

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

TAIWAN SEMICONDUCTOR MANUFACTURING COMPANY LIMITED,

Petitioner,

v.

ALIDDOUBLE, INC.,

Patent Owner.

IPR2023-00369

U.S. Patent No. 9,356,169

PATENT OWNER'S RESPONSE

UNDER 37 C.F.R. § 42.107

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TABLE OF EXHIBITS

Exhibit No.	Exhibit Name
2002	Declaration of Ron Maltiel
2003	Curriculum Vitae, Ron Maltiel

I. INTRODUCTION

Alidouble, Inc. (“Alidouble” or “Patent Owner”) submits this Patent Owner’s Response to Taiwan Semiconductor Manufacturing Company Ltd.’s (“Petitioner” or “TSMC”) Petition challenging Claims 1 – 20 of U.S. Patent No. 9,356,169. Ex. 1001 (hereinafter, the “’169 Patent”). For the reasons discussed below, the Petitioner has not shown that the references or combinations of references upon which Petitioner relies satisfies Petitioner’s burden to establish by a preponderance of the evidence that Claims 1 – 20 of the ‘169 Patent are unpatentable. *See* 35 U.S.C. § 316(e).

II. THE ‘169 PATENT

The ‘169 Patent is entitled *Apparatus, System And Method Of Backside Illumination (BSI) Complementary Metal-Oxide Semiconductor (CMOS) Pixel Array*, was filed on June 6, 2015, and issued to Assaf Lahav and Amos Fenigstein as inventors on May 31, 2016. ‘169 Patent, Cover Sheet.

A. The Technology Of Backside Illuminated Image Sensors

Solid state image sensors are used in video cameras and are in integrated circuits using a complementary metal oxide semiconductor (“CMOS”) technology. These image sensors are based on a two-dimensional array of pixels where each pixel includes a sensing element – a photo diode - that is capable of converting a portion of an optical image into an electronic signal and includes circuitry to measure

the intensity of light detected by the sensing element and then to generate electronic signals are then used by other circuitry to regenerate the optical image on a display. Ex. 2002 (Declaration of Ron Maltiel, ¶¶ 39-46 (hereinafter “Maltiel Decl.”)). CMOS image sensors were first developed in 1967 and utilize the photovoltaic response. *Id.* at ¶ 42. The photo-voltaic response occurs when silicon is exposed to light. When photons in the visible and near-IR regions of the spectrum impinge on a silicon surface and have sufficient energy to break covalent bonds to create an electron-hole pair. *Id.* at ¶42. The number of electrons generated is proportional to the light intensity. *Id.* at ¶42.

CMOS image sensors (“CIS”) have benefited from advances in CMOS technology for microprocessors and application specific integrated circuits. *Id.* at ¶43. Shrinking lithography, coupled with advanced signal-processing algorithms provide for sensor arrays, sensor array control, and image processing on one integrated circuit manufactured using well-established CMOS techniques. *Id.* at 43.

In frontside illuminated image sensors (“FSI”), the frontside surface of the semiconductor substrate includes the image sensor, the CMOS circuitry, and metal lines, manufactured of metals or polysilicon, that connect the image sensors to the CMOS circuitry and that connect both to peripheral circuitry that controls the image sensor in general, that transmits signals off the image sensor, that receive, interpret, and implement control signals from off the image sensor, and that provide power

and power control to all the circuits and sensors. Maltiel Decl., ¶ 44

CMOS Image Sensors (CIS) may be either FSI or BSI; the difference between a BSI image sensor and an FSI image sensor is the arrangement of imaging elements in the sensor with respect to incident light to the pixel. In FSI, the photons pass through the metal wiring layer before they reach the image sensors, *e.g.*, photodiodes. Maltiel Decl., ¶45. In contrast, in a BSI image sensor, the photons reach image sensors directly from the backside without passing through the metal wiring layer on the front side. Maltiel Decl., ¶46.

In BSI image sensors, the photons reach photodiodes directly without passing through metal wiring layer. Maltiel Decl., ¶46.

Although BSI image sensors contain the same components as FSI, the BSI's metal wiring layers are located behind the photodiode with respect to the direction of photons. Maltiel Decl., ¶¶ 45-46. The main technological challenge associated with producing BSI is the bonding of the original wafer to a protective substrate to provide structural support while the semiconductor substrate is being grinded down to a thickness of a few microns. Maltiel Decl., ¶¶ ¶¶ 39-46.

B. The Invention Of The '169 Patent

The '169 patent discloses a CMOS pixel array that includes a photodiodes and in-pixel processing transistors.'169 Patent, 3:30-33, 4:9-40. As the specification states, a pixel would have poor collection efficiency if photogenerated electrons are

absorbed not by the photodiode but by well regions (specifically, the N-well regions) of the transistors, which act as parasitic photodiodes. *Id.*, 4:41-61. The ' 169 patent addresses this issue by placing a barrier layer below the transistor well regions to prevent the photogenerated electrons from diffusing to the transistor well regions. *Id.*, 5:57-60, 6:57-60.

In summary, the '169 patent discloses a BSI CMOS image sensor pixel array, as shown in its FIG. 2 reproduced below, that includes: one or more MOS transistors with one or more well regions (N-well 214 and/or P-well 216), a photodiode 210, an epitaxial layer 220 with an area 22 from the one or more well regions 214 and 216 to prevent diffusion of electrons to both N-well region 214 and P-well region 216. Ex. 1001, Abstract, FIGS. 1 and 2.

