Doc #: 87-138

To: X3T9.2 Committee   Date: Aug. 17, 1987

From: Jim Schuessler, National Semiconductor

Subject: Fast SCSI

As an outgrowth of Kumar Sivasothy's testing of fast IPI/SCSI, I propose that synchronous transfer mode be allowed to achieve 10Mtransfers/sec. in SCSI-2. Several timing parameters need to be added and an Implementation Note indicating that the Fast SCSI numbers have only been tested using differential transceivers and 25m twisted pair cable. The one nagging question is how systems will select between the old and new numbers.

These are our final test results using a representative sample of DS3695 parts limited to 25°C temperature differential and 200mV voltage difference between parts on the same interface.

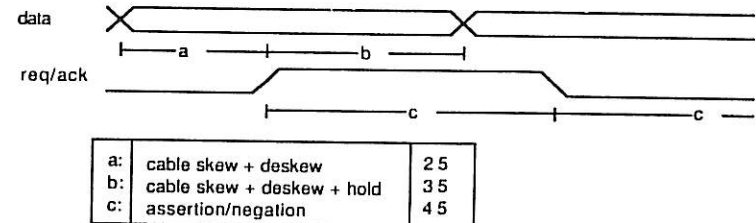|	FAST SCSI		
a	Clock Offset	5	
b	Transmitting Logic Skew	3	
c	Foil Delay	1	Within Cabinet
d	Transmitter Prop. Delay Skew	6	
e	Foil Delay	1	
f	Drop Cable Prop. Delay	1	
	CONNECTOR	-	
g	External Cable - Skew Between Pairs	5 (3)	
h	Distortion due to Cable Imbalance	1	Cable
i	Distortion due to Intersymbol Interference	2	
j	Bias Distortion	2	
	CONNECTOR	-	
k	Drop Cable Prop. Delay	1	
l	Foil Delay	1	Within Cabinet
m	Receiver Skew	9	
n	Foil Delay	1	
o	Logic Setup/Hold	5	
	Total	44nS (41)	

The numbers in parentheses are for a special cable Madison Cable is building for IPI use. It can also be used for SCSI.

I propose a set of Fast SCSI timing parameters derived from the chart above.

Table	SCSI-2	Value
g	Fast Cable Skew Delay	5
h - n	Fast Deskew Delay	17 shown, round to 20
o	Fast Hold Time	5 shown, allow 10
*	Fast Assertion Period	45
*	Fast Negation Period	45

* The Assertion and Negation periods are derived from isolated pulse measurements and represent a comfortable minimum pulse width which has the advantage that it can be produced from a 20MHz. clock.

Graphically, the new minimum times appear like this:

a:	cable skew + deskew	25
b:	cable skew + deskew + hold	35
c:	assertion/negation	45

Proposed Changes to SCSI-2 doc.:
Sec. 4.7.X: Fast Assertion Period (45 nanoseconds)
    When using the Fast SCSI option, the minimum time that a target shall assert REQ while using synchronous data transfers. Also, the minimum time that an initiator shall assert ACK while using synchronous data transfers.
Sec. 4.7.X: Fast Cable Skew Delay (5 nanoseconds)
    When using the Fast SCSI option, the maximum difference in propagation time allowed between any two SCSI bus signals when measured between any two SCSI devices.
Sec. 4.7.X: Fast Deskew Delay (20 nanoseconds)

When using the Fast SCSI option, the minimum time required for deskew of certain signals. *The main components of this deskew delay are cable distortion and receiver skew.*

Sec. 4.7.X: Fast Hold Time (10 nanoseconds)

When using the Fast SCSI option, the minimum time added between the assertion of REQ or ACK and the changing of the data lines to provide hold time in the initiator or target, respectively, while using synchronous data transfers.

Sec. 4.7.X: Fast Negation Period (45 nanoseconds)

When using the Fast SCSI option, the minimum time that a target shall negate REQ while using synchronous data transfers. Also, the minimum time that an initiator shall negate ACK while using synchronous data transfers.

Sec. TBD: Implementors Note:

Fast Data Transfer times have been tested using the differential transceiver option with 25m of twisted pair cable as specified in Sec. 4.2. The transceivers were subjected to a maximum temperature difference of 25°C and a maximum of 200mV of Vcc difference.

Remaining Question: How to select the Fast SCSI times over the SCSI-1 timing parameters.

Solution 1:

Any time a synchronous transfer rate over X.X Mtransfers/sec. is negotiated, the Fast timing parameters shall be observed. (Selecting X.X is the problem here...)

Solution 2:

Any time a synchronous transfer rate over 4.0Mtransfers/sec. is negotiated, a linear curve is followed from the old time to the fast parameter. For example, the SCSI-1 assertion period is 90nS, the Fast SCSI assertion period is 45nS. If a transfer rate of 7.0Mtransfers/sec. is chosen, the resulting assertion period is 67.5nS, half way between 4.0 and 10.0Mtransfers/sec. and half way between 45 and 90nS.

Solution 3:

Add a single byte Fast SCSI message. This message would only make sense after synchronous transfers were successfully negotiated. If rejected (as all old systems would) the SCSI-1 values would be mandatory. If accepted, go with Fast SCSI. The problem is that new devices would not be backward compatible with old devices. (Alternatively, this might fit as a bit in the synchronous transfer message although I couldn't find a place to put it.)

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