

Single-Event Effect Testing of the Vishay Si7414DN n-Type TrenchFET[®] Power MOSFET

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I. Introduction and Summary of Test Results

This study was being undertaken to determine the single event effect susceptibility of the commercial Vishay 60-V TrenchFET[®] power MOSFET, part # Si7414DN. Heavy-ion testing was conducted at the Texas A&M University Cyclotron Single Event Effects Test Facility (TAMU) and the Lawrence Berkeley National Laboratory BASE Cyclotron Facility (LBNL). In addition, initial 200-MeV proton testing was conducted at Massachusetts General Hospital (MGH) Francis H. Burr Proton Beam Therapy Center. Testing was performed to evaluate this device for single-event effects from lower-LET, lighter ions relevant to higher risk tolerant space missions.

All catastrophic failures during these tests were due to single-event burnout (SEB). SEB is defined to have occurred as a sudden increase in drain current that resulted in functional failure of the part such that the drain-source pathway became resistive. The part therefore failed the breakdown voltage (BV_{DSS}) test. At lower biases (down to and including 0 V_{DS}), localized dosing of the gate oxide from individual heavyion strikes occurred which effectively formed regions in the transistor channel with a substantially lower gate threshold voltage. As a result, at 0 V gate-source bias (V_{GS}), these regions either turned on or permitted substantial subthreshold current to flow, raising the off-state leakage current. This current could be reduced by the application of a negative V_{GS} (hard turn-off). Note that the elevated drain current upon catastrophic failure could not be turned off even with under the maximum -20 V gate-source bias. It is hypothesized that the catastrophic damage is due to a similar dosing mechanism whereby channel inversion upon an ion passing through the gate oxide resulted in a local increase in current flow that combined with the high V_{DS} , led to lattice damage from the sudden increase in power deposition in a very small volume of silicon. This mechanism would explain why the catastrophic event did not result in runaway drain current that is typical of SEB from an impact-ionization mechanism and turn-on of the parasitic BJT formed from the source (emitter), body (base), and drain (collector) junctions. Additional studies (which are beyond the scope of these tests) would be needed to identify the actual failure mechanism, especially in light of the ability to prevent SEB by adding a current-limiting resistor on the drain node which quenches the drain voltage upon a current spike.

Tests were conducted at normal beam incidence in air or in vacuum. Tests were performed under a 0 V gate-source bias, with the drain-source voltage (V_{DS}) incrementally increased before each beam run. A summary of the minimum last pass/first catastrophic fail V_{DS} is provided in Table I below as a function of the ion species, energy, range, and LET at the surface of the device under test (DUT). Incident energy, range, and LET were determined by either the TAMU Seuss software or LBNL software based upon SRIM. Sample size refers to the number of DUTs with the given passing/failing Vds. Figure 1 plots these results. In the plot, square markers indicate the last passing V_{DS} of an individual DUT, and the error bar extends to the V_{DS} at which catastrophic failure occurred. The red x marker indicates a DUT that failed upon the first beam run. This DUT demonstrates that the threshold for catastrophic failure is not reduced by the degradation occurring in prior beam exposures.

Ion Species	Surface- Incident Energy	Range	Surface- Incident LET	VGS	Maximum Last Passing V _{DS}	Minimum V _{DS} at Failure	Sample Size
	(MeV)	(µm)	$(MeV \cdot cm^2/mg)$	(V)	(V)	(V)	#
Ne	283	279	2.7	0	42	45	1
	519	202	8 1		30	33	1
Ar	540	202	0.2	0	42	45	2
	400	130	9.7			45	1
						39	1
Cu	659	108	21	0	39	42	1
					42	45	1
Kr	886	110	31	0	39	42	1

Table I: Summary of Heavy-Ion Test Results for Individual Samples



Figure 1. Maximum passing V_{DS} for each DUT as a function of ion LET. Error bars extend to the V_{DS} at which catastrophic failure occurred. The red x symbols mark the bias at which a DUT failed on its first beam exposure, suggesting prior exposures did not affect the V_{DS} necessary for failure.

II. Devices Tested

The sample size for this testing was 16 pieces, with an additional 12 pieces evaluated for heavy-ion induced localized dosing effects when in a grounded configuration. The Si7414DN is manufactured by Vishay Siliconix. It is a commercial-grade n-channel trench-gate vertical power MOSFET that has been optimized for pulse-width modulation. It is rated at 60 V, 8.7 A, with 25 m Ω on-state resistance, and comes in a PowerPAK 1212-8 plastic package.

The pieces were decapsulated either by acid-etch in-house by Ted Wilcox, ASRC, or sent out for decapsulation. Parts were electrically characterized at GSFC by Alyson Topper, ASRC, then retested onsite just prior to beam exposure. Manufacturer electrical specifications are provided in Appendix A. The die area is approximately 2.2 mm x 1.5 mm (0.03 cm²). Figure 2 shows a picture of a decapsulated sample mounted on a daughter card. The stripline cell topology is oriented as indicated by the arrow in the photo.



Figure 2. Photograph of decapsulated PowerPAK 1212-8 packaged Si7414DN device under test, mounted on a daughter card for testing. Yellow vertical arrow indicates direction of stripline cell topology.

III. Test Facilities

Facilities:

- Texas A&M University Cyclotron Single Event Effects Test Facility, 15 MeV/amu tune;
- Lawrence Berkeley National Laboratory BASE Cyclotron Facility, 10 MeV/amu tune;
- Massachusetts General Hospital Francis H. Burr Proton Beam Therapy Center, 200 MeV.

Flux:

- 1 x 10³ cm⁻²-s⁻¹ to 2 x 10⁴ cm⁻²-s⁻¹ for heavy-ion tests to establish SEB thresholds; 1 x 10⁸ cm⁻²-s⁻¹ for proton runs.
- $500 \text{ cm}^{-2}\text{-s}^{-1}$ to $1 \times 10^5 \text{ cm}^{-2}\text{-s}^{-1}$ for special unbiased (pins grounded) tests.

Fluence:

All exposures were run to the lesser of the following fluence or until destructive events occurred:

- 3 x 10⁵ cm⁻² to 3 x 10⁶ cm⁻² for heavy-ion tests to establish SEB thresholds; 1 x 10¹⁰ cm⁻² for proton runs (with a single DUT taken to a proton fluence of 1 x 10¹¹ cm⁻² at full rated V_{DS}).
- In steps up to a total of 1×10^7 cm⁻² for unbiased tests.

Ion species:

• H, Ne, Ar, Cu, and Kr

Table II below shows the surface-incident beam properties as calculated by the given facility software.

Facility	Ion	Air Gap (cm)	Surface Energy (MeV)	Surface LET (<i>MeV</i> ·cm ² /mg)	Range (µm)
MGH	¹ H	15	200	0.0036	138,600
TAMU	²⁰ Ne	1.5	283	2.7	279
TAMU	⁴⁰ Ar	1.5	548	8.2	202
LBNL	⁴⁰ Ar	0	400	9.7	130
LBNL	⁶⁵ Cu	0	659	21	108
LBNL	⁸⁶ Kr	0	886	31	110

Table II. Ion Beam Properties

IV. Test Setup

Heavy Ion Testing:

The test circuit for the power MOSFET and block diagrams of the setup are shown in Figures 3 and 4. The test circuit contains either a Keithley 2400 or 2635A source meter to provide the gate voltage while measuring the gate current. A filter is placed at the gate node of each device under test (DUT) to dampen noise at the gate. A Keithley 2410 or 2657A source meter provides the appropriate V_{DS} while measuring the drain current; a 500 Ω resistor is optionally switched into series with the Keithley 2410 or 2657A to protect it from sudden high-current transients; it is switched out during device characterization tests. Gate current is limited to 1 mA, and drain current limited to 20 mA (Keithley 2410) or 119 mA (Keithley 2657A), and recorded via GPIB card (2400 series) or Ethernet cable (2600 series) to a desktop computer at approximately 250 ms intervals. If desirable for error mode analysis, a current limiting resistor may be jumpered into series with the drain to protect the DUT from destructive SEB. All equipment is plugged into a power conditioner.

Six DUTs can be mounted on the test board via daughter cards and individually accessed via dry Reed relays controlled by an Agilent DAQ 34907A data acquisition/switch unit and powered by a 5-V power supply. All terminals of the devices not under test are then floating. Testing was conducted in air (TAMU) or in vacuum (LBNL) with the DUT centered within the 1 inch beam diameter. Unless otherwise specified, ion exposures were conducted at 0° tilt angle (where 0° tilt is normal incidence to the DUT). Photographs of the test setup and DUT test board are shown in Figure 5.

The test setup is controlled via a custom LabVIEW program written by Alyson Topper and Hak Kim, ASRC Federal Space and Defense, which forms a user interface for the Lua-based scripts that run the Keithley 2600 series SMUs, or SCPI commands to the Keithley 2400 series SMUs. The program controls the SMUs, providing a live plot of the gate and drain currents during sampling and recording, and performing a parametric analysis of each DUT prior to irradiation and following each beam run. Characterizations include, if selected: gate threshold voltage (V_{th}), I_D as a function of V_{GS} at various fixed V_{DS} values for evaluation of total ionizing dose effects, drain-source breakdown voltage (BV_{DSS}), zero gate voltage drain current (I_{DSS}), and I_G and I_D as a function of V_{GS} at 0 V_{DS} (post-irradiation gate stress (PIGS) test to check the integrity of the gate dielectric).



Figure 3. Equivalent test circuit for the Si7414DN power MOSFET.



Figure 4. Left: Block diagram of test setup with 2400-series Keithley SMUs; Right: setup with 2600-series Keithley SMUs.



Figure 5. Left: DUT test board and 2400-series equipment in TAMU beam cave; Right: Mother board with 6 daughter cards mounted.

Proton Testing:

Individual DUTs mounted to daughter cards were placed in a vise clamp and positioned at normal incidence, approximately 15 cm from the beam port in air (see Figure 6). Source, drain, and gate voltages were supplied directly by two Keithley 2400 SMUs controlled by the same LabVIEW codes described above. In this preliminary test, no stiffening capacitance was added to the drain node.



Figure 6. At proton test facility, DUT on daughter PCB aligned in air at normal incidence in proton beam (left photo) receives voltage inputs directly from two Keithley 2400 SMUs (right photo).

V. Test Results

Except when noted, parts were assessed for ion effects at a 0-V gate-source bias. Under irradiation with test ions heavier than protons, the Si7414DN was susceptible to single-event burnout at voltages indicated in Table I and Figure 1, in section I above. SEB is defined to have occurred upon a sudden increase in drain current that resulted in functional failure of the part such that the drain-source pathway became resistive rather than rectifying. The part therefore failed the breakdown voltage (BV_{DSS}) test. At lower biases (down to and including 0 V_{DS}), localized dosing of the gate oxide from individual heavy-ion strikes occurred. As a result of this dosing, at 0 V gate-source bias (V_{GS}), these dosed regions either turned on or permitted substantial subthreshold current to flow, raising the off-state leakage current. This current could be reduced by the application of a negative V_{GS} (hard turn-off). Note that the elevated drain current upon SEB could not be turned off even with under the maximum -20 V gate-source bias.

Preliminary 200-MeV proton tests revealed current spikes at V_{DS} greater than 42 V (see Appendix D, Figures D69-D84), with variability in the actual onset voltage. The frequency of these spikes increased substantially at 60 V_{DS}. Additional tests must be performed using the MIL-STD-750 TM1080-compliant test circuit shown in Figure 3, which includes a drain-node stiffening capacitor, to establish whether these current spikes are SEB events that were quenched due to SMU voltage sagging as the current demand from the SMU suddenly increased by several orders of magnitude.

It is well-established in the literature that trench-gate n-type MOSFETs are susceptible to substantial gate threshold voltage shifts due to ions passing through the gate oxide along the length of the channel. Ionized and subsequently trapped charge changes the flatband voltage at the ion strike location, effectively creating a local region within the overall channel width whose gate threshold voltage is lower than the surrounding channel width. This effect can be seen as a hump in the drain current vs. gate voltage curve because this region of the channel turns on prior to the rest of the transistor channel. The impact of the ions on the flatband voltage is dependent on the amount of charge trapped in the oxide or at the oxide/silicon interface, and thus is a function of the ion strike location, ion LET, and the electric field in the oxide (applied V_{GS} and V_{DS}). Additionally, the impact on the overall transistor performance is also dependent on the number of localized dosed locations (thus the effective total width of the channel having a reduced threshold voltage). Figure 7 shows the shift in measured threshold voltage for 5 samples, each irradiated with a different ion species. In the plot, for protons, neon, and argon, all runs began at the same bias conditions ($V_{DS} = 24 \text{ V}$, $V_{GS} = 0 \text{ V}$) and then were incremented in 3-V steps. For copper and krypton, the bias condition remained at $V_{DS} = 0 V$, $V_{GS} = 0 V$ for all runs. As can be seen in Figure 7, heavier ions have a greater impact on threshold voltage for a given dose. Importantly, this dosing occurs even when the part is in the off-state, such that cold spares on orbit will suffer degradation due to flatband voltage shifts that are larger in magnitude than would be predicted by standard total ionizing dose tests using gamma rays or even protons.

A summary of the SEB failure threshold as a function of ion species, energy, and LET is given in the Introduction of this report. Complete results are in the appendices. Appendix B provides the run logs; electrical characterization (pre- and post-irradiation) results are given in Appendix C, and striptape current measurements taken during the individual beam runs are plotted in Appendix D, and commentary on the results given in the Figure legends.

Included in the test campaign was a single sample irradiated with 548 MeV Ar while at -10 V_{GS} and 24 V_{DS} . This DUT (#12, run 39, TAMU September 2016) did not exhibit increases in drain current during irradiation (Figure D40) because the externally applied V_{GS} kept the part in the off state despite flatband voltage shifts. Upon electrical characterization, however, the part showed substantial dosing effects presumably due to the higher charge yield within the oxide. The pre- and post-rad IV curves are shown in Figure 8.

Finally, the SEB failure mechanism was verified in part by the addition of a 10-k Ω resistor in series with the drain node (see Figure 3 – the optional resistor location) of DUT 11 (runs 26-38 of the September 2016 TAMU test campaign). This part was irradiated with 548-MeV argon and exhibited only dosing effects but no SEB, up to the maximum rated 60 V_{DS}. Note that current limiting is not a valid SEB circumvention technique on orbit due to the transient current spikes (upon suppressed SEB events) stressing the part and potentially resulting in premature failure.



Figure 7. Threshold voltage shift (normalized to pre-rad threshold voltage) as a function of total ionizing dose from different ion species. Vgs = 0 V during irradiation. Each symbol for protons, Ar, and Ne represent 3-V step-wise increases in Vds from an initial value of 24 V; for Cu and Kr, Vds was held at 0 V for all dose steps.



Figure 8. Drain current versus gate bias at $V_{DS} = 50 \text{ mV}$ (solid lines) and 10 V (dashed lines), prior to irradiation with 548 MeV Ar (green lines) and immediately after irradiation at -10 V_{GS}, 24 V_{DS}. Additional measurement at 50 mV taken 9 months later (light orange line) shows no annealing has occurred. Total fluence during irradiation = $3x10^6 \text{ cm}^{-2}$ (393 rad(Si)).

Appendix A

Parameter	Condition	MIN	MAX	Units
Gate Threshold Voltage (V _{GS(th)})	$V_{DS}=V_{GS},I_D=250\;\mu A$	1	3	V
Zero Gate Voltage Drain Current (I _{DSS})	$V_{DS} = 60 V, V_{GS} = 0 V$		1	μΑ
Drain-Source Breakdown Voltage (BV _{DSS})	(rating only: condition not specified)*	60		V
Gate-Source Leakage Current (I _{GSS})	$V_{GS} = +/-20 V, V_{DS} = 0 V$		+/-100	nA
Static Drain-Source Resistance (R _{DS(on)})	$V_{GS} = 10 \text{ V}, \text{ I}_{D} = 8.7 \text{ A}$		0.025	Ω
Forward Voltage (V _{SD})	$I_{S} = 3.2 \text{ A}, V_{GS} = 0 \text{ V}$		1.2	V

Table A1. Si7414DN Manufacturer-Specified Electrical Parameters (Partial List)

*Condition used during this test campaign: $V_{GS} = 0$ V; $I_D = 250 \ \mu A$

Appendix B

 Table B1. Raw test data from 26 September 2016 at TAMU. Beam diameter = 1"; LET and energy are after beam airgap of 1.5mm.

 NOTE: Ion characteristics in table are from TAMU's SEUSS software based upon SRIM 1998.

										LET						External						
								Ξm		[MeV-	Air		Eff		Cum.	Drain						
Bun			DUT	SEL	VDS	VGS	;	le/	Men	cm²ł	Gap	Flux	Fluence	Dose	Dose	Resistor	Vth	B¥dss	+20	-20	Passł	
#	Date	Time	#	#	[V]	[Y]	lon	<u>5</u> 8	Šé.	mg]	[mm]	[cm ⁻² s ⁻¹]	[cm-2]	[rad(Si)]	[rad(Si)]	[Ohms]	[V]	[V]	PIGS	PIGS	Fail	Comments
																						Saw several breaks in the drain on the order of
																						100s of nA. Looks like it tries to recover after
																						each break. Appears to be one very small
1	9/26/2016	12:33:06 AM	7	1	24	0	Ar	13.7	548	8.2	15	3.30E+04	3.01E+06	4.07E+02	4.07E+02	0	1.34	67	5 pA	-175 pA	Pass	change in the gate.
																						Saw several breaks in the drain on the order of
2	9/26/2016	12:45:19 AM	7	1	27	0	Ar	13.7	548	8.2	15	3.96E+04	2.99E+06	3.91E+02	7.98E+02	0	1.11	67	10 p.A	-175 pA	Pass	a few uA.
																						Saw several breaks in the drain on the order of
3	9/26/2016	12:50:28 AM	7	1	30	0	Ar	13.7	548	8.2	15	3.42E+04	3.02E+06	3.95E+02	1.19E+03	0	0.94	67	5 pA	-175 pA	Pass	a few uA.
																						Saw several breaks in the drain on the order of
4	9/26/2016	12:54:37 AM	7	1	33	0	Ar	13.7	548	8.2	15	2.72E+04	2.99E+06	3.91E+02	1.58E+03	0	0.83	67	10 p.A	-150 pA	Pass	a few uA.
																						Saw several breaks in the drain on the order of
5	9/26/2016	12:58:46 AM	7	1	36	0	Ar	13.7	548	8.2	15	3.25E+04	2.99E+06	3.91E+02	1.97E+03	0	0.73	67	10 p.A	-150 pA	Pass	a few uA.
																						Saw several breaks in the drain on the order of
6	9/26/2016	1:03:36 AM	7	1	39	0	Ar	13.7	548	8.2	15	1.84E+04	2.99E+06	3.92E+02	2.37E+03	0	0.65	67	10 p.A	-150 pA	Pass	a few uA.
			L _													_					_	Saw several breaks in the drain on the order of
7	9/26/2016	1:08:19 AM	7	1	42	0	Ar	13.7	548	8.2	15	1.55E+04	3.00E+06	3.93E+02	2.76E+03	0	0.59	67	10 p.A	-145 pA	Pass	a few uA.
																						Saw one 1 mA break almost immediately after
																						the beam turned on and then there was a 12 mA
																						jump at the end of the run. After the beam was
																						turned orr there was a quick 7 mA spike, and
	010010010	110 54 444	-		45			10.7	E 40			1505 04	0.015 00	0.005.00	0.455,000		0.00	-				then current jumped back up to 19 mA and
8	372672016	1:13:54 AM			43	U	AF	13.7	548	8.2	CI	1.53E+04	3.01E+06	3.93E+02	3. IDE +03	U	0.30	2	1 MA	-1 MA	Fall	Femained there until voltage was removed.
																						100a of pA () (opt back and checked the
<u> </u>	ຝາວຍາວກາຍ	1-24-02 AM		2	12	0	٨.	12.7	E40	0.2	15	2.100 . 04	2005.00	2 925 . 02	ວ ໑ຉຬ . ∩ວ	0	1 40	66	250	17	Esil	presed europete were bigh to begin with
	3202010	1.24.02 AM	0	4	12	0	~	10.7	340	0.2	13	J. IOL + 04	J.00L+00	3.33E+02	J.JJL+02	0	1.45	00	230 HA	-truA		Saw several breaks in the drain on the order of
																						a few pA. Then there was one 500 pA break
10	9/26/2016	1:31:18 AM	9	3	6	0	Δr	13.7	548	82	15	2.66E+04	2,99E+06	3.91E+02	3.91E+02	0	181	66	30 nA	-200 nA	Pass	And then a 700 nA one
11	9/26/2016	1:36:44 AM	9	3	9	0	Ar	13.7	548	8.2	15	3.58E+04	2.98E+06	3.90E+02	7.82E+02	0	1.60	66	30 DA	-180 pA	Pass	Saw several small breaks.
12	9/26/2016	1:40:45 AM	9	3	12	0	Ar	13.7	548	8.2	15	3.99E+04	3.00E+06	3.92E+02	1.17E+03	0	1.45	66	25 DA	-175 pA	Pass	Saw several small breaks.
13	9/26/2016	1:45:30 AM	9	3	15	0	Ar	13.7	548	8.2	15	3.87E+04	2.99E+06	3.91E+02	1.56E+03	0	1.33	66	25 pA	-170 pA	Pass	Saw several small breaks.
14	9/26/2016	1:49:51 AM	9	3	18	0	Ar	13.7	548	8.2	15	3.35E+04	2.99E+06	3.90E+02	1.96E+03	0	1.21	66	20 pA	-160 pA	Pass	Saw several small breaks.
15	9/26/2016	1:54:57 AM	9	3	21	0	Ar	13.7	548	8.2	15	2.77E+04	3.01E+06	3.93E+02	2.35E+03	0	1.11		20 pA	-160 pA	Pass	Saw several small breaks.
16	9/26/2016	1:59:16 AM	9	3	24	0	Ar	13.7	548	8.2	15	2.16E+04	3.01E+06	3.93E+02	2.74E+03	0	1.02	66	20 pA	-160 pA	Pass	Saw several small breaks.
17	9/26/2016	2:04:03 AM	9	3	27	0	Ar	13.7	548	8.2	15	2.88E+04	3.00E+06	3.93E+02	3.13E+03	0	0.92	66	20 pA	-150 p.A	Pass	Saw several small breaks.
18	9/26/2016	2:08:43 AM	9	3	30	0	Ar	13.7	548	8.2	15	2.43E+04	3.01E+06	3.94E+02	3.53E+03	0	0.86	66	20 pA	-150 p.A	Pass	Saw several small breaks.
19	9/26/2016	2:13:20 AM	9	3	33	0	Ar	13.7	548	8.2	15	2.66E+04	3.01E+06	3.94E+02	3.92E+03	0	0.77	66	20 pA	-150 pA	Pass	Saw several small breaks.
20	9/26/2016	2:19:05 AM	9	3	36	0	Ar	13.7	548	8.2	15	3.03E+04	2.99E+06	3.91E+02	4.31E+03	0	0.71	66	20 pA	-145 pA	Pass	Saw several small breaks.
21	9/26/2016	2:23:58 AM	9	3	39	0	Ar	13.7	548	8.2	15	2.91E+04	3.01E+06	3.94E+02	4.71E+03	0	0.65	66	20 pA	-145 pA	Pass	Saw several small breaks.
22	9/26/2016	2:28:37 AM	9	3	42	0	Ar	13.7	548	8.2	15	2.78E+04	2.99E+06	3.91E+02	5.10E+03	0	0.59	62	20 pA	-140 pA	Pass	Saw several small breaks.
23	9/26/2016	2:32:58 AM	9	3	45	0	Ar	13.7	548	8.2	15	2.08E+04	3.00E+06	2.92E+02	5.39E+03	0	0.35	2	15 p.A	-140 pA	Fail	Current jumped to 10 mA almost immediately.

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											LET						External						
									Ξm	m	[MeV-	Air		Eff		Cum.	Drain						
	Bun			DUT	SEL	VDS	VGS		le/	M	cm²ł	Gap	Flux	Fluence	Dose	Dose	Resistor	Vth	BVdss	+20	-20	Passł	
	#	Date	Time	#	#	. IVI	11	lon	29	ŝŝ	mal	[mm]	[cm ⁻² s ⁻¹]	[cm-2]	[rad(Si)]	[rad(Si)]	[Ohms]	IVI	[V]	PIGS	PIGS	Fail	Comments
Г	24	9/26/2016	2.40.36 AM	10	4	30	0	Ar	13.7	548	82	15	2 11F+04	2,99E+06	3.91E+02	3.91E+02	0	129	66	10 nA	-185 nA	Pass	Saw current increases in the 10s of uA
F							-										-						Saw a 1 mA increase shortly after the beam
	25	9/26/2016	2.45.26 AM	10	4	33	0	Ar	13.7	548	82	15	2.21E+04	3.01E+06	3.93E+02	7.85E+02	0	0.92	6	5 nA	-175 nA	Fail	turned on
F							-										-						Scope was connected during the beam run but
																							no transietns were recorded. Parameters are all
	26	9/26/2016	2:53:36 AM	11	5	24	0	Ar	13.7	548	8.2	15	1.70E+04	3.01E+06	3.94E+02	3.94E+02	10k	1.47	67	70 DA	-220 DA	Pass	recorded in post file to remove resistor.
F																							Forgot to save transients, but scope never
																							triggered anyway. Parameters were recorded in
	27	9/26/2016	3:03:43 AM	11	5	27	0	Ar	13.7	548	8.2	15	2.76E+04	2.99E+06	3.92E+02	7.85E+02	10k	1.17	67	70 pA	-210 pA	Pass	post file.
F																							Scope was connected during the beam run but
																							no transietns were recorded. Parameters are all
	28	9/26/2016	3:09:39 AM	11	5	30	0	Ar	13.7	548	8.2	15	2.52E+04	2.99E+06	3.91E+02	1.18E+03	10k	1.03	67	70 pA	-210 pA	Pass	recorded in post file.
																							Scope was connected during the beam run but
																							no transietns were recorded. Parameters are all
	29	9/26/2016	3:14:53 AM	11	5	33	0	Ar	13.7	548	8.2	15	2.38E+04	3.01E+06	3.94E+02	1.57E+03	10k	0.90	67	70 pA	-200 pA	Pass	recorded in post file.
																							Scope was connected during the beam run but
																							no transietns were recorded. Parameters are all
	30	9/26/2016	3:19:20 AM	11	5	36	0	Ar	13.7	548	8.2	15	1.60E+04	2.99E+06	3.92E+02	1.96E+03	10k	0.81	67	70 pA	-200 pA	Pass	recorded in post file.
																							Scope was connected during the beam run but
																							no transietns were recorded. Parameters are all
	31	9/26/2016	3:24:50 AM	11	5	39	0	Ar	13.7	548	8.2	15	1.54E+04	2.99E+06	3.91E+02	2.35E+03	10k	0.73	67	70 pA	-200 pA	Pass	recorded in post file.
																							Scope was connected during the beam run but
																							no transietns were recorded. Parameters are all
	32	9/26/2016	3:31:16 AM	11	5	42	0	Ar	13.7	548	8.2	15	2.14E+04	2.99E+06	3.91E+02	2.74E+03	10k	0.64	67	70 pA	-200 pA	Pass	recorded in post file.
																							Scope was connected during the beam run but
																							no transietns were recorded. Parameters are all
	33	9/26/2016	3:36:51 AM	11	5	45	0	Ar	13.7	548	8.2	15	2.32E+04	3.00E+06	3.93E+02	3.14E+03	10k	0.57	66	70 pA	-200 pA	Pass	recorded in post file.
																							Beam run looks to be more of a constant
	34	9/26/2016	3:42:03 AM	11	5	48	0	Ar	13.7	548	8.2	15	2.29E+04	3.00E+06	3.93E+02	3.53E+03	10k	0.50	63	70 pA	-200 pA	Pass	degradation than jumps.
																							Beam run looks to be more of a constant
	35	9/26/2016	3:46:52 AM	11	5	51	0	Ar	13.7	548	8.2	15	1.99E+04	2.99E+06	3.92E+02	3.92E+03	10k	0.45	60	70 pA	-200 pA	Pass	degradation than jumps.
																							Beam run looks to be more of a constant
	36	9/26/2016	3:54:00 AM	11	5	54	0	Ar	13.7	548	8.2	15	2.07E+04	2.99E+06	3.91E+02	4.31E+03	10k	0.42	57	70 pA	-200 pA	Pass	degradation than jumps.
																							Beam run looks to be more of a constant
	37	9/26/2016	4:00:28 AM	11	5	57	0	Ar	13.7	548	8.2	15	2.11E+04	3.00E+06	3.92E+02	4.70E+03	10k	0.38	54	70 pA	-200 pA	Pass	degradation than jumps.
																							Beam run looks to be more of a constant
	38	9/26/2016	4:05:47 AM	11	5	60	0	Ar	13.7	548	8.2	15	2.38E+04	2.99E+06	3.91E+02	5.10E+03	10k	0.34	51	70 pA	-200 pA	Pass	degradation than jumps.
																							Saw 1 nA increase in drain current and
																							corresponding 50 pA increase in gate current
																							shortly after the beam turned on. After the beam
																							turned off, both currents returned to their
	39	9/26/2016	4:12:39 AM	12	6	24	-10	Ar	13.7	548	8.2	15	2.18E+04	3.00E+06	3.93E+02	3.93E+02	0	0.65	1	10 p.A	-175 pA	Fail??	original values. (looked like charge collection.)

									_	LET			Eff		C	External						
Run			DUT	SEL	VDS	VGS		iner MeV.	[Me	cm²ł	Ал Gap	Flux	Fluence	Dose	Cum. Dose	Resistor	Vth	B¥dss	+20	-20	Passł	
#	Date	Time	#	#	[V]	[V]	lon	E8	38	mg]	[mm]	[cm ⁻² s ⁻¹]	[cm-2]	[rad(Si)]	[rad(Si)]	[Ohms]	[V]	[V]	PIGS	PIGS	Fail	Comments
																						Only charge collection originally, but then saw a
																						20 nA break in the drain and then a 10 nA break
60	9/26/2016	6:50:51 AM	17	4	24	0	Ne	14.2	283	2.7	15	1.77E+04	3.00E+06	1.28E+02	127.8	0	2.17	67	2 nA	-2 nA	Pass	towards the end of the run.
																						Saw a 10 nA increase in drain current. And then
61	9/26/2016	6:56:31 AM	17	4	27	0	Ne	14.2	283	2.7	15	1.68E+04	3.01E+06	1.28E+02	255.8	0	2.06	67	2 nA	-2 nA	Pass	several small breaks.
62	9/26/2016	7:02:33 AM	17	4	30	0	Ne	14.2	283	2.7	15	1.35E+04	3.00E+06	1.28E+02	383.4	0	1.97	67	2 nA	-2 nA	Pass	Saw two 600 nA breaks in the drain.
63	9/26/2016	7:08:27 AM	17	4	33	0	Ne	14.2	283	2.7	15	1.57E+04	3.01E+06	1.28E+02	511.4	0	1.89	67	2 nA	-2 nA	Pass	Saw one small DECREASE in drain current.
64	9/26/2016	7:14:04 AM	17	4	36	0	Ne	14.2	283	2.7	15	1.72E+04	3.00E+06	1.28E+02	639.3	0	1.82	67	2 nA	-2 nA	Pass	Saw two small (50 nA) breaks
65	9/26/2016	7:19:24 AM	17	4	39	0	Ne	14.2	283	2.7	15	1.62E+04	2.99E+06	1.27E+02	766.7	0	1.78	67	2 nA	-2 nA	Pass	Saw one 200 nA break.
66	9/26/2016	7:25:12 AM	17	4	42	0	Ne	14.2	283	2.7	15	1.51E+04	3.01E+06	1.28E+02	894.7	0	1.71	67	2 nA	-2 nA	Pass	Saw several small breaks and one 1 uA one.
67	9/26/2016	7:30:45 AM	17	4	45	0	Ne	14.2	283	2.7	15	1.57E+04	2.99E+06	1.28E+02	1022.2	0	1.48	5	1nA	-1.2 nA	Fail	Saw several small breaks and then 13 mA

Table B2. Raw test data from 12 April 2017 at LBNL. LET and energy are at surface of die; testing was in vacuum. NOTE: Ion characteristics in table are as reported at LBNL. Pre- and post-drain & gate currents, as well as Igss values, are approximations only.

