Accredited Standards Committee*
X3, Information Technology

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Project:
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Reply to: John Lohmeyer

To: Membership of X3T10

From: John Lohmeyer, Chair X3T10
Larry Lamers, ViceChair X3T10

Subject: Minutes of SPI-2 and EPI Study Group Meeting
Bedford, NH -- September 11, 1995

Agenda

1. Opening Remarks
2. Approval of Agenda
3. Attendance and Membership
4. Review of Results from August 14th meeting in Denver, CO (95-309r0) [Lohmeyer]
5. Low Voltage / Low Power Differential Interface [Ham/Aloisi]
6. Hybrid Signaling? [McGrath]
7. Terminator Power Distribution [Aloisi/Ham]
8. Propagation Delay Length Limit [Ham]
9. Pin-out Definitions [Ham]
10. SPI-2 Architecture [Ham]
11. EPI Draft Document Outline (95-320) [Ham]
12. 50 Ohm Cable Specification (95-317r0) [McCall]
13. Should RST Signal Remain Single-Ended? [Gardner]
14. +/- Signal Skew [Jander]
15. Preliminary Test Results [Ham] (95-315)
16. Meeting Schedule
17. Adjournment

Results of Meeting

1. Opening Remarks

John Lohmeyer, the X3T10 Chair, called the meeting to order at 9:00 a.m., Monday September 11, 1995. He thanked Charles Monia of Digital Equipment Corp. for hosting the meeting.

As is customary, the people attending introduced themselves and a copy of the attendance list was circulated. Copies of the draft agenda and general information on X3T10 were made available to those attending.

2. Approval of Agenda

The following items were deleted from the agenda.
8) Determining Differential vs. Singled-ended [Aloisi/Ham]

The following items were added to the agenda.
15) Skew on +/- signal [Jander]
16) Preliminary Testing results [Ham]

The agenda was approved with the changes noted above.

3. Attendance and Membership

Attendance at study group meetings does not count toward minimum attendance requirements for X3T10 membership. Study group meetings are open to any person or organization directly and materially affected by X3T10's scope of work.

The following people attended the meeting:

Name	S	Organization	Electronic Mail Address
Mr. Norm Harris	P	Adaptec, Inc.	nharris@eng.adaptec.com
Mr. Lawrence J. Lamers	A#	Adaptec, Inc.	ljlamers@aol.com
Mr. Edward Fong	P	Amdahl Corp.	esf10@amail.amdahl.com
Mr. Bob Atkinson	O	AMP, Inc.	rdatkins@amp.com
Mr. Wayne E. Werner	V	AT&T	wew@aluxs.att.com
Mr. Dennis R. Haynes	P	Burr-Brown Corp.	haynes_dennis@bbrown.com
Mr. Justin McEldowney	V	Burr-Brown Corp.	mceldowney_justin@bbrown.com
Mr. Chris Millsaps	V	BusLogic	chrism@buslogic.com
Mr. Louis Grantham	P	Dallas Semiconductor	grantham@dalsemi.com
Mr. Charles Monia	P	Digital Equipment Corp.	monia@shr.dec.com
Dr. William Ham	A#	Digital Equipment Corp.	ham@subsys.enet.dec.com
Ms. Nancy Cheng	A#	Hitachi Computer Products	n_cheng@hitachi.com
Mr. Duncan Penman	P	IIX Consulting	penman@netcom.com
Mr. Dean Wallace	P	Linfinity Micro	75671.3443@compuserve.com
Mr. Peter Gossler	O	NSM Jukebox GmbH	73503.3467@compuserve.com
Dr. Akira James Miura	A	Panasonic Technologies, Inc	miura@tadw.research.panasonic.com
Mr. Param Panesar	O	Pioneer Research	
Mr. Skip Jones	P	QLogic Corp.	sk_jones@qlc.com
Mr. James McGrath	P	Quantum Corp.	JMCGRATH@QNTM.COM
Mr. Edward A. Gardner	A	Quantum Corp.	gardner@acm.org

Mr. David McCall	V	Quantum Corp.	dmccall@tdh.qntm.com
Mr. Richard Uber	V	Quantum Corp.	duber@tdh.qntm.com
Mr. Gene Milligan	P	Seagate Technology	Gene_Milligan@notes.seagate.com
Mr. Brian N. Davis	A#	Seagate Technology	brian_davis@notes.seagate.com
Mr. Gerald Houlder	A	Seagate Technology	Gerry_Houlder@notes.seagate.com
Mr. Greg Alvey	V	Solution Technology	g.alvey@genie.geis.com
Mr. Robert N. Snively	P	Sun Microsystems Computer Co	bob.snively@eng.sun.com
Mr. John Lohmeyer	P	Symbios Logic Inc.	john.lohmeyer@symbios.com
Mr. Rod DeKoning	V	Symbios Logic Inc.	rod.dekoning@symbios.com
Mr. Mark Jander	V	Symbios Logic Inc.	mark.jander@symbios.com
Mr. Tracy Spitler	V	Symbios Logic Inc.	tracy.spitler@symbios.com
Mr. Arlan P. Stone	A	UNISYS Corporation	arlan.stone@mv.unisys.com
Mr. Paul D. Aloisi	P	Unitrode Integrated Circuits	Aloisi@uicc.com
Mr. Matt Thomas	A	Unitrode Integrated Circuits	thomas@uicc.com
Mr. Tak Asami	A	Western Digital Corporation	asami@dt.wdc.com

35 People Present

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

4. Review of Results from August 14th meeting in Denver, CO (95-309r0) [Lohmeyer]

John went over the results of the LVDS signaling meeting held in Denver on August 14th, highlighting the agreements reached. The minutes are contained in 95-309r0. As is often the case, people not present for the Denver meeting questioned several of the agreements reached there. Several topics were re-opened.

