

Infineon technologies HiRel Discrete & MW Semiconductors	ESCC Comp. No.: 520503102R	Page: 1
	Wafer Lot: VE542630	Rep.No.: BUY15SR19 Issue: Iss. 1, Nov 2019
	Single Event Effect Test Report BUY15CS family	

§1 COVER SHEET

• Component and Test Identification

Comp. Type	BUY15CS57A-01(ES)
ESCC Comp. No.	520503102R
Lot Ident.	Wafer Lot No. VE542630
	Radiation Testing Level R: 100kRad
Test data	Test Plan TPIFX1522A
	Tested Sample Serial No.s 413-417
	Control Sample Serial No.s R418-R420

• Applicability of Test Results

Comp. Types	BUY15CS23J-01(ES) BUY15CS57A-01(ES) BUY15CS23K-01(ES) BUY15CS45B-01(ES)
ESCC Comp. Nos.	520503101R 520503102R 520503103R 520503104R

• Applicable Documents

Detail Specification	ESCC 5205/031 Issue 1, May 2016
Generic Specification	ESCC 5000 Issue 8, Jun. 2019
Process Identification Document	A63500-L5491-P000_Detail_PID_BUY25CS_8
Irradiation Specification	ESCC Basic Specification No. 25100 Iss. 2, Oct 2014

• Manufacturer / Facility

Silicon Die	Infineon Technologies Austria AG Siemensstrasse 2, 9500 Villach, Austria
Assembly & Testing	Infineon Technologies AG Am Campeon 1-15, D 85579 Neubiberg, Germany

• Report Issue, Date / Manufacturers Signatures

Iss. 1, Nov 2019

Total Number of Pages: 8

Process	Department	Name	Signatures
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Project Management	PMM RFS D HIR	Dr. T. Chirila	
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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 BUY15CS57A-01(ES). This test report applies to all BUY15CS power MOSFET family.

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

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}Xe (35+ charge state) are selected with an energy of 995 MeV yielding in silicon an LET = 62.5 MeVcm²/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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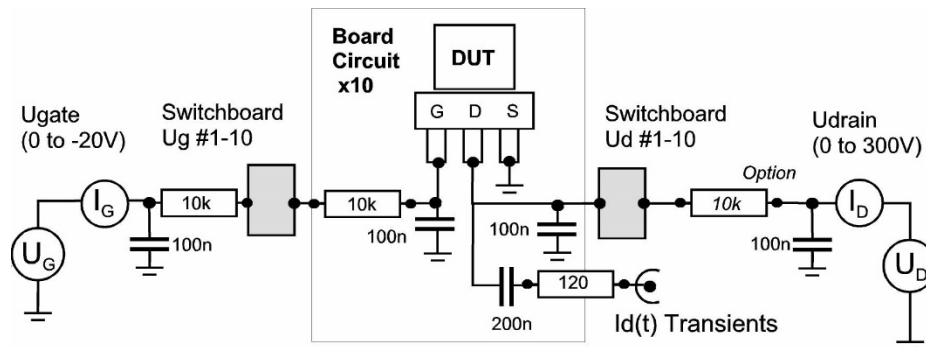


Fig. 1 Bias circuit for SEE tests

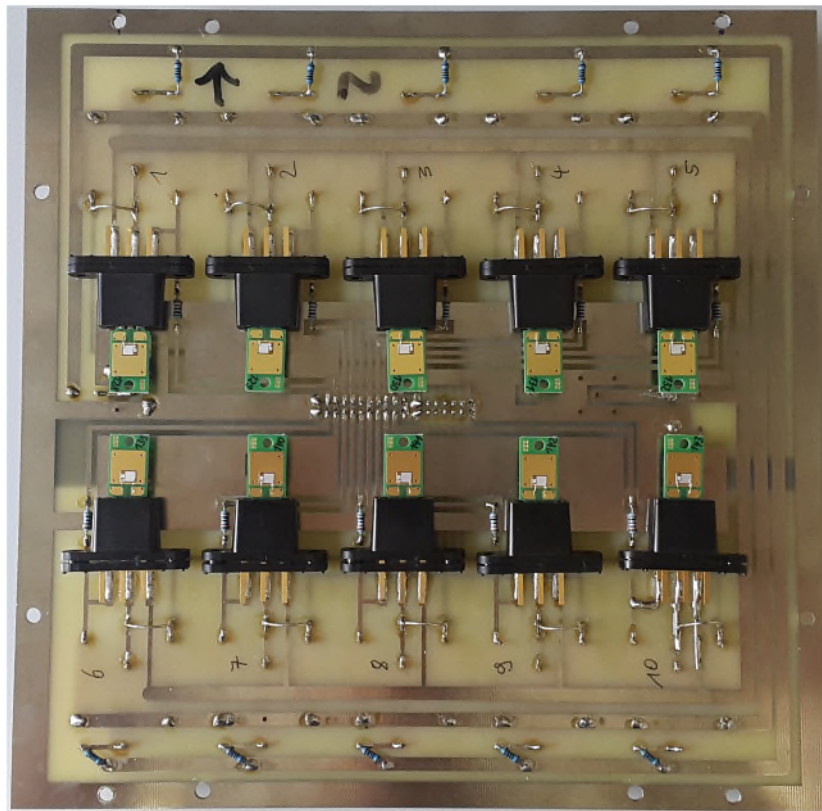


Fig. 2: Test-Board with 10 positions with TO test sockets. Separate bias of UDS and UGS for each device. Flat-band connector on back side.

