Product Specification

100G Quadwire® EDR QSFP28 Active Optical Cable

FCBN425QB2Cxx

PRODUCT FEATURES

- Four-channel full-duplex active optical cable
- Multirate capability: 10 Gb/s to 25 Gb/s per channel (See Section II.)
- QSFP28 high-density form factor
- Reliable VCSEL array technology using multimode fiber
- Round OFNP-rated cable standard
- Hot Pluggable
- Low power dissipation: <2.5W per cable end
- Commercial operating case temperature range: 0 ℃ to 70 ℃
- RoHS-6 Compliant

Compliant to RoHS Directive 2011/65/EU

APPLICATIONS

- Infiniband 4xEDR, 4xFDR, 4xQDR
- 10/25/40/100G Ethernet
- 4G/8G/16G/32G Fibre Channel
- SAS3
- Proprietary HPC Interconnections

PRODUCT SELECTION (Standard Lengths*)

FCBN425QB2C01	1-meter cable
FCBN425QB2C03	3-meter cable
FCBN425QB2C05	5-meter cable
FCBN425QB2C10	10-meter cable
FCBN425QB2C15	15-meter cable
FCBN425QB2C20	20-meter cable
FCBN425QB2C30	30-meter cable
FCBN425QB2C50	50-meter cable
FCBN425QB2CX0	100-meter cable

*For availability of additional cable lengths or cable types, please contact II-VI.

I. Pin Descriptions

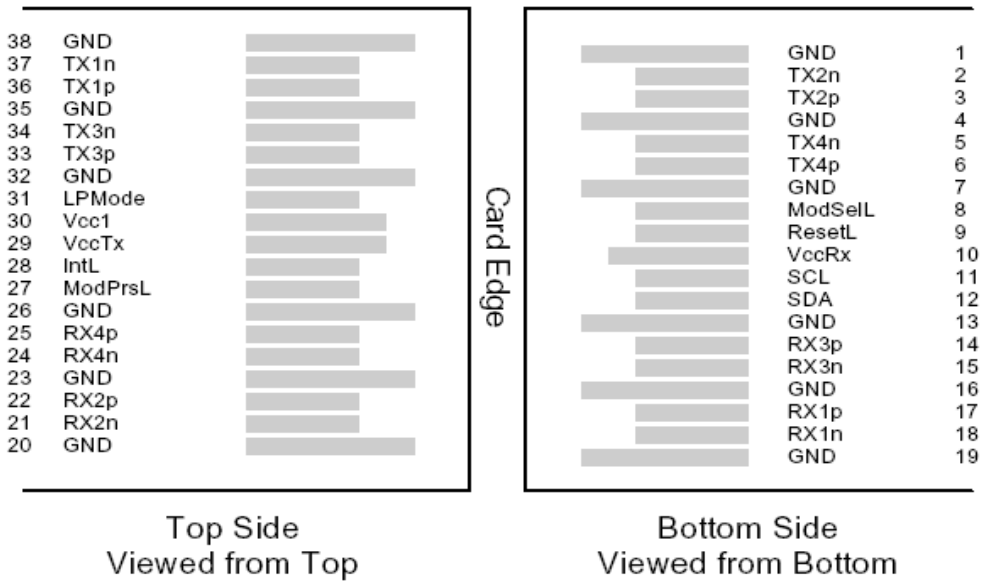

Figure 1 – QSFP28-compliant 38-pin connector (per SFF-8679)

Pin	Symbol	Name/Description	Notes
1	GND	Ground	1
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	
9	ResetL	Module Reset	
10	Vcc Rx	+3.3 V Power supply receiver	
11	SCL	2-wire serial interface clock	
12	SDA	2-wire serial interface data	
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	
28	IntL	Interrupt	
29	Vcc Tx	+3.3 V Power supply transmitter	
30	Vcc1	+3.3 V Power Supply	
31	LPMode	Low Power Mode	
32	GND	Ground	1
33	Tx3p	Transmitter Non-Inverted Data Input	
34	Tx3n	Transmitter Inverted Data Input	
35	GND	Ground	1
36	Tx1p	Transmitter Non-Inverted Data Input	
37	Tx1n	Transmitter Inverted Data Input	
38	GND	Ground	1

Notes
1. Circuit ground is internally isolated from chassis ground.

