ENGINEERING PRACTICE STUDY

PROJECT NUMBER: 5961-2008-044

TITLE: REVIEW OF REQUIREMENTS FOR MIL-STD-750 MAIN BODY

22 November 2010

FINAL REPORT

Prepared by:

Kyle Carpenter

ATTCH 1

I. OBJECTIVES: To solicit input from custodians, review activities, users (G-12), and manufacturers (JC-13.1) on this proposal for coordination and concurrence.

II. BACKGROUND: The JC-13.1 committee tasked DLA Land and Maritime and JC-22 to update the main body of MIL-STD-750. The DLA Land and Maritime representative met with JC.22 on 6-7 November 2007 and developed a draft proposal which was coordianted prior to final acceptance into MIL-STD-750. We addressed the following main issues:

a. Continuity verification for HTRB, burn-in and life tests.
b. Requirements for High Temperature Reverse Bias (HTRB) and burn-in.
c. Bias requirements.

III. RESULTS: Final results of this effort along with recommendations and conclusions are documented in attachment 1.

IV. CONCLUSIONS: The noted changes (attachment 1) shall be incorporated in the next revision of MIL-STD-750.

V. RECOMMENDATIONS:

a. All essential comments must be accepted or resolved through the DLA Land and Maritime spokesmen to the committees generating the drafts of those industry standards.

b. All suggested comments should be addressed by the industry committees or authors responsible for the draft documents.

NOTE: This draft dated 20 September 2010 prepared by DLA-CC has not been approved and is subject to modification. DO NOT USE PRIOR TO APPROVAL. (Project number 5961-2008-120).

COMMENTS ARE DUE BY 4 November 2010. P.O.C. Kyle Carpenter, PH (614) 692-7078, email: Kyle.Carpenter@dla.mil

MIL-STD-750F
INITIAL DRAFT
SUPERSEDING
MIL-STD-750E
20 NOVEMBER 2006

DEPARTMENT OF DEFENSE

TEST METHOD STANDARD

TEST METHODS FOR SEMICONDUCTOR DEVICES

AMSC N/A

FSC 5961

FOREWARD

1. This Standard is approved for use by all Departments and Agencies of the Department of Defense.

2. This entire standard has been revised.

3. Comments, suggestions, or questions on this document should be addressed to: Commander, DLA LAND AND MARITIME ~~Defense Supply Center Columbus, ATTN: DSCC~~-VAT, 3990 E. Broad Street, Columbus, OH 43218-5000, or emailed to semiconductor@dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at https://assist.daps.dla.mil.

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METHOD NO. TITLE

INDEX OF TEST METHODS - Continued.

1. SCOPE

1.1 Purpose. This standard establishes uniform methods for testing semiconductor devices, including basic environmental tests to determine resistance to deleterious effects of natural elements and conditions surrounding military operations, and physical and electrical tests. For the purpose of this standard, the term "devices" includes such items as transistors, diodes, voltage regulators, rectifiers, tunnel diodes, and other related parts. This standard is intended to apply only to semiconductor devices. The test methods described herein have been prepared to serve several purposes:

a. To specify suitable conditions obtainable in the laboratory that give test results equivalent to the actual service conditions existing in the field, and to obtain reproducibility of the results of tests. The tests described herein are not to be interpreted as an exact and conclusive representation of actual service operation in any one geographic location, since it is known that the only true test for operation in a specific location is an actual service test at that point.

b. To describe in one standard all of the test methods of a similar character which now appear in the various joint-services semiconductor device specifications, so that these methods may be kept uniform and thus result in conservation of equipment, man-hours, and testing facilities. In achieving this objective, it is necessary to make each of the general tests adaptable to a broad range of devices.

c. The test methods described herein for environmental, physical, and electrical testing of devices shall also apply, when applicable, to parts not covered by an approved military sheet-form standard, specification sheet, or drawing.

