

**IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION**

W&WSENS DEVICES INC.,	§	
	§	
Plaintiff,	§	
	§	
v.	§	
	§	CASE NO. 2:24-CV-00854-JRG
SAMSUNG ELECTRONICS CO., LTD,	§	
and SAMSUNG ELECTRONICS,	§	
AMERICA, INC.,	§	
	§	
Defendants.	§	

MEMORANDUM CLAIM CONSTRUCTION OPINION AND ORDER

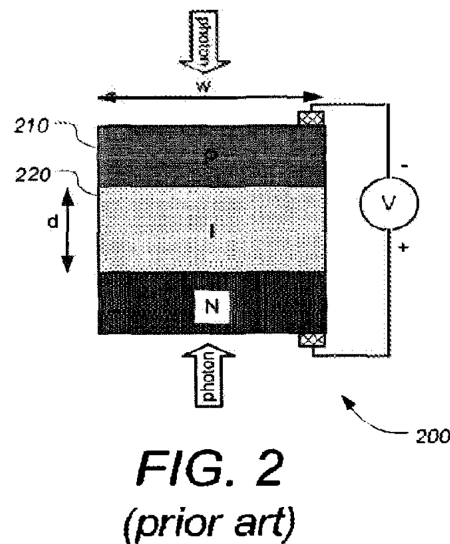
In this patent case, W&Wsens Devices Inc. alleges infringement of claims from five patents relating to photodetectors. Each of the patents, which are related,¹ concerns “photosensitive devices having microstructure enhanced absorption characteristics.” U.S. Patent 10,446,700 at 2:45–47. *See also* U.S. Patent 10,468,543 at 2:51–53 (same); U.S. Patent 11,621,360 at 1:46–47 (same); U.S. Patent 12,087,871 at 1:54–56 (same); U.S. Patent 12,243,948 at 1:56–57 (same).

The parties have three disputes about claim scope, with the main dispute concerning the meaning of “hole” in the context of the patents. Having considered the parties’ briefing, along with arguments of counsel at a February 3, 2026 hearing, the Court resolves the disputes as follows.

¹ *See* ’948 Patent at [60] (identifying each of the other patents as issuing from related applications). Despite their relationship, the patents have two different specifications. The ’542 Patent and ’700 Patent have one disclosure with one set of figures, while the other patents have a different disclosure with a different set of figures.

I. BACKGROUND

The patents relate to photodiodes, which are semiconductor devices that produce electrical current when absorbing photons. As shown in Figure 2 of the '871 Patent (below), a conventional photodiode has an intermediate absorption region (220), labeled "I," with thickness "d." As that region absorbs photons, it creates an electrical potential V between the P and N regions. *See* '871 Patent at 2:3–10.



Notably, however, the thickness of the intermediate region might limit the bandwidth to one that is relatively low speed for certain applications. The problem stems from the increased transparency of the intermediate region to energy with long wavelengths. '871 Patent at 2:11–17. While the thickness of the absorption region can be increased to compensate for those longer wavelengths, at some point “the thickness of the silicon ‘I’ region becomes so large that the device’s maximum bandwidth (also referred to as ‘data rate’) is too low for many current and future telecom and data center applications.” '700 Patent at 3:2–6.

To address this deficiency, the patents describe having an absorption region that includes “microstructures that are dimensioned and positioned to increase absorption of photons at a range

of wavelengths.” ’871 Patent at 2:50–52. These microstructures allow light to interact with the absorption layer for a longer time through reflection within the microstructure, which in turn increases the absorption of photons and “result[s] in a larger external quantum efficiency over a similar structure without microstructures.” ’700 Patent at 15:41–44.

The patents describe one type of these microstructures as “holes.” Figure 4 of the ’700 Patent (below), for example, shows a cross section of a “microstructure enhanced photodiode” (MSPD) with microstructure holes (412) etched into the structure. Because of how the impinging photons interact with the holes and surrounding surfaces, quantum efficiency of the diode is increased for certain bandwidths. ’700 Patent at 17:65–18:65.

