

100Gbps QSFP28 Active Optical Cable, 0~70C, Ethernet P/N: WS-Q28-AOCxCyyz



General Description

Quad Small Form-Factor Pluggable 28 (QSFP28) active optical cables (AOC) are high-performance active optical cable with bi-directional signal transmission and aggregate 100-Gbps bandwidth for both InfiniBand EDR and Ethernet 100G-SR4 applications. Compared to conventional copper cables, longer and lighter optical cables enable the ease of complicated data-center cabling. The AOCs utilize multimode fiber with 850-nm VCSELs and PIN PDs. The certificated cables have superior signal integrity and bit-error-rate, which enables reliable operation performance.

Feature

- Compliant with 100GBASE-SR4 and CAUI-4 specification per IEEE 802.3bm
- Compliant to SFF-8665 (QSFP28 Solution) Revision 1.8
- Supports 100 Gbps data rate links up to 30m/70m/100 m via OM2/OM3/OM4, respectively.
- Low power consumption of max 2.5W
- Hot pluggable electrical interface
- Using standard 12/8 lane optical fiber with 3-mm round cable
- 0 to 70°C case temperature operating range
- RoHS Compliant (lead-free)

Applications

- Ethernet for 100GBASE-SR4
- InfiniBand EDR, FDR, & QDR
- HPC Interconnects
- Proprietary Interconnections

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	0	70	°C	1
3.3V Power Supply Voltage	-0.5	3.6	V	
Data Input Voltage- Single Ended	-0.5		V _{cc} +0.5	
Control Input Voltage	-0.5	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		70	°C	
Power Supply Voltage	3.135	3.3	3.465	V	
Data Rate per Channel			25.78125	Gbps	
Bit Error Ratio (BER)		10 ⁻¹²			1, 2
Control Input Voltage High	2		V _{cc} +0.3	V	
Control Input Voltage Low	-0.3		0.8	V	
Two Wire Serial (TWS) Interface Clock Rate			400	kHz	
Differential Data Input / Output Load		100		Ohms	+/- 10%
Standard Cable Lengths			100	m	3

Notes:

1. Bit-Error-Rate (BER) is tested with PRBS 2³¹-1 pattern.
2. 100G QSFP28 AOC cable requires an electrical connector compliant with SFF-8662 or SFF-8672 which is used on the host board in order to guarantee its electrical interface specification.
3. Per 100GBASE-SR4 Standard, cable length support up to 30m / 70m / 100m via OM2 / OM3 / OM4, respectively. Different cable length within this range upon customization.

Electrical Characteristics

Parameter	Symbol	Min	Typical	Max	Unit	Note
Transceiver Electrical Characteristics						
TRx Power Consumption			1.8	2.5	W	
TRx Power-on Initialization Time				2000	Ms	
CAUI-4 Module Electrical Input Characteristics (TP1)						
Single Ended Input Voltage Tolerance		-0.4		3.3	V	
Differential pk-pk input voltage tolerance				900	mV	
Differential Input Return Loss	S _{dd11}	See Eq. 1			dB	1
Differential to Common-mode Input Return Loss	S _{dc11}	See Eq. 2			dB	2
DC common mode voltage		-350		2850	mV	

Notes:

$$1. \quad RL_d(f) \geq \begin{cases} 9.5 - 0.37f & 0.01 \leq f < 8 \\ 4.75 - 7.41 \log_{10} \left(\frac{f}{14} \right) & 8 \leq f < 19 \end{cases} \quad (\text{dB}) \quad (\text{Eq.1})$$

where

 f is the frequency in GHzRL_d is the CAUI-4 Chip-to-module input differential return loss

$$2. \quad RL_{dc}(f) \geq \begin{cases} 22 - 20 \left(\frac{f}{25.78} \right) & 0.01 \leq f < 12.89 \\ 15 - 6 \left(\frac{f}{25.78} \right) & 12.89 \leq f < 19 \end{cases} \quad (\text{dB}) \quad (\text{Eq.2})$$

where

 f is the frequency in GHzRL_{dc} is the CAUI-4 Chip-to-module input differential to common mode input return loss

