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PCI-SIG ENGINEERING CHANGE NOTICE

TITLE:	OCuLink Wiring Chart ECN
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AFFECTED DOCUMENT:	OCuLink 1.0
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Part I:

1. Summary of the Functional Changes

a. The connector and cable assembly pinout tables have been revised to show the complete OCuLink pinout assignments in all cases.
b. The two left-most columns in the cable pinout tables have been combined for clarity.
c. Due to the fact that the pinout tables span multiple pages, P1/P2 designations have been included in the appropriate column titles of the cable pinout tables to make it easier to follow which end of the cable is being addressed on each page in each table.

2. Benefits as a Result of the Changes

The changes provided will make it much easier for users to follow the pinouts for the plugs at each end of the cable interface.

3. Assessment of the Impact

Less chance of connection errors provides better quality

4. Analysis of the Hardware Implications

Less chance of connection errors during design and/or assembly. VSP lines that are recommended for use with REFCLK must be differentially coupled through the cable.

5. Analysis of the Software Implications

None

NOTE: This ECR incorporates changes from the BP Type and CPRSNT# ECRs.

Part II: Sections 2.3, 3.2, 3.3, and 6.7

NOTICE NOTICE NOTICE NOTICE NOTICE

2.3. Signal Description

Table 2-1. Signal Description

Signal	Description
…	…
5 V Power	External applications have optional end to end implementations for +5 V supplied by the root only.
…	…

3.2. Internal Connector Pinouts

- See Table 6-9 for the Full Crossover Internal Cable wiring.
- The sideband signal assignment differs between the Downstream Port and Upstream Port.
- The Fixed side must provide the 3.3 V to support the optional active cable.

3.2.1 Pinout for x4 Fixed Internal Connector (Downstream Port~~root~~)

- ~~See Table 6-9 for the Full Crossover Internal Cable wiring.~~
- ~~The sideband signal assignment differs between the root and end point.~~
- ~~The Fixed side must provide the 3.3 V to support the optional active cable~~

Table 3-1. Pinout for x4 Fixed Internal Connectors (Downstream Port~~root~~)

~~Pin #~~	~~Description~~	~~Mating Sequence of cable to board~~		~~Pin #~~	~~Description~~
~~Row Offset – no pin this side~~			~~2nd~~	~~B1~~	~~RESERVED~~
~~A1~~	~~POWER 3.3 Vact RX~~	~~2nd~~	~~1st~~	~~B2~~	~~GROUND~~
~~A2~~	~~GROUND~~	~~1st~~	~~2nd~~	~~B3~~	~~PETp0~~
~~A3~~	~~PERp0~~	~~2nd~~	~~2nd~~	~~B4~~	~~PETn0~~
~~A4~~	~~PERn0~~	~~2nd~~	~~1st~~	~~B5~~	~~GROUND~~
~~A5~~	~~GROUND~~	~~1st~~	~~2nd~~	~~B6~~	~~PETp1~~
~~A6~~	~~PERp1~~	~~2nd~~	~~2nd~~	~~B7~~	~~PETn1~~
~~A7~~	~~PERn1~~	~~2nd~~	~~1st~~	~~B8~~	~~GROUND~~
~~A8~~	~~GROUND~~	~~1st~~	~~2nd~~	~~B9~~	~~2-WIRE CLOCK~~
~~A9~~	~~BP TYPE~~	~~2nd~~	~~2nd~~	~~B10~~	~~2-WIRE DATA~~
~~A10~~	~~CWAKE#~~	~~2nd~~	~~1st~~	~~B11~~	~~GROUND~~
~~A11~~	~~GROUND~~	~~1st~~	~~2nd~~	~~B12~~	~~PERST#~~
~~A12~~	~~VSP~~	~~2nd~~	~~2nd~~	~~B13~~	~~CPRSNT#~~
~~A13~~	~~VSP~~	~~2nd~~	~~1st~~	~~B14~~	~~GROUND~~
~~A14~~	~~GROUND~~	~~1st~~	~~2nd~~	~~B15~~	~~PETp2~~
~~A15~~	~~PERp2~~	~~2nd~~	~~2nd~~	~~B16~~	~~PETn2~~
~~A16~~	~~PERn2~~	~~2nd~~	~~1st~~	~~B17~~	~~GROUND~~
~~A17~~	~~GROUND~~	~~1st~~	~~2nd~~	~~B18~~	~~PETp3~~
~~A18~~	~~PERp3~~	~~2nd~~	~~2nd~~	~~B19~~	~~PETn3~~
~~A19~~	~~PERn3~~	~~2nd~~	~~1st~~	~~B20~~	~~GROUND~~
~~A20~~	~~GROUND~~	~~1st~~	~~2nd~~	~~B21~~	~~POWER 3.3 Vact TX~~
~~A21~~	~~RESERVED~~	~~2nd~~	~~Row Offset – no pin this side~~		

