

<b>Infineon</b> technologies  <b>HiRel Discrete &amp; MW Semiconductors</b>	ESCC Comp. No.: 520502701R	Page: 1
	Wafer Lot: VE618466	Rep.No.: BUY25SR19 Issue: Iss. 1, Nov 2019
	<b>Single Event Effect Test Report</b> <b>BUY25CS family</b>	

## §1 COVER SHEET

### • Component and Test Identification

<b>Comp. Type</b>	BUY25CS54A-01(ES)
<b>ESCC Comp. No.</b>	520502701R
<b>Lot Ident.</b>	Wafer Lot No. VE618466
	Radiation Testing Level R: 100kRad
<b>Test data</b>	Test Plan TPIFX1522A
	Tested Sample Serial No.s 401-403
	Control Sample Serial No.s R404-R406

### • Applicability of Test Results

<b>Comp. Types</b>	BUY25CS12J-01(ES) BUY25CS04J-01(ES) BUY25CS54A-01(ES) BUY25CS12K-01(ES) BUY25CS12K-11(ES) BUY25CS45B-01(ES)
<b>ESCC Comp. Nos.</b>	520502601R 520502602R 520502701R 52050301R 52050302R 52050303R

### • Applicable Documents

<b>Detail Specification</b>	ESCC 5205/027 Issue 2, Apr 2014
<b>Generic Specification</b>	ESCC 5000 Issue 8, Jun. 2019
<b>Process Identification Document</b>	A63500-L5491-P000_Detail_PID_BUY25CS_8
<b>Irradiation Specification</b>	ESCC Basic Specification No. 25100 Iss. 2, Oct 2014

### • Manufacturer / Facility

<b>Silicon Die</b>	Infineon Technologies Austria AG Siemensstrasse 2, 9500 Villach, Austria
<b>Assembly &amp; Testing</b>	Infineon Technologies AG Am Campeon 1-15, D 85579 Neubiberg, Germany

### • Report Issue, Date / Manufacturers Signatures

Iss. 1, Nov 2019

Total Number of Pages: 7

Process	Department	Name	Signatures
Chip Assembly	PMM RFS D HIR	M. Kirsch	
Test Management	PMM RFS D HIR	D. Schwertberger	
Project Management	PMM RFS D HIR	Dr. T. Chirila	
HiRel Management	PMM RFS D HIR	Dr. B. Eisener	



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### §3 SCOPE AND TEST INFORMATION

This Test Report describes Single Event Effects (SEE) tests and results of radiation-hardened power MOSFETs from Infineon Technologies, types BUY25CS54A-01(ES). This test report applies to all BUY25CS power MOSFET family.

Test campaign SEE 6 has been performed at the facility CYCLONE in Louvain-la-Neuve, Belgium on the 28.8.2019.

As ordered, an extended data package is part of this report. Therefore read and record data from the electrical measurements of the tested and control samples is given in §7.5 of this report.

### §4 HEAVY ION IRRADIATION FACILITY

CYCLONE at UCL Louvain-la-Neuve is a cyclotron capable of providing a “cocktail” of heavy ions with about the same M/Q ratio. From a HIF cocktail  $^{124}\text{Xe}$  (35+ charge state) are selected with an energy of 995 MeV yielding in silicon an LET = 62.5 MeVcm<sup>2</sup>/mg and a stopping range of 73.1 µm (which is more than the depth of the active area <50 µm).

The test boards are mounted within a vacuum chamber with feedthroughs for electrical bias and signals. The ion beam is positioned on the device under test.

The homogeneity is ± 10 % on a 25 mm diameter. Control of beam homogeneity and dosimetry as well as beam operation is the responsibility of ion beam provider.

