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EVALUATION OF STM POWER MOSFET: ^{60}Co TID TEST RESULTS ON PART TYPE STRH40P10FSY3 (P-CHANNEL 100V 40A)

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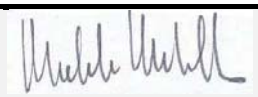
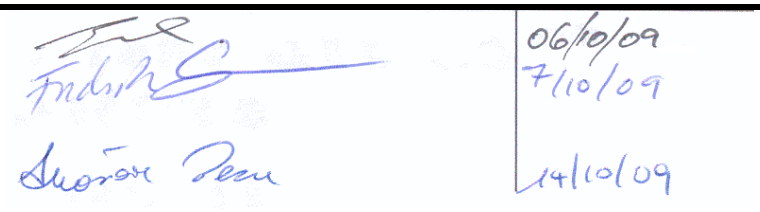
APPROVAL

author *auteur*	Michele Muschitiello TEC-QEC		date *date*	2 October 2009

approved by *approuvé by*	Nat Carthew		06/10/09 7/10/09 14/10/09
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Test Report Number	**ESA_QEC RA0554**
Project	European Component Initiative - phase I Critical Components
SCC Component no.	***n/a***
Component Designation	STRH40P10FSY3
Irradiation Spec. no.	ESA/SCC 22900
Family	P-Channel Power MOSFET
Group	Silicon
Package	TO3
Component Specification	STRH40P10FSY3, Issue 1, Rev. b - 04/05/2009
Test House Name	ESA / ESTEC
Irradiation Test Plan Number	***TEC_QEC_FS_HP0J_01rev D***
Manufacturer name	STM
Application type of Acceptance	n/a
Date Code (diffusion lot)	Diffusion Lot nr.3905672
Serial Number of samples	001, 002, 003, 004, 005, 006, 007, 008, 009, 010, 011, 012, 013, 014, 015, 016, 017, 018, 019, [034 reference device]
Irradiation Measurement schedule: Bias conditions: Circuit Reference: Temp ^{o}C: Duration:	0, 5, 12, 20, 30, 50, 70, 100, 150, 200 krad(Si) Total Dose ***BC1*** - s/n's 013, 014, 015, 016, 017: V_{DS} = 0V, V_{GS} = -15V ***BC2*** - s/n's 008, 009, 010, 011, 012: V_{DS} = -80V, V_{GS} = 0V ***BC3*** - s/n's 001, 002, 003, 004, 005: V_{DS} = 0V, V_{GS} = 0V ***BC4*** - s/n's 006, 007: V_{DS} = -100V, V_{GS} = +20V ***BC5*** - s/n's 018, 019: V_{DS} = 0V, V_{GS} = -12V Fig.1 Room temperature 20 ± 5 420 hours
Electrical Measurement Parameters:	I_{GSS_F1}, I_{GSS_R1} I_{DSS} @ Vds 5V, Vgs 0V, I_{DSS} @ Vds 80V, Vgs 0V , I_{DSS} @ Vds 100V, Vgs 0V V_{GS_th} @ Id 0.01 mA, V_{GS_th} @ Id 0.10 mA, V_{GS_th} @ Id 0.25 mA, V_{GS_th} @ Id 1.00 mA $V_{(BR)DSS}$ @Id=100uA, $V_{(BR)DSS}$ @Id=250uA, $V_{(BR)DSS}$ @Id=1mA R_{DS}(on) – Drain Source On-Resistance V_{SD} - Inverse Diode Fwd. Volt. V_{DS}(on) – Drain Source On-Voltage, $I_{D(on)}$ - On-State Drain Current. Gate Charge Qg, Qgs, Qgd
Facility Source: Energy: Dose Rate: Absorbing Material: Thickness: Temperature ^{o}C:	ESA/ESTEC ^{60}Co (gamma) 1.173 MeV 1.332 MeV 5.9 rad(Si)/min N/A N/A 20 ± 3

Dosimetry / Calibration method.	Calibrated NE2571, 0.6cc air ionisation chamber s/n 3112 Calibrated Farmer 2670 dosimeter s/n 109.
Annealing / Ageing	7 hours at Room Temperature 22 hours at Room Temperature 161 hours at Room Temperature 168 hours at 100 °C
Biasing conditions	***BC1*** - s/n's 013, 014, 015, 016, 017: V_{DS} = 0V, V_{GS} = -15V ***BC2*** - s/n's 008, 009, 010, 011, 012: V_{DS} = -80V, V_{GS} = 0V ***BC3*** - s/n's 001, 002, 003, 004, 005: V_{DS} = 0V, V_{GS} = 0V ***BC4*** - s/n's 006, 007: V_{DS} = -100V, V_{GS} = +20V ***BC5*** - s/n's 018, 019: V_{DS} = 0V, V_{GS} = -12V
Bias Circuit Reference	Fig.1

1 INTRODUCTION

The following document contains the conditions and the results of the total dose test campaign for the evaluation of the radiation tolerance of the discrete P-Channel PowerMOS, based on type STRH40P10FSY3, manufactured by STM.
This test was conducted on prototypes from diffusion lot n.r 3905672, packaged in TO3, provided by the manufacturer.

2 APPLICABLE DOCUMENTS

AD 1. ESA-ESTEC QEC document: TEST PLAN FOR TID EVALUATION STM POWER MOSFETS (draft status), rev.D 31.07.2009.
AD 2. ESA/SCC 22900 “Total Dose Steady-State Irradiation Test Method”, issue 3.
AD 3. Qualification program of N. And P. channel Rad-Hard Power Mosfets, STMictrolectronics RNS/PB/0907101ce Rev.03, March 12th 2009
AD 4. Detail specification (draft status), STRH40P10FSY3 issue 1 rev.B
AD 5. ESCC Generic Specification 5000, Issue 5 July 2009

3 TEST DESCRIPTION

Thirty five devices, POWER MOSFET based on type STRH40P10FSY3, manufactured by STM have been received for TID testing at the ESTEC ^{60}Co facility. All the devices have been serialised and electrically tested (go/no go). All the devices were accepted for TID test.

According to the Evaluation Test Plan [AD 1], nineteen devices have been irradiated. Table 1 summarise the information on test sample.

Table 1 received samples and their usage.

S/n's	Description
001-005	Unbiased during ^{60}Co irradiation (Bias Condition **BC3**)
006-007	Biased during ^{60}Co irradiation (V_{DS} = -100V, V_{GS} = +20V, Bias Condition **BC4**)
008-012	Biased during ^{60}Co irradiation (V_{DS} = - 80V, V_{GS} = 0V, Bias Condition **BC2**)
013-017	Biased during ^{60}Co irradiation (V_{DS} = 0V, V_{GS} = -15V, Bias Condition **BC1**)
018-019	Biased during ^{60}Co irradiation (V_{DS} = 0V, V_{GS} = -12V, Bias Condition **BC5**)
34	Reference device (not irradiated) - Electrically tested before and after each intermediate measurement run at irradiation step completion
35	Used for Gate Charge Measurement Set-up (not Irradiated).
020-033	Passed initial go/no go electrical measurements. Not Irradiated

Refer to TID Evaluation test plan [AD 1] for more details on test conditions.

4 RADIATION TEST PLAN

The actual radiation test steps are reported in Table 2.

Table 2 Irradiation Test Plan

Step	Total Dose (Si) krad	Dose Rate (Si)rad/min
(Pre irradiation) 0	==	==
Irradiation step # 1	5.0	5.73
Irradiation step # 2	12.6	5.76
Irradiation step # 3	20.4	5.78
Irradiation step # 4	30.0	5.80
Irradiation step # 5	52.8	5.77
Irradiation step # 6	70.0	5.78
Irradiation step # 7	112.6	6.08
Irradiation step # 8	137.3	6.05

At the completion of each irradiation step, intermediate electrical measurements were carried out according to the next paragraph. Fig.1 shows the bias circuits used during the irradiation.

At the end of the final irradiation run, all devices were electrically measured and annealed at room temperature (for 190 hours in total) and subsequently aged at 100°C (168 hrs), maintaining the same bias conditions applied during the TID test.
Table 3 reports the annealing/ageing sequence detail.

Table 3 Anneal/ageing sequence

Step	Temperature	Duration
Anneal	Room temperature	7 hours
Anneal	Room temperature	22 hours
Anneal	Room temperature	161 hours
Ageing	100 °C	168 hours

At the completion of each anneal/ageing step, all devices were electrically tested.

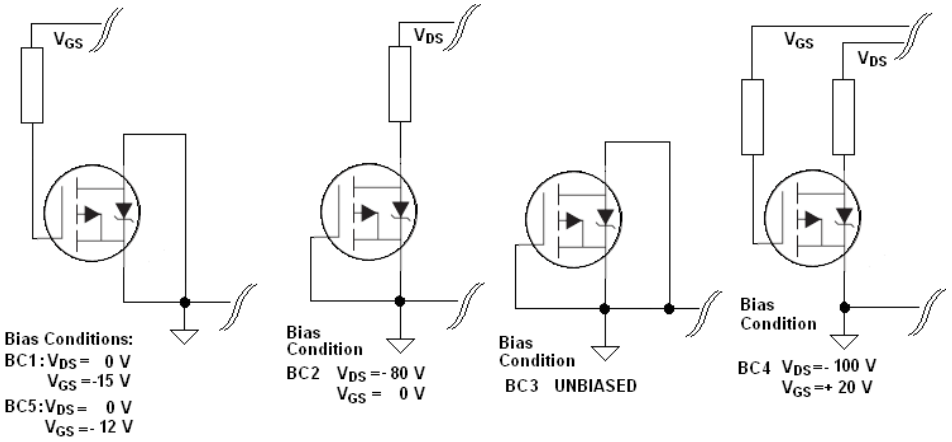


Fig.1 Radiation Test Biasing circuits.

4.1 Measurement set-up

No In-situ measurements were performed during irradiation. The measured parameters, the test conditions and the adopted Min-Max limits (pass/fail criteria) are listed in Table 4.

Table 4 Measured Parameters, Min-Max Limits and Test conditions

nr.	Parameter	Note	Limits		Unit	Mil-Std-750 test method	Test conditions
			Min.	Max.			
0	IGSS_F1	Gate Leakage Current (fwd)		100	nA	3411	V_{GS} = +12V
1	IGSS_R1	Gate Leakage Current (rev.)		100	nA	3411	V_{GS} = -12V
(b) 2	IDSS @ Vds 5V, Vgs 0V	Drain Current (off state)		10	µA	3413	V_{DS} = 5V V_{GS} = 0V
3	IDSS @ Vds 80V, Vgs 0V			10	µA	3413	V_{DS} = 80V V_{GS} = 0V
4	IDSS @ Vds 100V, Vgs 0V			10	µA	3413	V_{DS} = 100V V_{GS} = 0V
(b) 5	VGS_th @ I_D 0.01 mA	Gate threshold voltage	2000	4500	mV	3403	V_{DS} = V_{GS} I_D = 0.01mA
(a,b) 6	*VGS_th @ I_D 0.10 mA*		*2000*	*4500*	*mV*	3403	V_{DS} = V_{GS} I_D = 0.1mA
(a,b) 7	*VGS_th @ I_D 0.25 mA*		*2000*	*4500*	*mV*	3403	V_{DS} = V_{GS} I_D = 0.25mA
8	VGS_th @ I_D 1.00 mA		2000	4500	mV	3403	V_{DS} = V_{GS} I_D = 1mA
(b) 9	V(BR)DSS @I_D=100uA	V_{DS} Breakdown	100		V	3407	V_{GS} = 0V I_{DS} = 100uA
(b) 10	V(BR)DSS @I_D=250uA		100		V	3407	V_{GS} = 0V I_{DS} = 250uA
(b) 11	V(BR)DSS @I_D=1mA		100		V	3407	V_{GS} = 0V I_{DS} = 1mA
(c) 12	RDS(on) - D-S On-Resistance	Drain-Source On resistance		0.075	Ohm	3421	*V_{GS} = 10V* *I_{DS} = 20A*
13	VSD - Inverse Diode Fwd. Volt.	Fwd voltage inverse diode		1500	mV	4011	I_{SD} = 40A V_{GS} = 0V
(b) 14	VDS(on) - D-S On-Voltage	Drain-Source On voltage		2400	mV	3405	V_{GS} = 10V I_{DS} = 32A
(b) 15	ID(on) - On-State Drain Current	Drain-Source max On current	40		A	3413	V_{GS} = 10V V_{DS} = 10V
16	Q_G Total Gate Charge	Gate Charge switch-on characteristics	132	198	nC	3471	I_G = 1mA, V_{GS} = 12 V V_{DS}= 50V, I_{DS} = 20A
*(d)*17	Q_{GS} Gate – Source Charge		n.d.	n.d.	nC	3471	
*(d)*18	Q_{GD} Gate – Drain Charge		n.d.	n.d.	nC	3471	

(a) During the test campaign, a bug in the ATE software, affecting the measurement results for these parameters, was found.
(b) Parameter not listed in table 2.4.1. of Detail specification (draft status), STRH40P10FSY3 issue 1 rev.B.
(c) Test Conditions deviate from table 2.4.1. of (Detail specification (draft status), STRH40P10FSY3 issue 1 rev.B.) due to test equipment limitation.
(d) Min-Max limits not defined in table 2.4.1. of Detail specification (draft status), STRH40P10FSY3 issue 1 rev.B.

Parameters from nr.0 to nr.15 have been measured by using Unimet M3000 Automatic Test Equipment.

Parameters from nr.16 to nr.18 (Gate Charge) have been measured according to the test set-up schematized in Figure 2. More details are reported in paragraph 4.4.2 *GATE CHARGE WAVEFORMS*.

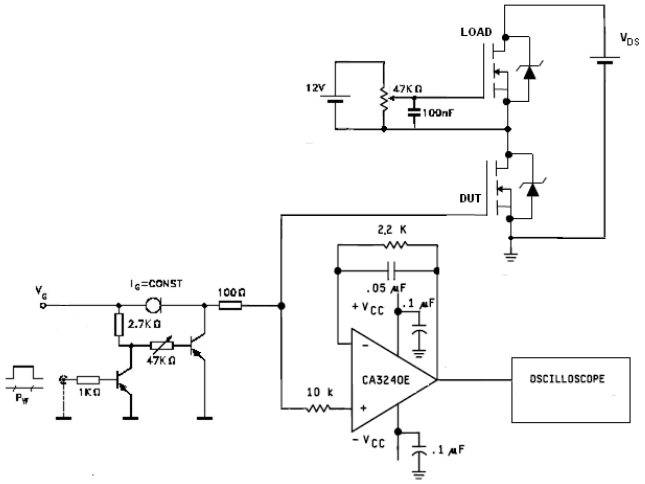


Figure 2 Gate Charge measurement circuit.

4.2 Thermal conditions

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

4.3 Dosimetry

Calibrated NE2571, 0.6cc air ionisation s/n 3112 chamber, read by calibrated Farmer 2670 s/n 109 dosimeter was used to measure the Total Ionising Dose.

4.4 Test Results

All measurement results are reported from Table 5 to Table 23. Test ended with a registered Total Dose of 137.3 krad(Si). At the end of the last irradiation step, electrical measurements were performed and the devices were tested again after 7, 22 and 161 hours annealing at room temperature. During the entire annealing, the irradiated devices were biased employing the same test board.
After the annealing, the samples went through accelerated ageing for 168 hrs at 100°C under the same bias conditions.

Following the accelerated ageing test, full parametric measurements were performed.

Electrical Measurement uncertainty values, reported in table footnotes, were estimated by observing the variations in the reference device (s/n 34) parameters, during the entire test campaign. Uncertainty has been calculated by using [1] below, with a coverage factor of 3.

[1] $$u = \frac{s}{\sqrt{n}},$$

u = estimated overall uncertainty
s = standard deviation
n= number of observations

Significant data from tables have been plotted from Figure 3 to Figure 21. Data, taken during and after the annealing/ageing sequence, have been plotted on the same graph with a gap between the TID X axis scale and the annealing/ageing time scale (arbitrarily set).

Details on the extracted gate charge parameters are reported in paragraph 4.4.2 *GATE CHARGE WAVEFORMS*.

During test campaign, an odd behaviour of the parameter Gate Voltage Threshold in two different test conditions: *VGS_th @ I_D 0.10 mA* and *VGS_th @ I_D 0.25 mA*, has been observed (refer to data in Table 11, Figure 9 and Table 12, Figure 10).

In particular, the measured data were not consistent with the behaviour of the same Gate Voltage Threshold, *VGS_th,* taken at different values of the I_D current (0.01 and 1.00mA.).

After a deep investigation, a bug in the ATE software, affecting the measurement results by an incorrect biasing setting time, was found. The affected parameters were not taken into the account in the evaluation conclusion.

4.4.1 Electrical Measurement Data

Table 5 – I_{GSS_F1} Gate Leakage Current (fwd) [nA] vs ^{60}Co Irradiation Total Dose [rad (Si)]

STRH40P10FSY3	Min.	Max.	Unit
Applicable limits:		100.0	[nA]

Detailed results - Measurement data in [nA]

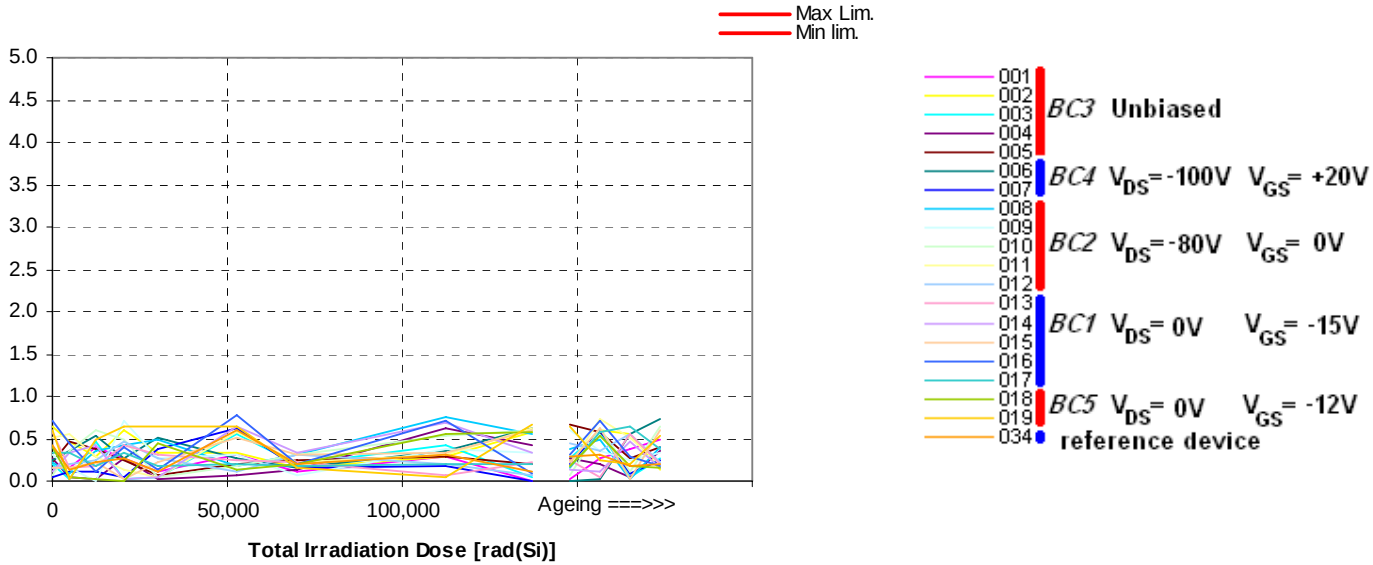
s/n	0	5002	12568	20379	30013	52776	70000	112578	137309	Annealing 7hrs RT	Annealing 22hrs RT	Annealing 161hrs RT	Ageing 168hrs 100'C	Applied Bias Condition
001	0.157	0.147	0.403	0.260	0.103	0.320	0.117	0.289	0.005	0.024	0.256	0.369	0.483	(V_{DS} 0V, V_{GS} 0V)
002	0.634	0.468	0.288	0.589	0.326	0.331	0.145	0.292	0.583	0.237	0.600	0.560	0.126	(V_{DS} 0V, V_{GS} 0V)
003	0.201	0.033	0.476	0.030	0.048	0.554	0.200	0.429	0.048	0.263	0.585	0.034	0.273	(V_{DS} 0V, V_{GS} 0V)
004	0.269	0.041	0.015	0.275	0.032	0.069	0.123	0.622	0.417	0.273	0.210	0.047	0.349	(V_{DS} 0V, V_{GS} 0V)
005	0.226	0.462	0.388	0.238	0.076	0.195	0.243	0.291	0.206	0.661	0.582	0.267	0.407	(V_{DS} 0V, V_{GS} 0V)
006	0.237	0.347	0.540	0.257	0.505	0.274	0.149	0.349	0.616	0.008	0.026	0.556	0.725	(V_{DS} -100V, V_{GS} +20V)
007	0.049	0.119	0.110	0.041	0.384	0.623	0.164	0.179	0.005	0.208	0.601	0.084	0.247	(V_{DS} -100V, V_{GS} +20V)
008	0.227	0.086	0.362	0.415	0.500	0.187	0.302	0.754	0.550	0.367	0.493	0.019	0.407	(V_{DS} -80V, V_{GS} 0V)
009	0.304	0.154	0.007	0.714	0.277	0.311	0.072	0.387	0.338	0.593	0.352	0.244	0.331	(V_{DS} -80V, V_{GS} 0V)
010	0.066	0.366	0.602	0.490	0.053	0.187	0.322	0.528	0.594	0.057	0.630	0.115	0.637	(V_{DS} -80V, V_{GS} 0V)
011	0.514	0.560	0.294	0.139	0.046	0.579	0.213	0.302	0.625	0.188	0.741	0.521	0.190	(V_{DS} -80V, V_{GS} 0V)
012	0.153	0.189	0.246	0.468	0.261	0.112	0.303	0.191	0.074	0.452	0.354	0.551	0.224	(V_{DS} -80V, V_{GS} 0V)
013	0.570	0.148	0.178	0.420	0.303	0.237	0.226	0.056	0.231	0.237	0.034	0.561	0.189	(V_{DS} 0V, V_{GS} -15V)
014	0.120	0.326	0.417	0.020	0.038	0.645	0.338	0.685	0.340	0.130	0.113	0.466	0.155	(V_{DS} 0V, V_{GS} -15V)
015	0.166	0.151	0.224	0.032	0.232	0.503	0.305	0.326	0.594	0.228	0.623	0.016	0.598	(V_{DS} 0V, V_{GS} -15V)
016	0.708	0.447	0.119	0.407	0.144	0.780	0.208	0.716	0.079	0.320	0.703	0.281	0.171	(V_{DS} 0V, V_{GS} -15V)
017	0.327	0.331	0.167	0.339	0.176	0.203	0.174	0.208	0.204	0.161	0.575	0.654	0.376	(V_{DS} 0V, V_{GS} -15V)
018	0.406	0.036	0.033	0.011	0.439	0.137	0.206	0.566	0.570	0.184	0.543	0.184	0.161	(V_{DS} 0V, V_{GS} -12V)
019	0.603	0.029	0.478	0.644	0.648	0.634	0.161	0.050	0.656	0.638	0.238	0.197	0.528	(V_{DS} 0V, V_{GS} -12V)
034	0.425	0.126	0.223	0.276	0.115	0.590	0.192	0.303	0.105	0.297	0.310	0.176	0.201	**Reference device**

Reference device **Mean value:** **0.257** **Estimated uncertainty:** **± 43.99 % (± 0.113 nA)**

Red values: greater than max limit
Dark red Values: lower than min limits

STRH40P10FSY3	Min.	Max.	Unit
Applicable limits:		100.0	[nA]

I_{GSS_F1} Gate Leakage Current (fwd) [nA] vs ^{60}Co Irradiation Total Dose [rad (Si)]



Data from irradiated devices

Figure 3

Table 6 – I_{GSS_R1} Gate Leakage Current (rev) [nA] vs ^{60}Co Irradiation Total Dose [rad (Si)]

STRH40P10FSY3	*Min.*	*Max.*	*Unit*
Applicable limits:		100.0	[nA]

Detailed results - Measurement data in [nA]

