

UNITED STATES PATENT AND TRADEMARK OFFICE

MICRON TECHNOLOGY, INC.,)
MICRON SEMICONDUCTOR)
PRODUCTS, INC., and MICRON)
TECHNOLOGY TEXAS, LLC,) Case No.
Petitioners,) IPR-2023-00900
)
VS.) U.S. Patent No.
) 7,378,702
BESANG, INC.,)
Patent Owner.)

ORAL AND VIDEOTAPED DEPOSITION OF

DR. JACK C. LEE

FEBRUARY 6, 2024

ORAL AND VIDEOTAPED DEPOSITION OF DR.

JACK C. LEE, produced as a witness at the instance of the Patent Owner, and duly sworn, was taken in the above-styled and numbered cause on February 6, 2024, from 9:03 a.m. to 3:03 p.m., before Donna Wright, CSR in and for the State of Texas, reported by machine shorthand, at the law offices of O'MELVENY & MYERS, 303 Colorado Street, Austin, Texas, pursuant to the provisions stated on the record or attached hereto.

DIGITAL EVIDENCE GROUP

1730 M Street, NW, Suite 812

Washington, D.C. 20036

(202) 232-0646

1 A P P E A R A N C E S

2

3 FOR THE PETITIONERS:

4 Mr. John Kappos

5 Mr. Patric Reinbold (via Telephone)

6 O'MELVENY & MYERS

7 2801 North Harwood Street

8 Suite 1600

9 Dallas, Texas 75201

10 (972) 360-1947

11 jkappos@omm.com

12 preinbold@omm.com

13

14 FOR THE PATENT OWNER BESANG, INC.:

15 Mr. Douglas R. Wilson

ARMOND WILSON LLP

16 13785 Research Boulevard

Suite 125

17 Austin, Texas 78750

(512) 267-1663

18 doug.wilson@armondwilson.com

19

20 ALSO PRESENT:

21 Peter Zierlein - Videographer

Warren McCarty

22 Xu Zhou

1	INDEX	
2	Examination by Mr. Wilson.....	6
3	Examination by Mr. Kappos.....	114
4	Further Examination by Mr. Wilson.....	153
5	Further Examination by Mr. Kappos.....	178
	Further Examination by Mr. Wilson.....	179

6

7

8 EXHIBITS

9	NUMBER	DESCRIPTION	PAGE
10	Exhibit 2021		42
11		Introduction to Flash	
12		Memory	
13	Exhibit 2022		44
14		2003 Edition of	
15		International Technology	
16		Roadmap for Semiconductors	
17	Exhibit 2023		77
18		Figure 12B showing SOI	
19		pillar	
20	Exhibit 2024		79
21		Figure 12B showing two	
22		pillars	

Page 4

1	EXHIBITS CON'T		
2	NUMBER	DESCRIPTION	PAGE
3	Exhibit 2025		81
4		Figure 12B showing	
5		insulators	
6	Exhibit 2026		94
7		Annotated figure	
8	Exhibit 1033		119
9		Beilliard reference	
10	Exhibit 1034		122
11		Patude reference	
12	Exhibit 1035		130
13		Reif paper	
14			
15			
16			
17			
18			
19			
20			
21			
22			

1 THE VIDEOGRAPHER: Here begins
2 the deposition of Dr. Jack Lee.
3 Today's date is February 6th, 2024.
4 The time is 9:03 a.m.

5 Will counsel please identify
6 themselves for the record, after which
7 the court reporter will swear in the
8 witness.

9 MR. WILSON: Douglas Wilson of
10 Armond Wilson for patent owner BeSang.
11 And with me are Warren McCarty and Xu
12 Zhou.

13 MR. KAPPOS: John Kappos
14 representing the Micron petitioners.
15 And Patric Reinbold is on the phone
16 with me. We are both from
17 O'Melveny & Myers.

18 And I'm also joined by Jan
19 Bissey from the Micron legal
20 department.

21 THE REPORTER: Will you raise
22 your right hand?

1 DR. JACK C. LEE,
2 having been first duly sworn, testified as
3 follows:

4 EXAMINATION

5 BY MR. WILSON:

6 Q. Good morning, Mr. Lee.

7 A. Good morning.

8 Q. Can you please state your full
9 name?

10 A. Jack C. Lee.

11 Q. And you reside in Austin,
12 Texas?

13 A. Yes.

14 Q. Okay. You have been deposed
15 before, correct?

16 A. Yes.

17 Q. You understand basically how a
18 deposition works and the rules associated
19 with it?

20 A. I believe so.

21 Q. Okay. If you need a break, ask
22 for a break because as long as a question is

1 not pending, we will take a break.

2 Is there any reason, as you sit
3 here this morning, why you can't testify
4 fully, truthfully, and accurately?

5 A. No.

6 Q. All right. You have some
7 documents with you there. Can you tell me
8 what you have?

9 A. I have the '702 patent, I have
10 my declaration for this IPR, and I also have
11 a copy of the PTAB decision.

12 Q. The institution decision?

13 A. The institution decision, yes.

14 Q. Okay. So you have a copy of
15 the '702 patent. That's Exhibit 1001?

16 A. Yes.

17 Q. Are there any markings or notes
18 in that document?

19 A. No, sir.

20 Q. You have a copy of your
21 declaration, which is Exhibit 1002?

22 A. Yes.

1 Q. Are there any markings or notes
2 on that document?

3 A. No, sir.

4 Q. And you have a copy of the
5 board's institution decision in this IPR?

6 A. Yes.

7 Q. Are there any markings or notes
8 in that document?

9 A. No.

10 Q. Okay. So I'm assuming you
11 would prefer to use your copy of your
12 declaration, then?

13 A. Either way.

14 Q. Okay. So either way, you have
15 a copy of Exhibit 1002 or I can hand you a
16 copy. It's up to you.

17 A. It's up to you.

18 Q. Okay.

19 MR. WILSON: Does anybody else
20 want a copy?

21 MR. KAPPOS: Thank you.

22 Q. Now, if you turn to the back

1 page of Exhibit 1002, Page 99.

2 A. Yes.

3 Q. That's your signature?

4 A. Yes.

5 Q. And it's dated May 3rd, 2023,
6 correct?

7 A. Yes.

8 Q. And Exhibit 1002 was a complete
9 statement of your opinions offered in this
10 case as of May 3rd, 2023, correct?

11 A. Yes, as of May 3rd, 2023.

12 Q. Okay. Now, you reviewed your
13 declaration, Exhibit 1002, prior to your
14 deposition today, correct?

15 A. Yes.

16 Q. Did you find any mistakes or
17 errors in it?

18 A. I did not find any mistakes or
19 errors in my declaration.

20 Q. Okay. You are confident in all
21 of the opinions expressed in Exhibit 1002?

22 A. Yes.

1 Q. You worked with the law firm of
2 O'Melveny & Myers in preparing your
3 declaration, correct?

4 A. Yes.

5 Q. Who specifically did you work
6 with?

7 A. Mr. John Kappos, Patric, and
8 Vincent Zhou.

9 THE REPORTER: What's the last
10 name?

11 THE WITNESS: Z-H-O-U.

12 Q. Okay. You referred to Patric.
13 Are you referring to Micron's in-house
14 lawyer?

15 A. No.

16 Q. Oh, the person participating
17 via --

18 A. In the -- yes. Reinbold --

19 Q. Okay.

20 A. -- is his last name.

21 Q. Anybody else?

22 A. No.

1 Q. Did you work with anyone at
2 Micron in preparing your declaration?

3 A. No.

4 Q. Okay. Turn to Page 2 of your
5 declaration, Paragraph 4. Okay. The first
6 sentence says, "I'm being compensated for my
7 time in this matter at an hourly rate,"
8 correct?

9 A. Yes.

10 Q. What's the hourly rate?

11 A. \$680 per hour.

12 Q. Is that your customary rate --

13 A. Yes.

14 Q. -- for expert witness service?

15 A. Yes.

16 Q. Now, if you go to Paragraph 16.

17 Okay. Paragraph 16 lists the materials that
18 you considered in preparing the opinions
19 expressed in Exhibit 1002, correct?

20 A. Yes.

21 Q. Okay. Is that a complete list
22 of the materials that you considered and

1 relied on in forming the opinions expressed
2 in Exhibit 1002?

3 A. Yes.

4 Q. Let's turn to Page 45. I want
5 to look at Paragraph 82.

6 Do you have that?

7 A. Yes.

8 Q. Now, in the first sentence of
9 Paragraph 82, you reference patent owner's
10 apparent construction, i.e., forming the
11 stackable add-on layer by sequential
12 deposition directly on the substrate.

13 Did I read that correctly?

14 A. What page?

15 Q. 45, Paragraph 82, first
16 sentence.

17 A. Yes.

18 Q. Okay. You see the reference to
19 patent owner's apparent construction, i.e.,
20 forming the stackable add-on layer by
21 sequential deposition directly on the
22 substrate?

1 Did I read that correctly?

2 A. Yes.

3 Q. Okay. And then you say, "Which
4 I disagree," correct?

5 A. Yes.

6 Q. So you disagree that forming
7 the stackable add-on layer by sequential
8 deposition directly on the substrate is the
9 appropriate construction of stackable add-on
10 layer, correct?

11 A. It's inappropriate.

12 Q. You think that construction is
13 inappropriate, correct?

14 A. Yes.

15 Q. Okay. Why?

16 A. As I mentioned, on Page 13 on
17 my footnote, the petitioner and I believe
18 that the intrinsic record does not support
19 any interpretation of 813 that encompasses
20 forming the stackable add-on layer by
21 sequential deposition directly on the
22 substrate.

1 Q. Okay. So Footnote 2 on
2 Page 13, which you are reading from, says
3 petitioner believes that, correct?

4 A. And I'm telling you that I
5 believe that also.

6 Q. Okay.

7 A. I strongly believe that.

8 Q. Okay. So, in your opinion,
9 what is the correct construction of stackable
10 add-on layer?

11 A. I believe that the correct
12 construction for stackable add-on layer is a
13 structure formed separately from the
14 substrate should be able to be bonded to the
15 dielectric layer positioned above the
16 substrate.

17 Q. Okay. And you were -- you read
18 that construction from the board's
19 institution decision, correct?

20 A. Not exactly.

21 Q. You're referencing the board's
22 institution decision. What page?

1 A. Page 9, the second paragraph on
2 Page 9, it says that, "Based on the language
3 of the claims and the disclosures found in
4 the written description, we understand that a
5 stackable add-on layer is a layer that is
6 formed separately from the substrate and then
7 bonded as a whole to the dielectric layer
8 positioned above the substrate."

9 Q. So you disagree with the
10 board's use of "as a whole," correct?

11 A. I believe that -- I don't
12 disagree with the sentence that I just read.

13 However, I believe that the
14 phrase as whole is redundant. A person of
15 ordinary skill in the art would understand
16 that a stackable add-on layer as a structure
17 formed separately from the substrate suitable
18 to be bonded to the dielectric layer
19 positioned above the substrate.

20 Q. So does a stackable add-on
21 layer have to be bonded to dielectric?

22 A. A stackable add-on layer can be

1 bonded to the dielectric layer positioned
2 above the substrate, as written in -- on
3 Page 9 of the institution decision and as I
4 provided in the claim construction.

5 However, it does not have to be
6 bonded to the dielectric position above the
7 substrate. It could be bonded to another
8 stackable add-on layer.

9 Q. Let's go back to Page 45 of
10 your declaration. So there you are opining
11 in Paragraph 82 that Watanabe's laminating
12 method discloses or renders obvious
13 limitation 13(c) of Claim 13 of the '702
14 patent, correct?

15 A. Yes. This is in the section of
16 Claim 13(c), the stackable add-on layer being
17 bonded to the dielectric layer.

18 And as I mentioned, as I stated
19 in the first sentence of Paragraph 82, about
20 Watanabe's laminated methods, which are
21 commonly referred to as sequential deposition
22 methods.

1 Also discloses or render
2 obvious the this element under the patent
3 owner's apparent construction, i.e., forming
4 the stackable add-on layer by sequential
5 deposition directly on the substrate, with
6 which I disagree.

7 Q. Okay. So, in your opinion,
8 Watanabe's laminating method does not satisfy
9 limitation 13(c), correct?

10 A. I believe that Watanabe's
11 laminating method, again, commonly referred
12 to sequential deposition method, is not --
13 does not meet the claimed constructions of
14 stackable add-on layer that I provided and
15 that a person of ordinary skill in the art
16 would understand from the specifications,
17 written specifications in '702 patent.

18 Q. Okay. So to sum up, in your
19 opinion, Watanabe's laminating method does
20 not satisfy limitation 13(c) of the '702
21 patent, correct?

22 A. Correct.

1 Q. Let's turn to Page 71 in
2 Exhibit 1002.

3 A. Let me emphasize that in my
4 opinion Watanabe's laminated method does not
5 meet the claim limitation of Element 13(c)
6 under the claim construction of a stackable
7 add-on layer.

8 However, under the patent
9 owner's apparent construction, Watanabe's
10 laminating -- laminating methods also
11 discloses and render obvious of this element
12 of 13(c).

13 Q. Are you on Page 71 in
14 Exhibit 1002?

15 A. Yes, sir.

16 Q. Let's look at Paragraph 117.
17 Now, here you are offering an opinion about
18 whether Lee discloses or renders obvious
19 limitation 13.B of the '702 patent, correct?

20 A. Yes.

21 Q. In your opinion, Lee does not
22 disclose limitation 13(b) of the '702 patent,

1 correct?

2 A. That is correct, under the
3 claim construction of a stackable add-on
4 layer that I provided earlier and
5 understanding the specification -- and
6 understanding the -- from the written
7 description, written specifications of the
8 '702 patent that Lee does not meet the
9 limitations of Element 13(b).

10 However, as I mentioned in
11 Footnote No. 4 on Page 71, Lee discloses the
12 subject matter of the '702 patent under the
13 interpretation patent owner appears to adopt.

14 And, therefore, under the
15 interpretation patent owner appears to adopt,
16 Lee discloses claim Element 13(b).

17 Q. But you disagree with the
18 interpretation that you say patent owner
19 appears to adopt, correct?

20 A. That is correct. I disagree
21 with the interpretation patent owner appears
22 to adopt in terms of what a stackable add-on

1 layer is.

2 Q. I'm going to hand you what was
3 previously marked as Exhibit 1003.
4 Exhibit 1003 is a copy of your CV, correct?

5 A. That is correct, it is a copy
6 of the CV that I sent to counsel.

7 Q. Okay. And this was accurate as
8 of May 2023?

9 A. Yes.

10 Q. Okay. Are you aware of any
11 mistakes in Exhibit 1003?

12 A. As of May 2023, this is
13 accurate.

14 Q. Okay. Now, do you have any
15 previous experience with NAND memory devices?

16 A. Yes.

17 Q. Can you point me in your CV to
18 your previous experience with NAND memory
19 devices?

20 A. Well, NAND device is a type of
21 non-volatile memory.

22 And, first of all, I teach a

1 graduate class, in addition to my
2 undergraduate class, at UT-Austin, University
3 of Texas at Austin, that includes memory
4 devices, which encompass non-volatile memory
5 and NAND devices.

6 I also have taught and still
7 teaching many short courses in industry. In
8 fact, last week I went to the Bay area to
9 teach such courses, and three weeks ago I
10 also taught another short course.

11 And I taught many short courses
12 every year and the short courses also include
13 non-volatile memory, semiconductor memory,
14 which includes non-volatile memory and NAND
15 devices.

16 And so, in fact, there's some
17 short courses that I taught exclusively
18 focused on memory -- semiconductor memory
19 devices. So that's my teaching experience.

20 My research experience also is
21 related to semiconductor memory, such as DRAM
22 and non-volatile memory. I have published

1 more than 600 articles. So I can look
2 through that and point to where I -- where
3 the paper specifically talked about
4 non-volatile memory --

5 Q. Okay.

6 A. -- if you want me to.

7 Q. Do any of the papers in your --
8 in your list in your CV address NAND
9 specifically?

10 A. I know over the years more
11 than -- I have been at UT for 35 years and
12 graduated more than 40 PhD students and a
13 number of Master students.

14 I know that we have in the lab
15 fabricated NAND devices, but I do not recall
16 whether we actually published it, the result.
17 But I know for sure that many of our -- my
18 papers, which I work with my students, are
19 related to non-volatile memory devices.

20 Q. But non-volatile memory devices
21 encompasses more than NAND, correct?

22 A. Yes.

1 Q. So just because a paper
2 addresses non-volatile memory doesn't mean it
3 addresses NAND memory, correct?

4 A. That could be viewed as
5 correct.

6 However, as I mentioned, that
7 these non-volatile memory could be
8 reconfigured to accomplish NAND structure. I
9 could look through my CV to see if there is
10 any of these over 600 papers specifically
11 talk about NAND devices.

12 Q. Well, I will represent to you
13 that I have looked through the list, searched
14 through the list and the word NAND, N-A-N-D,
15 does not appear.

16 A. In the title?

17 Q. In the title, correct.

18 A. Right. But have you looked at
19 all of the substances in the paper itself?

20 Q. I did not read the 600 papers.
21 But, presumably, if a paper were specifically
22 directed to NAND memory, it would appear in

1 the title, correct?

2 MR. KAPPOS: Object to form.

3 A. Not necessarily.

4 Q. Okay. As you sit here today,
5 you don't recall a single one of your 600
6 papers that is specifically directed to NAND
7 memory, correct?

8 MR. KAPPOS: Object to form.

9 A. I do not support or deny your
10 statement.

11 Q. Okay. But you can't point me
12 to one of these papers that is specifically
13 directed to NAND memory, correct?

14 A. I have more than 600 papers and
15 I trust you that the title might not have the
16 word NAND, N-A-N-D, in the title.

17 But some papers might discuss
18 NAND devices in the paper itself, but does
19 not -- but do not have the word NAND in the
20 title.

21 But I do know for sure that in
22 my research group over 35 years at UT, I have

1 worked on NAND memory devices.

2 Q. Take a look at your
3 declaration, Exhibit 1002, Page 2.

4 A. Yes.

5 Q. And, specifically, Paragraphs 7
6 through 15 describe your background and
7 qualifications to offer the opinions that you
8 express in Exhibit 1002, correct?

9 A. Yes.

10 Q. In those Paragraphs 7
11 through 15, you don't mention any specific
12 experience with NAND technology, correct?

13 A. In Paragraph 12, the first
14 sentence states, "My current research and
15 teaching interests including -- include
16 semiconductor devices, semiconductor memory
17 applications, fabrication processes," and so
18 on and so forth.

19 So one of ordinary skill in the
20 art would understand that semiconductor
21 memory encompass non-volatile memory and NAND
22 devices. It would be silly for me to list

1 all of the memory devices that I work on, and
2 including DRAM, SRAM, RAM, NAND, NOR, and so
3 on and so forth. Then the Paragraph 12 would
4 take up three or four pages in each category.

5 So, therefore, to be concise, I
6 just put down semiconductor memory
7 applications. A person of ordinary skill in
8 the art reading this would understand that
9 semiconductor memory devices and applications
10 encompass DRAM, SRAM, IRAM and non-volatile
11 memory, NAND and NOR devices.

12 Q. Semiconductor memory includes
13 volatile and non-volatile memory, correct?

14 A. Yes, that's what I said. DRAM
15 is a volatile memory.

16 Q. Okay. But you don't specify in
17 Paragraph 12 whether you mean, by
18 semiconductor memory applications, volatile
19 or non-volatile memory, correct?

20 A. Again, if I specified in each
21 category that I -- that I stated in the first
22 sentence of Paragraph 12, in each category,

1 for example, semiconductor devices, I have
2 worked on MOSFET, bipolar transistors,
3 diodes, MOS capacitors, all kinds of devices,
4 FinFET, gate-all-around and the list can go
5 on and on.

6 Similarly, if I list all of the
7 semiconductor memory that I work on that
8 include, as you mentioned, volatile memory,
9 non-volatile memory, and the details, such as
10 volatile memory, such as DRAM, SRAM;
11 non-volatile memory such as IRAM,
12 programmable read-only memory, EEPROM or
13 E2PROM, flash, NAND, NOR, the list can go on
14 and on.

15 And I don't think that would be
16 necessary and that would not be concise in
17 writing my experience such as in
18 Paragraph 12.

19 Q. Okay. So in a case in which
20 you opine on the obviousness of NAND memory
21 technology, you didn't think it was necessary
22 to specify your experience with NAND

1 technology, correct?

2 MR. KAPPOS: Objection, form.

3 A. This is the same CV that I send

4 to other cases, to other law firms, such as

5 the patents related to high-K dielectric.

6 It's the same CV that I sent. And I don't

7 play games and say, "Oh, this one is

8 high-K -- this case is on high-K dielectric,

9 let me move that to the front," or, "This is

10 on hafnium oxide, let me specifically write

11 that on hafnium oxide."

12 So this is the same CV that I

13 send and I don't see any reason to change it

14 just because the case is about hafnium oxide

15 or the case is about NAND.

16 Q. Okay. I have handed you what

17 was previously marked as Exhibit 1005. This

18 is U.S. Patent No. 5,091,762, which we

19 generally refer to as Watanabe. You have

20 seen Exhibit 1005 before, correct?

21 A. Yes.

22 Q. And you have reviewed it,

1 correct?

2 A. Yes.

3 Q. Let's look at Figure 2A. Now,
4 you see in Figure 2A the -- the pieces that
5 are marked 45 and 46?

6 A. Yes.

7 Q. Those two pieces form a
8 capacitor, correct?

9 A. Yes.

10 Well, correction. It's
11 actually three pieces; 45, 46 and 47.

12 Q. Now, Figure 2B is a top view of
13 Figure 2A, correct?

14 A. Yes.

15 Q. Now, in the top view,
16 Figure 2B, do you see the reference numerals
17 45 and 46?

18 A. Yes.

19 Q. Okay. Figure 2A combined with
20 Figure 2B make clear that the capacitor
21 formed by 45, 46 and 47 is planar; that is,
22 it's form of plates, correct?

1 Q. Can you explain what you mean
2 by planar?

3 Q. Planar, it's -- layers 45
4 and 46 are a plane.

5 A. Can you explain what you mean
6 by plane?

7 Q. Like a flat plate.

8 A. 46 is not a flat plate.

9 Q. Okay. 46 -- well, let me
10 strike that.

11 Why not?

12 A. As you can see, that 46 is
13 not -- if you look at the bottom boundary
14 of 46, it's not flat.

15 Q. Okay. And you're referencing
16 the protrusion that fills the gap or break in
17 layer 45?

18 A. The gap, and it's above 48.

19 Q. Okay. So aside from the
20 downward protrusions, 46 -- well, let me
21 strike that.

22 The upper surface of layer 46

1 is a flat plate, correct?

2 A. The upper boundary of 46 is
3 flat. Is that what you're saying?

4 Q. Yes.

5 A. Yes.

6 Q. And it's also planar in that it
7 forms a -- effectively a square, correct, as
8 shown in Figure 2B?

9 A. Well, let me tell you that,
10 number one, all of the figures, not only in
11 Watanabe reference, but '702 patent, are not
12 drawn to scale and all the -- a lot of the
13 details might not be illustrated in the
14 papers.

15 So to answer your question, it
16 may not be a square. It might be some
17 other -- it might be a rectangle. It's
18 definitely -- definitely not in the dimension
19 that's shown in Figure 2A and 2B.

20 Q. You're saying it's definitely
21 not in the dimensions shown in Figure 2A
22 and 2B?

1 MR. KAPPOS: Object to form.

2 A. Again, the figures are not
3 drawn to scale and it doesn't specify, you
4 know, here the dimension is one inch by one
5 inch. I don't know how much is -- you know,
6 what is the proportion of the actual
7 dimensions to the dimension that's drawn on
8 the page.

9 Not only that it's not drawn to
10 scale, but the aspect ratios of all of the
11 figures, including the figures in '702
12 patents, are not, like I said, the actual
13 aspect ratio of the actual devices.

14 Q. So in Figure 2A, layer 46
15 covers the memory cell, correct?

16 A. What do you mean by "covers"?

17 Q. It extends completely across
18 the memory cell, correct?

19 A. Number 46 is part of the memory
20 cell. I don't understand what you mean by
21 "covers the memory cell." It is part of the
22 memory cell.

1 Q. Okay. And it completely covers
2 the memory cell, correct?

3 A. What do you mean by "it
4 completely covers the memory cell"?

5 Q. I mean layer 46 extends all the
6 way from one side of the memory cell to the
7 other.

8 A. I disagree.

9 Q. And why do you disagree?

10 A. 43 is part of the memory cell.
11 That's the gate of the past transistors and
12 so, therefore, it is part of the memory
13 cells. So I don't understand what you mean
14 by 46 covers the entire memory cell.

15 First of all, 46 is part of the
16 memory cell. Second of all, it doesn't
17 cover 43, which is the gate of the passing
18 pads to access transistors of the DRAM memory
19 cell.

20 Q. Okay. You would agree that
21 the -- the capacitance of Watanabe's
22 capacitor formed by 45, 46 and 47 is

1 proportional to the area of the capacitor,
2 correct?

3 MR. KAPPOS: Object to form.

4 A. You said the capacitance of the
5 capacitor is proportional to the area of the
6 capacitor represented by Figure 2A of 46, 45,
7 and 47?

8 Q. No, that was not my question.

9 A. Okay. Can you repeat that,
10 please?

11 Q. Yes. The capacitance of
12 Watanabe's capacitor formed by 45, 46 and 47
13 is proportional to the area of that
14 capacitor, correct?

15 MR. KAPPOS: Object to form.

16 A. Area measured in what
17 direction?

18 Q. In the XY direction, horizontal
19 direction in Figure 2A.

20 A. Figure 2A shows the
21 cross-section. It doesn't show the XY
22 direction.

1 Q. Okay. Then the XY direction in
2 Figure 2B.

3 A. Are you saying that the
4 capacitance is proportional to the area
5 represented by the rectangle or the square
6 that is drawn in Figure 2B and labeled 45
7 and 46, approximately one inch by one inch?

8 Q. Sure.

9 A. Well, as I mentioned before,
10 the figures are not drawn to scale and the
11 actual area is much smaller and the shape
12 might be very different.

13 But your statement is that the
14 capacitance is proportional to area. As I
15 taught in my graduate class and undergraduate
16 classes, that capacitance is proportional to
17 the area of the capacitor and inversely
18 proportional to the thickness between the
19 upper layer and lower layer. So, therefore,
20 in general, capacitance is proportional to
21 the area.

22 Q. Okay. Increasing the capacity

1 of Watanabe's storage capacitor in 45, 46 and
2 47 would mean increasing the area of the
3 memory cells, correct?

4 MR. KAPPOS: Object to form.

5 A. Not necessarily.

6 Q. How would you increase the
7 capacity of the capacitor without increasing
8 the area of the memory cell?

9 A. You could do it many ways.

10 Q. Can you give me one?

11 A. I can give you more than one,
12 if you want me to. But one is reducing the
13 outside thickness between the layer 46
14 and 45.

15 Q. Okay. Can you give me another
16 one?

17 A. Another one is change the
18 material of 47.

19 Q. And what would you change it
20 to?

21 A. Well, if one used the material
22 instead of using, let's say, SiO₂, which is

1 a dielectric constant of 3.9 --

2 THE REPORTER: Which is what?

3 THE WITNESS: Dielectric

4 constant of 3.9.

5 THE REPORTER: Thank you.

6 THE WITNESS: If one changed it

7 to a so-called high-K dielectric, such

8 as hafnium oxide, which has a

9 dielectric constant of around 24

10 to 30, then one can increase the

11 capacitance without increasing the

12 area of the capacitor.

13 Q. Okay. If I were to increase
14 the area of Watanabe's storage capacitor, 45,
15 46 and 47, I would also have to increase the
16 size of the memory cell, correct?

17 MR. KAPPOS: Object to form.

18 A. What do you mean by "area"?

19 Q. The -- if I increase the area
20 of the capacitor, 45, 46 and 47, then also
21 proportionally increasing the area of the
22 memory cell, correct?

1 A. Not necessarily.

2 Q. How do you increase the area of
3 the capacitor without also increasing the
4 area of the memory cell?

5 A. For example, the area of the
6 capacitor could be using a hemispheric grain
7 structure, which increases the area of the
8 capacitor without increasing the real estate
9 of the capacitor.

10 Q. So you're saying change the
11 structure of the capacitor?

12 A. No, I'm not saying that.
13 Again, a lot of the details in many figures
14 are not shown.

15 And so a person of ordinary
16 skill in the art would understand that, to
17 answer your question, that you could increase
18 the area of the capacitors without increasing
19 the area of the real estate and, therefore,
20 do not increase the area of the chip.

21 Q. I have handed you what was
22 previously marked as Exhibit 1006.

1 Exhibit 1006 is U.S. Patent Application
2 Publication 2002 0,154,556, which we refer to
3 as Endoh, E-N-D-O-H.

4 You have seen Exhibit 1006
5 before, correct?

6 A. Yes.

7 Q. And you are familiar with it?

8 A. Yes.

9 Q. Okay. I want you to take a
10 look at your declaration, Page 33. Okay.
11 Paragraph 64.

12 Now, midway through the first
13 sentence there you start quoting Endoh,
14 correct?

15 A. Can you repeat that, please?

16 Q. Sorry?

17 A. Can you repeat that, please?

18 Q. Yeah, sure. You start with
19 "Recent development in semiconductor
20 technology."

21 Do you see that?

22 A. Yes.

1 Q. Okay. And you state,
2 "Especially" -- sorry, let me start over.

3 You quote, "With recent
4 development in semiconductor technology,
5 especially in micro-patterning techniques,
6 the size reduction and the capacity increase
7 of memory cells of EEPROM, i.e., non-volatile
8 memory, are rapidly progressing."

9 Did I read that correctly?

10 A. Yes.

11 Q. In your opinion, around the
12 time of 2002 when Endoh issued, memory cell
13 size was rapidly decreasing, correct?

14 A. Yes.

15 Q. Okay. Was memory cell size
16 rapidly decreasing in 1997?

17 A. In general, yes.

18 Q. Was memory cell size rapidly
19 decreasing in 1992?

20 A. In general, semiconductor
21 technology has been progressing with scaling
22 of device sizes and, therefore, the overall

1 size reductions per memory cell.

2 Q. Are you done? Does that
3 complete your answer?

4 A. No. I'm saying that in
5 general, ever since the realizations of
6 semiconductor devices, since 1947, the
7 discovery of the invention of bipolar
8 transistors, and 1961, the first
9 demonstrations of so-called MOSFET,
10 M-O-S-F-E-T, that ever since then, the size,
11 so-called the feature size, have been scaling
12 aggressively according to what is called
13 Moore's law, M-O-O-R-E, law; that basically
14 the size, the feature size and, therefore,
15 the device size and, therefore, the size of
16 the particular logic aid or particular memory
17 cell has been decreasing over the years,
18 whether it's 1992, 1982, or 1970.

19 So when you name all of those
20 years, it doesn't matter what year it is.
21 The general directions of the semiconductor
22 industry is reducing in feature size.

