SNIA

FMS

the Future of Memory and Storage

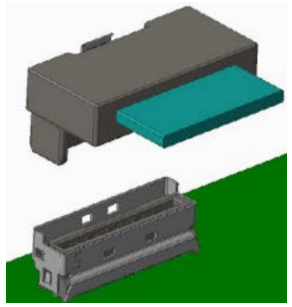
SFF: Connecting Everything Together

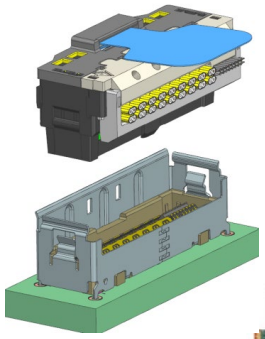
Presenter: Anthony Constantine

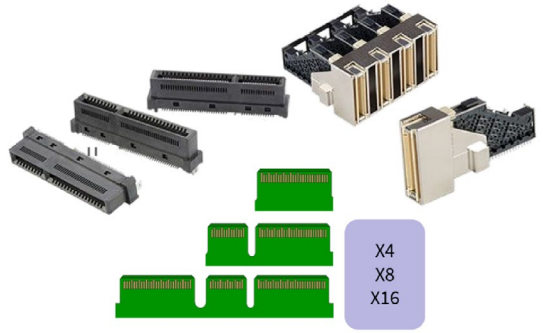
Co-chair of SNIA SFF TA

You may not know SFF, but you know our work

- SFF TA TWG develops technical specifications covering:
  - Cables
  - Connectors and cages
  - Form factors
  - Management interfaces
  - Copper transceiver modules
  - Optical transceiver modules
  - Electrical interfaces







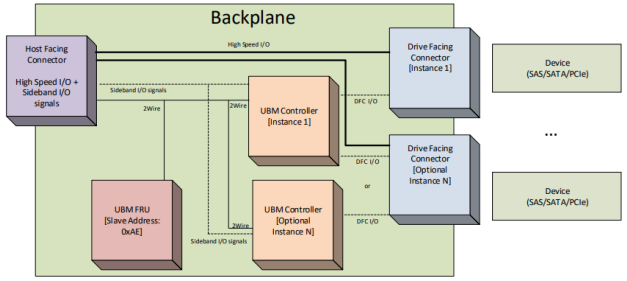
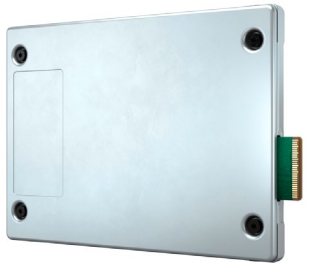
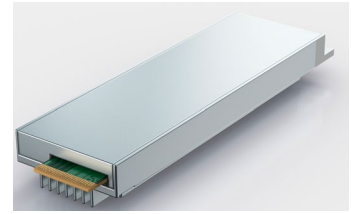
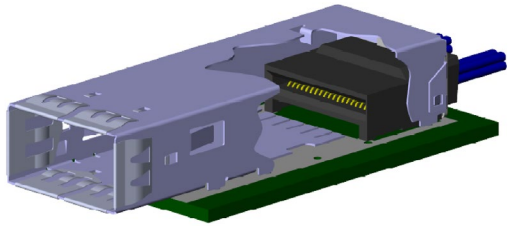
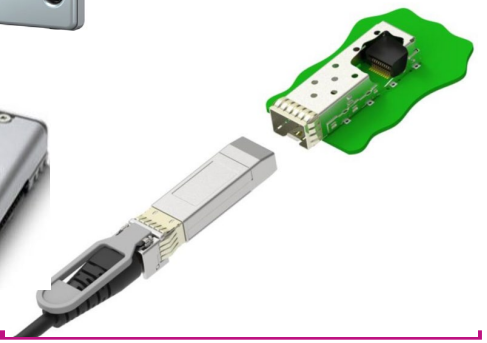


Figure 4-1 UBM Backplane Overview





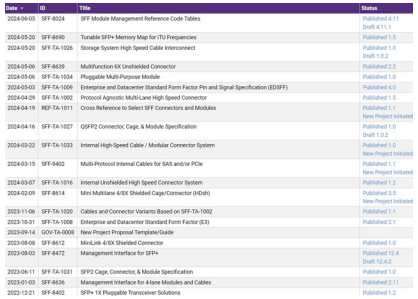




Who Are We?

