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UNISYS

Interoffice Memorandum

Rad-91-12

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 Subject:
 Radiation Report on DIH-149
 (GPEP W.R.# PP01023)

Date:
 June 11, 1991
 Location:
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A radiation evaluation was performed on DIH-149 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 Figures I and II.

The total dose testing was performed using a cobalt-60 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 control sample. The total dose radiation steps were 5, 10, 20, 30, 40, 50, and 75 krads. After 75 krads, parts were annealed at 25°C for 24 and 168 hours. The dose rate was between 0.25 - 1.25 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 (5) test samples passed all DC and AC parametric tests up to 10 krads. After 20 krads, four devices (SNs 102, 103, 104, and 105) failed to meet the minimum specification limit of 1.2V for turn-off input voltage (V_I OFF). The failed readings for V_I OFF were -0.78V. Also, two parts failed the output leakage current (I_{leak1}). After 30 krads, the four failing parts showed increased degradation of output leakage current (readings were on the order of several milliamperes). Also, these parts were failing a number of AC measurements (delay, rise and fall times). At the following radiation steps of 50 and 75 krads, the four failing parts continued to show increased degradation. No significant recovery was observed after annealing these parts for 24 and 168 hours.

SN 101 behaved quite differently from all other irradiated parts in that it passed all steps of the radiation testing. Table IV provides the mean and standard deviation values for each parameter after each radiation/annealing step.

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:	DIH-149
Manufacturer:	Dionics
Lot Date Code:	9018, 9030
Quantity Tested:	6
Serial Numbers of Radiation Samples:	104 (LDC 9018) 101, 102, 103, 105 (LDC 9030)
Serial Numbers of Control Sample:	100 (LDC 9030)
Part Function:	Solid State Relay
Part Technology:	MOS
Package Style:	6 Pin Metal

TABLE II. Radiation Schedule

EVENTS	DATE
1) Initial Electrical Measurements	02/15/91
2) 5 krads irradiation @ 250 rads/hr	02/25/91
Post 5 krads Electrical Measurements	02/26/91
3) 10 krads irradiation @ 250 rads/hr	02/26/91
Post 10 krads Electrical Measurements	02/27/91
4) 20 krads irradiation @ 500 rads/hr	02/27/91
Post 20 krads Electrical Measurements	02/28/91
5) 30 krads irradiation @ 500 rads/hr	02/28/91
Post 30 krads Electrical Measurements	03/01/91
6) 40 krads irradiation @ 500 rads/hr	03/01/91
Post 40 krads Electrical Measurements	03/02/91
7) 50 krads irradiation @ 500 rads/hr	03/02/91
Post 50 krads Electrical Measurements	03/03/91
8) 75 krads irradiation @ 1250 rads/hr	03/03/91
Post 75 krads Electrical Measurements	03/04/91
9) 24 hrs annealing	03/04/91
Post 24 hr Electrical Measurements	03/05/91
10) 168 hrs annealing	03/04/91
Post 168 hr Electrical Measurements	03/11/91

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 DIH-149*

Parameter	Limits for Config. I		Limits for Config. III		Units	Test Conditions
	Min	Max	Min	Max		
ON Resistance	-	.40	-	.10	ohm	Input=25mA load @ 5 A
Off state leakage	-	100	-	200	μ A	Load=350V
Output offset voltage	-	250	-	250	μ V	Input=25mA
Turn-on current	-	5	-	10	mA	1A load
Turn-off voltage	1.2	-	1.2	-	V	
Forward voltage drop	-	4.3	-	4.3	V	Input=10mA
	-	5.5	-	5.5	V	Input=25mA
Reverse voltage	10		10	-	V	Reverse current = 10 μ A
Delay Time (Td)**	-	4.5	-	4.0	mS	5A Load
Rise Time (Tr)**	-	4.5	-	5.5	mS	"
Storage Time (Ts)**	-	250	-	350	μ sec	"
Fall Time (Tf)**	-	100	-	100	μ sec	"

Parameter	Limits for	Limits for	Limits for	UNITS
	Configuration I	Configuration II	Configuration III	
Load current continuous	10	12	17	A
Load current (20ms Pulse, 1% duty cycle)	25	30	42	A
Load voltage (IL = 10 UA)	\pm 400	+400	+400	V

* Electrical characteristics were measured in two configurations (I and III). These measurements are identified by subscripts 1 (Configuration I) and 2 (Configuration III) in Table IV.

