

Petition for *Inter Partes* Review of U.S. Patent No 9,412,913
Claims 1-4 and 6

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO. LTD., AND
SAMSUNG ELECTRONICS AMERICA, INC.
Petitioner

v.

SINOTECHNIX LLC
Patent Owner

Case IPR2025-00334

PETITION FOR *INTER PARTES* REVIEW OF
U.S. PATENT NO. 9,412,913

CHALLENGING CLAIMS 1–4 AND 6
UNDER 35 U.S.C. § 312 AND 37 C.F.R. § 42.104

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Claims 1-4 and 6

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PETITIONER’S EXHIBIT LIST

Petitioner Exhibit No.	DESCRIPTION
1001	U.S. Patent No. 9,412,913 (“’913 Patent”)
1002	Declaration of Dr. Ioannis Kymissis
1003	U.S. Patent Publication No. 2004/0000727 (“Hsu”)
1004	Certified Translation of Japanese Patent Publication No. 2006-005281 (“Iwamasa”)
1005	U.S. Patent Publication No. 2007/0252250 (“Hui”)
1006	U.S. Patent Publication No. 2005/0280017 (“Oshio”)
1007	Certified Translation of Japanese Patent Publication No. 2007-134376 (“Takasaki”)
1008	File History of U.S. Patent No. 9,412,913
1009	U.S. Patent Publication No. 2005/0151149 (“Chia”)
1010	File History of U.S. Patent No. 8,963,196
1011	File History of U.S. Patent No. 8,659,050
1012	File History of U.S. Patent No. 8,319,248
1013	Docket Control Order in <i>Sinotechnix LLC v. Samsung Electronics et al.</i> , 2:24-cv-544-JRG-RSP
1014	Judicial Caseload For Eastern District of Texas
1015	Judge Gilstrap’s Case Schedule (May 4, 2026)

*All annotations, highlights, coloring, italics, and bolding throughout the Petition have been added unless indicated otherwise.

CLAIM LISTING

Claim 1

[1Pre] A light emitting diode (LED) package, comprising:

[1A] a first lead frame and a second lead frame separated from each other;

[1B] an LED chip disposed on the first lead frame and electrically connected with second lead frame; and

[1C] a resin covering at least portions of surfaces of the first and second lead frames, wherein:

[1D] at least one of the first and second lead frames comprises resin-holding components disposed along adjacent sides of one of the first and second lead frames, the resin-holding components being separated from each other at corners of the adjacent sides; and

[1E] the resin-holding components are disposed on two adjacent sides of each of the first lead frame and the second lead frame.

Claim 2

[2] The LED package of claim 1, wherein the resin-holding components comprise at least one hole.

Claim 3

[3] The LED package of claim 2, wherein the hole is filled with the resin to increase the bonding force between the resin and the lead frames.

Claim 4

[4] The LED package of claim 1, wherein the resin-holding components are disposed on three sides of at least one of the first and second lead frames.

Claim 6

[6Pre] A light emitting diode (LED) package, comprising:

[6A] a first lead frame and a second lead frame separated from each other;

[6B] an LED chip disposed on the first lead frame and electrically connected with second lead frame; and

[6C] a resin covering at least portions of surfaces of the first and second lead frames, wherein:

[6D] at least one of the first and second lead frames comprises resin-holding components disposed along adjacent sides of one of the first and second lead frames, the resin-holding components being separated from each other at corners of the adjacent sides; and

[6E] the first and the second lead frames comprise opposing sides facing each other, and the resin-holding components are disposed on the opposing sides.

I. Introduction

Samsung Electronics Co. Ltd. and Samsung Electronics America, Inc. collectively the “Petitioner,” requests *inter partes* review of Claims 1–4 and 6 of U.S. Patent No. 9,412,913 (the “’913 Patent”) (EX1001).

II. Mandatory Notices

A. Real Parties-In-Interest

Petitioner identifies itself as a real party-in-interest (“RPI”).

B. Related Matters

The ’913 Patent is currently asserted against Petitioner by Patent Owner in *Sinotechnix LLC v. Samsung Electronics Co., Ltd. et al.*, No. 2:24-cv-00544 (EDTX) (“Litigation”). Petitioner filed *inter partes* review of U.S. Patent Nos. 8,132,952 (IPR2025-00335), 7,748,873 (IPR2025-00333), 7,901,113 (IPR2025-00336), 7,618,162 (IPR2025-00331), and 7,951,626 (IPR2025-00332), each of which is being asserted against Petitioner in the Litigation.

C. Counsel

Petitioner is filing a Power of Attorney appointing the practitioners associated with Customer Number 132,593. Petitioner designates the following lead and back-up counsels:

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III. Fees

Petitioner is concurrently electronically submitting the required fees for this Petition. The Board is authorized to charge Desmarais LLP's deposit account, No. 50-6822, for any fee deficiency.

IV. Certification Of Grounds For Standing

Petitioner certifies that the '913 Patent is available for *inter partes* review and that Petitioner is not estopped or barred from requesting this *inter partes* review.

V. Identification Of Challenge And Relief Requested

Under 37 C.F.R. §§42.22(a)(1) and 42.104(b)(1)–(2), Petitioner requests cancellation of claims 1–4 and 6 (“Challenged Claims”) of the '913 Patent.

A. Identification Of Prior Art

The '913 Patent is a continuation of U.S. Patent No. 8,963,196, filed on January 22, 2014, which is a continuation of U.S. Patent No. 8,659,050, filed on September 28, 2012, which is a continuation of U.S. Patent No. 8,319,248, filed on June 2, 2010, which is a national stage application of International Application No. PCT/KR2008/006777, filed on November 18, 2008, which claims priority to Korean Patent Application No. 10-2007-0214469, filed December 3, 2007. Accordingly, this Petition applies pre-AIA provisions of 35 U.S.C. §§ 102 and 103.

The following references are pertinent to the grounds of unpatentability explained below:

1. U.S. Patent Publication No. 2004/0000727 (“Hsu”) (EX1003), published on January 1, 2004, is prior art under at least 35 U.S.C. §§ 102(a), (b), and (e).
2. Japanese Patent Publication No. 2006-005281 (“Iwamasa”) (EX1004),

published on January 5, 2006, is prior art under at least 35 U.S.C. §§ 102(a) and (b).

3. U.S. Patent Publication No. 2007/0252250 (“Hui”) (EX1005), published on November 1, 2007, is prior art under at least 35 U.S.C. §§ 102(a) and (e).

4. U.S. Patent Publication No. 2005/0280017 (“Oshio”) (EX1006), published on December 22, 2005, is prior art under at least 35 U.S.C. §§ 102(a), (b), and (e).

5. Japanese Patent Publication No. 2007-134376 (“Takasaki”) (EX1007), published on May 31, 2007, is prior art under at least 35 U.S.C. §102(a).

B. Grounds for Challenge

Petitioner requests cancellation of claims 1–4 and 6 of the ’913 Patent under 35 U.S.C. §102 and §103¹ based on the following Grounds.

Ground	35 U.S.C.	Claims	Prior Art References
I	§103	1–4, 6	Hsu, Iwamasa
II	§103	1–4, 6	Hsu, Iwamasa, Hui
III	§102	1–4, 6	Oshio
IV	§103	1–4, 6	Oshio, Hui
V	§102	1–4	Takasaki

This Petition, supported by the declaration of Dr. Kymissis (EX1002),

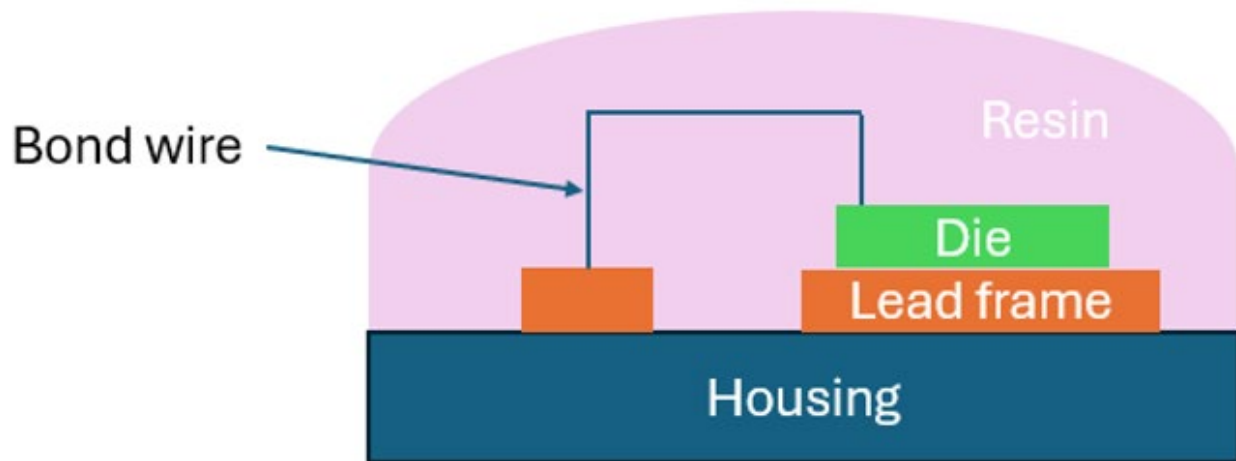
¹ Petitioner reserves the right to challenge the patentability of the claims under 35 U.S.C. §112 in other proceedings.

demonstrates that there is a reasonable likelihood that Petitioner would prevail with respect to at least one Challenged Claim. *See* 35 U.S.C. § 314(a). Petitioner respectfully requests institution.

VI. Technology Background

A. Light Emitting Diode (“LED”) Packages

A light emitting diode (“LED”) “emits light through recombination of electrons and holes by application of an electric current.” EX1001, 1:29–30. Such an LED “chip” is enclosed in a structure called an LED package. *See* EX1001, 1:30–32. One type of LED package, such as the schematic shown below, utilizes structures called lead frames to provide electric current to the LED chip. *See* EX1001, 1:32–36. “The lead frame type LED package has a structure wherein a cavity of a housing for supporting a lead frame is filled with an encapsulation material, with the LED chip positioned in the cavity of the housing.” EX1001, 1:36–39. EX1002, ¶35.



There are a few practical considerations associated with designing such LED packages. For example, the resin can undergo “a yellowing phenomenon by energy generated from the LED chip emitting light.” EX1001, 1:56–58. Moreover, as heat is generated during operation, the resin can detach, causing failure. Even further, certain LED packages require small dimensions, which may further exacerbate the heating and delamination problem. *See* EX1001, 1:43–45 (“For the lead frame type LED package, the housing supporting the lead frame has an excessive thickness, which make it difficult to fabricate a thin lead frame type LED package.”). EX1002, ¶¶36–37.

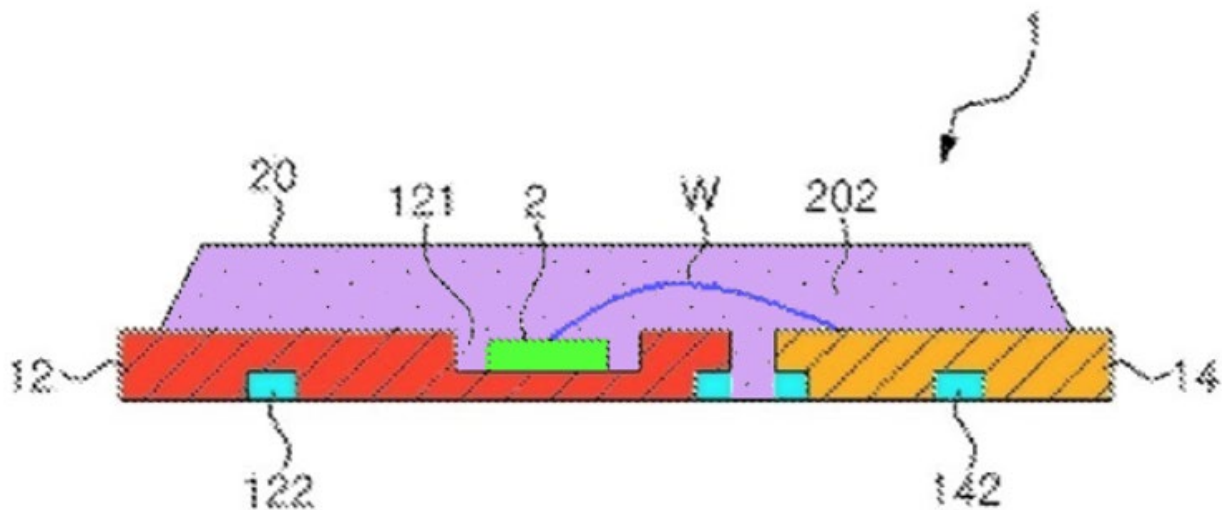
VII. Overview Of The '913 Patent

A. Purported Invention

The '913 Patent purports to solve these problems associated with resin delamination. The '913 Patent relates to a “slim LED package that is configured to

allow a transparent encapsulation material to directly support a lead frame.”
EX1001, 2:7–12. As shown below in Figure 2, the LED package includes a “**first**
[lead frame] and **second lead frame**” separated from each other; . . . an **LED chip**
mounted on a bottom surface of [a] chip mounting recess and connected with the
second lead frame via a **bonding wire**; and a transparent **encapsulation material**.”
EX1001, 2:13–24. EX1002, ¶¶38–40.

Fig. 2



EX1001, Fig. 2.

“The slim LED package may further include **openings** or **grooves** formed on an upper or lower surface of the **first** or **second lead frame** to increase a bonding force between the **first** or **second frames** and the **encapsulation material**.”
EX1001, 2:38–41. Figure 2 above shows four different **grooves 122, 142, and two unlabeled ones** on the lower surface of the **first** and **second lead frames**, “thereby

preventing separation of an interfacial surface between the **encapsulation material** and the **lead frames**.” EX1001, 3:16–21. EX1002, ¶41.

B. Prosecution History

The '913 Patent originated from U.S. Patent Application No. 14,624,172 (“’172 Application”), filed February 17, 2015. The '172 Application is a continuation of U.S. Patent Application No. 14/161,377 (“’377 Application”), filed on January 22, 2014, which is a continuation of U.S. Patent Application No. 13/631,060, filed on September 28, 2012, which is a continuation application of U.S. Patent Application No. 12/745,878, filed as PCT Application No. PCT/KR2008/006777, filed on November 18, 2008. The PCT application claims priority to Korean Patent Application No. 10-2007-0124469, filed on December 3, 2007. EX1001, Cover. EX1008. EX1010–EX1012. EX1002, ¶¶42–43.

The '172 Application originally included claims 1–14. EX1008, 33–35. Independent claims 1 and 10 were both directed to a “light emitting diode (LED) package.” EX1008, 33-34. In particular, claim 4 recited “wherein the two adjacent sides of each of the first lead frame and the second lead frame form a vertex, and the bond force-increasing components disposed on the two adjacent sides of the first and second lead frames are separated from each other around the vertex of each of the first lead frame and the second lead frame.” EX1008, 33. EX1002, ¶44.

In an Office Action dated July 9, 2015, the Examiner objected to claims 1–14

noting that “the limitation ‘bond force-increasing components’, is confusing” and “the limitation ‘vertex’ is confusing.” EX1008, 79. The Examiner also rejected claims 1–14 as being anticipated by U.S. Patent Publication No. 2005/051149 (“Chia”). EX1008, 79–83. EX1002, ¶45.

In response to the Office Action, Applicant, *inter alia*: (1) amended claim 1 to recite “~~bond force-increasing~~ resin-holding components disposed ~~on at least a portion of at least one side of the lead frame~~ along at least two sides of the at least one of the first and second lead frames and are separated from each other at an area where the sides meet”; (2) canceled original claim 4; and (3) amended claim 10 to replace “~~one or more bond force-increasing components~~” with “a circular hole”; and (4) argued that Chia does not teach the claims as amended. EX1008, 110–116. EX1002, ¶46.

In an Office Action dated November 5, 2015, the Examiner maintained the anticipation rejection over Chia for claims 1, 3, 5–9, and 12 and rejected claims 10, 11, 13, and 14 as being obvious over Chia and U.S. Patent Publication No. 2005/0280017 (“Oshio”). EX1008, 120–128. EX1002, ¶47.

In response to the Office Action, Applicant, *inter alia*: (1) amended claim 1 to recite “wherein at least one of the first and second lead frames comprises ~~one or more~~ resin-holding components disposed ~~along at least two~~ adjacent sides of ~~the at least one of the first and second lead frames, and are~~ the resin-holding components

being separated from each other at an area where the sides meet corners of the adjacent sides” to argue that Chia does not teach the claims as amended; and (2) canceled claims 10, 11, 13, and 14 to argue that the rejection based on Chia and Oshio is moot. EX1008, 134–140. EX1002, ¶48.

On January 15, 2016, the Examiner issued an Advisory Action noting that the arguments “appear[] to overcome the prior art.” EX1008, 146–149. But after a Request for Continued Examination was filed on January 25, 2016, the Examiner entered another Office Action dated February 22, 2016, rejecting claims 1 and 8 as being anticipated by Chia and claims 1, 3, and 7, and as being anticipated by U.S. Patent Publication No. 2015/0091040 (“Kobayakawa”). EX1008, 165. The Examiner noted that claims 5, 6, and 9 contain allowable subject matter. EX1002, ¶¶49–50.

In response to the Office Action, Applicant: (1) amended claim 1 to further recite “the resin-holding components are disposed on two adjacent sides of each of the first lead frame and the second lead frame”; and (2) amended claim 7 to be an independent claim. EX1008, 182–188. EX1002, ¶51.

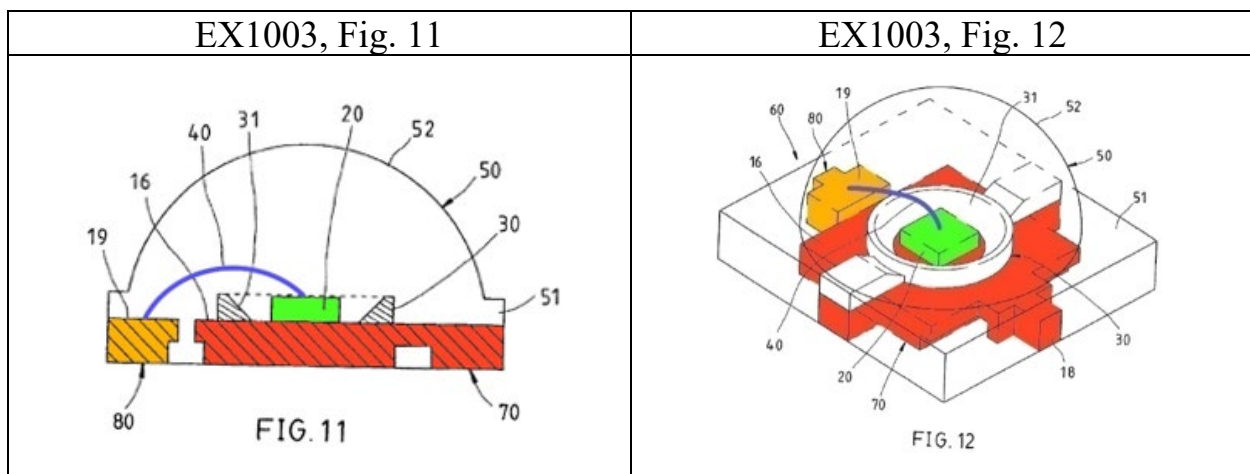
A Notice of Allowance was mailed on May 4, 2016, which stated that “one of the lead frames has resin-holding components disposed along adjacent sides which are separated for [sic] each other at corners of the sides, and the resin-holding components are disposed on two adjacent sides of both the first and second lead

frames.” EX1008, 213. The ’913 Patent issued on August 9, 2016. EX1008, 243.
EX1002, ¶¶52–53.

VIII. Overview Of Prior Art References

A. Hsu (EX1003)

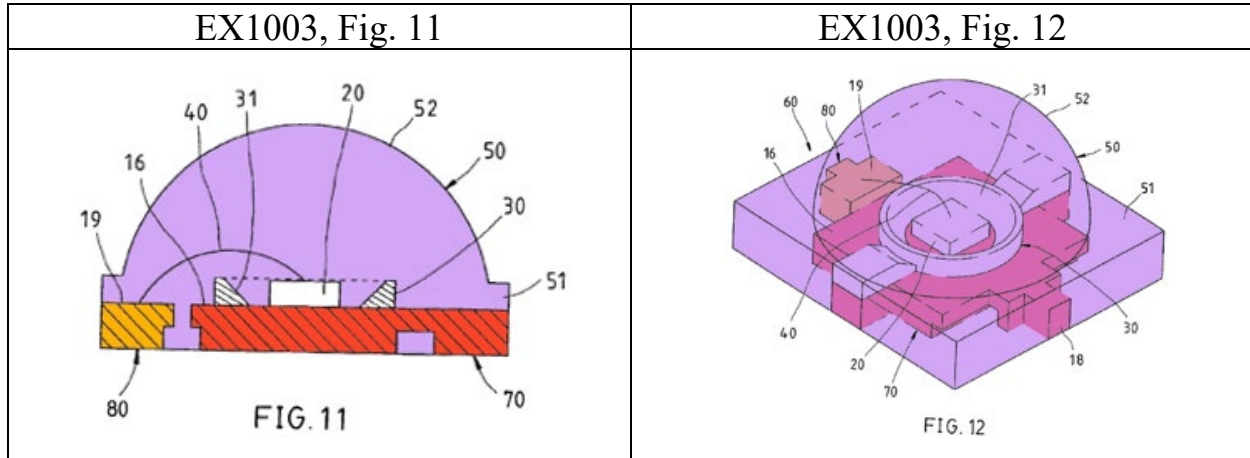
Hsu describes an “LED package.” EX1003, Title. As shown in Figures 11 and 12 below, “LED 60 package . . . includes a first terminal 70” and “a second terminal 80.” EX1003, [0025]. The “platelike first terminal [is] made of an electrically conductive metal” and the “second terminal [is] made of the electrically conductive metal and located at a side of said first terminal and spaced apart from said first terminal with a predetermined space.” EX1003, Claim 6. “The first terminal 70 is formed by the main plate 16, the extending arm 18 located at a right side of the main plate 16, and the bridges 17 [not labeled in Figure 12] respectively located at upper and lower sides of the main plates 16.... The second terminal 80[] is the separate arm 19.”, EX1003, [0025]. EX1002, ¶¶58–60.



Hsu describes that that “the LED 60 package . . . structurally includes . . . the **LED die 20**.” EX1003, [0025]. The “**LED die 20** has a bottom, which is smoothly bonded to a top surface of the main plate 16 of the **first terminal 70** such that an electrode at the bottom of the **LED die 20** is electrically connected to the **first terminal 70**.” EX1003, [0025]. EX1002, ¶61.

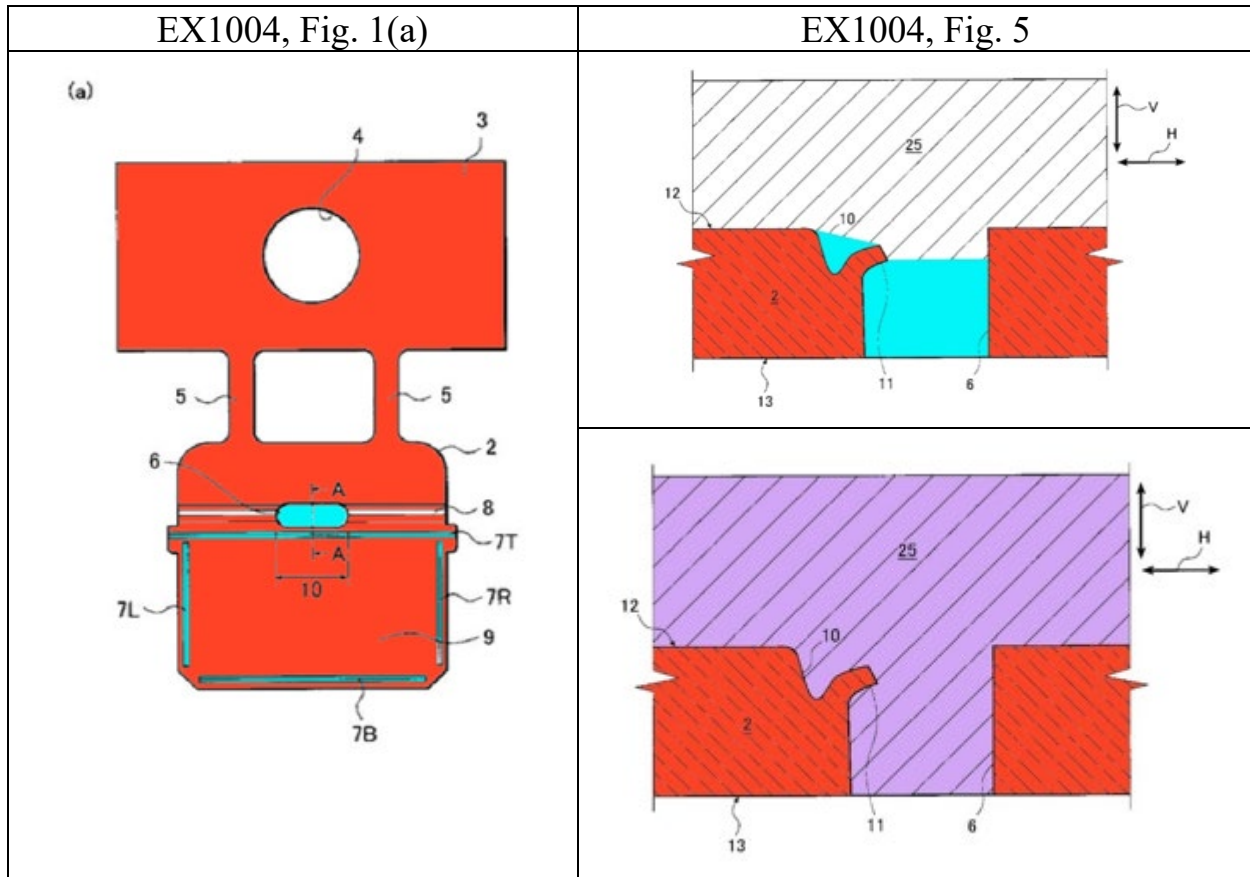
Hsu further teaches that a “**conductive wire 40** is connected between the other electrode of the top surface of the **die 20** and the top surface of the **second terminal 80**.” EX1003, [0025]. *See also, e.g., id.*, [0022] (“[C]onnect a top surface of the **die 20** to a top surface of the **separate arm 19** of the cell 11 with a gold conductive wire 40 of 99% Au by wire bonding technique such that the other electrode positioned on the top surface of the **die 20** can be electrically connected with the **separate arm 19**.”), [0005], Abstract, Claim 1, Claim 6. EX1002, ¶62.

Hsu additionally teaches, as shown in Figures 11 and 12 below, an “**encapsulant 50**, which material is [an] **insulated epoxy resin**” that “covers the top surface of the **first terminal 70** and the **second terminal 80** and fills the space therebetween to remain two terminals 70 and 80 spaced apart in opposite relationship.” EX1003, [0025]. *See also, e.g.,* EX1003, Abstract, [0005], [0023], Claim 1, Claim 6. EX1002, ¶63.



B. Iwamasa (EX1004)

Iwamasa describes “a **lead frame**, methods of manufacturing the same, and a **resin-sealed** semiconductor device.” EX1004, [0001]. As shown in Figures 1(a) and 5 below, Iwamasa teaches a **Base 2**, with “Die-Bonding Area 9 [] provided on the surface of **Base 2**.” EX1004, [0031]. “**Semiconductor Dies** . . . are die-bonded to Die-Bonding Area 9 of **Base 2**,” such that they are “electrically connected through **Base 2**”. EX1004, [0040]. EX1002, ¶¶64–67.

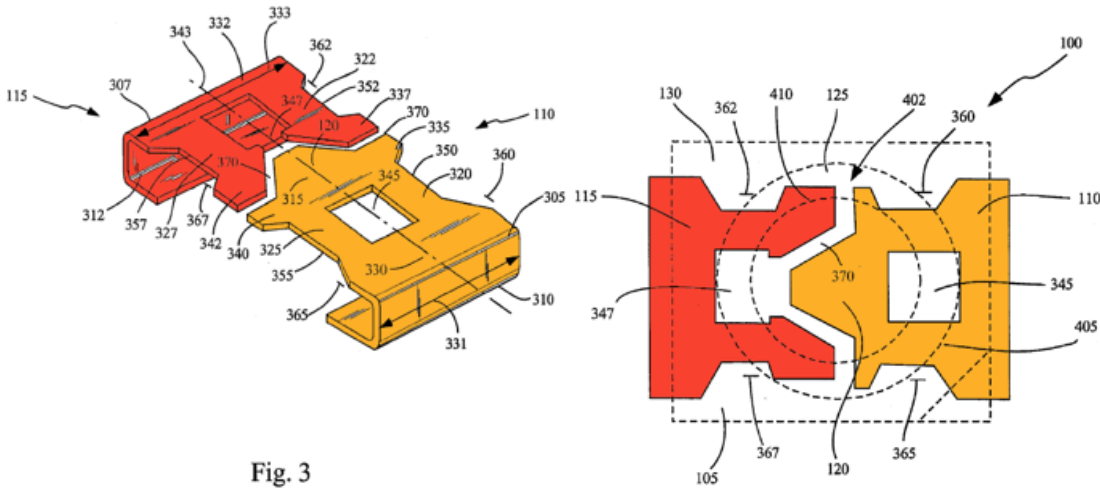


Iwamasa further teaches that a “**Through Hole 6** is provided adjacent to Die-Bonding Area 9.” EX1004, [0032]. Further, the top side of **Base 2** includes “**Grooves 7** (7T, 7L, 7R, and 7B),” where “**Groove 7** . . . consists of four **Straight Grooves**: 7T, 7L, 7R, and 7B.” EX1004, [0031]. Iwamasa describes that a “portion of the center of **Straight Groove 7T** is a **long groove 10** that separates Die-Bond Region 9 and **Through Hole 6**,” which creates “**Stopping Part 11** between **Long Groove 10** and **Through Hole 6** . . . thereby providing [an] anchoring effect of the sealing resin.” EX1004, [0032]. Further, the “**groove** is filled with the sealing **resin** during the resin-sealing process. Therefore, after **resin** sealing, the long **groove**

helps improve the bond strength and adhesion between the sealing **resin** and the **base**.” EX1004, [0019]. *See also, e.g.*, EX1004, [Means of Solving the Problems], [0040]. Similarly, Iwamasa teaches that “the seal **resin** and the **base** are joined also inside the **through hole**, [so] the bond strength and adhesion between the seal **resin** and the **base** are improved.” EX1004, [0009]. EX1002, ¶¶68–74.

