

Unisys

DATE: July 29, 1997
 TO: D. Krus/311
 FROM: K. Sahu/300.1 *ks*
 SUBJECT: Radiation Report on: LM105H/883QS
 Project: ADEOS
 Job #: F10057/58
 Project part #: LM105H/883QS (5962-8958801GX)

PPM-97-033

cc: A. Sharma/311
 OFA Library/300.1

A radiation evaluation was performed on LM105H/883QS (5962-8958801GX) Voltage Regulator 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 Co⁶⁰ gamma ray source. During the radiation testing, four parts were irradiated under bias (see Figure 1 for bias configuration) and one part was used as a control sample. The total dose radiation levels were 5.0, 10.0, 20.0, 30.0, 50.0, and 100.0 kRads.* The dose rate was between 0.125 and 0.50 kRads/hour (0.035 to 0.14 Rads/s). See Table II for the radiation schedule. After the 100.0 kRad exposure, the parts were annealed for 292 hours at 25°C. After each radiation exposure and annealing treatment, parts were electrically tested according to the test conditions and the specification limits** listed in Table III.

Initial electrical measurements were made on 5 samples. Four samples (SN's 82, 83, 84, and 85) were used as radiation samples while SN 81 was used as a control sample.

All parts passed all tests during initial electrical measurements and all steps through 100 kRads. No significant degradation was observed in any parameter.

After annealing the parts for 292 hours at 25°C, the parts did not show any rebound effects.

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 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. The manufacturer provided no post-irradiation limits at the time these tests were performed.

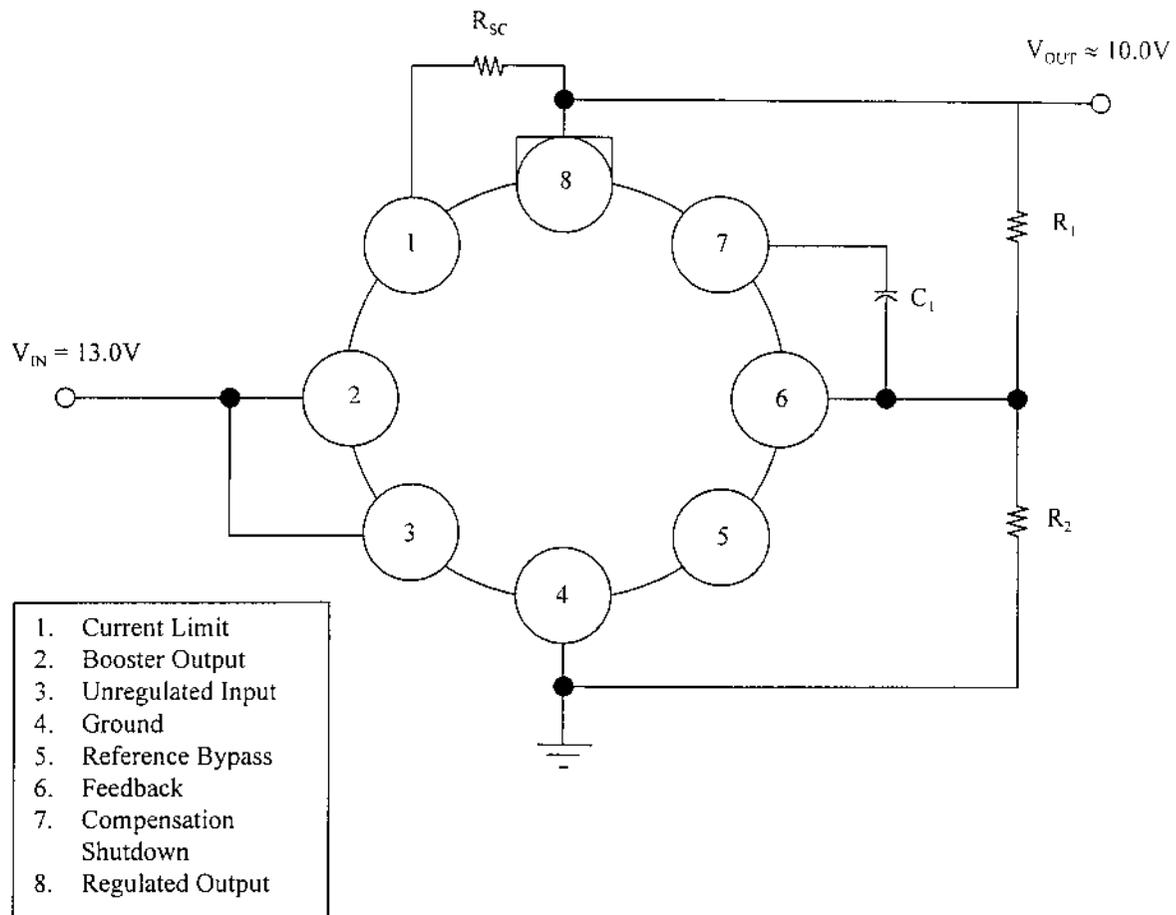
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Figure 1. Radiation Bias Circuit for LM105H

