

## 40G QSFP+ to 4xSFP+ Break-out AOC P/N: WST-QP4S+AOCxCyy/WS-QP4S+AOC5xCyy



### Features:

- Four-channel full-duplex active optical cable from QSFP+ to four SFP+
- Supports 10.3125Gb/s per channel
- Low Power Dissipation, Max 1.3W on QSFP+ end, Max. 0.8W on SFP+ end.
- Operating Case Temperature: 0°C~70°C
- GR-468: Reliability Qualification
- ROHS: Environment Safety
- QSFP+ form factor compliance to
  - SFF-8679 electrical interface
  - SFF-8661 Pluggable Module
  - SFF-8636 Management Interface
  - IEEE 802.3ba: Physical Layer Specifications and Management Parameters
- SFP+ form factor compliance to
  - SFF-8431 General Electrical
  - SFF-8472 Management Interface
  - SFF-8432 Pluggable Module
  - IEEE 802.3ae: Physical Layer Specifications and Management Parameters

### Applications:

- Ethernet for 40GBASE-SR4
- InfiniBand EDR, FDR
- Proprietary Interconnections

**General Product Characteristics**

Parameter	Value	Unit	Comments
Module Form Factor	QSFP+ and SFP+		Module Form Factor
Maximum Aggregate Data Rate	41.25	Gb/s	
Maximum Data Rate per Lane	10.3125	Gb/s	
Standard Cable Lengths	3, 5, 7, 10, 15, 20	meters	Other lengths may be available upon request
Protocols Supported	InfiniBand, Ethernet		
Electrical Interface and Pin-out	38-pin edge connector (QSFP+) and 20-pin edge connector (SFP+)		Pin-out as defined by SFF-8679 & SFF-8431
Standard Optical Cable Type	Multimode OM3( $\leq 100\text{m}$ ) Multimode OM4( $< 150\text{m}$ )		
Maximum Power Consumption per End	1.3 (QSFP+) and 0.8 (SFP+)	Watts	Varies with output voltage swing and pre-emphasis settings
Management Interface	Serial, I2C-based, 400 kHz maximum frequency		As defined by SFF-8636
BER	$< 10^{-12}$		PRBS:31, input signal swing 800mV differential

**Absolute Maximum Ratings**

Exceeding the limits below may damage the active optical cable permanently.

Parameter	Symbol	Min.	Typ.	Max.	Unit.	Ref.
Maximum Supply Voltage	$V_{CC}$	-0.5		3.6	V	
Storage Temperature	$T_{sto}$	-40		85	$^{\circ}\text{C}$	
Case Operating Temperature	$T_{op}$	0		70	$^{\circ}\text{C}$	
Relative Humidity	RH	0		85	%	1

Notes:

1. No-condensing.

**Recommended Operating Conditions**

Parameter	Symbol	Min.	Typ.	Max.	Unit.	Ref.
Supply Voltage	$V_{CC}$	3.14		3.46	V	
Power Consumption	$P_{Con}$			1.3 (QSFP28) 0.8 (SFP28)	W	
Bit Rate	BR		10.3125		Gb/s	1
Bit Error Ratio	BER			$10^{-12}$		2
Center wavelength	$\lambda_c$	840		860	nm	3
Number of Lanes		4				
Management Interface		Serial, I2C-based, maximum frequency 400 kHz				4
Logic Input Voltage High	$V_{ih}$	2		$V_{CC}+0.3$	V	
Logic Input Voltage Low	$V_{il}$	-0.3		0.8	V	

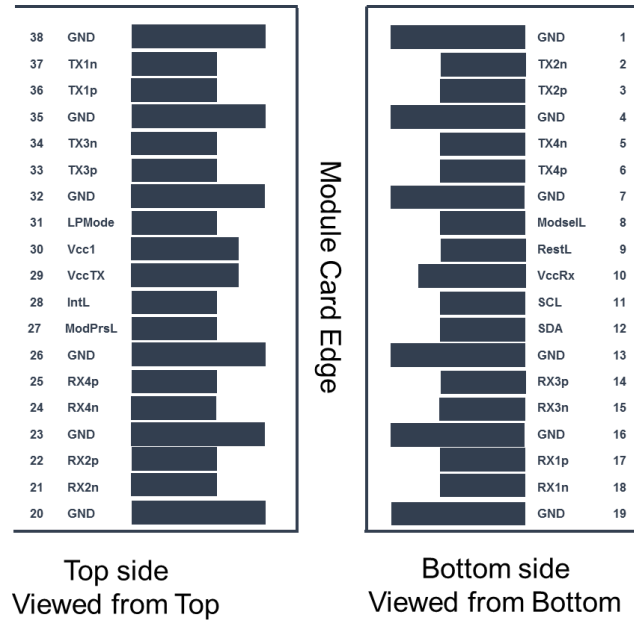
## Notes:

1. Single lane
2. PRBS=  $2^{31}-1$  @ 10.3125Gb/s
3. As defined by IEEE Std. 802.3ba
4. As defined by SFF-8636

**Electrical Characteristics**

Parameter	Symbol	Min.	Typ.	Max.	Unit.	Ref.
Transceiver Power Supply Current	$I_{cc}$			600 (QSFP28) 230 (SFP28)	mA	
Transceiver Power on Initialization Time	$T_{init}$			2000	ms	
<b>Transceiver Electrical Specifications (Per Lane)</b>						
Differential Data Input Voltage Peak to Peak Swing	$V_{in,pp}$			900	mV	
Common Mode Noise RMS				17.5	mV	
Differential Input Return Loss	SDD22	Per OIF CEI-28G-VSR and CAUI-4 Requirements			dB	
Common Mode to Differential Conversion and Differential to Common Mode Conversion	SDD22 SCD22				dB	
Common Mode Return Loss	SCC22				dB	
Transition Time, 20% to 80%	$T_r, T_f$	10			ps	
Common Mode Voltage	$V_{cm}$	-0.3		2.8	V	
Eye Width @ 1E-15 Probability	EW15	0.46			UI	
Eye Height @ 1E-15 Probability	EH15	94			mv	
<b>Receiver Electrical Specifications (Per Lane)</b>						
Differential Data Output Voltage Peak to Peak Swing	$V_{opp}$	300		900	mV	
Differential Output Impedance	$Z_{os}$	90	100	110	Ohms	
Common Mode Voltage	$V_{cm}$	-0.35		2.85	V	
Common Mode Noise RMS				17.5	mV	
Differential Output Return Loss	SDD22	Per OIF CEI-28G-VSR and CAUI-4 Requirements			dB	
Common Mode to Differential Conversion and Differential to Common Mode Conversion	SDD22 SCD22					
Common Mode Return Loss	SCC22			-2	dB	
Transition Time, 20% to 80%	$T_r, T_f$	10			ps	
Vertical Eye Closure	VEC			5.5	dB	A
Eye Width @ 1E-15 Probability	EW15	0.57			UI	
Eye Height @ 1E-15 Probability	EH15	228			mV	