The '169 patent is directed generally to a unique BSI image sensor and to methods of manufacturing the unique BSI image sensor. Maltiel Decl., ¶47. The '169 patent discloses an improved sensor by optimizing the collection of electrons all the way around the photodiode 110 (pink). Maltiel Decl., ¶47. The '169 Patent achieves its objective by implanting a “p” buried layer 126 (orange) in all the area inside the pixel under the P well and the N well surrounding the photodiode. Maltiel Decl., ¶47. Figure 1 below of the '169 patent is a cross-section of the wafer where the front wafer surface where the Photodiode, P well 116 (green), and N well 114 (blue) originate from is the bottom of the figure. Maltiel Decl., ¶47.

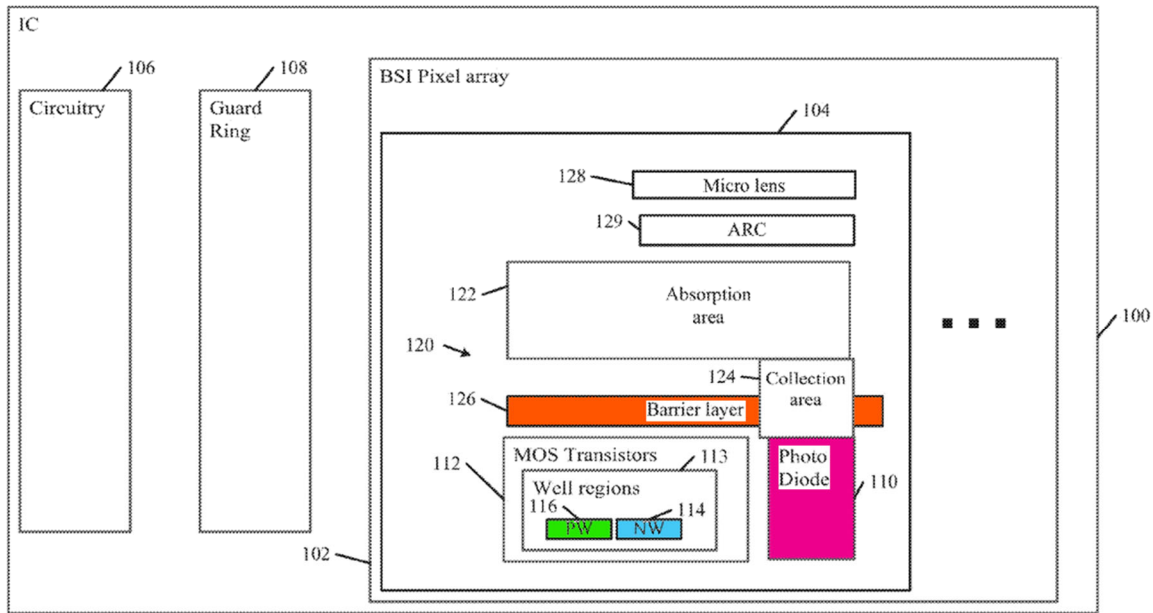


Fig. 1

The '169 Patent discloses that it creates the P buried layer by a high energy implant. Maltiel Decl., ¶48. Figure 3D is another cross-section showing the P buried layer 326 (orange) underneath all the area of the pixel. The P buried layer is underneath both P well (green) and N well (blue). Maltiel Decl., ¶48.

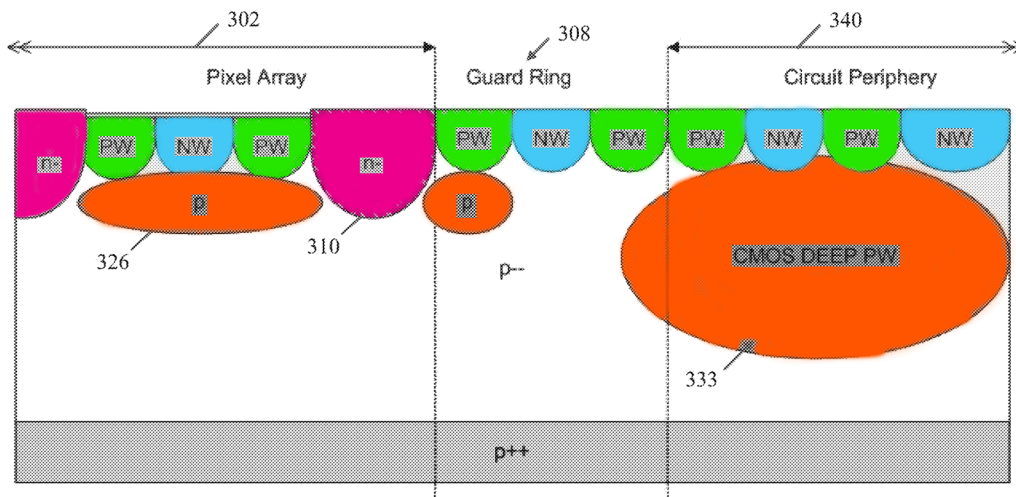


Fig. 3D

Maltiel Decl., ¶48.

The '169 Patent disclose that electrons will be collected underneath both the N well and P well and drift toward the photo diode:

In one example, the electrons may be generated in the well regions 113 of pixel 104. According to this example, a substantial amount of electrons, e.g., all electrons, which may be generated in NW region 114, may be lost and/or flow to the VDD and, as a result, may not contribute to a photo signal received by photodiode 110.

'169 Patent, 5:5-10; Maltiel Decl., ¶49.

In one example, absorption of the electrons in the PW region 116 may increase a probability of recombination of the electrons, and as a result, a reduced number of electrons may be collected by the photodiode 110.

'169 Patent, 5:16-19; Maltiel Decl., ¶49.

The '169 Patent explains how to solve this problem with a buried layer to improve the efficiency of collection. Maltiel Decl., ¶50. The buried layer under both P well and N well deflects electrons away from the N-well and the P-well:

a barrier layer 126 may be configured to reduce or even prevent diffusion of the electrons from absorption area 122 to the N-well region 114 and/or to the P-well region 116.

