

# CONNPRO **SLIM** SAS ACTIVE OPTICAL CABLE

## DESCRIPTION

Connpro's 48-Gbps Slim-SAS HD AOC is of high-performance with full-duplex and aggregate 48-Gbps bandwidth for SAS-3 protocol specialized in storage applications. Compared with conventional copper cables, longer, lighter, and flexible AOCs enable the ease of complicated data-center cablings because of its small cable diameter of only 3-mm. High-quality 850-nm VCSELs and PIN PDs are utilized in this AOC cable with superior signal integrity and bit-error-rate (BER) performance, which enables reliable operation performance.

This 48-Gbps Slim-SAS HD AOC is compliant with SFF-8644 MSA with mechanical requirement, whose reduced size of connector provides premium board space for implementing more I/O ports. The single lane speed is up to 12-Gbps to fulfill SAS-3 standard, also backward to fully compliant with SAS-2.1 of 6-Gbps lane speed. Also, the out-of-band (OOB) low-speed hand-shaking communication is also supported with optical mode selection. This cable can be compliant to 40GBASE-SR4 Ethernet or 40-Gbps QDR InfiniBand protocol to meet several existing standards.

## FEATURE

- 4Tx/Rx, Full-Duplex AOCs, Maximum aggregate speed of 48-Gbps for SAS3.0
- Backwards compatible to 6-Gbps SAS-2.1 of optical-mode capable systems with out-of-band (OOB) signal supported
- Bit-Error-Rate (BER) better than  $10^{-12}$
- Link length up to 100-m via OM3 MMF
- Round cable with small 3.0-mm outer diameter for flexible routing and easy cable management
- Compliant to SFF-8644 MSA standard in mechanical consideration
- Management interface compliant to SFF-8636
- QSFP<sup>+</sup> to Mini-SAS HD AOC with different form-factors over two ends is available upon customer request

## ABSOLUTE MAXIMUM RATING

Not necessarily applied together. Exceeding these values may cause permanent damage. Functional operation under these conditions is not implied.

Parameter	Min	Max	Unit	Note
Storage Temperature	-10	70	°C	1
3.3V Power Supply Voltage	-0.3	3.6	V	
Differential input Swig	--	1.6	Vpp	
Control Input Voltage	-0.3	3.6	V	
Relative Humidity	5	85	%	2

Notes:

1. Limited by the fiber cable jacket, not the active ends.
2. Non-condensing.

## RECOMMENDED OPERATING CONDITIONS

Parameter	Min	Typical	Max	Unit	Note
Case Operating Temperature	0	40	65	°C	SFF-8644
Power Supply Voltage	3.135	3.3	3.465	V	
Date Rate per Channel	1.0	12.0	12.5	Gbps	
Power Supply Noise Ripple Suscepti- bility (PSNR)			50	mVpp	1
Bit Error Ratio		10 <sup>-12</sup>			2
Control Input Voltage High	2		Vcc+0.3	V	
Control Input Voltage Low	-0.3		0.8	V	
Two Wire Serial (TWS) Interface Clock Rate		100	400	kHz	
Differential Data Input / Output Load		100		Ohms	
Standard Cable Lengths	3		100	m	3
Electrical Connector	Four-layers 36-pins			SFF-8644	
Management Interface	Two-Wire Serial			SFF-8636	

Notes:

1. Power supply noise is defined as peak-to-peak noise amplitude over 1K to 15 MHz frequency range at host supply side by the recommended power supply filter for module. See Section 10 for the recommended power supply filter.
2. Bit-Error-Rate (BER) test can be compliant to SCRAMBLED\_0 defined in Working Draft SAS Protocol Layer - 3 (SPL-3).
3. Longer cable length (up to 150-m via OM4) is available upon customer request.

