

### **QDD-400GB-DCO-ZRP-1DBM-J-OPC**

Juniper Networks® Compatible TAA 400GBase-Open ZR+ Coherent QSFP-DD Transceiver (SMF, 1528.77nm to 1567.13nm, 120km, LC, DOM, 1dBm)

#### **Features**

- Hot Pluggable QSFP-DD Footprint (Type 2A)
- Supports 400/300/200/100Gbps
- Duplex LC Connector
- Tunable C-Band Transmitter
- Coherent Receivers
- Power Dissipation is 26.1W
- Single +3.3V Power Supply
- Operating Case Temperature: 15 to 75 Celsius
- Tunable Output Power: -9dBm to +1dBm
- Supports both CFEC and oFEC
- RoHS Compliant and Lead Free



#### **Applications:**

- 400GBase Ethernet
- Open ZR+
- IP-over-DWDM

#### **Product Description**

This Juniper Networks® compatible QSFP-DD transceiver provides 400GBase-Open ZR+ throughput up to 120km over single-mode fiber (SMF) using a wavelength of 1528.77nm to 1567.13nm via an LC connector. It can operate at temperatures between 0 and 70C. Our transceiver is built to meet or exceed OEM specifications and is guaranteed to be 100% compatible with Juniper Networks®. It has been programmed, uniquely serialized, and tested for data-traffic and application to ensure that it will initialize and perform identically. All of our transceivers comply with Multi-Source Agreement (MSA) standards to provide seamless network integration. Additional product features include Digital Optical Monitoring (DOM) support which allows access to real-time operating parameters. This transceiver is Trade Agreements Act (TAA) compliant. We stand behind the quality of our products and proudly offer a limited lifetime warranty.

OptioConnect's transceivers are RoHS compliant and lead-free.

## Application Codes

| Application Code | Host Format   | Payload Rate | Media Format | FEC  | Modulation | Description                    | Media Lane Interface      | Default: Enhanced Mode (S=Standard, E=Enhanced) |
|------------------|---------------|--------------|--------------|------|------------|--------------------------------|---------------------------|-------------------------------------------------|
| 1                | 1 x 400GAUI-8 | 400G         | ZR           | CFEC | 16QAM      | OIF 400ZR app codes 0x01, 0x03 | 400G-400ZR-CFEC-16QAM-1-S | S                                               |
| 2                | 1 x 400GAUI-8 | 400G         | ZR           | CFEC | 16QAM      | OIF 400ZR app code 0x02        | 400G-400ER-CFEC-16QAM-1-S | S                                               |
| 3                | 1 x 400GAUI-8 | 400G         | OpenZR+      | oFEC | 16QAM      | OpenZR+ MSA                    | 400G-400ZR-oFEC-16QAM-1-S | S                                               |
| 4                | 2 x 200GAUI-4 | 400G         | OpenZR+      | oFEC | 16QAM      | OpenZR+ MSA                    | 200G-400ZR-oFEC-16QAM-1-S | S                                               |
| 5                | 4 x 100GAUI-2 | 400G         | OpenZR+      | oFEC | 16QAM      | OpenZR+ MSA                    | 100G-400ZR-oFEC-16QAM-1-S | S                                               |
| 6                | 1 x 400GAUI-8 | 400G         | OpenZR+      | oFEC | 16QAM      | OpenZR+ MSA                    | 400G-400ZR-oFEC-16QAM-1-E | E                                               |
| 7                | 2 x 200GAUI-4 | 400G         | OpenZR+      | oFEC | 16QAM      | OpenZR+ MSA                    | 200G-400ZR-oFEC-16QAM-1-E | E                                               |
| 8                | 4 x 100GAUI-2 | 400G         | OpenZR+      | oFEC | 16QAM      | OpenZR+ MSA                    | 400G-400ZR-oFEC-16QAM-1-E | E                                               |
| 9                | 3 x 100GAUI-2 | 300G         | OpenZR+      | oFEC | 8QAM       | OpenZR+ MSA                    | 100G-300ZR-oFEC-8QAM-1-SE | S                                               |
| 10               | 1 x 200GAUI-2 | 200G         | OpenZR+      | oFEC | QPSK       | OpenZR+ MSA                    | 200G-200ZR-oFEC-QPSK-1-S  | S                                               |
| 11               | 2 x 100GAUI-2 | 200G         | OpenZR+      | oFEC | QPSK       | OpenZR+ MSA                    | 100G-200ZR-oFEC-QPSK-1-S  | S                                               |
| 12               | 1 x 100GAUI-2 | 100G         | OpenZR+      | oFEC | QPSK       | OpenZR+ MSA                    | 100G-100ZR-oFEC-QPSK-1-S  | S                                               |

