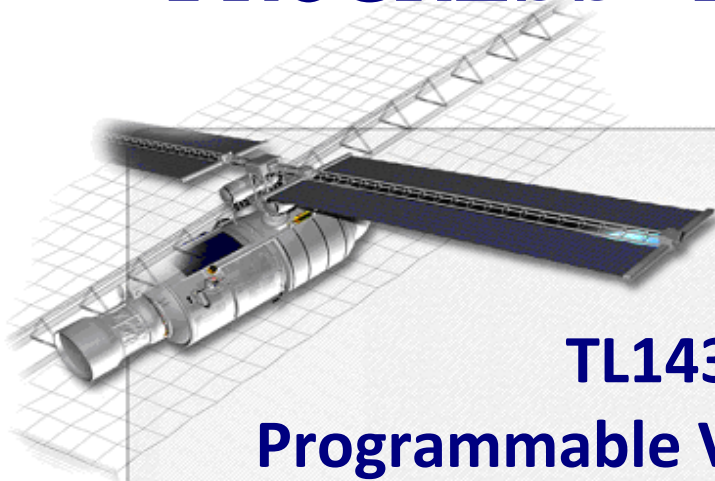




# TOTAL IONIZING DOSE PROGRESS TEST REPORT



## TL1431ACZT Programmable Voltage Reference GE334152 From STMicroelectronics

TRAD/TE/TL1431ACZT/334152/ESA/MV/1410		Labège, May 22 <sup>nd</sup> , 2015
 		TRAD, Bât Gallium 907, Voie l'Occitane - 31670 LABEGE France ☎: 05 61 00 95 60 Fax: 05 61 00 95 61 Email: <a href="mailto:trad@trad.fr">trad@trad.fr</a> Web Site: <a href="http://www.trad.fr">www.trad.fr</a> SIRET 397 862 038 00056 - TVA FR59397862038
Written by	Verified by / Quality control	Approved by
<b>M. VAILLÉ</b> 22/05/2015	<b>P. GARCIA</b> 12/06/2015	<b>N. SUKHASEUM</b> 12/06/2015
Revision: 0      Creation of the document		
Revision: 1      Addition of table of test parameters		
To: <b>ESA</b> <b>Mr Christian POIVEY</b>	Project/Program: Ref:	

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## 1. INTRODUCTION

This progress report describes the testing and characterization of the **TL1431ACZT** manufactured by **STMicroelectronics**. Testing began on January 05<sup>th</sup>, 2015 and ended on February 24<sup>th</sup>, 2015.

## 2. PART INFORMATION

### 2.1. Identification

<b>Part designation</b>	TL1431ACZT
<b>Manufacturer</b>	STMicroelectronics
<b>Part function</b>	Programmable Voltage Reference

### 2.2. Procurement information

<b>Package</b>	TO-92
<b>Bulk No</b>	GE334152
<b>Number of tested parts</b>	30 irradiated samples (Biased OFF) + 1 reference sample

## 3. COMMENTS

The irradiation test on **30 TL1431ACZT**, a **Programmable Voltage Reference** from **STMicroelectronics** is using gamma rays from Cobalt 60 source, at low dose rate (210 rad(Si)/h).

For an easier result visualisation, measurements and graphs have been separated per lot.

The black curve with no drift is the DUT reference (not irradiated).

All parts became out of specification during irradiation but remain functional.

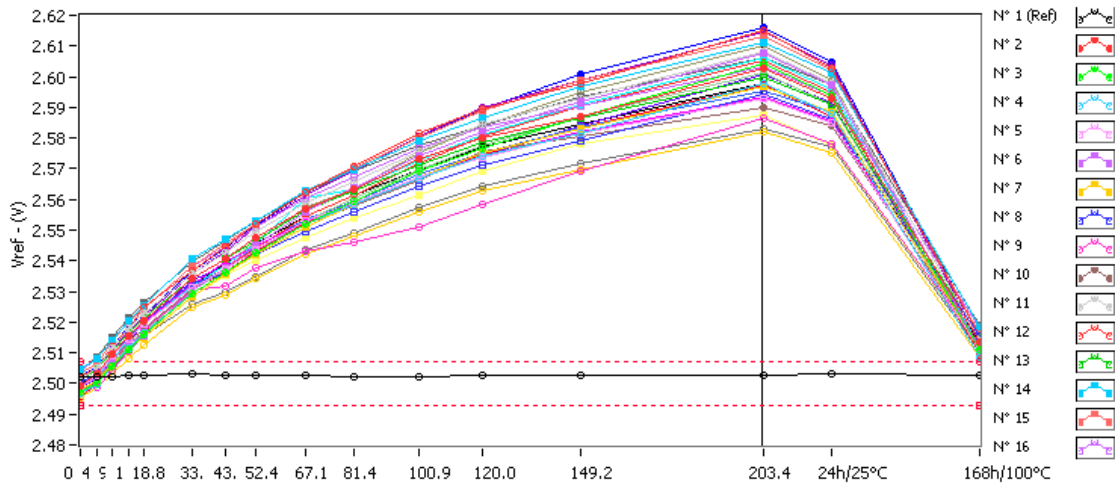
#### 4. TEST PARAMETERS

Parameters	Symbols	Test conditions
<b>Ta=25°C, unless otherwise specified</b>		
Reference Voltage	<b>Vref</b>	Vka=Vref; Ik=10mA
	<b>dVref/dVka</b>	Ik=10mA; 3V<Vka<36V
Reference Input Current	<b>Iref</b>	Ik=10mA; R1=10kΩ; R2=infinite
Minimum Cathode Current	<b>Imin</b>	Vka=Vref
Off State Cathode Current	<b>Ioff</b>	
Dynamic Impedance	<b>Zka</b>	Vka=Vref; 1mA<Ik<100mA

