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Transcript of Dr. David Kuan-Yu Liu

Date: December 17, 2024

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

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WORLDWIDE COURT REPORTING & LITIGATION TECHNOLOGY

YMTC Ex. 2021
Micron v. YMTC
IPR2024-00795 Page 1

1 UNITED STATES PATENT AND TRADEMARK OFFICE

2
3 BEFORE THE PATENT TRIAL AND APPEAL BOARD

4
5 MICRON TECHNOLOGY, INC.,

6 Petitioner,

7 v.

8 YANGTZE MEMORY TECHNOLOGIES COMPANY, LTD.,

9 Patent Owner.

10
11 Case IPR2024-00795
12 Patent 11,501,822

13
14 REPORTER'S TRANSCRIPT

15 DEPOSITION OF

16 DR. DAVID KUAN-YU LIU

17 TUESDAY, DECEMBER 17, 2024

18 Remote Video Teleconference

19 7:59 a.m. PST

20 to

21 10:39 a.m. PST

22
23 Stenographically Reported by:
24 Burgundy B. Ryan, RPR,
25 CSR No. 11373
Job No. 565014
Pages 1-94

A P P E A R A N C E S

ON BEHALF OF THE PETITIONER:

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ALSO PRESENT:

PARKER SIMPSON, Videographer
Planet Depos

DEPOSITION SUPPORT INDEX

QUESTIONS INSTRUCTED NOT TO ANSWER:

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QUESTIONS MARKED

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(None)

REPORTER'S NOTE:

QUOTATION MARKS ARE USED FOR CLARITY AND DO NOT
NECESSARILY REFLECT A DIRECT QUOTE.

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1 BE IT REMEMBERED that, pursuant to Notice
2 of Taking Deposition, and on Tuesday, December 17,
3 2024, commencing at 7:59 a.m. PST thereof, via
4 remote video teleconference, before me, Burgundy B.
5 Ryan, a Certified Shorthand Reporter in and for the
6 State of California, personally appeared

7 DR. DAVID KUAN-YU LIU,
8 a witness called on behalf of PATENT OWNER, and who,
9 having been first duly sworn by me to testify to the
10 truth, was examined and testified as follows:

11 THE VIDEOGRAPHER: Here begins the 07:58:30
12 videotaped deposition of Dr. David Kuan-Yu Liu in 07:58:32
13 the matter of Micron Technology, Incorporated versus 07:58:37
14 Yangtze Memory Technologies Company Limited, in the 07:58:42
15 United States Patent and Trademark Office before the 07:58:44
16 Patent and Trial Appeal Board, case number 07:58:47
17 IPR2024-00795. 07:58:54

18 Today's date is 12/17/2024. 07:59:00

19 The time on the video monitor is 7:59 07:59:03
20 Pacific time. 07:59:07

21 The remote videographer for today is 07:59:08
22 Parker Simpson representing Planet Depos. 07:59:10

23 All parties of this video deposition are 07:59:12
24 attending remotely. 07:59:14

25 Would Counsel please voice-identify 07:59:15

Transcript of Dr. David Kuan-Yu Liu
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1	themselves and state whom they represent.	07:59:16
2	MR. DAVIS: Jim Davis of Ropes & Gray for	07:59:21
3	Patent owner YMTC.	07:59:22
4	MR. HERMAN: Patrick Herman from Orrick,	07:59:26
5	Herrington & Sutcliffe here on behalf of	07:59:28
6	Petitioners.	07:59:29
7	THE VIDEOGRAPHER: The court reporter today	07:59:31
8	is Brooke Ryan representing Planet Depos.	07:59:32
9	The witness will now be sworn.	07:59:34
10	COURT REPORTER: Good morning. My name is	07:59:55
11	Burgundy Brooke Ryan, California CSR No. 11373.	07:59:55
12	(Whereupon, the witness was sworn.)	07:59:56
13	COURT REPORTER: Thank you very much.	07:59:56
14	Counsel, you may proceed.	07:59:56
15	MR. DAVIS: Thank you.	07:59:59
16	DAVID KUAN-YU LIU,	07:59:59
17	having been first duly sworn to tell the whole	07:59:59
18	truth, testified as follows:	07:59:59
19	EXAMINATION	07:59:59
20	By MR. DAVIS:	07:59:59
21	Q. Good morning, Dr. Liu.	07:59:59
22	A. Good morning.	08:00:00
23	Q. Could you please state your name?	08:00:01
24	A. My name is David Kuan-Yu Liu. L-i-u is the	08:00:03
25	last name.	08:00:07

Transcript of Dr. David Kuan-Yu Liu
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1	Q.	Where are you currently located?	08:00:08
2	A.	I'm currently located in Fremont,	08:00:10
3		California.	08:00:12
4	Q.	And what is your current occupation?	08:00:15
5	A.	Currently I am working as a consultant -- a	08:00:19
6		technical consultant.	08:00:23
7	Q.	You understand this is a remote deposition.	08:00:28
8		What is in front of you currently?	08:00:30
9	A.	I was advised not to have any documents so	08:00:34
10		I do not have anything in front of me.	08:00:36
11	Q.	So you just have a screen in front of you	08:00:38
12		from a laptop or a computer?	08:00:40
13	A.	I have a laptop that is hooked up to a	08:00:43
14		monitor so a bigger -- bigger display and I also	08:00:46
15		have my reading glasses just in case I need it.	08:00:50
16	Q.	Fully understand and sympathize.	08:00:54
17		On that screen are there any other windows	08:00:59
18		open beyond Zoom?	08:01:01
19	A.	No, not currently right now.	08:01:03
20	Q.	You understand that you are under oath	08:01:07
21		today?	08:01:08
22	A.	Yes, I do.	08:01:09
23	Q.	And you understand that I'll be asking the	08:01:10
24		questions and you'll be answering them?	08:01:12
25	A.	That's correct, yes.	08:01:16

Transcript of Dr. David Kuan-Yu Liu
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1	Q. And if you can wait for me to finish,	08:01:17
2	I'll -- I'll do my best to wait for you to finish as	08:01:19
3	well. Does that sound fair?	08:01:22
4	A. That sounds fair. Thank you.	08:01:24
5	Q. And is there any reason that you cannot	08:01:26
6	testify truthfully and fully today?	08:01:28
7	A. No, I don't believe so.	08:01:32
8	Q. And if I ask a question that you don't	08:01:34
9	understand, will you ask for clarification?	08:01:35
10	A. Yes, I will.	08:01:37
11	Q. Okay. Otherwise, I'll assume that you	08:01:38
12	understand the question. Is that fair?	08:01:40
13	A. Yes, that's fair.	08:01:42
14	Q. Have you ever been deposed before?	08:01:44
15	A. Yes, I have been dis- -- deposed before.	08:01:46
16	Three times.	08:01:48
17	Q. When was that?	08:01:54
18	A. The last one will be in August for a	08:01:57
19	different -- different matter.	08:02:02
20	Q. When were the prior two depositions?	08:02:06
21	A. And the one before that was -- I'm trying	08:02:09
22	to think. It was also sometime this year. Perhaps	08:02:16
23	in April -- in April, yes.	08:02:20
24	Q. And the first time you were deposed, when	08:02:24
25	was that?	08:02:27

1	A.	The very first time I was deposed I think	08:02:28
2		it would be -- I want to say 2013.	08:02:31
3	Q.	Were all three of those matters for work as	08:02:41
4		a consultant?	08:02:44
5	A.	Yes, they were.	08:02:47
6	Q.	How many times have you been retained as a	08:02:50
7		consultant for a patent litigation?	08:02:53
8	A.	I -- it's on my CV. I would say perhaps	08:03:00
9		over ten times because I remember -- I don't -- I	08:03:05
10		don't have it in front of me to counter, but ten	08:03:09
11		times, yeah. Sorry.	08:03:15
12	Q.	Okay. And of those ten or so times, do you	08:03:16
13		remember how many times you were actually put	08:03:21
14		forward as a testifying expert?	08:03:24
15	A.	I would say at least -- at least over five	08:03:34
16		of them.	08:03:37
17	Q.	In -- in the remainder of the engagements,	08:03:40
18		what was your role?	08:03:43
19	A.	Some of them were just non-testifying	08:03:46
20		expert to do certain source code review and some	08:03:51
21		were -- some cases never went to trial, so yeah.	08:03:57
22	Q.	So you said earlier that your current	08:04:13
23		occupation is a consultant. What does that	08:04:15
24		involve?	08:04:18
25		Mainly major portion is working as an	08:04:24

1	expert witness, and the other one also to -- not	08:04:26
2	currently right now but previously to -- to review	08:04:35
3	intellectual property's portfolios.	08:04:42
4	Q. Anything else?	08:04:47
5	A. No, I don't believe so. Yeah.	08:04:54
6	Q. So does the -- does all of your income	08:04:55
7	right now come from your work as an expert	08:04:58
8	witness?	08:05:00
9	MR. HERMAN: Objection. Form. Outside the	08:05:03
10	scope of direct.	08:05:04
11	THE WITNESS: I do have other incomes other	08:05:07
12	than expert witness work but it's -- it's personal.	08:05:09
13	But I do generate income from -- suffice it to say I	08:05:14
14	do generate income from expert witness work.	08:05:19
15	By MR. DAVIS:	08:05:21
16	Q. Is your main job as an expert witness?	08:05:21
17	MR. HERMAN: Objection. Form.	08:05:25
18	THE WITNESS: I would say a portion of	08:05:28
19	it -- a significant portion of it is, yes.	08:05:32
20	By MR. DAVIS:	08:05:35
21	Q. What portion of your work is -- of your	08:05:35
22	income is just from your expert witness work?	08:05:37
23	MR. HERMAN: Objection. Form. It's	08:05:41
24	outside the scope of direct.	08:05:43
25	THE WITNESS: I don't have a ballpark	08:05:47

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1	number because I do have other incomes. I will say	08:05:49
2	slightly north of 50 percent.	08:05:55
3	By MR. DAVIS:	08:06:01
4	Q. When did you first start working as an	08:06:01
5	expert consultant?	08:06:05
6	A. As I mentioned earlier when we had	08:06:07
7	conversation, I started working as -- I quit my	08:06:11
8	full-time job, my wife is a professor, her role is	08:06:15
9	quite busy and I didn't want my two sons to grow up	08:06:18
10	without parental presence at home after school so I	08:06:22
11	quit my full-time job to become a consultant so that	08:06:25
12	my time would be flexible. I believe the time frame	08:06:29
13	for that was around 2007 to 2008.	08:06:32
14	Q. And have you been doing that since then?	08:06:35
15	A. When I first quit my job, I was working	08:06:39
16	to -- to generate my own IP portfolio and	08:06:41
17	subsequently I was able to -- to -- we were acquired	08:06:45
18	by other entities and I started working initially to	08:06:52
19	review IP portfolio for different entities and	08:06:57
20	subsequently also working as an expert witness.	08:07:00
21	Q. When did you first start working as an	08:07:10
22	expert witness?	08:07:13
23	A. It would be very close to when I was first	08:07:17
24	deposed and I would say 2013 time frame. Maybe	08:07:21
25	earlier, yeah.	08:07:26

1	Q. Annually what would you say your income is	08:07:45
2	from your expert witness work?	08:07:47
3	MR. HERMAN: Objection. Form. Also,	08:07:49
4	outside the scope of direct.	08:07:50
5	THE WITNESS: I'm trying to think. It's --	08:07:59
6	it's off and on. Obviously I don't -- I'm not	08:08:00
7	engaged all the time and -- can you just bracket it	08:08:02
8	into a given -- given -- given year? As you know,	08:08:10
9	this kind of work, it's sometimes feast or famine,	08:08:13
10	right, so.	08:08:17
11	By MR. DAVIS:	08:08:18
12	Q. Sure. What about for 2024?	08:08:18
13	A. I would say it's -- so far it's less	08:08:24
14	than -- it's between 150,000 to 200,000.	08:08:27
15	Q. What about for 2023?	08:08:36
16	A. It was a lot less than that.	08:08:40
17	Q. When were you retained for this particular	08:08:46
18	IPR?	08:08:49
19	A. I would have to go back to my -- my -- my	08:08:55
20	files, the engagement letter. I do not recall. I	08:08:59
21	think -- I believe it's earlier this year some	08:09:01
22	time.	08:09:10
23	Q. So in the spring time?	08:09:11
24	A. Again, I -- I do not want to rely on my	08:09:14
25	memory but it was earlier this year, yeah. I -- I	08:09:17

1	do not know exact time unless I -- I have access to	08:09:25
2	my engagement letter.	08:09:28
3	Q. Okay. What rate do you charge for your	08:09:29
4	consulting work?	08:09:39
5	MR. HERMAN: Objection. Form.	08:09:40
6	THE WITNESS: I charge 550 an hour for time	08:09:43
7	of my consulting work.	08:09:51
8	By MR. DAVIS:	08:09:52
9	Q. And is that a standard rate?	08:09:52
10	A. What do you mean by "a standard rate?" My	08:09:59
11	standard rate or industry standard rate?	08:10:01
12	Q. Is that your standard rate?	08:10:04
13	A. Currently it is, yes.	08:10:06
14	Q. So you charge that same amount regardless	08:10:07
15	of the work that you're doing?	08:10:09
16	A. That's correct.	08:10:12
17	Q. Have you ever turned down a matter where	08:10:18
18	they've asked you to -- to work as an expert and	08:10:21
19	you've said no?	08:10:25
20	MR. HERMAN: Objection. Form. Also,	08:10:26
21	outside the scope of direct.	08:10:27
22	THE WITNESS: Yes, I have.	08:10:32
23	By MR. DAVIS:	08:10:34
24	Q. How many times?	08:10:34
25	A. I can't recall exactly but quite a few	08:10:40

1 times. I -- I generally -- yeah, in general I do 08:10:42
2 have certain guideline in terms of accepting 08:10:46
3 engagement. Whether that be ethical or wither that 08:10:55
4 be personal, I do not wish to divulge, but I do have 08:10:58
5 some guideline. 08:11:01

6 Q. You said earlier that one of the things 08:11:02
7 that you were doing when you became a consultant is 08:11:05
8 you were developing your own IP portfolio. How -- 08:11:09
9 how were you going about doing that? 08:11:13

10 A. When I quit my full-time job -- and during 08:11:22
11 my career when I was working for various companies I 08:11:25
12 was quite -- quite good at solving issues and then 08:11:31
13 inevitably every time you have not a way to resolve 08:11:36
14 issue, I was -- I was -- I applied for a patent 08:11:41
15 application and I was an inventor to quite a few 08:11:47
16 patents so one of the patent attorneys thought that 08:11:52
17 we could collaborate and then I started doing 08:11:55
18 industry survey and trying to find out what -- what 08:12:02
19 matters and what -- some of the idea. And sometimes 08:12:04
20 idea just came while taking a shower and I write it 08:12:08
21 down and we discuss to see if it's worthwhile. But 08:12:13
22 I don't do that anymore now. 08:12:15

