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Interoffice Memorandum

To
T. Miccolis
Department
Code 300.1
From
K. Sahu KS
Department
7809
Subject
Radiation Report on SMEX
Common Buy Part No. MTO2815T/ES

PPM-91-438
Date
July 1, 1991
Location
Lanham
Telephone
731-8954
Location
Lanham
cc
B. Fafaul/311
J. Denis/311
V. Edson
S. Esmacher
A. Casasnovas
M. Fowler
A. Moor

A radiation evaluation was performed on MTO2815T/ES 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, 15, 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 up to 50 krads. After 75 krads, two parts (SNs 1544 and 1561) failed the input current test (I_{in}) with readings of 34.8mA and 30.7mA against the maximum specification limit of 30mA; however, all parts continued to pass all other tests. After 100 krads exposure, all parts failed I_{in} with readings ranging from 37mA to 79mA. Some recovery was observed upon annealing the parts for 24 and 168 hours, but all parts continued to fail I_{in} while passing all other tests. After 200 krads exposure, continued degradation in I_{in} was observed. Although three parts were no longer functional after 300 krads, a general decrease of I_{in} was observed in the remaining five functioning parts; however, some parts failed the ripple output voltage test (VOR). 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:	MTO2815T/ES
SMEX Common Buy Part Number:	MTO2815T/ES
SMEX Common Buy Control Number:	2290A
Manufacturer:	Interpoint
Quantity Procured:	25
Lot Date Code:	9107
Quantity Tested:	10
Serial Numbers of Radiation Samples:	1543, 1544, 1547, 1550, 1552, 1554, 1556, 1561
Serial Numbers of Control Samples:	1534, 1538
Part Function:	DC/DC Converter
Part Technology:	Hybrid
Package Style:	Non-Standard 10 Pin DIP CAN

TABLE II. Radiation Schedule

EVENTS	DATE
1) Initial Electrical Measurements	03/26/91
2) 5 krads irradiation @ 250 rads/hr	03/27/91
Post 5 krads Electrical Measurements	03/28/91
3) 10 krads irradiation @ 250 rads/hr	03/28/91
Post 10 krads Electrical Measurements	03/29/91
4) 15 krads irradiation @ 250 rads/hr	03/29/91
Post 15 krads Electrical Measurements	03/30/91
5) 20 krads irradiation @ 114 rads/hr	03/30/91
Post 20 krads Electrical Measurements	04/01/91
6) 30 krads irradiation @ 500 rads/hr	04/01/91
Post 30 krads Electrical Measurements	04/02/91
7) 50 krads irradiation @ 1000 rads/hr	04/02/91
Post 50 krads Electrical Measurements	04/03/91
8) 75 krads irradiation @ 1250 rads/hr	04/03/91
Post 75 krads Electrical Measurements	04/04/91
9) 100 krads irradiation @ 1250 rads/hr	04/04/91
Post 100 krads Electrical Measurements	04/05/91
10) 24 hrs annealing	04/05/91
Post 24 hr Electrical Measurements	04/06/91
11) 168 hrs annealing	04/05/91
Post 168 hr Electrical Measurements	04/12/91
12) 200 krads irradiation @ 5000 rads/hr	04/18/91
Post 200 krads Electrical Measurements	04/19/91
13) 300 krads irradiation @ 5000 rads/hr	04/19/91
Post 300 krads Electrical Measurements	04/20/91

