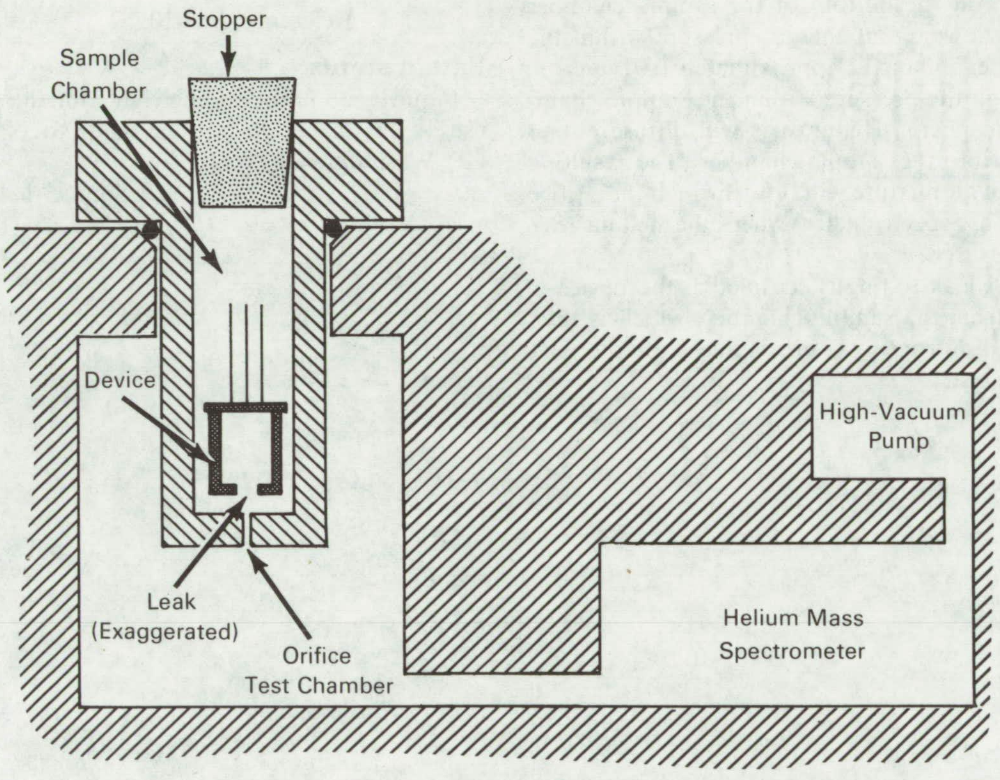
NASA TECH BRIEF

Reliable Method for Testing Gross Leaks in Semiconductor Component Packages



Various semiconductor components such as integrated circuit modules or cans are adversely affected by the presence of a few parts per million of water. The components must therefore be hermetically sealed to prevent the entrance of water vapor. Leak tests, used to determine seal effectiveness, are generally divided into two categories: gross-leak tests (for leak rates greater than 10^{-5} std cc/sec) and fine-leak tests (for leak rates less than 10^{-5} std cc/sec). Helium leak tests (involving a mass spectrometer), which have been commonly used for leak detection, are limited to leak rates of less than 10^{-5} std cc/sec. The conventional helium leak tests cannot, therefore, be reliably used for detecting gross leaks in integrated circuit cans. Bubble tests, which are often used for detecting gross leaks, are also unreliable.

A simple, reliable, inexpensive method for gross-leak testing has been devised, based upon the conventional fine-leak technique. The sensitivity ranges from the detection of very large leaks down to leaks of

(continued overleaf)

10^{-7} cc helium per sec. The tester includes a sample chamber mounted at the mouth of and connected by a small orifice to the test chamber, a helium mass spectrometer and a high-vacuum pump shown in the diagram. The test chamber is continuously evacuated, eliminating the necessity of vacuum cycling for each test, greatly simplifying the testing procedure.

In summary, the test consists of the following steps:

1. The devices, housed in open bottles, are pressurized with helium at 60 psig for at least 2 hours.
2. Immediately after pressurization, the bottles containing the devices are closed.
3. A particular device to be tested is removed from its bottle and placed into the sample chamber, which is then immediately closed with the rubber stopper. A high-vacuum pump continuously evacuates the test chamber through the helium mass spectrometer. The orifice at the bottom of the sample chamber limits gas flow so that the gas pressure within the test chamber remains at approximately 0.01 micron, even though the pressure within the sample chamber is atmospheric. Helium gas will diffuse out of the device into the sample chamber. The resulting helium and air mixture will flow through the orifice into the mass spectrometer, where the helium leak rate is measured.
4. After gross leak testing is completed, the device is removed from the sample chamber, which is then purged with nitrogen gas in readiness for the next gross-leak test.

Fine-leak testing of the device should be done after gross-leak testing. This may be accomplished by merely inserting the device into the test chamber (without using a sample chamber). The mouth of the test chamber is then sealed with a cap and the helium leak test is conducted in the conventional manner. It is not necessary to repressurize the device with helium. Also, only those devices that do not show gross leaks should be subjected to the fine-leak test. Because of the testing range of the gross-leak test, this test might be the *only* one required for many applications.

Notes:

Details may be obtained from:
Clearinghouse for Federal Scientific
and Technical Information
Springfield, Virginia 22151
Price $3.00
Reference: B68-10562

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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Category 01