#### 5. APPENDIX 1 MEASURED PARAMETERS

# 1. Vref

Ta=25°C; Vka=Vref; Ik=10mA

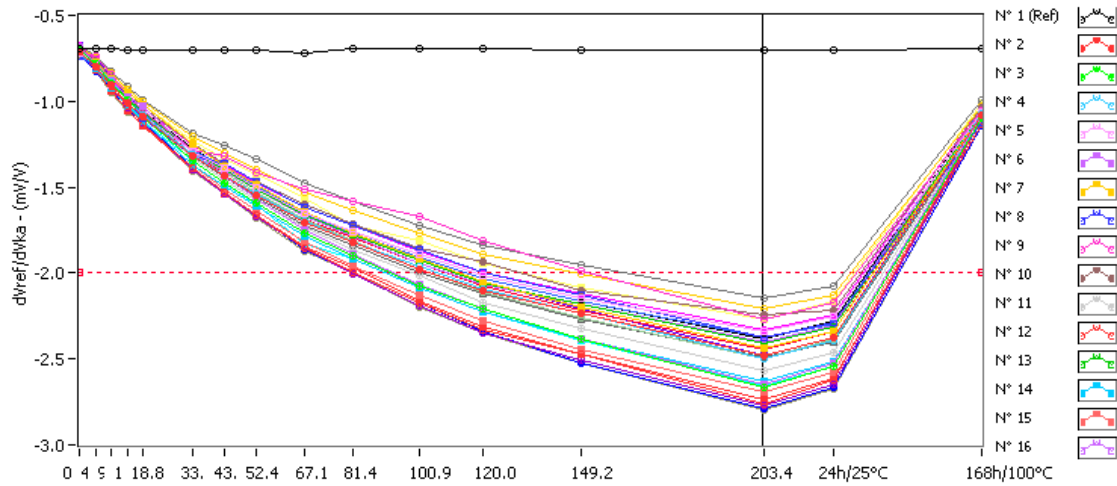


**Vref . (V) Min = 2.493 Max = 2.507**

	0.0 krad(Si)	4.9 krad(Si)	9.6 krad(Si)	14.2 krad(Si)	18.8 krad(Si)	33.5 krad(Si)	43.2 krad(Si)	52.4 krad(Si)	67.1 krad(Si)	81.4 krad(Si)	100.9 krad(Si)	120.0 krad(Si)	149.2 krad(Si)	203.4 krad(Si)	24h 25°C	168h 100°C
N° 1 (Ref)	2.5024	2.5022	2.5021	2.5024	2.5027	2.5030	2.5027	2.5026	2.5027	2.5023	2.5024	2.5026	2.5027	2.5027	2.5029	2.5027
N° 2	2.4991	2.5031	2.5094	2.5156	2.5205	2.5340	2.5406	2.5474	2.5567	2.5636	2.5730	2.5801	2.5871	2.6025	2.5931	2.5136
N° 3	2.4975	2.5002	2.5055	2.5111	2.5160	2.5291	2.5362	2.5427	2.5522	2.5596	2.5694	2.5766	2.5870	2.6043	2.5938	2.5112
N° 4	2.4969	2.4999	2.5059	2.5117	2.5167	2.5292	2.5364	2.5426	2.5518	2.5583	2.5669	2.5741	2.5817	2.5978	2.5881	2.5087
N° 5	2.4986	2.5024	2.5088	2.5146	2.5192	2.5313	2.5374	2.5437	2.5529	2.5591	2.5670	2.5737	2.5814	2.5931	2.5852	2.5112
N° 6	2.4985	2.5023	2.5075	2.5128	2.5157	2.5305	2.5379	2.5453	2.5557	2.5636	2.5742	2.5818	2.5917	2.6078	2.5971	2.5117
N° 7	2.4976	2.5012	2.5063	2.5114	2.5151	2.5284	2.5359	2.5421	2.5511	2.5584	2.5670	2.5749	2.5830	2.5971	2.5885	2.5113
N° 8	2.5003	2.5033	2.5092	2.5153	2.5205	2.5327	2.5355	2.5420	2.5495	2.5560	2.5642	2.5714	2.5791	2.5946	2.5861	2.5153
N° 9	2.4980	2.4987	2.5041	2.5108	2.5173	2.5301	2.5319	2.5375	2.5430	2.5463	2.5508	2.5586	2.5692	2.5867	2.5780	2.5121
N° 10	2.4988	2.5020	2.5075	2.5134	2.5182	2.5310	2.5373	2.5438	2.5518	2.5581	2.5663	2.5758	2.5808	2.5899	2.5840	2.5126
N° 11	2.5013	2.5050	2.5115	2.5177	2.5227	2.5357	2.5428	2.5496	2.5590	2.5659	2.5754	2.5847	2.5931	2.6080	2.5978	2.5147
N° 12	2.5020	2.5052	2.5120	2.5180	2.5248	2.5368	2.5444	2.5519	2.5624	2.5707	2.5814	2.5896	2.5981	2.6152	2.6029	2.5155
N° 13	2.5012	2.5048	2.5106	2.5166	2.5213	2.5344	2.5405	2.5468	2.5563	2.5628	2.5714	2.5786	2.5867	2.5996	2.5911	2.5150
N° 14	2.5047	2.5083	2.5142	2.5203	2.5252	2.5407	2.5471	2.5529	2.5627	2.5697	2.5792	2.5867	2.5967	2.6112	2.6010	2.5186
N° 15	2.5032	2.5069	2.5133	2.5204	2.5244	2.5382	2.5454	2.5522	2.5623	2.5701	2.5802	2.5888	2.5987	2.6130	2.6023	2.5161
N° 16	2.5041	2.5079	2.5138	2.5197	2.5245	2.5380	2.5446	2.5510	2.5604	2.5674	2.5769	2.5836	2.5905	2.6031	2.5941	2.5181
N° 17	2.4955	2.4986	2.5031	2.5082	2.5124	2.5246	2.5289	2.5342	2.5421	2.5479	2.5559	2.5630	2.5699	2.5819	2.5752	2.5088
N° 18	2.4987	2.5028	2.5093	2.5153	2.5199	2.5323	2.5399	2.5446	2.5528	2.5586	2.5671	2.5743	2.5819	2.5932	2.5853	2.5109
N° 19	2.5013	2.5047	2.5111	2.5172	2.5218	2.5359	2.5433	2.5508	2.5612	2.5694	2.5805	2.5898	2.5990	2.6147	2.6036	2.5140
N° 20	2.4967	2.5004	2.5063	2.5124	2.5171	2.5303	2.5372	2.5437	2.5532	2.5602	2.5698	2.5776	2.5868	2.6012	2.5908	2.5110
N° 21	2.4987	2.5021	2.5081	2.5141	2.5202	2.5317	2.5389	2.5455	2.5602	2.5634	2.5729	2.5812	2.5910	2.6062	2.5958	2.5119
N° 22	2.4967	2.5002	2.5066	2.5124	2.5170	2.5302	2.5375	2.5442	2.5543	2.5612	2.5719	2.5804	2.5904	2.6052	2.5946	2.5095
N° 23	2.5044	2.5087	2.5152	2.5213	2.5265	2.5397	2.5463	2.5529	2.5624	2.5690	2.5778	2.5838	2.5934	2.6062	2.5972	2.5189
N° 24	2.4994	2.5033	2.5092	2.5150	2.5207	2.5320	2.5374	2.5444	2.5534	2.5595	2.5682	2.5753	2.5836	2.5952	2.5884	2.5122
N° 25	2.4957	2.4997	2.5060	2.5116	2.5163	2.5307	2.5364	2.5430	2.5525	2.5587	2.5674	2.5746	2.5834	2.5972	2.5869	2.5102
N° 26	2.5021	2.5055	2.5115	2.5187	2.5223	2.5369	2.5442	2.5515	2.5624	2.5703	2.5800	2.5896	2.6010	2.6161	2.6045	2.5156
N° 27	2.4974	2.5011	2.5071	2.5133	2.5167	2.5315	2.5387	2.5460	2.5573	2.5632	2.5751	2.5840	2.5948	2.6100	2.5989	2.5101
N° 28	2.4976	2.5007	2.5051	2.5104	2.5153	2.5258	2.5297	2.5346	2.5435	2.5491	2.5576	2.5644	2.5718	2.5833	2.5773	2.5107
N° 29	2.4990	2.5015	2.5077	2.5141	2.5194	2.5337	2.5384	2.5438	2.5518	2.5581	2.5669	2.5740	2.5839	2.6006	2.5912	2.5120
N° 30	2.4971	2.5004	2.5057	2.5111	2.5156	2.5284	2.5351	2.5403	2.5477	2.5541	2.5611	2.5690	2.5782	2.5873	2.5777	2.5110
N° 31	2.4995	2.5031	2.5092	2.5150	2.5197	2.5324	2.5391	2.5454	2.5545	2.5614	2.5696	2.5769	2.5846	2.5977	2.5880	2.5132

