Final Report
R1.2 081106

Radiation Assured Devices
5017 N. 30th Street
Colorado Springs, CO 80919
(719) 531-0800

Radiation Lot Acceptance Test (RLAT) of the RH27CW Precision Op Amp for Linear Technology

Customer: Linear Technology, PO 49797L

RAD Job Number: 08-136

Part Type Tested: Linear Technology RH27CW Precision Op Amp

Commercial Part Number: RH27CW

Traceability Information: Lot Date Code: 0727A, FAB 10223511.1, Wafer 6, LOT 441652.1

Quantity of Units: 11 units total, 5 units for biased irradiation, 5 units for unbiased irradiation and 1 control unit.

External Traveler: None required

Pre-Irradiation Burn-In: Burn-In performed by Linear Technology prior to receipt by RAD, Inc.

TID Dose Rate and Maximum Total Dose: 50 to 300rad(Si)/s to 50krad(Si) total ionizing dose

TID Test Increments: Pre-Irradiation, 10krad(Si), 20krad(Si), 30krad(Si) and 50krad(Si)

TID Overtest and Post-Irradiation Anneal: No overtest. 24-hour room temperature anneal followed by a 168-hour 100°C anneal. Both anneals shall be performed in the same electrical bias condition as the irradiations. Electrical measurements shall be made following each anneal increment.

TID Test Standard: MIL-STD-883G, Method 1019.7, Condition A

TID Electrical Test Conditions: Pre-irradiation, and within one hour following each radiation exposure.

Test Programs: RH027FP.SRC

Hardware: LTS2020 Tester, 2101 Family Board, 0600 Fixture and RH027FP DUT Board

TID Bias Conditions: Serial numbers 958, 959, 960, 963 and 969 were biased during irradiation, serial numbers 964-968 were unbiased during irradiation and serial number 957 was used as the control.

Facility: Radiation Assured Devices Longmire Laboratories, Colorado Springs, CO

Radiation Sources: Co60 (JLSA 81-24)

Irradiation and Test Temperature: Ambient, room temperature

RLAT Result: PASSED. All parts met datasheet specifications to 50krad(Si) with no substantial degradation to any measured parameter

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1.0. Overview and Background

It is well known that total dose ionizing radiation can cause parametric degradation and ultimately functional failure in electronic devices. The damage occurs via electron-hole pair production, transport and trapping in the dielectric and interface regions. In discrete devices the bulk of the damage is frequently manifested as a reduction in the gain and/or breakdown voltage of the device. The damage will usually anneal with time following the end of the radiation exposure. Due to this annealing, and to ensure a worst-case test condition MIL-STD-883 TM1019.7 calls out a dose rate of 50 to 300rad(Si)/s as Condition A and further specifies that the time from the end of an incremental radiation exposure and electrical testing shall be 1-hour or less and the total time from the end of one incremental irradiation to the beginning of the next incremental radiation step should be 2-hours or less. The work described in this report was performed to meet MIL-STD-883 TM1019.7 Condition A.

2.0. Radiation Test Apparatus

The total ionizing dose testing described in this final report was performed using the facilities at Radiation Assured Devices' Longmire Laboratories in Colorado Springs, CO. The high dose rate total ionizing dose (TID) source is a JLSA 84-21 irradiator modified to provide a panoramic exposure. The Co-60 rods are held in the base of the irradiator heavily shielded by lead, during the radiation exposures the rod is raised by an electronic timer/controller and the exposure is performed in air. The dose rate for this irradiator in this configuration ranges from <1rad(Si)/s to a maximum of approximately 120rad(Si)/s, determined by the distance from the source. For high-dose rate experiments the bias boards are placed in a radial fashion equidistant from the raised Co-60 rods with the distance adjusted to provide the required dose rate. The irradiator calibration is maintained by Radiation Assured Devices Longmire Laboratories using thermoluminescent dosimeters (TLDs)) traceable to the National Institute of Standards and Technology (NIST). Figure 2.1 shows a photograph of the JLSA 81-24 Co-60 irradiator at RAD's Longmire Laboratory facility.

RAD is currently certified by the Defense Supply Center Columbus (DSCC) for Laboratory Suitability under MIL STD 750. Additional details regarding Radiation Assured Devices dosimetry for TM1019 Condition A testing are available in RAD's report to DSCC entitled: "Dose Rate Mapping of the J.L. Shepherd and Associates Model 81 Irradiator Installed by Radiation Assured Devices"

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Figure 2.1. Radiation Assured Devices' high dose rate Co-60 irradiator. The dose rate is obtained by positioning the device-under-test at a fixed distance from the gamma cell. The dose rate for this irradiator varies from approximately 120rad(Si)/s close to the rods down to 1rad(Si)/s at a distance of approximately 2-feet.

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3.0. Radiation Test Conditions

The RH27CW Operational Amplifier described in this final report was tested using two bias conditions, biased with a split 15V supply and all pins tied to ground, see Appendix A for details on biasing conditions. These bias circuits satisfy the requirements of MIL-STD-883G TM1019.7 Section 3.9.3 Bias and Loading Conditions which states "The bias applied to the test devices shall be selected to produce the greatest radiation induced damage or the worst-case damage for the intended application, if known. While maximum voltage is often worst case some bipolar linear device parameters (e.g. input bias current or maximum output load current) exhibit more degradation with 0 V bias."

The devices were irradiated to a maximum total ionizing dose level of 50krad(Si) with incremental readings at 10, 20, 30 and 50krad(Si). Electrical testing occurred within one hour following the end of each irradiation segment. For intermediate irradiations, the units were tested and returned to the total dose exposure within two hours from the end of the previous radiation increment. The TID bias board was positioned in the Co-60 cell to provide the required minimum of 50rad(Si)/s and was located inside a lead-aluminum enclosure. The lead-aluminum enclosure is required under MIL-STD-883G TM1019.7 Section 3.4 that reads as follows: "Lead/Aluminum (Pb/Al) container. Test specimens shall be enclosed in a Pb/Al container to minimize dose enhancement effects caused by low-energy, scattered radiation. A minimum of 1.5 mm Pb, surrounding an inner shield of at least 0.7 mm Al, is required. This Pb/Al container produces an approximate charged particle equilibrium for Si and for TLDs such as CaF2. The radiation field intensity shall be measured inside the Pb/Al container (1) initially, (2) when the source is changed, or (3) when the orientation or configuration of the source, container, or test-fixture is changed. This measurement shall be performed by placing a dosimeter (e.g., a TLD) in the device-irradiation container at the approximate test-device position. If it can be demonstrated that low energy scattered radiation is small enough that it will not cause dosimetry errors due to dose enhancement, the Pb/Al container may be omitted".

The final dose rate within the lead-aluminum box was determined based on TLD dosimetry measurements just prior to the beginning of the total dose irradiations. The final dose rate for this work was 50rad(Si)/s with a precision of ±5%.

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4.0. Tested Parameters

The following parameters were tested during the course of this work:

1. Power Supply Rejection Ratio, PSRR
2. Common Mode Rejection Ratio, CMRR
3. Power Dissipation, P_D
4. Open Loop Gain, AVOL
5. + Input Bias Current, $+I_B$
6. - Input Bias Current, $-I_B$
7. Input Offset Current, I_{OS}
8. Input Offset Voltage, V_{OS}

Appendix C details the measured parameters, test conditions, pre-irradiation specification and measurement resolution for each of the measurements.

The parametric data was obtained as "read and record" and all the raw data plus an attributes summary are contained in this report as well as in a separate Excel file. The attributes data contains the average, standard deviation and the average with the KTL values applied. The KTL values used is 2.742 per MIL HDBK 814 using one sided tolerance limits of 90/90 and a 5-piece sample size. This survival probability/level of confidence is consistent with a 22-piece sample size and zero failures analyzed using a lot tolerance percent defective (LTPD) approach. Note that the following criteria must be met for a device to pass the TID testing: following the radiation exposure the unit shall pass the specification value and the average value for each device must pass the specification value when the KTL limits are applied. If either of these conditions is not satisfied following the radiation exposure, then the lot could be logged as an RLAT failure.

Further, MIL-STD-883G, TM 1019.7 Section 3.13.1.1 Characterization test to determine if a part exhibits ELDRS" states the following: Select a minimum random sample of 21 devices from a population representative of recent production runs. Smaller sample sizes may be used if agreed upon between the parties to the test. All of the selected devices shall have undergone appropriate elevated temperature reliability screens, e.g. burn-in and high temperature storage life. Divide the samples into four groups of 5 each and use the remaining part for a control. Perform pre-irradiation electrical characterization on all parts assuring that they meet the Group A electrical tests. Irradiate 5 samples under a 0 volt bias and another 5 under the irradiation bias given in the acquisition specification at 50-300 rad(Si)/s and room temperature. Irradiate 5 samples under a 0 volt bias and another 5 under irradiation bias given in the acquisition specification at < 10mrad(Si)/s and room temperature. Irradiate all samples to the same dose levels, including 0.5 and 1.0 times the anticipated specification dose, and repeat the electrical characterization on each part at each dose level. Post irradiation electrical measurements shall be performed per paragraph 3.10 where the low dose rate test is considered

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Condition D. Calculate the radiation induced change in each electrical parameter (Δpara) for each sample at each radiation level. Calculate the ratio of the median Δpara at low dose rate to the median Δpara at high dose rate for each irradiation bias group at each total dose level. If this ratio exceeds 1.5 for any of the most sensitive parameters then the part is considered to be ELDRS susceptible. This test does not apply to parameters which exhibit changes that are within experimental error or whose values are below the pre-irradiation electrical specification limits at low dose rate at the specification dose.

Therefore, the data in this report can be analyzed along with the low dose rate report titled "Enhanced Low Dose Rate Sensitivity (ELDRS) Radiation Testing of The RH27CW Precision Op Amp for Linear Technology" to demonstrate that these parts do not exhibit ELDRS as defined in the current test method.

5.0. TID Test Results

Using the conditions stated above, the RH27CW devices passed the radiation lot acceptance test to 50krad(Si) with no significant degradation to any measured parameter. Figures 5.1 through 5.8 show plots of all the measured parameters versus total ionizing dose. In the data plots the solid diamonds are the average of the measured data points for the sample irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the units irradiated with all pins tied to ground. The black lines (solid or dashed) are the average of the data points after application of the KTL statistics on the sample irradiated in the biased condition while the shaded lines (solid or dashed) are the average of the data points after application of the KTL statistics on the sample irradiated in the unbiased condition. The red dotted line(s) are the pre- and/or post-irradiation minimum and/or maximum specification value as defined in the datasheet and/or test plan.