RUN I	NFO			DUT S	ETUP	BEAN	I DIAC	GNOSTI	CS: I	For Si	i, before	parylene co	ating			IRRADIAT	ON RESUL	TS										
Time	Run	DUT	Socket	V _{GS} [V]	V _{DS} [V]	lon	Energy [MeV/u]	Energy [MeV]	Tilt Angle	Roll Angle	LET [MeV- cm ² /mg]	Ave Flux [/(cm²-s)]	Eff. Fluence [/cm²]	Dose [rad(Si)]	Cum. Dose [rad(Si)]	Pre lg	Pre Id	Pass/Fail	Event Notes	Post Ig [A]	Post Id [A]	Delta Ig/ fluence	Delta Id/ fluence	Post Vth [V]	Post BVdss [V]	Post Idss [A]	Post Igss+ [A]	Post Igss- [A]
3:30	89	114	1	0	24	Cu	10	<mark>6</mark> 59	0	0	21.2	1.576E+03	3.01E+05	1.02E+02	1.020E+02	-4.00E-13	1.55E-10		250nA, hundreds of nA jumps	-4.50E-13	3.15E-06	-1.66E-19	1.05E-11	1.82	xxx	8.41E-06	-2.20E-11	-4.50E-11
3:35	90	114	1	0	27	Cu	10	659	0	0	21.2	1.560E+03	3.01E+05	1.02E+02	2.040E+02	-5.00E-13	2.49E-06		4uA event many small events	-1.00E-12	9.12E-06	-1.66E-18	2.20E-11	1.34	xxx	2.51E-05	-2.00E-11	-4.20E-11
3:40	91	114	1	0	30	Cu	10	659	0	0	21.2	1.537E+03	3.01E+05	1.02E+02	3.060E+02	-6.00E-13	8.56E-06		nothing notable	-1.00E-12	1.22E-05	-1.33E-18	1.21E-11	1.15	xxx	3.29E-05	-2.00E-11	-4.00E-11
3:45	92	114	1	0	33	Cu	10	659	0	0	21.2	1.541E+03	3.01E+05	1.02E+02	4.080E+02	-6.00E-13	1.22E-05		same as seen on previous Cu run	-6.00E-13	1.62E-05	0.00E+00	1.33E-11	1.02	xxx	4.18E-05	-2.00E-11	-4.00E-11
3:50	93	114	1	0	36	Cu	10	659	0	0	21.2	1.534E+03	3.01E+05	1.02E+02	5.100E+02	-6.50E-13	1.64E-05		no fails	-4.50E-13	2.30E-05	6.64E-19	2.22E-11	0.917	xxx	5.61E-05	-2.00E-11	-4.00E-11
3:56	94	114	1	0	39	Cu	10	659	0	0	21.2	2.782E+03	3.02E+05	1.02E+02	6.123E+02	-4.50E-13	2.39E-05		no fails, soft breakdown though	-5.00E-13	3.51E-05	-1.66E-19	3.70E-11	0.805	69	7.69E-05	-2.00E-11	-4.00E-11
4:01	95	114	1	0	42	Cu	10	659	0	0	21.2	2.751E+03	1.55E+05	5.26E+01	6.649E+02	-6.00E-13	3.52E-05	Fail	failed	-8.00E-13	9.23E-04	-1.29E-18	5.72E-09	0.684	10	xxx	-2.00E-11	-4.00E-11
4:07	96	120	2	0	33	Cu	10	659	0	0	21.2	2.731E+03	5.02E+05	1.70E+02	1.701E+02	-3.00E-13	2.85E-10		no failures, some charge collection, uA level jumps	-6.00E-13	6.97E-06	-5.97E-19	1.39E-11	1.53	xxx	1.73E-05	1.50E-10	-3.00E-10
4:12	97	120	2	0	36	Cu	10	659	0	0	21.2	2.697E+03	5.02E+05	1.70E+02	3.401E+02	-2.00E-13	6.60E-06		no failures, some charge collection, uA level jumps	-4.00E-13	4.43E-06	-3.98E-19	-4.32E-12	1.18	xxx	3.43E-05	1.50E-10	-3.00E-10
4:18	98	120	2	0	39	Cu	10	659	0	0	21.2	2.757E+03	5.02E+05	1.70E+02	5.101E+02	-2.00E-13	1.37E-05		no failures, some charge collection, uA level jumps	-5.00E-13	2.83E-05	-5.98E-19	2.91E-11	0.946	69	3.63E-06	1.50E-10	-3.00E-10
4:23	99	120	2	0	42	Cu	10	659	0	0	21.2	2.765E+03	5.02E+05	1.70E+02	6.802E+02	-2.00E-13	2.78E-05		no failures, some charge collection, uA level jumps	-5.00E-13	3.83E-05	-5.97E-19	2.09E-11	0.825	xxx	8.08E-05	1.50E-10	-3.00E-10
4:28	100	120	2	0	45	Cu	10	659	0	0	21.2	2.733E+03	8.56E+04	2.90E+01	7.092E+02	-2.00E-13	4.04E-05	Fail	failed	-1.00E-12	1.99E-03	-9.34E-18	2.28E-08	0.694	7	XXX	1.50E-10	-3.00E-10
4:33	101	107	3	0	39	Cu	10	659	0	0	21.2	2.685E+03	6.61E+04	2.24E+01	2.238E+01	-5.00E-13	3.40E-10	Fail	300uA jump, stopped run	-5.00E-13	3.13E-04	0.00E+00	4.74E-09	2.15	34	XXX	-2.00E-11	-4.50E-11
13:54	111	117	1	0	24	Kr	10	886	0	0	30.9	3.242E+03	3.03E+05	1.50E+02	1.495E+02	-4.00E-13	1.70E-10		no failures, some charge collection, uA level jumps	-4.00E-13	4.50E-06	0.00E+00	1.49E-11	1.69	xxx	1.22E-05	-2.20E-11	-1.00E-10
13:57	112	117	1	0	27	Kr	10	886	0	0	30.9	3.227E+03	3.03E+05	1.50E+02	2.991E+02	-4.00E-13	3.66E-06		no failures, some charge collection, uA level jumps	-4.00E-13	1.36E-05	0.00E+00	3.28E-11	1.21	72	3.56E-05	-2.00E-11	-1.00E-10
14:02	113	117	1	0	30	Kr	10	886	0	0	30.9	3.210E+03	3.03E+05	1.50E+02	4.486E+02	-5.00E-13	1.21E-05		no failures, some charge collection, uA level jumps	-4.00E-13	2.13E-05	3.30E-19	3.04E-11	1.02	XXX	5.33E-05	-2.00E-11	-1.00E-10
14:06	114	117	1	0	33	Kr	10	886	0	0	30.9	3.199E+03	3.02E+05	1.49E+02	5.977E+02	-4.00E-13	2.06E-05		no failures, some charge collection, uA level jumps	-5.00E-13	3.56E-05	-3.31E-19	4.97E-11	0.864	72	8.33E-05	-2.00E-11	-1.00E-10
14:10	115	117	1	0	36	Kr	10	886	0	0	30.9	3.180E+03	3.02E+05	1.49E+02	7.467E+02	-5.00E-13	3.59E-05		no failures, some charge collection, uA level jumps	-5.00E-13	4.72E-05	0.00E+00	3.74E-11	0.756	72	1.03E-04	-2.00E-11	-1.00E-10
14:14	116	117	1	0	39	Kr	10	886	0	0	30.9	3.131E+03	3.02E+05	1.49E+02	8.958E+02	-6.00E-13	4.79E-05		no failures, some charge collection, uA level jumps	-6.00E-13	6.30E-05	0.00E+00	5.00E-11	0.674	72	1.26E-04	-2.00E-11	-1.00E-10
14:18	117	117	1	0	42	Kr	10	886	0	0	30.9	3.127E+03	1.08E+05	5.33E+01	9.491E+02	-5.00E-13	6.49E-05	Fail	failed, mA	5.00E-12	1.38E-03	5.09E-17	1.22E-08	0.446	7	XXX	-2.00E-11	-1.00E-10

To be published on nepp.nasa.gov.

Table B3. Raw test data from 8 November 2016 at LBNL. LET and energy are at surface of die; testing was in vacuum. NOTE: Ion characteristics in table are as reported at LBNL. Pre- and post-drain & gate currents, as well as Igss values, are approximations only.

RU	N INFC)			dut s	ETUP	BEAN	I DIAGN	IOSTIC	S: For Si,	before paryl	lene coatir	g		IRRADIAT	ION RESU	LTS										
Ti	me F	tun	DUT	Socket	V _{GS} [V]	V _{DS} [V]	lon	Energy [MeV/u]	Energy [MeV]	LET [MeV- cm²/mg]	Flux [/(cm²-s)]	Eff. Fluence [/cm²]	Dose [rad(Si)]	Cum. Dose [rad(Si)]	Pre Ig	Pre Id	Pass/Fail	Event Notes	Post Ig [A]	Post Id [A]	Delta Ig/ fluence	Delta Id/ fluence	Post Vth [V]	Post BVdss [V]	Post Idss [A]	Post Igss+ [A]	Post Igss- [A]
4	:58	56	5	3	0	0	Cu	10.0	659	21.2	5.901E+02	1.04E+04	3.52E+00	3.523E+00	-3.0E-13	-2.9E-10		There was some spontaneous recover after the beam was turned (-340 pA) and then jumped again to -247 pA	-3.0E-13	-3.8E-10	0	-9.13462E-15	2.24	73	2.57E-09	-2.70E-11	-5.80E-11
5	:10	57	5	3	0	0	Cu	10.0	659	21.2	5.966E+02	1.05E+04	3.56E+00	7.079E+00	-5.0E-13	-3.2E-10			-5.0E-10	-3.2E-10	-4.8E-14	-2.85714E-16	2.23	73	2.63E-09	-2.60E-11	-5.50E-11
5	:17	58	5	3	0	0	Cu	10.0	659	21.2	5.640E+02	3.03E+04	1.03E+01	1.734E+01	-4.0E-13	-3.2E-10			-4.0E-13	-5.0E-08	0	-1.64015E-12	2.22	73	1.19E-06	-2.60E-11	-5.00E-11
5	:27	59	5	3	0	0	Cu	10.0	659	21.2	5.742E+02	5.04E+04	1.71E+01	3.441E+01	-4.00E-13	-3.60E-08			-4.00E-13	-4.40E-08	0	-1.58699E-13	2.20	73	9.21E-07	-2.60E-11	-4.60E-11
6	:47	60	6	4	0	0	Cu	10.0	659	21.2	6.231E+02	1.01E+05	3.40E+01	3.404E+01	1.60E-07	-5.90E-07		The gate, drain, and source are all shorted together on board	1.55E-07	-5.95E-07	-5E-14	-4.97512E-14	2.19	73	1.88E-08	-2.00E-11	-5.50E-11
6	:51	61	4	5	0	0	Cu	10.0	659	21.2	6.359E+02	1.01E+05	3.40E+01	3.404E+01				Passive irradiation G, D, S shorted together on board with no voltage applied.					2.18	73	1.28E-08	-2.00E-11	-5.00E-11
7	:00	62	1	3	0	0	Cu	10.0	659	21.2	6.594E+02	1.04E+04	3.52E+00	3.519E+00	-4.00E-13	-2.00E-11		Replicating DUT 5	-4.00E-13	6.80E-09	0	6.564E-13	2.16	73	2.60E-08	-3.00E-11	-4.80E-11
7	:07	63	1	3	0	0	Cu	10.0	659	21.2	6.930E+02	1.04E+04	3.53E+00	7.045E+00	-4.00E-13	-3.50E-09			-2.86E-13	-3.58E-09	1.1E-17	-7.68492E-15	2.16	73	1.86E-08	-3.00E-11	-4.50E-11
7	:10	64	1	3	0	0	Cu	10.0	659	21.2	6.920E+02	3.06E+04	1.04E+01	1.740E+01	-4.00E-13	-2.35E-09			-4.00E-13	-2.30E-09	0	1.63506E-15	2.15	73	1.52E-08	-2.50E-11	-1.00E-10
7	:15	65	1	3	0	0	Cu	10.0	659	21.2	7.529E+02	5.05E+04	1.71E+01	3.451E+01	-4.00E-13	-2.20E-09		one jump in Id	-4.00E-13	-3.00E-09	0	-1.58416E-14	2.13	73	1.65E-08	-3.00E-11	-1.00E-10
8	:06	66	16	6	0	45	Ar	10.0	400	9.7	1.633E+01	3.35E+02	5.22E-02	5.224E-02	-6.50E-13	3.60E-10	Fail	saw a 700 uA event almost immediately after turning the beam on. Now that it's broken, Id is creeping up after beam was turned off	-2.00E-13	6.80E-04	1.3E-15	2.02864E-06	2.28	23		-3.00E-11	-5.50E-11

			VDC	VCS	Enormy	Collimator	Poom	Tuon	Time	Livo Timo	Elux	Eff Eluonco	Doco	Cumulativo Doco	\/th	Dace	
Bup #	Timo	DUT#	111	[V]	[MoV]	Sizo	Style	MUL	Counte	Live fille	FIUX	[cm 2]	[rad/Si\]	[rad/Si)]	fv1	Fass/	Commonts
Kull#	mile	001#	[v]	[v]	[iviev]	5120	Style	IVIO	counts	(5)	[011-2 5-1]	[CIII-2]	[lau(SI)]	[140(51)]	[v]	Fall	Labuiana arabiana. Carab ant antina DV dan
																	Labview problem. Can tiget actual Byoss
1		100	24		200	1 in 1 in	Contton	03 017	1 70	107.4	0.005107	0.065.00	5 775 100	5 775 100	2.10	Deer	values on display. Have to go back and extract
- 1		102	24	0	200	1 in x 1 in	Scatter	83.017	1.79	107.4	9.285+07	9.902+09	5.775+02	5.77E+UZ	2.18	Pass	from data.
2		102	27	0	200	1 in x 1 in	Scatter	83.017	1.72	103.2	9.036+07	9.902+09	5.776+02	1.136+03	2.10	Pass	
3	10.11 014	102	30	0	200		Scatter	83.02	1.08	100.8	9.88E+07	9.965+09	5.77E+02	1.73E+03	2.14	Pass	
4	12:11 PM	102	33	0	200	1 in x 1 in	Scatter	83.03	1./1	102.6	9.71E+07	9.96E+09	5.77E+02	2.31E+03	2.13	Pass	
5	12:15 PM	102	30	0	200	1 in x 1 in	Scatter	83.04	1.00	99.6	1.00E+08	9.96E+09	5.77E+02	2.89E+03	2.11	Pass	
6	12:21 PM	102	39	0	200	1 in x 1 in	Scatter	83.02	1.76	105.6	9.43E+07	9.96E+09	5.7/E+02	3.46E+03	2.10	Pass	
	12:26 PM	102	42	0	200	1 in x 1 in	Scatter	83.02	1.8	108	9.22E+07	9.96E+09	5.7/E+02	4.04E+03	2.08	Pass	
8	12:31 PM	102	45	0	200	1 in x 1 in	Scatter	83.02	1.81	108.6	9.17E+07	9.96E+09	5.77E+02	4.62E+03	2.06	Pass	
9	12:36 PM	102	48	0	200	1 in x 1 in	Scatter	83.02	1.8	108	9.22E+07	9.96E+09	5.77E+02	5.19E+03	2.05	Pass	Saw two 120 nA spikes during the run
10	12:42 PM	102	51	0	200	1 in x 1 in	Scatter	83.02	1.85	111	8.98E+07	9.96E+09	5.77E+02	5.77E+03	2.03	Pass	
																	Saw a 90 nA, a 120 nA, and a 140 nA spike
11	12:47 PM	102	54	0	200	1 in x 1 in	Scatter	83.02	1.86	111.6	8.93E+07	9.96E+09	5.77E+02	6.35E+03	2.02	Pass	during the run
12	12:53 PM	102	57	0	200	1 in x 1 in	Scatter	83.03	1.85	111	8.98E+07	9.96E+09	5.77E+02	6.92E+03	2.01	Pass	Saw two 140 nA spikes during the run
																	Saw a 160 nA, 160 nA, 70 nA, 160 nA, 30 nA,
																	160 nA, 160 nA, 160 nA, 160 nA, 160 nA, and 40
13	12:58 PM	102	60	0	200	1 in x 1 in	Scatter	83.01	1.81	108.6	9.17E+07	9.96E+09	5.77E+02	7.50E+03	1.99	Pass	nA spikes during the run
14	1:11 PM	103	60	0	200	1 in x 1 in	Scatter	83.02	1.83	109.8	9.07E+07	9.96E+09	5.77E+02	5.77E+02	2.29	Pass	Saw a ton of ~160 nA spikes during the run
																	Lots of ~160 nA spikes and smaller, two ~320
15	1:16 PM	103	60	0	200	1 in x 1 in	Scatter	83.02	18.07	1084.2	9.19E+06	9.96E+09	5.77E+02	1.15E+03	2.13	Pass	nA, one ~350 nA during the run
																	Current started very high & continued to
16	1:38 PM	103	60	-10	200	1 in x 1 in	Scatter	83.01	1.86	111.6	8.93E+07	9.96E+09	5.77E+02	1.73E+03	2.06	Pass	decrease throughout run to ~ 550 uA by end
17	1:51 PM	104	45	0	200	1 in x 1 in	Scatter	83.02	1.89	113.4	8.79E+07	9.96E+09	5.77E+02	5.77E+02	2.25	Pass	One 120 nA, 20 nA during the run
18	1:56 PM	104	48	0	200	1 in x 1 in	Scatter	83.01	1.89	113.4	8.78E+07	9.96E+09	5.77E+02	1.15E+03	2.24	Pass	One 120 nA spike during the run
19	2:01 PM	104	51	0	200	1 in x 1 in	Scatter	83.02	1.88	112.8	8.83E+07	9.96E+09	5.77E+02	1.73E+03	2.22	Pass	One 140 nA spike during the run
																	One 140 nA, 60 nA, and 80 nA spike during the
20	2:06 PM	104	54	0	200	1 in x 1 in	Scatter	83.02	1.86	111.6	8.93E+07	9.96E+09	5.77E+02	2.31E+03	2.20	Pass	run
21	2:11 PM	104	57	0	200	1 in x 1 in	Scatter	83.01	1.84	110.4	9.02E+07	9.96E+09	5.77E+02	2.88E+03	2.19	Pass	One 85 nA spike during the run
22	2:16 PM	104	60	0	200	1 in x 1 in	Scatter	83.01	1.79	107.4	9.27E+07	9.96E+09	5.77E+02	3.46E+03	2.17	Pass	Several 160 nA, one 30 nA spikes during the
																	Current was again very high, so there's no way
																	we'll see any spikes on the order of 100s of
																	nAs. ID started at ~5 mA, but has dropped to
23	2:20 PM	104	60	-10	200	1 in x 1 in	Scatter	83.01	1.67	100.2	9.94F+07	9.96F+09	5.77F+02	4.04F+03	2.10	Pass	~650 uA by the end of the run.
24	2:31 PM	105	45	0	200	1 in x 1 in	Scatter	83.01	1.8	108	9.22E+07	9.96E+09	5.77E+02	5.77E+02	2.26	Pass	
25	2:37 PM	105	48	0	200	1 in x 1 in	Scatter	83.01	1.82	109.2	9.12E+07	9.96E+09	5.77E+02	1.15E+03	2.24	Pass	
26	2:07 PM	105	51	0	200	1 in x 1 in	Scatter	83.01	1.02	109.2	9 12E+07	9.965+09	5 77E+02	1.73E+03	2.24	Dace	
27	2.47 DM	105	5/	0	200	1 in v 1 in	Scattor	83.01	1.02	109.6	9 175+07	9.965+09	5 775+02	2 315+02	2.23	Dase	Saw three 140 nA snikes during the run
21	2.47 PW	105	54	v	200	TULXTU	Statter	05.01	1.01	100.0	3.1/6+0/	J.30ET03	J.77ET02	2.316103	2.21	Pass	saw one 140 nA one 10 nA spikes during the
28	2.52 DM	105	57	0	200	1 in v 1 in	Scatter	83.02	1.8	108	9 225+07	9 965+09	5 77E+02	2 88E+03	2 10	Dace	nun
20	2.52 PIVI	105	57	0	200		Scatter	02.02	1.0	106.9	9.226±07	9.905109	5 775102	2.000000	2.19	Pass	Saw 120 nA covoral 160 nA durign the sun
29	2:30 PIVI	102	00	0	200	TIUXTIU	scatter	05.01	1.78	100.8	9.33E+07	9.90E+09	3.77E+02	3.40E+03	2.18	Pass	Saw 120 hA, Several 100 hA durigh the ruh

