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

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
Patent 11,501,822

12

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:
Burgundy B. Ryan, RPR,
24 CSR No. 11373
Job No. 565014
25 Pages 1-94

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

2

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13 ALSO PRESENT:

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Planet Depos
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1 DEPOSITION SUPPORT INDEX
2
3 QUESTIONS INSTRUCTED NOT TO ANSWER:
4 PAGE LINE
5 (None)
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8 REQUEST FOR PRODUCTION OF DOCUMENTS
9 PAGE LINE
10 (None)
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13 STIPULATIONS
14 PAGE LINE
15 (None)
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17
18 QUESTIONS MARKED
19 PAGE LINE
20 (None)
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23 REPORTER'S NOTE:
24 QUOTATION MARKS ARE USED FOR CLARITY AND DO NOT
25 NECESSARILY REFLECT A DIRECT QUOTE.

1 I N D E X
2 PAGE
3 EXAMINATION BY MR. DAVIS..... 6
4
5 --o0o--
6
7 E X H I B I T S
8 EXHIBIT DESCRIPTION PAGE
9 2020 Series of Images 29
10 --o0o--
11
12
13
14
15
16
17
18
19
20
21
22
23
24
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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

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

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

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

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, 08:22:47
3 did you determine that any of the claims of the '822 08:22:49
4 patent were anticipated by prior art? 08:22:57
5 MR. HERMAN: Objection. Form. Also, 08:23:01
6 outside the scope of direct. 08:23:02
7 THE WITNESS: Counsel, I would like to see 08:23:07
8 my declaration. I don't believe I render any 08:23:08
9 opinion under the -- the -- under anticipation so I 08:23:11
10 do not know how to answer your question. 08:23:16
11 By MR. DAVIS: 08:23:20
12 Q. Right. Isn't that the answer to my 08:23:20
13 question, that you -- that you didn't formulate any 08:23:21
14 anticipation opinions? 08:23:24
15 MR. HERMAN: Objection. Outside the scope 08:23:29
16 of direct. 08:23:30
17 THE WITNESS: I think -- I think that's 08:23:36
18 correct. I -- I really would prefer if we can have 08:23:37
19 the declaration because I'm here to give testimony 08:23:39
20 based on my declaration and to -- to address any 08:23:43
21 question we have regarding the declaration. 08:23:48
22 By MR. DAVIS: 08:24:41
23 Q. Dr. Liu, I have put into the chat box what 08:24:41
24 has been previously marked as Exhibit 1003 in this 08:24:42
25 proceeding. Let me know when you have that opened 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 08:42:45
2 context of flash memory NAND, 3D NAND flash memory 08:42:47
3 or flash memory in general and the context of 08:42:55
4 mainstream, context of pre-charging, in the context 08:42:58
5 of you have X decoder, you have voltage generation 08:43:00
6 that -- that generated voltage for a specific -- for 08:43:04
7 a specific time period, which is the reference being 08:43:08
8 called the pre-charge time period or you can call it 08:43:12
9 pre-charging -- pre-prior step. Nonetheless, these 08:43:15
10 are to prepare to pre-charge all the different word 08:43:19
11 lines to be ready before the programming operation. 08:43:22
12 In that context, the opinion I render is 08:43:26
13 that the X decoder during the pre-charge period, the 08:43:29
14 word line voltage that is coming in is handed off to 08:43:34
15 the pre -- to the X decoder which is receiving its 08:43:38
16 voltage from the voltage generation circuit and that 08:43:41
17 voltage goes into the word line during that specific 08:43:46
18 pre-charging period or pre-charging time step. That 08:43:51
19 is in the form of the pulse in context with '822 08:43:54
20 patent. 08:43:58
21 And once the -- that period is over, then 08:43:59
22 the pre-charging circuit stopped the hand off and 08:44:03
23 the hand off of the voltage coming from both 08:44:09
24 generation circuit to pre-charge these word line go 08:44:13
25 off and then that step stops and then you have -- 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 08:52:52
2 refers to time, can you tell me whether any of the 08:52:56
3 figures shown in this exhibit, 2020, depicts a 08:53:00
4 pulse? 08:53:05
5 MR. HERMAN: Objection. Form. Also, 08:53:06
6 outside the scope of direct. 08:53:07
7 THE WITNESS: '822 clearly in the 08:53:16
8 specification illustrate a pulse. And Lee, Zhao and 08:53:18
9 Yang also in conformity with '822 and with my 08:53:26
10 knowledge as a person of ordinary skill in the art. 08:53:30
11 So this document, I'm sitting here, I see it for the 08:53:32
12 very first time. The -- the -- you just have it 08:53:36
13 labeled v(t), I don't know even know what the -- 08:53:40
14 the -- the lower axis, you know, X axis and I'm just 08:53:42
15 simply not -- not prepared to render an opinion on 08:53:50
16 this. 08:53:55
17 By MR. DAVIS: 08:53:57
18 Q. So I would like to direct you to my 08:53:57
19 question. My question is whether sitting here today 08:53:59
20 you can tell me whether any of these images in 08:54:02
21 Exhibit 2020 depicts a pulse assuming that V refers 08:54:06
22 to voltage and T refers to time? 08:54:09
23 MR. HERMAN: Objection. Form. 08:54:16
24 THE WITNESS: I need -- I need context. 08:54:19
25 Without context, I'm sorry, I'm not willing to 08:54:32

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 08:58:46
3 render an opinion in my declaration and this is 08:58:48
4 sitting here for the very first time I see this I 08:58:52
5 will not render an opinion on it. 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 08:59:07
10 to time in the context of Exhibit 2020, are you 08:59:10
11 willing to answer any questions about this 08:59:12
12 document? 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 09:01:38
4 me outside the context of the '822 patent whether 09:01:40
5 what's depicted in Figure A of Exhibit 2020 is a 09:01:45
6 pulse assuming that V refers to voltage and T refers 09:01:48
7 to time? 09:01:51
8 MR. HERMAN: Objection. Form. 09:01:52
9 THE WITNESS: I believe you 09:01:54
10 mischaracterized my answer again. It's not -- it's 09:01:58
11 not -- you said I cannot. I -- I don't know that's 09:02:02
12 a proper description. The proper description should 09:02:10
13 be that I'm willing to discuss within the context of 09:02:14
14 '822, and this document has no such context and I'm 09:02:17
15 here to render an opinion in my declaration and this 09:02:19
16 is outside. I haven't seen this document and this 09:02:24
17 is the first time I have seen it and I'm not -- I'm 09:02:26
18 not going to render opinion sitting right here for a 09:02:28
19 document I'm seeing for the very first time. 09:02:32
20 By MR. DAVIS: 09:02:36
21 Q. My question is whether you can answer my -- 09:02:36
22 whether you can tell me whether outside the context 09:02:38
23 of the '822 patent, just generally in your field, by 09:02:41
24 what's depicted in Figure A of Exhibit 2020 is a 09:02:45
25 pulse assuming V refers to voltage and T refers to 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 09:07:43
2 that this wave form was delivered as part of the 09:07:46
3 pre-charge period that's already disclosed in Lee, 09:07:49
4 according to you. So what additional context do you 09:07:53
5 need? 09:07:59
6 A. For example, when does the pre-charge 09:08:01
7 period begin in the X axis? Where is the pre-charge 09:08:03
8 period? 09:08:06
9 Q. Assume that this is -- this -- this wave 09:08:06
10 form is delivered during the pre-charge period -- at 09:08:08
11 some point during the pre-charge period. What 09:08:11
12 additional context do you need? 09:08:16
13 MR. HERMAN: Objection. Form. 09:08:18
14 THE WITNESS: So where does the pre-charge 09:08:31
15 period begin? Where is the programming period? It 09:08:32
16 just -- I'm sorry, this has to be in context of a 09:08:37
17 NAND flash operation during programming step where 09:08:40
18 you have different step and phases, you have 09:08:42
19 pre-charging phase or pre-charging step and you have 09:08:47
20 programming step where you have boosting voltage and 09:08:54
21 programming voltage and you have verification step 09:09:01
22 and then you repeat. So you then go -- you go -- 09:09:02
23 now we get into pre-charging step and programming 09:09:04
24 voltage step and then verification step. 09:09:10
25 By MR. DAVIS: 09:09:13

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

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

1 A. For example, where does the pre-charge 09:14:53
2 come in for controller commences and when does the 09:15:00
3 pre-charge period end and the actual voltage to -- 09:15:04
4 whether it would be to select a word line or 09:15:10
5 unselect a word line, I think it would just be 09:15:14
6 better to have more context. 09:15:17
7 And by the way, Counsel, it's okay, because 09:15:19
8 we started early and it's -- it's almost -- it's 09:15:21
9 definitely over an hour and 15 minutes, so whenever 09:15:25
10 you are ready, I would appreciate a bio break, yeah. 09:15:29
11 Q. Yeah, let me just finish this line. 09:15:31
12 So let's assume that the pre-charge period 09:15:35
13 starts before what is shown as negative 2 in Figure 09:15:38
14 A and that it ends after what's shown as 4 in Figure 09:15:42
15 A. Would that constitute a pulse then? 09:15:48
16 MR. HERMAN: Objection. Form. 09:15:58
17 THE WITNESS: Are you saying the pre-charge 09:16:38
18 starts at, what, minus 2? 09:16:40
19 MR. DAVIS: Sure. 09:16:43
20 By MR. DAVIS: 09:16:44
21 Q. So assume that the pre-charge starts at 09:16:44
22 minus 2 and ends at 4 in Figure A of Exhibit 2020, 09:16:46
23 would what's shown there be a pulse? 09:16:53
24 A. And assuming -- assuming the voltage -- I 09:17:10
25 would say that that voltage going up is coming from 09:17:20

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 09:55:23
2 high of the pulse begins at t1 because that's how 09:55:27
3 the voltage and how the architecture and how the 09:55:30
4 control circuit works to -- in order to reach the 09:55:33
5 pre_OD magnitude, it goes through an intermediate 09:55:38
6 point. It may have to do with how the charge pump 09:55:44
7 circuit is designed, how to optimally use the charge 09:55:47
8 pump circuit to avoid charge pump circuit being 09:55:52
9 collapsed. We have -- there are cases where charge 09:55:56
10 pump circuit will collapse because it simply cannot 09:55:58
11 handle the current. 09:56:01
12 So the pre-charge period starts at t1, and 09:56:04
13 that's when the voltage, pre_OD, that pulse voltage 09:56:06
14 is being governed and being generated and it needs 09:56:12
15 to pass through word line_VSB2(data). So it goes -- 09:56:15
16 it goes into that line at t1 and it just so happens 09:56:24
17 it goes through intermediate step and then before it 09:56:27
18 gets to its final -- final magnitude voltage. 09:56:29
19 Q. So can you tell me when the pulse that's on 09:56:35
20 WL_VSB2(data) in Figure 8B of Yang begins and ends? 09:56:38
21 A. Part of the voltage begins at t1 just like 09:56:58
22 WL_VSB1_unselect. The charging of that word line 09:57:02
23 begins at t1. The mechanism to reach the full pulse 09:57:07
24 height pre_OD -- _OD begins at t1. And then you may 09:57:13
25 have during the -- during the -- the traverse to the 09:57:22

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

A. Yes, I do. 10:11:40
Q. What is that in reference to? 10:11:42
A. Again, you -- it is referring to a 10:12:04
programming operation where you have boosting 10:12:09
voltage and you have the programming voltage. But 10:12:11
when these voltage are asserted onto this word line, 10:12:15
due to the nature of the NAND flash memory, 10:12:21
particularly 3D NAND, that the channel voltage now 10:12:26
is skated by these voltage coming in, boost voltage 10:12:30
or -- or the programming voltage, unless you have -- 10:12:34
and during that period of time there is a transient 10:12:40
period of time. 10:12:42
Unless you have performed your pre-charge 10:12:44
correctly, you may have voltages across the selected 10:12:46
word line, in the context of Lee, across 10:12:50
the especially selected word line of the memory 10:12:52
cell. On each side you may have voltage that if not 10:12:56
pre-charged correctly you may have temporarily, 10:13:01
either come in the form of electron being charged or 10:13:04
coming from a very high voltage that will cause 10:13:06
either the selected cell or the unintended 10:13:10
unpre-charged properly cell to see high voltage and 10:13:14
cause electrons to be placed on the folding gate and 10:13:17
cause the data to be -- unintended data to be -- to 10:13:20
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 10:29:11
2 of secondary considerations then. 10:29:14
3 MR. HERMAN: Objection. Form. 10:29:17
4 THE WITNESS: I think my declaration says I 10:29:21
5 know that no secondary consideration were 10:29:22
6 identified. 10:29:25
7 By MR. DAVIS: 10:29:26
8 Q. Did you consider any evidence of secondary 10:29:26
9 considerations? 10:29:29
10 MR. HERMAN: Objection. Form. 10:29:32
11 THE WITNESS: Well, for example, I mean, 10:29:38
12 this is -- this is the -- first of all, there is no 10:29:39
13 unexpected results. All -- everything in terms of 10:29:47
14 my analysis, it's obvious to combine and -- and -- 10:29:48
15 and a POSITA would have a reasonable confidence of 10:29:52
16 success because all these teaching are in the 10:29:57
17 same -- same area, the same motivation. And, for 10:30:01
18 example, with Lee and Zhao, one is taking care of 10:30:04
19 the source side, one is taking care of the drain 10:30:07
20 side, and both -- both system during the 10:30:09
21 pre-charge -- 10:30:12
22 By MR. DAVIS: 10:30:13
23 Q. Doctor -- Doctor, I'm asking about 10:30:13
24 secondary considerations. I'm not asking you to -- 10:30:15
25 MR. HERMAN: Do not interrupt the witness's 10:30:17

