



Single-Event-Effects Summary Report

IR RAD-Hard Gen-5 200V P-channel

SEE Qualifications of:

JANTXVR, F, G, H AND JANSR, F, G, H 2N7546U3 AND 2N7548T3 MIL-PRF-19500/712

JANTXVR, F, G, H AND JANSR, F, G, H 2N7549U2 AND 2N7549T1 MIL-PRF-19500/713

IRHNJ597230, IRHNJ593230, IRHNJ596230, IRHNJ598230 SCV AND SCS

IRHY597230CM, IRHY593230CM, IRHY596230CM, IRHY598230CM SCV AND SCS

IRHNA597260, IRHNA593260, IRHNA596260, IRHNA598260 SCV AND SCS

IRHMS597260, IRHMS593260, IRHMS596260, IRHMS598260 SCV AND SCS



Fab-2 Wafer Lot: E771875A
SEE Test Date: June 14th & Dec. 2nd 2008
SEE Test Facility: Texas A&M Cyclotron
SEE Test Date: Feb. 11th & 12th 2009
SEE Test Facility: BNL Accelerator

	Ion	Br	Xe	Au	
LET		37.14	63.4	87.2	MeV-cm ² /mg
Energy		287.6	348	372	MeV
Range		36.8	32.5	28.4	μm
Run Numbers			262-270	361-366	for June 2008 at TAMU
Run Numbers				18-40	for Dec. 2008 at TAMU
Run Numbers		68-93			for Feb. 2009 at BNL

IR Fab-5 Specs

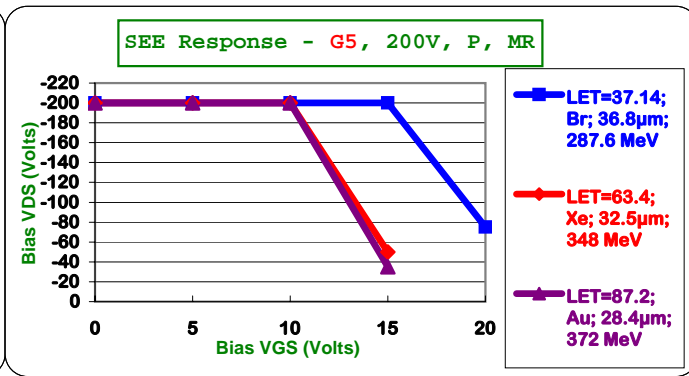
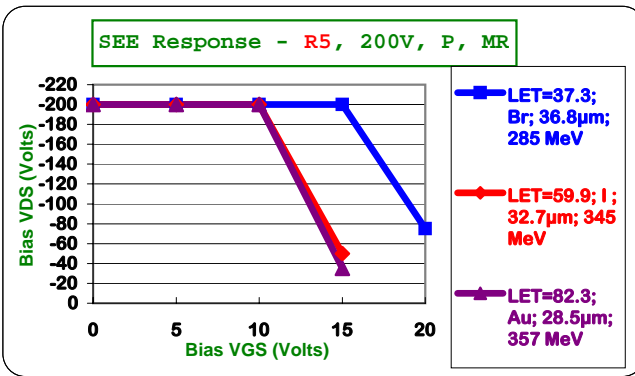
VDS Bias (Volts)

VGS (Volts)	LET=37.3; Br; 36.8μm; 285 MeV	LET=59.9; I; 32.7μm; 345 MeV	LET=82.3; Au; 28.5μm; 357 MeV
0	-200	-200	-200
5	-200	-200	-200
10	-200	-200	-200
15	-200	-50	-35
20	-75		

IR Fab-2 Qual to Specs

VDS Bias (Volts)

VGS (Volts)	LET=37.14; Br; 36.8μm; 287.6 MeV	LET=63.4; Xe; 32.5μm; 348 MeV	LET=87.2; Au; 28.4μm; 372 MeV
0	-200	-200	-200
5	-200	-200	-200
10	-200	-200	-200
15	-200	-50	-35
20	-75		



