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

FORCE MOS TECHNOLOGY, CO.,)
LTD.,)
)
Plaintiff,)
) Civil Action
v.) No. 2:22-cv-00460-JRG
)
ASUSTEK COMPUTER, INC.,)
)
Defendant.)

REMOTE ORAL AND VIDEOTAPED DEPOSITION OF
DAVID KUAN-YU LIU, PhD
Tuesday, February 13, 2024

REMOTE ORAL AND VIDEOTAPED DEPOSITION OF DAVID
KUAN-YU LIU, PhD, produced as a witness at the instance
of the Plaintiff, Force MOS Technology Co., Ltd., and
duly sworn, was taken in the above-styled and numbered
cause on the 13th of February, 2024, from 9:40 a.m. to
6:52 p.m., before Sharon Ross, Certified Shorthand
Reporter in and for the State of Texas, reported
remotely by computerized stenotype machine, pursuant to
the Federal Rules of Civil Procedure.

Reported by:
SHARON ROSS, Texas CSR #1961,
Hawaii CSR #432, RMR, CRR, CRC
Realtime Systems Administrator

1 APPEARANCES

2 For Plaintiff Force MOS Technology Co., Ltd.:

3 Michael D. Saunders (via Zoom)
4 Christopher E. Hanba (via Zoom, when noted)
5 Ross Spencer Garsson (via Zoom, when noted)
6 DICKINSON WRIGHT PLLC
7 607 West Third Street, Suite 2500
8 Austin, Texas 78701
9 512.582.6889
10 Msaunders@dickinson-wright.com
11 Chanba@dickinson-wright.com
12 Rgarsson@dickinsonwright.com

13 For Defendants ASUSTeK Computer, Inc.:

14 Richard V. Wells (via Zoom)
15 BAKER MCKENZIE LLP
16 815 Connecticut Avenue, N.W.
17 Washington, District of Columbia 20006
18 202.835.6155
19 Richard.wells@bakermckenzie.com

20 - and -

21 Mackenzie Martin (via Zoom)
22 BAKER MCKENZIE LLP
23 1900 North Pearl Street, Suite 1500
24 Dallas, Texas 75201
25 214.978.3048
Mackenzie.martin@bakermckenzie.com

- and -

Dorian Ojemen (via Zoom)
BAKER MCKENZIE LLP
800 Capitol Street, Suite 2100
Houston, Texas 77002
713.427.5032
Dorian.ojemen@bakermckenzie.com

Videographer:

Matt Richichi, Veritext (via Zoom)

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PROCEEDINGS

THE VIDEOGRAPHER: Okay. Good morning.
This is media unit 1 of the video-recorded deposition of
Dr. David Kuan Liu in the matter of Force MOS
Technologies Company, Ltd. V ASUSTeK Computer, Inc.,
filed in the USDC for the Eastern District of Texas,
Marshall Division, Cause No. 2:22-cv-00460-JRG.

This loca -- the location of this
deposition is being conducted remotely via Zoom
videoconferencing.

My name is Matthew Richichi. I'm
representing Veritext Legal Solutions as the Zoom tech
and videographer.

Today's reporter is Ms. Sharon Ross, also
with Veritext Legal Solutions.

At this time would counsel please identify
yourselves and the parties you represent and after which
Ms. Ross will then swear in the witness?

MR. SAUNDERS: Hi. This is Michael
Saunders of Dickinson Wright for Plaintiff Force MOS
Technology Co. Limited.

Also logged into the session on behalf of
plaintiff I have my colleagues, Chris Hanba and Ross
Garsson.

MR. WELLS: And good morning. This is

1 Richard Wells with the law firm of Baker McKenzie
2 representing ASUSTeK Computer, Inc. With me is
3 Mackenzie Martin and Dorian Ojemen, also with Baker
4 McKenzie law.

5 THE REPORTER: Dr. Liu, could you raise
6 your right hand, please?

7 DAVID KUAN-YU LIU, PhD,
8 having been first duly sworn, testified as follows:

9 EXAMINATION

10 BY MR. SAUNDERS:

11 Q. Good morning, Dr. Liu. Can you state your full
12 name for the record?

13 A. Good morning. My full name is David Kuan-Yu --
14 that's spelled K-U-A-N with a hyphen and Y-U -- and last
15 name is L-I-U.

16 Q. Okay. And do you understand you're here to
17 testify this morning as to a claim construction
18 declaration you submitted in this case?

19 A. Yes, I do.

20 Q. Okay. I'm going to go ahead and introduce that
21 as our first exhibit.

22 MR. WELLS: Okay. If you can, just give us
23 one to get the document.

24 MR. SAUNDERS: Yeah, I'll let you know when
25 it's submitted.

Page 6

1 THE REPORTER: Who was that speaking? Was
2 that Mr. Wells?

3 MR. WELLS: Yes. Sorry.

4 THE REPORTER: I --

5 MR. WELLS: I'll talk because I'm sitting
6 next to Dr. Liu and otherwise we'll get feedback.

7 THE REPORTER: I get it but it was -- your
8 audio was kind of breaking up a little bit.

9 MR. WELLS: Okay. I can sit closer.

10 THE WITNESS: Thank you.

11 (Liu Exhibit 1 marked.)

12 Q. (BY MR. SAUNDERS) All right. And, Dr. Liu, do
13 you now see Exhibit 1 to your deposition in the Exhibit
14 Share application?

15 A. Yes. Yes, I do.

16 Q. Okay. And that's the claim construction
17 declaration you submitted in this case?

18 A. It's waiting to pop up. Now it -- now it's
19 here.

20 Q. Okay. Okay. Do you now see Exhibit 1 as the
21 claim construction declaration you submitted in this
22 case?

23 A. I do see it now.

24 Q. Okay. Dr. Liu, you've been deposed before,
25 correct?

1 A. Yes, I have.

2 Q. About how many times?

3 A. I can't really recall exactly because there
4 were a few of them where there were second depositions.
5 So I would just say roughly about close to nine times.

6 Q. And you're familiar with the rules of
7 depositions. Is that fair?

8 A. I believe I am familiar with them, yes.

9 Q. And you understand if I ask you a question
10 today, I need you to provide a verbal answer such as yes
11 or no instead of nodding your head or gesturing? Do you
12 understand that?

13 A. Yes, I do.

14 Q. And today if I ask you a question and you don't
15 understand it, will you go ahead and ask me to clarify
16 it for you?

17 A. Yes, I will.

18 Q. And you understand you can ask for a break when
19 you need one, but I may ask you to finish answering a
20 pending question? Do you understand that?

21 A. Yes, I do.

22 Q. And is there any reason today why you can't
23 provide complete and accurate testimony?

24 A. No.

25 Q. And this deposition is being conducted remotely

1 via Zoom, correct?

2 A. That's correct.

3 Q. Okay. And where are you physically located
4 right now?

5 A. I'm located physically in Dallas, Texas, in my
6 counsel's office.

7 Q. That's the Dallas office of Baker McKenzie; is
8 that right?

9 A. That's correct.

10 Q. Okay. And who else is present in the room with
11 you?

12 A. As Mr. Richard announced, just counsel,
13 Mr. Richard, and also Mackenzie and Dorian.

14 Q. You'll agree with me you're not going to
15 communicate, you know, with any of those counsel
16 secretly while you're on the record of your deposition.
17 Is that -- will you agree with that?

18 A. Yes, I certainly do.

19 Q. Okay. And you're not going to secretly
20 communicate with anyone else while you're on the record
21 of this deposition. Do you agree with that?

22 A. Yes, I do.

23 Q. And will you agree to tell me if someone is
24 trying to secretly communicate with you while you're on
25 the record of this deposition?

1 A. It's hypothetical; but if I notice someone is
2 trying to secretly communicate with me, I will certainly
3 let both my counsel and you know as well, yeah.

4 Q. Do you have any printed materials with you
5 right now?

6 A. Just the exhibit that -- we opened the box, the
7 box that was delivered.

8 And it was handed to me a binder which
9 contains my declaration among other exhibits.

10 Q. Okay. And so it's a binder in there, and you
11 see that there's a number of documents with numbered
12 tabs?

13 A. That's correct.

14 Q. Okay. So I'll be formally introducing the
15 exhibits today in Exhibit Share; but for your
16 convenience, we've gone ahead and printed out a number
17 of those documents.

18 And I can kind of point you to those
19 exhibits by the tab numbers in your binder for your
20 convenience. Do you understand that?

21 A. Yes, and I appreciate that.

22 Q. Okay. Did you prepare for today's deposition?

23 A. Yes, I did.

24 Q. Okay. How did you prepare for today's
25 deposition?

1 A. I --

2 MR. WELLS: Sorry to interrupt, but I just
3 want to caution the witness not to divulge any
4 privileged attorney/client communications with his
5 answer.

6 A. Excuse me. I spent a bit of time before
7 traveling to Dallas going over some -- some of the --
8 some of my -- part of my declaration and I also spent a
9 few hours with my counsel going through my declaration
10 as well.

11 Q. (BY MR. SAUNDERS) Okay. So you went through
12 your declaration individually as well as in meetings
13 with counsel; is that right?

14 A. That's correct.

15 Q. Okay. About how long total did you take to
16 prepare for today's deposition?

17 A. I would say less than 12 hours.

18 Q. And how long were the meetings that you had to
19 prepare for today's deposition?

20 A. I'm sorry. I don't quite understand the
21 question. The meeting?

22 Q. So of those 12 hours, how much of that was time
23 in meetings with attorneys?

24 A. I spent roughly, I would say, six or seven
25 hours, including breaks and lunchtime; and I also stayed

1 in the office a little bit. So -- but not all the time
2 there would -- I would say was communicating with the
3 counsel.

4 Q. And in your meetings to prepare for today's
5 deposition, was anyone present at any of those meetings
6 other than attorneys from Baker McKenzie?

7 A. No.

8 Q. Can you tell me how long it took to prepare the
9 declaration that is Exhibit 1 to your deposition?

10 A. Could you please clarify the question? Do you
11 mean my time to prepare the declaration, to draft the
12 declaration, or to prepare the declaration for this
13 deposition?

14 Q. How much time did you spend on drafting the
15 declaration that is Exhibit 1 before it was -- you
16 submitted it?

17 A. It's not just drafting, but I also tried to
18 reread it and to -- for example, a certain word may be
19 the -- there might be some grammatic errors and I like
20 to just read -- proofread and correct my misspelling and
21 grammatic errors.

22 So if I take into totality all the time
23 spent, I would say probably less than ten hours.

24 Q. And when did you start working on your claim
25 construction declaration?

1 A. To be honest, sitting right here, I do not
2 recall the exact date that I started doing this
3 declaration; but it would be perhaps a week to two weeks
4 before the declaration was submitted.

5 Q. And who wrote your claim construction
6 declaration?

7 A. I was involved -- this is a collaborative
8 effort. I was involved in writing some key -- key
9 paragraphs of the declaration.

10 Of course, some of these legal matters, I
11 was informed by the counsel and they helped me draft
12 some of the -- that aspect of the declaration.

13 Q. So who were the other collaborators, then,
14 involved in that collaborative effort?

15 A. I would say my contact in terms of the feedback
16 to the declaration in terms of editing the declaration
17 would be Dorian.

18 Q. And that's a counsel at Baker McKenzie,
19 correct?

20 A. That's correct. That's the main contact, not
21 to say that I didn't have any other minor or some other
22 communication.

23 Q. Okay. Thank you. I'll have to beg your
24 pardon. I'm just going to take a few minutes while I
25 have to start introducing some of the additional

1 exhibits. So it will just take a second, but I'll kind
2 of walk through them as I do so.

3 (Liu Exhibit 2 marked.)

4 Q. (BY MR. SAUNDERS) Okay. Dr. Liu, I've
5 uploaded as Exhibit 2 US Patent No. 7,629,634.

6 Can you let me know when you see that?

7 A. I do have access to the printed copy. Do you
8 want me to open up the electronic copy as well?

9 Q. Yeah, it will be easy just so that it's
10 verified you've opened it up and looked at it; but after
11 that, feel free to refer to your printed copy of the
12 '634 patent.

13 A. Yes. My -- Dorian has helped me open up the
14 electronic copy as well.

15 Q. Okay. And so do you understand today that if I
16 refer to the '634 patent, that I'm referring to this
17 patent?

18 A. Yes, I do.

19 Q. Okay. And this is one of the patents that you
20 offered opinions about in your claim construction
21 declaration; is that right?

22 A. That's correct.

23 Q. Okay. All right. Moving on, I'm going to
24 introduce the next exhibit.

25 (Liu Exhibit 3 marked.)

1 (Discussion off the record.)

2 THE WITNESS: Okay. Got it. Thank you.

3 Q. (BY MR. SAUNDERS) All right. Dr. Liu, do you
4 see now that I've uploaded as Exhibit 3 to your
5 deposition US Patent No. 7,812,409?

6 A. Yes.

7 Q. Do you see that?

8 A. Yes. Again, it -- Dorian helped me open it up,
9 and so I see it now.

10 Q. And do you understand, if I refer to the '409
11 patent today, that's the patent I'm referring to?

12 A. Yes, I do.

13 Q. Okay. And this is one of the patents you
14 analyzed in your claim construction declaration; is that
15 right?

16 A. That's correct.

17 Q. And I'm moving on to the next.

18 (Liu Exhibit 4 marked.)

19 Q. (BY MR. SAUNDERS) All right. Dr. Liu, do you
20 now see that I've uploaded as Exhibit 4 to your
21 deposition US Patent No. 7,847,346?

22 A. Yes. Now it's open.

23 Q. Okay. And you understand if I refer to the
24 '346 patent today, I'm referring to that patent?

25 A. Yes, I do.

1 Q. Okay. And this is the third patent that you
2 analyzed in your claim construction declaration in this
3 case; is that right?

4 A. That's correct.

5 Q. All right. Moving on.

6 (Liu Exhibit 5 marked.)

7 Q. (BY MR. SAUNDERS) And I marked as Exhibit 5 to
8 your -- a declaration document previously produced in
9 this case bearing Bates Nos. FORCE-MOS 39 through
10 FORCE-MOS 124.

11 Do you see that document in Exhibit Share?

12 A. Yes, I do.

13 Q. Okay. And does this appear to be the '634
14 patent's file history?

15 A. Just looking at the first few pages, it appears
16 so. I haven't gone through the whole -- all the -- all
17 the pages yet.

18 Q. Okay. Moving on.

19 (Liu Exhibit 6 marked.)

20 Q. (BY MR. SAUNDERS) And, Dr. Liu, I've now
21 uploaded as Exhibit 6 to your deposition a document
22 previously produced with Bates Nos. FORCE-MOS 227
23 through FORCE-MOS 494.

24 Do you see that document?

25 A. Now I do.

1 Q. You do now; is that right?

2 A. Yeah, I do now, yeah.

3 Q. And does that appear to be the file history for
4 the '409 patent?

5 A. Again, just scanning through the first few
6 pages, it appears so.

7 Q. All right. And next document uploading.

8 (Liu Exhibit 7 marked.)

9 Q. (BY MR. SAUNDERS) And then, Dr. Liu, do you
10 see now that I've uploaded as Exhibit 7 to your
11 deposition a document previously produced with Bates
12 Nos. FORCE-MOS 125 to FORCE-MOS 226?

13 Do you see that?

14 A. Yes, I do.

15 Q. And does this appear to be the file history for
16 the '346 patent?

17 A. Again, based on the first few pages I scanned
18 through, it appears so.

19 Q. And you have the documents I've introduced as
20 Exhibits 1 through 7 to your deposition in tabs 1
21 through 7 to -- in your printed binder; is that right?

22 A. That's correct.

23 Q. Okay. Dr. Liu, you have submitted declarations
24 in connection with IPRs of the '634 and '409 patents; is
25 that correct?

1 A. That's correct.

2 Q. Okay. And let me get those uploaded.

3 (Liu Exhibit 8 marked.)

4 Q. (BY MR. SAUNDERS) And do you see I've uploaded
5 as Exhibit 8 to your deposition a declaration you
6 submitted in IPR No. 2024-00093?

7 Do you see that?

8 A. Yes, I do.

9 Q. Okay. And that's the declaration you submitted
10 in connection with the IPR of the '634 patent; is that
11 right?

12 A. It appears so. That's correct.

13 Q. All right. Marking the next exhibit.

14 (Liu Exhibit 9 marked.)

15 Q. (BY MR. SAUNDERS) And you understand today
16 when I'm referring to IPR, I'm referring to an Inter
17 Partes Review proceeding filed with the Patent Trial and
18 Appeal Board of the United States Patent Office?

19 A. Yes, I do.

20 Q. And, Dr. Liu, do you now see I've uploaded
21 Exhibit 9 to your deposition, a declaration you
22 submitted in IPR 2024-00094?

23 A. Yes, I do now.

24 Q. Okay. And that's the declaration you submitted
25 in connection with the IPR of the '409 patent; is that

1 right?

2 A. That's correct.

3 Q. Okay. When did you start working on
4 declarations for the IPRs in the '634 and '409 patents?

5 A. Let me --

6 THE WITNESS: Yeah, I've got mine.

7 A. I believe it was last October, October 2023 to
8 be exact.

9 Q. (BY MR. SAUNDERS) And had you done any work
10 related to any of Force MOS' patents before then?

11 A. No, I have not.

12 Q. And about how much time did you work on a
13 declaration you submitted in connection with the IPRs of
14 the '634 and '409 patents?

15 A. I think the -- it's a little bit difficult
16 because I would have -- I recall having to go through
17 the specification, the patents themselves, review the
18 patents, and then review some prior art and then work on
19 the declaration.

20 So it may be difficult for me to parse it
21 out right now.

22 Q. Okay. What's your best ballpark for the amount
23 of time you spent on those IPR declarations?

24 MR. WELLS: Objection, form.

25 A. Do you mean just drafting the -- the

1 declaration or do you mean all the background, all
2 the -- since I -- since getting the patents and
3 reviewing them and everything, just -- I'm trying to --
4 in my mind trying to parse them out.

5 Q. (BY MR. SAUNDERS) Okay. Well, let me ask it
6 this way.

7 So bef -- up until when you submitted the
8 declarations in your IPRs of the '634 and '409 patents,
9 how much time total did you spend on those matters?

10 A. I would assume the ballpark would be 20 hours
11 plus or minus five, I believe. It's hard to -- hard to
12 recall right now sitting here.

13 Q. Okay. I'm going to turn now to your claim
14 construction declaration that you submitted in this case
15 and start asking you some questions about your opinions
16 about particular terms.

17 So I'm going to start with your opinions
18 about the first term -- disputed term of the '634 patent
19 starting on Page 16 of your declaration.

20 So let me know when you're there.

21 A. I'm there.

22 Q. Okay. And so the first disputed claim terms
23 that you offer opinions about is the term "the sidewalls
24 of said trenches in said base layer"; is that right?

25 A. That's correct.

1 Q. Okay. And it's your opinion that ASUS'
2 construction is the -- let me withdraw.

3 It's your opinion that ASUS' proposed
4 construction is the correct construction; is that right?

5 A. That's correct. That's an opinion I offered.

6 Q. Okay. And so this claim term, "the sidewalls
7 of said trenches in said base layer," that appears in
8 claim 1 of the '634 patent as part of a larger phrase;
9 is that correct?

10 A. That's correct. The -- that's correct.

11 Q. Okay. So it appears as part of the phrase
12 "wherein the sidewalls of said trenches in said base
13 layer are covered by the lateral contact layer"; is that
14 right?

15 A. That's correct.

16 Q. Okay. And your opinions as to this claim term
17 are based on the written description and file history of
18 the '634 patent; is that right?

19 A. I -- I don't believe it's that -- just based on
20 that. I am definitely a person of ordinary skill in the
21 art.

22 So not only when I form an opinion how the
23 claims should be construed, of course, there's different
24 layers and different progression I go through; and that
25 include, among other things, looking through the

1 specification and, coming from a person of ordinary
2 skill in the art, what's plain and ordinary meaning and
3 looking at the claim in this context along with the
4 specification and also looking at what the invention is
5 trying to achieve.

6 I believe every aspect of these that I just
7 mentioned including, among other things, they all have
8 to be consistent and that's how I formed my opinion in
9 terms of how the term should be -- should be better
10 construed or should be best construed.

11 Q. Okay. It's fair to say that in the opinions
12 that you wrote in your section of declar -- of your
13 claim construction declaration for this term, the
14 evidence that they cite in support of your opinions are
15 the specification of the '634 patent and the file
16 history of the '634 patent and that's it; is that
17 correct?

18 A. Perhaps a better way to frame or characterize
19 that would be: I cited those as evidence among other
20 things I've considered.

21 Again, as I mentioned earlier, there are
22 different consideration, different layers or different
23 progression I go through -- and I believe that's in my
24 declaration -- to come to an opinion -- to offer my
25 opinion how to best construe -- construe the claims

1 limitation.

2 Q. Okay. Well, other than your general background
3 and experience and your overall understanding of all of
4 the evidence that you've said you reviewed, is there
5 anything else that you're specifically relying on for
6 your opinions as to this claim term other than the
7 specification and file history for the '634 patent?

8 A. I'm sorry. Please repeat that question because
9 I think you -- you were emphasizing two items. Can you
10 repeat the question for me again? I'm sorry.

11 Q. Yeah. I -- I mean, I -- so your opinions about
12 the sidewalls of said trenches in said base layer appear
13 in paragraphs 54 through 61 of your claim construction
14 declaration; is that correct?

15 A. That's correct.

16 Q. Okay. And in those paragraphs, the materials
17 that you specifically cite are the '634 patent
18 specification and the file history for the '634 patent;
19 is that correct?

20 A. I also taking into the totality of the claim
21 limitation itself as they appear within the context of
22 claim 1.

23 Q. All right. Is there anything else that you're
24 citing to in support of your opinion for this claim
25 term?

1 A. Again, going through the specification and
2 claim limitation as well as file history, in addition to
3 what the patent is -- invented as by the patent and
4 drawing upon my knowledge and expertise of the
5 technology at the time of invention, this is how I form
6 my opinion.

7 Q. All right. I -- let me withdraw.

8 In paragraphs 54 through 61 of your
9 declaration, you didn't leave out any specific piece of
10 evidence that you're relying on for your opinions; is
11 that correct?

12 A. I think "leaving out," it's just somewhat too
13 general.

14 I believe I offered these opinion. Whether
15 they're exclusive or just -- no other opinion but I
16 believe these opinion will be -- was -- will be
17 sufficient for me to make my point that -- how the claim
18 term of the sidewalls of said trenches in said base
19 layer should be construed.

20 Q. Let me just ask the question this way. If
21 there was evidence that you were aware of that you
22 thought was pertinent to your opinions about this claim
23 term, you would have cited that evidence in your
24 portions of on your declaration addressing that claim
25 term; is that correct?

1 MR. WELLS: Objection, form.

2 A. Again, as I answered earlier, there may be
3 other things I considered; but then I present in my
4 declaration what I believe will be sufficient to support
5 my conclusion, support my opinion that -- how the term
6 "the sidewalls of said trenches in said base layer"
7 should be construed.

8 Q. (BY MR. SAUNDERS) So sitting here today,
9 nothing comes to mind that you relied on for your
10 opinions as to this claim term but did not cite in your
11 section of this declaration as to this claim term? Is
12 that fair?

13 MR. WELLS: Same objection.

14 A. Again, I don't -- I don't want to characterize
15 my effort as being -- being so -- just contained.

16 Suffice to say that I believe the opinions
17 I offered in my declaration is strong enough and
18 sufficient enough of support to confirm my opinion
19 offered in construing the term.

20 Q. (BY MR. SAUNDERS) Would it be fair to say that
21 your declaration contains a complete statement of all
22 opinions that you're offering regarding the construction
23 of the sidewalls of said trenches in said base layer?

24 MR. WELLS: Same objection.

25 A. I don't like to use the word "complete." Of

1 course, can I be more verbose or can I be more concise?
2 That's -- that's different style but I do believe that,
3 again, what is contained in my declaration regarding
4 this claim term, I believe, is sufficient to support --
5 to offer support how I formed my opinion in construing
6 the term "the sidewall of said trenches in said base
7 layer."

8 Q. (BY MR. SAUNDERS) Well, Dr. Liu, I'm just
9 asking a simple question.

10 My understanding is you're obligated to
11 provide a complete statement of all opinions that you're
12 intending to offer, and I'm trying to ascertain whether
13 you did provide a complete statement of all opinions
14 that you're offering as the construction of this term in
15 your declaration or whether that the declaration is
16 incomplete.

17 So can you tell me whether the declaration
18 is complete or incomplete with respect to your opinions
19 as to the construction of the sidewalls of said trenches
20 in said base layer?

21 A. Again, as I have answered, if the complete
22 means it's sufficient to support my opinion, then in
23 that context, yes -- yes, it is sufficient. It is
24 complete in that context.

25 Q. All right. I'm next going to ask you about

1 your analysis of the file history of the '64 -- '34
2 patent in connection with your opinions as to this term.

3 You analyzed the file history for the '634
4 patent in reaching your opinions as to this claim term;
5 is that right?

6 A. Yes, that's correct.

7 Q. Okay. And in your declaration you cite to
8 specific portions of the file history for the '634
9 patent; is that right?

10 A. I believe there's a paragraph where I cited the
11 file history of '634 patent. That's correct.

12 Q. And that's paragraph 57; is that right?

13 A. That's correct.

14 Q. Okay. And you mention a notice of allowance
15 from the file history of the '634 patent; is that right?

16 A. That's correct.

17 Q. And you also mention an examiner inter --
18 initiated interview from the file history of the '634
19 patent as well; is that correct?

20 A. Let me go to my paragraph 57.

21 Yes, I do see that I opined that this
22 entire sidewall distinction was cited during the
23 examiner's initiated interview and as a reason for
24 allowance.

25 Q. And do you have an understanding of whether the

1 notice of allowance was a document submitted by the
2 patentee or by the examiner during prosecution of the
3 '634 patent?

4 A. Can you repeat the question? Because I may not
5 be as familiar with you in terms of file history
6 exchanges as you are.

7 Q. Yeah. So did you have an understanding of who
8 submitted the document that is the notice of allowance
9 during the prosecution of the '634 patent?

10 A. I believe the decision of allowance was coming
11 from the examiner and I believe based on the paragraph I
12 cited, it was during the -- during the conversation or
13 interview that was initiated by the examiner.

14 And I would assume that this interview is a
15 mutual communication.

16 Q. Okay. So you understand that the reasons for
17 allowance is one document and then there was another
18 document that is the examiner -- the summary of the
19 examiner initiated interview.

20 Do you understand that?

21 A. Yes. Yes, I do.

22 Q. Okay. So the -- you agree with me that the
23 reason for allowance document was a document that the
24 examiner submitted during prosecution of the '634
25 patent, correct?

1 A. That's correct. Again, based on my citation
2 and based on my review of the file history, such reason
3 for allowance was based on an interview in which both
4 mutual party have a conversation.

5 And the summary is -- should be the basis
6 of that mutual communication which leads to reasons for
7 allowance.

8 Q. And the document that's in the file history of
9 the '634 patent that's entitled the "Examiner-Initiated
10 Interview Summary," you understand that that physical
11 document was submitted by the examiner; is that correct?

12 A. Again, not being a legal person, I -- I do
13 understand that that was submitted by the examiner of
14 the summary of the interview.

15 Q. And so in reaching your conclusions about the
16 file history of the '634 patent and your conclusion that
17 it supports ASUS' proposed construction for this term,
18 you're relying on documents that were submitted by the
19 examiner during prosecution; is that correct?

20 MR. WELLS: Objection, form.

21 A. I think you simplified how I reached my
22 conclusion.

23 As I mentioned before, I went through a
24 progression and to come -- and I will be very happy to
25 go over again that progression.

1 And the file history is just one part of
2 the supporting evidence. Again, they all have to be
3 consistent and increase the file history, to the best of
4 my knowledge, that contains a summary of an interview
5 and I would assume that the pat -- inventor and the
6 examiner partic -- both participated in the interview
7 and come to agreement.

8 And based on that summary of interview,
9 there was a -- there was a reason for allowance.

10 This is only one aspect of the support --
11 supporting information I have to form my opinion. It's
12 not exclusively the only one; but being that this is a
13 mutual communication and having gone through patent
14 applications myself as an inventor of -- I don't want to
15 say hundred but at least 99, for sure, patents, I would
16 have -- I would assume that the inventor is fully aware
17 of the conversation and fully aware what it took to get
18 the reason for allowance.

19 Q. (BY MR. SAUNDERS) From your review of the file
20 history of the '634 patent, you didn't see the examiner
21 issue any rejections; is that correct?

22 A. To be honest with you, sitting right here, I
23 would have to go through the file history to be able to
24 answer your question.

25 Q. Well, let's say: Sitting right now, you don't

1 recall whether there were any; is that correct?

2 A. I would assume that initially -- initially the
3 invention was not -- was rejected. That was why --
4 that's why there would be a need for an interview and
5 trying to understand and trying to come to mutual
6 understanding of the inventive aspect and how it could
7 be distinguished from the prior art.

8 I'm not sure what you meant by "rejection."

9 Q. So you've -- you said you're familiar with the
10 prosecution of patents in your own personal efforts; is
11 that right?

12 A. To a certain extent, that's correct.

13 Q. And you were named as an inventor on a number
14 of patents; is that right?

15 A. Yes, that's correct.

16 Q. Okay. And in your personal experience with the
17 patent prosecution process, have you reviewed documents
18 entitled "Notice of Rejection"?