Parameter	Symbol	Min	Typical	Max	Unit	Note
CAUI-4 Module Electrical Output Characteristics (TP4)						
AC Common-Mode Output Voltage (RMS)				17.5	mV	
Differential Output Voltage				900	mV	
Eye Width		0.57			UI	
Eye Height, Differential		228			mV	
Vertical Eye Closure				5.5	dB	
Differential Output Return Loss	Sdd ₂₂	See Eq. 1			dB	1
Common to Differential Mode Conversion Return Loss	Scd ₂₂	See Eq. 2			dB	2
Transition Time (20% to 80%)		12			ps	
DC Common Voltage		-350		2850	mV	

Notes:

$$1. \quad RLd(f) \geq \begin{cases} 9.5 - 0.37f & 0.01 \leq f < 8 \\ 4.75 - 7.4 \log_{10} \left(\frac{f}{14} \right) & 8 \leq f < 19 \end{cases} \quad (\text{dB}) \quad (\text{Eq.1})$$

where

 f is the frequency in GHz

RLd is the CAUI-4 Chip-to-module host output differential return loss

$$2. \quad RLdc(f) \geq \begin{cases} 22 - 20 \left(\frac{f}{25.78} \right) & 0.01 \leq f < 12.89 \\ 15 - 6 \left(\frac{f}{25.78} \right) & 12.89 \leq f < 19 \end{cases} \quad (\text{dB}) \quad (\text{Eq.2})$$

where

 f is the frequency in GHz

RLdc is the CAUI-4 Chip-to-module output common to differential mode conversion return loss

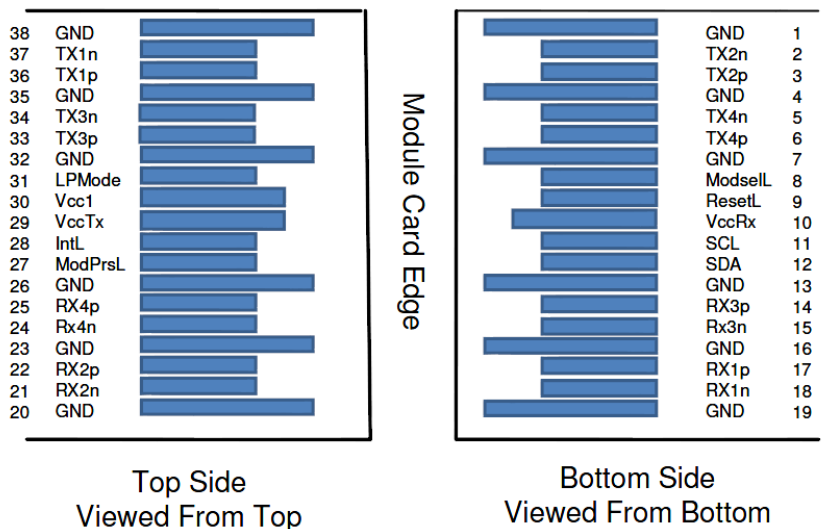
Optical Cable Specification

Parameter	Specification	Notes
Minimum Cable Bending Radius	~30 mm	
Cable Cross-Section Dimension	Round Cable with 3 mm in Diameter	
Cable Cover Type	LSZH	1
Standard Cable Length	3, 5, 7, 10, 15, 20, 30, 50, 70, 100-m	2
Cable Length Tolerance	+100/-0 cm	

Notes:

1. Cable cover type standard is LSZH. Other types can be available upon request.
2. Different cable length within this range upon customization.

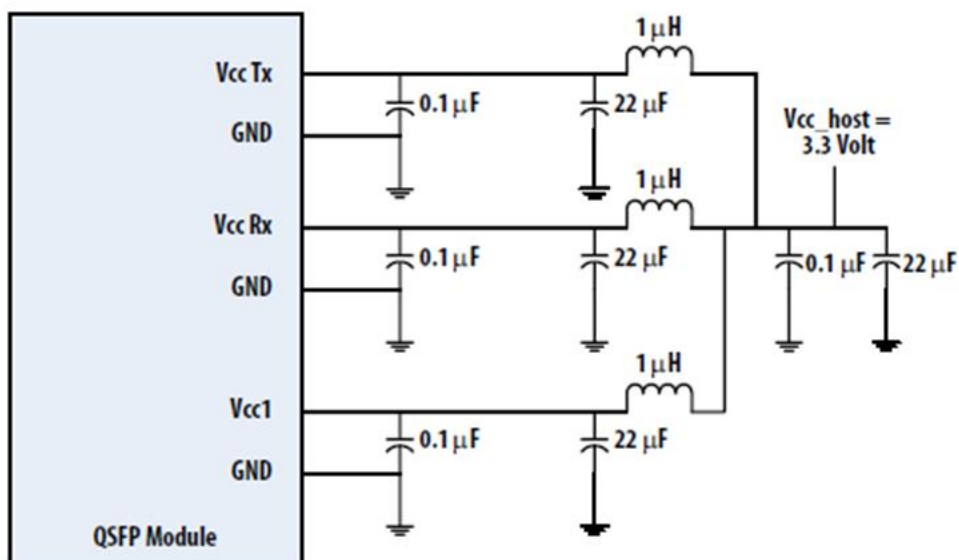
QSFP28 Module Pad Assignments and Descriptions