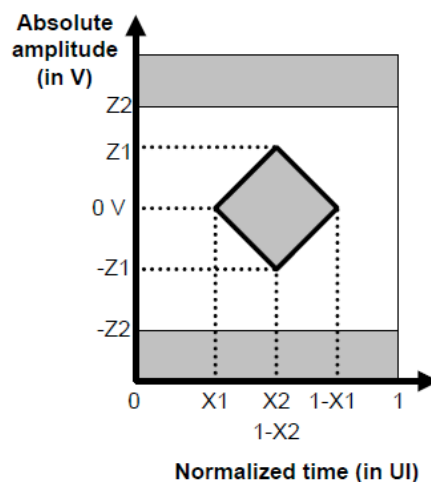
## ELECTRICAL CHARACTERISTICS

Parameter	Min	Typical	Max	Unit	Note
<b>Transceiver</b>					
Transceiver Power Consumption			1	W	
Transceiver Power-On Initialization Time			2000	ms	1
<b>Transmitter</b>					
Maximum input peak to peak voltage (2× Z2)			1200	mVpp	2
Minimum input eye opening (2× Z1)	200			mVpp	2
Maximum half of TJ (X1)			0.175	UI	2
Maximum RJ			0.15	UI	2
Center of bit time (X2)		0.5		UI	2
<b>Receiver</b>					
Maximum output peak to peak voltage (2× Z2)			1200	mVpp	2
Minimum out eye opening (2× Z1)	190			mVpp	2
Maximum half of CR-TJ (X1)			0.35	UI	2
Maximum CR-RJ			0.45	UI	2
Center of bit time (X2)		0.5		UI	2

**Notes:**

1. "Initialization Time" is the time from when the supply voltages reach and remain above the minimum "Recommended Operating Conditions" to the time when the module enables TWS access. The module at that point is fully functional.

2. Refer to the 12Gbps active cable eye mask from SAS-3 working draft Rev. 06a of Figure 102 and Table 31.



## OPTICAL CABLE SPECIFICATION

Parameter	Specification	Notes
Minimum Cable Bending Radius	30 mm	
Cable Cross-Section Dimension	Round Type Cable with 3 mm in Dia.	
Cable Cover Type	OFNP / LSZH	1
Standard Cable Length	10, 20, 30, 50, 100-m	2
Cable Length Tolerance	+1.0 / -0 m	

Notes:

1. Cable cover type standard is OFNP. Other types can be available upon request.
2. Different cable length may be recommended to adopt different multi-mode fiber (MMF) grades of OM2, OM3, or OM4.