Table B4. Raw test data from 15 October 2017 at MGH

Appendix C

		Run #:	pre	1	2	3	4	5	6	7	8	pre	9	I	
		DUT S/N:	7	7	7	7	7	7	7	7	7	8	8		
	R	un Vds (V):		24	27	30	33	36	39	42	45		12		
		on species:		Ar	Ar	٨r	٨r	۸r	٨r	Ar	۸r		Ar		
		on species.	1 (A)		A	A	A	A					A	r	
	_	Vgs (V)	Igs (A)											Ļ	
		0	-2.4E-13	-7.9E-13	5.4E-13	1.0E-12	9.2E-13	1.1E-13	1.0E-12	8.8E-13	1.5E-09	4.2E-09	2.9E-10		
		2	1.9E-13	5.2E-13	1.3E-12	-8.4E-12	-9.7E-12	-9.8E-12	-8.9E-12	-9.6E-12	7.8E-05	3.4E-07	3.3E-07		
		4	8.5E-12	5.5E-12	6.4E-12	5.9E-12	6.2E-12	5.3E-12	6.1E-12	6.0E-12	2.9E-04	1.1E-06	5.7E-07		
		6	-3.1E-11	-2.9E-11	-2.7E-11	-2.8E-11	-2.8E-11	-2.9E-11	-2.8E-11	-2.7E-11	6.3E-04	2.3E-06	1.2E-06		
		8	-2.6E-11	-2.2E-11	-2.1E-11	-2.2E-11	-2.1E-11	-2.2E-11	-2.2E-11	-2.1E-11	> 0.001	3.8E-06	8.2E-07		
		10	-2.2E-11	-1.6E-11	-1.5E-11	-1.6E-11	-1.6E-11	-1.7E-11	-1.7E-11	-1.6E-11	> 0.001	4.7E-06	1.2E-06		
	1	12	-1 8F-11	-1 OF-11	-0 5E-12	-1 1E-11	-1 1E-11	-1 1E-11	-1 1E-11	-1 1E-11	> 0.001	2.1E-06	1 1E-06		
		14	1 55 11	E 2E 12	2 55 12	E OF 12	6 15 12	6 / 5 12	E 0E 12	6 0F 12	> 0.001	4 35.07	1.05.06		
		14	1.05.11	-3.56-12	-5.36-12	-3.0E-12	-0.16-12	-0.46-12	-3.66-12	-0.96-12	20.001	4.30-07	1.02-00		
		10	-1.06-11	-0.0E-13	1.1E-12	-7.9E-13	-1.8E-12	-8.9E-13	-1.2E-12	-1.8E-12	> 0.001	4.20-07	2.85-07		
		18	-0./E-12	4.5E-12	5.4E-12	3.3E-12	3.4E-12	2.9E-12	3.9E-12	2.5E-12	> 0.001	1.3E-07	2.4E-07		
		20	-3.3E-12	9.1E-12	9.1E-12	7.0E-12	7.8E-12	7.3E-12	8.3E-12	6.6E-12	> 0.001	1.8E-07	2.3E-07		
		0	-6.1E-11	-8.9E-11	-8.9E-11	-8.7E-11	-8.7E-11	-8.7E-11	-8.6E-11	-8.6E-11	1.1E-09	-2.1E-08	-1.4E-08		
		-2	-8.1E-11	-3.2E-11	-3.3E-11	-3.1E-11	-3.1E-11	-3.2E-11	-3.0E-11	-3.1E-11	-4.7E-05	-1.2E-07	-7.5E-08		
	1	-4	-9.0E-11	-9.2E-11	-9.2E-11	-9.1E-11	-9.1E-11	-9.2E-11	-9.2E-11	-9.1E-11	-4.3E-04	-3.1E-07	-1.7E-07		
	1	-6	-9.2E-11	-9.6E-11	-9.6E-11	-9.6E-11	-9.3E-11	-9.4E-11	-9.4E-11	-9.6E-11	< -0.001	-7.3E-07	-3.2E-07		
		-8	-9.4F-11	-3.8F-11	-3.8F-11	-9.9F-11	-9.9F-11	-9.8F-11	-9.9F-11	-9.9F-11	< -0.001	-1.0E-06	-6.3F-07		
		-10	-9 6E-11	-1 OF-10	-1 OF-10	-/ 1E-11	_/ 1E_11	_/ 1E_11	-4 OE-11	-4 0E-11	<-0.001	-8 7E-07	-7 5E-07		
		10	-0.05 11	1 15 10	1 15 10	1.05.10	1.05.10	1.05.10	1 05 10	1 05 10	< 0.001	-8 25 07	9 65 07		
		-12	4.05.44	-1.1E-10	-1.1E-10	-1.0E-10	-1.0E-10	-1.0E-10	-1.0E-10	-1.0E-10	<-0.001	-0.20-07	-0.0E-07		
		-14	-4.UE-11	-4./E-11	-4./E-11	-4.5E-11	-4.5E-11	-4.5E-11	-4.4E-11	-4.4E-11	<-0.001	-8.4E-07	-1.2E-06		
		-16	-3.9E-11	-4.8E-11	-4.8E-11	-4.8E-11	-4.6E-11	-4.7E-11	-4.6E-11	-4.5E-11	< -0.001	-7.8E-07	-1.8E-06		
		-18	-4.9E-11	-1.1E-10	-1.1E-10	-1.1E-10	-1.1E-10	-1.1E-10	-1.1E-10	-1.1E-10	< -0.001	-8.9E-07	-1.7E-06		
		-20	-2.0E-10	-1.8E-10	-1.7E-10	-1.6E-10	-1.5E-10	-1.5E-10	-1.5E-10	-1.4E-10	< -0.001	-9.8E-07	-1.8E-06		
		BVdss (V):	67	67	67	67	67	67	67	67	1.995	67	66	I	
		Idss (uA):	0.1177	8.96	21.58	41.52	55.23	83.71	105	140.3	n/a	0.1331	7,472		
	1	Vth (V):	2.20	1.34	1.11	0.94	0.83	0.73	0.65	0.59	0.30	2.33	1.49		
Bup #		Vth (V):	2.20	1.34	1.11	0.94	0.83	0.73	0.65	0.59	0.30	2.33	1.49	22	22
Run #:	pre	Vth (V):	2.20 11	1.34 12	1.11 13	0.94 14	0.83 15	0.73 16	0.65 17	0.59 18	0.30 19	2.33 20	1.49 21	22	23
Run #: DUT S/N:	pre 9	Vth (V): 10 9	2.20 11 9	1.34 12 9	1.11 13 9	0.94 14 9	0.83 15 9	0.73 16 9	0.65 17 9	0.59 18 9	0.30 19 9	2.33 20 9	1.49 21 9	22 9	23 9
Run #: DUT S/N: Run Vds (V):	pre 9	Vth (V): 10 9 6	2.20 11 9 9	1.34 12 9 12	1.11 13 9 15	0.94 14 9 18	0.83 15 9 21	0.73 16 9 24	0.65 17 9 27	0.59 18 9 30	0.30 19 9 33	2.33 20 9 36	1.49 21 9 39	22 9 42	23 9 45
Run #: DUT S/N: Run Vds (V): Ion species:	pre 9 	Vth (V): 10 9 6 Ar	2.20 11 9 9 Ar	1.34 12 9 12 Ar	1.11 13 9 15 Ar	0.94 14 9 18 Ar	0.83 15 9 21 Ar	0.73 16 9 24 Ar	0.65 17 9 27 Ar	0.59 18 9 30 Ar	0.30 19 9 33 Ar	2.33 20 9 36 Ar	1.49 21 9 39 Ar	22 9 42 Ar	23 9 45 Ar
Run #: DUT S/N: Run Vds (V): Ion species: Vgs (V)	pre 9 lgs (A)	Vth (V): 10 9 6 Ar	2.20 11 9 9 Ar	1.34 9 12 Ar	1.11 13 9 15 Ar	0.94 14 9 18 Ar	0.83 15 9 21 Ar	0.73 16 9 24 Ar	0.65 17 9 27 Ar	0.59 18 9 30 Ar	0.30 19 9 33 Ar	2.33 20 9 36 Ar	1.49 21 9 39 Ar	22 9 42 Ar	23 9 45 Ar
Run #: DUT S/N: Run Vds (V): Ion species: Vgs (V) 0	pre 9 lgs (A) -1.6E-13	Vth (V): 10 9 6 Ar 1.7E-13	2.20 11 9 9 Ar 1.0E-12	1.34 9 12 Ar 1.7E-12	1.11 13 9 15 Ar 4.6E-13	0.94 14 9 18 Ar 3.0E-13	0.83 15 9 21 Ar 1.4E-12	0.73 16 9 24 Ar 2.3E-12	0.65 17 9 27 Ar 1.0E-12	0.59 18 9 30 Ar 2.1E-12	0.30 19 9 33 Ar 2.0E-12	2.33 20 9 36 Ar 1.8E-12	1.49 21 9 39 Ar 2.2E-12	22 9 42 Ar 1.5E-12	23 9 45 Ar 1.1E-12
Run #: DUT S/N: Run Vds (V): Ion species: Vgs (V) 0 2	pre 9 lgs (A) -1.6E-13 3.6E-12	Vth (V): 10 9 6 Ar 1.7E-13 4.3E-12	2.20 11 9 9 Ar 1.0E-12 8.2E-12	1.34 9 12 Ar 1.7E-12 4.1E-12	1.11 13 9 15 Ar 4.6E-13 2.9E-12	0.94 14 9 18 Ar 3.0E-13 3.1E-12	0.83 15 9 21 Ar 1.4E-12 3.4E-12	0.73 16 9 24 Ar 2.3E-12 4.6E-12	0.65 17 9 27 Ar 1.0E-12 -6.5E-12	0.59 18 9 30 Ar 2.1E-12 -5.9E-12	0.30 19 9 33 Ar 2.0E-12 -6.0E-12	2.33 20 9 36 Ar 1.8E-12 -6.0E-12	1.49 21 9 39 Ar 2.2E-12 5.0E-12	22 9 42 Ar 1.5E-12 3.9F-12	23 9 45 Ar 1.1E-12 -7.3E-12
Run #: DUT S/N: Run Vds (V): Ion species: Vgs (V) 0 2 4	pre 9 -1.6E-13 3.6E-12 1 4E-11	Vth (V): 10 9 6 Ar 1.7E-13 4.3E-12 1.6E-11	2.20 11 9 9 Ar 1.0E-12 8.2E-12 1.1E-11	1.34 9 12 Ar 1.7E-12 4.1E-12 1 1E-11	1.11 13 9 15 Ar 4.6E-13 2.9E-12 1.0E-11	0.94 14 9 18 Ar 3.0E-13 3.1E-12 9 7E-12	0.83 9 21 Ar 1.4E-12 3.4E-12 1.0E-11	0.73 16 9 24 Ar 2.3E-12 4.6E-12 1.1E-11	0.65 17 9 27 Ar 1.0E-12 -6.5E-12 1.0E-11	0.59 18 9 30 Ar 2.1E-12 -5.9E-12 1.1E-11	0.30 19 9 33 Ar 2.0E-12 -6.0E-12 1.1E-11	2.33 20 9 36 Ar 1.8E-12 -6.0E-12 1.0E-11	1.49 21 9 39 Ar 2.2E-12 5.0E-12 -8 4E-13	22 9 42 Ar 1.5E-12 3.9E-12 -1 4E-12	23 9 45 Ar 1.1E-12 -7.3E-12 -2 9E-12
Run #: DUT S/N: Run Vds (V): Ion species: Vgs (V) 0 2 4 6	pre 9 -1.6E-13 3.6E-12 1.4E-11 -2 3E-11	Vth (V): 10 9 6 Ar 1.7E-13 4.3E-12 1.6E-11 -2.0E-11	2.20 11 9 9 Ar 1.0E-12 8.2E-12 1.1E-11 -2.0E-11	1.34 9 12 Ar 1.7E-12 4.1E-12 1.1E-11 -2 0E-11	1.11 13 9 15 Ar 4.6E-13 2.9E-12 1.0E-11 .2 1E-11	0.94 14 9 18 Ar 3.0E-13 3.1E-12 9.7E-12 -2.2E-11	0.83 15 9 21 Ar 1.4E-12 3.4E-12 1.0E-11 -2 1E-11	0.73 16 9 24 Ar 2.3E-12 4.6E-12 1.1E-11 -2 1E-11	0.65 17 9 27 Ar 1.0E-12 -6.5E-12 1.0E-11 -2.2E-11	0.59 18 9 30 Ar 2.1E-12 -5.9E-12 1.1E-11 -2 1E-11	0.30 19 9 33 Ar 2.0E-12 -6.0E-12 1.1E-11 -2 1E-11	2.33 20 9 36 Ar 1.8E-12 -6.0E-12 1.0E-11 -2.1E-11	1.49 9 39 Ar 2.2E-12 5.0E-12 -8.4E-13 -2 1E-11	22 9 42 Ar 1.5E-12 3.9E-12 -1.4E-12 -2.0E-11	23 9 45 Ar 1.1E-12 -7.3E-12 -2.9E-12
Run #: DUT S/N: Run Vds (V): Ion species: Vgs (V) 0 2 4 6 6	pre 9 lgs (A) -1.6E-13 3.6E-12 1.4E-11 -2.3E-11	Vth (V): 10 9 6 Ar 1.7E-13 4.3E-12 1.6E-11 -2.0E-11 1.15 11	2.20 11 9 9 Ar 1.0E-12 8.2E-12 1.1E-11 -2.0E-11 1.2E-11	1.34 9 12 Ar 1.7E-12 4.1E-12 1.1E-11 -2.0E-11 1 25 12	1.11 13 9 15 Ar 4.6E-13 2.9E-12 1.0E-11 -2.1E-11 1.2E-11	0.94 14 9 18 Ar 3.0E-13 3.1E-12 9.7E-12 -2.2E-11 1.4E 11	0.83 15 9 21 Ar 1.4E-12 3.4E-12 1.0E-11 -2.1E-11 1.4E-12	0.73 16 9 24 Ar 2.3E-12 4.6E-12 1.1E-11 -2.1E-11 4.5E-11	0.65 17 9 27 Ar 1.0E-12 -6.5E-12 1.0E-11 -2.2E-11 1 55 11	0.59 18 9 30 Ar 2.1E-12 -5.9E-12 1.1E-11 -2.1E-11 1 45 12	0.30 19 9 33 Ar 2.0E-12 -6.0E-12 1.1E-11 -2.1E-11 1.4E-11	2.33 20 9 36 Ar 1.8E-12 -6.0E-12 1.0E-11 -2.1E-11 4.5 11	1.49 9 39 Ar 2.2E-12 5.0E-12 -8.4E-13 -2.1E-11	22 9 42 Ar 1.5E-12 3.9E-12 -1.4E-12 -2.0E-11	23 9 45 Ar -7.3E-12 -2.9E-12 -2.3E-11
Run #: DUT S/N: Run Vds (V): Ion species: Vgs (V) 0 2 4 6 8	pre 9 lgs (A) -1.6E-13 3.6E-12 1.4E-11 -2.3E-11 -1.6E-11 0.45-62	Vth (V): 10 9 6 Ar 1.7E-13 4.3E-12 1.6E-11 -2.0E-11 -1.1E-11 -1.1E-11	2.20 11 9 9 Ar 1.0E-12 8.2E-12 1.1E-11 -2.0E-11 -1.2E-11	1.34 12 9 12 Ar 1.7E-12 4.1E-12 1.1E-11 -2.0E-11 -2.0E-11	1.11 13 9 15 Ar 4.6E-13 2.9E-12 1.0E-11 -2.1E-11 -1.3E-11 5 7 5 15	0.94 14 9 18 Ar 3.0E-13 3.1E-12 9.7E-12 9.7E-12 -2.2E-11 -1.4E-11	0.83 15 9 21 Ar 1.4E-12 3.4E-12 1.0E-11 -2.1E-11 -2.1E-11 -2.5 +5	0.73 16 9 24 Ar 2.3E-12 4.6E-12 1.1E-11 -2.1E-11 -2.1E-11 -2.5 55	0.65 17 9 27 Ar 1.0E-12 -6.5E-12 1.0E-11 -2.2E-11 -1.5E-11 0 45 45	0.59 18 9 30 Ar 2.1E-12 -5.9E-12 1.1E-11 -2.1E-11 -2.1E-11 -2.5 ±5	0.30 19 9 33 Ar 2.0E-12 1.0E-12 1.1E-11 -2.1E-11 -2.1E-11 -2.1E-11	2.33 20 9 36 Ar 1.8E-12 -6.0E-12 1.0E-11 -2.1E-11 -2.1E-11 -2.5 55	1.49 9 39 Ar 2.2E-12 5.0E-12 -8.4E-13 -2.1E-11 -1.4E-11 -2.2E-12	22 9 42 Ar 1.5E-12 3.9E-12 -1.4E-12 -2.0E-11 -1.3E-11	23 9 45 Ar -7.3E-12 -2.9E-12 -2.3E-11 -1.6E-11
Run #: DUT S/N: Run Vds (V): Ion species: Vgs (V) 0 2 4 6 8 10	pre 9 	Vth (V): 10 9 6 Ar 1.7E-13 4.3E-12 1.6E-11 -2.0E-11 -1.1E-11 -3.1E-12	2.20 11 9 9 Ar 1.0E-12 8.2E-12 1.1E-11 -2.0E-11 -1.2E-11 -4.4E-12	1.34 9 12 Ar 1.7E-12 4.1E-12 1.1E-11 -2.0E-11 -1.2E-11 -5.7E-12	1.11 13 9 15 Ar 4.6E-13 2.9E-12 1.0E-11 -2.1E-11 -1.3E-11 -5.7E-12	0.94 14 9 18 Ar 3.0E-13 3.1E-12 9.7E-12 -2.2E-11 -1.4E-11 -7.8E-12	0.83 9 21 Ar 1.4E-12 3.4E-12 1.0E-11 -2.1E-11 -1.4E-11 -8.0E-12	0.73 16 9 24 Ar 2.3E-12 4.6E-12 1.1E-11 -2.1E-11 -1.4E-11 -6.6E-12	0.65 17 9 27 Ar 1.0E-12 -6.5E-12 1.0E-11 -2.2E-11 -1.5E-11 -8.4E-12	0.59 18 9 30 Ar 2.1E-12 -5.9E-12 1.1E-11 -2.1E-11 -1.4E-11 -7.8E-12	0.30 19 9 33 Ar 2.0E-12 -6.0E-12 1.1E-11 -2.1E-11 -1.4E-11 -8.2E-12	2.33 20 9 36 Ar 1.8E-12 -6.0E-12 1.0E-11 -2.1E-11 -1.4E-11 -7.8E-12	1.49 21 9 39 Ar 2.2E-12 5.0E-12 -8.4E-13 -2.1E-11 -1.4E-11 -8.2E-12	22 9 42 Ar 1.5E-12 3.9E-12 -1.4E-12 -2.0E-11 -1.3E-11 -7.6E-12	23 9 45 Ar -7.3E-12 -2.9E-12 -2.3E-11 -1.6E-11 -1.0E-11
Run #: DUT S/N: Run Vds (V): lon species: Vgs (V) 0 2 4 6 8 10 12	pre 9 1.6E-13 3.6E-12 1.4E-11 -2.3E-11 -1.6E-11 -9.4E-12 -3.6E-12	Vth (V): 10 9 6 Ar 1.7E-13 4.3E-12 1.6E-11 -2.0E-11 -1.1E-11 -3.1E-12 5.0E-12	2.20 11 9 9 Ar 1.0E-12 8.2E-12 1.1E-11 -2.0E-11 -1.2E-11 -4.4E-12 2.4E-12	1.34 9 12 Ar 1.7E-12 4.1E-12 1.1E-11 -2.0E-11 -1.2E-11 -5.7E-12 -1.5E-13	1.11 13 9 15 Ar 4.6E-13 2.9E-12 1.0E-11 -2.1E-11 -3.7E-12 -3.8E-14	0.94 14 9 18 Ar 3.0E-13 3.1E-12 9.7E-12 -2.2E-11 -1.4E-11 -7.8E-12 -1.6E-12	0.83 15 9 21 Ar 1.4E-12 3.4E-12 1.0E-11 -2.1E-11 -2.1E-11 -1.4E-11 -8.0E-12 -1.7E-12	0.73 16 9 24 Ar 2.3E-12 4.6E-12 1.1E-11 -2.1E-11 -1.4E-11 -6.6E-12 -9.0E-13	0.65 17 9 27 Ar 1.0E-12 -6.5E-12 1.0E-11 -2.2E-11 -1.5E-11 -8.4E-12 -1.4E-12	0.59 18 9 30 Ar 2.1E-12 -5.9E-12 1.1E-11 -2.1E-11 -1.4E-11 -7.8E-12 -2.5E-12	0.30 19 9 33 Ar 2.0E-12 -6.0E-12 1.1E-11 -2.1E-11 -1.4E-11 -8.2E-12 -3.0E-12	2.33 20 9 36 Ar -6.0E-12 1.0E-11 -2.1E-11 -1.4E-11 -7.8E-12 -2.6E-12	1.49 21 9 39 Ar 2.2E-12 5.0E-12 -8.4E-13 -2.1E-11 -1.4E-11 -8.2E-12 -2.0E-12	22 9 42 Ar 1.5E-12 3.9E-12 -1.4E-12 -2.0E-11 -1.3E-11 -7.6E-12 -2.4E-12	23 9 45 Ar -7.3E-12 -2.9E-12 -2.3E-11 -1.6E-11 -1.0E-11 -5.0E-12
Run #: DUT S/N: Run Vds (V): lon species: Vgs (V) 0 2 4 6 8 10 12 14	pre 9 1.6E-13 3.6E-12 1.4E-11 -2.3E-11 -1.6E-11 -9.4E-12 -3.6E-12 1.8E-12	Vth (V): 10 9 6 Ar 1.7E-13 4.3E-12 1.6E-11 -2.0E-11 -1.1E-11 -3.1E-12 5.0E-12 1.2E-11	2.20 11 9 9 Ar 1.0E-12 8.2E-12 1.1E-11 -2.0E-11 -2.0E-11 -1.2E-11 -4.4E-12 2.4E-12 9.2E-12	1.34 9 12 Ar 1.7E-12 4.1E-12 1.1E-11 -2.0E-11 -1.2E-11 -5.7E-12 -1.5E-13 6.1E-12	1.11 13 9 15 Ar 4.6E-13 2.9E-12 1.0E-11 -2.1E-11 -3.7E-12 -3.8E-14 5.6E-12	0.94 14 9 18 Ar 3.0E-13 3.1E-12 9.7E-12 -2.2E-11 -1.4E-11 -7.8E-12 -1.6E-12 5.2E-12	0.83 9 21 Ar 1.4E-12 3.4E-12 1.0E-11 -2.1E-11 -1.4E-11 -1.4E-11 -8.0E-12 -1.7E-12 3.9E-12	0.73 16 9 24 Ar 2.3E-12 4.6E-12 1.1E-11 -2.1E-11 -1.4E-11 -6.6E-12 -9.0E-13 4.6E-12	0.65 17 9 27 Ar 1.0E-12 -0.5E-12 1.0E-11 -2.2E-11 -1.5E-11 -8.4E-12 -1.4E-12 3.4E-12	0.59 18 9 30 Ar 2.1E-12 -5.9E-12 1.1E-11 -2.1E-11 -1.4E-11 -7.8E-12 -2.5E-12 2.7E-12	0.30 19 9 33 Ar 2.0E-12 -6.0E-12 1.1E-11 -2.1E-11 -1.4E-11 -8.2E-12 -3.0E-12 2.1E-12	2.33 20 9 36 Ar 1.8E-12 -6.0E-12 1.0E-11 -2.1E-11 -2.1E-11 -1.4E-11 -7.8E-12 -2.6E-12 3.2E-12	1.49 21 9 39 Ar 2.2E-12 5.0E-12 -8.4E-13 -2.1E-11 -1.4E-11 -1.4E-11 -8.2E-12 -2.0E-12 3.4E-12	22 9 42 Ar 1.5E-12 3.9E-12 -1.4E-12 -2.0E-11 -1.3E-11 -7.6E-12 -2.4E-12 2.6E-12	23 9 45 Ar -7.3E-12 -2.9E-12 -2.3E-11 -1.6E-11 -1.0E-11 -5.0E-12 -1.9E-13
Run #: DUT S/N: Run Vds (V): lon species: Vgs (V) 0 2 4 6 8 10 12 14 14 16	pre 9 1.6E-13 3.6E-12 1.4E-11 -2.3E-11 -1.6E-12 -9.4E-12 -3.6E-12 1.8E-12 6.5E-12	Vth (V): 10 9 6 1.7E-13 4.3E-12 1.6E-11 -2.0E-11 -3.1E-12 5.0E-12 5.0E-12 1.2E-11 1.8E-11	2.20 11 9 9 Ar 1.0E-12 8.2E-12 1.1E-11 -2.0E-11 -1.2E-11 -4.4E-12 2.4E-12 9.2E-12 1.5E-11	1.34 9 12 Ar 1.7E-12 4.1E-12 1.1E-11 -2.0E-11 -1.2E-11 -5.7E-12 -1.5E-13 6.1E-12 1.2E-11	1.11 13 9 15 Ar 4.6E-13 2.9E-12 1.0E-11 -2.1E-11 -3.7E-12 -3.8E-14 5.6E-12 1.1E-11	0.94 14 9 18 Ar 3.0E-13 3.1E-12 9.7E-12 -2.2E-11 -1.4E-11 -7.8E-12 -7.8E-12 -7.8E-12 -7.8E-12 5.2E-12 1.1E-11	0.83 9 21 Ar 1.4E-12 3.4E-12 1.0E-11 -2.1E-11 -1.4E-11 -8.0E-12 -1.7E-12 3.9E-12 9.4E-12	0.73 16 9 24 Ar 2.3E-12 4.6E-12 1.1E-11 -2.1E-11 -1.4E-11 -6.6E-12 -9.0E-13 4.6E-12 1.0E-11	0.65 17 9 27 Ar 1.0E-12 -6.5E-12 1.0E-11 -2.2E-11 -1.5E-11 -8.4E-12 3.4E-12 8.6E-12	0.59 18 9 30 Ar 2.1E-12 -5.9E-12 1.1E-11 -2.1E-11 -7.8E-12 2.7E-12 8.2E-12	0.30 19 9 33 Ar 2.0E-12 -6.0E-12 1.1E-11 -2.1E-11 -3.2E-12 -3.0E-12 2.1E-12 7.8E-12	2.33 20 9 36 Ar 1.8E-12 -6.0E-12 1.0E-11 -2.1E-11 -1.4E-11 -7.8E-12 -2.6E-12 8.2E-12 8.2E-12	1.49 21 9 39 Ar 2.2E-12 5.0E-12 -8.4E-13 -2.1E-11 -1.4E-11 -8.2E-12 -2.0E-12 3.4E-12 8.4E-12	22 9 42 Ar 1.5E-12 3.9E-12 -1.4E-12 -2.0E-11 -1.3E-11 -7.6E-12 2.6E-12 8.3E-12	23 9 45 Ar -7.3E-12 -2.9E-12 -2.3E-11 -1.6E-11 -1.0E-11 -5.0E-12 -1.9E-13 4.3E-12
Run #: DUT S/N: Run Vds (V): Ion species: Vgs (V) 0 2 4 6 8 10 12 14 16 18	pre 9 1.6E-13 3.6E-12 1.4E-11 -2.3E-11 -1.6E-11 -9.4E-12 -3.6E-12 1.8E-12 1.8E-12 6.5E-12 1.2E-11	Vth (V): 10 9 6 Ar 1.7E-13 4.3E-12 1.6E-11 -2.0E-11 -1.1E-11 -3.1E-12 5.0E-12 1.2E-11 1.8E-11 2.4E-11	2.20 11 9 9 Ar 1.0E-12 8.2E-12 1.1E-11 -2.0E-11 -1.2E-11 -4.4E-12 2.4E-12 9.2E-12 1.5E-11 2.2E-11	1.34 9 12 Ar 1.7E-12 4.1E-12 1.1E-11 -2.0E-11 -1.2E-11 -5.7E-12 -1.5E-13 6.1E-12 1.2E-11 1.8E-11	1.11 9 15 Ar 4.6E-13 2.9E-12 1.0E-11 -2.1E-11 -3.8E-11 -5.7E-12 -3.8E-14 5.6E-12 1.1E-11 1.7E-11	0.94 14 9 18 Ar 3.0E-13 3.1E-12 9.7E-12 -2.2E-11 -1.4E-11 -7.8E-12 5.2E-12 1.1E-11 1.6E-11	0.83 9 21 Ar 1.4E-12 3.4E-12 1.0E-11 -2.1E-11 -1.4E-11 -8.0E-12 -1.7E-12 3.9E-12 9.4E-12 9.4E-12	0.73 16 9 24 Ar 2.3E-12 4.6E-12 1.1E-11 -2.1E-11 -3.6E-12 -9.0E-13 4.6E-12 1.0E-11 1.5E-11	0.65 17 9 27 Ar 1.0E-12 -6.5E-12 1.0E-11 -2.2E-11 -3.4E-12 3.4E-12 8.6E-12 8.6E-12 1.3E-11	0.59 18 9 30 Ar 2.1E-12 -5.9E-12 1.1E-11 -2.1E-11 -7.8E-12 2.7E-12 8.2E-12 8.2E-12 1.3E-11	0.30 9 33 Ar 2.0E-12 -6.0E-12 1.1E-11 -2.1E-11 -3.0E-12 2.1E-12 7.8E-12 7.8E-12 1.3E-11	2.33 20 9 36 Ar 1.8E-12 -6.0E-12 1.0E-11 -2.1E-11 -7.8E-12 -2.6E-12 3.2E-12 8.2E-12 8.2E-12 1.3E-11	1.49 21 9 39 Ar 2.2E-12 5.0E-12 -8.4E-13 -2.1E-11 -1.4E-11 -8.2E-12 3.4E-12 8.4E-12 8.4E-12 1.4E-11	22 9 42 Ar 1.5E-12 3.9E-12 -1.4E-12 -2.0E-11 -1.3E-11 -7.6E-12 2.6E-12 8.3E-12 8.3E-12 1.4E-11	23 9 45 Ar 1.1E-12 -7.3E-12 -2.9E-12 -2.3E-11 -1.6E-11 -1.0E-11 -5.0E-12 -1.9E-13 4.3E-12 9.4E-12
Run #: DUT S/N: Run Vds (V): Ion species: Vgs (V) 0 2 4 6 8 10 12 14 16 18 20	pre 9 -	Vth (V): 10 9 6 Ar 1.7E-13 4.3E-12 1.6E-11 -1.1E-11 -3.1E-12 5.0E-12 1.2E-11 1.8E-11 2.4E-11 3.1E-11	2.20 11 9 9 Ar 1.0E-12 8.2E-12 1.1E-11 -1.2E-11 -4.4E-12 9.2E-12 1.5E-11 2.2E-11 2.8E-11	1.34 9 12 Ar 1.7E-12 4.1E-12 1.1E-11 -2.0E-11 -1.2E-11 -5.7E-12 -1.5E-13 6.1E-12 1.2E-11 1.8E-11 1.8E-11	1.11 9 15 Ar 4.6E-13 2.9E-12 1.0E-11 -0.7E-11 -3.8E-11 -3.8E-14 5.6E-12 1.1E-11 1.7E-11 2.3E-11	0.94 14 9 18 Ar 3.0E-13 3.1E-12 9.7E-12 -2.2E-11 -1.4E-11 -7.8E-12 5.2E-12 1.1E-11 1.6E-11 2.1E-11	0.83 9 21 Ar 1.4E-12 3.4E-12 1.0E-11 -1.0E-11 -1.4E-11 -3.0E-12 -1.7E-12 3.9E-12 9.4E-12 1.5E-11 2.1E-11	0.73 16 9 24 Ar 2.3E-12 1.1E-11 -1.4E-11 -6.6E-12 -9.0E-13 4.6E-12 1.0E-11 1.5E-11 1.5E-11	0.65 17 9 27 Ar 1.0E-12 -6.5E-12 1.0E-11 -2.2E-11 -1.5E-11 -3.4E-12 3.4E-12 3.4E-12 1.3E-11 1.5E-11 1.5E-12 1.3E-11 1.5E-12 1.5E-12 1.5E-12 1.5E-12 1.5E-12 1.5E-11 1.5E-11 1.5E-11 1.5E-12 1.5E-12 1.5E-11 1.5E-	0.59 18 9 30 Ar 2.1E-12 -5.9E-12 1.1E-11 -2.1E-11 -7.8E-12 2.7E-12 8.2E-12 1.3E-11 1.8E-11	0.30 9 33 Ar 2.0E-12 -6.0E-12 1.1E-11 -2.1E-11 -3.0E-12 2.1E-12 7.8E-12 1.3E-11 1.7E-11	2.33 20 9 36 Ar 1.8E-12 -6.0E-12 1.0E-11 -2.1E-11 -7.8E-12 -2.6E-12 3.2E-12 8.2E-12 1.3E-11 1.8E-11	1.49 21 9 39 Ar 2.2E-12 5.0E-12 -8.4E-13 -2.1E-11 -1.4E-11 -8.2E-12 3.4E-12 3.4E-12 1.4E-11 1.9E-11	22 9 42 Ar 1.5E-12 3.9E-12 -1.4E-12 -2.0E-11 -7.6E-12 2.6E-12 8.3E-12 1.4E-11 1.9E-11	23 9 45 Ar 1.1E-12 -7.3E-12 -2.9E-12 -2.9E-12 -2.3E-11 -1.6E-11 -1.0E-11 -5.0E-12 -1.9E-13 4.3E-12 9.4E-12 1.4E-11
Run #: DUT S/N: Run Vds (V): lon species: Vgs (V) 0 2 4 6 8 10 12 14 16 18 20 0	pre 9 -	Vth (V): 10 9 6 Ar 1.7E-13 4.3E-12 1.6E-11 -2.0E-11 -1.1E-11 -3.1E-12 5.0E-12 1.2E-11 1.8E-11 2.4E-11 3.1E-11 3.1E-11	2.20 11 9 9 Ar 1.0E-12 8.2E-12 1.1E-11 -2.0E-11 -2.0E-11 2.4E-12 9.2E-12 1.5E-11 2.2E-11 2.8E-11 2.8E-11	1.34 9 12 Ar 1.7E-12 4.1E-12 1.1E-11 -2.0E-11 -3.7E-12 -1.5E-13 6.1E-12 1.2E-11 1.8E-11 2.4E-11 2.4E-11	1.11 9 15 Ar 4.6E-13 2.9E-12 1.0E-11 -2.1E-11 -3.8E-11 5.6E-12 1.1E-11 1.7E-11 2.3E-11 -3.7E-11	0.94 14 9 18 Ar 3.0E-13 3.1E-12 9.7E-12 -2.2E-11 -1.4E-11 -7.8E-12 5.2E-12 1.6E-11 2.1E-11 1.6E-11 2.1E-11	0.83 9 21 Ar 1.4E-12 3.4E-12 1.0E-11 -2.1E-11 -2.1E-11 -3.9E-12 9.4E-12 1.5E-11 2.1E-11	0.73 16 9 24 Ar 2.3E-12 1.1E-11 -2.1E-11 -2.1E-11 1.5E-11 2.5E-11 2.1E-11 1.5E-11 2.3E-11	0.65 17 9 27 Ar 1.0E-12 -0.5E-12 1.0E-11 -2.2E-11 -3.4E-12 3.4E-12 8.6E-12 1.3E-11 1.9E-11 1.9E-11	0.59 18 9 30 Ar 2.1E-12 -5.9E-12 1.1E-11 -7.8E-12 2.7E-12 8.2E-12 1.3E-11 1.8E-11 1.8E-11	0.30 19 9 33 Ar 2.0E-12 -6.0E-12 -1.1E-11 -1.1E-11 -2.1E-11 -3.0E-12 2.1E-12 7.8E-12 1.3E-11 1.7E-11 -3.6E-11	2.33 20 9 36 Ar 1.8E-12 -6.0E-12 1.0E-11 -2.1E-11 -1.4E-11 -7.8E-12 -2.6E-12 3.2E-12 1.3E-11 1.8E-11 1.8E-14 -3.6E-11	1.49 21 9 39 Ar 2.2E-12 5.0E-12 -8.4E-13 -2.1E-11 -1.4E-11 -8.2E-12 3.4E-12 8.4E-12 1.4E-11 1.9E-11 1.9E-11	22 9 42 Ar 1.5E-12 3.9E-12 -1.4E-12 -2.0E-11 -1.3E-11 -7.6E-12 8.3E-12 1.4E-11 1.9E-11	23 9 45 Ar 1.1E-12 -7.3E-12 -2.9E-12 -2.9E-12 -1.6E-11 -1.0E-11 -1.0E-11 -1.0E-11 -1.9E-13 4.3E-12 9.4E-12 1.4E-12
Run #: DUT S/N: Run Vds (V): lon species: Vgs (V) 0 2 4 6 8 10 12 14 16 18 20 0 -2	pre 9 1.6E-13 3.6E-12 1.4E-11 -2.3E-11 -1.6E-11 -9.4E-12 -3.6E-12 1.8E-12 1.8E-12 1.2E-11 1.6E-11 -8.5E-11 -9.4E-12	Vth (V): 10 9 6 1.7E-13 4.3E-12 1.6E-11 -2.0E-11 -1.1E-11 -3.1E-12 5.0E-12 1.2E-11 1.8E-11 1.8E-11 3.1E-11 -3.8E-11 -2.2E-14	2.20 11 9 9 Ar 1.0E-12 8.2E-12 1.1E-11 -2.0E-11 -1.2E-11 2.4E-12 9.2E-12 1.5E-11 2.2E-11 2.8E-11 -3.8E-11 -3.8E-11 -2.1E-14	1.34 9 12 Ar 1.7E-12 4.1E-12 1.1E-11 -2.0E-11 -1.2E-11 -5.7E-12 1.2E-11 1.8E-11 2.4E-11 2.4E-11 -7.7E-11 3.3 E-11	1.11 9 15 Ar 4.6E-13 2.9E-12 1.0E-11 -2.1E-11 -3.7E-12 -3.7E-14 1.7E-11 2.3E-11 -3.7E-11 -3.7E-11 -3.7E-11 -3.7E-11	0.94 14 9 18 Ar 3.0E-13 3.1E-12 9.7E-12 -2.2E-11 -1.4E-11 -7.8E-12 -3.2E-12 1.1E-11 1.6E-11 2.1E-11 -3.8E-11 -3.2E-12	0.83 9 21 Ar 1.4E-12 3.4E-12 1.0E-11 -2.1E-11 -1.4E-11 -3.9E-12 9.4E-12 1.5E-11 2.1E-11 -3.7E-11 -1.9E-11 -1.9E-11	0.73 16 9 24 Ar 2.3E-12 4.6E-12 1.1E-11 -2.1E-11 -3.6E-12 1.0E-11 1.5E-11 2.1E-11 -3.6E-11 -1.9E-11 -	0.65 17 9 27 Ar 1.0E-12 -6.5E-12 1.0E-11 -2.2E-11 -3.4E-12 3.4E-12 3.4E-12 3.4E-12 1.3E-11 1.9E-11 -3.6E-11 -3.0E-11 -3.0E-11	0.59 18 9 30 Ar 2.1E-12 -5.9E-12 1.1E-11 -2.1E-11 -7.8E-12 2.7E-12 8.2E-12 1.3E-11 1.8E-11 -3.6E-11 -1.9E-11	0.30 19 9 33 Ar 2.0E-12 -6.0E-12 1.1E-11 -2.1E-11 -3.0E-12 2.1E-12 7.8E-12 1.3E-11 1.7E-11 -3.6E-11 -1.9E-11	2.33 9 36 Ar 1.8E-12 -6.0E-12 1.0E-11 -2.1E-11 -7.8E-12 -2.6E-12 3.2E-12 3.2E-12 3.2E-12 1.3E-11 1.8E-11 -3.6E-11 -1.9E-11 -3.6E-11 -3.6E-11 -3.6E-11 -3.6E-11 -3.6E-11 -3.6E-11 -3.6E-11 -3.6E-11 -3.6E-11 -3.6E-11 -3.6E-11 -3.6E-11 -3.6E-12 -3.6E-12 -3.2E-	1.49 21 9 39 Ar 2.2E-12 5.0E-12 -8.4E-13 -2.1E-11 -1.4E-11 -8.2E-12 -2.0E-12 3.4E-12 1.4E-11 1.9E-11 -3.6E-11 1.9E-11 -3.6E-11 -1.9E-11	22 9 42 Ar 1.5E-12 3.9E-12 -1.4E-12 -2.0E-11 -1.3E-11 -7.6E-12 -2.4E-12 2.6E-12 8.3E-12 1.4E-11 1.9E-11 -3.6E-11 1.9E-11	23 9 45 Ar 1.1E-12 -7.3E-12 -2.9E-12 -2.3E-11 -1.0E-11 -5.0E-12 -1.9E-13 4.3E-12 9.4E-12 1.4E-11 -3.7E-11 -2.2 E-11
Run #: DUT S/N: Run Vds (V): Ion species: Vgs (V) 0 2 4 6 8 10 12 14 16 18 20 0 -2 2	pre 9 	Vth (V): 10 9 6 Ar 1.7E-13 4.3E-12 1.6E-11 -2.0E-11 -3.1E-12 5.0E-12 1.2E-11 1.8E-11 1.8E-11 1.8E-11 -3.8E-11	2.20 11 9 9 Ar 1.0E-12 8.2E-12 1.1E-11 -2.0E-11 -2.0E-11 2.4E-12 9.2E-12 1.5E-11 2.5E-11 2.5E-11 2.5E-11 3.8E-11 -3.8E-11 -3.8E-11 -2.1E-11	1.34 9 12 Ar 1.7E-12 4.1E-12 1.1E-11 -2.0E-11 -1.2E-11 1.2E-11 1.2E-11 1.2E-11 1.2E-11 1.2E-11 -3.2E-11 -3.2E-11 0.02111	1.11 9 15 Ar 2.9E-12 1.0E-11 -2.1E-11 -3.7E-12 -3.8E-14 5.6E-12 1.1E-11 1.7E-11 2.3E-11 -3.7E-11 -3.7E-11 -2.1E-11 -2.9E-12 -3.7E-11 -3.7E-11 -3.7E-11	0.94 14 9 18 Ar 3.0E-13 3.1E-12 9.7E-12 -2.2E-11 -1.4E-11 -7.8E-12 5.2E-12 5.2E-12 1.1E-11 1.6E-11 2.1E-11 -3.8E-11 -2.0E-11 % or the second seco	0.83 9 21 Ar 1.4E-12 3.4E-12 1.0E-11 -2.1E-11 -1.4E-11 -3.9E-12 9.4E-12 1.5E-11 2.1E-11 -3.7E-11 -3.7E-11 -3.7E-11 -3.9E-11 -3.9E-11	0.73 16 9 24 Ar 2.3E-12 4.6E-12 1.1E-11 -2.1E-11 -3.6E-12 -9.0E-13 4.6E-12 1.0E-11 1.5E-11 2.1E-11 -3.6E-11 -3	0.65 17 9 27 Ar 1.0E-12 -6.5E-12 1.0E-11 -2.2E-11 -3.4E-12 3.4E-12 1.3E-11 1.9E-11 -3.6E-11 -2.0E-11 -2.0E-11	0.59 18 9 30 Ar 2.1E-12 -5.9E-12 1.1E-11 -2.1E-11 -7.8E-12 2.7E-12 8.2E-12 1.3E-11 1.8E-11 -3.6E-11 -3.6E-11 -3.6E-11	0.30 9 33 Ar 2.0E-12 -6.0E-12 1.1E-11 -2.1E-11 -3.0E-12 2.1E-12 7.8E-12 1.3E-11 1.7E-11 -3.6E-11 -3.6E-11 -3.6E-11 -3.6E-11	2.33 9 36 Ar 1.8E-12 -6.0E-12 1.0E-11 -2.1E-11 -7.8E-12 -2.6E-12 3.2E-12 1.3E-11 1.8E-11 -3.6E-11 -3.6E-11 -3.6E-11 -9.9E-11 -9.9E-11 -9.9E-11 -9.9E-11 -9.9E-11 -9.9E-11 -9.9E-11 -9.9E-11 -9.9E-11 -9.9E-11 -9.9E-11 -9.9E-11 -9.9E-11 -9.9E-11 -9.9E-11 -9.9E-11 -9.9E-12 -9.9	1.49 21 9 39 Ar 2.2E-12 5.0E-12 -8.4E-13 -2.1E-11 -1.4E-11 -8.2E-12 3.4E-12 1.4E-11 1.9E-11 -3.6E-11 -1.9E-11 -3.6E-11	22 9 42 Ar 1.5E-12 3.9E-12 -1.4E-12 -2.0E-11 -1.3E-11 -2.4E-12 2.6E-12 8.3E-12 1.4E-11 1.9E-11 -3.6E-11 -1.9E-11	23 9 45 Ar 1.1E-12 -7.3E-12 -2.9E-12 -2.3E-11 -1.6E-11 -1.0E-11 -5.0E-12 4.3E-12 9.4E-12 1.4E-11 -3.7E-11 -2.3E-11 -2.9E-11
Run #: DUT S/N: Run Vds (V): Ion species: Vgs (V) 0 2 4 6 8 10 12 14 16 18 20 0 -2 -4 -4	pre 9 -	Vth (V): 10 9 6 Ar 1.7E-13 4.3E-12 1.6E-11 -2.0E-11 -1.1E-11 -3.1E-12 5.0E-12 1.2E-11 1.8E-11 2.4E-11 3.1E-11 -3.8E-11 -2.2E-11 -9.0E-11 -9.0E-11	2.20 11 9 9 Ar 1.0E-12 8.2E-12 1.1E-11 -2.0E-11 -1.2E-11 2.4E-12 9.2E-12 1.5E-11 2.2E-11 2.2E-11 -3.8E-11 -3.8E-11 -8.8E-11 -8.8E-11	1.34 9 12 Ar 1.7E-12 4.1E-12 1.1E-11 -2.0E-11 -3.7E-12 -1.5E-13 6.1E-12 1.2E-11 1.8E-11 2.4E-11 -7.7E-11 -3.2E-11 -9.3E-11 9.3C+11	1.11 9 15 Ar 10,E-13 2.9E-12 1.0,E-11 -1.0,E-11 -3.8E-11 -3.8E-11 5.6E-12 1.1E-11 1.7E-11 -3.7E-11 -3.7E-11 -3.7E-11 -8.8E-11 -8.8E-11	0.94 14 9 18 Ar 3.0E-13 3.1E-12 9.7E-12 -2.2E-11 -1.4E-11 -7.8E-12 5.2E-12 1.1E-11 1.6E-11 2.1E-11 -3.8E-11 -8.8E-11 -8.4E-11	0.83 9 21 Ar 1.4E-12 3.4E-12 1.0E-11 -1.4E-11 -3.0E-12 -1.7E-12 3.9E-12 9.4E-12 1.5E-11 -3.7E-11 -3.7E-11 -3.7E-11 -8.6E-11 0.45 - 12	0.73 16 9 24 Ar 2.3E-12 4.6E-12 1.1E-11 -1.4E-11 -6.6E-12 -9.0E-13 4.6E-12 1.0E-11 1.5E-11 -1.5E-11 -3.6E-11 -3.6E-11 -8.6E-11 -8.6E-11	0.65 17 9 27 Ar 1.0E-12 -6.5E-12 1.0E-11 -2.2E-11 -3.4E-12 3.4E-12 3.4E-12 3.4E-12 1.3E-11 -3.6E-11 -3.6E-11 -8.6E-11 -8.6E-11	0.59 18 9 30 Ar 2.1E-12 -5.9E-12 1.1E-11 -7.8E-12 2.7E-12 8.2E-12 1.3E-11 1.3E-11 -3.6E-11 -1.9E-11 -8.4E-11 -8.4E-11	0.30 9 33 Ar 2.0E-12 -6.0E-12 1.1E-11 -2.1E-11 -3.0E-12 2.1E-12 7.8E-12 1.3E-11 1.7E-11 1.3E-11 -3.6E-11 -8.5E-11 -8.5E-11	2.33 20 9 36 Ar 1.8E-12 -6.0E-12 1.0E-11 -2.1E-11 -7.8E-12 3.2E-12 8.2E-12 1.3E-11 -3.6E-11 -3.6E-11 -8.8E-11 -8.8E-11 -8.2E-12	1.49 21 9 39 Ar 2.2E-12 5.0E-12 -8.4E-13 -2.1E-11 -1.4E-11 -8.2E-12 3.4E-12 3.4E-12 1.4E-11 -3.6E-11 -3.6E-11 -8.7E-11 -8.7E-11	22 9 42 Ar 1.5E-12 3.9E-12 -1.4E-12 -2.0E-11 -1.3E-11 -7.6E-12 2.6E-12 8.3E-12 1.4E-11 1.9E-11 -3.6E-11 -8.6E-11 -8.6E-11	23 9 45 Ar 1.1E-12 -7.3E-12 -2.9E-12 -2.9E-12 -2.3E-11 -1.0E-11 -1.0E-11 -1.9E-13 4.3E-12 9.4E-12 9.4E-12 1.4E-11 -3.7E-11 -3.7E-11 -8.8E-11 -8.8E-11
Run #: DUT S/N: Run Vds (V): lon species: Vgs (V) 0 2 4 6 8 10 12 14 16 18 20 0 -2 -4 -6	pre 9 -	Vth (V): 10 9 6 Ar 1.7E-13 4.3E-12 1.6E-11 -1.1E-11 -3.1E-12 5.0E-12 1.2E-11 1.8E-11 2.4E-11 3.1E-11 -3.8E-11 -2.2E-11 -9.0E-11 9.0E-11	2.20 11 9 9 Ar 1.0E-12 8.2E-12 1.1E-11 -1.2E-11 -4.4E-12 2.4E-12 9.2E-12 1.5E-11 2.2E-11 -3.8E-11 -3.8E-11 -3.8E-11 -9.7E-11	1.34 9 12 Ar 1.7E-12 4.1E-12 1.1E-11 -2.0E-11 -3.2E-11 1.2E-11 1.8E-11 1.8E-11 -3.2E-11 -3.2E-11 -9.3E-11 -9.9E-11	1.11 9 15 Ar 4.6E-13 2.9E-13 1.0E-11 -0.7E-11 -3.7E-12 -3.8E-14 5.6E-12 1.1E-11 1.7E-11 2.3E-11 -3.7E-	0.94 14 9 18 Ar 3.0E-13 3.1E-12 9.7E-12 -2.2E-11 -1.4E-11 -7.8E-12 5.2E-12 1.1E-11 1.6E-11 1.6E-11 -3.8E-11 -2.0E-11 -8.8E-11 -9.6E-11	0.83 9 21 Ar 1.4E-12 3.4E-12 1.0E-11 -1.0E-11 -1.4E-11 -3.0E-12 -1.7E-12 3.9E-12 9.4E-12 1.5E-11 -3.7E-11 -3.7E-11 -3.7E-11 -9.4E-11 -9.4E-11	0.73 16 9 24 Ar 2.3E-12 4.6E-12 1.1E-11 -1.4E-11 -6.6E-12 -9.0E-13 4.6E-12 1.0E-11 1.5E-11 1.5E-11 -3.6E-11 -9.9E-11 -8.6E-11 -9.9E-11 -9.9E-11 -9.9E-11 -9.9E-11 -9.9E-11 -9.9E-11 -9.9E-12 -9.9E-11 -9	0.65 17 9 27 Ar 1.0E-12 -6.5E-12 1.0E-11 -2.2E-11 -3.4E-12 3.4E-12 3.4E-12 1.3E-11 1.9E-11 -3.6E-11 -3.6E-11 -3.6E-11 -9.1E-11 -9.1E-11	0.59 18 9 30 Ar 2.1E-12 -5.9E-12 1.1E-11 -7.8E-12 -2.5E-12 2.7E-12 8.2E-12 1.3E-11 -3.6E-11 -3.6E-11 -3.9E-11 -8.4E-11 -9.2E-11	0.30 19 9 33 Ar 2.0E-12 -6.0E-12 1.1E-11 -2.1E-11 -3.0E-12 2.1E-12 7.8E-12 1.3E-11 -3.6E-11 -3.6E-11 -3.6E-11 -3.9E-11 -9.3E-11	2.33 20 9 36 Ar 1.8E-12 -6.0E-12 1.0E-11 -7.8E-12 -2.6E-12 3.2E-12 1.3E-11 -3.6E-11 -3.6E-11 -3.6E-11 -9.3E-11 -9.3E-11 -9.3E-11	1.49 21 9 39 Ar 2.2E-12 5.0E-12 -8.4E-13 -2.1E-11 -1.4E-11 -8.2E-12 3.4E-12 3.4E-12 1.4E-11 1.9E-11 -3.6E-11 -9.3E-11 -9.3E-11	22 9 42 Ar 1.5E-12 3.9E-12 -1.4E-12 -2.0E-11 -7.6E-12 2.6E-12 8.3E-12 1.4E-11 -3.6E-11 -3.6E-11 -9.4E-11 -9.4E-1	23 9 45 Ar -7.3E-12 -2.9E-12 -2.9E-12 -2.9E-12 -1.6E-11 -1.6E-11 -1.0E-11 -3.0E-12 9.4E-12 9.4E-12 1.4E-11 -3.7E-11 -3.7E-11 -3.7E-11 -9.3E-11
