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Transcript of Jack Lee, Ph.D.

Date: January 28, 2025
Case: Micron Technology, Inc. -v- Yangtze Memory Technologies Company, LTD., (PTAB)

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WORLDWIDE COURT REPORTING & LITIGATION TECHNOLOGY

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UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE PATENT TRIAL AND APPEAL BOARD
----------X
MICRON TECHNOLOGY, INC.,
Petitioner,
-against- Case IPR2024-00788
Case IPR2024-00909
Patent 10,658,378

YANGTZE MEMORY TECHNOLOGIES COMPANY, LTD.,
Patent Owner.
----------X

January 28, 2025
11:00 a.m.

REMOTE REALTIME VIDEOTAPED DEPOSITION of JACK LEE, Ph.D., held at the above date and time, and taken before Dorene Glover, an Registered Skilled Reporter and Notary Public within and for the State of New York.

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A P P E A R A N C E S:

ORRICK, HERRINGTON & SUTCLIFFE, LLP.
Attorneys for Petitioner
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New York, New York 10019
BY: PARTH SAGDEO, ESQ.

ROPES & GRAY, LLP.
Attorneys for Patent Owner
1900 University Avenue
6th floor
East Palo Alto, California 94303
BY: CHRISTOPHER BONNY, ESQ.
ALLEN CROSS, ESQ.

Also Present:
PARKER SIMPSON - VIDEOGRAPHER

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THE VIDEOGRAPHER: Here begins the videotaped deposition of Jack Lee, Ph.D., in the matter of Micron Technology, Incorporated, versus Yangtze Memory Technologies Company, Limited, in the United States Patent and Trademark Office, before Patent and Trial Appeal Board, case numbers IPR2024-00788 and IPR2024-00909.

Today's date is 1/28/2025. The time on the video monitor is 11:00 Eastern Time. The remote videographer for today is Parker Simpson representing Planet Depos. All parties in this video deposition are attending remotely.

Would counsel please voice identify themselves and state whom they represent?

MR. BONNY: Christopher Bonny from Ropes & Gray on behalf of patent owner Yangtze Memory Technologies Company, Limited. And I'm joined today by Allen

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Cross, also from Ropes & Gray.

(Reporter clarification.)

MR. SAGDEO: Parth Sagdeo from Orrick representing petitioner Micron.

THE VIDEOGRAPHER: The court reporter today is Dorene Glover representing Planet Depos. The witness will now be sworn.

DR. J A C K L E E,
the witness herein, having first been duly sworn by a Notary Public of the State of New York, was examined and testified as follows:

EXAMINATION BY
MR. BONNY:

Q. Please state your name for the record.

A. Jack Lee.

Q. And what is your address?

A. 5803 Westslope Cove, Westslope spelled one word, W-E-S-T-S-L-O-P-E, Cove, C-O-V-E, Austin, Texas 78731.

(Reporter clarification.)

5

1 Q. What is your occupation, Dr. Lee?
2 **A. Right now, I am a professor**
3 **emeritus, Department of Electrical and Computer**
4 **Engineering in the University of Texas at**
5 **Austin. Emeritus professor, or professor**
6 **emeritus, is essentially a retired professor**
7 **with a recognition of emeritus.**
8 Q. Do you have any other occupations
9 currently?
10 **A. No.**
11 Q. Do you have any materials in front
12 of you?
13 **A. No.**
14 Q. Other than the computer that you're
15 working on, do you have any other electronic
16 devices in front of you?
17 **A. No.**
18 Q. And do you understand that you're
19 under oath today?
20 **A. Yes.**
21 Q. So I think this is the recap for
22 you but just to summarize, I will be asking

6

1 questions of you today and you'll be answering
2 those. I'll just ask that you wait for me to
3 finish, and I will also do my best to wait for
4 you to finish before I speak. Does that make
5 sense?
6 **A. Yes.**
7 Q. Is there any reason why you cannot
8 testify truthfully and fully today?
9 **A. No.**
10 Q. And if I ask a question that you
11 don't understand, I request that you ask for
12 clarification. Does that make sense?
13 **A. Yes.**
14 Q. And otherwise, I'll assume that you
15 understand the question. Does that make sense?
16 **A. Yes.**
17 Q. Dr. Lee, have you been deposed
18 before?
19 **A. Yes.**
20 Q. Approximately how many times?
21 **A. I don't have the exact count.**
22 **There's more than 20, 25 maybe, yeah, or more.**

7

1 **I don't remember.**
2 Q. You said that you are a retired
3 professor; is that correct?
4 **A. Yes.**
5 Q. Does that mean that you are not
6 currently working at the university?
7 **A. What that means is that -- well, I**
8 **have been a professor at the University of**
9 **Texas for 35 years, and as of September 2023, I**
10 **retired from the University of Texas at Austin.**
11 **And so that is correct, I no longer**
12 **work at the University of Texas at Austin.**
13 **However, I still have an office there and --**
14 **because of the recognitions of professor**
15 **emeritus title.**
16 Q. You also consult in certain
17 litigation matters; is that correct?
18 **A. That is correct.**
19 Q. How long have you been providing
20 litigation consulting services?
21 **A. Quite a long time. I first was --**
22 **way back, I believe it was 2000, 2002, around**

8

1 **that timeframe, I was asked to be a consulting**
2 **expert, not a testifying expert. Then I**
3 **believe that around 2005, I don't recall exact**
4 **date, the exact year, 2005, 2006 was the first**
5 **time that I was consulting as a testifying**
6 **expert.**
7 Q. Approximately how many times have
8 you been retained as an expert witness in a
9 patent litigation matter?
10 **A. I don't recall the exact number.**
11 **Probably more than 40, 45 cases.**
12 Q. What is your consulting rate in
13 the -- at present IPR proceedings?
14 **A. It's $680 per hour.**
15 Q. Is that your standard consulting
16 rate?
17 **A. Currently, it is my standard**
18 **consulting rate.**
19 Q. Approximately how much money do you
20 make annually from consulting in patent
21 litigation matters?
22 **A. I don't -- I don't have a -- I**

9

1 **don't recall what the number is.**
2 Q. Do you know if it was more than a
3 hundred thousand?
4 **A. It varies from year to year. Some**
5 **year are better than others. So again, I**
6 **don't -- I don't recall what the -- what the**
7 **number is.**
8 Q. Do you know approximately how much
9 you make from consulting in patent litigation
10 matters in the year 2024?
11 **A. I don't -- I really don't have the**
12 **exact number, but probably over 100k.**
13 Q. How many -- approximately how many
14 expert reports have you prepared in patent
15 litigation matters?
16 **A. I'll say -- it's greater than --**
17 **greater than 50 expert reports.**
18 Q. And approximately how many times
19 have you testified at trial in patent
20 litigation matters?
21 **A. All of the cases that I have have**
22 **gone to trial.**

10

1 Q. Sorry, to clarify, you said that
2 all of the cases that you've been retained for
3 have gone to trial?
4 **A. Yes, sir.**
5 Q. Sorry, approximately how many cases
6 would that be, then, where you went to trial?
7 **A. Four.**
8 Q. Have you ever turned down a patent
9 litigation matter?
10 **A. Yes.**
11 Q. For what reason?
12 **A. Various reasons. It could be**
13 **conflict of interest. It could be due to the**
14 **fact that the area is slightly out of my**
15 **expertise. It could be the position that the**
16 **law firm takes is -- that I don't agree with.**
17 **So there's various reasons.**
18 Q. Within the set of cases where you
19 were retained, have you ever refused to offer
20 an opinion?
21 **A. Can you repeat that question,**
22 **please?**

