

UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE PATENT TRIAL AND APPEAL BOARD

NXP USA, INC.,

Petitioner,

v.

BELL SEMICONDUCTOR, LLC,

Patent Owner

Case: IPR2024-00168

U.S. Patent No. 7,345,245

PATENT OWNER PRELIMINARY RESPONSE

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TABLE OF CONTENTS

I.	INTRODUCTION	1
II.	BACKGROUND	2
III.	LEVEL OF ORDINARY SKILL IN THE ART	4
IV.	CLAIM CONSTRUCTION	5
V.	ARGUMENT.....	5
A.	PETITIONER FAILS TO ESTABLISH A REASONABLE LIKELIHOOD THAT ANY OF THE CHALLENGED CLAIMS ARE UNPATENTABLE	5
1.	Ground 1: Obviousness of Claims 7, 8, 10, and 11 by Devnani in view of AAPA.....	6
2.	Ground 2: Obviousness of Claim 9 by Devnani in View of AAPA and Pillai	20
3.	Ground 3: Obviousness of Claim 12 by Devnani in View of AAPA and Tanahashi	20
4.	Ground 4: Devnani in View of AAPA Does Not Render Claims 1, 2, 4, and 5 Obvious	20
5.	Ground 5 Fails to Render Obviousness Claim 3 Over Devnani in View of AAPA and Pillai	39
6.	Ground 6: Obviousness of Claim 6 Over Devnani in View of AAPA and Tanahashi	40
7.	Ground 7: Obviousness of Claims 1, 2, and 5 Over Chung in View of Celeron.....	41
8.	Ground 8: Obviousness of Claim 3 Over Chung in View of Celeron and Pillai.....	44
9.	Ground 9: Obviousness of Claim 4 Over Chung in View of Celeron and AAPA	45
10.	Ground 10: Obviousness of Claim 6 over Chung in view of Celeron and Tanahashi.....	45
11.	Ground 11: Obviousness of Claims 1 and 5 Over Devnani in View of Celeron	46

Case IPR2024-00168
Patent No. 7,345,245
Patent Owner Preliminary Response

12.	Ground 12: Obviousness of Claim 6 over Devnani in view of Celeron and Tanahashi.....	49
13.	Ground 13: Obviousness of Claim 7 Over Review of BGAs in View of Devnani and CRTA.....	50
VI.	CONCLUSION.....	50

TABLE OF AUTHORITIES

	Page(s)
Cases	
<i>Abbott Lab. v. Baxter Pharmaceutical</i> , 334 F.3d 1274 (Fed. Cir. 2003)	8, 27
<i>Cisco Systems, Inc. v. C-Cation Tech., LLC</i> , No. IPR2014-00454, Paper 12 (P.T.A.B. Aug. 29, 2014).....	22, 23, 37, 47
<i>Eiko Global, LLC v. Blackbird Tech. LLC</i> , No. IPR2017-00980, Paper 16 (P.T.A.B. Sept. 1, 2017)	23
<i>Forest Laboratories, LLC v. Sigmapharm Laboratories, LLC</i> , 918 F.3d 928 (Fed. Cir. 2019)	17
<i>Gardner v. TEC Syst., Inc.</i> , 725 F.2d 1338 (Fed. Cir. 1984)	19
<i>Hopkins Mfg. Corp. v. Cequent Performance Prods.</i> , IPR2015-00616, Paper 9 (P.T.A.B. Aug. 17, 2015)	25
<i>Hulu, LLC v. Sound View Innovations, LLC</i> , IPR2018-01039, Paper 29 (P.T.A.B. Dec. 20, 2019).....	43
<i>In re Dailey</i> , 357 F.2d 669 (C.C.P.A. 1966).....	20, 36
<i>In re Nomiya</i> , 509 F.2d 566 (C.C.P.A. 1975).....	8, 27
<i>In re Rinehart</i> , 531 F.2d 1048 (C.C.P.A. 1976).....	19
<i>In re Rose</i> , 220 F.2d 459 (C.C.P.A. 1955).....	19
<i>Intervet Inc. v. Boehringer Ingelheim Vetmedica Inc.</i> , No. IPR2018-01788, Paper 9 (P.T.A.B. Apr. 16, 2019)	24

Case IPR2024-00168
Patent No. 7,345,245
Patent Owner Preliminary Response

<i>Leo Pharm Prods Ltd v. Rea</i> , 726 F.3d 1346 (Fed. Cir. 2013)	17
<i>Phillips v. AWH Corp.</i> , 415 F.3d 1303 (Fed. Cir. 2005)	5

Statutes

35 U.S.C. § 312	passim
35 U.S.C. § 314	6

Regulations

37 C.F.R. § 42.100	5
37 C.F.R. § 42.104	passim
37 C.F.R. § 42.107	6, 20
37 C.F.R. § 42.22	21, 37, 46
37 C.F.R. § 42.24	23
37 C.F.R. § 42.6	21

Case IPR2024-00168
Patent No. 7,345,245
Patent Owner Preliminary Response

TABLE OF EXHIBITS

Exhibit	Description
2001	Expert Declaration of Dr. Joseph Bernstein in Support of Patent Owner's Preliminary Response
2002	Disclaimer in a Patent Under 37 CFR 1.321(a) for US Patent 7,345,245

Through the undersigned Counsel, Patent Owner Bell Semiconductor, LLC (“PO” or “Bell”) submits the following Patent Owner Preliminary Response pursuant to 37 C.F.R. § 42.107(a).

I. INTRODUCTION

The *Inter Partes* Review Petition (“the Petition”) filed by NXP USA, INC. (“NXP”) against U.S. Patent No. 7,345,245 (“the ’245 Patent”) should be denied because it fails to establish a reasonable likelihood that any of the challenged claims are unpatentable.

Claims 1-6, and 8 of the ’245 Patent (the “Challenged Claims”) recite a semiconductor package for a die with improved reliability under thermal cycling conditions. Petitioner fails to show a reasonable likelihood that these claims are obvious over the cited references for a number of reasons. First, Petitioner relies on parts of the ’245 Patent as prior art but fails to provide any analysis or evidence to prove such portions of the ’245 Patent are admitted prior art (“AAPA”). Second, Petitioner completely ignores claim limitations requiring ball pads in an area of high stress around the corner of the die. Third, the Petition fails to meet the particularity standard of 35 U.S.C. § 312(a)(3). Finally, the Petition fails to show that the Celeron secondary reference that Petitioner relies on in several grounds is prior art under 35 U.S.C. § 102.

Claims 7 and 9-12 of the '245 Patent have been statutorily disclaimed to simplify issues before the Board. (EX2002.)

For the above reasons, the Petition should be denied.

II. BACKGROUND

A. The '245 Patent

The '245 Patent, entitled “Robust High Density Substrate Design for Thermal Cycling Reliability,” has a priority date of October 8, 2003, and relates to a semiconductor package for a die with improved thermal cycling reliability. (EX1001 at Abstract; EX2001 at ¶ 47.) The development of the semiconductor package claimed in the '245 Patent represented an important advancement related to the design of a semiconductor device. (EX2001 at ¶ 48.) Specifically, the '245 Patent discloses an improved signal trace routing in the high stress area under the die corner that accommodates a range of die sizes. (EX1001 at 2:36–39; EX2001 at ¶ 49.) This responds to the increased demand for high density signal routing on organic BGA substrates based on advances in semiconductor technology. (EX2001 at ¶ 50.) Packages with a full area ball array were also adopted to reduce the package body size and provide a high input/output (IO) signal density. (*Id.* at 1:8–13; EX2001 at ¶ 51.) In the prior art, signal traces on the bottom routing layer were routed over the ball pads of the underlying layer. (*See id.* at 1:24–26, 1:57–58; EX2001 at ¶ 52.) The

die corner is associated with areas of high stress, which also affects the ball pads positioned under the surrounding area. (EX2001 at ¶ 53.) The edges of those ball pads act as stress concentration points and, under temperature cycling conditions associated with typical use of semiconductor device, cracks are initiated from the edges of the ball pads and extend into the dielectric layer above. (*Id.* at 1:58–65; EX2001 at ¶ 54.)

One solution to overcoming this problem is to place metal planes on the layer L9 under the die corner 28; however, this causes a reduction in signal density. (*Id.* at 2:3–6; EX2001 at ¶ 55.) Another solution is to define a circular area with a one-millimeter radius around the die corner and avoiding routing traces within this region on the bottom routing layer. (*Id.* at 2:6–9; EX2001 at ¶ 56.) However, these solutions are not sufficient to avoid trace cracks in the layer L8 under temperature cycling conditions for all packaging technologies. (*See id.* at 2:16–18; EX2001 at ¶ 58.)

Anand Govind, Zafer Kutly, and Farshad Ghahghahi (“the ’245 Inventors”), understood these issues and set out to develop an improved method for designing a semiconductor package that eliminates the occurrences of cracks in the signal traces. (EX2001 at ¶ 58.) The ’245 Inventors ultimately conceived of a methodology for signal trace routing in the high stress area under the die corner that accommodates a range of die sizes. (*Id.* at 2:36–39; EX2001 at ¶ 58.) One such embodiment of the

invention provides an improved package in which a high stress area associated with the die corner is defined as an area within two ball pad pitches of the die corner and in which the signal traces are routed so as to preferably be outside the high stress area or, if they cannot be moved outside the high stress area, to avoid being over ball pads within the high stress area. (*Id.* at 2:32–36; 3:45–50; EX2001 at ¶ 60.)

B. Cited Art

The Petition cites the following art:

1. U.S. Patent No. 7,345,245 to Govind et al. (Purported “AAPA”)
2. US Patent Pub. 2003/0183919 to Devnani et al. (“Devnani”)
3. US Patent Pub. 2003/0003705 to Chung, et al. (“Chung”)
4. US Patent No. 6,680,530 to Pillai et al. (“Pillai”)
5. Mobile Intel® Celeron® Processor (0.13 μ) in Micro-FCBGA and Micro-FCPGA Packages Datasheet (April 2003) (“Celeron”)
6. U.S. Patent No. 6,172,305 to Tanahashi (“Tanahashi”)

III. LEVEL OF ORDINARY SKILL IN THE ART

Petitioner and its expert Dr. Baker allege a definition of a person of ordinary skill in the art (“POSITA”). (Pet. at 4.) Neither explain why a POSITA would require such qualifications. For purposes of this Preliminary Response only, PO’s analysis

of the Challenged Claims and the cited art adopts Petitioner's alleged definition. Should a trial be instituted, PO reserves the right to present an alternative definition for a person of ordinary skill in the art, along with any appropriate additional evidence.

