	1.381	1.455	1.149
SN10	1.163	1.280	1.285	1.460	1.300	1.319	1.318	1.198	1.302
SN11	0.939	0.956	0.954	0.970	1.070	1.116	1.080	1.187	1.006
Statistics									
Min	0.939	0.956	0.954	0.924	1.070	1.013	1.080	0.946	1.006
Max	1.263	1.280	1.285	1.460	1.300	1.319	1.381	1.455	1.302
Average	1.123	1.123	1.141	1.156	1.168	1.140	1.258	1.175	1.126
Sigma	0.111	0.109	0.110	0.212	0.102	0.104	0.108	0.167	0.111

Drift Calculation

DNL+	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
OFF samples									
SN7	-	97.9E-03	134.3E-03	-145.7E-03	2.9E-03	-56.2E-03	126.4E-03	-123.5E-03	95.3E-03
SN8	-	-120.3E-03	-70.6E-03	-104.5E-03	102.7E-03	-108.2E-03	135.3E-03	-94.4E-03	-174.5E-03
SN9	-	-111.9E-03	-114.4E-03	85.5E-03	-146.9E-03	-86.2E-03	118.6E-03	192.5E-03	-113.9E-03
SN10	-	116.7E-03	121.5E-03	296.6E-03	136.2E-03	155.6E-03	154.4E-03	34.6E-03	138.8E-03
SN11	-	17.0E-03	15.6E-03	30.9E-03	131.3E-03	177.4E-03	140.9E-03	248.6E-03	66.9E-03
Average	-	-131.8E-06	17.3E-03	32.6E-03	45.2E-03	16.5E-03	135.1E-03	51.6E-03	2.5E-03
Sigma	-	100.5E-03	99.6E-03	156.9E-03	107.4E-03	123.8E-03	12.3E-03	149.0E-03	123.4E-03

Parameter : Differential Non Linearity Negative : DNL-
 Test conditions : Dvdd=Avdd=3.3V. 50 MSPS. IO(FS)= 20 mA. EXTIO Intern
 Unit : LSB
 Spec Limit Min : -2.000
 Spec Limit Max : 2.200
 Spec limits are represented in bold lines on the graphic.



Measurements

DNL-	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
SN1_REF	-0.779	-0.891	-0.848	-0.777	-0.824	-0.888	-0.797	-0.804	-0.785
ON samples									
SN2	-0.989	-0.963	-1.022	-1.068	-1.102	-0.960	-0.997	-1.001	-0.997
SN3	-0.793	-0.843	-0.854	-0.803	-0.798	-0.828	-0.814	-0.857	-0.754
SN4	-0.811	-0.807	-0.800	-0.781	-0.787	-0.906	-0.906	-0.801	-0.881
SN5	-0.939	-0.887	-0.860	-0.976	-0.864	-0.902	-0.838	-0.811	-0.906
SN6	-0.884	-0.862	-0.863	-0.968	-0.874	-0.819	-0.824	-0.785	-0.801
Statistics									
Min	-0.989	-0.963	-1.022	-1.068	-1.102	-0.960	-0.997	-1.001	-0.997
Max	-0.793	-0.807	-0.800	-0.781	-0.787	-0.819	-0.814	-0.785	-0.754
Average	-0.883	-0.872	-0.880	-0.919	-0.885	-0.883	-0.876	-0.851	-0.868
Sigma	0.074	0.052	0.075	0.110	0.114	0.053	0.068	0.079	0.085

Drift Calculation

DNL-	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
ON samples									
SN2	-	26.0E-03	-33.6E-03	-79.0E-03	-113.6E-03	28.5E-03	-8.0E-03	-12.5E-03	-8.0E-03
SN3	-	-49.7E-03	-61.2E-03	-10.4E-03	-5.0E-03	-34.7E-03	-21.5E-03	-63.9E-03	39.2E-03
SN4	-	4.1E-03	10.6E-03	29.7E-03	23.2E-03	-95.7E-03	-95.3E-03	9.6E-03	-70.9E-03
SN5	-	52.4E-03	79.3E-03	-36.7E-03	75.1E-03	37.3E-03	101.2E-03	127.9E-03	32.9E-03
SN6	-	22.0E-03	21.1E-03	-84.2E-03	10.0E-03	65.6E-03	60.6E-03	99.4E-03	83.5E-03
Average	-	11.0E-03	3.2E-03	-36.1E-03	-2.1E-03	211.1E-06	7.4E-03	32.1E-03	15.3E-03
Sigma	-	34.1E-03	48.3E-03	42.8E-03	62.0E-03	58.1E-03	68.2E-03	71.3E-03	52.0E-03

Hirex Engineering	TOTAL IONIZING DOSE TEST REPORT						Ref.:	HRX/TID/1206
	DAC5675AHFG			Texas Instruments			Issue:	01

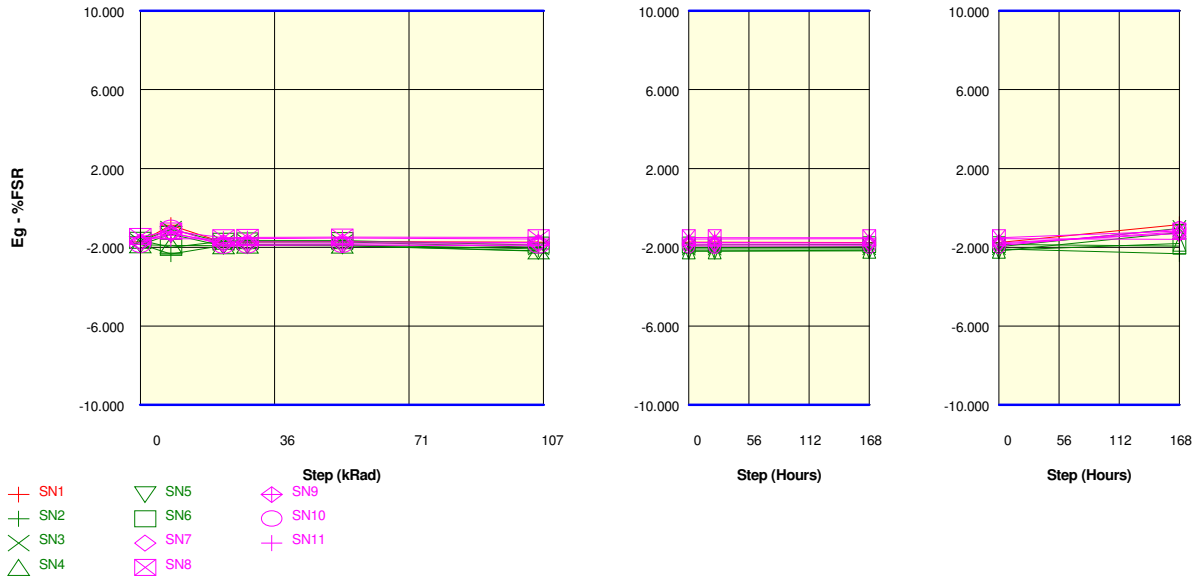
Measurements

DNL-	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
SN1_REF	-0.779	-0.891	-0.848	-0.777	-0.824	-0.888	-0.797	-0.804	-0.785
OFF samples									
SN7	-0.866	-0.795	-0.764	-0.775	-0.726	-0.792	-0.761	-0.762	-0.742
SN8	-0.864	-0.822	-0.745	-0.887	-0.895	-0.723	-0.751	-0.721	-0.830
SN9	-0.823	-0.837	-0.853	-0.765	-0.799	-0.777	-0.831	-0.748	-0.812
SN10	-0.816	-0.784	-0.771	-0.802	-0.831	-0.791	-0.813	-0.830	-0.740
SN11	-0.775	-0.809	-0.895	-0.780	-0.897	-0.791	-0.923	-0.807	-0.799
Statistics									
Min	-0.866	-0.837	-0.895	-0.887	-0.897	-0.792	-0.923	-0.830	-0.830
Max	-0.775	-0.784	-0.745	-0.765	-0.726	-0.723	-0.751	-0.721	-0.740
Average	-0.829	-0.809	-0.806	-0.802	-0.830	-0.775	-0.816	-0.774	-0.785
Sigma	0.034	0.019	0.058	0.045	0.064	0.026	0.062	0.040	0.037

Drift Calculation

DNL-	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
OFF samples									
SN7	-	71.0E-03	102.3E-03	91.2E-03	139.9E-03	74.0E-03	105.2E-03	103.7E-03	123.9E-03
SN8	-	42.6E-03	119.3E-03	-23.1E-03	-30.9E-03	141.5E-03	113.5E-03	142.8E-03	33.9E-03
SN9	-	-14.1E-03	-30.1E-03	58.5E-03	24.3E-03	46.5E-03	-8.2E-03	75.5E-03	11.5E-03
SN10	-	32.2E-03	45.1E-03	13.9E-03	-14.9E-03	25.1E-03	2.9E-03	-14.0E-03	76.1E-03
SN11	-	-34.8E-03	-120.9E-03	-5.3E-03	-122.5E-03	-16.0E-03	-148.2E-03	-32.5E-03	-24.1E-03
Average	-	19.4E-03	23.1E-03	27.0E-03	-818.2E-06	54.2E-03	13.0E-03	55.1E-03	44.3E-03
Sigma	-	38.5E-03	89.0E-03	42.0E-03	85.2E-03	52.6E-03	95.0E-03	67.7E-03	51.4E-03

Parameter : Gain Error : Eg
 Test conditions : Dvdd=Avdd=3.3V. 50 MSPS. IO(FS)= 20 mA. EXTIO Extern
 Unit : %FSR
 Spec Limit Min : -10.000
 Spec Limit Max : 10.000
 Spec limits are represented in bold lines on the graphic.



