Date: Sept. 12, 2000

To: T10 Committee (SCSI)

From: George Penokie (IBM)

Subject: Getting training started in SPI-4

Overview

The July SPI-4 working group accepted in principle that there were some problems with the timings associated with the indication of the start of a training pattern. The following shows the proposed corrections to this problem.

0.0.0.0.1 DT DATA IN phase training pattern

The target shall indicate a training pattern is going to occur on a DT DATA IN phase by asserting the SEL signal a minimum of two system deskew delays before asserting the REQ signal.

~~1) negating the SEL signal a minimum of two system deskew delays before changing the MSG, C/D, and I/O signals, and~~
~~2) asserting the SEL signal a minimum of two system deskew delays and a maximum of four deskew delays after asserting the MSG and I/O signals and negating the C/D.~~

Editors Note 1 - GOP: The above sets the latest the target can wait before it asserts SEL.

The target shall begin the section A of the training pattern only after all the signal restrictions between information transfers phases listed in 10.13 or the signal restrictions between a RESELECTION phase and a DT DATA IN phase listed in 10.7.2 are met. ~~no sooner than two system deskew delays one data release delay plus one bus settle delay after asserting the SEL I/O signal.~~ The target shall transmit the following training pattern:

Editors Note 2 - GOP: The above change is need because there is a requirement that the target cannot drive the bus until 800ns after asserting the I/O signal (see section 10.13)

Start of section A;
1) disable precompensation;
2) simultaneously assert REQ, P1, and DB(15-0,P_CRCA) signals;
3) wait the equivalent of 32 transfer periods (e.g., 200 ns at fast-160);
4) ~~s~~imultaneously negate REQ, P1, and DB(15-0,P_CRCA) signals;
5) wait the equivalent of 32 transfer periods;
6) set precompensation to negotiated state;
7) negate SEL signal;
8) simultaneously assert and negate REQ, P1, and DB(15-0,P_CRCA) signals at the negotiated transfer period 64 times ~~for 128 transfer periods~~, (e.g., (2 x 6,25 ns) x 64 = 800 ns at fast-160);

Start of section B;
1) wait the equivalent of 192 transfer periods from the first assertion of REQ in step 2 of section A (e.g., 1200 ns at fast-160);
2) ~~on the 128th transfer period negate~~ keep the P1, and DB(15-0,P_CRCA) signals negated while continuing to assert and negate REQ at the negotiated transfer period for the equivalent of 8 transfer periods (e.g., 50 ns at fast-160);
3) ~~negate~~ keep the REQ signal negated for the equivalent of 8 additional transfer periods;
4) simultaneously assert and negate P1 and DB(15-0,P_CRCA) signals at twice the negotiated

transfer period (i.e., simultaneously repeat a 1100b bit pattern 12 times on each signal) while asserting and negating REQ at the negotiated transfer period 24 times ~~for 48 transfer periods~~ (e.g., (2 x 6,25 ns) x 24 = 300 ns at fast-160);

Start of section C;

5) assert and negate REQ at the negotiated transfer period 64 times ~~for 128 transfer periods~~ and at the same time assert and negate P1 at twice the negotiated transfer period while repeating a 0000010011111011b bit pattern eight times on each of the DB(15-0,P_CRCA) signals (e.g., (2 x 6,25 ns) x 64 = 800 ns at fast-160); and
6) ~~After ACK negated for greater than 100 ns training pattern ends.~~

The initiator shall begin the training pattern ~~on detection of~~ if it detects the ~~assertion of the~~ SEL, ~~signal with~~ MSG, and I/O true and C/D false on the first assertion of the REQ signal. The initiator shall transmit the following training pattern:

Editors Note 3 - GOP: The above defines at what point the initiator decides whether to do a training pattern or not. This method adds no extra overhead to the normal start of a data phase.

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1) assert ACK signal within 200 ns of the first REQ assertion;
2) disable precompensation;
3) wait the equivalent of 32 transfer periods (e.g., 200 ns at fast-160);
4) negate ACK signal;
5) wait the equivalent of 32 transfer periods (e.g., 200 ns at fast-160);
6) set precompensation to negotiated state; and
7) assert and negate ACK signal at the negotiated transfer period 32 times ~~for 64 transfer periods~~, (e.g., (2 x 6,25) x 32 = 400 ns at fast-160).