1 Q. Okay. About how much do you
2 think memory cell size decreased between 1992
3 and 2002?

4 A. I do not recall the numbers of
5 the exact years and -- but it is known to
6 reduce the memory cell size.

7 Q. I have handed you what was
8 marked as Exhibit 2021.

9 (Exhibit 2021 marked)

10 Q. And Exhibit 2021 is a paper
11 entitled "Introduction to Flash Memory." You
12 can see it's dated April 2003.

13 Have you seen Exhibit 2021
14 before?

15 A. I don't recall.

16 Q. Okay. Take a look at Page 489,
17 which is essentially the first substantive
18 page. If you look at the bottom left, you
19 can see it's proceedings of the IEEE and it's
20 dated 2003.

21 Do you see that?

22 A. Yes.

1 Q. Okay. Now let's look at
2 Page 498. And if you look in the upper left,
3 do you see Figure 25?

4 A. Yes.

5 Q. And Figure 25 shows DRAM and
6 flash cell size reduction versus year.

7 Do you see that?

8 A. It says, "DRAM and flash cell
9 size reduction versus years." That's the
10 title.

11 Q. Yes. And the next sentence in
12 the caption of Figure 25 says, "The scaling
13 has been of about a factor 30 in ten years."

14 Do you see that?

15 A. That's what it says there.

16 Q. Do you have any reason to
17 disagree with that figure?

18 A. I do not confirm or deny that
19 sentence. Since this is the first time I
20 read this paper, I -- if you ask me whether
21 that sentence is accurate or not, I need to
22 look at other papers to confirm or deny this

1 accuracy of this sentence.

2 Q. So as you sit here today, you
3 agree that memory cell feature size has been
4 decreasing. But whether it's a factor of 30
5 over ten years, you are not sure, correct?

6 A. I'm saying that the feature
7 size have been decreasing over the years in
8 general. And whether the scaling has been a
9 factor of 30 in ten years, I would have to
10 check other references and another -- and
11 there are many books written about this,
12 whether that statement is correct or not.

13 Q. Let me hand you what we have
14 marked as Exhibit 2022.

15 (Exhibit 2022 marked)

16 Q. Okay. Exhibit 2022 is
17 International Technology Roadmap for
18 Semiconductors, 2003 edition.

19 Have you seen Exhibit 2022
20 before?

21 A. I don't recall. I have seen
22 many of these ITRS, stands for International

1 Technology Roadmap for Semiconductors. I do
2 not recall whether I have seen this
3 particular edition or not.

4 Q. Okay. If you look at Page 7,
5 that's numbered Page 7.

6 A. Yes.

7 Q. Okay. Do you see Table B?

8 A. Yes.

9 Q. And Table B is labeled "ITRS
10 Table Structure - Key Lithography-related
11 Characteristics by Product Type"?

12 A. Yes.

13 Q. Okay. You can see that by
14 2004, DRAM feature size was approaching 90
15 nanometers, correct?

16 A. Which row are you reading?

17 Q. The first row on the top table.

18 A. Technology node?

19 Q. Yes.

20 A. HP90, that's what you're
21 reading?

22 Q. Actually, I'm reading the row

1 under that, the DRAM row.

2 A. Yeah, that shows the half pitch
3 of DRAM. It says 90 nanometers.

4 Q. Okay. So what do you
5 understand the feature size to be then
6 around 2004?

7 A. The feature size around 2003 --
8 actually, in general -- again, of course, it
9 depends on the particular company. But in
10 general, 2003 is 90 nanometer technology
11 load. And so, yeah.

12 Q. Okay.

13 A. So around 2004, it could be 90,
14 it could be smaller than that, the feature
15 size.

16 Q. Okay. We have been going a
17 little over an hour. We can stop for a break
18 or we can keep going.

19 MR. KAPPOS: Up to the witness.

20 A. Are you done with this
21 particular paper?

22 Q. Yes.

1 A. Okay. Yeah, we can take a
2 break.

3 Q. Okay.

4 A. Thank you.

5 THE VIDEOGRAPHER: Going off
6 the record. The time is 10:14.

7 (Recess from 10:14 a.m. to 10:32 a.m.)

8 THE VIDEOGRAPHER: Back on the
9 record. This marks the beginning of
10 Media Unit No. 2. The time is 10:32.

11 Q. (BY MR. WILSON) All right.
12 Dr. Lee, I handed you what was previously
13 marked as Exhibit 1007, which is U.S. Patent
14 No. 6,881,994, which we have been calling
15 Lee. And you have seen Exhibit 1007 before,
16 correct?

17 A. Yes.

18 Q. You are familiar with it,
19 correct?

20 A. Yes.

21 Q. Okay. I want you to turn in
22 your declaration, Exhibit 1002, to Page 73.

1 A. 73, yes.

2 Q. Okay. On 73, you begin
3 discussing Element 13(c), the stackable
4 add-on layer being bonded to the dielectric
5 layer, correct?

6 A. I'm sorry, yes. You're reading
7 Element 13(c)?

8 Q. Yes.

9 A. The stackable add-on layer
10 being bonded to the dielectric layer.

11 Q. Okay. If we turn over to
12 Page 74.

13 A. Yes.

14 Q. Okay. In Paragraph 120 there,
15 you begin discussing Figure 83A.

16 Do you see that?

17 A. Yes.

18 Q. And Figure 83A shows a flash
19 memory array 5230, correct?

20 A. Yes.

21 Q. Okay. You state -- sorry, top
22 of next page, Page 75, the fourth line down,

1 do you see "Because"?

2 A. Yes.

3 Q. Okay. You state, "Because the
4 flash memory array 5230 (i.e., a stackable
5 add-on layer) is formed over the planarized
6 interlayer insulating layer 5231, a POSITA,"
7 P-O-S-I-T-A, "would have understood that the
8 array is bonded to the planarized interlayer
9 insulating layer 5231," correct?

10 A. Yes, that's what I wrote.

11 Q. And, in your opinion,
12 insulating layer 5231 is the dielectric layer
13 of limitation 13(c), correct?

14 A. Yes, that's one example.
15 However, in Figure 33 -- 35, 3102, the layer
16 3102 is also the dielectric layer described
17 in Element 13(c).

18 Q. Okay. I'm going to object to
19 your answer after "yes" and move to strike
20 it.

21 Did I ask you about Figure 35,
22 Dr. Lee?

1 A. No, but I just want to explain
2 that in that paragraph, we're focusing on
3 paragraph -- in Section 4, I just want to
4 explain that Figure 35 also had a dielectric
5 layer.

6 Q. Okay.

7 A. You can strike that if you
8 want.

9 Q. Okay. So, in your opinion, in
10 Figure 83A, the flash memory array 5230 is
11 the stackable add-on layer of limitation
12 13(c), correct?

13 A. Can you repeat that, please?

14 Q. In your opinion, in Figure 83A,
15 the flash memory array 5230 is the stackable
16 add-on layer of limitation 13(c), correct?

17 MR. KAPPOS: Object to form.

18 A. Are you referring to 5230,
19 which is the entire figure, basically the
20 entire device shown in Figure 83A?

21 Q. Yes.

22 A. Are you saying that that's just

1 one stackable add-on layer or is it three
2 stackable add-on layers?

3 Q. Well, I'm asking you what your
4 opinion is. You say on Page 75, "The flash
5 memory array 5230, i.e., a stackable add-on
6 layer."

7 Is it your opinion that the
8 flash memory array 5230 is a stackable add-on
9 layer?

10 MR. KAPPOS: Object to form.

11 A. Sorry, John. I understand that
12 A, legally -- I'm not a lawyer, so you tell
13 me. I understand that A could be -- mean
14 singular or more than one. So the flash
15 memory shown in Figure 83A actually shows
16 three separate stackable add-on layers.

17 Q. Okay. So, in your opinion, the
18 flash memory array 5230 shows three stackable
19 add on layers, correct?

20 A. That is correct.

21 Q. Now, in your opinion, Lee
22 discloses the flash memory array 5230 or the

1 three stackable add-on layers in 5230 being
2 bonded to the insulating layer 5231 in Figure
3 83A, correct?

4 A. Yes, that statement is correct.
5 The flash memory array, i.e., a stackable
6 add-on layer is formed over the planarized
7 interlayer insulator -- insulating layer.

8 5231, a POSITA would have
9 understood that the array designed it to a
10 planarized interlayer insulating layer, 5231.

11 Q. So, in your opinion, Lee's
12 Figure 83A discloses limitation 13(c),
13 correct?

14 MR. KAPPOS: Object to form.

15 A. I think you are taking it out
16 of context. Don't forget Paragraph 119, 120,
17 121. All of that, as a whole, meet the
18 limitation, not just Figure 83A.

19 Q. So, in your opinion, Figure 83A
20 by itself does not meet limitation 13(c),
21 correct?

22 A. I did not say that. I'm saying

1 that the evidence to support the invalidity
2 of element 13(c), the stackable add-on layer
3 bonded to the dielectric layer, is not just
4 Figure 83A, but also Figure 35. And the --
5 what I have written in Paragraph 119, 120,
6 and 121.

7 Q. Okay. In your opinion,
8 Figure 83A discloses a stackable add-on layer
9 being bonded to the dielectric layer,
10 correct?

11 A. That is -- that is correct.
12 Figure 83A shows a flash memory formed over a
13 planarized interlayer insulating layer, 5231.

14 Q. Okay. The three layers that
15 you referred to as stackable add-on layers in
16 memory array 5230, now, do they meet your
17 construction of stackable add-on layer?

18 A. Are you saying each of the
19 three layers or the three layers?

20 Q. Each of them.

21 A. Yes. Each of them -- let me
22 refer to -- one second.

1 Q. So that's Endoh that you're
2 looking at?

3 A. Endoh I'm looking at.

4 Q. Yeah. You understand that
5 Figure 83A came from Lee, right?

6 A. Oh, I'm sorry. I'm sorry.

7 Q. No problem.

8 A. I apologize. Yeah, you're
9 right.

10 Yes, I believe that each of the
11 stackable add-on layer is bonded to the
12 dielectric layer. For example, as you can
13 see, that the bottom layer is bonded to a
14 dielectric layer labeled 5231. The second
15 layer is bonded to an interlayer dielectric
16 layer, 5259. And the top layer is also
17 bonded to a dielectric layer, 5259.

18 Q. Okay. Do you recall earlier
19 testifying that, in your opinion, a stackable
20 add-on layer had to be formed separately?

21 A. That is what '702 patent
22 teaches and that's my claim construction what

1 a stackable add-on layer is, is a layer form
2 using stacking method. So that is correct.

3 Q. Okay. Were the layers in
4 Figure 83A that you referred to as stackable
5 add-on layers, were they formed separately?

6 A. No. Lee uses method which we
7 call laminating method, which commonly
8 referred to as sequence deposition method.

9 And as I mention in Footnote
10 No. 2 on Page 13 of my declaration, I believe
11 that '702 does not support any
12 interpretations of the claim that encompasses
13 forming the stackable add-on layer by
14 sequential deposition directly on the
15 substrate.

16 Q. Okay. So, in your opinion,
17 then, the layers, the three layers in
18 Figure 83A of Lee, are not, in fact,
19 stackable add-on layers, correct?

20 A. In my opinion, a person of
21 ordinary skill in the art who understands
22 what a stackable add-on layer by reading '702

1 patent, which is layers or structure form by
2 stacking method and the claim construction
3 that I gave you earlier.

4 However, if one takes the
5 construction apparently adopted by the patent
6 owner to interpret the stackable add-on layer
7 to cover sequential deposition method, then
8 Figure 82A and Figure 35 and other figures in
9 Lee would satisfy the limitation of 13(c),
10 stackable add-on layer being bonded to the
11 dielectric layer.

12 Q. Okay. And as you understand
13 that distinction between patent owner's
14 apparent interpretation, according to you,
15 and your own opinion as to the correct
16 construction of stackable add-on layer, the
17 difference boils down to how that layer is
18 formed, correct?

19 MR. KAPPOS: Object to form.

20 A. It is not just my opinion. It
21 is being taught by '702. One of ordinary
22 skill in the art would understand that

1 because the structure is formed by so-called
2 stacking methods and the structure that is
3 formed by so-called a sequential deposition
4 method would result in different in the
5 structure itself, and they are
6 distinguishable from one to another.

7 And so that -- the difference
8 is not just in the method that's being used
9 to fabricate the device, but also in the
10 final structure is also distinguishable.

11 Q. Okay. I don't think you
12 answered my question, but let me ask it a
13 different way.

14 Your definition of stackable
15 add-on layer requires forming separately,
16 correct?

17 A. But it's not just my claim
18 construction, but also one of ordinary skill
19 in the art would understand what a stackable
20 add-on layer and also what has been agreed --
21 also supported by the PTAB institution
22 decision that a stackable add-on layer is a

1 structure formed separately from the
2 substrate suitable to be bonded to the
3 dielectric layer positioned above the
4 substrate.

5 Q. So, in your opinion, the
6 correct construction of stackable add-on
7 layer requires that it be formed separately,
8 correct?

9 A. That is correct, according to
10 the claim construction that I -- that I
11 propose according to the reading of the
12 specification of '702. And also the
13 institution decision also supports that claim
14 construction.

15 Q. Okay. So a layer that is
16 instead formed by sequential deposition
17 cannot be a stackable add-on layer, in your
18 opinion, correct?

19 A. That is -- that is correct,
20 that a layer that is formed by sequential
21 deposition method would not be qualified as a
22 stackable add-on layer.

1 Again, in my Footnote No. 2 and
2 on Page 13, that -- the patent owner appears
3 to adopt a very different interpretation of
4 stackable add-on layer to cover sequential
5 deposition method.

6 Q. Okay. So the difference
7 between what you attribute to patent owner
8 and what you consider to be the correct
9 construction of stackable add-on layer is the
10 method of forming the layer, correct?

11 A. That is one difference.

12 Q. Okay. I have handed you
13 Exhibit 1007, which is Lee. So -- but take a
14 look at Page 75 of your declaration,
15 Paragraph 121.

16 So in Paragraph 121, you quote
17 Lee in Column 11, Lines 24 through 31.

18 Do you see that?

19 A. Yes.

20 Q. Okay. So you can look at Lee
21 for it or you can look at your declaration, I
22 don't care which. But I want to ask you some

1 questions about this passage.

2 First, Lee says, "Using
3 monolithic arrays improves device density,"
4 correct?

5 A. Yes, it says one method of
6 improving device density is to arrange the
7 devices in a monolithic three-dimensional
8 array of charge storage devices comprising a
9 plurality of device levels.

10 Q. Okay. If you look at the last
11 sentence of that passage, Lee says, "In
12 contrast, two-dimensional arrays may be
13 formed separately and then packaged together
14 to form a non-monolithic memory device."

15 Did I read that correctly?

16 A. Yes.

17 Q. So the "in contrast" language
18 is distinguishing non-monolithic memory
19 devices from monolithic ones, correct?

20 A. Yes, in that context, Lee
21 describes monolithic to correlate with
22 sequential deposition method of

1 non-monolithic to correlate with stacking
2 method.

3 Q. So Lee here in this passage
4 that you quoted is expressing a preference
5 for monolithic memory devices, correct?

6 MR. KAPPOS: Object to form.

7 A. I don't see how a person of
8 ordinary skill in the art reading that
9 particular passage would conclude that Lee
10 has a preference.

11 Q. Lee never says that
12 non-monolithic memory devices improve device
13 density, correct?

14 MR. KAPPOS: Object to form.

15 A. He also did not deny that
16 non-monolithic memory devices improve the
17 device density.

18 In other words, Lee never said
19 that non-monolithic memory devices using
20 stacking method does not improve the device
21 density.

22 Q. So the answer to my question

1 was yes?

2 A. What was your question again?

3 Q. Lee never says that

4 non-monolithic memory devices improve device
5 density, correct?

6 A. If you read just that paragraph
7 and perhaps take it out of context, that
8 paragraph does not -- specifically says that
9 non-monolithic memory devices improve device
10 density.

11 But when you say Lee never said
12 that, I have to look back in the Lee patent
13 itself to make sure that Lee never says that.
14 Would you like me to look through that?

15 Q. Are you aware of Lee ever
16 saying that non-monolithic devices improve
17 device density?

18 MR. KAPPOS: Object to form.

19 A. I don't recall, but it doesn't
20 mean that he never said that. A person of
21 ordinary skill in the art would understand
22 that three-dimensional array, whether you do

1 it monolithically or non-monolithically, in
2 other words, whether you use stacking method
3 or sequential deposition method, would
4 improve the device density.

5 Now, to answer your question, I
6 don't know whether Lee ever said that
7 non-monolithic memory improved the device
8 density or not improved the device density.
9 I just don't recall.

10 By reading that passage that
11 you quoted on Page 121, that particular
12 passage, he did not say that non-monolithic
13 approach improved device density.

14 But, again, I have to read
15 through and search the entire patent of Lee
16 to make sure that whether your statement that
17 "never said that" is correct or not. I just
18 cannot confirm or deny it.

19 Q. Take a look at Page 73 of your
20 declaration, Paragraph 118.

21 A. Yes, sir.

22 Q. Paragraph 118 starts on Page 72

1 and then goes over to Page 73. On Page 73,
2 you say, "Because Lee discloses a
3 three-dimensional nonvolatile memory array,
4 comprising a plurality of vertically
5 separated device levels in which each level
6 comprises an array of TFT EEPROMs," P-R-O-M,
7 "the memory array is a stackable add-on layer
8 having a plurality of vertically oriented
9 semiconductor memory cells."

10 Did I read that correctly?

11 A. Yes.

12 Q. Now, take a look at Lee,
13 Column 31, Lines 38 through 40.

14 Do you see that passage?

15 A. Yes.

16 Q. Okay. That passage says,
17 "Figures 37 through 44 illustrate a method of
18 making a TFT EEPROM nonvolatile flash memory
19 array 4001 according to the first preferred
20 embodiment of the present invention,"
21 correct?

22 A. Yes.

1 Q. If you take a look at
2 Figures -- let's look at Figures 42
3 through 44 specifically.

4 You would agree that Figures 42
5 through 44 show TFT EEPROMs, correct?

6 A. Yes, 37 and -- not just 37
7 to 44, Figure 37 to 44 illustrate a method of
8 forming TFT EEPROM nonvolatile memory array.

9 Q. Okay. Take a look at your
10 declaration, Page 33, Paragraph 64.

11 Do you see Paragraph 64?

12 A. Yes.

13 Q. Okay. You state there that
14 Endoh discloses pillar-form (i.e., vertical
15 columnar-shaped) semiconductor memory
16 devices, correct?

17 A. Yes, that's the first sentence.

18 Q. So, in your opinion, "pillar
19 form" means "vertical columnar shape,"
20 correct?

21 MR. KAPPOS: Object to form.

22 A. In my opinion and according to

1 the specifications of '702 patent, a pillar
2 structure is a dope stack structure.

3 THE REPORTER: What kind of
4 stack?

5 THE WITNESS: Dope, D-O-P-E.
6 That's what '702 teaches.

7 Q. Okay. So there is no -- in
8 your opinion, there is no shape implied by
9 the term "pillar," correct?

10 A. The '702 patent never talked
11 about the shape of the structure. All it
12 says is that a pillar structure is a dope
13 stack structure.

14 Q. Okay. So the answer to my
15 question is yes, there is no structure --
16 specific structure implied by the term
17 "pillar"?

18 A. I believe that was my answer.
19 Yes, this dope stack structure, according to
20 the teaching of '702, does not say anything
21 about the shape of the structure.

22 Q. Okay. And you don't think the

1 plain and ordinary meaning of the word
2 "pillar" connotes any particular structure?

3 A. My understanding is that to
4 understand what a pillar structure is, one
5 needs to understand what the patent teaches.

6 And the patent teaches that a
7 pillar structure is a dope stack structure.
8 I don't know what the plain and ordinary
9 meaning is for "pillar."

10 But my understanding of someone
11 of ordinary skill in the art in understanding
12 the claims need to look at the intrinsic
13 evidence of what a pillar structure is.

14 Q. Okay. And so you're looking at
15 a passage in the '702 patent?

16 A. You mean at this point?

17 Q. Yes.

18 A. Well, I'm looking at my
19 declaration, the '702 and the Lee patent.

20 Q. Okay.

21 A. So what are you talking about?

22 Q. Where are you getting the dope

1 stack structure language?

2 A. I see. In one place, if you
3 look at Column 6, Line 26 to 34, it says that
4 "In various embodiments of the present
5 convention, FLD -- AFLD can be directly
6 contact -- contacted by metal electrodes at
7 top, bottom, and intermediate regions all of
8 the individual dope stack structures (i.e.,
9 pillar structures)."

10 Q. So, in your opinion, that
11 passage is defining pillar structures as dope
12 stack structures?

13 A. Well, that's just one passage
14 in the '702 patent that clearly defined what
15 a pillar structure is, which is a stack -- a
16 dope stack structure.

17 Q. Is that passage defining pillar
18 or is it defining dope stack structures?

19 A. That -- that sentence believed
20 that pillar structure is equating to dope
21 stack structure. Whether you call that when
22 you have equations, X equals Y, whether you

1 call that equation define X or define Y, it's
2 the same difference.

3 Whether that sentence defines
4 dope stack structure or pillar structure,
5 that sentence basically equates dope stack
6 structure to pillar structure.

7 Q. Okay. And is -- when you say
8 that sentence is equating those things, is
9 that your understanding of the legal
10 significance of that sentence or are you
11 basing that on some principle of law that you
12 think applies here or is that just the
13 natural English language?

14 MR. KAPPOS: Object to form.

15 A. I'm not a lawyer, so you tell
16 me the legal interpretations of that
17 sentence.

18 But a person of ordinary skill
19 in the art reading this would understand that
20 dope stack structure is a pillar structure.
21 And, likewise, a pillar structure is a dope
22 stack structure.

1 Q. Okay. So you're saying that
2 passage reads individual dope stack
3 structures, i.e., pillar structures, as well
4 as pillar structures, i.e., dope stack
5 structures, correct?

6 A. What I'm saying is that a
7 person of ordinary skill in the art in
8 understanding what a pillar is, it is a dope
9 stack structure.

10 Now, again, I'm not a lawyer.
11 Whether under your -- whether it makes any
12 difference, whether you put the parenthesis
13 around pillar structure or dope stack
14 structure, I don't know.

15 So -- but a person of ordinary
16 skill in the art reading that sentence would
17 understand that pillar structure equates dope
18 stack structure.

19 Q. What does a person of ordinary
20 skill in the art understand the term "i.e."
21 to mean?

22 MR. KAPPOS: Object to form.

1 A. Well, my understanding, it
2 means "that is."

3 Q. Okay. So it's saying
4 individual dope stack structures, that is
5 pillar structures, correct?

6 A. Right.

7 Q. So it's characterizing
8 individual dope stack structures as pillar
9 structures, not the other way around,
10 correct?

11 A. I disagree. It means that dope
12 stack structure is equal to pillar structure.

13 Q. Okay. Well, you didn't say
14 that "i.e." meant "equal," correct?

15 A. Well, "i.e." means "that is."
16 But also a person of ordinary skill in the
17 art would understand that means it's equal
18 to. Whether -- whether you say pillar is
19 equal to dope stack structure or dope stack
20 structure is equal to pillar structure, a
21 person of ordinary skill in the art reading
22 that sentence will be -- will understand that

1 they are equal to each other.

2 Q. Okay. Is there any other basis
3 for your opinion that pillar means dope stack
4 structure?

5 A. So, for example, in Figure 12,
6 Figure 12 points to a 124, which is n+, p,
7 n+, p, n+. And in Column 8, Line 41 to 49,
8 it says that Figure 12 shows two vertical
9 DRAM cells with vertical connections of two
10 MOSFET in the stackable add-on layer and two
11 external capacitor. Without external
12 capacitor, the MOSFETs in the SOI pillar,
13 124, could work as a DRAM cell either as
14 explained in Figure 8 and Figure 13 shows the
15 schematic of equivalent circuit for the
16 structure showing Figure 12.

17 So, therefore, a person of
18 ordinary skill in the art would understand
19 that in this paragraph, it identified the
20 dope stack structure n+, p, n+, p, n+. It's
21 a pillar. So that's another supporting
22 evidence.

1 Q. Okay. Anything else?

2 A. I just gave you two, but there
3 could be more in the '702 patent. But if you
4 want, I can look through that again. But
5 those two particular passage clearly equate
6 dope stack structure to be the pillar
7 structure.

8 Q. Let's take a look at Figure 12B
9 in Lee.

10 A. Okay. Figure what?

11 Q. 12B.

12 A. 12B.

13 Q. If you would turn to Page 84 of
14 your declaration.

15 A. Okay.

16 Q. Paragraph 132, you refer to
17 Lee's Figure 12B.

18 Do you see that?

19 A. Yes.

20 Q. And you say, going from Page 84
21 over to Page 85, "Lee's Figure 12B
22 illustrates a method of forming a common

1 continuous film control gate between two or
2 more levels of pillar memories on a substrate
3 (not shown.) "

4 Did I read that correctly?

5 A. Yes.

6 Q. So Figure 12B shows a common
7 control gate, correct?

8 A. That's what it says in the --
9 in Lee Column 8, Line 55 through 56.

10 Q. Now, take a look at Figure 91
11 of Lee.

12 A. You said 91?

13 Q. Yes, Figure 91. It's on
14 Page 81.

15 A. You're talking about the '994
16 patent?

17 Q. Yes, yes.

18 A. Okay. Yes, Figure 91 on
19 Page 75.

20 Q. You know what, forget it.
21 Let's go back to Figure 12B.

22 A. What page?

1 Q. It's either in the declaration
2 on Page 85 or --

3 A. Okay. Page 8 of Lee.

4 Q. I seem to have different page
5 numbers here.

6 A. I'm reading the top.

7 Q. Oh, Sheet 8, okay. Yes, all
8 right. Okay.

9 So looking back at Figure 12B
10 either in your declaration or in Lee, the
11 memory cells in Level 1 and Level 2 are
12 arranged in parallel, correct?

13 A. By looking at Figure 12B alone,
14 I cannot tell whether they are connected in
15 parallel or in series because it doesn't show
16 the connection between Level 1 and Level 2.

17 Q. Okay. If we look at
18 Paragraph 133.

19 A. Yes.

20 Q. You refer to the fact that this
21 memory arrangement is known as the NOR
22 virtual ground array.

1 A. That's right.

2 Q. Does that tell you whether the
3 memory cells in Figure 12B are in parallel?

4 A. Okay. Your earlier question,
5 you said that's the figure itself. But
6 reading this paragraph, yes, it is a NOR
7 architecture array.

8 Q. Okay. So the memory cells in
9 Level 1 and Level 2 are raised in parallel,
10 correct?

11 A. A NOR architecture means that
12 it is not series -- it is not series
13 connections, but rather a parallel
14 connection.

15 Q. Now, you're relying on Lee's
16 Figure 12B for Claim 16, correct?

17 A. Well, I wouldn't say that -- I
18 rely -- to invalidate Claim 16, one cannot
19 take Figure 12B out of context.

20 One would have to read the
21 entire section, Paragraph 131 all the way
22 to 137. That's what I rely on in meeting the

1 limitation of the pending Claim 16.

2 Q. Let's look at Paragraph 132
3 where you show Figure 12B.

4 A. Yes.

5 Q. At the end of that paragraph,
6 you say, "Thus, Lee discloses at least two
7 non-volatile memory cells are vertically
8 oriented and formed with a first SOI pillar."

9 Did I read that correctly?

10 A. Yes.

11 Q. Okay. So, in your opinion,
12 Figure 12B shows a first SOI pillar, correct?

13 A. Yes, that's what Lee described.
14 It is a SOI -- it is a pillar. As you
15 understand it, it is a dope stack structure.

16 Q. Okay. What I would like for
17 you to do -- I have handed you Figure 12B,
18 which is marked as Exhibit 2023.

19 (Exhibit 2023 marked)

20 Q. And I would like for you to
21 take this pen and draw a box around the first
22 SOI pillar in Figure 12B.

1 MR. KAPPOS: Object to form.

2 A. So you can see two pillars that
3 are vertically oriented, right. So because
4 those are dope stack structure right here and
5 here, they are vertically oriented, as
6 described in '702 patent what vertically
7 means, right.

8 In Column 4 of '702 patent, in
9 Line 7 to Line 9, the term "vertical" means
10 substantially perpendicular to the major
11 surface of the substrate, such as, for
12 example, a semiconductor wafer.

13 So, therefore -- and, see, this
14 is a pillar, this is a pillar, this is a
15 pillar, this is a pillar.

16 Q. Okay. In the lower parts of
17 the figures here, you look like you are
18 including part of the metal contact. Is that
19 intentional or unintentional?

20 A. That's not metal contact. I
21 believe that's the insulator.

22 Q. This is an insulator?

1 A. I believe so.

2 Q. The hash line?

3 A. Yeah. So let me -- the dope
4 stack -- do you have another copy?

5 Q. Yes.

6 A. I will draw it more carefully.
7 I apologize.

8 Q. Keep that one. We will mark
9 this one as 2024.

10 A. Let me cross this out, I
11 apologize.

12 (Exhibit 2024 marked)

13 A. Let me label two pillars.
14 That's all we need. There you go.

15 Q. So, in your opinion, the
16 pillars in Figure 12B are just the n+, p-, n+
17 dope stack structures, correct?

18 A. That is correct. Those are the
19 pillars structure.

20 Q. Okay. You understand the term
21 "SOI" in the '702 patent stands for silicon
22 on insulator, correct?

1 A. That's right. In Column 4, it
2 says that the acronym SOI generally refers to
3 silicon on insulator.

4 Q. Okay. And you are familiar
5 with silicon on insulator and the meaning of
6 that term to a person of ordinary skill in
7 the art, correct?

8 A. Yes. And '702 also describes
9 what SOI layer is. If you look at
10 Paragraph 40 -- paragraph in Column 4,
11 Line 45 to Column 5, Line 7, it says, "The
12 SOI layer is used herein to refer to a
13 relatively thin single-crystal portion of the
14 semiconductor wafer that can be cleaved and
15 bonded to another previously fabricated
16 wafer, or similar type of substrate."

17 Let me stop there.

18 Q. Okay. Looking back at your
19 declaration, Page 85, Paragraph 132, again,
20 last sentence in Paragraph 132, you say that
21 Lee discloses at least two non-volatile
22 memory cells are vertically oriented and

1 formed with a first SOI pillar, correct?

2 A. Yes, sir.

3 Q. So, in your opinion, Figure 12B
4 is showing an SOI pillar, silicon on
5 insulated pillar, correct?

6 A. Yes.

7 Q. Okay. I'm going to hand you
8 what I have marked as Exhibit 2025. Again,
9 it's a copy of Figure 12B.

10 (Exhibit 2025 marked)

11 Q. If you can show me the
12 insulator from Figure 12B, if you can mark
13 that with the blue pen.

14 MR. KAPPOS: Object to form.

15 A. With all of the insulators?

16 Q. Sure.

17 A. Okay. Here is an insulator,
18 here is an insulator. Let me go ahead and
19 just -- it's identified only on the
20 right-hand side.

21 Q. Okay.

22 A. Of course this is also an

1 insulator, but that's just for those three.

2 Q. Okay.

3 A. Is that okay with you, because

4 I can --

5 Q. Sure.

6 A. Okay.

7 Q. Sure. You can just set that in
8 the exhibit stack.

9 A. Okay.

10 Q. We have been going for a little
11 over an hour. Are you guys ready to take a
12 break?

13 A. It's 11:40. We usually take
14 lunch at 12:00.

15 Q. I think lunch is not coming
16 until 12:30, right?

17 MR. KAPPOS: I'm not sure
18 exactly what time because you never
19 quite know. It could be 12:00, it
20 could be 12:15.

