Designation: F 979 – 86 (Reapproved 1998)ε1

AMERICAN SOCIETY FOR TESTING AND MATERIALS
100 Barr Harbor Dr., West Conshohocken, PA 19428
Reprinted from the Annual Book of ASTM Standards. Copyright ASTM

Standard Test Method for Hermeticity of Hybrid Microcircuit Packages Prior to Lidding [1]

This standard is issued under the fixed designation F 979; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

ε[1] NOTE—Editorial changes were made throughout in May l998.

1. Scope

1.1 The hermetic integrity of hybrid microcircuit packages is an important material or parts acceptance requirement. Determination of this parameter should be made before the hybrid circuit is assembled and sealed inside the package.

1.2 This test method covers a test for leaks in a package that is intended to be hermetically sealed after hybrid circuit assembly. Various types of hybrid packages may be tested by this test method. The test method is nondestructive and therefore suitable for 100 % inspection.

1.3 *This standard does not purport to address the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

F 78 Test Method for Calibration of Helium Leak Detectors by Use of Secondary Standards[2]

F 134 Test Methods for Determining Hermeticity of Electron Devices with a Helium Mass Spectrometer Leak Detector[3]

2.2 *Federal Standard:*

Fed. Std. No. 209 Clean Room and Work Station Requirements, Controlled Environment[4]

3. Summary of Method

3.1 The specimen package is placed on an elastomer surface with the inside cavity of the package facing an orifice in the elastomer. This orifice is an opening to the vacuum section of a mass spectrometer leak detector. Helium gas, to which the mass spectrometer is sensitive, is flooded over the outside of the package. Indication of a leak is detected by suitable instrumentation on the mass spectrometer.

4. Significance and Use

4.1 Hermeticity test methods, for example, Test Methods F 134, deal with sealed packages only and do not apply directly to unsealed packages. This test method is most applicable for determining the hermeticity of a package before it has been sealed with a lid or a cover. Packages that are intended for hermetic seal use are manufactured so as to prevent leakage of helium at a rate in excess of 1×10^{-8} atm cc/s under a pressure differential of 1 atm when tested on a helium mass spectrometer leak detector. This test should be conducted in a clean work area such as would be provided by a laminar flow clean bench as specified in Fed. Std. No. 209. This test method is not recommended for use in commerce until the precision has been determined.

4.2 Acceptance and rejection criteria for this test method shall be agreed upon by the purchaser and the supplier as part of the purchase contract.

NOTE 1—Packages that are not capable of meeting a maximum leak rate of 1×10^{-8} atm cc/s of helium at a pressure differential of 1 atm are customarily rejected on the basis that good quality assurance is achieved with this performance level.

5. Apparatus

5.1 *Fixtures and Fittings*, suitable for vacuum apparatus applications that will properly fit to the input plumbing on the mass spectrometer and hold the package style of interest on the seal gasket (see Fig. 1).

5.2 *Surgical Rubber Gasket*, or equivalent that has a surface dimension matching that of the seal ring on the package specimen.

5.3 *Vacuum Grease*. [5]

5.4 *Helium Mass Spectrometer Leak Detector*, with a detection sensitivity of one part of helium in ten million parts of air at a manifold pressure of 0.2 µm Hg (0.0267 Pa). The minimum detectable leak rate of this apparatus should be 5×10^{-11} atm cc/s for helium gas.

[1] This test method is under the jurisdiction of ASTM Committee F-1 on Electronics and is the direct responsibility of Subcommittee F01.03 on Metallic Materials.

Current edition approved March 27, 1986. Published June 1986.

[2] *Annual Book of ASTM Standards*, Vol 10.04.

[3] Discontinued; see *l996 Annual Book of ASTM Standards*, Vol 10.04.

[4] Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

[5] The sole source of supply of vacuum grease, Apiezon Type M or N known to the committee at this time is Miconite Ltd., P. O. Box 136 Manchester, M601AN, England, U.K. If you are aware of alternative suppliers, please provide this information to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.

