

DATE: September 15, 1995 PPM-95-178

TO: S. Hull/311.1

FROM: K. Sahu/300.1

SUBJECT: Radiation Report on HST/STIS  
Part No. AD829SQ  
Control No. 12887

cc: A. Sharma/311.0  
R. Williams/300.1  
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A radiation evaluation was performed on AD829 (Op-Amp) 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 III.

The total dose testing was performed using a Co<sup>60</sup> gamma ray source. During the radiation testing, five parts were irradiated under bias, and two parts were used as control samples. The total dose radiation levels were 1, 2, 3, and 10 krads\*. The dose rate was between 0.05 and 0.35 krads/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\*\*.

All parts passed initial electrical measurements. All irradiated parts passed all parametric tests throughout all irradiation steps with no observable radiation-induced effects.

Table III 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.

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\*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:                    | AD829              |
| HST/STIS<br>Part Number:                | AD829SQ/883B       |
| HST/STIS<br>Control Number:             | 12887              |
| Charge Number:                          | EE56352            |
| Manufacturer:                           | Analog Devices Inc |
| Lot Date Code:                          | 9443A              |
| Quantity Tested:                        | 7                  |
| Serial Number of<br>Control Samples:    | 60, 61             |
| Serial Numbers of<br>Radiation Samples: | 62, 63, 64, 65, 66 |
| Part Function:                          | Op-Amp             |
| Part Technology:                        | CMOS               |
| Package Style:                          | 8-pin Cerdip       |
| Test Equipment:                         | A540               |
| Test Engineer:                          | Tim Mondy          |

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

TABLE II. Radiation Schedule for AD829

| EVENTS  | DATE                 |
|---|----------------------|
| 1) INITIAL ELECTRICAL MEASUREMENTS  | 08/07/95             |
| 2) 1 KRAD IRRADIATION (0.05 KRADS/HOUR)<br>POST-1 KRAD ELECTRICAL MEASUREMENT   | 08/17/95<br>08/18/95 |
| 3) 2 KRAD IRRADIATION (0.05 KRADS/HOUR)<br>POST-2 KRAD ELECTRICAL MEASUREMENT   | 08/18/95<br>08/21/95 |
| 4) 3 KRAD IRRADIATION (0.05 KRADS/HOUR)<br>POST-3 KRAD ELECTRICAL MEASUREMENT   | 08/21/95<br>08/22/95 |
| 5) 10 KRAD IRRADIATION (0.35 KRADS/HOUR)<br>POST-10 KRAD ELECTRICAL MEASUREMENT | 08/22/95<br>08/23/95 |

