

## **FG-TRAN-QSFP-4XSFP-7M-OPC**

Fortinet® Compatible TAA Compliant 40GBase-AOC QSFP+ to 4xSFP+ Active Optical Cable (850nm, MMF, 7m)

### **Features**

- Compliant to Standard SFF-8436 for QSFP+ and Standard SFF-8431 for SFP+
- High-Speed/High-Density: Supports up to 4x100Gbps Bi-Directional Operation
- Reliable VCSEL and PIN Photonic Devices
- I2C Standard Management Interface
- Excellent High-Speed Signal Integrity
- Operating Case Temperature: 0 to 70 Celsius
- RoHS Compliant and Lead-Free



### **Applications:**

- 10G/40G Ethernet
- Proprietary High-Speed/High-Density Data
- High Performance Computing, Server and Data Storage

### **Product Description**

This is a Fortinet® compatible 40GBase-AOC QSFP+ to 4xSFP+ active optical cable that operates over multi-mode fiber with a maximum reach of 7.0m (23.0ft). At a wavelength of 850nm, it has been programmed, uniquely serialized, and data-traffic and application tested to ensure it is 100% compliant and functional. This active optical cable is TAA (Trade Agreements Act) compliant, and is built to comply with MSA (Multi-Source Agreement) standards. We stand behind the quality of our products and proudly offer a limited lifetime warranty.

### Absolute Maximum Ratings

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Storage Temperature	Tstg	-40		85	°C	
Operating Temperature	Tc	0	25	70	°C	
Relative Humidity	RH	5		85		
Maximum Supply Voltage	Vcc	0		3.6	V	

### Electrical Specifications

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Power Supply Voltage	Vcc	3.135	3.3	3.465	V	
Data Rate per Channel				4*10.3	Gbps	
Low Speed Output: Transmitter Fault (Tx_Fault)/Loss of Signal (LOS)	V\ H	2.0		Vcc	V	1
	V\ L	0		0.8	V	1
Low Speed Input: Transmitter Disable (Tx_Disable), M\)_D- 71, M\)_D- 72	V $\overline{\text{O}}$	2.0		Vcc	V	2
	V $\text{O}$	0		0.8	V	2
Clock Rate - I2C	f			400	kHz	3
Module Turn On Time				2000	ms	4

### Notes:

1. For all control input pins: LPMode, Reset, and ModSelL.
2. For all status output pins: ModPrsL and IntL.
3. For the management interface.
4. Time from module power on/insertion/ResetL de-assert to module fully functional.

## Optical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
<b>Transmitter</b>						
Reference Differential Input Impedance	Zd		100		Ω	1
Optical Return Loss Tolerance				12	dB	
Differential Data Input Swing	VIN,pp	180		1200	mV	
Differential Data Input Threshold			50		mV	2
<b>Receiver</b>						
Reference Differential Input Impedance	Zd		100		Ω	1
Differential Data Output Swing	VOOUT,pp	0		800	mV	
Pre-Emphasis Pulse Amplitude Percentage		0			%	3
		10			%	
		20			%	
		40			%	
Pre-Emphasis Pulse Duration			30		ps	
Signal Speed			4*10.3		Gbps	
Differential Data Output Swing		150		850	mV	
Differential Data Output Swing When Squelched				50	mV	
Rise/Fall Time		24			ps	

### Notes:

1. AC coupled inside the AOC module.
2. Input swing to trigger Tx\_Squelch.
3. User-selectable. Percentage is the ratio of pre-emphasis amplitude to output swing.

**Pin Descriptions (QSFP+ End)**

Pin	Symbol	Name/Description	Notes
1	GND	Transmitter Ground (Common with Receiver Ground).	1
2	Tx2-	Transmitter Inverted Data Input.	
3	Tx2+	Transmitter Non-Inverted Data Input.	
4	GND	Transmitter Ground (Common with Receiver Ground).	1
5	Tx4-	Transmitter Inverted Data Input.	
6	Tx4+	Transmitter Non-Inverted Data Input.	
7	GND	Transmitter Ground (Common with Receiver Ground).	1
8	ModSelL	Module Select.	2
9	ResetL	Module Reset.	2
10	VccRx	+3.3V Receiver Power Supply.	
11	SCL	2-Wire Serial Interface Clock.	2
12	SDA	2-Wire Serial Interface Data.	2
13	GND	Transmitter Ground (Common with Receiver Ground).	1
14	Rx3+	Receiver Non-Inverted Data Output.	
15	Rx3-	Receiver Inverted Data Output.	
16	GND	Transmitter Ground (Common with Receiver Ground).	1
17	Rx1+	Receiver Non-Inverted Data Output.	
18	Rx1-	Receiver Inverted Data Output.	
19	GND	Transmitter Ground (Common with Receiver Ground).	1
20	GND	Transmitter Ground (Common with Receiver Ground).	1
21	Rx2-	Receiver Inverted Data Output.	
22	Rx2+	Receiver Non-Inverted Data Output.	
23	GND	Transmitter Ground (Common with Receiver Ground).	1
24	Rx4-	Receiver Inverted Data Output.	1
25	Rx4+	Receiver Non-Inverted Data Output.	
26	GND	Transmitter Ground (Common with Receiver Ground).	1
27	ModPrs1	Module Present.	
28	IntL	Interrupt.	2
29	VccTx	+3.3V Transmitter Power Supply.	
30	Vcc1	+3.3V Power Supply.	
31	LPMode	Low-Power Mode.	2
32	GND	Transmitter Ground (Common with Receiver Ground).	1
33	Tx3+	Transmitter Non-Inverted Data Input.	
34	Tx3-	Transmitter Inverted Data Input.	
35	GND	Transmitter Ground (Common with Receiver Ground).	1
36	Tx1+	Transmitter Non-Inverted Data Input.	
37	Tx1-	Transmitter Inverted Data Input.	
38	GND	Transmitter Ground (Common with Receiver Ground).	1

