Emerging PCIe SSD Client & Enterprise Configurations

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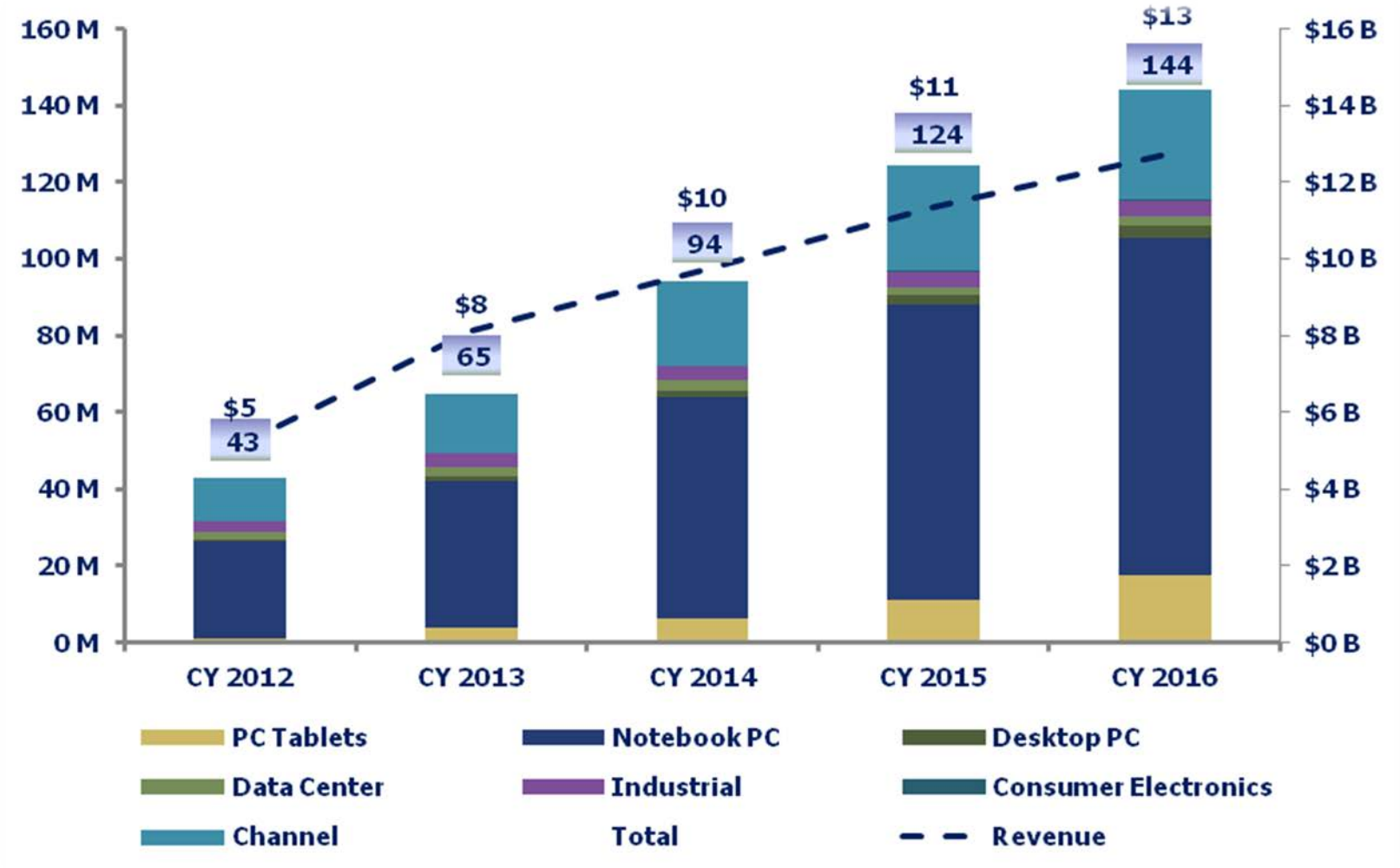
Client SSD Product Marketing Manager