'169 Patent, 6:57-60. In the '169 Patent, the “absorption area is the large area under both the “N-Well” and the “P-Well.” Maltiel Decl., ¶50.

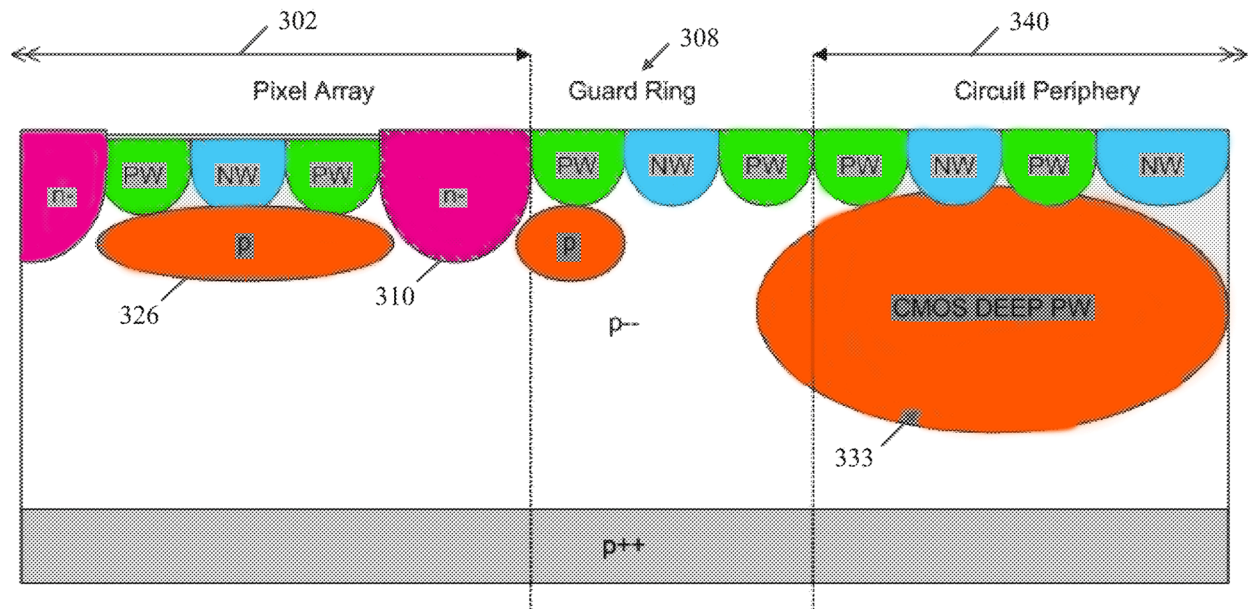


Fig. 3D

Maltiel Decl., ¶50.

III. PERSON OF ORDINARY SKILL

In view of the ‘169 Patent’s specification, claims and prosecution history, a POSITA would have at least a bachelor’s degree in electrical engineering, chemical engineering, or material science. Maltiel Decl., ¶¶ 25-26. A bachelor’s degree in one of these subjects is necessary to have a foundation in solid state physics and integrated circuit processing technology. *Id.* at 25-26. In addition, a POSITA would have 3-5 years’ experience that includes some experience in image sensors. *Id.* at 25-26.

IV. CLAIM CONSTRUCTION

In *inter partes* review, patent claims are construed under the *Phillips* standard,

37 C.F.R. § 42.100, according to their “ordinary and customary.” *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312-17 (Fed. Cir. 2005) (*en banc*); 37 C.F.R. § 42.100(b). Under *Phillips*, “the ordinary and customary meaning of a claim term is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention.” *Id.* at 1313. “Importantly, the person of ordinary skill in the art is deemed to read the claim term not only in the context of the particular claim in which the disputed term appears, but in the context of the entire patent, including the specification.” *Id.*

V. SUMMARY OF PETITIONER’S CITED REFERENCES

Petitioner cites five references, Lauxtermann, Ballin, Zucca, Akiyama, and Wang as references.

A. Lauxtermann

Lauxtermann is a U.S. patent directed to BSI CMOS image sensors with pinned photodiodes. Ex. 1004 (hereinafter, “Lauxtermann”). As shown in the figure reproduced below and discussed in detail later, Lauxtermann includes a semiconductor layer 53. All elements of the BSI CMOS sensor 54 including a source follower transistor 17 with a P-well 48 and an N-well 50, a pinned photodiode 12, and a P-layer 56 are formed on the semiconductor layer 53. *Id.*, 1:56-2:12, FIG. 4.