## CONNECTOR PAD ASSIGNMENTS AND DESCRIPTIONS

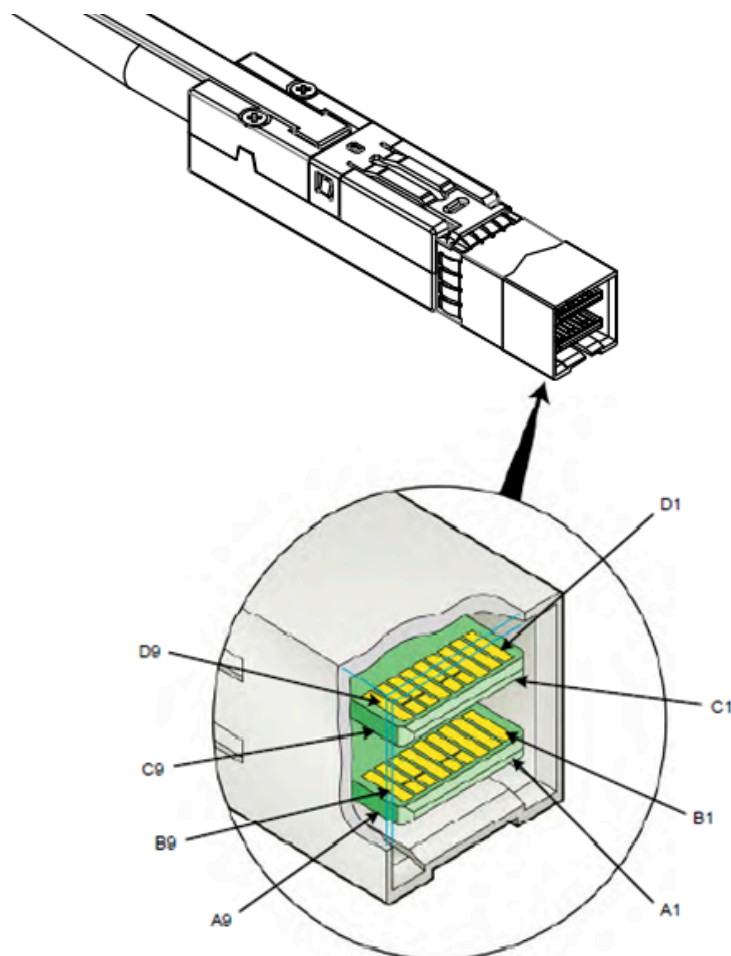
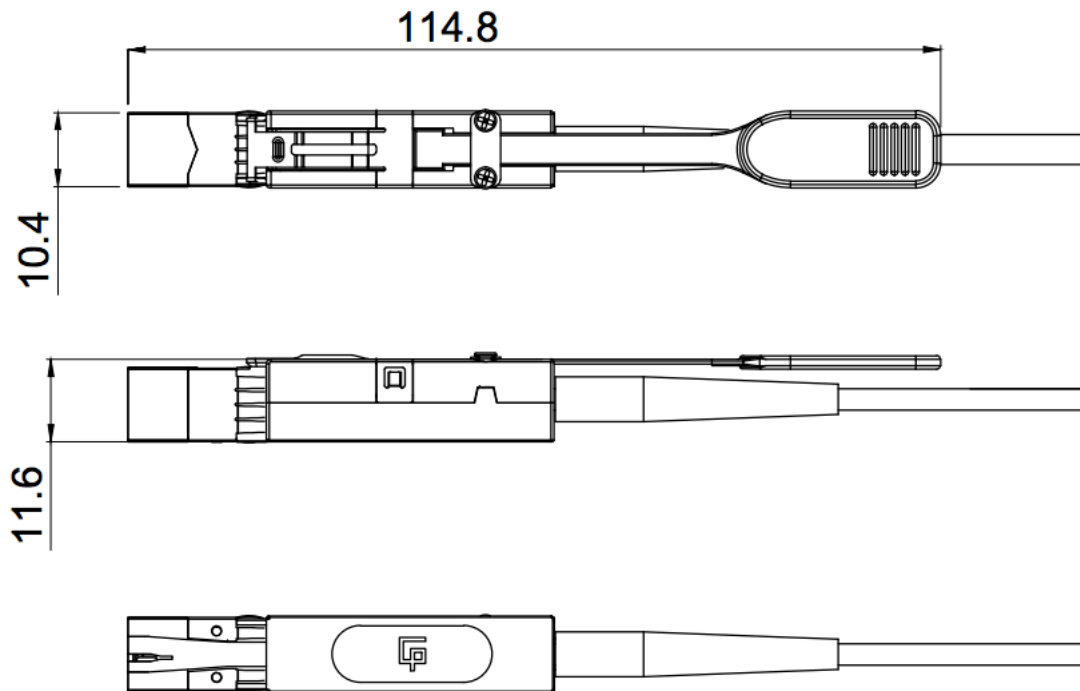


