03-240r0 SAS-1.1 Internal wide connector and cable

To:T10 Technical CommitteeFrom:Rob Elliott, HP (elliott@hp.com)Date:2 July 2003Subject:03-240r0 SAS-1.1 Internal wide connector and cable

Revision history

Revision 0 (2 July 2003) First revision

Related documents

sas-r04a - Serial Attached SCSI revision 4a sff-8484 - 4-Wide Internal Serial Attachment Connector (Brian Miller, Amphenol)

<u>Overview</u>

A 4-wide internal cable and connector solution is being designed for connecting controllers (e.g. PCI cards) to backplanes. It is intended to be used in place of: 4 SATA host connectors (on the controller) to 4 separate SATA cables to 4 SATA host connectors (on the backplane). This cable/connector is being proposed for both SATA II and SAS.

Figure 1 shows the connector. It follows the design of the SATA host connector. Either a round cable or a ribbon-like cable could be used.

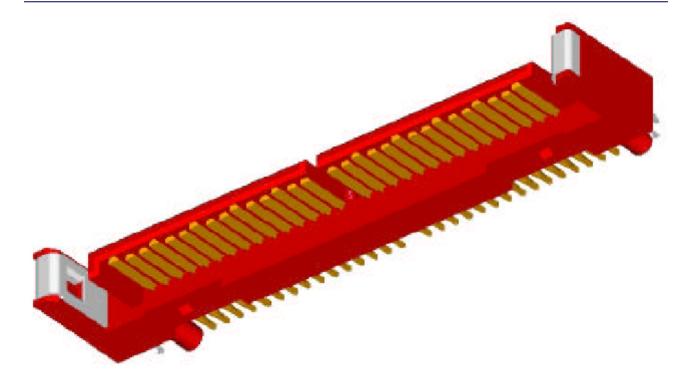


Figure 1 — 4-wide connector picture (from Amphenol)

The connector includes 4 high-speed serial channels and 4 sideband signals (in the middle). It is split into two tongues for stability.

SAS-1.1 should define signal assignments for this connector.

Suggested changes

[Add reference to SFF document]

5.2.3 Connectors

Figure 2 shows the internal wide cable environment.

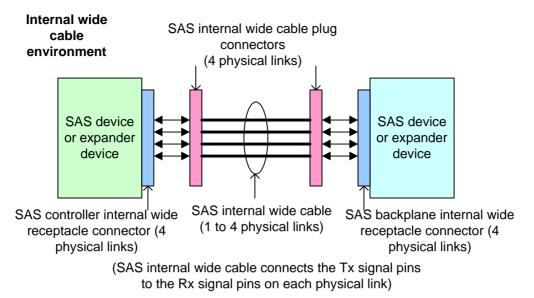


Figure 2 — Internal wide cable environment

The internal wide connectors have different pinouts for the controller side and the backplane side so one side's Tx signals are attached to the other side's Rx signals. Two controllers may also be attached together, provided all four physical links are used, since one side's physical link 0 is attached to the other side's physical link 3.

The internal wide connector contains 4 vendor-specific sideband signals which are crossed when attaching a controller to a backplane but are not crossed when attaching a controller to a controller.

Table 1 summarizes the connectors defined in this standard.

Type of connector	Physical links	Reference	Attaches to	Physical links	Reference
SAS plug	2		SAS internal cable receptacle	1 or 2	
			SAS backplane receptacle	2	
SAS internal cable SATA-style signal cable receptacle	1	ATA/ATAPI -7 V3	SATA-style host plug	1	ATA/ATAPI -7 V3
SAS internal cable	1 or 2		SAS plug	2	
receptacle	1012		SATA device plug	1	SATA
SAS backplane			SAS plug	2	
receptacle	2		SATA device plug	1	ATA/ATAPI -7 V3
SAS internal wide receptacle	<u>4</u>	<u>0.0.0</u>	SAS internal wide cable plug	<u>4</u>	<u>0.0.0</u>
SAS external cable plug	4		SAS external receptacle	4	
SAS external receptacle	4		SAS external cable plug	4	

 Table 1 — Connectors

0.0.0.1 SAS internal wide cable plug connector

SAS internal wide cables shall use the SAS internal wide cable plug connector. The SAS internal wide cable plug connector is defined in SFF-8484. The SAS internal wide cable plug connector attaches to a SAS internal wide receptacle connector, providing contact for up to four physical links.