Mating Level	Description	Pin #		Description	Mating Level
Row offset- no pin this side			B1	POWER 5V #1 (see Note 1)	2nd
2nd	POWER 3.3 Vact #1 (see Note 2)	A1	B2	GROUND	1st
1st	GROUND	A2	B3	PETp0	2nd
2nd	PERp0	A3	B4	PETn0	2nd
2nd	PERn0	A4	B5	GROUND	1st
1st	GROUND	A5	B6	PETp1	2nd
2nd	PERp1	A6	B7	PETn1	2nd
2nd	PERn1	A7	B8	GROUND	1st
1st	GROUND	A8	B9	2-WIRE CLOCK	2nd
2nd	BP TYPE/ VSP (see Note 3)	A9	B10	2-WIRE DATA	2nd
2nd	CWAKE# (see Note 4)	A10	B11	GROUND	1st
1st	GROUND	A11	B12	PERST#	2nd
2nd	VSP (see Note 5)	A12	B13	CPRSNT#	2nd
2nd	VSP (see Note 5)	A13	B14	GROUND	1st
1st	GROUND	A14	B15	PETp2	2nd
2nd	PERp2	A15	B16	PETn2	2nd
2nd	PERn2	A16	B17	GROUND	1st
1st	GROUND	A17	B18	PETp3	2nd
2nd	PERp3	A18	B19	PETn3	2nd
2nd	PERn3	A19	B20	GROUND	1st
1st	GROUND	A20	B21	POWER 3.3 Vact #2 (see Note 2)	2nd
2nd	POWER 5V #2 (see Note 1)	A21	Row offset- no pin this side		

Notes:

1. Option for 5 V power not permitted for internal cables; this pin must not be reassigned.
2. Assigned for use with optional active cables only. Pins must not be commoned; e.g., pins must be able to operate independently of each other.
3. This pin is assigned to report Backplane Type; however, once Backplane Type has been determined, the Controller/Root may use this pin for some other user/ vendor-specific purpose.
4. This pin is permitted to support OBFF in addition to CWAKE#. Refer to the Card Electromechanical (CEM) specification for more information on OBFF.
5. These pins may be used to implement clocking architecture. For information on implementation, refer to Table 2-2.

3.2.2 Pinout for x4 Fixed Internal Connector (Upstream Port~~end point~~)

- ~~See Table 6-9 for the Full Crossover Internal Cable wiring.~~
- ~~The sideband signal assignment differs between the root and end point.~~
- ~~The Fixed side must provide the 3.3 V to support the optional active cable.~~

Table 3-2. Pinout for x4 Fixed Internal Connectors (Upstream Port~~end point~~)

