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To

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Code 311  
From

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7809  
Subject

Radiation Report on JTXV2N6788  
GGS/WIND/WAVES Control No. 5735

Date PPM-92-103

Location March 10, 1992

Telephone GSFC

Location 731-8954

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A radiation evaluation was performed on JTXV2N6788 to determine the total dose tolerance of these parts. A brief summary of the test results is provided below. For detailed information, refer to Tables I through IV and Figure 1.

The total dose testing was performed using a cobalt-60 gamma ray source. During the radiation testing, two parts were irradiated under bias (see Figure 1 for bias configuration), and two parts were used as control samples. The total dose radiation steps were 5, 10, 15 and 20 krads\*. After 20 krads, parts were annealed at +25°C for 168 hours and then at +100°C for 168 hours. The dose rate was between 0.07 and 0.12 krads/hour, depending on the total dose level (see Table II for radiation schedule). After each radiation exposure and annealing treatment, parts were electrically tested according to the test conditions and the specification limits listed in Table III.

All parts passed all tests on irradiation to 10 krads. However, at 15 and 20 krads, both parts failed to meet the minimum specification limit of 2V for VGsth1. No significant recovery was observed after annealing at 25°C for 168 hours. However, both parts recovered to within specification limits after annealing for 168 hours at 100°C. No significant degradation was observed in any other parameters.

Table IV provides a summary of the functional test results in the form of mean and standard deviation values for each parameter initially and after each irradiation exposure and annealing step.

Any further details about this evaluation can be obtained upon request. If you have any questions, please call me at (301) 731-8954.

\*In this report, the term krads means krads (Si).

TABLE I. Part Information

Generic Part Number:	2N6788
GGG/WIND/WAVES Part Number:	JTXV2N6788
GGG/WIND/WAVES Control Number:	5735
Charge Number:	C23420
Manufacturer:	Siliconix
Lot Date Code:	8706
Quantity Tested:	4
Serial Numbers of Radiation Samples:	05, 06
Serial Numbers of Control Samples:	03, 04
Part Function:	N-Channel Power MOSFET
Part Technology:	CMOS
Package Style:	3-lead TO-5 can
Test Engineer:	A. Phung

TABLE II. Radiation Schedule for 2N6788

EVENTS	DATE
1) Initial Electrical Measurements	01/16/92
2) 5 KRAD IRRADIATION (0.11 krad/hour)	02/05/92
POST-5 KRAD ELECTRICAL MEASUREMENT	02/07/92
3) 10 KRAD IRRADIATION (0.07 krad/hour)	02/07/92
POST-10 KRAD ELECTRICAL MEASUREMENT	02/10/92
4) 15 KRAD IRRADIATION (0.12 krad/hour)	02/10/92
POST-15 KRAD ELECTRICAL MEASUREMENT	02/12/92
5) 20 KRAD IRRADIATION (0.12 KRADS/HOUR)	02/12/92
POST-20 KRAD ELECTRICAL MEASUREMENT	02/14/92
6) 168 HOUR ANNEALING @ 25°C	02/14/92
POST-168 HOUR 25°C ANNEAL ELECTRICAL MEASUREMENT	02/21/92
7) 168 HOUR ANNEALING @ 100°C	02/21/92
POST-168 HOUR 100°C ANNEAL ELECTRICAL MEASUREMENT	03/02/92

All parts irradiated under bias (See Fig.1).

All electrical tests performed at 25°C.

Table III. Electrical Characteristics of 2N6788

NO.	PARAMETER	TEST CONDITION	MIN	MAX	UNIT	METHOD
1	$V_{BRdss}$	$I_d = 1 \text{ mA} ; V_{gs} = 0 ; \text{COND. C}$	100		V	3407
2	$V_{gs(th)1}$	$V_{ds} > V_{gs} ; I_d = 0.25 \text{ mA}$	2	4	V	3403
3	$I_{gss1}$	$V_{ds} = 0 ; V_{gs} = \pm 20 \text{ V} ; \text{COND. C}$		+/- 100	nA	3411
4	$I_{dss1}$	$V_{ds} = 80 \text{ V} ; V_{gs} = 0 ; \text{COND. C}$		25	$\mu\text{A}$	3413
5	$R_{ds(on)1}$	$V_{gs} = 10 \text{ V} ; I_d = 3.5 \text{ A} ; \text{PULSED}$		0.30	Ohms	<del>3431</del> 3431
6	$V_{ds(on)}$	$V_{gs} = 10 \text{ V} ; I_d = 6 \text{ A} ; \text{PULSED}$		2.10	V	3405
7	$V_{sd}$	$I_s = 6 \text{ A} ; \text{PULSED}$	0.80	1.80	V	4011
8	$G_{fs}$	$I_d = 3.5 \text{ A} ; \text{PULSED}$	1.50	4.50	S	3475
9	$T_d(on)$	$I_d = 3.5 \text{ A} ; V_{gs} = 10 \text{ V} ; V_{dd} = 35 \text{ V}$		40	nS	3472
10	$T_r$	Gate drive impedance = 7.5 Ohms		70	nS	3472
11	$T_d(off)$	<del>TEST #9, 10, 11, 12 ON THE BENCH</del>		40	nS	3472
12	$T_f$			70	nS	3472