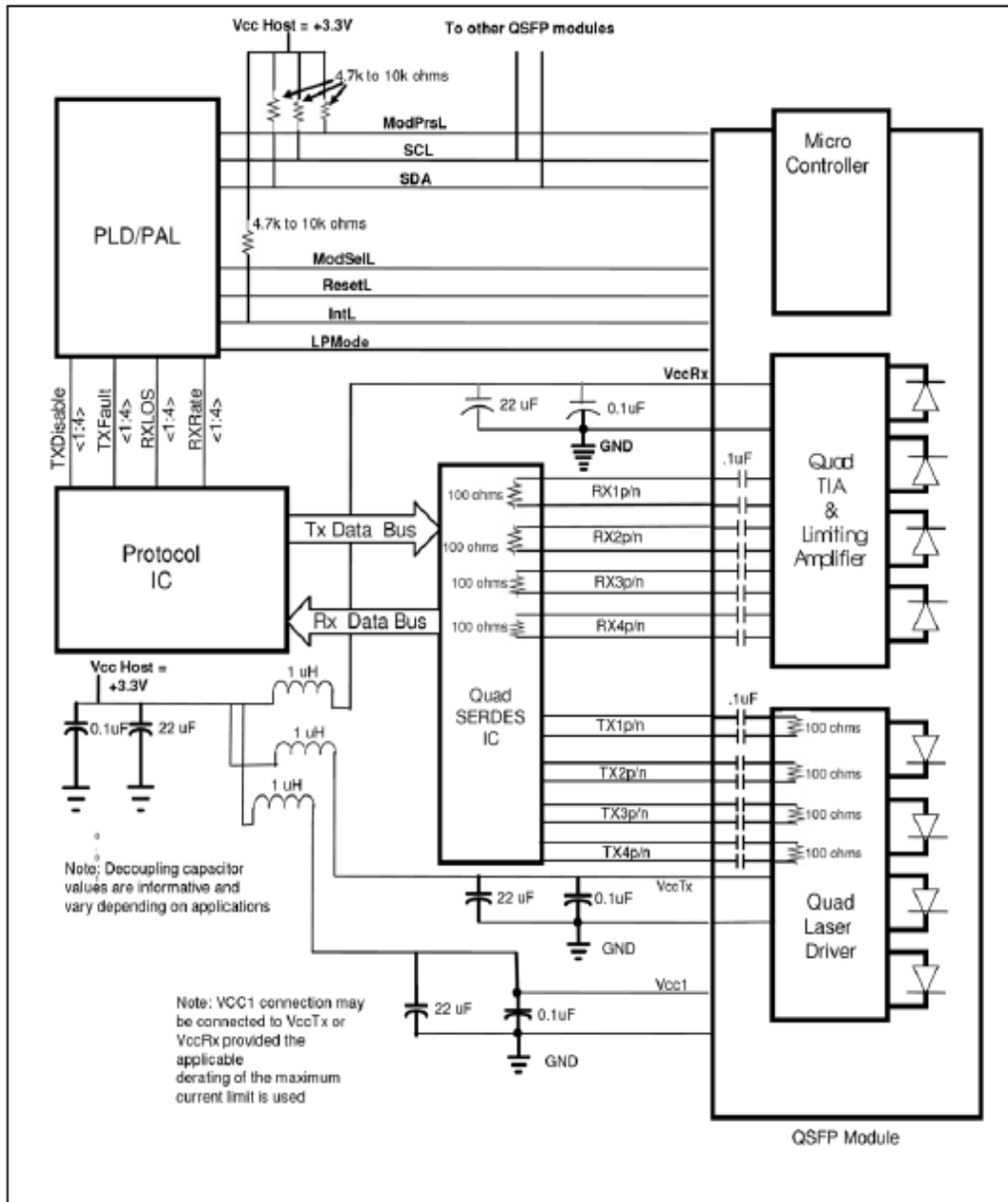
Pin	Logic	Symbol	Description	Plug Sequence	Notes
1		GND	Ground	1	
2	CML-I	Tx2n	Transmitter Inverted Data Input	3	
3	CML-I	Tx2p	Transmitter Non-Inverted Data Input	3	
4		GND	Ground	1	
5	CML-I	Tx4n	Transmitter Inverted Data Input	3	
6	CML-I	Tx4p	Transmitter Non-Inverted Data Input	3	
7		GND	Ground	1	
8	LVTTTL-I	ModSelL	Module Select	3	
9	LVTTTL-I	ResetL	Module Reset	3	
10		Vcc Rx	+3.3V Power Supply Receiver	2	
11	LVC MOS-I/O	SCL	2-wire serial interface clock	3	
12	LVC MOS-I/O	SDA	2-wire serial interface data	3	
13		GND	Ground	1	
14	CML-O	Rx3p	Receiver Non-Inverted Data Output	3	
15	CML-O	Rx3n	Receiver Inverted Data Output	3	
16		GND	Ground	1	
17	CML-O	Rx1p	Receiver Non-Inverted Data Output	3	
18	CML-O	Rx1n	Receiver Inverted Data Output	3	
19		GND	Ground	1	
20		GND	Ground	1	