As seen clearly in these figures, the pre- and post-irradiation data are within specification even after application of the KTL statistics (except for CMRR, as discussed in more detail below). The control units, as expected, show no significant changes to any of the parameters. Therefore we can conclude that the observed degradation (if any) was due to the radiation exposure. Similarly, tables 5.1 through 5.8 show the raw data, averages, standard deviation, +KTL statistics, -KTL statistics, specification limit and Pass/Fail condition for each parameter.

It should be noted that common mode rejection ratio (CMRR) was out of specification at the 20krad(Si) read point after application of the KTL statistics. This is primarily due to the relatively large standard deviation in the sample population relative to the specification value and our ability to measure this parameter with high precision (See Appendix C, Table C.2). We do not believe that this is a radiation-induced failure. The behavior seen in this report is consistent with the ELDRS data obtained on this component, which is also intermittently out of specification (see: "Enhanced Low Dose Rate Sensitivity (ELDRS) Radiation Testing of The RH27CW Precision Op Amp for Linear Technology". It is also important to understand that the testing and statistics used in this document are based on an "analysis of

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variables" technique, which relies on small sample sizes to qualify much larger lot sizes (see MIL-HDBK-814, p. 91 for a discussion of statistical treatments). Not all measured parameters are well suited to this approach due to inherent large variations where the device exhibits enhanced sensitivity to input conditions leading to a relatively large initial standard deviation. If necessary, larger samples sizes could be used to qualify these parameters using an "attributes" approach. If a lot tolerance percent defective (LTPD) approach were used, then 22-pieces could be tested and if all units pass (without application of any statistics) then the lot is qualified to a 90/90 survival probability/level of confidence, the same level as achieved using the KTL statistics discussed in this report on a 5-piece sample size.

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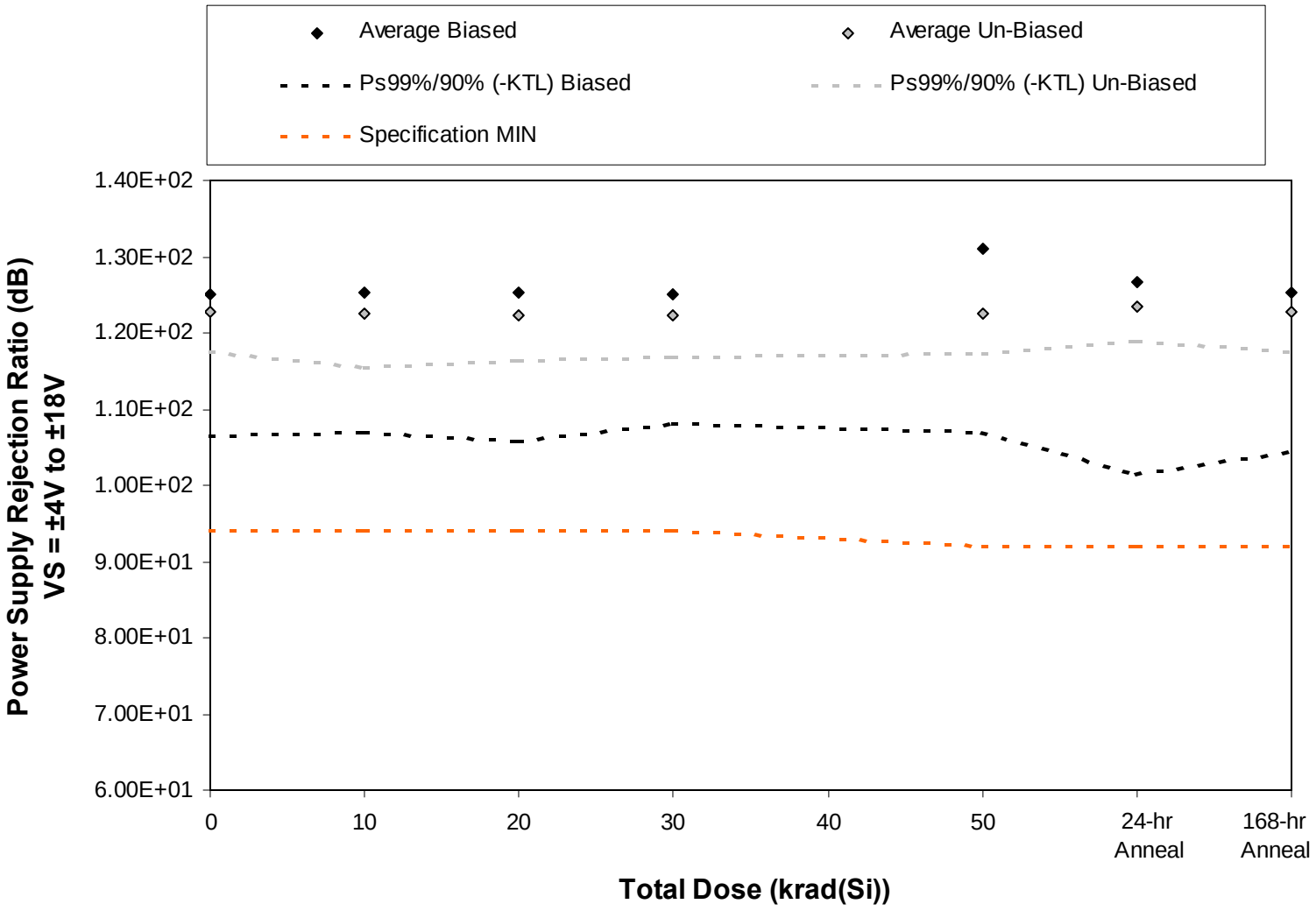

Figure 5.1. Plot of power supply rejection ratio versus total dose. The data shows no significant degradation with dose. The solid diamonds are the average of the measured data points for the sample irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the units irradiated with all pins tied to ground. The black lines (solid or dashed) are the average of the data points after application of the KTL statistics on the sample irradiated in the biased condition while the shaded lines (solid or dashed) are the average of the data points after application of the KTL statistics on the sample irradiated in the unbiased condition. The red dotted line(s) are the pre- and/or post-irradiation minimum and/or maximum specification value as defined in the datasheet and/or test plan.

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Table 5.1. Raw data for the power supply rejection ratio versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail)

Power Supply Rejection Ratio (dB) VS = ±4V to ±18V	Total Dose (krad(Si))					24 hr Anneal	168 hr Anneal
Device	0	10	20	30	50		
958	1.22E+02	1.22E+02	1.22E+02	1.22E+02	1.21E+02	1.22E+02	1.22E+02
959	1.37E+02	1.37E+02	1.38E+02	1.36E+02	1.38E+02	1.43E+02	1.39E+02
960	1.22E+02	1.23E+02	1.23E+02	1.23E+02	1.29E+02	1.23E+02	1.22E+02
969	1.23E+02	1.23E+02	1.24E+02	1.23E+02	1.42E+02	1.23E+02	1.23E+02
963	1.21E+02	1.21E+02	1.20E+02	1.21E+02	1.25E+02	1.22E+02	1.21E+02
964	1.23E+02	1.20E+02	1.20E+02	1.21E+02	1.22E+02	1.24E+02	1.23E+02
965	1.22E+02	1.22E+02	1.22E+02	1.22E+02	1.22E+02	1.22E+02	1.22E+02
966	1.21E+02	1.22E+02	1.22E+02	1.21E+02	1.21E+02	1.22E+02	1.21E+02
967	1.22E+02	1.22E+02	1.22E+02	1.22E+02	1.22E+02	1.23E+02	1.22E+02
968	1.26E+02	1.27E+02	1.26E+02	1.26E+02	1.26E+02	1.26E+02	1.26E+02
957	1.27E+02	1.28E+02	1.27E+02	1.27E+02	1.28E+02	1.28E+02	1.28E+02
Biased Statistics							
Average Biased	1.25E+02	1.25E+02	1.25E+02	1.25E+02	1.31E+02	1.27E+02	1.25E+02
Std Dev Biased	6.75E+00	6.65E+00	7.20E+00	6.20E+00	8.80E+00	9.18E+00	7.64E+00
Ps99%/90% (+KTL) Biased	1.43E+02	1.43E+02	1.45E+02	1.42E+02	1.55E+02	1.52E+02	1.46E+02
Ps99%/90% (-KTL) Biased	1.07E+02	1.07E+02	1.06E+02	1.08E+02	1.07E+02	1.01E+02	1.04E+02
Un-Biased Statistics							
Average Un-Biased	1.23E+02	1.23E+02	1.22E+02	1.22E+02	1.23E+02	1.23E+02	1.23E+02
Std Dev Un-Biased	1.92E+00	2.61E+00	2.19E+00	2.07E+00	1.95E+00	1.67E+00	1.92E+00
Ps99%/90% (+KTL) Un-Biased	1.28E+02	1.30E+02	1.28E+02	1.28E+02	1.28E+02	1.28E+02	1.28E+02
Ps99%/90% (-KTL) Un-Biased	1.18E+02	1.15E+02	1.16E+02	1.17E+02	1.17E+02	1.19E+02	1.18E+02
Specification MIN	9.40E+01	9.40E+01	9.40E+01	9.40E+01	9.20E+01	9.20E+01	9.20E+01
Status	PASS	PASS	PASS	PASS	PASS	PASS	PASS