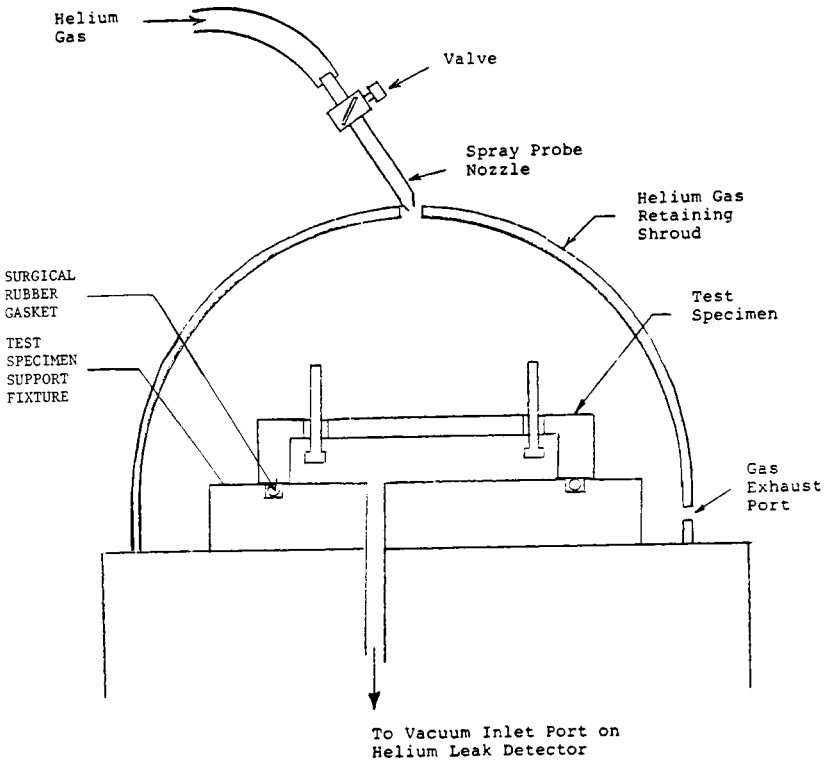

FIG. 1 Test Fixture Example Schematic

NOTE 2—Additional technical information on leak detecting with the helium mass spectrometer is provided in Test Methods F 134. Information on the calibration of these leak detectors is provided in Method F 78.

5.5 *Clean Work Area*, such as would be provided by a laminar flow clean bench as specified in Fed. Std. No. 209.

5.6 *Helium Gas Shroud*, as shown in Fig. 1. The purpose of the gas shroud is to maintain a concentration of helium gas around the test specimen for a time so that it can have an opportunity to penetrate a leak orifice before it is dispersed by surrounding atmosphere. Some of the shrouds have been made from glass battery jars, ceramic cups, or metal coffee cans, as examples.

6. Sampling

6.1 This test method is nondestructive. It provides for either 100 % inspection or for a selected sampling plan for inspection or screening of each production lot of packages. Agreement between the parties to the test shall decide the sampling plan to be used.

7. Calibration and Standardization

7.1 Calibrate the helium mass spectrometer leak detector to ensure a sensitivity of 1×10^{-8} atm cc/s by Test Method F 78.

8. Procedure

8.1 Install the proper fixtures into the leak detector orifice. Carefully apply a thin layer of vacuum grease over the surface of the rubber gasket to ensure correct seating of the package seal surface over the fixture evacuation port.

8.2 Verify the fixture assembly integrity prior to testing package specimens by placing a flat-surfaced clean metal plate (a gage block with a ground flat and lapped surface or a glass optical flat are acceptable) over the gasket and by checking the response of the leak testing system. It should not be greater than 5×10^{-9} atm cc/s.

8.3 Place a completed package specimen on the evacuation port with the package cavity toward the vacuum chamber. Allow time for the package cavity to be evacuated to the required pressure differential. Do not allow the grease to come in contact with the glass seals or the braze joints of the package as this will mask potential leak sites and void the test.

8.4 Apply helium gas around the outside of the package using the helium spray probe. Use a gas shroud similar to that shown in Fig. 1 placing the open end over the test specimen to ensure that the helium gas is maintained around the package to accommodate the time constant of small leaks. Spray the helium through the small hole in the shroud.

8.5 Observe the mass spectrometer output meter. Any deflection in excess of the maximum permissible leak rate indicates excessive helium gas leakage into the package (see 4.2 and Note 1).

8.6 Remove the tested part from the fixture and place the passed parts into a cleaning container.

NOTE 3—The vacuum grease should be removed from the packages before they are returned to the assembly flow process or to stock.

8.7 The rejected parts may be submitted to one time retesting. For this retest, clean the gasket and recoat it with fresh grease. Reclean the package prior to placing it onto the gasket. Take time to ensure correct seating of the package seal surface on the gasket.

8.8 To locate the leaks more precisely, use Method B, 11.3.4 and 11.3.5 of Test Methods F 134.

9. Report

9.1 The report shall include a qualitative description of the location of leakage sites when Method B of Test Methods F 134 is employed. If no leakage is detected, the report shall include an indication that the specimens are leak tight when tested in accordance with this procedure.

9.2 The report shall also include the following information:

9.2.1 Sample or specimen number,

9.2.2 Lot number,

9.2.3 Name of operator,

9.2.4 Date of test,

9.2.5 Test equipment identification,

9.2.6 Calibration data used to obtain corrected data, and

9.2.7 Flatness gage identification.

10. Precision and Bias

10.1 The precision and bias of this test method have notbeen determined; an interlaboratory evaluation for these purposes is planned. It is expected that results similar to those achievable using Test Method F 78 should be possible when applying this test method.

11. Keywords

11.1 helium leak testing; hermetic packages; hybrid microcircuits