23 Q. How long did you do that -- how long did 08:12:17
24 you try to generate an IP portfolio? 08:12:19

25 A. It was very early. I could -- it was very 08:12:22

1	early, right after I quit my full-time job and	08:12:27
2	before I was a known entity as an expert witness, so	08:12:31
3	I would say the first three or four years.	08:12:35
4	Q. How many patents did you file for?	08:12:43
5	A. I'm sorry, you mean total or -- or -- you	08:12:49
6	mean like I'm an inventor to how many total patents?	08:12:55
7	Is that -- is that your question?	08:12:59
8	Q. How many patent applications did you file	08:13:00
9	when you were trying to develop an IP portfolio of	08:13:03
10	your own?	08:13:05
11	A. I would say -- again, I don't do that	08:13:10
12	anymore. I would say that was right after my --	08:13:15
13	my -- my -- when I -- I would say maybe around ten	08:13:18
14	to fifteen.	08:13:27
15	Q. So the remainder of your patents were	08:13:30
16	patents that were filed for while you were working	08:13:33
17	for a company?	08:13:35
18	A. I believe that's correct, yes.	08:13:36
19	Q. And of the ten to fifteen patents that you	08:13:45
20	filed for while you were trying to generate an IP	08:13:49
21	portfolio, have you done anything with those	08:13:53
22	patents?	08:13:54
23	A. As I mentioned, the -- one set of portfolio	08:13:58
24	was acquired and I haven't done anything since with	08:14:01
25	that portfolio. It was -- it was -- it was many	08:14:04

1 years ago, and I have since -- so I do have lot -- I 08:14:14
2 still have a lot of patents -- as inventor a lot of 08:14:23
3 patents and they have just -- they have just been 08:14:26
4 dormant and idle, yes. 08:14:29

5 Q. I'm sorry, I may have misheard. You said a 08:14:31
6 portion of those patents were acquired? 08:14:34

7 A. One set of my patent portfolio was acquired 08:14:43
8 and they have nothing to do with this matter and 08:14:46
9 they were acquired and -- and -- and it was a long 08:14:50
10 time ago, it was I believe 2009 time frame. 08:14:56

11 Q. Okay. So when you say "acquired," that 08:15:02
12 means you sold them to somebody else? 08:15:03

13 A. That's correct. And I have -- I don't deal 08:15:07
14 with that aspect. It was the attorney I worked with 08:15:09
15 generating IP, he -- he wants to monetize them so he 08:15:13
16 was able to -- to give our portfolio acquired in a 08:15:22
17 patent -- patent auction, yeah. 08:15:26

18 Q. What did you do to prepare for the 08:15:41
19 deposition today? 08:15:43

20 A. I reviewed my declaration mainly and 08:15:47
21 reviewed the patent in this case, '822, and have a 08:15:52
22 few brief meeting with my counsel. 08:16:02

23 Q. Anything else? 08:16:05

24 A. No, that's about it. 08:16:09

25 Q. Do you have any changes to your declaration 08:16:11

1	that you want to change or --	08:16:17
2	MR. HERMAN: Objection. Form.	08:16:20
3	THE WITNESS: Can you repeat your question	08:16:23
4	again, please?	08:16:24
5	By MR. DAVIS:	08:16:25
6	Q. Sure. When you reviewed your declaration,	08:16:25
7	did you find any inaccuracies?	08:16:28
8	A. No, not -- not at the moment.	08:16:35
9	Q. So the declaration reflects the opinions	08:16:39
10	than you've formulated in this matter?	08:16:41
11	A. Yes, it does.	08:16:47
12	Q. In formulating your opinions, what	08:17:04
13	materials did you consider?	08:17:06
14	A. Just the standard. In the course of the	08:17:08
15	work I consider the patent in question and I review	08:17:11
16	the prior art and I rely also on the knowledge of a	08:17:17
17	person of ordinary skill in the art.	08:17:22
18	Q. Was there any information that you	08:17:26
19	requested but were not provided?	08:17:29
20	A. I'm sorry, can you repeat the question and	08:17:34
21	can you clarify the question? I don't -- I don't	08:17:36
22	quite understand the question.	08:17:39
23	Q. Was there any information that you	08:17:40
24	requested to be able to review but were not provided	08:17:42
25	as part of your analysis here?	08:17:45

1	A. No, I don't believe so.	08:17:47
2	Q. Did you review the petition in this case as	08:17:50
3	part of preparing your declaration?	08:17:56
4	A. I believe I may have reviewed -- I reviewed	08:18:01
5	the initial version of the petition and may -- may	08:18:05
6	have made some comments but mainly I focused on the	08:18:12
7	drafting and working of my declaration.	08:18:16
8	Q. Of the -- are you aware of the difference	08:18:42
9	between anticipation and obviousness?	08:18:46
10	A. Yes, I believe so to the extent that I'm	08:18:57
11	not -- I'm not a legal person, I'm a technical	08:18:58
12	person, but to that extent I do believe so.	08:19:01
13	Q. What's your understanding of the	08:19:04
14	difference?	08:19:06
15	MR. HERMAN: Objection. Form. It's	08:19:07
16	outside the scope of direct.	08:19:09
17	THE WITNESS: Is it okay if we can download	08:19:15
18	my declaration, I can -- I can -- I can cite to you	08:19:17
19	where I -- I mention that. Again, I'm not a legal	08:19:19
20	person so I will not want to provide any definition	08:19:21
21	so --	08:19:28
22	By MR. DAVIS:	08:19:29
23	Q. I just want to get your understanding.	08:19:29
24	What is your understanding sitting here of the	08:19:31
25	difference between anticipation and obviousness?	08:19:33

1	MR. HERMAN: Objection. Form. Also,	08:19:37
2	outside the scope of direct.	08:19:38
3	THE WITNESS: I believe -- is -- is it okay	08:19:42
4	to download that portion of declaration where I can	08:19:46
5	be more -- more precise? I don't want to say	08:19:50
6	something that due to the wording and everything it	08:19:51
7	may not convey my right understanding. But I -- I	08:19:54
8	do believe I know the difference between	08:19:57
9	anticipation and -- and obviousness.	08:20:00
10	I believe anticipation is something that	08:20:05
11	you -- it has to be clearly -- clearly -- clearly --	08:20:07
12	it has to be clearly cited, yeah.	08:20:18
13	By MR. DAVIS:	08:20:23
14	Q. And what is obviousness in your	08:20:23
15	understanding?	08:20:27
16	A. Again, it would be good if I can have my	08:20:27
17	declaration. I -- I do know the -- I do have an	08:20:30
18	understanding but I don't want to use the -- in	08:20:38
19	terms of describing it and have an inadequacy in my	08:20:41
20	description.	08:20:45
21	Q. Well just -- I -- we can get to your	08:20:45
22	declaration in a second. What is your understanding	08:20:48
23	kind of sitting here today of obviousness?	08:20:51
24	MR. HERMAN: Objection. Form. It's	08:20:53
25	outside the scope of direct.	08:20:55

1 THE WITNESS: I think obviousness would be 08:21:09
2 taken into totality of the context and along with 08:21:11
3 the -- what has been described and -- and taken into 08:21:16
4 the overall context and taken to knowledge of -- of 08:21:21
5 POSITA and you will render as the most -- one of the 08:21:25
6 most, if not the most, path to -- to -- to 08:21:29
7 conclude. 08:21:34

8 By MR. DAVIS: 08:21:40

9 Q. So you understand that -- that as part of 08:21:40
10 your analysis you analyzed certain claims of US 08:21:43
11 Patent No. 11,501,822; is that correct? 08:21:48

12 A. That's correct. 08:21:54

13 Q. And did you find that any of the claims of 08:21:56
14 that patent were anticipated by prior art? 08:22:00

15 MR. HERMAN: Objection. Outside the scope 08:22:10
16 of direct. 08:22:13

17 THE WITNESS: I believe in my declaration I 08:22:13
18 have different grounds and I -- I believe these -- 08:22:18
19 the grounds I presented clearly show that the -- the 08:22:21
20 claim in each of the ground that I cited are 08:22:28
21 rendered obvious both by the disclosure in the prior 08:22:32
22 art as well as by person of ordinary skill in the 08:22:36
23 art. 08:22:40

24 By MR. DAVIS: 08:22:42

25 Q. So my question was about anticipation, not 08:22:42

1 obviousness.

08:22:45

2 As part of your analysis for this matter,
3 did you determine that any of the claims of the '822
4 patent were anticipated by prior art?

08:22:47

08:22:49

08:22:57

5 MR. HERMAN: Objection. Form. Also,
6 outside the scope of direct.

08:23:01

08:23:02

7 THE WITNESS: Counsel, I would like to see
8 my declaration. I don't believe I render any
9 opinion under the -- the -- under anticipation so I
10 do not know how to answer your question.

08:23:07

08:23:08

08:23:11

08:23:16

11 By MR. DAVIS:

08:23:20

12 Q. Right. Isn't that the answer to my
13 question, that you -- that you didn't formulate any
14 anticipation opinions?

08:23:20

08:23:21

08:23:24

15 MR. HERMAN: Objection. Outside the scope
16 of direct.

08:23:29

08:23:30

17 THE WITNESS: I think -- I think that's
18 correct. I -- I really would prefer if we can have
19 the declaration because I'm here to give testimony
20 based on my declaration and to -- to address any
21 question we have regarding the declaration.

08:23:36

08:23:37

08:23:39

08:23:43

08:23:48

22 By MR. DAVIS:

08:24:41

23 Q. Dr. Liu, I have put into the chat box what
24 has been previously marked as Exhibit 1003 in this
25 proceeding. Let me know when you have that opened

08:24:41

08:24:42

08:24:46

1	up.	08:24:48
2	A. Do I hit download first or -- okay. It's	08:24:58
3	opened up now. Thank you.	08:25:02
4	Q. Is Exhibit 1003 your declaration that was	08:25:05
5	submitted in this proceeding?	08:25:08
6	A. Yes, that's correct.	08:25:10
7	Q. And if you flip to the very end, page 124,	08:25:17
8	that's your signature?	08:25:22
9	A. Yes, that's correct.	08:25:28
10	Q. Now that you have your declaration, do you	08:25:31
11	see any opinions regarding anticipation in your	08:25:34
12	declaration?	08:25:36
13	A. Excuse me.	08:25:44
14	As I testified earlier, no, I -- I do not	08:25:45
15	have any opinion based on anticipation.	08:25:45
16	Q. When assessing obviousness, did you	08:25:52
17	evaluate the differences between each claim of the	08:25:55
18	patent and the prior art?	08:25:59
19	A. Yes, I believe so.	08:26:03
20	Q. I also just put another document in the	08:26:41
21	chat. It's what's been marked as Exhibit 1001. Let	08:26:44
22	me know when you have it opened up.	08:26:49
23	A. I'm downloading it.	08:26:57
24	I have it opened up now.	08:27:10
25	Q. And this is U.S. Patent No. 11,501,822 that	08:27:12

1	we referenced earlier; is that correct?	08:27:18
2	A. Yes, that's correct.	08:27:20
3	Q. All right. I have just put another	08:27:52
4	document into the chat. It's Exhibit 1004. Let me	08:27:53
5	know when you have that opened up.	08:27:57
6	A. I have it opened up.	08:28:08
7	Q. And this is US Patent No. 10,121,529; is	08:28:10
8	that correct?	08:28:17
9	A. Yes, that's correct.	08:28:17
10	Q. And this is what you have been referring to	08:28:19
11	in your declaration as the Lee reference?	08:28:22
12	A. Yes, that's correct.	08:28:24
13	Q. Can you turn to Figure 4B?	08:28:32
14	A. Excuse me. Figure 4B of which -- which	08:28:37
15	one?	08:28:39
16	Q. Of Exhibit 1004.	08:28:40
17	A. Just a second.	08:28:47
18	I'm there.	08:28:56
19	Q. What is the selected word line in Figure	08:28:57
20	4B?	08:29:01
21	A. That's the -- indicated to be the word line	08:29:07
22	11.	08:29:11
23	Q. And word line 11 is in group number 2; is	08:29:21
24	that correct?	08:29:25
25	A. In Figure 4B it is in Group 2, yes, that's	08:29:33

1	correct.	08:29:36
2	Q. And you also see groups 1, 3 and 4 on	08:29:37
3	Figure 4B?	08:29:41
4	A. Yes, that's correct.	08:29:42
5	Q. In your opinion, are groups 1, 3 and 4	08:29:48
6	disposed in an order of distance from word line	08:29:52
7	11?	08:29:55
8	MR. HERMAN: Objection. Form. It's	08:29:58
9	outside the scope of direct.	08:29:59
10	THE WITNESS: Can you repeat the question	08:30:02
11	again?	08:30:03
12	By MR. DAVIS:	08:30:04
13	Q. Sure. In your opinion, are groups 1, 3 and	08:30:04
14	4 disposed in an order of distance from the selected	08:30:09
15	word line 11?	08:30:14
16	MR. HERMAN: Same objections.	08:30:15
17	THE WITNESS: You have to clarify your	08:30:19
18	question. I -- I -- I do not understand your	08:30:21
19	question. I'm sorry.	08:30:24
20	By MR. DAVIS:	08:30:26
21	Q. What do you not understand about the	08:30:26
22	question?	08:30:27
23	A. I see group 1, 2, 3, 4, and in Group 2	08:30:33
24	there is word line 11, and I'm not sure what you	08:30:38
25	meant by the -- the -- the order. Can you repeat	08:30:40

1	again?	08:30:45
2	Q. Sure. Are groups 1, 3 and 4 disposed in an	08:30:49
3	order of distance from the selected word line 11?	08:30:55
4	MR. HERMAN: Objection. Form. Objection.	08:31:00
5	Form. Also, outside the scope of direct.	08:31:02
6	THE WITNESS: Dispose of the order distance	08:31:10
7	from selected word line 11? I think they're	08:31:11
8	disposed in order either from the bid side -- the	08:31:23
9	bid line or from the source line and that is how the	08:31:29
10	sequence is going from WL0 through WL31. That is	08:31:32
11	the order. So I don't -- so group 1, 2, 3, 4 would	08:31:36
12	be disposed in relationship -- in order relationship	08:31:45
13	to the bid line or relationship to the source side,	08:31:48
14	depending on which way you are -- you are -- which	08:31:52
15	way is your perspective.	08:31:55
16	By MR. DAVIS:	08:32:05
17	Q. Are you familiar with the term "pulse?"	08:32:05
18	A. Yes, I'm familiar with term pulse.	08:32:10
19	Q. What is a pulse?	08:32:13
20	A. I don't know. I'm not here to define the	08:32:18
21	pulse. '822 did not define pulse so -- so suffice	08:32:24
22	to say that under the context of '822, it's a	08:32:31
23	voltage signal that occurs within a pre-charged --	08:32:39
24	in the context of '882 within the pre-charge time	08:32:47
25	period and it is a signal that comes before the	08:32:52