IV. CLAIM CONSTRUCTION

Claims in an *inter partes* review are construed using the same claim construction standard as in a civil action. 37 C.F.R. § 42.100(b). Under this standard, claims are construed in accordance with their ordinary and customary meaning as understood by a person of ordinary skill in the art ("POSITA" or "skilled artisan"). *Id.* The person of ordinary skill in the art is deemed to read the claim term in the context of the entire patent, including the specification and prosecution history. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313-1316 (Fed. Cir. 2005) (en banc). Indeed, claims must be construed so as to be consistent with the specification. *Id.*

The Petition alleges that no express constructions of the claims are necessary to assess whether the cited art reads on the challenged claims. (Pet. at 10.) For purposes of this Preliminary Response only, Patent Owner does not propose any express claim constructions. Patent Owner reserves the right to propose claim constructions should the proceeding be instituted.

V. ARGUMENT

A. PETITIONER FAILS TO ESTABLISH A REASONABLE

LIKELIHOOD THAT ANY OF THE CHALLENGED CLAIMS ARE UNPATENTABLE

The petitioner in an *inter partes* review bears the burden of proving that there is a reasonable likelihood that it will prevail with respect to at least one of the challenged claims. 35 U.S.C. § 314(a). Petitioner has failed to meet this burden. Specifically, Petitioner has failed to show a reasonable likelihood that the cited art renders obvious the claimed invention.

1. Ground 1: Obviousness of Claims 7, 8, 10, and 11 by Devnani in view of AAPA

Claims 7, 10, and 11 have been statutorily disclaimed. (EX2002.) Therefore, no *inter partes* review of claims 7, 10, and 11 may be instituted. 37 C.F.R. § 42.107(e) (“No *inter partes* review will be instituted based on disclaimed claims.”).

With regard to claim 8, Petitioner has failed to show a reasonable likelihood that Devnani-AAPA renders obvious the challenged claim because (1) Petitioner has not shown that the purported AAPA is in fact AAPA; and (2) even if the purported AAPA were considered AAPA (which it is not), Petitioner has not shown that the differences between claim 8 and Devnani-AAPA are such that the claimed invention would have been obvious to a POSITA. Therefore, Ground 1 fails and should not be instituted.

a) Petitioner Hasn’t Shown That The Portions of the ’245 Patent it Relies on as Prior Art Are Admitted Prior Art (AAPA)

FIGS. 1-3 of the '245 Patent are labeled “prior art” and show a full area ball array package described in the Background of the Invention as being “currently in wide use.” (EX1001 at 1:23–2:2; EX2001 at ¶ 61.) The prior art full area ball array package design is described as a “multi-layer organic BGA flip chip substrate that uses a 9-layer stackup 20 with a thin core,” in which “[n]umerous signal traces 36 and other metal structures extend across the layer L8 proximate the die corner 38a” and “[t]he signal traces 36 of layer L8 are routed over the ball pads 34 of layer L9.” (*Id.*; EX2001 at ¶ 62.)

The Background of the Invention also identifies a problem with such full area ball array packages and two “existing” solutions to the problem. (*Id.* at 1:58–2:15; EX2001 at ¶ 63.) The problem is that “areas of high stress are associated with the die corner 38a and in particular the ball pads which are positioned under the area surrounding the die corner 38a. The edges of the ball pads 34, which are associated with the die corner 38a act as stress concentration points and under thermal cycling conditions, cracks are initiated from the edges of the ball pads 34 and extend into the dielectric layer above layer L9. If traces 36 are routed or other metal structures are provided on layer L8 over the ball pads 34 associated with the die corner 38a, the cracks can extend through the traces 36 and cause failures due to trace cracks under cycled stress conditions.” (*Id.* at 1:58–2:2; EX2001 at ¶ 64.) The first “existing”

solution is to place metal planes on the layer L9 under the die corner. (*Id.* at 2:3–6; EX2001 at ¶ 65.) The second “existing” solution is to define “a circular shaped area with a one (1) millimeter radius using placement of the die corner 38a as the center of the circle” and not routing traces “within the circular region.” (*Id.* at 2:6–15; EX2001 at ¶ 66.)

Neither the problem nor the “existing” solutions are described in the ’245 Patent as being in the prior art or known by others. Nevertheless, without providing any analysis or evidence to support its position, Petitioner makes a conclusory allegation that both the problem identified in the ’245 Patent and the two “existing” solutions are admitted prior art. (Pet. at 5–8.)

“While valid prior art may be created by the admissions of a party, these admissions are generally characterized by statements made during prosecution describing certain work as ‘prior art.’” *Abbott Lab. v. Baxter Pharmaceutical*, 334 F.3d 1274, 1279 (Fed. Cir. 2003). Even if certain work is described as “prior art,” “[i]t is necessary to consider everything appellants have said about what is prior art to determine the exact scope of their admission.” *In re Nomiya*, 509 F.2d 566, 571 (C.C.P.A. 1975).

Here, the Background did not state that the problem was known in the prior art, nor did the Background describe the second “existing” solution as “prior art,”

and Petitioner has not presented any analysis or evidence to show that either the problem or the “existing solution” should be considered admitted prior art. In fact, there is ample evidence that the problem and “existing” solution should not be considered admitted prior art.

First, while Applicant clearly labeled the package design in FIGS. 1-3 as “prior art” and described it as being “currently in wide use,” it consciously avoided using similar terminology to describe the problem with the package design and solutions to the problem. Instead, Applicant merely explained the problem without characterizing it in any way (i.e., without any admission) and referred to the solutions as “existing” (which is not the same as ‘prior art’ or ‘currently in wide use’). The lack of any admission with respect to the problem and the use of different terminology with respect to the solutions evidence an intent on the part of the Applicant to distinguish these statements in the patent from the prior art.

Second, the invention is described throughout the patent in a way that encompasses the second “existing” solution. For example, in the Abstract, the Applicant describes the invention generally as defining “a high stress area associated with the corner of the dies” and “routing [signal traces] away from the high stress area,” and uses the term “preferably” when describing the embodiment wherein the high stress area is defined as “two ball pitches away from the corner of the die.” (*Id.*

at Abstract.) Similarly, in the Objects and Summary of the Invention, Applicant states “an embodiment of the present invention provides an improved package in which a high stress area associated with the die corner is defined and in which the signal traces are routed away from the high stress areas at the die corner.” (*Id.* at 2:32–39.) The Detailed Description also refers to the invention broadly as a package “in which signal traces are routed away from the high stress area associated with the ball pads and the corner of the die.” (*Id.* at 3:6–9.) Finally, it should be noted that independent claim 7 of the ’245 patent is in fact broader than the “existing” solution because it does not specify a specific size of the “surrounding area of increased stress.” (*Id.* at 4:38–48.) Thus, it is evident that the Applicant did not consider the problem or the “existing” solution to be in the prior art.

Accordingly, Petitioner’s conclusory allegation that the problem and “existing” solution described in the ’245 Patent are admitted prior art is not enough to establish a reasonable likelihood that the problem and solution are admitted prior art and should therefore be rejected. As explained below, even if the above-referenced disclosures of the ’245 Patent are considered AAPA (which they should not be), Ground 1 still fails to show a reasonable likelihood that claim 8 is rendered obvious by Devnani-AAPA.

b) Devnani-AAPA Does Not Render Claim 8 Obvious

Claim 8 depends from claim 7, which recites a semiconductor package comprising the following limitations:

a top layer having a die mounted thereon, ***said die having a corner defining a surrounding area of increased stress;***
and

a plurality of layers under the top layer, said plurality of layers comprising a bottom routing layer having signal traces thereon, and ball pad layer under the bottom routing layer, said ball pad layer having a plurality of ball pads dispersed thereon, ***wherein none of the signal traces of the bottom routing layer are located within the area of increased stress defined by the corner of the die.***

(EX1001 at 4:38–48 (emphasis added); EX2001 at ¶ 67.)

Claim 8 further recites:

wherein none of the signal traces of the bottom routing layer are located within two ball pad pitches of the corner of the die.

(EX1001 at 4:49–51 (emphasis added); EX2001 at ¶ 68.)

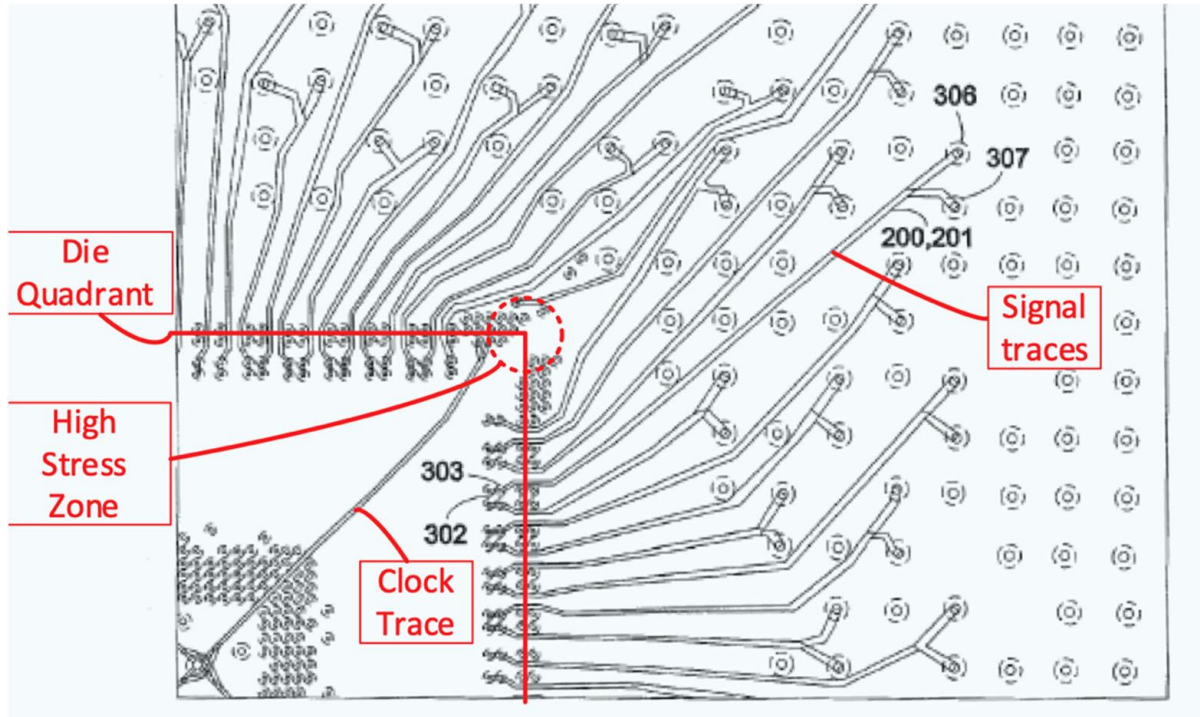
With regard to the claimed “area of increased stress,” the ’245 Patent explains that “[a]reas of high stress are associated with the die corner . . . and in particular ***the ball pads which are positioned under the area surrounding the die corner . . .***” (EX1001 at 1:58–60 (emphasis added); *see also id.* at 3:6–9, 28–30, and 45–50; EX2001 at ¶ 69.) The edges of the ball pads on the bottom-most layer under the area surrounding the die corner act as stress concentration points that, under temperature

