Paper No. _____

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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Sony Corporation

Petitioner
v.

Collabo Innovations, Inc.

(record) Patent Owner

IPR2016-00941
Patent No. 5,952,714

PETITIONER'S REPLY TO PATENT OWNER RESPONSE

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TABLE OF EXHIBITS

Exhibit No.	Description
1001	U.S. Patent No. 5,952,714 ("the '714 patent").
1002	Declaration of R. Michael Guidash.
1003	Certified translation of Japanese Unexamined Patent Application Publication No. S61-131690 ("Yoshino").
1004	Certified translation of Japanese Unexamined Patent Application Publication No. H07-045803 ("Wakabayashi").
1005	Certified translation of Japanese Unexamined Patent Application Publication No. S59-225560 ("Hikosaka").
1006	Japanese Unexamined Patent Application Publication No. S61-131690, published June 19, 1986.
1007	Japanese Unexamined Patent Application Publication No. H07-045803, published Feb. 14, 1995.
1008	Japanese Unexamined Patent Application Publication No. S59-225560, published December 18, 1984.
1009	Non-Final Office Action dated July 20, 1998, in file history of U.S. Pat. App. No. 08/809,845.
1010	Amendment dated December 21, 1998, in file history of U.S. Pat. App. No. 08/809,845.
1011	Certified translation of Japanese Unexamined Patent Application Publication No. H07-78951 ("Nita").
1012	Excerpt from Charles A. Harper & Martin B. Miller, Electronic Packaging, Microelectronics, and Interconnection Dictionary (1993).
1013	Japanese Unexamined Patent Application Publication No. H05-275611, published Oct. 22, 1993.

1014	Certified translation of Japanese Unexamined Patent Application Publication No. H05-006989 (“Onishi”).
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1019	Japanese Unexamined Patent Application Publication No. H06-029507, published Feb. 4, 1994.
1020	Certified translation of Japanese Unexamined Patent Application Publication No. S60-74880 (“Hirosawa”).
1021	Japanese Unexamined Patent Application Publication No. S60-74880, published April 25, 1985.
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1025	Japanese Unexamined Patent Application Publication No. H06-85221, published March 25, 1994.
1026	CV of R. Michael Guidash.
1027	Declaration of Jacob Zweig in support of motion for admission *pro hac vice*.
1028	Deposition transcript of Dr. Martin Afromowitz (April 6, 2017).

1029	Deposition transcript of Michael Guidash (January 11, 2017).
1030	U.S. Patent No. 5,009,102.

I. INTRODUCTION

Claims 1-13 and 15-16 of U.S. Patent No. 5,952,714 ("the '714 patent") are unpatentable, for the reasons set forth in the Petition. The arguments to the contrary presented in Patent Owner's Response ("POR") misconstrue what the references teach, mischaracterize the Petitioner's combinations, and are grounded in a proposed claim construction that is ambiguous and insupportably narrow.

II. CLAIM CONSTRUCTION

A. Mr. Guidash's testimony is credible.

Patent Owner ("Collabo") argues that Mr. Guidash's testimony should be afforded little weight, since he did not consider "relevant portions of the file histories." (POR:12). However, Collabo does not indicate what these portions of the file histories are, why they are relevant, or how they should have affected Mr. Guidash's opinion.

B. "Secured to said package via an adhesive" should be given its ordinary meaning, which would include a resin or molding process to secure the device to the package.

Each of the independent claims recites that the image sensor (or substrate) is "secured to [the] package via an adhesive", which Collabo construes as "gluing." (POR:13).

Collabo's proposed construction is ambiguous and insupportably narrow. "Secured to said package via an adhesive" only requires that the device be affixed to the package via a material that tends to adhere. *See* Institution Decision, p. 14

(recognizing "the plain and ordinary meaning of adhesive" as something that "tends to adhere" (citing Ex. 3001)). Nothing in the claims, the specification, or the file history necessitates any specific securing technique or adhesive agent, and this claim term should be given its plain and ordinary meaning.

Collabo misconstrues "secured" in an attempt to distinguish the primary prior art references, which teach that the image sensor is secured to the package via a particular type of adhesive called resin. (Yoshino, Ex. 1003, p. 003 ("molded resin"); Wakabayashi, Ex. 1004, ¶0015 ("adhesive resin")). (POR:14-15). To further its proposed distinction, Collabo morphs the passive claim term "secured" into an active securing *process*, which Collabo describes as "gluing with an adhesive." (POR:15). Collabo does not, however, clarify how a "gluing" process would differ from a process of "securing with an adhesive", except to argue that "gluing" would exclude molding processes. (POR:13-15).

The '714 patent does not exclude a molding process. The claims require only the "solid-state image sensing device being secured to said package via an adhesive." (*E.g.*, Ex. 1001, Claim 1). Collabo's arguments to the contrary are unconvincing. First (**§1**, below), references to "glue" in exemplary embodiments should not limit the actual claim term "secured…" in the claims. Second (**§2**, below), Collabo's argument that a molding process would interfere with the positioning process described in the '714 patent is not credible. Third (**§3**, below),

one of skill would have understood "secured…" to include securing using resins or molds. Fourth (**§4**, below), Collabo's construction is ambiguous, because Collabo cannot explain what is required by "gluing."

1. Use of "glued" in the specification does not limit the actual claim term "secured."

Collabo argues that "secured…" must be limited to "gluing" by attempting to import certain embodiments into the claims. Specifically, Collabo points to embodiments that describe the substrate/image sensor as "glued" to the package. (POR:13-14).

