WAVESPLITTER™ TECHNOLOGIES, INC.

Data Sheet

40G QSFP+ Active Optical Cable

P/N: WS-QSFP+AOCxCxxx

Features:

- Hot Pluggable QSFP Cable End
- Supports 10.3125Gb/s per channel
- Low Power Dissipation, Max 1.5W Each End
- Operating Case Temperature: 0℃~70℃
- SFF-8636 Management Interface
- SFF-8661: Pluggable Module
- SFF-8679: General Electrical
- GR-468: Reliability Qualification
- IEEE 802.3ba: Physical Layer Specifications and Management Parameters
- ROHS 2.0: Environment Safety

Applications:

- Ethernet for 40GBASE-SR4
- InfiniBand SDR, QDR, DDR
- Proprietary Interconnections

General Product Characteristics

Parameter	Value	Unit	Comments
Module Form Factor	QSFP	As defined by SFF-8661	Module Form Factor
Number of Lanes	4 TX and 4 RX		
Maximum Aggregate Data Rate	42	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		Pin-out as defined by SFF-8679
Standard Optical Cable Type	Multimode OM2 (≤30m) Multimode OM3 (≤100m) Multimode OM4(<150m)		

Maximum Power Consumption per End	1.5	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	℃	
Case Operating Temperature	T_{op}	0		70	℃	
Relative Humidity	RH	0		85	%	1

Notes:

1. No-condensing.

Parameters

Parameter	Symbol	Min.	Typ.	Max.	Unit.	Ref.
Supply Voltage	V_{cc}	3.14		3.46	V	
Power Consumption	P_{Con}			1.5	W	
Bit Rate	BR		10.3125		Gb/s	1
Bit Error Ratio	BER			10^{-12}		2
Center wavelength	λ_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		Vcc+0.3	V	
Logic Input Voltage Low	V_{il}	-0.3		0.8	V	

Notes:

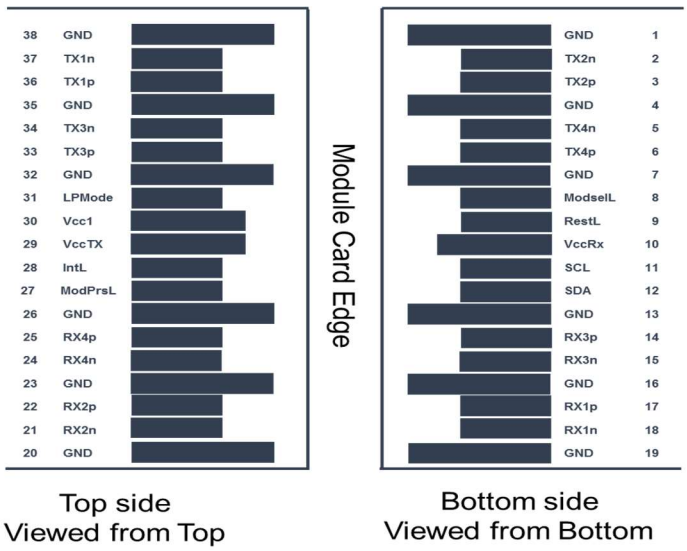
1. Single lane
2. PRBS= 231-1 @ 10.3125Gb/s
3. As defined by IEEE Std. 802.3ba – 2015

4. As defined by SFF-8636

Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit.	Ref.
Transceiver Power Supply Current	I_{cc}			450	mA	
Transceiver Power on Initialization Time	T_{init}			2000	ms	
Transmitter at TP1a						
Differential Data Input Voltage Peak to Peak Swing	$V_{in,pp}$	200		1200	mV	
Differential Input Impedance	Zin	90	100	110	Ohms	
Differential Input Return Loss	SDD11	$< -12 + 2 \times \mathrm{SQRT}(f), f$ in GHz			dB	0.01-4.1GHz
		$< -6.3 + 13 \times \log_{10}\left(\frac{f}{5.5}\right), f\ in\ GHz$			dB	4.1-11.1GHz
Differential to Common Mode Loss	SCD11			-10	dB	0.01-11.1GHz
Jitter Tolerance (Total)	TJ			0.4	UI	
Jitter Tolerance (Deterministic)	DJ			0.15	UI	
Receiver at TP4						
Differential Data Output Voltage Peak to Peak Swing	V_{opp}	300		800	mV	
Differential Output Impedance	Zout	90	100	110	Ohms	
Differential Output Return Loss	SDD22	$< -12 + 2 \times \mathrm{SQRT}(f), f$ in GHz			dB	0.01-4.1GHz
		$< -6.3 + 13 \times \log_{10}\left(\frac{f}{5.5}\right), f\ in\ GHz$			dB	4.1-11.1GHz
Common Mode Output Return Loss	SCC22	$< -7 + 1.6 \times f, f$ in GHz			dB	0.01-2.5GHz
				-3	dB	2.5-11.1GHz
Output Rise and Fall time (20% to 80%)	T_r, T_f	24			ps	
Deterministic Jitter	DJ_{out}			0.38	UI	
Total Jitter	TJ_{out}			0.64	UI	