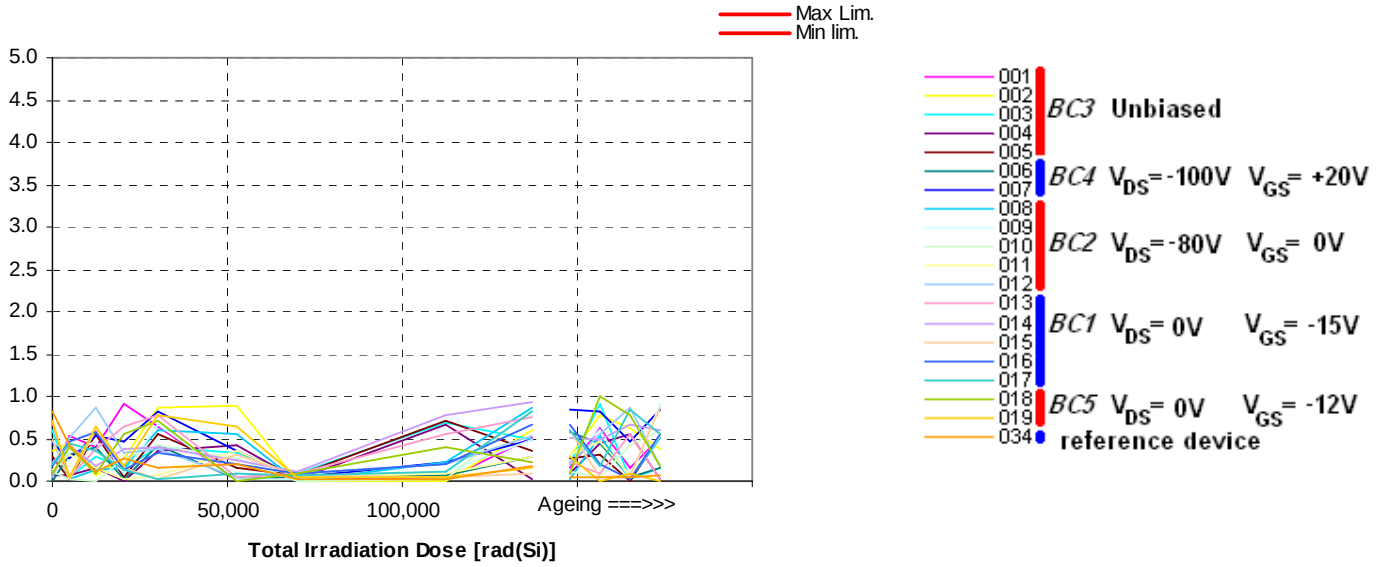
s/n	0	5002	12568	20379	30013	52776	70000	112578	137309	Annealing 7hrs RT	Annealing 22hrs RT	Annealing 161hrs RT	Ageing 168hrs 100'C	Applied Bias Condition
001	0.042	0.531	0.410	0.916	0.638	0.028	0.039	0.032	0.516	0.166	0.629	0.152	0.508	(V_{DS} 0V, V_{GS} 0V)
002	0.349	0.437	0.067	0.260	0.865	0.879	0.001	0.008	0.603	0.294	0.767	0.631	0.386	(V_{DS} 0V, V_{GS} 0V)
003	0.595	0.039	0.298	0.149	0.390	0.331	0.088	0.696	0.478	0.191	0.918	0.032	0.159	(V_{DS} 0V, V_{GS} 0V)
004	0.062	0.076	0.166	0.001	0.359	0.432	0.032	0.677	0.016	0.087	0.439	0.556	0.026	(V_{DS} 0V, V_{GS} 0V)
005	0.287	0.028	0.549	0.035	0.554	0.162	0.061	0.707	0.356	0.272	0.312	0.005	0.539	(V_{DS} 0V, V_{GS} 0V)
006	0.004	0.301	0.394	0.021	0.412	0.032	0.051	0.072	0.292	0.579	0.436	0.034	0.166	(V_{DS} -100V, V_{GS} +20V)
007	0.437	0.270	0.528	0.468	0.815	0.349	0.053	0.220	0.498	0.843	0.813	0.461	0.845	(V_{DS} -100V, V_{GS} +20V)
008	0.493	0.024	0.138	0.152	0.593	0.555	0.005	0.231	0.861	0.020	0.535	0.012	0.522	(V_{DS} -80V, V_{GS} 0V)
009	0.206	0.341	0.456	0.092	0.663	0.028	0.024	0.120	0.485	0.291	0.610	0.020	0.921	(V_{DS} -80V, V_{GS} 0V)
010	0.101	0.025	0.001	0.270	0.425	0.265	0.005	0.022	0.855	0.102	0.041	0.431	0.598	(V_{DS} -80V, V_{GS} 0V)
011	0.141	0.301	0.151	0.014	0.070	0.346	0.034	0.099	0.279	0.303	0.456	0.063	0.528	(V_{DS} -80V, V_{GS} 0V)
012	0.053	0.516	0.857	0.326	0.384	0.039	0.086	0.198	0.541	0.200	0.552	0.873	0.171	(V_{DS} -80V, V_{GS} 0V)
013	0.688	0.038	0.369	0.640	0.769	0.038	0.082	0.554	0.747	0.229	0.088	0.556	0.031	(V_{DS} 0V, V_{GS} -15V)
014	0.219	0.415	0.177	0.384	0.394	0.255	0.104	0.788	0.927	0.520	0.481	0.661	0.598	(V_{DS} 0V, V_{GS} -15V)
015	0.488	0.014	0.597	0.151	0.026	0.301	0.056	0.037	0.097	0.605	0.050	0.059	0.857	(V_{DS} 0V, V_{GS} -15V)
016	0.186	0.465	0.580	0.139	0.338	0.195	0.089	0.209	0.660	0.667	0.210	0.019	0.561	(V_{DS} 0V, V_{GS} -15V)
017	0.192	0.453	0.351	0.135	0.015	0.082	0.061	0.120	0.823	0.591	0.182	0.846	0.558	(V_{DS} 0V, V_{GS} -15V)
018	0.086	0.397	0.084	0.558	0.715	0.007	0.078	0.397	0.221	0.086	0.995	0.769	0.184	(V_{DS} 0V, V_{GS} -12V)
019	0.718	0.038	0.639	0.170	0.775	0.648	0.043	0.034	0.152	0.297	0.006	0.085	0.011	(V_{DS} 0V, V_{GS} -12V)
034	0.816	0.422	0.103	0.256	0.162	0.204	0.021	0.027	0.168	0.048	0.035	0.055	0.065	Reference device

Reference device **Mean value:** 0.183 **Estimated uncertainty:** ± 100.96 % (± 0.185 nA)

Red values: greater than max limit
Dark red Values: lower than min limits

STRH40P10FSY3	Min.	Max.	Unit
Applicable limits:		100.0	[nA]

I_{GSS_R1} Gate Leakage Current (rev) [nA] vs ^{60}Co Irradiation Total Dose [rad (Si)]



Data from irradiated devices

Figure 4

Table 7 – I_{DSS} @ V_{DS} 5V, V_{GS} 0V, Drain Current (off state) [nA] vs ^{60}Co Irradiation Total Dose [rad (Si)]

STRH40P10FSY3	Min.	Max.	Unit
Applicable limits:		10'000	[nA]

Detailed results - Measurement data in [nA]

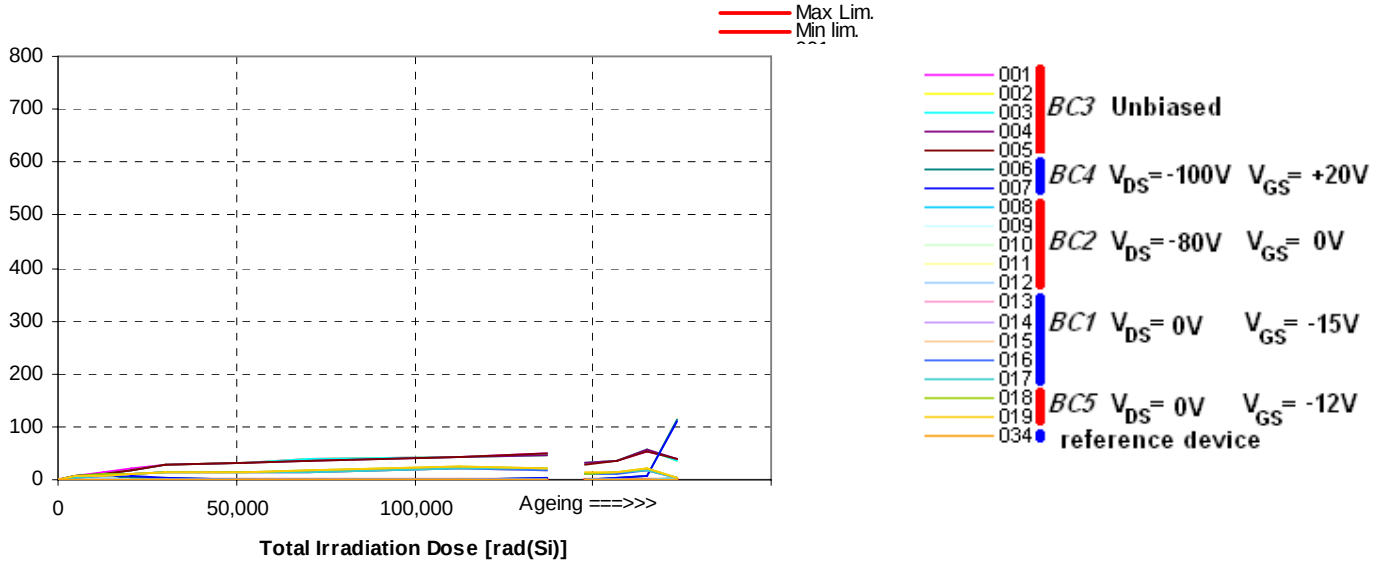
s/n	0	5002	12568	20379	30013	52776	70000	112578	137309	Annealing 7hrs RT	Annealing 22hrs RT	Annealing 161hrs RT	Ageing 168hrs 100'C	Applied Bias Condition
001	0.821	7.019	13.176	21.420	29.087	32.531	37.624	42.357	50.105	33.459	35.372	54.193	39.157	(V_{DS} 0V, V_{GS} 0V)
002	0.101	5.924	11.872	18.594	27.904	31.915	38.271	43.362	47.995	31.232	34.983	55.205	36.330	(V_{DS} 0V, V_{GS} 0V)
003	0.003	6.175	12.187	19.401	28.867	31.544	37.384	41.439	47.837	32.242	35.513	56.327	35.066	(V_{DS} 0V, V_{GS} 0V)
004	0.043	6.036	11.335	18.551	29.043	30.327	37.256	43.576	47.050	31.136	35.522	55.526	38.472	(V_{DS} 0V, V_{GS} 0V)
005	0.143	5.995	11.361	18.266	27.829	31.634	36.406	44.086	50.065	30.208	34.616	54.419	37.920	(V_{DS} 0V, V_{GS} 0V)
006	0.054	6.295	7.836	5.005	3.169	1.423	1.489	1.696	2.546	1.655	2.075	7.986	112.150	(V_{DS} -100V, V_{GS} +20V)
007	0.024	6.608	8.118	5.652	3.251	1.586	1.427	1.737	2.659	1.694	2.229	8.661	109.100	(V_{DS} -100V, V_{GS} +20V)
008	0.009	3.822	3.515	1.489	0.850	0.744	0.846	1.311	1.161	0.817	0.742	0.964	2.636	(V_{DS} -80V, V_{GS} 0V)
009	0.050	3.634	2.936	1.365	0.779	0.816	0.946	1.279	1.239	0.865	0.654	0.953	0.160	(V_{DS} -80V, V_{GS} 0V)
010	0.163	3.636	3.139	1.442	0.977	0.829	0.934	1.373	1.216	0.877	0.863	0.822	0.244	(V_{DS} -80V, V_{GS} 0V)
011	0.109	4.154	2.999	1.452	0.997	0.911	0.957	1.305	1.283	0.754	0.733	0.844	0.359	(V_{DS} -80V, V_{GS} 0V)
012	0.143	3.879	2.788	1.220	0.811	0.880	0.796	1.273	1.088	0.847	0.674	0.812	0.277	(V_{DS} -80V, V_{GS} 0V)
013	0.084	4.586	8.030	11.519	13.904	14.462	14.880	21.043	18.899	11.399	13.188	19.455	3.147	(V_{DS} 0V, V_{GS} -15V)
014	0.062	4.368	8.112	11.352	14.157	13.846	14.721	21.568	18.945	11.252	13.084	19.354	3.324	(V_{DS} 0V, V_{GS} -15V)
015	0.025	4.370	7.865	11.394	14.148	14.239	14.851	21.677	18.659	11.640	12.850	19.484	3.053	(V_{DS} 0V, V_{GS} -15V)
016	0.108	4.261	7.983	11.265	14.406	13.794	14.822	21.299	18.589	11.606	12.316	19.008	2.906	(V_{DS} 0V, V_{GS} -15V)
017	0.165	4.518	7.850	11.976	14.829	14.202	15.351	21.995	19.996	11.117	13.252	18.500	3.086	(V_{DS} 0V, V_{GS} -15V)
018	0.120	5.907	9.225	11.627	15.424	14.982	16.619	24.349	21.847	12.386	13.914	20.317	2.955	(V_{DS} 0V, V_{GS} -12V)
019	0.081	5.701	8.585	11.905	15.495	14.699	17.072	24.955	21.963	13.060	14.454	20.630	2.724	(V_{DS} 0V, V_{GS} -12V)
034	0.025	0.073	0.071	0.151	0.016	0.178	0.118	0.063	0.157	0.122	0.101	0.045	0.053	Reference device

Reference device **Mean value:** 0.090 **Estimated uncertainty:** ± 48.01 % (± 0.043 nA)

Red values: greater than max limit
Dark red Values: lower than min limits

STRH40P10FSY3	Min.	Max.	Unit
Applicable limits:		10'000	[nA]

I_{DSS} @ V_{DS} 5V, V_{GS} 0V, Drain Current (off state) [nA] vs ^{60}Co Irradiation Total Dose [rad (Si)]



Data from irradiated devices

Figure 5

Table 8 – I_{DSS} @ V_{DS} 80V, V_{GS} 0V, Drain Current (off state) [nA] vs ^{60}Co Irradiation Total Dose [rad (Si)]

STRH40P10FSY3	Min.	Max.	Unit
Applicable limits:		10'000	[nA]

Detailed results - Measurement data in [nA]

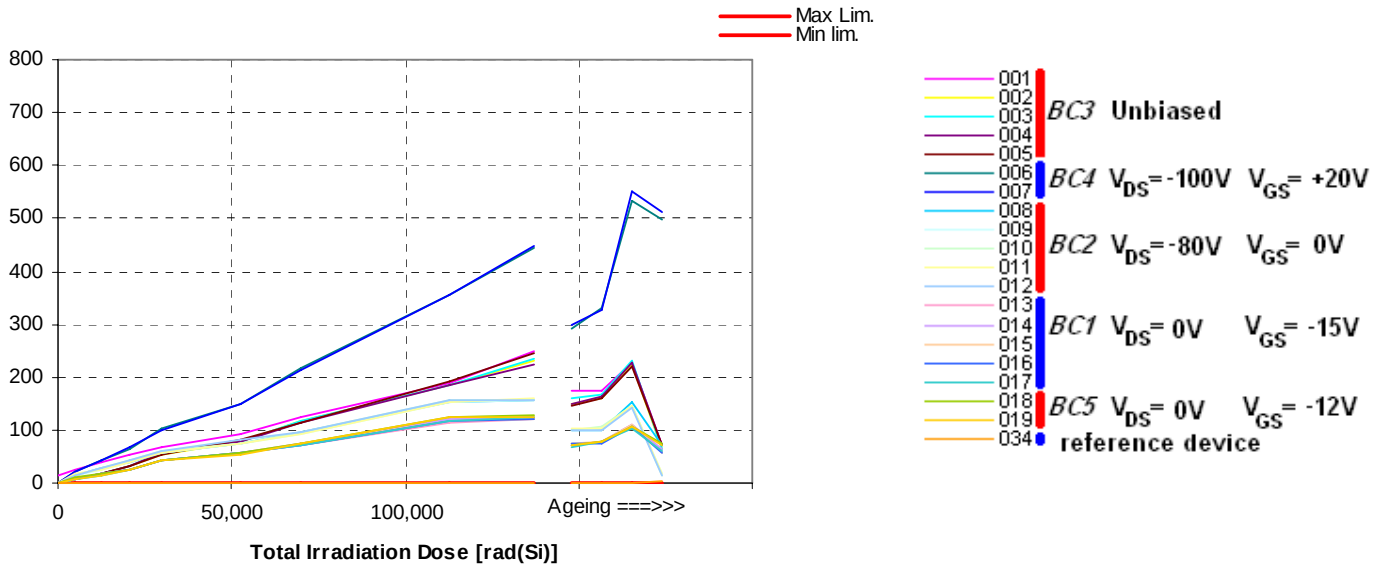
s/n	0	5002	12568	20379	30013	52776	70000	112578	137309	Annealing 7hrs RT	Annealing 22hrs RT	Annealing 161hrs RT	Ageing 168hrs 100'C	Applied Bias Condition
001	14.78	23.93	39.51	51.74	66.70	93.21	124.45	190.03	249.50	174.43	174.83	227.54	72.58	(V_{DS} 0V, V_{GS} 0V)
002	1.49	8.22	18.15	30.73	52.76	79.26	116.64	185.59	230.04	150.94	160.64	223.04	65.42	(V_{DS} 0V, V_{GS} 0V)
003	1.18	7.87	18.99	32.38	55.18	79.51	116.01	185.81	235.16	158.73	166.89	231.18	62.27	(V_{DS} 0V, V_{GS} 0V)
004	1.01	8.05	17.54	30.25	55.66	76.57	114.47	185.63	225.30	150.06	163.24	227.04	70.82	(V_{DS} 0V, V_{GS} 0V)
005	1.77	8.82	17.90	30.77	53.14	80.32	113.03	190.88	244.37	146.96	160.52	222.07	69.70	(V_{DS} 0V, V_{GS} 0V)
006	1.43	22.53	41.30	63.97	101.55	150.07	215.22	356.15	445.06	292.79	329.11	532.19	498.63	(V_{DS} -100V, V_{GS} +20V)
007	1.29	23.01	42.34	67.43	100.93	149.45	215.02	356.59	446.44	297.19	326.64	550.96	512.55	(V_{DS} -100V, V_{GS} +20V)
008	0.91	14.72	27.70	40.64	57.29	75.65	95.00	152.50	156.92	100.56	101.11	152.33	70.27	(V_{DS} -80V, V_{GS} 0V)
009	0.95	14.35	26.26	41.16	55.70	73.37	93.56	152.54	157.60	98.06	102.84	145.54	16.49	(V_{DS} -80V, V_{GS} 0V)
010	1.74	14.92	28.33	42.53	59.90	76.16	94.88	157.02	157.25	99.74	105.60	146.19	15.84	(V_{DS} -80V, V_{GS} 0V)
011	1.16	17.11	25.65	38.49	57.82	75.98	93.91	153.10	161.23	102.24	102.75	147.12	16.29	(V_{DS} -80V, V_{GS} 0V)
012	1.53	15.94	27.95	41.81	60.18	82.17	95.38	157.45	157.23	101.33	100.74	143.42	14.44	(V_{DS} -80V, V_{GS} 0V)
013	1.53	8.08	16.11	25.88	40.93	57.79	72.32	114.92	120.20	71.47	78.38	108.88	61.64	(V_{DS} 0V, V_{GS} -15V)
014	1.31	7.95	16.26	25.38	41.56	56.14	73.11	119.61	123.72	71.58	79.04	109.48	63.89	(V_{DS} 0V, V_{GS} -15V)
015	1.00	8.57	16.04	25.07	41.88	57.31	73.03	118.88	119.78	73.21	76.81	108.87	58.10	(V_{DS} 0V, V_{GS} -15V)
016	1.36	8.16	16.14	24.50	41.88	55.52	72.24	116.15	119.66	73.44	74.42	105.85	55.46	(V_{DS} 0V, V_{GS} -15V)
017	1.75	8.60	15.20	26.09	42.31	55.65	72.88	117.20	125.71	68.49	77.68	102.75	61.82	(V_{DS} 0V, V_{GS} -15V)
018	1.15	9.65	16.57	25.21	43.62	55.76	74.47	123.99	126.71	71.01	77.17	108.44	76.30	(V_{DS} 0V, V_{GS} -12V)
019	1.17	8.81	15.33	24.84	42.63	54.83	74.63	124.44	125.10	72.88	77.34	107.07	72.53	(V_{DS} 0V, V_{GS} -12V)
034	1.22	0.37	0.31	1.57	0.58	1.17	0.63	1.66	1.68	0.95	1.62	0.73	1.86	Reference device

Reference device **Mean value:** 1.105 **Estimated uncertainty:** ± 40.86 % (± 0.452 nA)

Red values: greater than max limit
Dark red Values: lower than min limits

STRH40P10FSY3	Min.	Max.	Unit
Applicable limits:		10'000	[nA]

I_{DSS} @ V_{DS} 80V, V_{GS} 0V, Drain Current (off state) [nA] vs ^{60}Co Irradiation Total Dose [rad (Si)]



Data from irradiated devices

Figure 6

Table 9 – I_{DSS} @ V_{DS} 100V, V_{GS} 0V, Drain Current (off state) [nA] vs ^{60}Co Irradiation Total Dose [rad (Si)]

STRH40P10FSY3	*Min.*	*Max.*	*Unit*
Applicable limits:		10'000	[nA]

Detailed results - Measurement data in [nA]