### §5 DEVICES MARKINGS AND SAMPLE PREPARATION

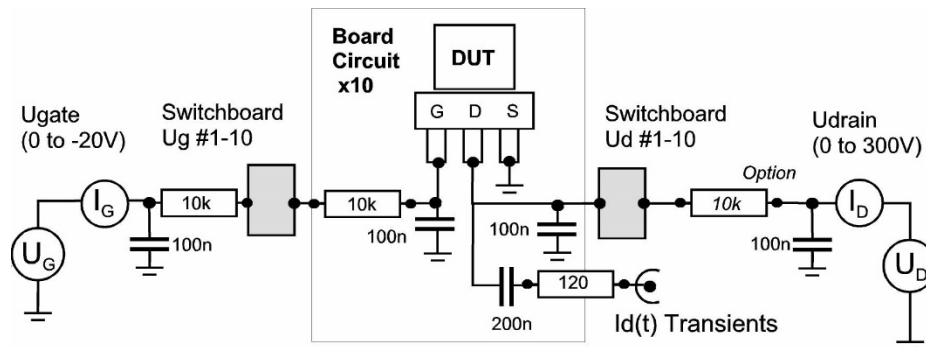
In order to contact devices with the test sockets on bias boards, chips have been soldered with AuZn solder material and bonded with 125µm Al wires to respective 3-pin PCB-TO-adaptor boards to connect Gate/Drain/Source contacts of the MOSFETs.

Devices' numbers are written on the PCB with a permanent marker. The number correlates in the sample list to the lot and wafer number.

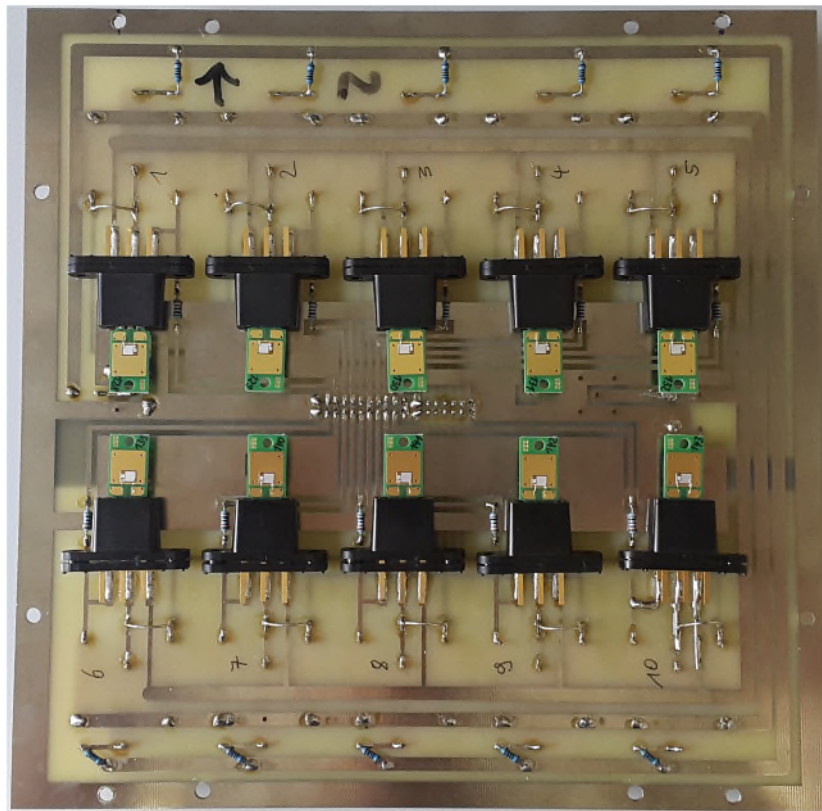
### §6 TEST SETUP

The test board was designed to accommodate up to 10 test samples, each consisting of an individual bias circuit (fig. 1). This test board (fig. 2) was fixed to the mechanical positioning stage provided at the Louvain/GANIL beam line. All voltages UDS and UGS were provided via a flat band cable from a switch board.

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**Fig. 1** Bias circuit for SEE tests



**Fig. 2:** Test-Board with 10 positions with TO test sockets. Separate bias of UDS and UGS for each device. Flat-band connector on back side.

As a voltage source for UDS and for ID current measurements a Keithley 237 High Voltage Measurement Unit has been employed. Gate voltage UGS and measurement of IG are provided by a Keithley 236 Source Measure Unit.

Voltages were set via computer software as were all recordings of run number, time, and sample number. All current readings, specifically PIGS currents, are logged.