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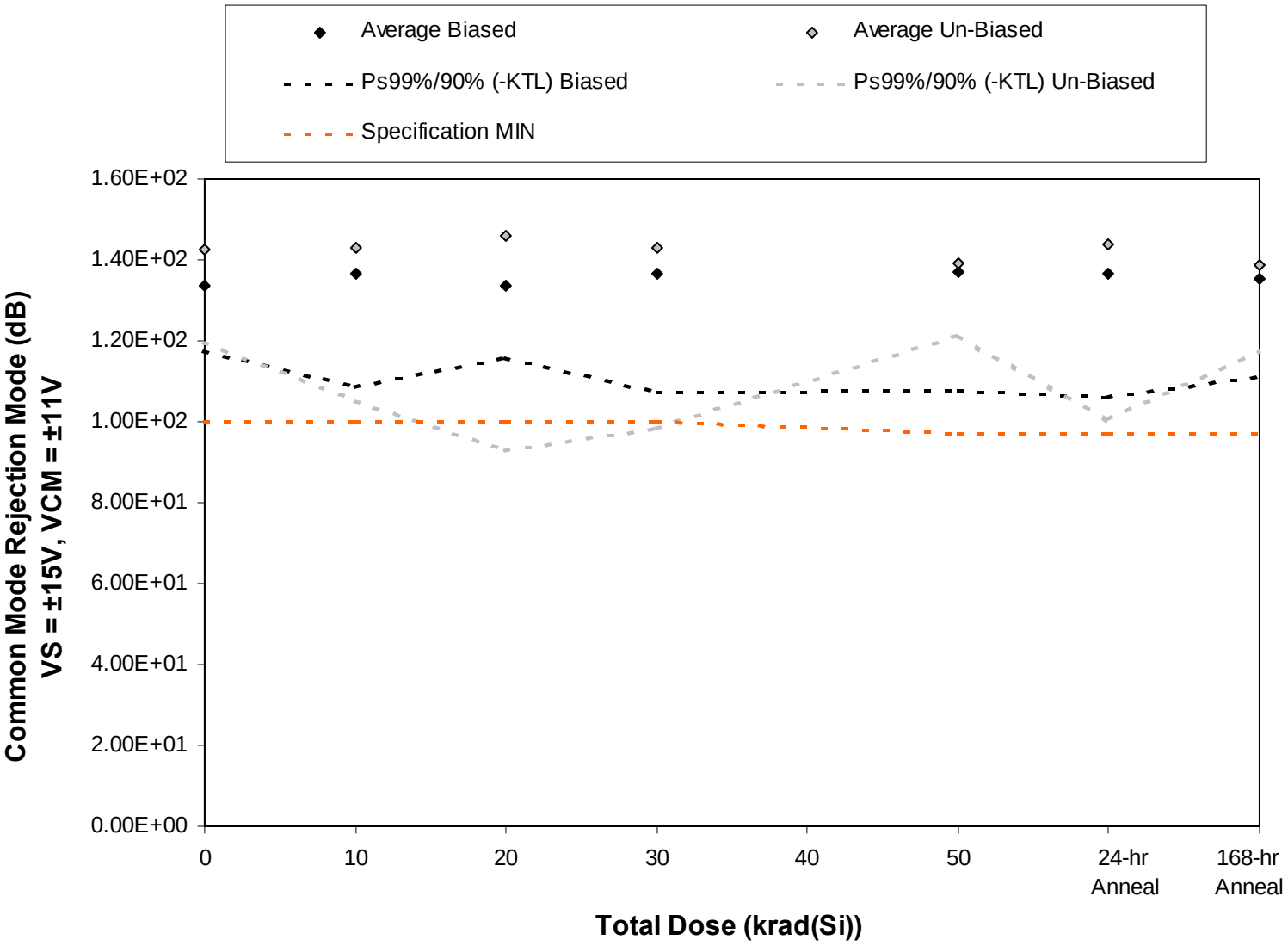

Figure 5.2. Plot of common mode rejection ratio versus total dose. The data shows no significant degradation with dose. Note that this parameter is "out of specification" for portions of the test after application of the KTL statistics due to a relatively large standard deviation of the population and limitations of the measurement resolution (see Appendix C, table C.2). The solid diamonds are the average of the measured data points for the sample irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the units irradiated with all pins tied to ground. The black lines (solid or dashed) are the average of the data points after application of the KTL statistics on the sample irradiated in the biased condition while the shaded lines (solid or dashed) are the average of the data points after application of the KTL statistics on the sample irradiated in the unbiased condition. The red dotted line(s) are the pre- and/or post-irradiation minimum and/or maximum specification value as defined in the datasheet and/or test plan.

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Table 5.2. Raw data for the common mode rejection ratio versus total dose, including the statistical analysis, the specification and the status of the testing (pass/fail).

Common Mode Rejection Mode (dB) VS = ±15V, VCM = ±11V	Total Dose (krad(Si))					24 hr Anneal	168 hr Anneal
Device	0	10	20	30	50		
958	1.40E+02	1.53E+02	1.43E+02	1.54E+02	1.54E+02	1.54E+02	1.49E+02
959	1.26E+02	1.27E+02	1.27E+02	1.27E+02	1.27E+02	1.27E+02	1.27E+02
960	1.37E+02	1.37E+02	1.35E+02	1.35E+02	1.36E+02	1.35E+02	1.33E+02
969	1.29E+02	1.29E+02	1.28E+02	1.29E+02	1.29E+02	1.27E+02	1.29E+02
963	1.37E+02	1.37E+02	1.35E+02	1.37E+02	1.40E+02	1.39E+02	1.38E+02
964	1.29E+02	1.30E+02	1.28E+02	1.30E+02	1.29E+02	1.30E+02	1.29E+02
965	1.44E+02	1.38E+02	1.40E+02	1.40E+02	1.38E+02	1.41E+02	1.37E+02
966	1.49E+02	1.42E+02	1.39E+02	1.37E+02	1.40E+02	1.38E+02	1.36E+02
967	1.50E+02	1.66E+02	1.79E+02	1.71E+02	1.47E+02	1.71E+02	1.50E+02
968	1.41E+02	1.38E+02	1.43E+02	1.36E+02	1.42E+02	1.39E+02	1.41E+02
957	1.84E+02	1.59E+02	1.53E+02	1.50E+02	1.67E+02	1.77E+02	1.54E+02
Biased Statistics							
Average Biased	1.34E+02	1.37E+02	1.34E+02	1.36E+02	1.37E+02	1.36E+02	1.35E+02
Std Dev Biased	5.97E+00	1.02E+01	6.47E+00	1.07E+01	1.08E+01	1.11E+01	8.79E+00
Ps99%/90% (+KTL) Biased	1.50E+02	1.65E+02	1.51E+02	1.66E+02	1.67E+02	1.67E+02	1.59E+02
Ps99%/90% (-KTL) Biased	1.17E+02	1.09E+02	1.16E+02	1.07E+02	1.08E+02	1.06E+02	1.11E+02
Un-Biased Statistics							
Average Un-Biased	1.43E+02	1.43E+02	1.46E+02	1.43E+02	1.39E+02	1.44E+02	1.39E+02
Std Dev Un-Biased	8.44E+00	1.37E+01	1.94E+01	1.62E+01	6.61E+00	1.58E+01	7.70E+00
Ps99%/90% (+KTL) Un-Biased	1.66E+02	1.80E+02	1.99E+02	1.87E+02	1.57E+02	1.87E+02	1.60E+02
Ps99%/90% (-KTL) Un-Biased	1.19E+02	1.05E+02	9.26E+01	9.84E+01	1.21E+02	1.01E+02	1.17E+02
Specification MIN	1.00E+02	1.00E+02	1.00E+02	1.00E+02	9.70E+01	9.70E+01	9.70E+01
Status	PASS	PASS	FAIL	FAIL	PASS	PASS	PASS

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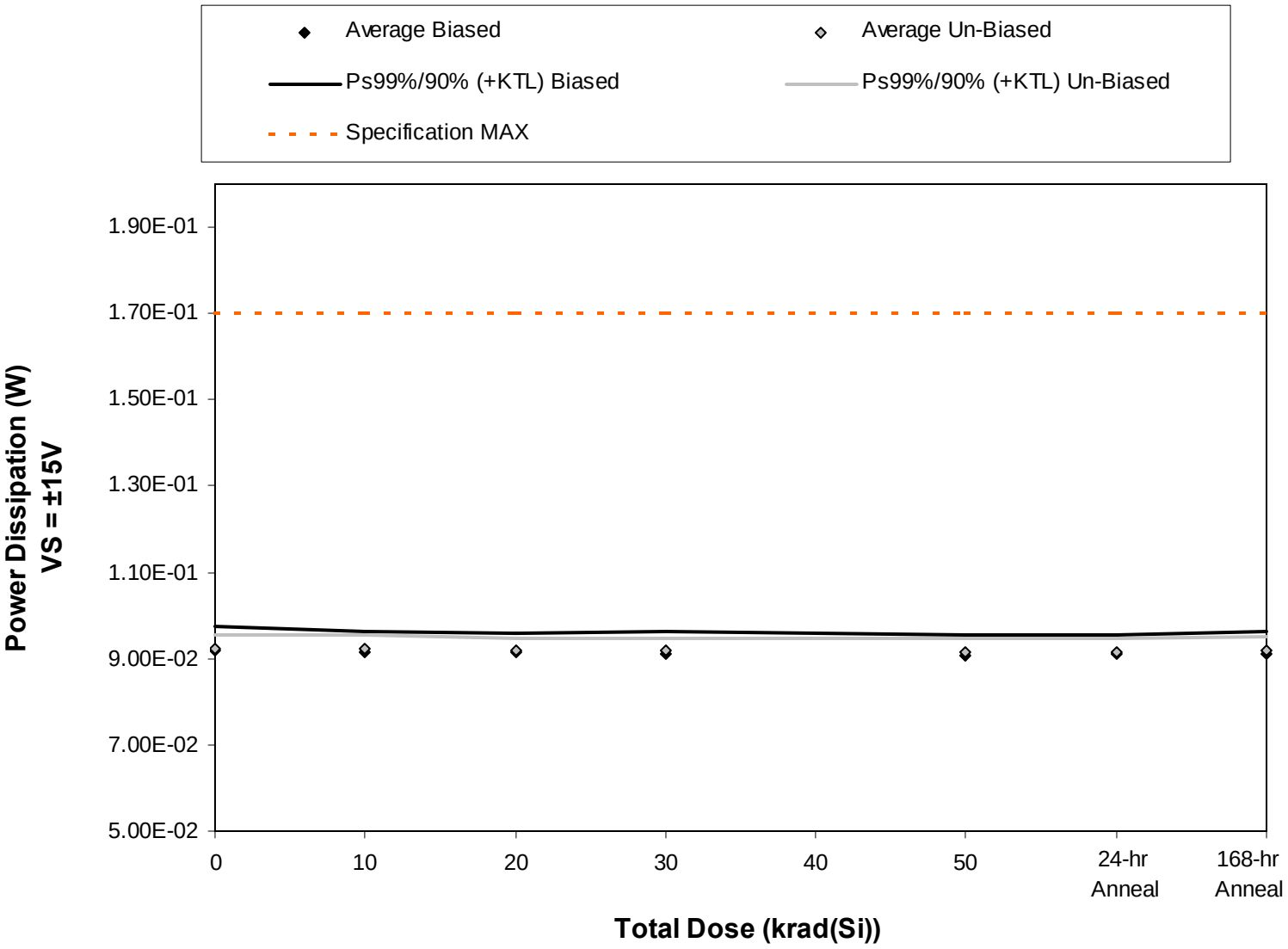

Figure 5.3. Plot of power dissipation versus total dose. The data shows no significant degradation with dose. The solid diamonds are the average of the measured data points for the sample irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the units irradiated with all pins tied to ground. The black lines (solid or dashed) are the average of the data points after application of the KTL statistics on the sample irradiated in the biased condition while the shaded lines (solid or dashed) are the average of the data points after application of the KTL statistics on the sample irradiated in the unbiased condition. The red dotted line(s) are the pre- and/or post-irradiation minimum and/or maximum specification value as defined in the datasheet and/or test plan.