19 A. I would assume on certain one I must have come
20 across -- across them.

21 Q. And you can't recall today whether there was
22 any document titled "Notice of Rejection" issued in the
23 file history of the '634 patent; is that correct?

24 A. I would have to go through the file history to
25 give you an affirmative answer.

1 Q. You don't cite any rejection in paragraph 57 of
2 your declaration, right?

3 A. I don't believe I did.

4 Q. And you didn't cite to any response by the
5 patentee to a rejection in paragraph 57 of your
6 declaration, correct?

7 A. Can you repeat the question again?

8 Q. So you understand that in your personal
9 experience with patent prosecution, that a patentee can
10 respond to a examiner's notice of rejection.

11 Do you have that understanding?

12 A. Yes, I do.

13 Q. And do you understand that those responses can
14 include arguments as to why the patentee believes that
15 the claims are allowable?

16 A. Repeat your question again, please.

17 Q. Do you understand that when a patentee responds
18 to an office action during prosecution, such as a notice
19 of rejection, the patentee can include arguments as to
20 why the patentee believes that the claims are allowable?

21 A. That's correct.

22 Q. Okay. And you don't cite to any such office
23 action response in paragraph 57 of your declaration,
24 right?

25 A. I don't agree with that characterization in the

1 sense that what I'm citing to is: There's an interview
2 between the examiner and the patentee in which this --
3 since this interview, there's a mutual understanding why
4 the claim term was allowed by the examiner.

5 And because it's an interview, I would
6 assume that the patentee agreed to the examiner's reason
7 for allowance.

8 Q. What's the basis for that assumption?

9 A. The assumption is because of the interview,
10 interview meaning that it's a two-way communication.

11 Q. And after the two-way communication, the actual
12 documents are prepared, correct?

13 MR. WELLS: Objection to form.

14 A. Again, I'm not familiar with the actual exam --
15 step of the procedure.

16 I'm simply opining that. Based on the file
17 history, based on the information contained in the file
18 history, there was an examiner-initiated interview and
19 one outcome of this interview involving the two party
20 was reason for allowance and it was stated for the
21 record by the examiner.

22 Q. (BY MR. SAUNDERS) All right. Do you see in
23 paragraph 57 of your declaration you state "I understand
24 the examiner distinguished Kobayashi on the basis that
25 the," quote, "'entire,'" quote, "sidewall of the source

1 contact trench in the base layer was covered by the
2 lateral contact layer in the '634 patent as opposed to
3 only being partially covered as in Kobayashi"?

4 Do you see that sentence that you wrote?

5 A. Yes, I do.

6 Q. Okay. I'm going to introduce another exhibit.
7 One moment.

8 (Liu Exhibit 10 marked.)

9 Q. (BY MR. SAUNDERS) And, Dr. Liu, do you see
10 that I've uploaded as Exhibit 10 to your deposition
11 US Patent No. 6,888,196? Do you see that?

12 A. Let me refresh to retrieve it. Yes, I do now.

13 Q. Okay. And that's the patent that is discussed
14 in the notice of allowance that you cite in paragraph 57
15 of your declaration; is that correct?

16 A. That's correct.

17 Q. Okay. And if I refer today as -- to the
18 Kobayashi patent, do you understand I'm referring to
19 this Exhibit 10?

20 A. Yes, I do.

21 Q. Have you reviewed Exhibit 10 before?

22 A. Yes, I have.

23 Q. And when you stated in paragraph 57 of your
24 declaration that "the examiner" was distinguished --
25 "distinguished Kobayashi on the basis that the 'entire'

1 sidewall of the source contact trench in the base layer
2 was covered by the lateral contact layer in the '634
3 patent, as opposed to only being partially covered as in
4 Kobayashi," did the examiner identify what structure in
5 the Kobayashi patent the examiner believe corresponded
6 to the lateral contact layer of the '634 patent?

7 MR. WELLS: Objection, form.

8 A. Sitting right here not being the examiner, I
9 cannot speak for the examiner but I would assume a
10 thorough examiner will look at all the teaching of
11 Kobayashi and come to -- come to make the distinction
12 of -- the reason for the distinction between Kobayashi
13 and the '634 patent.

14 Q. (BY MR. SAUNDERS) But sitting here today, you
15 don't see any specific cite to any specific structure in
16 Kobayashi in the reasons for allowance for the '634
17 patent, correct?

18 A. Can you repeat your question again?

19 Q. Sitting here today, you did not see in the
20 reasons for allowance in the '634 file history a
21 citation to any specific structure in Kobayashi; is that
22 correct?

23 A. Again, I -- I need to go through the file
24 history; but as I answer earlier, I would assume that
25 the examiner have the access of all the figures and all

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1 the structure in Kobayashi to make that distinction.

2 Q. I understand that and I appreciate that, but
3 I'm asking you a very simple question.

4 You have a screenshot on -- in paragraph 57
5 of your declaration of the reasons for allowance,
6 correct?

7 A. That's correct.

8 Q. Okay. And you're -- the '634 file history that
9 we've already introduced, you have that full page
10 available for you to review, correct?

11 A. '634. Which -- which full page? I'm sorry.

12 Q. Ending in Bates No. 67.

13 A. Okay.

14 Q. So the image that you pasted in paragraph 57 of
15 your declaration, that's the complete statement of the
16 reasons for allowance of the '634 patent by the examiner
17 during prosecution, correct?

18 A. That's -- that's correct. Now that I refresh
19 my memory by going over Page 67, that's correct.

20 Q. Okay. And in that reasons for allowance,
21 there's only one sentence that mentions Kobayashi,
22 correct?

23 A. They mention Kobayashi in the context of the
24 US 6,888,196 patent; and I would assume that would be
25 the totality of the patent.

1 Q. Okay. And in that sentence that the examiner
2 is providing in the reasons for allowance, he doesn't
3 cite to the number for any structure in Kobayashi's
4 figures, correct?

5 A. Not explicitly, that's correct.

6 Q. And you don't recall Kobayashi -- the Kobayashi
7 patent using the phrase "lateral contact layer"; is that
8 correct?

9 A. I have to go through the Kobayashi patent to
10 try to answer your question more accurately.

11 Q. All right. Let me ask the question this way:
12 So when you prepared the opinions in paragraph 57 of
13 your declaration, what was your understanding as to what
14 the examiner was identifying as the lateral contact
15 layer in Kobayashi?

16 A. Again, not speaking for the examiner, the
17 lateral contact would be looking at the sidewalls of the
18 trench in the base layer.

19 There's only an implant at the base of the
20 source contact trench. There's no intentional or effort
21 to additionally dope the sidewalls of Kobayashi.

22 Q. Is that implant that you're referring to the
23 item that's labeled 14 in Figure 5A of the Kobayashi
24 patent?

25 A. What I was referring to, yes, there was an

1 im -- there was a dopant -- P+ dopant at the base of the
2 source contact trench in Kobayashi.

3 Q. Okay. And that's -- that's labeled element 14
4 in Figure 5A of the Kobayashi patent; is that correct?

5 A. I do believe that's correct.

6 MR. SAUNDERS: Counsel, we've been going on
7 the record for about an hour now. Are you okay taking a
8 first break?

9 MR. WELLS: Yeah, sure. That's fine.

10 MR. SAUNDERS: All right. Let's go ahead
11 and go off the record.

12 THE VIDEOGRAPHER: Going off the record.
13 The time is 10:40 a.m.

14 (Recess from 10:40 a.m. to 10:52 a.m.)

15 THE VIDEOGRAPHER: Okay. We're back on the
16 record. The time is 10:52 a.m.

17 Q. (BY MR. SAUNDERS) Okay. Dr. Liu, you remember
18 before our break we were talking about portions of your
19 claim construction declaration about the '634 patent
20 term, "the sidewall of said trenches in said base
21 layer"? Do you remember that?

22 A. Yes, I do.

23 Q. Okay. And do you remember talking about
24 reasons for allowance issued by the examiner during
25 prosecution of the '634 patent? Do you remember that?

1 A. Yes, I do.

2 Q. Okay. And ASUS' proposed construction of this
3 term references the base layer; is that right?

4 A. Yes, that's correct.

5 Q. Okay. And going to the reasons for allowance
6 by the examiner, you don't see any reference to the base
7 layer, do you?

8 A. I don't necessarily agree with that because in
9 the reason for allowance, it says, "Claim 1 limits the
10 trenched MOSFET to having a trench in which the base and
11 entire sidewall are covered with the lateral contact
12 layer."

13 And I think the base layer is simply
14 necessary in the formation of a trenched MOSFET.

15 Q. But in the examiner's reasons for allowance,
16 they didn't specifically call out the base layer from
17 any other portion of the sidewalls of the trench,
18 correct?

19 A. It is correct in the sense that at least the
20 portion I cited, there's no place -- base layer but,
21 again, as I mentioned earlier, the base layer in this
22 context is simply there for a power MOSFET -- trenched
23 power MOSFET.

24 Q. In the sidewalls of said trenches for this
25 term, that's referring to the source contact trenches in

1 the claims; is that correct?

2 A. That's correct. The sidewall of said trenches
3 re -- the said trenches refer to the source contact
4 trenches.

5 Q. And if you look at Figure 2G of the '634
6 patent -- let me know when you're there.

7 A. I'm there.

8 Q. And in Figure 2G, the contact metal plugs are
9 element 211, correct?

10 A. We would say that's part of the contact element
11 but -- yes, 211. Of course, that's also liner 224,
12 yeah.

13 Q. In the 211, the contact metal plugs are what
14 are filling the source contact trenches, correct?

15 A. They are part of the conductor material filling
16 the contact trenches. That's correct.

17 Q. And so as illustrated, Figure 2G of the '634
18 patent, the source contact trench passes through
19 interlayer oxide film, 207, correct?

20 A. Repeat your question again, please.

21 Q. Yeah. As illustrated in Figure 2G of the '634
22 patent, the source contact trench passes through the
23 interlayer oxide film, 207, correct?

24 A. That's correct. That's one way to describe it.

25 Q. And the source contact trench in Figure 2G also

1 passes through the source layer, 206, correct?

2 A. Again, that's correct. That's one way to
3 describe it.

4 Q. Now, the Figure 2G doesn't illustrate
5 interlayer oxide film as having a lateral contact layer,
6 correct?

7 A. Repeat your question again.

8 Q. Yeah. So in -- let me withdraw and repeat --
9 let me rephrase the question.

10 In the portion of the source contact trench
11 in Figure 2G of the '634 patent that is passing through
12 interlayer oxide film, 207, there's no lateral contact
13 layer illustrated, correct?

14 A. Can you clarify what you meant by "lateral
15 contact layer"?

16 Q. Okay. You see in Figure 2G that there is a
17 structure identified as element 209?

18 A. Yes, I do.

19 Q. And you identify -- let me withdraw.

20 In your paragraph 56 of your declaration,
21 you quote to portions of the '634 patent identifying 209
22 as the P-type lateral contact layer; is that correct?

23 And -- sorry. Let me withdraw.

24 In paragraph 56 of your declaration, you
25 quote portions of the '634 patent referring to the

1 "P*-type lateral contact layer (209)"; is that correct?

2 A. That's what I cited from the '634 patent. Yes,
3 that's correct.

4 Q. And so looking at Figure 2G of the '634 patent,
5 you see element 209, correct?

6 A. I see there's a label 209 to point to -- point
7 to -- point to, yes.

8 Q. And so the region labeled 209 in Figure 2G is
9 present on the sidewalls of the lateral contact trench;
10 is that correct?

11 A. You may have to rephrase your question. I
12 don't understand "lateral contact trench."

13 Q. Sorry. Let me -- I probably misspoke.

14 Element 209 in Figure 2G is present at
15 sidewalls of the source contact trench; is that correct?

16 A. A better way to say it would be at the -- at
17 the entire sidewall of the trench in the base layer --
18 of the trench in -- of the trenched portion in the base
19 layer, yeah.

20 Q. So Figure 2G of the '634 patent doesn't depict
21 element 209 as being present in the portions of the
22 sidewall of the source contact trench that are in the
23 source layer, 206, correct?

24 A. 209 -- patent does not explicitly depict the
25 209 in the presence of the N+ source region, 206, that's

1 correct.

2 Q. And you don't recall any figures in the patent
3 that does show a lateral contact layer present in the
4 source layer; is that right?

5 A. Repeat the question again, please.

6 Q. From your review of the '634 patent, you don't
7 recall there being any figures depicting the lateral
8 contact layer being present in the sidewalls of the
9 trench -- of the source contact trench in the source
10 layer; is that correct?

11 A. I will answer the question this way. There's
12 an implant -- additional implant made to facilitate the
13 formation of the 209 -- the area depicted as 209.

14 And that's specifically mentioned in
15 Figure 3B as a large angle tilt implant, as we know in
16 our art.

17 And such implant could -- someone could
18 scatter into the region 206; but, no, because 206,
19 doping concentration is very high. Therefore, the 209
20 on -- is only depicted in the set base layer -- the
21 entire trench sidewall in the base layer.

22 Q. And you don't recall anywhere in the '634
23 patent depicting the lateral contact layer being present
24 at the sidewalls of the source contact trench in the
25 layer for the interlayer oxide film, 207, correct?

1 A. Again, not -- not accounting for any dopant
2 that may inevitably scatter into it, no.

3 On the sidewall that's labeled as 207 for
4 interlayer dielectric, there's no depiction. Only
5 depiction is in 209 which covers the entire sidewall of
6 the trench in the base layer.

7 Q. And so turning back to the examiner's reasons
8 for allowance in the '634 patent, do you see the
9 sentence -- the examiner says, "Claim 1 limits the
10 trenched MOSFET to having a trench in which the base and
11 entire sidewall are covered with the lateral contact
12 layer"?

13 Do you see that?

14 A. Yes, I do.

15 Q. That's not describing what's depicted in
16 Figure 2G of the '634 patent because Figure 2G does not
17 show the lateral contact layer as being present at the
18 source layer or the interlayer oxide film; is that
19 correct?

20 MR. WELLS: Objection to form.

21 A. Again, as I testified earlier, that implant is
22 formed through -- according to Figure 3B of '634 patent,
23 it took additional implant to ensure the formation of
24 the lateral contact 209 -- layer 209.

25 And such an implant inevitably will get

1 into the whole sidewall of the trench. It's just that
2 in the region where you have dielectric, they have --
3 there's no point. They're not conductive, being a
4 dielectric.

5 And in the region -- in the N+ region, it's
6 overwhelmed by the N+ dopant. So, again, there's no
7 point depicting; but that implant inevitably being a
8 large angle implant goes into the trench and it forms
9 distinctively in the entire sidewall of the trench
10 portion, the base layer.

11 Q. You would agree with me that the -- in
12 Figure 2G of the '634 patent, there are portions of the
13 sidewall of the source contact trench that are adjacent
14 to the source layer and the interlayer oxide film,
15 correct?

16 A. I'm sorry. Can you repeat your question again?

17 Q. Yeah. In Figure 2G of the '634 patent, you
18 would agree with me that there are portions of the
19 sidewalls of the source contact trench that are adjacent
20 to the source layer and the interlayer oxide film layer,
21 correct?

22 A. I would agree that trenched source contact is
23 going through to contact the N+ and the P base region
24 through the P+ and also through the lateral layer formed
25 on the sidewall of the trench in the base layer.

1 Q. So you consider the sidewalls of the source
2 contact trench in Figure 2G to include the portions of
3 the trench adjacent to layers 206 and 207, correct?

4 MR. WELLS: Objection to form.

5 A. It's a trench source contact. So the purpose
6 is to contact layer 206, 209, and 208.

7 Q. (BY MR. SAUNDERS) Well, I appreciate your
8 answer. That's not quite what I'm asking.

9 I'm trying to understand: Do you have an
10 understanding of the term "sidewalls," whether the
11 sidewalls are only some portion of what is the portions
12 of the trench that are filled in with 211 or is it the
13 entire portions of that trench that are filled in with
14 211 on the sides are the sidewalls?

15 A. The trench sidewall would be the -- would be
16 the sidewall of the trench of the -- of the trench. So
17 that would include 206 region but adjacent to 206 and
18 207.

19 Q. And earlier today in your testimony you
20 referred to an implant. Do you remember that?

21 A. I would ask you to clarify which implant I'm
22 referring to.

23 Q. I believe you used the phrase "implant" when we
24 were discussing the lateral contact layer. Do you
25 remember that?

1 A. I have mentioned an implant with regard to
2 Figure 3B for the formation lateral implant and
3 that's -- as I testified, that would inevitably go to
4 the entire sidewall, as you define, and, yet, manifest
5 electrically in the -- in the entire sidewall of the
6 trench in the base layer.

7 Q. What is an implant?

8 MR. WELLS: Objection, form.

9 A. In a simplified way, implant is a way to
10 introduce dopant into -- introduce dopant.

11 Q. (BY MR. SAUNDERS) Sorry. It's a way of
12 introducing dopant into a piece of semiconductor; is
13 that right?

14 A. You have to be careful on how you introduce
15 into P semiconductor, and that's not what I said.

16 It's implant and depending on the energy
17 level, it's penetrating through the top surface of the
18 semiconductor material upon which many layer may have
19 been formed on the substrate that supports this --
20 layers that build upon to form the semiconductor
21 material.

22 Q. And an implant is formed by ion implantation;
23 is that correct?

24 A. In the context of the implant, it is formed by
25 ion implantation.

1 Q. And what is ion implantation?

2 A. In a simplified form for the case of this
3 declaration, it is just way of introducing atoms or --
4 introducing atoms or dopant atoms into the semiconductor
5 material through accelerating that atom or molecule
6 through electrical force -- electrical field.

7 Q. And it was your understanding of the '634
8 patent that the lateral contact layer was -- sorry. Let
9 me withdraw.

10 It's your understanding in the '634 patent
11 that the lateral contact layer is a type of implant?

12 A. I think you mischaracterized my -- you may have
13 misunderstand.

14 I think the lateral contact layer could be
15 intro -- one way to formal introduce the lateral contact
16 layer is through an implant being done at specific
17 angles in order to cover the sidewall of the trench that
18 you intended.

19 Q. Well, let me ask the question this way: When
20 you were rendering your opinions about this claim term,
21 what was your understanding of the meaning of the phrase
22 "lateral contact layer"?

23 A. As I opined in my declaration, in the formation
24 of the power MOSFET, you do have issue that could
25 compromise your breakdown voltage.

1 And you do need to contact a source as well
2 as the P base in order to mitigate any voltage that
3 builds up between the P base layer and the N+.

4 So when I say the P base layer, it could --
5 the point of the contact could include a P+ diffusion
6 but according to -- at least in the context of the '634
7 patent, it was disclosed that if I simply have a P+
8 layer at the bottom of this source contact trench, if
9 the sidewall would not also cover by a dopant implant --
10 P type dopant implant, then you will have an only
11 contact being formed in the P type base region between
12 that and the source contact material.

13 So in order to improve upon that or remove
14 the ohmic contact, you would dope the sidewall of the
15 trench in the base layer to reduce the resistance or to
16 remove the ohmic contact.

17 Therefore, it doesn't make sense in -- it
18 doesn't make sense to not build the entire sidewall
19 because if you don't dope the entire sidewall, you still
20 will have region remaining only contact. That defeats
21 the purpose and -- defeats the purpose of '634.

22 Q. So is your understanding the lateral contact
23 layer in the '634 patent is an area of doping that
24 improves ohmic contact with the contact metal plug?

25 A. That is one aspect of it.

1 Q. What are the other aspects of it that I'm
2 leaving out?

3 A. There are other consideration, for example,
4 such as the dopant concentrations so as to -- as the
5 patent '634 described, so as to not to impact the
6 threshold voltage of the P -- of the power MOSFET.

7 Q. Is that what the '634 patent specification
8 refers to as the P* desk-type [sic] doping?

9 A. That's correct.

10 Q. And what is it your understanding of -- in the
11 context of the '634 patent that P*-type doping means?

12 A. I believe in my declaration, paragraph 56, I
13 have cited how the '634 patent states that the P+ type
14 base layer, POA, and the P*-type lateral contact layer,
15 209, are formed at the bottom and sidewall of the source
16 contact trenches respectively.

17 Q. So the base layer and lateral contact layer are
18 of the same doping type but a different magnitude of
19 dopant; is that correct?

20 A. That's correct, according to the context of
21 '634.

22 Q. And you've heard in -- sorry. Withdraw.

23 In your experience with MOSFETs and other
24 semiconductors, you've heard of P+ type doping before,
25 correct?

1 A. In various contexts, that's correct.

2 Q. And is it your understanding that kind of
3 refers to a standardized amount of positive doping in
4 the field?

5 A. It could be a certain amount or -- in terms of
6 those or it could be certain amount in terms of
7 concentration. It could also be a relative amount --
8 relative concentration as opposed to another doping
9 concentration.

10 Q. Have you understood -- sorry. Withdraw.

11 In your experience with MOSFETs, have you
12 heard of P+ type doping referred to as heavy doping?

13 A. In certain contexts you could describe P+
14 doping as high concentration doping or perhaps even
15 heavy doping concentration.

16 Q. And in the context of a MOSFET that has regions
17 with P+ type doping, would other regions with P type
18 doping refer to positive doping with less doping than
19 the P+ type regions?

20 MR. WELLS: Objection, form.

21 A. Can you -- can you repeat your question again?
22 That's -- that's quite a lengthy....

23 Q. (BY MR. SAUNDERS) Yeah. So if you're reading
24 a disclosure about MOSFETs that refer to dopant regions,
25 including both P+ and P dopant regions, what would you

1 understand those respective dopant regions to refer to?

2 MR. WELLS: Objection to form.

3 A. Different doping concentration will -- will be
4 used or to be designed for different consideration.

5 In the context of '634, to answer your
6 question, the P base layer as it is is sufficient to
7 facilitate a threshold voltage between -- for the power
8 MOSFET because you do need a certain type amount of
9 threshold voltage to determine whether you can turn on
10 or turn off the power MOSFET. That's one type of doping
11 that will be what I will consider in '634 to be the P
12 base layer doping. That simply is to facilitate -- able
13 to allow you to modulate the power MOS by turning on.

14 There is another doping you typically see
15 which is P+ doping at the base of the source contact
16 trench if the power MOSFET has source contact trench.

17 That P+ doping is heavier. Its purpose is
18 not to modulate the threshold voltage because it will be
19 too heavy.

20 Its purpose is to facilitate a good contact
21 between the N+ and the base layer of the power MOSFET to
22 prevent -- or to optimize the breakdown voltage.

23 And in the context of '634 around the
24 sidewall of -- around the entire sidewall of the trench,
25 the base layer, the use of P base doping will form --

1 allegedly form an ohmic contact. Therefore, having just
2 generic P based doping is not sufficient.

3 However, in the context of '634, having the
4 sidewall being the P+ doping that is the bottom of the
5 base layer is also not adequate in the sense that it
6 will not -- it will interfere with the threshold voltage
7 of the power MOSFET unless you put a lot of space
8 between them which would make your cell much bigger. So
9 it's not preferred.

10 Therefore, you need to have at least --
11 according to the context, according to the invention and
12 according to how the examiner understands it, based on
13 my review of the file history, you need to introduce
14 another doping that surround the entire sidewall of the
15 trench, the base layer, with the doping that would be an
16 authorization between not interfering with the threshold
17 voltage, yet, able to achieve an ohmic contact -- decent
18 ohmic contact between the conductor material that's
19 filling the trench and the liner with the P based layer.

20 So that's why in the '634 patent you -- the
21 patentee introduce this so-called P* doping into the
22 device.

23 Q. I want to turn to paragraph 56 of your claim
24 construction declaration. Let me know when you're
25 there.

1 A. I'm there.

2 Q. Do you see the second sentence, you say, "In
3 contrast, the '634 patent describes the purported
4 invention as a MOSFET with distinct base contact and
5 lateral contact layers"? And then it continues on.

6 Do you see that sentence?

7 A. Yes, I do.

8 Q. Are the base contact and lateral contact layers
9 distinct by virtue of their different doping levels in
10 the '634 patent?

11 A. To answer your question, they are distinct, not
12 simply based on the doping concentration but they're
13 distinct based on the additional implant to form -- to
14 facilitate the formation of the lateral contact layers.

15 Q. Okay. So one of the ways they're distinct is
16 in doping concentrations, and another way that they're
17 distinct is that the patent describes two different ion
18 implantation procedures for creating those layers; is
19 that correct?

20 MR. WELLS: Objection, form.

21 A. I don't believe that's the way I would
22 characterize my answer.

23 I would characterize my answer by saying
24 that the way the different doping concentration in the
25 lateral contact layer and in the base contact layer as

1 described in the specification and as described in
2 the -- as the invention is that it's through an
3 additional method of introducing dopant into the lateral
4 contact layers.

5 Q. (BY MR. SAUNDERS) So would you agree or
6 disagree with the statement that to have distinct base
7 contact in lateral contact layers, you would need
8 distinct implantation procedures?

9 MR. WELLS: Objection to form.

10 A. As I testified earlier, in -- ion implantation
11 is only one method to introduce -- to facilitate
12 introduction of doping concentration that -- that's
13 designed -- that's desired or that's by design.

14 So ion implantation is only one of the
15 method such doping profile could be achieved.

16 Q. Would you agree or disagree with the statement
17 that to have distinct base contact and lateral contact
18 layers you would need distinct doping procedures for
19 each?

20 MR. WELLS: Objection to form.

21 A. In my declaration I'm opining on the fact that
22 based on the teaching of '634, there is a introduction
23 of the lateral base -- lateral contact layer through
24 additional means apart from the P+ base doping
25 concentration.

1 Q. (BY MR. SAUNDERS) And if you could, turn back
2 to the Kobayashi patent and go to Figure 5A; and let me
3 know when you're there.

4 A. Kobayashi is Exhibit --

5 Q. I believe it's Exhibit 10, but let me
6 double-check. Yeah, Exhibit 10 to your deposition.

7 A. Which figure, please?

8 Q. Figure 5A.

9 A. I'm there.

10 Q. Figure 5A of Kobayashi doesn't depict a
11 distinct base contact layer and lateral contact layers,
12 correct?

13 A. Can you repeat your question again? I'm sorry.

14 Q. Figure 5A of the Kobayashi patent does not
15 depict distinct base contact layers and lateral contact
16 layers, correct?

17 MR. WELLS: Objection, form.

18 A. Figure 5A, along with other figures in the
19 context as Kobayashi, shows a P+ implant in the base
20 layer. And it also shows a illustrated way that P+
21 layer could be formed.

22 Q. (BY MR. SAUNDERS) Okay. And so that P+ layer
23 in Kobayashi, is that, in your understanding, a base
24 contact layer, a lateral contact layer, or neither?

25 And when I'm using those terms, "base

1 contact layer" and "lateral contact layer," I mean them
2 in the context of how the '634 patent uses those
3 phrases.

4 A. In the context of '634, I believe that P+ layer
5 will be mapped to the base layer in -- the P+ layer in
6 the Kobayashi will be mapped to the base layer of '634.

7 Q. And so Kobayashi's Figure 5A doesn't show a
8 distinct lateral contact layer and base contact layer,
9 correct?

10 MR. WELLS: Objection to form.

11 A. Can you repeat your question?

12 Q. (BY MR. SAUNDERS) Yeah. Figure 5A of the
13 Kobayashi patent does not depict a distinct base contact
14 layer and lateral contact layer as those terms are used
15 in the '634 patent, correct?

16 MR. WELLS: Same objection.

17 A. Figure 5A depict that you have a base layer
18 which is P type. That's the -- as I described before,
19 the formation of the threshold voltage of the power
20 MOSFET.

21 And it has a P+ layer at the base of the
22 source contact trench, which we call that base contact
23 layer, not to be confused with the base -- base doping
24 profile.

25 So in Kobayashi Figure 5A, there's a P+

1 layer at the base -- at the bottom of the source contact
2 trench and that is in the context of a P base layer -- P
3 base doping with a P.

4 Q. (BY MR. SAUNDERS) And because of that, there's
5 not a distinct base contact layer and lateral contact
6 layer in Figure 5A of Kobayashi, correct?

7 MR. WELLS: Objection to form.

8 A. I don't -- I'm confused. I -- sometime I maybe
9 have used the term loosely. So I just want to make sure
10 we don't have miscommunication.

11 Can you please repeat the question?

12 Q. (BY MR. SAUNDERS) Yeah. So, I mean, in your
13 declaration you talked about the '634 patent and having
14 distinct base contact and lateral contact layers.

15 Do you remember that?

16 A. Yes, I do.

17 Q. Okay. And I'm looking at Figure 5A of
18 Kobayashi, and I want and try and get your
19 understanding.

20 Does Figure 5A of Kobayashi depict a
21 distinct base contact layer and a distinct lateral
22 contact layer?

23 MR. WELLS: Same objection.

24 A. I don't believe Figure 5A -- I don't believe so
25 on Figure 5A.

1 Q. (BY MR. SAUNDERS) Is there some other figure
2 of Kobayashi that you understand is depicting a distinct
3 base contact layer and lateral contact layer?

4 A. Please give me a few minutes.

5 Q. Okay.

6 A. Okay. I'm sorry. Could you please repeat your
7 question again?

8 Q. Yeah. You're not aware of any of the figures
9 in the Kobayashi patent as depicting a distinct base
10 contact layer and a distinct lateral contact layer,
11 correct?

12 A. Sitting right here, I would say that's correct.

13 Q. Now, earlier today I believe we had some
14 discussion about Figures 3A and 3B of the '634 patent.
15 Do you remember that?

16 A. Yes, I do.

17 Q. And is it your understanding that the ion
18 implantation procedure in Figure 3B of the '634 patent
19 is being applied to the entire surface of the
20 semiconductor material?