1.2 Numbering system. The test methods are designated by numbers assigned in accordance with the following system:

1.2.1 Classification of tests. The tests are divided into five areas. Test methods numbered 1001 to 1999 inclusive, cover environmental tests; those numbered 2001 to 2999 inclusive, cover mechanical- characteristics tests. Electrical- characteristics tests are covered in two groups; 3001 to 3999 inclusive, covers tests for transistors and 4001 to 4999 inclusive, covers tests for diodes. Test methods numbered 5000 to 5999 inclusive, are for high reliability space applications.

1.2.2 Revisions. Revisions are numbered consecutively using a period to separate the test method number and the revision number. For example, 4001.1 is the first revision of test method 4001.

1.3 Method of reference. When applicable, test methods contained herein shall be referenced in the individual specification by specifying the method number of this standard, and the details required in the summary of the applicable method. To avoid the necessity for changing specifications that refer to this standard, the revision number should not be used when referencing test methods. (For example: use 4001, not 4001.1.)

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this standard. This section does not include documents cited in other sections of this standard or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-PRF-19500	-	Semiconductor Devices, General Specification for.

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-12	-	Abbreviations for used on Drawings, Specification Standards & in Technical Documents
MIL-STD-202	-	Test Method Standard Electronic and Electrical Component Parts.
MIL-STD-45662	-	Calibration Systems Requirements.
MIL-STD-1686	-	Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices) (Metric).
MIL-PRF-680	-	Degreasing solvent

DEPARTMENT OF DEFENSE HANDBOOKS

MIL-HDBK-263	-	Electrostatic Discharge Control Handbook for Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices) (Metric).

* (Copies of these documents are available online at https://assist.daps.dla.mil/quicksearch or https://assist.daps.dla.mil or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

~~2.2.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.~~

~~DRAWINGS - JAN~~

~~103 JAN - Filter for Testing Crystal Rectifier 1N23, 1N23A and 1N23B.~~
~~107 JAN - Mixer for Testing Crystal Rectifier Type 1N26.~~
~~118 JAN - Figure of Merit Holder for Crystal Rectifier 1N31.~~
~~124 JAN - Mixer and Coupling Circuit for Crystal Rectifiers 1N21B.~~
~~152 JAN - SA Band Crystal Detector Test Holder.~~
~~174 JAN - Mixer for Electron Tube Type 1N53.~~
~~231 JAN - Burn Out Testing Equipment for 1N25 Crystals Schematic Diagram.~~
~~233 JAN - Loss Measuring Equipment for 1N25 Crystals Schematic Diagram.~~
~~234 JAN - Loss Measuring Equipment for 1N25 Crystals Bill of Material.~~
~~236 JAN - Burn Out Testing Equipment for 1N25 Crystals Bill of Materials.~~
~~256 JAN - Reverse Pulse Recovery Time Test and Calibration Procedure.~~
~~266 JAN - Mixer Holder, Narrow, Band, for 1N263.~~

~~DRAWINGS - DESC ASSEMBLY~~

~~B66054 - Adaptor For Burn-Out Test.~~
~~C64169 - Sliding Load (S-Band) Used with D64100.~~
~~C65017 - Assembly, Tri-polar Diode Holder.~~
~~C65042 - Sliding Load (X-Band) Used with D65019.~~
~~C65101 - Sliding Load (Ku-Band) Used with D65064.~~
~~C66053 - Mixer Holder, Narrow Band, for 1N1838.~~
~~C66058 - Burn-Out Tester For Microwave Diodes.~~
~~D64100 - Diode Test Holder, 3,060 MHz (S-Band).~~
~~D65019 - Diode Test Holder, 9,375 GHz (X-Band).~~
~~D65064 - Diode Test Holder, 16 GHz (Ku-Band).~~

~~*(Copies of these documents are available online at http://assist.daps.dla.mil/quicksearch or http://www.dodssp.daps.mil or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)~~