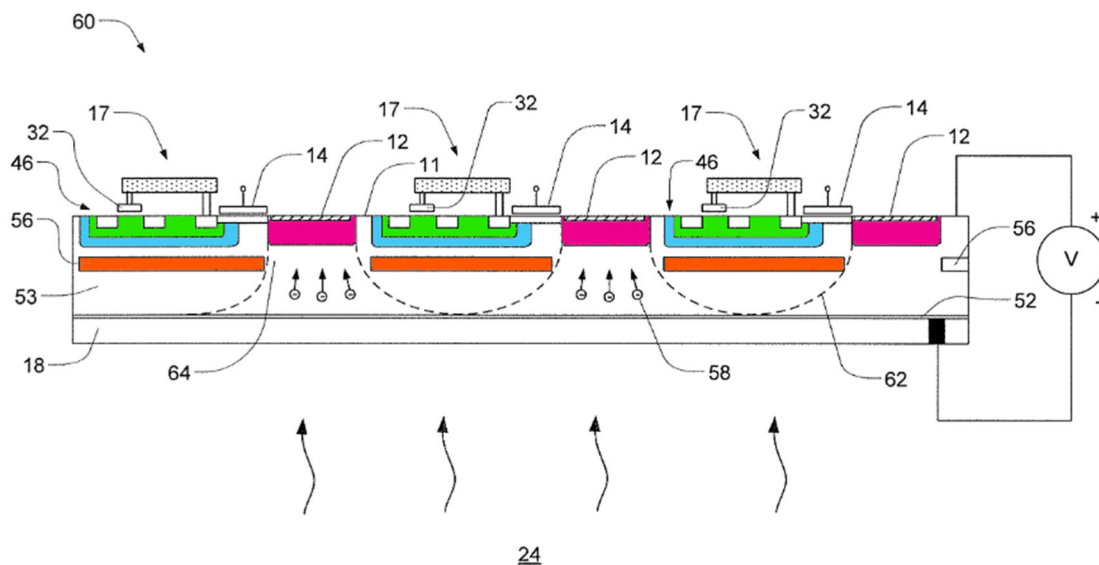


Figure 5

Lauxtermann, FIG. 5; Maltiel Decl., ¶¶ 52-56. As Figure 5 shows, Lauxtermann does not have a P-well adjacent to an N-Well, so any supposed “barrier layer” does not deflect electrons from a P-Well. Maltiel Decl., ¶53. What Petitioner points to as the “P-Well” 48 (green) is within an N-Well 50 (blue). “N-Well” 50 (blue) shields the “P-Well” 48 (green). In addition, Lauxtermann teaches that the device is biased – as shown by the voltage source Lauxtermann shows on the right side of Figure 4 and in its text:

Underneath the source follower transistor 17 is the triple well configuration 46 with n-doped 34, 35, and 40, isolated in p-well 48 that is further contained in n-well 50 Since the source follower transistor 17 may not be operable due to a back-side bias applied to the backside electrode 52, the triple well configuration 46 may be employed to maintain a constant threshold voltage of the NMOS pixel circuitry

Lauxtermann, Fig. 5 & 4:29-36.

Lauxterman does not disclose an “absorption region” and does not disclose a “collection region.” Maltiel Decl., ¶54. Because Lauxtermann uses an electrostatic lense:

Electrical field lines 62 form around the p-layers 56 and create electron funnels 64 that direct charge 58 to drift towards the pinned photodiode 12.

Lauxtermann, 5:52-54. The “electron funnel 64” limits the absorption to the small area directly under the pinned photodiode 12. *Id*; Maltiel Decl., ¶54.

In Lauxtermann, the photodiode is a “pinned diode.”

a p-layer may be used to drift the charges to the charge collecting US 7,498,650 B2 5 element of *the pinned photodiode 12*. FIG. 4 illustrates a backside illuminated CMOS image sensor 54 with a p-layer 56. The CMOS image sensor 54 may *include pinned photo diode 12*, source follower transistor 17, and backside electrode 52. The *pinned photodiode 12 collects charge due to light 24 incident on the pixel and outputs a signal to the source follower transistor 17*. Underneath the pinned photodiode 12 is n-doped region 42 of a high resistivity semiconductor layer 53. Transfer gate 14 transfers the signal from the pinned photodiode 12 to the NMOS source follower device 17.

Lauxtermann, 4:67 – 5:10 (emphasis added); Maltiel Decl., ¶55.

Lauxtermann starts with a “SOI wafer.” Lauxtermann, 3:24-27. An “SOI wafer” is a silicon on insulator wafer where the underneath the backside surface of the wafer is a dielectric such as silicon oxide.

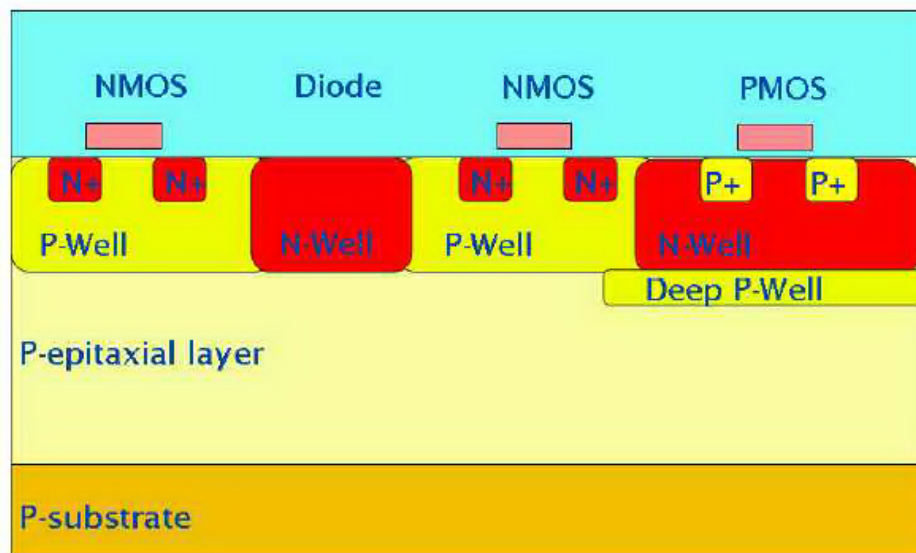
The starting SOI wafer for the CMOS image sensor 10 includes a buried oxide layer 18 between a silicon wafer and the semiconductor layer 16. The semiconductor layer 16 includes at least one pinned photodiode 12.

Id. Maltiel Decl., ¶56.

B. Ballin

Ballin is a printed publication directed to Monolithic Active Pixel Sensors (MAPS) and was published in a September 2008 edition of the journal Sensors. Ex. 1007 (hereinafter, “Ballin”). As shown in the FIG. 2 reproduced below, each pixel of Ballin's Xsensor includes: at least two NMOS transistors formed in P-wells and one PMOS transistor formed in an N-well, an N-well photodiode, a P-epitaxial layer, and a deep P-well implant only under the PMOS N-well. Ex. 1007, FIG. 2, 5339-40.