Pin Descriptions (compliant SFF-8679)



Top side
Viewed from Top

Bottom side
Viewed from Bottom

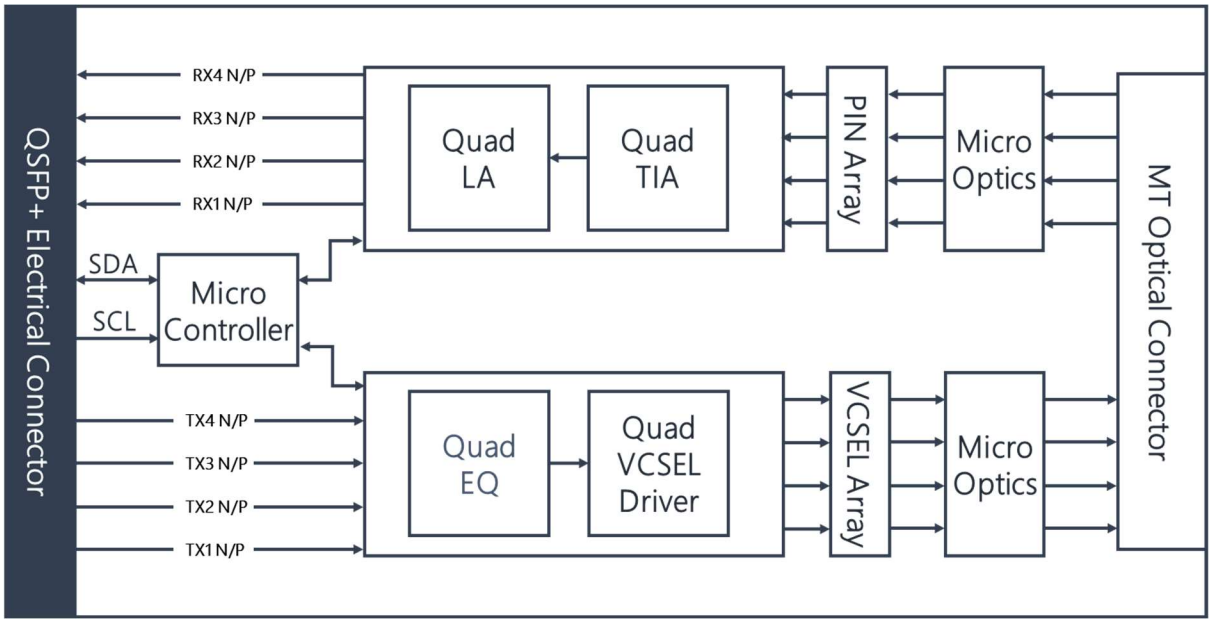
PIN	Symbol	Description	Ref.
1	GND	Ground	
2	TX2n	Transmitter Inverted Data Input	
3	TX2p	Transmitter Non-Inverted Data Input	
4	GND	Ground	1
5	TX4n	Transmitter Inverted Data Input	
6	TX4p	Transmitter Non-Inverted Data Input	
7	GND	Ground	1
8	ModSelL	Module Select	2
9	ResetL	Module Reset	2
10	V_{cc} RX	+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

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.

