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Transcript of Stanley Shanfield, Ph.D.

Date: July 14, 2026

Case: Taiwan Semiconductor Manufacturing Co. LTD, et al. -v- MYW Semitech,
LLC (PTAB)

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Phone: 888.433.3767

Email: transcripts@planetdepos.com

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Transcript of Stanley Shanfield, Ph.D.
Conducted on July 14, 2026

1 (1 to 4)

1	1	1	3
2	UNITED STATES PATENT AND TRADEMARK OFFICE	1	A P P E A R A N C E S
3	BEFORE THE PATENT TRIAL AND APPEAL BOARD	2	ON BEHALF OF PETITIONERS:
4	----- x	3	JENNIFER BAILEY, ESQUIRE
5	TAIWAN SEMICONDUCTOR :	4	ERISE IP
6	MANUFACTURING COMPANY LTD. : IPR2026-00065,	5	7015 College Boulevard
7	and APPLE INC., : 2026-00066, 2026-00067	6	Suite 700
8	Petitioners, :	7	Overland Park, Kansas 66211
9	v. : U.S. Patent Nos.	8	(913) 777-5604
10	MYW SEMITECH, LLC, : 11,107,768, 11,538,763	9	
11	Patent Owner. : and 11,894,306	10	ON BEHALF OF PATENT OWNER:
12	----- X	11	STEPHEN McBRIDE, ESQUIRE
13	Videotaped Deposition of STANLEY SHANFIELD, Ph.D.	12	DAIGNAULT IYER, LLP
14	Conducted Virtually	13	8229 Boone Boulevard
15	Tuesday, July 14, 2026	14	Suite 450
16	9:05 a.m. EDT	15	Vienna, Virginia 22182
17		16	(929) 280-1024
18		17	
19		18	
20	Job No.: 640339	19	ALSO PRESENT:
21	Pages 1 - 71	20	JOHN PARKMAN, Video Specialist
22	Reported by: Debra A. Whitehead	21	
		22	
1	2	1	4
2	Videotaped Deposition of STANLEY SHANFIELD,	1	C O N T E N T S
3	Ph.D., conducted virtually.	2	EXAMINATION OF STANLEY SHANFIELD, Ph.D. PAGE
4		3	By Mr. McBride 6
5		4	
6	Pursuant to notice, before Debra Ann Whitehead,	5	EXHIBITS MARKED IN PRIOR DEPOSITION(S)
7	E-Notary Public in and for the Commonwealth of	6	(Not Attached)
8	Virginia.	7	EXHIBIT PAGE
9		8	Exhibit 1001 36
10		9	Exhibit 1003, IPR2926-00065 16
11		10	
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2 (5 to 8)

<p>5</p> <p>1 PROCEEDINGS</p> <p>2 VIDEO SPECIALIST: Here begins Media</p> <p>3 Number 1 in the videotaped deposition of</p> <p>4 Dr. Stanley Shanfield in the matter of Taiwan</p> <p>5 Semiconductor Manufacturing Company Limited,</p> <p>6 et al., versus MYW Semitech, LLC; in the United</p> <p>7 States Patent and Trademark Office, before the</p> <p>8 Patent Trial and Appeal Board; IPR Numbers</p> <p>9 2026-00065, 00066, and 00067.</p> <p>10 Today's date is Tuesday, July 14, 2026.</p> <p>11 The time on the video monitor is now 9:05 a.m.</p> <p>12 eastern time. The remote videographer today is</p> <p>13 John Parkman, representing Planet Depos. All</p> <p>14 parties of this video deposition are attending</p> <p>15 remotely.</p> <p>16 Would counsel please voice-identify</p> <p>17 themselves and state whom they represent.</p> <p>18 MR. McBRIDE: For patent owner, Steve</p> <p>19 McBride, of Daignault Iyer.</p> <p>20 MS. BAILEY: For petitioners, Jennifer</p> <p>21 Bailey, from Erise IP.</p> <p>22 VIDEO SPECIALIST: The court reporter</p>	<p>7</p> <p>1 Q So you understand those IPRs are</p> <p>2 IPR2026-00065, IPR2026-00066, and IPR2026-00067.</p> <p>3 Correct?</p> <p>4 A Let me just double-check. '65, '66, '67.</p> <p>5 Yes.</p> <p>6 Q Okay. A few ground rules. We need</p> <p>7 verbal answers because of the stenographer.</p> <p>8 Do you understand that you need to answer</p> <p>9 everything audibly?</p> <p>10 A Yes, I do.</p> <p>11 Q If you need a break, please let me know.</p> <p>12 I may ask that you answer any pending question or</p> <p>13 a line of a few questions before requesting a</p> <p>14 break.</p> <p>15 Is that okay with you?</p> <p>16 A Sure.</p> <p>17 Q Before taking a break, that is.</p> <p>18 If you don't hear or understand a</p> <p>19 question, please let me know. Otherwise, if you</p> <p>20 answer I will assume that you understood the</p> <p>21 question.</p> <p>22 Is that fair?</p>
<p>6</p> <p>1 today is Debbie Whitehead, representing Planet</p> <p>2 Depos.</p> <p>3 The witness will now be sworn.</p> <p>4 STANLEY SHANFIELD, Ph.D.,</p> <p>5 having been duly sworn, testified as follows:</p> <p>6 MR. McBRIDE: Just as a housekeeping</p> <p>7 matter, I do want to note on the record that this</p> <p>8 deposition is covering all three IPRs in this</p> <p>9 case, IPR2026-00065, IPR2026-00066 and</p> <p>10 IPR2026-00067. And then opposing counsel can add</p> <p>11 anything she needs to that if need be during the</p> <p>12 deposition.</p> <p>13 EXAMINATION BY COUNSEL FOR PATENT OWNER</p> <p>14 BY MR. McBRIDE:</p> <p>15 Q Good morning, Dr. Shanfield. My name is</p> <p>16 Steve McBride, and I'll be taking your deposition</p> <p>17 today.</p> <p>18 A Good morning.</p> <p>19 Q Good morning.</p> <p>20 And you understand that this deposition</p> <p>21 covers your declaration in three IPRs?</p> <p>22 A Yes.</p>	<p>8</p> <p>1 A Yes.</p> <p>2 Q And you understand that you are under</p> <p>3 oath today. Correct?</p> <p>4 A Yes.</p> <p>5 Q Is there any reason that you cannot give</p> <p>6 complete, truthful, and accurate testimony to the</p> <p>7 best of your ability today?</p> <p>8 A No, no reason.</p> <p>9 Q I understand that you have clean soft</p> <p>10 copies of all documents on the record. Correct?</p> <p>11 A That's correct.</p> <p>12 Q So as we were discussing previously, I</p> <p>13 will try to identify accurately the document we're</p> <p>14 discussing, and then you can pull it up from the</p> <p>15 soft copies you have. If you need anything, any</p> <p>16 exhibits loaded, please let me know, and I will</p> <p>17 load them in the chat window for you.</p> <p>18 A Okay.</p> <p>19 Q Otherwise, I will assume that you have</p> <p>20 everything.</p> <p>21 Is that okay?</p> <p>22 A Yes.</p>

