



E-AC-QS-8D7xxxx41-CC

40-Gbps QSFP+ to 4x10-Gbps SFP+ Break-Out
Active Optical Cable

Data Sheet



General Description

The FOCI's E-AC-QS-8D7xxxx41-CC QSFP+ to SFP+ Break-Out AOC allows interoperable connections between a 40Gbps QSFP+ port and 4 separate 10Gbps SFP+ ports, enabling the flexible linkage of servers, switches, or storages with different port interfaces. This AOC is of high-performance with full-duplex and aggregate 40-Gbps.

Compared with conventional copper cables, longer, lighter, and flexible AOCs makes the ease of complicated data-center cabling because of its small cable diameter of only 3-mm. High-quality 850-nm VCSELs and PIN PDs are adopted in this AOC cable with superior signal integrity and link performance, bringing reliable operation performance.

Part number

40-Gbps QSFP+ to 4x10-Gbps SFP+ Break-Out
Active Optical Cable

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Where xxxx=cable length in meters

Features

- Full-Duplex & 10-Gbps per lane with maximum aggregate speed of 40-Gbps
- Bit-Error-Rate (BER) better than 10^{-12}
- 3.3V single power supply
- Low power consumption of max. 1.5W at QSFP+ and max. 0.5W at SFP+ side
- Hot pluggable interface
- Designed to meet MSA of SFF-8436 (QSFP+), SFF-8431, and SFF-8472 (SFP+)
- Programmable EEPROM for serial identification through I2C interface
- RoHS compliant

Applications

- 40GbE and 10GbE break-out applications for Datacom switch and router links
- 40G to 4x10G density applications for Datacom and Proprietary protocol applications

Absolute Maximum Rating

The parameters are 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		10.3125		Gbps	
Bit Error Ratio		10 ⁻¹²			1
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		100		kHz	
Differential Data Input / Output Load		100		Ohms	

Notes:

1. Bit-Error-Rate (BER) is tested with PRBS 2³¹-1 pattern.

Electrical Characteristics

QSFP+ Module Electrical Characteristics per 40GBase-SR4

Parameter	Min	Typical	Max	Unit	Note
Transceiver					
Transceiver Power Consumption			1.5	W	
Transceiver Power Supply Current			420	mA	
Transceiver Power-On Initialization Time			2000	ms	1
Transmitter					
Data Input Differential Peak-to-Peak Voltage Swing			1200	mVpp	
Differential Input Return Loss	Per IEEE 802.3ba, Section 86A.4.1.1			dB	2
Differential to Common Mode Input Return Loss	10			dB	2
J2 Jitter Tolerance	0.17			UI	
J9 Jitter Tolerance	0.29			UI	
Receiver					
Data Output Differential Peak-to-Peak Voltage Swing	200		900	mVpp	3
Output Transition Time 20% to 80%	28			ps	
Differential Output Return Loss	Per IEEE 802.3ba, Section 86A.4.2.1			dB	2
Common Mode Output Return Loss	Per IEEE 802.3ba, Section 86A.4.2.2			dB	2
Output Total Jitter			62	ps	
J2 Jitter Output			0.42	UI	
J9 Jitter Output			0.65	UI	
Eye Mask Coordinates:X1, X2; Y1, Y2.	Specification Value 0.29, 0.5; 150, 425.			UI;mV	4

Notes:

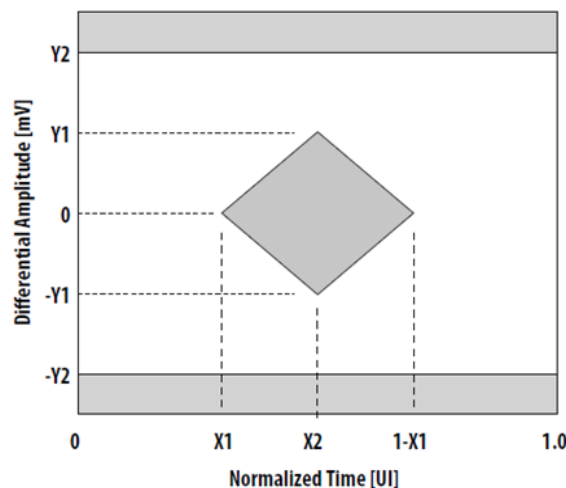
1. "Initialization Time" is the time from when the supply voltages reach and remain above the minimum "Recommended Operating Conditions" to the time when the module enables TWS access. The module at that point is fully functional.
2. 10M to 11.1 GHz according to IEEE 802.3ba specification.
3. AC-Coupled with 100Ω differential output impedance.
4. Hit ratio= 5×10^{-5} per sample with mask definition per below figure.

