



# **Single-Event-Effects Summary Report**

## **IR RAD-Hard Gen-6 250V N-channel**

### ***SEE Qualifications of:***

**JANTXVR, F, G, H AND JANSR, F, G, H 2N7593U3 MIL-PRF-19500/746**

**JANTXVR, F, G, H AND JANSR, F, G, H 2N7594T3 MIL-PRF-19500/755**

**JANTXVR, F, G, H AND JANSR, F, G, H 2N7585U2 MIL-PRF-19500/760**

**JANTXVR, F, G, H AND JANSR, F, G, H 2N7586T1 MIL-PRF-19500/753**

**IRHNJ67234, IRHNJ63234, IRHNJ66234, IRHNJ68234 SCV AND SCS**

**IRHYS67234CM, IRHYS63234CM, IRHYS66234CM, IRHYS68234CM SCV AND SCS**

**IRHNA67264, IRHNA63264, IRHNA66264, IRHNA68264 SCV AND SCS**

**IRHMS67264, IRHMS63264, IRHMS66264, IRHMS68264 SCV AND SCS**

# SEE Summary Report - RH, G6, N, MR, 250V



Fab-2 Wafer Lot: E772755  
SEE Test Date: Aug. 12th & Dec. 5th 2008  
SEE Test Facility: Texas A&M Cyclotron

Ion	Ag	Ag	Xe	Au
LET	44.5	41.2	59	90.1
Energy	1094	1376	826	1472
Range	99.7	128.2	66	80
Run Numbers			590-601	798-806
Run Numbers	301-335	336-356	537-543	

for August 12th 2008  
for December 5th 2008

## IR Fab-5 Specs

VDS Bias (Volts)

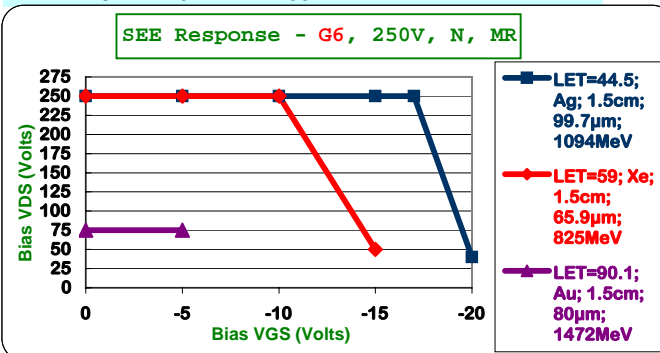
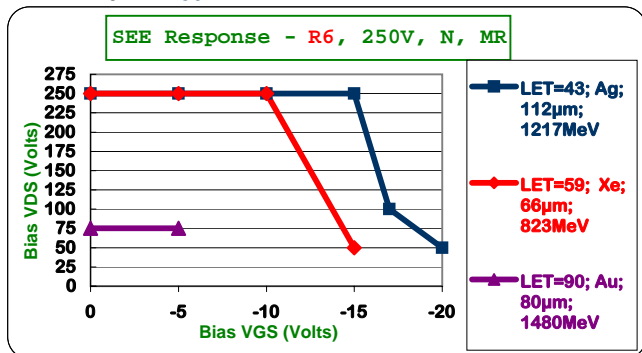
VGS Bias	LET=43; Ag; 112µm; 1217MeV	LET=59; Xe; 66µm; 823MeV	LET=90; Au; 80µm; 1480MeV
0	250	250	75
-5	250	250	75
-10	250	250	
-15	250	50	
-17	100		
-20	50		

## IR Fab-2 Qual to Specs

VDS Bias (Volts)

VGS Bias	LET=44.5; Ag; 1.5cm; 99.7µm; 1094MeV	LET=41.2; Ag; 1.5cm; 128.2µm; 1376MeV	LET=59; Xe; 1.5cm; 65.9µm; 825MeV	LET=90.1; Au; 1.5cm; 80µm; 1472MeV
0	250	250	250	75
-5	250	250	250	75
-10	250	250	250	
-15	250	250	50	
-17	250	250		
-20	40	50		