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

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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1 C E R T I F I C A T E
2
3 I, BURGUNDY B. RYAN, Certified Reporter and
4 Notary Public within and for the State of California
5 do hereby certify:
6
7 That Dr. David Kuan-Yu Liu, the
8 witness whose deposition is hereinbefore set forth,
9 was duly sworn by me before the commencement of such
10 deposition and that such deposition was taken before
11 me and is a true record of the testimony given by such
12 witness.
13
14 I further certify that the adverse party,
15 was represented by counsel at the deposition.
16
17 I further certify that the deposition of
18 Dr. David Kuan-Yu Liu, occurred virtually
19 on Tuesday, December 17, 2024, commencing at
20 7:59 am PST to 10:39 am PST.
21
22 I further certify the inspection, reading
23 and signing of said deposition were not waived by
24 counsel for the respective parties and by the witness.
25 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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A
ability
70:5, 81:13
able
11:17, 16:16, 17:24, 31:23, 53:24
about
12:12, 12:15, 14:9, 16:24, 20:25, 24:21, 34:5, 36:21, 36:22, 37:18, 37:19, 37:20, 44:11, 67:17, 71:5, 87:4, 89:23
above
67:16
accepting
14:2
access
13:1
according
50:4
achieve
68:9
acquired
11:17, 15:24, 16:6, 16:7, 16:9, 16:11, 16:16
across
64:18, 64:19, 79:14, 79:15, 80:5
action
94:1, 94:3
actual
29:8, 54:3, 67:1, 67:12, 73:19, 75:13, 80:8, 83:11, 85:25
actually
9:13, 58:22, 63:20, 64:14, 66:6, 69:19, 74:21, 80:6, 80:10, 81:12, 85:19, 86:21, 88:11
add
74:11
added
74:9
additional
49:25, 50:4, 50:12, 51:24
address
21:20, 35:15
adverse
93:14
advised
7:9
after
11:10, 15:1, 15:12, 26:22, 29:9, 33:20, 49:3, 54:14, 55:20, 63:14, 64:24, 65:3, 73:6, 74:14, 74:18, 80:6, 86:6, 87:11, 88:1, 88:24
afterwards
55:7
again
12:24, 15:11, 17:4, 18:19, 19:16, 24:11, 25:1, 28:10, 33:13, 35:10, 35:14, 38:17, 42:16, 42:22, 43:9, 44:14, 45:11, 46:10, 47:4, 48:2, 49:16, 49:20, 52:8, 57:9, 57:18, 64:25, 65:6, 68:2, 68:18, 71:13, 71:23, 78:10, 78:21, 79:3, 84:5, 88:3, 91:12
ago
16:1, 16:10, 57:6, 57:7
agree
45:10, 60:3, 60:8
ahead
39:5
all
5:23, 9:3, 10:6, 12:7, 23:3, 32:10, 43:9, 43:14, 43:15, 43:16, 43:18, 44:16, 45:20, 48:8, 51:1, 51:3, 51:4, 51:5, 55:14, 59:7, 59:16, 61:12, 64:18, 70:13, 74:13, 83:7, 83:13, 86:1, 87:20, 88:11, 89:12, 89:13, 89:16, 91:11, 92:3, 92:6
alleged
88:10, 91:1, 91:2
allegedly
53:2
allow
37:1, 90:6
allowed
57:16
almost
54:8
along
20:2, 30:15, 39:15, 45:12, 45:20, 48:23
alphabet
30:4
alphabetically
30:2
already
45:10, 50:3, 51:5, 56:21, 65:18, 70:24, 80:14
also
2:19, 7:14, 8:22, 10:1, 11:20, 12:3, 13:20, 17:16, 19:1, 21:5, 22:20, 24:2, 25:5, 26:21, 28:8, 28:24, 30:15, 34:9, 36:14, 36:24, 40:5, 40:9, 41:21, 83:12, 85:15, 85:16, 85:19, 87:2, 90:12, 92:1
alto
2:16
always
38:3, 64:11, 64:21, 86:20, 87:16, 87:20, 91:7
amending
38:7
amount
13:14, 83:3, 85:11
analysis
17:25, 20:10, 21:2, 33:19, 39:14, 86:16, 87:6, 87:7, 87:9, 88:17, 89:14
analyze
31:3, 87:25
analyzed
20:10, 33:16, 87:24, 90:25
annotated
74:4
annotation
74:8, 74:11

annually
12:1
another
22:20, 23:3, 26:21, 29:9, 29:14, 60:6, 60:7, 62:12, 70:25, 73:12
answer
3:3, 21:10, 21:12, 28:4, 31:24, 36:12, 36:20, 37:1, 37:13, 38:7, 44:11, 46:10, 46:21, 51:15, 55:25, 57:8, 58:2, 60:2, 61:25, 90:3, 90:7, 91:14
answered
28:9, 28:25, 34:10, 36:16, 87:23
answering
7:24, 37:14
anticipated
20:14, 21:4, 88:21
anticipation
18:9, 18:25, 19:9, 19:10, 20:25, 21:9, 21:14, 22:11, 22:15
any
7:9, 7:17, 8:5, 16:25, 17:7, 17:18, 17:23, 18:20, 20:13, 21:3, 21:8, 21:13, 21:20, 22:11, 22:15, 30:3, 30:4, 31:17, 33:24, 35:7, 35:16, 40:2, 40:20, 41:4, 43:4, 44:11, 78:15, 86:2, 86:5, 88:24, 89:1, 89:8, 90:22, 91:17, 91:24, 92:1, 94:1, 94:2
anymore
14:22, 15:12
anything
7:10, 10:4, 15:21, 15:24, 16:23, 35:6, 35:10, 35:11, 37:19, 38:4
apologize
81:22
appeal
1:3, 5:16
appear
29:24
appeared
5:6
appears
29:3
application
14:15
applications
15:8
applied
14:14, 43:1, 69:11, 71:18, 83:15
apply
39:14, 52:1, 53:23, 83:17
applying
37:15, 55:15
appreciate
54:10
appropriate
61:15
april
8:23
architecture
66:11, 68:19, 69:16, 70:2, 71:15, 72:3
area
89:17
argumentative
28:9, 36:15, 36:25, 41:20, 90:13
around
11:13, 15:13, 74:14, 84:10
art
17:16, 17:17, 20:14, 20:22, 20:23, 21:4, 22:18, 26:9, 27:8, 31:9, 34:18, 35:4, 39:8, 39:12, 39:15, 39:16, 40:10, 42:9, 42:24, 43:25, 64:20, 66:21, 78:8, 86:22, 88:8, 88:9, 91:4
asked
13:18, 28:9, 28:24, 34:9, 37:18, 37:20, 84:5, 90:1
asking
7:23, 34:4, 36:12, 36:20, 41:14, 51:25, 71:20, 87:4, 89:23, 89:24, 90:9, 91:11
aspect
16:14
assert
67:6, 67:13
asserted
45:18, 70:19, 71:3, 76:23, 79:6
assessing
22:16
assume
8:11, 48:16, 50:1, 50:9, 54:12, 54:21, 55:3, 58:18, 59:19, 61:5, 61:7
assuming
35:19, 35:22, 38:12, 40:1, 40:21, 41:4, 44:7, 44:8, 44:9, 45:2, 46:6, 46:25, 47:9, 47:24, 49:10, 51:8, 53:11, 54:24, 55:7, 55:16, 56:12, 58:12
assumption
56:9
assumptions
55:9
attending
5:24
attention
30:21
attorney
16:14, 94:2
attorneys
14:16
auction
16:17
august
8:18
avenue
2:14
avoid
72:8
aware
18:8
away
55:19
axes
51:17, 53:20
axis
30:10, 30:12, 30:15, 31:5, 40:14, 47:19, 50:7, 52:4, 53:24

B

back
12:19, 62:9,

65:19, 81:13, 87:15, 87:21, 91:22
background
65:20, 71:7, 73:18
ballpark
10:25
based
21:20, 22:15, 27:21, 27:22, 44:23, 75:12, 75:14, 76:5, 84:18, 87:18, 90:18, 91:4
beam
78:1
became
14:7
because
9:9, 11:1, 21:19, 27:19, 31:20, 44:13, 50:1, 54:7, 58:1, 58:16, 61:12, 61:25, 63:25, 64:17, 67:24, 70:22, 70:24, 72:2, 72:10, 73:9, 75:4, 76:7, 81:17, 83:13, 85:15, 85:18, 89:16, 91:9
become
11:11, 78:5
been
5:9, 6:17, 8:14, 8:15, 9:6, 11:14, 16:3, 20:3, 21:24, 22:21, 23:10, 29:15, 56:25, 62:13, 62:19, 67:17, 74:5, 84:14
before
1:3, 5:4, 5:15, 8:14, 8:15, 8:21, 15:2, 25:25, 26:3, 26:19, 29:8, 32:11, 34:21, 35:20, 37:24, 38:2, 44:20, 54:13, 55:6, 69:19, 70:4, 72:17, 73:12, 85:23, 87:25, 93:9, 93:10
beg
66:15
began
69:15
begin
33:1, 50:7, 50:15, 69:14, 69:15, 69:22, 70:11, 71:12, 71:25
begins
5:11, 70:2, 71:21, 72:2, 72:20, 72:21, 72:23, 72:24
behalf
2:3, 2:11, 5:8, 6:5
being
32:7, 34:20, 43:1, 45:13, 45:17, 66:4, 69:11, 70:19, 71:3, 71:18, 72:8, 72:14, 73:17, 79:19, 83:15
believe
8:7, 10:5, 11:12, 12:21, 15:18, 16:10, 18:1, 18:4, 18:10, 18:12, 19:3, 19:8, 19:10, 20:17, 20:18, 21:8, 22:19, 27:23, 34:11, 36:16, 46:9, 51:1, 51:5, 66:20, 66:21, 73:8, 77:17, 88:24
below
71:5
best
8:2, 43:20
better
54:6, 59:1, 59:4, 60:1, 65:19
between
12:14, 18:9, 18:25, 19:8, 22:17, 57:11, 57:12, 63:19, 63:22, 65:21, 71:6, 82:10, 82:13, 85:9
beyond
7:18, 78:8, 78:12, 84:4
bias
34:13, 81:18, 81:21
bid
25:8, 25:9, 25:13
bigger
7:14
bio
54:10
bit
51:19, 61:13, 61:20, 64:15, 66:3, 66:4, 66:11, 70:8, 80:23, 82:10, 84:3, 85:17
bl
61:3
blood
94:1
blue
57:19, 59:15
board
1:3, 5:16
body
82:21, 82:24
boil
66:1
boost
79:9
boosting
29:11, 45:17, 50:20, 73:19, 79:4, 80:10, 84:22, 84:24, 85:7, 85:8, 85:11, 85:14, 85:15, 85:18, 85:21
both
20:21, 32:23, 53:20, 89:20
bothering
59:10, 59:13, 59:14, 59:16
bottom
59:19, 60:6, 68:25
box
21:23
bracket
12:7, 56:5, 56:10
bracketed
49:17
break
54:10, 84:5
breaking
56:25
brief
16:22
brooke
6:8, 6:11
burgundy
1:28, 5:4, 6:11, 93:3
busy
11:9

