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Interoffice Memorandum

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Date

March 29, 1991

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Subject

Radiation Report on SG1524B

SMEX Common Buy Part No. 5962-8764501EA

A radiation evaluation was performed on SG1524B 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 5, 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 0.1 - 5.0 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 all tests on irradiation up to 100 krads and annealing for 24 and 168 hours. At 200 krads, four parts (SNs 202, 203, 205, 208) failed VOUT Emitter tests with SN 208 also failing VSAT B (IC = 10mA). At 300 krads, the above four parts in addition to SN 206 failed VOUT Emitter 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 731-8954.

TABLE I. Part Information

Generic Part Number:	SG1524B
SMEX Common Buy Part Number:	5962-8764501EA
SMEX Common Buy Control Number:	1690
Manufacturer:	Silicon General
Quantity Procured:	170
Lot Date Code:	9024
Quantity Tested:	10
Serial Numbers of Radiation Samples:	202, 203, 204, 205 206, 207, 208, 209
Serial Numbers of Control Samples:	200, 201
Part Function:	Pulse Width Modulator
Part Technology:	Bipolar
Package Style:	16-Pin DIP

TABLE II. Radiation Schedule

EVENTS	DATE
1) Initial Electrical Measurements	02/11/91
2) 5 krads irradiation	02/11/91
Post 5 krads Electrical Measurements	02/12/91
3) 10 krads irradiation	02/12/91
Post 10 krads Electrical Measurements	02/13/91
4) 20 krads irradiation	02/13/91
Post 20 krads Electrical Measurements	02/14/91
5) 30 krads irradiation	02/14/91
Post 30 krads Electrical Measurements	02/15/91
6) 50 krads irradiation	02/15/91
Post 50 krads Electrical Measurements	02/19/91
7) 75 krads irradiation	02/19/91
Post 75 krads Electrical Measurements	02/20/91
8) 100 krads irradiation	02/20/91
Post 100 krads Electrical Measurements	02/21/91
9) 24 hrs annealing	02/21/91
Post 24 hr Electrical Measurements	02/22/91
10) 168 hrs annealing	02/21/91
Post 168 hr Electrical Measurements	02/28/91
11) 200 krads irradiation	02/28/91
Post 200 krads Electrical Measurements	03/01/91
12) 300 krads irradiation	03/01/91
Post 300 krads Electrical Measurements	03/02/91

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 was performed at 25°C under bias.

TABLE III. Electrical Characteristics of SG1524B *

TEST NAME =====	MIN ===	MAX ===
TOTAL STANDBY CURRENT	3.00MA	12.00MA
ERROR AMP VIO	-5.00MV	5.00MV
ERROR AMP +IBIAS	-5.00UA	5.00UA
ERROR AMP -IBIAS	-5.00UA	5.00UA
ERROR AMP - IIO	-1.00UA	1.00UA
ERROR AMP VOL	0.00V	0.50V
ERROR AMP VOH	3.80V	6.00V
ERROR AMP CMR	70.00dB	1000.00dB
ERROR AMP AVS	60.00dB	1000.00dB
VREF OUTPUT VOLTAGE	4.95V	5.05V
VREF LINE REGULATION	-20.00MV	20.00MV
VREF LOAD REGULATION	-30.00MV	30.00MV
VREF SHORT CIRCUIT CURRENT	-120.00MA	-25.00MA
OSC MAX FREQUENCY	0.00KHZ	400.00KHZ
OSC FREQ VOLTAGE STABILITY	0.00%	1.00%
OSC OUTPUT AMPLITUDE	3.00V	6.00V
OSC OUTPUT PULSE WIDTH	0.20US	1.20US
DUTY CYCLE MIN A OUT	0.00%	0.00%
DUTY CYCLE MIN B OUT	0.00%	0.00%
DUTY CYCLE MAX A OUT	45.00%	49.00%
DUTY CYCLE MAX B OUT	45.00%	49.00%
COMP THRESH ZERO DUTY CYCLE	0.00V	1.50V
COMP THRESH MAX DUTY CYCLE	3.00V	5.00V
VCE A OUT	40.00V	110.00V
VCE B OUT	40.00V	110.00V
ILEAK A OUT	-0.01UA	50.00UA
ILEAK B OUT	-0.01UA	50.00UA
VSAT A OUT (10MA)	0.00V	0.40V
VSAT B OUT (10MA)	0.00V	0.40V
VSAT A OUT (100MA)	0.00V	2.00V
VSAT B OUT (100MA)	0.00V	2.00V
VOUT EMITTER A	17.50V	30.00V
VOUT EMITTER B	17.50V	30.00V
RISE TIME A OUT	0.00US	0.40US
RISE TIME B OUT	0.00US	0.40US
FALL TIME A OUT	0.00US	0.20US
FALL TIME B OUT	0.00US	0.20US
SHUTDOWN SENSE VOLTAGE	180.00MV	220.00MV
SHUTDOWN THRESHOLD	0.60V	5.00V