## 2. dVref/dVka

Ta=25°C; Ik=10mA, 3V<Vka<36V



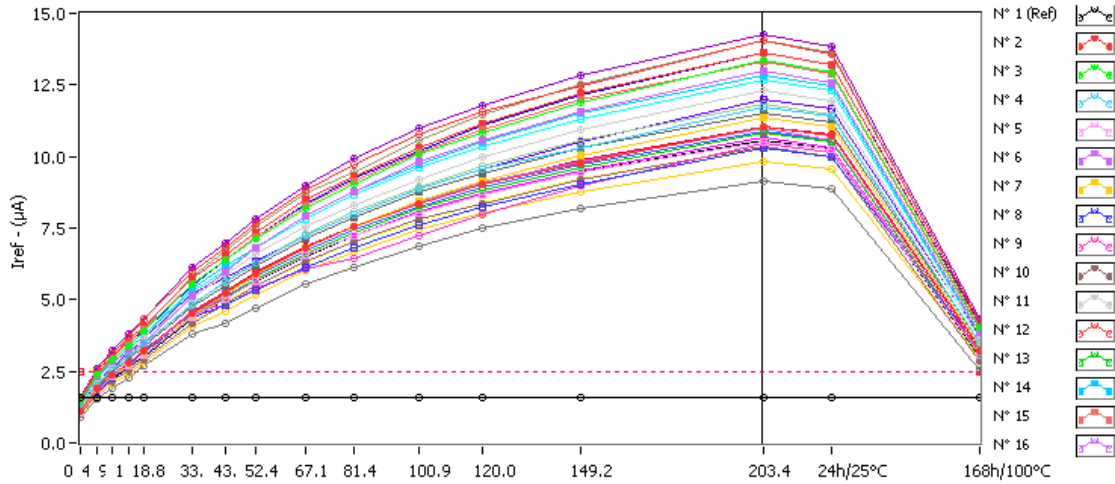
**dVref/dVka . (mV/V)**

**Min = -2.0**

	0.0 krad(Si)	4.9 krad(Si)	9.6 krad(Si)	14.2 krad(Si)	18.8 krad(Si)	33.5 krad(Si)	43.2 krad(Si)	52.4 krad(Si)	67.1 krad(Si)	81.4 krad(Si)	100.9 krad(Si)	120.0 krad(Si)	149.2 krad(Si)	203.4 krad(Si)	24h 25°C	168h 100°C
N° 1 (Ref)	-0.695	-0.690	-0.695	-0.698	-0.703	-0.703	-0.704	-0.698	-0.717	-0.695	-0.694	-0.698	-0.699	-0.700	-0.700	-0.698
N° 2	-0.711	-0.798	-0.908	-1.009	-1.093	-1.321	-1.434	-1.548	-1.710	-1.823	-1.979	-2.105	-2.236	-2.477	-2.372	-1.083
N° 3	-0.700	-0.785	-0.896	-0.996	-1.093	-1.343	-1.477	-1.593	-1.770	-1.904	-2.079	-2.210	-2.384	-2.667	-2.544	-1.099
N° 4	-0.700	-0.780	-0.891	-0.992	-1.081	-1.305	-1.429	-1.538	-1.701	-1.817	-1.964	-2.097	-2.232	-2.498	-2.391	-1.069
N° 5	-0.717	-0.794	-0.901	-0.996	-1.079	-1.289	-1.393	-1.501	-1.655	-1.760	-1.891	-2.012	-2.143	-2.341	-2.253	-1.062
N° 6	-0.689	-0.783	-0.882	-0.974	-1.029	-1.298	-1.431	-1.567	-1.750	-1.893	-2.066	-2.209	-2.380	-2.643	-2.527	-1.082
N° 7	-0.697	-0.775	-0.869	-0.952	-1.020	-1.246	-1.376	-1.488	-1.644	-1.772	-1.918	-2.054	-2.196	-2.436	-2.343	-1.069
N° 8	-0.740	-0.802	-0.909	-1.011	-1.102	-1.315	-1.363	-1.472	-1.614	-1.728	-1.864	-1.993	-2.129	-2.376	-2.285	-1.123
N° 9	-0.709	-0.742	-0.845	-0.955	-1.054	-1.284	-1.323	-1.418	-1.511	-1.579	-1.674	-1.814	-1.984	-2.267	-2.171	-1.059
N° 10	-0.689	-0.763	-0.863	-0.958	-1.041	-1.251	-1.360	-1.466	-1.604	-1.718	-1.859	-1.937	-2.106	-2.242	-2.215	-1.035
N° 11	-0.701	-0.790	-0.907	-1.011	-1.101	-1.326	-1.455	-1.576	-1.735	-1.861	-2.017	-2.174	-2.320	-2.569	-2.459	-1.085
N° 12	-0.693	-0.788	-0.916	-1.027	-1.136	-1.389	-1.531	-1.666	-1.853	-1.996	-2.172	-2.329	-2.475	-2.758	-2.625	-1.102
N° 13	-0.700	-0.779	-0.884	-0.984	-1.067	-1.292	-1.399	-1.509	-1.665	-1.780	-1.923	-2.055	-2.184	-2.408	-2.311	-1.064
N° 14	-0.717	-0.807	-0.923	-1.026	-1.116	-1.370	-1.494	-1.612	-1.783	-1.913	-2.081	-2.222	-2.380	-2.631	-2.519	-1.097
N° 15	-0.697	-0.794	-0.915	-1.031	-1.116	-1.375	-1.512	-1.635	-1.816	-1.958	-2.130	-2.280	-2.445	-2.691	-2.575	-1.105
N° 16	-0.689	-0.772	-0.880	-0.979	-1.061	-1.289	-1.403	-1.511	-1.670	-1.785	-1.941	-2.063	-2.185	-2.403	-2.305	-1.045
N° 17	-0.685	-0.750	-0.838	-0.928	-1.004	-1.208	-1.301	-1.395	-1.532	-1.634	-1.766	-1.889	-2.003	-2.208	-2.131	-1.032
N° 18	-0.675	-0.757	-0.867	-0.962	-1.040	-1.258	-1.373	-1.474	-1.614	-1.726	-1.872	-1.996	-2.123	-2.328	-2.242	-1.027
N° 19	-0.690	-0.793	-0.920	-1.033	-1.127	-1.398	-1.536	-1.672	-1.854	-2.003	-2.189	-2.351	-2.508	-2.772	-2.649	-1.108
N° 20	-0.676	-0.762	-0.873	-0.973	-1.059	-1.293	-1.411	-1.526	-1.687	-1.809	-1.975	-2.113	-2.259	-2.499	-2.385	-1.060
N° 21	-0.698	-0.791	-0.905	-1.015	-1.118	-1.347	-1.478	-1.598	-1.826	-1.914	-2.085	-2.229	-2.389	-2.655	-2.538	-1.100
N° 22	-0.722	-0.820	-0.943	-1.051	-1.145	-1.398	-1.535	-1.662	-1.843	-1.971	-2.160	-2.309	-2.472	-2.734	-2.616	-1.136
N° 23	-0.704	-0.792	-0.905	-1.008	-1.096	-1.323	-1.443	-1.560	-1.723	-1.841	-1.995	-2.117	-2.267	-2.493	-2.398	-1.089
N° 24	-0.693	-0.776	-0.883	-0.982	-1.068	-1.282	-1.384	-1.498	-1.652	-1.766	-1.907	-2.033	-2.167	-2.376	-2.299	-1.048
N° 25	-0.691	-0.778	-0.890	-0.989	-1.072	-1.311	-1.415	-1.527	-1.689	-1.796	-1.947	-2.075	-2.217	-2.447	-2.336	-1.058
N° 26	-0.723	-0.824	-0.936	-1.054	-1.120	-1.392	-1.534	-1.666	-1.861	-1.999	-2.175	-2.342	-2.525	-2.788	-2.662	-1.144
N° 27	-0.726	-0.827	-0.947	-1.059	-1.132	-1.406	-1.542	-1.679	-1.871	-1.996	-2.197	-2.352	-2.527	-2.794	-2.674	-1.139
N° 28	-0.676	-0.739	-0.825	-0.916	-0.996	-1.189	-1.255	-1.339	-1.481	-1.585	-1.723	-1.836	-1.952	-2.143	-2.074	-0.992
N° 29	-0.678	-0.747	-0.864	-0.969	-1.067	-1.325	-1.410	-1.506	-1.651	-1.764	-1.914	-2.047	-2.207	-2.485	-2.377	-1.064
N° 30	-0.676	-0.750	-0.849	-0.941	-1.017	-1.229	-1.336	-1.428	-1.569	-1.724	-1.807	-1.946	-2.088	-2.269	-2.163	-1.014
N° 31	-0.686	-0.767	-0.875	-0.971	-1.053	-1.275	-1.386	-1.494	-1.646	-1.764	-1.906	-2.028	-2.164	-2.385	-2.275	-1.045