21 A. Repeat your question again. I'm sorry. I
22 think we went through this before.

23 Q. Yeah, I'm just trying to confirm my
24 understanding of your opinions.

25 Figure 3B of the '634 patent depicts an ion

1 implantation procedure, correct?

2 A. Figure 3B, yes, correct.

3 Q. And that ion implantation procedure in
4 Figure 3B is being applied to the entire surface of the
5 semiconductor material; is that correct?

6 A. I would answer more accurately by saying that
7 that implant is depicted as an angle implant, A-N-G-L-E,
8 as having an angle. As such, its intention is to cover
9 the sidewalls of -- of the source contact trench.

10 And as I mentioned earlier in my testimony,
11 electrically speaking, after this implant has been done,
12 even though the entire sidewall will be -- will be open
13 to this -- or will be receptive to this angled implant,
14 only in the sidewall of the base layer they will
15 manifest themselves.

16 If we talk about the device operation, they
17 will -- only in the sidewall of the entire -- only
18 entire sidewall of the base layer of the trench they
19 will manifest itself.

20 It doesn't mean that a dopant did not go
21 into the N+ region or it doesn't mean that dopant did
22 not go into the inter-oxide layer.

23 But, electrically speaking, the dopant not
24 going to the inter-oxide layer are voided because
25 they're going to the insulator. And dopant going to the

1 N+ region also overwhelmed by the heavy N+ dose. So
2 it's actually non-effect in N+ -- it's not visible in N+
3 layer electrically.

4 It only manage by itself electrically in
5 the entire sidewall of the trench in the base layer
6 simply because this dopant concentration as described in
7 '634 -- this dopant concentration is heavier than the P
8 base layer, the P, but not heavy enough compared to the
9 P+ layer, at least in the implementation of '634, so as
10 not to impact the threshold voltage of the power MOSFET.

11 I believe that's very clear. I think I
12 have described this and testified this -- how the
13 implant goes, where the implant goes and, electrically
14 speaking, only in the portion of the -- that's --
15 it's -- as depicted, as surrounding the sidewall of the
16 trench in the base layer do they manifest themselves
17 electrically.

18 And in the case of '634, the purpose is to
19 help to facilitate an ohmic contact so that the
20 breakdown voltage of your power MOSFET will not be
21 compromised.

22 Q. I appreciate your answer, Dr. Liu. I don't
23 think I asked a question that addressed all of those
24 different subject matters.

25 I would appreciate it if you could try and

1 focus on the kind of specific questions I'm asking
2 because I think it -- in general I'm trying to ask a
3 little bit narrower question than that.

4 So let me ask a simple question about
5 Figure 3B. Is it fair to say that the dopant levels
6 that are going to be present at the sidewalls of the
7 source contact trench after the implantation procedure
8 that's depicted in 3B is going to depend, in at least
9 some degree, at the -- based on the dopant levels that
10 were present in those portions of the sidewalls prior to
11 the implantation procedures; is that correct?

12 MR. WELLS: Objection to form.

13 A. Can you -- see, this question is different from
14 the question I just answered. They are different, and I
15 tried to provide as much context to answer your
16 question.

17 So if I'm not answering your question,
18 please correct me; but this question right now is
19 different from the question you asked earlier.

20 So can you repeat your question again?

21 Q. (BY MR. SAUNDERS) Yeah. I'm trying to ask a
22 little narrower question so hopefully you can focus on a
23 narrower response.

24 So Figure 3B is depicting an ion
25 implantation procedure. And what I'm asking is: After

1 that ion implementa -- implantation procedure, you have
2 a certain doping level in the sidewalls of the source
3 contact trench.

4 And my question is: Does that level of
5 doping in the sidewalls after the ion implantation
6 procedure of Figure 3B depend, in at least in part, on
7 the doping levels that were present prior to the ion
8 implantation procedure?

9 MR. WELLS: Same objection.

10 A. Your question will have to -- will have to have
11 context.

12 For example, the P+ implant that's at the
13 bottom of the -- of the source contact trench will have
14 some -- a little bit of diffusion but just by that
15 alone, that may have -- it depend on how much the P+
16 region. It may have tiny bit going up due to the
17 diffusion profile.

18 But in the context of '634, whatever that
19 dopant -- in the background dope -- let's call it --
20 let's just designate it as a background doping
21 concentration.

22 Whatever that background doping
23 concentration, it's not sufficient to form the lateral
24 contact layer.

25 In the context of '634, given you have the

1 space for the background doping either from the P base
2 layer or from the P+ layer or not -- but that is not
3 sufficient, at least alone, the sidewall of the source
4 contact trench within the base layer to facilitate the
5 formation of ohmic contact.

6 Therefore, additional implant as in the
7 context of '634, additional process there, given the --
8 given the fact that any pro -- extra process that you
9 introduce into a silicon semiconductor processing cost
10 money; but, yet, '634 patent deemed as necessary to
11 introduce this as a trade-off between the breakdown
12 voltage and the -- and the process -- introduction of
13 process in order to facilitate a reduction or facilitate
14 a reduction of ohmic resistance in this contact region.

15 Q. (BY MR. SAUNDERS) I appreciate your answer. I
16 think you discussed a lot of matters that are kind of
17 outside the scope of my question. So I'm going to try
18 and break it down even narrower.

19 And let's just talk about the source layer
20 in Figure 3B, right? Prior to the ion implantation
21 procedure that's depicted in Figure 3B, source layer,
22 206, had N+ type doping, correct?

23 A. That's correct.

24 Q. And after the ion implantation procedure in
25 Figure 3B, source layer, 206, still has N+ type doping,

1 correct?

2 A. That's correct.

3 Q. And the ions that are being implanted in
4 Figure 3B are positive ions, correct?

5 A. If you call boron positive ion, yes, that's
6 correct.

7 Q. Well, boron is typically associated with P
8 doping, correct?

9 MR. WELLS: Objection, form.

10 A. That's correct but we don't call them positive
11 ion, but, anyway, that's fine, yeah.

12 Q. (BY MR. SAUNDERS) Okay. So the reason why the
13 N+ source layer -- sorry. Let me withdraw it.

14 The reason why the source layer, 206, stays
15 N+ after the doping in Figure 3B is because of the
16 amount and type of doping it had prior to the
17 implantation step of Figure 3B, correct?

18 MR. WELLS: Objection, form.

19 A. That's correct in the context that the N+
20 doping concentration is much heavier and it would -- so
21 the -- the P* type of implant to in -- to form P* type
22 of implant, that those will be insignificant in contrast
23 to the N+ doping.

24 Q. (BY MR. SAUNDERS) And --

25 A. It doesn't mean it's not there. It's just that

1 it's insignificant.

2 Q. And so in the Figure 3A, the sidewalls of the
3 trench in the base layer already have some P doping,
4 correct?

5 A. It already has the base implant doping, the P
6 or the very minimum in order to form a threshold voltage
7 barrier between the N+ -- between the source and the
8 drain to facilitate the modulation of the power MOSFET.
9 That's correct.

10 Q. And in Figure 3B, it's showing that the P's
11 asterisk regions are being formed by adding additional P
12 doping to the sidewalls of the source contact trench in
13 the base layer, correct?

14 A. That's correct in the context of '634, that
15 apparently this P base region is not -- it's not
16 conducive in terms of forming an ohmic contact which
17 degrades the avalanche breakdown behavior during the
18 switching of the power devices.

19 Q. And so that P* doped regions, 209 in Figure 3B,
20 include P doping that was deposited in the ion
21 implantation step depicted in 3B as well as P doping
22 that was already in that sidewall before the ion
23 implantation step in Figure 3B, correct?

24 MR. WELLS: Objection, form.

25 A. Can you repeat the question again, please? I

1 think you mentioned something that's -- I might have
2 missed it -- that's critical.

3 Q. (BY MR. SAUNDERS) Okay. Yeah. So in Figure
4 3B of the '634 patent, those P* regions, 209, that
5 contain positive doping both from the ion implantation
6 step depicted in 3B as well as positive doping that was
7 already in the base layer, correct?

8 MR. WELLS: (Incomprehensible.)

9 THE REPORTER: I'm sorry. Was there an
10 objection?

11 MR. WELLS: Same objection, yes.

12 THE REPORTER: Thank you.

13 A. Let's address your question in two parts. The
14 P -- P base layer doping is always going to be there,
15 and that's very light.

16 Okay. That's not -- that's -- for sure in
17 the context of '634, it's not conducive to forming the
18 only contact, at least not along the entire sidewall of
19 the trench -- source contact trench in the base layer.

20 Now, you mentioned P+ doping. That P+
21 doping, its purpose is actually to be -- to be at the
22 bottom of the source contact trench.

23 Q. Let me withdraw my question, then, because I
24 may have misspoken if I mentioned P+. I did not mean to
25 mention P+. Let me ask the question again.

1 In Figure 3B of the '634 patent, those P*
2 regions have positive doping from both the ion
3 implantation procedure that's depicted in Figure 3B as
4 well as the positive doping that was already present in
5 the base layer in Figure 3A, right?

6 MR. WELLS: Objection to form.

7 A. Again, it's a similar analogy to the fact of
8 the N+ -- we agree on the N+. When that implant in
9 Figure 3B introduced the overwhelming amount of N+
10 doping in the -- sorry -- entire source region simply
11 overwhelmed means that whatever P type you may have
12 introduced now manifested electrically.

13 And in the same analogy, whatever P base
14 doping you already have compared to the implant you
15 introduce in that 3B, if this -- the implant -- those
16 introduced in 3B electrically, that facilitate the
17 formation of an ohmic contact.

18 The P base layer by itself, it may be there
19 but it may be in the ratio of a couple order of
20 magnitude -- 2 or 3 order of magnitude is of -- no
21 effect in terms of contributing to the formation of
22 ohmic contact along the entire sidewall of the trench in
23 the base layer.

24 Q. (BY MR. SAUNDERS) You would agree with me that
25 some of the boron ions that are in element 209 in Figure

1 3B could have been present before the ion implantation
2 step in Figure 3B because 205 was already positively
3 doped with -- or was already doped with P type doping,
4 correct?

5 MR. WELLS: Objection to form.

6 A. I would answer the question this way. Similar
7 to the (incomprehensible) N type doping that was used to
8 grow an epitaxial layer, that will already also be in
9 the P base. It's just whether they manifest themselves
10 electrically speaking or not.

11 So if you want to ans -- if you want to
12 be -- if I were to follow your logic of answering the
13 question in that case in that P base layer, I will say
14 this, also, whatever N type dopant that is -- that's
15 there to use to form the epitaxial N minus layer for the
16 drain -- for that layer to be residing on top of the
17 silicon substrate, so that layer -- that epitaxial
18 layer, its doping concentration, which would be N type,
19 usually made with phosphorus or arsenic, that will also
20 be present there.

21 But so what? Do they manifest themself
22 electrically speaking or do they -- the answer would be
23 no because the P base layer would presumably be the one
24 that dictate the threshold voltage, whereas in this case
25 the P* profile introduced by this implant in 3B, giving

1 the background of having both the N type epitaxial layer
2 and the P base layer still would depend on the '634
3 patent. The inventor depend on this implant to
4 facilitate the formation of the ohmic contact.

5 Now, we can talk about whatever inherent
6 foundational -- whatever you want to call it --
7 inherent, intrinsic doping concen -- dopant were there
8 already.

9 It's fine but they do not contribute to the
10 formation of the ohmic contact there and they do not
11 contribute to the formation of the P* profile as
12 specified in the specification of '634 patent.

13 Q. (BY MR. SAUNDERS) Yeah, I understand your
14 answer; and I appreciate it. I asked a much simpler
15 question, and my question did not reference ohmic
16 contact or electrical contact.

17 My questions have been pretty simple, and
18 so let me ask it this way. Again, just asking about
19 dopant concentration, is it correct to say that the
20 dopant concentration that's going to be present in the
21 P* regions in Figure 3B after that ion implantation
22 procedure of Figure 3B is done is going to depend, in at
23 least some degree, on all of the prior dopant additions
24 that occurred before the ion implantation procedure of
25 Figure 3B?

1 MR. WELLS: Objection to form.

2 A. When you say depend on certain degree, for
3 example, the N+ certainly its electrical behavior will
4 be -- will not be impacted by the introduce --
5 introduction of this implant in 3B.

6 Similarly, in an analogous way, the P base
7 layer, the doping, however, they may be present. Yet,
8 they -- in terms of order of magnitude, I would say that
9 at least in order to facilitate the device structure,
10 you don't want to hear ohmic contact by at least -- in
11 order to facilitate the invention '634.

12 That doping concentration coming from the
13 implant of 3B is necessary and it is the -- the one that
14 dictates the profile of P* doping concentration.

15 Q. (BY MR. SAUNDERS) Okay. So is it fair to say
16 that the P* regions depend on all of the doping that
17 occurred before but that the ion implantation procedure
18 that's in Figure 3B is, by far, doing most of the doping
19 that's affecting the final result of the P* -- P* doping
20 that's depicted in Figure 3B? Is that fair?

21 MR. WELLS: Objection to form.

22 A. If you -- if you want me to answer the
23 question, in that case we will have to bring in the
24 epitaxial doping in the background when I roll the
25 epitaxial later on top of the silicon substrate.

1 1 And, you know, it's -- granted, they're
2 2 there; but they are not in contrast to the implant
3 3 introduced in 3B. They really don't -- they're there
4 4 but -- but they -- you used the word product -- you used
5 5 the word, I think, in terms of relativity. I will even,
6 6 you know, lower that even much more. I don't think they
7 7 even -- in terms of doping concentration, it will be
8 8 order of magnitude different and it's -- it will be
9 9 insignificant.

10 10 MR. SAUNDERS: Counsel, is now another time
11 11 for a good -- another good time for a break?

12 12 MR. WELLS: Yes, that would be great.

13 13 Thanks.

14 14 MR. OJEMEN: It's lunchtime.

15 15 MR. SAUNDERS: Let's go off the record.

16 16 MR. OJEMEN: So should we go for lunch --

17 17 MR. SAUNDERS: Oh, yeah.

18 18 THE VIDEOGRAPHER: Going off the record.

19 19 The time is 12:01 p.m.

20 20 12:53 20 (Recess from 12:01 p.m. to
21 21 p.m.)

22 22 THE VIDEOGRAPHER: Okay. We're back on the
23 23 12:53 22 record. The time is p.m.

24 24 Q. (BY MR. SAUNDERS) All right. Dr. Liu, do you
25 25 remember before the break we were talking about your
26 26 opinions relating to the '634 patent term, "the

1 sidewalls of said trenches in said base layer"?

2 Do you remember that?

3 A. Yes, I do.

4 Q. Okay. And I want you to turn to Figure 4 of
5 the '634 patent.

6 A. (Witness complies.) Okay. I'm there.

7 Q. What -- did you analyze Figure 4 of the '634
8 patent in connection with reaching your opinions about
9 claim construction in this case?

10 A. I analyzed -- I'm sorry. We're talking
11 about -- I just want to clarify. I'm -- we're talking
12 about '634, not the -- not the Kobayashi. We're talking
13 about '634, right?

14 Q. Yeah, Figure 4 of the '634 patent.

15 A. Yes, I analyzed '634, yes.

16 Q. Okay. What is Figure 4 of the '634 patent
17 depicting?

18 A. That's the figure axes indicated that denotes a
19 doping concentration versus depth.

20 Q. And the vertical -- or sorry. The -- let me
21 withdraw.

22 The depth range in Figure 4 corresponds to
23 the line that's labeled capital I to capital I in
24 Figure 2G of the '634 patent; is that correct?

25 A. I believe that's the case, yes.

1 Q. Okay. And that line is passing through the
2 source layer and the base layer and the epitaxial layer,
3 202; is that right?

4 A. That's correct.

5 Q. Prior to the ion implantation procedures of
6 Figure 3A and 3B, would you expect the doping profile of
7 the sidewalls of the source contact trench to be the
8 same as depicted in Figure 4 of the '634 patent?

9 A. Can you repeat your question again?

10 For example, you mentioned a lot of things.
11 I just want to make sure the context -- I understand
12 your context.

13 You mentioned before the implant. Which
14 implant and what are you referring to? Can you please
15 rephrase the question? I'm sorry.

16 Q. Yeah. So if -- if the '634 -- let me rephrase
17 the question.

18 So would you expect that a line that is
19 drawn through the same depth as the I-to-I line in
20 Figure 2G but was drawn through the sidewall area of the
21 source contact trench but that was drawn prior to the
22 steps of Figure 3A and 3B -- would that doping
23 concentration profile be the same as the doping
24 concentration profile that's depicted in Figure 4?

25 MR. WELLS: Objection to form.

1 A. So it appears -- if I understand you correctly,
2 you are asking me the doping concentration profile if I
3 were to look at -- in the vertical direction just
4 hypothetically going through the top and going down from
5 the I-I point? You want me to opine on how that
6 correlate with Figure 4?

7 Q. (BY MR. SAUNDERS) Well, let me ask it a
8 different way. Can you imagine taking the same I-to-I
9 line that's in Figure 2G and putting it in Figure 2D of
10 the '634 patent?

11 Are you following me so far?

12 A. 2D.

13 Q. Yeah.

14 A. 2B. Okay.

15 Q. 2D.

16 A. Okay.

17 Q. And Figure 2D of the '634 patent depicts what
18 the state of the MOSFET is in manufacturing before the
19 steps of Figures 3A and 3B, correct?

20 A. That's correct.

21 Q. Okay. And Figure 2E of the '634 patent
22 reflects the state of the MOSFET manufacturing after the
23 steps depicted in Figures 3A and 3B, correct?

24 A. That's correct.

25 Q. Okay. And so let me ask one question. So if

1 I -- if you took the exact same line that's in
2 Figure 2G, the I-to-I line, and you put it in Figure 2D
3 to analyze the doping profile at that time in
4 manufacturing, would you expect it to be the same
5 profile as Figure 4?

6 MR. WELLS: Objection to form.

7 A. Depending on the -- depending on temperature
8 cycle volume that is negatively impact due to
9 temperature cycle and everything, I would assume that
10 they are -- they would be of the same similar profile as
11 in -- depicted in Figure 4.

12 Q. (BY MR. SAUNDERS) Okay. And if I took that
13 I-to-I line that's in Figure 2G and I put it in
14 Figure 2D, except I moved it directly adjacent to the
15 source contract trench, would you also expect it to have
16 essentially the same doping concentration as depicted in
17 Figure 4?

18 MR. WELLS: Objection to form.

19 A. Let me -- let me back up a little bit, okay?

20 I think -- I think I need to clarify, and I
21 need to back up a little bit.

22 In Figure 2D, if I were to draw the I-to-I
23 at the same location as Figure 2G, the profile may not
24 be the same as the patent alluded to because when you do
25 this implant and when you have just this P+ implant and

1 as in prior art you may have a dopant diffusion and to
2 the extent -- what the impact of the dopant diffusion is
3 hopefully without compromising your threshold voltage of
4 power MOSFET, you will be another profile. To the
5 extent whether that profile is similar to Figure 4, it
6 would -- as I mentioned earlier, to the extent -- it
7 would -- depends on temperature cycle.

8 If there's no temperature cycle but then
9 you have an implant, it depends on the -- how the
10 implant profile is. There may be some differences.

11 Although in general the profile -- as I
12 mentioned earlier, the profile would be similar in the
13 sense that you would be able to see the junction. You
14 will see the demarcation between the N+ and the P base,
15 whether it is pre -- pre 2G or pre 2D versus -- and you
16 also see -- excuse me -- the junction between the base
17 and epitaxial layer, 202, which is what we -- I spent a
18 lot of time right before the break testifying that that
19 dopant is also present there.

20 So you will see the junction but exact
21 concentration -- the concentration, you may not -- may
22 not be identical between the two -- between the two
23 hypothetical case -- cases.

24 Q. (BY MR. SAUNDERS) So is it your testimony that
25 the dopant profile that you see in Figure 4, it has been

1 affected in some way by the procedures that created the
2 209 and 208 in Figure 2G?

3 A. Without knowing the dimension, the lateral
4 dimension in Figure 4, and without having -- knowing the
5 concentration, you ask a hypothetical question.

6 Figure 4 is after the formation of -- of
7 the P+ (incomprehensible) and the P* -- we call it
8 lateral contact layer.

9 And as to -- hypothetically to use that to
10 reproduce what would it be in terms of I-I at 2D, I'm
11 saying that to the extent that there will be some
12 diffusion from both of the implants and to what extent
13 that will impact the profile, I will have to have more
14 context and more information to give you a -- give you
15 an exact answer.

16 But my answer was it's consistent in the
17 sense that the junction -- where the junction is going
18 to be. And in terms of going down the I, it's going to
19 be -- it's going to be pretty accurate.

20 And as you can see in the profile, you have
21 both the N+ source, 206, and the 205, which is the P
22 base layer -- P base layer post the implant and then you
23 have the epitaxial layer.

24 Q. Okay. So turning back to Figure 2D, would you
25 expect that a graph of the doping profile for doping

1 concentration versus depth will be similar for a line
2 drawn immediately adjacent to the source contact trench
3 as would a -- the same kind of graph for the doping
4 profile for a line drawn in -- let's say halfway in
5 between the gate oxide and the source contact trench?

6 MR. WELLS: Objection to form.

7 A. I understand -- I think I understand your
8 question.

9 Can you pinpoint where you are asking me to
10 draw the comparison that -- the horizontal direction
11 you're asking me to? I'm sorry.

12 Q. (BY MR. SAUNDERS) Yeah. So similar vertical
13 dimensions of the line as the I-to-I line in 2G, but I
14 want you to kind of compare two hypothetical similar
15 lines that you could draw in 2D. Would you expect, if
16 you put the line next to -- immediately adjacent to the
17 source contact trench, 224, and you put another line
18 halfway in between 224 and 203, would you expect those
19 two lines to have essentially the same doping
20 concentration profile?

21 MR. WELLS: Same objection.

22 A. So I think this is a hypothetical question; but
23 as a person of ordinary skill in the art, I would expect
24 the profile of Figure 4, which is located more closer to
25 the gate trench to be a certain profile.

1 And I would expect as I move my I-I to the
2 right in Figure 2G or even in Figure 2D, depending on
3 where you want, I will simply give you a reference. If
4 I were to move that line to the right closer and closer
5 toward the trench source contact, I would expect to
6 see -- the N+ profile, at least at the surface, it's not
7 going to change; but I will expect the 205 B, that
8 profile is going to increase as I move the line from the
9 left -- let's use Figure 2G -- as I move the line in
10 Figure 2G, the I-I line, gradually to the right to be
11 closer to the trench source contact.

12 Q. (BY MR. SAUNDERS) Okay. So I'm just ask --

13 A. Sorry. I'm not finished yet.

14 So the reason I'm hesitant to make that --
15 such comparison, even though I answer your question, is
16 that as you move -- for example, if you move closer and
17 closer almost to the trench source contact, you actually
18 begin to see another big bump that you didn't see in
19 Figure 4, which will represent approaching the P+ base
20 layer. At least close to where the junction with 202 is
21 you'll see another bump.

22 So it's -- in a way, that's the reason I --
23 when I answer your question, your hypothetical question,
24 it has to have context and also has to have the --
25 taking the count into the process and also the

1 temperature cycle that the device has gone through.

2 Q. Okay. Figure 2D doesn't have, though, the P+
3 region yet, right?

4 A. That's correct, but I'm assuming that you were
5 asking me to move along with the presence of the P+
6 implant and the P base -- and the lateral contact layer.

7 Q. Let me ask the question this way: So looking
8 at line -- in Figure 2D, which is before we have the
9 implants 209 and 208, would you expect that the doping
10 profile would be relatively uniform anywhere that you
11 could draw the line provided that the line goes through
12 the same structures that the line in 2G goes through?

13 MR. WELLS: Objection, form.

14 A. Generally speaking, it may be similar but due
15 to the action -- due to the doping segregation, there
16 may be modifications to the profile.

17 Again, as we're seeing in the vertical
18 axis, there's no designation for the doping
19 concentration. It's just a relative drawing.

20 For example, this could be a logarithmic
21 scale as we know it; and in that case a little
22 separation could be an order or two order, even three
23 orders of magnitude.

24 Q. (BY MR. SAUNDERS) So turning back to Figure 4,
25 do you see in the figure that there are two local minima

1 in the graph?

2 A. Yes, I do.

3 Q. Okay. One of those little local minima is
4 closer to the left between the 206 label and the 205A
5 label; is that right?

6 A. That's correct.

7 Q. And a second local minima is somewhat above the
8 depth label that's at the bottom of the axis?

9 A. That's correct.

10 Q. Okay. And is it your understanding that the
11 region that's labeled 206 between the left axis and that
12 first local minima -- does that correspond to the doping
13 concentration of the source layer?

14 A. That's correct, although I must caution there
15 is -- there's a bit of a convolution in terms of
16 presentation in the sense that the depth -- even though
17 the I-I point to -- is pointing to going from the
18 interlayer dielectric all the way down to epitaxial
19 layer and, yet, I do not -- I do not know where the
20 demarcation between the (incomprehensible) source and
21 the dielectric layer because the figure simply want to
22 show that the profile begins within the interlayer
23 dielectric. So....

24 Q. Okay. So there should be a little bit more to
25 the left of that left axis where -- reflecting doping in

1 a dielectric layer or the absence of doping in a
2 dielectric layer. Is that fair?

3 A. That's one possibility. Another possibility is
4 that inter dielectric is accounted for in perhaps the
5 some -- he's trying to depict some doping that
6 segregated into. I can't speculate. I don't know -- I
7 don't know -- I'm not the inventor. I didn't draw -- I
8 just want to caution in interpreting this.

9 And I also want to caution interpreting
10 this that the doping concentration is not labeled. So
11 it could be -- it could be several order of magnitude in
12 between each of the -- of the so-called peak.

13 Q. Okay. And turning back to Figure 4 of the '634
14 patent, is it your understanding that the area of that
15 graph between the two local minima, which has the label
16 205 underneath that -- does that entire area correspond
17 to the doping profile of the base layer 205?

18 A. That correspond to the base layer 205, the
19 profile after the formation of the base layer and the
20 implants region. So some dopant compensation or --
21 compensation neutralization would occur. As you can
22 see, that's why the junction is formed.

23 Q. And the area after the second local minima
24 through to the end of the right end of the chart in
25 Figure 4 that has the label 202 underneath it, does that

1 area correspond to the doping concentration for the N
2 epitaxial layer, 202?

3 A. That's correct. And in looking at the figure,
4 just seeing that there seems to be an extended amount of
5 dopant in terms of the -- the extent of the amount
6 increase the dopant of the epi is gradually increasing.

7 As we go down in the I-I, it shows that
8 there's a lot of the -- at least the 205B profile, even
9 those shown illustrated such a high step.

10 In fact, there may be a lot of doping
11 compensation or neutralization going on which would
12 imply -- or give me some idea what the profile 205B is
13 relative to 202.

14 Q. So Figure 4 of the '634 patent indicates that
15 the doping concentration is not uniform with --
16 throughout the entire source layer, 206, correct?

17 A. Repeat your question again.

18 Q. Yes. So looking at Figure 4 of the '634
19 patent, that tells you that the doping concentration
20 within source layer 206 is not entirely uniform,
21 correct?

22 A. I think the more correct way will say that the
23 representation is showing sort of what we call like a
24 (incomprehensible) function or profile in which there's
25 a decreasing of the doping profile as we go closer to

1 the base region.

2 But, again, this is just graphical
3 representation. It also depend on what dopant is used.
4 Certain dopant we use tend to be able to get a very --
5 what we call -- we would call more of a -- much steeper
6 or I would say like a box dopant profile.

7 But given that this is just a graphic
8 representation, it's not trying to accurately depict the
9 total dopant concentration. I would agree that this --
10 this profile was shown with 206.

11 Q. Okay. And similarly the profile for 205, the
12 base layer in Figure 4 is not showing a uniform amount
13 of dopant within the base layer, correct?

14 A. Again, due to the doping compensation of the
15 counter doping and due to the processing and, again, due
16 to the fact that this is only a representation, it's
17 hard for me to -- to know how uniform that -- the extent
18 of the doping concentration in the base region but
19 suffice to say that the graphical representation
20 shows -- again, shows a profile.

21 Q. It's not unusual in the context of ion
22 implantation to have, you know, decreasing doping
23 concentration as you go deeper into the portion of the
24 semiconductor that's receiving an ion implantation; is
25 that correct?

1 MR. WELLS: Objection to form.

2 A. I would say it would depend on context, yes.
3 Normally when you form an implant, you're putting a
4 profile -- again, it's like a -- like for the lack of
5 better description, perhaps if I look at a profile being
6 an upside down U and then given the temperature cycle,
7 the -- that profile will get broadening out in all
8 direction.

9 Q. (BY MR. SAUNDERS) All right. Let's move on
10 now to your opinions about the next '34 patent term. I
11 believe it's in your declaration starting on Page 18 of
12 your claim construction declaration.

13 A. Let me get to my declaration. Did you say
14 Page 18?

15 Q. Yeah.

16 A. Thank you. I'm there.

17 Q. Okay. And so that's where you begin your
18 opinions about the term "a plurality of trench gates
19 covered by said interlayer oxide film are formed on top
20 of said source layer extended downwardly through said
21 base layer"; is that correct?

22 A. Paragraph 61, yes, that's true.

23 Q. It's actually starting at -- I guess the term
24 between -- appear between paragraph 61 and 62, right?

25 A. That's correct, yes, starting with 61 and then

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1 2 -- bullet 2, yeah.