Measurements

Eg	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
SN1_REF	-1.720	-0.878	-1.770	-1.727	-1.712	-1.749	-1.750	-1.762	-0.854
ON samples									
SN2	-1.848	-2.352	-1.913	-1.884	-1.874	-2.088	-2.083	-2.087	-2.335
SN3	-1.692	-1.075	-1.757	-1.727	-1.735	-1.996	-1.995	-1.979	-1.046
SN4	-1.872	-1.901	-1.924	-1.890	-1.901	-2.187	-2.184	-2.158	-1.806
SN5	-1.878	-1.350	-1.946	-1.913	-1.924	-2.202	-2.198	-2.178	-1.258
SN6	-1.641	-2.002	-1.702	-1.671	-1.664	-1.887	-1.881	-1.860	-1.942
Statistics									
Min	-1.878	-2.352	-1.946	-1.913	-1.924	-2.202	-2.198	-2.178	-2.335
Max	-1.641	-1.075	-1.702	-1.671	-1.664	-1.887	-1.881	-1.860	-1.046
Average	-1.786	-1.736	-1.848	-1.817	-1.820	-2.072	-2.068	-2.052	-1.677
Sigma	0.100	0.461	0.099	0.098	0.102	0.119	0.119	0.119	0.468

Drift Calculation

Eg	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
ON samples									
SN2	-	-504.0E-03	-65.1E-03	-35.8E-03	-25.4E-03	-239.3E-03	-235.0E-03	-238.8E-03	-486.8E-03
SN3	-	617.1E-03	-64.2E-03	-34.1E-03	-42.5E-03	-303.6E-03	-302.4E-03	-286.5E-03	646.8E-03
SN4	-	-28.4E-03	-51.9E-03	-18.0E-03	-29.1E-03	-314.8E-03	-311.3E-03	-285.5E-03	66.6E-03
SN5	-	527.5E-03	-68.4E-03	-35.4E-03	-46.8E-03	-324.3E-03	-320.7E-03	-300.7E-03	619.6E-03
SN6	-	-361.6E-03	-61.3E-03	-30.8E-03	-22.9E-03	-246.1E-03	-240.3E-03	-219.5E-03	-301.4E-03
Average	-	50.1E-03	-62.2E-03	-30.8E-03	-33.3E-03	-285.6E-03	-281.9E-03	-266.2E-03	109.0E-03
Sigma	-	454.3E-03	5.6E-03	6.6E-03	9.5E-03	35.7E-03	36.7E-03	31.3E-03	463.7E-03

Hirex Engineering	TOTAL IONIZING DOSE TEST REPORT						Ref.:	HRX/TID/1206
	DAC5675AHFG			Texas Instruments			Issue:	01

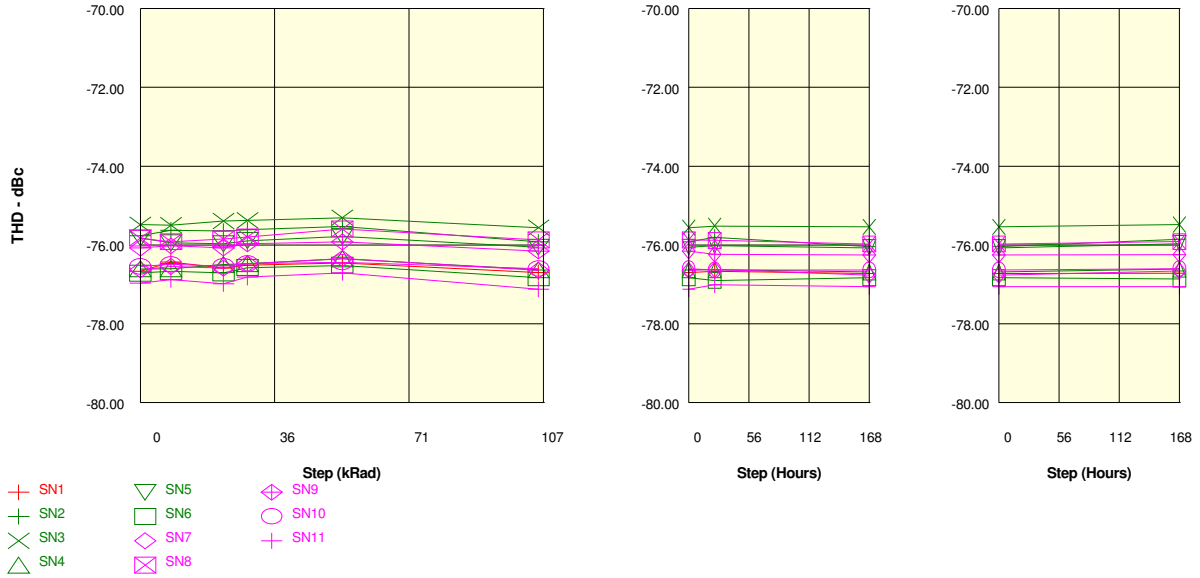
Measurements

Eg	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
SN1_REF	-1.720	-0.878	-1.770	-1.727	-1.712	-1.749	-1.750	-1.762	-0.854
OFF samples									
SN7	-1.703	-1.307	-1.757	-1.735	-1.724	-1.761	-1.766	-1.773	-1.312
SN8	-1.458	-1.182	-1.518	-1.500	-1.479	-1.506	-1.514	-1.518	-1.175
SN9	-1.778	-1.255	-1.850	-1.834	-1.819	-1.836	-1.843	-1.846	-1.234
SN10	-1.875	-1.019	-1.932	-1.912	-1.888	-1.924	-1.934	-1.928	-1.087
SN11	-1.503	-1.570	-1.578	-1.562	-1.537	-1.572	-1.587	-1.564	-1.599
Statistics									
Min	-1.875	-1.570	-1.932	-1.912	-1.888	-1.924	-1.934	-1.928	-1.599
Max	-1.458	-1.019	-1.518	-1.500	-1.479	-1.506	-1.514	-1.518	-1.087
Average	-1.663	-1.267	-1.727	-1.709	-1.689	-1.720	-1.729	-1.726	-1.281
Sigma	0.160	0.180	0.158	0.157	0.158	0.158	0.157	0.159	0.175

Drift Calculation

Eg	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
OFF samples									
SN7	-	395.5E-03	-54.2E-03	-32.2E-03	-21.8E-03	-58.7E-03	-63.9E-03	-70.8E-03	390.3E-03
SN8	-	275.7E-03	-59.9E-03	-42.2E-03	-20.8E-03	-48.5E-03	-56.2E-03	-60.0E-03	283.2E-03
SN9	-	522.9E-03	-72.2E-03	-56.3E-03	-41.5E-03	-57.7E-03	-64.6E-03	-67.6E-03	543.8E-03
SN10	-	856.0E-03	-57.1E-03	-37.0E-03	-12.8E-03	-48.6E-03	-58.4E-03	-52.5E-03	788.5E-03
SN11	-	-66.3E-03	-74.2E-03	-58.9E-03	-33.4E-03	-68.4E-03	-84.0E-03	-60.2E-03	-95.8E-03
Average	-	396.8E-03	-63.5E-03	-45.3E-03	-26.1E-03	-56.4E-03	-65.4E-03	-62.2E-03	382.0E-03
Sigma	-	302.0E-03	8.1E-03	10.6E-03	10.1E-03	7.4E-03	9.8E-03	6.4E-03	293.1E-03

Parameter : Total harmonic distortion : THD
 Test conditions : Dvdd=Avdd=3.3V. 50 MSPS. IO(FS)= 20 mA. EXTIO Intern
 Unit : dBc
 No spec limit specified.



Measurements

THD	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
SN1_REF	-76.67	-76.43	-76.59	-76.51	-76.45	-76.70	-76.67	-76.73	-76.72
ON samples									
SN2	-75.77	-75.62	-75.65	-75.61	-75.53	-75.93	-75.81	-76.04	-75.86
SN3	-75.49	-75.50	-75.39	-75.38	-75.31	-75.56	-75.52	-75.54	-75.48
SN4	-76.61	-76.61	-76.50	-76.48	-76.35	-76.63	-76.63	-76.69	-76.61
SN5	-75.82	-75.95	-75.97	-75.89	-75.79	-76.06	-76.02	-76.07	-75.97
SN6	-76.71	-76.67	-76.71	-76.58	-76.52	-76.83	-76.90	-76.83	-76.86
Statistics									
Min	-76.71	-76.67	-76.71	-76.58	-76.52	-76.83	-76.90	-76.83	-76.86
Max	-75.49	-75.50	-75.39	-75.38	-75.31	-75.56	-75.52	-75.54	-75.48
Average	-76.08	-76.07	-76.04	-75.99	-75.90	-76.20	-76.17	-76.23	-76.16
Sigma	0.49	0.49	0.50	0.47	0.47	0.47	0.51	0.47	0.51