-5V/50V Xe on Dec.08



Test Date	Run No.	Ion	DUT Id	Socket	Wafer	Serial	Batch	VGS Volts	VDS Volts	Pass/Fail Blank=Pass
8/12/2008	590	Xe	U1	13	1	1	15	-10	200	
8/12/2008	591	Xe	U1	13	1	1	15	-10	210	
8/12/2008	592	Xe	U1	13	1	1	15	-10	220	
8/12/2008	593	Xe	U1	13	1	1	15	-10	230	
8/12/2008	594	Xe	U1	13	1	1	15	-10	240	
8/12/2008	595	Xe	U1	13	1	1	15	-10	250	CurvePoint-1
8/12/2008	596	Xe	U2	14	1	2	15	-10	250	CurvePoint-1
8/12/2008	597	Xe	U3	15	1	3	15	-10	250	CurvePoint-1
8/12/2008	598	Xe	U4	16	1	4	15	-15	50	CurvePoint-2
8/12/2008	599	Xe	U5	17	1	5	15	-15	50	F
8/12/2008	600	Xe	U6	18	1	6	15	-15	40	CurvePoint-2
8/12/2008	601	Xe	U6	18	1	6	15	-15	50	
8/12/2008	798	Au	U7	7	1	7	19	-5	50	
8/12/2008	799	Au	U7	7	1	7	19	-5	75	
8/12/2008	800	Au	U7	7	1	7	19	-5	100	
8/12/2008	801	Au	U7	7	1	7	19	-5	100	F ReTest => SEGR
8/12/2008	802	Au	U8	8	1	8	19	-5	75	
8/12/2008	803	Au	U8	8	1	8	19	-5	100	F LeakyG+GS blown
8/12/2008	804	Au	U9	9	1	9	19	-5	75	CurvePoint-1?
8/12/2008	805	Au	U10	10	1	10	19	-5	75	CurvePoint-1?
8/12/2008	806	Au	U11	11	1	11	19	-5	75	CurvePoint-1?



Test Date	Run No.	Ion	DUT Id	Socket	Wafer	Serial	Batch	VGS Volts	VDS Volts	Pass/Fail Blank=Pass
12/5/2008	301	Ag	N1	1	1	10	7	-15	200	
12/5/2008	302	Ag	N1	1	1	10	7	-15	210	
12/5/2008	303	Ag	N1	1	1	10	7	-15	220	
12/5/2008	304	Ag	N1	1	1	10	7	-15	230	
12/5/2008	305	Ag	N1	1	1	10	7	-15	240	
12/5/2008	306	Ag	N1	1	1	10	7	-17	80	
12/5/2008	307	Ag	N1	1	1	10	7	-17	90	
12/5/2008	308	Ag	N1	1	1	10	7	-17	100	
12/5/2008	309	Ag	N1	1	1	10	7	-17	110	
12/5/2008	310	Ag	N1	1	1	10	7	-17	120	
12/5/2008	311	Ag	N1	1	1	10	7	-17	130	
12/5/2008	312	Ag	N1	1	1	10	7	-17	160	
12/5/2008	313	Ag	N1	1	1	10	7	-17	180	
12/5/2008	314	Ag	N1	1	1	10	7	-17	200	
12/5/2008	315	Ag	N1	1	1	10	7	-17	220	
12/5/2008	316	Ag	N1	1	1	10	7	-17	230	
12/5/2008	317	Ag	N1	1	1	10	7	-17	240	
12/5/2008	318	Ag	N1	1	1	10	7	-17	250	
12/5/2008	319	Ag	N1	1	1	10	7	-18	250	
12/5/2008	320	Ag	N1	1	1	10	7	-19	250	
12/5/2008	321	Ag	N1	1	1	10	7	-20	250	F
12/5/2008	322	Ag	N2	2	1	11	7	-17	250	
12/5/2008	323	Ag	N2	2	1	11	7	-20	50	
12/5/2008	324	Ag	N2	2	1	11	7	-20	75	F
12/5/2008	325	Ag	N3	3	1	12	7	-15	250	
12/5/2008	326	Ag	N3	3	1	12	7	-17	250	CurvePoint1
12/5/2008	327	Ag	N3	3	1	12	7	-20	50	CurvePoint2(40V)
12/5/2008	328	Ag	N4	4	1	13	7	-15	250	
12/5/2008	329	Ag	N4	4	1	13	7	-17	250	CurvePoint1
12/5/2008	330	Ag	N4	4	1	13	7	-20	50	CurvePoint2(40V)
12/5/2008	331	Ag	N5	5	1	14	7	-15	250	
12/5/2008	332	Ag	N5	5	1	14	7	-17	250	
12/5/2008	333	Ag	N5	5	1	14	7	-20	50	F
12/5/2008	334	Ag	N6	6	1	15	7	-20	40	CurvePoint2
12/5/2008	335	Ag	N6	6	1	15	7	-17	250	CurvePoint1
12/5/2008	336	Ag	N7	7	1	16	7	-15	250	
12/5/2008	337	Ag	N7	7	1	16	7	-17	100	
12/5/2008	338	Ag	N7	7	1	16	7	-17	125	
12/5/2008	339	Ag	N7	7	1	16	7	-17	150	
12/5/2008	340	Ag	N7	7	1	16	7	-17	175	
12/5/2008	341	Ag	N7	7	1	16	7	-17	200	
12/5/2008	342	Ag	N7	7	1	16	7	-17	225	
12/5/2008	343	Ag	N7	7	1	16	7	-17	250	
12/5/2008	344	Ag	N7	7	1	16	7	-20	40	
12/5/2008	345	Ag	N7	7	1	16	7	-20	50	
12/5/2008	346	Ag	N7	7	1	16	7	-20	60	
12/5/2008	347	Ag	N7	7	1	16	7	-20	70	F
12/5/2008	348	Ag	N8	8	1	17	7	-17	250	CurvePoint1
12/5/2008	349	Ag	N8	8	1	17	7	-20	40	
12/5/2008	350	Ag	N8	8	1	17	7	-20	50	CurvePoint2
12/5/2008	351	Ag	N9	9	1	18	7	-20	50	CurvePoint2
12/5/2008	352	Ag	N9	9	1	18	7	-17	250	CurvePoint1
12/5/2008	353	Ag	N10	10	1	1	7	-17	250	CurvePoint1
12/5/2008	354	Ag	N10	10	1	1	7	-20	50	CurvePoint2
12/5/2008	355	Ag	N11	11	1	2	7	-20	50	CurvePoint2
12/5/2008	356	Ag	N11	11	1	2	7	-17	250	CurvePoint1
12/5/2008	537	Xe	N12	1	1	3	13	-15	40	
12/5/2008	538	Xe	N12	1	1	3	13	-15	45	
12/5/2008	539	Xe	N12	1	1	3	13	-15	50	CurvePoint1
12/5/2008	540	Xe	N13	2	1	4	13	-15	45	
12/5/2008	541	Xe	N13	2	1	4	13	-15	50	CurvePoint1
12/5/2008	542	Xe	N14	3	1	5	13	-15	45	
12/5/2008	543	Xe	N14	3	1	5	13	-15	50	CurvePoint1



