



Total Ionizing Dose (TID) Radiation Testing of the RH117H-Positive Adjustable Regulator for Linear Technology

Customer: Linear Technology (PO# 55339L)

RAD Job Number: 10-120

Part Type Tested: Linear Technology RH117H Positive Adjustable Regulator

Commercial Part Number: RH117H

Traceability Information: Lot Date Code: 0947A, Assembly Lot# 547877.1, FAB Lot# W10737632.1, Wafer 2. Information obtained from Linear Technology PO# 55339L. See photograph of unit under test in Appendix A.

Quantity of Units: 12 units total, 5 units for biased irradiation, 5 units for unbiased irradiation and 2 control units. Serial numbers 1123, 1124, and 1114 to 1116 were biased during irradiation, serial numbers 1117 to 1121 were unbiased during irradiation and serial numbers 1135 and 1136 were used as controls. See Appendix B for the radiation bias connection table.

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

TID Dose Rate and Test Increments: 50-300rad(Si)/s with readings at pre-irradiation, 10, 20, 30, 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 Hardware: LTS2020 Tester, 2101 Family Board, 0606 Fixture and RH117 DUT Board

Test Programs: RH117LT.SRC

Facility and Radiation Source: Radiation Assured Devices Longmire Laboratories, Colorado Springs, CO using the JLSA 81-24 high dose rate Co60 source. Dosimetry performed by CaF₂ TLDs traceable to NIST. RAD's dosimetry has been audited by DSCC and RAD has been awarded Laboratory Suitability for MIL-STD-750 TM 1019.5

Irradiation and Test Temperature: Ambient room temperature for irradiation and test controlled to 24°C ± 6°C per MIL-STD-883.

High Dose Rate Test Result: PASSED. Units Passed to 50krad(Si) with all parameters remaining within their pre- and/or post-radiation specification limits. Further the units do not exhibit ELDRS as defined in the current test method.

An ISO 9001:2008 and DSCC Certified Company



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 to Test Method 1019 under MIL-STD-750 and MIL-STD-883. 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"



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.



3.0. Radiation Test Conditions

The RH117H-Positive Adjustable Regulator described in this final report was irradiated under 2 different conditions, one when biased with a split +/-15V supply, and one when unbiased with all pins tied to ground. See Appendix B for details on the biasing conditions during radiation exposure. In our opinion, 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 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 78.7rad(Si)/s with a precision of ±5%.

4.0. Tested Parameters

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

1. Reference Voltage, $V_{DIFF}=V_{IN}-V_{OUT}=3V$, $I_L=10mA$
2. Reference Voltage, $V_{DIFF}=40V$, $I_L=10mA$
3. Reference Voltage, $V_{DIFF}=3V$, $I_L=0.5A$
4. Reference Voltage, $V_{DIFF}=40V$, $I_L=0.15A$
5. Line Regulation, $V_{DIFF}=3V$ to $40V$, $I_L=10mA$
6. Load Regulation, $V_{OUT}\leq 5V$ $V_{DIFF}=5V$, $V_{IN}=6.25V$, $I_L=10mA$ to $0.5A$



7. Load Regulation, $V_{OUT} \geq 5V$ $V_{DIFF} = 5V$, $V_{IN} = 11.25V$, $I_L = 10mA$ to 0.5A
8. Adjust Pin Current, $V_{DIFF} = 2.5V$, $I_L = 10mA$
9. Adjust Pin Current, $V_{DIFF} = 5V$, $I_L = 10mA$
10. Adjust Pin Current, $V_{DIFF} = 40V$, $I_L = 10mA$
11. Adjust Pin Current Change, $V_{DIFF} = 5V$, $I_L = 10mA$ to 0.5A
12. Adjust Pin Current Change, $V_{DIFF} = 2.5V$ to 40V, $I_L = 10mA$
13. Minimum Load Current, $V_{DIFF} = 40V$
14. Current Limit $V_{DIFF} \leq 15V$, $V_{DIFF} = 15V$
15. Current Limit $V_{DIFF} = 40V$, $V_{DIFF} = 40V$

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 low dose rate test: following the radiation exposure each of the 5 pieces irradiated under electrical bias shall pass the specification value. The units irradiated without electrical bias and the KTL statistics are included in this report for reference only. If any of the 5 pieces irradiated under electrical bias exceed the datasheet specifications, then the lot could be logged as a 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 < 10mrads(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 Condition D. Calculate the radiation induced change in each electrical parameter (Δ_{para}) for each sample at each radiation level. Calculate the ratio of the median Δ_{para} at low dose rate to the median Δ_{para} 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) Testing of the RH117H-Positive Adjustable Regulator for Linear Technology” to demonstrate that these parts do not exhibit ELDRS as defined in the current test method.

5.0. Total Ionizing Dose Test Results

Using the conditions stated above, the RH117H-Positive Adjustable Regulator (from the lot date code identified on the first page of this test report) passed the total ionizing dose test to 50krad(Si) with all parameters remaining within their pre- and/or post-radiation specification limits. As noted above (Section 4) the data for the units-under-test irradiated in the unbiased condition and the KTL statistics presented in this report are for reference only and are not used for the determination of “PASS/FAIL” for the lot.

Figures 5.1 through 5.15 show plots of all the measured parameters versus total ionizing dose while Tables 5.1 – 5.15 show the corresponding raw data for each of these parameters. In these 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.

In addition to the radiation test results, the data plots and tables described above contain anneal data. The anneals are performed to better understand the underlying physical mechanisms responsible for radiation-induced parametric shifts and are not part of the criteria used to establish whether or not the lot passes or fails the low dose rate test. In all cases the parts either improved or exhibited no change during the anneal.

As seen clearly in these figures, the pre- and post-irradiation data are well within the specification even after application of the KTL statistics and the control units, as expected, show no significant changes to any of the parameters throughout the course of the measurements. Therefore we can conclude that the observed degradation was due to the radiation exposure and not drift in the test equipment.

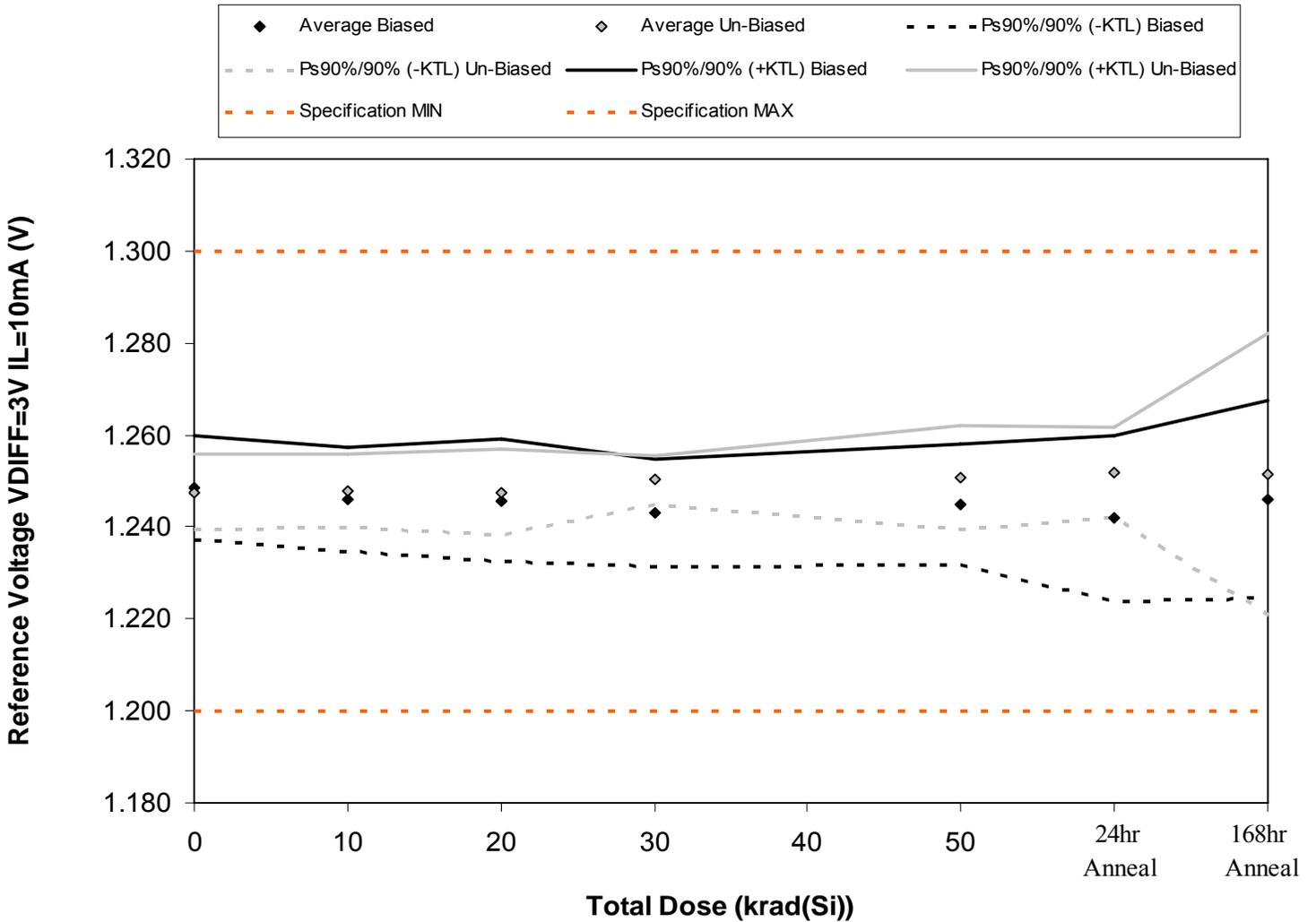


Figure 5.1. Plot of Reference Voltage VDIFF=3V IL=10mA (V) versus total dose. The solid diamonds are the average of the measured data points for the samples irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the samples irradiated with all pins tied to ground. The black lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated under electrical bias while the gray lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples 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.



**TID Report
10-120 100815 R1.1**

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Table 5.1. Raw data for Reference Voltage VDIFF=3V IL=10mA (V) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Reference Voltage VDIFF=3V IL=10mA (V)	Total Dose (krad(Si))					24-hr Anneal	168-hr Anneal
	0	10	20	30	50		
Device							
1123	1.254	1.251	1.252	1.249	1.251	1.244	1.254
1124	1.252	1.250	1.250	1.247	1.249	1.243	1.253
1114	1.246	1.243	1.243	1.241	1.241	1.236	1.247
1115	1.245	1.242	1.241	1.239	1.241	1.235	1.237
1116	1.246	1.244	1.243	1.242	1.242	1.251	1.239
1117	1.249	1.249	1.249	1.248	1.256	1.254	1.253
1118	1.243	1.243	1.242	1.251	1.246	1.246	1.270
1119	1.248	1.248	1.248	1.250	1.250	1.253	1.245
1120	1.251	1.251	1.251	1.253	1.254	1.255	1.247
1121	1.247	1.248	1.248	1.252	1.248	1.251	1.242
1135	1.248	1.244	1.244	1.249	1.248	1.248	1.242
1136	1.255	1.252	1.252	1.255	1.255	1.255	1.261
Biased Statistics							
Average Biased	1.249	1.246	1.246	1.243	1.245	1.242	1.246
Std Dev Biased	4.10E-03	4.18E-03	4.87E-03	4.22E-03	4.82E-03	6.53E-03	7.81E-03
Ps90%/90% (+KTL) Biased	1.260	1.257	1.259	1.255	1.258	1.260	1.267
Ps90%/90% (-KTL) Biased	1.237	1.235	1.232	1.232	1.232	1.224	1.225
Un-Biased Statistics							
Average Un-Biased	1.248	1.248	1.248	1.250	1.251	1.252	1.251
Std Dev Un-Biased	2.97E-03	2.95E-03	3.36E-03	1.92E-03	4.15E-03	3.56E-03	1.11E-02
Ps90%/90% (+KTL) Un-Biased	1.256	1.256	1.257	1.256	1.262	1.262	1.282
Ps90%/90% (-KTL) Un-Biased	1.239	1.240	1.238	1.245	1.239	1.242	1.221
Specification MIN	1.200	1.200	1.200	1.200	1.200	1.200	1.200
Status	PASS	PASS	PASS	PASS	PASS	PASS	PASS
Specification MAX	1.300	1.300	1.300	1.300	1.300	1.300	1.300
Status	PASS	PASS	PASS	PASS	PASS	PASS	PASS