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Table 5.3. Raw data for the power dissipation versus total dose, including the statistical analysis, the specification and the status of the testing (pass/fail)

Power Dissipation (W) **VS = ±15V**	Total Dose (krad(Si))					24 hr Anneal	168 hr Anneal
Device	0	10	20	30	50		
958	8.97E-02	9.00E-02	8.97E-02	8.97E-02	8.91E-02	8.94E-02	8.94E-02
959	9.03E-02	9.03E-02	9.00E-02	8.97E-02	8.97E-02	8.97E-02	8.97E-02
960	9.39E-02	9.30E-02	9.27E-02	9.30E-02	9.24E-02	9.27E-02	9.30E-02
969	9.18E-02	9.06E-02	9.09E-02	9.06E-02	9.00E-02	9.00E-02	9.03E-02
963	9.39E-02	9.36E-02	9.33E-02	9.33E-02	9.27E-02	9.27E-02	9.33E-02
964	9.21E-02	9.24E-02	9.21E-02	9.18E-02	9.15E-02	9.12E-02	9.18E-02
965	9.15E-02	9.15E-02	9.12E-02	9.09E-02	9.06E-02	9.06E-02	9.09E-02
966	9.42E-02	9.42E-02	9.36E-02	9.36E-02	9.33E-02	9.33E-02	9.39E-02
967	9.15E-02	9.15E-02	9.12E-02	9.12E-02	9.06E-02	9.06E-02	9.12E-02
968	9.21E-02	9.24E-02	9.21E-02	9.18E-02	9.12E-02	9.15E-02	9.21E-02
957	9.33E-02	9.36E-02	9.36E-02	9.36E-02	9.36E-02	9.36E-02	9.39E-02
Biased Statistics							
Average Biased	9.19E-02	9.15E-02	9.13E-02	9.13E-02	9.08E-02	9.09E-02	9.11E-02
Std Dev Biased	1.96E-03	1.67E-03	1.61E-03	1.77E-03	1.65E-03	1.66E-03	1.87E-03
Ps99%/90% (+KTL) Biased	9.73E-02	9.61E-02	9.57E-02	9.61E-02	9.53E-02	9.54E-02	9.63E-02
Ps99%/90% (-KTL) Biased	8.65E-02	8.69E-02	8.69E-02	8.64E-02	8.63E-02	8.64E-02	8.60E-02
Un-Biased Statistics							
Average Un-Biased	9.23E-02	9.24E-02	9.20E-02	9.19E-02	9.14E-02	9.14E-02	9.20E-02
Std Dev Un-Biased	1.11E-03	1.10E-03	9.81E-04	1.05E-03	1.11E-03	1.11E-03	1.17E-03
Ps99%/90% (+KTL) Un-Biased	9.53E-02	9.54E-02	9.47E-02	9.47E-02	9.45E-02	9.45E-02	9.52E-02
Ps99%/90% (-KTL) Un-Biased	8.92E-02	8.94E-02	8.93E-02	8.90E-02	8.84E-02	8.84E-02	8.88E-02
Specification MAX	1.70E-01	1.70E-01	1.70E-01	1.70E-01	1.70E-01	1.70E-01	1.70E-01
Status	PASS	PASS	PASS	PASS	PASS	PASS	PASS

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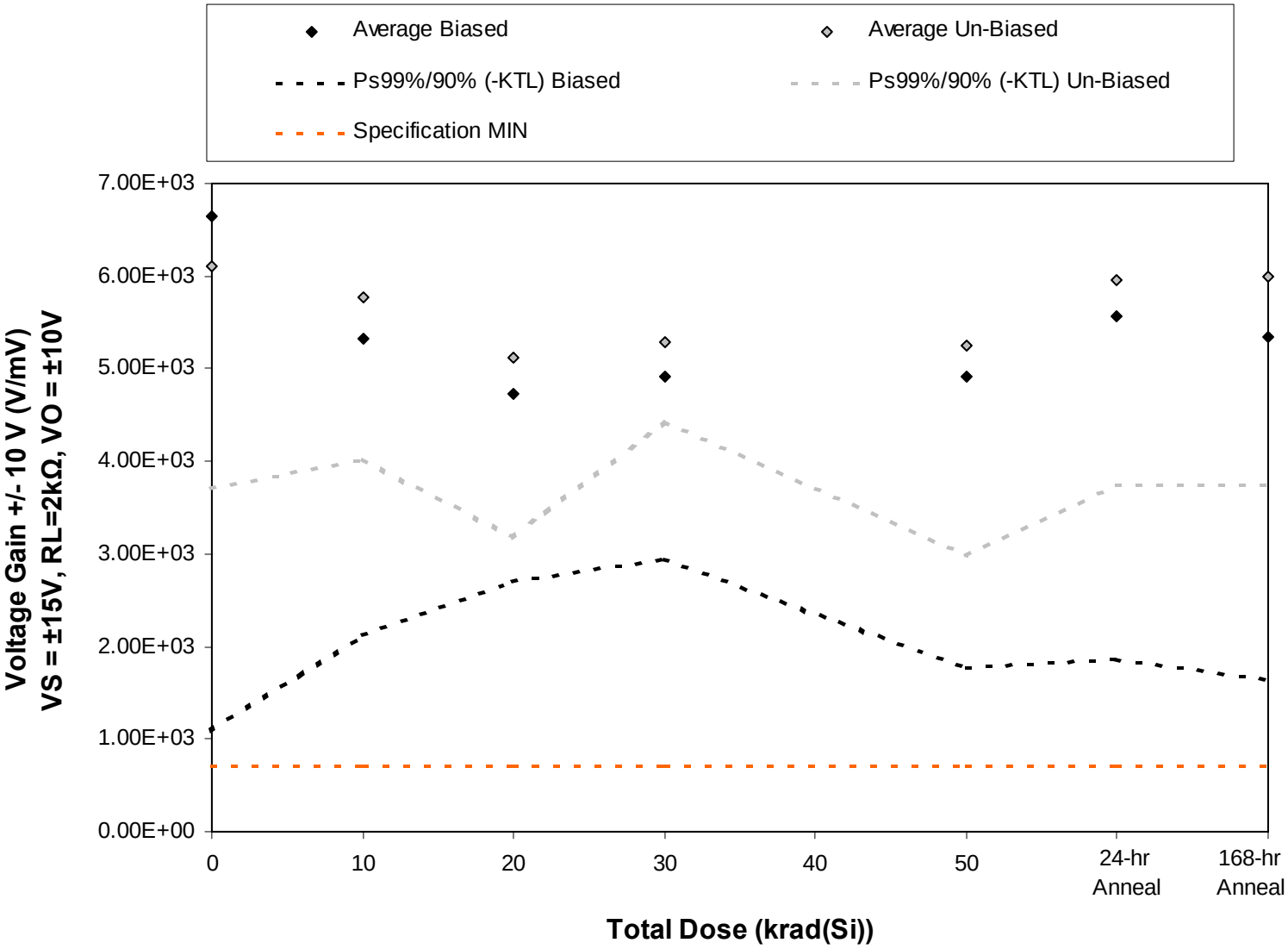

Figure 5.4. Plot of voltage gain versus total dose. The data shows some degradation with dose, however the average values remain within specification even after application of the KTL statistics. The solid diamonds are the average of the measured data points for the sample irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the units irradiated with all pins tied to ground. The black lines (solid or dashed) are the average of the data points after application of the KTL statistics on the sample irradiated in the biased condition while the shaded lines (solid or dashed) are the average of the data points after application of the KTL statistics on the sample irradiated in the unbiased condition. The red dotted line(s) are the pre- and/or post-irradiation minimum and/or maximum specification value as defined in the datasheet and/or test plan.

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Table 5.4. Raw data for voltage gain versus total dose, including the statistical analysis, the specification and the status of the testing (pass/fail).

Voltage Gain +/- 10 V (V/mV) **VS = ±15V, RL=2kΩ, VO = ±10V**	Total Dose (krad(Si))					24 hr Anneal	168 hr Anneal
Device	0	10	20	30	50		
958	9.96E+03	6.85E+03	5.21E+03	5.45E+03	6.80E+03	7.73E+03	6.32E+03
959	4.88E+03	3.93E+03	3.70E+03	4.11E+03	3.71E+03	4.43E+03	3.90E+03
960	6.90E+03	5.25E+03	5.56E+03	5.36E+03	4.51E+03	6.03E+03	7.01E+03
969	5.24E+03	4.53E+03	4.90E+03	4.13E+03	4.61E+03	4.69E+03	4.14E+03
963	6.25E+03	6.09E+03	4.31E+03	5.49E+03	4.96E+03	4.97E+03	5.32E+03
964	6.82E+03	4.97E+03	5.85E+03	5.70E+03	4.96E+03	5.32E+03	6.20E+03
965	6.58E+03	6.72E+03	4.98E+03	4.92E+03	4.77E+03	5.45E+03	6.05E+03
966	5.79E+03	5.60E+03	5.28E+03	5.49E+03	6.53E+03	6.64E+03	5.54E+03
967	6.67E+03	5.94E+03	5.47E+03	5.23E+03	4.42E+03	7.01E+03	7.19E+03
968	4.71E+03	5.58E+03	3.99E+03	5.10E+03	5.55E+03	5.37E+03	4.98E+03
957	5.48E+03	4.95E+03	4.22E+03	4.33E+03	5.89E+03	5.95E+03	6.02E+03
Biased Statistics							
Average Biased	6.64E+03	5.33E+03	4.74E+03	4.91E+03	4.92E+03	5.57E+03	5.34E+03
Std Dev Biased	2.02E+03	1.17E+03	7.41E+02	7.21E+02	1.15E+03	1.35E+03	1.35E+03
Ps99%/90% (+KTL) Biased	1.22E+04	8.54E+03	6.77E+03	6.89E+03	8.07E+03	9.28E+03	9.03E+03
Ps99%/90% (-KTL) Biased	1.10E+03	2.12E+03	2.71E+03	2.93E+03	1.77E+03	1.86E+03	1.65E+03
Un-Biased Statistics							
Average Un-Biased	6.11E+03	5.76E+03	5.11E+03	5.29E+03	5.25E+03	5.96E+03	5.99E+03
Std Dev Un-Biased	8.81E+02	6.38E+02	7.02E+02	3.09E+02	8.27E+02	8.05E+02	8.22E+02
Ps99%/90% (+KTL) Un-Biased	8.53E+03	7.51E+03	7.04E+03	6.14E+03	7.51E+03	8.17E+03	8.24E+03
Ps99%/90% (-KTL) Un-Biased	3.70E+03	4.01E+03	3.19E+03	4.44E+03	2.98E+03	3.75E+03	3.74E+03
Specification MIN	7.00E+02	7.00E+02	7.00E+02	7.00E+02	7.00E+02	7.00E+02	7.00E+02
Status	PASS	PASS	PASS	PASS	PASS	PASS	PASS

