SAE The Engineering Society For Advancing Mobility Land Sea Air and Space®
INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

SURFACE VEHICLE RECOMMENDED PRACTICE

SAE J1879

ISSUED
OCT88

Issued 1988-10

Submitted for recognition as an American National Standard

GENERAL QUALIFICATION AND PRODUCTION ACCEPTANCE CRITERIA FOR INTEGRATED CIRCUITS IN AUTOMOTIVE APPLICATIONS

***Foreword*—**This Document has not been changed other than to put it into the new SAE Technical Standards Board Format.

TABLE OF CONTENTS

QUESTIONS REGARDING THIS DOCUMENT: (724) 772-8512 FAX: (724) 776-0243
TO PLACE A DOCUMENT ORDER; (724) 776-4970 FAX: (724) 776-0790
SAE WEB ADDRESS http://www.sae.org

1. *Scope*

1. ***Scope*—**This document establishes the general environmental, mechanical and quality requirements pertaining to IC's. It also describes the qualification and production acceptance procedures performed by the supplier.

It is to be used as a guideline which device buyers can apply wholly or in part as appropriate for their needs and applications.

This document is essentially part number independent. The detail specification particular to a device part number will be given separately, containing all detailed electrical and mechanical parameters.

1.1 **Purpose—**The overall purpose of this document is to provide a common document (procedure) to specify automotive integrated circuits that will improve supplier-user interface relationships with resulting benefits such as:

- Improved quality
- Reduced cost
- Reduced development time
- Improved availability

This SAE Recommended Practice is intended as a guide toward standard practice and is subject to change to keep pace with experience and technical advances. The Electronics Reliability Subcommittee solicits comments to further enhance the usefulness of this document. Comments received will be reviewed and the document revised when appropriate (annually if required).

Comments should be addressed to: SAE Electronics Reliability Standards
Committee, c/o SAE, Troy, Michigan

Users are encouraged to compare their existing specifications with this document to determine whether their requirements are covered. In those cases where the requirements are different, they can be addressed in the user's purchase document.

2. *References*

2.1 **Applicable Publications—**The following publications form a part of the specification to the extent specified herein. Unless otherwise indicated the lastest revision of SAE publications shall apply.

2.1.1 MILITARY PUBLICATIONS—Available from DODSSP, Subscripton Services Desk, Building 4D, 700 Robins Avenue, Philadelphia, PA 19111-5094.

MIL-STD-883C—Test Methods and Procedures for Microelectronics
MIL-STD-105D—Inspection Level 2
MIL-M-38510F—Including Appendices
JEDEC STD 22B—Test Methods and Procedures for Solid State Devices Used in Automotive Transportation Applications

3. *Quality Assurance*

3.1 **General—**In general, the manufacturer must demonstrate with the help of a Quality Assurance Program that design, manufacture, inspection and testing of integrated circuits are adequate to assure compliance with state of the art quality standards. Such a Quality Assurance Program should be structured along MIL-M-38510 (all references to class S removed).

Upon previous request, the buyer shall have access to production areas in order to verify proper implementation of the procedures agreed upon.

3.2 Statistical Process Control (SPC)—A SPC program shall be followed assuring control of device parameters specified in the specific device Engineering Specification (ES).

3.2.1 CHARACTERIZATION REPORT—Prior to qualification approval, the supplier shall provide a Characterization report for Product Engineering approval. This report shall include all tests indicated in the specific device ES. These tests typically contain device parameters at various supply voltages. For qualification, the tests shall be run at five or more specific temperatures including (Ta min – 15 °C), (Ta max + 15 °C), 25 °C, Ta min and Ta max.

The data will be collected from 300 pieces (100 pieces from each of three qualification lots).

During production, the supplier shall do a limited characterization on ten parts per lot. This limited characterization is also outlined in the specific device ES. The tests indicated in the ES shall be run at Ta min, 25 °C and Ta max.