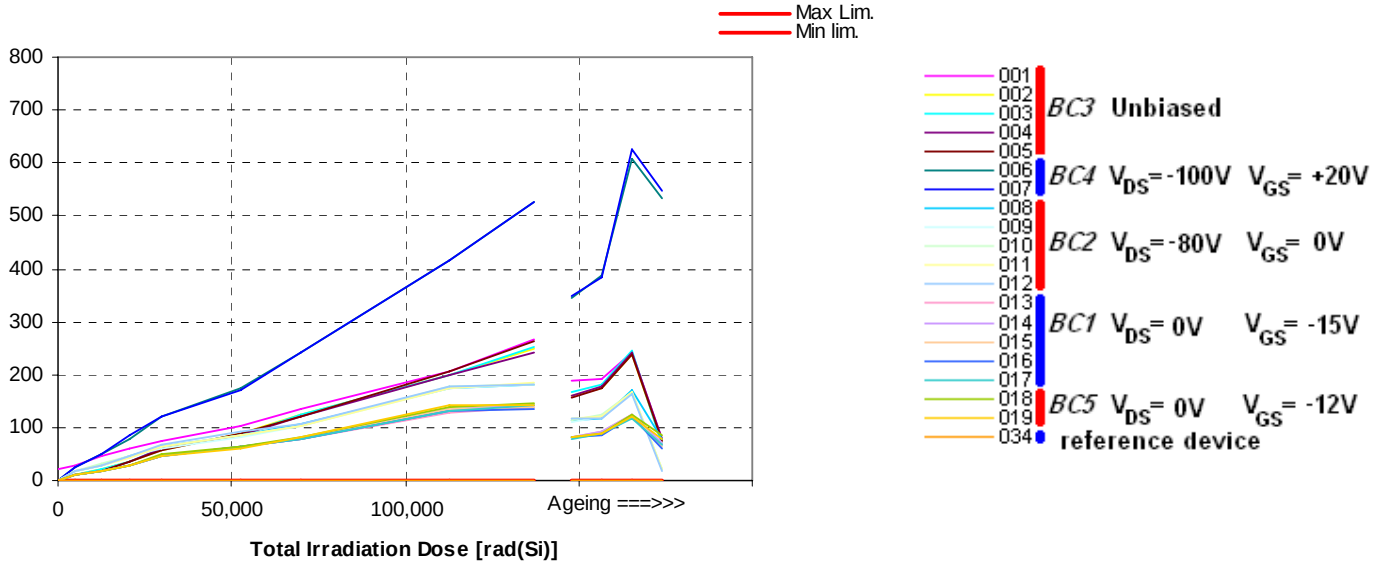
s/n	0	5002	12568	20379	30013	52776	70000	112578	137309	Annealing 7hrs RT	Annealing 22hrs RT	Annealing 161hrs RT	Ageing 168hrs 100'C	Applied Bias Condition
001	20.01	29.21	45.52	60.92	74.98	103.85	134.16	206.07	267.86	188.81	190.48	243.24	79.30	(V_{DS} 0V, V_{GS} 0V)
002	0.68	10.24	20.37	34.63	58.41	87.12	123.70	200.01	247.71	160.95	173.49	237.78	70.97	(V_{DS} 0V, V_{GS} 0V)
003	0.61	10.05	20.68	36.10	60.60	86.91	123.24	200.17	252.13	168.79	180.09	246.23	67.64	(V_{DS} 0V, V_{GS} 0V)
004	0.76	10.11	19.22	34.22	60.33	84.04	121.69	199.95	242.14	160.22	176.12	241.81	76.94	(V_{DS} 0V, V_{GS} 0V)
005	0.78	10.36	19.35	34.42	58.34	87.64	120.42	205.85	262.37	156.87	173.46	237.48	75.56	(V_{DS} 0V, V_{GS} 0V)
006	0.56	25.44	48.05	77.18	119.61	172.75	242.89	416.21	527.94	344.12	386.52	606.49	533.52	(V_{DS} -100V, V_{GS} +20V)
007	0.44	26.13	50.69	83.84	121.48	171.81	241.73	415.26	527.72	348.55	382.35	625.47	547.08	(V_{DS} -100V, V_{GS} +20V)
008	1.06	17.10	29.98	46.21	63.73	85.14	105.11	172.89	181.39	114.94	117.98	172.36	77.71	(V_{DS} -80V, V_{GS} 0V)
009	0.65	16.79	28.36	45.69	62.13	82.72	103.72	172.96	182.36	111.96	119.83	164.68	20.25	(V_{DS} -80V, V_{GS} 0V)
010	0.57	17.38	30.26	47.79	65.12	85.93	104.67	177.89	182.35	113.81	122.90	166.21	20.06	(V_{DS} -80V, V_{GS} 0V)
011	0.99	18.85	28.32	44.08	64.19	85.42	103.96	173.51	186.26	116.48	119.70	166.84	20.07	(V_{DS} -80V, V_{GS} 0V)
012	0.63	18.53	30.00	46.79	66.15	92.52	105.70	178.48	181.70	115.98	117.61	162.40	17.90	(V_{DS} -80V, V_{GS} 0V)
013	0.38	10.30	17.74	30.01	45.74	65.09	78.91	129.53	138.36	81.28	90.99	123.22	68.01	(V_{DS} 0V, V_{GS} -15V)
014	0.84	10.00	17.62	29.39	46.76	63.25	79.43	134.80	141.08	80.77	91.38	123.89	69.84	(V_{DS} 0V, V_{GS} -15V)
015	0.72	10.00	17.63	28.95	46.46	64.62	79.39	134.12	137.74	83.12	89.34	123.30	64.47	(V_{DS} 0V, V_{GS} -15V)
016	0.70	10.02	17.92	28.68	46.46	62.75	78.87	131.17	136.89	82.62	85.87	119.97	61.02	(V_{DS} 0V, V_{GS} -15V)
017	0.62	10.33	17.35	30.03	47.16	62.48	79.60	132.45	143.91	77.93	90.44	116.26	68.03	(V_{DS} 0V, V_{GS} -15V)
018	1.35	12.07	18.60	29.18	48.33	63.28	81.27	139.98	145.85	80.42	89.94	123.60	84.56	(V_{DS} 0V, V_{GS} -12V)
019	0.80	10.74	17.25	28.94	47.53	61.52	81.55	140.51	143.67	82.90	90.32	121.97	79.51	(V_{DS} 0V, V_{GS} -12V)
034	0.42	0.90	0.64	0.65	0.84	0.93	0.59	0.41	0.56	0.58	0.66	0.65	0.76	Reference device

Reference device **Mean value:** 0.660 **Estimated uncertainty:** ± 20.34 % (± 0.134 nA)

Red values: greater than max limit
Dark red Values: lower than min limits

STRH40P10FSY3	Min.	Max.	Unit
Applicable limits:		10'000	[nA]

I_{DSS} @ V_{DS} 100V, V_{GS} 0V, Drain Current (off state) [nA] vs ^{60}Co Irradiation Total Dose [rad (Si)]



Data from irradiated devices

Figure 7

Table 10 – V_{GS_th} @ I_{DS} 0.01 mA, Gate Threshold Voltage [mV] vs ^{60}Co Irradiation Total Dose [rad (Si)]

STRH40P10FSY3	*Min.*	*Max.*	*Unit*
Applicable limits:	2'000	4'500	[mV]

Detailed results - Measurement data in [mV]

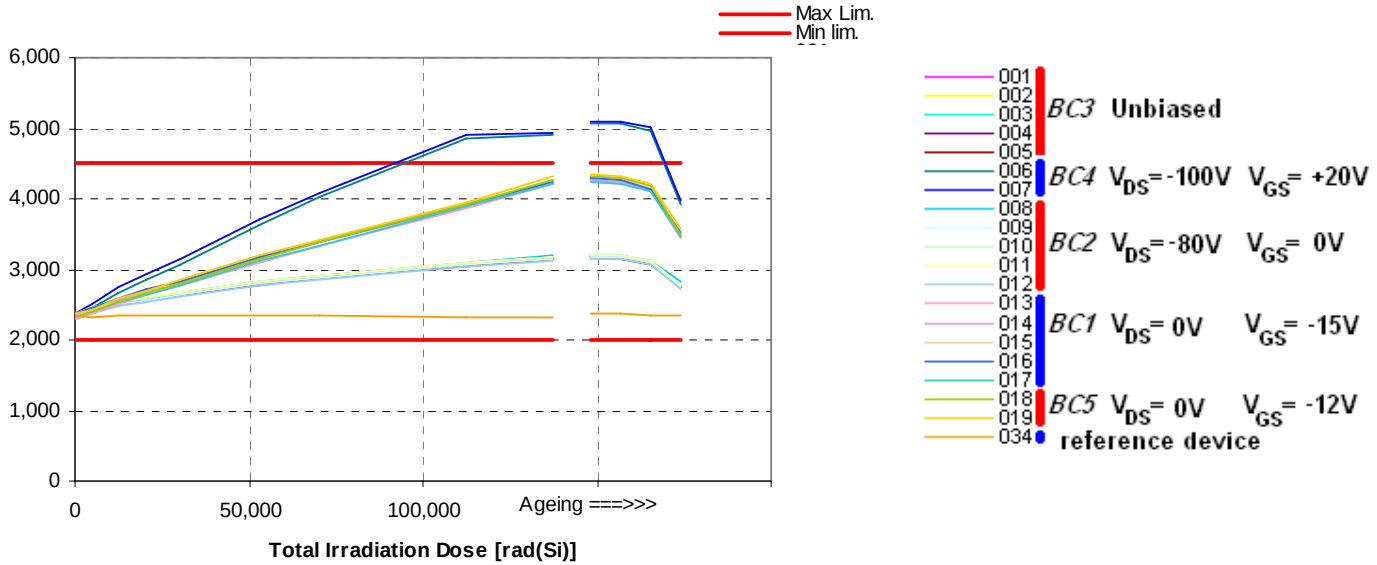
s/n	0	5002	12568	20379	30013	52776	70000	112578	137309	Annealing 7hrs RT	Annealing 22hrs RT	Annealing 161hrs RT	Ageing 168hrs 100'C	Applied Bias Condition
001	2,371.5	2,433.5	2,524.3	2,585.4	2,647.3	2,805.2	2,894.1	3,078.1	3,164.1	3,176.5	3,169.6	3,100.3	2,740.5	(V_{DS} 0V, V_{GS} 0V)
002	2,359.3	2,428.9	2,515.8	2,581.3	2,639.6	2,794.0	2,879.8	3,056.4	3,155.3	3,172.8	3,153.6	3,090.8	2,755.3	(V_{DS} 0V, V_{GS} 0V)
003	2,383.1	2,442.1	2,528.4	2,596.9	2,662.3	2,816.9	2,902.4	3,091.1	3,178.9	3,200.9	3,193.0	3,108.9	2,760.6	(V_{DS} 0V, V_{GS} 0V)
004	2,360.9	2,426.5	2,515.8	2,574.8	2,630.3	2,794.1	2,872.4	3,054.6	3,150.2	3,164.8	3,158.5	3,083.1	2,759.7	(V_{DS} 0V, V_{GS} 0V)
005	2,352.6	2,414.4	2,508.8	2,572.9	2,628.4	2,781.8	2,871.5	3,042.4	3,139.2	3,164.9	3,156.8	3,078.3	2,756.3	(V_{DS} 0V, V_{GS} 0V)
006	2,296.3	2,440.3	2,653.9	2,857.3	3,079.4	3,631.1	4,013.6	**4,851.0**	**4,907.3**	**5,065.9**	**5,058.8**	**4,961.6**	3,929.3	(V_{DS} -100V, V_{GS} +20V)
007	2,373.1	2,516.0	2,738.3	2,923.1	3,153.9	3,710.8	4,090.3	**4,917.1**	**4,925.1**	**5,096.9**	**5,099.3**	**5,009.3**	3,974.4	(V_{DS} -100V, V_{GS} +20V)
008	2,369.9	2,440.8	2,529.1	2,598.2	2,664.8	2,822.6	2,907.1	3,092.3	3,189.2	3,207.7	3,196.1	3,123.7	2,824.1	(V_{DS} -80V, V_{GS} 0V)
009	2,341.5	2,415.7	2,507.9	2,560.8	2,641.3	2,798.3	2,883.6	3,054.4	3,156.1	3,174.0	3,161.1	3,091.1	2,752.3	(V_{DS} -80V, V_{GS} 0V)
010	2,378.6	2,441.6	2,534.1	2,597.5	2,668.3	2,830.6	2,907.4	3,087.1	3,186.6	3,211.2	3,199.9	3,122.3	2,772.8	(V_{DS} -80V, V_{GS} 0V)
011	2,371.4	2,429.4	2,537.3	2,602.6	2,664.8	2,830.1	2,913.2	3,085.3	3,183.6	3,208.8	3,190.8	3,120.5	2,771.6	(V_{DS} -80V, V_{GS} 0V)
012	2,304.6	2,372.0	2,471.0	2,532.3	2,609.7	2,760.8	2,853.6	3,035.1	3,132.4	3,154.6	3,142.9	3,074.5	2,707.2	(V_{DS} -80V, V_{GS} 0V)
013	2,302.8	2,381.0	2,513.8	2,629.2	2,761.7	3,096.1	3,338.4	3,878.3	4,205.2	4,234.1	4,218.8	4,108.6	3,433.9	(V_{DS} 0V, V_{GS} -15V)
014	2,357.7	2,446.3	2,569.4	2,686.2	2,808.9	3,142.9	3,376.9	3,903.8	4,226.1	4,258.8	4,235.3	4,122.4	3,471.0	(V_{DS} 0V, V_{GS} -15V)
015	2,367.1	2,450.3	2,578.2	2,697.8	2,827.8	3,152.7	3,402.6	3,918.7	4,256.5	4,283.0	4,271.7	4,163.1	3,482.5	(V_{DS} 0V, V_{GS} -15V)
016	2,382.2	2,457.9	2,596.6	2,707.7	2,825.4	3,167.2	3,396.2	3,921.6	4,247.4	4,282.5	4,258.6	4,146.4	3,511.6	(V_{DS} 0V, V_{GS} -15V)
017	2,321.4	2,401.1	2,534.9	2,648.3	2,775.5	3,109.4	3,345.7	3,883.5	4,210.2	4,242.6	4,218.7	4,119.1	3,464.8	(V_{DS} 0V, V_{GS} -15V)
018	2,316.6	2,395.9	2,533.7	2,658.3	2,790.1	3,134.9	3,389.5	3,925.8	4,260.8	4,306.9	4,285.0	4,181.3	3,498.5	(V_{DS} 0V, V_{GS} -12V)
019	2,362.4	2,438.0	2,584.2	2,697.9	2,840.2	3,188.1	3,419.8	3,959.3	4,307.6	4,345.8	4,330.0	4,219.0	3,582.1	(V_{DS} 0V, V_{GS} -12V)
034	2,357.2	2,330.3	2,352.9	2,348.4	2,334.6	2,355.9	2,335.4	2,323.2	2,328.9	2,373.3	2,360.9	2,334.4	2,347.7	Reference device

Reference device **Mean value:** 2,344.9 **Estimated uncertainty:** ± 0.53 % (± 12.428 mV)

Red values: greater than max limit
Dark red Values: lower than min limits

STRH40P10FSY3	*Min.*	*Max.*	*Unit*
Applicable limits:	2'000	4'500	[mV]

V_{GS_th} @ I_{DS} 0.01 mA, Gate Threshold Voltage [mV] vs ^{60}Co Irradiation Total Dose [rad (Si)]



Data from irradiated devices

Figure 8

Table 11 – V_{GS_th} @ I_{DS} 0.10 mA, Gate Threshold Voltage [mV] vs ^{60}Co Irradiation Total Dose [rad (Si)]

STRH40P10FSY3	*Min.*	*Max.*	*Unit*
Applicable limits:	2'000	4'500	[mV]

Detailed results - Measurement data in [mV]

s/n	0	5002	12568	20379	30013	52776	70000	112578	137309	Annealing 7hrs RT	Annealing 22hrs RT	Annealing 161hrs RT	Ageing 168hrs 100'C	Applied Bias Condition
001	1,299.5	1,280.8	1,233.7	1,194.4	1,148.1	1,067.8	1,015.8	914.3	3,396.7	3,418.3	3,399.9	911.9	1,095.3	(V_{DS} 0V, V_{GS} 0V)
002	1,303.3	1,289.8	1,242.3	1,198.2	1,155.3	1,074.4	1,016.9	923.8	3,388.0	3,401.4	3,389.2	918.1	1,102.6	(V_{DS} 0V, V_{GS} 0V)
003	1,299.8	1,282.6	1,241.7	1,194.9	1,154.4	1,064.8	1,008.9	908.4	3,417.0	3,428.1	3,410.2	909.4	1,107.8	(V_{DS} 0V, V_{GS} 0V)
004	1,301.3	1,286.6	1,242.1	1,192.9	1,144.9	1,061.8	1,012.3	923.0	3,377.9	3,392.4	3,379.4	908.2	1,091.4	(V_{DS} 0V, V_{GS} 0V)
005	1,303.1	1,279.8	1,237.4	1,193.9	1,149.7	1,066.3	1,005.9	915.4	3,369.8	3,397.3	3,372.9	906.9	1,087.3	(V_{DS} 0V, V_{GS} 0V)
006	1,304.5	1,161.6	1,034.4	903.4	774.6	628.8	596.6	572.3	5,757.7	5,741.0	5,688.7	566.4	942.4	(V_{DS} -100V, V_{GS} +20V)
007	1,303.0	1,158.9	1,033.5	909.3	773.2	631.7	602.5	574.4	5,846.1	5,821.2	5,768.9	566.4	942.8	(V_{DS} -100V, V_{GS} +20V)
008	1,307.5	1,187.6	1,024.6	842.5	683.9	563.2	547.3	554.3	3,428.1	3,442.2	3,441.6	556.6	630.6	(V_{DS} -80V, V_{GS} 0V)
009	1,312.5	1,184.0	1,030.8	853.2	693.7	567.6	553.5	557.0	3,386.7	3,405.4	3,389.9	564.7	596.0	(V_{DS} -80V, V_{GS} 0V)
010	1,309.9	1,190.4	1,027.0	852.2	692.3	566.1	555.9	560.1	3,429.4	3,445.7	3,438.5	563.6	591.4	(V_{DS} -80V, V_{GS} 0V)
011	1,306.9	1,188.8	1,034.3	859.7	690.1	570.1	552.6	553.8	3,424.5	3,441.9	3,428.5	564.9	594.8	(V_{DS} -80V, V_{GS} 0V)
012	1,308.8	1,179.5	1,026.9	852.0	695.1	575.3	558.6	555.9	3,377.5	3,393.9	3,377.9	568.6	609.9	(V_{DS} -80V, V_{GS} 0V)
013	1,297.8	1,259.3	1,170.5	1,053.9	912.8	662.6	564.9	533.1	4,424.9	4,448.6	4,420.0	531.9	627.4	(V_{DS} 0V, V_{GS} -15V)
014	1,294.3	1,262.3	1,173.9	1,062.5	929.1	662.7	570.1	532.3	4,452.5	4,471.5	4,448.3	530.5	638.8	(V_{DS} 0V, V_{GS} -15V)
015	1,315.1	1,271.5	1,187.8	1,068.3	933.6	673.1	579.5	539.1	4,475.5	4,502.4	4,478.8	539.9	647.2	(V_{DS} 0V, V_{GS} -15V)
016	1,312.4	1,272.0	1,180.0	1,070.0	929.4	672.9	577.4	539.3	4,459.7	4,488.4	4,469.9	526.8	636.7	(V_{DS} 0V, V_{GS} -15V)
017	1,301.8	1,260.3	1,176.3	1,067.3	922.9	658.1	568.1	531.3	4,422.9	4,452.8	4,432.9	525.9	618.9	(V_{DS} 0V, V_{GS} -15V)
018	1,305.8	1,261.4	1,173.1	1,050.8	910.9	647.8	565.9	538.1	4,486.0	4,519.3	4,497.3	530.3	627.1	(V_{DS} 0V, V_{GS} -12V)
019	1,303.9	1,262.3	1,174.6	1,060.4	912.1	648.1	569.2	535.6	4,523.8	4,556.1	4,542.9	524.4	625.9	(V_{DS} 0V, V_{GS} -12V)
034	1,292.8	1,292.9	1,293.4	1,292.3	1,294.7	1,300.1	1,292.8	1,297.6	2,499.6	2,532.4	2,528.6	1,306.0	1,299.9	Reference device

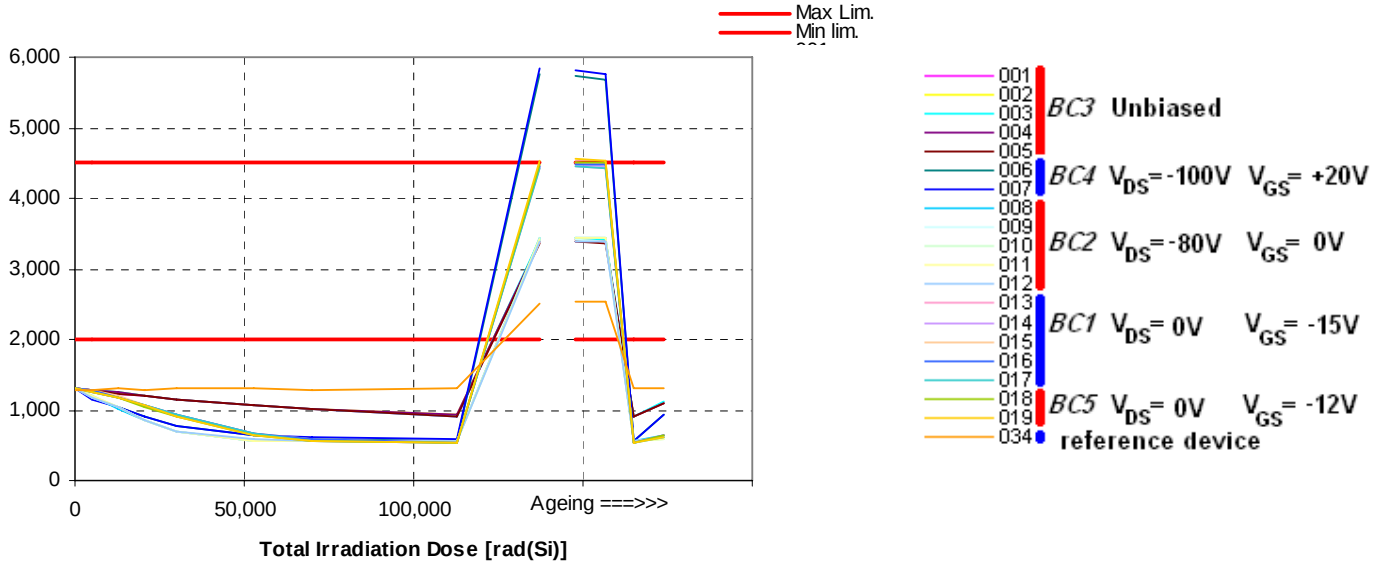
Reference device **Mean value:** 1,578.7 **Estimated uncertainty:** ± 28.29 % (± 446.611 mV)

Red values: greater than max limit
Dark red Values: lower than min limits

N.B. During the test campaign, a bug in the ATE software, affecting the measurement results for this parameter, was found. See page nr.11 for details.

STRH40P10FSY3	Min.	Max.	Unit
Applicable limits:	2'000	4'500	[mV]

V_{GS_th} @ I_{DS} 0.10 mA, Gate Threshold Voltage [mV] vs ^{60}Co Irradiation Total Dose [rad (Si)]



Data from irradiated devices

Figure 9

N.B. During the test campaign, a bug in the ATE software, affecting the measurement results for this parameter, was found. See page nr.11 for details.