cycling conditions, may initiate cracks that can extend upward through the dielectric layer and damage signal traces on the bottom routing layer above the ball pads. (*Id.* at 1:61–2:2; EX2001 at ¶ 70.) The invention of claim 8 solves this problem by routing signal traces such that “none of the signal traces of the bottom routing layer are located within two ball pad pitches of the corner of the die.” (*Id.* at 4:49–51; EX2001 at ¶ 71.)

Even if the purported AAPA is considered prior art, the invention of claim 8 would not be obvious over Devnani in view of AAPA for at least the following reasons.

(1) Devnani Does Not Have An Area of Increased Stress Around The Die Corner

Petitioner relies heavily on an annotated version of Figure 3 of Devnani (reproduced below) to attack claim 8. While Petitioner admits that Devnani does not *explicitly* state that the die corner in the figure defines a surrounding area of increased stress, it is argued that there is an area of increased stress near the die corner due to different thermal expansion characteristics. (Pet. at 18.) Petitioner also annotated Figure 3 to show an alleged high stress zone centered on the corner. (*Id.*)



Petitioner argues that Devnani Figure 3 shows all of the signal traces routed outside the alleged high stress zone. (Pet. at 22.) As backup, Petitioner argues that a POSITA implementing the semiconductor package of Devnani would look to the purported AAPA to route signal traces away from the alleged high stress zone in Figure 3. (*Id.*)

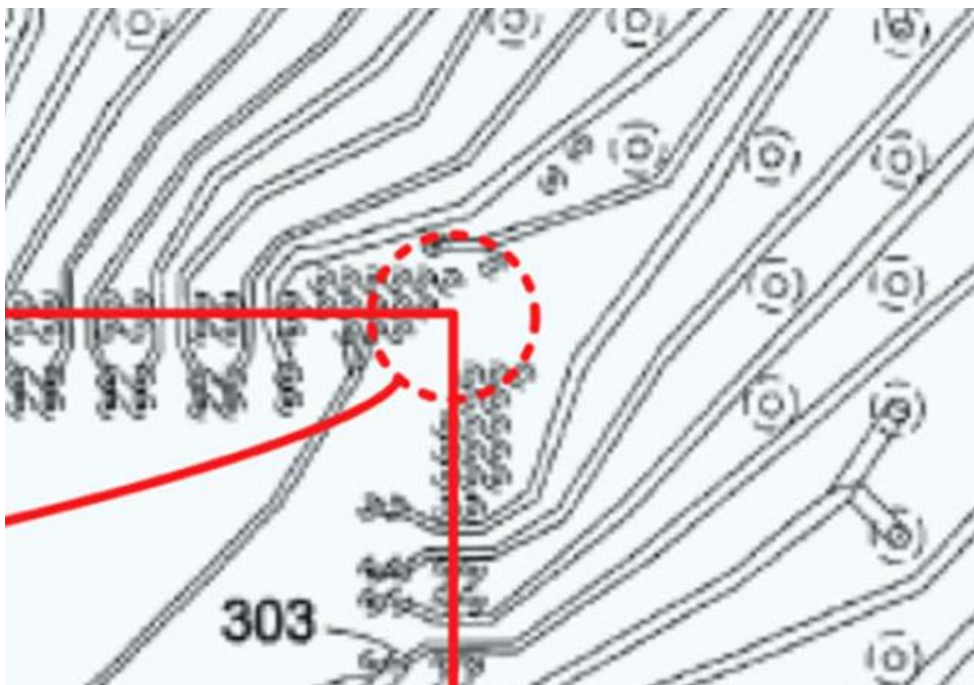
What Petitioner doesn't say about Figure 3 of Devnani is important—there are no ball pads on the bottom layer below the alleged area of increased stress surrounding the corner of the die. (EX2001 at ¶ 72.) Devnani explains that elements 306, 307 in Figure 3 are vias that connect to solder balls 401 (not shown). (EX1005 at ¶[0023]; EX2001 at ¶ 73.) Each of the vias is depicted as a circular hole

surrounded by a phantom circle. (EX2001 at ¶ 74.) There are numerous vias depicted in Figure 3, but they are all located far away from the die. (EX2001 at ¶ 75.) None of the vias (and, thus, none of the solder balls on the bottom layer) in Petitioner’s annotated Figure 3 are located below the alleged area of increased stress surrounding the die corner. (EX2001 at ¶ 76.) As explained above in Section II.A, the claimed “area of increased stress” is associated with ball pads below an area surrounding the die corner—not just thermal cycling. (EX2001 at ¶ 77.) The ball pads act as “stress concentration points.” (EX1001 at 1:61–65; EX2001 at ¶ 78.) Because there are no ball pads around the corner acting as stress concentration points, Devnani does not have “a corner defining a surrounding area of increased stress” as claimed. (EX2001 at ¶ 79.)

The consequences of this omission by Petitioner are two-fold. First, since Devnani does not have “a corner defining a surrounding area of increased stress” as claimed, there would be no reason to look to the purported AAPA for a solution to a non-existent problem. (EX2001 at ¶ 80.) Second, even if Devnani is considered to have a corner defining a surrounding area of increased stress due to different thermal characteristics, Petitioner has not shown that a POSITA would look to the purported AAPA for a solution, since the purported AAPA is focused on a different problem due to ball pads under an area surrounding the corner causing cracking, and there

are no ball pads within Petitioner's alleged high stress zone around the die corner in Devnani. (EX2001 at ¶ 81.) In particular, there is no basis for Petitioner's addition of a high stress zone defined by a one millimeter circle centered on the corner of the die in Figure 3 of Devnani. (EX2001 at ¶ 82.) Why would one millimeter be appropriate if there are no ball pads under Devnani's die corner?

Finally, it should also be noted that, even in Petitioner's annotated version of Figure 3 of Devnani reproduced below, the alleged high stress zone encompasses a signal trace (near an upper portion of the circle) and therefore does not meet the claim limitation "wherein none of the signal traces of the bottom routing layer are located within the area of increased stress defined by the corner of the die." (EX2001 at ¶ 83.)



(Pet. at 22 (Annotation by Petitioner) (enlarged).)

For these reasons alone, Petitioner has failed to show a reasonable likelihood that claim 8 is obvious over Devnani and the purported AAPA.

(2) The “Two Ball Pad Pitches” Limitation Would Not Be Obvious in View of Devnani and Purported AAPA

In addition to lacking the above limitations, neither Devnani nor the purported AAPA solution discloses “wherein none of the signal traces of the bottom routing layer are located within two ball pad pitches of the corner of the die” (the “two ball pad pitches” limitation). (EX2001 at ¶ 84.) In fact, Petitioner admits that “Devnani does not explicitly state the signal traces that are not near the corner of the die are farther than two ball pad pitches.” (Pet. at 27). The purported AAPA is alleged by Petitioner to remedy these deficiencies. More specifically, based on the discussion in the ’245 Patent about the disadvantages of the purported AAPA solution, Petitioner argues that a POSITA would have been motivated to use a larger area. (Pet. at 27–28.) Furthermore, according to Petitioner, such larger area “would include an area defined by 2 ball pad pitches from the corner of the die.” (Pet. at 28.) There are at least two major problems with these arguments.

First, Petitioner has not shown a reasonable likelihood that the disadvantages of the purported AAPA solution were known in the prior art. In full, the ’245 Patent

merely states “[a] disadvantage of having a one (1) millimeter radius region under the die corner 38a is that it is not sufficient to avoid trace cracks in the layer L8 under temperature cycling conditions for all packaging technologies.” (EX1001 at 1:11–15; EX2001 at ¶ 85.) The ’245 Patent does not say the disadvantage was known in the prior art, or common knowledge, or otherwise, and there is absolutely no analysis in the Petition showing that the disadvantages were known in the prior art. (EX2001 at ¶ 86.) It’s simply assumed. Therefore, it’s improper for Petitioner to rely on the stated disadvantage for motivation to modify the purported AAPA solution. *See, e.g., Forest Laboratories, LLC v. Sigmapharm Laboratories, LLC*, 918 F.3d 928 (Fed. Cir. 2019) (“We have recognized that where a problem was not known in the art, the solution to that problem may not be obvious, because ‘ordinary artisans would not have thought to try at all because they would not have recognized the problem.’”) *citing Leo Pharm Prods Ltd v. Rea*, 726 F.3d 1346, 1357 (Fed. Cir. 2013).

Second, even if the disadvantage was known in the prior art (which Petitioner has not even tried to show is reasonably likely), there’s simply no support for Petitioner’s argument that “an area larger than 1 mm from the corner of the die . . . would include an area defined by 2 ball pad pitches from the corner of the die.” (EX2001 at ¶ 87.) This is nothing more than hindsight analysis. Petitioner has not

proffered any evidence to support the notion that any high stress zone larger than the purported AAPA solution would encompass the “two ball pad pitches” limitation.