### 3. Iref

Ta=25°C; Ik=10mA; R1=10kOhms; R2=infinite



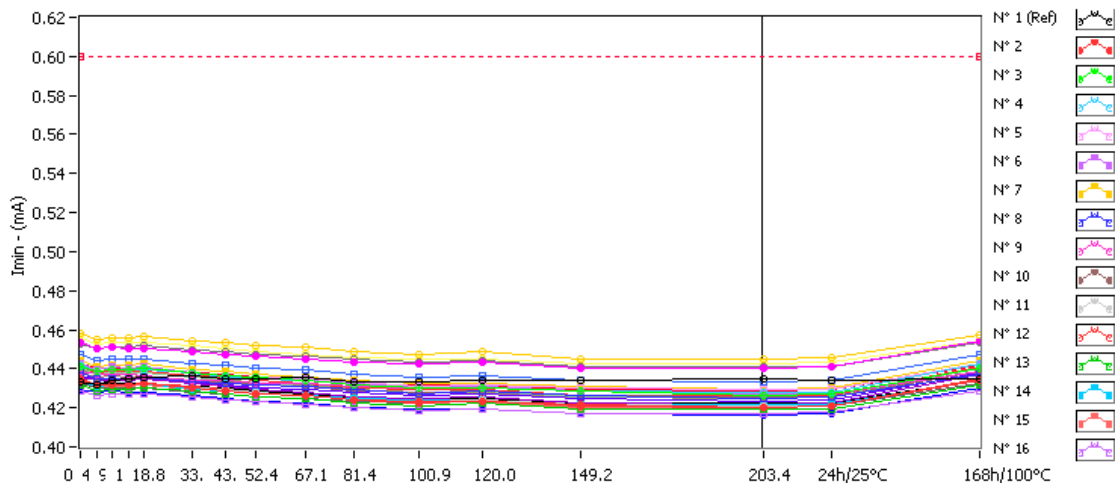
Iref (µA)