76 member companies

150+ published specs



Date	ID	Title	Status
2024-06-05	SFF-8024	SFF Module Management Reference Code Tables	Published 4.11 Draft 4.11.1
2024-05-20	SFF-8690	Tunable SFP+ Memory Map for ITU Frequencies	Published 1.5
2024-05-20	SFF-TA-1026	Storage System High Speed Cable Interconnect	Published 1.0 Draft 1.0.2
2024-05-06	SFF-8639	Multifunction 6X Unshielded Connector	Published 2.2
2024-05-06	SFF-TA-1034	Pluggable Multi-Purpose Module	Published 1.0
2024-05-03	SFF-TA-1009	Enterprise and Datacenter Standard Form Factor Pin and Signal Specification (EDSFF)	Published 4.0
2024-04-29	SFF-TA-1002	Protocol Agnostic Multi-Lane High Speed Connector	Published 1.5
2024-04-19	REF-TA-1011	Cross Reference to Select SFF Connectors and Modules	Published 1.1 New Project Initiated
2024-04-16	SFF-TA-1027	QSFP2 Connector, Cage, & Module Specification	Published 1.0 Draft 1.0.2
2024-03-22	SFF-TA-1033	Internal High-Speed Cable / Modular Connector System	Published 1.0 New Project Initiated
2024-03-15	SFF-8402	Multi-Protocol Internal Cables for SAS and/or PCIe	Published 1.1 New Project Initiated
2024-03-07	SFF-TA-1016	Internal Unshielded High Speed Connector System	Published 1.2
2024-02-09	SFF-8614	Mini Multilane 4/8X Shielded Cage/Connector (HDdi)	Published 3.5 New Project Initiated
2023-11-06	SFF-TA-1020	Cables and Connector Variants Based on SFF-TA-1002	Published 1.1
2023-10-31	SFF-TA-1008	Enterprise and Datacenter Standard Form Factor (E3)	Published 2.1
2023-09-14	GOV-TA-0008	New Project Proposal Template/Guide	
2023-08-08	SFF-8612	MiniLink 4/8X Shielded Connector	Published 1.0
2023-08-03	SFF-8472	Management Interface for SFP+	Published 12.4 Draft 12.4.2
2023-06-11	SFF-TA-1031	SFP2 Cage, Connector, & Module Specification	Published 1.0
2023-01-03	SFF-8636	Management Interface for 4-lane Modules and Cables	Published 2.11
2022-12-21	SFF-8402	SFP+ 1X Pluggable Transceiver Solutions	Published 1.2

Specifications used everywhere

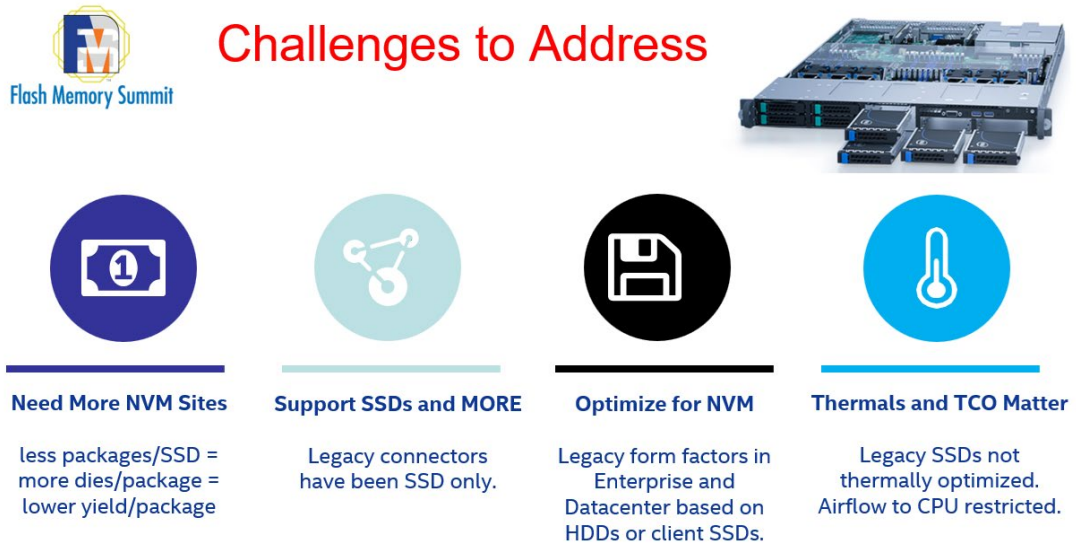
In the last year, we:

Published 5 new specifications

Revised 7 existing specifications

Example: Server Storage and CXL Memory

- **Problem:** Existing storage form factors did not meet needs of future usages
  - **Result:** EDSFF (E1.S, E1.L, E3)
- **New problem:** Scale for higher speeds?
  - **Result:** Added PCIe 5.0, 6.0 support, Thermal characterization spec, E1.S expanded skus
- **New Problem:** Need for new usages
  - **Result:** E3 NICs, JEDEC CXL Module support



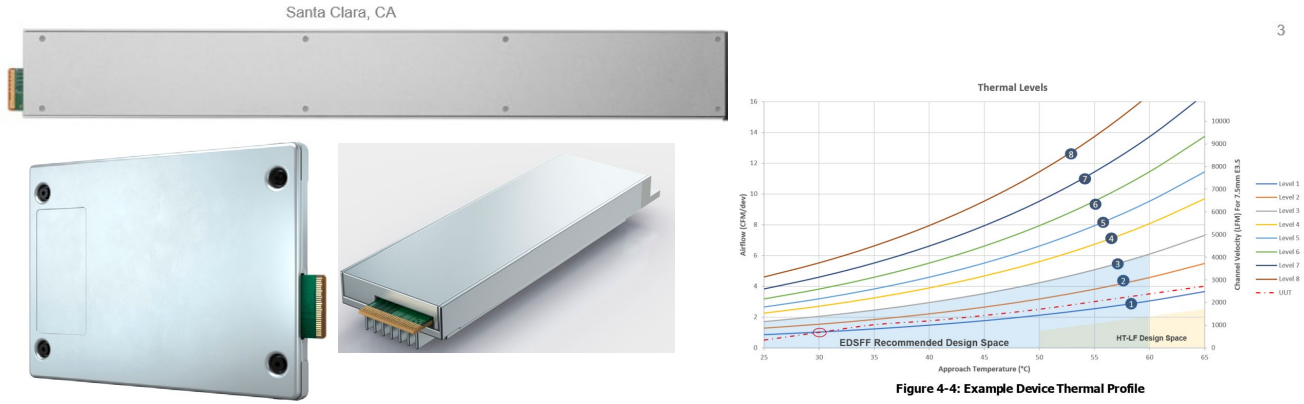
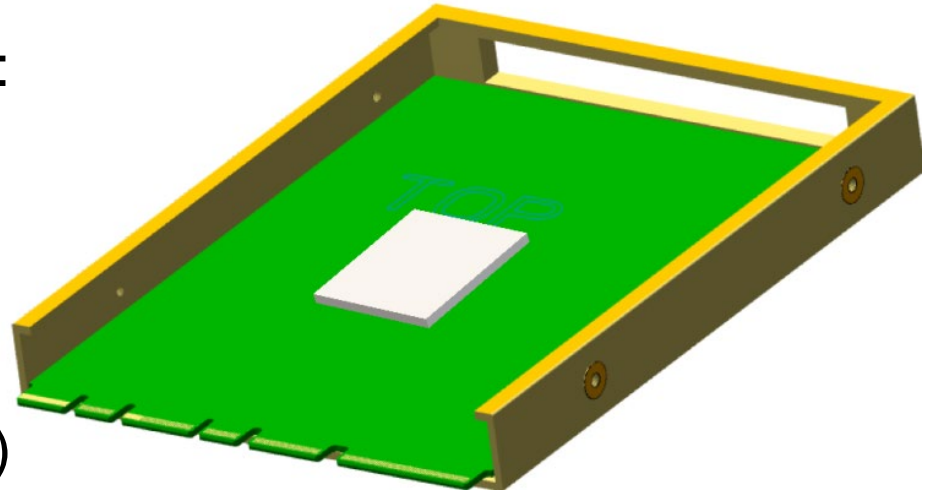