Table 2 and table 3 define the pin assignments.

0.0.0.2 SAS internal wide receptacle connector

The SAS internal wide receptacle connector is defined in SFF-8484. The SAS internal wide receptacle connector attaches to a SAS internal wide cable plug connector, providing contact for up to four physical links.

Table 2 and table 3 define the pin assignments.

0.0.0.3 SAS internal wide connector pin assignments

Table 2 defines how the connector signal pairs are used in internal wide connectors for controller applications using one, two, three, or four of the physical links. Internal wide cables should be labeled to indicate how many physical links are included (e.g., 1X, 2X, 3X, and 4X on each connector's housing). The sideband signals are vendor-specific.

Signal	Signal pin to use based on number of physical links supported by the cable					
	One	Two	Three	Four		
Rx 0+	S2	S2	S2	S2		
Rx 0-	S3	S3	S3	S3		
Tx 0-	S5 S5 S5		S5			
Tx 0+	S6	S6	S6	S6		
Rx 1+	N/C	S8	S8	S8		
Rx 1-	N/C	S9	S9	S9		
Tx 1-	N/C	S11	S11	S11		
Tx 1+	N/C	S12	S12	S12		
Sideband 0	SB14	SB14	SB14	SB14		
Sideband 1	SB15	SB15	SB15	SB15		
Sideband 2	SB16	SB16	SB16	SB16		
Sideband 3	SB17	SB17	SB17	SB17		
Rx 2+	N/C	N/C	S19	S19		
Rx 2-	N/C	N/C	S20	S20		
Tx 2-	N/C	N/C	S22	S22		
Tx 2+	N/C	N/C	S23	S23		
Rx 3+	N/C	N/C	N/C	S25		
Rx 3-	N/C	N/C	N/C	S26		
Tx 3-	N/C	N/C	N/C	S28		
Tx 3+	N/C	N/C	N/C	S29		
SIGNAL GROUND	G1, G4, G7, G10, G13, G18, G21, G24, G27, G30					
CHASSIS GROUND	Housing					
Key: N/C = not connected						

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Table 3 defines how the connector signal pairs are used in internal wide connectors for backplane applications using one, two, three, or four of the physical links. Internal wide cables should be labeled to indicate how many physical links are included (e.g., 1X, 2X, 3X, and 4X on each connector's housing). The sideband signals are vendor-specific.

Signal	Signal pin to use based on number of physical links supported by the cable					
	One Two		Three	Four		
Rx 3+	\$2	S2	S2	S2		
Rx 3-	S3	S3	S3	S3		
Tx 3-	S5	S5	S5	S5		
Tx 3+	S6	S6	S6	S6		
Rx 2+	N/C	S8	S8	S8		
Rx 2-	N/C	S9	S9	S9		
Tx 2-	N/C	S11	S11	S11		
Tx 2+	N/C	S12	S12	S12		
Sideband 3	SB14	SB14	SB14	SB14		
Sideband 2	SB15	SB15	SB15	SB15		
Sideband 1	SB16	SB16	SB16	SB16		
Sideband 0	SB17	SB17	SB17	SB17		
Rx 1+	N/C	N/C	S19	S19		
Rx 1-	N/C	N/C	S20	S20		
Tx 1-	N/C	N/C	S22	S22		
Tx 1+	N/C	N/C	S23	S23		
Rx 0+	N/C	N/C	N/C	S25		
Rx 0-	N/C	N/C	N/C	S26		
Tx 0-	N/C	N/C	N/C	S28		
Tx 0+	N/C	N/C	N/C	S29		
SIGNAL GROUND	G1, G4, G7, G10, G13, G18, G21, G24, G27, G30					
CHASSIS GROUND	Housing					
Key: N/C = not connected						

Table 3 — Backplane physical link usage in SAS internal wide connector

5.2.4 Cables

0.0.0.4 SAS internal wide cables

SAS internal wide cables shall use a SAS internal wide cable receptacle connector on each end. One connector shall have its key on the other side, causing the Tx pins on one side to route to the Rx pins on the other side.

