

T10/99-157r1

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To: T10 Committee (SCSI)

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Subject: Proposed modifications to SPI-3 description of DT CRC transfers.

### 11.xxxxxx P\_CRCA assertion and negation in DT data transfers

The target shall drive the P\_CRCA signal to a valid stable level a minimum of a CRC transmit setup time prior to each REQ transition, and hold it stable for a minimum of a CRC transmit hold time following each REQ transition

#### 11.1.5.2.2.2 CRC protected data field DT data transfer

If the I/O signal is true (transfer to the initiator), ~~the target shall negate the P\_CRCA signal within one deskew delay of starting the DT DATA phase (i.e., C/D negated and MSG asserted),~~ to transfer the data field the target shall drive the DB(15-0) signals to their desired values, ~~negate the P\_CRCA signal,~~ wait at least ~~the larger of a CRC setup time from the negation of P\_CRCA and a transmit setup time from DB(15-0) being driven with valid data,~~ then transition the REQ signal. The DB(15-0) signals shall be held valid for a minimum of one transmit hold time after the transition of the REQ signal. The target may then change or release the DB(15-0) signals. The target shall not change the REQ signal for a minimum of a transmit assertion period. The initiator shall read the value on the DB(15-0) signals within a receive hold time of the transition of the REQ signal. The initiator shall then respond with an ACK transition.

If the I/O signal is false (transfer to the target), ~~the target shall negate the P\_CRCA signal within one deskew delay of starting the DT DATA phase (i.e., C/D negated and MSG asserted),~~ to transfer the data field the initiator shall. after detecting a REQ transition ~~with P\_CRCA negated,~~ drive the DB(15-0) signals to their desired values, delay at least a transmit setup time, then transition the ACK signal. The initiator shall hold the DB(15-0) signals valid for at least a transmit hold time after the transition of the ACK signal. The initiator shall not change the ACK signal for a minimum of a transmit assertion period. The initiator may then change or release the DB(15-0) signals. The target shall read the value of the DB(15-0) signals within a receive hold time of the transition of the ACK.

~~The target shall not assert the P\_CRCA signal until the initiator has issued an ACK transition for each prior CRC byte. The target shall not transition REQ with P\_CRCA asserted for the current data group until the initiator has responded with all ACK transitions for the previous data group. This ensures the initiator is not required to maintain two simultaneous CRC calculations on different data groups.~~

#### 11.1.5.2.2.3 CRC protected pad field and CRC field DT data transfer to initiator

If the I/O signal is true (transfer to the initiator) and the target has completed the data field transfer of the current data group, the target shall first determine if pad field is required before the CRC field is transmitted (see 8.2.2.3). If a pad field is required the target shall:

- 1) Wait at least one CRC transmit hold time since the last REQ assertion.
- 2) Assert the P\_CRCA signal and drive the DB(15-0) signals to their desired pad values;
- 3) wait at least one CRC transmit setup time;
- 4) negate the REQ signal;
- 5) hold the DB(15-0) signals valid for a minimum of one transmit hold time;

- 6) hold the REQ signal negated for a minimum of a transmit assertion period;
- 7) drive the DB(15-0) signals to their desired CRC values;
- 8) wait at least one transmit setup time;
- 9) assert the REQ signal;
- 10) hold the DB(15-0) signals for a minimum of one transmit hold time;
- 11) hold the REQ signal asserted for a minimum of a transmit assertion period;
- 12) drive the DB(15-0) signals to their desired CRC values;
- 13) wait at least one transmit setup time;
- 14) negate the REQ signal;
- 15) hold the DB(15-0) signals for a minimum of one transmit hold time;
- 16) hold the P\_CRCA signal asserted for at least a CRC transmit hold time;
- ~~15) wait at least one CRC transmit hold time; and~~
- ~~16) negate the P\_CRCA signal.~~

If the target determines no pad field is required the target shall:

- 1) Wait at least one CRC transmit hold time since the last REQ negation.
- 2) Assert the P\_CRCA signal and drive the DB(15-0) signals to their desired CRC values;
- 3) wait at least one CRC transmit setup time;
- 4) assert the REQ signal;
- 5) hold the DB(15-0) signals for a minimum of one transmit hold time;
- 6) hold the REQ signal asserted for a minimum of a transmit assertion period;
- 7) drive the DB(15-0) signals to their desired CRC values;
- 8) wait at least one transmit setup time;
- 9) negate the REQ signal;
- 10) hold the DB(15-0) signals for a minimum of one transmit hold time;
- 11) hold the P\_CRCA signal asserted for a minimum of one CRC transmit hold time;
- ~~10) wait at least one CRC transmit hold time; and~~
- ~~11) negate the P\_CRCA signal.~~

After either of the above sequences is complete the target has ended a data group:

The initiator shall read the value on the DB(15-0) signals within one receive hold time of the transition of the REQ signal. The initiator shall then respond with an ACK transition.