Table 12 – V_{GS_th} @ I_{DS} 0.25 mA, Gate Threshold Voltage [mV] vs ^{60}Co Irradiation Total Dose [rad (Si)]

STRH40P10FSY3	*Min.*	*Max.*	*Unit*
Applicable limits:	2'000	4'500	[mV]

Detailed results - Measurement data in [mV]

s/n	0	5002	12568	20379	30013	52776	70000	112578	137309	Annealing 7hrs RT	Annealing 22hrs RT	Annealing 161hrs RT	Ageing 168hrs 100'C	Applied Bias Condition
001	2,603.0	2,661.9	2,746.9	2,802.8	2,868.8	2,982.5	3,033.1	3,051.1	3,019.2	3,040.8	3,050.3	3,038.9	2,934.3	(V_{DS} 0V, V_{GS} 0V)
002	2,587.6	2,655.9	2,739.8	2,798.6	2,859.6	2,979.3	3,033.6	3,064.1	3,035.9	3,070.5	3,067.4	3,048.9	2,945.9	(V_{DS} 0V, V_{GS} 0V)
003	2,614.8	2,670.0	2,760.4	2,817.9	2,877.1	2,997.1	3,046.3	3,051.1	3,029.2	3,055.8	3,059.0	3,046.1	2,951.4	(V_{DS} 0V, V_{GS} 0V)
004	2,583.6	2,653.9	2,742.6	2,796.2	2,853.3	2,981.9	3,022.3	3,053.3	3,025.5	3,057.4	3,059.2	3,039.6	2,942.8	(V_{DS} 0V, V_{GS} 0V)
005	2,579.3	2,638.8	2,727.2	2,793.2	2,842.5	2,963.4	3,020.1	3,038.5	3,008.2	3,047.9	3,047.6	3,036.1	2,943.1	(V_{DS} 0V, V_{GS} 0V)
006	2,526.6	2,666.4	2,848.8	2,954.3	2,798.5	2,412.6	2,173.9	**1,779.0**	**1,663.6**	**1,732.4**	**1,766.9**	**1,924.9**	3,098.5	(V_{DS} -100V, V_{GS} +20V)
007	2,608.8	2,740.1	2,926.7	2,973.4	2,804.1	2,427.4	2,186.1	**1,796.8**	**1,682.8**	**1,756.1**	**1,786.9**	**1,926.4**	3,107.7	(V_{DS} -100V, V_{GS} +20V)
008	2,607.7	2,664.8	2,755.8	2,800.4	2,737.4	2,327.6	2,096.3	**1,910.8**	**1,828.4**	**1,863.3**	**1,867.1**	**1,922.3**	2,554.9	(V_{DS} -80V, V_{GS} 0V)
009	2,568.9	2,634.4	2,721.8	2,771.0	2,742.6	2,350.2	2,121.9	**1,939.0**	**1,857.8**	**1,888.0**	**1,894.8**	**1,952.9**	2,494.3	(V_{DS} -80V, V_{GS} 0V)
010	2,605.4	2,674.3	2,755.7	2,800.9	2,750.3	2,347.3	2,127.8	**1,944.0**	**1,864.4**	**1,896.3**	**1,892.7**	**1,960.3**	2,518.9	(V_{DS} -80V, V_{GS} 0V)
011	2,600.8	2,661.4	2,756.8	2,804.5	2,746.9	2,339.9	2,123.3	**1,931.6**	**1,850.7**	**1,883.5**	**1,881.8**	**1,942.7**	2,515.4	(V_{DS} -80V, V_{GS} 0V)
012	2,529.3	2,603.4	2,687.9	2,737.8	2,723.2	2,356.3	2,146.3	**1,967.6**	**1,888.1**	**1,918.0**	**1,924.4**	**1,982.3**	2,544.0	(V_{DS} -80V, V_{GS} 0V)
013	2,528.6	2,615.1	2,741.9	2,846.3	2,965.4	2,704.2	2,386.8	**1,791.2**	**1,502.8**	**1,496.9**	**1,504.1**	**1,600.5**	2,534.5	(V_{DS} 0V, V_{GS} -15V)
014	2,591.9	2,668.1	2,793.8	2,902.9	3,005.2	2,725.8	2,413.3	**1,824.3**	**1,535.2**	**1,524.0**	**1,536.0**	**1,638.9**	2,578.5	(V_{DS} 0V, V_{GS} -15V)
015	2,597.2	2,678.8	2,804.3	2,912.6	3,019.1	2,757.1	2,442.5	**1,844.1**	**1,550.0**	**1,534.4**	**1,544.5**	**1,656.0**	2,628.6	(V_{DS} 0V, V_{GS} -15V)
016	2,619.3	2,691.2	2,813.3	2,925.8	3,026.8	2,756.4	2,441.4	**1,841.1**	**1,549.1**	**1,537.9**	**1,543.1**	**1,655.4**	2,590.6	(V_{DS} 0V, V_{GS} -15V)
017	2,554.5	2,630.3	2,755.9	2,854.9	2,972.2	2,726.1	2,401.5	**1,805.0**	**1,513.4**	**1,506.6**	**1,507.4**	**1,615.3**	2,536.3	(V_{DS} 0V, V_{GS} -15V)
018	2,540.6	2,618.1	2,752.1	2,868.3	2,982.7	2,701.5	2,379.6	**1,774.9**	**1,511.4**	**1,508.8**	**1,513.3**	**1,607.6**	2,538.3	(V_{DS} 0V, V_{GS} -12V)
019	2,592.6	2,672.9	2,809.7	2,915.2	3,022.6	2,707.7	2,377.4	**1,780.0**	**1,512.8**	**1,501.8**	**1,506.4**	**1,602.8**	2,523.3	(V_{DS} 0V, V_{GS} -12V)
034	2,582.4	2,566.8	2,592.4	2,578.0	2,567.4	2,585.1	2,574.4	2,559.4	2,565.9	2,597.6	2,588.9	2,565.9	2,574.3	Reference device

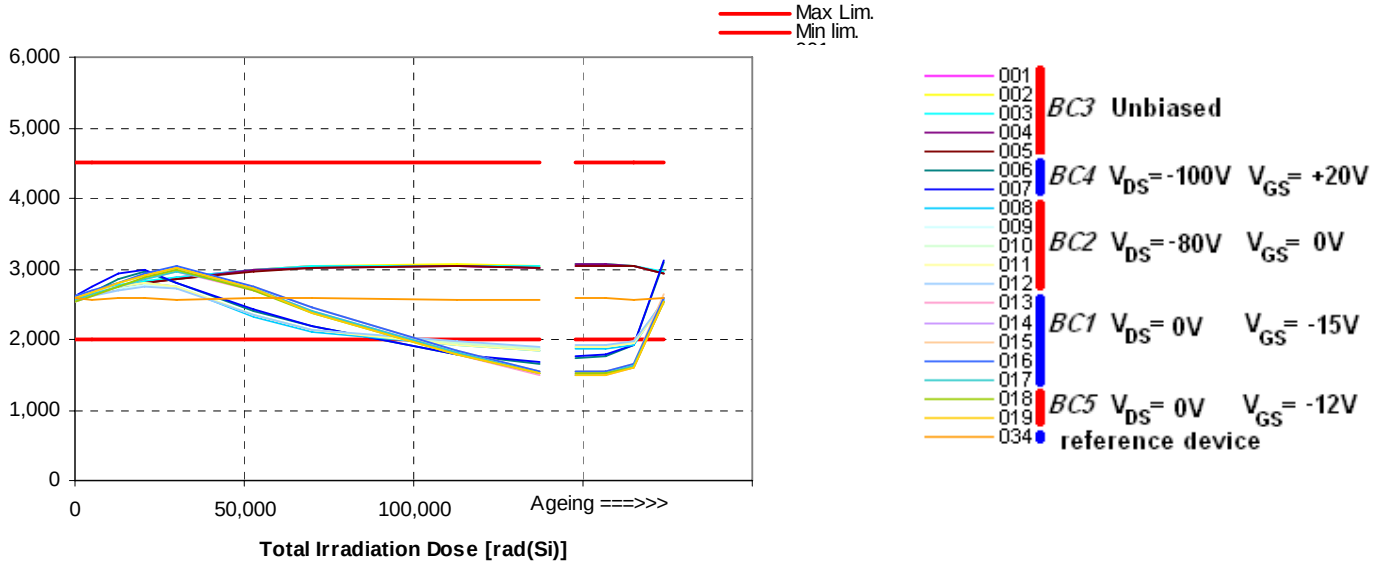
Reference device **Mean value:** 2,576.8 **Estimated uncertainty:** ± 0.38 % (± 9.792 mV)

Red values: greater than max limit
Dark red Values: lower than min limits

N.B. During the test campaign, a bug in the ATE software, affecting the measurement results for this parameter, was found. See page nr.11 for details.

STRH40P10FSY3	Min.	Max.	Unit
Applicable limits:	2'000	4'500	[mV]

V_{GS_th} @ I_{DS} 0.25 mA, Gate Threshold Voltage [mV] vs ^{60}Co Irradiation Total Dose [rad (Si)]



Data from irradiated devices

Figure 10

N.B. During the test campaign, a bug in the ATE software, affecting the measurement results for this parameter, was found. See page nr.11 for details.

Table 13 – V_{GS_th} @ I_{DS} 1.0 mA, Gate Threshold Voltage [mV] vs ^{60}Co Irradiation Total Dose [rad (Si)]

STRH40P10FSY3	*Min.*	*Max.*	*Unit*
Applicable limits:	2'000	4'500	[mV]

Detailed results - Measurement data in [mV]

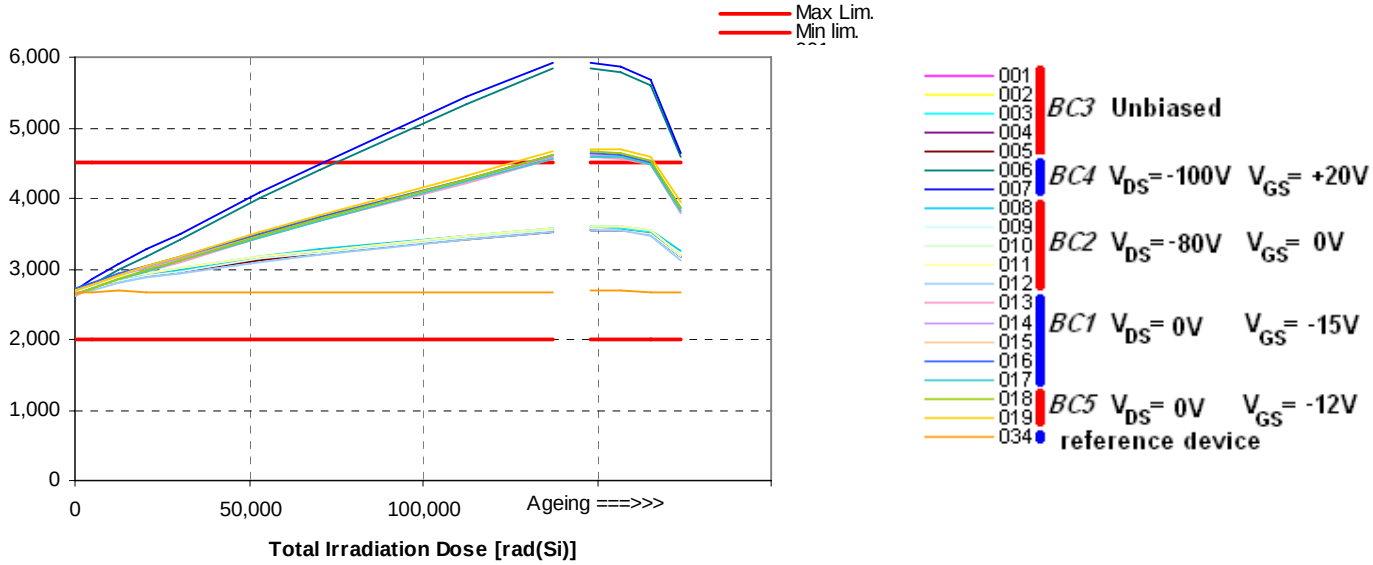
s/n	0	5002	12568	20379	30013	52776	70000	112578	137309	Annealing 7hrs RT	Annealing 22hrs RT	Annealing 161hrs RT	Ageing 168hrs 100'C	Applied Bias Condition
001	2,696.2	2,761.9	2,857.3	2,912.8	2,985.8	3,147.4	3,240.8	3,453.8	3,551.3	3,572.5	3,564.4	3,510.1	3,165.3	(V_{DS} 0V, V_{GS} 0V)
002	2,688.2	2,753.6	2,840.3	2,914.8	2,977.3	3,141.3	3,227.6	3,432.3	3,545.4	3,566.6	3,549.1	3,494.6	3,170.4	(V_{DS} 0V, V_{GS} 0V)
003	2,710.1	2,775.9	2,867.8	2,934.1	3,003.8	3,163.5	3,256.4	3,473.0	3,573.1	3,593.1	3,586.3	3,523.9	3,172.6	(V_{DS} 0V, V_{GS} 0V)
004	2,686.8	2,751.4	2,841.2	2,906.5	2,971.9	3,139.2	3,221.1	3,431.4	3,531.9	3,549.3	3,543.3	3,483.6	3,171.3	(V_{DS} 0V, V_{GS} 0V)
005	2,676.6	2,740.7	2,832.1	2,897.0	2,964.7	3,125.6	3,219.3	3,421.6	3,529.9	3,550.8	3,537.5	3,487.0	3,167.9	(V_{DS} 0V, V_{GS} 0V)
006	2,626.5	2,771.6	2,978.3	3,183.3	3,422.3	3,988.2	4,397.5	**5,339.8**	**5,843.6**	**5,831.6**	**5,785.1**	**5,604.1**	**4,578.0**	(V_{DS} -100V, V_{GS} +20V)
007	2,704.9	2,851.9	3,062.4	3,267.2	3,497.9	4,073.9	4,482.4	**5,431.1**	**5,928.4**	**5,917.0**	**5,870.3**	**5,686.7**	**4,645.4**	(V_{DS} -100V, V_{GS} +20V)
008	2,701.0	2,778.1	2,855.9	2,929.6	2,999.4	3,174.3	3,274.1	3,474.2	3,582.4	3,605.5	3,597.3	3,537.5	3,250.3	(V_{DS} -80V, V_{GS} 0V)
009	2,670.9	2,740.6	2,827.8	2,898.5	2,968.9	3,135.6	3,231.3	3,437.4	3,545.7	3,568.9	3,555.9	3,501.6	3,165.8	(V_{DS} -80V, V_{GS} 0V)
010	2,705.1	2,774.9	2,861.6	2,935.9	3,005.3	3,171.3	3,265.5	3,478.5	3,586.6	3,605.4	3,590.9	3,536.6	3,189.0	(V_{DS} -80V, V_{GS} 0V)
011	2,705.8	2,763.1	2,867.1	2,931.3	3,004.4	3,169.4	3,262.9	3,468.8	3,578.4	3,596.7	3,589.8	3,535.0	3,193.3	(V_{DS} -80V, V_{GS} 0V)
012	2,632.2	2,700.9	2,794.9	2,867.1	2,936.4	3,102.7	3,203.5	3,411.4	3,526.7	3,543.8	3,539.7	3,475.6	3,118.8	(V_{DS} -80V, V_{GS} 0V)
013	2,626.1	2,712.3	2,841.9	2,956.4	3,093.6	3,432.5	3,674.4	4,224.5	**4,564.4**	**4,592.5**	**4,573.3**	4,469.3	3,798.6	(V_{DS} 0V, V_{GS} -15V)
014	2,690.9	2,773.9	2,903.6	3,014.3	3,149.4	3,481.6	3,721.3	4,255.3	**4,585.3**	**4,619.2**	**4,599.1**	4,494.9	3,828.9	(V_{DS} 0V, V_{GS} -15V)
015	2,695.6	2,781.5	2,910.3	3,026.8	3,163.0	3,493.8	3,731.4	4,278.2	**4,623.9**	**4,644.9**	**4,633.5**	**4,520.8**	3,842.3	(V_{DS} 0V, V_{GS} -15V)
016	2,718.6	2,794.7	2,926.3	3,039.3	3,167.8	3,500.6	3,734.2	4,272.1	**4,609.0**	**4,630.2**	**4,616.3**	**4,514.8**	3,867.8	(V_{DS} 0V, V_{GS} -15V)
017	2,648.1	2,731.3	2,858.0	2,970.8	3,110.4	3,446.0	3,680.9	4,235.2	**4,566.6**	**4,592.6**	**4,581.9**	4,479.8	3,822.4	(V_{DS} 0V, V_{GS} -15V)
018	2,638.6	2,715.4	2,853.2	2,978.9	3,118.3	3,468.6	3,713.3	4,276.3	**4,626.3**	**4,657.9**	**4,647.3**	**4,544.1**	3,866.3	(V_{DS} 0V, V_{GS} -12V)
019	2,695.8	2,772.4	2,910.9	3,030.3	3,169.2	3,524.6	3,763.6	4,323.2	**4,670.9**	**4,702.6**	**4,691.1**	**4,587.6**	3,951.2	(V_{DS} 0V, V_{GS} -12V)
034	2,679.9	2,662.3	2,685.3	2,676.8	2,669.7	2,679.1	2,672.4	2,660.2	2,665.4	2,686.6	2,689.6	2,668.0	2,675.3	Reference device

Reference device **Mean value:** 2,674.7 **Estimated uncertainty:** ± 0.29 % (± 7.756 mV)

Red values: greater than max limit
Dark red Values: lower than min limits

STRH40P10FSY3	*Min.*	*Max.*	*Unit*
Applicable limits:	2'000	4'500	[mV]

V_{GS_th} @ I_{DS} 1.0 mA, Gate Threshold Voltage [mV] vs ^{60}Co Irradiation Total Dose [rad (Si)]



Data from irradiated devices

Figure 11

Table 14 – $V_{(BR)DSS}$ @I_{DS}=100uA – VDS Breakdown Voltage [V] vs ^{60}Co Irradiation Total Dose [rad (Si)]

STRH40P10FSY3	Min.	Max.	Unit
Applicable limits:	100		[V]

Detailed results - Measurement data in [V]

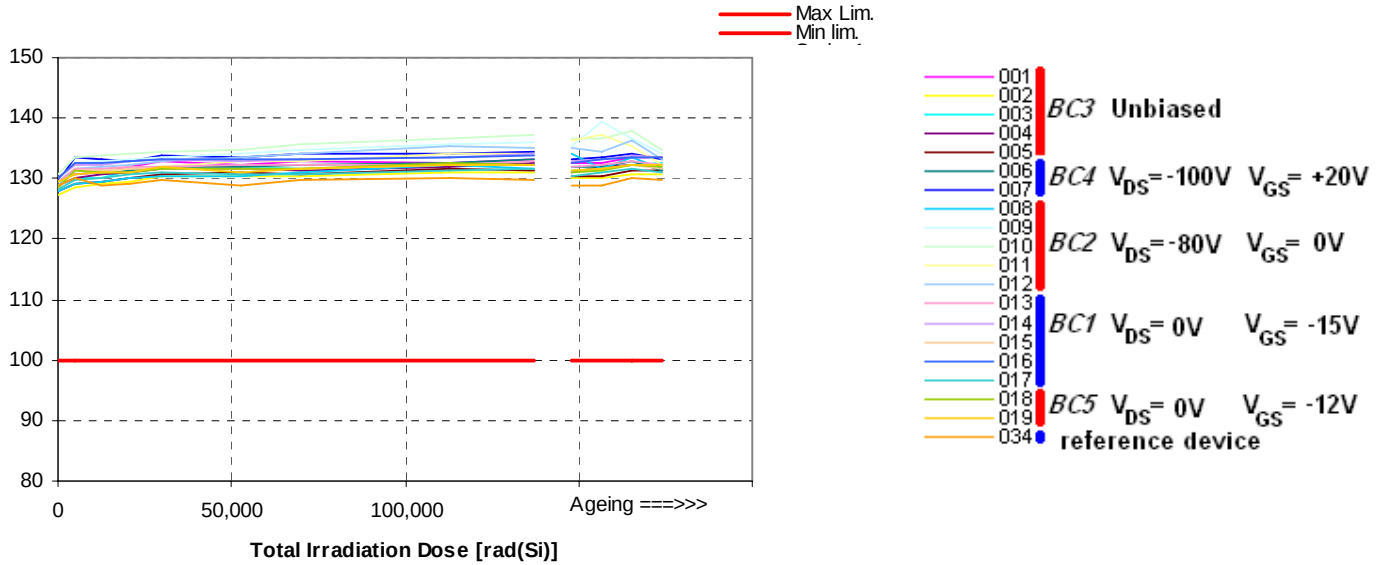
s/n	0	5002	12568	20379	30013	52776	70000	112578	137309	Annealing 7hrs RT	Annealing 22hrs RT	Annealing 161hrs RT	Ageing 168hrs 100'C	Applied Bias Condition
001	129.97	130.83	131.15	131.81	132.86	132.37	132.84	132.56	133.34	132.61	132.44	133.41	133.67	(V_{DS} 0V, V_{GS} 0V)
002	127.29	128.63	129.15	129.53	130.42	130.44	130.41	130.93	131.03	130.20	130.05	130.76	130.85	(V_{DS} 0V, V_{GS} 0V)
003	128.85	130.14	130.22	131.28	131.55	131.92	131.73	132.29	132.21	131.43	131.55	132.41	132.48	(V_{DS} 0V, V_{GS} 0V)
004	128.91	130.11	130.62	131.11	131.56	131.64	131.48	132.02	132.45	131.13	131.84	132.15	132.30	(V_{DS} 0V, V_{GS} 0V)
005	127.91	129.19	129.51	129.98	130.77	130.88	130.69	131.61	131.43	130.29	130.42	131.39	131.24	(V_{DS} 0V, V_{GS} 0V)
006	128.54	131.20	131.02	131.42	131.96	131.97	132.24	132.47	133.32	131.91	131.97	132.85	131.33	(V_{DS} -100V, V_{GS} +20V)
007	129.38	133.47	133.22	133.03	133.75	133.42	134.01	134.28	134.30	133.23	133.46	134.16	133.11	(V_{DS} -100V, V_{GS} +20V)
008	127.89	129.17	129.38	130.04	130.30	130.47	131.10	132.39	131.75	134.11	131.51	133.41	131.71	(V_{DS} -80V, V_{GS} 0V)
009	129.55	132.42	132.75	133.13	133.57	133.99	134.83	135.75	136.16	135.33	139.56	136.57	134.27	(V_{DS} -80V, V_{GS} 0V)
010	130.56	133.50	133.82	134.08	134.55	134.80	135.56	136.71	137.32	136.55	136.67	138.02	134.77	(V_{DS} -80V, V_{GS} 0V)
011	128.30	131.40	130.88	131.64	131.95	132.93	133.02	134.00	134.07	136.31	137.18	135.49	132.37	(V_{DS} -80V, V_{GS} 0V)
012	129.00	131.64	132.04	132.39	133.04	133.58	134.09	135.38	135.17	135.01	134.46	136.24	133.05	(V_{DS} -80V, V_{GS} 0V)
013	129.52	131.67	131.68	131.90	131.96	132.26	132.24	132.42	132.78	132.03	132.16	132.74	132.13	(V_{DS} 0V, V_{GS} -15V)
014	130.07	132.29	132.41	132.74	133.24	132.86	133.12	133.52	134.03	132.92	133.22	133.88	133.44	(V_{DS} 0V, V_{GS} -15V)
015	128.28	131.41	131.25	131.57	131.79	131.58	131.67	132.29	132.39	131.24	131.78	132.29	131.54	(V_{DS} 0V, V_{GS} -15V)
016	130.04	132.60	132.54	132.94	133.21	133.07	133.18	133.62	133.76	132.72	133.34	133.40	133.39	(V_{DS} 0V, V_{GS} -15V)
017	128.08	129.85	130.17	130.63	130.88	130.61	130.86	131.38	131.69	130.44	130.89	131.64	130.92	(V_{DS} 0V, V_{GS} -15V)
018	128.55	131.23	131.07	131.14	131.55	131.49	131.64	132.51	132.25	131.01	131.45	132.25	132.06	(V_{DS} 0V, V_{GS} -12V)
019	129.35	130.61	130.95	130.87	131.81	131.12	131.69	132.24	132.42	131.40	131.56	132.14	132.26	(V_{DS} 0V, V_{GS} -12V)
034	128.94	129.97	128.84	129.26	129.73	128.77	129.77	129.96	129.68	128.77	128.78	130.19	129.68	Reference device

Reference device **Mean value:** 129.4 **Estimated uncertainty:** ± 0.34 % (± 0.44 V)

Red values: greater than max limit
Dark red Values: lower than min limits

STRH40P10FSY3	Min.	Max.	Unit
Applicable limits:	100		[V]

$V_{(BR)DSS}$ @I_{DS}=100uA – VDS Breakdown Voltage [V] vs ^{60}Co Irradiation Total Dose [rad (Si)]



Data from irradiated devices

Figure 12

Table 15 – $V_{(BR)DSS}$ @I_{DS}=250uA – VDS Breakdown Voltage [V] vs ^{60}Co Irradiation Total Dose [rad (Si)]

STRH40P10FSY3	*Min.*	*Max.*	*Unit*
Applicable limits:	100		[V]

Detailed results - Measurement data in [V]

