# Product Specification

## 100G Quadwire® QSFP28 Active Optical Cable

## FCBR425QB1Cxx

### PRODUCT FEATURES

- Four-channel full-duplex active optical cable
- Multirate capability: 10 Gb/s to 25.78 Gb/s per channel
- QSFP28 high-density form factor
- Reliable VCSEL array technology using multimode fiber
- Round low smoke zero halogen (LSZH) cable
- Hot Pluggable
- Low power dissipation: <3.5W per cable end (<2.5W with CDRs off)
- Commercial operating case temperature range: 0ºC to 70ºC
- RoHS-6 Compliant

Compliant to RoHS Directive 2011/65/EU

### APPLICATIONS

- Infiniband 4xEDR, 4xFDR, 4xQDR
- 10/25/40/100G Ethernet
- SAS3
- Proprietary HPC Interconnections

### PRODUCT SELECTION (Standard Lengths*)

| | |
|---|---|
| **FCBR425QB1C01** | 1-meter cable |
| **FCBR425QB1C03** | 3-meter cable |
| **FCBR425QB1C05** | 5-meter cable |
| **FCBR425QB1C10** | 10-meter cable |
| **FCBR425QB1C15** | 15-meter cable |
| **FCBR425QB1C20** | 20-meter cable |
| **FCBR425QB1C30** | 30-meter cable |
| **FCBR425QB1C50** | 50-meter cable |
| **FCBR425QB1CX0** | 100-meter cable |

*For availability of additional cable lengths or cable types, please contact Finisar.

# I. Pin Descriptions

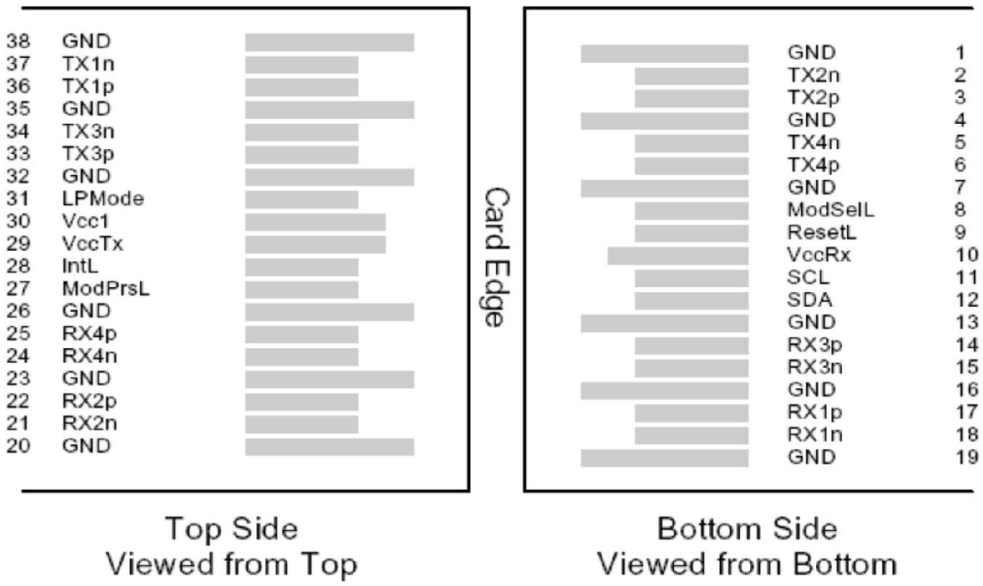


**Figure 1 – QSFP28-compliant 38-pin connector (per SFF-8679)**

| 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 | |
| Maximum Data Rate per Lane | 25.78 | Gb/s | |
| 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, 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)<br>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 | | 25.78 | | Gb/sec | 1 |
| Bit Error Ratio | BER | | | $10^{-12}$ | | 2 |

Notes:
1. Supports InfiniBand QDR/FDR/EDR and 10/25/40/100 Gigabit Ethernet data rates, with maximum bit error rate $10^{-12}$ at 25.78 Gb/sec.
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 >105 mm within 100 mm of either cable end module and >60 mm on the rest of the cable.
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 | 3.15 | | 3.45 | V | |
| Supply Current | Icc | | | 1010 | mA | |
| Power Dissipation per cable end | P | | | 3.5 | 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 temperature and voltage range.
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 Finisar Application Note AN-2150[7].