3.2.2 REPORT CONTENTS (QUALIFICATION)—For each parameter, if user has no other reporting format, the data shall be presented using the following format:

a. For the combination of three lots, the supplier shall generate a plot of the mean parameter value for each supply voltage versus temperature. This should be presented on one graph.

b. For each supply voltage, the supplier shall generate a separate graph showing the ±6 sigma, ±3 sigma and mean parameter values versus temperature.

c. For each of the three lots, the supplier shall generate a bar chart which plots the individual lot versus the range of measured parameters. For this graph, only data collected in the temperature range of Ta min <= Ta <= Ta max shall be included.

3.2.3 REPORT CONTENTS (PRODUCTION)—The production report shall consist of:

a. A control chart for each parameter in the table from the specific device ES at the three temperatures. Each chart will track the mean parameter value and standard deviation from lot to lot.

b. Corrective actions or out-of-control readings.

c. Process changes and effective dates.

4. Qualification And Production Acceptance (PA) Tests—The table of tests defines the requirements and acceptance criteria for all qualification and production level tests.

Compliance with all the tests in this section must be demonstrated as follows:

4.1 Qualification—These tests are used to demonstrate the potential of the process to produce parts that meet engineering requirements. They must be completed satisfactorily with initial parts from production tooling and processes before approval and authorization for shipment of parts can be effected.

4.2 Production Acceptance 1 (PA1)—These tests are used to demonstrate the capability and ongoing performance of the process and must be completed using parts from production tooling and processes prior to first production shipment approval. These tests are to continue in effect until process capability is demonstrated.

NOTE—In the event that qualification and PA1 tests could be performed concurrently and would be redundant, that is, if samples from production tooling and processes are available, and if a test plan is developed to accomplish the purpose of both qualification and PA1 test programs, it is acceptable to perform one series of tests for both qualification and PA1.

4.3 **Production Acceptance 2 (PA2)—**The PA2 test program may be implemented only after process capability to meet PA1 requirements has been established and only if the suppliers in-line quality and reliability monitoring procedures are accepted by the buyer. Samples for these tests must be randomly selected from production parts on a continuing basis to represent the entire production population.

4.4 **General Notes—**Approval for use of the PA2 test sequence will be granted if appropriate, based on the results of qualification testing and the availability of relevant specific and generic data attesting to the stability of the manufacturing process.

Alternate procedures for the tests defined in section 4 and sample plans contained in the table of tests may be proposed by the vendor. These can be approved by the buyer. The requirements for one or more of these tests may be deleted on the basis of commonality with previously approved parts or on the basis of acceptable part family data.