Max = 2.5

	0.0 krad(Si)	4.9 krad(Si)	9.6 krad(Si)	14.2 krad(Si)	18.8 krad(Si)	33.5 krad(Si)	43.2 krad(Si)	52.4 krad(Si)	67.1 krad(Si)	81.4 krad(Si)	100.9 krad(Si)	120.0 krad(Si)	149.2 krad(Si)	203.4 krad(Si)	24h 25°C	168h 100°C
N° 1 (Ref)	1.586	1.596	1.590	1.588	1.579	1.578	1.588	1.587	1.584	1.594	1.593	1.590	1.589	1.589	1.590	1.588
N° 2	1.123	1.905	2.375	2.800	3.215	4.549	5.233	5.898	6.816	7.544	8.356	9.037	9.795	11.060	10.720	3.246
N° 3	1.467	2.362	2.908	3.403	3.915	5.554	6.400	7.137	8.193	9.047	10.071	10.835	11.864	13.357	12.955	3.997
N° 4	1.245	2.032	2.554	3.014	3.464	4.832	5.626	6.284	7.226	7.971	8.861	9.552	10.326	11.727	11.383	3.462
N° 5	1.042	1.781	2.301	2.668	3.062	4.366	5.036	5.662	6.533	7.218	8.006	8.637	9.429	10.522	10.222	3.040
N° 6	1.408	2.347	2.870	3.195	3.482	5.149	5.994	6.805	7.909	8.776	9.802	10.576	11.579	12.974	12.581	3.859
N° 7	1.181	1.955	2.351	2.716	3.039	4.413	5.191	5.870	6.814	7.579	8.461	9.154	10.043	11.362	11.038	3.398
N° 8	1.127	1.769	2.277	2.725	3.149	4.387	4.787	5.310	6.132	6.798	7.610	8.242	9.045	10.315	9.997	3.281
N° 9	1.181	1.676	2.248	2.711	3.247	4.575	4.807	5.406	6.091	6.461	7.218	7.973	8.990	10.449	10.119	3.158
N° 10	1.010	1.722	2.149	2.552	2.930	4.190	4.849	5.467	6.329	7.022	7.824	8.327	9.211	10.343	9.986	2.835
N° 11	1.310	2.154	2.697	3.180	3.644	5.047	5.842	6.580	7.541	8.315	9.213	9.966	10.938	12.305	11.932	3.631
N° 12	1.541	2.517	3.137	3.688	4.334	5.948	6.829	7.654	8.806	9.709	10.752	11.562	12.481	14.042	13.592	4.227
N° 13	1.086	1.827	2.279	2.694	3.084	4.401	5.072	5.724	6.610	7.341	8.177	8.813	9.639	10.805	10.487	3.107
N° 14	1.376	2.248	2.792	3.293	3.764	5.412	6.164	6.838	7.904	8.745	9.738	10.513	11.494	12.846	12.453	3.739
N° 15	1.415	2.352	2.932	3.555	3.971	5.571	6.402	7.183	8.274	9.156	10.164	10.959	11.965	13.288	12.886	3.956
N° 16	1.117	1.883	2.354	2.785	3.192	4.554	5.240	5.888	6.807	7.539	8.400	9.060	9.809	10.973	10.566	3.113
N° 17	0.978	1.653	2.068	2.452	2.812	4.086	4.609	5.189	6.009	6.656	7.422	8.014	8.750	9.813	9.538	2.934
N° 18	1.059	1.800	2.261	2.676	3.078	4.389	5.143	5.689	6.541	7.233	8.064	8.709	9.520	10.657	10.320	3.108
N° 19	1.575	2.595	3.222	3.800	4.343	6.114	6.995	7.828	8.980	9.904	10.963	11.794	12.833	14.266	13.842	4.337
N° 20	1.242	2.062	2.562	3.014	3.444	4.876	5.604	6.300	7.279	8.061	8.932	9.664	10.580	11.814	11.469	3.499
N° 21	1.373	2.255	2.789	3.277	3.741	5.268	6.043	6.788	7.832	8.661	9.619	10.365	11.325	12.683	12.300	3.756
N° 22	1.486	2.442	3.032	3.567	4.078	5.733	6.573	7.367	8.484	9.298	10.310	11.147	12.191	13.622	13.212	4.125
N° 23	1.176	1.973	2.476	2.918	3.355	4.766	5.488	6.174	7.126	7.876	8.763	9.427	10.299	11.511	11.173	3.473
N° 24	1.074	1.847	2.321	2.752	3.268	4.508	5.243	5.812	6.698	7.432	8.263	8.912	9.737	10.856	10.540	3.118
N° 25	1.137	1.921	2.398	2.825	3.234	4.595	5.287	5.945	6.844	7.569	8.364	9.051	9.900	11.051	10.749	3.350
N° 26	1.469	2.419	3.034	3.560	3.923	5.515	6.384	7.201	8.364	9.257	10.212	11.079	12.157	13.615	13.209	4.148
N° 27	1.523	2.514	3.102	3.650	4.024	5.798	6.682	7.527	8.700	9.476	10.554	11.449	12.533	14.036	13.620	4.211
N° 28	0.885	1.522	1.923	2.288	2.707	3.799	4.194	4.703	5.544	6.147	6.885	7.480	8.160	9.140	8.869	2.551
N° 29	1.345	2.084	2.627	3.124	3.625	5.230	5.766	6.360	7.217	7.959	8.848	9.581	10.533	12.003	11.649	3.677
N° 30	1.019	1.724	2.160	2.550	2.927	4.188	4.898	5.482	6.286	7.002	7.729	8.377	9.227	10.325	9.976	2.924
N° 31	1.045	1.779	2.234	2.643	3.036	4.330	4.998	5.629	6.510	7.230	8.031	8.663	9.472	10.589	10.259	2.985

