IRRADIATION TEST REPORT: 1010TR20a

Total Induced Dose Characterization of Power MOSFETs
BUY25CS and BUY10CS family

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1. SCOPE

This Test Report describes Total Induced Dose (TID) tests and results of radiation-hardened power MOSFETs from Infineon Technologies, types BUY25CS12J and BUY25CS54A, in accordance to ESCC Basic Spec 22900.

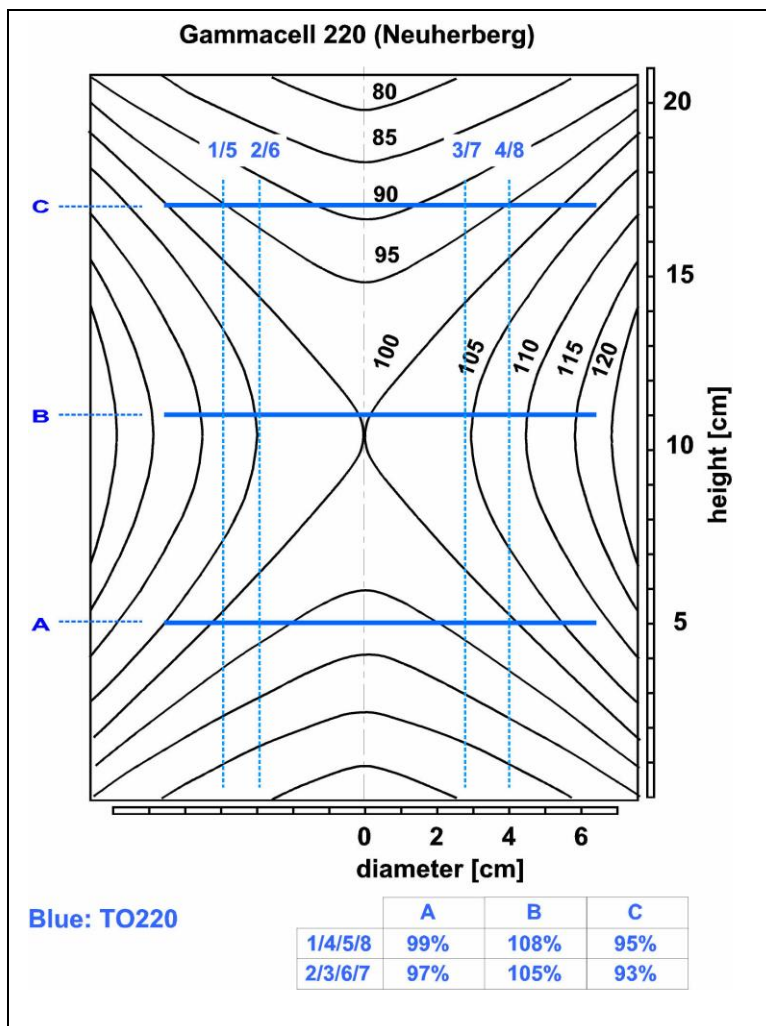
Tests have been performed at the facility Gammacell 1 of Helmholtz-Center, Department of Radiation Sciences, Munich-Neuherberg, Germany, week 29, 2011.

Test Plan (A63500-TID-TP01-*-76K5) for these tests have been established and reviewed by ESA and gives details on Sample preparation and test set-up.

2 IRRADIATION FACILITY

The Co60 Source "GAMMACELL 1" is a facility at the Helmholtz-Centre, Department of Radiation Sciences, Munich-Neuherberg, Germany.

Dose rate varies by +/-20% within the irradiation chamber. However, sample placement is such that position-dependent dose rate variation is from 93% to 108%, therefore, stays within +/-10% of nominal (fig. 4)



	A	B	C
1/4/5/8	99%	108%	95%
2/3/6/7	97%	105%	93%

Fig. 4: Gamma intensity within Co60 irradiation chamber. Samples are positioned in levels A-C at defined locations #1-8, indicated by vertical lines. The table gives the position-dependent intensity with respect to nominal 100%.

3 EXPERIMENTAL DETAILS

3.1 Sample Placement and Sample Size

Tab. 1 shows the individual placement of the devices including unirradiated control devices. Refer to fig. 4 for details of radiation exposure in Positions 1-8.

3.2 Irradiation Conditions

Dose rate: 127 Gy/h (Oct 2011, see note 1)

TID: >2400Gy on all parts (see note 2)

Bias: UGS= +15V; UDS = 0 V

Notes:

1. Dose rate performance of the source is updated monthly and recorded in the test report.
2. Position-dependence of dose rate is accounted for to achieve target dose on all parts.