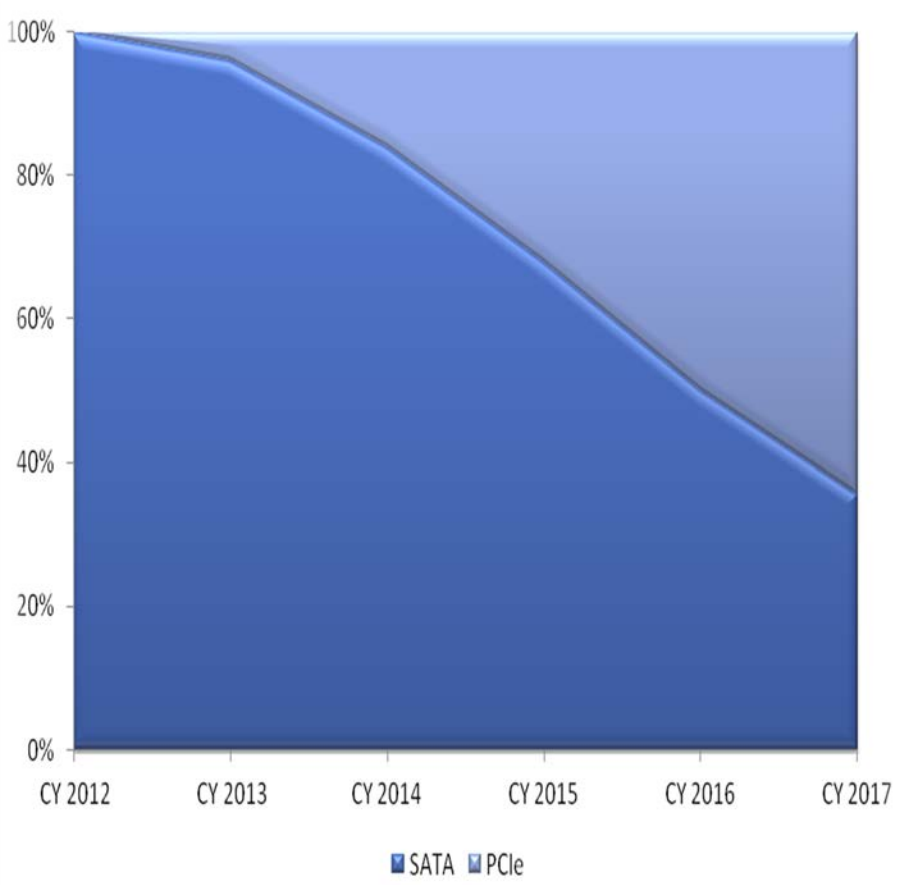
Ultrathin/Notebook and Tablet PCs fueling 47% Client SSD CAGR



Source: Micron

Client SSD Interface Trends

- Performance-class adoption in 2013-2014
- Growing to mainstream-class adoption levels in 2016



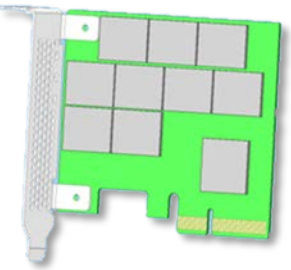
Source: Micron

Emerging Client PCIe SSD Form Factors

	M.2	SATA Express	SFF-8639	HHHLx4
Specification	PCI-SIG M.2	SATA Express	SFF-8639	PCIe CEM 2.0
Dimensions	(L) 80 mm (W) 22 mm (H) 2.15[1], 2.3[2] mm	(L) 100.45 mm (W) 69.85 mm (H) 5/7 mm	(L) 100.45 mm (W) 69.85 mm (H) 7 mm	(L) 167.65 mm (W) 68.9 mm (H) 18.71 mm
Host Interface	PCIe Gen2 or Gen3	PCIe Gen2 or Gen3	PCIe Gen2 or Gen3	PCIe Gen2 or Gen3
Lanes	1, 2 or 4	1 or 2	1, 2 or 4	1, 2 or 4