Run No.	Ion	DUT Id	Socket	Wafer	Serial	Batch	VGS Volts	VDS Volts	Pass/Fail Blank=Pass
Tested on June 14th 2008									
99	Kr	A1	1	5	20	3	10	-180	Invalid (wrong LET)
100	Kr	A1	1	5	20	3	10	-190	Invalid (wrong LET)
101	Kr	A1	1	5	20	3	10	-200	Invalid (wrong LET)
102	Kr	A1	1	5	20	3	15	-110	Invalid (wrong LET)
103	Kr	A1	1	5	20	3	15	-120	Invalid (wrong LET)
104	Kr	A1	1	5	20	3	15	-140	Invalid (wrong LET)
105	Kr	A1	1	5	20	3	15	-160	Invalid (wrong LET)
106	Kr	A1	1	5	20	3	15	-180	Invalid (wrong LET)
107	Kr	A1	1	5	20	3	15	-200	Invalid (wrong LET)
108	Kr	A1	1	5	20	3	20	-70	Invalid (wrong LET)
109	Kr	A1	1	5	20	3	20	-80	Invalid (wrong LET)
110	Kr	A1	1	5	20	3	20	-90	Invalid (wrong LET)
111	Kr	A1	1	5	20	3	20	-100	Invalid (wrong LET)
112	Kr	A1	1	5	20	3	20	-120	Invalid (wrong LET)
113	Kr	A2	2	5	19	3	15	-200	F Invalid (wrong LET)
114	Kr	A2	2	5	19	3	20	-75	Invalid (wrong LET)
115	Kr	A3	3	5	18	3	15	-200	Invalid (wrong LET)
116	Kr	A3	3	5	18	3	20	-75	Invalid (wrong LET)
117	Kr	A4	4	5	17	3	15	-200	Invalid (wrong LET)
118	Kr	A4	4	5	17	3	20	-75	Invalid (wrong LET)
262	Xe	A7	1	6	35	6	10	-200	
263	Xe	A7	1	6	35	6	15	-50	
264	Xe	A7	1	6	35	6	15	-60	F
265	Xe	A8	2	6	36	6	10	-200	CurvePoint-1
266	Xe	A8	2	6	36	6	15	-50	CurvePoint-2
267	Xe	A9	3	6	37	6	10	-200	CurvePoint-1
268	Xe	A9	3	6	37	6	15	-50	CurvePoint-2
269	Xe	A10	4	7	38	6	10	-200	CurvePoint-1
270	Xe	A10	4	7	38	6	15	-50	CurvePoint-2