Drift Calculation

THD	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
ON samples									
SN2	-	142.0E-03	116.0E-03	154.0E-03	234.0E-03	-160.0E-03	-42.0E-03	-274.0E-03	-91.0E-03
SN3	-	-12.0E-03	93.0E-03	108.0E-03	178.0E-03	-75.0E-03	-33.0E-03	-57.0E-03	4.0E-03
SN4	-	2.0E-03	108.0E-03	131.0E-03	253.0E-03	-22.0E-03	-22.0E-03	-79.0E-03	-4.0E-03
SN5	-	-122.0E-03	-144.0E-03	-69.0E-03	39.0E-03	-232.0E-03	-194.0E-03	-247.0E-03	-142.0E-03
SN6	-	42.0E-03	1.0E-03	138.0E-03	196.0E-03	-120.0E-03	-187.0E-03	-118.0E-03	-148.0E-03
Average	-	10.4E-03	34.8E-03	92.4E-03	180.0E-03	-121.8E-03	-95.6E-03	-155.0E-03	-76.2E-03
Sigma	-	85.3E-03	98.4E-03	82.0E-03	75.3E-03	71.8E-03	77.8E-03	88.7E-03	65.3E-03

Hirex Engineering	TOTAL IONIZING DOSE TEST REPORT						Ref.:	HRX/TID/1206
	DAC5675AHFG			Texas Instruments			Issue:	01

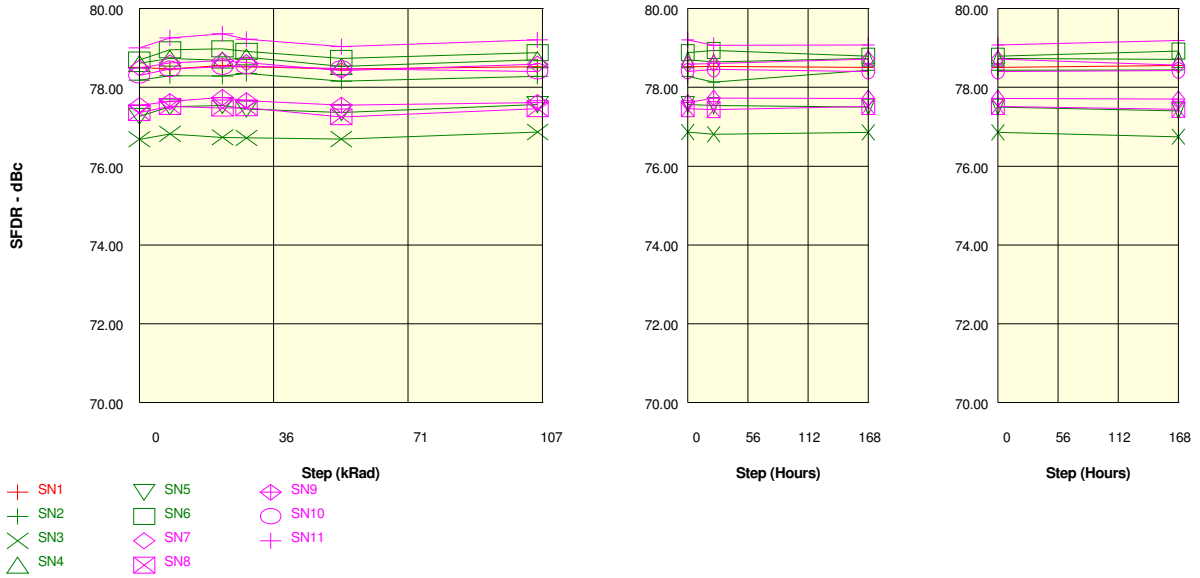
Measurements

THD	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
SN1_REF	-76.67	-76.43	-76.59	-76.51	-76.45	-76.70	-76.67	-76.73	-76.72
OFF samples									
SN7	-76.63	-76.55	-76.59	-76.48	-76.34	-76.64	-76.63	-76.77	-76.66
SN8	-75.83	-75.92	-75.85	-75.80	-75.60	-75.87	-75.88	-75.98	-75.92
SN9	-76.07	-76.02	-76.07	-75.97	-75.92	-76.16	-76.23	-76.25	-76.24
SN10	-76.55	-76.49	-76.54	-76.47	-76.44	-76.60	-76.64	-76.64	-76.60
SN11	-76.97	-76.88	-76.99	-76.82	-76.71	-77.12	-77.01	-77.06	-77.06
Statistics									
Min	-76.97	-76.88	-76.99	-76.82	-76.71	-77.12	-77.01	-77.06	-77.06
Max	-75.83	-75.92	-75.85	-75.80	-75.60	-75.87	-75.88	-75.98	-75.92
Average	-76.41	-76.37	-76.41	-76.31	-76.20	-76.48	-76.48	-76.54	-76.50
Sigma	0.41	0.36	0.40	0.37	0.39	0.43	0.39	0.38	0.39

Drift Calculation

THD	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
OFF samples									
SN7	-	85.0E-03	47.0E-03	148.0E-03	291.0E-03	-11.0E-03	7.0E-03	-135.0E-03	-28.0E-03
SN8	-	-92.0E-03	-18.0E-03	30.0E-03	231.0E-03	-42.0E-03	-56.0E-03	-147.0E-03	-89.0E-03
SN9	-	53.0E-03	0.0E+00	105.0E-03	150.0E-03	-83.0E-03	-161.0E-03	-178.0E-03	-170.0E-03
SN10	-	55.0E-03	8.0E-03	77.0E-03	110.0E-03	-54.0E-03	-89.0E-03	-88.0E-03	-53.0E-03
SN11	-	84.0E-03	-18.0E-03	147.0E-03	260.0E-03	-157.0E-03	-46.0E-03	-94.0E-03	-91.0E-03
Average	-	37.0E-03	3.8E-03	101.4E-03	208.4E-03	-69.4E-03	-69.0E-03	-128.4E-03	-86.2E-03
Sigma	-	65.9E-03	23.9E-03	44.6E-03	68.0E-03	49.5E-03	55.4E-03	33.7E-03	48.0E-03

Parameter : Spurious free dynamic range : SFDR
 Test conditions : Dvdd=Avdd=3.3V. 50 MSPS. IO(FS)= 20 mA. EXTIO Intern
 Unit : dBc
 No spec limit specified.



Measurements

SFDR	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
SN1_REF	78.51	78.47	78.56	78.52	78.46	78.52	78.53	78.51	78.56
ON samples									
SN2	78.18	78.29	78.28	78.35	78.16	78.28	78.14	78.44	78.44
SN3	76.68	76.82	76.73	76.72	76.69	76.87	76.81	76.86	76.75
SN4	78.61	78.74	78.69	78.77	78.53	78.70	78.65	78.74	78.71
SN5	77.27	77.51	77.54	77.45	77.36	77.57	77.54	77.50	77.40
SN6	78.70	78.95	78.98	78.91	78.74	78.88	78.94	78.79	78.92
Statistics									
Min	76.68	76.82	76.73	76.72	76.69	76.87	76.81	76.86	76.75
Max	78.70	78.95	78.98	78.91	78.74	78.88	78.94	78.79	78.92
Average	77.89	78.06	78.04	78.04	77.89	78.06	78.02	78.06	78.04
Sigma	0.79	0.80	0.82	0.83	0.76	0.75	0.77	0.76	0.83

Drift Calculation

SFDR	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
ON samples									
SN2	-	116.0E-03	107.0E-03	174.0E-03	-20.0E-03	100.0E-03	-38.0E-03	261.0E-03	266.0E-03
SN3	-	137.0E-03	49.0E-03	37.0E-03	7.0E-03	184.0E-03	131.0E-03	174.0E-03	64.0E-03
SN4	-	130.0E-03	82.0E-03	160.0E-03	-78.0E-03	96.0E-03	39.0E-03	130.0E-03	103.0E-03
SN5	-	240.0E-03	273.0E-03	187.0E-03	94.0E-03	299.0E-03	274.0E-03	231.0E-03	137.0E-03
SN6	-	258.0E-03	283.0E-03	217.0E-03	42.0E-03	182.0E-03	244.0E-03	97.0E-03	228.0E-03
Average	-	176.2E-03	158.8E-03	155.0E-03	9.0E-03	172.2E-03	130.0E-03	178.6E-03	159.6E-03
Sigma	-	60.1E-03	99.1E-03	61.9E-03	57.8E-03	73.9E-03	118.5E-03	61.0E-03	76.0E-03

Hirex Engineering	TOTAL IONIZING DOSE TEST REPORT						Ref.:	HRX/TID/1206
	DAC5675AHFG			Texas Instruments			Issue:	01

Measurements

SFDR	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
SN1_REF	78.51	78.47	78.56	78.52	78.46	78.52	78.53	78.51	78.56
OFF samples									
SN7	78.49	78.62	78.68	78.63	78.43	78.59	78.60	78.72	78.56
SN8	77.36	77.52	77.48	77.48	77.25	77.46	77.44	77.51	77.44
SN9	77.54	77.64	77.74	77.67	77.55	77.61	77.73	77.72	77.70
SN10	78.30	78.47	78.52	78.54	78.47	78.40	78.46	78.40	78.42
SN11	79.01	79.25	79.36	79.22	79.04	79.20	79.07	79.07	79.19
Statistics									
Min	77.36	77.52	77.48	77.48	77.25	77.46	77.44	77.51	77.44
Max	79.01	79.25	79.36	79.22	79.04	79.20	79.07	79.07	79.19
Average	78.14	78.30	78.35	78.31	78.15	78.25	78.26	78.29	78.26
Sigma	0.61	0.65	0.68	0.65	0.65	0.64	0.59	0.59	0.63

Drift Calculation

SFDR	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
OFF samples									
SN7	-	127.0E-03	183.0E-03	134.0E-03	-68.0E-03	93.0E-03	109.0E-03	226.0E-03	69.0E-03
SN8	-	159.0E-03	119.0E-03	123.0E-03	-108.0E-03	104.0E-03	80.0E-03	155.0E-03	84.0E-03
SN9	-	101.0E-03	199.0E-03	124.0E-03	9.0E-03	73.0E-03	188.0E-03	181.0E-03	162.0E-03
SN10	-	165.0E-03	221.0E-03	239.0E-03	174.0E-03	100.0E-03	155.0E-03	104.0E-03	124.0E-03
SN11	-	247.0E-03	352.0E-03	217.0E-03	29.0E-03	198.0E-03	62.0E-03	67.0E-03	180.0E-03
Average	-	159.8E-03	214.8E-03	167.4E-03	7.2E-03	113.6E-03	118.8E-03	146.6E-03	123.8E-03
Sigma	-	49.3E-03	76.6E-03	50.1E-03	97.2E-03	43.5E-03	46.7E-03	56.1E-03	42.9E-03

Parameter : Signal to noise ratio : SNR
 Test conditions : Dvdd=Avdd=3.3V. 50 MSPS. IO(FS)= 20 mA. EXTIO Intern
 Unit : dBc
 No spec limit specified.