Figure 2. Schematic cross-section of a CMOS wafer with the deep P-well implant. Not drawn to scale.



2.2. INMAPS CMOS

Ballin, FIG. 2 (colors in original); Maltiel Decl., ¶57. To the extent Petitioner contends that the “Deep P-Well” is a “barrier layer,” it does not extend under the P-Well. Ballin, Fig. 2. Ballin does not have a “barrier layer” that separates an absorption area from the P-Wells. Ballin does not disclose an absorption area

separate from a collection area adjacent to the photodiode. Maltiel Decl., ¶57.

C. Zucca

Zucca discloses a “Deep P-Well” only under the “N-Well.” Zucca at Fig. 1. Maltiel Decl., ¶58.

D. Akiyama

Petitioner only contends that Akiyama discloses “an antireflective coating (ARC) and a microlens 21.” Pet. 19; Maltiel Decl., ¶59.

E. Wang

Petitioner only contends that Wang discloses features of a “guard ring structures.” Pet., 20; Maltiel Decl., ¶60.

VI. APPLICABLE LEGAL STANDARD

Petitioner only asserts grounds based on obviousness, 35 U.S.C. Section 103. The Supreme Court has determined that when analyzing a claim for validity under Section 103:

a patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art. This is so because inventions in most, if not all, instances rely upon building blocks long since uncovered, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known.

KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, 418-19 (2007). For this reason:

it can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does

Id. at 418. “One cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art.” *In re Fine*, 837 F.2d 1071, 1075 (Fed. Cir. 1988).

[A] patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art.

KSR Int’l Co., 550 U.S. at 418. “This is so because inventions in most, if not all, instances rely upon building blocks long since uncovered, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known.”

Id. at 418-419. For this reason, “it can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does.” *Id.* at 418. “One cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art.” *In re Fine*, 837 at 1075.

“[M]ere conclusory statements” are not sufficient. *Wowza Media Sys., LLC v. Adobe Sys. Inc.*, IPR2013-00054, 2013 WL 5653113, at *8 (Patent Tr. & App. Bd. April 8, 2013). “In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016). The burden of persuasion never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015).

To carry its burden, a petitioner must both:

clearly point out the differences between the claimed invention and [the prior art] and

explain why a person of ordinary skill in the art would have found the claimed subject matter obvious in spite of those differences.

Synopsys, Inc. v. Mentor Graphics Corp., IPR2012-00041, 2013 WL 3355865 at *8 (Patent Tr. & App. Bd. Feb. 22, 2013). A petitioner must specifically recite where the challenged limitation is found in the secondary reference(s) and must explain why a POSITA would have modified the primary reference with the recited limitation from the secondary reference(s). *See Microsoft Corp. v. Secure Web Conf Corp.*, IPR2014-00745, 2014 WL 4925718, at *6-7 (P.T.A.B. Sept. 29, 2014).

VII. THE CITED PRIOR ART DOES NOT INVALIDATE THE CHALLENGED CLAIMS

A. Ground 1: Lauxtermann Does Not Render Claims 1 – 6 Or 10 - 15 Obvious

1. Claim 1

Petitioner has failed to carry its burden of establishing that Lauxtermann renders Claim 1 obvious. *Harmonic Inc.*, 815 F.3d at 1363; *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d at 1378.

Claim 1 includes the limitation:

an epitaxial (epi) layer comprising an absorption area and a collection area, said absorption area to absorb incoming photons and to generate electrons responsive to absorbed photons, and said collection area connecting said absorption area to said photodiode to provide said electrons from said absorption area to said photodiode

‘169 Patent, 15:51-57. Petitioner asserts that:

“absorption area” and “collection area” are disclosed because Lauxtermann discloses [w]ithin that epitaxial layer, layer 53 includes a collection area and an absorption area, the former of which connects the absorption area to the photodiode.

Pet. at 27. There is also a footnote stating:

[a]ccording to the plain language of the claims, absorption area and collection area are parts of the epitaxial layer. They need not be separate layers.

Id.

A POSITA would understand that the ‘169 patent describes and defines separate absorption area 122 and collection area 124 as shown in FIG. 5. ‘169 Patent, 8:29-46; Maltiel Decl., ¶62. In the ‘169 Patent, the “absorption area” is the large area under both the “N-Well” and the “P-Well. Maltiel Decl., ¶62. Petitioner does not point to specific disclosure in Lauxtermann that discloses, teaches or suggests the “absorption area” as the ‘169 Patent discloses. A POSITA would not understand that Lauxtermann discloses, teaches or suggests to teach an epi layer comprising an absorption area and a collection area connecting the absorption area to the photodiode according to Claim 1. Lauxtermann does not disclose an “absorption region” and does not disclose a “collection region.” Maltiel Decl., ¶62. Because Lauxtermann uses an electrostatic lense:

Electrical field lines 62 form around the p-layers 56 and create electron funnels 64 that direct charge 58 to drift towards the pinned photodiode 12.

Lauxtermann, 5:52-54, the “electron funnel 64” limits the absorption to the small area directly under the pinned photodiode 12. Maltiel Decl., ¶62.

i. Barrier Layer Separating Said Absorption Area From Said One Or More Well Regions

The alleged barrier layer that Lauxtermann discloses does not define a separate absorption area. Maltiel Decl., ¶63.

2. Claim 2

Claim 2 depends from Claim 1. First, Lauxtermann does not render Claim 2 obvious because Lauxtermann does not render Claim 1 obvious. *See Rembrandt Wireless Techs., LP v. Samsung Elecs. Co.*, 853 F.3d 1370, 1380 (Fed. Cir. 2017) (citing, *In re Fine*, 837 F.2d at 1076 (“Dependent claims are nonobvious under section 103 if the independent claims from which they depend are nonobvious.”)).

