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## Interoffice Memorandum

To  
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Department  
Code 311  
From  
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Department  
7809  
Subject  
Radiation Report on  
ISTP Common Buy Part No. JTXV2N6798

Rad-91-10  
Date  
April 30, 1991  
Location  
GSEC  
Telephone  
731-8954  
Location  
Lanham  
cc  
V. Edson  
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Jim Lohr

A radiation evaluation was performed on JTXV2N6798 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 2.5, 5, 7.5, 10, 20, 30, and 50 krads. After 50, krads, parts were annealed at 25°C for 24 and 168 hours. The dose rate was between 0.1 -1.0 krad/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 2.5 krads. AT 5 krads, parts passed all tests except for timing measurements, which could not be made at all because the parts started drawing heavy current under the test condition for timing measurements (see Table III for more details on electrical measurements). However, at the following radiation steps of 7.5, 10, 15, and 20 krads, parts passed all tests, and stayed well within the specification limits for all parameters.

On continuing irradiation to 30 and 50 krads, parts failed to meet the specification limits for VGStH, VBDSS, and IDSS. No significant recovery was observed on the annealing the parts for 24 and 168 hours at 25°C. Table IV provides the mean and standard deviation values for each parameter after different radiation exposures and annealing treatments.

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

TABLE I. Part Information

Generic Part Number:	2N6798
ISTP Common Buy Part Number:	JTXV2N6798 MIL-S-19500/557B
Manufacturer:	General Electric Corp.
Lot Date Codes:	8942 Requestor Parts 9030 Unisys Parts
Quantity Tested:	4
Serial Numbers of Radiation Samples:	205, 206
Serial Numbers of Control Samples:	201, 202
Part Function:	N-Channel MOSFET
Part Technology:	MOS
Package Style:	TO-39 / <i>TD-205 AF</i>

TABLE II. Radiation Schedule

EVENTS	DATE
1) Initial Electrical Measurements	03/23/91
2) 2.5 krads irradiation @ 125 rads/hr	03/26/91
Post 2.5 krads Electrical Measurements	03/27/91
3) 5.0 krads irradiation @ 125 rads/hr	03/27/91
Post 5.0 krads Electrical Measurements	03/28/91
4) 7.5 krads irradiation @ 83 rads/hr	03/28/91
Post 7.5 krads Electrical Measurements	03/29/91
5) 10 krads irradiation @ 250 rads/hr	03/29/91
Post 10 krads Electrical Measurements	03/30/91
8) 20 krads irradiation @ 250 rads/hr	03/30/91
Post 20 krads Electrical Measurements	04/01/91
9) 30 krads irradiation @ 147 rads/hr	04/02/91
Post 30 krads Electrical Measurements	04/03/91
10) 50 krads irradiation @ 1 krad/hr	04/03/91
Post 50 krads Electrical Measurements	04/04/91
11) 24 hrs annealing	04/04/91
Post 24 hr Electrical Measurements	04/05/91
12) 168 hrs annealing	04/05/91
Post 168 hr Electrical Measurements	04/12/91

## Notes:

- All parts were radiated under bias at the cobalt-60 gamma ray facility at GSFC.
- All electrical measurements were performed off-site at 25°C.
- Annealing performed at 25°C under bias.

TABLE III. Electrical Characteristics of JTX2N6798

TEST #	TEST NAME	TEST CONDITION	MIN	MAX	UNIT	METHO
1	VBR <sub>DSS</sub>	I <sub>D</sub> =1mA; V <sub>GS</sub> =0; COND. C	200		V	341
2	V <sub>GS(th)1</sub>	V <sub>DS</sub> ≥ V <sub>GS</sub> ; I <sub>D</sub> =-25mA	2	4	V	340
3	I <sub>GSS1</sub>	V <sub>GS</sub> =±20V; V <sub>DS</sub> =0; COND. C		±100	nA	341
4	I <sub>DSS1</sub>	V <sub>DS</sub> =160V; V <sub>GS</sub> =0; COND. C		25	μA	341
5	R <sub>DS(on)1</sub>	V <sub>GS</sub> =10V; I <sub>D</sub> =3.5A; COND. A; PULSED*		0.4	Ω	342
6	V <sub>DS(on)</sub>	V <sub>GS</sub> =10V; I <sub>D</sub> =5.5A; COND. A; PULSED*		2.2	V	340
7	V <sub>SD</sub>	V <sub>GS</sub> =0; I <sub>S</sub> =5.5A; PULSED*	0.7	1.4	V	401
8	g <sub>FS</sub>	I <sub>D</sub> =I <sub>D2</sub> =3.5A; PULSED*	2.5	7.5	S	347
9	T <sub>ON</sub>	I <sub>D</sub> =2.75A; V <sub>DD</sub> =100V R <sub>GEN</sub> =15Ω R <sub>GS</sub> =15Ω		30	nS	347
10	T <sub>OFF</sub>	CONDITIONS SAME FOR T <sub>ON</sub>		50	nS	347
11	T <sub>r</sub>			50	nS	347
12	T <sub>f</sub>			40	nS	347