* SMD 5962-87645 specifies the test conditions.

TABLE IV: Summary of Electrical Measurements
after Total Dose Exposures and Annealing for SG1524B
1/, 2/, 3/

Parameters	mA	min	max	Spec. Limits	Initials	Total Dose Exposure (krads)												Total Dose (krads)						
						10			20			50			100			168 hrs		200		300		
						mean	sd		mean	sd		mean	sd		mean	sd		mean	sd	mean	sd	mean	sd	
Istandby		3	12		9.9	0.1	9.9	0.1	9.9	0.3	9.5	0.3	9.7	0.2	9.6	0.2	9.6	0.2	9.7	0.3	9.4	0.2	9.4	0.2
Error Amp VIO	mV	-5	5		-1.8	0.4	-1.7	0.5	-2.1	0.7	-2.0	0.8	-1.8	0.4	-1.8	0.4	-1.7	0.4	-1.7	0.4	-1.4	0.8	-0.8	1.0
"	+IBIAS	uA	5	5	-0.8	0.3	-1.1	0.2	-0.7	0.6	-1.0	0.5	-0.9	0.2	-0.9	0.2	-1.0	0.3	-1.0	0.3	-0.5	1.0	-1.3	0.2
"	-IIO	uA	1	1	0.1	0.3	-0.2	0.4	-0.4	0.3	-0.1	0.3	0.1	0.8	0.1	0.8	-0.2	0.5	-0.2	0.5	-0.4	0.3	0.2	0.5
"	CMR	dB	70	1000	101	8	94	6	93	6	102	8	104	7	104	7	102	7	102	7	99	7	95	3
"	AVS	dB	60	1000	71	1	71	1	70	1	69	1	70	1	70	1	69	1	69	1	68	2	69	2
VO vref	V	4.95	5.05		5.00	.02	5.00	.02	5.00	.02	5.01	.02	4.99	.01	4.99	.01	5.00	.02	5.00	.02	5.00	.01	5.00	.01
Line reg vref	mV	-20	20		-1.9	0.1	-1.7	0.2	-1.9	0.1	-1.8	0.1	-1.8	0.2	-1.8	0.2	-1.8	0.2	-1.8	0.2	-1.7	0.1	-1.7	0.1
Load reg vref	mV	-30	30		6.2	2.0	7.1	1.5	7.2	1.3	6.7	0.5	7.3	0.4	7.3	0.4	8.1	1.0	8.1	1.0	6.5	1.0	7.8	0.3
Isc vref	mA	-120	-25		-68	2	-68	2	-67	2	-68	2	-67	2	-67	2	-68	3	-68	3	-67	1	-66	2
Fmax osc	kHz	0	400		356	5	355	4	353	5	357	4	351	6	351	6	353	5	353	5	357	4	355	5
F.Stab osc	%	0	1.0		.03	.02	.06	.03	.04	.03	.04	.03	.03	.02	.03	.02	.06	.02	.06	.02	.04	.01	.03	.01
Osc Amplitude	V	3.0	6.0		3.9	0	3.9	0	3.9	0.1	3.9	0.1	3.9	0	3.9	0	3.9	0	3.9	0	3.9	0	3.9	0
"	Pulse Width	us	0.2	1.2	0.86	.05	0.86	.05	0.86	.05	0.85	.05	0.90	.05	0.90	.05	0.87	.05	0.87	.05	0.89	.05	0.87	.05
Dut.Cyc (Amin)	%	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dut.Cyc (Amax)	%	45	49		47.4	0.2	47.4	0.2	47.3	0.2	47.3	0.2	47.2	0.1	47.2	0.1	47.3	0.2	47.3	0.2	47.3	0.2	47.4	0.2