Figure 3 shows the SAS internal wide cable attaching two controllers.

SAS internal wide cable assembly

G30 GROUND G30 S29 TX3+ S29 S28 TX3- S28 G27 GROUND G27 G26 RX3- S26 S25 RX3+ S25 S26 S5 S5 S27 GROUND G27 G4 G4 G4 G24 GROUND G24 S23 TX2+ S23 S23 TX2+ S23 S23 TX2+ S23 S24 G7 G7 G21 GROUND G24 S21 S8 S8 S22 TX2+ S23 S20 RX2- S20 S21 G10 G10 GROUN S20 RX2- S20 S11 S11 TX1+ S12 S12 TX1+ S12 S12 TX1+ S13 G13 GROUND S14 S15 S15 S16 S14 SIDEBAND1 S13 S17 S19 S19	ID ID
S29 TX3+ S29 S28 TX3- S28 G27 GROUND G27 S26 RX3- S26 S25 RX3+ S25 G24 GROUND G24 G21 G7 G7 G22 S9 S9 S23 TX2+ S23 S23 TX2+ S22 S20 S11 S11 S21 G10 G10 G10 G21 GROUND G21 G10 G10 G10 S20 RX2- S20 S11 S11 TX1- S19 RX2+ S19 S12 S12 TX1+ G18 GROUND G18 G13 G13 GROUN SB14 SIDEBAND3 SB17 SB16 SB16 SB16 SB16 SB14 SIDEBAND1 SB15 SB17 SB17 SB17 SB17 SB16 SB14 SIDEBAND2 SB16 SB16 SB16 SB16 SB16 S12 T	ID ID
G27 GROUND G27 S26 RX3- S26 S25 RX3+ S25 G24 GROUND G24 G24 GROUND G24 G27 G7 G7 G24 GROUND G24 G27 S25 S8 S23 TX2+ S23 S22 S9 S9 G21 GROUND G21 G21 GROUND G21 G21 GROUND G21 G10 G10 G10 G10 G10 GROUND S20 S11 S11 S11 S11 TX1- S19 RX2+ S19 G13 G13 G13 SB16 SIDEBAND3 SB17 SB16 SB14 SIDEBAND1 SB15 SB16 SB16 SB16 SB17 SB17 SB18 SB17 SB17 SB17 SB17 SB17 S12 <td>ID</td>	ID
S26 RX3- S26 S5 S5 TX0- S25 RX3+ S25 S6 S6 TX0+ G24 GROUND G24 G7 G7 GROUN S23 TX2+ S23 S8 S8 RX1+ S22 TX2- S22 S9 S9 RX1- G21 GROUND G21 G10 G10 GROUND S20 RX2- S20 S11 S11 TX1- S19 RX2+ S19 G13 G13 G13 GROUND SB17 SIDEBAND3 SB17 SB14 SB14 SIDEBA SB16 SIDEBAND2 SB16 SB15 SB15 SIDEBA SB14 SIDEBAND0 SB14 SB15 SB17 SB17 SIDEBA S11 TX1+ S12 S17 SIDEBA SB16 SIDEBA S14 SIDEBAND0 SB14 SB15 SB17 SB17 SIDEBA S12 TX1+ S12 S19 S19 R12 S19	ID
S25 RX3+ S25 S6 S6 TX0+ G24 GROUND G24 G7 G7 GROUND S23 TX2+ S23 S8 S8 RX1+ S22 TX2- S22 S9 S9 RX1- G21 GROUND G21 G10 G10 GROUND S20 RX2- S20 S11 S11 TX1- S19 RX2+ S19 G13 G13 G13 GROUND SB17 SIDEBAND3 SB17 SB14 SIDEBAND3 SB17 SB15 SB15 SIDEBA SB16 SIDEBAND2 SB16 SB15 SB16 SB16 SIDEBA SB14 SIDEBAND1 SB15 SB16 SB16 SIDEBA SB14 SIDEBAND0 SB14 G18 G18 G18 G18 G18 S11 TX1+ S12 S17 SB17 SIDEBA SB16 SB16 SIDEBA S12 TX1+ S12 S19 S19 RX2+ S19 S19	
