



DATE: December 28, 1993
TO: S. Pszcolka/311.1
FROM: K. Sahu/300.1
SUBJECT: Radiation Report on ISTEP/SOHO/CELIAS
Part No. MP7628SD/883 (MP7628)
Control No. 8708

PPM-93-108

cc: A. Sharma/311
Library/300.1

A radiation evaluation was performed on MP7628 (Quad 8-bit D/A Converter) 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 one part was used as a control sample. The total dose radiation levels were 2, 5, 10, 15, 20 and 50 krads*. The dose rate was between 0.10 and 1.58 krads/hour, depending on the total dose level (see Table II for radiation schedule). After the 50 krad irradiation, parts were annealed at 25°C for 168 hours, after which the parts were annealed at 100°C for 168 hours. 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 initial electrical measurements. Both irradiated parts passed all parametric tests throughout all irradiation and annealing steps. No significant changes in any parameter were observed through the testing.

Table IV provides a summary of the functional test results, as well as the mean and standard deviation values for each parameter after different irradiation exposures and annealing steps.

Any further details about this evaluation can be obtained upon request. If you have any questions, please call me at (301) 731-8954.

*The term rads, as used in this document, means rads(silicon). All radiation levels cited are cumulative.

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TABLE I. Part Information

Generic Part Number:	MP7628
ISTP/SOHO/CELIAS Part Number:	MP7628SD/883
ISTP/SOHO/CELIAS Control Number:	8708
Charge Number:	C33660
Manufacturer:	Micro Power Systems
Lot Date Code:	8848
Quantity Tested:	3
Serial Number of Control Sample:	50
Serial Numbers of Radiation Samples:	51, 52
Part Function:	Quad 8-bit D/A Converter
Part Technology:	CMOS
Package Style:	24-pin DIP
Test Equipment:	Teradyne A540
Test Engineer:	C. Nguyen

TABLE II. Radiation Schedule for MP/628

EVENTS	DATE
1) INITIAL ELECTRICAL MEASUREMENTS	10/15/93
2) 2 KRAD IRRADIATION (0.10 KRADS/HOUR) POST-2 KRAD ELECTRICAL MEASUREMENT	10/18/93 10/19/93
3) 5 KRAD IRRADIATION (0.15 KRADS/HOUR) POST-5 KRAD ELECTRICAL MEASUREMENT	10/19/93 10/20/93
4) 10 KRAD IRRADIATION (0.25 KRADS/HOUR) POST-10 KRAD ELECTRICAL MEASUREMENT	10/20/93 10/25/93
5) 15 KRAD IRRADIATION (0.25 KRADS/HOUR) POST-15 KRAD ELECTRICAL MEASUREMENT	10/25/93 10/26/93
6) 20 KRAD IRRADIATION (0.26 KRADS/HOUR) POST-20 KRAD ELECTRICAL MEASUREMENT	10/26/93 10/27/93
7) 50 KRAD IRRADIATION (1.58 KRADS/HOUR) POST-50 KRAD ELECTRICAL MEASUREMENT	10/27/93 10/28/93
8) 168-HOUR ANNEALING @25°C POST-168 HOUR ANNEAL ELECTRICAL MEASUREMENT	10/28/93 11/05/93
9) 168-HOUR ANNEALING @100°C** POST-168 HOUR ANNEAL ELECTRICAL MEASUREMENT	11/05/93 11/15/93

PARTS WERE IRRADIATED AND ANNEALED UNDER BIAS; SEE FIGURE 1.

*High temperature annealing is performed to accelerate long term time dependent effects (TDE), namely, the "rebound" effect due to the growth of interface states after the radiation exposure. For more information on the need to perform this test, refer to MIL-STD-8830, Method 1019, Para. 3.10.1.