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

ASTM Test Method D1120 - Standard Test Method for Boiling Point of Engine Coolants
ASTM Test Method D1331 - Standard Test Methods for Surface and Interfacial Tension of Solutions of Surface-Active Agents
ASTM Test Method D2109 - Standard Test Methods for Nonvolatile Matter in Halogenated Organic Solvents and Their Admixtures
ASTM Test Method D877 - Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes
ASTM Test Method D941 - Standard Test Method for Density and Relative Density (Specific Gravity) of Liquids by Lipkin Bicapillary Pycnometer
ASTM Test Method D971 - Standard Test Method for Interfacial Tension of Oil Against Water by the Ring Method
ASTM Test Method F134 - Standard Test Methods for Determining Hermeticity of Electron Devices with a Helium Mass Spectrometer Leak Detector
ASTM Test Method F50 - Standard Practice for Continuous Sizing and Counting of Airborne Particles in Dust-Controlled Areas and Clean Rooms Using Instruments Capable of Detecting Single Sub-Micrometre and Larger Particles
ASTM Test Method F25 - Standard Test Method for Sizing and Counting Airborne Particulate Contamination in Cleanrooms and Other Dust-Controlled Areas
SAE-ARP-743 - Procedure for the Determination of Particulate Contamination of Air in Dust Controlled Spaces by the Manual Particle Count Method
ASTM Test Method F-1192 - Standard Guide for he Measurement of Single-Event Phenomena from Heavy Ion Irradiation of Semiconductor Devices
Standard Handbook for Electrical Engineers.

(Application for copies should be addressed to the McGraw-Hill Book Company, Inc., New York, N.Y. 42840.)

NBS Handbook 59 - Permissible Dose From External Sources of Ionizing Radiation, Recommendations of National Committee on Radiation Protection.
NBS Handbook 73 - Protection Against Radiations from Sealed Gamma Sources.
NBS Handbook 76 - Medical X-Ray Protection Up to 3 Million Volts.

(Application for copies should be addressed to the Superintendent of Documents, Washington, DC 20402.)

ANSI/NCSL-Z540-1-1994
EIA/JESD57 - Test Procedures for the Measurement of Single-Event Effects in Semiconductor Devices from Heavy Ion Irradiation.
TT-I-735 - Isopropyl Alcohol
Whelon, N.V., "Graphical Relation Between Surface Parameters of Silicon, to be Used in Connections with MOS Capacitance Measurements", Phillips Res. Apt., 620-630.

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. DEFINITIONS

3.1 Abbreviations, symbols, and definitions. For the purposes of this standard, the abbreviations, symbols, and definitions specified in MIL-PRF-19500, MIL-STD-12, and herein shall apply.

3.1.1 Abbreviations used in this standard. Abbreviations used in this standard are defined as follows:

a. ATE - Automatic test equipment.

b. BIST - Backward instability shock test.

c CFM - Cubic Feet per Minute.

d. DPA - Destructive physical analysis.

e. DUT - Device under test.

f. ESD - Electrostatic discharge.

g. ESDS - Electrostatic discharge sensitivity.

h. FET - Field-effect transistor.

i. FIST - Forward instability shock test.

j. FWHM - Full-width half-max.

k. GaAs - Gallium Arsenide.

l. HTRB - High temperature reverse bias.

m. Hz - Hertz.

n. IF - Intermediate frequency.

o IGBT - Insulated gate bipolar transistor.

p. LCC - Leadless chip carrier.

q. LINAC - Linear accelerator.

r. mH - Microhenries.

s. MOSFET - Metal oxide semiconductor field-effect transistor.

t. NIST - National Institute of Standards and Technology.

u. ns - Nanosecond.

v. PIND - Particle impact noise detection.

w. pF - Picofarad.

x. RH - Relative humidity.

y.	SEM	-	Scanning electron microscope.
z.	SOA	-	Safe operating area.
aa.	SSOP	-	Steady-state operating power.
bb.	STU	-	Sensitivity test unit.
cc.	SWR	-	Standing wave ratio.
dd.	TLD	-	Thermoluminescence dosimetry.
ee.	TSP	-	Temperature sensitive parameter.
ff.	UHF	-	Ultra high frequency.