**Table III: Summary of Electrical Measurements after Total Dose Exposures and Annealing for AD829 /1**

| Test # | Parameters             | Units | Spec. Lim./2<br>min max |      | Total dose Exposure (krads) |      |       |      |       |      |       |      |       |      |
|--------|------------------------|-------|-------------------------|------|-----------------------------|------|-------|------|-------|------|-------|------|-------|------|
|        |                        |       |                         |      | Initial                     |      | 1     |      | 2     |      | 3     |      | 10    |      |
|        |                        |       |                         |      | mean                        | sd   | mean  | sd   | mean  | sd   | mean  | sd   | mean  | sd   |
| 1      | Plus_Icc_15V           | mA    | 0                       | 6.8  | 5.44                        | 0.07 | 5.51  | 0.09 | 5.48  | 0.09 | 5.42  | 0.07 | 5.49  | 0.10 |
| 2      | Minus_Icc_15V          | mA    | -6.8                    | 0    | -5.45                       | 0.08 | -5.51 | 0.09 | -5.49 | 0.09 | -5.42 | 0.07 | -5.51 | 0.10 |
| 3      | Plus_Icc_5V            | mA    | 0                       | 6.5  | 5.35                        | 0.07 | 5.41  | 0.08 | 5.39  | 0.08 | 5.33  | 0.07 | 5.39  | 0.09 |
| 4      | Minus_Icc_5V           | mA    | -6.5                    | 0    | -5.35                       | 0.07 | -5.41 | 0.08 | -5.39 | 0.08 | -5.33 | 0.07 | -5.40 | 0.09 |
| 5      | I_VOS @ 5V             | uV    | -500                    | 500  | 48                          | 14   | 46    | 12   | 46    | 13   | 44    | 13   | 35    | 13   |
| 6      | P_IIB @ 5V             | uA    | -7                      | 7    | 3                           | 0.21 | 3     | 0.19 | 3     | 0.18 | 3     | 0.19 | 4     | 0.15 |
| 7      | N_IIB @ 5V             | uA    | -7                      | 7    | 3                           | 0.21 | 3     | 0.19 | 3     | 0.19 | 3     | 0.19 | 4     | 0.15 |
| 8      | I_IOS @ 5V             | nA    | -500                    | 500  | -2.63                       | 5.37 | -1.79 | 4.91 | 0.71  | 5.75 | 1.24  | 6.60 | 19.2  | 15.5 |
| 9      | I_VOS @ 15V            | uV    | -500                    | 500  | 71                          | 18   | 71    | 18   | 66    | 19   | 62    | 18   | -13   | 24   |
| 10     | P_IIB @ 15V            | uA    | -7                      | 7    | 3                           | 0.2  | 3     | 0.18 | 3     | 0.18 | 3     | 0.18 | 3     | 0.14 |
| 11     | N_IIB @ 15V            | uA    | -7                      | 7    | 3                           | 0.2  | 3     | 0.19 | 3     | 0.18 | 3     | 0.18 | 3     | 0.15 |
| 12     | I_IOS @ 15V            | nA    | -500                    | 500  | 1.57                        | 5.15 | 2.42  | 5.75 | 4.54  | 5.63 | 5.59  | 6.78 | 28.1  | 16.1 |
| 13     | +CMRR_1                | dB    | 100                     | -    | 119                         | 5.9  | 119   | 6.08 | 130   | 23   | 129   | 21   | 121   | 7.93 |
| 14     | -CMRR_1                | dB    | 100                     | -    | 122                         | 6.65 | 121   | 6.53 | 123   | 7.85 | 123   | 7.43 | 120   | 5.59 |
| 15     | +CMRR_2                | dB    | 100                     | -    | 127                         | 16.4 | 121   | 8.03 | 127   | 11.8 | 126   | 10.7 | 127   | 13.6 |
| 16     | -CMRR_2                | dB    | 100                     | -    | 113                         | 4.41 | 115   | 4.69 | 123   | 6.95 | 123   | 7.06 | 123   | 6.62 |
| 17     | PSRR                   | dB    | 98                      | -    | 118                         | 2.11 | 118   | 2.15 | 119   | 2.41 | 120   | 2.43 | 106   | 2.27 |
| 18     | P_VOUT @ 12mA          | V     | 12                      | -    | 14.3                        | 0.02 | 14.1  | 0.02 | 13.9  | 0.01 | 13.9  | 0.01 | 13.9  | 0.01 |
| 19     | P_VOUT @ 20mA          | V     | 10                      | -    | 14.1                        | 0.02 | 14.0  | 0.02 | 13.6  | 0.02 | 13.6  | 0.02 | 13.6  | 0.01 |
| 20     | N_VOUT @ 12mA          | V     | -                       | -12  | -13.6                       | 0.01 | -13.6 | 0.0  | -13.6 | 0.0  | -13.6 | 0.01 | -13.6 | 0.0  |
| 21     | N_VOUT @ 20mA          | V     | -                       | -10  | -13.4                       | 0.01 | -13.4 | 0.01 | -13.4 | 0.01 | -13.4 | 0.01 | -13.4 | 0.01 |
| 22     | P_VOUT @ 6mA           | V     | 3                       | -    | 3.51                        | 0.01 | 3.65  | 0.01 | 4.04  | 0.01 | 4.04  | 0.0  | 4.04  | 0.01 |
| 23     | P_VOUT @ 16mA          | V     | 2.5                     | -    | 3.29                        | 0.01 | 3.49  | 0.01 | 3.74  | 0.01 | 3.74  | 0.01 | 3.73  | 0.01 |
| 24     | N_VOUT @ 6mA           | V     | -                       | -3   | -3.83                       | 0.0  | -3.83 | 0.0  | -3.83 | 0.0  | -3.83 | 0.0  | -3.83 | 0.0  |
| 25     | N_VOUT @ 16mA          | V     | -                       | -2.5 | -3.53                       | 0.0  | -3.53 | 0.01 | -3.52 | 0.01 | -3.53 | 0.01 | -3.53 | 0.0  |
| 26     | P_AOL V/mV @ 10mV V/mV | 50    | -                       | -    | 103                         | 5.07 | 103   | 4.77 | 101   | 4.61 | 100   | 4.72 | 98.1  | 4.56 |
| 27     | V_AOL V/mV @ 10mV V/mV | 50    | -                       | -    | 111                         | 5.17 | 111   | 5.08 | 110   | 4.98 | 109   | 4.93 | 106   | 4.94 |
| 28     | P_AOL V/mV @ 5mV V/mV  | 30    | -                       | -    | 59.1                        | 1.39 | 61.9  | 1.31 | 62.9  | 1.51 | 62.1  | 1.41 | 59.6  | 1.23 |
| 29     | V_AOL V/mV @ 5mV V/mV  | 30    | -                       | -    | 69.7                        | 4.22 | 70.2  | 4.45 | 70.2  | 4.34 | 69.1  | 4.20 | 65.9  | 3.87 |
| 30     | VNoise                 | nV    |                         |      | 2.34                        | 0.08 | 2.33  | 0.07 | 2.43  | 0.09 | 2.39  | 0.11 | 2.42  | 0.88 |
| 31     | INoise                 | fA    |                         |      | 68                          | 0.75 | 69    | 0.69 | 69    | 0.71 | 68    | 0.79 | 67    | 0.81 |
| 32     | Slew Rate              | V/uS  |                         |      | 164                         | 3.61 | 162   | 3.32 | 162   | 3.51 | 165   | 4.01 | 162   | 3.41 |
| 33     | GBW                    | MHz   |                         |      | 719                         | 15.2 | 728   | 11.2 | 722   | 9.27 | 725   | 12.2 | 727   | 10.9 |
| 34     | Settling               | nS    |                         |      | 80                          | 0.0  | 80    | 0.0  | 80    | 0.0  | 80    | 0.0  | 80    | 0.0  |

Notes:

- 1/ The mean and standard deviation values were calculated over the five parts irradiated in this testing. The control samples remained constant throughout the testing and are not included in this table.
- 2/ These are manufacturer's pre-irradiation data sheet specification limits.