Third, with regard to Petitioner’s allegation that “there is no specific disclosure regarding any advantages, criticality, or unexpected results related to [the “two ball pitch” limitation],” this is provably false. (EX2001 at ¶ 88.) In fact, the ‘245 Inventors stated that the purported AAPA solution is “not sufficient to avoid trace cracks . . . under temperature cycling conditions for all packaging technologies,” (EX1001 at 2:11–15), that “an improved package is needed,” (*id.* at 2:16–18), and that “[t]he present invention provides such a package,” (*id.* at 2:19). (EX2001 at ¶ 89.) In other words, the inventors believed that, unlike the purported AAPA solution, the claimed invention was sufficient to avoid trace cracks under temperature cycling conditions ***for all packaging technologies***. (EX2001 at ¶ 90.) This is certainly an advantage and a significant improvement over the purported AAPA solution. (EX2001 at ¶ 91.) A POSITA reading the ‘245 Patent would also understand that the “two ball pad pitch” limitation is advantageous and significant in that it provides an adjustable solution suitable “for all packaging technologies” (e.g., the “area of increased stress” adjusts to accommodate packages having ball grids with different ball pitches) as opposed to a one-size-fits-all fixed radius area like the purported AAPA solution. (EX2001 at ¶ 92.) The claimed invention is thus

distinguishable from the cases cited by Petitioner relating to simple changes in size/proportion and shape. (See Pet. at 8–9; EX2001 at ¶ 93.)

In the first case cited by Petitioner, *In re Rose*, 220 F.2d 459 (C.C.P.A. 1955), the Court held a claim to a lumber package unpatentable because the only difference between the claimed invention and the prior art was a change in the size of the article in question. Here, claim 8 does not recite a change in the size of the semiconductor package, and the “two ball pad pitch” limitation of claim 8 differs from the fixed one (1) millimeter radius in that it is not fixed in size and can therefore accommodate a variety of ball pad pitch sizes. (EX2001 at ¶ 94.)

The claim in *In re Rinehart*, 531 F.2d 1048 (C.C.P.A. 1976), involved “mere scaling up of a prior art process capable of being scaled up.” Here, the size of the zone in the alleged prior art was fixed regardless of the size of the die (i.e., not scalable). (EX2001 at ¶ 95.)

The only difference between the claims and the prior art in *Gardner v. TEC Syst., Inc.*, 725 F.2d 1338 (Fed. Cir. 1984), *cert. denied*, 469 U.S. 830 (1984) was a recitation of relative dimensions of the claimed device that did not cause the device to perform differently than the prior art device. Here, the claimed package performs differently from the alleged prior art in being less prone to cracking and more reliable “for all packaging technologies” due to the adjustability of the “two ball pad pitches”

limitation. (EX2001 at ¶ 96.)

Finally, in *In re Dailey*, 357 F.2d 669 (C.C.P.A. 1966), there was no evidence that the particular configuration of the claimed disposable plastic nursing container was significant. Here, the configuration of the claimed package is significant because it is less prone to cracking than alleged prior art packages and is more reliable “for all packaging technologies” due to the adjustability of the “two ball pad pitches” limitation. (EX2001 at ¶ 97.)

It should also be noted that, in contrast to PO, Petitioner did not analyze claim 8 (or its parent claim 7) under any of the above cases with any degree of particularity.

Accordingly, Petitioner has not shown a reasonable likelihood that claim 8 would have been obvious over Devnani in view of the purported AAPA.

2. Ground 2: Obviousness of Claim 9 by Devnani in View of AAPA and Pillai

Claim 9 has been statutorily disclaimed. (EX2002.) Therefore, no *inter partes* review of claim 9 may be instituted. 37 C.F.R. § 42.107(e).

3. Ground 3: Obviousness of Claim 12 by Devnani in View of AAPA and Tanahashi

Claim 12 has been statutorily disclaimed. (EX2002.) Therefore, no *inter partes* review of claim 12 may be instituted. 37 C.F.R. § 42.107(e).

4. Ground 4: Devnani in View of AAPA Does Not Render Claims 1, 2, 4, and 5 Obvious

a) Ground 4 Fails to Render Obvious Claim 1 Because It Lacks Particularity

A petition for IPR must identify “with particularity, each claim challenged, the grounds on which the challenge to each claim is based, and the evidence that supports the grounds for the challenge to each claim.” 35 U.S.C. § 312(a)(3); *see also* 37 C.F.R. § 42.104(b)(4)-(5) (requiring that “the petition” identify “[h]ow the construed claim is unpatentable,” as well as “[t]he exhibit number of the supporting evidence relied upon to support the challenge and the relevance of the evidence to the challenge raised, including identifying specific portions of the evidence that support the challenge”); 37 C.F.R. § 42.22(a)(2) (requiring petitions in general to include “[a] full statement of the reasons for the relief requested, including a detailed explanation of the significance of the evidence”). Petitioner is required to set forth its arguments and evidence in the Petition and may not incorporate by reference arguments contained in other documents. 37 C.F.R. § 42.6(a)(3) (“Arguments must not be incorporated by reference from one document into another document.”).

Here, Petitioner provides conclusory analysis of claim 1 in its Petition. The Petition relies extensively on the Baker Declaration to provide argument and analysis which are nowhere to be found in the Petition itself regarding the challenged claim limitations. (See Pet. at 35–36.) The Board should deny institution on that basis alone. *See, e.g., Cisco Systems, Inc. v. C-Cation Tech., LLC*, No. IPR2014-

00454, Paper 12, at 10 (P.T.A.B. Aug. 29, 2014) (refusing to consider “arguments that are not made in the Petition, but are instead incorporated by reference . . .” and refusing to institute because the obviousness grounds failed to “address meaningfully the scope and content of the prior art, and differences between the claim subject matter and the prior art,” while also failing to “provide sufficient articulated reasoning with rational underpinning” explaining why the POSITA would modify the applied reference in the manner proposed).

The Petition improperly relies on the Baker Declaration to present its arguments. For example, Petitioner’s entire discussion of nearly all of the limitations of claim 1 is a single sentence. (Pet. at 36 (“Devnani-AAPA teaches these limitations.”).) In support of this single conclusory sentence, Petitioner cites to seven paragraphs of the Baker Declaration that include multiple pages of annotated figures and analysis found nowhere in the Petition. Petitioner also improperly cites Sections IX.B.1(a)-(d) of the Petition that reference another eighteen paragraphs of the Baker Declaration. Worse, these improper eighteen paragraphs of the Baker Declaration rely on an additional four purported prior art references (Xie, EX1011; CRTA, EX1016; PCIP, EX1017; Review of BGAs, EX1018) that are not included in Ground 4. Again, nowhere in the Petition does Petitioner provide a detailed explanation as to how these improper Baker Declaration citations and purported prior art references

render any element of claim limitations 1(a)-(c) as obvious.

In *Cisco Systems, Inc.*, No. IPR2014-00454, the Board denied institution based on Cisco doing exactly what Petitioner does here: providing conclusory analysis in its petition, while providing its actual arguments in an expert declaration that was not subject to the word count limits of 37 C.F.R. § 42.24(a)(1)(ii). The Board criticized Petitioner's citations to large portions of an expert declaration, including lengthy claim charts, to support conclusory statements in the petition, and refused to consider arguments not made in the petition and only incorporated by reference. *Cisco*, Paper 12 at 7–10. It thereafter denied institution because the petition did not specify sufficiently where each element of the claims was disclosed in the cited prior art references. In denying institution, the Board commented:

One purpose of the prohibition against incorporation by reference is to eliminate abuses that arise against incorporation. In the petition before us, incorporation by reference of numerous arguments from [expert's] 250-page Declaration into the Petition serves to circumvent the page limits imposed on petitions for inter partes review, while imposing on our time by asking us to sift through over 250 pages of [expert's Declaration. . . to locate the specific arguments corresponding to the numerous paragraphs cited to support Petitioner's assertions.

Id. at 10 (internal citations omitted). The *Cisco* decision is not an isolated one. In *Eiko Global, LLC v. Blackbird Tech. LLC*, No. IPR2017-00980, Paper 16 (P.T.A.B. Sept. 1, 2017), “[t]he Petition’s substantive analysis as to how [reference] allegedly

disclose[d] the limitation amount[ed] to a single sentence . . . with an unexplained citation to five distinct passages of [reference] and four paragraphs of [expert’s] declaration.” *Id.* at 22. The Board denied institution of the pertinent ground due to this rule violation, stating:

This conclusory analysis, which does not identify which elements of [reference] allegedly correspond to the claim elements and parrots the claim language with a bare assertion that [reference] discloses the limitation, falls far below the particularity and specificity that our governing statute and rules require of arguments and evidence in a petition. ***The Petition also impermissibly incorporates by reference the more detailed analysis in [expert’s] declaration. Arguments that are not presented and developed in the Petition, and instead are incorporated by reference to [expert’s] declaration, are not entitled to consideration.***

Id. at 22–23 (citations omitted) (emphasis added). Similarly, in *Intervet Inc. v. Boehringer Ingelheim Vetmedica Inc.*, No. IPR2018-01788, Paper 9 (P.T.A.B. Apr. 16, 2019), the Board denied institution based on the Petitioner’s massive use of incorporation by reference, stating, “[i]ncorporation by reference amounts to a self-help increase in the length of the brief and is a pointless imposition on the court’s time. A brief must make all the arguments accessible to the judges, rather than ask them to play archeologist with the record.” *Id.* at 8 (internal citations, quotation marks, and alterations omitted).

As explained above, the Petition itself does not identify “where each element

of the claim is found in the prior art,” nor does it identify “the relevance of the evidence,” which is a required component of each ground of the petition. 37 C.F.R. § 42.104(b)(4)-(5). “The Board may exclude or give no weight to the evidence where a party has failed to state its relevance or to identify specific portions of the evidence that support the challenge.” 37 C.F.R. § 42.104(b)(5). By including conclusory summaries of its grounds in the Petition and extensively incorporating by reference material contained with the Baker Declaration, Petitioner violates these rules, warranting denial of institution. “Incorporation by reference serves to circumvent the [word limits] imposed on petitions for *inter partes* review, while also obscuring the arguments and evidence by requiring the Patent Owner and the Board to sift through the declaration to locate specific, relevant arguments.” *Hopkins Mfg. Corp. v. Cequent Performance Prods.*, IPR2015-00616, Paper 9, at 44–45 (P.T.A.B. Aug. 17, 2015). Arguments that are not presented in the Petition but instead incorporated by reference to the Baker Declaration, are not entitled to consideration, and as shown above, without the Baker Declaration and improper cross-referencing, the Petition fails to identify “with particularity, each claim challenged, the grounds on which the challenge to each claim is based, and the evidence that supports the grounds for each challenge to each claim.” 35 U.S.C. § 312(a)(3).

