

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

3 -----
4 SAMSUNG DISPLAY CO., LTD; SAMSUNG ELECTRONICS CO.,
5 LTD.; and SAMSUNG ELECTRONICS AMERICA, INC.,
6 Petitioner

7 vs

8 POLARIS POWERLED TECHNOLOGIES, LLC,
9 Patent Owner
10 -----

11 CASE IPR2023-00771
12 U.S. Patent No. 7,259,521

13 Oral deposition of

14 ALEX Z. KATTAMIS, Ph.D., PE

15 VIA VIDEO/TELECONFERENCE

16 FRIDAY, JANUARY 19, 2024

17 11:05 a.m. EASTERN TIME
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19

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22 Reported by: Lisa V. Feissner, RDR, CRR, CLR

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3 Oral deposition of ALEX Z. KATTAMIS,
4 Ph.D., PE, held REMOTELY, VIA ZOOM, on FRIDAY,
5 JANUARY 19, 2024, beginning at 11:05 a.m., pursuant
6 to Notice, before Lisa V. Feissner, RDR, CRR, CLR,
7 Notary Public.
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1 A P P E A R A N C E S:

2 O N B E H A L F O F P E T I T I O N E R:

3 M A R K O D A, E S Q U I R E

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1 A P P E A R A N C E S (cont'd):

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C O N T E N T S

EXAMINATION OF ALEX Z. KATTAMIS, Ph.D., PE	PAGE
By Mr. Hamill	7
By Mr. Oda	106
By Mr. Hamill	109

EXHIBITS REFERENCED

EXHIBIT NUMBER	PAGE
2100 Patent Owner's Corrected Notice of Deposition of Alex Z. Kattamis, Ph.D., P.E.	13
1001 U.S. Patent No. 7,259,521	62
1002 Declaration of Alex Z. Kattamis, Ph.D., P.E. in Support of Petition For Inter Partes Review of U.S. Patent No. 7,259,521	22
1003 Curriculum vitae Alex Kattamis, Ph.D., P.E., CFEI, CVFI	17
1006 Patent Application Publication Pub. No. US 2005/0190128A1	89

EXHIBITS REFERENCED

EXHIBIT NUMBER		PAGE
1007	Patent Application Publication Pub. No. US 2005/0140600 A1	76
1011	Excerpt, Active Matrix Liquid Crystal Displays, Fundamentals and Applications, Willem den Boer	26
1012	AM backplane for AMOLED, Min-Koo Han	53

1 P R O C E E D I N G S

2 ALEX Z. KATTAMIS, Ph.D., PE,
3 having been first duly sworn, was examined and
4 testified as follows:

5 EXAMINATION

6 BY MR. HAMILL:

7 Q Good morning. Could you please state
8 your name and address for the record.

9 A My name is Alex Kattamis. It's spelled
10 K-A-T-T-A-M-I-S. I live at 233 27th Street in
11 Brooklyn, New York.

12 Q And have you been deposed before?

13 A Yes.

14 Q How many times?

15 A I'd have to look. I think around ten.

16 Q Okay. I'm sure you've been through this
17 before, but I'll go over some ground rules.

18 I'll be asking you questions today.
19 Those questions along with your answers will be
20 recorded by the court reporter. So you'll need to
21 answer the questions orally since the court reporter
22 cannot record a nod or shake of the head.

1 Do you understand?

2 A Yes.

3 Q If you don't understand any question,
4 please let me know that you don't understand it, and
5 I'll do my best to rephrase it.

6 Is that fair?

7 A Yes, that works.

8 Q If at any point you need to take a break,
9 please let me know. I only ask that if a question
10 is pending that you answer the question before we
11 take a break.

12 Is that fair?

13 A Yes.

14 Q Do you understand that you're under oath
15 and have sworn to tell the truth as if you were in a
16 court before a judge?

17 A Yes.

18 Q Is there any reason you can think of why
19 you're not able to answer my questions fully and
20 truthfully here today?

21 A No.

22 Q Okay. And where are you located today?

1 A Today I'm located in the offices of Baker
2 Botts in Manhattan.

3 Q And who is in the room with you?

4 A Currently in the room with me is Mark
5 Oda.

6 Q And looks like you do not have a personal
7 computer in front of you.

8 Is there a -- do you have access to a
9 computer in that room with you today?

10 A Mark Oda does have computers, or has two
11 computers.

12 Q And I see you have a number of documents
13 with you.

14 What are those?

15 A Yeah, sure. So the big one here is one
16 of the exhibits or the materials I cited to. It's
17 the book by Horowitz.

18 Directly in front of me, I have my
19 declaration and my CV.

20 And then in this binder, I have
21 additional materials, the patent, the '521, the file
22 history, the Complaint, the three prior art

1 references, Hayafuji, Kim, and Steer.

2 And then the extrinsic citations I made
3 in my report, so Nilsson, Horowitz, den Boer, Han,
4 and then the institution decision.

5 Q Okay. And did you do anything to prepare
6 for this deposition?

7 A Yes.

8 Q What did you do?

9 A I reviewed my report. I reviewed all the
10 documents I just mentioned. That's what I did.

11 Q Have you worked as an expert witness
12 before?

13 A I've testified before, yes, so yes.

14 Q Okay. And how many -- and how many PTAB
15 cases have you worked as an expert witness?

16 A That would have to be -- I'd have to look
17 at my deposition history to confirm that.
18 Otherwise, I'd be kind of ballparking the number.

19 Q Okay. Can you give me an estimate?

20 A Sure. Six to seven.

21 Q And how many non-PTAB cases have you been
22 an expert in before?

1 A If you define expert as all the way
2 through deposition or having --

3 (Cross-talk.)

4 Q How many have you worked on? Not
5 necessarily depositions, but how many have you
6 worked on?

7 A Over the -- since 2007, I can't really
8 guess. I would be guessing.

9 Q Can you give me an estimate?

10 A Sure. 30?

11 Q And have you ever testified in a trial?

12 A No.

13 Q And in what areas of technology have you
14 provided expert testimony?

15 A I've provided in consumer electronics,
16 consumer products generally, displays, power
17 distribution equipment, and I'm sure there are
18 others.

19 Q And you're an expert in all those fields?

20 A Yes.

21 Q In your PTAB cases, would you say you've
22 done more work for petitioners or patent owners?

1 A I'd have to look, but I think I would say
2 probably more for petitioners.

3 Q Can you give me an estimate for a
4 percentage?

5 A No. But I would say it's mostly for
6 petitioners. I'd have to go back to check.

7 Q Has the PTAB ever determined that you
8 were not qualified as an expert witness?

9 A I don't believe so.

10 Q How about a court?

11 A I don't believe so.

12 Q Have you ever had an opinion excluded by
13 the PTAB?

14 A I don't believe so, no.

15 MR. HAMILL: I want to introduce the
16 first exhibit. This is the deposition notice.

17 Counsel, can you show it to him?

18 MR. ODA: Yes. He can see it.

19 MR. HAMILL: Okay. You have a screen up
20 there?

21 MR. ODA: Yes, it's on the screen.

22 MR. HAMILL: I guess we can call this

1 Exhibit 1.

2 MR. ODA: Counsel, can we have these
3 exhibits that you're introducing start with 2, as
4 they're patent owner's exhibits?

5 MR. HAMILL: So 2-1?

6 MR. ODA: The exhibits for patent owner,
7 I believe, are four digits. I'll look at what the
8 latest one is. But along the lines of 2001, which
9 is the Credell [ph] declaration, and so on. So
10 ideally following the most recent patent owner's
11 exhibits.

12 MR. WILLIAMS: This is Eliot. If you
13 want to just start at 2100, that will probably give
14 you all the numbers you need, Andrew.

15 MR. HAMILL: Okay. Sure. Why don't we
16 call it 2100, then.

17 (Exhibit 2100 marked for identification.)

18 BY MR. HAMILL:

19 Q Dr. Kattamis, can you please turn to
20 page 2 of the deposition notice, Exhibit 2100.

21 A Yes. It's up on the screen.

22 Q Okay. In the middle, it says -- do you

1 see that there's a field that says Declarant's Name,
2 and it says, Alex Z. Kattamis, Ph.D., PE?

3 A I do.

4 Q Is that you?

5 A Yes, it is.

6 Q Okay. And you understand the testimony
7 you're providing today will be used in Inter Partes
8 Review proceeding, IPR2023-00771?

9 A I do.

10 Q And the matter pertains to U.S. Patent
11 No. 7,259,521.

12 Are you comfortable if we refer to it by
13 the last three digits, or '521?

14 A Yes, I am.

15 Q And if I use the acronym POSA or POSITA,
16 do you understand that to mean a person of ordinary
17 skill in the art?

18 A Yes, I do.

19 Q Do you provide any opinions in this case?

20 A Yes, I do.

21 Q And are all of your opinions set forth in
22 your declaration?

1 A Yes.

2 Q Are the bases for all of your opinions in
3 your declaration?

4 A I believe so, yes.

5 Q Were there any other investigations you
6 wanted to complete?

7 MR. ODA: Objection, form.

8 A I'm not really sure what you mean by that
9 question.

10 Q With respect to your opinions, were there
11 any other investigations you wanted to complete?

12 MR. ODA: Objection, form.

13 A I don't believe so, no.

14 Q And did you review your declaration
15 before submitting it?

16 A Yes.

17 Q Are there any errors in your declaration?

18 A Not that I've noticed upon reviewing it,
19 no.

20 Q And you've been retained as an expert in
21 this matter?

22 A Yes.

1 Q Who is your retention agreement with?

2 A Baker Botts.

3 Q And how many hours have you billed on
4 this matter, approximately?

5 A It would be -- that's a number I can get.
6 If I were just estimate, maybe on the order of 60 to
7 70.

8 Q And what rate are you charging for this
9 matter?

10 A Should be in my report. We just came up
11 to a new year. But can I look real quick --

12 Q Sure.

13 A -- to see what it was last year?
14 525 per hour.

15 Q And is that your standard rate?

16 A That was my rate in 2023.

17 Q And when did you become involved in this
18 case?

19 A I think at the tail end of 2022, or early
20 '23.

21 Q And who contacted you?

22 A I'd have to go back through my records,

1 but I believe it was Neil Sirota.

2 Q Have you worked with Baker Botts before?

3 A I'm sure I have, yes.

4 Q Have you been retained by Samsung at any
5 point?

6 A I've always been retained by counsel.

7 (Previously marked Exhibit 1003
8 referenced.)

9 BY MR. HAMILL:

10 Q Dr. Kattamis, please refer to Exhibit
11 1003, your CV.

12 A Yes, I have it open.

13 Q Dr. Kattamis, are you currently employed?

14 A Yes, I am.

15 Q Who do you work for?

16 A My company is called Exponent.

17 Q And how long have you worked at Exponent?

18 A I believe I started in 2007.

19 Q And have you had any other jobs from 2007
20 to today?

21 A No. I've been with one employer.

22 Q And what did you do before you joined

1 Exponent?

2 A Prior to joining Exponent, I was a
3 master's/Ph.D. student at Princeton University.

4 Q And from what years were you at
5 Princeton?

6 A From I think 2002 to 2007.

7 Q And did you have any jobs during that
8 time aside from being a student?

9 A Yeah. I had jobs internal to the
10 university. Academic.

11 Q And before joining Princeton, did you --
12 what did you do before?

13 A I got my bachelor's degree prior to
14 joining Princeton, and did internships.

15 Q On page 1 of your CV, in the second
16 paragraph under Professional Profile, it says you
17 have expertise in the design, fabrication, and
18 failure analysis of semiconductor devices, including
19 thin-film electronics, flexible electronics,
20 memories, LEDs, LCDs, AMOLEDs, as well as others.

21 What experience do you have with respect
22 to design, fabrication, and failure analysis of

1 AMOLEDs?

2 A Sure. So in my grad program, my research
3 was focused on developing transistors to drive --
4 transistors for operating AMOLED displays. We were
5 kind of at the beginning of that development for
6 AMOLED displays, kind of moving away from LCDs. So
7 focused on developing the transistors that would
8 integrate and operate those OLEDs.

9 Q And what does AMOLED stand for in this
10 context?

11 A Active-matrix OLED.

12 Q And so your experience focused on the
13 design of transistors for driving the OLEDs.

14 Is that right?

15 A It would be the design of everything from
16 pixels to actual set-ups that allowed for operation
17 of small, novel displays on various substrate types.

18 Q Okay. And what does substrate type mean
19 in this context?

20 A Substrates as opposed to rigid surfaces,
21 like glass, plastics, for example.

22 Q Okay. And in the context of an AMOLED,

1 what is a substrate?

2 A You can have an AMOLED on various
3 substrates, various types.

4 Q Okay. But just more generally, what does
5 a substrate mean in this context?

6 A The surface in that case where you build
7 it on.

8 Q In the next paragraph of your
9 professional profile section of the CV, on page 1,
10 it says that your research focused on large-area
11 flexible electronics including the design,
12 fabrication, and characterization of TFT display
13 backplanes for electrophoretic displays and AMOLEDs
14 on metal foils and polymer substrates.

15 What is that --

16 (Cross-talk.)

17 Q What is a TFT display backplane?

18 A These are the thin-film transistors that
19 are below, in this case, the OLED emitters.

20 Q And what does the word "backplane" mean
21 in this context?

22 A "Backplane" means the area or the surface

1 upon which -- sorry, the surface on which your
2 active -- your active emission is occurring.

3 Q And what is the difference between a
4 substrate and a backplane in the context of AMOLEDs?

5 A The substrate is really just the surface
6 onto which you're going to put everything. So, you
7 know, I would have to think about it. But a
8 backplane is put on that surface.

9 Q Since joining Exponent in 2007, have you
10 worked in the design, fabrication, or failure
11 analysis of AMOLEDs?

12 A Yes.

13 Q Can you briefly describe your work in
14 that area since 2007?

15 A Yeah, I've worked on specifically -- I
16 mean, there are many cases over the last, I don't
17 know what it is since '07, but X years, you know,
18 involving things like manufacturing issues,
19 tolerance issues, that impact the actual
20 fabrication. So this would be a little bit
21 different than designing the various components.

22 And so that's just one example of, you

1 know, a fabrication.

2 And aside from that, and along with that
3 would also be reviews of designs for various
4 displays, AMOLED displays.

5 (Previously marked Exhibit 1002
6 referenced.)

7 BY MR. HAMILL:

8 Q Let's turn to Exhibit 1002, your
9 declaration.

10 A I have it open.

11 Q Please turn to page 26.

12 A Yeah.

13 Q Okay. Here, you have a discussion of the
14 den Boer Text.

15 Is that right?

16 A No. On page 26 of my declaration,
17 there's some discussions about Horowitz, it looks
18 like, and Nilsson.

19 Q Oh, okay. I'm going, yeah, by the page
20 of the PDF.

21 So can you turn to page 26 of the PDF,
22 which is 23, in terms of the numbering.

1 A Yes, I see it.

2 Q And the den Boer Text discusses LCD
3 displays as of 2005, right?

4 A Yeah. It discusses, you know,
5 retrospectively in 2005, correct.

6 Q And is the material in den Boer
7 applicable to AMOLEDs?

8 A Yeah, I would say it is. It's on the
9 kind of the -- is that the -- it's at the beginning
10 of kind of the cutting edge of AMOLED designs. So
11 you're talking, like, 2004, 2005, really a lot of
12 research starting up in that field.

13 So it does cover the basics, I would say.
14 But it does have a bit more focus, I think, on LCDs.
15 But it does cover both.

16 Q And can you turn to page 29 of your
17 declaration, 32 of the PDF.

18 A Yes, I see that.

19 Q And so here, there's a discussion of
20 active-matrix displays. And in paragraph 67, you
21 referred to the den Boer Text.

22 So is the discussion in den Boer of

1 active-matrix displays applicable to AMOLEDs?

2 A So at least page 67, I believe this is
3 more focused on LCDs, but in general, on a high
4 level, I suppose so.

5 Q And here in the middle of that paragraph,
6 you have a sentence, it says, It was known that an
7 active-matrix display includes arrays of TFTs that
8 work with pixels, source (data) lines, and gate
9 drivers.

10 Do you see that?

11 A Yes, I do.

12 Q And so would those concepts discussed in
13 den Boer apply to AMOLEDs as well?

14 A Again, at a very high level, yes,
15 although the biasing requirements for FETs or TFTs
16 in the two contexts are slightly different.

17 Q And what is a biasing requirement?

18 A The way you're going to put power to the
19 final transistor that's going to, in an LCD, for
20 example, bias the surface, to allow light to come
21 through or not.

22 Q Then turning to paragraph 68, it says

1 here, It was also known to drive the pixels using a
2 "TFT pixel array circuit with select buslines, data
3 buslines, a TFT at each pixel, and storage capacitor
4 at each pixel."

5 Do you see that?

6 A I do.

7 Q Okay. What does it mean to drive the
8 pixels?

9 A Bias the pixels. So put the voltage
10 necessary on that transistor that's going to finally
11 power the surface to allow light to transfer through
12 in the context of an LCD.

13 Q And what is a select busline in this
14 context?

15 A These are part of how you address an
16 active-matrix system.

17 Q Okay. And could you be a little bit more
18 specific of what a select busline is?

19 MR. ODA: Objection, form.

20 A I mean, as the word says, select, it's
21 activating or selecting a certain portion of the
22 matrix.

1 Q And how about busline, what does that
2 mean?

3 A Busline is a connection, a conductor.

4 Q And what is connected to the select
5 busline?

6 A It depends on the design of the display.
7 It's activating a certain portion of the display.

8 Q What does data buslines mean in this
9 context?

10 A Data buslines contain information.

11 Q Okay. And in this context, what is
12 connected to a data busline?

13 A Circuitry required to drive the -- drive
14 TFT.

15 Q Okay. Let's take a look at den Boer. So
16 that's Exhibit 1011.

17 (Previously marked Exhibit 1011
18 referenced.)

19 BY MR. HAMILL:

20 Q Please turn to that exhibit.

21 A I have it open.

22 Q Please turn to page 39 of the book, which

1 is page 26 of the exhibit.

2 A I have it open. Could you repeat the
3 page of the book?

4 Q Page 39 of the book, page 26 of the
5 exhibit. So page 26 of the exhibit has pages 39 and
6 40 of the book.

7 A Yes, I have page 26 open.

8 Q Okay. And there's a heading, 2.7 Basic
9 Pixel Circuit and Addressing Methods.

10 Do you see that?

11 MR. ODA: Page 39 of the book.

12 A Sorry.

13 Q I'm (inaudible) to page 39 instead of
14 page 26.

15 A Yes. You're pointing me to page 39,
16 which starts, Basic Pixel Circuit and Addressing
17 Methods?

18 Q Right. And then in this section, there's
19 a Figure 2.17.

20 Do you see that figure?

21 A Yes, I do.

22 Q Okay. And in the discussion before the

1 figure, it says that this figure shows select
2 buslines and data buslines, a TFT at each pixel.

3 Do you see that?

4 A I do, yeah.

5 Q Okay.

6 A Yes, I --

7 Q So in Figure 2.17, a number of the pixels
8 are shown, right?

9 A Yeah, as defined in this implementation,
10 correct, yeah.

11 Q Okay. And is each pixel connected to a
12 select line?

13 A Yes.

14 Q And is each pixel connected to a data
15 line?

16 A Yes.

17 Q Okay. And so in this example, what do
18 the select lines do?

19 A Activate transistors.

20 Q And what transistors do they activate?

21 A I don't know how they're defined in this
22 implementation. This is a very basic LCD.

1 But it's the transistors that you see
2 here, one at each pixel.

3 Q And so in this implementation, does each
4 pixel have a transistor -- well, let me back up.

5 What -- let me turn your attention to the
6 text on page 40. So in about the middle of the
7 large paragraph.

8 It says, While one row is selected, the
9 data signals for that row are applied to the data
10 buslines from peripheral electronic data circuits
11 and transferred by the TFT to the pixel electrodes.

12 Do you see that?

13 A Yes.

14 Q What does that mean?

15 MR. ODA: Objection, form.

16 A That means a voltage is transferred
17 across that transistor or that TFT and placed on the
18 pixel electrode.

19 Q And that would be the data voltage?

20 A Yes.

21 Q And then the next sentence says, When the
22 row is deselected, the TFTs switch off and the data

1 voltage is stored for the remainder of the frame
2 time, and there's some details.

3 A I see.

4 Q And it says, while the other rows are
5 scanned.

6 So what does that mean?

7 A That's just describing kind of basic
8 addressing of active-matrix displays. The
9 transistor is turned off -- or the TFT, excuse me,
10 is turned off.

11 Q And it says, the data voltage is stored
12 for the remainder of the frame time.

13 How is it stored?

14 A As with anything, I mean, there would be
15 a requirement for some capacitance or capacitor to
16 hold that charge or voltage.

17 Q And then the next sentence says, All rows
18 in the display are sequentially selected during the
19 frame time so that the voltage on each pixel is
20 refreshed once during each frame time.

21 So what does that describe?

22 A The basic operation of an active-matrix

1 display.

2 Q Okay. So this discussion is -- describes
3 basic operations of an active-matrix display in
4 terms of the rows being selected and data voltage
5 being stored?

6 A Yeah. Of one type, but yes, of a basic
7 operation of an active-matrix display, yes.

8 Q Please turn to page 34 of the exhibit,
9 which has pages 93 and 94 of the book.

10 A Yeah, I see this. Yeah.

11 Q Okay. And there's a heading, 4.2, Row
12 Select and Column Data Drivers.

13 Do you see that?

14 A Yes, I do.

15 Q And there's a discussion here of a row
16 driver.

17 What is a row driver?

18 A Yeah, I see that.

19 Q In an active-matrix display, what is a
20 row driver?

21 A Sorry. I'm just trying to see how it's
22 shown in the image. Just one second.

1 It's the circuitry. I believe here it
2 may be referred to as a gate driver. But yeah, as
3 it says, the driver or the -- that circuitry address
4 is each row in the display sequentially.