[1]2280-S2-B-M

[2]2280-S3-B-M



PCIe Client SSD Target Applications

PC Tablet

Ultrathin

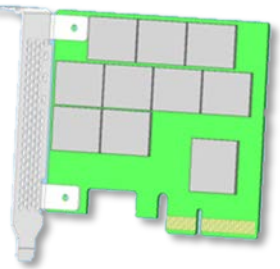
Notebook

Desktop/
Workstation

Increasing Features & Performance

M.2 PCIe Gen2 x 2

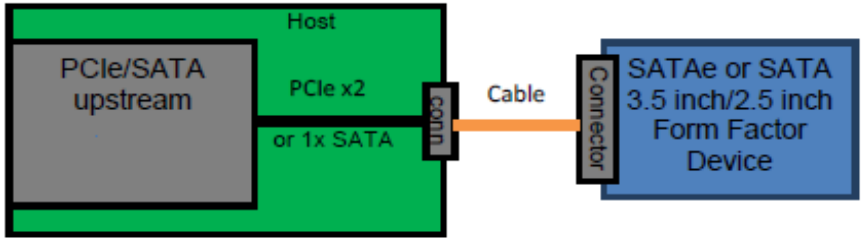
HHHL Gen2 x4



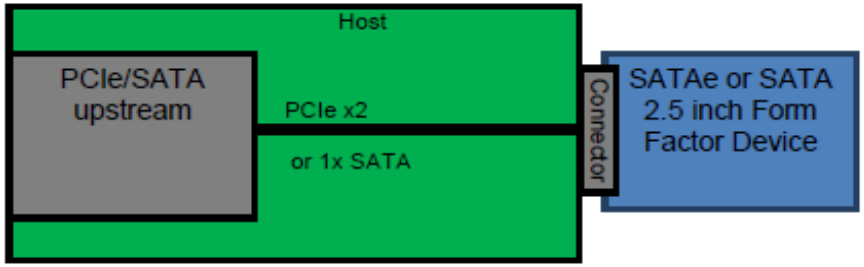
2.5” Gen2 x 2/4
(SATA Express/SFF-8639)

Example SATA Express Configurations

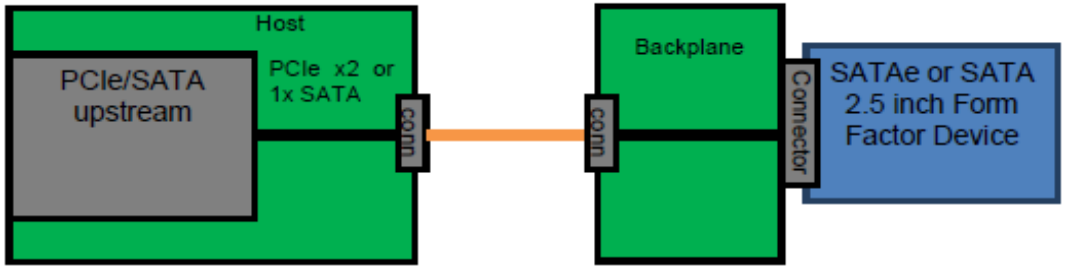
Typical desktop configuration with cable



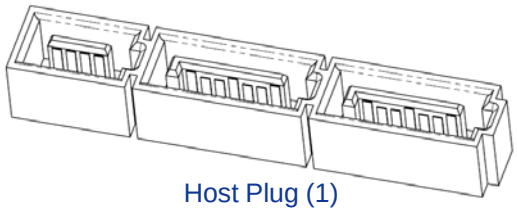
Typical notebook direct-connect configuration



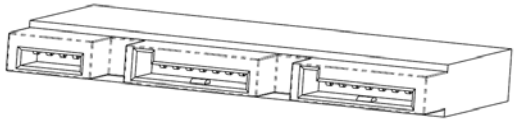
Typical server configuration with cable and backplane



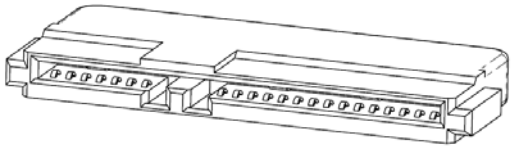
SATA Express Connector Configurations: PCIe Device



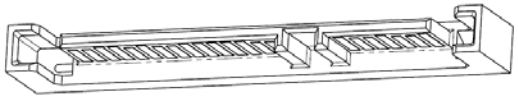
Host Plug (1)



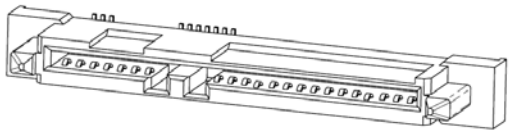
Host Cable Receptacle (2)