4. GENERAL REQUIREMENTS

4.1 Test conditions. Unless otherwise specified herein or in the individual specification, all measurements and tests shall be made at thermal equilibrium at an ambient temperature of 25°C ±3°C and at ambient atmospheric pressure and relative humidity and the specified test condition C (at environmentally elevated and reduced temperatures) shall have a tolerance of ±3 percent or +3°C, whichever is greater. Whenever these conditions must be closely controlled in order to obtain reproducible results, the referee conditions shall be as follows: Temperature 25°C ±1°C, relative humidity 50 ±5 percent, and atmospheric pressure from 650 to 800 millimeters of mercury. Unless otherwise specified in the detail test method, for mechanical test methods, 2000 series, the ambient temperature may be 25°C ±10°C.

4.1.1 Permissible temperature variation in environmental chambers. When chambers are used, specimens under test shall be located only within the working area defined as follows:

a. Temperature variation within working area: The controls for the chamber shall be capable of maintaining the temperature of any single reference point within the working area within ±2°C or ±4 percent, whichever is greater.

b. Space variation within working area: Chambers shall be so constructed that, at any given time, the temperature of any point within the working area shall not deviate more than ±3°C or ±3 percent, whichever is greater, from the reference point, except for the immediate vicinity of specimens generating heat.

c. Chambers with specified minimum temperatures (such as those used in burn-in and life tests): When test requirements involve a specified minimum test temperature, the controls and chamber construction shall be such that the temperature of any point within the working area shall not deviate more than +8°C, -0°C; or +8 percent, -0 percent, whichever is greater, from the specified minimum temperature, except for the immediate vicinity of the specimens generating heat.

4.1.2 Electrical test frequency. Unless otherwise specified, the electrical test frequency shall be 1,000 ±25 Hertz (Hz).

4.1.3 Accuracy. The specified limits are for absolute (true) values, obtained with the specified (nominal) test conditions. Proper allowance shall be made for measurement errors (including those due to deviations from nominal test conditions) in establishing the working limits to be used for the measured values, so that the true values of the device parameters (as they would be under nominal test conditions) are within the specified limits.

The following electrical test tolerances and precautions, unless otherwise specified in the applicable acquisition document, shall be maintained for all device measurements to which they apply (3000, 4000 series and other specified electrical measurements). Wherever test conditions are specified in the applicable acquisition document to a precision tighter than the tolerances indicated below, the specified conditions shall apply and take precedence over these general requirements.

a. Bias conditions shall be held to within 3 percent of the specified value.

b. Such properties as input pulse characteristics, repetition rates, and frequencies shall be held to within 10 percent. Nominal values should be chosen so that ±10 percent variation (or the actual test equipment variation, if less than 10 percent) does not affect the accuracy or validity of the measurement of the specified value.

c. Voltages applied in breakdown testing shall be held within 1 percent of specified value.

d. Resistive loads shall be ±5 percent tolerance.

e. Capacitive loads shall be ±10 percent or ±1 picofarad (pF) tolerance, whichever is greater.

f. Inductive loads shall be ±10 percent or ±5 microhenries (mH) tolerance, whichever is greater.

g. Static parameters shall be measured to within 1 percent.

h. Switching parameters shall be measured to within 5 percent or 1 nanosecond (ns), whichever is greater.

4.1.3.1 Test methods and circuits. Unless otherwise stated in the specific test method, the methods and circuits shown are given as the basic measurement method. They are not necessarily the only method or circuit which can be used, but the manufacturer shall demonstrate to the acquiring activity that alternate methods or circuits which they may desire to use are equivalent and give results within the desired accuracy of measurement (see 4.1.3).

4.1.4 Calibration requirements. Calibration and certification procedures shall be provided in accordance with ANSI/NCSL-Z540-1-1994 for plant standards and instruments used to measure or control production processes and semiconductor devices under test. For those measurements that are not traceable to the National Institute of Standards and Technology (NIST), correlation samples shall be maintained and used as the basis of proving acceptability when such proof is required. In addition, the following requirements shall apply:

a. The accuracy of a calibrating instrument shall be at least four times greater than that of the item being calibrated, unless the item being calibrated is state of the art equipment, which may be near or equal in accuracy to the state of the art calibrating equipment, in which case the four time requirement does not apply. However, the instrument shall be calibrated to correlate with standards established by the NIST.

b. Except in those cases where the NIST recommends a longer period and concurrence is obtained from the qualifying activity, calibration intervals for plant electrical standards shall not exceed one year, and for plant mechanical standards shall not exceed two years.