**b) The Portions of the '245 Patent Purported by
Petitioner to be Prior Art in Ground 4 Are Not Admitted**

Prior Art (AAPA)

As explained above in Section V.A.1(a), FIGS. 1–3 of the '245 Patent are labeled “prior art” and show a full area ball array package described in the Background of the Invention as being “currently in wide use.” (EX1001 at 1:23–2:2; EX2001 at ¶ 98.) The prior art full area ball array package design is described as a “multi-layer organic BGA flip chip substrate that uses a 9-layer stackup 20 with a thin core,” in which “[n]umerous signal traces 36 and other metal structures extend across the layer L8 proximate the die corner 38a” and “[t]he signal traces 36 of layer L8 are routed over the ball pads 34 of layer L9.” (*Id.*; EX2001 at ¶ 99.)

The Background of the Invention also identifies a problem with such full area ball array packages and two “existing” solutions to the problem. (*Id.* at 1:58–2:15; EX2001 at ¶ 100.) The problem is that “areas of high stress are associated with the die corner 38a and in particular the ball pads which are positioned under the area surrounding the die corner 38a. The edges of the ball pads 34, which are associated with the die corner 38a acts as stress concentration points and under thermal cycling conditions, cracks are initiated from the edges of the ball pads 34 and extend into the dielectric layer above layer L9. If traces 36 are routed or other metal structures are provided on layer L8 over the ball pads 34 associated with the die corner 38a, the cracks can extend through the traces 36 and cause failures due to trace cracks under

cycled stress conditions.” (*Id.* at 1:58–2:2; EX2001 at ¶ 101.) The first “existing” solution is to place metal planes on the layer L9 under the die corner. (*Id.* at 2:3–6; EX2001 at ¶ 102.) The second “existing” solution is to define “a circular shaped area with a one (1) millimeter radius using placement of the die corner 38a as the center of the circle” and not routing traces “within the circular region.” (*Id.* at 2:6–15; EX2001 at ¶ 103.)

Neither the problem nor the “existing” solutions are described in the ’245 Patent as being in the prior art or known by others. Nevertheless, without providing any analysis or evidence to support its position, Petitioner makes a conclusory allegation that both the problem identified in the ’245 Patent and the two “existing” solutions are admitted prior art. (Pet. at 5–8.)

“While valid prior art may be created by the admissions of a party, these admissions are generally characterized by statements made during prosecution describing certain work as ‘prior art.’” *Abbott Lab.*, 334 F.3d at 1279.. Even if certain work is described as “prior art,” “[i]t is necessary to consider everything appellants have said about what is prior art to determine the exact scope of their admission.” *In re Nomiya*, 509 F.2d at 571 .

Here, the Background did not state that the problem was known in the prior art, nor did the Background describe the second “existing” solution as “prior art,”

and Petitioner has not presented any analysis or evidence to show that either the problem or the “existing solution” should be considered admitted prior art. In fact, there is ample evidence that the problem and “existing” solution should not be considered admitted prior art.

First, while Applicant clearly labeled the package design in FIGS. 1-3 as “prior art” and described it as being “currently in wide use,” it consciously avoided using similar terminology to describe the problem with the package design and solutions to the problem. Instead, Applicant merely explained the problem without characterizing it in any way (i.e., without any admission) and referred to the solutions as “existing” (which is not the same as ‘prior art’ or ‘currently in wide use’). The lack of any admission with respect to the problem and the use of different terminology with respect to the solutions evidence an intent on the part of the Applicant to distinguish these statements in the patent from the prior art.

Second, the invention is described throughout the patent in a way that encompasses the second “existing” solution. For example, in the Abstract, the Applicant describes the invention generally as defining “a high stress area associated with the corner of the dies” and “routing [signal traces] away from the high stress area,” and uses the term “preferably” when describing the embodiment wherein the high stress area is defined as “two ball pitches away from the corner of the die.” (*Id.*

at Abstract.) Similarly, in the Objects and Summary of the Invention, Applicant states “an embodiment of the present invention provides an improved package in which a high stress area associated with the die corner is defined and in which the signal traces are routed away from the high stress areas at the die corner.” (*Id.* at 2:32–39.) The Detailed Description also refers to the invention broadly as a package “in which signal traces are routed away from the high stress area associated with the ball pads and the corner of the die.” (*Id.* at 3:6–9.) Finally, it should be noted that independent claim 7 of the ’245 Patent is in fact broader than the “existing” solution because it does not specify a specific size of the “surrounding area of increased stress.” (*Id.* at 4:38-48.) Thus, it is evident that the Applicant did not consider the problem or the “existing” solution to be in the prior art.

Accordingly, Petitioner’s conclusory allegation that the problem and “existing” solution described in the ’245 Patent are admitted prior art is not enough to establish a reasonable likelihood that the problem and solution are admitted prior art and should therefore be rejected. As explained below, even if the above-referenced disclosures of the ’245 Patent are considered AAPA (which they should not be), Ground 4 still fails to show a reasonable likelihood that claim 1 is rendered obvious by Devnani-AAPA.

c) Devnani and the Purported AAPA Solution Do Not Render Claim 1 Obvious on the Merits

Claim 1 recites a semi-conductor package comprising the following limitations:

a top layer having a die mounted thereon, said die having a corner; and

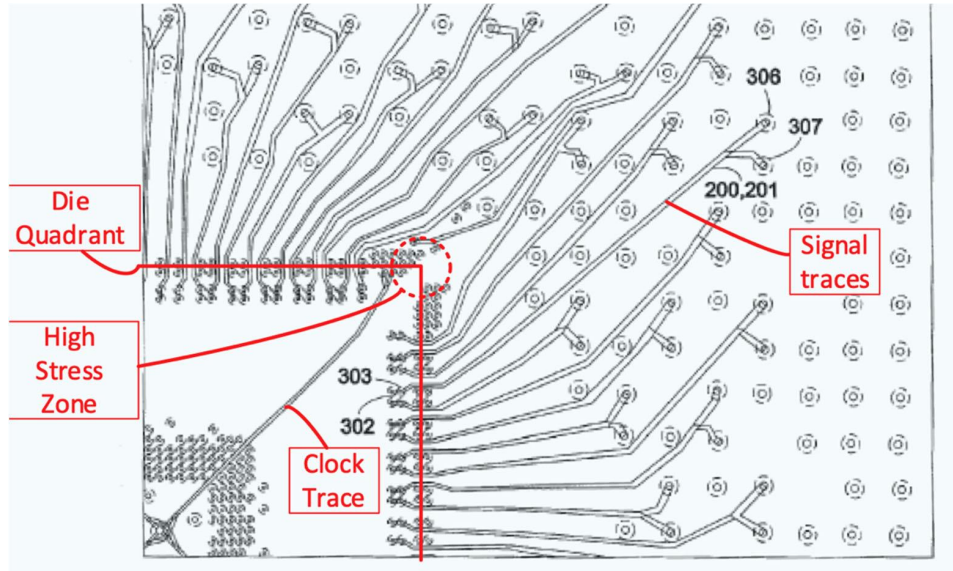
a plurality of layers under the top layer, said plurality of layers comprising a bottom routing layer having signal traces thereon, and a ball pad layer under the bottom routing layer, said ball pad layer having a plurality of ball pads, ***wherein none of the signal traces of the bottom routing layer are located over ball pads of the ball pad layer which are disposed in an area within two ball pad pitches of the corner of the die.***

(EX1001 at 4:10–20 (emphasis added); EX2001 at ¶ 104.)

Petitioner has failed to show a reasonable likelihood that claim 1 is unpatentable over Devnani in view of the purported AAPA for at least the following reasons.

(1) The “Two Ball Pad Pitches” Limitation

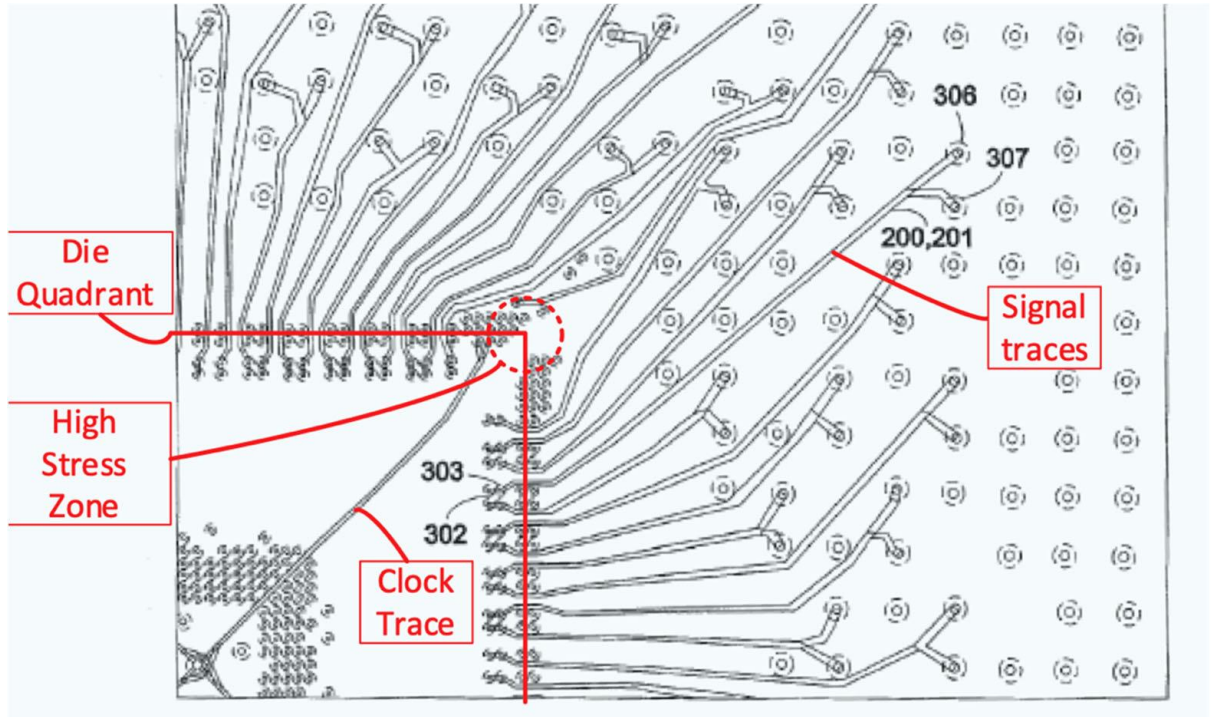
In Ground 4, Petitioner relies on its annotated version of Figure 3 of Devnani (reproduced below) to argue that Devnani inherently shows the phrase “wherein none of the signal traces of the bottom routing layer are located over ball pads of the ball pad layer.” (Pet. at 36–37.)