Measurements

SNR	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
SN1_REF	62.25	62.21	62.18	62.23	62.24	62.21	62.20	62.19	62.21
ON samples									
SN2	62.02	61.95	61.94	61.98	61.99	61.94	61.94	61.92	61.98
SN3	62.22	62.15	62.15	62.18	62.19	62.12	62.12	62.10	62.16
SN4	62.08	62.02	62.02	62.05	62.08	62.00	62.02	62.00	62.04
SN5	62.18	62.11	62.10	62.11	62.15	62.08	62.08	62.08	62.15
SN6	62.06	62.01	61.98	62.02	62.06	62.00	61.99	61.99	62.04
Statistics									
Min	62.02	61.95	61.94	61.98	61.99	61.94	61.94	61.92	61.98
Max	62.22	62.15	62.15	62.18	62.19	62.12	62.12	62.10	62.16
Average	62.11	62.05	62.04	62.07	62.09	62.03	62.03	62.02	62.07
Sigma	0.07	0.07	0.08	0.07	0.07	0.06	0.06	0.06	0.07

Drift Calculation

SNR	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
ON samples									
SN2	-	-61.0E-03	-74.0E-03	-33.0E-03	-24.0E-03	-79.0E-03	-75.0E-03	-92.0E-03	-34.0E-03
SN3	-	-67.0E-03	-64.0E-03	-40.0E-03	-32.0E-03	-98.0E-03	-103.0E-03	-122.0E-03	-55.0E-03
SN4	-	-61.0E-03	-63.0E-03	-34.0E-03	-5.0E-03	-82.0E-03	-66.0E-03	-80.0E-03	-41.0E-03
SN5	-	-62.0E-03	-80.0E-03	-63.0E-03	-28.0E-03	-97.0E-03	-94.0E-03	-95.0E-03	-31.0E-03
SN6	-	-53.0E-03	-81.0E-03	-48.0E-03	-8.0E-03	-61.0E-03	-74.0E-03	-74.0E-03	-28.0E-03
Average	-	-60.8E-03	-72.4E-03	-43.6E-03	-19.4E-03	-83.4E-03	-82.4E-03	-92.6E-03	-37.8E-03
Sigma	-	4.5E-03	7.7E-03	11.1E-03	10.9E-03	13.6E-03	13.8E-03	16.6E-03	9.6E-03

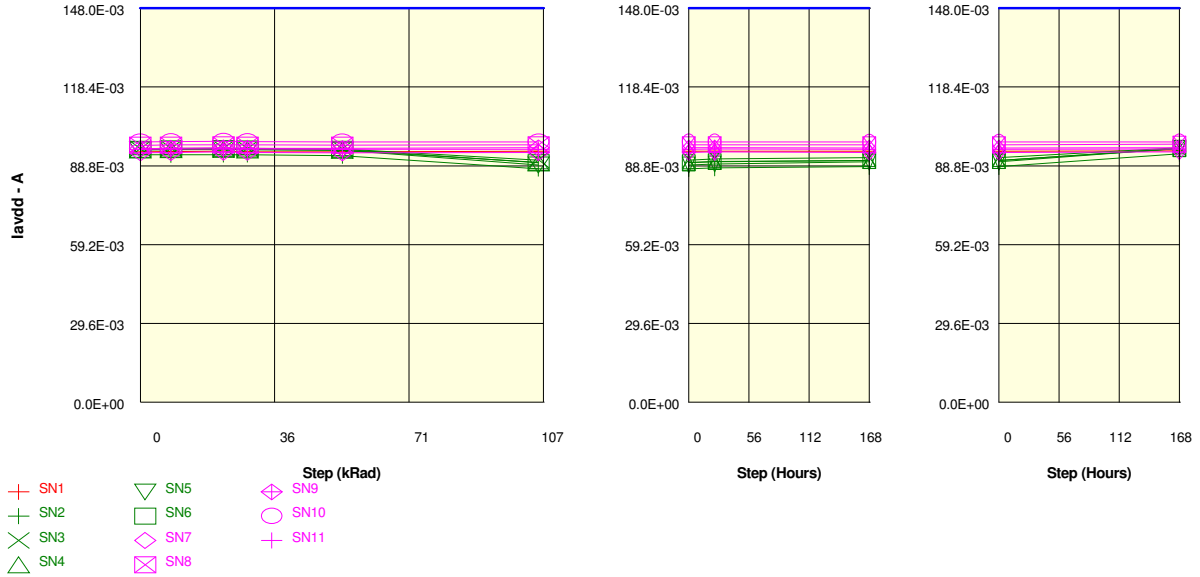
Measurements

SNR	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
SN1_REF	62.25	62.21	62.18	62.23	62.24	62.21	62.20	62.19	62.21
OFF samples									
SN7	62.17	62.12	62.09	62.12	62.15	62.11	62.11	62.11	62.15
SN8	62.19	62.13	62.11	62.13	62.17	62.13	62.13	62.13	62.16
SN9	62.19	62.12	62.11	62.12	62.13	62.14	62.12	62.12	62.14
SN10	62.22	62.16	62.14	62.16	62.20	62.16	62.14	62.18	62.17
SN11	62.15	62.09	62.06	62.08	62.11	62.07	62.07	62.10	62.10
Statistics									
Min	62.15	62.09	62.06	62.08	62.11	62.07	62.07	62.10	62.10
Max	62.22	62.16	62.14	62.16	62.20	62.16	62.14	62.18	62.17
Average	62.18	62.12	62.10	62.12	62.15	62.12	62.11	62.13	62.14
Sigma	0.02	0.02	0.02	0.03	0.03	0.03	0.02	0.03	0.02

Drift Calculation

SNR	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
OFF samples									
SN7	-	-46.0E-03	-78.0E-03	-53.0E-03	-16.0E-03	-55.0E-03	-59.0E-03	-60.0E-03	-22.0E-03
SN8	-	-53.0E-03	-75.0E-03	-58.0E-03	-15.0E-03	-58.0E-03	-58.0E-03	-58.0E-03	-25.0E-03
SN9	-	-65.0E-03	-75.0E-03	-67.0E-03	-53.0E-03	-44.0E-03	-69.0E-03	-68.0E-03	-44.0E-03
SN10	-	-63.0E-03	-86.0E-03	-61.0E-03	-27.0E-03	-59.0E-03	-78.0E-03	-44.0E-03	-51.0E-03
SN11	-	-64.0E-03	-89.0E-03	-75.0E-03	-42.0E-03	-85.0E-03	-79.0E-03	-50.0E-03	-47.0E-03
Average	-	-58.2E-03	-80.6E-03	-62.8E-03	-30.6E-03	-60.2E-03	-68.6E-03	-56.0E-03	-37.8E-03
Sigma	-	7.5E-03	5.8E-03	7.6E-03	14.8E-03	13.5E-03	9.0E-03	8.3E-03	11.9E-03

Parameter : Analog Supply Current : lavdd
 Test conditions : Dvdd=Avdd=3.3V. 50 MSPS. IO(FS)= 20 mA. EXTIO Intern
 Unit : A
 Spec Limit Max : 148.0E-03
 Spec limits are represented in bold lines on the graphic.



