



DATE: May 1, 1995 PPM-95-150

TO: P. Jones/311

FROM: K. Sahu/300.1

SUBJECT: Radiation Report on NOAA KLM
Part No. AD645SH
Control No. 12738

cc: A. Sharma/311.0
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A radiation evaluation was performed on AD645SH (Operational Amplifier) 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 control sample. The total dose radiation levels were 1, 2.5, 5, and 10 krad*. The dose rate was between 0.05 and 0.25 krad/hour, depending on the total dose level (see Table II for radiation schedule). After each radiation exposure, parts were electrically tested according to the test conditions and the specification limits** listed in Table III.

All parts passed initial electrical measurements. All irradiated parts passed all electrical tests up to the 1 krad level. After the 2.5 krad irradiation, S/N 93 and S/N 94 exceeded the maximum specification limit of 500 μV for v_{io} with readings of 801 μV and 660 μV , respectively. After the 5 krad irradiation, all irradiated parts exceeded the maximum specification limit for v_{io} with readings ranging from 803 μV to 1660 μV . After the 10 krad irradiation, the same parts continued to exceed the maximum specification limit for v_{io} with readings ranging from 2112 μV to 3202 μV .

No significant degradation was observed for any other parameter.

Table IV provides a summary of the mean and standard deviation values for each parameter after different irradiation exposures and 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.

*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:	AD645
NOAA KLM/SBUV Part Number:	AD645SH
NOAA KLM/SBUV Control Number:	12738
Charge Number:	EE56296
Manufacturer:	Analog Devices
Lot Date Code:	9334A, 9338B
Quantity Tested:	6
Serial Number of Control Samples:	90
Serial Numbers of Radiation Samples:	91, 92, 93, 94, 95
Part Function:	Operational Amplifier
Part Technology:	Bi-FET
Package Style:	8 Pin metal can
Test Equipment:	A540
Test Engineer:	C. Nguyen

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

TABLE II. Radiation Schedule for AD645

EVENTS	DATE
1) INITIAL ELECTRICAL MEASUREMENTS	01/03/95
2) 1 KRAD IRRADIATION (0.05 KRADS/HOUR) POST-1 KRAD ELECTRICAL MEASUREMENT	01/03/95 01/04/95
3) 2.5 KRAD IRRADIATION (0.75 KRADS/HOUR) POST-2.5 KRAD ELECTRICAL MEASUREMENT	01/04/95 01/05/95
4) 5 KRAD IRRADIATION (0.125 KRADS/HOUR) ▪ POST-5 KRAD ELECTRICAL MEASUREMENT	04/05/95 04/06/95
5) 10 KRAD IRRADIATION (0.250 KRADS/HOUR) POST-10 KRAD ELECTRICAL MEASUREMENT	04/06/95 04/07/95

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

Table III. Electrical Characteristics of AD645

tst #	Test name	Min	Max	Conditions
1	I _{dd}	0.00 ma	* 3.50 ma	
2	I _{ss}	-3.50 ma	0.00 ma	
3	+V _{o_2K}	10.00 v		R _L = 2K
4	-V _{o_2K}		-10.00 v	R _L = 2K
5	v _{io}	-500.0 uv	500.0 uv	V _{cm} = 0.0v
6	+i _{bias}	-5.00 pa	5.00 pa	V _{cm} = 0.0v
7	i _{bias}	-5.00 pa	5.00 pa	V _{cm} = 0.0v
8	i _{io}	-1.00 pa	1.00 pa	V _{cm} = 0.0v
9	A _{vol}	114.0 db		R _L =2K, V _o = +/- 10v
10	cm _{rr}	90.0 db		V _{cm} = +/- 10.0v
11	+ps _{rr}	90.0 db		V _{cc} = 10v to 18v
12	-ps _{rr}	90.0 db		V _{ss} = -10v to -18v

TABLE IV: Summary of Electrical Measurements after Total Dose Exposures and Annealing for AD645 /1

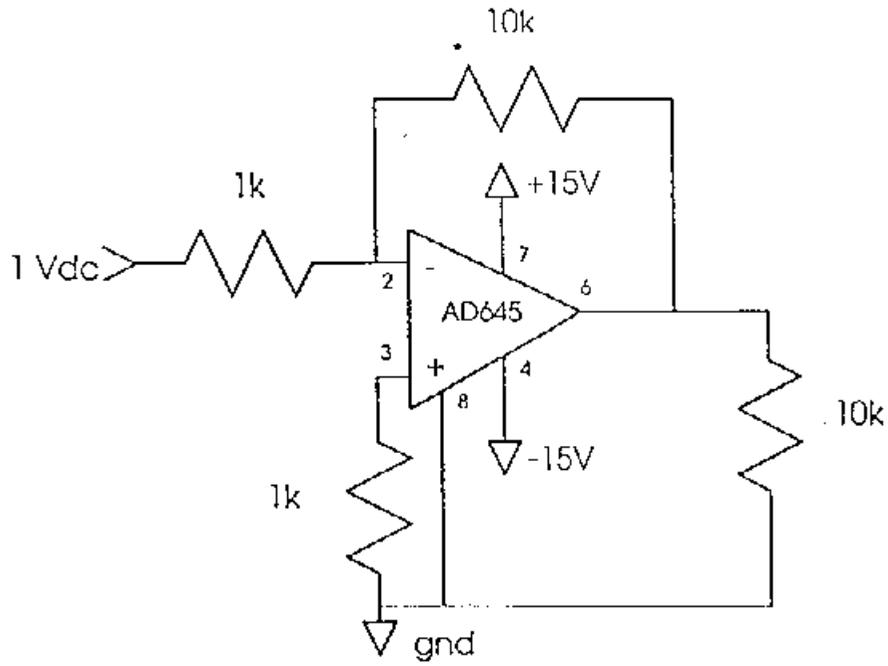
Test #	Parameters	Units	min	max	Spec. Lim./2	Total Dose Exposure (krads)									
						Initial		1		2.5		5		10	
						mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
1	I _{dd}	mA	0	3.5		2.87	0.02	2.86	0.02	2.86	0.03	2.87	0.03	2.87	0.03
2	I _{ss}	mA	-3.5	0		-2.86	0.02	-2.86	0.02	-2.87	0.03	-2.87	0.03	-2.87	0.02
3	+V _{o_2k}	V	10	-		13.7	0.01	13.7	0.01	13.7	0.01	13.7	0.01	13.7	0.01
4	-V _{o_2k}	V	-	-10		-14.3	0.0	-14.3	0.0	-14.3	0.0	-14.3	0.01	-14.3	0.01
5	v _{io}	μV	-500	500		-73	227	94	186	513	207	1099	339	2654	510
6	i _{bias}	pA	-5	5		-1.47	0.73	-0.45	0.17	-2.08	0.04	-0.89	0.18	0.52	0.25
7	i _{io}	pA	-1	1		0.14	0.20	0.04	0.04	0.13	0.03	0.20	0.03	0.28	0.09
8	A _{v01}	db	114	-		141	5.45	139	3.97	139	3.45	140	3.89	138	3.74
9	cmrr	db	90	-		114	3.43	114	3.19	114	2.90	115	3.04	-1908	4523
10	psrr	db	90	-		122	11.7	122	11.6	121	9.74	120	8.26	120	8.81

Notes:

- 1/ The mean and standard deviation values were calculated over the five parts irradiated in this testing.
The control 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 by the manufacturer at the time the tests were performed.

Radiation-sensitive parameter: v_{io}.

Figure 1. Radiation Bias Circuit for AD645



NOTES:

1. Pins 1 and 5 are not connected.
2. All resistances in ohms.