The thrust of Petitioner’s argument is that Figure 3 shows all of the signal traces being routed away from a high stress zone associated with the corner of the die; and, with all signal traces being routed away from the high stress zone, the claim limitation “none of the signal traces of the bottom routing layer are located over ball pads of the ball pad layer” is met. (*Id.*; EX2001 at ¶ 105.) Petitioner then goes on to talk about the limitation “two ball pad pitches of the corner of the die” and how the purported AAPA renders it obvious. (*Id.* at 37–41; EX2001 at ¶ 106.)

What Petitioner doesn’t mention is that it has deliberately parsed the claim language to leave out the phrase—“which are disposed in an area within”—that connects the former limitation with the latter limitation. When the phrases are read together, the full limitation reads “wherein none of the signal traces of the bottom

routing layer are located over ball pads of the ball pad layer which are disposed in an area within two ball pad pitches of the corner of the die” (the “Two Ball Pad Pitches” limitation). (EX2001 at ¶ 107.) This conveys a much different meaning, as it refers to “ball pads of the ball pad layer which are disposed in an area within two ball pad pitches of the corner of the die,” meaning the package ***must have ball pads in the defined area***. (EX2001 at ¶ 108.) As discussed above in Section V.A.1(b)(1) (Ground 1), and shown below in Devnani Figure 3, there are no ball pads in the area within two ball pad pitches of the corner of the die. (EX2001 at ¶ 109.) Devnani explains that elements 306, 307 in Figure 3 are vias that connect to solder balls 401 (not shown). (EX1005 at ¶[0023]; EX2001 at ¶ 110.) Each of the vias is depicted as a circular hole surrounded by a phantom circle. (EX2001 at ¶ 111.) There are numerous vias depicted in Figure 3, but they are all located far away from the die. (EX2001 at ¶ 112.) None of the vias (and, thus, none of the solder balls on the bottom layer) is located below the die, much less in an area within two ball pitches of the die corner. (EX2001 at ¶ 113.) Therefore, Devnani Figure 3 fails to meet this limitation. (EX2001 at ¶ 114.)



Devnani Figure 3 (Annotated by Petitioner)

Petitioner relies on the purported AAPA for the “area within two ball pad pitches of the corner of the die” limitation. (Pet. at 37.) However, a consequence of the above omission by Petitioner is that, even if the purported AAPA is prior art (which it is not), there would have been no reason to look to the purported AAPA for a solution. (EX2001 at ¶ 115.) That is, since Devnani Figure 3 does not have ball pads of the ball pad layer disposed in the area surrounding the die corner where they can cause cracking, there would be no reason to look to the purported AAPA for a solution because the problem the purported AAPA is focused on is ball pads causing cracking. (EX2001 at ¶ 116.) In particular, there is no basis for Petitioner’s addition

of a high stress zone defined by a one millimeter circle centered on the corner of the die in Devnani Figure 3. (EX2001 at ¶ 117.) As asked earlier, why would one millimeter be appropriate if there are no ball pads?

Petitioner admits that Devnani does not explicitly disclose that the corner defines a surrounding area of increased stress (*see* Pet. at 37) and relies on alleged AAPA in the '245 patent (i.e., the second “existing” solution defining a circular shaped area with a one (1) millimeter radius centered on the die corner) to show that it would be obvious to define a high stress area within two ball pad pitches of the corner of the die. But, again, the second “existing” solution is not admitted prior art (AAPA), as explained above. And, even if this second solution is considered as AAPA (which it should not), Petitioner still misses the mark on claim 1 because, as explained above, the two ball pad pitch implementation of claim 1 (as with claim 8) differs from the fixed one (1) millimeter radius in that the two ball pad pitch implementation is not fixed in size and can therefore accommodate a variety of ball pad pitch sizes. (EX2001 at ¶ 118.) Even though Petitioner mischaracterizes the two ball pad pitch implementation as merely being a larger version of the 1 mm solution, the actual size depends on the ball pad pitch of the package. (EX2001 at ¶ 119.)

As the '245 Patent explains, the two ball pad pitch implementation depends on the size of the die and how the ball pads are dispersed. ('245 Patent at 2:36-39;

3:10-30; FIG. 4; EX2001 at ¶ 120.) The Petition fails to account for this key fact. (EX2001 at ¶ 121.) The two ball pad pitch implementation of claim 1 (as opposed to hard-coding a 1 mm circle) is critical to the invention to “reduce cracks in the signal traces and therefore avoids functional failures caused by stresses under the die corner.” (’245 Patent at 2:16-18; EX2001 at ¶ 122.) Contrary to Petitioner’s assertions, the size or shape of the high stress zone is clearly defined by the language of claim 1 and in view of the ’245 Patent’s specification. (’245 Patent at 4:10-20, 2:36-39, 3:10-30, FIGS. 4, 5; EX2001 at ¶ 123.)

Petitioner also presents contradictory obviousness arguments. For example, Petitioner contradicts itself within the same paragraph by stating in one sentence that “a POSITA would naturally select [] **any size or shaped area** they believe would result in reducing failures due to trace cracks[]” and in the next sentence stating that “a POSITA would have anticipated success in reducing the number of stress cracks in signal traces by routing signal traces around a **larger area than 1 mm** from the corner of the die . . . ” (Pet. at 41.) Petitioner’s obviousness ground on claim 1 cannot stand on such contradictory positions where on one hand the high stress zone can be anything a POSITA believes is correct and on the other hand, an area larger than 1 mm.

Nor is this a case of “shape modifications without clear significance,” as

alleged by Petitioner. (Pet. at 42.) In *In re Dailey*, 357 F.2d 669 (C.C.P.A. 1966), the case cited by Petitioner, there was no evidence that the particular configuration of the claimed disposable plastic nursing container was significant. Here, the configuration of the claimed package is significant because it reduces cracks in the signal traces and avoids functional failures caused by stresses under the die corner for all packaging technologies. ('245 Patent at 2:16–19, 37–39; EX2001 at ¶ 124.) The one-size-fits-all approach of the 1 mm radius does not. ('245 Patent at 2:12–15; EX2001 at ¶ 125.) Thus, *In re Dailey* does not provide a basis to find claim 1 obvious.

Accordingly, Petitioner has not shown a reasonable likelihood that claim 1 would have been obvious over Devnani in view of the purported AAPA.

d) Ground 4 Fails to Render Obvious Claim 2 Because It Lacks Particularity

A petition for IPR must identify “with particularity, each claim challenged, the grounds on which the challenge to each claim is based, and the evidence that supports the grounds for the challenge to each claim.” 35 U.S.C. § 312(a)(3); *see also* 37 C.F.R. § 42.104(b)(4)-(5) (requiring that “the petition” identify “[h]ow the construed claim is unpatentable,” as well as “[t]he exhibit number of the supporting evidence relied upon to support the challenge and the relevance of the evidence to the challenge raised, including identifying specific portions of the evidence that

support the challenge”); 37 C.F.R. § 42.22(a)(2) (requiring petitions in general to include “[a] full statement of the reasons for the relief requested, including a detailed explanation of the significance of the evidence”). Petitioner is required to set forth its arguments and evidence in the Petition and may not incorporate by reference arguments contained in other documents. 37 C.F.R. § 42.6(a)(3) (“Arguments must not be incorporated by reference from one document into another document.”).

Here, Petitioner provides only conclusory analysis of claim 2 in its Petition. Instead of providing detailed analysis and explanation of its position, Petitioner improperly incorporates arguments from a different part of the Petition dealing with a different claim (Section IX.D.1(d) that concerns claim 12, not claim 1). Worse, Petitioner relies on five purported prior art references (Moore & Jarvis, EX1010; Xie, EX1011; CRTA, EX1016; PCIP, EX1017; Review of BGAs, EX1018) that are not included in Ground 4. Again, nowhere in the Petition does Petitioner provide a detailed explanation as to how Section IX.D.1(d) of its Petition and the purported prior art references render any element of claim 2 as obvious. The Board should deny institution on that basis alone. *See, e.g., Cisco Systems*, No. IPR2014-00454, Paper 12, at 10.

e) Ground 4 Fails to Render Obvious Claim 2 on the Merits

Dependent claim 2 recites a package as recited in claim 1, wherein:

none of the signal traces of the bottom routing layer are located within two ball pad pitches of the corner of the die.

(EX1001 at 4:21–23; EX2001 at ¶ 126.)

A dependent claim contains all of the limitations of the claim or claims from which it depends. Therefore, claim 2 distinguishes over Devnani-AAPA for at least all of the reasons discussed in Section V.A.1(b)(1)-(2) above with regard to claim 1. Moreover, Petitioner fails to show how the Devnani-AAPA 1 mm circle radius upon which it based its arguments with respect to claim 1 now includes “a distance of two ball pad pitches.” (Pet. at 43.) Therefore, Petitioner fails to establish a reasonable likelihood that claim 2 is obvious over Devnani-AAPA.

PO reserves the right to present additional arguments for patentability of claim 2 should *inter partes* review be instituted.

f) Ground 4 Fails to Render Obvious Claim 4 on the Merits

Dependent claim 4 recites a package as recited in claim 1, wherein:

the package comprises nine layers with the routing layer being the eighth layer and the ball pad layer being the ninth layer, on a bottom of the package.