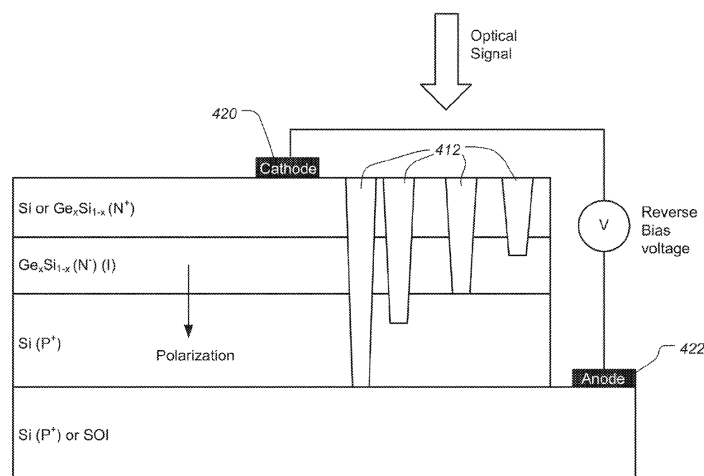


FIG. 4 of the ’700 Patent

The main dispute between the parties concerns the meaning of “hole” in the claims. Samsung says a “hole” cannot be an “isolation trench,” which the ’700 Patent shows as a trench etched to isolate two components. Figure 97 of the ’700 Patent (below), for example, shows an isolation trench (9760) between an MSPD and an ASIC (9770), which “separate[s] any potential electrical interference between the photodetector and the ASICs.” ’700 Patent at 110:7–10. While Claim 1 of the ’700 Patent is directed to “[a] single-chip device comprising an integrated combination of a

[MSPD],” *id.* at 118:25–26, Claim 40 further requires that single-chip device have “an isolation trench between the MSPD and the active electronic circuit,” *id.* at 121:17–19.

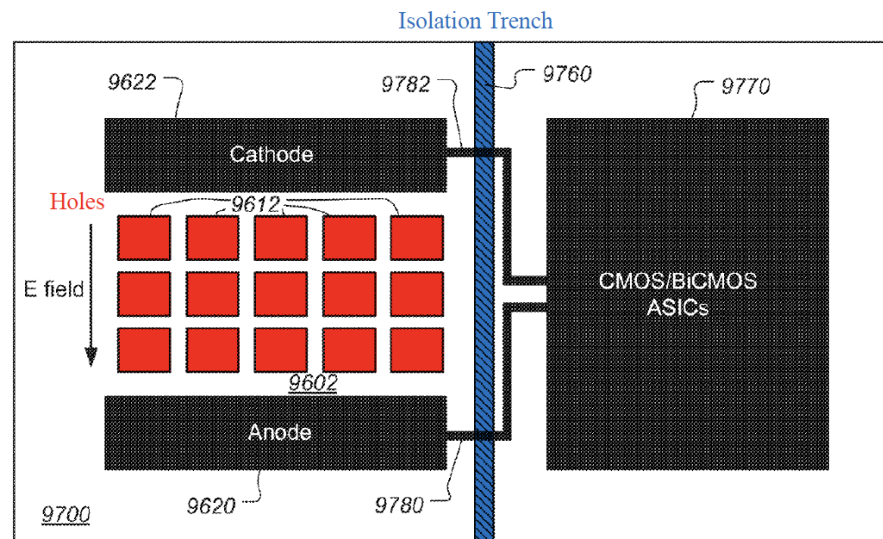


FIG. 97 of the '700 Patent, as annotated by Samsung, showing an “isolation trench” (9760) in the substrate separating the photodetector from the ASIC (9770) See Dkt. No. 103 at 7.

II. LEGAL STANDARDS

“[T]he claims of a patent define the invention to which the patentee is entitled the right to exclude.” *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312 (Fed. Cir. 2005) (en banc). As such, if the parties dispute the scope of the claims, the court must determine their meaning. *See, e.g., Verizon Servs. Corp. v. Vonage Holdings Corp.*, 503 F.3d 1295, 1317 (Fed. Cir. 2007) (Gajarsa, J., concurring in part); *see also Markman v. Westview Instruments, Inc.*, 517 U.S. 370, 390 (1996), *aff'g*, 52 F.3d 967, 976 (Fed. Cir. 1995) (en banc).