1	programming signal to prepare the word lines for	08:32:55
2	programming. So in that context, the voltage signal	08:32:59
3	is before the programming voltage signal and that's	08:33:05
4	the context '822.	08:33:10
5	Q. And that's your understanding of a pulse?	08:33:13
6	A. That's one understanding of a pulse in the	08:33:18
7	context of '822.	08:33:21
8	Q. So does pulse have a plain and ordinary	08:33:28
9	meaning in the art?	08:33:31
10	MR. HERMAN: Objection. Form.	08:33:32
11	THE WITNESS: I think the task for -- the	08:33:39
12	task for me to do is in terms of '822. '822	08:33:43
13	illustrate the various pulses to the selected word	08:33:46
14	line, unselected word line following the guideline	08:33:51
15	and following the description, that it's to prepare	08:33:52
16	the programming voltage. So in that case that	08:33:59
17	voltage signal will come -- come in and it will come	08:34:03
18	in during the time period of this pre-charge and	08:34:06
19	that pre-charge time period is before the	08:34:11
20	programming operation.	08:34:13
21	Put another way, as -- as Lee also	08:34:15
22	indicated, that the programming operation is after	08:34:18
23	this -- this -- these pulse pre-charge -- pre-pulse	08:34:20
24	signal that occurred to pre-charge the word line to	08:34:27
25	prepare for the programming operation	08:34:29

1	By MR. DAVIS:	08:34:35
2	Q. What is the plain and ordinary meaning of	08:34:35
3	the term pulse?	08:34:37
4	MR. HERMAN: Objection. Form.	08:34:39
5	THE WITNESS: I'm not here to define the	08:34:51
6	meaning of pulse. What I did was I looked at '822	08:34:53
7	and looked at how the context of pulses and I look	08:34:58
8	at the prior art and -- and I look at how the	08:35:01
9	controller operates. Definitely that given the	08:35:04
10	pre-charge period you have -- you have a pulse as	08:35:07
11	seen in -- similar to what's exemplified in the '822	08:35:12
12	patent.	08:35:24
13	By MR. DAVIS:	08:35:26
14	Q. So do you have an understanding of the	08:35:26
15	plain and ordinary meaning of the term pulse?	08:35:28
16	MR. HERMAN: Objection. Form.	08:35:31
17	THE WITNESS: I do have a plain and	08:35:35
18	ordinary meaning of the pulse. I may not verbalize	08:35:36
19	it because I'm not here to define -- define the	08:35:39
20	pulse, but I do have plain and ordinary meaning of	08:35:42
21	pulse. And based on -- as you can see in my	08:35:45
22	declaration, based on the description and based in	08:35:47
23	the context of '822 in question, I believe Lee	08:35:50
24	clearly -- Lee clearly described this -- the most	08:35:54
25	obvious, the same as '822, they describe pulses to	08:36:00

1	the selected/unselected word line during the period	08:36:04
2	that is called pre-charge period.	08:36:07
3	By MR. DAVIS:	08:36:09
4	Q. Sir, I would like you to answer my question	08:36:09
5	which you weren't doing.	08:36:12
6	What is the plain and ordinary meaning of	08:36:14
7	the term pulse?	08:36:16
8	MR. HERMAN: Objection. Form. Also,	08:36:17
9	argumentative and asked and answered.	08:36:20
10	THE WITNESS: Again, I know the meaning,	08:36:30
11	but once you verbalize it, then there may be	08:36:35
12	limitation due to the language and I'm not here to	08:36:38
13	provide a definition of pulse. I do understand what	08:36:41
14	is a pulse and I do understand the pulse as	08:36:45
15	indicated in the figure demonstrated -- illustrated	08:36:48
16	in '822 and as well as the other obvious pulses in	08:36:52
17	Lee, Zhao and Yang. So I do have plain and ordinary	08:37:02
18	meaning understanding of the term pulse.	08:37:09
19	By MR. DAVIS	08:37:11
20	Q. So you are saying you do have an	08:37:11
21	understanding of the plain and ordinary meaning of	08:37:12
22	the word pulse. Can you tell me what the plain and	08:37:15
23	ordinary meaning is?	08:37:18
24	MR. HERMAN: Objection. Form. Also, asked	08:37:19
25	and answered.	08:37:20

1	THE WITNESS: Looking in the context of	08:37:32
2	'822 and conforming to my plain and ordinary	08:37:33
3	meaning, a pulse is a voltage signal that appears on	08:37:37
4	the selected and unselected word line during the	08:37:50
5	pre-charge period or, as Lee says, is during the	08:37:54
6	pre-charging step of the overall programming	08:37:59
7	operation. And the purpose of pulse is to prepare,	08:38:05
8	it's before the actual programming voltage before,	08:38:11
9	another way that a programming voltage comes after	08:38:14
10	that the -- the pre-pulse and it's to prepare the	08:38:17
11	word line for eventual boosting during the	08:38:22
12	programming operation.	08:38:26
13	By MR. DAVIS:	08:39:03
14	Q. I have just put another exhibit, this is	08:39:03
15	Exhibit 2020, in the chat. This has not been	08:39:05
16	previously marked and we will need to get it marked.	08:39:13
17	But let me know when you have that open.	08:39:15
18	(Whereupon, Liu Exhibit 2020 was marked for	08:39:19
19	identification.)	08:39:19
20	THE WITNESS: I have it open.	08:39:19
21	By MR. DAVIS:	08:39:28
22	Q. And do you see that Exhibit 2020 is a	08:39:28
23	series of different images?	08:39:31
24	A. Yes. They appear to be a series of	08:39:35
25	different images, yes.	08:39:37

1	Q.	And they are labeled A through T?	08:39:38
2	A.	They are labeled alphabetically and I don't	08:39:45
3		know if any -- sitting right here, I am not counting	08:39:48
4		to see if any of the alphabet is missing.	08:39:51
5	Q.	I'm sorry, I didn't understand that.	08:39:57
6		Do you see that they are labeled with the	08:40:00
7		letters A through T?	08:40:01
8	A.	Yes, I do see that.	08:40:07
9	Q.	And do you see that in each of the images	08:40:10
10		there is a Y axis labeled $v(t)$?	08:40:12
11	A.	Yes, I do.	08:40:28
12	Q.	And the numbers go in that axis from 0 to 1	08:40:28
13		in two-tenths increments?	08:40:32
14	A.	Yes, that's correct.	08:40:41
15	Q.	And do you also see along the X axis it	08:40:41
16		goes from negative 2 to past the number 4?	08:40:44
17	A.	Yes, I do.	08:40:51
18	Q.	And that has hash marks every increment of	08:40:53
19	1.	Do you see that?	08:40:58
20	A.	I see hash mark, yeah.	08:41:07
21	Q.	Directing your attention to the image	08:41:10
22		that's labeled A. Do you see that one?	08:41:11
23	A.	Yes, I do.	08:41:17
24	Q.	Is what's shown in A a pulse?	08:41:19
25	MR. HERMAN:	Objection. Form. It's	08:41:23

1 outside the scope of direct. 08:41:24

2 THE WITNESS: Counsel, this is the -- I did 08:41:28
3 not analyze document. This document is presented to 08:41:31
4 me at this deposition. I have never seen it. And 08:41:34
5 without the label of the X axis or Y axis to have 08:41:38
6 context, I'm -- sitting right here I'm not going to 08:41:43
7 comment on this. But I would be very happy to 08:41:46
8 comment on my declaration regarding how the various 08:41:49
9 prior art references render claim '822 obvious. 08:41:54

10 By MR. DAVIS: 08:42:01

11 Q. Sitting here today can you tell me whether 08:42:01
12 A is a pulse? 08:42:03

13 MR. HERMAN: Objection. Form. It's 08:42:06
14 outside the scope of direct. 08:42:07

15 THE WITNESS: Without context, without 08:42:10
16 the -- the -- the full context such as the '822 or 08:42:11
17 any of the Lee or Zhao or Yang reference provided, I 08:42:17
18 do not know what these -- these things are. I do 08:42:21
19 not know the context of -- I do not wish to comment 08:42:21
20 on this because this is the first time I have seen 08:42:28
21 this document and it's not part of my declaration. 08:42:30

22 By MR. DAVIS: 08:42:33

23 Q. What context would you need to be able to 08:42:33
24 answer my question as to whether what's shown in 08:42:35
25 Figure A there is a pulse? 08:42:38

1 A. Well, in the context of '822, in the
2 context of flash memory NAND, 3D NAND flash memory
3 or flash memory in general and the context of
4 mainstream, context of pre-charging, in the context
5 of you have X decoder, you have voltage generation
6 that -- that generated voltage for a specific -- for
7 a specific time period, which is the reference being
8 called the pre-charge time period or you can call it
9 pre-charging -- pre-prior step. Nonetheless, these
10 are to prepare to pre-charge all the different word
11 lines to be ready before the programming operation.

12 In that context, the opinion I render is
13 that the X decoder during the pre-charge period, the
14 word line voltage that is coming in is handed off to
15 the pre -- to the X decoder which is receiving its
16 voltage from the voltage generation circuit and that
17 voltage goes into the word line during that specific
18 pre-charging period or pre-charging time step. That
19 is in the form of the pulse in context with '822
20 patent.

21 And once the -- that period is over, then
22 the pre-charging circuit stopped the hand off and
23 the hand off of the voltage coming from both
24 generation circuit to pre-charge these word line go
25 off and then that step stops and then you have --

08:42:45
08:42:47
08:42:55
08:42:58
08:43:00
08:43:04
08:43:08
08:43:12
08:43:15
08:43:19
08:43:22
08:43:26
08:43:29
08:43:34
08:43:38
08:43:41
08:43:46
08:43:51
08:43:54
08:43:58
08:43:59
08:44:03
08:44:09
08:44:13
08:44:16

1	you have -- then you begin to try to commence the	08:44:22
2	programming step. That's the context of the pulse	08:44:25
3	in the context '822, in the context of Lee, in the	08:44:28
4	context of Zhao, and the context of Yang.	08:44:32
5	Q. So in that context would you consider	08:44:34
6	Figure A to be a pulse?	08:44:36
7	MR. HERMAN: Objection. Form. It's	08:44:38
8	outside the scope.	08:44:40
9	THE WITNESS: I do not --	08:44:42
10	Sorry, Counsel. Please.	08:44:46
11	MR. HERMAN: Just objection. Form.	08:44:46
12	Outside the scope of direct.	08:44:48
13	THE WITNESS: Again, I do not know these --	08:44:51
14	these -- what this illustration is showing. I do	08:44:54
15	not know where it comes from. I do not know the	08:44:58
16	context. I -- I have not analyzed this. And	08:45:00
17	sitting right here, this is the first time I see	08:45:05
18	this. If this is going to be -- if this is part of	08:45:07
19	the thing that requires my further analysis, I will	08:45:13
20	be happy to -- after the deposition, I'm happy to	08:45:16
21	render an opinion, but I'm sitting right here and	08:45:18
22	I'm here to discuss my declaration and this -- I	08:45:18
23	have not seen this document. This is the first time	08:45:23
24	I have seen it. And without any context, I would	08:45:24
25	rather not -- I would rather not get into a	08:45:26

1	discussion.	08:45:29
2	By MR. DAVIS:	08:45:31
3	Q. I understand that you would rather not get	08:45:31
4	into a discussion. I'm asking whether you can have	08:45:33
5	a discussion about this.	08:45:35
6	Can you -- sitting here today, can you tell	08:45:38
7	me whether what's shown in Figure A there, whether	08:45:39
8	that's a pulse?	08:45:43
9	MR. HERMAN: Objection. Form. Also, asked	08:45:44
10	and answered.	08:45:45
11	THE WITNESS: I believe in my declaration	08:45:48
12	I'm rendering an opinion on pre-charge pulse or	08:45:50
13	pre-signal bias in the context of prepping or	08:45:55
14	preparing for programming operation. I do not know	08:46:00
15	the context of these -- these wave forms. I do not	08:46:04
16	where they come from and I do not know -- know this.	08:46:08
17	So as a person of ordinary skill in the	08:46:12
18	art, I fully understanding the plain and ordinary	08:46:13
19	meaning of pulse but I'm not going to -- sitting	08:46:19
20	right here, being presented with something I have	08:46:22
21	never seen before without a context, I cannot even	08:46:25
22	know what these numbers represent, I -- I would not	08:46:27
23	want to comment on them until I see -- I see the	08:46:29
24	full context and I see the -- the context with	08:46:33
25	respect to '822 which is opinion I'm rendering in my	08:46:36

1	declaration.	08:46:40
2	By MR. DAVIS:	08:46:41
3	Q. So V -- what does V mean to you in -- as a	08:46:41
4	person of skill in the art?	08:46:47
5	A. Well, this has no context so it -- it could	08:46:54
6	be anything. Okay. This is no context right now.	08:46:57
7	I do not see any context.	08:47:00
8	Q. So V can't mean voltage to you?	08:47:01
9	MR. HERMAN: Objection. Form.	08:47:04
10	THE WITNESS: Again, V could be anything.	08:47:08
11	It could be velocity. It could be anything.	08:47:10
12	Look, this has no context and I -- I prefer -- I	08:47:12
13	would need time to look into the context, look into	08:47:18
14	these. I'm -- again, I'm -- I'm not prepared to	08:47:22
15	address something that -- sitting right here that is	08:47:25
16	shown to me for the very first time without any	08:47:28
17	context.	08:47:30
18	By MR. DAVIS:	08:47:31
19	Q. So assuming that V means voltage, you have	08:47:31
20	seen that before in your work, Doctor?	08:47:35
21	MR. HERMAN: Objection. Form.	08:47:39
22	THE WITNESS: Even assuming that's	08:47:47
23	voltage, I would have to know the context of that	08:47:49
24	voltage, context of that wave form. Voltage don't	08:47:53
25	come out in a vacuum. I need to know the context.	08:47:59

1	So in the context of '822, in the context of Lee, in	08:48:01
2	the context of Zhao, in the context of Yang, it's	08:48:05
3	very clear, you have an X decoder, you have a	08:48:08
4	controller, and you have X decoder, you have voltage	08:48:10
5	generation circuit, and at certain time the	08:48:11
6	controller dictates by the word line voltage are	08:48:15
7	handed off to the pre-pulse generation voltage	08:48:21
8	circuit so the voltage goes into the word line	08:48:26
9	during that period the pre-charge phase --	08:48:28
10	By MR. DAVIS:	08:48:32
11	Q. Dr. Liu, do you understand that you are	08:48:32
12	just supposed to answer the question I'm asking;	08:48:34
13	right?	08:48:37
14	MR. HERMAN: Objection. Form. Also,	08:48:38
15	argumentative.	08:48:39
16	THE WITNESS: I believe I answered your	08:48:42
17	question. It says --	08:48:43
18	By MR. DAVIS:	08:48:45
19	Q. Dr. Liu, do you understand you are supposed	08:48:45
20	to answer the question I'm asking? You're not	08:48:47
21	supposed to go on long explanations about other	08:48:49
22	things you want to talk about.	08:48:52
23	Do you understand that's how this works?	08:48:55
24	MR. HERMAN: Objection. Form. Also,	08:48:57
25	argumentative.	08:48:58