C

california
2:16, 5:6,

6:11, 7:3, 93:4, 94:13
call
32:8, 44:16, 67:5, 74:23, 82:21
called
5:8, 28:2, 32:8, 43:17, 45:15, 48:25
came
14:20, 43:11
can't
13:25, 35:8, 41:3, 47:22, 91:14
cannot
8:5, 34:21, 38:3, 46:3, 46:11, 72:10
capacitor
64:20
capacitors
64:17
care
89:18, 89:19
career
14:11
case
1:11, 5:16, 7:15, 16:21, 18:2, 26:16, 64:13, 65:12, 65:17, 65:20, 68:1, 70:21, 73:17, 80:17, 80:18, 82:2, 83:9, 88:22, 90:11, 91:5, 91:7, 91:8
cases
9:21, 72:9
cause
64:3, 79:20, 79:23, 79:24, 80:16, 80:25, 81:4, 81:10, 81:12, 85:16, 85:19
causes
77:23
cell
77:21, 79:17, 79:21, 79:22, 80:10, 81:4, 81:5, 82:4, 83:5, 83:16, 83:23, 83:24, 83:25, 85:1, 85:5, 85:7, 86:3
certain
9:20, 14:2, 20:10, 36:5, 43:17, 59:8, 70:3, 71:6, 81:20
certainly
87:1, 91:6
certified
5:5, 93:3
certify
93:5, 93:14, 93:17, 93:22, 93:25
chain
83:25
challenged
86:7, 87:11
change
17:1, 69:10, 78:15
changed
78:16
changes
16:25
changing
61:19
channel
79:8, 80:5, 80:13, 80:18, 80:20, 81:2, 81:11, 84:8, 84:16, 84:21, 84:24, 85:7, 85:8, 85:10, 85:25
channels
81:1
charge
13:3, 13:6, 13:14, 56:10, 64:13, 64:17, 65:13, 66:22, 68:2, 68:3, 68:19, 69:18, 70:4, 70:5, 70:7, 70:9, 70:23, 70:24, 72:6, 72:7, 72:8, 72:9, 73:2, 74:25, 80:7
charged
69:19, 79:19
charges
68:1, 85:17
charging
64:3, 68:23, 72:22
chat
21:23, 22:21, 23:4, 29:15, 62:13
circuit
32:16, 32:22, 32:24, 36:5, 36:8, 43:19, 43:24, 44:19, 45:14, 55:2, 56:7, 57:17, 58:25, 64:1, 65:8, 65:9, 66:23, 67:4, 67:7, 67:13, 68:6, 68:21, 70:1, 70:6, 72:4, 72:7, 72:8, 72:10
circuits
67:25, 70:14
cite
18:18
cited
19:12, 20:20, 38:10
claim
20:20, 22:17, 31:9, 87:18, 88:21
claims
20:10, 20:13, 21:3, 86:7, 87:11, 88:1
clarification
8:9, 81:15, 81:19, 82:23
clarify
17:21, 24:17, 74:20
clarity
3:24
clear
36:3, 83:19
clearly
19:11, 19:12, 20:19, 27:24, 40:7, 83:14
close
11:23
closer
84:19, 84:20
code
9:20, 58:22
collaborate
14:17
collapse
72:10
collapsed
72:9
column
77:3, 78:18, 78:21, 84:12, 84:13
com
2:9, 2:18
combination
90:18, 90:19
combine
89:14, 91:9
come
10:7, 26:17, 34:16, 35:25,

43:14, 43:15, 43:22, 54:2, 57:16, 79:19, 80:9, 81:3, 81:13
comes
25:25, 29:9, 33:15, 49:3, 49:5, 81:3, 86:1
coming
32:14, 32:23, 44:19, 45:13, 53:8, 54:25, 55:1, 56:6, 67:23, 76:8, 78:2, 78:4, 79:9, 79:20
commence
33:1
commencement
93:9
commences
54:2
commencing
5:3, 61:15, 93:19
comment
31:7, 31:8, 31:19, 34:23
comments
18:6
common
82:11
companies
14:11
company
1:8, 5:14, 15:17
component
64:2, 64:12, 66:2, 80:3, 82:13, 82:18, 83:7, 83:8, 83:21
components
64:20, 87:21
computer
7:12
conclude
20:7
concluded
86:6, 87:11, 88:1, 92:9
concludes
92:7
conditioned
80:14
conducting
81:10, 81:11
conduction
80:20, 80:21
confidence
89:15
conformed
52:4
conforming
29:2
conformity
40:9
connect
59:5
connected
82:20
consider
17:13, 17:15, 33:5, 42:8, 48:19, 68:10, 68:12, 86:4, 86:9, 86:10, 86:15, 86:19, 87:8, 89:1, 89:8, 90:10
consideration
68:7, 68:8, 86:12, 88:5, 88:13, 88:25, 89:5, 90:20, 90:24
considerations
86:5, 86:6, 86:16, 87:5, 87:9, 87:25, 89:2, 89:9, 89:24, 90:10, 90:16
considered
49:13, 55:12, 87:10, 90:24
constant
63:14
constitute
51:11, 53:15, 54:15, 61:9
constitutes
53:25
consultant
7:5, 7:6, 9:4, 9:7, 9:23, 11:5, 11:11, 14:7
consulting
13:4, 13:7
consumption
68:7, 68:22
continue
73:6
control
72:4, 82:9, 82:10, 85:24
controller
27:9, 36:4, 36:6, 43:16, 43:25, 54:2, 58:17, 70:17, 71:14, 73:10, 75:13
conversation
11:7
convey
19:7
correct
7:25, 13:16, 15:18, 16:13, 20:11, 20:12, 21:18, 22:6, 22:9, 23:1, 23:2, 23:8, 23:9, 23:12, 23:24, 24:1, 24:4, 30:14, 38:25, 41:6, 41:7, 51:6, 51:7, 51:9, 53:15, 60:23, 61:1, 62:17, 62:18, 63:23, 85:21
correctly
79:14, 79:18
cost
68:23
could
6:23, 14:17, 14:25, 35:5, 35:10, 35:11, 37:11, 37:22, 38:3, 38:4, 38:5, 52:1, 55:17, 55:18, 55:21, 67:5, 69:15, 75:12, 77:20, 78:3, 78:4, 81:17, 87:18, 88:14, 88:21, 88:22
couldn't
39:8, 60:15
counsel
5:25, 6:14, 16:22, 21:7, 31:2, 33:10, 37:1, 37:4, 43:9, 45:8, 54:7, 56:24, 93:15, 93:24
counter
9:10
counting
30:3
coupling
82:10
course
17:14, 81:13, 86:21, 86:24, 88:12
court
6:7, 6:10, 6:13, 81:15, 81:19, 82:23
create
64:17
csr
1:29, 6:11
current
7:4, 9:22,

68:7, 68:22, 72:11, 80:20, 80:21, 81:11
currently 7:1, 7:2, 7:5, 7:8, 7:19, 10:2, 13:13
curve 64:6, 65:23, 65:24, 66:1
curved 63:21, 63:23, 63:24, 64:25
cv 9:8

D

data 78:15, 79:24
date 5:18
david 1:17, 5:7, 5:12, 6:16, 6:24, 92:7, 93:7, 93:18
davis 2:13, 4:3, 6:2, 6:15, 6:20, 10:15, 10:20, 11:3, 12:11, 13:8, 13:23, 17:5, 18:22, 19:13, 20:8, 20:24, 21:11, 21:22, 24:12, 24:20, 25:16, 27:1, 27:13, 28:3, 28:19, 29:13, 29:21, 31:10, 31:22, 34:2, 35:2, 35:18, 36:10, 36:18, 37:3, 37:5, 37:17, 38:11, 38:24, 40:17, 41:2, 42:7, 42:18, 43:2, 44:6, 46:2, 46:20, 47:5, 47:21, 48:15, 49:8, 49:24, 50:25, 51:23, 53:10, 53:22, 54:19, 54:20, 56:8, 56:19, 57:2, 57:7, 57:22, 60:11, 60:20, 61:17, 62:4, 62:11, 64:23, 69:3, 69:13, 75:17, 75:24, 76:9, 76:15, 81:23, 86:14, 87:22, 88:15, 89:7, 89:22, 90:4, 90:8, 91:24, 92:3
davis@ropesgray 2:18
day 94:8
dc 80:21
deal 16:13, 68:5
decaying 63:17, 75:1, 75:5, 75:7, 75:8, 75:15, 75:18, 76:1, 76:5, 76:7, 76:11, 76:17
decays 64:25
december 1:18, 5:2, 93:19, 94:8
declaration 16:20, 16:25, 17:6, 17:9, 18:3, 18:7, 18:18, 19:4, 19:17, 19:22, 20:17, 21:8, 21:19, 21:20, 21:21, 22:4, 22:10, 22:12, 23:11, 27:22, 31:8, 31:21, 33:22, 34:11, 35:1, 38:8, 38:9, 38:21, 41:9, 42:2, 44:3, 44:23, 45:10, 46:15, 48:4, 48:12, 49:6, 52:7, 52:12, 53:9, 53:19, 65:6, 73:21, 74:6, 77:12, 82:7, 86:10, 89:4, 90:23
decoded 61:13, 71:2
decoder 32:5, 32:13, 32:15, 36:3, 36:4, 43:15, 43:23, 45:13, 55:1, 56:7, 65:7, 65:10, 67:1, 67:3, 67:7, 67:15, 68:1, 69:24, 70:16, 70:17, 71:13, 73:11, 73:14, 73:17, 75:1
decoders 63:16
decoding 73:15
define 25:20, 25:21, 27:5, 27:19, 52:10
defined 77:11, 81:8
definitely 27:9, 42:11, 54:9
definition 18:20, 28:13
delay 63:15, 64:3
delivered 48:18, 49:12, 50:2, 50:10, 51:10, 51:21, 53:12
demarcate 75:12, 75:14, 75:15, 76:6, 76:19
demarcated 75:11
demarcation 59:1, 59:4, 84:18
demarcations 59:11
demonstrated 28:15
denotation 37:11
depending 25:14, 64:14, 70:2
depends 52:13, 66:8, 66:9, 66:10, 71:13, 71:14, 75:10, 75:15, 81:14
depict 41:4, 43:5, 48:20
depicted 46:5, 46:24, 51:9, 56:13, 58:19, 61:6, 63:7
depicts 40:3, 40:21, 45:4, 47:9
depos 2:21, 5:22, 6:8
deposed 8:14, 8:15,

8:24, 9:1, 11:24
deposition
1:16, 3:1, 5:2, 5:12, 5:23, 7:7, 16:19, 31:4, 33:20, 41:15, 92:7, 93:8, 93:10, 93:15, 93:17, 93:23
depositions
8:20
describe
27:25, 48:24
described
20:3, 27:24, 45:25
describing
19:19
description
4:8, 19:20, 26:15, 27:22, 46:12
design
66:9, 68:5, 68:6
designated
65:12
designed
72:7
detail
90:25
determine
21:3, 39:9, 65:25
determines
65:24
develop
15:9
developing
14:8
device
81:17
dictates
36:6
difference
18:8, 18:14, 18:25, 19:8
differences
22:17
different
8:19, 11:19, 20:18, 29:23, 29:25, 32:10, 50:18, 58:9, 60:21, 60:24, 67:10, 67:24, 67:25, 70:20, 73:2, 75:2, 78:3, 85:20
differential
85:9
direct
3:25, 10:10, 10:24, 12:4, 13:21, 18:16, 19:2, 19:25, 20:16, 21:6, 21:16, 24:9, 25:5, 31:1, 31:14, 33:12, 38:16, 40:6, 40:18, 43:7, 45:7, 48:22
directing
30:21, 37:21
direction
85:20
directly
64:5
dis
8:15
discharge
65:4, 65:16, 76:24, 80:7
discharged
65:18
disclosed
49:11, 50:3
disclosure
20:21
disconnect
82:16
discuss
14:21, 33:22, 38:20, 38:22, 41:8, 41:14, 42:2, 45:9, 45:21, 45:22, 46:13, 48:4, 48:10, 48:11, 52:6, 52:11, 53:9
discussing
57:14
discussion
34:1, 34:4, 34:5
display
7:14
dispose
25:6
disposed
24:6, 24:14, 25:2, 25:8, 25:12
distance
24:6, 24:14, 25:3, 25:6
disturb
77:7, 77:9, 77:11, 77:16, 77:23, 77:24, 78:7, 78:11, 78:14, 78:17
divulge
14:4
doctor
35:20, 57:23, 62:12, 84:4, 86:4, 89:23, 90:9, 92:3, 92:5
document
22:20, 23:4, 31:3, 31:21, 33:23, 38:19, 38:20, 38:25, 39:1, 39:22, 39:24, 40:11, 41:9, 42:3, 44:12, 44:22, 44:25, 45:22, 46:14, 46:16, 46:19, 48:5, 52:9, 53:6, 53:8, 55:14, 59:15
documents
3:8, 7:9
doing
11:14, 13:15, 14:7, 14:9, 14:17, 28:5
done
15:21, 15:24, 63:16
dormant
16:4
down
13:17, 14:21, 47:15, 55:20, 65:15, 65:23, 66:1, 67:10, 73:17, 76:8
download
18:17, 19:4, 22:2
downloading
22:23
dr
1:17, 5:7, 5:12, 6:21, 21:23, 36:11, 36:19, 37:6, 37:19, 57:8, 92:7, 93:7, 93:18
drafting
18:7
drain
81:14, 81:16, 81:21, 82:5, 82:8, 82:14, 83:2, 83:6, 84:1, 84:20, 89:19
drive
67:14
driven
66:4, 66:20, 66:21, 66:25, 85:2
driver
66:13, 66:17,