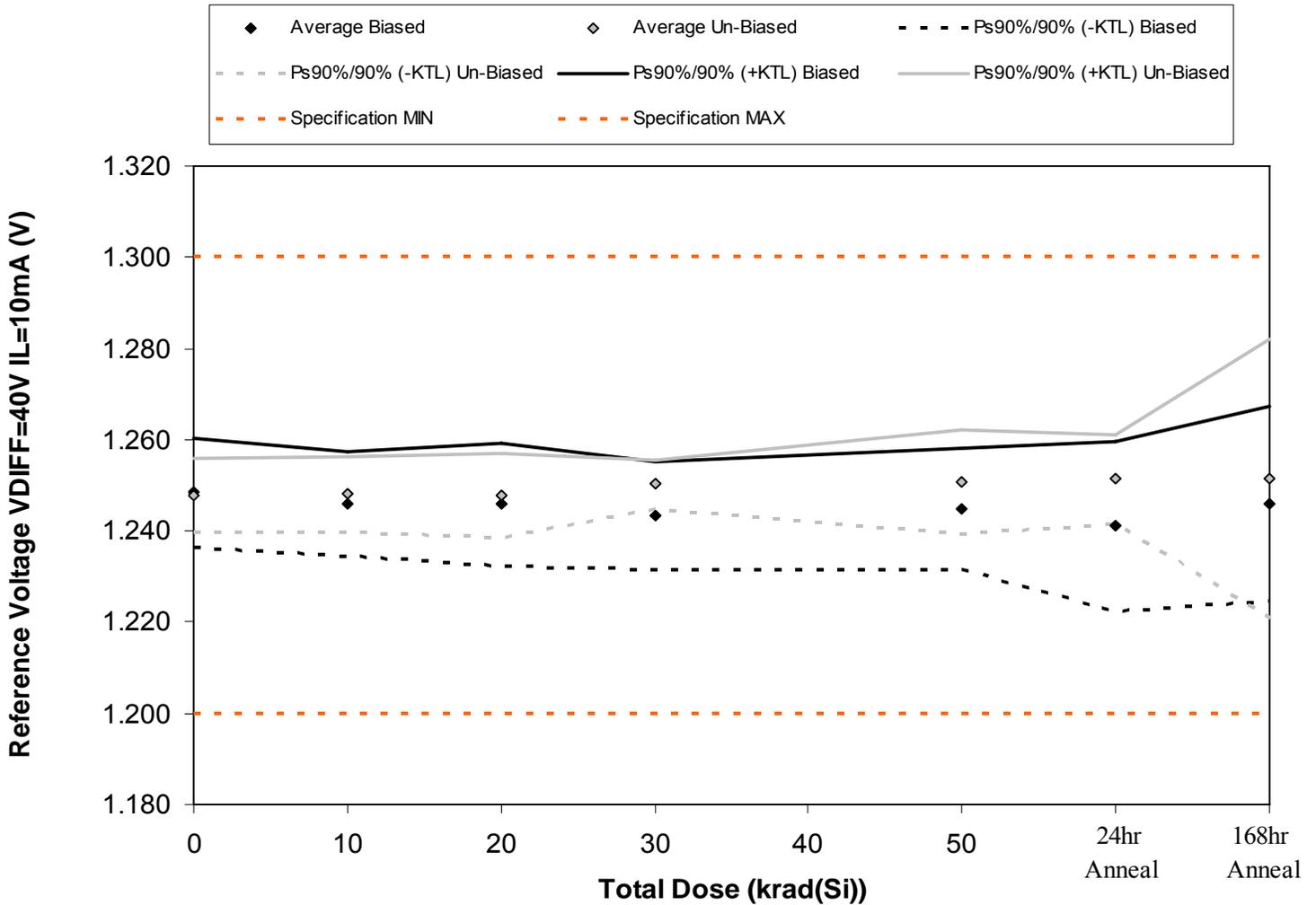


Figure 5.2. Plot of Reference Voltage VDIFF=40V IL=10mA (V) versus total dose. The solid diamonds are the average of the measured data points for the samples irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the samples irradiated with all pins tied to ground. The black lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated under electrical bias while the gray lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples 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 Reference Voltage VDIFF=40V IL=10mA (V) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Reference Voltage VDIFF=40V IL=10mA (V)	Total Dose (krad(Si))					24-hr Anneal	168-hr Anneal
	0	10	20	30	50		
Device							
1123	1.254	1.251	1.252	1.249	1.251	1.244	1.254
1124	1.252	1.250	1.250	1.248	1.249	1.243	1.253
1114	1.246	1.243	1.243	1.242	1.241	1.236	1.247
1115	1.244	1.242	1.241	1.239	1.241	1.234	1.237
1116	1.246	1.244	1.243	1.242	1.242	1.251	1.239
1117	1.249	1.249	1.249	1.248	1.256	1.254	1.253
1118	1.243	1.243	1.242	1.251	1.246	1.246	1.270
1119	1.248	1.249	1.249	1.250	1.250	1.253	1.245
1120	1.251	1.251	1.251	1.253	1.254	1.255	1.247
1121	1.248	1.248	1.248	1.252	1.248	1.251	1.242
1135	1.248	1.244	1.244	1.249	1.248	1.248	1.242
1136	1.255	1.252	1.252	1.255	1.255	1.256	1.261
Biased Statistics							
Average Biased	1.248	1.246	1.246	1.244	1.245	1.241	1.246
Std Dev Biased	4.34E-03	4.18E-03	4.87E-03	4.30E-03	4.82E-03	6.80E-03	7.81E-03
Ps90%/90% (+KTL) Biased	1.260	1.257	1.259	1.255	1.258	1.260	1.267
Ps90%/90% (-KTL) Biased	1.237	1.235	1.232	1.232	1.232	1.222	1.225
Un-Biased Statistics							
Average Un-Biased	1.248	1.248	1.248	1.250	1.251	1.251	1.251
Std Dev Un-Biased	2.95E-03	3.00E-03	3.42E-03	1.92E-03	4.15E-03	3.56E-03	1.11E-02
Ps90%/90% (+KTL) Un-Biased	1.256	1.256	1.257	1.256	1.262	1.261	1.282
Ps90%/90% (-KTL) Un-Biased	1.240	1.240	1.238	1.245	1.239	1.242	1.221
Specification MIN	1.200	1.200	1.200	1.200	1.200	1.200	1.200
Status	PASS	PASS	PASS	PASS	PASS	PASS	PASS
Specification MAX	1.300	1.300	1.300	1.300	1.300	1.300	1.300
Status	PASS	PASS	PASS	PASS	PASS	PASS	PASS

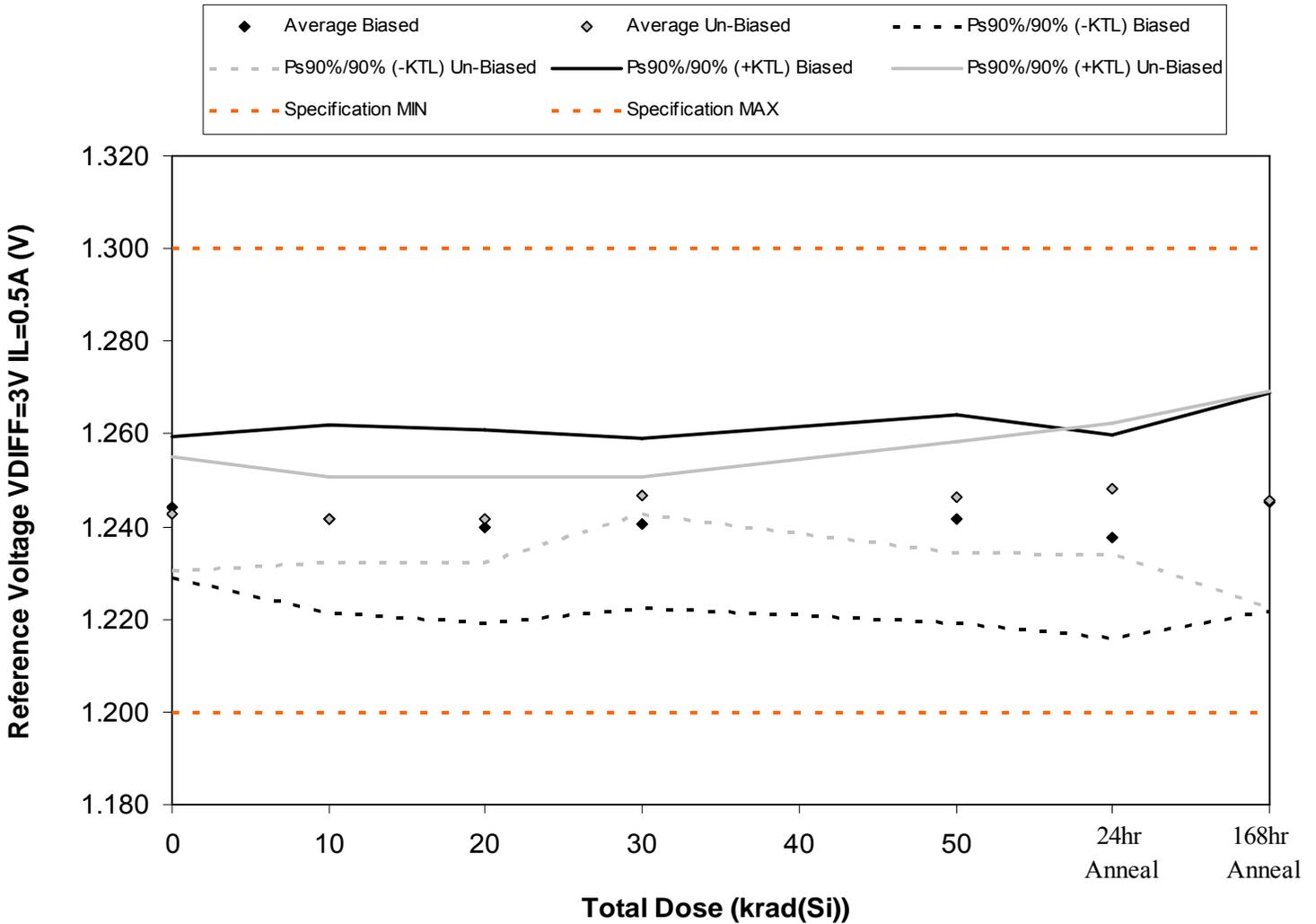


Figure 5.3. Plot of Reference Voltage VDIFF=3V IL=0.5A (V) versus total dose. The solid diamonds are the average of the measured data points for the samples irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the samples irradiated with all pins tied to ground. The black lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated under electrical bias while the gray lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples 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.



Table 5.3. Raw data for Reference Voltage VDIFF=3V IL=0.5A (V) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Reference Voltage VDIFF=3V IL=0.5A (V)	Total Dose (krad(Si))					24-hr Anneal	168-hr Anneal
	0	10	20	30	50		
Device							
1123	1.252	1.252	1.252	1.252	1.255	1.246	1.258
1124	1.246	1.244	1.243	1.243	1.244	1.237	1.249
1114	1.245	1.232	1.236	1.237	1.236	1.230	1.243
1115	1.238	1.242	1.233	1.235	1.236	1.230	1.240
1116	1.240	1.238	1.236	1.239	1.237	1.246	1.236
1117	1.243	1.243	1.243	1.245	1.252	1.256	1.255
1118	1.236	1.236	1.236	1.247	1.242	1.242	1.255
1119	1.248	1.242	1.242	1.247	1.245	1.247	1.240
1120	1.245	1.245	1.245	1.249	1.250	1.250	1.242
1121	1.241	1.242	1.242	1.248	1.243	1.246	1.237
1135	1.246	1.238	1.238	1.245	1.244	1.244	1.238
1136	1.249	1.246	1.246	1.251	1.251	1.251	1.257
Biased Statistics							
Average Biased	1.244	1.242	1.240	1.241	1.242	1.238	1.245
Std Dev Biased	5.50E-03	7.40E-03	7.65E-03	6.72E-03	8.20E-03	8.01E-03	8.58E-03
Ps90%/90% (+KTL) Biased	1.259	1.262	1.261	1.259	1.264	1.260	1.269
Ps90%/90% (-KTL) Biased	1.229	1.221	1.219	1.222	1.219	1.216	1.222
Un-Biased Statistics							
Average Un-Biased	1.243	1.242	1.242	1.247	1.246	1.248	1.246
Std Dev Un-Biased	4.51E-03	3.36E-03	3.36E-03	1.48E-03	4.39E-03	5.22E-03	8.58E-03
Ps90%/90% (+KTL) Un-Biased	1.255	1.251	1.251	1.251	1.258	1.263	1.269
Ps90%/90% (-KTL) Un-Biased	1.230	1.232	1.232	1.243	1.234	1.234	1.222
Specification MIN	1.200	1.200	1.200	1.200	1.200	1.200	1.200
Status	PASS	PASS	PASS	PASS	PASS	PASS	PASS
Specification MAX	1.300	1.300	1.300	1.300	1.300	1.300	1.300
Status	PASS	PASS	PASS	PASS	PASS	PASS	PASS

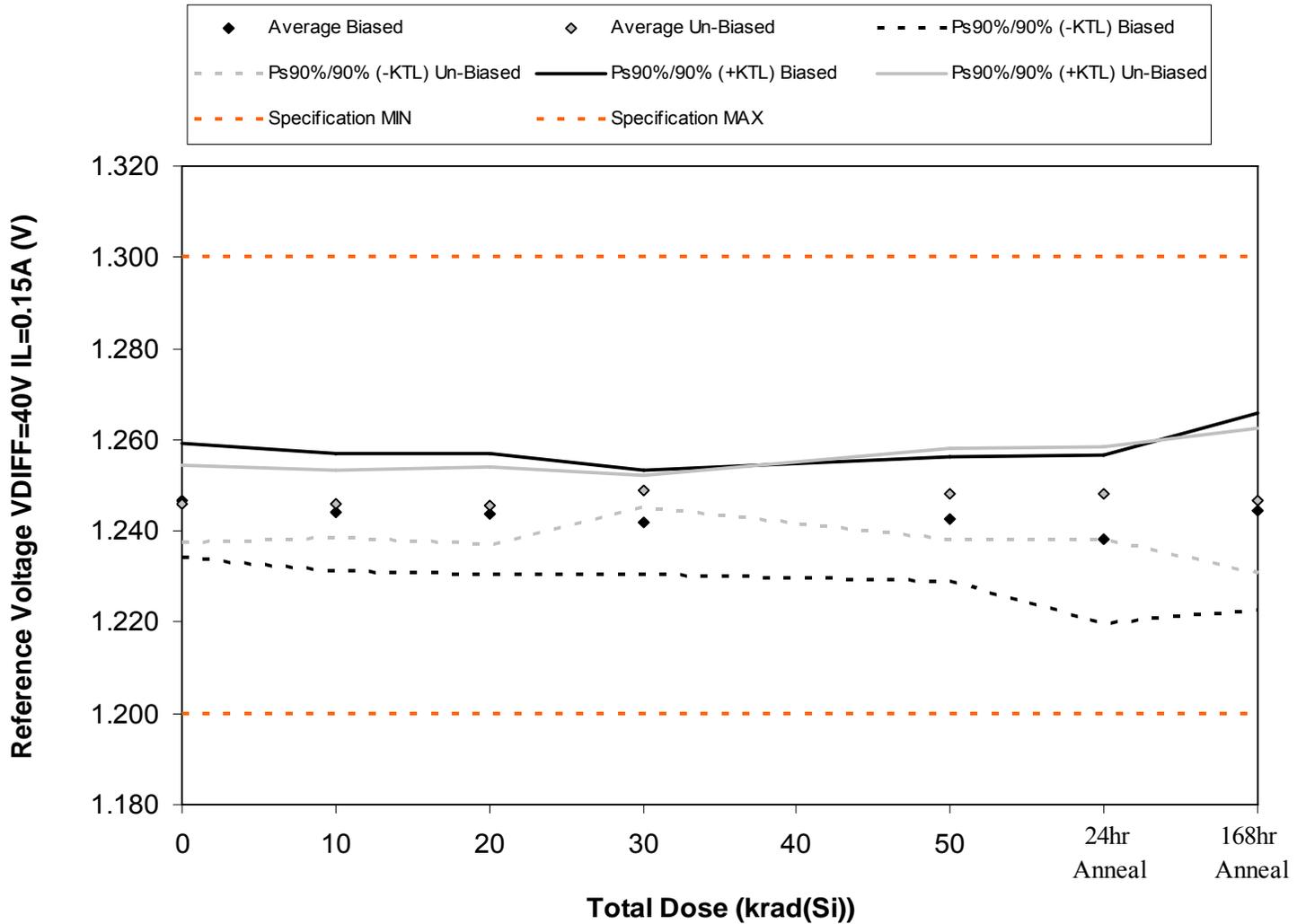


Figure 5.4. Plot of Reference Voltage VDIFF=40V IL=0.15A (V) versus total dose. The solid diamonds are the average of the measured data points for the samples irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the samples irradiated with all pins tied to ground. The black lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated under electrical bias while the gray lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples 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 Reference Voltage VDIFF=40V IL=0.15A (V) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Reference Voltage VDIFF=40V IL=0.15A (V)	Total Dose (krad(Si))					24-hr Anneal	168-hr Anneal
	0	10	20	30	50		
Device							
1123	1.252	1.250	1.250	1.247	1.249	1.240	1.254
1124	1.251	1.248	1.248	1.245	1.247	1.239	1.251
1114	1.244	1.240	1.241	1.239	1.239	1.233	1.245
1115	1.242	1.240	1.239	1.237	1.239	1.231	1.236
1116	1.244	1.242	1.241	1.241	1.239	1.248	1.238
1117	1.248	1.247	1.247	1.247	1.252	1.251	1.252
1118	1.241	1.241	1.240	1.249	1.244	1.243	1.254
1119	1.246	1.247	1.247	1.248	1.247	1.249	1.244
1120	1.249	1.247	1.247	1.250	1.252	1.252	1.246
1121	1.246	1.247	1.247	1.250	1.246	1.246	1.240
1135	1.246	1.243	1.243	1.246	1.246	1.246	1.241
1136	1.253	1.250	1.250	1.253	1.253	1.253	1.259
Biased Statistics							
Average Biased	1.247	1.244	1.244	1.242	1.243	1.238	1.244
Std Dev Biased	4.56E-03	4.69E-03	4.87E-03	4.15E-03	4.98E-03	6.69E-03	7.85E-03
Ps90%/90% (+KTL) Biased	1.259	1.257	1.257	1.253	1.256	1.257	1.266
Ps90%/90% (-KTL) Biased	1.234	1.231	1.230	1.230	1.229	1.220	1.223
Un-Biased Statistics							
Average Un-Biased	1.246	1.246	1.246	1.249	1.248	1.248	1.247
Std Dev Un-Biased	3.08E-03	2.68E-03	3.13E-03	1.30E-03	3.63E-03	3.70E-03	5.76E-03
Ps90%/90% (+KTL) Un-Biased	1.254	1.253	1.254	1.252	1.258	1.258	1.262
Ps90%/90% (-KTL) Un-Biased	1.238	1.238	1.237	1.245	1.238	1.238	1.231
Specification MIN	1.200	1.200	1.200	1.200	1.200	1.200	1.200
Status	PASS	PASS	PASS	PASS	PASS	PASS	PASS
Specification MAX	1.300	1.300	1.300	1.300	1.300	1.300	1.300
Status	PASS	PASS	PASS	PASS	PASS	PASS	PASS