Mating Level	Description	Pin #		Description	Mating Level
Row offset- no pin this side			B1	POWER 5V #1 (see Note 1)	2nd
2nd	POWER 3.3 Vact #1 (see Note 2)	A1	B2	GROUND	1st
1st	GROUND	A2	B3	PETp0	2nd
2nd	PERp0	A3	B4	PETn0	2nd
2nd	PERn0	A4	B5	GROUND	1st
1st	GROUND	A5	B6	PETp1	2nd
2nd	PERp1	A6	B7	PETn1	2nd
2nd	PERn1	A7	B8	GROUND	1st
1st	GROUND	A8	B9	BP TYPE/ VSP (see Note 3)	2nd
2nd	2-WIRE CLOCK	A9	B10	CWAKE# (see Note 4)	2nd
2nd	2-WIRE DATA	A10	B11	GROUND	1st
1st	GROUND	A11	B12	VSP (see Note 5)	2nd
2nd	PERST#	A12	B13	VSP (see Note 5)	2nd
2nd	CPRSNT#	A13	B14	GROUND	1st
1st	GROUND	A14	B15	PETp2	2nd
2nd	PERp2	A15	B16	PETn2	2nd
2nd	PERn2	A16	B17	GROUND	1st
1st	GROUND	A17	B18	PETp3	2nd
2nd	PERp3	A18	B19	PETn3	2nd
2nd	PERn3	A19	B20	GROUND	1st
1st	GROUND	A20	B21	POWER 3.3 Vact #2 (see Note 2)	2nd
2nd	POWER 5V #2 (see Note 1)	A21	Row offset- no pin this side		

Notes:

1. Option for 5 V power not permitted for internal cables; this pin must not be reassigned.
2. Assigned for use with optional active cables only. Pins must not be commoned; e.g., pins must be able to operate independently of each other.

3. This pin is assigned to report Backplane Type; however, once Backplane Type has been determined, the Controller/Root may use the pin for some other user/ vendor-specific purpose.
4. This pin is permitted to support OBFF in addition to CWAKE#. Refer to the Card Electromechanical (CEM) specification for more information on OBFF.
5. These pins may be used to implement clocking architecture. For information on implementation, refer to Table 2-2.

Pin #	Description	Mating Sequence of cable to board		Pin #	Description
Row Offset – no pin this side			2nd	B1	RESERVED
A1	POWER 3.3 Vact RX	2nd	1st	B2	GROUND
A2	GROUND	1st	2nd	B3	PETp0
A3	PERp0	2nd	2nd	B4	PETn0
A4	PERn0	2nd	1st	B5	GROUND
A5	GROUND	1st	2nd	B6	PETp1
A6	PERp1	2nd	2nd	B7	PETn1
A7	PERn1	2nd	1st	B8	GROUND
A8	GROUND	1st	2nd	B9	BP TYPE
A9	2-WIRE CLOCK	2nd	2nd	B10	CWAKE#
A10	2-WIRE DATA	2nd	1st	B11	GROUND
A11	GROUND	2nd	2nd	B12	VSP
A12	PERST#	2nd	2nd	B13	VSP
A13	CPRSNT#	2nd	1st	B14	GROUND
A14	GROUND	1st	2nd	B15	PETp2
A15	PERp2	2nd	2nd	B16	PETn2
A16	PERn2	2nd	1st	B17	GROUND
A17	GROUND	1st	2nd	B18	PETp3
A18	PERp3	2nd	2nd	B19	PETn3
A19	PERn3	2nd	1st	B20	GROUND
A20	GROUND	1st	2nd	B21	POWER 3.3 Vact TX
A21	RESERVED	2nd	Row Offset – no pin this side		

NOTICE NOTICE NOTICE NOTICE NOTICE

3.3 External Connector Pinouts

- See Table 6-10 for x4 Free External Passive and Active Cable wiring.
- The sideband signal assignment is the same on the Downstream Port and Upstream Port.
- The Fixed side must provide the 3.3 V to support the optional active cable.
- The Fixed side must provide the 5 V for to support optional Power.