## Absolute Maximum Ratings

| Parameter                          | Symbol | Min.  | Typ. | Max.  | Unit | Notes |
|------------------------------------|--------|-------|------|-------|------|-------|
| Power Supply Voltage               | Vcc    | 3.135 | 3.3  | 3.465 | V    | 1     |
| Storage Temperature                | Tstg   | -40   |      | 85    | °C   |       |
| Operating Case Temperature         | Tc     | 15    |      | 75    | °C   |       |
| Relative Humidity (Non-Condensing) | RH     |       |      | 85    | %    |       |
| Optical Receiver Overload          |        |       |      | 1     | dBm  | 2     |

### Notes:

1. 3.3V ±5% measured at the electrical connector.
2. The optical input to the receiver should not exceed this value. Transmitters must never be directly connected to receivers before ensuring that proper optical attenuation is used.

## Electrical Characteristics

| Parameter              | Symbol             | Min.  | Typ. | Max.  | Unit | Notes |
|------------------------|--------------------|-------|------|-------|------|-------|
| Power Supply Voltage   | V <sub>CC</sub>    | 3.135 | 3.3  | 3.465 | V    | 1     |
| Power Supply Current   | I <sub>CC</sub>    |       |      | 8     | A    | 2     |
| Peak Sustained Current | I <sub>CC,sp</sub> |       |      | 8.7   | A    | 3     |
| Inrush Current         | I <sub>CC,ip</sub> |       |      | 10.5  | A    | 4     |
| Power Dissipation      | P <sub>DISS</sub>  |       |      | 26.1  | W    | 5     |
| Power Consumption      |                    |       |      | 2.75  | W    | 6     |

### Notes:

1. 3.3V ±5% measured at the electrical connector.
2. Steady state current.
3. Sustained peak current at high power enable.
4. Instantaneous peak current at high power enable.
5. At nominal power supply voltage.
6. Low-power mode.