The exemplary embodiments should not be imported into the claims. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1323 (Fed. Cir. 2005). The '714 patent does not *define* "adhesive" as "glue," and does not define "securing" as "gluing." The claims do not include the terms "glue" or "glued." Other than a meritless argument regarding the positioning process (*see* §II.B.2 below), Collabo does not point to anything in the specification or claims requiring a specific securing process or agent. Furthermore, only claims 13-16 recite the positioning process.

Collabo also contrasts the use of the term "glued" with an embodiment in which the package body is itself created by injecting resin into a mold. (POR:13-14). The fact that an unclaimed process step (that of creating the package body) uses a technique (molding) is not reason to construe a claim term describing a structural component produced by a different process step (securing the image

sensor to that package body) to exclude the common technique (molding). Collabo admits that the specification describes these processes in different terms, but does not point to anything suggesting that the description of the package body fabrication step was intended to limit the later "securing" step. (POR:13-14).

2. The '714 patent's positioning process does not require that "secured" be construed as "gluing."

Collabo makes various arguments that the '714 patent would not work unless "secured…" is construed to mean "gluing." (POR:14-15). Collabo bases its contention entirely on Dr. Afromowitz's opinion. (POR:15). Dr. Afromowitz claims, without support,[1] that an "injection or pressing operation forces flow of the viscous resin encapsulant, and ***if used around wire-bonded chips***, for example, can cause wire sweep …, resulting in shorts, and other deformations, including unintended movement of the chip." (*Id.*, ¶31) (emphasis added). This problem would not rise to the level of limiting the claims, however, because it does not exist for the '714 patent—even if everything Dr. Afromowitz says is true. The '714 patent *does not teach a wire-bonded chip* but rather one that is bonded using bumps or a conductive adhesive. (*E.g.*, Ex. 1001, Claim 1).

[1] Dr. Afromowitz mentions two references (Ex. 1028, ¶31), but Collabo did not submit these references as required by the rules. *See* 37 C.F.R. §§42.63(a) and 42.65(a).

Dr. Afromowitz's contention is also unpersuasive because the image sensor is bonded to the inner lead *before* being secured via an adhesive. (Ex. 1001, 10:64-11:4). Even if pressure was exerted by the resin flow, nothing indicates that these bonds cannot hold the chip in place. This is demonstrated, for example, by Yoshino, which teaches use of "molded resin (28)" *after* the image sensor is bonded to the leads via bumps of "conductive bonding material (27)," apparently without causing displacement. (Ex. 1003, p. 003).

Dr. Afromowitz also claims, without support, that a "gluing process" would allow the chip to be optically positioned, but that this would not be possible with a "molding process." (Ex. 2001, ¶32). Dr. Afromowitz points to an embodiment that uses signal feedback from an "optical position adjusting device," and contends that this would not be achievable while a mold was in place because the mold would enclose the chip. (*Id.*)

However, the '714 patent's positioning step takes place simultaneously with the step of bonding the image sensor to the lead frame, which takes place *before* the step of securing the sensor to the package. (Ex. 1001, 10:64-11:4). Although the specification describes embodiments in which the adhesive is applied at the same time, the claims do not reflect this. Nor has Collabo argued that the claims should be so construed. Thus, even assuming a molding process would enclose the chip, this would not interfere with positioning because the molding process would

take place *afterward*.

Furthermore, Dr. Afromowitz does not explain why a molding process must enclose the image sensor. The figures show that the adhesive (30) is applied to the back side of the sensor (27). (Ex. 1001, Fig. 2). Dr. Afromowitz admitted that the walls of an open cavity could themselves function as a mold for resin. (Ex. 1028, 38:2-39:12). Even if the '714 patent required that the adhesive be applied *during* the positioning step, and even if this ruled out use of a *separate* mold, this would not as a technical matter rule out a resin applied into the open cavity of the package's inlet (26), that would be "molded" by the interior walls of the package (21). (*See* Ex. 1001, Fig. 2). In this case, the securing process would include no separate mold. The chip would not be enclosed, and so Dr. Afromowitz's arguments that the positioning process would be ineffective during the molding process would not apply.

During deposition, Dr. Afromowitz raised a new argument that resins such as thermoset epoxies can shrink while curing, which could slightly shift the position of a chip bonded via indium bumps. (Ex. 1028, 72:9-73:20). However, the '714 patent does not teach indium bumps. Furthermore, both Yoshino and Wakabayashi teach using a resin to secure a bump-bonded chip to the package, and neither reports chip displacement issues when resin is cured. (Ex. 1003, p. 003; Ex. 1004, ¶0015).

3. One of skill would have understood that the phrase "secured to said package via an adhesive" includes molding methods.

Collabo argues, relying only on Dr. Afromowitz's opinion, that one of skill would have understood "adhesive" to exclude the use of injection molding. (POR:14-15). Dr. Afromowitz claims even more broadly (and without support) that one of skill would have understood "adhesive attachment" to exclude "other molding methods, such as reaction-injection, compression or transfer molding." (Ex. 2001, ¶ 32).