Claim construction, however, “is not an obligatory exercise in redundancy.” *U.S. Surgical Corp. v. Ethicon, Inc.*, 103 F.3d 1554, 1568 (Fed. Cir. 1997). Rather, “[c]laim construction is a matter of [resolving] disputed meanings and technical scope, to clarify and when necessary to

explain what the patentee covered by the claims” *Id.* A court need not “repeat or restate every claim term in order to comply with the ruling that claim construction is for the court.” *Id.*

When construing claims, “[t]here is a heavy presumption that claim terms are to be given their ordinary and customary meaning.” *Aventis Pharm. Inc. v. Amino Chems. Ltd.*, 715 F.3d 1363, 1373 (Fed. Cir. 2013) (citing *Phillips*, 415 F.3d at 1312–13). Courts must therefore “look to the words of the claims themselves . . . to define the scope of the patented invention.” *Id.* (citations omitted). 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, *i.e.*, as of the effective filing date of the patent application.” *Phillips*, 415 F.3d at 1313. This “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.*

Intrinsic evidence is the primary resource for claim construction. *See Power-One, Inc. v. Artesyn Techs., Inc.*, 599 F.3d 1343, 1348 (Fed. Cir. 2010) (citing *Phillips*, 415 F.3d at 1312). For certain claim terms, “the ordinary meaning of claim language as understood by a person of skill in the art may be readily apparent even to lay judges, and claim construction in such cases involves little more than the application of the widely accepted meaning of commonly understood words.” *Phillips*, 415 F.3d at 1314; *see also Medrad, Inc. v. MRI Devices Corp.*, 401 F.3d 1313, 1319 (Fed. Cir. 2005) (“We cannot look at the ordinary meaning of the term . . . in a vacuum. Rather, we must look at the ordinary meaning in the context of the written description and the prosecution history.”). But for claim terms with less-apparent meanings, courts consider “those sources available to the public that show what a person of skill in the art would have understood disputed claim language to mean . . . [including] the words of the claims themselves, the remainder of the specification, the

prosecution history, and extrinsic evidence concerning relevant scientific principles, the meaning of technical terms, and the state of the art.” *Phillips*, 415 F.3d at 1314.

III. THE LEVEL OF ORDINARY SKILL IN THE ART

The level of ordinary skill in the art is the skill level of a hypothetical person who is presumed to have known the relevant art at the time of the invention. *In re GPAC*, 57 F.3d 1573, 1579 (Fed. Cir. 1995). In resolving the appropriate level of ordinary skill, courts consider the types of and solutions to problems encountered in the art, the speed of innovation, the sophistication of the technology, and the education of workers active in the field. *Id.* Importantly, “[a] person of ordinary skill is also a person of ordinary creativity, not an automaton.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 421 (2007).

Here, neither party presents a level of ordinary skill in the art. Nor does either party have an expert that opines on the level of ordinary skill. Accordingly, the Court will resolve the level of ordinary skill only to the extent necessary to resolve the parties’ disputes.

IV. THE DISPUTED TERMS

- A. “hole” (’700 Patent, Claims 1, 7, 16, 20, 24, 28, 30; ’543 Patent, Claims 1, 7, 16, 20, 24, 28, 30; ’360 Patent, Claims 1, 3, 5, 6; ’871 Patent, Claims 1–4, 7, 12, 14, 18; ’948 Patent, Claims 1–3, 7, 13, 14)

W&Wsens’s Construction	Samsung’s Construction
Plain and ordinary meaning (“an absence of material” or “a physical void,” Dkt. No. 95 at 6)	“Plain and ordinary meaning (e.g., not isolation trenches)”

The parties first dispute the scope of “hole” and, more specifically, whether a “hole” excludes an “isolation trench.” Samsung stresses the claims separately recite the two terms, and the specifications repeatedly treat “holes” and “isolation trenches” as different features that perform

different functions. Dkt. No. 103 at 5–8. Samsung also points to extrinsic evidence that purportedly aligns with that position. *Id.* at 11 (citing industry articles coauthored by some of the patents’ named inventors).