At the completion of the training pattern the target continues asserting and negating the REQ signal at the negotiated transfer period (e.g., 6,25 ns transfer period at fast-160) and the P1 signal at twice the negotiated transfer period (e.g., 12 ns transfer period at fast-160). When the target is ready to transfer data it shall reverse the phase of P1 (see 10.8.4.3).

0.0.0.0.2 DT DATA OUT phase training pattern

The target shall request a training pattern on a DT DATA OUT phase by asserting the SEL signal a minimum of two system deskew delays before asserting the REQ signal.

~~1) negating the SEL signal a minimum of two system deskew delays before changing the MSG, C/D, and I/O signals, and~~
~~2) asserting the SEL signal a minimum of two system deskew delays and a maximum of four deskew delays after asserting the MSG signal and negating the C/D and I/O signals.~~

Editors Note 4 - GOP: The above sets the latest the target can wait before it asserts SEL.

The target shall begin the training pattern only after all the signal restrictions between information transfer phases listed in 10.13 or the signal restrictions between a SELECTION phase and a DT DATA OUT phase listed in 10.6.3 are met. ~~and no sooner than two system deskew delays after asserting the SEL REQ signal.~~ The target shall transmit the following training pattern:

Editors Note 5 - GOP: The above forces the target to follow the rule in 10.13 but still does not allow it to start training until after REQ.

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1) disable precompensation;
2) simultaneously assert REQ and P_CRCA signals;
3) wait the equivalent of 32 transfer periods (e.g., 200 ns at fast-160);
4) simultaneously negate REQ and P_CRCA signals;
5) wait 32 the equivalent of transfer periods (e.g., 200 ns at fast-160);
6) set precompensation to negotiated state;
7) negate SEL signal;
8) simultaneously assert and negate REQ and P_CRCA signals at the negotiated transfer period 32 times ~~for 64 transfer periods~~, (e.g., (2 x 6.25) x 32 = 400 ns at fast-160);
9) negate REQ and P_CRCA for at least ~~a minimum of~~ the equivalent of 16 transfer periods (e.g., 100 ns at fast-160); and
10) the target shall begin asserting and negating REQ to indicate to the initiator valid data may be sent. The number of REQ ~~transitions~~ assertions shall not exceed the negotiated offset.

Editors Note 6 - GOP: The above change from transitions to assertions assumes 00-311 passes. If it does not then the change must be reversed.

The initiator shall begin the section A of the training pattern ~~on detection of~~ if it detects the ~~assertion of the~~ SEL and ~~signal with~~ MSG true, and C/D and I/O false on the first assertion of the REQ signal. The initiator shall transmit the following training pattern:

Editors Note 7 - GOP: The above defines at what point the initiator decides whether to do a training pattern or not. This method adds no extra overhead to the normal start of a data phase.

Start of section A;

1) disable precompensation;
2) simultaneously assert ACK, P1, and DB(15-0) signals within the equivalent of 32 transfer periods of the first REQ assertion (e.g., 200 ns at fast-160);
3) wait the equivalent of 32 transfer periods (e.g., 200 ns at fast-160);
4) simultaneously negate ACK, P1, and DB(15-0) signals;
5) wait the equivalent of 32 transfer periods;
6) set precompensation to negotiated state;
7) simultaneously assert and negate ACK, P1, and DB(15-0) signals at the negotiated transfer period 64 times ~~for 128 transfer periods~~, (e.g., (2 x 6.25) x 64 = 800 ns at fast-160);

Start of section B;

1) wait the equivalent of 192 transfer periods from the first assertion of ACK in step 2 of section A (e.g., 1200 ns at fast-160);
2) ~~on the 128th transfer period negate~~ keep the P1, and DB(15-0) signals negated while continuing to assert and negate ACK at the negotiated transfer period for the equivalent of 8 transfer periods (e.g., 50 ns at fast-160);
3) ~~negate~~ keep the ACK signal negated for the equivalent of 8 additional transfer periods;
4) simultaneously assert and negate P1 and DB(15-0) signals at twice the negotiated transfer period (i.e., simultaneously repeat a 1100b bit pattern 12 times on each signal) while asserting and negating ACK at the negotiated transfer period 24 times ~~for 48 transfer periods~~ (e.g., (2 x 6.25 ns) x 24 = 300 ns at fast-160); and

Start of section C;

5) assert and negate ACK at the negotiated transfer period 64 times ~~for 128 transfer periods~~ and at the same time assert and negate P1 at twice the negotiated transfer period while repeating a 0000010011111011b bit pattern eight times on each of the DB(15-0) signals (e.g., (2 x 6.25 ns) x 64 = 800 ns at fast-160).