3.3.1 Pinout for x4 Fixed External Connectors (Upstream Port & Downstream Port~~root and end point~~)

- ~~See Table 6-10 for x4 Free External Passive and Active Cable wiring.~~
- ~~The sideband signal assignment is the same on the root and end point.~~
- ~~The Fixed side must provide the 3.3 V to support the optional active cable.~~
- ~~The Fixed side must provide the 5 V for optional Power.~~

Table 3-3. Pinout for x4 Fixed External Connector (~~root and end point~~Upstream Port & Downstream Port)

~~Pin #~~	~~Description Root~~	~~Mating Sequence of cable to board~~	~~Pin #~~	~~Description~~
~~Row Offset – no pin this side~~		~~2nd~~	~~B1~~	~~POWER 5 V #1~~
~~A1~~	~~POWER 3.3 Vact RX~~	~~2nd~~	~~1st~~	~~B2~~	~~GROUND~~
~~A2~~	~~GROUND~~	~~1st~~	~~2nd~~	~~B3~~	~~PETp0~~
~~A3~~	~~PERp0~~	~~2nd~~	~~2nd~~	~~B4~~	~~PETn0~~
~~A4~~	~~PERn0~~	~~2nd~~	~~1st~~	~~B5~~	~~GROUND~~
~~A5~~	~~GROUND~~	~~1st~~	~~2nd~~	~~B6~~	~~PETp1~~
~~A6~~	~~PERp1~~	~~2nd~~	~~2nd~~	~~B7~~	~~PETn1~~
~~A7~~	~~PERn1~~	~~2nd~~	~~1st~~	~~B8~~	~~GROUND~~
~~A8~~	~~GROUND~~	~~1st~~	~~2nd~~	~~B9~~	~~2-WIRE CLOCK~~
~~A9~~	~~UNASSIGNED~~	~~2nd~~	~~2nd~~	~~B10~~	~~2-WIRE DATA~~
~~A10~~	~~CWAKE#~~	~~2nd~~	~~1st~~	~~B11~~	~~GROUND~~
~~A11~~	~~GROUND~~	~~1st~~	~~2nd~~	~~B12~~	~~PERST#~~
~~A12~~	~~VSP~~	~~2nd~~	~~2nd~~	~~B13~~	~~CPRSNT#~~
~~A13~~	~~VSP~~	~~2nd~~	~~1st~~	~~B14~~	~~GROUND~~
~~A14~~	~~GROUND~~	~~1st~~	~~2nd~~	~~B15~~	~~PETp2~~
~~A15~~	~~PERp2~~	~~2nd~~	~~2nd~~	~~B16~~	~~PETn2~~
~~A16~~	~~PERn2~~	~~2nd~~	~~1st~~	~~B17~~	~~GROUND~~
~~A17~~	~~GROUND~~	~~1st~~	~~2nd~~	~~B18~~	~~PETp3~~
~~A18~~	~~PERp3~~	~~2nd~~	~~2nd~~	~~B19~~	~~PETn3~~
~~A19~~	~~PERn3~~	~~2nd~~	~~1st~~	~~B20~~	~~GROUND~~
~~A20~~	~~GROUND~~	~~1st~~	~~2nd~~	~~B21~~	~~POWER 3.3 Vact TX~~
~~A21~~	~~POWER 5 V #2~~	~~2nd~~	~~Row Offset – no pin this side~~		

Mating Level	Description	Pin #		Description	Mating Level
Row offset- no pin this side			B1	POWER 5V #1 (see Note 1)	2nd
2nd	POWER 3.3 Vact #1 (see Note 2)	A1	B2	GROUND	1st
1st	GROUND	A2	B3	PETp0	2nd
2nd	PERp0	A3	B4	PETn0	2nd
2nd	PERn0	A4	B5	GROUND	1st
1st	GROUND	A5	B6	PETp1	2nd
2nd	PERp1	A6	B7	PETn1	2nd
2nd	PERn1	A7	B8	GROUND	1st
1st	GROUND	A8	B9	2-WIRE CLOCK	2nd
2nd	UNASSIGNED	A9	B10	2-WIRE DATA	2nd
2nd	CWAKE# (see Note 3)	A10	B11	GROUND	1st
1st	GROUND	A11	B12	PERST#	2nd
2nd	VSP (see Note 4)	A12	B13	CPRSNT#	2nd
2nd	VSP (see Note 4)	A13	B14	GROUND	1st
1st	GROUND	A14	B15	PETp2	2nd
2nd	PERp2	A15	B16	PETn2	2nd
2nd	PERn2	A16	B17	GROUND	1st
1st	GROUND	A17	B18	PETp3	2nd
2nd	PERp3	A18	B19	PETn3	2nd
2nd	PERn3	A19	B20	GROUND	1st
1st	GROUND	A20	B21	POWER 3.3 Vact #2 (see Note 2)	2nd
2nd	POWER 5V #2 (see Note 1)	A21	Row offset- no pin this side		