21	CML-O	Rx2n	Receiver Inverted Data Output	3	
22	CML-O	Rx2p	Receiver Non-Inverted Data Output	3	
23		GND	Ground	1	
24	CML-O	Rx4n	Receiver Inverted Data Output	3	
25	CML-O	Rx4p	Receiver Non-Inverted Data Output	3	
26		GND	Ground	1	
27	LVTTTL-O	ModPrsL	Module Present	3	
28	LVTTTL-O	IntL	Interrupt	3	
29		Vcc Tx	+3.3V Power supply transmitter	2	
30		Vcc1	+3.3V Power supply	2	
31	LVTTTL-I	LPMODE	Low Power Mode	3	
32		GND	Ground	1	
33	CML-I	Tx3p	Transmitter Non-Inverted Data Input	3	
34	CML-I	Tx3n	Transmitter Inverted Data Input	3	
35		GND	Ground	1	
36	CML-I	Tx1p	Transmitter Non-Inverted Data Input	3	
37	CML-I	Tx1n	Transmitter Inverted Data Input	3	
38		GND	Ground	1	

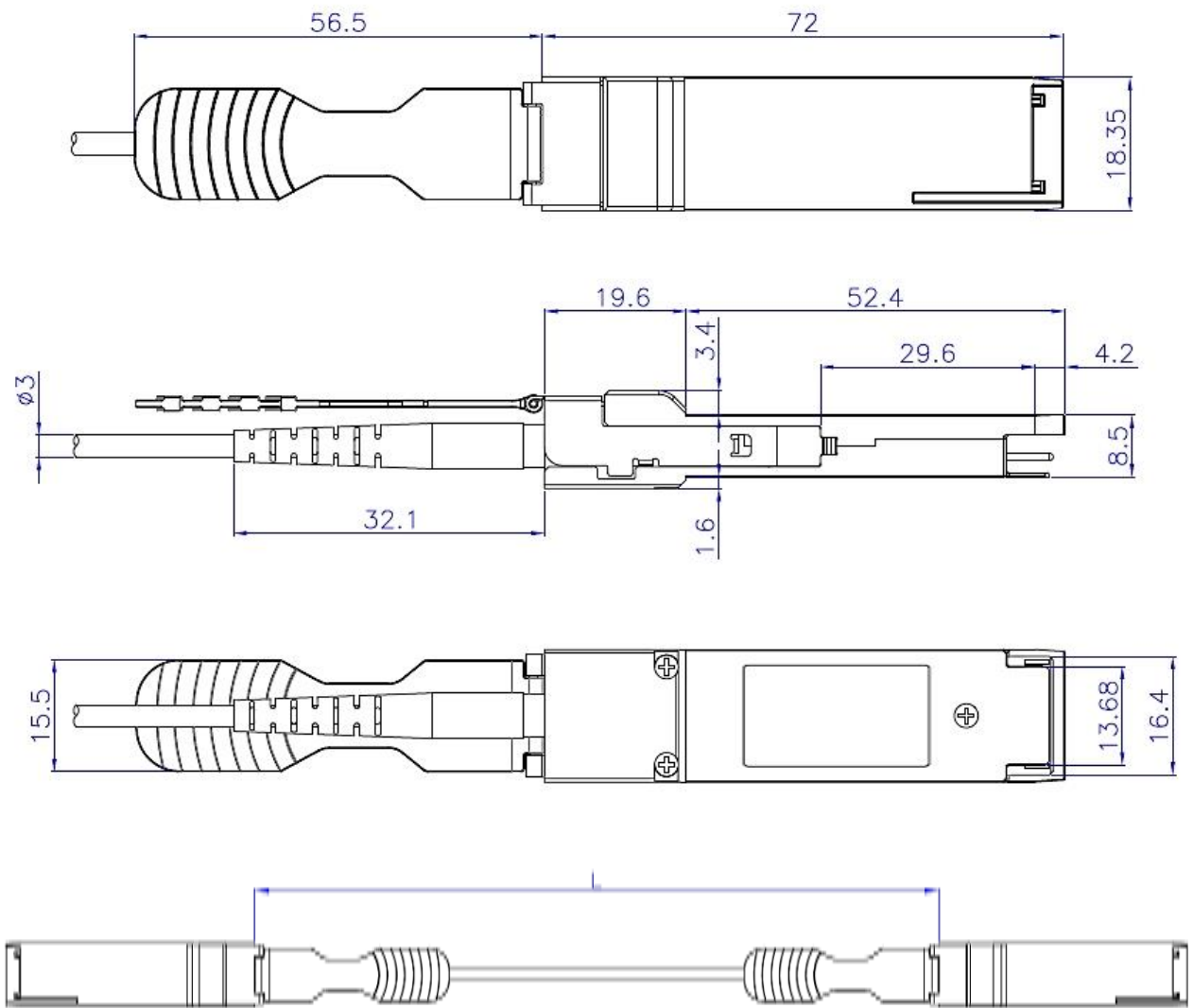
Recommended Host Board Power Supply Circuit