66:24, 67:1, 67:5, 67:11
drives
66:18, 71:14
due
19:6, 28:12, 43:9, 69:16, 69:17, 79:7
duly
5:9, 6:17, 93:9
duration
52:2, 55:16
during
14:10, 26:18, 28:1, 29:4, 29:5, 29:11, 32:13, 32:17, 36:9, 44:17, 45:14, 46:1, 48:18, 50:10, 50:11, 50:17, 53:13, 55:4, 57:15, 60:25, 61:8, 68:13, 69:1, 69:8, 69:12, 69:23, 71:16, 71:17, 72:25, 74:24, 75:22, 79:11, 80:12, 80:18, 83:10, 84:25, 89:20

E

each
20:20, 22:17, 30:9, 61:14, 79:17, 80:19
earlier
9:22, 11:6, 11:25, 12:21, 12:25, 14:6, 22:14, 23:1, 67:9, 70:7, 84:25
early
14:25, 15:1, 54:8
east
2:16
effect
82:22, 82:24, 82:25, 83:25
efficient
70:23
either
25:8, 65:11, 67:9, 79:19, 79:21, 80:7, 80:24, 81:4
electron
78:1, 78:6, 79:19, 80:24, 81:5, 85:6, 85:14, 85:19
electrons
79:23
element
78:2
else
10:4, 16:12, 16:23, 37:19
employed
94:2
end
22:7, 54:3, 73:4, 73:5, 81:2, 82:3
ended
76:10, 76:16
ends
54:14, 54:22, 72:20, 73:3
engaged
12:7
engagement
12:20, 13:2, 14:3
engagements
9:17
enough
37:4, 39:6, 51:22, 70:5, 78:5
ensure
85:22
entire
58:18
entities
11:18, 11:19
entity
15:2
especially
64:12, 79:16, 80:6, 83:1, 85:2, 86:25
esquire
2:5, 2:13
established
64:18
ethical
14:3
evacuation
44:20
evaluate
22:17, 42:1
even
34:21, 35:22, 40:13, 41:23, 41:24, 43:8, 43:10, 49:1, 53:11, 77:20, 83:9, 83:20
eventual
29:11
ever
8:14, 13:17
every
14:13, 30:18, 80:18
everything
19:6, 47:14, 48:9, 61:18, 85:24, 89:13, 91:7
evidence
86:5, 89:1, 89:8, 90:10
exact
13:1
exactly
13:25
examination
4:3, 6:19
examined
5:10
example
49:2, 49:19, 50:6, 54:1, 60:4, 60:6, 60:7, 66:3, 66:5, 66:11, 89:11, 89:18, 90:16
exclusively
55:22
excuse
22:13, 23:14, 44:7
exemplified
27:11
exhibit
4:8, 21:24, 22:4, 22:21, 23:4, 23:16, 29:14, 29:15, 29:18, 29:22, 40:3, 40:21, 43:5, 44:10, 45:4, 46:5, 46:24, 47:9, 47:23, 48:20, 49:11, 51:10, 53:12, 54:22, 55:10, 55:25, 56:13, 58:13, 58:19, 59:11, 59:20, 60:13, 61:22, 62:12, 62:13, 62:16, 73:21, 76:25
expert
9:14, 9:20, 10:1, 10:7, 10:12, 10:14, 10:16, 10:22, 11:5, 11:20, 11:22, 12:2, 13:18, 15:2, 90:22
explain
65:1, 65:5,

80:3, 84:3, 90:15
explaining 84:25
explanations 36:21
extent 18:10, 18:12

F

facilitate 78:5
fact 69:10
fair 8:3, 8:4, 8:12, 8:13, 91:2
familiar 25:17, 25:18, 37:6, 37:10
family 80:11
famine 12:9
far 12:13
fast 68:19
feast 12:9
feed 65:10
few 13:25, 14:15, 16:22
field 37:8, 38:14, 39:7, 42:12, 42:19, 45:2, 46:23, 47:8
fifteen 15:14, 15:19
figure 23:13, 23:14, 23:19, 23:25, 24:3, 28:15, 31:25, 33:6, 34:7, 38:13, 39:9, 45:4, 46:5, 46:24, 47:9, 47:23, 48:16, 48:19, 49:10, 51:9, 53:12, 54:13, 54:14, 54:22, 55:11, 55:25, 56:13, 58:4, 58:13, 58:19, 59:5, 59:19, 59:20, 59:23, 60:3, 60:10, 60:12, 60:14, 60:22, 60:24, 61:7, 61:20, 61:21, 62:22, 69:5, 69:22, 70:10, 71:12, 71:21, 71:24, 72:20, 74:4, 76:18
figures 39:2, 40:3, 41:4, 43:4
file 15:4, 15:8
filed 15:16, 15:20
files 12:20
final 68:3, 68:21, 71:1, 71:10, 71:15, 72:18, 73:1, 80:8, 83:4
finally 68:25
financially 94:4
find 14:18, 17:7, 20:13
fine 91:15
finish 8:1, 8:2, 54:11, 57:2
first 5:9, 6:17, 8:24, 9:1, 11:4, 11:15, 11:21, 11:23, 15:3, 22:2, 31:20, 33:17, 33:23, 35:16, 38:18, 39:19, 39:25, 40:12, 41:10, 42:4, 44:4, 45:23, 46:17, 46:19, 48:5, 52:8, 53:5, 55:13, 57:20, 59:14, 67:24, 68:1, 68:23, 88:7, 88:19, 89:12, 90:25
fit 37:2
five 9:15
fixed 45:15
flash 32:2, 32:3, 50:17, 52:23, 79:7, 82:2
flexible 11:12
flip 22:7
floor 2:15
focus 49:9
focused 18:6
folding 78:6, 79:23
following 26:14, 26:15
follows 5:10, 6:18
foreground 88:23
foremost 88:19
forms 34:15, 43:10, 58:9, 58:12, 60:14, 60:21, 78:3
formulate 21:13
formulated 17:10
formulating 17:12
forth 93:8
forward 9:14
four 15:3
frame 11:12, 11:24, 16:10, 45:15, 52:5, 52:22, 57:11, 75:2
fremont 7:2
frequent 66:6
front 7:8, 7:10, 7:11, 9:10, 73:22, 76:25
full 31:16, 34:24, 38:22, 48:7, 55:22, 72:1, 72:23
full-time 11:8, 11:11, 14:10, 15:1
fully 7:16, 8:6, 34:18, 53:7, 55:24, 69:19, 70:4
function 82:19, 83:7, 83:15, 87:2
further 33:19, 91:17,

91:24, 93:14, 93:17, 93:22, 93:25

G

gate 78:6, 79:23, 83:3, 83:23
gates 82:1
general 14:1, 32:3, 77:24, 78:15
generally 14:1, 45:2, 46:23, 47:8
generate 10:13, 10:14, 11:16, 14:24, 15:20, 66:22, 67:25
generated 32:6, 44:18, 45:14, 72:14
generating 16:15, 70:1
generation 32:5, 32:16, 32:24, 36:5, 36:7, 43:19, 43:24, 44:19, 45:14, 55:1, 56:7, 57:16, 58:24, 64:1, 65:8, 65:9, 66:23, 67:4, 67:6, 67:13, 69:25, 70:6, 70:14, 73:16
generator 73:7, 73:15
getting 56:25, 69:24, 70:15, 73:18, 85:6
give 16:16, 21:19, 77:13
given 12:8, 27:9, 43:17, 43:18, 55:12, 55:14, 64:13, 86:23, 93:11
glasses 7:15
go 12:19, 30:12, 32:24, 36:21, 39:4, 50:22, 55:8, 57:4, 59:11, 62:4, 63:25, 64:16, 65:4, 65:15, 68:23, 68:24, 71:6, 73:1, 82:7, 83:1, 87:6, 88:7, 88:8, 88:12, 91:16
goes 30:16, 32:17, 36:8, 58:17, 72:5, 72:15, 72:16, 72:17
going 14:9, 25:10, 31:6, 33:18, 34:19, 41:25, 42:5, 42:6, 46:18, 47:15, 47:20, 48:10, 49:22, 54:25, 55:8, 57:1, 57:10, 58:25, 59:9, 62:6, 64:11, 64:12, 64:14, 64:16, 64:19, 64:21, 70:14, 71:2, 73:11, 76:8, 81:1, 83:6, 85:16, 88:5, 91:19
gone 84:4
good 6:10, 6:21, 6:22, 14:12, 19:16, 56:25
governed 43:16, 72:14
gradual 68:9
gradually 81:1
gray 2:12, 6:2
ground 20:20
grounds 20:18, 20:19
group 23:23, 23:25, 24:23, 25:11
groups 24:2, 24:5, 24:13, 25:2
grow 11:9
guess 57:20, 57:24, 67:4, 88:13
guideline 14:2, 14:5, 26:14

H

half 71:8
halfway 71:6
hand 32:22, 32:23, 63:16, 73:11, 94:8
handed 32:14, 36:7, 44:18
handing 58:23
handle 72:11
hands 75:1
happened 44:20, 70:20
happens 72:16
happy 31:7, 33:20, 38:20, 42:1, 48:11
hash 30:18, 30:20
height 63:13, 72:24, 73:1
here 5:11, 6:5, 17:25, 18:24, 19:23, 21:19, 25:20, 27:5, 27:19, 28:12, 30:3, 31:6, 31:11, 33:17, 33:21, 33:22, 34:6, 34:20, 35:15, 37:22, 38:6, 39:17, 39:18, 39:24, 40:11, 40:19, 41:3, 41:8, 43:1, 43:22, 44:4, 44:22, 45:8, 46:15, 46:18, 47:22, 48:5, 51:10, 51:19, 52:9, 53:18, 58:1, 87:25, 88:17
hereby 93:5
hereinbefore 93:8
hereunto 94:7
herman 2:5, 6:4, 10:9, 10:17, 10:23, 12:3, 13:5, 13:20, 17:2, 18:15, 19:1,

19:24, 20:15, 21:5, 21:15, 24:8, 24:16, 25:4, 26:10, 27:4, 27:16, 28:8, 28:24, 30:25, 31:13, 33:7, 33:11, 34:9, 35:9, 35:21, 36:14, 36:24, 37:9, 37:25, 38:15, 40:5, 40:23, 41:19, 42:15, 42:21, 43:6, 45:6, 46:8, 47:2, 47:11, 48:1, 48:21, 49:15, 50:13, 51:13, 52:15, 53:16, 54:16, 56:2, 56:15, 56:24, 57:4, 59:25, 60:16, 61:10, 61:23, 64:8, 68:17, 69:6, 75:9, 75:20, 76:3, 76:13, 86:8, 86:18, 87:13, 88:2, 89:3, 89:10, 89:25, 90:6, 90:12, 92:1, 92:5
herrington
2:4, 6:5
hesitant
61:24
hey
90:23
high
65:11, 68:3, 69:20, 72:2, 78:5, 79:20, 79:22, 80:8, 80:11, 80:13, 80:15, 81:3, 85:3, 85:5, 85:9, 85:15, 85:16, 85:18, 86:1
highest
84:2
highlight
74:17
highlighted
74:13
highlighting
75:4, 75:5
hit
22:2
hold
73:8
home
11:10
hooked
7:13
hour
13:6, 54:9, 57:1
however
37:2, 70:1, 85:14

I

idea
14:19, 14:20
identification
29:19
identified
86:13, 88:25, 89:6
idle
16:4
ignore
59:18
illustrate
26:13, 40:8
illustrated
28:15
illustration
33:14
image
30:21
images
4:9, 29:23, 29:25, 30:9, 40:20
impact
88:14
inaccuracies
17:7
inadequacy
19:19
inadvertent
86:2
inc
1:5
include
38:7, 75:5, 75:14
included
60:13
income
10:6, 10:13, 10:14, 10:22, 12:1
incomes
10:11, 11:1
incorporated
5:13
increment
30:18
increments
30:13
index
3:1
indicate
64:7
indicated
23:21, 26:22, 28:15
induction
77:25
industry
13:11, 14:18
inevitably
14:13, 64:16, 65:9, 67:7, 78:2, 78:4, 80:17
information
17:18, 17:23
inhibit
85:1
initial
18:5, 58:21, 65:14
initially
11:18
inject
85:14
injected
81:5, 85:6
insert
62:2
inside
58:10, 58:19
inspection
93:22
instead
60:13, 61:6, 64:4
instructed
3:3
intellectual
10:3
intend
57:4
intended
77:18, 78:16
interested
94:4
intermediate
68:24, 69:18, 70:4, 70:9, 71:4, 72:5, 72:17
interrupt
89:25, 90:3
invention
88:11, 91:1, 91:2
inventor
14:15, 15:6, 16:2
inverter
65:10, 67:9
involve
9:24
involved
57:13
ip
11:16, 11:19,

14:8, 14:24, 15:9, 15:20, 16:15
ipr
1:11, 5:17, 12:18
issue
14:14
issues
14:12
itself
77:20