## Optical Characteristics

| Parameter                           | Symbol          | Min.             | Typ.        | Max.             | Unit     | Notes   |
|-------------------------------------|-----------------|------------------|-------------|------------------|----------|---------|
| Transmitter                         |                 |                  |             |                  |          |         |
| Average Output Power                | P <sub>o</sub>  | -9               |             | +1               | dBm      | 1, 2, 3 |
| Laser Linewidth                     |                 |                  |             | 300              | kHz      | 4       |
| Output Power Stability              |                 | -0.5             |             | +0.5             | dB       | 5       |
| Output Power Stability              |                 | -1               |             | +1               | dB       | 6       |
| In-Band OSNR                        |                 | 38               |             |                  | dB/0.1nm | 7       |
| Out-of-Band OSNR – Narrowband       |                 | 42               |             |                  | dB/0.1nm | 8       |
| Out-of-Band OSNR – Wideband         |                 | 42               |             |                  | dB/0.1nm | 9       |
| Frequency Range                     |                 | 191.275          |             | 196.125          | THz      | 10      |
| Center Frequency                    |                 | $\nu_T - 1.5$    | $\nu_T$     | $\nu_T + 1.5$    | GHz      | 11      |
| Channel Spacing                     |                 | 6.25             |             |                  | GHz      | 12      |
| Centre Wavelength Range             | T $\lambda$     | 1528.58          |             | 1567.34          | nm       |         |
| Centre Wavelength                   | T $\lambda$     | $\lambda_T - 15$ | $\lambda_T$ | $\lambda_T + 15$ | pm       |         |
| Receiver                            |                 |                  |             |                  |          |         |
| Maximum Rx Power                    |                 |                  |             | 13               | dBm      |         |
| Receiver Operating Wavelength       | R $\lambda$     | 1528.58          |             | 1567.34          | nm       |         |
| Receiver Sensitivity                | S               | -12              |             | -21              | dBm      | 13      |
|                                     | S               | -15              |             | -23              | dBm      | 14      |
|                                     | S               | -18              |             | -29              | dBm      | 15      |
|                                     | S               | -20              |             | -32              | dBm      | 16      |
| Receiver Overload                   | P <sub>OL</sub> |                  |             | 1                | dBm      | 17      |
| Receiver Input Power Range          |                 | -12              |             | 1                | dBm      | 18, 19  |
|                                     |                 | -15              |             | 1                | dBm      | 18, 20  |
|                                     |                 | -18              |             | 1                | dBm      | 18, 21  |
|                                     |                 | -20              |             | 1                | dBm      | 18, 22  |
| Extended Receiver Input Power Range |                 | -16              |             | 1                | dBm      | 23      |
| Acquisition Range                   |                 | -3.6             |             | 3.6              | GHz      | 24      |
| Upstream Tx Linewidth               |                 | -300             |             | 300              | kHz      |         |
| Transmitter VOA Dynamic Range       |                 | 10               |             |                  | dB       | 25      |
| OSNR Tolerance                      |                 |                  |             | 22.5             | dB       | 19      |
|                                     |                 |                  |             | 19.5             | dB       | 20      |
|                                     |                 |                  |             | 14.8             | dB       | 21      |
|                                     |                 |                  |             | 11.5             | dB       | 22      |
| Crosstalk Tolerance                 |                 |                  |             | 7                | dB       | 26      |

|                                       |  |          |         |          |       |        |
|---------------------------------------|--|----------|---------|----------|-------|--------|
| <b>Chromatic Dispersion Tolerance</b> |  | -52,000  | ±13,000 | +52,000  | ps/nm | 19, 27 |
|                                       |  | -100,000 | ±50,000 | +100,000 | ps/nm | 20, 27 |
|                                       |  | -100,000 | ±50,000 | +100,000 | ps/nm | 21, 27 |
|                                       |  | -160,000 | ±80,000 | +160,000 | ps/nm | 22, 27 |

**Notes:**

1. Output power is coupled into a 9/125µm single-mode fibre.
2. The output power is settable in steps of 0.1dB within the specified wavelength range.
3. +1dBm tunable down to -9dBm.
4. Frequency stability relative to flex grid channel setting.
5. Provisioned power greater than the maximum available Tx power. Output power change over temperature and over time, measured over 10ms intervals.
6. Provisioned power less than the maximum available Tx power. Output power change over temperature and over time, measured over 10ms intervals.
7. The 0.1nm bandwidth for the IB OSNR refers to 12.5GHz optical bandwidth. Measured using the linear interpolation method with ±100GHz offset noise marker. For ZR application codes 0x01-0x03, IB OSNR is defined within the bandwidth of the Tx spectral excursion.
8. Measured in frequency range 191.275THz .... fs - 75GHz and fs + 75GHz ... 196.125THz. Noise power is measured in 12.5GHz RBW and referenced to 12.5GHz noise bandwidth.
9. Measured in frequency range 191.275THz .... fs - 150GHz and fs + 150GHz ... 196.125THz. Noise power is measured in 62.5GHz RBW and referenced to 12.5GHz noise bandwidth.
10. Per ITU-T G.694.1 DWDM grid definition.
11. Applies also to LO.
12. Supports 100, 75, 50, 12.5, and 6.25GHz frequency grids.
13. Minimum input power needed to achieve post-FEC BER≤10<sup>-15</sup>, ZR400-OFEC-16QAM, OSNR>36dB.
14. Minimum input power needed to achieve post-FEC BER≤10<sup>-15</sup>, ZR300-OFEC-8QAM, OSNR>36dB.
15. Minimum input power needed to achieve post-FEC BER≤10<sup>-15</sup>, ZR200-OFEC-QPSK, OSNR>36dB.
16. Minimum input power needed to achieve post-FEC BER≤10<sup>-15</sup>, ZR100-OFEC-QPSK, OSNR>36dB.
17. The optical input to the receiver should not exceed this value. Transmitters must never be directly connected to receivers before ensuring that proper optical attenuation is used. Aggregate power of all channels.
18. An input power in this range guarantees optimum OSNR performance.
19. ZR400-OFEC-16QAM.
20. ZR300-OFEC-8QAM.
21. ZR200-OFEC-QPSK.
22. ZR100-OFEC-QPSK.
23. With ≤1dB OSNR tolerance degradation.
24. Frequency offset between received carrier and LO.
25. With Tx VOA attenuation set to minimum.
26. Ratio of accumulated crosstalk channels to signal power.
27. Less than 0.5dB receiver sensitivity penalty compared to OSNR>36dB.