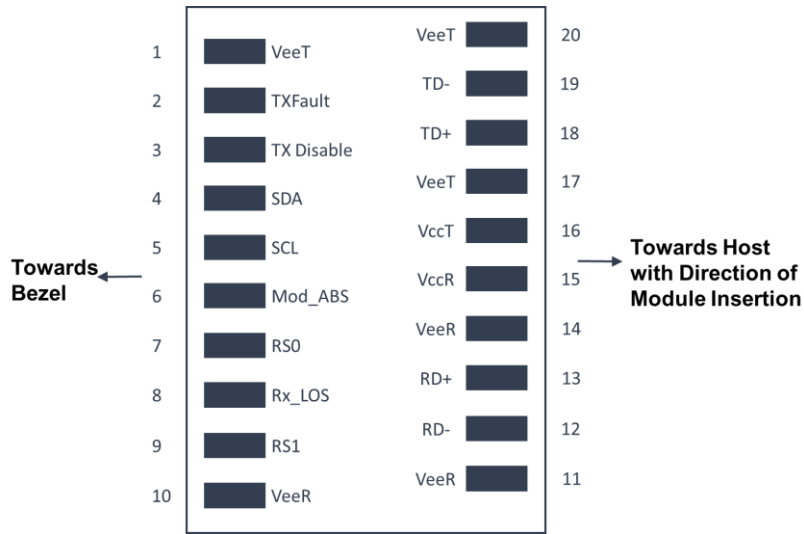
**Pin Assignment**  
**QSFP28 end**



PIN	Symbol	Description	Ref.
1	GND	Ground	
2	TX2n	Transmitter Inverted Data Input	
3	TX2p	Transmitter Non-Inverted Data Input	
4	GND	Ground	1
5	TX4n	Transmitter Inverted Data Input	
6	TX4p	Transmitter Non-Inverted Data Input	
7	GND	Ground	1
8	ModSelL	Module Select	2
9	ResetL	Module Reset	2
10	V <sub>cc</sub> RX	+3.3V Receiver Power Supply Receiver	
11	SCL	2-wire Serial Interface Clock	2
12	SDA	2-wire Serial Interface Data	2
13	GND	Ground	1
14	RX3p	Receiver Non-Inverted Data Output	
15	RX3n	Receiver Inverted Data Output	

16	GND	Ground	1
17	RX1p	Receiver Non-Inverted Data Output	
18	RX1n	Receiver Inverted Data Output	
19	GND	Ground	1
20	GND	Ground	1
21	RX2n	Receiver Inverted Data Output	
22	RX2p	Receiver Non-Inverted Data Output	
23	GND	Ground	1
24	RX4n	Receiver Inverted Data Output	
25	RX4p	Receiver Non-Inverted Data Output	
26	GND	Ground	1
27	ModPrsL	Module Present, internal pulled down to GND	
28	IntL	Interrupt output, should be pulled up on host board	
29	Vcc TX	+3.3V Transmitter Power Supply	
30	Vcc1	+3.3V Power Supply	
31	LPMODE	Low Power Mode	2
32	GND	Ground	
33	TX3p	Transmitter Non-Inverted Data Input	
34	TX3n	Transmitter Inverted Data Input	
35	GND	Ground	
36	TX1p	Transmitter Non-Inverted Data Input	
37	TX1n	Transmitter Inverted Data Input	
38	GND	Ground	1

**SFP28 end**



PIN	Symbol	Description	Ref.
1	VeeT	Module Transmitter Ground	1
2	TX_Fault	Module Transmitter Fault	2
3	TX_Disable	Transmitter Disable, turns off the laser output	
4	SDA	2-wire Serial Interface Data Lane	
5	SCL	2-wire Serial Interface Clock	
6	Mod_ABS	Module Absent, connected To VeeT or VeeR in the module	
7	RS0	Rate Select 0, optionally controls SFP+ module Receiver	
8	RX_LOS	Receiver Loss of Signal Indication	
9	RS1	Rate Select 1, optionally controls SFP+ module transmitter	
10	VeeR	module receiver ground	1
11	VeeR	module receiver ground	1
12	RD-	Receiver inverted Data Output	
13	RD+	Receiver Non-inverted Data Output	
14	VeeR	Module Receiver ground	1
15	VccR	Module Receiver 3.3V Supply	
16	VccT	Module Transmitter 3.3V Supply	
17	VeeT	Module Transmitter Ground	1
18	TD+	Transmitter Non-inverted Data Input	