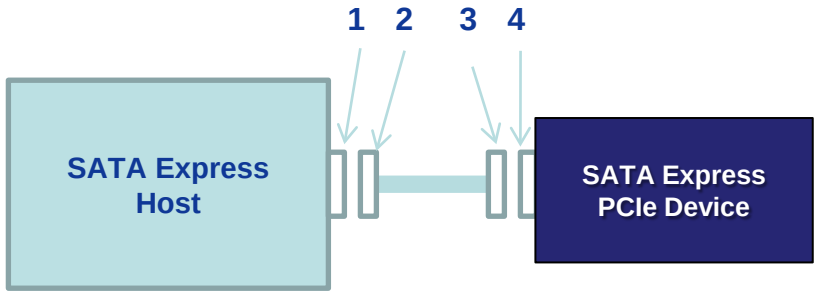
Device Cable Receptacle (3)



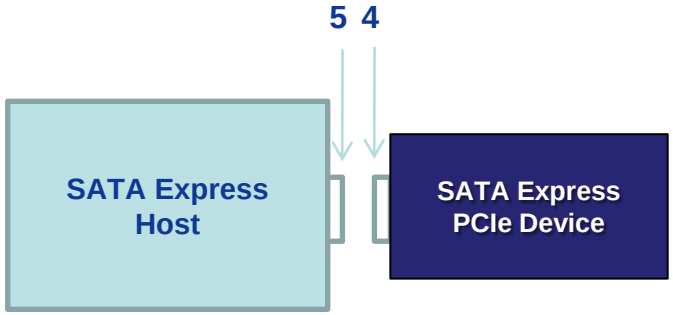
Device Plug (4)



Host Receptacle (5)



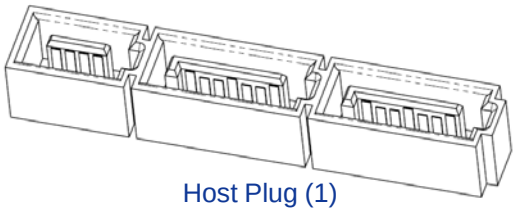
Cabled Configuration



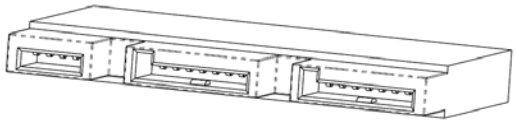
Direct-Connect Configuration

www.sata-io.org/technology/sataexpress.asp

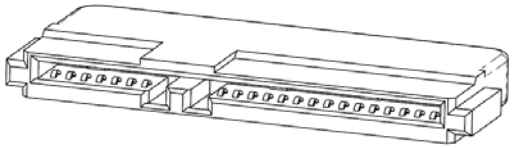
SATA Express Connector Configurations
SATA Device



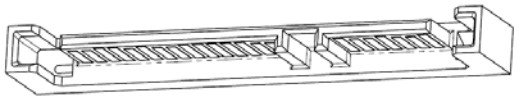
Host Plug (1)



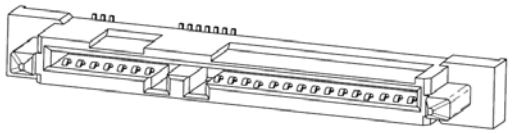
Host Cable Receptacle (2)



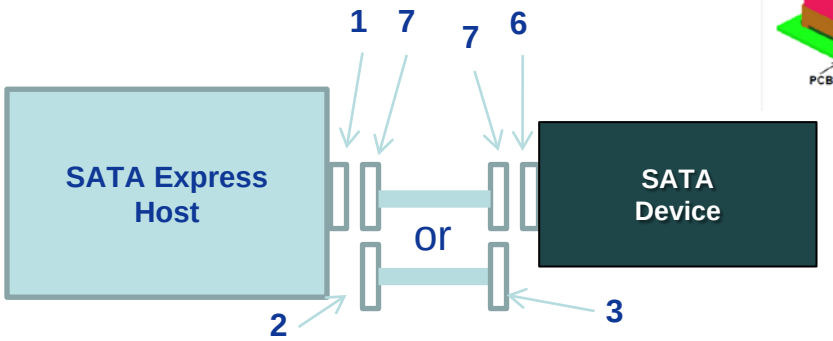
Device Cable Receptacle (3)