Run #: DUT S/N: Run Vds (V): lon species: Vgs (V) 0 2 4 6 8 10 12 14 16 18 20 0 -2 -4 -6 -8	pre 9 1.6E-13 3.6E-12 1.4E-11 -2.3E-11 -1.6E-11 -9.4E-12 -3.6E-12 1.2E-11 1.6E-11 -8.5E-11 -9.8E-11 -3.8E-11 -3.8E-11 -1.0E-10 -1.1E-10	Vth (V): 10 9 6 1.7E-13 4.3E-12 1.6E-11 -2.0E-11 -1.1E-11 -3.1E-12 5.0E-12 1.2E-11 1.8E-11 3.1E-11 3.1E-11 3.1E-11 -2.2E-11 -9.6E-11 -6.2E-11 -6.2E-11	2.20 11 9 9 Ar 1.0E-12 8.2E-12 1.1E-11 -2.0E-11 -1.2E-11 2.4E-12 9.2E-12 9.2E-12 1.5E-11 2.8E-11 -3.8E-11 -2.1E-11 -3.8E-11 -9.7E-11 -4.0E-11	1.34 9 12 Ar 1.7E-12 4.1E-12 1.1E-11 -2.0E-11 -1.2E-11 1.2E-11 1.2E-11 1.2E-11 1.2E-11 1.2E-11 2.4E-11 -7.7E-11 -3.2E-11 -9.3E-11 -9.3E-11 -9.3E-11 -9.3E-11	1.11 13 9 15 Ar 4.6E-13 2.9F-12 1.0E-11 -2.1E-11 -3.7E-12 -3.8E-11 2.3E-11 2.3E-11 -3.7E-11 -2.1E-11 -3.7E-11	0.94 14 9 18 Ar 3.0E-13 3.1E-12 9.7E-12 -2.2E-11 -1.4E-11 -7.8E-12 5.2E-12 1.1E-11 1.6E-11 2.1E-11 -3.8E-11 -9.6E-11 -3.8E-11	0.83 15 9 21 Ar 1.4E-12 3.4E-12 1.0E-11 -2.1E-11 -1.4E-11 -1.7E-12 3.9E-12 3.9E-12 1.5E-11 2.1E-11 -3.7E-11 -9.4E-11 -3.7E-11	0.73 16 9 24 Ar 2.3E-12 4.6E-12 1.1E-11 -2.1E-11 -3.0E-12 1.0E-11 1.5E-11 2.1E-11 -3.6E-11 -9.3E-11 -3.6E-11 -3.6E-11	0.65 17 9 27 Ar 1.0E-12 -6.5E-12 1.0E-11 -2.2E-11 -3.4E-12 3.4E-12 3.4E-12 3.4E-12 1.3E-11 1.9E-11 -3.6E-11 -2.0E-11 -8.6E-11 -2.0E-11 -3.6E-11 -2.0E-11 -3.6E-11 -2.0E-11 -3.6E-11 -3.0E-12 -3.6E-11 -3.0E-11 -3.0E-11 -3.6E-12 -3.6E-12 -3.6E-12 -3.6E-12 -3.6E-11 -3.6E-12 -3	0.59 18 9 30 Ar 2.1E-12 -5.9E-12 1.1E-11 -2.1E-11 -7.8E-12 2.7E-12 8.2E-12 1.3E-11 1.3E-11 1.3E-11 -3.6E-11 -1.9E-11 -9.2E-11 -9.8E-11	0.30 19 9 33 Ar 2.0E-12 -6.0E-12 1.1E-11 -2.1E-11 -2.1E-11 -3.0E-12 2.1E-12 7.8E-12 1.3E-11 1.7E-11 1.7E-11 -3.6E-11 -1.9E-11 -9.3E-11 -9.3E-11 -1.0E-10	2.33 20 9 36 Ar 1.8E-12 -6.0E-12 1.0E-11 -2.1E-11 -7.8E-12 3.2E-12 3.2E-12 3.2E-12 3.2E-12 1.3E-11 1.3E-11 -3.6E-11 -1.9E-11 -8.8E-11 -9.3E-11 -1.0E-10	1.49 21 9 39 Ar 2.2E-12 5.0E-12 -8.4E-13 -2.1E-11 -1.4E-11 -8.2E-12 3.4E-12 3.4E-12 1.4E-11 1.9E-11 -3.6E-11 -1.9E-11 -9.3E-11 -9.3E-11 -9.7E-11	22 9 42 Ar 1.5E-12 3.9E-12 -1.4E-12 -2.0E-11 -1.3E-11 -7.6E-12 -2.4E-12 8.3E-12 1.4E-11 1.9E-11 -3.6E-11 -1.9E-11 -9.4E-11 -9.9E-11	23 9 45 Ar -7.3E-12 -2.9E-12 -2.3E-11 -1.0E-11 -5.0E-12 -1.9E-13 4.3E-12 9.4E-12 1.4E-11 -3.7E-11 -2.3E-11 -9.3E-11 -9.8E-11
Run #: DUT S/N: Run Vds (V): lon species: Vgs (V) 0 2 4 6 8 10 12 14 16 18 20 0 -2 -4 -6 -8 -10	pre 9 	Vth (V): 10 9 6 Ar 1.7E-13 4.3E-12 1.6E-11 -2.0E-11 -3.1E-12 5.0E-12 1.2E-11 1.8E-11 2.4E-11 3.1E-11 -3.8E-11 -2.0E-11 -9.0E-11 -9.0E-11 -4.4E-11	2.20 11 9 9 Ar 1.0E-12 8.2E-12 1.1E-11 -2.0E-11 -2.0E-11 2.4E-12 9.2E-12 1.5E-11 2.5E-11 2.5E-11 2.5E-11 2.5E-11 -3.8E-11 -3.8E-11 -3.8E-11 -9.7E-11 -4.0E-11 -4.0E-11 -4.2E-11	1.34 9 12 Ar 1.7E-12 4.1E-12 1.1E-11 -2.0E-11 -1.2E-11 1.2E-11 1.2E-11 1.2E-11 1.2E-11 1.2E-11 1.2E-11 -3.2E-11 -9.3E-11 -9.3E-11 -9.3E-11 -9.3E-11 -1.0E-10	1.11 9 15 Ar 9 15 Ar 1.0E-11 -2.1E-11 -3.8E-11 -3.8E-11 -9.6E-11 -3.8E-11 -9.6E-11	0.94 14 9 18 Ar 3.0E-13 3.1E-12 9.7E-12 -2.2E-11 -1.4E-11 -7.8E-12 5.2E-12 5.2E-12 5.2E-12 1.1E-11 1.6E-11 1.6E-11 -3.8E-11 -9.6E-11 -3.8E-11 -9.6E-11 -3.8E-11 -9.6E-11 -3.8E-11 -9.6E-11 -3.8E-11 -9.6E-11	0.83 9 21 Ar 1.4E-12 3.4E-12 1.0E-11 -2.1E-11 -1.4E-11 -3.9E-12 9.4E-12 1.5E-11 2.1E-11 -3.7E-11 -3.7E-11 -8.6E-11 -9.4E-11 -3.7E	0.73 16 9 24 Ar 2.3E-12 4.6E-12 1.1E-11 -2.1E-11 -3.6E-12 -9.0E-13 4.6E-12 -9.0E-11 1.5E-11 2.1E-11 -3.6E-11 -	0.65 17 9 27 Ar 1.0E-12 -6.5E-12 1.0E-11 -2.2E-11 -3.4E-12 3.4E-12 1.3E-11 1.9E-11 -3.6E-11 -2.0E-11 -8.6E-12 -9.1E-11 -1.0E-10 -9.1E-11	0.59 18 9 30 Ar 2.1E-12 -5.9E-12 1.1E-11 -2.1E-11 -7.8E-12 2.7E-12 8.2E-12 1.3E-11 1.8E-11 -3.6E-11 -3.6E-11 -9.2E-12 -9.2E-12 -	0.30 9 33 Ar 2.0E-12 -6.0E-12 1.1E-11 -2.1E-11 -3.4E-11 -3.0E-12 1.3E-11 1.7E-11 -3.6E-11 -3.6E-11 -9.3E-11 -9.3E-11 -0.41E-11	2.33 20 9 36 Ar 1.8E-12 -6.0E-12 1.0E-11 -2.1E-11 -1.4E-11 -7.8E-12 3.2E-12 3.2E-12 3.2E-12 1.3E-11 1.8E-11 -3.6E-11 -3.6E-11 -9.3E-11 -0.9.3E-11 -1.0E-10 -4.0E-11	1.49 21 9 39 Ar 2.2E-12 5.0E-12 -8.4E-13 -2.1E-11 -1.4E-11 -8.2E-12 3.4E-12 1.4E-11 1.9E-11 -3.6E-11 -9.3E-11	22 9 42 Ar 1.5E-12 3.9E-12 -1.4E-12 -2.0E-11 -1.3E-11 -7.6E-12 -2.4E-12 2.6E-12 2.6E-12 3.6E-11 -3.6E-11 -3.6E-11 -9.4E-11 -9.4E-11	23 9 45 Ar -7.3E-12 -2.9E-12 -2.3E-11 -1.6E-11 -1.0E-11 -5.0E-12 -1.9E-13 4.3E-12 9.4E-12 1.4E-11 -3.7E-11 -2.3E-11 -9.3E-11 -9.3E-11 -9.3E-11 -4.0E-11
Run #: DUT S/N: Run Vds (V): Ion species: Vgs (V) 0 2 4 6 8 10 12 14 16 18 20 0 -2 -4 -6 -8 -10 -12	pre 9 	Vth (V): 10 9 6 Ar 1.7E-13 4.3E-12 1.6E-11 -2.0E-11 -1.1E-11 -3.1E-12 5.0E-12 1.2E-11 1.8E-11 3.1E-11 -3.8E-11 -2.2E-11 -9.0E-11 -4.2E-11 -4.2E-11 -5.0E-11	2.20 11 9 9 Ar 1.0E-12 8.2E-12 1.1E-11 -2.0E-11 -1.2E-11 -4.4E-12 2.4E-12 9.2E-12 1.5E-11 2.2E-11 2.2E-11 2.2E-11 -3.8E-11 -3.8E-11 -9.7E-11 -4.0E-11 -4.2E-11 -4.2E-11 -4.2E-11 -4.2E-11	1.34 9 12 Ar 1.7E-12 4.1E-12 1.1E-11 -2.0E-11 -1.2E-11 -3.2E-11 2.4E-11 1.8E-11 2.4E-11 -3.2E-11 -9.3E-11 -9.3E-11 -9.3E-11 -1.0E-10 -1.0E-10 -1.1E-10	1.11 13 9 15 Ar 9 1.0F-11 -0.0F-11 -2.1E-11 -3.8E-14 5.6E-12 1.1E-11 -3.7E-11 -3.7E-11 -3.7E-11 -3.7E-11 -3.8E-11 -9.6E-11 -3.8E-11 -4.0E-11	0.94 14 9 18 Ar 3.0E-13 3.1E-12 9.7E-12 -2.2E-11 -1.4E-11 -7.8E-12 5.2E-12 1.1E-11 1.6E-11 2.0E-11 -3.8E-11 -9.6E-11 -3.8E-11 -3.8E-11 -4.0E-11 -3.8E-11 -4.0E-11 -3.8E-11 -4.0E-11 -3.8E-11 -4.0E-11 -3.8E-11 -4.0E-11 -3.8E-11 -4.0E-11 -3.8E-11 -4.0E-11 -3.8E-11 -3	0.83 9 21 Ar 1.4E-12 3.4E-12 1.0E-11 -2.1E-11 -1.4E-11 -3.9E-12 9.4E-12 1.5E-11 -3.7E-11 -3.7E-11 -3.7E-11 -3.7E-11 -3.8E-11 -3.8E-11 -3.8E-11 -3.8E-11 -3.8E-11	0.73 16 9 24 Ar 2.3E-12 4.6E-12 1.1E-11 -2.1E-11 -3.6E-12 1.0E-11 1.5E-11 2.1E-11 -3.6E-11 -3.7E-11 -	0.65 17 9 27 Ar 1.0E-12 -6.5E-12 1.0E-11 -2.2E-11 -3.4E-12 3.4E-12 3.4E-12 8.6E-12 1.3E-11 1.3E-11 1.3E-11 1.3E-11 -3.6E-11 -9.1E-11 -1.0E-10 -1.0E-10 -1.0E-10 -1.0E-10 -1.0E-11 -1.0E-12 -1.0E-12 -1.0E-12 -1.0E-12 -1.0E-12 -1.0E-12 -1.0E-12 -1.0E-12 -1.0E-12 -1.0E-12 -1.0E-12 -1.0E-12 -1.0E-12 -1.0E-12 -1.0E-12 -1.0E-12 -1.0E-11 -1.0E-12 -1.0E-11 -1.0E-12 -1.0E-12 -1.0E-11 -2.0E-11 -3.6E-11 -1.0E-12 -1.0E-12 -1.0E-12 -1.0E-12 -1.0E-11 -1.0E-12 -1.0E-11 -3.6E-11 -1.0E-11 -1.0E-11 -1.0E-12 -1.0E-12 -1.0E-12 -1.0E-12 -1.0E-12 -1.0E-12 -1.0E-12 -1.0E-12 -1.0E-12 -1.0E-12 -1.0E-12 -1.0E-12 -1.0E-11 -1.0E-11 -3.6E-11 -1.0E-11 -1.0E-11 -1.0E-11 -2.0E-11 -3.6E-11 -3.0	0.59 18 9 30 Ar 2.1E-12 -5.9E-12 1.1E-11 -2.1E-11 -7.8E-12 2.7E-12 8.2E-12 8.2E-12 1.3E-11 1.3E-11 1.3E-11 -3.6E-11 -1.9E-11 -9.8E-11 -9.8E-11 -4.1E-11 -4.1E-11	0.30 19 9 33 Ar 2.0E-12 1.1E-11 -2.1E-11 -1.4E-11 -3.0E-12 2.1E-12 7.8E-12 2.1E-12 7.8E-12 1.3E-11 1.3E-11 1.3E-11 -3.6E-11 -9.3E-11 -1.0E-10 -4.1E-11 -4.1E-11	2.33 20 9 36 Ar 1.8E-12 -6.0E-12 1.0E-11 -2.1E-11 -7.8E-12 -2.6E-12 3.2E-12 8.2E-12 8.2E-12 8.2E-12 8.2E-12 1.3E-11 1.3E-11 -3.6E-11 -9.3E-11 -9.3E-11 -1.0E-10 -4.0E-11 -4.0E-11	1.49 21 9 39 Ar 2.2E-12 5.0E-12 -8.4E-13 -2.1E-11 -1.4E-11 -8.2E-12 3.4E-12 8.4E-12 8.4E-12 8.4E-12 1.4E-11 1.9E-11 -3.6E-11 -9.7E-11 -9.7E-11 -4.0E-11 -4.0E-11	22 9 42 Ar 1.5E-12 3.9E-12 -1.4E-12 -2.0E-11 -1.3E-11 -7.6E-12 2.6E-12 8.3E-12 8.3E-12 1.4E-11 1.9E-11 -3.6E-11 -9.9E-11 -9.9E-11 -4.0E-11	23 9 45 Ar -7.3E-12 -2.9E-12 -2.3E-11 -1.0E-11 -1.0E-11 -5.0E-12 -1.9E-13 4.3E-12 -3.7E-11 -3.7E-11 -3.7E-11 -9.3E-11 -9.3E-11 -9.3E-11 -9.4.0E-11
Run #: DUT S/N: Run Vds (V): lon species: Vgs (V) 0 2 4 6 8 10 12 14 16 18 20 0 -2 -4 -6 -8 -10 -12 -14	pre 9 	Vth (V): 10 9 6 Ar 1.7E-13 4.3E-12 1.6E-11 -3.1E-12 5.0E-12 1.2E-11 1.8E-11 2.4E-11 3.1E-11 -3.8E-11 -2.2E-11 -9.0E-11 -9.0E-11 -4.4E-11 -5.0E-12 -5.0E-11 -1.2E-10	2.20 11 9 9 Ar 1.0E-12 8.2E-12 1.1E-11 -1.2E-11 -4.4E-12 2.4E-12 9.2E-12 1.5E-11 2.8E-11 -3.8E-11 -3.8E-11 -3.8E-11 -9.7E-11 -4.0E-11 -4.2E-11 -4.2E-11 -1.1E-10	1.34 9 12 Ar 1.7E-12 4.1E-12 1.1E-11 -2.0E-11 -1.2E-11 -3.7E-12 -1.5E-13 6.1E-12 1.2E-11 1.8E-11 -3.2E-11 -9.3E-11 -9.3E-11 -9.9E-11 -1.1E-10 -1.1E-10 -1.1E-10	1.11 13 9 15 Ar 10E-11 -0.0E-11 -1.3E-11 -5.7E-12 -3.8E-14 5.6E-12 1.1E-11 -7.7E-11 -3.7E-11 -4.0E-11 -4.4E-11 -1.1E-10	0.94 14 9 18 Ar 3.0E-13 3.1E-12 9.7E-12 -2.2E-11 -1.4E-11 -7.8E-12 5.2E-12 1.1E-11 1.6E-11 -3.8E-11 -3.8E-11 -3.8E-11 -4.0E-11 -4.3E-11 -1.1E-10	0.83 9 21 Ar 1.4E-12 3.4E-12 1.0E-11 -1.0E-11 -1.4E-11 -3.7E-11 -3	0.73 16 9 24 Ar 2.3E-12 4.6E-12 1.1E-11 -1.4E-11 -6.6E-12 -9.0E-13 4.6E-12 1.0E-11 1.5E-11 -3.6E-11 -3.6E-11 -3.7E-11 -3.7E-11 -1.1E-10	0.65 17 9 27 Ar 1.0E-12 -6.5E-12 1.0E-11 -2.2E-11 -3.4E-12 3.4E-12 3.4E-12 3.4E-12 3.4E-12 1.3E-11 -3.6E-11 -3.6E-11 -3.6E-11 -9.1E-11 -1.0E-10 -4.1E-11 -4.2E-11 -4.6E-11	0.59 18 9 30 Ar 2.1E-12 -5.9E-12 1.1E-11 -7.8E-12 -2.5E-12 2.7E-12 8.2E-12 1.3E-11 -3.6E-11 -1.9E-11 -9.2E-11 -9.2E-11 -4.1E-11 -4.1E-11 -4.5E-11	0.30 19 9 33 Ar 2.0E-12 -6.0E-12 1.1E-11 -2.1E-11 -1.4E-11 -3.0E-12 2.1E-12 7.8E-12 1.3E-11 1.7E-11 -3.6E-11 -3.6E-11 -9.3E-11 -9.3E-11 -1.0E-10 -4.1E-11 -4.6E-11	2.33 20 9 36 Ar 1.8E-12 -6.0E-12 1.0E-11 -2.1E-11 -1.4E-11 -7.8E-12 -2.6E-12 3.2E-12 3.2E-12 3.2E-12 1.3E-11 -1.9E-11 -3.6E-11 -3.6E-11 -1.9E-11 -4.0E-11 -4.0E-11 -4.5E-11	1.49 21 9 39 Ar 2.2E-12 5.0E-12 -8.4E-13 -2.1E-11 -1.4E-11 3.4E-12 3.4E-12 1.4E-11 1.9E-11 -3.6E-11 -3.6E-11 -9.3E-11 -9.3E-11 -9.3E-11 -9.3E-11 -9.3E-11 -4.0E-11 -4.5E-11	22 9 42 Ar 1.5E-12 3.9E-12 -1.4E-12 -2.0E-11 -1.3E-11 -7.6E-12 8.3E-12 1.4E-11 1.9E-11 -3.6E-11 -9.4E-11 -9.9E-11 -4.0E-11 -4.0E-11	23 9 45 Ar -7.3E-12 -2.9E-12 -2.3E-11 -1.0E-11 -1.0E-11 -3.0E-12 -1.9E-13 4.3E-12 9.4E-12 1.4E-11 -3.7E-11 -8.8E-11 -9.3E-11 -9.8E-11 -4.0E-11 -4.0E-11 -4.3E-11
Run #: DUT S/N: Run Vds (V): lon species: Vgs (V) 0 2 4 6 8 10 12 14 16 18 20 0 -2 -4 -6 -8 -10 -12 -14 -16	pre 9 	Vth (V): 10 9 6 1.7E-13 4.3E-12 1.6E-11 -2.0E-11 -1.1E-11 -3.1E-12 5.0E-12 1.2E-11 1.8E-11 3.1E-11 3.1E-11 3.1E-11 -2.2E-11 -9.0E-11 -9.0E-11 -4.2E-11 -4.2E-11 -1.2E-10 -1.2E-10 -1.2E-10 -1.2E-10	2.20 11 9 9 Ar 1.0E-12 8.2E-12 1.1E-11 -2.0E-11 -1.2E-11 2.4E-12 9.2E-12 9.2E-12 1.5E-11 2.8E-11 2.8E-11 -3.8E-11 -3.8E-11 -3.8E-11 -3.8E-11 -4.7E-11 -4.2E-11 -4.2E-11 -4.2E-11 -1.7E-10 -1.2E-10	1.34 9 12 Ar 1.7E-12 4.1E-12 1.1E-11 -2.0E-11 -1.2E-11 1.2E-11 1.2E-11 1.2E-11 1.2E-11 1.2E-11 1.3.2E-11 -3.2E-11 -9.3E-11 -9.3E-11 -9.3E-11 -9.3E-11 -0.1E-10 -1.1E-10 -1.2E-10	1.11 13 9 15 Ar 9 15 Ar 4.6E-13 2.9E-12 1.0E-11 -3.1E-11 -5.7E-12 -3.8E-11 -3.7E-11 -3.7E-11 -3.7E-11 -3.8E-11 -9.6E-11 -3.8E-11 -4.0E-11 -1.7E-10	0.94 14 9 18 Ar 3.0E-13 3.1E-12 9.7E-12 -2.2E-11 -1.4E-11 -7.8E-12 5.2E-12 1.1E-11 1.6E-11 2.1E-11 1.6E-11 2.8.8E-11 -3.8E-11 -3.8E-11 -3.8E-11 -3.8E-11 -3.8E-11 -3.8E-11 -1.1E-10 -1.2E-10	0.83 15 9 21 Ar 1.4E-12 3.4E-12 1.0E-11 -2.1E-11 -1.4E-11 -3.7E-11 2.1E-11 2.1E-11 2.1F-11 2.1F-11 -3.7E-11 -3.7E-11 -3.7E-11 -3.7E-11 -3.8E-11 -3.7E-11 -3.8E-11 -1.1E-10 0.12E-10	0.73 16 9 24 Ar 2.3E-12 4.6E-12 1.1E-11 -2.1E-11 -3.6E-12 1.0E-11 1.5E-11 2.1E-11 -3.6E-11 -3.6E-11 -3.6E-11 -3.6E-11 -3.7E-11 -3.7E-11 -1.1E-10 0.12E-10	0.65 17 9 27 Ar 1.0E-12 -6.5E-12 1.0E-11 -2.2E-11 -3.5E-11 1.3E-11 1.3E-11 1.3E-11 1.3E-11 1.3E-11 1.9E-11 -2.0E-11 -3.6E-11 -2.0E-11 -3.6E-11 -1.0E-10 -4.1E-11 -4.2E-11 -4.2E-11 -1.1E-10	0.59 18 9 30 Ar 2.1E-12 -5.9E-12 1.1E-11 -2.1E-11 -7.8E-12 2.7E-12 8.2E-12 1.3E-11 1.8E-11 1.3E-11 1.9E-11 -9.8E-11 -9.8E-11 -4.1E-11 -4.1E-11 -4.5E-11 -1.1E-10	0.30 19 9 33 Ar 2.0E-12 -6.0E-12 1.1E-11 -2.1E-11 -2.1E-11 -3.0E-12 2.1E-12 7.8E-12 1.3E-11 1.7E-11 -3.6E-11 -1.9E-11 -9.3E-11 -1.9E-11 -4.1E-11 -4.1E-11 -4.1E-11 -1.1E-10	2.33 20 9 36 Ar 1.8E-12 -6.0E-12 1.0E-11 -2.1E-11 -1.4E-11 -7.8E-12 3.2E-12 3.2E-12 3.2E-12 3.2E-12 1.3E-11 1.3E-11 -3.6E-11 -1.9E-11 -3.6E-11 -1.9E-11 -1.9E-11 -4.0E-11 -4.0E-11 -4.0E-11 -4.0E-11 -4.5E-11 -1.1E-10	1.49 21 9 39 Ar 2.2E-12 5.0E-12 -8.4E-13 -2.1E-11 -1.4E-11 -8.2E-12 3.4E-12 3.4E-12 1.4E-11 1.9E-11 -3.6E-11 -1.9E-11 -9.3E-11 -9.3E-11 -9.3E-11 -4.0E-11 -4.0E-11 -4.5E-11 -1.1E-10	22 9 42 Ar 1.5E-12 3.9E-12 -1.4E-12 -2.0E-11 -1.3E-11 -7.6E-12 -2.4E-12 2.4E-12 8.3E-12 1.4E-11 1.9E-11 -3.6E-11 -9.9E-11 -9.9E-11 -4.0E-11 -4.0E-11 -4.4E-11 -1.1E-10	23 9 45 Ar 1.1E-12 -7.3E-12 -2.9E-12 -2.9E-12 -2.3E-11 -1.0E-11 -5.0E-12 -1.9E-13 4.3E-12 9.4E-12 1.4E-11 -3.7E-11 -3.7E-11 -9.3E-11 -9.3E-11 -4.0E-11 -4.3E-11 -4.3E-11 -1.1E-10
Run #: DUT S/N: Run Vds (V): lon species: Vgs (V) 0 2 4 6 8 10 12 14 16 18 20 0 -2 -4 -6 -8 -10 -12 -14 -16 -12 -14 -16 -18	pre 9 	Vth (V): 10 9 6 Ar 1.7E-13 4.3E-12 1.6E-11 -2.0E-11 -3.1E-12 5.0E-12 1.2E-11 1.8E-11 2.4E-11 3.1E-11 -3.8E-11 -2.0E-11 -3.8E-11 -9.0E-11 -9.0E-11 -5.0E-11 -5.0E-11 -1.2E-10 -1.2E-11 -1.2E-11 -1.2E-11 -1.2E-11 -1.2E-11 -1.2E-11 -1.2E-11 -1.2E-11 -1.2E-11 -1.2E-11 -1.2E-11 -1.2E-11 -1.2E-11 -1.2E-11 -1.2E-11 -1.2E-10 -1.2E-11 -1.2E-10 -1.2E-10 -1.2E-10 -1.2E-10 -1.2E-11 -1.2E-10	2.20 11 9 9 Ar 1.0E-12 8.2E-12 1.1E-11 -2.0E-11 -1.2E-11 2.4E-12 9.2E-12 9.2E-12 9.2E-12 9.2E-12 9.2E-11 2.8E-11 -3.8E-11 -3.8E-11 -3.8E-11 -4.0E-111 -4.0E-111 -4.0E-111 -4.2E-111 -4.2E-11 -1.1E-10 -1.2E-10 1.3E-10	1.34 9 12 Ar 1.7E-12 4.1E-12 1.1E-11 -2.0E-11 -1.2E-11 1.2E-11 1.2E-11 1.2E-11 1.2E-11 1.2E-11 1.2E-11 1.2E-11 -3.2E-11 -9.3E-11 -9.3E-11 -9.3E-11 -1.0E-10 -1.1E-10 -1.2E-10 -1.2E-10	1.11 13 9 15 Ar 2.9E-12 1.0E-11 -2.1E-11 -3.8E-11 -3.8E-11 -9.6E-11 -3.8E-11 -9.6E-11 -4.0E-11 -1.1E-10 -1.1E-11	0.94 14 9 18 Ar 3.0E-13 3.1E-12 9.7E-12 -2.2E-11 -1.4E-11 -7.8E-12 5.2E-12 5.2E-12 5.2E-12 1.1E-11 1.6E-11 2.1E-111 -3.8E-111 -3.8E-111 -3.8E-111 -3.8E-111 -3.8E-111 -3.8E-111 -4.0E-111 -4.3E-111 -1.1E-100 -1.2E-100 -1.2E-100	0.83 9 21 Ar 1.4E-12 3.4E-12 1.0E-11 -2.1E-11 -1.4E-11 -3.9E-12 9.4E-12 1.5E-11 2.1E-11 -3.7E-11 -3.7E-11 -3.7E-11 -3.7E-11 -3.8E-11 -3.2E-11 -3.2E-11 -1.1E-10 -1.2E-10 -1.2E-10	0.73 16 9 24 Ar 2.3E-12 4.6E-12 1.1E-11 -2.1E-11 -3.6E-12 -9.0E-13 4.6E-12 -9.0E-11 1.5E-11 2.1E-11 -3.6E-11 -3.6E-11 -3.6E-11 -3.6E-11 -3.6E-11 -3.6E-11 -3.6E-11 -3.6E-11 -3.6E-11 -3.6E-11 -3.6E-11 -3.6E-11 -3.6E-11 -3.6E-11 -3.6E-11 -3.6E-11 -3.6E-11 -3.6E-11 -3.6E-12 -3.6E-12 -3.6E-12 -3.6E-12 -3.6E-12 -3.6E-11 -3.7E-11 -3.6E-11 -3.7E-11 -	0.65 17 9 27 Ar 1.0E-12 -6.5E-12 1.0E-11 -2.2E-11 -3.4E-12 3.4E-12 3.4E-12 1.3E-11 1.9E-11 -3.6E-11 -9.1E-11 -1.0E-10 -4.1E-11 -4.6E-11 -1.2E-10 1.2E-10	0.59 18 9 30 Ar 2.1E-12 -5.9E-12 1.1E-11 -2.1E-11 -7.8E-12 2.7E-12 2.7E-12 8.2E-12 1.3E-11 1.3E-11 1.3E-11 -9.2E-11 -9.2E-11 -9.2E-11 -9.2E-11 -9.2E-11 -4.1E-11 -4.1E-11 -1.1E-10 -1.2E-10	0.30 9 33 Ar 2.0E-12 -6.0E-12 1.1E-11 -2.1E-11 -3.0E-12 2.1E-12 2.1E-12 2.1E-12 1.3E-11 1.7E-11 -3.6E-11 -1.9E-11 -8.5E-11 -9.3E-11 -1.0E-10 -4.1E-11 -4.6E-11 -1.1E-10 -1.2E-10	2.33 20 9 36 Ar 1.8E-12 -6.0E-12 1.0E-11 -2.1E-11 -1.4E-11 -7.8E-12 3.2E-12 3.2E-12 3.2E-12 1.3E-11 1.8E-11 -3.6E-11 -1.9E-10 -4.0E-11 -4.0E-11 -4.5E-11 -1.2E-10 -1.2E-10	1.49 21 9 39 Ar 2.2E-12 5.0E-12 -8.4E-13 -2.1E-11 -1.4E-11 -8.2E-12 3.4E-12 1.4E-11 1.9E-11 -3.6E-11 -9.3E-11 -9.3E-11 -9.3E-11 -9.3E-11 -9.3E-11 -9.3E-11 -4.0E-11 -4.5E-11 -1.2E-10 -1.2E-10	22 9 42 Ar 1.5E-12 3.9E-12 -1.4E-12 -2.0E-11 -1.3E-11 -7.6E-12 -2.4E-12 2.6E-12 2.6E-12 2.6E-12 1.4E-11 1.9E-11 -3.6E-11 -9.4E-11 -9.4E-11 -9.4E-11 -4.0E-11 -4.0E-11 -4.0E-11 -1.1E-10 -1.2E-10	23 9 45 Ar 1.1E-12 -7.3E-12 -2.9E-12 -2.3E-11 -1.0E-11 -1.0E-11 -5.0E-12 9.4E-12 1.4E-11 -3.7E-11 -3.7E-11 -9.3E-11 -9.3E-11 -9.3E-11 -4.0E-11 -4.0E-11 -4.3E-11 -1.1E-10 -1.2E-10
Run #: DUT S/N: Run Vds (V): Ion species: Vgs (V) 0 2 4 6 8 10 12 14 16 18 20 0 -2 -4 -6 -8 -10 -12 -14 -16 -12 -14 -16 -18 20	pre 9 	Vth (V): 10 9 6 Ar 1.7E-13 4.3E-12 1.6E-11 -2.0E-11 -1.1E-11 -3.1E-12 5.0E-12 1.2E-11 1.8E-11 3.1E-11 -3.8E-11 -2.2E-11 -4.2E-11 -4.2E-11 -4.2E-11 -5.0E-11 -1.2E-10 -1.2E-11 -1.2E-10	2.20 11 9 9 Ar 1.0E-12 8.2E-12 1.1E-11 -2.0E-11 -1.2E-11 -2.0E-11 2.2E-11 2.2E-11 2.2E-11 2.2E-11 -3.8E-11 -3.8E-11 -9.7E-11 -4.0E-11 -4.2E-11 -4.2E-11 -4.2E-11 -1.1E-10 -1.2E-10 -1.2E-10 -1.3E-10 -1.	1.34 9 12 Ar 1.7E-12 4.1E-12 1.1E-11 -2.0E-11 -1.2E-11 -3.7E-12 1.2E-11 1.8E-11 2.4E-11 -7.7E-11 -3.2E-11 -9.3E-11 -9.3E-11 -9.3E-11 -1.0E-10 -1.1E-10 -1.2E-10 -1.3E-10 -1.3E-10	1.11 13 9 15 Ar 9 10F-11 -3.8E-14 5.6E-12 1.1E-11 -3.7E-11 -3.7E-11 -3.7E-11 -3.7E-11 -3.8E-11 -9.6E-11 -3.8E-11 -4.0E-11 -4.0E-11 -1.1E-10 -1.2E-10 -1.2E-10	0.94 14 9 18 Ar 3.0E-13 3.1E-12 9.7E-12 -2.2E-11 -1.4E-11 -7.8E-12 5.2E-12 1.1E-11 1.6E-11 2.1E-11 -3.8E-11 -3.8E-11 -9.6E-11 -3.8E-11 -4.0E-11 -3.8E-11 -4.0E-11 -3.8E-11 -4.3E-11 -1.1E-10 -1.2E-10 -1.2E-10 -1.2E-10 -1.2E-10	0.83 9 21 Ar 1.4E-12 3.4E-12 1.0E-11 -2.1E-11 -1.4E-11 -3.7E-12 3.9E-12 9.4E-12 1.5E-11 -3.7E-12 -3.7E-12 -3.7E-12 -3.7E-12 -3.7E-12 -3.7E-12 -3.7E-12 -3.7E	0.73 16 9 24 Ar 2.3E-12 4.6E-12 1.1E-11 -2.1E-11 -3.6E-12 1.0E-11 1.5E-11 1.5E-11 -3.6E-12 -3.6E-11 -3.7E-11 -3.6E-11 -3.7E-11 -	0.65 17 9 27 Ar 1.0E-12 -6.5E-12 1.0E-11 -2.2E-11 -3.4E-12 3.4E-12 3.4E-12 3.4E-12 8.6E-12 3.4E-11 -3.6E-11 -9.1E-11 -1.0E-10 -4.1E-11 -4.6E-11 -1.1E-10 -1.2E-10 -1.5E-12 -1.5E-14 -1.5E-11 -1.5E-11 -1.5E-11 -1.5E-11 -1.5E-11 -1.5E-11 -1.5E-11 -1.5E-11 -1.5E-11 -1.5E-11 -1.5E-11 -1.5E-11 -1.5E-11 -1.5E-11 -1.5E-11 -3.6E-11 -1.5E-11 -1	0.59 18 9 30 Ar 2.1E-12 -5.9E-12 1.1E-11 -2.1E-11 -7.8E-12 2.7E-12 8.2E-12 8.2E-12 8.2E-12 8.2E-12 8.2E-12 9.2E-11 -9.8E-11 -9.8E-11 -9.8E-11 -9.8E-11 -4.1E-11 -4.1E-11 -1.1E-10 -1.2E-10 1.5E-10	0.30 19 9 33 Ar 2.0E-12 -6.0E-12 1.1E-11 -2.1E-11 -3.0E-12 2.1E-12 7.8E-12 1.3E-11 1.7E-11 -3.6E-11 -1.9E-11 -4.1E-11 -4.1E-11 -1.1E-10 -1.2E-10 1.5E-10 1.5E-10 -1.5E-11 -1.	2.33 20 9 36 Ar 1.8E-12 -6.0E-12 1.0E-11 -2.1E-11 -1.4E-11 -7.8E-12 -2.6E-12 3.2E-12 8.2E-12 8.2E-12 8.2E-12 1.3E-11 -1.9E-11 -3.6E-11 -1.0E-10 -4.0E-11 -4.0E-11 -1.2E-10 -1.2E-10 -1.2E-10 -1.2E-10	1.49 21 9 39 Ar 2.2E-12 5.0E-12 -8.4E-13 -2.1E-11 -1.4E-11 -8.2E-12 3.4E-12 8.4E-12 8.4E-12 8.4E-12 8.4E-12 8.4E-12 9.3E-11 -9.3E-11 -9.7E-11 -9.7E-11 -9.7E-11 -4.0E-11 -4.0E-11 -1.1E-10 -1.2E-10 1.4E-10	22 9 42 Ar 1.5E-12 3.9E-12 -1.4E-12 -2.0E-11 -1.3E-11 -7.6E-12 2.6E-12 8.3E-12 1.4E-11 1.9E-11 -3.6E-11 -9.9E-11 -9.9E-11 -9.9E-11 -4.0E-11 -4.0E-11 -1.1E-10 -1.2E-10 1.4E-12	23 9 45 Ar 1.1E-12 -7.3E-12 -2.9E-12 -2.3E-11 -1.0E-11 -1.0E-11 -3.0E-12 -1.9E-13 4.3E-12 9.4E-12 1.4E-11 -3.7E-11 -9.3E-11 -9.3E-11 -9.3E-11 -4.0E-11 -4.3E-11 -1.1E-10 -1.2E-12
Run #: DUT S/N: Run Vds (V): lon species: Vgs (V) 0 2 4 6 8 10 12 14 16 18 20 0 -2 -4 -6 -8 -10 -12 -14 -16 -18 -20 -2	pre 9 	Vth (V): 10 9 6 Ar 1.7E-13 4.3E-12 1.6E-11 -1.1E-11 -3.1E-12 5.0E-12 1.2E-11 1.8E-11 2.4E-11 3.1E-11 -3.8E-11 -2.2E-11 -9.0E-11 -4.2E-11 -4.2E-11 -4.2E-11 -1.2E-10 -1.2E-10 -1.2E-10 -2.2E-10 -1.2E-10 -2.2E-11 -1.2E-10 -1.2E-10 -2.2E-10 -1.2E-11 -1.2E-10 -1.2E-10	2.20 11 9 9 Ar 1.0E-12 8.2E-12 1.1E-11 -1.2E-11 -4.4E-12 2.4E-12 9.2E-12 1.5E-11 2.8E-11 -3.8E-11 -3.8E-11 -3.8E-11 -4.0E-11 -4.0E-11 -4.0E-11 -4.2E-11 -1.1E-10 -1.3E-10 -1.	1.34 9 12 Ar 1.7E-12 4.1E-12 1.1E-11 -2.0E-11 -3.2E-11 -3.2E-11 -3.2E-11 -3.2E-11 -3.2E-11 -3.2E-11 -3.2E-11 -3.2E-11 -1.0E-10 -1.1E-10 -1.1E-10 -1.3E-11 -1.3E-10 -1.3E-10 -1	1.11 9 15 Ar 2.9E-12 1.0E-11 -0.7E-11 -3.8E-14 5.6E-12 1.1E-11 1.7E-11 2.3E-11 -3.7E	0.94 14 9 18 Ar 3.0E-13 3.1E-12 -2.2E-11 -1.4E-11 -7.8E-12 -7.8E-12 -1.6E-12 5.2E-12 1.1E-11 1.6E-11 2.1E-11 -3.8E-11 -3.8E-11 -3.8E-11 -4.0E-11 -4.3E-11 -1.1E-10 -1.2E-10 -	0.83 9 21 Ar 1.4E-12 3.4E-12 1.0E-11 -1.0E-11 -1.4E-11 -3.7E-11 2.1E-11 -3.7E-11 -3.7E-11 -3.7E-11 -3.7E-11 -3.7E-11 -3.8E-11 -3.8E-11 -3.8E-11 -1.2E-10 -1.2E-10 -1.2E-10 -1.6E-10	0.73 16 9 24 Ar 2.3E-12 4.6E-12 1.1E-11 -1.4E-11 -3.6E-12 -9.0E-13 4.6E-12 -9.0E-13 4.6E-12 1.0E-11 1.5E-11 -3.6E-11 -3.6E-11 -3.7E-11 -3.7E-11 -1.1E-10 -1.2E-10 -1	0.65 17 9 27 Ar 1.0E-12 -6.5E-12 1.0E-11 -2.2E-11 -3.4E-12 3.4E-12 3.4E-12 3.4E-12 3.4E-12 3.4E-12 1.3E-11 -3.6E-11 -3.6E-11 -3.6E-11 -4.1E-11 -4.1E-11 -4.2E-11 -4.2E-11 -1.1E-10 -1.2E-10 -1.2E-10 -1.5E-10	0.59 18 9 30 Ar 2.1E-12 -5.9E-12 1.1E-11 -2.1E-11 -1.4E-11 -7.8E-12 2.7E-12 8.2E-12 1.3E-11 1.8E-11 -3.6E-11 -1.9E-11 -9.8E-11 -9.8E-11 -4.1E-11 -4.1E-11 -4.1E-11 -1.1E-10 -1.2E-10 -	0.30 19 9 33 Ar 2.0E-12 -6.0E-12 1.1E-11 -2.1E-11 -1.4E-11 -3.0E-12 2.1E-12 7.8E-12 1.3E-11 1.7E-11 -3.6E-11 -1.9E-11 -3.6E-11 -1.9E-11 -4.1E-11 -4.1E-11 -4.1E-11 -1.1E-10 -1.2E-10 -	2.33 20 9 36 Ar 1.8E-12 -6.0E-12 1.0E-11 -2.1E-11 -1.4E-11 -7.8E-12 3.2E-12 3.2E-12 3.2E-12 3.2E-12 3.2E-12 3.2E-12 1.3E-11 -1.9E-11 -3.6E-11 -1.9E-11 -4.0E-11 -4.0E-11 -4.0E-11 -4.0E-11 -1.1E-10 -1.2	1.49 21 9 39 Ar 2.2E-12 5.0E-12 -8.4E-13 -2.1E-11 -1.4E-11 -3.4E-12 3.4E-12 3.4E-12 1.4E-11 1.9E-11 -3.6E-11 -9.3E-11 -9.3E-11 -9.3E-11 -9.3E-11 -9.3E-11 -1.9E-11 -4.0E-11 -4.0E-11 -4.5E-11 -1.1E-10 -1.2E-10 -1.2E-10 -1.4E-10 -1.4E-10 -1.4E-10 -1.4E-10 -1.4E-10 -1.4E-10 -1.4E-10 -1.4E-10 -1.4E-10 -1.4E-10 -1.4E-10 -1.4E-10 -1.4E-10 -1.4E-10 -1.4E-10 -1.4E-11 -1.4E-11 -1.4E-11 -1.4E-11 -1.9E-10 -1.9E-10 -	22 9 42 Ar 1.5E-12 3.9E-12 -1.4E-12 -2.0E-11 -1.3E-11 -7.6E-12 8.3E-12 1.4E-11 1.9E-11 -3.6E-11 -9.9E-11 -4.0E-11 -4.0E-11 -4.0E-11 -1.1E-10 -1.2E-10 -1.2E-10 -1.4E-10	23 9 45 Ar -7.3E-12 -2.9E-12 -2.3E-11 -1.0E-11 -1.0E-11 -3.0E-12 -1.9E-13 4.3E-12 9.4E-12 1.4E-11 -3.7E-11 -8.8E-11 -9.3E-11 -9.8E-11 -4.0E-11 -4.0E-11 -4.0E-11 -1.1E-10 -1.2E-10 -1.2E-10 -1.2E-10
Run #: DUT S/N: Run Vds (V): lon species: Vgs (V) 0 2 4 6 8 10 12 14 16 18 20 0 -2 -4 -6 -8 -10 -12 -14 -16 -18 -10 -12 -14 -16 -18 -20 BVdss (V):	pre 9 	Vth (V): 10 9 6 A.7 3 1.7E-13 4.3E-12 1.6E-11 -2.0E-11 -1.1E-11 -3.1E-12 5.0E-12 1.2E-11 -3.8E-11 -3.8E-11 -9.0E-11 -9.6E-11 -9.6E-11 -9.6E-11 -1.2E-10	2.20 11 9 9 Ar 1.0E-12 8.2E-12 1.1E-11 -2.0E-11 -1.2E-11 2.4E-12 9.2E-12 9.2E-12 1.5E-11 2.2E-11 2.8E-11 -3.8E-11 -3.8E-11 -3.8E-11 -4.0E-11 -4.0E-11 -4.2E-11 -4.2E-11 -1.2E-10 -1.3E-10 -1.3E-10 -1.3E-10 -1.8E-10 -66	1.34 9 12 Ar 1.7E-12 4.1E-12 1.1E-11 -2.0E-11 -1.2E-11 1.2E-11 1.2E-11 1.2E-11 1.2E-11 1.2E-11 1.3.2E-11 -3.2E-11 -3.2E-11 -9.3E-11 -9.3E-11 -0.3.2E-11 -1.1E-10 -1.1E-10 -1.2E-11 -1.2E-10 -1.2	1.11 9 15 Ar 2.9F-12 1.0E-11 -2.1E-11 -3.1E-11 1.3E-11 1.7E-11 2.3E-11 1.7E-11 2.3E-11 -3.7E-11 -3.7E-11 -3.8E-11 -3.8E-11 -3.8E-11 -3.8E-11 -4.0E-11 -4.4E-11 -1.2E-10 -1.2E-10 -1.3E-10 -1.2E-10 -1.3E-10 -1.2E-10 -1.3E-10 -1.2E-10 -1.3E-10 -1.2E-10 -1.3E-10 -1.2E-10 -1.3E-10 -1.2E-10 -1.3E-10 -1.2E-10 -1.3E-10 -1.2E-10 -1.3E-10 -1.2E-10 -1.3E-10 -1.2E-10 -1.3E-10 -1.2E-10 -1.3E-10 -1.2E-10 -1.3E-10 -1.2E-10 -1.3E-	0.94 14 9 18 Ar 3.0E-13 3.1E-12 9.7E-12 -2.2E-11 -1.4E-11 -7.8E-12 1.1E-11 2.1E-11 1.6E-11 2.1E-11 1.6E-11 2.8E-11 -3.8	0.83 9 21 Ar 1.4E-12 3.4E-12 1.0E-11 -2.1E-11 -1.4E-11 -3.7E-11 2.1E-11 2.1E-11 2.1E-11 2.1E-11 -3.7E-11 -3.7E-11 -3.7E-11 -3.7E-11 -3.8E-11 -3.7E-11 -3.8E-11 -3.7E-10 -1.2E-	0.73 16 9 24 Ar 2.3E-12 4.6E-12 1.1E-11 -2.1E-11 -3.4E-12 1.0E-11 1.5E-11 2.1E-11 -3.6E-11 -3.6E-11 -3.6E-11 -3.6E-11 -3.6E-11 -3.7E-11 -3.6E-11 -3.7E-11 -1.1E-10 -1.2E-10 -	0.65 17 9 27 Ar 1.0E-12 -6.5E-12 1.0E-11 -2.2E-11 -3.4E-12 3.4E-12 3.4E-12 3.4E-12 3.4E-12 1.3E-11 1.9E-11 -3.0E-11 -3.0E-11 -3.0E-11 -3.0E-11 -4.0E-11 -4.1E-11 -4.2E-11 -1.1E-10 -1.2E-10 -1.2E-10 -1.5E-10 -66	0.59 18 9 30 Ar 2.1E-12 -5.9E-12 1.1E-11 -2.1E-11 -7.8E-12 2.7E-12 8.2E-12 1.3E-11 1.3E-11 1.3E-11 1.9.2E-11 -9.2E-11 -9.2E-11 -9.2E-11 -9.2E-11 -1.1E-10 0 -1.2E-10 -1.5E-10 66	0.30 9 33 Ar 2.0E-12 -6.0E-12 1.1E-11 -2.1E-11 -2.1E-11 -3.0E-12 2.1E-12 7.8E-12 1.3E-11 1.7E-11 -3.6E-11 -1.9E-11 -9.3E-11 -1.9E-11 -4.6E-11 -4.1E-11 -4.1E-11 -1.1E-10 0 -1.2E-10 -1.5E-10 66	2.33 9 36 Ar 1.8E-12 -6.0E-12 1.0E-11 -2.1E-11 -1.4E-11 -7.8E-12 -2.6E-12 3.2E-12 3.2E-12 3.2E-12 3.2E-12 1.3E-11 1.8E-11 -3.6E-11 -1.9E-11 -1.9E-11 -4.0E-11 -4.0E-11 -4.0E-11 -4.0E-11 -4.0E-11 -1.1E-10 -1.1E-10 -1.2E-10 -1.5E-10 66	1.49 9 39 Ar 2.2E-12 5.0E-12 -8.4E-13 -2.1E-11 -1.4E-11 -3.4E-12 3.4E-12 1.4E-11 1.9E-11 -3.6E-11 -1.9E-11 -9.3E-11 -9.3E-11 -9.3E-11 -4.0E-11 -4.0E-11 -4.0E-11 -4.0E-11 -1.1E-10 0 -1.2E-10 -1.4E-10 66	22 9 42 Ar 1.5E-12 3.9E-12 -1.4E-12 -2.0E-11 -1.3E-11 -7.6E-12 -2.4E-12 2.4E-12 2.4E-12 3.3E-12 1.4E-11 1.9E-11 -3.6E-11 -9.9E-11 -9.9E-11 -4.0E-11 -4.0E-11 -4.0E-11 -4.1E-10 -1.2E-10 -1.4E-10 62	23 9 45 Ar -7.3E-12 -2.9E-12 -2.9E-12 -2.3E-11 -1.0E-11 -5.0E-12 -5.0E-12 -1.9E-13 4.3E-12 9.4E-12 1.4E-11 -3.7E-11 -3.7E-11 -9.3E-11 -9.3E-11 -9.3E-11 -4.0E-11 -4.0E-11 -4.3E-10 -1.1E-10 0 -1.2E-10 -1.4E-10 1.995
Run #: DUT S/N: Run Vds (V): lon species: Vgs (V) 0 2 4 6 8 10 12 14 16 18 20 0 -2 -4 -6 -8 -10 -12 -14 -16 -18 -20 BVdss (uA):	pre 9 	Vth (V): 10 9 6 Ar 1.7E-13 4.3E-12 1.6E-11 -2.0E-11 -1.1E-11 -3.1E-12 5.0E-12 1.2E-11 1.8E-11 -3.8E-11 -9.0E-11 -9.0E-11 -9.6E-11 -1.2E-10 -1.3E-10 -2.0E-10 -1.3E-10 -2.0E-10 66 1.42	2.20 11 9 9 Ar 1.0E-12 8.2E-12 1.1E-11 -2.0E-11 -1.2E-11 2.4E-12 9.2E-12 9.2E-12 9.2E-12 9.2E-12 9.2E-12 9.2E-11 2.8E-11 -3.8E-11 -3.8E-11 -3.8E-11 -4.0E-111 -1.0E-10 -1.3E-10	1.34 9 12 4.1E-12 1.1E-11 -2.0E-11 -1.2E-11 -3.2E-11 1.2E-11 1.2E-11 1.2E-11 1.2E-11 1.2E-11 1.2E-11 1.2E-11 1.2E-11 1.2E-11 -3.2E-11 -9.3E-11 -9.3E-11 -9.3E-11 -1.1E-10 -1.1E-10 -1.1E-10 -1.3E-11 -1.3E-10 -1.3	1.11 13 9 15 Ar 2.9E-12 1.0E-11 -2.1E-11 -3.8E-11 -3.8E-11 -9.6E-11 -3.8E-11 -9.6E-11 -3.8E-11 -9.6E-11 -1.1E-10 -1.2E-10 -1.3E-10 -1.3E-10 -3.8E-11 -9.6E-11 -3.8E-11 -9.6E-11 -3.8E-11 -9.6E-11 -1.1E-10 -1.2E-10 -1.3E-10 -1.3E-10 -1.3E-10 -1.3E-10 -1.3E-10 -1.3E-10 -1.3E-10 -1.3E-10 -1.3E-10 -3.7F8	0.94 14 9 18 Ar 3.0E-13 3.1E-12 9.7E-12 -2.2E-11 -1.4E-11 -7.8E-12 5.2E-12 5.2E-12 5.2E-12 5.2E-12 5.2E-11 -3.8E-11 -3.	0.83 9 21 Ar 1.4E-12 3.4E-12 1.0E-11 -2.1E-11 -1.4E-11 -3.9E-12 1.5E-11 2.1E-11 -3.7E-11 -3.7E-11 -3.7E-11 -3.7E-11 -3.4E-11 -3.4E-11 -3.4E-11 -1.2E-10 -1.2	0.73 16 9 24 Ar 2.3E-12 1.1E-11 -2.1E-11 -3.1E-11 1.5E-11 2.1E-11 1.5E-11 2.1E-11 1.5E-11 2.3.6E-11 -3.6E-11 -3.6E-11 -3.6E-11 -3.6E-11 -3.6E-11 -3.7E-11 -1.1E-10 -1.2E-10 -1.2E-10 -1.6E-10 -1.2E-10 -1.6E-10 -1.2E-10 -1.6E-10 -1.2E-10 -1.6E-10 -1.2E-10 -1.6E-10 -1.2E-10 -1.6E-10 -1.2E-10 -	0.65 17 9 27 Ar 1.0E-12 -6.5E-12 1.0E-11 -2.2E-11 -3.4E-12 3.4E-12 1.3E-11 1.9E-11 -3.6E-11 -3.6E-11 -3.6E-11 -3.6E-11 -1.0E-10 -4.1E-11 -4.6E-11 -1.2E-10 -1.5E-10 -1.5E-10 -66 37.94	0.59 18 9 30 Ar 2.1E-12 -5.9E-12 1.1E-11 -2.1E-11 -1.4E-11 -7.8E-12 2.7E-12 2.7E-12 8.2E-12 1.3E-11 1.3E-11 1.3E-11 -3.6E-11 -9.2E-11 -9.2E-11 -9.2E-11 -4.1E-11 -4.1E-11 -4.1E-11 -1.2E-10 1.2E-10 66 47.66	0.30 9 33 Ar 2.0E-12 -6.0E-12 1.1E-11 -2.1E-11 -3.4E-11 1.3E-11 1.3E-11 1.3E-11 1.3E-11 1.3E-11 -3.6E-11 -1.9E-10 -3.1E-12 -3.4E-11 -1.0E-10 -4.1E-11 -1.1E-10 -1.2E-10 -1.5E-10 66 74.00	2.33 9 36 Ar 1.8E-12 -6.0E-12 1.0E-11 -2.1E-11 -1.4E-11 -7.8E-12 -2.6E-12 3.2E-12 8.2E-12 1.3E-11 1.8E-11 -3.6E-11 -1.9E-11 -3.6E-11 -1.0E-10 -3.93E-11 -1.0E-10 -4.0E-11 -4.5E-11 -1.2E-10 -1.5E-10 66 86.46	1.49 9 39 Ar 2.2E-12 5.0E-12 -8.4E-13 -2.1E-11 -1.4E-11 -8.2E-12 -2.0E-12 3.4E-12 1.4E-11 1.9E-11 -3.6E-11 -9.3E-11 -9.3E-11 -9.3E-11 -9.3F-11 -4.0E-11 -4.0E-11 -4.5E-11 -1.2E-10 -1.2E-10 -1.4E-11 -1.4E-10 -1.4	22 9 42 Ar 1.5E-12 3.9E-12 -1.4E-12 -2.0E-11 -1.3E-11 -7.6E-12 -2.4E-12 2.6E-12 2.6E-12 2.6E-12 1.4E-11 1.9E-11 -3.6E-11 -9.4E-11 -9.4E-11 -9.4E-11 -9.4E-11 -4.0E-11 -4.0E-11 -1.2E-10 -1.2E-10 -1.4E-10 62 224.8	23 9 45 Ar 1.1E-12 -7.3E-12 -2.9E-12 -2.3E-11 -1.6E-11 -1.0E-11 -5.0E-12 -1.9E-13 4.3E-12 9.4E-12 1.4E-11 -3.7E-11 -2.3E-11 -9.3E-11 -9.3E-11 -9.3E-11 -4.0E-11 -4.0E-11 -4.3E-10 -1.2E-10 1.9E5 n/a

