

EIA-703-B

EIA STANDARD

General Resistor Stress Test Qualification Specification

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Electronic Components Industry Association

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(From Standards Proposal No. 5447, formulated under the cognizance of the P-1 Committee on EIA Resistive Devices Standards).

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GENERAL RESISTOR STRESS TEST QUALIFICATION SPECIFICATION

(From EIA Standards Proposal No. 5447, formulated under the cognizance of the P-1 Committee on Resistive Devices Standards).

1 Scope

1.1 Description

This specification defines the qualification program for resistors. The qualification program is defined in table 1. Specification sheets can be added, as required, to define specific products or to cover unique/specific requirements.

1.2 Preconditioning

Preconditioning of the test sample resistors shall be required before life test, load humidity test, thermal shock test and temperature stability test. Preconditioning is to be performed per J-STD-075A or to the limits of the current product sensitivity level (PSL) value established by the supplier except for vibration test and terminal strength test; moisture soak shall not be required. If the PSL limit is used, the PSL value shall be stated as part of the qualification report. Full sample size shall be selected from parts that have successfully passed initial electrical measurements following preconditioning. See profile curves in J-STD-075A (wave solder, IR reflow, reworking) as needed for qualification.

1.3 Reference documents

The current revision of the referenced documents will be in effect at the date of agreement to the qualification plan. Subsequent qualification plans will automatically use the latest revisions of these referenced documents.

ASTM-2863	Flammability of Plastics Using the Oxygen Index Method
EIA/IS-34	Leaded Surface Mount Resistor Networks Fixed Film
EIA-451	Resistor Network-Fixed Film
EIA-575	Resistors, Rectangular, Surface Mount, General Purpose
EIA-576	Resistors, Rectangular, Surface Mount, Precision
EIA-977	Test Method – Electronic Passive Components Exposure to Atmospheric Sulfur.
IEC 60115-1	Fixed resistors for use in electronic equipment - Part 1: Generic specification
IEC 60695-11-5	Fire hazard testing - Part 11-5: Test flames - Needle-flame test method - Apparatus, confirmatory test arrangement and guidance
J-STD-075A	Classification of Non-IC Components for Assembly Processes
MIL-HDBK-53	Military Handbook - Guide for Attribute Lot Sampling Inspection
MIL-STD-202	Test Methods for Electronic and Electrical Component Parts
MIL-STD-883	Test Methods and Procedures for Microelectronics
UL-94	Tests for Flammability of Plastic Materials

2 General specifications

This specification includes requirements with the intention of developing a set of robust qualification tests that would enable a supplier to leverage test results to satisfy the requirements of multiple OEM customers.

Certain passive components containing silver that may be exposed to the atmosphere are susceptible to the effect of environmental sulfur. Such susceptibility results in the corrosion of silver in the presence of sulfur compounds in a liquid or gaseous state, potentially leading to component failure. Test method ANSI/EIA-977 was written to test passive components for this susceptibility and may optionally be performed to qualify a component family as being sulfur resistant.

2.1 Objective

The objective of this qualification program is to ensure that the device to be qualified meets a minimum set of qualification requirements.

2.2 Generic data

2.2.1 The use of generic data to satisfy qualification requirements

Qualification shall be based on specific requirements associated with each characteristic of the device and manufacturing process. These requirements, listed in table 1, are the same for both new processes and requalification associated with a process change. For each stress test, two or more qualification families can be combined if reasoning for this is technically sound, supported by data and periodically reviewed for soundness of original assumptions. With proper attention to these qualification guidelines, greater information applicable to other devices in the family can be accumulated and used to demonstrate their reliability so that qualification testing on new devices entering a family can be minimized. For example, this can be achieved through extensive qualification and monitoring of the most complex device in the reliability family and applied to less complex devices that subsequently join this family. Sources of generic data shall come from supplier-certified test labs, and can include internal supplier's qualification, user-specific qualifications and supplier's in-process monitors, as long as the test conditions and endpoint test temperatures address the worst case temperature extremes and other conditions defined in this specification.

2.2.2 Qualification families

In order to qualify as a family, the qualification samples must represent the same manufacturing process, materials and formulation. The supplier will provide a complete description of each process and material of significance. Samples should represent three different values within the family and be separated by one week of date code. The values should represent the low, critical, and upper values of the family. There must be valid and obvious links between the data and the subject of qualification.

2.2.3 Manufacturing site (fabrication and assembly)

Each manufacturing site and line is to be considered independently for site qualification, meaning that the site is proven to be capable (resources and equipment) of running particular processes. A site cannot be qualified based on the results from a different location. Qualification families do not apply across manufacturing sites.

2.3 Test samples

2.3.1 Lot requirements

Test samples shall consist of representative devices from the qualification family. Multiple lot samples are specified in 4.1, and test samples shall be the same values from three

non-consecutive lots, with each assembly lot composed of a different date code and separated by at least one week unless otherwise specified by one of the test standards.

