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Acoustic microscopy for nonhermetic encapsulated electronic components

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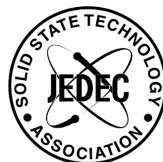

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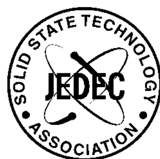

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ACOUSTIC MICROSCOPY FOR NONHERMETIC ENCAPSULATED ELECTRONIC COMPONENTS

FOREWORD

A PAS is a technical specification not fulfilling the requirements for a standard, but made available to the public and established in an organization operating under given procedures.

IEC-PAS 62191 was submitted by JEDEC and has been processed by IEC technical committee 47: Semiconductor devices.

The text of this PAS is based on the following document:	This PAS was approved for publication by the P-members of the committee concerned as indicated in the following document:
Draft PAS	**Report on voting**
47/1476/PAS	47/1512/RVD

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ACOUSTIC MICROSCOPY FOR NONHERMETIC ENCAPSULATED ELECTRONIC COMPONENTS

(From JEDEC Board Ballot JCB-98-99, under the cognizance of the JC-14.1 Committee on Reliability Test Methods for Packaged Devices an with the IPC.)

1 Scope

This test method defines the procedures for performing acoustic microscopy on nonhermetic encapsulated electronic components. This method provides users with an acoustic microscopy process flow for detecting anomalies (delamination, cracks, mold compound voids, etc.) nondestructively in plastic packages while achieving reproducibility.

2 Definitions

2.1 A-mode

Acoustic data collected at the smallest X-Y-Z region defined by the limitations of the given acoustic microscope. An A-mode display contains amplitude and phase/polarity information as a function of time of flight at a single point in the X-Y plane. See Figure 1 - Example of A-mode Display.

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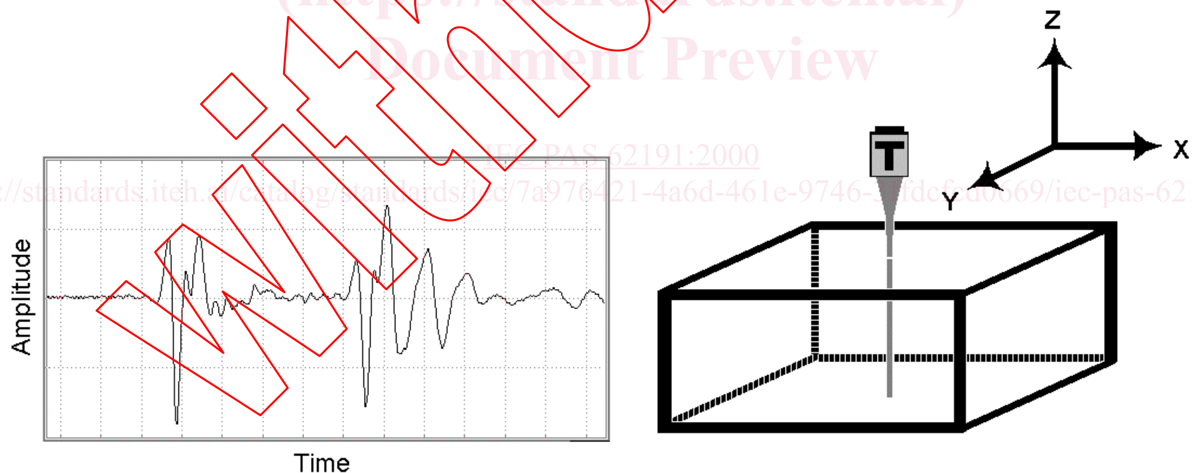

Figure 1 — Example of A-mode Display

2.2 B-mode

Acoustic data collected along an X-Z or Y-Z plane versus depth using a reflective acoustic microscope. A B-mode scan contains amplitude and phase/polarity information as a function of time of flight at each point along the scan line. A B-mode scan furnishes a two-dimensional (cross-sectional) description along a scan line (X or Y). See Figure 2 - Example of B-mode Display.

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2.2 B-mode (cont'd)