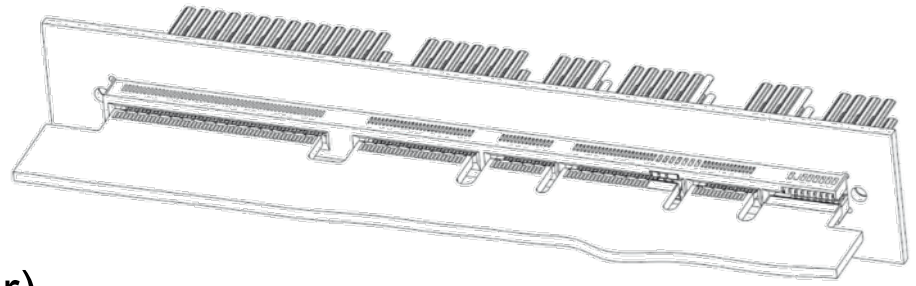
Figure 4-4: Example Device Thermal Profile

Example: AI Form Factor

- **Problem:** Form Factors for AI are missing a sweet spot:
  - Serviceability
  - Power
  - Lane count
  - Stranded lanes

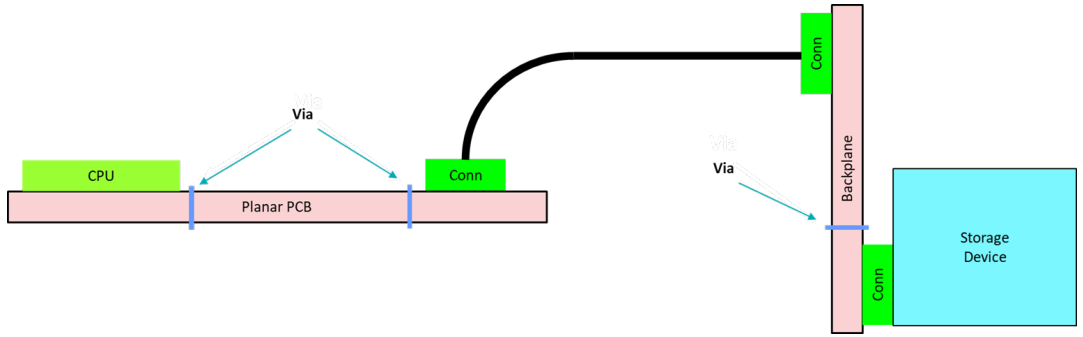


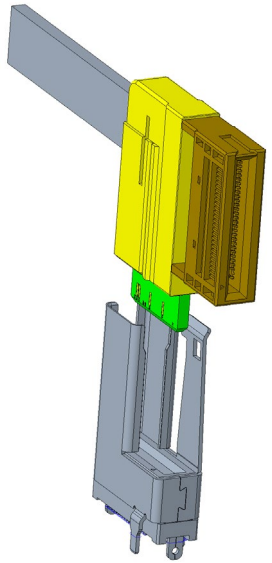
- **Result:** Created Pluggable Multipurpose Module (PMM) and connector to address this need
  - Support for NICs, XPUs, CXL
  - Front/rear loadable
  - 600W support
  - 32 lanes
  - Lane subdivision and directional configurability
  - Compatibility to OCP NIC 3.0 and EDSFF (via interposer).