II. General Product Characteristics

Parameter	Value	Unit	Notes
Module Form Factor	QSFP28		As defined by SFF-8661
Number of Lanes	4 Tx and 4 Rx		
Maximum Aggregate Data Rate	103.12	Gb/s	112.20 Gb/s Max. Aggregate Data Rate with BER 10^{-6} (per 32G Fibre Channel)
Maximum Data Rate per Lane	25.78	Gb/s	28.05 Gb/s Max. Data Rate per Lane with BER 10^{-6} (per 32G Fibre Channel)
Standard Cable Lengths	1, 3, 5, 10, 15, 20, 30, 50, 100	meters	Other lengths may be available upon request
Protocols Supported	Typical applications include InfiniBand QDR/FDR/EDR, 10/25/40G/100G Ethernet, 4/8/16/32G Fibre Channel, SAS3		
Electrical Interface and Pin-out	38-pin edge connector		Pin-out as defined by SFF-8679
Standard Optical Cable Type	Multimode round fiber cable, plenum-rated		OFNP. Low Smoke Zero Halogen (LSZH), round fiber cable also available
Maximum Power Consumption per End	3.5 (retimed Tx) 2.5 (unretimed)	Watts	Varies with output voltage swing and pre-emphasis settings
Management Interface	Serial, I2C-based, 450 kHz maximum frequency		As defined by SFF-8636

Data Rate Specifications	Symbol	Min	Typ	Max	Units	Ref.
Bit Rate per Lane	BR	10.00	25.78	28.05	Gb/sec	1
Bit Error Ratio	BER					1,2

Notes:
1. Supports InfiniBand QDR/FDR/EDR, 10/25/40/100 Gigabit Ethernet and 8/16/32G Fibre Channel applications but at 28.05 Gb/sec BER is limited to 10^{-6} (10^{-12} is at 25.78 Gb.s). Data rates support other than 25.78Gbps is only available through request and customization.
2. Tested with a PRBS 2^{31}-1 test pattern.

III. Absolute Maximum Ratings

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Maximum Supply Voltage	Vcc1, VccTx, VccRx	-0.5		3.6	V	
Storage Temperature	T_S	-40		85	°C	1
Case Operating Temperature	T_{OP}	0		70	°C	
Relative Humidity	RH	0		85	%	2

Notes:
1. Assumes no mechanical load force on the unit. Ensuring no mechanical load force requires a cable bend radius of >70 mm.
2. Non-condensing.

IV. Electrical Characteristics (T_{OP} = 0 to 70°C, V_{CC} = 3.3 ±5% Volts)

NOTE: The Quadwire EDR requires an electrical connector compliant with SFF-8662 or SFF-8672 be used on the host board to guarantee its electrical interface specification. Please check with your connector supplier.

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Supply Voltage	Vcc1, VccTx, VccRx	3.135		3.465	V	
Supply Current	Icc			0.8	A	
Power Dissipation per cable end	P			2.5	W	1, 2
Link Turn-On Time						
Transmit turn-on time				2000	ms	3
Input electrical specifications (per Lane)						
Differential Voltage pk-pk				900	mV	
Common Mode Noise RMS				17.5	mV	
Differential Termination Resistance Mismatch				10	%	
Differential Return Loss	SDD22	Per OIF CEI-28G-VSR and CAUI-4 requirements			dB	
Common Mode to Differential conversion and Differential to Common Mode Conversion	SDC22, SCD22				dB	
Common Mode Return Loss	SCC22				dB	
Transition Time, 20 to 80%	Tr, Tf	10			ps	
Common Mode Voltage	Vcm	-0.3		2.8	V	
Eye Width at 1E-15 probability	EW15	0.46			UI	
Eye Height at 1E-15 probability	EH15	94			mV	
Output electrical specifications (per Lane)						
Differential Voltage pk-pk				900	mV	
Common Mode Voltage	Vcm	-350		2850	mV	
Common Mode Noise RMS				17.5	mV	
Differential Termination Resistance Mismatch				10	%	
Differential Return Loss	SDD22	Per OIF CEI-28G-VSR and CAUI-4 requirements			dB	
Common Mode to Differential conversion and Differential to Common Mode Conversion	SDC22, SCD22					
Common Mode Return Loss	SCC22			-2	dB	
Transition Time, 20 to 80%	Tr, Tf	9.5			ps	
Vertical Eye Closure	VEC			5.5	dB	
Eye Width at 1E-15 probability	EW15	0.57			UI	

Eye Height at 1E-15 probability	EH15	228			mV	

Notes:
1. Maximum total power value is specified across the full operational temperature and voltage range when CDRs are locked or a lack of input signal results in squelch being activated. If incorrect frequencies cause the CDRs to continuously attempt to lock, maximum power dissipation may reach 3.5 W.
2. Settable in various discrete steps via the I2C interface.
3. From power-on and end of any fault conditions.

V. Memory Map and Control Registers

Compatible with SFF-8636. Please see II-VI Application Note AN-2150[7].

VI. Environmental Specifications

II-VI Quadwire EDR Active Optical Cables have an operating temperature range from 0 ℃ to +70 ℃ case temperature.