3.3 Pre- and Post-Irradiation Tests

The following parameters will be measured for test sample type BUY25CS12J (SMD05):

- IDSS(200V),
- IGSS(+/-20V),
- RDSON(8A, Ugs=10V),
- VSD(12.4A),
- Vgs(th)(1mA),
- BVDSS (0.25mA).

The following parameters will be measured for test sample type BUY25CS54A (SMD2):

- IDSS(200V),
- IGSS(+/-20V),
- RDSON(34A, Ugs=10V),
- VSD(54A),
- Vgs(th)(1mA),
- BVDSS (0.25mA).

4. RADIATION EXPOSURE AND TEST SEQUENCE

Irradiation- anneal- and characterization steps according to the *FLOW CHART FOR QUALIFICATION TESTING* of Basic Specifications ESCC22900.

1. Sample serialization
2. Electrical pre-test according to ***3.3***.
3. Irradiation with a dose rate of 130 Gy/h for a dose of >2400Gy, in one irradiation step,
4. Transport of samples, cooled to -23°C from irradiation site to electrical characterization site.
5. Parameter measurements according to ***3.3.***
6. Room temperature anneal for 24 hours under bias of UGS=+10V (UDS=0V), followed by parameter measurements according to ***3.3***.
7. Accelerated aging under bias of UGS=+10V (UDS=0V): 168 hours at 100°C.
8. Electrical post-rad/post anneal test, according to ***3.3***.

5. TEST RESULTS

In the following, each of the electrically parameters listed in 3.3 is plotted for four points of the testing sequence, i.e.

1. Prior to irradiation (pre-rad)
2. Post-irradiation (post-rad 2400Gy)
3. Posterior to room-temperature anneal of 24 hours at UGS=+10 V/UDS=0 V (anneal 24h)
4. Posterior to 168 hours of anneal at 100°C at UGS=+10 V/UDS=0 V (anneal 168h)

Two groups of graphs are given coded by line-color (see tab. 1 and tab. 2):

1. Unirradiated control (reference) devices (legend: ***Reference*** in BLUE)
2. Irradiated devices (legend: ***TID*** in BLACK)

5.1 BUY25CS12J (SMD05)

BUY25CS12J-01 / L5490B / SMD05

REF/TID {5/6}

2:VGSTH [V]

4.0
3.5
3.0
2.5
2.0

pre-rad post-rad 2400Gy anneal 24h anneal 168h

REF/TID {5/6}

3:IGSS20 [pA]

300
200
100
0

pre-rad post-rad 2400Gy anneal 24h anneal 168h

REF/TID {5/6}

4:IGSS-20 [nA]

0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0

pre-rad post-rad 2400Gy anneal 24h anneal 168h

REF/TID {5/6}

5:IDSS_80% [nA]

1000.0
100.0
10.0
1.0
0.1

pre-rad post-rad 2400Gy anneal 24h anneal 168h

REF/TID {5/6}

6:BVDSS [V]

286
285
284
283
282
281

pre-rad post-rad 2400Gy anneal 24h anneal 168h

REF/TID {5/6}

10:RO10 [mOhm]

129
124
119
114
109

pre-rad post-rad 2400Gy anneal 24h anneal 168h

REF/TID {5/6}

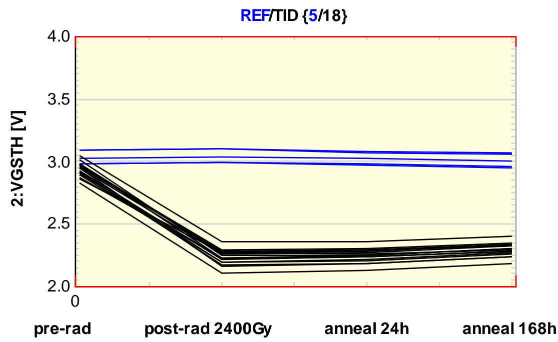
10:VSD [V]

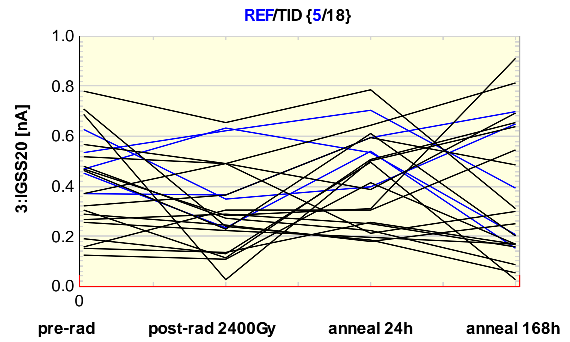
0.9305
0.928
0.9255
0.923
0.9205
0.918

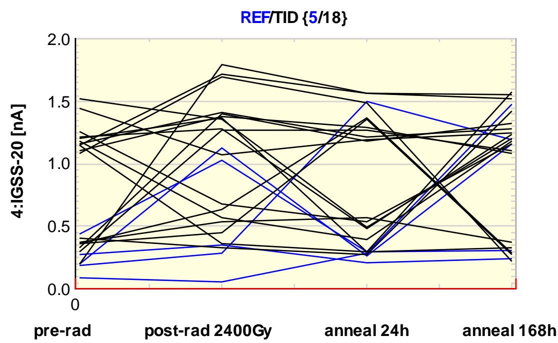
pre-rad post-rad 2400Gy anneal 24h anneal 168h