Recommended Interface Circuit



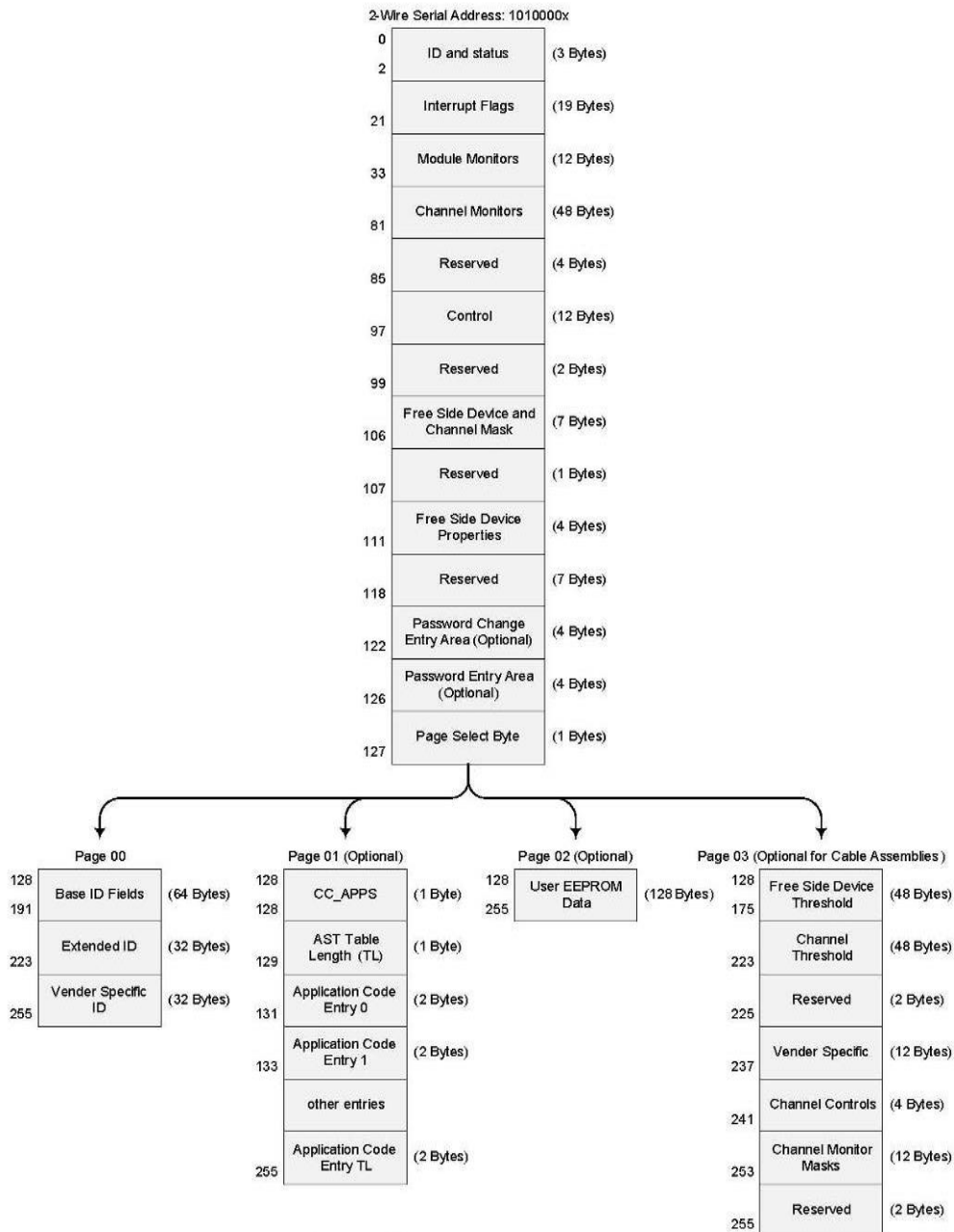
Mechanical Design Diagram



Unit: mm

Memory Map

The memory map is structured as a single address and multiple page approaches, according to the QSFP SFF-8636 SNIA 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.



Ordering Information

Part No	Specification						
	Package	Data Rate	Fiber	Cable Type*	Cable Length	Temp.	Application
WS-Q28-AOCLC012	QSFP28 to QSFP28	4x25Gbps	OM2	Round LSZH	1m	0~70°C	100G Ethernet
WS-Q28-AOCLC032	QSFP28 to QSFP28	4x25Gbps	OM2	Round LSZH	3m	0~70°C	100G Ethernet
WS-Q28-AOCLC052	QSFP28 to QSFP28	4x25Gbps	OM2	Round LSZH	5m	0~70°C	100G Ethernet
WS-Q28-AOCLC072	QSFP28 to QSFP28	4x25Gbps	OM2	Round LSZH	7m	0~70°C	100G Ethernet
WS-Q28-AOCLC102	QSFP28 to QSFP28	4x25Gbps	OM2	Round LSZH	10m	0~70°C	100G Ethernet
WS-Q28-AOCLC152	QSFP28 to QSFP28	4x25Gbps	OM2	Round LSZH	15m	0~70°C	100G Ethernet
WS-Q28-AOCLC202	QSFP28 to QSFP28	4x25Gbps	OM2	Round LSZH	20m	0~70°C	100G Ethernet