Environmental Specifications	Symbol	Min	Typ	Max	Units	Ref.
Case Operating Temperature	T_{op}	0		70	℃	
Storage Temperature	T_{sto}	-40		85	℃	1,2

Notes:
1. Assumes no mechanical load force on the unit. Ensuring no mechanical load force requires a cable bend radius of >70 mm.
2. II-VI recommends storing the cables in Moisture Barrier Bags (MBB)

VII. Regulatory Compliance

II-VI Quadwire EDR Active Optical Cables are RoHS-6 Compliant. Copies of certificates to be available at II-VI Incorporated upon request.

Quadwire EDR Active Optical Cables are Class 1 laser eye safety compliant per IEC 60825-1.

Standard fiber cable type is round-section construction, plenum-rated. Other cable types can be supported upon request such as LSZH, round-section construction.

VIII. Mechanical Specifications

The Quadwire EDR mechanical specifications are compliant with the QSFP28 transceiver module specifications (as defined in SFF-8661), substituting the MPO12 receptacle with a fiber optics cable connecting both ends.

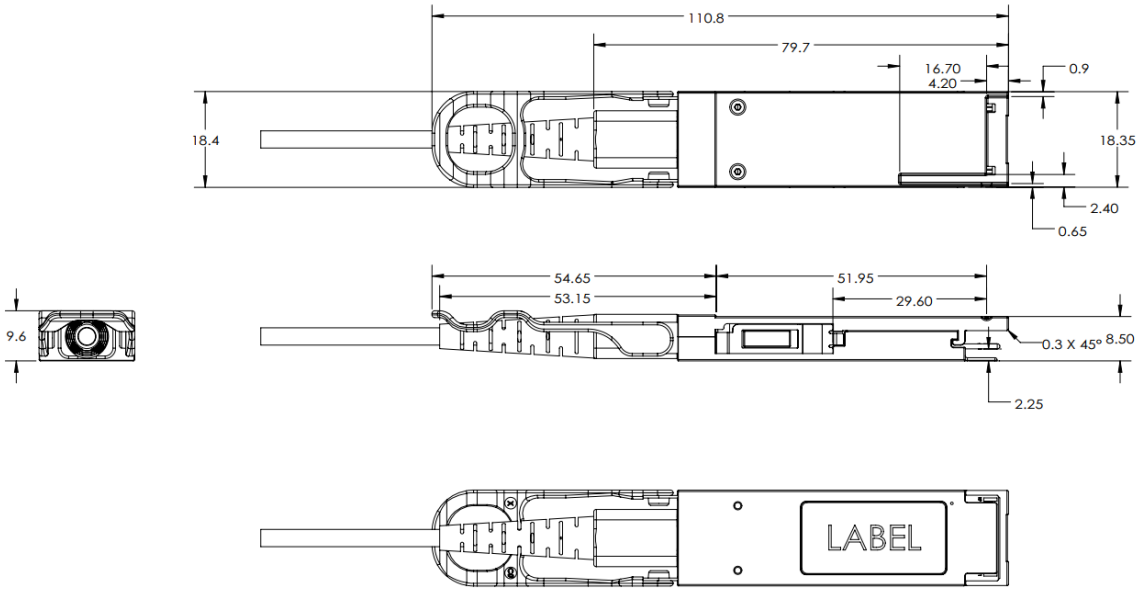

Figure 2 – Quadwire EDR mechanical drawing

Insertion, Extraction and Retention Forces	**Min**	**Max**	**Units**	**Notes**
Cable Proof (Tensile) Test (0 º)		44.0	Newtons	
Cable Proof (Tensile) Test (90 º)		33.0	Newtons	
Impact		8	Cycles	1.5m drop
Flex		8.9	Newtons	
Twist		13.0	Newtons	
Module retention	90	N/A	Newtons	No damage below 90N
Host Connector Retention	180	N/A	Newtons	No damage below 180N

IX. References

1. InfiniBand™ Architecture Release, Vol. 2 – Physical Specifications, Rev. 1.3, November 2012.

2. SFF-8665 – QSFP+ 28Gb/s 4X Pluggable Transceiver Solution (QSFP28), Rev 1.8, May, 2013.

3. SFF-8636 – Specification for Common Management Interface, Rev 1.7, January 2014.

4. "CAUI-4" Retimed 4x25G electrical interface, to be defined by IEEE 802.3

5. CEI-28G-VSR Implementation Agreement, per OIF 2012.290.00

6. Directive 2011/65/EU of the European Council Parliament and of the Council, "on the restriction of the use of certain hazardous substances in electrical and electronic equipment." Certain products may use one or more exemptions as allowed by the Directive.

7. "Application Note AN-2150: EDR Quadwire EEPROM Mapping."

X. For More Information

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