11

1 Q. Yeah. Within the set of patent
2 litigation matters for which you were retained,
3 have you ever refused to offer an opinion?
4 MR. SAGDEO: Objection, form.
5 **A. I don't recall if I have -- if I**
6 **have refused to offer testimony after I've been**
7 **retained in a case.**
8 Q. So is it possible that you have
9 never refused to offer testimony in a case that
10 you were retained for for patent litigation?
11 MR. SAGDEO: Objection, form.
12 **A. Before I offer an opinion, if I**
13 **disagree with the positions of the law firm, I**
14 **would probably decline the case already.**
15 Q. You have some patents to your name,
16 correct?
17 **A. Yes.**
18 Q. How many patents do you have?
19 **A. It should be on my CV. Can you**
20 **bring up my CV?**
21 Q. Yeah. Just one moment.
22 So I've shared an exhibit which

12

1 I'll introduce in a moment through the chat.
2 Are you able to see that, Dr. Lee?
3 **A. Not yet. Oh, yeah. Sure. Can I**
4 **download it?**
5 Q. Yes, please. Let me know when you
6 have that downloaded.
7 **A. Okay. Got it.**
8 Q. So the document that I've shared is
9 marked as Exhibit 1004 in IPR2024-788. Do you
10 recognize --
11 (Whereupon, an off-the-record
12 discussion was held.)
13 Q. Dr. Lee, do you recognize this
14 document?
15 **A. Yes.**
16 Q. And this document is a copy of your
17 CV that you provided in this set of IPRs?
18 **A. Yes, I believe so.**
19 Q. So looking at your CV, how many
20 patents do you have?
21 **A. On page 5 of my CV, near the**
22 **bottom, it indicate that I have nine patent**

13

1 **issued.**
2 Q. Do any of those patents relate to
3 the area of technology that's relevant to the
4 U.S. Patent No. 10,658,378?
5 MR. SAGDEO: Objection, form.
6 **A. Can you clarify the question when**
7 **you say "related"? Because all the patent is**
8 **related to semiconductor devices, and the**
9 **patent that I have issued, '378, also**
10 **semiconductor device related.**
11 **So one can say that the patents**
12 **that I have are also in the same area as the**
13 **'378 patent, in the sense that they both --**
14 **they all are in a area of semiconductor**
15 **devices.**
16 (Reporter clarification.)
17 Q. So is it the case that all nine of
18 the patents that you have relate to
19 semiconductors?
20 **A. Would you mind repeating the**
21 **question, please?**
22 Q. All nine of your patents relate to

14

1 semiconductors?
2 **A. Yes.**
3 Q. What did you do to prepare for this
4 deposition?
5 **A. Well, I read my declarations in**
6 **petition one and petition two. I read the**
7 **preliminary response from the patent owner in**
8 **both petition one and petition two. I also**
9 **read the decision granting institution, PTAB,**
10 **in both petition one and petition two.**
11 **Of course, I also reviewed all the**
12 **patents related to this case, including the**
13 **'378 patent and the prior arts. And I probably**
14 **also relayed -- reviewed some of the articles,**
15 **book chapters, and other documents that I cited**
16 **in my declarations.**
17 **And in preparation for this**
18 **deposition, I also discussed with counsel and**
19 **discussed various issues.**
20 Q. I'd like to just unpack a couple of
21 items in your response just now.
22 You referred to petition one and

15

1 petition two. Is petition one the petition in
2 IPR2024-788?
3 **A. Can you -- perhaps can you -- I**
4 **don't remember the exact number. Can you share**
5 **my declaration? I believe that has that**
6 **number, of both petition one and petition two.**
7 Q. Sure. I'd be happy to do so.
8 **A. Thank you.**
9 Q. But to start with, and I'll give
10 you a minute to load this up before you
11 respond, but I've introduced a document that's
12 labeled as Exhibit 1003 in IPR2024-788. Please
13 let me know when you have that up.
14 **A. Yes. Can you also share my**
15 **declaration for the petition two?**
16 Q. Yes, yeah, just a moment. So
17 starting with this -- strike that.
18 So to clarify, do you mean that you
19 need both to answer the question I asked a
20 moment ago?
21 **A. Yeah. The earlier one is petition**
22 **one, and the later one is petition two. So I**

16

1 **think it would be good to have the date so I**
2 **don't -- I can answer it accurately. If that**
3 **makes sense.**
4 Q. So now also sharing a document
5 labeled as -- marked as Exhibit 1003 in
6 IPR2024-909. And please let me know when you
7 have that one up.
8 **A. Yes.**
9 Q. So Exhibit 1003 in IPR2024-788
10 is -- corresponds to what you previously
11 referred to as the first petition, correct?
12 **A. That is correct. That's the -- if**
13 **I look at the last page of IPR ending with 788,**
14 **that is signed on April 30th, 2024, whereas the**
15 **petition that end with case number 909, the**
16 **signature date was May 19, 2024.**
17 **So therefore, the IPR ending with**
18 **788 is the -- what I referred to as petition**
19 **one earlier. And the IPR case number ended**
20 **with 909 is what I referred to as petition two**
21 **earlier.**
22 Q. So in this deposition, I will refer

17

1 to Exhibit 1003 in IPR2024-788 as your first
2 declaration. Is that okay?
3 **A. Yes.**
4 Q. And I will refer to Exhibit 1003 in
5 IPR2024-909 as your second declaration. And
6 you'll understand what I mean when I say your
7 "second declaration"?
8 **A. Yes.**
9 Q. You also mentioned earlier the '378
10 patent. And am I correct that you are
11 referring to U.S. Patent No. 10,658,378?
12 **A. I don't recall the exact number.**
13 **Can you share that with me on the screen?**
14 Q. So I shared the document that's
15 been marked as Exhibit 1001 in IPR2024-788.
16 Please let me know when you have that up.
17 **A. Yes, I have.**
18 Q. Exhibit 1001 is the document U.S.
19 Patent No. 10,658,378. Do you recognize this
20 document?
21 **A. Yes. The patent number is**
22 **10,658,378. That is correct.**

18

1 Q. And this is the patent for which
2 you offered opinions in these IPRs, correct?
3 **A. That is correct.**
4 Q. And when you referred to the '378
5 patent, this is the patent that you were
6 referring to?
7 **A. Yes, sir.**
8 Q. And it's the same '378 patent
9 that's at issue in both what you referred to as
10 the first petition and the second petition,
11 correct?
12 **A. Yes.**
13 Q. Other than the documents that are
14 cited in either your first declaration or your
15 second declaration, did you review any other
16 documents in preparation for this deposition?
17 **A. No. But those -- the material**
18 **should be cited in both of my declarations.**
19 Q. And actually, I should clarify.
20 Based on your prior answer, other than the
21 documents cited in your first and second
22 declaration and the patent owner preliminary

19

1 responses and the institution decisions, are
2 there any other documents that you reviewed in
3 preparation for this deposition?
4 **A. No, I don't think so.**
5 Q. You reviewed your first declaration
6 before signing it, correct?
7 **A. Yes.**
8 Q. And did you find any inaccuracies
9 before you signed it?
10 **A. I don't recall any errors. So yes,**
11 **I have reviewed and I believe that what is in**
12 **the declarations are my testimony, and I**
13 **don't -- I don't recall any errors or spelling**
14 **typos or anything in those declarations.**
15 Q. And your first declaration reflects
16 the opinions you formulated in IPR2024-788?
17 **A. Yes.**
18 Q. And your second declaration
19 reflects the opinions you formulated in
20 IPR2024-909?
21 **A. Yes.**
22 Q. And just to be complete here, you