3. Claim 3

Claim 2 depends from Claim 1. Lauxtermann does not render Claim 2 obvious because Lauxtermann does not render Claim 1 obvious. *See Rembrandt Wireless Techs.*, 853 F.3d at 1380.

4. Claim 4

Claim 2 depends from Claim 1. Lauxtermann does not render Claim 2 obvious because Lauxtermann does not render Claim 1 obvious. *See Rembrandt Wireless Techs.*, 853 F.3d at 1380.

5. Claim 5

Claim 2 depends from Claim 1. Lauxtermann does not render Claim 2 obvious because Lauxtermann does not render Claim 1 obvious. *See Rembrandt Wireless Techs.*, 853 F.3d at 1380.

6. Claim 6

Claim 2 depends from Claim 1. Lauxtermann does not render Claim 2 obvious because Lauxtermann does not render Claim 1 obvious. *See Rembrandt Wireless Techs.*, 853 F.3d at 1380.

7. Claim 10

Claim 2 depends from Claim 1. Lauxtermann does not render Claim 2 obvious because Lauxtermann does not render Claim 1 obvious. *See Rembrandt Wireless Techs.*, 853 F.3d at 1380.

8. Claim 11

Claim 2 depends from Claim 1. Lauxtermann does not render Claim 2 obvious because Lauxtermann does not render Claim 1 obvious. *See Rembrandt Wireless Techs.*, 853 F.3d at 1380.

9. Claim 12

Claim 2 depends from Claim 1. Lauxtermann does not render Claim 2 obvious because Lauxtermann does not render Claim 1 obvious. *See Rembrandt Wireless Techs.*, 853 F.3d at 1380.

10. Claim 13

Claim 2 depends from Claim 1. Lauxtermann does not render Claim 2 obvious because Lauxtermann does not render Claim 1 obvious. *See Rembrandt Wireless Techs.*, 853 F.3d at 1380.

11. Claim 14

Claim 2 depends from Claim 1. Lauxtermann does not render Claim 2 obvious because Lauxtermann does not render Claim 1 obvious. *See Rembrandt Wireless Techs.*, 853 F.3d at 1380.

12. Claim 15

Claim 2 depends from Claim 1. Lauxtermann does not render Claim 2 obvious because Lauxtermann does not render Claim 1 obvious. *See Rembrandt Wireless Techs.*, 853 F.3d at 1380.

B. Ground 2: Lauxtermann In View of Zucca Does Not Render Claims 2, 6, 7, Or 9 Obvious

Petitioner has failed to carry its burden of establishing that Lauxtermann in view of Zucca renders Claim 10 obvious. *Harmonic Inc.*, 815 F.3d at 1363; *Dynamic Drinkware*, 800 F.3d at 1378.

1. Claim 2

Claim 2 depends from Claim 1. Lauxtermann fails to render claim 1 obvious. Thus, Petitioner has not carried its burden of establishing that Lauxtermann in view of Zucca renders Claim 2 obvious. *See Rembrandt Wireless Techs.*, 853 F.3d at 1380.

As Lauxtermann in fails to render Claim 1 obvious, and the additional disclosure in Zucca, which Petitioner does not argue as being relevant to the obviousness of Claim 1, does not render Claim 2 obvious.

Petitioner cites Zucca for the proposition that Zucca teaches a low fill factor diode and epitaxial layers with certain minimum thicknesses. Zucca, however, does not disclose backside illumination sensors. Nothing in Zucca or Lauxtermann would give a POSITA motivation to combine them to achieve the patented properties. Maltiel Decl., ¶¶ 76-77.

2. Claim 6

Claim 6 depends from Claim 1. As Lauxtermann in view of Zucca does not render Claim 1 obvious, so Lauxtermann in view of Zucca does not render Claim 6 obvious. *See Rembrandt Wireless Techs*, 853 F.3d at 1380.

3. Claim 7

Claim 7 depends from Claim 1. As Lauxtermann in view of Zucca does not render Claim 1 obvious, so Lauxtermann in view of Zucca does not render Claim 7 obvious. *See Rembrandt Wireless Techs*, 853 F.3d at 1380.

4. Claim 9

Claim 9 depends from Claim 1. As Lauxtermann in view of Zucca does not render Claim 1 obvious, Lauxtermann in view of Zucca does not render Claim 9 obvious. *See Rembrandt Wireless Techs*, 853 F.3d at 1380.

C. Ground 3: Lauxtermann In View Of Akiyama Does Not Render Claims 10 Or 11 Obvious

Petitioner has failed to carry its burden of establishing that Lauxtermann in view of Akiyama renders Claims 10 or 11 obvious. *Harmonic Inc.*, 815 F.3d at 1363; *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d at 1378.

Lauxtermann fails to render Claim 1 obvious. Section VII.A.1; Maltiel Decl., ¶ 81. The additional disclosure in Akiyama, which Petitioner does not argue as being relevant to the obviousness of Claim 1, does not render Claim 1 obvious. Thus, dependent Claims 10 and 11, which depend from Claim 1, are not obvious. *See Rembrandt Wireless Techs*, 853 F.3d at 1380.

D. Ground 4: Lauxtermann In View Of Wang Does Not Render Claims 16 - 20 Obvious

Petitioner has failed to carry its burden of establishing that Lauxtermann in view of Wang renders Claims 16 - 20 obvious. *Harmonic Inc.*, 815 F.3d at 1363; *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d at 1378.