4.2 Orientations:

X is the orientation of a device with the main axis of the device normal to the direction of the accelerating force, and the major cross section parallel to the direction of the accelerating force.

Y is the orientation of a device with the main axis of the device parallel to the direction of the accelerating force, and the principal base toward (Y_1), or away from (Y_2), the point of application of the accelerating force.

Z is the orientation of a device with the main axis and the major cross section of the device normal to the direction of the accelerating force. Z is 90 degrees of X.

NOTE: For case configurations, other than those shown on figures 1 and 2, the orientation of the device shall be as specified in the individual specification.

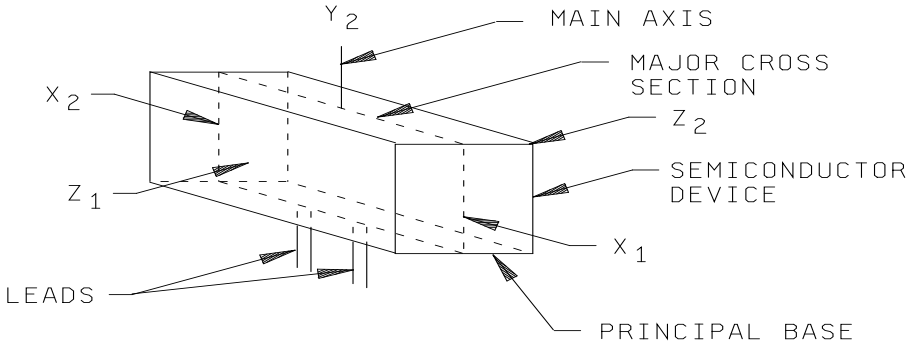

FIGURE 1. Orientation of noncylindrical semiconductor device to direction of accelerating force.

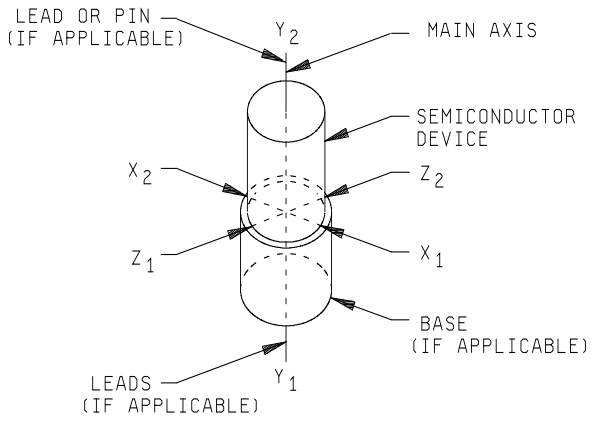

FIGURE 2. Orientation of cylindrical semiconductor device to direction of accelerating force.

4.3 General precautions. The following precautions shall be observed in testing the devices.

4.3.1 Transients. Devices shall not be subjected to conditions in which transients cause the rating to be exceeded.

4.3.2 Test conditions for electrical measurements. Unless otherwise required for a specified test method, semiconductor devices should not be subjected to any condition that will cause any maximum rating of the device to be exceeded. Rated maximum junction temperatures may be exceeded for short periods of time on Avalanche Breakdown Diode Transient Voltage Suppressors if a random recurring transient condition is not repeated until the device has returned to the original thermal equilibrium conditions. Also see 4.8 for nondestructive tests. The precautions should include limits on maximum instantaneous currents and applied voltages. High series resistances (constant current supplies) and low capacitances are usually required. If low cutoff, or reverse current devices are to be measured; for example, nanoampere units, care should be taken to ensure that parasitic circuit currents or external leakage currents are small, compared with the cutoff or reverse current of the device to be measured.

4.3.2.1 Steady-state dc measurements (method 4000). Unless otherwise specified, all steady-state dc parameters are defined using steady-state dc conditions.