Table III. Electrical Characteristics of MP7628

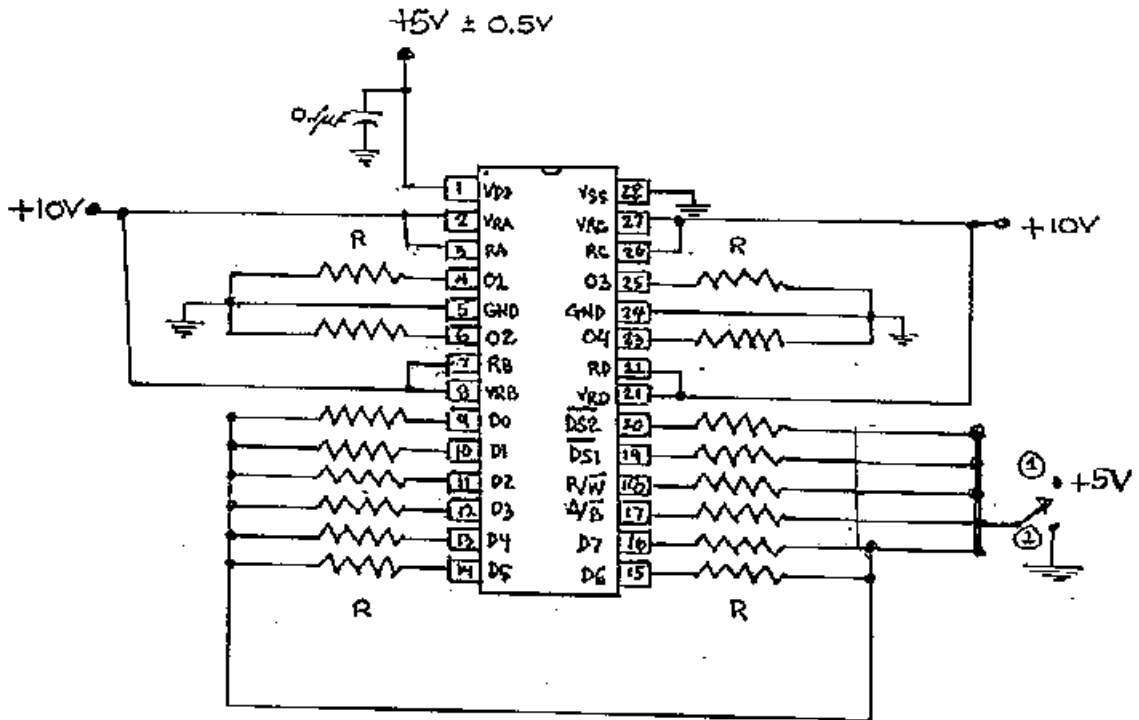
	min limit	max limit	Test Name and Conditions
Vcc = 5v Vref = +10v			
unless otherwise specified			
\$1		< 50ua	"IDD"
\$2	> -1.0ua	< 1.0ua	"Ii1 B8 0.8v"
\$3	> -1.0ua	< 1.0ua	"Ii1 B7 0.8v"
\$4	> -1.0ua	< 1.0ua	"Ii1 B6 0.8v"
\$5	> -1.0ua	< 1.0ua	"Ii1 B5 0.8v"
\$6	> -1.0ua	< 1.0ua	"Ii1 B4 0.8v"
\$7	> -1.0ua	< 1.0ua	"Ii1 B3 0.8v"
\$8	> -1.0ua	< 1.0ua	"Ii1 B2 0.8v"
\$9	> -1.0ua	< 1.0ua	"Ii1 B1 0.8v"
\$10	> -1.0ua	< 1.0ua	"Ii1 DS2 0.8v"
\$11	> -1.0ua	< 1.0ua	"Ii1 DS1 0.8v"
\$12	> -1.0ua	< 1.0ua	"Ii1 R_W 0.8v"
\$13	> -1.0ua	< 1.0ua	"Ii1 A_B 0.8v"
\$14	> -1.0ua	< 1.0ua	"Iih B8 2.4v"
\$15	> -1.0ua	< 1.0ua	"Iih B7 2.4v"
\$16	> -1.0ua	< 1.0ua	"Iih B6 2.4v"
\$17	> -1.0ua	< 1.0ua	"Iih B5 2.4v"
\$18	> -1.0ua	< 1.0ua	"Iih B4 2.4v"
\$19	> -1.0ua	< 1.0ua	"Iih B3 2.4v"
\$20	> -1.0ua	< 1.0ua	"Iih B2 2.4v"
\$21	> -1.0ua	< 1.0ua	"Iih B1 2.4v"
\$22	> -1.0ua	< 1.0ua	"Iih DS2 2.4v"
\$23	> -1.0ua	< 1.0ua	"Iih DS1 2.4v"
\$24	> -1.0ua	< 1.0ua	"Iih R_W 2.4v"
\$25	> -1.0ua	< 1.0ua	"Iih A_B 2.4v"
\$26	> -0.0196	< 0.0196	"Accuracy DAC A"
\$27	> -0.0196	< 0.0196	"Diff Lin. DAC A"
\$28	> -0.0196	< 0.0196	"Accuracy DAC B"
\$29	> -0.0196	< 0.0196	"Diff Lin. DAC B"
\$30	> -0.0196	< 0.0196	"Accuracy DAC C"
\$31	> -0.0196	< 0.0196	"Diff Lin. DAC C"
\$32	> -0.0196	< 0.0196	"Accuracy DAC D"
\$33	> -0.0196	< 0.0196	"Diff Lin. DAC D"