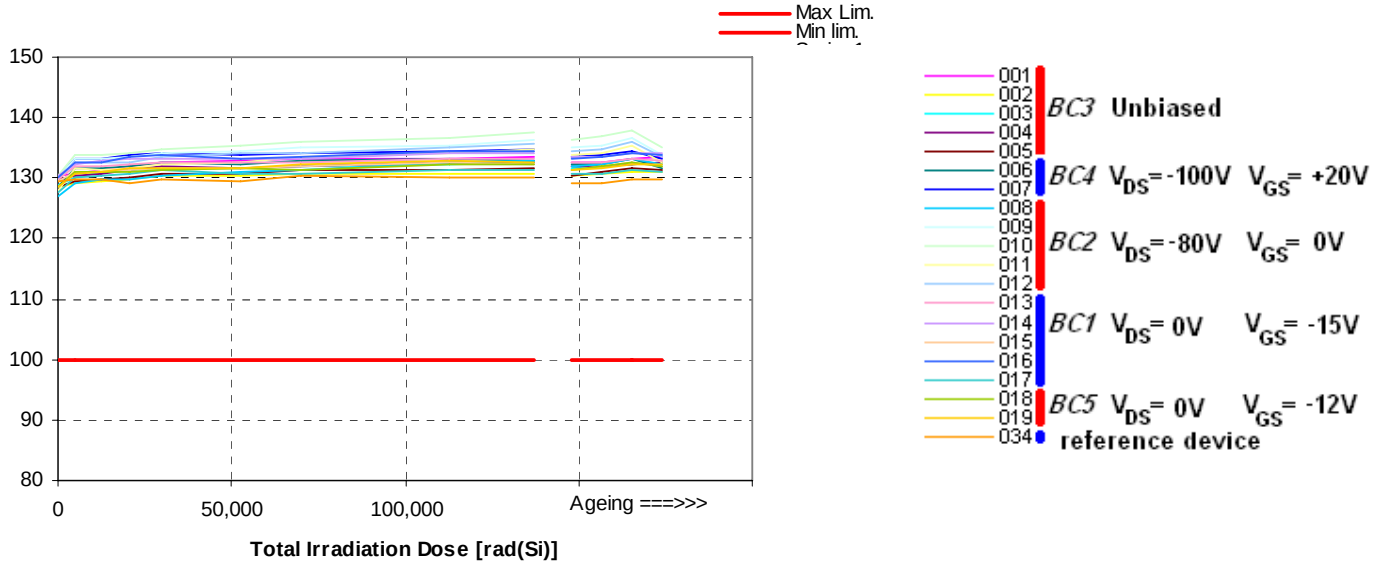
s/n	0	5002	12568	20379	30013	52776	70000	112578	137309	Annealing 7hrs RT	Annealing 22hrs RT	Annealing 161hrs RT	Ageing 168hrs 100'C	Applied Bias Condition
001	130.28	130.58	131.31	132.10	132.47	132.77	133.08	133.25	133.50	132.62	132.69	133.32	133.56	(V_{DS} 0V, V_{GS} 0V)
002	128.64	129.05	129.45	129.81	130.28	130.26	130.57	130.73	130.82	130.31	130.59	130.94	130.95	(V_{DS} 0V, V_{GS} 0V)
003	128.98	130.10	131.07	131.42	131.65	131.71	131.94	132.23	132.64	131.76	132.01	132.31	132.54	(V_{DS} 0V, V_{GS} 0V)
004	129.74	130.30	130.84	131.43	131.84	131.63	132.04	132.58	132.47	131.96	131.88	132.36	132.65	(V_{DS} 0V, V_{GS} 0V)
005	128.67	129.62	129.85	130.10	130.77	130.68	131.27	131.28	131.64	130.43	130.88	131.72	131.34	(V_{DS} 0V, V_{GS} 0V)
006	128.46	131.73	131.64	131.93	132.53	132.39	132.77	133.08	133.04	132.26	132.24	133.19	131.65	(V_{DS} -100V, V_{GS} +20V)
007	130.04	133.24	133.32	133.68	133.98	133.96	134.19	134.31	134.81	133.56	133.96	134.50	133.28	(V_{DS} -100V, V_{GS} +20V)
008	127.11	129.25	129.80	129.89	130.30	131.15	131.46	132.46	132.97	132.08	132.18	133.21	132.21	(V_{DS} -80V, V_{GS} 0V)
009	130.18	133.17	133.06	133.56	134.21	134.34	134.92	135.43	136.25	134.95	135.45	136.59	133.95	(V_{DS} -80V, V_{GS} 0V)
010	130.47	133.70	133.82	134.24	134.77	135.50	136.08	136.71	137.49	136.23	136.83	137.76	134.99	(V_{DS} -80V, V_{GS} 0V)
011	128.06	131.63	131.28	131.57	132.19	132.44	133.57	134.18	134.67	133.69	134.09	135.32	132.63	(V_{DS} -80V, V_{GS} 0V)
012	129.80	132.48	132.60	132.69	133.37	134.15	134.04	134.94	135.58	134.55	134.91	135.96	133.59	(V_{DS} -80V, V_{GS} 0V)
013	129.82	131.82	131.93	132.26	132.62	132.47	132.67	133.34	133.23	132.46	132.49	133.26	132.87	(V_{DS} 0V, V_{GS} -15V)
014	130.27	132.30	132.91	133.13	133.30	133.23	133.35	134.04	134.21	133.59	133.50	134.22	134.09	(V_{DS} 0V, V_{GS} -15V)
015	129.56	131.15	131.16	131.42	131.70	131.77	131.84	132.55	132.14	131.32	131.88	132.62	131.83	(V_{DS} 0V, V_{GS} -15V)
016	130.06	132.43	132.69	133.61	133.67	133.27	133.65	134.37	134.42	133.34	133.57	134.29	133.72	(V_{DS} 0V, V_{GS} -15V)
017	127.52	130.21	130.30	130.82	131.28	130.67	130.74	131.25	131.44	130.64	130.76	131.30	131.09	(V_{DS} 0V, V_{GS} -15V)
018	128.63	131.06	131.15	131.06	131.37	131.64	131.45	132.38	132.38	131.37	131.84	132.46	132.05	(V_{DS} 0V, V_{GS} -12V)
019	128.49	130.70	131.03	131.54	131.58	131.63	132.14	132.86	132.50	131.31	131.76	132.38	132.17	(V_{DS} 0V, V_{GS} -12V)
034	129.52	129.82	129.92	129.26	129.74	129.40	130.50	130.15	130.00	129.15	129.24	129.86	129.81	Reference device

Reference device **Mean value:** 129.7 **Estimated uncertainty:** ± 0.25 % (± 0.324 V)

Red values: greater than max limit
Dark red Values: lower than min limits

STRH40P10FSY3	Min.	Max.	Unit
Applicable limits:	100		[V]

$V_{(BR)DSS}$ @I_{DS}=250uA – VDS Breakdown Voltage [V] vs ^{60}Co Irradiation Total Dose [rad (Si)]



Data from irradiated devices

Figure 13

Table 16 – $V_{(BR)DSS}$ @I_{DS}= 1 mA – VDS Breakdown Voltage [V] vs ^{60}Co Irradiation Total Dose [rad (Si)]

STRH40P10FSY3	*Min.*	*Max.*	*Unit*
Applicable limits:	100		[V]

Detailed results - Measurement data in [V]

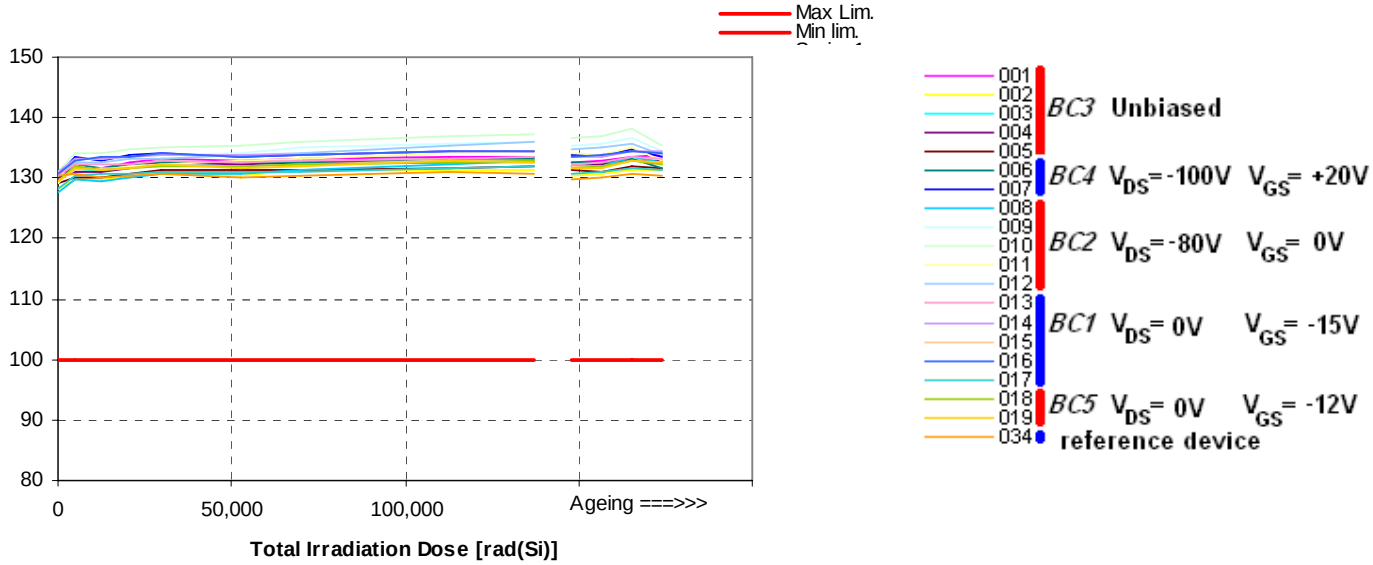
s/n	0	5002	12568	20379	30013	52776	70000	112578	137309	Annealing 7hrs RT	Annealing 22hrs RT	Annealing 161hrs RT	Ageing 168hrs 100'C	Applied Bias Condition
001	130.76	131.77	131.78	132.68	133.21	133.00	133.09	133.61	133.50	132.71	132.84	133.50	133.69	(V_{DS} 0V, V_{GS} 0V)
002	128.31	129.79	129.80	130.19	130.90	130.51	131.18	131.33	131.31	130.49	130.68	131.45	131.22	(V_{DS} 0V, V_{GS} 0V)
003	130.04	130.95	131.47	131.74	132.32	132.28	132.27	132.53	132.69	131.84	132.23	132.96	132.65	(V_{DS} 0V, V_{GS} 0V)
004	129.95	131.16	130.98	131.60	132.45	132.18	132.62	132.42	132.95	131.91	132.18	132.91	132.74	(V_{DS} 0V, V_{GS} 0V)
005	129.21	130.23	130.17	130.83	131.30	131.30	131.41	131.72	131.91	131.18	131.02	131.82	131.78	(V_{DS} 0V, V_{GS} 0V)
006	129.37	132.22	131.56	132.17	132.46	132.43	132.58	133.24	133.31	132.46	132.64	133.09	131.78	(V_{DS} -100V, V_{GS} +20V)
007	130.35	133.52	133.03	133.76	134.13	133.64	133.93	134.50	134.49	133.94	133.75	134.67	133.44	(V_{DS} -100V, V_{GS} +20V)
008	127.48	129.62	129.57	130.08	130.56	130.79	131.32	132.30	132.87	131.93	132.09	133.45	132.58	(V_{DS} -80V, V_{GS} 0V)
009	130.46	133.05	133.26	133.63	133.95	134.22	135.03	135.75	135.98	135.37	135.58	136.72	134.47	(V_{DS} -80V, V_{GS} 0V)
010	131.15	134.18	134.15	134.72	135.18	135.27	135.99	136.95	137.37	136.63	137.01	138.07	135.42	(V_{DS} -80V, V_{GS} 0V)
011	129.12	131.87	131.31	131.84	132.36	132.84	133.05	134.17	134.45	134.00	133.87	135.12	133.01	(V_{DS} -80V, V_{GS} 0V)
012	130.35	132.66	132.44	133.06	133.34	133.75	134.21	135.36	135.85	134.74	135.17	135.77	133.86	(V_{DS} -80V, V_{GS} 0V)
013	130.28	132.21	132.31	132.33	132.76	132.70	132.98	133.14	133.41	132.30	132.62	133.50	133.10	(V_{DS} 0V, V_{GS} -15V)
014	130.87	133.11	133.22	133.56	133.86	133.77	133.73	134.43	134.45	133.58	133.64	134.44	134.43	(V_{DS} 0V, V_{GS} -15V)
015	129.53	131.46	131.69	131.75	132.23	132.08	132.21	132.87	132.82	131.97	132.08	132.84	132.51	(V_{DS} 0V, V_{GS} -15V)
016	130.85	133.01	133.42	133.59	134.18	133.66	133.74	134.41	134.49	133.58	133.88	134.42	134.01	(V_{DS} 0V, V_{GS} -15V)
017	128.30	130.55	130.59	130.83	131.15	130.97	131.12	131.75	132.09	130.72	130.99	131.50	131.24	(V_{DS} 0V, V_{GS} -15V)
018	129.54	131.87	131.44	131.71	131.97	131.99	132.18	132.55	132.82	131.79	131.93	132.84	132.38	(V_{DS} 0V, V_{GS} -12V)
019	129.41	131.53	131.46	131.74	132.16	131.77	132.10	132.99	132.66	131.71	131.78	132.81	132.69	(V_{DS} 0V, V_{GS} -12V)
034	130.35	130.64	130.04	130.35	130.60	130.12	130.43	131.17	130.79	129.80	129.98	130.71	130.31	Reference device

Reference device **Mean value:** 130.4 **Estimated uncertainty:** ± 0.24 % (± 0.313 V)

Red values: greater than max limit
Dark red Values: lower than min limits

STRH40P10FSY3	Min.	Max.	Unit
Applicable limits:	100		[V]

$V_{(BR)DSS}$ @I_{DS}= 1mA – VDS Breakdown Voltage [V] vs ^{60}Co Irradiation Total Dose [rad (Si)]



Data from irradiated devices

Figure 14

Table 17 – RDS(on) Drain-Source On-Resistance [Ohm] vs ^{60}Co Irradiation Total Dose [rad (Si)]

STRH40P10FSY3	Min.	Max.	Unit
Applicable limits:		0.075	[Ohm]

Detailed results - Measurement data in [Ohm]

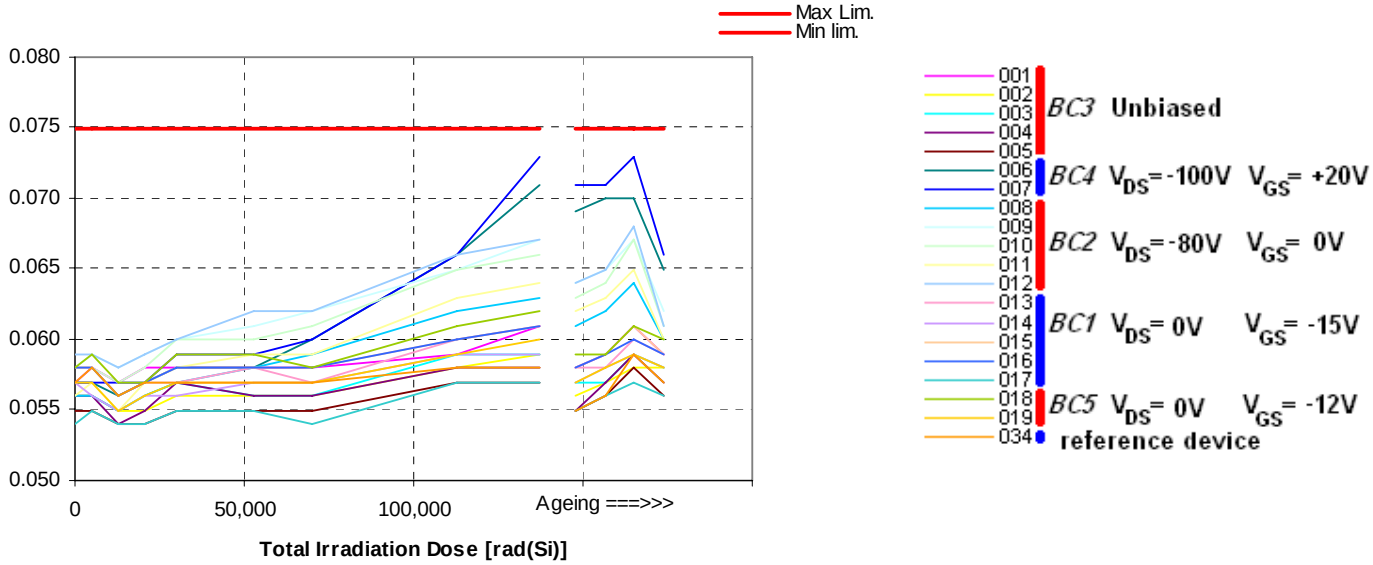
s/n	0	5002	12568	20379	30013	52776	70000	112578	137309	Annealing 7hrs RT	Annealing 22hrs RT	Annealing 161hrs RT	Ageing 168hrs 100'C	Applied Bias Condition
001	0.057	0.058	0.057	0.058	0.058	0.058	0.058	0.059	0.061	0.058	0.059	0.061	0.059	(V_{DS} 0V, V_{GS} 0V)
002	0.056	0.056	0.055	0.055	0.056	0.056	0.056	0.058	0.059	0.056	0.057	0.058	0.058	(V_{DS} 0V, V_{GS} 0V)
003	0.056	0.056	0.055	0.056	0.057	0.056	0.056	0.059	0.059	0.057	0.057	0.059	0.058	(V_{DS} 0V, V_{GS} 0V)
004	0.056	0.056	0.054	0.055	0.057	0.056	0.056	0.058	0.058	0.055	0.057	0.059	0.057	(V_{DS} 0V, V_{GS} 0V)
005	0.055	0.055	0.054	0.054	0.055	0.055	0.055	0.057	0.057	0.055	0.056	0.058	0.056	(V_{DS} 0V, V_{GS} 0V)
006	0.057	0.057	0.056	0.057	0.058	0.058	0.060	0.066	0.071	0.069	0.070	0.070	0.065	(V_{DS} -100V, V_{GS} +20V)
007	0.057	0.057	0.057	0.057	0.059	0.059	0.060	0.066	0.073	0.071	0.071	0.073	0.066	(V_{DS} -100V, V_{GS} +20V)
008	0.056	0.056	0.055	0.056	0.057	0.058	0.059	0.062	0.063	0.061	0.062	0.064	0.060	(V_{DS} -80V, V_{GS} 0V)
009	0.058	0.059	0.058	0.059	0.060	0.061	0.062	0.065	0.067	0.064	0.065	0.067	0.062	(V_{DS} -80V, V_{GS} 0V)
010	0.058	0.058	0.057	0.058	0.060	0.060	0.061	0.065	0.066	0.063	0.064	0.067	0.061	(V_{DS} -80V, V_{GS} 0V)
011	0.056	0.057	0.055	0.057	0.058	0.059	0.059	0.063	0.064	0.062	0.063	0.065	0.060	(V_{DS} -80V, V_{GS} 0V)
012	0.059	0.059	0.058	0.059	0.060	0.062	0.062	0.066	0.067	0.064	0.065	0.068	0.061	(V_{DS} -80V, V_{GS} 0V)
013	0.058	0.058	0.056	0.057	0.057	0.058	0.057	0.060	0.061	0.058	0.058	0.060	0.059	(V_{DS} 0V, V_{GS} -15V)
014	0.057	0.056	0.055	0.056	0.056	0.057	0.057	0.059	0.059	0.057	0.058	0.059	0.058	(V_{DS} 0V, V_{GS} -15V)
015	0.058	0.058	0.056	0.057	0.058	0.058	0.058	0.060	0.061	0.058	0.059	0.061	0.059	(V_{DS} 0V, V_{GS} -15V)
016	0.058	0.058	0.056	0.057	0.058	0.058	0.058	0.060	0.061	0.058	0.059	0.060	0.059	(V_{DS} 0V, V_{GS} -15V)
017	0.054	0.055	0.054	0.054	0.055	0.055	0.054	0.057	0.057	0.055	0.056	0.057	0.056	(V_{DS} 0V, V_{GS} -15V)
018	0.058	0.059	0.057	0.057	0.059	0.059	0.058	0.061	0.062	0.059	0.059	0.061	0.060	(V_{DS} 0V, V_{GS} -12V)
019	0.057	0.057	0.055	0.056	0.057	0.057	0.057	0.059	0.060	0.057	0.058	0.059	0.058	(V_{DS} 0V, V_{GS} -12V)
034	0.057	0.058	0.056	0.057	0.057	0.057	0.057	0.058	0.058	0.055	0.056	0.059	0.057	Reference device

Reference device **Mean value:** **0.057** **Estimated uncertainty:** **± 1.51 % (± 0.001 Ohm)**

Red values: greater than max limit
Dark red Values: lower than min limits

STRH40P10FSY3	*Min.*	*Max.*	*Unit*
Applicable limits:		0.075	[Ohm]

RDS(on) Drain-Source On-Resistance [Ohm] vs ^{60}Co Irradiation Total Dose [rad (Si)]



Data from irradiated devices

Figure 15

Due to test equipment limitation, the following deviation from Detail Spec. Test condition, have been applied:

Required test conditions	Actual Test conditions
I_D = 20A V_{GS} = 12 V	I_D = 20A V_{GS} = 10 V

Table 18 – V_{SD}(on) Inverse Diode Forward Voltage [mV] vs ^{60}Co Irradiation Total Dose [rad (Si)]

STRH40P10FSY3	*Min.*	*Max.*	*Unit*
Applicable limits:		1'500	[mV]

Detailed results - Measurement data in [mV]

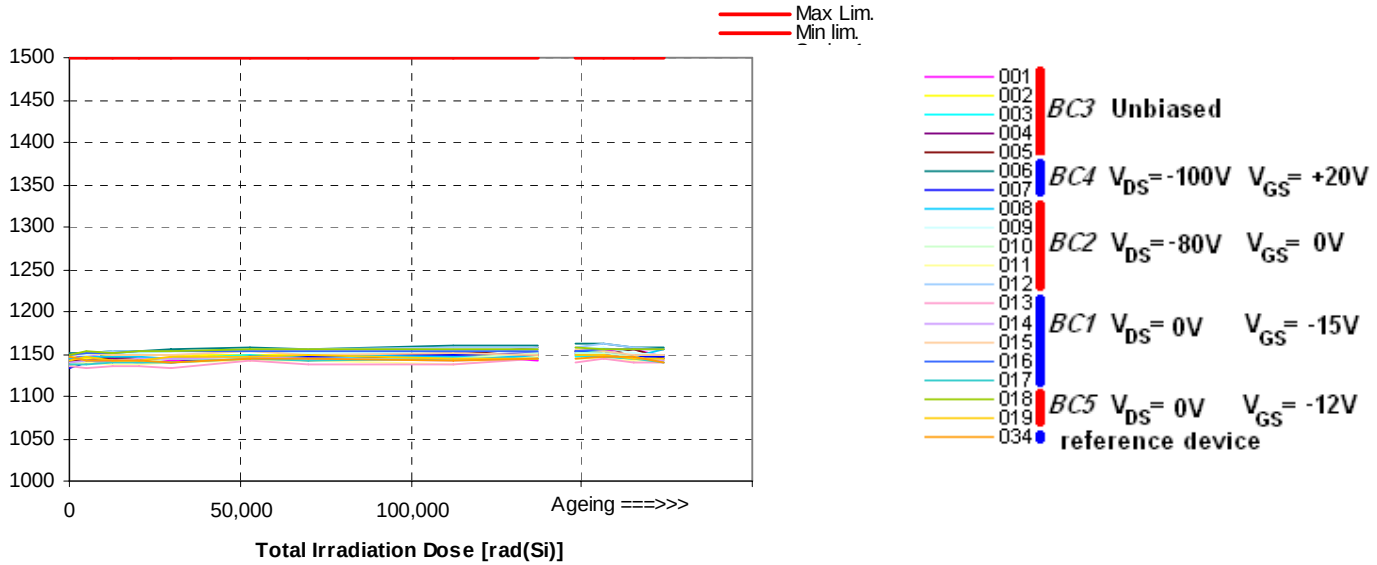
s/n	0	5002	12568	20379	30013	52776	70000	112578	137309	Annealing 7hrs RT	Annealing 22hrs RT	Annealing 161hrs RT	Ageing 168hrs 100'C	Applied Bias Condition
001	1,144.0	1,149.7	1,143.5	1,144.1	1,143.0	1,145.8	1,146.5	1,149.9	1,143.0	1,151.1	1,152.4	1,154.5	1,147.4	(V_{DS} 0V, V_{GS} 0V)
002	1,146.6	1,143.9	1,148.2	1,148.3	1,147.8	1,148.4	1,149.7	1,147.2	1,150.0	1,149.5	1,147.5	1,148.8	1,148.4	(V_{DS} 0V, V_{GS} 0V)
003	1,142.1	1,142.1	1,145.4	1,142.2	1,144.2	1,148.4	1,144.2	1,145.7	1,147.2	1,147.0	1,149.3	1,142.2	1,146.1	(V_{DS} 0V, V_{GS} 0V)
004	1,140.3	1,141.4	1,144.2	1,142.3	1,140.8	1,146.4	1,147.5	1,150.1	1,149.9	1,153.4	1,149.3	1,149.6	1,148.9	(V_{DS} 0V, V_{GS} 0V)
005	1,142.2	1,142.9	1,146.3	1,145.4	1,145.1	1,146.8	1,143.3	1,148.1	1,156.7	1,152.6	1,148.8	1,155.1	1,145.5	(V_{DS} 0V, V_{GS} 0V)
006	1,150.2	1,150.2	1,152.6	1,153.3	1,154.6	1,157.7	1,156.0	1,159.5	1,160.5	1,161.6	1,161.8	1,158.8	1,158.5	(V_{DS} -100V, V_{GS} +20V)
007	1,134.1	1,138.9	1,141.9	1,140.8	1,140.5	1,147.6	1,147.2	1,148.3	1,151.5	1,152.3	1,150.2	1,147.1	1,146.5	(V_{DS} -100V, V_{GS} +20V)
008	1,144.4	1,146.2	1,146.6	1,146.7	1,145.2	1,145.0	1,149.1	1,145.6	1,147.6	1,151.5	1,152.3	1,147.3	1,156.0	(V_{DS} -80V, V_{GS} 0V)
009	1,148.5	1,149.8	1,151.6	1,151.0	1,153.3	1,154.1	1,152.0	1,153.9	1,156.0	1,156.4	1,157.6	1,152.1	1,149.1	(V_{DS} -80V, V_{GS} 0V)
010	1,138.3	1,141.8	1,141.1	1,140.4	1,144.0	1,144.7	1,143.4	1,143.6	1,151.5	1,150.2	1,150.4	1,147.5	1,139.7	(V_{DS} -80V, V_{GS} 0V)
011	1,135.6	1,140.0	1,138.4	1,138.0	1,139.2	1,143.2	1,141.4	1,138.1	1,146.8	1,144.6	1,144.1	1,141.3	1,141.3	(V_{DS} -80V, V_{GS} 0V)
012	1,149.5	1,151.7	1,154.4	1,154.3	1,153.3	1,155.8	1,156.4	1,156.7	1,158.4	1,158.6	1,162.2	1,156.7	1,155.4	(V_{DS} -80V, V_{GS} 0V)
013	1,134.9	1,134.1	1,136.1	1,134.8	1,134.2	1,141.2	1,137.3	1,138.4	1,144.5	1,139.7	1,144.4	1,139.6	1,140.8	(V_{DS} 0V, V_{GS} -15V)
014	1,139.5	1,142.7	1,142.6	1,144.6	1,143.4	1,146.6	1,145.1	1,142.0	1,144.1	1,148.7	1,149.6	1,145.1	1,141.8	(V_{DS} 0V, V_{GS} -15V)
015	1,148.4	1,150.5	1,147.8	1,148.9	1,148.0	1,152.4	1,148.9	1,150.3	1,149.3	1,154.9	1,153.3	1,149.7	1,148.4	(V_{DS} 0V, V_{GS} -15V)
016	1,149.2	1,151.0	1,150.2	1,152.6	1,153.3	1,153.1	1,152.6	1,152.4	1,152.7	1,154.3	1,154.9	1,155.7	1,156.4	(V_{DS} 0V, V_{GS} -15V)
017	1,138.8	1,137.1	1,139.9	1,139.2	1,141.0	1,144.3	1,141.5	1,143.7	1,143.9	1,148.8	1,147.1	1,145.1	1,140.5	(V_{DS} 0V, V_{GS} -15V)
018	1,148.9	1,153.2	1,150.6	1,154.0	1,152.7	1,154.8	1,156.2	1,155.4	1,156.6	1,157.1	1,156.3	1,154.7	1,154.5	(V_{DS} 0V, V_{GS} -12V)
019	1,141.4	1,145.9	1,143.0	1,143.0	1,145.6	1,146.4	1,148.7	1,144.8	1,144.5	1,148.8	1,148.6	1,145.4	1,144.4	(V_{DS} 0V, V_{GS} -12V)
034	1,147.4	1,143.3	1,142.4	1,142.8	1,141.1	1,144.5	1,144.2	1,142.7	1,144.7	1,144.0	1,146.3	1,146.4	1,139.8	Reference device