**Notes:**

- 1. The module signal grounds are isolated from the module case.
- 2. This is an open collector/drain output that, on the host board, requires a 4.7kΩ to 10kΩ pull-up resistor to the Host\_Vcc.

**Electrical Pin-Out Details (QSFP+ End)**



### Pin Descriptions (SFP+ End)

Pin	Symbol	Name/Description	Notes
1	VeeT	Transmitter Ground.	1
2	Tx_Fault	Transmitter Fault. LVTTTL-O. "High" indicates a fault condition.	2
3	Tx_Disable	Transmitter Disable. LVTTTL-I. "High" or "open" disables the transmitter.	3
4	SDA	2-Wire Serial Interface Data. LVCMOS-I/O. MOD_DEF2.	4
5	SCL	2-Wire Serial Interface Clock. LVCMOS-I/O. MOD_DEF1.	4
6	MOD_ABS	Module Absent. Output. Connected to the VeeT or VeeR in the module.	5
7	RS0	Rate Select 0. Not used. Presents high input impedance.	
8	Rx_LOS	Receiver Loss of Signal. LVTTTL-O.	2
9	RS1	Rate Select 1. Not used. Presents high input impedance.	
10	VeeR	Receiver Ground.	1
11	VeeR	Receiver Ground.	1
12	RD-	Inverse Received Data Out. CML-O.	
13	RD+	Receiver Data Out. CML-O.	
14	VeeR	Receiver Ground.	
15	VccR	+3.3V Receiver Power.	
16	VccT	+3.3V Transmitter Power.	
17	VeeT	Transmitter Ground.	1
18	TD+	Transmitter Data In. CML-I.	
19	TD-	Inverse Transmitter Data In. CML-I.	
20	VeeT	Transmitter Ground.	1

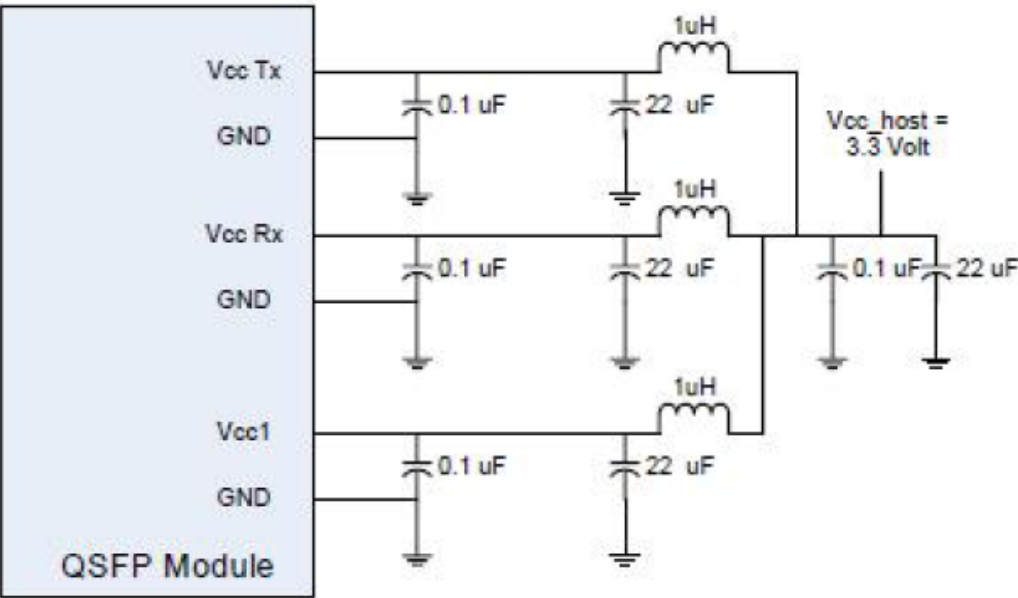
### Notes:

1. The module signal grounds are isolated from the module case.
2. This is an open collector/drain output that, on the host board, requires a 4.7k $\Omega$  to 10k $\Omega$  pull-up resistor to the Host\_Vcc.
3. This input is internally biased high with a 4.7k $\Omega$  to 10k $\Omega$  pull-up resistor to the VccT.
4. 2-wire serial interface clock and data lines require an external pull-up resistor dependent on the capacitance load.
5. This is a ground return that, on the host board, requires a 4.7k $\Omega$  to 10k $\Omega$  pull-up resistor to the Host\_Vcc.