Notes:

1. Assigned for optional 5V power only; reassignment of this pin is not permitted. Pins must not be commoned; e.g., pins must be able to operate independently of each other.
2. Assigned for use with optional active cables only. Pins must not be commoned; e.g., pins must be able to operate independently of each other.
3. This pin is permitted to support OBFF in addition to CWAKE#. Refer to the Card Electromechanical (CEM) specification for more information on OBFF.
4. These pins may be used to implement clocking architecture. For information on implementation, refer to Table 2-2.

6.7 Free Cable Assembly Wiring Charts

~~All Internal ribbon cables are to be wired as complete crossovers.~~

~~Internal unassigned pins to be wired to enable crossover functionality~~

Internal and External cable assemblies are not interchangeable; refer to sections 6.7.1 and 6.7.2 for details regarding Internal and External cables, respectively.~~.~~

- ~~External 5 V power does not crossover~~

6.7.1. Wiring Chart for x4 Internal Cables

- See ~~Internal Connector Pinout~~ Table 3-1 and Table 3-2 for Internal cable pinouts.
- ~~The wiring charts for~~ Passive and Active cable assemblies are the same; they are crossover cables.
- Active cables are defined as having active components only within the cable plug.
- The Fixed side must provide the 3.3 V to support optional active cable plugs (no wire passes down the cable).

Table 6-9. Wiring Chart for x4 Internal Passive and Active Crossover Cables

P1 Row Position	Downstream Port	Cable Termination & Signal Direction	Upstream Port	P2 Row Position
A1 (Bevel)	POWER 3.3 Vact #1 (see Note 1)	NO WIRE	POWER 5V #1 (see Note 5)	B1
A2	GROUND	———	GROUND	B2
A3	PERp0	←———	PETp0	B3
A4	PERn0	←———	PETn0	B4
A5	GROUND	———	GROUND	B5
A6	PERp1	←———	PETp1	B6
A7	PERn1	←———	PETn1	B7
A8	GROUND	———	GROUND	B8
A9	BP TYPE/ VSP (see Note 2)	<---------	BP TYPE/ VSP (see Note 2)	B9
A10	CWAKE# (see Note 3)	<---------	CWAKE# (see Note 3)	B10
A11	GROUND	———	GROUND	B11
A12	VSP (see Note 4)	———	VSP	B12
A13	VSP (see Note 4)	———	VSP	B13
A14	GROUND	———	GROUND	B14
A15	PERp2	←———	PETp2	B15
A16	PERn2	←———	PETn2	B16
A17	GROUND	———	GROUND	B17
A18	PERp3	←———	PETp3	B18
A19	PERn3	←———	PETn3	B19
A20	GROUND	———	GROUND	B20
A21	POWER 5V #2 (see Note 5)	NO WIRE	POWER 3.3 Vact #2 (see Note 1)	B21

Table continued on next page.

	Row	ROOT/ Downstream	Cable Termination & Signal Direction	Row	END POINT/ Upstream
1	A1	POWER 3.3 Vact RX	NO WIRE	B1	RESERVED
2	A2	GROUND	———	B2	GROUND
3	A3	PERp0	←	B3	PETp0
4	A4	PERn0	←	B4	PETn0
5	A5	GROUND	———	B5	GROUND
6	A6	PERp1	←	B6	PETp1
7	A7	PERn1	←	B7	PETn1
8	A8	GROUND	———	B8	GROUND
9	A9	BP TYPE	←	B9	BP TYPE
10	A10	CWAKE# (Note 1)	←	B10	CWAKE#
11	A11	GROUND	———	B11	GROUND
12	A12	VSP	———	B12	VSP
13	A13	VSP	———	B13	VSP
14	A14	GROUND	———	B14	GROUND
15	A15	PERp2	←	B15	PETp2
16	A16	PERn2	←	B16	PETn2
17	A17	GROUND	———	B17	GROUND
18	A18	PERp3	←	B18	PETp3
19	A19	PERn3	←	B19	PETn3
20	A20	GROUND	———	B20	GROUND
21	A21	RESERVED	NO WIRE	B21	POWER 3.3 Vact TX

Note:

CWAKE# is permitted to also be used for OBFF and if both ends support OBFF the signal becomes bidirectional.