## Pin Descriptions

| Pin | Logic       | Symbol  | Name/Description                                 | Notes |
|-----|-------------|---------|--------------------------------------------------|-------|
| 1   |             | GND     | Module Ground (Logic and Power Return Path).     | 1     |
| 2   | CML-I       | Tx2-    | Transmit Differential Pairs from Host to Module. |       |
| 3   | CML-I       | Tx2+    | Transmit Differential Pairs from Host to Module. |       |
| 4   |             | GND     | Module Ground (Logic and Power Return Path).     | 1     |
| 5   | CML-I       | Tx4-    | Transmit Differential Pairs from Host to Module. |       |
| 6   | CML-I       | Tx4+    | Transmit Differential Pairs from Host to Module. |       |
| 7   |             | GND     | Module Ground (Logic and Power Return Path).     | 1     |
| 8   | LVTTL-I     | ModSelL | Module Select.                                   |       |
| 9   | LVTTL-I     | ResetL  | Module Reset.                                    |       |
| 10  |             | VccRx   | +3.3V Receiver Power Supply.                     | 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     | Module Ground (Logic and Power Return Path).     | 1     |
| 14  | CML-O       | Rx3+    | Receive Differential Pairs from Module to Host.  |       |
| 15  | CML-O       | Rx3-    | Receive Differential Pairs from Module to Host.  |       |
| 16  |             | GND     | Module Ground (Logic and Power Return Path).     | 1     |
| 17  | CML-O       | Rx1+    | Receive Differential Pairs from Module to Host.  |       |
| 18  | CML-O       | Rx1-    | Receive Differential Pairs from Module to Host.  |       |
| 19  |             | GND     | Module Ground (Logic and Power Return Path).     | 1     |
| 20  |             | GND     | Module Ground (Logic and Power Return Path).     | 1     |
| 21  | CML-O       | Rx2-    | Receive Differential Pairs from Module to Host.  |       |
| 22  | CML-O       | Rx2+    | Receive Differential Pairs from Module to Host.  |       |
| 23  |             | GND     | Module Ground (Logic and Power Return Path).     | 1     |
| 24  | CML-O       | Rx4-    | Receive Differential Pairs from Module to Host.  |       |
| 25  | CML-O       | Rx4+    | Receive Differential Pairs from Module to Host.  |       |
| 26  |             | GND     | Module Ground (Logic and Power Return Path).     | 1     |
| 27  | LVTTL-O     | ModPrsL | Module Present.                                  | 4     |
| 28  |             | IntL    | Interrupt.                                       | 5     |
| 29  |             | VccTx   | +3.3V Transmitter Power Supply.                  | 2     |
| 30  |             | Vcc1    | +3.3V Power Supply.                              | 2     |
| 31  | LVTTL-I     | LPMODE  | Low-Power Mode.                                  |       |
| 32  |             | GND     | Module Ground (Logic and Power Return Path).     | 1     |
| 33  | CML-I       | Tx3+    | Transmit Differential Pairs from Host to Module. |       |
| 34  | CML-I       | Tx3-    | Transmit Differential Pairs from Host to Module. |       |