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 MTO2815T/ES

TEST NAME =====	TEST CONDITIONS =====	LIMITS =====
Input current	Vin= 28V, No load	< 30mA
Output Voltage	Vin= 28V, P=15W	+5V > 4.95V < 5.05V Dual > 14.85V < 15.15V
Output Current (see note 4)	Vin= 28V, P=15W	+5V > 60mA < 2.1A Dual > 15mA < 168mA
Output Power (see note 4)	Vin= 28V	+5V > 0W < 10.2W Dual > 0W < 2.55W
Efficiency	Po = 15W	> 76%
Line Regulation	Vin=16V to 36V P=15W	+5V < 0.2% Dual < 0.4%
Load Regulation	Vin=28V Load= min to max	+5V < 0.4% Dual < 0.4%
Output ripple Voltage	Vin=28V P=15W	+5V < 80mV p-p Dual < 30mV p-p
Input Ripple Voltage	Vin =28V P=15W	+5V < 50mV p-p Dual < 50mV p-p
I/O isolation	V=500VDC Test point pin#3&10	< 10 Mohms

COMMENTS AND EXCEPTIONS :

- 1 - Input Voltage performed Go/NoGo throughout the test.
- 2 - Output temp. coefficient shall be calculated after final electrical measurement at -55°C and +85°C.

$$\text{Output temp. coeff} = \frac{V_{out}(t2) - V_{out}(t1) * 100 * (t2 - t1)}{V_{out}(t1)}$$

- 3 - Output Ripple Voltage, Input Ripple Current and I/O Isolation data shall be taken manually.
- 4 - Due to fixed resistors are used for output loadings, the output current limits therefore are entered as 2.1A for +5V and 168mA for Dual Outputs. Additional Power output calculations are also included for evaluation purpose. The minimum load for +5V output is 5V/76 ohms = 65.7mA, and for +/-15V is 15V/1Kohms = 15mA.

TABLE IV: Summary of Electrical Measurements
after Total Dose Exposures and Annealing for MTO2815T/ES

1/, 2/, 3/

Parameters	Spec. Limits min max	Initials		Total Dose Exposure (krads)											
				10		20		30		50		75		100	
		mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
Iin mA	- 30	23.0	2.0	23.6	0.5	23.8	0.3	22.9	0.7	24.9	0.6	27.3	2.0	63.4	9.0
Vo @5V V	4.95 5.05	5.00	0	5.00	0	4.99	.004	5.00	.003	5.00	0	4.98	.003	4.98	.003
Vo @-15V V	14.85 15.15	-15.03	.01	-15.02	.01	-15.02	.01	-15.01	.01	-15.01	.01	-14.99	.01	-14.97	.01
Vo @15V V	14.85 15.15	15.01	.01	15.00	.01	15.00	.01	15.00	.01	14.99	.01	14.97	.01	14.95	.01
Io @5V A	.06 2.1	2.00	0	2.00	0	2.00	.003	1.99	.003	2.00	.004	1.99	.003	1.99	.003
Io @-15V A	.015 .168	-.167	0	-.167	0	-.167	0	-.167	0	-.167	0	-.167	0	-.166	0
Io @15V A	.015 .168	.167	0	.167	0	.167	0	.167	0	.166	0	.166	0	.166	0
Po @5V W	0 10.2	10.0	.01	9.98	.01	9.97	.01	9.98	.01	9.97	.01	9.93	.01	9.90	.02
Po @-15V W	0 2.55	2.51	.005	2.51	0	2.50	0	2.50	0	2.51	0	2.50	0	2.49	0
Po @15V W	0 2.55	2.50	.005	2.50	.003	2.50	0	2.50	0	2.50	0	2.49	0	2.48	0
Efficiency %	76 200	82	0.5	82	0.2	82	0.4	82	0.3	81	0.3	84	3	79	0.7
Line Rg @5V %	-0.2 0.2	-.01	.005	-.01	.003	-.01	.003	-.01	.003	-.01	.003	-.01	.01	0	.01
" Rg @-15V %	-0.4 0.4	.04	.01	.07	.01	.06	.01	.04	.07	.03	.02	.03	.02	-.03	.02
" Rg @15V %	-0.4 0.4	.04	.01	.08	.02	.07	.02	.05	.02	.04	.02	.03	.02	-.04	.02
Load Rg @5V %	-0.4 0.4	.16	.01	.17	.01	.18	.01	.17	.01	.18	.01	.19	.01	.19	.01
" Rg @-15V %	-0.4 0.4	-.07	.03	-0.12	.04	-.08	.04	-.09	.03	-0.10	.03	-.09	.02	-.08	.03
" Rg @15V %	-0.4 0.4	.02	.04	.05	.05	.01	.04	.03	.04	.03	.04	.02	.02	.04	.02
VOR @5V mV	- 80	36	2	35	2	34	2	32	3	34	2	33	2	35	2
VOR @-15V mV	- 30	11	1	11	2	10	0	10	0	10	0	10	0	10	0
VOR @15V mV	- 30	11	1	11	2	10	0	10	0	10	0	10	0	10	0
I/O Iso P/F		Pass		Pass		Pass		Pass		Pass		Pass		Pass	