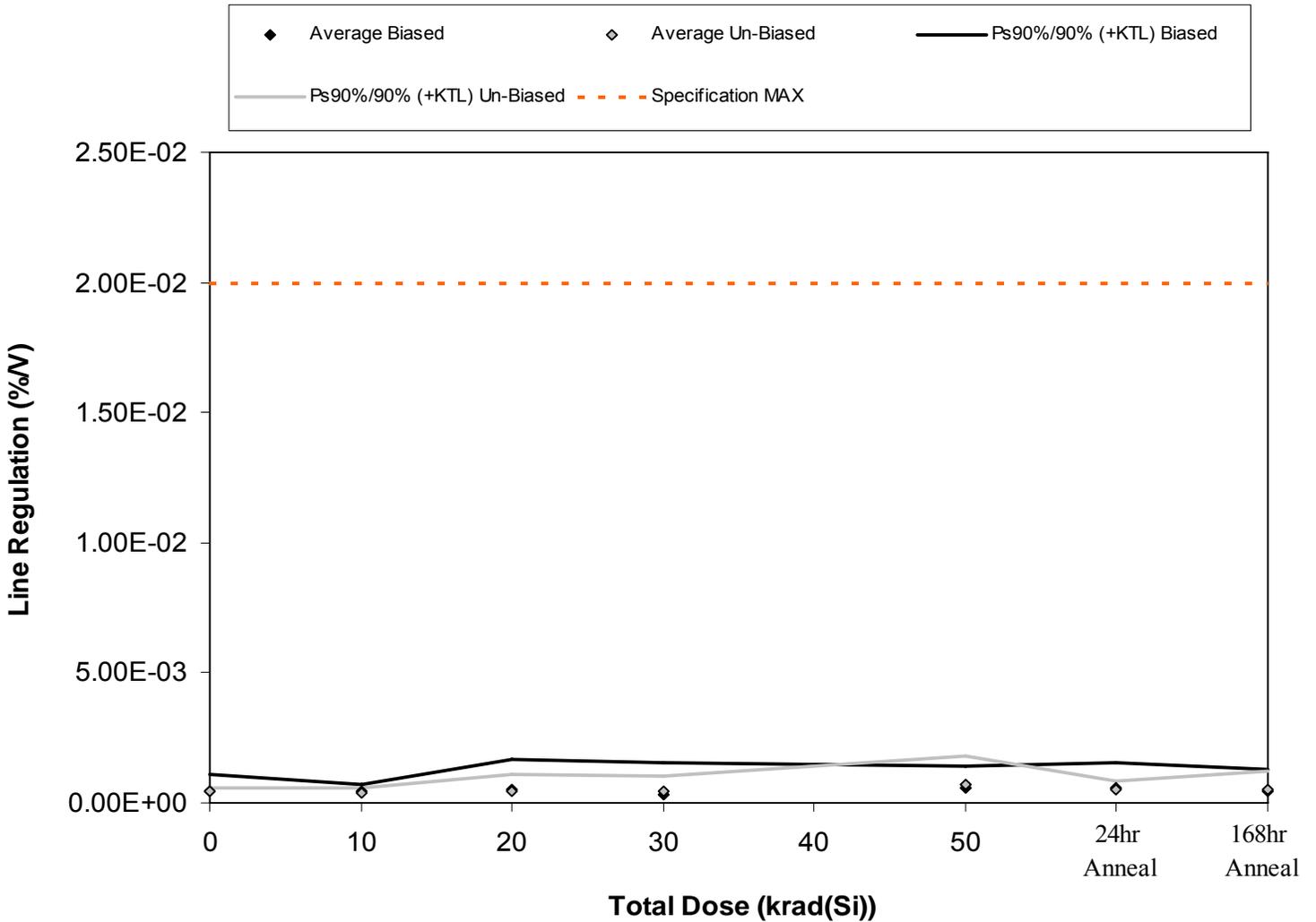


Figure 5.5. Plot of Line Regulation (%V) versus total dose. The solid diamonds are the average of the measured data points for the samples irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the samples irradiated with all pins tied to ground. The black lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated under electrical bias while the gray lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples 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.



Table 5.5. Raw data for Line Regulation (%/V) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Line Regulation (%/V)	Total Dose (krad(Si))					24-hr Anneal	168-hr Anneal
	0	10	20	30	50		
Device							
1123	3.00E-04	5.00E-04	1.00E-04	-1.00E-04	2.00E-04	5.00E-04	0.00E+00
1124	4.00E-04	3.00E-04	0.00E+00	2.00E-04	4.00E-04	3.00E-04	7.00E-04
1114	5.00E-04	5.00E-04	1.00E-03	9.00E-04	1.00E-03	1.20E-03	3.00E-04
1115	2.00E-04	3.00E-04	8.00E-04	0.00E+00	7.00E-04	5.00E-04	7.00E-04
1116	8.00E-04	5.00E-04	6.00E-04	7.00E-04	7.00E-04	4.00E-04	6.00E-04
1117	5.00E-04	4.00E-04	7.00E-04	7.00E-04	4.00E-04	4.00E-04	8.00E-04
1118	5.00E-04	4.00E-04	4.00E-04	4.00E-04	1.10E-03	5.00E-04	6.00E-04
1119	5.00E-04	5.00E-04	6.00E-04	5.00E-04	9.00E-04	5.00E-04	7.00E-04
1120	4.00E-04	4.00E-04	3.00E-04	1.00E-04	1.00E-04	5.00E-04	4.00E-04
1121	4.00E-04	3.00E-04	1.00E-04	4.00E-04	9.00E-04	7.00E-04	2.00E-04
1135	5.00E-04	5.00E-04	4.00E-04	1.00E-04	2.00E-04	-1.00E-04	6.00E-04
1136	7.00E-04	5.00E-04	0.00E+00	2.00E-04	2.00E-04	3.00E-04	2.00E-04
Biased Statistics							
Average Biased	4.40E-04	4.20E-04	5.00E-04	3.40E-04	6.00E-04	5.80E-04	4.60E-04
Std Dev Biased	2.30E-04	1.10E-04	4.36E-04	4.39E-04	3.08E-04	3.56E-04	3.05E-04
Ps90%/90% (+KTL) Biased	1.07E-03	7.20E-04	1.70E-03	1.54E-03	1.45E-03	1.56E-03	1.30E-03
Ps90%/90% (-KTL) Biased	-1.91E-04	1.20E-04	-6.95E-04	-8.65E-04	-2.45E-04	-3.97E-04	-3.76E-04
Un-Biased Statistics							
Average Un-Biased	4.60E-04	4.00E-04	4.20E-04	4.20E-04	6.80E-04	5.20E-04	5.40E-04
Std Dev Un-Biased	5.48E-05	7.07E-05	2.39E-04	2.17E-04	4.15E-04	1.10E-04	2.41E-04
Ps90%/90% (+KTL) Un-Biased	6.10E-04	5.94E-04	1.07E-03	1.01E-03	1.82E-03	8.20E-04	1.20E-03
Ps90%/90% (-KTL) Un-Biased	3.10E-04	2.06E-04	-2.35E-04	-1.74E-04	-4.57E-04	2.20E-04	-1.20E-04
Specification MAX	2.00E-02	2.00E-02	2.00E-02	2.00E-02	2.00E-02	2.00E-02	2.00E-02
Status	PASS	PASS	PASS	PASS	PASS	PASS	PASS

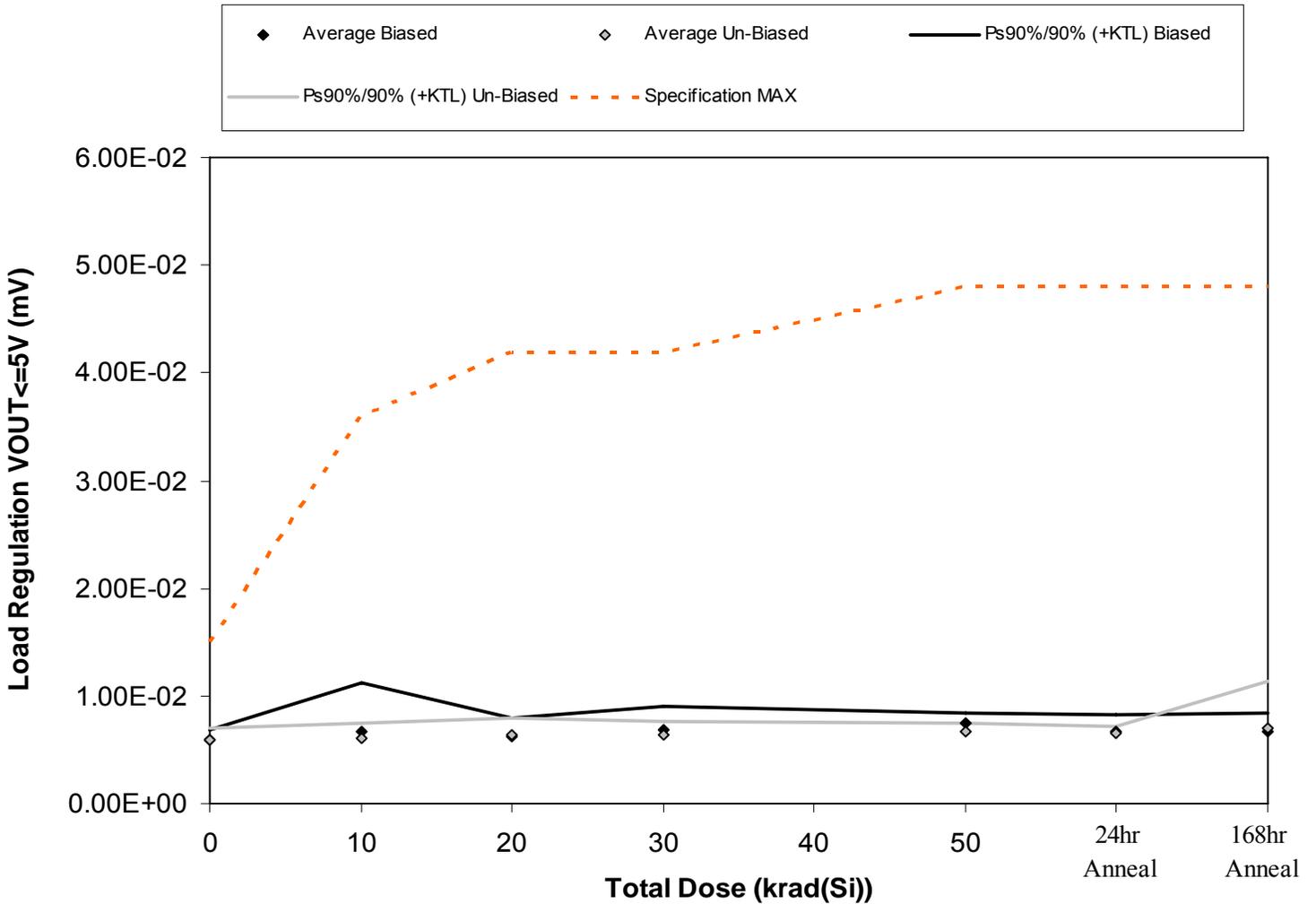


Figure 5.6. Plot of Load Regulation $V_{OUT} \leq 5V$ (mV) versus total dose. The solid diamonds are the average of the measured data points for the samples irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the samples irradiated with all pins tied to ground. The black lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated under electrical bias while the gray lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples 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.



Table 5.6. Raw data for Load Regulation $V_{OUT} \leq 5V$ (mV) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Load Regulation $V_{OUT} \leq 5V$ (mV)	Total Dose (krad(Si))					24-hr Anneal	168-hr Anneal
	0	10	20	30	50		
Device							
1123	5.63E-03	5.83E-03	5.84E-03	6.50E-03	7.16E-03	5.94E-03	6.33E-03
1124	5.74E-03	6.18E-03	6.77E-03	8.25E-03	7.81E-03	7.31E-03	7.33E-03
1114	6.52E-03	9.60E-03	7.09E-03	7.07E-03	7.44E-03	7.09E-03	6.38E-03
1115	5.83E-03	5.91E-03	5.84E-03	6.40E-03	6.90E-03	6.26E-03	6.16E-03
1116	5.64E-03	5.68E-03	5.79E-03	6.40E-03	7.73E-03	6.94E-03	7.49E-03
1117	5.91E-03	6.59E-03	7.07E-03	6.20E-03	6.87E-03	6.53E-03	6.33E-03
1118	5.54E-03	6.74E-03	5.71E-03	6.30E-03	6.35E-03	6.58E-03	9.77E-03
1119	6.59E-03	5.56E-03	6.42E-03	6.35E-03	7.02E-03	6.55E-03	6.33E-03
1120	6.06E-03	5.78E-03	6.80E-03	7.17E-03	6.95E-03	6.94E-03	5.81E-03
1121	5.61E-03	5.76E-03	6.28E-03	6.01E-03	6.67E-03	6.25E-03	6.64E-03
1135	6.03E-03	5.89E-03	6.25E-03	6.30E-03	6.43E-03	7.11E-03	6.62E-03
1136	5.98E-03	5.96E-03	6.43E-03	6.53E-03	6.40E-03	6.03E-03	6.57E-03
Biased Statistics							
Average Biased	5.87E-03	6.64E-03	6.27E-03	6.92E-03	7.41E-03	6.71E-03	6.74E-03
Std Dev Biased	3.71E-04	1.67E-03	6.15E-04	7.93E-04	3.83E-04	5.79E-04	6.20E-04
Ps90%/90% (+KTL) Biased	6.89E-03	1.12E-02	7.95E-03	9.10E-03	8.46E-03	8.29E-03	8.44E-03
Ps90%/90% (-KTL) Biased	4.85E-03	2.07E-03	4.58E-03	4.75E-03	6.36E-03	5.12E-03	5.04E-03
Un-Biased Statistics							
Average Un-Biased	5.94E-03	6.08E-03	6.46E-03	6.41E-03	6.77E-03	6.57E-03	6.98E-03
Std Dev Un-Biased	4.19E-04	5.37E-04	5.22E-04	4.48E-04	2.72E-04	2.46E-04	1.59E-03
Ps90%/90% (+KTL) Un-Biased	7.09E-03	7.56E-03	7.89E-03	7.63E-03	7.52E-03	7.24E-03	1.13E-02
Ps90%/90% (-KTL) Un-Biased	4.79E-03	4.61E-03	5.02E-03	5.18E-03	6.03E-03	5.90E-03	2.62E-03
Specification MAX	1.50E-02	3.60E-02	4.20E-02	4.20E-02	4.80E-02	4.80E-02	4.80E-02
Status	PASS	PASS	PASS	PASS	PASS	PASS	PASS