C. Hui (EX1005)

Hui describes “surface mount devices used to mount electronic elements, such as ... a light emitting diode (LED)...” EX1005, [0018]. “FIG. 3 depicts an enlarged perspective view of the **first** and **second electrode 110, 115** without the casing 105 where the **first** and **second electrodes** are separated by an insulation gap 370.” EX1005, [0022]. “FIG. 4 depicts a partially transparent overhead view of the surface mount device 100.” EX1005, [0035]. The LED “is typically coupled with and/or supported by the **first electrode 110** at the chip carrier part 120. . . . Some implementations include the fill material that fills at least some of the recess 125 in the casing 105, and typically surrounds and/or covers the electronic element, the exposed portions of the **first** and **second electrodes 110, 115**, and the electrical connection(s) between the electronic element and the electrodes.” EX1005, [0037].



EX1005, Figs. 3, 4. EX1002, ¶120–22.

D. Oshio (EX1006)

Oshio describes “a semiconductor light emitting device.” EX1006, [0030]. As shown in Figures 1, 5A, 5B, and 12 below, Oshio teaches that “the semiconductor light emitting device . . . comprises a pair of **leads 20** and **30**” and that it “is desirable that the **leads 20** and **30** be supplied in the form of the so-called ‘lead frame’.” EX1006, [0049], [0084]. Oshio describes that an “**LED chip 10** is die bonded to the bottom face of the recess 20C of the **lead 20**” and the “electrode of the **LED chip 10** is connected to the other inner **lead section 30B** via **bonding wire 60**.” EX1006, [0061]. Oshio further teaches that an “**embedding resin 40** [is] formed to encompass **inner lead sections 20B** and **30B** of the **leads 20** and **30**.” EX1006, [0049].

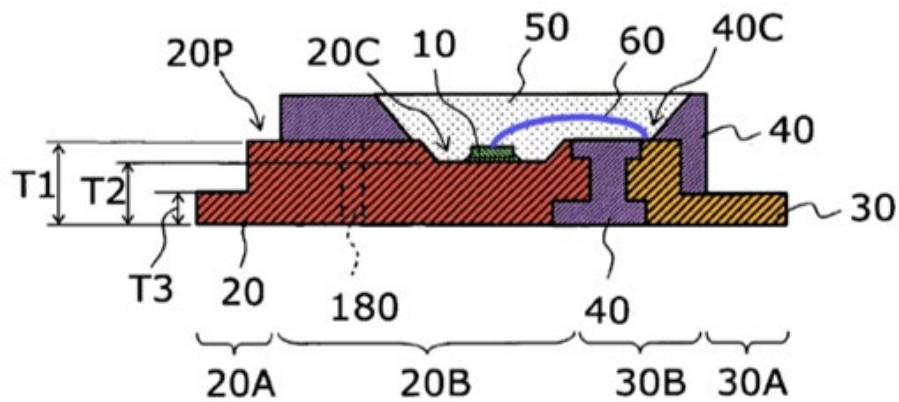
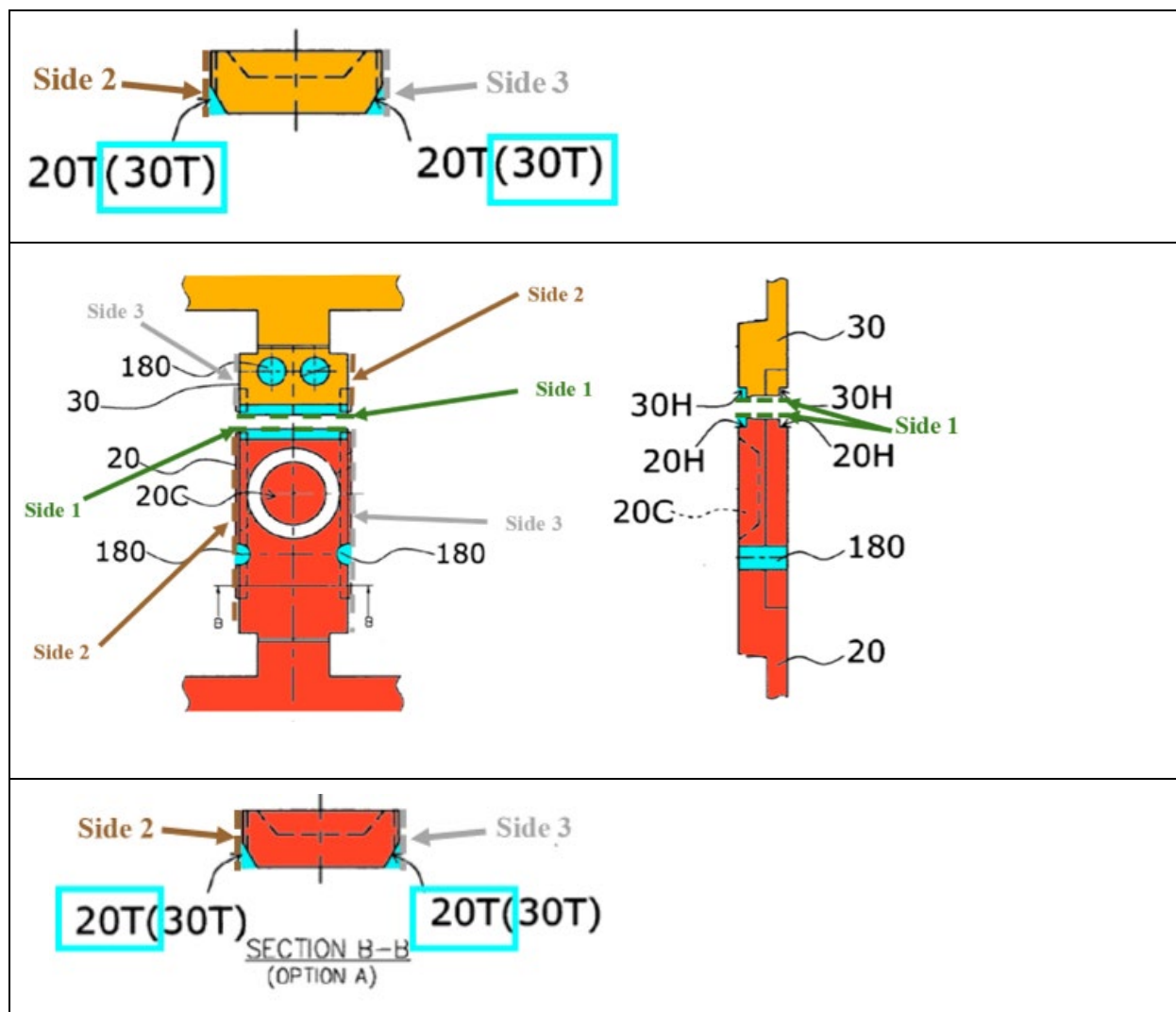


FIG. 1

EX1006, Fig. 1. EX1002, ¶¶135–38.

Additionally, as shown below in Figure 12, Oshio teaches that its **lead 20** and **lead 30** include multiple “**structure[s]**” for enhancing bonding strength between **leads 20, 30** and **resin 40**.” EX1006, [0034]. *See also, e.g.*, EX1006, [0076] (“It is therefore desirable to use a structure having increased bonding strength to avoid peeloff of **these leads** from the **embedding resin 40**.”), [0077].



EX1006, Fig. 12. EX1002, ¶¶139–40.

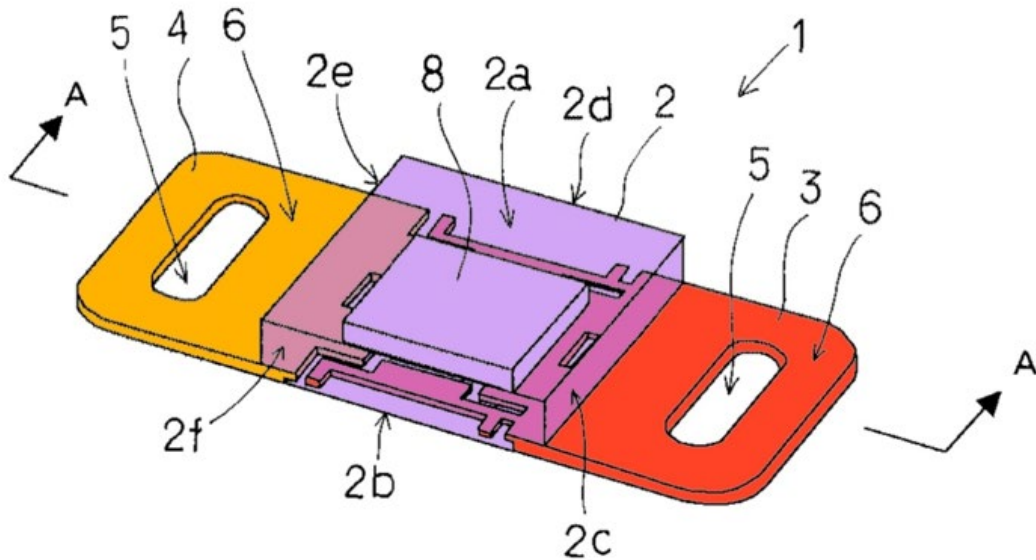
For example, Oshio teaches “**asperities 20H** and **30H** . . . provided at the tip of the inner lead sections of the **lead 20** and **30**,” respectively, “to improve ‘biting’ to the **resin 40**, so that the bonding strength can be enhanced.” EX1006, [0079]. “Furthermore, as shown as line A-A’ cross section in FIG. 5B,” Oshio teaches “a **tapered portion 20T (30T)** with its width decreasing toward the rear face may be provided on the sidewall of the **lead 20 (30)**” and explains that this “facilitates

supporting the **lead 20 (30)** with the **tapered portion 20T (30T)** obliquely from below, thereby preventing peeloff of the **resin 40**.” EX1006, [0080]. Oshio further teaches that “**anchor holes 180** are provided through the **lead 20 (30)** so that the **embedding resin 40** may fill in these **anchor holes 180**,” which “serves to reduce ‘loosening’ between the leads and the injection molded object and to increase adhesion strength and contact area, so that peeloff of the leads from the **resin 40** can be prevented.” EX1006, [0078]. *See also, e.g.*, EX1006, [0081] (“The **anchor holes 180**, **asperities 20H (30H)**, and **tapered portion 20T (30T)** described above . . . serve to reduce ‘loosening’ between the leads and the injection molded object and to increase adhesion strength and contact area, so that peeloff of the leads from the **resin 40** can be prevented.”), [0051], [0087]. EX1002, ¶¶141–44.

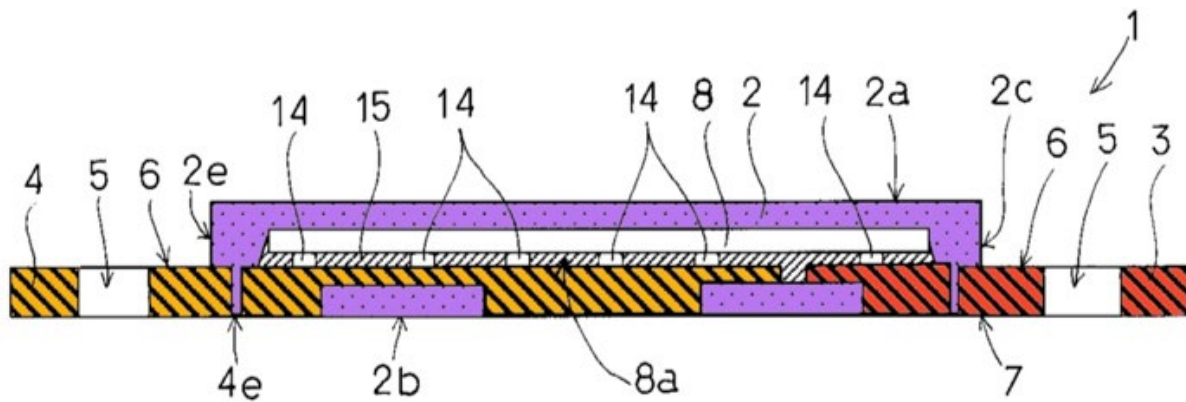
E. Takasaki (EX1007)

Takasaki teaches “a light emitting diode device that can be made thinner and a method for manufacturing the same.” EX1007, [0011]. As shown in Figures 1 and 2, Takasaki teaches that “the light emitting diode device 1” has “**a flat electrode plate (first electrode plate) 3 . . . and a flat electrode plate (second electrode plate) 4**” EX1007, [0056]. The “light emitting diode device has an **encapsulant** made of **transparent insulating resin** in which a yellow phosphor is dispersed” EX1007, [Means for solving the problems]. Takasaki teaches that the “**encapsulant 2** is configured to seal first surfaces 6 (upper surfaces in FIG. 1)

of the inner ends of a pair of **electrode plates 3 and 4** that are arranged in series and face each other.” EX1007, [0057]. EX1002, ¶¶183–86.



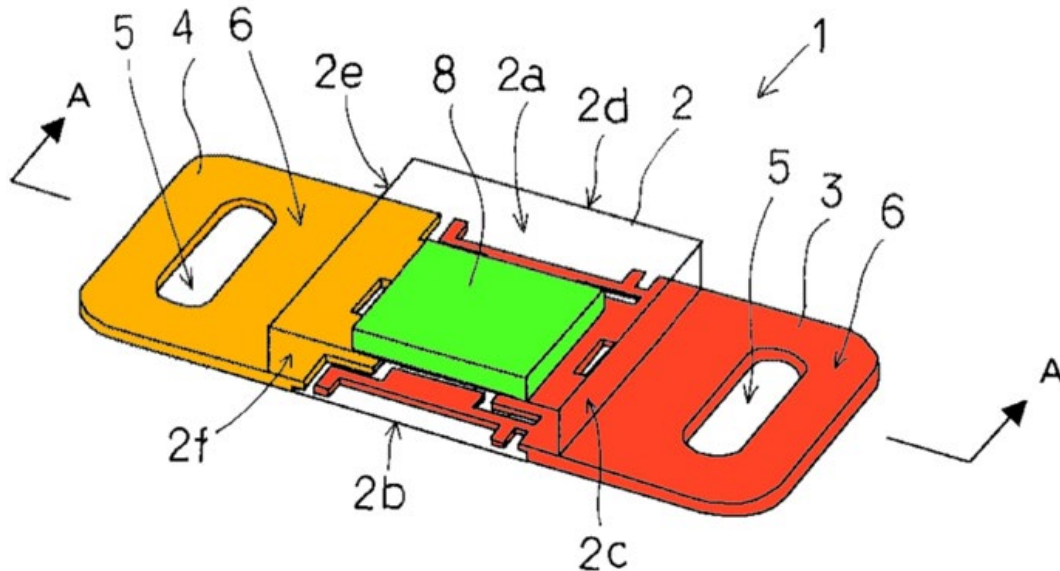
EX1007, Fig. 1.



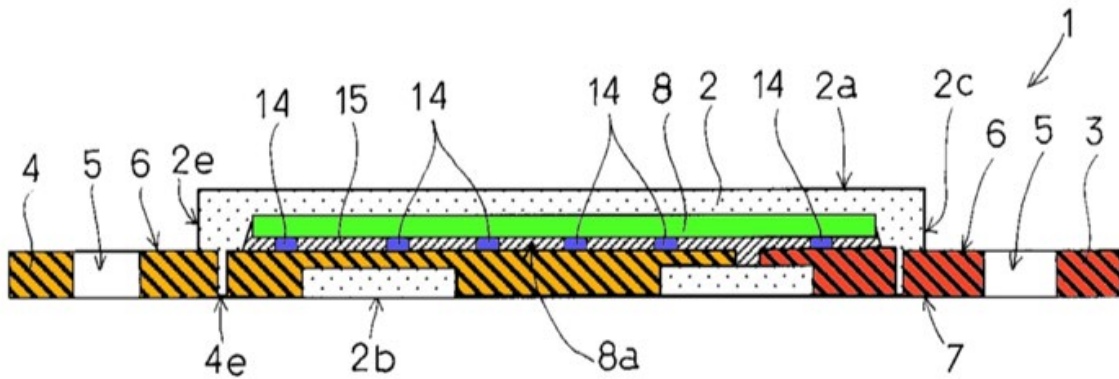
EX1007, Fig. 2.

As further shown in Figures 1 and 2 below, Takasaki teaches that a “**light emitting diode chip 8** that emits blue light [] located within the encapsulant 2.” EX1007, [0060]. The “**light emitting diode chip 8** is mounted on the first surface

6 (upper surface) of each of the **first** and **second electrode plates 3, 4** by flip chip connection.” EX1007, [0092]. Takasaki teaches, for example, that in “the **electrode plates 3, 4** . . . a plurality of lands 9 are formed on the first surface 6” which “correspond[] to bump electrodes 11 provided on the first surface 8a of the **light emitting diode chip 8**.” EX1007, [0061]. Additionally, Takasaki teaches that “the connection portion between the bump electrode 11 provided on the first surface 8a of the **light emitting diode chip 8** and the lands 9 (gold stud electrodes) of the first electrode plate 3 and the second electrode plate 4” form “**a connection portion 14**.” EX1007, [0064]. Takasaki further teaches that, alternatively, “instead of the bump electrodes, the connection may be made by using a paste material of Au-Sn or a ribbon (sheet).” EX1007, [0112]. EX1002, ¶¶187–89.

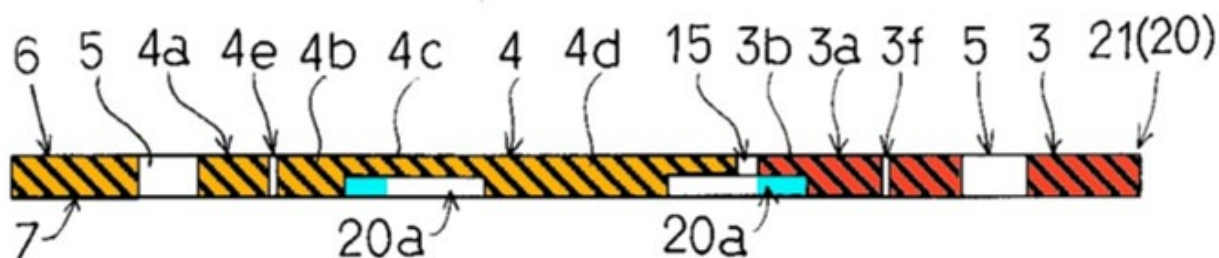


EX1007, Fig. 1.

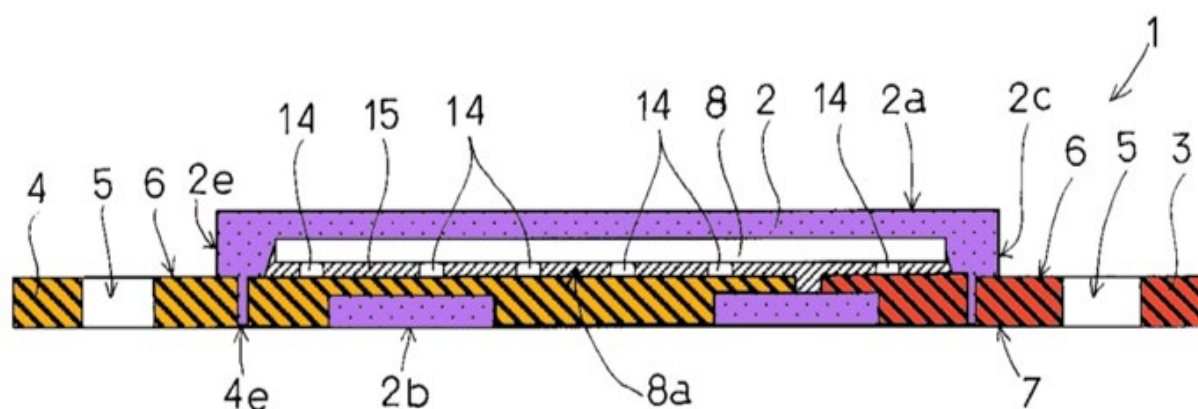


EX1007, Fig. 2.

Additionally, as shown in Figures 5(a) and 2 below, Takasaki teaches that “the **first electrode plate 3** and the **second electrode plate 4** are thinned by removing a predetermined depth from the second surface 7 side of the lead frame” with the removal “performed, for example, by etching (half etching).” EX1007, [0081]. The etching forms, for example, “**space 20a**” on the **first** and **second electrode plates 3, 4**. EX1007, [0081]. The **space 20a** formed on the **first** and **second electrode plates 3, 4** holds the **sealing body 2** formed of **resin**, thereby “making it difficult for the electrode plates (**first** and **second electrode plates 3, 4**) to peel off from the **sealing body**, and improving the reliability of the sealing.” EX1007, [0093]. EX1002, ¶¶190–92.

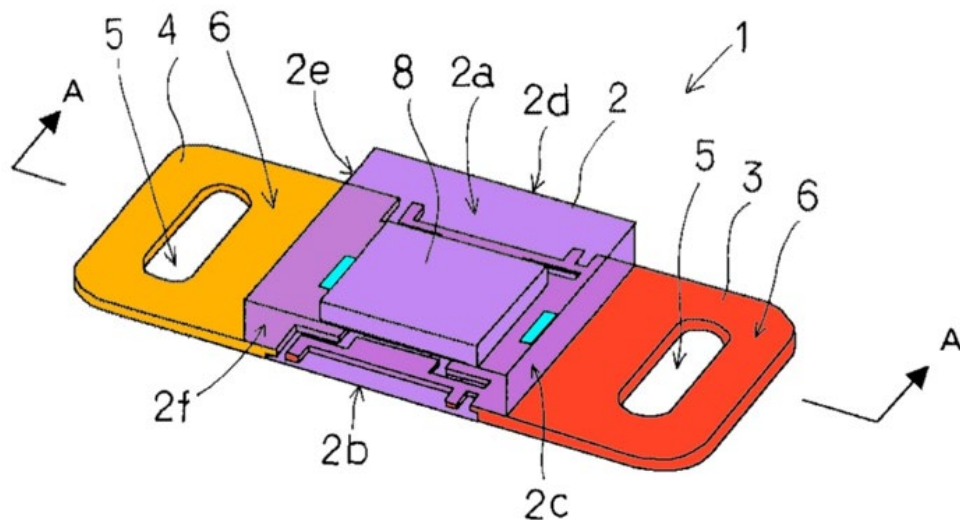


EX1007, Fig. 5(a).

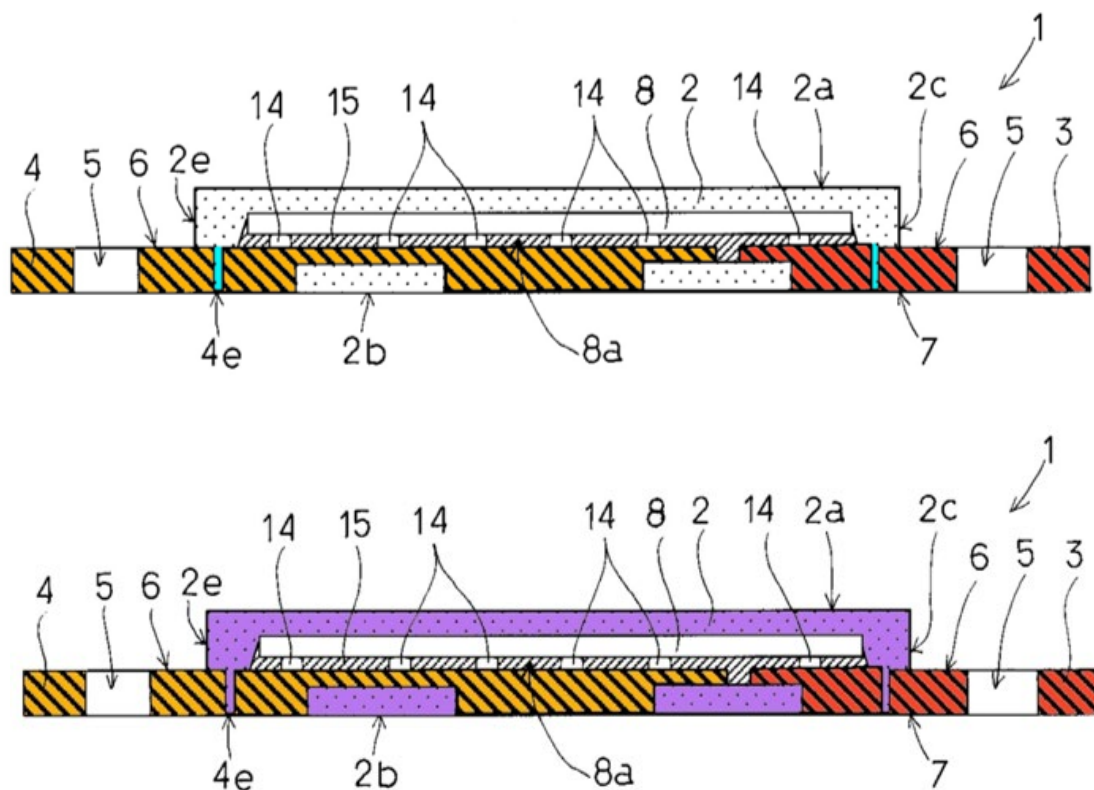


EX1007, Fig. 2.

As further shown in Figures 1 and 2 below, Takasaki additionally teaches that “the **electrode plates 3, 4** are formed with the **through holes 3f, 4e**.” EX1007, [0073]. Takasaki teaches that in the “portions of the **first** and **second electrode plates 3, 4** covered by the **encapsulant 2**, the **through holes (through holes 3f, 4e)** penetrating the electrode plates are filled with **resin** that forms the **encapsulant 2**, so that the **electrode plates** are held well by the **encapsulant 2**, the **electrode plates** are less likely to peel off from the **encapsulant 2**, and the reliability of the sealing is improved.” EX1007, [0095]. EX1002, ¶¶193–94.



EX1007, Fig. 1.



EX1007, Fig. 2.

IX. Level Of Ordinary Skill In The Art

“Factors that may be considered in determining level of ordinary skill in the art include: (1) the educational level of the inventor; (2) type of problems encountered in the art; (3) prior art solutions to those problems; (4) rapidity with which innovations are made; (5) sophistication of the technology; and (6) educational level of active workers in the field.” *Env’t Designs, Ltd. v. Union Oil Co. of California*, 713 F.2d 693, 696 (Fed. Cir. 1983). However, “[n]ot all such factors may be present in every case, and one or more of these or other factors may predominate.” *id.*

The ’913 Patent is directed to a “slim LED package.” EX1001, Title, Abstract. As explained in Section VIII, the field of LED was well developed by the earliest claimed priority date of the ’913 Patent—December 3, 2007. The types of problems encountered in the art, such as the desire to “more rigidly hold the encapsulation material,” (EX1001, 6:37–41), and solutions to those problems, such as providing certain depressions around the lead frames to allow the encapsulation material to more securely adhere to the lead frames, were all well known in the art, as demonstrated by prior art made of record in the ’913 Patent. *See, e.g.*, EX1008, 80–83 (*citing* EX1009, Figure 2). Accordingly, a person of ordinary skill in the relevant field or art (“POSITA”) as of December 3, 2007 would have had a Bachelor’s degree in Electrical Engineering, Material Science, Physics, or an

equivalent field, and approximately two years of experience in the field of LEDs. Lack of professional experience can be substituted by additional education, and vice versa. EX1002, ¶54.

X. Claim Construction

The claims should be construed “in accordance with the ordinary and customary meaning of such claims as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” 37 C.F.R. §42.100(b); *see also Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (*en banc*). The Board “need[s] only construe terms ‘that are in controversy, and only to the extent necessary to resolve the controversy.’” *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor, Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017). Petitioner submits no terms require construction for the purposes of this IPR.² EX1002, ¶¶56–57.

XI. Specific Grounds Of Invalidity

² Petitioner reserves all rights to raise claim construction arguments in other forums, including challenges under 35 U.S.C. §112.

A. Ground I: Claims 1–4 And 6 Are Rendered Obvious By Hsu In Combination With Iwamasa

1. Independent Claims 1 And 6

a. [1Pre, 6Pre] A light emitting diode (LED) package, comprising:

Hsu teaches [1Pre, 6Pre]. Hsu teaches an “LED package and the process making the same.” EX1003, Title. For example, Figure 12 shown below teaches “a finished LED package of the preferred embodiment of the present invention.” EX1003, [0017]. Hsu teaches that “the LED 60 package . . . includes a first terminal 70, a second terminal 80, the LED die 20, the reflecting ring 30, the conductive wire 40, and the encapsulant 50.” EX1003, [0025]. *See also, e.g.*, EX1003, Claim 1 (“A process for fabricating light emitting diode (LED) packages, comprising the steps of . . .”), Claim 6 (“An LED package comprising . . .”), Abstract, [0001], [0004], [0005], [0018], [0024], [0025], Fig. 11.