20

1 also reviewed your second declaration before
2 you signed that declaration, correct?
3 **A. Yes.**
4 Q. And did you find any inaccuracies
5 before you signed your second declaration?
6 **A. No, I did not find any inaccuracy**
7 **or error before I signed the declaration ending**
8 **with number 909, what I call petition two, or**
9 **declaration. This is my second declaration.**
10 Q. Is there any information you
11 requested but were not provided in connection
12 with declaration -- with your first
13 declaration?
14 MR. SAGDEO: Objection to form.
15 **A. What exactly do you mean, did I**
16 **request it? I requested to whom?**
17 Q. Is there any information that you
18 requested from anyone, including counsel, but
19 were not provided in connection with your first
20 declaration?
21 **A. No.**
22 Q. Is there any information that you

21

1 requested but were not provided in connection
2 with your second declaration?
3 **A. No.**
4 Q. Did you review the first petition
5 in preparing your first declaration?
6 **A. Can you repeat the question again,**
7 **I'm sorry.**
8 Q. Yes. Did you review the first
9 petition in the process of preparing your first
10 declaration?
11 **A. I don't recall but I don't think**
12 **so.**
13 MR. SAGDEO: And I just instruct
14 the witness not to reveal any privileged
15 information.
16 Q. Did you review the first -- strike
17 that.
18 Did you review the second petition
19 in the process of preparing your second
20 declaration?
21 MR. SAGDEO: Same instruction.
22 **A. I don't think so. But I don't**

22

1 **recall it --**
2 Q. I'm sorry, go ahead.
3 **A. I don't think so but I don't recall**
4 **exactly -- exactly the timing.**
5 Q. Dr. Lee, are you aware of the
6 differences between anticipation and
7 obviousness?
8 MR. SAGDEO: Objection, form.
9 **A. I'm not a lawyer, so --**
10 Q. Is that the end of your answer?
11 **A. On page 9 -- actually, on page 10,**
12 **I understand that -- well, first of all, I**
13 **stated on page 9 that I'm not an attorney, but**
14 **I have instructed in and applied the law as**
15 **described in this section.**
16 **So on page 10, it shows what is the**
17 **ability based on obviousness. The paragraph 20**
18 **stated that the patent is unpatentable and**
19 invalid (sic) as obvious that the subject
20 matter of the claim as a whole would have been
21 obvious to a person of ordinary skill in the
22 art of the claim subject matter, as of the time

23

1 of the invention at issue.
2 It went on, and I state, "The
3 factors include the scope and contents of the
4 prior art," two, "the difference or differences
5 between each claim of the patent and the prior
6 art," and three, "the level of ordinary skills
7 in the art at the time of the patent filed."
8 So that's the -- my understanding
9 of what is obviousness, and -- at least that's
10 part of it, because it went on to explain in
11 the next numbered paragraph 'til paragraph 33.
12 And I don't think you want me to read the whole
13 thing to you.
14 Q. I don't think that's necessary.
15 Just to confirm, though, your understanding of
16 obviousness is summarized in your first and
17 second declarations?
18 **A. Yes.**
19 Q. Do you have an understanding of
20 "anticipation"?
21 MR. SAGDEO: Objection, form.
22 **A. Since I have -- since in this -- in**

24

1 **both declarations, I applied invalidity**
2 **argument of obviousness, I was -- we did not**
3 **discuss what is -- say it again, the term that**
4 **you mentioned?**
5 Q. Anticipation.
6 **A. Anticipation. So I did not look at**
7 **the -- what is anticipation, but I believe**
8 **that -- I believe that based on -- again, I'm**
9 **not an attorney, so it might be -- my**
10 **recollection might not be accurate.**
11 **But my understanding is that**
12 **anticipation is based on prior art and that the**
13 **prior art is expressly or explicitly disclose**
14 **every element of the claim invention, or**
15 **inherently discloses every element of the claim**
16 **limitations, that, unlike obviousness, I**
17 **believe that anticipation does not require or**
18 **does not allow combinations of various**
19 **references or various prior arts. That's my**
20 **recollection.**
21 **Again, since the -- in this**
22 **particular case, for petition one and petition**

25

1 **two, I apply the law of obviousness. So I did**
2 **not explain what is anticipation. So I might**
3 **be missing some details of what is**
4 **anticipation. So correct me if I'm -- if I was**
5 **wrong, but again, I'm not an attorney like you.**
6 Q. In these IPRs, did you find that
7 any of the claims of the '378 patent were
8 anticipated by prior art?
9 MR. SAGDEO: Objection, form.
10 **A. I'm sorry, are you saying that, is**
11 **there any plain limitations that we could have**
12 **applied anticipation?**
13 Q. I'm -- to clarify, I'm asking
14 whether, in these IPR proceedings, you have
15 offered any opinions that the claims of the
16 '378 patent are anticipated by prior art.
17 **A. So you're saying that, are there**
18 **any IPR other than these two that I offered an**
19 **opinion that '378 patent is invalid due to**
20 **anticipation? Is that your question?**
21 Q. No. No, in these two IPRs, have
22 you offered an opinion that the '378 patent

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1 claims are anticipated by prior art?
2 **A. No, I don't think so. That is why**
3 **that in paragraph 19 to 33, I -- I'm sorry, to**
4 **39 -- wait -- let me rephrase that. Let me**
5 **start from the beginning.**
6 **No, I do not think I applied**
7 **anticipation in patent -- in petition number**
8 **one and petition number two to invalidate the**
9 **claims of '378. In the sections of**
10 **understanding of the law, I only describe what**
11 **is obviousness.**
12 **So that was -- that is the --**
13 **obviousness is what we applied, what I applied**
14 **in invalidating the claims that are at issues**
15 **of the '378 patent.**
16 Q. Why did you not include any
17 opinions on anticipation in your first and
18 second declarations?
19 MR. SAGDEO: Objection, form.
20 And you know, I'm actually going to
21 instruct the witness not to answer
22 because that calls for privileged

27

1 information.
2 Q. Dr. Lee, are you following that
3 instruction?
4 **A. Yes.**
5 Q. Dr. Lee, have you ever designed
6 memory devices?
7 **A. Yes.**
8 Q. In what context have you designed
9 memory devices?
10 **A. I'm not sure if I understand the**
11 **question.**
12 Q. Did you design memory devices in
13 connection with any of your past employment?
14 **A. Yes.**
15 Q. Where were you employed when you
16 designed memory devices?
17 **A. Well, I have been with the**
18 **Department of Electrical and Computer**
19 **Engineering at the University of Texas at**
20 **Austin since 1988 to 1993 -- to 2023, or**
21 **35 years.**
22 **As you can see in my CV, there**

28

1 **are -- which has more than 600 publications,**
2 **and many of those related to semiconductor**
3 **memory devices.**
4 Q. Are you saying that in connection
5 with some of those publications, you designed
6 memory devices?
7 **A. Well, not only designing of memory**
8 **devices, but also fabricating the memory**
9 **devices and testing the memory devices, and**
10 **understand the memory devices and report the**
11 **findings of the characteristics and**
12 **understanding of memory devices in the form of**
13 **general publications or conference proceedings.**
14 Q. Is there a particular portion of
15 memory devices that you focus on, or is your
16 work directed to the entire device?
17 **A. I'm not sure I understand your**
18 **question. What do you mean by "portion of the**
19 **memory devices"?**
20 Q. Is there a part of the device less
21 than the whole that your work focuses on, or is
22 your work directed to the entire device?