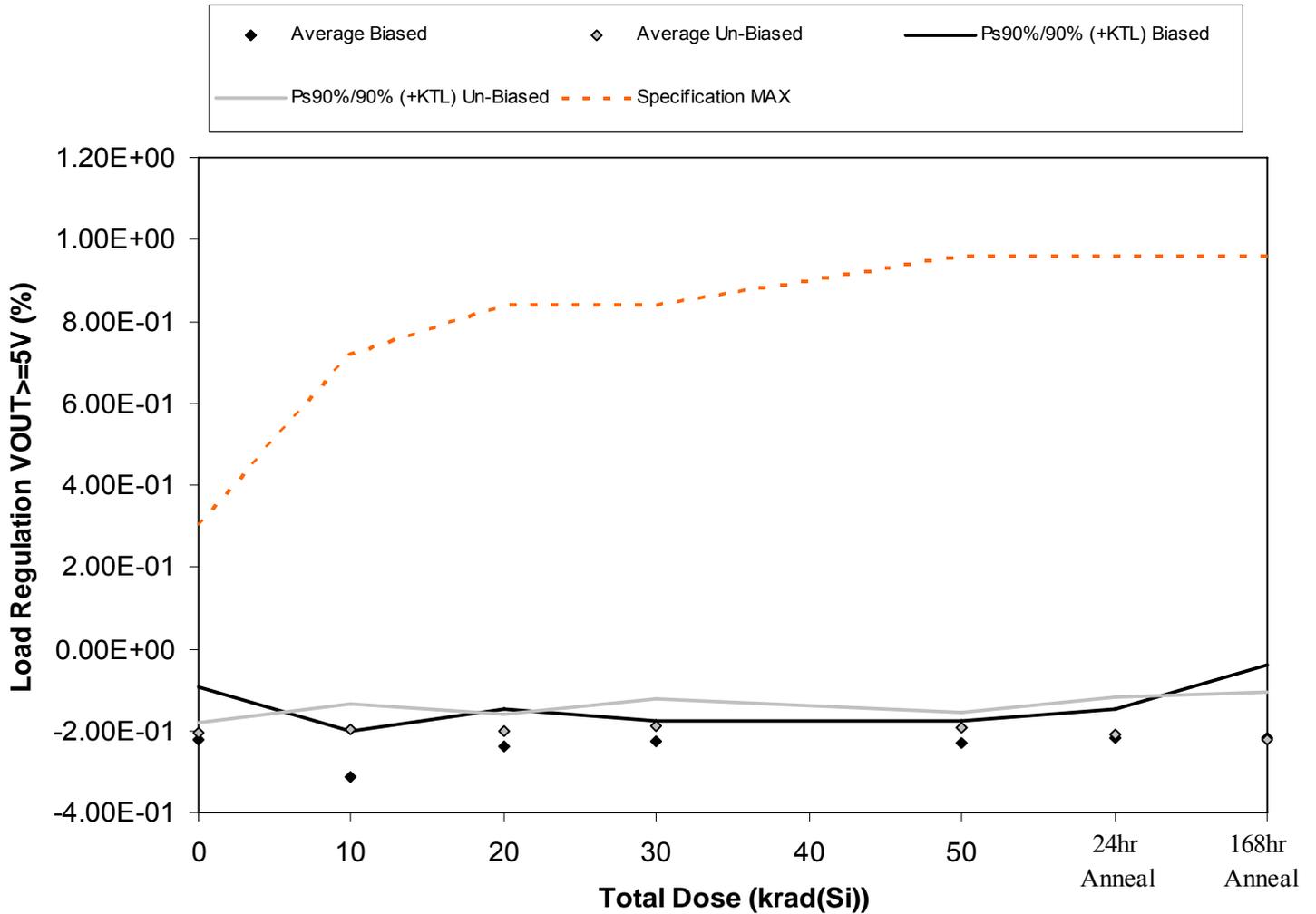


Figure 5.7. Plot of Load Regulation $V_{OUT} \geq 5V$ (%) versus total dose. The solid diamonds are the average of the measured data points for the samples irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the samples irradiated with all pins tied to ground. The black lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated under electrical bias while the gray lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples 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 for Load Regulation $V_{OUT} \geq 5V$ (%) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Load Regulation $V_{OUT} \geq 5V$ (%)	Total Dose (krad(Si))					24-hr Anneal	168-hr Anneal
	0	10	20	30	50		
Device							
1123	-2.09E-01	-2.76E-01	-2.36E-01	-2.21E-01	-2.42E-01	-1.82E-01	-2.63E-01
1124	-1.65E-01	-2.62E-01	-2.78E-01	-2.26E-01	-2.49E-01	-2.02E-01	-1.06E-01
1114	-2.88E-01	-3.21E-01	-2.53E-01	-2.43E-01	-2.02E-01	-2.18E-01	-2.52E-01
1115	-2.42E-01	-3.41E-01	-2.25E-01	-1.96E-01	-2.18E-01	-2.36E-01	-2.59E-01
1116	-1.99E-01	-3.55E-01	-1.91E-01	-2.38E-01	-2.45E-01	-2.47E-01	-2.14E-01
1117	-2.02E-01	-2.31E-01	-1.86E-01	-2.11E-01	-2.00E-01	-2.17E-01	-1.81E-01
1118	-2.19E-01	-2.14E-01	-1.86E-01	-1.66E-01	-1.75E-01	-1.76E-01	-2.01E-01
1119	-2.15E-01	-1.87E-01	-2.00E-01	-1.94E-01	-1.93E-01	-2.26E-01	-2.25E-01
1120	-1.95E-01	-1.89E-01	-2.12E-01	-2.16E-01	-2.10E-01	-1.75E-01	-2.14E-01
1121	-2.02E-01	-1.72E-01	-2.17E-01	-1.62E-01	-1.84E-01	-2.54E-01	-2.95E-01
1135	-2.09E-01	-1.95E-01	-2.14E-01	-2.07E-01	-1.77E-01	-1.75E-01	-1.70E-01
1136	-1.68E-01	-2.05E-01	-1.70E-01	-1.65E-01	-1.54E-01	-2.03E-01	-1.53E-01
Biased Statistics							
Average Biased	-2.21E-01	-3.11E-01	-2.37E-01	-2.25E-01	-2.31E-01	-2.17E-01	-2.19E-01
Std Dev Biased	4.66E-02	4.05E-02	3.24E-02	1.84E-02	2.03E-02	2.60E-02	6.60E-02
Ps90%/90% (+KTL) Biased	-9.28E-02	-2.00E-01	-1.48E-01	-1.74E-01	-1.75E-01	-1.46E-01	-3.79E-02
Ps90%/90% (-KTL) Biased	-3.48E-01	-4.22E-01	-3.25E-01	-2.75E-01	-2.87E-01	-2.88E-01	-4.00E-01
Un-Biased Statistics							
Average Un-Biased	-2.07E-01	-1.99E-01	-2.00E-01	-1.90E-01	-1.92E-01	-2.10E-01	-2.23E-01
Std Dev Un-Biased	1.00E-02	2.36E-02	1.44E-02	2.50E-02	1.36E-02	3.40E-02	4.33E-02
Ps90%/90% (+KTL) Un-Biased	-1.79E-01	-1.34E-01	-1.61E-01	-1.21E-01	-1.55E-01	-1.16E-01	-1.04E-01
Ps90%/90% (-KTL) Un-Biased	-2.34E-01	-2.63E-01	-2.40E-01	-2.58E-01	-2.30E-01	-3.03E-01	-3.42E-01
Specification MAX	3.00E-01	7.20E-01	8.40E-01	8.40E-01	9.60E-01	9.60E-01	9.60E-01
Status	PASS	PASS	PASS	PASS	PASS	PASS	PASS

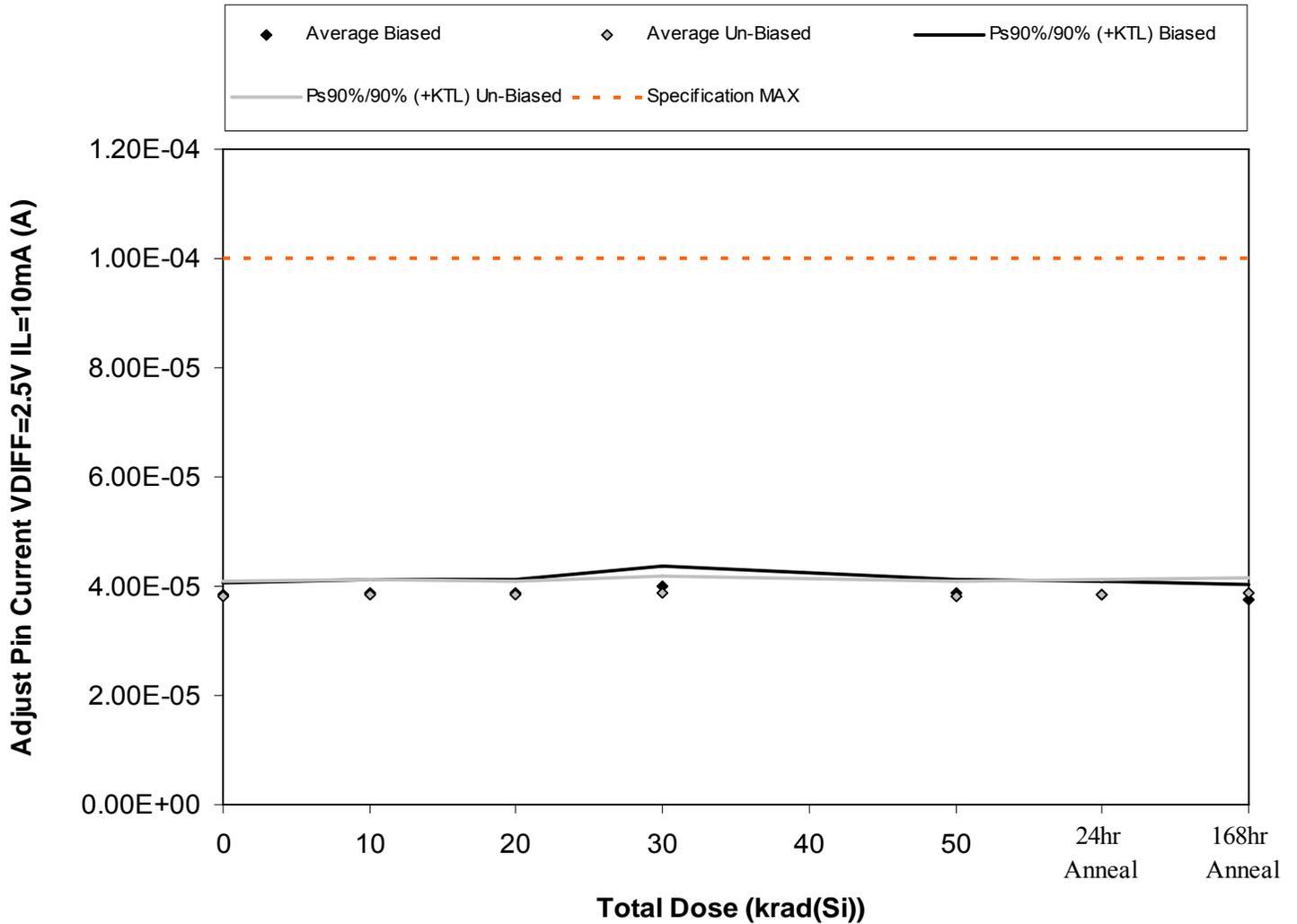


Figure 5.8. Plot of Adjust Pin Current VDIFF=2.5V IL=10mA (A) versus total dose. The solid diamonds are the average of the measured data points for the samples irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the samples irradiated with all pins tied to ground. The black lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated under electrical bias while the gray lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples 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 Adjust Pin Current VDIFF=2.5V IL=10mA (A) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Adjust Pin Current VDIFF=2.5V IL=10mA (A)	Total Dose (krad(Si))					24-hr Anneal	168-hr Anneal
	0	10	20	30	50		
Device							
1123	3.97E-05	4.02E-05	4.05E-05	4.01E-05	4.04E-05	4.02E-05	3.80E-05
1124	3.76E-05	3.79E-05	3.84E-05	3.78E-05	3.84E-05	3.80E-05	3.58E-05
1114	3.85E-05	3.88E-05	3.87E-05	3.93E-05	3.88E-05	3.82E-05	3.69E-05
1115	3.84E-05	3.86E-05	3.85E-05	4.12E-05	3.83E-05	3.80E-05	3.83E-05
1116	3.85E-05	3.84E-05	3.85E-05	4.10E-05	3.85E-05	3.84E-05	3.83E-05
1117	3.97E-05	3.98E-05	3.95E-05	4.02E-05	3.93E-05	3.96E-05	4.02E-05
1118	3.86E-05	3.90E-05	3.87E-05	3.93E-05	3.86E-05	3.87E-05	3.90E-05
1119	3.86E-05	3.88E-05	3.88E-05	3.93E-05	3.86E-05	3.89E-05	3.88E-05
1120	3.70E-05	3.74E-05	3.72E-05	3.77E-05	3.71E-05	3.71E-05	3.74E-05
1121	3.76E-05	3.76E-05	3.74E-05	3.79E-05	3.72E-05	3.72E-05	3.85E-05
1135	3.83E-05	3.86E-05	3.84E-05	3.87E-05	3.82E-05	3.84E-05	3.88E-05
1136	3.78E-05	3.75E-05	3.73E-05	3.84E-05	3.76E-05	3.79E-05	3.82E-05
Biased Statistics							
Average Biased	3.85E-05	3.88E-05	3.89E-05	3.99E-05	3.89E-05	3.86E-05	3.74E-05
Std Dev Biased	7.36E-07	8.79E-07	8.81E-07	1.40E-06	8.82E-07	9.03E-07	1.08E-06
Ps90%/90% (+KTL) Biased	4.06E-05	4.12E-05	4.13E-05	4.37E-05	4.13E-05	4.10E-05	4.04E-05
Ps90%/90% (-KTL) Biased	3.65E-05	3.64E-05	3.65E-05	3.61E-05	3.65E-05	3.61E-05	3.45E-05
Un-Biased Statistics							
Average Un-Biased	3.83E-05	3.85E-05	3.83E-05	3.89E-05	3.82E-05	3.83E-05	3.88E-05
Std Dev Un-Biased	1.02E-06	1.01E-06	9.80E-07	1.06E-06	9.63E-07	1.09E-06	1.01E-06
Ps90%/90% (+KTL) Un-Biased	4.11E-05	4.13E-05	4.10E-05	4.18E-05	4.08E-05	4.13E-05	4.15E-05
Ps90%/90% (-KTL) Un-Biased	3.55E-05	3.57E-05	3.56E-05	3.60E-05	3.55E-05	3.53E-05	3.60E-05
Specification MAX	1.00E-04	1.00E-04	1.00E-04	1.00E-04	1.00E-04	1.00E-04	1.00E-04
Status	PASS	PASS	PASS	PASS	PASS	PASS	PASS