1	Counsel, please allow the witness to answer	08:48:59
2	however he sees fit.	08:49:00
3	MR. DAVIS: You can keep your objections --	08:49:01
4	enough of the speaking objections, Counsel.	08:49:02
5	By MR. DAVIS:	08:49:05
6	Q. Dr. Liu, are you familiar with the term V	08:49:05
7	or the -- the term V as referring to voltage in your	08:49:10
8	field; yes or no?	08:49:13
9	MR. HERMAN: Objection. Form.	08:49:17
10	THE WITNESS: I'm familiar that you	08:49:22
11	could -- you could you use V as a denotation for	08:49:23
12	voltage. But I'm trying to provide context. I'm	08:49:28
13	not trying to not answer your question. I'm	08:49:30
14	answering your question by providing context now.	08:49:32
15	The context in applying plain and ordinary meaning	08:49:35
16	of the term pulse is in the context of '822 --	08:49:38
17	By MR. DAVIS:	08:49:43
18	Q. I just asked about V. I just asked about	08:49:43
19	V, Dr. Liu. I didn't ask about anything else. I	08:49:46
20	just asked about the letter V, okay?	08:49:49
21	So directing you to my question. The	08:49:52
22	letter V, as used here, could be referring to	08:49:54
23	voltage. You've seen that term referred to --	08:49:57
24	you've seen V referred to voltage before?	08:49:59
25	MR. HERMAN: Objection. Form.	08:50:02

1	THE WITNESS: I see V referred to voltage	08:50:05
2	before, but I -- with the proper context. You	08:50:07
3	cannot just say a V is always voltage or it could be	08:50:11
4	a voltage. It could be anything. It could be	08:50:15
5	velocity, it could be viscosity, it could be -- I'm	08:50:17
6	sitting right here, I have no context, and I'm	08:50:21
7	simply amending my -- my answer to include the	08:50:24
8	context. My context is in the declaration and the	08:50:28
9	declaration for the petition of '822 and in the	08:50:33
10	context of the references I cited.	08:50:36
11	By MR. DAVIS:	08:50:40
12	Q. So assuming that V refers to voltage and T	08:50:40
13	refers to time, is what is shown in Figure A there a	08:50:43
14	pulse in your field?	08:50:47
15	MR. HERMAN: Objection. Form. It's	08:50:50
16	outside the scope of direct.	08:50:51
17	THE WITNESS: Again, I need to look at the	08:50:54
18	context and right now simply this is first time I	08:50:59
19	see this document and I have not reviewed this	08:51:04
20	document and I would be very happy to discuss my	08:51:07
21	declaration and I do not wish to -- to -- without	08:51:11
22	the full context to -- to discuss -- to -- to render	08:51:16
23	an opinion.	08:51:20
24	By MR. DAVIS:	08:51:21
25	Q. This document is one page; correct?	08:51:21

1	A. This document is one page with many	08:51:25
2	figures.	08:51:29
3	Q. Okay. Do you need time to review it? You	08:51:29
4	can take time to read it -- review it right now. Go	08:51:33
5	ahead.	08:51:37
6	A. This is not enough context. I'm sorry.	08:51:39
7	Q. So in your field it's your testimony that a	08:51:44
8	person of ordinary skill in the art couldn't	08:51:50
9	determine whether what's shown in Figure A is a	08:51:53
10	pulse if V refers to voltage and T refers to time?	08:51:57
11	A. No, that is not my testimony. My testimony	08:52:02
12	is that as a person of ordinary skill in the art, I	08:52:04
13	know what a pulse means in plain and ordinary	08:52:10
14	meaning and then apply it in my analysis of '822	08:52:11
15	with prior art of Lee, Zhao and Yang, along with my	08:52:15
16	knowledge as a person of ordinary skill in the art.	08:52:19
17	And right now sitting here, I am not willing to	08:52:22
18	opine on some things that I'm seeing here for the	08:52:27
19	very first time. So I -- I think you are	08:52:32
20	mischaracterizing my testimony.	08:52:34
21	I do know -- and I do know just that this	08:52:37
22	document is presented to me without context and I'm	08:52:39
23	not -- I'm not -- I don't want to -- to render	08:52:43
24	opinion just sitting right here seeing the document	08:52:48
25	for the first time.	08:52:51

1 Q. So assuming that V refers to voltage and T
2 refers to time, can you tell me whether any of the
3 figures shown in this exhibit, 2020, depicts a
4 pulse?

5 MR. HERMAN: Objection. Form. Also,
6 outside the scope of direct.

7 THE WITNESS: '822 clearly in the
8 specification illustrate a pulse. And Lee, Zhao and
9 Yang also in conformity with '822 and with my
10 knowledge as a person of ordinary skill in the art.
11 So this document, I'm sitting here, I see it for the
12 very first time. The -- the -- you just have it
13 labeled $v(t)$, I don't know even know what the --
14 the -- the lower axis, you know, X axis and I'm just
15 simply not -- not prepared to render an opinion on
16 this.

17 By MR. DAVIS:

18 Q. So I would like to direct you to my
19 question. My question is whether sitting here today
20 you can tell me whether any of these images in
21 Exhibit 2020 depicts a pulse assuming that V refers
22 to voltage and T refers to time?

23 MR. HERMAN: Objection. Form.

24 THE WITNESS: I need -- I need context.
25 Without context, I'm sorry, I'm not willing to

1	render an opinion.	08:54:35
2	By MR. DAVIS:	08:54:36
3	Q. So sitting here today you can't tell me	08:54:36
4	whether any of these figures depict a pulse assuming	08:54:38
5	that V refers to voltage and T refers to time; is	08:54:41
6	that correct?	08:54:44
7	A. That's not correct. I'm -- I'm sitting in	08:54:45
8	here, I'm -- I'm ready to discuss my opinion in my	08:54:48
9	declaration, and this document I'm seeing for the	08:54:52
10	first time, I do not wish to render an opinion. But	08:54:58
11	that doesn't mean that I do not know but I	08:55:01
12	just don't -- I just don't think that this is --	08:55:03
13	this is the -- the -- the material I'm prepared	08:55:05
14	to -- I'm -- I'm asking to review or discuss in this	08:55:09
15	deposition.	08:55:15
16	Q. So you mean you know whether some of these	08:55:15
17	are pulses but you just don't want to tell me, is	08:55:18
18	that what your testimony is?	08:55:21
19	MR. HERMAN: Objection. Form. It's	08:55:23
20	argumentative.	08:55:24
21	THE WITNESS: That is also not what I said.	08:55:24
22	I'm just simply saying that I do not wish to render	08:55:27
23	or to even -- I need time to review. I need time to	08:55:31
24	know the context. So without that, I'm not even	08:55:36
25	willing to -- I'm not going to render an opinion	08:55:39

1 or -- or evaluate it. I'm perfectly happy to 08:55:41
2 discuss my declaration and -- and where I render 08:55:44
3 opinions on pre-charge pulses and -- this document, 08:55:49
4 seeing it for the very first time, I'm simply not -- 08:55:55
5 not going to -- to review it or to -- I'm simply not 08:55:58
6 going to opine on it. 08:56:04

7 By MR. DAVIS: 08:56:08

8 Q. Do you consider yourself to be a person of 08:56:08
9 ordinary skill in the art in the context of the '822 08:56:12
10 patent? 08:56:15

11 A. Yes, most definitely. 08:56:18

12 Q. And in your field, does the term pulse have 08:56:23
13 a plain and ordinary meaning? Is that a term that 08:56:30
14 is used? 08:56:32

15 MR. HERMAN: Objection. Form. 08:56:35

16 THE WITNESS: Repeat your question again. 08:56:46
17 I'm sorry, I got lost. 08:56:47

18 By MR. DAVIS: 08:56:49

19 Q. In your field, does the term pulse have a 08:56:49
20 plain and ordinary meaning? 08:56:51

21 MR. HERMAN: Objection. Form. 08:56:58

22 THE WITNESS: Again, in the context of '822 08:56:59
23 and the Lee and Zhao and Yang, as a person of 08:57:02
24 ordinary skill in the art, there is a plain and 08:57:09
25 ordinary meaning and understanding of the pulse that 08:57:11

1	is being applied here.	08:57:12
2	By MR. DAVIS:	08:57:15
3	Q. Okay. Under that plain and ordinary	08:57:15
4	meaning, are any of the -- do any of the figures in	08:57:19
5	Exhibit 2020 depict a pulse?	08:57:26
6	MR. HERMAN: Objection. Form. It's	08:57:30
7	outside of the scope of direct.	08:57:31
8	THE WITNESS: In the context, I do not even	08:57:34
9	know -- again, Counsel, with all due respect, I do	08:57:36
10	not even know what these wave forms represent, where	08:57:40
11	they came from. I do know the '822, and I do know	08:57:42
12	in Lee, I do know in Zhao, I do know in Yang the	08:57:46
13	so-called pre-charge, pre-pulse signal, the	08:57:50
14	pre-biased voltage they come from -- they all come	08:57:56
15	from -- come through to the X decoder, they all be	08:58:00
16	governed by the controller, and they all, at a	08:58:06
17	certain given time, which is called pre-charge	08:58:12
18	period, they all were given the voltage from the	08:58:14
19	voltage generation circuit for that period of time.	08:58:20
20	And under that context, the best to my	08:58:22
21	understanding, and then -- and so in sitting right	08:58:26
22	here, there is no context where these come from. I	08:58:29
23	do not know this X decoder. I do not know this	08:58:32
24	voltage generation circuit. I do not know the	08:58:36
25	controller in the context of the prior art I	08:58:40

1 reviewed and in '822 I reviewed.

08:58:43

2 So there is no -- I do not -- I do not
3 render an opinion in my declaration and this is
4 sitting here for the very first time I see this I
5 will not render an opinion on it.

08:58:46

08:58:48

08:58:52

08:58:55

6 By MR. DAVIS:

08:58:59

7 Q. So assuming voltage refers to -- excuse me.

08:58:59

8 Assuming that voltage -- strike that.

08:59:05

9 Assuming V refers to voltage and T refers
10 to time in the context of Exhibit 2020, are you
11 willing to answer any questions about this
12 document?

08:59:07

08:59:10

08:59:12

08:59:14

13 A. No, I'm not, because there is no context.

08:59:18

14 Again, the context of '822 is -- is -- is same as

08:59:20

15 context of Lee, same context Zhao, same context

08:59:25

16 Yang. They all have a period they call the

08:59:28

17 pre-charge period. During that period the word line

08:59:32

18 voltage are handed off by whatever is generated

08:59:36

19 coming in from the voltage generation circuit for

08:59:39

20 evacuation and that happened before the programming.

08:59:41

21 And that's the context of the understanding of '822.

08:59:43

22 So sitting right here, this document does not

08:59:48

23 provide that context and my declaration is based on

08:59:51

24 that context. I'm not -- I'm not prepared to render

08:59:53

25 opinion on this -- on this document.

08:59:57

1 Q. So outside the context of the '822 09:00:00
2 patent, just generally in the field, assuming that V 09:00:02
3 refers to voltage and T refers to time, can you tell 09:00:08
4 me whether Figure A in Exhibit 2020 depicts a 09:00:11
5 pulse? 09:00:15

6 MR. HERMAN: Objection. Form. It's 09:00:17
7 outside the scope of direct. 09:00:18

8 THE WITNESS: Look, Counsel, I'm here to 09:00:23
9 discuss under the context of '822 and we -- we 09:00:24
10 already agree with that in my declaration. And, 09:00:27
11 again, I would just repeat again, Lee, Zhao, Yang, 09:00:29
12 along with '822 have the context of these pulses 09:00:35
13 coming from -- coming into the X decoder being 09:00:42
14 generated by voltage generation circuit during a 09:00:49
15 fixed time frame which is called a pre-pulse period 09:00:52
16 or pre-biased step. And that step occurred prior to 09:00:56
17 programming voltage being -- boosting voltage being 09:01:01
18 asserted in the word line. 09:01:07

19 So it's in that context that Lee, Zhao, 09:01:08
20 Yang, along with '822, all have that context of what 09:01:10
21 a pulse is. So that is what I'm prepared to discuss 09:01:17
22 and I'm not prepared to discuss a document I just 09:01:19
23 seen for the very first time without context, much 09:01:23
24 less without context in that -- in the context of 09:01:27
25 what I just described regarding the word line 09:01:31

1 voltage during the pre-pulse period.

09:01:35

2 By MR. DAVIS:

09:01:38

3 Q. So it's your testimony that you cannot tell
4 me outside the context of the '822 patent whether
5 what's depicted in Figure A of Exhibit 2020 is a
6 pulse assuming that V refers to voltage and T refers
7 to time?

09:01:38

09:01:40

09:01:45

09:01:48

09:01:51

8 MR. HERMAN: Objection. Form.

09:01:52

9 THE WITNESS: I believe you
10 mischaracterized my answer again. It's not -- it's
11 not -- you said I cannot. I -- I don't know that's
12 a proper description. The proper description should
13 be that I'm willing to discuss within the context of
14 '822, and this document has no such context and I'm
15 here to render an opinion in my declaration and this
16 is outside. I haven't seen this document and this
17 is the first time I have seen it and I'm not -- I'm
18 not going to render opinion sitting right here for a
19 document I'm seeing for the very first time.

09:01:54

09:01:58

09:02:02

09:02:10

09:02:14

09:02:17

09:02:19

09:02:24

09:02:26

09:02:28

09:02:32

20 By MR. DAVIS:

09:02:36

21 Q. My question is whether you can answer my --
22 whether you can tell me whether outside the context
23 of the '822 patent, just generally in your field, by
24 what's depicted in Figure A of Exhibit 2020 is a
25 pulse assuming V refers to voltage and T refers to

09:02:36

09:02:38

09:02:41

09:02:45

09:02:51

1	time?	09:02:54
2	MR. HERMAN: Objection. Form.	09:02:57
3	THE WITNESS: Can you ask your question	09:03:01
4	again? I'm --	09:03:02
5	By MR. DAVIS:	09:03:07
6	Q. My question is whether you can tell me	09:03:07
7	outside the context of the '822 patent, just	09:03:12
8	generally in your field, whether what's shown in	09:03:15
9	Figure A of Exhibit 2020 depicts a pulse, assuming	09:03:20
10	that V refers to voltage and T refers to time?	09:03:25
11	MR. HERMAN: Objection. Form.	09:03:29
12	THE WITNESS: So your question is can I	09:03:38
13	tell you? It's -- you have to -- you have to have	09:03:40
14	the context -- everything has to have relative -- a	09:03:59
15	pulse -- there is a wave form going up and down, and	09:04:03
16	what's your reference, what's your -- what's your --	09:04:09
17	it's like a reference to sea level. So it's --	09:04:14
18	look, there is no context and you just simply have a	09:04:18
19	P axis and v(t) axis. There is no context. I'm not	09:04:24
20	going to render an opinion on it.	09:04:27
21	By MR. DAVIS:	09:04:30
22	Q. So sitting here today you can't tell me	09:04:30
23	whether what's shown in Figure A of Exhibit 2020 is	09:04:33
24	a pulse assuming that V refers to voltage and T	09:04:38
25	refers to time.	09:04:41