G24 GROUND G24 G7 G7 GROUND S23 TX2+ S23 S8 S8 RX1+ S22 TX2- S22 S9 S9 RX1- G21 GROUND G21 G10 G10 GROUND S20 RX2- S20 S11 S11 TX1- S19 RX2+ S19 G13 G13 GROUND SB17 SIDEBAND3 SB17 SB14 SIDEBAND2 SB16 SB14 SIDEBAND2 SB16 SB15 SB15 SB16 SIDEBAND3 SB14 SIDEBAND1 SB15 SB16 SB16 SIDEBA SB14 SIDEBAND1 SB15 SB16 SIDEBA SB14 SIDEBAND0 SB14 G18 G18 G18 G13 GROUND G13 S17 SB17 SIDEBA S12 TX1+ S12 S17 S19 S19 S19 RX2+ S11 TX1- S11 S19 S19 RX2+ S19 S19 S20	
S23 TX2+ S23 S22 TX2- S22 G21 GROUND G21 G21 GROUND G21 S20 RX2- S20 S11 S11 TX1- S19 RX2+ S19 G18 GROUND G13 SB17 SIDEBAND3 SB17 SB16 SIDEBAND2 SB16 SB14 SIDEBAND1 SB15 SB14 SIDEBAND1 SB15 SB14 SIDEBAND1 SB15 SB14 SIDEBAND1 SB14 S11 SX17 SIDEBAND1 S11 SX17 SIDEBAND2 SB14 SIDEBAND1 SB15 SB14 SIDEBAND0 SB14 S11 SX1+ S10 S11 SX1+ S10 S11 S11 S11 S12 SX1+ S12 S11 S12 S11 S11 TX1+ S11 S11 TX1+ S11 S11 <td< td=""><td></td></td<>	
S22 TX2- S22 S9 S9 RX1- G21 GROUND G21 G10 G10 GROUND S20 RX2- S20 S11 S11 TX1- S19 RX2+ S19 G13 G13 GROUND SB17 SIDEBAND3 SB17 SB14 SB14 SIDEBAN SB16 SIDEBAND2 SB16 SB15 SB15 SIDEBA SB14 SIDEBAND1 SB15 SB16 SB16 SIDEBA SB14 SIDEBAND1 SB15 SB16 SB16 SB16 SB14 SIDEBAND0 SB14 SB16 SB16 SIDEBA SB14 SIDEBAND1 SB15 SB16 SB16 SIDEBA SB14 SIDEBAND0 SB14 SB17 SIDEBA S11 TX1+ S12 S17 SIDEBA S12 TX1+ S12 S19 S19 S19 RX2+ S11 TX1- S11 S20 S20 RX2- G10 GROUND G10 G21	D
G21 GROUND G21 S20 RX2- S20 S11 S11 S11 S19 RX2+ S19 G18 GROUND G18 SB17 SIDEBAND3 SB17 SB16 SIDEBAND2 SB16 SB14 SIDEBAND1 SB15 SB14 SIDEBAND0 SB14 SB14 SIDEBAND0 SB14 SB14 SIDEBAND1 SB15 SB14 SIDEBAND0 SB14 S11 SB17 SB16 SB14 SIDEBAND0 SB14 S11 SB15 SB16 SB14 SIDEBAND0 SB14 S11 SB17 SB17 SB16 SB16 SB16 SB17 SB17 SB17 SB17 SB17 SB17 S11 TX1+ S12 S11 TX1+ S12 S11 TX1- S11 G10 GROUND G10 S9 RX1- S9	ID
S20 RX2- S20 S19 RX2+ S19 G18 GROUND G18 SB17 SIDEBAND3 SB17 SB16 SIDEBAND2 SB16 SB14 SIDEBAND1 SB15 SB14 SIDEBAND2 SB16 SB14 SIDEBAND1 SB15 SB14 SIDEBAND0 SB14 G13 GROUND G13 S11 S11 TX1+ S11 S11 S11 S12 S12 TX1+ S16 SIDEBAND1 SB15 SB14 SIDEBAND0 SB14 S11 S11 S11 S11 S12 S11 S11 S11 S11 S11 S11 S11 S12 S11 S11 S12 TX1+ S12 S11 S11 S19 S12 TX1+ S11 S11 TX1- S11 G10 G20 S20 S20 S22 S	ID