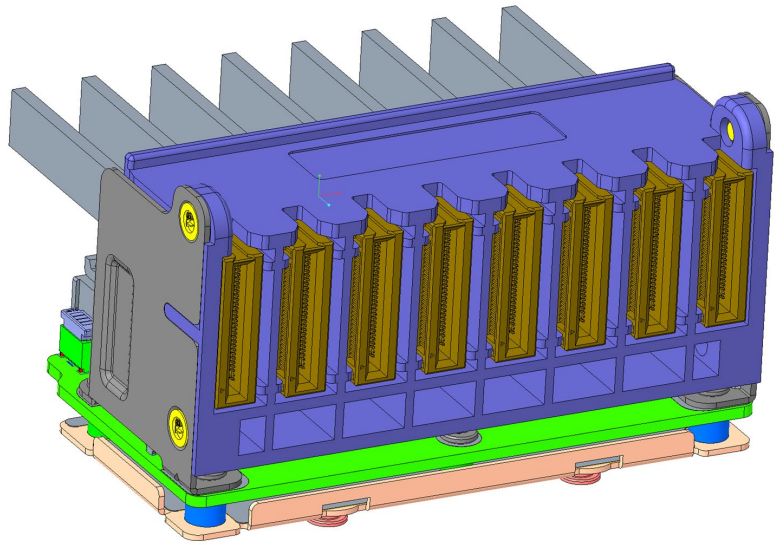


Example: PCIe Storage Signaling

- **Problem:** Current SI budget forces system vendors to very expensive low loss PCB materials or the addition of PCIe retimers
- **Result:** Ortho-Hybrid Connector (found in SFF-TA-1016)
  - Eliminates the backplane SI component
  - Backplane under connector provides power/sidebands
  - Supports different thicknesses through connector removal
  - Backplane can support x8 by swapping out the connector cage and cables

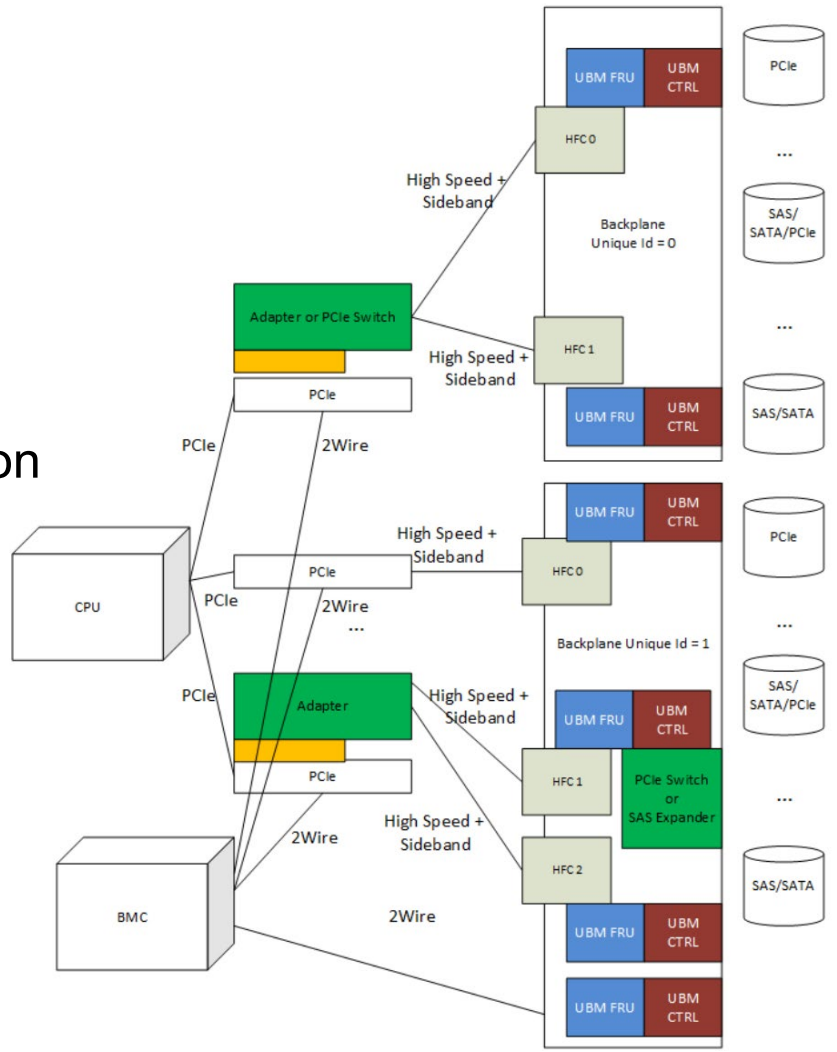






Example: Backplane Management

- **Problem:** Traditional backplane management could not scale beyond 8 devices and did not support PCIe needs.
  - **Result:** SFF-TA-1005 (UBM) was created to offload the host
    - Uses I2C to inform the Host of the backplane configuration
    - Take over former SGIO needs
    - Handles LED pattern generation.
- **New problem:** New usages and evolving needs
  - **Result:** Updated to support EDSFF for SSDs, NICs, and CXL Memory devices