TO-5 Metal Can Package



Notes: R_{sc} is $27\Omega \pm 5\% \frac{1}{2}W$, $R_1 = 10k\Omega \pm 5\% \frac{1}{2}W$, $R_2 = 2k\Omega \pm 5\% \frac{1}{2}W$, $C_1 = 47pf, 50V$.

TABLE I. Part Information

Generic Part Number:	LM105H/883QS
ADEOS Part Number	5962-8958801GX
Charge Number:	F10057/58
Manufacturer:	National Semiconductor
Lot Date Code (LDC):	9640
Quantity Tested:	5
Serial Number of Control Samples:	81
Serial Numbers of Radiation Samples:	82, 83, 84, 85
Part Function:	Voltage Regulator
Part Technology:	Bipolar
Package Style:	TO-5
Test Equipment:	A540
Test Engineer:	D. Davis

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

TABLE II. Radiation Schedule for LM105H

EVENT	DATE
1) INITIAL ELECTRICAL MEASUREMENTS	07/07/97
2) 5.0 KRAD IRRADIATION (0.125 KRADS/HOUR)	07/07/97
POST-5.0 KRAD ELECTRICAL MEASUREMENT	07/09/97
3) 10.0 KRAD IRRADIATION (0.125 KRADS/HOUR)	07/09/97
POST-10.0 KRAD ELECTRICAL MEASUREMENT	07/11/97
4) 20.0 KRAD IRRADIATION (0.250 KRADS/HOUR)	07/11/97
POST-20.0 KRAD ELECTRICAL MEASUREMENT	07/14/97
5) 30.0 KRAD IRRADIATION (0.250 KRADS/HOUR)	07/14/97
POST-30.0 KRAD ELECTRICAL MEASUREMENT	07/16/97
6) 50.0 KRAD IRRADIATION (0.500 KRADS/HOUR)	07/16/97
POST-50.0 KRAD ELECTRICAL MEASUREMENT	07/18/97
7) 100.0 KRAD IRRADIATION (0.500 KRADS/HOUR)	07/18/97
POST-100.0 KRAD ELECTRICAL MEASUREMENT	07/23/97
8) 292 HOUR ANNEALING @25°C	07/23/97
POST-292 HOUR ANNEAL ELECTRICAL MEASUREMENT	08/04/97

Effective Dose Rate = 100,000 RADS/17 DAYS = 254.1 RADS/HOUR=0.068 RADS/SEC

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

Table III. Electrical Characteristics of LM105H 1/

All tests performed with $V_O = 4.5V$, $R_{SC} = 0.0\Omega$

Test #	Parameters /1	Units	Test Conditions	Spec. Lim.	
				min	max
1	Resistance	Ω	$V_{DS} = 0.25V$	200	1200
2	I_Q	mA	$V_{IN} = 50.0V$		2.00
3	V_{REF}	V	$V_{IN} = 8.4V$	1.63	1.81
4	V Load1	%	$V_{IN} = 8.4, I_L = 0.7$ to 13mA		0.05000
5	V Load2	%	$V_{IN} = 50.0V, I_L = 0.7$ to 13mA		0.05000
6	V Load3	%	$V_{IN} = 43.0V, I_L = 13$ to 0.7mA		0.05000
7	V Out	V			40.0
8	V Line1	%	$I_L = 13.0mA, V_{IN} = 8.4$ to 44.5V		1.000
9	V Line2	%	$I_L = 0.7mA, V_{IN} = 8.4$ to 44.5V		1.000
10	V Line3	%	$I_L = 0.7mA, V_{IN} = 43.0$ to 50.0V		0.200
11	V Line4	%	$I_L = 13.0mA, V_{IN} = 50.0$ to 43.0V		0.200
12	Vrange 8.5V	V	No Load	4.0	5.0
13	Vrange 50.0V	V	No Load	4.0	5.0