4.3.2.2 Pulse measurements (method 4000). When device static or dynamic parameters are measured under pulsed conditions, in order to avoid measurement errors introduced by device heating during the measurement period, the following items should be covered in the performance specification sheet:

a. The statement "pulsed test" shall be placed by the test specified.

b. Unless otherwise specified, the pulse time (t_p) shall be ≤10 milliseconds and the duty cycle shall be a maximum of 2 percent; within this limit the pulse must be long enough to be compatible with test equipment capability and the accuracy required, and short enough to avoid heating.

c. Automatic test Equipment pulse measurements may also be used for dc measurements when correlation to thermal equilibrium is established such as in 4.3.2.2b. Also see JESD320-A.

4.3.3 Test circuits. The circuits shown are given as examples which may be used for the measurements. They are not necessarily the only circuits which can be used but the manufacturer shall demonstrate to the Government that other circuits which they may desire to use will give results within the desired accuracy of measurement. Circuits are shown for PNP transistors in one circuit configuration only. They may readily be adapted for NPN devices and for other circuit configurations.

4.3.3.1 Test method variation. Variation from the specified test methods used to verify the electrical parameters are allowed provided that it is demonstrated to the preparing activity or their agent that such variations in no way relax the requirements of this specification and that they are approved before testing is performed. For proposed test variations, a test method comparative error analysis shall be made available for checking by the preparing activity or their agent

4.3.4 Soldering. Adequate precautions shall be taken to avoid damage to the device during soldering required for tests.

4.3.5 Order of connection of leads. Care should be taken when connecting a semiconductor device to a power source. The common terminal shall be connected first.

4.3.6 Radiation precautions. Due precautions shall be used in storing or testing semiconductor devices in substantial fields of X-rays, neutrons, or other energy particles.

4.3.7 Handling precautions.

4.3.7.1 UHF and microwave devices. Handling precautions for UHF and microwave devices shall be as follows:

a. Ground all equipment.

b. Make hand contact to the equipment while holding the base end and maintain hand contact with the equipment until the device is in place.

c. Where applicable, keep devices in metal shields until they are inserted in the equipment or until necessary to remove for test.

4.3.7.2 Electrostatic discharge sensitive devices. Handling precautions shall be observed in accordance with MIL-HDBK-263 during testing of Electrostatic Discharge Sensitive (ESDS) devices. The area where ESDS device tests are performed shall meet the requirements of an ESD Protected Area of MIL-STD-1686.

4.4 Continuity verification of burn-in and life tests. The test setup shall be monitored at the test temperature initially and at the conclusion of the test to establish that all devices are being stressed to the specified requirements. The following is the minimum acceptable monitoring procedure:

a. Device sockets. Initially and at least each 6 months thereafter, each test board or tray shall be checked to verify continuity to connector points to assure that the correct voltage bias will be applied. Except for this initial and periodic verification, each device or device socket does not have to be checked; however, random sampling techniques shall be applied prior to each time a board is used and shall be adequate to assure that there are correct and continuous electrical connections to the Device under test (DUT).

b. Connectors to test boards or trays. After the test boards are loaded with devices, inserted into the system, and brought up to the specified operating conditions, each required test voltage and signal condition shall be verified in at least one location on each test board or tray so as to assure electrical continuity and the correct application of specified electrical stresses or bias for each connection or contact pair for the DUTs used in the applicable test configuration. If the system (chamber) must be opened for performing these tests, the system may be opened for a maximum of 10 minutes. Where possible, the test node points shall be accessible external to the oven chamber (HTRB) to avoid opening the door since that immediately reduces operating temperature. That can also influence leakage currents and bias to DUTs with resistors in series for power supply protection.

c. At the conclusion of the test period, prior to removal of devices from temperature and bias conditions, the voltage and signal condition verification of 4.4b shall be repeated.

d. For class S devices, each test board or tray and each test socket shall be verified prior to test to assure that the specified bias conditions are applied to each device. This may be accomplished by verifying the device functional response at each device output(s) or by performing a socket verification on each socket prior to loading. An approved alternate procedure may be used.