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<p>9</p> <p>1 Q Can you confirm that you have all</p> <p>2 applications other than Zoom and, you know, access</p> <p>3 to the soft copies of the record closed on your</p> <p>4 computer?</p> <p>5 A Yes, I confirm that.</p> <p>6 Q From time to time your attorney may</p> <p>7 object. Unless your attorney asserts privilege</p> <p>8 and instructs you not to answer, you still have to</p> <p>9 answer the question.</p> <p>10 Do you understand that?</p> <p>11 A Yes.</p> <p>12 Q Okay. So prior to the start of the</p> <p>13 deposition I added into the chat box the documents</p> <p>14 marked Exhibit 1003 from all three IPRs, the</p> <p>15 000065, 00066, and 00067.</p> <p>16 These are your declarations in the three</p> <p>17 IPRs respectively. Correct?</p> <p>18 A Yes.</p> <p>19 Q And are you representing TSMC and Apple</p> <p>20 in these IPRs?</p> <p>21 A Yes, that's correct.</p> <p>22 Q So to break down the three IPRs,</p>	<p>11</p> <p>1 Exhibit 1001 in its respective IPR. Correct?</p> <p>2 A Mine are marked 1003.</p> <p>3 Q I'm sorry, I'm sorry. The patents</p> <p>4 themselves, not your declarations.</p> <p>5 A Yes. Right.</p> <p>6 Q Your declaration in each IPR is marked</p> <p>7 Exhibit 1003. Correct?</p> <p>8 A That's right.</p> <p>9 Q Is it your understanding that the '768,</p> <p>10 '763, and '306 patents each share a common</p> <p>11 specification?</p> <p>12 A There's differences in the specifications</p> <p>13 between them.</p> <p>14 Q What are those differences?</p> <p>15 A Do you want me to do a search and find</p> <p>16 them or just --</p> <p>17 Q Well, what did you have in mind in terms</p> <p>18 of the differences when you said --</p> <p>19 A The claims, for example.</p> <p>20 Q Right. So the claims are different</p> <p>21 between the three patents. Correct?</p> <p>22 A Right.</p>
<p>10</p> <p>1 IPR2026-00065 involves U.S. Patent Number</p> <p>2 11,107,768. Correct?</p> <p>3 A That's right.</p> <p>4 Q And when I refer to the '768 patent,</p> <p>5 you'll understand that I'm referring to U.S.</p> <p>6 Patent Number 11,107,768. Correct?</p> <p>7 A Yes, right.</p> <p>8 Q IPR2026-00066 involves U.S. Patent Number</p> <p>9 11,538,763. Correct?</p> <p>10 A That's correct.</p> <p>11 Q And when I refer to the '763 patent,</p> <p>12 you'll understand that I am referring to U.S.</p> <p>13 Patent Number 11,538,763. Correct?</p> <p>14 A Yes, that's right.</p> <p>15 Q IPR2026-00067 involves U.S. Patent Number</p> <p>16 11,894,306. Correct?</p> <p>17 A Yes, that's right.</p> <p>18 Q When I refer to the '306 patent, you'll</p> <p>19 understand I am referring to U.S. Patent Number</p> <p>20 11,894,306. Correct?</p> <p>21 A Yes, correct.</p> <p>22 Q And each of these patents has been marked</p>	<p>12</p> <p>1 Q But the specification, the disclosure in</p> <p>2 the specification, is more or less the same.</p> <p>3 Right?</p> <p>4 A More or less, yes.</p> <p>5 Q And in general if something in the</p> <p>6 specification, not talking about the claims here,</p> <p>7 but if something in the specification of one</p> <p>8 patent -- if something is disclosed in the</p> <p>9 specification of one patent, it's present in the</p> <p>10 other two patents as well. Right?</p> <p>11 A I'll take your word for it. I haven't</p> <p>12 actually done a comparison.</p> <p>13 Q Okay. Well, if there's anything</p> <p>14 different that comes to mind as I'm asking</p> <p>15 questions, please let me know.</p> <p>16 A Okay.</p> <p>17 Q And I guess just following up on that a</p> <p>18 little bit. Setting aside the claims, are you</p> <p>19 aware of any substantive differences in the</p> <p>20 specifications for the '768, '763, and '306</p> <p>21 patents?</p> <p>22 A No, nothing substantive.</p>

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<p>13</p> <p>1 Q What did you do to prepare for this 2 deposition?</p> <p>3 A Well, I started by reading the background 4 material, including the -- obviously the patents 5 and their history. I had material for references 6 specific to what was being cited in the patents, 7 and reviewed all that.</p> <p>8 That's my dog.</p> <p>9 Q I'm sorry, was there a dog barking in the 10 background?</p> <p>11 A Yeah. And this dog knows how to open the 12 door here. So if you see him come in, I'll kick 13 him out.</p> <p>14 Q Okay. Sounds good.</p> <p>15 MR. McBRIDE: Can we go off the record 16 for just a second. I want to get my real time up 17 and running.</p> <p>18 VIDEO SPECIALIST: We're going off the 19 record. The time is now 9:14 a.m.</p> <p>20 (A recess was taken.)</p> <p>21 VIDEO SPECIALIST: We're back on the 22 record. The time is now 9:16 a.m.</p>	<p>15</p> <p>1 A I'd estimate somewhere between a hundred 2 and 200 hours.</p> <p>3 Q And is that collectively or for each, 4 each declaration?</p> <p>5 A That's collectively.</p> <p>6 MS. BAILEY: May I interject real quickly 7 with a logistics point. Steve's video has gone 8 off. I'm not sure if it's on my end.</p> <p>9 MR. McBRIDE: Oh, let me see. Let me try 10 to correct that.</p> <p>11 MS. BAILEY: Okay. I think you're coming 12 back up now, Steve.</p> <p>13 Well, it's a black screen, but I at least 14 see you.</p> <p>15 Perhaps we should go off the record again 16 to fix this.</p> <p>17 MR. McBRIDE: Yeah, let's go off the 18 record.</p> <p>19 VIDEO SPECIALIST: We're going off the 20 record. The time is 9:19 a.m.</p> <p>21 (A recess was taken.)</p> <p>22 VIDEO SPECIALIST: We're back on the</p>
<p>14</p> <p>1 BY MR. McBRIDE:</p> <p>2 Q So, Dr. Shanfield, did you have any 3 meetings to prepare for this deposition?</p> <p>4 A Yes.</p> <p>5 Q And who did you meet with?</p> <p>6 A I met with counsel, Jennifer Bailey.</p> <p>7 Q Anyone else?</p> <p>8 A Yes; her assistant.</p> <p>9 Q How long -- how many of these meetings 10 were there?</p> <p>11 A They were all virtual, of course. I'd 12 estimate maybe six or seven.</p> <p>13 Q Six or seven meetings to prepare for this 14 deposition?</p> <p>15 A Well, I'd say maybe three in preparation, 16 direct preparation.</p> <p>17 Q And the other meetings were for what?</p> <p>18 A We were reviewing progress on the 19 declaration, each declaration as I wrote it or 20 made changes.</p> <p>21 Q How many hours did you spend working on 22 your declarations?</p>	<p>16</p> <p>1 record. The time is now 9:21 a.m.</p> <p>2 BY MR. McBRIDE:</p> <p>3 Q Okay. Dr. Shanfield, please open up your 4 declaration in the 00065 IPR.</p> <p>5 A Which one?</p> <p>6 Q This would be for the '768 patent, 7 IPR2026-00065. Exhibit 1003.</p> <p>8 (Exhibit 1003, IPR2026-00065, previously 9 marked, not attached.)</p> <p>10 A Okay.</p> <p>11 Q Go to the very last page, Page 372 of 12 372.</p> <p>13 A Yes.</p> <p>14 Q And you see where you have Expert Witness 15 Experience --</p> <p>16 A Yes.</p> <p>17 Q -- and it says, See attachment?</p> <p>18 A Yes.</p> <p>19 Q Was there supposed to be an attachment to 20 this? I didn't see the actual experience 21 anywhere.</p> <p>22 A I think there was. And I assume we can</p>

