Government Systems Group

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UNISYS

DATE: December 23, 1994

PPM-95-113

TO: B. Fafaul/311
FROM: K. Sahu/300.1 K Sahu
SUBJECT: Radiation Report on HST/STIS
Part No. HCPL-5631
Control No. 11686

cc: A. Sharma/311.0
OFA Library/300.1

A radiation evaluation was performed on HCPL-5631 (High CMR, High Speed Hermetically sealed Optocoupler) 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 ^{60}Co gamma ray source. During the radiation testing, five 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 1, 2, 3, and 10 krads*. The dose rate was between 0.06 and 0.11 krads/hour, depending on the total dose level (see Table II for radiation schedule). After the 10 krad irradiation, parts were annealed at 25°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. These tests included three functional tests at 1MHz.

All parts passed initial electrical measurements. All irradiated parts passed all parametric and functional tests throughout all irradiation and annealing steps with no observable radiation-induced effects.

Table IV provides a summary of 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.
**These are manufacturer's pre-irradiation data specification limits. No post-irradiation limits were provided by the manufacturer at the time these tests were performed.

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TABLE I Part Information

Generic Part Number:	HCPL-5631
HST/STIS Part Number:	HCPL-5631
HST/STIS Control Number:	11686
Charge Number:	EE56044
Manufacturer:	Hewlett Packard
Lot Date Code:	9415
Quantity Tested:	6
Serial Number of Control Samples:	52
Serial Numbers of Radiation Samples:	53, 54, 55, 56, 57
Part Function:	High CMR, High Speed Optocoupler
Part Technology:	Bipolar
Package Style:	8-pin DIP
Test Equipment:	S-50
Test Engineer:	P. Srioudom

* No radiation tolerance/hardness was guaranteed by the manufacturer for this part.

TABLE II. Radiation Schedule for HCPL-5631

EVENTS	DATE
1) INITIAL ELECTRICAL MEASUREMENTS	11/08/94
2) 1 KRAD IRRADIATION (0.06 KRADS/HOUR)	11/08/94
POST-1 KRAD ELECTRICAL MEASUREMENT	11/16/94
3) 2 KRAD IRRADIATION (0.06 KRADS/HOUR)	11/16/94
POST-2 KRAD ELECTRICAL MEASUREMENT	11/17/94
4) 3 KRAD IRRADIATION (0.06 KRADS/HOUR)	11/17/94
POST-3 KRAD ELECTRICAL MEASUREMENT	11/18/94
5) 10 KRAD IRRADIATION (0.11 KRADS/HOUR)	11/18/94
POST-10 KRAD ELECTRICAL MEASUREMENT	11/21/94
6) 168-HOUR ANNEALING @ 25°C*	11/21/94
POST-168 HOUR ANNEAL ELECTRICAL MEASUREMENT	12/07/94

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-883D, Method 1019, Para. 3.10.1.

Table III. Electrical Characteristics of HCPL-5631

FUNCTIONAL TESTS PERFORMED

PARAMETER	VCC	VIL	VIH	CONDITIONS	PINS	LIMITS AT +25C ONLY
FUNCT 1	4.5V	0.00V	3.30V	FREQ=1.000MHZ	ALL I/O	VOL<1.5V , VOH>1.5V
FUNCT 2	5.0V	0.00V	3.30V	FREQ=1.000MHZ	ALL I/O	VOL<1.5V , VOH>1.5V
FUNCT 3	5.5V	0.00V	3.30V	FREQ=1.000MHZ	ALL I/O	VOL<1.5V , VOH>1.5V
			STD LOAD <=	[IOH = -0MA]		
				[VREF= 1.5V]		
				[IOL = 10.0MA]		

DC PARAMETRIC TESTS PERFORMED

PARAMETER	VCC	VIL	VIH	CONDITIONS	PINS	LIMITS AT +25C ONLY
IOH	5.5V	1.3V	1.5V	VOUT= 5.5V IF = 250UA	OUTS	>0.0MA , <250UA
VOL	5.5V	0.0V	3.5V	LOAD = 10MA	OUTS	>+0.0V , <+0.6V
VF	0.0V	0.0V	5.1V	IF = 20MA	INS	> 0.0V , <1.9V
ICCH	5.5V	0.0V	0.0V	IF = 0.0MA	VCC	>+0.0A , <+28MA
ICCL	5.5V	5.1V	5.1V	IF = 20MA	VCC	>+0.0A , <+36MA
TPLH	5.0V	0.0V	3.85V	LOAD = 13MA	OUTS	>+0.0NS , <100.0NS
TPHL	5.0V	0.0V	3.85V	LOAD = 13MA	OUTS	>+0.0NS , <100.0NS

COMMENTS/EXCEPTIONS

(1) ALL TESTS ARE PERFORMED AT +25C ONLY.

TABLE IV: Summary of Electrical Measurements after Total Dose Exposures and Annealing for HCPL5631 /1

Test #	Paramete	Units	Spec. Lim./2 min	Spec. Lim./2 max	Total Dose Exposure (krads) Initial mean	Initial sd	1 mean	1 sd	2 mean	2 sd	3 mean	3 sd	10 mean	10 sd	Annealing 168 hrs @25°C mean	Annealing 168 hrs @25°C sd
1	IOH	µA	0	250	2.95	0.92	2.99	0.95	3.02	0.95	3.03	0.97	3.11	0.98	3.05	0.96
2	VOL	mV	0	600	298	6.51	297	6.06	297	6.13	297	5.68	297	5.91	298	5.71
3	VF	mV	0	1900	1518	7.48	1515	5.0	1515	5.0	1516	6.63	1515	5.0	1514	4.89
4	ICCH	mA	0	28	12.3	0.13	12.3	0.13	12.3	0.14	12.3	0.14	12.3	0.15	12.3	0.15
5	ICCL	mA	0	36	15.6	0.16	15.6	0.16	15.5	0.17	15.6	0.17	15.5	0.16	15.6	0.16
6	TPLH	nS	0	100	50.7	0.59	50.9	0.61	51.4	0.64	51.2	0.62	51.7	0.61	51.7	0.67
7	TPHL	nS	0	100	49.4	0.55	49.4	0.51	49.6	0.53	49.6	0.53	49.9	0.52	50.7	0.51
8	FUNC1, Vcc=4.5V, Vil=-0.0V, Vih=3.3V, 1MHz				P		P		P		P		P		P	
9	FUNC1, Vcc=5V, Vil=-0.0V, Vih=3.3V, 1MHz				P		P		P		P		P		P	
10	FUNC1, Vcc=5.5V, Vil=-0.0V, Vih=3.3V, 1MHz				P		P		P		P		P		P	

Notes:

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

2/ These are manufacturer's pre-irradiation data sheet specification limits. No post-irradiation limits were provided the manufacturer at the time the tests were performed.

3/ In the Functional Tests, "P" means that all parts passed this test at this irradiation or annealing level.

Figure 1. Radiation Bias Circuit for HCPL-5631