The revised power budget was apparently not documented, yet.

There was concern expressed that single-ended Fast-40 was eliminated from consideration. The reasons for not documenting single ended Fast-40 are 1) too much effort required to document it; 2) the universal driver probably cannot run at 40 megatransfers single-ended; and 3) it would likely have extremely restrictive cable lengths and device counts.

There were objections to this approach, since the industry is likely to develop single-ended Fast-40 whether or not it is documented; the topic was deferred to a reflector discussion and a possible vote at the November plenary meeting.

5. Low Voltage / Low Power Differential Interface [Ham/Aloisi]

Bill Ham reviewed his proposal for LVDS. A more correct model of the terminator was developed, the previous model turned out to be erroneous.

Mark Jander proposed that the Fast-80 hold times be reduced by 0.5 ns which would result in 6.0 ns transmitter hold time and 2.0 ns receiver hold time. This will simplify transmitter design be reducing the hold time to less than

50% of the cycle time (12.5 ns). There was no objection to Mark's proposal and Bill agreed to revise the SPI-2 electrical interface document.

6. Hybrid Signaling? [McGrath]

Hybrid signaling is using single-ended for the low-speed control signals (RST, BSY, SEL, ATN, C/D, I/O, and MSG) and LVDS for REQ, ACK, data and parity. This would save 7 pins on protocol chips by using one pin/signal on the slower signals instead of two pins/signal.

This was a controversial topic. The Denver study group had rejected the concept, but it was brought up again by its proponents (who had not attended the Denver meeting).

Bill Ham noted that allowing a hybrid solution would sacrifice common mode noise rejection. Frank Gasparik sent a foil to the meeting with Tracy Spitler illustrating that near-end crosstalk would be an issue as the higher power single-ended signals couple into the LVDS signals. The crosstalk foil become controversial because several people argued that flat ribbon cable should not be used with any kind of differential. Others felt that flat ribbon cable would get used anyway. Gene Milligan suggested that the single-ended signals should use a new low-voltage single-ended, which had not been discussed yet (and was not discussed further at the meeting).

John Lohmeyer was concerned that the architectural precedent of a hybrid interface would be present a roadblock to future enhancements. It would be very difficult, if not impossible, to migrate to a pure LVDS interface after setting a hybrid precedent -- we have no mechanism to sense the difference.

Can we live with the extra 7 pins? The answer completely depends on package sizes. Some designs might be forced into a larger size, while others would fit. There was no resolution on this issue at the meeting. It will be discussed further at the October meetings.

7. Terminator Power Distribution [Aloisi/Ham]

This topic was not covered.

8. Propagation Delay Length Limit [Ham]

This topic was deferred until the SCSI-3 General Working Group meeting due to insufficient time.

9. Pin-out Definitions [Ham]

Bill Ham briefly showed a foil of an 8-bit version of an LVDS cable. Other than a minor error Bill noticed, there were no issues identified.

10. SPI-2 Architecture [Ham]

Larry Lamers lead a discussion of the marketing impact of how the documents are focused and written. Should Fast-40 SE, Fast-40 LVDS, Fast-20, and SPI be integrated into a singular document. A unified document will add at least 6-8 months to the develop for resolution of the issues arising from integration. The benefit is that a singular document exists and associated issues should be resolved. The negative is the added time to market (time to forwarding) will make it appear that the advanced physical interfaces are not yet stable.

Jim McGrath volunteered to host a marketing oriented meeting on packaging the technical work.

11. EPI Draft Document Outline (95-320) [Ham]

This topic was deferred until the SCSI-3 General Working Group meeting due to insufficient time.

12. 50 Ohm Cable Specification (95-317r0) [McCall]

David McCall presented a proposal for SPI-2 to consider a reduced impedance cable specification. Recommendations include dropping differential impedance to 75 ohms and allowing for a 60 ohm termination option. The benefit is a better match with backplane implementations. The consequence is increased power consumption in the transceivers. No conclusions were reached.

13. Should RST Signal Remain Single-Ended? [Gardner]

This topic was not covered.

14. +/- Signal Skew [Jander]

Mark Jander requested that the maximum skew time between the + and - lines on each LVDS signal be increased considerably from the current 50 ps specification. After some discussion, the group agreed to specify this number as 500 ps.

15. Preliminary Test Results [Ham] (95-315)

Bill Ham presented some preliminary test data based on a reasonable approximation of the LVDS interface. Operation is feasible at Fast-100 over 25-30 meters in point-to-point mode. With multi-drop, Fast-80 may work at 15-20 meters.

Intersymbol interference is a real issue as the speeds increase. A balancing scheme may be needed. Bill plans to do more testing.

16. Meeting Schedule

Two meetings interim meetings were scheduled at the meeting, one on SPI-2 technical issues and another on parallel SCSI marketing issues. The marketing meeting is not an X3T10 activity. Unfortunately, both meetings were re-scheduled the next day at the SCSI-3 Working Group meeting due to conflicts. The re-scheduled meetings are:

Friday, October 13, 1995 - SPI-2 Technical Meeting at the Denver Stouffer Concourse Hotel hosted by Symbios
Monday, October 16, 1995 - SPI-2 Marketing Meeting in the San Jose area hosted by Quantum

In addition to the above meetings, a SPI-2 Study Group meeting was scheduled for 9:00-5:00 Monday November 6th in Palm Springs and a EPI Study Group meeting was scheduled for 9:00-12:00 Tuesday November 7th in Palm Springs.

17. Adjournment

The meeting was adjourned at 6:00 p.m. on Monday September 11, 1995.