WS-Q28-AOCLC302	QSFP28 to QSFP28	4x25Gbps	OM2	Round LSZH	30m	0~70°C	100G Ethernet
WS-Q28-AOCLC503	QSFP28 to QSFP28	4x25Gbps	OM3	Round LSZH	50m	0~70°C	100G Ethernet
WS-Q28-AOCLC703	QSFP28 to QSFP28	4x25Gbps	OM3	Round LSZH	70m	0~70°C	100G Ethernet
WS-Q28-AOCLCH04	QSFP28 to QSFP28	4x25Gbps	OM4	Round LSZH	100m	0~70°C	100G Ethernet
WS-Q28-AOCxCyyz	QSFP28 to QSFP28	4x25Gbps	See Note	Round, see Note	See Note	0~70°C	100G Ethernet

Note:

Cable type (x): L for LSZH, P for OFNP, and R for OFNR

Length (yy): 01 for 1m, 10 for 10m, H0 for 100m

Fiber (z): 2 for OM2 (<30m), 3 for OM3 (<70m), and 4 for OM4 (<100m)

Variant Length, Cable Types, and Fiber can be customized. Please contact our sales for detail information.

Modification History

Revision	Date	Description	Originator	Review	Approved
V1.0	17-Jun-2016	New Issue	Ivy Chen	Wayne Liao	Wayne Liao
V1.1	20-Apr-2020	PN update	Ivy Chen	Wayne Liao	Wayne Liao
V1.2	18-Jun-2021	Update Order Information	ShaoYu lee	Wayne Liao	Wayne Liao



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