Electrical Pin-Out Details (SFP+ End)



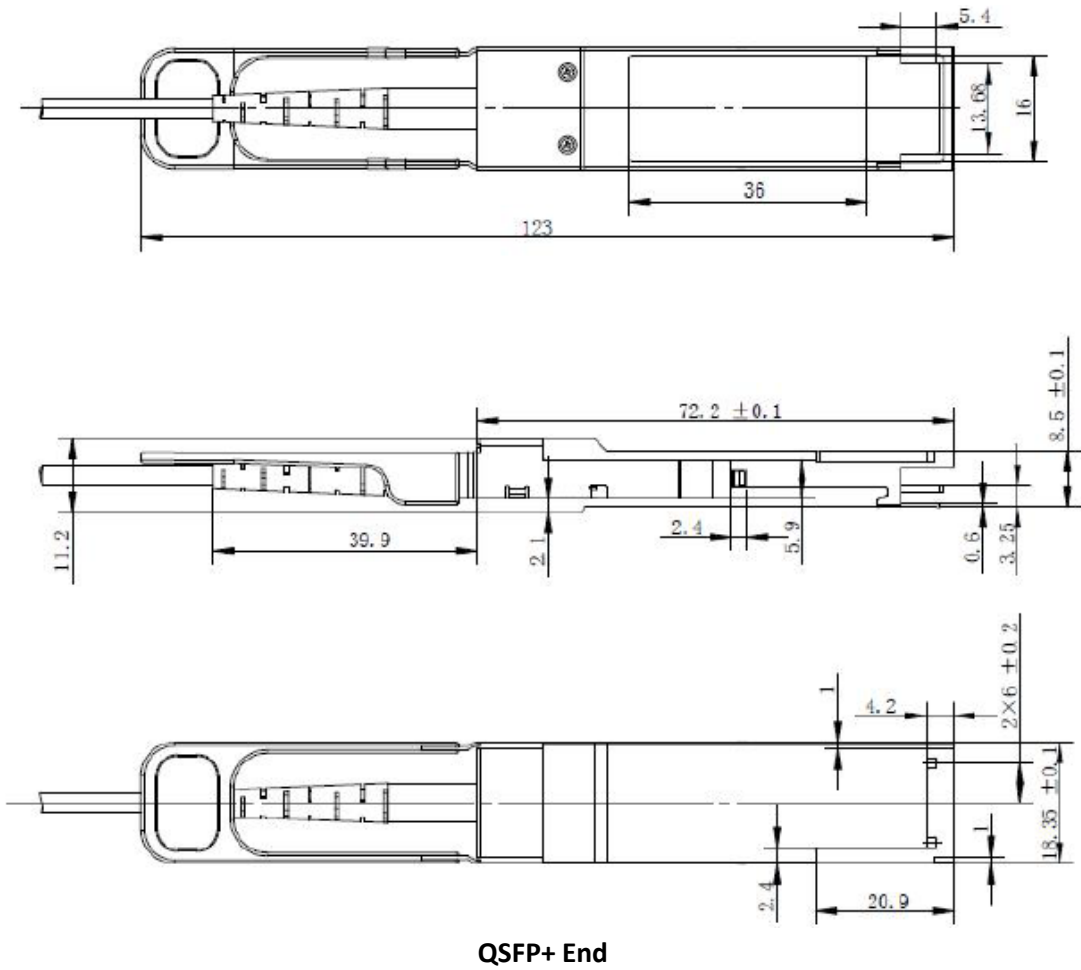
Application Interface Circuit



Active Optical Cable Specifications

Parameter	Symbol	Min.	Typ.	Max.	Unit
AOC Cable Length ( $L1 \leq 5m$ )	L1	$L - 0.06$	L	$L + 0.06$	M
AOC Cable Length ( $L1 > 5m$ )	L1	$L * 95\%$	L	$L * 105\%$	M
AOC Cable Length of Branch ( $L2 \leq 3m$ )	L2	$L - 0.06$	L	$L + 0.06$	M
Module Retention		90		170	N
Module Insertion		0		18	N
Module Extraction		0		25	N
Cable Pull Strength - Apply Load at 0°		25			N
Cable Pull Strength - Apply Load at 90°		20			N
Cable Bending Radius		30			mm
Insertion/Removal Cycles		50			cycles

Mechanical Specifications







Unit:mm



**SFP+ End**