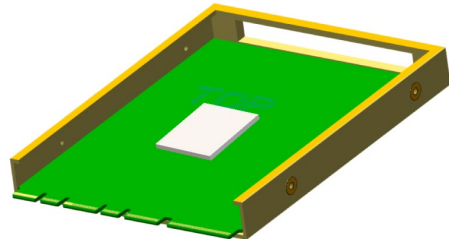
Example: Protocol Agnostic Cables

- **Problem:** How do use same cable for different protocols (e.g., SAS, PCIe)?
  - **Solution:** Created SFF-9402 for Common naming/direction convention

	Root / Controller				CABLE	Endpoint / Backplane				Devices on Backplane		
SFF-9400	SFF-8654 (38-circuit)	SFF-8621 (42-circuit)	9402 Multi-Protocol (OCuLink, Other Protocol (O/P), SAS-4)) x4 Cable Interface			9402 Multi-Protocol (OCuLink, Other Protocol (O/P), SAS-4)) x4 Cable Interface		SFF-8621 (42-circuit)	SFF-8654 (38-circuit)	SFF-8639 Connector		
Type 1 4X	O/P SAS-4	OCuLink / SAS-4	OCuLink and SAS-4/ SFF-8448 Signal Names			OCuLink and SAS-4/ SFF-8448 Signal Names		OCuLink / SAS-4	O/P SAS-4	Quad PCI Express® (x4)	SFF-TA-1001 (x4)	MultiLink SAS™
	PIN	PIN	ROOT	Controller	DIR	Endpoint	Backplane	PIN	PIN	PIN	PIN	PIN
RSV		A1	POWER 3.3 Vact RX	RESERVED	NO WIRE	POWER 5 V #1	RESERVED	B1				
GND	A1	A2	GROUND	GROUND	–	GROUND	GROUND	B2	B1			
HS	A2	A3	PERp0	RX0+	←	PETp0	TX0+	B3	B2	E14 (PERp0)	S6 (PERp0)	S6 (TX0+)
HS	A3	A4	PERn0	RX0-	←	PETn0	TX0-	B4	B3	E13 (PERn0)	S5 (PERn0)	S5 (TX0-)
GND	A4	A5	GROUND	GROUND	–	GROUND	GROUND	B5	B4			
HS	A5	A6	PERp1	RX1+	←	PETp1	TX1+	B6	B5	S21 (PERp1)	S13 (PERp1)	S13 (TX1+)
HS	A6	A7	PERn1	RX1-	←	PETn1	TX1-	B7	B6	S20 (PERn1)	S12 (PERn1)	S12 (TX1-)
GND	A7	A8	GROUND	GROUND	–	GROUND	GROUND	B8	B7			
SB	A8	A9	BP_TYPE (VSP)	BP_TYPE (SB7)	↔	BP_TYPE (VSP)	BP_TYPE (SB7)	B9	B8			
SB	A9	A10	CWAKE#,OBFF (VSP)	RESET, SDataOut (SB4)	↔	CWAKE#,OBFF/(VSP)	RESET, SDataOut (SB4)	B10	B9	P1 (WAKE#)	P1 (WAKE#)	
SB	A10	A11	GND	GND (SB3)	–	GND	GND (SB3)	B11	B10			
SB	A11	A12	REFCLK+(VSP+)	(SB+)	→	REFCLK+(VSP+)	(SB+)	B12	B11	E7 (REFCLK+)	E7 (REFCLK+)	
SB	A12	A13	REFCLK-(VSP-)	(SB-)	→	REFCLK-(VSP-)	(SB-)	B13	B12	E8 (REFCLK-)	E8 (REFCLK-)	
GND	A13	A14	GROUND	GROUND	–	GROUND	GROUND	B14	B13			
HS	A14	A15	PERp2	RX2+	←	PETp2	TX2+	B15	B14	S27 (PERp2)	S21(PERp2)	S21 (TX2+)