S19 RX2+ S19 S12 S12 TX1+ G18 GROUND G18 G13 G13 GROUND SB17 SIDEBAND3 SB17 SB14 SB14 SIDEBAND2 SB16 SIDEBAND1 SB15 SB15 SB15 SIDEBA SB14 SIDEBAND1 SB15 SB16 SB16 SIDEBA SB14 SIDEBAND0 SB14 SB15 SB16 SB16 SIDEBA SB14 SIDEBAND0 SB14 SB15 SB16 SB16 SIDEBA S12 TX1+ S11 S12 S17 SI17 SIDEBA G13 GROUND G13 G18 G18 G18 GROUND S12 TX1+ S12 S19 S19 RX2+ S11 TX1- S11 S20 S20 RX2- G10 G21 G21 G21 G21 G21 G21 G21 GROUND S9 RX1- S9 S22 S22 TX2- S22 S22 S22 S22	
G18 GROUND G18 SB17 SIDEBAND3 SB17 SB16 SIDEBAND2 SB16 SB14 SIDEBAND1 SB15 SB14 SIDEBAND1 SB15 SB14 SIDEBAND1 SB15 SB14 SIDEBAND1 SB15 SB14 SIDEBAND0 SB14 S12 TX1+ S11 TX1- G10 GROUND G10 S9 RX1- S9	
SB17SIDEBAND3SB17SB16SIDEBAND2SB16SB16SIDEBAND1SB14SIDEBAND1SB14SIDEBAND0SB14SIDEBAND0SB14SIDEBAND0SB14SB15SB14SIDEBAND0G13GROUNDG13G18S12TX1+S11TX1-G10GROUNDS9RX1-S17S12S17S12S17S12S17S12S18S19S19S19S10G21G21G21G21G21G21G21S22S23S22S23S22S23S22S23S23S23S23S24S24S25S24S25S25S25S25S25S25S25S25S25S25S25S25S25S25 <td></td>	
SB16SIDEBAND2SB16SB15SB15SB15SIDEBASB14SIDEBAND0SB15SB16SB16SB16SIDEBAG13GROUNDG13G18G18G18GROUNDS12TX1+S12S19S19S19RX2+S11TX1-S11S20S20RX2-G10GROUNDG10G21G21G21GROUNDS9RX1-S9S22S22TX2-	D
SB14 SIDEBAND1 SB15 SB16 SB16 SB16 SIDEBA SB14 SIDEBAND0 SB14 SB17 SB17 SIDEBA G13 GROUND G13 G18 G18 G18 G18 GROUND S12 TX1+ S12 S19 S19 S19 RX2+ S11 TX1- S11 G10 G21 G21 G21 G21 GROUND S9 RX1- S9 S9 S12 TX2- S20 S22 TX2-	ND0
SB14 SIDEBAND0 SB14 SB17 SB17 SB17 SIDEBA G13 GROUND G13 G18 G18 GROUND S12 TX1+ S12 S19 S19 S19 RX2+ S11 TX1- S11 G10 G21 G21 G21 G21 GROUND S9 RX1- S9 S9 S10 S22 S22 TX2-	ND1
G13 GROUND G13 S12 TX1+ S12 S11 TX1- S11 G10 GROUND G10 S9 RX1- S9	ND2
S12 TX1+ S12 S19 S19 RX2+ S11 TX1- S11 S20 S20 RX2- G10 GROUND G10 G21 G21 G21 GROUND S9 RX1- S9 S9 S20 S22 TX2-	
S11 TX1- S11 S20 S20 RX2- G10 GROUND G10 G21 G21 G21 GROUND S9 RX1- S9 S2 S22 TX2-	D
G10 GROUND S9 RX1- S9 G10 G21 G21 GROUN S22 S22 TX2-	
S9 RX1- S9 S22 S22 TX2-	
	D
S8 RX1+ S8 S23 S23 TX2+	
G7 GROUND G7 G24 G24 GROUN	D
S6 TX0+ S6 S25 S25 RX3+	
S5 TX0- S5 S26 RX3-	
G4 GROUND G4 G27 G27 GROUN	ID
S3 RX0- S3 S28 X3-	
S2 RX0+ S2 S29 TX3+	
G1 GROUND G1 G30 G30 GROUN	D
SAS internal wide plug connector for a Key controller Key receptacle connector SAS internal w controller controller	