2.3.2 Production requirements

All test samples shall be processed, tested, screened and inspected on the same production site and with the same production process for which the device in the qualification family to be qualified will be manufactured for production.

2.3.3 Reusability of test samples

Devices which have been used for nondestructive qualification tests may be used to populate other qualification tests.

2.3.4 Prestress and post-stress test requirements

All endpoint test temperatures (room, hot and/or cold) are to be specified in 4.2 to 4.20.

2.4 Definition of electrical test failure after stressing

Electrical test failures are defined as those devices not meeting the individual device requirements called out in clause 4 of this document.

2.5 Criteria for passing qualification

Passing all appropriate qualification tests in this specification qualifies the device per this document.

3 Qualification and requalification

3.1 Qualification of a new device

The stress test requirements and corresponding test conditions for the qualification of a new device are listed in table 1. For each qualification, the supplier must present data for all of these tests, either specific to the device to be qualified or acceptable reliability family data. Justification for the use of generic data must be demonstrated by the supplier and approved by the user.

3.2 Changes requiring requalification

Changes to a commodity, or the processes used in its fabrication, will require retesting as agreed upon between the supplier and the user. The supplier and the user should agree upon the appropriate test plan prior to starting the requalification.

3.2.1 Criteria for passing requalification

Passing all appropriate requalification tests specified in this document and agreed to between the user and supplier qualifies the change per this document. All requalification failures should be analyzed for root cause, and demonstration of corrective and preventative actions are required.

4 Test requirements

4.1 Sampling plan

Individual samples per test required in table 1 are selected from one manufacturing lot. A minimum of three manufacturing lots separated by at least one week of date code shall be selected as described in 2.2.2.

Table 1 - Resistor qualification test program approval levels and sampling plan

Test method	Resistor inspection	Sample size per lot	Total sample size	Defects permitted
4.2	Electrical characteristic	234	702	0
4.3	Visual and mechanical	5	15	0
4.4	Life test	40	120	0
4.5	Load humidity test	40	120	0
4.6	Moisture resistance	40	120	0
4.7	Terminal strength	5	15	0
4.8	Thermal shock	40	120	0
4.9	Dielectric withstanding voltage	5	15	0
4.10	Insulation resistance	5	15	0
4.11	Temperature coefficient of resistance (TCR)	5	15	0
4.12	Shear test	5	15	0
4.13	a. Solderability b. Resistance to electrode leaching	20	60	0
4.14	Vibration	5	15	0
4.15	Shock			
4.16	Static noise	5	15	0
4.17	Short time overload	5	15	0
4.18	DPA	4	12	0
4.19	ESD sensitivity	5	15	0
4.20	Flammability			Present certificate of compliance
4.21	Resistance to Atmospheric Sulfur (if chosen by supplier)	From Table 1 of ANSI/EIA-977		

4.2 Electrical characteristics

Total samples required in table 1 shall be measured initially before subsequent testing. Electrical parameters shall not exceed the values listed in the product specifications.

4.3 Visual and mechanical examination

Resistors shall be examined visually to verify that no defects in workmanship exist. Mechanical dimensions will be measured and shall meet the requirements defined in the detail specification sheet or reference documents. Unless otherwise specified, when resistors are tested in accordance with the environmental tests listed below and the specification, there shall be no evidence of mechanical damage or measurable discontinuity.

4.3.1 Chips or chipouts, on the resistive element side, greater than 0.076 mm in depth or extending more than 50% of a side or 50% of the top or bottom are not acceptable. (Usually due to a fracture and found on the edges.)

4.3.2 Pinholes that extend to a depth of more than 0.051 mm or that expose the metal electrode are unacceptable.

4.4 Life test

Resistors shall be tested per MIL-STD-202, Method 108A, except:

- a) Preconditioning is required.
- b) Measure and record initial resistance value at $25\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$.
- c) Place mounted units in an air circulating environment at $70\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$.
 - 1) Power the units at 100% of their full rated power, but not exceeding the maximum specified continuous working rated voltage, for 1000 hours, or
 - 2) Power the units at 100% of their full rated power, but not exceeding the maximum specified voltage, for 1.5 hours ON, 0.5 hours OFF, for 2000 hours.
- d) At 50h, 250 h, 500 h, 750 h, and 1000 h for Condition 1 above or 50 h, 250 h, 500 h, 750 h, 1000 h, 1500 h, and 2000 h for Condition 2 above, remove power and after stabilization at $25\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$, sequentially remeasure and record the resistance value and calculate the change in resistance from initial. Measure and record final resistance value at $25\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$.

NOTE LIMIT—Change in % from the initial resistance value at each of the time intervals shall not exceed the maximum ΔR specified in annex A.