At the completion of the training pattern the initiator continues asserting and negating the ACK signal at the

negotiated transfer period (e.g., 6,25 ns transfer period at fast-160) and the P1 signal at twice the negotiated transfer period (e.g., 12 ns transfer period at fast-160). When the initiator is ready to transfer data and the REQ/ACK offset value is not zero ~~there are outstanding REQs~~ it shall reverse the phase of P1 (see 10.8.4.3).

0.0.0.0.3 Starting pacing transfers with no training pattern

~~The target shall not change the MSG, I/O or C/D signals until after detecting SEL false.~~

~~In DT DATA IN phase the target shall assure the SEL signal is negated for at least two dekew delays before the first assertion of REQ if no training pattern is going to be requested. If the SEL signal is not negated the target shall wait until the SEL signal is negated before the first assertion of REQ.~~

Before starting the DT DATA IN phase the target shall wait at least two deskew delays after the SEL signal is negated before the first assertion of the REQ signal.

The DT DATA IN phase without training starts on the first assertion of REQ if the SEL is not asserted.

The target shall begin pacing transfers only after meeting all the following:

a) signal restrictions between information transfer phases listed in 10.13;
b) the signal restrictions between a RESELECTION phase and a DT DATA IN phase listed in 10.7.2; or
c) the signal restrictions between a SELECTION phase and a DT DATA OUT phase listed in 10.6.3.

The target shall begin pacing transfers by:

~~At the start of a DT DATA IN phase without a training pattern (i.e., the SEL signal is not asserted at the start of the DT DATA phase), the target shall begin pacing transfers by:~~

~~1) The target shall begin asserting and negating the REQ signal at the negotiated transfer period 400 ns, or 800 ns if the previous phase was a DT DATA OUT phase, after asserting the MSG and I/O signals and negating the C/D;~~
2) simultaneously with the assertion of REQ the target shall begin asserting and negating P1 at twice the negotiated transfer period (e.g., 12,5 ns for fast-160);
3) target shall assert and negate P1 ~~for~~ at least 8 times ~~16 transfer periods~~ (e.g., (2 x 6,25 ns) x 8 = 100 ns at fast-160); and
4) the target may establish a data valid state as described in 10.8.4.3.1.

The DT DATA OUT phase without training starts on the first assertion of REQ if the SEL is not asserted.

~~At the start of a DT DATA OUT phase without a training pattern (i.e., the SEL signal is not asserted at the start of the DT DATA phase) the following target and initiator actions occur.~~

The target shall begin pacing transfers only after meeting all the following:

a) signal restrictions between information transfer phases listed in 10.13;
b) the signal restrictions between a RESELECTION phase and a DT DATA IN phase listed in 10.7.2; or
c) the signal restrictions between a SELECTION phase and a DT DATA OUT phase listed in 10.6.3.

The initiator shall begin pacing transfers by:

~~1) The initiator shall begin asserting and negating the ACK signal two system deskew delays after detecting the assertion of the MSG signal and negation of the C/D and I/O signals;~~
2) simultaneously with the assertion of ACK the initiator shall begin asserting and negating P1 at twice the negotiated transfer period (e.g., 12,5 ns for fast-160);

3) initiator shall assert and negate P1 ~~for~~ at least 8 times ~~16 transfer periods~~ (e.g., (2 x 6.25 ns) x 8 = 100 ns at fast-160); and
~~4) initiator shall wait for the assertion of the REQ signal; and~~
5) the initiator may establish a data valid state as described in 10.8.4.3.1.

~~The target shall not asset REQ until it has established the data invalid state by detecting valid assertions and negations on the ACK and P1 signals.~~