29

1 **A. Well, it depends on the research.**
2 **Some we look at the entire device, some we look**
3 **at a portion of the memory device, such as the**
4 **certain layers or process steps related to the**
5 **fabrications of the memory device.**
6 Q. What types of materials have you
7 used in the memory devices that you designed?
8 **A. Say it again.**
9 Q. What types of materials have you
10 used in the memory devices that you've
11 designed?
12 **A. What types of the material? Are**
13 **you meaning -- do you mean the substrate**
14 **material, or the material involved in**
15 **fabricating the memory devices?**
16 **Well, let me answer your question**
17 **perhaps this way, that the memory devices that**
18 **I looked at consist of various material.**
19 **Silicon, S-I-L-I-C-O-N, S-L-I-I-C-O-N.**
20 **Silicon. Okay.**
21 **It consists of semiconductor**
22 **material such as silicon, or III-V material**

30

1 **such as gallium arsenide. Gallium arsenide,**
2 **G-A-L-I-U-M, and arsenide, A-R-S-E-N-I-D-E,**
3 **sorry. And there are other materials which**
4 **include insulating material, conductive**
5 **material, and other materials within the**
6 **device.**
7 (Reporter clarification.)
8 Q. I assume for the conductive --
9 strike that.
10 I assume for the metal layers in
11 the device you used -- strike that.
12 For the conductive portions of the
13 device, did you use metal materials?
14 **A. Yeah, it could be metal, or it**
15 **could be other ceramic material which is --**
16 **which is -- which could be a conductive**
17 **material. It could be compound, such as**
18 **titanium nitride.**
19 **It could be semiconductor, like**
20 **doped polysilicon, D-O-P-E-D, poly, P-O-L-Y,**
21 **silicon, S-I-L-I-C-O-N. Polysilicon is one**
22 **word. So it could be -- when you say**

31

1 **"conductor," it could be metal, such as copper,**
2 **aluminium, tungsten, T-U-N-G-S-T-E-N.**
3 **It could be semiconductor which is**
4 **polysilicon. It could be metal compound such**
5 **as titanium nitride, N-I-T-R-I-D-E. So there's**
6 **various material that can be used that are**
7 **involved in building semiconductor memory**
8 **devices.**
9 (Reporter clarification.)
10 Q. Did any of the memory devices that
11 you designed include stacks of metal layers in
12 the memory structure?
13 **A. Stack of metal layers? What do you**
14 **mean by "stack of metal layers"? You mean**
15 **within the device, we have various stack of**
16 **metal layers? I believe so, yes.**
17 Q. And did you include dielectric
18 materials between those metal layers?
19 (Reporter clarification.)
20 **A. Yes. In order to make sure that**
21 **different layers of conductive material are not**
22 **shorted together, in general, we have to put in**

32

1 **dielectric material. Dielectric is**
2 **D-I-E-L-E-C-R-I-C.**
3 **Dielectric materials also are known**
4 **as insulators, such as silicon dioxide, silicon**
5 **nitride, or what is called the high-k**
6 **dielectrics.**
7 Q. So a single memory device can have
8 multiple metal layers and multiple dielectric
9 structures?
10 **A. Yes.**
11 MR. BONNY: We've been going for
12 about an hour, Dr. Lee. Do you want to
13 take a break or continue?
14 THE WITNESS: Sure.
15 MR. BONNY: Let's go off the
16 record.
17 THE VIDEOGRAPHER: We are going off
18 the record. The time is 11:57.
19 (Whereupon, an off-the-record
20 discussion was held.)
21 THE VIDEOGRAPHER: And we're back
22 on the record. The time is 12:11.

33

1 Q. Dr. Lee, what is your understanding
2 of the meaning of the term "on" in the '378
3 patent?
4 **A. Meaning of the term "on" in '378.**
5 **So in '378, column four, line 30 -- sorry, line**
6 **20 to 40, it explained that the -- in that**
7 **paragraph, in that section, the '378 patent**
8 **provide spatially relative term such as "on,"**
9 **as you can see that they are intended to**
10 **encompass different orientation, right?**
11 **Including rotating 90 degree or at any**
12 **orientations.**
13 **So in the section, basically**
14 **explained what is the meaning of "on," "above,"**
15 **and "over" in the '378 disclosure. It state**
16 **that it should be interpreted in the broadest**
17 **manner, such as -- such that "on," not only**
18 **meaning directly on something, but also**
19 **included the meaning of "on," something with**
20 **intermediate features or a layer there between.**
21 **And that "above" or "over," not**
22 **only meaning -- not only the meaning of above**

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1 **or over something, but can also include the**
2 **meaning it is above or over something with no**
3 **intermediate feature or layer there between**
4 **that is directly on something.**
5 **Furthermore, in the next paragraph,**
6 **basically, it says that the spatially relative**
7 **terms are intended to encompass different**
8 **orientations that divide in use or operation,**
9 **in addition to the orientation depicted in the**
10 **figures.**
11 **The apparent apparatus may be**
12 **otherwise oriented, "(rotated 90 degrees or at**
13 **other orientation), and the spatially relative**
14 **descriptor used herein might likewise be**
15 **interpreted accordingly."**
16 **So the meaning of "on" in the '378**
17 **patent and its disclosures are clearly**
18 **explained in column four of the '378 patent.**
19 Q. So the term "on" in your view does
20 not include -- or require, rather, does not
21 require direct contact?
22 MR. SAGDEO: Object to form.

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1 **A. Again, it clearly -- I thought you**
2 **said something. No? It clearly stated in**
3 **column four line 23 that "on," "above," or**
4 **"over," or that "on" meaning directly on**
5 **something, but also including -- also includes**
6 **the meaning of on something with an**
7 **intermediate features or a layer there between.**
8 Q. And is it your opinion that "on" is
9 not limited to any orientation?
10 MR. SAGDEO: Object to form.
11 **A. That's correct that in column four**
12 **line 34, it explained that the spatially**
13 **relative terms, such as "on," "above," or**
14 **"over," encompassed different orientations.**
15 **For example, over there it says "rotating**
16 **90 degrees or at other orientations."**
17 Q. So taking your interpretation of
18 the term "on," which you've said allows for
19 intermediate features and is not limited to any
20 orientation, is it your opinion that any
21 structure in a memory device is on every other
22 structure?

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1 MR. SAGDEO: Object to form.
2 **A. I'm not sure I understand your**
3 **question. Can you repeat that again?**
4 Q. Yes. Is it your opinion that any
5 structure in a memory device is on every other
6 structure?
7 MR. SAGDEO: Object to form.
8 **A. Can you give me an example? I'm**
9 **not sure. I mean, this is such a general**
10 **question that you're saying that any layer or**
11 **structure can be, quote, "on" at any -- on any**
12 **other structure in the memory device. Is that**
13 **what you're saying?**
14 Q. That's what I'm asking you.
15 **A. I have not considered such general**
16 **argument that any structure in a memory device**
17 **can be said "on" at any other structures or**
18 **layer in the memory device, but I did conclude**
19 **that parts that are relevant to the claim**
20 **limitations that we considered, using the**
21 **description that we just cited in column four**
22 **of the '378 patent.**

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1 Q. Can you please turn to Exhibit 1001
2 which is the '378 patent?
3 **A. Yes.**
4 Q. And can you please turn to figure
5 two?
6 **A. Hold on one second. Let me -- let**
7 **me rotate. Okay.**
8 Q. You have figure two in front of
9 you?
10 **A. Yes.**
11 Q. I'd like to just ask about a couple
12 of the features in figure two of the '378
13 patent. To start with, is isolation structure
14 233 on the alternating -- is isolation
15 structure 233 on the alternating
16 inductor/dielectric stack 210?
17 (Reporter clarification.)
18 **A. I have not considered that because**
19 **the claim limitation involved the term "on" is**
20 **related to whether the isolation structure is**
21 **with the substrate, or whether the substrate is**
22 **with an isolation structure.**