5 Q So the row driver or gate driver
6 generates the select signals?

7 MR. ODA: Objection, form.

8 Q Does that go in the select line that we
9 were discussing previously?

10 A Yeah, in this representation, the gate
11 driver activates the row of transistors or thin-film
12 transistors.

13 Q And there's also a discussion here of
14 column drivers. So in the second paragraph under
15 that heading, it says, The column drivers supply the
16 video data signals to the data lines connected to
17 the source of the TFTs at each pixel. They are
18 commonly referred to as the source drivers.

19 Do you see that?

20 A Yes.

21 Q And so in the figure we were looking at
22 previously, the column driver or source driver would

1 provide the signals on the data lines?

2 A Yeah. They would apply a voltage to
3 the -- well, through the thin-film transistor to the
4 liquid crystal element.

5 Q And that data voltage is stored in a
6 capacitor in the pixel circuit?

7 A For LCDs, it's a little bit different.
8 It does look like this Figure 4.8 includes storage
9 capacitors. You also have an additional capacitance
10 from the LC crystal itself. That's kind of that box
11 there.

12 Q Okay. But the data voltage is stored in
13 a capacitor in the pixel circuit?

14 MR. ODA: Objection, form.

15 A Yeah, I mean, so the data voltage is
16 stored via capacitance. In this case, there's two
17 sources of the capacitance. One is that -- the
18 capacitor itself, that's kind of above that box.
19 And the other would be the liquid crystal element,
20 which also has capacitance.

21 Q Okay. And so do these features of an
22 active-matrix display that we've talked about apply

1 to both active-matrix LCD displays as well as
2 active-matrix OLED displays?

3 MR. ODA: Objection, form.

4 A Yeah, at a very high level, it's
5 explaining to you how active matrix addressing
6 works.

7 Q And so this active matrix addressing
8 would apply to AMOLEDs as well?

9 MR. ODA: Objection, form.

10 A There are different ways to address a
11 display. But yes, in general, this is how you would
12 do it. You would select a certain section to
13 activate. You would set up the voltages. And then
14 move on to the next row for, you know -- until you
15 complete the whole display.

16 Q Okay. And on this page, there's a
17 Figure 4.8 that you referred to earlier.

18 Do you see that?

19 A Yeah, this is the same one we've been
20 discussing?

21 Q Correct. So in this diagram, there's a
22 box labeled, Source driver ICs.

1 What do you understand that to mean?

2 A The electronics in this case, or more
3 fundamentally, circuitry that sets up the voltage,
4 you know, in this simple representation that will
5 turn on or off the liquid crystal element, or open
6 or close, I should say.

7 Q Okay. And ICs in this context would mean
8 integrated circuits?

9 A Yes.

10 Q And then there's a box labeled, Gate
11 driver ICs.

12 Do you see that?

13 A Yes, I do.

14 Q Okay. And so would that be the circuitry
15 that activates the select signals sequentially?

16 MR. ODA: Objection, form.

17 A Yeah, the gate drivers would select which
18 transistors or thin-film transistors to turn on.

19 Q Okay. And in the rectangle between
20 source driver ICs and gate driver ICs, that's where
21 the matrix of pixel circuits would be, right?

22 MR. ODA: Objection, form.

1 A In this single embodiment, it's putting
2 them outside of the LC panel.

3 Q Putting what outside of the LC panel?

4 MR. ODA: Objection, form.

5 A In this specific embodiment, it's putting
6 the gate driver and source driver -- depending on
7 what the definition is of that box, right. I mean,
8 there's not a lot of details here for that.

9 So frankly, I can't say whether they're
10 necessarily outside of the LC panel. That is what's
11 hinted here at this -- you know, in this specific
12 example.

13 Q My question, though, wasn't about that.
14 It was just, the box that's between the gate driver
15 ICs and the source driver ICs labeled LCD panel,
16 this would be where you have a matrix of pixel
17 circuits, right?

18 MR. ODA: Objection, form.

19 A Among other things, you have a matrix,
20 yeah.

21 Q Okay. Also in this diagram, there's a
22 label to the left, it says, RGB video signal.

1 Do you see that?

2 A I do see that, yes.

3 Q What do you understand that to represent?

4 MR. ODA: Objection, form.

5 A Can I just look if there's any -- is
6 there any written information about it in the -- at
7 page 93 or 94? Can you just give me one second to
8 look?

9 Q Sure. Go ahead and look.

10 A What's written here says RGB video signal
11 TTL or LVDS. I can't remember off the top of my
12 head what those mean. But I would expect it's some
13 signal containing your video information.

14 Q Okay. Please turn to the next page, page
15 35 of the exhibit.

16 A I have it.

17 Q Okay. And on this page, there's a Figure
18 4.9.

19 Do you see that?

20 A Yes, I do.

21 Q And it says in the caption of the figure
22 that it's the basic architecture of a gate driver

1 IC?

2 A Yeah, I see that.

3 Q And there are a number of components for
4 the gate driver, starting at the bottom. One of
5 those is a box labeled, Shift registers.

6 Do you see that?

7 A Yep.

8 Q What do the shift registers do in a gate
9 driver?

10 MR. ODA: Objection, form.

11 A One second.

12 The shift registers, I mean, they work
13 with digital data, and they move it, depending on
14 where it's needed, on a kind of high level.

15 Q Okay. And then above that, there's a
16 level shifter. What does that do?

17 MR. ODA: Objection, form.

18 A Yeah, it's all about manipulating this
19 digital information, right, to get it where it needs
20 to be.

21 Q Okay. And in the discussion on page 95
22 of the book, it says, The level shifters raise the

1 logical voltage levels of 0 and 3.3 volts to output
2 levels of negative 5 volts and about 20 to 25 volts,
3 respectively.

4 Do you see that?

5 A Yeah, I do.

6 Q Okay. And then it says, The final levels
7 are compatible with the required on and off voltage
8 levels on the gates of the a-Si TFTs.

9 A Yeah, amorphous silicon TFTs.

10 Q Okay. So is the level shifting --
11 shifting the voltage to the level such that you get
12 the desired response from the transistors in the
13 matrix?

14 MR. ODA: Objection, form.

15 A Yeah, I mean, what this whole system is
16 doing is getting those digital signals to a level --
17 keeping in mind that digital signal is still a
18 voltage -- getting them to the right levels so that
19 they can actually operate the TFT.

20 Q And then above that in Figure 4.9,
21 there's a box labeled, Output buffer. And in the
22 text below the figure it says, Output buffers reduce

1 the output impedance to a sufficiently low level in
2 order to drive the gate lines of the AMLCD.

3 What does it mean to reduce the output
4 impedance to a sufficiently low level?

5 MR. ODA: Objection, form.

6 A All these things are there for different
7 reasons.

8 In this case, what I believe this is here
9 for is to deal with increasing size of the display
10 and basically resistive drops that will occur, based
11 on the size. And so you're manipulating the
12 impedance so that you can still turn on and off the
13 thin-film transistor.

14 So it's just another component that's
15 there for that to work.

16 Q So that's to make sure that the signal on
17 the line can make it all the way across the row.

18 Is that fair?

19 MR. ODA: Objection, form.

20 A I would say so that it can still turn --
21 so that it can still operate or activate the TFT.

22 Q But it's to mitigate the challenge of the

1 row line being long?

2 MR. ODA: Objection, form.

3 A These are all really dependent on kind of
4 the overall design of the whole display. But yes,
5 that would be part of it.

6 Q You said to deal with the increasing size
7 of the display and resistive drops. So I'm just
8 trying to understand what you meant by that.

9 So by that, were you referring to that
10 select line from the gate driver being long in terms
11 of distance?

12 MR. ODA: Objection, form.

13 A Yeah, I'd say that's part of it, yes.

14 Q Okay. Can you please turn to the next
15 page, page 36 of the exhibit, which has pages 97 and
16 98 of the book.

17 A Yeah, I see it.

18 MR. HAMILL: And, you know, we've been
19 going a little over an hour. Why don't we go ahead
20 and take a break now. Is ten minutes okay?

21 MR. ODA: That works.

22 (Recess from 12:08 p.m. until 12:19 p.m.)

1 BY MR. HAMILL:

2 Q Dr. Kattamis, we were looking at Exhibit
3 1011. Do you still have that in front of you?

4 A I do.

5 Q Okay. And can you turn to page 36,
6 please.

7 A Yes.

8 Q Do you see Figure 4.11?

9 A I do.

10 Q And the caption says, Basic architecture
11 of a source driver IC, as well as some other things.

12 Do you see that?

13 A I do.

14 Q Okay. And so this would apply to the
15 source driver. This is the driver that provides the
16 data voltage on the data lines in an active-matrix
17 display --

18 MR. ODA: Objection.

19 Q -- as discussed in this book?

20 MR. ODA: Objection, form.

21 A Yeah, as discussed for this particular
22 AMLCD, yes.

1 Q And this figure shows a number of
2 components inside of a source driver.

3 A Yes.

4 Q And is it -- is the basic flow here that
5 the output is at the top and the input is at the
6 bottom?

7 A Yes.

8 Q Okay. So there's a box at the bottom
9 labeled, Shift registers. What does that do?

10 A As before, it moves binary or digital
11 information.

12 Q Okay. Then the next one above it is
13 labeled, Latch. What does that do?

14 A I think probably the best way to think
15 about that is, think about it as like temporary
16 storage or temporary holding of digital information.

17 Q The next one above that is level shifter,
18 and what does that do?

19 A Yeah, as I think similarly to the IC we
20 were discussing before, it would change the level or
21 the digital level.

22 Q So that would change the voltage so that

1 it can properly drive the relevant transistors.

2 Is that right?

3 MR. ODA: Objection, form.

4 A Yeah, it's part of what gets the voltage
5 correct or the voltage to a point where it can
6 operate that thin-film transistor.

7 Q And then above that, there's a box
8 labeled, Digital to analog converter. What does
9 that do?

10 A This would take -- as it says, it changes
11 digital information to analog information.

12 Q So the driver takes digital information
13 as input, and outputs analog information?

14 MR. ODA: Objection, form.

15 A As it's defined for this application, in
16 this instance, yes.

17 Q Okay. And then above that there's an
18 output buffer. What does that do?

19 A Just as the previous example, it reduces
20 the output impedance to charge the line and allow
21 for the functioning of the TFTs.

22 Q And in this example, the discussion is of

1 an active matrix LCD. Would the source driver for
2 an active matrix OLED do the same functions that the
3 components here do in this figure?

4 MR. ODA: Objection, form.

5 A Yeah, I mean, I would say there would be
6 similarities. There are different issues when it
7 comes to driving an OLED display versus an LCD
8 display.

9 Q What are some of the different issues?

10 MR. ODA: Objection, form.

11 A Things like current control may be more
12 important in an OLED display. There are many.

13 Q Okay. But what we discussed would be
14 applicable to both?

15 MR. ODA: Objection, form.

16 A I'd have to do an analysis and compare it
17 to an actual LED -- or OLED product. But a lot of
18 these components would be there.

19 Q So below the figure, there's -- below
20 Figure 4.11, it says, The 6-bit digital data signals
21 for red, green, and blue channels are latched into a
22 128 by 3-line latch and then level-shifted from the

1 logical levels to the VDD level.

2 What does it mean to level-shift from the
3 logical levels to the VDD level?

4 MR. ODA: Objection, form.

5 A I think what it means, based on what I'm
6 seeing here, is that you're taking digital signals
7 that have a specific logic level in that circuitry,
8 and you're shifting it so it can be used in a
9 different circuitry with different logic levels.

10 Q And what does VDD level mean in this
11 context?

12 MR. ODA: Objection, form.

13 A Like the -- so VDD, just traditionally
14 for us, is a voltage level -- power supply voltage
15 level, for example, and all it means is, we're
16 changing logic levels from a different power supply
17 level, in this case called logic levels, right, and
18 so this would just be a reference to a different
19 power supply level.

20 So you're moving them to operate with
21 another power supply level, a VDD level.

22 Q Okay. And can you please turn to page 38

1 of Exhibit 1011.

2 A Yeah.

3 Q Okay. And at the bottom of page 102 of
4 the book here, there's a heading, 4.4, Integration
5 of Electronics on Glass.

6 Do you see that?

7 A I do.

8 Q What does that mean, integration of
9 electronics on glass?

10 MR. ODA: Objection, form, scope.

11 A Can I read here? I just want to see what
12 they're describing.

13 Q Sure.

14 A I believe what this is discussing is,
15 different ways and different types of transistors
16 that can be used to fully integrate all these
17 systems onto one piece of glass.

18 Q In that context, would the glass be the
19 substrate?

20 MR. ODA: Objection, form, scope.

21 A That's one way to interpret it, yes, is,
22 can you get everything onto the same surface, I

1 suppose is the way to say it.

2 Q And if you turn to the next page,
3 page 39, at the bottom of page 104 of the book,
4 there's a Figure 4.16. And it says, Example of
5 configuration for a "system-on-panel."

6 Do you see that?

7 MR. ODA: Objection, scope.

8 A Yeah, I do.

9 Q So is this an example of a display where
10 components have been put onto the same surface?

11 MR. ODA: Objection, form, scope.

12 A That's what it's showing here, yes,
13 system on a panel.

14 Q And in this figure, there's a rectangle
15 labeled, Select driver.

16 Do you see that?

17 MR. ODA: Objection, scope.

18 A Yeah, I see it.

19 Q Okay. Would that be electronics that
20 perform what the gate driver we were just talking
21 about does in this example?

22 MR. ODA: Objection, form, scope.

1 A That's what the text is saying, right.

2 It's going through an AMLCD example.

3 Q And then there's another rectangle

4 labeled, Data driver.

5 Do you see that?

6 MR. ODA: Objection, scope.

7 A Yes, I do.

8 Q Okay. So does that represent the data

9 driver or source driver that we were looking at

10 earlier, something that performs those functions on

11 the surface?

12 MR. ODA: Objection, form, scope.

13 A As being described here for this example

14 in the book, yeah, it goes sequentially.

15 Q And then there's an area labeled, Viewing

16 area.

17 Do you see that?

18 MR. ODA: Objection, scope.

19 A I do.

20 Q And so in this example, is that where the

21 matrix of pixels would be, at the intersection of

22 data lines and select lines that come from the

1 select driver and data driver?

2 MR. ODA: Objection, form, scope.

3 A I mean, among other things, I would say
4 that the viewing area includes the area that has
5 liquid crystal on it.

6 Q And so the pixel circuits would be
7 located there, connected to the select lines and
8 data lines from the select driver and data driver?

9 MR. ODA: Objection, form, scope.

10 A Yeah, in this example, for this AMLCD,
11 yes, it would be.

12 Q When we were talking about your
13 background, you mentioned that you did work at
14 Princeton with respect to AMOLEDs on different
15 substrates and different types of backplanes.

16 Do you recall that?

17 A I do.

18 Q Did you do any work with AMOLEDs on
19 glass, as in this example?

20 MR. ODA: Objection, form, scope.

21 A Yeah, I did.

22 Q And so the AMOLEDs that you worked with

1 on glass, did they have the data driver and select
2 driver on the glass?

3 MR. ODA: Objection, form.

4 A No, I never integrated something like
5 this in my research.

6 Q When you say you never integrated
7 something like this, do you mean you never
8 integrated the select driver, data driver, and pixel
9 circuits onto one surface?

10 MR. ODA: Objection, form, scope.

11 Q Or was it just specifically glass that
12 you were excluding?

13 MR. ODA: Objection, form, scope.

14 A No, in research, we're usually making
15 parts and researching how individual components
16 work, right. And so I've never made a full
17 system-on-panel as shown here.

18 Q What are some of the challenges of
19 integrating these components on a single panel?

20 MR. ODA: Objection, form, scope.

21 A I think that really depends on when, time
22 frame.

1 Q Okay. How about in 2005?

2 MR. ODA: Objection, form, scope.

3 A I mean, I think in 2005, I can only read
4 what's written here. And some of those issues may
5 have -- or have become easier to deal with as
6 technology improves.

7 At that time, these were all achievable.
8 You know, you have a debate sometimes between, you
9 know, what you can do in a lab as far as making
10 proof of concepts and that kind of thing versus a
11 manufacturability where you might have costs
12 involved.

13 So yeah, the list includes, you know,
14 mobility, for example, of devices.

15 Q Okay. In the -- in an integrated design
16 where you have a data or source driver and select or
17 gate driver and the pixel array on one surface,
18 those components would still function in terms of
19 addressing and providing data in the way you
20 discussed where a select driver would select rows,
21 pixel circuits, and the data driver would be stored
22 in a capacitance?

1 MR. ODA: Objection, form, scope.

2 A Yeah, I mean, to the extent that that
3 really summarizes what we've been over so far, just
4 taking the book as what's written, that's what the
5 book is talking about.

6 Q Dr. Kattamis, please turn to Exhibit
7 1012.

8 (Previously marked Exhibit 1012
9 referenced.)

10 BY MR. HAMILL:

11 Q This is the article by Han.

12 A Yes, I have it open.

13 Q Okay. On the first page, first column,
14 there's the introduction and the first paragraph
15 there. There's a discussion of the non-uniformity
16 of electrical properties of poly-Si TFT, such as the
17 threshold voltage and field effect mobility.

18 What does non-uniformity of electrical
19 properties mean in this context?

20 MR. ODA: Objection, form.

21 A I believe what they are discussing here
22 is the non-uniformity of the electrical properties

1 of polysilicon itself as a material, and those --
2 we'll call them differences in electronic
3 properties, right, of that material itself can
4 change. And I believe that, you know, it discusses
5 this later, how different fabrication -- or
6 deposition techniques for polysilicon can impact how
7 that uniformity -- or how bad that non-uniformity
8 issue is.

9 Q And what does "non-uniformity" mean in
10 this context?

11 MR. ODA: Objection, form.

12 Q Is that within a single transistor, the
13 polysilicon is not uniform?

14 MR. ODA: Objection, form.

15 A Here, I -- not -- let me just get to the
16 line. One second.

17 Yeah, it just means that the electrical
18 properties, you know, could affect differently each
19 transistor.

20 Q So the various transistors in a display
21 would not operate exactly the same? Is that the
22 concern?

1 MR. ODA: Objection, form.

2 A I think that's a fair interpretation,
3 yes.

4 Q And how about field effect mobility, what
5 does that mean?

6 MR. ODA: Objection, form.

7 A Field effect mobility is really -- it's
8 one of the parameters that governs how a transistor
9 operates; for example, what -- what speed can it be
10 operated at in an electronic circuit, what -- how
11 much current can it deliver based on its size,
12 mobility would influence that as a parameter.

13 So it's just a parameter of the final
14 transistor product.

15 Q Okay. So with respect to these
16 non-uniformity -- well, let me scratch that.

17 So here in this paragraph, it says, the
18 non-uniformity of electrical properties of
19 polysilicon TFT, such as the threshold voltage and
20 field effect mobility, causes the non-uniformity of
21 luminance in one pixel to another one.

22 So does that mean that different pixels

1 could have different brightnesses in undesirable
2 ways?

3 MR. ODA: Objection, form.

4 A Yeah, now thinking back at this time, I
5 think this is -- well, it says 2006 -- polysilicon
6 was kind of on the cutting edge at that time. And
7 as I explained before, there were many different
8 ways to make it, and I think each way had its host
9 of issues.

10 And yeah, it caused them to not operate
11 the same across a display surface.

12 Q Okay. Also on this page with the heading
13 under the discussion, number 2, towards the bottom
14 of the second column, it says, Voltage programmed
15 LTPS-TFT pixel.

16 What does "voltage programmed" mean?

17 A I think I lay it out pretty well in the
18 background of my report. But there are -- at least
19 that's one way of biasing the circuitry in order to
20 emit light through the OLED.

21 Q In the context of an AMOLED display,
22 would an AMOLED display use one or the other, either

1 voltage programming or current programming?

2 MR. ODA: Objection, form.

3 A I think it really depends on the time
4 period and the technology and the application.

5 Q Are you familiar with AMOLED displays
6 that use both voltage programming and current
7 programming?

8 MR. ODA: Objection, form, scope.

9 A I don't have any in mind. I'm assuming
10 you're speaking about the 2005 time frame?

11 Q Sure. In the 2005 time frame -- I'll
12 just specify.

13 In the 2005 time frame, are you aware of
14 any AMOLED displays at that time that used both
15 voltage programming and current programming?

16 MR. ODA: Objection, form, scope.

17 A Not off the top of my head. I'd have to
18 go through articles.

19 Q How about since then, are you aware of
20 any AMOLED displays after the 2005 time frame that
21 used both voltage programming and current
22 programming?

1 MR. ODA: Objection, form, scope.

2 A I'm sure it's out there. I haven't
3 looked at circuitry specifically recently.

4 Q Please turn to page 2 of Exhibit 1012.
5 In the bottom right, under Figure 3, it says, The
6 supply voltage drop phenomena -- actually, hang on.

7 Yeah, okay. I'll start again.

8 So at the bottom of page 2, in the lower
9 right, it says, The supply voltage drop phenomena is
10 also the serious problem in the voltage programmed
11 pixel circuits.

12 Do you see that?

13 A I do.

14 Q What is "supply voltage drop" in this
15 context?

16 MR. ODA: Objection, form.

17 A I need just a moment to read a little
18 more.

19 Q Sure.

20 A Yeah, I see it.

21 Could you repeat the question? Sorry.

22 Or read back.

1 Q Sure. What is "supply voltage drop" in
2 this context?

3 MR. ODA: Objection, form.

4 A I believe what it's discussing here is
5 that the voltage drops basically across the panel
6 based on the resistance of the lines.

7 Q And what lines are being discussed here?

8 MR. ODA: Objection, form.

9 A Well, as it says, the voltage supply
10 line.

11 Q Okay. And so the resistance across the
12 panel, would that result in the voltage being
13 different at different parts of the panel?

14 MR. ODA: Objection, form.

15 A Yeah, I mean, whenever you have a current
16 going on a line, the voltage will be different along
17 that line based on the intrinsic resistance of the
18 resistance of the line.

19 Q Can you turn to page 3, please -- sorry,
20 page 4.

21 A Yes.

22 Q There's a heading here, 4. Feedback-type

1 LTPS-TFT pixel.

2 Do you see that?

3 A I do.

4 Q What is feedback-type pixel in this
5 context, what does that mean?

6 MR. ODA: Objection, form, scope.

7 A So I would need to review what's written
8 here. But generally, feedback is a way to rely on
9 something to correct for something.