J

james
2:13, 2:18
jim
6:2
job
1:30, 10:16, 11:8, 11:11, 11:15, 14:10, 15:1

K

keep
37:3, 86:20
kind
12:9, 19:23, 55:21, 65:9
know
12:8, 13:1, 19:8, 19:17, 21:10, 21:25, 22:22, 23:5, 25:20, 28:10, 29:17, 30:3, 31:18, 31:19, 33:13, 33:15, 34:14, 34:16, 34:22, 35:23, 35:25, 39:13, 39:21, 40:13, 40:14, 41:11, 41:16, 41:24, 43:9, 43:10, 43:11, 43:12, 43:23, 43:24, 46:11, 49:2, 49:3, 49:4, 52:4, 57:10, 60:8, 62:2, 62:14, 64:9, 66:11, 66:13, 66:16, 73:7, 83:12, 88:4, 89:5
knowledge
17:16, 20:4, 39:16, 40:10, 86:23, 88:9
known
15:2
kuan-yu
1:17, 5:7, 5:12, 6:16, 6:24, 92:7, 93:7, 93:18

L

l-i-u
6:24
label
31:5, 51:17, 52:4, 53:19, 53:20, 71:7
labeled
30:1, 30:2, 30:6, 30:10, 30:22, 40:13, 51:17, 58:6, 63:2, 69:4
labels
53:23
lack
65:19
language
28:12
laptop
7:12, 7:13
last
6:25, 8:18
later
84:22
least
9:15, 81:10
leave
90:4
lee
23:11, 26:21, 27:23, 27:24, 28:17, 29:5, 31:17, 33:3, 36:1, 39:15, 40:8, 42:23, 43:12, 44:15, 45:11, 45:19, 48:12, 48:17, 48:23, 49:6, 49:11, 49:18, 50:3, 51:1, 51:3, 51:5, 51:15, 52:1, 52:2, 52:5, 52:20, 53:13, 55:5, 55:15, 55:18, 56:4, 65:5, 77:1, 77:14, 78:19, 79:15, 80:17, 80:21, 82:15, 82:17, 83:14, 83:19, 84:11, 86:25, 87:1, 87:2, 89:18, 91:6, 91:8
lee's
83:10
legal
18:11, 18:19
less
12:13, 12:16, 45:24
let's
48:16, 54:12, 57:2, 64:13, 82:7
letter
12:20, 13:2, 37:20, 37:22
letters
30:7
level
47:17, 64:5, 64:6
limitation
28:12, 67:8
limited
5:14
line
3:4, 3:9, 3:14, 3:19, 23:19, 23:21, 23:23, 24:6, 24:15, 24:24, 25:3, 25:7, 25:9, 25:13, 26:14, 26:24, 28:1, 29:4, 29:11, 32:14, 32:17, 32:24, 36:6, 36:8, 44:17, 45:18, 45:25, 48:18, 49:1, 49:12, 51:10, 53:14, 54:4, 54:5, 54:11, 57:2, 57:5, 57:17, 58:22, 60:4, 60:5, 60:7, 60:12, 60:25, 61:13, 61:20, 63:19, 64:2, 64:3, 64:15, 65:14, 65:16, 66:3, 66:4, 66:5, 66:7, 66:12, 66:14, 66:18, 67:16, 67:17, 67:20, 68:25, 69:12, 70:20, 71:14, 71:18, 71:21, 72:16, 72:22, 75:23, 76:23, 78:18, 79:6, 79:15, 79:16, 80:23, 82:11, 84:10, 85:2, 85:17
line_vsb2(data
72:15

lines
26:1, 32:11, 64:15, 77:5, 78:22
litigation
9:7
little
70:8, 84:3
liu
1:17, 5:7, 5:12, 6:16, 6:21, 6:24, 21:23, 29:18, 36:11, 36:19, 37:6, 37:19, 57:8, 92:7, 93:7, 93:18
llp
2:4, 2:12
load
56:21
located
7:1, 7:2
location
87:2
long
14:23, 16:9, 36:21, 57:4
longer
73:14
look
27:7, 27:8, 35:12, 35:13, 38:17, 45:8, 47:18, 48:23, 51:25, 52:2, 53:5, 56:3, 60:2, 77:5, 86:25, 88:4, 88:10, 88:20, 90:23
looked
27:6, 27:7, 58:13, 60:21, 91:6
looking
29:1, 58:1, 60:24, 74:5, 84:14
looks
61:6
lose
85:17
lost
42:17
lot
12:16, 16:1, 16:2, 57:12, 65:25
lower
40:14, 64:5, 65:20

M

made
18:6
magnitude
52:5, 52:14, 68:13, 69:1, 72:5, 72:18, 85:12
main
10:16
mainly
9:25, 16:20, 18:6
mainstream
32:4
major
9:25
make
53:24, 55:9, 56:9, 68:20, 80:4, 80:12, 82:16, 90:25
managed
69:9
manifestation
55:23
many
9:6, 9:13, 13:24, 15:4, 15:6, 15:8, 15:25, 39:1, 64:15, 66:3, 66:4, 66:10, 66:11, 66:12, 69:4, 82:20
mark
30:20
marked
3:18, 21:24, 22:21, 29:16, 29:18, 62:13
marks
3:24, 30:18
marriage
94:2
material
41:13
materials
17:13
matter
5:13, 8:19, 13:17, 16:8, 17:10, 21:2, 53:18, 73:10, 94:5
matters
9:3, 14:19
maybe
11:24, 15:13, 75:2
mean
13:10, 15:5, 15:6, 35:3, 35:8, 41:11, 41:16, 52:25, 58:15, 63:4, 63:9, 67:11, 81:11, 82:12, 89:11
meaning
26:9, 27:2, 27:6, 27:15, 27:18, 27:20, 28:6, 28:10, 28:18, 28:21, 28:23, 29:3, 34:19, 37:15, 39:14, 42:13, 42:20, 42:25, 43:4, 52:11, 83:8
means
16:12, 35:19, 39:13, 67:2, 81:12, 82:17, 82:18
meant
24:25, 66:24, 77:22
mechanism
72:23
meeting
16:22
memory
1:8, 5:14, 12:25, 32:2, 32:3, 77:21, 79:7, 79:16, 82:2, 82:4, 83:4, 83:23, 83:24, 85:1, 85:5, 85:7, 86:3
mention
18:19
mentioned
11:6, 15:23, 51:20, 65:3, 67:8, 82:8
mentioning
52:21, 91:5
metal
66:7
micron
1:5, 5:13
middle
60:5
might
74:19, 74:20
mind
86:20, 87:15, 87:21, 90:20
minimize
68:22
minus
52:24, 52:25, 54:18, 54:22, 55:16, 55:19, 55:20, 57:11, 59:7, 62:1

minutes
54:9, 57:1, 57:6, 57:7
mis
74:20
mischaracterized
46:10
mischaracterizes
90:13
mischaracterizing
39:20, 52:18
misheard
16:5
missing
30:4
mode
85:23
modified
79:25
moment
17:8
monetize
16:15
monitor
5:19, 7:14
more
19:5, 53:20, 53:21, 54:6, 62:2, 70:23, 84:3, 84:5
morning
6:10, 6:21, 6:22
morph
60:8
most
20:5, 20:6, 27:24, 42:11
motivation
89:17, 91:9
move
73:12, 91:13
much
6:13, 45:23, 52:6, 53:9

N

name
6:10, 6:23, 6:24, 6:25
nand
32:2, 50:17, 52:22, 53:3, 53:4, 79:7, 79:8
nature
79:7
nd
2:6
necessarily
3:25
need
7:15, 29:16, 31:23, 35:13, 35:25, 38:17, 39:3, 40:24, 41:23, 49:16, 50:1, 50:5, 50:12, 51:24, 62:2, 67:13, 69:18, 70:25, 73:9, 74:20
needs
64:15, 65:4, 65:15, 65:18, 70:6, 72:14
negative
30:16, 54:13, 56:12, 59:11, 59:18
never
9:21, 31:4, 34:21
nevertheless
71:1
new
2:7
night
82:3
nodes
61:15
non-obviousness
86:12, 88:6, 88:25
non-testifying
9:19
none
3:5, 3:10, 3:15, 3:20
nonetheless
32:9, 71:16, 75:3
nonresponsive
91:13
normally
64:10
north
11:2
notary
93:4, 94:12
note
3:23, 78:8, 86:11
noted
86:11
nothing
16:8
notice
5:1
nuances
57:13
number
5:16, 11:1, 23:23, 30:16, 48:9, 52:24, 59:17
numbers
30:12, 34:22
numerically
49:4

O

oath
7:20
object
91:13
objection
10:9, 10:17, 10:23, 12:3, 13:5, 13:20, 17:2, 18:15, 19:1, 19:24, 20:15, 21:5, 21:15, 24:8, 25:4, 26:10, 27:4, 27:16, 28:8, 28:24, 30:25, 31:13, 33:7, 33:11, 34:9, 35:9, 35:21, 36:14, 36:24, 37:9, 37:25, 38:15, 40:5, 40:23, 41:19, 42:15, 42:21, 43:6, 45:6, 46:8, 47:2, 47:11, 48:1, 48:21, 49:15, 50:13, 51:13, 52:15, 53:16, 54:16, 56:2, 56:15, 59:25, 60:16, 61:10, 61:23, 64:8, 68:17, 69:6, 75:9, 75:20, 76:3, 76:13, 86:8, 86:18, 87:13, 88:2, 89:3, 89:10, 90:12
objections
24:16, 37:3, 37:4, 90:5
obvious
20:21, 27:25, 28:16, 31:9, 48:13, 86:7, 86:25, 87:12, 87:18, 88:1, 88:11, 88:22, 89:14, 91:3
obviously
12:6, 86:20, 88:19
obviousness
18:9, 18:25, 19:9, 19:14, 19:23, 20:1, 21:1, 22:16, 86:16, 87:6, 87:10, 87:14, 88:6, 88:20,

88:23, 90:19
occupation
7:4, 9:23
occurred
26:24, 45:16, 93:18
occurs
25:23, 61:8
od
69:8, 72:24
office
1:1, 5:15
offset
62:1
oh
56:21, 56:23
okay
8:11, 9:12, 13:3, 16:11, 18:17, 19:3, 22:2, 35:6, 37:20, 39:3, 43:3, 51:8, 54:7, 55:9, 57:17, 58:4, 61:2, 62:4, 74:3, 74:23, 75:11, 77:4, 78:23, 82:15, 84:15, 84:23, 86:9, 89:1, 91:19
once
28:11, 32:21, 65:14, 86:22
one
8:18, 8:21, 10:1, 14:6, 14:16, 15:23, 16:7, 20:5, 23:15, 26:6, 30:22, 38:25, 39:1, 49:21, 49:22, 55:21, 55:22, 58:12, 60:4, 60:13, 66:5, 67:8, 67:16, 68:10, 71:4, 78:16, 80:3, 80:4, 80:9, 80:10, 80:19, 81:1, 83:6, 83:23, 84:18, 84:19, 84:20, 85:2, 89:18, 89:19, 90:16
only
55:22, 61:19, 83:16
open
7:18, 29:17, 29:20, 62:14, 62:15
open-ended
90:1
opened
21:25, 22:3, 22:22, 22:24, 23:5, 23:6
operates
27:9
operation
26:20, 26:22, 26:25, 29:7, 29:12, 32:11, 34:14, 50:17, 73:20, 78:17, 78:25, 79:4, 80:1, 80:2, 80:15
opine
39:18, 42:6, 53:24
opinion
21:9, 22:15, 24:5, 24:13, 32:12, 33:21, 34:12, 34:25, 38:23, 39:24, 40:15, 41:1, 41:8, 41:10, 41:25, 44:3, 44:5, 44:25, 46:15, 46:18, 47:20, 48:6, 49:23, 51:18, 53:7, 88:14
opinions
17:9, 17:12, 21:14, 22:11, 42:3, 91:12
opt-out
83:22
optimally
72:7
optimization
85:21
order
24:6, 24:14, 24:25, 25:3, 25:6, 25:8, 25:11, 25:12, 53:17, 70:5, 72:4
ordinary
17:17, 20:22, 26:8, 27:2, 27:15, 27:18, 27:20, 28:6, 28:17, 28:21, 28:23, 29:2, 34:17, 34:18, 37:15, 39:8, 39:12, 39:13, 39:16, 40:10, 42:9, 42:13, 42:20, 42:24, 42:25, 43:3, 52:11, 66:21, 91:3
origin
48:9, 67:12
orrick
2:4, 6:4
other
7:17, 10:1, 10:11, 11:1, 11:18, 28:16, 36:21, 59:7, 68:20, 78:7, 78:11, 81:2, 85:16, 87:21
otherwise
8:11, 94:4
out
14:18, 35:25, 57:19, 58:23, 59:15, 75:1
outcome
94:4
outside
10:9, 10:24, 12:4, 13:21, 18:16, 19:2, 19:25, 20:15, 21:6, 21:15, 24:9, 25:5, 31:1, 31:14, 33:8, 33:12, 38:16, 40:6, 43:7, 45:1, 45:7, 46:4, 46:16, 46:22, 47:7, 48:22
over
9:9, 9:15, 32:21, 54:9, 65:15
overall
20:4, 29:6
own
11:16, 14:8, 15:10
owner
1:9, 2:11, 5:8, 6:3