21 Do you want to go until I get a
22 message saying lunch is here or do you

1 want to take a break now, come back
2 and do another short session? It's up
3 to you.

4 MR. WILSON: Let's take a short
5 break.

6 THE VIDEOGRAPHER: Going off
7 the record. The time is 11:41.

8 (Recess from 11:41 a.m. to 12:32 a.m.)

9 THE VIDEOGRAPHER: Back on the
10 record. This marks the beginning of
11 Media Unit No. 3. The time is 12:32.

12 THE WITNESS: Excuse me. I
13 would like to make a correction to my
14 earlier answer. In fact, not really a
15 correction, but an addition to my
16 earlier answer.

17 Q. (BY MR. WILSON) Okay. What
18 was it?

19 A. Your question was where is the
20 intrinsic -- intrinsic evidence of pillars
21 meaning dope stack structure, right, and I
22 gave you two examples.

1 Remember that?

2 Q. Yes.

3 A. And, actually, there are a lot
4 more examples, as I mentioned. If you would
5 like, I can point those out to you.

6 Q. Sure, go ahead and point them
7 out.

8 A. Okay. For example, in Figure 6
9 on Page 6, all of these figures point to the
10 identification of 124 as pillar, okay. As
11 you can see, Figure 6 in 124 point to a
12 pillar and Column 6 show that 124 is a
13 pillar, okay.

14 And then, furthermore, Figure 8
15 on Page 8 of the '702 patent also point to
16 n+, p, n+ as 124. And as shown in Figure --
17 Column 8, also point to 124 as the pillar.

18 Furthermore, Figure 12 that I
19 pointed out earlier on Page 12, on Sheet
20 No. 12, says 124. And if you look at the
21 description and the specification in Column 8
22 show that 124 is a pillar, which is a dope

1 stack structure.

2 Similarly, at Figure 14 of
3 Sheet No. 14 point to n+, p, n+, p, n+ of 124
4 in Column 8 also identify that as a pillar,
5 okay. 124, these are all pillars.

6 Figure 16, similarly, 124 is a
7 dope stack structure and show that it is a
8 pillar as well with the same identification.

9 Figure 18 -- let's go to
10 Figure 20, which has also identified 124, p+,
11 n, p, n+, p, n+, p, n+, p, n, p+, identify as
12 124. And Column 9 they call 124 as the
13 pillar.

14 Similarly, Figure 22 on
15 Sheet No. 22, they call those layer as 124 as
16 also a dope stack structure.

17 Figure 27 in Sheet No. 27,
18 again, 124 point to a dope stack structure,
19 n+, p, n, p, n+. In Column 9 -- in Column 9,
20 down to Line 55, 124, again, is called a
21 pillar.

22 THE REPORTER: Called what?

1 THE WITNESS: Pillar,

2 P-I-L-L-A-R.

3 And I gave you all of these
4 supporting evidence from the intrinsic
5 evidence in the '702 patent. There
6 might be more. And -- but all of this
7 supporting a person of ordinary skill
8 in the art would understand pillar is
9 a dope stack structure.

10 Q. Okay.

11 A. Thank you, sir.

12 Q. All right. Going back to your
13 definition of stackable add-on layer, the
14 term "stackable add-on layer" is part of a
15 structure, correct?

16 MR. KAPPOS: Object to form.

17 A. What do you mean, part of a
18 structure?

19 Q. Well, the claim, Claim 13 from
20 which that term comes, is an apparatus claim,
21 correct?

22 A. When you say --

1 MR. KAPPOS: Objection, form.

2 THE WITNESS: Sorry, John.

3 Can you repeat that question,
4 please?

5 Q. Claim 13 is an apparatus claim,
6 correct?

7 A. That is correct.

8 Q. It's directed to a structure,
9 correct?

10 A. You mean a semiconductor memory
11 structure?

12 Q. Sure.

13 A. Okay.

14 Q. Okay. So the term "stackable
15 add-on layer" is a component of that
16 structure, correct?

17 MR. KAPPOS: Object to form.

18 A. Can you explain what you mean
19 by "component"?

20 Q. It's a structural piece of the
21 overall semiconductor structure, correct?

22 MR. KAPPOS: Object to form.

1 A. What do you mean by "structural
2 piece"?

3 Q. It recites structure that forms
4 part of the semiconductor structure, correct?

5 A. You can put it that way --

6 Q. Okay.

7 A. -- if you like.

8 Q. But the construction that you
9 believe is correct for stackable add-on layer
10 limits the structure, the stackable add-on
11 layer, to the process by which it is made,
12 correct?

13 MR. KAPPOS: Object to form.

14 A. It is not my opinion as what
15 described and spelled out clearly in '702
16 patent. And it's also strongly supported by
17 the institution decision.

18 Q. Okay. So be that as it may,
19 the definition of "stackable add-on layer"
20 that you believe is correct and that you
21 believe is also supported by the institution
22 decision limits the scope of that term,

1 depending on the process by which that
2 structural component is made, correct?

3 MR. KAPPOS: Object to form.

4 A. Again, '702 patent clearly
5 spelled out, and I can point to you all of
6 the intrinsic evidence that describes what is
7 a stackable add-on layer.

8 For example, in Column 2, it
9 says that in another aspect of the present
10 invention, dynamic random access memory, DRAM
11 cells; standard random access memory, SRAM
12 cells; non-volatile memory cells; and similar
13 structure may be formed in a stackable add-on
14 layer for use in conjunction with a separate
15 fabricated substrate.

16 Q. Okay. I'm not asking you for
17 the intrinsic evidence supporting your
18 construction. I'm asking you about your
19 construction.

20 A. But I'm telling you that if one
21 reads the specification of '702, that it
22 relates the stackable add-on layer in terms

1 of how it is formed separately from the
2 substrate and then bonded as whole to a
3 dielectric layer positioned above the
4 substrate. So I don't know anyone in the art
5 would deny that.

6 Q. Okay. So, in your opinion, no
7 one in the art would deny that a stackable
8 add-on layer in the context of the '702
9 patent is determined by the process by which
10 the layer is made, correct?

11 MR. KAPPOS: Object to form.

12 A. Well, the '702 patent is very
13 specific what is a stackable add-on layer.
14 It is a structure that is formed separately
15 from the substrate suitable to be bonded to a
16 dielectric layer positioned above the
17 substrate.

18 In other words, it is a
19 structure formed by stacking method and not
20 sequential deposition method.

21 Q. Right. So you determine
22 whether something is a stackable add-on layer

1 or not by the process by which it is made,
2 correct?

3 MR. KAPPOS: Object to form.

4 A. That's what '702 teaches. And
5 a person of ordinary skill in the art would
6 understand that the structure itself of a
7 stackable add-on layer formed by stacking
8 method is very different than a layer formed
9 or the structure formed using sequential
10 deposition method.

11 So one can say that this is a
12 structural claim or apparatus claim. And you
13 are the lawyer, you tell me whether methods
14 can be read onto this.

15 But I'm telling you that the
16 '702 patent clearly specified what is a
17 stackable add-on layer in agreement with the
18 institution decision and in agreement with my
19 claim constructions.

20 And, furthermore, structurally,
21 they are distinguishable from -- they are
22 distinguishable of the structure form by

1 stacking method. In other words, the
2 stackable add-on layer compared to structure
3 that are formed by sequential deposition
4 methods.

5 Q. Okay. I want to turn back in
6 your declaration now to Page 84.

7 A. Yes.

8 Q. And on Page 84, you're
9 addressing Claim 16.

10 Do you see that?

11 A. Yes.

12 Q. Okay. Paragraph 132, you rely
13 on Figure 12B, correct?

14 A. Yes.

15 Q. Okay. Now, turn to the next
16 page, Page 86, Paragraph 134.

17 Okay. In this paragraph, you
18 talk about it would -- a person of ordinary
19 skill in the art would have found it obvious
20 to use the NAND architecture, correct?

21 A. Yes.

22 Q. Okay. The last sentence in

1 Paragraph 134, you say, "Thus, a person of
2 ordinary skill in the art would have found it
3 obvious to modify Lee's pillar structure to
4 use the NAND structure and a serial
5 connection as taught by Endoh."

6 Did I read that correctly?

7 A. You read that sentence
8 correctly, yes.

9 Q. Okay. So, in your opinion, a
10 person of ordinary skill in the art would
11 have thought it was obvious to modify
12 Figure 12B, the NOR architecture, to be a
13 serial connection, a NAND architecture,
14 correct?

15 A. I didn't say that has to modify
16 Figure 12B. I'm just saying that you can
17 modify Lee's pillar structure to use the NAND
18 architecture and a serial connection taught
19 by Endoh.

20 Q. Okay. And Lee's pillar
21 structure, as you point out in Paragraph 132,
22 you believe is shown in Figure 12B, correct?

1 A. And maybe -- yes, and many
2 other places.

3 Q. Okay. Well, let's just stick
4 with the one you specifically referenced here
5 in Paragraph 132.

6 So, in your opinion, a person
7 of ordinary skill in the art would have
8 thought it was obvious to modify the pillar
9 structure in Lee's Figure 12B to be a serial
10 connection, a NAND serial connection, right?

11 A. Yes.

12 (Exhibit 2026 marked)

13 Q. Okay. I'm going to hand you
14 what I have marked as 2026. And I would like
15 for you to annotate that figure and show me
16 how you would convert that into a serial NAND
17 architecture.

18 MR. KAPPOS: Object to form.

19 A. So one approach you can do is
20 simply, as you -- as you can see in Endoh,
21 right, that you have n+, p, n+, and then p,
22 n+, right, to form a serial connection, as

1 shown in -- for example, in Figure 65 on
2 Page 87, okay, and with different date.

3 So perhaps one approach you can
4 do is simply remove this oxide in between
5 those two metals. That's one approach.

6 Q. Okay.

7 A. And so -- but a person --
8 again, a person of ordinary skill in the art
9 would understand you have a basic
10 non-volatile memory cell.

11 The only difference between NOR
12 architecture and NAND architecture is how
13 these memory cells are connected to each
14 other, okay.

15 One is, you can say, parallel
16 connections or basically a matrix form. And
17 the other one is all of the memory cells are
18 connected in series, meaning that -- you
19 know, think of it as a head to tail and then
20 the tail connects to a head and the next one,
21 and so on and so forth.

22 So Lee teaches how to form a

1 memory cell, a non-volatile memory cell and
2 in a pillar form, as I talked about earlier.
3 And so a person of ordinary skill in the art
4 would understand simply connecting in series
5 to achieve NAND structure.

6 Q. Okay. So, in your opinion, for
7 example, you would remove the oxide between
8 Level 1 and Level 2 on the right-hand side of
9 Figure 12B, correct?

10 A. Well, that's the first step,
11 right.

12 Q. Okay.

13 A. You remove the oxide, separate
14 into two memory cells so that the n+ region
15 of the top pillar structure would connect to
16 the next n+ region of the memory cell in
17 Level 1.

18 Of course, there might be other
19 modification, but that way then you -- you
20 achieve the serial or series combination.

21 Q. Okay. Can you annotate that on
22 Exhibit 2026?

1 A. (Witness complies.)

2 MR. KAPPOS: Object to form.

3 Q. Okay. And is that the only
4 change you would make to Figure 12B to
5 convert it into a serial NAND architecture?

6 A. As I mentioned --

7 MR. KAPPOS: Object to form.

8 THE WITNESS: Sorry, John.

9 As I mentioned, that's one of
10 the first steps one needs to
11 accomplish. There might be other
12 things that we need in order to
13 have -- achieve Figure 65 to have a
14 NAND architecture.

15 And -- but I have not thought
16 about this and I would hate to give
17 you an answer off the top of my head.
18 But when you give me some time, I
19 would be able to achieve and formulate
20 Figure 65 from, say, Figure 12B or
21 other figures.

22 But, you know, I have to be

1 carefully -- I have to be careful in
2 making all of the changes in order to
3 achieve Figure 65. And I haven't
4 thought about it and I would like not
5 to answer your questions without
6 clearly thinking about all of the
7 modification.

8 But, as you can see, that --
9 one of the steps is simply remove the
10 oxide in between Level 1 and Level 2
11 to achieve a series connection.

12 Q. Okay. You opine in your
13 declaration, Exhibit 1002, that a person of
14 ordinary skill in the art would have found it
15 obvious to modify Figure 12B to be a serial
16 NAND architecture, correct?

17 A. Where do you read that?

18 Q. Paragraph 134, the last
19 sentence.

20 A. Once again, the -- they didn't
21 say in Figure 12B. It just says, "Modify
22 Lee's pillar structure."

1 There are a lot of pillar
2 structure shown in Lee 9 -- what's the
3 number?

4 Q. In Paragraph 132, you point to
5 Figure 12B as a pillar structure in Lee,
6 correct?

7 A. That's one of the pillar
8 structure.

9 Q. Where do you point to a
10 different one?

11 MR. KAPPOS: Object to form.

12 A. Well, I'll just give you an
13 example. In Paragraph 124 in my declaration,
14 specifically Lee's Figure 2 dictates a pillar
15 memory 200. So there is another pillar
16 structure that you have an n+, p, n+. That's
17 a pillar structure.

18 Q. Okay. You didn't reference
19 Figure 2 regarding Claim 16, did you?

20 A. In the last sentence we quoted.
21 I didn't specifically mention pillar
22 structure in Figure 12B. There are other --

1 other figures in figure -- in the Lee
2 structure -- in the Lee patent shows pillar
3 structure.

4 Q. Okay. Well, let's --

5 A. So, for example -- may I finish
6 my answer?

7 Q. Sure.

8 A. For example, on Page 82,
9 Figure 7 and the sentence above that, "Lee's
10 Figure 7 (annotated below) is an illustration
11 of a pillar memory of an embodiment of the
12 present invention having a charge trapping
13 dielectric."

14 In other words, here we go
15 again. There is an n+, p-, n+. That's a
16 pillar structure.

17 And so just because in Claim 16
18 I did not specifically point to all of the
19 pillar structure that Lee described, a person
20 of ordinary skill in the art in reading the
21 last sentence without modifying it would
22 understand that Lee's pillar structure,

1 including Figure 12B, Figure 7, Figure 2, are
2 all pillar structures.

3 Q. So you don't feel comfortable
4 further describing how Figure 12B would be
5 modified to convert it to a NAND serial
6 architecture, correct?

7 MR. KAPPOS: Object to form.

8 A. No, I perfectly feel
9 comfortable if you give me enough time. I
10 can show you how this is -- how it can be
11 modified to change -- to modify this
12 connection to achieve a NAND configuration.

13 Q. How much time would it take?

14 A. I don't know. Again, you told
15 me a hypothetical question and I don't know
16 how much time I need.

17 Q. Okay. Would you feel
18 comfortable sitting right here explaining how
19 Figure 7 would be modified to convert it to a
20 serial NAND architecture?

21 A. Well, one thing that you need
22 to do is to add stack layers above -- a dope

1 stack layer above what's shown in Figure 7,
2 such as using n+, p-, n+, and then you add
3 another n+, p-, n+, and add another n+ -- n+,
4 p-, n+.

5 Basically stack all of these
6 pillars together to form a strand of memory
7 cells connected in series. And on top, you
8 have the wiring, the bit line. And on the
9 bottom, you can have the ground and then
10 connected -- well, actually, you have to
11 connect to a select transistor and all of the
12 gates are your -- all of your --

13 So a person of ordinary skill
14 in the art would be able to modify that to
15 achieve NAND configurations.

16 And as I explained in
17 Paragraph 128 to 130, and more later, a
18 person of ordinary skill in the art would not
19 only be able to modify to achieve NAND
20 structure, but also have the motivation to
21 combine Lee and Endoh to achieve higher --
22 even higher memory density.

1 Q. Now, if you changed Lee's
2 memory structure in Figure 12B or in Figure 7
3 to be a serial NAND architecture, you would
4 also have to change other aspects of the
5 chip, correct?

6 A. What do you mean by "other
7 aspects"?

8 Q. The read program and erase
9 functions of the chip would have to change,
10 correct?

11 A. Yes, possibly, yes.

12 Q. Why do you say "possibly"?

13 A. I mean, you could -- you know,
14 there are -- there are various ways of
15 tracing it. And, yeah, it's -- but that's
16 something that a design engineer of NAND
17 memory cells can accomplish that pretty
18 straightforwardly.

19 Q. The voltage supplies for those
20 cycles would have to change, correct?

21 A. What generation are you talking
22 about? What --

1 Q. So look at Exhibit 2026,
2 Figure 12B, the NOR architecture we have been
3 talking about.

4 Do you see that?

5 A. 2026?

6 Q. You have it in front of you
7 there.

8 A. Oh, I see.

9 Q. The voltages that are used to
10 read, erase, and write that NOR architecture
11 would have to change for a NAND architecture,
12 correct?

13 A. Well, it depends on the outside
14 thickness that you use, it depends on whether
15 it's charge trapping or floating gate. It
16 depends on whether you use nanocrystal or
17 not.

18 So, yeah, the design, whether
19 you -- the voltage and -- that you apply,
20 those are very, you know, well-known to a
21 person of ordinary skill in the art to
22 understand in programming a NAND structure.

1 So, yeah, they might have to
2 change, but it's not a -- it's very
3 straightforward to a person of ordinary skill
4 in the art.

5 Q. Okay. So not only would you
6 have to change Figure 12B, but the supporting
7 circuitry for read, erase, and write
8 functions for that memory in Figure 12B would
9 also have to change, correct?

10 MR. KAPPOS: Object to form.

11 A. So when you read the memory
12 cell, you need a certain -- certain voltage.
13 When you program -- whether it's NAND or NOR,
14 when you program the memory cell to -- to
15 address the devices, one would have to -- you
16 know, basically Lee -- okay. Let me put it
17 this way.

18 Lee describes a memory cell,
19 okay, and a person of ordinary skill in the
20 art, suppose they decide to design and
21 connect these memory cell in series to
22 achieve NAND architecture, all right.

1 So we know a person of ordinary
2 skill in the art would know how much voltage
3 does it take to program the cells, to read
4 the cell, and to erase the cell. These are
5 all well-known. And to combine them and
6 connect them in certain architecture, a
7 person of ordinary skill in the art would
8 know how to do so.

9 So Lee teaches memory cell
10 and -- and using certain methods, and a
11 person of ordinary skill in the art would
12 simply connect them either in parallel to
13 achieve NOR or in series to achieve NAND.

14 And whether, you know, what
15 voltage you apply depends on the generations,
16 depends on how the specific design of the --
17 of the memory cell, whether it is a charge
18 trapping type or floating gate or
19 nanocrystal. So these are all well-known
20 approaches.

21 Q. So you do agree they would have
22 to change to go from the -- sorry, let me

1 strike that.

2 So you do agree that the
3 peripheral circuitry for read, erase, and
4 write would have to change if you change
5 Figure 12B from NOR to NAND, correct?

6 A. Well, Figure 12B simply shows
7 two memory cells vertically connected, okay.
8 It's two memory cells vertically oriented and
9 it says nothing about connecting them.

10 And so when you -- when you
11 choose to connect them in series, you would
12 apply -- one would look up -- one would
13 understand how to program, read, and write --
14 program, read and erase as -- for NAND.

15 Q. So that's a yes?

16 MR. KAPPOS: Object to form.

17 A. Well, if you start out with the
18 memory cells and you want to have a NAND
19 structure, as I describe in the Technology
20 Background section, and you have the memory
21 cell, it is connected vertically and you have
22 vertical -- vertical oriented devices,

1 whether you want to connect it in series,
2 such as in the NAND structure or NOR
3 structure, a person of ordinary skill in the
4 art would understand how to and what voltage
5 is applied, needed to apply, in order to
6 achieve NAND structure, NAND serial
7 connection.

8 I'm not sure what you mean by
9 "has to change."

10 Q. Well, for example, the voltages
11 needed to read, erase, and write, the NAND
12 cell are going to be different from those for
13 the NOR architecture, correct?

14 A. Yes. That's -- yeah, it is.
15 But it's not -- it's not -- you know, it's
16 just applied different voltage and it's not
17 like, wow, this is so difficult.

18 Q. So the voltages are applied to
19 different places to accomplish and erase in a
20 NAND architecture versus a NOR architecture,
21 correct?

22 MR. KAPPOS: Object to form.

1 A. Either within NAND or NOR, some
2 users have electron, some users have
3 tunneling. So it depends on what you're
4 talking about. It could be very different.

5 It could be -- yeah, so it --
6 within NAND itself, there is various types of
7 memory cells and whether it is one bit per
8 memory cell, two bit, or four bit.

9 So these are all well-known
10 techniques and you make it sound like it's so
11 difficult, and it's not.

12 Q. I'm just asking whether it
13 would have to change to go from NOR to NAND.

14 A. Yeah, it does. I answered you
15 already. But it's not such difficult things
16 to change.

17 Q. So I think you have Watanabe in
18 front of you.

19 A. Yes, sir.

20 Q. Exhibit 1005. Okay. Take a
21 look at Column 6, Line 6. And there it says
22 is, "As shown in Figure 6C, the planar

1 members thus formed are bonded together."

2 Do you see that?

3 A. Yes.

4 Q. Now, before the planar members
5 are bonded together, they would have to be
6 aligned, correct?

7 A. Yes.

8 Q. Alignment is a critical step in
9 the process and manufacturing an integrated
10 circuit, correct?

11 MR. KAPPOS: Object to form.

12 A. Every step is important.

13 Q. Okay. Including alignment,
14 correct?

15 A. Every step of the semiconductor
16 processing is important, including alignment.

17 Q. Okay. Do you see in Figure 6C
18 the landing pads at the top of each layer?

19 MR. KAPPOS: Object to form.

20 A. What do you mean by "landing
21 pad"?

22 Q. So you see how at the top of

1 each layer, the through wiring forms a --
2 like what looks like a funnel?

3 A. Are you talking about the
4 contact pad?

5 Q. Yes.

6 A. Okay. Yeah.

7 Q. Okay. And it's expanded there
8 to try and help the alignment when you put
9 these layers together, correct?

10 A. Yes, that is one of the major
11 differences between structure that are formed
12 with stacking method compared to structures
13 that are formed in sequential deposition
14 method, yes, you're right.

15 Q. Okay. And misalignment between
16 the layers greater than the size of these
17 contact pads would result in open circuits,
18 correct?

19 A. Well, it depends on how much
20 misaligned.

21 Q. Well, if the misalignment is
22 greater than the size of those contact pads,

1 there would be open circuits, correct?

2 MR. KAPPOS: Object to form.

3 A. You are saying that if the
4 upper layer metal completely not touch the
5 underlying contact pad?

6 Q. Yes.

7 A. Yeah. And the wire would not
8 to be connected together, that is a no-no.

9 Q. Okay. If there were, in fact,
10 open circuits as a result of misalignment,
11 the transistors in those open circuits would
12 not function, correct?

13 A. You mean if it was misaligned
14 from the top layer to the bottom layer in
15 Figure 6B?

16 Q. I'm looking at Figure 6C, but
17 sure.

18 A. Figure 6C, and you apply the
19 voltage on the bottom on the CMOS transistor
20 on the bottom. And you are saying that if
21 there was a misalignment, the top transistors
22 or the top layer will not function because

1 there is no voltage applied to that
2 transistor.

3 Is that what you're saying?

4 Q. Yes.

5 A. Yeah, then, you know, if there
6 is a misalignment that is so large that not
7 only the contact resistance go up, the
8 contact resistance essentially become open
9 circuit, then, yes, you would not be able to
10 operate a transistor and operate it.

11 Is that what you mean?

12 Q. Yes.

13 A. Yes. Okay.

14 Q. Okay. So it's possible for a
15 misalignment to result in a nonfunctional
16 device, correct?

17 A. That is correct. If the
18 misalignment is so large that it leaves an
19 open circuit, then the device basically would
20 not function. Even with a slight
21 misalignment, the contact resistance would go
22 up so high that it might -- it might be

1 functioning, but that's not what we would
2 expect.

3 Q. Okay. Let's take a quick break
4 because I might be done.

5 THE VIDEOGRAPHER: Going off
6 the record. The time is 2:17 --
7 sorry, 1:17.

8 (Recess from 1:17 p.m. to 1:25 p.m.)

9 THE VIDEOGRAPHER: Back on the
10 record. The time is 1:25.

11 Q. (BY MR. WILSON) Dr. Lee,
12 during the course of your deposition today,
13 during any break, over lunch, did you have
14 any discussion of any of your questions or
15 answers or prospective questions or answers
16 with anyone other than me?

17 A. No.

18 MR. WILSON: Okay. We will
19 pass the witness.

20 MR. KAPPOS: Okay. I have a
21 few questions that I wanted to ask.

22 EXAMINATION

1 BY MR. KAPPOS:

2 Q. Professor Lee, do you recall
3 the discussion earlier today about the
4 differences between the claim construction
5 that you offered for the term "stackable
6 add-on layer" as being one that's formed by
7 the stacking method and the structure that's
8 formed instead by the sequential deposition
9 method? Do you recall those questions you
10 were asked?

11 A. Yes.

12 Q. And I think you were asked
13 whether the difference in that process is the
14 only difference between the two different
15 structures or whether there are others, and
16 you said that's one difference.

17 Do you recall that?

18 A. Yes.

19 Q. What were the other
20 differences?

21 A. Well, because these layers or
22 these structures are formed by two different

1 methods, namely stacking method sequential
2 deposition method, the resulting structure is
3 quite different from -- from each of the two
4 deposition methods.

5 Q. Okay. Can you tell us at least
6 one of those structural differences that
7 you're referring to?

8 A. So one of the differences, as
9 discussed earlier today, in Watanabe,
10 Figure 6A through B are formed by stacking
11 methods, okay. And Figure 5A through E,
12 their structure are formed by sequential
13 deposition methods.

14 As you can see, if you compare
15 Figure 5E and Figure 6B, the contact pad that
16 resolved from stacking methods as shown in
17 Figure 6D, or counsel called that the landing
18 pad, either way, the contact pads form in
19 the -- using the stacking methods are larger
20 than the contacts between the layers in the
21 methods are using sequential deposition
22 method as shown in Figure 5E.

1 So as one can tell, '702 patent
2 teaches a stackable add-on layer. In other
3 words, '702 patent teaches stacking methods,
4 not sequential deposition methods.

5 As you can see in all of the
6 figures, including the one in the front page,
7 show that the contacts are larger than the
8 upper layer wider. And that's the nature of
9 the alignment when you use stacking methods
10 that you have to align the wafer instead of
11 using photolithography.

12 In fact, Column 6 of '702
13 discussed that, that using stacking method
14 instead of the photolithographic process, it
15 uses wafer alignment mark and bump-type
16 alignment mark.

17 And so, therefore, those -- any
18 time you align with alignment mark, a bump-
19 type alignment mark, the alignment is not as
20 accurate as the conventional photolithography
21 alignment as in using -- as -- if you use the
22 sequential deposition method.

1 So, therefore, the contact size
2 are different.

3 Q. Is there any literature that
4 you're aware of that has discussed this
5 difference?

6 A. Yes.

7 MR. WILSON: Objection, outside
8 the scope of direct -- or outside the
9 scope of cross, outside the scope of
10 the deposition.

11 Q. And what literature are you
12 referring to?

13 A. For example, the Beilliard that
14 I --

15 THE REPORTER: The what?

16 THE WITNESS: The reference
17 given by Beilliard.

18 (Discussion off the record)

19 MR. WILSON: We're going to
20 object to any exhibit you mark.

21 MR. KAPPOS: Yep, I know you're
22 going to object and your objection is

1 noted.

2 Here, I'm going to just call
3 it --

4 MR. WILSON: It should be 1033.
5 That's your next number.

6 MR. KAPPOS: Thank you.

7 (Exhibit 1033 marked)

8 Q. I'm handing you a document
9 that's been marked as Exhibit 1033.

10 MR. WILSON: And we're
11 objecting to Exhibit 1033 and every
12 question that's asked about
13 Exhibit 1033 as outside the proper
14 scope of redirect.

15 Q. Sir, is this the Beilliard
16 reference to which you referred a moment ago?

17 A. Yes.

18 Q. Can you explain how Beilliard
19 illustrates the landing pad structural
20 difference between the stacking -- products
21 that are produced by stacking versus products
22 produced by sequential deposition?

1 A. Yes. In Table No. 1, they talk
2 about the stacking methods using different
3 contact pad size. And it shows that if you
4 use a larger contact pad, the alignment and
5 the contact resistance will be maintained
6 low.

7 In fact, on the same page as
8 Table 1, on the left of it, it says,
9 "Contrary to the other DC, the bonding pads
10 of DCP1 in which they use a larger area, that
11 this design maintained a constant contact
12 area despite -- despite the bonding
13 misalignment, which helps better estimate the
14 contact resistivity."

15 In other words, using a larger
16 contact area pad in the -- in the stacking
17 method would allow better alignment -- would
18 enable better alignment and, therefore --
19 therefore, a better contact resistance.

20 Q. Would this difference in
21 landing pad have been known at the time of
22 the '702 patent? In other words, in 2004?

1 A. Absolutely.

2 Q. What is the practical
3 significance of this difference if you're
4 designing a semiconductor memory product?

5 A. Well, any time you use a larger
6 contact pad or larger devices, your -- you
7 would inevitably increase the size of the
8 chip and, therefore, the cost of the -- the
9 cost per memory cell would increase. And if
10 the chip size increases, your yield would go
11 down.

12 So the -- the significant
13 implications is that not only the cost of the
14 manufacture go up, but also the yield would
15 go down.

16 Q. You mentioned that there were
17 several structural differences between
18 products from stacking -- the stacking method
19 versus products from sequential deposition.

20 What's another difference?

21 A. The other difference --

22 MR. WILSON: Objection, outside

1 the scope -- or outside the proper
2 scope of redirect.

3 Q. Go ahead. You can answer.

4 A. The other difference, as
5 illustrated in one of the references that I
6 provided, Patude, P-A-T-U-D-E.

7 Q. Go ahead. What's that other
8 structural difference?

9 A. Okay. So it -- in the case of
10 stackable -- may I have that?

11 (Exhibit 1034 marked)

12 Q. I'm handing you what's been
13 marked as Exhibit 1034, which I believe is
14 the Patude. I'll ask you, is this the Patude
15 reference that you referred to a moment ago?

16 MR. WILSON: And I'll object to
17 all questions based on Exhibit 1034 as
18 outside the proper scope of redirect.

19 A. As described in this reference
20 and as well understood by a person of
21 ordinary skill in the art back in 2004, 2002
22 timeframe, that a stackable add-on layer

1 using stacking method, the upper layer is
2 a -- is formed separately. So, therefore, it
3 can withstand high temperature and -- such as
4 using SOI devices.

5 And so as a result, the upper
6 layer of the devices in upper layer using the
7 stacking methods, in general, a
8 single-crystal semiconductor microstructure.

9 On the other hand, when one
10 uses the sequential deposition method, the
11 upper layer of transistors has a limited
12 temperature processing.