## VI. Environmental Specifications

Finisar Quadwire EDR Active Optical Cables have an operating temperature range from 0°C to +70°C case temperature.

| Environmental Specifications | Symbol | Min | Typ | Max | Units | Ref. |
|---|---|---|---|---|---|---|
| Case Operating Temperature | $T_{op}$ | 0 | | 70 | °C | |
| Storage Temperature | $T_{sto}$ | -10 | | 70 | °C | |

## VII. Regulatory Compliance

Finisar Quadwire EDR Active Optical Cables are RoHS-6 Compliant. Copies of certificates to be available at Finisar Corporation 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.

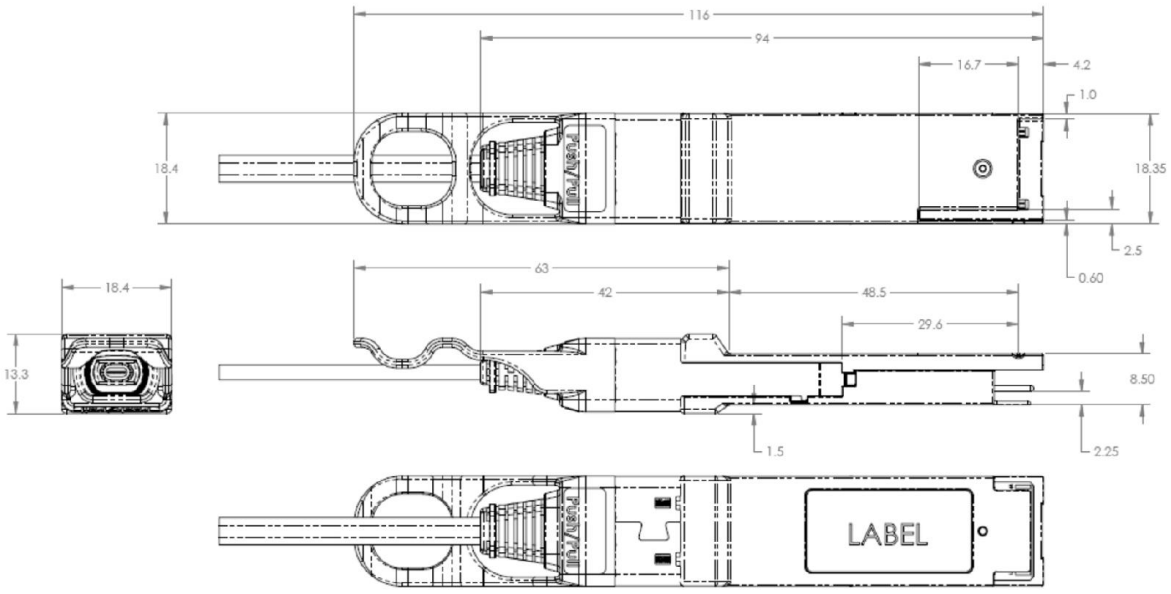


**Figure 2 – Quadwire EDR mechanical drawing**

| 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


Finisar Corporation
1389 Moffett Park Drive
Sunnyvale, CA 94089-1133
Tel. 1-408-548-1000
Fax 1-408-541-6138
sales@finisar.com
www.finisar.com

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**ООО «ЛайфЭлектроникс»** **“LifeElectronics” LLC**

*ИНН 7805602321 КПП 780501001 Р/С 40702810122510004610 ФАКБ "АБСОЛЮТ БАНК" (ЗАО) в г.Санкт-Петербурге К/С 30101810900000000703 БИК 044030703*

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*Тел: +7 (812) 336 43 04 (многоканальный)*
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