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1 **So I have not considered whether**
2 **the 233 in figure two, whether it is on the**
3 **region 210. That's what you're asking; is that**
4 **right?**
5 (Reporter clarification.)
6 Q. That's right. Yeah, I'm just -- I
7 know you've explained your understanding of the
8 term "on." And so now I'm asking you to apply
9 that term as you understand it.
10 And it sounds like you're not able
11 to tell me whether 233 is on 210?
12 MR. SAGDEO: Objection to form.
13 **A. Why -- what is written on column**
14 **four, that the 233, which is the STI, shadow**
15 **trench isolation -- shadow trench, T-R-E-N-C-H,**
16 **isolation -- whether it is on the element 210,**
17 **which is layers of word lines -- word lines,**
18 **W-O-R-D, lines -- and dielectric layers.**
19 **I suppose if you rotate figure two**
20 **90 degrees, one could say that 233, although**
21 **not directly on 210, but is above 210. And so**
22 **in the broadest manner, I guess one could still**

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1 **say that it is not directly on but diagonally**
2 **on 210.**
3 **But again, I did not consider the**
4 **questions of whether 233 is on 210 or not. But**
5 **I focused on the relevant element involved in**
6 **the claim imitations.**
7 Q. Applying your understanding of the
8 term "on" from the '378 patent, is -- are bit
9 lines 250 on the isolation structure 233?
10 MR. SAGDEO: Object to form.
11 **A. Are you referring to figure two?**
12 Q. Yes. In figure two -- and let me
13 ask a different question actually.
14 In figure two, is the isolation
15 structure 233 on the bit lines 250?
16 MR. BONNY: Object to form.
17 **A. In my declaration, I have not**
18 **considered whether the region 233 is above the**
19 **layers 250. However, based on the description**
20 **in column four, that spatially relative terms**
21 **are intended to encompass different**
22 **orientations of the device, including rotating**

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1 **90 degree or at any other -- or other --**
2 **sorry -- rotate 90 degrees or at other**
3 **orientations.**
4 **So I suppose that one can rotate**
5 **figure two, or the device described in figure**
6 **two, say, in 45 degree, either plus or minus 45**
7 **degree, and 233 will be on the bitlines 250.**
8 **B-I-T-L-I-N-E-S.**
9 (Reporter clarification.)
10 Q. Applying your understanding of the
11 term "on" from column four of the '378 patent,
12 are there any structures in figure two that are
13 not on every other structure?
14 MR. SAGDEO: Objection, form.
15 **A. I have not considered that scenario**
16 **and that hypothetical question, but the way the**
17 **column four described what is considered to be**
18 **on, which include rotating the apparatus 90**
19 **degree or at any other orientation,**
20 **specifically for figure two, it might be.**
21 **But at this point, I cannot**
22 **identify whether any structure is -- I mean,**

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1 personal of ordinary skill in the art would
2 apply that definition. That -- that "on" is so
3 general that it's just not -- does not
4 include -- does not limit it to directly on,
5 and it can be rotating the apparatus by 90
6 degree or at any orientation.
7 Such broad description of the
8 meaning of "on," "above," or "over" in such
9 broadest manner would seem to suggest that, at
10 least specifically for figure two, that any
11 element, by rotating the structure in figure
12 two at different orientation, could probably
13 consider it "on" at other elements.
14 But once again, that was not the
15 issue that I was considered in invalidating the
16 claim in these petitions, petition one and
17 petition two.
18 Q. Are you able to think of any
19 examples, and it doesn't have to be limited to
20 figure two, but are you able to think of any
21 examples of a structure that's not on another
22 structure?

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1 MR. SAGDEO: Object to form.
2 A. Let me take a look at -- sorry.
3 Sorry, I'm taking some time at this point. Are
4 you saying including structure that I --
5 outside of this -- of this '378 patent?
6 Q. I'm wondering, under the meaning of
7 "on" from the context of the '378 patent, are
8 you able to come up with any examples or
9 hypotheticals where one structure is not on the
10 other structure?
11 MR. SAGDEO: Object to form.
12 A. Not included outside of '378,
13 right?
14 Q. To clarify, I'm fine with -- I'm
15 not interested in any example in the '378 or
16 otherwise, but under your interpretation of
17 "on" from column four of the '378 patent.
18 So using that interpretation of
19 "on," can you provide any examples anywhere of
20 a structure that's not on another structure?
21 MR. SAGDEO: Objection, form.
22 A. Let's see. Okay. Let me take a

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1 look at this. So I can think of it in
2 semiconductor fabrications. Particles that are
3 involved in vacuum chamber during processing,
4 they are suspended in space, right, during some
5 deposition process such as chemical vapor
6 deposition, and they're not in contact with any
7 other structure in the substrate.
8 So I would think that that might be
9 an example of a structure or particle that is
10 not on any other structure, for example.
11 Q. Are you saying that "on" requires
12 direct contact?
13 MR. SAGDEO: Object to form.
14 A. Well, I'm saying that when --
15 during the deposition, when the film is in the
16 transient state, as it moves through the gas
17 phase, before it lands on the substrate, one
18 might consider that, during the deposition,
19 that it's not glorifying the meaning of "on"
20 because they are suspended in space.
21 In column four, the description
22 seems to describe spacial relative terms of

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1 layers that are within the structure of the
2 device. So when you have a layer that is
3 floating and suspended in space, column four
4 doesn't seem to include such situation in
5 explaining the meaning of "on."
6 Q. Are there any other examples that
7 you can think of outside of the vacuum chamber
8 situation?
9 MR. SAGDEO: Object to form.
10 A. So it appears that column four
11 described a broad definition of "on" that
12 allows for direct or indirect contact, that is
13 indirect contact with intermediate layers of
14 different orientations.
15 So in addition to a particle in
16 space during vacuum deposition, such as
17 chemical vapor deposition process, perhaps
18 another structure may be that when you have
19 electrostatic levitations, right, or
20 electromagnetic levitations, in which a layer
21 or a structure is held in a position in space
22 such that it is not physically on, either

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1 directly on or indirectly on any other
2 structure, such as a substrate.
3 So that could be another example
4 where you have electrostatic or
5 electromagnetics levitations. So again, I have
6 not considered such hypothetical question in a
7 scenario, but top of my head, those are the two
8 examples that I can think of.
9 Does that make sense, sir?
10 Q. So just to clarify then, for the
11 purposes of applying the term "on," based on
12 your understanding of column four of the '378
13 patent, it sounds like as long as two
14 structures are directly or indirectly
15 contacting one another as part of the same
16 physical structure, like a memory device, then
17 they would be considered on each other?
18 MR. SAGDEO: Object to form.
19 A. You're throwing in a term "art of."
20 I did not say that. I'm saying that a person
21 of ordinary skill in the art reading column
22 four, that column four give a broad definition

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1 of "on" that allows for direct or indirect
2 contact, "indirect contact" meaning having
3 intermediate layers or different structures and
4 different orientations.
5 So to answer your question, the two
6 examples that I give are structure that are
7 levitated above the substrate, such as
8 particles in the vacuum chamber during the
9 depositions, or structure that are levitated by
10 electrostatic force or electromagnetic force.
11 At this point, those are the two
12 examples that I can think of, but it appears
13 that, based on the understanding of person of
14 ordinary skill in the art reading such broad
15 explanation of what "on" is, that a device that
16 has layers that are either directly on or
17 indirectly contacting the substrate, it
18 probably allows that any layers or any
19 structure in the device perhaps can be
20 considered on other layers or any structures of
21 the device.
22 But once again, in my declaration,

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1 I only considered the relevant layers and
2 structures related to the claim limitations. I
3 have not and I did not consider such broad
4 hypothetical questions about any layers or any
5 other example in the universe.
6 Q. All right. I'd like to switch
7 topics now. I have shared the document that's
8 been marked as Exhibit 1006, which is U.S.
9 Patent No. 10,354,980 to Mushiga,
10 M-U-S-H-I-G-A.
11 Please let me know when you have it
12 up, Dr. Lee.
13 (Reporter clarification.)
14 A. This is the '980 patent to Mushiga?
15 Q. That's correct.
16 A. Yes, I just had it open.
17 Q. This is one of the prior art
18 references that you opined on in your first
19 declaration, correct?
20 A. That is correct.
21 Q. Could you please turn to figure 11
22 and rotate --