|    |             |          |                                                      |   |
|----|-------------|----------|------------------------------------------------------|---|
| 35 |             | GND      | Module Ground (Logic and Power Return Path).         | 1 |
| 36 | CML-I       | Tx1+     | Transmit Differential Pairs from Host to Module.     |   |
| 37 | CML-I       | Tx1-     | Transmit Differential Pairs from Host to Module.     |   |
| 38 |             | GND      | Module Ground (Logic and Power Return Path).         | 1 |
| 39 |             | GND      | Module Ground (Logic and Power Return Path).         | 1 |
| 40 | CML-I       | Tx6-     | Transmit Differential Pairs from Host to Module.     |   |
| 41 | CML-I       | Tx6+     | Transmit Differential Pairs from Host to Module.     |   |
| 42 |             | GND      | Module Ground (Logic and Power Return Path).         | 1 |
| 43 | CML-I       | Tx8-     | Transmit Differential Pairs from Host to Module.     |   |
| 44 | CML-I       | Tx8+     | Transmit Differential Pairs from Host to Module.     |   |
| 45 |             | GND      | Module Ground (Logic and Power Return Path).         | 1 |
| 46 |             | Reserved | For Future Use. Not Connected.                       | 6 |
| 47 | LVC MOS-O   | VS1      | Module Vendor-Specific 1.                            | 6 |
| 48 |             | VccRx1   | +3.3V Receiver Power Supply.                         | 2 |
| 49 | LVC MOS-I   | VS2      | Module Vendor-Specific 2.                            | 6 |
| 50 | LVC MOS-I/O | VS3      | Module Vendor-Specific 3.                            | 6 |
| 51 |             | GND      | Module Ground (Logic and Power Return Path).         | 1 |
| 52 | CML-O       | Rx7+     | Receive Differential Pairs from Module to Host.      |   |
| 53 | CML-O       | Rx7-     | Receive Differential Pairs from Module to Host.      |   |
| 54 |             | GND      | Module Ground (Logic and Power Return Path).         | 1 |
| 55 | CML-O       | Rx5+     | Receive Differential Pairs from Module to Host.      |   |
| 56 | CML-O       | Rx5-     | Receive Differential Pairs from Module to Host.      |   |
| 57 |             | GND      | Module Ground (Logic and Power Return Path).         | 1 |
| 58 |             | GND      | Module Ground (Logic and Power Return Path).         | 1 |
| 59 | CML-O       | Rx6-     | Receive Differential Pairs from Module to Host.      |   |
| 60 | CML-O       | Rx6+     | Receive Differential Pairs from Module to Host.      |   |
| 61 |             | GND      | Module Ground (Logic and Power Return Path).         | 1 |
| 62 | CML-O       | Rx8-     | Receive Differential Pairs from Module to Host.      |   |
| 63 | CML-O       | Rx8+     | Receive Differential Pairs from Module to Host.      |   |
| 64 |             | GND      | Module Ground (Logic and Power Return Path).         | 1 |
| 65 |             | NC       | Not Connected.                                       | 6 |
| 66 |             | Reserved | For Future Use. Not Connected.                       | 6 |
| 67 |             | VccTx1   | +3.3V Transmitter Power Supply.                      | 2 |
| 68 |             | Vcc2     | +3.3V Power Supply.                                  | 2 |
| 69 | LVTTL-I     | ePPS     | Precision Time Protocol (PTP) Reference Clock Input. |   |
| 70 |             | GND      | Module Ground (Logic and Power Return Path).         | 1 |