The initiator shall continue to use the pad bytes, if any, for checking against the computed CRC for the current data group. Upon receipt of the last byte of the CRC field, the received CRC and computed CRC shall be compared. If they do match (i.e., no CRC error). then the initiator shall negate the ACK signal.

If received CRC and computed CRC do not match (i.e., a CRC error is detected), or if an improperly formatted data group is transferred, then the initiator shall establish an attention condition (see 11.2.1) by asserting the ATN signal before the ACK signal is negated for the last bytes of the CRC field. When the target switches to a MESSAGE OUT phase the initiator shall send an INITIATOR DETECTED ERROR message (see 12.7.2.5) to the target. This message notifies the target that data contained within the data group was invalid.

If the target does not retry transferring the information transfer or it exhausts its retry limit the target shall go into a STATUS phase and send a CHECK CONDITION status with a sense key set to ABORTED COMMAND and an additional sense code set to INITIATOR DETECTED ERROR MESSAGE RECEIVED for the task associated with the received INITIATOR DETECTED ERROR message.

#### 11.1.5.2.2.4 CRC protected pad field and CRC field DT data transfer to target

If the I/O signal is false (transfer to the target) and the initiator determines the data field transfer is complete by detecting an assertion of the P\_CRCA signal, **the initiator must first transfer data bytes for the ACKs required to match all REQs received prior to the REQ which had P\_CRCA asserted.** The initiator shall

determine if pad field is required before the CRC field is transmitted (see 8.2.2.3). If a pad field is required, the initiator shall first transfer the two pad bytes, then the four bytes of CRC. If a pad field is not required, the initiator shall transfer the four CRC bytes. During the transfer, the rules in effect for the currently negotiated transfer rate and synchronous offset apply. The target may continue to send REQs (within the negotiated offset) for the next data group

If a pad field is required the initiator shall:

- ~~1) Wait for the target to negate the REQ signal;~~
- 1) Transfer data bytes for all outstanding REQs received prior to the REQ which had P\_CRCA asserted.
- 2) drive the DB(15-0) signals to their desired pad values;
- 3) delay at least one transmit setup time;
- 4) negate the ACK signal;
- 5) hold the DB(15-0) signals valid for a minimum of one transmit hold time;
- 6) hold the ACK signal negated for a minimum of a transmit assertion period;
- 7) delay at least one transmit setup time;
- 8) drive the DB(15-0) signals to their desired CRC values;
- 9) delay at least one transmit setup time;
- 10) assert the ACK signal;
- 11) hold the DB(15-0) signals valid for a minimum of one transmit hold time;
- 12) hold the ACK signal asserted for a minimum of a transmit assertion period;
- 13) delay at least one transmit setup time;
- 14) drive the DB(15-0) signals to their desired CRC values;
- 15) delay at least one transmit setup time;
- 16) negate the ACK signal;
- 17) hold the DB(15-0) signals valid for a minimum of one transmit hold time;
- 18) hold the ACK signal negated for a minimum of a transmit assertion period;
- 19) delay at least one transmit setup time;
- 20) wait for the target to negate the P\_CRCA signal;

If no pad field is required the initiator shall:

- ~~1) Wait for the target to assert the REQ signal;~~
- 1) Transfer data bytes for all outstanding REQs received prior to the REQ which had P\_CRCA asserted.
- 2) drive the DB(15-0) signals to their desired CRC values;
- 3) delay at least one transmit setup time;
- 4) assert the ACK signal;
- 5) hold the DB(15-0) signals valid for a minimum of one transmit hold time;
- 6) hold the ACK signal asserted for a minimum of a transmit assertion period;
- 7) delay at least one transmit setup time;
- 8) drive the DB(15-0) signals to their desired CRC values;
- 9) delay at least one transmit setup time;
- 10) negate the ACK signal;
- 11) hold the DB(15-0) signals valid for a minimum of one transmit hold time;
- 12) hold the ACK signal negated for a minimum of a transmit assertion period;
- 13) delay at least one transmit setup time;
- 14) wait for the target to negate the P\_CRCA signal;

After either of the above sequences is complete the target has ended a data group.

The target shall read the value of the DB(15-0) signals within one receive hold time of the transition of the ACK signal.

The initiator shall use the pad bytes, if any, in the generation of the transmitted CRC. The target shall then use those pad bytes, if any, for checking against the computed CRC for the current data group. Upon receipt of the last byte of the CRC field, the received CRC and computed CRC shall be compared. If they

do match (i.e., no CRC error). then the target may transfer another data group or transition to another phase.