DELTA LIMITS : ΔI<sub>GSS1</sub> = ±20nA OR ±100%;  
 ΔI<sub>DSS1</sub> = ±25μA OR ±100%;  
 ΔR<sub>DS(on)1</sub> = ±20%  
 ΔV<sub>GS(th)1</sub> = ±20%

t<sub>pulse</sub> = 800μS  
 DUTY CYCLE ≤ 2%

TABLE IV: Summary of Electrical Measurements after  
Total Dose Exposures and Annealing for 2N6798

1/

Parameters	Spec. Limits min max	Total Dose Exposure (krads)													
		Initials		2.5		5.0		7.5		10		15			
		mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd		
V <sub>BDSS</sub> V		Pass		Pass		Pass		Pass		Pass		Pass		Pass	
V <sub>GSth</sub> V	2 4	2.9	0.1	2.77	0.1	2.55	0.1	2.53	0.1	2.43	0.1	2.3	0.2		
I <sub>GSS</sub> nA	0 100	1.7	0	1.5	0.2	1.4	0	1.1	0	1.1	0	1.5	0.3		
I <sub>GSSSr</sub> nA	0 100	0.25	0.5	0.4	0.1	0.5	0.1	0.5	0	0.4	0.1	0.25	0.1		
I <sub>DSS</sub> uA	0 25	3.3	0.1	3.2	0.1	4.1	0.1	4.6	0.2	4.1	0	4.8	0.2		
R <sub>DS on</sub> mohms	0 400	261	0.2	260	1.0	261	2	263	6	263	5	257	0.5		
V <sub>DS on</sub> V	0 2.2	1.48	0.1	1.47	0.1	1.48	0.1	1.48	0.5	1.5	0.1	1.45	0.1		
V <sub>SD</sub> V	0.7 1.4	1.15	0	1.17	0	1.17	0	1.18	0.1	1.2	0.1	1.17	0.1		
V <sub>GS th</sub> V	0 15	4.75	0.1	4.65	0	4.54	0	4.45	0	4.38	0	4.26	0		
g <sub>fs</sub> mohm	2.5 7.5	4.74	0.2	4.7	0.1	4.7	0.1	4.65	0	4.7	0.1	4.7	0.1		
T <sub>d on</sub> nsec	- 30	29	0	28.5	2.0	*	*	25.2	2	26.5	2	25	2		
T <sub>d off</sub> nsec	- 50	6	0	6	0	*	*	6	0	6	0	6	0		
T <sub>r</sub> nsec	- 50	9	0	27.5	2	*	*	27	1	24	2	21	2		
T <sub>f</sub> nsec	- 40	2	0	26	1	*	*	27	1	24	1	20	0		

Notes:

1/ The mean and standard deviation values were calculated over the two parts irradiated in the testing. The control samples remained constant throughout the testing and are not included in this table.

\* indicates that timing measurements could not be made due to excessive drain current.