P

pacific
5:20
page
3:4, 3:9, 3:14, 3:19, 4:2, 4:8, 22:7, 38:25, 39:1, 73:25, 74:5
pages
1:31, 74:2
palo
2:16
paragraph
73:24

parasitic
64:2, 64:11
pardon
66:15
parental
11:10
parker
2:20, 5:22
part
17:25, 18:3, 20:9, 21:2, 31:21, 33:18, 48:17, 49:12, 50:2, 51:11, 59:20, 71:9, 72:1, 72:21, 73:2, 75:8, 75:19, 76:1, 76:7, 76:11, 76:17, 76:22, 86:16, 87:5, 87:9
particular
12:17
particularly
79:8
parties
5:23, 93:24, 94:1, 94:3
party
93:14
pass
67:3, 69:25, 70:16, 72:15, 80:9, 81:3, 83:9
passage
84:14
passed
61:14
passes
70:17
passing
58:23
past
30:16
patent
1:1, 1:3, 1:9, 1:12, 2:11, 5:8, 5:15, 5:16, 6:3, 9:7, 14:14, 14:16, 15:8, 16:7, 16:17, 16:21, 17:15, 20:11, 20:14, 21:4, 22:18, 22:25, 23:7, 27:12, 32:20, 42:10, 45:2, 46:4, 46:23, 47:7, 59:23, 60:14, 60:23, 61:21, 62:16
patents
14:16, 15:4, 15:6, 15:15, 15:16, 15:19, 15:22, 16:2, 16:3, 16:6
path
20:6
patrick
2:5, 6:4
pdf
73:24, 74:2, 77:3
people
82:21
percent
11:2
perfectly
42:1, 48:13
performed
79:13, 88:16
perhaps
8:22, 9:8, 51:18
period
25:25, 26:18, 26:19, 27:10, 28:1, 28:2, 29:5, 32:7, 32:8, 32:13, 32:18, 32:21, 36:9, 43:18, 43:19, 44:16, 44:17, 45:15, 46:1, 48:18, 48:24, 48:25, 49:13, 49:19, 49:20, 50:3, 50:7, 50:8, 50:10, 50:11, 50:15, 53:13, 54:3, 54:12, 56:11, 57:15, 58:7, 58:10, 58:16, 58:20, 59:2, 59:4, 59:22, 60:2, 60:22, 61:1, 61:9, 61:16, 61:25, 63:16, 65:14, 68:14, 69:2, 69:9, 69:12, 69:23, 69:24, 70:12, 71:16, 71:17, 72:12, 74:22, 76:6, 76:20, 79:11, 79:12, 80:12
person
17:17, 18:11, 18:12, 18:20, 20:22, 34:17, 35:4, 39:8, 39:12, 39:16, 40:10, 42:8, 42:23, 66:20, 88:9, 91:3
personal
10:12, 14:4
personally
5:6
perspective
25:15
perspectives
80:4
petition
18:2, 18:5, 38:9, 90:23
petitioner
1:6, 2:3
petitioners
6:6
phase
36:9, 50:19, 51:11, 74:23, 74:24, 75:4, 75:11, 75:12, 75:23
phases
50:18
phenomenon
77:7, 77:9, 77:11, 77:16
pherman@orrick
2:9
pink
74:8, 74:13
place
80:13
placed
79:23
placement
78:6
plain
26:8, 27:2, 27:15, 27:17, 27:20, 28:6, 28:17, 28:21, 28:22, 29:2, 34:18, 37:15, 39:13, 42:13, 42:20, 42:24, 43:3, 52:10
planet
2:21, 5:22, 6:8
please
5:25, 6:23, 17:4, 33:10, 37:1, 56:17, 60:19
point
50:11, 56:25, 58:21, 59:8, 63:20, 68:20, 70:4, 70:9, 71:4, 71:6, 72:6, 74:25, 84:9
policies
87:1

portfolio
11:16, 11:19, 14:8, 14:24, 15:9, 15:21, 15:23, 15:25, 16:7, 16:16
portfolios
10:3
portion
9:25, 10:18, 10:19, 10:21, 16:6, 19:4, 63:22, 65:20, 73:13, 73:14, 73:20, 74:17, 75:6, 75:7, 75:8, 75:19, 76:1, 76:5, 76:7, 76:10, 76:11, 76:16, 76:17
posita
20:5, 80:3, 83:12, 86:23, 89:15
possible
56:17
potential
85:25
pre
32:15
pre-biased
43:14, 45:16
pre-charge
25:24, 26:18, 26:19, 26:23, 26:24, 27:10, 28:2, 29:5, 32:8, 32:10, 32:13, 32:24, 34:12, 36:9, 42:3, 43:13, 43:17, 44:17, 48:18, 48:25, 49:12, 49:19, 50:3, 50:6, 50:7, 50:10, 50:11, 50:14, 51:11, 53:13, 54:1, 54:3, 54:12, 54:17, 54:21, 57:15, 58:7, 58:10, 58:16, 58:17, 58:20, 58:21, 59:1, 59:4, 59:22, 60:2, 60:22, 60:25, 61:8, 61:16, 61:25, 63:16, 65:14, 68:13, 69:12, 69:23, 69:24, 70:12, 71:16, 71:17, 72:12, 74:22, 74:23, 74:24, 75:4, 75:11, 75:12, 75:14, 75:23, 76:6, 76:10, 76:16, 76:20, 79:13, 80:1, 80:2, 80:14, 80:18, 83:11, 89:21
pre-charged
25:23, 79:18
pre-charging
29:6, 32:4, 32:9, 32:18, 32:22, 50:19, 50:23, 53:4, 69:2, 69:9, 83:10, 85:22
pre-od
70:1, 70:6, 70:9, 70:21, 70:25
pre-prior
32:9
pre-pulse
26:23, 29:10, 36:7, 43:13, 45:15, 46:1, 55:4, 55:6, 69:11
pre-signal
34:13
pre_od
68:21, 71:15, 72:5, 72:13, 72:24
precise
19:5, 53:20
prefer
21:18, 35:12, 49:5, 58:15
prepare
16:18, 26:1, 26:15, 26:25, 29:7, 29:10, 32:10, 48:25, 49:16, 73:18
prepared
35:14, 40:15, 41:13, 44:24, 45:21, 45:22, 48:3, 52:6, 53:9
preparing
18:3, 34:14
prepping
34:13
presence
11:10
present
2:19
presented
20:19, 31:3, 34:20, 39:22, 48:4, 88:23
pretty
52:6
prevent
85:4
previously
10:2, 21:24, 29:16
prior
8:20, 17:16, 20:14, 20:21, 21:4, 22:18, 27:8, 31:9, 39:15, 43:25, 45:16, 75:23, 86:22, 88:8, 91:4
probably
56:24
proceed
6:14
proceeding
21:25, 22:5
proceedings
92:9
process
65:23
production
3:8
professor
11:8
program
77:6, 77:9, 77:11, 77:16, 77:23, 77:24, 78:7, 78:11, 78:14, 78:16, 78:25, 80:8, 81:3
programmed
77:22
programming
26:1, 26:2, 26:3, 26:16, 26:20, 26:22, 26:25, 29:6, 29:8, 29:9, 29:12, 32:11, 33:2, 34:14, 44:20, 45:17, 49:1, 49:19, 50:15, 50:17, 50:20, 50:21, 50:23, 52:23, 53:4, 55:7, 55:8, 73:13, 73:14, 73:19, 77:17, 77:19, 77:21, 78:4, 78:9, 78:12, 78:17, 79:4, 79:5, 79:10, 80:16, 83:11, 85:1, 85:23, 86:1, 86:2

progression
88:4, 88:18, 90:21
proper
38:2, 46:12, 49:17
properly
79:22, 80:7, 80:14, 80:24, 80:25
property's
10:3
provide
18:20, 28:13, 37:12, 44:23
provided
17:19, 17:24, 31:17
providing
37:14
pst
1:21, 1:25, 5:3, 93:20
public
93:4, 94:12
pull
67:9
pulled
65:15, 73:17
pulses
26:13, 27:7, 27:25, 28:16, 41:17, 42:3, 45:12, 68:11, 69:5
pummel
85:19
pump
66:22, 70:5, 70:23, 70:24, 72:6, 72:8, 72:10, 74:25
purpose
29:7
pursuant
5:1
put
9:13, 21:23, 22:20, 23:3, 26:21, 29:14, 56:5, 62:12, 65:11, 78:1, 82:3

Q

question
8:8, 8:12, 15:7, 17:3, 17:15, 17:20, 17:21, 17:22, 20:25, 21:10, 21:13, 21:21, 24:10, 24:18, 24:19, 24:22, 27:23, 28:4, 31:24, 36:12, 36:17, 36:20, 37:13, 37:14, 37:21, 40:19, 42:16, 46:21, 47:3, 47:6, 47:12, 49:9, 51:3, 51:19, 58:2, 60:17, 60:18, 60:19, 66:16, 69:8, 71:23, 75:25, 76:14, 76:20, 78:10, 87:24, 90:1, 90:7, 91:12, 91:14
questioning
57:3, 57:5
questions
3:3, 3:18, 7:24, 44:11, 84:6, 91:18, 91:25, 92:2
quit
11:7, 11:11, 11:15, 14:10, 15:1
quite
11:9, 13:25, 14:12, 14:15, 17:22
quotation
3:24
quote
3:25, 66:25

R

ramping
55:19, 55:20, 64:22
rand
82:3
random
52:24
rate
13:3, 13:9, 13:10, 13:11, 13:12
rather
33:25, 34:3, 83:22
rc
69:17
reach
72:1, 72:4, 72:23
reaches
63:18, 63:20
reaching
63:14, 68:25
read
39:4, 86:22, 86:23, 87:15
reading
7:15, 93:22
ready
32:11, 41:8, 54:10, 69:25, 70:15, 70:16, 73:18
real
64:11
realize
88:10
really
21:18, 51:15, 57:19, 66:8, 66:9, 77:15, 88:13
reason
8:5, 61:24, 65:7, 83:16
reasonable
89:15, 91:10
recall
12:20, 13:25
receives
67:3
receiving
32:15
recess
62:8, 91:21
record
62:5, 62:7, 62:10, 91:17, 91:20, 91:23, 93:11
recovery
82:1
reduce
66:7
reduced
85:10, 85:12
reference
23:11, 31:17, 32:7, 47:16, 47:17, 48:9, 62:20, 77:6, 78:24, 79:2, 84:21, 86:22, 87:16, 87:19
referenced
23:1, 78:9, 78:13, 78:14
references
31:9, 38:10, 49:7
referred
37:23, 37:24, 38:1
referring
23:10, 37:7, 37:22, 62:19, 79:3
refers
38:12, 38:13, 39:10, 40:1,

40:2, 40:21, 40:22, 41:5, 44:7, 44:9, 45:3, 46:6, 46:25, 47:10, 47:24, 47:25
reflect 3:25
reflects 17:9
regard 49:17
regarding 21:21, 22:11, 31:8, 45:25
regardless 13:14
reinserted 64:1
related 93:25
relationship 25:12, 25:13
relative 47:14
rely 12:24, 17:16
remainder 9:17, 15:15
remember 9:9, 9:13
remembered 5:1
remote 1:19, 5:4, 5:21, 7:7
remotely 5:24
remove 80:24
removed 65:3
render 20:5, 21:8, 31:9, 32:12, 33:21, 38:22, 39:23, 40:15, 41:1, 41:10, 41:22, 41:25, 42:2, 44:3, 44:5, 44:24, 46:15, 46:18, 47:20, 48:6, 48:13, 49:22, 51:18, 53:6
rendered 20:21, 87:18, 88:11, 88:22, 91:3
rendering 34:12, 34:25
repeat 17:3, 17:20, 24:10, 24:25, 42:16, 45:11, 50:22, 51:3, 60:17, 60:18, 66:15, 71:23, 76:14, 78:10, 91:11
reported 1:27
reporter 5:5, 6:7, 6:10, 6:13, 81:15, 81:19, 82:23, 93:3
reporter's 1:15, 3:23
represent 6:1, 34:22, 43:10
represented 93:15
representing 5:22, 6:8
request 3:8
requested 17:19, 17:24
required 85:13
requirement 72:1
requires 33:19
resistance 64:19, 66:8, 82:12
resistant 83:7
resisting 69:17
resistor 82:18
resolve 14:13
respect 34:25, 43:9, 83:5, 84:17
respective 57:17, 93:24
respectively 82:9
responding 90:2
responsible 64:16
rest 70:8
result 90:17, 90:18
results 89:13
retained 9:6, 12:17
reverse 65:2, 65:22
review 9:20, 10:2, 11:19, 17:15, 17:24, 18:2, 39:3, 39:4, 41:14, 41:23, 42:5
reviewed 16:20, 16:21, 17:6, 18:4, 38:19, 44:1
right 7:19, 10:2, 10:7, 12:10, 15:1, 15:12, 19:7, 21:12, 23:3, 30:3, 31:6, 33:17, 33:21, 34:20, 35:6, 35:15, 36:13, 38:6, 38:18, 39:4, 39:17, 39:24, 43:21, 44:22, 46:18, 51:19, 55:19, 56:5, 74:14, 74:23, 90:3, 92:3, 92:6
role 9:18, 11:8
ropes 2:12, 6:2
rpr 1:28
ryan 1:28, 5:5, 6:8, 6:11, 93:3