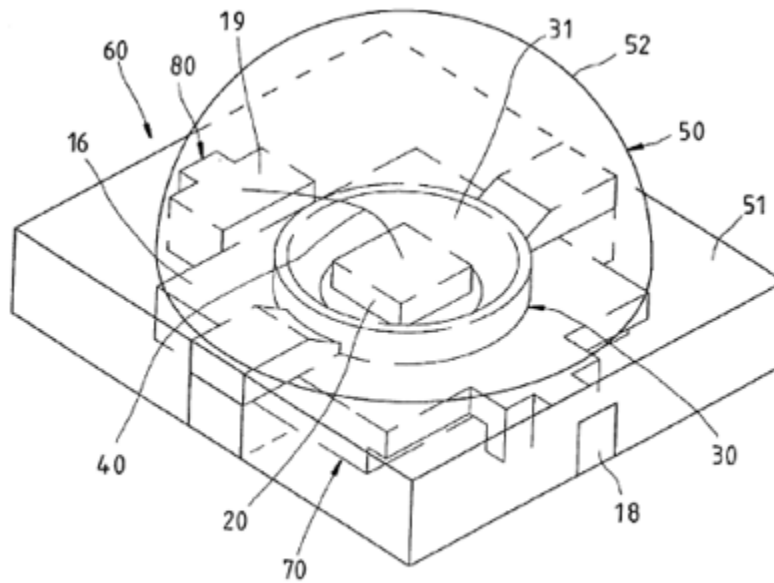


FIG. 12

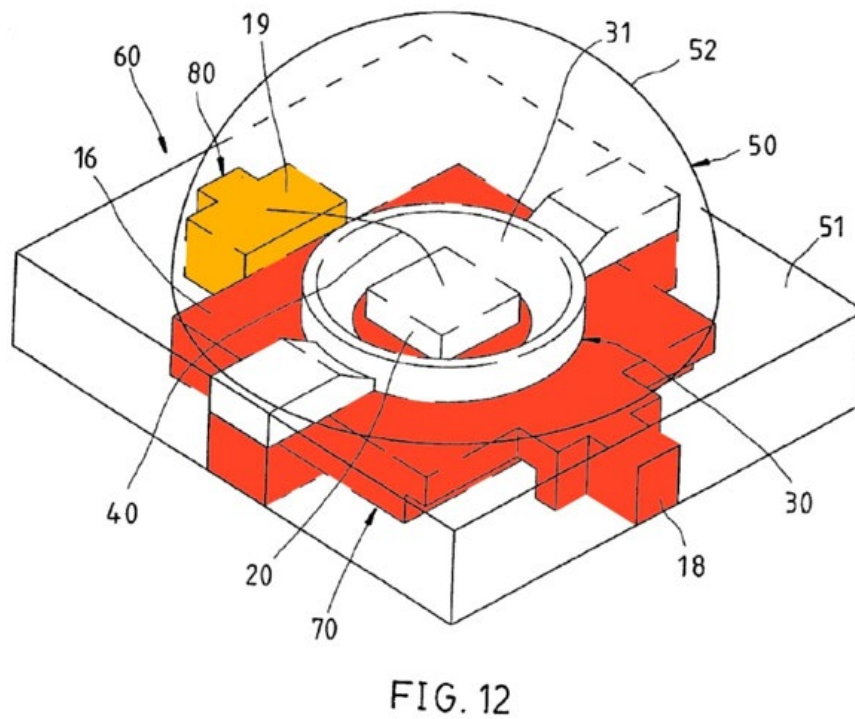
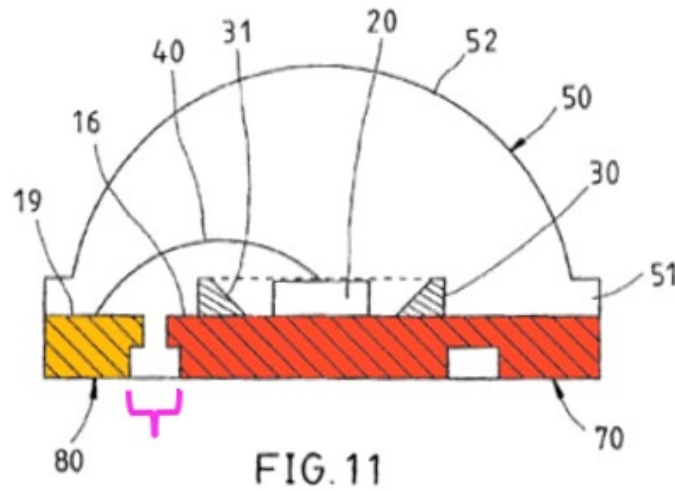
EX1003, Fig. 12. EX1002, ¶¶75–77.

b. [1A, 6A] a first lead frame and a second lead frame separated from each other;

Hsu teaches [1A, 6A]. As shown in Figures 11 and 12 below, Hsu teaches that “the LED 60 package . . . includes a first terminal 70” and “a second terminal 80.” EX1003, [0025]. Hsu teaches that, for example, “[w]hen the LED package 60 is in use, generally [] the first terminal 70 [is taken] as positive electrode and the second terminal 80 as negative electrode such that the LED die 20 is charged by the electricity to emit white light.” EX1003, [0025]. *See also*, e.g., EX1003, [0025] (“The first terminal 70 is formed by the main plate 16, the extending arm 18 located at a right side of the main plate 16, and the bridges 17 respectively located at upper and lower sides of the main

plates 16. . . . The **second terminal 80**[] is the separate arm 19.”), [0005], Claim 1, Claim 6 (“An LED package comprising: a platelike **first terminal** made of an electrically conductive metal; a **second terminal** made of the electrically conductive metal and located at a side of said first terminal and spaced apart from said first terminal with a predetermined space; an LED die having a bottom bonded on a top surface of said **first terminal** such that an electrode located on the bottom of said die is electrically connected to said **first terminal** . . . a conductive wire connected the other electrode on a top surface of said die to a top surface of said **second terminal**”). EX1002, ¶¶78–81.

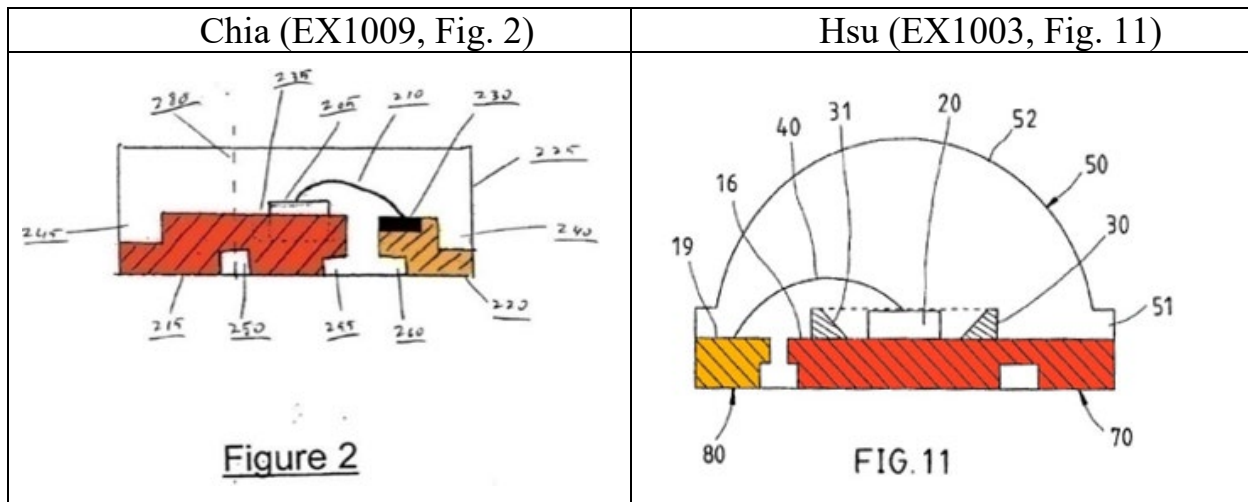
Hsu further teaches that the **second terminal** is “located at a side of said **first terminal** and *spaced apart from said **first terminal** with a predetermined space*” (indicated with **dark pink brackets** below). EX1003, Claim 6. *See also, e.g.*, EX1003, [0025] (“The **second terminal 80**, which is the separate arm 19, is located at a left side of the **first terminal 70** and *spaced an appropriate distance apart* from the **first terminal 70** and made of the same electrically conductive metal.”), [0005], Claim 1.



EX1003, Figs. 11–12. EX1002, ¶82.

Hsu's **first terminal 70** and **second terminal 80** are just like the structures the examiner found to meet the claimed **first lead frame** and **second lead frame**, respectively. For example, the examiner found that U.S. Patent Publication No.

2005/051149 (“Chia”) disclosed “at least figures 2–4 ... [a] light emitting diode (LED) package comprising: a **first lead frame 215** and a **second lead frame 220** separated from each other.” EX1008, 80. As shown below, Chia’s **first lead frame 215** and **second lead frame 220** are nearly identical to Hsu’s **first terminal 70** and **second terminal 80**. EX1002, ¶83.



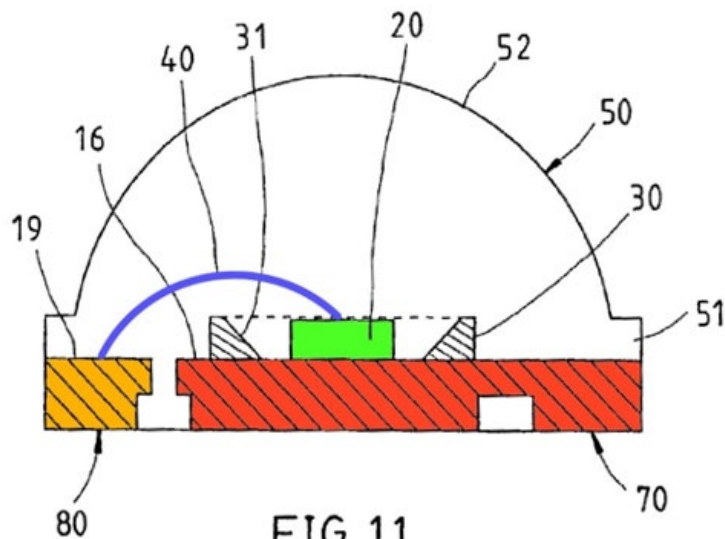
- c. [1B, 6B] an **LED chip** disposed on the **first lead frame** and electrically connected with **second lead frame**; and

Hsu teaches [1B, 6B]. As shown in Figures 11 and 12 below, Hsu teaches that “the LED 60 package . . . structurally includes . . . the **LED die 20**.” EX1003, [0025]. *See also, e.g.*, EX1003, Abstract, [0005], [0020], [0022], Claim 1, Claim 6. EX1002, ¶¶84–85.

Hsu teaches that the “**LED die 20** has a bottom, which is smoothly bonded to a top surface of the main plate 16 of the **first terminal 70** such that an electrode at the bottom of the **LED die 20** is electrically connected to the **first terminal 70**.”

EX1003, [0025]. *See also, e.g.,* EX1003, [0020] (“[A] white **LED die 20** is bonded on a top surface of each of the **main plates 16** of the frame 10 by means of silver adhesives (not shown).”), Abstract, [0005], [0026], Claim 1, Claim 6. EX1002, ¶86.

As shown in Figure 11 and 12 below, Hsu further teaches that a “**conductive wire 40** is connected between the other electrode of the top surface of the **die 20** and the top surface of the **second terminal 80**.” EX1003, [0025]. *See also, e.g., id.,* [0022] (“[C]onnect a top surface of the **die 20** to a top surface of the **separate arm 19** of the cell 11 with a gold conductive wire 40 of 99% Au by wire bonding technique such that the other electrode positioned on the top surface of the **die 20** can be *electrically connected with the separate arm 19*.”), [0005], Abstract, Claim 1, Claim 6.



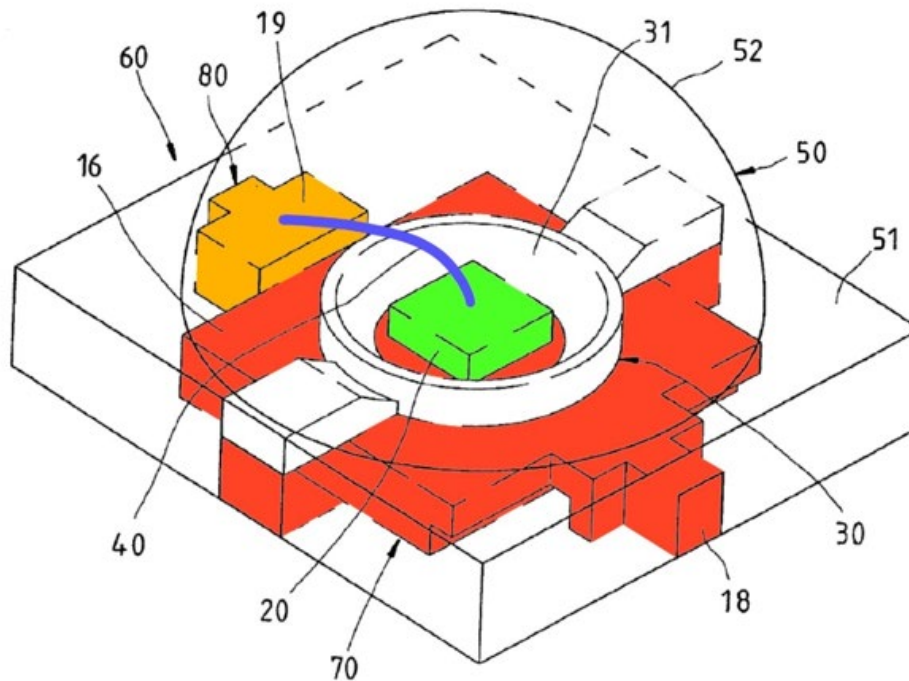


FIG. 12

EX1003, Figs. 11–12. EX1002, ¶87.

d. [1C, 6C] a resin covering at least portions of surfaces of the first and second lead frames, wherein:

Hsu teaches [1C, 6C]. As shown in Figures 11 and 12 below, Hsu teaches an “encapsulant 50, which material is the insulated epoxy resin,” which “covers the top surface of the first terminal 70 and the second terminal 80.” EX1003, [0025]; *see also id.*, [0005] (“Form an encapsulant on each cell of the frame with epoxy resin . . . wherein the encapsulant . . . covers the main plate and the separate arm.”), Abstract, [0023], [0025], Claim 1, Claim 6.

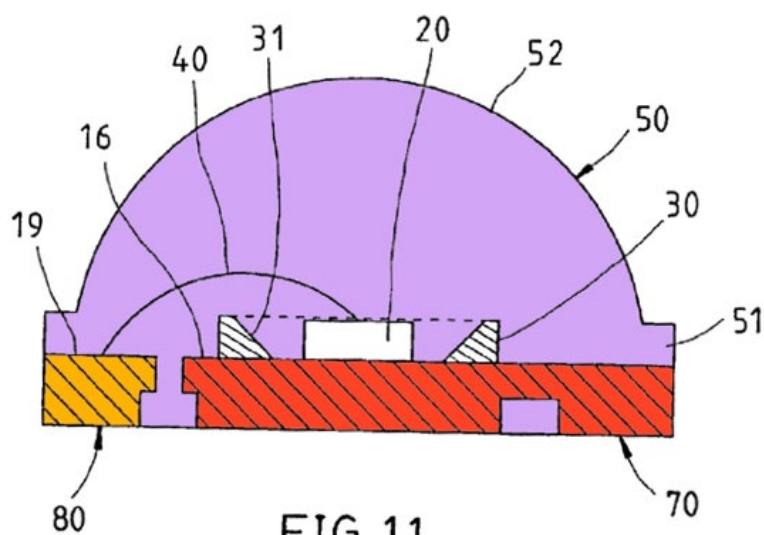


FIG. 11

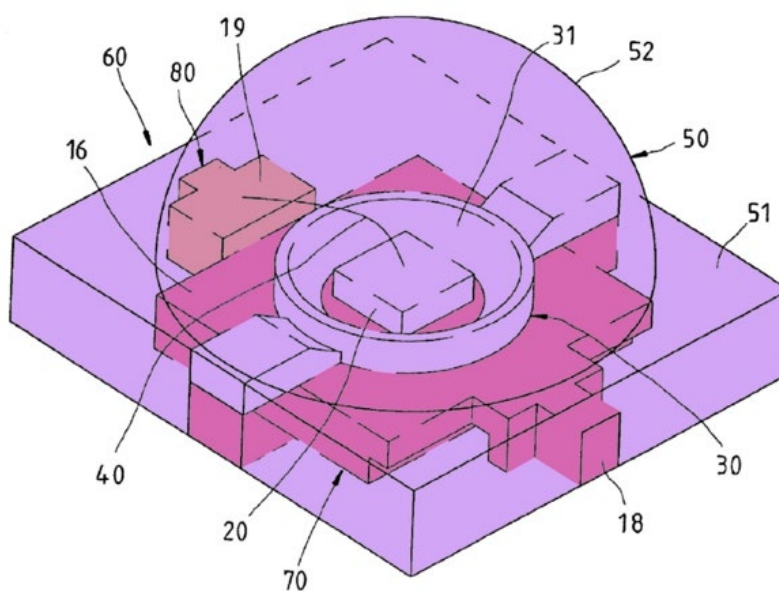
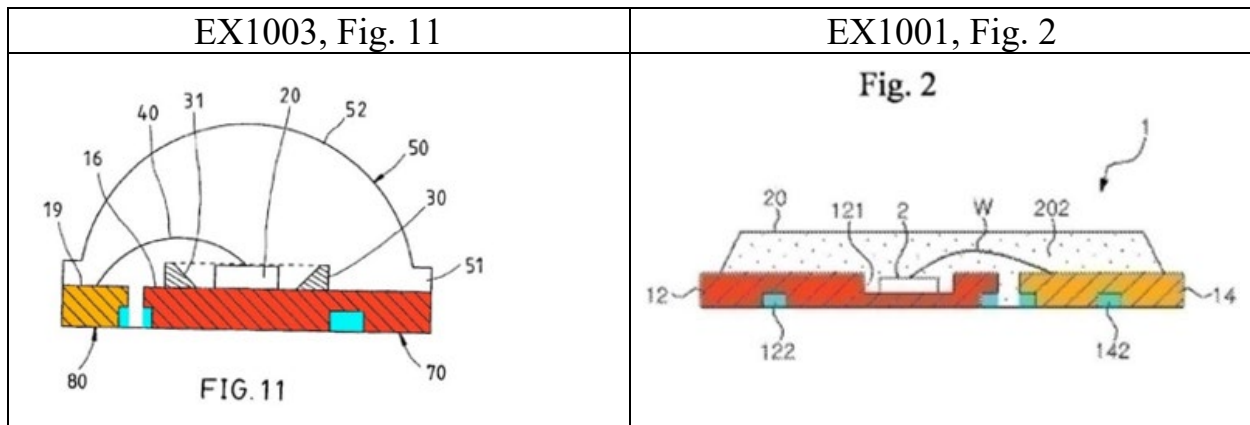


FIG. 12

EX1003, Figs. 11–12. EX1002, ¶¶88–90.

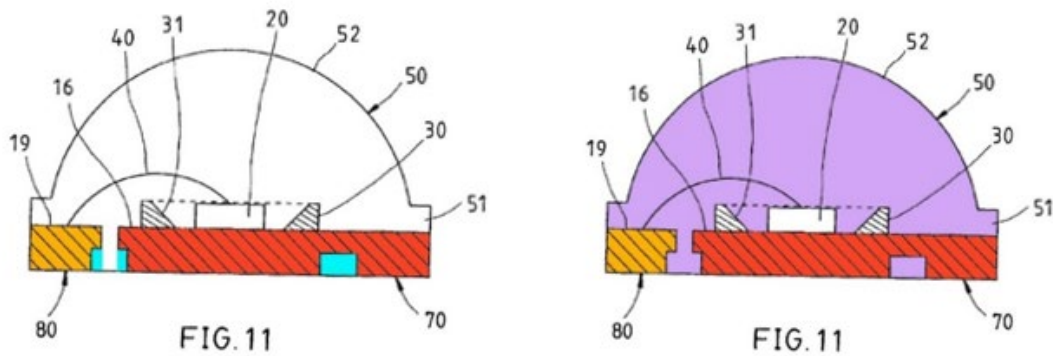
- e. [1D, 6D] at least one of the **first** and **second lead frames** comprises **resin-holding components** disposed along adjacent sides of one of the **first** and **second lead frames**, the **resin-holding components** being separated from each other at corners of the adjacent sides; and
- f. [1E] the **resin-holding components** are disposed on two adjacent sides of each of the **first lead frame** and the **second lead frame**.

Hsu in combination with Iwamasa renders obvious [1D, 1E, and 6D]. *First*, regarding [1D, 6D], the lateral sides and bottom side of the **first terminal 70** and **second terminal 80** have **grooves** that are filled with **resin**. These **grooves** meet the claimed **resin-holding components** because these **grooves** are nearly identical to those “**openings or grooves are formed on the lead frames**” shown below in Figure 2 of the '913 Patent. EX1001, 3:16–21. EX1002, ¶¶91–92.



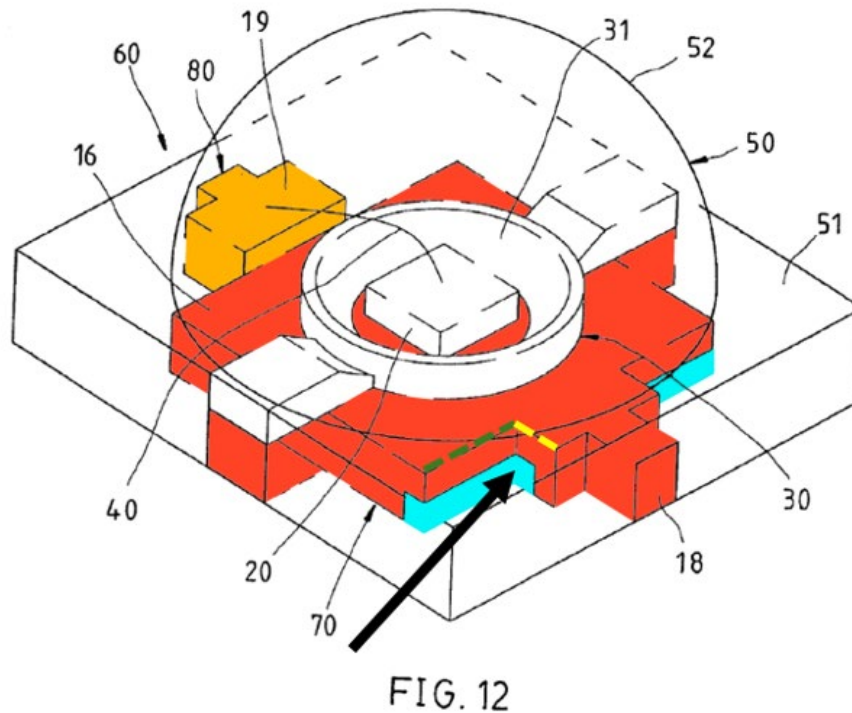
Indeed, these **grooves** hold **resin** and meet the claimed **resin-holding component** because the “**encapsulant 50 . . . with epoxy resin**,” which “*fills the openings of*

the cell.” EX1003, [0023]. For example, Hsu teaches that the **epoxy resin** “fills the space between the **main plate** and the **separate arm.**” EX1003, [0005].



EX1003, Fig. 11. EX1002, ¶¶93–94.

Second, regarding [1D, 6D], as shown in Figure 12 below, Hsu also teaches “**resin-holding components** that are disposed along two adjacent sides (indicated with dark green and yellow dashed lines below) of the **first lead frame.**” EX1003, Fig. 11, Fig. 12; *see also id.*, [0025], Claim 1, Claim 6.



EX1003, Fig. 12. EX1002, ¶95.

Third, Hsu in combination with Iwamasa renders obvious [1D, 1E, 6D]. As shown above, Hsu teaches **grooves** that are connected to—and not “separated from”—each other at the corner (see black arrow) of two laterally adjacent sides (indicated with dark green and yellow dashed lines below) of the **first terminal 70**. Moreover, Hsu does not explicitly show the grooves disposed on two adjacent sides of the **second terminal 80**. EX1002, ¶96.

But the combination of Hsu and Iwamasa renders obvious [1D, 1E, 6D]. Specifically, as more fully explained below, Hsu and Iwamasa render obvious **resin-holding components** that are disposed on two adjacent sides of each of the **first terminal 70** and the **second terminal 80** and are separated from each other at corner

between the upper sides and lateral sides of each of the **first terminal 70** and the **second terminal 80**. *See, e.g.*, EX1001, 3:21–25 (referring to the upper surface of the LED package as an “upper side”), 6:18–21 (discussing “opposite sides of the lead frames 12, 14 facing each other”); *see also* EX1008, 124 (finding that “Chia illustrates in figures 2–4 the **resin-holding components 240, 245, 250, 255, 260** are disposed on three sides of at least one of the **first and second lead frames 215, 220**”).

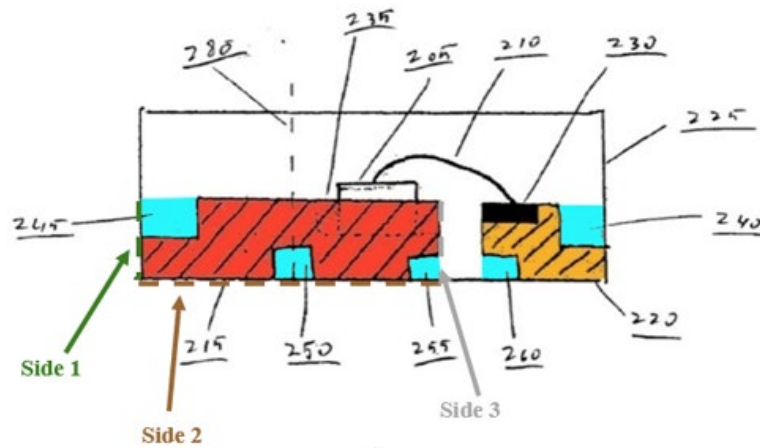
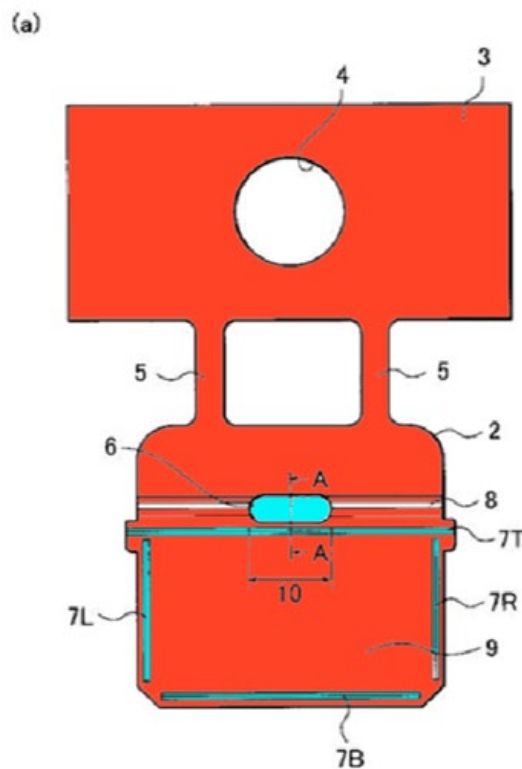


Figure 2

EX1009 [Chia], Fig. 2. EX1002, ¶¶97–98.

For example, Iwamasa teaches a **lead frame** with **grooves and holes** that function just like the claimed **resin-holding components**. For example, Iwamasa teaches that the **top side** of its **Base 2** includes “**Grooves 7** (7T, 7L, 7R, and 7B),” where “**Groove 7** . . . consists of four **Straight Grooves: 7T, 7L, 7R, and 7B.**” EX1004, [0031]. Iwamasa further teaches that the “**groove** is filled with the sealing

resin during the resin-sealing process. Therefore, after resin sealing, the long groove helps improve the bond strength and adhesion between the sealing resin and the base.” EX1004, [0019]; *see also, id.*, [0040]. Similarly, Iwamasa teaches that “the seal resin and the base are joined also inside the through hole, [so] the bond strength and adhesion between the seal resin and the base are improved.” EX1004, [0009].