SFP+ Module Electrical Characteristics per SFF-8431 MSA Sec. 3.6.2, Tab. 19.

Parameter	Min	Typical	Max	Unit	Note
Transceiver					
Transceiver Power Consumption			0.5	W	
Transceiver Power Supply Current			140	mA	
Transceiver Power-On Initialization Time			300	ms	1
Transmitter					
Data Input Differential Peak-to-Peak Voltage Swing	300		1200	mVpp	
Differential Input Return Loss	-10			dB	2
Receiver					
Data Output Differential Peak-to-Peak Voltage Swing	500		850	mVpp	3
Differential Output Return Loss	-10			dB	2
Output Rise & Fall Time (20-80)	28			ps	
Total Jitter			0.7	UI	
Eye Mask Coordinates: X1, X2; Y1, Y2.	Specification Value 0.29 , 0.5 ;150 , 425.			UI;mV	4

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. SDD11/22 differential input and output return loss from 0.05G to 3.9G.
3. AC-Coupled with 100Ω differential output impedance.
4. Hit ratio= 5×10^{-5} per sample with mask definition per below figure.



Rx Electrical Eye Mask Coordinates (TP4) at Hit ratio 5×10^{-5} hits per sample

QSFP+ end to break-out region

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
Cable Length Tolerance	L1-m+100/- 0 cm	TBD

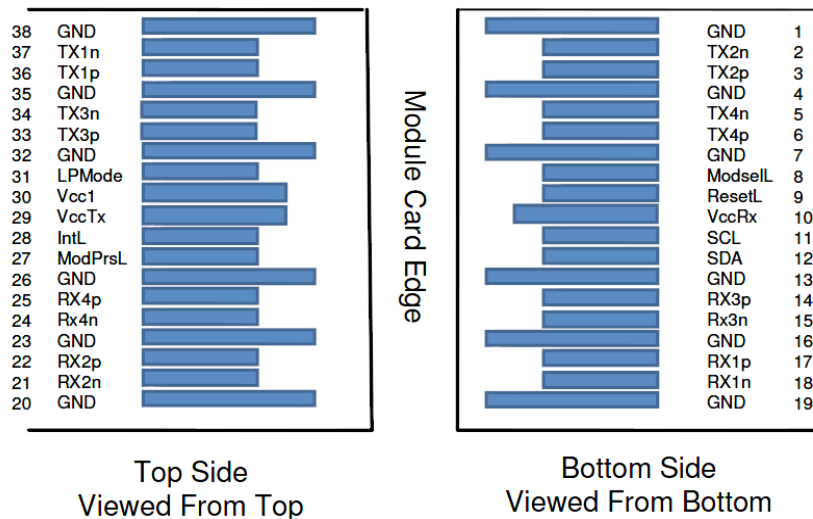
SFP+ end to break-out region

Parameter	Specification	Notes
Minimum Cable Bending Radius	30 mm	
Cable Cross-Section Dimension	Round Cable with 2-mm in Diameter	
Cable Cover Type	LSZH	TBD
Standard Cable Length	1m+0.1m / - 0 cm	

Notes:

1. Cable cover type standard is LSZH. Other types can be available upon request.

QSFP+ Module Pad Assignments and Descriptions

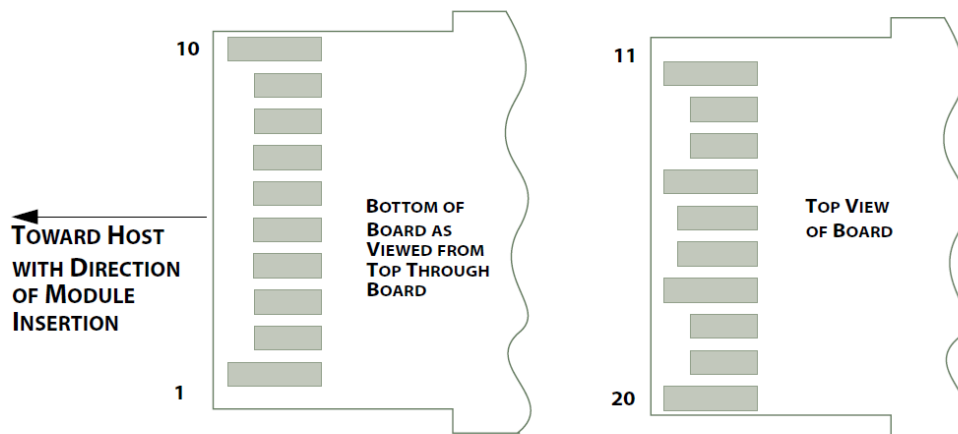


Pin	Logic	Symbol	Description	Plug Sequence	Notes
1		GND	Ground	1	1
2	CML-I	Tx2n	Transmitter Inverted Data Input	3	
3	CML-I	Tx2n	Transmitter Non-Inverted Data Input	3	
4		GND	Ground	1	1
5	CML-I	Tx4n	Transmitter Inverted Data Input	3	
6	CML-I	Tx4p	Transmitter Non-Inverted Data Input	3	
7		GND	Ground	1	1
8	LVTTL-I	ModselL	Module Select	3	
9	LVTTL-I	ResetL	Module Reset	3	
10		Vcc Rx	+3.3V Power Supply Receiver	2	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	2
14	CML-O	Rx3p	Receiver Non-Inverted Data Output	3	
15	CML-O	Rx3n	Receiver Inverted Data Output	3	
16		GND	Ground	1	1
17	CML-O	Rx1p	Receiver Non-Inverted Data Output	3	
18	CML-O	Rx1n	Receiver Inverted Data Output	3	
19		GND	Ground	1	1
20		GND	Ground	1	1
21	CML-O	Rx2n	Receiver Inverted Data Output	3	
22	CML-O	Rx2p	Receiver Non-Inverted Data Output	3	
23		GND	Ground	1	1
24	CML-O	Rx4n	Receiver Inverted Data Output	3	
25	CML-O	Rx4p	Receiver Non-Inverted Data Output	3	
26		GND	Ground	1	1
27	LVTTL-O	ModPrsL	Module Present	3	
28	LVTTL-O	IntL	Interrupt	3	
29		Vcc Tx	+3.3V Power supply transmitter	2	2
30		Vcc1	+3.3V Power supply	2	2
31	LVTTL - I	LPMODE	Low Power Mode	3	
32		GND	Ground	1	1
33	CML-I	Tx3p	Transmitter Non-Inverted Data Input	3	
34	CML-I	Tx3n	Transmitter Inverted Data Input	3	
35		GND	Ground	1	1
36	CML-I	Tx1p	Transmitter Non-Inverted Data Input	3	
37	CML-I	Tx1n	Transmitter Inverted Data Input	3	
38		GND	Ground	1	1

Notes:

1. GND is the symbol for signal and supply (power) common for the QSFP+ module. All are common within the QSFP+ module and all module voltages are referenced to this potential unless otherwise noted. Connect these directly to the host board signal-common ground plane.
2. Vcc Rx, Vcc1 and Vcc Tx are the receiver and transmitter power supplies and shall be applied concurrently. Requirements defined for the host side of the Host Edge Card Connector are listed in Table 6. Recommended host board power supply filtering is shown in Figure 4. Vcc Rx Vcc1 and Vcc Tx may be internally connected within the QSFP+ module in any combination. The connector pins are each rated for a maximum current of 500 mA.