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TABLE IV. (continued)

Parameters	Spec. Limits min max	Initials	Total Dose Exposure (krads)																				
			10			20			50			100			168 hrs			200			300		
			mean	sd		mean	sd		mean	sd		mean	sd		mean	sd		mean	sd		mean	sd	
COMP 0 DUT	V 0 1.5	0.9	0.1	0.9	0	0.9	0	0.9	0	0.9	0	0.9	0.1	0.9	0	0.9	0	0.9	0	0.9	0	0.9	0
" max	V 3.0 5.0	3.55	0	3.55	0	3.55	0	3.55	0	3.55	0	3.55	0	3.55	0	3.55	0	3.55	0	3.55	0	3.55	0
VCE A OUT	V 40 110	49.5	0	49.5	0	49.5	0	49.5	0	49.5	0	49.5	0	49.5	0	49.5	0.1	49.6	0.1	49.6	0.1	49.6	0.1
I LEAK A OUT	uA .01 50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VSAT1 A OUT	V 0 0.4	0.32	.03	0.36	.04	0.37	.03	0.37	.03	0.37	.03	0.37	.03	0.38	.04	0.38	0.85	0.86	1.35	0.86	1.34	0.86	1.34
VSAT2 A OUT	V 0 2.0	1.2	0.2	1.2	0.3	1.2	0.2	1.3	0.2	1.3	0.2	1.4	0.3	1.3	0.2	1.3	0.1	1.3	0.1	1.3	0.2	1.3	0.2
VOUT Emit A	V 17.5 30.0	18.9	0.2	18.8	0.3	18.6	0.5	18.9	0.2	18.9	0.2	18.5	0.4	18.4	0.5	17.2	2.2	11.4	6.3	11.4	6.3	11.4	6.3
VOUT Emit B	V 17.5 30.0	18.7	0.5	18.8	0.1	18.9	0.2	18.5	0.4	18.6	0.4	18.6	0.4	18.5	0.5	13.7	5.8	12.9	5.3	12.9	5.3	12.9	5.3
TR A	us 0 0.4	0.16	0	0.16	0	0.16	0	0.16	0	0.16	0	0.16	0	0.16	0	0.16	0	0.16	0	0.16	0	0.16	0
TF A	us 0 0.2	0	0	0	0	0	0	0	0	0	0	0	0	0.01	.01	.01	0	.01	0	.01	0	.01	0
Shtdown sense	mV 180 220	194	2	193	2	194	3	194	2	194	2	194	2	193	2	195	2	194	3	194	3	194	3
Shut Thres.	V 0.6 5.0	2.6	0	2.6	0	2.6	0	2.6	0	2.6	0	2.6	0	2.6	0	2.6	0	2.6	0	2.6	0	2.6	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/ Table IV provides radiation characteristics of parts at selected total dose exposures and annealing treatments. The data at other radiation exposures and annealing treatments is available and can be obtained upon request.

3/ Radiation characteristics on those parameters not included in Table IV were similar to the radiation characteristics of the corresponding tests shown in Table IV (eg. ILEAK B OUT had similar radiation characteristics to ILEAK A OUT).

Figure 1. Radiation Bias Circuit for SG1524B

