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(101)

Interoffice Memorandum

To
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Department
Code 300.1
From
K. Sahu ks
Department
7809
Subject
Radiation Report on SMEX
Common Buy Part No. JTXV2N3868
Control No. 1920B

PPM-91-759
Date
December 26, 1991
Location
Lanham
Telephone
731-8954
Location
Lanham
cc
B. Fafaul/311
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A radiation evaluation was performed on JTXV2N3868 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 10, 20, 30, 50, 75 and 100 krads*. After 100 krads, parts were annealed at 25°C for 24 and 168 hours, and then irradiation was continued to 200 and 300 krads (cumulative). The dose rate was between 0.2 - 5.6 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 eight parts passed all tests to 300 krads. Only the hFE tests showed degradation after each radiation exposure. These measurements showed a gradual decrease throughout the radiation testing. At 300 krads, average hFE1 measurements were 40 lower than the pre-irradiation measurements, and the other three hFE tests showed an average drop of 30; however, all parts met the minimum specification limits for these tests. 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.

*In this report, the term "rads" is used as an abbreviation for rads (Si).

TABLE I. Part Information

Generic Part Number:	JTXV2N3868
SMEX Common Buy Part Number:	JTXV2N3868
SMEX Common Buy Control Number:	1920B
Charge Number:	C92043
Manufacturer:	New England Semiconductor
Quantity Procured:	146
Lot Date Code:	9030A
Quantity Tested:	10
Serial Numbers of Radiation Samples:	138, 139, 140, 141 142, 143, 145, 146
Serial Numbers of Control Samples:	131, 137
Part Function:	Switching Transistor
Part Technology:	Bipolar (PNP)
Package Style:	Can
Test Engineer:	Anh Phung

TABLE II. Radiation Schedule

EVENTS	DATE
1) Initial Electrical Measurements	10/29/91
2) 10 krads irradiation @ 500 rads/hr Post 10 krads Electrical Measurements	10/31/91 11/01/91
3) 20 krads irradiation @ 525 rads/hr Post 20 krads Electrical Measurements	11/01/91 11/02/91
4) 30 krads irradiation @ 220 rads/hr Post 30 krads Electrical Measurements	11/02/91 11/04/91
5) 50 krads irradiation @ 1000 rads/hr Post 50 krads Electrical Measurements	11/04/91 11/05/91
6) 75 krads irradiation @ 1250 rads/hr Post 75 krads Electrical Measurements	11/05/91 11/06/91
7) 100 krads irradiation @ 1320 rads/hr Post 100 krads Electrical Measurements	11/06/91 11/07/91
8) 24 hrs annealing at 25°C Post 24 hr Electrical Measurements	11/07/91 11/08/91
9) 168 hrs annealing at 25°C Post 168 hr Electrical Measurements	11/07/91 11/14/91
10) 200 krads irradiation @ 5550 rads/hr Post 200 krads Electrical Measurements	11/14/91 11/15/91
11) 300 krads irradiation @ 5000 rads/hr Post 300 krads Electrical Measurements	11/15/91 11/16/91

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.
- All annealing performed under bias at 25°C.