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1 A. Sorry, let me -- doesn't seem to be
2 rotating, it seems like. Figure 11? Yes, I
3 got it.
4 Q. Are you familiar with the various
5 components that are shown in figure 11 of
6 Mushiga?
7 A. Yes, I'm familiar with various
8 layers, especially the one that I used for
9 invalidity document in my declaration --
10 (Reporter clarification.)
11 Invalidity analysis.
12 Q. Do you see backside insulating
13 layer 306?
14 A. Yes.
15 Q. What is the function of that
16 structure?
17 A. What is what?
18 Q. What is the function of backside
19 insulating layer 306?
20 A. Well, 306 is an insulating layer.
21 And it's on the backside of the substrate. So
22 it is used to insulate the semiconductor

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1 **substrate from any other potential conductor or**
2 **semiconductor.**
3 Q. And how was backside insulating
4 layer 306 formed?
5 **A. Well, it's formed by depositions of**
6 **insulating material, for example, silicon oxide**
7 **deposition.**
8 (Reporter clarification.)
9 Q. Do you see insulating material
10 liner layer 303 in figure 11?
11 **A. You mean 302?**
12 Q. Yes. I'm sorry. I misspoke.
13 Do you see insulating material
14 liner layer 302 in figure 11?
15 **A. Yes.**
16 Q. What is the function of component
17 303 -- sorry, 302. What is the function of
18 component 302?
19 **A. Well, the insulating material liner**
20 **302 is also an insulator which can be deposit,**
21 **for example, a plasma-enhanced physical or**
22 **physically deposition, so-called PECPD process.**

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1 **So the purpose of this 302 layer is**
2 **to make sure that the structure -- to make sure**
3 **that conductors are not shorted together, for**
4 **example, region 310, which is a metal film**
5 **layer, that it should not be shorted to the**
6 **region nine, which is a semiconductor layer I**
7 **believe.**
8 **So with the insulating layer 302,**
9 **that basically is used to prevent a shorting of**
10 **these two regions, 310 and number nine.**
11 Q. And component nine is a
12 semiconductor layer, correct?
13 **A. Yes. Number nine is a**
14 **semiconductor substrate layer. So --**
15 Q. Did you say -- go ahead.
16 **A. So that the insulating material**
17 **liner 302 is providing an electrically**
18 **isolation of adjacent regions.**
19 (Reporter clarification.)
20 Q. Do you see insulating material
21 layer 760?
22 **A. Yes.**

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1 Q. What is the function of 760?
2 **A. 760 is also an insulator. So it's**
3 **providing an insulating function so that**
4 **conductive material would not be shorted**
5 **inadvertently.**
6 Q. Are you able to tell which specific
7 conductive material 760 is providing insulation
8 for?
9 **A. Well, 76- -- you mean 760?**
10 Q. Yes, 760.
11 **A. 760 provided insulations wherever**
12 **it contact to conductor material.**
13 Q. Do you see first retro-stepped
14 dielectric material portion 165?
15 **A. Right, yes.**
16 Q. What is that structure?
17 **A. 165 is also an insulator, which**
18 **provide an insulation to avoid conductor**
19 **regions shorted together. So it's providing an**
20 **insulation function.**
21 Q. Do you see second retro-stepped
22 dielectric material portion 265?

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1 (Reporter clarification.)
2 **A. Yes.**
3 Q. What is that structure?
4 **A. That structure is also a insulating**
5 **layer, which provide insulation function to**
6 **ensure that adjacent conductors would not be**
7 **inadvertently shorted together.**
8 Q. Do you see inter-tier dielectric
9 layer 180? That's I-N-T-E-R dash T-I-E-R.
10 (Reporter clarification.)
11 **A. Yes.**
12 Q. What is the function of that
13 structure?
14 **A. The structure 180 is also a**
15 **dielectric layer, which provide an insulation**
16 **function that it insulate adjacent conductive**
17 **material so that they don't inadvertently short**
18 **it together.**
19 Q. Is structure two -- strike that.
20 Is structure 760 deposited before
21 the staircase structure is formed?
22 **A. Can you repeat that again? Is 760**

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1 **deposit before which layer?**
2 Q. Is 760 deposited before the
3 staircase structure is formed?
4 **A. I believe so.**
5 Q. Is layer 165 deposited after the
6 staircase structure is formed?
7 **A. I believe so. I'm not -- I have to**
8 **go back and look at it because this is not a**
9 **method claim, but I believe that isolation**
10 **region 165 was deposited after the staircase.**
11 Q. Is that also true for structure
12 265?
13 **A. Yes, I believe that 265 was**
14 **deposited after the staircase was deposited.**
15 Q. Do you see second insulating cap
16 later 270? And that's cap, C-A-P.
17 (Reporter clarification.)
18 **A. 270?**
19 Q. Yes.
20 **A. Yes.**
21 Q. What is the function of 270?
22 **A. 270 is what is called an insulating**

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1 **cap layer. So it's also serving a function of**
2 **insulation, that they provide an insulation**
3 **between adjacent conductive material so that**
4 **those conductive material would not be shorted**
5 **inadvertently.**
6 Q. Is the first contact level
7 dielectric layer 280?
8 **A. Yes.**
9 Q. What is the function of 280?
10 **A. 280 is also a dielectric layer,**
11 **also called insulating layer. So it provide**
12 **the function of insulation, which prevent**
13 **adjacent conductive material be shorted**
14 **inadvertently.**
15 Q. Does second contact level
16 dielectric layer 282 have that same function?
17 **A. 282 is also a dielectric layer. So**
18 **it served the function of insulation.**
19 Q. Do you see line level dielectric
20 layer 284?
21 **A. Yes.**
22 Q. What is the function of 284?

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1 **A. 284 is also a dielectric layer,**
2 **which means it, sort of, is used to serve a**
3 **function of insulation and to prevent adjacent**
4 **conductive material to be shorted**
5 **inadvertently.**
6 Q. And lastly, do you see additional
7 interconnect level dielectric layer 290?
8 (Reporter clarification.)
9 **A. Yes.**
10 Q. What is the function of 290?
11 **A. 290 is also a dielectric layer**
12 **which is used to serve the function of**
13 **insulation and to prevent adjacent conductive**
14 **material shorted inadvertently.**
15 Q. Can you please turn to paragraph
16 204 of your first declaration?
17 **A. 204.**
18 Q. Which is Exhibit 1003 in
19 IPR2024-788.
20 **A. Yes.**
21 Q. And in particular, I'd like to
22 point you to the figure that's at the end of

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1 that paragraph on the following page.
2 **A. Meaning the top page of the next**
3 **page?**
4 Q. Correct. At the top of page 129,
5 you have an annotated version of figure 11,
6 correct?
7 **A. Yes.**
8 Q. And in that figure, you labeled a
9 portion of the device as a dielectric
10 structure?
11 **A. Yes.**
12 Q. What was your process for
13 determining which components to combine as what
14 you have labeled as a dielectric structure?
15 MR. SAGDEO: Object to form.
16 **A. What do you mean, "the process"?**
17 Q. How did you -- how did you
18 determine which dielectric structures to
19 combine as the claimed dielectric structure?
20 **A. So in paragraph 204, near the end**
21 **of the paragraph, I said "dielectric**
22 **structure," which include elements 760, 165,**

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180, 265, and 586, are the dielectric structure.

And so I formed the grouping of this dielectric, basically is used to serve the functional and structural integration taught by Mushiga, and it's understood by a person of ordinary skill in the art.

So I determined that those elements together will meet the limitations of the claimed element of dielectric structure in claim 15 point H. H as in Henry.

(Reporter clarification.)

