

IRRADIATION TEST REPORT: 1544TR10

**Total Induced Dose Characterization of Power MOSFETs**

**\*\*BUY25CS45B\*\***

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## 1. SCOPE

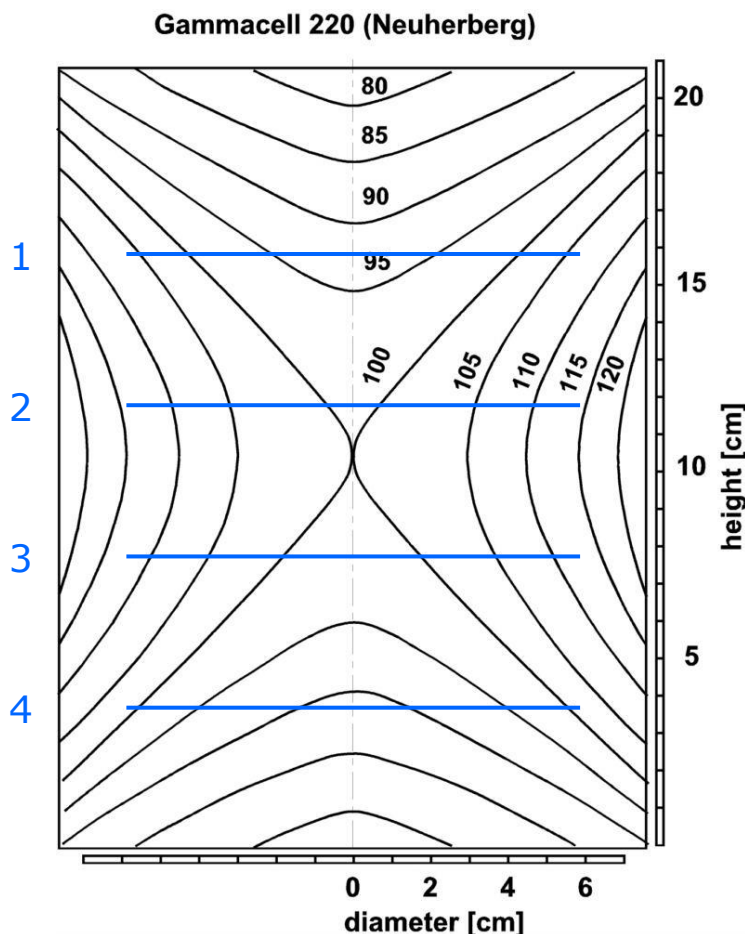
This Test Report describes Total Induced Dose (TID) tests and results of radiation-hardened power MOSFETs from Infineon Technologies, types BUY25CS45B, in accordance to ESCC Basic Spec 22900.

Tests have been performed at the facilities Gammacell 1 of Helmholtz-Center, Department of Radiation Sciences, Munich-Neuherberg, Germany, week 3, 2016.

## 2 IRRADIATION FACILITIES

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 85 % to 110 %, therefore, stays within +/-15 % of nominal (Fig. 1)



**Fig. 1:** Gamma intensity within Co60 irradiation chamber. Samples are positioned in levels 1-4 at defined locations.

### 3. EXPERIMENTAL DETAILS

#### 3.1 Sample Placement and Sample Size

Tab. 1 shows the individual placement of the devices and the local radiation exposure. The dies are mounted on a PCB.

#### 3.2 Irradiation Conditions

Dose rate: 72,4 Gy/h (Jan 2016, see note 1)

TID: >1000 Gy on all parts (see note 2)

Bias: C1: UGS= +20 V; UDS = 0 V

C2: UGS= - 20 V; UDS = 0 V

C3: UGS= 0 V; UDS = +250 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 BUY25CS45B:

- IDSS(200 V),
- IGSS(+/-20 V),
- RDSON(29 A, Ugs=10 V),
- VSD(45 A),
- Vgs(th)(1 mA),
- BVDSS (0.25 mA).

#### 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 72,4 Gy/h for a dose of >1000Gy, 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 same bias conditions as during TID, followed by parameter measurements according to **3.3**
7. Accelerated aging under same bias conditions as during TID: 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 (see Fig.2), i.e.

1. Prior to irradiation (pre-rad)
2. Post-irradiation (post-rad 1000Gy)
3. Posterior to room-temperature anneal of 24 hours under same bias conditions as during TID (anneal 24h)
4. Posterior to 168 hours of anneal at 100°C under same bias conditions as during TID (anneal 168h)