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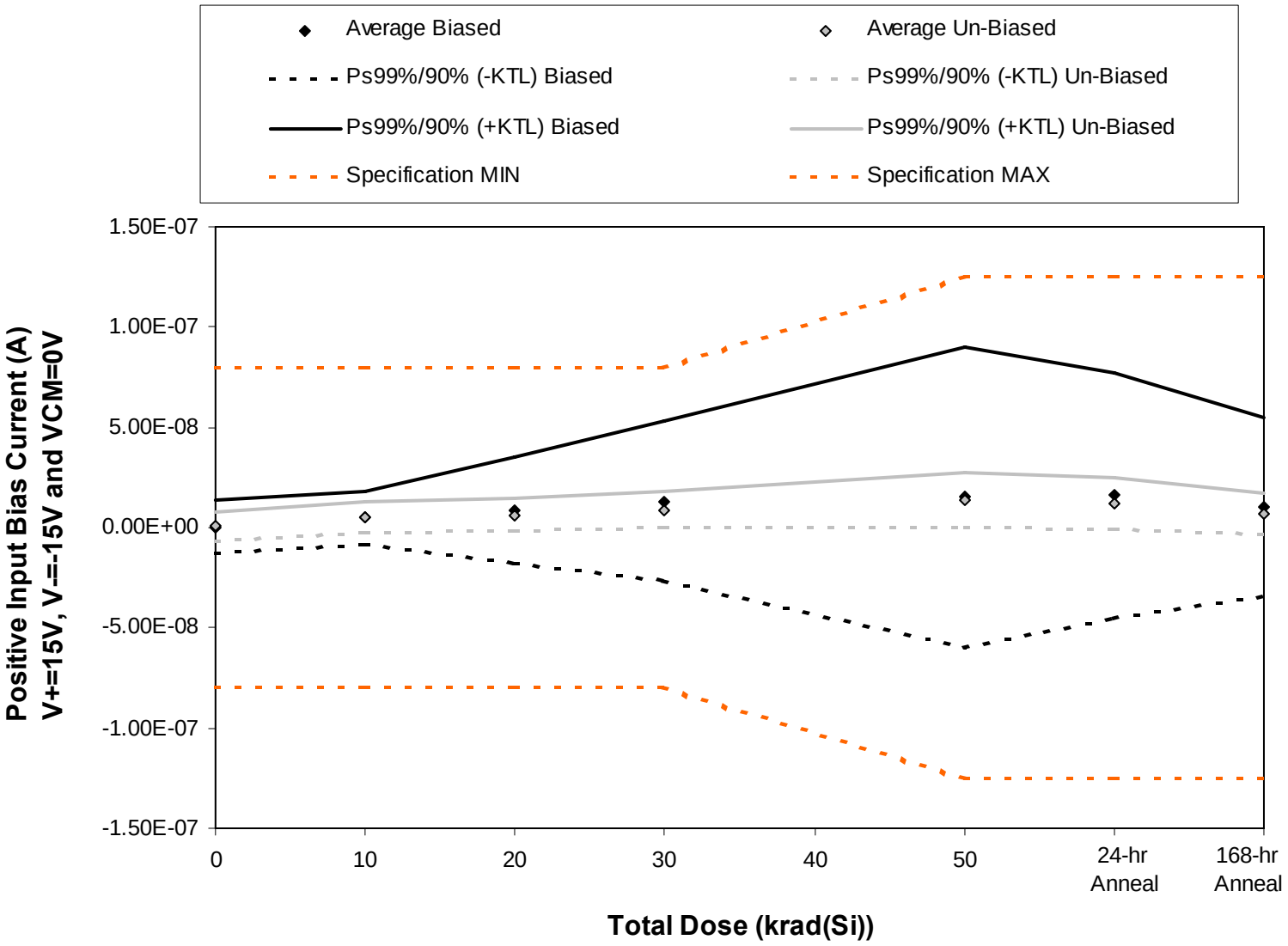

Figure 5.5. Plot of input bias current (non-inverting input) versus total dose. The data shows no significant degradation with dose. The solid diamonds are the average of the measured data points for the sample irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the units irradiated with all pins tied to ground. The black lines (solid or dashed) are the average of the data points after application of the KTL statistics on the sample irradiated in the biased condition while the shaded lines (solid or dashed) are the average of the data points after application of the KTL statistics on the sample irradiated in the unbiased condition. The red dotted line(s) are the pre- and/or post-irradiation minimum and/or maximum specification value as defined in the datasheet and/or test plan.

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Table 5.5. Raw data for input bias current (non-inverting input) versus total dose, including the statistical analysis, the specification and the status of the testing (pass/fail).

Positive Input Bias Current (A) V+=15V, V-=-15V and VCM=0V	Total Dose (krad(Si))					24 hr Anneal	168 hr Anneal
Device	0	10	20	30	50		
958	-6.00E-09	1.10E-08	2.50E-08	3.80E-08	6.10E-08	5.60E-08	3.90E-08
959	7.00E-09	8.00E-09	1.00E-08	1.30E-08	-1.20E-08	5.00E-09	4.00E-09
960	2.00E-09	5.00E-09	6.00E-09	9.00E-09	1.20E-08	1.00E-08	7.00E-09
969	0.00E+00	0.00E+00	1.00E-09	2.00E-09	6.00E-09	5.00E-09	0.00E+00
963	-2.00E-09	0.00E+00	2.00E-09	4.00E-09	8.00E-09	5.00E-09	1.00E-09
964	0.00E+00	5.00E-09	6.00E-09	8.00E-09	1.20E-08	1.10E-08	6.00E-09
965	5.00E-09	9.00E-09	1.10E-08	1.40E-08	2.20E-08	2.00E-08	1.30E-08
966	0.00E+00	5.00E-09	6.00E-09	8.00E-09	1.30E-08	1.10E-08	6.00E-09
967	0.00E+00	5.00E-09	6.00E-09	9.00E-09	1.20E-08	1.10E-08	6.00E-09
968	-2.00E-09	1.00E-09	3.00E-09	5.00E-09	9.00E-09	7.00E-09	3.00E-09
957	8.00E-09	8.00E-09	8.00E-09	8.00E-09	8.00E-09	8.00E-09	8.00E-09
Biased Statistics							
Average Biased	2.00E-10	4.80E-09	8.80E-09	1.32E-08	1.50E-08	1.62E-08	1.02E-08
Std Dev Biased	4.82E-09	4.87E-09	9.73E-09	1.45E-08	2.73E-08	2.24E-08	1.63E-08
Ps99%/90% (+KTL) Biased	1.34E-08	1.81E-08	3.55E-08	5.30E-08	8.99E-08	7.75E-08	5.50E-08
Ps99%/90% (-KTL) Biased	-1.30E-08	-8.55E-09	-1.79E-08	-2.66E-08	-5.99E-08	-4.51E-08	-3.46E-08
Un-Biased Statistics							
Average Un-Biased	6.00E-10	5.00E-09	6.40E-09	8.80E-09	1.36E-08	1.20E-08	6.80E-09
Std Dev Un-Biased	2.61E-09	2.83E-09	2.88E-09	3.27E-09	4.93E-09	4.80E-09	3.70E-09
Ps99%/90% (+KTL) Un-Biased	7.75E-09	1.28E-08	1.43E-08	1.78E-08	2.71E-08	2.52E-08	1.69E-08
Ps99%/90% (-KTL) Un-Biased	-6.55E-09	-2.76E-09	-1.50E-09	-1.69E-10	8.33E-11	-1.15E-09	-3.35E-09
Specification MIN	-8.00E-08	-8.00E-08	-8.00E-08	-8.00E-08	-1.25E-07	-1.25E-07	-1.25E-07
Status	PASS	PASS	PASS	PASS	PASS	PASS	PASS
Specification MAX	8.00E-08	8.00E-08	8.00E-08	8.00E-08	1.25E-07	1.25E-07	1.25E-07
Status	PASS	PASS	PASS	PASS	PASS	PASS	PASS

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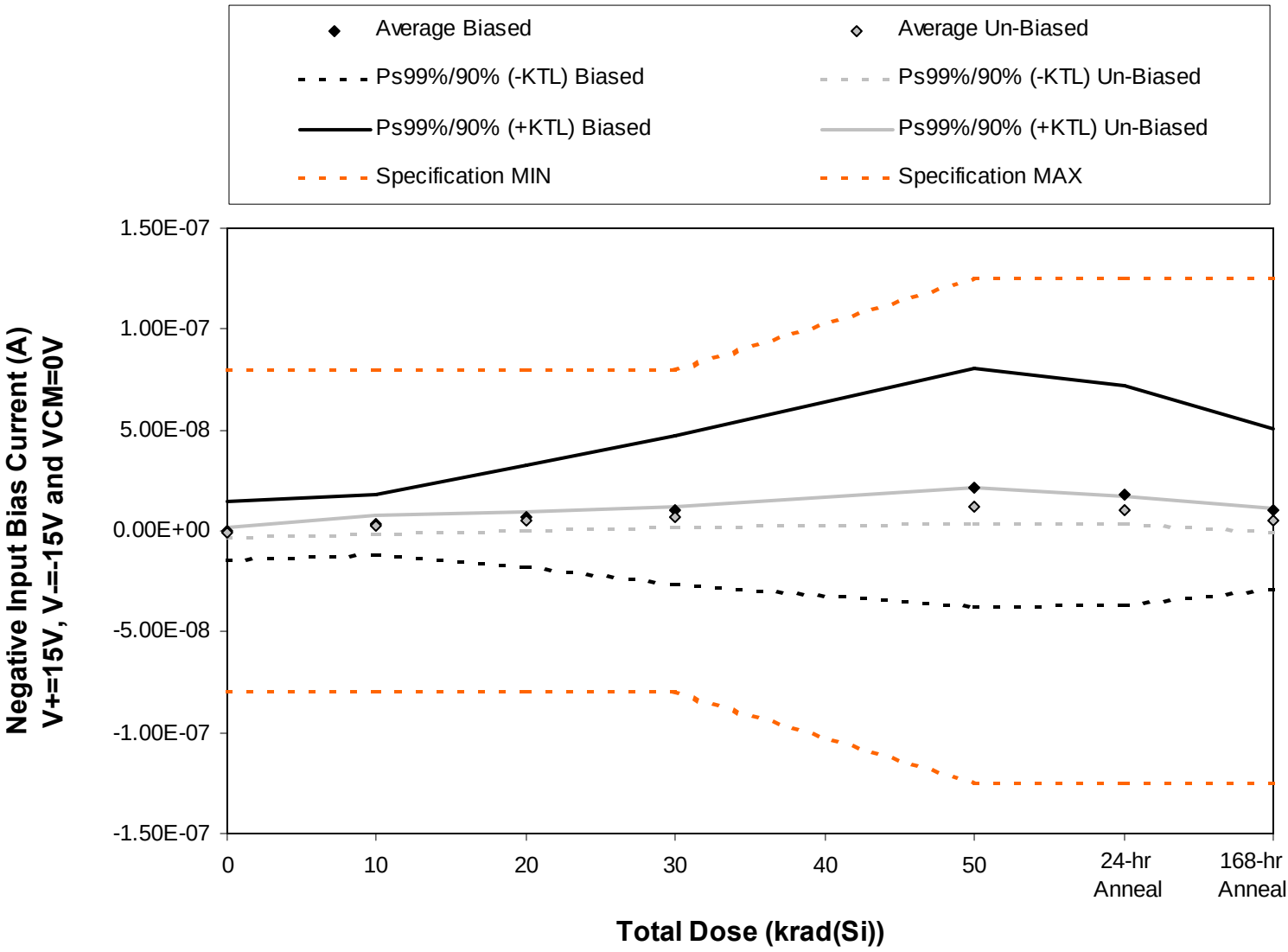

Figure 5.6. Plot of input bias current (inverting input) versus total dose. The data shows no significant degradation with dose. The solid diamonds are the average of the measured data points for the sample irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the units irradiated with all pins tied to ground. The black lines (solid or dashed) are the average of the data points after application of the KTL statistics on the sample irradiated in the biased condition while the shaded lines (solid or dashed) are the average of the data points after application of the KTL statistics on the sample irradiated in the unbiased condition. The red dotted line(s) are the pre- and/or post-irradiation minimum and/or maximum specification value as defined in the datasheet and/or test plan.