Notes:

1/ These are the manufacturer's non-irradiated data sheet specification limits. No post-irradiation limits were provided by the manufacturer at the time the tests were performed

TABLE IV: Summary of Electrical Measurements after Total Dose Exposures and Annealing for LM105H /1

Test #	Parameters	Units	Spec. Lim. /2		Total Dose Exposure (kRads)												Annealing											
			min	max	Initial			5.0			10.0			20.0			30.0			50.0			100.0			292 hours @25°C		
					mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
1	Resistance	Ω	200	1200	33	1.8	332	5.1	334	5.0	338	7.7	352	5.5	363	1.3	370	3.7	376	4.3								
2	IQ	mA		2.0	1.8	0.07	1.8	0.07	1.7	0.07	1.7	0.07	1.8	0.07	1.8	0.07	1.8	0.1	1.8	0.1	1.8	0.1						
3	VREF	V	1.63	1.81	1.70	0.01	1.70	0.01	1.70	0.01	1.69	0.01	1.69	0.01	1.69	0.01	1.70	0.02	1.70	0.01	1.70	0.01						
4	V_Load1	%		0.05000	0.0493	0.0073	0.0380	0.0062	0.0460	0.0058	0.0353	0.0122	0.0350	0.0157	0.0386	0.0061	0.0388	0.0156	0.0354	0.0070	0.0354	0.0070						
5	V_Load2	%		0.05000	0.0079	0.0081	0.0078	0.0081	0.0160	0	0.0160	0	0.0159	0.0087	0.0118	0.0069	0.0120	0.0068	0.0119	0.0067	0.0119	0.0067						
6	V_Load3	%		0.05000	-0.0003	0	-0.0003	0	0.0081	0.0079	-0.0003	0	-0.0003	0	-0.0042	0.0068	0.0077	0.0080	-0.0042	0.0069	0.0069	0.0069						
7	V_Out	V		40.0	39.3	0.4	38.8	0.2	38.9	0.1	39.0	0.1	39.0	0.1	39.1	0.1	39.1	0.2	39.1	0.01	39.1	0.01						
8	V_Line1	%		1.000	-0.284	0	-0.250	0.061	-0.214	0.071	-0.285	0.001	-0.250	0.061	-0.285	0.100	-0.356	0.070	-1.285	0.001	-1.285	0.001						
9	V_Line2	%		1.000	-0.284	0	-0.258	0.001	-0.285	0.001	-0.285	0.001	-0.285	0.001	-0.285	0.001	-0.285	0.001	-0.285	0.001	-0.285	0.001						
10	V_Line3	%		0.200	-0.073	0.071	-0.037	0.061	-0.037	0.061	-0.037	0.061	-0.073	0.071	-0.002	0	-0.038	0.061	-0.037	0.061	-0.037	0.061						
11	V_Line4	%		0.200	0.033	0.061	-0.037	0.061	-0.002	0	-0.035	0.057	-0.070	0.068	-0.002	0	-0.034	0.058	0.033	0.061	0.033	0.061						
12	Vrange_8.5V	V	4.0	5.0	4.4	0	4.4	0	4.4	0	4.4	0	4.4	0	4.4	0	4.4	0	4.4	0	4.4	0						
13	Vrange_50.0V	V	4.0	5.0	4.5	0.5	4.4	0	4.4	0	4.4	0	4.4	0	4.4	0	4.4	0	4.4	0	4.4	0						

Notes:

- 1/ The mean and standard deviation values were calculated over the four parts irradiated in this testing. The control samples remained constant throughout testing and are 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 parameters: None.