2 Q. And your opinions about this term are set forth
3 in paragraphs 62 through 71 of your declaration; is that
4 right?

5 A. Give me a second. Yes, that's correct.

6 Q. And it's your opinion that ASUS' proposed
7 construction is the correct construction for this term;
8 is that right?

9 A. That's correct.

10 Q. And paragraph 62 through 71 set forth the
11 complete basis and reasons for why you believe ASUS'
12 proposed construction is the correct construction; is
13 that correct?

14 A. It set forth the reason I believe is sufficient
15 to -- in this declaration to support my conclusion and
16 my opinion that ASUS' claim construction is correct,
17 yes.

18 Q. Sitting here today, you can't think of any way
19 that paragraphs 62 through 71 of your declaration are
20 somehow incomplete with respect to what your opinions
21 are about this term?

22 A. Again, I -- as we discussed this morning, I --
23 I don't know, when you throw the term "complete," what
24 that means, but suffice to say I stand by -- I -- what I
25 put in -- in my declaration as the sufficient argument

1 to support my opinion of the claim construction of this
2 term.

3 Q. And it's your opinion that Force MOS' proposed
4 construction is not appropriate or correct; is that
5 correct?

6 Let me rephrase it a different way. It's
7 your opinion that you disagree with Force MOS' proposed
8 construction for this term, right?

9 A. That's correct. I'm more comfortable with -- I
10 disagree with Force MOS' proposed construction.

11 Q. And is it your understanding that the
12 difference between ASUS' proposed construction and Force
13 MOS' proposed construction, that ASUS' proposed
14 construction requires the tops of the gates be higher
15 than the tops of the source layer?

16 A. Can you repeat the question again, please?

17 Q. Yeah. I'm trying to confirm your understanding
18 of the difference between ASUS' proposed construction
19 and Force MOS' proposed construction.

20 So is it fair to say the difference between
21 those two constructions, in your mind, is that ASUS'
22 proposed construction requires the tops of the gates to
23 be higher than the top of the source layer?

24 A. Perhaps because the lunch -- having food coma,
25 I'm having a little hard time parsing your question. So

1 I would beg for a little latitude, I think, and try to
2 repeat the question again because I think there's
3 some -- there may be -- the way I understand the
4 question may not be the same as you intend to ask.

5 Q. Okay. Let me try and point you to something.
6 So do you -- can you turn to paragraph 65 of your
7 declaration?

8 A. (Witness complies.) Yes, I'm there.

9 Q. And then you see in the sentence that crosses
10 between Pages 19 and 20, you say, "As depicted in
11 Figure 2D, the trenched gates are formed slightly above
12 the source layer and then extend downwardly into the
13 base layer"? Do you see that?

14 A. I do see it.

15 Q. And it's your understanding that ASUS' proposed
16 construction requires the trenched gates to be formed
17 above the source layer; is that correct?

18 A. I think my -- my analysis and my opinion are a
19 little -- perhaps a little bit more than simply that.

20 I believe that my analysis or the ASUS --
21 of the ASUS proposed construction does not try to
22 introduce terms, and it's more in line or more faithful
23 to what an actual process flow would be in understanding
24 of a person of ordinary skill in the art.

25 Q. Okay. Let's turn to paragraph 69 of your

1 declaration. Let me know when you're there.

2 A. (Witness complies.) I'm there.

3 Q. And you say, in that first sentence there, "As
4 shown, Figure 2D clearly depicts the trenched gates
5 (204) that are not coplanar with or on the same level as
6 the source layer (206)."

7 Do you see that?

8 A. Yes, I do.

9 Q. And is it your understanding that ASUS'
10 construction excludes having trenched gates be coplanar
11 with the source layer?

12 MR. WELLS: Objection, form.

13 A. It is un -- it is my understanding and going
14 through the claim construction analysis and based on the
15 evidence and based on my understanding as a person of
16 ordinary skill in the art, I believe ASUS' claim
17 construction of a priority of trenched gates covered by
18 said interlayer oxide film, that claim construction form
19 on top of said source layer extending downward through
20 said base layer should be a quality of trenched gates
21 covered by said interlayer oxide film and are formed and
22 extend from above said source layer through said base
23 layer.

24 Q. (BY MR. SAUNDERS) So "from above" means they
25 can't be coplanar; is that right?

1 A. Given -- again, given the analysis, given the
2 patent specification, and given the understanding of the
3 process for -- from a person of ordinary skill in the
4 art, I agree with ASUS' claim construction is a form and
5 extend from above. That's correct.

6 Q. Okay. And so the sentence that you're -- you
7 provide in that first -- the first sentence of paragraph
8 69 of your declaration, it's your opinion that sentence
9 is -- is something that is supporting ASUS' proposed
10 construction and is refuting Force MOS' proposed
11 construction; is that correct?

12 A. You mean paragraph 69. Which particular
13 section of paragraph 69?

14 Q. The very first sentence.

15 A. I'm pointing out -- based on Figure 2D and
16 based on a depiction, I'm pointing out they are not
17 coplanar or on the same level as the source layer.

18 Q. And the reason you're pointing it out is
19 because you believe that supports ASUS' construction,
20 correct?

21 A. The reason I point it out, because it's
22 factual; and also it's my understanding as person of
23 ordinary skill in the art that -- how the process
24 sequence will come about and how the relative position
25 will be.

1 And that -- that understanding and with the
2 inclusion of Figure 2D support my opinion that ASUS'
3 claim construction is the correct one.

4 Q. Okay. Well, let me ask it this way: If
5 Figure 2D had depicted the top of the trenched gates as
6 being coplanar with the top of the source layer, then
7 Figure 2D would not support ASUS' construction in that
8 hypothetical, correct?

9 A. Repeat your hypothetical question again,
10 please.

11 Q. Yeah, if -- if Figure 2D had instead depicted
12 the tops of the trenched gates, 204, as being coplanar
13 with the tops of source layer, 206, then that figure in
14 that hypothetical would not support ASUS' construction,
15 correct?

16 A. Given this hypothetical case, I would look at
17 the process flow which, by the way, would not support
18 this hypothetical case.

19 So you're asking me: Given this
20 hypothetical case, it would not support the -- the claim
21 construction of ASUS.

22 And I think -- I think this is hypothetical
23 because as we discussed earlier, in forming my opinion
24 of the claim construction and making this declaration,
25 there is different layers, different progression of

1 consideration, and, of course, specification; and this
2 figure is one aspect.

3 I also rely on the claim taken as a whole
4 in the context of the specification invention and also
5 taken as a whole of my knowledge as a person of ordinary
6 skill in the art.

7 So in this hypothetical case, I -- I don't
8 know how to -- how to answer your question.

9 Q. Well, I'm just trying to understand your
10 opinions and the basis for your opinions and what you're
11 doing in regards to Figure 2 and why you think Figure 2
12 is relevant to your analysis.

13 I assume that you're citing Figure 2
14 because you believe it supports your ultimate conclusion
15 that ASUS' construction is correct. Is that true?
16 And -- sorry. Let me withdraw it.

17 Is -- are you citing Figure 2D in paragraph
18 68 and 69 of your declaration because you believe
19 Figure 2D supports ASUS' proposed construction of this
20 term?

21 A. Okay. Let me answer your question in this
22 fashion. Again, as I discussed earlier this morning how
23 I come about in forming my opinion with the claim
24 construction and how I opine and the analysis I go
25 through, in the analysis the reason Figure 2D would be

1 included is because it is consistent with all the
2 progression I've gone through in forming my opinion.

3 Again, that includes the context of -- of
4 the '634 patent. That includes the context of this
5 figure. That includes the context of the claim. That
6 also include my understanding of the process sequence.

7 And to the fact -- to the extent that
8 Figure 2D is consistent with my understanding of the
9 process, and -- it gives me confidence or it gives
10 credence to that Figure 2D would be consistent in
11 representing how the actual flow would be.

12 And that is part of the basis in forming my
13 opinion and -- with this -- with this term -- in
14 pursuing this term.

15 Q. Okay. It's fair to say that there are a number
16 of figures in the '634 patent that you did not
17 specifically cite or discuss in your opinions about this
18 claim term in your declaration, correct?

19 A. I would -- I would have to -- I'm trying to
20 understand. I mean, I think I could include as many
21 figures I want but that would -- and I would risk
22 being -- overloading information, plus the figure would
23 have to be faithful representation of what is actually
24 happening in the process flow.

25 Q. Okay. And so you chose Figure 2D as opposed to

1 some of the other figures because you believe it
2 supported your conclusion as to the correct construction
3 of this term in a way that particularly exemplified your
4 opinions. Is that fair?

5 MR. WELLS: Objection to form.

6 A. I believe I answer your question already. I --
7 putting sufficient evidence, and all the evidence will
8 have to be consistent. That includes, again, the
9 citation for information from the specification as well
10 as my knowledge of the process flow, being a person of
11 ordinary skill in the art, and taking into the context
12 of what the invention is trying to achieve.

13 And that's the consideration and all these
14 are consistent and these will be used as basis of my --
15 to support my conclusion and my opinion.

16 Q. (BY MR. SAUNDERS) All right. Let's go to
17 paragraph 64 of your declaration. Do you see in that
18 paragraph you have images from Figures 2C and 2D of the
19 '634 patent?

20 A. Yes, I do.

21 Q. And these are two images from different phases
22 of the manufacturing process for making a MOSFET
23 described in the '634 patent; is that right?

24 A. Repeat your question again.

25 Q. Yeah. So Figures 2C and 2D are showing two

1 different points in time in the manufacturing process
2 for a -- for making a MOSFET, right?

3 A. In the context of '634 patent, that's correct.

4 Q. And the Figure 2D shows later than -- in that
5 process than what's shown in Figure 2C, right?

6 A. That's correct.

7 Q. And between Figure 2D and 2C, what occurs is
8 that the interlayer oxide film, 207, is deposited and
9 the source contact trenches, 224, are etched; is that
10 correct?

11 A. We have to -- to answer your question, we have
12 to go back to the '634 patent in terms -- to understand
13 the process sequence.

14 The -- as you can see in my declaration, I
15 faithfully produced both 2C and 2D and so -- as not to
16 cherry-pick.

17 However, in the process flow as a person of
18 ordinary skill in the art will understand that when you
19 form the gate -- trenched gate, you first have the gate
20 oxide lining every area including a trench and the top
21 surface of your semiconductor material that has all
22 these layers already on top of the substrate.

23 And then you subsequently either through
24 CMP, which is chemical mechanical polishing, or through
25 a dry etch -- regardless what method you use, you cannot

1 change the fact that at that etching step, that
2 polysilicon or the trenched gate -- the gate itself,
3 because of being a conductor, is always on top of the
4 gate oxide, which at the time of etch is still on top of
5 the post service of semiconductor material.

6 So to the extent that Figure 2D is actually
7 a faithful representation of the difference in terms of
8 the material that are actually in, on top -- that
9 actually in -- should be with the device at the time of
10 Figure 2D, which is to say that the polysilicon after
11 you planarize it with the gate oxide -- the polysilicon
12 will always be higher or on top of the N+ source and
13 drained by at least a thickness of the gate oxide.

14 And this is the process flow and this is
15 the -- one of the consistent evidence to connect
16 Figure 4D with the actual process flow for a person of
17 ordinary skill in the art at the time of invention.

18 There's no getting around it -- the fact
19 that if you planarize it -- as the '634 patent described
20 clearly, if you planarize it, no matter how you slice
21 it, you cannot deny the fact that the polysilicon
22 gate -- the material to form the gate, polysilicon, is
23 higher than N+ source and drain by a thickness of at
24 least a gate oxide layer.

25 MR. SAUNDERS: I'm going to object as

1 nonresponsive.

2 Q. (BY MR. SAUNDERS) I'm going to ask you,
3 Dr. Liu, to please listen carefully to my question.

4 I'm asking a pretty simple question. I was
5 asking about the differences and what's happening
6 between steps 2C and 2D.

7 So let me ask it much more concretely. If
8 you look at column 3 of the '634 patent starting at line
9 41, continuing on to lines 49, that's the portion of the
10 '634 patent that is describing the steps that are
11 performed between Figures 2C and what is depicted in
12 Figure 2D; is that right?

13 A. Can you give me a few minutes to look through
14 it?

15 Q. Yeah, that's fine.

16 A. Okay.

17 Q. Okay. So you would agree with me that
18 column 3, lines 41 through 49 of the '634 patent, are
19 where it's describing the steps that are performed
20 between Figures 2C and Figure 2D of the patent; is that
21 right?

22 A. That's correct in that context, yes.

23 Q. Okay. Now, looking at Figure 2C of the '634
24 patent, you would agree with me that in Figure 2C it
25 depicts that the top of the gates, 204, are coplanar

1 with the top of the source layer, 206, in Figure 2C; is
2 that correct?

3 A. That's -- that's correct. It appears so.

4 Q. Okay. And so I want to walk through the steps
5 that are happening in column 3, lines 41 through 49.

6 So one of the steps mentioned there is the
7 addition of interlayer oxide film, 207.

8 Do you see that step?

9 A. Okay. Yes, I do.

10 Q. Okay. And that's the first step that's
11 mentioned in column 3 regarding Figure 2D, correct?

12 A. Repeat your question again.

13 Q. Yeah. So focusing again on the steps that
14 happened after Figure 2C to result in what's shown in
15 Figure 2D, what is described as the first of those steps
16 in column 3 is that we're depositing interlayer oxide
17 film, 207, by CVD procedure; is that right?

18 A. Yes, that's correct.

19 Q. Okay. Depositing the interlayer oxide film by
20 CVD procedure would not increase the amount of
21 polysilicon material that is labeled 204 in Figure 2C,
22 correct?

23 A. That's correct.

24 Q. Because the interlayer oxide film is made of a
25 different material than polysilicon, right?

1 A. That's correct.

2 Q. Okay. And depositing the interlayer oxide
3 film, 207, by CVD would not lower the profile of source
4 layer, 206, correct?

5 MR. WELLS: Objection to form.

6 A. That's correct.

7 Q. (BY MR. SAUNDERS) Okay. And, in fact, the CVD
8 procedure is about adding material, right?

9 A. That you -- I don't want to answer with
10 definitive yes or no because you're talking to nuances
11 but, in general, CVD stands for chemical vapor
12 deposition but there may be precursor or maybe precursor
13 removal type of step, but, in general, CVD stands for
14 chemical vapor deposition.

15 Q. And in column 3 in the discussion of Figure 2D,
16 after the CVD procedure for depositing interlayer oxide
17 film, 207, the next step mentioned is patterning --
18 "patterning is carried out by photolithography."

19 Do you see that step?

20 A. Yes, I do.

21 Q. And do you understand that as being --
22 referring to a step for creating a specific mask on top
23 of the semiconductor material?

24 MR. WELLS: Objection, form.

25 A. Can you repeat your question again? I'm sorry.

1 Q. (BY MR. SAUNDERS) Yeah. So the patterning
2 carried out by photolithography in column 3, lines 42 to
3 43, that's being done so that a mask can be applied to
4 the top of the semiconductor material, correct?

5 MR. WELLS: Same objection.

6 A. The patterning means applying photolithography
7 to define different region that you may want your
8 subsequent process to be carried out.

9 Q. (BY MR. SAUNDERS) And so in this context, the
10 photolithography is being used so that in the later
11 steps we're only etching in the areas that eventually
12 become 224, the source contact trenches; and we're not
13 etching in the other areas of the semiconductor,
14 correct?

15 A. That's correct.

16 Q. Okay. And after the photolithography step in
17 column 3, it talks about etching by dry oxide and it
18 talks about silicon etching.

19 Do you see both of those?

20 A. Yes, I do.

21 Q. And both of those are etching steps that are
22 used to create the source contact trenches, 224,
23 correct?

24 A. Correct.

25 Q. And those -- the source contact trench is

1 displaced horizontally from the gates, correct?

2 A. What do you mean by "horizontally"?

3 Q. So you're not etching into the gates themselves
4 when you're creating the source contact trench, 224,
5 right?

6 A. That's correct.

7 Q. The source contact trenches are depicted in
8 Figure 2D as being between gates, right?

9 A. That's correct.

10 Q. Okay. And so the steps of etching the source
11 contact trenches is not affecting the height of the
12 gates, correct?

13 A. That's correct.

14 Q. And other than the portions actually being
15 etched, the etching steps discussed in column 3, lines
16 42 through 49, are not changing the top of the source
17 contact layer; is that correct?

18 A. I -- I think they're -- repeat your question
19 again.

20 Q. Yeah. So the etching is making a hole that
21 passes through the oxide and the source contact layer
22 into the base layer, right?

23 A. That's correct.

24 Q. Okay. But it's not etching all of the source
25 layer, right?

1 MR. WELLS: Objection, form.

2 A. It's etching all the source layer that's being
3 opened by the mask.

4 Q. (BY MR. SAUNDERS) Okay. And so some of the
5 source layer is not being opened by the mask, right?

6 A. That's correct.

7 Q. Okay. And so for the sta -- the portions of
8 the source area that are not being opened by a mask, the
9 etching process is not changing that height profile of
10 that source layer, right?

11 A. Yes, that's correct.

12 Q. Okay. And so the steps described in column 3,
13 lines 41 through 49, of the '634 patent should not be
14 changing the relative coplanarity of the top of the
15 gates and the top of the source layer; is that correct?

16 MR. WELLS: Objection to form.

17 A. Again, I think I answered in very much detail
18 including the process flow and the sequence of
19 polysilicon formed on the surface of the gate oxide
20 throughout the gate trench as well as other area in the
21 formation step.

22 And as I mention, again, that once you
23 planarize it in -- prior to Figure 2C or prior to
24 description in Figure 2C, the -- you cannot change the
25 fact that the -- there's a -- there's a gate oxide on

1 top of the N+ source layer right next to the gate. And
2 that creates a step -- a height or height differential
3 between the polysilicon and the N+ source.

4 Q. (BY MR. SAUNDERS) So that gate oxide that you
5 believe that is creating a height differential, where is
6 that depicted in Figures 2C or 2D?

7 A. In Figure 2D that gate oxide, by the virtue of
8 being removed -- that's why in Figure 2D the step height
9 or the fact that the gate is on top of entire source is
10 manifested because at that step -- the N -- the gate on
11 top -- gate oxide on top on N+ is removed prior -- is
12 removed so you -- the step height is manifested.

13 Q. So what step do you think that the gate oxide
14 film on top of the source layer is removed?

15 A. There are a few possibility, and I analyzed
16 both cases.

17 One is that a gate oxide is not removed and
18 then, therefore, you have a step height or the gate
19 oxide is removed because remove -- gate oxide removal --
20 selected gas removal is very straightforward and you
21 still have a step height.

22 Q. Where do you analyze that in your declaration
23 on this term?

24 A. You -- can you rephrase your question? I'm
25 not -- I'm not following.

1 Q. Yeah. You just identified two potential
2 interpretations of process step. I'm trying to
3 understand if those -- that discussion or analysis is
4 written up somewhere in your declaration, and so I asked
5 you to point me to where that is.

6 A. I mentioned that as a person of ordinary skill
7 in the art in the process flow; and looking at the
8 process flow as depicted by '634 patent, it supports my
9 opinion of the claim construction of this place on top.

10 Q. Okay. So where -- what paragraph of your
11 declaration do you want to point me to?

12 A. I think paragraph 65 would encapsulate the
13 understanding of the process flow through Figure 2D.

14 So I said, "As depicted in Figure 2D, the
15 trenched gates are formed slightly above the source
16 layer and then extend downwardly into the base layer."

17 Q. And where in paragraph 65 are you discussing
18 the gate oxide layer?

19 A. I'm not sure I understand your question.

20 Q. Well, I believe asking a bunch of questions
21 that -- about your opinions on this term you've referred
22 to the gate oxide layer as creating a height
23 differential between the top of the gates and the top of
24 the source layer. Is that -- am I remembering your
25 testimony correctly?

1 A. Yes. And that was in the context of a person
2 of ordinary skill in the art looking at '630 --
3 patent -- the '634 patent and understand the process
4 flow.

5 That was in the context, and I was trying
6 to elaborate that aspect of the progression that I went
7 through to form my opinion.

8 And this term of a priority of trenched
9 gates covered by said interlayer oxide film are formed
10 on top of said source layer extending downwardly through
11 the base layer, it is based on the process flow.

12 And I elaborated in this deposition it's
13 based on the process flow based on the context of '634
14 and based on the figures -- the figure that described
15 the process sequence that I opine that -- what the terms
16 should be construed.

17 So in this deposition, I'm simply trying
18 to -- you're asking me -- I'm trying to elaborate the
19 nuances just like you're asking me to elaborate on
20 nuances of implantation -- what implantation is.

21 Nowhere in my deposition do I mention
22 implantation, but I took the time to explain
23 implantation to you.

24 Similarly, as a person of ordinary skill in
25 the art, the way I understand the process flow, the

1 way -- the progression I go through to form my opinion,
2 you are asking me this opinion; and I'm elaborating it.

3 Q. Okay. But it's fair to say I'm not missing
4 somewhere where you discussed -- in the written draft of
5 your declaration submitted in this case, that explains
6 the role of the gate oxide layer in creating a height
7 differential between the tops of the gates and the
8 source layer.

9 I'm not missing it, right? It's just not
10 there. Is that fair?

11 MR. WELLS: Objection, form.

12 A. It's just like you're not missing my
13 description of ion implantation within my declaration,
14 I'm simply trying to let you know that in the
15 progression as we discussed this morning in forming --
16 in pursuing the -- to forming my opinion on how the term
17 is construed and we discussed the process flow that I --
18 based on my understanding of the process flow.

19 And you got into the process flow. You
20 lead me into the process flow to column 3 of '634. So
21 I'm trying to -- with a benefit, adding color or context
22 to the process flow. So, no, you didn't miss it.

23 Q. (BY MR. SAUNDERS) Okay. Can you go to
24 Figure 2B of the '634 patent? Let me know when you're
25 there.

1 A. I'm there.

2 Q. Okay. So what is the element that's labeled
3 222 in that figure?

4 A. Will be the oxide film.

5 Q. Okay. And is that the same oxide film that's
6 labeled 203 in Figure 2C?

7 A. It would be on the sidewall of the -- of the
8 gate trench -- trenched gate.

9 Q. But the portions of that oxide film that are
10 above the source layer, 206, have been etched away by
11 the time you get to Figure 2C; is that right?

12 A. Again, there will be -- when you planarize it,
13 you're trying to achieve planarization between the
14 gate -- polysilicon gate and the oxide.

15 And as -- if -- I don't want you to come
16 back to say, you know, where in the -- but in the
17 specification it's very clear that they're -- the oxide
18 will be removed and, thus, there will be -- so the oxide
19 will be etched -- etched back.

20 Q. It will be etched back so that the top of the
21 surface is planar, as you say, right?

22 A. The planarization itself will make the top of
23 the surface planar. So that gate oxide -- the top of
24 the gate oxide and the top of polysilicon will be
25 planar.

1 Q. So once that planarization process is done,
2 your -- the only place that you're going to have that
3 gate oxide layer is within the gate trenches themselves,
4 as shown in Figure 2C; is that right?

5 A. I -- I want to be cautious in saying that
6 because the specification says that the planarization is
7 done, okay? And -- will you repeat your question again?

8 Q. Yeah. So after the planarization process you
9 mentioned, the gate oxide layer is only present in the
10 gate trenches, as illustrated in Figure 2C, correct?

11 A. Also, in Figure 2C the gate oxide is only in --
12 in the trench but there's a step going through to get to
13 that stage and it may not be a faithful representation
14 of the process flow.

15 The -- as I testified, the polysilicon will
16 always be due to the gate oxide -- during the formation,
17 the polysilicon will always be buffered or will always
18 be on top of the entire source and drain by that gate
19 oxide.

20 So now if you remove the planarization --
21 you do the planarization and if Figure 2C is to show
22 that the gate oxide is removed outside of the trench,
23 then that step height is there because the polysilicon
24 initially was formed on top of the gate oxide.

25 Q. Is there a figure showing -- sorry. Let me

1 withdraw it.

2 Before Figure 2D in the patent, is there a
3 figure that's showing the polysilicon for the gates
4 being formed above the gate oxide layer?

5 A. That will be Figure 2B.

6 Q. Okay. So in Figure 2B there's polysilicon
7 above the -- above the source regions but by the time
8 you've done planarization in 2C, you no longer have that
9 polysilicon above the source regions; is that correct?

10 A. If CMP is done to planarize at that point
11 the -- if 2C were to be the true representation of the
12 CMP making the surface planar, then in that case the
13 polysilicon will be coplanar with the gate oxide -- the
14 surface of the gate oxide layer on top of the source
15 region.

16 Q. Okay. Let's see.

17 A. And that's the gate -- because once you
18 planarize it, the gate -- each of the gate trenches are
19 isolated. Of course, the patent always -- also talks
20 about need to take that gate -- connection gate
21 elsewhere.

22 That's another nuances, of course, not in
23 my declaration; but it's in the '634. The point I bring
24 up is I consider all aspect of the process flow into
25 making -- to support my opinion or the claim

1 construction of how the term should be construed.

2 Q. Okay. Are you complete with your answer?

3 A. I believe I am.

4 Q. Okay. Now, if you could, turn to Exhibit 8,
5 which was your declaration you submitted in the IPR of
6 the '634 patent. Let me know.

7 A. Exhibit 8?

8 Q. Yeah, I believe it's Exhibit 8. Go ahead and
9 confirm it's the -- your declaration submitted the '634
10 patent's IPR.

11 MR. WELLS: Yeah. Counsel, would this be a
12 good time to take a break? We've been going for about
13 an hour and 15 minutes.

14 MR. SAUNDERS: Yeah, that's fine. We can
15 go off the record.

16 THE WITNESS: Thank you.

17 MR. SAUNDERS: Are we off?

18 THE VIDEOGRAPHER: Sorry. Stepped away
19 there. Going off the record. The time is 2:08 p.m.

20 (Recess from 2:08 p.m. to 2:21 p.m.)

21 THE VIDEOGRAPHER: Okay. We're back on the
22 record. The time is 2:21 p.m.

23 Q. (BY MR. SAUNDERS) Okay. Dr. Liu, do you have
24 Exhibit 8 to your deposition, your declaration submitted
25 in the IPR of the '634 patent?

1 A. Yes, I do.

2 Q. And in that declaration, starting on Page 20
3 you have a section on "Claim Construction"; is that
4 correct?

5 A. That's correct.

6 Q. Okay. And in that section you address the
7 construction of the term "the sidewalls of said trenches
8 in said base layer"; is that correct?

9 A. Give me a minute to get to that, yeah. Do you
10 mean in paragraph 62?

11 Q. Yeah. Generally in that section which is all
12 of paragraphs 58 through 62 of your IPR declaration, the
13 only term whose construction you're addressing is the
14 term "the sidewalls of said trenches in said base
15 layer"; is that correct?

16 A. I think in the -- a correct way to say that:
17 In the scope of the IPR work, I offered how a POSITA
18 would construe the term, "the sidewall of said trenches
19 in said base layer" in the scope of the IPR work.

20 Q. And in your IPR decla -- sorry. Let me
21 withdraw.

22 In your declaration submitted in the IPR of
23 the '634 patent, in the claim construction section you
24 don't address the construction of the term "a plurality
25 of trench gates covered by said interlayer oxide film

1 are formed on top of said source layer extending
2 downwardly through said base layer"; is that correct?

3 A. Without looking through my declaration that was
4 done last year, I believe the section within the scope
5 of the IPR declaration where I'm tasked to -- where I'm
6 given specific tasks of -- to compare the prior art with
7 respect to the '634 patent, yes, I offered the -- how to
8 construe the term a person of -- a person of ordinary
9 skill in the art would construe the term "the sidewall
10 of said trenches in said base layer."

11 Q. Okay. But for the term "a plurality of trench
12 gates covered by said interlayer oxide film are formed
13 on top of said source layer extending downwardly through
14 said base layer," you didn't offer an express
15 construction of that term in your IPR declaration,
16 correct?

17 A. Yes. I think that's fair to say, yeah. No, I
18 did not offer a construction. Again, this -- within the
19 flow of the IPR petition that I offered the claim
20 construction of the term "the sidewalls of said trenches
21 in said base layer."

22 Q. I'm going to upload a new exhibit. One moment
23 while it uploads.

24 (Liu Exhibit 11 marked.)

25 Q. (BY MR. SAUNDERS) And, Dr. Liu, can you

1 confirm to me that you see uploaded what has been marked
2 as Exhibit 11 to your deposition, a US Patent
3 Application Publication with publication No. US
4 2004/0021174?

5 Do you see that?

6 A. Yes, I do.

7 Q. Okay. And is this the Kobayashi publication
8 that you analyzed in your declaration submitted in the
9 IPR of the '634 patent?

10 A. Yes, as part of the prior art, yes.

11 Q. Okay. And I know it could be a little bit
12 confusing because we already talked about a Kobayashi
13 patent.

14 So if today I talk about the Kobayashi
15 publication or the Kobayashi '174, do you understand I'm
16 referring to what's been marked as Exhibit 11 to your
17 deposition?

18 A. Okay.

19 Q. All right. And if you look back on Exhibit 10
20 to your deposition, which is the Kobayashi patent, do
21 you see there in the field 65 for "Prior Publication
22 Data" the same publication number as the Kobayashi '174
23 publication?

24 MR. WELLS: Objection to form.

25 A. I'm sorry. I'm getting a lot of numbers.

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1 I'm -- and it's the afternoon and I'm having a hard time
2 (incomprehensible) --

3 Q. (BY MR. SAUNDERS) I understand.

4 A. So I'm really sorry.

5 Q. Yeah. So I just want to confirm: You
6 understand that we already previously marked a Kobayashi
7 patent as Exhibit 10 to your deposition.