HS	A15	A16	PERn2	RX2-	←	PETn2	TX2-	B16	B15	S26 (PERn2)	S20 (PERn2)	S20 (TX2-)
GND	A16	A17	GROUND	GROUND	–	GROUND	GROUND	B17	B16			
HS	A17	A18	PERp3	RX3+	←	PETp3	TX3+	B18	B17	E21 (PERp3)	S27 (PERp3)	S27 (TX3+)
HS	A18	A19	PERn3	RX3-	←	PETn3	TX3-	B19	B18	E20 (PERn3)	S26 (PERn3)	S26 (TX3-)
GND	A19	A20	GROUND	GROUND	–	GROUND	GROUND	B20	B19			
RSV		A21	POWER 5 V #2	RESERVED	NO WIRE	POWER 3.3 Vact TX	RESERVED	B21				
RSV		B1	POWER 5 V #1	RESERVED	NO WIRE	POWER 3.3 Vact RX	RESERVED	A1				
GND	B1	B2	GROUND	GROUND	–	GROUND	GROUND	A2	A1			
HS	B2	B3	PETp0	TX0+	→	PERp0	RX0+	A3	A2	E10 (PETp0)	S2 (PETp0)	S2 (RX0+)
HS	B3	B4	PETn0	TX0-	→	PERn0	RX0-	A4	A3	E11 (PETn0)	S3 (PETn0)	S3 (RX0-)
GND	B4	B5	GROUND	GROUND	–	GROUND	GROUND	A5	A4			
HS	B5	B6	PETp1	TX1+	→	PERp1	RX1+	A6	A5	S17 (PETp1)	S9 (PETp1)	S9 (RX1+)
HS	B6	B7	PETn1	TX1-	→	PERn1	RX1-	A7	A6	S18 (PETn1)	S10 (PETn1)	S10 (RX1-)
GND	B7	B8	GROUND	GROUND	–	GROUND	GROUND	A8	A7			
SB	B8	B9	2W-CLK	2W-CLK, SClock (SB0)	↔	2W-CLK	2W-CLK, SClock (SB0)	A9	A8			
SB	B9	B10	2W-DATA	2W-DATA, SLoad (SB1)	↔	2W-DATA	2W-DATA, SLoad(SB1)	A10	A9			
SB	B10	B11	GND	GND (SB2)	–	GND	GND(SB2)	A11	A10			
SB	B11	B12	PERST# (VSP)	ADD, SDatain (SB5)	↔	PERST# (VSP)	ADD, SDatain (SB5)	A12	A11	E5 (PERST#)	E5 (PERST#)	
SB	B12	B13	CPRSNT# (VSP)	CNTRLR_TYPE (SB6)	↔	CPRSNT#(VSP)	CNTRLR_TYPE (SB6)	A13	A12			
GND	B13	B14	GROUND	GROUND	–	GROUND	GROUND	A14	A13			
HS	B14	B15	PETp2	TX2+	→	PERp2	RX2+	A15	A14	S23 (PETp2)	S17 (PETp2)	S17 (RX2+)
HS	B15	B16	PETn2	TX2-	→	PERn2	RX2-	A16	A15	S24 (PETn2)	S18 (PETn2)	S18 (RX2-)
GND	B16	B17	GROUND	GROUND	–	GROUND	GROUND	A17	A16			
HS	B17	B18	PETp3	TX3+	→	PERp3	RX3+	A18	A17	E17 (PETp3)	S23 (PETp3)	S23 (RX3+)
HS	B18	B19	PETn3	TX3-	→	PERn3	RX3-	A19	A18	E18 (PETn3)	S24 (PETn3)	S24 (RX3-)
GND	B19	B20	GROUND	GROUND	–	GROUND	GROUND	A20	A19			
RSV		B21	POWER 3.3 Vact TX	RESERVED	NO WIRE	POWER 5 V #2	RESERVED	A21				