## 4. Imin

Ta=25°C; Vka=Vref



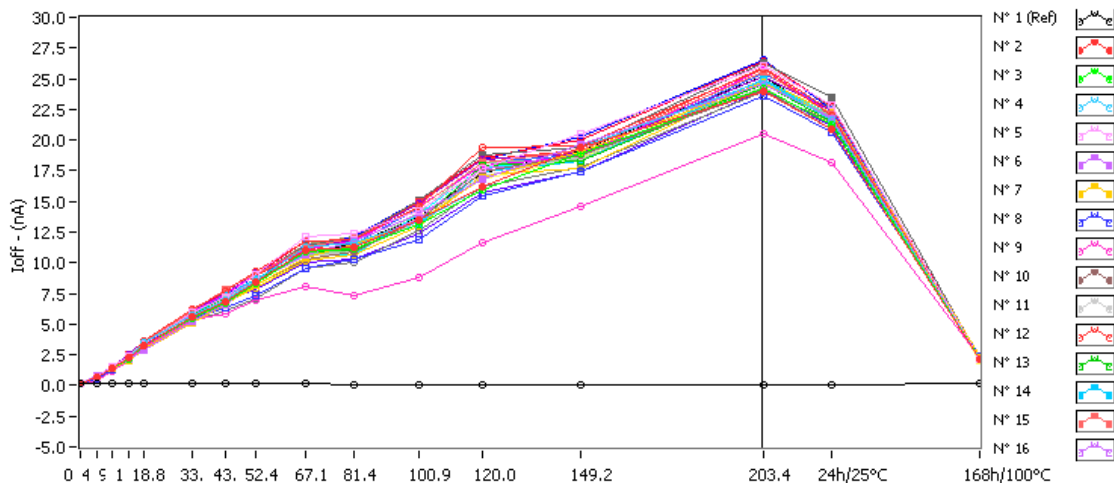
**Imin . (mA) Max = 0.6**

	0.0 krad(Si)	4.9 krad(Si)	9.6 krad(Si)	14.2 krad(Si)	18.8 krad(Si)	33.5 krad(Si)	43.2 krad(Si)	52.4 krad(Si)	67.1 krad(Si)	81.4 krad(Si)	100.9 krad(Si)	120.0 krad(Si)	149.2 krad(Si)	203.4 krad(Si)	24h 25°C	168h 100°C
N° 1 (Ref)	0.4335	0.4319	0.4340	0.4349	0.4360	0.4364	0.4345	0.4348	0.4354	0.4336	0.4334	0.4342	0.4343	0.4351	0.4341	0.4345
N° 2	0.4348	0.4317	0.4321	0.4319	0.4322	0.4300	0.4286	0.4275	0.4266	0.4243	0.4229	0.4230	0.4220	0.4203	0.4208	0.4345
N° 3	0.4411	0.4388	0.4397	0.4397	0.4403	0.4382	0.4364	0.4354	0.4344	0.4320	0.4301	0.4303	0.4284	0.4265	0.4273	0.4406
N° 4	0.4415	0.4389	0.4392	0.4393	0.4398	0.4377	0.4356	0.4348	0.4340	0.4320	0.4302	0.4304	0.4290	0.4276	0.4282	0.4427
N° 5	0.4421	0.4388	0.4395	0.4395	0.4400	0.4382	0.4366	0.4359	0.4351	0.4330	0.4310	0.4319	0.4303	0.4293	0.4297	0.4429
N° 6	0.4426	0.4395	0.4407	0.4401	0.4411	0.4382	0.4366	0.4358	0.4341	0.4324	0.4305	0.4307	0.4288	0.4272	0.4281	0.4428
N° 7	0.4444	0.4412	0.4422	0.4416	0.4426	0.4398	0.4384	0.4374	0.4359	0.4341	0.4323	0.4327	0.4307	0.4291	0.4300	0.4442
N° 8	0.4377	0.4347	0.4350	0.4350	0.4354	0.4334	0.4327	0.4315	0.4308	0.4292	0.4274	0.4283	0.4262	0.4249	0.4254	0.4374
N° 9	0.4386	0.4370	0.4369	0.4368	0.4366	0.4342	0.4337	0.4325	0.4325	0.4307	0.4300	0.4309	0.4285	0.4264	0.4272	0.4384
N° 10	0.4383	0.4357	0.4362	0.4360	0.4365	0.4342	0.4332	0.4319	0.4306	0.4288	0.4280	0.4283	0.4267	0.4259	0.4259	0.4384
N° 11	0.4346	0.4319	0.4320	0.4319	0.4324	0.4301	0.4291	0.4279	0.4264	0.4243	0.4232	0.4240	0.4216	0.4207	0.4212	0.4351
N° 12	0.4339	0.4316	0.4318	0.4318	0.4322	0.4307	0.4295	0.4280	0.4266	0.4241	0.4227	0.4244	0.4212	0.4204	0.4210	0.4338
N° 13	0.4317	0.4289	0.4295	0.4297	0.4302	0.4283	0.4271	0.4259	0.4248	0.4226	0.4213	0.4228	0.4197	0.4193	0.4197	0.4321
N° 14	0.4334	0.4311	0.4319	0.4319	0.4322	0.4297	0.4287	0.4280	0.4264	0.4246	0.4237	0.4244	0.4215	0.4215	0.4219	0.4338
N° 15	0.4331	0.4307	0.4312	0.4310	0.4317	0.4298	0.4288	0.4273	0.4260	0.4241	0.4227	0.4231	0.4205	0.4202	0.4208	0.4345
N° 16	0.4289	0.4261	0.4269	0.4269	0.4275	0.4254	0.4242	0.4229	0.4217	0.4198	0.4185	0.4197	0.4171	0.4171	0.4178	0.4290
N° 17	0.4580	0.4548	0.4558	0.4558	0.4566	0.4542	0.4536	0.4522	0.4511	0.4490	0.4475	0.4487	0.4452	0.4449	0.4456	0.4575
N° 18	0.4532	0.4501	0.4508	0.4503	0.4506	0.4487	0.4471	0.4466	0.4452	0.4437	0.4426	0.4430	0.4401	0.4403	0.4407	0.4544
N° 19	0.4357	0.4337	0.4342	0.4342	0.4346	0.4325	0.4310	0.4298	0.4280	0.4259	0.4248	0.4253	0.4223	0.4219	0.4227	0.4368
N° 20	0.4399	0.4372	0.4378	0.4376	0.4378	0.4357	0.4340	0.4329	0.4313	0.4288	0.4282	0.4289	0.4255	0.4252	0.4258	0.4399
N° 21	0.4331	0.4310	0.4315	0.4317	0.4319	0.4300	0.4287	0.4277	0.4261	0.4238	0.4231	0.4238	0.4206	0.4203	0.4209	0.4345
N° 22	0.4407	0.4383	0.4388	0.4388	0.4390	0.4367	0.4356	0.4342	0.4324	0.4305	0.4295	0.4296	0.4266	0.4262	0.4267	0.4410
N° 23	0.4323	0.4299	0.4301	0.4302	0.4301	0.4281	0.4272	0.4259	0.4247	0.4229	0.4224	0.4232	0.4203	0.4203	0.4211	0.4322
N° 24	0.4472	0.4444	0.4449	0.4449	0.4446	0.4428	0.4416	0.4402	0.4396	0.4372	0.4360	0.4367	0.4337	0.4335	0.4340	0.4476
N° 25	0.4426	0.4399	0.4402	0.4404	0.4407	0.4383	0.4369	0.4356	0.4346	0.4322	0.4315	0.4319	0.4292	0.4285	0.4291	0.4418
N° 26	0.4296	0.4277	0.4283	0.4278	0.4281	0.4260	0.4250	0.4236	0.4221	0.4203	0.4194	0.4197	0.4172	0.4166	0.4171	0.4303
N° 27	0.4395	0.4371	0.4379	0.4377	0.4388	0.4360	0.4346	0.4329	0.4314	0.4294	0.4281	0.4280	0.4254	0.4247	0.4253	0.4399
N° 28	0.4529	0.4503	0.4510	0.4513	0.4517	0.4499	0.4490	0.4476	0.4467	0.4446	0.4434	0.4440	0.4414	0.4411	0.4413	0.4532
N° 29	0.4365	0.4345	0.4340	0.4344	0.4349	0.4323	0.4314	0.4301	0.4295	0.4277	0.4264	0.4273	0.4248	0.4235	0.4242	0.4376
N° 30	0.4555	0.4528	0.4535	0.4534	0.4537	0.4516	0.4500	0.4485	0.4474	0.4456	0.4447	0.4452	0.4427	0.4427	0.4430	0.4546
N° 31	0.4349	0.4321	0.4329	0.4324	0.4328	0.4309	0.4299	0.4284	0.4269	0.4253	0.4240	0.4246	0.4226	0.4222	0.4224	0.4344



## 5. Ioff

Ta=25°C



Ioff . (nA)