8 Do you remember that?

9 A. That's correct.

10 Q. Okay. And do you understand that this is the
11 publication of the application that ultimately resulted
12 in that Kobayashi patent that was marked as Exhibit 10?

13 A. Yes, I do.

14 Q. Okay. And if we flip back to your IPR
15 declaration for the '634 patent, you have an analysis of
16 the Kobayashi '174 application as compared to claim 1 of
17 the '634 patent starting on Page 58 of your declaration.

18 Do you see that?

19 Actually let me rephrase so I'm a little
20 bit clearer.

21 Do you see on Page 58 of your '634 patent
22 IPR declaration begins a section where you're analyzing
23 claims 1 through 9 of the '634 patent against a
24 combination of Kobayashi in light of Shiraishi?

25 Do you see that?

1 A. Can you give me the paragraph number again,
2 please?

3 Q. Yes. It's the section with the section heading
4 immediately before paragraph 135 of your IPR
5 declaration.

6 A. For some reason, my -- the printed declaration
7 has a lot of unrecognizable characters.

8 Q. Oh, I'm sorry about that. Well, can you pull
9 up the version that's in the web page, then?

10 A. You mean the -- in the Exhibit --

11 Q. Exhibit Share, yeah. That would have been,
12 yeah, Exhibit 8.

13 A. Exhibit 8?

14 Q. Yeah.

15 A. Yeah, I was looking at the wrong exhibit.
16 My -- did you say paragraph 135?

17 Q. Yeah, so 135 of your '634 patent IPR
18 declaration.

19 A. Okay. I'm there.

20 Q. Okay. And so this is the beginning of the
21 section where you're comparing claims 1 through 9 of the
22 '634 patent against a combination of Kobayashi and --
23 the Kobayashi '174 publication and a Shiraishi
24 reference.

25 Do you see that?

1 A. Yes.

2 Q. Okay. And if you will go to Page 62, do you
3 see you have, in paragraphs 141 and 142 of your '634 IPR
4 declaration, an analysis of the claim limitation, "a
5 plurality of trenched gates covered by said interlayer
6 oxide film are formed on top of said source layer
7 extending downwardly through said base layer to a
8 portion of said epitaxial layer"?

9 Do you see that?

10 A. Yes, I do.

11 Q. You labeled that element 1[e] in your IPR
12 declaration?

13 A. That's correct.

14 Q. And in paragraph 141 of your IPR declaration,
15 you site to Figure 5A of the Kobayashi '174 publication;
16 is that correct?

17 A. That's correct.

18 Q. And if you want to, go ahead and go back to the
19 Kobayashi '174 application and turn to Figure 5A; and
20 let me know when you're there.

21 A. I'm there.

22 Q. Okay. And do you see in Figure 5A of the
23 Kobayashi '174 appli -- publication that there are gates
24 labeled 7? I'm sorry. Let me withdraw it.

25 Do you see in Figure 5A of the Kobayashi

1 '174 publication gates that are labeled 8?

2 A. Yes, I do.

3 Q. And do you see in that same figure an N+ source
4 layer labeled 10?

5 A. Yes, I do.

6 Q. And do you see that the top of the N+ source
7 layer is coplanar with the top of the gates in Figure 5A
8 of the '174 Kobayashi publication?

9 MR. WELLS: Counsel, I'd just like to
10 object. I don't believe this reference was in the
11 citation of evidence in the joint claim construction
12 chart.

13 If it was, if you guys can please point us
14 to it. Otherwise, I'd just object to this line of
15 questioning based on that fact.

16 MR. SAUNDERS: I understood -- your
17 objection is noted. We will plan on asking questions to
18 test Dr. Liu's testimony.

19 Q. (BY MR. SAUNDERS) So, Dr. Liu, do you want me
20 to ask the question again?

21 A. Yes, please. Go ahead.

22 Q. Okay. So looking at Figure 5A of the Kobayashi
23 '174 application, you would agree with me that the top
24 of the gates are coplanar with the top of the N+ source
25 layer?

1 MR. WELLS: Objection (incomprehensible).

2 THE REPORTER: I'm sorry. What was the
3 objection?

4 MR. WELLS: Form.

5 THE REPORTER: Thank you.

6 A. Give me a -- can you give me a minute to try to
7 adjust this?

8 Q. (BY MR. SAUNDERS) Yeah. Please, take your
9 time.

10 A. I just read through as soon as I -- could you
11 please ask your question again, please? I'm sorry.

12 Q. Yeah. So going back and looking at the
13 Kobayashi '174 publication and Figure 5A, the top of the
14 gates are coplanar with the top of the N+ source layer,
15 correct?

16 MR. WELLS: Objection to form.

17 A. In -- as illustrated in Figure 5A, the gate
18 appears to be coplanar with the top of N+ source.
19 That's correct.

20 Q. (BY MR. SAUNDERS) And going back to your IPR
21 declaration in paragraph 141, you conclude that element
22 1[e] was disclosed in Kobayashi based on the fact that
23 Figure 5A discloses "a plurality of trench gates ...
24 that are covered by the interlayer oxide film (11) and
25 that extend downward through source layer (10) to base

1 layer (9) and into the epitaxial layer (2)"; is that
2 correct?

3 A. In the scope of the IPR work where I'm trying
4 to -- in the scope of work where I'm trying to compare
5 the prior art with the alleged invention and trying to
6 find similarity to support -- or to point out that the
7 invention is either rendered anticipated or obvious --
8 in that scope of work, I -- my scope of work was not to
9 construe every term as I am here for the IPR
10 declaration.

11 To the extent that if you find the -- in
12 the IPR that I have a -- I have offered claim
13 construction for form on top and especially with the
14 phrase "form on top of said source layer" and -- I'll be
15 happy to try to get there and try to look into it.

16 But, again, the scope of the IPR petition
17 was to see whether the patent alleged inventions render
18 obvious or anticipated as opposed to here in the -- in
19 the claim construction work where there are terms that
20 are designated to be construed and there are one
21 construction offered by ASUSTeK and another construction
22 offered by Force MOS.

23 So now I have the -- I will say the benefit
24 of knowing that my task is to construe these terms in
25 light of both the ASUS claim construction and in light

1 of the Force MOS claim construction and compare and
2 contrast.

3 And based on my knowledge as the person
4 with ordinary skill in the art and based on all the
5 review, I am offering the opinion of ASUS construction,
6 the -- the accuracy or the more correct construction
7 offered by ASUS as opposed to the construction coffered
8 by Force MOS because to adopt Force MOS' claim
9 construction, as I indicate in my print -- in my claim
10 construction declaration, there's a few issue and I
11 highlighted.

12 So I just want to highlight that in my IPR,
13 I did not offer a claim construction for -- for this
14 particular term because my -- the scope of my work is
15 different in the IPR as opposed to in the -- in this
16 claim construction declaration.

17 Q. So it would be fair to say in paragraphs 141
18 and 142 of your declaration submitted in the '634 patent
19 IPR, you didn't analyze whether or not the gates of
20 Kobayashi were relatively above the source layer of
21 Kobayashi, correct?

22 MR. WELLS: Objection to form.

23 A. I wouldn't agree -- I would disagree to that
24 characterization because as you can see in my
25 declaration, I specifically mention there are three

1 distinct possibility, which I believe we covered nearly
2 all of them, if not all of them, which is the -- I want
3 to make sure I use the right term -- which is the
4 trenched gate cover set into oxide layer film forming --
5 covered by the said interlayer oxide film on top of said
6 source layer.

7 And to construe these -- to construe this
8 term there are three distinct possibility. One is
9 above. One is coplanar. One is below.

10 And given the context of the '634 patent
11 and given the knowledge of a person with ordinary skill
12 in the art and given the context of all the
13 consideration, this is the opinion in the scope of
14 IPR -- in the scope of -- sorry -- claim construction
15 declaration I offered my opinion.

16 Q. (BY MR. SAUNDERS) So going back to your IPR
17 declaration, when you're analyzing element 1[e] as
18 compared to Kobayashi, you didn't make that analysis of
19 coplanar, above, or below that you just discussed,
20 right?

21 MR. WELLS: Objection to form.

22 A. Again, I think you are somehow pushing the --
23 my testimony. I'm simply saying that in the scope of
24 the IPR petition, I am not -- I am not -- the scope of
25 the work was not to construe every term.

1 And now in the scope of this claim
2 construction declaration, I now have -- you can say that
3 I have now the knowledge of both ASUSTeK's claim
4 construction versus Force MOS' claim construction.

5 And you have to compare and contrast and
6 find one and -- with one that -- first, there's two
7 competing claim construction. And as person of --
8 person of ordinary skill in the art, my understanding,
9 in view of reviewing the patent, in view of
10 specification, in view of my knowledge, I find the claim
11 construction the way it's construed by the ASUSTeK is
12 much more consistent in all aspect.

13 Q. (BY MR. SAUNDERS) You would agree with me that
14 applying the claim construction that ASUS has proposed
15 in this case to element 1[e] of the '634 patent, that
16 Kobayashi's Figure 5A would not disclose that
17 limitation, correct?

18 MR. WELLS: Objection to form. I just want
19 to state again for the record that neither the Kobayashi
20 reference nor the IPR declarations are in Force MOS'
21 identification of the evidence. So I just want to lodge
22 that for the record.

23 A. Counsel, this deposition is for the declaration
24 of claim construction. I just want to highlight I don't
25 want you to say, you know, I did not offer.

1 But since you ask me a question, there's a
2 subtle difference in terms of the description of the
3 process flow. I do not wish to -- to delve into the IPR
4 petition.

5 Suffice to say that, again, my declaration
6 is very clear that I analyzed the possibility of being
7 coplanar or being above, be on top, or being -- or not
8 being on top.

9 I analyzed these distinct possibility in
10 light of the -- what the specification in light of the
11 process flow and despite the fact that some of the
12 specification seems to be very much -- very much similar
13 or analyzed.

14 But based on the analysis, based on the
15 progression I go through, this is the claim term that I
16 agree with the construction. This is the claim term
17 that my opinions support this construction versus a
18 Force MOS claim construction.

19 Q. (BY MR. SAUNDERS) So has your understanding of
20 the appropriate construction of "a plurality of trenched
21 gates covered by said interlayer oxide film are formed
22 on top of said source layer extending downwardly through
23 said base layer" -- has your understanding of the
24 construction of that term changed since you submitted
25 your IPR declaration for the '634 patent?

1 MR. WELLS: Objection to form.

2 A. I disagree with the fact it changed. I would
3 categorize -- or characterize my understanding of this
4 term is that given that there's a Force MOS claim
5 construction in which certain word are introduced and,
6 because those word were introduced, it become more of a
7 method claim in which -- which did not -- was not
8 consistent with the process flow.

9 Whereas, I reviewed the claim construction
10 and the evidence supporting my opinion. I find that the
11 claim construction -- the ASUS claim construction are
12 most consistent and represent the '634 patent much more
13 consistent -- in a consistent way.

14 So I -- that's how I will characterize my
15 understanding of the -- how the term is construed.

16 I wouldn't say that -- I wouldn't agree
17 that whether my understanding of claim changed or not;
18 but I will understand a little bit more, for example,
19 how Force MOS -- the way Force MOS construct a claim
20 would not be consistent. Therefore, I'm trying to offer
21 a most consistent claim construction for this term.

22 Q. (BY MR. SAUNDERS) When rendering your opinions
23 about limitation 1[e] in your declaration for the '634
24 IPR, you didn't analyze the -- expressly analyze the
25 process flow in the Kobayashi '174 publication, correct?

1 MR. WELLS: Objection to form.

2 A. I would disagree with that. And as you can
3 see, some of the reference -- prior art reference, we
4 cited and somehow -- somehow selectively not brought up
5 in this conversation is that we also have prior art that
6 clearly shows the gate is formed on top of the source
7 layer.

8 All I'm saying is that the scope of the
9 claim -- scope of my work in IPR declaration is to look
10 at the existing invention or the existing prior art
11 whether they already offered the '634 patent, whether
12 they already rendered that anticipated or obvious.

13 That was the scope of my work in IPR
14 petition, whereas the scope of this work, I understand
15 these terms are now terms to be construed.

16 And they are actually two different
17 construction and going through -- as I proceed in going
18 through the progression and going through the layer,
19 I -- my understanding support that the claim
20 construction offered by ASUSTeK is the most consistent
21 one.

22 Q. (BY MR. SAUNDERS) You understand in the
23 context of an IPR petition, you have to compare the
24 claims as properly construed to the prior art? Do you
25 have that understanding?

1 MR. WELLS: Objection to form.

2 A. Again, there is a scope of work for IPR
3 petition; and there's a scope of work for claim
4 construction.

5 The fact that claim construction work come
6 after the IPR, I do not have the full knowledge of
7 certain terms will be construed. And that's not the
8 scope of that work.

9 But in -- the scope of work which I am here
10 to discuss and to be deposed is on the claim
11 construction work for these terms, and I do -- I do
12 not -- I don't think I cite any of my IPR petition work
13 in my declaration.

14 And, again, I want to emphasize the scope
15 of work is different and, again, that in my claim
16 construction declaration, given the two claim
17 construction from both side, it is my opinion as a
18 POSITA, after going through all the due diligence, that
19 the claim construction offered by ASUSTeK is the most
20 consistent given all the context given -- of the
21 petition claim, claim limitation and a person of
22 ordinary skill in the art and his knowledge in the art.

23 Q. (BY MR. SAUNDERS) Could you turn to Page 5 of
24 your '634 IPR declaration and paragraph 19?

25 A. Page 5?

1 Q. Yeah. Let me know when you're there.

2 A. I'm there.

3 Q. Okay. So Page 5 of your '634 IPR declaration
4 starts a section called "Applicable Legal Standards"; is
5 that right?

6 A. Uh-huh, yes.

7 Q. And the first sentence of paragraph 19 in that
8 section is "It has" explained -- "been explained to me
9 that a claim must be properly construed in order to be
10 compared to prior art."

11 Do you see that?

12 A. Yes, I do.

13 Q. And did you apply that understanding in your
14 work on the declaration you submitted in the '634 IPR?

15 MR. WELLS: Objection to form.

16 A. Repeat your question again.

17 Q. (BY MR. SAUNDERS) Yeah. So that first
18 sentence in paragraph 19 of your declaration submitted
19 in the '634 patent IPR, did you apply that legal
20 standard in your analysis?

21 MR. WELLS: Same objection.

22 A. I do believe I applied. Again, you have to --
23 as a way of looking through different scope of different
24 lenses, I apply it under the scope of the work for the
25 IPR petition which is -- as I understand it, is to

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1 determine -- excuse me -- obviousness or anticipation
2 based on the prior art in light of the understanding of
3 the -- of the claim limitation.

4 So I apply to the best of my knowledge
5 within that scope of -- within the scope of IPR
6 petition.

7 Q. (BY MR. SAUNDERS) In the IPR of the '634
8 patent you worked with the attorneys at Baker McKenzie,
9 correct?

10 A. That's correct. That's -- that's the firm that
11 engaged me, yes.

12 Q. The same firm that has engaged you in
13 connection with this pending litigation between ASUS and
14 Force MOS in District Court, right?

15 A. I -- to be honest with you, I do not know the
16 extent of my engagement. I'm simply working based on a
17 task I'm given as I go. I try to do the best according
18 to my knowledge as POSITA.

19 Q. And you have understand -- let me withdraw.

20 Are you aware that it was ASUS that
21 proposed the term "a plurality of trench gates covered
22 by said interlayer oxide film are formed on top of said"
23 layer -- "said source layer extending downwardly through
24 said base layer" -- that ASUS was the party that
25 proposed that as a term needing to be construed in this

1 case?

2 MR. WELLS: Objection to form.

3 A. I don't recall who is the one who proposed
4 which term to be construed. I -- I simply would know
5 that a term is being un -- is being construed as a claim
6 construction term.

7 And I tried to apply my knowledge as a
8 person of ordinary skill in the art to try to support or
9 analyze for the best and most consistent construction of
10 that term.

11 Q. (BY MR. SAUNDERS) Do you have any explanation
12 why this term was a term that you didn't think needed to
13 be explained -- sorry. Let me withdraw it.

14 Do you have any explanation of why you
15 think that this term is a term that did not need to be
16 expressly construed when you submitted your IPR
17 declaration but now you think is a term that needs to be
18 expressly construed?

19 MR. WELLS: Objection to form.

20 A. I think somehow the -- my testimony is maybe
21 mischaracterized. I did not say that that's -- you
22 know, whether IPR -- if I understand, you know, which
23 term to be construed.

24 I'm simply opining that in the IPR petition
25 in looking at the patent and looking at the inventive --

1 alleged inventive feature of the patent and in trying to
2 compare prior art for invalidity vers -- and -- prior
3 art for anticipation versus obviousness.

4 And my scope of work did not involve
5 comparing, competing, or do not involve having different
6 claim construction for the term "form on top" at the
7 time of IPR petition.

8 Q. (BY MR. SAUNDERS) In the IPR declaration that
9 you submitted in connection with the '634 patent's IPR,
10 do you remember analyzing a reference called Hirler,
11 H-I-R-L-E-R?

12 A. I remember -- yes, I remember analyzing a
13 Hirler as well as Shiraishi as well as this Kobayashi.

14 Q. And can you turn to Page 22 of your IPR
15 declaration for the '634 patent's IPR?

16 A. I'm there.

17 Q. And in paragraph 63 you have an annotated
18 version of Figure 2F of Hirler?

19 A. That's correct.

20 Q. And in that figure element 15 are the gates; is
21 that right?

22 MR. WELLS: I'm just going to object,
23 again, to this line of question.

24 I don't believe Hirler is in the citation
25 of evidence from Force MOS.

1 But you can answer, if you can.

2 A. I think the -- we designated -- I designated 15
3 as gate trench, but G is really denoting the -- G is
4 also used there as well.

5 Q. (BY MR. SAUNDERS) So the -- that line that
6 connects between the G symbol there -- and there's a
7 little black dot that's at the top of element 15. Do
8 you see that little black dot?

9 A. Uh-huh. Yes, I do see it.

10 Q. Okay. That little black dot is placed on where
11 you understand the top of the gates to be in Figure 2F
12 of Hirler; is that right?

13 MR. WELLS: Objection to form.

14 A. Do you want me to go to Hirler to answer your
15 question? And I believe that's a translated patent.

16 Q. (BY MR. SAUNDERS) I -- if you think you need
17 it, I can go ahead and upload those exhibits. I think
18 you have copies of it as well in the versions that were
19 submitted in the IPR, but let me know if you need to
20 review that.

21 A. I would review -- I would like to review the
22 printed copy you gave me just to make sure I refresh my
23 memory, if you don't mind.

24 Q. Okay. I guess for sake of completeness of the
25 record, I'm going to go ahead and introduce the Hirler

1 German and the translation.

2 (Liu Exhibits 12 and 13 marked.)

3 MR. WELLS: I just want to note for the
4 record our objection to the introduction of these
5 exhibits as not being the evidence of the citation and
6 beyond the scope of this deposition.

7 Q. (BY MR. SAUNDERS) All right. Did you get a
8 chance to review the Hirler reference, Dr. Liu?

9 A. Yes, I have.

10 Q. Okay. And so that -- was your understanding
11 from that Figure 2F of Hirler where the top of the gates
12 are?

13 MR. WELLS: Same objection.

14 Q. (BY MR. SAUNDERS) Maybe I can ask this in a
15 better way because, you know, it can be hard talking
16 about diagrams this way.

17 Going back to Figure 2F of Hirler, the
18 source layer is labeled as 13. Do you see that?

19 A. That's correct.

20 Q. And in Hirler's Figure 2F, the gates are
21 below -- sorry. Let me withdraw it.

22 In Hirler's Figure 2F, the top of the gates
23 are below the top of the source layer, 13, correct?

24 MR. WELLS: Okay. I'm going to reenter my
25 objections and instruct Dr. Liu not to answer this line

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1 of questioning.

2 He is not here to opine on the IPR
3 declaration. He's here to opine on the claim
4 construction declaration submitted in support of this
5 litigation.

6 MR. SAUNDERS: Well, Counsel, I am
7 entitled -- since you are relying on Dr. Liu and his
8 declaration submitted in this case and submitted in the
9 Ford F3 evidence, I'm entitled to test the veracity of
10 Dr. Liu's opinions, including any potential
11 inconsistencies.

12 And here Dr. Liu has submitted sworn
13 declarations in another matter involving the '634
14 patent. And, therefore, I am fully permitted to test
15 inconsistencies in Dr. Liu's opinions before him --
16 between his opinions submitted in this case and his
17 opinion submitted in the IPR of '634 patent.

18 If you prohibit us from asking from that,
19 we can both seek to compel as well as to seek to strike
20 any reliance on Dr. Liu's testimony in this matter.

21 So with that being said, are you
22 instructing the witness not to answer further questions
23 about his IPR declaration?

24 MR. WELLS: So it's our position that you
25 are free to test any competing claim constructions he

1 took in the IPR declarations and the claim construction
2 declaration in the support litigation.

3 What I'm saying is -- is Dr. Liu is not
4 here to opine on invalidity. So if there are competing
5 constructions that he took in the IPR declaration versus
6 what he took in the District Court litigation, he can
7 discuss that; but I think it's already been established
8 for the record that no construction was taken for this
9 particular claim raised and the IPR declaration.

10 MR. SAUNDERS: I understand that, Counsel.
11 And obviously even without an express construction,
12 there can be an implicit construction.

13 And so I'm trying to understand whether the
14 implicit construction used in Dr. Liu's analysis in the
15 IPR of the '634 patent is consistent with Dr. Liu's
16 claim construction declaration submitted in this case.

17 Are you going to allow me to continue
18 asking those questions or are you going to instruct the
19 witness not to answer the questions?

20 MR. WELLS: Okay. Counsel, let me -- let's
21 go off the record just for five minutes so I can confer
22 with my co-counsel; and then we can get back to this
23 issue, okay?

24 MR. SAUNDERS: All right. Let's go off the
25 record.

1 THE VIDEOGRAPHER: Okay. Going off the
2 record. The time is 3:04 p.m.

3 (Recess from 3:04 p.m. to 3:13 p.m.)

4 THE VIDEOGRAPHER: Okay. We're back on the
5 record. The time is 3:13 p.m.

6 MR. WELLS: Counsel, we've given you quite
7 a bit of latitude today to sort of deviate from the
8 scope of this deposition, which is on the claim
9 construction declaration in the District Court
10 litigation.

11 However, we will permit examination to
12 continue subject to the objections we've already lodged
13 on the record to apply to this entire line of
14 questioning.

15 And to the extent the questions are
16 repeated the same way over and over and have been asked
17 and answered, then we can address an objection at that
18 time for that.

19 Subject to that, you may proceed.

20 MR. SAUNDERS: Well, I'll disagree with the
21 characterization; but I do plan on proceeding.

22 Q. (BY MR. SAUNDERS) Thank you, Dr. Liu. Did you
23 speak with counsel at all during the last break we just
24 had?

25 A. Not at all. I tried to run away from them

1 then.

2 Q. Okay. Thank you, Dr. Liu.

3 So I think I was asking you questions about
4 Page 22 of your declaration submitted in the IPR of the
5 '634 patent. Are you still there?

6 A. Yes, I am.

7 Q. And I was asking questions about that annotated
8 version of Figure 2F of Hirler in paragraph 63. Are you
9 still there?

10 A. Yes, I am.

11 Q. And I was asking you -- do you remember --
12 well, actually let me ask this clean again.

13 In Figure 2F of Hirler, is the top of the
14 gate illustrated as being below the top of the source
15 layer?

16 MR. WELLS: Objection to form.

17 A. Yes, it appears so.

18 Q. (BY MR. SAUNDERS) And so that would be -- let
19 me withdraw.

20 So applying ASUS' construction from the
21 District Court case here, Hirler would not satisfy
22 limitation 1[e] of the '634 patent; is that correct?

23 MR. WELLS: Objection to form.

24 A. Sitting here, I cannot opine on what might
25 happen. I -- I don't know how to answer your question.

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1 Q. (BY MR. SAUNDERS) You have no opinion
2 explaining how element 1[e] could be disclosed by Hirler
3 applying ASUS' construction of this term; is that right?

4 A. Can you repeat your question again?

5 Q. Yeah. Sitting here today, you don't have an
6 explanation about how Hirler could disclose element 1[e]
7 of the '634 patent under ASUS' proposed construction of
8 that term; is that right?

9 MR. WELLS: Objection to form.

10 A. Like I said, I don't know how to answer your
11 question in the sense that for IPR petition, I'm tasked
12 with one scope of work.

13 And for claim construction, I'm tasked,
14 again, with another -- with a different scope of work.

15 And in the claim construction, which is
16 the -- this deposition is about, I offered a very
17 consistent analysis and support on how this term should
18 be construed with respect to what has been offered by
19 Force MOS, and now you want me to analyze.

20 I have not done that analysis. And given
21 the -- in my -- as you can see in my claim construction
22 declaration, I have not offered the analysis of Hirler.

23 So I will not be able to answer your
24 question sitting here right now. I will have to do
25 further analysis.

1 Q. (BY MR. SAUNDERS) Okay. So I'd like to move
2 on now to some of your opinions in your claim
3 construction declaration about the '409 patent, which I
4 believe the first term is starting on Page 29 of your
5 claim construction declaration which is Exhibit 1. Let
6 me know when you're there.

7 A. Let me do a little bit of housekeeping work
8 (incomprehensible). Okay. I'm there.

9 Q. Okay. And so the first term of the '409 patent
10 you address in your declaration is the term "rounded
11 corners"; is that right?

12 A. That's correct.

13 Q. Okay. And it's your opinion that ASUS'
14 proposed construction is the correct construction of
15 that term; is that right?

16 A. That's correct.

17 Q. And in -- your analysis for this term is set
18 forth in paragraphs 85 through 92 of your claim
19 construction declaration; is that correct?

20 A. I think that's correct.

21 Q. And sitting here today, do you believe that
22 those paragraphs set forth the complete basis and
23 reasons for your opinions as to the construction of this
24 term?

25 A. I think we -- we went through this with the

1 other patent. It is the -- it is the opinion I offer to
2 support my analysis of this -- how this claim should be
3 construed.

4 And I believe that this analysis is
5 sufficient to support my -- I mean, this -- these are --
6 what I cited or what I've written in between paragraph
7 89 and 92 is sufficient to support my analysis.

8 Q. Okay. Sitting here today, you can't think of
9 any way that paragraphs 85 through 92 are somehow
10 incomplete in expressing your reasons or basis for your
11 opinions?

12 A. Perhaps not at the moment, yeah, no.

13 Q. Okay. And turning to the '409 patent, you
14 would agree with me that the patent discusses both
15 rounded corners and truncated corners; is that correct?

16 A. Can you please state your question again?

17 Q. Yeah. So the '409 patent discusses both
18 truncated corners and rounded corners, correct?

19 A. I think there are terms of rounded and
20 truncated; but I believe in the context of the rounded
21 corner is corner that are truncated and by design layout
22 and then rounded in the context of the '409 patent.

23 Q. Okay. Can you turn to '409 patent and, in
24 particular, a sentence that starts at the bottom of
25 column 1 at about line 66 and then continues on to line

1 3 of column 2?

2 And let me know when you've read that
3 sentence.

4 A. Okay.

5 Q. Okay. And so you see that sentence mentions "a
6 MOSFET device with a close cell unit configuration with
7 the surrounding gate arranged with truncated corner or
8 rounded corner layout"? Do you see that?

9 A. Yes, I do.

10 Q. And when it's talking about -- let me withdraw.

11 When it's using the word "layout" in that
12 sentence, is that referring to the design layout of the
13 mask or is that referring to the layout of the MOSFET
14 device af -- as it's fabricated?

15 MR. WELLS: Objection to form.

16 A. Repeat your question again, please.

17 Q. (BY MR. SAUNDERS) Yeah. So you see that --
18 the word "layout" there on column 2, line 3 of the '409
19 patent?

20 A. Yes, I do.

21 Q. Okay. Is that referring to a design layout
22 that is in a mask or is that referring to a layout of a
23 MOSFET device as a result of the complete fabrication
24 process?

25 MR. WELLS: Same objection.

1 A. I'm -- the way I -- in the context of '409
2 patent when you talk about mask layout, you clearly use
3 the word "mask layout."

4 In this context, I'm looking at it again.
5 I would think the context would also be in the context
6 of mask layout.

7 Q. (BY MR. SAUNDERS) Okay. And so when ASUS'
8 proposed construction uses the phrase "design layout,"
9 is it your understanding that that's referring to a mask
10 layout?

11 A. Yes, that's correct.

12 Q. And is there -- so that sentence that goes from
13 line -- column 1, line 66 through column 2, line 3, that
14 is referring to both a truncated corner mask layout and
15 a rounded corner mask layout; is that correct?

16 A. Perhaps the way to answer is that the
17 truncation -- truncation -- taken to the extreme, if you
18 truncate with -- if you truncate it, is -- at the mask
19 level is a progression toward making even the layout
20 rounded.

21 Q. Is it possible to create a rounded corner of a
22 gate trench using a mask layout having rounded corners?

23 A. Repeat your question again. I think you used
24 "rounded" twice. I want to make sure it's in the right
25 context.

1 Q. Yeah. So can you make a MOSFET with gate
2 trenches having rounded corners using a mask layout
3 having rounded corners?