Table C1. Pre- and Post-Irradiation Electrical Characterization Test Results for 9/26/2017 TAMU Tests Note: Shaded columns flag new DUT. Out-of-spec values are in orange or red text.

Run #:	pre	24	25	pre		26	27	28	29		30	31	32		33	34	35	5	36	37	38
DUT S/N:	10	10	10	11		11	11	11	11		11	11	11		11	11	11	1	11	11	11
Run Vds (V):		30	33		24,	10 kΩ	27, 10 k (230, 10 k	Ω33, 10	kΩ36,	10 kΩ	39, 10	kΩ42, 10) kΩ 4	45, 10 k (248, 10	kΩ 51, 1(0 kΩ	54, 10 kΩ	57, 10 kΩ	60, 10 kΩ
Ion species:		Ar	Ar			Ar	Ar	Ar	Ar		Ar	Ar	Ar		Ar	Ar	A	r	Ar	Ar	Ar
Vgs (V)									_												
0	2.9E-13	4.2E-13	-3.2E-13	-1.6E-1	2 9.	5E-13	1.6E-12	2.1E-12	2 2.0E-1	12 2.9	9E-12	2.3E-1	2 2.2E-	12	8.4E-13	1.4E-1	2 1.5E	-12	5.4E-13	2.1E-12	2.2E-12
2	-/.1E-12	1.7E-12	-9.2E-12	1.1E-1() 3.	0E-12	1.2E-11	3.0E-12	2 3.4E-:	12 2.8	8E-12	3.0E-1	2 3.2E-	12	2.4E-12	2.0E-1	.2 1.2E	-11	8.7E-13	2.6E-12	2.3E-12
4	1./E-11	7.2E-12	6.5E-12	2.5E-10) 2.	8E-11	2.4E-11	2.5E-1	1 2.5E-:	11 2.5	5E-11	2.5E-1	1 2.4E-	11	2.4E-11	2.4E-1	.1 1.3E	-11	1.3E-11	1.3E-11	1.4E-11
. 0	-2.1E-11	-2.6E-11	-2./E-11	3.8E-10		7E-13	-4.8E-13	2.4E-1:	3 -1.1E-		1E-13	3./E-1	3 0.5E-	13	-1.3E-12	1.4E-1	.3 1.5E	-13	-3.8E-13	-2.1E-13	5.3E-13
10	-1.4E-11	-1.9E-11	-2.0E-11	7.25-10	$\begin{array}{c c} 1 \\ 1 \\ 1 \\ 2 \\ \end{array}$	3E-11	1.2E-11 2.4E-11	1.3E-1.	1 1.2E	11 1.3	3E-11 2E 11	1.3E-1	1 2 2 5	11	1.1E-11 2.2E 11	1.2E-1	1 2 2 5	11	1.1E-11 2.1E-11	1.1E-11 2.1E-11	1.2E-11 2.2E-11
10	-7.0L-12	-1.56-11	-1.46-11	9.0F-10		20.11	2.46-11	2.46-1	1 2.46-	11 2.3	25-11	2.46-1	1 2.50	11	2.25-11	2.20-1	1 2.50	11	2.10-11	2.10-11	2.25-11
14	7 1E-12	-7.4L-12	-0.0L-12	1 OF-0		5E-11	4 4F-11	4 3E-1	1 4 4 F-1	11 43	3E-11	4 2E-1	1 4 2F-	11	4 1F-11	4 2E-1	1 4 35	-11	4.0F-11	4.0E-11	3 9F-11
16	1.1E-11	3 5F-12	-3 3E-13	1.2F-0	9 5	4F-11	5 4F-11	5 2F-1	1 5 3E-	11 52	2F-11	5 2F-1	1 5 3F-	11	5 1F-11	5 1E-1	1 5 16	-11	5.0F-11	4 8F-11	4 8F-11
18	1.7E-11	7.0E-12	4.4E-12	1.4E-0	6	4E-11	6.3E-11	6.2E-1	1 6.2E-:	11 6.1	1E-11	6.1E-1	1 6.2E-	11	6.0E-11	6.0E-1	1 5.9E	-11	5.9E-11	5.6E-11	5.7E-11
20	2.3E-11	1.0E-11	8.5E-12	1.5E-0	7	3E-11	7.2E-11	7.1E-1	1 7.2E-	11 7.0	0E-11	7.0E-1	1 7.1E-	11	7.0E-11	6.9E-1	1 6.8E	-11	6.8E-11	6.5E-11	6.5E-11
0	-6.7E-11	-9.5E-11	-9.3E-11	-2.2E-1	0 -6.	1E-11	-6.1E-11	-6.1E-1	1 -6.1E-	11 -6.	1E-11	-6.1E-1	11 -6.1E	-11	-6.1E-11	-6.1E-3	11 -6.1E	-11	-6.1E-11	-6.1E-11	-6.0E-11
-2	-8.8E-11	-3.2E-11	-9.7E-11	-4.1E-1	0 -3.	2E-11	-3.2E-11	-3.1E-1	1 -3.1E-	11 -3.	1E-11	-3.1E-1	1 -3.1E	-11	-3.1E-11	-3.1E-1	11 -3.1E	-11	-3.0E-11	-3.0E-11	-3.0E-11
-4	-1.0E-10	-9.3E-11	-9.9E-11	-5.3E-1	0 -4.	1E-11	-4.0E-11	-4.0E-1	1 -3.9E-	11 -3.	9E-11	-3.9E-1	L1 -4.0E	-11	-4.0E-11	-3.9E-1	11 -3.9E	-11	-3.9E-11	-3.8E-11	-3.8E-11
-6	-4.0E-11	-9.7E-11	-9.9E-11	-6.5E-1	0 -1.	2E-10	-1.2E-10	-1.1E-1	0 -1.1E-	10 -1.	1E-10	-1.1E-1	LO -1.2E	-10	-1.1E-10	-1.1E-3	10 -1.1E	-10	-1.1E-10	-1.1E-10	-1.1E-10
-8	-1.0E-10	-3.8E-11	-3.8E-11	-7.6E-1	0 -1.	3E-10	-1.3E-10	-1.3E-1	0 -1.3E-	10 -1.	3E-10	-1.3E-1	LO -1.3E	-10	-1.3E-10	-1.3E-1	10 -1.3E	-10	-1.2E-10	-1.3E-10	-1.2E-10
-10	-1.1E-10	-1.0E-10	-1.0E-10	-8.6E-1	0 -1.	3E-10	-1.2E-10	-1.2E-1	0 -1.3E-	10 -1.	2E-10	-1.2E-1	10 -1.3E	-10	-1.2E-10	-1.2E-3	10 -1.2E	-10	-1.2E-10	-1.2E-10	-1.3E-10
-12	-1.1E-10	-1.1E-10	-1.1E-10	-9.5E-1	0 -1.	5E-10	-1.5E-10	-1.5E-1	0 -1.4E-	10 -1.	5E-10	-1.5E-1	LO -1.5E	-10	-1.5E-10	-1.5E-1	10 -1.5E	-10	-1.4E-10	-1.4E-10	-1.4E-10
-14	-1.2E-10	-4.7E-11	-1.1E-10	-9.2E-1	0 -1.	6E-10	-1.6E-10	-1.6E-1	0 -1.5E-	10 -1.	5E-10	-1.5E-1	1.6E	-10	-1.5E-10	-1.5E-3	10 -1.5E	-10	-1.5E-10	-1.5E-10	-1.4E-10
-16	-1.1E-10	-4.8E-11	-1.2E-10	-1.1E-0	9 -1.	7E-10	-1.7E-10	-1.7E-1	0 -1.6E-	10 -1.	6E-10	-1.6E-1	1.6E	-10	-1.6E-10	-1.6E-1	10 -1.6E	-10	-1.6E-10	-1.6E-10	-1.6E-10
-18	-1.4E-10	-1.2E-10	-1.1E-10	-1.2E-0	9 -1.	8E-10	-1.7E-10	-1.7E-1	0 -1.7E-	10 -1.	7E-10	-1.7E-1	LO -1.7E	-10	-1.7E-10	-1.7E-:	10 -1.7E	-10	-1.7E-10	-1.7E-10	-1.7E-10
-20	-2.4E-10	-1.9E-10	-1.8E-10	-1.4E-0	9 -2.	2E-10	-2.1E-10	-2.1E-1	0 -2.0E-	10 -2.	0E-10	-2.0E-1	LO -2.0E	-10	-2.0E-10	-2.0E-1	10 -2.0E	-10	-2.0E-10	-1.9E-10	-1.9E-10
BVdss (V):	66	66	5.995	6/	1	6/	6/	6/	6/		6/	6/	6/		66	63	59.9	99 62 0	57	54	51
Vth (V)	2 29	19.82	0.92	2 26	1	47	1 17	1 03	49.8		0.81	0.73	06	.0	0.57	0.50		02.9 15	n/a 0.42	0.38	0.34
v (ii (v).	2.25	1.50	0.52 Pu	. #1		20	•	1.00	60	61		62	63	6	0.57	65	66		67	0.50	0.54
			DUTS	/N·	12	1	2	17	17	17		17	17	1	7	17	17		17		
			Run Vds	V):		24 (-1	- OVgs)		24	27		30	33	3	6	39	42		45		
			lon spec	es:		A	r		Ne	Ne		Ne	Ne	N	le	Ne	Ne		Ne		
			Vgs (V)																	
			0	9.0	5E-14	3.0E	-12 -1	.1E-12	-2.1E-12	-2.0E-1	12 -7	.2E-13	-2.4E-13	-2.5	E-13 -6	.5E-13	4.6E-13	-5.7	7E-13		
			2	-6.	1E-12	-2.9E	-11 9.	2E-11	1.8E-10	1.9E-1	1.	9E-10	1.9E-10	1.9	E-10 1	9E-10	1.9E-10	8.4	4E-11		
			4	1.	'E-11	9.3E	-12 1.	9E-10	3.7E-10	3.8E-1	10 3.	7E-10	3.8E-10	3.8	E-10 3	8E-10	3.7E-10	2.0	DE-10		
			6	-2.	2E-11	-2.48	-11 2.	4E-10	5.2E-10	5.2E-1	10 5.	1E-10	5.2E-10	5.26	E-10 5	2E-10	5.1E-10	2.5	5E-10		
			8	-1.	4E-11	-1.8E	5-11 3.	3E-10	7.1E-10	7.1E-1	10 7.	0E-10	7.1E-10	7.16	E-10 7	1E-10	7.0E-10	3.5	5E-10		
			10	-7.	3E-12	-1.28	-11 4.	3E-10	8.9E-10	9.0E-1	10 8.	9E-10	9.0E-10	9.0	E-10 9	0E-10	8.9E-10	4.5	5E-10		
			12	-1.	4E-12	-6.8t	-12 5.	3E-10	1.1E-09	1.2E-0)9 1.	1E-09	1.2E-09	1.2	E-09 1	2E-09	1.1E-09	5.6	DE-10		
			14	3.	0E-12	-1.66	-12 0.	2E-10	1.3E-09	1.3E-0	$\frac{19}{1}$	3E-09	1.3E-09	1.3		3E-09	1.3E-09	0.0	DE-10		
			10	1.0	E-11	5.60	12 7.	1E-10 1E-10	1.5E-09	1.3E-0	10 1	75.00	1.3E-09	1.5		7E 00	1.3E-09	07	7E-10		
			20	1 0	F-11	9.0L	-12 9	1E-10	1.7E-09	1.7E-0	1 0	9E-09	1.7E-09	1 9	E-09 1	9E-09	1.7E-09	9.7	RE-10		
			0	-8.	4E-11	-9.36	-11 -1	1E-10	-4.4E-11	-4.2E-1	11 -4	.1E-11	-4.1E-11	-4.0	E-11 -4	.1E-11	-3.9E-11	-1.3	3E-10		
			-2	-9.	9E-11	-6.3E	-11 -2	.0E-10	-2.2E-10	-2.2E-1	10 -2	.1E-10	-2.1E-10	-2.1	E-10 -2	.1E-10	-2.1E-10	-2.1	1E-10		
			-4	-3.	8E-11	-2.88	-11 -3	.0E-10	-4.7E-10	-4.7E-1	10 -4	.6E-10	-4.6E-10	-4.6	E-10 -4	.6E-10	-4.6E-10	-3.1	1E-10		
			-6	-3.	6E-11	-8.8	-11 -3	.8E-10	-6.6E-10	-6.6E-3	10 -6	.5E-10	-6.6E-10	-6.5	E-10 -6	.5E-10	-6.5E-10	-4.0	0E-10		
			-8	-1.	0E-10	-9.58	-4	.7E-10	-8.3E-10	-8.5E-2	10 -8	.3E-10	-8.5E-10	-8.5	E-10 -8	.3E-10	-8.4E-10	-5.1	1E-10		
			-10	-4.	4E-11	-9.88	-11 -5	.7E-10	-9.8E-10	-9.8E-2	10 -9	.7E-10	-9.8E-10	-9.8	E-10 -9	.8E-10	-9.7E-10	-6.1	1E-10		
			-12	-4.	3E-11	-3.9E	-11 -6	.6E-10	-1.2E-09	-1.2E-0	09 -1	.2E-09	-1.2E-09	-1.2	E-09 -1	.2E-09	-1.2E-09	-7.1	1E-10		
			-14	-4.	8E-11	-3.88	-11 -7	.5E-10	-1.4E-09	-1.4E-0	09 -1	.4E-09	-1.4E-09	-1.4	E-09 -1	.4E-09	-1.4E-09	-8.2	2E-10		
			-16	-1.	1E-10	-4.0E	-11 -8	.3E-10	-1.6E-09	-1.6E-0	09 -1	.6E-09	-1.6E-09	-1.6	E-09 -1	.6E-09	-1.6E-09	-9.3	3E-10		
			-18	-1.	3E-10	-1.16	-10 -9	4E-10	-1.8E-09	-1.8E-(09 -1	./E-09	-1.8E-09	-1.8	E-09 -1	.8E-09	-1./E-09	-9.9	9E-10		
			-20 BV/dec/	-2.	67	-1.8	-10 -9	68 · · · · · · · · · · · · · · · · · · ·	-2.UE-U9	-2.UE-(09 -1.	.9E-09	-2.0E-09	-2.0	E-09 -2	.UE-U9	-1.9E-09	-1.1	1E-09		
			Idee (u		1394	0.95		1081	0.0199	0.036	5 0	07	0379		129 0) 551	5 696	4.	n/a		
			Vth /	vi:	.30	0,0	07	2.25	2.17	2.06		1.97	1.89	1	83	1.78	1.71		.48		
			V CIT	-1-1 - 4		0.0			L.1.1	2.00	. [.		1.00				217 X	_ <u>_</u>			