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<p>17</p> <p>1 supply that to you.</p> <p>2 Q Okay. What kind of expert witness work</p> <p>3 do you do?</p> <p>4 A I have a full-time job at Draper Labs in</p> <p>5 Cambridge, Massachusetts. But I also, because I'm</p> <p>6 a distinguished member of staff, I'm able to do</p> <p>7 expert work occasionally. So I do cases of</p> <p>8 interest to me in the semiconductor area,</p> <p>9 packaging and devices and physics.</p> <p>10 Q Is all of your expert work in the patent</p> <p>11 litigation field?</p> <p>12 A Yes.</p> <p>13 Q And how many patent litigations have you</p> <p>14 served as an expert on?</p> <p>15 A Well, if I count IPRs, it would be</p> <p>16 several dozen. I haven't actually counted.</p> <p>17 Q How many IPRs have you served as an</p> <p>18 expert on?</p> <p>19 A I'd say that's most of it.</p> <p>20 Q How many times have you been deposed?</p> <p>21 A I'm sorry, could you repeat that</p> <p>22 question?</p>	<p>19</p> <p>1 Q So this is a list of materials you</p> <p>2 considered in developing your opinions. Correct?</p> <p>3 A Yes.</p> <p>4 Q Are there any other materials you</p> <p>5 considered in developing your opinion for this</p> <p>6 IPR?</p> <p>7 A No.</p> <p>8 Q And is the same true for the other two</p> <p>9 declarations?</p> <p>10 A Yes.</p> <p>11 Q So if it's not listed in the list of</p> <p>12 materials considered, I can assume you have not</p> <p>13 considered it for purposes of these IPRs?</p> <p>14 A That would be correct.</p> <p>15 Q Please go down to Paragraph 9 of your</p> <p>16 declaration.</p> <p>17 The second sentence of this paragraph</p> <p>18 says, "For the purposes of this declaration I have</p> <p>19 been asked to assume that the priority date of the</p> <p>20 '768 patent is September 26, 2012."</p> <p>21 Do you see that?</p> <p>22 A Yes.</p>
<p>18</p> <p>1 Q How many times have you been deposed?</p> <p>2 A Oh, probably more than 30 times.</p> <p>3 Q Are these all in the context of patent</p> <p>4 litigation?</p> <p>5 A Yes.</p> <p>6 Q And most of those depositions are in the</p> <p>7 context of IPRs?</p> <p>8 A I'd say majority, yes.</p> <p>9 Q Okay. Please turn to Paragraph 8 of your</p> <p>10 declaration. And when I say "declaration" for</p> <p>11 now, I'm referring to Exhibit 1003 in the 00065</p> <p>12 IPR.</p> <p>13 A So when you say that, if you would repeat</p> <p>14 the patent number, because the case I think is the</p> <p>15 same.</p> <p>16 Q It's the '768 patent.</p> <p>17 A Oh, '65. Okay. Got it. Now I see it's</p> <p>18 different.</p> <p>19 Yes.</p> <p>20 Q This is the Materials Considered section.</p> <p>21 Correct?</p> <p>22 A That's right.</p>	<p>20</p> <p>1 Q So your opinions in this declaration are</p> <p>2 based on a September 26, 2012, priority date.</p> <p>3 Correct?</p> <p>4 A That's correct.</p> <p>5 Q And is that true for the other patents;</p> <p>6 that is, the '763 patent and '306 patent?</p> <p>7 A I don't remember if they have exactly the</p> <p>8 same priority date, but whatever that priority</p> <p>9 date is, yes.</p> <p>10 Q Please go down to Paragraph 18 of your</p> <p>11 declaration. And let me know when you're there.</p> <p>12 It's on Page 40.</p> <p>13 A Give me a moment to read it.</p> <p>14 Okay.</p> <p>15 Q The second sentence states, "I have also</p> <p>16 been informed that common sense may be</p> <p>17 considered."</p> <p>18 Do you see that?</p> <p>19 A Yes.</p> <p>20 Q What's your understanding of the meaning</p> <p>21 of common sense?</p> <p>22 A It's I think summarized in the next</p>

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<p>21</p> <p>1 sentence, which is that familiar items may have 2 obvious uses beyond their primary purposes. 3 Q Okay. So what do you mean by "familiar 4 items may have obvious uses"? I guess to back up, 5 to be clear, what do you understand that to mean, 6 "familiar items may have obvious uses beyond their 7 primary purposes"? 8 A Well, I think it's self-explanatory. 9 Just, you know, would an ordinary person 10 understand those words. 11 Q By "ordinary person" you mean a POSITA? 12 A Yes. Sorry. Yes. 13 Q Okay. So you're saying that a POSITA 14 would understand that familiar items may have 15 obviously uses beyond their primary purposes? 16 A Right. 17 Q So does this mean that -- are you saying 18 that a POSITA would understand that -- just to 19 unpack a little bit what you mean by familiar 20 items. 21 Like, what is -- how do you understand 22 that?</p>	<p>23</p> <p>1 its -- what would be understood to be its primary 2 purpose. 3 Q And how do you apply that in the 4 declaration in terms of, you know, the 5 patentability? 6 A Could you explain what you mean by 7 "patentability"? 8 Q Well, your declaration is opining on the 9 patentability of the challenged patents. Correct? 10 A Ultimately, yes. 11 Q So how does this common sense impact your 12 opinions on patentability? 13 A I guess in the same way as written, which 14 is that when I'm looking at prior art that might 15 have been -- might be related, or might actually 16 teach the same thing, I keep the fact that 17 familiar items may have uses that are obvious 18 beyond their usual purpose. 19 Q So how does that -- so are you saying -- 20 is your understanding here that, you know, when 21 you're looking at a piece of prior art that says, 22 you know, it has a particular component, that</p>
<p>22</p> <p>1 A Well, I guess, again, I think it's 2 self-explanatory. A familiar item might be 3 something familiar in a process of building a 4 package in the context of the patents. 5 Q So you're talking about, like, components 6 of the semiconductor, basically? 7 A Components of the package, yes. 8 Q And by "package" you mean semiconductor 9 package? 10 A That's correct, yeah. 11 Q Okay. So familiar components, how you 12 understand this is that familiar components might 13 have obvious uses beyond their primary purposes? 14 A Yes, that would be one, one meaning, yes. 15 Q Are there other meanings? 16 A Well, it would be a long list because 17 there are many familiar items. 18 Q And how have you applied this in your 19 declarations? 20 A Pretty much as written, which is that 21 when I'm considering a familiar item, I maintain 22 the thought that it may have obvious uses beyond</p>	<p>24</p> <p>1 component may also disclose limitations that are 2 not expressly discussed in the prior art because 3 they would be common sense to a POSITA? 4 A I read the prior art in view of what a 5 POSITA would understand. So that is something I 6 remain aware of interpreting the prior art and 7 interpreting the patents in question. 8 Q So do you believe the common sense of a 9 POSITA can supply limitations that are not 10 expressly disclosed in the prior art? 11 Is that your understanding? 12 A As far as understanding limitations, it's 13 what's written as a limitation in the claims is 14 what I use to determine what the limitation means. 15 And in understanding what that limitation means, I 16 keep in mind that it's as though a POSITA at the 17 time of the invention, 2012, is reading this. So 18 that -- that's my basis for understanding a 19 limitation. 20 Q My question is more I think about the 21 prior art itself and the disclosure of the prior 22 art.</p>

<p>25</p> <p>1 You know, you're reading limitations, 2 obviously, and you're looking to see if the prior 3 art discloses those limitations. Correct? 4 A That's right. 5 Q And so are you saying that as you're 6 looking to see if prior art discloses the 7 limitations, that the common sense of a POSITA 8 could supply some limitations that are not 9 expressly disclosed in the prior art? 10 MS. BAILEY: Objection. 11 A I think -- 12 THE WITNESS: Go ahead. 13 MS. BAILEY: Objection. Mischaracterizes 14 testimony. 15 You can go ahead and answer, 16 Dr. Shanfield. 17 A No, I don't agree with your statement. 18 Q Why not? 19 A Like I said, I look to the explicit 20 limitation as would be understood by a POSITA, and 21 that's in the context of the specification and 22 what the knowledge of an ordinary person in the</p>	<p>27</p> <p>1 guess this is in the context of a combination. 2 But if this was something that was obvious to try 3 as viewed by a POSITA, or at least anticipated 4 success, then it's probably a result of just a 5 common sense and ordinary skill rather than an 6 innovation, a nonobvious innovation. So -- 7 Q Okay. 8 A -- that summarizes it. 9 Q So that last sentence in your declaration 10 is the manner you are using "common sense" in your 11 declaration? 12 A That's correct. 13 Q Please turn to Paragraph 23 of your 14 declaration. Again, let me know when you're 15 there. 16 A Okay. Give me a moment to read it. 17 Okay. 18 Q Okay. This is the claim construction 19 section of your declaration. Correct? 20 A Yes. 21 Q And this is the only section in your 22 declaration I saw discussing claim construction.</p>
<p>26</p> <p>1 art would -- would know. 2 So, but the common sense of a POSITA is 3 not going to supply limitations itself. 4 Q So is it your understanding that unless 5 the prior art expressly discloses the limitation, 6 common sense of a POSITA cannot supply that 7 limitation? 8 A I guess I'd like to understand what you 9 mean by "common sense" in that sentence. 10 If something like written here, if a 11 combination, for example, is obvious, and at least 12 an anticipated success, then it's likely the 13 result of ordinary skill and common sense in that, 14 rather than a nonobvious innovation. 15 So that is a good description of how I 16 worked. 17 Q So I'm just asking about common sense as 18 used your declaration, what your understanding of 19 that term is. And I'm using it in that term. 20 Does that help? 21 A Well, I think that last sentence in my 22 Paragraph 18 explains it pretty clearly. And I</p>	<p>28</p> <p>1 Is that correct? 2 A I'll take your word for it. 3 Q Do you believe any claim terms from the 4 '768 patent require construction -- 5 A No. 6 Q -- in this IPR? 7 What about for the '763 patent; did any 8 claim construction -- 9 A No. 10 Q What about the '306 patent? 11 A No. 12 Q Do you believe that the claim term 13 "semiconductor chip" requires construction? 14 A No. 15 Q Do you have an opinion on or opinions on 16 what the construction for the claim term 17 "semiconductor chip" should be? 18 A Its plain and ordinary meaning. 19 Q Do you have any opinions on what the 20 plain and ordinary meaning of "semiconductor chip" 21 is? 22 A Well, one way of explaining it is</p>