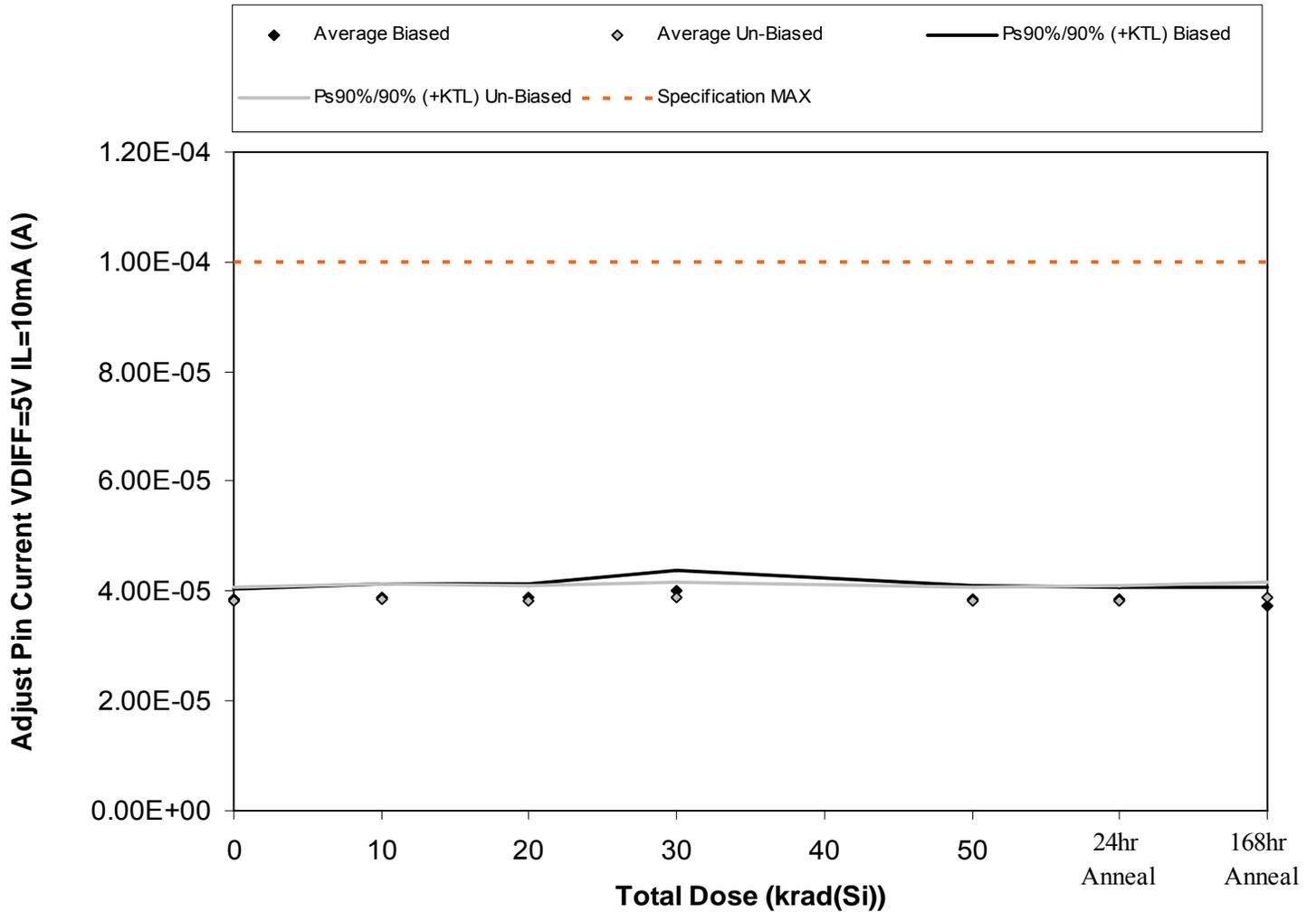


Figure 5.9. Plot of Adjust Pin Current VDIFF=5V IL=10mA (A) versus total dose. The solid diamonds are the average of the measured data points for the samples irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the samples irradiated with all pins tied to ground. The black lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated under electrical bias while the gray lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples 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 5.9. Raw data for Adjust Pin Current VDIFF=5V IL=10mA (A) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Adjust Pin Current VDIFF=5V IL=10mA (A)	Total Dose (krad(Si))					24-hr Anneal	168-hr Anneal
	0	10	20	30	50		
Device							
1123	3.96E-05	4.03E-05	4.05E-05	4.01E-05	4.02E-05	4.00E-05	3.83E-05
1124	3.76E-05	3.79E-05	3.87E-05	3.79E-05	3.81E-05	3.80E-05	3.57E-05
1114	3.85E-05	3.88E-05	3.87E-05	3.93E-05	3.84E-05	3.87E-05	3.69E-05
1115	3.82E-05	3.84E-05	3.87E-05	4.10E-05	3.85E-05	3.80E-05	3.85E-05
1116	3.84E-05	3.88E-05	3.86E-05	4.14E-05	3.81E-05	3.84E-05	3.81E-05
1117	3.94E-05	3.97E-05	3.94E-05	4.02E-05	3.94E-05	3.97E-05	3.99E-05
1118	3.85E-05	3.92E-05	3.90E-05	3.93E-05	3.86E-05	3.87E-05	3.94E-05
1119	3.88E-05	3.88E-05	3.89E-05	3.94E-05	3.84E-05	3.86E-05	3.89E-05
1120	3.73E-05	3.77E-05	3.73E-05	3.77E-05	3.72E-05	3.71E-05	3.74E-05
1121	3.74E-05	3.74E-05	3.74E-05	3.81E-05	3.72E-05	3.73E-05	3.81E-05
1135	3.85E-05	3.86E-05	3.85E-05	3.91E-05	3.81E-05	3.84E-05	3.86E-05
1136	3.77E-05	3.76E-05	3.75E-05	3.82E-05	3.76E-05	3.81E-05	3.79E-05
Biased Statistics							
Average Biased	3.85E-05	3.88E-05	3.90E-05	4.00E-05	3.86E-05	3.86E-05	3.75E-05
Std Dev Biased	7.10E-07	9.09E-07	8.07E-07	1.40E-06	9.02E-07	8.13E-07	1.20E-06
Ps90%/90% (+KTL) Biased	4.04E-05	4.13E-05	4.12E-05	4.38E-05	4.11E-05	4.09E-05	4.08E-05
Ps90%/90% (-KTL) Biased	3.65E-05	3.63E-05	3.68E-05	3.61E-05	3.62E-05	3.64E-05	3.42E-05
Un-Biased Statistics							
Average Un-Biased	3.83E-05	3.86E-05	3.84E-05	3.89E-05	3.81E-05	3.83E-05	3.87E-05
Std Dev Un-Biased	8.84E-07	9.68E-07	9.87E-07	1.03E-06	9.69E-07	1.05E-06	1.01E-06
Ps90%/90% (+KTL) Un-Biased	4.07E-05	4.12E-05	4.11E-05	4.18E-05	4.08E-05	4.11E-05	4.15E-05
Ps90%/90% (-KTL) Un-Biased	3.58E-05	3.59E-05	3.57E-05	3.61E-05	3.55E-05	3.54E-05	3.60E-05
Specification MAX	1.00E-04	1.00E-04	1.00E-04	1.00E-04	1.00E-04	1.00E-04	1.00E-04
Status	PASS	PASS	PASS	PASS	PASS	PASS	PASS

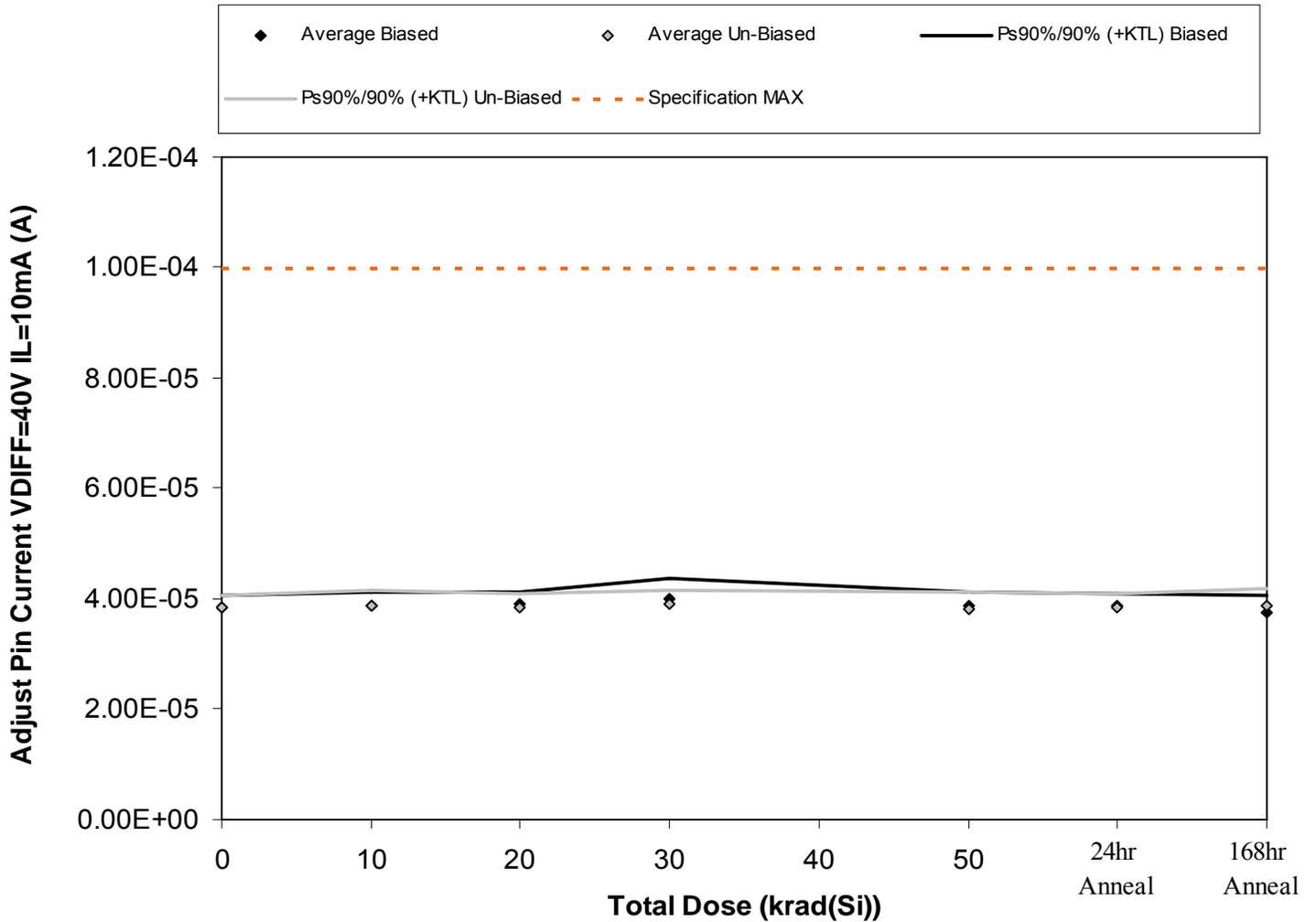


Figure 5.10. Plot of Adjust Pin Current VDIFF=40V IL=10mA (A) versus total dose. The solid diamonds are the average of the measured data points for the samples irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the samples irradiated with all pins tied to ground. The black lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated under electrical bias while the gray lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples 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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(719) 531-0800**

Table 5.10. Raw data for Adjust Pin Current VDIFF=40V IL=10mA (A) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Adjust Pin Current VDIFF=40V IL=10mA (A)	Total Dose (krad(Si))					24-hr Anneal	168-hr Anneal
	0	10	20	30	50		
Device							
1123	3.98E-05	4.04E-05	4.05E-05	4.01E-05	4.04E-05	4.00E-05	3.80E-05
1124	3.76E-05	3.82E-05	3.85E-05	3.81E-05	3.85E-05	3.79E-05	3.57E-05
1114	3.85E-05	3.88E-05	3.87E-05	3.93E-05	3.85E-05	3.87E-05	3.70E-05
1115	3.84E-05	3.86E-05	3.85E-05	4.10E-05	3.82E-05	3.83E-05	3.85E-05
1116	3.84E-05	3.84E-05	3.87E-05	4.14E-05	3.81E-05	3.86E-05	3.83E-05
1117	3.95E-05	3.99E-05	3.94E-05	4.02E-05	3.97E-05	3.95E-05	4.02E-05
1118	3.85E-05	3.92E-05	3.88E-05	3.94E-05	3.85E-05	3.86E-05	3.95E-05
1119	3.87E-05	3.89E-05	3.90E-05	3.93E-05	3.85E-05	3.87E-05	3.89E-05
1120	3.74E-05	3.74E-05	3.71E-05	3.79E-05	3.70E-05	3.73E-05	3.75E-05
1121	3.75E-05	3.77E-05	3.75E-05	3.81E-05	3.73E-05	3.74E-05	3.81E-05
1135	3.87E-05	3.84E-05	3.87E-05	3.93E-05	3.81E-05	3.84E-05	3.85E-05
1136	3.78E-05	3.77E-05	3.79E-05	3.82E-05	3.77E-05	3.80E-05	3.78E-05
Biased Statistics							
Average Biased	3.85E-05	3.89E-05	3.90E-05	4.00E-05	3.87E-05	3.87E-05	3.75E-05
Std Dev Biased	7.70E-07	8.52E-07	8.41E-07	1.32E-06	9.30E-07	7.90E-07	1.14E-06
Ps90%/90% (+KTL) Biased	4.06E-05	4.12E-05	4.13E-05	4.36E-05	4.13E-05	4.09E-05	4.06E-05
Ps90%/90% (-KTL) Biased	3.64E-05	3.65E-05	3.67E-05	3.64E-05	3.62E-05	3.65E-05	3.44E-05
Un-Biased Statistics							
Average Un-Biased	3.83E-05	3.86E-05	3.84E-05	3.90E-05	3.82E-05	3.83E-05	3.88E-05
Std Dev Un-Biased	8.75E-07	1.04E-06	9.93E-07	9.51E-07	1.08E-06	9.61E-07	1.09E-06
Ps90%/90% (+KTL) Un-Biased	4.07E-05	4.15E-05	4.11E-05	4.16E-05	4.11E-05	4.09E-05	4.18E-05
Ps90%/90% (-KTL) Un-Biased	3.59E-05	3.58E-05	3.56E-05	3.64E-05	3.52E-05	3.57E-05	3.58E-05
Specification MAX	1.00E-04	1.00E-04	1.00E-04	1.00E-04	1.00E-04	1.00E-04	1.00E-04
Status	PASS	PASS	PASS	PASS	PASS	PASS	PASS