Max = 500.0

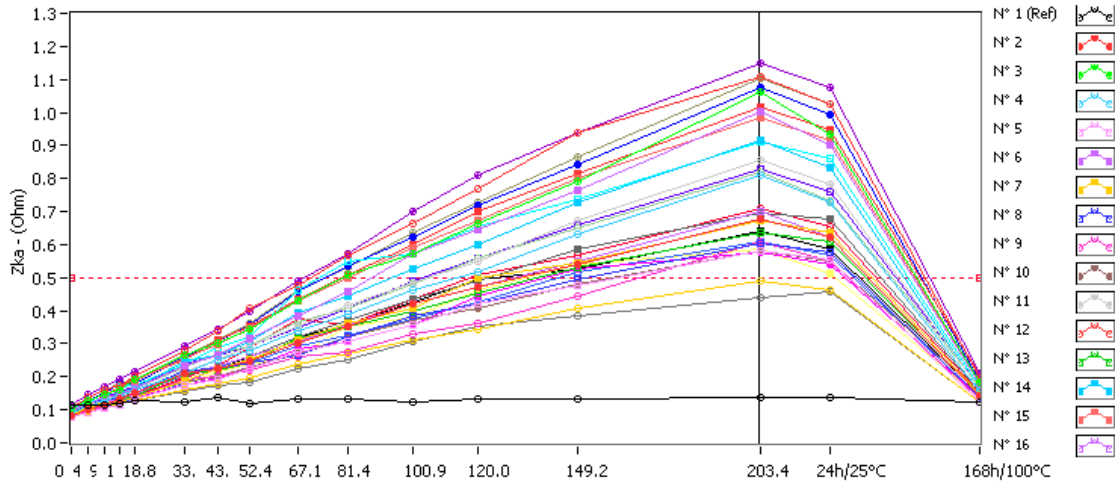
	0.0 krad(Si)	4.9 krad(Si)	9.6 krad(Si)	14.2 krad(Si)	18.8 krad(Si)	33.5 krad(Si)	43.2 krad(Si)	52.4 krad(Si)	67.1 krad(Si)	81.4 krad(Si)	100.9 krad(Si)	120.0 krad(Si)	149.2 krad(Si)	203.4 krad(Si)	24h 25°C	168h 100°C
N° 1 (Ref)	0.150	0.120	0.144	0.152	0.174	0.156	0.144	0.143	0.123	0.038	0.064	0.110	0.085	0.015	0.011	0.199
N° 2	0.155	0.701	1.447	2.287	3.314	5.617	6.857	8.458	11.030	11.295	13.506	16.154	19.403	24.014	20.843	2.144
N° 3	0.144	0.659	1.391	2.166	3.214	5.494	6.719	8.304	10.855	11.199	13.140	15.967	18.879	24.232	21.215	2.158
N° 4	0.147	0.674	1.441	2.310	3.470	5.764	6.928	8.547	11.285	11.591	13.417	16.208	19.347	24.839	21.652	2.162
N° 5	0.152	0.695	1.501	2.402	3.381	6.022	7.185	9.076	12.084	12.437	14.186	17.694	20.516	26.025	22.806	2.205
N° 6	0.138	0.731	1.470	2.114	2.883	5.273	6.557	8.479	10.687	11.796	13.933	16.854	19.699	24.548	21.733	2.152
N° 7	0.149	0.674	1.365	2.043	2.930	5.061	6.606	8.218	10.411	11.464	13.322	16.913	19.007	24.712	21.774	2.241
N° 8	0.154	0.586	1.329	2.218	3.338	5.485	6.325	7.308	9.488	10.301	11.841	15.512	17.464	23.574	20.632	2.405
N° 9	0.147	0.409	1.122	2.009	3.123	5.399	5.810	6.910	8.115	7.359	8.816	11.630	14.654	20.517	18.224	2.250
N° 10	0.143	0.683	1.410	2.206	3.239	5.462	6.929	8.229	10.305	10.919	13.453	17.370	18.816	24.081	20.907	2.164
N° 11	0.152	0.711	1.474	2.344	3.456	5.585	7.129	8.595	10.556	10.860	13.310	17.041	18.617	24.381	20.907	2.239
N° 12	0.148	0.732	1.522	2.410	3.633	6.208	7.752	9.297	11.719	11.893	14.556	19.430	19.501	25.820	21.948	2.224
N° 13	0.148	0.688	1.439	2.312	3.441	5.740	7.064	8.511	10.891	11.048	13.358	17.961	18.260	24.589	21.519	2.260
N° 14	0.151	0.701	1.468	2.303	3.336	5.772	7.296	8.721	10.745	11.345	13.092	17.423	18.343	24.910	21.646	2.121
N° 15	0.150	0.726	1.522	2.425	3.530	6.148	7.756	9.058	11.303	11.957	14.504	18.210	19.169	25.540	22.113	2.224
N° 16	0.149	0.699	1.468	2.314	3.429	5.840	7.245	8.561	10.826	11.422	13.656	17.666	18.314	24.625	21.854	2.165
N° 17	0.149	0.634	1.351	2.130	3.057	5.358	6.719	7.886	10.130	10.641	13.042	17.181	17.625	24.776	22.253	2.412
N° 18	0.151	0.712	1.558	2.409	3.387	6.020	7.478	9.049	11.172	11.812	14.587	17.867	18.642	25.785	22.143	2.290
N° 19	0.150	0.750	1.580	2.470	3.579	6.102	7.467	9.222	11.171	11.887	14.888	18.404	18.924	25.181	22.358	2.250
N° 20	0.144	0.720	1.513	2.373	3.393	5.844	7.015	8.624	10.617	11.047	14.068	18.195	18.456	24.755	22.009	2.283
N° 21	0.147	0.701	1.482	2.357	3.350	5.590	7.029	8.544	10.610	10.629	13.942	17.766	18.235	24.922	21.974	2.180
N° 22	0.146	0.748	1.577	2.495	3.498	5.902	7.527	8.901	11.011	11.893	15.004	18.439	19.152	25.915	22.360	2.191
N° 23	0.151	0.745	1.552	2.482	3.514	5.987	7.587	9.025	11.352	11.957	15.124	18.788	19.453	26.360	23.466	2.265
N° 24	0.147	0.740	1.505	2.461	3.466	5.787	7.274	8.555	11.561	11.552	14.487	18.133	18.820	25.492	22.463	2.228
N° 25	0.152	0.760	1.573	2.530	3.606	6.148	7.590	9.028	11.733	11.843	15.136	18.558	20.033	26.468	22.734	2.226
N° 26	0.155	0.751	1.537	2.425	3.300	5.738	7.428	8.929	11.206	12.102	15.145	18.445	20.234	26.603	22.533	2.148
N° 27	0.148	0.751	1.553	2.462	3.482	5.964	7.579	8.961	11.556	12.150	15.045	18.400	20.281	26.380	22.631	2.119
N° 28	0.140	0.638	1.311	2.121	3.121	5.217	6.048	7.065	9.587	10.004	12.657	16.137	17.773	24.013	21.554	2.147
N° 29	0.149	0.630	1.330	2.282	3.450	5.952	6.940	7.851	9.985	10.227	12.349	15.739	17.407	24.038	21.179	2.210
N° 30	0.153	0.701	1.458	2.262	3.231	5.522	6.964	8.227	10.178	11.031	13.733	16.796	18.525	24.970	21.310	2.086
N° 31	0.141	0.723	1.521	2.335	3.397	5.778	7.296	8.560	10.714	11.560	13.716	17.273	19.172	25.156	21.662	2.166

The Scale has been adapted to observe the low drift of this parameter.