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 MeVcm²/mg
- Flux 3E+3 ions/cm²/s
- Fluence 3E+5 ions/cm²
- 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 ² /s]	Fluence [1/cm ²]	Acc. Dose [krad]	UDS [V]	UGS [V]	PIGS pass/fail	Remarks
28.08.2019 02:33	18	8	415	3000	3.00E+05	0.30	150	0	pass	
28.08.2019 02:35	19					0.60	150	-5	pass	
28.08.2019 02:38	20					0.90	150	-10	pass	
28.08.2019 02:40	21					1.21	150	-15	pass	
28.08.2019 02:42	22					1.51	100	-20	pass	
28.08.2019 02:45	23	7	414	3000	3.00E+05	0.30	150	0	pass	
28.08.2019 02:47	24					0.60	150	-5	pass	
28.08.2019 02:49	25					0.91	150	-10	pass	
28.08.2019 02:52	26					1.21	150	-15	pass	
28.08.2019 02:54	27					1.46	100	-20	fail	
28.08.2019 02:57	28	6	413	3000	3.00E+05	0.30	150	0	pass	
28.08.2019 02:59	29					0.60	150	-5	pass	
28.08.2019 03:01	30					0.90	150	-10	pass	
28.08.2019 03:04	31					1.20	150	-15	pass	
28.08.2019 03:06	32					1.51	80	-20	pass	
28.08.2019 03:08	33	9	416	3000	3.00E+05	1.81	90	-20	pass	
28.08.2019 03:11	34					0.30	150	0	pass	
28.08.2019 03:14	35					0.60	150	-5	pass	
28.08.2019 03:16	36					0.90	150	-10	pass	
28.08.2019 03:18	37					1.20	150	-15	pass	
28.08.2019 03:20	38	10	417	3000	3.00E+05	1.51	80	-20	pass	
28.08.2019 03:21	39					1.81	90	-20	pass	
28.08.2019 03:24	40					0.30	150	0	pass	
28.08.2019 03:26	41					0.60	150	-5	pass	

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Date/Time	Test Run No.	Board Position	Sample No.	Flux [1/cm²/s]	Fluence [1/cm²]	Acc. Dose [krad]	UDS [V]	UGS [V]	PIGS pass/fail	Remarks
28.08.2019 03:28	42					0.91	150	-10	pass	
28.08.2019 03:31	43					1.21	150	-15	pass	
28.08.2019 03:33	44					1.51	80	-20	pass	
28.08.2019 03:35	45					1.81	90	-20	pass	
28.08.2019 03:37	46					1.87	100	-20	fail	SEGR after ~ 0.7E+5 ions

§7.5 READ AND RECORD DATA OF ELECTRICAL MEASUREMENTS

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

Due to the mounting process for these tests and very high currents, RDSon (45A, 10V) absolute values are higher than specified in the Detail Specification – see also control samples and initial measurements.

§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	150	2						
max		4	100	100	25	16	1.2	
413	170	2.92	0.7	1.9	0.007	15.2	1.183	
414	170	2.91	0.7	2.0	0.007	15.1	1.185	
415	170	2.91	0.8	2.1	0.007	15.2	1.184	
416	169	2.92	0.7	1.1	0.007	15.1	1.183	
417	168	2.90	0.7	1.9	0.007	15.2	1.189	
R418	169	2.90	0.7	1.8	0.007	15.0	1.180	
R419	168	2.92	0.8	1.9	0.007	15.6	1.197	
R420	170	2.92	0.7	1.9	0.007	15.2	1.184	

§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	150	2						
max		4	100	100	25	16	1.2	
413	169	2.92	1.8	3.8	0.004	15.2	1.184	
414	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	
415	169	2.92	1.7	4.7	0.003	15.1	1.187	
416	168	2.92	1.6	4.4	0.003	15.1	1.185	
417	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	
R418	168	2.91	1.5	3.9	0.002	15.0	1.181	
R419	169	2.93	1.8	3.6	0.002	15.5	1.198	
R420	170	2.93	1.6	4.3	0.002	15.2	1.186	

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§8 GRAPHICAL SEE-SOA