Table 6-9. ~~(Cont'd).~~ Wiring Chart for x4 Internal Passive and Active Crossover Cables (continued from previous page)~~.~~

P1 Row Position	Downstream Port	Cable Termination & Signal Direction	Upstream Port	P2 Row Position
B1	POWER 5V #1 (see Note 5)	NO WIRE	POWER 3.3 Vact #1 (see Note 1)	A1 (Bevel)
B2	GROUND		GROUND	A2
B3	PETp0		PERp0	A3
B4	PETn0		PERn0	A4
B5	GROUND		GROUND	A5
B6	PETp1		PERp1	A6
B7	PETn1		PERn1	A7
B8	GROUND		GROUND	A8
B9	2-WIRE CLOCK		2-WIRE CLOCK	A9
B10	2-WIRE DATA		2-WIRE DATA	A10
B11	GROUND		GROUND	A11
B12	PERST#		PERST#	A12
B13	CPRSNT#		CPRSNT#	A13
B14	GROUND		GROUND	A14
B15	PETp2		PERp2	A15
B16	PETn2		PERn2	A16
B17	GROUND		GROUND	A17
B18	PETp3		PERp3	A18
B19	PETn3		PERn3	A19
B20	GROUND		GROUND	A20
B21	POWER 3.3 Vact #2 (see Note 1)	NO WIRE	POWER 5V #2 (see Note 5)	A21

Notes:

1. Assigned for use with optional active cables only. Pins must not be commoned; e.g., pins must be able to operate independently of each other.
2. If this pin is used for BP Type, the signal direction is from Upstream Port to Downstream Port. If this pin is used for VSP, the signal direction is defined by the vendor.
3. If this pin is used for CWAKE#, the signal direction is from Upstream Port to Downstream Port. If this pin is used for OBFF and both ends support OBFF, the signal becomes bidirectional. Refer to the Card Electromechanical (CEM) specification for more information on OBFF.
4. These wires must be built to support the transmission of low speed, differential signals. They may be used to implement clocking architecture; for information on implementation, refer to Table 2-2.
5. Option for 5 V power not permitted for internal cables; this pin must not be reassigned.

	Row	ROOT/ Downstream	Cable Termination & Signal Direction	Row	END POINT/ Upstream
1	B1	RESERVED	NO WIRE	A1	POWER 3.3 Vact RX
2	B2	GROUND		A2	GROUND
3	B3	PETp0		A3	PERp0
4	B4	PETn0		A4	PERn0
5	B5	GROUND		A5	GROUND
6	B6	PETp1		A6	PERp1
7	B7	PETn1		A7	PERn1
8	B8	GROUND		A8	GROUND
9	B9	2-WIRE CLOCK		A9	2-WIRE CLOCK
10	B10	2-WIRE DATA		A10	2-WIRE DATA
11	B11	GROUND		A11	GROUND
12	B12	PERST#		A12	PERST#
13	B13	CPRSNT#		A13	CPRSNT#
14	B14	GROUND		A14	GROUND
15	B15	PETp2		A15	PERp2
16	B16	PETn2		A16	PERn2
17	B17	GROUND		A17	GROUND
18	B18	PETp3		A18	PERp3
19	B19	PETn3		A19	PERn3
20	B20	GROUND		A20	GROUND
21	B21	POWER 3.3 Vact TX	NO WIRE	A21	RESERVED

6.7.2. Wiring Chart for x4 External Cables

- See External Connector Pinout Table 3-3.