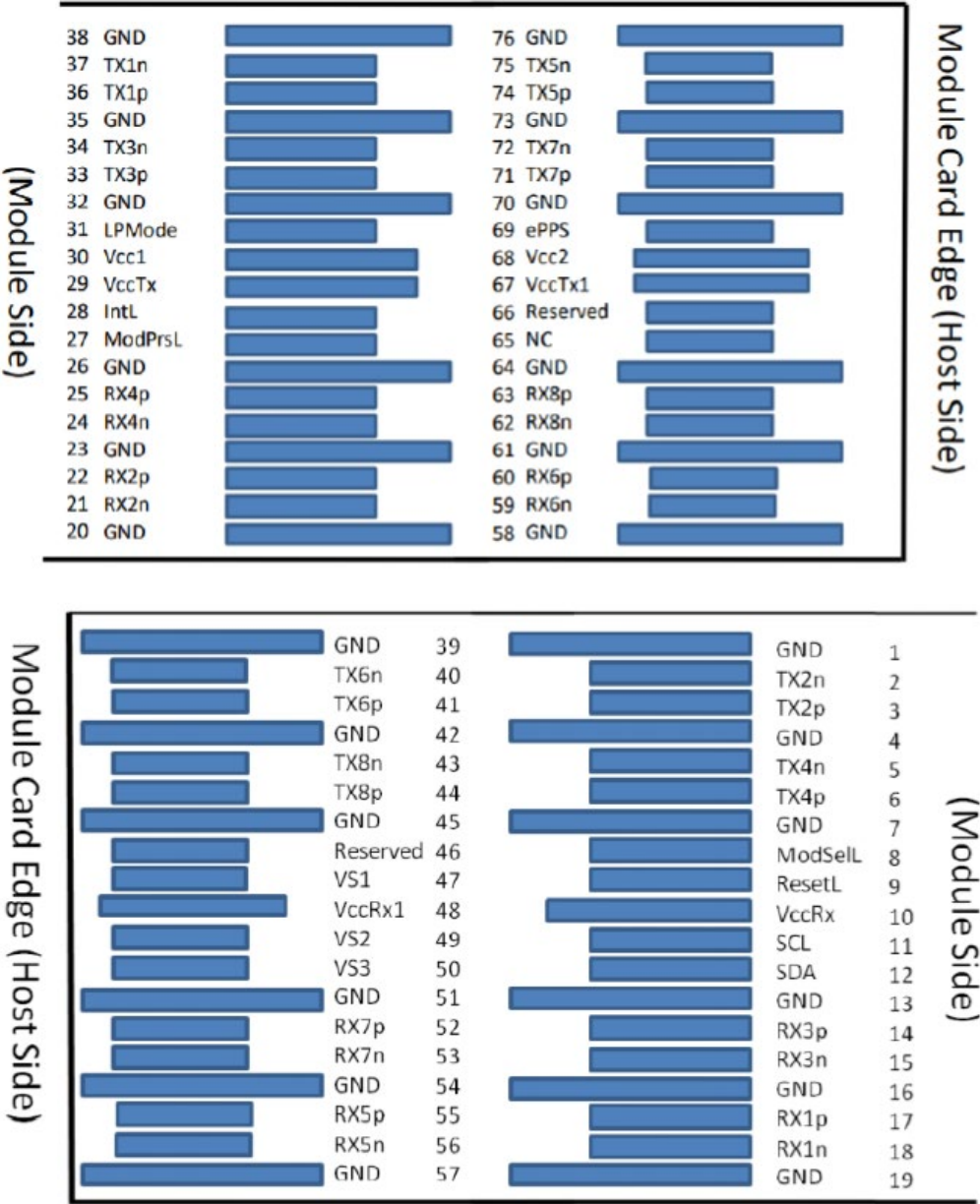
|    |       |      |                                                  |   |
|----|-------|------|--------------------------------------------------|---|
| 71 | CML-I | Tx7+ | Transmit Differential Pairs from Host to Module. |   |
| 72 | CML-I | Tx7- | Transmit Differential Pairs from Host to Module. |   |
| 73 |       | GND  | Module Ground (Logic and Power Return Path).     | 1 |
| 74 | CML-I | Tx5+ | Transmit Differential Pairs from Host to Module. |   |
| 75 | CML-I | Tx5- | Transmit Differential Pairs from Host to Module. |   |
| 76 |       | GND  | Module Ground (Logic and Power Return Path).     | 1 |