19	TD-	Transmitter Inverted Data Input	
20	VeeT	Module Transmitter Ground	1

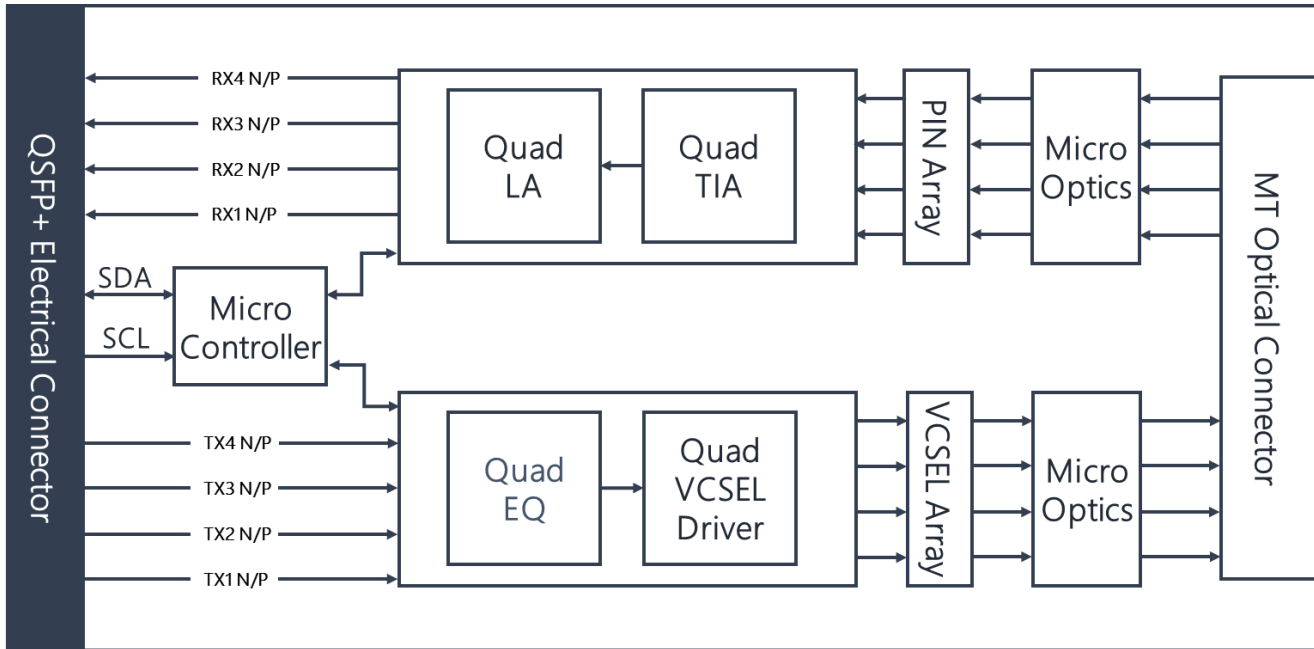
## Notes:

1. GND is the symbol for signal and supply (power) common for the module. All are common within the module and all module voltages are reference to this potential unless otherwise noted. Module circuit ground is isolated from module chassis ground within the module.
2. Open collector should be pulled up with 4.7~10K ohms on the host board to a voltage between 3.15V and 3.6V.
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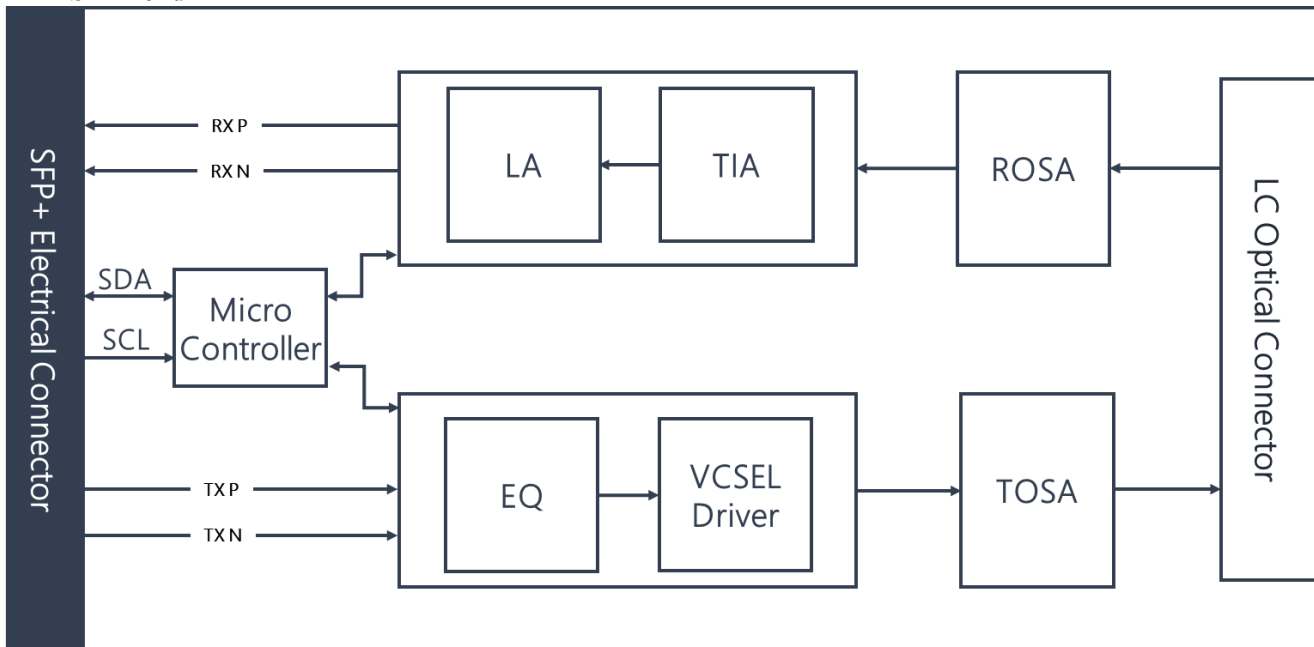