10 Q Is a feedback-type pixel, could that
11 encompass voltage programming or current
12 programming?

13 MR. ODA: Objection, form, scope.

14 A I'd have to read what it says here. For
15 example -- give me one second to read.

16 Q Sure.

17 A At least the first example is about
18 feedback in the form of a photo sensor used to -- in
19 this, case it appears to be used for a voltage
20 programmed system.

21 Q Okay. And turning back to page 3,
22 there's a Figure 4 in the upper left. And it has

1 the circuit diagram. And the caption says, The
2 reported AMOLED pixel circuit employing a reference
3 voltage source VSUS which compensates the VDD supply
4 voltage drop as well as the threshold voltage
5 variation of polysilicon TFT.

6 A I see that.

7 Q What is a reference voltage source VSUS
8 in this context?

9 MR. ODA: Objection, form, scope.

10 A I would have to read this section to
11 understand what they're doing.

12 Q Is the term "VSUS" something that's used
13 in the field?

14 MR. ODA: Objection, form, scope.

15 A Not that I know of as a term of art, for
16 example.

17 Q And here it's referred to as a
18 compensation voltage. Or sorry, a reference
19 voltage.

20 MR. ODA: Objection, form, scope.

21 Q What is a reference voltage?

22 MR. ODA: Objection, form, scope.

1 A In this context, I can only say it means
2 a voltage.

3 MR. HAMILL: Let's go to the next
4 exhibit.

5 (Previously marked Exhibit 1001
6 referenced.)

7 BY MR. HAMILL:

8 Q Please turn to the '521 patent, Exhibit
9 1001.

10 Dr. Kattamis, in your view, what is the
11 '521 patent about?

12 A I think I lay that out in my report.

13 Q Can you tell me briefly here today?

14 MR. ODA: Objection, form.

15 A Yeah, reading the abstract, it's about an
16 AMOLED display system that includes various
17 features.

18 Q There are some examples in the patent in
19 column 1, starting at line 40, of power supply
20 voltage variations.

21 A Yeah, I see that.

22 Q On line 41, it starts, In particular,

1 when the AMOLED display is incorporated in a battery
2 powered application, the power supply voltage will
3 inevitably fluctuate whenever circuitry in the
4 application device is powered up from being in a
5 stand-by mode. For example, the AMOLED display may
6 be incorporated in a cellular telephone where the
7 battery voltage is coupled to a voltage regulator to
8 provide the power supply voltage for the AMOLED
9 display system.

10 Can you explain what is being described
11 here?

12 A You know, as it says, there are many
13 sources for power supply variations, and this is
14 pointing to some -- some causes of those variations,
15 at least including the stand-by mode voltage
16 regulators.

17 Q What is a voltage regulator?

18 A It's interesting. It's just as it says,
19 it's an electronic device that regulates a voltage,
20 or a voltage output.

21 Q In your experience, is a component
22 powering on in a battery powered application a

1 potential source of voltage fluctuation?

2 MR. ODA: Objection, form.

3 A I would say yes, potential, among many
4 others.

5 Q And what impact would that have on the
6 power supply voltage for the AMOLED display?

7 MR. ODA: Objection, form.

8 A Other than saying it could impact it, I'd
9 need a little bit more information, or a different
10 example. So something with some parameters.

11 Q Just as an example, would it cause the
12 voltage to drop?

13 MR. ODA: Objection, form.

14 A Would what cause the voltage to drop?

15 Q So in the example here, a circuitry in
16 the battery powered device powering up.

17 MR. ODA: Objection, form.

18 A Yeah, I mean, I think it really depends
19 on many factors. It could, yes. It could cause the
20 voltage to drop if I add additional loads to a
21 battery. But if, you know, depending on how -- the
22 ampacity of the battery, you may or may not actually

1 have that phenomenon occur.

2 (Reporter interruption.)

3 Q Could you please turn to -- before we do
4 that.

5 There's the discussion of a Figure 1
6 starting in this column. And it describes an AMOLED
7 display system video source that provides a source
8 to video signals, and it says here -- so I'm looking
9 from line 55 down to the end of the column 1.

10 It says, In most systems, the video
11 signals are digital in nature and the final
12 processing step of video source 12 is to convert the
13 digital signals to analog signals, and it says here,
14 the analog video signal Video.DAC is summed with a
15 DC voltage source DC at summer 20.

16 So with that in mind, could you turn to
17 Figure 1.

18 A Yes.

19 Q So in this figure, do you see the
20 component labeled number 20? Is that the summer?

21 A Yes.

22 Q And so that's combining the voltage at

1 VDC with the video signal, right?

2 A Yes.

3 Q Okay. And then if you turn back to
4 column 2 now, just continuing, it describes this a
5 little more.

6 Starting on line 8 of column 2, it says,
7 The DC voltage VDC is added to the analog signal of
8 Video.DAC to bring the DC range of the analog video
9 signal to within the range of the AMOLED display
10 panel.

11 Do you see that?

12 A I do.

13 Q Okay. Would this summing, could that be
14 described as level shifting as that term was used in
15 the den Boer Text?

16 MR. ODA: Objection, form.

17 A Yeah, I can only read what it says here.
18 It says that it is added to the analog signal VDAC
19 to bring the DC range of the analog signal to within
20 the range of the AMOLED display panel.

21 Q So does that describe level shifting?

22 MR. ODA: Objection, form.

1 A It is changing the level of Video.DAC.

2 Q Is it fair to call that level shifting?

3 MR. ODA: Objection, form.

4 A Yeah, it's shifting the level.

5 MR. HAMILL: We've been going about an
6 hour. How about another ten-minute break?

7 MR. ODA: Sure.

8 (Recess from 1:11 p.m. until 1:23 p.m.)

9 BY MR. HAMILL:

10 Q Dr. Kattamis, continuing with
11 Exhibit 1001, so can you turn to Figure 1 again,
12 please.

13 A Yes, I have.

14 Q Okay. There's a box that's labeled
15 AMOLED display panel.

16 A Yeah, I see it.

17 Q And it shows a schematic of one pixel
18 inside of it.

19 Do you understand this to be a simplified
20 schematic of what's being discussed in terms of a
21 display panel, which would have many pixels?

22 MR. ODA: Objection, form.

1 A Yeah, this is a representation, you know,
2 of -- in this case, as it says, an AMOLED display
3 pixel which would contain -- I have to look at the
4 exact language, but yes, more than one.

5 Q And in this figure, the circuitry
6 relating to the select lines is not shown, but
7 the -- to one of ordinary skill in AMOLED display
8 would include the select lines that we discussed for
9 activating different rows?

10 MR. ODA: Objection, form.

11 A Yeah, I mean, in the term of AM of OLED,
12 that means active matrix, that means you would have
13 a way to address.

14 Q And in this example, in Figure 1, the
15 summer that is changing the level of the voltage of
16 the video signal, that's located outside of the
17 panel and any of the pixel circuits, right?

18 MR. ODA: Objection, form.

19 A In this one prior art drawing, that is
20 how it's represented here.

21 Q Okay. And can you turn to column 2
22 again.

1 At the bottom of column 2, there's a
2 discussion of the current that would flow to the
3 OLED pixel.

4 A I see that.

5 Q And there's -- so there are a number of
6 equations labeled Equation 4. The first one, VDD
7 minus $v(t)$.

8 And do you understand $v(t)$ here to be the
9 voltage applied to the gate of the drive transistor?

10 MR. ODA: Objection, form.

11 A Yeah, that is what is described and shown
12 at Figure 1.

13 Q And in this discussion, there's no
14 discussion of threshold voltage, is there?

15 A No, there is no discussion of threshold
16 voltage in these words.

17 Q Is threshold voltage addressed at all by
18 the '521 patent?

19 MR. ODA: Objection, form.

20 A I can't recall off the top of my head,
21 no.

22 Q Okay. Turning back to Equation 4 at the

1 bottom of column 2. So there's the VDD in the
2 equation.

3 Do you understand that to be the power
4 supply voltage?

5 A Yeah, as stated here, the power supply
6 voltage, VDD.

7 Q And the nomenclature "VDD," is that
8 commonly used in the field to refer to the power
9 supply voltage?

10 MR. ODA: Objection, form.

11 A Yes, among others, it is.

12 Q And in the second row of Equation 4, VDD
13 has been broken out into three parts, VDDI, VDRIFT,
14 and VNOISE.

15 Do you see that?

16 A I see it.

17 Q What do you understand "drift" to be?

18 MR. ODA: Objection, form.

19 A I think it can have different meanings in
20 different contexts. I don't think it applies to one
21 thing.

22 Q In column 1, line 51, it says,

1 Furthermore, battery voltage tends to drift over
2 time.

3 Is that something you're familiar with?

4 A Yes. That's one example of drift.

5 Q And does that -- is your understanding of
6 that that the voltage of the power from the battery
7 changes slowly?

8 MR. ODA: Objection, form.

9 A It would depend on the context. So one
10 example could be the general decrease in battery
11 voltage over time, just as it's consumed, or as the
12 energy stored is used. That's one example.

13 Q There are a number of embodiments
14 discussed in the specification. Could you turn to
15 Figure 2, please. So this is the first embodiment.

16 And so the patent discusses a video
17 driver labeled 102, right?

18 A Yes.

19 Q And in this embodiment, the video driver
20 is separate from the display panel or any of the
21 pixel circuits, right?

22 MR. ODA: Objection, form.

1 A I mean, yeah, in this 1D representation
2 as shown here. I don't think that that's
3 necessary -- that that's necessarily shown here.

4 Q What's not necessarily shown here?

5 A For example, this is a 2D representation,
6 and in this representation, it is showing a box
7 around circuitry that it's placing in this case to
8 the left of the display, but the language in the
9 patent I don't think necessitates that.

10 Q But in the figure, the video driver is
11 separate from the display and pixel circuits, right?

12 MR. ODA: Objection, form.

13 A As drawn here, it is drawn to the left,
14 yes.

15 Q And can you turn to column 4, the last
16 paragraph. There's a discussion of referencing the
17 video signal to the power supply voltage VDD.

18 Is it fair to say that, in this
19 embodiment, that VDD is used for level shifting the
20 video signal?

21 MR. ODA: Objection, form.

22 A I don't believe so, no.

1 Q Why not?

2 MR. ODA: Objection, form.

3 A Level shifting, as we've discussed so
4 far, is more like adding an offset to the signal.

5 Q If you turn to the -- if you continue
6 down from the bottom of column 4 to the top of
7 column 5, there's a formula for the signal $v(t)$
8 going to the pixel VDD minus Video.DAC.

9 Would you consider that to be an offset
10 from VDD?

11 MR. ODA: Objection, form.

12 A Usually, I mean, I wouldn't -- usually an
13 offset is not power rail. So that's the only reason
14 I would say no.

15 Q What does "power rail" mean in this
16 context?

17 A So "power rail" meaning the highest
18 voltage I can achieve. So for example, if the
19 highest voltage I have is VDD, if I put an offset of
20 VDD to my signal, then I can't use it against VDD.
21 So I would expect it to be less in the traditional
22 sense of offset.

1 Q Can you turn back to the figures.

2 In Figure 3, on page 3 of the exhibit,
3 the shows a different embodiment of the video driver
4 labeled 202 this time.

5 Do you see that?

6 A Yes.

7 Q And in this embodiment, the video driver
8 is also separate from the display panel and pixel
9 circuit, right?

10 MR. ODA: Objection, form.

11 A That's how it's shown diagrammatically,
12 yes.

13 Q Okay. And turning to Figure 4, the third
14 embodiment, this shows a different embodiment of the
15 video driver labeled 302. This one is also shown
16 separate from the display panel and the pixel
17 circuits, right?

18 MR. ODA: Objection, form.

19 A Yes. Diagrammatically, it's showing it
20 separate, just as the previous one.

21 Q Okay. Can you turn to claim 1. This is
22 at the bottom of column 8.

1 And at line 52, there's a -- the first
2 limitation starts, a video driver receiving the
3 video signal and generating a video drive signal
4 indicative of a video signal and referenced to a
5 positive power supply voltage of the AMOLED display
6 panel.

7 For your analysis, how are you
8 interpreting the term "video driver"?

9 A I have to look in my report. In my claim
10 construction section, I believe that for this one, I
11 would be applying customary meaning, as a person of
12 ordinary skill in the art.

13 Q And what is the customary meaning to a
14 POSITA of a video driver in this context of this
15 patent?

16 A Just as it reads here, circuitry that
17 takes a video signal and generates a video drive
18 signal.

19 Q Is there anything else?

20 MR. ODA: Objection, form.

21 A I'm unclear as to what else you're asking
22 about.

1 Q Is there anything else in the customary
2 meaning that you're applying in your analysis with
3 respect to the term "video driver"?

4 MR. ODA: Objection, form.

5 A No, I don't believe so.

6 Q Turning to claim 2, there is a phrase in
7 claim 2 -- or a clause that says, wherein the video
8 drive signal is indicative of the sum of or the
9 difference between the positive power supply voltage
10 and the video signal.

11 How have you interpreted that in your
12 analysis?

13 A I think we'd have to go kind of
14 limitation by limitation in my analysis.

15 MR. HAMILL: Let's go to the next
16 exhibit.

17 (Previously marked Exhibit 1007
18 referenced.)

19 BY MR. HAMILL:

20 Q Exhibit 1007, the Kim reference.

21 So on page 14 of the exhibit, paragraph
22 7, it says, Figure 2 shows a conventional voltage

1 programming-type pixel circuit.

2 A Is there a paragraph?

3 Q Yeah, paragraph 7.

4 A Yes.

5 Q And turning to Figure 2, would you agree
6 that that shows a conventional analog pixel circuit?

7 MR. ODA: Objection, form.

8 A That's what it says here, and it says
9 it's representing a certain number of pixels. It
10 includes other things. But it would also include
11 the pixel.

12 Q I'm sorry, I'm not sure I understood your
13 answer.

14 Would you agree that, in your opinion, is
15 Figure 2 a conventional AMOLED pixel circuit?

16 MR. ODA: Objection, form.

17 A I don't know if I would use the word
18 necessarily "conventional." But it's a common, you
19 know, starting level voltage programmed pixel
20 circuit.

21 Q What do you mean by "starting level"?

22 A I'd characterize it as like the most

1 basic.

2 Q So it has the characteristics of an
3 AMOLED pixel circuit and not much else. Is that
4 what you mean?

5 MR. ODA: Objection, form.

6 A Yeah, it's really -- it's a
7 representation of the most basic voltage programmed
8 2-TFT pixel circuit.

9 Q By 2 TFT, you mean so there are two
10 transistors, one that determines whether or not --
11 that's connected to the slack line to pass the data
12 voltage through and another drive transistor?

13 MR. ODA: Objection, form.

14 A Yeah.

15 Q And a capacitor to store the data
16 voltage?

17 MR. ODA: Objection, form.

18 A Yes. That's what it states here.

19 Q Okay. Then turning to paragraph 46,
20 which is on page 16 of the exhibit, Kim discusses
21 Figure 3, and it discusses a plurality of data lines
22 and a plurality of scan lines, and pixel circuits

1 that are adjacent to the data lines and scan lines.
2 And then paragraph 47 discusses a scan driver and
3 data driver.

4 And so turning to Figure 3, would you say
5 this overall architecture is a conventional AMOLED
6 display architecture?

7 MR. ODA: Objection, form.

8 A I would stick to what it says in the
9 patent, in Kim, that this is describing a panel, a
10 basic panel.

11 Q Okay. And this shows some of the basic
12 active-matrix components in terms of a data driver
13 with data lines, a scan driver with scan lines.

14 Is that right?

15 A Yeah, these are the basics that are
16 required for active matrix addressing.

17 Q And then the pixel circuits in this
18 diagram are the circles. One of them is labeled 10,
19 and so the details of those are not shown in this
20 diagram, right?

21 A Correct. Paragraph 46 refers to 10 as
22 pixel circuit, and so we have a plurality of pixel

1 circuits.

2 Q And then the next paragraph on page 16 is
3 48. It says that the scan driver, data driver, and
4 display panel can be -- can have different formats.
5 It talks about a chip format.

6 What would you understand a chip format
7 to be?

8 A Integrated into a certain package.

9 Q How about a TCP, what is that?

10 MR. ODA: Objection, form.

11 A As it says, a package, another package.

12 Q Okay. And then those examples, do you
13 understand this to describe a system that would
14 still have a scan driver, a data driver, and a
15 display panel, just in different formats and
16 packages?

17 A Yeah, I mean, that talks about how you
18 would assemble them.

19 Q Okay. And the discussion continues, the
20 same can be attached to the display panel 100 and
21 installed in a chip format on a flexible printed
22 circuit or a film coupled to the display panel,

1 referred to as a chip on flexible board or chip on
2 film.

3 Are you familiar with those?

4 A Yeah. These are, again, just alternative
5 ways to connect devices.

6 Q So in these examples, you would still
7 have a scan driver, a data driver, and a display
8 panel, but they would be connected in different
9 ways?

10 A

11 MR. ODA: Objection, form.

12 A Yeah, I mean, that's what is described
13 here as, you know, among other possibilities,
14 including being installed on the same glass
15 substrate.

16 Q Okay. And we talked about a display on
17 the glass substrate earlier. So in that case, the
18 drivers and the pixels would be on a single piece of
19 glass?

20 A Yeah. That's one example I think it's
21 describing here.

22 Q Okay.

1 MR. ODA: Objection, form.

2 Q And in that example, the drivers -- the
3 data driver and the scan driver would still have
4 their functions; they would just be connected or
5 packaged in a certain way?

6 MR. ODA: Objection, form.

7 A Yeah. As described here, the functions
8 would be the same.

9 Q Turning back to page 14, paragraph 13, it
10 discusses here voltage drop or IR drop.

11 Does "voltage drop" in this context mean,
12 what you described earlier, where the voltage on
13 a -- across the voltage line changes across the
14 distance of the line?

15 MR. ODA: Objection, form.

16 A IR is current resistance drop which is --
17 it says generated on a line for supplying VDD.

18 Q And what is current resistance drop?

19 MR. ODA: Objection, form.

20 A A voltage drop that is based on the
21 amount of current and the amount of resistance in
22 the line.

1 Q And then down in paragraph 15, it talks
2 about deviations of a threshold voltage of a driving
3 transistor.

4 Is that the issue of non-uniformity of
5 threshold voltages that was discussed in the Han
6 article? Is that the same concept?

7 MR. ODA: Objection, form, scope.

8 A Not necessarily, no.

9 Q What does this refer to?

10 MR. ODA: Objection, form.

11 Q What does this discussion in paragraph 15
12 of deviations of a threshold voltage mean?

13 A There can be many causes for deviation in
14 threshold voltage. Transistor met a stability, for
15 example, in the materials and how the material
16 changes, based on time, temperature, a host of
17 effects.

18 So it could come from different causes,
19 that threshold deviation.

20 Q Okay. So the threshold deviation could
21 have many causes, but the negative impact is the
22 same as what was discussed in Han where you got

1 differences in brightness across the display?

2 MR. ODA: Objection, form, scope.

3 A Among other things, yes.

4 Q Okay. And so turning to paragraph 26,
5 this refers to an embodiment. Specifically, it says
6 that Figure 4 shows a diagram of a pixel circuit,
7 according to a first embodiment.

8 So if you turn to Figure 4, is what's
9 shown here a pixel circuit?

10 A That's what it states, Figure 4 shows a
11 brief diagram of a pixel circuit.

12 Q And in the context of Kim, there's a
13 voltage compensator box shown in this figure. In
14 the context of Kim, is the voltage compensator a
15 part of the pixel circuit?

16 A Yeah, it's within the pixel circuit.

17 Q Okay. And then turning to Figure 10,
18 this is a specific -- more specific embodiment
19 showing the insides of that voltage compensator,
20 right?

21 MR. ODA: Objection, form.

22 A Let me read the description here.

1 Yeah, it's the fourth embodiment. Yeah,
2 of the pixel circuit.

3 Q And this embodiment shown in Figure 10,
4 there are two different voltages -- well, you have a
5 number of inputs. One of them is VDD. What is VDD
6 in this context?

7 A The patent describes it as the power
8 supply voltage.

9 Q And what is VSUS?

10 MR. ODA: Objection, form.

11 A I just want to look at how it describes
12 it in the patent. One moment.

13 Refers to VSUS as a compensation voltage.

14 Q And what is a compensation voltage?

15 MR. ODA: Objection, form.

16 A I'd have to look through the patent to
17 see how it's defined, other than a voltage that
18 compensates.

19 It compensates the voltage at B4.

20 Q And what does it mean to "compensate the
21 voltage"?

22 MR. ODA: Objection, form.

1 A Offset it, change it, shift it. I mean,
2 it really depends, you know, on what the patent is
3 describing. But at a high level, it's changing that
4 number -- or that voltage, that B4.

5 Q And is it known in the field to use a
6 compensation voltage in pixel circuits?

7 MR. ODA: Objection, form.

8 A I think it really depends on the
9 application. You could -- I don't want to
10 speculate, right, but it could be -- all it says in
11 the patent here is that it's a compensation -- there
12 are other compensation techniques. It's basically
13 shifting the value of the voltage at B4.

14 Q Are you familiar with other uses of a
15 compensation voltage in a pixel circuit?

16 MR. ODA: Objection, form.

17 A I'm sure I've come across them before,
18 yes.

19 Q What is the source of the compensation
20 voltage?

21 MR. ODA: Objection, form.

22 A I'm unclear what you mean, the source of

1 the compensation voltage.

2 Q Where does it come from?

3 MR. ODA: Objection, form.

4 A It depends on what circuit generates it.

5 MR. HAMILL: We've been going about an
6 hour, I think. So why don't we -- should we take a
7 half hour?

8 MR. ODA: Sure. If that works for Lisa.

9 COURT REPORTER: That's perfect. Thank
10 you.

11 (Recess from 2:13 p.m. until 2:46 p.m.)