According to W&Wsens, however, the specifications use “hole” to simply mean “an absence of material” or “a physical void.” Dkt. No. 95 at 6 (citing Oxford English Dict., Dkt. No. 95-6 at 638). That’s consistent, it says, with other cases construing the term. *Id.* at 7–8 (citing district court cases construing “hole” in the context of different technology). In W&Wsens’s view, an “isolation trench” is a *type* of hole and, more specifically, “an elongated hole in a semiconductor material to electrically isolate one region from another.” *Id.* at 8. In fact, it says, the patents expressly state “trenches” are “holes.” *Id.* at 8–9 (citing ’871 Patent at 55:3–9).

The Court agrees with Samsung that a “hole” in the context of these patents is not just a “void” or “absence of material.” Rather, “holes” are a type of “microstructure” with a specific purpose of increasing absorption of photons by way of their position and shape relative to the incident light. *See* ’871 Patent at 2:50–53 (describing “microstructures” as “dimensioned and positioned [within the absorption region] to increase absorption of photons”); ’700 Patent at 15:41–46 (noting microstructures “enhance the absorption of incident signal photons”). In contrast, the disclosed isolation trench electrically separates the photodetector and other components on the same chip. *See* ’700 Patent at 110:7–10.²

The extrinsic evidence also shows holes are not just absences of material. Samsung cites three industry articles, each of which distinguishes between holes and isolation trenches. *See*

² The present disputes relate more to deep trench isolation (DTI) in the photodetectors rather than an isolation trench as disclosed in the ’700 Patent.

Devine et al., *Optimization of CMOS Image Sensors With Single Photon-Trapping Hole Per Pixel for Enhanced Sensitivity in Near-Infrared*, Dkt. No. 103-1 at 1 (“Microholes are known to increase the crosstalk between pixels but this problem can be limited with deep trench isolation (DTI)”); Devine et al., *CMOS Image Sensor With Micro-Nano Holes to Improve NIR Optical Efficiency: Holes on Top Surface Versus on Bottom*, IEEE Sensors Journal, Vol. 21, No. 17 (Sept. 2023), Dkt. No. 103-2 at 19256 (recognizing increased crosstalk from holes in the shape of inverted pyramids that was reduced using deep trench isolation); Devine et al., *Single Microhole Per Pixel in CMOS Image Sensors With Enhanced Optical Sensitivity in Near-Infrared*, IEEE Sensors Journal, Vol. 21, No. 9 (May 1, 2021), Dkt. No. 103-3 at 10556 (comparing “different shapes and sizes of single hole and hole arrays,” showing a certain size and shape in single hole-based pixels “contribute to stronger enhancement of optical efficiencies,” and describing how to reduce crosstalk “by employing trenches between pixels”).

W&Wsens’s arguments for a lay meaning of “hole” are not persuasive. For one, although W&Wsens does not propose a level of ordinary skill, the Court struggles to see how a skilled artisan, undoubtedly someone with experience in semiconductors, would apply the lay definition of “hole” in the context of this technology. Nor are constructions from other litigation concerning different technology relevant.

W&Wsens also points to the patents’ supposed disclosure of trenches as holes. Dkt. No. 95 at 8 (asserting that, “[i]n the context of semiconductors, trenches are elongated holes that are dug in a semiconductor material to electrically isolate on region from another”). Pointing to FIGS. 57A

and 57B, two figures added to the later applications,³ W&Wsens says the patents “expressly state that ‘holes’ include trenches and describe holes filled with insulating dielectric material, which are isolation trenches.” *Id.* at 9 (citing ’871 Patent at 55:3–9). Moreover, emphasizes W&Wsens, the patents explain “holes” may have “any combination of shapes and dimensions.” *Id.* at 8 (quoting ’700 Patent at 19:38–43).