However, Dr. Afromowitz's testimony is not credible, because his deposition revealed that he is unfamiliar with the molding methods he referred to in his declaration. He could not describe these methods, some not even in general terms. (Ex. 1028, 35:18-36:4 (injection molding), 40:3-17 (reaction-injection molding), 41:14-42:20 (compression molding), 43:15-44:11 (transfer molding)). Although he holds a patent directed to "Fabrication of Molds and Mold Components Using a Photolithographic Technique and Structures Made Therefrom," he admitted that it is only "peripherally related to molding of resins that are part of the technology described in patent '714." (Ex. 1028, 13:17-25).

Moreover, Dr. Afromowitz lacks practical experience with package design. He admitted to involvement in only one industry project—prior to 1974—relating to packaging, in which he analyzed heat flow for a semiconductor laser. (Ex. 1028, 9:21-11:1, 16:4-13; Ex. 2001, Appendix A). He also admitted that he did not

teach classes on the design or fabrication of semiconductor packaging. (Ex. 1028, 11:12-15). Although he incidentally employed certain packaging techniques in some projects, he admitted to not having performed any research concerning packaging or package design. (Ex. 1028, 12:3-13:17).

Mr. Guidash, on the other hand, has a much better basis for his testimony that "molded resin" is "a material sometimes used in the fabrication of package bodies that functions here as an adhesive." (Ex. 1002 ¶¶ 69, 108). During Mr. Guidash's 31 years at Kodak, he held positions such as product engineer and yield enhancement engineer, and was at one time "[r]esponsible for all aspects of IC … packaging" for "Instant Camera IC's." (Ex. 1026, pp. 001-002). These positions involved hands-on experience with and oversight of packaging-related projects. For example, in his deposition, Mr. Guidash described four projects in which he took part in the design of image sensor packages. (Ex. 1029, 7:11-10:12; 11:8-12:24; 19:13-20:7; 34:19-37:18; 44:19-45:20). Mr. Guidash's extensive, practical, industry experience with image sensor package design and fabrication shows that he is more qualified to opine on how one of skill would have understood the materials and processes used.

Furthermore, Dr. Afromowitz's deposition testimony and a reference from the relevant timeframe—Dr. Afromowitz's own U.S. Patent No. 5,009,102 (issued April 23, 1991) ("the '102 patent")—support Mr. Guidash's opinion. In his

declaration, Dr. Afromowitz contrasted a "molded resin"—such as an "epoxy resin" or a resin that is "thermoplastic or thermosetting"—with an "adhesive." (Ex. 2001, ¶26, ¶31). However, he admitted in deposition that resins—such as thermosetting resins and epoxy resins—were well-known adhesives in the relevant timeframe:

> "Q. (By Mr. Zweig) Okay. So you would agree, then, that thermosetting resins were known as structural adhesives in the relevant time frame?
>
> A. Correct.
>
> MR. KLIEWER: Objection, form. Objection, asked and answered.
>
> Q. (By Mr. Zweig) Okay. Epoxy resins were used in integrated circuit packaging in the relevant time frame, correct?
>
> MR. KLIEWER: Objection, form. Objection, outside the scope. Objection, foundation.
>
> A. Epoxy resins were used in integrated circuit packaging in the relevant time frame.
>
> …
>
> Q. (By Mr. Zweig) Can an epoxy resin be used as an adhesive?
>
> MR. KLIEWER: Objection, form.
>
> A. Yes, epoxy resins can be used as an adhesive."

(Ex. 1028, 48:5-49:16).

Dr. Afromowitz's own '102 patent—a patent he cited to demonstrate his

expertise in the field—teaches that "[t]hermosetting resins are well-known and are widely used as matrices for advanced composite materials and structural adhesives." (Ex. 1030, 4:46-48; Ex. 1028, 14:14-15:3). Dr. Afromowitz confirmed that, even when used as a matrix for a composite material, such a resin functions as a "binder" to hold together particles that otherwise would not "adhere to one another." (Ex. 1028, 52:1-12).

Dr. Afromowitz's '102 patent also teaches that *the same thermosetting resins* it describes as being widely used as adhesives can also be used in molds. (Ex. 1030, 1:35-36 ("[I]n a large molded structure of a thermoset resin, the degree of cure may vary from place to place….")). In fact, Dr. Afromowitz admitted that when used in a molded process, a resin would need a special "releasing agent" in order for it to *not* act as an adhesive with regard to the mold itself. (Ex. 1028, 53:10-15).

Dr. Afromowitz's testimony and his own '102 patent thus indicate that one of skill would have understood "secured…" to include securing via a resin applied using a molding process.

4. Collabo's construction of "secured to said package via an adhesive" is ambiguous.

Collabo construes "secured…" as "gluing." However, Collabo offers no explanation of what this would require. (POR:13-15). Other than to say that "gluing" excludes a molding process, even Dr. Afromowitz could not define "glue"

other than a circular definition of "adhesive" about which "there's hardly any generalized statement one could make." (Ex. 1028, 67:6-68:17). Collabo's construction is therefore ambiguous, and should not be adopted for that additional reason.

III. THE PETITION DOES NOT IMPROPERLY INCORPORATE MATERIAL BY REFERENCE

Collabo argues that the petition incorporates by reference "a number of arguments" to circumvent the word count. (POR:15-17). Collabo then identifies a single alleged argument: the level of ordinary skill. Collabo's complaint is not pertinent, however, because the petition did not incorporate Mr. Guidash's testimony as opposed to simply citing it. Moreover, Collabo itself makes no argument (and provides no evidence[2]) as to the relevant level of skill, nor says how the level impacts the issues. Even so, the disclosure of the prior art reflects the level of ordinary skill. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001).