**Notes:**

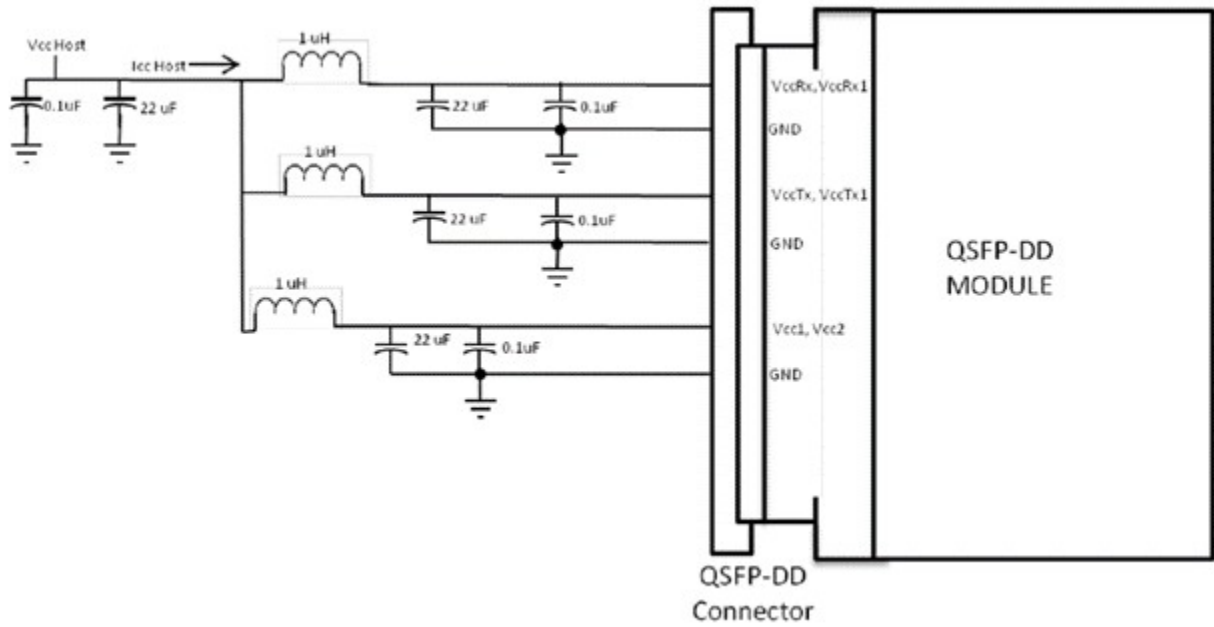
1. QSFP-DD uses common ground (GND) for all signals and supply (power). All are common with the QSFP-DD module, and all module voltages are referenced to this potential unless otherwise noted. Connect these directly to the host board signal common ground plane.
2. VccRx, VccRx1, Vcc1, Vcc2, VccTx, and VccTx1 shall be applied concurrently. VccRx, VccRx1, Vcc1, Vcc2, VccTx, and VccTx1 are internally connected within the module. The connector Vcc pins are each rated for a maximum current of 1.0A.
3. Open drain. Requires 1.0k to 3.3k pull-up resistor to 3.3V on the host.
4. Indication from module to host. Requires 4.7k to 10k pull-up resistor to 3.3V on the host.
5. Open collector. Interrupt request from module to host. Requires 4.7k pull-up resistor to 3.3V on the host.
6. Reserved and NC pins may be terminated with 50Ω to ground on the host. Vendor-Specific and Reserved pads shall have an impedance to the GND that is greater than 10kΩ and is less than 100pF.