<p style="text-align: right;">29</p> <p>1 describing all -- many examples, like a DRAM, an 2 SRAM, a NAND, a DRAM, a FPGA, phase-locked loop. 3 Those are all semiconductor chips. 4 Q Have you formed any other opinions about 5 what the plain and ordinary meaning of 6 "semiconductor chip" is in the context of the 7 intrinsic record? 8 A Well, I would -- I'd call a semiconductor 9 chip a -- it's a semiconductor device comprising 10 an integrated circuit. 11 Q Have you formed an opinion on whether any 12 of the claim terms in the '768 patent are 13 indefinite? 14 MS. BAILEY: Objection. Scope. 15 A I did not consider that in itself. It 16 didn't come up. It was -- the terms were clear 17 enough for me to understand for my analysis. 18 Q And is that the same across all three 19 patents? 20 A Yes. 21 Q For the other claim terms in the claims 22 of these three patents, is it your opinion that</p>	<p style="text-align: right;">31</p> <p>1 Q When you say "I'd have to go back and 2 look," where are you talking about going back and 3 looking? 4 A Well, your question is does the field of 5 endeavor for -- I presume you meant the '768 6 patent -- include anything other than 7 semiconductor packaging. I'd go look at the '768 8 and related literature and decide if it was. 9 Q For the purpose of this IPR, have you 10 formed an opinion that the field of endeavor for 11 the '768 patent includes anything other than 12 semiconductor packaging? 13 MS. BAILEY: Objection. Scope. 14 A Like I said, I didn't consider that 15 question. 16 Q So for purposes of this IPR, the entire 17 field of endeavor is semiconductor packaging. 18 Correct? 19 MS. BAILEY: Objection. Mischaracterizes 20 testimony. 21 A What I wrote was, a POSITA would 22 understand that the field of endeavor of the '768</p>
<p style="text-align: right;">30</p> <p>1 you are applying the plain and ordinary meaning of 2 the claim terms for these other three patents? 3 And by that I mean the '768, '763, and '306 4 patents. 5 A Yes. 6 Q Please turn to Paragraph 33 of your 7 declaration. And let me know when you're there. 8 A Give me a moment to read it. 9 Q Sure. 10 A All right. 11 Q In the last sentence you state, "For 12 these reasons, a POSITA would understand that the 13 field of endeavor of the '768 patent includes 14 semiconductor packaging." 15 Do you see that? 16 A Yes. 17 Q In your opinion, does the field of 18 endeavor include anything other than semiconductor 19 packaging? 20 MS. BAILEY: Objection. Scope. 21 A I didn't examine that question, so I'd 22 have to go back and look.</p>	<p style="text-align: right;">32</p> <p>1 patent includes semiconductor packaging. And the 2 word "includes" doesn't preclude other areas. 3 Q And what I'm trying to get at is, in your 4 opinion -- well, strike that. 5 What I'm trying to get at is you don't 6 provide any opinions that the field of endeavor 7 for the '768 package is anything other than 8 semiconductor packaging. Correct? 9 A I'd have to examine my declarations again 10 to know if there was any opinion expressed like 11 that. But I guess the point in that paragraph is 12 that as viewed by a POSITA, the field of endeavor 13 in the '768 includes semiconductor packaging. 14 Q But sitting here right now, you have no 15 opinion other than the field of endeavor for the 16 '768 patent is semiconductor packaging. Correct? 17 A No. 18 Q And is your answer the same for the '763 19 patent as well? 20 A What I said was that I would have to 21 examine my declarations -- that includes the other 22 patents -- and understand if there was opinions in</p>

<p style="text-align: right;">33</p> <p>1 the field -- that the field of endeavor included 2 something other than semiconductor packaging. I 3 haven't determined that. 4 Q Right. I understand that. So our 5 deposition today is about your declarations in 6 these IPRs as they stand. I'm wondering in your 7 declarations you're not providing any opinions 8 that the field of endeavor is anything other than 9 semiconductor packaging. Correct? 10 A No, I didn't say that. 11 Q Then why is it not correct? 12 A I said you'd have to let me, in order to 13 decide that, have a look at my declarations. 14 Q But I'm asking about your declaration -- 15 A Yeah, I know you are. And I'd have to 16 see if there was opinions that the field of 17 endeavor is anything other than semiconductor 18 packaging. So I can't tell you without doing 19 that. I haven't considered it, so I can't tell 20 you right now, just sitting here. 21 Q But there may be opinions in the other -- 22 some of these declarations that the field of</p>	<p style="text-align: right;">35</p> <p>1 are you aware of any place in your declaration 2 that you've taken? 3 I understand that you haven't read all 4 the declarations, sitting here today. But I'm 5 just saying, do you know off the top of your head, 6 sitting here, if there is some place you've taken 7 a different position? 8 A I don't know. 9 Q Please turn to Paragraph 36. Let me know 10 when you're there. 11 A Okay. Just give me a moment to read it. 12 Okay. 13 Q So second sentence you state, "Thus, a 14 POSITA would have understood the '768 patent to be 15 directed, in part, to solving the problem of 16 creating chip packages with pre-testability 17 capability." 18 Do you see that? 19 A Yes. 20 Q Can you explain what you mean? 21 A In the context of the patent -- 22 Q Yes.</p>
<p style="text-align: right;">34</p> <p>1 endeavor is something other than semiconductor 2 packaging. Correct? 3 A For the purposes of my analysis, it was 4 sufficient to understand what I wrote there, which 5 is that a POSITA would understand that the field 6 of endeavor of the '768 patent includes 7 semiconductor packaging. 8 The other things it might include weren't 9 something I considered and may or may not -- I 10 mean, I'll leave it at that. Strike the "may or 11 may not." 12 Q So sitting here for this deposition, are 13 you able to identify any places in the 14 declarations where there's a different field of 15 inventor -- endeavor? 16 A That would take me hours to do that. 17 Q So you're not aware of any. 18 Is that correct? 19 A I didn't say that. I said I'd need to 20 analyze it. 21 Q I'm sorry, I'm not asking you to analyze 22 it. I'm saying sitting here at the deposition,</p>	<p style="text-align: right;">36</p> <p>1 A -- pre-testability means the 2 understanding that before you invest in building 3 the entire package, you can get access to the 4 chips and test them so that you don't continue 5 building or inserting chips that -- or 6 combinations of chips that are not functional. 7 Q So when I read the quote from the patent, 8 this is Exhibit 1001, at 1:58 through 64. If you 9 want to pull up the patent, feel free to. But it 10 seems like it was talking about this problem being 11 in the context of flip chips. 12 Is that correct? 13 A Could you direct me to where in the 14 patent you're seeing this? 15 Q Yes. Column 1, Lines 58 through 64. 16 (Exhibit 1001, previously marked, not 17 attached.) 18 A Hold on one minute. Let me bring up 19 '768. It's telling me I have a corrupted copy of 20 the patent. Did you put that patent in the chat? 21 Q I did. And the one I put in there I 22 downloaded it directly from the patent office</p>