SFP+ Connector Pin per SFF-8431, SFF-8432

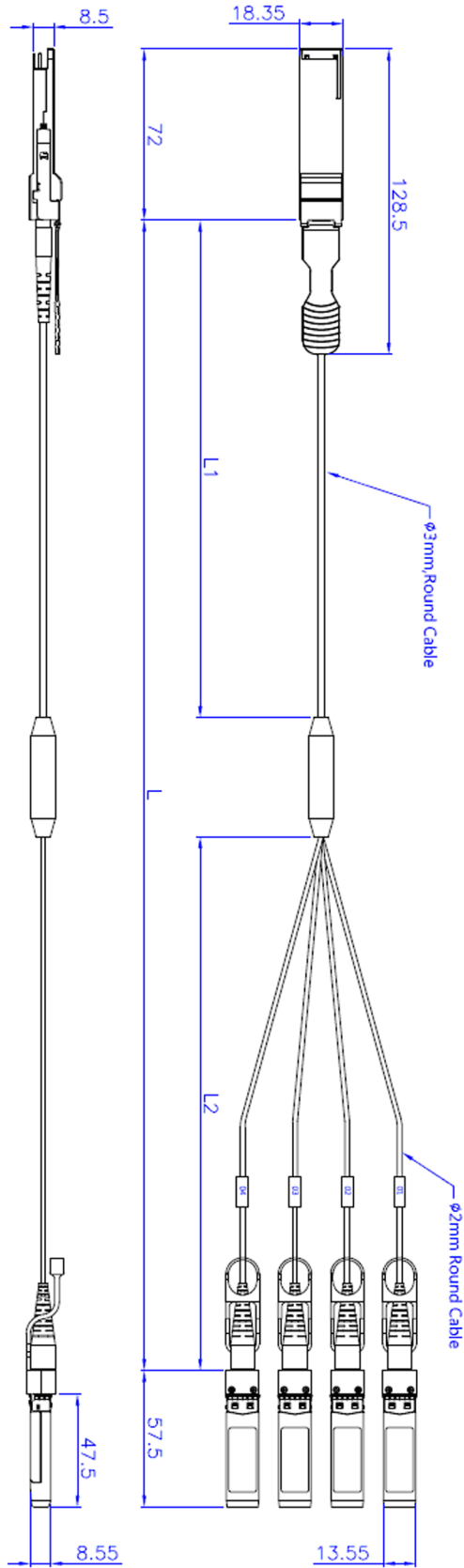


Pin	Logic	Symbol	Description	Plug Sequence	Notes
1	VeeT		Module Transmitter Ground		1
2	Tx_Fault	LVTTL-O	Not supported.		3
3	Tx_Disable	LVTTL-I	Not supported.		3
4	SDA	LVTTL-I/O	2-wire Serial Interface Data Line		2
5	SCL	LVTTL-I/O	2-wire Serial Interface Clock		2
6	Mod_ABS		Module Absent		2
7	RS0	LVTTL-I	Not supported.		3
8	Rx_LOS	LVTTL-O	Not supported.		2
9	RS1	LVTTL-I	Not supported.		3
10	VeeR		Module Receiver Ground		1
11	VeeR		Module Receiver Ground		1
12	RD -	CML-O	Receiver Inverted Data Output		
13	RD+	CML-O	Receiver Non-Inverted Data Output		
14	VeeR		Module Receiver Ground		1
15	VccR		Module Receiver 3.3 V Supply		4
16	VccT		Module Transmitter 3.3 V Supply		4
17	VeeT		Module Transmitter Ground		1
18	TD+	CML-I	Transmitter Non-Inverted Data Input		
19	TD -	CML-I	Transmitter Inverted Data Input		
20	VeeT		Module Transmitter Ground		1

Notes:

1. Module circuit ground pins are isolated from the module chassis ground.
2. Pullup to VccHost with 4.7k – 10k Ω .
3. No connection required.
4. Power supply filtering circuit required.

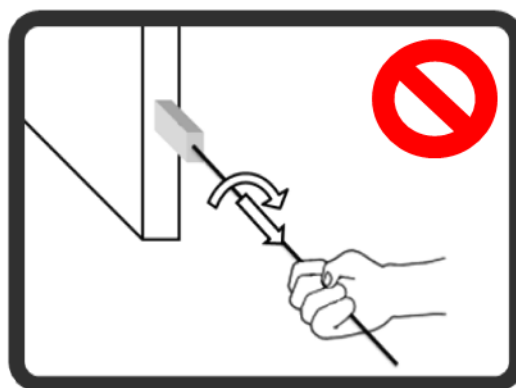
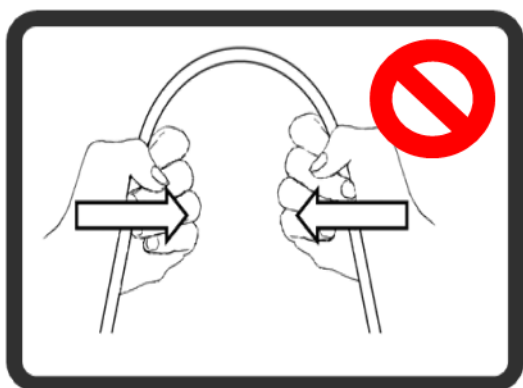
Package Outlook



Unit: mm

Handling

Care should be taken to restrict exposure to the conditions defined in the Absolute Maximum Ratings. Place 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 subjected 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.



For product information and a complete list of cloud computing and data center related products, please go to our website: www.foci.com.tw
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