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Table 5.6. Raw data for input bias current (inverting input) versus total dose, including the statistical analysis, the specification and the status of the testing (pass/fail).

Negative Input Bias Current (A) V+=15V, V-=-15V and VCM=0V	Total Dose (krad(Si))					24 hr Anneal	168 hr Anneal
Device	0	10	20	30	50		
958	-5.00E-09	9.00E-09	2.20E-08	3.30E-08	5.40E-08	4.90E-08	3.30E-08
959	7.00E-09	7.00E-09	8.00E-09	1.10E-08	3.20E-08	2.60E-08	1.70E-08
960	4.00E-09	5.00E-09	6.00E-09	8.00E-09	1.20E-08	9.00E-09	6.00E-09
969	-2.00E-09	-2.00E-09	0.00E+00	0.00E+00	4.00E-09	3.00E-09	-1.00E-09
963	-4.00E-09	-3.00E-09	-1.00E-09	0.00E+00	4.00E-09	2.00E-09	-2.00E-09
964	0.00E+00	4.00E-09	6.00E-09	8.00E-09	1.30E-08	1.10E-08	6.00E-09
965	0.00E+00	5.00E-09	7.00E-09	9.00E-09	1.70E-08	1.40E-08	8.00E-09
966	-1.00E-09	1.00E-09	4.00E-09	7.00E-09	1.20E-08	1.00E-08	4.00E-09
967	-1.00E-09	3.00E-09	4.00E-09	7.00E-09	1.10E-08	1.00E-08	5.00E-09
968	-2.00E-09	1.00E-09	3.00E-09	4.00E-09	8.00E-09	7.00E-09	2.00E-09
957	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Biased Statistics							
Average Biased	-1.65E-25	3.20E-09	7.00E-09	1.04E-08	2.12E-08	1.78E-08	1.06E-08
Std Dev Biased	5.24E-09	5.40E-09	9.22E-09	1.35E-08	2.16E-08	1.99E-08	1.46E-08
Ps99%/90% (+KTL) Biased	1.44E-08	1.80E-08	3.23E-08	4.75E-08	8.05E-08	7.24E-08	5.07E-08
Ps99%/90% (-KTL) Biased	-1.44E-08	-1.16E-08	-1.83E-08	-2.67E-08	-3.81E-08	-3.68E-08	-2.95E-08
Un-Biased Statistics							
Average Un-Biased	-8.00E-10	2.80E-09	4.80E-09	7.00E-09	1.22E-08	1.04E-08	5.00E-09
Std Dev Un-Biased	8.37E-10	1.79E-09	1.64E-09	1.87E-09	3.27E-09	2.51E-09	2.24E-09
Ps99%/90% (+KTL) Un-Biased	1.49E-09	7.71E-09	9.31E-09	1.21E-08	2.12E-08	1.73E-08	1.11E-08
Ps99%/90% (-KTL) Un-Biased	-3.09E-09	-2.11E-09	2.94E-10	1.87E-09	3.23E-09	3.52E-09	-1.13E-09
Specification MIN	-8.00E-08	-8.00E-08	-8.00E-08	-8.00E-08	-1.25E-07	-1.25E-07	-1.25E-07
Status	PASS	PASS	PASS	PASS	PASS	PASS	PASS
Specification MAX	8.00E-08	8.00E-08	8.00E-08	8.00E-08	1.25E-07	1.25E-07	1.25E-07
Status	PASS	PASS	PASS	PASS	PASS	PASS	PASS

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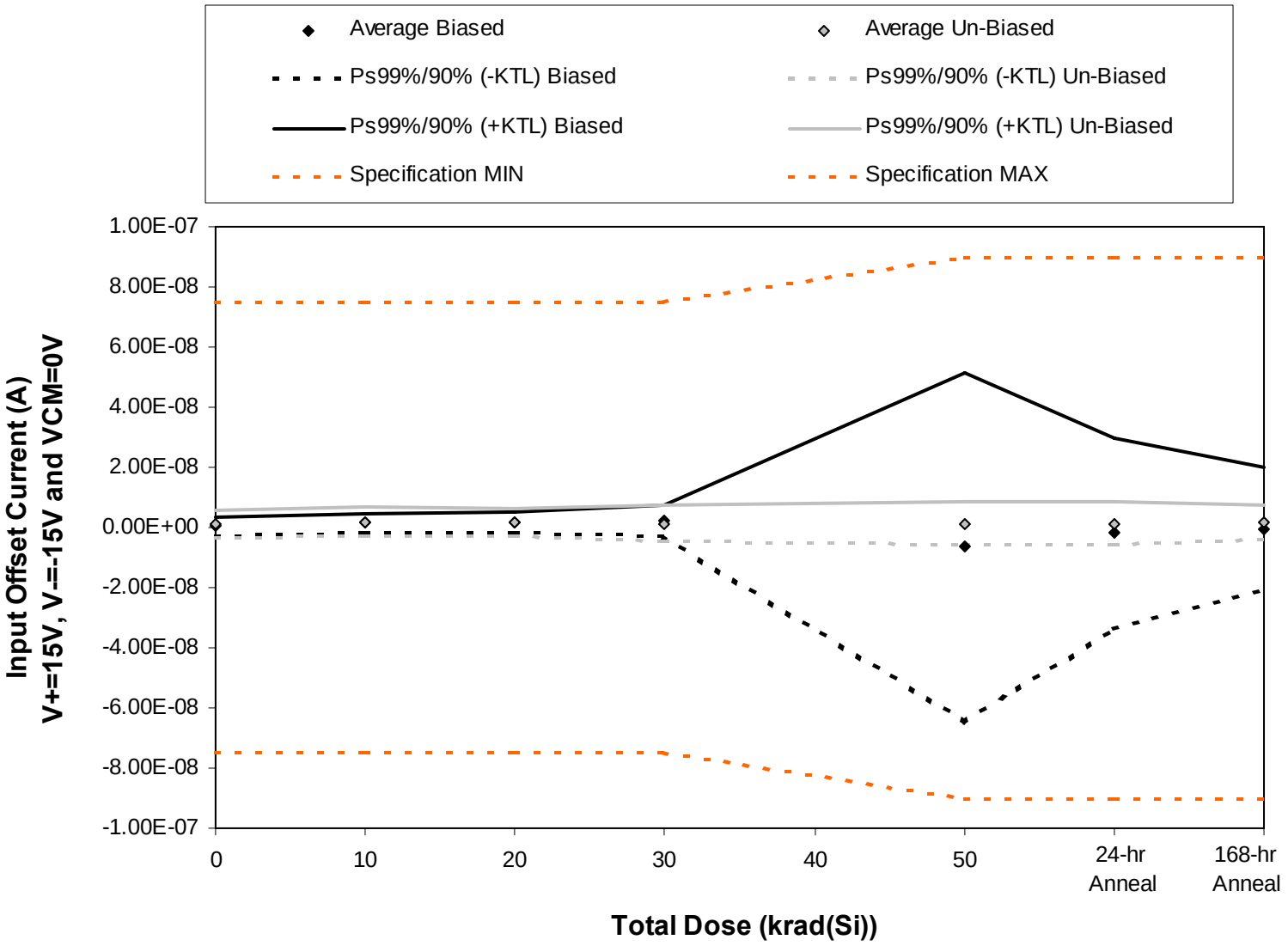

Figure 5.7. Plot of input offset current versus total dose. The data show no significant degradation with total dose. The solid diamonds are the average of the measured data points for the sample irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the units irradiated with all pins tied to ground. The black lines (solid or dashed) are the average of the data points after application of the KTL statistics on the sample irradiated in the biased condition while the shaded lines (solid or dashed) are the average of the data points after application of the KTL statistics on the sample irradiated in the unbiased condition. The red dotted line(s) are the pre- and/or post-irradiation minimum and/or maximum specification value as defined in the datasheet and/or test plan.

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Table 5.7. Raw data of input offset current versus total dose, including the statistical analysis, the specification and the status of the testing (pass/fail).