Q. Just to make sure I understand, you chose the particular dielectric structures in the Mushiga reference that you could combine to read on limitation 15.H of the '378 patent?

A. That is correct.

MR. BONNY: I think we've been going for about another hour and a half, so this would be a good time for a break. Can we go off the record?

THE WITNESS: Okay. How many

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minutes?

THE VIDEOGRAPHER: Sorry, I was on mute. We went off the record at 13:25.

(Whereupon, an off-the-record discussion was held.)

THE VIDEOGRAPHER: We are back on the record. The time is 13:35.

Q. Dr. Lee, I'd like to ask about some of the terms in claim 15 of the '378 patent. So feel free if you'd like to pull up Exhibit 1001 and turn to claim 15.

A. Okay.

Q. Claim 15 recites a substrate with an isolation structure. What is a substrate?

A. So in column four, line 41, it describe what is a substrate. It says that the substrate -- the term "substrate" refer to a material on which subsequent material layers are added or otherwise disposed, and that a substrate can be a layer, it can include one or more layers therein, and/or can have one or more layers thereupon, there above, and/or

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there below.

Q. If there are multiple layers in that passage that you just read, are each of those individually a substrate, or is it collectively a substrate, or both?

A. Well, as I explained in paragraph 172 in my petition one, my declaration of petition one, Exhibit 1003, there I said that Mushiga discloses a first semiconductor substrate eight on which other layers are added.

So layer eight, highlighted in yellow in figure 11 on page 105 of my declaration, Exhibit 1003, is what disclose by Mushiga as a substrate.

Q. So my question wasn't about Mushiga. I was asking about the '378 patent and its disclosure.

Let's just move on to the next question.

What is an alternating conductor/dielectric layer stack as we cited in

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claim 15 of the '378 patent?

A. Well, those are the word lines and insulating layers separating word lines as shown in figure 11. I believe is label 132 and 232 as the insulating layers, and 146 and 246 is electrically conductive layers.

Q. I'm sorry, which figure -- are you referring to figure two?

A. Oh, I thought you were talking about my -- the Mushiga.

Q. Oh, sorry, so these questions I'm not asking anything about Mushiga. I'm just asking about the '378 patent.

So in the '378 patent, what is an alternating conductor/dielectric layer stack?

A. So if you're referring to figure two?

Q. If you want to refer to figure two, that's fine. But I'm just wanting to understand what your understanding is of the term "alternating conductor/dielectric layer stack."

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1 A. So the -- what that refer to is the
2 dielectric -- I mean, the -- it refer to the
3 word line. The word lines, for example, in
4 figure two -- 206 is a conductive layers, and
5 these conductive layers are separated by
6 dielectric layers 208.
7 So those are the -- what claim 15
8 refer to as the alternating conductor
9 dielectric layers.
10 Q. So the alternating
11 conductor/dielectric layer stack includes
12 multiple conductor structures and multiple
13 dielectric structures?
14 MR. SAGDEO: Object to form.
15 A. As I mentioned, it's in -- for
16 example, column eight, they specifically said
17 that the arrayed device can include a polarity
18 of mainstream 204 that extend through a
19 polarity of conductive -- conductor layer 206
20 and dielectric layer 208 pairs.
21 The polarity of
22 conductor/dielectric layer pairs are referred

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1 to as alternating conductor dielectric stack
2 210.
3 So a person of ordinary skill in
4 the art reading the claim terms and alternating
5 conductor/dielectric layer stack to mean the
6 word lines separated by polarity of dielectric
7 layers.
8 Q. Claim 15 recites that the
9 alternating conductor/dielectric layer stack --
10 (Reporter clarification.)
11 I'll just re-ask the question to
12 get a clean record.
13 Claim 15 recites that the
14 alternating conductor/dielectric layer stack
15 abuts a side wall surface of the dielectric
16 structure. Do you see that?
17 A. Yes.
18 Q. What is a side wall surface of the
19 dielectric structure?
20 A. Well, '378 identify what is a side
21 wall -- what is a dielectric structure. And
22 the border, the border, one can think that the

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1 border, or alternatively called the side wall
2 surface, is -- is the dielectric -- is the --
3 for example, if you look at figure -- figure
4 two in '378 patent, that the side wall is
5 between structure 210 and insulating layer 232
6 as the side wall, that is the side wall surface
7 of the dielectric structure.
8 Q. What is the function of the
9 dielectric structure in the '378 patent?
10 A. Like any other dielectric
11 structure, the side wall -- the insulating --
12 the dielectric structure is to serve the
13 function of insulations to avoid neighboring
14 conductor be shorted inadvertently.
15 Q. What are the functions of the
16 channel structures recited in claim 15 of the
17 '378 patent?
18 (Reporter clarification.)
19 A. Well, the channel structure are
20 basically the memory stack structure. It's
21 where the memories are stored in the NAND
22 memory chip. That's what is called the channel

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1 structure.
2 Q. Just to clarify, did you say "NAND
3 memory structure," as in N-A-N-D?
4 A. Yes.
5 Q. In claim 15, the channel structures
6 must extend vertically through the alternating
7 conductor/dielectric layer stack, correct?
8 A. That's what the claim says.
9 Q. What does "vertically" mean in that
10 context?
11 A. "Vertically" means 90 degree with
12 respect to the orientation of the substrate.
13 Q. What are the functions of the slit
14 structures, S-L-I-T, in claim 15 of the '378
15 patent?
16 A. So -- let's see. I'm looking for
17 an explanation in 1001, the '378 patent. I
18 don't think you can explain specifically what
19 the function is, but in general, for 3D NAND,
20 the split structure is basically providing the
21 mechanical support, what -- one of the many
22 function, it provide mechanical and structural

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1 support for various structure.
2 It also -- because the slit
3 structure consists of -- yeah, consists of
4 conductive layer, for example, 114 in figure
5 1A, and so it serve, not only for supporting
6 the structure of the NAND, but it also
7 functioned as a common source contact for an
8 array of NAND strain.
9 And it also served as a function of
10 dividing a 3D memory device into multiple
11 memory blocks. So I'm reading this in
12 figure -- in column six, line 25, 24 to 29.
13 So there it says that a function is
14 a common source contact for an array. It's
15 also served as a structure that divide the
16 memory device into multiple blocks, and so that
17 it can operate more effectively.
18 But in addition, it also provides
19 structural support. I don't know if this
20 patent talk about that. And also provides heat
21 dissipation.
22 (Reporter clarification.)

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1 Q. And what is the function of the
2 local contact recited in line 15 of the '378
3 patent?
4 A. So in column 11 line 15, around 15,
5 it says that local contact is essentially
6 provide a conducting layer with memory array
7 structures, such as the NAND string 204,
8 S-T-R-I-N-G-S, 204, slit structures 226,
9 conductive layer or word line 206, and the
10 staircase structure 212.
11 So the local contact basically is
12 an interconnect to connect the memory array
13 structure to, for example, external -- external
14 input, outputs.
15 (Reporter clarification.)
16 Q. And what is the through array
17 contact in claim 15 of the '378 patent?
18 A. So the function of through array
19 contact is, basically it's a vertical
20 electrical conductivity. So for example, in
21 figure 1A is the region 120. So it served as
22 basically vertical electrical contacts for

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1 various purposes, such as connecting to
2 peripheral circuits.
3 I'm trying to locate the section
4 that specifically describes that in
5 Exhibit 1001. So for example, in figure two,
6 element 234 is an example of through array
7 contact that, according to the specification,
8 column five line 35 through 40, is an
9 interconnect structure that allows contacts to
10 various memory array structure to be fabricated
11 in a number of -- in a number of -- in a
12 limited number of steps, a single step or two
13 steps, thereby reducing the process of
14 complexity and manufacturing costs.
15 So in essence, the through array
16 contact simply provide electrical connection
17 between the 3D memory array and the peripheral
18 circuits. So that's essentially the structure
19 and the functions of through array contacts or
20 the patent contact, T-A-C, TACs.
21 (Reporter clarification.)
22 Q. In claim 17 of the '378 patent,