12 BY MR. HAMILL:

13 Q So Dr. Kattamis, we had been discussing
14 the Kim reference, Exhibit 1007.

15 In Kim -- so we were talking about
16 Figure 10, one of the embodiments. And Figure 10 is
17 a pixel circuit, right?

18 A Yeah, the patent refers to it as a pixel
19 circuit.

20 Q And Kim does not refer to any part of the
21 pixel circuit as a driver, right?

22 MR. ODA: Objection, form.

1 A Within the pixel circuit as a driving
2 transistor.

3 Q Okay. But Kim doesn't refer to that as a
4 driver, right?

5 MR. ODA: Objection, form.

6 A In the discussion of the -- of the
7 Figure 10, I'm not seeing the word "driver."

8 Q Can you turn back to page 14 of this
9 exhibit. And do you see Equation 1 at the top of
10 the second column?

11 A I do.

12 Q And what is VTH in the context of
13 Equation 1?

14 A As it says at paragraph 11, VTH is the
15 threshold voltage at transistor MA.

16 Q And Equation 1 provides a way of
17 calculating the current going to the OLED pixel,
18 right?

19 MR. ODA: Objection, form.

20 A Yeah, as explained in paragraph 11, IOLED
21 is the current flowing to the OLED.

22 Q How does the threshold voltage impact the

1 current flowing to the OLED?

2 MR. ODA: Objection, form.

3 A So in this example, for -- which is
4 referring to Figure 2, the threshold voltage --
5 sorry, -- IOLED depends on the difference between
6 the gate to source voltage and the threshold
7 voltage.

8 Q And is that generally true of TFT
9 transistors?

10 MR. ODA: Objection, form.

11 A Yeah, this is a general equation for a --
12 for a transistor in a -- what we call a state of
13 saturation. So it's a simplified equation.

14 MR. HAMILL: Let's turn to the next
15 exhibit, Exhibit 1006, Hayafuji.

16 (Previously marked Exhibit 1006
17 referenced.)

18 BY MR. HAMILL:

19 Q And Hayafuji's Figure 6 shows a circuit
20 diagram. If you could turn to Figure 6.

21 What does VA represent in this figure?

22 A The way it's laid out here, it looks like

1 the power supply -- the power supply that's going to
2 be used to operate the transistor TR2 to cause
3 emission through element 1, the light emitter.

4 Q Okay. And in this diagram, there's an
5 arrow from VA to the box, ripple component
6 extraction circuit, and then there's an output from
7 that box, VRI.

8 What is VRI?

9 A He refers to it as a ripple component, or
10 an extractor of a ripple component. So VRI would be
11 a ripple component.

12 Q And what does the ripple component
13 extraction circuit do?

14 MR. ODA: Objection, form.

15 A As stated at 48, it extracts a ripple
16 component.

17 Q And what do you understand a ripple
18 component to be?

19 A A nonideal part of the -- or a nonideal
20 component of the power supply voltage.

21 Q Okay. And then VRI goes into voltage
22 addition circuit.

1 Do you see that?

2 A Yes.

3 Q As does VDATA, right?

4 A Yes.

5 Q And does what does a voltage addition
6 circuit do?

7 A I can read what's here. Voltage addition
8 circuit 15 -- this is at paragraph 49 -- treating
9 data voltage as a base, the ripple component VRI
10 extracted by the extraction circuit 14 is added to
11 the base.

12 Q So VRI is added to VDATA?

13 MR. ODA: Objection, form.

14 A Yeah, that's what it says here.

15 Q Okay. Could you turn to your
16 declaration, Exhibit 1002, and specifically
17 paragraph 205, which is on page 98.

18 And in paragraph 205, you state that the
19 voltage VA can be expressed as the sum of a constant
20 DC output voltage VDC and the ripple component VRI,
21 right?

22 A Yes.

1 Q Okay. And in Hayafuji, if you could turn
2 back to Hayafuji, Figure 6, the voltage addition
3 circuit does not add VDC to the video signal VDATA,
4 right?

5 MR. ODA: Objection, form.

6 A Could you ask that again? Sorry.

7 Q Okay. In your report, you expressed VA
8 as the sum of VDC and VRI, right?

9 A Yes.

10 Q The addition circuit in Hayafuji's
11 Figure 6 does not add VDC to the video signal VDATA,
12 right?

13 MR. ODA: Objection, form.

14 A No. It's -- it subtracts it.

15 Is that what you're asking?

16 Q No. My question was about what the
17 voltage addition circuit 15 in Figure 6 of Hayafuji
18 does.

19 And so my question was, the addition
20 circuit in Hayafuji's Figure 6 does not add VDC to
21 the video signal VDATA, right?

22 MR. ODA: Objection, form.

1 A If you follow to the next step of the
2 equation where you substitute in VDC, which is VA
3 minus VRI, then VGATE includes the term VDATA and
4 VDC.

5 (Reporter interruption.)

6 Q You said if you followed the next step of
7 the equation. I wasn't asking about the equation.
8 I was asking about the voltage addition circuit in
9 Figure 6 of Hayafuji.

10 So that circuit, the voltage addition
11 circuit in Figure 6 of Hayafuji, my question is
12 about that circuit.

13 So does the voltage addition circuit in
14 Hayafuji's Figure 6 -- let me rephrase it.

15 The voltage addition circuit in
16 Hayafuji's Figure 6 does not add VDC to VDATA,
17 right?

18 MR. ODA: Objection, form.

19 A So, yeah, as shown in this diagram,
20 right, the addition circuit is adding VRI, right, to
21 VDATA, and VRI is VDD or VA minus VDC. So it's
22 still part of the total solution for VGATE.

1 Q So VRI, not VDC, is what's added to
2 VDATA?

3 MR. ODA: Objection, form.

4 A Yeah. In 15, VRI and VDATA are added
5 together, but VRI is also related to VA or equals VA
6 minus the DC component.

7 Q Please turn back to Exhibit 1002, your
8 report. And please turn to paragraph 313.

9 Well, actually, before we go there, let's
10 go to another page.

11 Please turn to page 143 of the report.

12 And in paragraph 299, you say that, Steer
13 discloses that the video drive signal is indicative
14 of the sum of or the difference between the positive
15 power supply voltage and the video signal and the
16 current drive voltage is indicative of the
17 difference between the positive power supply voltage
18 and the video drive signal.

19 And just so I understand, is it your
20 opinion is that Steer discloses claim 2 of the '521?

21 A Yes.

22 Q Okay. Could you please jump down to

1 page 149, paragraph 313.

2 In paragraph 313 you say that, Steer is
3 silent on the value of the resistors in the
4 differential circuit of the video driver. A POSA
5 would have been motivated to make the obvious design
6 choice of using the same value of resistors in the
7 differential circuit making the amplifier
8 unity-gain.

9 Do you see that?

10 A Yeah, I do.

11 Q If the value of the resistors in the
12 differential circuit of the alleged video driver
13 that you've identified in Steer are not the same, so
14 the resistors have different values, would Steer
15 disclose this claim limitation?

16 MR. ODA: Objection, form.

17 A Can I look at Steer real quick?

18 Q Sure. You can look at Steer, but I went
19 to the wrong page first. So this is a discussion of
20 claim 3, not claim 2.

21 So why don't we stay on your report. Let
22 me rephrase my question.

1 If you could turn to page 146. Here is
2 the beginning of your discussion of claim 3 with
3 respect to Steer, right?

4 A Yes.

5 Q Okay. And it is your opinion that it
6 would -- a POSA would have made the design choice of
7 using the same value resistors in the differential
8 circuit, right, in paragraph 313?

9 A Yes.

10 Q If the resistors don't have the same
11 values, does Steer disclose claim 3?

12 MR. ODA: Objection, form.

13 A It's interesting because the 102 -- or
14 block 102 of the '521 patent labels all the
15 resistors R the same, but later has a disclosure
16 that they could be different. So I'd really have to
17 do a full analysis to see if -- you know, if some
18 differences in Steer's resistors would still meet --
19 or still disclose claim 3.

20 Q So if the resistors have different
21 values, you're not sure whether Steer discloses
22 claim 3?

1 MR. ODA: Objection, form.

2 A I just want to look at the '521 real
3 quick.

4 I think what I would say is that both the
5 '521 and Steer have similar differential circuit
6 described.

7 If embodiment 1 of the '521 patent meets
8 this limitation and allows for differences in those
9 resistors, then the same would be true for Steer.

10 Q Okay. So looking at the claim 3 as
11 written, though, is it your opinion that Steer
12 discloses what's claimed -- setting aside any of the
13 embodiments from the specification, is it your
14 opinion that Steer discloses claim 3 if the
15 resistors have different values?

16 MR. ODA: Objection, form.

17 A Well, I have to analyze claim 3 in light
18 of the '521 specification.

19 So if the specification of the '521 is an
20 embodiment that meets this limitation that allows
21 for differences, as stated at column 5, line 30 of
22 the '521 patent, I don't see how it wouldn't as

1 well.

2 Q Well, in the context of claim 3, what is
3 the differential instrumentation amplifier circuit?

4 A According to the '521 patent, box 102
5 uses a, quote, differential instrumentation
6 amplifier circuit.

7 Q So your understanding of differential
8 instrumentation amplifier circuit is box 102 of
9 Figure 2 of the '521 patent?

10 A I can only say exactly how it's written
11 in the patent, and that's what the patent says. The
12 '521 says that that is a differential
13 instrumentation amplifier circuit.

14 Q Okay. And is it your opinion that
15 circuit 50 in Steer is a differential
16 instrumentation amplifier circuit?

17 MR. ODA: Objection, form.

18 A Yeah. Steer refers to it as a
19 differential amplifier circuit.

20 Q Okay. And in Steer, if the resistors do
21 not have the same values, is the output the
22 difference between the positive power supply voltage

1 and the video signal?

2 MR. ODA: Objection, form.

3 A It would be -- because of the
4 amplification, there would be an adjustment to that
5 difference in the same fashion that would apply to
6 the '521. There would be a gain applied.

7 Q Can you turn back to Exhibit 1001, the
8 '521 patent.

9 A Yes.

10 Q And turn to column 7, line 52.

11 And in that paragraph starting at line
12 54, it reads, Alternately, the video driver circuit
13 of the present invention can be implemented as an
14 integrated circuit to be incorporated in the AMOLED
15 display system.

16 What does that mean?

17 A He's just describing one way to implement
18 the video driver.

19 Q Is that a specific implementation?

20 MR. ODA: Objection, form.

21 A I'm not sure what you mean by "specific
22 implementation."

1 Q This doesn't describe the actual -- what
2 components would be used, right?

3 A No, it doesn't describe what components
4 can be used.

5 Q Does this describe the packaging such as
6 whether it would be --

7 MR. ODA: Objection, form.

8 Q Sorry, let me rephrase it.

9 Does this describe the packaging?

10 MR. ODA: Objection, form.

11 A An integrated circuit may be a package
12 device. Integrated circuit means it could be
13 packaged.

14 Q The next sentence reads, Furthermore, the
15 video driver circuit of the present invention can be
16 integrated with other circuitry of the AMOLED
17 display panel into a single integrated circuit.

18 What does that mean?

19 A I think it's just broadly saying that
20 this can be designed in many ways and implemented in
21 many ways.

22 Q And so earlier we looked at, in the den

1 Boer, there were row drivers and column drivers
2 implemented as integrated circuits in that textbook,
3 right?

4 MR. ODA: Objection, form.

5 A They were implemented in the form of
6 integrated circuits, and there was a whole host of
7 ways to connect and/or mount on the same surface, et
8 cetera.

9 Q Okay. And then at the bottom of this
10 column, it says, The video driver of the present
11 invention can be integrated with the AMOLED display
12 panel when desired to reduce the component count and
13 size of the PC board space used.

14 Is that similar to the example in den
15 Boer where the drivers were on the same substrate as
16 the display panel?

17 MR. ODA: Objection, form.

18 A I would say it's, again, listing similar
19 choices, as you would have in den Boer, to -- as to
20 where you're going to locate this circuitry.

21 MR. HAMILL: We've been going almost an
22 hour. Why don't we go ahead and take a ten-minute

1 break here.

2 (Recess from 3:34 p.m. until 3:45 p.m.)

3 BY MR. HAMILL:

4 Q Dr. Kattamis, would you please turn to
5 page 101 of your declaration. And on this page,
6 your discussion of Ground 4 begins. And for Ground
7 4 you're relying on obviousness in view of Hayafuji
8 and the knowledge of a POSA, right?

9 A Yes.

10 Q And then jumping down to page 104,
11 paragraph 214, here you propose modifications to the
12 circuits of Hayafuji, right?

13 A Yes.

14 Q And so with respect to Ground 4, your
15 opinions about obviousness assume that these
16 modifications are made, right?

17 MR. ODA: Objection, form.

18 A Just let me look real quick at one thing.
19 Yes. For specifically claims 3 and 5...
20 I think that's accurate, yes, for 3 and
21 5, claims 3 and 5.

22 Q And do you have any opinions about

1 obviousness of claims 1 and 2 with respect to
2 Hayafuji?

3 MR. ODA: Objection, form.

4 A As it's stated in my report, my opinion
5 is that claim 1 and 2 of the '521 is anticipated by
6 Hayafuji, and 3 and 5 are obvious in view of
7 Hayafuji and the knowledge of a POSA.

8 Q And so you don't have an opinion as to
9 claims 1 and 2 with respect to obviousness in view
10 of Hayafuji and the knowledge of a POSA?

11 MR. ODA: Objection, form.

12 A No, I don't have an analysis here of
13 that.

14 Q So you don't have an opinion with respect
15 to claims 1 and 2?

16 MR. ODA: Objection, form.

17 A No, I haven't done that analysis. So I
18 would say it's just anticipated for claims 1 and 2
19 of the '521.

20 Q Okay. And so then for claims 3 and 5,
21 your obviousness analysis of Hayafuji, in view of
22 the knowledge of a POSA, requires the modifications

1 that you've proposed here?

2 MR. ODA: Objection, form.

3 A I would say that, you know, this is one
4 modification that I made. I haven't done other
5 analyses that could potentially also -- you know,
6 whether that's modifications or other modifications
7 that could potentially also meet claim 3.

8 Q Okay. And if you turn to paragraph 217,
9 you state that, The modification includes the
10 removal of filter 14, right?

11 A Yes.

12 Q So that's one modification.

13 And then you would apply VA to one
14 terminal of amplifier OP3, right?

15 A Yes.

16 Q So that's a second modification?

17 MR. ODA: Objection, form.

18 Q And then you say, applying the data
19 signal from 16 to the other terminal of OP3.

20 So that's another modification?

21 MR. ODA: Objection, form.

22 A I mean, I would say I'm -- I'm using the

1 same op-amp that's there, OP3. I'm just changing
2 the connections to it.

3 So I don't know if I would characterize
4 it as an additional modification. I would -- I
5 would say there is the removal of the filter, and
6 then a rewiring of OP3.

7 Q And when you say removal of the filter,
8 you're referring to a removal of the ripple
9 extraction circuit, right?

10 MR. ODA: Objection, form.

11 A Yeah. Sorry, yeah. Removal of the
12 capacitor/resistor combination, which forms a
13 filter.

14 Q And that's referred to in Hayafuji as the
15 ripple component extraction circuit, right?

16 A Let me just look real quick. I just want
17 to see how it's described.

18 Yes.

19 Q Okay. And so your opinion is not that
20 Hayafuji without these modifications renders obvious
21 claim 4 or 5, right?

22 MR. ODA: Objection, form.

1 A No, I haven't done that analysis, so I
2 have not made that opinion.

3 Q And with respect to claim 5, Ground 4 is
4 the only ground in which you're providing an opinion
5 that claim 5 is either disclosed or rendered
6 obvious?

7 MR. ODA: Objection, form.

8 A Yeah, that's accurate. That's what's in
9 my report.

10 MR. HAMILL: Okay. No further questions.

11 MR. ODA: Let's take a short break.

12 (Recess from 3:56 p.m. until 3:56 p.m.)

13 EXAMINATION

14 BY MR. ODA:

15 Q I have a few questions on our side.

16 So Dr. Kattamis, do you recall being
17 asked whether you have an opinion as to claims 1 and
18 2 with respect to obviousness in view of Hayafuji?

19 A I do.

20 Q Have you performed such an analysis in
21 your declaration?

22 A Yes, I have.

1 Q What is your view?

2 A My view as to obviousness? Let me just
3 find the paragraphs.

4 So my view is that the modified circuit
5 of Hayafuji, the circuit that I modified, still
6 meets, of course, the limitations of claim 1 and 2.
7 And that's also restated with respect to claim 7.

8 Q Do you mean claim 5?

9 A I'm sorry, claim 5, yes.

10 Q Is there anything you'd like to point out
11 in your declaration regarding that?

12 A Yeah, one moment. Let me just find it.

13 Q Tell us when you get to the paragraph
14 you're looking for.

15 A So, for example -- I'm just trying to
16 find the headers here.

17 So with respect to claim 3, I state that,
18 The modified circuit still satisfies claim 1 and 2
19 of the '521 patent.

20 Q What paragraph is that?

21 A Sorry, 229.

22 Q 229?

1 A Yep.

2 So then we do the modification, and we
3 understand that a POSITA that, at claim 3 -- I'm
4 sorry, let me just find...

5 So I think the question -- can you repeat
6 the question?

7 Q Sure. So have you performed an analysis
8 of claims 1 and 2 with respect to obviousness in
9 view of Hayafuji as modified in Ground 4? And what
10 is your view?

11 A Yes. And so I'm trying to find the page
12 real quick. Sorry about that.

13 Q No problem. I believe you pointed to
14 paragraph 229 just now.

15 A 229 is one of them.

16 Q And does paragraphs 230 through 234
17 support your statement in paragraph 229 as an
18 analysis of obviousness of claims 1 and 2 in view of
19 Hayafuji?

20 A Yeah. So upon doing -- upon the
21 modifying the circuitry in Hayafuji, I, you know,
22 redid the analysis according to the claims, and

1 that's encompassed from 230 to 234.

2 Q Okay. And do you stand by that analysis?

3 A Yes.

4 Q Okay.

5 A And then for claim 5, I believe it's the
6 same annotation -- or it's the -- it's, of course,
7 the same modification.

8 Q Are you referring to paragraph 236?

9 A Yeah. So as we stated before, it's the
10 same modified circuit, and so, of course, it still
11 meets elements -- all the elements of claim 1 and 2
12 as modified.

13 Q And is that based on the same analysis
14 from paragraphs 230 to --

15 A Yes.

16 Q Okay. And do you stand by that analysis
17 with regard to claim 5, according to paragraph 236?

18 A Yes.

19 MR. ODA: Okay. No further questions. I
20 pass the witness.

21 MR. HAMILL: Just real quick.

22 EXAMINATION

1 BY MR. HAMILL:

2 Q Dr. Kattamis, with respect to your
3 analysis of claim 3 for Ground 4, your discussion
4 starting on paragraph 229 through 234, this analysis
5 relies on the same modifications you proposed for
6 claim 3, right?

7 A Yes. The modified circuit here above
8 paragraph 229 is the same modified circuit -- well,
9 it's the modi- -- this is the modified circuit that
10 I used for claim 3.

11 MR. HAMILL: Okay. No further questions.

12 COURT REPORTER: Anything else for the
13 record?

14 MR. HAMILL: No.

15 MR. ODA: No. I would like to give
16 the witness a chance to read and sign and correct
17 any issues that need to be corrected.

18 COURT REPORTER: Very good.

19 (Transcript orders discussed.)

20 COURT REPORTER: Thank you. That's all I
21 need.

22 (Off the record at 4:17 p.m.)

1 CERTIFICATE OF SHORTHAND REPORTER - NOTARY PUBLIC

2
3 I, Lisa V. Feissner, RDR, CRR and Notary
4 Public in and for the District of Columbia, do
5 hereby certify:

6
7 That ALEX Z. KATTAMIS, Ph.D., PE, the
8 witness whose deposition is hereinbefore set forth,
9 was duly sworn by me before the commencement of such
10 deposition, and that such deposition was taken
11 before me and is a true record of the testimony
12 given by such witness.

13
14 I further certify that the adverse party,
15 SAMSUNG DISPLAY CO., LTD et al., was represented by
16 counsel at the deposition.

17
18 I further certify that the deposition of
19 ALEX Z. KATTAMIS, Ph.D., PE, occurred REMOTELY on
20 FRIDAY, JANUARY 19, 2024, commencing at 11:05 a.m.
21 and concluding at 4:17 p.m.
22

1 I further certify that I am not related
2 to any of the parties to this action by blood or
3 marriage, I am not employed by or an attorney to any
4 of the parties to this action, and that I am in no
5 way interested, financially or otherwise, in the
6 outcome of this matter.