Input Offset Current (A) V+=15V, V-=-15V and VCM=0V	Total Dose (krad(Si))					24 hr Anneal	168 hr Anneal
Device	0	10	20	30	50		
958	0.00E+00	2.00E-09	3.00E-09	5.00E-09	6.00E-09	7.00E-09	6.00E-09
959	0.00E+00	1.00E-09	1.00E-09	2.00E-09	-4.40E-08	-2.20E-08	-1.30E-08
960	-1.00E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
969	1.00E-09	2.00E-09	2.00E-09	2.00E-09	2.00E-09	2.00E-09	2.00E-09
963	2.00E-09	3.00E-09	3.00E-09	3.00E-09	4.00E-09	4.00E-09	3.00E-09
964	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-2.00E-09	0.00E+00	0.00E+00
965	4.00E-09	4.00E-09	4.00E-09	5.00E-09	5.00E-09	6.00E-09	5.00E-09
966	1.00E-09	3.00E-09	2.00E-09	0.00E+00	1.00E-09	0.00E+00	2.00E-09
967	1.00E-09	2.00E-09	2.00E-09	2.00E-09	2.00E-09	1.00E-09	1.00E-09
968	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
957	7.00E-09	7.00E-09	7.00E-09	7.00E-09	7.00E-09	7.00E-09	7.00E-09
Biased Statistics							
Average Biased	4.00E-10	1.60E-09	1.80E-09	2.40E-09	-6.40E-09	-1.80E-09	-4.00E-10
Std Dev Biased	1.14E-09	1.14E-09	1.30E-09	1.82E-09	2.11E-08	1.16E-08	7.37E-09
Ps99%/90% (+KTL) Biased	3.53E-09	4.73E-09	5.38E-09	7.38E-09	5.16E-08	3.00E-08	1.98E-08
Ps99%/90% (-KTL) Biased	-2.73E-09	-1.53E-09	-1.78E-09	-2.58E-09	-6.44E-08	-3.36E-08	-2.06E-08
Un-Biased Statistics							
Average Un-Biased	1.20E-09	1.80E-09	1.60E-09	1.40E-09	1.20E-09	1.40E-09	1.60E-09
Std Dev Un-Biased	1.64E-09	1.79E-09	1.67E-09	2.19E-09	2.59E-09	2.61E-09	2.07E-09
Ps99%/90% (+KTL) Un-Biased	5.71E-09	6.71E-09	6.19E-09	7.41E-09	8.30E-09	8.55E-09	7.29E-09
Ps99%/90% (-KTL) Un-Biased	-3.31E-09	-3.11E-09	-2.99E-09	-4.61E-09	-5.90E-09	-5.75E-09	-4.09E-09
Specification MIN	-7.50E-08	-7.50E-08	-7.50E-08	-7.50E-08	-9.00E-08	-9.00E-08	-9.00E-08
Status	PASS	PASS	PASS	PASS	PASS	PASS	PASS
Specification MAX	7.50E-08	7.50E-08	7.50E-08	7.50E-08	9.00E-08	9.00E-08	9.00E-08
Status	PASS	PASS	PASS	PASS	PASS	PASS	PASS

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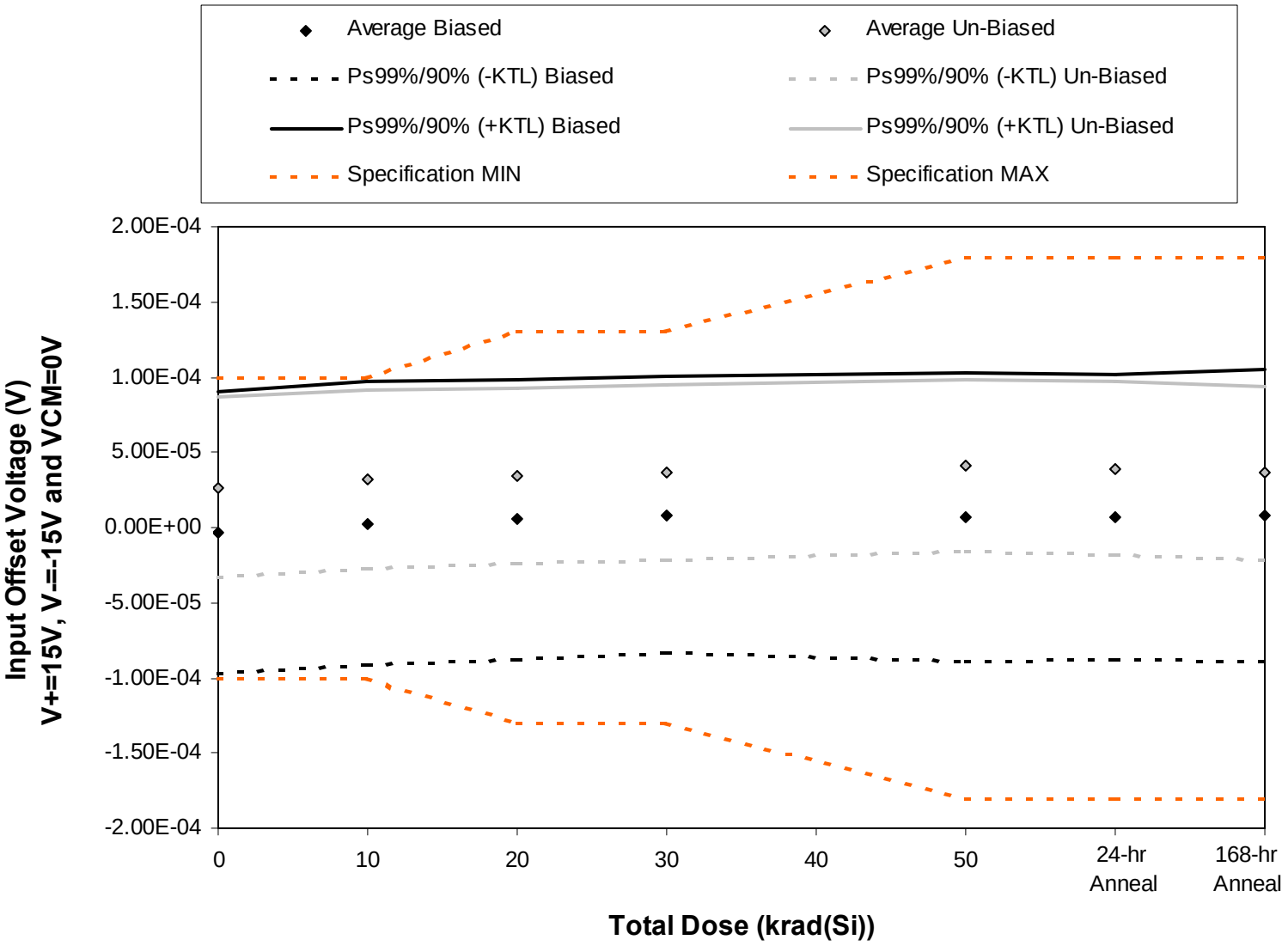

Figure 5.8. Plot of input offset voltage versus total dose. The data shows no significant degradation with total dose. The solid diamonds are the average of the measured data points for the sample irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the units irradiated with all pins tied to ground. The black lines (solid or dashed) are the average of the data points after application of the KTL statistics on the sample irradiated in the biased condition while the shaded lines (solid or dashed) are the average of the data points after application of the KTL statistics on the sample irradiated in the unbiased condition. The red dotted line(s) are the pre- and/or post-irradiation minimum and/or maximum specification value as defined in the datasheet and/or test plan.

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Table 5.8. Raw data for the input offset voltage versus total dose, including the statistical analysis, the specification and the status of the testing (pass/fail).

Input Offset Voltage (V) **V+=15V, V-=-15V and VCM=0V**	Total Dose (krad(Si))					24 hr Anneal	168 hr Anneal
Device	0	10	20	30	50		
958	3.40E-05	4.00E-05	4.00E-05	4.20E-05	4.20E-05	3.90E-05	4.80E-05
959	-2.40E-05	-2.00E-05	-1.70E-05	-1.50E-05	-1.70E-05	-2.00E-05	-1.60E-05
960	-1.50E-05	-8.00E-06	-5.00E-06	0.00E+00	0.00E+00	0.00E+00	-4.00E-06
969	-4.30E-05	-3.60E-05	-3.30E-05	-3.00E-05	-3.40E-05	-3.00E-05	-3.00E-05
963	3.00E-05	3.80E-05	4.20E-05	4.40E-05	4.40E-05	4.70E-05	4.30E-05
964	3.80E-05	4.30E-05	4.40E-05	4.80E-05	5.20E-05	5.10E-05	4.90E-05
965	6.00E-06	1.10E-05	1.40E-05	1.60E-05	2.10E-05	2.00E-05	1.40E-05
966	2.00E-05	2.50E-05	2.80E-05	3.10E-05	3.40E-05	3.20E-05	3.00E-05
967	1.00E-05	1.60E-05	2.00E-05	2.10E-05	2.60E-05	2.40E-05	2.20E-05
968	5.90E-05	6.40E-05	6.70E-05	6.80E-05	7.20E-05	7.00E-05	6.60E-05
957	-3.50E-05	-3.50E-05	-3.50E-05	-3.50E-05	-3.60E-05	-3.50E-05	-3.50E-05
Biased Statistics							
Average Biased	-3.60E-06	2.80E-06	5.40E-06	8.20E-06	7.00E-06	7.20E-06	8.20E-06
Std Dev Biased	3.41E-05	3.45E-05	3.40E-05	3.35E-05	3.50E-05	3.45E-05	3.53E-05
Ps99%/90% (+KTL) Biased	8.98E-05	9.74E-05	9.86E-05	1.00E-04	1.03E-04	1.02E-04	1.05E-04
Ps99%/90% (-KTL) Biased	-9.70E-05	-9.18E-05	-8.78E-05	-8.37E-05	-8.90E-05	-8.75E-05	-8.86E-05
Un-Biased Statistics							
Average Un-Biased	2.66E-05	3.18E-05	3.46E-05	3.68E-05	4.10E-05	3.94E-05	3.62E-05
Std Dev Un-Biased	2.19E-05	2.17E-05	2.13E-05	2.13E-05	2.10E-05	2.09E-05	2.11E-05
Ps99%/90% (+KTL) Un-Biased	8.67E-05	9.14E-05	9.31E-05	9.52E-05	9.85E-05	9.66E-05	9.41E-05
Ps99%/90% (-KTL) Un-Biased	-3.35E-05	-2.78E-05	-2.39E-05	-2.16E-05	-1.65E-05	-1.78E-05	-2.17E-05
Specification MIN	-1.00E-04	-1.00E-04	-1.30E-04	-1.30E-04	-1.80E-04	-1.80E-04	-1.80E-04
Status	PASS	PASS	PASS	PASS	PASS	PASS	PASS
Specification MAX	1.00E-04	1.00E-04	1.30E-04	1.30E-04	1.80E-04	1.80E-04	1.80E-04
Status	PASS	PASS	PASS	PASS	PASS	PASS	PASS

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6.0. Summary / Conclusions

The high dose rate total ionizing dose testing described in this final report was performed using the facilities at Radiation Assured Devices' Longmire Laboratories in Colorado Springs, CO. The high dose rate total ionizing dose (TID) source is a JLSA 84-21 irradiator modified to provide a panoramic exposure. The dose rate for this irradiator in this configuration ranges from <1rad(Si)/s to a maximum of approximately 120rad(Si)/s, determined by the distance from the source. Samples of the RH27CW Precision Op Amp described in this report were irradiated biased with a split 15V supply and unbiased (all leads tied to ground). The devices were irradiated to a maximum total ionizing dose level of 50krad(Si) with a pre-rad baseline reading as well as incremental readings at 10, 20, and 30krad(Si). Electrical testing occurred within one hour following the end of each irradiation segment. For intermediate irradiations, the units were tested and returned to total dose exposure within two hours from the end of the previous radiation increment. In addition, all units-under-test received a 24hr room temperature and168hr 100°C anneal, using the same bias conditions as the radiation exposure.

