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To: X3T9.2 Committee (SCSI)

From: Gerry Houlder MPI/CDC

Subject: Pinouts for double density alternative 2 connector

This proposal suggests an easy way to upgrade to a 2 byte wide SCSI bus while remaining within the form factor of the existing alternative 2 connector (also known as the ribbon connector). The advantages of this idea are as follows:

* The double density ribbon connector provides for 100 pins in the same connector housing as the existing 50 pin connector described in Appendix D. This doesn't provide enough pins to add 3 data bytes plus 2 lines to control odd byte transfers, so the proposal only adds lines for 8 data lines, 1 parity line, 1 odd byte control line, a CABLE SENSE line to detect connection of a 50 pin connector with the 100 pin connector, and another TERMPWR pin. This leaves up to 13 pairs of unused lines for future definition (my proposal suggests GROUND for some of these).

* The existing ribbon connector is the most popular shielded connector for SCSI. It makes sense to remain compatible with an accepted shielded option when many users of a 2 byte wide SCSI will use external peripheral subsystems.

* The double density connector can mate with the existing 50 pin ribbon connector without harming system operation. The system cannot operate in 2 byte wide mode, but the current 1 byte wide SCSI can still operate. The CABLE SENSE signal detects the 50 pin connector and disables 2 byte wide mode in the same way that DIFFSENS disables the differential drivers if a single-ended device is connected to the SCSI bus.

* Cables made with the 100 pin connector can be used with devices that only use the existing 50 pin connector. The resulting use of 2 wires in the cable for each of the 50 contacts lowers the resistance of the cable and the redundant wire and contact increases the reliability (because one bad contact or one bad wire won't break the connection). Shielded, round cable with 50 pairs of 28 ga. wire is only slightly larger than a cable with 25 pairs of 28 ga. wire and it is just as flexible.

* The addition of a second data byte to the interface will double the maximum data transfer rate.

* The increased data rate is achieved without increasing the amount of real estate required for the connector. More room will probably be required by the extra circuitry for the additional interface lines, however. This is the most space effective proposal so far to accommodate two byte wide data transfers.

* The existing Wide SCSI Transfer message can still allow each peripheral to negotiate for 1 or 2 byte wide transfers as desired.

* This proposal includes pinouts for both differential and single-ended driver options.

There are some disadvantages that must be noted, however. They are listed here:

- A new terminator is required for the 100 pin versus the 50 pin style. Further, the new terminator cannot be used in a 50 pin SCSI bus unless it were designed to sense which type of connector it is plugged into and connect/disconnect the extra resistors accordingly. This may not be cost effective or reliable enough.

- Because of the terminator differences, 50 pin devices should not be mixed with 100 pin devices on the same bus. If the 50 pin devices were all at the same end of the bus, however, a 100 pin to 50 pin adaptor module could allow coexistence. The module would pass through the original SCSI signals and provide termination resistors for the new signals. A "100 pin terminator" would be at one end of the bus and a "50 pin terminator" would be at the other end. The adaptor module could be the same size as the terminator modules now available for Apple SCSI applications.

Pinouts for differential and single-ended versions of the 100 pin connector are on the following pages. The pinouts maintain the existing pin numbers and shows the additional pins as a "B" suffix of the pin that it would be shorted to if a 50 pin connector were mated to the 100 pin connector. The actual connector probably won't be numbered this way, but this makes it easier to visualize potential problems of mating a 50 pin connector with the 100 pin connector.

The new signals in the cables are as follows:

DB lines - Data lines 8 through 15 and parity line P1 are added. During data transfers, these lines are validated by the existing REQ and ACK lines during 2 byte wide, data phase transfers.

ODDBYTE line - When in 2 byte transfer mode, this line is driven to show that only the Data bits 0-7, P are valid. When it is not driven, it indicates that all Data and parity bits are valid.

CABLSENS (Cable Sense) line - This connects to a circuit like in Figure 4-8 of the SCSI-2 draft. When a 50 pin connector is plugged into a 100 pin connector, the connection to GROUND causes the circuit to disable any drivers on the DB 8-15, P, and ODDBYTE lines.