7

8 IN WITNESS WHEREOF, I have hereunto set
9 my hand this 22nd day of JANUARY, 2024.

10

11



12

13

NOTARY PUBLIC IN AND FOR

14

THE DISTRICT OF COLUMBIA

15

MY COMMISSION EXPIRES JUNE 15, 2028

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A			
a-si	acronym	91:7, 92:2,	al
39:8	14:15	92:10, 92:17,	111:15
al	across	92:19, 93:8,	alberti
5:22, 6:5	29:17, 40:17,	93:10, 93:13,	4:4
able	56:11, 59:5,	93:15, 93:20	alex
8:19	59:11, 82:13,	additional	1:16, 2:3, 5:2,
about	84:1, 86:17	9:21, 33:9,	5:13, 5:15,
12:10, 21:7,	action	64:20, 105:4	5:20, 7:2, 7:9,
22:17, 26:1,	112:2, 112:4	address	14:2, 111:7,
29:6, 33:22,	activate	7:8, 25:15,	111:19
36:13, 37:6,	28:19, 28:20,	32:3, 34:10,	all
38:18, 39:2,	34:13, 40:21	68:13	10:9, 11:1,
43:15, 48:21,	activates	addressed	11:19, 13:14,
50:12, 52:1,	32:11, 35:15	69:17	14:21, 15:2,
53:5, 55:4,	activating	addressing	30:17, 38:18,
57:10, 57:19,	25:21, 26:7,	27:9, 27:16,	40:6, 40:17,
60:17, 62:11,	68:9	30:8, 34:5,	41:3, 46:15,
62:15, 67:5,	active	34:7, 52:19,	47:16, 52:7,
67:6, 75:22,	6:6, 21:2,	79:16	69:17, 86:10,
80:5, 80:9,	34:5, 34:7,	adjacent	96:14, 109:11,
80:17, 81:16,	45:1, 45:2,	79:1	110:20
83:2, 87:5,	68:12, 79:16	adjustment	alleged
87:15, 92:16,	active-matrix	99:4	95:12
93:7, 93:8,	19:11, 23:20,	adverse	allow
93:12, 102:15,	24:1, 24:7,	111:14	24:20, 25:11,
102:22, 108:12	25:16, 30:8,	affect	44:20
above	30:22, 31:3,	54:18	allowed
33:18, 38:15,	31:7, 31:19,	after	19:16
39:20, 43:12,	33:22, 34:1,	57:20	allows
43:17, 44:7,	34:2, 42:16,	again	97:8, 97:20
44:17, 110:7	79:12	24:14, 58:7,	almost
abstract	actual	67:11, 68:22,	101:21
62:15	19:16, 21:19,	81:4, 92:6,	along
academic	45:17, 100:1	101:18	7:19, 13:8,
18:10	actually	against	22:2, 59:16
access	39:19, 58:6,	73:20	also
9:8	64:22, 94:9	agree	22:3, 25:1,
according	add	77:5, 77:14	32:13, 33:9,
84:7, 98:4,	64:20, 92:3,	agreement	33:20, 36:21,
108:22, 109:17	92:11, 92:20,	16:1	56:12, 58:10,
accurate	93:16	ahamill@krameral-	74:8, 74:15,
102:20, 106:8	added	berti	77:10, 94:5,
achievable	66:7, 66:18,	4:9	104:5, 104:7,
52:7	91:10, 91:12,	ahead	107:7
achieve	94:1, 94:4	37:9, 41:19,	alternately
73:18	adding	101:22	99:12
	73:4, 93:20	airport	alternative
	addition	4:5	81:4
	90:22, 91:5,		

although 24:15 always 17:6 america 1:5 amlcd 40:2, 42:22, 49:2, 50:10 amoled 6:9, 19:4, 19:6, 19:9, 19:22, 20:2, 22:4, 23:10, 56:21, 56:22, 57:5, 57:14, 57:20, 61:2, 62:16, 63:1, 63:5, 63:8, 64:6, 65:6, 66:9, 66:20, 67:15, 68:2, 68:7, 75:5, 77:15, 78:3, 79:5, 99:14, 100:16, 101:11 amoleds 18:20, 19:1, 20:13, 21:4, 21:11, 23:7, 24:1, 24:13, 34:8, 50:14, 50:18, 50:22 among 36:19, 50:3, 64:3, 70:11, 81:13, 84:3 amorphous 39:9 amount 82:21 ampacity 64:22 amplification 99:4 amplifier 95:7, 98:3, 98:6, 98:8,	98:13, 98:16, 98:19, 104:14 analog 44:8, 44:11, 44:13, 65:13, 65:14, 66:7, 66:8, 66:18, 66:19, 77:6 analyses 104:5 analysis 18:18, 18:22, 21:11, 45:16, 75:7, 76:2, 76:12, 76:14, 96:17, 103:12, 103:17, 103:21, 106:1, 106:20, 108:7, 108:18, 108:22, 109:2, 109:13, 109:16, 110:3, 110:4 analyze 97:17 andrew 4:3, 13:14 annotation 109:6 another 40:14, 46:21, 49:3, 55:21, 67:6, 78:12, 80:11, 94:10, 104:20 answer 7:21, 8:10, 8:19, 77:13 answers 7:19 anticipated 103:5, 103:18 any 8:3, 8:8, 8:18, 14:19, 15:5, 15:11, 15:17, 17:4, 17:19, 18:7, 37:5, 37:6, 50:18,	57:9, 57:14, 57:20, 68:17, 71:20, 87:20, 97:12, 102:22, 110:17, 112:2, 112:3 anything 10:5, 30:14, 75:19, 76:1, 107:10, 110:12 appeal 1:2 appears 60:19 applicable 23:7, 24:1, 45:14 application 5:21, 6:4, 44:15, 57:4, 63:2, 63:4, 63:22, 86:9 applications 6:7 applied 29:9, 69:9, 99:6 applies 70:20 apply 24:13, 33:2, 33:22, 34:8, 42:14, 99:5, 104:13 applying 75:11, 76:2, 104:18 approximately 16:4 architecture 37:22, 42:10, 79:5, 79:6 area 20:22, 21:14, 49:15, 49:16, 50:4 areas 11:13	around 7:15, 72:7 array 25:2, 52:17 arrays 24:7 arrow 90:5 art 9:22, 14:17, 61:15, 68:19, 75:12 article 53:11, 83:6 articles 57:18 aside 18:8, 22:2, 97:12 asked 106:17 asking 7:18, 75:21, 92:15, 93:7, 93:8 assemble 80:18 assume 102:15 assuming 57:9 attached 80:20 attention 29:5 attorney 112:3 aware 57:13, 57:19 away 19:6 B b4 85:19, 86:4, 86:13 bachelor's 18:13
--	---	---	---

back 12:6, 16:22, 29:4, 56:4, 58:22, 60:21, 66:3, 69:22, 74:1, 82:9, 88:8, 92:2, 94:7, 99:7 background 50:13, 56:18 backplane 6:9, 20:17, 20:20, 20:22, 21:4, 21:8 backplanes 20:13, 50:15 bad 54:7 baker 3:6, 9:1, 16:2, 17:2 ballparking 10:18 base 91:9, 91:11 based 40:10, 46:5, 55:11, 59:6, 59:17, 82:20, 83:16, 109:13 bases 15:2 basic 27:8, 27:16, 28:22, 30:7, 30:22, 31:3, 31:6, 37:22, 42:10, 43:4, 78:1, 78:7, 79:10, 79:11 basically 40:10, 59:5, 86:12 basics 23:13, 79:15 battery 63:1, 63:7, 63:22, 64:16,	64:21, 64:22, 71:1, 71:6, 71:10 because 96:13, 99:3 become 16:17, 52:5 been 7:3, 7:12, 7:16, 10:21, 15:20, 17:4, 17:6, 17:21, 34:19, 41:18, 48:10, 53:3, 67:5, 70:13, 87:5, 87:13, 95:5, 101:21 before 1:2, 2:6, 7:12, 7:17, 8:10, 8:16, 10:12, 10:13, 10:22, 15:15, 17:2, 17:22, 18:11, 18:12, 27:22, 43:10, 43:20, 56:7, 65:3, 86:17, 94:9, 109:9, 111:9, 111:11 beginning 2:5, 19:5, 23:9, 96:2 begins 102:6 behalf 3:2, 4:2 being 18:8, 31:4, 31:5, 41:1, 41:10, 49:13, 59:7, 59:12, 63:4, 63:10, 67:20, 81:14, 106:16 believe 12:9, 12:11, 12:14, 13:7,	15:4, 15:13, 17:1, 17:18, 24:2, 32:1, 40:8, 47:14, 53:21, 54:4, 59:4, 72:22, 75:10, 76:5, 108:13, 109:5 below 20:19, 39:22, 45:19 bemben 4:11 best 8:5, 43:14 between 21:3, 35:19, 36:14, 52:8, 76:9, 89:5, 94:14, 94:17, 98:22 bias 24:20, 25:9 biasing 24:15, 24:17, 56:19 big 9:15 billed 16:3 binary 43:10 binder 9:20 bit 21:20, 23:14, 25:17, 33:7, 64:9 block 96:14 blood 112:2 blue 45:21 board 1:2, 81:1, 101:13 boer 6:8, 10:3,	22:14, 23:2, 23:6, 23:21, 23:22, 24:13, 26:15, 66:15, 101:1, 101:15, 101:19 book 9:17, 26:22, 27:3, 27:4, 27:6, 27:11, 31:9, 38:22, 41:16, 42:19, 47:4, 48:3, 49:14, 53:4, 53:5 both 23:15, 34:1, 45:14, 57:6, 57:14, 57:21, 97:4 bottom 38:4, 43:6, 43:8, 47:3, 48:3, 56:13, 58:5, 58:8, 69:1, 70:1, 73:6, 74:22, 101:9 botts 3:6, 9:2, 16:2, 17:2 boulevard 4:5 box 33:10, 33:18, 34:22, 35:10, 36:7, 36:14, 38:5, 39:21, 43:8, 44:7, 67:14, 72:6, 84:13, 90:5, 90:7, 98:4, 98:8 break 8:8, 8:11, 41:20, 67:6, 102:1, 106:11 brief 84:11
--	--	---	---

briefly 21:13, 62:13 brightness 84:1 brightnesses 56:1 bring 66:8, 66:19 broadly 100:19 broken 70:13 brooklyn 7:11 buffer 39:21, 44:18 buffers 39:22 build 20:6 burlingame 4:7 busline 25:13, 25:18, 26:1, 26:3, 26:5, 26:12 buslines 25:2, 25:3, 26:8, 26:10, 28:2, 29:10	37:11, 69:20, 73:20 cannot 7:22 capacitance 30:15, 33:9, 33:16, 33:17, 33:20, 52:22 capacitor 25:3, 30:15, 33:6, 33:13, 33:18, 78:15, 105:12 capacitors 33:9 caption 37:21, 42:10, 61:1 case 1:12, 14:19, 16:18, 20:6, 20:19, 33:16, 35:2, 40:8, 46:17, 60:19, 68:2, 72:7, 81:17 cases 10:15, 10:21, 11:21, 21:16 cause 64:11, 64:14, 64:19, 90:2 caused 56:10 causes 55:20, 63:14, 83:13, 83:18, 83:21 cellular 63:6 certain 25:21, 26:7, 34:12, 77:9, 80:8, 82:5 certificate 111:1 certify 111:5, 111:14,	111:18, 112:1 cetera 101:8 cfei 5:20 challenge 40:22 challenges 51:18 chance 110:16 change 43:20, 43:22, 54:4, 86:1 changes 44:10, 71:7, 82:13, 83:16 changing 46:16, 67:1, 68:15, 86:3, 105:1 channels 45:21 characteristics 78:2 characterization 20:12 characterize 77:22, 105:3 charge 30:16, 44:20 charging 16:8 check 12:6 chip 80:5, 80:6, 80:21, 81:1 choice 95:6, 96:6 choices 101:19 circles 79:18 circuit 25:2, 27:9, 27:16, 33:6, 33:13, 55:10,	61:1, 61:2, 74:9, 77:1, 77:6, 77:15, 77:20, 78:3, 78:8, 79:22, 80:22, 84:6, 84:9, 84:11, 84:15, 84:16, 85:2, 86:15, 87:4, 87:17, 87:19, 87:21, 88:1, 89:19, 90:6, 90:13, 90:22, 91:6, 91:8, 91:10, 92:3, 92:10, 92:17, 92:20, 93:8, 93:10, 93:11, 93:12, 93:13, 93:15, 93:20, 95:4, 95:7, 95:12, 96:8, 97:5, 98:3, 98:6, 98:8, 98:13, 98:15, 98:16, 98:19, 99:12, 99:14, 100:11, 100:12, 100:15, 100:17, 105:9, 105:15, 107:4, 107:5, 107:18, 109:10, 110:7, 110:8, 110:9 circuitry 26:13, 32:1, 32:3, 35:3, 35:14, 46:7, 46:9, 56:19, 58:3, 63:3, 64:15, 68:5, 72:7, 75:16, 100:16, 101:20, 108:21 circuits 29:10, 35:8, 35:21, 36:17, 50:6, 51:9,
C			
ca 3:9, 4:7 calculating 88:17 california 3:7 call 12:22, 13:16, 54:2, 67:2, 89:12 called 17:16, 46:17 came 16:10 can't 11:7, 36:9,			

52:21, 58:11, 68:17, 71:21, 72:11, 74:17, 78:22, 79:17, 80:1, 86:6, 101:2, 101:6, 102:12 citations 10:2 cited 9:16 claim 74:21, 75:9, 76:6, 76:7, 94:20, 95:15, 95:20, 96:2, 96:11, 96:19, 96:22, 97:10, 97:14, 97:17, 98:2, 103:5, 104:7, 105:21, 106:3, 106:5, 107:6, 107:7, 107:8, 107:9, 107:17, 107:18, 108:3, 109:5, 109:11, 109:17, 110:3, 110:6, 110:10 claimed 97:12 claims 102:19, 102:21, 103:1, 103:9, 103:15, 103:18, 103:20, 106:17, 108:8, 108:18, 108:22 clause 76:7 close 35:6 clr 1:26, 2:6 columbia 111:4, 112:14 column 31:12, 32:14,	32:15, 32:22, 53:13, 56:14, 62:19, 65:6, 65:9, 66:4, 66:6, 68:21, 69:1, 70:1, 70:22, 72:15, 73:6, 73:7, 74:22, 88:10, 97:21, 99:10, 101:1, 101:10 com 3:11, 3:12, 3:13, 4:9, 4:17 combination 105:12 combining 65:22 come 24:20, 49:22, 83:18, 86:17, 87:2 comes 45:7 comfortable 14:12 commencement 111:9 commencing 111:20 commission 112:15 common 77:18 commonly 32:18, 70:8 company 17:16 compare 45:16 compatible 39:7 compensate 85:20 compensates 61:3, 85:18, 85:19 compensation 61:18, 85:13,	85:14, 86:6, 86:11, 86:12, 86:15, 86:19, 87:1 compensator 84:13, 84:14, 84:19 complaint 9:22 complete 15:6, 15:11, 34:15 component 40:14, 63:21, 65:20, 90:5, 90:9, 90:10, 90:11, 90:12, 90:16, 90:18, 90:20, 91:9, 91:20, 94:6, 101:12, 105:15 components 21:21, 38:3, 43:2, 45:3, 45:18, 48:10, 51:15, 51:19, 52:18, 79:12, 100:2, 100:3 computer 9:7, 9:9 computers 9:10, 9:11 concept 83:6 concepts 24:12, 52:10 concern 54:22 concluding 111:21 conductor 26:3 configuration 48:5 confirm 10:17 connect 81:5, 101:7	connected 26:4, 26:12, 28:11, 28:14, 32:16, 50:7, 78:11, 81:8, 82:4 connection 26:3 connections 105:2 consider 73:9 constant 91:19 construction 75:10 consumed 71:11 consumer 11:15, 11:16 cont'd 4:1 contacted 16:21 contain 26:10, 68:3 containing 37:13 context 19:10, 19:19, 19:22, 20:5, 20:21, 21:4, 25:12, 25:14, 26:9, 26:11, 35:7, 46:11, 47:18, 53:19, 54:10, 56:21, 58:15, 59:2, 60:5, 61:8, 62:1, 71:9, 73:16, 75:14, 82:11, 84:12, 84:14, 85:6, 88:12, 98:2 contexts 24:16, 70:20 continue 73:5
--	--	--	--

continues 80:19 continuing 66:4, 67:10 control 45:11 conventional 76:22, 77:6, 77:15, 77:18, 79:5 convert 65:12 converter 44:8 correct 23:5, 28:10, 34:21, 44:5, 60:9, 79:21, 110:16 corrected 5:11, 110:17 costs 52:11 could 7:7, 25:17, 27:2, 54:18, 56:1, 58:21, 60:10, 64:8, 64:19, 65:3, 65:16, 66:13, 71:10, 71:14, 83:18, 83:20, 86:9, 86:10, 89:20, 91:15, 92:1, 92:6, 94:22, 96:1, 96:16, 100:12, 104:5, 104:7 counsel 12:17, 13:2, 17:6, 111:16 count 101:12 coupled 63:7, 80:22 course 107:6, 109:6, 109:10	court 7:20, 7:21, 8:16, 12:10, 87:9, 110:12, 110:18, 110:20 cover 23:13, 23:15 credell 13:9 cross-talk 11:3, 20:16 crr 1:26, 2:6, 111:3 crystal 6:6, 33:4, 33:10, 33:19, 35:5, 50:5 current 45:11, 55:11, 57:1, 57:6, 57:15, 57:21, 59:15, 60:11, 69:2, 82:16, 82:18, 82:21, 88:17, 88:21, 89:1, 94:16 currently 9:4, 17:13 curriculum 5:19 customary 75:11, 75:13, 76:1 cutting 23:10, 56:6 cv 9:19, 17:11, 18:15, 20:9 cvfi 5:20	data 24:8, 25:2, 26:8, 26:10, 26:12, 28:2, 28:14, 29:9, 29:10, 29:19, 29:22, 30:11, 31:4, 31:12, 32:16, 33:1, 33:5, 33:12, 33:15, 38:13, 42:16, 45:20, 49:4, 49:8, 49:22, 50:1, 50:8, 51:1, 51:8, 52:16, 52:19, 52:21, 78:11, 78:15, 78:21, 79:1, 79:3, 79:12, 79:13, 80:3, 80:14, 81:7, 82:3, 91:9, 104:18 day 112:9 dc 4:15, 65:15, 66:7, 66:8, 66:19, 91:20, 94:6 deal 40:9, 41:6, 52:5 debate 52:8 decision 10:4 declarant's 14:1 declaration 5:15, 9:19, 13:9, 14:22, 15:3, 15:14, 15:17, 22:9, 22:16, 23:17, 91:16, 102:5, 106:21, 107:11	decrease 71:10 define 11:1 defined 28:9, 28:21, 44:15, 85:17 definition 36:7 degree 18:13 deliver 55:11 den 6:8, 10:3, 22:14, 23:2, 23:6, 23:21, 23:22, 24:13, 26:15, 66:15, 100:22, 101:14, 101:19 depend 71:9 dependent 41:3 depending 36:6, 38:13, 64:21 depends 26:6, 51:21, 57:3, 64:18, 86:2, 86:8, 87:4, 89:5 deposed 7:12 deposition 1:15, 2:3, 5:12, 10:6, 10:17, 11:2, 12:16, 13:20, 54:6, 111:8, 111:10, 111:16, 111:18 depositions 11:5 describe 21:13, 30:21, 66:21, 80:13,
---	---	--	--

100:1, 100:3, 100:5, 100:9 described 49:13, 63:10, 66:14, 69:11, 81:12, 82:7, 82:12, 97:6, 105:17 describes 31:2, 65:6, 66:4, 85:7, 85:11 describing 30:7, 47:12, 79:9, 81:21, 86:3, 99:17 description 84:22 deselected 29:22 design 18:17, 18:22, 19:13, 19:15, 20:11, 21:10, 26:6, 41:4, 52:15, 95:5, 96:6 designed 100:20 designing 21:21 designs 22:3, 23:10 desired 39:12, 101:12 details 30:2, 36:8, 79:19 determined 12:7 determines 78:10 developing 19:3, 19:7 development 19:5 deviation 83:13, 83:19,	83:20 deviations 83:2, 83:12 device 63:4, 63:19, 64:16, 100:12 devices 18:18, 52:14, 81:5 diagram 34:21, 36:21, 61:1, 79:18, 79:20, 84:6, 84:11, 89:20, 90:4, 93:19 diagrammatically 74:11, 74:19 difference 21:3, 76:9, 89:5, 94:14, 94:17, 98:22, 99:5 differences 54:2, 84:1, 96:18, 97:8, 97:21 different 21:21, 24:16, 33:7, 34:10, 40:6, 45:6, 45:9, 46:9, 46:16, 46:18, 47:15, 50:14, 50:15, 54:5, 55:22, 56:1, 56:7, 59:13, 59:16, 64:9, 68:9, 70:19, 70:20, 74:3, 74:14, 80:4, 80:15, 81:8, 83:18, 85:4, 95:14, 96:16, 96:20, 97:15 differential 95:4, 95:7, 95:12, 96:7, 97:5, 98:3,	98:5, 98:7, 98:12, 98:15, 98:19 differently 54:18 digital 38:13, 38:19, 39:16, 39:17, 43:10, 43:16, 43:21, 44:8, 44:11, 44:12, 45:20, 46:6, 65:11, 65:13 digits 13:7, 14:13 directly 9:18 disclose 95:15, 96:11, 96:19 disclosed 106:5 discloses 94:13, 94:20, 96:21, 97:12, 97:14 disclosure 96:15 discussed 24:12, 42:19, 42:21, 45:13, 52:20, 59:7, 67:20, 68:8, 71:14, 73:3, 83:5, 83:22, 110:19 discusses 23:2, 23:4, 54:4, 71:16, 78:20, 78:21, 79:2, 82:10 discussing 32:9, 34:20, 43:20, 47:14, 53:21, 59:4, 87:13 discussion 22:13, 23:19,	23:22, 27:22, 31:2, 31:15, 32:13, 38:21, 44:22, 53:15, 56:13, 65:5, 69:2, 69:13, 69:14, 69:15, 72:16, 80:19, 83:11, 88:6, 95:19, 96:2, 102:6, 110:3 discussions 22:17 display 1:4, 20:12, 20:17, 24:7, 26:6, 26:7, 30:18, 31:1, 31:3, 31:7, 31:19, 32:4, 33:22, 34:11, 34:15, 40:9, 41:4, 41:7, 42:17, 45:7, 45:8, 45:12, 48:9, 54:20, 56:11, 56:21, 56:22, 62:16, 63:1, 63:5, 63:9, 64:6, 65:7, 66:9, 66:20, 67:15, 67:21, 68:2, 68:7, 71:20, 72:8, 72:11, 74:8, 74:16, 75:5, 79:6, 80:4, 80:15, 80:20, 80:22, 81:7, 81:16, 84:1, 99:15, 100:17, 101:11, 101:16, 111:15 displays 6:7, 11:16, 19:4, 19:6, 19:17, 20:13, 22:4, 23:3,
---	--	--	---