TABLE 1—TABLE OF TESTS 4.1 1/ - ENVIRONMENTAL

TEST NAME	TEST NUMBER	CORRESPONDING STANDARD	QUALIFICATION		PROD.ACCEPT. - 1 (PA1)		PROD.ACCEPT. - 2 (PA2)	
			MINIMUM SAMPLE SIZE	STATISTICAL ACCEPTANCE CRITERIA	MINIMUM SAMPLE SIZE	STATISTICAL ACCEPTANCE CRITERIA	MINIMUM SAMPLE SIZE	STATISTICAL ACCEPTANCE CRITERIA
HERM. DEVICE WATER VAPOR CONTENT	4.1.1	MIL-STD 883 1018	3	0 REJECTS	3 ONCE PER QUARTER	0 REJECTS	3 ONCE PER QUARTER	0 REJECTS
TEMP. CYCLING MOLDED DEVICES	4.1.2	MIL-STD 883 1010C	45 DEVICES FROM EA. OF 3 LOTS TOT-135	LTPD-5 0 FAIL PER LOT	45 PER QUARTER		45 PER QUARTER	
THERMAL SHOCK QUALIFICATION	4.1.3	MIL-STD 883 1011C	45 DEVICES FROM EA. OF 3 LOTS TOT-135	LTPD-5 0 FAIL PER LOT	45 ONCE PER QUARTER	LTPD-5 (0 REJ)	45 ONCE PER 6 MOS.	LTPD-5 (0 REJ)
UNBIASED AUTOCLAVE QUALIFICATION	4.1.4	JEDEC 22 A102A	77 DEVICES FROM EA. OF 3 LOTS TOT-231	LTPD-5 1 FAIL PER LOT	77 ONCE PER QUARTER	LTPD-5 (1 REJ)	77 ONCE PER 6 MOS.	LTPD-5 (1 REJ)
UNBIASED AUTOCLAVE PRODUCTION LEVEL	4.1.5	JEDEC 22 A102A			45 PER LOT	LTPD-5 (0 REJ)	45 PER LOT	LTPD-5 (0 REJ)
BIASED HUMIDITY	4.1.6	JEDEC 22 A101 COND.A	45 DEVICES FROM EA. OF 3 LOTS TOT-135	LTPD-5 0 FAIL PER LOT	45 ONCE PER QUARTER	LTPD-5 (0 REJ)	45 ONCE PER 6 MOS.	LTPD-5 (0 REJ)
SALT ATMOSPHERE	4.1.7	MIL-STD 883 1009A	38	LTPD-10 (1 REJ)				
OPERATING LIFE QUALIFICATION	4.1.8	JEDEC 22 A108	76 DEVICES FROM EA. OF 3 LOTS TOT-228	LTPD-3 0 FAIL PER LOT				

1/ REQUIREMENTS:

- When subgroup sample sizes are greater than the minimum specified and permit acceptance with one or more rejects, the buyer must be notified prior to the start of testing.
- When a sample size is tied to a period of time longer than that which is noramlly controlled and shipped as a lot, e.g., X/quarter; one sample of the specified number of pieces must be selected from one lot manufactured in that specified time period.

TABLE 1—TABLE OF TESTS 4.1 1/ - ENVIRONMENTAL (continued)

TEST NAME	TEST NUMBER	CORRESPONDING STANDARD	QUALIFICATION		PROD.ACCEPT. - 1 (PA1)		PROD.ACCEPT. - 2 (PA2)	
			MINIMUM SAMPLE SIZE	STATISTICAL ACCEPTANCE CRITERIA	MINIMUM SAMPLE SIZE	STATISTICAL ACCEPTANCE CRITERIA	MINIMUM SAMPLE SIZE	STATISTICAL ACCEPTANCE CRITERIA
BURN-IN	4.1.9	JEDEC 22 A108	100%		REFER TO TEXT		REFER TO TEXT	
HIGH TEMP REVERSE BIAS	4.1.10	JEDEC 22 A108	76	LTPD-3 (0 REJ)				
POWER AND TEMP. CYCLE	4.1.11	JEDEC 22 A105	76	LTPD-3 (0 REJ)				

1/ REQUIREMENTS:

- •When subgroup sample sizes are greater than the minimum specified and permit acceptance with one or more rejects, the buyer must be notified prior to the start of testing.
- •When a sample size is tied to a period of time longer than that which is noramlly controlled and shipped as a lot, e.g., X/quarter; one sample of the specified number of pieces must be selected from one lot manufactured in that specified time period.

TABLE 2—TABLE OF TESTS 1/ - MECHANICAL

TEST NAME	TEST NUMBER	CORRESPONDING STANDARD	QUALIFICATION		PROD.ACCEPT. - 1 (PA1)		PROD.ACCEPT. - 2 (PA2)	
			MINIMUM SAMPLE SIZE	STATISTICAL ACCEPTANCE CRITERIA	MINIMUM SAMPLE SIZE	STATISTICAL ACCEPTANCE CRITERIA	MINIMUM SAMPLE SIZE	STATISTICAL ACCEPTANCE CRITERIA
INTERNAL EXAM A	4.2.1	MIL-STD 883 2014	3	(0 REJ)	3 ONCE PER QUARTER	(0 REJ)	3 ONCE PER QUARTER	(0 REJ)
INTERNAL EXAM B	4.2.2	MIL-STD 883 2010-B	100%	REMOVE DEFECTIVES	100%	REMOVE DEFECTIVES		
PHYSICAL DIMENSION	4.2.3	MIL-STD 883 2016	3	(0 REJ)	3 PER LOT	(0 REJ)	3 PER LOT	(0 REJ)
EXTERNAL VISUAL	4.2.4	MIL-STD 883 2009	76	LTPD-3 (O REJ)	4 PER LOT	(O REJ)	4 PER LOT	(O REJ)