Fig. Slim SAS AOC Plug connector

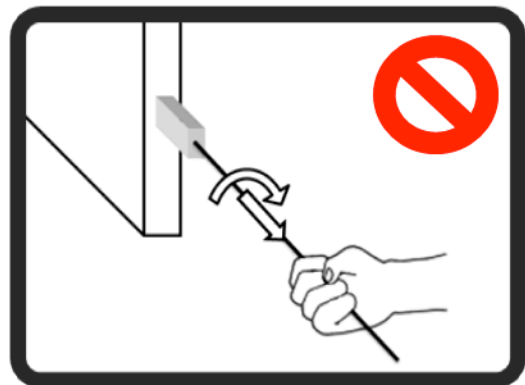
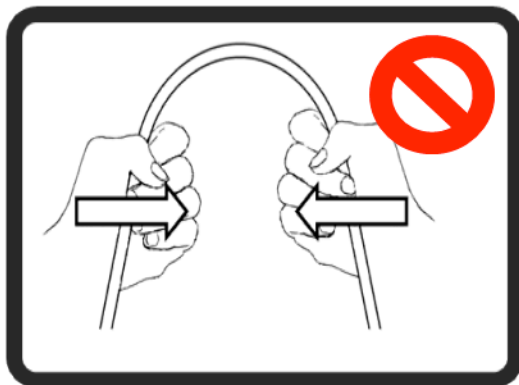
Signal	Pin	Mating Level	Definition
Reserved	A1	Second	Reserved for future use
IntL	A2	Second	Management interface interrupt signal
GND	A3	First	Signal ground
RX1+	A4	Third	Fixed side receiver channel 1 non-inverting input
RX1-	A5	Third	Fixed side receiver channel 1 inverting input
GND	A6	First	Signal ground
RX3+	A7	Third	Fixed side receiver channel 3 non-inverting input
RX3-	A8	Third	Fixed side receiver channel 3 inverting input
GND	A9	First	Signal ground
Vact	B1	Second	Free side power input for non-management interface circuitry
ModPrsL	B2	Second	Free side active low present output
GND	B3	First	Signal ground
RX0+	B4	Third	Fixed side receiver channel 0 non-inverting input
RX0-	B5	Third	Fixed side receiver channel 0 inverting input
GND	B6	First	Signal ground
RX2+	B7	Third	Fixed side receiver channel 2 non-inverting input
RX2-	B8	Third	Fixed side receiver channel 2 inverting input
GND	B9	First	Signal ground
SCL	C1	Second	Management interface serial clock
SDA	C2	Second	Management interface serial data output
GND	C3	First	Signal ground
TX1+	C4	Third	Fixed side transmitter channel 1 non-inverting output
TX1-	C5	Third	Fixed side transmitter channel 1 inverting output
GND	C6	First	Signal ground
TX3+	C7	Third	Fixed side transmitter channel 3 non-inverting output
TX3-	C8	Third	Fixed side transmitter channel 3 inverting output
GND	C9	First	Signal ground
Vact	D1	Second	Free side power input for non-management interface circuitry
Vman	D2	Second	Free side power input for management interface circuitry
GND	D3	First	Signal ground
TX0+	D4	Third	Fixed side transmitter channel 0 non-inverting output
TX0-	D5	Third	Fixed side transmitter channel 0 inverting output
GND	D6	First	Signal ground
TX2+	D7	Third	Fixed side transmitter channel 2 non-inverting output
TX2-	D8	Third	Fixed side transmitter channel 2 inverting output
GND	D9	First	Signal ground