23:20, 24:1, 30:8, 34:1, 34:2, 57:5, 57:14, 57:20 distance 41:11, 82:14 distribution 11:17 district 111:4, 112:14 documents 9:12, 10:10 doing 39:16, 61:11, 108:20 done 11:22, 103:17, 104:4, 106:1 down 65:9, 73:6, 83:1, 94:22, 102:10 dr 13:19, 17:10, 17:13, 42:2, 53:6, 62:10, 67:10, 87:13, 102:4, 106:16, 110:2 drawing 68:19 drawn 72:13 drift 70:17, 71:1, 71:4 drive 19:3, 25:1, 25:7, 26:13, 40:2, 44:1, 69:9, 75:3, 75:17, 76:8, 78:12, 94:13, 94:16, 94:18 driver 31:16, 31:17, 31:20, 32:2, 32:3, 32:5,	32:11, 32:22, 34:22, 35:11, 35:20, 36:6, 36:14, 36:15, 37:22, 38:4, 38:9, 41:10, 42:11, 42:15, 43:2, 44:12, 45:1, 48:15, 48:20, 49:4, 49:9, 50:1, 50:8, 51:1, 51:2, 51:8, 52:16, 52:17, 52:20, 52:21, 71:17, 71:19, 72:10, 74:3, 74:7, 74:15, 75:2, 75:8, 75:14, 76:3, 79:2, 79:3, 79:12, 79:13, 80:3, 80:14, 81:7, 82:3, 87:21, 88:4, 88:7, 95:4, 95:12, 99:12, 99:18, 100:15, 101:10 drivers 24:9, 31:12, 32:14, 32:15, 32:18, 35:17, 81:18, 82:2, 101:1, 101:15 driving 19:13, 45:7, 83:2, 88:1 drop 58:6, 58:9, 58:14, 59:1, 61:4, 64:12, 64:14, 64:20, 82:10, 82:11, 82:16, 82:18, 82:20 drops 40:10, 41:7,	59:5 duly 7:3, 111:9 during 18:7, 30:18, 30:20 E each 25:3, 25:4, 28:2, 28:11, 28:14, 29:2, 29:3, 30:19, 30:20, 32:4, 32:17, 54:18, 56:8 earlier 34:17, 49:10, 81:17, 82:12, 100:22 early 16:19 easier 52:5 eastern 1:20 edge 23:10, 56:6 effect 53:17, 55:4, 55:7, 55:20 effects 83:17 either 56:22, 106:5 electrical 53:16, 53:18, 53:22, 54:17, 55:18 electrode 29:18 electrodes 29:11 electronic 29:10, 54:2, 55:10, 63:19 electronics 1:4, 1:5,	11:15, 18:19, 20:11, 35:2, 47:5, 47:9, 48:19 electrophoretic 20:13 element 33:4, 33:19, 35:5, 90:3 elements 109:11 eliot 3:4, 3:12, 13:12 else 75:19, 75:21, 76:1, 78:3, 110:12 embodiment 36:1, 36:5, 71:15, 71:19, 72:19, 74:3, 74:7, 74:14, 84:5, 84:7, 84:18, 85:1, 85:3, 97:7, 97:20 embodiments 71:13, 87:16, 97:13 emission 21:2, 90:3 emit 56:20 emitter 90:3 emitters 20:19 employed 17:13, 112:3 employer 17:21 employing 61:2 encompass 60:11 encompassed 109:1
---	---	---	---

end 16:19, 65:9 energy 71:12 equals 94:5 equation 69:6, 69:22, 70:2, 70:12, 88:9, 88:13, 88:16, 89:11, 89:13, 93:2, 93:7 equations 69:6 equipment 11:17 eric 3:5, 3:13 errors 15:17 esquire 3:3, 3:4, 3:5, 4:3, 4:11 estimate 10:19, 11:9, 12:3, 16:6 et 101:7, 111:15 ever 11:11, 12:7, 12:12 everything 19:15, 21:6, 47:22 exact 68:4 exactly 54:21, 98:10 examination 5:2, 7:5, 106:13, 109:22 examined 7:3 example 19:21, 21:22, 24:20, 28:17, 36:12, 44:19,	44:22, 46:15, 48:4, 48:9, 48:21, 49:2, 49:13, 49:20, 50:10, 50:19, 52:14, 55:9, 60:15, 60:17, 61:16, 63:5, 64:10, 64:11, 64:15, 68:14, 71:4, 71:10, 71:12, 72:5, 73:18, 81:20, 82:2, 83:15, 89:3, 101:14, 107:15 examples 62:18, 80:12, 81:6 excerpt 6:6 excluded 12:12 excluding 51:12 excuse 30:9 exhibit 5:10, 6:3, 12:16, 13:1, 13:17, 13:20, 17:7, 17:10, 22:5, 22:8, 26:16, 26:17, 26:20, 27:1, 27:5, 31:8, 37:15, 41:15, 42:2, 47:1, 53:6, 53:8, 58:4, 62:4, 62:5, 62:8, 67:11, 74:2, 76:16, 76:17, 76:20, 76:21, 78:20, 87:14, 88:9, 89:15, 89:16, 91:16, 94:7, 99:7	exhibits 5:8, 6:1, 9:16, 13:3, 13:4, 13:6, 13:11 expect 37:12, 73:21 experience 18:21, 19:12, 63:21 expert 10:11, 10:15, 10:22, 11:1, 11:14, 11:19, 12:8, 15:20 expertise 18:17 expires 112:15 explain 63:10 explained 56:7, 88:20 explaining 34:5 exponent 17:16, 17:17, 18:1, 18:2, 21:9 expressed 91:19, 92:7 extent 53:2 extracted 91:10 extraction 90:6, 90:13, 91:10, 105:9, 105:15 extractor 90:10 extracts 90:15 extrinsic 10:2 F fabrication 18:17, 18:22, 20:12, 21:10,	21:20, 22:1, 54:5 factors 64:19 failure 18:18, 18:22, 21:10 fair 8:6, 8:12, 40:18, 55:2, 67:2, 72:18 familiar 57:5, 71:3, 81:3, 86:14 far 52:9, 53:3, 73:4 faragi 3:5 faragi@bakerbotts 3:13 fashion 99:5 features 33:21, 62:17 feedback 60:8, 60:18 feedback-type 59:22, 60:4, 60:10 feissner 1:26, 2:6, 111:3 fets 24:15 few 106:15 field 14:1, 23:12, 53:17, 55:4, 55:7, 55:20, 61:13, 70:8, 86:5 fields 11:19 figure 27:19, 27:20, 28:1, 28:7,
---	---	--	--

32:21, 33:8, 34:17, 37:17, 37:21, 39:20, 39:22, 42:8, 43:1, 45:3, 45:19, 45:20, 48:4, 48:14, 58:5, 60:22, 65:5, 65:17, 65:19, 67:11, 68:5, 68:14, 69:12, 71:15, 72:10, 74:2, 74:13, 76:22, 77:5, 77:15, 78:21, 79:4, 84:6, 84:8, 84:10, 84:13, 84:17, 85:3, 87:16, 88:7, 89:4, 89:19, 89:20, 89:21, 92:2, 92:11, 92:17, 92:20, 93:9, 93:11, 93:14, 93:16, 98:9 figures 74:1 file 9:21 film 80:22, 81:2 filter 104:10, 105:5, 105:7, 105:13 final 24:19, 39:6, 55:13, 65:11 finally 25:10 financially 112:5 find 107:3, 107:12, 107:16, 108:4, 108:11 first 7:3, 12:16,	53:13, 53:14, 60:17, 69:6, 71:15, 75:1, 84:7, 95:19 flexible 18:19, 20:11, 80:21, 81:1 floor 4:14 flow 43:4, 69:2 flowing 88:21, 89:1 fluctuate 63:3 fluctuation 64:1 focus 23:14 focused 19:3, 19:7, 19:12, 20:10, 24:3 foils 20:14 follow 93:1 followed 93:6 following 13:10 follows 7:4 format 80:5, 80:6, 80:21 formats 80:4, 80:15 forms 105:12 formula 73:7 forth 14:21, 111:8 four 13:7 fourth 85:1	fox 4:12 frame 30:1, 30:12, 30:19, 30:20, 51:22, 57:10, 57:11, 57:13, 57:20 francisco 3:9 frankly 36:9 friday 1:19, 2:4, 111:20 front 9:7, 9:18, 42:3 full 51:16, 96:17 fully 8:19, 47:16 function 52:18 functioning 44:21 functions 45:2, 49:10, 82:4, 82:7 fundamentally 35:3 fundamentals 6:7 further 106:10, 109:19, 110:11, 111:14, 111:18, 112:1 furthermore 71:1, 100:14 G gain 99:6 gate 24:8, 32:2, 32:5, 32:10, 35:10, 35:17, 35:20, 36:6, 36:14, 37:22,	38:4, 38:8, 40:2, 41:10, 48:20, 52:17, 69:9, 89:6 gates 39:8 general 24:3, 34:11, 71:10, 89:11 generally 11:16, 20:4, 60:8, 89:8 generated 82:17 generates 32:6, 75:17, 87:4 generating 75:3 getting 39:16, 39:18 give 10:19, 11:9, 12:3, 13:13, 37:7, 60:15, 110:15 given 111:12 glass 19:21, 47:5, 47:9, 47:17, 47:18, 50:19, 51:1, 51:2, 51:11, 81:14, 81:17, 81:19 go 7:17, 12:6, 16:22, 32:8, 37:9, 41:19, 57:18, 62:3, 76:13, 76:15, 94:9, 94:10, 101:22 goes 49:14, 90:21 going 21:6, 22:19, 24:18, 24:19,
---	---	--	---

25:10, 41:19, 49:2, 59:16, 67:5, 73:8, 87:5, 88:17, 90:1, 101:20, 101:21 goldstein 4:12 good 7:7, 110:18 governs 55:8 grad 19:2 green 45:21 ground 7:17, 102:6, 102:14, 106:3, 106:4, 108:9, 110:3 guess 11:8, 12:22 guessing 11:8	53:11, 83:5, 83:22 hand 112:9 hang 58:6 hayafuji 10:1, 89:15, 92:1, 92:2, 92:17, 93:9, 93:11, 102:7, 102:12, 103:2, 103:6, 103:7, 103:10, 103:21, 105:14, 105:20, 106:18, 107:5, 108:9, 108:19, 108:21 hayafuji's 89:19, 92:10, 92:20, 93:14, 93:16 head 7:22, 37:12, 57:17, 69:20 headers 107:16 heading 27:8, 31:11, 32:15, 47:4, 56:12, 59:22 held 2:4 here 8:20, 9:15, 22:13, 23:19, 24:5, 25:1, 29:2, 31:15, 32:1, 32:13, 36:8, 36:11, 37:10, 40:8, 43:4, 45:3, 46:6, 47:4, 47:11, 48:12, 49:13, 51:17, 52:4, 53:21, 54:15, 55:17, 59:4, 59:7,	59:22, 60:8, 60:14, 61:17, 62:13, 63:11, 64:15, 65:8, 65:13, 66:17, 68:20, 69:8, 70:5, 72:2, 72:3, 72:4, 72:13, 75:16, 77:8, 78:18, 81:13, 81:21, 82:7, 82:10, 84:9, 84:22, 86:11, 89:22, 91:7, 91:14, 96:1, 102:1, 102:11, 103:12, 104:1, 107:16, 110:7 hereby 111:5 hereinbefore 111:8 hereunto 112:8 high 24:3, 24:14, 34:4, 38:14, 86:3 highest 73:17, 73:19 hinted 36:11 history 9:22, 10:17 hold 30:16 holding 43:16 horowitz 9:17, 10:3, 22:17 host 56:8, 83:16, 101:6 hour 16:14, 41:19, 67:6, 87:6,	87:7, 101:22 hours 16:3 I ic 38:1, 42:11, 43:19 ics 34:22, 35:7, 35:11, 35:20, 36:15 ideally 13:10 identification 13:17 identified 95:13 image 31:22 impact 21:19, 54:6, 64:5, 64:8, 83:21, 88:22 impedance 40:1, 40:4, 40:12, 44:20 implement 99:17 implementation 28:9, 28:22, 29:3, 99:19, 99:22 implemented 99:13, 100:20, 101:2, 101:5 important 45:12 improves 52:6 inc 1:5 include 68:8, 77:10 includes 24:7, 33:8, 50:4, 52:13, 62:16, 77:10,
H half 87:7 hamill 4:3, 5:3, 5:5, 7:6, 12:15, 12:19, 12:22, 13:5, 13:15, 13:18, 17:9, 22:7, 26:19, 41:18, 42:1, 53:10, 62:3, 62:7, 67:5, 67:9, 76:15, 76:19, 87:5, 87:12, 89:14, 89:18, 101:21, 102:3, 106:10, 109:21, 110:1, 110:11, 110:14 han 6:9, 10:3,			

93:3, 104:9 including 18:18, 20:11, 63:15, 81:14 incorporated 63:1, 63:6, 99:14 increasing 40:9, 41:6 indicative 75:4, 76:8, 94:13, 94:16 individual 51:15 inevitably 63:3 influence 55:12 information 26:10, 37:6, 37:13, 38:19, 43:11, 43:16, 44:11, 44:12, 44:13, 64:9 input 43:5, 44:13 inputs 85:5 inside 43:2, 67:18 insides 84:19 installed 80:21, 81:14 instance 44:16 instead 27:13 institution 10:4 instrumentation 98:3, 98:5, 98:8, 98:13, 98:16 integrate 19:8, 47:16 integrated 35:8, 51:4,	51:6, 51:8, 52:15, 80:8, 99:14, 100:11, 100:12, 100:16, 100:17, 101:2, 101:6, 101:11 integrating 51:19 integration 47:4, 47:8 inter 5:17, 14:7 interested 112:5 interesting 63:18, 96:13 internal 18:9 internships 18:14 interpret 47:21 interpretation 55:2 interpreted 76:11 interpreting 75:8 interruption 65:2, 93:5 intersection 49:21 intrinsic 59:17 introduce 12:15 introducing 13:3 introduction 53:14 invention 99:13, 100:15, 101:11 investigations 15:5, 15:11 involved 16:17, 52:12 involving 21:18	ioled 88:20, 89:5 ipr 1:12, 14:8 ir 82:10, 82:16 issue 54:8, 83:4 issues 21:18, 21:19, 45:6, 45:9, 52:4, 56:9, 110:17 itself 33:10, 33:18, 54:1, 54:3 J january 1:19, 2:5, 111:20, 112:9 job 1:24 jobs 17:19, 18:7, 18:9 joined 17:22 joining 18:2, 18:11, 18:14, 21:9 judge 8:16 jump 94:22 jumping 102:10 june 112:15 K k-a-t-t-a-m-i-s 7:10 kattamis 1:16, 2:3, 5:2, 5:13, 5:15, 5:20, 7:2, 7:9, 13:19, 14:2,	17:10, 17:13, 42:2, 53:6, 62:10, 67:10, 87:13, 102:4, 106:16, 110:2, 111:7, 111:19 keeping 39:17 kessler 4:12 kim 10:1, 76:20, 78:20, 79:9, 84:12, 84:14, 87:14, 87:15, 87:20, 88:3 kind 10:18, 19:5, 19:6, 23:9, 23:10, 30:7, 33:10, 33:18, 38:14, 41:3, 52:10, 56:6, 76:13 know 8:4, 8:9, 21:7, 21:17, 22:1, 23:4, 28:21, 34:14, 35:4, 36:11, 41:18, 52:8, 52:9, 52:13, 54:4, 54:18, 61:15, 63:12, 64:21, 68:1, 77:17, 77:19, 81:13, 86:2, 96:17, 104:3, 104:5, 105:3, 108:21 knowledge 102:8, 103:7, 103:10, 103:22 known 24:6, 25:1, 86:5 kramer 4:4 L lab 52:9
---	---	--	---

label 36:22	60:17, 63:15	limitation 75:2, 76:14,	llc 1:8
labeled 34:22, 35:10,	led 45:17	95:15, 97:8,	llp 4:4
36:15, 38:5,	leds 18:20	limitations 107:6	loads 64:20
39:21, 43:9,	left 36:22, 60:22,	line 28:12, 28:15,	locate 101:20
43:13, 44:8,	72:8, 72:13	32:8, 40:17,	located 8:22, 9:1,
48:15, 49:4,	less 73:21	41:1, 41:10,	50:7, 68:16
49:15, 65:20,	let's 22:8, 26:15,	44:20, 54:16,	logic 46:7, 46:9,
67:14, 69:6,	62:3, 76:15,	59:10, 59:16,	46:16, 46:17
71:17, 74:4,	89:14, 94:9,	59:17, 59:18,	logical 39:1, 46:1,
74:15, 79:18	106:11	62:19, 62:22,	46:3
labels 96:14	level 24:4, 24:14,	65:9, 66:6,	long 17:17, 41:1,
laid 89:22	34:4, 38:14,	70:22, 75:1,	41:10
language 68:4, 72:8	38:16, 38:22,	78:11, 82:13,	look 7:15, 10:16,
large 29:7	39:10, 39:11,	82:14, 82:17,	12:1, 13:7,
large-area 20:10	39:16, 40:1,	82:22, 97:21,	16:11, 26:15,
last 14:13, 16:13,	40:4, 43:17,	99:10, 99:11	33:8, 37:5,
21:16, 72:15	43:20, 43:21,	lines 13:8, 24:8,	37:8, 37:9,
latch 43:13, 45:22	46:1, 46:3,	28:18, 32:16,	68:3, 75:9,
latched 45:21	46:7, 46:10,	33:1, 40:2,	85:11, 85:16,
later 54:5, 96:15	46:14, 46:15,	42:16, 49:22,	95:17, 95:18,
latest 13:8	46:17, 46:19,	50:7, 50:8,	97:2, 102:18,
lay 56:17, 62:12	46:21, 66:14,	59:6, 59:7,	105:16
lc 33:10, 36:2,	66:21, 67:1,	68:6, 68:8,	looked 58:3, 100:22
36:3, 36:10	67:2, 67:4,	78:21, 78:22,	looking 32:21, 42:2,
lcd 23:2, 24:19,	68:15, 72:19,	79:1, 79:13	49:9, 65:8,
25:12, 28:22,	73:3, 77:19,	liquid 6:6, 33:4,	97:10, 107:14
34:1, 36:15,	77:21, 86:3	33:19, 35:5,	looks 9:6, 22:17,
45:1, 45:7	level-shift 46:2	50:5	89:22
lcds 18:20, 19:6,	level-shifted 45:22	lisa 1:26, 2:6,	lot 23:11, 36:8,
23:14, 24:3,	levels 39:1, 39:2,	87:8, 111:3	45:17
33:7	39:6, 39:8,	list 52:13	low 40:1, 40:4
least 24:2, 56:18,	39:18, 46:1,	listing 101:18	lower 58:8
	46:3, 46:9,	little 21:20, 25:17,	ltps-tft 56:15, 60:1
	46:16, 46:17	33:7, 41:19,	
	light 24:20, 25:11,	58:17, 64:9,	
	56:20, 90:3,	66:5	
	97:17	live 7:10	
	lim 4:4		

luminance 55:21 lvds 37:11 M ma 88:15 made 10:2, 51:16, 96:6, 102:16, 104:4, 106:2 make 40:16, 40:17, 56:8, 95:5 making 51:14, 52:9, 95:7 manhattan 9:2 manipulating 38:18, 40:11 manufacturability 52:11 manufacturing 21:18 many 7:14, 10:14, 10:21, 11:4, 11:5, 16:3, 21:16, 45:12, 56:7, 63:12, 64:3, 64:19, 67:21, 83:13, 83:21, 100:20, 100:21 mark 3:3, 3:11, 9:4, 9:10 marked 13:17, 17:7, 22:5, 26:17, 53:8, 62:5, 76:17, 89:16 marriage 112:3 master's 18:3	material 23:6, 54:1, 54:3, 83:15 materials 9:16, 9:21, 83:15 matrix 6:6, 25:22, 34:5, 34:7, 35:21, 36:16, 36:19, 39:13, 45:1, 45:2, 49:21, 68:12, 79:16 matter 14:10, 15:21, 16:4, 16:9, 112:6 maybe 16:6 mean 14:16, 15:8, 19:18, 20:5, 20:20, 21:16, 25:7, 25:20, 26:2, 26:8, 29:14, 30:6, 30:14, 33:15, 35:1, 35:7, 36:7, 37:12, 38:12, 39:15, 40:3, 45:5, 46:2, 46:10, 47:8, 50:3, 51:7, 52:3, 53:2, 53:19, 54:9, 55:5, 55:22, 56:16, 59:15, 60:5, 64:18, 68:11, 72:1, 73:12, 73:15, 77:21, 78:4, 78:9, 80:17, 81:12, 82:11, 83:12, 85:20, 86:1, 86:22, 99:16, 99:21, 100:18,	104:22, 107:8 meaning 73:17, 75:11, 75:13, 76:2 meanings 70:19 means 20:22, 29:16, 46:5, 46:15, 54:17, 62:1, 68:12, 100:12 meant 41:8 meet 96:18, 104:7 meets 97:7, 97:20, 107:6, 109:11 memories 18:20 mentioned 10:10, 50:13 met 83:14 metal 20:14 methods 27:9, 27:17 middle 13:22, 24:5, 29:6 might 52:11 min-koo 6:9 mind 39:17, 57:9, 65:16 minus 69:7, 73:8, 93:3, 93:21, 94:6 minutes 41:20 mitigate 40:22 mobility 52:14, 53:17,	55:4, 55:7, 55:12, 55:20 mode 63:5, 63:15 modi 110:9 modification 104:4, 104:9, 104:12, 104:16, 104:20, 105:4, 108:2, 109:7 modifications 102:11, 102:16, 103:22, 104:6, 105:20, 110:5 modified 107:4, 107:5, 107:18, 108:9, 109:10, 109:12, 110:7, 110:8, 110:9 modifying 108:21 moment 58:17, 85:12, 107:12 more 11:22, 12:2, 20:4, 23:14, 24:3, 25:17, 35:2, 45:11, 58:18, 64:9, 66:5, 68:4, 73:4, 84:18 morning 7:7 most 13:10, 65:10, 77:22, 78:7 mostly 12:5 motivated 95:5 mount 101:7 move 34:14, 38:13 moves 43:10
---	--	---	--