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<p>37</p> <p>1 website, so hopefully that one isn't corrupted.</p> <p>2 A Okay. Do you mind if I do that too so I</p> <p>3 don't end up with a corrupted copy? Because</p> <p>4 that's where I got my copy, was from you.</p> <p>5 Q Yeah, you can pull the patent from either</p> <p>6 your hard drive or from the chat, whichever one.</p> <p>7 A Okay. So direct me to the point you were</p> <p>8 making in the patent. You had said --</p> <p>9 Q Sure. So we were looking at Paragraph</p> <p>10 36, and the citation in Paragraph 36 is Column 1,</p> <p>11 Lines 58 through 64.</p> <p>12 And my question essentially was, isn't</p> <p>13 this pre-testability concept in the context of</p> <p>14 flip-chip packaging?</p> <p>15 A No.</p> <p>16 MR. McBRIDE: All right. I'm getting</p> <p>17 some background noise.</p> <p>18 A No, it wasn't from me.</p> <p>19 MS. BAILEY: I apologize. It was people</p> <p>20 in our hallway. I'll have the -- I'll have it</p> <p>21 closed off.</p> <p>22 MR. McBRIDE: Okay. Thank you.</p>	<p>39</p> <p>1 A When you say "your opinion," it would</p> <p>2 depend on the context.</p> <p>3 So I think what I wrote, if I can go back</p> <p>4 to my paragraph that you referenced just a minute.</p> <p>5 Can you remind me what the paragraph was we were</p> <p>6 just looking at in my declaration?</p> <p>7 Q Yes. Paragraph 36 from your declaration</p> <p>8 for the '768 patent.</p> <p>9 A So what I wrote was that a POSITA would</p> <p>10 have understood the '768 patent to be directed, in</p> <p>11 part, to solving the problem of creating chip</p> <p>12 packages, not necessarily flip-chip packages, with</p> <p>13 pre-testability capability.</p> <p>14 Q Okay. So your opinion is that the</p> <p>15 problem of pre-testability identified at Paragraph</p> <p>16 36 is not strictly in the context of the flip-chip</p> <p>17 technique.</p> <p>18 Is that correct?</p> <p>19 MS. BAILEY: Objection. Mischaracterizes</p> <p>20 testimony.</p> <p>21 A Yeah, I did not say that, no.</p> <p>22 Q All right. Why don't you try to tell me</p>
<p>38</p> <p>1 Q So why isn't the -- your opinion on the</p> <p>2 problem of pre-testability in the context of the</p> <p>3 flip-chip technique?</p> <p>4 A That wasn't the question I answered,</p> <p>5 first of all.</p> <p>6 You were asking me about what was being</p> <p>7 referenced in this paragraph. Are you changing</p> <p>8 the question?</p> <p>9 Q Well, your opinion is that a POSITA would</p> <p>10 have understood the '768 patent to be directed in</p> <p>11 part to solving the problem of creating chip</p> <p>12 packages with pre-testability capability.</p> <p>13 Did I read that correctly?</p> <p>14 A Yes.</p> <p>15 Q And my question was, at the citation you</p> <p>16 provided in your declaration, Column 1, Lines 58</p> <p>17 through 64, it seems to be talking about problems</p> <p>18 with flip-chip, the flip-chip technique.</p> <p>19 So I was wondering if your opinion was in</p> <p>20 the context of the flip-chip technique or if it</p> <p>21 was broad -- more broadly applied to all</p> <p>22 semiconductor packaging.</p>	<p>40</p> <p>1 what your opinion is.</p> <p>2 A Could you repeat the question you want me</p> <p>3 to answer?</p> <p>4 Q Yeah. It's the same question,</p> <p>5 Dr. Shanfield.</p> <p>6 Your opinion is a POSITA would have</p> <p>7 understood the '768 patent to be directed, in</p> <p>8 part, to solving the problem of creating chip</p> <p>9 packages with pre-testability capability.</p> <p>10 So my question is, is that problem of</p> <p>11 creating chip packages with pre-testability</p> <p>12 capability in the context of the flip-chip</p> <p>13 technique, or does it apply more broadly to</p> <p>14 semiconductor packages in general?</p> <p>15 A Like I said a few minutes ago, it would</p> <p>16 depend on the context. If you take me to a</p> <p>17 specific part of the '768 patent and ask me --</p> <p>18 Q Well, I'm sorry. Your declaration cites</p> <p>19 one place in the '768 patent, Column 1, Lines 58</p> <p>20 through 64. So that's the context I'm asking. I</p> <p>21 think you understand that.</p> <p>22 A And I think I answered you on that.</p>

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<p>41</p> <p>1 Q What's your answer?</p> <p>2 A Let me read it.</p> <p>3 Q I'm sorry, for the record, are you</p> <p>4 reading Column 1, Lines 58 through 64, again?</p> <p>5 A No. I'm reading what I said before.</p> <p>6 What I answered was, What I wrote was</p> <p>7 that a POSITA would have understood the '768</p> <p>8 patent to be directed, in part, to solving the</p> <p>9 problem of creating chip packages, not necessarily</p> <p>10 flip-chip packages, with pre-testability</p> <p>11 capability.</p> <p>12 Q So when you're using "chip packages" in</p> <p>13 your declaration, the term "chip packages," you're</p> <p>14 not limiting that to flip-chip packages. Correct?</p> <p>15 A It means exactly what it says, which is</p> <p>16 chip packages, not necessarily flip-chip packages.</p> <p>17 So it's solving that problem with chip packages,</p> <p>18 the pre-testability capability problem.</p> <p>19 Q What is a flip-chip package?</p> <p>20 A If I could direct you to Paragraph 43 in</p> <p>21 my '768 dec. I say, Traditional wire bonding</p> <p>22 techniques were replaced with flip-chip</p>	<p>43</p> <p>1 that. Correct?</p> <p>2 A Yes.</p> <p>3 Q And you've reviewed the claims of the</p> <p>4 '768 patent. Correct?</p> <p>5 A Yes.</p> <p>6 Q So I'm asking if the '768 patent,</p> <p>7 including its claims, if those are directed to</p> <p>8 what it terms flip-chip technique, or is it more</p> <p>9 broadly applicable to semiconductor packaging in</p> <p>10 general?</p> <p>11 A Well, I think maybe Paragraph 33 in my</p> <p>12 dec explains it best, where I say the '768 patent</p> <p>13 expressly places its work in the context of</p> <p>14 flip-chip technology. It explains that flip-chip</p> <p>15 technology fabricates bumps on pads of chip and</p> <p>16 interconnects the bumps directly to the package</p> <p>17 media. This arrangement provides the highest</p> <p>18 density of interconnections to the device, low</p> <p>19 inductance interconnection to the package.</p> <p>20 So like I had said before, a POSITA would</p> <p>21 understand the field of endeavor in the '768</p> <p>22 includes semiconductor packaging that encompasses</p>
<p>42</p> <p>1 technology; namely, the chip is not wire bonded</p> <p>2 for interconnect, but instead flipped face to face</p> <p>3 with the substrate surface, hence the name</p> <p>4 flip-chip, and the interconnection between the die</p> <p>5 and substrate is made through an array of bumps</p> <p>6 that are placed on the bonding pads of the die</p> <p>7 surface.</p> <p>8 Q So is this the idea that the chip itself</p> <p>9 already has the interconnections molded onto it,</p> <p>10 and then it's flipped just straight down on the</p> <p>11 substrate and connects?</p> <p>12 A Well, I think all I'm saying is the</p> <p>13 interconnection between the die and the substrate</p> <p>14 is made through this array of bumps.</p> <p>15 Q Is the '768 patent directed to flip-chip</p> <p>16 technique?</p> <p>17 MS. BAILEY: Objection. Foundation.</p> <p>18 A I think you need to explain what you mean</p> <p>19 by "Is the '768 patent directed to flip-chip</p> <p>20 technique." Maybe step a few statements back so</p> <p>21 that I understand in what context you're asking.</p> <p>22 Q Well, the '768 patent, you've reviewed</p>	<p>44</p> <p>1 flip-chip as well.</p> <p>2 MR. McBRIDE: Okay. Let's take a short</p> <p>3 break.</p> <p>4 THE WITNESS: Sure. How long?</p> <p>5 MR. McBRIDE: Do you want to come back</p> <p>6 at -- I'm sorry.</p> <p>7 VIDEO SPECIALIST: We're going off the</p> <p>8 record. The time is 10:17 a.m.</p> <p>9 (A recess was taken.)</p> <p>10 VIDEO SPECIALIST: We're back on the</p> <p>11 record. The time is now 10:27 a.m.</p> <p>12 BY MR. McBRIDE:</p> <p>13 Q Dr. Shanfield, please turn to Paragraph</p> <p>14 37.</p> <p>15 A Give me a moment to read.</p> <p>16 Okay.</p> <p>17 Q Can you explain to me what the problem of</p> <p>18 the -- so let's back up. Second sentence you</p> <p>19 state, "Thus, a POSITA would have understood the</p> <p>20 '768 patent to be directed, in part, to solving</p> <p>21 the problem of the impact of miniaturization on</p> <p>22 circuit performance."</p>