The maximum specification defined in the datasheet (500nA) is not visible on this graph.

## 6. Zka

Ta=25°C; Vka=Vref; 1mA<Ik<100mA



**Zka . (Ohm) Max = 0.5**

	0.0 krad(Si)	4.9 krad(Si)	9.6 krad(Si)	14.2 krad(Si)	18.8 krad(Si)	33.5 krad(Si)	43.2 krad(Si)	52.4 krad(Si)	67.1 krad(Si)	81.4 krad(Si)	100.9 krad(Si)	120.0 krad(Si)	149.2 krad(Si)	203.4 krad(Si)	24h 25°C	168h 100°C
N° 1 (Ref)	0.116	0.116	0.116	0.118	0.127	0.123	0.137	0.118	0.132	0.131	0.122	0.134	0.135	0.138	0.135	0.123
N° 2	0.083	0.101	0.114	0.133	0.152	0.210	0.223	0.248	0.303	0.350	0.420	0.473	0.542	0.677	0.624	0.141
N° 3	0.104	0.127	0.146	0.162	0.193	0.265	0.303	0.344	0.431	0.507	0.571	0.664	0.794	1.060	0.933	0.182
N° 4	0.093	0.112	0.128	0.144	0.158	0.211	0.253	0.278	0.341	0.389	0.462	0.519	0.632	0.811	0.726	0.155
N° 5	0.076	0.090	0.103	0.114	0.132	0.173	0.191	0.222	0.276	0.308	0.355	0.421	0.475	0.582	0.555	0.125
N° 6	0.098	0.120	0.139	0.147	0.164	0.235	0.267	0.314	0.383	0.457	0.574	0.644	0.765	1.003	0.900	0.180
N° 7	0.088	0.106	0.123	0.125	0.137	0.188	0.225	0.250	0.310	0.361	0.408	0.500	0.544	0.671	0.638	0.146
N° 8	0.087	0.118	0.132	0.133	0.150	0.218	0.225	0.242	0.265	0.322	0.384	0.420	0.495	0.605	0.578	0.139
N° 9	0.097	0.093	0.109	0.123	0.139	0.190	0.203	0.220	0.259	0.273	0.329	0.364	0.444	0.607	0.549	0.134
N° 10	0.087	0.103	0.118	0.125	0.142	0.182	0.203	0.229	0.270	0.321	0.369	0.409	0.481	0.580	0.550	0.156
N° 11	0.090	0.112	0.132	0.144	0.159	0.217	0.253	0.292	0.351	0.415	0.485	0.550	0.674	0.854	0.783	0.164
N° 12	0.107	0.136	0.159	0.175	0.202	0.281	0.338	0.409	0.478	0.568	0.663	0.771	0.940	1.106	1.027	0.196
N° 13	0.089	0.104	0.119	0.129	0.142	0.211	0.221	0.245	0.317	0.351	0.397	0.451	0.529	0.638	0.608	0.146
N° 14	0.091	0.112	0.132	0.152	0.164	0.247	0.267	0.307	0.393	0.443	0.528	0.599	0.728	0.915	0.835	0.160
N° 15	0.104	0.127	0.146	0.165	0.186	0.255	0.297	0.346	0.431	0.499	0.589	0.672	0.801	0.985	0.913	0.183
N° 16	0.087	0.106	0.125	0.133	0.148	0.206	0.233	0.259	0.307	0.355	0.419	0.471	0.547	0.700	0.624	0.140
N° 17	0.083	0.096	0.106	0.119	0.127	0.159	0.179	0.197	0.237	0.268	0.311	0.343	0.406	0.488	0.464	0.125
N° 18	0.085	0.098	0.116	0.127	0.137	0.174	0.197	0.222	0.282	0.305	0.358	0.442	0.526	0.576	0.542	0.137
N° 19	0.115	0.145	0.167	0.194	0.215	0.294	0.345	0.398	0.489	0.573	0.698	0.809	0.940	1.148	1.075	0.209
N° 20	0.098	0.117	0.134	0.148	0.165	0.227	0.272	0.294	0.365	0.409	0.480	0.557	0.651	0.821	0.733	0.170
N° 21	0.099	0.124	0.139	0.170	0.173	0.240	0.289	0.322	0.463	0.547	0.570	0.654	0.738	0.909	0.862	0.170
N° 22	0.097	0.121	0.142	0.167	0.193	0.254	0.311	0.353	0.435	0.506	0.600	0.702	0.813	1.015	0.949	0.208
N° 23	0.095	0.107	0.127	0.138	0.150	0.201	0.236	0.262	0.321	0.371	0.435	0.489	0.588	0.694	0.676	0.156
N° 24	0.079	0.095	0.110	0.120	0.134	0.176	0.235	0.243	0.292	0.325	0.376	0.426	0.515	0.609	0.568	0.136
N° 25	0.085	0.113	0.130	0.129	0.143	0.197	0.233	0.290	0.377	0.358	0.434	0.507	0.567	0.709	0.653	0.153
N° 26	0.102	0.129	0.150	0.177	0.179	0.263	0.307	0.357	0.457	0.536	0.623	0.718	0.844	1.074	0.992	0.190
N° 27	0.098	0.126	0.153	0.182	0.187	0.262	0.310	0.363	0.462	0.529	0.635	0.729	0.864	1.102	1.023	0.198
N° 28	0.082	0.095	0.106	0.123	0.128	0.154	0.175	0.182	0.223	0.252	0.306	0.352	0.387	0.440	0.459	0.125
N° 29	0.103	0.121	0.138	0.155	0.170	0.236	0.264	0.295	0.346	0.406	0.488	0.557	0.658	0.827	0.759	0.172
N° 30	0.081	0.094	0.108	0.117	0.133	0.181	0.215	0.238	0.267	0.350	0.378	0.461	0.539	0.584	0.513	0.137
N° 31	0.089	0.104	0.121	0.128	0.143	0.187	0.226	0.260	0.323	0.356	0.424	0.494	0.527	0.643	0.585	0.145

We can observe that few parts (part plotted in grey for example) have not the same drift as the others.

This is due to the great sensibility of the measurement:

It's difficult to reach a better repeatability than 0.04 Ohms (corresponding to 4mV with the parameter condition) with the DUT contact in the test card carrier.