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Interoffice Memorandum

To
M. DiPreto
Department
Code 300.1
From
K. Sahu KS
Department
7809
Subject
Radiation Report on
ISTP Non-Common Buy Part No. MC35184L

PPM-91-255
Date
April 12, 1991.
Location
GSFC
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731-8954
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A radiation evaluation was performed on MC35184L 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, eight parts were irradiated under bias (see Figure 1 for bias configuration), and two parts were used as control samples. The total dose radiation steps were 10, 20, 30, and 50 krads. After 50 krads, parts were annealed at 25°C for 24 and 192 hours. The dose rate was between 0.5 - 1.0 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 (8) parts passed all tests, except slew rate, after 10 krads exposure. SNs 3, 5, 6, 7, 8, 9, and 10 failed to meet the minimum slew rate (SR) of 7.0 V/us at this radiation step (readings were in the range of 5.7 - 7.2 V/us). The parts continued to deteriorate with increasing total dose exposures. At 20 krads, all parts failed AOL, +ISC and SR (AOL readings were in the range of 20 - 23 V/mV against minimum specification limit of 25 V/mV, +ISC readings were in the range of 2.4 - 2.9 mA against the minimum specification limit of 3.0 mA and SR readings were in the range of 2.2 - 4.5 V/us). After 30 krads, all parts continued to fail the above tests in addition to +VOUT (readings for +VOUT were in the range of 10.9 - 13.3 V against the minimum specification limit of 13.5 V). Also, the devices had degraded so much that slew rate measurements could not be made and the AOL of the parts fell below the minimum (20 V/mV) that could be measured by the test equipment. After 50 krads, all parts continued to fail the above tests. On annealing for 24 and 192 hours, the parts showed slight recovery, but continued to fail all the above tests. Table IV provides the mean and standard deviation values for each parameter after different radiation exposures and annealing treatments.

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

TABLE I. Part Information

Generic Part Number:	MC35184L
ISTP Non-Common Buy Part Number:	MC35184L
ISTP Non-Common Buy Control Number:	3384
Manufacturer:	Motorola
Quantity Procured:	55
Lot Date Code:	9037
Quantity Tested:	10
Serial Numbers of Radiation Samples:	3, 4, 5, 6 7, 8, 9, 10
Serial Numbers of Control Samples:	1, 2
Part Function:	Quad Operational Amplifier
Part Technology:	Bipolar/JFET
Package Style:	14-Pin DIP

TABLE II. Radiation Schedule

EVENTS	DATE
1) Initial Electrical Measurements	03/14/91
2) 10 krads irradiation @ 550 rads/hr Post 10 krads Electrical Measurements	03/15/91 03/16/91
3) 20 krads irradiation @ 550 rads/hr Post 20 krads Electrical Measurements	03/16/91 03/17/91
4) 30 krads irradiation @ 500 rads/hr Post 30 krads Electrical Measurements	03/17/91 03/18/91
5) 50 krads irradiation @ 1000 rads/hr Post 50 krads Electrical Measurements	03/18/91 03/19/91
6) 24 hrs annealing Post 24 hr Electrical Measurements	03/19/91 03/20/91
7) 192 hrs annealing Post 192 hr Electrical Measurements	03/20/91 03/27/91

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 performed at 25°C under bias.

Table III. Electrical Characteristics of MC35184L

Test -----	Min -----	Max -----
+IS	0.0mA	1.0mA
-IS	-1.0mA	0.0mA
VOS	-10mV	10mV
IOS	-1.0nA	1.0nA
+IB	-1.0nA	1.0nA
-IB	-1.0nA	1.0nA
AOL	25V/mV	301581V/mV
CMRR	-1000dB	-70dB
PSRR	-1000dB	-70dB
+VOUT	13.5V	22.9V
-VOUT	-22.9V	-13.5V
+ISC	3.0mA	50mA
-ISC	-50.0mA	-8.0mA
+SLEW	7.0V/us	6702V/us

TABLE IV: Summary of Electrical Measurements after
Total Dose Exposures and Annealing for MC35184L