IV. GROUND 1: CLAIM 1 IS ANTICIPATED BY YOSHINO

Although Collabo states that distinct teachings of a reference cannot be

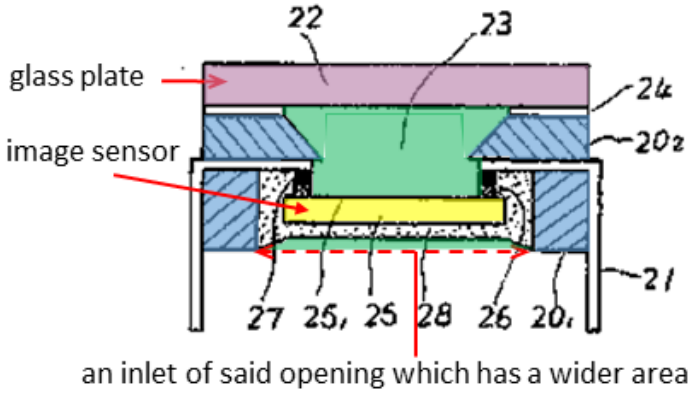
[2] Dr. Afromowitz only refers to a level of ordinary skill in ¶100 of his declaration, a paragraph that was mistakenly copied from a declaration concerning another proceeding. (Ex. 1028, 7:23-8:12).

combined to anticipate, Collabo does not appear to argue Petitioner has proposed such a combination. (POR:19-30). Instead, Collabo makes two arguments against Yoshino, which are addressed below.

A. Yoshino teaches the image sensor being mounted by being inserted from the opening with a wider area.

Collabo argues that Yoshino does not teach the "mounted in said package by being inserted from an inlet of said opening which has a wider area" limitation of claim 1, because one cannot ascertain which of the two openings of Yoshino's device has a "wider area." (POR:21-27).

Yoshino's Fig. 1 depicts a device with two openings, the lower of which is wider. Because Yoshino teaches that the upper, narrower opening is sealed with glass plate 22 *before* the image sensor is inserted, the sensor must be inserted in the lower, wider opening. (Ex. 1003, p. 003; *see also* Fig. 1, below, with annotations by Petitioner).



Collabo bases its argument on an implicit construction of the term "wider area" as "greater area." (*See* Ex. 2001, ¶35). However, all claim 1 requires is that

the opening through which the sensor is inserted have a larger *width* dimension. This is what Yoshino's Fig. 1 shows.

Even under Collabo's interpretation, Yoshino anticipates claim 1. First, Yoshino *does* address the area of top opening (23), as follows:

> "The smallest **area** of the opening (23) formed by this is set to the size that can at least cover the effective photosensitive section of the solid state image sensor (25)."

(Ex. 1003, p. 003) (emphasis added). Thus, the area of top opening (23) corresponds to the photosensitive section of the image sensor; the term "section" indicates that this photosensitive area is a *portion* of the sensor's area. The sensor therefore has an area *greater* than that of the photosensitive section, and likewise an area greater than that of the correspondingly-sized top opening. Because the sensor fits in the bottom opening, the bottom opening must *also* have a greater area than the top opening.

Second, Collabo's argument imagines a hypothetical cross section taken at 90 degrees to the one shown in Yoshino's Fig. 1, in which the *top* opening is wider. (POR:24). However, Yoshino teaches that the chip is inserted through the package's bottom opening and affixed to the underside of lip portion of the upper section of the package body—a lip portion that is present because the upper opening is narrower. (*See* Ex. 1003, p. 003 and Fig. 1 (see above)). Thus, the chip must be narrower than the bottom opening, but wider than the upper opening. If

the upper opening was wider than the bottom opening in the hypothetical cross mentioned above, the opening would be wider than the chip along this axis.

This would not make sense. The above-quoted passage indicates that the upper opening corresponds to the shape of the chip. (Ex. 1003, p. 003). Dr. Afromowitz appeared to concede at his deposition that generally, the shape of the opening would correspond to the shape of the chip. (*See* Ex. 1028, 32:2-6). Thus, it would not make sense for the opening to be wider than the chip along *either* axis. Also, that Yoshino's package is intended to be compact indicates that the opening would not be wider than the chip along either axis; this would add extra bulk. (*See* Ex. 1003, p. 004).

Dr. Afromowitz's speculation that Yoshino's openings could have various shapes (Ex. 2001, ¶35) is belied by his admission that image sensor chips are rectangular (Ex. 1028, 57:11-13), and that the shape of the chip would impact the shape of the opening.

Collabo's speculation that Yoshino might be referring to example packages disclosed by other prior art of record is similarly unconvincing. (POR:25-26). Yoshino teaches a particular type of through-hole package with a lead frame, intended to compactly house an image sensor. (Ex. 1003, p. 004). That other packages may have other features does nothing to detract from Yoshino's teachings.

B. Yoshino teaches the image sensor being secured to the package via an adhesive.

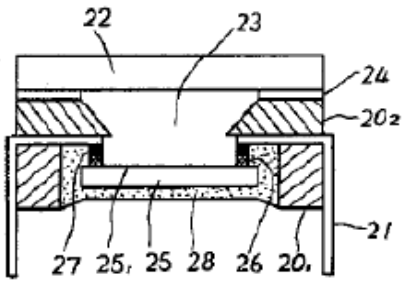
Collabo argues, under its proposed construction of "secured," that Yoshino does not teach "said solid-state image sensing device being secured to said package via an adhesive", relying on Dr. Afromowitz's opinion that one of skill "would not understand Yoshino's molded resin [28] to disclose the claimed 'adhesive.'" (POR:27-30 (citing Ex. 2001, ¶36)).

