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(12)

To
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Department
Code 310.1
From
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7809
Subject
Radiation Report on
ISTP Non-Common Buy Part No. MC35181U

PPM-91-109
Date
February 22, 1991
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A radiation evaluation was performed on MC35181U 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 5, 10, 20, 30, 50, 75 and 100 krads. After 100 krads, parts were annealed at 25°C for 24 and 168 hours, and then the irradiation was continued to 200 and 300 krads (cumulative). The dose rate was between 0.25 - 5.0 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 on irradiation up to 20 krads. At 30 krads, all parts failed to meet the minimum specification limit on slew rate. The slew rate readings were in the range 5.5 - 6.95V/us against the specification limit of 7V/us minimum. However, parts passed all other tests on irradiation up to 30 krads.

The parts continued to deteriorate with increasing total dose exposures. At 50 krads, parts failed to meet the minimum specification limit on AOL, +ISC and VOS also. At 75 krads, +VOUT readings on all parts were also below the minimum specification limit. The degradation in slew rate, AOL, ISC, VOS and VOUT continued on irradiation to 100 krads.

Parts showed some recovery on annealing for 24 and 168 hours, but the recovery was not enough to bring any of the parameters within the specification limits. On continued irradiation to 200 and 300 krads (cumulative), parts showed increased degradation in all of the above parameters. However, the remaining parameters: +IS,

-IS, IOS, +IB, -IB, CMRR, PSRR, -VOUT and -ISC were within specification limits throughout the radiation testing up to 300 krads. 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:	MC35181U
ISTP Non-Common Buy Part Number:	MC35181U
ISTP Non-Common Buy Control Number:	2116
Manufacturer:	Motorola
Quantity Procured:	56
Lot Date Code:	8829
Quantity Tested:	10
Serial Numbers of Radiation Samples:	74, 75, 76, 77, 78, 79, 80, 81
Serial Numbers of Control Samples:	72, 73
Part Function:	Low Power Operational Amplifier
Part Technology:	Bipolar with JFET Inputs
Package Style:	8-Pin DIP

TABLE II. Radiation Schedule

EVENTS	DATE
1) Initial Electrical Measurements	01/02/91
2) 5 krads irradiation @ 250 rads/hr Post 5 krads Electrical Measurements	01/07/91 01/08/91
3) 10 krads irradiation @ 250 rads/hr Post 10 krads Electrical Measurements	01/08/91 01/09/91
4) 20 krads irradiation @ 500 rads/hr Post 20 krads Electrical Measurements	01/09/91 01/10/91
5) 30 krads irradiation @ 500 rads/hr Post 30 krads Electrical Measurements	01/10/91 01/11/91
6) 50 krads irradiation @ 294 rads/hr Post 50 krads Electrical Measurements	01/11/91 01/14/91
7) 75 krads irradiation @ 1250 rads/hr Post 75 krads Electrical Measurements	01/14/91 01/15/91
8) 100 krads irradiation @ 1250 rads/hr Post 100 krads Electrical Measurements	01/15/91 01/16/91
9) 24 hrs annealing Post 24 hr Electrical Measurements	01/17/91
10) 168 hrs annealing Post 168 hr Electrical Measurements	01/23/91
11) 200 krads irradiation @ 5000 rads/hr Post 200 krads Electrical Measurements	01/23/91 01/24/91
12) 300 krads irradiation @ 5000 rads/hr Post 300 krads Electrical Measurements	01/24/91 01/25/91

Notes:

- 1) All parts were radiated under bias at the cobalt-60 gamma ray facility at GSFC.
- 2) All electrical measurements were performed off-site at 25°C.
- 3) Annealing performed at 25°C under bias.