W&Wsens overstates the patent’s disclosure about the relationship between trenches and holes. For one, the portions of the specification to which W&Wsens cites don’t call “isolation trenches” “holes.” Nor do they say holes filled with an insulator are, by definition, “isolation trenches.” Instead, the patent describes dielectric-filled “voids” “configured to reduce dispersion and reduce loss associated within the microwave transmission lines . . . by reducing current loop flow and/or eddy currents.” ’871 Patent at 4:35–38. In fact, the patents treat “voids” differently than “pillars” and “holes,” with “voids” consistently described as “buried.” *See, e.g., id.* at 3:62–67 (“voids are buried in a layer of material so as to effectively lower the refractive index at the signal wavelength(s) and as well as lower the capacitance of the layer of material”). And even if “holes” may have “any combination of shapes and dimensions,” ’700 Patent at 19:38–43, they must still be “holes,” whatever that term means in the context of these patents.

W&Wsens’s other arguments relate to the extrinsic evidence. W&Wsens cites a paper it purportedly shared with Samsung years ago that “describes isolation trenches as ‘microholes,’” Dkt. No. 106 at 6 (citing Park et al., *Pixel Technology for Improving IR Quantum Efficiency of Backside-Illuminated CMOS Image Sensor*, Dkt. No. 106-3), but the Court does not see that

³ The ’360 Patent, filed in March 2022, does not include Figures 57A and 57B. The ’871 Patent, filed in October 2023 and which claims priority to the ’360 Patent, includes these figures.

description. The paper instead differentiates between what it calls “backside scattering technology” (BST), which look like “holes,” and deep trench isolation (DTI), the latter of which “suppress[es] the optical/electrical crosstalk” between photodiodes. Park et al., *Pixel Technology for Improving IR Quantum Efficiency of Backside-Illuminated CMOS Image Sensor*, Dkt. No. 106-3). Separately, W&Wsens says Samsung’s extrinsic evidence—the three industry articles co-authored by some of the patents’ named inventors—contradicts the clear meaning of the claim terms and should not be considered. *Id.* at 3. The Court, however, sees no such clear contradiction given its interpretation of the intrinsic record.

In short, the Court rejects W&Wsens’s assertion that “the Asserted Patents disclose and claim embodiments where holes are isolation trenches.” Dkt. No. 95 at 10. At most the patents disclose *isolation trenches* can be filled with dielectrics. *See* ’700 Patent at 100:18–19 (“In some cases, isolation trenches can be filled with dielectrics such as silicon dioxide and/or silicon oxide.”). So far as *claiming* holes as isolation trenches, W&Wsens only shows two claims that recite holes filled with a dielectric material. Dkt. No. 95 at 9 (citing Claim 1 of the ’871 Patent and Claim 21 of the ’700 Patent). Those claims do *not* establish *holes* filled with dielectric are “isolation trenches.” And given both claims issued well after the patents’ 2013 priority date, they have less weight when interpreting terms used in the original claims or disclosure, like “hole.” *See Total Containment v. Environ Prods.*, Nos. 96-1138, 96-1151, 1997 WL 16032, at *2 (Fed. Cir. 1997) (“To permit the use of claims added during reexamination [to change claim scope] would invite manipulation of the reexamination process and would not be a reliable guide to the meaning of language used in the original claims.”).

Here, the intrinsic evidence does not support W&Wsens’s “mere absence of material” interpretation. Rather, the intrinsic and extrinsic evidence supports the notion that microstructures

like “holes” and “pillars” are for increasing the absorption of incident photons. Accordingly, the Court construes “hole” as “a void whose primary purpose is to increase the absorption of light entering the void by the light absorbing material abutting the void.”