S

s-o-u-r-c-e 81:21
said 9:22, 13:19, 14:6, 16:5, 41:21, 46:11, 48:3, 51:5, 52:18, 57:5, 57:23, 57:25, 63:18, 64:24, 74:1, 93:23
same 13:14, 24:16, 27:25, 44:14, 44:15, 61:14, 61:18, 61:21, 73:15, 84:14, 85:17, 89:17
satisfied 75:22
saw 77:18
say 9:2, 9:8, 9:15, 10:13, 10:18,

11:1, 11:24, 12:1, 12:13, 15:3, 15:11, 15:12, 15:13, 16:11, 19:5, 25:22, 38:3, 53:18, 54:25, 55:15, 64:13, 71:11, 71:20
saying
28:20, 41:22, 48:3, 52:20, 54:17, 59:3, 74:21, 76:19, 90:23
says
29:5, 36:17, 61:2, 65:6, 89:4
scale
53:1
school
11:10
scope
10:10, 10:24, 12:4, 13:21, 18:16, 19:2, 19:25, 20:15, 21:6, 21:15, 24:9, 25:5, 31:1, 31:14, 33:8, 33:12, 38:16, 40:6, 43:7, 45:7, 48:22
screen
7:11, 7:17
scrolling
62:25
sea
47:17
second
19:22, 23:17, 77:13
secondary
86:4, 86:5, 86:12, 86:15, 87:4, 87:8, 87:24, 88:5, 88:13, 88:24, 89:2, 89:5, 89:8, 89:24, 90:10, 90:16, 90:20, 90:24
see
14:21, 21:7, 22:11, 24:2, 24:23, 27:21, 29:22, 30:4, 30:6, 30:8, 30:9, 30:15, 30:19, 30:20, 30:22, 33:17, 34:23, 34:24, 35:7, 38:1, 38:19, 40:11, 44:4, 57:20, 57:24, 58:6, 58:9, 58:25, 61:3, 62:24, 63:2, 63:6, 63:19, 67:16, 67:20, 69:5, 74:4, 74:8, 74:15, 77:6, 78:24, 79:22, 80:15, 84:7, 84:21, 86:10, 91:2, 91:17
seeing
39:18, 39:24, 41:9, 42:4, 46:19, 48:5, 57:19, 85:5
seen
27:11, 31:4, 31:20, 33:23, 33:24, 34:21, 35:20, 37:23, 37:24, 45:23, 46:16, 46:17, 52:9, 53:6, 55:13, 59:15
sees
37:2, 85:3
select
54:4, 81:24, 81:25, 82:5, 82:8, 82:9, 82:13, 82:14, 84:7, 84:16, 84:17, 84:19, 84:20
selected
23:19, 24:14, 25:3, 25:7, 26:13, 28:1, 29:4, 77:18, 79:14, 79:16, 79:21, 80:23, 81:5, 83:13, 83:16, 83:20, 85:2
selection
67:2, 77:20
sense
76:5
sentence
84:22
separate
86:17
sequence
25:10
series
4:9, 29:23, 29:24, 82:20
set
15:23, 16:7, 73:12, 93:8, 94:7
shake
91:2
shape
61:19, 61:21, 65:24, 65:25
shorthand
5:5
should
46:12
show
20:19, 51:18, 91:7
showed
60:9
shower
14:20
showing
33:14
shown
30:24, 31:24, 34:7, 35:16, 38:13, 39:9, 40:3, 47:8, 47:23, 48:16, 48:19, 49:2, 49:10, 53:12, 54:13, 54:14, 54:23, 55:10, 55:25, 58:13, 59:20, 59:22, 60:12, 61:7
shows
83:14, 91:6, 91:8
shut
80:19, 83:17, 83:18
sic
71:19
side
25:8, 25:13, 79:17, 81:16, 84:7, 84:16, 84:19, 84:20, 89:19, 89:20
signal
25:23, 25:25, 26:1, 26:2, 26:3, 26:17, 26:24, 29:3, 43:13, 56:6, 63:25, 64:12, 64:25, 65:17, 67:14, 69:11, 75:6, 75:13, 75:14, 76:17
signature
22:8
signature-p1kal
94:10
significant
10:19
significantly
85:10

signing
93:23
similar
27:11, 71:4
simple
90:11, 91:12
simply
38:7, 38:18, 40:15, 41:22, 42:4, 42:5, 47:18, 66:1, 70:22, 72:10, 81:8, 82:18
simpson
2:20, 5:22
since
11:14, 15:24, 16:1, 64:12
sir
28:4
sitting
18:24, 19:23, 30:3, 31:6, 31:11, 33:17, 33:21, 34:6, 34:19, 35:15, 38:6, 39:17, 39:24, 40:11, 40:19, 41:3, 41:7, 43:21, 44:4, 44:22, 46:18, 47:22, 51:19
skated
79:9
skill
17:17, 20:22, 34:17, 35:4, 39:8, 39:12, 39:16, 40:10, 42:9, 42:24, 66:21, 88:9, 91:3
slight
64:3
slightly
11:2
so-called
43:13, 75:3, 83:7
sold
16:12
solving
14:12
some
9:19, 9:20, 9:21, 12:21, 14:5, 14:19, 18:6, 39:18, 41:16, 50:11, 64:21, 65:9, 78:14, 82:21
somebody
16:12
somehow
78:5
something
19:6, 19:10, 34:20, 35:15, 52:13, 86:17, 87:10
sometime
8:22
sometimes
12:9, 14:19
sons
11:9
sorry
9:11, 15:5, 16:5, 17:20, 24:19, 30:5, 33:10, 39:6, 40:25, 42:17, 50:16, 56:23, 62:24, 62:25, 77:15
sort
64:21, 68:9
sound
8:3
sounds
8:4
source
9:20, 25:9, 25:13, 81:16, 81:17, 81:20, 81:24, 81:25, 82:1, 82:2, 82:9, 82:11, 82:13, 82:22, 82:24, 82:25, 83:2, 83:5, 83:8, 83:14, 83:17, 83:22, 84:7, 84:16, 84:19, 89:19
spans
74:2
speaking
37:4, 90:4
specific
32:6, 32:7, 32:17, 52:21
specification
40:8
specified
55:4
speculate
64:10
spring
12:23
stand
62:6
standard
13:9, 13:10, 13:11, 13:12, 17:14
start
11:4, 11:21, 55:19, 55:20, 58:23, 58:25, 59:9, 63:17, 68:23, 70:15, 70:18, 70:19, 70:21, 70:25, 73:17
started
11:7, 11:18, 14:17, 54:8
starting
55:18, 58:15
starts
54:13, 54:18, 54:21, 63:13, 69:24, 70:1, 71:3, 72:12, 75:1
state
5:6, 6:1, 6:23, 93:4, 94:13
states
1:1, 5:15
stays
61:18
stenographically
1:27
step
29:6, 32:9, 32:18, 32:25, 33:2, 45:16, 50:17, 50:18, 50:19, 50:20, 50:21, 50:23, 50:24, 53:4, 55:5, 55:6, 55:8, 58:17, 67:24, 68:9, 72:17, 85:22
stick
49:5
still
16:2, 60:15, 62:25, 73:8, 76:22, 81:14, 81:17, 87:23
stipulations
3:13
stop
66:6
stopped
32:22
stops
32:25
storage
78:1
street
2:6
strike
44:8, 91:14
strikes
87:17
string
80:5, 80:6,

82:4, 83:1, 83:5, 83:12, 83:13, 83:18, 83:20
submitted 22:5
subsequent 83:24
subsequently 11:17, 11:20
success 89:16, 91:10
suffice 10:13, 25:21
summarize 87:7
supplying 68:21
support 3:1
supposed 36:12, 36:19, 36:21
sure 12:12, 17:6, 24:13, 24:24, 25:2, 54:19, 55:24, 57:24, 66:24, 67:10, 68:20, 80:4, 80:12, 82:16, 87:23, 90:25
survey 14:18
sutcliffe 2:4, 6:5
sworn 5:9, 6:9, 6:12, 6:17, 93:9
sympathize 7:16
system 89:20

T

t1 63:13, 63:19, 63:22, 69:15, 70:11, 70:12, 71:3, 71:12, 72:2, 72:12, 72:16, 72:21, 72:23, 72:24, 74:14, 74:22, 75:3, 76:6
t2 63:22
t3 63:15, 64:24, 65:21, 73:3, 73:4, 73:5, 73:6, 74:14, 74:18, 75:2, 76:11, 76:17, 76:20
t4 65:21, 74:23, 75:3, 76:6
take 39:4, 61:2, 70:7, 70:8
taken 20:2, 20:3, 20:4, 93:10
takes 63:25, 68:4, 76:23
taking 5:2, 14:20, 89:18, 89:19
talk 36:22
talked 71:5
talking 67:17
task 26:11, 26:12
teaches 87:1
teaching 89:16
technical 7:6, 18:11, 90:25
technologies 1:8, 5:14
technology 1:5, 5:13, 66:10
teleconference 1:19, 5:4
tell 6:17, 28:22, 31:11, 34:6, 40:2, 40:20, 41:3, 41:17, 45:3, 46:3, 46:22, 47:6, 47:13, 47:22, 55:10, 60:15, 71:22, 72:19
telling 73:10
temporarily 79:18
ten 9:9, 9:10, 9:12, 15:13, 15:19, 57:5, 57:7
term 25:17, 25:18, 27:3, 27:15, 28:7, 28:18, 37:6, 37:7, 37:16, 37:23, 42:12, 42:13, 42:19, 48:13, 84:7, 88:21
terms 14:2, 19:19, 26:12, 52:21, 52:22, 52:23, 70:23, 85:24, 87:2, 89:13
testified 5:10, 6:18, 22:14, 70:7
testify 5:9, 8:6, 53:14
testifying 9:14
testimony 21:19, 39:7, 39:11, 39:20, 41:18, 46:3, 52:14, 52:16, 52:18, 90:1, 90:14, 93:11
th 94:8
thank 6:13, 6:15, 8:4, 22:3, 92:3, 92:4, 92:5
thanks 57:3
themselves 6:1
therefore 64:21
thereof 5:3
thing 33:19, 55:21, 61:19
things 14:6, 31:18, 36:22, 39:18, 59:7, 65:25, 87:19
think 8:22, 9:1, 12:5, 12:21, 20:1, 21:17, 25:7, 26:11, 39:19, 41:12, 48:2, 52:6, 52:17, 53:6, 54:5, 57:13, 58:21, 60:1, 65:22, 76:4, 77:10, 84:4, 86:19, 87:14, 88:18, 88:19, 89:4, 90:21
thought 14:16
three 8:16, 9:3, 15:3
threshold 81:7, 81:8,

82:19, 83:4, 83:6, 83:23, 84:1
through
25:10, 30:1, 30:7, 43:15, 56:7, 58:24, 61:14, 65:4, 66:23, 67:7, 67:14, 68:24, 70:3, 71:6, 72:5, 72:15, 72:17, 73:1, 74:22, 75:3, 76:6, 88:7, 88:8
time
5:19, 5:20, 8:24, 9:1, 11:12, 11:24, 12:7, 12:22, 12:23, 13:1, 13:6, 14:13, 16:10, 25:24, 26:18, 26:19, 31:20, 32:7, 32:8, 32:18, 33:17, 33:23, 35:13, 35:16, 36:5, 38:13, 38:18, 39:3, 39:4, 39:10, 39:19, 39:25, 40:2, 40:12, 40:22, 41:5, 41:10, 41:23, 42:4, 43:17, 43:19, 44:4, 44:10, 45:3, 45:15, 45:23, 46:7, 46:17, 46:19, 47:1, 47:10, 47:25, 48:5, 48:7, 48:24, 52:5, 52:8, 52:21, 53:1, 53:5, 55:13, 57:11, 57:20, 58:15, 59:10, 59:14, 61:14, 62:7, 62:10, 63:25, 64:22, 68:4, 69:18, 70:11, 70:12, 75:2, 76:23, 79:11, 79:12, 84:1, 91:18, 91:20, 91:23, 91:25, 92:8
times
8:16, 9:6, 9:9, 9:11, 9:12, 9:13, 13:24, 14:1
today
5:21, 6:7, 7:21, 8:6, 16:19, 19:23, 31:11, 34:6, 40:19, 41:3, 47:22
today's
5:18
told
50:1
top
60:4, 61:2, 83:5
total
15:5, 15:6, 69:19
totality
20:2
trademark
1:1, 5:15
trailed
57:23
transcript
1:15
transient
79:11
transistor
81:9, 81:10, 81:24, 81:25, 82:6, 82:8, 82:9, 82:13, 82:14, 82:19, 82:20, 83:10, 83:18, 83:21, 84:17
trapped
80:25
traverse
70:3, 70:21, 71:3, 71:9, 72:25
trial
1:3, 5:16, 9:21
true
93:11
truth
5:10, 6:18
truthfully
8:6
try
14:24, 33:1, 80:19, 80:22, 87:15, 90:22
trying
8:21, 12:5, 14:18, 15:9, 15:20, 37:12, 37:13, 65:5, 67:5, 69:7, 90:15
tuesday
1:18, 5:2, 93:19
turn
23:13, 62:22, 73:24, 77:3, 78:18, 81:9
turned
13:17
turns
74:25
two
8:20, 11:9, 67:24, 68:10, 73:1, 80:3, 80:4
two-tenths
30:13
types
78:7, 78:11
typical
78:25

U

under
7:20, 21:9, 25:22, 43:3, 43:20, 45:9, 85:24
understand
7:7, 7:16, 7:20, 7:23, 8:9, 8:12, 17:22, 20:9, 24:18, 24:21, 28:13, 28:14, 30:5, 34:3, 36:11, 36:19, 36:23, 48:7, 48:8, 52:10, 59:3, 59:6, 60:18, 69:7
understanding
18:13, 18:23, 18:24, 19:7, 19:15, 19:18, 19:22, 26:5, 26:6, 27:14, 28:18, 28:21, 34:18, 42:25, 43:21, 44:21, 53:7, 58:3, 82:17
understood
55:24, 80:2
unexpected
89:13, 90:17, 90:18
unintended
77:17, 77:19, 77:21, 78:3, 78:8, 78:12, 78:15, 79:21, 79:24, 80:16
unintentional
77:25, 78:1
unintentionally
81:6

united
1:1, 5:15
university
2:14
unless
13:1, 79:10, 79:13
unpre-charged
79:22
unquote
66:25
unselect
54:5
unselected
26:14, 28:1, 29:4, 61:3, 61:20, 66:4, 66:6, 80:10, 80:24, 81:4, 83:19, 85:5, 85:17
until
34:23, 57:8
upload
56:17, 56:18
upper
64:6
use
19:18, 37:11, 72:7, 80:19, 80:22, 86:21
using
84:18
usually
85:4

V

v(t
30:10, 40:13, 47:19, 53:2, 59:9, 59:16
vacuum
35:25
vague
51:20
various
14:11, 26:13, 31:8, 66:22, 87:1
vbypass
63:14, 63:18, 63:20, 65:13, 65:17, 68:2, 68:16, 70:22, 70:24, 71:6, 71:8
velocity
35:11, 38:5
verbalize
27:18, 28:11
verification
50:21, 50:24
version
18:5, 74:4
versus
5:13, 91:8
vgpm
80:11
via
5:3
video
1:19, 5:4, 5:19, 5:23
videographer
2:20, 5:11, 5:21, 6:7, 62:6, 62:9, 91:19, 91:22, 92:6
videotaped
5:12
virtually
93:18
viscosity
38:5
vision
85:18
voice-identify
5:25
volt
73:7, 85:4
voltages
66:22, 70:13, 73:12, 79:14, 80:9
vpgm
85:3
vpre_od
68:3, 68:4, 68:13, 68:25, 69:1, 69:8, 71:18
vsb2(data
67:18

W

wait
8:1, 8:2
waived
93:23
want
9:2, 11:9, 12:24, 17:1, 18:20, 18:23, 19:5, 19:18, 34:23, 36:22, 39:23, 41:17, 49:9, 51:15, 52:19, 53:23, 59:5, 64:10, 68:20, 68:22, 80:4, 80:12, 82:15, 86:11, 88:19
wants
16:15
wave
34:15, 35:24, 43:10, 47:15, 48:19, 49:13, 49:18, 49:21, 50:2, 50:9, 51:9, 51:17, 53:11, 55:18, 56:6, 57:18, 58:9, 58:12, 58:18, 59:19, 59:21, 60:12, 60:14, 60:21, 60:25, 61:2, 61:5, 61:6, 61:8, 61:20, 63:2, 63:7, 64:4, 64:24, 75:6
way
14:13, 25:14, 25:15, 26:21, 29:9, 54:7, 60:1, 64:18, 65:5, 70:23, 74:13, 85:1, 85:4, 87:17, 94:3
we're
57:14, 62:6, 62:9
we've
67:17, 74:5, 84:14
weakest
77:10
went
9:21, 64:5
weren't
28:5
west
2:6
whatever
44:18, 65:11, 65:16, 65:17, 71:8
whenever
54:9
whereof
94:7
whereupon
6:12, 29:18
whether
14:3, 31:11, 31:24, 34:4, 34:7, 39:9, 40:2, 40:19, 40:20, 41:4, 41:16, 45:4, 46:4, 46:21, 46:22, 47:6, 47:8, 47:23, 52:13, 53:14, 53:25, 54:4, 55:10, 60:15, 73:7, 73:9, 74:24, 82:1,

87:5, 88:20, 90:9, 91:17
whole
6:17, 87:7
wife
11:8
willing
39:17, 40:25, 41:25, 44:11, 46:13, 48:10, 53:14
windows
7:17
wish
14:4, 31:19, 38:21, 41:10, 41:22, 48:6
wither
14:3
within
25:23, 25:24, 46:13, 53:21, 93:4
without
11:10, 31:5, 31:15, 33:24, 34:21, 35:16, 38:21, 39:22, 40:25, 41:24, 45:23, 45:24, 48:6, 48:7, 49:20, 53:7, 73:16
witness
5:8, 6:9, 6:12, 10:1, 10:8, 10:11, 10:12, 10:14, 10:16, 10:18, 10:22, 10:25, 11:20, 11:22, 12:2, 12:5, 13:6, 13:22, 15:2, 17:3, 18:17, 19:3, 20:1, 20:17, 21:7, 21:17, 24:10, 24:17, 25:6, 26:11, 27:5, 27:17, 28:10, 29:1, 29:20, 31:2, 31:15, 33:9, 33:13, 34:11, 35:10, 35:22, 36:16, 37:1, 37:10, 38:1, 38:17, 40:7, 40:24, 41:21, 42:16, 42:22, 43:8, 45:8, 46:9, 47:3, 47:12, 48:2, 48:23, 49:16, 50:14, 51:14, 52:16, 53:17, 54:17, 56:3, 56:16, 57:9, 60:1, 60:17, 61:11, 61:24, 64:9, 68:18, 69:7, 75:10, 75:21, 76:4, 76:14, 81:16, 81:20, 82:24, 86:9, 86:19, 87:14, 88:3, 89:4, 89:11, 90:2, 90:6, 90:15, 92:4, 93:8, 93:12, 93:24, 94:7
witness's
89:25, 90:13
wl
25:10
wl0
25:10
wl_vsb1_unsel
63:3, 63:9
wl_vsb1_unselect
63:4, 71:5, 72:22
wl_vsb2
71:2
wl_vsb2(data
69:4, 69:21, 71:12, 71:24, 72:20, 74:18, 76:18
wl_vsb_unselected
64:14
wls_vsb2
71:18
word
23:19, 23:21, 23:23, 24:6, 24:15, 24:24, 25:3, 25:7, 26:1, 26:13, 26:14, 26:24, 28:1, 28:22, 29:4, 29:11, 32:10, 32:14, 32:17, 32:24, 36:6, 36:8, 44:17, 45:18, 45:25, 48:18, 49:1, 49:12, 51:10, 53:13, 54:4, 54:5, 57:17, 58:22, 60:4, 60:5, 60:7, 60:25, 61:13, 64:2, 64:3, 64:15, 65:14, 65:16, 65:19, 66:5, 66:7, 66:12, 66:14, 66:17, 67:16, 67:17, 67:20, 69:12, 70:20, 71:14, 71:18, 71:21, 72:15, 72:22, 75:23, 76:23, 77:18, 79:6, 79:15, 79:16, 80:23, 85:2, 86:21
wording
19:6
work
9:3, 10:7, 10:12, 10:14, 10:21, 10:22, 12:2, 12:9, 13:4, 13:7, 13:15, 13:18, 17:15, 35:20
worked
16:14
working
7:5, 9:25, 11:4, 11:7, 11:15, 11:18, 11:20, 11:21, 14:11, 15:16, 18:7
works
36:23, 70:24, 72:4
world
64:11
worthwhile
14:21
write
14:20

Y

yang
28:17, 31:17, 33:4, 36:2, 39:15, 40:9, 42:23, 43:12, 44:16, 45:11, 45:20, 48:12, 48:24, 49:7, 49:18, 51:16, 56:4, 62:20, 66:20, 70:10, 71:12, 71:25, 72:20, 74:5, 74:21, 75:18, 75:21, 76:1, 76:18, 80:21
yangtze
1:8, 5:14
yeah
9:11, 9:21, 10:5, 11:25, 12:25, 14:1, 16:17, 19:12,

30:20, 54:10, 54:11, 55:3, 56:23, 84:12, 86:13
year 8:22, 12:8, 12:21, 12:25
years 15:3, 16:1
yep 78:22
yes-or-no 91:12
ymtc 6:3
york 2:7
yourself 42:8

Z

zero 57:11, 62:1
zhao 28:17, 31:17, 33:4, 36:2, 39:15, 40:8, 42:23, 43:12, 44:15, 45:11, 45:19, 48:12, 48:24, 49:6, 49:18, 51:16, 55:18, 56:4, 80:21, 89:18, 91:7, 91:8
zoom 7:18

.

.4 53:2
.4000 2:17
.5000 2:8
.6 53:3
.8 53:3

0

0.2 53:2
00795 1:11, 5:17

1

1 1:31
10 1:25, 91:20, 91:23, 92:8
10,121,529 23:7
10,726,920 62:17
1001 22:21
10019 2:7
1003 21:24, 22:4, 73:21
1004 23:4, 23:16, 76:25
1010 62:14, 62:16
10:39 am 93:20
11 23:22, 23:23, 24:7, 24:15, 24:24, 25:3, 25:7
11,501,822 1:12, 20:11, 22:25
11373 1:29, 6:11
12 5:18
124 22:7
145 73:24, 74:1
15 54:9, 77:3
150,000 12:14
17 1:18, 5:2, 5:18, 93:19
18 85:4
1900 2:14

2

2 23:23
20 57:1, 85:4, 94:8
200,000 12:14
2007 11:13
2008 11:13
2009 16:10
2013 9:2, 11:24
2020 4:9, 29:15, 29:18, 29:22, 40:3, 40:21, 43:5, 44:10, 45:4, 46:5, 46:24, 47:9, 47:23, 48:20, 49:11, 51:10, 53:12, 54:22, 55:10, 55:25, 56:14, 58:14, 58:19, 59:5, 59:11, 59:20, 60:9, 60:13, 61:7, 61:22
2023 12:15
2024 1:11, 1:18, 5:3, 5:17, 5:18, 12:12, 93:19, 94:8
212.506 2:8
24 94:8
25 78:18, 78:22
29 4:9

3

30 84:10
31 25:10, 62:7
32 78:18, 78:22, 91:20
37 62:10
39 1:25, 91:23, 92:8
3d 32:2, 79:8

4

42 74:2
43 73:25, 74:2, 74:5
4b 23:13, 23:14, 23:20, 23:25, 24:3

5

50 11:2
51 2:6
52 2:6, 77:5
550 13:6
56 77:5

565014
1:30
59
1:21, 5:3, 5:19

6

650.617
2:17
6th
2:15

7

7
1:21, 5:3, 5:19
7:59 am
93:20

8

822
16:21, 21:3, 25:21, 25:22, 26:4, 26:7, 26:12, 27:6, 27:11, 27:23, 27:25, 28:16, 29:2, 31:9, 31:16, 32:1, 32:19, 33:3, 34:25, 36:1, 37:16, 38:9, 39:14, 40:7, 40:9, 42:9, 42:22, 43:11, 44:1, 44:14, 44:21, 45:1, 45:9, 45:12, 45:20, 46:4, 46:14, 46:23, 47:7, 48:14, 48:23, 49:6, 49:18, 51:16, 55:6, 56:3, 56:17, 56:18, 58:1, 58:2, 58:4, 58:7, 59:6, 59:23, 60:14, 60:22, 61:12, 61:18, 61:21, 66:19, 80:22, 86:23, 87:18, 88:8
882
25:24
8b
62:22, 63:1, 63:8, 69:5, 69:22, 70:10, 71:12, 71:21, 71:24, 72:20, 74:5, 76:18

9

9
62:7, 62:10
94
1:31
94303
2:16