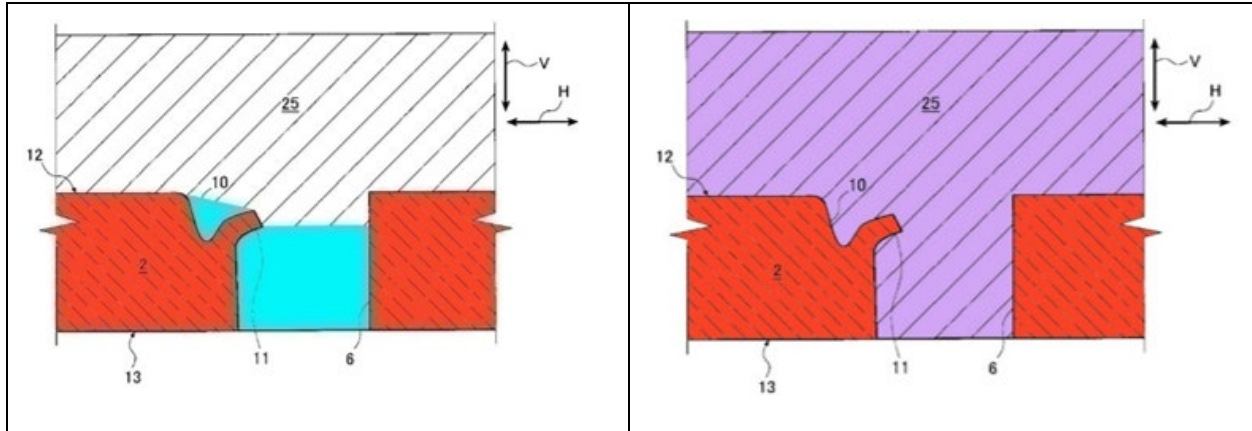


EX1004, Fig. 1(a). EX1002, ¶¶99–100.

Figure 5 of Iwamasa further shows a cross-sectional view of **groove 7T** near **through-hole 6**. As shown, the **resin** fills the **groove** and **through-hole 6** to

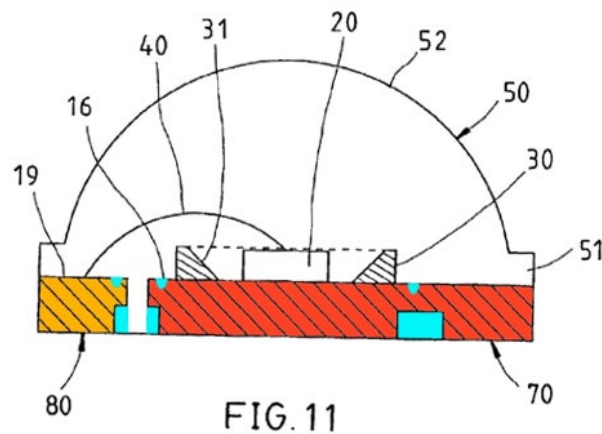
improve the “bond strength and adhesion between the seal resin and the base.”

EX1004, [0009].

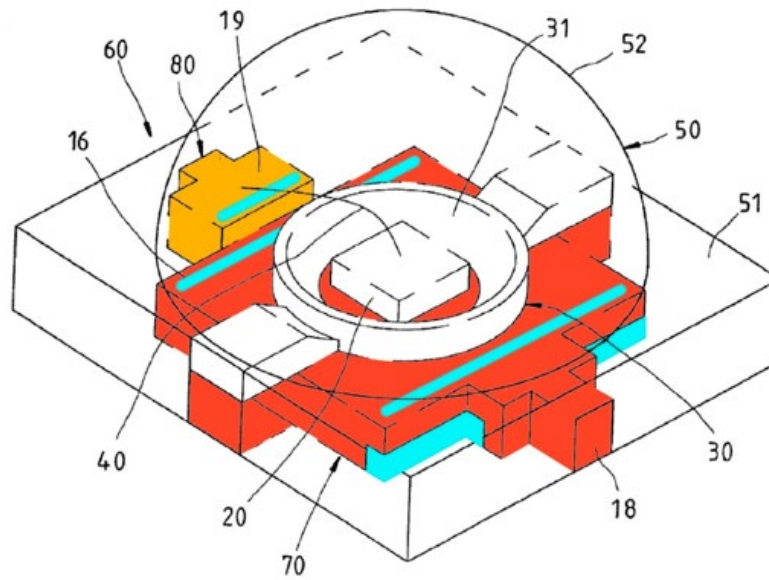


EX1004, Fig. 5. EX1002, ¶¶101–02.

It would have been obvious to modify Hsu to add Iwamasa’ **grooves** on the upper sides of each of its **first lead frame** and **second lead frame** with a reasonable expectation of success to arrive at the structure shown in modified Figures 11 and 12 below.

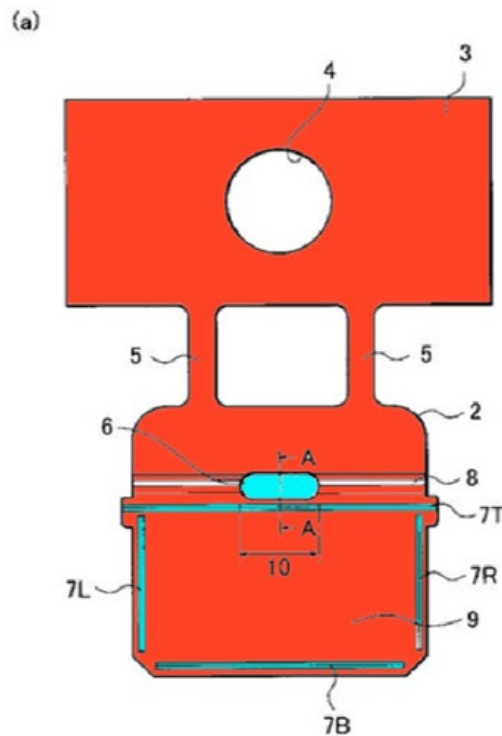


EX1003, Fig. 11 (modified).

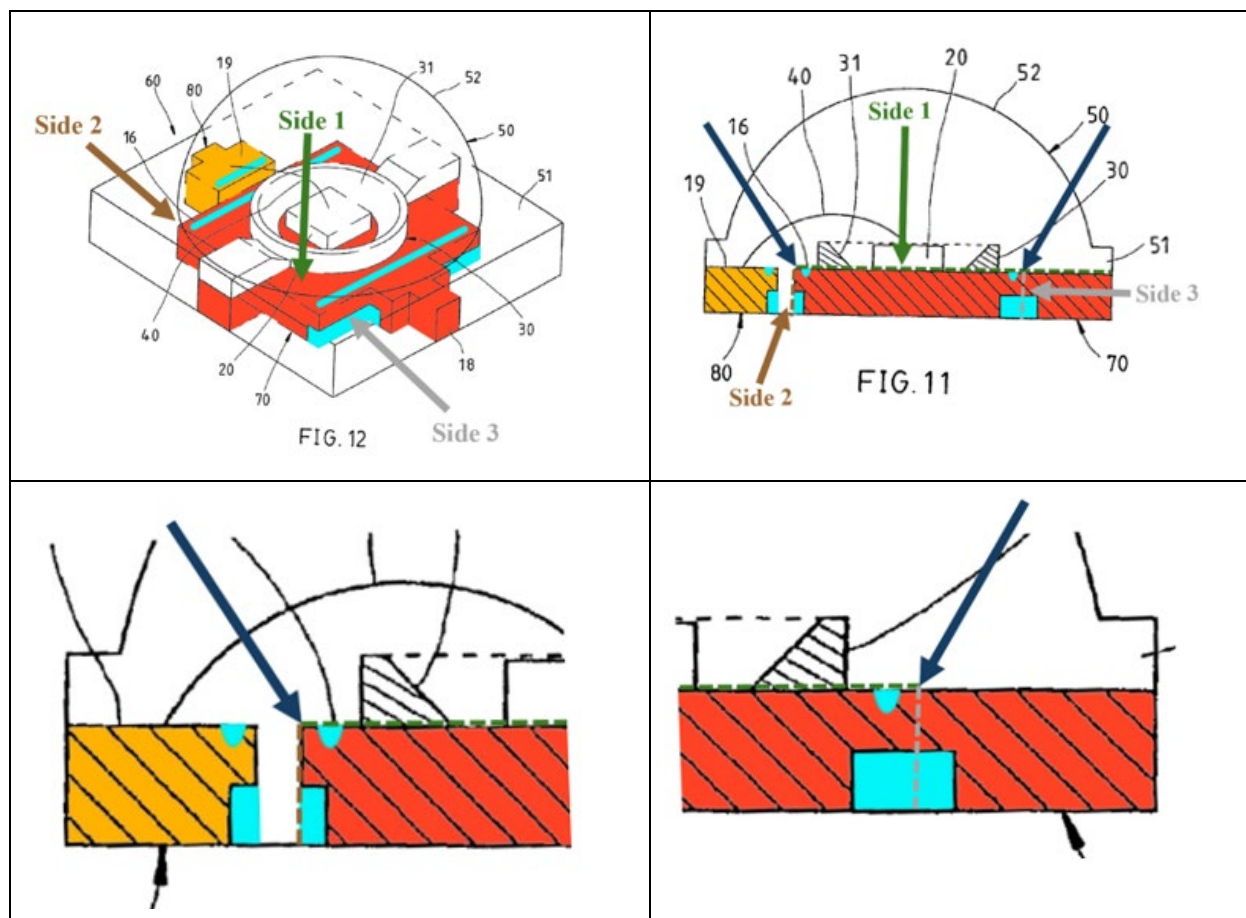


EX1003, Fig. 12 (modified). EX1002, ¶103.

For example, the modification amounts to nothing more than adding **grooves** disposed along Hsu's **upper side** ("Side 1") of **first terminal 70**, placed thereon just like the **grooves** taught by Iwamasa. For example, just like Iwamasa's **grooves 7T**, **7R**, **7B**, and **7L** are separated from each other on the top surface of Iwamasa's top side of the **base** terminal, the **grooves** are added to Hsu's upper side ("Side 1") so that they are separated from each other. Moreover, the **grooves** are placed near the outer edge of the top side of the **base** in certain places (e.g., **grooves 7L**, **7B** and **7R**) and in regions that are well-within the main body of the top side of the **base** (e.g., **groove 7T**).

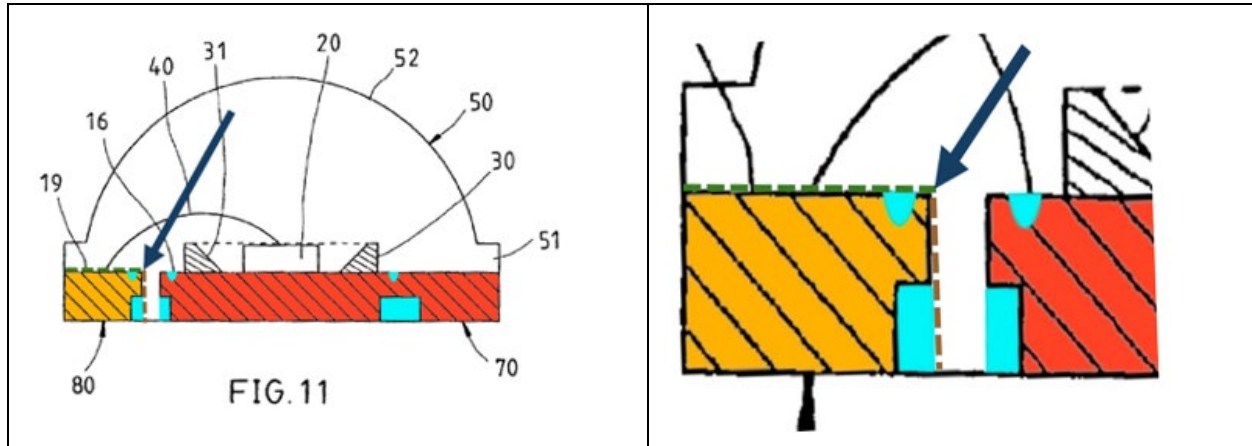


EX1004, Fig. 1(a). As a result, as shown below, the **groove** disposed along Hsu's **upper side** ("Side 1") is separated from Hsu's **groove** at **lateral Side 2** at the **corner** (see **arrow**) where the **upper side** and adjacent **lateral Side 2** meet. Hsu's **first terminal 70** further includes a **groove** disposed along its **lateral side** ("Side 3") and another **groove** disposed along the adjacent **upper side**, with those **grooves** separated at the **corner** where the **upper side** and adjacent **lateral side** meet.



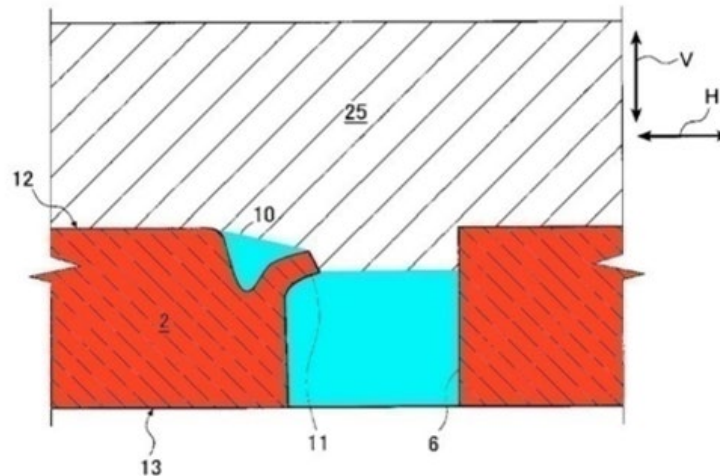
EX1003, Figs. 11 and 12 (modified). EX1002, ¶104.

Further, just as with the **first terminal 70**, it would have been trivial to add additional **grooves** along the **upper side** of Hsu's **second terminal 80**. As shown, the additional **groove** disposed along its **upper side** is separated from the **groove** disposed along its adjacent **lateral side** at the **corner** where the **upper side** and adjacent **lateral side** meet.



EX1003, Fig. 11 (modified). EX1002, ¶105.

Indeed, the modification is nearly identical to the Iwamasa’s **groove 10** near **through hole 6**, which includes a “**Stopping Part 11**” in between the two spaces that individually provide improved bonding and adhesion between the **resin** and the underlying **base** terminal. *See* EX1004, [0009], [0019]. As shown below in Figure 5, Iwamasa teaches that “**Long Groove 10** is positioned in some proximity to **Through Hole 6**,” creating “**Stopping Part 11**.” EX1004, [0038]. *See also, e.g.,* EX1004, [0036]. Iwamasa teaches that “the shape of **Stopping Part 11** between **Long Groove 10** and **Through Hole 6** . . . provid[es] the anchoring effect of the sealing resin.” EX1004, [0032]; *see also id.*, [0009], [0019]. A POSITA would have expected that **Stopping Part 11** to similarly be formed at the portions of the **first terminal 70** and the **second terminal 80** that remain at the corner between the two **grooves** with a reasonable expectation of success.



EX1004, Fig. 5. EX1002, ¶106.

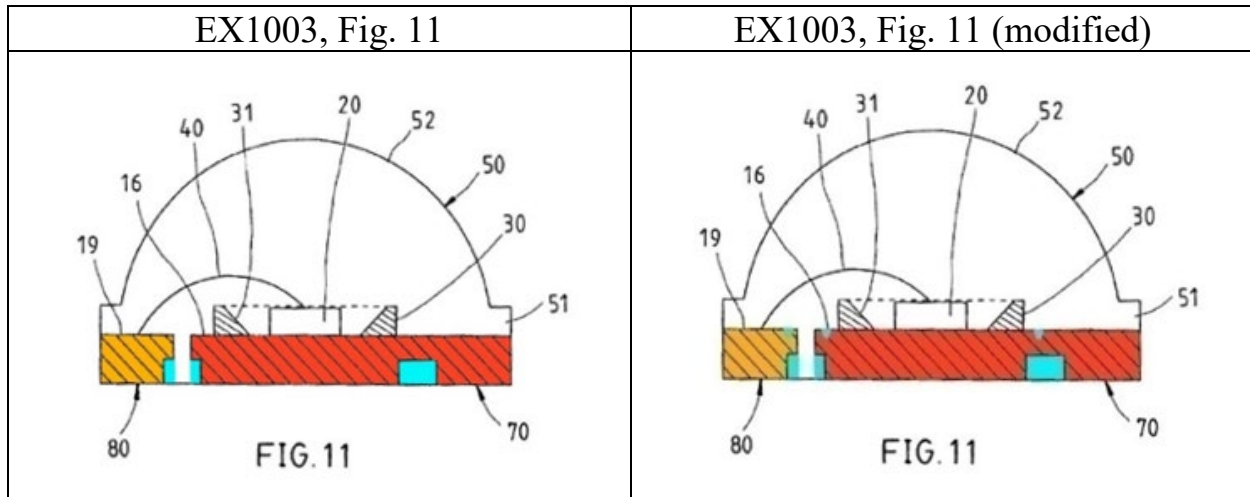
Indeed, a POSITA would have been able to readily make the proposed modification because both Hsu and Iwamasa are directed to LED packages including one or more metallic lead frames sealed in **resin**, with the lead frames including at least one form of **resin-holding component**. *See, e.g.*, Sections VIII. A–B [Overview Of Hsu And Iwamasa], XI.A.1.a–d [Ground I, 1Pre–C, 6Pre–C] above. Further, both Hsu and Iwamasa’s lead frames include significantly planar surfaces on their upper sides. *See, e.g.*, EX1003, Claim 6 (“An LED package comprising: **a platelike first terminal**”), Figs. 11, 12; EX1004, Fig. 1. A POSITA would have understood the possibility of separation between such planar surfaces and the resin. Accordingly, a POSITA would have been motivated to look to the teachings of Iwamasa to improve the adhesion between the upper sides of Hsu’s lead frames and the encapsulating resin—which Iwamasa teaches can be achieved by adding grooves near the outer edges of a lead frame’s upper side. *See, e.g.*, EX1004, [0019] (The

“groove is filled with the sealing resin during the resin-sealing process. Therefore, after resin sealing, the long groove helps improve the bond strength and adhesion between the sealing resin and the base.”). EX1002, ¶107–08.

Moreover, the modification would have amounted to merely adding a known element to Hsu to obtain predictable results of enhancing the bond strength between its lead frames and resin. Indeed, Hsu’s lead frames already include one form of resin-holding component on multiple lateral sides. *See, e.g.*, EX1003, [0005], [0023], [0025], Fig. 11, Fig. 12. Iwamasa’s **grooves** are merely an additional form of **resin-holding component** implemented on a lead frame’s upper side, which a POSITA would have understood would further increase the bond strength between Hsu’s lead frames and resin. *See, e.g.*, EX1004, [0019], [0032], [0036]. EX1002, ¶¶108–09.

g. [6E] the first and the second lead frames comprise opposing sides facing each other, and the resin-holding components are disposed on the opposing sides.

Hsu teaches or Hsu in combination with Iwamasa renders obvious [6E]. As shown in Figure 11 below, Hsu (and Hsu as modified with Iwamasa) teaches that the **first** and the **second lead frames** comprise opposing sides facing each other, and the **grooves** are disposed on the opposing sides.



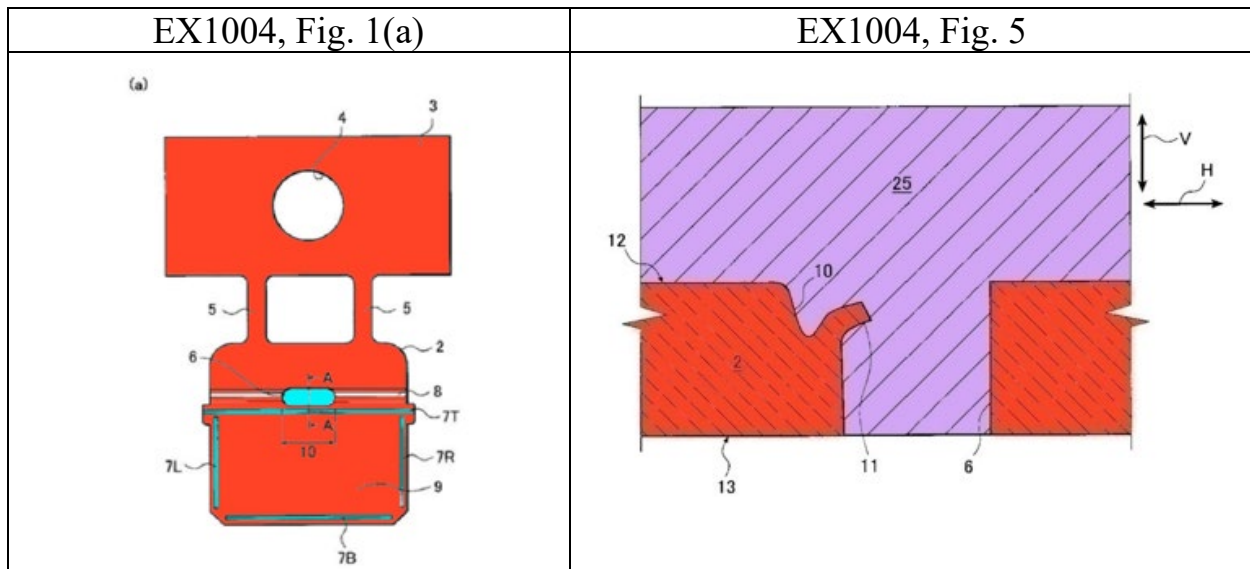
EX1002, ¶¶110–11.

2. Dependent Claims 2 and 3

- a. [2] The LED package of claim 1, wherein the **resin-holding components** comprise at least one **hole**.
- b. [3] The LED package of claim 2, wherein the **hole** is filled with the **resin** to increase the bonding force between the resin and the lead frames.

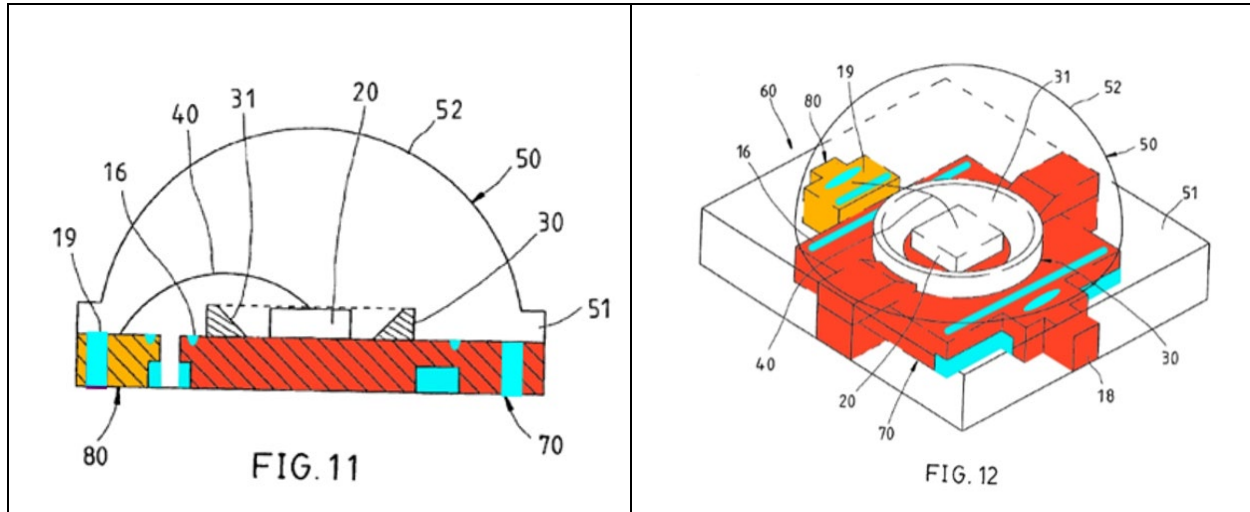
Hsu in combination with Iwamasa renders obvious [2] and [3]. As explained above in Section XI.A.1 [Ground I, Claims 1 and 6], Iwamasa, as shown in Figures 1(a) and 5 below, teaches a **lead frame** including a **Through Hole 6**. “The form shown in Figure 6 is a structure in which **Sealing Resin 25** is adhered to the entire interior surface of **Through Hole 6**, and **Through Hole [6]** is configured in **Sealing Resin 25** so as to pass through **Through Hole 6**.” EX1004, [0044]. Iwamasa further teaches that “the **sealing resin** in **Through Hole 6** is unable to easily escape due to the presence of Stopping Part 11.” EX1004, [0044]. Accordingly, Iwamasa teaches, “the mechanical bond strength of **Base 2** and **Sealing Resin 25** with respect to the

vertical direction V shown in the figure is improved” and that “the mechanical bond strength of **Base 2** and **Sealing Resin 25** with respect to the horizontal direction H shown in the figure is improved by fitting **Sealing Resin 25** inside **Through Hole 6**.” EX1004, [0044]. In other words, Iwamasa teaches that its **lead frame** is filled with **resin** to increase the bonding force between the **resin** and the **lead frame**.



EX1002, ¶¶112–14.

It would have been obvious to additionally modify Hsu to add Iwamasa’s oval-shaped **through-hole** to Hsu’s **first terminal 70** and/or **second terminal 80** with a reasonable expectation of success, as illustrated in modified Figures 11 and 12 below.



EX1003, Figs. 11 and 12 (modified). EX1002, ¶115.

The additional modification to Hsu would have amounted to nothing more than a trivial mechanical alteration of punching a **hole** in Hsu's **first terminal 70** and **second terminal 80**. For example, the modification would have merely amounted to combining prior art elements (e.g., Hsu's LED package and Iwamasa's grooves and hole) according to known methods (e.g., simple mechanical alteration of the lead frames' structures) to yield predictable results (e.g., reduced delamination of the resin 50 from the lead frames). EX1002, ¶115.

Indeed, both Hsu and Iwamasa are directed to LED packages including one or more metallic lead frames sealed in **resin**, with the lead frames including at least one form of a **resin-holding component**. See, e.g., Sections VIII.A–B [Overview Of Hsu And Iwamasa], XI.A.1.a–d [Ground I, 1Pre–C, 6Pre–C] above. Further, both Hsu and Iwamasa's lead frames include significantly planar surfaces on their top sides. See, e.g., EX1003, Claim 6 ("An LED package comprising: a platelike **first**

terminal), Figs. 11, 12; EX1004, Fig. 1. A POSITA would have understood the possibility of separation between such planar surfaces and the **resin**. Accordingly, a POSITA would have been motivated to look to the teachings of Iwamasa to improve the adhesion between the Hsu's lead frames and the **encapsulating resin**—which Iwamasa teaches can be achieved by adding a **through-hole** through a **lead frame**. *See, e.g.*, EX1004, [0044], Figs. 1, 5, 6. EX1002, ¶116.

The additional modification to Hsu would have amounted to merely adding one of a select set of known elements that would provide predictable results of enhancing the bond strength between the **lead frame** and the **resin**. Indeed, Hsu's **lead frames** already include one form of **resin-holding component** on multiple lateral sides. *See, e.g.*, Section XI.A.1.d–f [Ground I, 1C–E, 6C–D] above. Iwamasa's **through-hole** is merely one additional form of **resin-holding component** implemented on a lead frame to be filled with the **resin**, which a POSITA would have understood would further increase the bond strength between Hsu's **lead frames** and **resin**. *See, e.g.*, EX1004, [0044], Figs. 1, 5, 6. EX1002, ¶117.

Furthermore, the additional modification to Hsu would have amounted to using a known technique of adding a through hole to a lead frame, as taught by Iwamasa, to improve similar devices (the Hsu-Iwamasa combination presented with

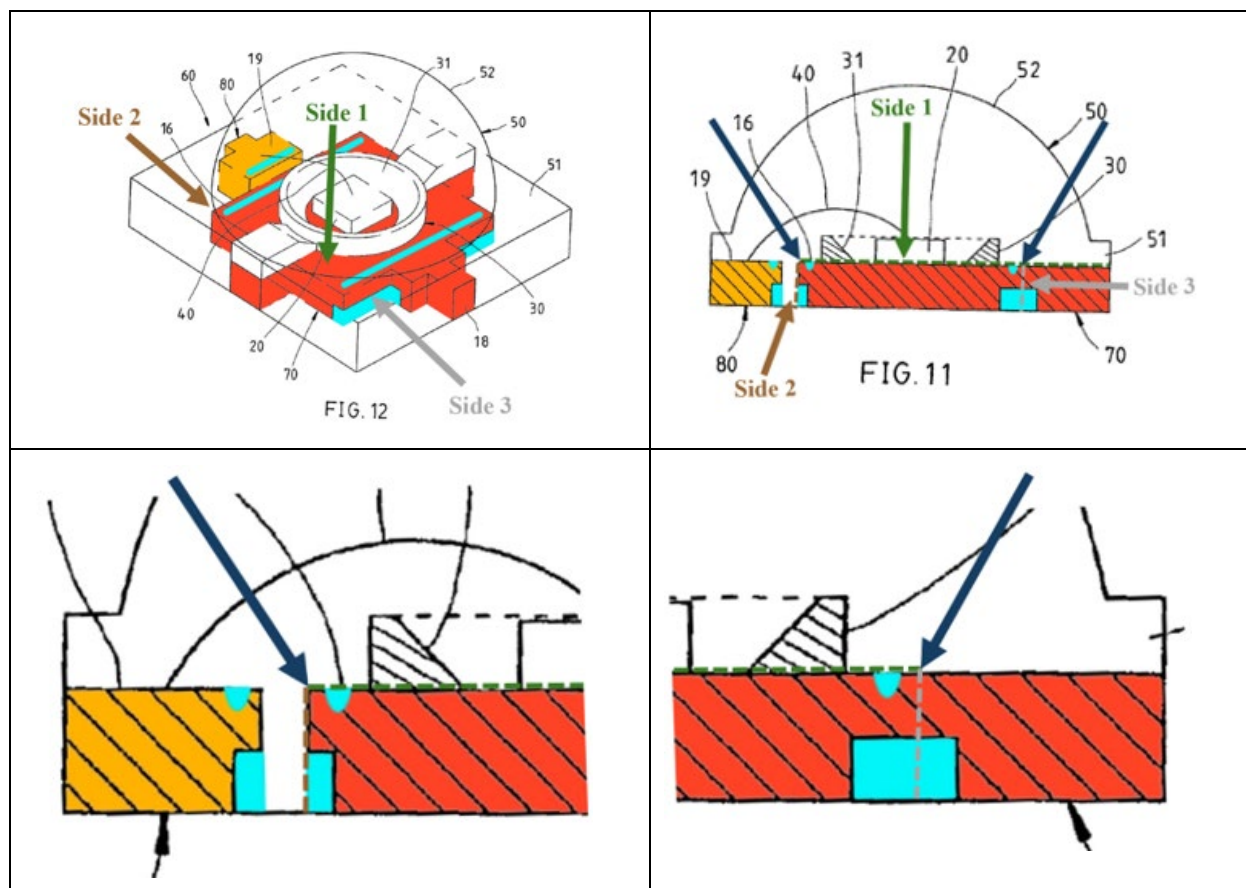
respect to claim 1) in the same way (improving the bond strength between the **lead frame** and the **resin**). EX1002, ¶118.

