PPM - 91-459

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UNISYS

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Interoffice Memorandum

PPM-91-459

To
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Department
Code 300.1
From
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7809
Subject
Radiation Report on ISTP
Non-Common Buy Part No. JTXV4N49

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July 11, 1991
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A radiation evaluation was performed on JTXV4N49 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, eight 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 25, 50, 75, and 100 krads. After 100 krads, parts were annealed at 25°C for 24 and 168 hours (cumulative). Then the parts were further irradiated for 200 and 300 krads. The dose rate was between 1.3 - 5.3 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 (8) parts passed initial electrical measurements. However, after the first radiation exposure of 25 krads, parts failed to meet the minimum specification limit on IC_{ON}. Readings for IC_{ON} ranged from 1.2-1.8 mA against the minimum specification limit of 2mA. However, parts passed all other tests. After 50 krads, parts showed continued degradation in IC_{ON}, and one part (SN 157) also exceeded the maximum specification limit of 0.3V for VCESAT with a reading of 2.05V. After 75 and 100 krads irradiation, VCESAT was measured to be greater than 2.0V on all parts.

No significant recovery was observed on annealing the parts for 24 and 168 hours. On continued irradiation to 200 and 300 krads, parts showed continued degradation in IC_{ON} and VCESAT. In addition two parts failed IC_{OFF} after 200 krads and all parts failed IC_{OFF} after 300 krads. 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 (301) 731-8954.

TABLE I. Part Information

Generic Part Number:	4N49
ISTP Non-Common Buy Part Number:	JTXV4N49
ISTP Non-Common Buy Control Number:	2092A
Charge Number:	C90265
Manufacturer:	TI
Quantity Procured:	39
Lot Date Code:	8843
Quantity Tested:	8
Serial Numbers of Radiation Samples:	153, 154, 155, 156 157, 158, 159, 160
Serial Numbers of Control Samples:	151, 152
Part Function:	Opto-Coupler
Part Technology:	Bipolar
Package Style:	8 Pin Metal Can

TABLE II. Radiation Schedule

EVENTS	DATE
1) Initial Electrical Measurements	06/06/91
2) 25 krads irradiation @ 1470 rads/hr	06/06/91
Post 25 krads Electrical Measurements*	06/10/91
3) 50 krads irradiation @ 1515 rads/hr	06/10/91
Post 50 krads Electrical Measurements	06/11/91
4) 75 krads irradiation @ 1470 rads/hr	06/11/91
Post 75 krads Electrical Measurements	06/12/91
5) 100 krads irradiation @ 1250 rads/hr	06/12/91
Post 100 krads Electrical Measurements	06/13/91
6) 24 hour annealing	06/13/91
Post 24 hr Electrical Measurements	06/14/91
7) 168 hour annealing	06/13/91
Post 168 hr Electrical Measurements	06/20/91
8) 200 krads irradiation @ 5260 rads/hr	06/20/91
Post 200 krads Electrical Measurements	06/21/91
9) 300 krads irradiation @ 1490 rads/hr	06/21/91
Post 300 krads Electrical Measurements	06/24/91

Notes:

1) All parts were radiated under bias at the cobalt-60 gamma ray facility at GSFC.

2) All electrical measurements were performed off-site at 25°C.

3) Annealing performed at 25°C under bias.

* Post 25 krad electrical measurements were scheduled for 06/07/91; however, due to calibration of the test equipment, parts were held under bias until measurements could be made on 06/10/91.

Table III. Electrical Characteristics of JTXV4N49

TEST #	TEST NAME	TEST CONDITION	MIN	MAX	UNIT	METHOD
1	I_R	$V_R = 2V$		100	μA	4016
2	V_{F1}	$I_F = 10mA$	0.8	1.5	V	4011
3	V_{BRCEO}	$I_C = 1mA$; $I_B = 0$; $I_F = 0$	40		V	3011
4	V_{BRCBO}	$I_C = 100\mu A$; $I_F = 0$; $I_E = 0$	45		V	3001
5	V_{BREBO}	$I_E = 100\mu A$; $I_C = 0$; $I_F = 0$	7		V	3026
6	$I_{C(OFF)1}$	$V_{CE} = 20V$; $I_B = 0$; $I_F = 0$		100	nA	3041
7	$I_{CB(OFF)}$	$V_{CB} = 20V$; $I_F = 0$		10	nA	
8	h_{FE}	$V_{CE} = 5V$; $I_C = 10mA$; $I_F = 0$	100			3076
9	$I_{C(ON)1}$	$V_{CE} = 6V$; $I_F = 1mA$	2	10	mA	
10	$I_{CB(ON)}$	$V_{CB} = 5V$; $I_F = 10mA$	30		μA	
	$V_{CE(SAT)}$	$I_C = 2mA$; $I_F = 2mA$		0.3	V	

DELTA LIMITS : $\Delta I_R = 25\mu A$ OR 100%
$\Delta I_{C(OFF)1} = 25nA$ OR 100%
$\Delta h_{FE} = \pm 20\%$
$\Delta I_{C(ON)1} = \pm 25\%$

TABLE IV: Summary of trical Measurements after Total Dose Exposures and Annealing for JTXV4N49 1/, 2/, 3/

				Initials		Total Dose Exposure (krads)								Annealing		Total Dose (krads)			
		Spec. Limits				25		50		75		100		168 hrs		200		300	
Parameters		min	max	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
IR	uA		100	8.8	21.7	8	18.9	8.8	18.9	9.7	20.4	2.1	1.9	7.2	16.4	9.5	17.6	7.4	16.8
VF	V	0.8	1.5	1.2	.01	1.2	.01	1.2	.01	1.2	.01	1.2	.01	1.2	.01	1.2	.01	1.2	.01
VBRCEO	V	40		Pass		Pass		Pass		Pass		Pass		Pass		Pass		Pass	
VBRCBO	V	45		Pass		Pass		Pass		Pass		Pass		Pass		Pass		Pass	
VBREBO	V	7		Pass		Pass		Pass		Pass		Pass		Pass		Pass		Pass	
ICOFF	nA		100	0.43	0.27	3.83	0.91	3.1	0.31	5.86	2.05	6.6	1.8	11.5	11.1	74.6	47.2	449.2	442.8
ICBOFF	nA		10	0.2	0.35	1.10	0.28	2.08	0.21	2.81	.29	2.61	0.34	1.84	0.56	4.96	0.26	5.04	0.77
ICON	mA	2	10	3.23	0.25	1.49	0.18	0.58	0.09	0.36	0.08	0.22	0.05	0.37	0.09	0.11	0.05	0.11	0.06
ICBON	uA	30		104	4	92	4.1	78	3.7	68	3.6	62	3.5	64.4	3.8	42.4	3.7	33.6	3.7
HFE		100		702	28	490	13	371	14	325	13	280	15	327	19	228	24	224	38
VCESAT	V		0.3	0.11	.01	0.13	0.01	0.44	0.65	>2.0	-	>2.0	-	>2.0	-	>2.0	-	>2.0	-

Notes:

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

2/ Statistical data for post 24 hour annealing measurements is not included in Table IV, but is available upon request.

3/ After 75 krads and beyond, VCESAT for all parts was greater than the upper limit (2.0V) of the testing range of the test equipment for this parameter.

Figure 1. Radiation Bias Circuit for JTXV4N49