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<p>1 Do you see that?</p> <p>2 A Yes.</p> <p>3 Q Can you explain to me what you mean by</p> <p>4 "the problem of the impact of miniaturization on</p> <p>5 circuit performance"?</p> <p>6 A Yes. In fact, I had some comments on</p> <p>7 that in the next paragraph. But one important</p> <p>8 factor is the resistance of the metal</p> <p>9 interconnections increases with increasing</p> <p>10 miniaturization.</p> <p>11 Q And how does the resistance of the metal</p> <p>12 intersections increasing impact circuit</p> <p>13 performance?</p> <p>14 A The transmission of a digital or even</p> <p>15 analog signal is -- the speed at which it can go</p> <p>16 from point to point is limited by the resistance</p> <p>17 of the interconnect and the capacitance, effective</p> <p>18 capacitance, in that interconnect. And it creates</p> <p>19 a time constant that if it's very high resistance</p> <p>20 would be very long, so it would slow down the</p> <p>21 digital circuitry.</p> <p>22 So that's -- that's an important problem.</p>	<p>45</p> <p>1 which degrades the chip performance significantly,</p> <p>2 end quote, that is a result of the miniaturization</p> <p>3 we were discussing?</p> <p>4 A It can be, yes.</p> <p>5 Q What are some other factors that can lead</p> <p>6 to increase of parasitic capacitance and</p> <p>7 resistance of metal interconnections?</p> <p>8 A Well, factors associated with</p> <p>9 miniaturization include bringing interconnects</p> <p>10 closer to each other, which can increase</p> <p>11 capacitance per unit length.</p> <p>12 Q Does the '768 patent discuss any factors</p> <p>13 increasing parasitic capacitance and resistance of</p> <p>14 metal interconnections other than the</p> <p>15 miniaturization?</p> <p>16 A I'd have to spend a few minutes looking</p> <p>17 at the '768 to see.</p> <p>18 Q But sitting here right now, are you aware</p> <p>19 of any?</p> <p>20 A I just don't -- I mean, it's not a memory</p> <p>21 test. I just don't remember whether it did or</p> <p>22 not.</p> <p>47</p>
<p>46</p> <p>1 Q So with increasing miniaturization,</p> <p>2 effectively the resistance increases and the</p> <p>3 circuit slows down.</p> <p>4 Is that correct?</p> <p>5 A That's one possible side effect of</p> <p>6 miniaturization.</p> <p>7 Q All right. You mentioned that you had</p> <p>8 some comments on miniaturization in the next</p> <p>9 paragraph, which I'm guessing is Paragraph 38.</p> <p>10 What were those comments?</p> <p>11 A Yes, the 76 -- what I wrote is the '768</p> <p>12 patent describes that parasitic capacitance and</p> <p>13 resistance of the metal interconnections</p> <p>14 increases -- increase, rather, which degrades the</p> <p>15 chip performance significantly.</p> <p>16 Q And is this parasitic capacitance related</p> <p>17 to the miniaturization we discussed a second ago?</p> <p>18 A Combination of parasitic capacitance and</p> <p>19 increased resistance is, yes.</p> <p>20 Q Okay. So when you're quoting in</p> <p>21 Paragraph 38, quote, Parasitic capacitance and</p> <p>22 resistance of the metal interconnections increase,</p>	<p>48</p> <p>1 Q So you don't know?</p> <p>2 A Right.</p> <p>3 Q Please turn to Paragraph 39, and let me</p> <p>4 know when you get there.</p> <p>5 A Okay. If you will just give me a moment.</p> <p>6 Okay.</p> <p>7 Q This is the level of ordinary skill</p> <p>8 section of your declaration. Correct?</p> <p>9 A Yes.</p> <p>10 Q And if we jump down to the end of the</p> <p>11 second sentence, it says, "A POSITA in the field</p> <p>12 of the '768 patent at the time of the earliest</p> <p>13 possible priority date (September 26, 2012) would</p> <p>14 have had" a at -- "at least a Bachelor's Degree in</p> <p>15 electrical engineering, materials science, or</p> <p>16 physics (or an equivalent degree) and at least two</p> <p>17 years of experience in semiconductor design or</p> <p>18 semiconductor manufacturing."</p> <p>19 Do you see that?</p> <p>20 A Yes.</p> <p>21 Q Are there any other experiences outside</p> <p>22 of semiconductor design or semiconductor</p>

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<p style="text-align: right;">49</p> <p>1 manufacturing that might be sufficient for a 2 POSITA?</p> <p>3 MS. BAILEY: Objection. Scope.</p> <p>4 A I didn't consider whether there would be 5 or not, so I'd have to think about it.</p> <p>6 Q So for example, would somebody with a 7 career in academics qualify, you know, a 8 professor, as having experience in semiconductor 9 design or semiconductor manufacturing?</p> <p>10 A If they met this criteria of having a 11 Bachelor's Degree in EE, materials science, or 12 physics, or equivalent, and two years of 13 experience actually doing semiconductor design or 14 participating in semiconductor manufacturing.</p> <p>15 Q What if their experience was, you know, 16 purely academic, I mean, and they weren't actually 17 designing semiconductors or manufacturing 18 semiconductors, but they were involved in, you 19 know, the semiconductor field through teaching or 20 research or what-have-you?</p> <p>21 A Well, I guess I wrote that they need at 22 least two years of direct experience in design,</p>	<p style="text-align: right;">51</p> <p>1 Is that correct?</p> <p>2 A Well, the experience is in either 3 semiconductor design or semiconductor 4 manufacturing. That's what experience I'm 5 referring to.</p> <p>6 Q But could additional education or 7 experience outside of those fields substitute for 8 experience in semiconductor design or 9 manufacturing?</p> <p>10 A Well, I did mention equivalent degree, so 11 there might be an equivalent degree, you know, 12 applied physics, for example. So that might 13 substitute for some of the work experience as 14 well, like I explain in this paragraph.</p> <p>15 Q Please turn to Paragraph 48 at Page 53, 16 and let me know when you're there.</p> <p>17 A Okay. Just give me a moment.</p> <p>18 Okay.</p> <p>19 Q This is the section titled Interposers 20 and Dielectric Materials. Correct?</p> <p>21 A Yes.</p> <p>22 Q What is an interposer?</p>
<p style="text-align: right;">50</p> <p>1 semiconductor design or manufacturing. So for a 2 professor, if they've laid out an integrated 3 circuit and they've done that for a few years, 4 that would qualify, assuming they have the 5 degrees.</p> <p>6 Or if they had some experience working at 7 a -- you know, a manufacturing facility solving 8 processing problems, for example. So as long as 9 they met this criteria, then I'd consider them a 10 POSITA in the field.</p> <p>11 Q What about if somebody was -- they 12 weren't employed designing or manufacturing the 13 semiconductors, but they used -- I guess they used 14 the end product and, you know, a customer gives 15 you input; would that qualify?</p> <p>16 A Well, I guess I wrote that additional 17 education or experience might substitute for the 18 above requirements. So I'd have to hear the 19 specifics.</p> <p>20 Q So the additional education or experience 21 could be in place of experience in semiconductor 22 design or semiconductor manufacturing.</p>	<p style="text-align: right;">52</p> <p>1 A Well, this explains it pretty well, this 2 reference. They're used in electronic assemblies 3 to facilitate connection between components with 4 different connection configurations or to provide 5 a needed spacing between the components. And it 6 can include dielectric elements, like sheet or 7 layer of a dielectric material with conductive 8 traces on or within the sheet or layer. There can 9 be one or multiple levels throughout this -- 10 throughout a single dielectric layer, separated by 11 the portions of dielectric material within the 12 layer.</p> <p>13 Q So an interposer can be comprised of a 14 single sheet or multiple sheets. Correct?</p> <p>15 A Yeah, a single sheet or multiple sheets 16 of dielectric material.</p> <p>17 Q What is the typical thickness for an 18 interposer?</p> <p>19 MS. BAILEY: Objection. Foundation.</p> <p>20 A I think I need to understand the context 21 of that question, because --</p> <p>22 Q Well --</p>