13 In other words, the processing
14 of the upper layer transistors cannot go
15 above 650 degrees C, as described in this
16 reference. And the reason for that is
17 because if you do that, if you use anything
18 higher than 650 degrees C, then the
19 transistor at the lower layers, particularly
20 the CMOS transistor in the -- in the
21 substrate level --

22 THE REPORTER: What level?

1 THE WITNESS: Substrate.

2 THE REPORTER: Okay.

3 THE WITNESS: -- would
4 experience dopant diffusion and
5 interfacial oxide glow, which is
6 detrimental to the characteristics of
7 the transistors.

8 So, therefore, as shown in
9 Figure 5 of this reference, that upper
10 layer of the structure formed by
11 sequential depositions typically use
12 polycrystalline silicon. And because
13 when you deposit poly silicon you can
14 have lower temperature, 650 degrees C,
15 whereas if you have one
16 single-crystal, you would have to have
17 much higher temperature.

18 But sequential deposition does
19 not permit high temperature processing
20 in the upper layer.

21 So, in short, the other
22 difference is that the upper layer of

1 the stacking method is usually
2 single-crystal semiconductor structure
3 and the upper layer in the -- from the
4 sequential deposition methods are
5 polycrystalline silicon.

6 Q. Have you heard of something
7 called a thermal budget or a temperature
8 budget?

9 MR. WILSON: Objection, outside
10 the scope of redirect.

11 A. Yes. The thermal budget or
12 temperature budget is essentially what is the
13 temperature or the temperature times time
14 that one can allow to processing.

15 Q. Does this Patude reference that
16 you're looking at, Exhibit 1034, does it talk
17 about the temperature budget?

18 A. Yes. In Section A, it says
19 that the bottom transistors are processed
20 with standard high temperature, HT, budget,
21 which is approximately 1050 degrees C.

22 However, we're talking about in

1 the case of sequential deposition method. To
2 avoid additional -- it says, states, "To
3 avoid additional dopant diffusion or
4 interfacial oxide growth on the bottom
5 transistors, low temperature, LT, less than
6 650 degrees C, field-effect transistor, top
7 FETs, process is mandatory."

8 Q. This reference is from 2012,
9 December 2012, Patude. But I have heard you
10 refer to 2004 before. Is -- was it known --
11 this thermal budget issue, was that known
12 back in 2004?

13 MR. WILSON: Objection,
14 leading.

15 A. Yes. Stacking methods and
16 obviously sequential deposition methods are
17 well-known way before 1990s.

18 Q. What about the thermal budget?
19 Was that known also at the time?

20 A. Absolutely.

21 Q. What is the practical
22 significance of using the stacking method to

1 achieve single-crystal silicon versus using
2 sequential deposition where you would be
3 depositing polycrystalline silicon? Can you
4 explain the practical difference between
5 those two?

6 MR. WILSON: Objection, outside
7 the scope of redirect.

8 A. So the reason why
9 single-crystal silicon is preferred is
10 because if you look at silicon substrate,
11 it's all single -- well, 99.9 percent
12 single-crystal because the electrons in
13 single-crystal travel much faster.

14 It says mobility of electrons
15 and mobility of positive charge holds are
16 much higher in single-crystal silicon
17 compared to the mobility of electron and
18 mobility to post in polycrystalline silicon.

19 Polycrystalline means that it
20 is single-crystal, but in small portion. And
21 so those single crystals are separated by a
22 so-called grain boundary. And when electrons

1 go through the material of polycrystalline
2 microstructure, each time you run into these
3 grain boundary, it basically slows it down.

4 So the significant impact of
5 single-crystal in the material that's formed
6 in stacking methods and the polycrystalline
7 form in sequential deposition is that the
8 transistor performed much better and,
9 therefore, the circuit and the resulting
10 memory cell -- memory chips or logic chip,
11 whatever you use, will be much higher
12 performance using stacking method compared to
13 the structure used -- formed by using
14 sequential deposition method.

15 Q. Are there any other structural
16 differences between products from stacking
17 versus products from sequential deposition?

18 MR. WILSON: Objection, outside
19 the scope of direct.

20 A. Yes.

21 Q. What's another one?

22 A. The other one is the interface

1 between subsequent layers, okay. For
2 example, as shown in Beilliard, it will show
3 that when you form 3D integration by stacking
4 method, you have to basically put one layer
5 on top of the others, right. Each layer is
6 processed separately.

7 And so you have to -- the
8 interface quality is extremely, extremely
9 important. If there is surface roughness
10 that those two layers will not bond well
11 together, that will result in borings as
12 shown -- as pointed out in Figure 7 and
13 Figure 9.

14 And those are basically air
15 bubbles and cause adhesion issues. And this
16 is -- what they have shown is copper to
17 copper and copper to oxide interface. And so
18 I have another reference by Reif.

19 Q. Let me pause. I think you may
20 be referring to this document.

21 A. Yes.

22 Q. I'm handing you what's been

1 marked as Exhibit 1035.

2 (Exhibit 1035 marked)

3 Q. Is that the Reif paper you're
4 referring to?

5 MR. WILSON: Objection. We're
6 going to object to Exhibit 1035 and
7 all questions based on it as it's
8 outside the proper scope of redirect.

9 A. On Page 262 to Page 271, when
10 you bond two stackable add-on layers together
11 and subsequently stack on top of each other,
12 not only you have to worry about the copper
13 to copper interface, but -- and copper to
14 copper -- copper to oxide interface, you also
15 have to worry about and pay attention to
16 oxide to oxide interface.

17 And this particular paper
18 describes that the surface roughness is very
19 important, that the surface roughness has to
20 be less than one nanometer in order to have
21 high quality bonding.

22 Furthermore, if we're not

1 careful, just like the previous reference
2 that I mentioned, Beilliard, that you would
3 have borings also in the oxide to oxide
4 bonding, which is shown in Figure 8.

5 And, therefore, the bonding
6 strength would be very different as shown in
7 Figure 7. If bonding strength is not good,
8 the bonding will not be strong. And so over
9 time, or even after fabrications, the layer
10 might be -- start peeling off and that
11 affects your yield and that affects your
12 reliability.

13 Q. Was this difference that you
14 just described, the voids at the bonding
15 interface between products from stacking
16 versus products from sequential deposition,
17 is that -- was that difference known back in
18 2004 at the time of the '702 patent?

19 A. Yeah. For example, this paper
20 by Reif has been published in 2004. And, as
21 I mentioned, the stacking approach was
22 well-known back in 1990s and those -- this

1 quality of the interface have been known
2 since then.

3 Q. And just to be clear, so you
4 are saying that you -- you observed the voids
5 and interface defects when you used
6 stacking -- when you build products by using
7 stackable add-on layers, but you do not see
8 those voids or interface defects from the
9 sequential deposition?

10 MR. WILSON: Objection, outside
11 the scope of redirect.

12 A. Yes.

13 Q. Do you know of any company that
14 uses the stacking method to manufacture a
15 commercial product in the semiconductor
16 industry?

17 A. Oh, yes.

18 MR. WILSON: Objection, outside
19 the proper scope of redirect.

20 THE WITNESS: Sorry.

21 Yes, there are many companies
22 that uses this. One example is AMD

1 microprocessors. And in terms of
2 memory, YMTC used -- have used the
3 stacking method.

4 Q. Do you know if that method is
5 used to make 3D NAND?

6 A. Yes.

7 MR. WILSON: Objection, outside
8 the proper scope of redirect.

9 A. As I mentioned, YMTC NAND
10 memory -- memory chips uses the stacking
11 method.

12 Q. So earlier today, counsel
13 directed you to your declaration and asked
14 about the materials considered being complete
15 as of the date that your declaration was
16 signed.

17 Do you remember that --

18 A. Yes.

19 Q. -- from the very beginning?

20 So were there additional
21 materials that you've reviewed since
22 providing that declaration back in May of

1 last year?

2 MR. WILSON: Objection, outside
3 the scope of redirect.

4 A. Yeah. So, for example, these
5 three references.

6 Q. Yeah. What about the
7 institution decision? Was that another paper
8 that you considered?

9 MR. WILSON: Objection, outside
10 the scope of redirect.

11 A. Yes. The institution decision
12 obviously was made on November 17th, 2023,
13 and the declaration was signed and complete
14 in May 3rd, 2023.

15 Q. I believe that you referred to
16 Page 9 of the institution decision earlier.

17 Do you recall PTAB asking for a
18 construction of stackable add-on layer?

19 A. Yes.

20 Q. Where is that?

21 A. On Page 9, Footnote No. 9, it
22 says, "The parties are encouraged to

1 expressly construe this term during trial,"
2 the term meaning the stackable add-on layer,
3 "and to explain how a stackable add-on layer
4 is structurally distinguishable from the
5 layer that is sequentially deposited."

6 Q. Okay. And do you recall that
7 the PTAB also asked for a construction of the
8 term "SOI pillar"?

9 A. Yes.

10 Q. I'll direct you to Page 17.

11 A. 17, yes.

12 Q. What did they say there?

13 A. They said that the parties are
14 encouraged to provide and express definition
15 of SOI pillars.

16 Q. Now, I know earlier today you
17 had an extended discussion with counsel on
18 the meaning of the term "pillar." So I'm not
19 going to ask you about that again.

20 But do you have an opinion on
21 the meaning of the term "SOI pillar" in the
22 context of the '702 patent?

1 MR. WILSON: Objection, outside
2 the scope of redirect.

3 A. Following instructions from
4 PTAB and their institution decision, I
5 construed the term "SOI pillar."

6 As I mentioned before, pillar
7 means dope stack structure. So, therefore,
8 an SOI pillar, if you look at Column 4 in
9 line -- of '702 in Line around 49 to 51, that
10 describes what an SOI layer means.

11 So, therefore, an SOI pillar,
12 to a person of ordinary skill in the art and,
13 therefore, I construed, is a dope stack
14 structure formed from a single-crystal
15 portion of a semiconductor wafer transferred
16 from one wafer to another previously
17 fabricated wafer or similar type of
18 substrate.

19 Q. So on that same page in the
20 institution decision on Page 17 that you just
21 read from, do you see where the board is
22 asking for an explanation as to whether

1 stacks of broad horizontal structures would
2 be understood in the art to comprise a
3 pillar, as that term is used in the '702
4 patent?

5 Do you see that?

6 A. Yes.

7 Q. What is -- have you formed an
8 opinion on that question?

9 MR. WILSON: Objection, outside
10 the scope of redirect.

11 A. Yes.

12 Q. What's your opinion?

13 MR. WILSON: Objection, outside
14 the scope of redirect.

15 A. The sentence says, "The parties
16 are encouraged to provide and express
17 definition of 'SOI pillar,' including an
18 explanation to whether stacks that are
19 horizontally structured would be understood
20 in the art to comprise a pillar," as that
21 term is used in the '702 patent.

22 As I discussed earlier this

1 morning, that nowhere in the '702 patent when
2 they describe what a pillar is, mention the
3 dimension, whether it's vertical dimension,
4 horizontal dimension, whether vertical
5 dimension is wider -- larger than the
6 horizontal dimensions or vice versa.

7 So, therefore, if a device
8 has -- is of broad horizontal structure, as
9 long as it is a dope stack structure formed
10 from a single-crystal portion of a
11 semiconductor wafer transferred from one
12 wafer to another previously fabricated wafer,
13 or similar type of substrate, whether it's
14 broad or narrow, horizontal structure, it
15 will still be an SOI pillar.

16 Q. Based on the process node that
17 was -- that existed in 2004, the time of the
18 '702 patent, do you have a general
19 understanding as to whether the dope stack
20 structure would be higher than it is wide or
21 wider than it is high?

22 MR. WILSON: Objection, outside

1 the proper scope of redirect.

2 A. Back in 2003, 2004, we are
3 talking about 90-nanometer technology node.
4 So, in other words, the horizontal dimension
5 of typically 90 nanometers.

6 But if you are talking about
7 the vertical dimension, such as the n+, p,
8 n+, the vertical dimensions in those things
9 are controlled very well.

10 And, for example, let me just
11 give you an example. Hafnium oxide is down
12 to one nanometer. The diffusion is down to
13 few tenths of nanometer.

14 THE REPORTER: How much?

15 THE WITNESS: Ten nanometers or
16 so. So -- or much less.

17 So, therefore, in general, the
18 horizontal dimension back in 19 --
19 back in the 2003, 2004 timeframe are
20 much larger than the vertical
21 dimension.

22 So, as I discussed earlier,

1 that figures in '702 or the Lee patent
2 or the Watanabe patent are not drawn
3 to scale. And they might draw in such
4 a way that it looks like vertical
5 dimension is larger than horizontal
6 dimension, but the actual reality is
7 that it's reversed. The vertical
8 dimension is smaller than horizontal
9 dimension.

10 Perhaps one reason why they do
11 this is so that they can write n+, p,
12 n+ within the space that is allowed.

13 If the vertical dimension is
14 not large enough, they may not -- you
15 know, writing, identifying the n+
16 region, the p region or n+ region
17 might be more difficult.

18 Q. You were asked a number of
19 questions today about the prior art reference
20 to Lee and then the reference to Watanabe.

21 Do you recall those
22 discussions?

1 A. Yes.

2 Q. And you mentioned a moment ago,
3 you explained this structural difference and
4 advantage of monocrystalline silicon and
5 polycrystalline silicon. I believe you just
6 explained that to me a few minutes ago,
7 right?

8 A. Yes.

9 MR. WILSON: Objection, outside
10 the proper scope of redirect.

11 Q. Does that difference inform
12 your view on the desirability of using the
13 stacking method to replace Lee's sequential
14 deposition method?

15 MR. WILSON: Objection, outside
16 the proper scope of redirect.

17 A. As I mentioned, that stacking
18 methods -- there are three major differences,
19 right.

20 The first one, stacking method
21 result in single-crystal silicon in the upper
22 layer. So, therefore, the speed of the

1 transistor and, therefore, the speed of the
2 circuit might be higher.

3 Secondly, the stacking method
4 requires larger contact area. So, therefore,
5 the chip size might be larger and, therefore,
6 the cost per memory cell might be higher and
7 the yield -- overall yield might be degraded.

8 Thirdly, there is an
9 interfacial quality concern with the stacking
10 method and not with sequential deposition
11 method. So each method has some advantages
12 and disadvantages. So it depends on, you
13 know, the -- the balance between costs and
14 performance and reliability. Those are all
15 of the -- and yield. Those are all the
16 concern when a company -- a semiconductor
17 company in choosing what method to use.

18 And so it depends on the
19 considerations. One might choose stacking
20 method, one might choose sequential
21 deposition method.

22 Q. Do you have an opinion on

1 whether the use of monocrystalline silicon to
2 achieve its advantages that you mentioned
3 earlier in using stackable add-on layers
4 would be an advantage that you might realize
5 from Watanabe's stacking method as applied to
6 Lee?

7 MR. WILSON: Objection, outside
8 the proper scope of redirect.

9 A. Yes, one would -- if one
10 chooses the -- if one chooses to take
11 advantage of the higher speed, one would
12 replace Lee with -- with the stacking method.

13 Watanabe also mentioned that in
14 Column 6, Line 1 through 5, they talk about
15 the stacking method, that the wiring is
16 performed for each planar member. The planar
17 member means for each stackable add-on layer.
18 This improves the accuracy of wiring. They
19 are talking about the accuracy of wiring with
20 the IC devices in each layer.

21 So not only using stacking
22 method, you can have single crystal silicon

1 transistors in the upper layer and,
2 therefore, the speed of the transistor and,
3 therefore, the speed of the memory chip can
4 be higher, but it also can improve the
5 alignment of the wiring.

6 So there is -- there is a
7 motivation in modifying Lee with Watanabe's
8 stacking method to achieve higher speed and
9 better alignment accuracy with wiring.

10 Q. Sir, you were asked a lot of
11 questions earlier today by counsel about
12 Figure 12B in your declaration. I think you
13 referred to this in Paragraphs 131 and 132 on
14 Page 84.

15 A. Yes.

16 Q. Do you remember that
17 discussion?

18 A. Yes.

19 Q. Paragraph 131, at the end --
20 I'll let you get there first.

21 A. Yes.

22 Q. So at the end of 131, do you

1 see where it refers to Sections 7(c)(5)

2 and 7(c)(6)?

3 A. Yes.

4 Q. Do you have an understanding as

5 to whether those sections discuss other

6 pillars beside the pillar that you mentioned

7 in Figure 12B?

8 A. Can you direct me to the page,

9 please?

10 Q. Yes, this would be Pages 76

11 through 80.

12 MR. WILSON: Objection,

13 mischaracterizes his testimony.

14 A. Are you referring to the

15 comparison between floating gate and charge-

16 trapping and nanocrystal?

17 Q. Yeah. What I'm asking is

18 whether those -- whether you were referring

19 back to other examples of pillars.

20 MR. WILSON: Objection,

21 leading.

22 A. So, yes.

1 Q. Where do you see that?

2 A. Okay. Essentially, Figure 35
3 shows a high level of vertical integrations
4 of memory cells, okay.

5 And Figure 1A and B shows
6 generic memory cells in Figure 35.

7 Figure 7 -- so Figure 2 shows
8 the floating gate memory -- memory cell and
9 figure -- those are all SOI pillar.

10 And Figure 7 shows charge-
11 trapping memory cells.

12 And Figure 6 shows nanocrystal
13 semiconductor -- nanocrystal type charge-
14 trapping gate insulator.

15 And so that -- in -- on Page 24
16 to 27, I discuss that the -- it's well-known
17 the floating gate and charge-trapping gates
18 are interchangeable. And I talk about the
19 advantages and -- of charge-trapping compared
20 to floating gate and the features of
21 nanocrystal added to charge-trapping type of
22 memories and the advantages and disadvantages

1 of floating gate.

2 Q. Do you recall a discussion that
3 you had with counsel this morning about
4 element 13(c) of the '702 patent and its
5 applicability to Lee?

6 I believe this was a discussion
7 with reference to Pages 73 through 75 of your
8 declaration. I'm just asking you if you
9 remember talking about that.

10 A. Yes, yes, I do.

11 Q. And I think most of that
12 discussion was with reference to Figure 83A.

13 Do you remember that?

14 A. Yes.

15 Q. At one point, you tried to
16 refer to Figure 35. And I just wanted to ask
17 you, can you show us the dielectric layer in
18 Figure 35 in Lee, 994?

19 MR. WILSON: Objection, outside
20 the scope of proper redirect.

21 A. So Lee, in Figure 35,
22 highlighted in green on Page 74 is 3102, is

1 an insulating layer, okay. And the stack of
2 memory cells are in the layer of 3104
3 highlighted in blue.

4 So the reason why I added
5 Figure 83 is to demonstrate how layers of
6 Lee's memory cells -- of memory devices are
7 formed and bonded, okay. And, in fact, we
8 don't really need to add Figure 83A because
9 Figure 35 also shows how the memory devices
10 in Lee are bonded to the substrate.

11 In fact, as noted by the
12 institution decisions on Page 35, it says
13 that the petitioner cite to Figure 83 and
14 this rail stack device to support his
15 argument that Lee discloses stackable add-on
16 layer bonded to dielectric layer.

17 And they follow by saying, "In
18 this ground, however, we understand
19 petitioner to rely on Figure 83 to show what
20 one of ordinary skill in the art would
21 understand about how layers of Lee's memory
22 devices are formed and bonded."

1 In other words, that -- the
2 reason why we include Figure 83, it just
3 simply shows how memory cells in Lee are
4 formed and bonded.

5 But Figure 35 by itself, I
6 believe, would be sufficient to show the
7 purpose of bonding. But including 83 --
8 Figure 83A wouldn't hurt.

9 Q. This morning you were asked by
10 counsel a number of questions about your
11 qualifications in the memory area, and for
12 NAND in particular. And I think you talked
13 about coursework that you teach, research
14 that you've done, your 600-plus publications.

15 Is there anything else beyond
16 what you talked about this morning that makes
17 you qualified to give testimony on NAND
18 memory structures?

19 A. Well, in addition to memory
20 courses that I taught in -- at UT and
21 research that I have done at UT with
22 nonvolatile memory, including NAND structure,

1 I also teach and consult industrial company
2 on memory devices, including NAND -- NAND
3 memory.

4 Q. What about books? Have you
5 authored any books or chapters in that area?

6 A. Yes, as shown in Exhibit 1003.

7 Q. Are you talking about the end
8 of the last two pages?

9 A. Yeah. The last two pages show
10 that -- that I have publications on memory --
11 memory devices, including non-volatile memory
12 devices and -- not only in books, but also in
13 patent issues.

14 Q. Which of those -- can you
15 identify any of those books or chapters that
16 are about non-volatile memory?

17 A. Well, No. 1, No. 2, No. 3,
18 No. 4, No. 6. Actually, No. 5 also.

19 So five out of eight are
20 related to -- and No. 6. So six out of the
21 eight are related to -- of my books are
22 related to nonvolatile memory.

1 Q. Are you a referee for any
2 journals?

3 A. Yes, I have been asked to
4 review work as a reviewer for journals, such
5 as Transactions on Electron Devices, Electron
6 Device Letters, Applied Physics Letters,
7 Journal of Applied Physics.

8 And conferences, such as
9 International Electron Devices Meeting, DRC,
10 Device Research Conference, numerous
11 conferences and journals and letters that I
12 have been asked to not only work as a -- not
13 only provide my service as a reviewer, but
14 also as a program -- a program committee
15 and -- and also organizer -- organizing
16 conference committees, as well as teaching
17 short course in conferences.

18 Q. Do any of those conference
19 positions or work journal referee positions
20 that you're referring to, do any of those
21 involve nonvolatile memory or NAND?

22 A. Yes. There are -- I have

1 been -- I have served as a reviewer for many,
2 many times per year, probably more than I can
3 count, ten to fifteen papers per year at
4 least. Many of them are nonvolatile memory
5 and many -- and within that, many of them are
6 NAND devices, including 3D NAND.

7 Q. Are you a member of the IEEE?

8 A. Yes. I'm a fellow of IEEE, not
9 just a member.

10 Q. And does that relate in any way
11 or get you involved in non-volatile memory or
12 NAND issues?

13 A. Yes. Because I have been
14 actively involved in IEEE, I have been asked
15 to serve in conference, committee, reviewing
16 various workshop, including NAND,
17 non-volatile memory, and preview NAND
18 structures.

19 Q. What about awards? Have you
20 received any awards on semiconductor
21 structures or manufacturing or non-volatile
22 memory?

1 A. Yes. As I described in my CV,
2 not only that I have received many best paper
3 awards listed in my publication and my
4 awards, I also received a number of research
5 awards, such as the SRC inventor award and
6 also research -- engineering research award,
7 and so on and so forth.

8 Q. Did any of those specifically
9 relate to nonvolatile memory?

10 A. A lot of my best paper awards
11 are related to nonvolatile memory.

12 MR. KAPPOS: Okay. Pass the
13 witness. No further questions.

14 FURTHER EXAMINATION

15 BY MR. WILSON:

16 Q. Dr. Lee, the testimony that you
17 just gave about your background as it relates
18 to non-volatile memory, the book chapters,
19 the awards, when did you discuss or prepare
20 that testimony with counsel?

21 MR. KAPPOS: Object to form.

22 A. I beg your pardon?

1 Q. When did you discuss or prepare
2 that testimony with counsel, the testimony
3 that you just gave?

4 A. Well, we looked at all of the
5 documents, including '702 patents, and my
6 declaration, my CV. And one of the things
7 that we discussed is my qualification. So we
8 did discuss that.

9 Q. When did you discuss it?

10 A. Yesterday.

11 Q. You didn't discuss it today?

12 A. No.

13 Q. So he miraculously knew to ask
14 you about book chapters and nonvolatile
15 memory --

16 MR. KAPPOS: Object to form.

17 Q. -- without you having discussed
18 it with him?

19 A. I told you we discussed it
20 yesterday.

21 Q. Okay. And he knew to ask you
22 about your awards without you having

1 discussed it today, correct?

2 A. As I mentioned, we did not
3 discuss anything today except the weather and
4 triathlons and Idaho and Utah. But --

5 Q. So --

6 A. Let me finish, please. But we
7 did discuss my CV yesterday.

8 Q. So when I asked you about your
9 background as it pertained to NAND and
10 nonvolatile memory and you didn't mention any
11 of those things, why didn't you?

12 MR. KAPPOS: Object to form.

13 A. It skipped my mind.

14 Q. Skipped your mind, okay.

15 Now, if you can look at the
16 table of contents of your declaration, can
17 you point me to Section 7(c)(5) or 7(c)(6) in
18 the table of contents?

19 A. Are you referring to what we
20 just quoted on Page, what was it, 90?

21 Q. Page 84.

22 A. 84.

1 Q. Yes. In Paragraph 131, you
2 reference Section 7(c)(5) and 7(c)(6). Can
3 you point me to those sections?

4 A. I believe that was labeled
5 incorrectly.

6 Q. There aren't a Section 7(c)(5)
7 or 7(c)(6) in your declaration, correct?

8 MR. KAPPOS: Object to form.

9 A. There is a Section of 10(c)(5)
10 and 10(c)(6).

11 Q. But that's not what you
12 reference in Paragraph 131, is it?

13 A. No. That was a typo.

14 Q. Okay. Now, when you prepared
15 your declaration, Exhibit 1002, you
16 understood that the construction of stackable
17 add-on layer was at issue, correct?

18 MR. KAPPOS: Object to form.

19 A. I understand that the '702
20 patent talks about forming the structure
21 using so-called the stackable add-on layer by
22 stacking methods, the intrinsic evidence

1 support that '702 is using stackable --
2 stacking method to form those layers or those
3 structures called stackable add-on layer.

4 However, I also understand that
5 patent owner interpreted a stackable add-on
6 layer to cover sequential deposition method.

7 So, therefore, I also
8 understand that this needs to be resolved,
9 but because of two different viewpoints, I --
10 I drafted and provided my declaration as is.

11 Q. Why didn't you offer a
12 construction of stackable add-on layer in
13 your declaration? If you knew and understood
14 it was at issue and its resolution would --
15 or would determine whether or not certain
16 prior art met the limitation, why didn't you
17 offer a construction in your declaration?

18 MR. KAPPOS: Object to form.

19 A. As I mentioned, that petitioner
20 and myself believe that '702 teaches stacking
21 method to form the stackable add-on layer.

22 However, the patent owners at

1 least appears to interpret stackable add-on
2 layer to cover sequential deposition method.

3 So at the time, I do not know
4 what PTAB -- how PTAB would decide. Not only
5 that, in drafting my declaration in this
6 case, especially if patent owners adopted the
7 stackable add-on layer to cover sequential
8 deposition, I want to prove that with that
9 construction that the prior art would also
10 use to invalidate Claim 13 and the -- and
11 their dependent claims.

12 Q. So did you need to know what
13 the PTAB would say about stackable add-on
14 layers to form your opinion as to what it
15 meant?

16 MR. KAPPOS: Object to form.

17 A. No. As I mentioned in Footnote
18 No. 2, that I do not believe that the
19 interpretation of 13 would encompass forming
20 the stacking -- stackable add-on layer by
21 sequential deposition directly on the
22 substrate.

1 So I don't need to know what
2 the PTAB decides to form my opinion. But now
3 that PTAB explicitly asked the parties to
4 construe the term "stackable add-on layer,"
5 I, therefore, provide my testimony, including
6 providing the claim construction of what a
7 stackable add-on layer is.

8 Q. Did you know when you drafted
9 your declaration, Exhibit 1002, what you
10 thought the appropriate construction of
11 stackable add-on layer was?

12 A. It's clearly discussed in my
13 footnote on Page 13 that at the time of
14 the -- my declaration, which is including the
15 Footnote No. 2 on Page 13, I repeat that we
16 believe and I believe and the petitioner
17 believes that the intrinsic record does not
18 support any interpretation of Claim 13 that
19 encompasses forming the stackable add-on
20 layer by sequential deposition directly on
21 the substrate.

22 Q. So had you formed, in your

1 mind, an opinion as to what "stackable add-on
2 layer" affirmatively means at the time you
3 drafted this declaration, Exhibit 1002?

4 A. Can you repeat that, please?

5 Q. Had you formed, as of the time
6 you drafted Exhibit 1002, your declaration,
7 an affirmative opinion as to what the
8 definition of "stackable add-on layer" was?

9 A. As I stated in Claim 13 -- I
10 mean, Page 13 in Footnote No. 2, we believe
11 that, "we" meaning the petitioner and myself,
12 that the stackable add-on layer is the layer
13 that is -- that is a structure that is formed
14 separately from the substrate and transfer
15 from one wafer to another previously
16 fabricated wafer or similar type of wafer.

17 So at the time, yes, I do know
18 what stackable add-on layer is.

19 However, the patent owner
20 appears to believe that stackable add-on
21 layer is to cover sequential deposition. So,
22 therefore, in tracking my declaration, and if

1 you read it carefully, I said using the
2 definition of what a stackable add-on layer
3 by the patent owner, which I disagree, if you
4 look at my -- every time I mention patent
5 owner interpretation and I said, "I
6 disagree." However, if one uses it, the
7 claim is still invalid.

8 Q. Okay. So you, at the time you
9 drafted your declaration, Exhibit 1002, made
10 a decision not to disclose your definition of
11 "stackable add-on layer," correct?

12 MR. KAPPOS: Object to form.

13 A. No. I -- as I mentioned, that
14 it doesn't include forming the stackable
15 layer by sequential deposition.

16 Q. Right. So you said what it was
17 not in your declaration, but you didn't say
18 what it was?

19 A. I believe that -- I believe
20 that, first of all, a person of ordinary
21 skill in the art that it does not cover
22 sequential deposition. And the other method

1 is stacking method.

2 And as I describe in my
3 declaration, combining Lee with Watanabe is
4 based on the fact that Watanabe talked about
5 both stacking method and sequential
6 deposition method.

7 So, therefore, a person of
8 ordinary skill in the art would understand
9 that the stackable add-on layer are related
10 to methods of -- stacking methods as
11 described in my declaration.

12 Q. Okay. So you understood at the
13 time you drafted your declaration,
14 Exhibit 1002, what you thought "stackable
15 add-on layer" meant, but you didn't provide
16 it in Exhibit 1002, correct?

17 MR. KAPPOS: Object to form.

18 A. At the time, as I describe in
19 Section 7, in Paragraph 35, I do not believe
20 that any terms -- any term required explicit
21 construction to resolve the issues presented
22 in these petitions.

1 My understanding -- and,
2 therefore, I ascribed the plain meaning to
3 each claim terms as that plain meaning would
4 have been understood by a person of ordinary
5 skill in the art at the time of the alleged
6 invention.

7 In Paragraph 36, I mention a
8 few terms that '702 specifically defined.
9 And in Paragraph 37, I indicate that I
10 reserve the right to offer an opinion on any
11 claim construction proposed in this
12 proceeding or to offer an opinion on
13 additional construction in the District
14 Court.

15 So now that the institution
16 decision explicitly asked us to construe
17 stackable add-on layer term and SOI pillars,
18 and, therefore, today I offer my construction.

19 Q. Did you -- strike that.

20 So you also knew what you
21 thought the term "SOI pillar" meant when you
22 drafted Exhibit 1002, correct?

1 A. We have not -- I have not
2 construed the term "SOI pillar" as
3 expressed -- expressly -- explicitly as I did
4 today, nor a non-SOI pillar and the SOI -- I
5 mean, the stackable add-on layer.

6 But, overall, as a person of
7 ordinary skill in the art reading '702
8 patent, we knew -- I knew what those terms
9 mean, okay. I knew what those terms mean.