Measurements

lavdd	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
SN1_REF	94.0E-03	94.2E-03	94.2E-03	94.1E-03	94.0E-03	94.2E-03	94.3E-03	94.3E-03	94.4E-03
ON samples									
SN2	92.9E-03	93.0E-03	93.0E-03	93.0E-03	92.6E-03	87.7E-03	88.0E-03	88.5E-03	93.4E-03
SN3	95.2E-03	95.3E-03	95.4E-03	95.3E-03	95.2E-03	91.0E-03	91.4E-03	91.9E-03	95.7E-03
SN4	94.8E-03	94.9E-03	94.9E-03	94.8E-03	94.7E-03	90.0E-03	90.4E-03	90.8E-03	95.2E-03
SN5	94.8E-03	94.9E-03	95.0E-03	94.9E-03	94.7E-03	89.1E-03	89.5E-03	90.2E-03	95.3E-03
SN6	95.0E-03	95.1E-03	95.2E-03	95.1E-03	95.0E-03	90.0E-03	90.4E-03	90.8E-03	95.4E-03
Statistics									
Min	92.9E-03	93.0E-03	93.0E-03	93.0E-03	92.6E-03	87.7E-03	88.0E-03	88.5E-03	93.4E-03
Max	95.2E-03	95.3E-03	95.4E-03	95.3E-03	95.2E-03	91.0E-03	91.4E-03	91.9E-03	95.7E-03
Average	94.5E-03	94.6E-03	94.7E-03	94.6E-03	94.4E-03	89.5E-03	89.9E-03	90.4E-03	95.0E-03
Sigma	836.3E-06	853.5E-06	859.2E-06	839.8E-06	933.8E-06	1.1E-03	1.1E-03	1.1E-03	809.8E-06

Drift Calculation

lavdd	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
ON samples									
SN2	-	80.0E-06	130.0E-06	90.0E-06	-280.0E-06	-5.2E-03	-4.9E-03	-4.4E-03	510.0E-06
SN3	-	130.0E-06	190.0E-06	100.0E-06	-30.0E-06	-4.2E-03	-3.8E-03	-3.3E-03	450.0E-06
SN4	-	110.0E-06	160.0E-06	80.0E-06	-90.0E-06	-4.8E-03	-4.4E-03	-3.9E-03	490.0E-06
SN5	-	110.0E-06	170.0E-06	40.0E-06	-140.0E-06	-5.7E-03	-5.3E-03	-4.6E-03	460.0E-06
SN6	-	130.0E-06	210.0E-06	140.0E-06	50.0E-06	-5.0E-03	-4.6E-03	-4.2E-03	390.0E-06
Average	-	112.0E-06	172.0E-06	90.0E-06	-98.0E-06	-5.0E-03	-4.6E-03	-4.1E-03	460.0E-06
Sigma	-	18.3E-06	27.1E-06	32.2E-06	110.9E-06	494.4E-06	518.5E-06	436.5E-06	41.0E-06

Hirex Engineering	TOTAL IONIZING DOSE TEST REPORT						Ref.:	HRX/TID/1206
	DAC5675AHFG			Texas Instruments			Issue:	01

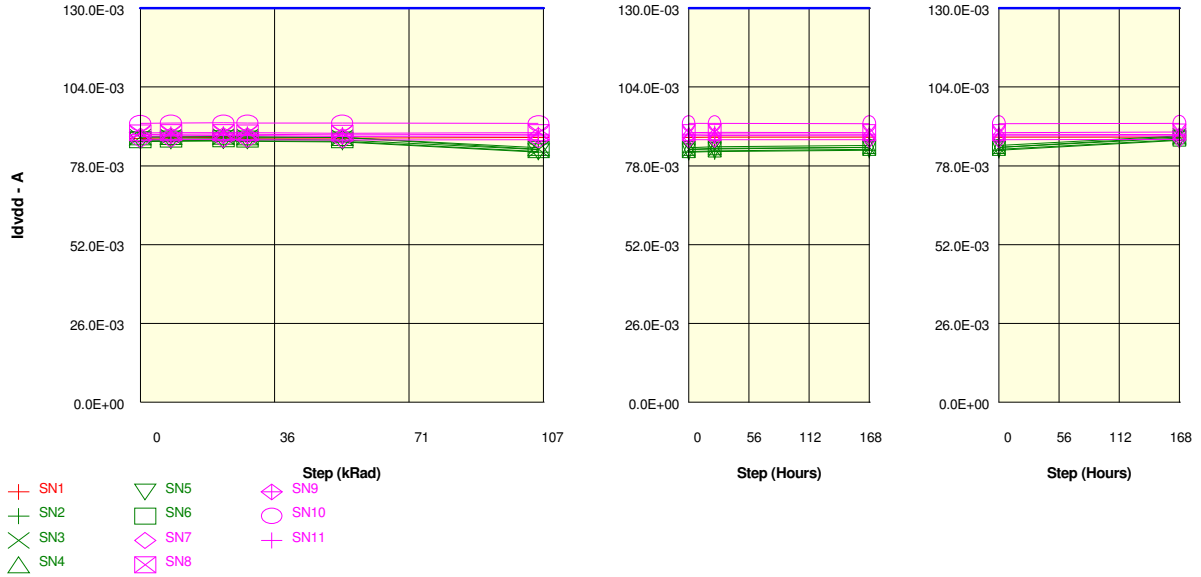
Measurements

lavdd	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
SN1_REF	94.0E-03	94.2E-03	94.2E-03	94.1E-03	94.0E-03	94.2E-03	94.3E-03	94.3E-03	94.4E-03
OFF samples									
SN7	95.2E-03	95.4E-03	95.5E-03	95.4E-03	95.3E-03	95.5E-03	95.5E-03	95.5E-03	95.6E-03
SN8	96.5E-03	96.6E-03	96.6E-03	96.6E-03	96.5E-03	96.7E-03	96.7E-03	96.6E-03	96.9E-03
SN9	93.7E-03	93.8E-03	94.0E-03	93.9E-03	93.7E-03	93.8E-03	94.0E-03	93.8E-03	94.1E-03
SN10	97.8E-03	97.9E-03	98.0E-03	97.9E-03	97.8E-03	97.7E-03	97.8E-03	97.7E-03	97.8E-03
SN11	95.0E-03	95.1E-03	95.2E-03	95.1E-03	95.0E-03	95.0E-03	95.1E-03	95.0E-03	95.1E-03
Statistics									
Min	93.7E-03	93.8E-03	94.0E-03	93.9E-03	93.7E-03	93.8E-03	94.0E-03	93.8E-03	94.1E-03
Max	97.8E-03	97.9E-03	98.0E-03	97.9E-03	97.8E-03	97.7E-03	97.8E-03	97.7E-03	97.8E-03
Average	95.6E-03	95.8E-03	95.8E-03	95.8E-03	95.7E-03	95.7E-03	95.8E-03	95.7E-03	95.9E-03
Sigma	1.4E-03	1.4E-03	1.4E-03	1.4E-03	1.4E-03	1.4E-03	1.3E-03	1.3E-03	1.3E-03

Drift Calculation

lavdd	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
OFF samples									
SN7	-	170.0E-06	280.0E-06	190.0E-06	40.0E-06	270.0E-06	270.0E-06	250.0E-06	360.0E-06
SN8	-	120.0E-06	140.0E-06	120.0E-06	30.0E-06	160.0E-06	210.0E-06	140.0E-06	380.0E-06
SN9	-	150.0E-06	280.0E-06	190.0E-06	0.0E+00	130.0E-06	290.0E-06	170.0E-06	410.0E-06
SN10	-	100.0E-06	170.0E-06	100.0E-06	30.0E-06	-70.0E-06	0.0E+00	-100.0E-06	-50.0E-06
SN11	-	170.0E-06	200.0E-06	160.0E-06	20.0E-06	30.0E-06	120.0E-06	20.0E-06	110.0E-06
Average	-	142.0E-06	214.0E-06	152.0E-06	24.0E-06	104.0E-06	178.0E-06	96.0E-06	242.0E-06
Sigma	-	27.9E-06	57.1E-06	36.6E-06	13.6E-06	115.9E-06	106.8E-06	122.7E-06	181.0E-06

Parameter : Digital Supply Current : Idvdd
 Test conditions : Dvdd=Avdd=3.3V. 50 MSPS. IO(FS)= 20 mA. EXTIO Intern
 Unit : A
 Spec Limit Max : 130.0E-03
 Spec limits are represented in bold lines on the graphic.



Measurements

Idvdd	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
SN1 REF	87.1E-03	87.2E-03	87.3E-03	87.1E-03	87.1E-03	87.3E-03	87.4E-03	87.4E-03	87.5E-03
ON samples									
SN2	86.0E-03	86.1E-03	86.2E-03	86.1E-03	85.8E-03	82.5E-03	82.7E-03	83.2E-03	86.4E-03
SN3	87.4E-03	87.5E-03	87.6E-03	87.5E-03	87.3E-03	83.4E-03	83.7E-03	84.2E-03	87.6E-03
SN4	87.5E-03	87.6E-03	87.7E-03	87.6E-03	87.3E-03	84.0E-03	84.3E-03	84.7E-03	87.9E-03
SN5	86.3E-03	86.3E-03	86.4E-03	86.3E-03	86.1E-03	82.7E-03	83.0E-03	83.4E-03	86.6E-03
SN6	86.6E-03	86.8E-03	86.9E-03	86.8E-03	86.5E-03	83.3E-03	83.6E-03	84.1E-03	87.1E-03
Statistics									
Min	86.0E-03	86.1E-03	86.2E-03	86.1E-03	85.8E-03	82.5E-03	82.7E-03	83.2E-03	86.4E-03
Max	87.5E-03	87.6E-03	87.7E-03	87.6E-03	87.3E-03	84.0E-03	84.3E-03	84.7E-03	87.9E-03
Average	86.8E-03	86.9E-03	87.0E-03	86.9E-03	86.6E-03	83.2E-03	83.4E-03	83.9E-03	87.1E-03
Sigma	625.0E-06	616.3E-06	605.2E-06	594.6E-06	616.8E-06	546.5E-06	544.7E-06	551.2E-06	554.4E-06