As discussed in §II.B above, Collabo's construction should be rejected. Moreover, even under Collabo's construction, Yoshino anticipates claim 1. As discussed below, Yoshino's resin is an adhesive. Dr. Afromowitz could not define "glue" more specifically than an "adhesive substance," except to say that this would not include a molding process. (Ex. 1028, 67:6-68:17). Although Yoshino uses the term "molded resin," Yoshino does not disclose use of a molding process or even a separate mold.

Yoshino teaches "supporting the solid-state image sensor (25) in the packaging substrate (20) via a molded resin (28)." (Ex. 1003, p. 003). The term "supporting" indicates that Yoshino's resin serves to **secure** the image sensor to the package (even if the sensor is *also* held in place by "conductive bonding material (27)," which bonds the sensor's pads to the lead frame). (*Id.*) If "molded resin 28" did not have adhesive properties, it would be loose and prone to slip out of place, rendering it unsuitable for "supporting" the sensor. (Ex. 1003, p. 003 and

Fig 1, below).

FIG. 1



As Mr. Guidash explained, Yoshino's molded resin functions as an adhesive. (Ex. 1002, ¶69). As discussed in §II.B above, Dr. Afromowitz admits that resins were commonly used adhesives in the relevant timeframe and, as his own '102 patent shows, these same resins can be used in molds. (Ex. 1028, 48:5-49:16, 52:1-12; Ex. 1030, 4:46-48, 1:35-36). Dr. Afromowitz's testimony also indicates that resins remain adhesive even when used in molds. (Ex. 1028, 53:10-15). Dr. Afromowitz further admitted that the walls of an open cavity could themselves serve as a mold (Ex. 1028, 38:2-39:12), and so Yoshino's resin 28 could be "molded" by the interior walls of the package 20. Moreover, Dr. Afromowitz stated, "[t]here's very little information about [Yoshino's] molded resin 28. In fact, it just says molded resin 28. And that's all we know about it." (Ex. 1028, 76:25-77:3). The most reasonable interpretation of Yoshino is therefore not Dr. Afromowitz's—which reads into Yoshino molding processes not taught by Yoshino and speculates about how one of skill would have understood such

processes—but Mr. Guidash's.

V. GROUND 2: CLAIM 6 IS OBVIOUS OVER YOSHINO IN VIEW OF IZUMI

Collabo contends that one of skill would not have been motivated to combine Izumi's teaching of a "substrate on which a solid-state image sensing device and a peripheral circuit chip are mounted" with Yoshino's package. Collabo argues that this is because (a) the modifications to Izumi's substrate would render it inoperable, and (b) using Izumi's substrate would interfere with the positioning process of the '714 patent. (POR:30-36).

Collabo's first argument misses the point: Petitioner has not asserted that Izumi's substrate and everything attached to it should be physically incorporated with Yoshino's sensor. (*See* Ex. 1029, 74:7-75:12; Ex. 1002, ¶133). *See In re Mouttet*, 686 F.3d 1322, 1332 (Fed. Cir. 2012) (citing *In re Keller*, 642 F.2d 413, 425 (CCPA 1981) ("The test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference . . . .")).

The modifications in combining Yoshino and Izumi are also not extreme, and are in fact shown in Yoshino. For example, Dr. Afromowitz argues that Yoshino's lead frame could not connect to Izumi's innermost bond pads. (Ex. 2001, ¶45). But the pads used to connect Izumi's image sensor and peripheral chip to the substrate need not be the *same* pads used to connect the substrate to external

circuits via the lead frame. The petition cites Izumi's existing connection points to show that Izumi contemplates connection via surface pads. (*See* Petition, p. 24). As Mr. Guidash explained, one of skill would know how to locate pads for connection to the lead frame in the periphery of the substrate (Ex. 1002, ¶133), as Yoshino teaches for its image sensor. (*See* Ex. 1003, Fig. 1).

With regard to Collabo's second argument, Dr. Afromowitz opines that Izumi's image sensor is mounted on its substrate; with the substrate fixed to a circuit board via pins, the sensor could not be positioned. (Ex. 2001, ¶43).

Claim 6, however, does not recite optical positioning. Moreover, Petitioner has not asserted that Izumi's pins or circuit board should be part of the combination. In the combination, the substrate is not connected via pins but bonded via pads to a lead frame. (*See* Petition, p. 24). The *entire* substrate (including the image sensor) can be moved within the package during positioning, as the '714 patent admits. (Ex. 1001, 6:1-23; 6:29-50). Thus, the combination enables the optical positioning process in the same way the '714 patent does. *See In re Epstein*, 32 F.3d 1559, 1568 (Fed. Cir. 1994).

VI. GROUND 3: CLAIM 7 IS OBVIOUS OVER YOSHINO IN VIEW OF NAGANO AND WAKABAYASHI

Claim 7 depends from claim 1, and Collabo focuses on the limitation "a semiconductor substrate having a solid-state image sensing device and a peripheral circuit chip disposed on an upper surface thereof." This limitation is taught by

Nagano, which teaches a semiconductor substrate having a "light receiving part" and a peripheral circuit chip referred to as a "computing part" disposed on its upper surface. (Ex. 1018, Abstract). Collabo contends that Nagano's single photodiode device is not an image sensor, such that (a) one of skill would not have looked to Nagano and (b) would not have been motivated to use the Nagano substrate with the Yoshino package. (POR:36-40).