At a minimum, it would have been obvious for a POSITA to try adding a **hole** near the **grooves** disposed along the upper side of Hsu's **first terminal 70** and **second terminal 80**, as taught by Iwamasa with its **Through Hole 6** placed near **Long Groove 10** of its **Base 2**. As explained above, Iwamasa teaches there is a design need to improve the bond strength between **lead frames** and overlying **resin**, and that such bond strength would be improved by adding **grooves** and **Through Hole 6** to the sides on **lead frames**. Accordingly, it would have been common sense and obvious to try to add both the **grooves** and **Through Hole 6**—as taught by Iwamasa—to Hsu's **lead frames** to further improve the bond strength between Hsu's **lead frames** and overlying **resin**. EX1002, ¶¶118.

3. Dependent Claim 4

- c. [4] The LED package of claim 1, wherein the **resin-holding components** are disposed on three sides of at least one of the **first** and **second lead frames**.

Hsu in combination with Iwamasa further renders obvious [4]. For example, as shown below in modified Figures 11 and 12 of Hsu in combination with Iwamasa, **grooves** exist on three sides of the **first terminal 70**.



EX1003, Figs. 11 and 12 (modified). EX1002, ¶119.

B. Ground II: Claims 1–4 And 6 Are Rendered Obvious By Hsu In Combination With Iwamasa And Hui

1. Independent Claims 1 And 6

d. [1Pre, 6Pre] A light emitting diode (LED) package, comprising:

See Section XI.A.1.a [Ground I, 1Pre, 6Pre]. EX1002, ¶123.

e. [1A, 6A] a **first lead frame** and a **second lead frame** separated from each other;

See Section XI.A.1.b [Ground I, 1A, 6A]. EX1002, ¶124.

- f. [1B, 6B] an **LED chip** disposed on the **first lead frame** and electrically connected with **second lead frame**; and

See Section XI.A.1.c [Ground I, 1B, 6B]. EX1002, ¶125.

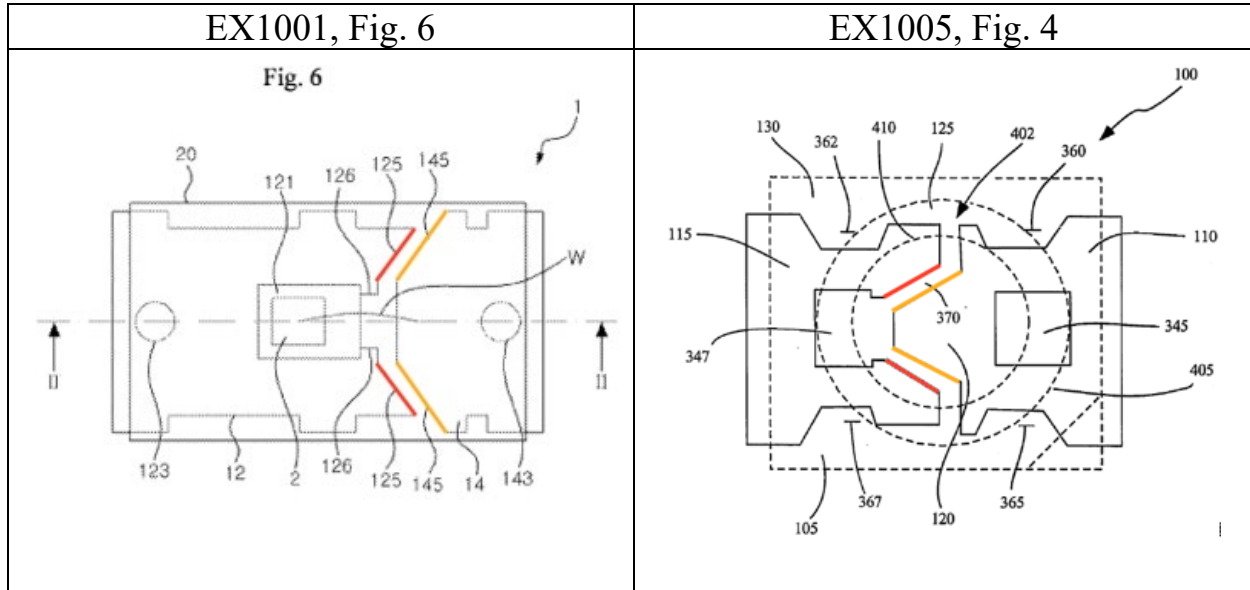
- g. [1C, 6C] a **resin** covering at least portions of surfaces of the **first** and **second lead frames**, wherein:

See Section XI.A.1.d [Ground I, 1C, 6C]. EX1002, ¶126.

- h. [1D, 6D] at least one of the **first** and **second lead frames** comprises **resin-holding components** disposed along adjacent sides of one of the **first** and **second lead frames**, the **resin-holding components** being separated from each other at corners of the adjacent sides; and

- i. [1E] the **resin-holding components** are disposed on two adjacent sides of each of the **first lead frame** and the **second lead frame**.

To the extent Patent Owner argues that the claimed “**resin-holding components**” require “**slant parts 125, 145** [that] disperse the force diagonally, thereby preventing the **encapsulation material 20** from being broken on the opposite sides of the **lead frames 12, 14**,” (EX1001, 6:34–37), such lead frames having slanted parts were well-known in the art, such as found in Hui (below). Hsu in combination with Iwamasa and Hui would have rendered obvious [1D, 1E, and 6D]. EX1002, ¶¶127–29.



In addition to the modifications to Hsu with Iwamasa, as discussed above in Section XI.A.1.e–f [Ground I, 1D, 1E, 6D], it would have been obvious to utilize Hui’s “**first** and **second electrodes 110, 115**” that includes similar slanted sides. EX1005, [0035]. EX1002, ¶130.

It would have been obvious to further modify Hsu and Iwamasa’s combination with Hui to replace Hsu’s **first terminal 70** and **second terminal 80** with Hui’s “**first** and **second electrodes 110, 115**” that have slanted sides with a reasonable expectation of success. The modification amounts to nothing more than simple substitution of one known component (Hsu’s **first terminal 70** and **second terminal 80**) with another (Hui’s **first** and **second electrodes 110, 115** that have slanted sides) with the predictable result of forming an LED package. EX1002, ¶130.

At a minimum, it would have been obvious to try different types of lead frames that have different shapes, such as those taught by Hui’s **first** and **second electrodes 110, 115** that have slanted sides. Indeed, a POSITA would have been motivated to make the substitution because Hui teaches that “[t]he enhanced bonding provided through and around the **first** and **second electrodes 110, 115**, at least in part, enhance the stability of the **first** and **second electrodes 110, 115** relative to the casing 105 and the structural integrity of the surface mount device 100. The structural integrity is further maintained, at least in part, through the electrodes 110, 115 adhering to the casing 105, the fill material, and/or the optoelectronic element.” EX1005, [0047]. EX1002, ¶131.

- j. [6E] the **first** and the **second lead frames** comprise opposing sides facing each other, and the **resin-holding components** are disposed on the opposing sides.

Hsu teaches or Hsu in combination with Iwamasa and Hui renders obvious [6E]. *See* Section XI.A.1.g [Ground I, 6E] and XI.B.1.h–i [Ground II, 1D, 1E, and 6D]. EX1002, ¶132.

2. Dependent Claims 2 and 3

- k. [2] The LED package of claim 1, wherein the **resin-holding components** comprise at least one **hole**.
- l. [3] The LED package of claim 2, wherein the **hole** is filled with the **resin** to increase the bonding force between the resin and the lead frames.

See Section XI.A.2 [Ground I, 2 and 3]. EX1002, ¶133.

3. Dependent Claim 4

m. [4] The LED package of claim 1, wherein the resin-holding components are disposed on three sides of at least one of the first and second lead frames.

See Section XI.A.3 [Ground I, 4]. EX1002, ¶¶134.

C. Ground III: Claims 1–4 And 6 Are Anticipated By Oshio

1. Independent Claims 1 And 6

a. [1Pre, 6Pre] A light emitting diode (LED) package, comprising:

To the extent limiting, Oshio teaches [1Pre, 6Pre]. For example, Figure 1 shown below shows “a semiconductor light emitting device.” EX1006, [0030]. The semiconductor device is an LED package because it shows “a package structure in which a light emitting diode chip, that is, an LED chip, is received.” EX1001, 1:31–32. For example, as shown below, “LED chip 10 is die bonded to the bottom face of the recess 20C of the lead 20.” EX1006, [0061]. Moreover, “[t]he electrode of the LED chip 10 is connected to the other inner lead section 30B via bonding wire 60.” *id.*; *see also, id.*, Abstract (A “semiconductor light emitting chip mounted on a portion of the first inner section exposed in a recess provided on an upper face of the embedding resin....”), [0010], [0018], [0030–33], [0035], [0040–44], [0046–49], [0055], [0082–83], [0101], Claim 1, Claim 14, Fig. 2, Figs. 2–19.

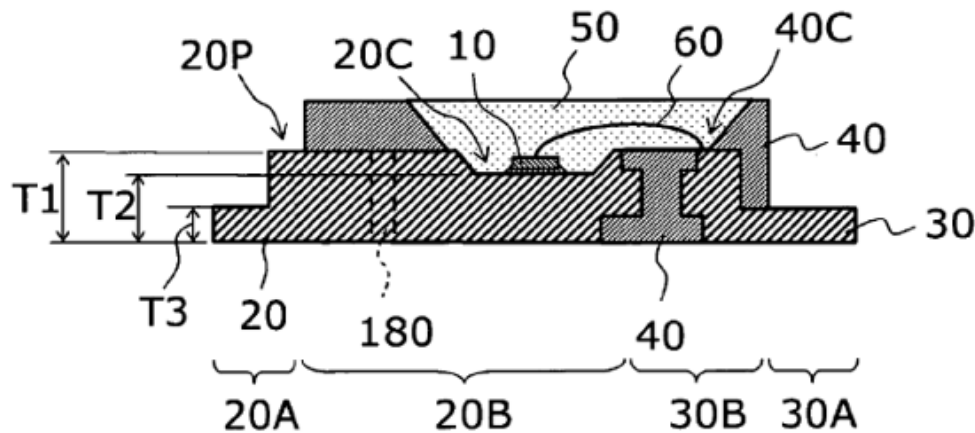


FIG. 1

EX1006, Fig. 1. EX1002, ¶¶145–49.

b. [1A, 6A] a **first lead frame** and a **second lead frame** separated from each other;

Oshio teaches [1A, 6A]. As shown in Figures 1 and 12 below, Oshio teaches that “the semiconductor light emitting device . . . comprises a pair of **leads 20** and **30**.” EX1006, [0049]. Oshio teaches that it “is desirable that the **leads 20** and **30** be supplied in the form of the so-called ‘lead frame’.” EX1006, [0084]. *See also, e.g.*, EX1006, Abstract (“A semiconductor light emitting device comprises: embedding resin; a **first lead**” and “a **second lead**.”), [0010–13], [0018–23], [0036–39], [0069], [0085–86], Claim 1, Claim 14. EX1002, ¶¶150–51.

As is further shown below, Oshio teaches that the **first lead** and **second lead** are separated from each other (indicated with **dark pink brackets** below).

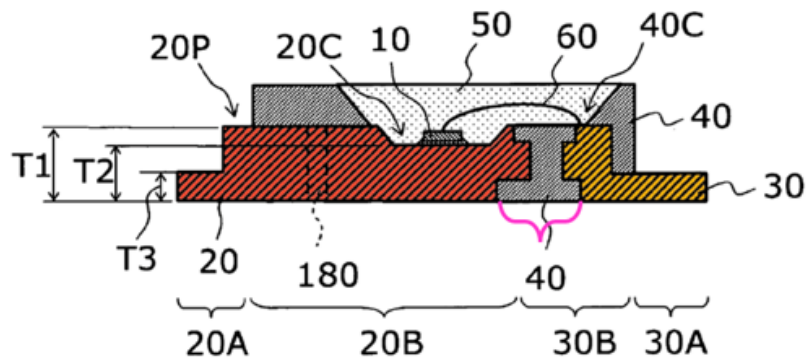


FIG. 1

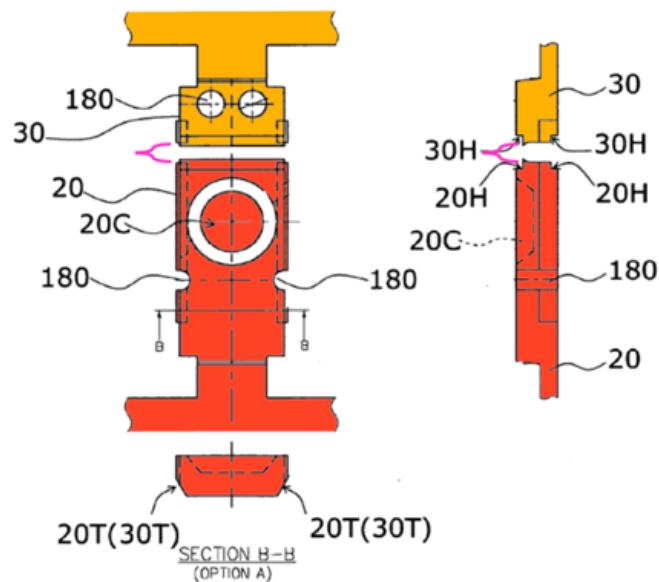


FIG. 12

EX1006, Figs. 1, 12. EX1002, ¶152.

- c. [1B, 6B] an LED chip disposed on the first lead frame and electrically connected with second lead frame; and

Oshio teaches [1B, 6B]. As shown in Figure 1 below, Oshio teaches that an “**LED chip 10** is die bonded to the bottom face of the recess 20C of the **lead 20**”

and the “electrode of the LED chip 10 is connected to the other inner lead section 30B via bonding wire 60” (the wire shown in blue below, which connects the semiconductor light emitting chip to the second lead). EX1006, [0061]. *See also, e.g.*, EX1006, Abstract (A “semiconductor light emitting chip [is] mounted on a portion of the first inner lead section exposed in a recess provided on an upper face of the embedding resin; and a wire connect[s] the semiconductor light emitting chip with the second lead.”), [0010–15], [0018–25], [0049], [0053], [0065–68], [0070], [0084], [0089], [0098], [0110], Claim 1, Claim 9, Claim 13, Claim 14.

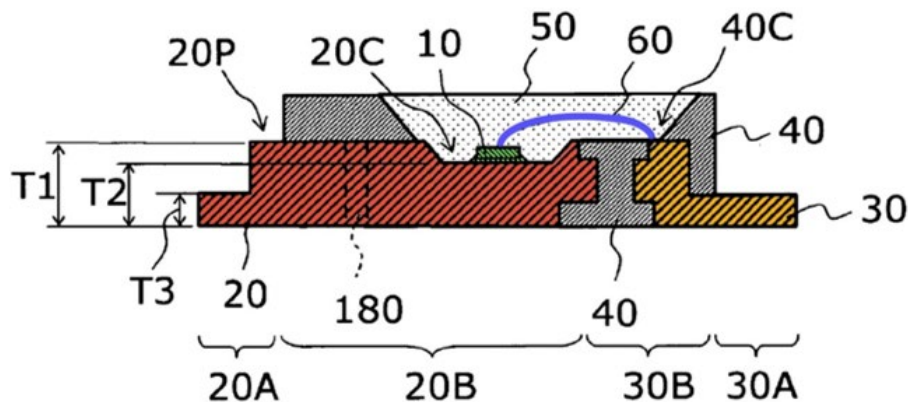


FIG. 1

EX1006, Fig. 1. EX1002, ¶¶153–55.

d. [1C, 6C] a resin covering at least portions of surfaces of the first and second lead frames, wherein:

Oshio teaches [1C, 6C]. As shown in Figures 1 and 2 below, Oshio teaches an “embedding resin 40 formed to encompass inner lead sections 20B and 30B of the leads 20 and 30.” EX1006, [0049]. *See also, e.g.*, EX1006, [0010–13] (“[T]here

is provided a semiconductor light emitting device comprising: **embedding resin**; a **first lead** having a **first inner lead section embedded in the embedding resin**” and “a **second lead** having a **second inner lead section embedded in the embedding resin**.”), Abstract, [0018–23], [0038], [0061], [0071–75], [0089], [0092], [0095], Claim 1, Claim 14.

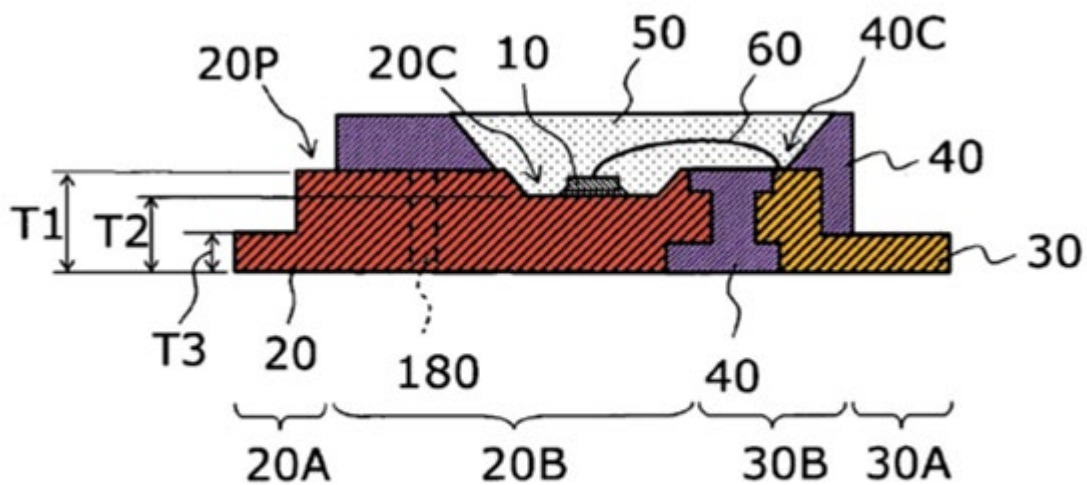


FIG. 1

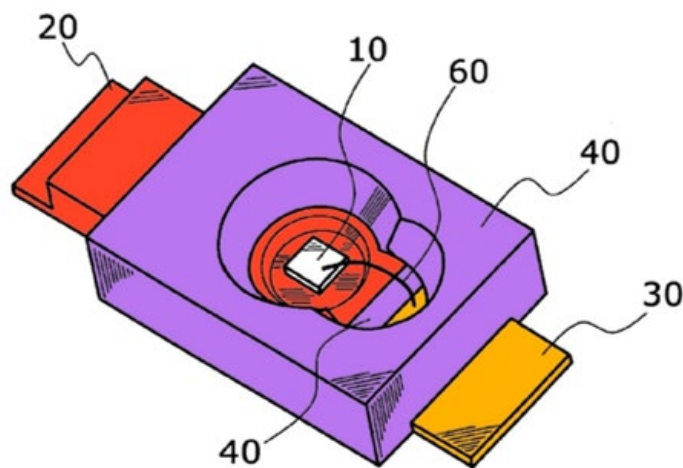
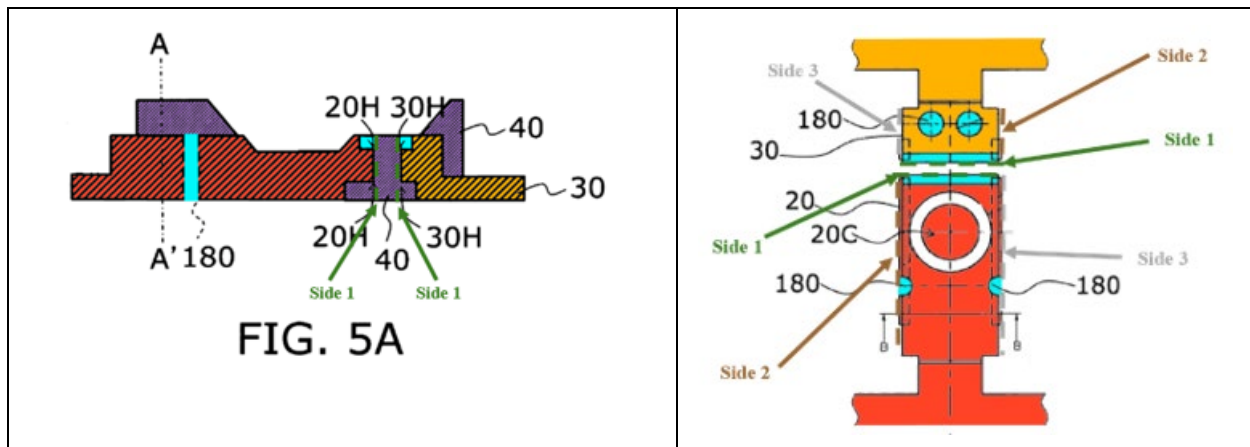


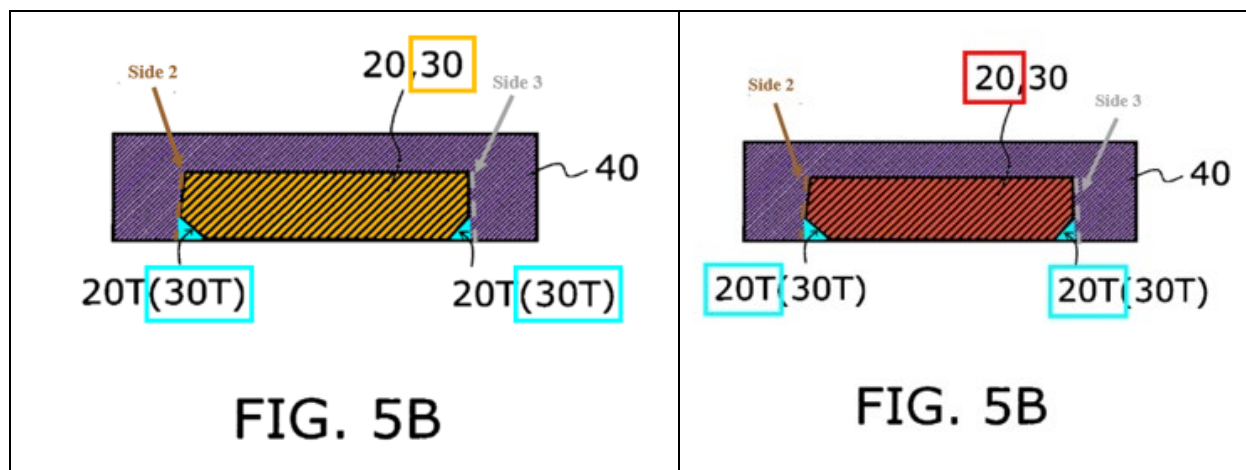
FIG. 2

EX1006, Figs. 1, 2. EX1002, ¶¶156–58.

- e. [1D, 6D] at least one of the **first** and **second lead frames** comprises **resin-holding components** disposed along adjacent sides of one of the **first** and **second lead frames**, the **resin-holding components** being separated from each other at corners of the adjacent sides; and
- f. [1E] the **resin-holding components** are disposed on two adjacent sides of each of the **first lead frame** and the **second lead frame**.

Oshio teaches [1D, 1E, and 6D]. As shown in Figures 5A, 5B, and 12 below, Oshio teaches that its **lead 20** and **lead 30** include multiple forms of **resin-holding components**, which are “structure[s] for enhancing bonding strength between **leads 20, 30** and **resin 40**.” EX1006, [0034]. *See also, e.g.,* EX1006, [0076] (“It is therefore desirable to use a structure having increased bonding strength to avoid peeloff of **these leads** from the **embedding resin 40**.”), [0077].

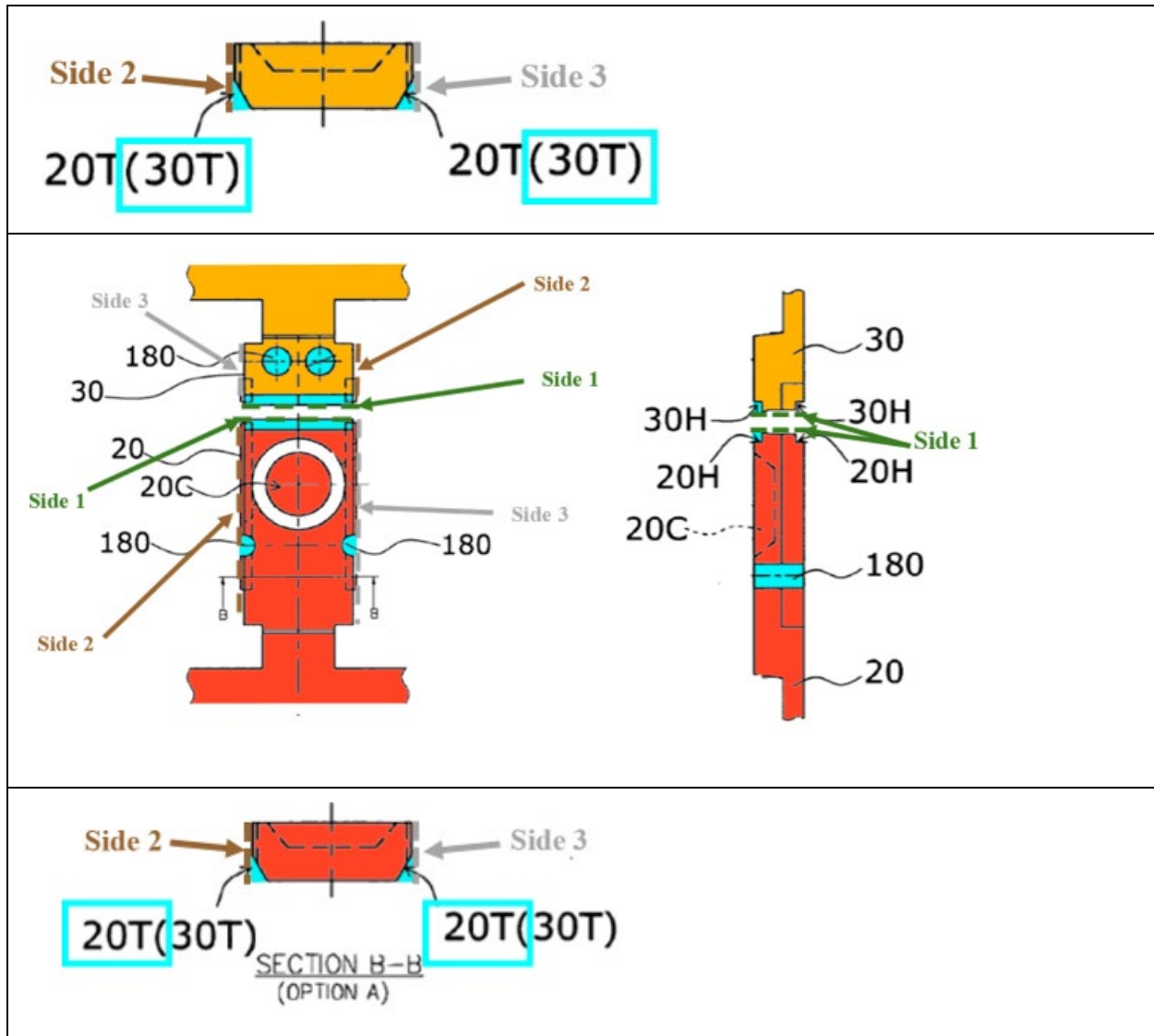




EX1006, Figs. 5A, 5B, 12. EX1002, ¶¶159–61.