1/2/

Parameters	Spec. Limits min max	Initials mean sd		Total Dose Exposure (krads)								Annealing at 25°C					
				10		20		30		50		24 hrs.		192 hrs.			
				mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd		
+IS	mA	0	1.0	0.70	.02	0.61	.03	0.54	.04	0.47	.04	0.36	.01	0.39	.01	0.45	.02
-IS	mA	-1.0	0	-0.72	.08	-0.62	.03	-0.53	.02	-0.46	.04	-0.35	.01	-0.41	.03	-0.45	.03
VOS	mV	-10	10	0.2	1.0	0.4	3.0	-0.7	1.0	0.3	1.0	0.2	1.0	0.1	1.0	0.1	1.0
IOS	nA	-1.0	1.0	.05	.03	.05	.05	.02	.01	.05	.05	.04	.05	.03	.03	.04	.04
+IB	nA	-1.0	1.0	.09	0.1	-.06	.05	-0.12	0.1	-0.19	0.1	-0.43	.02	-0.3	.05	-0.2	0.1
-IB	nA	-1.0	1.0	0	.02	-.06	.04	-0.15	.05	-0.2	0	-0.46	.05	-0.35	.05	-0.3	0.1
AOL	V/mV	25	325	54.0	2.0	31.2	1.0	20.2	0.1	< 20	-	< 20	-	< 20	-	< 20	-
CMRR	dB	-1000	-70	-95	8	-96	8	-98	10	-95	12	-96	10	-93	20	-96	12
PSRR	dB	-1000	-70	-97	6	-94	6	-93	7	-94	7	-98	10	-95	10	-98	10
+VOUT	V	13.5	22.9	14.0	0	14.0	0	14.0	0.1	12.3	1.5	5.6	2.0	8.4	1.2	12.1	1.0
-VOUT	V	-22.9	-13.5	-14.2	0	-14.2	0	-14.2	0	-14.1	0.1	-14.1	0	-14.1	0	-14.1	0
+ISC	mA	3	50	5.1	0.2	4.0	0.2	2.7	0.2	1.6	0.2	0.7	0.1	1.1	0.2	1.7	0.2
-ISC	mA	-50	-8	-14.0	0.1	-13.8	0.3	-13.2	0.2	-12.7	0.4	-11.9	0.4	-12.3	0.2	-12.8	0.1
+SLEW	V/us	7.0	6702	8.1	0.2	6.4	0.6	3.4	1.5	*	-	*	-	*	-	*	-

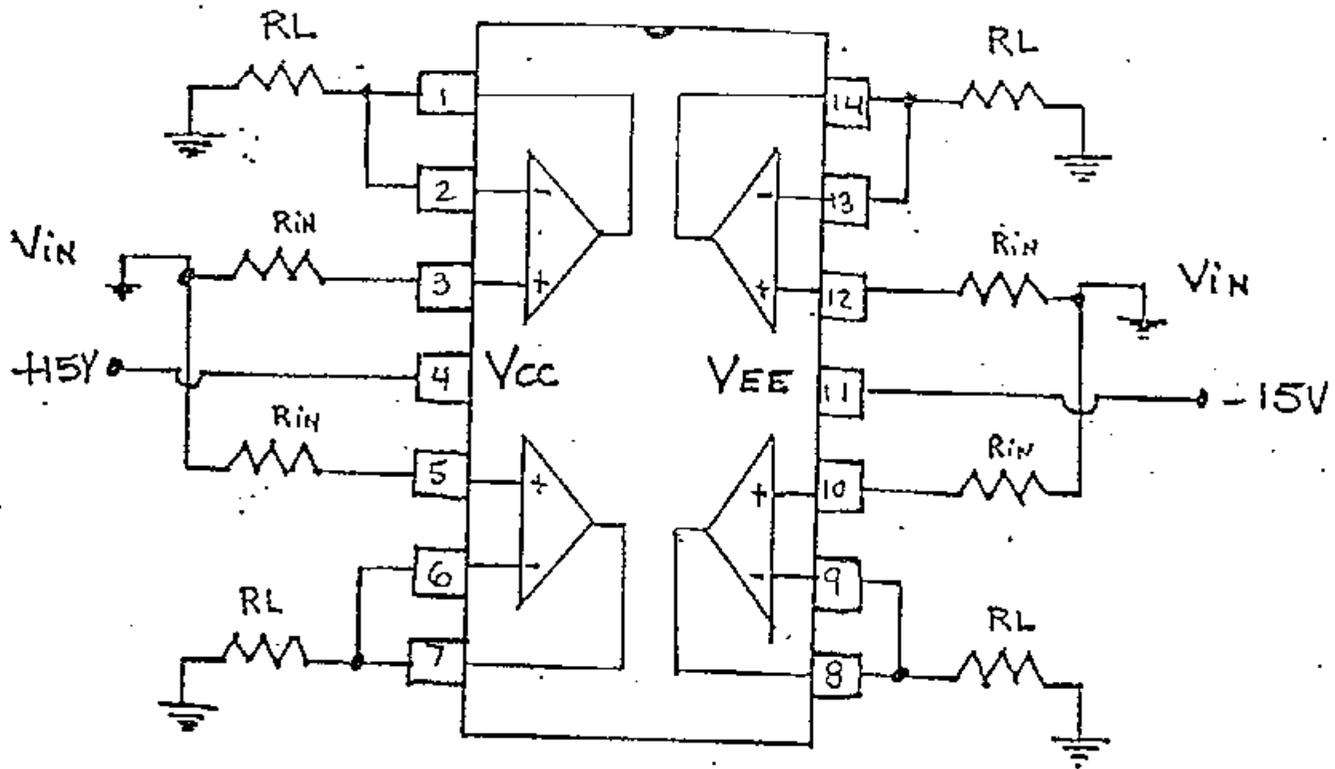
Notes:

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

2/ At 30 krads and above, the AOL of the parts degraded below the minimum (20 V/mV) that can be measured by the test equipment.

* At 30 krads and above, the slew rate had degraded so much that no valid measurements could be made for this parameter on any of the irradiated devices.

Figure 1. Radiation Bias Circuit for MC35184L



$$V_{EE} = -15V \pm 0.5V$$

$$V_{CC} = +15V \pm 0.5V$$

$$R_L = 1K\Omega \pm 5\%, 1/2 W$$

$$R_{iN} = 47K\Omega \pm 5\%, 1/4 W$$