NOTICE NOTICE NOTICE NOTICE NOTICE

- This is not a full crossover cable~~,~~ only the high speed lines crossover.
- The wiring charts for Passive and Active cable assemblies are the same.
- Active cables are defined as having active components only within the cable plug.
- The Fixed side must provide the 3.3 V to support ~~an~~ optional active cable plugs (no wire passes down the cable).
- The Fixed side must provide the 5 V for Optional Power cables.

Table 6-10. Wiring Chart for x4 External Passive and Active Cables; with and without Power

	Row	ROOT/ Downstream	Cable Termination & Signal Direction	Row	END POINT/ Upstream
1	A1	POWER 3.3 Vact RX	NO WIRE	A1	POWER 3.3 Vact RX
2	A2	GROUND	———	B2	GROUND
3	A3	PERp0	←———	B3	PETp0
4	A4	PERn0	←———	B4	PETn0
5	A5	GROUND	———	B5	GROUND
6	A6	PERp1	←———	B6	PETp1
7	A7	PERn1	←———	B7	PETn1
8	A8	GROUND	———	B8	GROUND
9	A9	UNASSIGNED	———	A9	UNASSIGNED
10	A10	CWAKE# (Note 1)	←———	A10	CWAKE#
11	A11	GROUND	———	B11	GROUND
12	A12	VSP	———	A12	VSP
13	A13	VSP	———	A13	VSP
14	A14	GROUND	———	B14	GROUND
15	A15	PERp2	←———	B15	PETp2
16	A16	PERn2	←———	B16	PETn2
17	A17	GROUND	———	B17	GROUND
18	A18	PERp3	←———	B18	PETp3
19	A19	PERn3	←———	B19	PETn3
20	A20	GROUND	———	B20	GROUND
21	A21	POWER 5 V #2	AS REQUIRED	A21	POWER 5 V #2

Note:

1. CWAKE# is permitted to also be used for OBFF and if both ends support OBFF the signal becomes bidirectional.

NOTICE NOTICE NOTICE NOTICE NOTICE

P1 Row Position	Downstream Port	Cable Termination & Signal Direction	Upstream Port	P2 Row Position
A1 (Bevel)	POWER 3.3 Vact #1 (see Note 1)	NO WIRE	POWER 3.3 Vact #1 (see Note 1)	A1 (Bevel)
A2	GROUND	———	GROUND	B2
A3	PERp0	←———	PETp0	B3
A4	PERn0	←———	PETn0	B4
A5	GROUND	———	GROUND	B5
A6	PERp1	←———	PETp1	B6
A7	PERn1	←———	PETn1	B7
A8	GROUND	———	GROUND	B8
A9	UNASSIGNED	———	UNASSIGNED	A9
A10	CWAKE# (see Note 2)	<- - - - - - - -	CWAKE# (see Note 2)	A10
A11	GROUND	———	GROUND	B11
A12	VSP (see Note 4)	———	VSP (see Note 4)	A12
A13	VSP (see Note 4)	———	VSP (see Note 4)	A13
A14	GROUND	———	GROUND	B14
A15	PERp2	←———	PETp2	B15
A16	PERn2	←———	PETn2	B16
A17	GROUND	———	GROUND	B17
A18	PERp3	←———	PETp3	B18
A19	PERn3	←———	PETn3	B19
A20	GROUND	———	GROUND	B20
A21	POWER 5V #2 (see Note 3)	AS NEEDED	POWER 5V #2 (see Note 3)	A21

Table continued on next page.