Table III. Electrical Characteristics of MC35181U

Test	Conditions	MIN	MAX
+IS	No Load, VO = 0V.	-0.13uA	250uA
-IS	No Load, VO = 0V.	-250uA	0.13uA
VOS	RS=50, VO=0V.	-2.00mV	2.00mV
IOS	VCM=0V, VO=0V.	-1.00nA	1.00nA
+IB	VCM=0V, VO=0V.	-1.00nA	1.00nA
-IB	VCM=0V, VO=0V.	-1.00nA	1.00nA
AOL	RL=10k, VO=±10V.	25.00V/mV	301580.80V/mV
CMRR	RS=50, VCM = VICR, VO = 0V.	-1000.00dB	-70.00dB
PSRR	RS=50, VCM = 0V, VO = 0V.	-1000.00dB	-70.00dB
+VOUT	VID=1.0V, RL=10k.	13.50V	22.87V
-VOUT	VID=1.0V, RL=10k.	-22.87V	-13.50V
+ISC	VID=1.0V	3.00mA	50.00mA
-ISC	VID=1.0V	-50.00mA	-8.00mA
+Slew	VIN=-10V to 10V, RL=10k, CL=100pF.	7.00V/us	--

Table IV. Summary of Electrical Measurements after
Total Dose Exposures and Annealing for MC35181U

1/ 2/

Parameters	Units	Spec. Limits min max		Initials mean sd	Total Dose Exposure (krads)												Anneal		
					10		20		30		50		75		100		168 hrs.		
					mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	
+IS	uA	-0.13	250	222	3.0	225	6	220	6	205	6	177	6	145	7	124	10	163	7
-IS	uA	-250	0.13	-224	2.0	-223	5	-215	7	-205	8	-180	10	-145	6	-124	6	-161	11
VOS	mV	-2.0	2.0	-0.6	0.2	-0.6	0.3	-0.9	0.2	-1.0	0.3	-2.1	0.6	-2.6	0.9	-3.2	1.1	-4.1	0.7
IOS	nA	-1.0	1.0	-0.05	0.02	-0.03	0.07	-0.06	0.04	0.2	0.1	-0.05	0.07	-0.06	0.04	-0.09	0.04	-0.1	0
+IB	nA	-1.0	1.0	-0.1	0.03	-0.1	0.1	-0.1	0.1	-0.2	0.1	-0.2	0.1	-0.3	0.1	-0.4	0.1	-0.3	0
-IB	nA	-1.0	1.0	0.0	0.03	-0.1	0.1	0.1	0.1	-0.4	0	-0.1	0	-0.2	0.1	-0.3	0.1	-0.2	0.1
AOL	V/mV	25.0	3E5	65.5	1.0	49.0	3.9	37.0	1.6	28.2	1.2	20.3	0.1	20.2	0	20.2	0	20.2	0.1
CMRR	dB	-1000	-70	-92.3	2.5	-94.2	6	-93.7	5.8	-93.5	6.0	-93.9	6.1	-95.4	7.7	-96.8	8.9	-93.5	5.9
PSRR	dB	-1000	-70	-98.8	2.3	-100	8.9	-101	8.9	-98.2	7.9	-98.2	12.5	-96.8	6.9	-96.7	4.9	-97.0	10.6
+VOUT	V	13.5	22.9	14.0	0	14.0	0	14.0	0	14.0	0	13.9	0	10.9	1.2	6.6	2.8	12.4	0.6
-VOUT	V	-22.9	-13.5	-14.1	0	-14.1	0	-14.1	0	-14.1	0	-14.1	0	-14.1	0	-14.1	0	-14.1	0
+ISC	mA	3.0	50	6.5	0.2	7.8	0.4	6.5	0.3	5.1	0.3	2.9	0.2	1.3	0.2	0.7	0.1	1.8	0.2
-ISC	mA	-50	-8.0	-12.2	0.1	-12.1	0.1	-11.9	0.1	-11.4	0.1	-10.9	0.1	-10.3	0.2	-9.8	0.2	-10.5	0.2
+Slew *	V/us	7.0	-	9.9	0.2	9.4	0.2	8.0	0.3	5.9	0.5	2.43	0.8	< 0.1	-	< 0.1	-	< 0.1	-

* At 75 krads and above, the slew rate readings for all parts were below the minimum value of 0.1V/us that can be recorded by the test equipment.