4.4.1 Bias interruption. Where failures or open contacts occur which result in removal of the required bias stresses for any period of the required bias duration, the bias time shall be extended to assure actual exposure for the total minimum specified test duration. Any loss(es) or interruption(s) of bias in excess of 10 minutes total duration while the chamber is at temperature during the final 8 hours of burn-in shall require extension of the bias duration for an uninterrupted 8 hours minimum, after the last bias interruption. Incidental or momentary power interruptions less than 10 seconds shall be ignored.

4.5 Requirements for High Temperature Reverse Bias (HTRB) and burn-in.

a. The temperature of +20°C minimum is the ambient air temperature to which all devices should be exposed during power screening where room ambient is specified.

b. An increase in effective ambient temperature from cumulative induced power to DUTs shall not result in device junction temperature exceeding maximum ratings.

c. For HTRB, the coolest ambient temperature shall not be below the required minimum when measured in various locations ~~measured in the~~ of convection current (below or above) or upstream or downstream (Fan Air) of DUTs.

d. Moving air greater than 30 CFM (natural convection) may be allowed for the purpose of temperature equalization within high device density burn-in racks.

e. High velocity or cooled air shall not be used unless T_J minimum requirements have also been complied with as well as minimum required burn-in currents~~for the purpose of increasing device ratings~~.

f. Power up of burn-in racks may occur when ambient is less than specified. When thermal equilibrium has been reached, or five hours maximum has occurred, the ambient shall be at the specified value. Time accrued prior to reaching specified ambient shall not be chargeable to the life test duration.

g. If the ambient, at or beyond the five hour point is not the specified value, a nonconformance shall exist requiring corrective action.

h. Time is not chargeable during the period when specified conditions are not maintained. If device maximum ratings are exceeded during Conformance Inspection life testing and they remain good, finish the test and use for credit. However if maximum ratings are exceeded during HTRB or burn-in screening and the typical PDA observed is exceeded, the product on test shall be evaluated by re-starting them from zero hours at the specified temperature and verifying that the end-point failure rate on this restart is typical for this product type from a review of established records. ~~If device maximum ratings (if life test, finish the test and use for credit; if shippable, use this criteria) are exceeded and the manufacturer intends to submit the lot affected, the product on test shall be evaluated by re-starting the burn-in or HTRB from zero hours at the specified temperature and verifying that the end-point failure rate is typical for this product type from a review of established records.~~

i. Chamber temperature for HTRB and burn-in shall be controlled to ±3 percent of the specified value (unless otherwise specified in 4.1.1). This temperature shall be maintained within the chamber. Forced air may be used to equalize temperature within the chamber but shall not be used as a coolant to increase device power capability.

4.6 Bias requirements.

a. Bias errors at the power supply source caused by changing power supply loads during temperature transitions shall not exceed ±5 percent of that specified value.

b. Bias values at the source, during stabilized conditions, shall not exceed ±3 percent of the specified value.

c. Burn-in apparatus shall be arranged so as to result in the approximate average power dissipation for each device whether devices are tested individually or in a group. Bias and burn-in circuitry tolerances should not vary test conditions to individual devices by more than ±5 percent of specified conditions.

d. Normal variation in individual device characteristics need not be compensated for by burn-in circuitry.

e. Burn-in equipment shall be arranged so that the existence of failed or abnormal devices in a group does not negate the effect of the test for other devices in the group unless equipment monitoring capabilities and procedures identifies and removes those devices for possible rescreening. Periodic verification will assure that specified conditions are being maintained. Verification shall be performed, as a minimum, at the starting and the end of screening.

f. Lead, stud, or case mounted devices shall be mounted in their normal mounting configuration and the point of mechanical connection shall be maintained at no less than the specified ambient.