4 MR. WELLS: Objection to form.

5 A. I'm having a hard time parsing, you know, the
6 question. I'm sorry. It's getting late in the
7 afternoon and I'm -- I appreciate a little bit of
8 latitude and just indulge me by asking the question
9 again.

10 Q. (BY MR. SAUNDERS) Sure, yeah. So just -- I'll
11 back up a little bit.

12 I mean, we've been talking about mask
13 layouts and we've been talking about, you know,
14 fabricated devices that -- you know, at the end of a
15 manufacturing process for MOSFETs.

16 And what I'm trying to understand is: Can
17 you start with a mask layout that has rounded corners
18 and end up with a MOSFET that has gate trenches with
19 rounded corners?

20 MR. WELLS: Same objection.

21 A. Yes, I believe so.

22 Q. (BY MR. SAUNDERS) And it's fair to say it's
23 also your opinion that you could start with a mask
24 layout that has truncated corners and end up with a
25 MOSFET that's fabricated with rounded corners; is that

1 correct?

2 A. Yes, that's correct.

3 Q. Okay. And when the sentence here is
4 discussing -- well, let's go to the next sentence there.

5 Do you see the sentence staring on column
6 2, line 3 start -- that says, "The purpose of the
7 truncated corners or the rounded corners of the gate
8 trenches is to make the space between the trench gate
9 and the metal contact more uniform in the closed cell to
10 enhance the device ruggedness."

11 Do you see that?

12 A. Yes, I do.

13 Q. Okay. And when it's talking about truncated
14 corners there, it's talking about truncated corners of
15 the actual fabricated MOSFET as opposed to simply the
16 truncated corners of a mask layout; is that correct?

17 A. Repeat your question again.

18 Q. Yeah. So that sentence there that's column 2
19 of the '409 patent, lines 3 through 7, when it's
20 referring to truncated corners, it's referring to the
21 truncated corners of the gate trenches of an actual
22 fabricated MOSFET device rather than simply a mask
23 layout; is that correct?

24 A. I disagree with that.

25 Q. And in -- why do you disagree?

1 A. Of course, you're going to have a final
2 separation based on what you have in the mask layout;
3 but clearly in the context of '409, you are driving to
4 ensure the separation.

5 In fact, there's a context in the
6 specification that you prefer the separation -- between
7 the maximum separation and the minimum separation to be
8 as uniform as possible.

9 So one way to drive that will be to -- in
10 the mask layout you have a design rule that says: I do
11 not want to have more than 1.4 -- that ratio.

12 And one way to do it is that the mask
13 layout, if I truncate it, and then that distance -- the
14 maximum distance would, therefore, be reduced through
15 the -- through the truncation.

16 So this is -- this is very clear with
17 respect to Figure 2 of the '409 patent.

18 Q. So in column 2, line 5 of the '409 patent
19 through column -- column 2, line 7, do you see it's
20 referring to "the space between the trenched gate and
21 the metal contact more uniform in the closed cell to
22 enhance the device ruggedness."

23 Do you see that?

24 A. Yes, I do.

25 Q. That's talking about a MOSFET that's actually

1 been fabricated, right?

2 A. I disagree, not necessarily. I disagree.

3 Q. A mask layout does not have, for example, in
4 and of itself, metal contact; is that right?

5 MR. WELLS: Objection to form.

6 A. The mask layout will have a design rule that
7 would dictate the separation between the trenched gate
8 and the mask contact -- and the metal contact.

9 There will be a design rule at the mask
10 level -- mask level that you can actually check and
11 verify. Again, the Figure 2 of '409 illustrate this
12 concept very clearly as compared to the prior art.

13 By truncating it, you are able to, on the
14 mask layout level, reduce the separation. And mask
15 contact is one layer, and then the layout rule would
16 dictate -- will also dictate the separation between
17 different layers.

18 Q. So can you just explain at a high level what a
19 mask is in the context of the '409 patent?

20 A. I just want to point out: This is similar to
21 an implant layer, similar to process flow you're asking
22 me, right?

23 Q. I -- that is the question I asked, yes.

24 A. But it's not in my declaration, is it?

25 Q. Well, I -- I do believe that you do cite to the

1 '409 patent and you do discuss design layout and you
2 discuss mask layout in paragraph 88 of your declaration.

3 So I do think it makes sense to ask what
4 you mean by a mask when you discuss mask layout in your
5 declaration.

6 So if you'd please go ahead and let me
7 know: What does mask mean in the context of the '409
8 patent.

9 A. Yes, I'll be very happy to elaborate what mask
10 means. In the -- in the general term, the making of
11 semiconductor devices starting from a silicon structure
12 and try to build layers on top of that certain
13 substrate, sometime there is a need to either take away
14 or adding things selectively.

15 And the way you select where to add and
16 where to remove will be through the use of a mask. And
17 each mask layer need to be -- have a relationship with
18 the previous mask layer such that you can form a proper
19 device.

20 I always explain to my kid, similar to
21 forming stamps -- I don't know if you collect stamps,
22 but in the edge of stamp there's what's called alignment
23 mark. So each color is printed with different layer or
24 different mask so that when you print the stamp, you
25 want to -- say the feature of a person so that -- each

1 layer has to align correctly. Otherwise, the outcome
2 will not be -- the image will not be correct.

3 Similarly to form different -- selectively
4 different material or take away different material, each
5 layer has to be aligned to the previous layer.

6 Therefore, that's why in the context --
7 perfectly fine in the context of what we've gone through
8 in column 2 regarding the space between trenched gate
9 and the metal contact more uniform because that will be
10 a design rule that with respect to metal contact layer
11 and respect to the trenched gate you want on the mask
12 level, these look -- they are to be more uniform.

13 So in a sense that -- this is not talking
14 about what's actually formed. So you can actually have
15 a trenched contact, no, this is -- on the mask level you
16 need to have the different layer and if different layer
17 need to have a proper spacing between one another to
18 facilitate fabricate -- fabricating of the most optimum
19 device.

20 Q. All right. Going on to column 2 starting at
21 line 18 of the '409 patent, do you see a sentence that
22 says, "It is by nature that truncated corners in layout
23 become rounded after exposure due to resolution issue of
24 0.18 tilde 0.35 micrometer photolithography."

25 Do you see that?

1 A. Yes, I do.

2 Q. Okay. What does that mean by the term
3 "resolution issue"?

4 A. In the -- this is not regarding the formation
5 of the mask. This is regarding the exposure, meaning
6 that you're trying to transfer through the live wave the
7 pattern that's already on the mask to reproduce them
8 onto this photoresist that's on top of the semiconductor
9 material.

10 So the live by its nature have wavelength.
11 For example, making at the time of invention, the reason
12 .18 and .35 micron are mentioned, at the time of
13 invention in making power MOSFET, usually power MOSFET
14 technology being very high voltage tend to be not as
15 advanced compared to your standard logic that you use to
16 make your graphic cards to play your video games.

17 So then at the time of the invention --
18 from .18-.35 micron photolithography, that refers to the
19 generation of technology as we try to shrink smaller and
20 smaller.

21 So in (incomprehensible) lithography
22 technology, the wavelength that we use is certain
23 wavelength. It could be I line.

24 In that case that -- the wavelength itself
25 could also be incomparable to your feature size.

1 Therefore, due to the weight -- lightweight
2 interference, a straight corner will not be printed a
3 straight corner. The resolution will actually cause it
4 to become rounded.

5 Q. So when it's talking about resolution in that
6 0.18 to 0.35 micrometer range, 0.18 micrometer would be
7 something with better resolution than 0.35 micrometer;
8 is that right?

9 A. I wouldn't necessarily characterize that term,
10 but I would rather clari -- classify that .18 to .35
11 technology, a person of ordinary skill in the art would
12 know certain type of wavelength that's used to expose
13 the photolithography pattern from the mask onto the
14 silicon -- or onto the semiconductor device.

15 Q. So everything being otherwise equal, you would
16 expect that a photolithography process using 0.18
17 microns would result in something better reflecting the
18 structure of the mask than a photolithography process
19 using 0.35 microns; is that right?

20 MR. WELLS: Objection to form.

21 A. I think this -- it's not -- that is not what
22 I -- it's not a good characterization of what I
23 testified.

24 The way we designate .18 micron or .35
25 micron, we usually associate that -- associate the

1 number -- what we call the minimum feature size, meaning
2 that as the technology advance from .35 to .18, let's
3 say, in this case range or compare a .35 micron to .18
4 micron, on my mask layout, I may be able to allow
5 certain feature that's smaller for a .18 micron
6 technology versus .35 micron technology.

7 However, if both technology used the same
8 wavelength to print to -- as the photolithography to
9 transfer the pattern from the mask onto the wafer, then
10 because the wavelength is the same, you may be able to
11 print a certain feature.

12 But the rounding is dictated simply by the
13 wavelength of the light that you are using to print.
14 Therefore, it's not correct or necessary correct to say
15 that .18 micron versus .35 micron, if one will have less
16 rounding compared to the other one, you have to know
17 which wavelength of photolithography technology you are
18 using to print to transfer your pattern from the mask
19 onto the semiconductor device.

20 Q. (BY MR. SAUNDERS) So through the history of
21 the development of semiconductor process fabrication,
22 new processes have come out that have used lights with
23 shorter wavelengths; is that correct?

24 A. That's the -- one of the way to keep allowing
25 to print tighter design rule.

1 Q. So over time new processes that have come out
2 with shorter wavelengths have permitted, you know,
3 smaller critical dimensions in the fabricated
4 semiconductors; is that right?

5 A. That's correct. But, again, I want to caution
6 that each generation, due to the nature of the
7 wavelength being finite, there is always going to be
8 rounding.

9 Q. Okay. But if you took the same mask and you
10 used one process that had a longer wavelength and one
11 that used a narrower wavelength, you would expect that
12 there would be less rounding in the process that used
13 the narrower wavelength of light; is that correct?

14 MR. WELLS: Objection to form.

15 A. You are asking me to speculate. In general,
16 the wavelength is the cause of interference and cause of
17 the rounding.

18 In the corner -- if I say in the corner, I
19 would -- I would characterize that the rounding will
20 be -- rounding will always be there; but because you
21 have a corner, you'll go, oh, it's going to be -- be
22 rounded.

23 But may -- it may be the case -- some cases
24 where you are trying to print a tighter line than the
25 extent of your rounding because they're more narrow, you

1 may think that the extent of rounding is less; but
2 that's because the artifact of printing different
3 features.

4 So another way of saying is that if I print
5 the trenched gate which is wider compared to the
6 center -- compared to the source contact layer which
7 could be smaller in feature, they both were round. And
8 that rounding is -- could also be in proportion to the
9 feature size that I'm trying to print.

10 Q. (BY MR. SAUNDERS) So it's fair to say that one
11 of the factors that can affect the shape of trenched
12 gates as described in the '409 patent would be the mask
13 layout; is that right?

14 A. Repeat your question again. I'm not quite
15 sure --

16 Q. Okay. Yeah, I just kind of want to go through
17 the different factors that could affect the ultimate
18 shape of trenched gates described in the '409 patent.

19 And I want to confirm, first of all, one of
20 those things that's going to control that shape is the
21 mask layout, right?

22 A. I -- I don't know when you -- when you say the
23 word "control." You're always going to have -- for
24 example, let's say the matter of rounding....

25 Q. Let me withdraw because maybe "control" is a

1 bad word there.

2 So let me go through the factors that can
3 affect the shape of the trenched gates described in the
4 '409 patent.

5 One of the factors that can affect the
6 ultimate shape of the trenched gates in the fabricated
7 device is the mask layout; is that correct?

8 A. One of the way to -- to -- sir, begin your
9 question, please. I'm --

10 Q. Yeah, I'm just trying to go through and
11 understand all the different factors that can affect how
12 the gates ultimately are shaped and the dimensions of
13 the gates on a MOSFET design, you know, a fin --
14 sorry -- a MOSFET finely fabricated device using the
15 '409 patent.

16 So is one of the factors that ultimately
17 has an effect on the shape of the trenched gates the
18 mask layout?

19 A. In the context of the '409 patent, one of the
20 way to affect the maximum distance and the minimum
21 distance between the con -- source contact and the
22 trenched gate is through truncating.

23 So the shape, to a certain extent, will
24 come through photolithography especially in the case of
25 having corners.

1 But you certainly can enforce design rule
2 to -- trying to have a little bit of -- little bit of
3 leeway or a little bit of a tighter -- tighter allowance
4 for that spacing between the source contact trench and
5 the gate -- all around the gate, the maximum distance
6 versus minimum distance.

7 Q. Okay. So having truncated corners in a mask
8 layout is one way that you can affect the shape of the
9 trenched gates in the final device; is that right?

10 A. My testimony is that one way to affect the
11 spacing between -- in the context of '409 is through
12 truncating as you -- as I pointed out in Figure 2.
13 That's one way to implement value V -- value B, as in
14 boy, over value A.

15 Q. And so another factor that will affect the
16 ultimate shape of the trenched gates is the wavelength
17 of the photolithography process; is that correct?

18 A. Repeat your question again.

19 Q. Yeah. So I'm trying to work through those
20 factors that can affect the ultimate shape of the
21 trenched gates in a final device.

22 I want to confirm my understanding that the
23 wavelength of the photolithography process can affect
24 the ultimate shape of the trenched gates?

25 A. In the context of the effect -- in the context

1 '409 is that the sharp edges or sharp corner will be --
2 will be rounded due to photolithography process due to
3 the transferring of the pattern through light from the
4 mask onto the semiconductor device.

5 Q. And the degree of that rounding can depend, in
6 at least in part, on the wavelength of the
7 photolithography process; is that correct?

8 A. It really depends on the shape we're talking
9 about, but my testimony is that the feature -- the
10 minimum feature size is affected by the wavelength you
11 use. That's just simple physics.

12 If I use a wider wavelength, I'm -- I can
13 only print certain resolution well. If I use a smaller
14 wavelength, I will be able to print a smaller resolution
15 better. That's just simply physics.

16 Q. In the '409 patent, the mask that is used for
17 creating the gate trenches is allowing for selectively
18 etching silicon material out to form the gate trenches;
19 is that correct?

20 MR. WELLS: Objection to form.

21 A. That -- repeat your question again.

22 Q. (BY MR. SAUNDERS) Yeah. Well, I'll maybe ask
23 the question this way: How does a mask ultimately
24 determine the shape of the trenched gates?

25 MR. WELLS: Objection, form.

1 A. So you have your -- you have designed a device
2 and you know in this device where you want to form the
3 gate, where you want to form other -- other parts.

4 And then the mask, each layer would help
5 you selectively add or remove certain feature so that
6 you can fabricate this device.

7 Q. (BY MR. SAUNDERS) So in the context of a
8 trench, you want to selectively remove certain material
9 that -- material that's presently where you want the
10 trench to be, right?

11 A. Yes, in a sense that the -- selectively
12 wherever is unprotected will be your trench feature
13 where you will remove silicon to form the trench or any
14 layer -- any layer that's below the photoresist or below
15 the covering, yeah.

16 Q. And that selective removal is performed via
17 what's called etching, right?

18 A. Yes. Etching is one -- is one way.

19 Q. Okay. And so there are different types of
20 etching, right, used in semiconductor fabrication?

21 A. Can you rephrase your question? I'm not sure.

22 Q. So you've heard of, in connection with a
23 semiconductor fabrication, plasma etching? Have you
24 heard of that?

25 A. Yes, I have.

1 Q. And have you heard of wet etching?

2 A. Yes, I have.

3 Q. And those are different types of etching used
4 in semiconductor fabrication?

5 A. Those are different type of chemistry or method
6 used for etching. That's correct.

7 Q. Okay. And those are two methods that can both
8 be used for etching silicon?

9 A. That's correct.

10 Q. Okay. And when you're designing a
11 semiconductor fabrication process and just into choosing
12 the type of etching, there are other parameters involved
13 in controlling how that etching is performed; is that
14 right?

15 MR. WELLS: Objection to form.

16 A. Counsel, is it possible after this question we
17 take a break?

18 Q. (BY MR. SAUNDERS) Yeah, that's fine. Why
19 don't we just ask -- let's finish this question, and we
20 can take our break.

21 A. Yeah. Can you repeat your question again?

22 Q. Yeah. So in addition to -- sorry. Let me
23 withdraw it.

24 When you're implementing a semiconductor
25 fabrication process that involves etching silicon, in

1 addition to the type of etching, there are other
2 parameters involved in that etching procedure that have
3 to be determined; is that correct?

4 MR. WELLS: Objection to form.

5 A. I find the question a little bit vague to
6 answer. Can you -- can you be more specific?

7 Q. (BY MR. SAUNDERS) Well, you would have to look
8 at how long you're performing the etching for. Is that
9 something that you have to decide when you're doing
10 etching?

11 A. It's -- it's all -- I will say, a lack of
12 better word, a closed loop.

13 For example, as you alluded to, knowing the
14 etching chemistry, you will know what we call the X
15 rate.

16 And then, based on that, you are trying to
17 close the gap in terms of how much time you would spend
18 for etching; but it's not like you can do it infinitely
19 because there are constrained -- there are other
20 consideration, if that's your question.

21 Q. Okay. I think that's good.

22 MR. SAUNDERS: Why don't we go off the
23 record?

24 THE VIDEOGRAPHER: Okay. Going off the
25 record. The time is 3:59 p.m.

1 (Recess from 3:59 p.m. to 4:26 p.m.)

2 THE VIDEOGRAPHER: Okay. We're back on the
3 record. The time is 4:26 p.m.

4 Q. (BY MR. SAUNDERS) Thanks, Dr. Liu.

5 Do you remember before our break we were
6 talking about etching? Do you remember that?

7 A. Yes, I -- I do.

8 Q. I think you remember -- you mentioned something
9 about etch rate? Do you remember that?

10 A. That's correct.

11 Q. And do you remember that you also discussed the
12 time that etching would occur? It's something that also
13 occurs as part of the parameters of an etching process;
14 is that right?

15 A. That's correct.

16 Q. Okay. And so the etch rate and the time that
17 etching is occurring are two parameters that would
18 ultimately affect the dimensions of the gate trenches of
19 the MOSFET to the '409 patent; is that right?

20 A. I disagree, and that's not -- that's not
21 necessarily true.

22 Q. Well, if you had a higher etch rate and
23 everything else being equal, you would have a deeper
24 gate trench, right?

25 MR. WELLS: Objection to form.

1 A. Maybe you -- maybe we can go back to your
2 earlier question when I disagreed because I think the --
3 we may have different understanding of the question.

4 Q. (BY MR. SAUNDERS) Okay. Well, why don't you
5 elaborate?

6 I had asked you about whether etch rate and
7 time -- etch time would affect the dimensions of the
8 gate trenches of the '409 patent.

9 Do you remember that?

10 A. Yes, I do.

11 Q. Okay. And you disagreed with that?

12 A. I disagree in the sense that when you mention
13 dimension, I probably need to clarify which dimension
14 are you talking about?

15 Q. Okay. Well, it would -- it would certainly
16 affect the depth of the trenches, right?

17 A. That -- yes, I can agree.

18 Q. Okay. Would -- now, so the photoresist is
19 trying to protect the areas that you don't want to etch,
20 right?

21 A. Yes, in the context if the mask is used for
22 etching mask -- etching step, yes.

23 Q. Okay. But if you're using a mask to create a
24 photoresist for an etching step, there's still going to
25 be some etch under the photoresist, right?

1 A. It's -- I would say that it's not as
2 straightforward because there are competing mechanism.

3 So, generally speaking, you would like
4 the -- at least the opening, in your case the -- the
5 depth of the etching and you would like to keep it --
6 keep it high such that the lateral dimension or the
7 opening itself doesn't get blown up during the process
8 of the etching.

9 That's why you have different etching
10 process. And I believe -- yeah, let me just -- yeah,
11 that's -- just leave it at that. That's why you have
12 different process and....

13 Q. Okay. So you want to choose the right etching
14 process that's not going to etch too much that you don't
15 want to be etched; is that right?

16 MR. WELLS: Objection to form.

17 A. You want to choose the process that will
18 maintain the feature that already being transferred onto
19 the photo --

20 (Brief interruption.)

21 THE REPORTER: Apologize.

22 A. You will want to preserve the feature or the
23 mask (audio glitch) that has been transferred through
24 photolithography onto the photoresist.

25 So the rounding that occurs in such

1 transfer of the lithography onto the photoresist, that
2 has already taken place. There's nothing you can do
3 about it.

4 So, now, you just want to be able to -- be
5 able to faithfully produce, to the best you can, the
6 feature that's already transferred through
7 photolithography.

8 Q. But etching technology at the time of the '409
9 patent was not so perfect that you could guarantee there
10 would be no under-etching underneath the photoresist,
11 right?

12 A. I would disagree with that. For example, in my
13 PAC thesis, I was able to etch up to a 20 micron trench
14 without incurring significant -- I believe what you're
15 trying to say is the blowing up of the dimension in the
16 lateral direction.

17 So, again, as I alluded to earlier, it
18 depends on the etching mechanism. For example, we used
19 a term called isotropic etch for anisotropic etch.

20 And since you mentioned the plasma etching,
21 typically plasma etching is classified as anisotropic
22 etching which means that that etch itself is very
23 directional, whereas the wet edge tend to be isotropic
24 meaning that it will just etch in all direction.
25 There's no preferential or no directional etching.

1 So a dry etch and especially a certain type
2 of dry etch with a certain chemistry will be very
3 faithful in terms of producing the feature without -- as
4 you -- I think you want to say undercut -- without
5 introducing too much undercut.

6 Q. All right. Let's turn to column 3 of the '409
7 patent.

8 MR. OJEMEN: Counsel, there's a pop-up that
9 came up on Dr. Liu's screen. I just need to clear it.
10 Just give us one second.

11 MR. SAUNDERS: Okay.

12 MR. OJEMEN: Okay. Good to go. Thanks.

13 Q. (BY MR. SAUNDERS) All right. Dr. Liu, go
14 ahead and turn to column 3 of the '409 patent. Let me
15 know when you're there.

16 A. I'm there.

17 Q. Okay. And you see in a section -- starting at
18 line 10 there's a section titled "Brief Description of
19 the Drawings"?

20 Do you see that?

21 A. Yes, I do. Yes, I do.

22 Q. Okay. And you see that around column 3, line
23 17 through 20 that there is a brief description of
24 Figure 2 of the '409 patent?

25 Do you see that?

1 A. Okay.

2 Q. And you see that it mentions that Figure 2 is
3 an improved cell layout?

4 Do you see that?

5 A. Okay. Yes, I do.

6 Q. Okay. Is it your understanding that Figure 2
7 is depicting a mask layout or the layout of a MOSFET
8 after fabrication?

9 A. The description said -- says "an improved cell
10 layout" and the fact that in the figure -- right at
11 Figure 2 it says mask layout.

12 I think that's a pretty clear and
13 convincing fact to support that it is a mask layout.

14 Q. And then going to column 3 starting on line 22
15 through about line 26, do you see there's a
16 description -- brief description of Figure 3?

17 A. Yes, I do.

18 Q. And do you see it says, "Figure 3 is another
19 improved cell layout"?

20 Do you see that phrase?

21 A. Yes, I do.

22 Q. Is it your understanding that Figure 3 is a
23 mask layout or is the layout for a fabricated MOSFET?

24 A. I believe Figure 3 is a layout for a fabricated
25 MOSFET.

1 Q. And so the term "cell layout" has a different
2 meaning when the '409 patent is talking about Figure 2
3 as opposed to Figure 3?

4 A. I disagree because Figure 3 does not say mask
5 layout in this designation.

6 Q. Any other reasons why you disagree?

7 A. If you look at Figure 3, it says, "near
8 circular contact after exposure." It points to the
9 source contact by saying "near circle contact after
10 exposure."

11 Q. If you go to Figures 2A through 2C of the '409
12 patent -- let me know when you're there.

13 A. Did you say 2A to 2C?

14 Q. Yeah. They're all on the same page.

15 A. I'm there.

16 Q. Okay. These are cross-sections of a fabricated
17 MOSFET, correct?

18 A. Given that's a cross-section, I would assume --
19 I would assume so, yes.

20 Q. One mask in and of itself is not going to have,
21 like, layers of silicon material, right?

22 A. I'm not sure what your question is but -- I'm
23 not sure what your question is.

24 Q. All right. Let me withdraw, then.

25 Do you see that in Figures 2A through 2C

1 there's these dimensions W1, W2, and W3, respectively?

2 A. Yes, I do.

3 Q. And then do you see in Figure 2 that there's
4 also lines labeled W1, W2, and W3?

5 A. Repeat your question again. I'm sorry.

6 Q. So the -- is it your understanding -- well, let
7 me ask a simple question.

8 In Figure 2 proper, just Figure 2 without
9 the A, B, or C, you also see W1, W2, and W3 in that
10 figure, right?

11 A. That's correct.

12 Q. And you understand that those Ws correspond to
13 the same Ws in Figures 2A through 2C?

14 A. Can you repeat your question? I don't know if
15 they're -- please repeat your question.

16 Q. Well, yeah, let me ask it simpler.

17 So do you see in Figure 2 that there's a
18 line between A and A prime, which is an A with a as -- a
19 single quote after it? Do you see that line?

20 A. I'm sorry. I don't. Can you help me?

21 Q. Why don't I share, then?

22 All right. All right. Do you see shared
23 in the Zoom application Figure 2 of the '409 patent?

24 A. Yes, I do.

25 Q. And do you see about halfway through there is a

1 line that's got a label A on the left and a label A,
2 single quote, on the right?

3 A. Yes, I do.

4 Q. And then going to Figure 2A, do you see that
5 after Figure 2A, it says in parentheses "(A-A' Cross
6 Section)"?

7 Do you see that?

8 A. Yes, I do.

9 Q. Do you understand that the Figure 2A
10 corresponds to a cross-section that -- of -- at the
11 place that's the line A to A prime is in Figure 2?

12 A. Your question again, please.

13 Q. Yeah. So do you understand that the
14 cross-section that's depicted in Figure 2A is supposed
15 to correspond to the line that's labeled A to A prime in
16 Figure 2?

17 A. Yes.

18 Q. Okay. But --

19 A. Sorry.

20 Q. If what was in Figure 2 was a mask, the
21 cross-section wouldn't actually look like what's
22 depicted in Figure 2A, right?

23 MR. WELLS: Objection to form.

24 A. Figure 2A through C could be cross-sectioned
25 based on the layout and rather -- or -- and not by

1 the -- not by the actual silicon.

2 The -- there's no reason that you cannot
3 have a cross-section that's intended to show the benefit
4 of a truncated layout.

5 Q. (BY MR. SAUNDERS) Okay. So turning to
6 Figure 2, do you see here that there's a measurement for
7 W2?

8 Do you see that?

9 A. Yes, I do.

10 Q. So that measurement is corresponding to lines
11 that go up to where the B to B prime line intersects
12 with the outside of the trench?

13 Do you see that?

14 A. Yes. Counsel, can you give me a minute to go
15 through this -- the -- I want to refresh my memory on --
16 I'd like to refresh my memory a little bit.

17 Q. Okay. Let me know when you're ready.

18 A. Okay. Okay. I'm ready. Thank you for giving
19 me the time.

20 Q. Okay. So my question is: Do you see this
21 length W2 in Figure 2 of the '409 patent?

22 A. Yes, I do.

23 Q. Okay. And that length there is corresponding
24 to where the line B to B prime is intersecting this --
25 the -- let's call it a square with truncated corners.

1 Do you see that?

2 A. Yes, I do. On Figure 2, correct?

3 Q. Yes. And then do you see in Figure 2B that
4 there's also a W2 number as well?

5 A. Yes, I do.

6 Q. And is it your understanding that those two W2
7 numbers are supposed to refer to the same distance?

8 A. The way to answer the question is relying on
9 the information from Figure 2 -- 2A through 2C, okay?

10 It says the distance between contact and
11 gate oxide and -- that's greater than square root of
12 trench CD variation.

13 So when you print something in the mask
14 transfer, we focused earlier mainly on the rounding; but
15 you could also -- as I was saying, you want to
16 faithful -- faithfully reproduce.

17 You could also print -- just like when
18 you're taking picture, overexposure or underexposure,
19 the dimension may not also fully reproduce well.

20 So there's a -- what we call a trench CD
21 variation which stands for critical dimension variation.
22 So if I -- for example, if I try to print .18 micron, I
23 may get .18 plus/minus .05, that type of thing.

24 And then contact CD variation -- so there's
25 also contact CD variation and, plus, misalignment

1 between contact and trench.

2 So taking this together, there's a
3 transition going from Figure 2 to Figure 2A, B, and C.
4 Based on what the description, it appears that Figure
5 2A, B, and C may already be at least gone through the
6 photolithography exposure so that the W1, W2, W3 -- it's
7 not exactly identical but it's a representation of what
8 happened with the mask layout of Figure 2 and how you
9 would be getting -- and I think the key information is
10 really the dimension between W1, W2, and W3.

11 Q. So, in your opinion, W2 is a different distance
12 in Figure 2 as opposed to Figure 2B; is that correct?

13 MR. WELLS: Objection, form.

14 A. In my experience, based on what a POSITA would
15 know is that on the mask layout, the dimension is very,
16 very clear. It's W1, W2, W3. This is how you draw it.

17 Now, going from Figure 2 -- going to Figure
18 2A, 2B, 2C, the fact that there is mentioning of A, a
19 distance; and that takes into account of misalignment
20 which, as I mentioned, you want to align one layer to
21 the next layer.

22 So that dimension will be attenuated.
23 However, the relative dimension in terms of relative
24 perspective of W1, W2, W3 should -- will be maintained.