					0			r			0			
Run #:	pre 89	89	90	91	92	93	94	95	pre 96	96	97	98	99	100
DUT S/N:	114	114	114	114	114	114	114	114	120	120	120	120	120	120
Run Vds (V):	n/a	24	27	30	33	36	39	42	n/a	33	36	39	42	45
Vgs (V)	lgs (A)	Cu	Cu	Cu	Cu	Cu	Cu	Cu	n/a	Cu	Cu	Cu	Cu	Cu
0	-3.24E-13	3.82E-13	-4.23E-14	-8.03E-14	2.62E-13	-9.03E-14	4.06E-13	-2.79E-14	-5.55E-13	-9.99E-13	-1.28E-12	-8.66E-13	-9.01E-13	-4.96E-13
4	4.31E-12	4.18E-12	3.67E-12	3.84E-12	3.90E-12	3.97E-12	4.03E-12	4.00E-12	1.95E-11	3.19E-11	3.34E-11	3.43E-11	3.47E-11	3.17E-11
8	-3.51E-11	-3.60E-11	-3.44E-11	-3.37E-11	-3.34E-11	-3.38E-11	-3.37E-11	-3.26E-11	6.77E-11	7.46E-11	7.61E-11	7.48E-11	7.63E-11	7.76E-11
12	-3.00E-11	-2.97E-11	-2.94E-11	-2.89E-11	-2.86E-11	-2.88E-11	-2.92E-11	-2.86E-11	5.90E-11	5.96E-11	6.04E-11	6.03E-11	6.09E-11	6.06E-11
16	-2.69E-11	-2.67E-11	-2.63E-11	-2.58E-11	-2.67E-11	-2.43E-11	-2.58E-11	-2.58E-11	1.21E-10	1.21E-10	1.22E-10	1.22E-10	1.22E-10	1.21E-10
20	-2.39E-11	-2.40E-11	-2.27E-11	-2.21E-11	-2.30E-11	-2.19E-11	-2.24E-11	-2.29E-11	1.50E-10	1.50E-10	1.53E-10	1.53E-10	1.54E-10	1.52E-10
0	-9.96E-12	-4.61E-11	-2.85E-11	-4.61E-11	-4.64E-11	-4.65E-11	-4.63E-11	-4.64E-11	-2.81E-11	-1.48E-10	-1.50E-10	-1.50E-10	-1.50E-10	-1.51E-10
-4	-7.27E-11	-1.21E-11	-1.15E-11	-1.25E-11	-1.23E-11	-1.22E-11	-1.26E-11	-7.71E-11	-4.37E-11	-3.26E-11	-3.28E-11	-3.33E-11	-3.35E-11	-1.94E-10
-8	-7.68E-11	-7.49E-11	-7.71E-11	-7.98E-11	-7.64E-11	-7.92E-11	-7.85E-11	-8.07E-11	-1.93E-10	-5.28E-11	-5.27E-11	-5.31E-11	-5.30E-11	-2.09E-10
-12	-8.14E-11	-8.12E-11	-8.24E-11	-8.17E-11	-8.06E-11	-8.12E-11	-8.07E-11	-8.35E-11	-2.18E-10	-2.11E-10	-2.12E-10	-2.14E-10	-2.11E-10	-2.25E-10
-16	-8.25E-11	-8.38E-11	-8.45E-11	-8.54E-11	-8.46E-11	-8.44E-11	-8.37E-11	-8.58E-11	-2.38E-10	-2.38E-10	-2.35E-10	-2.37E-10	-2.38E-10	-2.44E-10
-20	-5.35E-11	-4.70E-11	-4.37E-11	-4.12E-11	-4.01E-11	-3.92E-11	-3.80E-11	-3.76E-11	-3.10E-10	-3.03E-10	-2.97E-10	-2.97E-10	-2.92E-10	-2.92E-10
BVdss (V):	69						69	10	69			69		7
Idss (μA):	0.001393	8.415	25.12	32.94	41.82	56.08	76.85		0.001413	17.31	34.31	62.92	80.76	
Vth (V)	2.22	1 9 2	1 3/	1 15	1 02	0.017	0.805	0.684	2 20	1 5 3	1 1 2	0.046	0.825	0 604
v cii (v).	2.22	1.02	1.54	1.15	1.02	0.917	0.005	0.004	2.35	1.55	1.10	0.940	0.025	0.054
var (v).	2.22	1.82 Run #	t: pre 101	1.15	pre 111	111	112	113	114	115	1116	117	0.825	0.034
var (v).	LILL	Run #	pre 101 1: 107	101 107	pre 111 117	111 117	112 117	113 117	114 117	115 117	116 117	117 117	0.825	0.034
vin (v).	LILL	Run # DUT S/N Run Vds (V)	r: pre 101 1: 107 1: n/a	101 107 39	pre 111 117 n/a	111 117 24	112 117 27	113 117 30	114 117 33	1.55 115 117 36	1116 1117 39	117 117 42	0.023	0.034
var (v).	LILL	Run # DUT S/N Run Vds (V) Vgs (V)	<pre>1.34 pre 101 1: 107 1: n/a lgs (A)</pre>	1.15 101 107 39 Cu	pre 111 117 n/a n/a	111 117 24 Kr	112 117 27 Kr	113 117 30 Kr	2.39 114 117 33 Kr	115 117 36 Kr	1116 1117 39 Kr	117 117 42 Kr		0.034
var (v).	LILL	Run # DUT S/N Run Vds (V) Vgs (V) 0	I:34 f: pre 101 l: 107): n/a lgs (A) -2.14E-1.1	1.15 101 107 39 Cu 3 -5.37E-13	pre 111 117 n/a n/a 3 -2.03E-13	111 117 24 Kr 3	112 117 27 Kr 8 -1.09E-12	113 117 30 Kr 2 -1.13E-12	2.33 114 117 33 Kr 2 -1.03E-12	1.55 115 117 36 Kr 2 -1.13E-12	1.10 116 117 39 Kr 2 -8.20E-13	117 117 42 Kr 5 -5.45E-13	0.825	0.054
voi (v).	2.22	Run # DUT S/N Run Vds (V) Vgs (V) 0 4	I:34 pre 101 1: 107): n/a lgs (A) -2.14E-11 5.34E-12	1.13 101 107 39 Cu 3 -5.37E-13 2 5.41E-12	pre 111 117 n/a n/a 3 -2.03E-13 2 3.97E-12	111 117 24 Kr 3 -8.51E-13 4.27E-12	112 117 27 Kr 3.71E-12	113 117 30 Kr 2 -1.13E-12 3.79E-12	2.33 114 117 33 Kr 2 -1.03E-12 3.93E-12	1.55 115 117 36 Kr 2 -1.13E-12 4.56E-12	116 116 117 39 Kr 2 -8.20E-13 4.68E-12	117 117 42 Kr -5.45E-13 2.83E-12	0.825	0.054
vor(v).	L.LL	Run # DUT S/N Run Vds (V) Vgs (V) 0 4 8	Image: rel	1.13 101 107 39 Cu 3 -5.37E-13 2 5.41E-12 1 -3.20E-13	pre 111 117 n/a 3 -2.03E-12 2 3.97E-12 1 -3.60E-12	111 117 24 Kr 3 -8.51E-13 4.27E-12 -3.24E-11	112 117 27 Kr 3.71E-12 -3.28E-11	113 117 30 Kr 2 -1.13E-12 3.79E-12 -3.20E-11	2.33 114 117 33 Kr 21.03E-12 3.93E-12 13.16E-11	1.33 115 117 36 Kr 2 -1.13E-12 4.56E-12 -3.21E-11	1.16 116 117 39 Kr 2 -8.20E-13 4.68E-12 -3.09E-11	117 117 42 Kr 5 -5.45E-13 2.83E-12 -3.14E-11		0.034
	LILL	Run # DUT S/N Run Vds (V) Vgs (V) 0 4 8 12	I: pre 101 I: 107 n/a Igs (A) -2.14E-11 5.34E-12 -3.22E-11 -2.73E-1	101 107 39 Cu 3 -5.37E-11 2 5.41E-12 1 -3.20E-11 1 -2.64E-11	pre 111 117 n/a 8 -2.03E-12 3.97E-12 1 -3.60E-12 1 -3.09E-12	111 117 24 Kr 3 -8.51E-13 4.27E-12 -3.24E-11 -2.78E-11	112 117 27 Kr 3.71E-12 -3.28E-11 -2.70E-11	113 117 30 Kr 2 -1.13E-12 3.79E-12 -3.20E-11 -2.85E-11	2.33 114 117 33 Kr 2 -1.03E-12 3.93E-12 3.16E-11 2.64E-11	1135 115 117 36 Kr 2 -1.13E-12 4.56E-12 4.56E-12 -3.21E-11 1 -2.69E-11	116 117 39 Kr * * -8.20E-13 4.68E-12 -3.09E-11 -2.60E-11 -2.60E-11	117 117 42 Kr -5.45E-13 2.83E-12 -3.14E-11 -2.67E-11		0.034
vu(v).	LILL	Run # DUT S/N Run Vds (V) Vgs (V) 0 4 8 12 16	Issue 1134 107 108 109 109 109 100 100 101 102 103 104 105 105 <	101 107 39 Cu 3 -5.37E-12 5.41E-12 1 -3.20E-11 -2.64E-12 1 -2.17E-12	pre 111 117 n/a 3 -2.03E-12 1 -3.97E-12 1 -3.09E-12 1 -2.74E-12	111 117 24 Kr 3 -8.51E-13 4.27E-12 -3.24E-11 -2.78E-11 -2.46E-11	112 117 27 Kr 3.71E-12 -3.28E-11 -2.70E-11 -2.32E-11	113 117 30 Kr 2 -1.13E-12 3.79E-12 -3.20E-11 -2.85E-11 -2.35E-11	2.33 114 117 33 Kr 21.03E-12 3.93E-12 13.16E-11 12.64E-11 12.20E-11	11.55 115 117 36 Kr 2 -1.13E-12 4.56E-12 4.56E-12 -3.21E-11 -2.69E-11 -2.19E-11	116 117 39 Kr * * -8.20E-13 4.68E-12 -3.09E-11 -2.60E-11 -2.60E-11 -2.16E-11 -2.16E-11	117 117 117 42 Kr 3 -5.45E-13 2.83E-12 -3.14E-11 -2.67E-11 -2.14E-11		0.034
vu (v).	LILL	Run # DUT S/N Run Vds (V) Vgs (V) 0 4 8 12 16 20	Instruction Image: second s	1.13 101 107 39 Cu 3 -5.37E-12 2 5.41E-12 1 -3.20E-11 -2.64E-12 1 -2.17E-12 1 -1.83E-12	Instant pre 111 117 n/a n/a 3 -2.03E-12 3.97E-12 1 -3.60E-12 1 -3.09E-12 1 -2.74E-12 1 -2.48E-12	Kr -8.51E-13 4.27E-12 -3.24E-11 -2.78E-11 -2.46E-11 -2.25E-11	112 117 27 Kr 3.71E-12 -3.28E-11 -2.70E-11 -2.32E-11 -2.10E-11	113 117 30 Kr 2 -1.13E-12 3.79E-12 -3.20E-11 -2.85E-11 -2.35E-11 -2.04E-11	2.33 114 117 33 Kr 2 -1.03E-12 3.93E-12 1 -3.16E-11 1 -2.64E-11 1 -2.20E-11 1 -1.90E-11	115 117 36 Kr 2 -1.13E-12 4.56E-12 -3.21E-11 -2.69E-11 -2.19E-11 -1.89E-11	116 117 39 Kr -8.20E-13 4.68E-12 -3.09E-11 -2.60E-11 -2.16E-11 -1.82E-11	Kr -5.45E-13 2.83E-12 -3.14E-11 -2.67E-11 -2.14E-11 -1.84E-11		0.034
vu (v).	LILL	Run # DUT S/N Run Vds (V) Vgs (V) 0 4 8 12 16 20 0	Instruction Image: second s	1.13 101 107 39 Cu 3 -5.37E-12 2 5.41E-12 1 -3.20E-12 1 -2.64E-12 1 -2.17E-12 1 -1.83E-12 1 -4.73E-12	pre 111 117 n/a n/a 3 -2.03E-12 1 -3.60E-12 1 -3.09E-12 1 -2.74E-12 1 -2.48E-12 1 -9.40E-12	Kr -8.51E-13 4.27E-12 -3.24E-11 -2.78E-11 -2.46E-11 -2.52E-11 -5.29E-11	112 117 27 Kr 3.71E-12 -3.28E-11 -2.70E-11 -2.32E-11 -2.32E-11 -5.36E-11	113 117 30 Kr 2 -1.13E-12 3.79E-12 -3.20E-11 -2.85E-11 -2.35E-11 -2.35E-11 -2.44E-11 -5.40E-11	2.33 114 117 33 Kr 2 -1.03E-12 3.93E-12 1 -3.16E-11 1 -2.64E-11 1 -2.20E-11 1 -1.90E-11 1 -5.52E-11	115 117 36 Kr 2 -1.13E-12 4.56E-12 4.56E-12 -3.21E-11 -2.69E-11 -2.19E-11 -1.89E-11 -5.48E-11	116 117 39 Kr -8.20E-13 4.68E-12 -3.09E-11 -2.60E-11 -2.16E-11 -1.82E-11 -5.53E-11	Kr -5.45E-13 2.83E-12 -3.14E-11 -2.67E-11 -2.14E-11 -5.51E-11		0.054
vu (v).	LILL	Run # DUT S/N Run Vds (V) Vgs (V) 0 4 8 12 16 20 0 -4	1134 Image: Image of the state of the	1.13 101 107 39 Cu 3 -5.37E-12 5.41E-12 1 -3.20E-12 1 -2.64E-12 1 -2.64E-12 1 -2.17E-12 1 -4.73E-12 1 -4.73E-12 1 -7.92E-12	pre 111 117 n/a 3 -2.03E-12 3.97E-12 1 -3.60E-11 1 -3.09E-12 1 -2.74E-12 1 -2.74E-12 1 -2.48E-12 1 -7.35E-12	III 117 24 Kr 3 -8.51E-13 4.27E-12 -3.24E-11 -2.78E-11 -2.46E-11 -2.25E-11 2 -5.29E-11 -1.27E-11	112 117 27 Kr 3.71E-12 3.71E-12 3.71E-12 1.09E-11 -2.32E-11 -2.32E-11 -2.10E-11 -5.36E-11 -1.32E-11	113 117 30 Kr 2 -1.13E-12 3.79E-12 3.79E-12 1.3.20E-11 -2.35E-11 -2.35E-11 -2.04E-11 -5.40E-11 -1.35E-11	2.33 114 117 33 Kr 2 -1.03E-12 3.93E-12 3.93E-12 12.64E-11 -2.64E-11 -2.20E-11 -1.90E-11 -5.52E-11 -1.40E-11	11.5 115 117 36 Kr 2 4.56E-12 4.56E-12 -3.21E-11 -2.69E-11 -2.19E-11 -5.48E-11 -5.48E-11 -1.43E-11	1.10 116 117 39 Kr 2 -8.20E-13 4.68E-12 -3.09E-11 -2.60E-11 -2.16E-11 -1.82E-11 -5.53E-11 -1.48E-11	1.340 117 117 117 42 Kr 3 2.83E-12 -3.14E-11 -2.67E-11 -2.14E-11 -1.84E-11 -5.51E-11 -4.71E-11		0.034
vu (v).	LILL	Run # DUT S/N Run Vds (V) Vgs (V) 0 4 8 12 16 20 0 -4 -8	1.94 I: pre 101 I: 107 n/a lgs (A) -2.14E-1 -3.22E-1 -3.22E-1 -2.31E-1 -2.31E-1 -1.93E-1 -1.10E-1 -7.43E-1 -8.17E-1 -8.17E-1	1.13 101 107 39 Cu 3 -5.37E-13 2 5.41E-12 1 -3.20E-13 1 -2.64E-13 1 -2.17E-13 1 -2.17E-13 1 -4.73E-13 1 -7.92E-13 1 -8.23E-13	pre 111 117 n/a 3 -2.03E-12 3.97E-12 1 -3.60E-11 1 -3.09E-12 1 -2.74E-12 1 -2.74E-12 1 -2.48E-12 1 -7.35E-12 1 -7.55E-12	III 111 117 24 Kr 3 -8.51E-13 4.27E-12 -3.24E-11 1 -2.78E-11 -2.46E-11 -2.25E-11 2 -5.29E-11 -1.27E-11 -7.75E-11	III2 117 27 Kr 3.71E-12 3.728E-11 -2.70E-11 -2.32E-11 -2.32E-11 -2.10E-11 -5.36E-11 -1.32E-11 -7.80E-11	113 117 30 Kr 2 -1.13E-12 3.79E-12 -3.20E-11 -2.85E-11 -2.35E-11 -2.45E-11 -2.04E-11 -5.40E-11 -1.35E-11 -7.72E-11	2.33 114 117 33 Kr 2 -1.03E-12 3.93E-12 3.93E-12 1 -2.64E-11 1 -2.20E-11 1 -2.20E-11 1 -5.52E-11 1 -5.52E-11 1 -7.88E-11	11.5 115 117 36 Kr 2 -1.13E-12 4.56E-12 -3.21E-11 -2.69E-11 -2.19E-11 -5.48E-11 -5.48E-11 -1.43E-11 -7.78E-11	I.16 116 117 39 Kr 2 -8.20E-13 4.68E-12 -3.09E-11 -2.60E-11 -2.16E-11 -1.82E-11 -5.53E-11 -1.48E-11 -7.86E-11	1.340 117 117 117 42 Kr 3 -5.45E-13 2.83E-12 -3.14E-11 -2.67E-11 -2.14E-11 -1.84E-11 -5.51E-11 -4.71E-11 -8.08E-11		0.034
vu (v).	LILL	Run # DUT S/N Run Vds (V) Vgs (V) 0 4 8 12 16 20 0 -4 -8 -12	1.94 I: pre 101 I: 107 n/a lgs (A) -2.14E-1 -3.22E-1 -3.22E-1 -2.31E-1 -2.31E-1 -1.08E-1 -7.43E-1 -8.17E-1 -8.36E-1 -8.36E-1	1.13 101 107 39 Cu 3 -5.37E-13 5.41E-12 1 -3.20E-13 1 -2.64E-13 1 -2.17E-13 1 -4.73E-13 1 -7.92E-13 1 -8.23E-13 1 -8.64E-13	pre 111 117 n/a n/a 3 -2.03E-12 3.97E-12 1 -3.60E-12 1 -3.09E-11 1 -2.74E-12 1 -2.74E-12 1 -2.74E-12 1 -2.74E-12 1 -7.35E-12 1 -7.55E-12 1 -7.87E-12	III 111 117 24 Kr 3 -8.51E-13 4.27E-12 -3.24E-11 1 2.78E-11 -2.78E-11 -2.78E-11 -2.25E-11 2 -5.29E-11 -1.27E-11 -7.75E-11 -7.94E-11	III2 117 27 Kr 3.71E-12 4.3.28E-11 2.70E-11 2.232E-11 2.210E-11 -5.36E-11 -1.32E-11 -7.80E-11 -7.80E-11 -8.32E-11	113 117 30 Kr 2 -1.13E-12 3.79E-12 -3.20E-11 -2.85E-11 -2.35E-11 -2.45E-11 -5.40E-11 -5.40E-11 -7.72E-11 -8.20E-11	2.33 114 117 33 Kr 2 -1.03E-12 3.93E-12 3.93E-12 12.64E-11 -2.20E-11 12.20E-11 12.20E-11 15.52E-11 14.0E-11 17.88E-11 18.15E-11	11.5 115 117 36 Kr 2 -1.13E-12 4.56E-12 -3.21E-11 -2.69E-11 -2.19E-11 -1.89E-11 -5.48E-11 -7.78E-11 -7.78E-11 -8.22E-11	I.16 116 117 39 Kr 2 -8.20E-13 4.68E-12 -3.09E-11 -2.60E-11 -2.16E-11 -1.82E-11 -5.53E-11 -1.48E-11 -7.86E-11 -8.27E-11	1.340 117 117 117 42 Kr 3 -5.45E-13 2.83E-12 -3.14E-11 -2.67E-11 -2.14E-11 -5.51E-11 -4.71E-11 -8.08E-11 -8.45E-11		0.034
vu (v).	LILL	Run # DUT S/N Run Vds (V) Vgs (V) 0 4 8 12 16 20 0 -4 -8 -12 -16	1.94 I: pre 101 I: 107 n/a Igs (A) -2.14E-1 -3.22E-1 -3.22E-1 -2.31E-1 -2.31E-1 -1.08E-1 -7.43E-1 -8.17E-1 -8.36E-1 -8.36E-1 -8.36E-1 -8.36E-1	1.13 101 107 39 Cu 3 -5.37E-13 5.41E-12 1 -3.20E-13 1 -2.64E-13 1 -2.17E-13 1 -4.73E-13 1 -7.92E-13 1 -8.23E-13 1 -8.64E-13 1 -9.09E-13	pre 111 117 n/a n/a 3 -2.03E-12 3.97E-12 1 -3.60E-12 1 -3.60E-12 1 -2.74E-12 1 -2.74E-12 1 -2.74E-12 1 -2.74E-12 1 -7.35E-12 1 -7.55E-12 1 -7.87E-12 1 -8.24E-12	111 117 24 Kr 3 -8.51E-13 4.27E-12 -3.24E-11 1-2.78E-11 2-2.78E-11 2-2.76E-11 2-2.52E-11 2-5.29E-11 1-1.27E-11 2-7.75E-11 2-7.94E-11 2-8.31E-11	III2 117 27 Kr 3.71E-12 2.32E-11 2.232E-11 2.210E-11 2.5.36E-11 -1.32E-11 -7.80E-11 -8.32E-11 -8.32E-11	113 117 30 Kr 2 -1.13E-12 3.79E-12 3.79E-12 1 -2.85E-11 -2.35E-11 -2.40E-11 -5.40E-11 -5.40E-11 -7.72E-11 -8.20E-11 -8.62E-11	2.33 114 117 33 Kr 2 -1.03E-12 3.93E-12 3.93E-12 1 -2.64E-11 -2.20E-11 -2.20E-11 -1.90E-11 -5.52E-11 -5.52E-11 -7.88E-11 -8.15E-11 -8.58E-11	11.5 115 117 36 Kr 2 -1.13E-12 4.56E-12 -3.21E-11 -2.69E-11 -2.19E-11 -1.89E-11 -5.48E-11 -7.78E-11 -8.22E-11 -8.74E-11	1.10 116 117 39 Kr 2 -8.20E-13 4.68E-12 -3.09E-11 -2.60E-11 -2.16E-11 -1.82E-11 -5.53E-11 -1.48E-11 -7.86E-11 -8.27E-11 -8.67E-11	1.940 117 117 42 Kr -5.45E-13 2.83E-12 -3.14E-11 -2.67E-11 -2.14E-11 -5.51E-11 -4.71E-11 -8.08E-11 -8.45E-11 -9.09E-11		0.034
vu (v).	LILL	Run # DUT S/N Run Vds (V) Vgs (V) 0 4 8 12 16 20 0 -4 -8 -12 -16 -20	1.34 Image: second s	1.13 101 107 39 Cu 39 5.41E-12 1-3.20E-11 1-2.64E-11 1-2.77E-11 1-8.3E-11 1-7.92E-11 1-8.23E-11 1-8.64E-11 1-9.09E-11 1-8.58E-11	pre 111 117 n/a n/a 3 -2.03E-12 3.97E-12 1 -3.60E-12 1 -3.60E-12 1 -2.74E-12 1 -2.74E-12 1 -2.74E-12 1 -2.74E-12 1 -7.35E-12 1 -7.35E-12 1 -7.55E-12 1 -7.87E-12 1 -8.24E-12 1 -3.40E-12	111 117 24 Kr 3 -8.51E-13 4.27E-12 -3.24E-11 1-2.78E-11 2-2.78E-11 2-2.78E-11 2-2.5E-11 2-5.29E-11 1-1.27E-11 2-7.75E-11 2-7.94E-11 2-9.97E-11	112 117 27 Kr 3.71E-12 -3.28E-11 -2.70E-11 -2.32E-11 -2.10E-11 -5.36E-11 -1.32E-11 -7.80E-11 -8.32E-11 -8.32E-11 -8.32E-11 -8.32E-11	113 117 30 Kr 2 -1.13E-12 3.79E-12 3.79E-12 1 -2.85E-11 -2.35E-11 -2.40E-11 -5.40E-11 -5.40E-11 -7.72E-11 -8.20E-11 -8.62E-11 -9.89E-11	2.33 114 117 33 Kr 2 -1.03E-12 3.93E-12 3.93E-12 12.64E-11 12.20E-11 12.20E-11 12.20E-11 15.52E-11 15.52E-11 17.88E-11 18.58E-11 18.58E-11 19.74E-11	11.5 115 117 36 Kr 2 -1.13E-12 4.56E-12 -3.21E-11 -2.69E-11 -2.19E-11 -5.48E-11 -7.78E-11 -8.22E-11 -8.74E-11 -9.90E-11	1116 117 39 Kr 2 -8.20E-13 4.68E-12 -3.09E-11 -2.60E-11 -2.16E-11 -1.82E-11 -5.53E-11 -1.48E-11 -7.86E-11 -8.27E-11 -8.67E-11 -9.99E-11	117 117 117 42 Kr -5.45E-13 2.83E-12 -3.14E-11 -2.67E-11 -2.14E-11 -5.51E-11 -4.71E-11 -8.08E-11 -8.45E-11 -9.09E-11 -9.85E-11		0.034
vu (v).	LILL	Run # DUT S/N Run Vds (V) Vgs (V) 0 4 8 12 16 20 0 -4 -8 -12 -16 -20 BVdss (V)	1:34 : pre 101 : 107 : n/a -2.14E-1. 5.34E-12 -3.22E-1 -2.73E-1 -2.31E-1 -1.05E-1 -3.42E-1 -8.36E-1 -8.17E-1 -8.36E-1 -8.36E-1 -8.75E-1 -4.75E-1 -8.06E-1	1.13 101 107 39 Cu 39 5.41E-12 1 -3.20E-11 1 -2.64E-11 1 -2.64E-11 1 -2.64E-11 1 -2.64E-11 1 -4.73E-11 1 -7.92E-11 1 -8.23E-11 1 -8.64E-11 -9.09E-11 1 -4.58E-11 34	pre 111 117 n/a n/a 3 -2.03E-12 3.97E-12 1 -3.60E-12 1 -3.60E-12 1 -2.74E-12 1 -2.74E-12 1 -2.74E-12 1 -2.74E-12 1 -7.35E-12 1 -7.55E-12 1 -7.87E-12 1 -8.24E-12 1 -3.40E-12 72	111 117 24 Kr 3 -8.51E-13 4.27E-12 -3.24E-11 1-2.78E-11 -2.78E-11 -2.78E-11 -2.75E-11 -7.75E-11 -7.94E-11 -8.31E-11 -9.97E-11	112 117 27 Kr 3.71E-12 -3.28E-11 -2.70E-11 -2.32E-11 -2.32E-11 -2.32E-11 -2.32E-11 -3.36E-11 -3.36E-11 -3.32E-11 -3.32E-11	113 117 30 Kr 2 -1.13E-12 3.79E-12 3.79E-12 1 -2.85E-11 -2.85E-11 -2.45E-11 -5.40E-11 -5.40E-11 -7.72E-11 -8.62E-11 -8.62E-11 -9.89E-11	2.33 114 117 33 Kr 2 -1.03E-12 3.93E-12 3.93E-12 -3.16E-11 -2.64E-11 -2.02E-11 -1.90E-11 -5.52E-11 -1.40E-11 -7.88E-11 -8.15E-11 -8.58E-11 -9.74E-11 72	11.5 115 117 36 Kr 2 -1.13E-12 4.56E-12 -3.21E-11 -2.69E-11 -2.19E-11 -5.48E-11 -7.78E-11 -8.22E-11 -8.74E-11 -9.90E-11 72	1116 117 39 Kr 2 -8.20E-13 4.68E-12 -3.09E-11 -2.60E-11 -2.16E-11 -1.82E-11 -5.53E-11 -1.48E-11 -7.86E-11 -8.27E-11 -8.67E-11 -9.99E-11 72	117 117 117 42 Kr 2.83E-12 -3.14E-11 -2.67E-11 -2.14E-11 -5.51E-11 -4.71E-11 -8.08E-11 -8.45E-11 -9.09E-11 -9.85E-11 7		0.034
vu (v).	LILL	Run # DUT S/N Run Vds (V) Vgs (V) 0 4 8 12 16 20 0 -4 -8 -12 -16 -20 BVdss (V) Idss (µA)	1:34 Image: second s	1.13 101 107 39 Cu 39 5.37E-13 5.41E-12 1 -3.20E-13 1 -2.64E-13 1 -2.64E-13 1 -2.64E-13 -4.73E-13 1 -7.92E-13 1 -8.64E-13 1 -9.09E-13 1 -4.58E-13 34	1.02 pre 111 117 n/a 3 -2.03E-12 3.97E-12 1 1 -3.60E-12 1 -3.09E-12 1 -2.74E-12 1 -2.48E-12 1 -7.35E-11 1 -7.55E-12 1 -7.87E-12 1 -3.40E-12 72 0.001625	111 117 24 Kr 3 -8.51E-13 4.27E-12 -3.24E-11 -2.78E-11 -2.78E-11 -2.78E-11 -2.75E-11 -5.29E-11 -7.75E-11 -7.75E-11 -7.94E-11 -9.97E-11 -9.97E-11 -7.24	112 117 27 Kr 3.71E-12 -3.28E-11 -2.32E-11 -2.32E-11 -2.32E-11 -2.32E-11 -2.32E-11 -3.28E-11 -7.00E-11 -8.32E-11 -8.32E-11 -8.32E-11 -8.32E-11 -8.32E-11 72 35.55	113 117 30 Kr 2 -1.13E-12 3.79E-12 3.79E-12 -3.20E-11 -2.85E-11 -2.35E-11 -2.40E-11 -5.40E-11 -5.40E-11 -7.72E-11 -8.62E-11 -8.62E-11 -9.89E-11 53.27	2.33 114 117 33 Kr 2 -1.03E-12 3.93E-12 3.93E-12 1 -3.16E-11 -2.64E-11 -2.20E-11 -2.64E-11 -5.52E-11 -5.52E-11 -4.40E-11 -7.88E-11 -8.15E-11 -8.58E-11 -9.74E-11 72 83.27	11.5 115 117 36 Kr 2 -1.13E-12 4.56E-12 -3.21E-11 -2.69E-11 -2.19E-11 -5.48E-11 -7.78E-11 -8.22E-11 -8.74E-11 -9.90E-11 72 102.6	11.10 116 117 39 Kr 2 -8.20E-13 4.68E-12 -3.09E-11 -2.60E-11 -2.16E-11 -1.82E-11 -5.53E-11 -1.48E-11 -7.86E-11 -8.27E-11 -8.67E-11 -9.99E-11 72 126.4	1.340 117 117 117 42 Kr 2.83E-12 -3.14E-11 -2.67E-11 -2.14E-11 -5.51E-11 -4.71E-11 -8.08E-11 -8.45E-11 -9.09E-11 -9.85E-11 7		0.034

Table C2. Pre- and Post-Irradiation Electrical Characterization Test Results for 4/12/2017 LBNL Tests Note: Shaded columns flag new DUT. Out-of-spec values are in orange or red text