1. Claims 16 And 19

Lauxtermann fails to render Claim 1 obvious. Section VII.A.1; Maltiel Decl., ¶ 82. Lauxtermann does not disclose the “barrier layer separating said absorption area from said well regions.” *Id.* at ¶ 82. Similarly, Lauxtermann does not disclose the “barrier layer” limitation of Claims 16 and 19. Maltiel Decl., ¶¶ 82. The

additional disclosure in Wang, which Petitioner does not argue as disclosing the epi layer limitation or the barrier layer limitation, would not render independent Claims 16 or 19 obvious.

2. Claim 17

Claim 17 depends from Claim 16. Lauxtermann in view of Wang does not render Claim 17 obvious at least because Lauxtermann in view of Wang does not render Claim 16 obvious. Maltiel Decl., ¶83. *See Rembrandt Wireless Techs.*, 853 F.3d at 1380.

3. Claim 18

Claim 18 depends from Claim 17. Lauxtermann in view of Wang does not render Claim 18 obvious because Lauxtermann in view of Wang does not render Claim 17 obvious. Maltiel Decl., ¶84. *See Rembrandt Wireless Techs.*, 853 F.3d at 1380.

4. Claim 20

Claim 20 depends from Claim 19. Lauxtermann in view of Wang does not render Claim 20 obvious because Lauxtermann in view of Wang does not render Claim 19 obvious. Maltiel Decl., ¶85. *See Rembrandt Wireless Techs.*, 853 F.3d at 1380.

E. Ground 5: Ballin Does Not Render Claims 1, 3 – 8, Or 12 - 15 Obvious

1. Claim 1

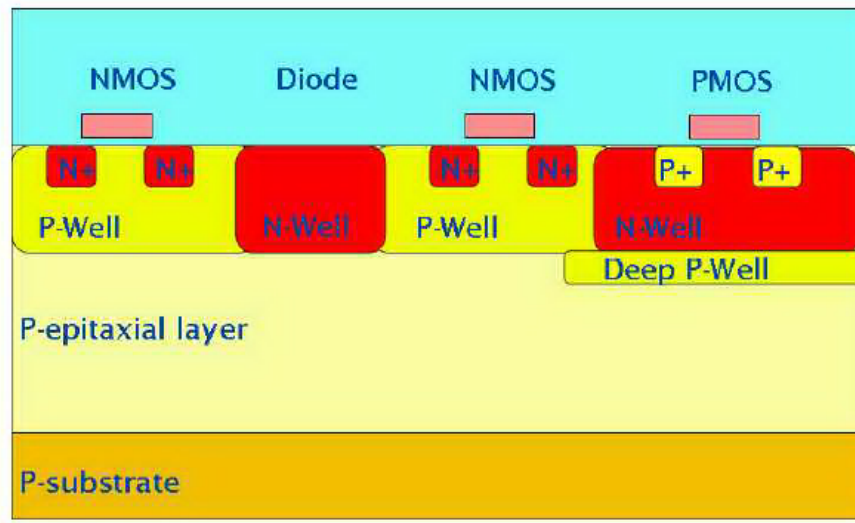
Claim 1 includes the limitation:

a barrier layer separating said absorption area from said one or more well regions.

‘169 Patent, 15:57-58. Petitioner argues that “Ballin’s deep P-well separates the N-wells of the PMOS transistors from the P-epitaxial layer” and “[a] POSA would have understood that Ballin’s deep P-well implant is a barrier layer separating the absorption area from the one or more well regions.” Pet. at 73-74.

The deep P-well does not function as a barrier layer because it separates the asserted absorption area only from the N-well of the PMOS transistors, but not both the N-well and P-well regions. Maltiel Decl., ¶87. A POSITA would not understand that Ballin’s deep P-well implant is barrier layer separating the absorption area from the one or more well regions Ballin describes the function of the “deep P-well” to isolate only an N-well, but not the P-well. Ballin, 4-5. Maltiel Decl., ¶87.

Figure 2. Schematic cross-section of a CMOS wafer with the deep P-well implant. Not drawn to scale.



2.2. INMAPS CMOS

Ballin, Fig. 2; Maltiel Decl., ¶87.

Further, the “absorption area” and “collection area” recited in Claim 1 (“an epitaxial (epi) layer comprising an absorption area and a collection area, said absorption area to absorb incoming photons and to generate electrons responsive to absorbed photons, and said collection area connecting said absorption area to said photodiode to provide said electrons from said absorption area to said photodiode”) are not also disclosed by Ballin. Maltiel Decl., ¶¶88-91.

Petitioner asserts that “absorption area” and “collection area” are disclosed because FIG. 2 of Ballin discloses “an epitaxial layer that includes an absorption area and a collection area, the latter of which connects the absorption area to a photodiode.” Pet. 71, Maltiel Decl., ¶¶ 88-91. There is also a same footnote as shown in the Petitioner’s arguments with Lauxtermann: “[a]ccording to the plain

language of the claims, absorption area and collection area are parts of the epitaxial layer. They need not be separate layers.” Pet. 71; Maltiel Decl., ¶¶ 88-91.