## RadHard MOSFET - G6, Size 6, 250V, N-channel

Expected Good Devices

SEE-Failed Devices

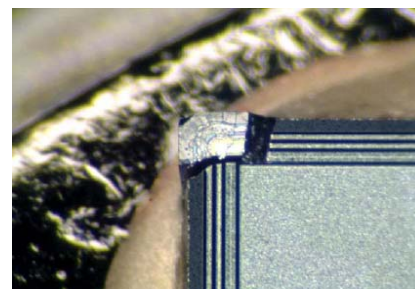
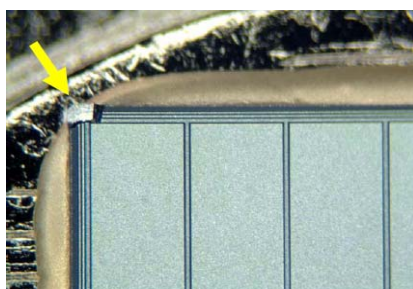
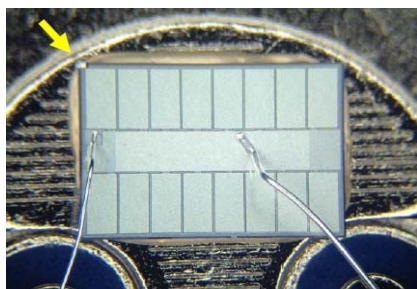
### Post - SEE Electricals Data