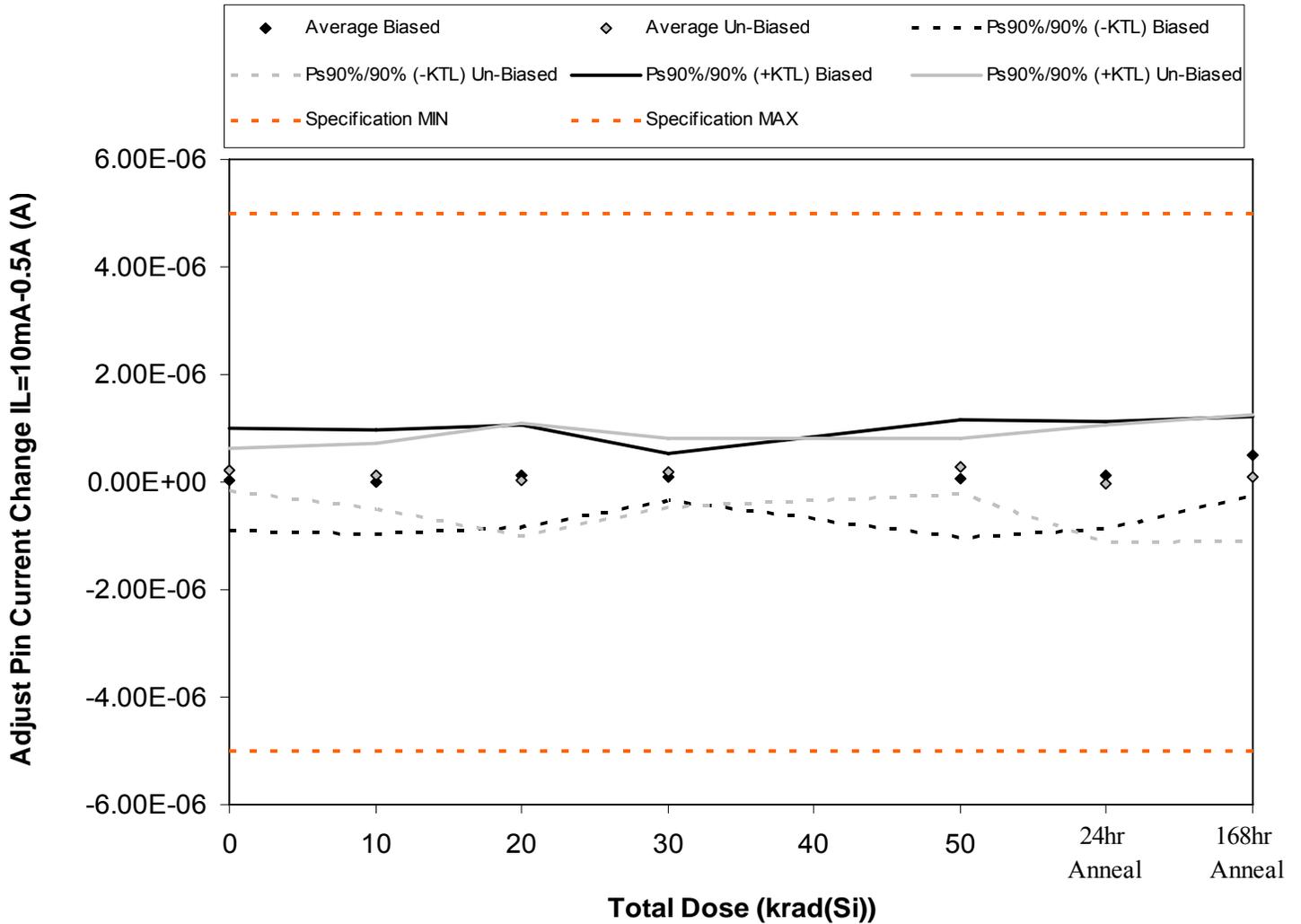


Figure 5.11. Plot of Adjust Pin Current Change IL=10mA-0.5A (A) versus total dose. The solid diamonds are the average of the measured data points for the samples irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the samples irradiated with all pins tied to ground. The black lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated under electrical bias while the gray lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples 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 5.11. Raw data for Adjust Pin Current Change IL=10mA-0.5A (A) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Adjust Pin Current Change IL=10mA-0.5A (A)	Total Dose (krad(Si))					24-hr Anneal	168-hr Anneal
	0	10	20	30	50		
Device							
1123	-2.70E-07	-3.10E-07	9.00E-08	-7.00E-08	4.00E-07	4.50E-07	4.00E-08
1124	6.20E-07	-9.00E-08	-7.00E-08	3.30E-07	-1.60E-07	-1.80E-07	7.40E-07
1114	0.00E+00	0.00E+00	0.00E+00	2.00E-08	3.60E-07	-1.80E-07	5.80E-07
1115	0.00E+00	-1.80E-07	7.10E-07	1.80E-07	2.20E-07	-4.00E-08	5.30E-07
1116	-1.80E-07	6.00E-07	-1.80E-07	0.00E+00	-5.30E-07	5.80E-07	5.80E-07
1117	1.30E-07	1.30E-07	-9.00E-08	4.00E-08	1.80E-07	9.00E-08	5.80E-07
1118	4.00E-08	3.80E-07	2.20E-07	0.00E+00	2.20E-07	-2.70E-07	-3.60E-07
1119	3.30E-07	0.00E+00	2.50E-07	0.00E+00	1.80E-07	0.00E+00	1.80E-07
1120	4.00E-07	2.70E-07	-5.60E-07	2.90E-07	2.20E-07	-5.30E-07	3.60E-07
1121	2.70E-07	-1.80E-07	4.00E-07	5.30E-07	6.20E-07	5.30E-07	-3.60E-07
1135	5.80E-07	5.30E-07	0.00E+00	-1.80E-07	8.90E-07	-3.60E-07	1.80E-07
1136	4.90E-07	-1.80E-07	-2.20E-07	4.00E-07	2.70E-07	4.00E-07	-7.10E-07
Biased Statistics							
Average Biased	3.40E-08	4.00E-09	1.10E-07	9.20E-08	5.80E-08	1.26E-07	4.94E-07
Std Dev Biased	3.48E-07	3.52E-07	3.50E-07	1.61E-07	3.96E-07	3.63E-07	2.66E-07
Ps90%/90% (+KTL) Biased	9.88E-07	9.70E-07	1.07E-06	5.35E-07	1.14E-06	1.12E-06	1.22E-06
Ps90%/90% (-KTL) Biased	-9.20E-07	-9.62E-07	-8.49E-07	-3.51E-07	-1.03E-06	-8.68E-07	-2.35E-07
Un-Biased Statistics							
Average Un-Biased	2.34E-07	1.20E-07	4.40E-08	1.72E-07	2.84E-07	-3.60E-08	8.00E-08
Std Dev Un-Biased	1.47E-07	2.21E-07	3.82E-07	2.34E-07	1.89E-07	3.99E-07	4.26E-07
Ps90%/90% (+KTL) Un-Biased	6.37E-07	7.25E-07	1.09E-06	8.13E-07	8.02E-07	1.06E-06	1.25E-06
Ps90%/90% (-KTL) Un-Biased	-1.69E-07	-4.85E-07	-1.00E-06	-4.69E-07	-2.34E-07	-1.13E-06	-1.09E-06
Specification MIN	-5.00E-06	-5.00E-06	-5.00E-06	-5.00E-06	-5.00E-06	-5.00E-06	-5.00E-06
Status	PASS	PASS	PASS	PASS	PASS	PASS	PASS
Specification MAX	5.00E-06	5.00E-06	5.00E-06	5.00E-06	5.00E-06	5.00E-06	5.00E-06
Status	PASS	PASS	PASS	PASS	PASS	PASS	PASS

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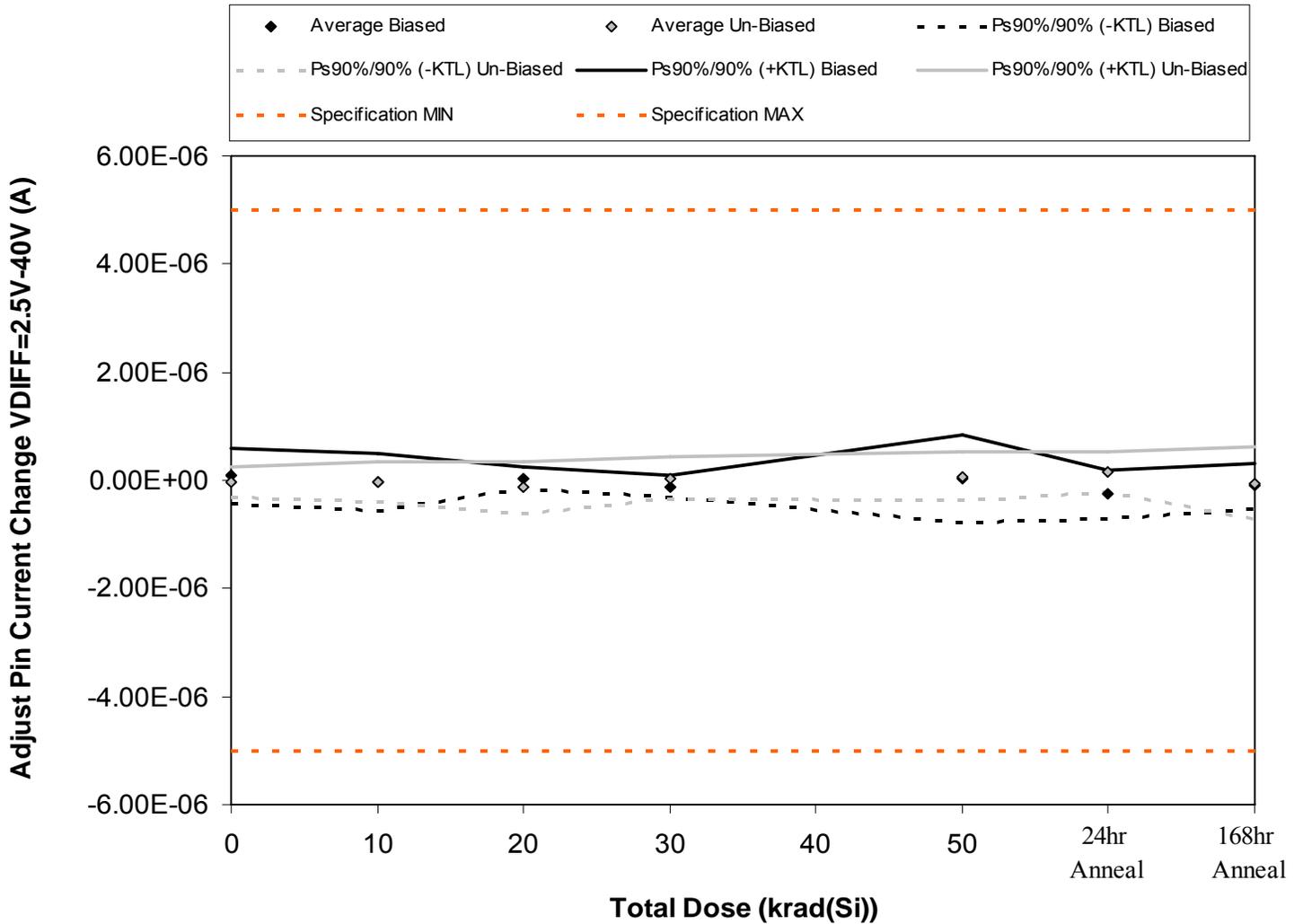


Figure 5.12. Plot of Adjust Pin Current Change VDIFF=2.5V-40V (A) versus total dose. The solid diamonds are the average of the measured data points for the samples irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the samples irradiated with all pins tied to ground. The black lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated under electrical bias while the gray lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples 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.



Table 5.12. Raw data for Adjust Pin Current Change VDIFF=2.5V-40V (A) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Adjust Pin Current Change VDIFF=2.5V-40V (A)	Total Dose (krad(Si))					24-hr Anneal	168-hr Anneal
	0	10	20	30	50		
Device							
1123	-2.00E-08	-1.10E-07	-4.00E-08	-1.10E-07	1.30E-07	-3.60E-07	-9.00E-08
1124	1.60E-07	-2.90E-07	1.60E-07	-7.00E-08	-9.00E-08	-3.60E-07	4.00E-08
1114	2.00E-08	4.00E-08	4.00E-08	-2.00E-08	1.80E-07	0.00E+00	-3.60E-07
1115	-1.30E-07	2.20E-07	0.00E+00	-1.80E-07	-4.00E-07	-3.80E-07	-9.00E-08
1116	3.60E-07	0.00E+00	4.00E-08	-1.80E-07	3.60E-07	-1.80E-07	-4.00E-08
1117	-1.30E-07	7.00E-08	-2.00E-07	-1.80E-07	1.30E-07	9.00E-08	-3.60E-07
1118	-7.00E-08	7.00E-08	-4.00E-08	2.00E-08	0.00E+00	0.00E+00	-2.50E-07
1119	1.10E-07	4.00E-08	4.00E-08	4.00E-08	3.30E-07	2.70E-07	1.80E-07
1120	-1.10E-07	-2.20E-07	-4.20E-07	1.10E-07	0.00E+00	9.00E-08	1.80E-07
1121	4.00E-08	-1.30E-07	-7.00E-08	2.00E-07	-9.00E-08	3.10E-07	0.00E+00
1135	-1.80E-07	-7.00E-08	0.00E+00	-1.80E-07	-1.30E-07	-4.50E-07	1.80E-07
1136	0.00E+00	-9.00E-08	-1.10E-07	2.00E-08	2.70E-07	-1.80E-07	-2.70E-07
Biased Statistics							
Average Biased	7.80E-08	-2.80E-08	4.00E-08	-1.12E-07	3.60E-08	-2.56E-07	-1.08E-07
Std Dev Biased	1.89E-07	1.89E-07	7.48E-08	6.98E-08	2.92E-07	1.65E-07	1.51E-07
Ps90%/90% (+KTL) Biased	5.96E-07	4.89E-07	2.45E-07	7.94E-08	8.36E-07	1.95E-07	3.05E-07
Ps90%/90% (-KTL) Biased	-4.40E-07	-5.45E-07	-1.65E-07	-3.03E-07	-7.64E-07	-7.07E-07	-5.21E-07
Un-Biased Statistics							
Average Un-Biased	-3.20E-08	-3.40E-08	-1.38E-07	3.80E-08	7.40E-08	1.52E-07	-5.00E-08
Std Dev Un-Biased	1.03E-07	1.33E-07	1.80E-07	1.41E-07	1.63E-07	1.32E-07	2.47E-07
Ps90%/90% (+KTL) Un-Biased	2.51E-07	3.31E-07	3.55E-07	4.24E-07	5.21E-07	5.14E-07	6.28E-07
Ps90%/90% (-KTL) Un-Biased	-3.15E-07	-3.99E-07	-6.31E-07	-3.48E-07	-3.73E-07	-2.10E-07	-7.28E-07
Specification MIN	-5.00E-06	-5.00E-06	-5.00E-06	-5.00E-06	-5.00E-06	-5.00E-06	-5.00E-06
Status	PASS	PASS	PASS	PASS	PASS	PASS	PASS
Specification MAX	5.00E-06	5.00E-06	5.00E-06	5.00E-06	5.00E-06	5.00E-06	5.00E-06
Status	PASS	PASS	PASS	PASS	PASS	PASS	PASS