								<u> </u>			2			
Rui	n #: pre 1	1	2	3	4	5	6	7	8	9	10	11	12	13
DUT S	/N: 102	102	102	102	102	102	102	102	102	102	102	102	102	102
Run Vds ((V): 0	24	27	30	33	36	39	42	45	48	51	54	57	60
commer	nts:													
Vgs (V)) Ids (A)	1												
0	-7.40E-12	9.26E-12	1.22E-11	8.35E-12	1.43E-11	8.17E-12	8.31E-12	5.50E-12	7.06E-12	3.18E-12	1.39E-11	6.66E-12	2.60E-12	4.43E-12
2	-5.87E-12	1.13E-11	1.59E-11	1.08E-11	1.44E-11	1.12E-11	9.54E-12	8.63E-12	8.59E-12	4.58E-12	1.45E-11	5.17E-12	3.08E-12	5.57E-12
4	-3.39E-12	1.39E-11	1.41E-11	1.29E-11	1.40E-11	1.21E-11	9.19E-12	1.05E-11	1.07E-11	8.13E-12	7.66E-12	7.26E-12	8.98E-12	5.29E-12
6	4.39E-13	1.61E-11	1.44E-11	1.44E-11	9.92E-12	1.71E-11	2.02E-11	9.56E-12	1.16E-11	8.65E-12	2.63E-12	1.44E-11	1.22E-11	8.93E-12
8	-7.71E-13	1.73E-11	1.58E-11	1.53E-11	1.76E-11	1.97F-11	1.91F-11	1.25E-11	1.68E-11	1.25E-11	1.20F-11	1.62E-11	1.51E-11	1.62E-11
10	6 50F-12	2 11E-11	1 99E-11	1 96E-11	2 66E-11	2 50E-11	1 59E-11	1 57E-11	2 08F-11	1 57E-11	2 57E-11	2 41E-11	1 77E-11	1.81E-11
12	1 10F-11	2.55E-11	2 50F-11	2 25E-11	2.60E 11	2.56E-11	2 19E-11	1.89E-11	2.00E 11	1.84F-11	2.07C 11	2 10F-11	1.84F-11	1.01C 11
14	1 295-11	2.000 11	2.07E-11	2.525-11	2.040 11	2.000 11	2 295-11	2 295-11	2.615-11	2 225-11	1.925-11	1.665-11	2 205-11	2 195-11
16	1.550 11	2.000 11	2 715-11	2.055-11	2 715-11	2.555.11	2.065-11	2.200 11	2.010 11	2,230 11	2 505-11	2 595-11	2.500 11	2.655-11
10	1.040-11	2.0/1-11	2 575 11	2 265 11	4.025.11	2 505 11	2 405 11	2.000-11	2 715 11	2.010-11	2.300-11	2.330-11	2.000-11	2.001-11
10	1.046-11	2.665 11	2 225 11	3.30E-11	4.02E-11 2.05E 11	2.005 11	3.40E-11	3.346-11	3.71E-11	3.002-11	3.30E-11	2.705-11	3.140-11	3.275-11
20	1.37E-11 6.42E-11	5.002-11	5.220-11	4.04E-11	5.55E-11	5.55E-11	4.4JE-11	6 00E 11	4.07E-11	5.35E-11 6.07E-11	4.14C-11 7.00E 11	7 715 11	7 505 11	7.055 11
-2	-0.45E-11	DITER 11	-3.45E-11	0.775.11	-0.546-11	-0.00E-11	-0.00E-11	-0.05E-11	-0.752-11	-0.572-11	-7.092-11	-7.710-11	-7.300-11	2.265.11
-4	-3.37E-11	/SE-11	-2.90E-11	-2.//E-11	-3.02E-11	-2.09E-11	-2.2/E-11	-2.28E-11	-2.43E-11	-2.52E-11	-2.32E-11	-2.98E-11	-2.58E-11	-3.20E-11
-0	-3.2/E-11	-1.74E-11	-1.33E-11	-2.15E-11	-1./6E-11	-1./6E-11	-1.46E-11	-1.93E-11	-2.3/E-11	-2.24E-11	-1.9/E-11	-2.21E-11	-2.30E-11	-2.04E-11
-8	-3.08E-11	-1./2E-11	-1.89E-11	-1./5E-11	-1.62E-11	-2.3/E-11	-1.96E-11	-2.16E-11	-2.50E-11	-2.51E-11	-2.86E-11	-1.//E-11	-2.64E-11	-2.62E-11
-10	-3.26E-11	-1.83E-11	-2.65E-11	-1./6E-11	-2.14E-11	-2.63E-11	-2.58E-11	-2.59E-11	-2.75E-11	-3.03E-11	-2.23E-11	-2.83E-11	-3.10E-11	-3.28E-11
-12	-2.91E-11	-2.13E-11	-1.91E-11	-2.2/E-11	-2.83E-11	-2.83E-11	-2./9E-11	-2.92E-11	-2./6E-11	-3.19E-11	-2.86E-11	-2./6E-11	-3.44E-11	-3.33E-11
-14	-2.80E-11	-2.50E-11	-2.73E-11	-2.47E-11	-2.84E-11	-2.85E-11	-2.76E-11	-3.34E-11	-3.36E-11	-3.51E-11	-2.80E-11	-3.67E-11	-3.92E-11	-3.58E-11
-16	-3.19E-11	-2.73E-11	-3.22E-11	-2.75E-11	-3.61E-11	-3.19E-11	-3.36E-11	-3.41E-11	-3.62E-11	-3.77E-11	-4.15E-11	-4.00E-11	-4.50E-11	-4.41E-11
-18	-4.33E-11	-3.14E-11	-3.09E-11	-3.38E-11	-3.85E-11	-3.12E-11	-4.39E-11	-4.13E-11	-4.41E-11	-4.89E-11	-3.66E-11	-4.99E-11	-4.88E-11	-5.53E-11
-20	-8.87E-11	-6.53E-11	-5.62E-11	-5.83E-11	-5.62E-11	-5.73E-11	-6.23E-11	-5.68E-11	-6.09E-11	-5.82E-11	-6.00E-11	-6.30E-11	-6.33E-11	-6.43E-11
BVdss ((∨):													
Idss (u	A): 0.000866	0.000922	0.000927	0.001017	0.001158	0.001123	0.001113	0.001229	0.001249	0.001299	0.001355	0.00146	0.001576	0.001581
146 /	111. 2.10	0.40		0.44	0.40	2.11	2.1	0.00		0.05	2.02	0.00	2.01	1 00
Vtn (V): 2.19	2.18	2.16	2.14	2.13	2.11	Z.1	2.08	2.06	2.05	2.03	2.02	2.01	1.99
vtn (Run #:	pre 14	2.16 14	15	2.13 16	pre 17	17	2.08 18	2.06 19	2.05 20	2.03 21	2.02	2.01	1.99
Vtn (Run #: DUT S/N:	2.18 pre 14 103	2.16 14 103	15 103	103	pre 17 104	17 104	2.08 18 104	2.06 19 104	2.05 20 104	2.03 21 104	2.02 22 104	2.01 23 104	1.99
vtn (Run #: DUT S/N: Run Vds (V):	pre 14 103 0	2.16 14 103 60	2.14 15 103 60	2.13 16 103 60	pre 17 104 0	2.1 17 104 45	2.08 18 104 48	2.06 19 104 51	2.05 20 104 54	2.03 21 104 57	2.02 22 104 60	2.01 23 104 60	1.99
Vtn (Run #: DUT S/N: Run Vds (V): comments:	2.18 pre 14 103 0	2.16 14 103 60	2.14 15 103 60	2.13 16 103 60 Vgs = -10V	pre 17 104 0	2.1 17 104 45	2.08 18 104 48	2.06 19 104 51	2.05 20 104 54	2.03 21 104 57	2.02 22 104 60	2.01 23 104 60 Vgs = -10V	1.99
Vtn (Run #: DUT S/N: Run Vds (V): comments: Vgs (V)	pre 14 103 0	2.16 14 103 60	2.14 15 103 60	2.13 16 103 60 Vgs = -10V	pre 17 104 0	2.1 17 104 45	2.08 18 104 48	2.06 19 104 51	2.05 20 104 54	2.03 21 104 57	2.02 22 104 60	23 104 60 Vgs = -10V	1.99
Vtn (Run #: DUT S/N: Run Vds (V): comments: Vgs (V) 0	2.18 pre 14 103 0 1.58E-12	2.16 14 103 60 -5.20E-12	2.14 15 103 60 -5.27E-12	2.13 16 103 60 Vgs = -10V 6.57E-13	2.11 pre 17 104 0 -4.41E-11	2.1 17 104 45 -3.82E-12	2.08 18 104 48 1.19E-11	2.06 19 104 51 1.58E-12	2.05 20 104 54 4.42E-12	2.03 21 104 57 8.85E-12	2.02 22 104 60 8.44E-12	23 104 60 Vgs = -10V 1.59E-11	1.99
	V): 2:19 Run #: DUT S/N: Run Vds (V): comments: Vgs (V) 0 2	2.18 pre 14 103 0 1.58E-12 -8.20E-12	2.16 14 103 60 -5.20E-12 -4.61E-12	-5.27E-12 -2.63E-12	2.13 16 103 60 Vgs = -10V 6.57E-13 5.05E-12	2.11 pre 17 104 0 -4.41E-11 -4.08E-11	2.1 17 104 45 -3.82E-12 -1.38E-12	2.08 18 104 48 1.19E-11 1.32E-11	2.06 19 104 51 1.58E-12 4.28E-12	2.05 20 104 54 4.42E-12 7.92E-12	2.03 21 104 57 8.85E-12 9.04E-12	2.02 22 104 60 8.44E-12 1.06E-11	23 104 60 Vgs = -10V 1.59E-11 1.79E-11	1.99
	Run #: DUT S/N: Run Vds (V): comments: Vgs (V) 0 2 4	2.18 pre 14 103 0 1.58E-12 -8.20E-12 2.38E-12	2.16 14 103 60 -5.20E-12 -4.61E-12 -1.26E-12	2.14 15 103 60 -5.27E-12 -2.63E-12 4.51E-12	2.13 16 103 60 Vgs = -10V 6.57E-13 5.05E-12 9.89E-12	2.11 pre 17 104 0 -4.41E-11 -4.08E-11 -3.70E-11	2.1 17 104 45 -3.82E-12 -1.38E-12 -7.75E-13	1.19E-11 1.32E-11 1.29E-11	2.06 19 104 51 1.58E-12 4.28E-12 8.91E-12	2.05 20 104 54 4.42E-12 7.92E-12 1.06E-11	2.03 21 104 57 8.85E-12 9.04E-12 1.25E-11	2.02 22 104 60 8.44E-12 1.06E-11 2.03E-11	2.01 23 104 60 Vgs = -10V 1.59E-11 1.79E-11 1.96E-11	1.99
 	Run #: DUT S/N: Run Vds (V): comments: Vgs (V) 0 2 4 6	2.18 pre 14 103 0 1.58E-12 -8.20E-12 2.38E-12 -2.24E-12	2.16 14 103 60 -5.20E-12 -4.61E-12 -1.26E-12 2.15E-12	2.14 15 103 60 -5.27E-12 -2.63E-12 4.51E-12 1.73E-11	2.13 16 103 60 Vgs = -10V 6.57E-13 5.05E-12 9.89E-12 1.94E-11	2.11 pre 17 104 0 -4.41E-11 -4.08E-11 -3.70E-11 -4.34E-11	2.1 17 104 45 -3.82E-12 -1.38E-12 -7.75E-13 6.93E-12	2.08 18 104 48 1.19E-11 1.32E-11 1.29E-11 9.11E-12	2.06 19 104 51 1.58E-12 4.28E-12 8.91E-12 1.65E-11	2.05 20 104 54 4.42E-12 7.92E-12 1.06E-11 1.70E-11	2.03 21 104 57 8.85E-12 9.04E-12 1.25E-11 1.67E-11	2.02 22 104 60 8.44E-12 1.06E-11 2.03E-11 2.04E-11	2.01 23 104 60 Vgs = -10V 1.59E-11 1.79E-11 1.96E-11 1.49E-11	1.99
	V: 2.13 Run #: DUT S/N: Run Vds (V): comments: Vgs (V) 0 2 4 6 8	2.18 pre 14 103 0 1.58E-12 -8.20E-12 2.38E-12 -2.24E-12 -1.00E-11	2.16 14 103 60 -5.20E-12 -4.61E-12 -1.26E-12 2.15E-12 8.36E-12	-5.27E-12 -2.63E-12 4.51E-12 1.73E-11 1.42E-11	2.13 16 103 60 Vgs = -10V 6.57E-13 5.05E-12 9.89E-12 1.94E-11 2.11E-11	-4.41E-11 -4.08E-11 -3.70E-11 -4.34E-11 -4.21E-11	-3.82E-12 -1.38E-12 -7.75E-13 6.93E-12 7.33E-12	1.19E-11 1.32E-11 1.29E-11 9.11E-12 1.84E-11	2.06 19 104 51 1.58E-12 4.28E-12 8.91E-12 1.65E-11 2.37E-11	2.05 20 104 54 4.42E-12 7.92E-12 1.06E-11 1.70E-11 2.53E-11	2.03 21 104 57 8.85E-12 9.04E-12 1.25E-11 1.67E-11 2.47E-11	2.02 22 104 60 8.44E-12 1.06E-11 2.03E-11 2.04E-11 1.97E-11	2.01 23 104 60 Vgs = -10V 1.59E-11 1.79E-11 1.96E-11 1.49E-11 2.06E-11	1.99
-	V: 2.13 Run #: DUT S/N: Run Vds (V): comments: Vgs (V) 0 2 4 6 8 10	2.18 pre 14 103 0 1.58E-12 -8.20E-12 2.38E-12 -2.24E-12 -1.00E-11 -7.09E-13	2.16 14 103 60 -5.20E-12 -4.61E-12 -1.26E-12 2.15E-12 8.36E-12 1.14E-11	-5.27E-12 -2.63E-12 4.51E-12 1.73E-11 1.42E-11 1.39E-11	2.13 16 103 60 Vgs = -10V 6.57E-13 5.05E-12 9.89E-12 1.94E-11 2.11E-11 2.23E-11	-4.41E-11 -4.08E-11 -3.70E-11 -4.34E-11 -4.21E-11 -3.57E-11	-3.82E-12 -3.82E-12 -1.38E-12 -7.75E-13 6.93E-12 7.33E-12 1.60E-11	1.19E-11 1.32E-11 1.29E-11 9.11E-12 1.84E-11	2.06 19 104 51 1.58E-12 4.28E-12 8.91E-12 1.65E-11 2.37E-11 2.47E-11	2.05 20 104 54 4.42E-12 7.92E-12 1.06E-11 1.70E-11 2.53E-11 2.57E-11	2.03 21 104 57 8.85E-12 9.04E-12 1.25E-11 1.67E-11 2.47E-11 2.76E-11	2.02 22 104 60 8.44E-12 1.06E-11 2.03E-11 2.04E-11 1.97E-11 2.69E-11	2.01 23 104 60 Vgs = -10V 1.59E-11 1.79E-11 1.96E-11 1.49E-11 2.06E-11 3.36E-11	1.99
	V: 2.13 Run #: DUT S/N: Run Vds (V): comments: Vgs (V) 0 2 4 6 8 10 12	2.18 pre 14 103 0 1.58E-12 -8.20E-12 2.38E-12 -2.24E-12 -1.00E-11 -7.09E-13 5.85E-12	2.16 14 103 60 -5.20E-12 -4.61E-12 -1.26E-12 2.15E-12 8.36E-12 1.14E-11 1.56E-11	2.14 15 103 60 -5.27E-12 -2.63E-12 4.51E-12 1.73E-11 1.42E-11 1.39E-11 2.19E-11	2.13 16 103 60 Vgs = -10V 6.57E-13 5.05E-12 9.89E-12 1.94E-11 2.11E-11 2.23E-11 2.77E-11	2.11 pre 17 104 0 -4.41E-11 -4.08E-11 -3.70E-11 -4.34E-11 -4.21E-11 -3.57E-11 -2.74E-11	2.1 17 104 45 -3.82E-12 -1.38E-12 -7.75E-13 6.93E-12 7.33E-12 1.60E-11 1.70E-11	2.08 18 104 48 1.19E-11 1.32E-11 1.29E-11 9.11E-12 1.84E-11 1.54E-11	2.06 19 104 51 1.58E-12 4.28E-12 8.91E-12 1.65E-11 2.37E-11 2.42F-11 2.42E-11	2.05 20 104 54 4.42E-12 7.92E-12 1.06E-11 1.70E-11 2.53E-11 2.57E-11 2.43E-11	2.03 21 104 57 8.85E-12 9.04E-12 1.25E-11 1.67E-11 2.47E-11 2.76E-11 3.17E-11	2.02 22 104 60 8.44E-12 1.06E-11 2.03E-11 2.04E-11 1.97E-11 2.69E-11 3.95E-11	2.01 23 104 60 Vgs = -10V 1.59E-11 1.79E-11 1.96E-11 1.49E-11 2.06E-11 3.36E-11	1.99
-	V: 2.13 Run #: DUT S/N: Run Vds (V): comments: Vgs (V) 0 2 4 6 8 10 12 14	2.18 pre 14 103 0 1.58E-12 -8.20E-12 2.38E-12 -2.24E-12 -1.00E-111 -7.09E-13 5.85E-12 -6.18E-13	2.16 14 103 60 -5.20E-12 -4.61E-12 2.15E-12 8.36E-12 1.14E-11 1.56E-11	2.14 15 103 60 -5.27E-12 -2.63E-12 4.51E-12 1.73E-11 1.39E-11 2.19E-11 3.36E-11	2.13 16 103 60 Vgs = -10V 6.57E-13 5.05E-12 9.89E-12 1.94E-11 2.11E-11 2.71E-11 3.68E-11	-4.41E-11 -4.08E-11 -3.70E-11 -4.34E-11 -4.21E-11 -3.57E-11 -2.74E-11 -3.09E-11	-3.82E-12 -3.82E-12 -1.38E-12 -7.75E-13 6.93E-12 7.33E-12 1.60E-11 1.70E-11	2.08 18 104 48 1.19E-11 1.32E-11 1.29E-11 9.11E-12 1.84E-11 1.54E-11 2.38E-11	2.06 19 104 51 1.58E-12 4.28E-12 8.91E-12 1.65E-11 2.37E-11 2.47E-11 2.42E-11 3.05E-11	2.05 20 104 54 4.42E-12 7.92E-12 1.06E-11 1.70E-11 2.53E-11 2.43E-11 3.12E-11	2.03 21 104 57 8.85E-12 9.04E-12 1.25E-11 1.67E-11 2.47E-11 3.17E-11 3.17E-11	2.02 22 104 60 8.44E-12 1.06E-11 2.03E-11 2.04E-11 1.97E-11 3.95E-11 4.13E-11	2.01 23 104 60 Vgs = -10V 1.59E-11 1.79E-11 1.96E-11 1.49E-11 3.36E-11 3.66E-11 3.50E-11	1.99
-	V: 2.13 Run #: DUT S/N: Run Vds (V): comments: Vgs (V) 0 2 4 6 8 10 12 14 16	2.18 pre 14 103 0 1.58E-12 -8.20E-12 2.38E-12 -2.24E-12 -1.00E-11 -7.09E-13 5.85E-12 -6.18E-13 2.21E-12	-5.20E-12 -5.20E-12 -4.61E-12 -1.26E-12 2.15E-12 8.36E-12 1.14E-11 1.56E-11 1.66E-11 1.15E-11	2.14 15 103 60 -5.27E-12 -2.63E-12 4.51E-12 1.73E-11 1.42E-11 1.39E-11 3.36E-11 3.36E-11	2.13 16 103 60 Vgs = -10V 6.57E-13 5.05E-12 9.89E-12 1.94E-11 2.11E-11 2.23E-11 3.68E-11 3.72E-11	2.11 pre17 104 0 -4.41E-11 -4.08E-11 -3.70E-11 -4.34E-11 -3.57E-11 -2.74E-11 -3.09E-11 -2.63E-11	2.1 17 104 45 -3.82E-12 -1.38E-12 -7.75E-13 6.93E-12 7.33E-12 1.60E-11 1.70E-11 1.69E-11 2.35E-11	2.08 18 104 48 1.19E-11 1.32E-11 1.29E-11 9.11E-12 1.84E-11 1.54E-11 2.38E-11 2.51E-11	2.06 19 104 51 1.58E-12 4.28E-12 8.91E-12 1.65E-11 2.37E-11 2.47E-11 3.05E-11 3.05E-11	2.05 20 104 54 4.42E-12 7.92E-12 1.06E-11 1.70E-11 2.53E-11 3.12E-11 3.12E-11	2.03 21 104 57 8.85E-12 9.04E-12 1.25E-11 1.67E-11 2.47E-11 3.17E-11 3.76E-11 3.76E-11	2.02 22 104 60 8.44E-12 1.06E-11 2.03E-11 1.97E-11 2.69E-11 3.95E-11 4.13E-11 3.67E-11	2.01 23 104 60 Vgs = -10V 1.59E-11 1.79E-11 1.96E-11 1.49E-11 2.06E-11 3.64E-11 3.50E-11 4.13E-11	1.33
-	V: 2.13 Run #: DUT S/N: Run Vds (V): <u>comments:</u> Vgs (V) 0 2 4 6 8 10 12 14 16 18	2.18 pre 14 103 0 1.58E-12 -8.20E-12 2.38E-12 -2.24E-12 -1.00E-11 -7.09E-13 5.85E-12 -6.18E-13 2.21E-12 1.41E-11	-5.20E-12 -4.61E-12 -1.26E-12 2.15E-12 2.15E-12 8.36E-12 1.14E-11 1.56E-11 1.15E-11 1.15E-11	2.14 15 103 60 -5.27E-12 -2.63E-12 4.51E-12 1.73E-11 1.42E-11 1.39E-11 2.19E-11 3.36E-11 4.09E-11 4.09E-11	2.13 16 103 60 Vgs = -10V 6.57E-13 5.05E-12 9.89E-12 1.94E-11 2.11E-11 2.23E-11 2.77E-11 3.68E-11 3.72E-11	2.11 pre 17 104 0 -4.41E-11 -4.08E-11 -3.70E-11 -4.34E-11 -4.34E-11 -3.57E-11 -2.74E-11 -2.63E-11 -2.63E-11 -2.11E-11	2.1 17 104 45 -3.82E-12 -1.38E-12 -7.75E-13 6.93E-12 7.33E-12 1.60E-11 1.70E-11 1.69E-11 2.35E-11 2.44E-11	2.08 18 104 48 1.19E-11 1.32E-11 1.29E-11 9.11E-12 1.84E-11 1.54E-11 2.38E-11 2.51E-11	2.06 19 104 51 1.58E-12 4.28E-12 8.91E-12 1.65E-11 2.37E-11 2.47E-11 2.42E-11 3.05E-11 3.90E-11	2.05 20 104 54 4.42E-12 7.92E-12 1.06E-11 1.70E-11 2.53E-11 2.57E-11 2.43E-11 3.12E-11 4.34E-11	2.03 21 104 57 8.85E-12 9.04E-12 1.25E-11 1.67E-11 2.47E-11 3.17E-11 3.76E-11 3.97E-11 4.28F-11	2.02 22 104 60 8.44E-12 1.06E-11 2.03E-11 2.04E-11 1.97E-11 2.69E-11 3.95E-11 4.13E-11 3.67E-11	2.01 23 104 60 Vgs = -10V 1.59E-11 1.79E-11 1.96E-11 3.6E-11 3.6E-11 3.6E-11 3.50E-11 4.13E-11 5.42F-11	1.33
-	V: 2.13 Run #: DUT S/N: Run Vds (V): comments: Vgs (V) 0 2 4 6 8 10 12 14 16 18 20	2.18 pre 14 103 0 1.58E-12 -8.20E-12 2.38E-12 -2.24E-12 -1.00E-11 -7.09E-13 5.85E-12 -6.18E-13 2.21E-12 1.41E-11 1.08F-11	-5.20E-12 -4.61E-12 -1.26E-12 2.15E-12 2.15E-12 8.36E-12 1.14E-11 1.56E-11 1.15E-11 2.00E-11 2.85E-11	2.14 15 103 60 -5.27E-12 -2.63E-12 4.51E-12 1.73E-11 1.42E-11 1.39E-11 2.19E-11 3.36E-11 4.09E-11 5.01E-11	2.13 16 103 60 Vgs = -10V 6.57E-13 5.05E-12 9.89E-12 1.94E-11 2.11E-11 2.23E-11 2.77E-11 3.68E-11 3.78E-11 3.84E-11 4.20E-11	2.11 pre 17 104 0 -4.41E-11 -4.08E-11 -3.70E-11 -4.34E-11 -3.57E-11 -2.74E-11 -2.74E-11 -2.03E-11 -2.03E-11 -2.11E-11 -2.45E-11	2.1 17 104 45 -3.82E-12 -1.38E-12 -7.75E-13 6.93E-12 7.33E-12 1.60E-11 1.70E-11 1.69E-11 2.34E-11 2.44E-11	2.08 18 104 48 1.19E-11 1.32E-11 1.29E-11 9.11E-12 1.84E-11 1.54E-11 2.38E-11 2.51E-11 3.57E-11 3.57E-11	2.06 19 104 51 1.58E-12 4.28E-12 8.91E-12 1.65E-11 2.37E-11 2.47E-11 2.42E-11 3.05E-11 3.05E-11 3.70E-11	2.05 20 104 54 4.42E-12 7.92E-12 1.06E-11 1.70E-11 2.53E-11 2.57E-11 2.43E-11 3.12E-11 4.34E-11	2.03 21 104 57 8.85E-12 9.04E-12 1.25E-11 1.67E-11 2.47E-11 3.17E-11 3.76E-11 3.97E-11 4.28E-11	2.02 22 104 60 8.44E-12 1.06E-11 2.03E-11 2.04E-11 1.97E-11 3.95E-11 4.13E-11 3.67E-11 4.73E-11	2.01 23 104 60 Vgs = -10V 1.59E-11 1.79E-11 1.96E-11 3.36E-11 3.36E-11 3.36E-11 3.36E-11 5.42E-11 5.42E-11 5.55E-11	1.99
	VI: 2.13 Run #: DUT S/N: Run Vds (V): comments: Vgs (V) 0 2 4 6 8 10 12 14 16 18 20 -2	2.18 pre14 103 0 1.58E-12 -8.20E-12 2.38E-12 -2.24E-12 -1.00E-11 5.85E-12 -6.18E-13 2.21E-12 1.41E-11 1.08E-11 -7.30E-11	2.16 14 103 60 -5.20E-12 -4.61E-12 -1.26E-12 2.15E-12 8.36E-12 1.14E-11 1.56E-11 1.56E-11 1.15E-11 2.00E-11 2.85E-11	2.14 15 103 60 -5.27E-12 -2.63E-12 4.51E-12 1.73E-11 1.42E-11 1.39E-11 3.36E-11 4.09E-11 5.01E-11 4.50E-11 -7.41E-11	2.13 16 103 60 Vgs = -10V 6.57E-13 5.05E-12 9.89E-12 1.94E-11 2.71E-11 3.68E-11 3.72E-11 3.84E-11 4.20E-11 -6.42E-11	-4.41E-11 104 0 -4.48E-11 -4.08E-11 -3.70E-11 -4.34E-11 -4.21E-11 -3.57E-11 -2.74E-11 -2.63E-11 -2.11E-11 -2.45E-11 -1.06E-10	2.1 17 104 45 -3.82E-12 -1.38E-12 -7.75E-13 6.93E-12 7.33E-12 1.60E-11 1.70E-11 1.69E-11 2.35E-11 2.44E-11 3.01E-11 -7.75E-13	2.08 18 104 48 1.19E-11 1.32E-11 1.29E-11 9.11E-12 1.84E-11 1.54E-11 2.38E-11 2.51E-11 3.57E-11 3.57E-11 3.97E-11	2.06 19 104 51 1.58E-12 4.28E-12 8.91E-12 1.65E-11 2.37E-11 2.47E-11 2.42E-11 3.05E-11 3.70E-11 4.48E-11 6.79E-11	2.05 20 104 54 4.42E-12 7.92E-12 1.06E-11 1.70E-11 2.57E-11 2.43E-11 4.34E-11 4.34E-11 4.34E-11 4.34E-11	2.03 21 104 57 8.85E-12 9.04E-12 1.25E-11 1.67E-11 2.47E-11 3.76E-11 3.97E-11 4.28E-11 4.28E-11 4.64E-11 -7 13E-11	2.02 22 104 60 8.44E-12 1.06E-11 2.03E-11 2.04E-11 1.97E-11 3.95E-11 4.13E-11 3.67E-11 4.73E-11 5.02E-11 5.02E-11 7.07E-11	2.01 23 104 60 Vgs = -10V 1.59E-11 1.96E-11 1.49E-11 2.06E-11 3.36E-11 3.36E-11 3.36E-11 4.13E-11 5.52E-11 5.52E-11 5.759E-11	1.99
-	V: 2.13 Run #: DUT S/N: Run Vds (V): comments: Vgs (V) 0 2 4 6 8 10 12 14 16 18 20 -2 -4	2.18 pre 14 103 0 1.58E-12 -8.20E-12 2.38E-12 -2.24E-12 -1.00E-11 -7.09E-13 2.21E-12 1.41E-11 1.08E-11 -7.30E-11 -7.30E-11 -2.9 SE-11	2.16 14 103 60 -5.20E-12 -4.61E-12 -1.26E-12 2.15E-12 8.36E-12 1.14E-11 1.56E-11 1.56E-11 1.55E-11 2.83E-11 2.83E-11 -2.00E-11 -2.06E-11 -2.06E-11	2.14 15 103 60 -5.27E-12 -2.63E-12 4.51E-12 1.73E-11 1.42E-11 1.39E-11 3.36E-11 4.09E-11 5.01E-11 4.50E-11 -7.41E-11 -2.61E-11	2.13 16 103 60 Vgs = -10V 6.57E-13 5.05E-12 9.89E-12 1.94E-11 2.11E-11 3.68E-11 3.72E-11 3.84E-11 4.20E-11 -6.43E-11 -2.09E-11	-4.41E-11 -4.08E-11 -3.70E-11 -4.34E-11 -3.70E-11 -4.34E-11 -3.57E-11 -3.57E-11 -2.63E-11 -2.11E-11 -2.45E-11 -1.06E-10 -5.80E-11	2.1 17 104 45 -3.82E-12 -1.38E-12 -7.75E-13 6.93E-12 7.33E-12 1.60E-11 1.60E-11 1.60E-11 2.35E-11 2.44E-11 3.01E-11 -7.25E-11 -7.25E-11 -7.25E-11	2.08 18 104 48 1.19E-11 1.32E-11 1.29E-11 9.11E-12 1.84E-11 1.54E-11 2.38E-11 2.51E-11 3.57E-11 3.59E-11 -7.02E-11 -7.02E-11	2.06 19 104 51 1.58E-12 4.28E-12 8.91E-12 1.65E-11 2.37E-11 3.05E-11 3.70E-11 3.70E-11 4.48E-11 -6.79E-11 -3.02E-11	2.05 20 104 54 4.42E-12 7.92E-12 1.06E-11 1.70E-11 2.53E-11 3.12E-11 4.34E-11 4.34E-11 4.34E-11 4.34E-11 -7.33E-11 -2 40E-11	2.03 21 104 57 8.85E-12 9.04E-12 1.25E-11 1.67E-11 2.47E-11 3.17E-11 3.17E-11 3.97E-11 4.28E-11 4.28E-11 4.64E-11 -7.13E-11 -2 70E-11	2.02 22 104 60 8.44E-12 1.06E-11 2.03E-11 2.03E-11 1.97E-11 4.13E-11 3.05E-11 4.73E-11 5.02E-11 -7.07E-11 -2 96E-11	2.01 23 104 60 Vgs = -10V 1.59E-11 1.79E-11 1.49E-11 2.06E-11 3.36E-11 3.36E-11 3.36E-11 5.35E-11 5.42E-11 5.42E-11 5.35E-11 -7.59E-11	1.99
-	V: 2.13 Run #: DUT S/N: Run Vds (V): comments: Vgs (V) 0 2 4 6 8 10 12 14 16 18 20 -2 -4 -6 -6	2.18 pre 14 103 0 1.58E-12 -8.20E-12 2.38E-12 -2.24E-12 -1.00E-11 -7.09E-13 5.85E-12 -6.18E-13 2.21E-12 1.41E-11 1.08E-11 -7.30E-11 -2.78E-11 -2.78E-11	2.16 14 103 60 -5.20E-12 -4.61E-12 -1.26E-12 2.15E-12 8.36E-12 1.14E-11 1.56E-11 1.56E-11 1.55E-11 2.85E-11 2.85E-11 -2.00E-11 -2.06E-11 -2.072-11	2.14 15 103 60 -5.27E-12 -2.63E-12 4.51E-12 1.73E-11 1.42E-11 1.39E-11 3.36E-11 4.09E-11 5.01E-11 4.50E-11 -7.41E-11 -2.61E-11 1.81E-11	2.13 16 103 60 Vgs = -10V 6.57E-13 5.05E-12 9.89E-12 1.94E-11 2.11E-11 2.23E-11 3.68E-11 3.72E-11 3.64E-11 4.20E-11 -6.43E-11 -2.09E-11 -1.76E-11	-4.41E-11 -4.08E-11 -3.70E-11 -4.34E-11 -3.370E-11 -4.34E-11 -3.57E-11 -3.57E-11 -2.74E-11 -2.74E-11 -2.45E-11 -2.45E-11 -5.80E-10 -5.88E-11	2.1 17 104 45 -3.82E-12 -1.38E-12 -7.75E-13 6.93E-12 7.33E-12 1.60E-11 1.60E-11 1.69E-11 2.35E-11 2.44E-11 3.01E-11 -7.25E-11 -2.92E-11 -2.92E-11	2.08 18 104 48 1.19E-11 1.32E-11 1.29E-11 9.11E-12 1.84E-11 1.54E-11 1.54E-11 1.54E-11 3.57E-11 3.99E-11 -2.97E-11	2.06 19 104 51 1.58E-12 4.28E-12 8.91E-12 1.65E-11 2.37E-11 2.47E-11 3.05E-11 3.05E-11 3.05E-11 4.48E-11 -6.79E-11 -3.02E-11 -2.77E-11	2.05 20 104 54 4.42E-12 7.92E-12 1.06E-11 1.70E-11 2.57E-11 2.43E-11 4.34E-11 4.34E-11 4.34E-11 4.34E-11 4.34E-11 -7.33E-11 -2.45E-11	2.03 21 104 57 8.85E-12 9.04E-12 1.25E-11 1.67E-11 2.47E-11 3.17E-11 3.17E-11 3.64E-11 4.28E-11 4.64E-11 -7.13E-11 -2.70E-11 -2.70E-11	2.02 22 104 60 8.44E-12 1.06E-11 2.03E-11 2.04E-11 1.97E-11 2.69E-11 3.07E-11 4.13E-11 5.02E-11 -7.07E-11 -2.96E-11 -3.07E-11	23 104 60 Vgs = -10V 1.59E-11 1.79E-11 1.96E-11 1.96E-11 3.36E-11 3.50E-11 4.13E-11 5.55E-11 -7.59E-11 -3.10E-11 -2.85E-11	1.33
-	V: 2.13 Run #: DUT S/N: Run Vds (V): comments: Vgs (V) 0 2 4 6 8 10 12 14 16 18 20 -2 -4 -6 -8 -8	2.18 pre 14 103 0 1.58E-12 -8.20E-12 2.38E-12 -2.24E-12 -1.00E-11 -7.09E-13 5.85E-12 -6.18E-13 2.21E-12 1.41E-11 1.08E-11 -7.30E-11 -2.38E-11 -2.38E-11 -2.34E-11	2.16 14 103 60 -5.20E-12 -4.61E-12 -1.26E-12 2.15E-12 8.36E-12 1.14E-11 1.56E-11 1.56E-11 1.56E-11 2.00E-11 2.30E-11 -2.00E-11 -3.00E-11	2.14 15 103 60 -5.27E-12 -2.63E-12 4.51E-12 1.73E-11 1.42E-11 1.39E-11 3.36E-11 4.09E-11 5.01E-11 4.50E-11 -7.41E-11 -2.51E-11 -2.51E-11	2.13 16 103 60 Vgs = -10V 6.57E-13 5.05E-12 9.89E-12 1.94E-11 2.11E-11 2.23E-11 3.68E-11 3.68E-11 3.68E-11 -6.43E-11 -6.43E-11 -2.05E-11 -2.72E-11	-4.41E-11 -4.41E-11 -4.08E-11 -3.70E-11 -4.34E-11 -4.34E-11 -3.57E-11 -2.74E-11 -2.74E-11 -2.63E-11 -2.11E-11 -2.45E-11 -1.06E-10 -5.80E-11 -5.88E-11 -6.21E-11	2.1 17 104 45 -3.82E-12 -1.38E-12 -7.75E-13 6.93E-12 7.33E-12 1.60E-11 1.60E-11 1.69E-11 2.45E-11 3.01E-11 -7.25E-11 -2.92E-11 -2.92E-11	2.08 18 104 48 1.19E-11 1.32E-11 1.29E-11 9.11E-12 1.84E-11 1.54E-11 2.51E-11 3.57E-11 3.99E-11 -7.02E-11 -2.97E-11 -2.40E-11	2.06 19 104 51 1.58E-12 4.28E-12 8.91E-12 1.65E-11 2.37E-11 2.47E-11 3.05E-11 3.05E-11 3.05E-11 4.48E-11 -6.79E-11 -2.78E-11 -2.78E-11	2.05 20 104 54 4.42E-12 7.92E-12 1.06E-11 1.70E-11 2.53E-11 2.53E-11 4.34E-11 4.34E-11 4.34E-11 4.34E-11 4.34E-11 -7.33E-11 -2.40E-11 -2.40E-11	2.03 21 104 57 8.85E-12 9.04E-12 1.25E-11 1.67E-11 2.47E-11 3.76E-11 3.76E-11 3.76E-11 4.28E-11 4.64E-11 -7.13E-11 -2.70E-11 -2.312E-11	2.02 22 104 60 8.44E-12 1.06E-11 2.03E-11 2.04E-11 1.97E-11 3.95E-11 3.95E-11 3.67E-11 4.13E-11 5.02E-11 -7.07E-11 -3.07E-11 3.03E-11	2.01 23 104 60 Vgs = -10V 1.59E-11 1.79E-11 1.96E-11 1.49E-11 2.06E-11 3.36E-11 3.50E-11 5.55E-11 -7.59E-11 -2.86E-11 2.28E-11	1.33
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	VI: 2.13 Run #: DUT S/N: Run Vds (V): comments: Vgs (V) 0 2 4 6 8 10 12 14 16 18 20 -2 -4 -6 -8 -10 -12 -14 -16 -18 -20 -20 -2 -4 -6 -18 -20 -2 -4 -6 -18 -20 -2 -14 -16 -18 -20 -2 -4 -6 -16 -12 -12 -14 -16 -12 -12 -14 -16 -12 -12 -14 -16 -12 -12 -14 -16 -12 -12 -14 -16 -12 -12 -14 -16 -12 -12 -14 -16 -12 -12 -14 -16 -12 -12 -14 -16 -12 -12 -14 -16 -12 -12 -14 -16 -12 -12 -14 -16 -12 -12 -14 -16 -12 -12 -14 -16 -12 -12 -14 -16 -12 -12 -14 -16 -12 -14 -16 -12 -14 -16 -12 -14 -16 -12 -14 -16 -12 -14 -16 -12 -14 -16 -12 -14 -16 -12 -14 -16 -12 -14 -16 -12 -14 -16 -18 -20 -2 -2 -4 -10 -12 -14 -16 -18 -20 -2 -2 -4 -16 -18 -20 -2 -2 -4 -16 -18 -20 -2 -2 -14 -16 -18 -20 -2 -2 -14 -16 -18 -20 -2 -2 -2 -2 -14 -16 -20 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2	2.18 pre 14 103 0 1.58E-12 -8.20E-12 2.38E-12 -2.24E-12 -1.00E-11 -7.09E-13 5.85E-12 -6.18E-13 2.21E-12 1.41E-11 1.08E-11 -2.78E-11 -3.36E-11 -3.36E-11 -3.36E-11 -3.04E-11 -3.04E-11 -4.03E-11 -7.10E-11	-5.20E-12 -4.61E-12 -1.26E-12 2.15E-12 2.15E-12 2.35E-12 2.35E-12 1.14E-11 1.56E-11 1.56E-11 1.5E-11 2.00E-11 -2.27E-11 -3.71E-11 -3.71E-11 -3.73E-11 -4.43E-11 -6.16E-11	2.14 15 103 60 -5.27E-12 -2.63E-12 4.51E-12 1.73E-11 1.42E-11 1.39E-11 4.39E-11 4.09E-11 5.01E-11 4.50E-11 -7.41E-11 -2.61E-11 -2.48E-11 -3.75E-11 -3.29E-11 -4.83E-11 -6.55E-11	2.13 16 103 60 Vgs = -10V 6.57E-13 5.05E-12 9.89E-12 1.94E-11 2.11E-11 2.23E-11 3.68E-11 3.68E-11 3.68E-11 3.68E-11 -2.02E-11 -3.04E-11 -3.04E-11 -3.04E-11 -3.78E-11 -3.78E-11 -4.39E-11 -6.46E-11	2.11 pre17 104 0 -4.41E-11 -4.08E-11 -3.70E-11 -4.34E-11 -4.21E-11 -3.57E-11 -2.74E-11 -2.74E-11 -2.74E-11 -2.74E-11 -5.80E-11 -5.80E-11 -5.80E-11 -5.51E-11 -6.21E-11 -6.21F-11 -6.21F-11 -6.27E-11 -6.77E-11 -7.69E-11 -7.69E-11 -1.21E-10	2.1 17 104 45 -3.82E-12 -7.38E-12 -7.75E-13 6.93E-12 7.33E-12 1.60E-11 1.70E-11 1.70E-11 1.70E-11 2.35E-11 2.44E-11 -2.93E-11 -3.27E-11 -	2.08 18 104 48 1.19E-11 1.32E-11 1.29E-11 9.11E-12 1.84E-11 1.54E-11 1.54E-11 2.51E-11 3.57E-11 3.99E-11 -7.02E-11 -2.04E-11 -3.04E-11 -4.43E-11 -4.43E-11 -4.43E-11 -7.54E-11	2.06 19 104 51 1.58E-12 4.28E-12 8.91E-12 1.65E-11 2.37E-11 2.47E-11 3.05E-11 3.05E-11 3.05E-11 3.07E-11 -3	2.05 20 104 54 4.42E-12 7.92E-12 1.06E-11 1.70E-11 2.57E-11 2.43E-11 4.34E-11 4.34E-11 4.34E-11 4.34E-11 4.34E-11 -2.40E-11 -3.45E-11 -3.45E-11 -3.60E-11 -3.79E-11 -3.79E-11 -3.89E-11 -4.89E-11 -8.01E-11	2.03 21 104 57 8.85E-12 9.04E-12 1.25E-11 1.67E-11 2.47E-11 2.76E-11 3.17E-11 3.76E-11 3.76E-11 4.28E-11 4.28E-11 4.28E-11 -2.70E-11 -3.13E-11 -3.44E-11 -3.44E-11 -3.56E-11 -4.29E-11 -4.99E-11 -7.25E-11	2.02 22 104 60 8.44E-12 1.06E-11 2.03E-11 2.04E-11 1.97E-11 2.04E-11 3.95E-11 3.95E-11 4.13E-11 5.02E-11 7.07E-11 -3.03E-11 -3.03E-11 -3.95E-11 -3.95E-11 -4.40E-11 -5.28E-11 -7.41E-11	2.01 23 104 60 Vgs = -10V 1.59E-11 1.79E-11 1.96E-11 1.49E-11 2.06E-11 3.36E-11 3.36E-11 3.36E-11 4.13E-11 5.55E-11 -7.59E-11 -2.83E-11 -3.26E-11 -3.39E-11 -4.38E-11 -5.35E-11 -7.35E-11	
	V: 2.13 Run #: DUT S/N: Run Vds (V): comments: Vgs (V) 0 2 4 6 8 10 12 14 16 18 20 -2 -4 -6 -8 -10 -12 -14 -16 -18 -20 BVdss (V): BVdss (V):	2.18 pre 14 103 0 1.58E-12 -8.20E-12 2.38E-12 -2.24E-12 -1.00E-11 -7.09E-13 5.85E-12 -6.18E-13 2.21E-12 1.41E-11 1.08E-11 -2.78E-11 -3.36E-11 -3.36E-11 -3.04E	2.16 14 103 60 -5.20E-12 -4.61E-12 -1.26E-12 2.15E-12 2.35E-12 1.46E-11 1.56E-11 1.66E-11 1.55E-11 2.00E-11 -2.00E-11 -2.76E-11 -3.71E-11 -3.71E-11 -3.73E-11 -4.13E-11 -3.93E-11 -4.43E-11 -6.16E-11	2.14 15 103 60 -5.27E-12 -2.63E-12 4.51E-12 1.73E-11 1.42E-11 1.39E-11 3.36E-11 4.09E-11 5.01E-11 4.09E-11 -7.41E-11 -2.51E-11 -2.51E-11 -3.75E-11	2.13 16 103 60 Vgs = -10V 6.57E-13 5.05E-12 9.89E-12 1.94E-11 2.11E-11 2.23E-11 3.68E-11 3.68E-11 3.68E-11 -2.23E-11 -3.24E-11 -3.24E-11 -3.21E-11	-4.41E-11 -4.08E-11 -3.70E-11 -4.34E-11 -3.57E-11 -3.57E-11 -2.74E-11 -2.63E-11 -2.63E-11 -2.63E-11 -2.63E-11 -5.80E-11 -5.51E-11 -6.21E-11 -5.51E-11 -6.47E-11 -6.47E-11 -6.47E-11 -7.69E-11 -7.69E-11 -2.21E-10	2.1 17 104 45 -3.82E-12 -1.38E-12 -7.75E-13 6.93E-12 7.33E-12 1.60E-11 1.70E-11 1.69E-11 2.44E-11 3.01E-11 -2.92E-11 -2.92E-11 -3.12E-11 -3.12E-11 -3.12E-11 -3.82E-12 -3.82E-12 -3.82E-12 -3.82E-12 -3.82E-12 -3.82E-12 -3.82E-12 -3.82E-12 -3.82E-12 -3.82E-11	2.08 18 104 48 1.19E-11 1.32E-11 1.29E-11 9.11E-12 1.84E-11 1.54E-11 1.54E-11 2.38E-11 2.37E-11 3.97E-11 -2.07E-11 -2.40E-11 -3.04E-11 -4.18E-11 -4.18E-11 -4.38E-11 -5.54E-11	2.06 19 104 51 1.58E-12 4.28E-12 8.91E-12 1.65E-11 2.37E-11 2.47E-11 3.05E-11 3.05E-11 3.05E-11 3.07E-11 4.48E-11 -2.78E-11 -3.10E-11 -3.	2.05 20 104 54 4.42E-12 7.92E-12 1.06E-11 1.70E-11 2.53E-11 2.53E-11 2.43E-11 4.34E-11 4.34E-11 4.34E-11 4.34E-11 4.34E-11 -2.40E-11 -3.45E-11 -3.10E-11 -3.1	2.03 21 104 57 8.85E-12 9.04E-12 1.25E-11 1.67E-11 2.76E-11 3.76E-11 3.76E-11 3.76E-11 4.28E-11 4.64E-11 -7.13E-11 -2.70E-11 -3.13E-11 -3.56E-11 -3.56E-11 -4.29E-11 -4.79E-11 -7.25E-11	2.02 22 104 60 8.44E-12 1.06E-11 2.03E-11 2.04E-11 1.97E-11 2.09E-11 3.95E-11 4.13E-11 5.02E-11 -7.07E-11 -3.03E-11 -3.03E-11 -3.03E-11 -3.95E-11 -4.40E-11 -4.81E-11 5.28E-11 -7.41E-11	2.01 23 104 60 Vgs = -10V 1.59E-11 1.79E-11 1.96E-11 1.49E-11 2.06E-11 3.36E-11 3.36E-11 3.50E-11 4.13E-11 5.55E-11 -7.59E-11 -2.86E-11 -3.26E-11 -3.26E-11 -3.293E-11 -4.38E-11 -5.35E-11 -7.35E-11	1.33
	V: 2.13 Run #: DUT S/N: Run Vds (V): comments: Vgs (V) 0 2 4 6 8 10 12 14 16 18 20 -2 -4 -6 -8 -10 -12 -14 -16 -18 -20 BVdss (V): Idss (uA):	2.18 pre 14 103 0 1.58E-12 -8.20E-12 2.38E-12 -2.24E-12 -2.24E-12 -2.24E-12 -2.24E-12 -3.612E-13 2.35E-13 2.21E-12 1.41E-11 1.08E-11 -2.78E-11 -3.43E-11 -3.43E-11 -3.04	2.16 14 103 60 -5.20E-12 -4.61E-12 -1.26E-12 2.15E-12 2.35E-12 2.35E-11 1.56E-11 1.56E-11 1.56E-11 2.00E-11 ⁰ [60E-11 ⁰ [60E-11] ⁰	2.14 15 103 60 -5.27E-12 -2.63E-12 4.51E-12 1.73E-11 1.42E-11 1.39E-11 2.19E-11 3.36E-11 4.09E-11 5.01E-11 4.09E-11 -2.61E-11 -2.61E-11 -2.61E-11 -2.48E-11 -3.75E-11 -3.29E-11 -4.83E-11 -4.83E-11 -6.55E-11 0.0014	2.13 16 103 60 Vgs = -10V 6.57E-13 5.05E-12 9.89E-12 1.94E-11 2.11E-11 2.23E-11 3.72E-11 3.72E-11 3.72E-11 3.72E-11 -2.23E-11 -2.23E-11 -3.17E-11 -3.17E-11 -3.78E-11 -4.39E-11 -0.2834	-4.41E-11 -4.08E-11 -3.70E-11 -4.34E-11 -3.70E-11 -4.34E-11 -3.57E-11 -2.74E-11 -3.09E-11 -2.63E-11 -3.09E-11 -2.63E-11 -3.09E-11 -5.80E-11 -5.80E-11 -5.51E-11 -6.47E-11 -6.47E-11 -6.47E-11 -7.69E-11 -7.69E-11 -7.69E-11 -7.69E-11 -7.69E-11	2.1 17 104 45 -3.82E-12 -1.38E-12 -7.75E-13 6.93E-12 7.33E-12 1.60E-11 1.70E-11 1.69E-11 2.35E-11 2.44E-11 3.01E-11 -2.92E-11 -2.92E-11 -3.27E-11 -3.26E-11 -3.56E-11 -	2.08 18 104 48 1.19E-11 1.32E-11 1.29E-11 9.11E-12 1.84E-11 1.54E-11 1.54E-11 3.57E-11 3.57E-11 3.99E-11 -2.57E-11 -2.40E-11 -3.04E-11 -4.18E-11 -4.38E-11 -4.38E-11 -3.77E-11 -4.38E-11 0.000756	2.06 19 104 51 1.58E-12 4.28E-12 8.91E-12 1.65E-11 2.37E-11 2.47E-11 2.47E-11 3.05E-11 3.05E-11 3.02E-11 -3.02E-11 -3.02E-11 -3.02E-11 -3.74E-11 -3.74E-11 -4.42E-11 -4.42E-11 -7.28E-11 0.000927	2.05 20 104 54 4.42E-12 7.92E-12 1.06E-11 1.70E-11 2.53E-11 2.43E-11 3.12E-11 4.34E-11 4.34E-11 4.34E-11 4.34E-11 -2.40E-11 -2.40E-11 -3.45E-11 -3.79E-11 -3.	2.03 21 104 57 8.85E-12 9.04E-12 1.25E-11 1.67E-11 2.76E-11 3.17E-11 4.28E-11 4.28E-11 4.28E-11 4.28E-11 4.28E-11 -7.13E-11 -2.70E-11 -3.13E-11 -3.13E-11 -3.13E-11 -3.56E-11 -4.21E-11 -4.29E-11 -7.25E-11	2.02 22 104 60 8.44E-12 1.06E-11 2.03E-11 2.04E-11 1.97E-11 2.695E-11 4.13E-11 5.02E-11 4.13E-11 7.07E-11 -3.07E-11 -3.07E-11 -3.03E-11 -3.395E-11 -4.481E-11 -5.28E-11 -7.41E-11 0.001048	2.01 23 104 60 Vgs = -10V 1.59E-11 1.79E-11 1.96E-11 1.49E-11 2.06E-11 3.36E-11 3.36E-11 3.36E-11 5.42E-11 5.55E-11 -7.59E-11 -2.86E-11 -3.93E-11 -4.38E-11 -4.38E-11 -3.93E-11 -4.38E-11 -5.35E-11 -7.35E-11 -7.35E-11	1.33