10 And -- but in providing my
11 opinion in the declarations, I don't believe
12 that it requires explicit construction.

13 Q. You knew what the term
14 "stackable add-on layer" and "SOI pillar"
15 meant at the time you drafted Exhibit 1002,
16 correct?

17 MR. KAPPOS: Object to form.

18 A. Again, I have not formed an
19 explicit construction at the time.

20 Q. So you didn't have an opinion
21 as to what those terms meant at the time you
22 drafted Exhibit 1002?

1 MR. KAPPOS: Object to form.

2 A. Well, as I point out in
3 Footnote No. 2, and other places, I knew what
4 the term means, and especially as in
5 Paragraph 36, that '702 has described what
6 vertical means, what device means, what SOI
7 means, and what the Vbias means.

8 And so, yes, I knew more or
9 less what those two terms means. But I did
10 not offer and I did not form any opinion on
11 the exact explicit construction.

12 Q. Now, you were asked by counsel
13 for Micron to offer some new opinions on why
14 a person of ordinary skill in the art may or
15 may not elect to use a stackable method,
16 correct?

17 Do you recall that?

18 A. Can you repeat that question,
19 please?

20 Q. You were asked to offer some
21 new opinions on why a person of ordinary
22 skill in the art may or may not elect to use

1 a stacking method to form a semiconductor, a
2 3D semiconductor.

3 Do you recall that?

4 A. Yes.

5 Q. And you were asked questions
6 about Exhibits 1033, 1034, and 1035, correct?

7 A. Yes.

8 Q. Now, you didn't cite any of
9 Exhibit 1033, 1034, or 1035 in Exhibit 1002,
10 correct?

11 A. Well, when I offered that
12 opinion, not only did I refer to 1003 --
13 1033, 1034, and 1035, I also discussed the
14 Watanabe reference, Exhibit 1005, okay. So
15 that's why.

16 At the time of the declaration,
17 the task that I was asked to do is to study
18 '702 patent and the prior art to see whether
19 the prior art would be -- can be used to meet
20 the limitations of the asserted claims, and
21 that's what I was asked to do.

22 And now that the institution

Page 167

1 decision came out and one of the tasks that
2 was asked is to explain how the stackable
3 add-on layer is structurally distinguishable
4 from the layer that is sequentially
5 deposited.

6 So at the time when I wrote the
7 declaration, my task was not to discuss how
8 those two result in structure that are
9 distinguishable, but simply to understand the
10 prior art and how they can be -- how they
11 are -- how the prior art can meet the claimed
12 limitation.

13 But afterward, PTAB
14 specifically asked the parties to explain the
15 differences.

16 Q. You understand that PTAB is
17 asking for the parties to tell it what they
18 believe the scope of stackable add-on layer
19 is; that is, what falls within stackable
20 add-on layer and what falls outside of it.

21 You understand that's the task
22 they are asking, correct?

1 MR. KAPPOS: Object, form.

2 A. I don't understand what you
3 mean by "the scope."

4 Q. They are asking the parties to
5 draw a line and say, "These -- this subject
6 matter is inside the stackable add-on layer
7 and this other subject matter is outside."

8 What falls within stackable
9 add-on layer and what falls outside of it,
10 that's what they are asking, correct?

11 MR. KAPPOS: Object to form.

12 A. Footnote No. 5 on Page 9 has
13 nothing to talk about the scope. What the
14 PTAB asks is construe those terms, construe
15 the term "stackable add-on layer."

16 It doesn't say what the scope
17 of the term is, whether it's inside the scope
18 or outside the scope. All they are asking is
19 expressly construe the term "stackable add-on
20 layer."

21 So I don't understand what you
22 mean by that the PTAB is asking us about the

1 scope of the term.

2 Q. They are asking the parties to
3 expressly construe this term. That means
4 provide a definition, tell us what's inside
5 and what's outside stackable add-on layer.

6 How do we know whether
7 something is a stackable add-on layer or not?

8 MR. KAPPOS: Object to form.

9 A. Well, I'm construing the term
10 means to provide claim construction. Am I
11 right?

12 Q. Yes.

13 A. And that's what I did.

14 Q. My point is, you already had a
15 construction when you drafted Exhibit 1002,
16 correct?

17 A. No, I did not.

18 Q. But you just testified earlier
19 you did.

20 A. No, I did not. I said that I
21 did not explicitly provide a claim
22 construction for stackable add-on layer.

1 But, you know, a person of
2 ordinary skill in the art reading the '702
3 patent more or less knows what a stackable
4 add-on layer is. But I did not provide
5 explicit construction.

6 Q. Right. I understand that you
7 didn't. But I'm saying, you knew what you
8 thought it meant; you just didn't provide it
9 in Exhibit 1002, correct?

10 MR. KAPPOS: Object to form.

11 A. No. As you -- as you read my
12 patent that's in Footnote No. 5, I'll use
13 your word, the scope of the term, that I know
14 the scope of the term exclude the formation
15 using sequential deposition method.

16 Q. Right. That says what it's
17 not, not what it is.

18 MR. KAPPOS: Object to form.

19 A. A person of ordinary skill in
20 the art reading the '702 patent would have
21 understood that there is two methods. One is
22 stacking, one is sequential deposition

1 method.

2 So in reading my declaration,
3 and I understood that the -- if you read it
4 carefully, for example, the prior art,
5 Watanabe, you see that there is two methods,
6 stacking method and sequential deposition
7 method when you fabricate 3D NAND.

8 And if you exclude sequential
9 deposition method, it means that the scope
10 include the stacking method.

11 Q. So you understand Lee discloses
12 a monolithic structure, correct?

13 MR. KAPPOS: Object to form.

14 A. Yes.

15 Q. Okay. In your opinion, you
16 cannot use a stacking method to form the same
17 structure that you can with a sequential
18 deposition method, correct?

19 A. Can you repeat that question,
20 please?

21 Q. Sure. In your opinion, you
22 cannot form the same structure through

1 sequential -- sorry -- through stacking that
2 you can through sequential deposition,
3 correct?

4 A. You cannot, you said?

5 Q. You cannot.

6 A. Watanabe just showed that you
7 could achieve the same structure. As shown
8 in Figure 5 and Figure 6, one is using
9 stacking method in Figure 6 and one is using
10 what he called laminated method, which is
11 sequential deposition method.

12 Q. But you just testified this
13 afternoon as to why those structures are not
14 the same; the contact pads, the crystalline
15 structure, and various quality concerns.

16 A. You mean the bonding and --

17 Q. Yes.

18 A. Right, you got it.

19 Q. So those structures are not the
20 same, in your opinion, correct?

21 A. Well, define "the same." If
22 you look at Figure 6 -- Figure 6 and

1 Figure 5, yeah, there are some differences,
2 but they perform the same way. It's a 3D
3 integration of memory devices. Yeah, there
4 are some minor differences that might be
5 important, including the contact size,
6 including the microstructure, including the
7 bonding interface.

8 But when you say whether they
9 are the same or not, well, it depends on what
10 you mean by "the same." You know, they
11 perform -- they perform by the function of 3D
12 NAND, of 3D non-volatile memory. So do you
13 call that the same or not?

14 Q. They perform the same function?

15 A. Right.

16 Q. They achieve the same result?

17 A. Right.

18 MR. KAPPOS: Object to form.

19 THE WITNESS: Sorry, John.

20 They perform similar function
21 and the performance, the reliability
22 might not be the same.

1 It's just like a Ford and GM,
2 they all -- they both produce cars,
3 they both perform the same function,
4 driving from point A to point B, but
5 the detail could be different.

6 Q. And they perform it in the same
7 way, correct?

8 MR. KAPPOS: Object to form.

9 A. What do you mean, "they"? Are
10 you talking about cars now?

11 Q. No, I'm talking about the
12 sequential depositions versus stacking
13 method.

14 A. That they perform --

15 Q. They perform the same function
16 and they perform it in the same way, correct?

17 MR. KAPPOS: Object to form.

18 Q. They use the same structural
19 features, correct?

20 A. Well, again, it depends on what
21 you mean by "the same."

22 Q. Well, let --

1 A. May I finish my answer?

2 Q. Sure.

3 A. They both perform -- they both
4 are 3D non-volatile memory and they both are
5 3D stack memory devices. So, therefore, they
6 both perform the function of memory devices.

7 But as I described together
8 with the three references that I provided
9 together with Watanabe, that there are some
10 differences.

11 Just like a car from GM and a
12 car from Ford, they perform the same
13 function, but there are some differences.

14 Q. Okay.

15 A. So I don't know what you mean
16 by they perform the same function. Yeah,
17 they perform the function if you -- if by
18 that you mean the same function as a 3D NAND
19 and memory cell, yeah, they perform the
20 function of memory cell.

21 Q. In fact, they are using the
22 same semiconductor structures to perform that

1 function, correct?

2 MR. KAPPOS: Object to form.

3 A. What do you mean by
4 "structure"?

5 Q. I mean, they are using the
6 same NAND memory cell structure to perform
7 the memory function.

8 MR. KAPPOS: Object to form.

9 Q. Right?

10 A. As you can see in Figure 5, the
11 difference between Figure 5 and Figure 6, as
12 I described the differences as was directed
13 by -- by the institution decision to explain
14 how a stackable add-on layer is structurally
15 distinguishable from a layer that is
16 sequentially deposited.

17 So they perform a similar
18 function, which is function of memory
19 devices, but there are some differences
20 structurally and performance-wise.

21 Q. Okay. And the structural
22 differences you're talking about are the

1 larger contact pads, the single-crystal
2 structure, and the quality concerns with
3 bonding, correct?

4 MR. KAPPOS: Object to form.

5 A. I will put it this way, that
6 the difference of microstructure differences,
7 which one is probably silicon and one is
8 single-crystal.

9 The second is the size of the
10 contact pad; one is larger, one is smaller.

11 And the third is the quality of
12 the bonding. One has perhaps bonding issues
13 and the others do not -- does not.

14 Yes, you're right that they
15 perform similar function, but have some
16 differences.

17 Q. Okay. And they achieve the
18 same result, the functional NAND memory,
19 correct?

20 MR. KAPPOS: Object to form.

21 A. They achieve a similar result.

22 MR. WILSON: Okay. I don't

1 have any further questions.

2 FURTHER EXAMINATION

3 BY MR. KAPPOS:

4 Q. Just one follow-up, Professor.

5 You were asked a number of
6 questions about why you did not provide a
7 claim construction for stackable add-on
8 layer.

9 Do you recall that?

10 A. Yes.

11 Q. Can you please read the last
12 sentence of Footnote 2 in your declaration?
13 It's on Page 13.

14 A. Sorry. So the last sentence on
15 Footnote 2 says, "For purposes of this
16 petition, this issue need not be resolved
17 because the prior art discloses or renders
18 obvious forming a stackable add-on layer in
19 the same manner as described in the '702
20 specification."

21 Q. And "this issue," is that
22 referring to the construction of stackable

1 add-on layer?

2 A. That's right.

3 Q. So does that remind you why you
4 did not to have a claim construction for
5 stackable add-on layer in your declaration?

6 A. That is correct, I don't need
7 to.

8 MR. KAPPOS: No further
9 questions.

10 FURTHER EXAMINATION

11 BY MR. WILSON:

12 Q. Okay. On that last sentence,
13 not all of the prior art discloses or renders
14 obvious forming a stackable add-on layer,
15 does it?

16 A. Well --

17 Q. Tell you what, I'll withdraw
18 the question.

19 Let me just go back to earlier
20 today, we discussed the fact that, in your
21 opinion, under your construction of stackable
22 add-on layer, Lee does not disclose a

1 stackable add-on layer, correct?

2 A. As I describe in Footnote No. 2,
3 that I believe the '702 patent, at least
4 intrinsic evidence, does not support any
5 interpretations of Claim 13 to encompass this
6 forming the stackable add-on layer using
7 sequential deposition method, and Lee uses
8 sequential deposition method.

9 Q. So, in fact, the construction
10 of stackable add-on layer determines whether
11 or not Lee discloses this limitation,
12 correct?

13 MR. KAPPOS: Object to form.

14 A. So if you look at my
15 declarations on Page 71, I stated that claim
16 element 13(b), which is related to stackable
17 add-on layer, that Lee discloses the subject
18 matter of '702 patent under the interpretation
19 patent owner appears to adopt.

20 Q. Right. But not under your
21 construction, correct?

22 MR. KAPPOS: Object to form.

1 A. As I discussed in my Footnote
2 No. 2, that stackable add-on layer does not
3 encompass methods as structured in a form
4 using sequential deposition.

5 Q. Okay.

6 A. No, it --

7 Q. Okay. So your construction at
8 the time you drafted Exhibit 1002 determined
9 whether or not Lee, in fact, disclosed this
10 limitation, correct?

11 MR. KAPPOS: Object to form.

12 A. Are you saying that under my
13 construction Lee would not meet 13.B?

14 Q. Yes. And that was true at the
15 time you drafted Exhibit 1002?

16 A. But, as I clearly stated, under
17 the interpretations patent owner appears to
18 adopt, Lee discloses the claim limitation of
19 13(b).

20 Q. Right. That was -- your
21 opinion was if the board were to adopt patent
22 owner's construction, then Lee would disclose

1 limitation 13(b), correct?

2 A. No. I'm saying that under the
3 interpretation patent owner appears to adopt,
4 Lee discloses claim element 13(b). I didn't
5 mention anything about the board.

6 Q. Okay. Fair enough.

7 A. Okay.

8 Q. But if the board were to --
9 sorry, let me strike that.

10 But under your construction,
11 Lee does not disclose limitation 13(b),
12 correct?

13 A. I believe my construction is
14 the correct one, and, therefore, you are
15 right, if stackable add-on layer that exclude
16 construction formation by sequential
17 deposition method directly on the substrate,
18 a person of ordinary skill in the art would
19 understand that Lee does not disclose 13.B.

20 However, it is obvious in --
21 under the interpretations that the patent
22 owner appears to adopt, Lee discloses it.

1 And also with combination of other
2 references, such as Watanabe and Endoh -- and
3 in Watanabe and Endoh, it discloses elements
4 such as 13.B and 14, 15, 16, and 17.

5 MR. WILSON: Okay. I don't
6 have any more questions.

7 MR. KAPPOS: I think we're
8 done.

9 THE VIDEOGRAPHER: This
10 concludes the deposition of Dr. Jack
11 Lee. Going off the record. The time
12 is 3:03.

13 THE REPORTER: Mr. Kappos, do
14 you want a rough draft later today?

15 MR. KAPPOS: Yes, please.

16 (Proceedings concluded at 3:03 p.m.)

17

18

19

20

21

22

1 REPORTER'S CERTIFICATION OF THE ORAL
2 DEPOSITION OF DR. JACK C. LEE
3 FEBRUARY 6, 2024

4 I, Donna Wright, a Certified Shorthand
5 Reporter and Notary Public in and for the
6 State of Texas, hereby certify to the
7 following:

8 That the witness, DR. JACK C. LEE, was
9 duly sworn by the officer and that the
10 transcript of the oral deposition is a true
11 record of the testimony given by the witness;

12 That the original deposition was
13 delivered to Mr. John Kappos.

14 That a copy of this certificate was
15 served on all parties and/or the witness
16 shown herein on _____;

17 I further certify that pursuant to FRCP
18 Rule 30(3) that the signature of the
19 deponent:

20 ___X___ was requested by the deponent or
21 a party before the completion of the
22 deposition and that the signature is to be
before any notary public and returned within
30 days from date of receipt of the
transcript. If returned, the attached
Changes and Signature Page contains any
changes and the reasons therefore:

___ was not requested by the deponent
or a party before the completion of the
deposition.

I further certify that I am neither
counsel for, related to, nor employed by any
of the parties or attorneys in the action in
which this proceeding was taken, and further
that I am not financially or otherwise
interested in the outcome of the action.

Certified to by me on this, the 6th
day of February, 2024.

20

Donna Wright

21

Donna Wright, CSR No. 1971

22

Expiration Date: 11/20/24. Firm Registration No. 719

Page 185

1 Dr. Jack C. Lee, c/o

O'MELVENY & MYERS

2 2801 North Harwood Street, Suite 1600

Dallas, Texas 75201

3

Case: Micron Technology, Inc. et al. v. BeSang, Inc.

4 Date of deposition: February 6, 2024

Deponent: Dr. Jack C. Lee

5

6 Please be advised that the transcript in the above
referenced matter is now complete and ready for signature.

7 The deponent may come to this office to sign the transcript,

8 a copy may be purchased for the witness to review and sign,

9 or the deponent and/or counsel may waive the option of

10 signing. Please advise us of the option selected.

11 Please forward the errata sheet and the original signed

12 signature page to counsel noticing the deposition, noting the

13 applicable time period allowed for such by the governing

14 Rules of Procedure. If you have any questions, please do

15 not hesitate to call our office at (202)-232-0646.

16

17

18 Sincerely,

19 Digital Evidence Group

20 Copyright 2024 Digital Evidence Group

21 Copying is forbidden, including electronically, absent

22 express written consent.

Page 186

1 Digital Evidence Group, L.L.C.
1730 M Street, NW, Suite 812
2 Washington, D.C. 20036
(202) 232-0646

3

4 SIGNATURE PAGE

Case: Micron Technology, Inc. et al. v. BeSang, Inc.
5 Witness Name: Dr. Jack C. Lee
Deposition Date: February 6, 2024

6

I do hereby acknowledge that I have read
7 and examined the foregoing pages
of the transcript of my deposition and that:

8

9 (Check appropriate box):

() The same is a true, correct and
10 complete transcription of the answers given by
me to the questions therein recorded.

11 () Except for the changes noted in the
attached Errata Sheet, the same is a true,
12 correct and complete transcription of the
13 answers given by me to the questions therein
14 recorded.

15

16

17 _____
DATE_____
WITNESS SIGNATURE

18

19

20

21

22 _____
DATE_____
NOTARY

Page 187

1 Digital Evidence Group, LLC
2 1730 M Street, NW, Suite 812
3 Washington, D.C. 20036
4 (202) 232-0646

5

6

ERRATA SHEET

7

8 Case: Micron Technology, Inc. et al. v. BeSang, Inc.

9 Witness Name: Dr. Jack C. Lee

10 Deposition Date: February 6, 2024

11 Page No. Line No. Change

12

13

14

15

16

17

18

19

20

21

22

Signature_____
Date

A				
a.m 1:14 5:4 47:7 47:7 83:8,8	48:4,9 49:5 50:11,16 51:1,2 51:5,8,16 52:1	addressing 92:9 adhesion 129:15	alleged 163:5 allow 120:17 125:14	applied 108:5,16 108:18 113:1 143:5 151:6,7
able 14:14 97:19 102:14,19 113:9	52:6 53:2,8,15 53:17 54:11,20 55:1,5,13,19,22	adopt 19:13,15 19:19,22 59:3 180:19 181:18 181:21 182:3 182:22	allowed 140:12 185:13 AMD 132:22 and/or 184:8 185:9	applies 69:12 apply 104:19 106:15 107:12 108:5 112:18
above-styled 1:14	56:6,10,16 57:15,20,22	adopted 56:5 158:6	annotate 94:15 96:21	approach 63:13 94:19 95:3,5 131:21
absent 185:21	58:6,17,22 59:4 59:9 64:7 72:10	advantage 141:4 143:4,11	annotated 4:7 100:10	approaches 106:20
Absolutely 121:1 126:20	86:13,14 87:15 88:9,10,19 89:7	advantages 142:11 143:2 146:19,22	answer 31:15 38:17 41:3 49:19 61:22 63:5 66:14,18 83:14,16 97:17 98:5 100:6 122:3 175:1	approaching 45:14
access 33:18 89:10,11	90:13,22 91:7 91:17 92:2 115:6 117:2 122:22 130:10 132:7 134:18 135:2,3 143:3 143:17 148:15 156:17,21 157:3,5,12,21 158:1,7,13,20 159:4,7,11,19 160:1,8,12,18 160:20 161:2 161:11 162:9 162:15 163:17 164:5,14 167:3 167:18,20 168:6,9,15,19 169:5,7,22 170:4 176:14 178:7,18 179:1 179:5,14,22 180:1,6,10,17 181:2 182:15	advise 185:10 advised 185:6 affirmative 160:7 affirmatively 160:2 AFLD 68:5 afternoon 172:13 afterward 167:13 aggressively 41:12 ago 21:9 119:16 122:15 141:2,6 agree 33:20 44:3 65:4 106:21 107:2 agreed 57:20 agreement 91:17 91:18 ahead 81:18 84:6 122:3,7 aid 41:16 air 129:14 al 185:3 186:4 187:8 align 117:10,18 aligned 110:6 alignment 110:8 110:13,16 111:8 117:9,15 117:16,18,19 117:19,21 120:4,17,18 144:5,9	anybody 8:19 10:21 apologize 54:8 79:7,11 apparatus 86:20 87:5 91:12 apparent 12:10 12:19 17:3 18:9 56:14 apparently 56:5 appear 23:15,22 appears 19:13,15 19:19,21 59:2 158:1 160:20 180:19 181:17 182:3,22 applicability 147:5 applicable 185:13 Application 39:1 applications 25:17 26:7,9,18	appropriate 13:9 159:10 186:9 approximately 35:7 125:21 April 42:12 architecture 76:7 76:11 92:20 93:12,13,18 94:17 95:12,12 97:5,14 98:16 101:6,20 103:3 104:2,10,11 105:22 106:6 108:13,20,20 area 21:8 34:1,5 34:13,16 35:4 35:11,14,17,21 36:2,8 37:12,14 37:18,19,21 38:2,4,5,7,18 38:19,20 120:10,12,16 142:4 149:11 150:5 argument 148:15 Armond 2:15 5:10 arrange 60:6 arranged 75:12 arrangement 75:21 array 48:19 49:4 49:8 50:10,15
accomplish 23:8 97:11 103:17 108:19				
accuracy 44:1 143:18,19 144:9				
accurate 20:7,13 43:21 117:20				
accurately 7:4				
achieve 96:5,20 97:13,19 98:3 98:11 101:12 102:15,19,21 105:22 106:13 106:13 108:6 127:1 143:2 144:8 172:7 173:16 177:17 177:21				
acknowledge 186:6				
acronym 80:2				
action 184:17,18				
actively 152:14				
actual 32:6,12,13 35:11 140:6				
add 51:19 101:22 102:2,3 148:8				
add-on 12:11,20 13:7,9,20 14:10 14:12 15:5,16 15:20,22 16:8 16:16 17:4,14 18:7 19:3,22				
	added 146:21 148:4 addition 21:1 83:15 149:19 additional 126:2 126:3 133:20 163:13 address 22:8 105:15 addresses 23:2,3			

51:5,8,18,22 52:5,9 53:16 60:8 62:22 64:3 64:6,7,19 65:8 75:22 76:7 arrays 60:3,12 art 15:15 17:15 25:20 26:8 38:16 55:21 56:22 57:19 61:8 62:21 67:11 69:19 70:7,16,20 71:17,21 72:18 80:7 86:8 90:4 90:7 91:5 92:19 93:2,10 94:7 95:8 96:3 98:14 100:20 102:14 102:18 104:21 105:4,20 106:2 106:7,11 108:4 122:21 136:12 137:2,20 140:19 148:20 157:16 158:9 161:21 162:8 163:5 164:7 165:14,22 166:18,19 167:10,11 170:2,20 171:4 178:17 179:13 182:18 articles 22:1 ascribed 163:2 aside 30:19 asked 115:10,12 119:12 133:13 135:7 140:18 144:10 149:9 151:3,12 152:14 155:8 159:3 163:16 165:12,20 166:5,17,21 167:2,14 178:5	asking 51:3 89:16,18 109:12 134:17 136:22 145:17 147:8 167:17 167:22 168:4 168:10,18,22 169:2 asks 168:14 aspect 32:10,13 89:9 aspects 103:4,7 asserted 166:20 associated 6:18 assuming 8:10 attached 1:19 184:13 186:11 attention 130:15 attorneys 184:17 attribute 59:7 Austin 1:17 2:17 6:11 21:3 authored 150:5 avoid 126:2,3 award 153:5,6 awards 152:19 152:20 153:3,4 153:5,10,19 154:22 aware 20:10 62:15 118:4 B B 45:7,9 116:10 146:5 174:4 back 8:22 16:9 47:8 62:12 74:21 75:9 80:18 83:1,9 86:12 92:5 114:9 122:21 126:12 131:17 131:22 133:22 139:2,18,19 145:19 179:19 background 25:6 107:20 153:17	155:9 balance 142:13 based 15:2 122:17 130:7 138:16 162:4 basic 95:9 basically 6:17 41:13 50:19 69:5 95:16 102:5 105:16 113:19 128:3 129:4,14 basing 69:11 basis 72:2 Bay 21:8 beg 153:22 beginning 47:9 83:10 133:19 begins 5:1 Beilliard 4:9 118:13,17 119:15,18 129:2 131:2 believe 6:20 13:17 14:5,7,11 15:11,13 17:10 54:10 55:10 66:18 78:21 79:1 88:9,20,21 93:22 122:13 134:15 141:5 147:6 149:6 156:4 157:20 158:18 159:16 159:16 160:10 160:20 161:19 161:19 162:19 164:11 167:18 180:3 182:13 believed 68:19 believes 14:3 159:17 BeSang 1:7 2:14 5:10 185:3 186:4 187:8 best 153:2,10 better 120:13,17	120:18,19 128:8 144:9 beyond 149:15 bipolar 27:2 41:7 Bissey 5:19 bit 102:8 109:7,8 109:8 blue 81:13 148:3 board 136:21 181:21 182:5,8 board's 8:5 14:18 14:21 15:10 boils 56:17 bond 129:10 130:10 bonded 14:14 15:7,18,21 16:1 16:6,7,17 48:4 48:10 49:8 52:2 53:3,9 54:11,13 54:15,17 56:10 58:2 80:15 90:2 90:15 110:1,5 148:7,10,16,22 149:4 bonding 120:9,12 130:21 131:4,5 131:7,8,14 149:7 172:16 173:7 177:3,12 177:12 book 153:18 154:14 books 44:11 150:4,5,12,15 150:21 borings 129:11 131:3 bottom 30:13 42:18 54:13 68:7 102:9 112:14,19,20 125:19 126:4 Boulevard 2:16 boundary 30:13 31:2 127:22 128:3	box 77:21 186:9 break 6:21,22 7:1 30:16 46:17 47:2 82:12 83:1 83:5 114:3,13 broad 137:1 138:8,14 bubbles 129:15 budget 125:7,8 125:11,12,17 125:20 126:11 126:18 build 132:6 bump- 117:18 bump-type 117:15 C C 1:10,13 2:1 6:1 6:10 123:15,18 124:14 125:21 126:6 184:1,4 185:1,4 186:5 187:9 c/o 185:1 call 55:7 68:21 69:1 85:12,15 119:2 173:13 185:15 called 41:12 85:20,22 116:17 125:7 157:3 172:10 calling 47:14 capacitance 33:21 34:4,11 35:4,14,16,20 37:11 capacitor 29:8,20 33:22 34:1,5,6 34:12,14 35:17 36:1,7 37:12,14 37:20 38:3,6,8 38:9,11 72:11 72:12 capacitors 27:3 38:18
--	---	---	---	--

capacity 35:22 36:7 40:6	106:3 107:7,8 107:18 109:7	chips 128:10 133:10	Colorado 1:17	complete 9:8
caption 43:12	146:4,6,11	choose 107:11	Column 59:17	11:21 41:3
car 175:11,12	148:2,6 149:3	142:19,20	64:13 68:3 72:7	133:14 134:13
care 59:22	certain 105:12,12	chooses 143:10	74:9 78:8 80:1	185:6 186:10
careful 98:1	106:6,10	143:10	80:10,11 84:12	186:12
131:1	157:15	choosing 142:17	84:17,21 85:4	completely 32:17
carefully 79:6	certificate 184:7	circuit 72:15	85:12,19,19	33:1,4 112:4
98:1 161:1	CERTIFICAT...	110:10 113:9	89:8 109:21	completion
171:4	184:1	113:19 128:9	117:12 136:8	184:11,15
cars 174:2,10	Certified 184:2	142:2	143:14	complies 97:1
case 1:4 9:10	184:19	circuitry 105:7	columnar 65:19	component 87:15
27:19 28:8,14	certify 184:3,9,16	107:3	columnar-shap...	87:19 89:2
28:15 122:9	change 28:13	circuits 111:17	65:15	comprise 137:2
126:1 158:6	36:17,19 38:10	112:1,10,11	combination	137:20
185:3 186:4	97:4 101:11	cite 148:13 166:8	96:20 183:1	comprises 64:6
187:8	103:4,9,20	claim 16:4,13,16	combine 102:21	comprising 60:8
cases 28:4	104:11 105:2,6	18:5,6 19:3,16	106:5	64:4
category 26:4,21	105:9 106:22	54:22 55:12	combined 29:19	CON'T 4:1
26:22	107:4,4 108:9	56:2 57:17	combining 162:3	concern 142:9,16
cause 1:14	109:13,16	58:10,13 76:16	come 83:1 185:7	concerns 172:15
129:15	187:11	76:18 77:1	comes 86:20	177:2
cell 32:15,18,20	changed 37:6	86:19,19,20	comfortable	concise 26:5
32:21,22 33:2,4	103:1	87:5,5 91:12,12	101:3,9,18	27:16
33:6,10,14,16	changes 98:2	91:19 92:9	coming 82:15	conclude 61:9
33:19 36:8	184:13,14	99:19 100:17	commercial	concluded
37:16,22 38:4	186:11	115:4 158:10	132:15	183:16
40:12,15,18	chapters 150:5	159:6,18 160:9	committee	concludes 183:10
41:1,17 42:2,6	150:15 153:18	161:7 163:3,11	151:14 152:15	conference
43:6,8 44:3	154:14	169:10,21	committees	151:10,16,18
72:13 95:10	characteristics	178:7 179:4	151:16	152:15
96:1,1,16	45:11 124:6	180:5,15	common 73:22	conferences
105:12,14,18	characterizing	181:18 182:4	74:6	151:8,11,17
105:21 106:4,4	71:7	claimed 17:13	commonly 16:21	confident 9:20
106:9,17	charge 60:8	167:11	17:11 55:7	configuration
107:21 108:12	100:12 104:15	claims 15:3 67:12	companies	101:12
109:8 121:9	106:17 127:15	158:11 166:20	132:21	configurations
128:10 142:6	charge- 145:15	class 21:1,2 35:15	company 46:9	102:15
146:8 175:19	146:10,13	classes 35:16	132:13 142:16	confirm 43:18,22
175:20 176:6	charge-trapping	clear 29:20 132:3	142:17 150:1	63:18
cells 33:13 36:3	146:17,19,21	clearly 68:14	compare 116:14	conjunction
40:7 64:9 72:9	check 44:10	73:5 88:15 89:4	compared 92:2	89:14
75:11 76:3,8	186:9	91:16 98:6	111:12 127:17	connect 96:15
77:7 80:22	chip 38:20 103:5	159:12 181:16	128:12 146:19	102:11 105:21
89:11,12,12	103:9 121:8,10	cleaved 80:14	comparison	106:6,12
95:13,17 96:14	128:10 142:5	CMOS 112:19	145:15	107:11 108:1
102:7 103:17	144:3	123:20	compensated	connected 75:14
			11:6	95:13,18 102:7