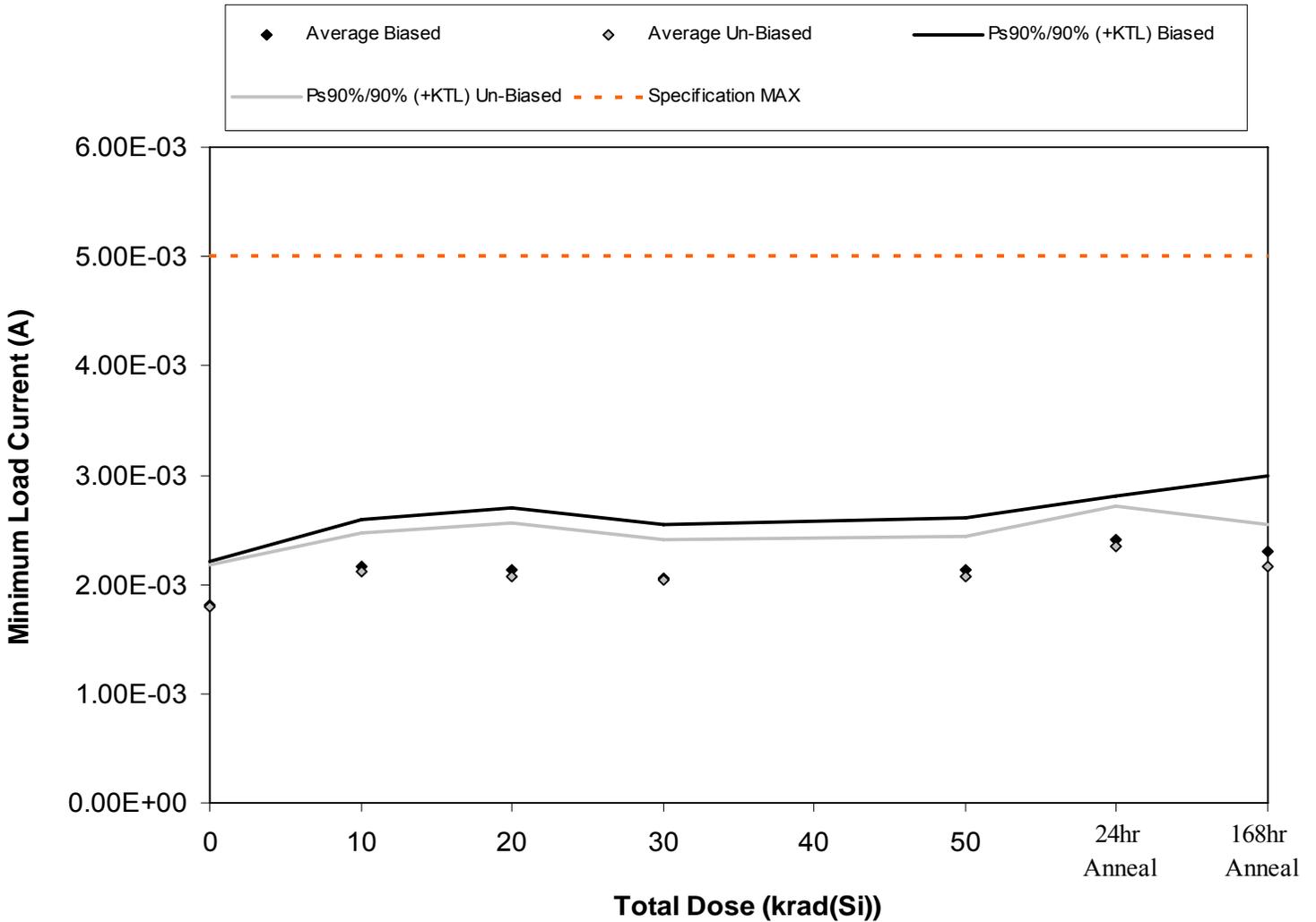


Figure 5.13. Plot of Minimum Load Current (A) versus total dose. The solid diamonds are the average of the measured data points for the samples irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the samples irradiated with all pins tied to ground. The black lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated under electrical bias while the gray lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples 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.



Table 5.13. Raw data for Minimum Load Current (A) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Minimum Load Current (A)	Total Dose (krad(Si))					24-hr Anneal	168-hr Anneal
	0	10	20	30	50		
Device							
1123	1.71E-03	2.04E-03	1.94E-03	1.90E-03	1.98E-03	2.31E-03	2.10E-03
1124	1.61E-03	1.94E-03	1.88E-03	1.83E-03	1.90E-03	2.20E-03	2.04E-03
1114	1.92E-03	2.24E-03	2.25E-03	2.18E-03	2.25E-03	2.51E-03	2.33E-03
1115	1.92E-03	2.29E-03	2.33E-03	2.20E-03	2.27E-03	2.53E-03	2.35E-03
1116	1.90E-03	2.29E-03	2.25E-03	2.18E-03	2.25E-03	2.49E-03	2.68E-03
1117	1.81E-03	2.18E-03	2.16E-03	2.04E-03	2.06E-03	2.35E-03	2.23E-03
1118	2.00E-03	2.29E-03	2.33E-03	2.24E-03	2.27E-03	2.55E-03	2.37E-03
1119	1.75E-03	2.08E-03	1.92E-03	2.00E-03	2.02E-03	2.31E-03	2.12E-03
1120	1.61E-03	1.94E-03	1.88E-03	1.86E-03	1.90E-03	2.18E-03	2.00E-03
1121	1.79E-03	2.12E-03	2.04E-03	2.04E-03	2.08E-03	2.37E-03	2.12E-03
1135	2.02E-03	2.35E-03	2.24E-03	2.24E-03	2.24E-03	2.53E-03	2.33E-03
1136	1.63E-03	1.96E-03	1.88E-03	1.86E-03	1.86E-03	2.12E-03	1.94E-03
Biased Statistics							
Average Biased	1.81E-03	2.16E-03	2.13E-03	2.06E-03	2.13E-03	2.41E-03	2.30E-03
Std Dev Biased	1.45E-04	1.60E-04	2.05E-04	1.77E-04	1.76E-04	1.45E-04	2.54E-04
Ps90%/90% (+KTL) Biased	2.21E-03	2.60E-03	2.70E-03	2.54E-03	2.62E-03	2.81E-03	3.00E-03
Ps90%/90% (-KTL) Biased	1.42E-03	1.72E-03	1.57E-03	1.57E-03	1.65E-03	2.01E-03	1.61E-03
Un-Biased Statistics							
Average Un-Biased	1.79E-03	2.12E-03	2.07E-03	2.04E-03	2.07E-03	2.35E-03	2.17E-03
Std Dev Un-Biased	1.40E-04	1.29E-04	1.83E-04	1.34E-04	1.34E-04	1.33E-04	1.41E-04
Ps90%/90% (+KTL) Un-Biased	2.18E-03	2.48E-03	2.57E-03	2.41E-03	2.44E-03	2.72E-03	2.55E-03
Ps90%/90% (-KTL) Un-Biased	1.41E-03	1.77E-03	1.57E-03	1.67E-03	1.70E-03	1.99E-03	1.78E-03
Specification MAX	5.00E-03	5.00E-03	5.00E-03	5.00E-03	5.00E-03	5.00E-03	5.00E-03
Status	PASS	PASS	PASS	PASS	PASS	PASS	PASS

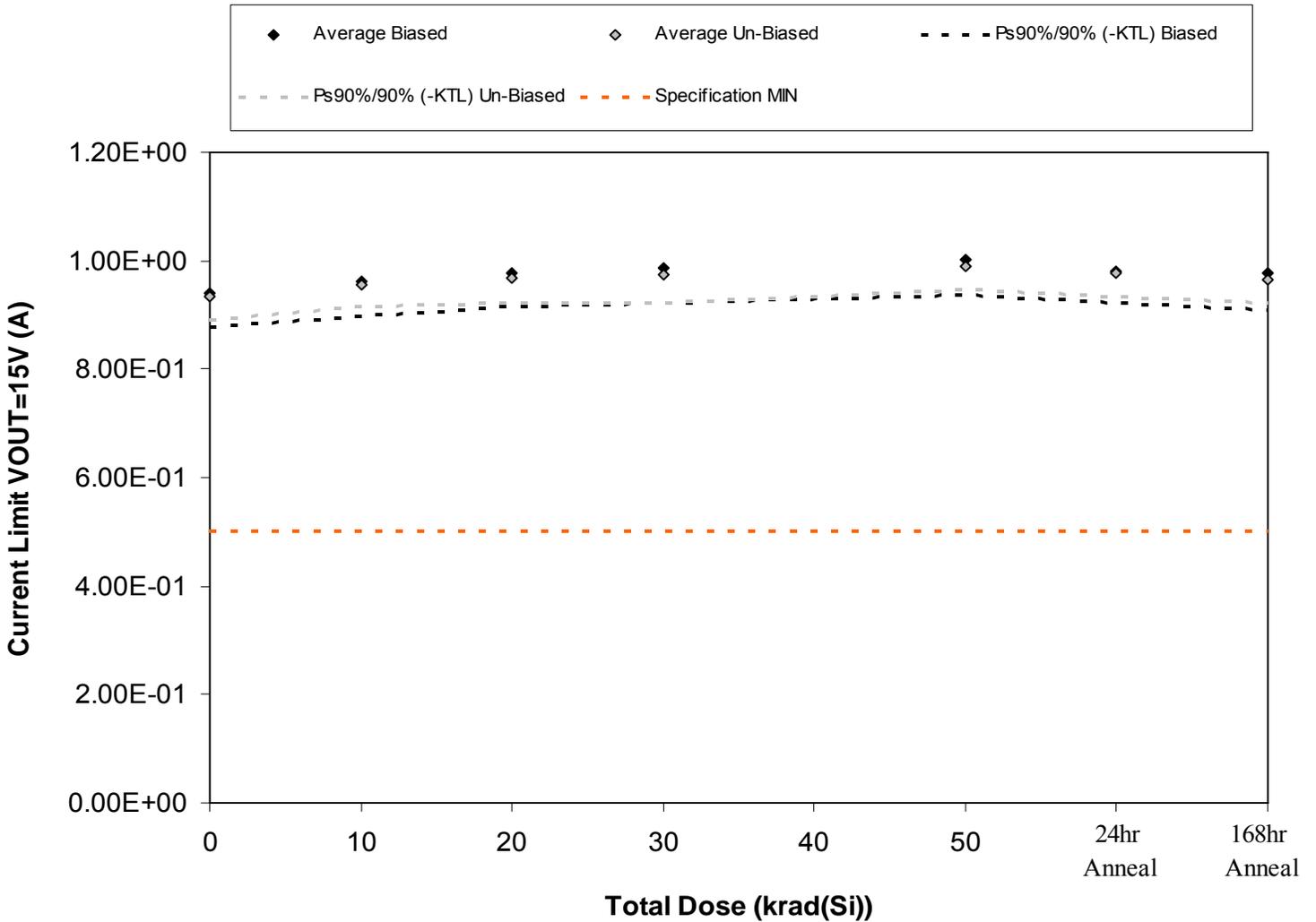


Figure 5.14. Plot of Current Limit VOUT=15V (A) versus total dose. The solid diamonds are the average of the measured data points for the samples irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the samples irradiated with all pins tied to ground. The black lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated under electrical bias while the gray lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples 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.



Table 5.14. Raw data for Current Limit VOUT=15V (A) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Current Limit VOUT=15V (A)	Total Dose (krad(Si))					24-hr Anneal	168-hr Anneal
	0	10	20	30	50		
Device							
1123	9.41E-01	9.53E-01	9.70E-01	9.81E-01	9.97E-01	9.75E-01	9.75E-01
1124	9.03E-01	9.26E-01	9.42E-01	9.48E-01	9.64E-01	9.47E-01	9.36E-01
1114	9.58E-01	9.81E-01	9.98E-01	1.00E+00	1.02E+00	9.97E-01	9.97E-01
1115	9.36E-01	9.64E-01	9.81E-01	9.92E-01	1.01E+00	9.80E-01	9.81E-01
1116	9.58E-01	9.81E-01	9.92E-01	1.00E+00	1.03E+00	9.97E-01	9.97E-01
1117	9.58E-01	9.76E-01	9.87E-01	9.98E-01	1.01E+00	9.91E-01	9.86E-01
1118	9.41E-01	9.64E-01	9.76E-01	9.81E-01	9.97E-01	9.91E-01	9.75E-01
1119	9.30E-01	9.53E-01	9.64E-01	9.64E-01	9.92E-01	9.75E-01	9.64E-01
1120	9.14E-01	9.37E-01	9.42E-01	9.48E-01	9.64E-01	9.53E-01	9.42E-01
1121	9.30E-01	9.53E-01	9.64E-01	9.76E-01	9.92E-01	9.80E-01	9.64E-01
1135	9.69E-01	9.76E-01	9.81E-01	9.76E-01	9.75E-01	9.75E-01	9.75E-01
1136	8.97E-01	8.98E-01	9.03E-01	9.03E-01	8.97E-01	8.97E-01	8.97E-01
Biased Statistics							
Average Biased	9.39E-01	9.61E-01	9.77E-01	9.85E-01	1.00E+00	9.79E-01	9.77E-01
Std Dev Biased	2.25E-02	2.29E-02	2.21E-02	2.28E-02	2.41E-02	2.05E-02	2.50E-02
Ps90%/90% (+KTL) Biased	1.00E+00	1.02E+00	1.04E+00	1.05E+00	1.07E+00	1.04E+00	1.05E+00
Ps90%/90% (-KTL) Biased	8.77E-01	8.98E-01	9.16E-01	9.23E-01	9.37E-01	9.23E-01	9.09E-01
Un-Biased Statistics							
Average Un-Biased	9.35E-01	9.57E-01	9.67E-01	9.73E-01	9.91E-01	9.78E-01	9.66E-01
Std Dev Un-Biased	1.62E-02	1.45E-02	1.68E-02	1.87E-02	1.62E-02	1.56E-02	1.63E-02
Ps90%/90% (+KTL) Un-Biased	9.79E-01	9.96E-01	1.01E+00	1.02E+00	1.04E+00	1.02E+00	1.01E+00
Ps90%/90% (-KTL) Un-Biased	8.90E-01	9.17E-01	9.21E-01	9.22E-01	9.46E-01	9.35E-01	9.21E-01
Specification MIN	5.00E-01	5.00E-01	5.00E-01	5.00E-01	5.00E-01	5.00E-01	5.00E-01
Status	PASS	PASS	PASS	PASS	PASS	PASS	PASS