The parametric data was obtained as "read and record" and all the raw data plus an attributes summary were presented in this report. The attributes data contains the average, standard deviation and the average with the KTL values applied. The KTL value used was 2.742 per MIL HDBK 814 using one-sided tolerance limits of 99/90 and a 5-piece sample size. Note that the following criteria was used to determine the outcome of the testing: following the radiation exposure each parameter had to pass the specification value and the average value for the ten-piece sample must pass the specification value when the KTL limits are applied. If these conditions were not both satisfied following the radiation exposure, then the lot would be logged as an RLAT failure.

Based on these criteria, the RH27CW Precision Op Amp discussed in this report passed the RLAT to the highest level tested of 50krad(Si). The following minor exception should be noted: CMRR was "out of specification" at the 20krad(Si) read point after application of the KTL statistics primarily due to the relatively large standard deviation in the sample population relative to the specification value and our ability to measure this parameter with high precision (See Appendix C, Table C.2). However, the KTL statistics improved for CMRR with increasing radiation dose such that this parameter was within specification at the highest total dose of 50krad(Si). If this exception is a concern, we believe this lot could be qualified to the same statistical limits without any exceptions using a lot-tolerance-percent-defective (LTPD) approach

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Appendix A: TID Bias Connections

Biased Samples:

Pin	Function	Connection / Bias
1	N/C	N/C
2	VOS TRIM	N/C
3	-INPUT	To Pin 7 via 10kΩ Resistor
4	+INPUT	To 8V via 10kΩ Resistor
5	V-	To -15V using 0.1µF Decoupling
6	N/C	N/C
7	OUT	To Pin 3 via 10kΩ Resistor
8	V+	To +15V using 0.1µF Decoupling
9	VOS TRIM	N/C
10	N/C	N/C

Unbiased Samples:

Pin	Function	Connection / Bias
1	N/C	GND
2	VOS TRIM	GND
3	-INPUT	GND
4	+INPUT	GND
5	V-	GND
6	N/C	GND
7	OUT	GND
8	V+	GND
9	VOS TRIM	GND
10	N/C	GND

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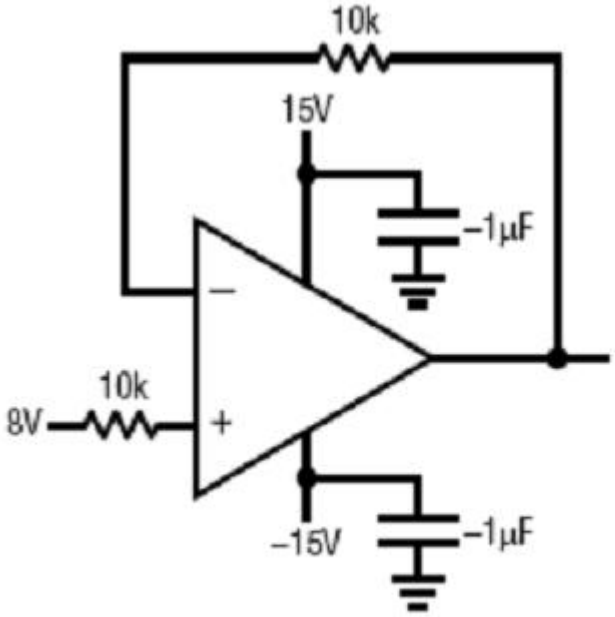

Figure A.1. Irradiation bias drawing for the units to be irradiated under electrical bias. This figure was extracted from LINEAR TECHNOLOGY CORPORATION, RH27C Datasheet.

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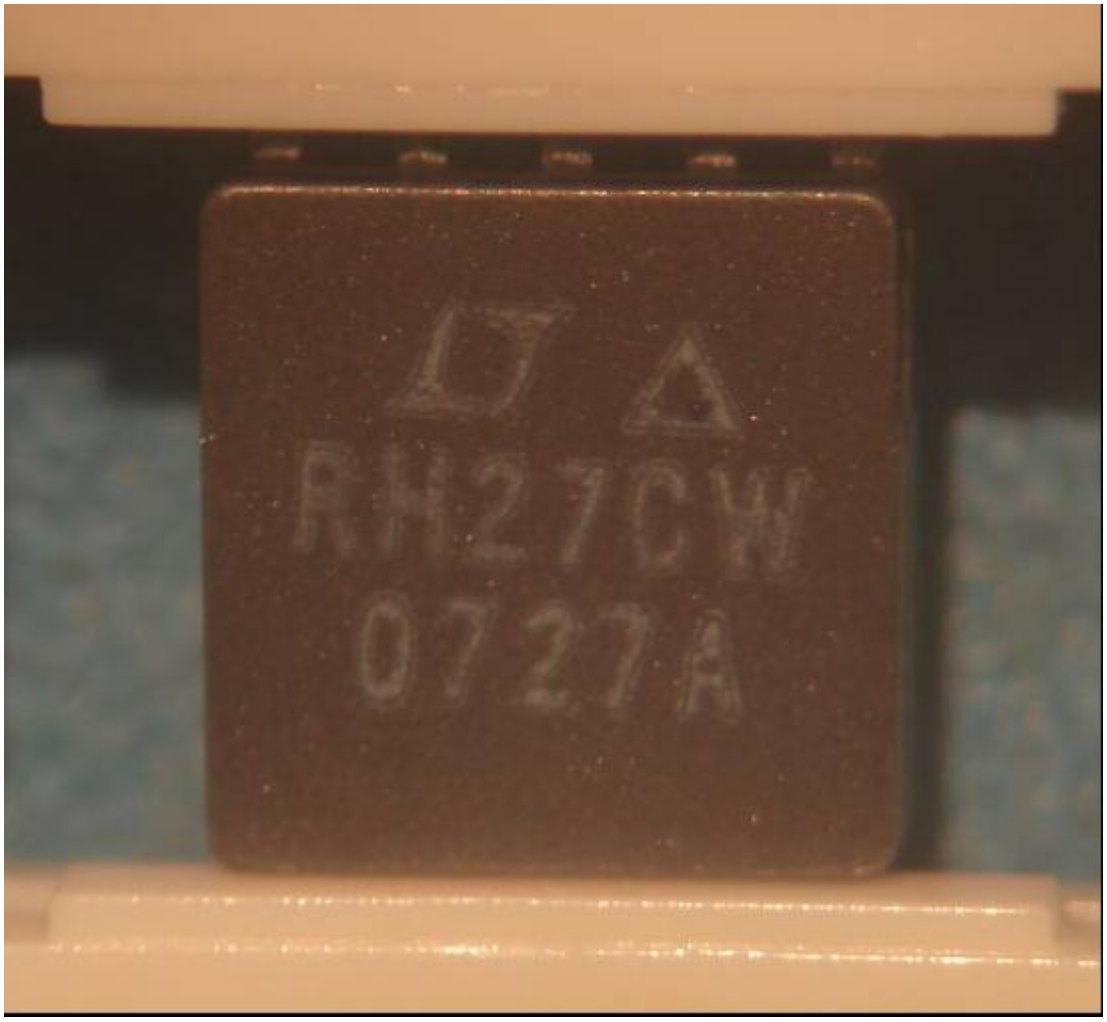
Appendix B: Photograph of device-under-test to show part markings



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Appendix C: Electrical Test Parameters and Conditions (All Subgroup 1 Parameters Plus V_{OS} and A_{VOL})

All electrical tests for this device are performed on one of Radiation Assured Device's LTS2020 Test Systems. The LTS2020 Test System is a programmable parametric tester that provides parameter measurements for a variety of digital, analog and mixed signal products including voltage regulators, voltage comparators, D to A and A to D converters. The LTS2020 Test System achieves accuracy and sensitivity through the use of software self-calibration and an internal relay matrix with separate family boards and custom personality adapter boards. The tester uses this relay matrix to connect the required test circuits, select the appropriate voltage / current sources and establish the needed measurement loops for all the tests performed. The tests will be conducted using the LTS-2101 Linear Family Board, LTS-0600 Socket Assembly and the RH027FP DUT board. The measured parameters and test conditions are shown in Table C.1

A listing of the measurement precision/resolution for each parameter is shown in Table C.2. The precision/resolution values were obtained either from test data or from the DAC resolution of the LTS-2020. To generate the precision/resolution shown in Table C.2, one of the units-under-test was tested repetitively (a total of 10-times with re-insertion between tests) to obtain the average test value and standard deviation. Using this test data MIL-HDBK-814 90/90 KTL statistics were applied to the measured standard deviation to generate the final measurement range. This value encompasses the precision/resolution of all aspects of the test system, including the LTS2020 mainframe, family board, socket assembly and DUT board as well as insertion error. In some cases, the measurement resolution is limited by the internal DACs, which results in a measured standard deviation of zero. In these instances the precision/resolution will be reported back as the LSB of the DAC.

Note that the testing and statistics used in this document are based on an "analysis of variables" technique, which relies on small sample sizes to qualify much larger lot sizes (see MIL-HDBK-814, p. 91 for a discussion of statistical treatments). Unfortunately, not all measured parameters are well suited to this approach due to inherent large variations. One such parameter is pre-irradiation Open Loop Gain, where the device exhibits extreme sensitivity to input conditions, resulting in a very large standard deviation and a statistical error often greater than the measured value. If necessary, larger samples sizes could be used to qualify these parameters using an "attributes" approach.

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Table C.1. Measured parameters and test conditions for the RH27CW.

TEST NUMBER*	TEST DESCRIPTION	TEST CONDITIONS
1	PSRR	$V_S = \pm 4V$ to $\pm 18V$
2	CMRR	$V_S = \pm 15V$, $V_{CM} = \pm 11V$
3	Power Dissipation	$V_S = \pm 15V$
6.3	Open Loop Gain	$V_S = \pm 15V$, $R_L = 2k\Omega$, $V_O = \pm 10V$
7.1	+ Input Bias Current	V+=15V, V-=-15V and V_{CM}=0V
7.2	- Input Bias Current	V+=15V, V-=-15V and V_{CM}=0V
8	Input Offset Current	V+=15V, V-=-15V and V_{CM}=0V
9	Input Offset Voltage	V+=15V, V-=-15V and V_{CM}=0V

*Note that the test number reflects the test code numbering and may not be sequential for the tests described in this test plan.

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Table C.2. Measured parameters, pre-irradiation specifications and measurement resolution for the RH27CW.

Measured Parameter	Pre-Irradiation Specification	Measurement Resolution/Precision
PSRR	94dB	± 8.71E-01 dB
CMRR	100dB	± 1.75E+00 dB
Power Dissipation	170mW	± 7.18E-04 W
Open Loop Gain	700V/mV	± 1.34E+03 V/mV
+ Input Bias Current	±80nA	± 8.71E-10 A
- Input Bias Current	±80nA	± 9.97E-10 A
Input Offset Current	75nA	± 1.39E-09 A
Input Offset Voltage	100µV	± 4.24E-06 V