

Unisys

DATE: October 20, 1999 PPM-99-033
TO: R. Reed/562
FROM: K. Sahu/S. Kniffin/300.1
SUBJECT: Radiation Report on **INA117SM (Burr-Brown) (LDC 9837)**
PROJECT: GLAS

cc: G. Henegar/564.9, R. Hardesty/550.0, A. Sharma/562, OFA Library/300.1

A radiation evaluation was performed on **INA117SM High Common-Mode Voltage Difference Amplifier (Burr-Brown)** to determine the total dose tolerance of these parts. The total dose testing was performed using a Co^{60} gamma ray source. During the radiation testing, one part was irradiated under bias to determine the initial degradation level. Seven parts were then irradiated under bias (see Figure 1 for bias configuration) and two parts were used as control samples. The total dose radiation levels were 10.0, 17.5, 25.0, and 50.0kRads.¹ The average dose rate was 0.22kRads/hour (0.06Rads/s). See Table II for the radiation schedule and average dose rate calculation. After the 50.0kRad irradiation, the parts were annealed under bias at 25°C for 168 hours.² After each radiation exposure and annealing step, parts were electrically tested according to the test conditions and the specification limits³ listed in Table III. An executive summary of the test results is provided below in bold, followed by a detailed summary of the test results after each radiation level and annealing step.

All parts passed all tests through 25kRads. After the 50kRad irradiation, two parts marginally exceeded the specification limit for Voffset. After annealing the parts at 25°C for 168 hours, the parts showed complete recovery.

Initial electrical measurements were made on 10 samples. One part was used to determine the initial degradation level (SN 49). Seven samples (SN's 41, 42, 43, 44, 45, 46, and 47) were used as radiation samples while SN's 40 and 48 were used as control samples. All parts passed all tests during initial electrical measurements.

All parts passed all tests up to 25kRads.

After the 50kRad irradiation, two parts marginally exceeded the specification limit of 1.00mV for Voffset with readings of 1.03 and 1.01mV. **All parts passed all other tests.**

After annealing the parts for 168 hours at 25°C, the parts showed complete recovery. All parts passed all tests.

Table IV provides a summary of the test results with the mean and standard deviation values for each parameter after each irradiation exposure and annealing step.

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

¹ The term Rads, as used in this document, means Rads (silicon). All radiation levels cited are cumulative.

² The temperature 25°C as used in this document implies room temperature.

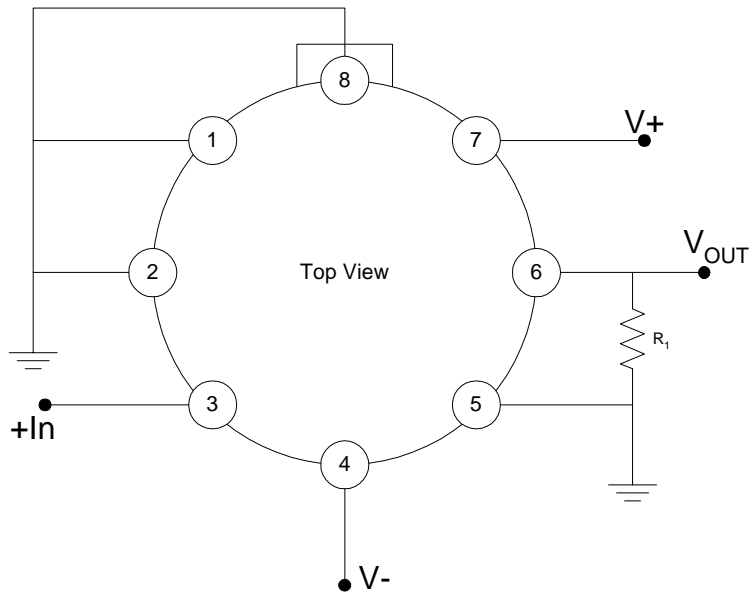
³ These are manufacturer's pre-irradiation data specification limits. The manufacturer provided no post-irradiation limits at the time these tests were performed.

ADVISORY ON THE USE OF THIS DOCUMENT

The information contained in this document has been developed solely for the purpose of providing general guidance to employees of the Goddard Space Flight Center (GSFC). This document may be distributed outside GSFC only as a courtesy to other government agencies and contractors. Any distribution of this document, or application or use of the information contained herein, is expressly conditional upon, and is subject to, the following understandings and limitations:

- (a) The information was developed for general guidance only and is subject to change at any time;
- (b) The information was developed under unique GSFC laboratory conditions which may differ substantially from outside conditions;
- (c) GSFC does not warrant the accuracy of the information when applied or used under other than unique GSFC laboratory conditions;
- (d) The information should not be construed as a representation of product performance by either GSFC or the manufacturer;
- (e) Neither the United States government nor any person acting on behalf of the United States government assumes any liability resulting from the application or use of the information.

Figure 1. Radiation Bias Circuit for INA117SM



Notes:

1. $+V = +15V \pm 0.5V$.
2. $-V = -15V \pm 0.5V$.
3. $+V_{IN} = +10V \pm 0.5V$.
4. $R_1 = 510\Omega \pm 5\%$, $\frac{1}{4}W$.
5. $V_O \approx 5.0V$.