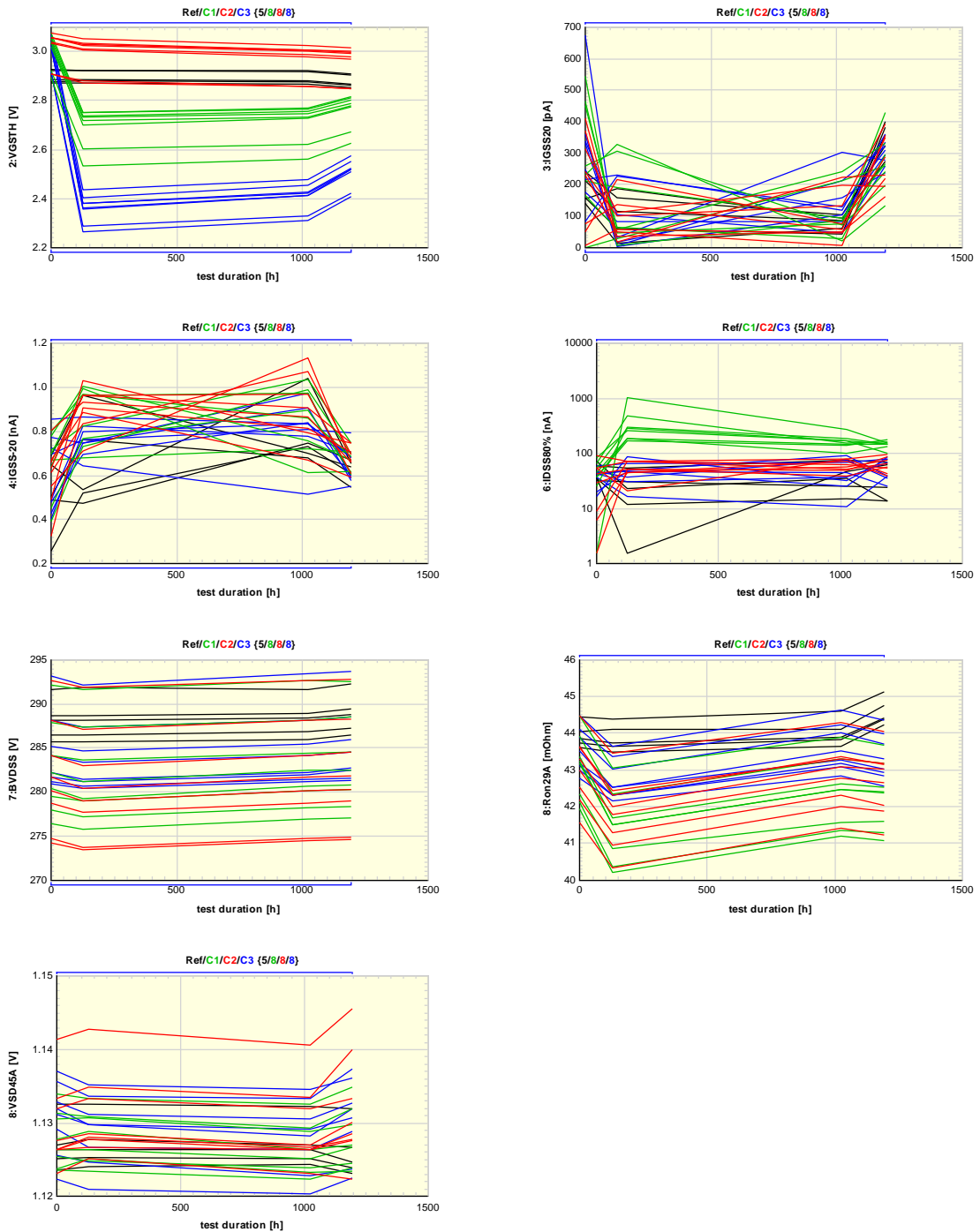
Four groups of graphs are given coded by line-color (see Table 1):

1. Reference samples (black)
2. C1: UGS= +20 V; UDS = 0 V (green)
3. C2: UGS= - 20 V; UDS = 0 V (red)
4. C3: UGS= 0 V; UDS = +250 V (blue)

**Total Induced Dose Test on Infineon Rad-Hard MOSFETs Type BUY25CS45B**  
 February 8th, 2016



BUY25CS45B / L5471A / PCB



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**Fig. 2:** Plot of TID test results for BUY25CS45B

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**6. SUMMARY**

SN	FE Wafer Lot	Wafer	Bias Condition	VGS	VDS	Level	Intensitiy [%]	Result
1544AK#115	VE519979	09	C1	+20	0	3	105	pass
1544AK#116	VE519979	09	C2	-20	0	4	95	pass
1544AK#117	VE519979	09	C3	0	250	2	105	pass
1544AK#118	VE519979	09	C1	+20	0	3	100-105	pass
1544AK#119	VE519979	09	C2	-20	0	4	90-95	pass
1544AK#120	VE519979	09	C3	0	250	2	100-105	pass
1544AK#121	VE519979	10	C1	+20	0	3	100	pass
1544AK#122	VE519979	10	C2	-20	0	4	90	pass
1544AK#123	VE519979	10	C3	0	250	2	105	pass
1544AK#124	VE519979	10	C1	+20	0	3	95-100	pass
1544AK#125	VE519979	10	C2	-20	0	4	85-90	pass
1544AK#126	VE519979	10	C3	0	250	2	105-110	pass
1544AK#127	VE519979	12	C1	+20	0	3	100	pass
1544AK#128	VE519979	12	C2	-20	0	4	90	pass
1544AK#129	VE519979	12	C3	0	250	2	110	pass
1544AK#130	VE519979	12	C1	+20	0	3	100-105	pass
1544AK#131	VE519979	12	C2	-20	0	4	90-95	pass
1544AK#132	VE519979	12	C3	0	250	2	110	pass
1544AK#133	VE519979	13	C1	+20	0	3	105	pass
1544AK#134	VE519979	13	C2	-20	0	4	95	pass
1544AK#135	VE519979	13	C3	0	250	2	105-110	pass
1544AK#136	VE519979	13	C1	+20	0	3	110	pass
1544AK#137	VE519979	13	C2	-20	0	4	95-100	pass
1544AK#138	VE519979	13	C3	0	250	2	100-105	pass
1544AK#139	VE519979	13	-	-	-	-	-	reference
1544AK#140	VE519979	13	-	-	-	-	-	reference
1544AK#141	VE519979	13	-	-	-	-	-	reference
1544AK#142	VE519979	13	-	-	-	-	-	reference
1544AK#143	VE519979	13	-	-	-	-	-	reference

**Table 1:** List of irradiated and unirradiated Devices