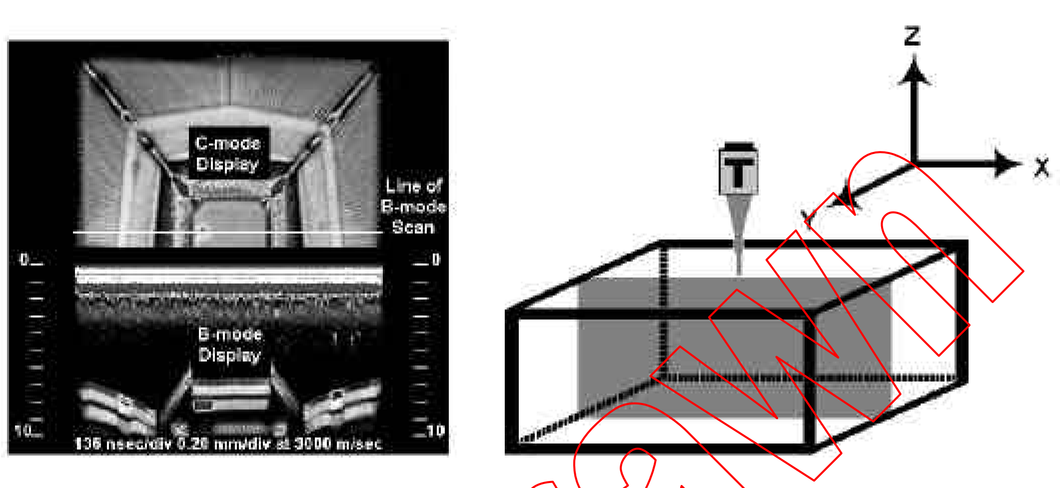

Figure 2 — Example of B-mode Display (bottom half of picture on left)

2.3 Back-Side Substrate View Area (Refer to Annex A, Type IV)

The interface between the encapsulant and the back of the substrate within the outer edges of the substrate surface.

2.4 C-mode

Acoustic data collected in an X-Y plane at depth (Z) using a reflective acoustic microscope. A C-mode scan contains amplitude and phase/polarity information at each point in the scan plane. A C-mode scan furnishes a two-dimensional (area) image of echoes arising from reflections at a particular depth (Z). See Figure 3.

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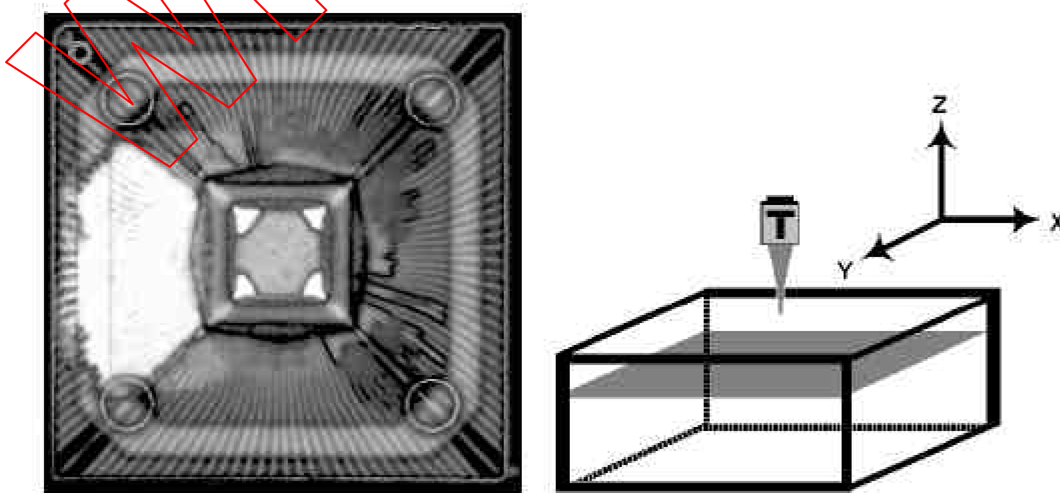

Figure 3 — Example of C-mode Display

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2.5 Through Transmission Mode

Acoustic data collected in an X-Y plane throughout the depth (Z) using a through transmission acoustic microscope. A Through Transmission mode scan contains only amplitude information at each point in the scan plane. A Through Transmission scan furnishes a two-dimensional (area) image of transmitted ultrasound through the complete thickness/depth (Z) of the sample/component. See Figure 4 – Example of Through Transmission Display.