5 New Projects Completed

- Pluggable Multi-Purpose Module (SFF-TA-1034)
  - Front or rear loadable form factor for general purpose device
- Internal High-Speed Cable / Modular Connector System (SFF-TA-1033)
  - Internal cable/connector solution supporting high-speed and power transmission
- SFP2 Cage, Connector, & Module Specification (SFF-TA-1031)
  - 112Gb/s and beyond Transceiver
- QSFP2 Connector, Cage, & Module Specification (SFF-TA-1027)
  - 112Gb/s and beyond over 4 lanes Transceiver
- MiniLink 4/8X Shielded Connector (SFF-8612)
  - High-speed serial connector for multi-gigabit speeds



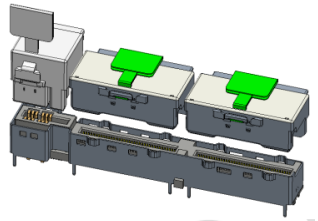


Figure 4-5 Separate RA 74 Pin Cables and a RA 21A Power Cable Application

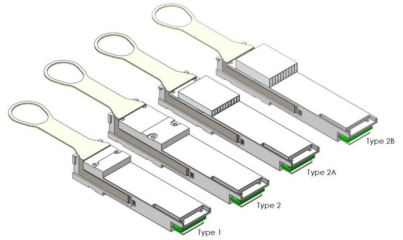
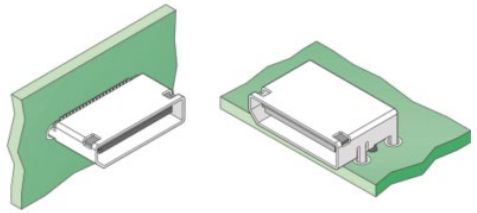


Figure 7-1 QSFP2 Module Types



a) PTH shell

7 Projects Recently Revised

- Cables and Connector Variants Based on SFF-TA-1002 (SFF-TA-1020)
- Internal Unshielded High Speed Connector System (SFF-TA-1016)
- Enterprise and Datacenter Standard Form Factor Pin and Signal Specification (EDSFF) (SFF-TA-1009)
- Enterprise and Datacenter Standard Form Factor (E3) (SFF-TA-1008)
- Protocol Agnostic Multi-Lane High Speed Connector (SFF-TA-1002)
- Mini Multilane 4/8X Shielded Cage/Connector (HDsh) (SFF-8614)
- SFF Module Management Reference Code Tables (SFF-8024)

Future SFF Work

- AI Interconnects
- CXL Interconnects
- Making our specs better
- Better Education

The 18 Open Projects

- SFF-TA-1038: Low Profile High Density Flexible Cable Connector
- SFF-TA-1037: Connectors For Pluggable Multi-Purpose Module
- SFF-TA-1036: Cable Optimized Boot Peripheral Connector
- SFF-TA-1035: Next Gen High Speed Cable Connector System
- SFF-TA-1033: Internal High-Speed Cable / Modular Connector System
- SFF-TA-1032: Multi-lane External High Speed Cable System
- SFF-TA-1029: Cabled QSFP Cage & Connector
- SFF-TA-1027: QSFP2 Connector, Cage, & Module Specification
- SFF-TA-1026: Storage System High Speed Cable Interconnect
- SFF-9402: Multi-Protocol Internal Cables for SAS and/or PCIe
- SFF-8679: QSFP+ 4X Hardware and Electrical Specification
- SFF-8665: QSFP+ 28 Gb/s 4X Pluggable Transceiver Solution (QSFP28)
- SFF-8614: Mini Multilane 4/8X Shielded Cage/Connector (HDsh)
- SFF-8613: Mini Multilane 4/8X Unshielded Connector (HDun)
- SFF-8472: Management Interface for SFP+
- SFF-8419: SFP+ Power and Low Speed Interface
- SFF-8024: SFF Module Management Reference Code Tables
- REF-TA-1011: Cross Reference to Select SFF Connectors and Modules

Getting Involved in SFF

- Come to SDC and bring us your problems: https://www.sniadeveloper.org/
  - Our opinionated experts want feedback
  - Tell us what problem you need solved
  - Tell us what problem we created

- Resources:
  - How to Join: https://www.snia.org/sff/join
  - Public Site: https://www.snia.org/sff
  - Specifications: https://www.snia.org/sff/specifications
  - Questions about membership? Please send mail to membership@snia.org
  - Additional questions? Please send mail to sff_ta_twgchair@snia.org