1	MR. HERMAN: Objection. Form.	09:04:44
2	THE WITNESS: Again, I think -- that's not	09:04:44
3	what I said. What I'm saying is that I'm prepared	09:04:46
4	to discuss my declaration and which you presented a	09:04:49
5	document seeing it here for the very first time. I	09:04:52
6	do not wish to render an opinion on it without the	09:04:55
7	full context, without having time to understand the	09:04:58
8	context, understand the -- the -- the -- all of the	09:05:03
9	origin and the number reference and everything, so	09:05:13
10	I'm not willing to -- to discuss it. I'm not going	09:05:14
11	to discuss it. But I would be happy to discuss my	09:05:18
12	declaration and how Lee, Zhao, and -- and Yang	09:05:21
13	perfectly render obvious the term pulse in the	09:05:24
14	context of '822.	09:05:30
15	By MR. DAVIS:	09:05:38
16	Q. Well, let's assume that Figure A was shown	09:05:38
17	in -- as part of Lee as -- as the voltage that was	09:05:44
18	delivered to a word line during a pre-charge period.	09:05:50
19	Would you consider that wave form shown in Figure A	09:05:55
20	of Exhibit 2020 then to depict a pulse?	09:06:00
21	MR. HERMAN: Objection. Form. It's	09:06:04
22	outside the scope of direct.	09:06:05
23	THE WITNESS: Look, '822, along with Lee	09:06:10
24	and Zhao and Yang, they describe the time period	09:06:11
25	which is called the pre-charge period to prepare the	09:06:17

1 word line for programming. And I do not even 09:06:19
2 know -- this -- this was shown in, for example, A. 09:06:26
3 I do not know what comes after A. I do not know 09:06:29
4 the -- the voltage numerically. I do not know where 09:06:33
5 it comes from. I would prefer if we just stick with 09:06:36
6 my declaration and with '822, with Lee and Zhao and 09:06:41
7 Yang references. 09:06:45

8 By MR. DAVIS: 09:06:47

9 Q. I want you to focus on my question. 09:06:47

10 Assuming that what is shown in Figure A of 09:06:50
11 Exhibit 2020 was disclosed in Lee as the voltage 09:06:55
12 delivered to a word line as part of a pre-charge 09:07:00
13 period, would that wave form be considered a 09:07:02
14 pulse? 09:07:05

15 MR. HERMAN: Objection. Form. 09:07:07

16 THE WITNESS: Again, you need to prepare it 09:07:10
17 for bracketed in the proper context with regard to 09:07:16
18 Lee, Zhao, Yang and '822. In that wave form, where 09:07:18
19 is, for example, the programming period, pre-charge 09:07:24
20 period? So, again, it's -- it's without context. 09:07:29
21 It's just one -- one -- one wave form and just 09:07:32
22 one -- I'm not -- I'm not -- I'm not going to render 09:07:37
23 an opinion. 09:07:41

24 By MR. DAVIS: 09:07:42

25 Q. What -- what -- what additional context do 09:07:42

1 you need? Because I told -- I told you to assume
2 that this wave form was delivered as part of the
3 pre-charge period that's already disclosed in Lee,
4 according to you. So what additional context do you
5 need?

6 A. For example, when does the pre-charge
7 period begin in the X axis? Where is the pre-charge
8 period?

9 Q. Assume that this is -- this -- this wave
10 form is delivered during the pre-charge period -- at
11 some point during the pre-charge period. What
12 additional context do you need?

13 MR. HERMAN: Objection. Form.

14 THE WITNESS: So where does the pre-charge
15 period begin? Where is the programming period? It
16 just -- I'm sorry, this has to be in context of a
17 NAND flash operation during programming step where
18 you have different step and phases, you have
19 pre-charging phase or pre-charging step and you have
20 programming step where you have boosting voltage and
21 programming voltage and you have verification step
22 and then you repeat. So you then go -- you go --
23 now we get into pre-charging step and programming
24 voltage step and then verification step.

25 By MR. DAVIS:

1	Q. You believe all that is in Lee, don't	09:09:13
2	you?	09:09:16
3	A. Repeat your question. What is all in Lee?	09:09:22
4	Q. All that -- all that context that you just	09:09:26
5	said, you believe all of that is already in Lee; is	09:09:27
6	that correct?	09:09:30
7	A. Yes, that's correct.	09:09:30
8	Q. Okay. So assuming that that context is	09:09:31
9	correct and that this wave form depicted in Figure A	09:09:34
10	here of Exhibit 2020 is delivered to the word line	09:09:40
11	as part of a pre-charge phase, would that constitute	09:09:44
12	a pulse?	09:09:49
13	MR. HERMAN: Objection. Form.	09:09:52
14	THE WITNESS: I would like you to -- if you	09:09:59
15	really want me to answer in the context of Lee and	09:10:00
16	context of Zhao, context Yang, context '822, I would	09:10:04
17	like to you label the wave form labeled axes and	09:10:06
18	show me, then perhaps I can render an opinion. But	09:10:08
19	sitting right here your question is -- is a bit	09:10:11
20	vague. You just mentioned that that is a pulse and	09:10:14
21	it's delivered in the -- I -- there is -- there is	09:10:16
22	not enough context.	09:10:20
23	By MR. DAVIS:	09:10:22
24	Q. What additional context do you need?	09:10:22
25	A. Look, you're asking are these in the	09:10:54

1	context -- could they apply in the context of Lee?	09:10:58
2	Now, look, the context of Lee, the duration of the	09:11:01
3	pulse and the -- not just the pulse, I'm not -- I do	09:11:04
4	not know if this axis label conformed with the	09:11:16
5	magnitude and -- and the time frame in Lee. So I	09:11:21
6	think I'm pretty much prepared to discuss my	09:11:23
7	declaration.	09:11:27
8	And, again, this is the first time I have	09:11:27
9	seen this document and I'm not here to -- to -- to	09:11:29
10	define a pulse, but I do understand the plain and	09:11:34
11	ordinary meaning of a pulse, so we can just discuss	09:11:39
12	my declaration.	09:11:42
13	Q. So whether something is a pulse depends on	09:11:46
14	the magnitude, is that your testimony?	09:11:50
15	MR. HERMAN: Objection. Form.	09:11:51
16	THE WITNESS: No, that's not my testimony.	09:11:55
17	I'm not -- I'm -- when I -- I think you're	09:11:56
18	mischaracterizing my -- my testimony. I said I	09:12:01
19	want -- you want -- you want this to be in the	09:12:03
20	context of Lee, and I'm just saying that Lee does	09:12:07
21	have specific mentioning in terms of the time	09:12:11
22	frame, in terms of the -- in the context of NAND	09:12:15
23	flash programming and in terms of voltage. Just a	09:12:19
24	random number, minus 2 to 4, and -- what's minus? I	09:12:24
25	mean, what is -- what is -- what does it mean, minus	09:12:27

1	2 in time scale? And then you have this	09:12:29
2	v(t) and allegedly to be voltage, you have 0.2, .4,	09:12:33
3	.6, .8, are they -- are they in the context of NAND	09:12:38
4	pre-charging or NAND programming step?	09:12:45
5	I -- I -- look, this is the first time I	09:12:51
6	have seen the document and I think I will not render	09:12:54
7	an opinion on this without fully understanding the	09:13:00
8	context and where this document is coming from. And	09:13:02
9	I'm very much prepared to discuss my declaration.	09:13:05
10	By MR. DAVIS:	09:13:08
11	Q. So even assuming that this wave form that's	09:13:08
12	shown in Figure A of Exhibit 2020 is delivered	09:13:11
13	during the pre-charge period in Lee to a word	09:13:16
14	line, you're not willing to testify as to whether	09:13:19
15	that would constitute a pulse; is that correct?	09:13:24
16	MR. HERMAN: Objection. Form.	09:13:28
17	THE WITNESS: So in order to -- for me to	09:14:08
18	say it's a pulse in the context of the matter here	09:14:15
19	in my declaration, we can label -- we can label the	09:14:19
20	axes and label both axes, and to be more precise, to	09:14:26
21	be more within the context of -- of the -- of the --	09:14:32
22	By MR. DAVIS:	09:14:43
23	Q. What labels do you want to apply to the X	09:14:43
24	and Y axis that would make you able to opine as to	09:14:47
25	whether this constitutes a pulse?	09:14:50

1 A. For example, where does the pre-charge
2 come in for controller commences and when does the
3 pre-charge period end and the actual voltage to --
4 whether it would be to select a word line or
5 unselect a word line, I think it would just be
6 better to have more context.

7 And by the way, Counsel, it's okay, because
8 we started early and it's -- it's almost -- it's
9 definitely over an hour and 15 minutes, so whenever
10 you are ready, I would appreciate a bio break, yeah.

11 Q. Yeah, let me just finish this line.

12 So let's assume that the pre-charge period
13 starts before what is shown as negative 2 in Figure
14 A and that it ends after what's shown as 4 in Figure
15 A. Would that constitute a pulse then?

16 MR. HERMAN: Objection. Form.

17 THE WITNESS: Are you saying the pre-charge
18 starts at, what, minus 2?

19 MR. DAVIS: Sure.

20 By MR. DAVIS:

21 Q. So assume that the pre-charge starts at
22 minus 2 and ends at 4 in Figure A of Exhibit 2020,
23 would what's shown there be a pulse?

24 A. And assuming -- assuming the voltage -- I
25 would say that that voltage going up is coming from

1	the X decoder and coming from the voltage generation	09:17:22
2	circuit.	09:17:26
3	Q. Yeah, we can assume that as well.	09:17:27
4	A. And during the -- specified as a pre-pulse	09:17:29
5	step by -- in the context, such as Lee and such	09:17:33
6	as -- such as '822, a pre-pulse step before the	09:17:36
7	programming. And assuming that afterwards you are	09:17:40
8	going to go into a programming step.	09:17:43
9	Q. Okay, you can make those assumptions. Can	09:17:47
10	you tell me whether what's shown in Exhibit 2020	09:17:49
11	Figure A is a pulse?	09:17:52
12	A. It may be considered -- like given that	09:18:36
13	this is the first time I have seen this -- this	09:18:45
14	document and given all the context such as in the	09:18:48
15	context of Lee when they say that I'm applying this	09:18:50
16	and assuming that the minus 2, the duration, and	09:18:53
17	then you could -- you could -- you could have -- as	09:18:56
18	Lee and Zhao, you could have the wave form starting	09:19:03
19	right away at minus 2 of what will start ramping at	09:19:06
20	minus 2 and start ramping down after -- after 4,	09:19:11
21	this kind of thing. This could be one -- could be	09:19:14
22	one full pulse. Not exclusively the only	09:19:16
23	manifestation of a pulse.	09:19:20
24	Q. I'm not sure I fully understood your	09:19:24
25	answer. Is what's shown in Figure A of Exhibit 2020	09:19:25

1	a pulse?	09:19:30
2	MR. HERMAN: Objection. Form.	09:19:34
3	THE WITNESS: Look, in the context of '822,	09:19:43
4	in context of Lee, context of Yang and Zhao, I just	09:19:47
5	ask you to bracket it, put it into context; right?	09:19:52
6	So is the wave form or the signal coming in from	09:19:54
7	voltage generation circuit through the X decoder?	09:19:59
8	By MR. DAVIS:	09:20:04
9	Q. You can make that assumption, yes.	09:20:04
10	A. And where would you bracket the V charge	09:20:06
11	period?	09:20:15
12	Q. From negative 2 to 4. Assuming it's that,	09:20:16
13	is that -- is what's depicted in Figure A of Exhibit	09:20:22
14	2020 a pulse?	09:20:25
15	MR. HERMAN: Objection. Form.	09:20:32
16	THE WITNESS: The context of -- can you	09:20:46
17	upload '822 for me, please? Is it possible to	09:20:49
18	upload '822?	09:20:53
19	By MR. DAVIS:	09:20:55
20	Q. You have it with you.	09:20:55
21	A. Oh, you load it already?	09:20:56
22	Q. Yes.	09:20:59
23	A. Oh, yeah. Sorry.	09:21:04
24	MR. HERMAN: Counsel, we are probably	09:21:05
25	getting to a good breaking point. We have been	09:21:06

1	going for an hour and 20 minutes.	09:21:09
2	MR. DAVIS: Let's finish this line of	09:21:13
3	questioning. Thanks.	09:21:14
4	MR. HERMAN: How long do you intend to go	09:21:16
5	with this line of questioning? You said that ten	09:21:17
6	minutes ago.	09:21:19
7	MR. DAVIS: It wasn't ten minutes ago.	09:21:21
8	Until I get an answer from Dr. Liu.	09:21:23
9	THE WITNESS: Again, the context -- I will	09:22:13
10	have to know why would it be -- what -- what's going	09:22:18
11	on in time frame between minus 2 and zero and then	09:22:22
12	between 2 and 4. There is -- there is a lot of	09:22:24
13	nuances involved. And I think you -- in the context	09:22:28
14	what we're discussing is the -- that there is a	09:22:34
15	pre-charge period and during that period the voltage	09:22:43
16	allowed to come in from the voltage generation	09:22:48
17	circuit into the respective word line, okay.	09:22:52
18	And so, again, I -- with this wave form,	09:23:01
19	it's really out of -- out of the blue. I'm seeing	09:23:05
20	it for the first time. I guess I would like to see	09:23:11
21	the -- the --	09:23:18
22	By MR. DAVIS:	09:23:53
23	Q. You trailed off there, Doctor. You said,	09:23:53
24	"I guess I would like to see the," and I'm not sure	09:23:55
25	what you said.	09:23:58

1	A.	I'm looking at '822. Because I'm here to	09:23:59
2		answer the question in the context of '822, that's	09:24:07
3		my understanding.	09:24:12
4	Q.	Okay. Do you have Figure 4 of '822?	09:24:14
5	A.	Yes, I do.	09:24:23
6	Q.	And do you see what's labeled the	09:24:25
7		"Pre-charge period" in '822?	09:24:29
8	A.	Yes, I do.	09:24:33
9	Q.	Do you see different wave forms there	09:24:34
10		inside that pre-charge period?	09:24:36
11	A.	Yes, I do.	09:24:40
12	Q.	Assuming that one of those wave forms	09:24:41
13		looked like what's shown in Figure A of Exhibit	09:24:43
14		2020, would that be a pulse?	09:24:48
15	A.	I mean I would prefer the starting time to	09:24:59
16		be at the pre-charge period because that is when the	09:25:09
17		controller goes into the pre-charge step.	09:25:13
18	Q.	Assume that the entire wave form that is	09:25:22
19		depicted in Figure A of Exhibit 2020 is inside that	09:25:25
20		pre-charge period, would that be a pulse?	09:25:28
21	A.	I think the initial point of pre-charge is	09:25:45
22		when -- when the word line -- actually code is now	09:25:49
23		passing -- so start handing out these voltage	09:25:54
24		through the -- through the voltage generation	09:25:56
25		circuit start going in. So I would like to see a	09:26:00

1	better -- better demarcation of the pre-charge	09:26:03
2	period.	09:26:08
3	Q. I don't understand what you're saying. A	09:26:12
4	better demarcation of the pre-charge period where?	09:26:15
5	A. If you want to connect the Figure 2020A to	09:26:18
6	be in the context of '822. I don't understand why	09:26:22
7	you have minus 2, 0, and all these other things. At	09:26:26
8	a certain point there is -- there is -- there is a	09:26:28
9	$v(t)$ start going up.	09:26:34
10	Q. So it's bothering you that the time	09:26:37
11	demarcations in Exhibit 2020 go from negative 2 to	09:26:42
12	4?	09:26:47
13	A. It's bothering me that there is no context.	09:26:48
14	It's bothering me that this is the first time I have	09:26:51
15	seen this document out of the blue and it's	09:26:55
16	bothering me that the $v(t)$ with all these	09:26:58
17	number, yes.	09:27:00
18	Q. Ignore -- ignore the negative 2 to 4 at the	09:27:01
19	bottom of Figure A. Just assume that that wave form	09:27:04
20	that's shown in Figure A of Exhibit 2020 is part of	09:27:07
21	the wave form that's -- is -- is the wave form	09:27:13
22	that's -- that's in a pre-charge period as shown in	09:27:17
23	Figure 4 of the '822 patent. Would that be a	09:27:20
24	pulse?	09:27:23
25	MR. HERMAN: Objection. Form.	09:27:25