1/ REQUIREMENTS:

- •When subgroup sample sizes are greater than the minimum specified and permit acceptance with one or more rejects, the buyer must be notified prior to the start of testing.
- •When a sample size is tied to a period of time longer than that which is normally controlled and shipped as a lot, e.g., X/quarter; one sample of the specified number of pieces must be selected from one lot manufactured in that specified time period.

TABLE 2—TABLE OF TESTS 1/ - MECHANICAL (continued)

TEST NAME	TEST NUMBER	CORRESPONDING STANDARD	QUALIFICATION		PROD.ACCEPT. - 1 (PA1)		PROD.ACCEPT. - 2 (PA2)	
			MINIMUM SAMPLE SIZE	STATISTICAL ACCEPTANCE CRITERIA	MINIMUM SAMPLE SIZE	STATISTICAL ACCEPTANCE CRITERIA	MINIMUM SAMPLE SIZE	STATISTICAL ACCEPTANCE CRITERIA
RESISTANCE TO SOLVENTS	4.2.5	MIL-STD 883 2015	76	LTPD-3 (O REJ)	4 PER LOT	0 REJECTS	4 PER LOT	0 REJECTS
VISUAL INSPECTION	4.2.6	MIL-STD 883 2009	100%	REMOVE DEFECTIVES	100%	REMOVE DEFECTIVES	100%	REMOVE DEFECTIVES
BOND STRENGTH	4.2.7	MIL-STD 883 2011 C OR D	76 BONDS FROM EA OF 3 LOTS TOT-228	LTPD-3 (O REJ)	76 BONDS PER LOT	LTPD-3 (O REJ)	76 BONDS PER LOT	LTPD-3 (O REJ)
TERMINAL STRENGTH & DURABILITY	4.2.8	MIL-STD 883 2004B2, 1014 JEDEC22, A102A	22	LTPD-10 (O REJ)				
SOLDERABILITY	4.2.9	MIL-STD 883 2003	22	LTPD-10 (0 REJ)	3 LEADS ON 7 DEV. PER LOT	LTPD-10 (0 REJ)	3 LEADS ON 7 DEV. PER LOT	LTPD-10 (0 REJ)
HERM. DEVICE PACKAGE INTEGRITY - TEST 1	4.2.10	MIL-STD 883 1010C, 2001E 1014	45	LTPD-5 (0 REJ)	45 ONCE PER QUARTER	LTPD-5 (0 REJ)	45 ONCE PER 6 MOS.	LTPD-5 (0 REJ)
HERM. DEVICE PACKAGE INTEGRITY - TEST 2	4.2.11	MIL-STD 883 2001B, 2002B 1014	22	LTPD-10 (0 REJ)	22 ONCE PER QUARTER	LTPD-10 (0 REJ)	22 ONCE PER 6 MOS.	LTPD-10 (0 REJ)

1/ REQUIREMENTS:

- When subgroup sample sizes are greater than the minimum specified and permit acceptance with one or more rejects, the buyer must be notified prior to the start of testing.
- When a sample size is tied to a period of time longer than that which is normally controlled and shipped as a lot, e.g., X/quarter; one sample of the specified number of pieces must be selected from one lot manufactured in that specified time period.