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<p>53</p> <p>1 A -- it's very general.</p> <p>2 Q Would a POSITA have a range in mind for</p> <p>3 typical thicknesses of an interposer?</p> <p>4 A Again, what's the context you're coming</p> <p>5 from? Where -- is this in the '768, a particular</p> <p>6 section of thickness? Or what is this range</p> <p>7 pertaining to?</p> <p>8 Q Well, it's a POSITA. Right? So it's</p> <p>9 somebody that's reviewed the intrinsic record.</p> <p>10 So in the context of the patents, is</p> <p>11 there a typical thickness for interposers?</p> <p>12 A Well, I think Paragraph 50, a few</p> <p>13 sentences down, I wrote something relevant. I</p> <p>14 said, "Thus, it would be understood that a polymer</p> <p>15 substrate layer" -- so this is a specific layer</p> <p>16 I'm talking about -- "would have a suitable</p> <p>17 thickness to support and protect the coupled</p> <p>18 semiconductor devices, as well as to support</p> <p>19 mechanical processes such as drilling to form vias</p> <p>20 or receptacles." And then --</p> <p>21 Q So --</p> <p>22 A -- what Lee teaches on that subject.</p>	<p>55</p> <p>1 thickness?</p> <p>2 A You'll have to give me a context. I</p> <p>3 can't agree with that just in thin air.</p> <p>4 Q So the type of material used -- so I'm</p> <p>5 sorry, so you need more information to answer</p> <p>6 whether the type of material used impacts the</p> <p>7 thickness of the interposer?</p> <p>8 A No; whether -- whether it affects; not</p> <p>9 just how, but whether it does.</p> <p>10 Q So the type of material might not impact</p> <p>11 the thickness of the interposer.</p> <p>12 Is that correct?</p> <p>13 A I don't even know what that statement</p> <p>14 means. That's such a general remark I can't</p> <p>15 answer it.</p> <p>16 Q What else would you need to know to</p> <p>17 answer the question?</p> <p>18 A I need some context. Talk to me about</p> <p>19 what Lee is teaching or, you know, give me</p> <p>20 something to focus on.</p> <p>21 Q So again, the context is a POSITA who has</p> <p>22 read the intrinsic record. Right? So that's</p>
<p>54</p> <p>1 Q So the sentence you just read is</p> <p>2 discussing a polymer substrate, which is one type</p> <p>3 of substrate. Correct?</p> <p>4 A Yes.</p> <p>5 Q So there are other types of substrates.</p> <p>6 Correct?</p> <p>7 A That's right.</p> <p>8 Q And those might have different</p> <p>9 thicknesses.</p> <p>10 Is that right?</p> <p>11 A Yeah. Again, I need the context to give</p> <p>12 more information than, yes, that's true. But,</p> <p>13 yeah.</p> <p>14 Q Well, I guess unpacking it a little bit.</p> <p>15 What I'm getting at is, a suitable thickness for</p> <p>16 polymer might not be the same as a suitable</p> <p>17 thickness for another material. Correct?</p> <p>18 A It depends on the context.</p> <p>19 Q But in general, different materials</p> <p>20 might -- different materials might have different</p> <p>21 thicknesses, depending on the material used.</p> <p>22 Right? I mean, that's one factor deciding the</p>	<p>56</p> <p>1 basically what --</p> <p>2 A So that's not a context. I'm talking</p> <p>3 about the specifics of the interposer.</p> <p>4 Q So you'd need more information to give an</p> <p>5 opinion on whether the material used for the</p> <p>6 interposer impacts the thickness you would use.</p> <p>7 Is that correct?</p> <p>8 A Yes.</p> <p>9 Q And so when you point to Paragraph 50,</p> <p>10 you've used this term, "suitable thickness."</p> <p>11 So what are the factors that impact how</p> <p>12 you determine what a suitable thickness is?</p> <p>13 A Many factors determine what's suitable.</p> <p>14 Q So what are some of the factors that</p> <p>15 impact how you determine what a suitable thickness</p> <p>16 is?</p> <p>17 A For example, if you're looking to use</p> <p>18 reactive ion etching to cut vias into the</p> <p>19 substrate layer, there's a limit to the aspect</p> <p>20 ratio you can achieve, depending on the process</p> <p>21 you're using.</p> <p>22 So you first have to understand what the</p>

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<p>57</p> <p>1 reactive ion process is that you have available, 2 what its aspect ratio is, can achieve. 3 And therefore you might then adjust your 4 thickness to -- because if the aspect ratio is not 5 very high, you'll end up taking up area 6 accommodating that aspect ratio and displacing 7 potential room for more electronics, more chip 8 area. 9 Q Okay. Please turn to Paragraph 56 at 10 Page 58. 11 A Give me a moment. 12 Okay. 13 Q So the first sentence states, "It was 14 known that while -- quote, epoxy alone is a very 15 high coefficient of thermal expansion, around 80 16 times 10 to the negative 6 degrees Celsius, 17 compared to the silicon chip or copper lead frame 18 or organic substrate.)" 19 Is epoxy a polymer? 20 A Yes. 21 Q The second sentence states, "Notably, 22 filling, quote -- again quoting from Exhibit 1012,</p>	<p>59</p> <p>1 coefficient of thermal expansion of silicon." 2 Do you see that? 3 A Yes. 4 Q So when you say, "more closely match the 5 coefficient of thermal expansion of silicon," 6 you're trying to -- you're talking about bringing 7 the polymer CTE down lower. Correct? 8 A Well, lower than it is without the 9 filler, yes. 10 Q All right. To get it closer to silicon, 11 which is lower than the polymer itself. 12 Is that correct? 13 A Lower than the -- Well, it depends on the 14 polymer. Because there are polymers with very low 15 CTE. But if we're presuming that the polymer has 16 a higher CTE, yes. 17 Q Polymers usually have high CTEs compared 18 to silicon. Correct? 19 MS. BAILEY: Objection. Foundation. 20 A I'd -- you'd need to be more specific. 21 Q Well, what I'm saying is, polymer-based 22 materials with low CTEs that might match those of</p>
<p>58</p> <p>1 "Filling the epoxy with silica filler brings down 2 the thermal expansion coefficient into the teens, 3 which would match the lead frame or substrate but 4 would still be high compared to silicon," end 5 quote. 6 Is silica filler a polymer? 7 A Well, epoxy with silica filler is a 8 polymer. 9 Q Yeah, but I'm asking whether silica 10 filler is a polymer? 11 A Silica filler alone -- 12 Q Yeah. 13 A -- without any epoxy, no. 14 There are fillers that are polymers, 15 though. 16 Q Please turn to Paragraph 57 now. 17 A Give me a moment. 18 Okay. 19 Q Okay. The last sentence states, "Thus, 20 it was well understood that low-CTE polymer-based 21 materials, such as a filled epoxy, could be used 22 as a packaging material to more closely match the</p>	<p>60</p> <p>1 silicon are the exception, not the rule. Correct? 2 A I don't even understand that statement. 3 The exception to what? 4 Q Those polymers -- 5 A There's all kinds of polymers, and you 6 can obtain them with all kinds of CTEs. 7 Q So you don't agree with the general 8 statement that polymers usually have high CTEs 9 compared to silicon. 10 Is that correct? 11 A I'd prefer phrasing it as polymers can be 12 obtained with a wide range of CTEs. 13 Q Please turn to Paragraph 66 at Page 63. 14 Let me know when you're there. 15 A Yeah. Give me a moment. 16 Okay. 17 Q Okay. So the first sentence there 18 states, "It was well known that solder contained 19 pure tin, a tin-silver alloy, a tin-lead alloy or 20 a tin silver-copper alloy." 21 Do you see that? 22 A Yes.</p>