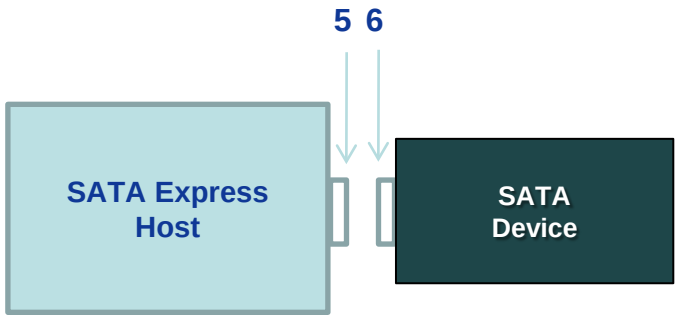
Device Plug (4)



Host Receptacle (5)

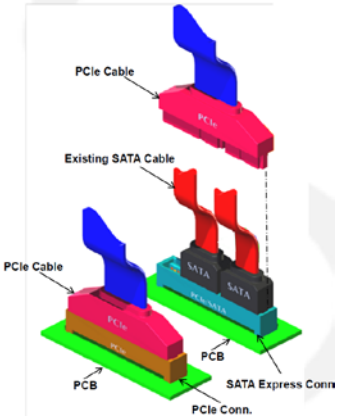


Cabled Configuration



Direct-Connect Configuration

SATA Connectors
(6) Device Plug; (7) SATA Cable



www.sata-io.org/technology/sataexpress.asp

SFF-8639 Host Receptacle

Connects with

- SFF-8482
- SFF-8630
- SFF-8680
- SATA Express

Source: SSD Form Factor specification

SATA Express (Client PCIe)

Signal names do not match SATA spec

Name	Pin	Pin	Name
GND	S1	E7	RefClk0+
S0T+ (A+)	S2	E8	RefClk0-
S0T- (A-)	S3	E9	GND
GND	S4	E10	PETp0
S0R- (B-)	S5	E11	PETn0
S0R+ (B+)	S6	E12	GND
GND	S7	E13	PERn0
RefClk1+	E1	E14	PERp0
RefClk1-	E2	E15	GND
3.3Vaux	E3	E16	RSVD
ePERst1#	E4	S8	GND
ePERst0#	E5	S9	S1T+
RSVD	E6	S10	S1T-
RSVD(Wake#) /SASAct2	P1	S11	GND
sPCIeRst/SAS	P2	S12	S1R-
RSVD(DevSLP#	P3	S13	S1R+
IfDet#	P4	S14	GND
Ground	P5	E17	RSVD
	P6	E18	GND
5 V	P7	E19	PETp1/S2T+
	P8	E20	PETn1/S2T-
	P9	E21	GND
PRSNT#	P10	E22	PERn1/S2R-
Activity	P11	E23	PERp1/S2R+
GND	P12	E24	GND
12 V	P13	E25	PETp2/S3T+
	P14	E26	PETn2/S3T-
	P15	E27	GND
		E28	PERn2/S3R-
		E29	PERp2/S3R+
		E30	GND
		E31	PETp3
		E32	PETn3
		E33	GND
		E34	PERn3
		E35	PERp3
		E36	GND
		E37	SMClk
		E38	SMDat
		E39	DualPortEn#

Orange=SAS, SATA, SATAe
Light=Optional
Gray=unused

SAS x4

Name	Pin	Pin	Name
GND	S1	E7	RefClk0+
S0T+ (A+)	S2	E8	RefClk0-
S0T- (A-)	S3	E9	GND
GND	S4	E10	PETp0
S0R- (B-)	S5	E11	PETn0
S0R+ (B+)	S6	E12	GND
GND	S7	E13	PERn0
RefClk1+	E1	E14	PERp0
RefClk1-	E2	E15	GND
3.3Vaux	E3	E16	RSVD
ePERst1#	E4	S8	GND
ePERst0#	E5	S9	S1T+
RSVD	E6	S10	S1T-
RSVD(Wake#) /SASAct2	P1	S11	GND
sPCIeRst/SAS	P2	S12	S1R-
RSVD(DevSLP#	P3	S13	S1R+
IfDet#	P4	S14	GND
Ground	P5	E17	RSVD
	P6	E18	GND
5 V	P7	E19	PETp1/S2T+
	P8	E20	PETn1/S2T-
	P9	E21	GND
PRSNT#	P10	E22	PERn1/S2R-
Activity	P11	E23	PERp1/S2R+
GND	P12	E24	GND
12 V	P13	E25	PETp2/S3T+
	P14	E26	PETn2/S3T-
	P15	E27	GND
		E28	PERn2/S3R-
		E29	PERp2/S3R+
		E30	GND
		E31	PETp3
		E32	PETn3
		E33	GND
		E34	PERn3
		E35	PERp3
		E36	GND
		E37	SMClk
		E38	SMDat
		E39	DualPortEn#