Drift Calculation

Idvdd	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
ON samples									
SN2	-	80.0E-06	180.0E-06	130.0E-06	-160.0E-06	-3.5E-03	-3.3E-03	-2.8E-03	430.0E-06
SN3	-	70.0E-06	120.0E-06	20.0E-06	-120.0E-06	-4.0E-03	-3.8E-03	-3.3E-03	200.0E-06
SN4	-	70.0E-06	160.0E-06	40.0E-06	-240.0E-06	-3.5E-03	-3.3E-03	-2.8E-03	310.0E-06
SN5	-	90.0E-06	180.0E-06	40.0E-06	-180.0E-06	-3.6E-03	-3.3E-03	-2.8E-03	390.0E-06
SN6	-	160.0E-06	260.0E-06	170.0E-06	-110.0E-06	-3.3E-03	-3.1E-03	-2.6E-03	500.0E-06
Average	-	94.0E-06	180.0E-06	80.0E-06	-162.0E-06	-3.6E-03	-3.3E-03	-2.9E-03	366.0E-06
Sigma	-	33.8E-06	45.6E-06	59.0E-06	46.6E-06	241.5E-06	226.8E-06	228.2E-06	103.3E-06

Hirex Engineering	TOTAL IONIZING DOSE TEST REPORT						Ref.:	HRX/TID/1206
	DAC5675AHFG			Texas Instruments			Issue:	01

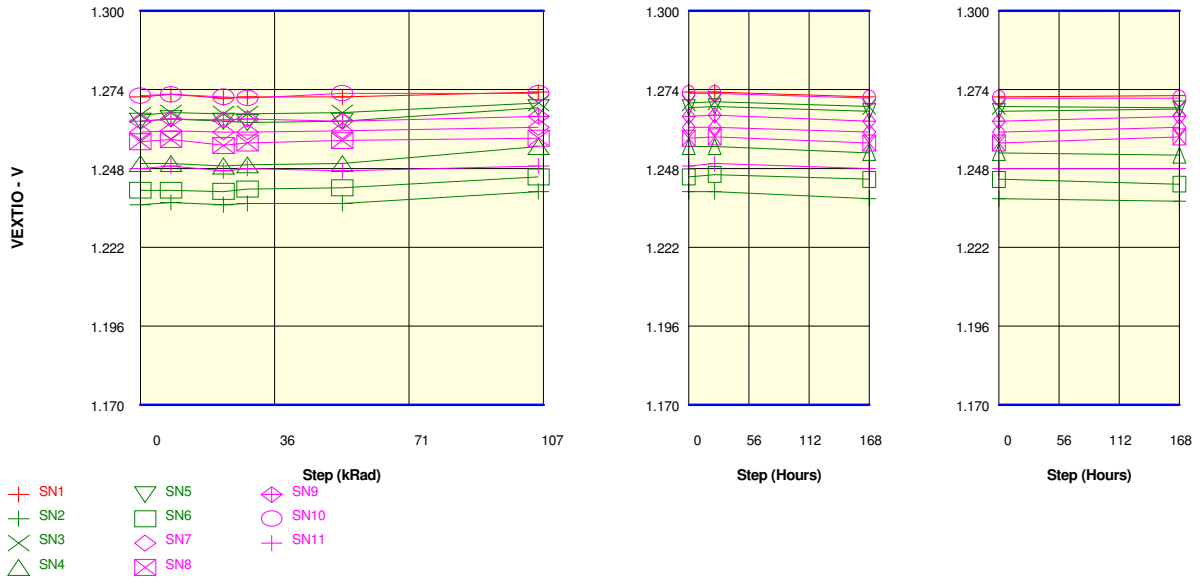
Measurements

ldvdd	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
SN1_REF	87.1E-03	87.2E-03	87.3E-03	87.1E-03	87.1E-03	87.3E-03	87.4E-03	87.4E-03	87.5E-03
OFF samples									
SN7	86.5E-03	86.7E-03	86.7E-03	86.7E-03	86.5E-03	86.6E-03	86.7E-03	86.6E-03	86.7E-03
SN8	88.9E-03	89.0E-03	89.0E-03	88.9E-03	88.8E-03	88.9E-03	89.0E-03	88.9E-03	89.2E-03
SN9	87.8E-03	87.9E-03	88.0E-03	87.9E-03	87.7E-03	87.9E-03	88.0E-03	87.9E-03	87.9E-03
SN10	92.0E-03	92.1E-03	92.2E-03	92.1E-03	92.1E-03	92.0E-03	92.0E-03	91.9E-03	92.0E-03
SN11	88.3E-03	88.4E-03	88.5E-03	88.5E-03	88.2E-03	88.3E-03	88.5E-03	88.4E-03	88.3E-03
Statistics									
Min	86.5E-03	86.7E-03	86.7E-03	86.7E-03	86.5E-03	86.6E-03	86.7E-03	86.6E-03	86.7E-03
Max	92.0E-03	92.1E-03	92.2E-03	92.1E-03	92.1E-03	92.0E-03	92.0E-03	91.9E-03	92.0E-03
Average	88.7E-03	88.8E-03	88.9E-03	88.8E-03	88.7E-03	88.7E-03	88.8E-03	88.8E-03	88.8E-03
Sigma	1.8E-03	1.8E-03	1.8E-03	1.8E-03	1.9E-03	1.8E-03	1.8E-03	1.8E-03	1.8E-03

Drift Calculation

ldvdd	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
OFF samples									
SN7	-	180.0E-06	200.0E-06	120.0E-06	-50.0E-06	100.0E-06	140.0E-06	90.0E-06	210.0E-06
SN8	-	100.0E-06	90.0E-06	30.0E-06	-90.0E-06	70.0E-06	150.0E-06	80.0E-06	290.0E-06
SN9	-	140.0E-06	240.0E-06	170.0E-06	-60.0E-06	110.0E-06	250.0E-06	150.0E-06	150.0E-06
SN10	-	120.0E-06	150.0E-06	120.0E-06	120.0E-06	-30.0E-06	-20.0E-06	-100.0E-06	0.0E+00
SN11	-	130.0E-06	170.0E-06	160.0E-06	-70.0E-06	40.0E-06	200.0E-06	140.0E-06	0.0E+00
Average	-	134.0E-06	170.0E-06	120.0E-06	-30.0E-06	58.0E-06	144.0E-06	72.0E-06	130.0E-06
Sigma	-	26.5E-06	50.2E-06	49.4E-06	76.2E-06	50.4E-06	90.9E-06	90.2E-06	115.1E-06

Parameter : Reference Voltage : VEXTIO
 Test conditions : Dvdd=Avdd=3.3V. 50 MSPS. IO(FS)= 20 mA. EXTIO Intern
 Unit : V
 Spec Limit Min : 1.170
 Spec Limit Max : 1.300
 Spec limits are represented in bold lines on the graphic.



Measurements

VEXTIO	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
SN1_REF	1.272	1.272	1.271	1.272	1.272	1.273	1.273	1.272	1.272
ON samples									
SN2	1.236	1.237	1.236	1.236	1.236	1.240	1.240	1.238	1.237
SN3	1.266	1.266	1.266	1.266	1.266	1.270	1.270	1.268	1.268
SN4	1.250	1.250	1.249	1.249	1.250	1.255	1.255	1.253	1.252
SN5	1.264	1.264	1.264	1.263	1.264	1.268	1.268	1.267	1.268
SN6	1.241	1.241	1.240	1.241	1.242	1.245	1.246	1.244	1.243
Statistics									
Min	1.236	1.237	1.236	1.236	1.236	1.240	1.240	1.238	1.237
Max	1.266	1.266	1.266	1.266	1.266	1.270	1.270	1.268	1.268
Average	1.251	1.252	1.251	1.251	1.252	1.256	1.256	1.254	1.254
Sigma	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.013

Drift Calculation

VEXTIO	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
ON samples									
SN2	-	800.0E-06	0.0E+00	400.0E-06	400.0E-06	4.4E-03	4.4E-03	2.0E-03	1.2E-03
SN3	-	800.0E-06	400.0E-06	400.0E-06	800.0E-06	4.0E-03	4.4E-03	2.8E-03	2.4E-03
SN4	-	0.0E+00	-800.0E-06	-400.0E-06	0.0E+00	5.6E-03	5.6E-03	3.6E-03	2.8E-03
SN5	-	800.0E-06	0.0E+00	-400.0E-06	0.0E+00	4.4E-03	4.8E-03	3.2E-03	4.0E-03
SN6	-	0.0E+00	-400.0E-06	400.0E-06	800.0E-06	4.4E-03	5.2E-03	3.6E-03	2.0E-03
Average	-	480.0E-06	-160.0E-06	80.0E-06	400.0E-06	4.6E-03	4.9E-03	3.0E-03	2.5E-03
Sigma	-	391.9E-06	407.9E-06	391.9E-06	357.8E-06	542.6E-06	466.5E-06	598.7E-06	926.1E-06

Hirex Engineering	TOTAL IONIZING DOSE TEST REPORT						Ref.:	HRX/TID/1206
	DAC5675AHFG			Texas Instruments			Issue:	01

Measurements

VEXTIO	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
SN1_REF	1.272	1.272	1.271	1.272	1.272	1.273	1.273	1.272	1.272
OFF samples									
SN7	1.260	1.260	1.260	1.260	1.260	1.262	1.262	1.260	1.262
SN8	1.257	1.258	1.256	1.256	1.257	1.258	1.258	1.256	1.258
SN9	1.264	1.264	1.264	1.264	1.264	1.265	1.266	1.264	1.265
SN10	1.272	1.272	1.272	1.271	1.273	1.273	1.273	1.271	1.271
SN11	1.248	1.249	1.247	1.248	1.247	1.249	1.250	1.248	1.248
Statistics									
Min	1.248	1.249	1.247	1.248	1.247	1.249	1.250	1.248	1.248
Max	1.272	1.272	1.272	1.271	1.273	1.273	1.273	1.271	1.271
Average	1.260	1.261	1.260	1.260	1.260	1.261	1.262	1.260	1.261
Sigma	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008