Run No.	Ion	DUT Id	Socket	Wafer	Serial	Batch	VGS Volts	VDS Volts	Pass/Fail Blank=Pass
Tested on June 14th 2008									
361	Au	A13	13	4	8	8	5	-200	CurvePoint-1
362	Au	A14	14	4	7	8	5	-200	CurvePoint-1
363	Au	A15	15	4	6	8	5	-200	CurvePoint-1
364	Au	A16	16	4	5	8	10	-200	
365	Au	A17	17	4	4	8	10	-200	F
366	Au	A18	18	4	3	8	10	-200	
Tested on Dec. 2nd 2008									
18	Au	B1	9	25	5	1	10	-100	
19	Au	B1	9	25	5	1	10	-100	
20	Au	B1	9	25	5	1	10	-110	
21	Au	B1	9	25	5	1	10	-120	
22	Au	B1	9	25	5	1	10	-130	
23	Au	B1	9	25	5	1	10	-140	
24	Au	B1	9	25	5	1	10	-150	
25	Au	B1	9	25	5	1	10	-160	
26	Au	B1	9	25	5	1	10	-170	
27	Au	B1	9	25	5	1	10	-180	
28	Au	B1	9	25	5	1	10	-190	Invalid - wrong airgap
29	Au	B1	9	25	5	1	10	-200	CurvePoint-1
30	Au	B2	10	25	6	1	10	-200	Invalid - biases at pos# 1
31	Au	B2	10	25	6	1	10	-200	CurvePoint-1
32	Au	B3	11	25	21	1	10	-200	CurvePoint-1
33	Au	B4	12	25	22	1	10	-200	CurvePoint-1
34	Au	B5	13	25	23	1	15	-30	
35	Au	B5	13	25	23	1	15	-32	
36	Au	B5	13	25	23	1	15	-34	
37	Au	B5	13	25	23	1	15	-36	CurvePoint-2
38	Au	B6	14	25	24	1	15	-35	CurvePoint-2
39	Au	B7	15	25	25	1	15	-35	CurvePoint-2
40	Au	B8	16	25	2	1	15	-35	CurvePoint-2
Tested on Feb. 11th 2009									
			at BNL for closer to Specs						
Run No.	Ion	DUT Id	Socket	Wafer	Serial	Batch	VGS Volts	VDS Volts	Pass/Fail Blank=Pass
68	Br	E1	1	4	1	3	10	-100	
69	Br	E1	1	4	1	3	10	-120	
70	Br	E1	1	4	1	3	10	-140	
71	Br	E1	1	4	1	3	10	-160	
72	Br	E1	1	4	1	3	10	-180	
73	Br	E1	1	4	1	3	10	-200	
74	Br	E1	1	4	1	3	15	-120	
75	Br	E1	1	4	1	3	15	-140	
76	Br	E1	1	4	1	3	15	-160	
77	Br	E1	1	4	1	3	15	-180	
78	Br	E1	1	4	1	3	15	-200	CurvePoint-1
79	Br	E1	1	4	1	3	20	-50	
80	Br	E1	1	4	1	3	20	-75	
81	Br	E2	2	4	2	3	15	-200	CurvePoint-2
82	Br	E2	2	4	2	3	20	-75	CurvePoint-1
83	Br	E3	3	4	3	3	20	-75	CurvePoint-2
84	Br	E3	3	4	3	3	15	-200	CurvePoint-1
85	Br	E4	4	4	4	3	15	-200	CurvePoint-1
86	Br	E4	4	4	4	3	20	-75	CurvePoint-2
87	Br	E5	5	4	5	3	20	-75	
88	Br	E5	5	4	5	3	20	-100	
89	Br	E5	5	4	5	3	20	-120	F
90	Br	E6	6	4	6	3	20	-100	
91	Br	E6	6	4	6	3	20	-140	
92	Br	E6	6	4	6	3	20	-160	
93	Br	E6	6	4	6	3	20	-180	F