Yoshino discloses a semiconductor image sensor, which is a semiconductor substrate with an image sensor disposed on an upper surface thereof. (Petition, p. 26). Even if Nagano's chip does not comprise an image sensor, the only element of the combination that Nagano must supply is the peripheral circuit chip. (*See id.*). As Mr. Guidash explained, Nagano's "computing part" is a peripheral circuit chip, and one of skill would have known how to make any necessary modifications. (Ex. 1002, ¶¶148-149).

Furthermore, one of skill would have looked to Nagano. To qualify as prior art, either "(1) the reference must be from the same field of endeavor; or (2) the reference must be reasonably pertinent to the particular problem with which the inventor is involved." *K-Tec, Inc. v. Vita-Mix Corp.*, 696 F.3d 1364, 1375 (Fed. Cir. 2012). The scope of analogous art is to be construed broadly. *Wyers v. Master Lock Co.*, 616 F.3d 1231, 1238 (Fed. Cir. 2010) (citing *KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. 398 (2007)).

Nagano discloses a device that senses and computes incident light, and is thus in the same field as a more complex device that senses and computes incident light, such as a multi-photodiode image sensor. (*E.g.*, Ex. 1018, ¶0005). A device such as that disclosed by Nagano also shares the same packaging requirements as a more complex image sensor—*e.g.*, there must be an opening to allow light to reach the photodiode(s)—so Nagano is also reasonably pertinent to the problem the '714 patent addresses.

Furthermore, as Mr. Guidash explained, one of skill would have been motivated to combine Yoshino with Nagano to reduce the length of electrical connections, reduce noise, and reduce package size. (Ex. 1002, ¶149). Nagano recognizes that having both devices on one substrate achieves a chip that is "compact and resistant to electrical noise." (Ex. 1018, ¶0017). This complements the size-reduction goal of Yoshino. (Ex. 1003, p. 004).

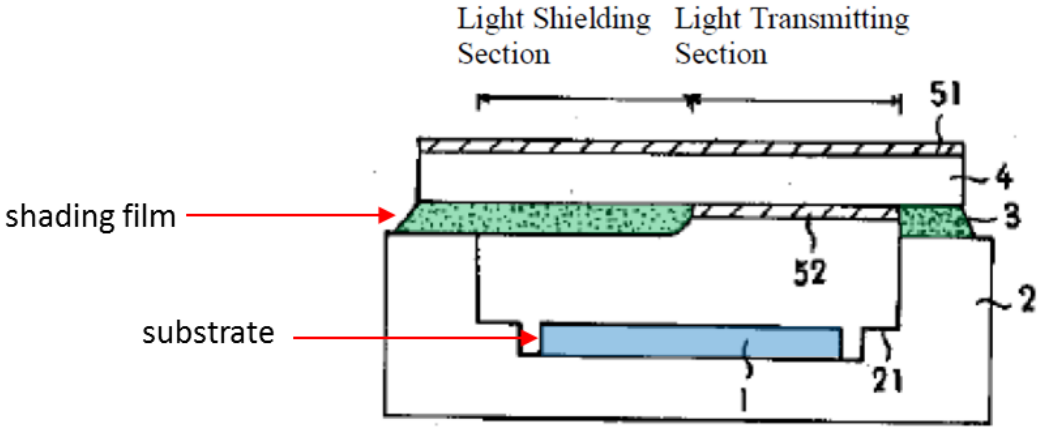
VII. GROUND 4: CLAIM 8 IS OBVIOUS OVER YOSHINO IN VIEW OF IZUMI OR NAGANO, IN FURTHER VIEW OF HIROSAWA AND NITA

Ground 4 cites Nita and Hirosawa as exemplifying the well-known advantages of shading film—to protect peripheral circuit elements while leaving the image sensor unshaded. (Petition, p. 29). Collabo argues that neither Hirosawa nor Nita discloses "a shading film [that] covers an entire upper surface of said substrate except an upper surface of the solid-state image sensing device." (POR:40-45).

Fundamentally, Collabo's argument fails because it does not respond to the reasoning in the petition that "[u]sing a light-shading film, such as that of Hirosawa or Nita, over the entire area of the substrate not having the image sensor would have the predictable advantage of protecting the peripheral chip from light (or of minimizing light reaching the peripheral chip that might obtain with partial coverage)." (Petition, pp. 30-31). Rather than responding to this reasoning, Collabo argues that Nita and Hirosawa do not use enough light-shading film to meet claim 8 by themselves.