Drift Calculation

VEXTIO	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
OFF samples									
SN7	-	400.0E-06	0.0E+00	0.0E+00	400.0E-06	1.6E-03	1.6E-03	0.0E+00	1.6E-03
SN8	-	800.0E-06	-1.2E-03	-400.0E-06	400.0E-06	1.2E-03	1.6E-03	-400.0E-06	1.6E-03
SN9	-	800.0E-06	400.0E-06	800.0E-06	0.0E+00	1.6E-03	2.0E-03	0.0E+00	1.6E-03
SN10	-	400.0E-06	-400.0E-06	-800.0E-06	800.0E-06	800.0E-06	800.0E-06	-800.0E-06	-800.0E-06
SN11	-	800.0E-06	-800.0E-06	0.0E+00	-800.0E-06	800.0E-06	1.6E-03	0.0E+00	0.0E+00
Average	-	640.0E-06	-400.0E-06	-80.0E-06	160.0E-06	1.2E-03	1.5E-03	-240.0E-06	800.0E-06
Sigma	-	196.0E-06	565.7E-06	530.7E-06	542.6E-06	357.8E-06	391.9E-06	320.0E-06	1.0E-03

Parameter : High-level input current : lih_Sleep

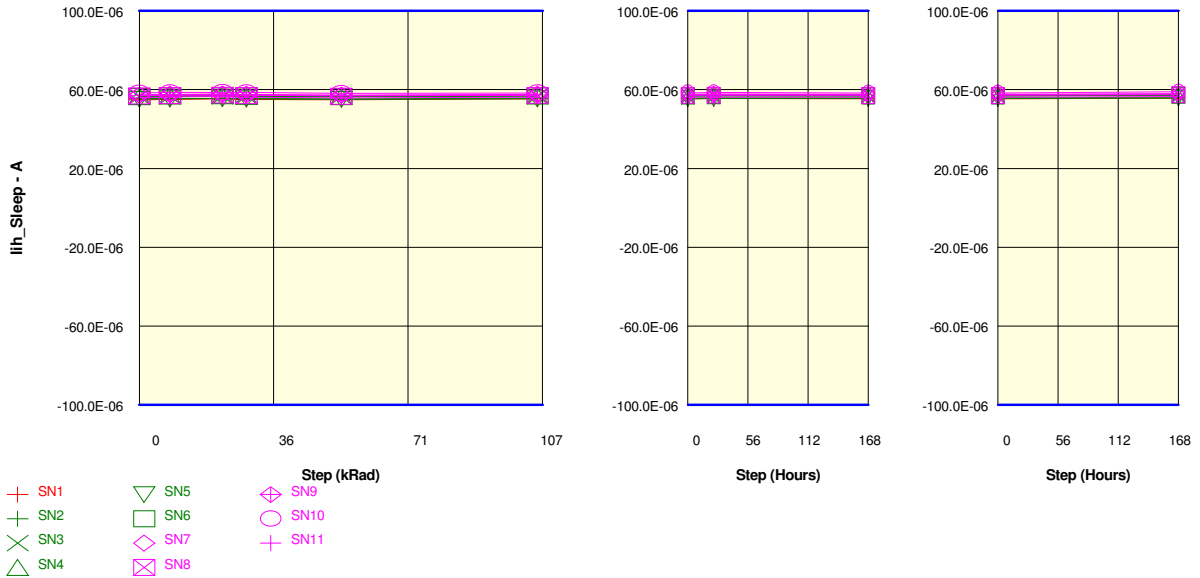
Test conditions : Dvdd=Avdd=3.3V

Unit : A

Spec Limit Min : -100.0E-06

Spec Limit Max : 100.0E-06

Spec limits are represented in bold lines on the graphic.



Measurements

lih_Sleep	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
SN1_REF	54.8E-06	55.1E-06	55.3E-06	55.0E-06	54.9E-06	55.3E-06	55.4E-06	55.4E-06	55.7E-06
ON samples									
SN2	55.4E-06	55.5E-06	55.6E-06	55.6E-06	55.4E-06	55.7E-06	55.7E-06	55.8E-06	56.2E-06
SN3	56.5E-06	56.7E-06	56.7E-06	56.6E-06	56.4E-06	56.7E-06	56.8E-06	56.9E-06	57.1E-06
SN4	56.5E-06	56.8E-06	56.9E-06	56.7E-06	56.4E-06	56.9E-06	56.9E-06	57.0E-06	57.2E-06
SN5	55.1E-06	55.3E-06	55.5E-06	55.3E-06	55.1E-06	55.4E-06	55.5E-06	55.5E-06	55.6E-06
SN6	56.5E-06	56.8E-06	56.9E-06	56.8E-06	56.5E-06	56.8E-06	56.9E-06	56.8E-06	57.3E-06
Statistics									
Min	55.1E-06	55.3E-06	55.5E-06	55.3E-06	55.1E-06	55.4E-06	55.5E-06	55.5E-06	55.6E-06
Max	56.5E-06	56.8E-06	56.9E-06	56.8E-06	56.5E-06	56.9E-06	56.9E-06	57.0E-06	57.3E-06
Average	56.0E-06	56.2E-06	56.3E-06	56.2E-06	56.0E-06	56.3E-06	56.4E-06	56.4E-06	56.7E-06
Sigma	594.3E-09	662.2E-09	636.9E-09	615.9E-09	612.1E-09	629.3E-09	632.2E-09	637.7E-09	644.3E-09

Drift Calculation

lih_Sleep	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
ON samples									
SN2	-	94.0E-09	198.0E-09	124.0E-09	-38.0E-09	274.0E-09	306.0E-09	322.0E-09	756.0E-09
SN3	-	208.0E-09	246.0E-09	72.0E-09	-34.0E-09	234.0E-09	328.0E-09	404.0E-09	612.0E-09
SN4	-	318.0E-09	404.0E-09	196.0E-09	-40.0E-09	370.0E-09	444.0E-09	520.0E-09	704.0E-09
SN5	-	214.0E-09	344.0E-09	168.0E-09	-52.0E-09	228.0E-09	346.0E-09	360.0E-09	524.0E-09
SN6	-	374.0E-09	442.0E-09	294.0E-09	42.0E-09	340.0E-09	444.0E-09	364.0E-09	800.0E-09
Average	-	241.6E-09	326.8E-09	170.8E-09	-24.4E-09	289.2E-09	373.6E-09	394.0E-09	679.2E-09
Sigma	-	97.0E-09	92.4E-09	74.5E-09	33.7E-09	56.8E-09	58.9E-09	68.1E-09	99.7E-09

Hirex Engineering	TOTAL IONIZING DOSE TEST REPORT						Ref.:	HRX/TID/1206
	DAC5675AHFG			Texas Instruments			Issue:	01

Measurements

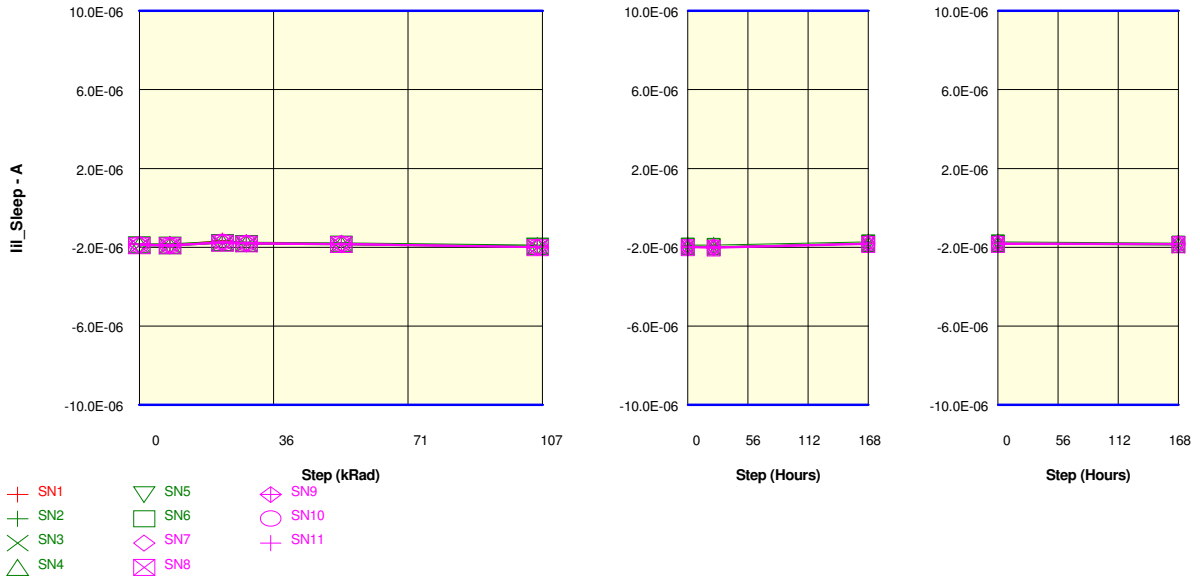
lih_Sleep	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
SN1_REF	54.8E-06	55.1E-06	55.3E-06	55.0E-06	54.9E-06	55.3E-06	55.4E-06	55.4E-06	55.7E-06
OFF samples									
SN7	57.3E-06	57.7E-06	57.8E-06	57.7E-06	57.2E-06	57.7E-06	57.8E-06	57.7E-06	57.9E-06
SN8	56.8E-06	57.0E-06	57.2E-06	57.0E-06	56.7E-06	57.1E-06	57.2E-06	57.0E-06	57.4E-06
SN9	57.2E-06	57.4E-06	57.6E-06	57.4E-06	57.2E-06	57.4E-06	57.6E-06	57.4E-06	57.8E-06
SN10	58.3E-06	58.5E-06	58.6E-06	58.5E-06	58.2E-06	58.4E-06	58.5E-06	58.3E-06	58.8E-06
SN11	55.9E-06	56.3E-06	56.4E-06	56.2E-06	55.9E-06	56.1E-06	56.3E-06	56.1E-06	56.5E-06
Statistics									
Min	55.9E-06	56.3E-06	56.4E-06	56.2E-06	55.9E-06	56.1E-06	56.3E-06	56.1E-06	56.5E-06
Max	58.3E-06	58.5E-06	58.6E-06	58.5E-06	58.2E-06	58.4E-06	58.5E-06	58.3E-06	58.8E-06
Average	57.1E-06	57.4E-06	57.5E-06	57.4E-06	57.0E-06	57.3E-06	57.5E-06	57.3E-06	57.7E-06
Sigma	774.9E-09	730.6E-09	726.0E-09	742.9E-09	720.5E-09	756.7E-09	748.5E-09	745.6E-09	732.2E-09