Figure 3 — SAS internal wide cable attaching controller to controller

NOTE 1 - For controller to controller applications, all four physical links should be used, because one side's physical link 0 is the other side's physical link 3. If both sides just used physical link 0, they would not communicate. The sideband signals are also crossed.

Figure 4 shows the SAS internal wide cable being used to attach a controller to a backplane.

G30 GROUND	G30	1	G1	G1	GROUND
S29 TX3+	S29		S2	S2	RX3+
S28 TX3-	S28		S3	S3	RX3-
G27 GROUND	G27		G4	G4	GROUND
S26 RX3-	S26		S5	S5	TX3-
S25 RX3+	S25		S6	S6	TX3+
G24 GROUND	G24		G7	G7	GROUND
S23 TX2+	S23		S8	S8	RX2+
S22 TX2-	S22		S9	S9	RX2-
G21 GROUND	G21		G10	G10	GROUND
S20 RX2-	S20		S11	S11	TX2-
S19 RX2+	S19		S12	S12	TX2+
G18 GROUND	G18		G13	G13	GROUND
SB17 SIDEBAND3	SB17		SB14	SB14	SIDEBAND3
SB16 SIDEBAND2	SB16		SB15	SB15	SIDEBAND2
SB14 SIDEBAND1	SB15		SB16	SB16	SIDEBAND1
SB14 SIDEBAND0	SB14	4>	SB17	SB17	SIDEBAND0
G13 GROUND	G13		G18	G18	GROUND
S12 TX1+	S12		S19	S19	RX1+
S11 TX1-	S11		S20	S20	RX1-
G10 GROUND	G10		G21	G21	GROUND
S9 RX1-	S9	►	S22	S22	TX1-
S8 RX1+	S8	►	S23	S23	TX1+
G7 GROUND	G7		G24	G24	GROUND
S6 TX0+	S6		S25	S25	RX0+
S5 TX0-	S5		S26	S26	RX0-
G4 GROUND	G4		G27	G27	GROUND
S3 RX0-	S3	►	S28	S28	TX0-
S2 RX0+	S2		S29	S29	TX0+
G1 GROUND	G1		G30	G30	GROUND
					▲
	1	\sim			
SAS internal wide	/	SAS internal wide ca	ble		nternal wide
plug connector for a	Key	receptacle connect			nnector for a
controller				ba	ckplane

SAS internal wide cable assembly

Figure 4 — SAS internal wide cable attaching controller to backplane

NOTE 2 - For controller to backplane applications, up to four physical links may be used. The sideband signals are not crossed.