Pin Out:

1. Ref B
2. -In
3. +In
4. V-
5. Ref A
6. Output
7. V+
8. Comp

TABLE I. Part Information

Generic Part Number:	INA117
GLAS Part Number	INA117SM
GLAS TID Requirement	25kRads (RDM = 5)
Charge Number:	M90432
Manufacturer:	Burr-Brown
Lot Date Code (LDC):	9837
Quantity Tested:	10
Serial Numbers of Control Samples:	70, 78
Serial Number of Initial Degradation Sample:	79
Serial Numbers of Radiation Samples:	71, 72, 73, 74, 75, 76, 77
Part Function:	High Common-Mode Voltage Difference Amplifier
Part Technology:	Bipolar Hybrid
Package Style:	TO-99
Test Equipment:	A540
Test Engineer:	A. Duvalsaint

- The manufacturer for this part guaranteed no radiation tolerance/hardness.

TABLE II. Radiation Schedule for INA117SM

EVENT	DATE
1) INITIAL ELECTRICAL MEASUREMENTS	09/16/99
One Part Test Runs	
2) 8 KRAD IRRADIATION (0.177 KRADS/HOUR).....	09/27/99
POST-8 KRAD ELECTRICAL MEASUREMENT	09/24/99
3) 16.0 KRAD IRRADIATION (0.114 KRADS/HOUR).....	09/24/99
POST-16.0 KRAD ELECTRICAL MEASUREMENT	09/27/99
4) 24.0 KRAD IRRADIATION (0.166 KRADS/HOUR).....	09/27/99
POST-24.0 KRAD ELECTRICAL MEASUREMENT	09/29/99
All Remaining Parts	
5) 10.0 KRAD IRRADIATION (0.158 KRADS/HOUR).....	10/01/99
POST 10.0 KRAD ELECTRICAL MEASUREMENT	10/04/99
6) 17.5 KRAD IRRADIATION (0.192 KRADS/HOUR).....	10/04/99
POST-17.5 KRAD ELECTRICAL MEASUREMENT	10/06/99
7) 25.0 KRAD IRRADIATION (0.170 KRADS/HOUR).....	10/06/99
POST-25.0 KRAD ELECTRICAL MEASUREMENT	10/08/99
8) 50.0 KRAD IRRADIATION (0.278 KRADS/HOUR).....	10/08/99
POST-50.0 KRAD ELECTRICAL MEASUREMENT	10/12/99
9) 168 HOUR ANNEALING @25°C.....	10/12/99
POST-168 HOUR ANNEAL ELECTRICAL MEASUREMENT	10/19/99

Average Dose Rate = 50,000 RADS/229 HOURS=218.3 RADS/HOUR=0.06RADS/SEC

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

Table III. Electrical Characteristics INA117SM (1)

Test #	Parameter	Units	Spec. Limit		Test Conditions (2)
			min	max	
1	I _{cc}	mA		2.00	V _O = 0V
2	V _{offset}	mV	-1.00	1.00	
3	P _{PSRR_pos}	dB	74		V _S = +5V to +18V
4	P _{PSRR_neg}	dB	74		V _S = -5V to -18V
5	CMRR	dB	70		Zero source impedance.
6	+V _O	V	10		I _O = +20mA, -5mA
7	slew_rate_A	V/μs	2.00		
8	full_power_bw	kHz	30.0		V _O = 20V p-p

Notes:

(1) These are the manufacturer's non-irradiated data sheet specification limits. The manufacturer provided no post-irradiation limits at the time the tests were performed.

(2) V_S = ±15V unless otherwise specified.

TABLE IV: Summary of Electrical Measurements after Total Dose Exposures and Annealing for INA117 (1)

Test #	Parameters	Units	Spec. Lim. (2)		Total Dose Exposure (kRads Si)										Annealing	
					Initial		10.0		17.5		25.0		50.0		168 hours @25°C	
					mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
1	Icc	mA		2.00	1.46	0.04	1.49	0.04	1.52	0.05	1.48	0.18	1.71	0.06	1.56	0.07
2	Voffset	mV	-1.00	1.00	0.10	0.15	0.83	0.06	0.42	0.29	0.67	0.39	0.84	0.31	0.62	0.41
3	P_PSRR_pos	dB	74		96	0.5	96	0.5	96	0.4	96	0.5	95	0.5	96	0.5
4	P_PSRR_neg	dB	74		100	0.5	100	0.5	100	0.5	100	0.5	100	0.3	100	0.3
5	CMRR	dB	70		104	0.5	105	0.5	105	0.5	105	0.5	105	0.5	105	0.5
6	+Vo	V	10		11.4	0.5	12.2	0.3	12.9	0.2	13.3	0.1	13.8	0.2	13.7	0.3
7	slew_rate_A	V/ms	2.00		2.75	0.05	2.71	0.06	2.64	0.15	2.52	0.15	2.11	0.06	2.44	0.15
8	full_power_bw	kHz	30.0		641	13	632	14	629	13	617	12	493	14	570	35

Notes:

- (1) The mean and standard deviation values were calculated over the seven parts irradiated in this testing. The control samples remained constant throughout testing and are not included in the data.
- (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 parameters: Voffset.