102:10 107:7 107:21 112:8 connecting 96:4 107:9 connection 75:16 76:14 93:5,13 93:18 94:10,10 94:22 98:11 101:12 108:7 connections 72:9 76:13 95:16 connects 95:20 connotes 67:2 consent 185:22 consider 59:8 considerations 142:19 considered 11:18 11:22 133:14 134:8 constant 37:1,4,9 120:11 construction 12:10,19 13:9 13:12 14:9,12 14:18 16:4 17:3 18:6,9 19:3 53:17 54:22 56:2,5,16 57:18 58:6,10,14 59:9 88:8 89:18,19 115:4 134:18 135:7 156:16 157:12,17 158:9 159:6,10 162:21 163:11 163:13,18 164:12,19 165:11 169:10 169:15,22 170:5 178:7,22 179:4,21 180:9 180:21 181:7 181:13,22 182:10,13,16 constructions 17:13 91:19	construe 135:1 159:4 163:16 168:14,14,19 169:3 construed 136:5 136:13 164:2 construing 169:9 consult 150:1 contact 68:6 78:18,20 111:4 111:17,22 112:5 113:7,8 113:21 116:15 116:18 118:1 120:3,4,5,11,14 120:16,19 121:6 142:4 172:14 173:5 177:1,10 contacted 68:6 contacts 116:20 117:7 contains 184:13 contents 155:16 155:18 context 52:16 60:20 62:7 76:19 90:8 135:22 continuous 74:1 Contrary 120:9 contrast 60:12,17 control 74:1,7 controlled 139:9 convention 68:5 conventional 117:20 convert 94:16 97:5 101:5,19 copper 129:16,17 129:17 130:12 130:13,13,14 130:14 copy 7:11,14,20 8:4,11,15,16,20 20:4,5 79:4 81:9 184:7	185:8 Copying 185:21 Copyright 185:20 correct 6:15 9:6 9:10,14 10:3 11:8,19 13:4,10 13:13 14:3,9,11 14:19 15:10 16:14 17:9,21 17:22 18:19 19:1,2,19,20 20:4,5 22:21 23:3,5,17 24:1 24:7,13 25:8,12 26:13,19 28:1 28:20 29:1,8,13 29:22 31:1,7 32:15,18 33:2 34:2,14 36:3 37:16,22 39:5 39:14 40:13 44:5,12 45:15 47:16,19 48:5 48:19 49:9,13 50:12,16 51:19 51:20 52:3,4,13 52:21 53:10,11 55:2,19 56:15 56:18 57:16 58:6,8,9,18,19 59:8,10 60:4,19 61:5,13 62:5 63:17 64:21 65:5,16,20 66:9 70:5 71:5,10,14 74:7 75:12 76:10,16 77:12 79:17,18,22 80:7 81:1,5 86:15,21 87:6,7 87:9,16,21 88:4 88:9,12,20 89:2 90:10 91:2 92:13,20 93:14 93:22 96:9 98:16 99:6	101:6 103:5,10 103:20 104:12 105:9 107:5 108:13,21 110:6,10,14 111:9,18 112:1 112:12 113:16 113:17 155:1 156:7,17 161:11 162:16 163:22 164:16 165:16 166:6 166:10 167:22 168:10 169:16 170:9 171:12 171:18 172:3 172:20 174:7 174:16,19 176:1 177:3,19 179:6 180:1,12 180:21 181:10 182:1,12,14 186:9,12 correction 29:10 83:13,15 correctly 12:13 13:1 40:9 60:15 64:10 74:4 77:9 93:6,8 correlate 60:21 61:1 cost 121:8,9,13 142:6 costs 142:13 counsel 5:5 20:6 116:17 133:12 135:17 144:11 147:3 149:10 153:20 154:2 165:12 184:16 185:9,12 count 152:3 course 21:10 46:8 81:22 96:18 114:12 151:17 courses 21:7,9,11	21:12,17 149:20 coursework 149:13 court 5:7 163:14 cover 33:17 56:7 59:4 157:6 158:2,7 160:21 161:21 covers 32:15,16 32:21 33:1,4,14 critical 110:8 cross 79:10 118:9 cross-section 34:21 crystal 143:22 crystalline 172:14 crystals 127:21 CSR 1:15 184:21 current 25:14 customary 11:12 CV 20:4,6,17 22:8 23:9 28:3 28:6,12 153:1 154:6 155:7 cycles 103:20
D				
D-O-P-E 66:5 D.C 1:21 186:2 187:3 Dallas 2:9 185:2 date 5:3 95:2 133:15 184:12 184:22 185:4 186:5,17,22 187:10,22 dated 9:5 42:12 42:20 day 184:19 days 184:12 DC 120:9 DCP1 120:10 December 126:9 decide 105:20 158:4				

decides 159:2	defining 68:11,17	13:8,21 16:21	describing 101:4	143:20 148:6,9
decision 7:11,12	68:18	17:5,12 55:8,14	description 3:9	148:22 150:2
7:13 8:5 14:19	definitely 31:18	56:7 57:3 58:16	4:2 15:4 19:7	150:11,12
14:22 16:3	31:18,20	58:21 59:5	84:21	151:5,9 152:6
57:22 58:13	definition 57:14	60:22 63:3	design 103:16	173:3 175:5,6
88:17,22 91:18	86:13 88:19	90:20 91:10	104:18 105:20	176:19
134:7,11,16	135:14 137:17	92:3 111:13	106:16 120:11	dictates 99:14
136:4,20	160:8 161:2,10	114:12 115:8	designed 52:9	dielectric 14:15
161:10 163:16	169:4	116:2,4,13,21	designing 121:4	15:7,18,21 16:1
167:1 176:13	degraded 142:7	117:4,22	desirability	16:6,17 28:5,8
decisions 148:12	degrees 123:15	118:10 119:22	141:12	37:1,3,7,9 48:4
declaration 7:10	123:18 124:14	121:19 123:10	despite 120:12,12	48:10 49:12,16
7:21 8:12 9:13	125:21 126:6	124:18 125:4	detail 174:5	50:4 53:3,9
9:19 10:3 11:2	delivered 184:7	126:1,16 127:2	details 27:9	54:12,14,15,17
11:5 16:10 25:3	demonstrate	128:7,14,17	31:13 38:13	56:11 58:3 90:3
39:10 47:22	148:5	131:16 132:9	determine 90:21	90:16 100:13
55:10 59:14,21	demonstrations	141:14 142:10	157:15	147:17 148:16
63:20 65:10	41:9	142:21 157:6	determined 90:9	difference 56:17
67:19 73:14	density 60:3,6	158:2,8,21	181:8	57:7 59:6,11
75:1,10 80:19	61:13,17,21	159:20 160:21	determines	69:2 70:12
92:6 98:13	62:5,10,17 63:4	161:15,22	180:10	95:11 115:13
99:13 133:13	63:8,8,13	162:6 170:15	detrimental	115:14,16
133:15,22	102:22	170:22 171:6,9	124:6	118:5 119:20
134:13 144:12	deny 24:9 43:18	171:18 172:2	development	120:20 121:3
147:8 154:6	43:22 61:15	172:11 180:7,8	39:19 40:4	121:20,21
155:16 156:7	63:18 90:5,7	181:4 182:17	device 20:20	122:4,8 124:22
156:15 157:10	department 5:20	183:10 184:1,5	40:22 41:15	127:4 131:13
157:13,17	dependent	184:6,11,15	50:20 57:9 60:3	131:17 141:3
158:5 159:9,14	158:11	185:4,12 186:5	60:6,9,14 61:12	141:11 176:11
160:3,6,22	depending 89:1	186:7 187:10	61:17,20 62:4,9	177:6
161:9,17 162:3	depends 46:9	depositions	62:17 63:4,7,8	differences
162:11,13	104:13,14,16	124:11 174:12	63:13 64:5	111:11 115:4
166:16 167:7	106:15,16	describe 25:6	113:16,19	115:20 116:6,8
171:2 178:12	109:3 111:19	107:19 138:2	138:7 148:14	121:17 128:16
179:5	142:12,18	162:2,18 180:2	151:6,10 165:6	141:18 167:15
declarations	173:9 174:20	described 49:16	devices 20:15,19	173:1,4 175:10
164:11 180:15	deponent 184:10	77:13 78:6	21:4,5,15,19	175:13 176:12
decreased 42:2	184:10,14	88:15 100:19	22:15,19,20	176:19,22
decreasing 40:13	185:4,7,9	122:19 123:15	23:11 24:18	177:6,16
40:16,19 41:17	deposed 6:14	131:14 153:1	25:1,16,22 26:1	different 35:12
44:4,7	deposit 124:13	162:11 165:5	26:9,11 27:1,3	57:4,13 59:3
defects 132:5,8	deposited 135:5	175:7 176:12	32:13 41:6 60:7	75:4 91:8 95:2
define 69:1,1	167:5 176:16	178:19	60:8,19 61:5,12	99:10 108:12
172:21	depositing 127:3	describes 60:21	61:16,19 62:4,9	108:16,19
defined 68:14	deposition 1:10	80:8 89:6	62:16 65:16	109:4 115:14
163:8	1:12 5:2 6:18	105:18 130:18	105:15 107:22	115:22 116:3
defines 69:3	9:14 12:12,21	136:10	121:6 123:4,6	118:2 120:2

131:6 157:9 174:5 difficult 108:17 109:11,15 140:17 diffusion 124:4 126:3 139:12 Digital 1:20 185:19,20 186:1 187:1 dimension 31:18 32:4,7 138:3,3 138:4,5 139:4,7 139:18,21 140:5,6,8,9,13 dimensions 31:21 32:7 138:6 139:8 diodes 27:3 direct 118:8 128:19 135:10 145:8 directed 23:22 24:6,13 87:8 133:13 176:12 direction 34:17 34:18,19,22 35:1 directions 41:21 directly 12:12,21 13:8,21 17:5 55:14 68:5 158:21 159:20 182:17 disadvantages 142:12 146:22 disagree 13:4,6 15:9,12 17:6 19:17,20 33:8,9 43:17 71:11 161:3,6 disclose 18:22 161:10 179:22 181:22 182:11 182:19 disclosed 181:9 discloses 16:12	17:1 18:11,18 19:11,16 51:22 52:12 53:8 64:2 65:14 77:6 80:21 148:15 171:11 178:17 179:13 180:11 180:17 181:18 182:4,22 183:3 disclosures 15:3 discovery 41:7 discuss 24:17 145:5 146:16 153:19 154:1,8 154:9,11 155:3 155:7 167:7 discussed 116:9 117:13 118:4 137:22 139:22 154:7,17,19 155:1 159:12 166:13 179:20 181:1 discussing 48:3 48:15 discussion 114:14 115:3 118:18 135:17 144:17 147:2,6 147:12 discussions 140:22 distinction 56:13 distinguishable 57:6,10 91:21 91:22 135:4 167:3,9 176:15 distinguishing 60:18 District 163:13 document 7:18 8:2,8 119:8 129:20 documents 7:7 154:5 Donna 1:15 184:2,21	dopant 124:4 126:3 dope 66:2,5,12,19 67:7,22 68:8,11 68:16,18,20 69:4,5,20,21 70:2,4,8,13,17 71:4,8,11,19,19 72:3,20 73:6 77:15 78:4 79:3 79:17 83:21 84:22 85:7,16 85:18 86:9 101:22 136:7 136:13 138:9 138:19 doug.wilson@a... 2:18 Douglas 2:15 5:9 downward 30:20 Dr 1:10,12 5:2 6:1 47:12 49:22 114:11 153:16 183:10 184:1,4 185:1,4 186:5 187:9 draft 183:14 drafted 157:10 159:8 160:3,6 161:9 162:13 163:22 164:15 164:22 169:15 181:8,15 drafting 158:5 DRAM 21:21 26:2,10,14 27:10 33:18 43:5,8 45:14 46:1,3 72:9,13 89:10 draw 77:21 79:6 140:3 168:5 drawn 31:12 32:3 32:7,9 35:6,10 140:2 DRC 151:9 driving 174:4	duly 1:13 6:2 184:5 dynamic 89:10 E E 2:1,1 116:11 E-N-D-O-H 39:3 E2PROM 27:13 earlier 19:4 54:18 56:3 76:4 83:14,16 84:19 96:2 115:3 116:9 133:12 134:16 135:16 137:22 139:22 143:3 144:11 169:18 179:19 edition 3:14 44:18 45:3 EEPROM 27:12 40:7 64:18 65:8 EEPROMs 64:6 65:5 effectively 31:7 eight 150:19,21 either 8:13,14 72:13 75:1,10 106:12 109:1 116:18 elect 165:15,22 electrodes 68:6 electron 109:2 127:17 151:5,5 151:9 electronically 185:21 electrons 127:12 127:14,22 element 17:2 18:5,11 19:9,16 48:3,7 49:17 53:2 147:4 180:16 182:4 elements 183:3 embodiment 64:20 100:11 embodiments	68:4 emphasize 18:3 employed 184:16 enable 120:18 encompass 21:4 25:21 26:10 158:19 180:5 181:3 encompasses 13:19 22:21 55:12 159:19 encouraged 134:22 135:14 137:16 Endoh 39:3,13 40:12 54:1,3 65:14 93:5,19 94:20 102:21 183:2,3 engineer 103:16 engineering 153:6 English 69:13 entire 33:14 50:19,20 63:15 76:21 entitled 42:11 equal 71:12,14 71:17,19,20 72:1 equals 68:22 equate 73:5 equates 69:5 70:17 equating 68:20 69:8 equation 69:1 equations 68:22 equivalent 72:15 erase 103:8 104:10 105:7 106:4 107:3,14 108:11,19 errata 185:11 186:11 187:6 errors 9:17,19 especially 40:2,5
--	--	--	--	--

158:6 165:4 essentially 42:17 113:8 125:12 146:2 estate 38:8,19 estimate 120:13 et 185:3 186:4 187:8 evidence 1:20 53:1 67:13 72:22 83:20 86:4,5 89:6,17 156:22 180:4 185:19,20 186:1 187:1 exact 42:5 165:11 exactly 14:20 82:18 Examination 3:2 3:3,4,5,5 6:4 114:22 153:14 178:2 179:10 examined 186:7 example 27:1 38:5 49:14 54:12 72:5 78:12 84:8 89:8 95:1 96:7 99:13 100:5,8 108:10 118:13 129:2 131:19 132:22 134:4 139:10 139:11 171:4 examples 83:22 84:4 145:19 exclude 170:14 171:8 182:15 exclusively 21:17 Excuse 83:12 exhibit 3:10,13 3:17,20 4:3,6,8 4:10,12 7:15,21 8:15 9:1,8,13 9:21 11:19 12:2 18:2,14 20:3,4 20:11 25:3,8 28:17,20 38:22	39:1,4 42:8,9 42:10,13 44:14 44:15,16,19 47:13,15,22 59:13 77:18,19 79:12 81:8,10 82:8 94:12 96:22 98:13 104:1 109:20 118:20 119:7,9 119:11,13 122:11,13,17 125:16 130:1,2 130:6 150:6 156:15 159:9 160:3,6 161:9 162:14,16 163:22 164:15 164:22 166:9,9 166:14 169:15 170:9 181:8,15 Exhibits 3:8 4:1 166:6 existed 138:17 expanded 111:7 expect 114:2 experience 20:15 20:18 21:19,20 25:12 27:17,22 124:4 expert 11:14 Expiration 184:22 explain 30:1,5 50:1,4 87:18 119:18 127:4 135:3 167:2,14 176:13 explained 72:14 102:16 141:3,6 explaining 101:18 explanation 136:22 137:18 explicit 162:20 164:12,19 165:11 170:5	explicitly 159:3 163:16 164:3 169:21 express 25:8 135:14 137:16 185:22 expressed 9:21 11:19 12:1 164:3 expressing 61:4 expressly 135:1 164:3 168:19 169:3 extended 135:17 extends 32:17 33:5 external 72:11,11 extremely 129:8 129:8 F fabricate 57:9 171:7 fabricated 22:15 80:15 89:15 136:17 138:12 160:16 fabrication 25:17 fabrications 131:9 fact 21:8,16 55:18 75:20 83:14 112:9 117:12 120:7 148:7,11 162:4 175:21 179:20 180:9 181:9 factor 43:13 44:4 44:9 Fair 182:6 falls 167:19,20 168:8,9 familiar 39:7 47:18 80:4 faster 127:13 feature 41:11,14 41:22 44:3,6	45:14 46:5,7,14 features 146:20 174:19 February 1:11,14 5:3 184:2,19 185:4 186:5 187:10 feel 101:3,8,17 fellow 152:8 FETs 126:7 field-effect 126:6 fifteen 152:3 figure 3:18,21 4:4,7 29:3,4,12 29:13,16,19,20 31:8,19,21 32:14 34:6,19 34:20 35:2,6 43:3,5,12,17 48:15,18 49:15 49:21 50:4,10 50:14,19,20 51:15 52:2,12 52:18,19 53:4,4 53:8,12 54:5 55:4,18 56:8,8 65:7 72:5,6,8 72:14,14,16 73:8,10,17,21 74:6,10,13,18 74:21 75:9,13 76:3,5,16,19 77:3,12,17,22 79:16 81:3,9,12 84:8,11,14,16 84:18 85:2,6,9 85:10,14,17 92:13 93:12,16 93:22 94:9,15 95:1 96:9 97:4 97:13,20,20 98:3,15,21 99:5 99:14,19,22 100:1,9,10 101:1,1,1,4,19 102:1 103:2,2 104:2 105:6,8	107:5,6 109:22 110:17 112:15 112:16,18 116:10,11,15 116:15,17,22 124:9 129:12 129:13 131:4,7 144:12 145:7 146:2,5,6,7,9 146:10,12 147:12,16,18 147:21 148:5,8 148:9,13,19 149:2,5,8 172:8 172:8,9,22,22 173:1 176:10 176:11,11 figures 31:10 32:2,11,11 35:10 38:13 56:8 64:17 65:2 65:2,4 78:17 84:9 97:21 100:1 117:6 140:1 fills 30:16 film 74:1 final 57:10 financially 184:18 find 9:16,18 FinFET 27:4 finish 100:5 155:6 175:1 firm 10:1 184:22 firms 28:4 first 6:2 11:5 12:8,15 16:19 20:22 25:13 26:21 33:15 39:12 41:8 42:17 43:19 45:17 60:2 64:19 65:17 77:8,12,21 81:1 96:10 97:10 141:20 144:20
--	--	---	--	--

161:20 five 150:19 flash 3:11 27:13 42:11 43:6,8 48:18 49:4 50:10,15 51:4,8 51:14,18,22 52:5 53:12 64:18 flat 30:7,8,14 31:1,3 FLD 68:5 floating 104:15 106:18 145:15 146:8,17,20 147:1 focused 21:18 focusing 50:2 follow 148:17 follow-up 178:4 following 136:3 184:4 follows 6:3 footnote 13:17 14:1 19:11 55:9 59:1 134:21 158:17 159:13 159:15 160:10 165:3 168:12 170:12 178:12 178:15 180:2 181:1 forbidden 185:21 Ford 174:1 175:12 foregoing 186:7 forget 52:16 74:20 form 24:2,8 28:2 29:7,22 32:1 34:3,15 36:4 37:17 50:17 51:10 52:14 55:1 56:1,19 60:14 61:6,14 62:18 65:19,21 69:14 70:22	78:1 81:14 86:16 87:1,17 87:22 88:13 89:3 90:11 91:3 91:22 94:18,22 95:16,22 96:2 97:2,7 99:11 101:7 102:6 105:10 107:16 108:22 110:11 110:19 112:2 116:18 128:7 129:3 153:21 154:16 155:12 156:8,18 157:2 157:18,21 158:14,16 159:2 161:12 162:17 164:17 165:1,10 166:1 168:1,11 169:8 170:10,18 171:13,16,22 173:18 174:8 174:17 176:2,8 177:4,20 180:13,22 181:3,11 formation 170:14 182:16 formed 14:13 15:6,17 29:21 33:22 34:12 49:5 52:6 53:12 54:20 55:5 56:18 57:1,3 58:1,7,16,20 60:13 77:8 81:1 89:13 90:1,14 90:19 91:7,8,9 92:3 110:1 111:11,13 115:6,8,22 116:10,12 123:2 124:10 128:5,13 136:14 137:7	138:9 148:7,22 149:4 159:22 160:5,13 164:18 forming 12:1,10 12:20 13:6,20 17:3 55:13 57:15 59:10 65:8 73:22 156:20 158:19 159:19 161:14 178:18 179:14 180:6 forms 31:7 88:3 111:1 formulate 97:19 forth 25:18 26:3 95:21 153:7 forward 185:11 found 15:3 92:19 93:2 98:14 four 26:4 109:8 fourth 48:22 FRCP 184:9 front 28:9 104:6 109:18 117:6 full 6:8 fully 7:4 function 112:12 112:22 113:20 173:11,14,20 174:3,15 175:6 175:13,16,17 175:18,20 176:1,7,18,18 177:15 functional 177:18 functioning 114:1 functions 103:9 105:8 funnel 111:2 further 3:4,5,5 101:4 153:13 153:14 178:1,2 179:8,10 184:9	184:16,17 furthermore 84:14,18 91:20 130:22 G games 28:7 gap 30:16,18 gate 33:11,17 74:1,7 104:15 106:18 145:15 146:8,14,17,20 147:1 gate-all-around 27:4 gates 102:12 146:17 general 35:20 40:17,20 41:5 41:21 44:8 46:8 46:10 123:7 138:18 139:17 generally 28:19 80:2 generation 103:21 generations 106:15 generic 146:6 getting 67:22 give 36:10,11,15 97:16,18 99:12 101:9 139:11 149:17 given 118:17 184:6 186:10 186:13 glow 124:5 GM 174:1 175:11 go 11:16 16:9 27:4,13 74:21 79:14 81:18 82:21 84:6 85:9 100:14 106:22 109:13 113:7 113:21 121:10 121:14,15	122:3,7 123:14 128:1 179:19 goes 64:1 going 20:2 46:16 46:18 47:5 49:18 73:20 81:7 82:10 83:6 86:12 94:13 108:12 114:5 118:19,22 119:2 130:6 135:19 183:11 good 6:6,7 131:7 governing 185:13 graduate 21:1 35:15 graduated 22:12 grain 38:6 127:22 128:3 greater 111:16 111:22 green 147:22 ground 75:22 102:9 148:18 group 1:20 24:22 185:19,20 186:1 187:1 growth 126:4 guys 82:11 H hafnium 28:10 28:11,14 37:8 139:11 half 46:2 hand 5:22 8:15 20:2 44:13 81:7 94:13 123:9 handed 28:16 38:21 42:7 47:12 59:12 77:17 hanging 119:8 122:12 129:22 Harwood 2:7 185:2 hash 79:2
--	--	--	--	---

hate 97:16	identification	26:2 32:11	78:21,22 79:22	86:4 89:6,17
head 95:19,20	84:10 85:8	78:18 101:1	80:3,5 81:12,17	156:22 159:17
97:17	identified 72:19	110:13,16	81:18 82:1	180:4
heard 125:6	81:19 85:10	117:6 137:17	146:14	Introduction
126:9	identify 5:5 85:4	149:7,22 150:2	insulators 4:5	3:11 42:11
help 111:8	85:11 150:15	150:11 152:6	81:15	invalid 161:7
helps 120:13	identifying	152:16 154:5	integrated 110:9	invalidate 76:18
hemispheric 38:6	140:15	159:5,14 173:5	integration 129:3	158:10
hereto 1:19	IEEE 42:19	173:6,6 185:21	173:3	invalidity 53:1
hesitate 185:15	152:7,8,14	incorrectly 156:5	integrations	invention 41:7
high 113:22	illustrate 64:17	increase 36:6	146:3	64:20 89:10
123:3 124:19	65:7	37:10,13,15,19	intentional 78:19	100:12 163:6
125:20 130:21	illustrated 31:13	38:2,17,20 40:6	interchangeable	inventor 153:5
138:21 146:3	122:5	121:7,9	146:18	inversely 35:17
high-K 28:5,8,8	illustrates 73:22	increases 38:7	interested 184:18	involve 151:21
37:7	119:19	121:10	interests 25:15	involved 152:11
higher 102:21,22	illustration	increasing 35:22	interface 128:22	152:14
123:18 124:17	100:10	36:2,7 37:11,21	129:8,17	IPR 7:10 8:5
127:16 128:11	impact 128:4	38:3,8,18	130:13,14,16	IPR-2023-00900
138:20 142:2,6	implications	INDEX 3:1	131:15 132:1,5	1:5
143:11 144:4,8	121:13	indicate 163:9	132:8 173:7	IRAM 26:10
highlighted	implied 66:8,16	individual 68:8	interfacial 124:5	27:11
147:22 148:3	important	70:2 71:4,8	126:4 142:9	issue 126:11
holds 127:15	110:12,16	industrial 150:1	interlayer 49:6,8	156:17 157:14
horizontal 34:18	129:9 130:19	industry 21:7	52:7,10 53:13	178:16,21
137:1 138:4,6,8	173:5	41:22 132:16	54:15	issued 40:12
138:14 139:4	improve 61:12	inevitably 121:7	intermediate	issues 129:15
139:18 140:5,8	61:16,20 62:4,9	inform 141:11	68:7	150:13 152:12
horizontally	62:16 63:4	inside 168:6,17	International	162:21 177:12
137:19	144:4	169:4	3:15 44:17,22	ITRS 44:22 45:9
hour 11:11 46:17	improved 63:7,8	instance 1:13	151:9	
82:11	63:13	institution 7:12	interpret 56:6	J
hourly 11:7,10	improves 60:3	7:13 8:5 14:19	158:1	Jack 1:10,13 5:2
HP90 45:20	143:18	14:22 16:3	interpretation	6:1,10 183:10
HT 125:20	improving 60:6	57:21 58:13	13:19 19:13,15	184:1,4 185:1,4
hurt 149:8	in-house 10:13	88:17,21 91:18	19:18,21 56:14	186:5 187:9
hypothetical	inappropriate	134:7,11,16	59:3 158:19	Jan 5:18
101:15	13:11,13	136:4,20	159:18 161:5	jkappos@omm...
	inch 32:4,5 35:7	148:12 163:15	180:18 182:3	2:11
I	35:7	166:22 176:13	interpretations	John 2:4 5:13
i.e 12:10,19 17:3	include 21:12	instructions	55:12 69:16	10:7 51:11 87:2
40:7 49:4 51:5	25:15 27:8	136:3	180:5 181:17	97:8 173:19
52:5 65:14 68:8	149:2 161:14	insulated 81:5	182:21	184:7
70:3,4,20 71:14	171:10	insulating 49:6,9	interpreted	joined 5:18
71:15	includes 21:3,14	49:12 52:2,7,10	157:5	journal 151:7,19
IC 143:20	26:12	53:13 148:1	intrinsic 13:18	journals 151:2,4
Idaho 155:4	including 25:15	insulator 52:7	67:12 83:20,20	151:11

K	know 22:10,14 22:17 24:21 32:4,5,5 63:6 67:8 70:14 74:20 82:19 90:4 95:19 97:22 101:14 101:15 103:13 104:20 105:16 106:1,2,8,14 108:15 113:5 118:21 132:13 133:4 135:16 140:15 142:13 158:3,12 159:1 159:8 160:17 169:6 170:1,13 173:10 175:15	140:5 142:4,5 177:1,10 law 1:16 10:1 28:4 41:13,13 69:11 lawyer 10:14 51:12 69:15 70:10 91:13 layer 12:11,20 13:7,10,20 14:10,12,15 15:5,5,7,16,18 15:21,22 16:1,8 16:16,17 17:4 17:14 18:7 19:4 20:1 30:17,22 32:14 33:5 35:19,19 36:13 48:4,5,9,10 49:5,6,9,12,12 49:15,16 50:5 50:11,16 51:1,6 51:9 52:2,6,7 52:10 53:2,3,8 53:9,13,17 54:11,12,13,14 54:15,16,16,17 54:20 55:1,1,13 55:22 56:6,10 56:11,16,17 57:15,20,22 58:3,7,15,17,20 58:22 59:4,9,10 64:7 72:10 80:9 80:12 85:15 86:13,14 87:15 88:9,11,19 89:7 89:14,22 90:3,8 90:10,13,16,22 91:7,8,17 92:2 102:1 110:18 111:1 112:4,14 112:14,22 115:6 117:2,8 122:22 123:1,6 123:6,11,14 124:10,20,22	125:3 129:4,5 131:9 134:18 135:2,3,5 136:10 141:22 143:17,20 144:1 147:17 148:1,2,16,16 156:17,21 157:3,6,12,21 158:2,7,20 159:4,7,11,20 160:2,8,12,12 160:18,21 161:2,11,15 162:9,15 163:17 164:5 164:14 167:3,4 167:18,20 168:6,9,15,20 169:5,7,22 170:4 176:14 176:15 178:8 178:18 179:1,5 179:14,22 180:1,6,10,17 181:2 182:15 layers 30:3 51:2 51:16,19 52:1 53:14,15,19,19 55:3,5,17,17,19 56:1 101:22 111:9,16 115:21 116:20 123:19 129:1 129:10 130:10 132:7 143:3 148:5,21 157:2 158:14 leading 126:14 145:21 leaves 113:18 Lee 1:10,13 5:2 6:1,6,10 18:18 18:21 19:8,11 19:16 47:12,15 49:22 51:21 54:5 55:6,18	56:9 59:13,17 59:20 60:2,11 60:20 61:3,9,11 61:18 62:3,11 62:12,13,15 63:6,15 64:2,12 67:19 73:9 74:9 74:11 75:3,10 77:6,13 80:21 95:22 99:2,5 100:1,2,19 102:21 105:16 105:18 106:9 114:11 115:2 140:1,20 143:6 143:12 144:7 147:5,18,21 148:10,15 149:3 153:16 162:3 171:11 179:22 180:7 180:11,17 181:9,13,18,22 182:4,11,19,22 183:11 184:1,4 185:1,4 186:5 187:9 Lee's 52:11 73:17 73:21 76:15 93:3,17,20 94:9 98:22 99:14 100:9,22 103:1 141:13 148:6 148:21 left 42:18 43:2 120:8 legal 5:19 69:9,16 legally 51:12 let's 12:4 16:9 18:1,16 29:3 36:22 43:1 65:2 73:8 74:21 77:2 83:4 85:9 94:3 100:4 114:3 letters 151:6,6,11 level 64:5 75:11 75:11,16,16
L	known 42:5 75:21 120:21 126:10,11,19 131:17 132:1 knows 170:3			
Kappos 2:4 3:3,5 5:13,13 8:21 10:7 24:2,8 28:2 32:1 34:3 34:15 36:4 37:17 46:19 50:17 51:10 52:14 56:19 61:6,14 62:18 65:21 69:14 70:22 78:1 81:14 82:17 86:16 87:1,17 87:22 88:13 89:3 90:11 91:3 94:18 97:2,7 99:11 101:7 105:10 107:16 108:22 110:11 110:19 112:2 114:20 115:1 118:21 119:6 153:12,21 154:16 155:12 156:8,18 157:18 158:16 161:12 162:17 164:17 165:1 168:1,11 169:8 170:10,18 171:13 173:18 174:8,17 176:2 176:8 177:4,20 178:3 179:8 180:13,22 181:11 183:7 183:13,15 184:7 keep 46:18 79:8 Key 45:10 kind 66:3 kinds 27:3 knew 154:13,21 157:13 163:20 164:8,8,9,13 165:3,8 170:7	lab 22:14 label 79:13 labeled 35:6 45:9 54:14 156:4 laminated 16:20 18:4 172:10 laminating 16:11 17:8,11,19 18:10,10 55:7 landing 110:18 110:20 116:17 119:19 120:21 language 15:2 60:17 68:1 69:13 large 113:6,18 140:14 larger 116:19 117:7 120:4,10 120:15 121:5,6 138:5 139:20			