TABLE 3—TABLE OF TESTS 4.3 1/ - ELECTRICAL

TEST NAME	TEST NUMBER	CORRESPONDING STANDARD	QUALIFICATION		PROD.ACCEPT. - 1 (PA1)		PROD.ACCEPT. - 2 (PA2)	
			MINIMUM SAMPLE SIZE	STATISTICAL ACCEPTANCE CRITERIA	MINIMUM SAMPLE SIZE	STATISTICAL ACCEPTANCE CRITERIA	MINIMUM SAMPLE SIZE	STATISTICAL ACCEPTANCE CRITERIA
HIGH TEMP. CONTINUITY	4.3.1	JEDEC 22 C100	100%	REMOVE DEFECTIVES	100%	REMOVE DEFECTIVES		
ELECTROSTATIC DISCHARGE	4.3.2	MIL-STD 883 3015	10 DEVICES	0 REJECTS				
FINAL ELECTRICAL	4.3.3		100%	REMOVE DEFECTIVES	100%	REMOVE DEFECTIVES	100%	REMOVE DEFECTIVES
ELECTRICAL QUALITY	4.3.4		100%	0 REJECTS	200 PER LOT	0 REJECTS	200 PER LOT	0 REJECTS
ELECTRICAL QUALITY TEMP LIMITS	4.3.5		100%	0 REJECTS	200 PER LOT	0 REJECTS	200 PER LOT	0 REJECTS

1/ REQUIREMENTS:

- When subgroup sample sizes are greater than the minimum specified and permit acceptance with one or more rejects, the buyer must be notified prior to the start of testing.
- When a sample size is tied to a period of time longer than that which is normally controlled and shipped as a lot, e.g., X/quarter; one sample of the specified number of pieces must be selected from one lot manufactured in that specified time period.

5. *Test Procedures And Requirements*—The following paragraphs describe the tests identified in section 3, the table of tests. These functional and durability tests may be conducted in any sequence except for the electrical tests 4.3.3, 4.3.4 and 4.3.5. Some of these tests are made up of a series of steps which must be carried out in the sequence indicated. Parts subjected to these tests may not be delivered as production parts unless specifically indicated to the contrary in the test description. Temperature tolerance is ±3°C.

NOTE—For tests which require multiple lots, the number of lots required may be reduced by the submission of generic data.

5.1 Environmental Tests

5.1.1 HERMETIC DEVICE WATER VAPOR CONTENT—Performed on hermetic devices only.

Step 1 - Internal Water Vapor Content: MIL-STD-883, method 1018. Criteria: 5000 ppm maximum water vapor content at 100 °C.

5.1.2 TEMPERATURE CYCLING—Performed on molded devices only.

Step 1 - Electrical Parameters: Verification of functionality and measurements of DC parameters to be made per 4.3.4 and 4.3.5. Datalogs to be retained for review.

Step 2 - Temperature Cycling: MIL-STD-883, method 1010, modified condition C (–55 to 150 °C), 1000 cycles.

Step 3 - Electrical Parameters: Verification of functionality and measurements of DC parameters to be made per 4.3.4 and 4.3.5. Datalogs to be retained for review.

Step 3 (alternate) - Procedures and sampling criteria per manufacturer's specification may be substituted for PA2 tests after approval by the buyer.

5.1.3 THERMAL SHOCK—Performed on molded devices only.

Step 1 - Electrical Parameters: Verification of functionality and measurement of DC parameters to be made per 4.3.4 and 4.3.5. Datalogs to be retained for review.

Step 2 - Thermal Shock: MIL-STD-883, method 1011, modified condition C (–55 to 150 °C), 1000 cycles.

Step 3 - Electrical Parameters: Verification of functionality and measurement of DC parameters to be made per 4.3.4 and 4.3.5. Datalogs to be retained for review.

Step 3 (alternate) - Procedures and sampling criteria per manufacturer's specification may be substituted for PA2 tests after approval by the buyer.