Table 6-10. ~~(Cont'd).~~ Wiring Chart for x4 External Passive and Active Crossover Cables, with and without Power (continued from previous page)

	~~Row~~	~~ROOT/ Downstream~~	~~Cable Termination & Signal Direction~~	~~Row~~	~~END POINT/ Upstream~~
~~1~~	~~B1~~	~~POWER 5 V #1~~	~~AS REQUIRED~~	~~B1~~	~~POWER 5 V #1~~
~~2~~	~~B2~~	~~GROUND~~		~~A2~~	~~GROUND~~
~~3~~	~~B3~~	~~PETp0~~		~~A3~~	~~PERp0~~
~~4~~	~~B4~~	~~PETn0~~		~~A4~~	~~PERn0~~
~~5~~	~~B5~~	~~GROUND~~		~~A5~~	~~GROUND~~
~~6~~	~~B6~~	~~PETp1~~		~~A6~~	~~PERp1~~
~~7~~	~~B7~~	~~PETn1~~		~~A7~~	~~PERn1~~
~~8~~	~~B8~~	~~GROUND~~		~~A8~~	~~GROUND~~
~~9~~	~~B9~~	~~2-WIRE CLOCK~~	~~AS REQUIRED~~	~~B9~~	~~2-WIRE CLOCK~~
~~10~~	~~B10~~	~~2-WIRE DATA~~	~~AS REQUIRED~~	~~B10~~	~~2-WIRE DATA~~
~~11~~	~~B11~~	~~GROUND~~		~~A11~~	~~GROUND~~
~~12~~	~~B12~~	~~PERST#~~		~~B12~~	~~PERST#~~
~~13~~	~~B13~~	~~CPRSNT#~~		~~B13~~	~~CPRSNT#~~
~~14~~	~~B14~~	~~GROUND~~		~~A14~~	~~GROUND~~
~~15~~	~~B15~~	~~PETp2~~		~~A15~~	~~PERp2~~
~~16~~	~~B16~~	~~PETn2~~		~~A16~~	~~PERn2~~
~~17~~	~~B17~~	~~GROUND~~		~~A17~~	~~GROUND~~
~~18~~	~~B18~~	~~PETp3~~		~~A18~~	~~PERp3~~
~~19~~	~~B19~~	~~PETn3~~		~~A19~~	~~PERn3~~
~~20~~	~~B20~~	~~GROUND~~		~~A20~~	~~GROUND~~
~~21~~	~~B21~~	~~POWER 3.3 Vact TX~~	~~NO WIRE~~	~~B21~~	~~POWER 3.3 Vact TX~~

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P1 Row Position	Downstream Port	Cable Termination & Signal Direction	Upstream Port	P2 Row Position
B1	POWER 5V #1 (see Note 3)	AS NEEDED	POWER 5V #1 (see Note 3)	B1
B2	GROUND	———	GROUND	A2
B3	PETp0	→	PERp0	A3
B4	PETn0	→	PERn0	A4
B5	GROUND	———	GROUND	A5
B6	PETp1	→	PERp1	A6
B7	PETn1	→	PERn1	A7
B8	GROUND	———	GROUND	A8
B9	2-WIRE CLOCK	AS NEEDED	2-WIRE CLOCK	B9
B10	2-WIRE DATA	AS NEEDED	2-WIRE DATA	B10
B11	GROUND	———	GROUND	A11
B12	PERST#	→	PERST#	B12
B13	CPRSNT#	←	CPRSNT#	B13
B14	GROUND	———	GROUND	A14
B15	PETp2	→	PERp2	A15
B16	PETn2	→	PERn2	A16
B17	GROUND	———	GROUND	A17
B18	PETp3	→	PERp3	A18
B19	PETn3	→	PERn3	A19
B20	GROUND	———	GROUND	A20
B21	POWER 3.3 Vact #2 (see Note 1)	NO WIRE	POWER 3.3 Vact #2 (see Note 1)	B21

Notes:

1. Assigned for use with optional active cables only. Pins must not be commoned; e.g., pins must be able to operate independently of each other.
2. If this pin is used for CWAKE#, the signal direction is from Upstream Port to Downstream Port. If this pin is used for OBFF and both ends support OBFF, the signal becomes bidirectional. Refer to the Card Electromechanical (CEM) specification for more information on OBFF.
3. Assigned for use with optional 5V power only; reassignment of this pin is not permitted. Pins must not be commoned; e.g., pins must be able to operate independently of each other.
4. These wires must be built to support the transmission of low speed, differential signals. They may be used to implement clocking architecture; for information on implementation, refer to Table 2-2.