Recommended Host Board Schematic



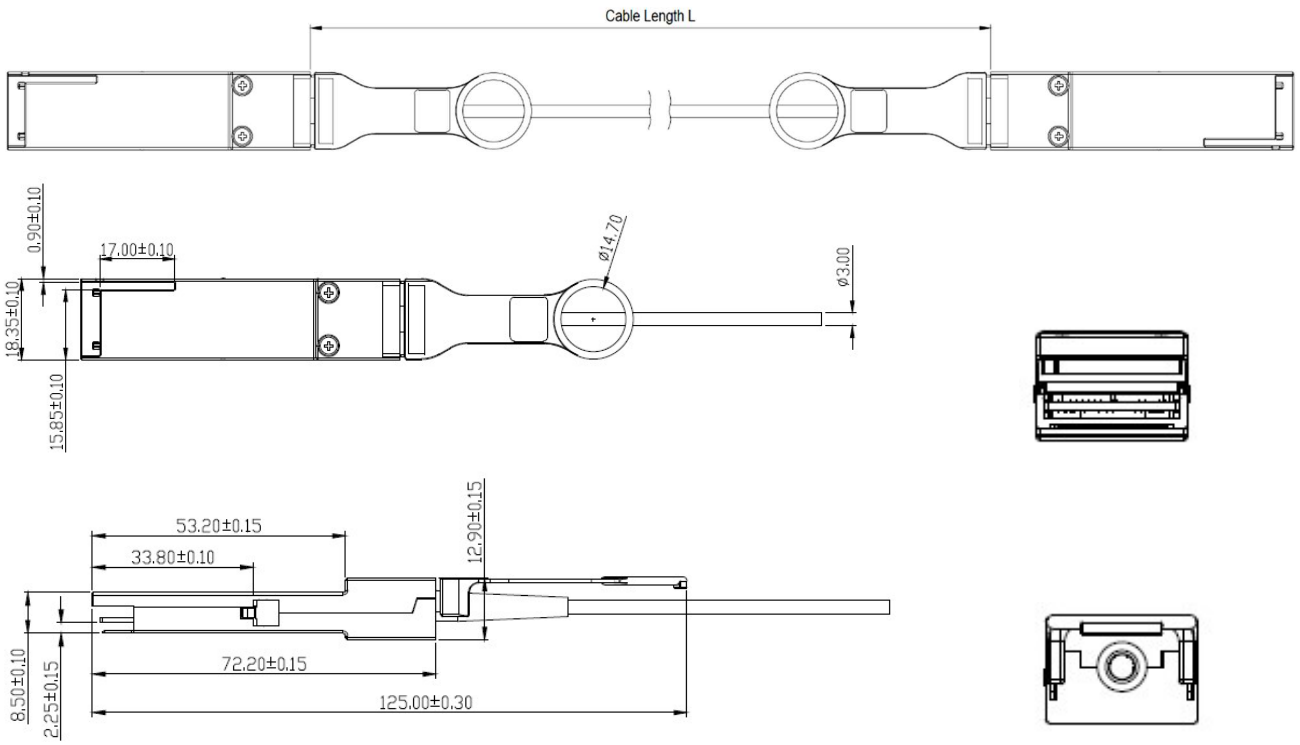
Memory map

	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

	Optional	Optional	Optional
Upper Page 00h	Page 01h	Page 02h	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)		
	130-131 Application Code Entry 0		
	132-133 Application Code Entry 1		
	134-253 other entries		
			176-223 Channel Thresholds
192-223 Extended ID			
224-255 Vendor Specific ID			224 TX EQ & RX Emphasis Magnitude ID
			225 RX output amplitude indicators
			226-241 Channel Monitor Masks
	254-255 Application Code Entry TL		252-255 Reserved

Mechanical Drawing

Product shall be of design, construction and physical dimensions specified on applicable product drawing.



Unit: mm

The force specification for AOC is in the list below:

Parameter	Min.	Max.	Unit.	Comments.
QSFP Module Insertion		40	Newton	
QSFP Module Extraction		30	Newton	
QSFP Module Retention	90		Newton	
Insertion and removal cycles	50		Cycle	
Cable outer Diameter	2.9	3.0	mm	
Cable Jacket Material	PVC/LSZH/OFNP			

Ordering Information

Part No	Specification						
	Package	Data rate	Fiber	Cable Type	Cable Length	Temp.	Application
WS-QSFP+AOCxC012	QSFP+	40Gbps	OM2	Ribbon PVC/LSZH/OFNP	1m	0~70°C	40GbE InfiniBand SDR, QDR, DDR
WS-QSFP+AOCxC032	QSFP+	40Gbps	OM2	Ribbon PVC/LSZH/OFNP	3m	0~70°C	40GbE InfiniBand SDR, QDR, DDR
WS-QSFP+AOCxC052	QSFP+	40Gbps	OM2	Ribbon PVC/LSZH/OFNP	5m	0~70°C	40GbE InfiniBand SDR, QDR, DDR
WS-QSFP+AOCxC072	QSFP+	40Gbps	OM2	Ribbon PVC/LSZH/OFNP	7m	0~70°C	40GbE InfiniBand SDR, QDR, DDR
WS-QSFP+AOCxC102	QSFP+	40Gbps	OM2	Ribbon PVC/LSZH/OFNP	10m	0~70°C	40GbE InfiniBand SDR, QDR, DDR
WS-QSFP+AOCxC152	QSFP+	40Gbps	OM2	Ribbon PVC/LSZH/OFNP	15m	0~70°C	40GbE InfiniBand SDR, QDR, DDR
WS-QSFP+AOCxC202	QSFP+	40Gbps	OM2	Ribbon PVC/LSZH/OFNP	20m	0~70°C	40GbE InfiniBand SDR, QDR, DDR
WS-QSFP+AOCxC302	QSFP+	40Gbps	OM2	Ribbon PVC/LSZH/OFNP	30m	0~70°C	40GbE InfiniBand SDR, QDR, DDR
WS-QSFP+AOCxC503	QSFP+	40Gbps	OM3	Ribbon PVC/LSZH/OFNP	50m	0~70°C	40GbE InfiniBand SDR, QDR, DDR
WS-QSFP+AOCxC703	QSFP+	40Gbps	OM3	Ribbon PVC/LSZH/OFNP	70m	0~70°C	40GbE InfiniBand SDR, QDR, DDR
WS-QSFP+AOCxCH03	QSFP+	40Gbps	OM3	Ribbon PVC/LSZH/OFNP	100m	0~70°C	40GbE InfiniBand SDR, QDR, DDR

Note: x: - for PVC, L for LSZH, P: OFNP

Modification History

Revision	Date	Description	Originator	Review	Approved
V1.0	13-Feb-2020	New Issue	Ivy Chen	Wayne Liao	Wayne Liao
V1.1	22-Jul-2020	Update PN and PVC	Ivy Chen	Wayne Liao	Wayne Liao

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