1 THE WITNESS: I think the better way to 09:27:29
2 answer this is if I look at the pre-charge period in 09:27:30
3 Figure 4 and I -- I would agree that, for 09:27:33
4 example, what is on the top word line is one example 09:27:37
5 of pulse, what is in the middle of the word line is 09:27:40
6 another example of pulse, and what is in the bottom 09:27:43
7 word line is another example of pulse. I would 09:27:46
8 agree to that, but I don't know how to morph what 09:27:48
9 you showed me in A of 2020 into -- into -- into 09:27:54
10 Figure 4 so -- 09:27:58

11 By MR. DAVIS: 09:28:00

12 Q. So if the wave line that's shown in Figure 09:28:00
13 A of Exhibit 2020 were included instead of one of 09:28:03
14 the wave forms in Figure 4 of the '822 patent, you 09:28:06
15 still couldn't tell me whether that is a pulse. 09:28:09

16 MR. HERMAN: Objection. Form. 09:28:15

17 THE WITNESS: Repeat your question. I 09:28:16
18 don't understand your question. Can you repeat your 09:28:17
19 question, please? 09:28:24

20 By MR. DAVIS: 09:28:25

21 Q. You just looked at different wave forms in 09:28:25
22 the pre-charge period of Figure 4 of the '822 09:28:27
23 patent; correct? 09:28:29

24 A. Yes, I am looking at Figure 4 for different 09:28:34
25 wave form on the word line during the pre-charge 09:28:36

1	period, that's correct.	09:28:39
2	Q. Okay. Take the top wave form where it says	09:28:40
3	"Unselected BL," do you see that?	09:28:43
4	A. Yes, I do.	09:28:48
5	Q. Now, assume that that wave form that's	09:28:52
6	depicted there instead looks like the wave form	09:28:54
7	that's shown in Figure A of 2020, and assume that	09:28:57
8	that wave form occurs during that pre-charge	09:29:00
9	period, does that constitute a pulse?	09:29:03
10	MR. HERMAN: Objection. Form.	09:29:08
11	THE WITNESS: It may not be a pulse in the	09:29:29
12	context of '822 because in the '822 all the -- all	09:29:31
13	these word line and the bit line are decoded at the	09:29:36
14	same time and passed through to the -- each	09:29:44
15	appropriate nodes are the -- are the commencing of	09:29:47
16	the pre-charge period.	09:29:53
17	By MR. DAVIS:	09:29:56
18	Q. So everything in the '822 stays the same.	09:29:56
19	The only thing that is changing is the shape of the	09:29:58
20	wave form for the unselected bit line in Figure 4 of	09:30:01
21	the '822 patent to have the same shape as Figure A	09:30:05
22	of Exhibit 2020. Is that a pulse?	09:30:08
23	MR. HERMAN: Objection. Form.	09:30:14
24	THE WITNESS: The reason I'm hesitant to	09:30:46
25	answer is that because in the pre-charge period why	09:30:48

1	would you have an offset of like minus 2 to zero and	09:30:51
2	insert it into that? It just -- I need to know more	09:30:57
3	context.	09:31:01
4	MR. DAVIS: Okay. Why don't we go off the	09:31:02
5	record.	09:31:05
6	THE VIDEOGRAPHER: Stand by. We're going	09:31:07
7	off the record. The time is 9:31.	09:31:11
8	(Recess.)	09:33:53
9	THE VIDEOGRAPHER: And we're back on the	09:37:07
10	record. The time is 9:37.	09:37:08
11	By MR. DAVIS:	09:37:19
12	Q. Doctor, I have just put another exhibit	09:37:19
13	into the chat. It's what's been marked as Exhibit	09:37:21
14	1010. Let me know when you have that open.	09:37:25
15	A. I have it open now.	09:37:35
16	Q. And Exhibit 1010 is US Patent No.	09:37:36
17	10,726,920; is that correct?	09:37:39
18	A. That's correct.	09:37:41
19	Q. It's what you've been referring to as the	09:37:42
20	Yang reference?	09:37:46
21	A. Yes, it is.	09:37:46
22	Q. Can you turn to Figure 8B?	09:37:47
23	A. Yes.	09:38:00
24	Q. Sorry. Do you see that?	09:38:02
25	A. I'm still scrolling. I'm sorry.	09:38:05

1	8B, yes, I'm there.	09:38:09
2	Q. Do you see the wave form that's labeled	09:38:15
3	WL_VSB1_unsel?	09:38:20
4	A. You mean, WL_VSB1_unselect?	09:38:31
5	Q. Yes.	09:38:35
6	A. Yes, I do see that.	09:38:36
7	Q. Is there a pulse depicted for that wave	09:38:42
8	form in 8B?	09:38:46
9	A. You mean WL_VSB1_unsel?	09:38:53
10	Q. Yes.	09:39:00
11	A. Yes, there is.	09:39:01
12	Q. Where is it?	09:39:02
13	A. It starts at t1 and the pulse height would	09:39:05
14	be reaching to Vbypass after the -- the constant	09:39:17
15	delay. And then at the t3 when the -- the	09:39:20
16	pre-charge period is done, the X decoders hand off	09:39:26
17	the voltage and then the voltage start decaying.	09:39:33
18	Q. You said that the voltage reaches Vbypass.	09:39:38
19	Do you see that the line there between t1 and -- and	09:39:45
20	the point where it actually reaches Vbypass is -- is	09:39:51
21	curved?	09:39:54
22	A. The portion of it between t1 and t2 is	09:40:01
23	curved, that's correct.	09:40:03
24	Q. Why is it curved?	09:40:05
25	A. Because the signal takes time to go from	09:40:08

1 the voltage generation circuit and be reinserted to 09:40:11
2 the word line, there would be a parasitic component 09:40:16
3 that cause slight delay in charging the word line. 09:40:21

4 Q. If the voltage for that wave form instead 09:40:43
5 went directly from the -- the lower level to the 09:40:47
6 upper level so there wasn't a curve, what would that 09:40:50
7 indicate to you? 09:40:53

8 MR. HERMAN: Objection. Form. 09:40:57

9 THE WITNESS: I -- I -- I don't know if I 09:41:04
10 want to speculate, but normally in the -- in the 09:41:14
11 real world there is always going to be parasitic 09:41:19
12 component and especially since the signal is going 09:41:25
13 to charge, let's say in this given case, 09:41:28
14 WL_VSB_unselected, it's actually going -- depending 09:41:28
15 on how many bit lines, where this word line needs to 09:41:34
16 go be responsible for and that inevitably is going 09:41:38
17 to create capacitors because it has a charge -- the 09:41:44
18 voltage has to be established across -- all the way 09:41:48
19 across and there is going to be resistance, 09:41:51
20 components of the art -- capacitor components, so 09:41:54
21 therefore it's always going to be having some sort 09:41:56
22 of ramping time. 09:41:59

23 By MR. DAVIS: 09:42:04

24 Q. You said after t3 for this wave form that 09:42:04
25 the signal decays and it's curved again there. Can 09:42:09

1	you explain that?	09:42:13
2	A. It's -- it's just reverse of what I just	09:42:16
3	mentioned is that after the voltage is removed --	09:42:19
4	and this voltage needs to go to discharge through --	09:42:22
5	so the way which I was trying to explain in Lee	09:42:29
6	and -- and -- and, again, like my declaration says,	09:42:33
7	the reason is that the X decoder gets the voltage	09:42:43
8	from the voltage generation circuit, and that	09:42:45
9	voltage generation circuit inevitably has some kind	09:42:49
10	of inverter to feed a decoder.	09:42:52
11	So it's either put high to whatever	09:42:55
12	designated voltage, in this case it would be	09:42:57
13	Vbypass, and that voltage would have to charge the	09:42:58
14	word line or initial -- once the pre-charge period	09:43:02
15	is over it needs to go down -- get pulled down to	09:43:07
16	discharge the word line, whatever word line that is,	09:43:12
17	in this case the Vbypass signal, and whatever	09:43:15
18	voltage is on there already needs to be discharged	09:43:18
19	back to -- for lack of a better word -- the	09:43:20
20	background voltage in this case, the lower portion	09:43:23
21	between t3 and t4, and that's -- and that's just	09:43:27
22	reverse of what you think of the -- the reverse	09:43:31
23	process of the curve up and the curve down.	09:43:36
24	Q. What determines the shape of that curve?	09:43:46
25	A. A lot of things that determine the shape of	09:43:54

1 the curve but if we boil it down just to simply R 09:43:56
2 and C component. 09:44:05
3 So, for example, how many bit line -- how 09:44:06
4 many bit line are being driven by this unselected 09:44:08
5 word line. For example, there is one of them, and 09:44:13
6 how frequent do you actually stop these unselected 09:44:16
7 word line and -- with -- with metal to reduce the 09:44:20
8 resistance. So it's -- it's -- it really depends on 09:44:29
9 design. It really depends on the -- on the 09:44:32
10 technology and depends on -- on how many -- you 09:44:35
11 know, your architecture, for example. How many bit 09:44:39
12 line, how many word line. 09:44:40
13 Q. Do you know what the voltage driver is for 09:44:46
14 that word line? 09:44:49
15 A. I beg your pardon. Can you repeat your 09:44:55
16 question? Do I know what? 09:44:57
17 Q. What is the voltage driver for that word 09:44:59
18 line? What drives the voltage? 09:45:01
19 A. In the context of '822, in the context of 09:45:03
20 Yang, I believe it is driven -- and as a person of 09:45:09
21 ordinary skill in the art, I believe it is driven by 09:45:16
22 a charge pump that generate these various voltages 09:45:19
23 through the voltage generation circuit. I'm not 09:45:23
24 sure if that is what you meant by driver. 09:45:26
25 The voltage are driven by, quote, unquote, 09:45:37

1 the actual driver is the X decoder. The X decoder 09:45:40
2 is the -- is the selection and -- and the means to 09:45:45
3 pass a voltage. So the X decoder receives the 09:45:49
4 voltage from voltage generation circuit, and I guess 09:45:53
5 you could call that driver, and then trying to 09:45:56
6 assert this voltage from the voltage generation 09:46:00
7 circuit through the X decoder circuit inevitably is 09:46:02
8 like one limitation would be, as I mentioned 09:46:06
9 earlier, like an inverter to either pull up or pull 09:46:10
10 down to the different voltage. So I'm not sure what 09:46:12
11 you mean by driver. 09:46:15
12 The actual origin of the voltage is from 09:46:16
13 voltage generation circuit, but the need to assert 09:46:20
14 or to -- to drive the signal is through the X 09:46:24
15 decoder. 09:46:28
16 Q. Do you see the word line above the one 09:46:33
17 we've been talking about, it's word line 09:46:35
18 _VSB2(data)? 09:46:37
19 A. Yes, I do. 09:46:41
20 Q. Do you see a pulse on that word line? 09:46:43
21 A. Yes, I do. 09:46:49
22 Q. Where? 09:46:51
23 A. The pulse is -- is coming in the form of 09:46:54
24 two -- two step. First, because they are different 09:46:57
25 circuits, they generate different voltage. So in 09:47:04

1 the case like that, the X decoder will first charges 09:47:07
2 to Vbypass and then charge again to charge up again, 09:47:11
3 charge up to Vpre_OD. So the final pulse high is 09:47:17
4 Vpre_OD. It just takes time to get there. It 09:47:23
5 has -- it may have to do deal with how you design 09:47:28
6 the circuit, how you design the -- the -- for the 09:47:32
7 current consideration, for current consumption 09:47:34
8 consideration that you do this in a -- in a -- in 09:47:36
9 sort of a gradual step to achieve that pulse. 09:47:40
10 Q. So do you consider that to be one or two 09:47:46
11 pulses? 09:47:48
12 A. I consider that to be there is a pulse of 09:47:57
13 the magnitude Vpre_OD during the pre-charge 09:48:01
14 period. 09:48:05
15 Q. There is not a -- there is not a pulse to 09:48:06
16 get to Vbypass? 09:48:09
17 MR. HERMAN: Objection. Form. 09:48:13
18 THE WITNESS: Again, it may have to do with 09:48:22
19 architecture and how fast you can charge and how you 09:48:26
20 want to make sure that the other point of the 09:48:28
21 circuit is supplying this final pre_OD pulse. You 09:48:31
22 may want to minimize the current consumption and 09:48:36
23 cost, so you go -- first, you start charging it 09:48:40
24 and -- and go through intermediate voltage and then 09:48:43
25 finally reaching the Vpre_OD. So bottom line is 09:48:47

1	that there is a pulse of magnitude Vpre_OD during	09:48:52
2	the period of pre-charging.	09:48:58
3	By MR. DAVIS:	09:49:02
4	Q. For what's labeled WL_VSB2(data), how many	09:49:02
5	pulses do you see in Figure 8B?	09:49:11
6	MR. HERMAN: Objection. Form.	09:49:18
7	THE WITNESS: I'm trying to understand your	09:49:30
8	question. There is a pulse of Vpre_OD -- _OD during	09:49:33
9	the pre-charging period. And how it managed to get	09:49:41
10	there doesn't change the fact that there is a	09:49:49
11	pulse -- a pre-pulse signal, a pulse, being applied	09:49:52
12	to a word line during this pre-charge period.	09:49:55
13	By MR. DAVIS:	09:50:08
14	Q. When does that pulse begin?	09:50:08
15	A. The pulse began -- it could begin at t1.	09:50:30
16	It's just -- just a pulse due to the architecture,	09:50:33
17	due to the resisting RC. You may have -- you may	09:50:36
18	need a time to charge up to -- to intermediate	09:50:42
19	before you are actually fully charged to this total	09:50:47
20	pulse high.	09:50:52
21	Q. So when does the pulse for WL_VSB2(data) in	09:50:52
22	Figure 8B begin?	09:51:00
23	A. There is the pre-charge period. And during	09:51:12
24	this pre-charge period the X decoder starts getting	09:51:14
25	ready to pass the voltage and the voltage generation	09:51:22

1	circuit starts generating this pre-OD. However,	09:51:26
2	depending on architecture, when the pulse begins,	09:51:33
3	you may have to traverse through certain	09:51:39
4	intermediate point before you fully charge up in	09:51:42
5	order to get enough charge ability to pump up to	09:51:45
6	pre-OD. These voltage generation circuit needs to	09:51:53
7	charge, as I testified earlier, so it may take a	09:51:57
8	while. It may take a little bit of rest at	09:52:01
9	intermediate the point to charge up to this pre-OD.	09:52:03
10	Q. So does the pulse in Figure 8B of Yang	09:52:08
11	begin at time t1?	09:52:23
12	A. Time t1 is the pre-charge period and that	09:52:26
13	is when the -- all the voltages are -- all the	09:52:29
14	voltage generation circuits are going -- going to	09:52:32
15	start getting the voltage ready and start getting	09:52:35
16	ready to pass them on to the X decoder -- the	09:52:39
17	controller passes them on to the X decoder and that	09:52:44
18	is when the voltage will start -- the pulse will	09:52:47
19	start being -- the voltage start being asserted onto	09:52:49
20	these different word line and it just so happened in	09:52:54
21	this case it traverse to pre-OD. You may start at	09:53:00
22	Vbypass, it may -- simply because that may be the	09:53:04
23	way more efficient in terms of how the charge pump	09:53:08
24	works because you already have a Vbypass charge pump	09:53:10
25	and now you need to start another pre-OD.	09:53:15