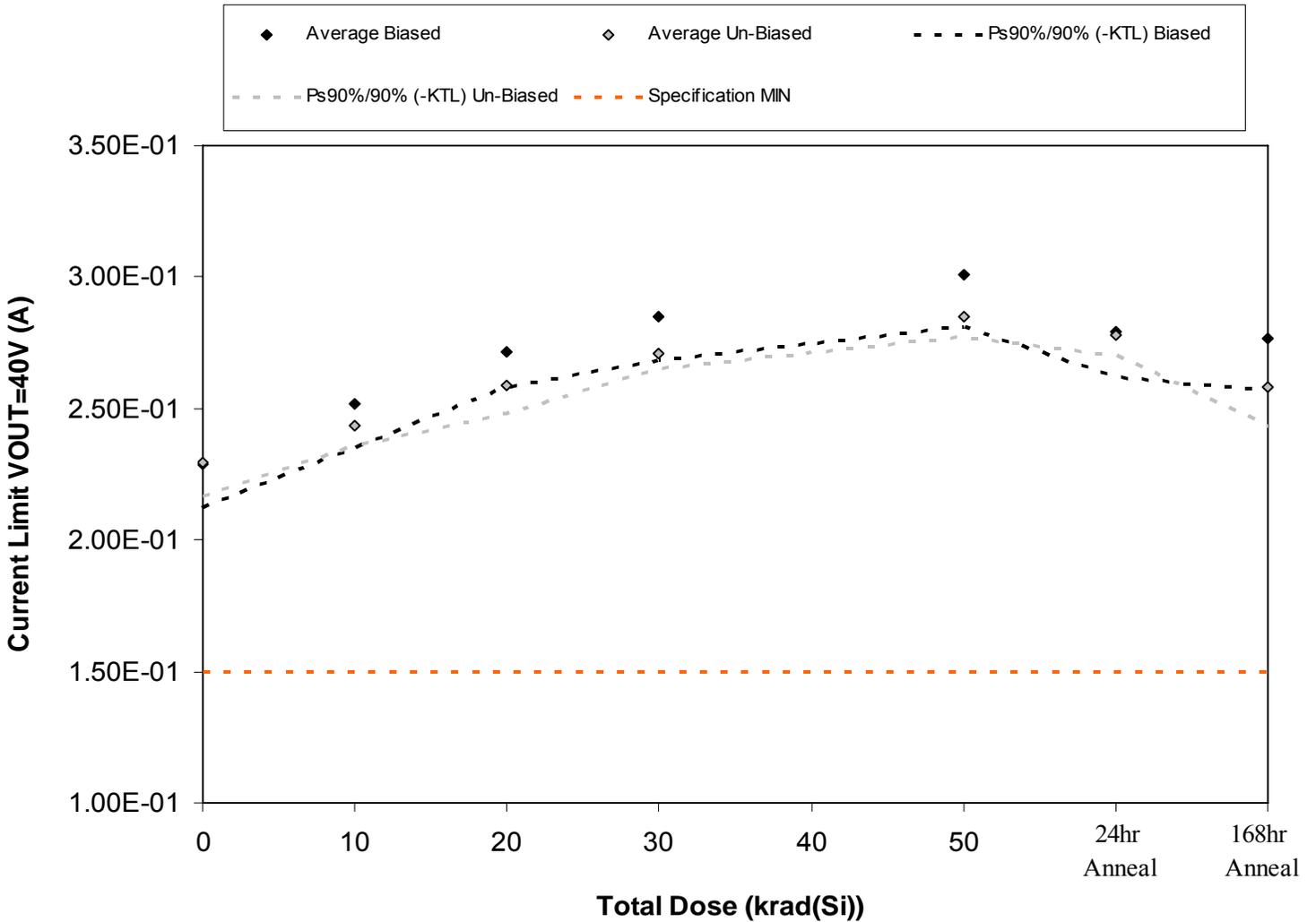


Figure 5.15. Plot of Current Limit VOUT=40V (A) versus total dose. The solid diamonds are the average of the measured data points for the samples irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the samples irradiated with all pins tied to ground. The black lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated under electrical bias while the gray lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples 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.



Table 5.15. Raw data for Current Limit VOUT=40V (A) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Current Limit VOUT=40V (A)	Total Dose (krad(Si))					24-hr Anneal	168-hr Anneal
	0	10	20	30	50		
Device							
1123	2.36E-01	2.53E-01	2.75E-01	2.86E-01	2.97E-01	2.80E-01	2.80E-01
1124	2.19E-01	2.42E-01	2.64E-01	2.75E-01	2.91E-01	2.69E-01	2.64E-01
1114	2.30E-01	2.59E-01	2.70E-01	2.86E-01	3.02E-01	2.80E-01	2.80E-01
1115	2.30E-01	2.53E-01	2.75E-01	2.86E-01	3.08E-01	2.80E-01	2.80E-01
1116	2.30E-01	2.53E-01	2.75E-01	2.92E-01	3.08E-01	2.86E-01	2.80E-01
1117	2.36E-01	2.48E-01	2.64E-01	2.75E-01	2.86E-01	2.80E-01	2.64E-01
1118	2.30E-01	2.42E-01	2.59E-01	2.70E-01	2.80E-01	2.75E-01	2.53E-01
1119	2.30E-01	2.42E-01	2.59E-01	2.70E-01	2.86E-01	2.75E-01	2.58E-01
1120	2.25E-01	2.42E-01	2.59E-01	2.70E-01	2.86E-01	2.80E-01	2.53E-01
1121	2.25E-01	2.42E-01	2.53E-01	2.70E-01	2.86E-01	2.80E-01	2.64E-01
1135	2.53E-01	2.53E-01	2.53E-01	2.53E-01	2.52E-01	2.52E-01	2.53E-01
1136	2.25E-01	2.31E-01	2.25E-01	2.25E-01	2.25E-01	2.25E-01	2.30E-01
Biased Statistics							
Average Biased	2.29E-01	2.52E-01	2.72E-01	2.85E-01	3.01E-01	2.79E-01	2.77E-01
Std Dev Biased	6.16E-03	6.16E-03	4.87E-03	6.16E-03	7.33E-03	6.16E-03	7.16E-03
Ps90%/90% (+KTL) Biased	2.46E-01	2.69E-01	2.85E-01	3.02E-01	3.21E-01	2.96E-01	2.96E-01
Ps90%/90% (-KTL) Biased	2.12E-01	2.35E-01	2.58E-01	2.68E-01	2.81E-01	2.62E-01	2.57E-01
Un-Biased Statistics							
Average Un-Biased	2.29E-01	2.43E-01	2.59E-01	2.71E-01	2.85E-01	2.78E-01	2.58E-01
Std Dev Un-Biased	4.55E-03	2.68E-03	3.90E-03	2.24E-03	2.68E-03	2.74E-03	5.50E-03
Ps90%/90% (+KTL) Un-Biased	2.42E-01	2.51E-01	2.69E-01	2.77E-01	2.92E-01	2.86E-01	2.73E-01
Ps90%/90% (-KTL) Un-Biased	2.17E-01	2.36E-01	2.48E-01	2.65E-01	2.77E-01	2.70E-01	2.43E-01
Specification MIN	1.50E-01	1.50E-01	1.50E-01	1.50E-01	1.50E-01	1.50E-01	1.50E-01
Status	PASS	PASS	PASS	PASS	PASS	PASS	PASS



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 $<1\text{rad}(\text{Si})/\text{s}$ to a maximum of approximately $120\text{rad}(\text{Si})/\text{s}$, determined by the distance from the source.

Samples of the RH117H-Positive Adjustable Regulator described in this report were irradiated biased with a split $\pm 15\text{V}$ supply and unbiased (all leads tied to ground). The devices were irradiated to a maximum total ionizing dose level of $50\text{krad}(\text{Si})$ with a pre-rad baseline reading as well as incremental readings at 10, 20, and $30\text{krad}(\text{Si})$. 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 and 168hr 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 are contained in a separate Excel file. The attributes data contains the average, standard deviation and the average with the KTL values applied. The KTL value used in this work is 2.742 per MIL-HDBK-814 using one sided tolerance limits of 90/90 and a 5-piece sample size. The 90/90 KTL values were selected to match the statistical levels specified in the MIL-PRF-38535 sampling plan for the qualification of a radiation hardness assured (RHA) component. Note that the following criteria must be met for a device to pass the low dose rate test: following the radiation exposure each of the 5 pieces irradiated under electrical bias shall pass the specification value. The units irradiated without electrical bias and the KTL statistics are included in this report for reference only. If any of the 5 pieces irradiated under electrical bias exceed the datasheet specifications, then the lot could be logged as a failure.

Using the conditions stated above, the RH117H-Positive Adjustable Regulator (from the lot date code identified on the first page of this test report) passed the total ionizing dose test to $50\text{krad}(\text{Si})$ with all parameters remaining within their pre- and/or post-radiation specification limits. Note that the data for the units-under-test irradiated in the unbiased condition and the KTL statistics presented in this report are for reference only and are not used for the determination of "PASS/FAIL" for the lot. Further, the data in this report can be analyzed along with the low dose rate report titled "Enhanced Low Dose Rate Sensitively (ELDRS) Testing of the RH117H-Positive Adjustable Regulator for Linear Technology" to demonstrate that these parts do not exhibit ELDRS as defined in the current test method.



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





Appendix B: TID Bias Connections

Biased Samples:

Pin	Function	Connection / Bias
1	VIN	To 15V, 0.1 μ F decoupling to -15V
2	ADJ	2k Ω to -15V
3	VOUT	61.9 Ω to -15V

Unbiased Samples:

Pin	Function	Connection / Bias
1	VIN	GND
2	ADJ	GND
3	VOUT	GND

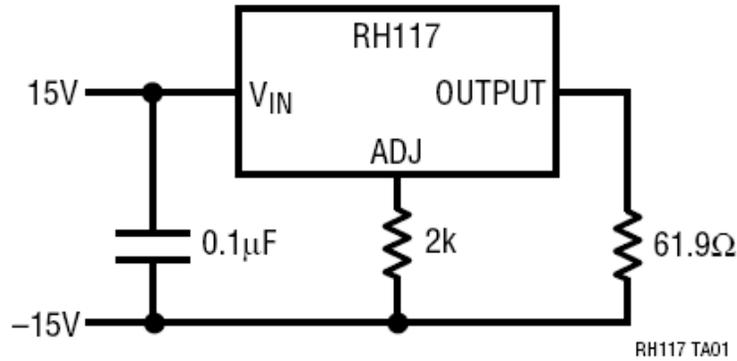


Figure B.1. Irradiation bias drawing for the units to be irradiated under electrical bias. This figure was extracted from LINEAR TECHNOLOGY CORPORATION, RH117 Datasheet.

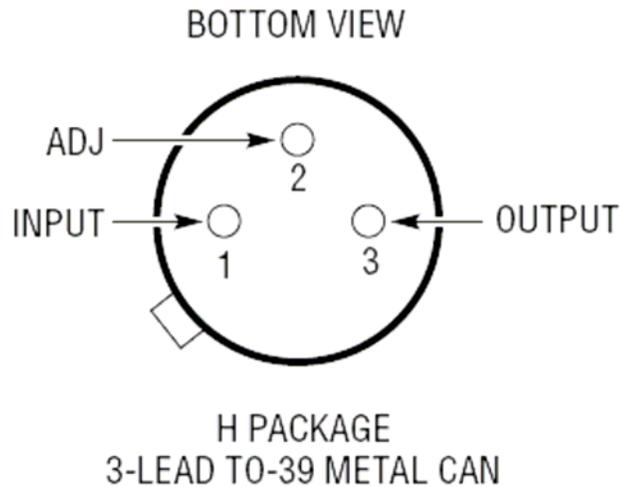


Figure B.2. H package drawing (for reference only). This figure was extracted from the LINEAR TECHNOLOGY CORPORATION RH117 Datasheet.



Appendix C: Electrical Test Parameters and Conditions

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-0606 Socket Assembly and the RH117 DUT board. The measured parameters and test conditions are shown in Tables C.1.

A listing of the measurement precision/resolution for each parameter is shown in Tables 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). Not all measured parameters are well suited to this approach due to inherent large variations. If necessary, larger samples sizes could be used to qualify these parameters using an "attributes" approach.



Table C.1. Measured parameters and test conditions RH117H.

TEST DESCRIPTION	TEST CONDITIONS
Reference Voltage	$V_{DIFF}=V_{IN}-V_{OUT}=3V, I_L=10mA$
	$V_{DIFF}=40V, I_L=10mA$
	$V_{DIFF}=3V, I_L=0.5A$
	$V_{DIFF}=40V, I_L=0.15A$
Line Regulation	$V_{DIFF}=3V$ to $40V, I_L=10mA$
Load Regulation $V_{OUT} \leq 5V$	$V_{DIFF}=5V, V_{IN}=6.25V, I_L=10mA$ to $0.5A$
Load Regulation $V_{OUT} \geq 5V$	$V_{DIFF}=5V, V_{IN}=11.25V, I_L=10mA$ to $0.5A$
Adjust Pin Current	$V_{DIFF}=2.5V, I_L=10mA$
	$V_{DIFF}=5V, I_L=10mA$
	$V_{DIFF}=40V, I_L=10mA$
Adjust Pin Current Change	$V_{DIFF}=5V, I_L=10mA$ to $0.5A$
	$V_{DIFF}=2.5V$ to $40V, I_L=10mA$
Minimum Load Current	$V_{DIFF}=40V$
Current Limit $V_{DIFF} \leq 15V$	$V_{DIFF}=15V$
Current Limit $V_{DIFF}=40V$	$V_{DIFF}=40V$

Table C.2. Measured parameters, pre-irradiation specifications and measurement resolutions for the RH117H.

Measured Parameter	Pre-Irradiation Specification	Measurement Resolution/Precision
Reference Voltage	$1.25V \pm 50mV$	$\pm 1.09E-03V$
Line Regulation	0.02%/V MAX	$\pm 3.40E-04\%/V$
Load Regulation $V_{OUT} \leq 5V$	15mV MAX	2.40E-04V
Load Regulation $V_{OUT} \geq 5V$	0.3% MAX	4.48E-03%
Adjust Pin Current	100 μ A MAX	2.26E-06A
Adjust Pin Current Change	$\pm 5\mu$ A MAX	4.20E-07A
Minimum Load Current	5mA MAX	2.84E-05A
Current Limit $V_{DIFF} \leq 15V$	0.5A MAX	5.22E-03A
Current Limit $V_{DIFF}=40V$	0.15A MAX	6.53E-03A



Appendix D: List of Figures used in Section 5 (Test Results)

- 5.1 Reference Voltage $V_{DIFF}=3V$ $I_L=10mA$ (V)
- 5.2 Reference Voltage $V_{DIFF}=40V$ $I_L=10mA$ (V)
- 5.3 Reference Voltage $V_{DIFF}=3V$ $I_L=0.5A$ (V)
- 5.4 Reference Voltage $V_{DIFF}=40V$ $I_L=0.15A$ (V)
- 5.5 Line Regulation (%/V)
- 5.6 Load Regulation $V_{OUT}\leq 5V$ (mV)
- 5.7 Load Regulation $V_{OUT}\geq 5V$ (%)
- 5.8 Adjust Pin Current $V_{DIFF}=2.5V$ $I_L=10mA$ (A)
- 5.9 Adjust Pin Current $V_{DIFF}=5V$ $I_L=10mA$ (A)
- 5.10 Adjust Pin Current $V_{DIFF}=40V$ $I_L=10mA$ (A)
- 5.11 Adjust Pin Current Change $I_L=10mA-0.5A$ (A)
- 5.12 Adjust Pin Current Change $V_{DIFF}=2.5V-40V$ (A)
- 5.13 Minimum Load Current (A)
- 5.14 Current Limit $V_{OUT}=15V$ (A)
- 5.15 Current Limit $V_{OUT}=40V$ (A)