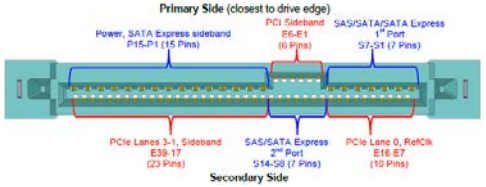
Purple-SAS
Light=Optional
Gray=unused

Enterprise PCIe (SFF-8639)

Name	Pin	Pin	Name
GND	S1	E7	RefClk0+
S0T+ (A+)	S2	E8	RefClk0-
S0T- (A-)	S3	E9	GND
GND	S4	E10	PETp0
S0R- (B-)	S5	E11	PETn0
S0R+ (B+)	S6	E12	GND
GND	S7	E13	PERn0
RefClk1+	E1	E14	PERp0
RefClk1-	E2	E15	GND
3.3Vaux	E3	E16	RSVD
ePERst1#	E4	S8	GND
ePERst0#	E5	S9	S1T+
RSVD	E6	S10	S1T-
RSVD(Wake#) /SASAct2	P1	S11	GND
sPCIeRst/SAS	P2	S12	S1R-
RSVD(DevSLP#	P3	S13	S1R+
IfDet#	P4	S14	GND
Ground	P5	E17	RSVD
	P6	E18	GND
5 V	P7	E19	PETp1/S2T+
	P8	E20	PETn1/S2T-
	P9	E21	GND
PRSNT#	P10	E22	PERn1/S2R-
Activity	P11	E23	PERp1/S2R+
GND	P12	E24	GND
12 V	P13	E25	PETp2/S3T+
	P14	E26	PETn2/S3T-
	P15	E27	GND
		E28	PERn2/S3R-
		E29	PERp2/S3R+
		E30	GND
		E31	PETp3
		E32	PETn3
		E33	GND
		E34	PERn3
		E35	PERp3
		E36	GND
		E37	SMClk
		E38	SMDat
		E39	DualPortEn#

Blue=sPCIe
Light=Optional
Dark=DaulP
Gray=unused

Connector Mating Matrix



	SATA Express Host Cable Receptacle (2)	SATA Express Device Cable Receptacle (3)	SATA Express Host Receptacle (5)	SATA Cable Receptacle (7)	SFF-8639 Backplane Receptacle	SAS MultiLink Receptacle
 SATA Express Host Plug (1)	✓			✓		
 SATA Express Device Plug (4)		✓	✓		✓ c	✓ d
SATA Device Plug (6)		✓	✓	✓	✓ d	✓ d

Legend: ✓**= Mates & is functional** **Blank = Does not mate**

Notes:

a. SATA Express host supports SATA Express and SATA devices
b. Numbers after connector descriptions in table correlate to numbers in connection configurations
c. SATA Express Device Plug mates with SFF-8639 connector and is functional only if host supports SATA Express devices
d. Mates with SFF-8639 and SAS MultiLink connectors and is functional only if host supports SATA and SATA Express devices

www.sata-io.org/technology/sataexpress.asp

SATA Express Device Compatibility Matrix

	SATA Express Host Plug E9=Open	SATA Express Host Receptacle E9=Open	SATA Express Host Receptacle E9=GND	SFF-8639 Host E9=GND
RefClk only				Note 1
SRIS only			Note 2	Note 2
RefClk/SRIS	SRIS mode	SRIS mode	w/ Host RefClk	w/ Host RefClk

Device Does Not Work | Device Works

Note 1: Device works if SFF-8639 host supports PCIe on SATA/SAS data pins

Note 2: Device ignores Host RefClk and tries to use independent RefClk

Summary

- Client SSDs saturating the SATA III interface
- New connectors and device form factors aid interface transition from SATA III to PCIe
- Leveraging existing standards to facilitate low-risk, cost-effective transition
- New standards extend Client SSD application base