76:9,9 96:8,8 96:17 98:10,10 123:21,22 146:3 levels 60:9 64:5 74:2 likewise 69:21 limitation 16:13 17:9,20 18:5,19 18:22 49:13 50:11,16 52:12 52:18,20 56:9 77:1 157:16 167:12 180:11 181:10,18 182:1,11 limitations 19:9 166:20 limited 123:11 limits 88:10,22 line 48:22 68:3 72:7 74:9 78:9 78:9 79:2 80:11 80:11 85:20 102:8 109:21 136:9,9 143:14 168:5 187:11 Lines 59:17 64:13 list 11:21 22:8 23:13,14 25:22 27:4,6,13 listed 153:3 lists 11:17 literature 118:3 118:11 Lithography-r... 45:10 little 46:17 82:10 LLC 1:4 187:1 LLP 2:15 load 46:11 logic 41:16 128:10 long 6:22 138:9 look 12:5 18:16 22:1 23:9 25:2	29:3 30:13 39:10 42:16,18 43:1,2,22 45:4 59:14,20,21 60:10 62:12,14 63:19 64:12 65:1,2,9 67:12 68:3 73:4,8 74:10 75:17 77:2 78:17 80:9 84:20 104:1 107:12 109:21 127:10 136:8 155:15 161:4 172:22 180:14 looked 23:13,18 154:4 looking 54:2,3 67:14,18 75:9 75:13 80:18 112:16 125:16 looks 111:2 140:4 lot 31:12 38:13 84:3 99:1 144:10 153:10 low 120:6 126:5 lower 35:19 78:16 123:19 124:14 LT 126:5 lunch 82:14,15 82:22 114:13 M M 1:21 186:1 187:2 M-O-O-R-E 41:13 M-O-S-F-E-T 41:10 machine 1:15 maintained 120:5,11 major 78:10 111:10 141:18 making 64:18 98:2	mandatory 126:7 manner 178:19 manufacture 121:14 132:14 manufacturing 110:9 152:21 mark 79:8 81:12 117:15,16,18 117:19 118:20 marked 20:3 28:17 29:5 38:22 42:8,9 44:14,15 47:13 77:18,19 79:12 81:8,10 94:12 94:14 119:7,9 122:11,13 130:1,2 markings 7:17 8:1,7 marks 47:9 83:10 Master 22:13 material 36:18 36:21 128:1,5 materials 11:17 11:22 133:14 133:21 matrix 95:16 matter 11:7 19:12 41:20 168:6,7 180:18 185:6 McCarty 2:21 5:11 mean 23:2 26:17 30:1,5 32:16,20 33:3,5,13 36:2 37:18 51:13 62:20 67:16 70:21 86:17 87:10,18 88:1 103:6,13 108:8 110:20 112:13 113:11 160:10 164:5,9,9 168:3 168:22 172:16 173:10 174:9	174:21 175:15 175:18 176:3,5 meaning 67:1,9 80:5 83:21 95:18 135:2,18 135:21 160:11 163:2,3 means 65:19 71:2 71:11,15,17 72:3 76:11 78:7 78:9 127:19 136:7,10 143:17 160:2 165:4,6,6,7,7,9 169:3,10 171:9 meant 71:14 158:15 162:15 163:21 164:15 164:21 170:8 measured 34:16 Media 47:10 83:11 meet 17:13 18:5 19:8 52:17,20 53:16 166:19 167:11 181:13 meeting 76:22 151:9 member 143:16 143:17 152:7,9 members 110:1,4 memories 74:2 146:22 memory 3:12 20:15,18,21 21:3,4,13,13,14 21:18,18,21,22 22:4,19,20 23:2 23:3,7,22 24:7 24:13 25:1,16 25:21,21 26:1,6 26:9,11,12,13 26:15,18,19 27:7,8,9,10,11 27:12,20 32:15 32:18,19,21,22 33:2,4,6,10,12	33:14,16,18 36:3,8 37:16,22 38:4 40:7,8,12 40:15,18 41:1 41:16 42:2,6,11 44:3 48:19 49:4 50:10,15 51:5,8 51:15,18,22 52:5 53:12,16 60:14,18 61:5 61:12,16,19 62:4,9 63:7 64:3,7,9,18 65:8,15 75:11 75:21 76:3,8 77:7 80:22 87:10 89:10,11 89:12 95:10,13 95:17 96:1,1,14 96:16 99:15 100:11 102:6 102:22 103:2 103:17 105:8 105:11,14,18 105:21 106:9 106:17 107:7,8 107:18,20 109:7,8 121:4,9 128:10,10 133:2,10,10 142:6 144:3 146:4,6,8,8,11 148:2,6,6,9,21 149:3,11,18,19 149:22 150:2,3 150:10,11,11 150:16,22 151:21 152:4 152:11,17,22 153:9,11,18 154:15 155:10 173:3,12 175:4 175:5,6,19,20 176:6,7,18 177:18 mention 25:11 55:9 99:21
---	---	--	---	--

138:2 155:10 161:4 163:7 182:5 mentioned 13:16 16:18 19:10 23:6 27:8 35:9 84:4 97:6,9 121:16 131:2 131:21 133:9 136:6 141:2,17 143:2,13 145:6 155:2 157:19 158:17 161:13 message 82:22 met 157:16 metal 68:6 78:18 78:20 112:4 metals 95:5 method 16:12 17:8,11,12,19 18:4 55:2,6,7,8 56:2,7 57:4,8 58:21 59:5,10 60:5,22 61:2,20 63:2,3 64:17 65:7 73:22 90:19,20 91:8 91:10 92:1 111:12,14 115:7,9 116:1,2 116:22 117:13 117:22 120:17 121:18 123:1 123:10 125:1 126:1,22 128:12,14 129:4 132:14 133:3,4,11 141:13,14,20 142:3,10,11,11 142:17,20,21 143:5,12,15,22 144:8 157:2,6 157:21 158:2 161:22 162:1,5 162:6 165:15 166:1 170:15	171:1,6,7,9,10 171:16,18 172:9,10,11 174:13 180:7,8 182:17 methods 16:20 16:22 18:10 57:2 91:13 92:4 106:10 116:1,4 116:11,13,16 116:19,21 117:3,4,9 120:2 123:7 125:4 126:15,16 128:6 141:18 156:22 162:10 162:10 170:21 171:5 181:3 micro-patterni... 40:5 Micron 1:3,3,4 5:14,19 11:2 165:13 185:3 186:4 187:8 Micron's 10:13 microprocessors 133:1 microstructure 123:8 128:2 173:6 177:6 midway 39:12 mind 155:13,14 160:1 minor 173:4 minutes 141:6 miraculously 154:13 misaligned 111:20 112:13 misalignment 111:15,21 112:10,21 113:6,15,18,21 120:13 mischaracterizes 145:13 mistakes 9:16,18	20:11 mobility 127:14 127:15,17,18 modification 96:19 98:7 modified 101:5 101:11,19 modify 93:3,11 93:15,17 94:8 98:15,21 101:11 102:14 102:19 modifying 100:21 144:7 moment 119:16 122:15 141:2 monocrystalline 141:4 143:1 monolithic 60:3 60:7,19,21 61:5 171:12 monolithically 63:1 Moore's 41:13 morning 6:6,7 7:3 138:1 147:3 149:9,16 MOS 27:3 MOSFET 27:2 41:9 72:10 MOSFETs 72:12 motivation 102:20 144:7 move 28:9 49:19 Myers 1:17 2:6 5:17 10:2 185:1 N n 2:1 72:6,7,7,20 72:20,20 79:16 79:16 84:16,16 85:3,3,3,11,11 85:11,11,11,19 85:19,19 94:21 94:21,22 96:14 96:16 99:16,16 100:15,15	102:2,2,3,3,3,3 102:4 139:7,8 140:11,12,15 140:16 N-A-N-D 23:14 24:16 name 6:9 10:10 10:20 41:19 186:5 187:9 NAND 20:15,18 20:20 21:5,14 22:8,15,21 23:3 23:8,11,14,22 24:6,13,16,18 24:19 25:1,12 25:21 26:2,11 27:13,20,22 28:15 92:20 93:4,13,17 94:10,16 95:12 96:5 97:5,14 98:16 101:5,12 101:20 102:15 102:19 103:3 103:16 104:11 104:22 105:13 105:22 106:13 107:5,14,18 108:2,6,6,11,20 109:1,6,13 133:5,9 149:12 149:17,22 150:2,2 151:21 152:6,6,12,16 152:17 155:9 171:7 173:12 175:18 176:6 177:18 nanocrystal 104:16 106:19 145:16 146:12 146:13,21 nanometer 46:10 130:20 139:12 139:13 nanometers 45:15 46:3	139:5,15 narrow 138:14 natural 69:13 nature 117:8 necessarily 24:3 36:5 38:1 necessary 27:16 27:21 need 6:21 43:21 67:12 79:14 97:12 101:16 101:21 105:12 148:8 158:12 159:1 178:16 179:6 needed 108:5,11 needs 67:5 97:10 157:8 neither 184:16 never 61:11,18 62:3,11,13,20 63:17 66:10 82:18 new 165:13,21 no-no 112:8 node 45:18 138:16 139:3 non-monolithic 60:14,18 61:1 61:12,16,19 62:4,9,16 63:7 63:12 non-monolithic... 63:1 non-SOI 164:4 non-volatile 20:21 21:4,13 21:14,22 22:4 22:19,20 23:2,7 25:21 26:10,13 26:19 27:9,11 40:7 77:7 80:21 89:12 95:10 96:1 150:11,16 152:11,17,21 153:18 173:12 175:4
---	---	--	---	--

nonfunctional 113:15	88:13 89:3 90:11 91:3	157:17 163:10 163:12,18	79:20 80:4,18 81:7,17,21 82:2	52:11,19 53:7 54:19 55:16,20
nonvolatile 64:3	94:18 97:2,7	165:10,13,20	82:3,6,9 83:17	56:15,20 58:5
64:18 65:8	99:11 101:7	offered 9:9 115:5	84:8,10,13 85:5	58:18 65:18,22
149:22 150:22	105:10 107:16	166:11	86:10 87:13,14	66:8 68:10 72:3
151:21 152:4	108:22 110:11	offering 18:17	88:6,18 89:16	77:11 79:15
153:9,11	110:19 112:2	office 1:1 185:7	90:6 92:5,12,15	81:3 88:14 90:6
154:14 155:10	118:20,22	185:15	92:17,22 93:9	93:9 94:6 96:6
North 2:7 185:2	122:16 130:6	officer 184:5	93:20 94:3,13	135:20 137:8
notary 184:3,12	153:21 154:16	offices 1:16	95:2,6,14 96:6	137:12 142:22
186:22	155:12 156:8	Oh 10:16 28:7	96:12,21 97:3	158:14 159:2
noted 119:1	156:18 157:18	54:6 75:7 104:8	98:12 99:18	160:1,7 163:10
148:11 186:11	158:16 161:12	132:17	100:4 101:17	163:12 164:11
notes 7:17 8:1,7	162:17 164:17	okay 6:14,21	105:5,16,19	164:20 165:10
noticing 185:12	165:1 168:1,11	7:14 8:10,14,18	107:7 109:20	166:12 171:15
noting 185:12	169:8 170:10	9:12,20 10:12	110:13,17	171:21 172:20
November	170:18 171:13	10:19 11:4,5,17	111:6,7,15	179:21 181:21
134:12	173:18 174:8	11:21 12:18	112:9 113:13	opinions 9:9,21
number 3:9 4:2	174:17 176:2,8	13:3,15 14:1,6	113:14 114:3	11:18 12:1 25:7
22:13 31:10	177:4,20	14:8,17 17:7,18	114:18,20	165:13,21
32:19 99:3	180:13,22	20:7,10,14 22:5	116:5,11 122:9	option 185:9,10
119:5 140:18	181:11	24:4,11 26:16	124:2 129:1	oral 1:10,12
149:10 153:4	objecting 119:11	27:19 28:16	135:6 146:2,4	184:1,5
178:5	objection 28:2	29:19 30:9,15	148:1,7 153:12	order 97:12 98:2
numbered 1:14	87:1 118:7,22	30:19 33:1,20	154:21 155:14	108:5 130:20
45:5	121:22 125:9	34:9 35:1,22	156:14 161:8	ordinary 15:15
numbers 42:4	126:13 127:6	36:15 37:13	162:12 164:9	17:15 25:19
75:5	128:18 130:5	39:9,10 40:1,15	166:14 171:15	26:7 38:15
numerals 29:16	132:10,18	42:1,16 43:1	175:14 176:21	55:21 56:21
numerous 151:10	133:7 134:2,9	44:16 45:4,7,13	177:17,22	57:18 61:8
NW 1:21 186:1	136:1 137:9,13	46:4,12,16 47:1	179:12 181:5,7	62:21 67:1,8,11
187:2	138:22 141:9	47:3,21 48:2,11	182:6,7 183:5	69:18 70:7,15
	141:15 143:7	48:14,21 49:3	Once 98:20	70:19 71:16,21
O	145:12,20	49:18 50:6,9	ones 60:19	72:18 80:6 86:7
O'Melveny 1:16	147:19	51:17 53:7,14	open 111:17	91:5 92:18 93:2
2:6 5:17 10:2	observed 132:4	54:18 55:3,16	112:1,10,11	93:10 94:7 95:8
185:1	obvious 16:12	56:12 57:11	113:8,19	96:3 98:14
object 24:2,8	17:2 18:11,18	58:15 59:6,12	operate 113:10	100:20 102:13
32:1 34:3,15	92:19 93:3,11	59:20 60:10	113:10	102:18 104:21
36:4 37:17	94:8 98:15	64:16 65:9,13	opine 27:20	105:3,19 106:1
49:18 50:17	178:18 179:14	66:7,14,22	98:12	106:7,11 108:3
51:10 52:14	182:20	67:14,20 69:7	opining 16:10	122:21 136:12
56:19 61:6,14	obviously 126:16	70:1 71:3,13	opinion 14:8 17:7	148:20 161:20
62:18 65:21	134:12	72:2 73:1,10,15	17:19 18:4,17	162:8 163:4
69:14 70:22	obviousness	74:18 75:3,7,8	18:21 40:11	164:7 165:14
78:1 81:14	27:20	75:17 76:4,8	49:11 50:9,14	165:21 170:2
86:16 87:17,22	offer 25:7 157:11	77:11,16 78:16	51:4,7,17,21	170:19 182:18

organizer 151:15	P	92:8,16,16 95:2	156:1,12	39:1 47:13
organizing	p 2:1,1 72:6,7,20	100:8 117:6	162:19 163:7,9	54:21 56:1,5,13
151:15	72:20 84:16	120:7 130:9,9	165:5	59:2,7 62:12
oriented 64:8	85:3,3,10,11,11	134:16,21	Paragraphs 25:5	63:15 66:1,10
77:8 78:3,5	85:11,11,11,19	135:10 136:19	25:10 144:13	67:5,6,15,19
80:22 107:8,22	85:19 94:21,21	136:20 144:14	parallel 75:12,15	68:14 73:3
original 184:6	99:16 139:7	145:8 146:15	76:3,9,13 95:15	74:16 78:6,8
185:11	140:11,16	147:22 148:12	106:12	79:21 84:15
outcome 184:18	p- 79:16 100:15	155:20,21	pardon 153:22	86:5 88:16 89:4
outside 36:13	102:2,3,4	159:13,15	parenthesis	90:9,12 91:16
104:13 118:7,8	P-A-T-U-D-E	160:10 168:12	70:12	100:2 117:1,3
118:9 119:13	122:6	178:13 180:15	part 32:19,21	120:22 131:18
121:22 122:1	P-I-L-L-A-R	184:13 185:12	33:10,12,15	135:22 137:4
122:18 125:9	86:2	186:4 187:11	78:18 86:14,17	137:21 138:1
127:6 128:18	P-O-S-I-T-A	pages 26:4	88:4	138:18 140:1,2
130:8 132:10	49:7	145:10 147:7	participating	147:4 150:13
132:18 133:7	P-R-O-M 64:6	150:8,9 186:7	10:16	156:20 157:5
134:2,9 136:1	p.m 1:15 114:8,8	paper 4:13 22:3	particular 41:16	157:22 158:6
137:9,13	183:16	23:1,19,21	41:16 45:3 46:9	160:19 161:3,4
138:22 141:9	packaged 60:13	24:18 42:10	46:21 61:9	164:8 166:18
141:15 143:7	pad 110:21 111:4	43:20 46:21	63:11 67:2 73:5	170:3,12,20
147:19 167:20	112:5 116:15	130:3,17	130:17 149:12	180:3,18,19
168:7,9,18	116:18 119:19	131:19 134:7	particularly	181:17,21
169:5	120:3,4,16,21	153:2,10	123:19	182:3,21
overall 40:22	121:6 177:10	papers 22:7,18	parties 134:22	patents 28:5
87:21 142:7	pads 33:18	23:10,20 24:6	135:13 137:15	32:12 154:5
164:6	110:18 111:17	24:12,14,17	159:3 167:14	Patric 2:5 5:15
owner 1:7,13	111:22 116:18	31:14 43:22	167:17 168:4	10:7,12
2:14 5:10 19:13	120:9 172:14	152:3	169:2 184:8,17	Patude 4:11
19:15,18,21	177:1	paragraph 11:5	parts 78:16	122:6,14,14
56:6 59:2,7	page 3:9 4:2 9:1	11:16,17 12:5,9	party 184:11,15	125:15 126:9
157:5 160:19	9:1 11:4 12:4	12:15 15:1	pass 114:19	pause 129:19
161:3,5 180:19	12:14 13:16	16:11,19 18:16	153:12	pay 130:15
181:17 182:3	14:2,22 15:1,2	25:13 26:3,17	passage 60:1,11	peeling 131:10
182:22	16:3,9 18:1,13	26:22 27:18	61:3,9 63:10,12	pen 77:21 81:13
owner's 12:9,19	19:11 25:3 32:8	39:11 48:14	64:14,16 67:15	pending 7:1 77:1
17:3 18:9 56:13	39:10 42:16,18	50:2,3 52:16	68:11,13,17	percent 127:11
181:22	43:2 45:4,5	53:5 59:15,16	70:2 73:5	perfectly 101:8
owners 157:22	47:22 48:12,22	62:6,8 63:20,22	passing 33:17	perform 173:2
158:6	48:22 51:4	65:10,11 72:19	patent 1:1,6,7,13	173:11,11,14
oxide 28:10,11,14	55:10 59:2,14	73:16 75:18	2:14 5:10 7:9	173:20 174:3,6
37:8 95:4 96:7	63:11,19,22	76:6,21 77:2,5	7:15 12:9,19	174:14,15,16
96:13 98:10	64:1,1 65:10	80:10,10,19,20	16:14 17:2,17	175:3,6,12,16
124:5 126:4	73:13,20,21	92:12,16,17	17:21 18:8,19	175:17,19,22
129:17 130:14	74:14,19,22	93:1,21 94:5	18:22 19:8,12	176:6,17
130:16,16	75:2,3,4 80:19	98:18 99:4,13	19:13,15,18,21	177:15
131:3,3 139:11	84:9,15,19 92:6	102:17 144:19	28:18 31:11	performance

128:12 142:14 173:21 performance-... 176:20 performed 128:8 143:16 period 185:13 peripheral 107:3 permit 124:19 perpendicular 78:10 person 10:16 15:14 17:15 26:7 38:15 55:20 61:7 62:20 69:18 70:7,15,19 71:16,21 72:17 80:6 86:7 91:5 92:18 93:1,10 94:6 95:7,8 96:3 98:13 100:19 102:13 102:18 104:21 105:3,19 106:1 106:7,11 108:3 122:20 136:12 161:20 162:7 163:4 164:6 165:14,21 170:1,19 182:18 pertained 155:9 Peter 2:21 petition 178:16 petitioner 13:17 14:3 148:13,19 157:19 159:16 160:11 petitioners 1:5 2:3 5:14 petitions 162:22 PhD 22:12 phone 5:15 photolithograp... 117:14 photolithograp...	117:11,20 phrase 15:14 Physics 151:6,7 piece 87:20 88:2 pieces 29:4,7,11 pillar 3:19 65:18 66:1,9,12,17 67:2,4,7,9,13 68:9,11,15,17 68:20 69:4,6,20 69:21 70:3,4,8 70:13,17 71:5,8 71:12,18,20 72:3,12,21 73:6 74:2 77:8,12,14 77:22 78:14,14 78:15,15 81:1,4 81:5 84:10,12 84:13,17,22 85:4,8,13,21 86:1,8 93:3,17 93:20 94:8 96:2 96:15 98:22 99:1,5,7,14,15 99:17,21 100:2 100:11,16,19 100:22 101:2 135:8,18,21 136:5,6,8,11 137:3,20 138:2 138:15 145:6 146:9 163:21 164:2,4,14 pillar-form 65:14 pillar,' 137:17 pillars 3:22 78:2 79:13,16,19 83:20 85:5 102:6 135:15 145:6,19 163:17 pitch 46:2 place 68:2 places 94:2 108:19 165:3 plain 67:1,8 163:2,3	planar 29:21 30:2,3 31:6 109:22 110:4 143:16,16 planarized 49:5,8 52:6,10 53:13 plane 30:4,6 plate 30:7,8 31:1 plates 29:22 play 28:7 please 5:5 6:8 34:10 39:15,17 50:13 87:4 145:9 155:6 160:4 165:19 171:20 178:11 183:15 185:6 185:10,11,14 plurality 60:9 64:4,8 point 20:17 22:2 24:11 67:16 84:5,6,9,11,15 84:17 85:3,18 89:5 93:21 99:4 99:9 100:18 147:15 155:17 156:3 165:2 169:14 174:4,4 pointed 84:19 129:12 points 72:6 poly 124:13 polycrystalline 124:12 125:5 127:3,18,19 128:1,6 141:5 portion 80:13 127:20 136:15 138:10 POSITA 49:6 52:8 position 16:6 positioned 14:15 15:8,19 16:1 58:3 90:3,16 positions 151:19	151:19 positive 127:15 possible 113:14 possibly 103:11 103:12 post 127:18 practical 121:2 126:21 127:4 prefer 8:11 preference 61:4 61:10 preferred 64:19 127:9 preinbold@om... 2:12 prepare 153:19 154:1 prepared 156:14 preparing 10:2 11:2,18 present 2:20 64:20 68:4 89:9 100:12 presented 162:21 presumably 23:21 pretty 103:17 preview 152:17 previous 20:15 20:18 131:1 previously 20:3 28:17 38:22 47:12 80:15 136:16 138:12 160:15 principle 69:11 prior 9:13 140:19 157:16 158:9 166:18,19 167:10,11 171:4 178:17 179:13 probably 152:2 177:7 problem 54:7 Procedure 185:14	proceeding 163:12 184:17 proceedings 42:19 183:16 process 88:11 89:1 90:9 91:1 110:9 115:13 117:14 126:7 138:16 processed 125:19 129:6 processes 25:17 processing 110:16 123:12 123:13 124:19 125:14 produce 174:2 produced 1:13 119:21,22 product 45:11 121:4 132:15 products 1:4 119:20,21 121:18,19 128:16,17 131:15,16 132:6 Professor 115:2 178:4 program 103:8 105:13,14 106:3 107:13 107:14 151:14 151:14 programmable 27:12 programming 104:22 progressing 40:8 40:21 proper 119:13 122:1,18 130:8 132:19 133:8 139:1 141:10 141:16 143:8 147:20 proportion 32:6
--	--	--	--	---

34:1,5,13 35:4 35:14,16,18,20 proportionally 37:21 propose 58:11 proposed 163:11 prospective 114:15 protrusion 30:16 protrusions 30:20 prove 158:8 provide 135:14 137:16 151:13 159:5 162:15 169:4,10,21 170:4,8 178:6 provided 16:4 17:14 19:4 122:6 157:10 175:8 providing 133:22 159:6 164:10 provisions 1:18 PTAB 7:11 57:21 134:17 135:7 136:4 158:4,4 158:13 159:2,3 167:13,16 168:14,22 public 184:3,12 publication 39:2 153:3 publications 149:14 150:10 published 21:22 22:16 131:20 purchased 185:8 purpose 149:7 purposes 178:15 pursuant 1:18 184:9 put 26:6 70:12 88:5 105:16 111:8 129:4 177:5	Q qualification 154:7 qualifications 25:7 149:11 qualified 58:21 149:17 quality 129:8 130:21 132:1 142:9 172:15 177:2,11 question 6:22 31:15 34:8 38:17 57:12 61:22 62:2 63:5 66:15 76:4 83:19 87:3 101:15 119:12 137:8 165:18 171:19 179:18 questions 60:1 98:5 114:14,15 114:21 115:9 122:17 130:7 140:19 144:11 149:10 153:13 166:5 178:1,6 179:9 183:6 185:14 186:10 186:13 quick 114:3 quite 82:19 116:3 quote 40:3 59:16 quoted 61:4 63:11 99:20 155:20 quoting 39:13	rate 11:7,10,12 ratio 32:13 ratios 32:10 read 12:13 13:1 14:17 15:12 23:20 40:9 43:20 60:15 62:6 63:14 64:10 74:4 76:20 77:9 91:14 93:6,7 98:17 103:8 104:10 105:7 105:11 106:3 107:3,13,14 108:11 136:21 161:1 170:11 171:3 178:11 186:6 read-only 27:12 reading 14:2 26:8 45:16,21 45:22 48:6 55:22 58:11 61:8 63:10 69:19 70:16 71:21 75:6 76:6 100:20 164:7 170:2,20 171:2 reads 70:2 89:21 ready 82:11 185:6 real 38:8,19 reality 140:6 realizations 41:5 realize 143:4 really 83:14 148:8 reason 7:2 28:13 43:16 123:16 127:8 140:10 148:4 149:2 reasons 184:14 recall 22:15 24:5 42:4,15 44:21 45:2 54:18 62:19 63:9	115:2,9,17 134:17 135:6 140:21 147:2 165:17 166:3 178:9 receipt 184:12 received 152:20 153:2,4 Recess 47:7 83:8 114:8 recites 88:3 reconfigured 23:8 record 1:19 5:6 13:18 47:6,9 83:7,10 114:6 114:10 118:18 159:17 183:11 184:6 recorded 186:10 186:14 rectangle 31:17 35:5 redirect 119:14 122:2,18 125:10 127:7 130:8 132:11 132:19 133:8 134:3,10 136:2 137:10,14 139:1 141:10 141:16 143:8 147:20 reduce 42:6 reducing 36:12 41:22 reduction 40:6 43:6,9 reductions 41:1 redundant 15:14 refer 28:19 39:2 53:22 73:16 75:20 80:12 126:10 147:16 166:12 referee 151:1,19 reference 4:9,11	12:9,18 29:16 31:11 99:18 118:16 119:16 122:15,19 123:16 124:9 125:15 126:8 129:18 131:1 140:19,20 147:7,12 156:2 156:12 166:14 referenced 94:4 185:6 references 44:10 122:5 134:5 175:8 183:2 referencing 14:21 30:15 referred 10:12 16:21 17:11 53:15 55:4,8 119:16 122:15 134:15 144:13 referring 10:13 50:18 116:7 118:12 129:20 130:4 145:14 145:18 151:20 155:19 178:22 refers 80:2 145:1 regarding 99:19 region 96:14,16 140:16,16,16 regions 68:7 Registration 184:22 Reif 4:13 129:18 130:3 131:20 Reinbold 2:5 5:15 10:18 relate 152:10 153:9 related 21:21 22:19 28:5 150:20,21,22 153:11 162:9 180:16 184:16 relates 89:22
	R R 2:1,15 rail 148:14 raise 5:21 raised 76:9 RAM 26:2 random 89:10,11 rapidly 40:8,13 40:16,18			

relatively 80:13	25:14 149:13	179:2 180:20	41:11 43:12	132:7 136:21
reliability 131:12	149:21 151:10	181:20 182:15	44:8	137:5 145:1
142:14 173:21	153:4,6,6	right-hand 81:20	schematic 72:15	146:1 166:18
relied 12:1	reserve 163:10	96:8	scope 88:22	171:5 176:10
rely 76:18,22	reside 6:11	Roadmap 3:16	118:8,9,9	seen 28:20 39:4
92:12 148:19	resistance 113:7	44:17 45:1	119:14 122:1,2	42:13 44:19,21
relying 76:15	113:8,21 120:5	rough 183:14	122:18 125:10	45:2 47:15
remember 84:1	120:19	roughness 129:9	127:7 128:19	select 102:11
133:17 144:16	resistivity 120:14	130:18,19	130:8 132:11	selected 185:10
147:9,13	resolution 157:14	row 45:16,17,22	132:19 133:8	semiconductor
remind 179:3	resolve 162:21	46:1	134:3,10 136:2	1:3 21:13,18,21
remove 95:4 96:7	resolved 116:16	Rule 184:9	137:10,14	25:16,16,20
96:13 98:9	157:8 178:16	rules 6:18 185:14	139:1 141:10	26:6,9,12,18
render 17:1	result 22:16 57:4	run 128:2	141:16 143:8	27:1,7 39:19
18:11	111:17 112:10		147:20 167:18	40:4,20 41:6,21
renders 16:12	113:15 123:5	S	168:3,13,16,17	64:9 65:15
18:18 178:17	129:11 141:21	S 2:1	168:18 169:1	78:12 80:14
179:13	167:8 173:16	satisfy 17:8,20	170:13,14	87:10,21 88:4
repeat 34:9 39:15	177:18,21	56:9	171:9	110:15 121:4
39:17 50:13	resulting 116:2	saying 31:3,20	search 63:15	123:8 125:2
87:3 159:15	128:9	35:3 38:10,12	searched 23:13	132:15 136:15
160:4 165:18	returned 184:12	41:4 44:6 50:22	second 15:1	138:11 142:16
171:19	184:13	52:22 53:18	33:16 53:22	146:13 152:20
replace 141:13	reversed 140:7	62:16 70:1,6	54:14 177:9	166:1,2 175:22
143:12	review 151:4	71:3 82:22	Secondly 142:3	Semiconductors
reported 1:15	185:8	93:16 112:3,20	section 16:15	3:16 44:18 45:1
reporter 5:7,21	reviewed 9:12	113:3 132:4	50:3 76:21	send 28:3,13
10:9 37:2,5	28:22 133:21	148:17 170:7	107:20 125:18	sent 20:6 28:6
66:3 85:22	reviewer 151:4	181:12 182:2	155:17 156:2,6	sentence 11:6
118:15 123:22	151:13 152:1	says 11:6 14:2	156:9 162:19	12:8,16 15:12
124:2 139:14	reviewing 152:15	15:2 43:8,12,15	sections 145:1,5	16:19 25:14
183:13 184:3	right 5:22 7:6	46:3 60:2,5,11	156:3	26:22 39:13
REPORTER'S	23:18 47:11	61:11 62:3,8,13	see 12:18 23:9	43:11,19,21
184:1	54:5,9 71:6	64:16 66:12	28:13 29:4,16	44:1 60:11
represent 23:12	75:8 76:1 78:3	68:3 72:8 74:8	30:12 39:21	65:17 68:19
represented 34:6	78:4,7 80:1	80:2,11 84:20	42:12,19,21	69:3,5,8,10,17
35:5	82:16 83:21	89:9 98:21	43:3,7,14 45:7	70:16 71:22
representing	86:12 90:21	107:9 109:21	45:13 48:16	80:20 92:22
5:14	94:10,21,22	120:8 125:18	49:1 54:13	93:7 98:19
requested 184:10	96:11 101:18	126:2 127:14	59:18 61:7	99:20 100:9,21
184:14	105:22 111:14	134:22 137:15	64:14 65:11	137:15 178:12
required 162:20	129:5 141:7,19	148:12 170:16	68:2 73:18 78:2	178:14 179:12
requires 57:15	161:16 163:10	178:15	78:13 84:11	separate 51:16
58:7 142:4	169:11 170:6	scale 31:12 32:3	92:10 94:20	89:14 96:13
164:12	170:16 172:18	32:10 35:10	98:8 104:4,8	separated 64:5
research 2:16	173:15,17	140:3	110:2,17,22	127:21
21:20 24:22	176:9 177:14	scaling 40:21	116:14 117:5	separately 14:13

