UNITED STATES PATENT AND TRADEMARK OFFICE

_____

BEFORE THE PATENT TRIAL AND APPEAL BOARD

_____

SAMSUNG ELECTRONICS CO., LTD.,
MICRON TECHNOLOGY, INC.,
MICRON SEMICONDUCTOR PRODUCTS, INC., and
MICRON TECHNOLOGY TEXAS LLC,

Petitioner,

v.

NETLIST, INC.,

Patent Owner.

_____

IPR2022-00711

U.S. Patent No. 10,860,506

ZOOM DEPOSITION OF DR. WILLIAM HENRY MANGIONE-SMITH

(Reported Remotely via video & Web videoconference)

Kirkland, Washington (Deponent's location)

Thursday, May 4, 2023

Volume 1

STENOGRAPHICALLY REPORTED BY:
REBECCA L. ROMANO, RPR, CSR, CCR
California CSR No. 12546
Nevada CCR No. 827
Oregon CSR No. 20-0466
Washington CCR No. 3491

JOB NO. J9467698

PAGES 1 - 279

Samsung Ex. 1046, p. 1
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 1
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

UNITED STATES PATENT AND TRADEMARK OFFICE

_____

BEFORE THE PATENT TRIAL AND APPEAL BOARD

_____

SAMSUNG ELECTRONICS CO., LTD.,
MICRON TECHNOLOGY, INC.,
MICRON SEMICONDUCTOR PRODUCTS, INC., and
MICRON TECHNOLOGY TEXAS LLC,

Petitioner,

v.

NETLIST, INC.,

Patent Owner.

_____

IPR2022-00711

U.S. Patent No. 10,860,506

ZOOM DEPOSITION OF DR. WILLIAM HENRY MANGIONE-SMITH, taken on behalf of the Petitioner, with the deponent located in Kirkland, Washington, commencing at 9:01 a.m., Thursday, May 4, 2023, remotely reported via video & Web videoconference before REBECCA L. ROMANO, a Registered Professional Reporter, Certified Shorthand Reporter, Certified Court Reporter.

Samsung Ex. 1046, p. 2
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 2
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

APPEARANCES OF COUNSEL

(All parties appearing via Web videoconference)

For the Petitioner - Samsung Electronics Co., Ltd.:

BAKER BOTTS L.L.P.
BY: THEODORE W. CHANDLER
Attorney at Law
1801 Century Park East
Suite 2400
Los Angeles, California
(213) 202-5702
ted.chandler@bakerbotts.com

and

BY: FERENC PAZMANDI
Attorney at Law
101 California Street
Suite 3200
San Francisco, California 94111
(415) 291-6255
ferenc.pazmandi@bakerbotts.com

/////

Samsung Ex. 1046, p. 3
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 3
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

APPEARANCES OF COUNSEL(cont'd)

(All parties appearing via Web videoconference)

For the Patent Owner:

IRELL & MANELLA LLP
BY: JONATHAN M. LINDSAY
Attorney at Law
840 Newport Center Drive
Suite 400
Newport Beach, California 92660
(949) 760-0991
jlindsay@irell.com

ALSO PRESENT:

John Reidt, Videographer

/////

Samsung Ex. 1046, p. 4
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 4
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

I N D E X

DEPONENT EXAMINATION

DR. WILLIAM HENRY MANGIONE-SMITH PAGE
VOLUME 1

BY MR. CHANDLER 10

BY MR. LINDSAY 260

BY MR. CHANDLER 270

E X H I B I T S

NUMBER PAGE

(PREMARKED)

Exhibit 1001 US 10,860,506 B2;

Exhibit 1003 Declaration of Dr. Robert Wedig Regarding U.S. Patent No. 10,860,506;

Exhibit 1005 US Patent Application 2010/0312956 A1;

Exhibit 1006 US 8,020,022 B2;

Exhibit 1007 US Patent Application 2006/0277355 A1;

Exhibit 1008 US 6,184,701 B1;

Exhibit 1018 Jedec Standard No. 21-C DDR SDRAM Registered Design Specification;

Exhibit 1020 JEDEC STANDARD DDR3 SDRAM JESD79-3C;

Exhibit 1029 US Patent Application 2007/0008791 A1;

/////

Samsung Ex. 1046, p. 5
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 5
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

E X H I B I T S(cont'd)

NUMBER		PAGE
	(PREMARKED)	
Exhibit 2006	Declaration of Dr. William Henry Mangione-Smith;	
Exhibit 2007	Joint Claim Construction Chart Pursuant to P.R. 4-4(d);	
Exhibit 2010	JEDEC STANDARD Double Data Rate (DDR) SDRAM Specification;	
Exhibit 2011	JEDEC STANDARD DDR SDRAM Specification JESD79-3A;	
Exhibit 2012	JEDEC STANDARD DDR2 SDRAM SPECIFICATION JESD792;	
	(NEW)	
Exhibit 1047	Netlist Technology Tutorial dated May 8, 2017;	55
Exhibit 1048	'506 patent (EX1001) Fig. 15 & Fig. 16;	116
Exhibit 1049	Data Register Buffer (300) in Hiraishi (EX1005);	179
Exhibit 1050	Hiraishi (EX1005) S4 read leveling;	229
Exhibit 1051	Hiraishi (EX1005) S4 write leveling;	205
Exhibit 1052	Butt (EX1029) Figures 2 and 3;	239
Exhibit 1053	JEDEC STANDARD FBDIMM: Advanced Memory Buffer (AMD).	246

/////

Samsung Ex. 1046, p. 6
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 6
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Kirkland, Washington, Thursday, May 4, 2023
9:01 a.m.
---o0o---

THE VIDEOGRAPHER: Good morning, everybody. We are on the record. The time is 9:01 a.m. 09:01:20

This marks the beginning of Media Unit No. 1 in the video-recorded deposition of Dr. William Mangione-Smith, in the matter of Samsung Electronics Co., Ltd., et al. versus Netlist, Inc., being heard before the United States Patent and Trademark Office before the Patent Trial and Appeal Board. Case file number is IPR2022-00711, Patent No. 10,860,506 B2. 09:01:32 09:01:52

This deposition is being held via Zoom on this 4th day of May 2023.

My name is John Reidt. I am the videographer today. The court reporter is Rebecca Romano. And we are representing Esquire Deposition Solutions. 09:02:16

Counsel, will you please introduce yourselves and state your affiliations, and the witness will be sworn in.

MR. CHANDLER: Good morning. This is 09:02:28

Samsung Ex. 1046, p. 7
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 7
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Theodore Chandler from Baker Botts on behalf of the Petitioner, Samsung Electronics Co., Ltd. 09:02:28

And with me is my colleague, Ferenc Pazmandi.

MR. LINDSAY: And this is Jonathan Lindsay with Irell & Manella on behalf of Netlist, Patent Owner, defending Dr. Mangione-Smith today. 09:02:39

THE VIDEOGRAPHER: Thank you, Counsel.

Will the tran- -- will the court reporter please swear in the witness, and we may proceed. 09:02:54

THE COURT REPORTER: At this time, I will ask counsel to agree on the record that there is no objection to this deposition officer administering a binding oath to the deponent via remote videoconference, starting with the noticing attorney, please. 09:02:58

MR. CHANDLER: No objection.

MR. LINDSAY: No objection here.

THE COURT REPORTER: Okay, Doctor. If you could raise your right hand for me, please. 09:03:14

THE DEPONENT: (Complies.)

THE COURT REPORTER: You do solemnly state, under penalty of perjury, that the testimony you are about to give in this deposition shall be 09:03:14

Samsung Ex. 1046, p. 8
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 8
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

1	the truth, the whole truth and nothing but the	09:03:14
2	truth?	
3	THE DEPONENT: Yes, I do.	
4		
5		09:03:14
6		
7		
8		
9		
10		09:03:14
11		
12		
13		
14		
15		09:03:14
16		
17		
18		
19		
20		09:03:14
21		
22		
23		
24		
25	/////	09:03:29

Samsung Ex. 1046, p. 9
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 9
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

DR. WILLIAM HENRY MANGIONE-SMITH, 09:03:29
having been administered an oath, was examined and testified as follows:

EXAMINATION

BY MR. CHANDLER: 09:03:31

Q. Please state your name for the record.

A. William Henry Mangione-Smith.

Q. What do you do for a living, Dr. Mangione-Smith?

A. I am an engineer by profession. 09:03:39

Q. And what else do you do?

A. I provide engineering consultation. I am an engineer.

Q. Were you retained by Netlist to provide opinions in this matter related to Netlist's '506 patent? 09:03:51

A. I was through Irell & Manella. Yes.

Q. And the '506 patent has been marked as Exhibit 1001 and is U.S. Patent No. 10,860,506, correct? 09:04:11

A. Yes.

Q. And where do you live?

A. I live in Kirkland, Washington.

Q. And do you have your declaration, marked as Exhibit 2006? 09:04:22

Samsung Ex. 1046, p. 10
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 10
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

A. I do. 09:04:25
Q. And if you go to PDF page 109. Let me know when you're there. Actually 106.
A. Okay. I don't have the -- yeah. I don't have the PDF. I have the Word. So I -- you may 09:04:47
want to send that along as well. Sorry about that.
Q. I did. It was the first thing I sent to you.
A. You did. Okay. Sorry. Let me find that. 09:04:59
Yes, I have it. All right. 109.
Q. 109.
Does PDF 109 of Exhibit 2006 provide your current contact information --
A. Yes. 09:05:23
Q. -- at the top?
Is that a yes?
A. Yes.
Q. Given that this is a remote deposition, meaning we are not in the same physical room 09:05:32
together, there are a few questions I need to ask, starting with: Where are you physically located right now during this deposition?
A. At that address, which is my home address. 09:05:47

Samsung Ex. 1046, p. 11
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 11
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. In Kirkland, Washington? 09:05:47
A. Yes, sir.
Q. And is there anyone else in the room with you right now?
A. There is no one else in the house. 09:05:53
Q. And given that I cannot see the room that you are in, would you please let us know if somebody enters the room that you are in at any time before this deposition concludes.
A. Yes. 09:06:05
Q. And, Dr. Mangione-Smith, what did you bring, if anything, with you to your deposition today?
A. I'm not sure how to answer that question. This is my home office. It's full of stuff. 09:06:20
Q. What do you have in front of you?
A. I've got, on the left, the PDF of my declaration and, to my right, the video Zoom call.
Q. Did you bring any printed documents relevant to this matter for your deposition? 09:06:38
A. No.
Q. And do you have anything besides unmarked PDFs of the documents that have been filed in this IPR?
A. I'm sorry. Could you repeat the 09:06:56

Samsung Ex. 1046, p. 12
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 12
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

question. 09:06:58

Q. Are all of the PDFs that you have in front of you clean copies of documents that were filed in this IPR, or do you have any PDF files with notes on them? 09:07:09

A. I have no notes on any of the PDF files in front of me.

Q. And given that I cannot see whether you have anything in front of you, would you please let us know if you or anyone else puts anything in front of you at any time before this deposition concludes. 09:07:18

A. Sure.

Q. I'll take breaks throughout the deposition, but I want to remind you that during those breaks, under the rules of the PTAB, you should not consult with your counsel about the substance of your testimony. 09:07:30

Understood?

A. I will happily take your representation. I'm not personally familiar with that rule. 09:07:43

Q. And during the deposition, I would ask that you do not look up things on the Internet or do other things on your computer or your phone that we can't see on the camera. 09:07:57

Samsung Ex. 1046, p. 13
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 13
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Understood? 09:07:59

A. Understood.

Q. And do you understand that during your deposition, you should not be emailing or texting other people related to the substance of your 09:08:06 testimony today?

A. Yes, I understand your statement.

Q. What did Netlist ask you to do in this matter?

A. They asked me to -- excuse me -- consider 09:08:20 some documents that were made available as part of the IPR process and to provide expert commentary on -- on them.

Q. Including the '506 patent?

A. Yes. 09:08:41

Q. Did anyone help you with your work?

A. Well, the -- my declaration comprises my conclusions, not conclusions from anyone else.

Did anyone help me with my work? Sure, in various degrees. For example, the exhibits were 09:08:59 made available to me. That certainly was helpful.

Q. And who helps you with your work?

A. I don't recall who made the exhibits available to me. It would have been somebody at Irell. 09:09:16

Samsung Ex. 1046, p. 14
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 14
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. The law firm, Irell & Manella? 09:09:16
A. Yes, sir.
Q. Was there anyone else outside of the law firm of Irell & Manella that helped you with your work in this matter? 09:09:29
A. No.
Q. What did you do to prepare for today's deposition?
A. Well, I -- I had a phone call over -- on Saturday, and -- I had a phone call -- or a Zoom call, rather, on Saturday, and a Zoom call yesterday, and I reviewed a number of documents. 09:09:42
Q. And who attended those phone calls or Zoom meetings on Saturday and yesterday?
A. Mr. Lindsay, and then on Saturday, Ms. Zhong. 09:09:59
Q. Annita Zhong? Is that who you're referring to?
A. Yes, sir.
Q. And how long did -- were those meetings to prepare for the deposition today? 09:10:13
A. So the -- the Zoom call on Saturday was -- was scheduled for four hours. I don't remember if we took the full four hours.
And then there were actually two calls 09:10:32

Samsung Ex. 1046, p. 15
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 15
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

yesterday, which were probably another five hours. 09:10:34

Q. And then you also prepared on your own time for today's deposition; is that correct?

A. Yes, sir, that's correct.

Q. And approximately how long did you prepare in your own time for today's deposition? 09:10:45

A. I couldn't possible answer that. In some sense, from the very first day when I took up this matter was preparation for this testimony.

Q. Within the past week, how long did you prepare on your own for today's deposition? 09:11:01

A. In addition to those last Zoom calls, I would estimate another maybe ten hours.

Q. And in preparation for today's deposition, did you read your expert declaration marked as Exhibit 2006? 09:11:19

A. Yes, I reviewed it.

Q. Approximately how many hours in total have you spent working on this matter?

A. On the IPR specifically? 09:11:41

Q. Yes, on this IPR.

A. I couldn't answer, in part because -- well, I don't keep estimates that closely. And I haven't separated out time from the IPR versus district court litigation time. 09:11:58

Samsung Ex. 1046, p. 16
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 16
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. Have you also been consulting for Netlist with respect to the '506 patent in related district court litigation? 09:12:04

A. I'd have to go back and double-check if this was one of the patents that was asserted. I think I was asserted early on and then taken off. 09:12:20

But I have consulted with them outside of the IPR process in the '506, yeah.

Q. In the past year, approximately how many hours have you spent consulting for Netlist? 09:12:33

A. In all matters, I assume you are asking about?

Q. Yes.

A. Yeah, I -- I don't know. Certainly more than the 20 or so that I did immediately preparing for this deposition and, you know, less than a thousand. I don't know. I don't have a good estimate. 09:12:47

Q. Would a few hundred hours be a good estimate? 09:13:03

A. It might be.

Q. How much are you charging Netlist per hour for your time spent on this matter?

A. I am charging them at what is my current regular hourly rate, which is $750 an hour. 09:13:19

Samsung Ex. 1046, p. 17
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 17
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. So would it be fair to say over the past year, you have charged Netlist in excess of $100,000? 09:13:28

A. I would certainly be comfortable with saying that. 750 times the 20 hours that I said I -- I am confident I immediately used to prepare for this is the amount that I've charged them. I don't know about higher estimate. I could review my billing information, should you wish, and get you the accurate number. 09:13:37 09:13:56

Q. All right. You have that available in your home office?

A. Yes, in my files somewhere.

Q. Okay. Maybe at one of the breaks you could take a quick look. 09:14:05

Is that possible?

A. It is possible.

Q. Okay. Approximately how many times have you been deposed before?

A. Oh, I don't know. More than ten times. Probably more than 15 days. So I would -- some of the matters have involved multiple days. 09:14:16

Q. And have you been qualified as an expert witness before?

A. Yes. 09:14:29

Samsung Ex. 1046, p. 18
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 18
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. In any of the previous cases where you have appeared as an expert witness, has a judge ever stricken parts of your expert report or excluded any opinions that were contained in your expert reports, as far as you know? 09:14:32 09:14:48

A. As far as I know, I'm not sure. There were some portions for the recent Netlist/Samsung district court case of my report that were removed. I don't know if the judge did that or if it was agreement of the two parties or what. 09:15:12

Q. And have you testified at trial as an expert before?

A. Yes, I have.

Q. And how many times?

A. I don't know. Mostly at the ITC in district court. In front of juries, I think three times. 09:15:24

Q. You have Exhibit 2006 in front of you, and then if you could go to PDF page 112.

And let me know when you're there. 09:15:50

A. Okay.

Q. Do PDF pages 112 through 131 of Exhibit 2006 list all of your expert depositions and trial testimony?

A. As of the date when I submitted this CV 09:16:17

Samsung Ex. 1046, p. 19
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 19
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

to Irell & Manella as part of this process, it was my endeavor to list all of my testimony in my -- yes, in this document. I don't know of any errors there. 09:16:20

Q. And if you look on the first page of Exhibit 2006, the document was submitted to Irell & Manella on January 31st, 2023; is that correct? 09:16:35

A. Sure. But I assume you mean this document, not the CV that was included in the appendix. I don't know what date I provided that CV to them. 09:17:04

Q. Well, to be clear, there was -- we only got one document, which is Exhibit 2006, which is what you have, the declaration with the CV at the end. 09:17:15

So when do you think this CV is accurate as of?

A. I believe it was accurate as of the date when I submitted it to Irell. They packaged -- they packaged it up. I did not produce this final PDF. 09:17:29

Q. And approximately when do you believe you submitted your CV to Irell?

A. I don't have an approximate date. I 09:17:41

Samsung Ex. 1046, p. 20
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 20
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

would be happy with submitting one that's current as of today if counsel allows and that would be helpful. But I don't remember exactly when I sent that CV out. 09:17:47

Q. Yeah. I mean, if you have a current CV, we'll take it. 09:17:56

Is that something you have on your computer?

A. Yes, I do.

Q. Okay. Maybe at a break. We don't have to do it right this second. But at the next break, we can get your billing record information and your CV. 09:18:08

Fair enough?

MR. LINDSAY: Objection. This is producing new evidence in the case outside of the normal procedure. 09:18:21

Q. (By Mr. Chandler) Dr. Mangione-Smith, when did you start your work for Netlist in this matter? 09:18:34

A. Assuming "in this matter" means the IPR, I don't know exactly. It was sometime after I started my engagement with them related to Netlist, Netlist and the district court case. This was part of what came out of that work. 09:18:54

Samsung Ex. 1046, p. 21
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 21
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. And that was in 2022 according to PDF page 112 of your expert declaration marked as Exhibit 2006, correct? 09:18:57

A. That seems right.

Q. Is your expert declaration marked as Exhibit 2006 complete, meaning does it provide a complete statement of all the opinions you intend to express in this matter along with the basis and reasons for those opinions? 09:19:14

A. I mean, it holds a complete list of the opinions that I had stated in the declaration. I have no intention of stating any particular opinion going forward. I'll just do my best to answer questions as they come up. 09:19:28

Q. Is your expert declaration marked as Exhibit 2006 accurate as far as you know, meaning it does not have any mistakes? 09:19:52

A. No.

Q. No, it's not accurate; or yes, it is accurate? 09:20:06

A. No, it's not accurate.

Q. So what is inaccurate about your expert declaration marked as Exhibit 2006? Or did you mishear the question?

A. No, I heard the question. There was at 09:20:23

Samsung Ex. 1046, p. 22
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 22
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

least -- well, there was -- there was one section where I believe that we -- that I saw in the review yesterday where the declaration says -- it's talking about a patent, and it misidentifies who owns the patent. 09:20:27 09:20:45

I think it said something like Netlist has a patent that does X, Y and Z. And it really should have been the Petitioner.

Q. And do you know where that mistake is?

A. Not off the top of my head. I could look for it though. 09:21:08

Q. Okay. Please do that and let me know.

And while you're doing that, was there a second mistake, or is that the only one?

A. That's the only one that I'm familiar with. 09:21:16

Q. Is it paragraph 11 on page 4 or something else?

A. Let me check. I'm pretty sure it was much later than that, but... 09:22:39

Yes, that -- you found a second one where -- where I say that I have relied on Petitioner's attorneys for these legal standards. I assume the correct legal term would have been Respondents or Patent Owner. 09:23:07

Samsung Ex. 1046, p. 23
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 23
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. Yes. 09:23:11

A. But that's -- that's not the one that I was thinking of. And I've done a couple of likely search terms and not found it. So I know roughly on the page where it appeared. I believe there was 09:23:25 a footnote on that page as well, if I'm remembering correctly.

Q. Okay. If you find it during the deposition, will you point it out?

A. Yes. I will be happy to. And I'll just 09:23:46 add the commentary that I -- I do think in the context, the -- the proper intention was clear. But if I run across it, I will let you know exactly what I was thinking of.

Q. And to be clear, the mistake that you're 09:24:03 referring to is that you identified the wrong owner of a patent number, but you identified the correct patent number?

A. Yes. Yeah.

Q. Okay. And do you have any -- 09:24:15

A. Oh, I was just going to say, it wasn't -- I am not talking about a patent that's been cited in this matter. It's not part of the prior art. It's just a comment on elements of patents and what people have -- what different entities have done 09:24:32

Samsung Ex. 1046, p. 24
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 24
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

with patents and how they have claimed things in the past. 09:24:35

Q. Okay. Do you have any present plans to correct or supplement your expert declaration marked as Exhibit 2006? 09:24:46

A. I don't know whether that's possible or not. And I have not discussed it with counsel at Irell & Manella.

Q. If you look at the bottom of page 43, top of 44, is that the mistake you're referring to? 09:25:04

A. I believe so, although it is one of the exhibits. Yeah, I assume that that's one of the Samsung's patents. I'd have to -- I don't recall the exhibit number, but that seems right. I identify that as Patent Owner's DDR patents. 09:25:35

Q. Right, but it's not Netlist's patent; it's Samsung's patent. So that's a mistake at the bottom of the page 43, correct?

A. Yes. Yeah, I believe the exhibit and the patent number are correctly identified. The reference to the patent, to who owns it, was incorrect. 09:25:49

Q. And, in fact, the exhibit number is, I think, incorrect as well. It's Exhibit 2009, not 2008? 09:26:03

Samsung Ex. 1046, p. 25
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 25
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

A. I wouldn't know. I -- that could be the case as well. I certainly endeavored to get it correct at the time. 09:26:03

Q. Dr. Mangione-Smith, have you carefully read Netlist's '506 patent marked as Exhibit 1001? 09:26:15

A. Yes, I have.

Q. And do you believe you understand the '506 patent marked as Exhibit 1001?

A. I have an understanding of it. Yes.

Q. Do you recall you understand the figures of the '506 patent marked as Exhibit 1001? 09:26:32

A. Yes, I have an understanding of the figures.

Q. And do you believe you understand the claims at the end of the '506 patent marked as Exhibit 1001? 09:26:44

A. I have an understanding of the claims.

Q. Have you carefully read the Hiraishi prior art reference marked as Exhibit 1005?

A. Yes, I have. 09:27:03

Q. Do you believe you understand the Hiraishi prior art reference marked as Exhibit 1005?

A. Yes, I believe so.

Q. Have you carefully read the Tokuhiro 09:27:13

Samsung Ex. 1046, p. 26
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 26
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

prior art reference marked as Exhibit 1006? 09:27:16

A. Yes.

Q. And do you believe you understand the Tokuhiro prior art reference marked as Exhibit 1006? 09:27:28

A. I have an understanding of that, yes.

Q. Have you carefully read the Butt reference marked as Exhibit 1029?

A. Yes, I would say so. Although with regards to the art reference, for example, by -- by 09:27:41 the Petitioners, I focused on the arguments that they made. But yes, I have an understanding of it.

Q. And do you believe you understand the Butt reference marked as Exhibit 1029?

A. Yes, I do. 09:27:59

Q. Have you carefully read the Ellsberry reference marked as Exhibit 1007?

A. Yes, I have.

Q. And do you believe you understand the Ellsberry reference marked as Exhibit 1007? 09:28:11

A. I believe I have an understanding necessary for forming the opinions that I was asked to consider, yes.

Q. Have you carefully read the Kim reference marked as Exhibit 1008? 09:28:25

Samsung Ex. 1046, p. 27
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 27
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

A. Yes, although unless -- my recollection of Kim is a little bit less. But yes. 09:28:34

Q. Do you believe you -- I'm sorry.

Say it again?

A. But yes, I have reviewed it. 09:28:42

Q. And do you believe you understand the Kim reference marked as Exhibit 1008?

A. I have an understanding of it, yeah.

Q. Have you carefully read the JEDEC Standard JESD79-3C marked as Exhibit 1020? 09:28:54

A. Yes, I have reviewed it.

Q. And do you believe you understand the JEDEC Standard JESD79-3C marked as Exhibit 1020?

A. I have an understanding of it with regards to the issues that I was asked to consider. 09:29:26

Q. And in your declaration, you also cited to some other JEDEC standards as well, correct?

A. Likely.

Q. And do you believe you understood the JEDEC standards that you cited in your expert declaration marked as Exhibit 2006? 09:29:46

A. I believe I have an understanding to the extent needed for me to consider the materials I was asked to consider.

Q. Could you please turn to page 37 of your 09:30:02

Samsung Ex. 1046, p. 28
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 28
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

expert declaration marked as Exhibit 2006. 09:30:06

And let me know when you're there.

A. All right. Yeah, I'm there.

Q. In your expert declaration, did you use July 2012 as the date for a person of ordinary skill in the art with respect to the '506 patent? 09:30:45

A. Yes, I believe so.

Q. Unless stated otherwise today, can you please answer my questions from the perspective of a person of ordinary skill in the art as of July 2012. 09:31:11

A. I will do my best to do that as appropriate, sure.

Q. And can you also answer my questions today in a way that you believe is consistent with the ordinary and accustomed meaning of words to a person of ordinary skill in the art as of July 2012. 09:31:29

A. Yes, I will endeavor to do that as it makes sense in the context of the question. 09:31:48

Q. Before this matter, had you done work for Netlist previously?

A. Yes, I have.

Q. When did you first do any work for Netlist? 09:32:08

Samsung Ex. 1046, p. 29
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 29
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

A. I believe that's listed on my CV. That would have been a few years ago in a matter at the ITC. 09:32:09

Q. If you go to PDF page 116 of your expert declaration marked as Exhibit 2006. Are you referring to the ITC case Netlist versus SK hynix, Case No. 337-TA-1023? 09:32:28

A. Yes, although there were two. I am not sure if that's the first one or the second one. But that is one of them. 09:32:53

Q. And then the second one is above that on the same page, ITC Case No. 337-TA-1089 in 2018; is that correct?

A. Yeah, I see that. Yes, that's -- that's correct. 09:33:10

Q. So were the first two matters that you worked on for Netlist starting in 2017 and 2018?

A. Yes.

Q. And besides those cases and this series of related cases, is there any other work that you've done for Netlist? 09:33:31

A. There was a matter in the -- there was a previous matter in district court, is my recollection, that was involving the law firm Mintz Levin, not Irell. And I did some work for 09:33:54

Samsung Ex. 1046, p. 30
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 30
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

that. I don't think I testified or provided any reports, but I did a small amount of work for that. 09:33:58

Q. And you're referring to what's shown on page 114 of your expert declaration marked as 2006, a matter in the year 2020, Netlist versus SK hynix in the Western District of Texas; is that correct? 09:34:10

A. Yes.

Q. Before you were first engaged by Netlist in 2017, did you know any of the named inventors on the '506 patent identified as Hyun Lee and Jayesh Bhakta? 09:34:29

A. Possibly. Not that I recall however.

Q. When was the first time that you'd heard of the Hyun Lee and Jayesh Bhakta, the named inventors of the '506 patent? 09:34:48

A. I -- I wouldn't know. To be honest with you, I don't usually pay attention to the inventor names. So if you had asked me if I knew those people today before identifying them as the inventors, I probably wouldn't have recalled it. I focus on the -- try to focus more on the technical details. 09:35:02

Q. Do you own any Netlist stock or stock options?

A. No, I do not. 09:35:11

Samsung Ex. 1046, p. 31
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 31
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. And is your compensation in this case contingent in any way on the outcome? 09:35:12

A. No, it is not.

Q. In your expert declaration marked as Exhibit 2006, could you please go to paragraph 10 on page 4. 09:35:24

Let me know when you're there.

A. Okay.

Q. You reviewed the declaration submitted in this matter by Dr. Khatri, correct? 09:35:48

A. Yes, that's correct.

Q. Do you disagree with any of Dr. Khatri's opinions?

A. I wasn't asked to consider whether I agreed with every opinion he stated in that declaration. So there may be ones that I disagree with. I don't recall as I sit here. 09:36:12

Q. Do you identify any disagreement with Dr. Khatri in your declaration?

A. I don't believe so. 09:36:28

No, that's the only reference to him.

Q. And so to be clear, if you want to double-check, his declaration was marked as Exhibit 2005.

A. I -- I don't know. I am searching for 09:37:23

Samsung Ex. 1046, p. 32
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 32
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

2005. I don't see a reference to that in mine. 09:37:25

MR. LINDSAY: Counsel, could I ask, if you'd like the witness to consider a document, please introduce it.

MR. CHANDLER: Well, I am trying to ask him if he expressed any disagreement with Dr. Khatri. 09:37:39

Q. (By Mr. Chandler) And, Dr. Mangione-Smith, now that you've had an opportunity to search through your declaration marked as Exhibit 2006, are you aware of any instance where you disagree with any opinions by Dr. Khatri? 09:37:56

A. Not that I am aware of, no.

Q. Could you go to paragraph 38 of your declaration marked as Exhibit 2006. 09:38:13

And let me know when you're there.

A. All right. I'm at paragraph 38.

Q. Am I correct you adopted the Petitioner's statement with respect to the level of ordinary skill in the art for a person of ordinary skill in the art; is that fair? 09:38:51

A. Yes.

Q. Let me give you, if you don't have it already, Exhibit 1003, which is Dr. Wedig's 09:39:16

Samsung Ex. 1046, p. 33
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 33
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

declaration. I'll just send it through the chat, or you can pull it up if you have it locally, whatever is easiest for you. 09:39:21

And go to Dr. Wedig's statement about the person of ordinary skill in the art, which appears on page 12 of Exhibit 1003, starting at paragraph 37. 09:39:35

And let me know when you're there.

A. All right. I see it.

Q. All right. For purposes of this proceeding, do you agree that a person of ordinary skill in the art would have been someone with an advanced degree in electrical or computer engineering; and at least two years of work experience in the field of memory module design and operation, or a bachelor's degree in such engineering disciplines; and at least three years of work experience in the field? 09:40:13 09:40:25

A. If that matches my representation of my understanding of the Petitioner's definition on paragraph 37 of my declaration, yes. 09:40:44

Q. It's a little unclear to me. Were you -- so you're indicating that you were looking at the petition. So let's go ahead and look at the petition then. 09:41:10

Samsung Ex. 1046, p. 34
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 34
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Do you have the petition, or do you want me to send it to you? 09:41:13

A. I do not have it handy.

Q. All right.

A. And I will let you know once I have it opened. 09:41:39

Q. All right. Do you see at the bottom of page 2 of the petition marked as Paper 1, there is a heading "Person of Ordinary Skill in the Art"?

A. Yes, I see that. 09:42:14

Q. And you see that the petition marked as Paper 1 cites to Dr. Wedig's declaration marked as Exhibit 1003, specifically to paragraph 37, in support of the definition of a person of ordinary skill in the art? 09:42:34

A. I see that there is a -- a citation to that.

Q. And for purposes of this proceeding, do you agree that a person of ordinary skill in the art would have been someone with an advanced degree in electrical or computer engineering; and at least two years of work experience in the field of memory module design and operation, or a bachelor's degree in such engineering disciplines; and at least three years of work experience in the field? 09:42:46 09:43:02

Samsung Ex. 1046, p. 35
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 35
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

A. Yes. I was following along. That's what I say at paragraph 37 of my declaration. 09:43:09

Q. And do you believe that you personally are at least a person of ordinary skill in the art?

A. Yes. 09:43:19

Q. Do you agree a person of ordinary skill in the art would have been familiar with the JEDEC industry standards?

A. They may have been.

Q. Do you agree a person of ordinary skill in the art would have been knowledgeable about the design and operation of computer memories, including DRAM and SDRAM devices that were compliant with various standards and how they interact with other components of a computer system, such as memory controllers? 09:43:32 09:43:45

A. They may have been. There are many different types of memory systems. The JEDEC specifications refer to, you know, one of the most commercially common types in use today. 09:44:02

Q. And when you say "one of the most commercially types in use today," what are you referring to?

A. The various JEDEC standards. It's an industrial consortium, as I understand it. So 09:44:16

Samsung Ex. 1046, p. 36
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 36
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

they're trying to develop standards and specifications in order to sell products. 09:44:18

Q. With respect to memory devices and memory modules?

A. Yes. 09:44:30

Q. Do you agree a person of ordinary skill in the art would have been familiar with the structure and operation of circuitry used to access and control computer memories and other components of the memory system? 09:44:43

A. They likely would have been -- have some familiarity with some of those types of circuits, yes.

Q. Do you agree a person of ordinary skill in the art would have been familiar with circuits such as ASICs and CPLDs, as well as low-level circuits such as data buffers, tri-state buffers, flip-flops and registers? 09:44:55

A. I would not say that, no.

Q. Why not? 09:45:17

A. Well, some of those that you referred to are literally circuits. Others are largely devices that are used to implement other circuits. So it's a circuit design technology, I guess I would say, rather than being circuits of any particular type 09:45:42

Samsung Ex. 1046, p. 37
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 37
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

of interest in this matter. 09:45:46

Q. Do you agree a person of ordinary skill in the art would be familiar with what's known as ASICs and CPLDs?

A. They would probably have some familiarity with that. 09:46:00

Q. And what is an ASIC?

A. ASIC stands for application-specific integrated circuit.

Q. And what's a CPLD? 09:46:14

A. That stands for complex programmable logic device. Sometimes it's used to refer to elements that are also called FPGAs. The -- the precise boundary between the two is, in my opinion and experience, a little bit blurry. 09:46:34

Q. And at a high level, how would you explain to a layperson what an ASIC is and what a CPLD is?

A. Well, certainly at -- at a very high level outside of the -- the particular context of this matter, I would say an ASIC is a physical, what we call, chip that somebody designed to serve a specific purpose. 09:46:53

So, for example, Intel makes CPUs that are called general purpose that -- that would not 09:47:18

Samsung Ex. 1046, p. 38
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 38
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

be an ASIC. 09:47:20

When I was at Motorola, I was involved in the design of a memory interface chip that was an ASIC, because that particular design was intended to work with one particular product. 09:47:37

Q. And what about a CPLD? How would you explain that at a high level to a layperson?

A. Well, so one type of circuitry that we design is called digital logic. And a CPLD is one way to implement digital logic. So I could come up 09:47:58 with a digital logic circuit that served a particular task that I needed implemented and then decide to put that -- the -- actually instantiate it, create it, in the form of an ASIC; or, in many cases, I could use -- I could choose to implement 09:48:19 it using a CPLD or an FPGA.

Those are oftentimes engineering or economic design choices, just alternatives.

Q. So if I understand what you just said, digital logic could be implemented in an ASIC, or 09:48:38 alternatively in a CPLD, or alternatively in an FPGA; is that fair?

A. Yes, although it depends on the particular digital circuit. Some of them -- if it's relatively small and relatively low speed, 09:48:56

Samsung Ex. 1046, p. 39
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 39
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

that is in general the case that you could use any of those three alternatives. 09:48:59

But ASIC designs tend to provide much greater speed. So if speed is a dramatic concern, one implementation technology would be more attractive over another. And some may just not be practical at all. 09:49:14

Q. You referred to some design choices or alternatives between an ASIC, CPLD and FPGA.

At a high level, how would characterize the design choices that would lead a person of ordinary skill in the art to either an ASIC or a CPLD or an FPGA? 09:49:32

MR. LINDSAY: Objection. Form.

THE DEPONENT: Oftentimes those sorts of decisions are made -- they are -- they are significant economic consequences in terms of marketing and development cost. So those decisions are made by people -- not by what we're discussing as a person of ordinary skill in the art here, although a person who makes those kinds of decisions could also be a person of ordinary skill in the art in the context of the '506 patent. 09:49:49 09:50:09

Q. (By Mr. Chandler) So when you say "significant economic decisions," do you mean that 09:50:23

Samsung Ex. 1046, p. 40
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 40
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

there's a -- more of a business reason to choose an ASIC, CPLD or FPGA as opposed to a technical reason? Or were you referring to something else? 09:50:26

MR. LINDSAY: Objection. Form.

THE DEPONENT: I am referring to that there almost always are significant business reasons on top of the technical reasons that we talked about previously. 09:50:39

Q. (By Mr. Chandler) And at a high level, what would be the sort of business reasons in favor of an ASIC or a CPLD or an FPGA compared to the other alternatives? 09:50:50

MR. LINDSAY: Objection. Form.

THE DEPONENT: Well, for the most part, an ASIC is going to provide what we would refer to as the greatest density. So the -- the literal resources in terms of silicon required for implementing a particular circuit will be smaller with an ASIC, the power consumption will tend to be much lower, and the speed will -- the ASIC will give the opportunity to achieve increased performance. 09:51:06 09:51:25

One big problem with an ASIC -- or rather, the downside is that some elements of the engineering design process are much more 09:51:41

Samsung Ex. 1046, p. 41
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 41
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

significant, and there's much greater -- up-front manufacturing costs, often referred to as NREs, nonrecov- -- nonrecurring engineering costs. 09:51:44

Whereas an FPGA or a CPLD, there are no -- essentially no NREs costs. Those are commodity parts that are produced by a third party. Someone could go out and just buy those, and then they have to do the design time process to figure out how to implement the circuit in them. 09:52:04

CLPDs have historically been smaller and slower and cheaper. FPGAs have historically been larger, more complex, more capable, more expensive. But as I suggested, the line between them is a little bit blurry. 09:52:22

It's easy -- it's oftentimes easy for me to look at something and say, "Oh, yeah that's a FPGA"; and an alternative, "Oh, no, that's -- that's a CPLD," you know. But as they get closer together, different people might disagree. 09:52:42

Q. (By Mr. Chandler) You mentioned an ASIC has a larger up-front cost. Does the ASIC have a lower marginal cost if you are producing a high volume of the ASICs? 09:52:57

MR. LINDSAY: Objection. Form.

Q. (By Mr. Chandler) Compared to a CPLD or 09:53:10

Samsung Ex. 1046, p. 42
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 42
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

FPGA? 09:53:12

MR. LINDSAY: Objection. Form.

THE DEPONENT: I really don't know. I mean, I would -- I would assume so. As products go into higher volume, they tend to move to ASICs if 09:53:20 they didn't use one to begin with.

But that's really not my area of expertise.

Q. (By Mr. Chandler) Do you believe a person of ordinary skill in the art would be 09:53:31 familiar with circuits such as data buffers, tri-state buffers, flip-flops and registers?

A. Certainly tri-state buffers, flip-flops, and I think the last one you said was registers.

Data buffers have a particular meaning, I 09:53:54 believe, in the context of much of the art that we're looking at. So a person of ordinary skill in the art would have an understanding of the general concept of a data buffer. They wouldn't necessarily have an understanding of the specific 09:54:14 way that term is used in the context, for example, of the -- the JEDEC standards.

Q. What's a register, and how would you explain it to a layperson?

A. Well, I haven't taught in quite a few 09:54:32

Samsung Ex. 1046, p. 43
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 43
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

years. But at a very high level, off the top of my head, I would say a register is a piece of hardware that's able to store, over a period of time, a piece of digital information. Typically, that information can be updated over time and accessed at a later point in time. 09:54:34 09:54:55

Q. And how would you explain what a flip-flop is to a layperson?

A. A flip-flop a little bit more complicated because there are many different types of flip-flops. One of the most common would be called a D flip-flop which, in many ways, people often -- I believe people often would consider that to be a 1-bit register. 09:55:14

Q. And how does a D flip-flop or a 1-bit register work at a high level? 09:55:30

A. There is a piece of information that's coming in. And there's a 1-bit input, there's a 1-bit output, there's a clock signal, and then typically there's a signal that says "write" or "update." 09:55:50

And so the output signal produces -- makes available whatever 1 bit of information is stored in the D flip-flop continuously.

And then the update signal, or sometimes 09:56:07

Samsung Ex. 1046, p. 44
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 44
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

it's called a write-enable signal, causes the D flip-flop to change the value. Well, to -- to make sure that the value it contains reflects the value on its input line. 09:56:10

Q. And what gets output of the flip-flop? 09:56:29

A. Whatever -- well, in the case of the -- the D flip-flop, whatever 1 bit of information it had been told to maintain over time.

Q. And you may have explained it a moment ago, but I just didn't understand it. 09:56:58

What does the clock do in a D flip-flop?

A. A clock is used generally to make sure that the whole system maintains a sense of synchronization. Most digital logic is called "synchronous," which means that all of the state information for the digital circuitry changes on a -- on a regular sort of heartbeat. And that's the clock I was referring to. 09:57:15

Q. How would you explain what a tri-state buffer is to a layperson? 09:57:34

A. Well, at a high level, I'd be inclined to say that a tri-state buffer is like a gate. So there's an input and there's an output. And then there's a control signal, which says "make sure the output reflects what the input is." 09:57:57

Samsung Ex. 1046, p. 45
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 45
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

It's a little bit tricky in the sense that if that control is turned off, the output of the tri-state buffer is something such that it doesn't reflect any particular value. And the outputs of two tri-state buffers can be wired together, and as long as only one of them is activated at a time, they won't run into electrical problems. 09:58:04 09:58:18

Q. And is there a name for that state you were just referring to? 09:58:32

A. Broken.

Q. "Broken," like broken wire?

A. No, no. I mean, if -- if you have two tri-state buffers outputs connected together, and they are both turned on, you've got -- you've got a broken design. It's wrong. It's prone to failure. 09:58:45

Q. And what I was trying to refer to is when the two tri-state buffers are not turned on and your system is not broken, what is the name of that state -- 09:59:09

A. Okay.

Q. -- when the tri-state buffer is not turned on?

A. The output is oftentimes referred to as a Z state. 09:59:21

Samsung Ex. 1046, p. 46
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 46
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. The letter Z? 09:59:22
A. Yes, sir.
Q. And what does the letter Z stand for or mean?
A. To be honest with you, I don't recall. 09:59:33
Yeah. It just means that the -- the buffer is -- is not driving any signal. So if somebody else is trying to drive a signal that's connected to the output of the buffer, that it will be okay. The buffer won't interfere with it. 09:59:54
Otherwise, the problem is if you have two buffers turned on, and one of them is trying to drive an output of 0 volts, and the other one is trying to drive an output of 5 volts, that's a logical error. And it's difficult to describe, to 10:00:09 be sure, exactly what the actual value on that combined output wire would be.
Q. Why is it called a tri-state buffer? What are the three states?
A. Well, we're talking about digital logic. 10:00:29 So the three states would be either 0, 1 and Z; or high, low and Z, with 0 and 1 being the same as -- I guess I said that, and I reversed the order.
0 is typically called low, and 1 is typically called high. But they're referring to 10:00:49

Samsung Ex. 1046, p. 47
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 47
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

the same two states. 10:00:52

Q. And how would you explain to a layperson what the Z state of a tri-state buffer is?

A. It's a Z -- it's a state where the buffer has no -- I might be inclined to say it's a state 10:01:08 where the buffer has no impact on the wire on the circuit to which it is connected.

Q. If I understand correctly, would it be fair to say when a tri-state buffer is in a Z state, it's as if that tri-state buffer were 10:01:32 disconnected from the rest of the circuit?

A. That is certainly the logical intent. Of course, it is still connected. There are still some electrical properties. But that is the intention for the tri-state buffer. 10:01:50

Q. Okay.

MR. CHANDLER: Why don't we take a quick break. And during the break, if you could do two things for me.

One, quickly look at your billing records 10:02:02 with respect to how much you have billed Netlist in the last year.

And, second, quickly look at your current CV and let me know if the CV that's attached to the back of Exhibit 2006 is out of date, or if the CV 10:02:14

Samsung Ex. 1046, p. 48
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 48
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

at the back of 2006 is essentially more or less current. 10:02:19

Fair enough?

THE DEPONENT: I will talk to Mr. Lindsay. 10:02:27

MR. LINDSAY: I object.

Okay. Just because he's sitting in his office doesn't mean you get to take additional discovery of everything he has in his desk and on his computer. 10:02:35

You can ask him questions, and he's going to answer to the best of his knowledge, and that's it.

MR. CHANDLER: All right. Let's go off the record, and we'll come back. 10:02:44

THE VIDEOGRAPHER: We're going off the record. The time is 10:02.

(Recess taken.)

THE VIDEOGRAPHER: We're going back on the record. The time is 10:13. 10:13:19

Q. (By Mr. Chandler) Dr. Mangione-Smith, as a reminder, did you talk with your counsel or anyone else during the break?

A. No, I did not.

Q. Do you believe the CV at the end of your 10:13:36

Samsung Ex. 1046, p. 49
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 49
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

declaration marked as Exhibit 2006 is up to date? 10:13:39

A. Let me review that.

No. I can identify at least one matter that I have worked on that is not there, which related to -- which was on behalf of DivX in a 10:14:30 disagreement they had with Harman.

Q. Do you want to spell it, for the benefit of the court reporter, DivX and Harman.

A. DivX is D-I-V-X. And Harman, I guess, is H-A-R-M-A-N. 10:14:49

Q. Other than the DivX versus Harman matter, are you aware of anything else that is missing from your CV at the end of Exhibit 2006?

A. Not that occurs to me as I sit here.

Q. All right. And, approximately, how much 10:15:11 do you believe that you have billed to Netlist over the past year?

MR. LINDSAY: Objection. Asked and answered.

THE DEPONENT: Yeah, I -- I don't really 10:15:21 have any more information to provide above and beyond what we discussed prior to the first break.

Q. (By Mr. Chandler) Were you familiar with the JEDEC standards at the time of the claimed invention in the '506 patent, which is to say 10:15:41

Samsung Ex. 1046, p. 50
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 50
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

around July of 2012? 10:15:44

A. I was familiar -- I had a familiarity with JEDEC, the organization.

Q. Had you ever taught any of the JEDEC standards to any of your students? 10:15:57

A. I have taught, certainly, many aspects of interfacing to memory devices, some of which are key elements of various JEDEC standards. But I wouldn't say that I ever stepped back and said, "Okay, now we are going to learn specifically about this JEDEC standard." 10:16:22

Q. When you taught students, do you recall ever showing any of them any specific JEDEC standards?

A. No, it was largely focused in when I taught on technology, not industrial consortiums. 10:16:43

Q. Have you ever attended a JEDEC meeting yourself?

A. No, I have not.

Q. Could you turn to your CV at the back of Exhibit 2006, which I believe starts on page 109 of the PDF file. 10:17:10

A. Okay. I am there.

Q. And your CV runs from PDF pages 109 through 136 of Exhibit 2006, correct? 10:17:33

Samsung Ex. 1046, p. 51
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 51
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

A. Yes, I believe so. 10:17:42
Q. So it's 28 pages long, single-spaced?
A. There's multiple spaces in some cases. I -- it's -- yeah, it runs from 109 through -- to the end, which I think is 136. 10:17:58
Q. 28 pages?
A. Yeah, sure.
Q. I searched your CV for the acronym "JEDEC," but I did not see a match.
Does that sound possible to you? 10:18:12
A. Anything is possible.
Q. When you search for "JEDEC," do you see any hits in your CV?
A. I haven't felt the need to go back and search for "JEDEC" in my CV in the past. 10:18:34
Q. Can you do it right now?
A. I do not see that word in my CV.
Q. And then if you search for "memory module" in your CV, all of the hits are related to your consulting for Netlist, correct? 10:19:16
A. They may be. I haven't searched for "memory module" in my CV in the past.
Furthermore, it's my opinion that memory modules, in my work for Netlist, have a particular meaning, for example, DDR DIMMs of various sorts, 10:19:37

Samsung Ex. 1046, p. 52
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 52
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

while -- while the term "memory module" can have a much broader meaning in general. 10:19:45

Q. Can you explain that last answer a little bit more, what -- the point you are trying to make?

MR. LINDSAY: Objection. Form. 10:20:02

THE DEPONENT: Well, if I -- I could build a memory system with separate DRAM chips and own my custom controller or an ASIC that are -- or even simpler. I could take the components of -- literally of a DDR DIMM and put them on a motherboard, so that there was no separate PC board or no inserting something into a socket. 10:20:19

From an engineering point of view, I would say that nothing has changed, while certainly things have changed from a business and manufacturing point of view. 10:20:43

So one could say, "Well, that's still a memory module," if it was one.

Or one could say, "No, that's not a memory module. A memory module means something that can be inserted into a -- or coupled to a motherboard," for example. 10:20:54

Q. (By Mr. Chandler) And how do you believe that a person of ordinary skill in the art would understand the phrase "memory module"? 10:21:10

Samsung Ex. 1046, p. 53
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 53
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

MR. LINDSAY: Objection. Form. 10:21:13

THE DEPONENT: I think it depends on the context. I think in the context of the '506 and what we are talking about, largely, absent some other illuminating language, a person would 10:21:24 generally understand it to at least cover things like various DDR DIMMs.

Q. (By Mr. Chandler) And for the benefit of the court reporter, could you spell DIMM and explain what that is. 10:21:39

A. Yeah. DIMM is D-I-M-M. And that stands for dual in-line memory module.

And D-D-R stands for double data rate.

Q. So can you search your CV for "memory module" and confirm that the only hits are for the 10:22:02 consulting work you did for Netlist.

A. The phrase "memory modules" appears to only appear under the -- in my CV under headings for work that I've done for Netlist.

MR. CHANDLER: I'd like to introduce a 10:22:50 new exhibit, which I'll mark as Exhibit 1047. And I'll send it through the chat to everyone.

(Exhibit 1047 was marked for identification by the Court Reporter and is attached hereto.) 10:22:58

Samsung Ex. 1046, p. 54
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 54
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. (By Mr. Chandler) Let me know when you have it on your screen, Dr. Mangione-Smith. 10:23:00

A. Yes, I see that.

Q. Exhibit 1047 is Netlist's "Technology Tutorial" in the ITC case where you were providing expert testimony about memory modules, correct? 10:23:24

A. I'll take your representation that that number is the ITC -- is one of the ITC cases. I don't recall for sure.

Q. And do you recall this technology tutorial marked as Exhibit 1047? 10:23:43

A. No, not really.

Q. But you were at trial in the ITC Case 337-TA-1023 when the "Technology Tutorial" marked as Exhibit 1047 was presented to the judge, correct? 10:24:03

A. I may have been. Oftentimes I am not -- even when I'm in town to testify, I am not in trial the full time.

And furthermore, particularly at the ITC, I've seen technology tutorials that were done well in advance of trial and without me present. I don't recall if that was the case here or not. 10:24:18

Q. Do you recall any errors or misstatement in Netlist's "Technology Tutorial" marked as 10:24:33

Samsung Ex. 1046, p. 55
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 55
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Exhibit 1047? 10:24:37

A. Given that I don't recall the "Technology Tutorial," I would say that I don't recall any errors or misstatements within it.

Q. Could you turn to page 2 of Exhibit 1047. 10:24:48
And let me know when you're there.

A. Yes, I'm there.

Q. Does page 2 of Exhibit 1047 show a picture of a DIMM, which I believe you said is a dual in-line memory module? 10:25:04

A. Yes, it does.

Q. Could you turn to page 3 of Exhibit 1047.
Let me know when you're there.

A. Okay. I'm there.

Q. Do you agree that SDRAM memory devices 10:25:22
"emerged in the 1990s and have been standardized by JEDEC" [as read]?

A. That may be the case. I don't have that particular opinion. I haven't -- like I said, I don't recall seeing this document or reviewing 10:25:45
them. It's not clearly wrong as to my recollection as I sit here today.

Q. Do you agree that "SDRAM has evolved in several generations, including DDR, DDR 2, DDR 3 and currently DDR 4"? 10:26:01

Samsung Ex. 1046, p. 56
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 56
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

A. Those are examples of SDRAM technology. There are many other examples of SDRAM technology as well. 10:26:06

Q. But I believe you said earlier that's one of the common examples of SDRAM technology: DDR1, DDR2, DDR3 and currently DDR4; is that fair? 10:26:16

A. I don't -- I don't recall testifying to that.

Q. Do you believe that's correct?

A. It is certainly a common form of SDRAM. But SDRAM is used in many contexts that are not DDR of any sort. 10:26:34

Q. Please turn to page 4 of Exhibit 1047.

Let me know when you're there.

A. Okay. 10:26:55

Q. Do you agree that "SDRAM contains several sections called banks"?

A. It might. It depends on the particular SDRAM.

Q. Do you agree that each bank within an SDRAM "consists of rows and columns of memory"? 10:27:15

A. It might. That's a common design. It depends on the details of the particular design.

Q. So would it be fair to say that a common design of SDRAM is that it "contains several 10:27:34

Samsung Ex. 1046, p. 57
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 57
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

sections called banks" and "each bank consists of rows and columns of memory"? 10:27:37

Would that be a common design?

A. Outside of the context of any particular patent, that might be a common design. Although, as I said, we're examining a document that I certainly don't recall and I'm not sure I ever seen. 10:27:45

Q. Could you turn to page 5 of Exhibit 1047.

And let me know when you're there. 10:28:01

A. Okay. I'm there.

Q. Do you agree that "a rank is a set of DRAMs that are written to or read from together"?

A. In -- in this context, in this example, that's how the term "rank" is typically used for DDR DIMMs, multi-rank DDR DIMMs. Many DIMMs only have one rank. 10:28:17

Q. And what does "DQ" stand for?

A. Oftentimes, that's used to refer to the data which is moved between a memory controller, which is typically -- in the context of a system that uses DDR DIMMs is going to be on a motherboard, and the DIMM itself. 10:28:45

Q. And do you agree that this page 5 of Exhibit 1047 illustrates the concept of two ranks, 10:29:05

Samsung Ex. 1046, p. 58
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 58
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

highlighted in green and red, where each rank comprises eight DRAM memory devices, each DRAM memory device is 8 bits wide, resulting in each rank of memory devices having a total bit width of 64 bits? 10:29:11 10:29:32

A. Some aspects of what you just said I think are clearly illustrated here. Some aspects of it are much less clear.

Q. And what's less clear to you?

A. Well, for example, it's not clear that the devices marked DRAM1, 2, 3, 4 and 5 are physical devices. 10:29:53

Most DRAM chips that I'm familiar with, at least currently, are 4 bits, not 8 bits.

But you can design a physical chip like that to have various widths, usually in terms of a power of two. 10:30:11

Q. All right. And so are memory modules limited to a 64-bit width, or are other bit widths possible? 10:30:37

MR. LINDSAY: Objection. Form.

THE DEPONENT: Other bit widths are possible. In fact, I believe that we've seen some examples where other bit widths are used. Yeah.

Q. (By Mr. Chandler) So, for example, the 10:30:52

Samsung Ex. 1046, p. 59
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 59
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

memory module could be 32 bits or 16 bits; is that fair? 10:30:53

MR. LINDSAY: Objection. Form.

THE DEPONENT: They -- they could be. I don't know that that would then satisfy what's colloquially referred to as a DDR or a DDR DIMM in general, let alone any particular JEDEC standard. A more common example would be 72 bits, which certainly falls within various JEDEC standards. 10:31:00

Q. (By Mr. Chandler) In the example on page 5 of Exhibit 1047, you see at the bottom it says "x8," which is referred to in the middle of as "by eight"? 10:31:26

A. Yes, I see that.

Q. And what's "by eight" mean? 10:31:43

A. Well, it says -- in the middle there, it says it "writes 8DQ bits," and then that's referred to as "by eight."

So it means there's -- it's representing that each one of those arrows conveys 8 bits of data, which almost always means it's got eight physical signal lines, although it might have -- easily have 16 or some control signals as well. 10:31:57

Q. So in the example on page 5 of Exhibit 1047, would each DRAM be 8 bits wide or 10:32:18

Samsung Ex. 1046, p. 60
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 60
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

referred to as by-eight DRAM? 10:32:24

MR. LINDSAY: Objection. Form.

THE DEPONENT: That seems to be what they're indicating here, yes.

Q. (By Mr. Chandler) And -- 10:32:38

A. In this -- in this particular example, yeah.

Q. And did you state previously that DIMM memory modules can also have DRAMs of other widths, such as by-four, which would be 4 bits wide? 10:32:50

MR. LINDSAY: Objection. Form.

THE DEPONENT: Yes. I believe -- well, yes. I'll just leave it at that.

Q. (By Mr. Chandler) What are the most common bit widths for DRAMs on a memory module? 10:33:06

A. I was just about to comment on that. But then I caught myself because the fact of the matter is, I -- I don't sell products in that marketplace. I don't know what's the most common.

I believe that by-four is not at all uncommon. But -- and it may very well be the most common. But the fact of the matter is, I really don't know. 10:33:22

Q. But at least by-four and by-eight would be well-known widths of DRAM memory devices for a 10:33:38

Samsung Ex. 1046, p. 61
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 61
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

DIMM memory module; is that fair? 10:33:45

MR. LINDSAY: Objection. Form.

THE DEPONENT: I -- I would think so, although I'm only cautious to the extent I'm really not sure how common by-eight is. As a concept, 10:33:54 it's -- it's certainly not surprising. I just don't know. Even less than the by-four, I don't know what sort of market penetration it has.

Q. (By Mr. Chandler) Right.

So your instinct is that by-four would be 10:34:08 more common than by-eight as far as a bit width for a DRAM memory device on a memory module?

MR. LINDSAY: Objection. Form.

THE DEPONENT: I would say that that sounds like my instincts as I sit here today for 10:34:21 the current market. But that may just be a consequence of the particular devices that I have reviewed over the last few years.

Q. (By Mr. Chandler) And do you agree that the data lines on a standard DIMM are 10:34:36 bidirectional, meaning that the same data line that's used for a write operation can also be used at a later time for a read operation and vice versa?

MR. LINDSAY: Objection. Form. Also 10:34:52

Samsung Ex. 1046, p. 62
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 62
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

beyond the scope of direct. 10:34:53

THE DEPONENT: Yes. Most memory modules of this sort are intended to both -- for the memory controller to write data into it and to read data from it. And it's not uncommon for the read and write data to go over the same set of physical wires. 10:35:10

Q. (By Mr. Chandler) And you talk about bidirectional in your expert declaration marked as Exhibit 2006, right? 10:35:22

B-I, hyphen, directional.

A. Likely. It wouldn't surprise me, yeah.

Q. Can you turn to page 6 of Exhibit 1047.

Let me know when you're there.

A. Okay. 10:35:41

Q. Do you agree that DQS refers to the data strobe signal?

A. So I would say that DQS and what an engineer would refer to -- would speak as a DQS bar -- and it's shown here as DQS with a line over the top of it in this example -- together form a data strobe signal. 10:36:08

Although in -- in other contexts, outside of a DDR DIMM and the JEDEC standard, oftentimes you would only have one strobe, not two. Or one 10:36:28

Samsung Ex. 1046, p. 63
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 63
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

wire for that purpose, rather. 10:36:31

Q. And can you explain that a little bit more, what you're referring to by "DQS" and "DQS bar" and how they work together to create the data strobe signal. 10:36:43

MR. LINDSAY: Objection. Form.

THE DEPONENT: Yeah. So this mechanism of sending a piece of information like a strobe signal over two wires that are complementary is often used in -- as the speed of digital circuits 10:37:02 gets faster. And so by "complementary" here, all I mean is that when one of the physical wires, the -- the electrical signal on it -- as opposed to the logical signal -- when the electrical signal goes high, the complementary wire, the electrical signal 10:37:18 will go low.

And so a receiver can watch both of those signals, electrical signals, and more reliably determine when the logical signal, like the actual strobe signal that -- that someone wants to send, 10:37:34 has made a transition.

Q. (By Mr. Chandler) And is that concept shown on page 6 of Exhibit 1047, what you were just describing?

A. Yeah, as -- yes, I would -- I would say 10:37:51

Samsung Ex. 1046, p. 64
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 64
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

it is. You'll see there's a -- an arrow towards the left of the page that's marked "tDS." Like I said, I haven't reviewed this, but there's a concept called data setup or setup time. I assume that stands for time for data setup or time for, you know, the -- the D signal to be set up. 10:37:54 10:38:15

And then immediately to the right of that, there's something called "tDH." And that, I think, stands for time data hold.

So these are specifications that say, if you want to send that information, you to have adhere to whatever the setup and hold time specifications are. 10:38:35

Q. And do you agree that DQ can refer to the data signal? 10:38:52

A. It -- sure, it can. Yeah.

Q. And do you agree that the DQS data strobe clocks the DQ data signal into and out of the DRAM memory device?

MR. LINDSAY: Objection. Form. 10:39:11

THE DEPONENT: I don't know that I would say that. It -- it's used to control when the -- whatever is receiving this, the data, samples it. But ultimately, there will be some delay due to what we call propagation delay, and it's not -- 10:39:33

Samsung Ex. 1046, p. 65
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 65
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

it's not a clock signal. 10:39:38

Q. (By Mr. Chandler) When you say "it's not a clock signal," what is not a clock signal?

A. Neither the DQS nor the DQS bar nor the DQ data signals are clock signals. None of those 10:39:50 are clock signals. That's why -- I wouldn't generally be inclined to say they are clocking the data into whatever the receiver is.

Q. And what would you be inclined to say instead? 10:40:05

A. They control when the receiver captures the data, when it samples it. When it latches it, is a term that's also used, or when it registers it.

Q. And what about when data goes out of the 10:40:20 DRAM? How would you characterize that term for when the DQS strobe signal clocks the DQ data out of the DRAM? How would you describe that?

MR. LINDSAY: Objection. Form.

THE DEPONENT: Well, again, I -- I 10:40:42 wouldn't characterize it as clocking. And this is in the specific context of -- of DDR DIMM standard devices.

But, again, the strobe signals in general, and certainly in this case, are used to 10:40:58

Samsung Ex. 1046, p. 66
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 66
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

indicate that a particular time has arrived when data carried on some other signal wires should be sampled. 10:41:01

Q. (By Mr. Chandler) Does the DQS strobe signal -- is it used for when DQ data goes out of the DRAM or only when it goes into the DRAM? 10:41:20

A. Well, again, it -- it depends on the particular context. In the context of a JEDEC standard DDR DIMM, all of the ones that I'm familiar with, the -- the DQS signal -- and from now on, hopefully it's clear when I say "DQS," I mean the two complementary wires. But the DQS signal will go from a controller to the memory chip, telling it to sample when -- when a write is being done, and will generally come from the memory chip to a controller when a read is being done. 10:41:45 10:42:09

Q. Do you agree that "one nanosecond is one billionth of a second"?

A. Now you've -- you've hit one of my professional weaknesses. It says that here. I -- I don't recall. I have no reason to think it's wrong. I trust that whoever put that on there checked it. 10:42:30

I do know that it's about 18 inches of a copper wire, but that's... 10:42:48

Samsung Ex. 1046, p. 67
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 67
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. That was my next question. 10:42:49

Do you agree that a signal travels roughly 6 inches in one nanosecond in a memory module, not accounting for load?

A. It may. It -- well, first of all, you have to account for load. And it depends an awful lot on the impedance of what it's traveling over. 10:43:02

Q. What is load?

A. Load generally refers to other electrical circuits that have an impact on the propagation delay of a signal. 10:43:23

Q. Your recollection was that a signal would travel, I think you said, about 18 inches in 1 nanosecond on copper wire?

A. I think that's -- that's about right. There's a famous story by Admiral Grace Murray Hopper who would go around and give talks. She was an engineer and a Navy admiral who was behind a lot of supercomputing development. And this was back when 1 nanosecond was incredibly short. 10:43:40 10:43:56

And she would give talks and hold up a piece of wire and say, "You've got to think about this. If you're talking about 1 nanosecond, you can't have a wire go more than..."

And so I'm guessing it was probably about 10:44:09

Samsung Ex. 1046, p. 68
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 68
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

18 inches, because she would hold it up in her hand. 10:44:12

Q. And for the benefit of the court reporter, can you spell her last name, if you recall. 10:44:19

A. Yeah. Hopper, H-O-P-P-E-R.

Q. Do you agree that DDR2 memory devices use a clock speed that's approximately twice as fast as the clock speed for DDR1 memory devices?

A. I don't have an opinion on that. It indicates that on this slide, but I don't have any particular recollection. I haven't looked at comparing DDR2 to DDR1 with any degree of rigor, as far as I can recall. 10:44:39

Q. Do you agree that DDR3 memory devices use a clock speed that's approximately twice as fast as the clock speed for DDR2 memory devices? 10:44:56

A. I would be inclined to give the same answer. I -- I don't -- you know, that's what's represented here. I have no reason to think either that it's incorrect or that it's correct. 10:45:12

Q. Do you agree that with each generation of the DDR standard that the clock speeds generally got faster?

A. Yes, I would -- I would agree with that. 10:45:27

Samsung Ex. 1046, p. 69
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 69
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

I can't point to any one off the top of my head where that was not the case. Or rather, I would say that, generally, the -- the peak speed that's possible, because these modules can run at multiple speeds. 10:45:29 10:45:45

Q. This may refresh your recollection a little bit. If you go to your expert declaration and look at -- around paragraph 110, 111.

At the end of the paragraph 110, it's fair to say "DDR2 memory operated at effectively twice the speed of DDR1 memory," correct? 10:46:30

A. That's what it says. As I -- yes, that -- that's what it says. Although as I was suggesting, I could have been more precise and say that its peak speed is effectively twice the peak speed of the earlier technology. 10:47:04

Q. And then if you go to page 101 of your expert declaration marked as Exhibit 2006, on the third line from the top, you indicate that the clock period for a DDR3 memory device is 1.25 nanoseconds, correct? 10:47:20

A. It indicates that that's the clock speed for the fastest DDR3 when operating at that fastest rate.

Q. And that's consistent with page 6 of 10:47:42

Samsung Ex. 1046, p. 70
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 70
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Exhibit 1047 for DDR3, correct? 1.25 nanoseconds for DDR3? 10:47:47

A. Yes, that's what it says.

Q. Here's another difficult question for you: Is 1.25 nanoseconds 1,250 picoseconds? 10:48:02

A. I believe so, yeah.

Q. Please turn to page 7, Exhibit 1047.

Let me know when you're there.

A. I'm there.

Q. Do you agree page 7 of Exhibit 1047 illustrates an unbuffered DIMM, also known as a UDIMM? 10:48:23

A. That is how it's labeled, and it certainly illustrates aspects of a UDIMM, yes.

Q. In your opinion, did a person of ordinary skill in the art know about UDIMM memory modules? 10:48:40

A. They very well might. They might not.

Q. How would you explain to a layperson what a UDIMM is using the illustration on page 7 of Exhibit 1047? 10:48:59

MR. LINDSAY: Objection. Beyond the scope of direct.

THE DEPONENT: So I would largely say that over time, initially, memory systems of this sort did not have additional buffers beyond what's 10:49:13

Samsung Ex. 1046, p. 71
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 71
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

shown in this figure. And then some important core technology was introduced, some of which we've -- well, we're likely to see, that introduced data buffers into these designs. 10:49:20

And so at -- at some point, the industry decided it was useful to distinguish between ones that still did not have data buffers and those that do by using the term "unbuffered," or U in front of DIMM. 10:49:37

Q. (By Mr. Chandler) Can you turn to page 8 of Exhibit 1047. 10:49:55

Let me know when you're there.

A. Okay. I'm there.

Q. Do you agree that page 8 of Exhibit 1047 illustrates a registered DIMM, also known as an RDIMM? 10:50:05

A. That is how the figure is labeled, and I believe that they are intending to represent some of the -- some of the main aspects of an RDIMM, yes. 10:50:20

Q. In your opinion, did a person of ordinary skill in the art know about RDIMM memory modules?

A. As the term for "a person of ordinary skill in the art" is defined that we've been talking about, I think such a person might very 10:50:33

Samsung Ex. 1046, p. 72
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 72
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

well be familiar with RDIMMs. But they might not be. 10:50:36

Q. JEDEC had standardized RDIMM memory modules by July of 2012, right?

A. I don't recall. I believe it's likely, but to be honest with you, I don't recall. 10:50:50

Q. Using page 8 of Exhibit 1047, how would you explain to a layperson what an RDIMM is?

MR. LINDSAY: Objection. Beyond the scope of direct. 10:51:05

THE DEPONENT: I would say that an addition is made by adding a bit of circuitry, called a register in this figure, which sits between the memory controller and -- and an interface from the register to the various individual DRAM components. 10:51:26

Q. (By Mr. Chandler) And what signals does the register of an RDIMM register?

A. At a very high level, in a JEDEC RDIMM, the register will register control and -- and address signals. 10:51:44

Q. And the clock signal?

A. It does register a clock signal as well, but I wouldn't generally characterize that. It does have a clock signal come in and a clock signal 10:52:06

Samsung Ex. 1046, p. 73
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 73
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

that goes out. 10:52:09

Q. In an RDIMM, the register does not register the DQ data signals or the DQS strobe, correct?

A. In a JEDEC standard RDIMM, the register as shown here does not register the data either being read or written between the module and the memory controller. 10:52:26

Q. Please turn to page 9 of Exhibit 1047.

Let me know when you're there. 10:52:48

A. Okay. I'm there.

Q. Do you agree page 9 of Exhibit 1047 illustrates a fully-buffered DIMM, also known as a FBDIMM?

A. Yes, it is labeled "FBDIMM." 10:53:04

Q. In your opinion, did a person of ordinary skill in the art know about FBDIMM memory modules?

A. I would give the same answer I gave before: They may have; they may not have.

In my experience, I think FBDIMMs are much less common in the marketplace. So even if a person worked with JEDEC DIMMs of various forms, they may not have run across this. 10:53:22

But, you know, as I suggested before, I don't -- that's just my intuition. I really don't 10:53:40

Samsung Ex. 1046, p. 74
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 74
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

know what sort of volumes each different kind of DIMM sold in. 10:53:44

Q. But JEDEC had standardized FBDIMM memory modules by July of 2012, correct?

A. I don't -- I don't know. They may have. 10:53:53

Q. Using page 9 of Exhibit 1047, how would you explain to a layperson what an FBDIMM is?

MR. LINDSAY: Objection. Beyond the scope of direct.

THE DEPONENT: I would say that in this figure, it shows the data signals and the data strobe signals going into a block called AMB, and then signals with data and address and command and clock going out of that to the DRAMs. 10:54:09

Q. (By Mr. Chandler) And what does AMB stand for? 10:54:32

A. I don't recall as I sit here. I think it's advanced memory buffer.

Q. All right. Does the advanced memory buffer, abbreviated AMB, on an FBDIMM buffer all of the signals to and from the memory controller, including data, address, command and clock? 10:54:45

MR. LINDSAY: Objection. Beyond the scope of direct.

THE DEPONENT: Not that I know of, no. 10:55:04

Samsung Ex. 1046, p. 75
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 75
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. (By Mr. Chandler) Why do you say that? 10:55:07

A. I haven't endeavored to check to see if all the signals between the memory controller and the DIMM go through -- go through the AMB. Many of them do. We've talked about many of them. There 10:55:20 are other signals in use in such systems, some of which may not go through the AMB.

Q. In an FBDIMM, at least the address command, DQ data and DQS strobe signals are buffered by the AMB before going to the DRAM memory 10:55:39 devices and vice versa, correct?

MR. LINDSAY: Objection. Beyond the scope of direct.

THE DEPONENT: That is what's shown here.

Q. (By Mr. Chandler) And is that your 10:55:55 understanding and recollection of how an FBDIMM works at a high level?

MR. LINDSAY: Objection. Beyond the scope of direct. Also form.

THE DEPONENT: Yeah, it might be. I 10:56:08 haven't reviewed FBDIMM technology in any great detail in -- in a while. But it's not inconsistent with my understanding.

Q. (By Mr. Chandler) What's the benefit of buffering data lines on a memory module? 10:56:21

Samsung Ex. 1046, p. 76
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 76
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

MR. LINDSAY: Objection. Form. 10:56:25

THE DEPONENT: It depends on the particular system. There are benefits and there are costs.

Q. (By Mr. Chandler) Can you elaborate. 10:56:41

A. Sure. What would you like to know about?

Q. What are some of the primary benefits of buffering data lines on a memory module?

A. So oftentimes, data buffers are added in order to reduce the load seen by the memory 10:56:59 controller. That's -- can be particularly important in the context where a DIMM has more than one rank, as we've seen previously; or when the memory controller sees multiple -- meaning it can immediately communicate to multiple -- DIMMs. 10:57:21

So that is a common benefit.

Q. And why does reducing the load seen by the memory controller create a benefit? How would you explain that to a layperson?

MR. LINDSAY: Objection. Form. 10:57:44

THE DEPONENT: So the memory controller needs to be able to reliably send information to the DIMM, whether that's commands or an address of where to store data or the data to be stored. And the higher the load is, I would say, the more 10:58:03

Samsung Ex. 1046, p. 77
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 77
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

effort the memory controller needs to put into sending those commands; as well as the higher the load is, the more time it takes for those commands to be reliably received. 10:58:07

Q. (By Mr. Chandler) If I understand your last answer, are you saying that buffering the data lines can permit the memory controller to send data signals at higher speeds? 10:58:25

MR. LINDSAY: Objection. Misstates prior testimony. 10:58:41

THE DEPONENT: In certain use -- usage scenarios, that can be an important element to achieving greater speed of transactions, yes.

Q. (By Mr. Chandler) Can you turn to page 10 of Exhibit 1047. 10:59:00

And let me know when you're there.

A. Okay.

Q. Do you agree that page 10 of Exhibit 1047 illustrates a DDR3 LRDIMM memory module?

A. Yes, I see that it's labeled that way. 10:59:20

Q. In your opinion, did a person of ordinary skill in the art know about DDR3 LRDIMM memory modules?

A. I would say they may or they may not. And in particular, this is what they refer to as a 10:59:35

Samsung Ex. 1046, p. 78
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 78
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Gen1 LRDIMM. In my experience, that seems to be much less common, but with the usual caveats of me not having anything beyond my intuition with regards to market sales. 10:59:42

Q. But by July of 2012, JEDEC had standardized DDR3 LRDIMM memory modules, correct? 10:59:56

A. I don't recall. They may have.

Q. Using page 10 of Exhibit 1047, how would you explain to a layperson what a DDR3 LRDIMM memory module is? 11:00:21

A. Well, as shown here, the significant difference between, seems to me -- that's a good question.

So it combines the aspects of a circuit that does registering along the lines of what we talked about previously, registering and then forwarding the address, command, control and -- and clock signals, as well as registering the data signals flowing into and off of the LRDIMM module. 11:00:50

Q. Does the DDR3 LRDIMM have a fly-by arrangement for the command, address and clock signals going to the DRAM memory devices? 11:01:18

A. That depends on the particular context, what one means by "fly-by."

In this case, the command and control 11:01:37

Samsung Ex. 1046, p. 79
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 79
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

signals, for example, as well as the data signals as illustrated here are sent on a single central set of wires that then pass out to the left and to the right. And those wires are not registered along the way. 11:01:40 11:01:57

They do have propagation delay. So a signal will, for example, appear at DRAM5, the block labeled "DRAM5" on this image, prior to the same signal arriving at DRAM8.

Q. And similarly, the signal from the memory controller would arrive at DRAM4 prior to arriving at DRAM1, as shown as page 10 of Exhibit 1047; is that fair. 11:02:20

MR. LINDSAY: Objection. Form.

THE DEPONENT: There is this propagation and delay issue as you move away from that central set of wires, whether it's left to right or right to left. And both are -- both directions are illustrated here. 11:02:37

Q. (By Mr. Chandler) Can you turn to page 11 of Exhibit 1047. 11:02:56

And let me know when you're there.

A. Yes, I'm there.

Q. Do you agree that page 11 of Exhibit 1047 illustrates a memory module that today is known as 11:03:07

Samsung Ex. 1046, p. 80
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 80
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

a DDR4 LRDIMM memory module? 11:03:12

A. That -- that is what it's labeled, and I don't know of any particular error there.

Q. And using page 11 of Exhibit 1047, how would you explain to a layperson at a high level 11:03:33 what a DDR4 LRDIMM memory module is?

A. I would say that as this figure illustrates, it's similar to the DDR3 LRDIMMs except that the buffering of data signals is shown to take place in multiple locations, distributed 11:03:57 from left to right along the -- the DIMM module.

Q. And you're referring to the boxes labeled "DB"; is that correct?

A. Yes. DB stands for, in this context, data buffer. 11:04:17

Q. And a DDR4 LRDIMM memory module also has a fly-by arrangement for the command, address and clock signals; is that fair?

A. Yes.

Q. And DDR4 LRDIMM also has a fly-by 11:04:47 arrangement for the control signals to the DB data buffers, correct?

A. Well, we're not showing any control signals to the DB data buffers. I don't recall if those have a fly-by or more of what we would refer 11:05:11

Samsung Ex. 1046, p. 81
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 81
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

to as a daisy-chained structure. 11:05:14

Q. Could you look at Exhibit 1020.

Let me know when you have it in front of you.

A. Okay. 11:05:36

Q. And do you have your exhibits, such as Exhibit 2010, 2011, 2012?

A. Not that I can easily put my hands on.

Q. Let me try to help you.

Do you have them now? 11:06:23

A. I have 2010, and the others will be here any second. Did you want me to turn to one of them in particular?

Q. Sure. Let's start with 2010.

Let me know when you have it. 11:06:33

And I'll -- since we're at it, I'll send you one more.

A. Okay. I have it open.

Q. In your opinion, would a person of ordinary skill in the art have known about the JEDEC standard for DDR memory devices marked as Exhibit 2010 to your declaration? 11:06:51

MR. LINDSAY: Objection.

THE DEPONENT: They may have; they may not have. 11:07:09

Samsung Ex. 1046, p. 82
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 82
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. (By Mr. Chandler) Dated June 2000, that standard. 11:07:10

A. Yes, the same answer. They -- they may very well have; they may not have.

Q. And to be clear, I'm referring to a hypothetical person of ordinary skill in the art, which you understand, hypothetically, knows of all of the art in the field. 11:07:17

Do you understand that?

MR. LINDSAY: Objection. Form. 11:07:35

THE DEPONENT: I guess I -- I would say no, I didn't necessarily understand that. I don't know anybody who knows of all the art, but likely could get access to it.

But as well, in this context, the way that we've agreed that a person of ordinary skill in the art is defined, I don't think that that requires them to actually have been working with JEDEC DDR DIMMs or DDR memory chips of any sort. 11:07:56

But also, even if they are, oftentimes engineers are using that technology without going to a particular specification. That -- some of them have to, people who build memory modules. But a person of ordinary skill in the art may simply work with memory modules of the sort. 11:08:19 11:08:38

Samsung Ex. 1046, p. 83
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 83
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. (By Mr. Chandler) For purposes of forming your opinions in this matter, did you treat the JEDEC standard marked as Exhibit 2010, which is the DDR standard from June 2000, as something that was available to and known by the hypothetical person of ordinary skill in the art? 11:08:45 11:08:58

A. I believe that it's available to such a person. Although, to be honest with you, the standards have always been made available to me, so I don't know if there's some payment that -- I don't know if they're just publicly available on the Internet, for example. But certainly under some situation, they would be available to a person of ordinary skill in the art. 11:09:21

Q. Okay. So would a person of ordinary skill in the art have known about the JEDEC standard for DDR memory devices marked as Exhibit 2010? 11:09:40

A. They -- they may have, particularly if they were working with those particular SDRAM chips. But a lot of people in -- in the art -- a lot of -- a person of ordinary skill in the art, as I said, wouldn't be working with those chips directly, or they wouldn't -- even if they were being used in a system. 11:10:01 11:10:22

Samsung Ex. 1046, p. 84
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 84
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. In forming your nonobviousness opinions in this matter, did you treat the JEDEC standard for DDR1 memory devices, marked as Exhibit 2010, as within the knowledge of a person of ordinary skill in the art or not? 11:10:23 11:10:41

MR. LINDSAY: Objection. Asked and answered.

THE DEPONENT: Well, I think to the extent that certainly -- well, give me a moment to review. 11:10:57

Yeah, I don't have -- I don't believe I necessarily formed an opinion on that.

But Mr. Wedig says that Tokuhiro notes that the JEDEC standard -- I'm sorry. That's not the reference I was thinking of. 11:11:26

He says a person of ordinary skill in the art would have been familiar with the industry standard -- with the JEDEC industry standards. And so in my task of analyzing his arguments, I took into the context his belief in that statement. 11:11:44

Q. (By Mr. Chandler) So analyzing Dr. Wedig's arguments, did you assume that a person of ordinary skill in the art would have known about the JEDEC standard for DDR memory devices marked as Exhibit 2010? 11:12:04

Samsung Ex. 1046, p. 85
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 85
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

A. Yes, I accepted -- accepted that assumption because, as I understood it, that set the context for his analysis. 11:12:06

Of course, the notion of "familiar with the JEDEC industry standards" is not very precise. For example, I think a lot of people who would be POSAs -- a person of ordinary skill in the art -- could be familiar that the JEDEC organization exists and that they write standards, without necessarily being familiar with any particular standard. 11:12:26 11:12:48

Q. But they would know that JEDEC had standards available for DDR1, DDR2, and DDR3 memory devices, correct?

A. I accepted that assumption in the context of my analysis because Mr. Wedig used that for the context of his analysis. 11:13:10

Q. Dr. Wedig, you mean?

A. Yes. Thank you. I felt -- I stumbled over that two or three times only because I didn't recall for sure if he had his Ph.D. But yes. 11:13:26

Thank you for correcting me. I'm usually more careful about that as well.

Q. The DDR1 JEDEC standard is dated in the year 2000, as shown in Exhibit 2010, correct? On 11:13:45

Samsung Ex. 1046, p. 86
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 86
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

the cover. 11:14:00

A. Yeah, I need to find it because there are multiple windows open. Yes, the cover says June 2010 -- June 2000 rather.

Q. And the JESD79-2 standard for DDR2 memory devices is dated September of 2003, as shown in Exhibit 2012, correct? 11:14:12

A. I didn't open 2012 yet. I -- I will double-check, but I assume that that's the case, 2003. 11:14:42

Yes, it says September 2003.

Q. And then Exhibit 2011 is the JEDEC standard JESD79-3A for DDR3 memory devices dated September 2007 that you cited, correct?

A. Yes. 11:15:10

Q. And then Exhibit 1020 is the JEDEC JESD79-3C standard for DDR3 memory devices dated April of 2008, correct?

A. No, I believe it's -- that was the underlying document, and this is a revision from November of 2008. 11:15:38

Q. My mistake.

To be clear, Exhibit 1020 is the JESD79-3 standard for DDR3 memory devices dated November 2008, correct? 11:15:56

Samsung Ex. 1046, p. 87
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 87
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

A. Yeah, and it says "-3C" to indicate the different revisions, to make that a little clearer. 11:16:00

Q. Okay.

THE DEPONENT: Would now be a good time to take a brief break? 11:16:20

MR. CHANDLER: Of course. Five minutes.

THE VIDEOGRAPHER: We're going off the record. The time is 11:16.

(Recess taken.)

THE VIDEOGRAPHER: We're going back on the record. The time is 11:26. 11:26:09

Q. (By Mr. Chandler) Dr. Mangione-Smith, could you please turn to your expert declaration marked as Exhibit 2006, and go to the top of page 17. 11:26:23

Let me know when you're there.

A. The PDF page or the numbered page at the bottom?

Q. Numbered page. Numbered page.

A. I'm there. 11:26:41

Q. All right. I want to get from you a high-level explanation of how the '506 patent works as a preface to some more detailed questions. But with that goal in mind, can you answer my next few questions? 11:27:04

Samsung Ex. 1046, p. 88
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 88
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Fair enough? 11:27:06

MR. LINDSAY: Objection. Form.

THE DEPONENT: Yeah, I'll try with the usual caveat that I don't typically characterize patents. The -- the patent claims are what's 11:27:15
important generally, and so I focus on exactly what the patent claims say.

But the '506 relates to data buffers of the sort that we've been talking about.

Q. (By Mr. Chandler) Let me ask -- let me 11:27:34
ask the question. I didn't mean for you to try to explain something in the abstract.

Just to give you background, so what I want to talk about is some of the figures and some of the text in the '506 patent that describe some 11:27:47
of the exemplary embodiments of the claimed invention.

Fair enough?

A. Got it.

Q. And so at the top of page 17 of your 11:28:01
expert declaration marked as Exhibit 2006, you cite to Claim 1 of the '506 patent on the fourth line, correct?

Where you say "see id., cl. 1," right?

A. Yeah. 11:28:25

Samsung Ex. 1046, p. 89
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 89
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. And then you cite to column 15, lines 23 through 26, correct? 11:28:25

A. Yes.

Q. All right. And would it be fair to say that column 15, lines 23 to 26, of the '506 patent relates to an exemplary embodiment of the claimed inventions of the '506 patent? 11:28:35

A. I would -- I believe that's the case, yeah.

Q. And then if you look at the '506 patent marked as Exhibit 1001, could you go to Figures 12A and 12B. 11:28:55

And let me know when you're there.

A. Sure. I'm there.

Q. Good. 11:29:32

And you understand Figures 12A and 12B of the '506 patent?

A. I have an understanding of them, yes.

Q. And it would be fair to say that Figures 12A and 12B of the '506 patent illustrate an exemplary embodiment of the claimed inventions of the '506 patent? 11:29:42

A. That wouldn't surprise me. I don't recall for sure exactly how they are characterized.

Q. Can you explain to a layperson what 11:29:58

Samsung Ex. 1046, p. 90
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 90
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Figures 12A and 12B of the '506 patent are teaching and how that relates to the claimed inventions? 11:30:05

MR. LINDSAY: Objection. Form.

THE DEPONENT: Sure. In the column 3, it says that 12A to 12B are timing diagrams, which is grammatically problematic. But there are timing diagrams illustrating a write operation and a read operation respectively, performed by a memory module according to one embodiment. 11:30:30

Q. (By Mr. Chandler) And so I am looking at Figure 12A, and I've got your 12B. Can you explain to me as a layperson what these figures are teaching with respect to the claimed invention. 11:30:52

A. I, in general, wouldn't endeavor to do that. These are not intended to be informative for a layperson. It's fairly -- there's an awful lot of technical detail here. 11:31:19

Q. How would you explain to a person of ordinary skill in the art what Figures 12A and 12B are teaching with respect to the claimed invention? 11:31:33

A. I would point them to what the patent literally says, which I -- where I read the summary of how they characterize 12A and 12B, as well as further discussion throughout the specification.

Q. And can you explain it to me as an expert 11:31:52

Samsung Ex. 1046, p. 91
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 91
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

without just reading to me from the patent. 11:31:53

A. Yeah, I could, but I'm -- I'm not really inclined to do that. I will point out that one key element, which is illustrated in 12B, is that it shows a delay of the -- of a data strobe, which is 11:32:07 one element or relevant to an awful lot of the claims. Perhaps all the claims. I don't recall if it's relevant to all of the claims.

Q. All right. Could you explain that a little bit more. 11:32:24

A. Yeah. If you look at 12B, it shows at time t8, there is a -- well, it's -- it's shown in -- there's a signal called DQS which is shown in dotted lines, with an arrow in dotted lines above that going to another box labeled "DQS" that is in 11:32:48 solid lines, and it's marked "delay," which to me indicates that 12B is saying that that signal should be delayed in this context from t8 to t9.

Q. And do Figures 12A and 12B indicate how to calculate the amount of delay for the DQS strobe 11:33:12 signal shown in Figure 12B?

A. I don't see any calculation there, other than they're indicating specifically to delay it from what looks to be one time unit, t8 to t9.

Q. So in your opinion, Figure 12A and 12B 11:33:39

Samsung Ex. 1046, p. 92
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 92
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

don't disclose how to determine the delay. They only show in Figure 12B that there's some delay that is applying to the DQS strobe signal; is that fair? 11:33:43

MR. LINDSAY: Objection. Form. Misstates prior testimony. 11:34:01

THE DEPONENT: There's no equation, for example, shown in 12A or 12B to show how to calculate that delay. I don't recall if the discussion of 12A or 12B says, for example, "Well, look at these three factors illustrated here." 11:34:15

The delay would be calculated in some particular way, in which case one might say, "Yeah, 12A and 12B shows to calculate that delay."

I -- I don't recall. I haven't reviewed it for that aspect. 11:34:32

Q. (By Mr. Chandler) I mean, but you did review the '506 patent carefully in preparation for your deposition today, correct?

A. I believe I -- I testified to that previously. Mostly for my preparation -- specific preparation over the last week or so, I focused on what Dr. Wedig said and what I said to refresh myself of the -- myself of the issues at hand, and then, as needed, went back to the '506. 11:34:48 11:35:08

Samsung Ex. 1046, p. 93
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 93
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

But I certainly did not sit down and do a from-the-fresh, complete review of the '506. 11:35:12

Q. At the top of page 17 of your declaration marked as Exhibit 2006, you cited to column 15, lines 23 to 26, correct? 11:35:31

A. Yes.

Q. Are those relevant -- are those lines of column 15 relevant to understanding Figures 12A and 12B of the '506 patent?

A. I did cite them here, sure. I tend not to cite material that I think is irrelevant. 11:36:01

Q. So can you explain to me and to the board what Figures 12A and 12B are teaching to a person of ordinary skill in the art with respect to the claimed inventions of the '506 patent. 11:36:28

MR. LINDSAY: Objection. Asked and answered.

Q. (By Mr. Chandler) And if you can't, that's fine, and we'll move on. But I just want to, you know, make sure I've got your testimony here. 11:36:40

A. Yeah, it certainly is illustrating a delay of the DQS strobe. I haven't looked at any particular figure and said, well, you know, what exactly is the full breadth of what it's teaching 11:36:52

Samsung Ex. 1046, p. 94
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 94
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

here given the context where it's discussed. 11:36:56

So I -- you know, I don't feel prepared to answer that in greater detail without further review beyond what we've been discussing with regards to the delay that's illustrated in 12B. 11:37:09

Q. And I believe you said you spent approximately 20 hours preparing for your deposition today over the last week; is that fair?

A. That seems about right.

Q. Are you able to explain, using Figures 12A and 12B, how the delay in Figure 12B would be determined as taught by the '506 patent? 11:37:31

A. Not as I sit here. I -- I haven't reviewed that.

The determination of the specific delay, the claims require that there be a predetermined delay. I don't -- I'd have to review all of them. Maybe some of the independent claims further narrow it down, but I don't think that they required there to be a predetermined delay with an exact particular value or calculation. 11:37:55 11:38:14

Q. And to be clear, I didn't say "predetermined." I said "determined." So in other words, it could be determined on the fly as opposed to just picking some predetermined delay. 11:38:30

Samsung Ex. 1046, p. 95
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 95
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

A. Yeah. Understood. Yeah. 11:38:34

Q. Does the '506 patent teach how to determine a delay that is then later used to delay the DQS strobe signal as shown in Figures 12B?

MR. LINDSAY: Objection. Form. 11:39:01

THE DEPONENT: I -- sure. In 12B, it teaches that it can be one time period.

Q. (By Mr. Chandler) And how does the '506 patent teach that you would determine that the delay should be one time period rather than another 11:39:21 amount, such as two or three time periods?

A. It shows it right there. So it -- it teaches that, in this case, it has determined that the delay should be one time period.

Q. And what was the basis, according to the 11:39:39 '506 patent, for determining that the delay should be one time period? Not that the delay that's actually applied as shown in Figure 12B is one time period, but that beforehand you've determined, okay, I want to delay the strobe period, and I've 11:39:56 determined that the proper amount is one time period. How is that taught by the '506 patent?

MR. LINDSAY: Objection. Form.

THE DEPONENT: To be honest with you, as we sit here, I -- I don't recall. I don't recall 11:40:10

Samsung Ex. 1046, p. 96
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 96
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

that being an issue that Mr. Wedig specifically was addressing. 11:40:14

He did bring up a calculation for the delay in the context of some of the prior art, and I did respond to that. But I -- I don't recall commenting on it or specifically searching out what does it talk about for how the delay can be calculated. 11:40:26

Q. (By Mr. Chandler) You have Dr. Wedig's declaration marked as Exhibit 1003 in front of you, correct? 11:40:46

A. I can bring it up, yes.

Q. And on pages 17, 18 and 19 of Dr. Wedig's declaration marked as Exhibit 1003, he discussed Figures 12A and 12B of the '506 patent, correct? 11:41:05

A. Yes, I see that.

Q. And you reviewed Dr. Wedig's declaration in preparation for today's deposition, correct?

A. I did.

Q. Does that refresh your recollection as to how the '506 patent teaches determining how to delay the strobe signal DQS in Figure 12B? 11:41:22

A. Yes, he appears to be completely consistent with what I just testified.

Q. All right. So explain to me, how does 11:41:43

Samsung Ex. 1046, p. 97
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 97
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Figure 12A and 12B together teach how much of a delay should be applied to the DQS strobe signal in Figure 12B? 11:41:46

MR. LINDSAY: Objection. Asked and answered. 11:42:03

THE DEPONENT: It teaches that it should be one clock cycle. As Dr. Wedig says, Figure 12A, shows that the data buffer determines a time interval based on reception of the signals. So the -- the figures for 12A are teaching that. 11:42:18

Q. (By Mr. Chandler) Okay. And the one-clock-cycle time interval is between where and where in Figure 12A?

A. It's between t8 and t9.

Q. No. In Figure 12A, is what we are talking about. 11:42:38

A. Oh, yes, but the delay is shown in 12B.

Q. Yes.

But I thought you just said that Dr. Wedig indicated a delay is determined in Figure 12A. 11:42:46

A. I -- I meant to say Figure 12. I thought that's what I said, but -- which covers 12A and 12B.

I think he said Figure 12 as well. Oh, 11:43:01

Samsung Ex. 1046, p. 98
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 98
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

no, he says 12A. Okay. Yeah. Yeah. 11:43:06

So I said Figure 12. I was referring to both of them.

Q. So I'm still a little confused.

What's your testimony as to how Figures 12A and 12B teach coming up with the -- with the one-clock-cycle delay for the DQS strobe shown in Figure 12B? 11:43:20

MR. LINDSAY: Objection. Form. Asked and answered. 11:43:38

THE DEPONENT: Yeah, as I said before, Figure 12B teaches that, in this example, the delay should be one clock period, the period from t8 to t9.

Q. (By Mr. Chandler) So it's only the t8 to t9 that's relevant to determining the delay according to the '506 patent; is that correct? 11:43:54

A. I -- I wouldn't say that. We're focusing on the two figures, but you have to take the discussion around the figures, the context, into account. 11:44:17

I haven't memorized it. I don't recall if there's a greater explanation of why, in this particular case, that particular time is the delay that should be used above and beyond it being shown 11:44:32

Samsung Ex. 1046, p. 99
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 99
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

in the figure itself. 11:44:35

Q. Do you disagree with any part of Dr. Wedig's summary of Figures 12A and 12B on pages 17, 18 and 19 of this declaration marked as Exhibit 1003? 11:44:48

A. Perhaps. If I thought -- if I saw a disagreement, and I thought a disagreement was relevant and worth commenting on, I likely would have said that in my declaration. But, you know, as I sit here, I haven't -- I certainly haven't 11:45:04 memorized those pages of exactly what he said and where the particular points that I had disagreed with occur in his declaration.

Q. And to be clear, I didn't see any disagreement in your declaration with Dr. Wedig's 11:45:17 discussion of Figures 12A and 12B. So sitting here today, do you recall any disagreement that you have or had with Dr. Wedig's analysis of Figures 12A and 12B?

A. No, I don't recall any particular 11:45:33 disagreement. But it's slightly over 100 pages, my declaration. And if it's in there, I simply don't recall it at the moment and would be happy to review if there was a particular section you wanted to point me to. 11:45:47

Samsung Ex. 1046, p. 100
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 100
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. Could you look at Figures 14 through 16 of the '506 patent marked as Exhibit 1001. 11:45:53

And just let me know when you have those in front of you.

A. Yes, I'm there. 11:46:12

Q. Do you Figures 14 through 16 in the '506 patent illustrate an exemplary embodiment of the claimed inventions of the '506 patent, in your opinion?

A. I would have to go back and review how they are discussed, but I would certainly expect that they do. 11:46:23

Q. All right. And do you understand Figures 14 through 16 of the '506 patent?

A. I have an understanding of them, yes. It may simply be the case that these are illustrating parts of an embodiment without illustrating other aspects. I don't recall. 11:46:35

Q. What's the relationship between Figure 14 and Figure 15 of the '506 patent? 11:46:50

So Figure 14 in the bottom right is numbered 320/620; and then Figure 15 is numbered 620 in the bottom right.

Do you see that?

A. Yes, I see that. 11:47:06

Samsung Ex. 1046, p. 101
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 101
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. All right. So what's your understanding of the relationship between Figures 14 and 15 of the '506 patent? 11:47:09

A. So Figure 14 is a diagram illustrating a DQ or DQS routing circuit in a data buffer according to an embodiment, whereas 15 is a diagram illustrating a DQS routing circuit having a delay circuit in a data buffer according to an embodiment. That's how they describe the relationship between them. 11:47:32 11:47:51

Q. And what is the relationship between Figure 14, which is numbered 320/620 in the bottom right, and Figure 16, which is numbered 320 in the bottom right?

A. Well, the inventors say Figure 16 is a diagram illustrating a DQ routing circuit having a delay circuit in a data buffer according to an embodiment. 11:48:04

Q. In Figure 15 of '506 patent, do you see that on the right side, there is a line labeled "YB DQS"? 11:48:23

A. Yes, I see that.

Q. Using Figure 15 of the '506 patent, can you explain to me the path taken by DQS strobe signal in the read direction starting at YB DQS, 11:48:49

Samsung Ex. 1046, p. 102
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 102
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

and can you sort of briefly explain what happens at each step of the way. 11:48:57

MR. LINDSAY: Objection to form.

THE DEPONENT: Yeah, I -- I can talk through the path. There are a number of elements here whose function are not clearly labeled. But I will do my best to explain what is visible on Figure 15 and that I recall. 11:49:08

So YB DQS comes into 620. It's received on the right-hand side. It passes through this block, which is labeled "1502B." I don't recall exactly what that does. 11:49:24

That line then goes down, and it's connected to the output of a tri-state buffer as well as the input to what's called a multiplexor, or a MUX, that's labeled "1550." And that multiplexer is used to select either YB DQS or YA DQS. 11:49:45

That's then fed into Figure 1560 -- or element 1560, which also takes in a data strobe signal and a clock. 11:50:11

Then it's forwarded on to 1570. And the output of 1570 goes through, again, another tri-state buffer, 1580, and is sent through 1501 and then produced as DQS. 11:50:35

Samsung Ex. 1046, p. 103
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 103
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. (By Mr. Chandler) And the output of 1570 also goes up to RDQS, correct? 11:50:42

A. It does also do that, yes.

Q. And I think you said DS -- the line at the bottom of the Figure 15 is a data strobe. I am not sure that's correct. 11:51:01

A. It is labeled "DS." Hopefully what I said is I believe that's a data strobe, but I'm not sure. Like I said, I haven't gone back and reviewed the specific figures that closely. 11:51:17

Q. All right. What does 1502B do?

A. Figure 15 -- just a moment.

So the patent says in the read strobe path, a select circuit 1550, which is the multiplexer we talked about, selects either a read strobe signal via DQS pin 1502A, or a read strobe signal based on DQS pin 1502B. 11:52:55

So they are indicating that those are pins on a package.

Q. Okay. And I think you said 1550 is the multiplexer, correct? 11:53:18

A. Yes.

Q. And if you look at the top of column 11, line 1, I think it says "DS" is a delay signal; is that fair? 11:53:36

Samsung Ex. 1046, p. 104
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 104
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

In other words, not a -- not a strobe, but it calls it "a delay signal DS." 11:53:39

A. Yeah, I assume so. Yep, it's --

Q. It's line --

A. It says "a delay signal DS." That's correct. Thank you for reorienting me there. 11:53:50

Q. All right. So what does 1560 in Figures 15 do?

A. So what it -- so the selected read strobe is delayed by a delay circuit 1560. So that is the circuit that delays that signal, the -- the read strobe signal that was selected between the A and the B path. 11:54:15

Q. And what is this vertical line CK0?

A. Sorry. I need to go back to that page. 11:54:47

So that appears to be being used to clock element 1520.

Q. I'm referring to CK0 that goes into 1560, along with DS that goes into 1560.

Do you see that? 11:55:23

A. Did I read off the wrong part? Let me see.

I see. Thank you.

Yeah, vertically it goes 1520. It does also go into 1560, yeah. 11:55:38

Samsung Ex. 1046, p. 105
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 105
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. Okay. So what is CK0? 11:55:40
A. CK0 is a signal that's being used to clock those two, those two box. It's a reconstructed clock -- or regenerated clock.
Q. All right. So what are the signals CK0 and DS going into 1560 doing? 11:56:01
A. They're being used to clock those elements, to control those elements.
Q. And which element are you referring to?
A. The -- the two elements it goes into, the two buffers. It only goes into two elements. 11:56:46
Q. I think I may have confused you. So I'm focusing on 1560 in Figures 15.
Do you see that?
A. Yep. 11:57:00
Q. And then coming into 1560, there are, I guess, two signals, labeled "CK0" and the other is labeled "DS," for delay signal, correct?
A. Yes.
Q. How do the signals CK0, the clock signal, and the DS, the delay signal, affect 1560? 11:57:18
A. Well, the delay signal indicates a -- an amount for delay that should be applied. And the clock signal, I believe, indicates when to clock that device 1560. 11:57:46

Samsung Ex. 1046, p. 106
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 106
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. And what do you mean by "clock that device 1560"? 11:57:51

A. Well, as we talked about before, most digital circuits are called "synchronous," so their state or their registers only get updated on a clock edge. And that's typically what clocks are used for. So it's updating the state of 1560. 11:58:04

Q. Okay. And what's the label for 1560? How does the patent describe it?

A. Just a moment. They call it a delay circuit. 11:58:43

MR. CHANDLER: Do you need to take your phone call?

THE DEPONENT: I do. Thank you very much. I completely lost time. And you warned me that you might, but thank you for not. 11:58:52

MR. CHANDLER: But to be clear, I mean, should we stop now, or are you waiting for someone to call you such that we should keep going?

THE DEPONENT: No, I need to get onto -- I need to jump onto a Zoom call. 11:59:02

MR. CHANDLER: And how long will that be?

THE DEPONENT: Probably half an hour. Yeah, I don't think it's going to go any longer. I won't go any longer. Let's put it that way. 11:59:12

Samsung Ex. 1046, p. 107
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 107
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

MR. CHANDLER: Okay. Well, let's take a break then and -- until 12:45. And we can -- is that enough time for you to do your call and get lunch? 11:59:15

MR. LINDSAY: Well, yeah, we can go off the record and talk about that off -- 11:59:24

MR. CHANDLER: Yeah.

THE VIDEOGRAPHER: We're going off the record. The time is 11:59.

(Recess taken.) 11:59:37

THE VIDEOGRAPHER: We're going back on the record. The time is 1:04.

Q. (By Mr. Chandler) Welcome back, Dr. Mangione-Smith.

Do you have any corrections or clarifications that you would like to make to your testimony from before lunch, or are you ready to proceed? 01:04:16

A. I am ready to proceed.

Q. So we were discussing Figure 15 of the '506 patent. Do you still have that up in front of you? 01:04:31

A. In just a moment. Okay. Yep.

Q. And we were discussing the path that the DQS strobe signal takes in the redirection from 01:04:49

Samsung Ex. 1046, p. 108
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 108
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

right to left. And in Figure 15, I think we left off at box 1560. And I wanted to pick up from there. 01:04:51

Is that all right?

A. Sure. 01:05:11

Q. Okay. So what happens after box 1560?

A. So then it enters box 1570, which is described as a sampler circuit.

Q. Okay. And what does the sampler circuit 1570 in Figure 15 of the '506 patent do? 01:05:29

A. It samples that input.

Q. And "that input" being the -- the DQS --

(Simultaneously speaking.)

THE DEPONENT: Yeah. The delayed DQS.

Q. (By Mr. Chandler) All right. And what does the clock signal CK0 going into the sampler circuit 1570 do? 01:05:51

MR. LINDSAY: Objection --

THE DEPONENT: Well --

MR. LINDSAY: Objection. Form. 01:06:04

THE DEPONENT: Well, in column 15, it says that the sampler circuit 1570 samples according to the buffered module clock signal CK0.

Q. (By Mr. Chandler) So does the clock signal CK0 cause sampler circuit 1570 to sample the 01:06:26

Samsung Ex. 1046, p. 109
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 109
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

stroke signal? 01:06:32

A. That appears to be what it's indicating, yes.

Q. And how does it -- that work?

A. When the buffered clock signal is transitioned, 1570 samples its -- its input. 01:06:47

Q. And then what happens?

MR. LINDSAY: Objection. Form.

THE DEPONENT: So then it gets -- then the output of 1570 gets passed to 1580, which is a tri-state buffer. 01:07:13

Q. (By Mr. Chandler) And as I think we discussed, I guess it also goes up to RDQS, correct?

A. That's correct. 01:07:28

Q. And at 11, column 11, line 1, RDQS is the read DQS strobe; is that the way it's described?

A. Yes, that's the label it's given.

Q. And is that a delayed strobe?

A. I believe it's delayed with the value of DS. 01:08:01

Q. Okay. And then after tri-state buffer 1580, what happens next in Figure 15 of the '506 patent?

A. So next, it goes to element 1501, which I 01:08:16

Samsung Ex. 1046, p. 110
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 110
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

believe is just, again, another pin output. But -- but I will check for sure. 01:08:19

Yes, it's a pin.

Q. Okay. Could you turn to Figure 16 of the '506 patent. 01:08:39

And let me know when you're there.

A. Okay.

Q. Using Figure 16 of the '506 patent, can you explain the path taken by DQ data signal in the read direction starting at the YB line on the right side. And briefly explain what happens at each step of the way, and -- and also pause at each step of the way because I may have questions. 01:08:59

A. Sure. So the YB signal is input -- is provided to pin 1602B. 01:09:26

Q. And to be clear, that's a DQ data signal; is that fair?

A. Let me go back -- I -- I haven't reviewed this in quite some time -- and see.

So Figure 16 is a diagram illustrating a DQ routing circuit having a delay circuit in a data buffer according to an embodiment. So yes, it should be a DQ data signal. 01:09:58

Q. Okay. So after the data signal comes in on line YB into 1602B, the pin, what happens next? 01:10:14

Samsung Ex. 1046, p. 111
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 111
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

A. Then it's connected to the output of the tri-state buffer 1630B as well as input to a multiplexer 1650. 01:10:22

Q. Okay. What does the multiplexer 1650 do in Figure 16? 01:10:40

A. It multiplexes between the two input -- possible input signals YA and YB.

Q. Okay. So we're assuming YB gets selected in this example. So what happens next after multiplexer 1650 selects the DQ data signal from YB? 01:11:03

A. Then it gets passed to element 1660.

Q. And what does 1660 do with the DQ data signal?

A. 1660 is a delay circuit that includes a set of delay stages. 01:11:26

Q. And what does the CK0 clock signal and DS delay signal going into 1660 do?

A. Well, as best I recall, the DS, the delay signal, delays the input, the YB values. And then once they pass through that delay, they are clocked when CK0 is asserted. 01:12:02

Q. All right. And what happens next in Figure 16 of the '506 patent after the DQ data signal comes out of 1660? 01:12:22

Samsung Ex. 1046, p. 112
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 112
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

A. So after that, it goes to element 1670. 01:12:42
Q. And what is element 1670?
A. So that's characterized in column 17 as a receiver circuit.
Q. And when I searched for it, I actually 01:13:18
came up with a different description. Is there another description of 1670 in the '506 patent?
A. I don't see one.
Q. The first hit that comes up when I searched is, I guess, column 18, line 4. 01:13:50
A. Sure. It's referenced there, yeah.
Q. So is 1670 a sampler circuit, or a receiver circuit, or both or neither?
MR. LINDSAY: Objection. Form.
THE DEPONENT: So it is referred to 01:14:20
clearly as a receiver circuit, column 18. And it says that it refers to the sampler circuit 1570 or 1670. So 1570 is a sampler circuit. 1670, as I read this, is a receiver circuit.
Q. (By Mr. Chandler) Okay. What does the 01:14:40
receiver circuit 1670 do?
A. It receives the input and samples it.
Q. And what does the delay read strobe signal RDQS going into 1670 do?
A. It controls when that -- when those 01:15:06

Samsung Ex. 1046, p. 113
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 113
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

signals are sampled. 01:15:12

Q. And how does that work?

MR. LINDSAY: Objection. Form.

THE DEPONENT: I am not following you. In principal, it could work in a number of 01:15:26 different ways. It's used to strobe, presumably, those values.

Q. (By Mr. Chandler) And what do you mean by the RDQS is used to strobe those values? What values are you referring to, and what do you mean 01:15:48 by the verb "strobe"?

MR. LINDSAY: Objection. Form.

THE DEPONENT: The values are the input values that proceeded from the far right where we started the conversation. And I believe it's YB, 01:16:03 but I'm looking at the figure right now. And "strobe" is the action generally taken as a consequence of receiving a strobe signal. It causes a sampling to happen.

Q. (By Mr. Chandler) Now, the RDQS signal 01:16:30 coming into Figure 16 was delayed by Figure 15, right?

MR. LINDSAY: Objection. Form.

THE DEPONENT: They do both refer to RDQS. It could be the case that's what is delayed 01:16:45

Samsung Ex. 1046, p. 114
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 114
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

from Figure 15. I haven't put the two of them together in quite sometime. 01:16:49

Q. (By Mr. Chandler) Does the delay to the RDQS strobe signal delay the DQ data signal in Figure 16? 01:17:15

A. Well, the -- the RDQS signal does cause 1670 to sample the -- the delayed input values, yeah.

Q. And then what does 1670 do after that?

A. So after that, let's go back to Figure 16. After that, the output goes to a tri-state buffer 1680. And then the output of that buffer, if it's activated, goes to 1601, which is a pin. 01:17:55

Q. And what causes 1670 to output the data? 01:18:23

MR. LINDSAY: Objection. Form.

THE DEPONENT: I -- I guess I don't know for sure. It indicates that the -- that there is an output that flows to 1680. I don't recall that there was much discussion beyond it samples the input. Yeah. 01:18:50

MR. CHANDLER: Let me mark an exhibit.

(Exhibit 1048 was marked for identification by the Court Reporter and is attached hereto.) 01:19:09

Samsung Ex. 1046, p. 115
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 115
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. (By Mr. Chandler) All right. You should be getting Exhibit 1048. 01:19:14

And once you open that up, let me know when you have it.

A. Okay. I have it. 01:19:38

Q. All right. So Exhibit 1048 is Figures 15 and 16 of the '506 patent marked as Exhibit 1001, annotated with some color arrows. There's a dashed orange arrow at the bottom for DQS. There's a solid orange arrow at the top for DQ going through 01:19:58 Figure 16. And then there's the blue arrow for RDQS going up from Figure 15 into Figure 16.

Do you see all that?

A. Yes.

MR. LINDSAY: Objection. Foundation. 01:20:20 Beyond the scope of direct.

Q. (By Mr. Chandler) When the DQ data signal comes out of the left side of Figure 16 on line 322, is it edge-aligned with the DQS strobe signal coming out of the left side of Figure 15 on 01:20:39 line 324?

MR. LINDSAY: Objection. Foundation. Beyond the scope of direct.

Q. (By Mr. Chandler) And this is also -- and you can also look at Figure 14. I don't want 01:20:55

Samsung Ex. 1046, p. 116
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 116
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

to limit you to Exhibit 1048. Feel free to, you know, look at Figure 14 or other figures as well, if it's helpful. 01:20:59

A. Yeah. So it might be; it might not be.

Q. And why do you say that? 01:21:17

A. Because when -- when we started talking about RDQS, I said that I hadn't reviewed how 15 and 16 go together. They both do say RDQS. I don't know that that's -- I don't recall that that's the same signal. It might be. 01:21:39

Then there's also the issue of, in my mind, what does "edge-aligned" mean. There has to be some degree of closeness for something to be aligned or not. They're never going to be perfectly aligned, I guess is what I'm trying to -- trying to speak to. 01:22:00

Q. Okay. So it would be fair to say that, in your opinion, DQ data signal and DQS strobe signal will not always be aligned with each other?

MR. LINDSAY: Objection. Foundation. Beyond the scope of direct. 01:22:18

THE DEPONENT: It depends on the -- on the situation. I think that depending on how it's implemented and what the -- what's the word I'm looking for -- the -- the -- how tight the timing 01:22:34

Samsung Ex. 1046, p. 117
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 117
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

parameters are, if these are implemented together -- if -- one could determine that they are aligned or that they are not aligned. 01:22:38

Q. (By Mr. Chandler) And what do you believe the '506 patent teaches, after your -- after your -- 01:22:48

MR. LINDSAY: Objection.

Q. (By Mr. Chandler) -- review?

MR. LINDSAY: Form.

THE DEPONENT: I think the '506 patent teaches the inventions in the claims. 01:23:00

Q. (By Mr. Chandler) A little different -- that wasn't quite my question.

My question was, what do you believe the '506 patent teaches with respect to whether the DQ data signal coming out of Figure 16 and also Figure 14 -- whether or not it's aligned with the DQS strobe signal coming out of Figure 15, also shown as coming out of Figure 14? 01:23:14

MR. LINDSAY: Objection. Form. 01:23:37

THE DEPONENT: I -- I don't recall. If there's something in particular in the '506 you want to point me to. I don't recall if they said that it's intended to be edge-aligned or not.

Q. (By Mr. Chandler) So I'm a little 01:23:55

Samsung Ex. 1046, p. 118
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 118
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

confused by your testimony in your declaration. At some points, you and your declaration seem to insist that DQ and DQS will always be edge-aligned. At other times, you say, as you just said now, "Well, it depends. They may not be edge-aligned." 01:23:56 01:24:12

So I'm trying to get your best testimony on this issue.

MR. LINDSAY: Objection. Form.

THE DEPONENT: Would you like to point me to where in my report I discuss that? I'd be happy to refresh my memory. 01:24:24

Q. (By Mr. Chandler) Well, I think it's referred to probably over 20 times.

A. Pardon me?

Q. I think it's referred to in your report over probably 20 times. 01:24:39

So I'm a little confused about what your testimony is.

MR. LINDSAY: Is there a question pending, Counsel? 01:25:09

MR. CHANDLER: It's the same question I've been asking a few times about --

THE DEPONENT: I'm not seeing any reference to Figure 16 in my report.

Q. (By Mr. Chandler) Correct. 01:25:25

Samsung Ex. 1046, p. 119
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 119
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

You refer to DQ and DQS in your report, which is shown in Figure 15 and Figure 16. So that's what I'm trying to understand is, how would a person of ordinary skill in the art reading the '506 patent, in your opinion, understand whether or not the DQ data signal and the DQS strobe signal shown in Figures 15 and 16, as well as Figure 14, whether or not those two signals are in line with each other. 01:25:25 01:25:44

MR. LINDSAY: Objection. Form. 01:26:04

THE DEPONENT: One would read the patent in detail and see if it specifies that. These are, I think we've agreed -- I think the phrase you used "exemplary embodiments." These are embodiments of at least aspects of the claim. 01:26:27

As I said, I don't recall if the patent specifically said 15 and 16 go together. They very well might. I'm not seeing a reference to Figure 16 either.

So you're asking me details about a figure -- two figures that may go together or may not, may be embodiments that go together. Oftentimes, embodiments or parts of embodiments don't go together. That, as far as I can tell, didn't come up in my declaration or Wedig's, which 01:26:44 01:27:04

Samsung Ex. 1046, p. 120
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 120
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

is what I focused on. 01:27:08

And -- and in some cases, the signals are -- the DQ and DQS are intended to be edge-aligned; and in some cases, they are not intended to be edge-aligned. 01:27:23

Q. (By Mr. Chandler) And in other cases, they could become misaligned, correct?

A. If -- if by "misaligned" you mean out of alignment to such a degree that the system fails to work, sure. Any -- any electrical system has operating limitations, yeah. 01:27:37

Q. And including Figure 15 and 16 in the '506 patent; is that fair enough?

MR. LINDSAY: Objection. Form.

THE DEPONENT: That's underspecified. I mean, presumably, if one were to build those circuits, they would have some maximal clock speed that they could operate at. And if you tried to operate them at twice that clock speed, they would fail. Or they'd have some maximal voltage that they could operate at. If you tried to operate them at twice that voltage, they would likely fail. 01:27:57 01:28:13

Q. (By Mr. Chandler) Turn to Figure 10A in the '506 patent.

Let me know when you're there. 01:28:33

Samsung Ex. 1046, p. 121
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 121
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

A. Okay. I'm there. 01:28:35
Q. And you see in upper left, there's 910?
A. You said Figure 10. You meant -- you said 10A or...
Q. Yes. 01:29:04
A. Okay. I was on 10D. Yes, I see 910.
Q. All right. What is 910 in the '506 patent?
A. 910 is illustrating this circuit, Figure 10A. 01:29:22
Q. And how does the '506 patent describe what 910 is?
A. It says, "In an embodiment, a receiver circuit includes a metastability detection circuit (MDC)" [as read], labeled "910." 01:29:49
Q. Okay. And what is 1042 in Figure 10A?
A. It says that "MDC910 includes a sampler circuit 1042." [as read]
Q. And what does the sampler circuit 1042 take as its inputs? 01:30:27
A. It says it "samples MCS1 according to CK0 and outputs a sampled result A."
Q. And what is MSC1 and what is CK0?
A. Well, MCS1 is the output from multiplexer 1071 and CK0 is the output from multiplexor 1072. 01:31:25

Samsung Ex. 1046, p. 122
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 122
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. But what is MCS1? What kind of signal is that? 01:31:31

A. It's the output of the multiplexor 1071.

Q. Is MCS1 a module control signal?

A. I don't recall. I haven't -- yeah, it could be. 01:31:57

Q. You read the patent carefully, right?

A. Yes, that's correct.

Q. Column 12, line 13.

A. Yes, I see it. 01:32:34

Q. So what is MCS1 going into 1042?

A. 1042 is a sampler circuit "that samples MCS1 according to CK0."

I thought we just talked about that, but -- but that's how it's characterized. 01:33:09

Q. All right. So what happens when the clock signal CK0 goes to the sampler circuit 1042?

A. It's used as an input to 1042 in order to control sampling of MCS1.

Q. And what does sampler circuit 1042 do next? 01:33:41

A. It "outputs a sampled result A to sampler circuit 1044." [as read]

Oh, no. Hold on a second.

Yeah, it "outputs a sampled result A." 01:34:12

Samsung Ex. 1046, p. 123
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 123
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. Not to 1044 but to 1050, right? 01:34:16

A. Give me a moment.

Yes, that's correct.

Q. And so what is "metastability," and what is this metastability detection circuit 910 accomplishing? 01:34:40

MR. LINDSAY: Objection. Outside the scope of direct. Form.

THE DEPONENT: Metastability is a problem that occurs within latches or flip-flops of digital circuits that can cause a value to be -- well, it causes misoperation, malfunction of the latch of the register of the flip-flop. 01:34:51

Q. (By Mr. Chandler) And why? Why is there a misoperation? 01:35:18

MR. LINDSAY: Objection. Form. Outside the scope of direct.

THE DEPONENT: Metastability happens when an input value changes at an unfortunate point in time such that its value cannot be reliably sampled. 01:35:34

Q. (By Mr. Chandler) Could you look at Figure 7 of the '506 patent marked as Exhibit 1001.

Let me know when you're there.

A. Sure. I'm there. 01:35:53

Samsung Ex. 1046, p. 124
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 124
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. Figure 7 shows module control circuit 116 on the left side, correct? 01:35:54

A. Yes.

Q. And then coming out of the module control circuit are two signals labeled "MCS" for module control signal and "CK" for clock, correct? 01:36:10

MR. LINDSAY: Objection. Form.

THE DEPONENT: Yes, MCS, and then a complementary clock, CK and CK bar.

Q. (By Mr. Chandler) All right. And take a look at column 12 of the '506 patent marked as Exhibit 1001, lines 51 through 62. 01:36:30

Does the '506 patent indicate that the MCS signal and the CK clock signal can become misaligned? As shown, for example, in Figure 8. 01:37:03

A. I'm still reading that longish passage.

So they -- they suggest that the alignment can change and they cannot be perfectly aligned. I'm not sure if they're -- I don't think they are using the -- I didn't see the phrase "misaligned," and I sort of talked about that before. 01:37:48

I would be inclined to think "misaligned" means so much out of alignment that things won't work. 01:38:03

Samsung Ex. 1046, p. 125
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 125
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. Figure 8 shows that the module control signal MCS and the clock signal CK can become misaligned such that the result is metastability, correct? 01:38:06

MR. LINDSAY: Objection. Outside the scope of direct. 01:38:31

THE DEPONENT: I wouldn't say that, and I -- I don't recall either me or Dr. Wedig commenting on this. I haven't looked at this in quite some time. 01:38:43

Q. (By Mr. Chandler) Column 12, lines 51 through 62, teach that the alignment of the CK clock signal and the MCS module control signal can be shifted to such an extent that the result, as shown at the bottom of Figure 8, can be metastability, correct? 01:39:08

MR. LINDSAY: Objection. Outside the scope of direct.

THE DEPONENT: You said you were back at column 12, right, 51 through 60-something? 01:39:35

Q. (By Mr. Chandler) 62. I mean, it -- you can carry it over to the top of column 13 if you want.

A. Yes, I see that. It says "that the sampled results could be metastable." 01:40:16

Samsung Ex. 1046, p. 126
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 126
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. And the reason the sampled results would be metastable is because the CK clock signal and the MCS module control signal are so far out of alignment that the result is metastability? 01:40:20

MR. LINDSAY: Objection. Form. 01:40:40

THE DEPONENT: Yeah. If the necessary setup and hold times are not adhered to, metastability can be a result.

Q. (By Mr. Chandler) And in Figure 8, how far off is the alignment between the clock signal CK and the module control signal as shown at 840, approximately? 01:40:53

MR. LINDSAY: Objection. Outside the scope of direct.

THE DEPONENT: It's hard to say, because it's not clear if they're -- if the alignment is supposed to be going to the left or to the right. They're -- they do not -- the transition of those signals does not appear to be aligned. 01:41:31

Q. (By Mr. Chandler) Well, in Figure 8 at row 810, the clock signal and the module control signal is perfectly aligned, correct? 01:41:53

MR. LINDSAY: Objection. Outside the scope of direct. Form.

THE DEPONENT: I think they're trying to 01:42:07

Samsung Ex. 1046, p. 127
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 127
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

illustrate that, sure. I mean, nothing is ever perfectly aligned, but I think that's the principle they are trying to illustrate. 01:42:09

Q. (By Mr. Chandler) But, I mean, that's the phrase they use, correct, is "perfectly aligned," at line 52 of column 12? 01:42:18

MR. LINDSAY: Objection. Outside the scope.

THE DEPONENT: I thought -- I thought you asked me if they were perfectly aligned, not if they used the phrase "perfectly aligned." 01:42:30

Q. (By Mr. Chandler) The '506 patent teaches in Figure 8 that the clock signal and the module control signal are "perfectly aligned" at row 810, correct? 01:42:47

MR. LINDSAY: Objection. Outside the scope.

THE DEPONENT: I -- I believe it uses that phrase, sure.

Q. (By Mr. Chandler) And then down at 840, how far out of alignment in terms of clock cycles is the CK signal and the module control signal MCS, approximately? 01:42:55

MR. LINDSAY: Objection. Outside the scope. Form. 01:43:14

Samsung Ex. 1046, p. 128
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 128
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

THE DEPONENT: I think we answered that before. I answered that. You asked it before we moved onto 1 -- to 810. Looking at that figure, I think it's impossible to say. 01:43:19

Q. (By Mr. Chandler) And why do you say "it's impossible to say"? 01:43:34

MR. LINDSAY: Objection. Outside the scope.

THE DEPONENT: There's not enough information on there to say how far out of alignment they are. 01:43:40

Q. (By Mr. Chandler) But it's so far out of alignment that it causes metastability, correct?

MR. LINDSAY: Objection. Outside the scope. Form. 01:43:52

THE DEPONENT: The discussion says that they're -- yes, the clock is rising in a metastability region.

Q. (By Mr. Chandler) What causes or what can cause the clock signal to become not aligned with the module control signal MCS? 01:44:10

MR. LINDSAY: Objection. Form. Outside the scope, if it's referring to the same figure.

THE DEPONENT: So they're assuming they were effectively aligned at some point. They could 01:44:40

Samsung Ex. 1046, p. 129
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 129
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

then become out of alignment by having either one of them delayed or both of them delayed by an unequal amount. 01:44:43

Q. (By Mr. Chandler) And what could cause an unequal delay between those two signals? 01:45:04

MR. LINDSAY: Objection. Outside the scope. Form.

THE DEPONENT: Presumably a difference in electrical properties along the propagation path for the signals. 01:45:21

Q. (By Mr. Chandler) Is it possible for two signals that travel in parallel on a memory module to become not aligned with each other as a result of electrical properties along the propagation path of those two signals? 01:45:58

A. Yes, it's possible.

Q. Is it possible for a DQ data signal and a DQS strobe signal that travel in parallel on a memory module to become not aligned with each other as a result of electrical properties along the propagation path of those two signals? 01:46:26

A. Well, given that I just talked about signals in general and agreed that they could become not aligned, and these are just particular signals, yes. And any two signals following a 01:46:44

Samsung Ex. 1046, p. 130
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 130
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

parallel path could become not -- that were considered aligned at one point could become not aligned at the end point. 01:46:49

Q. Could you look at your expert declaration marked as Exhibit 2006. 01:47:09

Let me know when you have it in front of you.

A. Okay.

Q. And go to page 58.

Let me know when you've got that in front of you. 01:47:27

A. Okay.

Q. Okay. In paragraph 109 and 110 and 111 -- I think we discussed this briefly before -- you refer to the DDR1 standard, the DDR2 standard and the DDR3 standard that came out in 2000, 2003 and 2007, respectively; is that right? 01:47:42

A. That sounds right.

Q. Did either the DDR1 standard or the DDR2 standard provide for read or write leveling? 01:48:02

A. I'm not sure. I thought the read leveling came in at DDR3. But I -- I don't recall for sure.

Q. Did the DDR3 standard provide for read and write leveling? 01:48:25

Samsung Ex. 1046, p. 131
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 131
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

A. I think it did. Yeah, I comment here that it -- DDR3 provides leveling. I just don't recall for sure if it provided both read and write. 01:48:31

Q. Why was leveling needed for the DDR3 standard? 01:48:58

A. Likely for many reasons. To get a complete answer, you would have to ask members of the committee. At least one part of it was the use of what we've been referring to as fly-by communications methods. 01:49:18

Q. But to be clear, I mean, fly-by communication methods existed with the DDR1 and DDR2 standard for things like RDIMMs, correct?

A. Correct.

MR. LINDSAY: Objection. Form. 01:49:33

THE DEPONENT: I don't remember that there were RDIMMs for DDR1 and DDR2, and I'm not suggesting that fly-by was something developed as part of DDR3. But the use of that communications pattern is one of the things that was addressed by use of leveling techniques. 01:49:55

Q. (By Mr. Chandler) So how does read and write leveling address issues related to fly-by arrangements? What are you trying to get at with that statement? 01:50:22

Samsung Ex. 1046, p. 132
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 132
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

MR. LINDSAY: Objection. Form. 01:50:25

THE DEPONENT: So when there's a fly-by communication structure, there's an order as a sequence of components. In this case, SDRAM chips that receive signals over a common communications 01:50:40 channel. So there's no register breaking it up.

And as we talked about, physical wires have a propagation delay. As a consequence of that, the signals will be received at some chips before they're received at others. 01:51:01

And leveling is one technique -- one aspect of leveling is accounting for possible errors as a result of the timing of activation between the nearest and the farthest element.

Q. (By Mr. Chandler) And so what does 01:51:26 leveling accomplish?

A. Well, one thing that it's designed to accomplish in general is to avoid having an error caused by the result of the use of -- pardon me -- the use of fly-by communications. 01:51:44

Q. And why would fly-by communications result in an error, and how does leveling prevent that error from happening?

MR. LINDSAY: Objection. Form.

THE DEPONENT: Well, fly-by 01:52:01

Samsung Ex. 1046, p. 133
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 133
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

communications can introduce an error -- it doesn't always -- as a result of different modules getting, receiving, a signal at different points in time. And leveling is a technique to try to undo the problem -- the timing problems introduced by the fly-by communications. 01:52:02 01:52:23

Q. (By Mr. Chandler) And so as a result of leveling, what signals in particular get leveled with each other?

A. It -- it depends. There's different ways to do read leveling and write leveling in different systems. It's in general an attempt to correct the -- any possible errors or avoid errors that could be because caused by the fly-by communications. 01:52:40 01:52:57

Q. Can you look at the DDR3 standard marked as Exhibit 1020. Let me know when you're there.

A. Okay. I got it open.

Q. Go to page 26 of Exhibit 1020.

Let me know when you're there. 01:53:15

A. Okay.

Q. Are you familiar with the MRS command, the mode register set command, in the JEDEC standard?

MR. LINDSAY: Objection. Outside the 01:53:43

Samsung Ex. 1046, p. 134
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 134
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

scope of direct. 01:53:43

THE DEPONENT: I -- I don't recall. Have I reviewed this at some point? Likely, but I don't recall "Mode Register 1," for example.

Q. (By Mr. Chandler) There is a command JEDEC called the MRS, or mode register set, command that sets various mode registers in the DDR memory device; is that fair? 01:54:05

MR. LINDSAY: Objection. Outside the scope of direct. Form. 01:54:23

THE DEPONENT: I -- I don't recall. I haven't really looked at this specification in detail with regards to this investigation. I mean, if there's something in particular you want to point me to, I'd be happy to review it. And, yeah, this is presumably just for this specification as opposed to, you know, all JEDEC SDRAM devices. 01:54:41

Q. (By Mr. Chandler) Sure.

So on page 33 of Exhibit 1020, you see the first row is the command "Mode Register Set", abbreviated "MRS"? 01:54:59

MR. LINDSAY: Objection. Outside the scope.

THE DEPONENT: Yes, I see those words.

Q. (By Mr. Chandler) And then back on 01:55:11

Samsung Ex. 1046, p. 135
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 135
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

page 26 of Exhibit 1020, one of the mode registers set by the MRS command is labeled "A7, Write leveling enable." 01:55:14

Do you see that?

MR. LINDSAY: Objection. Outside the scope. 01:55:44

THE DEPONENT: I wouldn't say it that way. But I do see that it appears that there's a 1-bit register, A7, labeled "write leveling enable." 01:55:54

Q. (By Mr. Chandler) And the 1-bit register, A7, labeled "write leveling enable" is configured by the mode register set command, MRS, correct?

MR. LINDSAY: Objection. Outside the scope. Form. 01:56:17

THE DEPONENT: Could be.

Q. (By Mr. Chandler) And --

A. I haven't reviewed this anytime recently, so... 01:56:28

Q. All right. So page 22 of Exhibit 1020 at the top says that the four mode registers provided by the DDR3 SDRAM "must be programmed via a mode register set (MRS) command," correct?

MR. LINDSAY: Objection. Outside the 01:56:54

Samsung Ex. 1046, p. 136
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 136
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

scope.

THE DEPONENT: I'm sorry. I'm not following. Where exactly on page 22?

Q. (By Mr. Chandler) The top, the first line. The "four Mode Registers, provided by the DDR3 SDRAM . . . must be programmed via a Mode Register Set (MRS) command," correct? 01:57:13

MR. LINDSAY: Objection. Outside the scope.

THE DEPONENT: It says that, yes. 01:57:30

Q. (By Mr. Chandler) And it goes on to say the -- at the end of that line, the "contents of the Mode Registers must be fully initialized and/or re-initialized, i.e., written, after power up and/or reset for proper operation," correct? 01:57:45

MR. LINDSAY: Objection. Outside the scope.

THE DEPONENT: I believe you have read that correctly, yeah.

Q. (By Mr. Chandler) So at power-up, one of the mode registers shown on page 26 of Exhibit 1020 is whether or not write leveling is enabled, correct? 01:57:56

MR. LINDSAY: Objection. Outside the scope. 01:58:14

Samsung Ex. 1046, p. 137
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 137
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

THE DEPONENT: So one of the -- one element of mode register MR1, as we talked about, is this 1-bit A7 field which indicates whether write leveling is enabled. 01:58:18

Q. (By Mr. Chandler) And then on the bottom of page 27 of the DDR3 standard marked as Exhibit 1020 is a description of write leveling, correct? 01:58:35

MR. LINDSAY: Objection. Outside the scope. 01:58:47

THE DEPONENT: There's a section labeled "Write leveling," yeah. And we can read it and discuss what it literally says, but I don't, as I sit here, have an understanding of exactly what it's referring to. 01:59:02

Q. (By Mr. Chandler) But you would agree that the DDR3 JEDEC standard marked as Exhibit 1020, dated November 2008, provided for write leveling, fair?

A. It discusses what it calls "write leveling," sure. 01:59:23

Q. And it teaches, at the bottom of page 27 of Exhibit 1020, that "For better signal integrity, DDR3 memory module adopted fly-by topology for the commands, addresses, control signals, and clocks," 01:59:55

Samsung Ex. 1046, p. 138
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 138
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

correct? 01:59:57

A. Yes, that's what it says.

Q. And that "causes flight time skew between clock and strobe at every DRAM on the DIMM," according to this DDR3 JEDEC standard, correct? 02:00:11

A. Yes, that's roughly what it says there. Yep.

Q. And would it be fair to say that write leveling is intended to correct for "flight time skew between the clock and the strobe at every DRAM on the DIMM"? 02:00:31

MR. LINDSAY: Objection. Outside the scope.

THE DEPONENT: Well, at the bottom of the page, it says that there is "a 'write leveling' feature to allow the controller to compensate for skew." 02:00:45

Q. (By Mr. Chandler) And page 42 of the DDR3 DIMM standard marked as Exhibit 1020 provides more detail about write leveling, correct? 02:01:05

A. It would appear to go into more detail on what write leveling means in this context, yeah.

Q. Now I want to switch to read leveling, all right?

A. Sure. 02:01:28

Samsung Ex. 1046, p. 139
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 139
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. The DDR3 standard marked as Exhibit 1020 has, on page 31, a reference to a "Multi-Purpose Register (MPR)" at the bottom of page 31, correct? 02:01:29

MR. LINDSAY: Objection. Outside the scope. Form. 02:01:49

THE DEPONENT: Yes, I see Section 3.4.5.1 is titled "Multi-Purpose Register," and then, parenthetically, "(MPR)."

Q. (By Mr. Chandler) And the DDR3 standard teaches that the MRS command will set a mode register bit A0 and bit A1 which will affect the MPR location, correct? 02:02:08

MR. LINDSAY: Objection. Outside the scope. Form.

THE DEPONENT: You're paraphrasing a lot of words there, so let me try to -- from different sentences. 02:02:34

I'm sorry. I'm having trouble following. Could you repeat the question.

Q. (By Mr. Chandler) Let me ask a slightly different question. 02:03:07

In the DDR3 standard marked as Exhibit 1020, on page 31, the mode register set command will set various bits in mode register MR3, including bit A2, titled MPR. 02:03:26

Samsung Ex. 1046, p. 140
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 140
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

And I will stop there; is that correct? 02:03:42

MR. LINDSAY: Objection. Outside the scope of direct.

THE DEPONENT: Yeah, the second sentence says, "To enable the MPR, a MODE Register Set command must be issued to MR3 Register with bit A2 equal to 1." [as read] 02:03:49

Q. (By Mr. Chandler) And if bit A2 equals 1, then the multi-purpose register, abbreviated "MPR," is enabled, correct? 02:04:08

MR. LINDSAY: Objection. Outside the scope of direct.

THE DEPONENT: I think it's -- I think it's enabled regardless, it looks to me.

Q. (By Mr. Chandler) "To enable the MPR" -- the multi-purpose register -- "a MODE Register Set command must be issued to MR3 Register with bit A2 equal to 1" [as read], correct? 02:04:40

MR. LINDSAY: Objection. Outside the scope of direct. 02:04:54

THE DEPONENT: That's -- that's what it says. It's a little bit confusing, but that's what it says.

I don't know how that register is disabled. It's got a value or 1 or 0 in it. 02:05:21

Samsung Ex. 1046, p. 141
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 141
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

It's -- the register itself is going to be enabled. 02:05:26

Q. (By Mr. Chandler) To disable the mode -- the multi-purpose register, MPR, the bit A2 would be set to zero, correct?

MR. LINDSAY: Objection. Foundation. 02:05:55
Outside the scope of direct.

THE DEPONENT: It says if MR3 bit A2 is set to zero, then the MPR is disabled.

Q. (By Mr. Chandler) All right. And then look at page 48 of the DDR3 standard marked as 02:06:28
Exhibit 1020.

Let me know when you're there.

A. Sure.

Q. Page 48 of the DDR3 standard marked as Exhibit 1020 provides some additional detail about 02:06:47
the multi-purpose register, abbreviated "MPR," correct?

MR. LINDSAY: Objection. Outside the scope.

THE DEPONENT: It's got a section titled 02:07:00
"Multi Purpose Register" and a figure that's labeled "MPR Block Diagram."

Q. (By Mr. Chandler) And in Figure 20 of the "MPR Block Diagram," on the right-hand side, it says "Multipurpose register Pre-defined data for 02:07:13

Samsung Ex. 1046, p. 142
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 142
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Reads," correct? 02:07:18

MR. LINDSAY: Objection. Outside the scope.

THE DEPONENT: That's what it says. Is it saying that's the multi-purpose register? 02:07:26

Q. (By Mr. Chandler) The DDR3 standard teaches using the multi-purpose register for calibrating reads "until the read data capture at the memory controller is optimized" [as read], as stated on page 51, correct? 02:07:58

MR. LINDSAY: Objection.

THE DEPONENT: I don't have --

MR. LINDSAY: Outside the scope of direct.

THE DEPONENT: Yeah, if it says -- it says what it says. We were looking -- yeah, this is -- based on the line of questions you -- well, let me see. 02:08:04

Q. (By Mr. Chandler) So page 51, second line from the top of Exhibit 1020, the "memory controller repeats these calibration reads until read data capture at memory controller is optimized," correct? 02:08:22

A. Yes, that's what it says.

MR. LINDSAY: Objection. Outside the 02:08:38

Samsung Ex. 1046, p. 143
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 143
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

scope of the direct. 02:08:38

Q. (By Mr. Chandler) And that's using the MPR multipurpose register shown in Figure 21, correct?

MR. LINDSAY: Objection. Outside the scope of direct. Foundation. 02:08:45

THE DEPONENT: There is no register shown in 21, Figure 21. Furthermore, what you pointed me to as the MPR is that 1-bit register. And now there's a whole bunch of functions which are labeled "MPR" which can't possibly be accomplished with a 1-bit register, so... 02:09:01

Q. (By Mr. Chandler) I think -- I think perhaps you've become a little confused.

So there is a register for enabling the MPR functionality that we discussed with respect to the mode register set command. But then separate from that, there is this multi-purpose register which can be used to read out predefined data patterns, as taught on page 51 of Exhibit 1020, correct? 02:09:17 02:09:40

MR. LINDSAY: Objection. Outside the scope. Form.

THE DEPONENT: So they -- they work close together, and they're both labeled "MPR." They're 02:09:50

Samsung Ex. 1046, p. 144
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 144
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

both multipurpose registers. 02:09:52

Yeah, it's -- I -- I likely do misunderstand. It's very confusing.

Q. (By Mr. Chandler) Top of page 48 of Exhibit 1020 states, "The Multi Purpose Register (MPR) function is used to Read out a predefined system timing calibration bit sequence," correct? 02:10:14

MR. LINDSAY: Objection. Outside the scope.

THE DEPONENT: That's what it says. 02:10:30

Q. (By Mr. Chandler) And then page 51 of Exhibit 1020 shows, in Figure 21, the "MPR Readout of predefined pattern," correct?

MR. LINDSAY: Objection. Outside the scope. 02:10:45

THE DEPONENT: Where is that?

Q. (By Mr. Chandler) The title of Figure 21 at the bottom of page 51.

A. No, I mean where does it show that?

Q. It shows the DQ data coming out in a predefined pattern, correct? 02:11:00

MR. LINDSAY: Objection. Assumes facts not in evidence. Outside the scope of direct.

THE DEPONENT: I don't know. I haven't reviewed this in quite a long time. 02:11:12

Samsung Ex. 1046, p. 145
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 145
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. (By Mr. Chandler) By the time of the DDR3 standard, was read leveling known? 02:11:18

A. Maybe. I'm not sure. I don't know when the -- you know, at what point the concept was introduced. 02:11:52

Q. By the time of the '506 patent in July of 2012, was read leveling and write leveling known?

A. Well, again, I don't know what date the concept of read leveling in particular was introduced into the community, so I can't answer that. 02:12:12

Q. Well, but you know that Hiraishi is prior art and refers to read leveling and write leveling, correct?

MR. LINDSAY: Objection. Form. 02:12:23

THE DEPONENT: He does refer to read leveling. It's not clear what he means by read leveling. How it's implemented is pretty sparse. But that is prior art, yeah.

Q. (By Mr. Chandler) And the '506 patent refers to read leveling and write leveling as a prior art technique, correct? 02:12:34

A. I -- I don't recall. I haven't memorized it. If it does, it does. It wouldn't surprise me at all. 02:12:47

Samsung Ex. 1046, p. 146
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 146
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. In paragraph 114 of your expert declaration marked as 2006, you talk about Butt; is that correct? 02:13:04

A. Yes. Pardon me. Yes.

Q. And that discussion of Butt actually begins on paragraph 109 and carries over to paragraph 114; is that fair? 02:13:28

A. Yes, that's the -- 109 is the start of the section discussing Butt and Hiraishi.

Q. And you characterize Butt as having "old DDR teachings," correct, in paragraph 109 of your declaration marked as Exhibit 2006? 02:13:47

A. Yes, that's the heading of that Section C is --

Q. And so your -- 02:14:07

A. -- is "Old DDR Technology," that phrase. Yeah.

Q. So your opinion is a person of ordinary skill in the art would not have looked at Butt's, quote, old DDR teachings, end quote, to modify or provide details about Hiraishi's DDR memory modules, correct? 02:14:15

A. Yeah, I think I say pretty clearly that they would not have looked to Butt to modify Hiraishi. 02:14:32

Samsung Ex. 1046, p. 147
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 147
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. In forming your opinions, you believe that Butt's teachings were limited to the old DDR1 standard published in 2000, correct? 02:14:32

A. I don't believe I said that. I'd be happy to review something if you wanted me to. 02:14:50

Q. Is that not what you said in paragraph 110?

A. Yeah, but I thought your question was it -- it only relates to that. Maybe I misheard. It does relate -- it does relate to the older technology, but that doesn't mean it doesn't relate to newer technology as well. 02:15:11

Q. That was my next question.

So Butt's teachings are not limited to the DDR1 technology but are also relevant to the DDR2 and DDR3 technology, correct? 02:15:23

A. I don't know. Perhaps. I mean, yeah, I -- it's -- maybe; maybe not. I don't recall if Dr. Wedig commented on that and if I replied to it, I don't think that that was really one of the material elements that was -- yeah, I guess I'll leave it at that. 02:15:50

Q. In forming your nonobviousness opinions, did you consider whether or not Butt's teachings were relevant to the DDR3 memory modules? 02:16:08

Samsung Ex. 1046, p. 148
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 148
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

A. In forming my opinions, I reviewed the arguments that Dr. Wedig put forth and evaluated them. 02:16:16

Q. And Dr. Wedig relied on Butt, correct?

A. Yes. 02:16:31

Q. And in forming your nonobviousness opinions, did you believe that Butt's teachings were relevant to DDR3 memory modules or not?

A. That's not an exercise that anybody I'm familiar with would conduct. I -- I wasn't asked to look at art not owned by my client and consider whether it applies to products not sold by my client. That's -- that would be something new, you know. 02:16:53

Dr. Wedig made some arguments. I was asked to consider the arguments, analyze them, and comment on them. And that's what I endeavored to do. 02:17:12

Q. All right. So just to be sure I understand, you did not consider whether Butt's teachings are relevant to DDR3 memory modules? 02:17:26

MR. LINDSAY: Objection. Misstates testimony. Form.

THE DEPONENT: Not in the abstract outside of my analysis of Dr. Wedig's opinions and 02:17:43

Samsung Ex. 1046, p. 149
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 149
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

arguments. 02:17:50

Q. (By Mr. Chandler) In forming your nonobviousness opinions, did you consider whether Butt's teachings were relevant to read leveling?

A. Only to the extent that Dr. Wedig relied upon -- relied upon that concept. 02:18:16

Q. But what about your opinions? I'm trying to understand your opinions, not Dr. Wedig.

A. Yeah, my opinions are focused in the context of his arguments. That's what I was asked to address. 02:18:36

So there -- there's certainly -- for example, there's a lot of technology that Butt refers to which absolutely is used in DDR2 and DDR3 and 4 and 5 and will be used in 6. 02:18:54

I'm not saying it's, you know, Butt's claimed inventions or anything in particular, or how significant Butt is as -- as an origin, a seminal piece of work, in any of those particular areas. 02:19:14

Q. Butt teaches centering the DQS strobe relative to the DQ data signal, correct?

A. Butt talks about a way to accomplish that, yes.

Q. And that teaching is relevant to DDR2 and 02:19:34

Samsung Ex. 1046, p. 150
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 150
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

DDR3 technology, right? 02:19:38

MR. LINDSAY: Objection. Form.

THE DEPONENT: Could be.

Q. (By Mr. Chandler) You haven't formed the opinion that it's not relevant, right? 02:19:54

MR. LINDSAY: Objection. Form.

THE DEPONENT: I have charged my client only for the time that they asked me and the task they asked me to look at, which was evaluating Dr. Wedig's arguments. Not whether some of the art 02:20:11 was related to other specs -- specifications on products that my clients, as far as I know, don't make.

Q. (By Mr. Chandler) Butt's teachings on centering the DQS strobe signal with the DQ data 02:20:35 signal are relevant to DDR2 memory modules, DDR3 memory modules, DDR4 memory modules being sold today, and the latest standard, DDR5 memory modules, correct?

MR. LINDSAY: Objection. Form. 02:21:03

THE DEPONENT: Maybe. You'll have to refresh my memory if I took a stand on that.

Q. (By Mr. Chandler) Do you have any opinion now on that question?

MR. LINDSAY: Same objection. 02:21:18

Samsung Ex. 1046, p. 151
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 151
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

THE DEPONENT: Well, Butt talks about a particular way to accomplish -- to determine how to do that centering. There are other ways to do it. So, you know, whether Butt is relevant to some -- to the data centering technique in a specific specification or not, I -- I don't know. I don't have an opinion as I sit here. 02:21:25 02:21:40

Q. (By Mr. Chandler) Is centering the strobe signal relative to the DQ data signal, is that important to DDR3 and later technologies? 02:21:57

MR. LINDSAY: Objection. Form.

THE DEPONENT: In many situations. In some situations, it -- it might not be. In fact, in some situations you may want to have them not centered. 02:22:19

Q. (By Mr. Chandler) But in many situations, you would want them centered, because otherwise you could get problems such as metastability or, in the worst case, the circuit just doesn't work, right? 02:22:38

If the DQ and -- data signal and DQS strobe signal becomes misaligned, you get some problems?

A. Well, that assumes --

MR. LINDSAY: Objection. Form. 02:22:49

Samsung Ex. 1046, p. 152
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 152
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

THE DEPONENT: Yeah, that assumes that the setup in all times are equal. They don't have to be equal. 02:22:50

Q. (By Mr. Chandler) In your opinion, are the teachings of Butt relevant to DDR3 memory modules such as Hiraishi? Or do you not know? 02:23:16

A. No, it's -- it's not relevant.

Q. So in forming your nonobviousness opinions, you believe that Butt's teachings were not relevant to DDR3 memory modules like Hiraishi, correct? 02:23:48

A. What I'm saying is they're not relevant to Hiraishi. Hiraishi has circuitry for centering the signals. It does the 90 percent delay. That's the delay. 02:24:12

Butt is -- is trying to figure what the delay should be. Hiraishi doesn't need Butt. Hiraishi knows what the delay should be.

Q. In a DDR3 memory module, the DQ data signal and the DQS strobe signal can become out of alignment, as taught by Butt, correct? 02:24:32

A. Sure. Yeah.

Q. And when that happens, Butt's technique can solve that problem of the DQ data signal and the DQS strobe signal being out of alignment; is 02:24:57

Samsung Ex. 1046, p. 153
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 153
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

that fair? 02:25:01

MR. LINDSAY: Objection. Form.

THE DEPONENT: I think that that accurately paraphrases some of what Butt claims to teach, sure. 02:25:13

Q. (By Mr. Chandler) And when a memory module tries to capture the read data, having the DQS strobe signal properly centered is important, right?

MR. LINDSAY: Objection. Form. 02:25:31

THE DEPONENT: It might be, but as I mentioned, that assumes that the setup and hold times are -- are equal.

Q. (By Mr. Chandler) Butt teaches that when capturing the read data, centering the DQS strobe signal is important, correct? 02:25:52

A. Yeah, I believe -- I believe that's accurate.

Q. Can you look at the DDR3 JEDEC standard marked as Exhibit 1020 and go to page 58. 02:26:18

Let me know when you're there.

A. Okay.

Q. What is the difference between a clock signal and a strobe signal?

A. As a starting point, a clock signal is 02:26:39

Samsung Ex. 1046, p. 154
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 154
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

periodic. 02:26:41

Q. And in slightly less technical terms, what do you mean by "a clock signal is periodic"?

A. Yeah, it goes up and down at a regular rate. So it can be used to time how long an event takes. 02:26:56

Q. But a strobe signal also goes up and down at a regular rate, doesn't it?

A. No.

Q. And why do you say that? 02:27:12

A. Because it doesn't. I mean, it -- it just doesn't.

Q. So what does a strobe signal do?

MR. LINDSAY: Objection. Form.

THE DEPONENT: A strobe signal goes up and down when it needs to indicate to something that we might call a sampler that it should sample its inputs. 02:27:23

Q. (By Mr. Chandler) But when the strobe signal is going up and down, it's going up and down at a regular rate until it stops going up and down; is that fair? 02:27:37

A. No.

Q. Why do you say that?

A. Because it -- it doesn't. It -- if -- 02:27:49

Samsung Ex. 1046, p. 155
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 155
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

if -- you -- you could have a strobe signal that, in a certain context, in a certain piece of hardware, actually went up and down for some period of time at a regular rate. That is not at all the property of strobe signals in general. It's not at all the property of strobe signals in the context that we are talking about. 02:27:53 02:28:08

Q. Okay. So how would you explain to a layperson what a clock signal is versus what a strobe signal is. 02:28:28

MR. LINDSAY: Objection. Form.

THE DEPONENT: A clock signal, in general, is used to measure a time. And a strobe signal is used to indicate that some data should be sampled. It's -- it's known to be in a good state, so it can be accurately read when the strobe signal is asserted. 02:28:47

Q. (By Mr. Chandler) And when you say "when the strobe signal is asserted," is -- I think previously you used the word "transition"; is that -- 02:29:04

A. Yeah, although usually it's just on one edge as a concept. So if you had one strobe signal, typically you'd say when it goes from zero -- from low to high, that's the transition 02:29:17

Samsung Ex. 1046, p. 156
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 156
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

that causes the sampling to happen. 02:29:20

But, you know, we've seen complementary strobe signals, and DDR uses both edges. But, yeah, in -- in general, when it transitions from one state to another, there will be a direction of 02:29:35 transition that is known to be indicating that sampling should occur.

Q. Okay. And so page 58 of Exhibit 1020 shows a clock signal at the top of Figure 28; is that fair? 02:29:50

A. Yes, it shows a clock signal.

Q. And then the next row of Figure 28 on page 58 of Exhibit 1020 shows a DQS strobe signal; is that fair?

A. Yes. 02:30:07

Q. And the JEDEC standard shows the DQS strobe signal going low for a clock cycle and then transitioning from low to high; is that correct?

A. Sort of. It's showing both DQS complementary signals transitioning. So one goes 02:30:34 low to high, the other one goes high to low.

Q. Okay. For simplicity, let's just focus on the DQS strobe with the understanding that there would be a complementary strobe as well.

Is that okay? 02:30:52

Samsung Ex. 1046, p. 157
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 157
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

A. Yes, fair enough. 02:30:54

Q. So the JEDEC standard shows the DQS strobe signal going low for a clock cycle and, then it transitions high, correct?

A. Yes, some portions of this figure show 02:31:11 that sequence.

Q. Okay. Why does the strobe do that?

A. Because it's indicating to the receiver that it should sample its inputs.

Q. Why does it have to go low before it 02:31:29 goes -- for a clock cycle before it goes high?

A. Because it's the transition that triggers the sampling, not the value. So it's not when the thing is high it samples or when it's low it samples. It's when it goes low to high. 02:31:47

Q. Why does the JEDEC standard have the DQS strobe signal go low for a clock period before it goes high?

A. You would have to ask them.

Q. Is that common in the JEDEC standard for 02:32:02 the strobe signal to go low, for a clock signal then to go high, and then alternate between low and high every half clock cycle?

MR. LINDSAY: Objection. Form.

THE DEPONENT: Well, it's -- even on this 02:32:22

Samsung Ex. 1046, p. 158
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 158
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

figure, it's not always doing that. I'll point out, at the beginning, it's low for longer than a clock cycle. 02:32:23

So, yeah, I mean, in this specification, it's showing it going low to high one, two, three, I think four times. 02:32:36

Q. (By Mr. Chandler) And then it goes low?

A. Then it goes low, and then it goes to high Z.

Q. And is high Z what you were discussing earlier as the Z state, the -- 02:32:53

A. Yes. Yeah, it's -- it's considered a high-impedance state. So sometimes it's just called Z; sometimes it's high Z.

Q. Does the clock signal ever go to a high Z state? 02:33:09

A. If it does, you've got a real problem. I don't see it here. And it shouldn't. If a clock signal does that, then any synchronous digital circuit that it drives will, at least for that time period, stop changing at all, stop working. 02:33:25

Q. The JEDEC standard refers to something called the preamble of the DQS strobe; is that correct?

A. Likely. Preambles are used quite often. 02:33:42

Samsung Ex. 1046, p. 159
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 159
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

I don't recall reading about the preamble in this context and -- and how it's used. 02:33:46

Q. So footnote 4 on page 58 of Exhibit 1020 refers to the preamble, correct?

A. It says, "The minimum pulse width of read preamble is defined by tRPE (min)." [as read] 02:34:06

Q. "tRPRE (min)"?

A. Yes, that's right.

Q. And that's shown on the DQS line, correct? 02:34:31

A. Yes, both the middle line and on the bottom line.

Q. So the JEDEC standard teaches the DQS strobe signal as a preamble of tRPRE, which is longer than one clock cycle before the strobe transitions from low to high; is that right? 02:34:53

A. I don't know. I haven't reviewed this any time recently. It's a dense document.

The figure here is showing tRPRE as being bigger than one clock cycle. It could certainly be the case that -- it almost certainly is a variable. Otherwise, it would have said exactly what it was. It could be multiple clock cycles; it could be less than a clock cycle. It's not -- 02:35:14

Q. Yeah, I guess -- 02:35:30

Samsung Ex. 1046, p. 160
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 160
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

A. It's not clear from here what -- exactly how long it is. 02:35:31

Q. But it would be defined in the JEDEC standard if we looked for it, I assume?

A. It -- it would be defined. It may not be statically defined. It may be defined based on values that change at run time. I would be surprised if tRPRE min was not defined somewhere else. Otherwise, somebody trying to implement this would -- would say, "How do I know how long that is? You haven't told me." 02:35:40 02:35:59

Q. So it looks like it's defined on page 164 of Exhibit 1020; is that fair?

THE VIDEOGRAPHER: Counsel, we've been on the record for a hour and 30 minutes. Can we go off the record for one second? 02:36:18

MR. CHANDLER: Let me get an answer to the question, and then we'll --

THE VIDEOGRAPHER: Sure.

THE DEPONENT: I'm almost there. 02:36:32

No, it's not defined. It's characterized as -- as a range. It's not clear what exactly it is.

Q. (By Mr. Chandler) It's got to be a minimum of 0.9 times the clock cycle tCK, correct? 02:37:23

Samsung Ex. 1046, p. 161
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 161
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

A. That appears to be what it's saying, yeah. 02:37:28

MR. CHANDLER: All right. Let's go off the record for about five minutes for the videographer, and then we'll resume. 02:37:40

THE DEPONENT: Great.

THE VIDEOGRAPHER: Thank you, Counsel. We're going off the record. The time is 2:37.

(Recess taken.)

THE VIDEOGRAPHER: We're going back on the record. The time is 2:47. 02:47:56

Q. (By Mr. Chandler) Dr. Mangione-Smith, do you still have page 164 of Exhibit 1020, the JEDEC DDR3 standard, in front of you?

A. Yes, I do. 02:48:11

Q. And you discussed this very page of this very document in your declaration, right?

A. I may have. It wouldn't surprise me. I don't recall. I'd be happy to refresh my memory if you want to point me to something. 02:48:27

Q. Page 65 of your declaration marked as Exhibit 2006 cites to this very table appearing on page 164 of the DDR3 standard marked as Exhibit 1020, correct?

A. Yes. 02:48:48

Samsung Ex. 1046, p. 162
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 162
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. So you've looked at this table, and you understand it, right? 02:48:48

A. I -- I understand the elements that I commented on, yeah. At least those.

Q. Look at page 100 of your declaration marked as Exhibit 2006. 02:49:09

Let me know when you're there.

A. I'm there.

Q. Table 50 of the JEDEC DDR3 standard, top row, shows that for a DDR3-800 memory device, the minimum clock cycle is 2.5 nanoseconds, correct? 02:49:28

A. Yeah, that appears to be the case.

Q. So that's 2,500 picoseconds?

A. Sure.

Q. And then if you go to page 65 of your declaration marked as Exhibit 2006, you cite to Table 65 of the DDR3 standard, which shows that there can be a skew between the DQS strobe signal and the DQ data signal when leaving the memory device that is up to 200 picoseconds, correct? 02:49:48 02:50:15

A. Yeah, I mean, I -- it probably should have said something like the maximum tolerable skew according to spec is 200 picoseconds.

Q. So under the DDR3 standard, a DQS-to-DQ skew of up to 200 picoseconds is permitted for the 02:50:49

Samsung Ex. 1046, p. 163
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 163
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

signals coming out of the DDR3 memory device, correct? 02:50:59

A. Yeah, it says that -- well, specifically for DDR3-800, that is the maximum tolerable skew. Yeah. 02:51:24

Q. And so a math question for you: If the skew is 200 picoseconds, and the clock period is 2,500 picoseconds, as we discussed a moment ago, how many degrees can the DQS strobe be skewed relative to the DQ data signal? 02:51:48

A. I don't know. I'm not going to do the math in my head while being videotaped.

Q. Would it be 200 divided by 2,500 times 360 degrees?

A. Could be. 02:52:08

Q. Well, can you tell me. You can pull up a calculator if you want, or you can ask me to --

A. No, I just -- you know, it's -- it is a mathematical equation. It is whatever it is. I don't want to use a calculator. I don't really want to calculate it. I haven't -- I don't usually deal with delays in terms of degrees. If you represent that that's what it is, I have no reason to disbelieve you. 02:52:20

Q. Well, I mean, you refer a lot to a 02:52:33

Samsung Ex. 1046, p. 164
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 164
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

90-degree delay, right? 02:52:35

A. Yes.

Q. And that's one-quarter of a clock cycle?

A. Yes.

Q. In this page, 65 of your declaration, 02:52:49
you're referring to 200 picoseconds relative to a clock cycle of 2,500 picoseconds. And so I'm trying to understand, to make an apples-to-apples comparison, how many degrees that is.

A. Sure. I understand, yeah. 02:53:09

Q. So I'll perform the calculation for you, but I want to make sure that the equation is correct in your mind to calculate --

A. It -- it might be a little easier, at least for me, to go the other way, if you'll buy 02:53:26
this: That if it's 2,500 picoseconds, figuring out what a quarter of that is, that's easier math for me to do on the spot, and then comparing that to the 200.

Q. Sure. 02:53:45

So a quarter of 2,500 is 625?

A. That sounds right to me. And I apologize for cutting you off there. I just -- I didn't want to stall, but I didn't want to --

Q. I got it. 02:54:04

Samsung Ex. 1046, p. 165
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 165
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

A. -- do the other equation wrong on the spot and feel silly. 02:54:05

Q. So if the skew were 625 picoseconds, that would be a 90-degree skew. Here it's about a third of that. It's 200 picoseconds. And by my calculation, that's 28.8 degrees. 02:54:17

Does that sound reasonable?

A. Sure. That's about a third of the 90 degrees. That sounds reasonable. Although, I mean, this is not -- this is not the skew you're seeing. This is the -- the worst-case skew you could have to operate under the specification. 02:54:32

Q. So the maximum skew permitted for the DDR3-800 is, in terms of degrees, 200 picoseconds divided by 2,500 picoseconds, which is the clock cycle, times 360 degrees equals 28.8 degrees. 02:54:54

Does that sound reasonable?

A. Yes.

Q. And to be clear, this 28.8-degree skew permitted by the DDR3 standard, that's at the moment the DQS and DQ signals are leaving the memory device, correct? 02:55:13

In other words, JEDEC can't guarantee that as the DQ and DQS travels along the wire that they won't become further skewed. 02:55:43

Samsung Ex. 1046, p. 166
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 166
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

A. Yes, that -- that's correct. And towards the bottom of paragraph 124, I say that it's only complying if the DQS signal were activated; and then, up to 200 picoseconds later, the DQ signal was activated. 02:55:49 02:56:06

Q. And so that's referring to coming out of the memory device?

A. Indeed.

Q. All right. And so it's possible -- I'm not saying it's necessary -- but it's possible the skew of up to 28.8 degrees could get worse as the signals travel along the wire and the memory module to their destination; is that fair? 02:56:21

A. Sure. I think that spec we were looking at was just for the DRAM chip, not for the DIMMs. So it would make sense that it would only be talking the -- the chip performance. 02:56:41

Q. So at various points you referred to taking a DQS strobe signal and delaying it by 90 degrees, correct? 02:57:11

A. Yes.

Q. But to be clear, under the DDR3 standard, that DQS strobe signal could end up anywhere from less than 61.2 degrees to more than 118.8 degrees relative to the DQ data signal, correct, given that 02:57:36

Samsung Ex. 1046, p. 167
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 167
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

skew that we just discussed at 28.8 degrees? 02:57:42

A. I -- to be honest with you, I'm not sure. Reading this, it's only talking about the skew to one side, not both, right, with the DQS signal being activated first, and then subsequently the DQ 02:58:04 signals being activated.

It may be that -- that the skew coming out is symmetric. I don't recall for sure.

Q. The standard doesn't limit the direction in which the skew exists, right? It could be a 02:58:25 skew in one direction or it could be a skew in the other direction, right?

A. It certainly could be. I just don't recall if this skew that it will tolerate can go in either direction. It may be symmetric; it may be 02:58:45 asymmetric.

Q. Now, in forming your -- I apologize. I lost something where I was.

Bear with me one moment.

Look at page 57 of the JEDEC standard 03:00:03 marked as Exhibit 1020.

Are you there?

A. No. Almost. Okay.

Q. So the bottom of page 57 of the JEDEC standard marked as Exhibit 1020 shows that the 200 03:00:39

Samsung Ex. 1046, p. 168
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 168
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

picosecond skew that we were discussing, labeled "tDQSQ," can be either to the left of the eye or to the right of the eye, correct? 03:00:44

A. It's showing tDQSQ can be either to the left or to the right. 03:01:17

Q. Okay. Can you turn to paragraph 114 of your declaration marked as Exhibit 2006.

A. Or actually, is that -- I'm sorry. I'm -- I'm trying to read this again.

It looks -- it looks to me like it's only to the left. But maybe I'm reading the chart wrong. So the -- the -- there's a red circle with a line going to the left for tDQSQ, and it goes to the left in both cases. 03:01:36

Q. Up above, it indicates tDQSQ describes the latest valid transition for the rising data strobe. 03:02:07

A. I was looking at the bottom figure. Where are you pointing me to?

Q. The same page, but at the top. There's some text. 03:02:22

A. Okay.

Q. "tDQSQ."

A. Yeah, I see that.

Q. And then it also, for the following 03:02:32

Samsung Ex. 1046, p. 169
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 169
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

strobe, it says "tDQSQ describes the latest valid transition"? 03:02:34

A. Sure. Yeah.

Q. And so do you think the skew is only to one side or to both sides, the permitted skew? Or are you not sure? 03:03:00

A. No, this -- this seems to show only to the one side. It's double data rate. So there's a transition on the rising transition and the falling edge. 03:03:16

But as -- as I've said, it's been a long time since I've looked at this, and there's huge parts I did not rely upon.

Q. Well, I mean, you refer to the 200 picosecond skew, which is why I was bringing this up. I mean, that is something you talked about, right? 03:03:38

A. Yes, out of the 211 pages, that -- that is a piece that I brought out. Yeah.

Q. So look at your declaration in paragraph 114. 03:03:58

A. You said paragraph or page? You must have meant paragraph, yeah.

Q. Page 60, paragraph 114.

A. Okay. I'm there. 03:04:17

Samsung Ex. 1046, p. 170
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 170
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. At the end of that paragraph, you assert the data centering for purposes of capturing/sampling data is not read leveling, correct? 03:04:18

A. Yes. 03:04:26

Q. In forming your nonobviousness opinions, you believe that read leveling does not include the step of aligning the DQS strobe signal with the DQ data signal; is that correct?

MR. LINDSAY: Objection. Misstates prior testimony. 03:04:54

THE DEPONENT: I -- I wouldn't say that, no.

Q. (By Mr. Chandler) In your opinion, does read leveling include the step of aligning the DQS strobe signal with the DQ data signal? 03:05:00

A. No.

Q. Okay. So in forming your opinion, you believe that read leveling does not include the step of aligning the DQS strobe signal with the DQ data signal; is that correct? 03:05:21

A. Unless when you say "aligning" you -- you include relative aligning. They're -- they're not aligned. They're -- well, for example, delayed by 90 degrees is a delay between them. 03:05:37

Samsung Ex. 1046, p. 171
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 171
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. I was trying to exclude relative alignment. 03:05:52

A. Okay.

Q. Because -- so let me be more clear with that caveat in mind. 03:06:00

Do you believe that read leveling includes the step of centering the DQS strobe signal with the DQ data signal?

A. I would expect so. I think it depends on the specific situation in any case, certainly in read leveling, but in other situations where there's some circuit that's sampling its input. 03:06:19

You want to have a relationship between the -- when the sample data is valid and when the strobe signal is asserted that gives you confidence you'll be within the eye, within the greater-than-the-whole time and less -- I'm sorry -- greater that the setup time and less than the hold time. 03:06:39

But in some situations, that's so easy to accomplish, you don't really need to think about much of anything. It's just that the DDR systems, the timing is so aggressive, it becomes a very complicated problem. 03:06:54

Q. So with at least the DDR systems, do you 03:07:10

Samsung Ex. 1046, p. 172
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 172
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

think it would be normal for the read leveling process to include the step of centering the DQS strobe signal with the DQ data signal? 03:07:16

A. Yeah, because if my recollection is right, they're -- they're coming out edge-aligned, and they have to not be edge-aligned for the sampling. 03:07:35

Q. And are you referring to simply delaying the strobe signal by precisely 90 degrees? Or are you referring to actually aligning the strobe signal with the data signal even if that requires a delay more than 90 degrees or less than 90 degrees to get it centered? 03:08:16

A. I'm just talking about the delaying it such that the designer has confidence that the data will be reliably sampled, would be within the eye. 03:08:37

Q. And sometimes that delay might be more than 90 degrees to get it in the center of the eye, and other times it might be less than 90 degrees to get it in the center of the eye; is that fair? 03:08:56

A. Well, it doesn't have to get it in the center of the eye. In some cases, the delay might be more than 90 degrees or less than 90 degrees because there are limitations in precision. Maybe I'm trying to make it exactly 90 degrees, and it's 03:09:14

Samsung Ex. 1046, p. 173
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 173
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

as close as I can get it. That's good enough. 03:09:17

There could also be situations where for -- perhaps I accounted for the 28, et cetera, degrees of difference that we were just talking about and set the delay to something other than 03:09:29 approximately 90 degrees.

Q. And I'm trying to look at what you just said.

You referred to 28 degrees, et cetera. You're referring there to the 28.8 degree skew 03:10:08 permitted by the DDR3 standard that we discussed a moment ago?

A. Yes.

Q. And then as we discussed, the skew, though, can sometimes be more than 28.8 degrees 03:10:29 given what happens along the wires in the memory module, correct?

A. Yeah. It's a specification for the DRAM chip, not the memory module.

I'm sorry. Not -- not the DIMM. 03:10:47

Q. Can you look at the Hiraishi marked as 2006.

A. I'm assuming that's the same Hiraishi we --

Q. I'm sorry. 1006. 03:11:19

Samsung Ex. 1046, p. 174
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 174
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

You know what -- I'm sorry -- 1005. 03:11:22

A. Okay. Yes.

Q. Okay. And in your declaration marked as 2006, you refer to Hiraishi in paragraph 42, correct? Among others, but we'll start at 03:11:51 paragraph 42 on page 19.

A. Yes.

Q. Hiraishi, marked as Exhibit 1005, discloses data buffers on the memory module, correct? 03:12:14

A. Yes, it believe it does. Yeah.

Q. At the end of paragraph 42, you state that there "was a well-known difference between buffered and unbuffered DIMMs," correct?

A. That's correct. That's what it says. 03:12:31

Q. And as stated in the paragraph and as we discussed a little bit earlier, the data buffer can help reduce the load capacitance that the memory module experiences, correct?

A. Yes. You'll -- you'll see in this 03:12:52 figure, for example -- I think when we talked about it before, I commented on it's useful when there are multiple ranks. And this image, Figure 3, shows two ranks.

Q. And so Hiraishi includes data buffers to 03:13:08

Samsung Ex. 1046, p. 175
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 175
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

reduce the load capacitance to permit a high data transfer rate, as you indicate at the beginning of paragraph 42; is that fair? 03:13:10

A. Yes, that's the intent of -- that's one of the intents of those data buffers. 03:13:23

Q. And Hiraishi's data buffers are distributed along the memory module. There's not a single central data buffer, but instead there's multiple distributed data buffers on Hiraishi's memory module, correct? 03:13:42

A. I don't recall for sure. I think that's the case. Yeah. Yeah, that appears to be the case.

Q. That's shown, for example, on Figure 1 of Hiraishi marked as Exhibit 1005? 03:13:52

A. Yes.

Q. Turn to page 45 of your expert declaration marked as Exhibit 2006.

Let me know when you're there.

A. I'm sorry. You said page 45? 03:14:21

Q. Yes.

A. Okay. I'm almost there.

Okay.

Q. Figure 5 of Hiraishi shows some buffers labeled "INB" and "OUTB," correct? 03:14:42

Samsung Ex. 1046, p. 176
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 176
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

A. Yes.
Q. Would you pronounce that "INB" or "OUTB," or how would you say?
A. Yeah, I think that's -- it's input buffer and output buffer. Yeah, "INB" and "OUTB." 03:14:58
Q. And the upper right of Figure 5 shows a buffer control signal BC that goes to the INB and the OUTB buffers, correct?
A. Yes, although it's -- it's two signals. I don't recall if they call BC in or BC out or BC1 or BC2. But they have to be two signals since if they're both asserted, you've got a problem. 03:15:17
Q. All right. What does the control signal do to the INB buffer and the OUTB buffer?
A. So those signals coming in from the -- the sides of the triangles control whether the buffer is activated or whether its output state is in the Z state. 03:15:37
Q. So are INB and OUTB buffers in Figure 5 of Hiraishi tri-state buffers? 03:15:57
A. Yes.
Q. And the control signal coming either to the -- I guess it always comes to the top of the triangle -- would either put the tri-state buffer in a high Z state, or it would enable the buffer to 03:16:18

Samsung Ex. 1046, p. 177
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 177
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

pass the input to the output. 03:16:27

Is that a fair summary?

A. Yes, I think that's accurate.

Q. Could you turn to page 24 of your expert declaration marked as Exhibit 2006. 03:16:50

Let me know when you're there.

A. Okay.

Q. In paragraph 52 of your expert declaration marked as Exhibit 2006, you indicate that Hiraishi has both S4 leveling and S5 leveling, 03:17:05 correct?

A. Yes.

Q. In Hiraishi, S4 leveling is performed by write leveling circuit 322 and read leveling circuit 323 in data register control circuit 320 of 03:17:24 the data register buffer 300 shown in Figure 5?

A. Yes.

Q. S5 leveling, in contrast, is performed by circuitry inside the system memory controller, correct? 03:17:52

A. In part, yeah.

Q. What do you mean by that, "in part"?

A. Well, we -- we've really only been talking about S4. I thought S4 was read and write leveling from the buffer to the memory. 03:18:12

Samsung Ex. 1046, p. 178
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 178
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. Okay. Look at paragraph 53, the next page. 03:18:16

A. Okay.

Q. That's what I was getting at.

So -- 03:18:23

A. Okay. Yeah. Yeah.

Q. And so S5 leveling is performed by the system memory controller and the host computer outside --

A. That's -- 03:18:40

Q. -- the memory module, correct?

A. That's right.

Q. And since you seemed to have a momentary confusion between S4 and S5 made me feel better, because I had the same confusion. 03:18:55

MR. CHANDLER: And to that end, let me introduce Exhibit 1049.

(Exhibit 1049 was marked for identification by the Court Reporter and is attached hereto.) 03:19:02

Q. (By Mr. Chandler) And let me know when you have it up.

A. Okay.

Q. So Exhibit 1049 is something I created simply to try to allow us all to remember the 03:19:24

Samsung Ex. 1046, p. 179
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 179
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

difference between S4 leveling and S5 leveling. 03:19:28

A. Yeah. I had -- I had the relationship right in my head, just a question of where the control function resided.

But yeah, S4 is from the buffer to the memory, and S5 is from the buffer to the memory controller. 03:19:42

Q. Okay. So as shown in Exhibit 1049, Hiraishi discloses both S4 read and write leveling between the data register buffer 300 and the memory chip, which is shown on the right side as green. Plus, Hiraishi also discloses S5 read and write leveling between the memory controller in the host computer and the data register buffer 300; is that fair? 03:19:59 03:20:25

A. Yeah. I guess I would just say that it -- it discloses that S5 leveling is done. It may not be disclosing exactly how it's done, if it's being done in the host memory controller. But it is disclosing S4 and S5 for read and write. 03:20:41

Q. And S5 read and write leveling, it's not performed by the data register buffer 300, correct?

That's what you stated in --

A. Yeah, that's -- that's correct.

Q. -- paragraph -- okay. 03:21:01

Samsung Ex. 1046, p. 180
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 180
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Whereas S4 read and write leveling is performed by the circuitry in the data register buffer 300 of Figure 5 of Hiraishi, correct? 03:21:03

A. Yes, that's correct.

Q. Okay. And that's really all that this exhibit was intended to memorialize. Feel free to keep it or put it aside. 03:21:19

A. Okay.

Q. So I want to focus for a moment on S4.

Okay? 03:21:52

A. Yes, sir.

Q. What does S4 read leveling in Hiraishi accomplish?

A. It's -- it's an attempt to control the system such the buffers distributed across the DIMM can reliably sample the -- the data values being read from the DRAM chips. 03:22:10

Q. And what is being leveled relative to what in Hiraishi's S4 read leveling?

A. I mean, I can tell you what it does. I don't -- it's always struck me as a weird term, so I don't -- "what is being leveled." 03:22:40

I mean, it's -- it's responding to the fact that as the control signals propagate from the middle of the DIMM out to the edges, there's a 03:22:52

Samsung Ex. 1046, p. 181
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 181
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

propagation delay. And as a consequence of that, the data out and the data strobes from the DRAMs will be sent at different times. Across, you know, one chip will be different from the next chip from the next chip. 03:22:54 03:23:11

Q. During Hiraishi's S4 read leveling, does the memory device change the timing of the data that is being output, or does the timing of the memory device stay the same during read leveling?

A. Well, the memory -- if I understand the question right, the memory device, in principle, I don't think it knows -- I don't think it has to know anything about read leveling. A chip could be used on its own or with a different mechanism for distributing the control signals such that they -- if the control signals were fully aligned, then there wouldn't be this fly-by problem. 03:23:37 03:23:53

So, yeah, I think the read leveling issue only comes up at the data buffers, not at the memory chip itself. 03:24:13

Q. Okay. So in Hiraishi's S4 read leveling, the data register buffer 300 shown in Figure 5 is what performs the read leveling; is that fair?

A. Yes, that's my understanding.

Q. During S4 read leveling in Hiraishi, does 03:24:32

Samsung Ex. 1046, p. 182
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 182
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

the data register buffer 300 change the timing of either the DQS strobe signal or the DQ data signal? 03:24:37

A. No, that's -- that's completely controlled by the -- by the SDRAM chip.

Q. So in your opinion, as we -- I think you said a moment ago, the SDRAM chip doesn't change its timing, correct, during read leveling? 03:25:04

A. Correct.

Q. And furthermore, if I understand you correctly, your opinion is that Hiraishi's data register buffer 300, during S4 read leveling, also does not change the timing of either the DQS strobe signal or the DQ data signal, correct? 03:25:23

A. Not as they come out of the DRAM. They just yeah, come out of the DRAM as they come out. 03:25:41

Now, I want to be a little bit careful. There's -- there's really -- there's typically two parts to something like read or write leveling. There's a training and setup period, and then there's a regular operation. During regular operation, it is doing read leveling, but it's not being trained. It's not considering any other values in any way. 03:25:57

Q. As a result of Hiraishi's S4 read leveling, does the data register buffer 300 change 03:26:16

Samsung Ex. 1046, p. 183
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 183
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

the timing of either the DQS strobe signal or the DQ data signal as it goes through the data register buffer 300? 03:26:22

A. Sure. It probably shouldn't, but it could, yeah. 03:26:49

Q. Why do you say "it probably shouldn't"?

A. Well, what the read leveling circuit is doing is it's generating these BC signals. And so if a -- the timing -- there is -- from a point of view of physics, there will be a time delay to go through each of those tri-state buffers, but we want them to be essentially instantaneous. So let's assume that they're exactly the same. I'm sorry. That there is no effective time delay. 03:27:17

So the only way I could think that it could change the timing of the DQ or the DQS is if it turned on the buffer later than it should have, in which case the system would just fail. 03:27:32

Q. Okay. But assuming the system doesn't fail, in your opinion, S4 read leveling in Hiraishi, based on your understanding, should not change the timing of either the DQS strobe signal or the DQ data signal as it passes through the data register buffer 300, correct? 03:27:51

A. I think that that's right. I mean, 03:28:18

Samsung Ex. 1046, p. 184
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 184
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

the -- these data buffers are presumed to all be identical. There's, you know, eight or nine of them on a -- on a distributed data buffer design. They have the same delay through that circuitry for the DQ and DQS. So, yeah, it shouldn't be changing the -- the delay within the buffer itself. 03:28:19 03:28:36

Q. And that's the understanding of Hiraishi that you used in forming your nonobviousness opinions, correct?

A. Yeah. There's -- there's no -- there's no variable delay path in there that I see. I mean, there is -- there is a fixed delay for the DQS in the delay circuit 372, so I guess that was a little bit inaccurate. It was inaccurate. 03:29:00

But other than that, that's a fixed delay. It -- you know, everything else is anticipated to not have any delay. 03:29:19

Q. So in your opinion, in S4 read leveling in Hiraishi, the data register buffer is not supposed to create any variable delay for either the DQS strobe signal or the DQ data signal in your opinion, correct? 03:29:42

MR. LINDSAY: Objection. Misstates prior testimony. Form.

THE DEPONENT: Well, it's not supposed to 03:29:58

Samsung Ex. 1046, p. 185
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 185
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

create any delay for the -- for the DQ signals. And then it -- it introduces this fixed delay for the DQS signal. 03:29:59

Q. (By Mr. Chandler) But not any sort of variable delay that depends on the fly-by delay, correct? 03:30:18

A. That's right. The fly-by delay causes the signals coming out the DRAM chip to have delays relative to each other but not within one of the DRAM chips. 03:30:39

Q. And in your opinion, Hiraishi's S4 read leveling does not remove any of the fly-by delays, correct?

A. No, I wouldn't -- I wouldn't say that.

Q. Why not? 03:31:03

A. Well, the fly-by delays are still there. It -- it does change the timing of the INB path, but the signals come out of the chips as they -- as they come out. That -- that is affected by the fly-by time. And it goes through Hiraishi's data buffer in a -- in a fixed delay. Well, no delay -- essentially no delay, with the exception of the FIFO and then the delay circuitry 372. 03:31:25

Q. In your opinion, after S4 read leveling, Hiraishi's data buffer will send the DQS strobe 03:31:48

Samsung Ex. 1046, p. 186
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 186
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

signal and the DQ data signal to the system memory controller without any changes to the timing of those signals, other than the fixed 90-degree adjustment of the strobe signal, correct? 03:31:53

A. I -- I don't think so. But maybe I misheard the question. 03:32:15

Could you repeat it.

Q. In your opinion, after S4 read leveling, Hiraishi's data register buffer 300, shown in Figure 5, will send the DQS strobe signal and the DQ data signal to the system memory controller without any changes to the timing of those signals other than the fixed 90-degree delay to the DQS strobe signal, correct? 03:32:30

A. No. 03:32:55

Q. Okay. Explain it to me, then.

A. Well, the DQS signal is not sent through the memory controller. That's -- that's one issue.

The second issue is that there's a FIFO 302 which introduces some clock-period-based delay. 03:33:14

Q. Why do you say that the DQS strobe signal is not sent to the system memory controller?

A. Because it's not.

Q. Where does it go?

A. It goes into -- well, it goes through the 03:33:43

Samsung Ex. 1046, p. 187
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 187
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

tri-state buffers first, and then it goes into a selector, and then it goes into a delay circuit, and then it goes into the FIFO 302. 03:33:50

Q. But then the data register buffer 300 outputs a DQS strobe signal, right, at 350? 03:34:09

A. Not the DQS strobe signal that we've been talking about. You were talking about it going from one side and passing through and asking about delays. It -- there is no such signal.

Q. I want to focus on the timing of the DQS strobe signal that comes into the data register buffer 300 and the DQS strobe signal that goes out of the register data buffer 300 in Hiraishi. 03:34:30

Understood?

A. Okay. Sure. 03:34:47

Q. And Hiraishi calls it "DQS" in both instances, right?

A. It is labeled "DQS." It's a signal used to strobe data.

Q. In your opinion, does Hiraishi's data buffer 300, after S4 read leveling, introduce a variable delay to the DQS strobe signal that's sent to the system memory controller? 03:34:59

A. Possibly. I mean, the emphasis of the analysis has been on the read side, but I would 03:35:45

Samsung Ex. 1046, p. 188
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 188
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

have to review. I think 376, the -- well, no. 03:35:48

I guess I'd have to say the answer to that is no.

Q. So in forming your nonobviousness opinions, you believe that Hiraishi's data register buffer 300, after S4 read leveling, does not introduce a variable delay in the DQS strobe signal that's sent to the system memory controller, correct? 03:36:03

A. That's right. It gets generated. It goes through a tri-state buffer. It goes out the pin. 03:36:27

Q. So in your opinion, the fly-by delays that exist on the memory module will be present both at the input to Hiraishi's data register buffer 300 for the DQS strobe signal as well as the output of the DQS strobe signal that goes to the system memory controller; is that fair? 03:37:17

A. I don't know that I would say that. That's not really something I've discussed. 03:37:43

Q. I'm just trying to understand what you believe the S4 read leveling accomplishes, if anything, relative to the DQS strobe signal that's coming into the data register buffer 300 in comparison to the DQS strobe signal that's going 03:38:01

Samsung Ex. 1046, p. 189
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 189
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

out the data register buffer 300. 03:38:05

A. Read leveling is about accounting for timing differences caused by the fly-by communications path in the buffer for reading that data. 03:38:20

So that's why one of things that it does is it turns on the -- the inbound, the INB path, but only turns it on when it needs to be turned on. That's part of read leveling, knowing when to turn that on. 03:38:38

But ultimately, you know, if -- if everything works according to plan, the data gets put into a FIFO circuit, which is labeled "302." And then at some point after that, it gets clocked out, and the system generates a value of DQS to coincide with that. 03:38:54

Q. Could you look at paragraph 12 of Hiraishi marked as Exhibit 1005.

Let me know when you're there.

Do you see the heading "Brief Description of the Drawings" in -- 03:39:45

A. Yes, I -- yes, I do.

Q. And then do you see in paragraph 13, there is a reference to a schematic diagram; and then in paragraph 14, there's a reference to a 03:39:56

Samsung Ex. 1046, p. 190
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 190
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

block diagram? 03:39:56

A. Yes.

Q. What's the difference between a schematic diagram and a block diagram?

A. I don't know what they mean by the 03:40:06
difference here. Let me go back and see if I can identify what I would consider a difference.

One view is that schematics often are illustrating electrical components, like resistors and transistors. 03:40:24

Oh, okay, yeah. This is -- so Figure 1 is more of a component, a physical component, organization. It shows some nonfunctional blocks, for example, nonfunctional elements. Whereas Figure 2 is just focusing on major functional 03:40:41
element and the communications between them.

Q. And outside of Hiraishi, is it common to distinguish between a schematic diagram and a block diagram? Is that a distinction that you're familiar with? 03:41:05

A. It's -- it's not uncommon. It's -- I would say it's not unheard of, either, to use the term to describe both. You know, here's a -- I would feel fine if somebody turned to Figure 2 and said, "Here's a schematic of, you know, the -- the 03:41:22

Samsung Ex. 1046, p. 191
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 191
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

major components." 03:41:25

You know, Figure 1 is much less a block diagram because it doesn't show just blocks. But Figure 2 I could say is a schematic or a block diagram. 03:41:40

Q. All right. But the way Hiraishi describes it is Figure 1 is a schematic diagram, and Figure 2 is a block diagram.

A. Yes, sir.

Q. Figure 5 is a block diagram, correct, in Hiraishi? 03:41:51

A. If he describes it -- yeah, if he describes it that way. He probably would.

It's sort of, I would say, halfway between, because it does show blocks, but it also does show what I would consider to be literal circuits, like the tri-state buffers. 03:42:07

Q. But paragraph 17 of Hiraishi describes Figure 5 as a block diagram, correct?

A. Let me see. Yes. 03:42:24

Q. Hiraishi does not describe Figure 5 as a schematic diagram, correct?

A. Not in paragraph -- not in paragraph 17.

Q. And not elsewhere either, right?

A. I -- I don't recall. Like I said, to me, 03:42:47

Samsung Ex. 1046, p. 192
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 192
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

in many cases the terms are interchangeable, 03:42:51
although there are situations where they're not.
Q. But Hiraishi doesn't use them
interchangeably, right? He either describes the
figure as a block diagram or a schematic diagram? 03:43:03
MR. LINDSAY: Objection. Form.
THE DEPONENT: Yeah, I don't know.
Hiraishi is -- describes it as -- as he describes
it.
In these paragraphs 12 through 17, he 03:43:12
appears to not be using them interchangeably.
Q. (By Mr. Chandler) So Figure 1, according
to Hiraishi, is a schematic diagram; Figure 2 is a
block diagram; Figure 5 is a block diagram;
Figure 6 is a block diagram; Figures 8A and 8B are 03:43:31
schematic diagram; Figures 9A and 9B are a
schematic diagram, according to Hiraishi.
Is that correct?
A. I'm going to trust that you repeated it
accurately. 03:43:48
I was going back and looking at Figure 4,
which he doesn't characterize as either. It's not
clear to me why he calls that a perspective view.
Figure 4 has got functional blocks, and it shows
communications paths between them. 03:44:02

Samsung Ex. 1046, p. 193
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 193
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

So again, he describes them the way he does. It's not clear to me in each of these cases why he chooses those terms or, you know, what significance there would be between one or the other. 03:44:13 03:44:24

I would say Figure 4 is a block diagram and it's a schematic.

Q. But that's not what Hiraishi says, right?

A. No, no. That's what I would say. Yeah. I don't think his -- 03:44:36

Q. Right.

A. I don't think his terminology there is -- at least in those passages we've -- we've looked at just now, his terminology is not clear, why -- why he calls one -- one thing versus the other. 03:44:49

Q. But he clearly uses a different description for different figures, right? Some are schematic diagrams in his view, and some are block diagrams in his view; is that fair?

MR. LINDSAY: Objection. Asked and answered. 03:45:09

THE DEPONENT: Yeah, and some are perspective views. And, you know, it could be the case that, you know, he's calling one -- one as being subsumed in his view by another. I don't 03:45:22

Samsung Ex. 1046, p. 194
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 194
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

know exactly what -- what he means and what the bounds are for what he means when he calls something a schematic versus a block diagram. Maybe block diagrams are all -- also schematics, or vice versa. 03:45:25 03:45:39

Q. (By Mr. Chandler) Could you turn to page 45 of your expert declaration marked as Exhibit 2006.

Let me know when you're there.

A. Sure. 03:45:59

Q. You've annotated Figure 5 of Hiraishi on page 45 of your declaration marked as Exhibit 2006, correct?

A. Yes. I've added coloring. I don't think there's any changes other than highlighting certain paths and elements. 03:46:12

Q. In the upper right of Figure 5 of Hiraishi, you've highlighted the data register control circuit 320 in red, correct?

A. Yes, that's correct. 03:46:27

Q. The data register control circuit 320 in Figure 5 of Hiraishi receives an input signal labeled "DRC" at the top of the figure, correct?

A. Yes, I see that.

Q. And DRC is a signal coming from the 03:46:44

Samsung Ex. 1046, p. 195
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 195
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

module controller on Hiraishi's memory module, correct, as shown, for example, in Figure 7? 03:46:52

A. Yes.

Q. Does Figure 5 of Hiraishi show any other input signals to block 320 besides the DRC signal coming from the module controller? 03:47:21

A. Any other input -- input signals?

Q. That was my question.

A. Yeah, it's -- it's showing quite a few.

Oh, I'm sorry. Let me take a step back. Could you repeat the question. I want to make sure I'm oriented. 03:47:42

Q. Does Figure 5 of Hiraishi show any other input signals to block 320 besides the DRC signal from the module controller? 03:47:56

A. No, it does not.

Q. For example, does Figure 5 of Hiraishi show block 320 receiving the DQS strobe signals from lines 351 and 352?

A. No, it does not. 03:48:21

Q. Does Figure 5 of Hiraishi show block 320 receiving the DQ data signals from lines 341 and 342?

A. No, it does not.

Q. In forming your opinions about Hiraishi, 03:48:36

Samsung Ex. 1046, p. 196
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 196
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

did you believe that the read leveling circuit inside block 320 of Figure 5 does not receive any information about the DQS strobe signals from line 351 and 352 or the DQ data signals from lines 341 and 342? 03:48:40 03:48:58

A. No, I wouldn't say that.

Q. Can you explain why not.

A. Sure. The DRC signal is configuring the delay or configuring, for example, the -- the read leveling, which is information about the DQS and DQ signals. 03:49:19

Q. The DQS and DQ signals don't go to the module controller though, right?

A. That's correct.

Q. And in your opinion, the DQS and DQ signals don't go to block 320 of Figure 5 of Hiraishi either, correct? 03:49:38

A. This doesn't show that. I don't know why they would.

Q. So in forming your opinions about Hiraishi, is it fair to say you believe that the read leveling circuit inside block 320 of Figure 5 does not receive information about the DQS strobe signals from lines 351 and 352 going to the memory chip or from the DQ data signals, lines 341 and 03:49:53 03:50:21

Samsung Ex. 1046, p. 197
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 197
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

342, going to the memory chip? 03:50:26

A. I think --

MR. LINDSAY: Objection. Form.

THE DEPONENT: Yeah. I think you said information about those. And if that's -- if I heard correctly. Again, like I said before, I would disagree with that characterization. 03:50:33

Q. (By Mr. Chandler) So what information about the DQS strobe signal and the DQ data signal, in your opinion, goes to the read leveling circuit inside block 320? 03:50:48

A. Information that comes over the DRC signals.

Q. And how does the DRC signal know anything about the DQS strobe signal or the DQ data signal? 03:51:04

A. Well, I can talk about how that's often done. I haven't really focused on that with regards to Hiraishi, how Hiraishi does it. But the whole intent is to account for the skew that fly-by introduces. 03:51:28

Q. Okay.

A. So during S4 training, it accounts for the skew the fly-by introduces, and that skew particular to each DRAM chip is directly related -- is information that's directly related to when the 03:51:43

Samsung Ex. 1046, p. 198
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 198
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

DQ and DQ strobe signals will be generated. 03:51:47

Q. So in your opinion, the read leveling circuit inside block 320 of Figure 5 of Hiraishi will receive information about the DQS strobe signals and the DQ data signals, correct? 03:52:05

A. Yes. It needs that in order, at least in part, to know when to turn on the input buffers.

Q. But in your opinion, the read leveling circuit inside block 320 of Figure 5 of Hiraishi does not receive the DQS strobe signal itself from 03:52:33 lines 351 and 352 and does not receive the DQ data signal from lines 341 and 342, correct?

MR. LINDSAY: Objection. Form.

THE DEPONENT: Yeah, Figure 5 does not show it receiving either of those signals. I'm not 03:52:53 relying on the notion that it receives either one of those signals. I don't know why it would need to receive either one of those signals.

So I would agree with you, barring there's some weird part of Hiraishi that neither I 03:53:08 nor Dr. Wedig have discussed, where they discuss, "Oh, we could do something interesting with -- with those signals." But I don't think that it's receiving them, no.

Q. (By Mr. Chandler) And that's the 03:53:22

Samsung Ex. 1046, p. 199
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 199
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

understanding that you've used in forming your nonobviousness opinions, correct? 03:53:22

A. Yes, that's correct.

Q. And the module controller does not receive the DQS strobe signals or the DQ data signals from any of the memory chips, correct? 03:53:36

A. That's correct.

Q. So the module controller doesn't know about any of the timing of the DQS strobe signals or the DQ data signals coming out of the memory chips on the memory module, correct? 03:53:56

A. It might. That information is generally presented to it, but simply to pass along. I don't know why it would retain that information or what use it would make out of it. 03:54:14

Q. Why do you say -- so I'm a little confused, because a moment ago you told me that the DQS strobe signal and the DQ data signal, it doesn't go to the module controller and it doesn't go to the read leveling circuit. 03:54:26

So how would either the read leveling circuit or the module controller know anything about these DQS strobe signals and DQ data signals that go directly from memory chip to the data buffer? 03:54:42

Samsung Ex. 1046, p. 200
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 200
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

A. My son's name is Ryan. Have you ever met Ryan? No. But I just told you something about him. The -- the data buffer knows to do read leveling by virtue of knowing something about the DQ and DQS signals. That doesn't mean it has to get them. 03:54:47 03:55:04

It's -- you, I think, have consistently, at least several times, said "any information about them." That's different from knowing them.

So both the module controller receives information about the timing of DQS and DQ, as does the -- the data buffer, but -- as does the element 320 of the data buffer. But doesn't require that they actually receive those signals directly or even indirectly. 03:55:18 03:55:41

Q. If it doesn't receive it directly or indirectly, how does it receive?

A. It doesn't have to receive it. It has to receive -- you asked me information about it, not it. That -- it receives information about it. It knows the data buffer that's closest to the -- the midline on the DIMM has its read leveling programmed such that it knows that the fly-by delays for that DRAM chip will be relatively small. And the one that's all the way far on the left has 03:55:57 03:56:21

Samsung Ex. 1046, p. 201
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 201
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

different read leveling levels programmed into it that indicate a different delay value for the RDRAMs, and those values get programmed through the module controller. 03:56:24

So the -- the information about the delays per column of the DRAMs goes through the module controller and goes to the data buffers. 03:56:35

Q. And that's done before -- that's done regardless of the actual DQS and DQ signals coming out. That's based on the physical layout of the memory module, correct? 03:57:04

MR. LINDSAY: Objection. Form.

THE DEPONENT: Yeah. It's -- it's largely based on the -- on the physical layout as well as some dynamic issues. As these things get hot, their performance changes. But the fundamental issue that's trying to be addressed here is the physical layout. 03:57:16

Q. (By Mr. Chandler) Okay. So during the S4 read leveling itself, you believe that the read leveling circuit inside block 320 does not receive the DQS strobe signals from lines 351 and 352 and does not receive the DQ data signals from lines 341 and 342, correct? 03:57:29

MR. LINDSAY: Objection. Asked and 03:57:52

Samsung Ex. 1046, p. 202
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 202
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

answered. Form. 03:57:52

THE DEPONENT: Yes. As far as I know, element 320 does not receive the DQ or DQS signals either during the S4 read level training or during what I would characterize as normal operations. 03:58:09

Q. (By Mr. Chandler) And that's the understanding that you used when forming your nonobviousness opinions?

A. I would -- I would say so. But it really didn't enter into the analysis at all, where they 03:58:25 draw a box -- to label this. I mean, Dr. Wedig, I don't think, relied on whether that was the case or not. I -- I believe it's the case that those signals are not received, but it's not really something that occurred to me. It's not shown 03:58:45 here. I don't know why it would happen, but I guess it could.

Q. In forming your opinions about Hiraishi with respect to S4 write leveling, you believe that the write leveling circuit inside block 320 of 03:59:02 Figure 5 does not receive the DQS strobe signals from lines 351 and 352 or the DQ data signals from lines 341 and 342, correct?

MR. LINDSAY: Objection. Beyond the scope of direct. Form. 03:59:20

Samsung Ex. 1046, p. 203
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 203
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

THE DEPONENT: Yeah. I -- I -- really, we've been talking about the read path, not the write path. I -- I don't have a complete characterization of everything that Hiraishi does, but -- DQ, DQS... 03:59:25 03:59:39

Again, I don't -- I don't see any path that goes from DQS 350 and DQ 340 into block 320. I haven't relied on it either being present or not, such -- such communications either being present or not present. I'm not aware of why those signals would need go in there. 04:00:20

Q. (By Mr. Chandler) Turn to page 27 of your expert declaration marked as Exhibit 2006.

Let me know when you're there?

A. Will do. 04:00:34

Q. In paragraph 55 of your expert declaration, you discuss S4 write leveling in Hiraishi, and you've annotated Figures 14A and 14B as part of that discussion, correct?

A. Yes. 04:00:51

Q. So I want to introduce an exhibit just for sort of easy of reference.

MR. CHANDLER: This will be Exhibit 1051.

(Exhibit 1051 was marked for identification by the Court Reporter and is 04:01:05

Samsung Ex. 1046, p. 204
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 204
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

attached hereto.) 04:01:05

Q. (By Mr. Chandler) Let me know when you have it.

A. Will do. Okay.

Q. So Exhibit 1051 shows Figure 5 of Hiraishi in the upper left; Figures 14A and 14B of Hiraishi in the upper right, as annotated by you; and then paragraphs 142 through 146 of Hiraishi along the bottom. 04:01:22

Understood? 04:01:39

A. Yes.

Q. And Figures 14A and 14B of Hiraishi explain the S4 write leveling operation that takes place in Hiraishi's data register buffer 300 in Figure 5, correct? 04:01:57

A. Yes.

Q. And Figure 14A shows before write leveling, and Figure 14B shows after write leveling, correct?

A. Yes. 04:02:26

Q. What's the goal of Hiraishi's S4 write leveling? What are you trying to accomplish?

A. The goal is to allow the -- in essence, it's the same goal as with read leveling. It's to allow the receiver of the data to reliably sample 04:02:45

Samsung Ex. 1046, p. 205
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 205
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

it.
Q. And what signal is being leveled according to Figures 14A and 14B in Hiraishi's S4 write leveling? 04:02:50
A. I don't -- I don't know. I don't think of it as a signal being leveled. 04:03:05
Could you rephrase the question.
Q. What signal is being delayed in Hiraishi's S4 write leveling to permit reliable sampling of the data, as you stated a moment ago? 04:03:30
MR. LINDSAY: Objection. Form.
THE DEPONENT: Yeah. Hold on a second.
"What signal is being delayed"? So no signal is being delayed.
Q. (By Mr. Chandler) So after S4 write leveling in Hiraishi, your opinion is that no signal coming out of the data buffer is delayed in comparison to before the write leveling operation was performed; is that correct? 04:04:18
A. Well, we've been only talking about two signals. Yeah, let me take a step back. 04:04:39
We've been talking about two signals, the -- the DQ signal and the DQS. So, again, I tripped myself up. There -- there is a plurality of clock cycle delay for the DQ signal based on 04:04:55

Samsung Ex. 1046, p. 206
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 206
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

FIFO 301. But then the DQS signal terminates at 301. 04:05:02

Q. Figure 14A, in comparison to Figure 14B, shows that there's been a change in the timing of at least one of the signals, right? 04:05:27

A. No, I -- I don't think so. What are you -- what are you pointing to?

Q. I'm pointing to what you're pointing to, which is, your annotations show that given the change in the timing, when DQS(IN) transitions, in one instance, DQ(OUT) is high; in the other instance, DQ(OUT) is low, right? 04:05:42

A. When DQ in -- when DQS transitions, you said?

Q. Yes. 04:06:17

A. Okay.

Q. In paragraph 145 of Hiraishi teaches that the write leveling circuit 322 of the data register buffer 300 changes an output timing of the data strobe signal DQS, correct? 04:06:40

A. Yeah, but that's not delaying it. It generates the output timing.

Q. And it changes it. It delays the signal in the sense that it's changing its relative phase compared to the clock signal, right? 04:07:03

Samsung Ex. 1046, p. 207
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 207
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

MR. LINDSAY: Objection. Asked and answered. 04:07:06

THE DEPONENT: No. Absolutely not. No. That is not how it works. It's not changing it. It didn't exist before. It's creating it. And so it's not delaying it relative to something else. It's just determining when it should be sent. 04:07:16

Q. (By Mr. Chandler) It's changing the output timing, right?

A. No. There was no output timing until it created it. It's not changing it from anything. 04:07:29

Q. It's changing --

A. It's not delaying it from anything. It's just determining it.

Q. It's changing it from Figure 14A to Figure 14B, right? 04:07:39

A. Maybe we are looking at two different things.

Okay. So we're looking at DQS(OUT). Well, yeah, but -- but even if it is, these -- these are two different time periods. It's -- it's -- there is no DQS(OUT) signal that then is delayed or that has timing which is then changed. 04:08:00

Q. During write leveling, during Hiraishi's S4 write leveling -- 04:08:26

Samsung Ex. 1046, p. 208
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 208
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

A. Yeah. 04:08:30
Q. -- what signal is Hiraishi's data buffer sending to the memory chip?
A. So it's sending to the -- the data buffer is sending to the memory chips DQ and DQS. 04:08:45
Q. Are you sure about that?
A. During -- during the S4 write level training period? Sure. It's -- it's trying to do a write with its current configuration, and then the -- whether the write actually succeeded is 04:09:03 going to be checked.
Q. And that's on -- in Figure 14A, you see there's DQS(OUT) for the data register buffer?
A. Yes.
Q. So Figure 14A shows that Hiraishi's data 04:09:26 buffer is sending to the memory chip the DQS(OUT) signal, correct?
A. Yes.
Q. During S4 write leveling, Hiraishi's data buffer does not send a DQ data signal to the memory 04:09:48 chip. The DQ data signal is an incoming data signal from the memory chip, right? Or do you not know?
A. During -- during write leveling, what has to happen is you have to check and see if the 04:10:06

Samsung Ex. 1046, p. 209
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 209
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

current configuration can reliably write data to the memory. So you -- you write -- you write data. You send DQ data to the memory, and then you turn it around and you read it back, and you see if what you got back is what you wrote. And if you don't, if it's not, you indicate an error, and somebody adjust the timing. 04:10:10 04:10:24

At least that's the only way I know write leveling can work. But -- the training part, yeah.

Q. During S4 write leveling, the memory chip sends back to Hiraishi's data buffer a signal on the DQS(IN) line, correct? 04:10:43

A. Unless I'm reading this --

Q. I'm sorry. I apologize.

During Hiraishi's S4 write leveling, the memory chip sends a signal back to the data register buffer on the DQ line. And so when that signal comes out of the memory chip, it's described as DQ(OUT); and when it goes into the data register buffer, it's described as DQ(IN), correct? 04:11:14 04:11:36

A. Maybe I'm just reading this wrong. I -- I don't think so. I believe this is saying -- I thought this was saying DQS(IN) is the signal coming in from memory controller to data buffer, and DQS(OUT) is the signal going out of the data 04:11:59

Samsung Ex. 1046, p. 210
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 210
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

buffer to the memories. 04:12:02

Q. Now you've confused me, because you started introducing the memory controller. There's --

A. Yeah. 04:12:08

Q. There's no memory controller in S4 write leveling. It's just between the data register buffer and the memory chip, correct?

A. There's -- there's a memory controller that's intimately involved in it. 04:12:17

Q. You told me previously that in S4 write leveling, that's performed by the data register buffer, and then separately, there's S5 write leveling that's performed by the system memory controller, correct? 04:12:34

A. No.

Q. Figure 14 --

A. The -- S4 is doing read and write leveling between the data buffer and -- and the DRAMs. That doesn't mean that those are the only two components involved. It's -- it's accounting for the fly-by errors introduced there. Similarly, S5 is between the memory controller and the -- and the data buffers. But that doesn't that mean that the DRAMs aren't involved there. They are. 04:12:47 04:13:02

Samsung Ex. 1046, p. 211
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 211
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. Figure 14A only shows the data register buffer and the memory chip, correct? 04:13:05

A. It has labels for those two components, yes.

Q. And same with Figure 14B? 04:13:19

A. Yes. Yes, that's true as well.

Q. Figures 14A and 14B, which are describing Hiraishi's S4 write leveling, only show that the memory chip is sending a signal on the DQ line back to the data register buffer, correct? 04:13:58

MR. LINDSAY: Objection. Asked and answered.

THE DEPONENT: So it's my understanding that this is talking about how the write leveling is used. This is how operations happen. 04:14:16

Hiraishi doesn't really talk about -- much at all that I can recall about how read or write leveling, the training, is actually accomplished, which is why I said I think the DQ(IN) is coming in from the memory controller and going -- and the DQ(OUT) is going the other way. 04:14:36

But like I said, maybe I'm just reading it wrong.

Q. (By Mr. Chandler) I think you're reading it wrong. I mean, paragraphs 142, 143, et cetera, 04:14:45

Samsung Ex. 1046, p. 212
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 212
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

are describing what you characterize as the training for write leveling. They're not describing a normal write operation. They're describing what happens during S4 write leveling to, as you describe it, train the data register buffer to change the output timing that's described in paragraph 145 of the data strobe signal DQS, correct? 04:14:48 04:15:06

A. No, I don't -- I mean, it just says -- and this is one of my frustrations. I think I understand it. But, you know, I would have preferred if he had said something like "read/write leveling training." Because during regular operations, when you do a read, you do read leveling. You're not training. You're using the read leveling training. 04:15:36 04:15:53

So this is -- I think the way he's using "write leveling" here is just talking about doing a regular write operation. Because there's -- I don't think there's any discussion of detecting an error and sending a signal back. Maybe there is and I just missed it. 04:16:11

Q. Okay. So when forming your opinions, you understood Figures 14A and 14B and the associated discussion in Hiraishi to be describing a regular 04:16:29

Samsung Ex. 1046, p. 213
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 213
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

write operation as opposed to the training involved for write leveling; is that fair? 04:16:33

A. I -- I think this is doing write leveling based on the results of the training, yeah.

Q. So in forming your opinions, you did not understand Figures 14A and 14B as doing the training needed for write leveling. Instead, you understood Figures 14A and 14B as write operations later on that take advantage of the results of that training; is that correct? 04:17:01 04:17:32

A. Yeah, because if it was a training, you would be showing the memory chip having DQ inputting data and outputting data.

Q. And in your opinion, Figures 14A and 14B don't show inputting data and outputting data? 04:18:09

A. Well, there's only DQ(OUT) labeled, so I think that they're just focusing on one signal called DQ(OUT), or one set of logical signal as DQ(OUT).

Q. But there's also DQ(IN), right? 04:18:30

A. To the memory chip?

Q. On the data register buffer, there's a signal going out called DQS, and there's a signal coming in called DQ. In the memory chip, there's a signal coming in called DQS, and there's a signal 04:18:45

Samsung Ex. 1046, p. 214
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 214
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

going out called DQ, right? 04:18:48

A. Yeah. The data buffer generates the DQS(OUT), and it -- it receives, during a -- during a regular write operation, DQ(IN) from the memory controller. 04:19:05

Q. Okay. But to be clear, your understanding of Figures 14A and 14B is that those show a regular write operation; they're not showing the training that would take place during initialization of the memory module. 04:19:18

A. Give me -- give me just one moment to finish refreshing my memory.

Yeah, I'm sorry. No. This is describing the training. You're right.

Q. Okay. During Hiraishi's S4 write leveling, the data buffer sends a strobe signal on what's labeled DQS(OUT) to the memory chip, correct? 04:20:08

A. Yes.

Q. And then during Hiraishi's S4 write leveling, the memory chip sends back to the data register buffer 300 a signal on the line DQ, correct? 04:20:28

A. Yes.

Q. And when that signal leaves the memory 04:21:00

Samsung Ex. 1046, p. 215
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 215
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

chip, it's labeled DQ(OUT), and when that same signal arrives at the data register buffer, it's labeled DQ(IN) in Figures 14A and 14B of Hiraishi, correct? 04:21:02

A. Yes. 04:21:18

Q. And in your opinion, Hiraishi's write leveling circuit in block 320 does not receive the signal that comes back from the memory chip on the DQ line, correct?

A. Yeah, let me see. 04:21:38

Yeah, I don't think it receives the DQ signal. 320 doesn't receive the DQ signal. But let me -- having my recollection be wrong once, let me read a little more carefully.

Yeah. So the end of paragraph 146 says as "a result of the write leveling" -- "a result of the write leveling operation is stored in the data register control unit 320." [as read] 04:22:17

So there does have to be -- well, yeah, it says that. It doesn't say it's receiving the DQ directly or indirectly. 04:22:36

Q. In your opinion, does Hiraishi's write leveling circuit in block 320 receive the signal on DQ from the memory chip during S4 write leveling?

A. I think we've talked about this a couple 04:23:23

Samsung Ex. 1046, p. 216
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 216
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

of times. But having been wrong once, let me restate my opinion. 04:23:24

320, there's no signal paths shown here for 320 to receive the -- the DQ values, the DQ signals. I don't know why it would. I don't recall Hiraishi discussing that. But, you know, it doesn't change my opinion one way or another whether it does or not. 04:23:46

Q. Is it possible, in your opinion, that Figure 5 does not show every connection and that, in fact, the DQ signal that comes from the memory chip does go to block 320 and is used by the write leveling circuit 322? Is that a possible understanding of Hiraishi, in your opinion? 04:24:11

MR. LINDSAY: Objection. Form. 04:24:39

THE DEPONENT: No, Hiraishi doesn't disclose anything that would require that, explain how it would -- would be used. No. I can't imagine that. I -- I don't know what it would possibly do with that information. 04:24:55

Q. (By Mr. Chandler) That's why I wanted to be clear.

So your opinion is that it's not possible, and it wouldn't -- not make any sense, in your view, for the signal from the memory chip sent 04:25:04

Samsung Ex. 1046, p. 217
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 217
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

over DQ during S4 write leveling to go to the write leveling circuit in block 320 of the data register buffer 300, correct? 04:25:11

MR. LINDSAY: Objection. Form.

THE DEPONENT: It is absolutely possible. I could design this any way I wanted. I don't see any purpose. And in context of Hiraishi, I don't think it's possible, because I think if it was done, they would have discussed it. 04:25:29

I think what's -- what's not discussed is always possible, but, you know, when I'm looking at this art, I consider it in the context of what it discloses and what a person of ordinary skill in the art would understand. 04:25:43

Is it possible that that's done? Yes. For what reason? I have no idea. Is there any way to -- to suspect they would do it? Not that I'm aware of. 04:25:56

Q. (By Mr. Chandler) Would it be obvious for a write leveling circuit to use the signal coming back from the memory chip on the DQ line as part of write leveling, in your opinion? 04:26:07

A. The way Hiraishi is constructed, it would not be obvious for 320 to use either DQ or DQS. There is no rational explanation for any use that 04:26:34

Samsung Ex. 1046, p. 218
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 218
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

it would make -- that I -- that I have -- that I could imagine or that I've heard anybody talk about. 04:26:39

So not only is it not obvious. I have no idea why anybody, even with hindsight, would do that. 04:26:46

Q. And that's the understanding that you used in forming your nonobviousness opinions, correct?

A. That is my understanding. That was my understanding when I formed those opinions. 04:26:59

But as I said, Dr. Wedig, as far as I recall, didn't introduce that. So I -- this is not something I sat down, "Okay, I need to get this issue straight in my mind." 04:27:15

I've got an understanding of Hiraishi, I looked at the arguments he made, and I responded to them.

MR. LINDSAY: I just want to see -- we've been going awhile -- if there was a breaking point coming up? 04:27:31

MR. CHANDLER: Soon.

Q. (By Mr. Chandler) The last sentence in paragraph 144 of Hiraishi states that "the signal DQ is input to the data register buffer 300, by 04:27:44

Samsung Ex. 1046, p. 219
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 219
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

which the data register buffer 300 can find a direction of phase shift of the clock signal CK and the data strobe signal DQS," correct? 04:27:51

And this is all in the context of S4 write leveling. 04:28:09

A. That's -- that is literally what it says, yeah.

Q. And, in your opinion, that is done without the DQ signal going into block 320 of Hiraishi's data register buffer 300, shown in Figure 5? 04:28:29

A. Yeah. I mean, even if it went into there, it couldn't determine the direction of the phase shift.

MR. CHANDLER: Okay. Why don't we take a short break. 04:28:49

MR. LINDSAY: Sounds good.

THE VIDEOGRAPHER: We are going off the record. The time is 4:29.

(Recess taken.) 04:28:58

THE VIDEOGRAPHER: We going back on the record. The time is 4:41.

Q. (By Mr. Chandler) Dr. Mangione-Smith, could you look at Exhibit 2007, which I put in the chat in case you don't have it handy. 04:41:40

Samsung Ex. 1046, p. 220
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 220
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

A. I will let you know once I have it open. 04:41:48
Yes, I see it.
Q. Exhibit 2007 is the "Joint Claim Construction Chart" that was filed in the Eastern District of Texas on September 30th, 2022, 04:42:14
correct?
A. Yes.
Q. And if you go to page 10 of Exhibit 2007.
Let me know when you're there.
A. PDF or numbered page 10? 04:42:42
Q. Numbered in the bot- --
A. Sorry.
Q. Numbered in the bottom right corner. So "Netlist Exhibit 2007, p.10." [as read]
A. Got it. Yes, I'm there. 04:42:57
Q. And do you see that in district court, the parties agreed that the proper construction for the phrase "one or more or previous operations" in the '506 patent should be "one or more previous memory operations"? 04:43:09
A. Yes, I see that.
Q. Okay. Do you agree with that claim construction?
MR. LINDSAY: Objection. Outside the scope of direct. 04:43:20

Samsung Ex. 1046, p. 221
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 221
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

THE DEPONENT: I haven't really considered it. I haven't read any arguments behind it or -- yeah. 04:43:23

Q. (By Mr. Chandler) Do you disagree with it? 04:43:32

MR. LINDSAY: Objection. Outside the scope of direct.

THE DEPONENT: I -- I don't have an opinion as I sit here. Claim construction, I -- I don't recall looking at that claim construction term previously. Maybe I did. 04:43:40

Let me see.

Q. (By Mr. Chandler) And to be clear, I don't see a section in your declaration on claim construction. But I just want to make sure whether or not you're offering any opinions on claim construction, including specifically for this phrase, "one or more previous operations." 04:44:08

A. No, I'm not.

Q. All right. Do you have any opinion on whether or not the claim limitation "one or more previous operations" can include or must exclude operations related to read leveling and write leveling? 04:44:23

MR. LINDSAY: Objection. Outside the 04:44:44

Samsung Ex. 1046, p. 222
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 222
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

scope of direct. 04:44:44

Q. (By Mr. Chandler) Do you have any opinion on that?

A. No, I haven't considered it.

Q. Okay. So as a claim construction matter, you don't have any opinion on that issue? 04:44:50

A. To the best of my recollection, yeah.

Q. Could you turn to page 69 of your expert declaration marked as Exhibit 2006.

And do you see that you've annotated Figure 5 of Hiraishi at the top of page 69 of Exhibit 2006? 04:45:21

A. Yes, I see that. Yes. That's right. Yeah.

Q. Toward the left side of Figure 5 of Hiraishi, do you see there's a strobe generating circuit 376? 04:45:34

A. Yes.

Q. Figure 5 of Hiraishi only shows one input to the strobe generating circuit 376, and that's the clock signal "LCLKR," correct? 04:45:45

A. Yes, that's what it shows.

Q. How would you pronounce "LCLKR"?

A. I guess it's local clock read. But I -- I don't know that I would -- I try to not pronounce 04:46:10

Samsung Ex. 1046, p. 223
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 223
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

it, I guess. 04:46:12

Q. The clock signal LCKLR [sic] is a periodic signal, as we discussed previously, correct?

MR. LINDSAY: Objection. Misstates prior testimony. 04:46:27

THE DEPONENT: Yeah, I think we talked about clocks being periodic. I assume that signal is an ordinary clock and that it is also periodic.

Q. (By Mr. Chandler) In your opinion, does the strobe generating circuit 376 need any other inputs besides the clock signal LCKLR to function properly. 04:46:40

A. Hiraishi doesn't appear to think that there's anything significant worth mentioning. There's nothing that I'm aware of. 04:47:02

The output buffer shown to the left of it can be used effectively to turn it on or off, although alternatively, you could have incorporated that as an input to the strobe generating circuit and thought of it that way. 04:47:19

Q. But the way that Figure 5 of Hiraishi is set up, the LCKLR signal would cause the strobe generating circuit 376 to always output a strobe signal, and then it's up to the output buffer to 04:47:56

Samsung Ex. 1046, p. 224
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 224
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

either permit that signal to pass through or to essentially block that signal; is that fair? 04:47:59

MR. LINDSAY: Objection. Form.

THE DEPONENT: Let me go back and review exactly what it says about 376 and the rest of the disclosure. That seems to be the case, but going simply off of my recollection. 04:48:10

Yeah. It doesn't seem to identify any other input. It's -- it's not equating it. I'm -- I'm looking at paragraph 84 where it says that the "strobe generating circuit 376 generates a data strobe signal DQS to be supplied to the data connector 120, in synchronization with an internal clock that is generated by a DLL circuit." [as read] 04:49:07 04:49:31

So it is synchronized. It says it's a strobe signal, which suggests that it's not the local clock, but it doesn't say exactly how it would be modified. Or at least it suggests to me that it's some -- it's not just the local clock. 04:49:46

Q. (By Mr. Chandler) I'm sorry. When you say "it's not just the local clock," what do you mean by "it"? So what is not just the local clock?

A. The output. The strobe that it generates. 04:50:00

Samsung Ex. 1046, p. 225
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 225
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. Can you state affirmatively your understanding of what Figure 5 shows in Hiraishi with the respect to the strobe generating circuit 376, how it works. 04:50:05

A. Sure. It -- the strobe generating circuit gener- -- well, it says it generates an output strobe. I think that that's not quite accurate as far as I can tell, because in which case you might not need the output buffer. But the combination of the strobe generating circuit and the output buffer forms a DQS. 04:50:20 04:50:41

Q. And what's the relevance of the LCLKR clock signal to the strobe generating circuit 376?

A. Well, that's used to allow the DQ and the DQS signals leaving to the left of the Figure 5 to be edge-aligned. 04:51:09

Q. From the perspective of the strobe generating circuit 376, can the clock signal LCKLR be delayed by more than one clock cycle? Or does that not make sense because the rising edge of the clock cycle will look the same either way? 04:51:47

A. Well, it's -- it's not delayed at all. It's just generated.

Q. But the DLL circuit can essentially shift the clock circuit LCLKR, correct? 04:52:30

Samsung Ex. 1046, p. 226
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 226
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

A. It can be used to -- to shift that, although DLL is typically -- more typically just used to generate a new clock, not -- it's a delay locked loop. The delay of the loop is locked. It's not being used to delay a clock. 04:52:37 04:52:52

Q. From the perspective of the strobe generating circuit 376, the clock signal LCKLR is never delayed by more than one clock cycle because every rising edge of a clock signal looks the same, right? 04:53:13

A. It's -- from the point of view of 376, it's never delayed at all.

Q. And it can't be delayed by more than one clock cycle, right?

A. It can't be delayed. It's not that it can't be delayed by more than one clock cycle. It can't be delayed at all. 04:53:33

Q. So to be clear, do you believe that the other clock cycle LCLKW can be delayed?

A. Sure. It's fed into a delay circuit 370. 04:54:26

Q. And from the perspective of strobe generating circuit 374, is it fair to say that the clock cycle LCLKW cannot be delayed by more than one clock cycle because every rising edge of a clock cycle -- signal, rather, looks the same? 04:54:51

Samsung Ex. 1046, p. 227
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 227
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

A. No. 04:54:56

Q. So in your opinion, strobe generating circuit 376 does not ever receive a delayed clock cycle L -- sorry -- clock signal LCLKR, correct?

A. I'm sorry. I think you -- could you repeat that. I think you might have mispronounced, or maybe I misheard, which one of the clocks you were thinking of. 04:55:32

Q. I'm going to focus back on the left clock in the read direction, 376. 04:55:44

A. Got it.

Q. So in your opinion, the clock signal LCLKR is not delayed, period, correct?

A. No, it is delayed. From the point of view of the strobe generating circuit 376, it's not delayed. 04:56:05

Q. How much is the clock signal LCLKR delayed by?

A. However much, presumably, 310 is configured to implement. And it -- it's phase delayed typically from CK, although the -- it could be a multiple in which case it's not just delayed. 04:56:30

Q. But if 310 delays the clock signal LCLKR by more than one clock cycle, the strobe generating circuit 376 won't know that because every rising 04:57:01

Samsung Ex. 1046, p. 228
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 228
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

edge looks the same, correct? 04:57:10

A. If it delays it by half of a clock cycle, 376 won't know it for exactly the same reason. It doesn't know that the signal was delayed at all.

Q. DLL circuit 310 cannot delay clock cycle LCLKR by a phase of more than 360 degrees, correct? 04:57:24

A. Yeah, I guess -- I guess that's accurate. It could delay it for a greater period of time, but it's -- the multiples will disappear out.

(Exhibit 1050 was marked for identification by the Court Reporter and is attached hereto.) 04:57:58

MR. CHANDLER: Let me introduce a new exhibit, which will be 1050. I will put it in the chat. 04:58:32

Q. (By Mr. Chandler) Let me know when you have it.

A. All right. I have it.

Q. Exhibit 1050 shows, for convenience, several figures from Hiraishi as well as several paragraphs for easy of reference. 04:59:00

In particular, in the upper left, there's Figure 5 of Hiraishi. In the upper right, there's Figure 15 of Hiraishi. Towards the bottom right, there's Figure 11 of Hiraishi. And then on the 04:59:15

Samsung Ex. 1046, p. 229
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 229
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

bottom left and the bottom, there's paragraphs 147, 150, 151, 123 and 130 of Hiraishi. 04:59:20

Understood?

A. Yes.

Q. Figure 15 of Hiraishi explains the S4 read leveling operation that takes place in Hiraishi's data register buffer 300 in Figure 5, correct? 04:59:32

A. Yes, it says it's a timing chart for explaining the read leveling operation between the data register buffer 300 and the memory chip 200. 05:00:04

Q. And the timing operation for S4 read leveling is performed by the read leveling circuit 323 shown in Figure 5, according to paragraph 147 of Hiraishi, correct? 05:00:27

A. That's what it says.

Q. If Figure 15 of Hiraishi, each data register buffer receives a read command at time zero, which I've sort of highlighted in a red box in Exhibit 1050, correct? 05:00:46

A. I'm sorry. Could you reorient me again or repeat the question.

Q. Yeah, sure. First let me just sort of get you looking at it. And then let me know when you're looking, and then I'll ask the question. 05:00:54

Samsung Ex. 1046, p. 230
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 230
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

So I'm sort of focused on Figure 15, which is kind of the upper right of Exhibit 1050. And I'm focused on the date of register buffer, which is sort of the bottom half of Figure 15. I've highlighted in blue where it says "data register buffer," as opposed to the top half of Figure 15, it says "memory chip" highlighted in green. 05:00:55 05:01:07

Are you with me?

A. Yep, I'm with you. 05:01:16

Q. In Figure 15 of Hiraishi, each data register buffer receives a read command at time T0 as shown in the red box that I've added to Exhibit 1050, correct?

A. Yes. 05:01:37

Q. In Figure 15 of Hiraishi, there is a time "A," which I have highlighted with a blue box in Exhibit 1050, correct?

A. Yes, I see that.

Q. According to Figure 15 of Hiraishi, data buffer 300-0 will receive the DQ data signal from memory shift 200-0 in a shorter amount of time than data buffer 300-4 will receive its DQ data signal from memory chip 200-19. 05:01:54

Correct? 05:02:18

Samsung Ex. 1046, p. 231
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 231
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

A. Yes, I see. 05:02:18

Q. So, for example, data buffer 300-0 receives the DQ data signal from its memory chip at around time T5 plus about one-quarter; whereas data buffer 300-4 receives the DQ signal from its memory chip at around time T5 plus about three-quarters. 05:02:37

Is that a reasonable description of what's shown in Figure 15?

A. Now I think you lost -- oh, I see. Yeah, that doesn't -- sure. That doesn't seem wrong to me. 05:03:08

Q. So Figure 15 of Hiraishi shows that different data buffers can receive the DQ data signal from the memory chip at different times, correct? 05:03:21

A. Yeah, different data buffers will receive the DQ data signals from different SDRAMs at different times.

Q. Paragraph 151 of Hiraishi teaches that during S4 read leveling, the data register buffer measures time A, which is related to when the DQ data signal arrives from the memory chip. And then the data register buffer stores that information in the data register control circuit 320, correct? 05:03:39

A. Sure, I see that. 05:04:02

Samsung Ex. 1046, p. 232
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 232
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. Figure 11 of Hiraishi shows the timing for a read operation after S4 read leveling has taken place, correct? So in other words, a normal read operation? 05:04:30

A. I believe that's the case, yeah. 05:04:58

Q. At the bottom of Figure 11 in Hiraishi, do you see the line DQS(OUT) and DQ(OUT) at the very bottom of Figure 11?

A. Yes.

Q. Those are signals that the data register buffer is sending to the system memory controller, correct? As part of a read operation? 05:05:18

A. Yes, that's my understanding.

Q. For example, Figure 11 of Hiraishi shows that around time T5, the data register buffer, starts to send the preamble for the DQS strobe signal to the system memory controller on the line DQS(OUT), correct? 05:06:00

A. T5? It looks like that might be the end of the preamble. 05:06:33

Q. Around T5 to T6 would be the preamble that the data register buffer sends to the system memory controller in DQS(OUT); is that fair?

A. It -- it may say that. I -- I don't recall. My recollection just looking at this is 05:06:53

Samsung Ex. 1046, p. 233
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 233
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

that the preamble was not necessarily in multiples of a clock, and it -- it just looks like the time from T4 to T5 matches what we were looking at previously for the preamble. 05:06:55

Q. Well, I want to make sure we're looking at the same thing. So in Figure 11, I'm looking at the, you know, second line from the bottom that's labeled DQS(OUT), and -- 05:07:11

A. I was looking -- I was looking at the one above. Sorry. Okay. 05:07:25

Q. So let me ask the question again. And, you know, feel free to zoom in on the exhibit.

A. I have it.

Q. Figure 11 of Hiraishi shows that around T5, the data register buffer starts to send the preamble for the DQS strobe signal to the system memory controller on the line DQS(OUT), correct? 05:07:42

A. Yes, I'm with you there.

Q. And Figure 11 of Hiraishi shows that the preamble for the strobe signal DQS(OUT) is low for an entire clock cycle from T5 to T6, approximately; and then the strobe signal transitions every half clock cycle until approximately time T10, correct? 05:07:58

A. Yes, I see that.

Q. Figure 11 of Hiraishi shows that at 05:08:26

Samsung Ex. 1046, p. 234
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 234
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

precisely T6, which is to say, six clock cycles after the data buffer received the read command, the data buffer sends the DQ data signal to the system memory controller on the line DQ(OUT), correct? 05:08:30 05:08:52

A. Yes, I see that.

Q. So Figure 15 of Hiraishi shows that each data register buffer can receive the data signal from the memory chip at a different time on line DQ(IN). And Figure 11 of Hiraishi shows that each data register buffer will output the data signal to the system memory controller on line DQ(OUT) at precisely time T6, correct? 05:09:12

A. Yes, in this example. Yes, that's right.

Q. Dr. Mangione-Smith, would it be fair to say that Netlist did not invent the memory module? In other words, memory modules were known before the '506 patent, right? 05:09:46

A. Sure.

Q. Netlist did not invent DDR1 memory devices, correct? 05:09:58

A. Not as far as I'm aware.

Q. Netlist did not invent DDR2 memory devices, correct?

A. That's right. Although that isn't really 05:10:09

Samsung Ex. 1046, p. 235
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 235
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

something I was asked to consider, yep. 05:10:12

Q. Netlist did not invent DDR3 memory devices either, right?

A. Not as far as I know.

Q. Netlist did not invent buffered DIMM memory modules, correct? Those existed before the '506 patent? 05:10:21

A. As far as I know, they haven't claimed to invent them, no.

Q. Netlist did not invent distributed data buffers for a memory module, correct? 05:10:34

MR. LINDSAY: Objection. Outside the scope.

THE DEPONENT: Yeah, so part of the -- I -- actually, getting back to the buffer aspect as well, I mean, in this family of patents, data buffers have a particular meaning, I think. So simply, they -- they didn't invent the concept of a tri-state, for example, or putting a tri-state buffer between a memory controller and -- and an SDRAM chip. However, the -- the partic- -- they invented the inventions that they claim. 05:10:47 05:11:06

Q. (By Mr. Chandler) Netlist did not invent the concept of putting a data buffer on the memory module, correct? 05:11:24

Samsung Ex. 1046, p. 236
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 236
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

A. I think they invented the concept of inventing -- of putting the claimed kind of data buffers on memory modules. But writ broad data buffers, anything that could be a data buffer, no, they did not invent that. 05:11:27 05:11:41

Q. And Netlist did not invent write leveling, correct?

MR. LINDSAY: Objection. Outside the scope of direct.

THE DEPONENT: Not as far as I know. 05:11:51

Q. (By Mr. Chandler) Netlist did not invent read leveling, correct?

MR. LINDSAY: Objection. Outside the scope of direct.

THE DEPONENT: Not as far as I know, but I also haven't endeavored to figure out when read or write leveling were invented. 05:11:59

Q. (By Mr. Chandler) Netlist did not invent the ability to delay a strobe signal, correct?

MR. LINDSAY: Objection. 05:12:15

THE DEPONENT: Probably not. Probably not. But I haven't reviewed all of their IP.

MR. CHANDLER: Okay. Why don't we take a short break.

MR. LINDSAY: Sure. 05:12:27

Samsung Ex. 1046, p. 237
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 237
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

THE VIDEOGRAPHER: We're going off the record. The time is 5:12. 05:12:28

(Recess taken.)

THE VIDEOGRAPHER: We're going back on the record. The time is 5:24. 05:24:25

Q. (By Mr. Chandler) Please turn to the Tokuhiro reference marked as Exhibit 1006.

Let me know when you have it up.

A. All right.

Q. And could you look at Figure 11 of Tokuhiro, please. 05:24:44

A. Yes, I see it.

Q. The left side of Figure 11 of Tokuhiro shows an element labeled "DR1," correct?

A. Yes. 05:25:10

Q. DR1 in Figure 11 of Tokuhiro, marked as Exhibit 1006, is a variable delay element, correct?

A. That is my recollection.

Q. And Tokuhiro uses the diagonal arrow to indicate a variable delay, correct? 05:25:32

A. Yes.

Q. Could you turn to Figure 5 of Tokuhiro.

A. Okay.

Q. And Figure 5 of Tokuhiro shows the variable delay element, DR1, correct? Sort of in 05:25:58

Samsung Ex. 1046, p. 238
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 238
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

the middle. 05:26:06

A. Yes, I see it.

Q. And Figure 5 also shows the variable delay element DW1, correct?

A. Yes. 05:26:17

Q. And there's also, I guess, a variable delay element DW0, correct?

Towards the top. Sorry.

A. Thank you. Yes, I see it.

Q. And further toward the right, under FF0, there's a different variable delay element that's not labeled. 05:26:44

A. Yes, I see that.

Q. With the diagonal arrow, correct?

A. Yes. 05:27:03

Q. And then at the bottom of Figure 5, there's more variable delay element to DR1, DR2, DW1 and DW2, correct?

A. That's right.

(Exhibit 1052 was marked for identification by the Court Reporter and is attached hereto.) 05:27:18

MR. CHANDLER: All right. I'm going to mark a new Exhibit 1052, coming through to you.

THE DEPONENT: Okay. 05:27:46

Samsung Ex. 1046, p. 239
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 239
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. (By Mr. Chandler) So Exhibit 1052 is, again, more for convenience really. But just to be clear, what I've done is I've reprinted Figure 2 to have Butt reference, marked as Exhibit 1029, on the left side; and I've reprinted Figure 3A from the Butt reference on the right side. And I've just added an arrow showing the relationship between Figure 3A and Figure 2, which is the -- Figure 3A provides some more detail about element 114 that is highlighted in red in Figure 2 on Exhibit 1052. 05:27:47 05:28:06 05:28:29

Understood?

A. Yes.

Q. And in Figure 2 of Butt, at the bottom, do you see a box labeled 118, and it says "GATEON circuit"? 05:28:52

A. Yes.

Q. And then on the right side of Figure 3A, do you see that there's a GATEON_UN signal going to 123a?

A. Yes. 05:29:08

Q. What does the GATEON signal do in general, and in particular with respect to 123a?

A. Well, this is -- so -- so 123a has the signal GATEON, G-A-T-E-O-N, and then _UN. And then that's shown going to a multiplexer which selects 05:29:48

Samsung Ex. 1046, p. 240
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 240
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

between a zero value and an input value of, it says, "DQS/DQS_UN." 05:29:55

Q. And what is your understanding of how -- Butt, marked as 1029, uses the GATEON signal in his circuitry? 05:30:22

A. Well, here, it's shown being driven to this -- I don't recall what the "UN" designation meant. But it's shown being driven to that multiplexer to select between those two input values that I just mentioned. 05:30:39

Q. Is it possible that "UN" refers to "upper nibble"?

A. Yeah, it could be. Yeah.

Q. Okay. So when GATEON is enabled, what does multiplexer 123a do; and then when GATEON is disabled, what does multiplexer 123a do? 05:31:05

A. Well, it looks to me like when it's on, the multiplexer outputs whatever is on DQS/DQS, as you suggested, upper nibble. And when it's off, it's connected to ground or logical zero low value logic. 05:31:30

Q. So using Exhibit 1052, I want to sort of walk through with you how a DQS strobe signal travels from the DDR memory chip on the right of Figure 2 of Butt to the left side of Figure 2 to 05:32:06

Samsung Ex. 1046, p. 241
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 241
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

the memory controller. 05:32:12

Understood? What our...

A. I do, with the caveat that I wasn't endeavoring to understand Butt any more than to be able to evaluate the arguments made by Dr. Wedig. 05:32:25

Q. But you did review Figures 2 and 3A of Butt, right?

A. I did.

Q. And you also read Butt, marked as Exhibit 1029, correct? 05:32:42

A. Yes, but I'll have a greater recollection and fluidity with the elements that Dr. Wedig relied upon.

Q. So Figure 2 of Butt shows a DQS strobe signal going from the DDR memory device 106, which I've highlighted in green in Exhibit 1052, going to an IO buffer 108, correct? As shown in Figure 2. 05:33:00

A. Yes. Yeah, I see it.

Q. And then after, that the DQS strobe signal goes to selector 123a in box 114, which is shown in Figure 3A of Butt, correct? 05:33:29

A. Yes.

Q. And as you indicated a moment ago, when the GATEON_UN signal is enabled, the DQS signal will pass through selector 123a and will go in a 05:33:55

Samsung Ex. 1046, p. 242
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 242
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

couple places, but for now let's go up. It will go up to delay element 124a; is that correct? 05:34:08

A. Yes.

Q. And delay element 124a will delay the DQS strobe signal by a variable amount indicated by that diagonal arrow, correct? 05:34:25

A. Yes.

Q. After being delayed by 124a, the DQS strobe signal goes to register 121a, among other places, correct? 05:34:51

A. Yes.

Q. The delayed DQS strobe signal at register 121a causes the DQ read data to be registered and then output towards the left of Figure 3A, correct?

A. Yes. 05:35:25

Q. And then both the delay DQS strobe signal, which I guess is now being labeled PDQS_OUT_UN, and the DQ data signal, which is now being labeled DR_PDQ_OUT, go to the asynchronous FIFO 112 shown in Figure 2 of Butt, correct? 05:35:56

A. Yes.

Q. And then finally, the DQS and DQ signal go from the asynchronous FIFO to the memory controller on lines that are labeled -- well, let me ask you. 05:36:37

Samsung Ex. 1046, p. 243
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 243
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

What happens after the asynchronous FIFO 112 to -- to the data signal? 05:36:38

A. Well, the data signal looks like it's being written out under -- over -- I guess it's P -- I don't know if it's PI or PL_R_PDQ and PI_R_NDQ. 05:36:58

Q. Could you turn to paragraph 63 of the Butt reference mark as Exhibit 1029.

Let me know when you're there.

A. Almost there. Okay. 05:37:37

Q. In paragraph 63 of the Butt reference marked as Exhibit 1029, Butt teaches that his invention could be implemented in an application-specific integrated circuit, abbreviated "ASIC," correct? 05:37:56

A. Yes.

Q. Alternatively, his invention could be implemented in an FPGA, correct?

A. That's what he states, yeah.

Q. That's what Butt states in paragraph 63 of Exhibit 1029? 05:38:12

A. Yes.

Q. And as we discussed earlier, you believe a person of ordinary skill in the art would know what an FPGA is what an ASIC is, correct? 05:38:24

Samsung Ex. 1046, p. 244
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 244
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

A. Yes. That doesn't necessarily mean they would know how to work with one or design with them, but they would be familiar with the concept and -- 05:38:31

Q. They would under what Butt is trying to convey in paragraph 63 of Exhibit 1029? 05:38:39

A. I would think so.

Q. Can you go to your declaration marked as Exhibit 2006, and go to page 52.

And do you see paragraph 95? 05:39:03

A. Not yet. Okay.

Q. You would agree that the Butt reference marked as Exhibit 1029 teaches how to determine the optimin -- optimum, rather, offset delay values for the DQS strobe signal, correct? 05:39:24

A. I would agree that that is what Butt claims, yes.

MR. CHANDLER: Why don't we take a quick break, and hopefully we will finish up soon.

THE VIDEOGRAPHER: We're going off the record. The time is 5:39. 05:39:43

(Recess taken.)

THE VIDEOGRAPHER: We're going back on the record. The time is 5:48.

Q. (By Mr. Chandler) Dr. Mangione-Smith, 05:48:52

Samsung Ex. 1046, p. 245
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 245
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

are there any corrections or clarifications you'd like to make to any of the testimony that you've given to me so far today? 05:48:53

A. Not that occurs to me, no.

(Exhibit 1053 was marked for identification by the Court Reporter and is attached hereto.) 05:49:03

MR. CHANDLER: All right. Let me mark the next exhibit, 1053, in the chat.

Q. (By Mr. Chandler) Let me know when you have it. 05:49:10

A. Okay. I have it.

Q. Exhibit 1053 is the JEDEC standard JESD82-20, dated March 2007, for the FBDIMM advanced memory buffer, abbreviated "AMB"; is that correct? 05:49:45

A. Yes.

Q. And earlier today, we were looking at Netlist's technology portfolio marked as Exhibit 1047 which, on page 9, showed an FBDIMM illustration at a high level, correct? 05:50:04

A. Yes, I recall discussing that with you.

Q. And I think you may have been a little unsure at that point whether or not FBDIMM was prior art to the '506 patent. But now that you 05:50:23

Samsung Ex. 1046, p. 246
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 246
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

have Exhibit 1053, would you agree that FBDIMM had been standardized by JEDEC before the '506 patent came out? 05:50:27

A. That appears to be the case.

Q. In Exhibit 1053, could you look at page 15 in the bottom right page number. It's labeled as "Figure 1.1 - Advanced Memory Buffer Block Diagram." 05:50:43

And let me know when you're --

A. Yes. 05:51:03

Q. So do you have in front of you the advanced memory buffer block diagram for the JEDEC FBDIMM standard marked as Exhibit 1053?

A. Yes, I do.

Q. And this is the block diagram for the AMB, which is -- if you look at the tutorial slide 1047, page 9, is that central buffer on the memory module that buffers address command DQ data and DQS strobe signals, correct? 05:51:18

MR. LINDSAY: Objection. Outside the scope of direct. 05:51:48

THE DEPONENT: Yeah. It appears that it's referring to the same AMB.

But I'll just mention, just like I commented on at presentation, I don't recall 05:52:00

Samsung Ex. 1046, p. 247
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 247
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

reviewing the JEDEC standard, this JEDEC standard, one way or another. I may have. I simply have no recollection of it as I sit here. 05:52:03

Q. (By Mr. Chandler) Okay. The AMB buffer, shown here on page 15 of Exhibit 1053, contains several different blocks, correct? Is that a -- a fair characterization to start? 05:52:18

MR. LINDSAY: Objection. Outside the scope of direct.

THE DEPONENT: Visually, there are multiple rectangular objects in the figure, yes. 05:52:44

Q. (By Mr. Chandler) So, for example, towards the upper left, the AMB includes a command decoder? There's a box for that, right?

MR. LINDSAY: Objection. Outside the scope of direct. 05:53:03

THE DEPONENT: The upper left, I see the PLL and the reset control.

Q. (By Mr. Chandler) A little bit below that to the right. 05:53:13

A. Yes. Okay. I see a box labeled "Command Decoder & and CRC Check."

Q. The AMB and FBDIMM also includes core control, correct?

MR. LINDSAY: Objection. Outside the 05:53:29

Samsung Ex. 1046, p. 248
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 248
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

scope of direct. 05:53:30

THE DEPONENT: I only know that it's got a box labeled "Core Control and CRSs." I don't have any other understanding of what that is as I sit here. 05:53:43

Q. (By Mr. Chandler) The AMB includes data CRC. And you're familiar with CRC, correct?

A. Yes.

MR. LINDSAY: Objection. Outside the scope. 05:53:55

THE DEPONENT: It has a box labeled "Data CRC Generation & Read FIFO." [as read] But as I've said, I don't have any understanding beyond simply what the labels say.

Q. (By Mr. Chandler) You understand what data CRC is? 05:54:12

A. Sure.

Q. Could you explain that briefly.

MR. LINDSAY: Objection. Outside the scope of direct. 05:54:17

THE DEPONENT: "CRC" is an abbreviation for "cyclic redundancy check." It's a way to protect against errors in information that's being communicated.

Q. (By Mr. Chandler) The AMB in an FBDIMM 05:54:34

Samsung Ex. 1046, p. 249
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 249
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

also has in the middle what is described as "MEMBIST," which stands for "memory built-in self test," correct? 05:54:38

MR. LINDSAY: Objection. Assumes facts not in evidence. Outside the scope of direct. Form. 05:54:59

THE DEPONENT: It's got a box labeled "External MEMBIST DDR Calibration & DDR IOBIST" -- that's I-O-B-I-S-T, slash, D-F-X.

And MEMBIST is M-E-M-B-I-S-T. 05:55:18

And BIST typically, or often, has a meaning "built-in self test," but I don't know exactly what this block is doing.

Q. (By Mr. Chandler) The MEMBIST, built-in self test, in the AMB at the FBDIMM, that's described further on page 38 of Exhibit 1053, correct? 05:55:37

MR. LINDSAY: Objection. Outside the scope of direct.

THE DEPONENT: I -- I don't believe so, but -- because I -- I haven't -- I don't recall. However, it -- it doesn't say "built-in MEMBIST." It says "external MEMBIST." 05:55:48

Q. (By Mr. Chandler) On page 38 of Exhibit 1053, there's a Section 3.8, "DDR MEMBIST," 05:56:06

Samsung Ex. 1046, p. 250
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 250
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

correct? 05:56:13

MR. LINDSAY: Objection. Outside the scope of direct.

THE DEPONENT: I'm sorry. Can you give me the page number again. 05:56:25

Q. (By Mr. Chandler) And again, I'm looking at the -- the bottom right page number.

A. Yeah.

Q. So Exhibit 1053, page 38, as shown in the bottom right of the -- the exhibit. 05:56:35

A. So yes, section 3.8 has the title "DDR MEMBIST."

Q. And that's referring to the MEMBIST in the AMB shown on page 15 of the block diagram for the AMB, correct? 05:57:00

MR. LINDSAY: Objection. Outside the scope of direct.

THE DEPONENT: I have no opinion on that, other than they use -- they both use the word "MEMBIST." 05:57:10

Q. (By Mr. Chandler) And you understand what built-in self test is, correct?

MR. LINDSAY: Objection. Outside the scope of direct.

THE DEPONENT: It's a general concept 05:57:22

Samsung Ex. 1046, p. 251
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 251
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

with a number of different implementations, but yes, I do. 05:57:23

Q. (By Mr. Chandler) At a high level, could you explain what MEMBIST built-in self test is.

MR. LINDSAY: Objection. Outside the scope of direct. 05:57:34

THE DEPONENT: "BIST" stands -- stands for "built-in self test." It's a mechanism for a device to test itself. The term "MEMBIST" isn't confusing to me, but it's also not a common -- 05:57:50

memory built-in self test or memory BIST, sure. But I'm just saying the particular phrasing here, "MEMBIST," is not something that I recall seeing before. But it doesn't confuse me.

Q. (By Mr. Chandler) All right. And on page 15 of Exhibit 1053, below the MEMBIST box, there's another box for a pattern generator, correct? 05:58:06

MR. LINDSAY: Objection. Outside the scope of direct. 05:58:19

THE DEPONENT: I see a box labeled "Sync & Idle Pattern Generator." But I have no understanding of it beyond how it's titled.

Q. (By Mr. Chandler) In the AMB, on the FBDIMM memory module, there is an SMBus controller 05:58:37

Samsung Ex. 1046, p. 252
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 252
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

shown sort of towards the bottom left of page 15 of Exhibit 1053, correct? 05:58:42

MR. LINDSAY: Objection. Outside the scope of direct.

THE DEPONENT: Yes, I see a box labeled "SMBus Controller." 05:58:54

Q. (By Mr. Chandler) And you understand what the SMBus is, correct?

A. Yes. I don't know what it's used for here, however. 05:59:07

Q. What's the standard usage for an SMBus on a memory module?

MR. LINDSAY: Objection. Outside the scope of direct.

THE DEPONENT: It's -- it's used for a number of different purposes. It's -- it's an old-technology, slow, very small -- so it's got advantages and disadvantages -- communications bus between multiple chips. 05:59:24

Q. (By Mr. Chandler) And "SMBus" stands for "system management bus"; is that correct? 05:59:38

MR. LINDSAY: Objection. Outside the scope of direct.

THE DEPONENT: That's correct.

Q. (By Mr. Chandler) And, for example, the 05:59:48

Samsung Ex. 1046, p. 253
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 253
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

SMBus can be used during power-on for initial communications between the memory module and the system memory controller. That's one potential use for the SMBus, correct? 05:59:49

MR. LINDSAY: Objection. Outside the scope of direct. 06:00:04

THE DEPONENT: It makes more sense to me to discuss specific implementations. I've seen that in some context. Not in the AMB context.

Q. (By Mr. Chandler) The AMB on an FBDIMM includes a number of different multiplexers, labeled "mux," as shown on page 15 of Exhibit 1053, correct? 06:00:21

MR. LINDSAY: Objection. Outside the scope of direct. 06:00:33

THE DEPONENT: It seems to show, I think, four different multiplexers: One near the top going into the purple box; two on the right-hand side going to the DDR IOs; one sort of near the bottom, going into a box labeled "failover." 06:01:00

But beyond those images and the label, I have no particular understanding of what they're used for here.

Q. (By Mr. Chandler) The AMB chip in the FBDIMM includes a DDR state controller, as shown 06:01:22

Samsung Ex. 1046, p. 254
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 254
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

right in the middle of Figure 15 -- I'm sorry -- page 15 of Exhibit 1053, correct? 06:01:30

A. I would --

MR. LINDSAY: Objection. Outside of the scope of direct. 06:01:41

THE DEPONENT: Yeah, I wouldn't know.

Q. (By Mr. Chandler) On page 15 of Exhibit 1053, the block diagram for the advanced memory buffer shows that there is a DDR state controller inside that chip, correct? 06:02:00

MR. LINDSAY: Objection. Outside the scope of direct.

THE DEPONENT: No, I wouldn't say that. We've been talking about this figure. This figure does show a block that says "DDR State Controller and CSRs." 06:02:12

Q. (By Mr. Chandler) That's what I was referring to.

A. I -- I don't know what's in any particular chip, or on any particular DIMM, or on what -- talking about AMB -- or -- 06:02:23

Q. That's what I meant. That's what I meant, the -- what I meant. When I said "chip," I meant the AMB chip.

A. Got it. 06:02:41

Samsung Ex. 1046, p. 255
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 255
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Q. So, for clarity, the AMB chip as a whole would include functionality for a DDR state controller as shown on page 15 of Exhibit 1053, correct? 06:02:41

MR. LINDSAY: Objection. Outside the scope of direct. 06:02:53

THE DEPONENT: Yeah, I wouldn't -- I wouldn't go that far. I'm comfortable saying Figure 1.1 shows that box. That's what it shows.

Q. (By Mr. Chandler) And there are a number of other boxes shown in the block diagram for the advanced memory buffer that would -- that page 15 of Exhibit 1053 teaches as being included in the advanced memory buffer. But we just haven't discussed all of those other blocks, correct? 06:03:07 06:03:32

MR. LINDSAY: Objection. Outside the scope of direct.

THE DEPONENT: I'm sorry. Could you repeat the question.

Q. (By Mr. Chandler) We've discussed a number of different blocks shown in the block diagram for the advanced memory buffer on page 15 of Exhibit 1053. But there are even more blocks beyond what we've discussed, correct? 06:03:43

MR. LINDSAY: Objection. Outside the 06:04:02

Samsung Ex. 1046, p. 256
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 256
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

scope of direct. 06:04:03

THE DEPONENT: There are even more labels on boxes that we have not read, yes.

Q. (By Mr. Chandler) All right. So there's additional functionality in the AMB buffer even beyond what we've been discussing for the last 10 or 15 minutes, right? 06:04:10

MR. LINDSAY: Objection. Outside the scope of direct.

THE DEPONENT: Well, beyond the -- the multiplexers and an SMBus controller, I don't know that we've been discussing any functionality. We've been reading labels on the boxes. 06:04:24

Q. (By Mr. Chandler) And Exhibit 1053 is over 175 pages long, and it provides a description of the advanced memory buffer for an FBDIMM, correct? 06:04:44

MR. LINDSAY: Objection. Outside the scope of direct.

THE DEPONENT: Based on simply reading the title and the label of Figure 1, it would appear that that's likely the case. 06:05:03

Q. (By Mr. Chandler) And so if you look, for example, at the table of contents on page 5 of Exhibit 1053, there's a description of the FBD 06:05:15

Samsung Ex. 1046, p. 257
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 257
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

channel interface, correct? 06:05:25

MR. LINDSAY: Objection. Outside the scope of direct.

THE DEPONENT: Yes, I see labeled "FBD Channel Interface." 06:05:36

Q. (By Mr. Chandler) There's a description for the DDR interface for the AMB, correct?

A. I wouldn't say that. There's a section that says DDR interface.

Q. There's a section starting at page 24, according the table of contents, for DDR calibration, correct? 06:05:51

MR. LINDSAY: Objection. Outside the scope of direct.

THE DEPONENT: The table of contents has a listing for DDR calibration and the number 24 next to it. 06:06:04

Q. (By Mr. Chandler) And I'm running out of time, but there's -- there's a lot. There's a lot in here in Exhibit 1053 about the advanced memory buffer, right? 06:06:24

MR. LINDSAY: Objection. Form. Outside the scope of direct.

THE DEPONENT: 190 pages is not a particularly long standard, but there appears to be 06:06:36

Samsung Ex. 1046, p. 258
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 258
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

a lot of material in here. 06:06:42

Q. (By Mr. Chandler) And there appears to be a lot of blocks in Figure 1.1 on page 15 of Exhibit 1053, the block diagram for the AMB; is that fair? 06:07:00

A. There are --

MR. LINDSAY: Objection. Outside the scope of direct. Form.

THE DEPONENT: There are several additional blocks above and beyond what we've labeled. 06:07:06

Q. (By Mr. Chandler) Dr. Mangione-Smith, do you have any clarifications or corrections that you would like to make to your testimony that you gave to me today? 06:07:18

THE DEPONENT: No, sir.

MR. CHANDLER: All right. I think I'm out of time, so I will pass the witness.

MR. LINDSAY: Okay. Let's take five minutes. 06:07:30

THE VIDEOGRAPHER: We're going off the record. The time is 6:07.

(Recess taken.)

THE VIDEOGRAPHER: We are going back on the record. The time is 6:13. 06:13:35

Samsung Ex. 1046, p. 259
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 259
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

EXAMINATION

BY MR. LINDSAY:

Q. Okay. Dr. Mangione-Smith, I just want to ask a few clarifying questions so that the record's clear. 06:13:46

Can you turn to your declaration, Exhibit 2006, paragraph 60, 6-0.

A. I will let you know when I'm there.

Okay.

Q. Okay. In this paragraph, do you say that "Hiraishi describes an approach for read leveling that does not rely on adjusting the timing of the strobe signals themselves, but instead only adjusts the timing of when the input buffers INB are turned so that they are active when data arrives"? 06:14:29 06:14:49

MR. CHANDLER: Objection. Outside --

THE DEPONENT: Yes.

MR. CHANDLER: Sorry, Dr. Mangione-Smith. If you can just wait until I can get my objection so we don't speak over each other. 06:14:57

Objection. Outside the scope of cross. And objection. Leading.

THE DEPONENT: Yes, that is -- that's what I said. That's my opinion. And hopefully, if I testified throughout this long day on something 06:15:09

Samsung Ex. 1046, p. 260
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 260
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

touching the subject, I didn't suggest something contrary to that. 06:15:13

Q. (By Mr. Lindsay) So all of your testimony here today is consistent with what you stated in paragraph 60? 06:15:20

A. As far as I know.

MR. CHANDLER: Objection. Leading.

And your answer, Dr. Mangione-Smith.

THE DEPONENT: As far as I know, my testimony is consistent. 06:15:34

Q. (By Mr. Lindsay) In the last sentence of paragraph 60, do you say that Hiraishi does describe a separate retiming operation, which you say you will discuss below?

MR. CHANDLER: Objection. Outside the scope of cross. And leading. 06:15:50

THE DEPONENT: Yes. Yes.

Q. (By Mr. Lindsay) Okay. If you can scroll down for to me to paragraph 73, and the last sentence of paragraph -- 06:16:12

A. I'm there.

Q. -- 73.

Could you read that last sentence for me, please.

MR. CHANDLER: Objection. Outside the 06:16:19

Samsung Ex. 1046, p. 261
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 261
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

scope of cross. As well as objection to leading. 06:16:19

THE DEPONENT: So it says "I also do not agree that Hiraishi's S4 leveling operation adjusts read timing within Hiraishi's data buffer, although Hiraishi does perform a separate retiming operation 06:16:36 which I describe below."

Q. (By Mr. Lindsay) Is that still your opinion?

A. Yes.

MR. CHANDLER: Objection. 06:16:46

Q. (By Mr. Lindsay) And all of your testimony here today consistent with that opinion?

MR. CHANDLER: Objection. We got to back up.

So objection. Outside the scope of 06:16:54 cross. And objection. Leading.

THE DEPONENT: Is my video frozen again?

MR. CHANDLER: It is.

MR. LINDSAY: Yes.

MR. CHANDLER: Even Zoom objects. 06:17:06

THE DEPONENT: One could hardly blame it.

(Technical difficulties; discussion off the stenographic record.)

THE DEPONENT: Okay.

Q. (By Mr. Lindsay) Okay. And then if you 06:17:34

Samsung Ex. 1046, p. 262
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 262
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

scroll down to paragraph 115 for me. In your declaration still, of course. 06:17:35

A. Okay.

Q. Okay. Do you recall earlier today testifying about fly-by delays and whether Hiraishi corrected for those fly-by delays when it receives signals from the memory devices? 06:17:55

A. Yes.

Q. Do you state here that for those fly-by delays that "Hiraishi uses an entirely different retiming operation which Petitioner does not address and which is also unrelated to strobe-centering"? 06:18:18

MR. CHANDLER: Objection. Outside the scope of cross. And objection. Leading. 06:18:31

THE DEPONENT: Yes, that's what I say.

Q. (By Mr. Lindsay) Does the next sentence go on to say that "this re-timing operation is based on an internal local clock which re-times the read data output from FIFO and generates a new DQS strobe signal using the strobe generating circuit 376 that's in synchronization with the internal clock LCLKR"? 06:18:49

MR. CHANDLER: Objection. Outside the scope of cross. And objection. Leading. 06:19:06

Samsung Ex. 1046, p. 263
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 263
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

THE DEPONENT: Yes, I see that text. And that is still your opinion. 06:19:10

Q. (By Mr. Lindsay) And is that consistent with all of your earlier testimony today?

A. I believe so. 06:19:20

MR. CHANDLER: Sorry. Objection. Leading.

Q. (By Mr. Lindsay) Does Hiraishi apply a fixed delay to the DQS strobe signal that it receives using circuit 372? 06:19:39

A. Yes, that's my recollection, assuming 372 is the 90-degree delay circuitry.

Q. If you look at paragraph 87. Sorry to jump around, but I just wanted to orient your memory there. 06:20:32

Paragraph 87 of your declaration, the second --

A. Okay. Yes, I'm there.

Q. -- sentence from the end.

Does it say "delay circuit 372 then applies the fixed delay to the selected DQS"? 06:20:44

MR. CHANDLER: Objection. Outside the scope of cross. And objection. Leading.

THE DEPONENT: Yes, that's -- that's what it says, that is my understanding, and I believe 06:20:58

Samsung Ex. 1046, p. 264
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 264
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

it's consistent with my testimony throughout the day. 06:21:01

Q. (By Mr. Lindsay) In your opinion, why does Hiraishi delay the DQS signal by that fixed amount? 06:21:14

A. Because it believes that that is an effective way to get the DQS centered in the eye.

Q. Other than delaying the DQS by that fixed amount using circuit 372, does Hiraishi describe any sort of other data centering operations? 06:21:34

A. No, not that I can think of.

Q. Other than delaying the DQS signal by that fixed amount using circuit 372, does Hiraishi indicate the need to perform any sort of additional data strobe centering such as that described in Butt? 06:21:56

MR. CHANDLER: Objection. Leading.

THE DEPONENT: No, I don't believe so. Hiraishi seems -- "Hiraishi," rather, seems to believe that it's a complete and effective design and doesn't identify any flaws in that approach of using a 90-degree delay. 06:22:14

Q. (By Mr. Lindsay) Other than delaying the DQS signal by that fixed amount using circuit 372, would a person of ordinary skill in the art believe 06:22:31

Samsung Ex. 1046, p. 265
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 265
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

that Hiraishi would benefit from an additional data centering operation such as what Butt describes? 06:22:34

MR. LINDSAY: Objection. Form. And objection. Leading.

THE DEPONENT: I don't believe so. I think reading Hiraishi, a person would understand how the -- the delay centers the strobe in the eye and wouldn't -- wouldn't identify any particular flaw in that approach. I don't recall Dr. Wedig identifying any particular flaw in that approach. 06:22:50 06:23:13

Q. (By Mr. Lindsay) Okay. Can you, if you wouldn't mind, turn to the Butt reference, Exhibit 1029.

A. Okay.

Q. Okay. Do you recall a short time ago discussing paragraph 63 with Mr. Chandler, particularly the part where it talks about the invention being implemented as an application specific integrated circuit? 06:23:37

A. Yes, I recall that discussion. 06:24:02

Q. Okay. The paragraph directly above that, could you read the first sentence into the record --

MR. LINDSAY: We lost video. Are you still there, Dr. Mangione-Smith? 06:24:17

Samsung Ex. 1046, p. 266
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 266
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

(Technical difficulties; discussion off the stenographic record.) 06:24:25

MR. CHANDLER: So objection. Outside the scope of cross. And objection. Leading.

THE DEPONENT: So you asked me to read the first sentence of paragraph 62; is that correct? 06:24:31

Q. (By Mr. Lindsay) Yes.

MR. CHANDLER: Same objection.

THE DEPONENT: So it says "the functions performed by the flow diagrams of Figures 5 through 7 may be implemented using a conventional general purpose digital computer programmed according to the teachings of the present specification as well be apparent to those skilled in the relevant arts." [as read] 06:24:38 06:24:54

Q. (By Mr. Lindsay) Okay. And if you could scroll up to Figure 5. We'll take a look at 5, 6 and 7 briefly.

MR. CHANDLER: Objection. Outside the scope of cross. And objection. Leading. 06:25:15

MR. LINDSAY: I don't think there's actually a question there.

Q. (By Mr. Lindsay) What is Figure 5 describing? 06:25:28

Samsung Ex. 1046, p. 267
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 267
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

A. You have to give a moment. It's been a long day, and my computer seems to be losing its mind. 06:25:30

MR. CHANDLER: And objection. Outside the scope of cross. 06:25:38

THE DEPONENT: Figure 5 seems to be describing an algorithm Butt is discussing for determining what delay to use for the data strobe.

Q. (By Mr. Lindsay) Okay. And then Figure 6, if you could turn to that and describe what -- what it is showing us? 06:26:03

MR. CHANDLER: Objection. Outside the copy of cross.

THE DEPONENT: So this is further a part of that testing approach and how one might determine what the maximum delay value is. So it's -- it's setting a delay value testing it, and increasing the delay value until the test fails, and then marking the last one that passed as the maximum value. 06:26:29 06:26:50

Q. (By Mr. Lindsay) Okay. And then what is Figure 7?

MR. CHANDLER: Objection. Outside the scope of cross.

THE DEPONENT: Figure 7 is using a 06:27:06

Samsung Ex. 1046, p. 268
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 268
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

similar approach to determine the minimum value, in that it keeps decreasing the delay value until the test fails, at which point it says the last minimal value that I use shall be -- that passed the test will be registered as the minimum -- minimum value that works. 06:27:07 06:27:25

Q. (By Mr. Lindsay) So back to paragraph 62. Does paragraph 62 then indicate that the strobe centering technique that Butt describes is implemented using a general purpose digital computer? 06:27:45

MR. LINDSAY: Objection. Outside the scope of cross. And objection. Leading.

THE DEPONENT: Yes, I believe that it's indicating that. 06:27:58

MR. LINDSAY: Okay. I have no more questions.

MR. CHANDLER: All right. Let's go off the record briefly.

THE VIDEOGRAPHER: Counsel, would you like to take a break for a minute. 06:28:18

MR. CHANDLER: Yes, please.

THE VIDEOGRAPHER: Yes. Very good.

We're going off the record. The time is 6:28. 06:28:24

Samsung Ex. 1046, p. 269
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 269
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

(Recess taken.) 06:28:25

THE VIDEOGRAPHER: We're going back on the record. The time is 6:31.

FURTHER EXAMINATION

BY MR. CHANDLER: 06:31:44

Q. Dr. Mangione-Smith, could you please turn back to the Butt reference marked as Exhibit 1029, and go to paragraph 62 and 63.

And let me know when you're there.

A. Yes, I'm there. 06:31:55

Q. The Butt reference, in paragraph 62, teaches that certain functionality may be implemented using a conventional general purpose digital computer. But Butt doesn't say that it's required to implement his invention using a 06:32:17
conventional general purpose digital computer, correct?

A. That's correct.

Q. And, in fact, in paragraph 63 of Butt, marked as Exhibit 1029, he teaches that his 06:32:32
invention may also be implemented in an ASIC or an FPGA or a few other ways that are described in paragraph 63, correct?

A. Well, in 62, he's specifically talking about the flow diagrams of 5 through 7. If the -- 06:33:03

Samsung Ex. 1046, p. 270
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 270
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

assuming the present invention covers those flow diagrams, then sure, he's talking about these other modes of implementation. 06:33:05

Q. And if you look, for example, in paragraph 12 of Butt, he indicates that Figure 5 is part of the present invention, correct? 06:33:23

A. It's -- it says it's -- it doesn't say it is a preferred embodiment of the invention. It says it's a flow diagram illustrating a turning process in accordance with it. 06:33:53

I'm not saying it's not part of the present invention. I'm just pointing out that he's using different words to characterize it there. And I don't recall if -- yeah, I guess I'll leave it at that. 06:34:06

Q. Figure 5 is a preferred embodiment of the present invention, correct?

A. Well, Figure 5 is a flow diagram illustrating a training process in accordance with a preferred embodiment. 06:34:22

Q. Of the present invention, right?

A. Yeah.

Q. And paragraph 63 of Butt tells us that the present invention may be implemented in an ASIC, correct? 06:34:35

Samsung Ex. 1046, p. 271
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 271
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

A. Yes. 06:34:39
Q. Or an FPGA, right?
A. Yes, that's correct.
Q. And Butt never says that the only way to implement his invention would be using a 06:34:48
conventional general purpose digital computer, correct?
A. He says that the flow diagrams may be implemented that way, and that the invention may be implemented using an FPGA or an ASIC. 06:35:06
Q. So Butt is teaching some alternative ways to implement his invention, correct?
MR. LINDSAY: Objection. Asked and answered.
THE DEPONENT: Yeah, Butt is at least 06:35:23
teaching that his invention can be implemented with an FPGA, an ASIC. I'd have to go back. I think they said a CPLD again or -- I think there was a third technology.
Q. (By Mr. Chandler) Butt never says that 06:35:40
his invention must be implemented using a conventional general purpose digital computer, only that it may be, correct?
MR. LINDSAY: Objection. Asked and answered. 06:35:50

Samsung Ex. 1046, p. 272
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 272
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

THE DEPONENT: We've talked about Butt. We've looked at that sentence saying it may be. I haven't memorized Butt, so I'm not going to say that it doesn't say that it must be. My expectation is that it probably does not say that, but I can't say authoritatively. 06:35:55 06:36:07

Q. (By Mr. Chandler) And with respect to, you know, what the present invention is, if you look at Claim 1 of Butt, determining an optimum offset delay value is part of Butt's claimed invention, right? 06:36:22

MR. LINDSAY: Objection. Outside the scope of direct or redirect.

THE DEPONENT: So Claim 1 does state a method for calibrating a data-valid window, compromising the steps of, and then it moves forward, yeah. 06:36:50

Q. (By Mr. Chandler) And part of the claimed invention in Claim 1 is determining an optimum offset delay value, correct? 06:37:04

MR. LINDSAY: Objection. Outside the scope of redirect.

THE DEPONENT: That is what the language says.

Q. (By Mr. Chandler) And Butt teaches that 06:37:14

Samsung Ex. 1046, p. 273
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 273
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

the present invention can be implemented in an ASIC or an FPGA or other methods described in paragraph 63, correct? 06:37:15

MR. LINDSAY: Objection. Asked and answered. 06:37:30

THE DEPONENT: Yeah, I think we've been over that a couple times. It -- he uses the language, the present invention may also be implemented by the preparation of an ASIC, ASSP -- that's what he used -- FPGA. 06:37:49

Q. (By Mr. Chandler) For example, Butt does not say that the claimed invention in Claim 1 must be implemented using a conventional general purpose digital computer; is that fair?

MR. LINDSAY: Objection. Again, asked and answered. 06:38:08

THE DEPONENT: Yeah, I think I just answered that a moment ago. I won't take a position on that. I know he says that it may be. I don't know any place off the top of my head where it says it must be. 06:38:22

Q. (By Mr. Chandler) And you're not offering the opinion, either in your declaration or right now, that Butt has taken the position that his invention must be implemented in a general 06:38:32

Samsung Ex. 1046, p. 274
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 274
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

purpose digital computer, correct? That's not an opinion that you're offering? 06:38:37

A. Not as I sit here, particularly because of what's recited in paragraph 63.

MR. CHANDLER: Okay. Thank you, Dr. Mangione-Smith. I have no further questions. That concludes your deposition. 06:39:15

THE DEPONENT: All right. Thank you. Have a good evening, everybody.

MR. LINDSAY: Okay. 06:39:26

THE VIDEOGRAPHER: Thank you, Counsel. Before I go off the record, I just want to make sure you have standing orders for video?

MR. CHANDLER: At some point we will order the video, yes. 06:39:39

THE VIDEOGRAPHER: No order at this time. Okay. Thank you. Then this concludes the deposition of Dr. William Mangione-Smith. The number of media units used was one, containing ten video clips. 06:39:48

We're going off the record. The time is 6:39.

(Deposition concluded at 6:39 p.m.)

---o0o--- 06:39:55

Samsung Ex. 1046, p. 275
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 275
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

I, DR. WILLIAM HENRY MANGIONE-SMITH, do hereby declare under penalty of perjury that I have read the foregoing transcript; that I have made any corrections as appear notes; that my testimony as contained herein, as corrected, is true and correct.

Executed this ____ day of _____, 2023, at _____, _____.

_____
DR. WILLIAM HENRY MANGIONE-SMITH

Samsung Ex. 1046, p. 276
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 276
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

I, Rebecca L. Romano, a Registered Professional Reporter, Certified Shorthand Reporter, Certified Court Reporter, do hereby certify:

That the foregoing deposition testimony was taken remotely before me at the time and place therein set forth; that any deponent in the foregoing deposition, prior to testifying, was administered an oath; that a record of the deposition was recorded stenographically by me and which was thereafter transcribed under my direction; that the foregoing transcript is a true record of the testimony given.

Further, that if the foregoing pertains to the original transcript of a deposition in a Federal Case, before completion of the proceedings, review of the transcript [ ] was [X] was not requested.

I further certify I am neither financially interested in the action nor a relative or employee of any attorney or any party to this action.

IN WITNESS WHEREOF, I have subscribed my name this 9th day of May, 2023.

Rebecca L. Romano, RPR, CCR
CSR. No 12546

Samsung Ex. 1046, p. 277
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 277
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

DEPOSITION ERRATA SHEET

Case Name: Samsung Electronics v. Netlist, Inc.
Name of Deponent: Dr. William Henry Mangione-Smith
Date of Deposition: May 4, 2023
Job No.: J9467698
Reason Codes: 1. To clarify the record.
2. To conform to the facts.
3. To correct transcript errors.

Page _____ Line _____ Reason _____

From _____ to _____

Page _____ Line _____ Reason _____

From _____ to _____

Page _____ Line _____ Reason _____

From _____ to _____

Page _____ Line _____ Reason _____

From _____ to _____

Page _____ Line _____ Reason _____

From _____ to _____

Page _____ Line _____ Reason _____

From _____ to _____

Page _____ Line _____ Reason _____

From _____ to _____

Page _____ Line _____ Reason _____

From _____ to _____

Page _____ Line _____ Reason _____

From _____ to _____

Samsung Ex. 1046, p. 278
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 278
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

DEPOSITION ERRATA SHEET

Page _____ Line _____ Reason _____

From _____ to _____

Page _____ Line _____ Reason _____

From _____ to _____

Page _____ Line _____ Reason _____

From _____ to _____

Page _____ Line _____ Reason _____

From _____ to _____

Page _____ Line _____ Reason _____

From _____ to _____

Page _____ Line _____ Reason _____

From _____ to _____

Page _____ Line _____ Reason _____

From _____ to _____

Page _____ Line _____ Reason _____

From _____ to _____

Page _____ Line _____ Reason _____

From _____ to _____

Page _____ Line _____ Reason _____

From _____ to _____

_____ Subject to the above changes, I certify that the transcript is true and correct

_____ No changes have been made. I certify that the transcript is true and correct.

_____

DR. WILLIAM HENRY MANGIONE-SMITH

Samsung Ex. 1046, p. 279
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 279
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

$

$100,000
18:3

$750
17:25

-

---o0o---
7:3
275:25

-3C
88:1

0

0
47:13,21,
22,24
141:25

0.9
161:25

1

1
7:9 35:8,
12 44:23
45:7
47:21,22,
24 68:14,
20,23
89:22,24
104:24
110:16
129:3
135:4
141:7,9,
18,25
176:14
191:11
192:2,7
193:12
257:21
273:9,14,
19 274:12

1,250
71:5

1-bit
44:14,15,
18,19
136:9,11
138:3
144:9,12

1.1
247:7
256:9
259:3

1.25
70:20
71:1,5

10
32:5
78:15,18
79:8
80:12
122:3
221:8,10
257:6

10,860,506
7:15
10:19

100
100:21
163:5

1001
10:19
26:5,8,
11,16
90:11
101:2
116:7
124:23
125:12

1003
33:25
34:6
35:13
97:10,14
100:5

1005
26:19,23
175:1,8
176:15
190:18

1006
27:1,5
174:25
238:7,17

1007
27:17,20

1008
27:25
28:7

101
70:17

1020
28:10,13
82:2
87:16,23
134:17,19
135:19
136:1,21
137:21
138:7,18,
23 139:19
140:1,23
142:11,15
143:20
144:20
145:5,12
154:20
157:8,13
160:3
161:13
162:13,24
168:21,25

1029
27:8,14
240:4
241:4
242:10
244:8,12,
21 245:6,
13 266:13
270:7,20

1042
122:16,
18,19
123:11,
12,17,18,
20

1044
123:23
124:1

1047
54:21,23
55:4,11,
15 56:1,
5,8,12
57:13
58:9,25
60:11,25
63:13
64:23
71:1,7,
10,20
72:11,14
73:7
74:9,12
75:6
78:15,18
79:8
80:12,21,
24 81:4
246:20
247:17

1048
115:23
116:2,6
117:1

1049
179:17,
18,24
180:8

1050
124:1
229:10,
14,19
230:20
231:2,14,
18

1051
204:23,24
205:5

1052
239:20,24
240:1,10
241:22
242:16

1053
246:5,9,
13 247:1,
5,13
248:5
250:16,25
251:9
252:16
253:2
254:12
255:2,8
256:3,13,
23
257:14,25
258:20
259:4

106
11:3
242:15

1071
122:25
123:3

1072
122:25

108
242:17

109
11:2,11,
12,13
51:21,24
52:4
131:13
147:6,8,
11

10:02
49:17

10:13
49:20

10A
121:23
122:4,10,
16

10D
122:6

11
23:17
80:21,24
81:4
104:23
110:16
229:25
233:1,6,
8,14
234:6,14,
19,25
235:10
238:10,
13,16

110
70:8,9
131:13
148:7

111
70:8
131:14

112
19:19,22
22:2
243:20
244:2

114
31:4
147:1,7
169:6
170:21,24
240:9
242:20

115
263:1

116
30:4
125:1

118
240:14

118.8
167:24

11:16
88:8

11:26
88:11

11:59
108:9

12
34:6
98:22,25
99:2
123:9
125:11
126:11,20
128:6
190:17
193:10
271:5

120
225:13

121a
243:9,13

123
230:2

123a
240:19,
22,23
241:15,16
242:20,25

124
167:2

124a
243:2,4,8

12:45
108:2

12A
90:11,16,
20 91:1,
5,11,19,
23 92:19,
25 93:8,
10,14
94:8,13
95:11
97:15
98:1,7,
10,13,15,
21,23
99:1,6
100:3,16,
18

12B
90:12,16,
20 91:1,
5,11,19,
23 92:4,
11,17,19,
21,25
93:2,8,
10,14
94:9,13
95:5,11
96:4,6,18
97:15,22
98:1,3,
17,24
99:6,8,12
100:3,16,
19

13
123:9
126:22
190:23

130
230:2

131
19:22

136
51:25
52:5

14
101:1,6,
14,19,21
102:2,4,
12 116:25
117:2
118:17,19
120:7
190:25
211:17

142
205:8
212:25

143
212:25

144
219:24

145
207:17
213:7

146
205:8
216:15

147
230:1,14

14A
204:18
205:6,12,
17 206:3
207:3
208:15
209:12,15
212:1,7
213:24
214:6,8,
14 215:7
216:3

14B
204:18
205:6,12,
18 206:3
207:3
208:16
212:5,7
213:24
214:6,8,
14 215:7
216:3

15
18:21
90:1,5
94:4,8
101:20,22
102:2,6,
19,23
103:8
104:5,12
105:8
106:13
108:20
109:1,10,
21 110:23
114:21
115:1
116:6,12,
20 117:7
118:18
120:2,7,
17 121:12
229:24
230:5,17
231:1,4,
7,11,16,
20 232:8,

Samsung Ex. 1046, p. 281
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 281
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

12 235:7
247:6
248:5
251:14
252:16
253:1
254:12
255:1,2,7
256:3,12,
22 257:7
259:3

150
230:2

1501
103:24
110:25

1502A
104:16

1502B
103:11
104:11,17

151
230:2
232:19

1520
105:17,24

1550
103:16
104:14,20

1560
103:19,20
105:7,10,
18,19,25
106:6,13,
16,21,25
107:2,7,8
109:2,6

1570
103:22,23
104:1
109:7,10,
17,22,25
110:6,10
113:17,18

1580
103:24
110:10,23

16
60:1,23
101:1,6,
14
102:13,15
111:4,8,
20 112:5,
24 114:21
115:5,11
116:7,11,
12,18
117:8
118:16
119:24
120:2,7,
17,19
121:12

1601
115:13

1602B
111:15,25

1630B
112:2

164
161:12
162:13,23

1650
112:3,4,
10

1660
112:12,
13,15,18,
25

1670
113:1,2,
7,12,18,
21,24
115:7,9,
15

1680
115:12,19

17
88:15
89:20
94:3
97:13
100:4
113:3
192:18,23
193:10

175
257:15

18
67:24
68:13
69:1
97:13
100:4
113:10,16

19
97:13
100:4
175:6

190
258:24

1990s
56:16

1:04
108:12

2

2
35:8
56:5,8,24
59:11
191:15,24
192:4,8
193:13
240:3,8,
10,13
241:25
242:6,14,
17 243:20

2,500
163:13
164:8,13
165:7,16,
21 166:15

2.5
163:11

20
17:15
18:5 95:7
119:13,16
142:23

200
163:20,
23,25
164:7,13
165:6,19
166:5,14
167:4
168:25
170:14
230:11

200-0
231:22

200-19
231:24

2000
83:1 84:4
86:25
87:4
131:16
148:3

2003
87:6,10,
11 131:16

2005
32:24
33:1

2006
10:25
11:13
16:16
19:18,23
20:6,14
22:3,6,
16,23
25:5
28:21
29:1 30:5
31:4 32:5
33:11,16
48:25
49:1
50:1,13
51:21,25
63:10
70:18
88:14
89:21
94:4
131:5
147:2,12
162:22
163:6,16
169:7
174:22
175:4
176:18
178:5,9
195:8,12
204:13
223:9,12
245:9
260:7

2007
87:14
131:17
220:24
221:3,8,
14 246:14

2008
25:25
87:18,21,
25 138:18

2009

Samsung Ex. 1046, p. 282
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 282
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

25:24

2010
82:7,11,
14,22
84:3,18
85:3,25
86:25
87:4

2011
82:7
87:12

2012
29:5,11,
18 51:1
73:4 75:4
79:5 82:7
87:7,8
146:7

2017
30:17
31:9

2018
30:12,17

2020
31:5

2022
22:1
221:5

2023
7:1,17
20:7

21
144:3,8
145:12,17

211
170:18

22
136:21
137:3

23
90:1,5
94:5

24
178:4
258:10,16

26
90:2,5
94:5
134:19
136:1
137:21

27
138:6,22
204:12

28
52:2,6
157:9,12
174:3,9

28.8
166:6,16
167:11
168:1
174:10,15

28.8-degree
166:19

2:37
162:8

2:47
162:11

3

3
56:12,24
59:11
91:4
175:23

3.4.5.1
140:6

3.8
250:25
251:11

30
161:15

300
178:16
180:10,
14,22
181:3
182:22
183:1,11,
25 184:3,
24 187:9
188:4,12,
13,21
189:6,16,
24 190:1
205:14
207:19
215:22
218:3
219:25
220:1,10
230:7,11

300-0
231:21
232:2

300-4
231:23
232:5

301
207:1,2

302
187:20
188:3
190:13

30th
221:5

31
140:2,3,
23

310
228:19,23
229:5

31st
20:7

32
60:1

320
102:13
178:15
195:19,21
196:5,14,
18,21
197:2,16,
22 198:11
199:3,9
201:13
202:21
203:3,20
204:7
216:7,12,
18,23
217:3,4,
12 218:2,
24 220:9
232:24

320/620
101:22
102:12

322
116:19
178:14
207:18
217:13

323
178:15
230:14

324
116:21

33
135:19

337-TA-1023
30:7
55:14

337-TA-1089
30:12

340
204:7

341
196:22
197:4,25
199:12
202:23
203:23

342
196:23
197:5
198:1
199:12
202:24
203:23

350
188:5
204:7

351
196:19
197:4,24
199:11
202:22
203:22

352
196:19
197:4,24
199:11
202:22
203:22

360
164:14
166:16
229:6

37
28:25
34:7,21
35:13
36:2

370
227:20

372
185:13

186:23
264:10, 11,20
265:9,13, 24

374
227:22

376
189:1
223:17,20
224:11,24
225:5,11
226:4,13, 18 227:7, 11 228:3, 10,15,25
229:3
263:22

38
33:15,18
250:16,24
251:9

3A
240:5,8, 17 242:6, 21 243:14

4

4
7:1 23:17
32:6
56:25
57:13
59:11,14
61:10
113:10
150:15
160:3
193:21,24
194:6

42
139:18
175:4,6, 12 176:3

43
25:9,18

44
25:10

45
176:17,20
195:7,12

48
142:10,14
145:4

4:29
220:19

4:41
220:22

4th
7:17

5

5
47:14
58:9,24
59:11
60:11,24
150:15
176:24
177:6,19
178:16
181:3
182:22
187:10
192:10, 19,21
193:14
195:11, 17,22
196:4,13, 17,21
197:2,16, 22 199:3, 9,14
203:21
205:5,15
217:10
220:11
223:11, 15,19
224:22
226:2,15
229:23
230:7,14
238:22,24
239:3,16
257:24
267:11, 18,24
268:6
270:25
271:5,16, 18

50
163:9

506
10:15,18
14:14
17:2,8
26:5,8, 11,15
29:6
31:10,15
40:23
50:25
54:3
88:22
89:8,15, 22 90:5, 7,10,17, 20,22
91:1
93:18,25
94:2,9,15
95:12
96:2,8, 16,22
97:15,21
99:17
101:2,6, 8,14,20
102:3,19, 23 108:21
109:10
110:23
111:5,8
112:24
113:7
116:7
118:5,10, 15,22
120:5
121:13,24
122:7,11
124:23
125:11,13
128:12
146:6,20
221:19
235:18
236:7
246:25
247:2

51
125:12
126:11,20
143:10,19
144:20
145:11,18

52
128:6
178:8
245:9

53
179:1

55
204:16

57
168:20,24

58
131:9
154:20
157:8,13
160:3

5:12
238:2

5:24
238:5

5:39
245:21

5:48
245:24

6

6
63:13
64:23
68:3
70:25
150:15
193:15
267:18
268:10

6-0
260:7

60
170:24
260:7
261:5,12

60-something
126:20

61.2
167:24

62
125:12
126:12,21
267:6
269:8
270:8,11, 24

620
101:23
103:9

625
165:21
166:3

63
244:7,11,
20 245:6
266:16
270:8,19,
23 271:23
274:3
275:4

64
59:5

64-bit
59:19

65
162:21
163:15,17
165:5

69
223:8,11

6:07
259:22

6:13
259:25

6:28
269:25

6:31
270:3

6:39
275:22,23

7

7
71:7,10,
19 124:23
125:1
196:2
267:12,19
268:22,25
270:25

72
60:8

73
261:19,22

750
18:5

8

8
59:3,14
60:20,25
72:10,14
73:7
125:15
126:1,15
127:9,20
128:13

810
127:21
128:15
129:3

84
225:10

840
127:11
128:20

87
264:13,16

8A
193:15

8B
193:15

8DQ
60:17

9

9
74:9,12
75:6
246:20
247:17

90
153:14
166:9
167:20
171:25
173:9,12,
18,19,23,
25 174:6

90-degree
165:1
166:4
187:3,13
264:12
265:22

910
122:2,6,
7,9,12,15
124:5

95
245:10

9:01
7:2,7

9A
193:16

9B
193:16

A

a.m.
7:2,7

A0
140:11

A1
140:11

A2
140:25
141:6,8,
17 142:3,
7

A7
136:2,9,
12 138:3

abbreviated
75:20
135:21
141:9
142:16
244:15
246:15

abbreviation
249:21

ability
237:19

absent
54:4

absolutely
150:14
208:3
218:5

abstract
89:12
149:24

accepted
86:1,15

access
37:8
83:14

accessed
44:5

accomplish
133:16,18
150:23
152:2
172:21
181:13
205:22

accomplished
144:11
212:19

accomplishes
189:22

accomplishing
124:6

accordance
271:10,19

account
68:6
99:21
198:19

accounted
174:3

accounting
68:4
133:12
190:2
211:21

accounts
198:22

accurate
18:10
20:17,19
22:16,19,
20,21
154:18
178:3
226:8
229:7

accurately
154:4
156:16
193:20

accustomed
29:16

achieve
41:21

achieving
78:13

acronym
52:8

action
114:17

activated
46:7
115:13
167:3,5
168:5,6
177:17

activation
133:13

active
260:15

actual
47:16
64:19
202:9

add
24:11

added
77:9
195:14
231:13
240:7

adding
73:12

addition
16:12
73:12

additional
49:8
71:25
142:15
257:5
259:10
265:14
266:1

address
11:24,25
73:21
75:13,22
76:8
77:23
79:17,21
81:17
132:23
150:11
247:18
263:12

addressed
132:20
202:17

addresses
138:25

addressing
97:2

adhere
65:12

adhered
127:7

adjust
210:7

adjusting
260:12

adjustment
187:4

adjusts
260:13
262:3

administered
10:2

administering
8:14

admiral
68:16,18

adopted
33:19
138:24

advance
55:22

advanced
34:13
35:20
75:18,19
246:15
247:7,12
255:8
256:12,14,22
257:16
258:20

advantage
214:9

advantages
253:18

affect
106:21
140:11

affected
186:19

affiliations
7:23

affirmatively
226:1

aggressive
172:23

agree
8:13
34:11
35:19
36:6,10
37:6,14
38:2
56:15,23
57:16,20
58:12,24
62:19
63:16
65:14,17
67:17
68:2
69:7,15,22,25
71:10
72:14
74:12
78:18
80:24
138:16
199:19
221:22
245:12,16
247:1
262:3

agreed
32:15
83:16
120:13
130:23
221:17

agreement
19:10

ahead
34:24

algorithm
268:7

aligned
117:14,15,19
118:3,17
125:19
127:19,22
128:2,6,10,11,14
129:20,25
130:13,19,24
131:2,3
171:24
182:16

aligning
171:8,15,20,22,23
173:10

alignment
121:9
125:18,24
126:12
127:4,10,16 128:21
129:11,13
130:1
153:21,25
172:2

alternate
158:22

alternative
42:17
272:11

alternatively
39:21
224:19
244:17

alternatives
39:18
40:2,9
41:12

AMB
75:12,15,20 76:4,7,10
246:15
247:16,23
248:4,13,23 249:6,25 250:15
251:14,15
252:24
254:9,10,24
255:21,24
256:1
257:5

258:7
259:4

amount
18:7 31:2
92:20
96:11,21
106:23
130:3
231:22
243:5
265:5,9,
13,24

analysis
86:3,16,
17 100:18
149:25
188:25
203:10

analyze
149:16

analyzing
85:19,21

and/or
137:13,15

Annita
15:17

annotated
116:8
195:11
204:18
205:7
223:10

annotations
207:9

anticipated
185:17

anytime
136:19

apologize
165:22
168:17
210:14

apparent
267:15

Appeal
7:14

appeared
19:2 24:5

appearing
162:22

appears
34:5
54:17
97:23
105:16
110:2
136:8
162:1
163:12
176:12
193:11
247:4,22
258:25
259:2

appendix
20:11

apples-to-apples
165:8

application
266:18

application-specific
38:8
244:14

applied
96:18
98:2
106:23

applies
149:12
264:21

apply
264:8

applying
93:3

approach
260:11
265:21
266:9,10
268:15
269:1

approximate
20:25

approximately
16:5,18
17:9
18:18
20:23
50:15
69:8,16
95:7
127:12
128:23
174:6
234:21,23

April
87:18

area
43:7

areas
150:20

arguments
27:11
85:19,22
149:2,15,
16 150:1,
10 151:10
219:17
222:2
242:5

arrangement
79:21
81:17,21

arrangements
132:24

arrive
80:11

arrived
67:1

arrives
216:2
232:22
260:15

arriving
80:9,11

arrow
65:1
92:14
116:9,10,
11 238:19
239:14
240:7
243:6

arrows
60:20
116:8

art
24:23
26:19,22
27:1,4,10
29:6,10,
17 33:21,
22 34:5,
12 35:9,
15,20
36:4,7,11
37:7,15
38:3
40:12,20,
23 43:10,
16,18
53:24
71:16
72:22,24
74:17
78:22
82:20
83:6,8,
13,17,24
84:6,14,
16,21,22
85:5,17,
23 86:7
91:19
94:14
97:4
120:4
146:13,
19,22
147:19
149:11
151:10
218:12,14
244:24
246:25
265:25

arts
267:15

ASIC
38:7,8,
17,21
39:1,4,
14,20
40:3,9,12
41:2,11,
15,19,20,
23 42:20,
21 53:8
244:15,25
270:21
271:25
272:10,17
274:1,9

ASICS
37:16
38:4
42:23
43:5

aspect
93:16
133:12

Samsung Ex. 1046, p. 287
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 287
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

236:15

aspects
51:6
59:6,7
71:14
72:19
79:14
101:18
120:15

assert
171:1

asserted
17:5,6
112:22
156:17,19
172:15
177:12

ASSP
274:9

assume
17:11
20:9
23:24
25:12
43:4 65:4
85:22
87:9
105:3
161:4
184:13
224:8

assumes
145:22
152:24
153:1
154:12
250:4

assuming
21:21
112:8
129:24
174:23
184:19
264:11
271:1

assumption
86:2,15

asymmetric
168:16

asynchronous
243:19,23
244:1

attached
48:24
54:25
115:25
179:20
205:1
229:12
239:22
246:7

attempt
134:12
181:14

attended
15:13
51:17

attention
31:17

attorney
8:17

attorneys
23:23

attractive
40:6

authoritatively
273:6

avoid
133:18
134:13

aware
33:11,14
50:12
204:10
218:18
224:16
235:22

awful
68:6
91:16
92:6

awhile
219:20

B

B-I
63:11

B2
7:15

bachelor's
34:16
35:23

back
17:4
48:25
49:1,15,
19 51:9,
20 52:14
68:19
88:10
93:25
101:10
104:9
105:15
108:11,13
111:18
115:10
126:19
135:25
162:10
191:6
193:21
196:10
206:21
210:4,5,
11,16
212:9
213:21
215:21
216:8
218:21
220:21
225:4
228:9
236:15
238:4
245:23
259:24
262:13
269:7
270:2,7
272:17

background
89:13

Baker
8:1

bank
57:20
58:1

banks
57:17
58:1

bar
63:20
64:4 66:4
125:9

barring
199:19

based
98:9
104:17
143:17
161:6
184:21
202:10,14
206:25
214:4
257:20
263:19

basis
22:8
96:15

BC
177:7,10
184:8

BC1
177:11

BC2
177:11

Bear
168:19

begin
43:6

beginning
7:8 159:2
176:2

begins
147:6

behalf
8:1,6
50:5

belief
85:20

believes
265:6

benefit
50:7 54:8
69:3
76:24
77:16,18
266:1

benefits
77:3,7

Bhakta
31:11,14

bidirectional
62:21
63:9

big
41:23

bigger
160:20

billed
48:21
50:16

billing
18:9
21:12
48:20

billionth
67:18

binding
8:15

BIST
250:11
252:7,11

bit
28:2
38:15
42:14
44:9,23
45:7 46:1
53:4
59:4,19,
22,24
61:15
62:11
64:2 70:7
73:12
92:10
140:11,25
141:6,8,
17,22
142:3,7
145:7
175:17
183:16
185:14
248:19

bits
59:3,5,14
60:1,8,
17,20,25
61:10
140:24

blame
262:21

block
75:12
80:8
103:11
142:22,24
191:1,4,
18 192:2,
4,8,10,19
193:5,14,
15 194:6,
18 195:3,
4 196:5,
14,18,21
197:2,16,
22 198:11
199:3,9
202:21
203:20
204:7
216:7,23
217:12
218:2
220:9
225:2
247:8,12,
15 250:13
251:14
255:8,15
256:11,21
259:4

blocks
191:13
192:3,15
193:24
248:6
256:15,
21,23
259:3,10

blue
116:11
231:5,17

blurry
38:15
42:14

board
7:14
53:11
94:12

bot-
221:11

bottom
25:9,18
35:7
60:11
88:18
101:21,23
102:12,14
104:5
116:9
126:15
138:5,22
139:14
140:3
145:18
160:12
167:2
168:24
169:18
205:9
221:13
229:24
230:1
231:4
233:6,8
234:7
239:16
240:13
247:6
251:7,10
253:1
254:20

Botts
8:1

boundary
38:14

bounds
195:2

box
92:15
106:3
109:2,6,7
203:11
230:19
231:13,17
240:14
242:20
248:14,21
249:3,11
250:7
252:16,
17,21
253:5
254:18,20
256:9

boxes
81:12
256:11
257:3,13

breadth
94:25

break
21:10,11
48:18
49:23
50:22
88:5
108:2
220:16
237:24
245:19
269:21

breaking
133:6
219:20

breaks
13:14,16
18:14

briefly
103:1
111:11
131:14
249:18
267:19
269:19

bring
12:12,19
97:3,12

bringing
170:15

broad
237:3

broader
53:2

broken
46:11,12,
16,19

brought
170:19

buffer
43:19
45:20,22
46:3,22
47:6,9,
10,18
48:3,4,6,
9,10,15
75:18,20
81:15
98:8
102:5,8,
17
103:14,24
110:11,22
111:22
112:2
115:12,13
175:17
176:8

Samsung Ex. 1046, p. 289
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 289
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

177:4,5,
7,14,17,
24,25
178:16,25
180:5,6,
10,14,22
181:3
182:22
183:1,11,
25 184:3,
17,24
185:3,6,
19
186:21,25
187:9
188:4,12,
13,21
189:6,11,
16,24
190:1,4
200:25
201:3,12,
13,21
205:14
206:17
207:19
209:2,4,
13,16,20
210:11,
17,20,24
211:1,8,
13,19
212:2,10
213:6
214:22
215:2,16,
22 216:2
218:3
219:25
220:1,10
224:17,25
226:9,11
230:7,11,
18 231:3,
6,12,21,
23 232:2,
5,20,23
233:11,
15,22
234:15
235:2,3,
8,11
236:15,
20,24
237:4
242:17
246:15
247:7,12,
17 248:4
255:9
256:12,
14,22
257:5,16
258:21
262:4

buffered
76:10
109:23
110:5
175:14
236:5

buffering
76:25
77:8 78:6
81:9

buffers
37:17
43:11,12,
13,15
46:5,14,
18 47:12
71:25
72:4,7
77:9
81:22,24
89:8
106:11
175:9,25
176:5,6,
9,24
177:8,19,
20 181:15
182:19
184:11
185:1
188:1
192:17
199:7
202:7
211:24
232:13,16
236:11,17
237:3,4
247:18
260:14

build
53:7
83:23
121:16

built-in
250:2,12,
14,22
251:22
252:4,8,
11

bunch
144:10

bus
253:18,21

business
41:1,6,10
53:15

Butt
27:7,14
147:2,5,
9,10,24
149:4
150:13,
18,21,23
152:1,4
153:5,16,
17,21
154:4,14
240:4,6,
13 241:4,
25 242:4,
7,9,14,21
243:20
244:8,11,
12,20
245:5,12,
16 265:16
266:2,12
268:7
269:9
270:7,11,
14,19
271:5,23
272:4,11,
15,20
273:1,3,
9,25
274:11,24

Butt's
147:19
148:2,14,
24 149:7,
20 150:4,
16 151:14
153:9,23
273:10

buy
42:7
165:15

by-eight
61:1,24
62:5,11

by-four
61:10,20,
24 62:7,
10

C

calculate
92:20
93:9,14
164:21
165:13

calculated
93:12
97:8

calculation
92:22
95:21
97:3
165:11
166:6

calculator
164:17,20

calibrating
143:8
273:15

calibration
143:21
145:7
250:8
258:12,16

call
12:18
15:9,10,
11,22
38:22
65:25
107:10,
13,19,21
108:3
155:17
177:10

called
38:13,25
39:9
44:11
45:1,14
47:18,24,
25 57:17
58:1
65:4,8
73:13
75:12
92:13
103:15
107:4

Samsung Ex. 1046, p. 290
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 290
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

135:6
159:14,23
214:18,
23,24,25
215:1

calling
194:24

calls
15:13,25
16:12
105:2
138:20
188:16
193:23
194:15
195:2

camera
13:25

capable
42:12

capacitance
175:18
176:1

capture
143:8,22
154:7

captures
66:11

capturing
154:15

**capturing/
sampling**
171:3

careful
86:23
183:16

carefully
26:4,18,
25 27:7,
16,24
28:9
93:18

123:7
216:14

carried
67:2

carries
147:6

carry
126:22

case
7:14 19:8
21:16,24
26:2
30:6,7,12
32:1 40:1
45:6
55:5,13,
23 56:18
66:25
70:2
79:25
87:9 90:8
93:13
96:13
99:24
101:16
114:25
133:4
152:19
160:21
163:12
172:10
176:12,13
184:18
194:24
203:12,13
220:25
225:6
226:9
228:22
233:5
247:4
257:22

cases
19:1

30:19,20
39:15
52:3 55:8
121:2,4,6
169:14
173:22
193:1
194:2

caught
61:17

caused
133:19
134:14
190:3

cautious
62:4

caveat
89:4
172:5
242:3

caveats
79:2

center
173:18,
20,22

centered
152:15,17
154:8
173:13
265:7

centering
150:21
151:15
152:3,5,8
153:13
154:15
171:2
172:7
173:2
265:10,15
266:2
269:9

centers
266:7

central
80:2,16
176:8
247:17

cetera
174:3,9
212:25

Chandler
7:25 8:1,
18 10:5
21:18
33:5,8
40:24
41:9
42:20,25
43:9
48:17
49:14,21
50:23
53:23
54:8,20
55:1
59:25
60:10
61:5,14
62:9,19
63:8
64:22
66:2 67:4
72:10
73:17
75:15
76:1,15,
24 77:5
78:5,14
80:20
83:1 84:1
85:21
88:6,12
89:10
91:10
93:17
94:18

96:8 97:9
98:11
99:15
104:1
107:12,
17,22
108:1,7,
13
109:15,24
110:12
113:20
114:8,20
115:3,22
116:1,17,
24 118:4,
8,12,25
119:12,
21,25
121:6,23
124:14,22
125:10
126:11,21
127:9,20
128:4,12,
20 129:5,
12,19
130:4,11
132:22
133:15
134:7
135:5,18,
25
136:11,18
137:4,11,
20 138:5,
16 139:18
140:9,20
141:8,15
142:2,9,
23 143:6,
19 144:2,
13 145:4,
11,17
146:1,20
150:2
151:4,14,
23 152:8,

16 153:4
154:6,14
155:19
156:18
159:7
161:17,24
162:3,12
171:14
179:16,21
186:4
193:12
195:6
198:8
199:25
202:19
203:6
204:12,23
205:2
206:15
208:8
212:24
217:21
218:19
219:22,23
220:15,23
222:4,13
223:2
224:10
225:21
229:13,16
236:23
237:11,18,23
238:6
239:23
240:1
245:18,25
246:8,10
248:4,12,19 249:6,15,25
250:14,24
251:6,21
252:3,15,24 253:7,20,25
254:10,24
255:7,17
256:10,20
257:4,14,23 258:6,18 259:2,12,17
260:16,18
261:7,15,25
262:10,13,18,20
263:14,24
264:6,22
265:17
266:16
267:3,9,20 268:4,12,23
269:18,22
270:5
272:20
273:7,18,25
274:11,22
275:5,14

change
45:2
125:18
161:7
182:7
183:1,6,12,25
184:16,22
186:17
207:4,10
213:6
217:7

changed
53:14,15
208:23

changing
159:21
185:5
207:24
208:4,8,11,12,15

channel
133:6
258:1,5

characterization
198:7
204:4
248:7

characterize
40:10
66:16,21
73:24
89:4
91:23
147:10
193:22
203:5
213:1
271:13

characterized
90:24
113:3
123:15
161:21

charged
18:2,7
151:7

charging
17:22,24

chart
169:11
221:4
230:9

chat
34:1
54:22
220:25
229:15
246:9

cheaper
42:11

check
23:19
76:2
111:2
209:25
248:22
249:22

checked
67:23
209:11

chip
38:22
39:3
59:15
67:14,16
167:15,17
174:19
180:11
182:4,5,13,20
183:4,6
186:8
197:25
198:1,24
200:24
201:24
209:3,16,21,22
210:10,16,18
211:8
212:2,9
214:12,21,24
215:17,21
216:1,8,24
217:12,25
218:21
230:11
231:7,24
232:3,6,14,22
235:9
236:21
241:24
254:24
255:10,20,23,24
256:1

chips
53:7
59:13
83:19
84:21,23
133:4,9
181:17
186:10,18
200:6,11
209:5
253:19

choices
39:18
40:8,11

choose
39:15
41:1

chooses
194:3

circle
169:12

circuit
37:24
38:9
39:11,24
41:18
42:9
48:7,11
79:14
102:5,7,8,16,17
104:14
105:10,11
107:11
109:8,9,17,22,25
111:21

Samsung Ex. 1046, p. 292
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 292
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

112:15
113:4,12,
13,16,17,
18,19,21
122:9,14,
18,19
123:12,
17,20,23
124:5
125:1,5
152:19
159:20
172:12
178:14,15
184:7
185:13
188:2
190:13
195:19,21
197:1,22
198:10
199:3,9
200:20,22
202:21
203:20
207:18
216:7,23
217:13
218:2,20
223:17,20
224:11,
20,24
225:11,14
226:3,6,
10,13,18,
24,25
227:7,20,
22 228:3,
15,25
229:5
230:13
232:24
240:15
244:14
263:21
264:10,20
265:9,13,
24 266:19

circuitry
37:8 39:8
45:16
73:12
153:13
178:19
181:2
185:4
186:23
241:5
264:12

circuits
37:12,15,
17,22,23,
25 43:11
64:10
68:10
107:4
121:17
124:11
192:17

citation
35:16

cite
89:21
90:1
94:10,11
163:16

cited
24:22
28:16,20
87:14
94:4

cites
35:12
162:22

CK
125:6,9,
14 126:2,
12 127:2,
11 128:22
220:2
228:21

CK0
105:14,18
106:1,2,
5,17,20
109:16,
23,25
112:17,22
122:21,
23,25
123:13,17

cl
89:24

claim
89:22
120:15
221:3,22
222:9,10,
14,16,21
223:5
236:22
273:9,14,
19 274:12

claimed
25:1
50:24
89:16
90:6,21
91:2,13,
20 94:15
101:8
150:17
236:8
237:2
273:10,19
274:12

claims
26:15,17
89:5,7
92:7,8
95:16,18
118:11
154:4
245:17

clarificati
ons
108:16
246:1
259:13

clarifying
260:4

clarity
256:1

clean
13:3

clear
20:13
24:12,15
32:22
59:8,9,10
67:11
83:5
87:23
95:22
100:14
107:17
111:16
127:16
132:11
146:17
161:1,22
166:19
167:22
172:4
193:23
194:2,14
215:6
217:22
222:13
227:18
240:3
260:5

clearer
88:2

client
149:11,13
151:7

clients
151:12

clips
275:20

clock
44:19
45:11,12,
18 66:1,
3,5,6
69:8,9,
16,17,23
70:20,22
73:22,23,
25 75:14,
22 79:18,
21 81:18
98:7
99:13
103:21
105:16
106:3,4,
7,20,24
107:1,6
109:16,
23,24
110:5
112:17
121:17,19
123:17
125:6,9,
14 126:2,
13 127:2,
10,21
128:13,21
129:17,20
139:4,10
154:23,25
155:3
156:9,12
157:9,11,
17 158:3,
11,17,21,
23 159:3,
15,18
160:15,
20,23,24

Samsung Ex. 1046, p. 293
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 293
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

161:25
163:11
164:7
165:3,7
166:15
206:25
207:25
220:2
223:21,24
224:2,9,12
225:14,18,20,22,23
226:13,18,19,21,25 227:3,5,7,8,9,14,16,19,23,24,25
228:3,4,9,12,17,23,24
229:2,5
234:2,21,23 235:1
263:19,23

clock-period-based
187:20

clocked
112:21
190:14

clocking
66:7,21

clocks
65:18
66:17
107:6
138:25
224:8
228:7

close
144:24
174:1

closely
16:23
104:10

closeness
117:13

closer
42:18

closest
201:21

CLPDS
42:10

coincide
190:16

colleague
8:3

colloquially
60:6

color
116:8

coloring
195:14

column
90:1,5
91:4
94:4,8
104:23
109:21
110:16
113:3,10,16 123:9
125:11
126:11,20,22
128:6
202:6

columns
57:21
58:2

combination
226:10

combined
47:17

combines
79:14

comfortable
18:4
256:8

command
75:13,22
76:9
79:17,21,25 81:17
134:22,23
135:5,6,20 136:2,13,24
137:7
140:10,24
141:6,17
144:17
230:18
231:12
235:2
247:18
248:13,21

commands
77:23
78:2,3
138:25

comment
24:24
61:16
132:1
149:17

commentary
14:12
24:11

commented
148:19
163:4
175:22
247:25

commenting
97:6
100:8
126:9

commercially
36:20,22

committee
132:8

commodity
42:6

common
36:20
44:11
57:5,10,22,24
58:3,5
60:8
61:15,19,22 62:5,11 74:21
77:16
79:2
133:5
158:20
191:17
252:10

communicate
77:15

communicated
249:24

communication
132:12
133:3

communications
132:10,19
133:5,20,21 134:1,6,15
190:4
191:16
193:25
204:9
253:18
254:2

community
146:10

compared
41:11
42:25
207:25

comparing
69:13
165:18

comparison
165:9
189:25
206:18
207:3

compensate
139:16

compensation
32:1

complementary
64:9,11,15 67:12
125:9
157:2,20,24

complete
22:6,7,10
94:2
132:7
204:3
265:20

completely
97:23
107:15
183:3

Samsung Ex. 1046, p. 294
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 294
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

complex
38:11
42:12

compliant
36:14

complicated
44:9
172:24

Complies
8:22

complying
167:3

component
191:12

components
36:15
37:9 53:9
73:16
133:4
191:9
192:1
211:21
212:3

comprises
14:17
59:2

compromising
273:16

computer
13:24
21:8
34:13
35:21
36:12,15
37:9
49:10
179:8
180:14
267:13
268:2
269:11
270:14,16
272:6,22
274:14
275:1

concept
43:19
58:25
62:5
64:22
65:4
146:4,9
150:6
156:23
236:18,24
237:1
245:3
251:25

concern
40:4

concluded
275:23

concludes
12:9
13:12
275:7,18

conclusions
14:18

conduct
149:10

confidence
172:15
173:15

confident
18:6

configuration
209:9
210:1

configured
136:13
228:20

configuring
197:8,9

confirm
54:15

confuse
252:14

confused
99:4
106:12
119:1,17
144:14
200:17
211:2

confusing
141:22
145:3
252:10

confusion
179:14,15

connected
46:14
47:8
48:7,13
103:14
112:1
241:20

connection
217:10

connector
225:13

consequence
62:17
114:18
133:8
182:1

consequences
40:17

considered
131:2
159:12
222:2
223:4

consistent
29:15
70:25
97:24
261:4,10
262:12
264:3
265:1

consistently
201:7

consists
57:21
58:1

consortium
36:25

consortiums
51:16

constructed
218:23

construction
221:4,17,
23 222:9,
10,15,17
223:5

consult
13:17

consultation
10:12

consulted
17:7

consulting
17:1,10
52:20
54:16

consumption
41:19

contact
11:14

contained
19:4

contents
137:12
257:24
258:11,15

context
24:12
29:20
38:20
40:23
43:16,21
54:3
58:4,14,
21 66:22
67:8
77:12
79:23
81:14
83:15
85:20
86:3,15,
17 92:18
95:1 97:4
99:20
139:22
150:10
156:2,6
160:2
218:7,12
220:4
254:9

contexts
57:11
63:23

contingent
32:2

continuously
44:24

contrary
261:2

contrast
178:18

control
37:9
45:24
46:2
60:23
65:22
66:11
73:20
79:17,25
81:21,23
106:8
123:4,19
125:1,4,6
126:1,13
127:3,11,21
128:14,22
129:21
138:25
177:7,13,16,22
178:15
180:4
181:14,24
182:15,16
195:19,21
216:18
232:24
248:18,24
249:3

controlled
183:4

controller
53:8
58:20
63:4
67:13,16
73:14
74:8
75:21
76:3
77:11,14,18,21
78:1,7
80:11
139:16
143:9,21,22 178:19
179:8
180:7,13,19 187:2,11,18,22
188:23
189:8,18
196:1,6,15 197:13
200:4,8,19,22
201:10
202:4,7
210:24
211:3,6,9,15,23
212:20
215:5
233:11,17,23
234:17
235:4,12
236:20
242:1
243:24
252:25
253:6
254:3,25
255:10,15
256:3
257:11

controllers
36:16

controls
113:25

convenience
229:19
240:2

conventional
267:12
270:13,16
272:6,22
274:13

conversation
114:15

convey
245:6

conveys
60:20

copies
13:3

copper
67:25
68:14

copy
268:13

core
72:1
248:23
249:3

corner
221:13

correct
10:20
16:3,4
20:8 22:3
23:24
24:17
25:4,18
26:3
28:17
30:13,15
31:6
32:10,11
33:19
51:25
52:20
55:6,16
57:9
69:21
70:11,21
71:1 74:4
75:4
76:11
79:6
81:13,22
86:14,25
87:7,14,18,25
89:23
90:2
93:19
94:5
97:11,15,18 99:17
104:2,6,21 105:6
106:18
110:14,15
119:25
121:7
123:8
124:3
125:2,6
126:4,16
127:22
128:5,15
129:13
132:13,14
134:12
136:14,24
137:7,15,23 138:8
139:1,5,9,20
140:3,12
141:1,10,18 142:4,17 143:1,10,23
144:4,21
145:7,13,21
146:14,22
147:3,11,22 148:3,16 149:4
150:22
151:19
153:11,21
154:16
157:18
158:4
159:24
160:4,10
161:25
162:24
163:11,20
164:2
165:13
166:22
167:1,20,25 169:3
171:4,9,21 174:17
175:5,10,14,15,19
176:10,25
177:8
178:11,20
179:11
180:22,24
181:3,4
183:7,8,13 184:24
185:9,22
186:6,13
187:4,14
189:9
192:10,19,22
193:18
195:13,19,20,23
196:2
197:14,17
199:5,12
200:2,3,6,7,11
202:11,24
203:23
204:19
205:15,19
206:19
207:20
209:17
210:12,20
211:8,15
212:2,10

Samsung Ex. 1046, p. 296
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 296
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

213:8
214:10
215:18,23
216:4,9
218:3
219:9
220:3
221:6
223:21
224:4
226:25
228:4,13
229:1,6
230:8,15,20
231:14,18,25
232:15,24
233:3,12,18
234:17,23
235:5,13,21,24
236:6,11,25 237:7,12,19
238:14,17,20,25
239:4,7,14,18
242:10,17,21
243:2,6,10,14,20
244:15,18,25
245:15
246:16,21
247:19
248:6,24
249:7
250:3,17
251:1,15,22 252:18
253:2,8,21,24
254:4,13
255:2,10
256:4,15,24 257:17
258:1,7,12 267:7
270:17,18,23
271:6,17,25 272:3,7,12,23
273:20
274:3
275:1

corrected
263:6

correcting
86:22

corrections
108:15
246:1
259:13

correctly
24:7
25:20
48:8
137:19
183:10
198:6

cost
40:18
42:21,22

costs
42:2,3,5
77:4

counsel
7:22 8:9,13 13:17
21:2 25:7
33:2
49:22
119:20
161:14
162:7
269:20
275:11

couple
24:3
216:25
243:1
274:7

coupled
53:21

court
7:19
8:10,12,20,23
16:25
17:3
19:8,16
21:24
30:23
50:8
54:9,24
69:3
115:24
179:19
204:25
221:16
229:11
239:21
246:6

cover
54:6
87:1,3

covers
98:23
271:1

CPLD
38:10,18
39:6,9,16,21
40:9,13
41:2,11
42:4,18,25 272:18

CPLDS
37:16
38:4

CPUS
38:24

CRC
248:22
249:7,12,16,21

create
39:14
64:4
77:18
185:20
186:1

created
179:24
208:11

creating
208:5

cross
260:21
261:16
262:1,16
263:15,25
264:23
267:4,21
268:5,13,24 269:13

CRSS
249:3

CSRS
255:16

current
11:14
17:24
21:1,5
48:23
49:2
62:16
209:9
210:1

custom
53:8

cutting
165:23

CV
19:25
20:10,12,15,17,24
21:4,5,13
30:1
48:24,25
49:25
50:13
51:20,24
52:8,13,15,17,19,22 54:14,18

cycle
98:7
157:17
158:3,11,23 159:3
160:15,20,24
161:25
163:11
165:3,7
166:16
206:25
226:19,21
227:8,14,16,19,23,24,25
228:4,24
229:2,5
234:21,23

cycles
128:21
160:23
235:1

cyclic
249:22

D

D-D-R

54:13

D-F-X
250:9

D-I-M-M
54:11

D-I-V-X
50:9

daisy-chained
82:1

dashed
116:8

data
37:17
43:11,15, 19 54:13
58:20
60:21
62:20,21
63:4,6, 16,22
64:4
65:4,5,9, 15,17,18, 23 66:5, 8,12,15, 17 67:2,5
72:3,7
74:3,6
75:11,13, 22 76:9, 25 77:8, 9,24
78:6,7
79:18
80:1
81:9,15, 21,24
89:8 92:5
98:8
102:5,8, 17 103:20
104:5,8
111:9,16, 21,23,24
112:10, 13,24
115:4,15
116:17
117:18
118:16
120:6
130:17
142:25
143:8,22
144:19
145:20
150:22
151:15
152:5,9, 21
153:19,24
154:7,15
156:14
163:19
164:10
167:25
169:16
170:8
171:2,3, 9,16,21
172:8,14
173:3,11, 15 175:9, 17,25
176:1,5, 6,8,9
178:15,16
180:10, 14,22
181:2,16
182:2,7, 19,22
183:1,2, 10,13,25
184:2,23
185:1,3, 19,21
186:20,25
187:1,9, 11 188:4, 11,13,19, 20 189:5, 15,24
190:1,5, 12
195:18,21
196:22
197:4,25
198:9,15
199:5,11
200:5,10, 18,23,24
201:3,12, 13,21
202:7,23
203:22
205:14,25
206:10,17
207:18,19
209:2,4, 13,15,19, 20,21
210:1,2, 3,11,16, 19,24,25
211:7,12, 19,24
212:1,10
213:5,7
214:13, 15,22
215:2,16, 21 216:2, 17 218:2
219:25
220:1,3, 10
225:11,12
230:7,11, 17 231:5, 11,20,21, 23 232:2, 3,4,13, 16,17,20, 22,23,24
233:10, 15,22
234:15
235:2,3, 8,11
236:10, 16,24
237:2,3,4
243:13,18
244:2,3
247:18
249:6,11, 16 260:15
262:4
263:20
265:10,15
266:1
268:8

data-valid
273:15

date
19:25
20:11,19, 25 29:5
48:25
50:1
146:8
231:3

dated
83:1
86:24
87:6,13, 17,24
138:18
246:14

day
7:17 16:8
260:25
265:2
268:2

days
18:21,22

DB
81:13,14, 21,24

DDR
25:15
52:25
53:10
54:7
56:24,25
57:11
58:16,22
60:6
63:24
66:22
67:9
69:23
82:21
83:19
84:4,17
85:24
135:7
147:11, 16,20,21
157:3
172:22,25
241:24
242:15
250:8,25
251:11
254:19,25
255:9,15
256:2
258:7,9, 11,16

DDR1
57:5
69:9,13
70:11
85:3
86:13,24
131:15,19
132:12,17
148:2,15
235:20

DDR2
57:6
69:7,13, 17 70:10
86:13

Samsung Ex. 1046, p. 298
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 298
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

87:5
131:15,19
132:13,17
148:16
150:14,25
151:16
235:23

DDR3
57:6
69:15
70:20,23
71:1,2
78:19,22
79:6,9,20
81:8
86:13
87:13,17,24
131:16,22,24
132:2,4,19 134:16
136:23
137:6
138:6,17,24 139:5,19 140:1,9,22
142:10,14
143:6
146:2
148:16,25
149:8,21
150:14
151:1,16
152:10
153:5,10,19 154:19
162:14,23
163:9,17,24 164:1
166:20
167:22
174:11
236:2

DDR3-800
163:10
164:4
166:14

DDR4
57:6
81:1,6,16,20
151:17

DDR5
151:18

deal
164:22

decide
39:13

decided
72:6

decisions
40:16,18,22,25

declaration
10:24
12:18
14:17
16:15
20:15
22:2,5,11,15,23
23:3 25:4
28:16,21
29:1,4
30:5 31:4
32:4,9,16,19,23
33:10,16
34:1,21
35:12
36:2 50:1
63:9
70:7,18
82:22
88:13
89:21
94:3
97:10,14,17 100:4,9,13,15,22 119:1,2 120:25
131:4
147:2,12
162:17,21
163:5,16
165:5
169:7
170:20
175:3
176:18
178:5,9
195:7,12
204:13,17
222:14
223:9
245:8
260:6
263:2
264:16
274:23

decoder
248:14,22

decreasing
269:2

defending
8:7

defined
72:24
83:17
160:6
161:3,5,6,8,12,21

definition
34:20
35:14

degree
34:13,16
35:20,23
69:13
117:13
121:9
174:10

degrees
14:20
164:9,14,22 165:9
166:6,9,14,16
167:11,20,24
168:1
171:25
173:9,12,18,19,23,25 174:4,6,9,15
229:6

delay
65:24,25
68:11
80:6,16
92:5,16,20,23
93:1,2,9,12,14
94:23
95:5,11,15,17,20,25 96:3,10,14,16,17,20
97:4,7,22
98:2,17,20 99:7,12,16,24
102:7,17
104:24
105:2,5,10
106:18,21,22,23
107:10
111:21
112:15,16,18,19,21 113:23
115:3,4
130:5
133:8
153:14,15,17,18
165:1
171:25
173:12,17,22
174:5
182:1
184:10,14
185:4,6,11,12,13,16,17,20
186:1,2,5,7,21,22,23
187:13,20
188:2,22
189:7
197:9
202:2
206:25
227:3,4,5,20
229:5,8
237:19
238:17,20,25
239:4,7,11,17
243:2,4,16 245:14
264:9,12,20,21
265:4,22
266:7
268:8,16,17,18
269:2
273:10,20

delayed
92:18
105:10
109:14

Samsung Ex. 1046, p. 299
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 299
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

110:19,20
114:21,25
115:7
130:2
171:24
206:8,13,14,17
208:23
226:19,22
227:8,12,13,15,16,17,19,23
228:3,13,14,16,18,21,22
229:4
243:8,12

delaying
167:19
173:8,14
207:21
208:6,13
265:8,12,23

delays
105:11
112:20
164:22
186:8,12,16 188:9
189:13
201:24
202:6
207:23
228:23
229:2
263:5,6,10

dense
160:18

density
41:16

depending
117:23

depends
39:23
54:2
57:18,23
67:7 68:6
77:2
79:23
117:22
119:5
134:10
172:9
186:5

deponent
8:15,22
9:3 40:15
41:5,14
43:3 49:4
50:20
53:6 54:2
59:22
60:4
61:3,12
62:3,14
63:2 64:7
65:21
66:20
71:23
73:11
75:10,25
76:14,20
77:2,21
78:11
80:15
82:24
83:11
85:8 88:4
89:3 91:4
93:7
96:6,24
98:6
99:11
103:4
107:14,20,23
109:14,19,21
110:9
113:15
114:4,13,24 115:17
117:22
118:10,21
119:9,23
120:11
121:15
124:9,18
125:8
126:7,19
127:6,15,25 128:9,18 129:1,9,16,24
130:8
132:16
133:2,25
135:2,11,24 136:7,17 137:2,10,18
138:1,11
139:14
140:6,15
141:4,13,21 142:7,20 143:4,12,15
144:7,24
145:10,16,24
146:16
149:24
151:3,7,21 152:1,12 153:1
154:3,11
155:15
156:12
158:25
161:20
162:6
171:12
185:25
193:7
194:22
198:4
199:14
202:13
203:2
204:1
206:12
208:3
212:13
217:16
218:5
222:1,8
224:7
225:4
236:14
237:10,15,21
239:25
247:22
248:10,17
249:2,11,21 250:7,20 251:4,18,25
252:7,21
253:5,15,24 254:7,16 255:6,13 256:7,18 257:2,10,20
258:4,15,24 259:9,16
260:17,23
261:9,17
262:2,17,21,24
263:16
264:1,24
265:18
266:5
267:5,10
268:6,14,25 269:14
272:15
273:1,14,23 274:6,17 275:8

deposed
18:19

deposition
7:9,16,21
8:14,25
11:19,23
12:9,12,20 13:11,15,22
14:4
15:8,21
16:3,6,11,15
17:16
24:9
93:19
95:8
97:18
275:7,18,23

depositions
19:23

describe
47:15
66:18
89:15
102:9
107:9
122:11
191:23
192:21
213:5
261:13
262:6
265:9
268:10

describes
169:15
170:1
192:7,12,13,18
193:4,8

Samsung Ex. 1046, p. 300
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 300
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

194:1
260:11
266:2
269:9

describing
64:24
212:7
213:1,3,
4,25
215:13
267:25
268:7

description
113:6,7
138:7
190:20
194:17
232:7
257:15,25
258:6

design
34:15
35:23
36:12
37:24
39:3,4,9,
18 40:8,
11 41:25
42:8
46:16
57:22,23,
25 58:3,5
59:15
185:3
218:6
245:2
265:20

designation
241:7

designed
38:22
133:17

designer
173:15

designs
40:3 72:4

desk
49:9

destination
167:13

detail
76:22
91:17
95:3
120:12
135:13
139:20,21
142:15
240:9

detailed
88:23

details
31:22
57:23
120:20
147:21

detecting
213:20

detection
122:14
124:5

determination
95:15

determine
64:19
93:1
96:3,9
118:2
152:2
220:13
245:13
268:16
269:1

determined
95:12,23,
24 96:13,
19,21
98:20

determines
98:8

determining
96:16
97:21
99:16
208:7,14
268:8
273:9,19

develop
37:1

developed
132:18

development
40:18
68:19

device
38:12
59:3
62:12
65:19
70:20
106:25
107:2
135:8
163:10,20
164:1
166:22
167:7
182:7,9,
11 242:15
252:9

devices
36:13
37:3,22
51:7
56:15
59:2,4,
11,12
61:25
62:17
66:23
69:7,9,
15,17
76:11
79:22
82:21
84:17
85:3,24
86:14
87:6,13,
17,24
135:17
235:21,24
236:3
263:7

diagonal
238:19
239:14
243:6

diagram
102:4,6,
16 111:20
142:22,24
190:24
191:1,4,
18,19
192:3,5,
7,8,10,
19,22
193:5,13,
14,15,16,
17 194:6
195:3
247:8,12,
15 251:14
255:8
256:11,22
259:4
271:9,18

diagrams
91:5,7
194:18,19
195:4
267:11
270:25
271:2
272:8

difference
79:12
130:8
154:23
174:4
175:13
180:1
191:3,6,7

differences
190:3

difficult
47:15
71:4

difficulties
262:22
267:1

digital
39:9,10,
11,20,24
44:4
45:14,16
47:20
64:10
107:4
124:10
159:19
267:13
269:10
270:14,16
272:6,22
274:14
275:1

DIMM
53:10
54:9,11
56:9
58:23
60:6 61:8
62:1,20
63:24
66:22

Samsung Ex. 1046, p. 301
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 301
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

67:9
71:11
72:9,15
74:13
75:2 76:4
77:12,23
81:11
139:4,11,
19 174:20
181:15,25
201:22
236:5
255:20

DIMMS
52:25
54:7
58:16,22
74:22
77:15
83:19
167:15
175:14

direct
63:1
71:22
73:10
75:9,24
76:13,19
116:16,23
117:21
124:8,17
126:6,18
127:14,24
135:1,10
141:3,12,
20 142:6
143:14
144:1,6
145:23
203:25
221:25
222:7
223:1
237:9,14
247:21
248:9,16
249:1,20
250:5,19
251:3,17,
24 252:6,
20 253:4,
14,23
254:6,15
255:5,12
256:6,17
257:1,9,
19 258:3,
14,23
259:8
273:13

direction
102:25
111:10
157:5
168:9,11,
12,15
220:2,13
228:10

directional
63:11

directions
80:18

directly
84:24
198:24,25
200:24
201:14,16
216:21
266:21

disable
142:2

disabled
141:25
142:8
241:16

disadvantages
253:18

disagree
32:12,16
33:12
42:19
100:2
198:7
222:4

disagreed
100:12

disagreement
32:18
33:6 50:6
100:7,15,
17,21

disappear
229:9

disbelieve
164:24

disciplines
34:17
35:24

disclose
93:1
217:17

discloses
175:9
180:9,12,
17 218:13

disclosing
180:18,20

disclosure
225:6

disconnected
48:11

discovery
49:9

discuss
119:10
138:13
199:21
204:17
254:8
261:14

discussed
25:7
50:22
95:1
97:14
101:11
110:13
131:14
144:16
162:16
164:8
168:1
174:11,14
175:17
189:20
199:21
218:9,10
224:3
244:23
256:15,
20,24

discusses
138:20

discussing
40:19
95:4
108:20,24
147:9
159:10
169:1
217:6
246:22
257:6,12
266:16
268:7

discussion
91:24
93:10
99:20
100:16
115:20
129:16
147:5
204:19
213:20,25
262:22
266:20
267:1

distinction
191:19

distinguish
72:6
191:18

distributed
81:10
176:7,9
181:15
185:3
236:10

distributing
182:15

district
16:25
17:2
19:8,16
21:24
30:23
31:6
221:5,16

divided
164:13
166:15

Divx
50:5,8,9,
11

DLL
225:14
226:24
227:2
229:5

Doctor
8:20

document

20:3,6, 10,14 33:3 56:20 58:6 87:20 160:18 162:17

documents 12:19,23 13:3 14:11 15:12

dotted 92:14

double 54:13 170:8

double-check 17:4 32:23 87:9

downside 41:24

DQ 58:18 65:14,18 66:5,17 67:5 74:3 76:9 102:5,16 111:9,16, 21,23 112:10, 13,24 115:4 116:10,17 117:18 118:15 119:3 120:1,6 121:3 130:17 145:20 150:22 151:15 152:9,21 153:19,24 163:19 164:10 166:21,24 167:4,25 168:5 171:8,16, 20 172:8 173:3 183:2,13 184:2,16, 23 185:5, 21 186:1 187:1,11 196:22 197:4,10, 12,15,25 198:9,15 199:1,5, 11 200:5, 10,18,23 201:5,11 202:9,23 203:3,22 204:5,7 206:23,25 207:13 209:5,20, 21 210:3, 17 212:9 214:12,24 215:1,22 216:9,11, 12,20,24 217:4,11 218:1,21, 24 219:25 220:9 226:14 231:21,23 232:3,5, 13,17,21 235:3 243:13, 18,22 247:18

DQ(IN) 210:20 212:20 214:20 215:4 216:3 235:10

DQ(OUT) 207:11,12 210:19 212:21 214:16, 18,19 216:1 233:7 235:4,12

DQS 63:16,18, 19,20 64:3 65:17 66:4,17 67:4,10, 11,12 74:3 76:9 92:13,15, 20 93:3 94:23 96:4 97:22 98:2 99:7 102:5,7, 21,24,25 103:9,17, 18,25 104:16,17 108:25 109:12,14 110:17 116:9,19 117:18 118:18 119:3 120:1,6 121:3 130:18 150:21 151:15 152:21 153:20,25 154:8,15 157:13, 16,19,23 158:2,16 159:23 160:9,13 163:18 164:9 166:21,24 167:3,19, 23 168:4 171:8,15, 20 172:7 173:2 183:2,12 184:1,16, 22 185:5, 13,21 186:3,25 187:10, 13,17,21 188:5,6, 10,12,16, 18,22 189:7,16, 17,23,25 190:15 196:18 197:3,10, 12,15,23 198:9,15 199:4,10 200:5,9, 18,23 201:5,11 202:9,22 203:3,21 204:5,7 206:23 207:1,13, 20 209:5 213:7 214:23,25 218:24 220:3 225:12 226:11,15 233:16 234:16 241:23 242:14, 19,24 243:4,8, 12,16,22 245:15 247:18 263:20 264:9,21 265:4,7, 8,12,24

DQS(IN) 207:10 210:12,23

DQS(OUT) 208:19,22 209:13,16 210:25 215:3,17 233:7,18, 23 234:8, 17,20

DQS-TO-DQ 163:24

DQS/DQS 241:18

DQS/DQS_UN 241:2

DR1 238:14, 16,25 239:17

DR2 239:17

Samsung Ex. 1046, p. 303
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 303
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

DR_PDQ_OUT
243:19

DRAM
36:13
53:7
59:2,13
60:25
61:1,25
62:12
65:18
66:16,18
67:6
73:16
76:10
79:22
139:4,10
167:15
174:18
181:17
183:14,15
186:8,10
198:24
201:24

DRAM1
59:11
80:12

DRAM4
80:11

DRAM5
80:7,8

DRAM8
80:9

dramatic
40:4

DRAMS
58:13
61:9,15
75:14
182:2
202:6
211:20,25

draw
203:11

Drawings
190:21

DRC
195:23,25
196:5,14
197:8
198:12,14

drive
47:8,13,
14

driven
241:6,8

drives
159:20

driving
47:7

DS
104:4,7,
24 105:2,
5,19
106:6,18,
21 110:21
112:17,19

dual
54:12
56:10

due
65:24

DW0
239:7

DW1
239:4,18

DW2
239:18

dynamic
202:15

E

earlier
57:4
70:16
159:11
175:17
244:23
246:18
263:4
264:4

early
17:6

easier
165:14,17

easiest
34:3

easily
60:23
82:8

Eastern
221:5

easy
42:15
172:20
204:22
229:21

economic
39:18
40:17,25

edge
107:6
156:23
170:10
226:20
227:9,24
229:1

edge-aligned
116:19
117:12
118:24
119:3,5
121:4,5
173:5,6
226:16

edges
157:3
181:25

effective
184:14
265:7,20

effectively
70:10,15
129:25
224:18

effort
78:1

elaborate
77:5

electrical
34:13
35:21
46:7
48:14
64:13,14,
15,18
68:9
121:10
130:9,14,
20 191:9

Electronics
7:11 8:2

element
78:12
92:4,6
103:20
105:17
106:9
110:25
112:12
113:1,2
133:14
138:2
191:16
201:12
203:3
238:14,
17,25
239:4,7,
11,17
240:9
243:2,4

elements
24:24
38:13
41:24
51:8
103:5
106:8,10,
11 148:21
163:3
191:14
195:16
242:12

Ellsberry
27:16,20

emailing
14:4

embodiment
90:6,21
91:9
101:7,17
102:6,9,
18 111:22
122:13
271:8,16,
20

embodiments
89:16
120:14,
22,23

emerged
56:16

emphasis
188:24

enable
136:3,10,
12 141:5,
15 177:25

enabled
137:22
138:4

141:10,14
142:1
241:14
242:24

enabling
144:15

end
20:16
26:15
49:25
50:13
52:5 70:9
131:3
137:12
147:20
167:23
171:1
175:12
179:16
216:15
233:19
264:19

endeavor
20:2
29:19
91:14

endeavored
26:2 76:2
149:17
237:16

endeavoring
242:4

engaged
31:8

engagement
21:23

engineer
10:10,13
63:19
68:18

engineering
10:12
34:14,17
35:21,24
39:17
41:25
42:3
53:13

engineers
83:21

enter
203:10

enters
12:8
109:7

entire
234:21

entities
24:25

equal
141:7,18
153:2,3
154:13

equals
141:8
166:16

equating
225:9

equation
93:7
164:19
165:12
166:1

error
47:15
81:3
133:18,
22,23
134:1
210:6
213:21

errors
20:3
55:24
56:4
133:13
134:13
211:22
249:23

Esquire
7:20

essence
205:23

essentially
42:5 49:1
184:12
186:22
225:2
226:24

estimate
16:13
17:18,20
18:8

estimates
16:23

et al
7:11

evaluate
242:5

evaluated
149:2

evaluating
151:9

evening
275:9

event
155:5

evidence
21:16
145:23
250:5

evolved
56:23

exact
95:20

EXAMINATION
10:4
260:1
270:4

examined
10:2

examining
58:6

examples
57:1,2,5
59:24

exception
186:22

excess
18:2

exclude
172:1
222:22

excluded
19:4

excuse
14:10

exemplary
89:16
90:6,21
101:7
120:14

exercise
149:9

exhibit
10:19,25
11:13
16:16
19:18,23
20:6,14
22:3,6,
16,23
25:5,14,
19,23,24
26:5,8,
11,16,19,
23 27:1,
5,8,14,
17,20,25
28:7,10,
13,21
29:1 30:5
32:5,24
33:11,16,
25 34:6
35:13
48:25
50:1,13
51:21,25
54:21,23
55:4,11,
15 56:1,
5,8,12
57:13
58:9,25
60:11,25
63:10,13
64:23
70:18
71:1,7,
10,20
72:11,14
73:7
74:9,12
75:6
78:15,18
79:8
80:12,21,
24 81:4
82:2,7,22
84:3,18
85:3,25
86:25
87:7,12,
16,23
88:14
89:21
90:11
94:4
97:10,14
100:5
101:2
115:22,23
116:2,6,7

117:1
124:23
125:12
131:5
134:17,19
135:19
136:1,21
137:21
138:7,18,
23 139:19
140:1,23
142:11,15
143:20
144:20
145:5,12
147:12
154:20
157:8,13
160:3
161:13
162:13,
22,24
163:6,16
168:21,25
169:7
175:8
176:15,18
178:5,9
179:17,
18,24
180:8
181:6
190:18
195:8,12
204:13,
21,23,24
205:5
220:24
221:3,8,
14 223:9,
12
229:10,
14,19
230:20
231:2,14,
18 234:12
238:7,17
239:20,24
240:1,4,
10 241:22
242:10,16
244:8,12,
21 245:6,
9,13
246:5,9,
13,20
247:1,5,
13 248:5
250:16,25
251:9,10
252:16
253:2
254:12
255:2,8
256:3,13,
23
257:14,25
258:20
259:4
260:7
266:13
270:7,20

exhibits
14:20,23
25:12
82:6

exist
189:14
208:5

existed
132:12
236:6

exists
86:9
168:10

expect
101:11
172:9

expectation
273:5

expensive
42:12

experience
34:15,18
35:22,25
38:15
74:20
79:1

experiences
175:19

expert
14:12
16:15
18:23
19:2,3,5,
12,23
22:2,5,
15,22
25:4
28:20
29:1,4
30:4 31:4
32:4 55:6
63:9
70:7,18
88:13
89:21
91:25
131:4
147:1
176:17
178:4,8
195:7
204:13,16
223:8

expertise
43:8

explain
38:17
39:7
43:24
44:7
45:19
48:2 53:3
54:10
64:2
71:18
73:8 75:7
77:19
79:9 81:5
89:12
90:25
91:11,18,
25 92:9
94:12
95:10
97:25
102:24
103:1,7
111:9,11
156:8
187:16
197:7
205:13
217:17
249:18
252:4

explained
45:9

explaining
230:10

explains
230:5

explanation
88:22
99:23
218:25

express
22:8

expressed
33:6

extent
28:23
62:4 85:9
126:14
150:5

external
250:8,23

eye
169:2,3
172:16
173:16,
18,20,22
265:7
266:7

F

fact
25:23
59:23
61:17,22
152:13
181:24
217:11
270:19

factors
93:11

facts
145:22
250:4

fail
121:20,22
184:18,20

failover
254:20

fails
121:9
268:18
269:3

failure
46:16

fair
18:1
21:14
33:22
39:22
48:9 49:3
57:6,24

60:2 62:1
70:10
80:13
81:18
89:1,18
90:4,19
93:4 95:8
104:25
111:17
117:17
121:13
135:8
138:19
139:8
147:7
154:1
155:22
157:10,14
158:1
161:13
167:13
173:20
176:3
178:2
180:15
182:23
189:18
194:19
197:21
214:2
225:2
227:22
233:23
235:15
248:7
259:5
274:14

fairly
91:16

falling
170:9

falls
60:9

familiar
13:21
23:15
36:7
37:7,15
38:3
43:11
50:23
51:2
59:13
67:10
73:1
85:17
86:4,8,10
134:22
149:10
191:20
245:3
249:7

familiarity
37:12
38:5 51:2

family
236:16

famous
68:16

farthest
133:14

fast
69:8,16

faster
64:11
69:24

fastest
70:23

favor
41:10

FBD
257:25
258:4

FBDIMM
74:14,15,17 75:3,7,20
76:8,16,21
246:14,20,24
247:1,13
248:23
249:25
250:15
252:25
254:10,25
257:16

FBDIMMS
74:20

feature
139:16

fed
103:19
227:20

feel
95:2
117:1
166:2
179:14
181:6
191:24
234:12

felt
52:14
86:19

Ferenc
8:4

FF0
239:10

field
34:15,18
35:22,25
83:8
138:3

FIFO
186:23
187:19
188:3
190:13
207:1
243:20,23
244:1
249:12
263:20

figure
42:8
72:1,17
73:13
75:11
81:7
91:11
92:21,25
93:2
94:24
95:11
96:18
97:22
98:1,3,7,13,15,21,22,25
99:2,8,12
100:1
101:19,20,21,22
102:4,12,13,15,19,23 103:8,19 104:5,12 108:20
109:1,10
110:23
111:4,8,20 112:5,24
114:16,21
115:1,5,11
116:11,12,18,20,25 117:2
118:16,17,18,19
119:24
120:2,7,19,21
121:12,23
122:3,10,16 124:23
125:1,15
126:1,15
127:9,20
128:13
129:3,23
142:21,23
144:3,8
145:12,17
153:16
157:9,12
158:5
159:1
160:19
169:18
175:21,23
176:14,24
177:6,19
178:16
181:3
182:22
187:10
191:11,15,24
192:2,4,7,8,10,19,21
193:5,12,13,14,15,21,24
194:6
195:11,17,22,23
196:2,4,13,17,21
197:2,16,22 199:3,9,14
203:21
205:5,15,17,18
207:3
208:15,16
209:12,15
211:17

Samsung Ex. 1046, p. 307
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 307
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

212:1,5
217:10
220:11
223:11, 15,19
224:22
226:2,15
229:23, 24,25
230:5,7, 14,17
231:1,4, 7,11,16, 20 232:8, 12 233:1, 6,8,14
234:6,14, 19,25
235:7,10
237:16
238:10, 13,16,22, 24 239:3, 16 240:3, 5,8,10, 13,17
241:25
242:14, 17,21
243:14,20
247:7
248:11
255:1,14
256:9
257:21
259:3
267:18,24
268:6,10, 22,25
271:5,16, 18

figures
26:10,13
89:14
90:11,16, 20 91:1, 12,19
92:19
94:8,13
95:11
96:4
97:15
98:10
99:6,19, 20 100:3, 16,18
101:1,6, 14 102:2
104:10
105:8
106:13
116:6
117:2
120:7,21
193:15,16
194:17
204:18
205:6,12
206:3
212:7
213:24
214:6,8, 14 215:7
216:3
229:20
242:6
267:11

figuring
165:16

file
7:14
51:22

filed
12:23
13:4
221:4

files
13:4,6
18:13

final
20:21

finally
243:22

find
11:9 24:8
87:2
220:1

fine
94:19
191:24

finish
215:12
245:19

firm
15:1,4
30:24

fixed
185:12,15
186:2,21
187:3,13
264:9,21
265:4,8, 13,24

flaw
266:9,10

flaws
265:21

flight
139:3,9

flip-flop
44:8,9, 12,15,24
45:2,5,7, 11 124:13

flip-flops
37:18
43:12,13
44:11
124:10

flow
267:11
270:25
271:1,9, 18 272:8

flowing
79:19

flows
115:19

fluidity
242:12

fly
95:24

fly-by
79:20,24
81:17,20, 25 132:9, 11,18,23
133:2,20, 21,25
134:6,14
138:24
182:17
186:5,7, 12,16,20
189:13
190:3
198:19,23
201:23
211:22
263:5,6,9

focus
31:21
89:6
157:22
181:9
188:10
228:9

focused
27:11
51:15
93:22
121:1
150:9
198:17
231:1,3

focusing
99:18
106:13
191:15
214:17

footnote
24:6
160:3

form
39:14
40:14
41:4,13
42:24
43:2 53:5
54:1
57:10
59:21
60:3
61:2,11
62:2,13, 25 63:21
64:6
65:20
66:19
76:19
77:1,20
80:14
83:10
89:2 91:3
93:5
96:5,23
99:9
103:3
109:20
110:8
113:14
114:3,12, 23 115:16
118:9,20
119:8
120:10
121:14
124:8,16
125:7
127:5,24
128:25

129:15,22
130:7
132:15
133:1,24
135:10
136:16
140:5,14
144:23
146:15
149:23
151:2,6,
20
152:11,25
154:2,10
155:14
156:11
158:24
185:24
193:6
198:3
199:13
202:12
203:1,25
206:11
217:15
218:4
225:3
250:6
258:22
259:8
266:3

formed
85:12
151:4
219:11

forming
27:22
84:2 85:1
148:1,23
149:1,6
150:2
153:8
168:17
171:6,18
185:8
189:4
196:25
197:20
200:1
203:7,18
213:23
214:5
219:8

forms
74:22
226:11

forward
22:13
273:17

forwarded
103:22

forwarding
79:17

found
23:21
24:4

Foundation
116:15,22
117:20
142:5
144:6

fourth
89:22

FPGA
39:16,22
40:9,13
41:2,11
42:4,17
43:1
244:18,25
270:22
272:2,10,
17 274:2,
10

FPGAS
38:13
42:11

free
117:1
181:6
234:12

from-the-fresh
94:2

front
12:16
13:3,7,9,
11 19:16,
18 72:8
82:3
97:10
101:4
108:21
131:6,10
162:14
247:11

frozen
262:17

frustrations
213:10

full
12:15
15:24
55:19
94:25

fully
137:13
182:16

fully-buffered
74:13

function
103:6
145:6
180:4
224:12

functional
191:15
193:24

functionality
144:16
256:2
257:5,12
270:12

functions
144:10
267:10

fundamental
202:17

G

G-A-T-E-O-N
240:24

gate
45:22

GATEON
240:14,
21,24
241:4,14,
15

GATEON_UN
240:18
242:24

gave
74:18
259:14

Gen1
79:1

gener-
226:6

general
38:25
40:1
43:18
53:2 60:7
66:25
91:14
130:23
133:18
134:12
156:5,13
157:4
240:22
251:25
267:12
269:10
270:13,16
272:6,22
274:13,25

generally
45:12
54:6 66:7
67:15
68:9
69:23
70:3
73:24
89:6
114:17
200:12

generate
227:3

generated
189:10
199:1
225:14
226:23

generates
190:15
207:22
215:2
225:11,25
226:6
263:20

generating
184:8
223:16,20
224:11,
20,24
225:11
226:3,5,
10,13,18
227:7,22

Samsung Ex. 1046, p. 309
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 309
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

228:2,15, 24 263:21

generation
69:22
249:12

generations
56:24

generator
252:17,22

give
8:25
33:24
41:21
68:17,21
69:18
74:18
85:9
89:13
124:2
215:11
251:4
268:1

goal
88:24
205:21, 23,24

good
7:5,25
17:17,19
79:12
88:4
90:15
156:15
174:1
220:17
269:23
275:9

Grace
68:16

grammatically
91:6

great
76:21
162:6

greater
40:4 42:1
78:13
95:3
99:23
172:18
229:8
242:11

greater-than-the-whole
172:17

greatest
41:16

green
59:1
180:11
231:8
242:16

ground
241:20

guarantee
166:23

guess
37:24
47:23
50:9
83:11
106:17
110:13
113:10
115:17
117:15
148:21
160:25
177:23
180:16
185:13
189:2
203:17
223:24
224:1
229:7
239:6
243:17
244:4
271:14

guessing
68:25

H

H-A-R-M-A-N
50:10

H-O-P-P-E-R
69:6

half
107:23
158:23
229:2
231:4,6
234:22

halfway
192:14

hand
8:21 69:2
93:24

hands
82:8

handy
35:3
220:25

happen
114:19
157:1
203:16
209:25
212:15

happening
133:23

happily
13:20

happy
21:1
24:10
100:23
119:10
135:15
148:5
162:19

hard
127:15

hardware
44:2
156:3

Harman
50:6,8,9, 11

head
23:10
44:2 70:1
164:12
180:3
274:20

heading
35:9
147:13
190:20

headings
54:18

heard
7:12
22:25
31:13
198:6
219:2

heartbeat
45:17

held
7:16

helped
15:4

helpful
14:21
21:3
117:3

helps
14:22

Henry
10:1,7

hereto
54:25
115:25
179:20
205:1
229:12
239:22
246:7

high
38:16,19
39:7
40:10
41:9
42:22
44:1,16
45:21
47:22,25
64:15
73:19
76:17
81:5
156:25
157:18,21
158:4,11, 14,15,18, 22,23
159:5,9, 10,14,15
160:16
176:1
177:25
207:11
246:21
252:3

high-impedance
159:13

high-level

Samsung Ex. 1046, p. 310
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 310
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

88:22

higher
18:8 43:5 77:25 78:2,8

highlighted
59:1 195:18 230:19 231:5,7, 17 240:10 242:16

highlighting
195:15

hindsight
219:5

Hiraishi
26:18,22 146:12 147:9,25 153:6,10, 13,17,18 174:21,23 175:4,8, 25 176:15,24 177:20 178:10,13 180:9,12 181:3,12 182:25 184:21 185:7,19 188:13,16 190:18 191:17 192:6,11, 18,21 193:3,8, 13,17 194:8 195:11, 18,22 196:4,13, 17,21,25 197:17,21 198:18 199:3,9, 20 203:18 204:4,18 205:6,7, 8,12 206:16 207:17 212:16 213:25 216:3 217:6,14, 16 218:7, 23 219:16,24 223:11, 16,19 224:14,22 226:2 229:20, 23,24,25 230:2,5, 15,17 231:11, 16,20 232:12,19 233:1,6, 14 234:14, 19,25 235:7,10 260:11 261:12 262:5 263:5,10 264:8 265:4,9, 13,19 266:1,6

Hiraishi's
147:21 176:6,9 181:19 182:6,21 183:10,24 186:11, 20,25 187:9 188:20 189:5,15 196:1 205:14,21 206:3,9 208:24 209:2,15, 19 210:11,15 212:8 215:15,20 216:6,22 220:10 230:7 262:3,4

historically
42:10,11

hit
67:19 113:9

hits
52:13,19 54:15

hold
65:9,12 68:21 69:1 123:24 127:7 154:12 172:19 206:12

holds
22:10

home
11:24 12:15 18:12

honest
31:16 47:5 73:6 84:8 96:24 168:2

Hopper
68:17 69:6

host
179:8 180:13,19

hot
202:16

hour
17:23,25 107:23 161:15

hourly
17:25

hours
15:23,24 16:1,13, 18 17:10, 19 18:5 95:7

house
12:5

huge
170:12

hundred
17:19

hynix
30:6 31:5

hyphen
63:11

hypothetical
83:6 84:5

hypothetically
83:7

Hyun
31:10,14

I

I-O-B-I-S-T
250:9

i.e.
137:14

id
89:24

idea
218:16 219:5

identical
185:2

identification
54:24 115:24 179:19 204:25 229:11 239:21 246:6

identified
24:16,17 25:20 31:10

identify
25:15 32:18 50:3 191:7 225:8 265:21 266:8

identifying
31:19 266:10

Samsung Ex. 1046, p. 311
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 311
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Idle
252:22

illuminating
54:5

illustrate
90:20
101:7
128:1,3

illustrated
59:7
80:2,19
92:4
93:11
95:5

illustrates
58:25
71:11,14
72:15
74:13
78:19
80:25
81:8

illustrating
91:7
94:22
101:16,17
102:4,7,
16 111:20
122:9
191:9
271:9,19

illustration
71:19
246:21

image
80:8
175:23

images
254:21

imagine
217:19
219:2

immediately
17:15
18:6 65:7
77:15

impact
48:6
68:10

impedance
68:7

implement
37:23
39:10,15
42:9
161:9
228:20
270:15
272:5,12

implementation
40:5
271:3

implementations
252:1
254:8

implemented
39:12,20
117:24
118:1
146:18
244:13,18
266:18
267:12
269:10
270:13,21
271:24
272:9,10,
16,21
274:1,9,
13,25

implementing
41:18

important
72:1
77:12
78:12
89:6
152:10
154:8,16

impossible
129:4,6

in-line
54:12
56:10

inaccurate
22:22
185:14

INB
176:25
177:2,5,
7,14,19
186:17
190:7
260:14

inbound
190:7

inches
67:24
68:3,13
69:1

inclined
45:21
48:5
66:7,9
69:18
92:3
125:23

include
171:7,15,
19,23
173:2
222:22
256:2

included
20:10
256:13

includes
112:15
122:14,17
172:7
175:25
248:13,23
249:6
254:11,25

including
14:14
36:13
56:24
75:22
121:12
140:25
222:17

incoming
209:21

inconsistent
76:22

incorporated
224:19

incorrect
25:22,24
69:21

increased
41:21

increasing
268:18

incredibly
68:20

independent
95:18

indicating
34:23

61:4
92:23
104:18
110:2
157:6
158:8
269:15

indirectly
201:15,17
216:21

individual
73:16

industrial
36:25
51:16

industry
36:8 72:5
85:17,18
86:5

information
11:14
18:9
21:12
44:4,5,
17,23
45:7,16
50:21
64:8
65:11
77:22
129:10
197:3,10,
23 198:5,
8,12,25
199:4
200:12,14
201:8,11,
19,20
202:5
217:20
232:23
249:23

informative
91:15

initial
254:1

initialization
215:10

initialized
137:13

initially
71:24

input
44:18
45:4,23,
25 103:15
109:11,12
110:6
111:14
112:2,6,
7,20
113:22
114:13
115:7,21
123:18
124:19
172:12
177:4
178:1
189:15
195:22
196:5,7,
14 199:7
219:25
223:19
224:20
225:9
241:1,9
260:14

inputs
122:20
155:18
158:9
224:12

inputting
214:13,15

inserted
53:21

inserting
53:12

inside
178:19
197:2,22
198:11
199:3,9
202:21
203:20
255:10

insist
119:3

instance
33:12
207:11,12

instances
188:17

instantaneous
184:12

instantiate
39:13

instinct
62:10

instincts
62:15

integrated
38:9
244:14
266:19

integrity
138:23

Intel
38:24

intend
22:7

intended
39:4 63:3
91:15
118:24
121:3,5
139:9
181:6

intending
72:18

intent
48:12
176:4
198:19

intention
22:12
24:12
48:15

intents
176:5

interact
36:15

interchangeable
193:1

interchangably
193:4,11

interest
38:1

interesting
199:22

interface
39:3
73:15
258:1,5,
7,9

interfacing
51:7

interfere
47:10

internal
225:13
263:19,22

Internet
13:23
84:12

interval
98:9,12

intimately
211:10

introduce
7:22 33:4
54:20
134:1
179:17
188:21
189:7
204:21
219:13
229:13

introduced
72:2,3
134:5
146:5,10
211:22

introduces
186:2
187:20
198:20,23

introducing
211:3

intuition
74:25
79:3

invent
235:16,
20,23
236:2,5,
9,10,18,
23 237:5,
6,11,18

invented
236:22
237:1,17

inventing
237:2

invention
50:25
89:17
91:13,20
244:13,17
266:18
270:15,21
271:1,6,
8,12,17,
21,24
272:5,9,
12,16,21
273:8,11,
19 274:1,
8,12,25

inventions
90:7,21
91:2
94:15
101:8
118:11
150:17
236:22

inventor
31:17

inventors
31:9,15,
20 102:15

investigation
135:13

involved
18:22
39:2
211:10,
21,25
214:1

involving
30:24

IO
242:17

IOBIST
250:8

IOS
254:19

IP
237:22

IPR
12:24
13:4
14:12
16:20,21,
24 17:8
21:21

IPR2022-00711
7:15

Irell
8:6 10:17
14:25
15:1,4
20:1,7,
20,24
25:8
30:25

irrelevant
94:11

issue
80:16
97:1
117:11
119:7
182:18
187:18,19
202:17
219:15
223:6

issued
141:6,17

issues
28:15
93:24
132:23
202:15

ITC
19:15
30:3,6,12
55:5,8,
13,20

J

January
20:7

Jayesh
31:11,14

JEDEC
28:9,13,
17,20
36:7,18,
24 43:22
50:24
51:3,4,8,
11,13,17
52:9,12,
15 56:17
60:7,9
63:24
67:8
73:3,19
74:5,22
75:3 79:5
82:21
83:19
84:3,16
85:2,14,
18,24
86:5,8,
12,24
87:12,16
134:23
135:6,17
138:17
139:5
154:19
157:16
158:2,16,
20 159:22
160:13
161:3
162:13
163:9
166:23
168:20,24
246:13
247:2,12
248:1

JESD79-2
87:5

JESD79-3
87:23

JESD79-3A
87:13

JESD79-3C
28:10,13
87:17

JESD82-20
246:14

John
7:18

Joint
221:3

Jonathan
8:6

judge
19:2,9
55:15

July
29:5,11,
18 51:1
73:4 75:4
79:5
146:6

jump
107:21
264:14

June
83:1 84:4
87:4

juries
19:16

K

key
51:8 92:3

Khatri
32:10,19
33:7,13

Khatri's
32:12

Kim
27:24
28:2,6

kind
75:1
123:1
231:2
237:2

kinds
40:21

Kirkland
7:1 10:23
12:1

knew
31:18

knowing
190:9
201:4,9

knowledge
49:12
85:4

knowledgeable
36:11

L

label
107:8
110:18
203:11
254:21
257:21

labeled
71:13
72:17
74:15
78:20
80:8
81:2,12
92:15
102:20
103:6,11,
16 104:7
106:17,18
122:15
125:5
136:2,9,
12 138:11
142:22
144:11,25
169:1
176:25
188:18
190:13
195:23
214:16
215:17
216:1,3
234:8
238:14
239:12
240:14
243:17,
19,24
247:7
248:21
249:3,11
250:7
252:21
253:5
254:12,20
258:4
259:11

Samsung Ex. 1046, p. 314
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 314
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

labels
212:3
249:14
257:2,13

language
54:5
273:23
274:8

largely
37:22
51:15
54:4
71:23
202:14

larger
42:12,21

latch
124:12

latches
66:12
124:10

latest
151:18
169:16
170:1

law
15:1,3
30:24

layout
202:10,
14,18

layperson
38:17
39:7
43:24
44:8
45:20
48:2
71:18
73:8 75:7
77:19
79:9 81:5
90:25
91:12,16
156:9

LCKLR
224:2,12,
23 226:18
227:7

LCLKR
223:21,23
226:12,25
228:4,13,
17,23
229:6
263:23

LCLKW
227:19,23

lead
40:11

leading
260:22
261:7,16
262:1,16
263:15,25
264:7,23
265:17
266:4
267:4,21
269:13

learn
51:10

leave
61:13
148:22
271:14

leaves
215:25

leaving
163:19
166:21
226:15

Lee
31:10,14

left
12:17
65:2
80:3,17,
18 81:11
109:1
116:18,20
122:2
125:2
127:17
169:2,5,
11,13,14
201:25
205:6
223:15
224:17
226:15
228:9
229:22
230:1
238:13
240:5
241:25
243:14
248:13,17
253:1

legal
23:23,24

let alone
60:7

letter
47:1,3

level
33:20
38:16,20
39:7
40:10
41:9
44:1,16
45:21
73:19
76:17
81:5
203:4
209:7
246:21
252:3

leveled
134:8
181:18,22
206:2,6

leveling
131:20,
22,25
132:2,4,
21,23
133:11,
12,16,22
134:4,8,
11 136:3,
9,12
137:22
138:4,7,
12,19,21
139:9,15,
20,22,23
146:2,7,
9,13,17,
18,21
150:4
171:3,7,
15,19
172:6,11
173:1
178:10,
13,14,18,
25 179:7
180:1,9,
13,17,21
181:1,12,
19 182:6,
9,13,18,
21,23,25
183:7,11,
18,21,25
184:7,20
185:18
186:12,24
187:8
188:21
189:6,22
190:2,9
197:1,10,
22 198:10
199:2,8
200:20,21
201:4,22
202:1,20,
21
203:19,20
204:17
205:13,
18,19,22,
24 206:4,
9,16,18
207:18
208:24,25
209:19,24
210:9,10,
15 211:7,
12,14,19
212:8,14,
18 213:2,
4,13,15,
16,18
214:2,3,7
215:16,21
216:7,16,
17,23,24
217:13
218:1,2,
20,22
220:5
222:23,24
230:6,10,
13 232:20
233:2
237:7,12,
17 260:11
262:3

levels
202:1

Levin
30:25

limit
117:1

Samsung Ex. 1046, p. 315
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 315
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

168:9

limitation
222:21

limitations
121:11
173:24

limited
59:19
148:2,14

Lindsay
8:5,6,19
15:15
21:15
33:2
40:14
41:4,13
42:24
43:2
49:5,6
50:18
53:5 54:1
59:21
60:3
61:2,11
62:2,13,
25 64:6
65:20
66:19
71:21
73:9
75:8,23
76:12,18
77:1,20
78:9
80:14
82:23
83:10
85:6 89:2
91:3 93:5
94:16
96:5,23
98:4 99:9
103:3
108:5
109:18,20
110:8
113:14
114:3,12,
23 115:16
116:15,22
117:20
118:7,9,
20 119:8,
19 120:10
121:14
124:7,16
125:7
126:5,17
127:5,13,
23 128:7,
16,24
129:7,14,
22 130:6
132:15
133:1,24
134:25
135:9,22
136:5,15,
25 137:8,
16,24
138:9
139:12
140:4,13
141:2,11,
19 142:5,
18 143:2,
11,13,25
144:5,22
145:8,14,
22 146:15
149:22
151:2,6,
20,25
152:11,25
154:2,10
155:14
156:11
158:24
171:10
185:23
193:6
194:20
198:3
199:13
202:12,25
203:24
206:11
208:1
212:11
217:15
218:4
219:19
220:17
221:24
222:6,25
224:5
225:3
236:12
237:8,13,
20,25
247:20
248:8,15,
25 249:9,
19 250:4,
18 251:2,
16,23
252:5,19
253:3,13,
22 254:5,
14 255:4,
11 256:5,
16,25
257:8,18
258:2,13,
22 259:7,
19 260:2
261:3,11,
18 262:7,
11,19,25
263:17
264:3,8
265:3,23
266:3,11,
24 267:8,
17,22,24
268:9,21
269:7,12,
16
272:13,24
273:12,21
274:4,15
275:10

lines
60:22
62:20
76:25
77:8 78:7
79:15
90:1,5
92:14,16
94:5,7
125:12
126:11
196:19,22
197:4,24,
25
199:11,12
202:22,23
203:22,23
243:24

list
19:23
20:2
22:10

listed
30:1

listing
258:16

literal
41:16
192:16

literally
37:22
53:10
91:22
138:13
220:6

litigation
16:25
17:3

live
10:22,23

living
10:8

load
68:4,6,8,
9 77:10,
17,25
78:3
175:18
176:1

local
223:24
225:18,
20,22,23
263:19

locally
34:2

located
11:22

location
140:12

locations
81:10

locked
227:4

logic
38:12
39:9,10,
11,20
45:14
47:20
241:21

logical
47:15
48:12
64:14,19
214:18
241:20

long
15:20
16:5,10
46:6 52:2
107:22

Samsung Ex. 1046, p. 316
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 316
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

145:25
155:5
161:2,10
170:11
257:15
258:25
260:25
268:2

longer
107:24,25
159:2
160:15

longish
125:16

looked
69:12
94:23
126:9
135:12
147:19,24
161:4
163:1
170:12
194:13
219:17
273:2

loop
227:4

losing
268:2

lost
107:15
168:18
232:9
266:24

lot
68:7,18
84:21,22
86:6
91:16
92:6
140:15
150:13
164:25
258:19
259:1,3

low
39:25
47:22,24
64:16
156:25
157:17,
18,21
158:3,10,
14,15,17,
21,22
159:2,5,
7,8
160:16
207:12
234:20
241:20

low-level
37:16

lower
41:20
42:22

LRDIMM
78:19,22
79:1,6,9,
19,20
81:1,6,
16,20

LRDIMMS
81:8

lunch
108:4,17

M

M-E-M-B-I-S-T
250:10

made
14:11,21,
23 27:12
40:16,19
64:21
73:12
84:9
149:15
179:14
219:17
242:5

main
72:19

maintain
45:8

maintains
45:13

major
191:15
192:1

make
45:2,12,
24 53:4
88:2
94:20
108:16
151:13
165:8,12
167:16
173:25
196:11
200:15
217:24
219:1
222:15
226:20
234:5
246:2
259:14
275:13

makes
29:20
38:24
40:21
44:23
254:7

malfunction
124:12

management
253:21

Manella
8:6 10:17
15:1,4
20:1,7
25:8

Mangione-smith
7:10 8:7
10:1,7,9
12:11
21:18
26:4 33:9
49:21
55:2
88:12
108:14
162:12
220:23
235:15
245:25
259:12
260:3,18
261:8
266:25
270:6
275:6,19

manufacturing
42:2
53:16

March
246:14

marginal
42:22

mark
54:21
115:22
239:24
244:8
246:8

marked
10:18,24
16:16
22:2,5,
15,23
25:5
26:5,8,
11,15,19,
22 27:1,
4,8,14,
17,20,25
28:7,10,
13,21
29:1 30:5
31:4
32:4,23
33:11,16
35:8,11,
12 50:1
54:23
55:11,14,
25 59:11
63:9 65:2
70:18
82:21
84:3,17
85:3,24
88:14
89:21
90:11
92:16
94:4
97:10,14
100:4
101:2
115:23
116:7
124:23
125:11
131:5
134:16
138:6,17
139:19
140:1,22
142:10,14
147:2,12
154:20
162:21,23
163:6,16

Samsung Ex. 1046, p. 317
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 317
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

168:21,25
169:7
174:21
175:3,8
176:15,18
178:5,9
179:18
190:18
195:7,12
204:13,24
223:9
229:10
238:7,16
239:20
240:4
241:4
242:9
244:12
245:8,13
246:5,19
247:13
270:7,20

market
62:8,16
79:4

marketing
40:18

marketplace
61:18
74:21

marking
268:19

marks
7:8

match
52:9

matches
34:19
234:3

material
94:11
148:21
259:1

materials
28:23

math
164:6,12
165:17

mathematical
164:19

matter
7:10
10:15
12:20
14:9 15:5
16:9,19
17:23
21:20,21
22:8
24:23
29:21
30:2,22,
23 31:5
32:10
38:1,21
50:3,11
61:17,22
84:2 85:2
223:5

matters
17:11
18:22
30:16

maximal
121:17,20

maximum
163:22
164:4
166:13
268:16,20

MCS
125:5,8,
14 126:2,
13 127:3
128:22
129:21

MCS1
122:21,24
123:1,4,
11,13,19

MDC
122:15

MDC910
122:17

meaning
11:20
22:6,16
29:16
43:15
52:25
53:2
62:21
77:14
236:17
250:12

means
21:21
45:15
47:6
53:20
60:19,21
79:24
125:24
139:22
146:17
195:1,2

meant
98:22
122:3
170:23
241:8
255:22,
23,24

measure
156:13

measures
232:21

mechanism
64:7
182:14
252:8

media
7:8
275:19

meeting
51:17

meetings
15:14,20

members
132:7

MEMBIST
250:2,8,
10,14,22,
23,25
251:12,
13,20
252:4,9,
13,16

memorialize
181:6

memories
36:12
37:9
211:1

memorized
99:22
100:11
146:23
273:3

memory
34:15
35:22
36:16,18
37:3,10
39:3 51:7
52:18,22,
23 53:1,
7,18,20,
25 54:12,
14,17
55:6
56:10,15
57:21
58:2,20
59:2,3,4,
18 60:1
61:9,15,
25 62:1,
12 63:2,3
65:19
67:13,15
68:3
69:7,9,
15,17
70:10,11,
20 71:16,
24 72:22
73:3,14
74:8,17
75:3,18,
19,21
76:3,10,
25 77:8,
10,14,18,
21 78:1,
7,19,22
79:6,10,
22 80:10,
25 81:1,
6,16
82:21
83:19,23,
25 84:17
85:3,24
86:13
87:5,13,
17,24
91:8
119:11
130:12,19
135:7
138:24
143:9,20,
22 147:21
148:25
149:8,21
151:16,
17,18,22
153:5,10,

Samsung Ex. 1046, p. 318
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 318
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

19 154:6
162:19
163:10,19
164:1
166:22
167:7,12
174:16,19
175:9,18
176:7,10
178:19,25
179:8,11
180:6,10,
13,19
182:7,9,
10,11,20
187:1,11,
18,22
188:23
189:8,14,
18 196:1
197:24
198:1
200:6,10,
11,24
202:11
209:3,5,
16,20,22
210:2,3,
10,16,18,
24 211:3,
6,8,9,14,
23 212:2,
9,20
214:12,
21,24
215:4,10,
12,17,21,
25 216:8,
24
217:11,25
218:21
221:20
230:11
231:7,22,
24 232:3,
5,14,22
233:11,
17,23
234:17
235:4,9,
12,16,17,
20,23
236:2,6,
11,20,24
237:3
241:24
242:1,15
243:23
246:15
247:7,12,
17 250:2
252:11,25
253:12
254:2,3
255:9
256:12,
14,22
257:16
258:20
263:7
264:15

mention
247:24

mentioned
42:20
154:12
241:10

mentioning
224:15

met
201:1

metastability
122:14
124:4,5,
9,18
126:3,16
127:4,8
129:13,18
152:19

metastable
126:25
127:2

method
273:15

methods
132:10,12
274:2

middle
60:12,16
160:11
181:25
239:1
250:1
255:1

midline
201:22

min
160:6,7
161:8

mind
88:24
117:12
165:13
172:5
219:15
266:12
268:3

mine
33:1

minimal
269:3

minimum
160:5
161:25
163:11
269:1,5

Mintz
30:25

minute
269:21

minutes
88:6
161:15
162:4
257:7
259:20

misaligned
121:7,8
125:15,
21,23
126:3
152:22

mishear
22:24

misheard
148:9
187:6
228:7

misidentifies
23:4

misoperation
124:12,15

mispronounced
228:6

missed
213:22

missing
50:12

misstatement
55:24

misstatements
56:4

Misstates
78:9 93:6
149:22
171:10
185:23
224:5

mistake
23:9,14
24:15
25:10,17
87:22

mistakes
22:17

misunderstand
145:3

mode
134:23
135:4,6,
7,20
136:1,13,
22,23
137:5,6,
13,21
138:2
140:10,
23,24
141:5,16
142:2
144:17

modes
271:3

modified
225:19

modify
147:20,24

module
34:15
35:23
52:19,22
53:1,18,
20,25
54:12,15
56:10
60:1
61:15
62:1,12
68:4 74:7
76:25
77:8

78:19
79:10,19
80:25
81:1,6,
11,16
91:9
109:23
123:4
125:1,4,5
126:1,13
127:3,11,
21
128:14,22
129:21
130:12,19
138:24
153:19
154:7
167:12
174:17,19
175:9,19
176:7,10
179:11
189:14
196:1,6,
15 197:13
200:4,8,
11,19,22
201:10
202:4,7,
11 215:10
235:16
236:11,25
247:18
252:25
253:12
254:2

modules
37:4
52:24
54:17
55:6
59:18
61:9 63:2
70:4
71:16
72:22
73:4
74:17
75:4
78:23
79:6
83:23,25
134:2
147:22
148:25
149:8,21
151:16,
17,19
153:6,10
235:17
236:6
237:3

moment
45:9 85:9
100:23
104:12
107:10
108:23
124:2
164:8
166:21
168:19
174:12
181:9
183:6
200:17
206:10
215:11
242:23
268:1
274:18

momentary
179:13

morning
7:5,25

motherboard
53:11,22
58:23

Motorola
39:2

move
43:5
80:16
94:19

moved
58:20
129:3

moves
273:16

MPR
140:3,8,
12,25
141:5,10,
15 142:3,
8,16,22,
24 144:3,
9,11,16,
25 145:6,
12

MR1
138:2

MR3
140:24
141:6,17
142:7

MSC1
122:23

Multi
142:21
145:5

multi-purpose
140:2,7
141:9,16
142:3,16
143:5,7
144:18

multi-rank
58:16

multiple
18:22
52:3 70:4
77:14,15
81:10
87:3
160:23
175:23
176:9
228:22
248:11
253:19

multiples
229:9
234:1

multiplexer
103:17
104:15,21
112:3,4,
10 122:24
240:25
241:9,15,
16,18

multiplexers
254:11,17
257:11

multiplexes
112:6

multiplexor
103:15
122:25
123:3

multipurpose
142:25
144:3
145:1

Murray
68:16

mux
103:16
254:12

N

named
31:9,14

names
31:18

nanosecond
67:17
68:3,14,
20,23

nanoseconds
70:21
71:1,5
163:11

narrow
95:18

Navy
68:18

nearest
133:14

necessarily
43:20
83:12
85:12
86:10
234:1
245:1

needed
28:23
39:12
93:25
132:4
214:7

Netlist
7:12 8:7
10:14
14:8
17:1,10,
22 18:2
21:19,23,
24 23:6

29:22,25
30:6,17,
21 31:5,
8,23
48:21
50:16
52:20,24
54:16,19
221:14
235:16,
20,23
236:2,5,
10,23
237:6,11,
18

Netlist's
10:15
25:16
26:5
55:4,25
246:19

Netlist/samsung
19:7

newer
148:12

nibble
241:12,19

nonfunctional
191:13,14

nonobviousness
85:1
148:23
149:6
150:3
153:8
171:6
185:8
189:4
200:2
203:8
219:8

nonrecov-
42:3

nonrecurring
42:3

normal
21:17
173:1
203:5
213:3
233:3

notes
13:5,6
85:13

noticing
8:16

notion
86:4
199:16

November
87:21,24
138:18

NRES
42:2,5

number
7:14
15:12
18:10
24:17,18
25:14,20,
23 55:8
103:5
114:5
247:6
251:5,7
252:1
253:16
254:11
256:10,21
258:16
275:19

numbered
88:17,19
101:22
102:12,13
221:10,
11,13

O

oath
8:15 10:2

object
49:6

objection
8:14,18,
19 21:15
40:14
41:4,13
42:24
43:2
50:18
53:5 54:1
59:21
60:3
61:2,11
62:2,13,
25 64:6
65:20
66:19
71:21
73:9
75:8,23
76:12,18
77:1,20
78:9
80:14
82:23
83:10
85:6 89:2
91:3 93:5
94:16
96:5,23
98:4 99:9
103:3
109:18,20
110:8
113:14
114:3,12,
23 115:16
116:15,22
117:20
118:7,20
119:8
120:10
121:14
124:7,16
125:7
126:5,17
127:5,13,
23 128:7,
16,24
129:7,14,
22 130:6
132:15
133:1,24
134:25
135:9,22
136:5,15,
25 137:8,
16,24
138:9
139:12
140:4,13
141:2,11,
19 142:5,
18 143:2,
11,25
144:5,22
145:8,14,
22 146:15
149:22
151:2,6,
20,25
152:11,25
154:2,10
155:14
156:11
158:24
171:10
185:23
193:6
194:20
198:3
199:13
202:12,25
203:24
206:11
208:1
212:11
217:15
218:4
221:24
222:6,25
224:5
225:3
236:12
237:8,13,
20 247:20
248:8,15,
25 249:9,
19 250:4,
18 251:2,
16,23
252:5,19
253:3,13,
22 254:5,
14 255:4,
11 256:5,
16,25
257:8,18
258:2,13,
22 259:7
260:16,
19,21,22
261:7,15,
25 262:1,
10,13,15,
16
263:14,
15,24,25
264:6,22,
23 265:17
266:3,4
267:3,4,
9,20,21
268:4,12,
23
269:12,13
272:13,24
273:12,21
274:4,15

Samsung Ex. 1046, p. 321
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 321
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

objects
248:11
262:20

obvious
218:19,24
219:4

occur
100:13
157:7

occurred
203:15

occurs
50:14
124:10
246:4

offering
222:16
274:23
275:2

office
7:13
12:15
18:12
49:8

officer
8:14

offset
245:14
273:10,20

oftentimes
39:17
40:15
42:15
46:24
55:17
58:19
63:24
77:9
83:20
120:23

old-technology
253:17

older
148:10

one-clock-cycle
98:12
99:7

one-quarter
165:3
232:4

open
82:18
87:3,8
116:3
134:18
221:1

opened
35:6

operate
121:18,19,21
166:12

operated
70:10

operating
70:23
121:11

operation
34:16
35:23
36:12
37:8
62:22,23
91:7,8
137:15
183:20,21
205:13
206:18
213:3,19
214:1
215:4,8
216:17
230:6,10,12 233:2,4,12
261:13
262:3,5
263:11,18
266:2

operations
203:5
212:15
213:14
214:8
221:18,20
222:18,22,23
265:10

opinion
22:12
32:15
38:14
52:23
56:19
69:10
71:15
72:21
74:16
78:21
82:19
85:12
92:25
101:9
117:18
120:5
147:18
151:5,24
152:7
153:4
171:14,18
183:5,10
184:20
185:18,22
186:11,24
187:8
188:20
189:13
197:15
198:10
199:2,8
206:16
214:14
216:6,22
217:2,7,9,14,23
218:22
220:8
222:9,20
223:3,6
224:10
228:2,12
251:18
260:24
262:8,12
264:2
265:3
274:23
275:2

opinions
10:15
19:4
22:7,9,11
27:22
32:13
33:12
84:2 85:1
148:1,23
149:1,7,25 150:3,7,8,9
153:9
171:6
185:9
189:5
196:25
197:20
200:2
203:8,18
213:23
214:5
219:8,11
222:16

opportunity
33:10
41:21

opposed
41:2
64:13
95:24
135:17
214:1
231:6

optimin
245:14

optimized
143:9,23

optimum
245:14
273:9,20

options
31:24

orange
116:9,10

order
37:2
47:23
77:10
123:18
133:3
199:6
275:15,16

orders
275:13

ordinary
29:5,10,16,17
33:20,21
34:5,11
35:9,14,19 36:4,6,10
37:6,14
38:2
40:12,20,22 43:10,17 53:24
71:15
72:21,23

Samsung Ex. 1046, p. 322
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 322
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

74:16
78:21
82:20
83:6,16,
24 84:6,
14,15,22
85:4,16,
23 86:7
91:19
94:14
120:4
147:18
218:13
224:9
244:24
265:25

**organizatio
n**
51:3 86:8
191:13

orient
264:14

oriented
196:12

origin
150:18

OUTB
176:25
177:2,5,
8,14,19

outcome
32:2

output
44:19,22
45:5,23,
25 46:2,
24 47:9,
13,14,17
103:14,23
104:1
110:10
111:1
112:1
115:11,
12,15,19
122:24,25
123:3
177:5,17
178:1
182:8
189:17
207:19,22
208:9,10
213:6
224:17,
24,25
225:24
226:7,9,
11 235:11
243:14
263:20

outputs
46:5,14
122:22
123:22,25
188:5
241:18

outputting
214:13,15

owned
149:11

owner
8:7 23:25
24:16

Owner's
25:15

owns
23:5
25:21

P

p.10.
221:14

p.m.
275:23

package
104:19

packaged
20:20,21

pages
19:22
51:24
52:2,6
97:13
100:4,11,
21 170:18
257:15
258:24

Paper
35:8,12

paragraph
23:17
32:5
33:15,18
34:7,21
35:13
36:2
70:8,9
131:13
147:1,6,
7,11
148:6
167:2
169:6
170:21,
22,23,24
171:1
175:4,6,
12,16
176:3
178:8
179:1
180:25
190:17,
23,25
192:18,23
204:16
207:17
213:7
216:15
219:24
225:10
230:14
232:19
244:7,11,
20 245:6,
10 260:7,
10 261:5,
12,19,20
263:1
264:13,16
266:16,21
267:6
269:7,8
270:8,11,
19,23
271:5,23
274:2
275:4

paragraphs
193:10
205:8
212:25
229:21
230:1

parallel
130:12,18
131:1

parameters
118:1

paraphrases
154:4

**paraphrasin
g**
140:15

pardon
119:14
133:19
147:4

**parenthetic
ally**
140:8

part
14:11
16:22
20:1
21:24
24:23
41:14
100:2
105:21
132:8,19
178:21,22
190:9
199:7,20
204:19
210:9
218:22
233:12
236:14
266:17
268:14
271:6,11
273:10,18

partic-
236:21

parties
19:10
221:17

parts
19:3 42:6
101:17
120:23
170:13
183:18

party
42:6

pass
80:3
112:21
178:1
200:13
225:1
242:25
259:18

passage
125:16

Samsung Ex. 1046, p. 323
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 323
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

passages
194:13

passed
110:10
112:12
268:19
269:4

passes
103:10
184:23

passing
188:8

past
16:10
17:9 18:1
25:2
50:17
52:15,22

patent
7:13,15
8:7
10:16,18,
19 14:14
17:2
23:4,5,7,
25 24:17,
18,22
25:15,16,
17,20,21
26:5,8,
11,15
29:6
31:10,15
40:23
50:25
58:5
88:22
89:5,7,
15,22
90:5,7,
10,17,20,
22 91:1,
21 92:1
93:18
94:9,15
95:12
96:2,9,
16,22
97:15,21
99:17
101:2,7,
8,14,20
102:3,19,
23 104:13
107:9
108:21
109:10
110:24
111:5,8
112:24
113:7
116:7
118:5,10,
15 120:5,
11,16
121:13,24
122:8,11
123:7
124:23
125:11,13
128:12
146:6,20
221:19
235:18
236:7
246:25
247:2

patents
17:5
24:24
25:1,13,
15 89:5
236:16

path
102:24
103:5
104:14
105:13
108:24
111:9
130:9,14,
21 131:1
185:11
186:17
190:4,7
204:2,3,6

paths
193:25
195:16
217:3

pattern
132:20
145:13,21
252:17,22

patterns
144:20

pause
111:12

pay
31:17

payment
84:10

Pazmandi
8:4

PC
53:11

PDF
11:2,5,13
12:17
13:4,6
19:19,22
20:22
22:1 30:4
51:22,24
88:17
221:10

PDFS
12:23
13:2

PDQS_OUT_UN
243:18

peak
70:3,15

penalty
8:24

pending
119:20

penetration
62:8

people
14:5
24:25
31:19
40:19
42:19
44:12,13
83:23
84:21
86:6

percent
153:14

perfectly
117:15
125:18
127:22
128:2,5,
10,11,14

perform
165:11
262:5
265:14

performance
41:22
167:17
202:16

performed
91:8
178:13,18
179:7
180:22
181:2
206:19
211:12,14
230:13
267:11

performs
182:23

period
44:3
70:20
96:7,10,
14,17,19,
20,22
99:13
156:3
158:17
159:21
164:7
183:19
209:8
228:13
229:8

periodic
155:1,3
224:3,8,9

periods
96:11
208:21

perjury
8:24

permit
78:7
176:1
206:9
225:1

permitted
163:25
166:13,20
170:5
174:11

person
29:5,10,
17 33:21
34:5,11
35:9,14,
19 36:4,
6,10

Samsung Ex. 1046, p. 324
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 324
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

37:6,14
38:2
40:11,20,
21,22
43:10,17
53:24
54:5
71:15
72:21,23,
25 74:16,
22 78:21
82:19
83:6,16,
24 84:6,
8,13,15,
22 85:4,
16,22
86:7
91:18
94:13
120:4
147:18
218:13
244:24
265:25
266:6

personally
13:21
36:3

perspective
29:9
193:23
194:23
226:17
227:6,21

petition
34:24,25
35:1,8,11

Petitioner
8:2 23:8
263:11

Petitioner's
23:23
33:19
34:20

Petitioners
27:11

Ph.d.
86:21

phase
207:24
220:2,14
228:20
229:6

phone
13:24
15:9,10,
13 107:13

phrase
53:25
54:17
120:13
125:20
128:5,11,
19 147:16
221:18
222:18

phrasing
252:12

physical
11:20
38:21
59:12,15
60:22
63:6
64:12
133:7
191:12
202:10,
14,18

physically
11:22

physics
184:10

PI
244:5

PI_R_NDQ
244:6

pick
109:2

picking
95:25

picosecond
169:1
170:15

picoseconds
71:5
163:13,
20,23,25
164:7,8
165:6,7,
16 166:3,
5,14,15
167:4

picture
56:9

piece
44:2,4,17
64:8
68:22
150:19
156:2
170:19

pin
104:16,17
111:1,3,
15,25
115:14
189:12

pins
104:19

PL_R_PDQ
244:5

place
81:10
205:14
215:9
230:6
233:3
274:20

places
243:1,10

plan
190:12

plans
25:3

PLL
248:18

plurality
206:24

point
24:9 44:6
53:4,13,
16 70:1
72:5
91:21
92:3
100:25
118:23
119:9
124:19
129:25
131:2,3
135:3,15
146:4
154:25
159:1
162:20
184:9
190:14
219:20
227:11
228:14
246:24
269:3
275:14

pointed
144:8

pointing
169:19
207:7,8
271:12

points
100:12
119:2
134:3
167:18

portfolio
246:19

portions
19:7
158:5

POSAS
86:7

position
274:19,24

possibly
31:12
144:11
188:24
217:20

potential
254:3

power
41:19
59:17
137:14

power-on
254:1

power-up
137:20

practical
40:7

Pre-defined
142:25

preamble
159:23
160:1,4,
6,14
233:16,
20,21

Samsung Ex. 1046, p. 325
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 325
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

234:1,4, 16,20

Preambles
159:25

precise
38:14
70:14
86:5

precisely
173:9
235:1,13

precision
173:24

predefined
144:19
145:6,13, 21

predetermined
95:16,20, 23,25

preface
88:23

preferred
213:12
271:8,16, 20

preparation
16:9,14
93:18,21, 22 97:18
274:9

prepare
15:7,21
16:6,11
18:6

prepared
16:2 95:2

preparing
17:15
95:7

present
25:3
55:22
189:14
204:8,9, 10 267:14
271:1,6, 12,17,21, 24 273:8
274:1,8

presentation
247:25

presented
55:15
200:13

presumed
185:1

pretty
23:19
146:18
147:23

prevent
133:22

previous
19:1
30:23
221:18,19
222:18,22

previously
29:22
41:8 61:8
77:13
79:16
93:21
156:20
211:11
222:11
224:3
234:4

primary
77:7

principal
114:5

principle
128:2
182:11

printed
12:19

prior
24:23
26:19,22
27:1,4
50:22
78:9
80:8,11
93:6 97:4
146:12, 19,22
171:10
185:23
224:5
246:25

problem
41:23
47:11
124:9
134:5
153:24
159:17
172:24
177:12
182:17

problematic
91:6

problems
46:8
134:5
152:18,23

procedure
21:17

proceed
8:11
108:18,19

proceeded
114:14

proceeding
34:11
35:18

process
14:12
17:8 20:1
41:25
42:8
173:2
271:10,19

produce
20:21

produced
42:6
103:25

produces
44:22

producing
21:16
42:22

product
39:5

products
37:2 43:4
61:18
149:12
151:12

profession
10:10

professional
67:20

programmable
38:11

programmed
136:23
137:6
201:23
202:1,3
267:13

prone
46:16

pronounce
177:2
223:23,25

propagate
181:24

propagation
65:25
68:10
80:6,15
130:9,14, 21 133:8
182:1

proper
24:12
96:21
137:15
221:17

properly
154:8
224:13

properties
48:14
130:9,14, 20

property
156:5,6

protect
249:23

provide
10:12,14
11:13
14:12
22:6 40:3
41:15
50:21
131:20,24
147:21

Samsung Ex. 1046, p. 326
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 326
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

provided
20:11
31:1
111:15
132:3
136:22
137:5
138:18

providing
55:5

PTAB
13:16

publicly
84:11

published
148:3

pull
34:2
164:16

pulse
160:5

purple
254:18

purpose
38:23,25
64:1
142:21
145:5
218:7
267:13
269:10
270:13,16
272:6,22
274:13
275:1

purposes
34:10
35:18
84:1
171:2
253:16

put
39:13
53:10
67:22
78:1 82:8
107:25
115:1
149:2
177:24
181:7
190:13
220:24
229:14

puts
13:10

putting
236:19,24
237:2

Q

qualified
18:23

quarter
165:17,21

question
12:14
13:1
22:24,25
29:20
68:1 71:4
79:13
89:11
118:13,14
119:19,21
140:19,21
148:8,13
151:24
161:18
164:6
180:3
182:11
187:6
196:8,11
206:7
230:22,25
234:11
256:19
267:23

questions
11:21
22:14
29:9,14
49:11
88:23,25
111:13
143:17
260:4
269:17
275:6

quick
18:15
48:17
245:18

quickly
48:20,23

quote
147:20

R

raise
8:21

range
161:22

rank
58:12,15,
17 59:1,4
77:13

ranks
58:25
175:23,24

rate
17:25
54:13
70:24
155:5,8,
21 156:4
170:8
176:2

rational
218:25

RDIMM
72:16,19,
22 73:3,
8,18,19
74:2,5

RDIMMS
73:1
132:13,17

RDQS
104:2
110:13,16
113:24
114:9,20,
25 115:4,
6 116:12
117:7,8

RDRAMS
202:3

re-initialized
137:14

re-times
263:19

re-timing
263:18

read
16:15
26:5,18,
25 27:7,
16,24
28:9
56:17
58:13
62:23
63:4,5
67:16
74:7
91:7,22
102:25
104:13,
15,16
105:9,11,
21 110:17
111:10
113:19,23
120:11
122:15,18
123:7,23
131:20,
21,24
132:3,22
134:11
137:18
138:12
139:23
141:7,18
143:8,9,
22 144:19
145:6
146:2,7,
9,13,16,
17,21
150:4
154:7,15
156:16
160:5,6
169:9
171:3,7,
15,19
172:6,11
173:1
178:14,24
180:9,12,
20,21
181:1,12,
17,19
182:6,9,
13,18,21,
23,25
183:7,11,
18,21,24
184:7,20
185:18
186:11,24
187:8

Samsung Ex. 1046, p. 327
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 327
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

188:21,25
189:6,22
190:2,9
197:1,9,
22 198:10
199:2,8
200:20,21
201:3,22
202:1,20
203:4
204:2
205:24
210:4
211:18
212:17
213:14,16
216:14,18
221:14
222:2,23
223:24
225:15
228:10
230:6,10,
12,13,18
231:12
232:20
233:2,4,
12 235:2
237:12,16
242:9
243:13
249:12
257:3
260:11
261:23
262:4
263:20
266:22
267:5,16

read/write
213:12

reading
92:1
120:4
125:16
160:1
168:3
169:11
190:4
210:13,21
212:22,24
257:13,20
266:6

Readout
145:12

reads
143:1,8,
21

ready
108:17,19

real
159:17

reason
41:1,3
67:21
69:20
127:1
164:23
218:16
229:3

reasonable
166:7,9,
17 232:7

reasons
22:9
41:7,10
132:6

Rebecca
7:20

recall
14:23
25:13
26:10
31:12
32:17
47:5
51:12
55:9,10,
23,24
56:2,3,20
57:7 58:7
67:21
69:5,14
73:5,6
75:17
79:7
81:24
86:21
90:24
92:7
93:9,15
96:25
97:5
99:22
100:17,
20,23
101:18
103:8,11
112:19
115:19
117:9
118:21,23
120:16
123:5
126:8
131:22
132:3
135:2,4,
11 146:23
148:18
160:1
162:19
168:8,14
176:11
177:10
192:25
212:17
217:6
219:13
222:10
233:25
241:7
246:22
247:25
250:21
252:13
263:4
266:9,15,
20 271:14

recalled
31:20

receive
133:5
197:2,23
199:4,10,
11,18
200:5
201:14,
16,17,18,
19
202:21,23
203:3,21
216:7,12,
23 217:4
228:3
231:21,23
232:13,16
235:8

received
78:4
103:9
133:9,10
203:14
235:2

receiver
64:17
66:8,11
113:4,13,
16,19,21
122:13
158:8
205:25

receives
113:22
195:22
199:16
201:10,20
215:3
216:11
230:18
231:12
232:3,5
263:6
264:10

receiving
65:23
114:18
134:3
196:18,22
199:15,24
216:20

recent
19:7

recently
136:19
160:18

reception
98:9

recess
49:18
88:9
108:10
162:9
220:20
238:3
245:22
259:23
270:1

recited
275:4

recollection
28:1
30:24
56:21
68:12
69:12
70:6
76:16
97:20
173:4
216:13
223:7
225:7

Samsung Ex. 1046, p. 328
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 328
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

233:25
238:18
242:11
248:3
264:11

reconstructed
106:4

record
7:6 8:13
10:6
21:12
49:15,17,20 88:8,11 108:6,9,12
161:15,16
162:4,8,11
220:19,22
238:2,5
245:21,24
259:22,25
262:23
266:23
267:2
269:19,24
270:3
275:12,21

record's
260:4

records
48:20

rectangular
248:11

red
59:1
169:12
195:19
230:19
231:13
240:10

redirect
273:13,22

redirection
108:25

reduce
77:10
175:18
176:1

reducing
77:17

redundancy
249:22

refer
36:19
38:12
41:15
46:17
58:19
63:19
65:14
78:25
81:25
114:24
120:1
131:15
146:16
164:25
170:14
175:4

reference
25:21
26:19,22
27:1,4,8,10,14,17,20,24
28:7
32:21
33:1
85:15
119:24
120:18
140:2
190:24,25
204:22
229:21
238:7
240:4,6
244:8,11
245:12
266:12
270:7,11

referenced
113:11

referred
37:21
40:8 42:2
46:24
60:6,12,17 61:1
113:15
119:13,15
167:18
174:9

referring
15:18
24:16
25:10
30:6 31:3
36:23
41:3,5
45:18
46:10
47:25
64:3
81:12
83:5 99:2
105:18
106:9
114:10
129:23
132:9
138:15
165:6
167:6
173:8,10
174:10
247:23
251:13
255:18

refers
63:16
68:9
113:17
146:13,21
150:14
159:22
160:4
241:11

reflect
46:4

reflects
45:3,25

refresh
70:6
93:23
97:20
119:11
151:22
162:19

refreshing
215:12

regenerated
106:4

region
129:18

register
43:23
44:2,14,16 73:13,15,18,20,23 74:2,3,5,6
124:13
133:6
134:23
135:4,6,20 136:9,12,13,24
137:7
138:2
140:3,7,11,23,24
141:5,6,9,16,17,24 142:1,3,16,21,25 143:5,7 144:3,7,9,12,15,17,18
145:5
178:15,16
180:10,14,22
181:2
182:22
183:1,11,25 184:2,24 185:19
187:9
188:4,11,13 189:5,15,24
190:1
195:18,21
205:14
207:18
209:13
210:17,19
211:7,12
212:1,10
213:5
214:22
215:22
216:2,18
218:2
219:25
220:1,10
230:7,11,18 231:3,6,12
232:20,23,24
233:10,15,22
234:15
235:8,11
243:9,12

registered
72:15
80:4

Samsung Ex. 1046, p. 329
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 329
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

243:13
269:5

registering
79:15,16,
18

registers
37:18
43:12,14
66:13
107:5
135:7
136:1,22
137:5,13,
21 145:1

regular
17:25
45:17
155:4,8,
21 156:4
183:20
213:13,
19,25
215:4,8

Reidt
7:18

relate
148:10,11

related
10:15
14:5 17:2
21:23
30:20
50:5
52:19
132:23
151:11
198:24,25
222:23
232:21

relates
89:8 90:6
91:2
148:9

relationship
101:19
102:2,10,
11 172:13
180:2
240:7

relative
150:22
152:9
164:10
165:6
167:25
171:23
172:1
181:18
186:9
189:23
207:24
208:6

relevance
226:12

relevant
12:20
92:6,8
94:7,8
99:16
100:8
148:15,25
149:8,21
150:4,25
151:5,16
152:4
153:5,7,
10,12
267:15

reliable
206:9

reliably
64:18
77:22
78:4
124:20
173:16
181:16
205:25
210:1

relied
23:22
149:4
150:5,6
203:12
204:8
242:13

rely
170:13
260:12

relying
199:16

remember
15:24
21:3
132:16
179:25

remembering
24:6

remind
13:15

reminder
49:22

remote
8:15
11:19

remove
186:12

removed
19:8

reorient
230:21

reorienting
105:6

repeat
12:25
140:19
187:7
196:11
228:6
230:22
256:19

repeated
193:19

repeats
143:21

rephrase
206:7

replied
148:19

report
19:3,8
119:10,
15,24
120:1

reporter
7:19
8:10,12,
20,23
50:8
54:9,24
69:4
115:24
179:19
204:25
229:11
239:21
246:6

reports
19:5 31:2

represent
72:18
164:23

representation
13:20
34:19
55:7

represented
69:20

representing
7:20
60:19

reprinted
240:3,5

require
95:16
201:13
217:17

required
41:17
95:19
270:15

requires
83:18
173:11

reset
137:15
248:18

resided
180:4

resistors
191:9

resources
41:17

respect
17:2 29:6
33:20
37:3
48:21
91:13,20
94:14
118:15
144:16
203:19
226:3
240:22
273:7

respond
97:5

Samsung Ex. 1046, p. 330
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 330
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

responded
219:17

Respondents
23:25

responding
181:23

rest
48:11
225:5

restate
217:2

result
122:22
123:22,25
126:3,14
127:4,8
130:13,20
133:13,
19,22
134:2,7
183:24
216:16

resulting
59:3

results
126:25
127:1
214:4,9

resume
162:5

retain
200:14

retained
10:14

retiming
261:13
262:5
263:11

reversed
47:23

review
18:8 23:2
50:2
85:10
93:18
94:2
95:4,17
100:24
101:10
118:8
135:15
148:5
189:1
225:4
242:6

reviewed
15:12
16:17
28:5,11
32:9
62:18
65:3
76:21
93:15
95:14
97:17
104:10
111:18
117:7
135:3
136:19
145:25
149:1
160:17
237:22

reviewing
56:20
248:1

revision
87:20

revisions
88:2

right-hand
103:10
142:24
254:18

rigor
69:13

rising
129:17
169:16
170:9
226:20
227:9,24
228:25

Romano
7:20

room
11:20
12:3,6,8

roughly
24:4 68:3
139:6

routing
102:5,7,
16 111:21

row
127:21
128:15
135:20
157:12
163:10

rows
57:21
58:2

rule
13:21

rules
13:16

run
24:13
46:7 70:4
74:23
161:7

running
258:18

runs
51:24
52:4

Ryan
201:1,2

S

S4
178:10,
13,24
179:14
180:1,5,
9,20
181:1,9,
12,19
182:6,21,
25
183:11,24
184:20
185:18
186:11,24
187:8
188:21
189:6,22
198:22
202:20
203:4,19
204:17
205:13,21
206:3,9,
15 208:25
209:7,19
210:10,15
211:6,11,
18 212:8
213:4
215:15,20
216:24
218:1
220:4
230:6,12
232:20
233:2
262:3

S5
178:10,18
179:7,14
180:1,6,
12,17,20,
21
211:13,23

sales
79:4

sample
67:14
109:25
115:7
155:17
158:9
172:14
181:16
205:25

sampled
67:3
114:1
122:22
123:22,25
124:21
126:25
127:1
156:15
173:16

sampler
109:8,9,
16,22,25
113:12,
17,18
122:17,19
123:12,
17,20,22
155:17

samples
65:23
66:12
109:11,22
110:6
113:22
115:20

Samsung Ex. 1046, p. 331
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 331
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

122:21
123:12
158:14,15

sampling
114:19
123:19
157:1,7
158:13
172:12
173:7
206:10

Samsung
7:11 8:2

Samsung's
25:13,17

sat
219:14

satisfy
60:5

Saturday
15:10,11,
14,15,22

scenarios
78:12

scheduled
15:23

schematic
190:24
191:3,18,
25 192:4,
7,22
193:5,13,
16,17
194:7,18
195:3

schematics
191:8
195:4

scope
63:1
71:22
73:10
75:9,24
76:13,19
116:16,23
117:21
124:8,17
126:6,18
127:14,24
128:8,17,
25 129:8,
15,23
130:7
135:1,10,
23 136:6,
16 137:1,
9,17,25
138:10
139:13
140:5,14
141:3,12,
20 142:6,
19 143:3,
13 144:1,
6,23
145:9,15,
23 203:25
221:25
222:7
223:1
236:13
237:9,14
247:21
248:9,16
249:1,10,
20 250:5,
19 251:3,
17,24
252:6,20
253:4,14,
23 254:6,
15 255:5,
12 256:6,
17 257:1,
9,19
258:3,14,
23 259:8
260:21
261:16
262:1,15
263:15,25
264:23
267:4,21
268:5,24
269:13
273:13,22

screen
55:2

scroll
261:19
263:1
267:18

SDRAM
36:13
56:15,23
57:1,2,5,
10,11,16,
19,21,25
84:20
133:4
135:17
136:23
137:6
183:4,6
236:21

SDRAMS
232:17

search
24:4
33:10
52:12,15,
18 54:14

searched
52:8,21
113:5,10

searching
32:25
97:6

section
23:1
100:24
138:11
140:6
142:20
147:9,13
222:14
250:25
251:11
258:8,10

sections
57:17
58:1

sees
77:14

select
103:17
104:14
241:9

selected
105:9,12
112:8
264:21

selector
188:2
242:20,25

selects
104:15
112:10
240:25

sell
37:2
61:18

seminal
150:19

send
11:6 34:1
35:2
54:22
64:20
65:11
77:22
78:7
82:16
186:25
187:10
209:20
210:3
233:16
234:15

sending
64:8 78:2
209:3,4,
5,16
212:9
213:21
233:11

sends
210:11,16
215:16,21
233:22
235:3

sense
16:8
29:20
45:13
46:1
167:16
207:24
217:24
226:20
254:7

sentence
141:4
219:23
261:11,
20,23
263:17
264:19
266:22
267:6
273:2

sentences
140:17

separate
53:7,11
144:17
261:13
262:5

separated
16:24

separately
211:13

September
87:6,11,
14 221:5

sequence
133:4
145:7
158:6

series
30:19

serve
38:22

served
39:11

set
58:12
63:6 65:6
80:3,17
86:2
112:16
134:23
135:6,20
136:2,13,
24 137:7
140:10,
23,24
141:5,16
142:4,8
144:17
174:5
214:18
224:23

sets
135:7

setting
268:17

setup
65:4,5,12
127:7
153:2
154:12
172:18
183:19

shift
220:2,14
226:24
227:1
231:22

shifted
126:14

short
68:20
220:16
237:24
266:15

shorter
231:22

show
56:8
93:2,8
145:19
158:5
170:7
192:3,15,
16 196:4,
13,18,21
197:18
199:15
207:9
212:8
214:15
215:8
217:10
254:16
255:15

showed
246:20

showing
51:13
81:23
157:19
159:5
160:19
169:4
196:9
214:12
215:8
240:7
268:11

shown
31:3
63:20
64:23
72:1 74:6
76:14
79:11
80:12
81:9
86:25
87:6
92:12,13,
21 93:8
96:4,18
98:17
99:8,25
118:19
120:2,7
125:15
126:15
127:11
137:21
144:3,7
160:9
176:14
178:16
180:8,11
182:22
187:9
196:2
203:15
217:3
220:10
224:17
230:14
231:13
232:8
240:25
241:6,8
242:17,21
243:20
248:5
251:9,14
253:1
254:12,25
256:3,11,
21

shows
75:11
92:5,11
93:14
96:12
98:8
125:1
126:1
145:12,20
157:9,11,
13,16
158:2
163:10,17
168:25
175:24
176:24
177:6
191:13
193:24
205:5,17,
18 207:4
209:15
212:1
223:19,22
226:2
229:19
232:12
233:1,14
234:14,
19,25
235:7,10
238:14,24
239:3
242:14
255:9
256:9

sic
224:2

side
102:20
103:10
111:11
116:18,20
125:2
142:24
168:4
170:5,8
180:11
188:8,25
223:15
238:13
240:5,6,
17 241:25
254:19

sides
170:5
177:16

signal
44:19,20,
22,25
45:1,24
47:7,8
60:22
63:17,22
64:5,9,
13,14,15,
19,20
65:6,15,
18 66:1,
3,17
67:2,5,
10,13
68:2,11,
12 73:22,
23,25
80:7,9,10
92:13,17,
21 93:3
96:4
97:22
98:2
102:25
103:21
104:16,

Samsung Ex. 1046, p. 333
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 333
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

17,24
105:2,5,
11,12
106:2,18,
20,21,22,
24 108:25
109:16,
23,25
110:1,5
111:9,14,
16,23,24
112:10,
14,17,18,
20,25
113:24
114:18,20
115:4,6
116:18,20
117:10,
18,19
118:16,18
120:6
123:1,4,
17 125:6,
14 126:2,
13 127:2,
3,10,11,
21,22
128:13,
14,22
129:20,21
130:17,18
134:3
138:23
150:22
151:15,16
152:9,21,
22
153:20,
24,25
154:8,16,
24,25
155:3,7,
13,15,20
156:1,9,
10,12,14,
16,19,24
157:9,11,
13,17
158:3,17,
21
159:15,19
160:14
163:18,19
164:10
167:3,4,
19,23,25
168:4
171:8,9,
16,20,21
172:8,15
173:3,9,
11 177:7,
13,22
183:2,13
184:1,2,
22,23
185:21
186:3
187:1,4,
10,11,14,
17,21
188:5,6,
9,11,12,
18,22
189:7,16,
17,23,25
195:22,25
196:5,14
197:8
198:9,14,
15
199:10,12
200:18
206:2,6,
8,13,14,
17,23,25
207:1,20,
23,25
208:22
209:2,17,
20,21,22
210:11,
16,18,23,
25 212:9
213:7,21
214:17,
18,23,25
215:16,
22,25
216:2,8,
12,23
217:3,11,
25 218:20
219:24
220:2,3,9
223:21
224:2,3,
8,12,23,
25 225:1,
2,12,17
226:13,18
227:7,9,
25 228:4,
12,17,23
229:4
231:21,23
232:3,5,
14,22
233:17
234:16,
20,22
235:3,8,
11 237:19
240:18,
21,24
241:4,23
242:15,
20,24
243:5,9,
12,17,18,
22 244:2,
3 245:15
263:21
264:9
265:4,12,
24

signals
60:23
64:18

66:5,6,24
73:17,21
74:3
75:11,12,
13,21
76:3,6,9
78:8
79:18,19,
22 80:1
81:9,18,
21,24
98:9
106:5,17,
20 112:7
114:1
120:8
121:2
125:5
127:19
130:5,10,
12,15,21,
23,25
133:5,9
134:8
138:25
153:14
156:5,6
157:3,20
164:1
166:21
167:12
168:6
177:9,11,
15 181:24
182:15,16
184:8
186:1,8,
18 187:3,
12 196:5,
7,14,18,
22 197:3,
4,11,12,
16,24,25
198:13
199:1,5,
15,17,18,
23 200:5,
6,9,10,23
201:5,14
202:9,22,
23 203:3,
14,21,22
204:10
206:21,22
207:5
217:5
226:15
232:17
233:10
247:19
260:13
263:7

significanc e
194:4

significant
40:17,25
41:6 42:1
79:11
150:18
224:15

silicon
41:17

silly
166:2

similar
81:8
269:1

similarly
80:10
211:22

simpler
53:9

simplicity
157:22

simply
83:24
100:22
101:16
173:8

Samsung Ex. 1046, p. 334
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 334
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

179:25
200:13
225:7
236:18
248:2
249:13
257:20

simultaneously
109:13

single
80:2
176:8

single-spaced
52:2

sir
12:2
15:2,19
16:4 47:2
181:11
192:9
259:16

sit
32:17
50:14
56:22
62:15
75:17
94:1
95:13
96:25
100:10
138:14
152:7
222:9
248:3
249:5
275:3

sits
73:13

sitting
49:7
100:16

situation
84:13
117:23
172:10

situations
152:12, 13,14,17
172:11,20
174:2
193:2

SK
30:6 31:5

skew
139:3,10, 17
163:18, 22,25
164:4,7
166:3,4, 10,11,13, 19 167:11
168:1,3, 7,10,11, 14 169:1
170:4,5, 15
174:10,14
198:19,23

skewed
164:9
166:25

skill
29:6,10, 17 33:21
34:5,12
35:9,15, 19 36:4, 6,10
37:6,14
38:2
40:12,20, 22 43:10, 17 53:24
71:16
72:22,24
74:17
78:22
82:20
83:6,16, 24 84:6, 14,16,22
85:4,16, 23 86:7
91:19
94:14
120:4
147:19
218:13
244:24
265:25

skilled
267:15

slash
250:9

slide
69:11
247:16

slightly
100:21
140:20
155:2

slow
253:17

slower
42:11

small
31:2
39:25
201:24
253:17

smaller
41:18
42:10

SMBUS
252:25
253:6,8, 11,20
254:1,4
257:11

socket
53:12

sold
75:2
149:12
151:17

solemnly
8:23

solid
92:16
116:10

Solutions
7:21

solve
153:24

son's
201:1

sort
41:10
45:17
57:12
62:8 63:3
71:25
75:1
83:19,25
89:9
103:1
125:21
157:19
186:4
192:14
204:22
230:19,23
231:1,4
238:25
241:22
253:1
254:19
265:10,14

sorts
40:15
52:25

sound
52:10
166:7,17

sounds
62:15
131:18
165:22
166:9
220:17

spaces
52:3

sparse
146:18

speak
63:19
117:16
260:20

speaking
109:13

spec
163:23
167:14

specific
38:23
43:20
51:13
66:22
93:21
95:15
104:10
152:5
172:10
254:8
266:19

specifically
16:20
35:13
51:10
92:23
97:1,6
120:17

Samsung Ex. 1046, p. 335
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 335
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

164:3
222:17
270:24

specification
83:22
91:24
135:12,16
152:6
159:4
166:12
174:18
267:14

specifications
36:19
37:2
65:10,13
151:11

specifies
120:12

specs
151:11

speed
39:25
40:4
41:20
64:10
69:8,9,16,17
70:3,11,15,16,22
78:13
121:17,19

speeds
69:23
70:5 78:8

spell
50:7 54:9
69:4

spent
16:19
17:10,23
95:6

spot
165:18
166:2

stages
112:16

stall
165:24

stand
47:3
58:18
75:16
151:22

standard
28:10,13
51:11
60:7
62:20
63:24
66:22
67:9
69:23
74:5
82:21
83:2
84:3,4,17
85:2,14,18,24
86:11,24
87:5,13,17,24
131:15,16,19,20,24 132:5,13
134:16,24
138:6,17
139:5,19
140:1,9,22
142:10,14
143:6
146:2
148:3
151:18
154:19
157:16
158:2,16,20 159:22
160:13
161:4
162:14,23
163:9,17,24 166:20
167:22
168:9,20,25 174:11
246:13
247:13
248:1
253:11
258:25

standardized
56:16
73:3 75:3
79:6
247:2

standards
23:23
28:17,20
36:8,14,24 37:1
43:22
50:24
51:5,8,14
60:9 84:9
85:18
86:5,9,13

standing
275:13

stands
38:8,11
54:11,13
65:5,9
81:14
250:2
252:7
253:20

start
21:19
82:14
147:8
175:5
248:7

started
21:23
114:15
117:6
211:3

starting
8:16
11:22
30:17
34:6
102:25
111:10
154:25
258:10

starts
51:21
233:16
234:15

state
7:23 8:24
10:6
45:15
46:9,20,25 48:3,4,5,10
61:8
107:5,7
156:15
157:5
159:11,13,16
175:12
177:17,18,25
226:1
254:25
255:9,15
256:2
263:9
273:14

stated
22:11
29:8
32:15
143:10
175:16
180:23
206:10
261:5

statement
14:7 22:7
33:20
34:4
85:20
132:25

states
7:12
47:19,21
48:1
145:5
219:24
244:19,20

statically
161:6

stating
22:12

stay
182:9

stenographic
262:23
267:2

step
103:2
111:12
171:8,15,20 172:7
173:2
196:10
206:21

stepped
51:9

Samsung Ex. 1046, p. 336
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 336
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

steps
273:16

stock
31:23

stop
107:18
141:1
159:21

stops
155:21

store
44:3
77:24

stored
44:24
77:24
216:17

stores
232:23

story
68:16

straight
219:15

stricken
19:3

strobe
63:17,22, 25 64:5, 8,20
65:17
66:17,24
67:4 74:3
75:12
76:9
92:5,20
93:3
94:23
96:4,20
97:22
98:2 99:7
102:24
103:20
104:5,8, 13,16
105:1,9, 12 108:25
110:17,19
113:23
114:6,9, 11,17,18
115:4
116:19
117:18
118:18
120:6
130:18
139:4,10
150:21
151:15
152:9,22
153:20,25
154:8,15, 24 155:7, 13,15,19
156:1,5, 6,10,13, 16,19,23
157:3,13, 17,23,24
158:3,7, 17,21
159:23
160:14,15
163:18
164:9
167:19,23
169:17
170:1
171:8,16, 20 172:7, 15 173:3, 9,10
183:2,12
184:1,22
185:21
186:25
187:4,10, 14,21
188:5,6, 11,12,19, 22 189:7, 16,17,23, 25 196:18
197:3,23
198:9,15
199:1,4, 10 200:5, 9,18,23
202:22
203:21
207:20
213:7
215:16
220:3
223:16,20
224:11, 20,23,24
225:11, 12,17,24
226:3,5, 7,10,13, 17 227:6, 21 228:2, 15,24
233:16
234:16, 20,22
237:19
241:23
242:14,19
243:5,9, 12,16
245:15
247:19
260:13
263:21
264:9
265:15
266:7
268:8
269:9

strobe-centering
263:13

strobes
182:2

stroke
110:1

struck
181:21

structure
37:8 82:1
133:3

students
51:5,12

stuff
12:15

stumbled
86:19

subject
261:1

submitted
19:25
20:6,20, 24 32:9

submitting
21:1

subsequentl y
168:5

substance
13:18
14:5

subsumed
194:25

succeeded
209:10

suggest
125:17
261:1

suggested
42:13
74:24
241:19

suggesting
70:14
132:18

suggests
225:17,19

summary
91:22
100:3
178:2

supercomput ing
68:19

supplement
25:4

supplied
225:12

support
35:14

supposed
127:17
185:20,25

surprise
63:12
90:23
146:24
162:18

surprised
161:8

surprising
62:6

suspect
218:17

swear
8:11

switch
139:23

sworn
7:24

symmetric
168:8,15

Samsung Ex. 1046, p. 337
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 337
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

Sync
252:21

synchroniza tion
45:14
225:13
263:22

synchronize d
225:16

synchronous
45:15
107:4
159:19

system
36:16
37:10
45:13
46:19
53:7
58:21
77:3
84:25
121:9,10
145:7
178:19
179:8
181:15
184:18,19
187:1,11, 22 188:23
189:8,18
190:15
211:14
233:11, 17,22
234:16
235:4,12
253:21
254:3

systems
36:18
71:24
76:6
134:12
172:22,25

T

T0
231:12

T10
234:23

T4
234:3

T5
232:4,6
233:15, 19,21
234:3,15, 21

T6
233:21
234:21
235:1,13

t8
92:12,18, 24 98:14
99:13,15

t9
92:18,24
98:14
99:14,16

table
162:22
163:1,9, 17 257:24
258:11,15

takes
78:3
103:20
108:25
155:6
205:13
230:6

taking
167:19

talk
49:4,22
63:8
89:14
97:7
103:4
108:6
147:2
198:16
212:16
219:2

talked
41:8 76:5
79:16
104:15
107:3
123:14
125:21
130:22
133:7
138:2
170:16
175:21
216:25
224:7
273:1

talking
23:4
24:22
47:20
54:4
68:23
72:25
89:9
98:16
117:6
156:7
167:17
168:3
173:14
174:4
178:24
188:7
204:2
206:20,22
212:14
213:18
255:14,21
270:24
271:2

talks
68:17,21
150:23
152:1
266:17

task
39:12
85:19
151:8

taught
43:25
51:4,6, 12,16
95:12
96:22
144:20
153:21

tck
161:25

tdh
65:8

tdqsq
169:2,4, 13,15,23
170:1

tds
65:2

teach
96:2,9
98:1 99:6
126:12
154:5

teaches
96:7,13
97:21
98:6
99:12
118:5,11, 15 128:13
138:22
140:10
143:7
150:21
154:14
160:13
207:17
232:19
244:12
245:13
256:13
270:12,20
273:25

teaching
91:1,13, 20 94:13, 25 98:10
150:25
272:11,16

teachings
147:11,20
148:2,14, 24 149:7, 21 150:4
151:14
153:5,9
267:14

technical
31:21
41:2,7
91:17
155:2
262:22
267:1

technique
133:11
134:4
146:22
152:5
153:23
269:9

techniques
132:21
technologies
152:10
technology
37:24
40:5
51:16
55:4,10,14,21,25
56:2
57:1,2,5
70:16
72:2
76:21
83:21
147:16
148:11,12,15,16
150:13
151:1
246:19
272:19
telling
67:14
tells
271:23
ten
16:13
18:20
275:20
tend
40:3
41:19
43:5
94:10
term
23:24
43:21
53:1
58:15
66:13,16
72:8,23
181:21
191:23
222:11
252:9
terminates
207:1
terminology
194:12,14
terms
24:4
40:17
41:17
59:16
128:21
155:2
164:22
166:14
193:1
194:3
test
250:3,12,15 251:22
252:4,8,9,11
268:18
269:3,4
testified
10:3
19:11
31:1
93:20
97:24
260:25
testify
55:18
testifying
57:7
263:5
testimony
8:24
13:18
14:6 16:9
19:24
20:2 55:6
78:10
93:6
94:20
99:5
108:17
119:1,6,18 149:23
171:11
185:24
224:6
246:2
259:14
261:4,10
262:12
264:4
265:1
testing
268:15,17
Texas
31:6
221:5
text
89:15
169:21
264:1
texting
14:4
Theodore
8:1
thing
11:7
133:17
158:14
194:15
234:6
things
13:23,24
25:1
48:19
53:15
54:6
125:24
132:13,20
190:6
202:15
208:18
thinking
24:3,14
85:15
228:8
thought
98:19,22
100:6,7
123:14
128:9
131:21
148:8
178:24
210:23
224:21
thousand
17:17
three-quarters
232:6
Thursday
7:1
tight
117:25
time
7:6 8:12
12:9
13:11
16:3,6,24,25
17:23
26:3
31:13
42:8
44:3,5,6
45:8 46:7
49:17,20
50:24
55:19
62:23
65:4,5,9,12 67:1
71:24
78:3
88:4,8,11
92:12,24
96:7,10,11,14,17,18,21
98:8,12
99:24
107:15
108:3,9,12 111:19
124:20
126:10
134:3
139:3,9
145:25
146:1,6
151:8
155:5
156:4,13
159:20
160:18
161:7
162:8,11
170:12
172:17,18,19
184:10,14
186:20
208:21
220:19,22
229:8
230:18
231:12,17,22
232:4,6,21 233:15
234:2,23
235:9,13
238:2,5
245:21,24
258:19
259:18,22,25
266:15
269:24

Samsung Ex. 1046, p. 339
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 339
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

270:3
275:16,21

times
18:5,18,
20 19:14,
17 86:20
119:4,13,
16,22
127:7
153:2
154:13
159:6
161:25
164:13
166:16
173:19
182:3
201:8
217:1
232:14,18
274:7

timing
91:5,6
117:25
133:13
134:5
145:7
172:23
182:7,8
183:1,7,
12 184:1,
9,16,22
186:17
187:2,12
188:10
190:3
200:9
201:11
207:4,10,
19,22
208:9,10,
23 210:7
213:6
230:9,12
233:1
260:12,14
262:4

title
145:17
251:11
257:21

titled
140:7,25
142:20
252:23

today
7:19 8:8
12:13
14:6
15:21
21:2
29:8,15
31:19
36:20,22
56:22
62:15
80:25
93:19
95:8
100:17
151:18
246:3,18
259:15
261:4
262:12
263:4
264:4

today's
15:7
16:3,6,
11,14
97:18

Tokuhiro
26:25
27:4
85:13
238:7,11,
13,16,19,
22,24

told
45:8
161:11
200:17
201:2
211:11

tolerable
163:22
164:4

tolerate
168:14

top
11:16
23:10
25:9 41:7
44:1
63:21
70:1,19
88:14
89:20
94:3
104:23
116:10
126:22
136:22
137:4
143:20
145:4
157:9
163:9
169:20
177:23
195:23
223:11
231:6
239:8
254:17
274:20

topology
138:24

total
16:18
59:4

touching
261:1

town
55:18

Trademark
7:13

train
213:5

trained
183:22

training
183:19
198:22
203:4
209:8
210:9
212:18
213:2,13,
15,16
214:1,4,
7,10,11
215:9,14
271:19

tran-
8:10

transaction
s
78:13

transfer
176:2

transistors
191:10

transition
64:21
127:18
156:20,25
157:6
158:12
169:16
170:2,9

transitione
d
110:6

transitioni
ng
157:18,20

transitions
157:4
158:4
160:16
207:10,13
234:22

travel
68:13
130:12,18
167:12

traveling
68:7

travels
68:2
166:24
241:24

treat
84:2 85:2

tri-state
37:17
43:12,13
45:19,22
46:3,5,
14,18,22
47:18
48:3,9,
10,15
103:14,24
110:11,22
112:2
115:12
177:20,24
184:11
188:1
189:11
192:17
236:19

trial
7:13
19:11,24
55:13,18,

22

triangle
177:24

triangles
177:16

tricky
46:1

triggers
158:12

tripped
206:24

trouble
140:18

trpe
160:6

trpre
160:7,14, 19 161:8

true
212:6

trust
67:22
193:19

truth
9:1,2

turn
28:25
51:20
56:5,12
57:13
58:9
63:13
71:7
72:10
74:9
78:14
80:20
82:12
88:13
111:4
121:23
169:6
176:17
178:4
190:9
195:6
199:7
204:12
210:3
223:8
224:18
238:6,22
244:7
260:6
266:12
268:10
270:6

turned
46:2,15, 18,23
47:12
184:17
190:8
191:24
260:14

turning
271:9

turns
190:7,8

tutorial
55:5,11, 14,25
56:3
247:16

tutorials
55:21

type
37:25
39:8

types
36:18,20, 22 37:12
44:10

typically
44:4,20
47:24,25
58:15,21
89:4
107:6
156:24
183:17
227:2
228:21
250:11

U

U.S.
10:19

UDIMM
71:12,14, 16,19

ultimately
65:24
190:11

UN
240:24
241:7,11

unbuffered
71:11
72:8
175:14

unclear
34:22

uncommon
61:21
63:5
191:21

underlying
87:20

underspecified
121:15

understand
14:3,7
26:7,10, 14,21
27:3,13, 19 28:6,
12 36:25
39:19
45:10
48:8
53:25
54:6 78:5
83:7,9,12
90:16
101:13
120:3,5
149:20
150:8
163:2,3
165:8,10
182:10
183:9
189:21
213:11
214:6
218:14
242:4
249:15
251:21
253:7
266:6

understanding
26:9,12, 17 27:6,
12,21
28:8,14,
22 34:20
43:18,20
76:16,23
90:18
94:8
101:15
102:1
138:14
157:23
182:24
184:21
185:7
200:1
203:7
212:13
215:7
217:14
219:7,10,
11,16
226:2
233:13
241:3
249:4,13
252:23
254:22
264:25

understood
13:19
14:1,2
28:19
86:2 96:1
188:14
205:10
213:24
214:8
230:3
240:11
242:2

undo
134:4

unequal
130:3,5

unfortunate
124:19

unheard
191:22

unit
7:8 92:24
216:18

United
7:12

units
275:20

unmarked
12:22

Samsung Ex. 1046, p. 341
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 341
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847

unrelated
263:12

unsure
246:24

up-front
42:1,21

update
44:21,25

updated
44:5
107:5

updating
107:7

upper
122:2
177:6
195:17
205:6,7
229:22,23
231:2
241:11,19
248:13,17

usage
78:11
253:11

usual
79:2 89:4

V

valid
169:16
170:1
172:14

values
112:20
114:7,9,
10,13,14
115:7
161:7
181:16
183:23
202:3
217:4
241:10
245:14

variable
160:21
185:11,20
186:5
188:22
189:7
238:17,
20,25
239:3,6,
11,17
243:5

verb
114:11

versa
62:24
76:11
195:5

versus
7:11
16:24
30:6 31:5
50:11
156:9
194:15
195:3

vertical
105:14

vertically
105:24

vice
62:23
76:11
195:5

video
12:18
262:17
266:24
275:13,
15,20

video-recorded
7:9

videoconference
8:16

view
53:13,16
184:10
191:8
193:23
194:18,
19,25
217:25
227:11
228:15

views
194:23

virtue
201:4

visible
103:7

Visually
248:10

voltage
121:20,22

volts
47:13,14

volume
42:23
43:5

volumes
75:1

W

wait
260:19

waiting
107:18

walk
241:23

wanted
100:24
109:2
148:5
217:21
218:6
264:14

warned
107:15

Washington
7:1 10:23
12:1

watch
64:17

ways
44:12
114:6
134:10
152:3
270:22
272:11

weaknesses
67:20

Wedig
85:13
86:16,18
93:23
97:1
98:7,20
126:8
148:19
149:2,4,
15 150:5,
8 199:21
203:11
219:12
242:5,12
266:9

Wedig's
33:25
34:4
35:12
85:22
97:9,13,
17 100:3,
15,18
120:25
149:25
151:10

week
16:10
93:22
95:8

weird
181:21
199:20

well-known
61:25
175:13

Western
31:6

wide
59:3
60:25
61:10

width
59:4,19
62:11
160:5

widths
59:16,19,
22,24
61:9,15,
25

William
7:10
10:1,7
275:19

window
273:15

windows
87:3

wire
46:12
47:17
48:6
64:1,15
67:25
68:14,22,
24 166:24
167:12

wired
46:5

wires
63:7
64:9,12
67:2,12
80:3,4,17
133:7
174:16

word
11:5
52:17
117:24
156:20
251:19

words
29:16
95:24
105:1
135:24
140:16
166:23
233:3
235:17
271:13

work
14:16,19,
22 15:5
21:19,25
29:21,24
30:20,25
31:2
34:14,18
35:22,25
39:5
44:16
52:24
54:16,19
64:4
83:25
110:4
114:2,5
121:10
125:25
144:24
150:19
152:20
210:9
245:2

worked
30:17
50:4
74:22

working
16:19
83:18
84:20,23
159:21

works
76:17
88:22
190:12
208:4
226:4
269:6

worse
167:11

worst
152:19

worst-case
166:11

worth
100:8
224:15

writ
237:3

write
44:20
62:22
63:4,6
67:14
86:9 91:7
131:20,25
132:3,23
134:11
136:2,9,
12 137:22
138:4,7,
12,19,20
139:8,15,
20,22
146:7,13,
21
178:14,24
180:9,12,
20,21
181:1
183:18
203:19,20
204:3,17
205:13,
17,18,21
206:4,9,
15,18
207:18
208:24,25
209:7,9,
10,19,24
210:1,2,
8,10,15
211:6,11,
13,18
212:8,14,
18 213:2,
3,4,18,19
214:1,2,
3,7,8
215:4,8,
15,20
216:6,16,
17,22,24
217:12
218:1,20,
22 220:5
222:23
237:6,17

write-enable
45:1

writes
60:17

written
58:13
74:7
137:14
244:4

wrong
24:16
46:16
56:21
67:22
105:21
166:1
169:12
210:21
212:23,25
216:13
217:1
232:10

wrote
210:5

X

x8
60:12

Y

YA
103:17
112:7

YB
102:20,25
103:9,17
111:10,
14,25
112:7,8,
11,20
114:15

year
17:9 18:2
31:5
48:22
50:17
86:25

years
30:2
34:14,17
35:22,25
44:1
62:18

yesterday
15:12,14
16:1 23:3

Z

Zhong
15:16,17

zoom
7:16
12:18
15:10,11,
14,22
16:12
107:21
234:12
262:20

Samsung Ex. 1046, p. 343
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2022-00711

Samsung Ex. 1075, p. 343
Samsung Electronics Co., Ltd. v. Netlist, Inc., IPR2023-00847