TABLE IV: Summary of Electrical Measurements after
Total Dose Exposures and Annealing for DIH-149 1/ 2/

Parameters	Spec. Limits min max		Initials mean sd		Total Dose Exposure (krads)										
					5		10		20		30		40		
					mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	
Ileak 1 @350V uA	-	100	0.1	0.1	1.2	0.2	0	0	203	165	>3.5E3	1.5E3	>3.5E3	1.5E3	
Ileak 2 @350V uA	-	200	1.4	4.0	5.4	6	0	0	86	130	>3.5E3	1.5E3	>3.5E3	1.4E3	
TR 1	ms	-	4.5	1.0	0.2	1.0	0.1	1.1	0.2	1.1	0.1	1.1	0.1	*	*
TF 1	us	-	100	5.7	3.0	8.1	6.0	15	14	57	22	*	*	*	*
TD 1	ms	-	4.5	1.7	0.3	1.5	0.1	1.4	1.1	1.1	0.2	.8	.5	3.8	3
TS 1	us	-	250	29	5.0	30	7.0	37	16	53	10.2	245	175	313	143
TR 2	ms	-	5.5	1.5	0	1.5	0.1	1.4	0.1	1.6	0.2	1.4	0.4	*	*
TF 2	us	-	100	11	4	15	11	25	20	67	35	*	*	201	341
TD 2	ms	-	4.0	1.5	0.2	1.4	0.1	1.3	0.8	1.1	0.2	2.3	2.7	3.6	3.4
TS 2	us	-	350	36	8	38	15	47	22	54	9	247	175	311	140
R (on) 1	mOhms	-	400	327	10	328	20	331	13	342	3	384	60	383	42
R (on) 2	mOhms	-	100	93	10	94	3.0	92	8	90	4.7	252	152	181	158
Ii (on)	mA	-	10	4.6	0.3	4.3	2.0	3.5	0.5	2.9	0.3	2.3	0.6	1.0	1.2
Vi (off)	V	1.2	-	2.6	0	2.6	0	2.5	0.1	-0.8	0.1	-0.6	7.1	-0.2	1.3
VF @ 25mA	V	-	5.5	5.1	0.1	5.1	0	5.1	0.1	5.1	0.1	5.1	0.1	5.1	0.1
VF @ 10mA	V	-	4.3	3.5	0.1	3.5	0.1	3.5	0.1	3.5	0.1	3.5	0.1	3.5	0.1
VR @ 10uA	V	10	-	10.2	0.1	10.1	0	10.1	0.1	10.2	0.1	11.4	2.6	10.1	0.2
Vos 1	uV	-	250	6.4	1.0	8.8	0.4	7.2	0.6	7.8	0.1	5.2	1.5	5.7	2
Vos 2	uV	-	250	22	2	23	0.1	23.5	0.2	24	0.3	22.1	0.4	22	0.8

* implies that no reliable measurements could be made due to significant parametric degradation at the noted radiation steps.

TABLE IV. (continued)

Parameters	Spec. Limits min max	Initials mean sd		Total Dose Exposure (krads)				Annealing			
				50		75		24 hrs		168 hrs	
				mean	sd	mean	sd	mean	sd	mean	sd
Ileak 1 @350V uA	- 100	0.1	0.1	>3.5E3	1.5E3	>3.5E3	1.5E3	>3.5E3	1.5E3	>3.5E3	1.5E3
Ileak 2 @350V uA	- 200	1.4	4.0	>3.5E3	1.5E3	>3.5E3	1.5E3	>3.5E3	1.5E3	>3.5E3	1.5E3
TR 1 ms	- 4.5	1.0	0.2	*	*	*	*	*	*	0.1	1.0
TF 1 us	- 100	5.7	3.0	*	*	1.0	0.1	1.0	0.1	8.6	13
TD 1 ms	- 4.5	1.7	0.3	2.0	5.0	7.7	0.1	7.7	0.1	7.6	2
TS 1 us	- 250	29	5.0	385	0.3	384	2.5	384	0.4	384	1.1
TR 2 ms	- 5.5	1.5	0	*	*	*	*	*	*	0.06	0.1
TF 2 us	- 100	11	4	*	*	6.2	18	1.0	0.1	23	27
TD 2 ms	- 4.0	1.5	0.2	45	20	7.6	0.3	7.7	0.1	7.6	1.5
TS 2 us	- 350	36	8	2E3	200	390	5.2	379	3.4	385	1.1
R (on) 1 mOhm	- 400	327	10	388	90	392	51	364	60	315	32
R (on) 2 mOhm	- 100	93	10	100	15	100	15	97	11	101	15
Ii (on) mA	- 10	4.6	0.3	1.0	2.0	1.0	2.1	2.0	6.1	1.6	1.3
Vi (off) V	1.2 -	2.6	0	-0.2	1.3	-1.7	1.3	0.5	2.3	-1.6	1.4
VF @ 25mA V	- 5.5	5.1	0.1	5.1	0.1	5.1	0.1	5.1	0.1	5.1	0.1
VF @ 10mA V	- 4.3	3.5	0.1	3.5	0.1	3.5	0.1	3.5	0.1	3.5	0.1
VR @ 10uA V	10 -	10.2	0.1	10.1	0.2	10.1	0.1	10.5	1.2	10.4	0.1
Vos 1 uV	- 250	6	1	6	2	6	2	8	2	7	6
Vos 2 uV	- 250	22	2	24	1	23	1	23	2	23	1