15:6,17 54:20 55:5 57:15 58:1 58:7 60:13 90:1 90:14 123:2 129:6 160:14 sequence 55:8 sequential 12:11 12:21 13:7,21 16:21 17:4,12 55:14 56:7 57:3 58:16,20 59:4 60:22 63:3 90:20 91:9 92:3 111:13 115:8 116:1,12,21 117:4,22 119:22 121:19 123:10 124:11 124:18 125:4 126:1,16 127:2 128:7,14,17 131:16 132:9 141:13 142:10 142:20 157:6 158:2,7,21 159:20 160:21 161:15,22 162:5 170:15 170:22 171:6,8 171:17 172:1,2 172:11 174:12 180:7,8 181:4 182:16 sequentially 135:5 167:4 176:16 serial 93:4,13,18 94:9,10,16,22 96:20 97:5 98:15 101:5,20 103:3 108:6 series 75:15 76:12,12 95:18 96:4,20 98:11 102:7 105:21 106:13 107:11 108:1	serve 152:15 served 152:1 184:8 service 11:14 151:13 session 83:2 set 82:7 shape 35:11 65:19 66:8,11 66:21 sheet 75:7 84:19 85:3,15,17 185:11 186:11 187:6 short 21:7,10,11 21:12,17 83:2,4 124:21 151:17 shorthand 1:16 184:2 show 34:21 65:5 75:15 77:3 81:11 84:12,22 85:7 94:15 101:10 117:7 129:2 147:17 148:19 149:6 150:9 showed 172:6 showing 3:18,21 4:4 72:16 81:4 shown 31:8,19,21 38:14 50:20 51:15 74:3 84:16 93:22 95:1 99:2 102:1 109:22 116:16 116:22 124:8 129:2,12,16 131:4,6 150:6 172:7 184:8 shows 34:20 43:5 46:2 48:18 51:15,18 53:12 72:8,14 74:6 77:12 100:2 107:6 120:3 146:3,5,7,10,12	148:9 149:3 side 33:6 81:20 96:8 sign 185:7,8 signature 9:3 184:9,11,13 185:6,12 186:4 186:17 187:22 signed 133:16 134:13 185:11 significance 69:10 121:3 126:22 significant 121:12 128:4 signing 185:10 silicon 79:21 80:3 80:5 81:4 124:12,13 125:5 127:1,3,9 127:10,16,18 141:4,5,21 143:1,22 177:7 silly 25:22 similar 80:16 89:12 136:17 138:13 160:16 173:20 176:17 177:15,21 similarly 27:6 85:2,6,14 simply 94:20 95:4 96:4 98:9 106:12 107:6 149:3 167:9 Sincerely 185:18 single 24:5 127:11,21 143:22 single-crystal 80:13 123:8 124:16 125:2 127:1,9,12,13 127:16,20 128:5 136:14 138:10 141:21 177:1,8	singular 51:14 SiO 36:22 sir 7:19 8:3 18:15 63:21 81:2 86:11 109:19 119:15 144:10 sit 7:2 24:4 44:2 sitting 101:18 six 150:20 size 37:16 40:6 40:13,15,18 41:1,10,11,14 41:14,15,15,22 42:2,6 43:6,9 44:3,7 45:14 46:5,7,15 111:16,22 118:1 120:3 121:7,10 142:5 173:5 177:9 sizes 40:22 skill 15:15 17:15 25:19 26:7 38:16 55:21 56:22 57:18 61:8 62:21 67:11 69:18 70:7,16,20 71:16,21 72:18 80:6 86:7 91:5 92:19 93:2,10 94:7 95:8 96:3 98:14 100:20 102:13,18 104:21 105:3 105:19 106:2,7 106:11 108:3 122:21 136:12 148:20 161:21 162:8 163:5 164:7 165:14 165:22 170:2 170:19 182:18 skipped 155:13 155:14 slight 113:20 slows 128:3	small 127:20 smaller 35:11 46:14 140:8 177:10 so-called 37:7 41:9,11 57:1,3 127:22 156:21 SOI 3:18 72:12 77:8,12,14,22 79:21 80:2,9,12 81:1,4 123:4 135:8,15,21 136:5,8,10,11 137:17 138:15 146:9 163:17 163:21 164:2,4 164:14 165:6 sorry 39:16 40:2 48:6,21 51:11 54:6,6 87:2 97:8 106:22 114:7 132:20 172:1 173:19 178:14 182:9 sound 109:10 space 140:12 specific 25:11 66:16 90:13 106:16 specifically 10:5 22:3,9 23:10,21 24:6,12 25:5 28:10 62:8 65:3 94:4 99:14,21 100:18 153:8 163:8 167:14 specification 19:5 58:12 84:21 89:21 178:20 specifications 17:16,17 19:7 66:1 specified 26:20 91:16 specify 26:16 27:22 32:3
---	---	---	--	---

speed 141:22 142:1 143:11 144:2,3,8 spelled 88:15 89:5 square 31:7,16 35:5 SRAM 26:2,10 27:10 89:11 SRC 153:5 stack 66:2,4,13 66:19 67:7 68:1 68:8,12,15,16 68:18,21 69:4,5 69:20,22 70:2,4 70:9,13,18 71:4 71:8,12,19,19 72:3,20 73:6 77:15 78:4 79:4 79:17 82:8 83:21 85:1,7,16 85:18 86:9 101:22 102:1,5 130:11 136:7 136:13 138:9 138:19 148:1 148:14 175:5 stackable 12:11 12:20 13:7,9,20 14:9,12 15:5,16 15:20,22 16:8 16:16 17:4,14 18:6 19:3,22 48:3,9 49:4 50:11,15 51:1,2 51:5,8,16,18 52:1,5 53:2,8 53:15,17 54:11 54:19 55:1,4,13 55:19,22 56:6 56:10,16 57:14 57:19,22 58:6 58:17,22 59:4,9 64:7 72:10 86:13,14 87:14 88:9,10,19 89:7 89:13,22 90:7	90:13,22 91:7 91:17 92:2 115:5 117:2 122:10,22 130:10 132:7 134:18 135:2,3 143:3,17 148:15 156:16 156:21 157:1,3 157:5,12,21 158:1,7,13,20 159:4,7,11,19 160:1,8,12,18 160:20 161:2 161:11,14 162:9,14 163:17 164:5 164:14 165:15 167:2,18,19 168:6,8,15,19 169:5,7,22 170:3 176:14 178:7,18,22 179:5,14,21 180:1,6,10,16 181:2 182:15 stacking 55:2 56:2 57:2 61:1 61:20 63:2 90:19 91:7 92:1 111:12 115:7 116:1,10,16,19 117:3,9,13 119:20,21 120:2,16 121:18,18 123:1,7 125:1 126:15,22 128:6,12,16 129:3 131:15 131:21 132:6 132:14 133:3 133:10 141:13 141:17,20 142:3,9,19 143:5,12,15,21 144:8 156:22	157:2,20 158:20 162:1,5 162:10 166:1 170:22 171:6 171:10,16 172:1,9 174:12 stacks 137:1,18 standard 89:11 125:20 stands 44:22 79:21 start 39:13,18 40:2 107:17 131:10 starts 63:22 state 1:15 6:8 40:1 48:21 49:3 65:13 184:3 stated 1:18 16:18 26:21 160:9 180:15 181:16 statement 9:9 24:10 35:13 44:12 52:4 63:16 states 1:1 25:14 126:2 step 96:10 110:8 110:12,15 steps 97:10 98:9 stick 94:3 stop 46:17 80:17 storage 36:1 37:14 60:8 straightforward 105:3 straightforwar... 103:18 strand 102:6 Street 1:17,21 2:7 185:2 186:1 187:2 strength 131:6,7 strike 30:10,21 49:19 50:7 107:1 163:19 182:9	strong 131:8 strongly 14:7 88:16 structural 87:20 88:1 89:2 91:12 116:6 119:19 121:17 122:8 128:15 141:3 174:18 176:21 structurally 91:20 135:4 167:3 176:14 176:20 structure 14:13 15:16 23:8 38:7 38:11 45:10 56:1 57:1,2,5 57:10 58:1 66:2 66:2,11,12,13 66:15,16,19,21 67:2,4,7,13 68:1,15,16,20 68:21 69:4,4,6 69:6,20,20,21 69:22 70:9,13 70:14,17,18 71:12,12,19,20 71:20 72:4,16 72:20 73:6,7 77:15 78:4 79:19 83:21 85:1,7,16,18 86:9,15,18 87:8 87:11,16,21 88:3,4,10 89:13 90:14,19 91:6,9 91:22 92:2 93:3 93:4,17,21 94:9 96:5,15 98:22 99:2,5,8,16,17 99:22 100:2,3 100:16,19,22 102:20 103:2 104:22 107:19 108:2,3,6 111:11 115:7 116:2,12	124:10 125:2 128:13 136:7 136:14 138:8,9 138:14,20 149:22 156:20 160:13 167:8 171:12,17,22 172:7,15 176:4 176:6 177:2 structured 137:19 181:3 structures 68:8,9 68:11,12,18 70:3,3,4,5 71:4 71:5,8,9 79:17 101:2 111:12 115:15,22 137:1 149:18 152:18,21 157:3 172:13 172:19 175:22 students 22:12 22:13,18 study 166:17 subject 19:12 168:5,7 180:17 subsequent 129:1 subsequently 130:11 substances 23:19 substantially 78:10 substantive 42:17 substrate 12:12 12:22 13:8,22 14:14,16 15:6,8 15:17,19 16:2,7 17:5 55:15 58:2 58:4 74:2 78:11 80:16 89:15 90:2,4,15,17 123:21 124:1 127:10 136:18 138:13 148:10 158:22 159:21 160:14 182:17
--	---	---	---	--

sufficient 149:6	106:3 109:20	186:4 187:8	21:3 184:3	117:18 120:21
suitable 15:17	114:3 143:10	Telephone 2:5	185:2	121:5 125:13
58:2 90:15	taken 1:14	tell 7:7 31:9	TFT 64:6,18 65:5	126:19 128:2
Suite 1:21 2:8,16	184:17	51:12 69:15	65:8	131:9,18
185:2 186:1	takes 56:4	75:14 76:2	Thank 8:21 37:5	138:17 158:3
187:2	talk 23:11 92:18	91:13 116:5	47:4 86:11	159:13 160:2,5
sum 17:18	120:1 125:16	117:1 167:17	119:6	160:17 161:4,8
supplies 103:19	143:14 146:18	169:4 179:17	thermal 125:7,11	162:13,18
support 13:18	168:13	telling 14:4 89:20	126:11,18	163:5 164:15
24:9 53:1 55:11	talked 22:3 66:10	91:15	thickness 35:18	164:19,21
148:14 157:1	96:2 149:12,16	temperature	36:13 104:14	166:16 167:6
159:18 180:4	162:4	123:3,12	thin 80:13	181:8,15
supported 57:21	talking 67:21	124:14,17,19	thing 101:21	183:11 185:13
88:16,21	74:15 103:21	125:7,12,13,13	things 69:8 97:12	timeframe
supporting 72:21	104:3 109:4	125:17,20	109:15 139:8	122:22 139:19
86:4,7 89:17	111:3 125:22	126:5	154:6 155:11	times 125:13
105:6	139:3,6 143:19	ten 43:13 44:5,9	think 13:12	152:2
supports 58:13	147:9 150:7	139:15 152:3	27:15,21 42:2	title 23:16,17
suppose 105:20	174:10,11	tenths 139:13	52:15 57:11	24:1,15,16,20
sure 22:17 24:21	176:22	term 66:9,16	66:22 69:12	43:10
35:8 39:18 44:5	talks 156:20	70:20 78:9	82:15 95:19	today 9:14 24:4
62:13 63:16	task 166:17	79:20 80:6	109:17 115:12	44:2 114:12
81:16 82:5,7,17	167:7,21	86:14,20 87:14	129:19 144:12	115:3 116:9
84:6 87:12	tasks 167:1	88:22 115:5	147:11 149:12	133:12 135:16
100:7 108:8	taught 21:6,10,11	135:1,2,8,18,21	183:7	140:19 144:11
112:17 171:21	21:17 35:15	136:5 137:3,21	thinking 98:6	154:11 155:1,3
175:2	56:21 93:5,18	159:4 162:20	third 177:11	163:18 164:4
surface 30:22	149:20	163:17,21	Thirdly 142:8	179:20 183:14
78:11 129:9	teach 20:22 21:9	164:2,13 165:4	thought 93:11	Today's 5:3
130:18,19	149:13 150:1	168:15,17,19	94:8 97:15 98:4	told 101:14
swear 5:7	teaches 54:22	169:1,3,9	159:10 162:14	154:19
sworn 1:13 6:2	66:6 67:5,6	170:13,14	163:21 170:8	top 29:12,15
184:5	91:4 95:22	terms 19:22	three 21:9 26:4	45:17 48:21
	106:9 117:2,3	89:22 133:1	29:11 51:1,16	54:16 68:7 75:6
T	157:20	162:20 163:3,8	51:18 52:1	96:15 97:17
table 45:7,9,10	teaching 21:7,19	164:8,9,21	53:14,19,19	102:7 110:18
45:17 120:1,8	25:15 66:20	165:9 168:14	55:17 82:1	110:22 112:14
155:16,18	151:16	testified 6:2	134:5 141:18	112:21,22
tail 95:19,20	techniques 40:5	169:18 172:12	175:8	126:6 129:5
take 7:1 25:2	109:10	testify 7:3	three-dimensio...	130:11
26:4 39:9 42:16	technology 1:3,4	testifying 54:19	60:7 62:22 64:3	touch 112:4
47:1 59:13 62:7	3:15 25:12	testimony 145:13	time 5:4 11:7	tracing 103:15
63:19 64:12	27:21 28:1	149:17 153:16	40:12 43:19	tracking 160:22
65:1,9 73:8	39:20 40:4,21	153:20 154:2,2	47:6,10 82:18	TRADEMARK
74:10 76:19	44:17 45:1,18	159:5 184:6	83:7,11 97:18	1:1
77:21 82:11,13	46:10 107:19	Texas 1:4,15,17	101:9,13,16	Transactions
83:1,4 101:13	139:3 185:3	2:9,17 6:12	114:6,10	151:5

transcript 184:5 184:13 185:6,7 186:7 transcription 186:10,12 transfer 160:14 transferred 136:15 138:11 transistor 102:11 112:19 113:2 113:10 123:19 123:20 126:6 128:8 142:1 144:2 transistors 27:2 33:11,18 41:8 112:11,21 123:11,14 124:7 125:19 126:5 144:1 trapping 100:12 104:15 106:18 145:16 146:11 146:14 travel 127:13 trial 135:1 triathlons 155:4 tried 147:15 true 181:14 184:5 186:9,11 trust 24:15 truthfully 7:4 try 111:8 tunneling 109:3 turn 8:22 11:4 12:4 18:1 47:21 48:11 73:13 92:5,15 two 3:21 29:7 72:8,9,10 73:2 73:5 74:1 77:6 78:2 79:13 80:21 83:22 95:5 96:14 107:7,8 109:8 115:14,22 116:3 127:5	129:10 130:10 150:8,9 157:9 165:9 167:8 170:21 171:5 two-dimensional 60:12 type 20:20 45:11 80:16 106:18 117:19 136:17 138:13 146:13 146:21 160:16 types 109:6 typically 124:11 139:5 typo 156:13 U U.S 1:6 28:18 39:1 47:13 undergraduate 21:2 35:15 underlying 112:5 understand 6:17 15:4,15 17:16 25:20 26:8 32:20 33:13 38:16 46:5 51:11,13 54:4 56:12,22 57:19 62:21 67:4,5 69:19 70:17,20 71:17,22 72:18 77:15 79:20 86:8 91:6 95:9 96:4 100:22 104:22 107:13 108:4 148:18 148:21 156:19 157:4,8 162:8 167:9,16,21 168:2,21 170:6 171:11 182:19 understanding 19:5,6 67:3,10 67:11 69:9 70:8 71:1 138:19 145:4 163:1	understands 55:21 understood 49:7 52:9 122:20 137:2,19 156:16 157:13 162:12 163:4 170:21 171:3 unintentional 78:19 Unit 47:10 83:11 UNITED 1:1 University 21:2 upper 30:22 31:2 35:19 43:2 112:4 117:8 123:1,5,6,11,14 124:9,20,22 125:3 141:21 144:1 use 8:11 15:10 63:2 89:14 92:20 93:4,17 104:14,16 117:9,21 120:4 120:10 121:5 123:17 124:11 128:11 142:17 143:1 158:10 165:15,22 170:12 171:16 174:18 users 109:2,2 uses 55:6 117:15 123:10 132:14 132:22 133:10 161:6 180:7 usually 82:13 125:1 UT 22:11 24:22 149:20,21 UT-Austin 21:2 Utah 155:4 V v 185:3 186:4 187:8	various 68:4 103:14 109:6 152:16 172:15 Vbias 165:7 versa 138:6 versus 43:6,9 108:20 119:21 121:19 127:1 128:17 131:16 174:12 vertical 65:14,19 72:8,9 78:9 107:22,22 138:3,4 139:7,8 139:20 140:4,7 140:13 146:3 165:6 vertically 64:4,8 77:7 78:3,5,6 80:22 107:7,8 107:21 vice 138:6 Videographer 2:21 5:1 47:5,8 83:6,9 114:5,9 183:9 VIDEOTAPED 1:10,12 view 29:12,15 141:12 viewed 23:4 viewpoints 157:9 Vincent 10:8 virtual 75:22 voids 131:14 132:4,8 volatile 26:13,15 26:18 27:8,10 voltage 103:19 104:19 105:12 106:2,15 108:4 108:16 112:19 113:1 voltages 104:9 108:10,18 VS 1:6	W wafer 78:12 80:14,16 117:10,15 136:15,16,17 138:11,12,12 160:15,16,16 waive 185:9 want 8:20 12:4 22:6 36:12 39:9 47:21 50:1,3,8 59:22 73:4 82:21 83:1 92:5 107:18 108:1 158:8 183:14 wanted 114:21 147:16 Warren 2:21 5:11 Washington 1:21 186:2 187:3 Watanabe 28:19 31:11 109:17 116:9 140:2,20 143:13 162:3,4 166:14 171:5 172:6 175:9 183:2,3 Watanabe's 16:11,20 17:8 17:10,19 18:4,9 33:21 34:12 36:1 37:14 143:5 144:7 way 8:13,14 33:6 57:13 71:9 76:21 88:5 96:19 105:17 116:18 126:17 140:4 152:10 173:2 174:7,16 177:5 ways 36:9 103:14 we're 50:2 118:19 119:10 125:22 130:5 130:22 183:7
---	--	--	--	---

weather 155:3	184:8 185:8	46:11 47:1 54:4	11:19 12:2 18:2	121 52:17 53:6
week 21:8	186:5,17 187:9	54:8 79:3	18:14 25:3,8	59:15,16 63:11
weeks 21:9	word 23:14 24:16	103:15 104:18	47:22 98:13	122 4:10
well-known	24:19 67:1	105:1 108:14	156:15 159:9	124 72:6,13 84:10
104:20 106:5	170:13	109:5,14 111:6	160:3,6 161:9	84:11,12,16,17
106:19 109:9	words 61:18 63:2	112:7 113:5	162:14,16	84:20,22 85:3,5
126:17 131:22	90:18 92:1	131:19 134:4,6	163:22 164:15	85:6,10,12,12
146:16	100:14 117:3	145:17 150:9	164:22 166:9	85:15,18,20
went 21:8	120:15,22	173:1,3 175:16	169:15 170:9	99:13
wide 138:20	123:13 139:4	175:19	181:8,15	125 2:16
wider 117:8	149:1	year 21:12 41:20	1003 20:3,4,11	128 102:17
138:5,21	work 10:5 11:1	43:6 134:1	150:6 166:12	12B 3:18,21 4:4
Wilson 2:15,15	22:18 26:1 27:7	152:2,3	1005 28:17,20	73:8,11,12,17
3:2,4,5 5:9,9,10	72:13 151:4,12	years 22:10,11	109:20 166:14	73:21 74:6,21
6:5 8:19 47:11	151:19	24:22 41:17,20	1006 38:22 39:1,4	75:9,13 76:3,16
83:4,17 114:11	worked 10:1 25:1	42:5 43:9,13	1007 47:13,15	76:19 77:3,12
114:18 118:7	27:2	44:5,7,9	59:13	77:17,22 79:16
118:19 119:4	works 6:18	Yep 118:21	1033 4:8 119:4,7	81:3,9,12 92:13
119:10 121:22	workshop 152:16	yesterday 154:10	119:9,11,13	93:12,16,22
122:16 125:9	worry 130:12,15	154:20 155:7	166:6,9,13	94:9 96:9 97:4
126:13 127:6	wouldn't 76:17	yield 121:10,14	1034 4:10 122:11	97:20 98:15,21
128:18 130:5	149:8	131:11 142:7,7	122:13,17	99:5,22 101:1,4
132:10,18	wow 108:17	142:15	125:16 166:6,9	103:2 104:2
133:7 134:2,9	Wright 1:15	YMTC 133:2,9	166:13	105:6,8 107:5,6
136:1 137:9,13	184:2,21		1035 4:12 130:1,2	144:12 145:7
138:22 141:9	write 28:10	Z	130:6 166:6,9	13 13:16 14:2
141:15 143:7	104:10 105:7	Z-H-O-U 10:11	166:13	16:13 55:10
145:12,20	107:4,13	Zhou 2:22 5:12	1050 125:21	59:2 72:14
147:19 153:15	108:11 140:11	10:8	11 59:17	86:19 87:5
177:22 179:11	writing 27:17	Zierlein 2:21	11/20/24 184:22	158:10,19
183:5	140:15		11:40 82:13	159:13,15,18
wire 112:7	written 15:4 16:2	0	11:41 83:7,8	160:9,10
wiring 102:8	17:17 19:6,7	0,154,556 39:2	114 3:3	178:13 180:5
111:1 143:15	44:11 53:5	1	117 18:16	13(b) 18:22 19:9
143:18,19	185:22	1 75:11,16 76:9	118 63:20,22	19:16 180:16
144:5,9	wrote 49:10	96:8,17 98:10	119 4:8 52:16	181:19 182:1,4
withdraw 179:17	167:6	120:1,8 143:14	53:5	182:11
withstand 123:3	X	150:17	12 25:13 26:3,17	13(c) 16:13,16
witness 1:13 5:8	X 68:22 69:1	1:17 114:7,8	26:22 27:18	17:9,20 18:5,12
10:11 11:14	184:10	1:25 114:8,10	72:5,6,8,16	48:3,7 49:13,17
37:3,6 46:19	Xu 2:22 5:11	10(c)(5) 156:9	84:18,19,20	50:12,16 52:12
66:5 83:12 86:1	XY 34:18,21 35:1	10(c)(6) 156:10	12:00 82:14,19	52:20 53:2 56:9
87:2 97:1,8	Y	10:14 47:6,7	12:15 82:20	147:4
114:19 118:16	Y 68:22 69:1	10:32 47:7,10	12:30 82:16	13.B 18:19
124:1,3 132:20	yeah 39:18 46:2	1001 7:15	12:32 83:8,11	181:13 182:19
139:15 153:13		1002 7:21 8:15	120 48:14 52:16	183:4
173:19 184:4,6		9:1,8,13,21	53:5	130 4:12 102:17

131 76:21 144:13 144:19,22 156:1,12 132 73:16 77:2 80:19,20 92:12 93:21 94:5 99:4 144:13 133 75:18 134 92:16 93:1 98:18 137 76:22 13785 2:16 14 85:2,3 183:4 15 25:6,11 183:4 153 3:4 16 11:16,17 76:16 76:18 77:1 85:6 92:9 99:19 100:17 183:4 1600 2:8 185:2 17 135:10,11 136:20 183:4 1730 1:21 186:1 187:2 178 3:5 179 3:5 17th 134:12 18 85:9 19 139:18 1947 41:6 1961 41:8 1970 41:18 1971 184:21 1982 41:18 1990s 126:17 131:22 1992 40:19 41:18 42:2 1997 40:16 1A 146:5	99:14,19 101:1 146:7 150:17 158:18 159:15 160:10 165:3 178:12,15 180:2 181:2 2:17 114:6 20 85:10 200 99:15 2002 39:2 40:12 42:3 122:21 2003 3:14 42:12 42:20 44:18 46:7,10 139:2 139:19 20036 1:21 186:2 187:3 2004 45:14 46:6 46:13 120:22 122:21 126:10 126:12 131:18 131:20 138:17 139:2,19 2012 126:8,9 202 1:22 186:2 202)-232-0646 185:15 202)232-0646 187:4 2021 3:10 42:8,9 42:10,13 2022 3:13 44:14 44:15,16,19 2023 3:17 9:5,10 9:11 20:8,12 77:18,19 134:12,14 2024 1:11,14 3:20 5:3 79:9,12 184:2,19 185:4 185:20 186:5 187:10 2025 4:3 81:8,10 2026 4:6 94:12,14 96:22 104:1,5 22 85:14,15 232-0646 1:22	186:2 24 37:9 59:17 146:15 25 43:3,5,12 26 68:3 262 130:9 267-1663 2:17 27 85:17,17 146:16 271 130:9 2801 2:7 185:2 2A 29:3,4,13,19 31:19,21 32:14 34:6,19,20 2B 29:12,16,20 31:8,19,22 35:2 35:6	152:6 166:2 171:7 173:2,11 173:12 175:4,5 175:18 3rd 9:5,10,11 134:14	5,091,762 28:18 51 136:9 512 2:17 5230 48:19 49:4 50:10,15,18 51:5,8,18,22 52:1 53:16 5231 49:6,9,12 52:2,8,10 53:13 54:14 5259 54:16,17 55 74:9 85:20 56 74:9 5A 116:11 5E 116:15,22
2 11:4 14:1 25:3 36:22 47:10 55:10 59:1 75:11,16 76:9 89:8 96:8 98:10	2	3 83:11 150:17 3.9 37:1,4 3:03 1:15 183:12 183:16 30 37:10 43:13 44:4,9 184:12 30(3) 184:9 303 1:17 31 59:17 64:13 3102 49:15,16 147:22 3104 148:2 33 39:10 49:15 65:10 34 68:3 35 22:11 24:22 49:15,21 50:4 53:4 56:8 146:2 146:6 147:16 147:18,21 148:9,12 149:5 162:19 36 163:7 165:5 360-1947 2:10 37 64:17 65:6,6,7 163:9 38 64:13 3D 129:3 133:5	4 11:5 19:11 50:3 78:8 80:1,10 136:8 150:18 40 22:12 64:13 80:10 4001 64:19 41 72:7 42 3:10 65:2,4 43 33:10,17 44 3:13 64:17 65:3,5,7,7 45 12:4,15 16:9 29:5,11,17,21 30:3,17 33:22 34:6,12 35:6 36:1,14 37:14 37:20 80:11 46 29:5,11,17,21 30:4,8,9,12,14 30:20,22 31:2 32:14,19 33:5 33:14,15,22 34:6,12 35:7 36:1,13 37:15 37:20 47 29:11,21 33:22 34:7,12 36:2,18 37:15,20 48 30:18 489 42:16 49 72:7 136:9 498 43:2	6 1:11,14 3:2 68:3 84:8,9,11 84:12 109:21 109:21 117:12 143:14 146:12 150:18,20 172:8,9,22,22 176:11 184:2 185:4 186:5 187:10 6,881,994 47:14 600 22:1 23:10,20 24:5,14 600-plus 149:14 64 39:11 65:10,11 65 95:1 97:13,20 98:3 650 123:15,18 124:14 126:6 680 11:11 6A 116:10 6B 112:15 116:15 6C 109:22 110:17 112:16,18 6D 116:17 6th 5:3 184:19
			5 80:11 124:9 143:14 150:18 168:12 170:12 172:8 173:1 176:10,11	7 25:5,10 45:4,5 78:9 80:11

100:9,10 101:1	76 145:10	139:3		
101:19 102:1	77 3:17	91 74:10,12,13,18		
103:2 129:12	78750 2:17	94 4:6		
131:7 146:7,10	79 3:20	972 2:10		
162:19		99 9:1		
7(c)(5) 145:1	8	99.9 127:11		
155:17 156:2,6	8 72:7,14 74:9	994 74:15 147:18		
7(c)(6) 145:2	75:3,7 84:14,15			
155:17 156:2,7	84:17,21 85:4			
7,378,702 1:6	131:4			
702 7:9,15 16:13	80 145:11			
17:17,20 18:19	81 4:3 74:14			
18:22 19:8,12	812 1:21 186:1			
31:11 32:11	187:2			
54:21 55:11,22	813 13:19			
56:21 58:12	82 12:5,9,15			
66:1,6,10,20	16:11,19 100:8			
67:15,19 68:14	82A 56:8			
73:3 78:6,8	83 148:5,13,19			
79:21 80:8	149:2,7			
84:15 86:5	83A 48:15,18			
88:15 89:4,21	50:10,14,20			
90:8,12 91:4,16	51:15 52:3,12			
117:1,3,12	52:18,19 53:4,8			
120:22 131:18	53:12 54:5 55:4			
135:22 136:9	55:18 147:12			
137:3,21 138:1	148:8 149:8			
138:18 140:1	84 73:13,20 92:6			
147:4 154:5	92:8 144:14			
156:19 157:1	155:21,22			
157:20 163:8	85 73:21 75:2			
164:7 165:5	80:19			
166:18 170:2	86 92:16			
170:20 178:19	87 95:2			
180:3,18				
71 18:1,13 19:11	9			
180:15	9 15:1,2 16:3			
719 184:22	78:9 85:12,19			
72 63:22	85:19 99:2			
73 47:22 48:1,2	129:13 134:16			
63:19 64:1,1	134:21,21			
147:7	168:12			
74 48:12 147:22	9:03 1:14 5:4			
75 48:22 51:4	90 45:14 46:3,10			
59:14 74:19	46:13 139:5			
147:7	155:20			
75201 2:9 185:2	90-nanometer			