SEE-UnTested Devices

Parameter	I DSS	I GSSf	I GSSr	V GS(th)	BV DSS	R DS(on)	VSD		
Conditions	VDS=-200V VGS=0V	VGS=-20V VDS=0V	VGS=20V VDS=0V	IDS=1mA VDS=VGS	IDSS=1mA	ID=31.5A VGS=12V	IS=50A		
Limits	0.999µA Max	-100nA Max	100nA Max	2V to 4V	250V Min	40mOhms	1.2V Max		
Unit	nA	nA	nA	V	V	Ohms	V		
SEE Id	Log Serial	<b>E772755 (TAMU 08-12-2008) IRHC67264</b>						Good	
U1	1	128.30	3.01	1.03	3.564	281.0	46.57	1.474	Pass Xe -10V / 250V
U2	2	116.20	2.92	1.07	3.639	276.7	44.06	1.399	Pass Xe -10V / 250V
U3	3	7.98	2.96	0.32	3.639	279.8	46.66	1.467	Pass Xe -10V / 250V
U4	4	20.20	3.14	1.19	3.637	280.9	46.00	1.464	Pass Xe -15V / 50V
U5	5	999900.00	999900.00	999900.00	3.602	36.8	44.09	1.437	Failed Xe -15V / 50V
U6	6	11.99	2.82	1.01	3.604	270.7	42.53	1.423	Pass Xe -15V / 40V & 50V
U7	7	13.97	14550.00	14590.00	3.563	280.2	44.69	1.407	Failed Au -5V / 100V
U8	8	15.12	17340.00	18780.00	3.587	275.5	44.88	1.440	Failed Au -5V / 100V
U9	9	3.34	3.92	2.82	3.565	272.5	43.39	1.415	Pass Au -5V / 75V
U10	10	3.56	3.25	1.88	3.623	274.2	44.76	1.470	Pass Au -5V / 75V
U11	11	17.97	3.06	1.08	3.622	274.5	44.69	1.464	Pass Au -5V / 75V
U12	12	1.09	2.89	1.14	3.632	280.9	45.68	1.439	Unused

### Failure Analysis on sample U5:

FA6591x1 shows Mechanical Damaged ... due to mis-handling / shipping





## RadHard MOSFET - G6, Size 6, 250V, N-channel

Expected Good Devices

SEE-Failed Devices

### Post - SEE Electricals Data

SEE-UnTested Devices

Parameter	IDSS	IGSSf	IGSSr	VGS(th)	BV DSS	R DS(on)	VSD
Conditions	VDS=-200V VGS=0V	VGS=-20V VDS=0V	VGS=20V VDS=0V	IDS=1mA VDS=VGS	IDSS=1mA	ID=7.8A VGS=12V	IS=12.4A
Limits	10µA Max	-100nA Max	100nA Max	2V to 4V	2V Min	211mOhms	1.2V Max
Unit	nA	nA	nA	V	V	Ohms	V

SEE Id	Log Serial	E772755 (TAMU 12-05-2008) IRHC67264							Good Matched Electricals to SEE
N1	10	451900.00	999900.00	999900.00	3.231	265.4	31.47	0.809	Failed Ag -20V / 250V
N2	11	590600.00	999900.00	999900.00	3.538	272.6	32.65	0.811	Failed Ag -20V / 75V
N3	12	1.76	6.43	3.10	3.600	273.5	32.82	0.813	Pass Ag -17V/250V & -20V/50V
N4	13	1.65	6.23	3.08	3.629	275.1	33.08	0.811	Pass Ag -17V/250V & -20V/50V
N5	14	497100.00	999900.00	999900.00	3.591	273.9	33.32	0.810	Failed Ag -20V / 50V
N6	15	1.56	6.25	3.12	3.560	276.2	33.33	0.810	Pass Ag -17V/250V & -20V/40V
N7	16	659800.00	999900.00	999900.00	3.531	271.7	33.28	0.812	Failed Ag -20V / 70V
N8	18	1.57	6.19	3.14	3.519	273.9	32.92	0.810	Pass Ag -17V/250V & -20V/50V
N9	1	1.46	6.00	3.19	3.535	275.5	33.34	0.810	Pass Ag -17V/250V & -20V/50V
N10	2	1.85	6.05	3.18	3.570	276.5	33.60	0.811	Pass Ag -17V/250V & -20V/50V
N11	3	3.31	6.29	3.12	3.493	283.9	34.73	0.810	Pass Ag -17V/250V & -20V/50V
N12	4	2.88	6.24	3.06	3.522	279.1	33.96	0.810	Pass Xe -15V / 50V
N13	5	2.67	5.98	3.09	3.409	269.2	31.65	0.807	Pass Xe -15V / 50V
N14	0	0.00	0.00	0.00	0.000	0.0	0.00	0.000	Pass Xe -15V / 50V

VGS (Volts)	LET=44±5%; 125µm±10%; 1350MeV±5%	LET=61±5%; 66µm±7.5%; 825MeV±5%	LET=90±5%; 80µm±5%; 1470MeV±5%
0	250	250	75
-5	250	250	75
-10	250	250	
-15	250	50	
-20	40		

### Final QPL Specs

for 2N7593U3/746 (IRHNJ67234)  
for 2N7594T3/755 (IRHYS67234CM)  
for 2N7585U2/760 (IRHNA67264)  
for 2N7586T1/753 (IRHMS67264)