Notes:

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

2/ At 30 krads and above, Ileak1 and Ileak2 exceeded the maximum limit that the test equipment could measure.

* implies that no reliable measurements could be made due to significant parametric degradation at the noted radiation steps.

Figure I. Radiation Bias Circuit for DIH-149

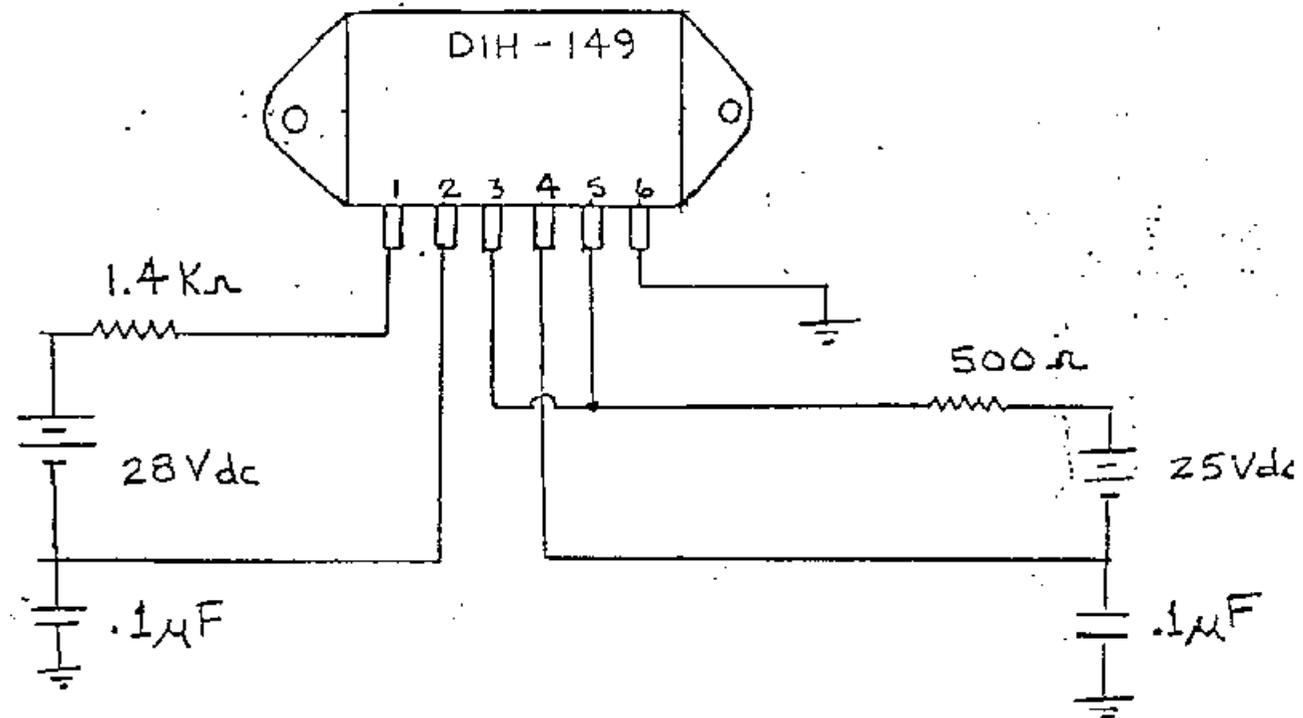


Figure II. Pin-out and Functional Diagrams and Wiring Configurations I, II, & III of DIH-149