5.1.4 UNBIASED AUTOCLAVE (QUALIFICATION)—Performed on molded devices only.

Reference: JEDEC 22B, A102A

Step 1 - Electrical Parameters: Verification of functionality and measurement of DC parameters to be made per 4.3.4. Leakage current measurements must be made. Datalogs and data to be retained for review.

Step 2 - Place parts in a stainless steel autoclave and maintain at 121 °C, 15 ± 2 psig for 96 hours. Use deionized water with resistivity no less than 1 x 10 E 6 ohm-cm at 25 °C. Parts to be dried at room temperature for 24 h prior to electrical testing. Testing is to be completed within 48 h after drying.

Step 3 - Electrical Parameters: Verification of functionality and measurements of DC parameters to be made per 4.3.4. Leakage current measurements shall be made. Datalogs and data to be retained for review. Lack of functionality or parametric deviations beyond specification limits shall indicate lack of sufficient durability.

5.1.5 UNBIASED AUTOCLAVE (PRODUCTION ACCEPTANCE)—Performed on molded devices only.

Reference: JEDEC 22B, A102A

Step 1 - Electrical Parameters: Verification of functionality and measurements of DC parameters to be made per 4.3.4. Leakage current measurements shall be made.

Step 2 - Place parts in stainless steel autoclave and maintain at 121°C, 15 ± 2 psig for 48 hours. Use deionized water with resistivity no less than 1 x 10 E 6 ohm-cm at 25 °C. Parts to be dried at room temperature for 24 h prior to electrical testing.

Step 3 - Electrical Parameters: Verification of functionality and measurements of DC parameters to be made per 4.3.4. Leakage current measurements shall be made. Lack of functionality or parametric deviations beyond specification limits shall indicate inability to adequately sustain stress.

Step 4 - Evaluation: If the LTPD criteria of the table of tests is not met, steps 1, 2 and 3 may be repeated one time. If the stated LTPD criteria is not met the second time, the lot is rejected.

5.1.6 BIASED HUMIDITY—Performed on molded devices only.

Reference: JEDEC 22B, A101 Condition A

Step 1 - Electrical Parameters: Verification of functionality and measurements of DC parameters to be made per 4.3.4. Leakage current measurements must be made. Datalogs and data to be retained for review.

Step 2 - Maintain parts in ambient of 85 °C, 85% RH for 1000 hours. Monitor part condition at 168, 504 and 1008 hours. Use deionized water with resistivity no less than 1 x 10 E 6 ohm-cm at 25 °C. The chamber must be sequenced during start up and shut down so as to avoid forming condensation on the test devices. Bias circuit to be specified in detailed part specification, to be configured for minimum power dissipation at 2/3 of minimum specified breakdown voltages. Parts to be dried at room temperature for 24 h prior to electrical testing. Testing to be completed within 48 h after drying.

Step 3 - Electrical Parameters: Verification of functionality and measurements of DC parameters to be made per 4.3.4. Leakage current measurements must be made. Datalogs and data to be retained for review. Lack of functionality or parametric deviations beyond specification limits shall indicate lack of sufficient durability.

5.1.7 SALT ATMOSPHERE—This test may be performed using electrical rejects.

Step 1 - Salt atmosphere (corrosion): MIL-STD-883, method 1009, condition A.

5.1.8 OPERATING LIFE (QUALIFICATION)—Reference: JEDEC 22B, A108

This test is intended for use on complex digital or digital and analog components. The high temperature reverse bias test may be used instead of this test for certain SSI digital and analog devices.

Step 1 - Electrical Parameters: Verification of functionality and measurements of DC parameters shall be made per 4.3.4 and 4.3.5. Full datalogs are to be retained for analysis. Twenty parts from each wafer fabrication run shall be tested and data retained to establish initial values of AC parameters and other parameters defined in the specific device ES which are not included in 4.3.4 and 4.3.5.

Step 2 - Subject all devices to the operating life test. The detailed test conditions will be defined in the specific device ES. In general, these conditions will determine load networks and operating frequencies or clock rates so as to maintain a maximum junction temperature of 150°C or an ambient temperature of 125 °C.