4.7 Destructive tests. Unless otherwise demonstrated, the following MIL-STD-750 tests are classified as destructive:

Method Number	Test
1017	Neutron irradiation
1019	Steady-state total dose irradiation
1020	ESDS classification
1021	Moisture resistance
1036,1037	Intermittent operation life
1041	Salt atmosphere
1042 (Condition D)	Burn-in/life test for power MOSFETs
1046	Salt spray
1056	Thermal shock (glass strain)
2017	Die shear test
2031	Soldering heat
2036	Terminal strength
2037	Post seal bond strength
2075	Decap internal visual design verification
2077	SEM

All other mechanical or environmental tests (other than those listed in 4.8) shall be considered destructive initially, but may subsequently be considered nondestructive upon accumulation of sufficient data to indicate that the test is nondestructive. The accumulation of data from five repetitions of the specified test on the same sample of product, without significant evidence of cumulative degradation in any device in the sample, is considered sufficient evidence that the test is nondestructive for the device of that manufacturer. Any test specified as a 100-percent screen shall be considered nondestructive for the stress level and duration or number of cycles applied as a screen.

4.8 Nondestructive tests. Unless otherwise demonstrated, the following MIL-STD-750 tests are classified as nondestructive:

Method number	Test
1001	Barometric pressure
1022	Resistance to solvents
1026, 1027	Steady-state life
1031, 1032	High temperature life (non-operating)
1038, 1039, 1040	Burn-in screen
1042 (Condition A, B, and C)	Burn-in/life test for power MOSFETs
1051 (100 cycles or less)	Thermal shock (temperature cycling)
1071	Hermetic seal tests
2006	Constant acceleration
2016	Shock
2026	Solderability (if the original lead finish is unchanged and if the maximum allowable number of reworks is not exceeded.)
2052	PIND test
2056	Vibration, variable frequency
2066	Physical dimensions
2069, 2070, 2072, 2073, 2074	Internal visual (pre-cap)
2071	External visual
2076	Radiographic inspection
2081	FIST
2082	BIST
3101	Thermal impedance testing of diodes
3103	Thermal impedance measurements for IGBTs
3104	Thermal impedance measurements for GaAs
3051, 3052, 3053 (with limited supply voltage)	SOA (condition A for method 3053)
3131	Thermal resistance (emitter to base forward voltage, emitter-only switching method)
4066	Surge current
4081	Thermal resistance of lead mounted diode (forward voltage, switching method)

When the junction temperature exceeds the device maximum rated junction temperature for any operation or test (including electrical stress test), these tests shall be considered destructive except under transient surge or nonrepetitive fault conditions or approved accelerated screening when it may be desirable to allow the junction temperature to exceed the rated junction temperature. The feasibility shall be determined on a part by part basis and in the case where it is allowed adequate sample testing, shall be performed to provide the proper reliability safeguards.

4.9 Laboratory suitability. Prior to processing any semiconductor devices intended for use in any military system or sub-system, the facility performing the test(s) must be audited by DLA Land and Maritime ~~the Defense Electronics Supply Center~~, Sourcing and Qualification ~~Division~~ Unit ~~(DESC-ELST)~~ and be granted written Laboratory Suitability status for each test method to be employed. Processing of any devices by any facility without Laboratory Suitability status for the test methods used shall render the processed devices nonconforming.

4.10 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible, provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

5. DETAILED REQUIREMENTS

This section is not applicable to this standard.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended Use. The intended use of this standard is to establish appropriate conditions for testing semiconductor devices to give test results that simulate the actual service conditions existing in the field. This standard has been prepared to provide uniform methods, controls, and procedures for determining with predictability the suitability of such devices within Military, Aerospace and special application equipment.

6.2 International standardization agreement. Certain provisions of this standard are the subject of international standardization agreement. When amendment, revision, or cancellation of this standard is proposed which will affect or violate the international agreement concerned, the preparing activity will take appropriate reconciliation action through international standardization channels, including departmental standardization offices, if required.

6.3 Subject term (key word) listing.

Environmental tests
Mechanical characteristics tests
Electrical characteristics tests for bipolar transistors
Circuit-performance and thermal resistance measurements
Low frequency tests
High frequency tests
Electrical characteristics tests for MOS field-effect transistors
Electrical characteristics tests for Gallium Arsenide transistors
Electrical characteristics tests for diodes
Electrical characteristics tests for microwave diodes
Electrical characteristics tests for tunnel diodes
High reliability space application tests

6.4 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.