For example, Oshio teaches “**asperities 20H** and **30H** . . . provided at the tip of the inner lead sections of the **lead 20** and **30**,” respectively, “to improve ‘biting’ to the **resin 40**, so that the bonding strength can be enhanced.” EX1006, [0079]. “Furthermore, as shown as line A-A’ cross section in FIG. 5B,” Oshio teaches “a **tapered portion 20T** [on the **first lead**] (**30T** [on the **second lead**]) with its width decreasing toward the rear face may be provided on the sidewall of the **lead 20** (**30**). This facilitates supporting the **lead 20** (**30**) with the **tapered portion 20T** (**30T**) obliquely from below, thereby preventing peeloff of the **resin 40**.” EX1006, [0080]. Oshio further teaches that “**anchor holes 180** are provided through the **lead 20** (**30**) so that the **embedding resin 40** may fill in these **anchor holes 180**,” which “serves to reduce ‘loosening’ between the leads and the injection molded object and to increase adhesion strength and contact area, so that peeloff of the leads from the **resin 40** can be prevented.” EX1006, [0078]. *See also, e.g.*, EX1006, [0081]

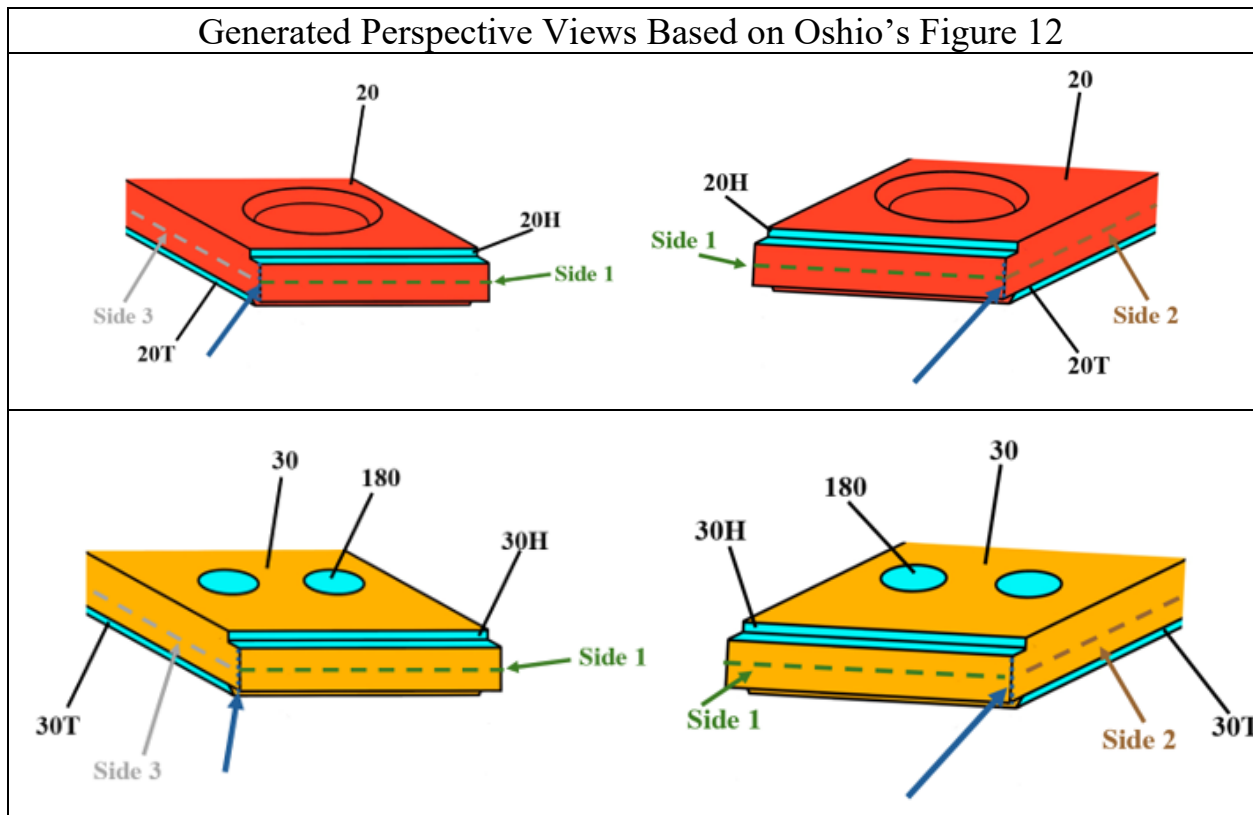
(“The **anchor holes 180**, **asperities 20H (30H)**, and **tapered portion 20T (30T)** described above . . . serve to reduce ‘loosening’ between the leads and the injection molded object and to increase adhesion strength and contact area, so that peeloff of the leads from the **resin 40** can be prevented.”), [0051], [0087].



EX1006, Fig. 12. EX1002, ¶¶162–65.

Based on these three schematic views of Oshio's leads in Figure 12—a top view, and two perpendicular cross-sectional views, Dr. Kymissis generated the

following perspective views of Oshio's **lead 20** and **lead 30** to facilitate the explanation. As shown below, Oshio teaches that the **upper asperity 20H** is disposed along the lateral side of **lead 20** that faces **lead 30** ("Side 1"). Oshio further teaches that **tapered portions 20T** are disposed along lateral sides of the **lead 20** adjacent to **Side 1** ("Side 2" and "Side 3"), and are separated from **upper asperity 20H** at the **corners (see arrows)** where **Side 2** and **Side 3**, respectively, meet **Side 1**.



Further, just as with the **lead 20**, Oshio teaches that the **upper asperity 30H** is disposed along the lateral side of the **lead 30** that faces the **lead 20** ("Side 1"). Oshio

further teaches that **tapered portions 30T** are disposed along lateral sides of the **lead 30** adjacent to **Side 1** (“**Side 2**” and “**Side 3**”), and are separated from **upper asperity 30H** at the **corners (see arrows)** where **Side 2** and **Side 3**, respectively, meet **Side 1**. EX1002, ¶¶166–67.

g. [6E] the **first** and the **second lead frames** comprise opposing sides facing each other, and the **resin-holding components** are disposed on the opposing sides.

Oshio teaches [6E]. As shown in Figure 5A below, Oshio teaches that **lead 20** and **lead 30** comprise opposing sides facing each other, and the **asperities 20H** and **30H** are disposed on the opposing sides.

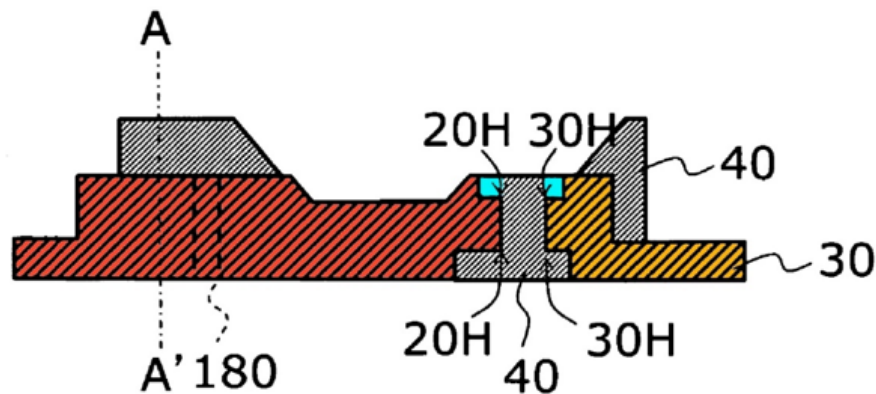


FIG. 5A

EX1006, Fig. 5A. EX1002, ¶¶168–69.

2. Dependent Claims 2 and 3

Oshio anticipates claims 2 and 3.

- a. [2] The LED package of claim 1, wherein the **resin-holding components** comprise at least one hole.
- b. [3] The LED package of claim 2, wherein the **hole** is filled with the **resin** to increase the bonding force between the resin and the lead frames.

Oshio anticipates [2] and [3] for the reasons provided in Section XI.B.1.e–f [Ground II, 1D, 6D, 1E]. EX1002, ¶170.

3. Dependent Claim 4

- a. [4] The LED package of claim 1, wherein the **resin-holding components** are disposed on three sides of at least one of the **first** and **second lead frames**.

Oshio further anticipates [4] for the reasons provided in Section XI.B.1.e–f [Ground II, 1D, 6D, 1E]. EX1002, ¶171.

D. Ground IV: Claims 1–4 And 6 Are Rendered Obvious By Oshio In Combination With Hui

1. Independent Claims 1 And 6

- a. [1Pre, 6Pre] A light emitting diode (LED) package, comprising:

See Section XI.C.1.a [Ground III, 1Pre, 6Pre]. EX1002, ¶172.

- b. [1A, 6A] a **first lead frame** and a **second lead frame** separated from each other;

See Section XI.C.1.b [Ground III, 1A, 6A]. EX1002, ¶173.

- c. [1B, 6B] an **LED chip** disposed on the **first lead frame** and electrically connected with **second lead frame**; and

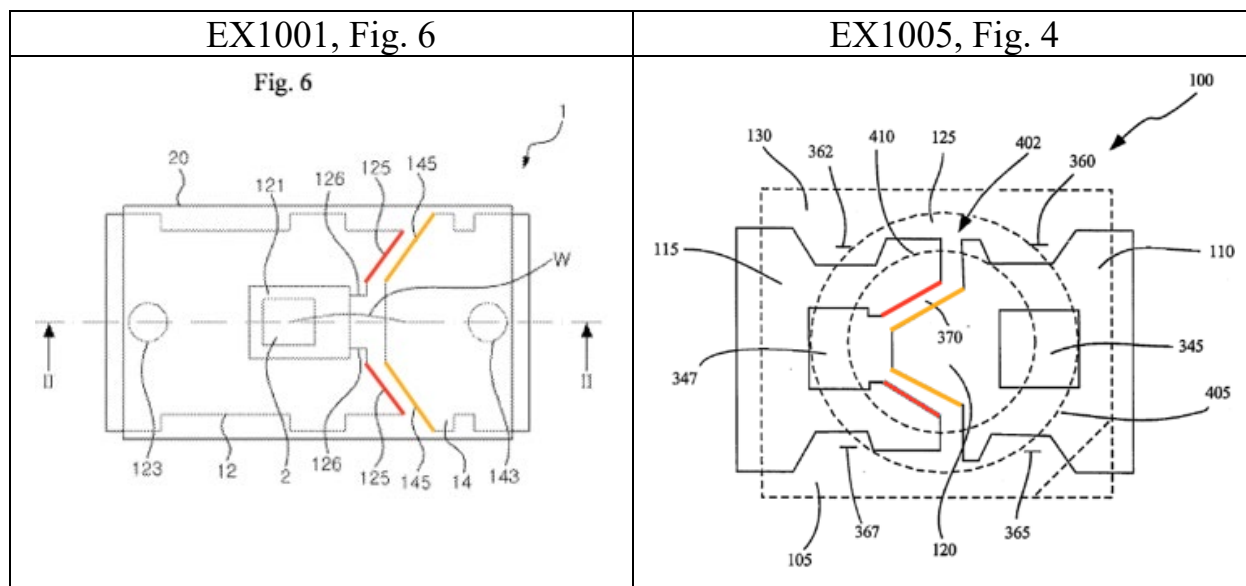
See Section XI.C.1.c [Ground III, 1B, 6B]. EX1002, ¶174.

- d. [1C, 6C] a **resin** covering at least portions of surfaces of the **first** and **second lead frames**, wherein:

See Section XI.C.1.d [Ground III, 1C, 6C]. EX1002, ¶175.

- e. [1D, 6D] at least one of the **first** and **second lead frames** comprises **resin-holding components** disposed along adjacent sides of one of the **first** and **second lead frames**, the **resin-holding components** being separated from each other at corners of the adjacent sides; and
- f. [1E] the **resin-holding components** are disposed on two adjacent sides of each of the **first lead frame** and the **second lead frame**.

To the extent Patent Owner argues that the claimed “**resin-holding components**” require “**slant parts 125, 145** [that] disperse the force diagonally, thereby preventing the **encapsulation material 20** from being broken on the opposite sides of the **lead frames 12, 14**,” (EX1001, 6:34–37), such lead frames having slanted parts were well-known in the art, such as found in Hui (below). Oshio in combination with Hui would have rendered obvious [1D, 1E, and 6D].



EX1002, ¶¶176–77.

It would have been obvious to replace Oshio’s **lead 20** and **lead 30** with Hui’s “**first** and **second electrodes 110, 115**” that have slanted sides with a reasonable expectation of success. The modification amounts to nothing more than simple substitution of one known component (Oshio’s **lead 20** and **lead 30**) with another (Hui’s **first** and **second electrodes 110, 115** that have slanted sides) with the predictable result of forming an LED package. EX1002, ¶178.

At a minimum, it would have been obvious to try different types of lead frames that have different shapes, such as those taught by Hui’s **first** and **second electrodes 110, 115** that have slanted sides. Indeed, a POSITA would have been motivated to make the substitution because Hui teaches that “[t]he enhanced bonding provided through and around the **first** and **second electrodes 110, 115**, at least in part, enhance the stability of the **first** and **second electrodes 110, 115** relative to the

casing 105 and the structural integrity of the surface mount device 100. The structural integrity is further maintained, at least in part, through the electrodes 110, 115 adhering to the casing 105, the fill material, and/or the optoelectronic element.” EX1005, [0047]. EX1002, ¶179.

g. [6E] the first and the second lead frames comprise opposing sides facing each other, and the resin-holding components are disposed on the opposing sides.

Oshio teaches or Oshio in combination with Hui renders obvious [6E]. *See* Section XI.C.1.g [Ground III, 6E] and XI.D.1.e–f [Ground IV, 1D, 1E, and 6D]. EX1002, ¶180.

2. Dependent Claims 2 and 3

- h. [2] The LED package of claim 1, wherein the resin-holding components comprise at least one hole.**
- i. [3] The LED package of claim 2, wherein the hole is filled with the resin to increase the bonding force between the resin and the lead frames.**

See Section XI.C.2 [Ground III, 2 and 3]. EX1002, ¶181.

3. Dependent Claim 4

- j. [4] The LED package of claim 1, wherein the resin-holding components are disposed on three sides of at least one of the first and second lead frames.**

See Section XI.C.3[Ground III, 4]. EX1002, ¶182.

E. Ground V: Claims 1–4 Are Anticipated By Takasaki

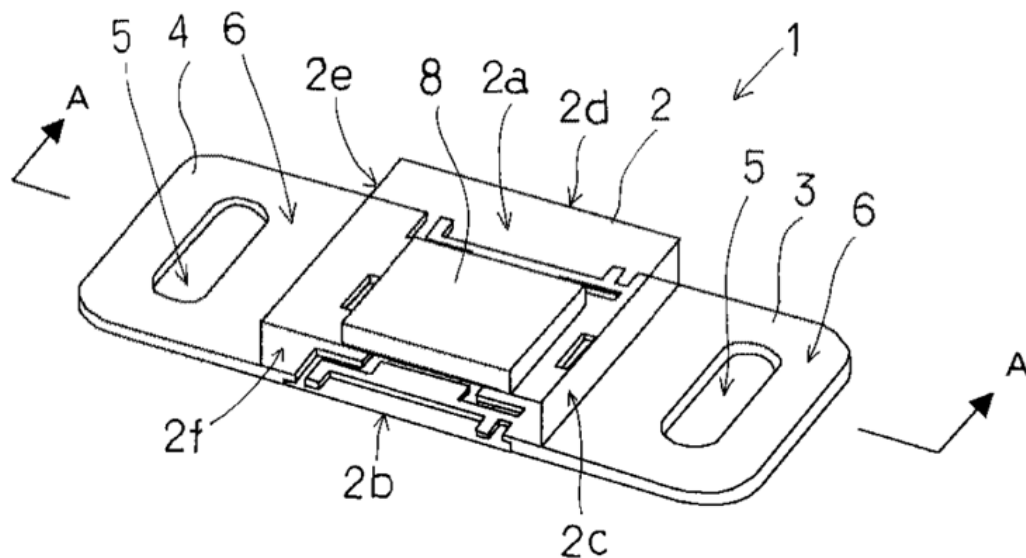
1. Independent Claim 1

a. [1Pre] A light emitting diode (LED) package, comprising:

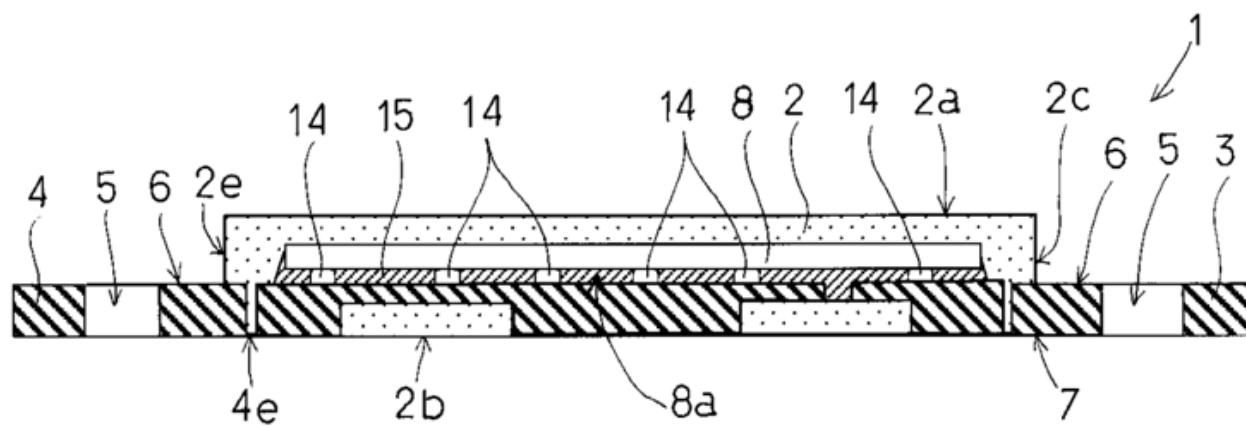
Takasaki teaches [1Pre]. Takasaki teaches “a light emitting diode device that can be made thinner and a method for manufacturing the same.” EX1007, [0010]. EX1002, ¶¶195–96.

For example, as shown in Figures 1–4(a) below, Takasaki teaches “the light emitting diode device 1 of Embodiment 1 has, in appearance, a flat rectangular encapsulant 2, a flat electrode plate (first electrode plate) 3 protruding from the lower part of one side surface of the encapsulant 2, and a flat electrode plate (second electrode plate) 4 protruding from the lower part of one side surface opposite the first side surface, and mounting holes 5 penetrating the electrode plates 3 and 4 are provided in the electrode plate portions protruding from both ends of the encapsulant 2.” EX1007, [0056]. EX1002, ¶197.

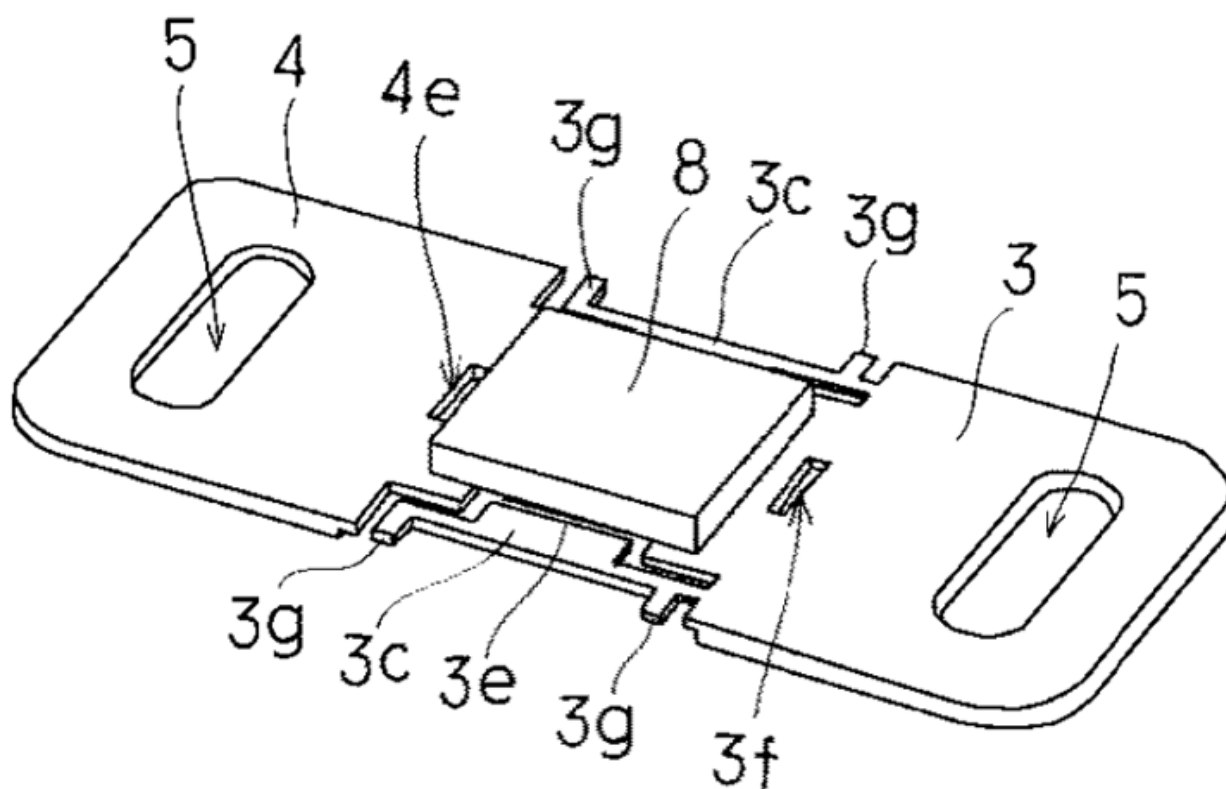
Takasaki further teaches that the “light emitting diode chip 8 is mounted on the first surface 6 (upper surface) of each of the first and second electrode plates 3, 4 by flip chip connection.” EX1007, [0092]. *See also, e.g.*, EX1007, [Title of invention], [Problem to be solved], [Means for solving the problems], [0001], [0004], [0008–09], [0011–12], [0014], [0024], [0035], [0049–52], [0054–55], [0090], Claims 1–29. EX1002, ¶¶198–99.



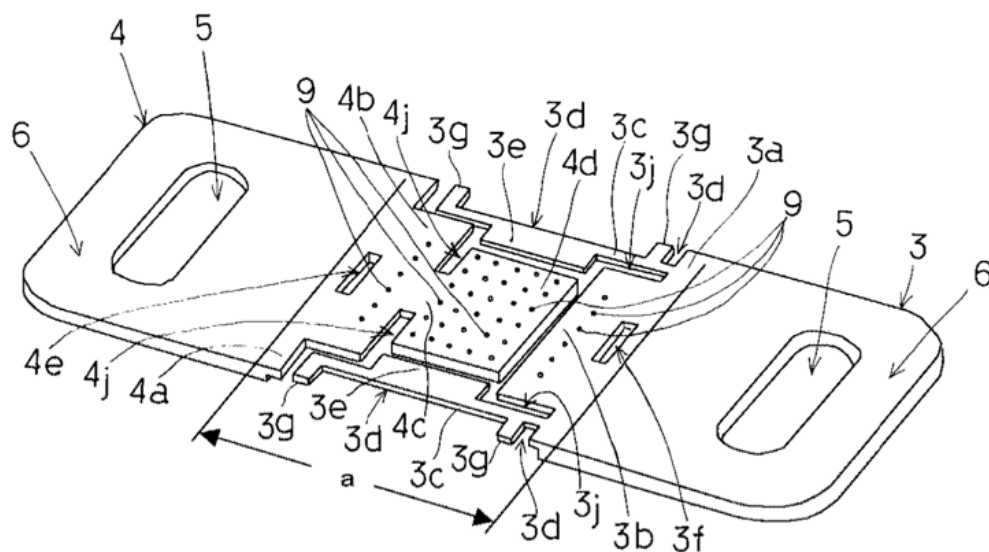
EX1007, Fig. 1.



EX1007, Fig. 2.



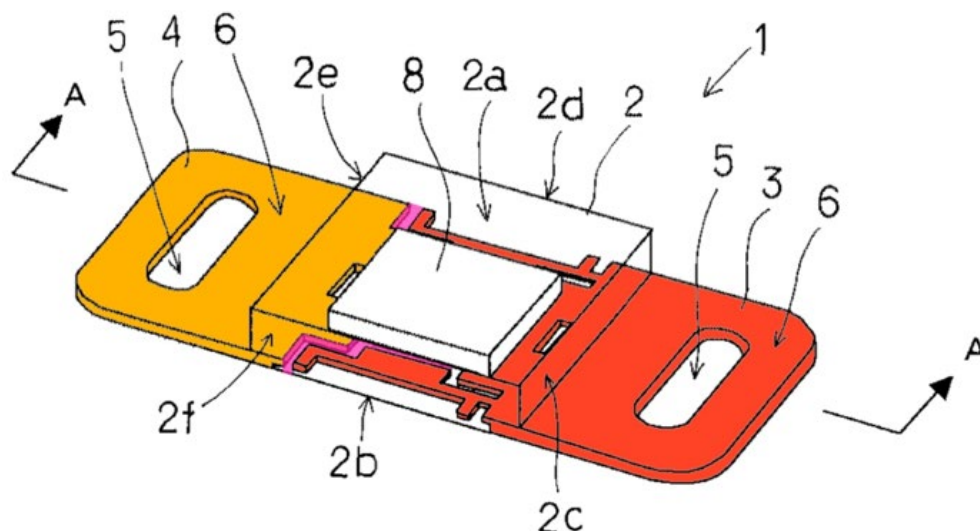
EX1007, Fig. 3.



EX1007, Fig. 4(a).

b. [1A] a first lead frame and a second lead frame separated from each other;

Takasaki teaches [1A]. . As shown in Figures 1, 2, and 4(a) below, Takasaki teaches that “the light emitting diode device 1 of Embodiment 1 has . . . a flat electrode plate (first electrode plate) 3 . . . and a flat electrode plate (second electrode plate) 4” EX1007, [0056]. Figure 1 shows “a perspective view of [the] light emitting diode device,” Figure 2 shows “a cross-sectional view taken along line A-A” of Figure 1, and Figure 4 shows “a perspective view of each component that constitutes a light emitting diode device, in which F[igure] 4(a) shows [the] pair of electrode plates” EX1007, [0056]. *See also, e.g.*, EX1007, Claim 1 (“A light emitting diode device characterized by having . . . a conductive first electrode plate made of a flat plate-like body . . . [and] a conductive second electrode plate formed of a flat plate-like body, the second electrode plate being arranged in series with the first electrode plate”), [Means for solving the problems], [0014], [0008], [0015–17], [0022], [0024], [0033], [0075], [0077], Claims 2–3, Claim 16. EX1002, ¶¶200–02.

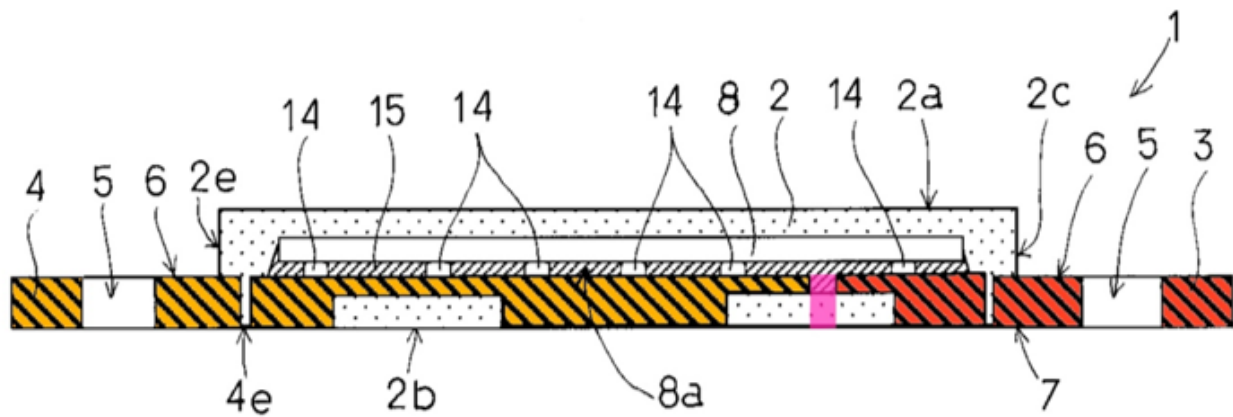


EX1007, Fig. 1.

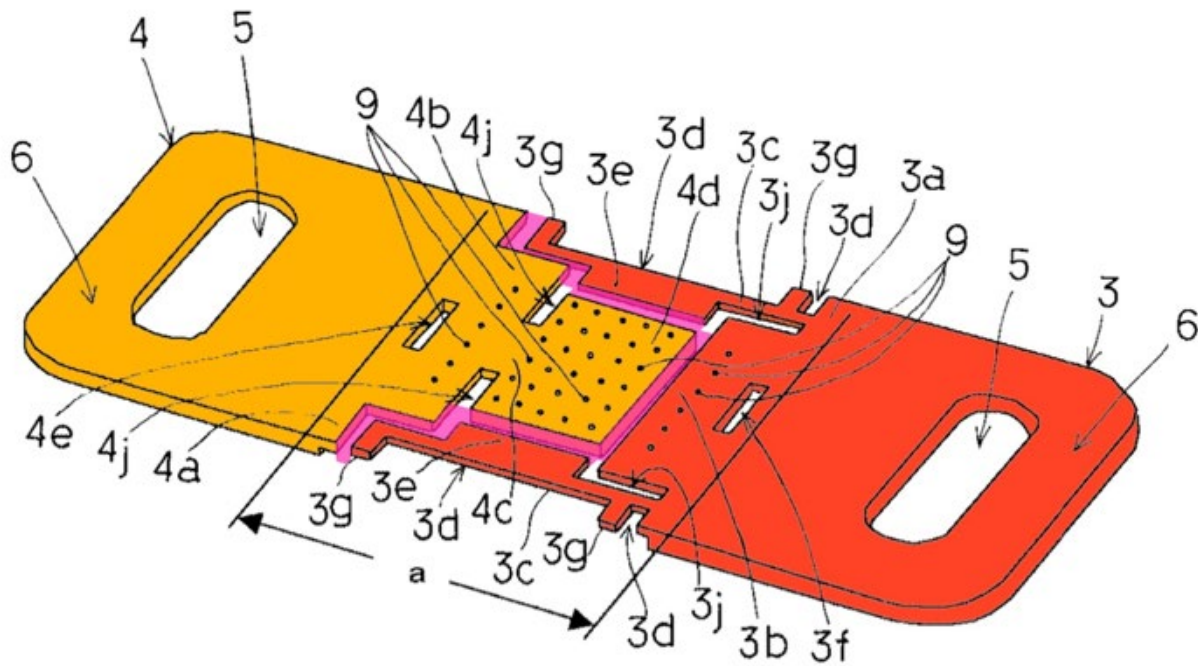
In particular, Takasaki teaches that “the light emitting diode device 1 is manufactured using a lead frame made of a flat plate of a constant thickness on which product forming portions for forming the light emitting diode device are arranged in a matrix. A **first electrode plate 3** and a **second electrode plate 4** are formed in the product forming section.” EX1007, [0058]. In “the final step of manufacturing the light emitting diode device 1, the lead frame is cut lengthwise and crosswise” such that “the **electrode plates 3, 4** are separated” EX1007, [0058]. EX1002, ¶203.