All samples will be tested per 4.3.4 after 96, 168, 504 and 1008 hours of operation. In addition, test all samples per 4.3.5 after 1008 h of operation.

The parts will be cooled to room temperature with power applied prior to removal from the burn-in oven. Electrical tests will be conducted within 96 h of removal of power except for the monitoring at 1008 h which shall be within 24 hours.

Step 3 - Data Analysis: Parts which successfully pass this test will be those which pass 4.3.4 at each monitoring point and 4.3.5 at 1008 hours.

In addition, leakage current measurements in 4.3.4 and any other parameters must remain within specified delta limits of zero hour data specified in the specific device ES. Any parameter drifts must have demonstrably "leveled off" by the final reading.

5.1.9 BURN-IN (QUALIFICATION, PRODUCTION ACCEPTANCE)—For production level, parts subjected to this test are deliverable as production parts.

Reference: JEDEC 22B, A108

Step 1 - Electrical Parameters: Verification of functionality and measurement of DC parameters is to be made using automatic test equipment. Though it is preferable that the test equipment be identical to the electric test of 4.3.3, the supplier may use an alternate test if the availability of suitable test equipment or other circumstances so dictates. In this case, the test program conditions and limits must be approved by the buyer.

Step 2 - Subject the components to burn-in at 125 °C using the operating life test circuitry, procedures and device specification. In most cases, this will be 4.1.8. For some components, such as analog or simple digital devices, this will consist of the high temperature reverse bias circuit defined for use in conjunction with 4.1.10.

During qualification, the failure rate versus burn-in time will be empirically determined by testing at intervals of 24, 48, 96, and 168 hours.

This data shall be used to determine the optimized ratio between costs and effectiveness of burn-in. A reasonable decision can be made with data from approximately 2000 devices from at least 10 wafer lots. The decision can be, depending on the results, to shorten the burn-in life or to introduce sample burn-in. The criteria for this decision shall be negotiated between the buyer and supplier.

Step 2 (alternate) - The supplier may substitute other time, temperature and circuit conditions if equivalent stress is demonstrated and approval is granted by the buyer.

Step 3 - Electrical Parameters: The testing described in Step 1 will be repeated.

5.1.10 HIGH TEMPERATURE REVERSE BIAS—Reference: JEDEC 22B, A108

Step 1 - Electrical Parameters: Verification of functionality and measurement of DC parameters is to be made using automatic test equipment. Though it is preferable that the test be identical to test of 4.3.4 and 4.3.5, the supplier may use an alternate test if the availability of suitable test equipment or other circumstances so dictate. In this case, the test program conditions and limits must be approved by the buyer.

Step 2 - Parts are to be operated in a reverse biased condition. Details of the bias circuit, temperature and time will be specified in the part specification. The parts will be operated for 250 h at a junction temperature of 175 °C or 1000 h at a junction temperature of 150 °C, or as specified in the part specification.

Step 3 - Electrical Parameters: Repeat Step 1.

5.1.11 POWER AND TEMPERATURE CYCLE—Reference: JEDEC 22B, A105

Step 1 - Electrical Parameters: Verification of functionality and measurements of DC parameters to be made at 25 °C per 4.3.4. Datalogs and data to be retained for review.

Step 2 - The components shall be operated in the same circuit utilized for the Operating Life test. The tests shall be conducted in an environmental chamber which maintains the selected ambient temperatures through air circulation. Power and appropriate drive signals shall be applied to the device in a cycle of 5 min on and 5 min off during the test. The environmental chamber shall provide a 1 h temperature cycle as follows:

- 1/4 h min at –40 °C
- Transition within 1/4 h
- 1/4 h min at 125 °C
- Transition within 1/4 h

The test shall be conducted for 1008 hours.

