UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

NICHIA CORPORATION,

Petitioner

v.

DOCUMENT SECURITY SYSTEMS, INC.,

Patent Owner

Case No. IPR2018-01166
Patent 7,256,486

PETITIONER'S DEMONSTRATIVE EXHIBITS

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Nichia Corporation

v.

Document Security Systems, Inc.

IPR2018-01166 (U.S. Patent No. 7,256,486)

ORAL ARGUMENT – AUGUST 28, 2019

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U.S. PATENT NO. 7,256,486

(12) **United States Patent**
Lee et al.

(10) **Patent No.: US 7,256,486 B2**
(45) **Date of Patent: Aug. 14, 2007**

(54) PACKAGING DEVICE FOR SEMICONDUCTOR DIE, SEMICONDUCTOR DEVICE INCORPORATING SAME AND METHOD OF MAKING SAME

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(73) Assignee: **Avago Technologies ECBU IP (Singapore) Pte. Ltd.**, Singapore (SG)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **10/608,605**

(22) Filed: **Jun. 27, 2003**

(65) **Prior Publication Data**

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(51) **Int. Cl.**
H01L 29/22 (2006.01)

(52) **U.S. Cl.** **257/690**; 257/784; 257/690

(58) **Field of Classification Search** 257/690, 257/784, 700, 689, 774, 783, 99, 100; 361/707, 361/718, 719, 706, 717, 720
See application file for complete search history.

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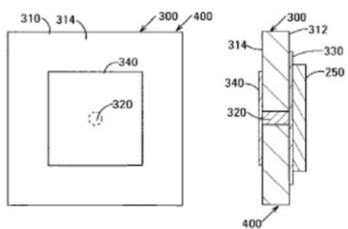
Primary Examiner—Sara Crane

(57) **ABSTRACT**

The packaging device includes a substrate, a mounting pad, a connecting pad and an interconnecting element. The substrate is substantially planar and has opposed major surfaces. The mounting pad is conductive and is located on one of the major surfaces. The connecting pad is conductive and is located on the other of the major surfaces. The conductive interconnecting element extends through the substrate and electrically interconnects the mounting pad and the connecting pad. The packaging device has a volume that is only a few times that of the semiconductor die and can be fabricated from materials that can withstand high-temperature die attach processes. The packaging device can be configured as the only packaging device used in the semiconductor device or as a submount for a semiconductor die that requires a high-temperature die attach process.

6 Claims, 8 Drawing Sheets



Patent No.: US 7,256,486 B2

PACKAGING DEVICE FOR SEMICONDUCTOR DIE, SEMICONDUCTOR DEVICE INCORPORATING SAME AND METHOD OF MAKING SAME

Filed: Jun. 27, 2003

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CLAIMS 1-6 ARE UNPATENTABLE

Claims	Prior Art Grounds
1-3	• Obvious over Nakajima in view of Weeks, Kish, or Edmond • Obvious over Rohm in view of Weeks, Kish, or Edmond • Obvious over Matsushita in view of Weeks, Kish, or Edmond
4-5	• Obvious over Nakajima in view of Weeks, Kish, or Edmond • Obvious over Rohm in view of Weeks, Kish, or Edmond, in further view of Nakajima • Obvious over Matsushita in view of Weeks, Kish, or Edmond, in further view of Nakajima
6	• Obvious over Nakajima in view of Weeks, Kish, or Edmond, in further view of Jochym • Obvious over Rohm in view of Weeks, Kish, or Edmond, in further view of Nakajima and Jochym • Obvious over Matsushita in view of Weeks, Kish, or Edmond, in further view of Nakajima and Jochym

Paper 2 (Pet.) at 4-6

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CLAIMS 1-6

1. A semiconductor device, comprising:
a substantially planar substrate having opposed major surfaces;
an electrically conductive mounting pad located on one of the major surfaces of the substrate;
a light emitting diode (LED) having a metallized bottom major surface that is mounted on the electrically conductive mounting pad, the metallized bottom major surface comprising one of an anode and a cathode of the LED;
a first electrically conductive connecting pad located on the other of the major surfaces of the substrate; and
a first electrically conductive interconnecting element extending through the substrate and electrically interconnecting the mounting pad and the first electrically conductive connecting pad.

2. The semiconductor device of claim **1**, further comprising:
an electrically conductive bonding pad located on the one of the major surfaces of the substrate;
a bonding wire extending between a metallized top major surface of the LED and the electrically conductive bonding pad;
a second electrically conductive connecting pad located on the other of the major surfaces of the substrate; and
a second electrically conductive interconnecting element extending through the substrate and electrically interconnecting the bonding pad and the second connecting pad.

3. The semiconductor device of claim **2** wherein the metallized top major surface comprises a first electrode of the LED and the metallized bottom major surface comprises a second electrode of the LED.

4. The semiconductor device of claim **1** wherein the first electrically conductive interconnecting element is selected to withstand an operating temperature when the LED is mounted on the electrically conductive mounting pad and to provide a low-resistance electrical connection between the mounting pad and the first electrically conductive connecting pad.

5. The semiconductor device of claim **4**, wherein the first electrically conductive interconnecting element comprises tungsten.

6. The semiconductor device of claim **4**, wherein the first electrically conductive interconnecting element comprises a slug of electrically conductive material, the slug having a diameter selected to press-fit the slug into a through hole located in the substrate between the mounting pad and the first electrically conductive connecting pad.

Ex. 1001 ('486 Patent), claims 1-6

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