**Recommended Host Board Schematic**

**QSFP+ end**



**SFP+ end**



**Memory map**  
**QSFP+**

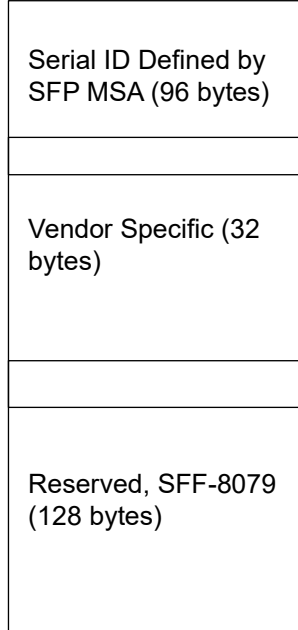
2-Wire Serial Address 1010000x	
Lower Page 00h	
0	Identifier
1-2	Status
3-21	Interrupt Flags
22-23	Free Side Device Monitors
34-81	Channel Monitors
82-85	Reserved
86-98	Control
99	Reserved
100-104	Hardware Interrupt Pin Masks
105-106	Vendor Specific
107	Reserved
108-110	Free Side Device Properties
111-112	Assigned for use by PCI Express
113	Free Side Device Properties
114-118	Reserved
119-122	Password Change Entry Area (Optional)
123-126	Password Entry Area (Optional)
127	Page Select Byte



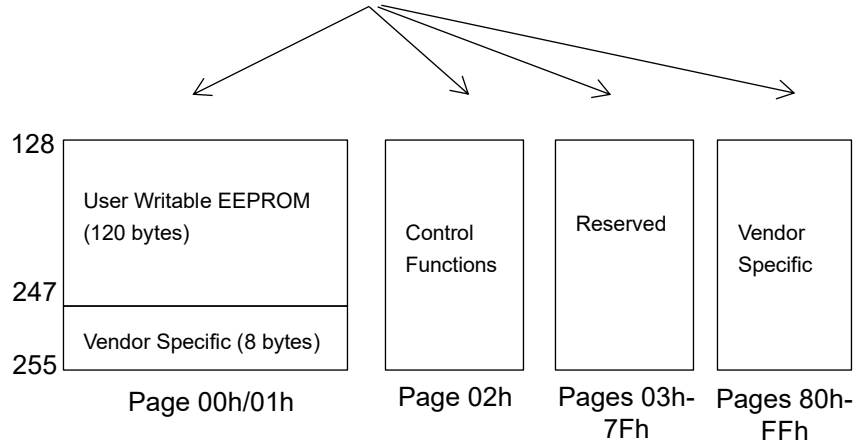
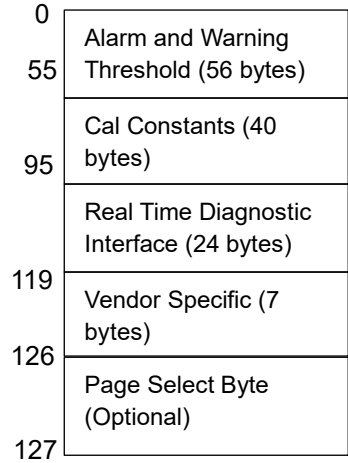
Upper Page 00h	Optional Page 01h	Optional Page 02h	Optional Page 03h		
128 Identifier	128 CC_APPS	128-255 User EEPROM data	128-175 Free Side Device Thresholds		
129-191 Base ID Fields	129 AST Table Length (TL)		176-223 Channel Thresholds	224 TX EQ & RX Emphasis Magnitude ID	
	130-131 Application Code Entry 0				225 RX output amplitude indicators
	132-133 Application Code Entry 1				
134-253 other entries	226-241 Channel Monitor Masks				
192-223 Extended ID	254-255 Application Code Entry TL	252-255 Reserved			
224-255 Vendor Specific ID					