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1 what is your understanding of the term "through
2 array contact region"?
3 MR. SAGDEO: Object to form.
4 A. Well, I think that perhaps through
5 array -- let's see -- so through array contacts
6 are the actual electrical -- electrical --
7 vertical electrical conductivity, whereas
8 through array contact regions include the
9 isolation around it. So it's a region consist
10 of the TAC, the contact itself, and the
11 insulation around it.
12 So for example, in figure 1A of the
13 '238 patent, the TAC I believe is 126, the TAC
14 structure is 126, and it is formed within the
15 TAC regions 120. So 120 included the
16 dielectric structure 124.
17 Did I answer your question?
18 Q. I think so. So it's -- the TAC
19 region includes those items you listed, and
20 it's next to the alternating
21 conductor/dielectric layer stack?
22 A. No. I didn't say that. I said

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1 that in column six line 14, TAC structure is
2 the 126, which is the vertical electrical
3 conductor itself, while 120 is the TAC regions,
4 which include the dielectric structure 124.
5 So basically, you have a dielectric
6 region, and inside the dielectric region
7 there's 126 -- which I say TAC structure. So
8 the TAC structure is the conductor itself, and
9 the TAC regions include the TAC structure and
10 the dielectric structure.
11 Does that make sense?
12 Q. Yeah. I think so. Does the TAC
13 region include anything else?
14 MR. SAGDEO: Object to form.
15 A. In the example of figure 1A and
16 related figures, the TAC region seems to
17 include only the TAC structure and the
18 surrounding dielectric structure.
19 Q. I wanted to switch to your second
20 declaration, Exhibit 1003 in IPR2024-909. In
21 that declaration, in your second declaration,
22 you only opined on one ground of invalidity

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1 based on the Toyama reference, correct?
2 Toyama, T-O-Y-A-M-A.
3 (Reporter clarification.)
4 A. I believe so, yes.
5 Q. Why didn't you include a ground
6 based on the Mushiga reference?
7 MR. SAGDEO: I'm going to instruct
8 the witness not to answer as that calls
9 for privileged information.
10 Q. Dr. Lee, are you following that
11 instruction?
12 A. Yes, sir.
13 Q. Claim one of the '378 patent
14 recites an epitaxial layer, E-P-I-T-A-X-I-A-L.
15 Do you see that?
16 A. Yes.
17 Q. What is an epitaxial layer?
18 A. Well, as I explained in paragraph
19 59 on my declaration, epitaxial growth in
20 semiconductor manufacturing, basically
21 involving a deposition of crystalline structure
22 of the materials on a crystalline substrate in

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1 the way that the crystallographic orientation
2 of the deposit material matches that of the
3 substrate.
4 So epitaxial layer is the deposit
5 crystalline layer formed on a crystalline
6 substrate through a process called epitaxial
7 growth.
8 Q. Claim one of the '378 patent also
9 recites an etch, E-T-C-H, stop plug. What is
10 that structure?
11 (Reporter clarification.)
12 A. Well, in general, an etch stop
13 structure is to prevent the etch from removing
14 material that are not intended to be removed.
15 Q. Going back to the term "epitaxial
16 layer," for that term, does the epitaxial
17 crystallographic orientation have to match the
18 substrates exactly?
19 A. In general, that epitaxial growth
20 is allowing -- involving a deposition of a
21 single crystal material on a single crystal
22 substrate in such a way that the orientation of

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1 the deposit material matches that of the
2 substrate.
3 Q. Sorry, just a moment.
4 Does -- claim one also recites a
5 contact layer. What is a contact layer as used
6 in claim one of the '378 patent?
7 A. Claim one of '378? Are you talking
8 about claim one?
9 Q. Yes. So in the final limitation of
10 claim one of the '378 patent, the claim recites
11 one or more contact layers and goes on.
12 So in that context there, what is a
13 contact layer?
14 A. Well, a contact layer in claim 1.J,
15 it says that one or more contact layers under
16 one or more TACs, T-A-C-S, the one or more
17 channel structure, and the slit structures.
18 So in column 11 line 51, it says
19 that a contact layer 242 can include dielectric
20 layers, can include a dielectric layer and a
21 polarity of contact. 246, for example, vias,
22 V-I-A-S, in the dielectric layer.

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Q. All right. I just have a couple of questions about claim 18 of the '378 patent. So claim 18 recites in part an "etch stop plug interposed between each local contact of the local contacts and each channel structure of the channel structures."

Do you see that?

A. Claim 18. Yeah, I see that.

Q. "Each local contact" in claim 18 is referring back to the local contacts recited in claim 15, correct?

A. That's right, yeah. Each -- each local contact is referred to what is described in claim 15, because claim 18 said that the 3D memory device of claim 15, further comprising an "etch stop plug interposed between each local contact of the local contacts and each channel structure of the channel structures."

So therefore, yes, the claim 18 depends on claim 15.

Q. And similarly, the phrase "each channel structure" in claim 18 refers back to

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the channel structures recited in claim 15, correct?

A. That is correct, that claim 18 depends on claim 15.

MR. BONNY: I think I may be wrapping this up. I just want to take a break to gather my thoughts. So can we go off the record, please?

THE VIDEOGRAPHER: Yes. We are going off the record. The time is 14:23.

(Whereupon, an off-the-record discussion was held.)

THE VIDEOGRAPHER: We are back on the record. The time is 14:28.

MR. BONNY: I have no further questions for Dr. Lee.

THE WITNESS: I -- during the break, I was looking at my declaration for petition two. Okay.

MR. BONNY: Sorry, there's no pending question.

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MR. SAGDEO: If counsel has no questions --

THE WITNESS: Okay. I'm sorry.

MR. SAGDEO: -- we're done.

THE WITNESS: Okay. Thank you.

(Continued on next page to include jurat.)

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MR. BONNY: Yes, I have no further questions.

MR. SAGDEO: No redirect.

THE VIDEOGRAPHER: Okay. If there's nothing further, this concludes the deposition of Jack Lee. The time is 14:29.

(Whereupon, at 2:29 p.m., the examination of this witness was concluded.)

_____
DR. JACK LEE

Subscribed and sworn to before me this _____ day of _____, 2025.

_____
NOTARY PUBLIC

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1 EXAMINATIONS
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1 C E R T I F I C A T E
2 STATE OF NEW YORK)
3 ss.:
4 STATE OF NEW YORK)
5 I, DORENE GLOVER, a Notary Public for
6 and within the State of New York, do hereby
7 Certify:
8 That JACK LEE, Ph.D., the witness whose
9 deposition is hereinbefore set forth, was duly
10 sworn by me before the commencement of such
11 deposition and that such deposition was taken
12 before me and is a true record of the testimony
13 given by such witness.
14 I further certify that the adverse party,
15 Petitioner, was represented by counsel at the
16 deposition.
17 I further certify that the deposition of
18 JACK LEE, Ph.D., occurred remotely via
19 videoconfernce on Tuesday, January 28, 2025,
20 commencing at 11:00 a.m. to 2:29 p.m..
21
22

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1 I further certify that I am not related to
2 any of the parties to this action by blood or
3 marriage, I am not employed by or an attorney to
4 any of the parties to this action, and that I am
5 in no way interested, financially or otherwise,
6 in the outcome of this matter.
7
8 Witness my hand this 4th day of February, 2025.
9
10 Dorene Glover
11 DORENE GLOVER
12
13
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80

1 STATE OF NEW YORK)
2 ss.:
3 COUNTY OF BRONX)
4
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6 the following reasons:
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