Table IV. (continued)

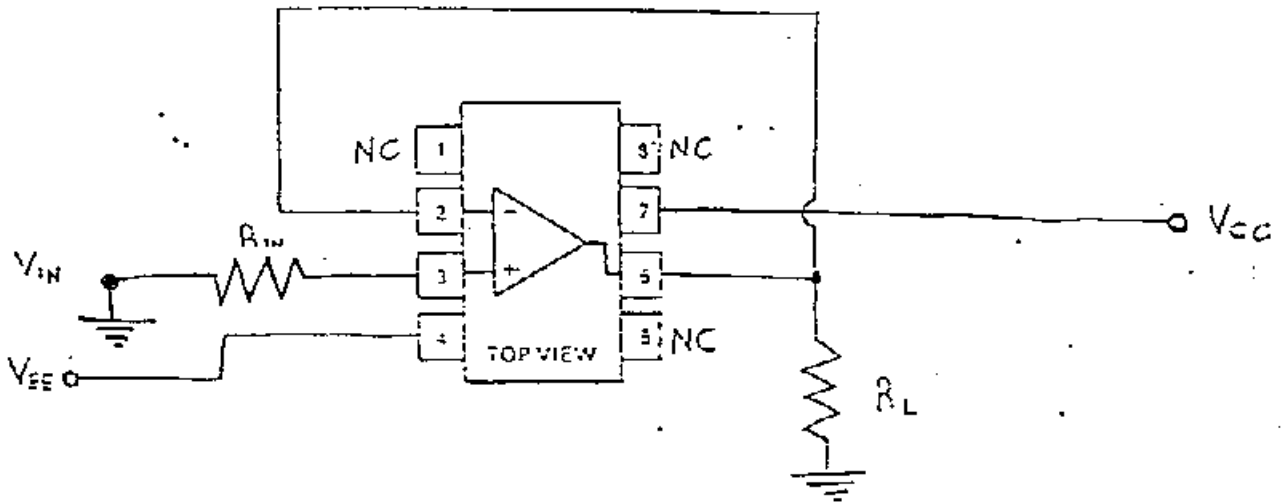
Parameters		Spec. Limits		Total Dose Exposure (krads)			
				200		300	
				min	max	mean	sd
+IS	uA	-0.13	250	90	6	83.7	4.8
-IS	uA	-250	0.13	-89	9	-88	4
VOS	mV	-2.0	2.0	-4.8	0.2	-4.9	0.1
IOS	nA	-1.0	1.0	0	0	0	0
+IB	nA	-1.0	1.0	-0.2	0.3	-0.1	0.1
-IB	nA	-1.0	1.0	-0.2	0.3	-0.1	0.1
AOL	V/mV	25.0	3E5	20.3	0	20.2	0
CMRR	dB	-1000	-70	-92.5	13.9	-82.0	1.0
PSRR	dB	-1000	-70	-98.1	8.8	-91.0	1.0
+VOUT	V	13.5	22.9	1.9	0.3	1.5	0.2
-VOUT	V	-22.9	-13.5	-13.7	0	-13.6	0
+ISC	mA	3.0	50	0.2	0	0.2	0
-ISC	mA	-50	-8.0	-8.6	0	-8.4	0.1
+Slew	V/us	7.0	-	< 0.1	-	< 0.1	-

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/ Table IV provides radiation characteristics of parts at selected total dose exposures and annealing treatments. The data at other radiation exposures and annealing treatments is available and can be obtained upon request.

Figure 1. Radiation Bias Circuit for MC35181U



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

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

$$R_L = 250\Omega \pm 5\% , 1/2 W$$

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