1 But nevertheless, the voltage -- the final 09:53:20
2 voltage that is going to be decoded onto WL_VSB2 09:53:21
3 starts being asserted at t1 and it just traverse. 09:53:25
4 It may have intermediate point. Similar to the one 09:53:30
5 below we just talked about, WL_VSB1_unselect, it may 09:53:33
6 go through a certain point halfway between Vbypass 09:53:40
7 and -- and the background voltage, and we can label 09:53:45
8 that as Vbypass half, whatever, we can -- we can do 09:53:48
9 that but it just -- it's part of this traverse into 09:53:50
10 this final voltage. 09:53:53
11 Q. So does the pulse that you say is on 09:54:01
12 WL_VSB2(data) in Figure 8B of Yang begin at t1? 09:54:04
13 A. Again, it depends on how X decoder and 09:54:15
14 controller drives this word line and it depends 09:54:19
15 architecture to its final voltage pre_OD. But, 09:54:23
16 nonetheless, during the pre-charge period with -- 09:54:28
17 during the pre-charge period there is voltage of 09:54:33
18 Vpre_OD being applied to the word line of WLS_VSB2 09:54:39
19 (sic). 09:54:46
20 Q. I'm just asking when the pulse that you say 09:54:48
21 is in Figure 8B for that word line begins. Can you 09:54:50
22 tell me that? 09:54:55
23 A. Repeat your question again? 09:54:57
24 Q. For WL_VSB2(data) in Figure 8B of 09:55:03
25 Yang, when does the pulse begin? 09:55:08

1 A. Part of the requirement to reach the full
2 high of the pulse begins at t1 because that's how
3 the voltage and how the architecture and how the
4 control circuit works to -- in order to reach the
5 pre_OD magnitude, it goes through an intermediate
6 point. It may have to do with how the charge pump
7 circuit is designed, how to optimally use the charge
8 pump circuit to avoid charge pump circuit being
9 collapsed. We have -- there are cases where charge
10 pump circuit will collapse because it simply cannot
11 handle the current.

12 So the pre-charge period starts at t1, and
13 that's when the voltage, pre_OD, that pulse voltage
14 is being governed and being generated and it needs
15 to pass through word line_VSB2(data). So it goes --
16 it goes into that line at t1 and it just so happens
17 it goes through intermediate step and then before it
18 gets to its final -- final magnitude voltage.

19 Q. So can you tell me when the pulse that's on
20 WL_VSB2(data) in Figure 8B of Yang begins and ends?

21 A. Part of the voltage begins at t1 just like
22 WL_VSB1_unselect. The charging of that word line
23 begins at t1. The mechanism to reach the full pulse
24 height pre_OD -- _OD begins at t1. And then you may
25 have during the -- during the -- the traverse to the

1	final pulse height you may have to go through two	09:57:25
2	different charge part to get to that voltage and	09:57:28
3	then -- and then it ends at t3.	09:57:31
4	Q. So the end of the pulse is at t3?	09:57:36
5	A. The end of the pulse is at t3.	09:57:39
6	Q. So the pulse doesn't continue after t3?	09:57:46
7	A. I don't know whether the volt generator	09:57:54
8	still hold that voltage, but I -- I don't believe it	09:57:58
9	does because you need -- whether it does or not	09:58:01
10	doesn't matter, but the controller is telling the X	09:58:03
11	decoder now I'm going to ask you to hand off to	09:58:06
12	another set of voltages before I move on to the	09:58:12
13	programming portion -- to a voltage in the	09:58:17
14	programming portion. So the X decoder now no longer	09:58:23
15	decoding from the same voltage generator -- same	09:58:26
16	voltage generation without those voltage and X	09:58:32
17	decoder start being pulled down in this case to the	09:58:35
18	background voltage and then getting ready to prepare	09:58:43
19	for the actual boosting and actual programming	09:58:46
20	portion of the -- of the operation.	09:58:49
21	Q. Do you have your declaration, Exhibit 1003,	09:58:57
22	in front of you?	09:59:00
23	A. I just got there now.	09:59:01
24	Q. Can you turn to paragraph 145? This is PDF	09:59:03
25	page 43.	09:59:09

1	A.	You said 145?	09:59:15
2	Q.	Yes. It spans PDF pages 42 and 43.	09:59:17
3	A.	Okay.	09:59:39
4	Q.	Do you see an annotated version of Figure	09:59:40
5		8B of Yang that we've been looking at on page 43 of	09:59:44
6		your declaration?	09:59:50
7	A.	Yes.	09:59:52
8	Q.	Do you see the pink annotation that was	09:59:55
9		added?	09:59:57
10	A.	Yes.	09:59:57
11	Q.	Did you add that annotation?	09:59:58
12	A.	Yes.	10:00:00
13	Q.	You've highlighted in pink all the way from	10:00:02
14		right around t1 to after t3.	10:00:06
15		Do you see that?	10:00:10
16	A.	Yes, I do.	10:00:12
17	Q.	Why did you highlight the portion of	10:00:15
18		WL_VSB2(data) after t3?	10:00:18
19	A.	The -- with the context, I might have -- I	10:00:40
20		might have mis- -- I need to clarify. In the	10:00:43
21		context of the Yang, Yang is actually saying that	10:00:49
22		it's -- it's -- the pre-charge period is t1 through	10:00:51
23		t4, okay? They call it pre-charge phase; right? So	10:00:56
24		the -- during this pre-charge phase, whether the --	10:01:06
25		the point is the charge pump turns off when this X	10:01:07

1 decoder hands out the voltage and starts decaying, 10:01:11
2 maybe at a different time frame such as t3, but, 10:01:19
3 nonetheless, the t1 through t4 is the so-called 10:01:22
4 pre-charge phase. I'm highlighting it because 10:01:26
5 the -- I'm highlighting it to include the decaying 10:01:28
6 portion of the -- of the wave form of the signal. 10:01:32
7 Q. So does the decaying portion -- is it -- is 10:01:36
8 the decaying portion part of the pulse? 10:01:41
9 MR. HERMAN: Objection. Form. 10:01:43
10 THE WITNESS: It depends. It depends how 10:01:47
11 the pre-charge phase is -- is demarcated, okay. So 10:01:49
12 you could demarcate pre-charge phase based on the 10:01:57
13 actual controller signal or you can -- you can 10:02:00
14 demarcate the pre-charge signal based on to include 10:02:03
15 the decaying. It just depends how you demarcate 10:02:08
16 it. 10:02:11
17 By MR. DAVIS: 10:02:12
18 Q. In the context of Yang, is the decaying 10:02:12
19 portion part of the pulse? 10:02:17
20 MR. HERMAN: Objection. Form. 10:02:22
21 THE WITNESS: In the context of Yang, it's 10:02:28
22 satisfied that there is a pulse during the 10:02:32
23 pre-charge phase prior to the word line. 10:02:36
24 By MR. DAVIS: 10:02:45
25 Q. Not my question. My question is, in the 10:02:45

1	context of Yang, is the decaying portion part of the	10:02:47
2	pulse?	10:02:50
3	MR. HERMAN: Objection. Form.	10:02:56
4	THE WITNESS: I think this is the -- in the	10:03:12
5	sense that decaying portion, based on if you	10:03:14
6	demarcate t1 through t4 as the pre-charge period,	10:03:20
7	the decaying portion is part of the pulse because	10:03:25
8	it's going up and coming down.	10:03:30
9	By MR. DAVIS:	10:03:39
10	Q. What if the pre-charge portion ended at	10:03:39
11	t3, would the decaying portion be part of the	10:03:42
12	pulse?	10:03:45
13	MR. HERMAN: Objection. Form.	10:03:49
14	THE WITNESS: Can you repeat your question?	10:03:55
15	By MR. DAVIS:	10:03:57
16	Q. If the pre-charge portion ended at	10:03:57
17	t3, would the decaying portion of the signal be part	10:04:00
18	of the pulse in WL_VSB2(data) in Figure 8B of Yang?	10:04:04
19	A. Are you saying if I were to demarcate the	10:04:52
20	pre-charge period to be t3? Is that your question?	10:04:56
21	Q. Yes.	10:05:00
22	A. It would still be part of the pulse that	10:05:12
23	was asserted on the word line. It just takes time	10:05:16
24	to -- to -- to discharge.	10:05:18
25	Q. Do you have Exhibit 1004 in front of you;	10:05:30

1	Lee?	10:05:34
2	A. Yes, I do.	10:05:35
3	Q. Can you turn to column 1? It's at PDF 15.	10:05:42
4	A. Okay. I'm there.	10:05:50
5	Q. Can you look at lines 52 to 56?	10:05:53
6	Do you see a reference there to "program	10:05:59
7	disturb phenomenon?"	10:06:01
8	A. Yes, I do.	10:06:05
9	Q. What is a "program disturb phenomenon?"	10:06:05
10	A. I think the weakest -- I think I have	10:06:12
11	defined the program disturb phenomenon in my	10:06:17
12	declaration and that's the -- in the --	10:06:22
13	Q. Give me a second to get there.	10:07:04
14	A. So in the context of Lee --	10:08:44
15	Q. I'm really sorry.	10:08:49
16	A. -- the program disturb phenomenon would	10:08:53
17	just be the unintended programming. I believe we	10:08:56
18	saw that word intended when selected for	10:09:03
19	programming. And then the unintended programming	10:09:05
20	could even be the selection itself. It's just	10:09:14
21	unintended programming of a memory cell that are not	10:09:18
22	meant to be programmed.	10:09:22
23	Q. What causes program disturb?	10:09:24
24	A. In general, it's the -- program disturb	10:09:35
25	is -- is the unintentional induction or	10:09:38

1	unintentional electron beam put into the storage	10:09:43
2	element, and inevitably it's coming from voltage.	10:09:50
3	It could be that the different forms of unintended	10:09:56
4	programming inevitably could be coming from voltage	10:09:59
5	that somehow become high enough to facilitate the	10:10:02
6	placement of electron onto the folding gate.	10:10:09
7	Q. Are there other types of program disturb	10:10:30
8	note in the art beyond just the unintended	10:10:33
9	programming that you referenced?	10:10:37
10	A. Repeat your question again.	10:10:41
11	Q. Are there other types of program disturb	10:10:42
12	beyond the unintended programming that you	10:10:44
13	referenced?	10:10:47
14	A. I referenced some form of program disturb,	10:10:53
15	but in general, any unintended change of the data by	10:10:56
16	one intended to be changed is a form of program	10:11:03
17	disturb in the programming operation.	10:11:08
18	Q. Can you turn to column 8, line 25 to 32?	10:11:10
19	A. Of Lee?	10:11:16
20	Q. Yes.	10:11:17
21	A. What is that again? Column 8?	10:11:19
22	Q. Yep. Lines 25 to 32.	10:11:21
23	A. Okay.	10:11:27
24	Q. Do you see that reference there to a	10:11:32
25	"typical program operation?"	10:11:34

1	A. Yes, I do.	10:11:40
2	Q. What is that in reference to?	10:11:42
3	A. Again, you -- it is referring to a	10:12:04
4	programming operation where you have boosting	10:12:09
5	voltage and you have the programming voltage. But	10:12:11
6	when these voltage are asserted onto this word line,	10:12:15
7	due to the nature of the NAND flash memory,	10:12:21
8	particularly 3D NAND, that the channel voltage now	10:12:26
9	is skated by these voltage coming in, boost voltage	10:12:30
10	or -- or the programming voltage, unless you have --	10:12:34
11	and during that period of time there is a transient	10:12:40
12	period of time.	10:12:42
13	Unless you have performed your pre-charge	10:12:44
14	correctly, you may have voltages across the selected	10:12:46
15	word line, in the context of Lee, across	10:12:50
16	the especially selected word line of the memory	10:12:52
17	cell. On each side you may have voltage that if not	10:12:56
18	pre-charged correctly you may have temporarily,	10:13:01
19	either come in the form of electron being charged or	10:13:04
20	coming from a very high voltage that will cause	10:13:06
21	either the selected cell or the unintended	10:13:10
22	unpre-charged properly cell to see high voltage and	10:13:14
23	cause electrons to be placed on the folding gate and	10:13:17
24	cause the data to be -- unintended data to be -- to	10:13:20
25	be modified.	10:13:25

1	Q. What is a pre-charge operation?	10:13:30
2	A. Pre-charge operation as understood by	10:13:38
3	POSITA has two component. One -- you can explain	10:13:38
4	two perspectives. One, you want to make sure that	10:13:43
5	your voltage in a channel across the string,	10:13:47
6	especially after like the string and -- and actually	10:13:51
7	either properly charge or discharge such that when	10:13:58
8	the actual final high V program voltage and the high	10:14:03
9	V pass voltage come in, these voltages, one is	10:14:12
10	boosting the unselected cell, one is actually the	10:14:14
11	high voltage family, VGPM. It's very high voltage.	10:14:17
12	You want to make sure that during that period when	10:14:20
13	they place this high voltage, the channel voltage is	10:14:22
14	already properly conditioned by the pre-charge	10:14:26
15	operation such that you won't see a very high	10:14:31
16	voltage to cause unintended programming.	10:14:35
17	So in the case of Lee, and inevitably in	10:14:39
18	every case, the channel during the pre-charge is	10:14:47
19	shut off and you try to use the voltage on each one.	10:14:50
20	There is no channel conduction current. There is no	10:14:56
21	DC conduction current in Lee, in Zhao, in Yang, in	10:14:59
22	'822. And you try to use these voltage on -- on the	10:15:03
23	bit line and voltage on the word line selected,	10:15:06
24	unselected to properly either remove the electron	10:15:10
25	that are trapped or properly cause the voltage to be	10:15:12

1 gradually going from -- from one of the channels to 10:15:16
2 the other end of the channel, such that when the 10:15:19
3 high voltage comes in, V program, V pass come in, 10:15:21
4 you will not cause the either unselected cell or the 10:15:25
5 selected cell to be injected with electron 10:15:29
6 unintentionally. 10:15:34

7 Q. What is a threshold voltage? 10:15:39

8 A. Threshold voltage is simply defined as the 10:15:47
9 voltage that would turn on the transistor or at 10:15:50
10 least cause the transistor to have a conducting 10:15:53
11 channel. It doesn't mean the current is conducting, 10:15:58
12 it just means that the voltage can actually cause 10:16:01
13 the -- the -- the ability to come back. Of course 10:16:05
14 it still depends on the voltage on the drain and -- 10:16:12

15 (Court Reporter clarification.) 10:16:21

16 THE WITNESS: -- source and drain side 10:16:22
17 because the device could still be off with source 10:16:24
18 bias and -- 10:16:33