(EX1001 at 4:28–31; EX2001 at ¶ 127.)

A dependent claim contains all of the limitations of the claim or claims from which it depends. Therefore, claim 4 distinguishes over Devnani-AAPA for at least

all of the reasons discussed above with regard to claim 1. Therefore, Petitioner fails to establish a reasonable likelihood that claim 4 is obvious over Devnani-AAPA.

PO reserves the right to present additional arguments for patentability of claim 4 should *inter partes* review be instituted.

g) Claim 5

Dependent claim 5 recites a package as recited in claim 1, wherein:

the die is mounted to the top layer in an arrangement other than a pin connection.

(EX1001 at 4:32–34; EX2001 at ¶ 128.)

A dependent claim contains all of the limitations of the claim or claims from which it depends. Therefore, claim 5 distinguishes over Devnani-AAPA for at least all of the reasons discussed above with regard to claim 1. Therefore, Petitioner fails to establish a reasonable likelihood that claim 5 is obvious over Devnani-AAPA.

PO reserves the right to present additional arguments for patentability of claim 5 should *inter partes* review be instituted.

5. Ground 5 Fails to Render Obviousness Claim 3 Over Devnani in View of AAPA and Pillai

Dependent claim 3 recites a package as recited in claim 1, wherein:

said ball pad layer has a plurality of ball pads dispersed thereon and no metal traces on the ball pad layer which are connected to the ball pads.

(EX1001 at 4:24-27; EX2001 at ¶ 129.)

A dependent claim contains all of the limitations of the claim or claims from which it depends. Therefore, claim 3 distinguishes over Devnani-AAPA for at least all of the reasons discussed above with regard to claim 1. Ground 5 does not rely on Pillai to overcome the deficiencies of Devnani-AAPA with respect to claim 1, from which claim 3 depends. Indeed, there is no analysis of Pillai in any respect in Ground 5—only impermissible referencing to a different section of the Petition and the Baker Declaration. Therefore, Petitioner fails to establish a reasonable likelihood that claim 3 is obvious over Devnani-AAPA-Pillai.

PO reserves the right to present additional arguments for patentability of claim 3 should *inter partes* review be instituted.

6. Ground 6: Obviousness of Claim 6 Over Devnani in View of AAPA and Tanahashi

Dependent claim 6 recites a package as recited in claim 1, wherein:

the signal traces on the bottom routing layer comprise at least one voltage bus bar.

(EX1001 at 4:35–37; EX2001 at ¶ 130.)

A dependent claim contains all of the limitations of the claim or claims from which it depends. Therefore, claim 6 distinguishes over Devnani-AAPA for at least all of the reasons discussed above with regard to claim 1. Ground 6 does not rely on Tanahashi to overcome the deficiencies of Devnani-AAPA with respect to claim 1,

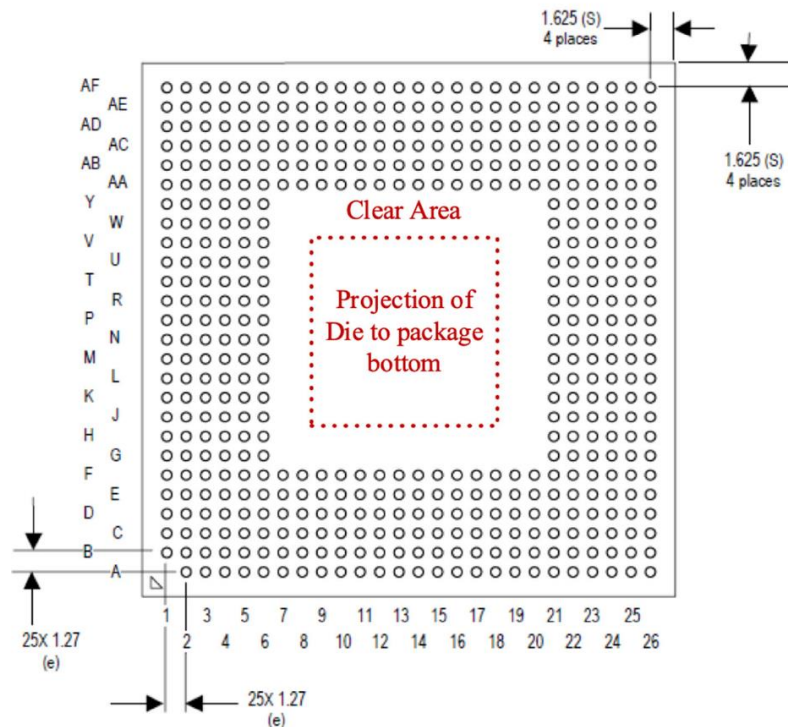
from which claim 6 depends. Indeed, there is no analysis of Tanahashi in any respect in Ground 6. Only impermissible referencing to a different section of the Petition and the Baker Declaration. Therefore, Petitioner fails to establish a reasonable likelihood that claim 3 is obvious over Devnani-AAPA-Tanahashi.

PO reserves the right to present additional arguments for patentability of claim 2 should *inter partes* review be instituted.

7. Ground 7: Obviousness of Claims 1, 2, and 5 Over Chung in View of Celeron

As noted previously, claim 1 recites, among other things, that “none of the signal traces of the bottom routing layer are located over ball pads of the ball pad layer which are disposed in an area within two ball pad pitches of the corner of the die.” (EX1001 at 4:17–20; EX2001 at ¶ 131.) In the proposed combination of references in Ground 7, Petitioner admits that Chung does not explicitly show that “none of the signal traces of the bottom routing layer are located over ball pads of the ball pad layer which are disposed in an area within two ball pad pitches of the corner of the die,” (Pet. at 48), and relies on Celeron for this limitation, (*id.* at 48–53). However, as admitted by Petitioner, “Celeron discloses that there are no ball pads in the ball pad layer ‘disposed in an area within two ball pad pitches of the corner of the die.’” (Pet. at 52.) Thus, the proposed combination would not have “ball pads of the ball pad layer which are disposed in an area within two ball pad

itches of the corner of the die.” (EX2001 at ¶ 132.) Petitioner’s flawed approach is manifest in annotated Figure 30 of Celeron (Pet. at 51), reproduced below, in which the area surrounding the corner of the die is free of ball pads. Petitioner even labels the area around the die without ball pads as “Clear Area.” (EX2001 at ¶ 133.)



Moreover, Chung and Celeron both fail to show the signal traces, so even if there were ball pads in the “Clear Area,” they cannot meet the claim limitation “wherein none of the signal traces of the bottom routing layer are located over ball pads of the ball pad layer which are disposed in an area within two ball pad pitches of the corner of the die,” in claim 1.. (EX2001 at ¶ 134.) Therefore, Chung-Celeron cannot render claim 1 obvious.

Furthermore, Petitioner has not established that Celeron is prior art. At the institution stage, the “***petition must identify, with particularity, evidence sufficient to establish a reasonable likelihood that the reference was publicly accessible before the critical date of the challenged patent*** and therefore that there is a reasonable likelihood that it qualifies as a printed publication.” *Hulu, LLC v. Sound View Innovations, LLC*, IPR2018-01039, Paper 29 at 13 (P.T.A.B. Dec. 20, 2019) (precedential) (emphasis added).

Here, Petitioner’s only discussion of the prior art status of Celeron (EX1008) is the following on page 12 of the Petition:

Celeron (Ex. 1008) was published in April of 2003, which is prior to the earliest effective filing date of the ’245 patent. Celeron, therefore, qualifies as prior art to the ’245 patent under at least pre-AIA 35 U.S.C. § 102(a).

Nothing more is provided regarding this datasheet. No evidence, at all. Baker’s Declaration is not even cited to support the prior art status of Celeron. Because Petitioner does not provide any evidence to establish the reasonable likelihood that Celeron was publicly accessible before the critical date of the ’245 Patent, Celeron does not qualify as prior art and Ground 7 fails.

For all of the above reasons, Petitioner has failed to show a reasonable likelihood that Chung in view of Celeron would render claim 1 obvious.

Claims 2 and 5 depend from claim 1. A dependent claim contains all of the

limitations of the claim or claims from which it depends. Therefore, claims 2 and 5 distinguish over Chung-Celeron for at least all of the reasons discussed above with regard to claim 1. Therefore, Petitioner fails to establish a reasonable likelihood that claims 2 and 5 would have been obvious over Chung-Celeron.

PO reserves the right to provide additional arguments for patentability of claims 2 and 5 should *inter partes* review be instituted.

8. Ground 8: Obviousness of Claim 3 Over Chung in View of Celeron and Pillai

Claim 3 depends from claim 1. A dependent claim contains all of the limitations of the claim or claims from which it depends. Therefore, claim 3 distinguishes over Chung-Celeron for at least all of the reasons discussed above with regard to claim 1. Ground 8 does not rely on Pillai to overcome the deficiencies of Chung-Celeron with respect to claim 1, from which claim 3 depends. Therefore, Petitioner fails to establish a reasonable likelihood that claim 3 is obvious over Chung-Celeron-Pillai.

Moreover, Celeron is not prior art, as discussed above. Thus, Ground 8 fails to establish a reasonable likelihood that claim 3 would have been obvious over Chung in view of Celeron and Pillai.

PO reserves the right to present additional arguments for patentability of claim 3 should *inter partes* review be instituted.

9. Ground 9: Obviousness of Claim 4 Over Chung in View of Celeron and AAPA

Claim 4 depends from claim 1. A dependent claim contains all of the limitations of the claim or claims from which it depends. Therefore, claim 4 distinguishes over Chung-Celeron for at least all of the reasons discussed above with regard to claim 1. Ground 9 does not rely on the purported AAPA to overcome the deficiencies of Chung-Celeron with respect to claim 1, from which claim 4 depends. Therefore, Petitioner fails to establish a reasonable likelihood that claim 4 is obvious over Chung-Celeron-AAPA.

Moreover, Celeron is not prior art, as discussed above. Nor is the purported AAPA, as discussed above. Thus, Ground 9 fails to establish a reasonable likelihood that claim 4 would have been obvious over Chung in view of Celeron and the purported AAPA.

PO reserves the right to present additional arguments for patentability of claim 4 should *inter partes* review be instituted.