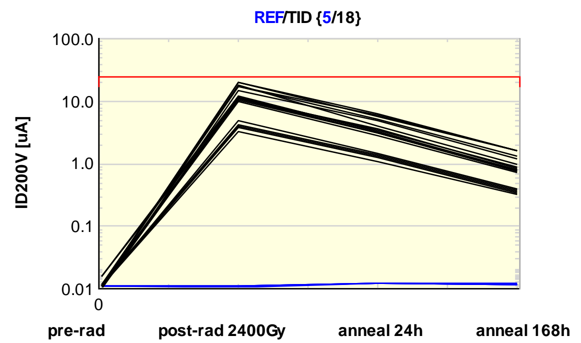
5.2 BUY25CS54A (SMD2):

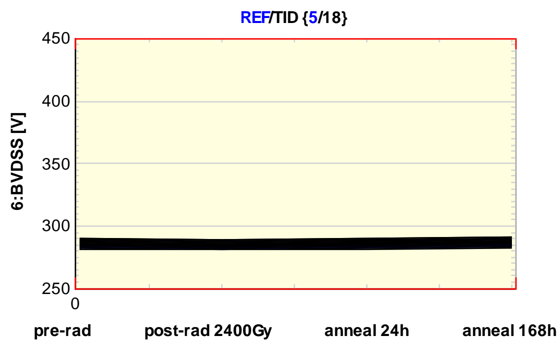
BUY25CS54A-01 / L5491A / SMD2

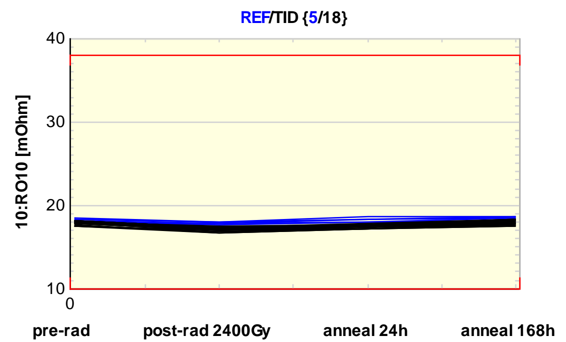


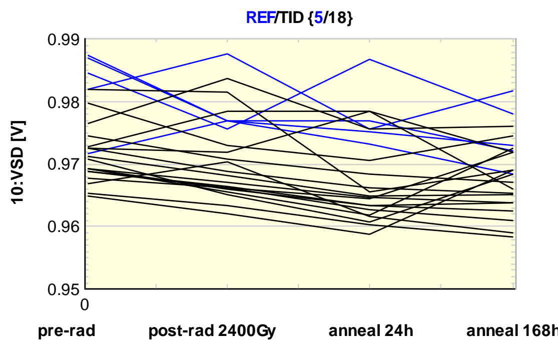












6. Summary of this Report

FE Wafer Lot	Wafer	Ass-Lot / SN	Package	Board/Pos	Comment
VE106719	07	1116.02#36-41	SMD05	C/3-C/8	Pass & released
VE115865	21	1124.01#172-174	SMD2	B/4 – B/6	Pass & released
VE115865	23	1124.02#177, 178	SMD2	B/7, B/8	Pass & released
VE115865	24	1124.03#180, 181	SMD2	C/1, C/2	Pass & released
VE127506	02	1136.03#185, 186	SMD2	A/1, A/2	Pass & released
VE127506	04	1136.03#187	SMD2	A/3	Pass & released
VE127506	05	1136.03#188	SMD2	A/4	Pass & released
VE127506	06	1136.03#189	SMD2	A/5	Pass & released
VE127506	07	1136.03#190	SMD2	A/6	Pass & released
VE127506	18	1136.03#191, 192	SMD2	A/7, A/8	Pass & released
VE127506	21	1136.03#194	SMD2	B/1	Pass & released
VE127506	22	1136.03#195	SMD2	B/2	Pass & released
VE127506	24	1136.03#196	SMD2	B/3	Pass & released
VE106719	07	1116.02#68-70	SMD05	-	Reference
VE106719	07	1116.03#119, 120	SMD05		Reference
VE112380	02	1116.04#98, 99	SMD2		Reference
VE112380	05	1116.06#163-165	SMD2		Reference

Table 1: List of irradiated and unirradiated Devices