<Table IV continued on next page>

TABLE IV. (continued)

Parameters		Spec. Limits min max		Initials mean sd		Annealing				Total Dose (krads)			
						24 hrs		168 hrs		200		300	
						mean	sd	mean	sd	mean	sd	mean	sd
I _{in}	mA	-	30	23.0	2.0	48.5	5.0	44.7	5.0	69.3	4.8	51.1	5.2
V _o @5V	V	4.95	5.05	5.00	0	4.98	.003	4.98	.003	4.98	.006	4.99	.004
V _o @-15V	V	14.85	15.15	-15.03	.01	-14.98	.01	-14.99	.01	-14.95	.04	-14.99	.02
V _o @15V	V	14.85	15.15	15.01	.01	14.96	.01	14.97	.01	14.93	.04	14.97	.02
I _o @5V	A	.06	2.1	2.00	0	1.99	.003	1.99	.003	2.00	.003	2.00	0
I _o @-15V	A	.015	.168	-.167	0	-.167	0	-.167	0	-.166	0	-.167	0
I _o @15V	A	.015	.168	.167	0	.166	0	.166	0	.166	0	.166	0
P _o @5V	W	0	10.2	10.0	.01	9.93	.02	9.95	.02	9.92	.03	9.97	.02
P _o @-15V	W	0	2.55	2.51	.005	2.50	0	2.50	0	2.49	.01	2.50	.01
P _o @15V	W	0	2.55	2.50	.005	2.49	0	2.49	0	2.47	.01	2.49	.01
Efficiency	%	76	200	82	0.5	80	0.3	80	0.3	79	0.4	79	0.5
Line R _g @5V	%	-0.2	0.2	-.01	.005	-.01	.01	-.01	.01	.03	.01	.01	.01
" R _g @-15V	%	-0.4	0.4	.04	.01	-.02	.02	.02	.02	-.03	.01	-.02	.01
" R _g @15V	%	-0.4	0.4	.04	.01	-.03	.02	-.05	.02	-.03	.01	-.04	.03
Load R _g @5V	%	-0.4	0.4	.16	.01	.18	.01	.19	.01	.20	.02	.21	.02
" R _g @-15V	%	-0.4	0.4	-.07	.03	-.08	.03	-.07	.03	-.05	.03	-.06	.02
" R _g @15V	%	-0.4	0.4	.02	.04	.06	.02	.05	.02	.06	.02	.07	.03
VOR @5V	mV	-	80	36	2	34	2	34	2	32	3	188	80
VOR @-15V	mV	-	30	11	1	10	0	10	0	10	0	102	70
VOR @15V	mV	-	30	11	1	10	0	10	0	9.8	0.5	95	70
I/O Iso	P/F			Pass		Pass		Pass		Pass		Pass	

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/ Three of the eight irradiated parts failed to function after 300 krads. Thus, the post 300 krad statistical data was calculated over the five functioning parts.
- 3/ Post 5 and 15 krad electrical measurement data is not included in Table IV, but is available upon request.

Figure 1. Radiation Bias Circuit for MTO2815T/ES