Table III. Electrical Characteristics of JTXV2N3868

NO.	PARAMETER	TEST CONDITIONS	MIN	MAX	UNIT	METHOD
1	$V_{BR\ CBO}$	$I_C = 100\ \mu A$	60		V	3001
2	$V_{BR\ EBO}$	$I_E = 100\ \mu A$	4		V	3026
3	$V_{BR\ CEO}$	$I_C = 20\ mA$, PULSED *	60		V	3011
4	I_{CEX1}	$V_{EB} = 2V$ $V_{CE} = 60V$		1	μA	3041
5	h_{FE1}	$V_{CE} = 1V$ $I_C = 500\ mA$, PULSED *	35			3076
6	h_{FE2}	$V_{CE} = 2V$ $I_C = 1.5A$, PULSED *	30	150		3076
7	h_{FE3}	$V_{CE} = 3V$ $I_C = 2.5A$, PULSED *	20			3076
8	h_{FE4}	$V_{CE} = 5V$ $I_C = 3A$, PULSED *	20			3076
9	$V_{CE(SAT)1}$	$I_C = 500\ mA$ $I_B = 50\ mA$, PULSED *		0.5	V	3071
10	$V_{CE(SAT)2}$	$I_C = 1.5A$ $I_B = 150\ mA$, PULSED *		0.75	V	3071
11	$V_{CE(SAT)3}$	$I_C = 2.5A$ $I_B = 250\ mA$, PULSED **		1.50	V	3071
12	$V_{BE(SAT)1}$	$I_C = 500\ mA$ $I_B = 50\ mA$, PULSED *		1.00	V	3066
13	$V_{BE(SAT)2}$	$I_C = 1.5A$ $I_B = 150\ mA$, PULSED *	0.90	1.40	V	3066
14	$V_{BE(SAT)3}$	$I_C = 2.5A$ $I_B = 250\ mA$, PULSED **		2.00	V	3066

DELTA DENOTES

$\Delta I_{CEX1} = \pm 200\ nA$ OR $\pm 100\%$, WHICHEVER IS GREATER.

$\Delta h_{FE2} = \pm 15\%$

* $t_{pulse} = 800\ \mu S$, DUTY CYCLE $\leq 2\%$

** $V_{CE(SAT)3}$ & $V_{BE(SAT)3}$ — $t_{pulse} = 1.3\ ms$

TABLE IV: Summary of Electrical Measurements after
Total Dose Exposures and Annealing for JTXV2N3868

1/, 2/

Parameters		Spec. Limits		Pre-Rad	Total Dose Exposure (krads)								Anneal		Total Dose (krads)				
					10		20		50		100		168 hrs		200		300		
					min	max	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean
VRCBO	V	60	-	Pass		Pass		Pass		Pass		Pass		Pass		Pass		Pass	
VBREBO	V	4	-	Pass		Pass		Pass		Pass		Pass		Pass		Pass		Pass	
VBRCEO	V	60	-	Pass		Pass		Pass		Pass		Pass		Pass		Pass		Pass	
ICEX1	nA	-	1000	0.8	0.1	0.4	0.1	0.4	0.1	0.4	0.2	0.3	0.1	0.3	0.2	0.4	0.2	0.7	0.4
hFE1		35	-	95	13	92	10	87	9	79	8	69	5	71	5	61	4	56	4
hFE2		30	150	83	5	79	8	77	8	67	5	60	4	61	4	53	3	49	3
hFE3		20	-	77	8	74	7	71	6	65	4	57	5	58	5	51	3	47	3
hFE4		20	-	76	9	75	7	72	6	65	4	58	4	59	4	51	4	47	3
VCEAT1	V	-	0.5	.18	.01	.19	.01	.19	.01	.19	.01	.20	.01	.20	.01	.20	.01	.21	.01
VCEAT2	V	-	0.75	.45	.01	.45	.01	.46	.01	.47	.01	.48	.01	.48	.01	.49	.01	.50	.01
VCEAT3	V	-	1.5	.90	.07	.87	.03	.89	.02	.93	.03	1.01	.03	1.00	.03	1.11	.03	1.20	.07
VBESAT1	V	-	1.0	.88	.02	.88	.01	.88	.01	.88	.01	.88	.01	.88	.01	.88	.01	.88	.01
VBESAT2	V	0.9	1.4	1.1	.03	1.1	.03	1.1	.03	1.1	.03	1.1	.03	1.1	.03	1.1	.03	1.1	.03
VBESAT3	V	-	2.0	1.4	.02	1.4	.02	1.4	.02	1.4	.02	1.4	.02	1.4	.02	1.4	.02	1.4	.02

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/ This table does not include the following radiation steps: 30 krads, 75 krads and 24-hour annealing. This data is available and can be obtained upon request.

Figure 1. Radiation Bias Circuit for JTXV2N3868