Reference device **Mean value:** 1,143.8 **Estimated uncertainty:** ± 0.16 % (± 1.83 mV)

Red values: greater than max limit
Dark red Values: lower than min limits

STRH40P10FSY3	Min.	Max.	Unit
Applicable limits:		1'500	[mV]

V_{SD}(on) Inverse Diode Forward Voltage [mV] vs ^{60}Co Irradiation Total Dose [rad (Si)]



Data from irradiated devices

Figure 16

Table 19 – V_{DS}(on) Drain-Source On Voltage [mV] vs ^{60}Co Irradiation Total Dose [rad (Si)]

STRH40P10FSY3	*Min.*	*Max.*	*Unit*
Applicable limits:		2'400	[mV]

Detailed results - Measurement data in [mV]

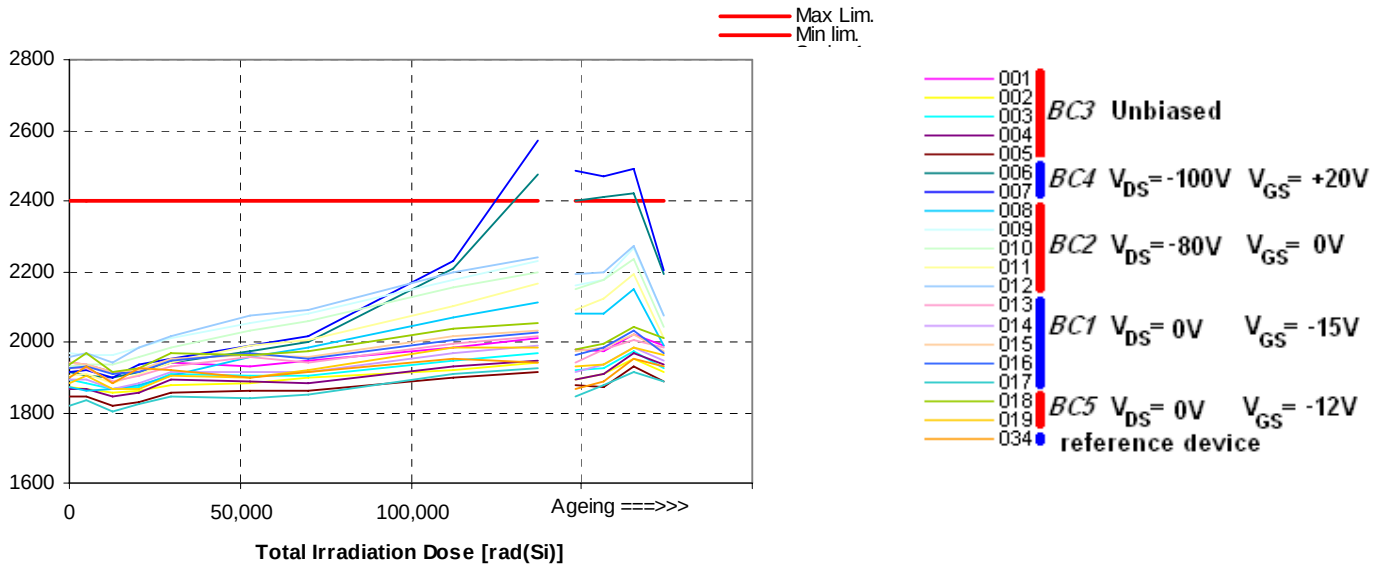
s/n	0	5002	12568	20379	30013	52776	70000	112578	137309	Annealing 7hrs RT	Annealing 22hrs RT	Annealing 161hrs RT	Ageing 168hrs 100'C	Applied Bias Condition
001	1,941.3	1,936.9	1,916.3	1,916.9	1,939.1	1,929.7	1,945.3	1,982.7	2,011.6	1,977.4	1,970.7	2,019.6	1,987.6	(V_{DS} 0V, V_{GS} 0V)
002	1,874.5	1,869.3	1,855.4	1,863.6	1,878.2	1,884.0	1,896.8	1,919.6	1,939.5	1,891.8	1,906.9	1,950.1	1,912.1	(V_{DS} 0V, V_{GS} 0V)
003	1,893.0	1,884.7	1,865.3	1,870.4	1,906.9	1,906.3	1,905.6	1,948.3	1,969.6	1,922.6	1,923.8	1,972.3	1,923.4	(V_{DS} 0V, V_{GS} 0V)
004	1,867.8	1,867.2	1,845.5	1,854.5	1,892.3	1,885.9	1,884.1	1,931.9	1,945.8	1,891.4	1,908.2	1,968.3	1,938.1	(V_{DS} 0V, V_{GS} 0V)
005	1,847.3	1,843.8	1,817.8	1,828.9	1,857.9	1,859.6	1,862.9	1,897.6	1,915.4	1,875.4	1,873.6	1,931.6	1,886.6	(V_{DS} 0V, V_{GS} 0V)
006	1,912.2	1,906.1	1,897.1	1,912.3	1,943.7	1,973.3	2,001.6	2,207.7	**2,476.5**	**2,401.3**	**2,412.8**	**2,419.1**	2,191.5	(V_{DS} -100V, V_{GS} +20V)
007	1,913.2	1,919.6	1,900.3	1,938.1	1,950.1	1,988.0	2,014.1	2,229.2	**2,569.3**	**2,484.1**	**2,471.6**	**2,493.3**	2,201.3	(V_{DS} -100V, V_{GS} +20V)
008	1,872.6	1,863.9	1,866.3	1,880.0	1,905.2	1,955.7	1,983.0	2,071.9	2,113.1	2,081.6	2,079.1	2,148.9	1,987.2	(V_{DS} -80V, V_{GS} 0V)
009	1,966.3	1,965.3	1,961.9	1,982.3	2,009.1	2,054.8	2,082.3	2,174.1	2,227.1	2,160.5	2,174.7	2,264.4	2,076.3	(V_{DS} -80V, V_{GS} 0V)
010	1,932.9	1,937.4	1,937.6	1,956.2	1,984.4	2,034.1	2,056.3	2,155.3	2,197.1	2,148.5	2,176.4	2,236.3	2,040.2	(V_{DS} -80V, V_{GS} 0V)
011	1,903.5	1,909.2	1,881.9	1,911.1	1,939.3	1,990.9	2,006.7	2,101.9	2,166.6	2,091.6	2,121.3	2,190.4	2,009.2	(V_{DS} -80V, V_{GS} 0V)
012	1,959.4	1,970.1	1,943.6	1,983.3	2,013.4	2,074.1	2,089.8	2,195.4	2,239.4	2,189.9	2,199.5	2,271.1	2,076.3	(V_{DS} -80V, V_{GS} 0V)
013	1,926.4	1,923.7	1,890.4	1,903.1	1,931.9	1,956.7	1,940.0	1,993.8	2,015.3	1,939.9	1,977.5	2,007.6	1,982.7	(V_{DS} 0V, V_{GS} -15V)
014	1,894.8	1,892.9	1,869.1	1,881.4	1,913.8	1,912.6	1,914.1	1,970.0	1,987.7	1,917.1	1,937.6	1,982.9	1,947.2	(V_{DS} 0V, V_{GS} -15V)
015	1,942.4	1,933.6	1,913.8	1,921.3	1,949.5	1,964.1	1,959.1	2,015.3	2,031.3	1,971.3	1,981.8	2,020.6	1,975.3	(V_{DS} 0V, V_{GS} -15V)
016	1,927.8	1,929.6	1,908.2	1,916.4	1,945.4	1,965.6	1,950.0	2,006.4	2,024.6	1,965.3	1,983.4	2,033.6	1,968.5	(V_{DS} 0V, V_{GS} -15V)
017	1,819.6	1,836.4	1,801.2	1,823.1	1,845.1	1,842.1	1,849.8	1,910.4	1,926.9	1,847.4	1,880.0	1,914.6	1,886.0	(V_{DS} 0V, V_{GS} -15V)
018	1,938.2	1,966.8	1,917.2	1,927.6	1,966.3	1,961.6	1,975.1	2,035.2	2,054.3	1,980.0	1,994.9	2,041.8	2,008.4	(V_{DS} 0V, V_{GS} -12V)
019	1,882.2	1,903.4	1,866.9	1,866.9	1,905.4	1,900.0	1,920.0	1,981.7	1,983.4	1,930.7	1,938.5	1,982.3	1,961.4	(V_{DS} 0V, V_{GS} -12V)
034	1,896.1	1,930.3	1,884.3	1,924.6	1,918.1	1,901.1	1,912.1	1,949.5	1,940.7	1,865.2	1,885.9	1,949.4	1,928.4	Reference device

Reference device **Mean value:** 1,914.3 **Estimated uncertainty:** ± 1.15 % (± 22.014 mV)

Red values: greater than max limit
Dark red Values: lower than min limits

STRH40P10FSY3	Min.	Max.	Unit
Applicable limits:		2'400	[mV]

V_{DS}(on) Drain-Source On Voltage [mV] vs ^{60}Co Irradiation Total Dose [rad (Si)]



Data from irradiated devices

Figure 17

Table 20 – I_{DS}(on) Drain-Source On Current [A] vs ^{60}Co Irradiation Total Dose [rad (Si)]

STRH40P10FSY3	*Min.*	*Max.*	*Unit*
Applicable limits:	40		[A]

Detailed results - Measurement data in [A]

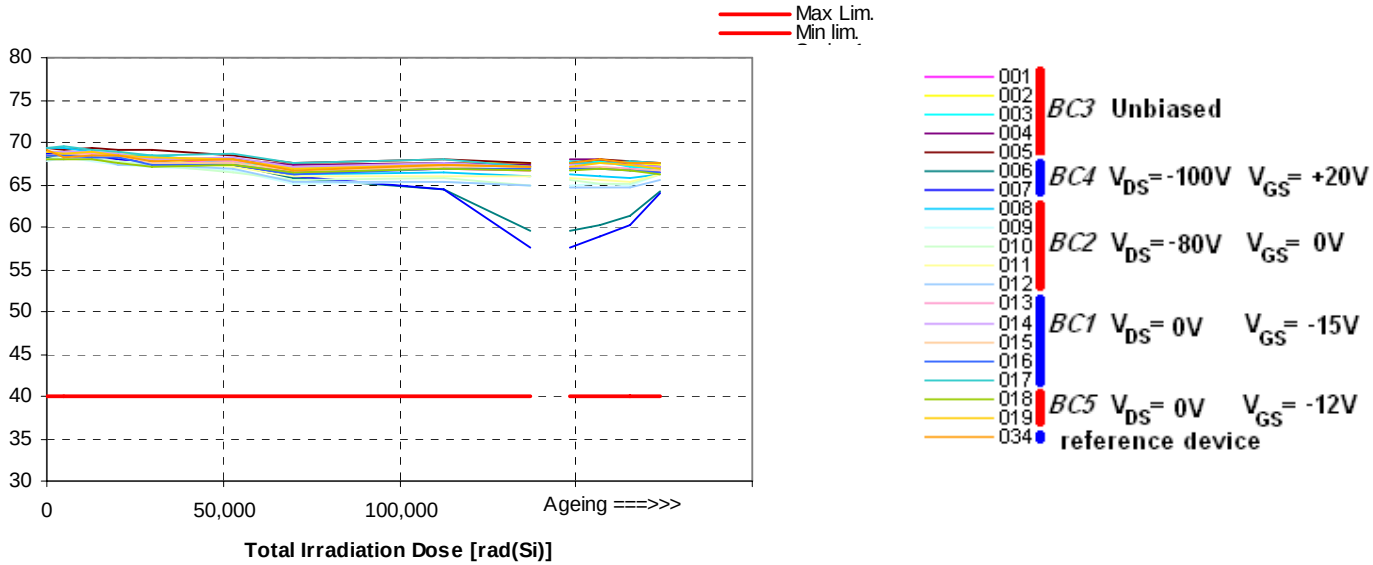
s/n	0	5002	12568	20379	30013	52776	70000	112578	137309	Annealing 7hrs RT	Annealing 22hrs RT	Annealing 161hrs RT	Ageing 168hrs 100'C	Applied Bias Condition
001	68.33	68.33	67.96	67.92	67.78	67.59	66.34	67.00	66.77	67.02	66.98	66.97	66.47	(V_{DS} 0V, V_{GS} 0V)
002	68.91	68.81	68.75	68.84	68.32	67.98	67.38	67.64	67.59	67.52	67.95	67.65	67.41	(V_{DS} 0V, V_{GS} 0V)
003	68.56	68.64	68.53	68.53	68.12	67.76	66.89	67.49	67.13	67.82	67.71	67.18	66.87	(V_{DS} 0V, V_{GS} 0V)
004	68.49	68.64	68.58	68.06	67.98	67.98	67.34	67.65	67.34	68.00	68.00	67.38	67.17	(V_{DS} 0V, V_{GS} 0V)
005	69.29	69.16	69.24	69.06	69.12	68.53	67.51	68.09	67.47	67.56	68.01	67.68	67.45	(V_{DS} 0V, V_{GS} 0V)
006	68.31	68.50	68.21	68.47	67.80	67.38	65.75	64.52	59.63	59.57	60.31	61.35	64.17	(V_{DS} -100V, V_{GS} +20V)
007	68.76	68.98	68.36	67.91	67.88	67.38	66.06	64.34	57.64	57.63	58.95	60.22	64.10	(V_{DS} -100V, V_{GS} +20V)
008	69.23	69.35	68.82	68.35	68.40	67.49	66.27	66.54	66.03	66.28	66.09	65.88	66.22	(V_{DS} -80V, V_{GS} 0V)
009	67.85	68.22	67.76	67.36	67.09	66.56	65.12	65.44	64.83	64.97	65.08	64.84	66.21	(V_{DS} -80V, V_{GS} 0V)
010	67.99	68.38	68.14	67.72	67.27	66.42	65.49	65.76	64.98	65.57	65.19	65.08	66.32	(V_{DS} -80V, V_{GS} 0V)
011	68.90	68.91	68.45	68.20	68.00	67.18	65.93	65.95	66.09	65.74	65.59	65.22	66.33	(V_{DS} -80V, V_{GS} 0V)
012	67.97	68.02	68.26	67.44	67.42	66.83	65.33	65.27	64.83	64.75	64.60	64.76	65.65	(V_{DS} -80V, V_{GS} 0V)
013	68.50	68.68	68.69	68.55	68.03	67.85	67.13	67.37	67.08	67.22	67.15	67.00	66.68	(V_{DS} 0V, V_{GS} -15V)
014	68.82	68.89	68.85	68.74	68.07	68.21	67.01	67.59	67.19	67.33	67.50	67.36	67.11	(V_{DS} 0V, V_{GS} -15V)
015	68.34	68.48	68.49	68.44	67.58	67.47	66.67	67.09	66.65	66.80	67.01	66.77	66.62	(V_{DS} 0V, V_{GS} -15V)
016	68.39	68.47	68.21	68.18	67.28	67.40	66.21	66.94	66.81	66.87	66.91	66.62	66.44	(V_{DS} 0V, V_{GS} -15V)
017	69.23	69.53	69.21	68.86	68.49	68.64	67.66	67.97	67.22	67.65	67.64	67.73	67.54	(V_{DS} 0V, V_{GS} -15V)
018	67.90	68.04	68.10	67.52	67.21	67.26	66.49	66.83	66.69	66.60	66.87	66.70	66.29	(V_{DS} 0V, V_{GS} -12V)
019	68.96	68.57	68.83	68.50	68.14	67.98	66.95	67.33	67.05	67.18	67.61	67.33	66.88	(V_{DS} 0V, V_{GS} -12V)
034	69.06	68.29	68.39	68.36	67.88	67.90	66.70	67.24	67.05	67.47	67.92	67.56	67.62	Reference device

Reference device **Mean value:** 67.803 **Estimated uncertainty:** ± 0.78 % (± 0.529 A)

Red values: greater than max limit
Dark red Values: lower than min limits

STRH40P10FSY3	Min.	Max.	Unit
Applicable limits:	40		[A]

I_{DS}(on) Drain-Source On Current [A] vs ^{60}Co Irradiation Total Dose [rad (Si)]



Data from irradiated devices

Figure 18

Table 21 – Qg Total Gate Charge [nCoulomb] vs ^{60}Co Irradiation Total Dose [rad (Si)]:

STRH40P10FSY3	*Min.*	*Max.*	*Unit*
Applicable limits:	132	198	[nC]

Detailed results - Measurement data in [nC]

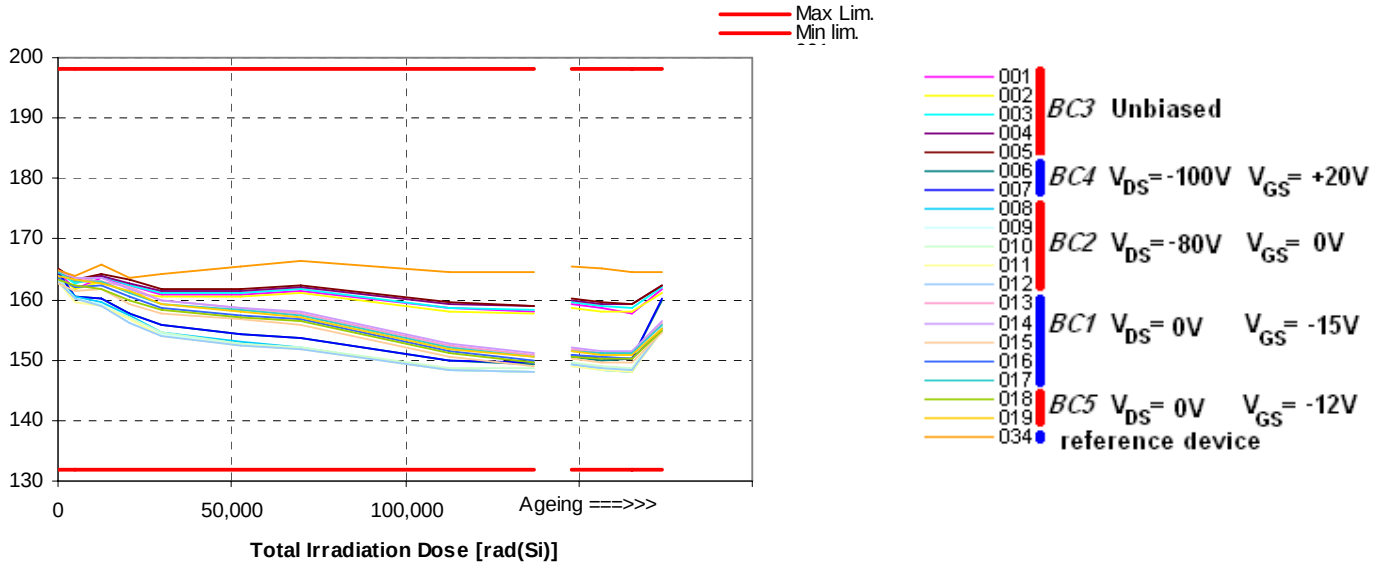
s/n	0	5002	12568	20379	30013	52776	70000	112578	137309	Annealing 7hrs RT	Annealing 22hrs RT	Annealing 161hrs RT	Ageing 168hrs 100'C	Applied Bias Condition
001	164.46	161.83	163.64	162.23	160.93	160.80	161.35	158.49	158.07	159.18	158.69	157.72	161.66	(V_{DS} 0V, V_{GS} 0V)
002	163.92	161.84	162.90	161.21	160.44	160.37	161.03	158.04	157.68	158.77	158.10	158.05	161.21	(V_{DS} 0V, V_{GS} 0V)
003	164.41	162.65	163.78	162.41	161.16	161.04	161.73	158.66	158.34	159.52	158.98	158.64	161.94	(V_{DS} 0V, V_{GS} 0V)
004	164.75	163.41	164.03	162.56	161.55	161.56	162.13	159.30	158.85	159.87	159.38	159.19	162.30	(V_{DS} 0V, V_{GS} 0V)
005	165.02	163.40	164.17	163.15	161.70	161.89	162.42	159.54	159.00	160.05	159.57	159.23	162.36	(V_{DS} 0V, V_{GS} 0V)
006	164.41	160.50	160.23	157.69	155.70	154.21	153.50	149.91	149.30	150.58	149.81	150.19	159.92	(V_{DS} -100V, V_{GS} +20V)
007	164.49	160.58	160.09	157.82	155.71	154.18	153.79	150.02	149.49	150.72	150.18	150.13	160.08	(V_{DS} -100V, V_{GS} +20V)
008	163.28	160.34	159.50	157.35	154.46	152.93	151.97	148.40	148.17	149.14	148.51	148.12	155.40	(V_{DS} -80V, V_{GS} 0V)
009	162.83	160.16	159.21	156.21	154.25	152.53	151.93	148.40	148.04	149.11	148.47	148.32	154.92	(V_{DS} -80V, V_{GS} 0V)
010	163.22	160.09	159.07	157.07	154.47	152.85	151.99	148.72	148.54	149.56	149.00	148.53	155.52	(V_{DS} -80V, V_{GS} 0V)
011	163.09	159.62	158.94	156.90	154.11	152.45	151.87	148.31	148.02	149.05	148.27	148.05	154.92	(V_{DS} -80V, V_{GS} 0V)
012	162.96	160.18	159.02	156.22	154.03	152.39	151.69	148.47	148.06	149.15	148.56	148.31	154.97	(V_{DS} -80V, V_{GS} 0V)
013	164.64	163.59	162.97	161.90	159.79	158.60	157.76	152.48	150.90	151.81	151.27	151.20	156.23	(V_{DS} 0V, V_{GS} -15V)
014	164.80	163.51	163.63	161.69	159.81	158.78	158.01	152.75	151.18	152.12	151.60	151.54	156.51	(V_{DS} 0V, V_{GS} -15V)
015	162.51	161.43	161.69	159.18	157.67	156.72	155.84	150.63	149.06	150.11	149.63	149.45	154.48	(V_{DS} 0V, V_{GS} -15V)
016	163.61	162.12	162.40	160.43	158.54	157.52	156.80	151.41	149.99	150.82	150.48	150.31	155.13	(V_{DS} 0V, V_{GS} -15V)
017	164.53	162.99	162.83	161.23	159.40	158.24	157.49	151.97	150.62	151.49	151.05	151.05	155.79	(V_{DS} 0V, V_{GS} -15V)
018	163.21	162.31	161.83	159.95	158.45	157.21	156.35	151.15	149.60	150.61	150.12	150.11	154.85	(V_{DS} 0V, V_{GS} -12V)
019	163.97	163.43	162.75	161.30	159.25	157.85	157.19	151.79	150.55	151.46	150.81	150.84	155.35	(V_{DS} 0V, V_{GS} -12V)
034	164.93	163.77	165.75	163.51	164.15	165.54	166.51	164.54	164.60	165.55	165.03	164.55	164.46	Reference device