B. “deliberately formed in-pillar holes . . . wherein said photodetector device is configured to respond to light photons incident on said array of pillars” (’360 Patent, Claim 1)

“holes that are deliberately formed into the light-receiving surfaces . . . extend into the photodetectors” (’871 Patent, Claim 1)

“holes intentionally formed therein . . . to concurrently receive . . . optical input . . . [that generates] electrical charges” (’543 Patent, Claim 1; ’700 Patent, Claim 1)

“holes that are fabricated as recesses at or under the light-receiving surface of each of at least some of the pillars . . . extend[s] into the pillar[s]” (’948 Patent, Claims 1, 13)

Term	W&Wsens’s Construction	Samsung’s Construction
“deliberately formed in-pillar holes . . . wherein said photodetector device is configured to respond to light photons incident on said array of pillars” (’360 Patent, Claim 1)	Plain and ordinary meaning	“holes deliberately formed in a pillar of a photodetector for absorbing light that is converted to electricity”
“holes that are deliberately formed into the light-receiving surfaces . . . extend into the photodetectors” (’871 Patent, Claim 1)		
“holes that are fabricated as recesses at or under the light-receiving surface of each of at least some of the pillars . . . extend[s] into the pillar[s]” (’948 Patent, Claims 1 and 13)		
“holes intentionally formed therein . . . to concurrently receive . . . optical input . . . [that generates] electrical charges” (’543 Patent, Claim 1; ’700 Patent, Claim 1)		“holes designed to absorb an optical input that is converted into an electrical output”

This dispute is similar to the first dispute. In Samsung’s view, its constructions explain the ordinary meaning of “hole” in the context of the patents, which are microstructures that must absorb light. Hr’g Tr., Dkt. No. 125 at 52:2–4. W&Wsens says the “holes” themselves do not need to absorb light, but only need to increase the absorption of the photodetector. Dkt. No. 106 at 7; Hr’g Tr., Dkt. No. 125 at 50:13–15. “[T]he holes impact the ability of the adjacent silicon to absorb light . . . by reflecting light back into the silicon material, increasing the effective optical path length, or otherwise increasing the time light spends in the absorbing material.” Dkt. No. 106 at 7.

This is another way of disputing the scope of “hole.” The Court, however, has addressed that scope more directly with its construction of “hole” *supra*, and doesn’t see another dispute that needs to separately be resolved by construing these longer phrases. Accordingly, subject to the Court’s construction for “hole,” this term will be given a “plain and ordinary meaning” construction.

C. “regions therebetween” (’871 Patent, Claim 1)

“intermediate region” (’543 Patent, Claims 1, 9, 10)

“intermediate semiconductor material” (’360 Patent, Claims 1, 6)

“intermediate layer” (’700 Patent, Claims 1, 9, 10)

W&Wsens’s Construction	Samsung’s Construction
Plain and ordinary meaning	“a [region/layer] fabricated between the first [region/layer] and the second [region/layer]”

These terms refer to a region, layer, or material between two other regions, layers, or materials. For example, Claim 1 of the ’871 Patent recites photodetectors “compris[ing] P-doped and N-doped regions and regions therebetween” ’871 Patent at 55:47–49. Claim 1 of the ’543 Patent recites a single-chip device with a MSPD

compris[ing] an *intermediate region*, a first region at one side of the

intermediate region, and a second region at an opposite side of the intermediate region, wherein . . . the *intermediate region* comprises a material that is less doped than at least one of the first and second regions or is undoped[.]

'543 Patent at 118:17–30 (emphasis added). *See also* '700 Patent at 118:33–46 (reciting the same language in Claim 1). Similarly, Claim 1 of the '360 Patent concerns a photodetector with an “intermediate semiconductor material . . . between said first and second doped semiconductor materials[,]” with “the intermediate semiconductor material [being] less doped than at least one of the first and second doped semiconductor materials[.]” '360 Patent at 55:21–27.

The parties' dispute centers on Samsung's use of “fabricated” in its construction. According to Samsung, that word “is necessary to reject W&Wsens's argument that reads out the requirement [of] distinct layers/regions.” Dkt. No. 103 at 20. Samsung says each “region” or “layer” must be a “separate layer[] of material” with “distinct boundaries” as opposed to, for example, a single piece of material that might have different “layers” of doping concentration within it. *See id.* (asserting a skilled artisan would understand “the intermediate layer/region must be fabricated so that it has sides that constitute a boundary between it and the surrounding layers/regions”); Hr'g Tr., Dkt. No. 125 at 61:21–62:7 (disputing W&Wsens's reply-brief assertion that a layer can be “a *portion* of semiconductor material with discrete properties” (emphasis added)).