Drift Calculation

lih_Sleep	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
OFF samples									
SN7	-	366.0E-09	446.0E-09	314.0E-09	-130.0E-09	400.0E-09	486.0E-09	368.0E-09	546.0E-09
SN8	-	188.0E-09	322.0E-09	184.0E-09	-142.0E-09	214.0E-09	354.0E-09	202.0E-09	596.0E-09
SN9	-	288.0E-09	430.0E-09	272.0E-09	2.0E-09	204.0E-09	474.0E-09	290.0E-09	666.0E-09
SN10	-	228.0E-09	318.0E-09	236.0E-09	-110.0E-09	88.0E-09	268.0E-09	34.0E-09	544.0E-09
SN11	-	418.0E-09	510.0E-09	372.0E-09	80.0E-09	208.0E-09	400.0E-09	196.0E-09	678.0E-09
Average	-	297.6E-09	405.2E-09	275.6E-09	-60.0E-09	222.8E-09	396.4E-09	218.0E-09	606.0E-09
Sigma	-	85.0E-09	74.6E-09	64.4E-09	86.7E-09	100.2E-09	80.4E-09	111.6E-09	57.1E-09

Parameter : Low-level input current : I_l Sleep
 Test conditions : V_{DD}=A_{DD}=3.3V

Unit : A
 Spec Limit Min : -10.0E-06
 Spec Limit Max : 10.0E-06
 Spec limits are represented in bold lines on the graphic.



Measurements

I _l Sleep	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
SN1_REF	-1.8E-06	-1.9E-06	-1.7E-06	-1.8E-06	-1.8E-06	-2.0E-06	-2.0E-06	-1.8E-06	-1.8E-06
ON samples									
SN2	-1.8E-06	-1.8E-06	-1.7E-06	-1.7E-06	-1.8E-06	-1.9E-06	-1.9E-06	-1.7E-06	-1.8E-06
SN3	-1.9E-06	-1.9E-06	-1.8E-06	-1.8E-06	-1.9E-06	-2.0E-06	-2.0E-06	-1.8E-06	-1.9E-06
SN4	-1.9E-06	-1.9E-06	-1.8E-06	-1.8E-06	-1.9E-06	-2.0E-06	-2.0E-06	-1.8E-06	-1.9E-06
SN5	-1.9E-06	-1.9E-06	-1.8E-06	-1.8E-06	-1.9E-06	-2.0E-06	-2.0E-06	-1.8E-06	-1.9E-06
SN6	-1.9E-06	-1.9E-06	-1.8E-06	-1.8E-06	-1.8E-06	-1.9E-06	-2.0E-06	-1.8E-06	-1.8E-06
Statistics									
Min	-1.9E-06	-1.9E-06	-1.8E-06	-1.8E-06	-1.9E-06	-2.0E-06	-2.0E-06	-1.8E-06	-1.9E-06
Max	-1.8E-06	-1.8E-06	-1.7E-06	-1.7E-06	-1.8E-06	-1.9E-06	-1.9E-06	-1.7E-06	-1.8E-06
Average	-1.9E-06	-1.9E-06	-1.8E-06	-1.8E-06	-1.8E-06	-2.0E-06	-2.0E-06	-1.8E-06	-1.8E-06
Sigma	35.1E-09	40.0E-09	38.6E-09	34.6E-09	34.7E-09	35.7E-09	41.6E-09	37.8E-09	34.9E-09

Drift Calculation

I _l Sleep	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
ON samples									
SN2	-	-2.4E-09	134.0E-09	81.8E-09	45.4E-09	-69.0E-09	-70.2E-09	98.0E-09	39.6E-09
SN3	-	-16.2E-09	123.2E-09	81.2E-09	43.0E-09	-73.6E-09	-86.2E-09	90.4E-09	35.8E-09
SN4	-	-15.8E-09	125.4E-09	84.4E-09	50.6E-09	-68.8E-09	-89.0E-09	91.4E-09	40.4E-09
SN5	-	-18.4E-09	121.4E-09	81.0E-09	47.0E-09	-64.0E-09	-92.2E-09	88.8E-09	45.0E-09
SN6	-	-24.4E-09	111.6E-09	71.8E-09	39.2E-09	-69.4E-09	-92.4E-09	88.4E-09	28.4E-09
Average	-	-15.4E-09	123.1E-09	80.0E-09	45.0E-09	-69.0E-09	-86.0E-09	91.4E-09	37.8E-09
Sigma	-	7.2E-09	7.2E-09	4.3E-09	3.8E-09	3.0E-09	8.2E-09	3.5E-09	5.6E-09

Hirex Engineering	TOTAL IONIZING DOSE TEST REPORT						Ref.:	HRX/TID/1206
	DAC5675AHFG			Texas Instruments			Issue:	01

Measurements

Ill_Sleep	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
SN1_REF	-1.8E-06	-1.9E-06	-1.7E-06	-1.8E-06	-1.8E-06	-2.0E-06	-2.0E-06	-1.8E-06	-1.8E-06
OFF samples									
SN7	-1.9E-06	-1.9E-06	-1.7E-06	-1.8E-06	-1.8E-06	-2.0E-06	-2.0E-06	-1.8E-06	-1.8E-06
SN8	-1.9E-06	-1.9E-06	-1.8E-06	-1.8E-06	-1.9E-06	-2.0E-06	-2.0E-06	-1.9E-06	-1.9E-06
SN9	-1.9E-06	-1.9E-06	-1.8E-06	-1.8E-06	-1.8E-06	-2.0E-06	-2.0E-06	-1.8E-06	-1.8E-06
SN10	-1.9E-06	-1.9E-06	-1.7E-06	-1.8E-06	-1.8E-06	-2.0E-06	-2.0E-06	-1.8E-06	-1.8E-06
SN11	-1.8E-06	-1.9E-06	-1.7E-06	-1.8E-06	-1.8E-06	-2.0E-06	-2.0E-06	-1.8E-06	-1.8E-06
Statistics									
Min	-1.9E-06	-1.9E-06	-1.8E-06	-1.8E-06	-1.9E-06	-2.0E-06	-2.0E-06	-1.9E-06	-1.9E-06
Max	-1.8E-06	-1.9E-06	-1.7E-06	-1.8E-06	-1.8E-06	-2.0E-06	-2.0E-06	-1.8E-06	-1.8E-06
Average	-1.9E-06	-1.9E-06	-1.8E-06	-1.8E-06	-1.8E-06	-2.0E-06	-2.0E-06	-1.8E-06	-1.8E-06
Sigma	30.0E-09	21.4E-09	21.0E-09	21.9E-09	22.7E-09	19.1E-09	21.8E-09	22.9E-09	24.4E-09

Drift Calculation

Ill_Sleep	0 kRad	8.2 kRad	22.3 kRad	28.7 kRad	54.1 kRad	106.7 kRad	24 Hours	168 Hours	168 Hours
OFF samples									
SN7	-	-26.0E-09	117.8E-09	72.0E-09	45.0E-09	-126.4E-09	-139.2E-09	49.4E-09	39.8E-09
SN8	-	-14.8E-09	128.0E-09	81.8E-09	48.2E-09	-110.4E-09	-129.2E-09	60.0E-09	42.6E-09
SN9	-	-46.4E-09	122.4E-09	73.2E-09	42.4E-09	-120.8E-09	-135.6E-09	53.4E-09	37.4E-09
SN10	-	-39.4E-09	127.8E-09	77.0E-09	39.6E-09	-127.4E-09	-135.8E-09	58.8E-09	44.6E-09
SN11	-	-66.2E-09	95.8E-09	52.6E-09	16.8E-09	-148.2E-09	-157.6E-09	36.6E-09	19.6E-09
Average	-	-38.6E-09	118.4E-09	71.3E-09	38.4E-09	-126.6E-09	-139.5E-09	51.6E-09	36.8E-09
Sigma	-	17.6E-09	11.9E-09	10.0E-09	11.2E-09	12.4E-09	9.6E-09	8.4E-09	8.9E-09