Table C3. Pre- and Post-Irradiation Electrical Characterization Test Results for 10/15/2016 MGH Tests Note: Shaded columns flag new DUT. Out-of-spec values are in orange or red text

Run #:	pre 24	24	25	26	27	28	29
DUT S/N:	105	105	105	105	105	105	105
Run Vds (V):	0	45	48	51	54	57	60
comments:							
Vgs (V)							
0	-2.40E-11	1.08E-12	2.65E-12	7.57E-12	1.11E-11	1.44E-11	1.39E-11
2	-1.86E-11	7.01E-12	1.13E-11	1.36E-11	2.20E-11	2.28E-11	2.64E-11
4	-6.68E-12	1.73E-11	1.37E-11	2.63E-11	3.10E-11	2.92E-11	3.81E-11
6	-5.31E-12	2.46E-11	2.79E-11	4.46E-11	3.57E-11	4.14E-11	4.39E-11
8	-5.02E-12	2.87E-11	4.49E-11	4.76E-11	4.77E-11	5.97E-11	5.59E-11
10	5.56E-13	3.34E-11	4.85E-11	5.78E-11	6.09E-11	6.14E-11	6.47E-11
12	1.38E-11	4.47E-11	4.56E-11	6.22E-11	6.61E-11	7.39E-11	7.50E-11
14	1.58E-11	4.89E-11	6.37E-11	7.65E-11	7.15E-11	7.84E-11	8.74E-11
16	2.08E-11	6.29E-11	7.43E-11	7.71E-11	8.34E-11	8.65E-11	9.81E-11
18	1.79E-11	6.34E-11	7.75E-11	9.03E-11	9.44E-11	9.09E-11	1.09E-10
20	2.41E-11	6.87E-11	7.41E-11	9.37E-11	9.85E-11	1.08E-10	1.20E-10
-2	-9.89E-11	-8.51E-11	-9.04E-11	-1.01E-10	-8.79E-11	-7.88E-11	-8.66E-11
-4	-5.27E-11	-3.84E-11	-4.36E-11	-5.34E-11	-4.29E-11	-4.08E-11	-4.09E-11
-6	-5.99E-11	-4.10E-11	-4.41E-11	-4.70E-11	-4.18E-11	-3.61E-11	-4.21E-11
-8	-6.30E-11	-4.27E-11	-4.86E-11	-4.21E-11	-5.08E-11	-4.67E-11	-4.95E-11
-10	-6.59E-11	-4.80E-11	-5.29E-11	-4.74E-11	-5.33E-11	-4.90E-11	-5.82E-11
-12	-6.93E-11	-5.53E-11	-6.79E-11	-6.43E-11	-5.99E-11	-6.23E-11	-6.79E-11
-14	-6.37E-11	-6.04E-11	-6.48E-11	-6.00E-11	-6.57E-11	-6.88E-11	-7.58E-11
-16	-6.76E-11	-6.70E-11	-6.23E-11	-7.47E-11	-7.77E-11	-8.17E-11	-8.61E-11
-18	-8.40E-11	-7.32E-11	-7.53E-11	-7.82E-11	-9.67E-11	-9.94E-11	-9.67E-11
-20	-1.03E-10	-9.27E-11	-1.02E-10	-1.03E-10	-1.08E-10	-1.11E-10	-1.09E-10
BVdss (V):							
Idss (uA):	0.000952	0.001048	0.001199	0.001224	0.001304	0.001536	0.001632
Vth (V):	2.27	2.26	2.24	2.23	2.21	2.19	2.18





Figure D1. Strip tape data from DUT 7, run 1: 548 MeV Ar. Run bias conditions: 0 Vgs, 24 Vds. Beam shuttered after about 97 seconds.



Figure D2. Strip tape data from DUT 7, run 2: 548 MeV Ar. Run bias conditions: 0 Vgs, 27 Vds. Beam shuttered after about 75 seconds.



Figure D3. Strip tape data from DUT 7, run 3: 548 MeV Ar. Run bias conditions: 0 Vgs, 30 Vds. Beam shuttered after about 90 seconds.



Figure D4. Strip tape data from DUT 7, run 4: 548 MeV Ar. Run bias conditions: 0 Vgs, 33 Vds. Beam shuttered after about 110 seconds.



Figure D5. Strip tape data from DUT 7, run 5: 548 MeV Ar. Run bias conditions: 0 Vgs, 36 Vds. Beam shuttered after about 96 seconds.



Figure D9. Strip tape data from DUT 7, run 6: 548 MeV Ar. Run bias conditions: 0 Vgs, 39 Vds. Beam shuttered after about 165 seconds.



Figure D10. Strip tape data from DUT 7, run 7: 548 MeV Ar. Run bias conditions: 0 Vgs, 42 Vds. Beam shuttered after about 200 seconds.



Figure D11. Strip tape data from DUT 7, run 8: 548 MeV Ar. Run bias conditions: 0 Vgs, 45 Vds. Beam shuttered after about 202 seconds. Right panel is the same plot but scaled to reveal gate current changes.



Figure D12. Strip tape data from DUT 8, run 9: 548 MeV Ar. Run bias conditions: 0 Vgs, 12 Vds. Beam shuttered after about 102 seconds. The gate leakage current on this DUT prior to exposure to Ar was out of spec; testing of this device was therefore discontinued.



Figure D13. Strip tape data from DUT 9, run 10: 548 MeV Ar. Run bias conditions: 0 Vgs, 6 Vds. Beam shuttered after about 115 seconds.



Figure D14. Strip tape data from DUT 9, run 11: 548 MeV Ar. Run bias conditions: 0 Vgs, 9 Vds. Beam shuttered after about 88 seconds.



Figure D15. Strip tape data from DUT 9, run 12: 548 MeV Ar. Run bias conditions: 0 Vgs, 12 Vds. Beam shuttered after about 79 seconds.



Figure D16. Strip tape data from DUT 9, run 13: 548 MeV Ar. Run bias conditions: 0 Vgs, 15 Vds. Beam shuttered after about 80 seconds.



Figure D17. Strip tape data from DUT 9, run 14: 548 MeV Ar. Run bias conditions: 0 Vgs, 18 Vds. Beam shuttered after about 95 seconds.



Figure D18. Strip tape data from DUT 9, run 15: 548 MeV Ar. Run bias conditions: 0 Vgs, 21 Vds. Beam shuttered after about 107 seconds.



Figure D19. Strip tape data from DUT 9, run 16: 548 MeV Ar. Run bias conditions: 0 Vgs, 24 Vds. Beam shuttered after about 146 seconds.



Figure D20. Strip tape data from DUT 9, run 17: 548 MeV Ar. Run bias conditions: 0 Vgs, 27 Vds. Beam shuttered after about 107 seconds.



Figure D21. Strip tape data from DUT 9, run 18: 548 MeV Ar. Run bias conditions: 0 Vgs, 30 Vds. Beam shuttered after about 128 seconds.



Figure D22. Strip tape data from DUT 9, run 19: 548 MeV Ar. Run bias conditions: 0 Vgs, 33 Vds. Beam shuttered after about 117 seconds.



Figure D23. Strip tape data from DUT 9, run 20: 548 MeV Ar. Run bias conditions: 0 Vgs, 36 Vds. Beam shuttered after about 132 seconds.



Figure D24. Strip tape data from DUT 9, run 21: 548 MeV Ar. Run bias conditions: 0 Vgs, 39 Vds. Beam shuttered after about 107 seconds.



Figure D25. Strip tape data from DUT 9, run 22: 548 MeV Ar. Run bias conditions: 0 Vgs, 42 Vds. Beam shuttered after about 113 seconds.



Figure D26. Strip tape data from DUT 9, run 23: 548 MeV Ar. Run bias conditions: 0 Vgs, 45 Vds. Beam shuttered after about 147 seconds. SEB occurs immediately upon beam exposure. Right panel shows same plot but with log scale. Gate current did not change. Instability of drain current is characteristic of trench MOSFET response to heavy-ion exposure and may reflect charge trapping/detrapping in the gate oxide/interface, effectively modifying the local gate threshold voltage at the ion strike location. Additional analyses would be required to understand this phenomenon and are out of scope of this report.



Figure D27. Strip tape data from DUT 10, run 24: 548 MeV Ar. Run bias conditions: 0 Vgs, 30 Vds. Beam shuttered after about 140 seconds.



Figure D28. Strip tape data from DUT 10, run 25: 548 MeV Ar. Run bias conditions: 0 Vgs, 33 Vds. Beam shuttered after about 140 seconds. SEB occurred shortly after beam turned on. Gate current remained unchanged, as shown in right panel.



Figure D29. Strip tape data from DUT 11, run 26: 548 MeV Ar. Testing in SEB-protective mode with 10 kΩ external resistor on drain node. Run bias conditions: 0 Vgs, 24 Vds. Beam shuttered after about 196 seconds.



Figure D30. Strip tape data from DUT 11, run 27: 548 MeV Ar. Testing in SEB-protective mode with 10 kΩ external resistor on drain node. Run bias conditions: 0 Vgs, 27 Vds. Beam shuttered after about 112 seconds.



Figure D31. Strip tape data from DUT 11, run 28: 548 MeV Ar. Testing in SEB-protective mode with 10 kΩ external resistor on drain node. Run bias conditions: 0 Vgs, 30 Vds. Beam shuttered after about 124 seconds.



Figure D32. Strip tape data from DUT 11, run 29: 548 MeV Ar. Testing in SEB-protective mode with 10 kΩ external resistor on drain node. Run bias conditions: 0 Vgs, 33 Vds. Beam shuttered after about 129 seconds.



Figure D33. Strip tape data from DUT 11, run 30: 548 MeV Ar. Testing in SEB-protective mode with 10 k Ω external resistor on drain node. Run bias conditions: 0 Vgs, 36 Vds. Beam shuttered after about 193 seconds.



Figure D34. Strip tape data from DUT 11, run 31: 548 MeV Ar. Testing in SEB-protective mode with 10 kΩ external resistor on drain node. Run bias conditions: 0 Vgs, 39 Vds. Beam shuttered after about 198 seconds.



Figure D35. Strip tape data from DUT 11, run 32: 548 MeV Ar. Testing in SEB-protective mode with 10 kΩ external resistor on drain node. Run bias conditions: 0 Vgs, 42 Vds. Beam shuttered after about 143 seconds.



Figure D36. Strip tape data from DUT 11, run 33: 548 MeV Ar. Testing in SEB-protective mode with 10 k Ω external resistor on drain node. Run bias conditions: 0 Vgs, 45 Vds. Beam shuttered after about 138 seconds.



Figure D37. Strip tape data from DUT 11, run 34: 548 MeV Ar. Testing in SEB-protective mode with 10 kΩ external resistor on drain node. Run bias conditions: 0 Vgs, 48 Vds. Beam shuttered after about 135 seconds.



Figure D38. Strip tape data from DUT 11, run 35: 548 MeV Ar. Testing in SEB-protective mode with 10 k Ω external resistor on drain node. Run bias conditions: 0 Vgs, 51 Vds. Beam shuttered after about 159 seconds.



Figure D39. Strip tape data from DUT 11, run 36: 548 MeV Ar. Testing in SEB-protective mode with 10 k Ω external resistor on drain node. Run bias conditions: 0 Vgs, 54 Vds. Beam shuttered after about 150 seconds.



Figure D40. Strip tape data from DUT 11, run 37: 548 MeV Ar. Testing in SEB-protective mode with 10 k Ω external resistor on drain node. Run bias conditions: 0 Vgs, 57 Vds. Beam shuttered after about 149 seconds.



Figure D41. Strip tape data from DUT 11, run 38: 548 MeV Ar. Testing in SEB-protective mode with 10 k Ω external resistor on drain node. Run bias conditions: 0 Vgs, 60 Vds. Beam shuttered after about 131 seconds.



Figure D42. Strip tape data from DUT 12, run 39: 548 MeV Ar. Run bias conditions: -10 Vgs, 24 Vds. Beam shuttered after about 139 seconds. Note that the negative gate bias precluded ion-induced increases in drain current because despite decreases in localized gate threshold voltage at the location of ion strikes through the gate oxide, the channel did not become conducting: the -10 V applied Vgs is sufficiently below the threshold voltage.



Figure D43. Strip tape data from DUT 16, run 66 (LBNL 11/8/2016): 400 MeV Ar. Run bias conditions: 0 Vgs, 45 Vds. Beam shuttered after about 21 seconds. SEB occurred after about 7 seconds. Lower left panel shows top plot on log scale; lower right panel shows small gate current transient upon initial jump in drain current at about 5 seconds. This test suggests prior dosing does not impact threshold drain voltage required for SEB.



Figure D44. Strip tape data from DUT 17, run 60: 283 MeV Ne. Run bias conditions: 0 Vgs, 24 Vds. Beam shuttered after about 175 seconds. The much lower LET of Ne results in smaller localized dosing effects upon an ion strike down the gate oxide. The fewer events suggests a smaller cross section of susceptibility.



Figure D45. Strip tape data from DUT 17, run 61: 283 MeV Ne. Run bias conditions: 0 Vgs, 27 Vds. Beam shuttered after about 185 seconds.



Figure D46. Strip tape data from DUT 17, run 62: 283 MeV Ne. Run bias conditions: 0 Vgs, 30 Vds. Beam shuttered after about 227 seconds.



Figure D47. Strip tape data from DUT 17, run 63: 283 MeV Ne. Run bias conditions: 0 Vgs, 33 Vds. Beam shuttered after about 202 seconds. Slight recovery after 100 seconds could be charge detrapping (see Figure D23).



Figure D48. Strip tape data from DUT 17, run 64: 283 MeV Ne. Run bias conditions: 0 Vgs, 36 Vds. Beam shuttered after about 183 seconds.



Figure D49. Strip tape data from DUT 17, run 65: 283 MeV Ne. Run bias conditions: 0 Vgs, 39 Vds. Beam shuttered after about 192 seconds.



Figure D50. Strip tape data from DUT 17, run 66: 283 MeV Ne. Run bias conditions: 0 Vgs, 42 Vds. Beam shuttered after about 205 seconds.



Figure D51. Strip tape data from DUT 17, run 67: 283 MeV Ne. Run bias conditions: 0 Vgs, 45 Vds. Beam shuttered after about 202 seconds. SEB occurs about 17 seconds into the beam run. Gate current does not change. Left panel is replotted on the right in log scale.



Figure D52. Strip tape data from DUT 114, run 89: 659 MeV Cu. Run bias conditions: 0 Vgs, 24 Vds. Beam shuttered after about 190 seconds.



Figure D53. Strip tape data from DUT 114, run 90: 659 MeV Cu. Run bias conditions: 0 Vgs, 27 Vds. Beam shuttered after about 193 seconds.



Figure D54. Strip tape data from DUT 114, run 91: 659 MeV Cu. Run bias conditions: 0 Vgs, 30 Vds. Beam shuttered after about 195 seconds.



Figure D55. Strip tape data from DUT 114, run 92: 659 MeV Cu. Run bias conditions: 0 Vgs, 33 Vds. Beam shuttered after about 195 seconds.



Figure D56. Strip tape data from DUT 114, run 93: 659 MeV Cu. Run bias conditions: 0 Vgs, 36 Vds. Beam shuttered after about 205 seconds.



Figure D57. Strip tape data from DUT 114, run 94: 659 MeV Cu. Run bias conditions: 0 Vgs, 39 Vds. Beam shuttered after about 112 seconds.



Figure D58. Strip tape data from DUT 114, run 95: 659 MeV Cu. Run bias conditions: 0 Vgs, 42 Vds. SEB occurs after about 52 seconds. Beam shuttered after about 56 seconds. Right panel shows the same plot with log scale. Gate current did not change during run.



Figure D59. Strip tape data from DUT 120, run 97: 659 MeV Cu. Run bias conditions: 0 Vgs, 36 Vds. Beam shuttered after about 185 seconds.



Figure D60. Strip tape data from DUT 120, run 98: 659 MeV Cu. Run bias conditions: 0 Vgs, 39 Vds. Beam shuttered after about 183 seconds.



Figure D61. Strip tape data from DUT 120, run 99: 659 MeV Cu. Run bias conditions: 0 Vgs, 42 Vds. Beam shuttered after about 182 seconds.



Figure D62. Strip tape data from DUT 120, run 100: 659 MeV Cu. Run bias conditions: 0 Vgs, 45 Vds. SEB occurred at about 27 seconds. Beam shuttered after about 32 seconds. Right panel shows the same plot with log scale. Gate current did not change during run.



Figure D63. Strip tape data from DUT 107, run 101: 659 MeV Cu. Run bias conditions: 0 Vgs, 39 Vds. SEB occurred at about 10 seconds. Beam shuttered after about 25 seconds. Lower left panel shows the top plot with log scale. Lower right panel is a linear plot showing ringing upon initial beam exposure. Gate current did not change during run. This DUT failed on its first beam exposure and thus may have been SEB-susceptible to Cu below 39 Vds.



Figure D64. Strip tape data from DUT 117, run 111: 886 MeV Kr. Run bias conditions: 0 Vgs, 24 Vds. Beam shuttered after about 93 seconds.



Figure D65. Strip tape data from DUT 117, run 112: 886 MeV Kr. Run bias conditions: 0 Vgs, 27 Vds. Beam shuttered after about 93 seconds.



Figure D66. Strip tape data from DUT 117, run 113: 886 MeV Kr. Run bias conditions: 0 Vgs, 30 Vds. Beam shuttered after about 94 seconds.



Figure D67. Strip tape data from DUT 117, run 114: 886 MeV Kr. Run bias conditions: 0 Vgs, 33 Vds. Beam shuttered after about 103 seconds.



Figure D68. Strip tape data from DUT 117, run 115: 886 MeV Kr. Run bias conditions: 0 Vgs, 36 Vds. Beam shuttered after about 95 seconds.



Figure D69. Strip tape data from DUT 117, run 116: 886 MeV Kr. Run bias conditions: 0 Vgs, 39 Vds. Beam shuttered after about 97 seconds.



Figure D70. Strip tape data from DUT 117, run 117: 886 MeV Kr. Run bias conditions: 0 Vgs, 42 Vds. SEB occurred at about 30 seconds. Beam shuttered after about 34 seconds. Right panel shows the same plot with log scale. Gate current did not change during run.



Figure D71. Strip tape data from DUT 102, run 8: 200 MeV protons. Run bias conditions: 0 Vgs, 45 Vds. Beam shuttered after about 110 seconds. Irradiation at lower Vds yielded similar striptapes and are thus not shown.



Figure D72. Strip tape data from DUT 102, run 9: 200 MeV protons. Run bias conditions: 0 Vgs, 48 Vds. Beam shuttered after about 110 seconds. Left panel shows two current spikes which may be quenched SEB events. Right panel is replot of left panel on smaller scale to reveal no change in gate current.

Figure D73. Strip tape data from DUT 102, run 10: 200 MeV protons. Run bias conditions: 0 Vgs, 51 Vds. Beam shuttered after about 111 seconds.

Figure D74. Strip tape data from DUT 102, run 11: 200 MeV protons. Run bias conditions: 0 Vgs, 54 Vds. Beam shuttered after about 113 seconds. Three current spikes may be quenched SEB events. No transients in gate current.

Figure D75. Strip tape data from DUT 102, run 12: 200 MeV protons. Run bias conditions: 0 Vgs, 57 Vds. Beam shuttered after about 110 seconds. Two drain current spikes may be quenched SEB events. Right panel repeats left plot but on smaller scale to show gate current transients that are not correlated with the drain current transients.

Figure D76. Strip tape data from DUT 102, run 13: 200 MeV protons. Run bias conditions: 0 Vgs, 60 Vds. Beam shuttered after about 110 seconds. Current spikes may be quenched SEB events. Lower panels are replots of top panel, on different y-axis scales.

Figure D77. Strip tape data from DUT 103, run 14: 200 MeV protons. Run bias conditions: 0 Vgs, 60 Vds. Beam shuttered after about 110 seconds. Nine current spikes may be quenched SEB events. Gate current shown on smaller scale in right panel.

Figure D78. Strip tape data from DUT 103, run 15: 200 MeV protons. Run bias conditions: 0 Vgs, 60 Vds. Beam shuttered after about 1086 seconds. 95 current spikes may be quenched SEB events. Gate current shown on smaller scale in right panel.

Figure D79. Strip tape data from DUT 104, runs 17 and 18: 200 MeV protons. Run bias conditions: 0 Vgs, 45 Vds (left) and 48 Vds (right).

Figure D80. Strip tape data from DUT 104, runs 19 and 20: 200 MeV protons. Run bias conditions: 0 Vgs, 51 Vds (left) and 54 Vds (right).

Figure D81. Strip tape data from DUT 104, runs 21 and 22: 200 MeV protons. Run bias conditions: 0 Vgs, 57 Vds (left) and 60 Vds (right).

Figure D82. Strip tape data from DUT 105, runs 24 and 25: 200 MeV protons. Run bias conditions: 0 Vgs, 45 Vds (left) and 48 Vds (right).

Figure D83. Strip tape data from DUT 105, runs 26 and 27: 200 MeV protons. Run bias conditions: 0 Vgs, 51 Vds (left) and 54 Vds (right).

Figure D84. Strip tape data from DUT 105, runs 28 and 29: 200 MeV protons. Run bias conditions: 0 Vgs, 57 Vds (left) and 60 Vds (right).