The Court need not construe these terms. First, there are really three disputes—one each about the meaning of “region,” “layer,” and “material”—but the parties don't address those terms individually. For example, the Court finds no evidence of how a skilled artisan would understand the terms “layer” and “region,” much less the difference in scope between those terms. Yet Samsung's position would treat those the same way.

Second, Samsung's construction would improperly limit how the structure is *made* rather

than what the structure *is*. To be sure, a layer must have a distinct boundary, or it wouldn't be a "layer," but Samsung's construction would require a certain type of "distinctness," which would unduly limit the scope of the claim.

Finally, as Samsung notes, some of these claims already impose additional structural limitations on the terms. For example, the "intermediate region" of Claim 1 of the '543 Patent must have "sides," and the "intermediate material" of Claim 1 of the '360 Patent is distinct from the "first" and "second materials" from the same claim. *See Becton, Dickinson & Co. v. Tyco Healthcare Grp.*, LP, 616 F.3d 1249, 1254 (Fed. Cir. 2010) (noting that, "where a claim lists elements separately, the clear implication of the claim language is that those elements are distinct components of the patented invention" (cleaned up)); *Engel Indus., Inc. v. Lockformer Co.*, 96 F.3d 1398, 1404–05 (Fed. Cir. 1996) (concluding that where a claim provides for two separate elements, those elements "logically cannot be one and the same"). Samsung's main argument, then, is essentially that the surrounding claim language imposes structural requirements on the regions, layers, and materials that W&Wsens disregards. That's an infringement issue more than a claim-construction issue. Accordingly, the Court holds no construction is necessary.

V. CONCLUSION

Disputed Term	The Court's Construction
"hole" ('700 Patent, Claims 1, 7, 16, 20, 24, 28, 30; '543 Patent, Claims 1, 7, 16, 20, 24, 28, 30; '360 Patent, Claims 1, 3, 5, 6; '871 Patent, Claims 1–4, 7, 12, 14, 18; '948 Patent, Claims 1–3, 7, 13, 14)	"a void whose primary purpose is to increase the absorption of light entering the void by the light absorbing material abutting the void"

Disputed Term	The Court's Construction
“deliberately formed in-pillar holes . . . wherein said photodetector device is configured to respond to light photons incident on said array of pillars” (’360 Patent, Claim 1)	Plain and ordinary meaning
“holes that are deliberately formed into the light-receiving surfaces . . . extend into the photodetectors” (’871 Patent, Claim 1)	
“holes that are fabricated as recesses at or under the light-receiving surface of each of at least some of the pillars . . . extend[s] into the pillar[s]” (’948 Patent, Claims 1, 13)	
“holes intentionally formed therein . . . to concurrently receive . . . optical input . . . [that generates] electrical charges” (’543 Patent, Claim 1; ’700 Patent, Claim 1)	
“regions therebetween” (’871 Patent, Claim 1)	No construction necessary.
“intermediate region” (’543 Patent, Claims 1, 9, 10)	
“intermediate semiconductor material” (’360 Patent, Claims 1, 6)	
“intermediate layer” (’700 Patent, Claims 1, 9, 10)	

The Court **ORDERS** each party not to refer, directly or indirectly, to its own or any other party’s claim-construction positions in the presence of the jury. Likewise, the Court **ORDERS** the parties to refrain from mentioning any part of this opinion, other than the actual positions adopted

by the Court, in the presence of the jury. Neither party may take a position before the jury that contradicts the Court's reasoning in this opinion. Any reference to claim construction proceedings is limited to informing the jury of the positions adopted by the Court.

So ORDERED and SIGNED this 13th day of July, 2026.



RODNEY GILSTRAP
UNITED STATES DISTRICT JUDGE