**SFP+**

2wire address 1010000x (A0h)



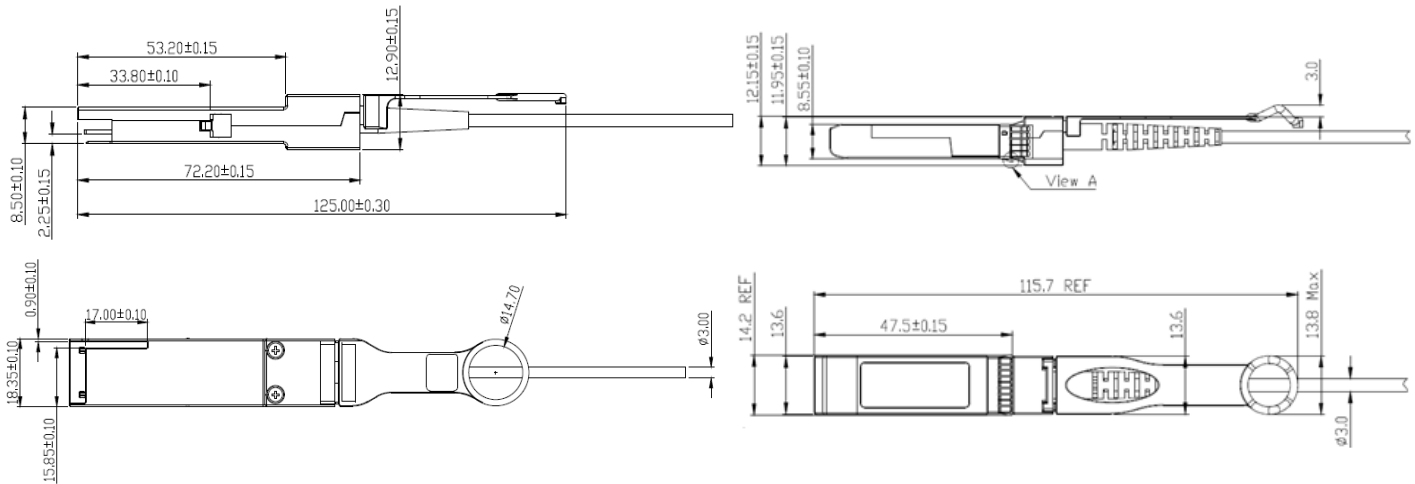
2wire address 1010001x (A2h)



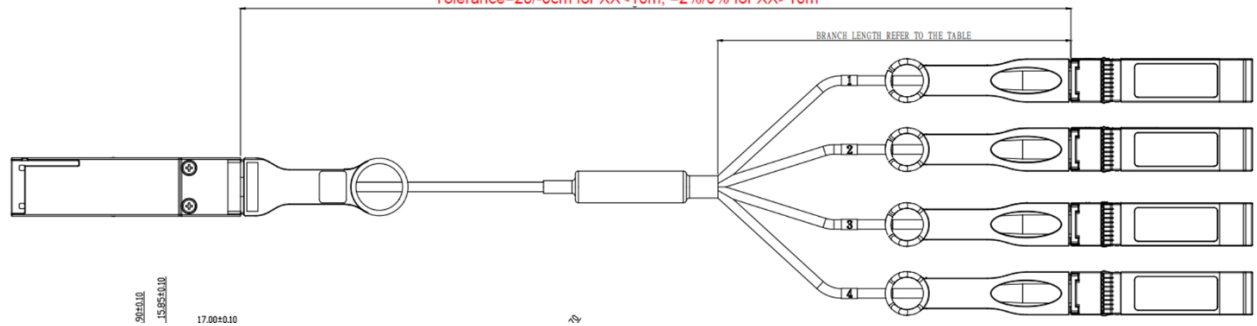
**Mechanical Drawing**

a. QSFP28 end

b. SFP28 end



Cable Length= XX meter+ Tolerance  
Tolerance=20/-0cm for XX<10m; ±2%/0% for XX>10m