moving 19:6, 46:20 much 55:11, 78:3 N name 7:8, 7:9, 14:1 nature 65:11 nd 112:9 necessarily 11:5, 36:10, 72:3, 72:4, 77:18, 83:8 necessary 25:10, 72:3 necessitates 72:9 need 7:20, 8:8, 13:14, 58:17, 60:7, 64:9, 110:17, 110:21 needed 38:14 needs 38:19 negative 39:2, 83:21 neil 17:1 never 51:4, 51:6, 51:7, 51:16 new 3:5, 7:11, 16:11 next 20:8, 29:21, 30:17, 34:14, 37:14, 41:14, 43:12, 43:17, 48:2, 62:3, 76:15, 80:2, 89:14, 93:1, 93:6, 100:14	nilsson 10:3, 22:18 nod 7:22 nomenclature 70:7 non-ptab 10:21 non-uniformity 53:15, 53:18, 53:22, 54:7, 54:9, 55:16, 55:18, 55:20, 83:4 nonideal 90:19 notary 2:7, 111:1, 111:3, 112:13 notice 2:6, 5:12, 12:16, 13:20 noticed 15:18 novel 19:17 number 5:10, 6:3, 9:12, 10:18, 16:5, 28:7, 38:3, 43:1, 56:13, 65:20, 69:5, 71:13, 77:9, 85:5, 86:4 numbering 22:22 numbers 13:14 nw 4:13 O oath 8:14 objection 15:7, 15:12, 25:19, 29:15, 32:7, 33:14,	34:3, 34:9, 35:16, 35:22, 36:4, 36:18, 37:4, 38:10, 38:17, 39:14, 40:5, 40:19, 41:2, 41:12, 42:18, 42:20, 44:3, 44:14, 45:4, 45:10, 45:15, 46:4, 46:12, 47:10, 47:20, 48:7, 48:11, 48:17, 48:22, 49:6, 49:12, 49:18, 50:2, 50:9, 50:20, 51:3, 51:10, 51:13, 51:20, 52:2, 53:1, 53:20, 54:11, 54:14, 55:1, 55:6, 56:3, 57:2, 57:8, 57:16, 58:1, 58:16, 59:3, 59:8, 59:14, 60:6, 60:13, 61:9, 61:14, 61:20, 61:22, 62:14, 64:2, 64:7, 64:13, 64:17, 66:16, 66:22, 67:3, 67:22, 68:10, 68:18, 69:10, 69:19, 70:10, 70:18, 71:8, 71:22, 72:12, 72:21, 73:2, 73:11, 74:10, 74:18, 75:20, 76:4, 77:7, 77:16, 78:5, 78:13, 78:17, 79:7, 80:10, 81:11, 82:1, 82:6,	82:15, 82:19, 83:7, 83:10, 84:2, 84:21, 85:10, 85:15, 85:22, 86:7, 86:16, 86:21, 87:3, 87:22, 88:5, 88:19, 89:2, 89:10, 90:14, 91:13, 92:5, 92:13, 92:22, 93:18, 94:3, 95:16, 96:12, 97:1, 97:16, 98:17, 99:2, 99:20, 100:7, 100:10, 101:4, 101:17, 102:17, 103:3, 103:11, 103:16, 104:2, 104:17, 104:21, 105:10, 105:22, 106:7 obvious 95:5, 103:6, 105:20, 106:6 obviousness 102:7, 102:15, 103:1, 103:9, 103:21, 106:18, 107:2, 108:8, 108:18 occur 40:10, 65:1 occurred 111:19 occurring 21:2 oda@bakerbotts 3:11 office 1:1, 3:4, 3:5 offices 9:1 offset 73:4, 73:9, 73:13, 73:19, 73:22, 86:1
--	--	---	---

oh 22:19 okay 7:16, 8:22, 10:5, 10:14, 10:19, 12:19, 13:15, 13:22, 14:6, 19:18, 19:22, 20:4, 22:13, 22:19, 25:7, 25:17, 26:11, 26:15, 27:8, 27:22, 28:5, 28:11, 28:17, 31:2, 31:11, 33:12, 33:21, 34:16, 35:7, 35:14, 35:19, 36:21, 37:14, 37:17, 38:15, 38:21, 39:6, 39:10, 41:14, 41:20, 42:5, 42:14, 43:8, 43:12, 44:17, 45:13, 46:22, 47:3, 48:19, 49:8, 52:1, 52:15, 53:13, 55:15, 56:12, 58:7, 59:11, 60:21, 66:3, 66:13, 67:14, 68:21, 69:22, 74:13, 74:21, 78:19, 79:11, 80:12, 80:19, 81:16, 81:22, 83:20, 84:4, 84:17, 88:3, 90:4, 90:21, 91:15, 92:1, 92:7, 94:22, 96:5, 97:10, 98:14, 98:20, 101:9, 103:20, 104:8, 105:19, 106:10,	109:2, 109:4, 109:16, 109:19, 110:11 oled 19:11, 20:19, 34:2, 45:2, 45:7, 45:12, 45:17, 56:20, 68:11, 69:3, 88:17, 88:21, 89:1 oleds 19:8, 19:13 once 30:20 one 9:15, 13:8, 17:21, 21:22, 29:2, 29:8, 31:6, 31:22, 33:17, 34:19, 37:7, 38:4, 38:11, 43:12, 43:17, 47:17, 47:21, 51:9, 52:17, 54:16, 55:8, 55:21, 56:19, 56:22, 60:15, 67:17, 68:4, 68:7, 68:19, 69:6, 70:20, 71:4, 71:9, 71:12, 74:15, 74:20, 75:10, 78:10, 79:18, 81:20, 85:5, 85:12, 87:16, 99:17, 102:18, 104:3, 104:12, 104:13, 107:12, 108:15 only 8:9, 52:3, 62:1, 66:17, 73:13, 98:10, 106:4 op-amp 105:1	op3 104:14, 104:19, 105:1, 105:6 open 17:12, 22:10, 26:21, 27:2, 27:7, 35:5, 53:12 operate 19:8, 39:19, 40:21, 44:6, 46:20, 54:21, 56:10, 90:2 operated 55:10 operates 55:9 operating 19:4 operation 19:16, 30:22, 31:7 operations 31:3 opinion 12:12, 77:14, 94:20, 96:5, 97:11, 97:14, 98:14, 103:4, 103:8, 103:14, 105:19, 106:2, 106:4, 106:17 opinions 14:19, 14:21, 15:2, 15:10, 102:15, 102:22 opposed 19:20 oral 1:15, 2:3 orally 7:21 order 16:6, 40:2, 56:19 orders 110:19 ordinary 14:16, 68:7,	75:12 other 15:5, 15:11, 17:19, 30:4, 33:19, 36:19, 42:11, 50:3, 56:22, 64:8, 77:10, 81:13, 84:3, 85:17, 86:12, 86:14, 100:16, 104:4, 104:6, 104:19 others 11:18, 18:20, 64:4, 70:11 otherwise 10:18, 112:5 out 56:17, 58:2, 62:12, 70:13, 89:22, 107:10 outcome 112:6 output 39:1, 39:21, 39:22, 40:1, 40:3, 43:5, 44:18, 44:20, 63:20, 90:6, 91:20, 98:21 outputs 44:13 outside 36:2, 36:3, 36:10, 68:16 over 7:17, 11:7, 21:16, 41:19, 53:3, 71:1, 71:11 overall 41:4, 79:5 owner 1:9, 4:2, 13:6 owner's 5:11, 13:4, 13:10 owners 11:22
---	---	---	--

P	59:13, 66:10, 66:20, 67:15, 67:21, 68:17, 71:20, 74:8, 74:16, 75:6, 79:9, 79:10, 80:4, 80:15, 80:20, 80:22, 81:8, 100:17, 101:12, 101:16	parties 112:2, 112:4 parts 51:15, 59:13, 70:13 party 111:14 pass 78:11, 109:20 patent 1:1, 1:2, 1:9, 1:13, 4:2, 5:11, 5:14, 5:18, 5:21, 6:4, 9:21, 11:22, 13:4, 13:6, 13:10, 14:10, 62:8, 62:11, 62:18, 69:18, 71:16, 72:9, 75:15, 79:9, 85:7, 85:12, 85:16, 86:2, 86:11, 87:18, 96:14, 97:7, 97:22, 98:4, 98:9, 98:11, 99:8, 107:19 pc 101:13 pdf 22:20, 22:21, 23:17 pe 1:16, 2:4, 5:2, 7:2, 14:2, 111:7, 111:19 pending 8:10 percentage 12:4 perfect 87:9 perform 48:20 performed 106:20, 108:7 performs 49:10	period 57:4 peripheral 29:10 person 14:16, 75:11 personal 9:6 pertains 14:10 petition 5:16 petitioner 1:6, 3:2 petitioners 11:22, 12:2, 12:6 ph 1:16, 2:4, 5:2, 5:13, 5:16, 5:20, 7:2, 13:9, 14:2, 18:3, 111:7, 111:19 phenomena 58:6, 58:9 phenomenon 65:1 photo 60:18 phrase 76:6 piece 47:17, 81:18 pixel 25:2, 25:3, 25:4, 27:9, 27:16, 28:2, 28:11, 28:14, 29:2, 29:4, 29:11, 29:18, 30:19, 32:17, 33:6, 33:13, 35:21, 36:16, 50:6, 51:8, 52:17, 52:21, 55:21, 56:15, 58:11, 60:1, 60:4, 60:10,
package 80:8, 80:11, 100:11 packaged 82:5, 100:13 packages 80:16 packaging 100:5, 100:9 page 5:2, 5:10, 6:3, 13:20, 18:15, 20:9, 22:11, 22:16, 22:19, 22:21, 23:16, 24:2, 26:22, 27:1, 27:3, 27:4, 27:5, 27:7, 27:11, 27:13, 27:14, 27:15, 29:6, 31:8, 34:16, 37:7, 37:14, 37:17, 38:21, 41:15, 42:5, 46:22, 47:3, 48:2, 48:3, 53:13, 56:12, 58:4, 58:8, 59:19, 59:20, 60:21, 74:2, 76:21, 78:20, 80:2, 82:9, 88:8, 91:17, 94:10, 94:11, 95:1, 95:19, 96:1, 102:5, 102:10, 108:11 pages 1:25, 27:5, 31:9, 41:15 panel 36:2, 36:3, 36:10, 36:15, 48:13, 51:19, 59:5, 59:12,	paragraph 18:16, 20:8, 23:20, 24:5, 24:22, 29:7, 32:14, 53:14, 55:17, 72:16, 76:21, 77:2, 77:3, 78:19, 79:2, 79:21, 80:2, 82:9, 83:1, 83:11, 84:4, 88:14, 88:20, 91:8, 91:17, 91:18, 94:8, 94:12, 95:1, 95:2, 96:8, 99:11, 102:11, 104:8, 107:13, 107:20, 108:14, 108:17, 109:8, 109:17, 110:4, 110:8 paragraphs 107:3, 108:16, 109:14 parameter 55:12, 55:13 parameters 55:8, 64:10 part 25:15, 41:5, 41:13, 44:4, 84:15, 87:20, 90:19, 93:22 partes 5:17, 14:7 particular 42:21, 62:22		

61:2, 67:17, 68:3, 68:17, 69:3, 71:21, 72:11, 73:8, 74:8, 74:16, 77:1, 77:6, 77:11, 77:15, 77:19, 78:3, 78:8, 78:22, 79:17, 79:22, 84:6, 84:9, 84:11, 84:15, 84:16, 85:2, 86:6, 86:15, 87:17, 87:18, 87:21, 88:1, 88:17 pixels 19:16, 24:8, 25:1, 25:8, 25:9, 28:7, 49:21, 55:22, 67:21, 77:9, 81:18 placed 29:17 placing 72:7 plastics 19:21 please 7:7, 8:4, 8:9, 13:19, 17:10, 22:11, 26:20, 26:22, 31:8, 37:14, 41:14, 42:6, 46:22, 53:6, 58:4, 59:19, 62:8, 65:3, 67:12, 71:15, 94:7, 94:8, 94:11, 94:22, 102:4 pll 4:12 plurality 78:21, 78:22, 79:22	point 8:8, 17:5, 44:5, 107:10 pointed 108:13 pointing 27:15, 63:14 polaris 1:8 poly-si 53:16 polymer 20:14 polysilicon 54:1, 54:6, 54:13, 55:19, 56:5, 61:5 portion 25:21, 26:7 posa 14:15, 95:4, 96:6, 102:8, 103:7, 103:10, 103:22 posita 14:15, 75:14, 108:3 positive 75:5, 76:9, 94:14, 94:17, 98:22 possibilities 81:13 potential 64:1, 64:3 potentially 104:5, 104:7 power 11:16, 24:18, 25:11, 46:14, 46:16, 46:19, 46:21, 62:19, 63:2, 63:8, 63:13, 64:6, 70:3, 70:5, 70:8, 71:6, 72:17, 73:13, 73:15, 73:17,	75:5, 76:9, 85:7, 90:1, 90:20, 94:15, 94:17, 98:22 powered 63:2, 63:4, 63:22, 64:16 powering 63:22, 64:16 powerled 1:8 prepare 10:5 present 99:13, 100:15, 101:10 pretty 56:17 previous 44:19, 74:20 previously 17:7, 22:5, 26:17, 32:9, 32:22, 53:8, 62:5, 76:17, 89:16 princeton 18:3, 18:5, 18:11, 18:14, 50:14 printed 80:21 prior 9:22, 18:2, 18:13, 68:19 probably 12:2, 13:13, 43:14 problem 58:10, 108:13 proceeding 14:8 processing 65:12 product 45:17, 55:14 products 11:16	professional 18:16, 20:9 profile 18:16, 20:9 program 19:2 programmed 56:14, 56:16, 58:10, 60:20, 77:19, 78:7 programming 57:1, 57:6, 57:7, 57:15, 57:21, 57:22, 60:11, 60:12 programming-type 77:1 proof 52:10 properly 44:1 properties 53:16, 53:19, 53:22, 54:3, 54:18, 55:18 propose 102:11 proposed 104:1, 110:5 provide 14:19, 33:1, 63:8 provided 11:14, 11:15 provides 42:15, 65:7, 88:16 providing 14:7, 52:19, 106:4 ptab 10:14, 11:21, 12:7, 12:13 pub 5:22, 6:5 public 2:7, 111:1, 111:4, 112:13
---	---	--	--

publication 5:21, 6:4 pursuant 2:5 put 21:6, 21:8, 24:18, 25:9, 48:10, 73:19 putting 36:1, 36:3, 36:5 Q qualified 12:8 question 8:3, 8:9, 8:10, 15:9, 36:13, 58:21, 92:16, 92:19, 93:11, 95:22, 108:5, 108:6 questions 7:18, 7:19, 7:21, 8:19, 106:10, 106:15, 109:19, 110:11 quick 16:11, 95:17, 97:3, 102:18, 105:16, 108:12, 109:21 quote 98:5 R rail 73:13, 73:15, 73:17 raise 38:22 range 66:8, 66:9, 66:19, 66:20 rate 16:8, 16:15, 16:16 rbemben@sterneke- ssler 4:17	rdr 1:26, 2:6, 111:3 read 47:11, 52:3, 58:17, 58:22, 60:14, 60:15, 61:10, 66:17, 84:22, 91:7, 110:16 reading 62:15 reads 75:16, 99:12, 100:14 real 16:11, 95:17, 97:2, 102:18, 105:16, 108:12, 109:21 really 11:7, 15:8, 21:5, 23:11, 41:3, 51:21, 53:3, 55:7, 57:3, 64:18, 78:6, 86:2, 86:8, 96:16 reason 8:18, 73:13 reasons 40:7 recall 50:16, 69:20, 106:16 receiving 75:2 recent 13:10 recently 58:3 recess 41:22, 67:8, 87:11, 102:2, 106:12 record 7:8, 7:22, 110:13, 110:22,	111:11 recorded 7:20 records 16:22 rectangle 35:19, 48:14, 49:3 red 45:21 redid 108:22 reduce 39:22, 40:3, 101:12 reduces 44:19 refer 14:12, 17:10, 70:8, 83:9, 87:20, 88:3 reference 46:18, 61:2, 61:7, 61:18, 61:21, 76:20, 87:14 referenced 5:8, 6:1, 17:8, 22:6, 26:18, 53:9, 62:6, 75:4, 76:18, 89:17 references 10:1 referencing 72:16 referred 23:21, 32:2, 32:18, 34:17, 61:17, 81:1, 105:14 referring 41:9, 89:4, 105:8, 109:8 refers 79:21, 84:5, 85:13, 87:18, 90:9, 98:18	refreshed 30:20 regard 109:17 regarding 107:11 registers 38:5, 38:8, 38:12, 43:9 regulates 63:19 regulator 63:7, 63:17 regulators 63:16 related 94:5, 112:1 relating 68:6 relevant 44:1 relies 110:5 rely 60:8 relying 102:7 remainder 30:1, 30:12 remember 37:11 remotely 2:4, 111:19 removal 104:10, 105:5, 105:7, 105:8, 105:11 rendered 106:5 renders 105:20 repeat 27:2, 58:21, 108:5 rephrase 8:5, 93:14, 95:22, 100:8 report 10:3, 10:9,
---	---	---	---

16:10, 56:18, 62:12, 75:9, 92:7, 94:8, 94:11, 95:21, 103:4, 106:9 reported 1:26, 61:2 reporter 7:20, 7:21, 65:2, 87:9, 93:5, 110:12, 110:18, 110:20, 111:1 represent 37:3, 49:8, 89:21 representation 32:10, 35:4, 68:1, 72:1, 72:5, 72:6, 78:7 represented 68:20, 111:15 representing 77:9 required 26:13, 39:7, 79:16 requirement 24:17, 30:15 requirements 24:15 requires 103:22 research 19:2, 20:10, 23:12, 51:5, 51:14 researching 51:15 resistance 59:6, 59:11, 59:17, 59:18, 82:16, 82:18, 82:21 resistive 40:10, 41:7 resistor 105:12	resistors 95:3, 95:6, 95:11, 95:14, 96:7, 96:10, 96:15, 96:18, 96:20, 97:9, 97:15, 98:20 respect 15:10, 18:21, 50:14, 55:15, 76:3, 96:3, 102:14, 103:1, 103:9, 103:14, 106:3, 106:18, 107:7, 107:17, 108:8, 110:2 respectively 39:3 response 39:12 restated 107:7 result 59:12 retained 15:20, 17:4, 17:6 retention 16:1 retrospectively 23:5 review 5:17, 14:8, 15:14, 60:7 reviewed 10:9 reviewing 15:18 reviews 22:3 rewiring 105:6 rgb 36:22, 37:10 richard 4:11 right 19:14, 22:15,	23:3, 27:18, 28:8, 35:21, 36:7, 36:17, 38:19, 39:18, 44:2, 46:17, 49:1, 51:16, 54:3, 58:5, 58:9, 66:1, 68:17, 71:17, 71:21, 72:11, 74:9, 74:17, 79:14, 79:20, 84:20, 86:10, 87:17, 87:21, 88:4, 88:18, 91:3, 91:21, 92:4, 92:8, 92:12, 92:21, 93:17, 93:20, 96:3, 96:8, 100:2, 101:3, 102:8, 102:12, 102:16, 104:10, 104:14, 105:9, 105:15, 105:21, 110:6 rigid 19:20 ripple 90:5, 90:9, 90:10, 90:11, 90:12, 90:15, 90:17, 91:9, 91:20, 105:8, 105:15 room 9:3, 9:4, 9:9 row 29:8, 29:9, 29:22, 31:11, 31:15, 31:17, 31:20, 32:4, 32:5, 32:11, 34:14, 40:17, 41:1, 70:12, 101:1 rows 30:4, 30:17,	31:4, 52:20, 68:9 rules 7:17 s s 3:1 said 41:6, 93:6 same 34:19, 45:2, 47:22, 48:10, 54:21, 56:11, 80:20, 81:14, 82:8, 83:6, 83:22, 95:6, 95:13, 96:7, 96:10, 96:15, 97:9, 98:21, 99:5, 101:7, 101:15, 105:1, 109:6, 109:7, 109:10, 109:13, 110:5, 110:8 samsung 1:4, 1:5, 17:4, 111:15 san 3:9 satisfies 107:18 saturation 89:13 say 11:21, 12:1, 12:5, 23:8, 23:13, 35:6, 36:9, 40:20, 41:13, 45:5, 48:1, 50:3, 51:6, 62:1, 64:3, 72:18, 73:14, 79:4, 94:12, 95:2, 97:4, 98:10, 101:18, 103:18, 104:3, 104:18,
--	--	--	---