Electrical Pad Layout



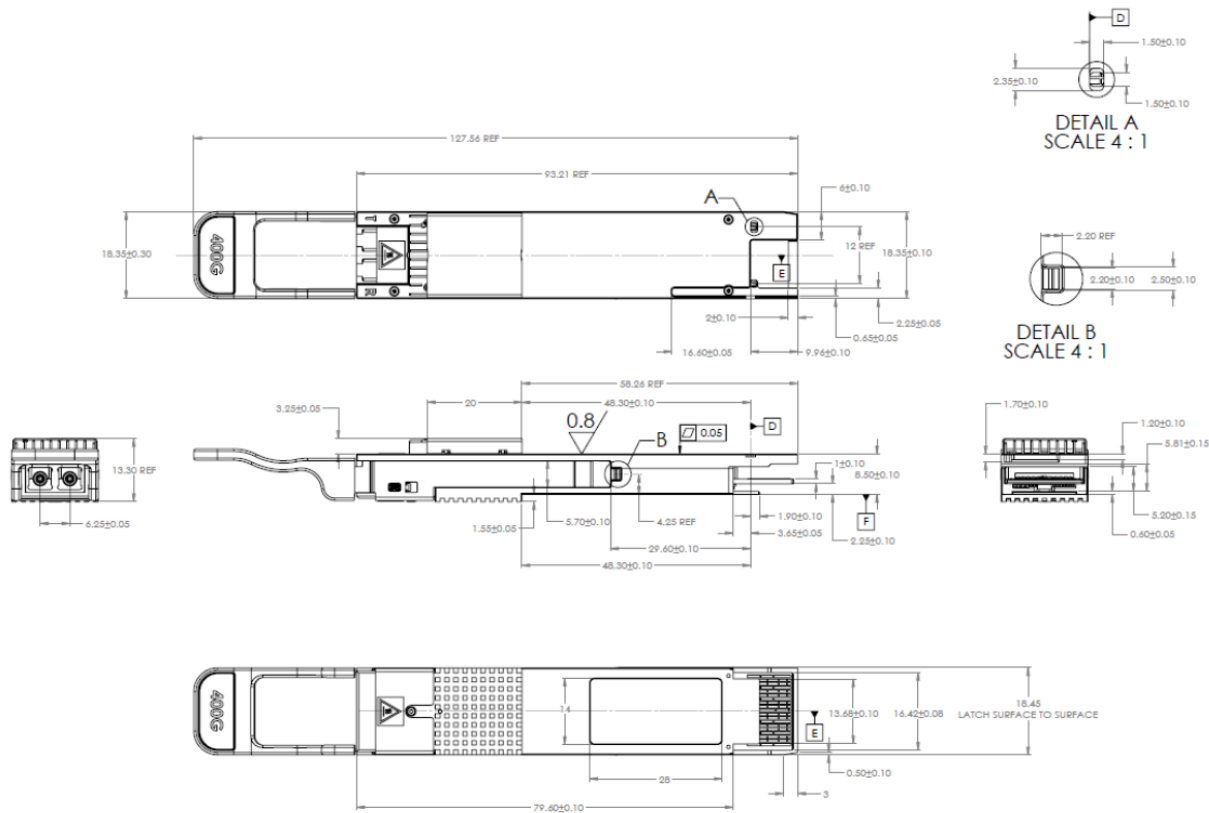
## Recommended Power Supply Filter



### Notes:

1. Filter capacitor values are informative vary depending on applications. Vcc1 and/or Vcc2 may be connected to the VccTx, VccTx1 or VccRx, VccRx1 provided the applicable derating of the maximum current limit is used.

Mechanical Specifications



## **OptioConnect**

### **Innovation for the Future of High-Speed Networking**

#### **Who We Are**

OptioConnect is reshaping the landscape of communication and high-speed networking through intelligent technology. With a core focus on cutting edge technology, we deliver smarter fiber optic solutions for enterprise networks, data centers, and next-gen telecom infrastructures.

#### **What We Do**

At OptioConnect, we fuse advanced engineering with intelligent automation to drive the future of networking. Our AI-integrated solutions are designed to optimize performance and streamline operations with:

- Superior Performance
- Network and traffic optimization
- