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Reply to: John Lohmeyer

To: Membership of T10

From: Ralph Weber, Secretary T10
Larry Lamers, Vice-chair T10
John Lohmeyer, Chair T10

Subject: Minutes of SPI-2 Working Group
May 5, 1997 -- Natick, MA

Agenda

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Results of Meeting

1. Opening Remarks

John Lohmeyer, the T10 Chair, called the Cinco de Mayo meeting to order at 9:00 a.m., Monday May 5, 1997. He thanked Charles Monia of Digital Equipment for hosting and arranging the meeting.

As is customary, the people attending introduced themselves and a copy of the attendance list was circulated.

2. Approval of Agenda

The agenda was approved with the following additions and changes:

4. Changing driver modes when hot plugging (96-270r1) [Penokie] – was deleted

3. Attendance and Membership

Attendance at working group meetings does not count toward minimum attendance requirements for T10 membership. Working group meetings are open to any person or organization directly and materially affected by T10's scope of work. The following people attended the meeting:

Name	S	Organization	Electronic Mail Address
Mr. Vincent Bastiani	A#	Adaptec, Inc.	bastiani@corp.adaptec.com
Mr. Lawrence J. Lamers	A	Adaptec, Inc.	ljlamers@aol.com
Mr. Wally Bridgewater	V	Adaptec, Inc.	wally@eng.adaptec.com
Mr. Richard Wagner	P	Cable Design Technologies	rwagner@montrose-cdt.com
Mr. Siegfried Schmalz	R	Dallas Semiconductor	siempfried.schmalz@dalsemi.com
Mr. Greg McSorley	P	Data General / Clariion	greg_mcsorley@dgc.ceo.dg.com
Dr. William Ham	A#	Digital Equipment Corp.	ham@subsys.enet.dec.com
Mr. Chris Nieves	P	Fujitsu	cnieves@fcpa.fujitsu.com
Mr. Don Vohar	A#	Fujitsu (FCPA)	dvohar@fcpa.fujitsu.com
Mr. George Penokie	P	IBM Corp.	gop@rchvmp3.vnet.ibm.com
Mr. Dean Wallace	P	Linfinity Micro	75671.3443@compuserve.com
Mr. Louis Grantham	A	Linfinity Micro	lgdatcom@ix.netcom.com
Mr. Alan Littlewood	O	LSI Logic	alanl@lsil.com
Mr. Skip Jones	P	QLogic Corp.	sk_jones@qlc.com
Mr. Ting Li Chan	A	QLogic Corp.	t_chan@qlc.com
Mr. James McGrath	P	Quantum Corp.	JMCGRATH@QNTM.COM
Mr. Richard Uber	V	Quantum Corp.	duber@tdh.qntm.com
Mr. Dana Hall	V	Quantum Corp.	dhall@tdh.qntm.com
Mr. Gene Milligan	P	Seagate Technology	Gene_Milligan@notes.seagate.com
Mr. Gerald Houlder	A	Seagate Technology	Gerry_Houlder@notes.seagate.com
Mr. Daniel (Dan) F. Smith	O	Seagate Technology	daniel_smith@notes.seagate.com
Mr. Dave Guss	P	Silicon Systems, Inc.	dave.guss@tus.ssi1.com
Mr. Vit Novak	A	Sun Microsystems, Inc.	vit.novak@sun.com
Mr. John Lohmeyer	P	Symbios Logic Inc.	john.lohmeyer@symbios.com
Mr. Ralph O. Weber	A	Symbios Logic Inc.	roweber@acm.org
Mr. Kenneth J. Hallam	P	UNISYS Corporation	ken.hallam@mv.unisys.com
Mr. Paul D. Aloisi	P	Unitrode Corporation	aloiisi@unitrode.com

Mr. Gregory Kapraun V Western Digital Corp. kapraun@wdroc.wdc.com

28 People Present

Status Key: P - Principal
 A, A# - Alternate
 O - Observer
 L - Liaison
 V - Visitor

4. Single-ended termination (96-245r2 and 97-174r0) [Wallace, Aloisi]

In reviewing document 97-174r0, Paul Aloisi called the group's attention power dissipation requirements for single-ended terminators (1.44 watts for narrow and 1.9 watts for wide). Several questions were raised regarding whether such requirements can appear in a standard, the definition of dissipated power, and other issues.

Paul, Bill Ham, Dean Wallace, and Louis Grantham discussed the Single-Ended Terminator IV curve to be included in SPI-2. Gene Milligan noted that he started this discussion several meetings ago by requesting that the SCSI-2 terminator be included in SPI-2. The group discussed many aspects of the IV curve.

At one point, Dean Wallace characterized a difference of opinion between Unitrode and Linfinity regarding the width of the allowable region in the IV curve, noting that Linfinity was more lenient than Unitrode. This led to a discussion of writing tighter specifications for drivers and whether the group intends to go faster with single-ended. Several IV curves were compared.

Dean and Paul agreed to take the advice of the group, conduct some additional testing of terminators presently sold on the general market, and produce a final-form draft proposal (to be numbered 96-245r3) for new terminator requirements and changes to existing terminator requirements in SPI-2 that includes specific wording (instead of statements of principles).

The group agreed that the next working group meeting will consider the node capacitance measuring scheme for measuring the node capacitance at another voltage, because the current scheme does not fully account for the possibility that highest capacitance might exist at a voltage other than the one used in the current measuring scheme.

5. Proposed clarification to Fig. 24 (97-115r1) [Moore]

Larry Lamers reported that Richard Moore says 30 mV will give much better interoperability than 60 mV and that the previously agreed changes in wording are necessary to avoid misinterpretations. John Lohmeyer noted that the April meeting agreed to make changes that include 60 mV and the addition of words clarifying how signals depicted by the figure are to be tested. Bill Ham expressed the belief that the additional wording is editorial, because it expresses the long-held opinion of the group. John was concerned that the existence of keywords such as "may" and "shall" in the additional wording made the changes arguably substantive. Larry agreed to work the issues off-line and to ask for agenda time at future meetings only if additional discussion is necessary. Otherwise, the group recommended that the plenary adopt the changes in Figure 24 as agreed at the April meeting.

6. Integration Issues [Lamers]

Gene Milligan noted that the group is losing track of what integration issues have reached agreement regarding changes in SPI-2. He noted that no formal list has been maintained, except possibly in meeting minutes.

John Lohmeyer noted that the plenary motion taken nine months ago to integrate SCSI-2, SPI, Fast-20, and SIP has not been addressed. The committee discussed how to address the plenary requirements. The group also discussed how best to handle the growing list of Ultra3 discussion topics. Gene Milligan stated his objection to

approving a SPI-3 project proposal when we do not have the committee-requested initial draft of the SPI-2 with the material beyond Fast-40 (the integrated document).

7. Bus Set Delay Reduction (97-116) [Ham]

Bill Ham expressed the belief that previous meetings had agreed to this change. Larry Lamers reviewed his disagreement with the proposal. The working group recommended that the plenary vote on 97-116 (if the document can be found).

8. Hot-Plugging Data (97-144r0) [Ham]

Bill Ham reported that he has not collected any additional data on hot plugging. Bill discussed his hot plugging data with Wally Bridgewater. Bill agreed that this item should be removed from future agendas.

9. REQ/ACK Glitch Filters [Ham]

Bill Ham agreed to provide a detailed written proposal. George Penokie asked that this agenda item be kept until he can get the specific information to his engineers and collect their responses.

10. LVD backplane testing (Fast-40 and Fast-80) [Ham]

Bill Ham asked that this item be removed from future agendas.

11. Ultra3 Topics

11.1 Requirements for Fast-100 operation (97-179r0) [Ham]

Bill Ham presented a list of problems with operation at 100 mega-transfers per second and showed some signal traces taken with pseudo-random data. He expressed surprise that the results with pseudo-random data were worse than the results from 'worst-case' patterns in some of his experiments. Bill noted that for the first time, ISI issues are becoming more pronounced. He plans to do future testing with pseudo-random test patterns.

Bill pointed out a low-frequency sinusoidal waveform superimposed on the signal that he was at a loss to explain. Dean Wallace said that this was aliasing from the terminator. Dean expressed a desire to give a more specific description of the problem, but he felt that more testing and research will be needed to add detail to the description.

During the discussion, Bill noted that he selected Fast-100 because his Fast-80 tests showed no serious problems. Bill concluded that transfer rates above Fast-80 have serious problems because the cable is not intended for such high frequencies. Gene Milligan, John Lohmeyer and George Penokie suggested that several other approaches could be considered, such as: other types of termination, equalization, and encoding (all of these are techniques used by existing serial interfaces). Using both edges of the REQ/ACK signals was also discussed, and Bill noted that such a change would necessarily result in the waveform being more symmetric.

The group discussed encoding schemes and the challenges of encoding several parallel lines. Some felt that encoding would not present serious difficulties for silicon designers. Others felt that encoding would overly difficult to fit in precious chip real estate. Two encoding schemes were mentioned; 8b/10b and 4b/5b. The group spent some time conducting self-education regarding the mechanics, implications, advantages, and disadvantages of encoding. John asked group members to begin discussing encoding with their engineering teams.

Bill presented the proposal that faster speeds be attained using regular pulses and using both edges of the REQ/ACK pulses. The group discussed the meaning of Bill's proposal. Bill expressed confidence that Fast-100 would be possible based solely on switching to using both edges.

The group discussed placing new requirements on host software to recognize that devices may report an ability to operate at speeds higher than the cable-plant will really support. It is possible that both the host and the target will be capable of operating at higher speeds but that high-speed operation is somehow inhibited by the cable or other interconnect components. In such cases, the host should negotiate a lower speed with the device. This process was compared to the fall-back speed negotiation process used by modems. It was recognized that a failure to communicate at the higher speed will often appear to be a bus hang during a data phase— this condition may not be easy to detect and recover.

11.2 Symmetrical Driver Margin Improvement (97-172r0, 97-178r0 slides 1-4 & 6-12, 97-181r0) [Bastiani/Bridgewater]

Vince Bastiani presented cable loss data (97-178r0 slides 1-4). Questions were raised regarding nature of the loads used in the multiple loads data. Also, the group discussed potential reasons for the loss, e.g. skin effects, stranded verses solid conductor, and of course, just plain cable attenuation.

Vince then presented analysis of driver and receiver properties based on the boundary conditions established for several design properties in SPI-2 (97-172r0). Concerns were raised about how the model considers only the fundamental signal and not the harmonics. However, there was agreement that losses can present significant problems for faster transfer rates.

Wally Bridgewater presented empirical data concerning signal loss on a biased bus (97-178r0 slides 6-12). After discussing the data, Bill Ham repeated his conclusion that operating in an environment with high attenuation is undesirable.

Wally presented a list of ten differences between symmetric and asymmetric signaling (97-181r0), which the group discussed.

11.3 Driver Power Consumption (97-178r0 slide 5) [Bastiani]

Vince Bastiani presented information supporting the conclusion that better signals can be produced with less power in an unbiased bus. Questions were raised regarding the dependence of the results on the tolerance around the common mode voltage.

11.4 Cable Specification Changes [Lamers]

The group discussed changes in the cable that might be beneficial for faster transfer rates (particularly lower attenuation cables), but eventually agreed that proposals should be sought from cable vendors.

11.5 First Pulse Compensation - Inter-Symbol Interference (ISI) [Lamers]

Larry Lamers noted his desire that ISI issues be discussed. He asked that this item be kept on the agenda for the next meeting.

11.6 Node Capacitance Reduction (97-181r0) [Bridgewater]

Wally Bridgewater presented model and analog circuit information to support his contention that a dual receiver (one biased and one unbiased) can be built that has only a 0.5 pF increase in capacitance over the unbiased receivers presently in use.

Concerns were raised regarding the effect of switchable terminators on node capacitance. The possibility was discussed of changing system requirements to eliminate the need (or possibility) for switchable terminators on disk drives.

11.7 Modeling Assumptions [Schneider]

Several people asked that the spice model presented by Frank Gasparik be distributed to the group via e-mail. John promised to investigate meeting the request. Questions were raised about whether the model addresses high frequency signaling issues.

11.8 Figure 25 Timing for Ultra-3 [Bastiani]

Vince Bastiani asked that this item be deferred to the next meeting.

12. Meeting Schedule

The next general SPI-2 working group meeting is scheduled for Monday July 14, 1997 in Colorado Springs, CO.

Larry Lamers noted that he will request the scheduling of a meeting to discuss parallel SCSI protocol-specific topics in late June. Gene Milligan objected to calling a meeting to discuss proposals that have not been distributed and have not even been previewed.

The group agreed to add the following items to the agenda for the July meeting:

- Capacitance Measurement at 2 Volts [Wallace/Ham]
- Universal Backplane Annex (9x-yyrz) [Wallace]
- Cable Company's Presentations for Low-Attenuation Cables ['Ham']

13. Adjournment

The meeting was adjourned at 5:30 p.m. on Monday May 5, 1997.