25 It's just that the exact dimension will be

1 subject to obviously what's shown in Figure 2A, 2B, 2C
2 regarding the -- either the CD variation of the trench
3 or CD variation for the contact or misalignment between
4 contact and trenches.

5 So what I -- my testimony is that W1 at
6 least (incomprehensible) to whether W1 is actual drawn
7 cross-section of manufactured device but at least -- I
8 mean -- sorry. 2A, 2B, 2C -- at least 2A, 2B, 2C -- the
9 W1 is representation of W1 in Figure 2 after taking into
10 account of what we call the process variation.

11 Q. (BY MR. SAUNDERS) You would agree with me that
12 if Figure 2 is a mask layout, that the rounding of the
13 corners that you believe would occur during fabrication
14 would mean that W2 in Figure 2 would no longer measure
15 the width of the cell as fabricated, correct?

16 MR. WELLS: Objection to form.

17 A. I disagree with that. It depends on the -- the
18 rounding. You are still taking cross-section of a
19 circle, just not at a diameter but lower part of the
20 circle.

21 So that's why progressively W1, W2, W3 will
22 also have different dimension as you go through the
23 rounding of a circle. Excuse me.

24 Q. (BY MR. SAUNDERS) So going to Figure 2B, it's
25 showing you W2 as measuring the distance between the

1 gates, trenches, correct?

2 A. That's correct.

3 Q. And going back to Figure 2, the -- let's
4 identify what's in this figure. So the center square
5 that's shaded in with gray is the source contact,
6 correct?

7 A. That's correct. And I also believe Figure 2B
8 faithfully represent by not having that source contact
9 because where the cross-section of B is taken is no
10 longer traversing through the source contact.

11 Q. And that portion -- so turning back to Figure 2
12 again, do you see this area -- sorry. Let me withdraw.

13 Turning back to Figure 2 again, do you see
14 here there's a label A with arrows pointing to the left
15 and right of it that is adjacent to that square source
16 contact but is within the -- the square with truncated
17 corners.

18 Do you see that?

19 A. Yes, I do.

20 Q. Okay. And do you see that same A is present in
21 Figure 2A of the '409 patent?

22 A. Yes, I do. And I'm very consistent. The
23 figure is trying to show going from mask layout of
24 Figure 2 into -- after tightening because there's a
25 varia -- CD variation and misalignment that's trying to

1 represent that that location -- that dimension,
2 so-called A, will be where it is and that it no longer
3 simply just -- may not -- may not simply just be the A
4 dimension as shown in Figure 2 but, rather, has gone
5 through some variation due to the printing of both the
6 trench -- not that A in the cross-section of Figure 2.

7 A will include the CD variation due to the
8 printing of trench -- trench and the printing of the
9 contact. By that, I mean source contact trench and gate
10 contact trench -- gate trench. Sorry. Not contact.
11 I'm sorry. Trench gate.

12 Q. And so the portion that's labeled A in Figure
13 2A of the '409 patent is the portion of the cell between
14 the gate and the source contact, correct?

15 A. They're right in the sense that the A in
16 Figure 2 is the dimension you intended as strong by the
17 mask layout, whereas the A in Figure 2A, at least -- in
18 2B, 2C, there's no A simply because it's not taking the
19 cross-section traversing through the contact.

20 But A in Figure 2A is representation of
21 that same dimension after the exposure because this
22 designation that you would need to take into account
23 of -- at least the minimum CD variation, misalignment,
24 and other possible factor but at least listed the three
25 of them.

1 Q. And going back to Figure 2, outside of that
2 truncated square is where you have the trench gate,
3 correct?

4 A. Repeat your question again. Outside of --

5 Q. Yeah. So we're looking at Figure 2. The
6 trench gate is outside of the truncated square, right?

7 A. Trench gate is in between -- is -- as shown,
8 110, is between the truncated square and the outside
9 rectangle or outside rectangle feature which could be a
10 square.

11 Q. Okay. I'm going to stop screen sharing for a
12 second.

13 Now I want to ask you a question about '409
14 patent at column 4, lines 53.

15 A. Okay.

16 Q. Let me know when you're there.

17 A. I just want to caution you I've been drinking a
18 lot of coffee and soda trying to keep myself alert and
19 awake. So I may have to ask for a bathroom bio break
20 pretty soon. So....

21 Q. Okay. I understand. Just let me know if you
22 need one. This shouldn't be too long.

23 A. I think at the moment I probably can only
24 handle this question before I have to -- it may become
25 urgent.

1 Q. All right. I'll ask you one question, and then
2 we'll go ahead and take another break. Does that sound
3 good?

4 A. Thank you so much.

5 Q. Okay. So column 4, lines 53 through 57 -- are
6 you there?

7 A. 53 through 57?

8 Q. Yeah, of column 4.

9 A. Yes, I'm there.

10 Q. Do you see it says, "The process for
11 manufacturing the semiconductor power device as
12 disclosed above thus includes a step of 'exposure
13 through the mask' such that the square contact becomes
14 approximately circular shaped contact and truncated
15 corners become smoother."

16 Do you see that?

17 A. Yes, I do.

18 Q. And so that's saying that one of the ways that
19 you can make a circular trench contact is by starting
20 with a square shape in a mask, right?

21 A. Please repeat your question again. I'm sorry.
22 "The process" --

23 Q. Yeah. So that sentence that's in column 4,
24 lines 53-57, that's saying that one of the ways that you
25 can make a circular shaped contact is by starting with a

1 square contact shape in a mask, correct?

2 A. I would agree that in that case that a
3 square-shaped contact after exposure due to the corner
4 rounded -- if the square is -- depending on the size of
5 the square, if the size of the square is of certain
6 feature being commensurate with that -- the amount of
7 rounding, yes, in that case that square contact will
8 become a circle.

9 But if I have -- as in prior art and also
10 in this shown, if I have a very, very thick square,
11 whereas my rounding for the given technology, as we
12 mentioned earlier, is given by the wavelength, in that
13 case you will only get -- you will get a square shape
14 with rounded corners.

15 So I just want to make that distinction so
16 that -- as well as -- you know, I believe for
17 (incomprehensible) and as well as prior art, I show them
18 very quick clearly.

19 So I just want to make sure that we're a
20 little careful to make it so general, yeah.

21 Q. Okay. Do you still want to take a break now?

22 A. Yes, please.

23 MR. SAUNDERS: All right. Let's go off the
24 record.

25 THE WITNESS: Thank you.

1 THE VIDEOGRAPHER: Okay. Going off the
2 record. The time is 5:02 p.m.

3 (Recess from 5:02 p.m. to 5:15 p.m.)

4 THE VIDEOGRAPHER: We're back on the
5 record. The time is 5:15 p.m.

6 Q. (BY MR. SAUNDERS) Welcome back, Dr. Liu.

7 I'm now going to ask you some questions
8 about your opinions as to the term "substantially
9 square-shaped" in the '409 patent.

10 A. Okay.

11 Q. And I think that's starting on Page 36 of your
12 claim construction declaration.

13 A. I'm there.

14 Q. All right. And it's your opinion that ASUS'
15 proposed construction is the correct construction; is
16 that right?

17 A. That's correct.

18 Q. And do you see in ASUS' proposed construction
19 it mentions a predefined value? Do you see that?

20 A. That's correct.

21 Q. What -- when is that value defined based on
22 your understanding of ASUS' proposed construction?

23 A. Strictly if nothing were done in the context of
24 '409 patent, the ratio of B to A would be -- excuse
25 me -- because being a square -- being a square or a 90

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1 degree, it will be -- a square of 2 would be 1.4.

2 So that would be a -- one ratio that's
3 predefined that you can work on because if -- anything
4 that's greater than that ratio, you haven't achieved
5 improving the ruggedness in your corners with the
6 teaching of '409 patent.

7 Q. Okay. But you agree with me that ASUS'
8 proposed construction doesn't recite a specific number
9 as being that predefined value, right?

10 A. Repeat your question again. I'm --

11 Q. Yeah. In your prior answer I think you
12 mentioned a number, and I just wanted you to confirm
13 with me you don't understand ASUS' proposed construction
14 as being limited to a particular number for the
15 predefined value; is that right?

16 A. Can you give me a few minutes to go through the
17 specification?

18 Q. Sure.

19 A. Okay. Thank you for allowing me to refresh my
20 memory.

21 Q. Sorry. Do you need me to reask my question?

22 A. Would you mind, please?

23 Q. Yeah. So it's your understanding of ASUS'
24 proposed construction that it doesn't recite any
25 particular number that that predefined value has to be,

1 right?

2 A. Not in the claim limitation but taking the
3 specification into account, it does mention that one of
4 the benefit of having a truncated (incomprehensible) --
5 excuse me -- and -- such that the B is less than 1.414
6 A.

7 So that is explicitly cited in column 4 of
8 '409 patent.

9 Q. Continue.

10 A. I'm sorry.

11 Q. Did you finish your answer?

12 A. It puts a context as to what substantially
13 squared would be, yeah.

14 Q. And you mention these A and B figures. Those
15 appear in Figure 2, correct?

16 A. I believe they appear in all the figures --

17 Q. Okay. But it's your opinion --

18 A. -- (incomprehensible).

19 THE REPORTER: I'm sorry. I didn't hear
20 the --

21 Q. (BY MR. SAUNDERS) It's your opinion --

22 THE REPORTER: I'm sorry. I didn't hear
23 the end of the answer.

24 A. I said figure -- I was trying to be more
25 specific. Instead of saying all figures, I was trying

1 to clarify it by saying that -- by saying it's Figure 1,
2 2, and 3. I'm sorry.

3 THE REPORTER: Thank you.

4 Q. (BY MR. SAUNDERS) Now, it's your opinion that
5 Figure 2 is a mask layout, correct?

6 A. That's correct. The fact that it says "Mask
7 Layout," that's correct.

8 Q. And it's your opinion that Figure 3 is not a
9 mask layout, correct?

10 A. That's correct, by the designation "near circle
11 contact after exposure."

12 Q. And so when a POSITA is trying to understand
13 whether something meets this claim limitation as
14 construed by ASUS, are they supposed to look at the mask
15 layout or are they supposed to look at the design as
16 fabricated?

17 MR. WELLS: Objection to form.

18 A. I'm trying to -- sorry. I'm trying to go
19 through the claim term before I give you my -- answer
20 your question.

21 In the -- in my claim construction -- in
22 the ASUS proposed claim construction that I agree with,
23 the -- it says specify -- satisfy design rule that the
24 greatest distance between longest distance and shortest
25 distance between circular trench contact and the trench

1 gate is significantly less than predefined value.

2 Given that it's a design rule, so it will
3 be at the mask layout.

4 Q. (BY MR. SAUNDERS) And so you could take those
5 A and B measurements for any closed cell MOSFET having
6 trenched gates forming the closed cell and a circular --
7 or, sorry -- a contact trench in the center, right?

8 MR. WELLS: Objection to form.

9 A. In answer to your question, I would say that
10 it's much easier to define it as a mask layout rather
11 than trying to measure it -- as you will say, measure it
12 because in measuring it you would have to go through
13 taking apart the device and de -- what we call decapping
14 by layer by layer and try to go down and try to measure
15 the separation.

16 So the fact that it's a design rule --
17 satisfy design rule, it's much easier to satisfy at
18 the -- it's much easier to have a layout that satisfy
19 design rule and easily verifiable -- it's just literally
20 on a screen with a ruler -- rather than trying to
21 satisfy a design rule that actually -- as you know,
22 there's no much -- the design rule will have gone
23 through CD variation, also gone through misalignment;
24 and then you have to deprocess it just to go ahead and
25 measure whether it falls below a predefined value.

1 Q. (BY MR. SAUNDERS) So it's your understanding
2 that the A measurement is the shortest distance between
3 the peripheral sides of the contact metal to the sides
4 of the trenched gate; is that right?

5 A. Just the way I answered, in trying to improve
6 the ruggedness of the de -- power device, you want to
7 make sure that the -- there's no -- you want to make
8 sure you don't have -- excuse me -- a very large
9 distance that would cause -- or have a propensity to
10 have voltage build up and cause the degradation to
11 avalanche breakdown.

12 Therefore, in a well-designed device, the
13 minimum distance and the greatest distance, hopefully --
14 ideally you would like them to be identical. If not,
15 you will like them to be designed to be certain --
16 within certain ratio such that the ruggedness of the
17 device will not be compromised significantly.

18 Q. So going back to the word "predefined" in ASUS'
19 (incomprehensible) construction, does that predefined
20 value have to be defined before you make the mask?

21 MR. WELLS: Objection to form.

22 A. It's a design rule. Therefore, when you are
23 actually performing the layout, you will try to make
24 sure in -- in a semiconductor technology, once we finish
25 layout of all the layers, there's a -- according to

1 certain design rule.

2 For example, there's a design rule for
3 minimum feature for seven layers. Once -- once you
4 finish the layout of all the different layers, you are
5 running through what we call a DRC. That means it's a
6 design rule check.

7 So they check both intralayer dimension --
8 critical dimension as well as interlayer critical
9 dimension in terms of both -- what we call the line
10 width and also separation between features.

11 Q. (BY MR. SAUNDERS) But that DRC, that occurs
12 before fabrication, correct?

13 A. The DRC occurred before the mask making,
14 certainly before the patenting because if some layout
15 designer were to a -- inadvertently draw something that
16 cannot be printed accurately due to the limitation of
17 the lithography, then that feature, once converted to
18 mask, could become problematic in the process of
19 fabricating a device.

20 Q. So if you were given a mask for a trench gate
21 MOSFET, how could you determine whether or not that mask
22 had a predefined value satisfying ASUS' proposed
23 construction?

24 MR. WELLS: Objection to form.

25 A. Repeat your question. I think I understand

1 your question but I just want to make sure -- confirm
2 the understanding so I can answer your question.

3 Q. (BY MR. SAUNDERS) Yes. I'm trying to
4 understand how ASUS' proposed construction could
5 actually be applied.

6 And so if a person with skill in the art
7 was looking at the mask for a closed cell trenched gate
8 MOSFET, how would they know from the mask itself whether
9 the -- there was a design rule satisfying ASUS' proposed
10 construction?

11 MR. WELLS: Same objection.

12 A. Let me answer the -- your question in the
13 sequence of going from layout to mask making and to
14 manufacturing. I think it's worthwhile to take the time
15 so I can clarify your -- your understanding.

16 So in the design rule is where we design
17 the feature or we lay out the feature with all the
18 dimensions for each of the layers.

19 And, of course, as I mentioned before,
20 these layers will be aligned to one another in the
21 process sequence; but when I draw the layer, they don't
22 automatically go onto the mask yet.

23 All the layers -- all the database -- we
24 call it GDS, graphical design database -- all these
25 layer will need to be run through DRC to make sure.

1 For example, in this case if we have a
2 design rule that require B to be less than certain
3 ratio, multiply ratio of 8, then we will run -- we
4 will -- the program will actually flag each of the
5 distance and it will run through a filter to see if that
6 distance requirement is met.

7 If not met, then you will get a DRC error
8 report that will list all the location of your layout
9 for each of the layer and also list where it would
10 happen to have problem between layer. In this case,
11 obviously it will be between layers.

12 Then it will flag the location for these in
13 between layer's errors and then the designer will look
14 at it and go: Oh, my design rule of this predefined
15 value is not met. I need to go back to my layout and
16 modify that layout.

17 And only -- it's only -- and only after
18 that DRC is clean, meaning that DRC does not flag any
19 more errors, then we ascertain that this database --
20 layout database is okay to go ahead and convert it into
21 the mask -- the pattern on the mask.

22 And usually that conversion is very -- is
23 more straightforward because it's written by electron
24 beam. So the feature, the distance, and everything is
25 very faithfully reproduced. So there's no -- what we'll

1 call translation error in between this.

2 It is the mask -- after the mask has been
3 made, then I go to print the pattern onto the wafer,
4 onto the semiconductor material; and when I try to print
5 that feature onto the semiconductor material, then
6 that's where the rounding occurs.

7 So then I don't want to check -- because
8 it's so complicated to check -- the bad design rule at
9 the fabricated device. I'd rather check at the layout
10 before even the mask is made because mask -- going
11 through (incomprehensible) right, mask is quite
12 expensive. Nowaday a single mask can easily cost you
13 upwards of \$10 million.

14 Q. (BY MR. SAUNDERS) The A and B type
15 measurements the '409 patent discussed would be
16 something that you could take from a mask that has
17 actually been printed for a closed cell trench gate
18 MOSFET, correct?

19 A. I think I need to -- I'm really sorry if I --
20 if you think I'm trying to give you a long-winded answer
21 because I do need to -- I don't want to -- I don't want
22 to sound condescending.

23 So forgive me if I sound like -- it's
24 not -- the mask itself is very expensive. As such, you
25 do not want to do any operation to that mask besides

1 printing it onto the wafer because any operation doing
2 measuring and whatever could possibly cause scratch to
3 the -- to the mask.

4 Think of it as the template for printing
5 bill. You don't want to have a scratch and all your \$20
6 bill have a scar across president's face.

7 So in a sense, you don't want to do that
8 measurement. That's much more complicated. Rather, you
9 do the measurement at the layout level by the EDA,
10 electron design automation system -- by the EDA.

11 That's why you have company like Synopsys,
12 Cadence. They help -- they have program to help you
13 check your predefined rules at the layout level.

14 Q. Okay. So if I have the layout file for a mask
15 that is going to be used for creating a closed cell
16 trenched gate MOSFET, I could use software tools for
17 measuring the A and B values of that mask's electronic
18 layout file, correct?

19 MR. WELLS: Objection to form.

20 A. There will be design rule, and you could
21 certainly check the design rule.

22 Q. (BY MR. SAUNDERS) But those dimensions that
23 the '409 patent refers to, A and B, will exist whether
24 or not you choose to implement a design rule check in
25 the DRC system; is that correct?

1 A. It will be separation as dictated by the
2 layout. And certainly if A refers to what the figure
3 shows to be the distance between the fab portion -- not
4 the corner portion of the gate and the contact and B
5 being the maximum distance between the truncated corner
6 on the mask -- if you call those A and B, yes, those
7 dimensions are readily available.

8 In fact --

9 Q. Okay. Sorry. For any A or B value that you
10 get, though, you can create a value that will be big
11 enough such that the -- let me read this accurately --
12 the -- a design rule is satisfied that the greatest
13 distance between the longest distance and the shortest
14 distance between the circular trench contacts and the
15 trenched gates is significantly less than that number,
16 right?

17 MR. WELLS: Objection to form.

18 A. Counsel, it went a bit -- a little bit too
19 long. Can you reparse it again? I'm sorry.

20 Q. (BY MR. SAUNDERS) Yeah. So if I have it -- if
21 I have the A and B for a particular mask layout, I can
22 always come up with some number that would satisfy the
23 relationship in ASUS' proposed construction as long as
24 that number is predefined as a design rule, right?

25 MR. WELLS: Objection to form.

1 A. There's a context in forming that number. The
2 context is that the device readiness given such a number
3 will not be compromised due to that -- due to the fact
4 that A and B, one, may not be identical. Ideally you
5 will want to be the same. That will facilitate more
6 uniform design for the ruggedness.

7 But given that, two, that may not be
8 uniform, you like to keep them as close as possible.

9 And knowing from the specification and
10 teaching of the '409 patent, one of the number that will
11 be -- will still be considered problematic was -- will
12 be 1.4. So we need to go down from that number.

13 Ideally if up to a very high voltage power
14 MOSFET, you would like that number to be as close to 1
15 as possible; but it is based on design and based on the
16 device specification or breakdown voltage requirement.

17 Q. (BY MR. SAUNDERS) The A and B values that are
18 in the figures of the '409 patent depend not only on the
19 shape and dimensions of the gate trenches but also the
20 shape and dimension of the source contact trench,
21 correct?

22 A. I would say the final dimension as on the
23 device will -- certainly depends on the shape of --
24 shape of both the gate and the source -- trench source
25 contact.

1 That is -- that is why you put the -- the
2 design rule is done or dictated or facilitated at the
3 layout level. So that's why you want to truncate your
4 corner, and that's why you want to have a layout of a
5 circular trench source contact at the layout level.

6 Q. Let's go onto the next term of the '409 in your
7 declaration. I believe it's "a top surface of said
8 semiconductor substrate" on Page 39. Let me know when
9 you're there.

10 A. I'm there.

11 Q. Now, ASUS' proposed construction is "Indefinite
12 or, in the alternative, 'the top surface of the bottom
13 base layer of the semiconductor power device'"; is that
14 right?

15 A. Reading here, that's correct.

16 Q. Okay. So is it your opinion that this term is
17 indefinite?

18 A. I've opined that if I just looked at
19 specification and the (incomprehensible) '409 patent, I
20 would say that the term "the top surface of" such --
21 "said semiconductor substrate" is indefinite because
22 it's unclear. Where are you trying to open this -- form
23 this opening?

24 Q. You say in paragraph 111 of your declaration,
25 "In the alternative, it is further my opinion that the

1 term 'a top surface of said semiconductor substrate'
2 should be construed as 'the top surface of the bottom
3 base layer of the semiconductor power device,' according
4 to ASUS' proposed construction."

5 Do you see that?

6 A. Yes, I do.

7 Q. Okay. Is there some ranking in your
8 preferences between indefinite and that construction, in
9 your mind?

10 I'm trying to understand how you're having
11 both -- both opinions at the same time. Is one an
12 altern -- like, is one above the other? Is this
13 construction -- if the court determines it's not
14 indefinite, then you think that's the correct
15 construction?

16 MR. WELLS: Objection to form.

17 A. The way I understand "indefinite," indefinite
18 is that by looking at the specification and looking at
19 the claim limitation, as a person of ordinary skill in
20 the art, I would not be able to fully comprehend or
21 grasp the scope of what has been taught with certainty
22 because -- the reason I'm saying that is because in the
23 way we use the term "semiconductor substrate" is very,
24 very -- in its context, also in the context of '409 and
25 also in the context of my testimony of depositions is

1 that semiconductor substrate simply refer to the
2 starting material -- as we mentioned how the process
3 flow, the starting material in which other layers or
4 other things will either be built upon or taken away
5 from it.

6 So, in this case, the epitaxial layer
7 that's on top of the substrate would not be considered
8 the silicon substrate. So it's very, very
9 straightforward, very clear.

10 So all I'm saying is that if you said that
11 a circular trench contact comprising a hole open from
12 the top surface of said semiconductor substrate, you
13 will inquire -- by the time I'm trying to form such
14 trench contact long before I -- there's no way I can
15 just simply only open the surface of semiconductor
16 substrate.

17 So in my -- if you want to ask me the
18 preference, I do not try to (incomprehensible). I'm
19 simply analyzing it and saying this claim term, as it is
20 used in the context of specification '409 and in the
21 claim limitation, is indefinite because as a person of
22 ordinary skill in the art, I do not know what that claim
23 limitation is trying to convey by saying the top surface
24 of semiconductor substrate in relationship to a circular
25 trench contact opening.

1 Q. Okay. In your prior answer you mentioned an
2 epitaxial layer. What is an epitaxial layer?

3 A. As a way of epitaxial layer, I just use this
4 illustration. It means that a layer that is formed or
5 deposited epitaxially -- in our field epitaxially on top
6 of the silicon substrate.

7 Q. And can you go to Figure 3A of the '409 patent?

8 A. (Witness complies.)

9 Q. You there?

10 A. Yes, I'm there.

11 Q. Okay. So in Figure 3A it has a layer labeled
12 "N+ Substrate." Do you see that?

13 A. Yes, I do.

14 Q. The -- that is what you are opining is the
15 appropriate structure for being the substrate if the
16 term is not indefinite, correct?

17 A. Can you repeat your question again?

18 Q. Yeah. So I'm asking about ASUS' alternative
19 construction, the top surface of the bottom base layer
20 of the semiconductor power device, is that N+ substrate
21 layer in Figure 3A the bottom base layer of the
22 semiconductor power device?

23 A. It will be the example of it.

24 Q. And in Figure 3A, am I right that the areas
25 that would be made out of the silicon would be the N+

1 substrate, the N epitaxial layer, the P body, and the N+
2 source as well as that P+ region at the bottom of the
3 source contact trench?

4 A. Can you repeat your question again? I'm sorry.
5 You -- there's a lot of thing. I'm trying to follow
6 each one by one.

7 Q. Okay. Well, let -- maybe another way to go --
8 so in Figure 3A, see on the top there there's "Source
9 Metal" on the top, right?

10 A. That's correct.

11 Q. Okay. So that's metal. That's not silicon,
12 right?

13 A. I -- I'm -- the reason I'm having a little
14 problem understanding your questions, we're talking
15 about semiconductor substrate.

16 I don't know if the claim terms refers
17 to -- let me confirm it. I don't know if the claim term
18 referred to silicon substrate in particular.

19 The only reason I want to qualify that is
20 because in certain power devices, the structure -- the
21 substrate is -- may or may not be silicon substrate, but
22 nonetheless it's still semiconductor substrate.

23 So I will caution -- try to answer the
24 question when you introduce the term "silicon."

25 Q. Okay. Well, let me ask it a better way, then.

1 The source metal in Figure 3A, that layer,
2 that's not semiconductor material because it's metal,
3 right?

4 A. That's fair, yes.

5 Q. Okay. And the -- what is the layer -- ignoring
6 the place where you have the source contact trench, what
7 is the layer that's immediately below the source metal
8 layer?

9 A. Layer immediately below the source metal layer,
10 it would be -- it would be what we call a liner. It
11 could be a certain embodiment -- oh, you mean the layer
12 that's right above N+ source?

13 Q. Well, I guess -- so there's a -- it looks like
14 there's a little liner layer above N+ source, and then
15 above that there's another layer between that liner and
16 the source metal layer. So that's what I'm asking about
17 first.

18 A. Right. So this is what we spent a lot of time
19 in earlier with the -- the other patent. That would be
20 the gate oxide. And as you can see, that gate oxide is
21 formed on top of the N+ source.

22 And it is my earlier testimony that this
23 gate oxide would be the distinguishing height between
24 the gate, 110, and the N+ source.

25 But having said that, that was my testimony

1 earlier; but now later, wherever you are referring to
2 would be the gate oxide layer.

3 Q. So it's an oxide layer. It's not meant to be a
4 semiconductor, right?

5 A. Typical gate oxide layer is not a
6 semiconductor.

7 Q. Okay. And then underneath that layer, we see a
8 liner layer that both layers the gate trenches and then
9 also separates the N+ source layer from the gate oxide
10 layer. Do you see that liner as well?

11 A. Yes, I see an N+ layer in the semiconductor
12 material that's formed on the N+ substrate as denoted in
13 Figure 2A.

14 Q. So the N+ source layer is made out of
15 semiconductor material, correct?

16 A. The N+ source is a semiconductor material
17 that's formed on top of the N+ substrate. That's
18 correct.

19 Q. And similarly the P body is also a
20 semiconductor material, correct?

21 A. I should probably answer this way: The
22 semiconductor device that's depicted on Figure 2A, that
23 semiconductor material will have a P body semiconductor
24 material sitting on top of an epitaxial layer which sit
25 on top of a semiconductor substrate in the form of N+

1 substrate.

2 Q. So the -- the P body and N+ source layers,
3 those can be created by doping a single piece of -- or
4 single epitaxially grown layer; is that correct?

5 A. Repeat your question. It's getting late. So I
6 want to make sure that -- repeat your question again.

7 Q. Yeah. So the N+ source and P body layers can
8 be created by doping a existing epitaxial later that was
9 grown as a single physical step of epitaxial growth that
10 includes all of the semiconductor material that's in the
11 N+ source and the P body and in the N epitaxial layer
12 shown in Figure 3A?

13 A. I would agree that by the process that's shown
14 in Figure 2A, you have N+ source. You have a P body,
15 and you have N epitaxial layer.

16 All these semiconductor layers are formed
17 on top of the semiconductor substrate which is the N+
18 substrate.

19 Q. And they could be all formed in a single -- all
20 the silicon that form those layers could be formed in a
21 single step of epitaxial growth, correct?

22 A. Repeat your question. I don't think -- I don't
23 think you asked the right question. I don't think you
24 want to ask that question.

25 Q. All the silicon that makes up the N+ source

1 layer, the P body and the N epitaxial layer can be
2 created as part of a single step of epitaxial growth and
3 then later get doping to create the individual layers
4 within, right?

5 MR. WELLS: Objection to form.

6 A. I would agree that there's an N epitaxial layer
7 formed on top semiconductor substrate in the form of N+
8 substrate.

9 And subsequently either doping
10 concentration, other method of, as we mentioned earlier,
11 removing or adding dopant or etching or not could be
12 formed on this N epitaxial layer which sits on the
13 semiconductor substrate.

14 Q. (BY MR. SAUNDERS) And Figure 3A doesn't show
15 the source contact trench penetrating into the lowest N+
16 substrate layer, right?

17 A. Say that again. I don't understand.

18 Q. Yeah. Looking at Figure 3A, the source contact
19 trench, 220, doesn't penetrate all the way down to the
20 N+ substrate layer, right?

21 A. I'm having a hard time locating 220.

22 Q. I can share again. So you see shared figures
23 3A through 3D of the '409 patent?

24 A. Okay. I'm sorry. I was looking at -- yeah,
25 fine.

1 Q. Okay. And you see 220 is labeled here in the
2 middle there?

3 A. That's correct.

4 Q. That's where you have the source contact?

5 A. That's correct.

6 Q. And the trench for that source contact stops in
7 the P body, right?

8 A. Stops within the P body, that's correct.

9 Q. It doesn't go all the way down to the N+
10 substrate, right?

11 A. It doesn't go down to the N+ substrate or the
12 semiconductor substrate in the sense that -- that's
13 correct.

14 Q. And turning to Figure 2A, the same thing is
15 true in Figure 2A, correct? The source contact doesn't
16 reach down to the N+ substrate layer?