104:22, 105:5, 105:7 saying 49:1, 64:8, 100:19 says 13:22, 14:1, 14:2, 18:16, 20:10, 24:6, 24:22, 25:20, 28:1, 29:8, 29:21, 30:4, 30:11, 30:17, 32:3, 32:15, 36:22, 37:10, 37:21, 38:22, 39:6, 39:22, 42:10, 44:10, 45:20, 48:4, 55:17, 56:5, 56:14, 58:5, 58:9, 59:9, 60:14, 61:1, 63:12, 63:18, 65:8, 65:10, 65:13, 66:6, 66:17, 66:18, 68:2, 70:22, 76:7, 76:22, 77:8, 79:8, 80:3, 80:11, 82:17, 84:5, 86:10, 88:14, 91:14, 98:11, 98:12, 101:10 scan 78:22, 79:1, 79:2, 79:13, 80:3, 80:14, 81:7, 82:3 scanned 30:5 schematic 67:17, 67:20 scope 47:10, 47:20, 48:7, 48:11, 48:17, 48:22,	49:6, 49:12, 49:18, 50:2, 50:9, 50:20, 51:10, 51:13, 51:20, 52:2, 53:1, 57:8, 57:16, 58:1, 60:6, 60:13, 61:9, 61:14, 61:20, 61:22, 83:7, 84:2 scratch 55:16 screen 12:19, 12:21, 13:21 second 18:15, 31:22, 32:14, 37:7, 38:11, 54:16, 56:14, 60:15, 70:12, 88:10, 104:16 section 20:9, 27:18, 34:12, 61:10, 75:10 see 9:12, 12:18, 14:1, 16:13, 23:1, 23:18, 24:10, 25:5, 27:10, 27:20, 28:3, 29:1, 29:12, 30:3, 31:10, 31:13, 31:18, 31:21, 32:19, 34:18, 35:12, 37:1, 37:2, 37:19, 38:2, 38:6, 39:4, 41:17, 42:8, 42:12, 47:6, 47:11, 48:6, 48:16, 48:18, 49:5, 49:17, 58:12, 58:20, 60:2,	61:6, 62:21, 65:19, 66:11, 67:16, 69:4, 70:15, 70:16, 74:5, 85:17, 88:9, 91:1, 95:9, 96:17, 97:22, 105:17 seeing 46:6, 88:7 select 25:2, 25:13, 25:18, 25:20, 26:4, 28:1, 28:12, 28:18, 31:12, 32:6, 32:8, 34:12, 35:15, 35:17, 41:10, 48:15, 49:22, 50:1, 50:7, 50:8, 51:1, 51:8, 52:16, 52:20, 68:6, 68:8 selected 29:8, 30:18, 31:4 selecting 25:21 semiconductor 18:18 sense 73:22 sensor 60:18 sentence 24:6, 29:21, 30:17, 100:14 separate 71:20, 72:11, 74:8, 74:16, 74:20 sequentially 30:18, 32:4, 35:15, 49:14 serious 58:10 set 14:21, 34:13,	111:8, 112:8 set-ups 19:16 sets 35:3 setting 97:12 seven 10:20 shake 7:22 shift 38:5, 38:8, 38:12, 43:9, 86:1 shifter 38:16, 43:17 shifters 38:22 shifting 39:10, 39:11, 46:8, 66:14, 66:21, 67:2, 67:4, 72:19, 73:3, 86:13 short 106:11 shorthand 111:1 should 16:10, 35:6, 87:6 show 12:17 showing 48:12, 72:6, 74:19, 84:19 shown 28:8, 31:22, 51:17, 68:6, 69:11, 72:2, 72:3, 72:4, 74:11, 74:15, 79:19, 84:9, 84:13, 85:3, 93:19 shows 28:1, 43:1,
--	---	--	--

67:17, 74:3, 74:14, 76:22, 77:6, 79:11, 84:6, 84:10, 89:19 side 106:15 sign 110:16 signal 36:22, 37:10, 37:13, 39:17, 40:16, 65:14, 66:1, 66:7, 66:9, 66:18, 66:19, 68:16, 72:17, 72:20, 73:4, 73:7, 73:20, 75:3, 75:4, 75:17, 75:18, 76:8, 76:10, 92:3, 92:11, 92:21, 94:13, 94:15, 94:18, 99:1, 104:19 signals 29:9, 32:6, 32:16, 33:1, 35:15, 39:16, 45:20, 46:6, 65:8, 65:11, 65:13 signature-plkal 112:11 silent 95:3 silicon 39:9 similar 97:5, 101:14, 101:18 similarities 45:6 similarly 43:19 simple 35:4	simplified 67:19, 89:13 since 7:21, 11:7, 21:9, 21:14, 21:17, 57:19 single 36:1, 51:19, 54:12, 81:18, 100:17 sirota 17:1 six 10:20 size 40:9, 40:11, 41:6, 55:11, 101:13 skill 14:17, 68:7, 75:12 slack 78:11 slightly 24:16 slowly 71:7 small 19:17 solution 93:22 some 7:17, 22:17, 30:2, 30:15, 37:12, 42:11, 45:9, 51:18, 52:4, 62:18, 63:14, 64:10, 79:11, 96:17 something 49:10, 51:4, 51:7, 60:9, 61:12, 64:10, 71:3 sometimes 52:8 sorry 21:1, 27:12,	31:21, 58:21, 59:19, 61:18, 77:12, 89:5, 92:6, 100:8, 105:11, 107:9, 107:21, 108:4, 108:12 source 24:8, 32:17, 32:18, 32:22, 34:22, 35:20, 36:6, 36:15, 42:11, 42:15, 43:2, 45:1, 49:9, 52:16, 61:3, 61:7, 64:1, 65:7, 65:12, 65:15, 86:19, 86:22, 89:6 sources 33:17, 63:13 space 101:13 speaking 57:10 specific 25:18, 36:5, 36:11, 46:7, 84:18, 99:19, 99:21 specifically 21:15, 51:11, 58:3, 84:5, 91:16, 102:19 specification 71:14, 97:13, 97:18, 97:19 specify 57:12 speculate 86:10 speed 55:9 spelled 7:9 stability 83:14	stand 19:9, 109:2, 109:16 stand-by 63:5, 63:15 standard 16:15 start 13:3, 13:13, 58:7 started 17:18 starting 23:12, 38:4, 62:19, 65:6, 66:6, 77:19, 77:21, 99:11, 110:4 starts 27:16, 62:22, 75:2 state 7:7, 89:12, 91:18, 104:9, 107:17 stated 70:5, 90:15, 97:21, 103:4, 109:9 statement 108:17 states 1:1, 78:18, 84:10 stay 95:21 steer 10:1, 94:12, 94:20, 95:2, 95:13, 95:14, 95:17, 95:18, 96:3, 96:11, 96:21, 97:5, 97:9, 97:11, 97:14, 98:15, 98:18, 98:20 steer's 96:18
--	--	---	--

step 65:12, 93:1, 93:6 sterne 4:12 stick 79:8 still 39:17, 40:12, 40:20, 40:21, 42:3, 52:18, 80:14, 81:6, 82:3, 93:22, 96:18, 96:19, 107:5, 107:18, 109:10 storage 25:3, 33:8, 43:16 store 78:15 stored 30:1, 30:11, 30:13, 31:5, 33:5, 33:12, 33:16, 52:21, 71:12 street 3:7, 4:13, 7:10 student 18:3, 18:8 submitting 15:15 substitute 93:2 substrate 19:17, 19:18, 20:1, 20:5, 21:4, 21:5, 47:19, 81:15, 81:17, 101:15 substrates 19:20, 20:3, 20:14, 50:15 subtracts 92:14 sufficiently 40:1, 40:4	suite 3:8, 4:6 sum 76:8, 91:19, 92:8, 94:14 summarizes 53:3 summed 65:14 summer 65:15, 65:20, 68:15 summing 66:13 supply 32:15, 46:14, 46:16, 46:19, 46:21, 58:6, 58:9, 58:14, 59:1, 59:9, 61:3, 62:19, 63:2, 63:8, 63:13, 64:6, 70:4, 70:5, 70:9, 72:17, 75:5, 76:9, 85:8, 90:1, 90:20, 94:15, 94:17, 98:22 supplying 82:17 support 5:16, 108:17 suppose 24:4, 48:1 sure 7:16, 9:15, 10:20, 11:10, 11:17, 13:15, 15:8, 16:12, 17:3, 19:2, 37:9, 40:16, 47:13, 57:11, 58:2, 58:19, 59:1, 60:16, 67:7, 77:12, 86:17, 87:8, 95:18, 96:21,	99:21, 108:7 surface 20:6, 20:22, 21:1, 21:5, 21:8, 24:20, 25:11, 47:22, 48:10, 49:11, 51:9, 52:17, 56:11, 101:7 surfaces 19:20 switch 29:22 sworn 7:3, 8:15, 111:9 system 25:16, 39:15, 48:13, 60:20, 62:16, 63:9, 65:7, 80:13, 99:15 system-on-panel 48:5, 51:17 systems 47:17, 65:10 T tail 16:19 take 8:8, 8:11, 26:15, 41:20, 44:10, 87:6, 101:22, 106:11 taken 111:10 takes 44:12, 75:17 taking 46:6, 53:4 talked 33:22, 81:16 talking 23:11, 48:20, 50:12, 53:5, 87:15 talks 80:5, 80:17,	83:1 tcp 80:9 techniques 54:6, 86:12 technologies 1:8 technology 11:13, 52:6, 57:4 teleconference 1:18 telephone 63:6 tell 8:15, 62:13, 107:13 temperature 83:16 temporary 43:15, 43:16 ten 7:15, 41:20 ten-minute 67:6, 101:22 tends 71:1 term 61:12, 61:15, 66:14, 68:11, 75:8, 76:3, 93:3 terminal 104:14, 104:19 terms 22:22, 31:4, 41:10, 52:18, 67:20, 79:12 testified 7:4, 10:13, 11:11 testimony 11:14, 14:6, 111:11 text 22:14, 23:2, 23:21, 29:6, 39:22, 49:1, 66:15
--	---	---	---

textbook 101:2 tft 20:12, 20:17, 25:2, 25:3, 26:14, 28:2, 29:11, 29:17, 30:9, 39:19, 40:21, 53:16, 55:19, 61:5, 78:9, 89:8 tfts 24:7, 24:15, 29:22, 32:17, 39:8, 39:9, 44:21 th 4:14, 7:10 thank 87:9, 110:20 thin-film 18:19, 20:18, 32:11, 33:3, 35:18, 40:13, 44:6 thing 52:10, 70:21, 102:18 things 21:18, 36:19, 40:6, 42:11, 45:11, 50:3, 77:10, 84:3 think 7:15, 8:18, 12:1, 16:19, 18:6, 21:7, 23:14, 43:14, 43:15, 43:19, 46:5, 51:21, 52:3, 55:2, 56:5, 56:8, 56:17, 57:3, 62:12, 64:18, 70:19, 70:20, 72:2, 72:9, 76:13, 81:20, 86:8, 87:6,	97:4, 100:19, 102:20, 108:5 thinking 56:4 third 74:13 three 9:22, 14:13, 70:13 threshold 53:17, 55:19, 61:4, 69:14, 69:15, 69:17, 83:2, 83:5, 83:12, 83:14, 83:19, 83:20, 88:15, 88:22, 89:4, 89:6 through 7:16, 11:2, 16:22, 24:21, 25:11, 33:3, 49:2, 56:20, 57:18, 78:12, 85:16, 90:3, 108:16, 110:4 time 1:20, 18:8, 30:2, 30:12, 30:19, 30:20, 51:21, 52:7, 56:4, 56:6, 57:3, 57:10, 57:11, 57:13, 57:14, 57:20, 71:2, 71:11, 74:4, 83:16 times 7:14 today 7:18, 8:20, 8:22, 9:1, 9:9, 14:7, 17:20, 62:13 together 94:5 tolerance 21:19	tonkovich 4:4 top 37:11, 43:5, 57:17, 69:20, 73:6, 88:9 total 93:22 towards 56:13 tr2 90:2 trademark 1:1 traditional 73:21 traditionally 46:13 transcript 110:19 transfer 25:11 transferred 29:11, 29:16 transistor 24:19, 25:10, 29:4, 29:17, 30:9, 33:3, 40:13, 44:6, 54:12, 54:19, 55:8, 55:14, 69:9, 78:12, 83:3, 83:14, 88:2, 88:15, 89:12, 90:2 transistors 19:3, 19:4, 19:7, 19:13, 20:18, 28:19, 28:20, 29:1, 32:11, 32:12, 35:18, 39:12, 44:1, 47:15, 54:20, 78:10, 89:9 treating 91:8 trial 1:2, 11:11	true 89:8, 97:9, 111:11 truth 8:15 truthfully 8:20 trying 31:21, 41:8, 107:15, 108:11 ttl 37:11 turn 13:19, 22:8, 22:11, 22:21, 23:16, 26:20, 26:22, 29:5, 31:8, 35:5, 35:18, 37:14, 40:12, 40:20, 41:14, 42:5, 46:22, 48:2, 53:6, 58:4, 59:19, 62:8, 65:3, 65:16, 66:3, 67:11, 68:21, 71:14, 72:15, 73:5, 74:1, 74:21, 84:8, 88:8, 89:14, 89:20, 91:15, 92:1, 94:7, 94:8, 94:11, 96:1, 99:7, 99:10, 102:4, 104:8 turned 30:9, 30:10 turning 24:22, 60:21, 69:22, 74:13, 76:6, 77:5, 78:19, 79:4, 82:9, 84:4, 84:17 two 9:10, 24:16, 33:16, 78:9,
--	---	---	---

85:4 type 19:18, 31:6 types 19:17, 20:3, 47:15, 50:15 U unclear 75:21, 86:22 under 8:14, 18:16, 32:14, 56:13, 58:5 understand 8:1, 8:3, 8:4, 8:14, 14:6, 14:16, 35:1, 37:3, 41:8, 61:11, 67:19, 69:8, 70:3, 70:17, 80:6, 80:13, 90:17, 94:19, 108:3 understanding 71:5, 98:7 understood 77:12 undesirable 56:1 uniform 54:13 uniformity 54:7 united 1:1 unity-gain 95:8 university 18:3, 18:10 until 34:14, 41:22, 67:8, 87:11, 102:2, 106:12 upper 60:22 use 14:15, 56:22,	57:6, 73:20, 77:17, 86:5 uses 86:14, 98:5 using 25:1, 95:6, 96:7, 104:22 usually 51:14, 73:12 V v(t 69:7, 69:8, 73:7 va 89:21, 90:5, 91:19, 92:7, 93:2, 93:21, 94:5, 104:13 value 86:13, 95:3, 95:6, 95:11, 96:7 values 95:14, 96:11, 96:21, 97:15, 98:21 variation 61:5 variations 62:20, 63:13, 63:14 various 19:17, 20:2, 20:3, 21:21, 22:3, 54:20, 62:16 vdac 66:18 vdata 91:3, 91:12, 92:3, 92:11, 92:21, 93:3, 93:16, 93:21, 94:2, 94:4 vdc 66:1, 66:7, 91:20, 92:3,	92:8, 92:11, 92:20, 93:2, 93:4, 93:16, 93:21, 94:1 vdd 46:1, 46:3, 46:10, 46:13, 46:21, 61:3, 69:6, 70:1, 70:6, 70:7, 70:12, 72:17, 72:19, 73:8, 73:10, 73:19, 73:20, 82:17, 85:5, 93:21 vddi 70:13 vdriift 70:13 versus 45:7, 52:10 vgate 93:3, 93:22 via 1:18, 2:4, 33:16 video 1:18, 32:16, 36:22, 37:10, 37:13, 65:7, 65:8, 65:10, 65:12, 65:14, 66:1, 66:8, 67:1, 68:16, 71:16, 71:19, 72:10, 72:17, 72:20, 73:8, 74:3, 74:7, 74:15, 75:2, 75:3, 75:4, 75:8, 75:14, 75:17, 76:3, 76:7, 76:10, 92:3, 92:11, 92:21, 94:13, 94:15, 94:18, 95:4, 95:12, 99:1, 99:12,	99:18, 100:15, 101:10 view 62:10, 102:7, 103:6, 103:9, 103:21, 106:18, 107:1, 107:2, 107:4, 108:9, 108:10, 108:18 viewing 49:15, 50:4 vitae 5:19 vnoise 70:14 voltages 34:13, 83:5, 85:4 volts 39:1, 39:2 vri 90:7, 90:8, 90:10, 90:21, 91:9, 91:12, 91:20, 92:8, 93:3, 93:20, 93:21, 94:1, 94:4, 94:5 vs 1:7 vsus 61:3, 61:7, 61:12, 85:9, 85:13 vth 88:12, 88:14 W want 12:15, 13:13, 47:11, 85:11, 86:9, 97:2, 105:16 wanted 15:6, 15:11 washington 4:15 way 11:1, 24:18,
---	---	---	---

40:17, 43:14, 47:21, 48:1, 52:19, 56:8, 56:19, 60:8, 68:13, 82:5, 88:16, 89:22, 99:17, 112:5 ways 34:10, 47:15, 56:2, 56:8, 81:5, 81:9, 100:20, 100:21, 101:7 we'll 54:2 we're 46:15, 51:14 we've 33:22, 34:19, 41:18, 53:3, 67:5, 73:3, 87:5, 101:21 went 95:18 whenever 59:15, 63:3 wherein 76:7 whereof 112:8 whether 36:9, 78:10, 96:21, 100:6, 104:6, 106:17 whole 34:15, 39:15, 41:4, 101:6 willem 6:8 williams 3:4, 13:12 williams@bakerbo- tts 3:12 within 54:12, 66:9, 66:19, 84:16, 88:1	without 105:20 witness 10:11, 10:15, 12:8, 109:20, 110:16, 111:8, 111:12, 112:8 word 20:20, 25:20, 77:17, 88:7 words 69:16 work 11:22, 17:15, 21:13, 24:8, 38:12, 40:15, 50:13, 50:18, 51:16 worked 10:11, 10:15, 11:4, 11:6, 17:2, 17:17, 21:10, 21:15, 50:22 works 8:7, 34:6, 41:21, 87:8 wouldn't 73:12, 97:22 written 37:6, 37:10, 52:4, 53:4, 60:7, 97:11, 98:10 wrong 95:19 Y yeah 9:15, 18:9, 21:15, 22:12, 22:19, 23:4, 23:8, 28:4, 28:9, 28:10, 31:6, 31:10, 31:18, 32:2, 32:10, 33:2, 33:15, 34:4,	34:19, 35:17, 36:20, 38:2, 38:18, 39:5, 39:9, 39:15, 41:13, 41:17, 42:21, 43:19, 44:4, 45:5, 47:2, 48:8, 48:18, 49:14, 50:10, 50:21, 52:13, 53:2, 54:17, 56:4, 56:10, 58:7, 58:20, 59:15, 62:15, 62:21, 64:18, 66:17, 67:4, 67:16, 68:1, 68:11, 69:11, 70:5, 72:1, 77:3, 78:6, 78:14, 79:15, 80:17, 81:4, 81:12, 81:20, 82:7, 84:16, 85:1, 87:18, 88:20, 89:11, 91:14, 93:19, 94:4, 95:10, 98:18, 105:11, 106:8, 107:12, 108:20, 109:9 year 16:11, 16:13 years 18:4, 21:17 yep 38:7, 108:1 york 3:5, 7:11 Z zoom 2:4 . .4300 4:8	.6234 3:10 .8549 4:16 0 00771 1:12, 14:8 0140600 6:5 0190128 5:22 05 1:20, 2:5, 111:20 07 21:17 08 41:22 1 1 67:8 10 4:14, 79:18, 79:21, 84:17, 85:3, 87:16, 88:7 100 80:20 1001 5:14, 62:5, 62:9, 67:11, 99:7 1002 5:15, 22:5, 22:8, 91:16, 94:7 1003 5:19, 17:7, 17:11 1006 5:21, 89:15, 89:16 1007 6:4, 76:17, 76:20, 87:14 101 3:7, 102:5
--	---	---	--

1011 6:6, 26:16, 26:17, 42:3, 47:1 1012 6:9, 53:7, 53:8, 58:4 102 47:3, 71:17, 96:13, 96:14, 98:4, 98:8 104 48:3, 102:10 106 5:4 109 5:5 11 1:20, 2:5, 67:8, 88:14, 88:20, 111:20 1101 4:13 112 1:25 12 41:22, 65:12 128 45:22 13 5:11, 82:9, 87:11 14 76:21, 82:9, 88:8, 91:10, 104:10 143 94:11 146 96:1 149 95:1 15 83:1, 83:11, 91:8, 92:17, 94:4, 112:15 16 78:20, 80:2,	104:19 17 5:19, 110:22, 111:21 19 1:19, 2:5, 41:22, 111:20 1d 72:1 2 2 87:11 2-1 13:5 2-tft 78:8 2.17 27:19, 28:7 2.7 27:8 20 39:2, 65:15, 65:20 20005 4:15 2001 13:8 2002 18:6 2004 23:11 2005 5:22, 6:5, 23:3, 23:5, 23:11, 52:1, 52:3, 57:10, 57:11, 57:13, 57:20 2006 56:5 2007 11:7, 17:18, 17:19, 18:6, 21:9, 21:14 202 74:4 202.772 4:16	2022 16:19 2023 1:12, 14:8, 16:16 2024 1:19, 2:5, 111:20, 112:9 2028 112:15 205 91:17, 91:18 2100 5:11, 13:13, 13:16, 13:17, 13:20 214 102:11 217 104:8 22 5:15, 112:9 229 107:21, 107:22, 108:14, 108:15, 108:17, 110:4, 110:8 23 16:20, 22:22, 67:8 230 108:16, 109:1, 109:14 233 7:10 234 108:16, 109:1, 110:4 236 109:8, 109:17 25 39:2 250 4:6 26 6:6, 22:11, 22:16, 22:21, 27:1, 27:4,	27:5, 27:7, 27:14, 84:4 27 7:10 29 23:16 299 94:12 2d 72:5 3 3 102:2, 106:12 3-line 45:22 3.3 39:1 30 11:10, 97:21 302 74:15 313 94:8, 95:1, 95:2, 96:8 32 23:17 3200 3:8 34 31:8, 102:2 35 37:15 36 41:15, 42:5 38 46:22 39 26:22, 27:4, 27:5, 27:11, 27:13, 27:15, 48:3 4 4 110:22, 111:21 4.11 42:8, 45:20
--	---	---	---

4.16 48:4 4.2 31:11 4.4 47:4 4.8 33:8, 34:17 4.9 37:18, 39:20 40 27:6, 29:6, 62:19 41 62:22 415.291 3:10 45 102:2 46 78:19, 79:21, 87:11 47 79:2 48 80:3, 90:15 49 91:8 5 50 98:15 51 70:22 52 75:1, 99:10 521 9:21, 14:13, 62:8, 62:11, 69:18, 94:20, 96:14, 97:2, 97:5, 97:7, 97:18, 97:19, 97:22, 98:4, 98:9, 98:12, 99:6, 99:8, 103:5, 103:19, 107:19	521039 1:24 525 16:14 53 6:9 54 99:12 55 65:9 56 106:12 577 4:5 5802 3:9 6 6-bit 45:20 60 16:6 62 5:14 650.825 4:8 67 23:20, 24:2 68 24:22 7 7,259,521 1:13, 5:14, 5:18, 14:11 70 16:7 76 6:4 8 89 5:21 9 93 31:9, 37:7 94 31:9, 37:7	94010 4:7 94111 3:9 95 38:21 97 41:15 98 41:16, 91:17	
---	---	---	--