10. Ground 10: Obviousness of Claim 6 over Chung in view of Celeron and Tanahashi

Claim 6 depends from claim 1. A dependent claim contains all of the limitations of the claim or claims from which it depends. Therefore, claim 6 distinguishes over Chung-Celeron for at least all of the reasons discussed above with regard to claim 1. Ground 10 does not rely on Tanahashi to overcome the

deficiencies of Chung-Celeron with respect to claim 1, from which claim 6 depends. Therefore, Petitioner fails to establish a reasonable likelihood that claim 6 is obvious over Chung-Celeron-Tanahashi.

Moreover, Celeron is not prior art, as discussed above. Thus, Ground 10 fails to establish a reasonable likelihood that claim 6 would have been obvious over Chung in view of Celeron and Tanahashi.

PO reserves the right to present additional arguments for patentability of claim 6 should *inter partes* review be instituted.

11. Ground 11: Obviousness of Claims 1 and 5 Over Devnani in View of Celeron

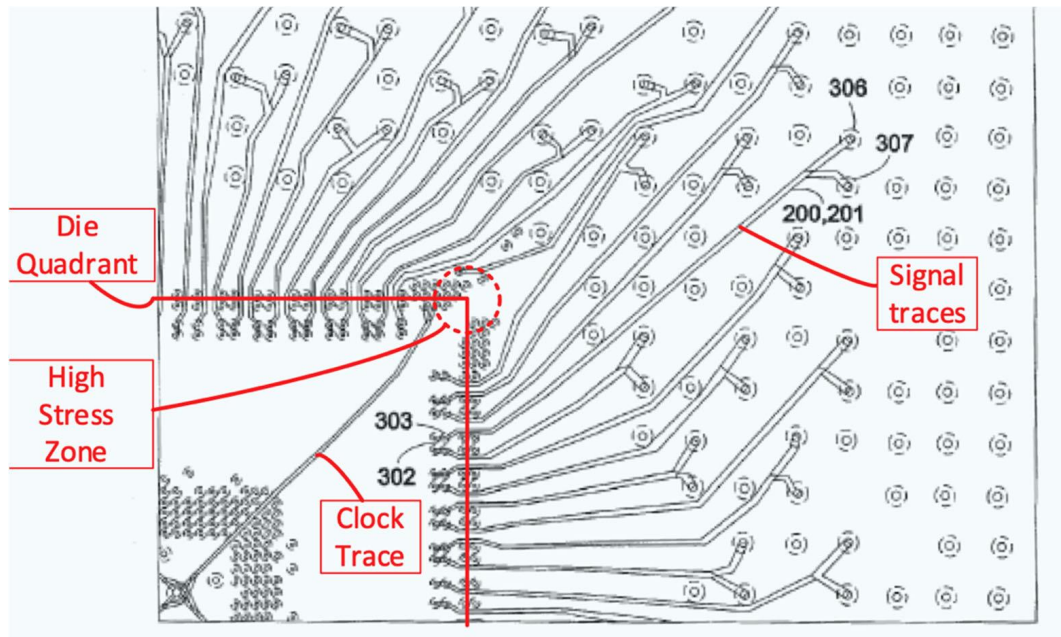
A petition for IPR must identify “with particularity, each claim challenged, the grounds on which the challenge to each claim is based, and the evidence that supports the grounds for the challenge to each claim.” 35 U.S.C. § 312(a)(3); *see also* 37 C.F.R. § 42.104(b)(4)-(5) (requiring that “the petition” identify “[h]ow the construed claim is unpatentable,” as well as “[t]he exhibit number of the supporting evidence relied upon to support the challenge and the relevance of the evidence to the challenge raised, including identifying specific portions of the evidence that support the challenge”); 37 C.F.R. § 42.22(a)(2) (requiring petitions in general to include “[a] full statement of the reasons for the relief requested, including a detailed explanation of the significance of the evidence”). Petitioner is required to set forth

its arguments and evidence in the Petition and may not incorporate by reference arguments contained in other documents. 37 C.F.R. § 42.6(a)(3) (“Arguments must not be incorporated by reference from one document into another document.”).

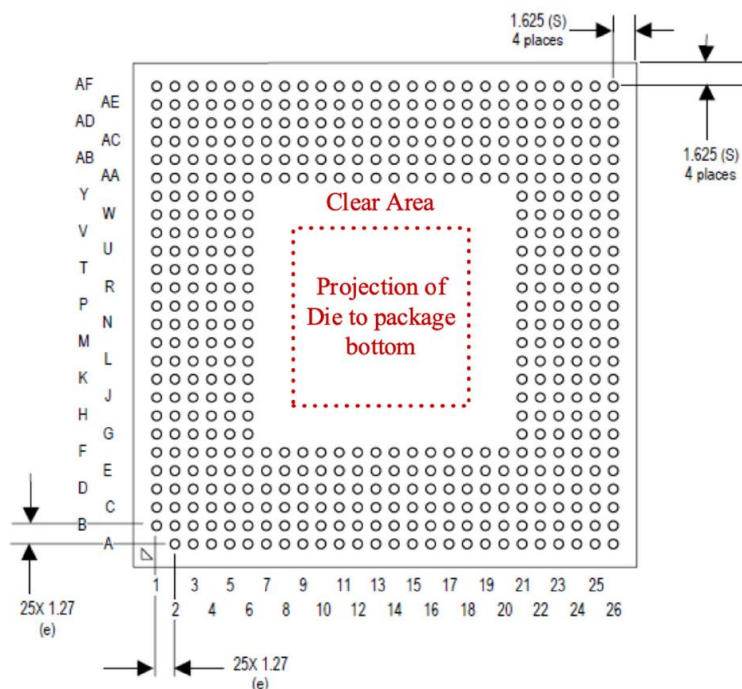
Here, Petitioner provides conclusory analysis of claim 1 and 5 in its Petition. For example, Petitioner begins by incorrectly stating that “Devnani and Celeron disclose or suggest all features recited in claims 1, 2, and 5.” (Pet. at 60.) In support of this conclusory statement, Petitioner improperly relies on ten paragraphs of the Baker Declaration. (*Id.*) But those paragraphs are just referencing other sections of the Baker Declaration and providing additional conclusory statements that fail to combine Devnani and Celeron with any specificity. The Board should deny institution on that basis alone. *See, e.g., Cisco Systems*, No. IPR2014-00454, Paper 12, at 10.

Petitioner fails to show a reasonable likelihood that Devnani in view of Celeron would render claim 1 obvious on the merits because, as noted above in Section V.A.4(c) (Ground 4) and Section V.A.7 (Ground 7), claim 1 requires “ball pads of the ball pad layer which are disposed in an area within two ball pad pitches of the corner of the die,” and neither Figure 3 of Devnani nor Figure 30 of Celeron have a ball pad within such an area relative to the die corner. (EX2001 at ¶ 135.) See Petitioner’s Annotated Figure 3 of Devnani (EX1005) and Petitioner’s Annotated

Figure 30 of Celeron (EX1008) reproduced below.



(Devnani, Figure 3 (Annotated by Petitioner).)



(Celeron, Figure 30 (Annotated by Petitioner).)

As such, neither would experience the problem described in the '245 Patent and, even if combined, the proposed combination would not have ball pads in Petitioner's alleged high stress zone around the corner of the die. (EX2001 at ¶ 136.) Therefore, the proposed combination would not include all the limitations of claim 1, which require ball pads in such a zone around a corner of a die. Moreover, Celeron has not been shown to be prior art, as discussed above in Section V.A.7. For at least the above reasons, Petitioner has failed to establish a reasonable likelihood that Devnani in view of Celeron would have rendered claim 1 obvious.

Claim 5 depends from claim 1. Since a dependent claim contains all of the limitations of the claim or claims from which it depends, claim 5 distinguishes over Devnani-Celeron for at least all of the reasons discussed immediately above in this Section with regard to claim 1. And, again, Celeron is not prior art. Thus, Ground 11 fails to establish a reasonable likelihood that claims 1 and 5 would have been obvious over Devnani in view of Celeron.

12. Ground 12: Obviousness of Claim 6 over Devnani in view of Celeron and Tanahashi

Claim 6 depends from claim 1. Since a dependent claim contains all of the limitations of the claim or claims from which it depends, claim 6 distinguishes over Devnani-Celeron for at least all of the reasons discussed above in Section V.A.11

with regard to claim 1. Petitioner relies on Tanahashi for allegedly disclosing the limitations of claim 6, not for overcoming the deficiencies of Devnani-Celeron with respect to claim 1, from which claim 6 depends. And Petitioner's fictitious annotations of Figure 3B of Tanahashi do not qualify as the signal traces on the bottom routing layer comprise at least one voltage bus bar. (See Tanahashi at 13:28-36; EX2001 at ¶ 137.) Therefore, Petitioner fails to establish a reasonable likelihood that claim 6 is obvious over Devnani-Celeron-Tanahashi.

PO reserves the right to present additional arguments for patentability of claim 6 should *inter partes* review be instituted.

13. Ground 13: Obviousness of Claim 7 Over Review of BGAs in View of Devnani and CRTA

Claim 7 has been statutorily disclaimed. (EX2002.) Therefore, no *inter partes* review of claim 7 may be instituted. 37 C.F.R. § 42.107(e).

VI. CONCLUSION

Pursuant to 35 U.S.C. § 314, Patent Owner respectfully requests that the Board refuse to institute *inter partes* review for the reasons stated herein.

Dated: February 20, 2024

Respectfully submitted,

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Case IPR2024-00168
Patent No. 7,345,245
Patent Owner Preliminary Response

CERTIFICATE OF COMPLIANCE WITH TYPE-VOLUME LIMITS

This Patent Owner Preliminary Response consists of 11,147 words, excluding cover page, table of contents, table of authorities, certificate of service, this certificate, or table of exhibits. The POPR complies with the type-volume limitation of 14,000 words as mandated in 37 C.F.R. §42.24. In preparing this certificate, counsel has relied on the word count of the word-processing system used to prepare the paper (Microsoft Word).

Dated: February 20, 2024

Respectfully submitted,

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CERTIFICATE OF SERVICE

I hereby certify that on this 20th day of February, 2024, the foregoing document was served by electronic mail to the following attorneys of record:

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