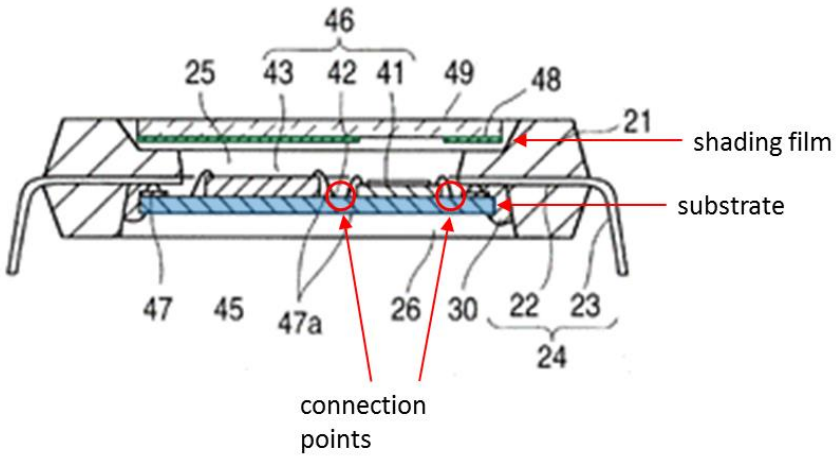
Even if the Ground had not provided a reason to meet the language of claim 8, Collabo's argument would be incorrect. Collabo's argument is based on an implicit and underdeveloped claim construction that is not plausible based on the specification of the '714 patent. For example, Collabo does not dispute that Nita's adhesive layer 3 (highlighted green by Petitioner in Fig. 3 of Nita below) is a shading film, or that the portion of Nita's substrate (chip 1, highlighted blue) that is not the image sensor (the "storage section") is underneath that shading film. (POR:43-44).

FIG. 3



Instead, Collabo argues that Nita's shading film would not protect against light entering at an angle because of vertical space between the shading film and the substrate. (POR:44-45). However, this is precisely the arrangement depicted in Fig. 7 of the '714 patent (see below, depicting space between shading film 48 (highlighted green by Petitioner) and substrate 42 (highlighted blue)).

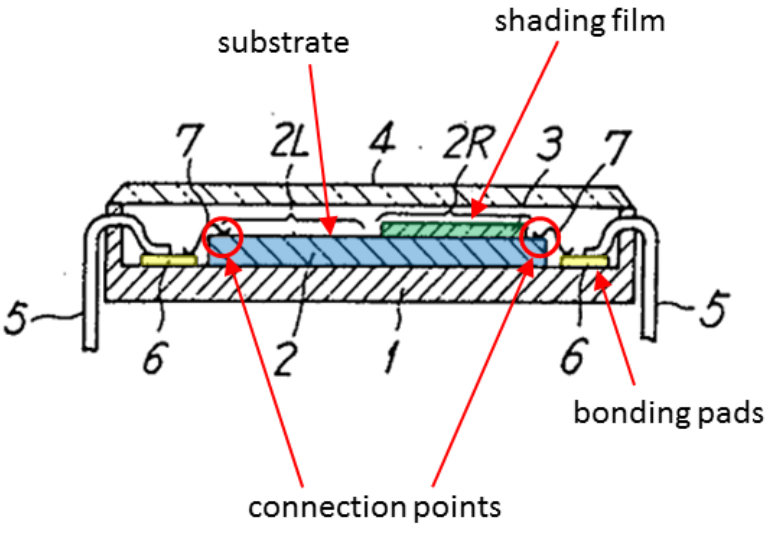
FIG. 7



Likewise, Collabo argues that Hirosawa's "contact pads" are not shaded.

(POR:42). As shown in Hirosawa's Fig. 1 below, Hirosawa's bonding pads 6 (highlighted yellow by Petitioner) *are not on the upper surface of* semiconductor substrate 2 (highlighted blue). (Ex. 1020, p. 003, Fig. 1). Thus, claim 8 does not require them to be covered by the shading film ("light-shielding plate 8 [sic:3]," highlighted green below). (Ex. 1020, p. 003). To the extent Collabo argues that Hirosawa fails to teach this limitation because connection points for leads 7 (circled in red by Petitioner) on substrate 2 are not depicted as shaded, this is again what the '714 patent teaches. (POR:42). Fig. 7 of the '714 patent depicts connection points (circled in red by Petitioner in Fig. 7, above) for wires on the upper surface of substrate 42 which might not, under Collabo's reasoning, be protected from light entering at an angle.

FIG. 1



Collabo further argues that Hirosawa teaches transmission means that might not be covered by the shading film. (POR:41-42). However, Hirosawa does not

teach or illustrate the transmission means as formed on the "upper surface" of the substrate, where claim 8 requires shading.

VIII. GROUNDS 5-11: CLAIMS 9-13 AND 15-16 ARE OBVIOUS

Collabo does not address the additional limitations or references set forth in grounds 5-11 relating to claims 9-13 and 15-16. Instead, Collabo relies solely on its analysis of Yoshino, which, as discussed in §IV above, is without merit.

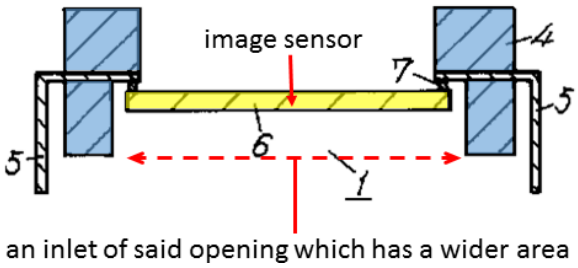
IX. GROUND 12: CLAIM 1 IS OBVIOUS OVER WAKABAYASHI

Collabo makes the same faulty arguments for Wakabayashi that it did for Yoshino. (POR:46-51). These are addressed below.

A. Wakabayashi teaches mounting the image sensor by insertion into the opening with a wider area.

Collabo argues that Wakabayashi's figures only illustrate cross-sectional views of its invention and therefore cannot show an opening with a "wider area." (POR:46-50).