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## §7 IRRADIATION TEST SEQUENCE

### §7.1 BEAM PARAMETERS AND TEST CRITERIA FOR ALL TESTS

- Ion Type  $^{124}\text{Xe}^{35+}$
- LET 62.5 MeVcm<sup>2</sup>/mg
- Flux 3E+3 ions/cm<sup>2</sup>/s
- Fluence 3E+5 ions/cm<sup>2</sup>
- Normal incidence of ion beam
- Destructive mode. FAIL current criteria: IDS>2 µA or IGS>100 nA.
- Required number of test samples per test case: 1(for FAIL)/3(for PASS)
- Post Irradiation Gate Stress (PIGS) test at any UDS (at respective UDS, UGS down to -25V, in steps of -5V). FAIL criteria: either IDS or IGS>100nA

### §7.2 TEST BIAS SEQUENCE FOR SEB-SOA

UGS: 0 V

UDS: Start at nominal maximum rated UDS. If *FAIL* occurs UDS is stepped-down by 10V until *PASS*.

### §7.3 TEST BIAS SEQUENCE FOR SEGR-SOA

UGS: negative, starting at -5 V, steps of -5 V.

UDS: Start at maximum UDS at which *PASS* value was obtained for previous UGS-test sequence (or UGS=0V). If *FAIL* occurs UDS is stepped-down by 10V until *PASS*.

### §7.4 DETAILS OF TEST RUNS

Date/Time	Test Run No.	Board Position	Sample No.	Flux [1/cm <sup>2</sup> /s]	Fluence [1/cm <sup>2</sup> ]	Acc. Dose [krad]	UDS [V]	UGS [V]	PIGS pass/fail	Remarks
28.08.2019 01:36	1	1	401	3000	3.00E+05	0.30	250	0	pass	
28.08.2019 01:43	2					0.60	250	-5	pass	
28.08.2019 01:47	3					0.90	250	-10	pass	
28.08.2019 01:49	4					1.20	250	-15	pass	
28.08.2019 01:53	5					1.50	160	-20	pass	
28.08.2019 01:57	6	2	402	3000	3.00E+05	0.30	250	0	pass	
28.08.2019 02:00	7					0.60	250	-5	pass	
28.08.2019 02:02	8					0.91	250	-10	pass	
28.08.2019 02:05	9					1.21	250	-15	pass	
28.08.2019 02:07	10					1.51	160	-20	pass	
28.08.2019 02:10	11					1.81	170	-20	pass	
28.08.2019 02:17	12					2.11	260	0	pass	
28.08.2019 02:20	13	3	403	3000	3.00E+05	0.30	250	0	pass	
28.08.2019 02:22	14					0.60	250	-5	pass	
28.08.2019 02:24	15					0.90	250	-10	pass	
28.08.2019 02:27	16					1.20	250	-15	pass	
28.08.2019 02:29	17					1.51	160	-20	pass	

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## §7.5 READ AND RECORD DATA OF ELECTRICAL MEASUREMENTS

This documentation contains the data from all tested parts and control samples.

### §7.5.1 INITIAL MEASUREMENTS

S/N	V(BR)DSS [V]	VGS(th) [V]	IGSS [nA]	IGSS- [nA]	IDSS [uA]	RDS(ON) [mOhm]	VSD [V]	Remarks
min	250	2						
max		4	100	100	25	30	1.2	
401	291	2.98	0.8	2.5	0.009	24.6	1.160	
402	291	2.99	0.8	2.0	0.009	24.7	1.179	
403	292	2.99	0.8	1.9	0.009	24.8	1.183	
R404	293	2.99	0.9	2.0	0.009	24.6	1.184	
R405	293	2.98	0.8	2.0	0.009	24.6	1.180	
R406	293	2.98	0.8	2.0	0.009	24.6	1.174	

### §7.5.2 ELECTRICAL MEASUREMENTS AFTER IRRADIATION

S/N	V(BR)DSS [V]	VGS(th) [V]	IGSS [nA]	IGSS- [nA]	IDSS [uA]	RDS(ON) [mOhm]	VSD [V]	Remarks.
min	250	2						
max		4	100	100	25	30	1.2	
401	291	2.99	1.5	4.2	0.005	24.5	1.163	
402	291	3.00	1.6	4.2	0.005	24.6	1.181	
403	291	3.00	1.7	4.6	0.005	24.7	1.185	
R404	292	3.00	1.7	4.5	0.003	24.5	1.186	
R405	293	2.99	1.6	4.2	0.003	24.4	1.180	
R406	292	2.99	1.5	4.8	0.003	24.5	1.176	

## §8 GRAPHICAL SEE-SOA