RadHard MOSFET - G5, Hex 3, 200V, P-channel

Expected Good Devices

SEE-Failed Devices

Post - SEE Electricals Data

SEE-UnTested Devices

SEE Id	Log Serial	Parameter	I DSS	I GSSf	I GSSr	V GS(th)	BV DSS	R DS(on)	VSD			
		Conditions	VDS=-160V VGS=0V	VGS=-20V VDS=0V	VGS=20V VDS=0V	IDS=1mA VDS=VGS	IDSS=1mA	ID=5A VGS=12V	IS=8A			
		Limits Unit	10µA Max nA	-100nA Max nA	100nA Max nA	2V to 4V V	200V Min V	505mOhms mOhms	5V Max V			
		E771875A (BNL 02-11-2009) IRHC597230							Good Matched Electricals to SEE			
E1	1	5.00	0.14	0.52	3.341	223.6	339.40	3.456	Pass	15/-200 & 20/-75V	Br	
E2	2	2.08	0.14	0.51	3.318	222.4	338.80	3.448	Pass	15/-200 & 20/-75V	Br	
E3	3	2.15	0.14	0.48	3.312	223.4	339.20	3.442	Pass	15/-200 & 20/-75V	Br	
E4	4	2.13	0.14	0.49	3.315	222.7	339.00	3.467	Pass	15/-200 & 20/-75V	Br	
E5	5	9890.00	999900.00	585900.00	3.321	223.5	339.20	3.425	Failed	20/-120V	Br	
E6	6	29410.00	999900.00	999900.00	3.320	222.9	340.20	3.479	Failed	20/-180V	Br	
	7	1.45	0.14	0.49	3.338	220.1	345.00	3.523		Unused		
	8	1.90	0.13	0.49	3.406	223.5	342.20	3.456		Unused		
	9	7.59	322.90	175.90	3.316	222.5	340.00	3.516		Unused		
		E771875A (TAMU 12-02-2008) IRHC597230							Good Matched Electricals to SEE			
B1	5	18.59	0.24	0.33	3.35	223.50	348.00	3.43	Pass	10/-200V	Au	
B2	6	64.01	0.11	0.26	3.36	224.50	349.20	3.59	Pass	10/-200V	Au	
B3	21	13.51	0.11	0.24	3.34	223.70	348.60	3.41	Pass	10/-200V	Au	
B4	22	11.68	0.11	0.25	3.34	224.50	347.00	3.39	Pass	10/-200V	Au	
B5	23	38.38	0.11	0.22	3.44	224.40	352.80	3.52	Pass	15/-35V	Au	
B6	24	13.71	0.11	0.23	3.33	223.80	350.00	3.42	Pass	15/-35V	Au	
B7	25	12.55	0.11	0.24	3.34	224.00	348.00	3.40	Pass	15/-35V	Au	
B8	2	15.41	0.12	0.23	3.40	224.70	353.80	3.51	Pass	15/-35V	Au	
		E771875A (TAMU 06-14-2008) IRHC597230							Good Insitu & Ion			
A2	2	34.85	3.45	3.84	3.391	226.6	347.80	3.470	Pass	Invalid LET	Kr	
A3	3	9999000.00	999900.00	999900.00	3.376	0.0	1014.00	3.567	Failed	Invalid LET	Kr	
A4	4	39.64	4.28	4.66	3.392	228.7	351.20	3.464	Pass	Invalid LET	Kr	
A13	13	9999000.00	999900.00	999900.00	3.362	0.3	821.40	3.655	Failed	5/-200	Au	
A14	14	43.76	4.65	4.78	3.322	224.6	339.80	3.373	Pass	5/-200	Au	
A15	15	41.27	4.24	4.42	3.359	223.5	346.40	3.485	Pass	5/-200	Au	
A8	8	29.45	3.23	3.47	3.292	223.9	352.40	3.424	Pass	10/-200 & 15/-50	Xe	
A9	9	29.39	3.04	3.51	3.292	221.2	346.80	3.395	Pass	10/-200 & 15/-50	Xe	
A10	10	30.19	3.10	3.58	3.358	229.8	358.40	3.439	Pass	10/-200 & 15/-50	Xe	
A16	16	32.54	4.61	4.84	3.386	223.1	346.80	3.517	Pass	10/-200	Au	
A18	18	33.35	3.75	4.50	3.351	223.2	341.40	3.395	Pass	10/-200	Au	

After correcting the minor mechanical distortion of the bond wires (shipping mis-handling) on both samples A3 and A13, both are re-retsted for Post-SEE Electricals with good results, as expected from the SEE Tests:

A3	3	37.27	3.89	4.09	3.381	227.5	344.40	3.429	Pass	Invalid LET	Kr
A13	13	37.75	3.82	4.02	3.355	224.7	350.80	3.498	Pass	5/-200	Au



VGS (Volts)	LET=38±5%; 35µm±7.5%; 270MeV±7.5%	LET=61±5%; 30µm±7.5%; 330MeV±7.5%	LET=84±5%; 28µm±7.5%; 350MeV±10%
0	-200	-200	-200
5	-200	-200	-200
10	-200	-200	-200
15	-200	-50	-35
20	-75		

Final QPL Specs

for 2N7546U3/712 (IRHNJ597230) and 2N7548T3/712 (IRHY597230CM)

for 2N7549U2/713 (IRHNA597260) and 2N7549T1/713 (IRHMS597260)