17 A. That's correct in the context that because
18 there's no opening formed on top -- on the top surface
19 of the N+ substrate.

20 Q. So you agree with me that when ASUS'
21 construction -- its alternative construction that says
22 the top surface of the bottom base layer of the
23 semiconductor power device -- well, let me -- let me
24 withdraw.

25 So this phrase, "a top surface of said

1 semiconductor substrate," that appears in a larger
2 phrase in claim 1 of the '409 patent, right?

3 A. That's correct.

4 Q. Okay. The longer phrase is "said circular
5 trench contact comprises a hole opened from a top
6 surface of said semiconductor substrate and is filled
7 with a contact metal plug," and then it continues on.

8 Do you see that in claim 1 of the '409?

9 A. Yes, I do.

10 Q. Okay. And so there's no hole in the N+
11 substrate layer in any of the embodiments in the
12 specification of the '409 patent, right?

13 A. Repeat your question again.

14 Q. Yeah. So we were just looking at
15 cross-sections, Figure 2A, Figure 3A of the '409 patent;
16 and we're talking about the N+ substrate layer.

17 My question is: Nowhere in the '409 patent
18 is there a description of a hole in the N+ substrate
19 layer, right?

20 A. Although it never -- it may not -- I need to
21 look through the patent specification with the claim
22 limitation.

23 Although it never describe -- may not have
24 described the hole opening at the N+ substrate or the
25 semiconductor substrate -- not unless it used the term

1 "semiconductor substrate" in a very consistent way of
2 denoting the layer on which the epitaxial --
3 (incomprehensible) epitaxial material is sitting on.

4 Q. You would agree with me if ASUS' con --
5 proposed construction for this term were adopted,
6 claim 1 would not read on any of the embodiments
7 disclosed in the specification of the '409 patent,
8 right?

9 MR. WELLS: Objection, form.

10 A. Can you repeat the question again?

11 Q. (BY MR. SAUNDERS) Yeah. If ASUS' proposed
12 construction of the term "a top surface of said
13 semiconductor substrate" were adopted by ASUS'
14 construction, referring to its alternative
15 construction -- if that construction were adopted, claim
16 1 of the '409 patent would not read on any of the
17 embodiments disclosed in the specification of the '409
18 patent, right?

19 MR. WELLS: Same objection.

20 A. I don't believe my -- I don't believe -- it is
21 not my -- I would not -- one of the purpose of giving
22 opinions that I would not try to import any
23 specification into the limitation.

24 Sitting here testifying, based on my
25 reading of the claim construction and based on my

1 reading of the claim limitation, and based on the
2 context of '409 patent, with respect to the term
3 "semiconductor substrate," it is very, very clear to --
4 to a person of ordinary skill in the art what that
5 semiconductor substrate is referring to. And it's
6 very -- it's very consistent.

7 And that's why with the claim construction
8 with the opinion I formed, that regardless what you just
9 said about reading to the specification -- but I'm
10 simply saying that given the consistent usage of the
11 term "semiconductor substrate" to refer to a
12 particular -- particular feature, the alternative
13 construction would be you would have to be -- open a
14 hole at the semiconduct -- the surface of semiconductor
15 substrate because the semiconductor substrate in the
16 usage throughout the claim limitation as well as the
17 specification is very consistent.

18 Q. (BY MR. SAUNDERS) And sitting here today, you
19 can't remember any embodiment in the '409 patent
20 describing having a hole in that bottom base layer,
21 right?

22 MR. WELLS: Objection to form.

23 A. The example given in the specification in the
24 limited Figure 2 -- 2 and 3, given that the
25 semiconductor substrate is very consistent we

1 described -- I would say, yes, I don't see -- in that
2 contact I don't see an opening in the specification --
3 an example in the given specification.

4 Q. (BY MR. SAUNDERS) Okay. Do you -- now, go
5 back to claim 1 of the '409 patent. In the very
6 beginning of that claim do you see, before the first
7 wherein clause, it says: A trench semiconductor power
8 device comprising a plurality of trenched gates
9 surrounding a plurality of transistor cells formed in a
10 semiconductor substrate"?

11 Do you see that?

12 A. Yes, I do.

13 Q. Do the figures of the '409 patent depict the
14 transistor cells being formed in the bottom base layer?

15 A. It -- it depict that the trench semiconductor
16 power device is formed in the semiconductor substrate.

17 Q. Which figure depicts that?

18 A. The trench semiconductor de -- power device --
19 the fact that this device is formed starting with the
20 substrate as the foundation layer and upon which you
21 built all this -- so the claim 1, it says, a trench
22 semiconductor power device. And it, of course, has
23 certain element comprising formed in a semiconductor
24 substrate.

25 So it's the semiconductor power device that

1 is formed in the semiconductor substrate. It's very
2 consistent in my understanding of the term
3 "semiconductor substrate."

4 Q. If it said formed "on" a semiconductor
5 substrate, would you interpret it as having the same
6 meaning, then?

7 MR. WELLS: Objection to form.

8 A. In certain context if the meaning is given
9 in -- consistent with the specification of '409,
10 consistent with a person of ordinary skill in the art,
11 that semiconductor substrate is the starting material
12 upon which you start forming the device -- if the
13 context is that, then I would agree, yes.

14 Q. (BY MR. SAUNDERS) Now, going back to the
15 Figure 3A -- sorry?

16 A. Sorry. When you ask -- maybe we need to start
17 thinking about another bio break, but go ahead.

18 Q. Why don't we go ahead and go off the record
19 again.

20 A. How long should we --

21 THE VIDEOGRAPHER: Going off the record.
22 The time is 6:10 p.m.

23 (Recess from 6:10 p.m. to 6:18 p.m.)

24 THE VIDEOGRAPHER: Okay. We're back on the
25 record. The time is 6:18 p.m.

1 Q. (BY MR. SAUNDERS) All right. Thank you,
2 Dr. Liu.

3 Now I'd like to ask you some questions
4 about claim construction regarding some of the terms of
5 the '346 patent.

6 Can you go ahead and turn to Page 52 of
7 your claim construction declaration and let me know when
8 you're there?

9 A. I'm there.

10 Q. Okay. And this is -- begins a section where
11 you have an opinion about the term a "plurality of
12 source contact trenches with vertical sidewalls
13 substantially perpendicular to a top epitaxial surface
14 within said source regions."

15 Do you see that?

16 A. Yes, I do.

17 Q. Okay. And part of what you cite in paragraph
18 138 of your declaration is a portion of the file history
19 for the '346 patent; is that right?

20 A. Among other things, yes, that's correct.

21 Q. Okay. And this portion of the prosecution
22 history relates to an examiner's rejection over the
23 Hshieh reference, H-S-H-I-E-H; is that right?

24 A. That's correct.

25 (Liu Exhibit 14 marked.)

1 Q. (BY MR. SAUNDERS) And I have marked as
2 Exhibit 14 to your deposition US patent No. 5,629,543.
3 Do you see that in the Exhibit Share?

4 A. It's -- what exhibit number?

5 Q. It should be Exhibit No. 14 in the Exhibit
6 Share.

7 A. Oh, I need to refresh. I haven't seen it.
8 Okay.

9 Q. Do you see that now?

10 A. Yes, I do.

11 Q. Okay. And do you see -- you should also have
12 that under tab 19 of your binder.

13 A. Okay.

14 Q. Is Exhibit 14 the Hshieh reference that is
15 being discussed in the portion of the prosecution
16 history that you cite in paragraph 138 of your
17 declaration?

18 A. I believe so, yes.

19 Q. And there's a discussion of Figure 3F with that
20 reference?

21 A. That's correct.

22 Q. And in particular, there's a discussion about
23 what's called the P+ deep region 24 in that reference;
24 is that right?

25 A. That's correct.

1 Q. What is your understanding of what the P+ deep
2 region is in the Hshieh reference?

3 A. P+ deep region is meant to -- it function as
4 what we have gone over earlier. Part of the function is
5 similar to the P+ base layer.

6 You use it to contact -- used for the
7 contact layer, which is 44, to contact both the N+ and
8 the P base of the -- of the trench power device in
9 Figure 3F.

10 Q. Element 24 in Figure 3F of Hshieh isn't a
11 trench, right?

12 MR. WELLS: That's -- excuse me. Objection
13 to form.

14 A. I believe in the implementation of Hshieh,
15 which was cited by examiner's prior art, the fact that
16 this P+ region is used to contact the N+ source and the
17 P base -- and I believe the examiner used this reference
18 as -- as a mapping analogous to the trench source
19 contact.

20 Q. (BY MR. SAUNDERS) Okay. I understand that's
21 what the examiner said; but from your own review of
22 Hshieh, you would agree with me that element 24 is just
23 a region of the semiconductor material that has P+
24 doping, correct?

25 A. I understand P+ as a region of doping that is

1 used to facilitate the source contact.

2 When I say "source contact," that means
3 contacting the source with the P base layer, as we
4 discussed earlier this morning.

5 Q. Element 24 in Hshieh isn't created by etching a
6 trench to contain that element, right?

7 MR. WELLS: Objection, form.

8 A. Element 24 is -- according to the embodiment in
9 the '543 patent, which is the Hshieh's patent, is using
10 the P+ layer to contact an N+ source and that N+ source,
11 prior to having the introduction of P+ in Figure 3F is
12 in Figure 3E -- as you can see, is perpendicular to the
13 top surface.

14 So that's what 3F is showing. And 3F after
15 the P+ is introduced to the N+ source with perpendicular
16 profile to the surface, then you have the profile of 3F.

17 Q. 3F is -- so element 24 in Hshieh is introduced
18 in 3F immediately after -- it's not --
19 (incomprehensible) -- let me withdraw it.

20 Element 24 in Hshieh is present in
21 Figure 3F; but it's not present in the earlier step of
22 Figure 3E, correct?

23 A. Yes. I will agree to that. The distinction
24 between Figure 3E and Figure 3F is based on the
25 introduction of the P+ region and, of course, also

1 trying to show as impact to the profile.

2 But 3E, you can see a very perpendicular N+
3 source profile with respect to the surface -- the top
4 surface of this semiconductor device. And you see that
5 perpendicular profile, which according to 3F, is what
6 happened after the introduction of the P+.

7 Q. Element 24 in Hshieh is an example of an
8 implant created by doping using ion implantation,
9 correct?

10 MR. WELLS: Objection to form.

11 A. I think perhaps a better way to answer the
12 question is that the P+ deep region, 24 -- one way could
13 be through the -- one way could be through ion
14 implantation.

15 Q. (BY MR. SAUNDERS) The semiconductor material
16 that makes up element 24 in Hshieh is present in
17 Figure 3E of Hshieh, correct?

18 A. Repeat your question again.

19 Q. Yeah. So that semiconductor material that
20 makes up the P+ region, element 24 in Figure 3F of
21 Hshieh, is already present in Figure 3E of Hshieh. It
22 just doesn't have the added P+ doping yet, right?

23 A. I'm -- I actually got lost by your question.
24 So if you don't mind, repeat again because you mentioned
25 initially the P+. I don't quite understand.

1 Q. Okay. Do you see in Figure 3F of Hshieh that
2 element 24 is -- is pointing to a region with P+ doping,
3 right?

4 A. That's correct.

5 Q. That's semiconductor material that has received
6 P+ doping, correct?

7 A. So Figure 3F is showing after the P+ -- they
8 call it P+ deep region has been formed.

9 Q. Okay. And that region is formed by adding
10 dopants to the silicon or other semiconductor that's
11 already present in Figure 3E, right?

12 A. In Figure 3E -- very much like the power of
13 MOSFET process flow, in Figure 3E, after the etch of the
14 gate -- trench gate, you introduce the P base layer and
15 you introduce the N+ layer.

16 Q. You would agree with me that the element 24 in
17 Figure 3F of Hshieh doesn't have any sidewalls, right?

18 MR. WELLS: Objection.

19 A. I -- I -- as we mentioned, the patent examiner
20 trying to draw a parallel or tried to map the source
21 contact trench as the P+.

22 In that context, he -- the patent examiner
23 will also map the N+ to be the N+ region where P+ -- P+
24 deep -- the P+ deep region will traverse will also be
25 mapped in the -- by the examiner asking these sidewalls

1 of the source trench contact.

2 Q. (BY MR. SAUNDERS) Okay. I understand your
3 answer, but I'm not asking you what the examiner
4 thought.

5 I'm asking your own interpretation of
6 Figure 3F of Hshieh. Element 24 does not have
7 sidewalls, correct?

8 MR. WELLS: Same objection.

9 A. It really depends, again, on the context. The
10 examiner is saying that that's a -- that's mapped as
11 trench contact. Therefore, you also map the map that's
12 sidewall for the -- for the trench contact through the
13 end region and through the P -- the P region.

14 So to that -- in that context, I am -- I
15 cannot -- I'm not offering opinion whether a person of
16 ordinary skill in the art in this -- in this declaration
17 I'm not offering an opinion regarding the mapping or
18 even the quality of mapping of patent attorney or
19 patent -- patent agent or examiner -- sorry -- examiner
20 with respect to the -- respect to the Hshieh invention.

21 Q. (BY MR. SAUNDERS) All right. Let's step back.

22 Outside of this particular Hshieh
23 reference, would you understand in a MOSFET where you
24 have a region where there is a single contiguous piece
25 of silicon material where there are two adjacent

1 differently doped regions, would you call that place
2 where those two differently doped regions meet a
3 sidewall?

4 MR. WELLS: Objection to form.

5 A. It's a hypothetical question. Again, in this
6 context, I -- in my declaration, I am not trying to
7 opine what will constitute as a sidewall.

8 I'm simply trying to use the patent file
9 history as the supporting evidence for my understanding
10 of the claim term and as the supporting evidence for my
11 conclusion of the -- of the claim construction of such
12 term.

13 Q. Well, I think we talked about sidewalls quite a
14 bit today in a number of patents.

15 Do you have, independent of the '346 patent
16 and its prosecution history, an understanding of your
17 own of what a sidewall is in the context of a MOSFET?

18 MR. WELLS: Objection to form.

19 A. This morning and late throughout the day, we
20 talked about trench -- trench gate and trench source
21 contact.

22 And I'm trying to use my recollection and
23 go -- we discussed the sidewall; but nonetheless, I
24 opined in '346 as regard to the claim construction of
25 the term which include sidewall.

1 But your question regarding how sidewall
2 could be applied in the -- I would have to say that
3 sidewall -- excuse me -- sidewall of the trench --
4 sidewall referring to -- regard to -- in the context of
5 trench does not necessarily preclude the use of sidewall
6 in regards to other semiconductor material which I have
7 not opined and I have to see the context.

8 But I'm opining regarding the claim --
9 claim 1 in this discussion of critical sidewall with
10 respect to source contact trenches, and that's the
11 opinion I'm offering in this declaration in this claim
12 construction.

13 Q. (BY MR. SAUNDERS) So you don't dispute that
14 Hshieh's element 24 lacks sidewalls, correct?

15 MR. WELLS: Objection to form.

16 A. I don't think I offered an opinion necessarily
17 regard to whether there's a sidewall of -- there's an
18 existence of a certain sidewall.

19 I'm simply using the communication and the
20 file history for this Hshieh -- for the examiner citing
21 Hshieh as my supporting evidence of the -- of the claim
22 construction of claim 1 of '346.

23 Q. (BY MR. SAUNDERS) Let's go back to an earlier
24 place in your declaration, and let's go to Page 45 of
25 your claim construction declaration. Let me know when

1 you're there.

2 A. I'm there.

3 Q. So this is a portion of your declaration
4 addressing the construction of the term in the '409
5 patent, "said circular trench contact is separate from
6 said trenched gates and said source region and body
7 region disposed between a gate oxide lining of said
8 trenched gates and all circumferential points of the
9 circular trench contact"; is that right?

10 A. I see the figure that's in context of paragraph
11 124, which is under, yeah, the claim construction of the
12 term.

13 Q. So in paragraph 124 you've annotated Figure 3A
14 of the '409 patent; is that right?

15 A. Yes, that's correct.

16 Q. And it's your opinion that the red Xs are
17 examples of circumferential points that satisfy ASUS'
18 proposed construction; is that right?

19 A. I'm sorry. I don't -- my printout does not
20 have color.

21 Q. All right. Let me share the image so that will
22 address that issue.

23 A. Thank you for the accommodation.

24 Q. That's no problem.

25 All right. Do you see now the annotated

1 version of Figure 3A from paragraph 124 of your claim
2 construction declaration?

3 A. Yes, I do.

4 Q. Okay. And there are -- you've added
5 annotations with red and blue Xs, right?

6 A. That's correct.

7 Q. Okay. And so is it your opinion that the red
8 Xs are examples of circumferential points that satisfy
9 ASUS' proposed construction? Is that right?

10 A. That's correct.

11 Q. And the blue Xs are examples of circumferential
12 points that do not satisfy ASUS' proposed construction;
13 is that right?

14 A. Under the context that -- yes, that's correct,
15 under the context that all circumferential points of the
16 circular trench contact, yes.

17 Q. Okay. Can you just explain to me why -- why
18 the red Xs meet the definition and the blue Xs don't?
19 Because I don't understand.

20 A. I believe it's very clearly disclosed in my
21 declaration. So I'll be happy to point -- to go through
22 the portion that you can point out that you may not
23 understand.

24 Q. Okay. Well, you mentioned that the blue Xs are
25 not close to the trench gate oxide lining, the source

1 region, or the body region.

2 Do you see that?

3 A. That's correct.

4 Q. Okay. And they're not close because they're
5 closer to where the interlayer oxide film meets the
6 source metal; is that right?

7 A. That's not the reason they don't meet the claim
8 limitation.

9 The claim limitation says the claim's use
10 of all would indicate that at every point around the
11 circular trench contact, meaning every point up and down
12 and going around in the circumference, will have to meet
13 the claim limitation, okay?

14 So in that case, going up and down, I would
15 run into -- from the top surface, run into the blue
16 cross and then subsequently run into the red cross.

17 And if I were to look at the red cross as
18 stated -- at the point where I drew the red cross for
19 the one on the right-hand side and to the right-hand
20 side I will see that at that point there's N+ source and
21 then P body; and then that is next to gate oxide liner
22 and the gate.

23 Q. If I drew a -- and let me make sure I'm sharing
24 again so you have the colors.

25 If I drew a line from that red X to the

1 bottom left -- sorry. The -- let me say -- if I -- let
2 me withdraw.

3 If I drew a line from the rightmost red X
4 in your annotated version of Figure 3A to the bottom
5 left corner of the rightmost gate, 210, that line would
6 cross through the N+ source region, the P body region,
7 and part of the epi -- N epitaxial layer; is that right?

8 A. Hang on a second. My wife, for some reason
9 thinking that this deposition would be over, is calling
10 me. I just canceled the phone call.

11 I'm sorry. Can you repeat the question
12 again? I'm really sorry.

13 Q. Yeah. So if I'm drawing a line from this
14 rightmost X to this gate 210, in particular the right X
15 to the bottom left corner of the right gate 210, that X
16 is going to pass through the N+ source region, and the P
17 body, and the N epitaxial layer before it reaches the
18 gate oxide, right?

19 MR. WELLS: Objection to form.

20 A. I do not know the purpose of drawing diagonal,
21 and I don't believe that's -- that's the right way to
22 look at it.

23 It's consistently that you go laterally and
24 that the -- as you go horizontally laterally, then you
25 will run into N+ source -- N+ source in the P -- P body

1 and go all the way to the gate oxide liner.

2 Q. (BY MR. SAUNDERS) Okay. Well, I'm -- maybe
3 I'm a little confused because when I look at the red Xs
4 here and if I look like I'm going laterally, it looks
5 like -- or horizontally, it looks like I would stay in
6 this interlayer oxide the entire time; is that right?

7 A. Perhaps the location is the way -- perhaps the
8 location, it's -- but what I'm trying to denote is at
9 that -- where red X is, the claim limitation going
10 across, you will hit -- you will run into N+ source and
11 then subsequently -- you run into N+ source which sits
12 in the body. So body is -- N+ source is within the
13 body, and then you will hit the -- hit oxide and then
14 you will hit the gate.

15 Q. Okay. But that's -- that red X place you
16 actually, you know, put in this figure, that's not true
17 because that red X is in the interlayer oxide layer,
18 right?

19 MR. WELLS: Objection to form.

20 A. Again, I think it's relative. I'm showing
21 that -- how in -- where the one location would meet the
22 claim, whereas the other location, if I go up to the --
23 up on the vertical sidewall of the trench, then that
24 would not meet the claim limitation.

25 It's -- it's meant to show the relative

1 comparison.

2 Q. (BY MR. SAUNDERS) All right. Let's talk about
3 the blue X for a second here. And I want to again talk
4 about a line.

5 If I was going to draw a line -- a diagonal
6 line from the rightmost blue X in your Figure 3A to the
7 oxide lining that's in the trench or gate, 210, there
8 are diagonal lines I could draw that would cross through
9 the N+ source layer and the P body before I reached the
10 oxide liner that's lining the gate trench, right?

11 A. That would not -- in the context of this '409
12 patent, that would not be the -- all the circumferential
13 point of the source contact -- trench source contact.

14 Q. I understand that's your opinion, and I'm just
15 asking you a simple question of geometry.

16 You could draw that diagonal line that
17 would go from the blue X through the N+ source layer,
18 the P body, and then reach the oxide lining around the
19 trench gate, 210, right?

20 A. What you're reading would actually cause some
21 confusion to some -- a person of ordinary skill in the
22 art.

23 If I would use your logic, I could also
24 draw a line, go all the way to the P+ substrate or even
25 to the metal contact layer of the N+ substrate; and I

1 can say that the source metal is drawing -- is
2 circumferential all the way to the drain.

3 And that's not simply how -- how we
4 would -- trying to convey the feature of an invention
5 and trying to make sense to a person of ordinary skill
6 in the art in terms of interpreting -- in terms of
7 understanding the scope of the teaching of the patent.

8 Q. But you don't dispute that you could draw such
9 a line, right?

10 A. I don't dispute that you want to draw such a
11 line.

12 Q. In paragraph 127 of your claim construction
13 declaration, you mention that "the patent does not
14 provide a figure depicting or disclosure describing an
15 embodiment where every point around the circumference of
16 the circular trench contact is disposed between the
17 source region, the body region, and the trench gate
18 oxide lining."

19 Do you see that?

20 A. Yes, I do.

21 Q. Okay. How would you have to modify Figure 3A
22 of the '409 patent to be consistent with ASUS' proposed
23 construction?

24 MR. WELLS: Objection, form.

25 A. Are you asking me a hypothetical question?

1 Q. (BY MR. SAUNDERS) Yes. Let's say
2 hypothetically if you wanted to start with what is the
3 design in Figure 3A of the '409 patent and result in a
4 structure for MOSFET that satisfies ASUS' proposed
5 construction for this term, what modifications would you
6 need to make?

7 MR. WELLS: Objection to form.

8 A. Sitting right here, I'm not trying to opine how
9 to fabricate novel power semiconductor devices. I've
10 done that in my PAC thesis already.

11 I'm not here to devise novel structure.
12 I'm here to offer, as a person with ordinary skill in
13 the art, how I would interpret given the context of the
14 specification, given the context of the claim language,
15 and claim limitation and using its ordinary -- plain
16 ordinary meaning -- given those contacts and using my
17 knowledge. I'm simply opining that the claim limitation
18 as interpreted by the -- by a POSITA would result in
19 such scenario.

20 That's my declaration. Again, although I
21 consider myself to be a creative person, I'm not going
22 to sit here in such short time to opine how such device
23 will be made so that every feature of the limitation of
24 '634 will be satisfied.

25 Q. (BY MR. SAUNDERS) So, sitting here today,

1 you're not sure if claim 1 of the '409 patent using
2 ASUS' proposed construction of this term could actually
3 result in a functional MOSFET; is that right?

4 MR. WELLS: Objection to form.

5 A. Repeat the question again.

6 Q. (BY MR. SAUNDERS) Yeah. So, sitting here
7 today, you can't tell me one way or another whether
8 claim 1 of the '409 patent under ASUS' proposed
9 construction of this term would actually describe a
10 working MOSFET?

11 MR. WELLS: Objection to form.

12 A. I don't believe I ever said that. I'm simply
13 saying as we've gone through in Figure 127, the patent
14 '634 -- '346 -- I'm sorry. This is '4 -- this is '346.

15 Q. (BY MR. SAUNDERS) This is '409.

16 A. Oh, '409. I'm sorry. Because there's a
17 boundary between '409 and '346.

18 Given I'm saying that the '349 patent in
19 the specification does not provide a figure depicting
20 the disclosure described in the embodiment, according to
21 claim 1, that's simply the opinion I'm offering.

22 I'm not offering -- I'm not sitting here --
23 I did not in my declaration offer what you -- what you
24 have just described.

25 Q. Okay. Well, thank you for your time, Dr. Liu.

1 MR. SAUNDERS: I pass the witness.

2 MR. WELLS: Okay. No, we don't have any
3 questions and the deposition is now closed and we'll
4 read and sign. Thank you.

5 MR. SAUNDERS: Thank you, everybody.
6 Appreciate your time.

7 THE VIDEOGRAPHER: Going off the record.
8 The time is 6:52 p.m.

9 (The deposition was concluded at 6:52 p.m.)
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1 I, DAVID KUAN-YU LIU, PhD, have read the
2 foregoing deposition and hereby affix my signature that
3 same is true and correct, except as noted herein.

4
5 _____
6 DAVID KUAN-YU LIU, PhD
7

8 THE STATE OF _____)

9 Before me _____, on this
10 day personally appeared DAVID KUAN-YU LIU, PhD, known to
11 me (or proved to me under oath or
12 _____) (description of identity card or
13 other document) to be the person whose name is
14 subscribed to the foregoing instrument and acknowledged
15 to me that they executed the same for the purposes and
16 consideration therein expressed.

17 Given under my hand and seal of office on
18 this _____ day of _____, _____.

19
20
21 _____
22 NOTARY PUBLIC IN AND FOR

23 THE STATE OF _____

24 My Commission Expires: _____
25

REPORTER'S CERTIFICATION

I, SHARON ROSS, Certified Shorthand Reporter, do hereby certify:

That on Tuesday, February 13, 2024, at 9:40 a.m., appeared before me DAVID KUAN-YU LIU, PhD, the witness whose deposition is contained herein; that prior to being examined was by me duly sworn;

That the deposition was taken down by me in machine shorthand and was thereafter reduced to typewriting; that the foregoing represents, to the best of my ability, a true and correct transcript of the proceedings had in the foregoing matter.

That a request for an opportunity to review and make changes to this transcript:

X Was made by the deponent or a party (and/or their attorney) prior to the completion of the deposition.

Was not made by the deponent or a party (and/or their attorney) prior to the completion of the deposition.

Was waived.

I further certify that I am not an attorney for any of the parties hereto, nor in any way concerned with the cause.

Dated February 15,



SHARON ROSS, HI CSR NO. 432,
TX CSR NO. 1961, CRR, RMR, CRC
Realtime Systems Administrator

1 Richard Wells

2 richard.wells@bakermckenzie.com

3 February 15, 2024

4 RE: Force Mos Technology Co, LTD v. Asustek Computer Inc
5 2/13/2024, David Kuan-Yu Liu , PhD (#6463003)

6 The above-referenced transcript is available for
7 review.

8 Within the applicable timeframe, the witness should
9 read the testimony to verify its accuracy. If there are
10 any changes, the witness should note those with the
11 reason, on the attached Errata Sheet.

12 The witness should sign the Acknowledgment of
13 Deponent and Errata and return to the deposing attorney.
14 Copies should be sent to all counsel, and to Veritext at
15 errata-tx@veritext.com.

16 Return completed errata within 30 days from
17 receipt of testimony.

18 If the witness fails to do so within the time
19 allotted, the transcript may be used as if signed.

20

21

22 Yours,

23 Veritext Legal Solutions

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Federal Rules of Civil Procedure

Rule 30

(e) Review By the Witness; Changes.

(1) Review; Statement of Changes. On request by the deponent or a party before the deposition is completed, the deponent must be allowed 30 days after being notified by the officer that the transcript or recording is available in which:

(A) to review the transcript or recording; and

(B) if there are changes in form or substance, to sign a statement listing the changes and the reasons for making them.

(2) Changes Indicated in the Officer's Certificate. The officer must note in the certificate prescribed by Rule 30(f)(1) whether a review was requested and, if so, must attach any changes the deponent makes during the 30-day period.

DISCLAIMER: THE FOREGOING FEDERAL PROCEDURE RULES ARE PROVIDED FOR INFORMATIONAL PURPOSES ONLY.

THE ABOVE RULES ARE CURRENT AS OF APRIL 1, 2019. PLEASE REFER TO THE APPLICABLE FEDERAL RULES OF CIVIL PROCEDURE FOR UP-TO-DATE INFORMATION.

VERITEXT LEGAL SOLUTIONS

COMPANY CERTIFICATE AND DISCLOSURE STATEMENT

Veritext Legal Solutions represents that the foregoing transcript is a true, correct and complete transcript of the colloquies, questions and answers as submitted by the court reporter. Veritext Legal Solutions further represents that the attached exhibits, if any, are true, correct and complete documents as submitted by the court reporter and/or attorneys in relation to this deposition and that the documents were processed in accordance with our litigation support and production standards.

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