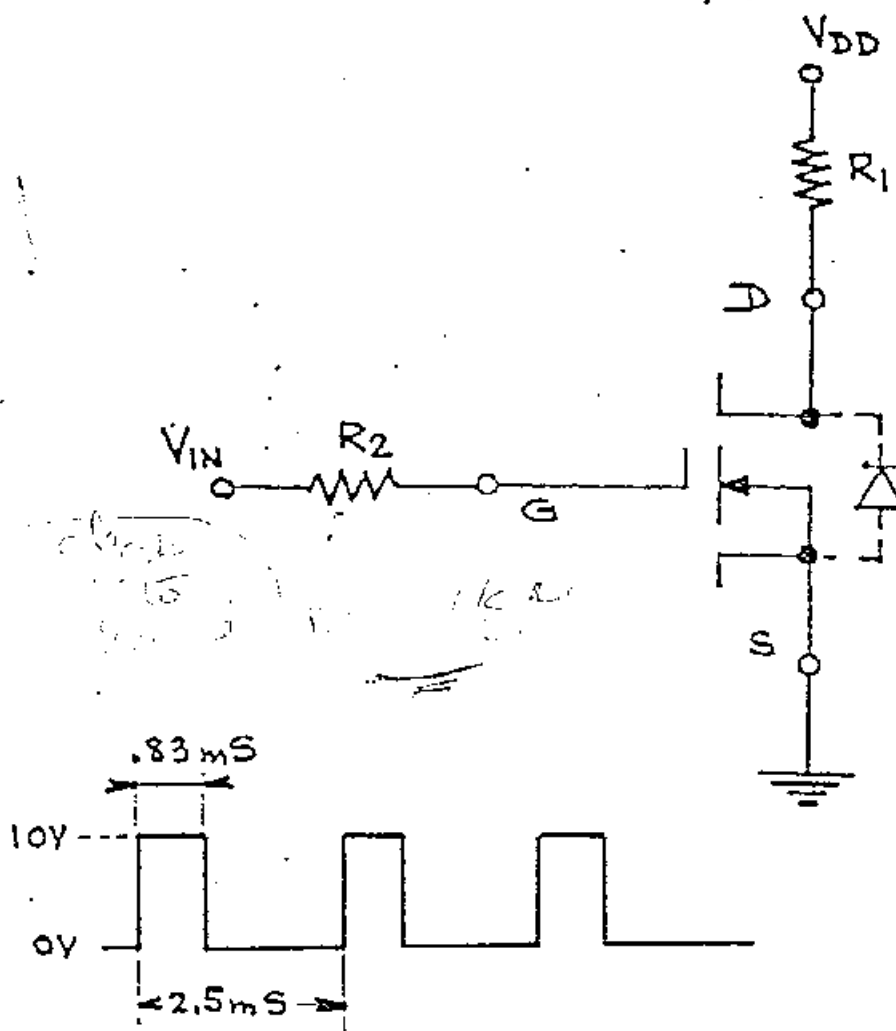
TABLE IV: (continued) 1/

Parameters		Spec. Limits		Initials	Total Dose Exposure (krads)						Annealing				
					20		30		50		24 HRS		168 HRS		
					min	max	mean	sd	mean	sd	mean	sd	mean	sd	mean
VBDSS	V			Pass		Pass		Pass	0	Pass		Pass	0	Pass	
VGSth	V	2	4	2.9	0.1	2.15	0.1	1.67	0.1	1.0	0.1	0.9	0.1	1.0	0.1
IGSS	nA	0	100	1.7	0	1.1	0.1	1.2	0.2	1.2	0.1	1.3	0.1	1.4	0.4
IGSSSr	nA	0	100	0.25	0.5	0.5	0	0.35	0.1	0.55	0.1	0.45	0.1	0.4	0.2
IDSS	uA	0	25	3.3	0.1	5.3	0	9.5	0.2	125	30	120	20	77	0.4
RDS on	mohms	0	400	261	0.2	258	0.3	269	5	274	1	287	6	268	2
VDS on	V	0	2.2	1.48	0.1	1.46	0.1	1.53	0.1	1.55	0	1.61	0.1	1.52	0.1
VSD	V	0.7	1.4	1.15	0	1.17	0.1	1.17	0.1	1.17	0.1	1.22	0.1	1.15	0.1
VGS th	V	0	15	4.75	0.1	4.14	0	1.17	0.1	3.0	0.1	1.25	0.1	3.2	0
gfs	mohm	2.5	7.5	4.74	0.2	4.65	0.1	3.6	0.1	3.76	0.1	3.58	0.2	3.7	0.1
Td on	nsec	-	30	29	0	26	1	29	0	18	2	22	4	22.5	3
Td off	nsec	-	50	6	0	6	0	6	0	7	1	805	1	8	0
Tr	nsec	-	50	9	0	26	0	14	0	29	2	24	1.5	15	7
Tf	nsec	-	40	2	0	20	0	20	0	20	0	20	0	20	0

Notes:

1/ The mean and standard deviation values were calculated over the two parts irradiated in the testing. The control samples remained constant throughout the testing and are not included in this table.

Figure 1. Radiation Bias Circuit for JTX2N6798



$$V_{IN} = 10V @ f = 400Hz \Rightarrow T = 2.5ms$$

$$V_{DD} = 28 \pm 0.5V$$

$$R_1 = 1k\Omega @ 1W$$

$$R_2 = 10k\Omega @ 1/4W$$