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<p>61</p> <p>1 Q Do all solders contain tin?</p> <p>2 A No.</p> <p>3 Q Let's turn to Paragraph 81 at Page 74.</p> <p>4 A Give me a moment to read.</p> <p>5 Q Sure.</p> <p>6 MR. McBRIDE: Oh, I just want to note the</p> <p>7 question before to you it, looks like was</p> <p>8 transcribed, Do all coppers contain tin. And the</p> <p>9 question I asked or intended to ask was, Do all</p> <p>10 solders contain tin. And I think that's what I</p> <p>11 asked. And your response was no.</p> <p>12 Q But I just wanted to make sure, Doctor,</p> <p>13 that my recollection was correct there.</p> <p>14 A Yes.</p> <p>15 Q Thank you. Let's go back to Paragraph</p> <p>16 81.</p> <p>17 A Okay.</p> <p>18 Q Looking at the second sentence of</p> <p>19 Paragraph 81 you state, "Specifically,</p> <p>20 semiconductor chips, such as integrated circuits,</p> <p>21 were known to be coupled using chip packaging</p> <p>22 techniques such as flip-chip packaging as noted</p>	<p>63</p> <p>1 question you asked earlier.</p> <p>2 Q Ah. So does a semiconductor chip have to</p> <p>3 comprise an integrated circuit?</p> <p>4 A Yes.</p> <p>5 Q Please turn to Paragraph 180 at Page 135.</p> <p>6 A Give me a moment to read it.</p> <p>7 Okay.</p> <p>8 Q Okay. The second sentence states, "As</p> <p>9 shown, Sundaram's first electronic device 125 is a</p> <p>10 first semiconductor chip under said first</p> <p>11 interconnection scheme."</p> <p>12 Do you see that?</p> <p>13 A Yes.</p> <p>14 Q And then below Paragraph 180 there's an</p> <p>15 annotated version of Figure 3 from Sundaram.</p> <p>16 Do you see that?</p> <p>17 A Yes.</p> <p>18 Q The number 125 there, it looks to me like</p> <p>19 it's, you know, covering all the different</p> <p>20 memories. But then in the annotated picture where</p> <p>21 you've identified the first semiconductor chip,</p> <p>22 only one of the memories is highlighted.</p>
<p>62</p> <p>1 above."</p> <p>2 Do you see that?</p> <p>3 A Yes.</p> <p>4 Q Are all semiconductor chips integrated</p> <p>5 circuits, in your opinion?</p> <p>6 MS. BAILEY: Objection. Scope and</p> <p>7 foundation.</p> <p>8 A I can't really answer that because it's</p> <p>9 such a generic question. So I think we need to --</p> <p>10 I need to understand what context you're</p> <p>11 discussing.</p> <p>12 Q So when you say "semiconductor chips such</p> <p>13 as integrated circuits" in your declaration, what</p> <p>14 I'm trying to understand is, are integrated</p> <p>15 circuits a type of semiconductor chip, or are all</p> <p>16 semiconductor chips integrated circuits?</p> <p>17 A What I said was, A semiconductor chip is</p> <p>18 a semiconductor device comprising an integrated</p> <p>19 circuit.</p> <p>20 Q Are you -- are you referring to something</p> <p>21 in your declaration now? Sorry, you said when --</p> <p>22 A No; I'm referring to an answer to a</p>	<p>64</p> <p>1 Can you help explain the difference</p> <p>2 there?</p> <p>3 A I don't understand what you mean by</p> <p>4 "difference." We're identifying a first</p> <p>5 semiconductor chip.</p> <p>6 Q What I'm asking is, is it just that</p> <p>7 first -- is that just the first memory layer that</p> <p>8 you've highlighted blue, or is it all of 125 as</p> <p>9 you discussed in Paragraph 180, or seemed to</p> <p>10 discuss in Paragraph 180?</p> <p>11 A It's what I've identified in as a first</p> <p>12 semiconductor chip in blue as the first</p> <p>13 semiconductor chip.</p> <p>14 Q Okay. Go ahead. I didn't mean to cut</p> <p>15 you off.</p> <p>16 A Yeah, that's it.</p> <p>17 Q Okay. Please turn to Paragraph 370 at</p> <p>18 Page 256.</p> <p>19 A Give me a moment.</p> <p>20 Okay.</p> <p>21 Q Okay. So the first sentence of Paragraph</p> <p>22 370 states, "Haba teaches a microelectronic</p>

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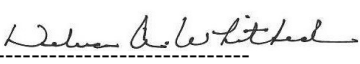
<p style="text-align: right;">65</p> <p>1 element 66 which may be one or more semiconductor 2 chips." 3 Do you see that? 4 A Yes. 5 Q Now, you might want to pull up Haba, but 6 I want to walk through what microelectronic 7 element 66 is in Haba. 8 So the question is, where does Haba 9 disclose microelectronic element 66? And I can 10 dump it in the -- I'll dump Haba in the chat, if 11 you want to look. 12 A Okay. 13 Q Okay. So the question is, what is 14 microelectronic element 66 in Haba? 15 MS. BAILEY: Objection. Vague. 16 A Well, I'll fill in the context, presuming 17 that's the context you mean. 18 In Paragraph 371 I have an explanation. 19 Q Sorry, can you explain the explanation 20 for us? 21 A Sure. So a POSITA would have understood, 22 first of all, that Haba teaches the embodiment of</p>	<p style="text-align: right;">67</p> <p>1 layer 70. And I'm showing that in this -- with 2 this red arrow. 3 Q So I'm -- so the red arrow is down on 4 Page 258? 5 A Yeah. 6 Q So in Haba Figure 10B, what you are 7 calling the first semiconductor chip is that blue 8 box that you annotated at Page -- 9 A Right. 10 Q -- 258. 11 MR. McBRIDE: Okay. That's actually all 12 the questions I have for now. Thank you very 13 much, Dr. Shanfield. 14 THE WITNESS: Okay. 15 Do you want to go off the record or -- 16 MS. BAILEY: Yes, let's go off the 17 record. 18 VIDEO SPECIALIST: One moment, please. 19 We are going off the record. The time is 20 11:18 a.m. This concludes today's deposition. 21 MS. BAILEY: I actually have no 22 questions, so we can fully conclude.</p>
<p style="text-align: right;">66</p> <p>1 Component 2 in Figure 9B can be used in an 2 assembly for attachment between a microelectronic 3 element and a PCB in a similar arrangement shown 4 in Figures 10A and 10B. And that Haba teaches 5 that the redistribution layer 70 of Figure 9B may 6 be included in the 10B embodiment. And that's 7 such that the redistribution layer 70 is 8 positioned over surface 26 in that 10B embodiment 9 between the dielectric layer 20 and the PCB. 10 Q Okay. Thanks for your answer. But my 11 question is, in Paragraph 370 you talk about in 12 quotes, microelectronic element 66, end quote. 13 Do you see that? 14 A Yes. 15 Q And I think you're quoting Haba there, 16 which is Exhibit 1009. So I would like you to 17 point me to microelectronic element 66 in Haba. 18 A Well, I can further go on. The 19 redistribution layer 70 is positioned between the 20 dielectric layer 20 and the PCB. So Haba is 21 teaching that this element 66, the first 22 semiconductor chip, is under the redistribution</p>	<p style="text-align: right;">68</p> <p>1 (Off the record at 11:18 a.m. EDT.) 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22</p>

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18 (69 to 72)

<p style="text-align: right;">69</p> <p>1 ACKNOWLEDGMENT OF DEPONENT</p> <p>2 I, STANLEY SHANFIELD, Ph.D., do hereby</p> <p>3 acknowledge that I have read and examined the</p> <p>4 foregoing testimony, and the same is a true,</p> <p>5 correct and complete transcription of the</p> <p>6 testimony given by me, and any corrections appear</p> <p>7 on the attached Errata sheet signed by me.</p> <p>8</p> <p>9 _____</p> <p>10 (DATE) (SIGNATURE)</p> <p>11</p> <p>12</p> <p>13</p> <p>14</p> <p>15</p> <p>16</p> <p>17</p> <p>18</p> <p>19</p> <p>20</p> <p>21</p> <p>22</p>	<p style="text-align: right;">71</p> <p>1 I further certify that I am not related to</p> <p>2 any of the parties to this action by blood or</p> <p>3 marriage, I am not employed by or an attorney to any</p> <p>4 of the parties to this action, and that I am in no</p> <p>5 way interested, financially or otherwise, in the</p> <p>6 outcome of this matter.</p> <p>7</p> <p>8 IN WITNESS WHEREOF, I have hereunto set my</p> <p>9 hand this 14th day of July, 2026.</p> <p>10</p> <p>11 My commission expires:</p> <p>12 October 31, 2027</p> <p>13</p> <p>14</p> <p>15  </p> <p>16 _____</p> <p>17 E-NOTARY PUBLIC IN AND FOR THE</p> <p>18 COMMONWEALTH OF VIRGINIA</p> <p>19</p> <p>20</p> <p>21</p> <p>22</p>
<p style="text-align: right;">70</p> <p>1 C E R T I F I C A T E</p> <p>2 I, Debra Ann Whitehead, E-Notary Public in and for</p> <p>3 the Commonwealth of Virginia, do hereby certify:</p> <p>4</p> <p>5 That STANLEY SHANFIELD, Ph.D., the witness</p> <p>6 whose deposition is hereinbefore set forth, was duly</p> <p>7 sworn by me before the commencement of such</p> <p>8 deposition and that such deposition was taken</p> <p>9 virtually and is a true record of the testimony</p> <p>10 given by such witness.</p> <p>11</p> <p>12 I further certify that the adverse</p> <p>13 parties, TAIWAN SEMICONDUCTOR MANUFACTURING COMPANY</p> <p>14 LTD. and APPLE INC., were represented by counsel at</p> <p>15 the deposition.</p> <p>16</p> <p>17 I further certify that the deposition of</p> <p>18 STANLEY SHANFIELD, Ph.D., occurred virtually, on</p> <p>19 Tuesday, July 14, 2026, from 9:05 a.m. to 11:18 a.m.</p> <p>20 EDT.</p> <p>21</p> <p>22</p>	

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