## MECHANICAL DESIGN DIAGRAM



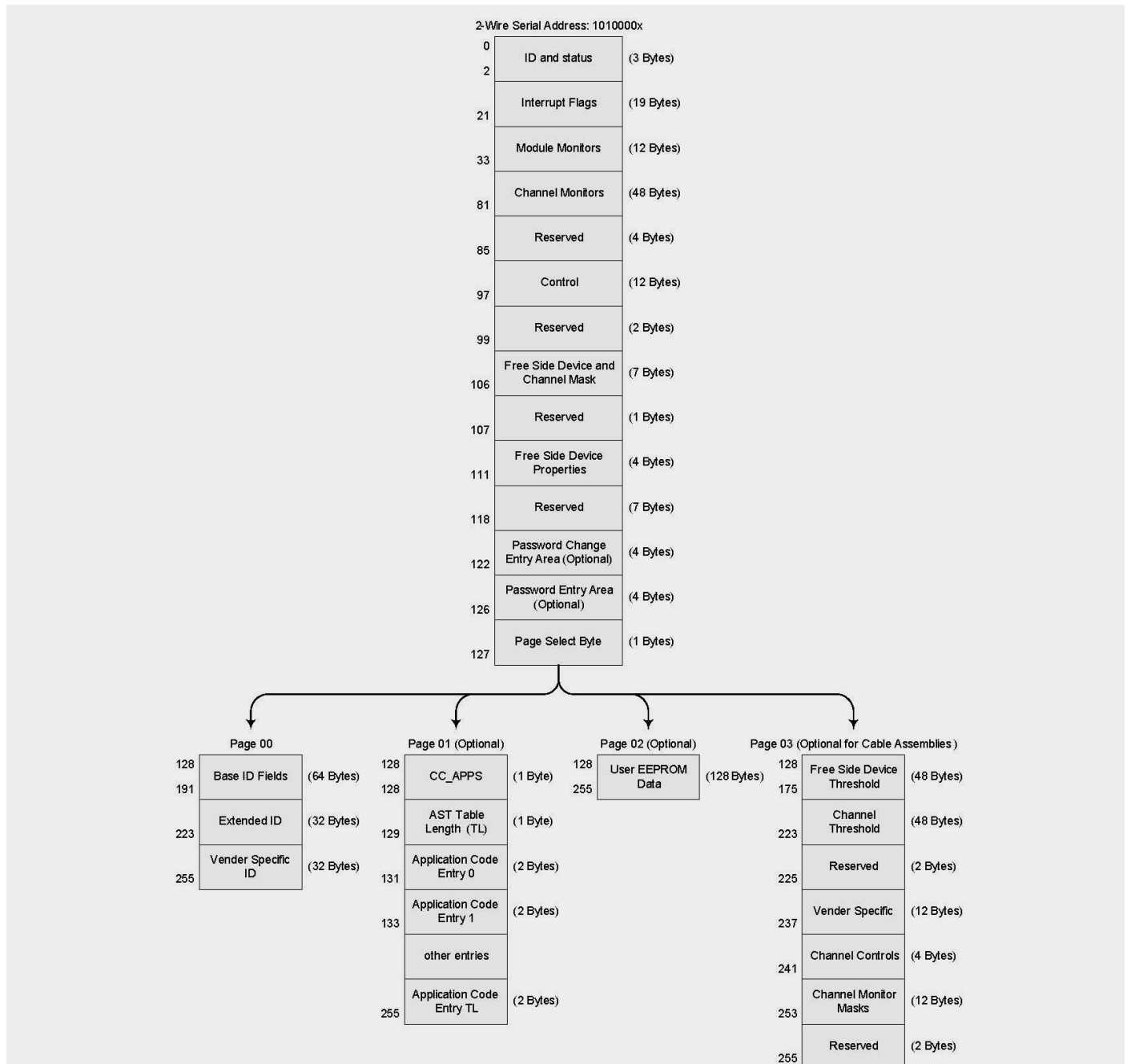
## HANDLING

Care should be taken to restrict exposure to the conditions defined in the Absolute Maximum Ratings. Put the product in an even and stable location. If the product falls down or drops, it may cause an injury or malfunction. The cable must not be subject to extreme bends during installation or while in operation. If you bend the cable at a radius less than the cable minimum bend radius, then the cable may get damaged. Don't twist or pull by force ends of the cable, which might cause malfunction.



## MEMORY MAP

The memory map is structured as a single address and multiple page approaches, according to SFF-8636 MSA specification as shown in the below. For more detailed description of this memory map or lower pages, please see our Memory Map document with flexible customization settings.



### PART NUMBERS

<b>AS35D5D5P10T01</b>	External Mini-SAS HD active optical cable, L=10M
<b>AS3AD5D5P30T01</b>	External Mini-SAS HD active optical cable, L=30M
<b>AS3AD5D5P50T01</b>	External Mini-SAS HD active optical cable, L=50M
<b>AS3AD5D5P10H01</b>	External Mini-SAS HD active optical cable, L=100M
<b>AS3AD5D5P15H01</b>	External Mini-SAS HD active optical cable, L=150M
<b>AS3AD5D5P30H01</b>	External Mini-SAS HD active optical cable, L=300M

### IMPORTANT NOTICE

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