Step 3 - Electrical Parameters: Verification of functionality and measurements of DC parameters to be made at 25 °C per 4.3.4. Datalogs and data to be retained for review. This test shall monitor Step 2 at 504 and 1008 hours.

5.2 Mechanical Tests

5.2.1 INTERNAL EXAM A—Step 1 - Internal Visual and Mechanical: MIL-STD-883, method 2014. Requirements for materials, design and construction to be those of PA1 devices. 8 x 10" photograph (per method 2014) of each die is to be supplied to the buyer.

5.2.2 INTERNAL EXAM B—Parts inspected to these criteria are deliverable as production parts.

Step 1 - Internal Visual: MIL-STD-883, method 2010, test condition B. Other details to be specified in detailed part print.

Step 1 (alternate) - Internal visual examination to manufacturers specification may be performed after approval of the procedure by the buyer.

5.2.3 PHYSICAL DIMENSION—This test may be performed using electrical rejects.

Step 1 - Physical Dimension: MIL-STD-883, method 2016. Other details to be specified in detailed part print.

Step 1 (alternate) - Insert and check for proper fit in specified gauge block.

5.2.4 EXTERNAL VISUAL—This test may be performed using electrical rejects.

Step 1 - External Visual: MIL-STD-883, method 2009.

5.2.5 RESISTANCE TO SOLVENTS—This test may be performed using electrical rejects.

Step 1 - Resistance to Solvents: MIL-STD-883, method 2015.

5.2.6 VISUAL INSPECTION—Parts subjected to this test are deliverable as production parts.

Step 1 - External Visual: MIL-STD-883, method 2009.

Step 1 (alternate) - External visual per manufacturers specification after approval by the buyer.

5.2.7 BOND STRENGTH—Step 1 - Bond Strength: MIL-STD-883, method 2011, conditions C or D.

Step 1 (alternate) - Bond strength procedure and sampling criteria per manufacturers specification may be utilized after approval by the buyer. SPC data may waive this requirement.

5.2.8 TERMINAL STRENGTH AND DURABILITY—Samples for this test may be drawn from those selected from 4.1.4.

Reference: JEDEC 22B, A102A

Step 1 - Lead Integrity: MIL-STD-883, method 2004, condition B2, two leads per device.

Step 2a - Hermetic Devices Only: Seal (fine and gross), MIL-STD-883, method 1014.

Step 2b - Molded Devices Only: Pressure cooker 121 C, 15 ± 2 psig, for 96 hours. Note that for convenience these devices may share the autoclave with devices being tested to requirements of 4.1.4.

Step 3 - Molded Devices Only: Electrical parameters: Verification of functionality and measurement of DC parameters per 4.3.5. Lack of full functionality and/or parametric deviations due to mechanical damage or corrosion shall indicate lack of sufficient terminal strength and durability.

5.2.9 SOLDERABILITY—Except for qualification, this test may be performed using electrical rejects.

Step 1 - Solderability: MIL-STD-883, method 2003. Solder all leads. For qualification, examine all leads per the method. For PA, view all leads at low magnification, then select the 3 worst leads per device and examine at higher magnification to the criteria of the method. Record the identification of the three leads examined for each device.

Step 2 - For qualification only, verification of functionality to be made per 4.3.4.

Step 1–2 (alternate) - Solderability testing to MIL-STD-883, method 2003, may be done per the manufacturer's sampling criteria upon approval of the buyer.

5.2.10 HERMETIC DEVICE PACKAGE INTEGRITY (TEST 1)—Performed on hermetic devices only.

Step 1 - Electrical Parameters: Verification of functionality and measurements of DC parameters to be made per 4.3.4 and 4.3.5. Datalogs to be retained for review.

Step 2 - Seal (fine and gross): MIL-STD-883, method 1014.

Step 3 - Temperature Cycling: MIL-STD-883, method 1010, condition C, 1000 cycles.

Step 4 - Constant Acceleration: MIL-STD-883, method 2001, condition E. Y1 plane only (condition D for packages = or > 40 pins).