Takasaki further teaches that the **flat electrode plate 3** and the **flat electrode plate 4** are separated from each other by an “**opening 17** of a fixed width.” The “**openings 17** are formed between the strip portion 3c and the same width portion 4a and the medium width portion 4b, and between the protruding portion 3e and the narrow width portion 4d, and are bent.” EX1007, [0071]. *See also, e.g.,* EX1007,

Claim 4 (“[A]n **opening** of a certain width is provided between at least a portion of a peripheral surface of the **first electrode plate** located within the encapsulant and at least a portion of a peripheral surface of the **second electrode plate** located within the encapsulant, and the opening is filled with a resin that forms the encapsulant.”), [0058] (“the **electrode plates 3, 4** are separated”), [0017], [0019], [0024], [0058], Claim 21. EX1002, ¶¶204–06.



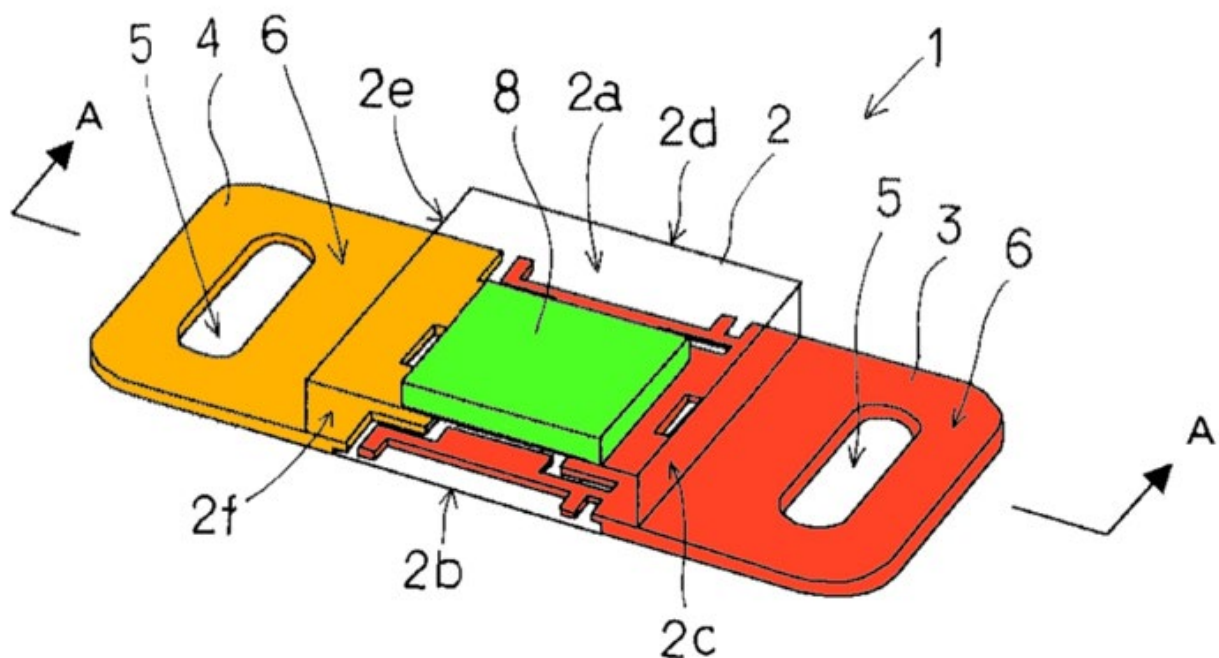
EX1007, Fig. 2.



EX1007, Fig. 4(a).

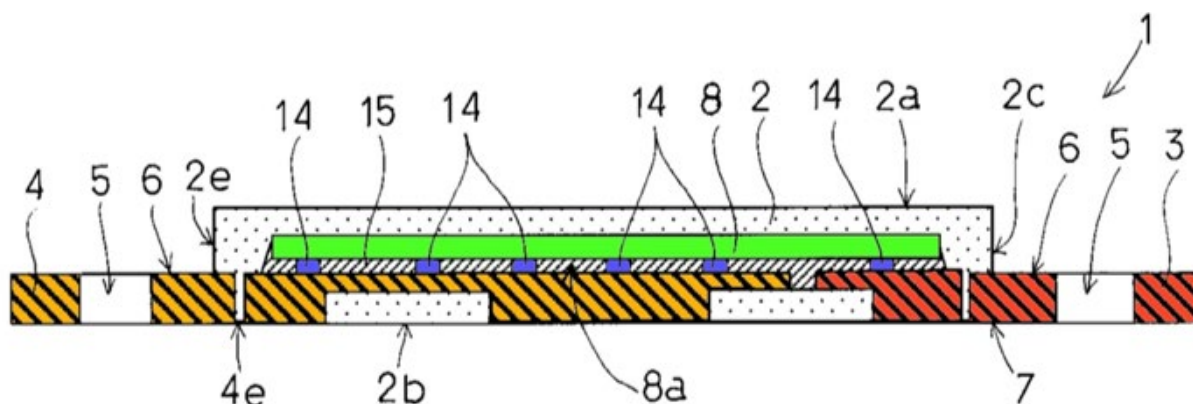
c. [1B] an **LED chip** disposed on the **first lead frame** and **electrically connected** with **second lead frame**; and

Takasaki teaches [1B]. As shown in Figures 1 and 2 below, Takasaki teaches a “**light emitting diode chip 8** that emits blue light [] located within the encapsulant 2.” EX1007, [0060]. *See also, e.g.,* EX1007, [Means for solving the problems], [0002–04], [0014], [0023–24], [0034–36], [0038], [0044], [0047], [0050], [0061–62], [0066], [0081], [0083–84], [0098–101], [0103–04], [0112], Claim 1, Claim 11, Claims 16–17. EX1002, ¶¶207–08.



EX1007, Fig. 1.

Takasaki teaches that the “**light emitting diode chip 8** is mounted on the first surface 6 (upper surface) of each of the **first** and **second electrode plates 3, 4** by flip chip connection.” EX1007, [0092]. Takasaki teaches, for example, that in “the electrode plates **3, 4** . . . a plurality of lands 9 are formed on the first surface 6” which “correspond[] to bump electrodes 11 provided on the first surface 8a of the **light emitting diode chip 8**.” EX1007, [0061]. As shown in Figure 2 below, “the connection portion between the bump electrode 11 provided on the first surface 8a of the **light emitting diode chip 8** and the lands 9 (gold stud electrodes) of the first electrode plate 3 and the second electrode plate 4” form “**a connection portion 14**.” EX1007, [0064]. EX1002, ¶209.



EX1007, Fig. 2.

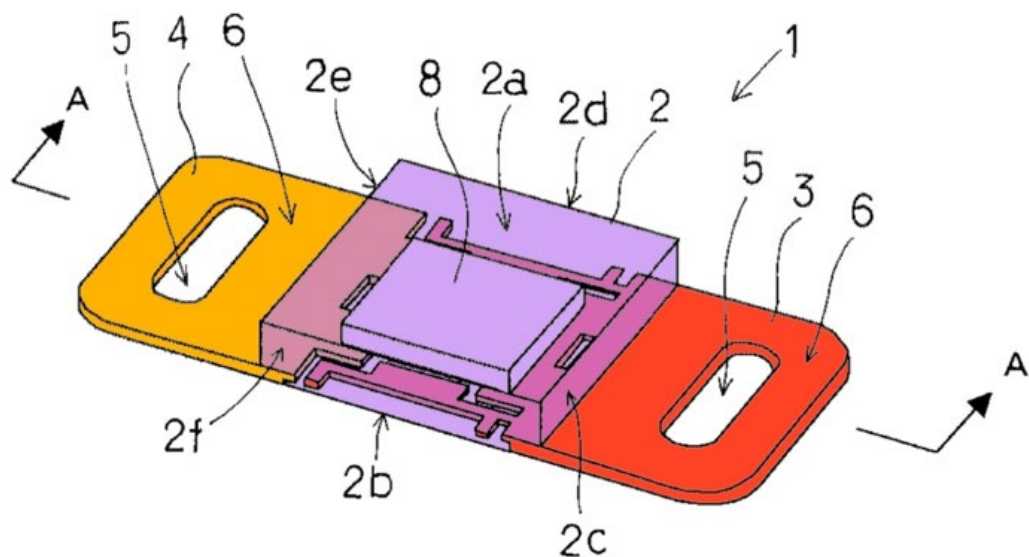
Takasaki further teaches that, alternatively, “instead of the bump electrodes, the connection may be made by using a paste material of Au-Sn or a ribbon (sheet).” EX1007, [0112]. *See also, e.g.*, EX1007, [Means for solving the problems] (“The white light emitting diode device has . . . a flat **first electrode plate** protruding from one end of the encapsulant, a flat **second electrode plate** protruding from the other end of the encapsulant, and a blue **light emitting diode chip** located within the encapsulant and having a p-electrode **connected to** the **first electrode plate** and an n-electrode **connected to** the **second electrode plate . . .**”), [0014] (“The white light emitting diode device comprises . . . a **light emitting diode chip** that is located within the sealed body, an electrode having a first polarity formed on the first surface is **connected to** the **first electrode plate** via a **connecting means**, an electrode having a second polarity formed on the first surface is **connected to** the **second electrode plate** via a **connecting means . . .**”), [0038] (“Furthermore, a **light**

emitting diode chip is mounted on the first surface (upper surface) of each of the **first** and **second electrode plates** by flip chip connection.”), [0023–24], [0026], [0036], [0044], [0047], [0061–62], [0066], [0081], [0083–84], [0098–101], [0103], Claim 1, Claim 11, Claims 16–17. EX1002, ¶¶210–14.

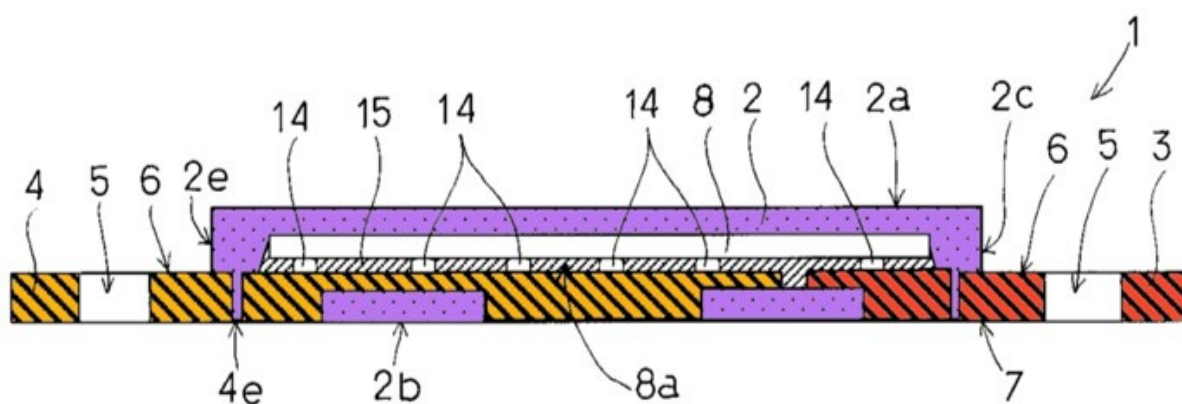
d. [1C] a resin covering at least portions of surfaces of the first and second lead frames, wherein:

Takasaki teaches [1C]. As shown in Figures 1 and 2 below, Takasaki teaches that the “light emitting diode device has an **encapsulant made of transparent insulating resin**. . . .” EX1007, [Means for solving the problems]. Takasaki teaches that the “**encapsulant 2** is configured to *seal* first surfaces 6 (upper surfaces in FIG. 1) of the inner ends of a pair of **electrode plates 3** and **4** that are arranged in series and face each other.” EX1007, [0057]. *See also, e.g.*, EX1007, [0025] (“selectively forming a **resin** layer on the first surface side of the **lead frame** using an insulating **resin** having a yellow phosphor dispersed therein so as to cover the semiconductor chip and the **first** and **second electrode plate** portions”), [0066] (“On the other hand, as shown in FIG. 4(a), various measures are taken in the embodiment to improve the bondability (adhesion) of the electrode plate portions of the **electrode plates 3** and **4** covered by the **encapsulant 2** with the **resin** that forms the **encapsulant 2**. The area indicated by a in FIG. 4(a) is the sealing area in the **electrode plates 3** and **4**.”), [Means for solving the problems], [0008], [0014], [0016], [0018–19], [0021],

[0027], [0033], [0035], [0039], [0055], [0057–58], [0059], [0066], [0072], [0086–87], [0092], [0093–94], [0104], Claim 1, Claim 3, Claim 16. EX1002, ¶¶215–20.



EX1007, Fig. 1.



EX1007, Fig. 2.

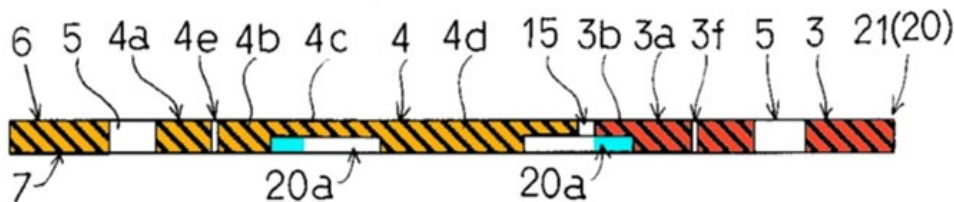
- e. [1D] at least one of the **first** and **second lead frames** comprises **resin-holding components** disposed along adjacent sides of one of the **first** and **second lead frames**, the **resin-holding components** being separated from each other at **corners** of the adjacent sides; and
- f. [1E] the **resin-holding components** are disposed on two adjacent sides of each of the **first lead frame** and the **second lead frame**.

Takasaki teaches [1D and 1E]. EX1002, ¶¶221.

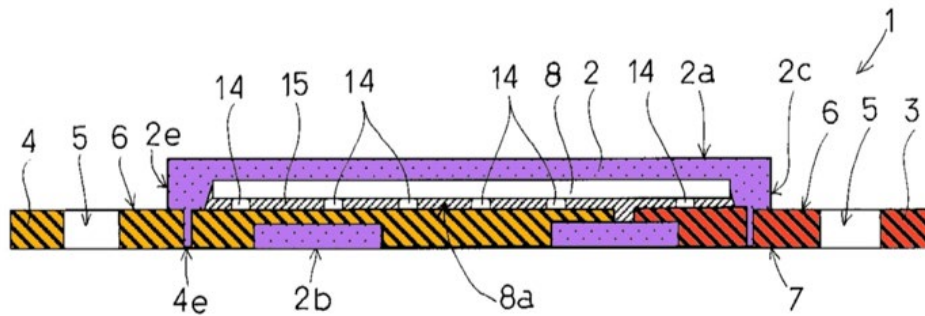
First, Takasaki teaches “at least one of the **first** and **second lead frames** comprises **resin-holding components**” in the form of “**space 20a**” along multiple sides of the **first electrode plate 3** and the **second electrode plate 4**. As explained below, the **resin-holding components** in the **first electrode plate 3** and the **second electrode plate 4** are created by thinning portions of the **first** and **second electrode plates**, leaving channels along multiple vertical sides of the **first** and **second electrode plates**, which are then filled with **resin**. EX1002, ¶222.

More specifically, as shown in Figures 5(a) and 2 below, Takasaki teaches that “the **first electrode plate 3** and the **second electrode plate 4** are thinned by removing a predetermined depth from the second surface 7 side of the lead frame” with the removal “performed, for example, by etching (half etching).” EX1007, [0080]. The etching forms, for example, “**space 20a**” on the **first** and **second electrode plates 3, 4**. EX1007, [0081]. EX1002, ¶223.

Takasaki further teaches that the **space 20a** formed on the bottom side of the **first** and **second electrode plates 3, 4** holds the **sealing body 2** formed of **resin**, thereby “making it difficult for the electrode plates (**first** and **second electrode plates 3, 4**) to peel off from the **sealing body**, and improving the reliability of the sealing.” EX1007, [0093] (The “portions of the **first** and **second electrode plates 3, 4** covered by the **sealing body 2**, the **resin** that forms the **sealing body 2** is filled **under the thin electrode plate portions**, and the **resin** supports the thin electrode plate portions so that the electrode plates are well held by the **sealing body 2**, making it difficult for the electrode plates (**first** and **second electrode plates 3, 4**) to peel off from the **sealing body**, and improving the reliability of the sealing.”). *See also*, e.g., EX1007, [0017] (“In the electrode plate portion located within the **encapsulant** of the **first** and **second electrode plates**, the second surface side of the electrode plate is partially removed to make it thinner, and the **removed portion** is filled with a **resin** that forms the **encapsulant**.”), [Means for solving the problems], [0039], [0072], [0095], Claim 3, Claim 20. EX1002, ¶¶224–25.



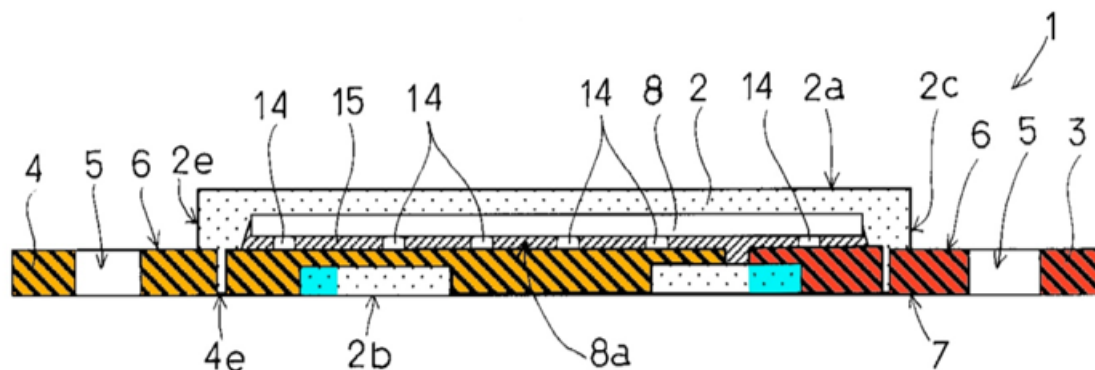
EX1007, Fig. 5(a).



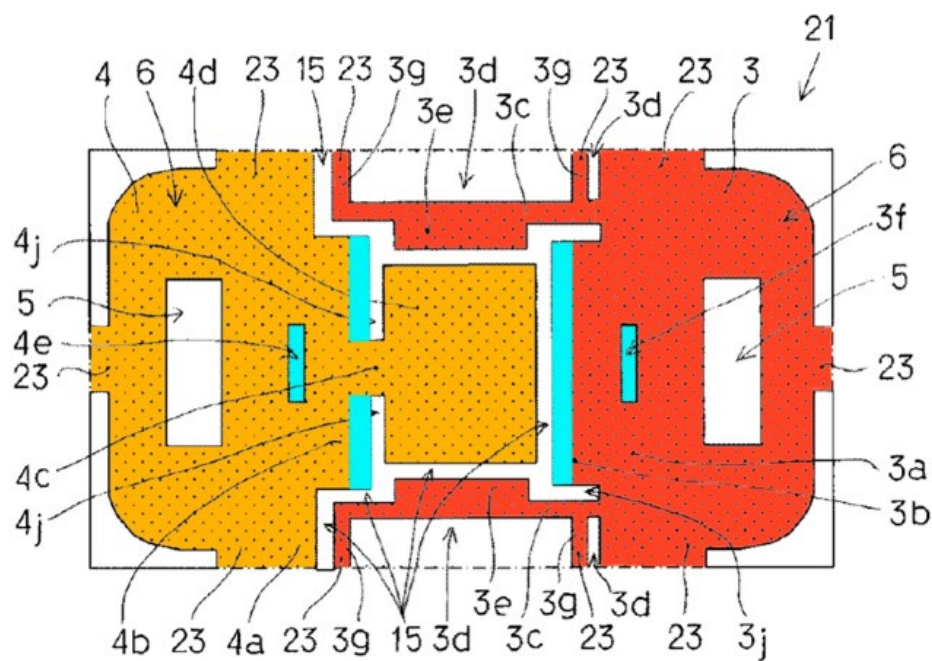
EX1007, Fig. 2.

As shown in Figures 2 and 7³ below, the thinned portion of **electrode plate 4** shown on the left below extends “from the middle part of the same width portion 4a to the constricted part 4c.” EX1007, [0068]. The **thinned area** of **electrode plate 4** is perpendicular to the constricted part 4c creates **resin-holding components** along two vertical sides of **electrode plate 4**, as shown at the left in Figure 7 below. The thinned portion shown on the right below includes a thinned portion of **electrode plate 3**, and creates a **resin-holding component** along the vertical side of **electrode plate 3** that faces **electrode plate 4**. EX1002, ¶¶226–27.

³ In Figure 7, the resin-holding components are not visible and are therefore indicated where they exist outside the plane of the page.



EX1007, Fig. 2.

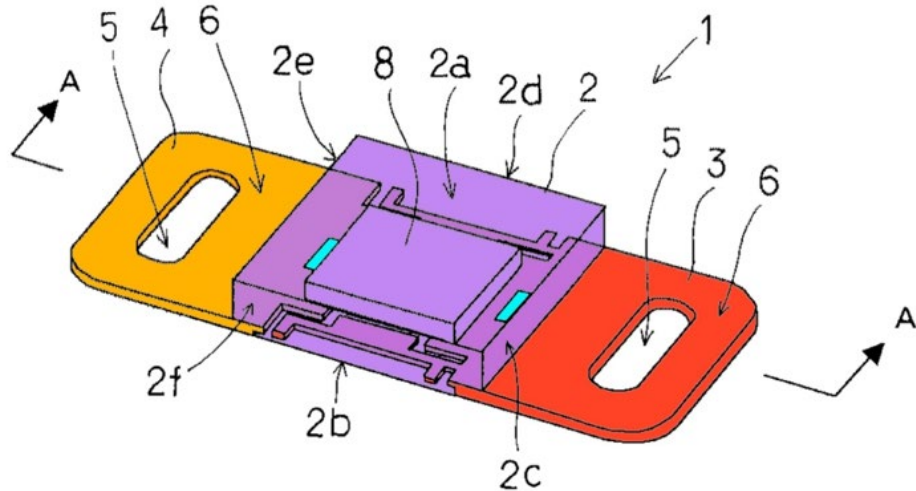


EX1007, Fig. 7.

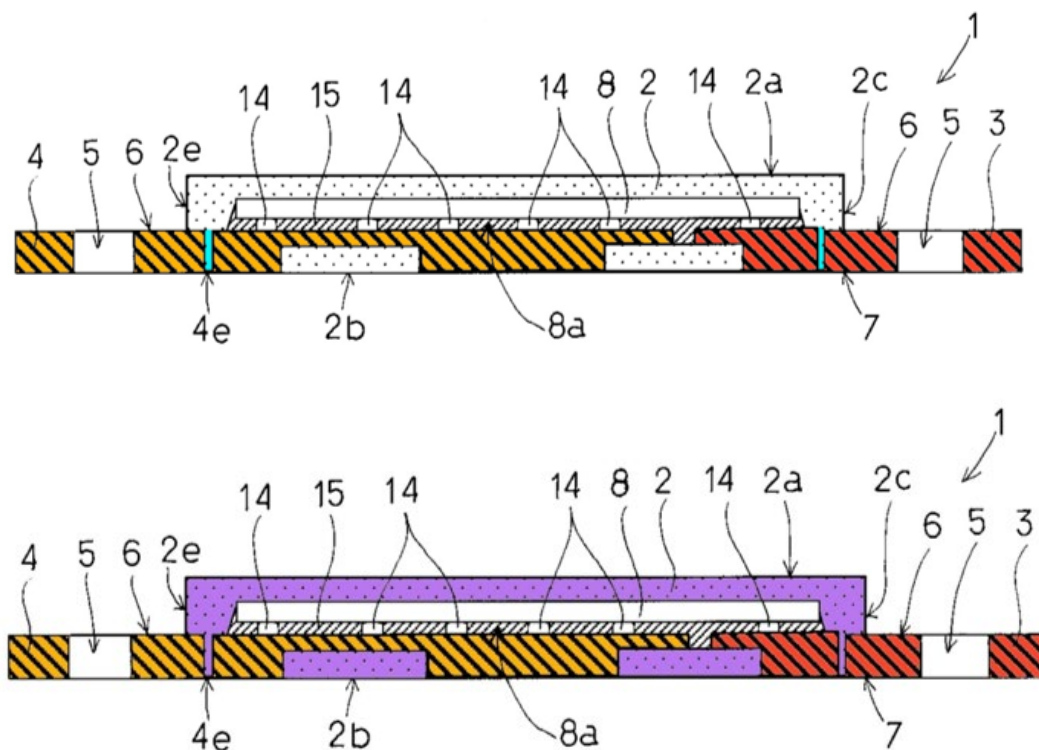
Second, Takasaki also teaches “at least one of the **first** and **second lead frames** comprises **resin-holding components**” in the form of **through-holes**

disposed along the upper and lower sides of each of the **first electrode plate 3** and the **second electrode plate 4** that are filled with **resin**. EX1002, ¶228.

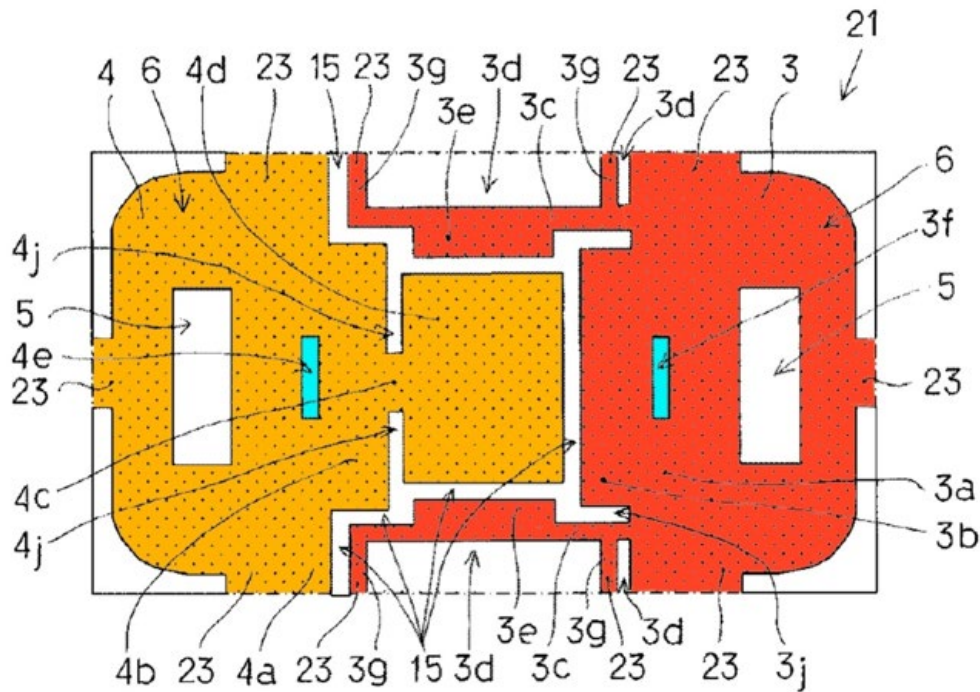
More specifically, as shown in Figures 1, 2, and 7 below, Takasaki teaches that “the **electrode plates 3, 4** are formed with the **through holes 3f, 4e**.” EX1007, [0073]. Takasaki teaches that in the “portions of the **first** and **second electrode plates 3, 4** covered by the **encapsulant 2**, the **through holes (through holes 3f, 4e)** penetrating the electrode plates are filled with **resin** that forms the **encapsulant 2**, so that the **electrode plates** are held well by the **encapsulant 2**, the **electrode plates** are less likely to peel off from the **encapsulant 2**, and the reliability of the sealing is improved.” EX1007, [0095]. *See also, e.g.*, EX1007, [0019] (“The electrode plate portions of the **first** and **second electrode plates** located within the **encapsulant** are provided with **through holes** penetrating the **electrode plates**, and the **through holes** are filled with a **resin** that forms the **encapsulant**.”), [Means for solving the problems], [0030], [0041], [0066], [0068], [0072], [0086], [0095], Claim 6, Claim 23. The **through holes 3f, 4e** form **resin-holding components** along the top and bottom sides of each of the **electrode plate 3** and the **electrode plate 4**. EX1002, ¶¶229–31.



EX1007, Fig. 1.