19 (Court Reporter clarification.) 10:16:33

20 THE WITNESS: With certain source, 10:16:34
21 s-o-u-r-c-e, or drain bias. 10:16:37

22 I apologize. Did you get that? 10:16:50

23 By MR. DAVIS: 10:16:57

24 Q. What is a source select transistor? 10:16:57

25 A. Source select transistor is a transistor 10:17:04

1 that gates whether the source voltage -- recovery 10:17:14
2 source voltage -- in the case of flash memory or 10:17:18
3 RAND context -- gets put in the end of the night 10:17:20
4 string, the -- the memory cell. 10:17:28

5 Q. What is -- what is a drain select 10:17:35
6 transistor? 10:17:38

7 A. Let's go to my declaration. 10:17:41

8 As I mentioned, the drain select transistor 10:17:57
9 and source select transistor respectively control 10:18:02
10 the -- control the coupling between the -- the bit 10:18:05
11 line and the common source line. 10:18:09

12 Q. What does it mean to have a resistance 10:18:13
13 component between the source select transistor and 10:18:15
14 the drain select transistor? 10:18:18

15 A. Okay. In the context of Lee -- I want to 10:18:21
16 make sure that there is no disconnect in 10:18:25
17 understanding. In the context of Lee, what it means 10:18:28
18 by resistor component is this: It simply means the 10:18:34
19 threshold voltage of a transistor is a function of 10:18:38
20 how many transistor was connected in series with it. 10:18:45
21 This has to do -- some people call this a body 10:18:49
22 effect or source voltage -- 10:18:51

23 (Court Reporter clarification.) 10:18:56

24 THE WITNESS: Body effect or source re -- 10:18:58
25 source voltage effect. 10:19:01

1	So in a string, especially if you go from	10:19:09
2	the source to the drain, and if I have a -- a	10:19:14
3	voltage on the gate, the amount of voltage -- the	10:19:20
4	threshold voltage of this -- of the final memory	10:19:25
5	cell in the string respect to the source, the top	10:19:28
6	one, the drain, the threshold voltage is going to be	10:19:33
7	a function of all the so-called resistant component	10:19:36
8	or the source component. Meaning that if I were	10:19:42
9	to -- if I were to pass a voltage, even in the case	10:19:46
10	of Lee's during pre-charging when the transistor is	10:19:52
11	off, in pre-charge and in actual programming, a	10:19:56
12	POSITA would know that the string -- also like the	10:20:00
13	string -- in the selected string are all off because	10:20:05
14	Lee clearly shows that there is a source voltage	10:20:09
15	being applied. That is a function of where the --	10:20:13
16	where the selected cell is. And the only reason you	10:20:15
17	apply the source voltage is to shut off that	10:20:18
18	transistor, to shut off that string.	10:20:22
19	So it's clear that in Lee the unselected	10:20:24
20	string, even selected string are off. So in the	10:20:27
21	context of transistor component, it's not that I	10:20:32
22	have an opt-out. Rather, that the source voltage of	10:20:33
23	one memory cell will gate the threshold voltage of	10:20:37
24	that memory cell and then the subsequent memory	10:20:42
25	cell. So it's like a -- like a -- a chain effect.	10:20:44

1	So by the time you get to the drain, the threshold	10:20:49
2	voltage is the highest.	10:20:53
3	If I may explain a little bit more.	10:20:55
4	Q. Doctor, I think you've gone beyond what I	10:20:58
5	asked again, but why don't I break this up with more	10:21:01
6	questions.	10:21:03
7	Do you see the term "source select side	10:21:22
8	channel?"	10:21:24
9	A. Can you point me to that?	10:21:26
10	Q. It's around line 30.	10:21:32
11	A. In Lee?	10:21:36
12	Q. Yeah. Column 8.	10:21:37
13	A. Column 8?	10:21:40
14	Q. Same passage we've been looking at.	10:21:42
15	A. Okay.	10:22:10
16	Q. What is a source select side channel?	10:22:13
17	A. With respect to the select transistor and	10:22:23
18	the one that -- based on using that demarcation, the	10:22:30
19	one closer to the source, the source select side,	10:22:32
20	the one closer to the drain, drain select side.	10:22:34
21	Q. Do you see the reference to "channel	10:22:43
22	boosting" later in that sentence?	10:22:46
23	A. Okay.	10:22:49
24	Q. What is channel boosting?	10:22:51
25	A. As I was explaining earlier, during the	10:23:03

1 programming, the way you inhibit the memory cell, 10:23:05
2 especially the one driven by the selected word line 10:23:11
3 which sees a very high voltage, VPGM, that is 10:23:16
4 usually like 18 or 20 volt. So the way you prevent 10:23:21
5 the unselected memory cell from seeing this high 10:23:25
6 voltage and getting the electron injected into the 10:23:29
7 memory cell is by boosting the channel voltage. By 10:23:34
8 boosting the channel voltage, the voltage 10:23:38
9 differential between that very high voltage and the 10:23:42
10 channel voltage is significantly reduced by the 10:23:45
11 amount of boosting voltage. 10:23:49

12 So the magnitude get reduced, then you 10:23:52
13 don't have -- you don't have the required voltage to 10:23:55
14 inject electron. However, this boosting voltage can 10:24:03
15 not also be too high because if these boosting 10:24:06
16 voltage are high, it's also going to cause the other 10:24:09
17 unselected in the same bit line to lose charges 10:24:11
18 because the boosting voltage -- high vision voltage 10:24:15
19 will actually also cause electron to pummel in a 10:24:17
20 different direction. So it's a -- it's a -- it's a 10:24:21
21 optimization to get a correct boosting voltage. 10:24:25

22 And the pre-charging step is to ensure that 10:24:28
23 before I -- before I get into the programming mode I 10:24:31
24 have everything under control in terms of the 10:24:38
25 channel potential such that when the actual 10:24:40

1	programming, all the high voltage pulse comes in,	10:24:44
2	there won't be any inadvertent programming of the	10:24:47
3	memory cell.	10:24:51
4	Q. Doctor, did you consider secondary	10:24:57
5	considerations or any evidence of secondary	10:25:00
6	considerations after you concluded that the	10:25:03
7	challenged claims were obvious?	10:25:08
8	MR. HERMAN: Objection. Form.	10:25:11
9	THE WITNESS: Okay. I consider -- as you	10:25:28
10	can see in my declaration, I consider it but I	10:25:30
11	don't -- I want to note I noted that the -- no	10:25:33
12	secondary consideration of non-obviousness were	10:25:34
13	identified, yeah.	10:25:37
14	By MR. DAVIS:	10:25:38
15	Q. So did you consider secondary	10:25:38
16	considerations as part of your obviousness analysis	10:25:41
17	or is it something that was separate?	10:25:43
18	MR. HERMAN: Objection. Form.	10:25:47
19	THE WITNESS: I think when I consider it	10:25:54
20	you always keep in mind but obviously the -- well, I	10:25:55
21	didn't actually use the word. But of course the --	10:25:59
22	once I read the reference art, I -- prior art, I	10:26:00
23	read the '822, and given the knowledge of POSITA, of	10:26:05
24	course the -- the -- the -- it was -- it was very	10:26:11
25	obvious to me that if you look at Lee, especially	10:26:15

1 Lee, Lee certainly teaches various policies as a 10:26:19
2 function of the location. And also Lee, in terms of 10:26:24
3 the -- 10:26:27

4 Q. I was asking about secondary 10:26:28
5 considerations, whether that was part of your 10:26:29
6 obviousness analysis or not. I didn't ask you to go 10:26:31
7 and summarize your whole analysis. 10:26:33

8 So did you consider secondary 10:26:35
9 considerations as part of your analysis for 10:26:36
10 obviousness or was that something you considered 10:26:40
11 after you concluded that the challenged claims were 10:26:42
12 obvious? 10:26:45

13 MR. HERMAN: Objection. Form. 10:26:46

14 THE WITNESS: I think obviousness in the 10:26:50
15 back of my mind, but then when you try to read a 10:26:51
16 reference -- reference you always -- always -- by 10:26:54
17 the way, what strikes you is how -- how -- how this 10:27:00
18 '822, how the claim could be rendered obvious based 10:27:06
19 on this reference, that reference, and things like 10:27:08
20 that. But you always have to have the -- all the 10:27:11
21 other components in the back of your mind. 10:27:13

22 By MR. DAVIS: 10:27:17

23 Q. So I'm still not sure you've answered my 10:27:17
24 question. When you analyzed secondary 10:27:19
25 considerations here, did you analyze that before or 10:27:22

1	after you concluded that the claims were obvious?	10:27:27
2	MR. HERMAN: Objection. Form.	10:27:29
3	THE WITNESS: Again, there are -- it's like	10:27:39
4	a progression. You -- you look at it, you know that	10:27:43
5	there is going to be secondary consideration for	10:27:47
6	non-obviousness or for obviousness, and -- and	10:27:50
7	you -- you go -- you have got to first go through	10:27:55
8	the prior art and go through the '822 with the	10:27:57
9	knowledge of a person with skill in the art, you	10:28:00
10	realize that, look, these -- these -- this alleged	10:28:04
11	invention actually rendered obvious by all these.	10:28:09
12	And then -- and then, of course, you go, well, I	10:28:14
13	guess there is really no secondary consideration	10:28:16
14	that could impact my opinion.	10:28:21
15	By MR. DAVIS:	10:28:24
16	Q. So that now is how you performed your	10:28:24
17	analysis here?	10:28:26
18	A. But I think -- I think it's a progression.	10:28:40
19	I think first and foremost obviously you want to	10:28:42
20	look at the -- the -- the obviousness, whether	10:28:44
21	the -- the -- the claim term could be anticipated or	10:28:48
22	could be rendered obvious. In our case we have	10:28:52
23	foreground presented for obviousness so -- and then	10:28:55
24	after that I don't believe there is any secondary	10:28:58
25	consideration for non-obviousness were identified.	10:29:03

1 Q. Okay. So you didn't consider any evidence
2 of secondary considerations then.

3 MR. HERMAN: Objection. Form.

4 THE WITNESS: I think my declaration says I
5 know that no secondary consideration were
6 identified.

7 By MR. DAVIS:

8 Q. Did you consider any evidence of secondary
9 considerations?

10 MR. HERMAN: Objection. Form.

11 THE WITNESS: Well, for example, I mean,
12 this is -- this is the -- first of all, there is no
13 unexpected results. All -- everything in terms of
14 my analysis, it's obvious to combine and -- and --
15 and a POSITA would have a reasonable confidence of
16 success because all these teaching are in the
17 same -- same area, the same motivation. And, for
18 example, with Lee and Zhao, one is taking care of
19 the source side, one is taking care of the drain
20 side, and both -- both system during the
21 pre-charge --

22 By MR. DAVIS:

23 Q. Doctor -- Doctor, I'm asking about
24 secondary considerations. I'm not asking you to --

25 MR. HERMAN: Do not interrupt the witness's

1 testimony. You asked him an open-ended question and 10:30:19
2 the witness was responding. You don't have the 10:30:21
3 right to interrupt his answer. 10:30:22

4 MR. DAVIS: You can leave your speaking 10:30:25
5 objections -- 10:30:26

6 MR. HERMAN: You have to allow the witness 10:30:27
7 to answer the question. 10:30:27

8 By MR. DAVIS: 10:30:31

9 Q. Doctor, I'm asking you whether you did or 10:30:31
10 didn't consider evidence of secondary considerations 10:30:33
11 in this case; yes or no. It's a simple yes or no. 10:30:36

12 MR. HERMAN: Objection. Form. Also, 10:30:38
13 argumentative and mischaracterizes the witness's 10:30:38
14 testimony. 10:30:42

15 THE WITNESS: I was trying to explain that, 10:30:43
16 for example, one of the secondary considerations 10:30:44
17 is -- is -- is unexpected result. There is no 10:30:47
18 unexpected result based on combination based on 10:30:51
19 the -- the -- the combination of obviousness. So I 10:30:53
20 do have a secondary consideration in mind but -- but 10:30:55
21 the progression, you -- you -- you -- I don't think 10:30:58
22 any expert would -- would -- would try to do a 10:31:01
23 petition or do a declaration by saying, hey, look, 10:31:05
24 that is considered secondary consideration. No. I 10:31:08
25 analyzed technical detail first to make sure that 10:31:10

1 the -- the alleged invention -- alleged invention is 10:31:13
2 a fair shake to see the alleged invention is 10:31:17
3 rendered obvious by a person of ordinary skill in 10:31:22
4 the art based on the -- the prior art. 10:31:24

5 In the case, as I was mentioning, if I 10:31:26
6 looked at Lee, Lee certainly shows -- Lee shows -- 10:31:27
7 always show everything. In the case of Zhao, Zhao 10:31:31
8 shows it as well. In the case of Zhao versus Lee, 10:31:33
9 there is motivation to combine because there is 10:31:37
10 reasonable success -- 10:31:40

11 Q. I'm not asking you to repeat all of your 10:31:40
12 opinions. Again, it's a simple yes-or-no question. 10:31:43

13 I would object as nonresponsive and move to 10:31:46
14 strike that. If you can't answer the question, 10:31:48
15 that's fine. 10:31:49

16 I -- I -- I -- why don't we go off the 10:31:51
17 record? I can see whether I have any further 10:31:54
18 questions at this time. 10:31:58

19 THE VIDEOGRAPHER: Okay. We are going off 10:31:59
20 the record. The time is 10:32. 10:32:00

21 (Recess.) 10:39:12

22 THE VIDEOGRAPHER: We are back on the 10:39:13
23 record. The time is 10:39. 10:39:14

24 MR. DAVIS: I don't have any further 10:39:19
25 questions at this time. 10:39:21

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1	MR. HERMAN: I also do not have any	10:39:22
2	questions.	10:39:24
3	MR. DAVIS: All right. Thank you, Doctor.	10:39:24
4	THE WITNESS: Thank you.	10:39:27
5	MR. HERMAN: Thank you, Doctor.	10:39:28
6	THE VIDEOGRAPHER: All right. This	10:39:29
7	concludes the deposition of Dr. David Kuan-Yu Liu.	10:39:30
8	The time is 10:39.	10:39:33
9	(Proceedings concluded.)	
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C E R T I F I C A T E

I, BURGUNDY B. RYAN, Certified Reporter and
Notary Public within and for the State of California
do hereby certify:

That Dr. David Kuan-Yu Liu, the
witness whose deposition is hereinbefore set forth,
was duly sworn by me before the commencement of such
deposition and that such deposition was taken before
me and is a true record of the testimony given by such
witness.

I further certify that the adverse party,
was represented by counsel at the deposition.

I further certify that the deposition of
Dr. David Kuan-Yu Liu, occurred virtually
on Tuesday, December 17, 2024, commencing at
7:59 am PST to 10:39 am PST.

I further certify the inspection, reading
and signing of said deposition were not waived by
counsel for the respective parties and by the witness.

I further certify that I am not related to

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

6
7 IN WITNESS WHEREOF, I have hereunto set my
8 hand this 20th day of December 2024.

9
10 
11 _____

12 NOTARY PUBLIC IN AND FOR THE
13 STATE OF CALIFORNIA
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