**PULSED:** Pulse width = 800  $\mu\text{S}$   
Duty cycle = 2 %

TABLE IV: Summary of Electrical Measurements After  
Total Dose Exposures and Annealing Steps for 2N6788 1/

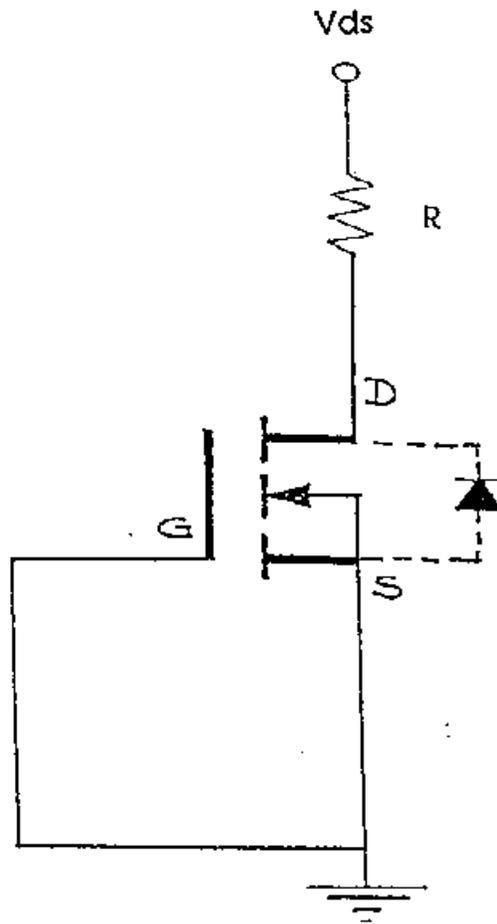
Parameters		Spec. Limits min max		Total Dose Exposure (TDE) (krads)										Anneal		Anneal	
				0 (Pre-Rad.)		5		10		15		20		168 hrs @25°C		168 hrs @+100°C	
				mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
VBDSS	V	100	-	PASS		PASS		PASS		PASS		PASS		PASS		PASS	
VGsth1	V	2	4	2.74	.02	2.43	.02	2.14	.03	1.87	.02	1.64	.03	1.58	.04	2.06	.02
IGSS	nA	0	100	1.05	.07	1.0	0	1.1	.07	1.1	.07	1.1	0	1.4	.07	0.95	.07
IGSSr	nA	0	100	0.5	0	0.55	.07	0.75	.21	0.65	.21	0.65	.21	0.70	.14	0.70	.14
IDSS	uA	0	25	4.37	6.2	4.37	6.2	4.35	6.1	4.38	6.2	4.41	6.2	4.42	6.2	4.38	6.2
RDS on	ohm	0	300	265.7	3.7	263.0	3.8	259	4.2	263.5	6.4	269.6	2.6	270.4	1.8	268.4	3.8
VDS on	V	0.80	2.10	1.61	.01	1.59	.01	1.56	.01	1.59	.02	1.63	0	1.64	.01	1.62	.01
VSD	V	0	1.80	1.52	.21	1.52	.20	1.54	.21	1.51	.20	1.47	.24	1.50	.21	1.53	.20
gfs	mho	1.5	4.5	2.72	.05	2.74	.03	2.73	.07	2.70	.03	2.67	.08	2.64	.03	2.71	.04
Td(on)	ns	-	40	24.5	0.7	24.0	0	26.0	0	23.0	1.4	24.0	0	24.0	0	18.0	0
Tr	ns	-	70	24.0	0	24.0	0	24.0	0	23.5	2.1	23.5	0.7	21.5	2.1	24.0	0
Td(off)	ns	-	40	8.0	0	8.5	0.7	9.5	0.7	9.0	1.4	7.5	0.7	9.5	0.7	10.0	0
Tf	ns	-	70	10.0	0	10.0	0	10.0	0	10.0	0	9.5	0.7	10.0	0	9.0	1.4

Note:

1/ The mean and standard deviation values were calculated over the two parts irradiated in this testing.

The control samples remained constant throughout the testing and are not included in this table.

Figure 1. Radiation Bias Circuit for 2N6788



$R = 10 \text{ Kohm} \pm 5\%$ , @  $1/4 \text{ W}$

$V_{ds} = 80 \text{ V}$

$V_{gs} = 0$