Unit: mm

The force specification for AOC is in the list below:

Parameter	Min.	Max.	Unit.	Comments.
Module Insertion		40 (QSFP) 18 (SFP)	Newton	
Module Extraction		30 (QSFP) 12.5 (SFP)	Newton	
Module Retention	90 (QSFP) 90 (SFP)	170 (SFP)	Newton	
Insertion and removal cycles	50		Cycle	
Cable outer Diameter	2.9	3.0	mm	
Cable Jacket Material	LSZH			

**Ordering Information**

Part No	Specification							
	Package	Data rate	Fiber	Cable Type	Cable Length	Branch length	Temp.	Application
WST-QP4S+AOC-C01	QSFP+ to SFP+	40G 4x10Gbps	OM3	Ribbon LSZH	1m	0.67m	0~70°C	40GbE InfiniBand FDR, EDR
WST-QP4S+AOC-C02	QSFP+ to SFP+	40G 4x10Gbps	OM3	Ribbon LSZH	2m	1.34m	0~70°C	40GbE InfiniBand FDR, EDR
WST-QP4S+AOC-C03	QSFP+ to SFP+	40G 4x10Gbps	OM3	Ribbon LSZH	3m	2m	0~70°C	40GbE InfiniBand FDR, EDR
WST-QP4S+AOC-C04	QSFP+ to SFP+	40G 4x10Gbps	OM3	Ribbon LSZH	4m	3m	0~70°C	40GbE InfiniBand FDR, EDR
WST-QP4S+AOC-C05	QSFP+ to SFP+	40G 4x10Gbps	OM3	Ribbon LSZH	5m	4m	0~70°C	40GbE InfiniBand FDR, EDR
WST-QP4S+AOCxCyy	QSFP+ to SFP+	40G 4x10Gbps	OMm	Ribbon LSZH or OFNP or OFNR	yym (>5m)	4m	0~70°C	40GbE InfiniBand FDR, EDR
WS-QP4S+AOC-C07	QSFP+ to SFP+	40G 4x10Gbps	OM3	Ribbon LSZH	7m	5m	0~70°C	Extended type 40GbE InfiniBand FDR, EDR
WS-QP4S+AOC5-C10	QSFP+ to SFP+	40G 4x10Gbps	OM3	Ribbon LSZH	10m	5m	0~70°C	Extended type 40GbE InfiniBand FDR, EDR
WS-QP4S+AOC5-C15	QSFP+ to SFP+	40G 4x10Gbps	OM3	Ribbon LSZH	15m	5m	0~70°C	Extended type 40GbE InfiniBand FDR, EDR
WS-QP4S+AOC5xCyy	QSFP+ to SFP+	40G 4x10Gbps	OM3	Ribbon LSZH or OFNP or OFNR	yym (>7m)	5m	0~70°C	Extended type 40GbE InfiniBand FDR, EDR

Note: WST-QP4S+AOCxCyy, WS-QP4S+AOC5xCyy

Cable type: x= - for LSZH, P for OFNP, and R for OFNR, Length: yy ,

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

**Modification History**

Revision	Date	Description	Originator	Review	Approved
V1.0	24-Feb-2019	New Issue	Ivy Chen	Wayne Liao	Wayne Liao
V2.0	01-Jul-2021	Update PN	ShaoYu Lee	Wayne Liao	Wayne Liao
V2.2	02-Dec-2022	Update PN, Drawing, Order information	ShaoYu Lee	Tom Tang	Wayne Liao
V2.3	19-Mar-2024	Updated company information	Joanne Ni	Ken Cheng	Wayne Liao

**Headquarter**

16F-5, No. 75, Sec. 1, Xintai 5th Rd., Xizhi Dist.,  
New Taipei City 22101, Taiwan  
Tel: +886-2-2698-7208  
Fax: +886-2-2698-7210  
Email: sales@wavesplitter.com  
Website: <https://wavesplitter.com/>