Reference device **Mean value:** 164.838 **Estimated uncertainty:** ± 0.42 % (± 0.692 nC)

Red values: greater than max limit
Dark red Values: lower than min limits

STRH40P10FSY3	*Min.*	*Max.*	*Unit*
Applicable limits:	132	198	[nC]

Qg Total Gate Charge [nCoulomb] vs ^{60}Co Irradiation Total Dose [rad (Si)]



Data from irradiated devices

Figure 19

Table 22 – Qgs Gate Source Charge [nCoulomb] vs ^{60}Co Irradiation Total Dose [rad (Si)]:

STRH40P10FSY3	*Min.*	*Max.*	*Unit*
Applicable limits:	nd	nd	[nC]

Detailed results - Measurement data in [nC]

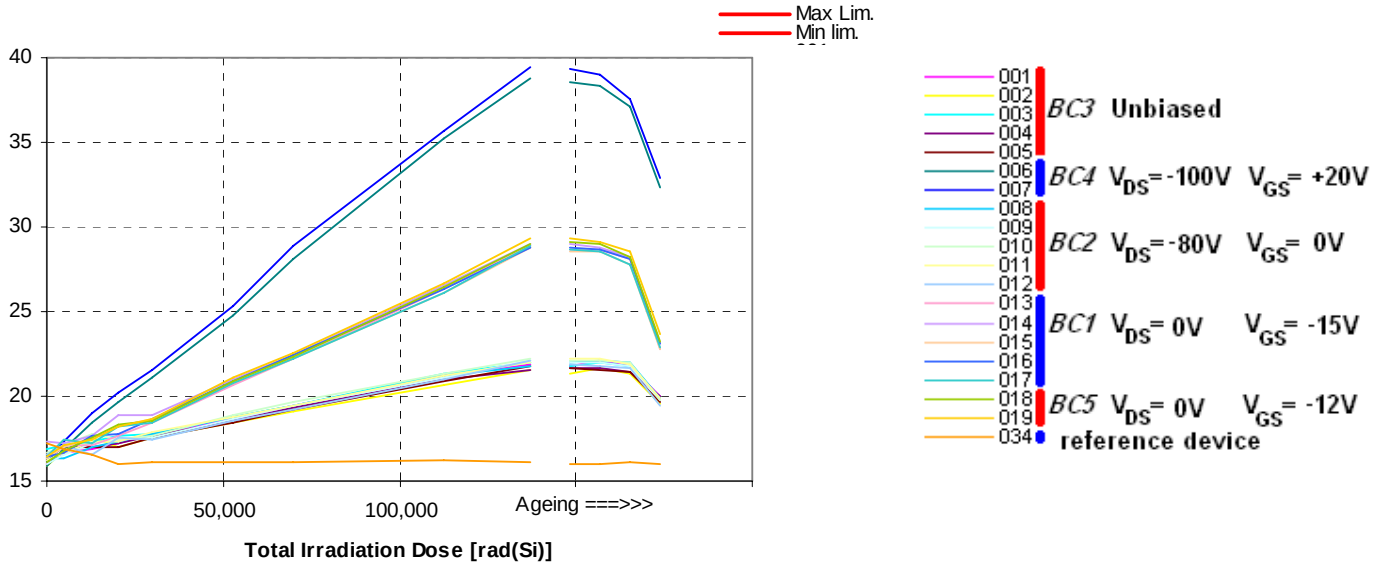
s/n	0	5002	12568	20379	30013	52776	70000	112578	137309	Annealing 7hrs RT	Annealing 22hrs RT	Annealing 161hrs RT	Ageing 168hrs 100'C	Applied Bias Condition
001	16.02	16.63	16.94	17.25	17.82	18.70	19.48	21.21	21.88	21.77	22.12	21.75	19.98	(V_{DS} 0V, V_{GS} 0V)
002	15.91	16.82	17.61	16.98	17.50	18.49	19.15	20.67	21.54	21.32	21.62	21.30	19.60	(V_{DS} 0V, V_{GS} 0V)
003	16.89	17.09	17.36	17.65	17.74	18.83	19.40	21.34	21.96	21.83	22.04	21.74	19.88	(V_{DS} 0V, V_{GS} 0V)
004	16.44	17.12	17.05	17.22	17.69	18.53	19.36	20.95	21.51	21.68	21.68	21.43	19.96	(V_{DS} 0V, V_{GS} 0V)
005	16.34	16.95	16.99	17.02	17.55	18.46	19.19	20.84	21.77	21.63	21.57	21.49	19.65	(V_{DS} 0V, V_{GS} 0V)
006	15.89	16.85	18.40	19.61	21.10	24.82	28.10	35.17	38.77	38.53	38.30	37.16	32.31	(V_{DS} -100V, V_{GS} +20V)
007	16.14	17.31	18.95	20.21	21.52	25.36	28.92	35.63	39.46	39.30	39.01	37.58	32.84	(V_{DS} -100V, V_{GS} +20V)
008	16.30	16.30	17.04	17.38	17.76	18.73	19.50	21.19	21.78	22.04	22.11	21.97	19.84	(V_{DS} -80V, V_{GS} 0V)
009	16.00	16.55	17.19	17.40	17.50	18.72	19.41	21.06	22.07	21.97	22.01	21.81	19.78	(V_{DS} -80V, V_{GS} 0V)
010	16.65	17.14	17.74	17.49	17.64	18.84	19.65	21.30	22.17	22.08	22.15	21.95	19.83	(V_{DS} -80V, V_{GS} 0V)
011	16.19	16.63	17.35	17.39	17.84	18.81	19.45	21.23	22.02	22.24	22.21	21.86	19.87	(V_{DS} -80V, V_{GS} 0V)
012	16.54	17.08	16.57	17.59	17.45	18.60	19.23	21.05	22.07	21.86	21.81	21.63	19.41	(V_{DS} -80V, V_{GS} 0V)
013	16.32	17.11	17.10	17.67	18.44	20.70	22.21	26.38	28.84	28.63	28.70	28.15	22.79	(V_{DS} 0V, V_{GS} -15V)
014	17.35	17.18	17.70	18.86	18.94	20.95	22.43	26.53	29.02	29.01	28.74	28.18	23.07	(V_{DS} 0V, V_{GS} -15V)
015	16.38	17.03	17.51	18.27	18.62	20.80	22.23	26.16	28.79	28.56	28.52	27.83	22.75	(V_{DS} 0V, V_{GS} -15V)
016	16.43	16.69	17.61	17.73	18.71	20.88	22.43	26.32	28.73	28.74	28.71	28.11	23.11	(V_{DS} 0V, V_{GS} -15V)
017	16.40	17.47	17.23	18.19	18.47	20.74	22.21	26.13	28.86	28.69	28.57	27.75	22.87	(V_{DS} 0V, V_{GS} -15V)
018	16.14	16.78	17.53	18.36	18.60	20.94	22.38	26.39	28.99	29.12	29.01	28.27	23.19	(V_{DS} 0V, V_{GS} -12V)
019	16.45	17.08	17.47	18.22	18.62	21.09	22.58	26.64	29.29	29.32	29.12	28.57	23.69	(V_{DS} 0V, V_{GS} -12V)
034	17.17	16.87	16.52	16.04	16.12	16.13	16.10	16.20	16.11	16.05	16.02	16.11	16.02	Reference device

Reference device **Mean value:** 16.267 **Estimated uncertainty:** ± 1.86 % (± 0.303 nC)

Red values: greater than max limit
Dark red Values: lower than min limits

STRH40P10FSY3	*Min.*	*Max.*	*Unit*
Applicable limits:	nd	nd	[nC]

Qgs Gate Source Charge [nCoulomb] vs ^{60}Co Irradiation Total Dose [rad (Si)]



Data from irradiated devices

Figure 20

Table 23 – Qgd Gate Drain Charge [nCoulomb] vs ^{60}Co Irradiation Total Dose [rad (Si)]:

STRH40P10FSY3	*Min.*	*Max.*	*Unit*
Applicable limits:	nd	nd	[nC]

Detailed results - Measurement data in [nC]

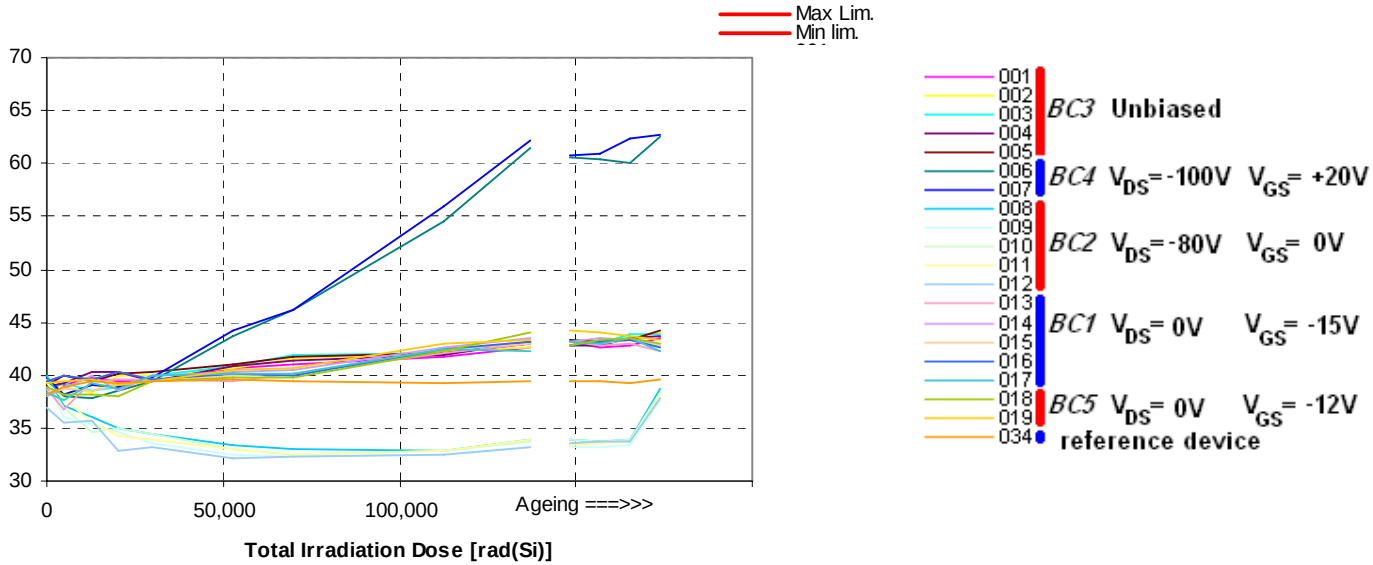
s/n	0	5002	12568	20379	30013	52776	70000	112578	137309	Annealing 7hrs RT	Annealing 22hrs RT	Annealing 161hrs RT	Ageing 168hrs 100'C	Applied Bias Condition
001	39.66	39.11	39.79	39.40	39.43	40.73	41.04	41.78	42.57	43.12	42.61	42.86	43.49	(V_{DS} 0V, V_{GS} 0V)
002	39.57	38.86	38.44	40.01	40.03	40.61	41.58	42.20	42.53	43.34	42.73	43.56	44.03	(V_{DS} 0V, V_{GS} 0V)
003	38.55	39.20	38.57	38.85	40.04	40.78	41.90	42.03	43.19	43.31	43.04	43.87	43.91	(V_{DS} 0V, V_{GS} 0V)
004	38.86	39.25	40.23	40.39	39.50	40.92	41.31	41.98	43.20	42.88	42.83	43.54	43.68	(V_{DS} 0V, V_{GS} 0V)
005	38.99	39.88	39.49	40.05	40.23	41.06	41.70	42.08	42.91	43.31	43.13	43.39	44.19	(V_{DS} 0V, V_{GS} 0V)
006	39.49	38.03	37.79	38.56	39.35	43.62	46.20	54.52	61.38	60.51	60.48	59.98	62.51	(V_{DS} -100V, V_{GS} +20V)
007	39.70	38.25	39.01	38.89	39.71	44.26	46.18	56.00	62.14	60.81	61.01	62.27	62.75	(V_{DS} -100V, V_{GS} +20V)
008	40.01	37.09	35.99	34.93	34.42	33.31	33.09	32.78	33.97	33.87	33.75	33.97	38.66	(V_{DS} -80V, V_{GS} 0V)
009	39.34	36.09	35.41	34.62	33.62	32.41	32.34	32.52	33.18	33.23	33.15	33.43	37.73	(V_{DS} -80V, V_{GS} 0V)
010	39.44	36.88	34.63	35.00	34.42	33.02	32.54	32.86	33.76	33.89	33.81	33.99	38.29	(V_{DS} -80V, V_{GS} 0V)
011	39.31	37.77	35.43	34.28	33.98	32.98	32.56	32.76	33.88	33.33	33.59	33.76	38.25	(V_{DS} -80V, V_{GS} 0V)
012	37.00	35.51	35.76	32.85	33.20	32.15	32.29	32.40	33.14	33.49	33.71	33.79	37.86	(V_{DS} -80V, V_{GS} 0V)
013	38.77	36.84	39.35	39.57	39.60	39.44	40.10	42.02	42.90	43.09	42.87	43.02	42.32	(V_{DS} 0V, V_{GS} -15V)
014	38.00	38.63	40.00	38.57	39.95	40.38	40.45	42.65	43.54	43.23	43.51	43.39	42.72	(V_{DS} 0V, V_{GS} -15V)
015	38.39	38.71	38.59	39.11	39.65	39.93	40.08	42.36	42.94	43.18	43.00	43.31	42.75	(V_{DS} 0V, V_{GS} -15V)
016	39.49	39.90	39.63	40.24	39.63	40.08	40.03	42.44	43.11	42.76	43.19	43.25	42.67	(V_{DS} 0V, V_{GS} -15V)
017	38.42	37.73	39.21	38.72	39.90	40.13	40.20	42.47	42.34	43.24	42.97	43.48	42.32	(V_{DS} 0V, V_{GS} -15V)
018	38.82	38.17	38.10	38.06	39.45	39.77	39.81	42.21	44.02	42.84	43.34	43.59	42.98	(V_{DS} 0V, V_{GS} -12V)
019	39.30	39.38	39.66	39.02	39.48	40.54	40.66	43.05	43.40	44.16	43.99	43.70	43.40	(V_{DS} 0V, V_{GS} -12V)
034	38.24	38.93	39.38	39.28	39.38	39.56	39.43	39.32	39.48	39.46	39.42	39.29	39.66	Reference device

Reference device **Mean value:** 39.294 **Estimated uncertainty:** ± 0.76 % (± 0.299 nC)

Red values: greater than max limit
Dark red Values: lower than min limits

STRH40P10FSY3	*Min.*	*Max.*	*Unit*
Applicable limits:	**nd**	**nd**	**[nC]**

Qgd Gate Drain Charge [nCoulomb] vs ^{60}Co Irradiation Total Dose [rad (Si)]



Data from irradiated devices

Figure 21

4.4.2 Gate Charge Waveforms

The total gate charge was measured according to MIL-STD-750 method 3471 cond.B, using test conditions as specified in Table 4 and the test circuit in Figure 2.

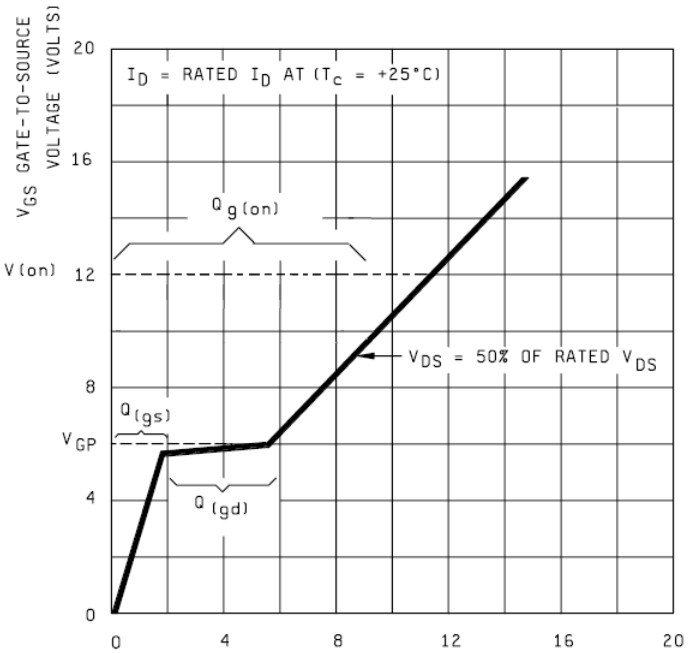


Figure 22 Gate Charge Waveform for N-channel MOSFET (Mil-Std-750E meth.3471) with the identification of Qg, Qgs and Qgd.

Figure 23 to Figure 27 show the measured Gate Voltage Waveforms grouped per bias condition.

For presentation plainness, only the initial and final waveform plus the waveform after the ageing, representative of the group behaviour have been plotted.
Note that the measured waveforms have reverse polarity with respect to Figure 22.

The markers on the Gate Charge waveforms, indicate the extracted charge parameters.

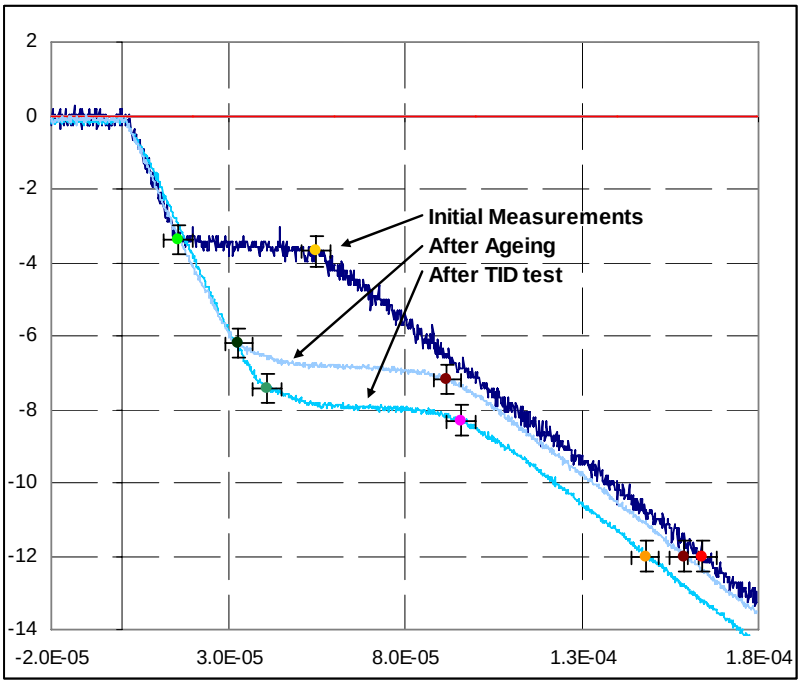


Figure 23

Gate charge waveforms

devices s/n 06 & s/n 07

Bias Conditions:

BC4 V_{GS} =+20V
V_{DS}= -100V

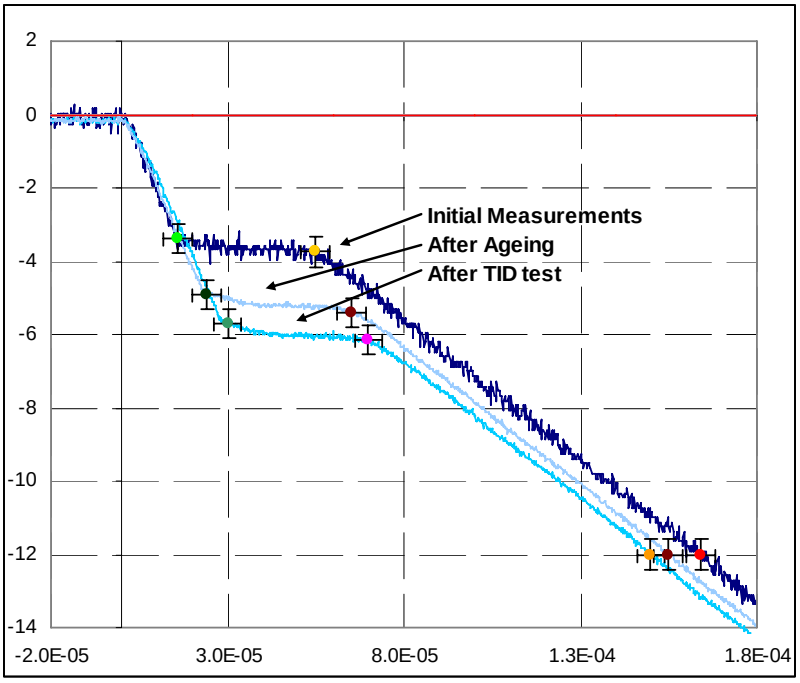


Figure 24

Gate charge waveforms

devices s/n 18 & s/n 19

Bias Conditions:

BC5 V_{GS} = -12V
V_{DS}= 0V

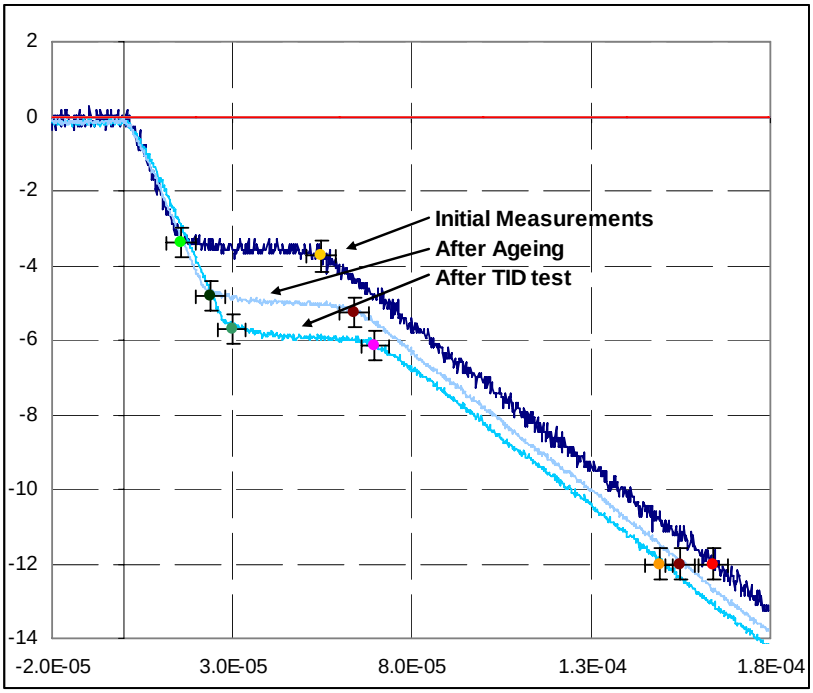


Figure 25

Gate charge waveforms

devices s/n 13 to s/n 17

Bias Conditions:

BC1 V_{GS} =-15V
V_{DS}= 0V

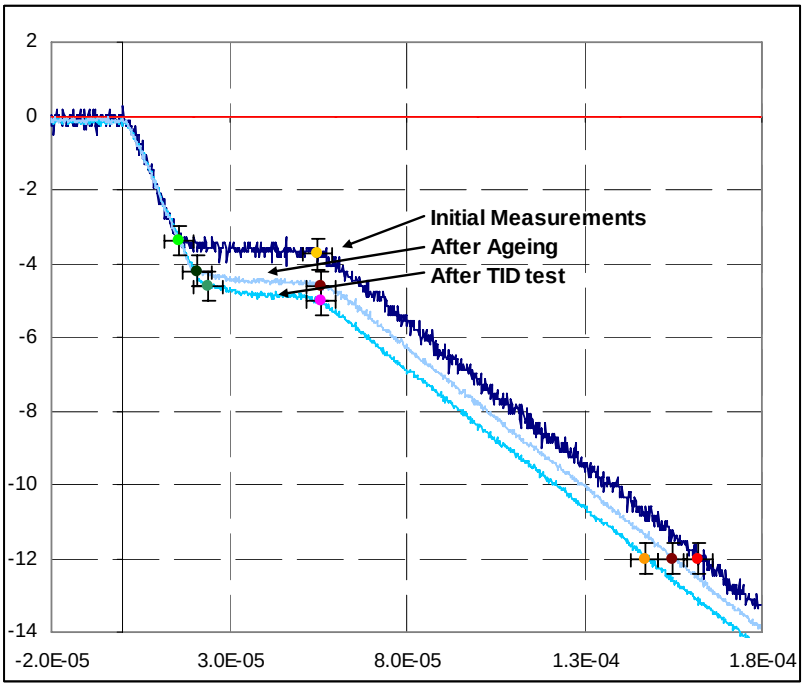


Figure 26

Gate charge waveforms

devices s/n 08 to s/n 12

Bias Conditions:

BC2 V_{GS} = 0V
V_{DS}= -80V

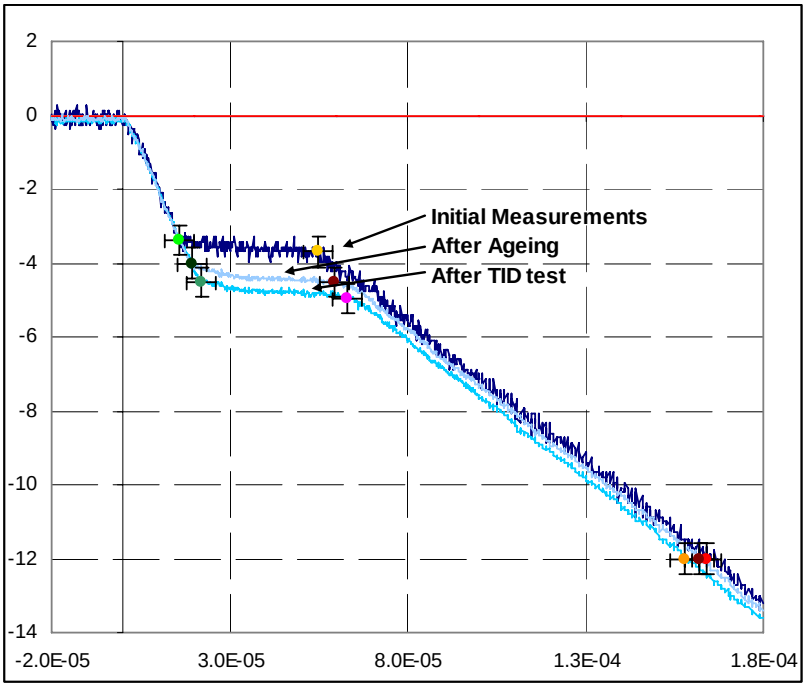


Figure 27

Gate charge waveforms

devices s/n 01 to s/n 05

Bias Conditions:

BC3 V_{GS} =0V
V_{DS}= 0V

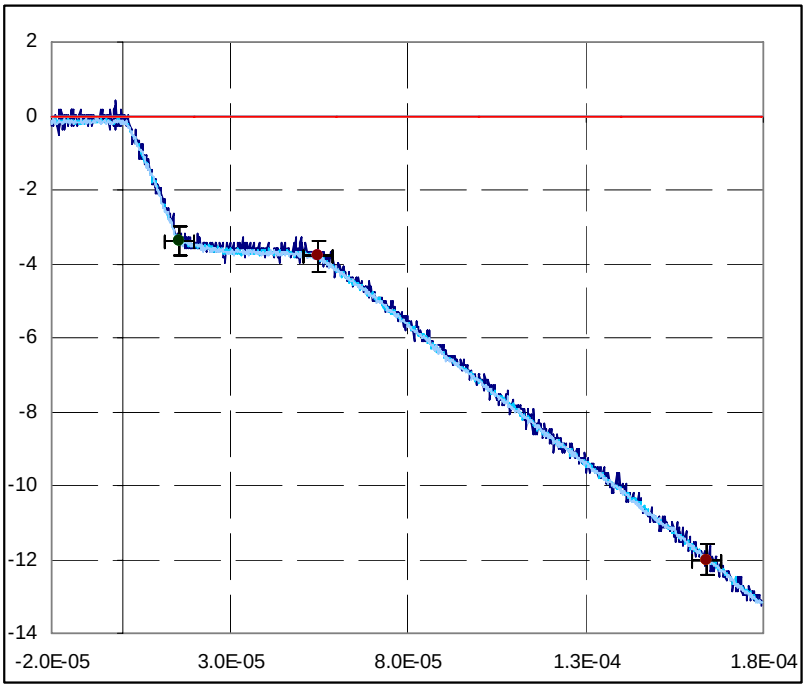


Figure 28

Gate charge waveforms

devices s/n34

Reference device

5 CONCLUSION

No catastrophic failures were observed up to 137.31 krad(Si). The parameter degradations induced by gamma radiation is summarized in Table 25, Table 26 and in Table 27.

Table 25 reports the total doses, recorded before and after the *out of limit* condition, aggregated by the bias condition applied, as described in Table 24:

Table 24 Bias condition descriptions

Bias Condition ID	Description	Irradiated s/n's
BC1	V_{DS} = 0V, V_{GS} = -15V	013, 014, 015, 016, 017
BC2	V_{DS} = -80V, V_{GS} = 0V	008, 009, 010, 011, 012
BC3	V_{DS} = 0V, V_{GS} = 0V	001, 002, 003, 004, 005
BC4	V_{DS} = -100V, V_{GS} = +20V	006, 007
BC5	V_{DS} = 0V, V_{GS} = -12V	018, 019

Table 25 TID levels, in [krad(Si)], before and after out of limit conditions per different BIAS conditions

nr.	Parameter	BC1		BC2		BC3		BC4		BC5	
		pass	*fail*	*pass*	*fail*	*pass*	*fail*	*pass*	*fail*	*pass*	*fail*
(a) 5	VGS_th @ I_D 0.01 mA	137	-	137	-	137	-	**70**	112	137	-
8	VGS_th @ I_D 1.00 mA	112	137	137	-	137	-	**70**	112	112	137
(a) 14	VDS(on) - D-S On-Voltage	137	-	137	-	137	-	112	137	137	-
17	Q_{GS} Gate – Source Charge	*limits in D.S. STRH40P10FSY3, issue 1, rev.B.: not defined*									
18	Q_{GD} Gate – Drain Charge										

(a) Parameter not listed in table 2.4.1. of Detail specification (draft status), STRH40P10FSY3 issue 1 rev.B.

Note that Table 25 lists only the parameters showing an "out of limit" condition (or not defined limits). Refer to Table 27 for a comprehensive description of the behaviour of all parameters.

Table 26 Detail of Failures

nr.	Parameter	Bias condition	Remarks	Table	Fig.
5	VGS_th @ I_D 0.01 mA	**BC4**	S/n's 006 and 007 pass at 70 krad(Si). Failures recovered after HT ageing.	10	8
8	VGS_th @ I_D 1.00 mA	**BC1**	S/n's 013, 014,015, 016 and 017 pass at 112 krad(Si). S/n's 013, 014 and 017 failures recovered after RT ageing. S/n 15 and s/n 16 failures recovered after HT ageing	13	11
		BC4	S/n's 006 and 007 pass at 70 krad(Si). Failures not recovered after HT ageing.		
		BC5	S/n's 018 and 019 pass at 112 krad(Si). Failures recovered after HT ageing.		
14	VDS(on) - D-S On-Voltage	**BC4**	S/n's 006 and 007 pass at 112 krad(Si). Failures recovered after HT ageing	19	17

All the degraded parameters, partially recovered during and after the annealing/ageing sequence.

The observations indicate the Gate Threshold Voltage V_{GSTH} @ 1mA most affected by the TID degradation. In Table 28 and Figure 29 are shown the normalized Gate Threshold Voltage Drift in [%] vs TID and anneal/ageing sequence.

Table 27 Summary of TID test results up to 137.31 krad(Si)

nr.	Parameter	Remarks	Worst Case Bias Condition	Table	Fig.
0	IGSS_F1	No evidence of TID dependence. No evidence of Bias condition dependence. All devices still within the limits.	n/a	5	3
1	IGSS_R1	No evidence of TID dependence. No evidence of Bias condition dependence. All devices still within the limits.	n/a	6	4
(b) 2	IDSS @ Vds 5V, Vgs 0V	Negligible TID dependence. Weak Bias condition dependence. All devices still within the limits.	n/a	7	5
3	IDSS @ Vds 80V, Vgs 0V	Weak TID dependence. Bias condition dependence. All devices still within the limits.	V_{DS}= –100V V_{GS}= +20V	8	6
4	IDSS @ Vds 100V, Vgs 0V	Weak TID dependence. Bias condition dependence. All devices still within the limits.	V_{DS}= –100V V_{GS}= +20V	9	7
(b) 5	VGS_th @ I_D 0.01 mA	Clear TID dependence. Bias condition dependence. Two devices found out of limits at 112krad.	V_{DS}= –100V V_{GS}= +20V	10	8
(a,b) 6	*VGS_th @ I_D 0.10 mA*	*Data not consistent (see page nr. 11)*		11	9
(a,b) 7	*VGS_th @ I_D 0.25 mA*			12	10
8	VGS_th @ I_D 1.00 mA	Clear TID dependence. Bias condition dependence. Two devices found out of limits at 112Krad. Seven more devices found out of limit at 137krad.	V_{DS}= –100V V_{GS}= +20V	13	11
(b) 9	V(BR)DSS @I_D=100uA	Negligible TID dependence. No evidence of Bias condition dependence. All devices still within the limits.	n/a	14	12
(b) 10	V(BR)DSS @I_D=250uA	Negligible TID dependence. No evidence of Bias condition dependence. All devices still within the limits.	n/a	15	13
(b) 11	V(BR)DSS @I_D=1mA	Negligible TID dependence. No evidence of Bias condition dependence. All devices still within the limits.	n/a	16	14
(c) 12	RDS(on) - D-S On-Resistance	Weak TID dependence. Weak Bias condition dependence. All devices still within the limits.	V_{DS}= –100V V_{GS}= +20V	17	15
13	VSD - Inverse Diode Fwd. Volt.	No evidence of TID dependence. No evidence of Bias condition dependence. All devices still within the limits.	n/a	18	16
(b) 14	VDS(on) - D-S On-Voltage	TID and Bias dependence mirrors RDS(on) trends. Two devices found out of limits at 137Krad.	V_{DS}= –100V V_{GS}= +20V	19	17
(b) 15	ID(on) - On-State Drain Current	Weak TID dependence (mirrors RDS on trends). Very weak Bias dependence . All devices still within the limits.	V_{DS}= –100V V_{GS}= +20V	20	18
16	Q_G Total Gate Charge	Weak TID dependence. Bias condition dependence. All devices still within the limits.	n/a	21	19
17	Q_{GS} Gate – Source Charge	Clear TID dependence. Clear Bias condition dependence.	Biased Gate	22	20
18	Q_{GD} Gate – Drain Charge	Clear TID dependence. Clear Bias condition dependence.	V_{DS}= –100V V_{GS}= +20V	23	21

(a) During the test campaign, a bug in the ATE software, affecting the measurement results for these parameters, was found.
(b) Parameter not listed in table 2.4.1. of Detail specification (draft status), STRH40P10FSY3 issue 1 rev.B.
(c) Test Conditions deviate from table 2.4.1. of (Detail specification (draft status), STRH40P10FSY3 issue 1 rev.B.) due to test equipment limitation.

Table 28 – V_{GS_th} @ I_{DS} 1.0 mA, Gate Threshold Voltage Drift from initial values [%] vs ^{60}Co Irradiation Total Dose [rad (Si)]

a) Bias Condition BC4 (V_{DS} -100V, V_{GS} +20V), detailed results - V_{GS_th} @ IDS 1.0 mA drift from Initial values in [%]

s/n	0	5002	12568	20379	30013	52776	70000	112578	137309	Annealing 7hrs RT	Annealing 22hrs RT	Annealing 161hrs RT	Ageing 168hrs 100'C
006	0.00%	5.52%	13.39%	21.20%	30.30%	51.84%	67.43%	103.3%	122.9%	122.03%	120.26%	113.37%	74.30%
007	0.00%	5.43%	13.21%	20.79%	29.31%	50.61%	65.71%	100.8%	119.2%	118.75%	117.02%	110.23%	71.74%
Avg	*0.00%*	*5.48%*	*13.30%*	*20.99%*	*29.81%*	*51.23%*	*66.57%*	*102.0%*	*120.8%*	*120.39%*	*118.64%*	*111.80%*	*73.02%*
St.dev	*0.00%*	*0.06%*	*0.13%*	*0.29%*	*0.70%*	*0.87%*	*1.21%*	*1.78%*	*2.35%*	*2.32%*	*2.29%*	*2.22%*	*1.81%*

b) Bias Condition BC5 (V_{DS} 0V, V_{GS} -12V), detailed results - V_{GS_th} @ IDS 1.0 mA drift from Initial values in [%]

s/n	0	5002	12568	20379	30013	52776	70000	112578	137309	Annealing 7hrs RT	Annealing 22hrs RT	Annealing 161hrs RT	Ageing 168hrs 100'C
018	0.00%	2.91%	8.13%	12.90%	18.18%	31.45%	40.73%	62.06%	75.33%	76.53%	76.13%	72.22%	46.53%
019	0.00%	2.84%	7.98%	12.41%	17.56%	30.74%	39.61%	60.37%	73.27%	74.44%	74.02%	70.17%	46.57%
Avg	*0.00%*	*2.87%*	*8.05%*	*12.65%*	*17.87%*	*31.10%*	*40.17%*	*61.22%*	*74.30%*	*75.49%*	*75.07%*	*71.19%*	*46.55%*
St.dev	*0.00%*	*0.05%*	*0.11%*	*0.35%*	*0.44%*	*0.50%*	*0.79%*	*1.20%*	*1.46%*	*1.48%*	*1.49%*	*1.44%*	*0.03%*

c) Bias Condition BC1 (V_{DS} 0V, V_{GS} -15V), detailed results - V_{GS_th} @ IDS 1.0 mA drift from Initial values in [%]

s/n	0	5002	12568	20379	30013	52776	70000	112578	137309	Annealing 7hrs RT	Annealing 22hrs RT	Annealing 161hrs RT	Ageing 168hrs 100'C
013	0.00%	3.28%	8.22%	12.58%	17.80%	30.71%	39.92%	60.86%	73.81%	74.88%	74.14%	70.18%	44.65%
014	0.00%	3.09%	7.90%	12.02%	17.04%	29.39%	38.29%	58.14%	70.40%	71.66%	70.92%	67.04%	42.29%
015	0.00%	3.19%	7.97%	12.29%	17.34%	29.61%	38.43%	58.71%	71.54%	72.32%	71.89%	67.71%	42.54%
016	0.00%	2.80%	7.64%	11.80%	16.53%	28.77%	37.36%	57.15%	69.54%	70.32%	69.80%	66.07%	42.27%
017	0.00%	3.14%	7.93%	12.19%	17.46%	30.13%	39.00%	59.93%	72.45%	73.43%	73.02%	69.17%	44.34%
Min	*0.00%*	*2.80%*	*7.64%*	*11.80%*	*16.53%*	*28.77%*	*37.36%*	*57.15%*	*69.54%*	*70.32%*	*69.80%*	*66.07%*	*42.27%*
Max	*0.00%*	*3.28%*	*8.22%*	*12.58%*	*17.80%*	*30.71%*	*39.92%*	*60.86%*	*73.81%*	*74.88%*	*74.14%*	*70.18%*	*44.65%*
Avg	*0.00%*	*3.10%*	*7.93%*	*12.17%*	*17.23%*	*29.72%*	*38.60%*	*58.96%*	*71.55%*	*72.52%*	*71.96%*	*68.04%*	*43.22%*
St.dev	*0.00%*	*0.18%*	*0.20%*	*0.29%*	*0.48%*	*0.74%*	*0.94%*	*1.47%*	*1.68%*	*1.73%*	*1.71%*	*1.65%*	*1.17%*

–< Continued >–

Table 28 – V_{GS_th} @ I_{DS} 1.0 mA, Gate Threshold Voltage Drift from initial values [%] vs ^{60}Co Irradiation Total Dose [rad (Si)]

d) Bias Condition BC2 (V_{DS} -80V, V_{GS} 0V), detailed results - V_{GS_th} @ IDS 1.0 mA drift from Initial values in [%]

s/n	0	5002	12568	20379	30013	52776	70000	112578	137309	Annealing 7hrs RT	Annealing 22hrs RT	Annealing 161hrs RT	Ageing 168hrs 100'C
008	0.00%	2.86%	5.74%	8.46%	11.05%	17.52%	21.22%	28.63%	32.63%	33.49%	33.18%	30.97%	20.34%
009	0.00%	2.61%	5.87%	8.52%	11.16%	17.40%	20.98%	28.70%	32.75%	33.62%	33.14%	31.10%	18.53%
010	0.00%	2.58%	5.79%	8.53%	11.10%	17.23%	20.72%	28.59%	32.59%	33.28%	32.75%	30.74%	17.89%
011	0.00%	2.12%	5.96%	8.34%	11.04%	17.14%	20.59%	28.20%	32.25%	32.93%	32.67%	30.65%	18.02%
012	0.00%	2.61%	6.18%	8.92%	11.56%	17.87%	21.70%	29.60%	33.98%	34.63%	34.48%	32.04%	18.49%
Min	*0.00%*	*2.12%*	*5.74%*	*8.34%*	*11.04%*	*17.14%*	*20.59%*	*28.20%*	*32.25%*	*32.93%*	*32.67%*	*30.65%*	*17.89%*
Max	*0.00%*	*2.86%*	*6.18%*	*8.92%*	*11.56%*	*17.87%*	*21.70%*	*29.60%*	*33.98%*	*34.63%*	*34.48%*	*32.04%*	*20.34%*
Avg	*0.00%*	*2.56%*	*5.91%*	*8.56%*	*11.18%*	*17.43%*	*21.04%*	*28.74%*	*32.84%*	*33.59%*	*33.24%*	*31.10%*	*18.65%*
St.dev	*0.00%*	*0.27%*	*0.18%*	*0.22%*	*0.22%*	*0.29%*	*0.44%*	*0.52%*	*0.66%*	*0.64%*	*0.73%*	*0.56%*	*0.98%*

e) Bias Condition BC3 (V_{DS} 0V, V_{GS} 0V), detailed results - V_{GS_th} @ IDS 1.0 mA drift from Initial values in [%]

s/n	0	5002	12568	20379	30013	52776	70000	112578	137309	Annealing 7hrs RT	Annealing 22hrs RT	Annealing 161hrs RT	Ageing 168hrs 100'C
001	0.00%	2.44%	5.97%	8.03%	10.74%	16.73%	20.20%	28.10%	31.72%	32.50%	32.20%	30.19%	17.40%
002	0.00%	2.43%	5.66%	8.43%	10.75%	16.86%	20.06%	27.68%	31.89%	32.68%	32.03%	30.00%	17.94%
003	0.00%	2.43%	5.82%	8.27%	10.84%	16.73%	20.16%	28.15%	31.85%	32.58%	32.33%	30.03%	17.07%
004	0.00%	2.40%	5.75%	8.18%	10.61%	16.84%	19.89%	27.71%	31.45%	32.10%	31.88%	29.65%	18.03%
005	0.00%	2.40%	5.81%	8.24%	10.76%	16.78%	20.28%	27.83%	31.88%	32.66%	32.17%	30.28%	18.36%
Min	*0.00%*	*2.40%*	*5.66%*	*8.03%*	*10.61%*	*16.73%*	*19.89%*	*27.68%*	*31.45%*	*32.10%*	*31.88%*	*29.65%*	*17.07%*
Max	*0.00%*	*2.44%*	*5.97%*	*8.43%*	*10.84%*	*16.86%*	*20.28%*	*28.15%*	*31.89%*	*32.68%*	*32.33%*	*30.28%*	*18.36%*
Avg	*0.00%*	*2.42%*	*5.80%*	*8.23%*	*10.74%*	*16.79%*	*20.12%*	*27.90%*	*31.76%*	*32.50%*	*32.12%*	*30.03%*	*17.76%*
St.dev	*0.00%*	*0.02%*	*0.12%*	*0.14%*	*0.08%*	*0.06%*	*0.15%*	*0.22%*	*0.18%*	*0.24%*	*0.17%*	*0.24%*	*0.52%*

f) Reference device:

	0	1	2	3	4	5	6	7	8	9	10	11	12
034	0.00%	-0.66%	0.20%	-0.12%	-0.38%	-0.03%	-0.28%	-0.74%	-0.54%	0.25%	0.36%	-0.45%	-0.17%

VGS_th @ IDS 1.0 mA, Gate Threshold Voltage Drift from initial values [%] vs 60Co Irradiation Total Dose [rad (Si)]

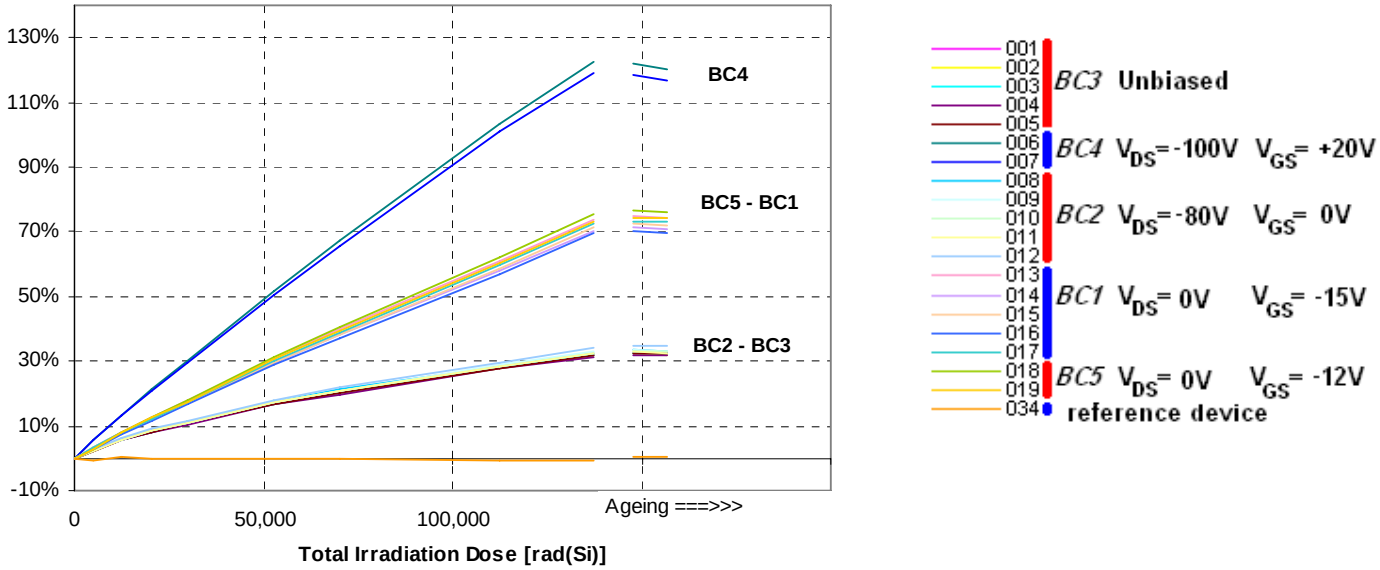


Figure 29