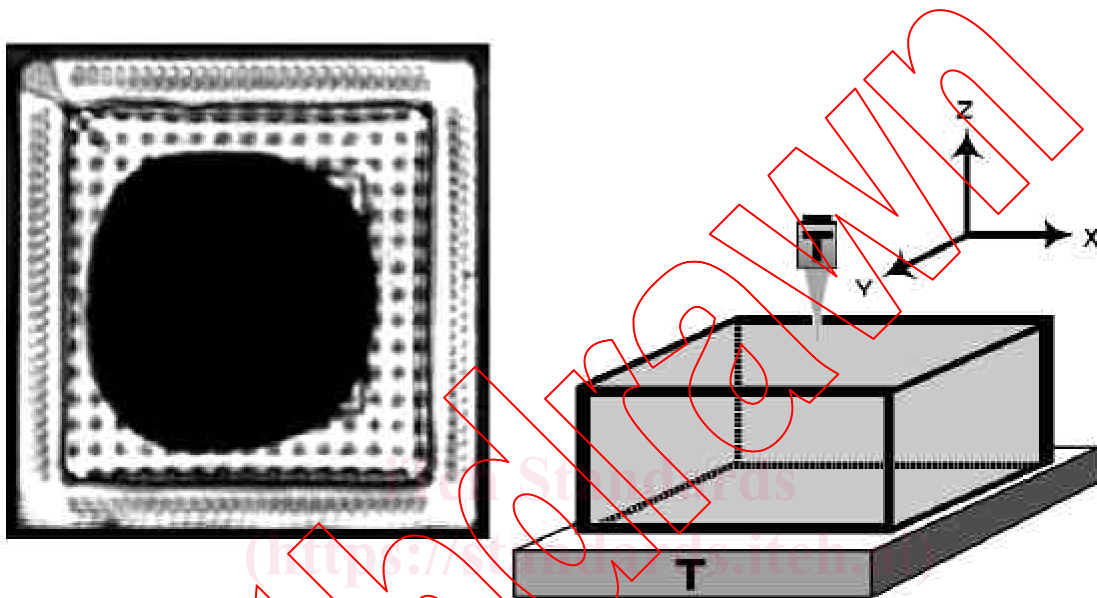

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Figure 4 — Example of Through Transmission Display

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2.6 Die Attach View Area (Refer to Annex A, Type II)

The interface between the die and the die attach adhesive and/or the die attach adhesive and the die attach substrate.

2.7 Die Surface View Area (Refer to Annex A, Type I)

The interface between the encapsulant and the active side of the die.

2.8 Focal Length (FL)

The distance in water at which a transducer's spot size is at a minimum.

2.9 Focus Plane

The X-Y plane at a depth (Z), which the amplitude of the acoustic signal is maximized.

2.10 Leadframe (L/F) View Area (Refer to Annex A, Type V)

The imaged area which extends from the outer L/F edges of the package to the L/F "tips" (wedge bond/stitch bond region of the innermost portion of the L/F.)

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2.11 Reflective Acoustic Microscope

An acoustic microscope that uses one transducer as both the pulser and receiver. (This is also known as a pulse/echo system.) See Figure 5 - Diagram of a Reflective Acoustic Microscope.

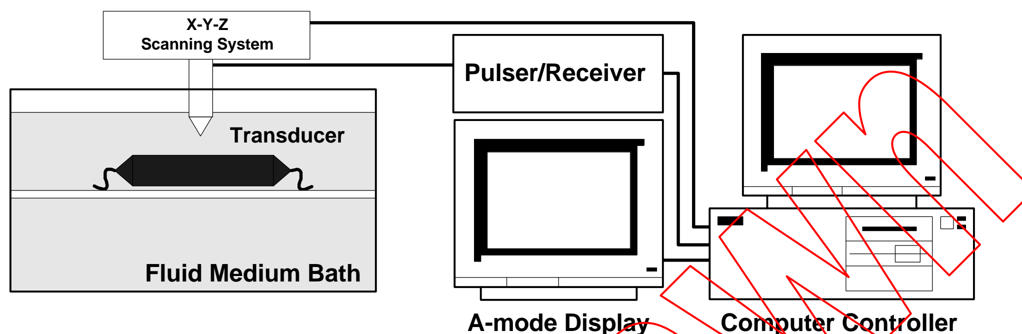

Figure 5 — Diagram of a Reflective Acoustic Microscope System

2.12 Through Transmission Acoustic Microscope

An acoustic microscope that transmits ultrasound completely through the sample from a sending transducer to a receiver on the opposite side. See Figure 6 - Diagram of a Through Transmission Acoustic Microscope System.

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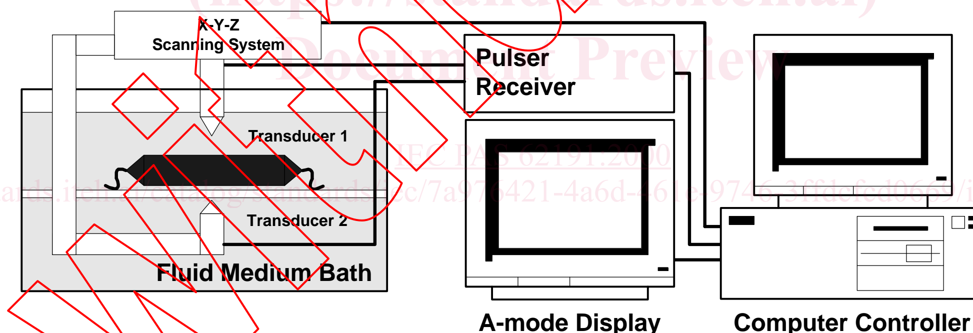

Figure 6 — Diagram of a Through Transmission Acoustic Microscope System

2.13 Time-of-Flight (TOF)

a) In reflective mode, the time of flight is the time it takes for the acoustic pulse to travel from a single transducer/receiver to the interface of interest and back.

b) In through transmission mode, the time of flight is the time it takes for the acoustic pulse to travel from the sending transducer through the sample to the receiving transducer.

2.14 Top-Side Die Attach Substrate View Area (Refer to Annex A, Type III)

The interface between the encapsulant and the die side of the die attach substrate surrounding the die.