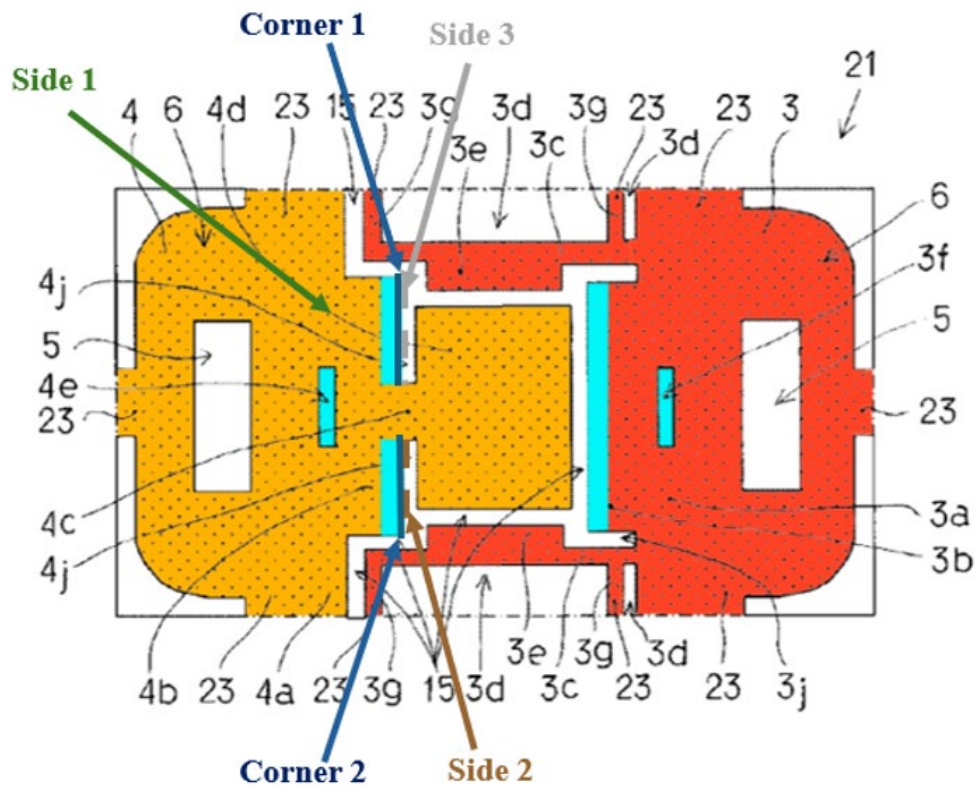


EX1007, Fig. 2.

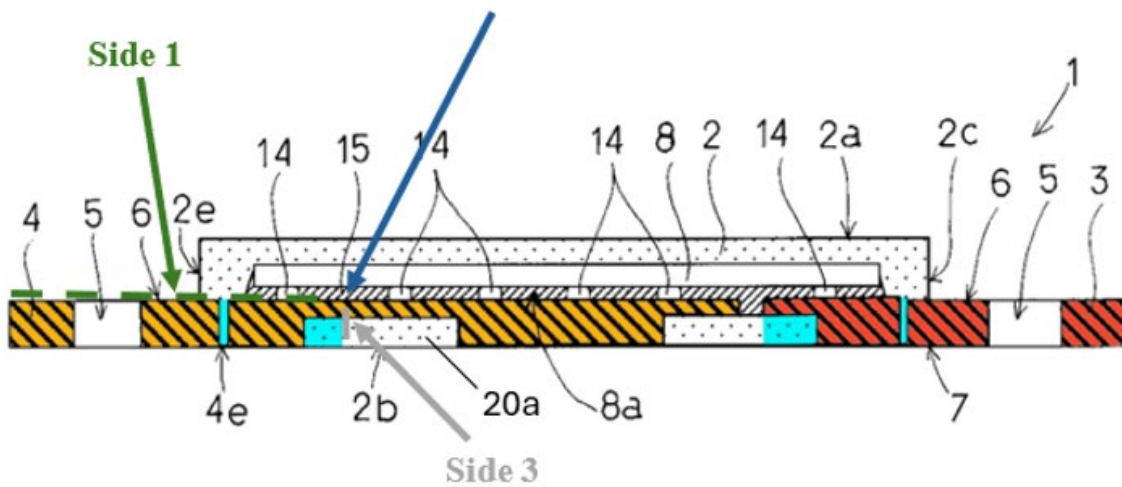


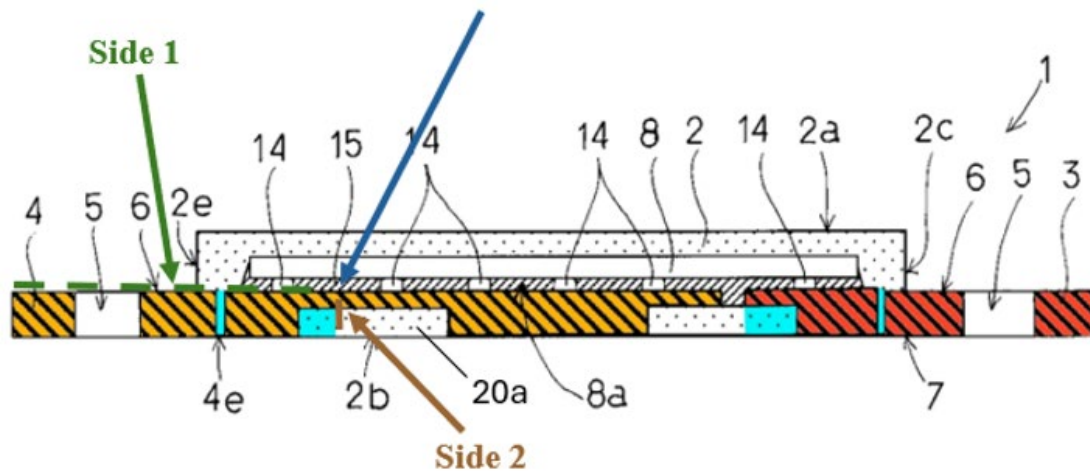
EX1007, Fig. 7.

Third, as shown in Figures 2 and 7 below, Takasaki teaches that the **resin-holding components**—the **through-hole 4e** and the **opening 20a**—are “separated from each other at **corners** of the adjacent sides.” Specifically, Takasaki teaches that the **through-hole 4e** is disposed along the **upper side (“Side 1”)** of the **second electrode plate 4**, which is adjacent to two vertical sides (**vertical “Side 2”** and **vertical “Side 3”**) of the **second electrode plate 4**, along each of which one of the channel-like **resin-holding components** is disposed. Takasaki further teaches that the **through-hole** is separated from the channel-like **resin-holding components** at the **corners** where **upper Side 1** meets **vertical Side 2** and **vertical Side 3**, respectively. EX1002, ¶¶232–33.



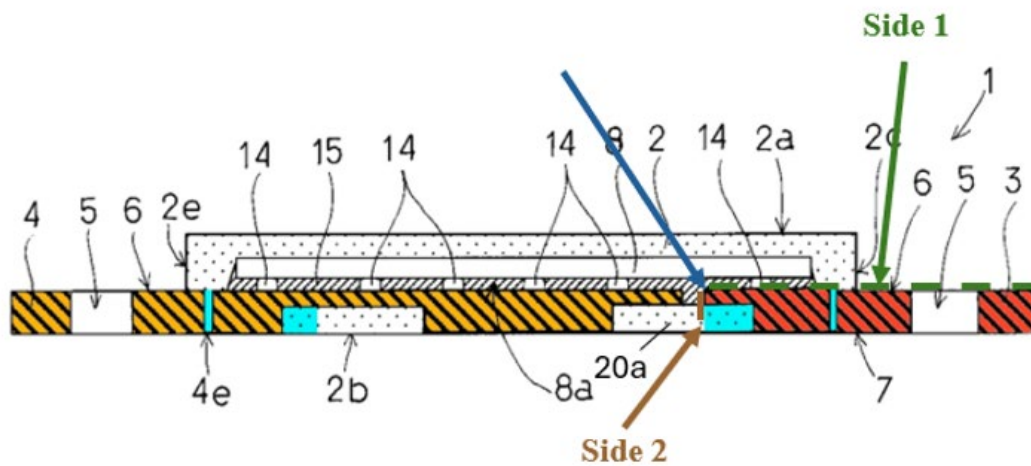
EX1007, Fig. 7.



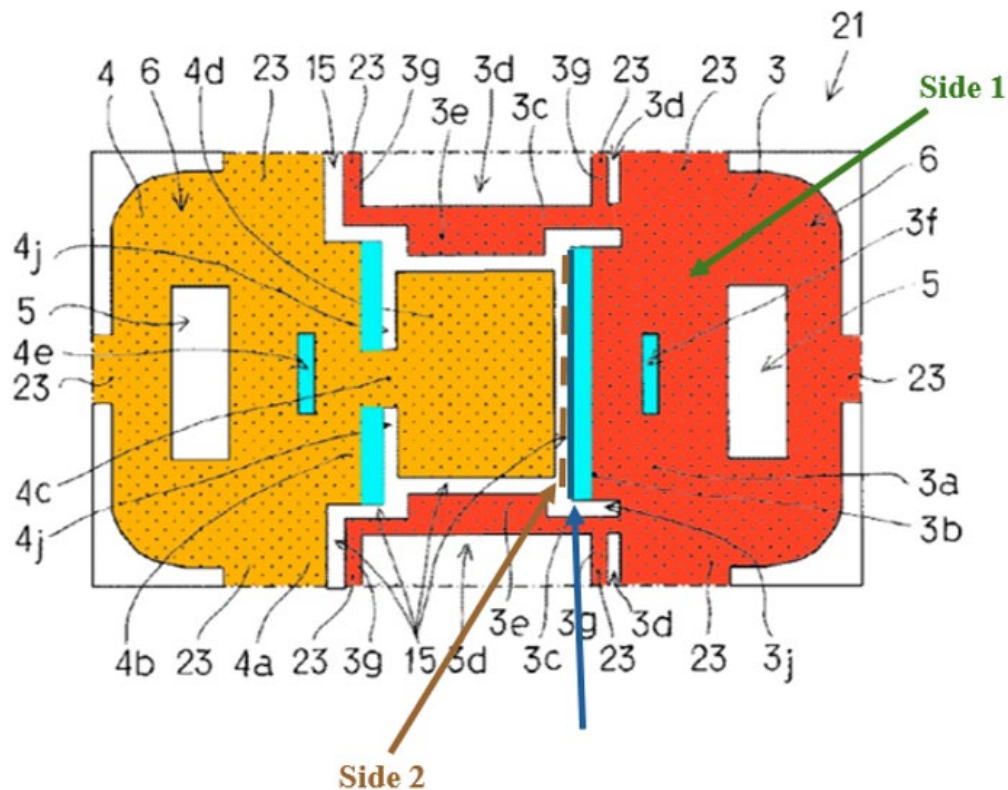


EX1007, Fig. 2 (label added indicating 20a).

Fourth, as shown in Figures 2 and 7 below, the **through hole 3f** is disposed along the **upper Side 1** of the **first electrode plate 3**, which is adjacent to **vertical Side 2** of the **first electrode plate 3**, along which a channel-like **resin-holding component** is disposed. EX1002, ¶234.



EX1007, Fig. 2 (label added indicating 20a).



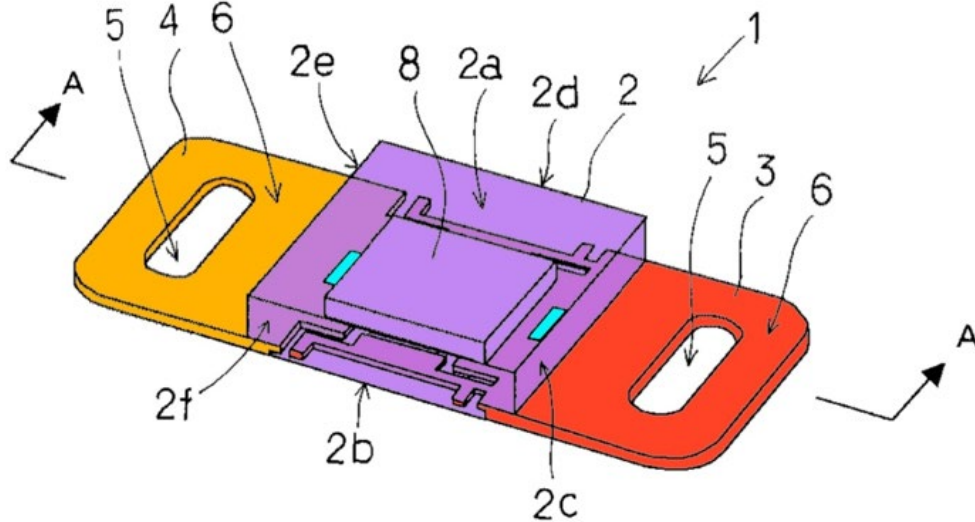
EX1007, Fig. 7.

2. Dependent Claims 2 and 3

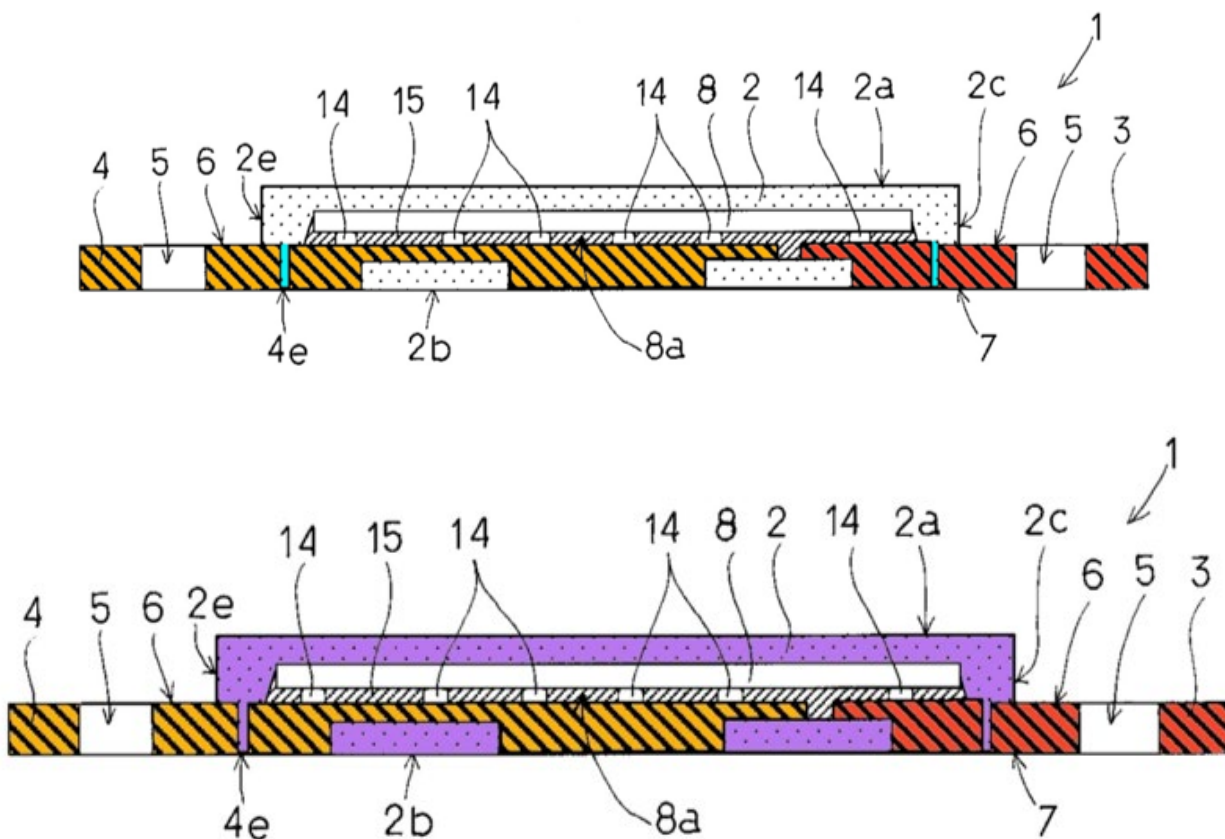
- a. [2] The LED package of claim 1, wherein the **resin-holding components** comprise at least one **hole**.
- b. [3] The LED package of claim 2, wherein the **hole** is filled with the **resin** to increase the bonding force between the resin and the lead frames.

Takasaki teaches [2] and [3]. As shown in Figures 1, 2, and 7 below, Takasaki teaches that “the **electrode plates 3, 4** are formed with the **through holes 3f, 4e**.” EX1007, [0073]. Takasaki teaches that in the “portions of the **first** and **second electrode plates 3, 4** covered by the **encapsulant 2**, the **through holes (through holes 3f, 4e)** penetrating the electrode plates are filled with **resin** that forms the

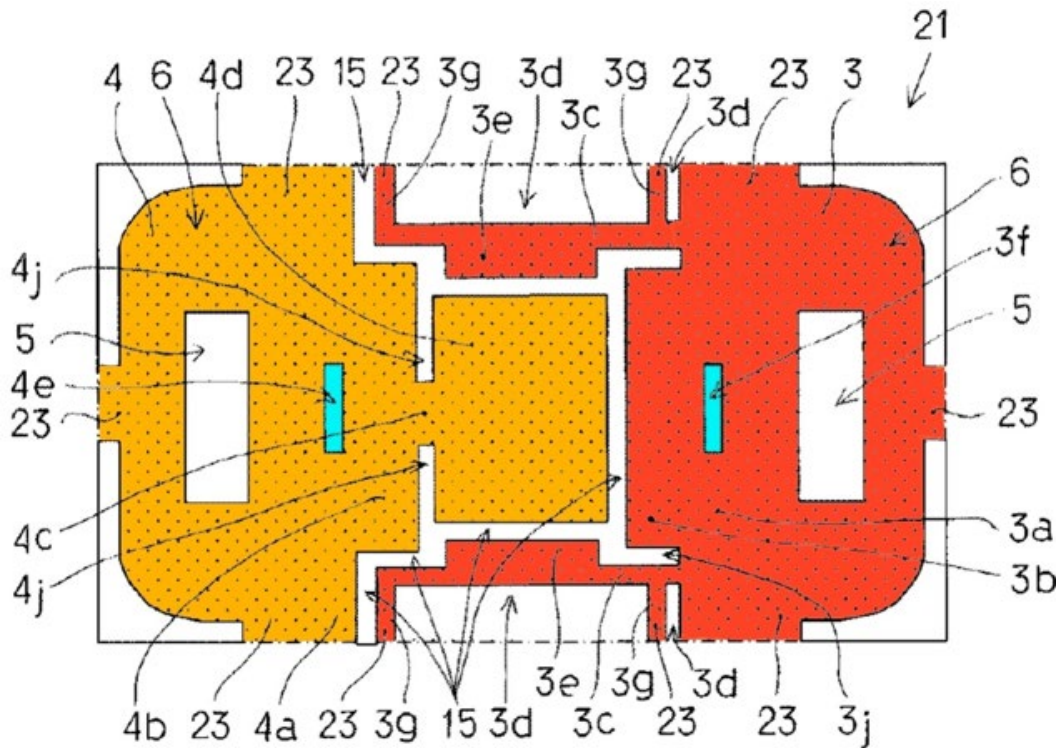
encapsulant 2, so that the electrode plates are *held well* by the encapsulant 2, the electrode plates are *less likely to peel off* from the encapsulant 2, and the reliability of the sealing is improved.” EX1007, [0095]. *See also, e.g.*, EX1007, [0019] (“The electrode plate portions of the first and second electrode plates located within the encapsulant are provided with through holes penetrating the electrode plates, and the through holes are filled with a resin that forms the encapsulant.”), [Means for solving the problems], [0030], [0041], [0066], [0068], [0072], [0086], [0095], Claim 6, Claim 23. EX1002, ¶¶235–38.



EX1007, Fig. 1.



EX1007, Fig. 2.

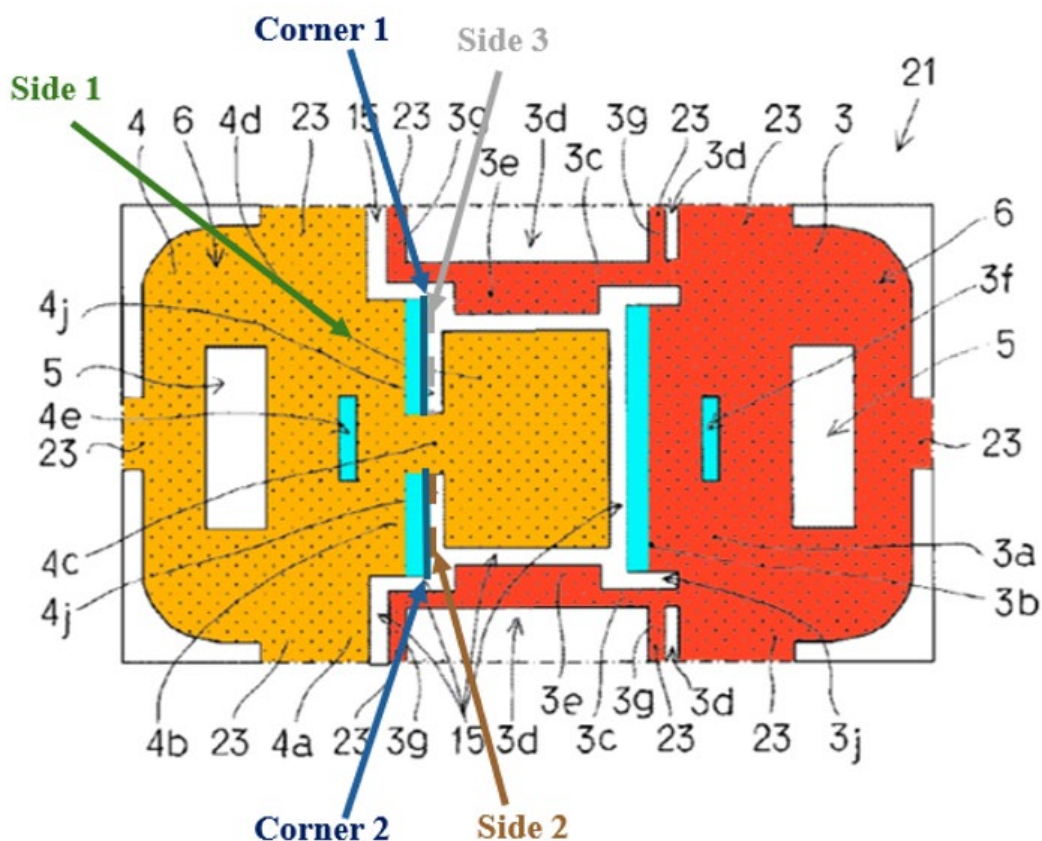


EX1007, Fig. 7.

3. Dependent Claim 4

- a. [4] The LED package of claim 1, wherein the **resin-holding components** are disposed on three sides of at least one of the **first** and **second lead frames**.

Takasaki teaches [4]. For example, as shown below in Figure 7, **resin-holding components** exist on three sides of the **electrode plate 4**. EX1002, ¶¶239.



EX1007, Fig. 7.

XII. Discretionary Factors Favor Institution

The discretionary factors the Board employs for its institution decisions favor institution.

A. *Advanced Bionics* Factors Favor Institution

The Board uses a two-pronged test to determine whether it will deny institution under 35 U.S.C. §325(d): (1) whether the same or substantially the same art or arguments were previously presented to the Office; and (2) if so, whether the Office erred in a manner material to patentability. *See Advanced Bionics LLC v.*

MED-EL Elektromedizinische Geräte GmbH, IPR2019-01469, Paper 6
(precedential).

1. Substantially Same Art/Arguments Not Considered

This Petition presents five prior art references—Hsu, Iwamasa, Hui, Oshio, and Kawasaki. Among the asserted art, Hsu, Iwamasa, Hui, and Takasaki were never considered. The only art substantively applied by the Examiner as a secondary reference against now canceled claims 10, 11, 13, and 14 is Oshio. EX1008, 120–128.

Hence, the asserted prior art references have material differences and are not cumulative over the art considered during prosecution. Moreover, Grounds I, II, V rely solely on Hsu, Iwamasa, Hui and/or Takasaki—references never previously considered by the Office. Similarly, Ground IV relies on the combination of Oshio with Hui—the combination never previously considered by the Office. Therefore, the first prong of *Advanced Bionics* favors institution at least based on Grounds I, II IV, and V.

2. Office Erred

To the extent Board finds the first prong of *Advanced Bionics* to be met because Oshio was previously considered, the Office erred.

Oshio was not applied against now issued claims, nor was Oshio applied to any of the claims based on the current articulation of how Oshio teaches the issued

claims. “Office’s prior failure to apply [Oshio] against the pending claims was an error that was material to the patentability of these claims.” *2985 LLC d/b/a Mountain Voyage Co. v. The Ridge Wallet, LLC*, IPR2024-00692, Paper 18, 45; *see also Advanced Bionics*, 10. Hence, the second prong of *Advanced Bionics* also favors institution.

B. *Fintiv* Factors Favor Institution

At the outset, Petitioner filed a motion to transfer the pending case from the Eastern District of Texas to the District of New Jersey, where Samsung Electronics America Inc. resides. *See Sinotechnix LLC v. Samsung Electronics Co. Ltd et al.*, Case No. 2:24-cv-00544, Dkt. No. 53 (EDTX). While Petitioner will inform the Board of the latest developments related to the *Fintiv* factors as they become available, the following analysis is based on the *current* venue in the Eastern District of Texas for the parallel district court litigation.

Based on the current facts, the six *Fintiv* factors guide against discretionary denial. *See Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 (precedential).

1. No Evidence Regarding A Stay

Factor 1 is neutral because no motion to stay has been filed.

2. Parallel Proceeding Trial Date

Factor 2 is neutral. The trial in the co-pending litigation is currently scheduled for May 4, 2026 (EX1013 [Docket Control Order]), which is only about 4 months

earlier than the expected final written decision date—around September 2026. Furthermore, it is at the very least uncertain that the '913 Patent will be tried on May 4, 2026 because Judge Gilstrap has scheduled trials for eleven other cases for May 4, 2026. EX1015 [Judge Gilstrap Trial List]. Hence, this factor is neutral.

3. Investment In Parallel Proceeding

Factor 3 favors institution because the co-pending litigation is in its early stages, and the investment in it has been minimal. For example, discovery opened only on December 17, 2024. Invalidity contentions were served just recently on February 14, 2025. EX1013, 5. The parties have not exchanged any positions on claim construction. The Markman hearing is not scheduled until November 7, 2025. EX1013, 3. The parties are not expected to complete expert discovery until January 20, 2026. EX1013, 4. And the parties have not completed the briefing of any dispositive invalidity motion. *See Verizon Bus. Network Servs. Inc. v. Huawei Techs. Co.*, IPR2020-01080, Paper 11, 13-14 (P.T.A.B. Jan. 14, 2021) (“the investment in the parallel proceeding related to the validity issue is minimal” when parties had not submitted dispositive briefing on validity issues). Hence, this factor favors institution.

4. Overlapping Issues With The Parallel Proceeding

Factor 4 strongly favors institution. Petitioner stipulates that, if this IPR is instituted, it will not advance the grounds that are raised or reasonably could have

been raised in this IPR in the co-pending district court proceeding, eliminating any overlap between the IPR and the co-pending district court proceeding. *Sotera Wireless, Inc. v. Masimo Corp.*, IPR2020-01019, Paper 12 (P.T.A.B. Dec. 1, 2020) (precedential as to § II.A). The *Sotera*-type stipulation strongly guides against discretionary denial, particularly when the district court trial is expected to precede the final written decision by only four months. *See Samsung Elecs. Co. v. RightQuestion, LLC*, IPR2022-00244, Paper 17 (PTAB Jun. 10, 2022) (instituting with *Sotera*-type stipulation when final written decision is about 9 months after scheduled trial date); *Resi Media LLC v. BoxCast Inc.*, IPR2022-00066, Paper 19 (PTAB Apr. 26, 2022) (same when final written decision is due about 8 months after scheduled trial date); *PNC Bank v. United Servs. Auto. Ass’n*, IPR2021-01077, Paper 21 (PTAB Jan. 24, 2022) (same when final written decision is due about 9 months after scheduled trial date).

5. Identity Of Parties

Petitioner is the defendant in the litigation. This factor should not be a basis for denying institution.

6. Other Circumstances, Including The Merits

Factor 6 guides against discretionary denial. Where “the merits of a ground raised in the petition seem particularly strong on the preliminary record, this fact [] favor[s] institution.” *Fintiv*, IPR2020-00019, Paper 11 at 14–15. Here, the evidence

of unpatentability is particularly strong, as evidenced by multiple Grounds laid out above, including anticipatory grounds.

Accordingly, *Fintiv* factors guide against discretionary denial.

C. *General Plastic* Factors Favor Institution

The '913 patent has not been challenged in any prior IPR petition, so none of the *General Plastic* factors apply to this Petition and favor institution.

XIII. Conclusion

Petitioner respectfully requests that the Board institute *inter partes* review, hold the challenged claims unpatentable, and cancel the challenged claims.

Dated: March 10, 2025

Respectfully submitted,

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CERTIFICATION UNDER 37 C.F.R. § 42.24(d)

I hereby certify that this Petition for *Inter Partes* Review of U.S. Patent No. 9,412,913 has, excluding the portions exempted under 37 C.F.R. § 42.24(a), 13,781 words as counted by the word-processing system used to prepare this document, in compliance with 37 C.F.R. § 42.24(d).

Dated: March 10, 2025

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CERTIFICATE OF SERVICE

Under 37 C.F.R. §§ 42.6(e) and 42.126, the undersigned certifies that on March 10, 2025, complete copies of the foregoing and any accompanying exhibits were caused to be served by sending them via Federal Express Priority Overnight shipping, which is at least as fast and reliable as U.S. Priority Mail Express, to the correspondence address of record for U.S. Patent No. 9,412,913 as indicated in Patent Center:

H.C. Park & Associates, PLC
1894 Preston White Drive, Reston, VA, 20191

Petitioner is also serving courtesy copies to the counsel of record in the Litigation via Federal Express Priority Overnight shipping at:

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Dated: March 10, 2025

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