The ‘169 patent describes and defines the absorption area 122 (generation area) and collection area 124 as shown clearly in FIG. 2 as reproduced above. Maltiel Decl., ¶¶ 88-91. Petitioner only relies on the attorney arguments and conclusory expert opinion, none of which are evidence. Compare, e.g., Pet. at 70-72 with Ex. 1003, 222-224 (parroting same argument with the use of same annotated Figures). It should be given no weight. See, e.g., *Xerox Corp. et al. v. Bytemark, Inc.*, IPR2022-00624, Paper 12 at 4-5 (Patent Tr. & App. Bd. Feb. 10, 2023) (expert declaration that offered conclusory assertions without underlying factual support and repeated, verbatim, Petitioner's conclusory arguments given little weight); *Unirac, Inc. v. Ecofasten Solar, LLC*, IPR2021-00532, 2021 WL 3116853, at *7 (Patent Tr. & App. Bd. July 22, 2021) (denying institution where “Petitioner's witness merely parrots the conclusory statements of Petitioner”); *Unified Patents Inc. v. GE Video Compression, LLC*, IPR2019-00726, 2019 WL 3714386, at *11 (Patent Tr. & App. Bd. Aug. 6, 2019) (giving little weight to expert testimony that “simply parrots the Petition without providing any basis for his opinion” and denying institution); *TQ Delta, LLC v. Cisco Sys., Inc.*, 942 F.3d 1352, 1359 (Fed. Cir. 2019) (“conclusory expert testimony is inadequate to support an obviousness determination”); *Elbit Sys. of Am., LLC v. Thales Visionix, Inc.*, 881 F.3d 1354, 1359 (Fed. Cir. 2018)

(“Attorney argument is not evidence.”) (quoting *Icon Health & Fitness, Inc. v. Strava, Inc.*, 849 F.3d 1034, 1043 (Fed. Cir. 2017)); *Free-Flow Packaging Int'l, Inc. v. Automated Packaging Sys., Inc.*, IPR2016-00447, Paper 7, at 10 (Patent Tr. & App. Bd. June 22, 2016) (denying institution where the petitioner's expert did “nothing more than parrot the language of the Petition word for word”).

Thus, Ballin does not teach an epi layer comprising an absorption area and a collection area connecting the absorption area to the photodiode as claimed by the ‘169 patent. Maltiel Decl., ¶¶ 88-91.

2. Claim 3

Claim 2 depends from Claim 1. First, Ballin does not render Claim 2 obvious because Ballin does not render Claim 1 obvious. *See Rembrandt Wireless Techs.*, 853 F.3d at 1380.

3. Claim 4

Claim 2 depends from Claim 1. First, Ballin does not render Claim 2 obvious because Ballin does not render Claim 1 obvious. *See Rembrandt Wireless Techs.*, 853 F.3d at 1380.

4. Claim 5

Claim 2 depends from Claim 1. First, Ballin does not render Claim 2 obvious because Ballin does not render Claim 1 obvious. *See Rembrandt Wireless Techs.*, 853 F.3d at 1380.

5. Claim 6

Claim 2 depends from Claim 1. First, Ballin does not render Claim 2 obvious because Ballin does not render Claim 1 obvious. *See Rembrandt Wireless Techs.*, 853 F.3d at 1380.

6. Claim 7

Claim 2 depends from Claim 1. First, Ballin does not render Claim 2 obvious because Ballin does not render Claim 1 obvious. *See Rembrandt Wireless Techs.*, 853 F.3d at 1380.

7. Claim 8

Claim 2 depends from Claim 1. First, Ballin does not render Claim 2 obvious because Ballin does not render Claim 1 obvious. *See Rembrandt Wireless Techs.*, 853 F.3d at 1380.

8. Claim 12

Claim 2 depends from Claim 1. First, Ballin does not render Claim 2 obvious because Ballin does not render Claim 1 obvious. *See Rembrandt Wireless Techs.*, 853 F.3d at 1380.

9. Claim 13

Claim 2 depends from Claim 1. First, Ballin does not render Claim 2 obvious because Ballin does not render Claim 1 obvious. *See Rembrandt Wireless Techs.*, 853 F.3d at 1380.

10. Claim 14

Claim 2 depends from Claim 1. First, Ballin does not render Claim 2 obvious because Ballin does not render Claim 1 obvious. *See Rembrandt Wireless Techs.*, 853 F.3d at 1380.

11. Claim 15

Claim 2 depends from Claim 1. First, Ballin does not render Claim 2 obvious because Ballin does not render Claim 1 obvious. *See Rembrandt Wireless Techs.*, 853 F.3d at 1380.

F. Ground 6: Ballin In View Of Akiyama Does Not Render Claims 10 Or 11 Obvious

As is demonstrated above, Ballin in view of Akiyama fails to render claim 1 obvious. Thus, the additional disclosure in Akiyama, which Petitioner does not argue as being relevant to the obviousness of claim 1, does not render claim 1 obvious.

1. Claim 10

Akiyama does not disclose, teach, or suggest a buried P layer beneath the n-well and p-well. Maltiel Decl., ¶104. Akiyama does not disclose, teach, or suggest a separate absorption region connected to a collection region. *Id.*

2. Claim 11

Claim 11 depends from Claim 10 that depends from Claim 1. As Akiyama does not render Claim 10 obvious, Ballin in view of Akiyama does not render Claim 11 obvious. Maltiel Decl., ¶105. *See Rembrandt Wireless Techs.*, 853 F.3d at 1380.

VIII. CONCLUSION

For these reasons, Patent Owner submits that Petitioner has failed to meet its burden of proving that any challenged claim of the '169 patent is unpatentable.

DATE: October 11, 2023

Respectfully Submitted,

/s/ Eric Cohen
Eric Cohen
Registration No. 27,429

Counsel for Patent Owner Alidouble Inc.

CERTIFICATE OF COMPLIANCE

Pursuant to 37 C.F.R. § 42.24, I hereby certify that the foregoing Patent Owner Response contains 5303 words as measured by the word processing software used to prepare the document, excluding the cover page, signature block, and portions exempted under 37 C.F.R. § 42.24.

DATE: October 11, 2023

Respectfully Submitted,

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Counsel for Patent Owner Alidouble Inc.

CERTIFICATE OF SERVICE

Pursuant to 37 CFR § 42.6(e), the undersigned hereby certifies that a copy of the Patent Owner's Response Under 37 C.F.R. §42.107 by P-TACS electronic notification and electronic mail to each of the following individuals on the date indicated below:

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