As Mr. Guidash explained, it would have been obvious to insert the image sensor through the opening shown as wider in Fig. 1 of Wakabayashi (see below with annotations by Petitioner). (Ex. 1002, ¶¶259-260). Notably, Collabo does not disagree with Mr. Guidash on this point.



Collabo bases its argument on an implicit construction of "wider area" as "greater area." (*See* Ex. 2001, ¶79). As discussed in §IV.A above, claim 1 only requires that the bottom opening through which the image sensor is inserted have a larger *width* than the upper opening, as demonstrated in Fig. 1 of Wakabayashi.

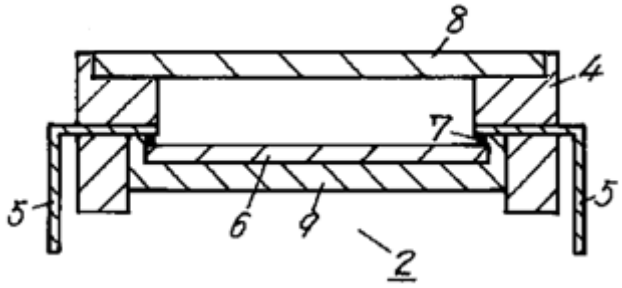
Even under Collabo's interpretation, claim 1 would still have been obvious over Wakabayashi. For the reasons discussed under §IV.A, it would not make sense for the upper of the two openings shown in Wakabayashi's Fig. 1 to have a greater area, particularly given Wakabayashi's objective to reduce package size. (*See* Ex. 1004, ¶0018).

Dr. Afromowitz's opinion that Wakabayashi teaches that the shape of its openings can "change" is a mischaracterization. (Ex. 2001, ¶83). Wakabayashi teaches that the "thicknesses" of the package walls can be varied "to form desirable shapes from the perspective of the optical characteristics and mechanical strength." (Ex. 1004, ¶0012). That the package walls can be of different thicknesses does not mean that the shape of the opening would not correspond to the shape of the chip (as discussed under §IV.A).

B. Wakabayashi teaches securing the image sensor with an adhesive.

Collabo argues that Wakabayashi does not disclose an image sensor "secured…", as that term has been construed by Collabo. As discussed in §IV.B above, Collabo's construction should be rejected. Moreover, even under Collabo's construction, claim 1 would still be obvious over Wakabayashi because, other than excluding a molding process, even Dr. Afromowitz could not define "glue" more specifically than as an "adhesive substance." (Ex. 1028, 67:6-68:17).

Wakabayashi discloses an "adhesive resin 7 [sic:9]" that seals the image sensor into the package, and by which "the bump joints are reinforced." (Ex. 1004, ¶0016-0016; *see also* Fig. 2, below).



As Mr. Guidash explained, Wakabayashi thus teaches the image sensor "being secured to [the] package via an adhesive." (Ex. 1002, ¶¶262-265). The term "reinforced" indicates that Wakabayashi's adhesive resin serves to secure the sensor to the package, even if the bump joints also provide a bond. (Ex. 1002, ¶264). That Wakabayashi explicitly refers to its resin as an "adhesive" further contradicts Collabo's contention. Wakabayashi does not teach a molding process or even use the term "mold." Moreover, as discussed in §II.B, Dr. Afromowitz

admits (and his own ’102 patent shows) that resins were commonly used as adhesives in the relevant timeframe.

X. GROUND 13-14: CLAIMS 2-5 ARE OBVIOUS

Collabo’s only contention regarding grounds 13 and 14 is that Petitioner provided no motivation to combine Fujii’s ledge with Wakabayashi’s package. (POR:51-53). However, Petitioner argued such an arrangement—in which the lid sits *on a ledge inside* rather than on top of the package—was “a structure already known in the prior art that is altered by the mere substitution of one element for another known in the field” that does no “more than yield a predictable result,” and hence the combination would have been obvious under *KSR*, 550 U.S. at 416. *See Rentrop v. Spectranetics Corp.*, 550 F.3d 1112, 1117 (Fed. Cir. 2008) (“[A]pplying the TSM principle as a rigid rule is error.”).

XI. GROUND 15: CLAIM 13 IS OBVIOUS OVER WAKABAYASHI IN VIEW OF HIKOSAKA

Collabo makes no arguments for this ground beyond those for Ground 12, which are refuted above in §IX.

XII. CONCLUSION

For the foregoing reasons, Petitioner respectfully requests that claims 1-13 and 15-16 of the ’714 patent be found unpatentable.

Date: May 12, 2017

/Jacob S. Zweig/ (pro hac vice)
Counsel for Petitioner

CERTIFICATE OF SERVICE

The undersigned hereby certifies that a copy of the foregoing Petitioners' Reply to Patent Owner Response, together with all Exhibits was served on May 12, 2017 by electronic mail (by prior agreement with the Patent Owner) to the attorneys of record at:

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CERTIFICATE OF WORD COUNT

The undersigned hereby certifies that, in compliance with 37 C.F.R. §42.24, the foregoing reply (excluding the table of contents, table of authorities, mandatory notices listed in §42.8(b), certificates of service and word count, and list of exhibits) contains currently 5,599 words according to the word processing software used to prepare the petition.

Date: May 12, 2017 Signed: /Jacob S. Zweig/ (pro hac vice)