Cable A - shielded - Differential Pin Assignments

Signal Name	Pin Number		Signal Name
GROUND	1	26	GROUND
GROUND	1B	26B	GROUND
+DB(0)	2	27	-DB(0)
+DB(8)	2B	27B	-DB(8)
+DB(1)	3	28	-DB(1)
+DB(9)	3B	28B	-DB(9)
+DB(2)	4	29	-DB(2)
+DB(10)	4B	29B	-DB(10)
+DB(3)	5	30	-DB(3)
+DB(11)	5B	30B	-DB(11)
+DB(4)	6	31	-DB(4)
+DB(12)	6B	31B	-DB(12)
+DB(5)	7	32	-DB(5)
+DB(13)	7B	32B	-DB(13)
+DB(6)	8	33	-DB(6)
+DB(14)	8B	33B	-DB(14)
+DB(7)	9	34	-DB(7)
+DB(15)	9B	34B	-DB(15)
+DB(P)	10	35	-DB(P)
+DB(P1)	10B	35B	-DB(P1)
-DIFFSENS	11	36	GROUND
NO CONNECT	11B	36B	-CABLSENS
GROUND	12	37	GROUND
GROUND	12B	37B	GROUND
TERMPWR	13	38	TERMPWR
TERMPWR	13B	38B	TERMPWR
GROUND	14	39	GROUND
GROUND	14B	39B	GROUND
+ATN	15	40	-ATN
NO CONNECT	15B	40B	NO CONNECT
GROUND	16	41	GROUND
+ODDBYTE	16B	41B	-ODDBYTE
+BSY	17	42	-BSY
NO CONNECT	17B	42B	NO CONNECT
+ACK	18	43	-ACK
NO CONNECT	18B	43B	NO CONNECT
+RST	19	44	-RST
NO CONNECT	19B	44B	NO CONNECT
+MSG	20	45	-MSG
NO CONNECT	20B	45B	NO CONNECT
+SEL	21	46	-SEL
NO CONNECT	21B	46B	NO CONNECT
+C/D	22	47	-C/D
NO CONNECT	22B	47B	NO CONNECT
+REQ	23	48	-REQ
NO CONNECT	23B	48B	NO CONNECT
+I/O	24	49	-I/O
NO CONNECT	24B	49B	NO CONNECT
GROUND	25	50	GROUND
GROUND	25B	50B	GROUND

Cable A - shielded - Single-Ended Pin Assignments

NOTE: Pins 13 and 13B shall be left open. Pins 1-12, 1B-12B, 14-25, and 14B-25B shall be connected to ground.

Signal	Pin Number
-DB(0)	26
-DB(8)	26B
-DB(1)	27
-DB(9)	27B
-DB(2)	28
-DB(10)	28B
-DB(3)	29
-DB(11)	29B
-DB(4)	30
-DB(12)	30B
-DB(5)	31
-DB(13)	31B
-DB(6)	32
-DB(14)	32B
-DB(7)	33
-DB(15)	33B
-DB(P)	34
-DB(P1)	34B
GROUND	35
GROUND	35B
GROUND	36
-CABLSENS	36B
GROUND	37
GROUND	37B
TERMPWR	38
TERMPWR	38B
GROUND	39
GROUND	39B
GROUND	40
GROUND	40B
-ATN	41
NO CONNECT	41B
GROUND	42
-ODDBYTE	42B
-BSY	43
NO CONNECT	43B
-ACK	44
NO CONNECT	44B
-RST	45
NO CONNECT	45B
-MSG	46
NO CONNECT	46B
-SEL	47
NO CONNECT	47B
-C/D	48
NO CONNECT	48B
-REQ	49
NO CONNECT	49B
-I/O	50
NO CONNECT	50B

There are good reasons for choosing the pinouts suggested here.

* All nine control lines would be shorted to a "no connect" if a 50 pin connector were mated with this connector. This means they wouldn't be shorted to another terminator and become double-terminated in this situation. Although data lines 0-7, P would get shorted to an adjacent terminator, the bus should still be good enough to allow operation in some situations.

* The DIFFSENS pin would be shorted to a "no connect" also. This assures that the DIFFSENS line works properly even if a 50 pin connector were attached.

* The CABLSENS pin would short to ground. This is required for this pin to do its job properly. If it doesn't disable the drivers for data bits 8-15, P, and ODDBYTE, they could be damaged by being connected to ground or a driver for another data bit.

* The ODDBYTE pin would short to ground. With the polarity chosen for this line, a device would only expect data lines 0-7 to be valid when this is grounded (lines 8-15 would be the same as 0-7 because they would be shorted together in this situation).

* The existing GROUND pins would short to another ground. This minimizes the chances of damaging a driver when a 50 pin connector is mated. With this pinout, ODDBYTE is the only signal whose driver may be damaged by being connected to ground.

* The existing TERMPWR would short to another TERMPWR line. If it shorted to anything else, an overcurrent condition can result.