TABLE IV: Summary of Electrical Measurements after Total Dose Exposures and Annealing for MP7628 /1

Parameters	min	max	Total Dose Exposure (krads)												Annealing						
			Initials		2		5		10		15		20		50		168 hrs @100°C		2.1		
			mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean
IDP	15.5	2.1	13.5	2.1	12.5	2.1	12.5	2.1	12.5	2.1	12.5	2.1	12.5	2.1	11.5	2.1	11.5	2.1	2.1	1.3	2.6
Iil B8	-1.0	1.0	0.05	.21	0	.14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iil B7	-1.0	1.0	0	.14	0	.05	.07	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iil B6	-1.0	1.0	0	.14	0	.14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iil B5	-1.0	1.0	0.05	.07	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iil B4	-1.0	1.0	0.05	.07	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iil B3	-1.0	1.0	0.05	.07	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iil B2	-1.0	1.0	0	.14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iil B1	-1.0	1.0	0	.14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iil DS2	-1.0	1.0	0	.14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iil DS1	-1.0	1.0	0	.14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iil R_W	-1.0	1.0	0	.14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iil A_B	-1.0	1.0	0	.14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iih B8	-1.0	1.0	0.15	.07	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iih B7	-1.0	1.0	0.15	.07	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iih B6	-1.0	1.0	0.05	.07	0.05	.07	0.15	.07	0	0	0	0	0	0	0	0	0	0	0	0	0
Iih B5	-1.0	1.0	0.05	.07	0.05	.07	0.05	.07	0.15	.07	0	0	0	0	0	0	0	0	0	0	0
Iih B4	-1.0	1.0	0.05	.07	0.05	.07	0.05	.07	0.15	.07	0	0	0	0	0	0	0	0	0	0	0
Iih B3	-1.0	1.0	0.05	.07	0.05	.07	0.05	.07	0.15	.07	0	0	0	0	0	0	0	0	0	0	0
Iih B2	-1.0	1.0	0.05	.07	0.05	.07	0.05	.07	0.15	.07	0	0	0	0	0	0	0	0	0	0	0
Iih B1	-1.0	1.0	0.05	.07	0.05	.07	0.05	.07	0.15	.07	0	0	0	0	0	0	0	0	0	0	0
Iih DS2	-1.0	1.0	0	.14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iih DS1	-1.0	1.0	0	.14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iih R_W	-1.0	1.0	0	.14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iih A_B	-1.0	1.0	0	.14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Accuracy DAC A	-.0196	.0196	0.001	.001	0.005	.005	0.005	.005	0.010	.010	0.010	.010	0.015	.015	0.020	.020	0.020	.020	0.025	.025	.025
Diff. Lin. DAC A	-.0196	.0196	0.001	.001	0.005	.005	0.005	.005	0.010	.010	0.010	.010	0.015	.015	0.020	.020	0.020	.020	0.025	.025	.025
Accuracy DAC B	-.0196	.0196	0.001	.001	0.005	.005	0.005	.005	0.010	.010	0.010	.010	0.015	.015	0.020	.020	0.020	.020	0.025	.025	.025
Diff. Lin. DAC B	-.0196	.0196	0.001	.001	0.005	.005	0.005	.005	0.010	.010	0.010	.010	0.015	.015	0.020	.020	0.020	.020	0.025	.025	.025
Accuracy DAC C	-.0196	.0196	0.001	.001	0.005	.005	0.005	.005	0.010	.010	0.010	.010	0.015	.015	0.020	.020	0.020	.020	0.025	.025	.025
Diff. Lin. DAC C	-.0196	.0196	0.001	.001	0.005	.005	0.005	.005	0.010	.010	0.010	.010	0.015	.015	0.020	.020	0.020	.020	0.025	.025	.025
Accuracy DAC D	-.0196	.0196	0.001	.001	0.005	.005	0.005	.005	0.010	.010	0.010	.010	0.015	.015	0.020	.020	0.020	.020	0.025	.025	.025
Diff. Lin. DAC D	-.0196	.0196	0.001	.001	0.005	.005	0.005	.005	0.010	.010	0.010	.010	0.015	.015	0.020	.020	0.020	.020	0.025	.025	.025

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

Figure 1. Radiation Bias Circuit for MP7628



Note: All resistors are 2kΩ, 5%, 1/4W.

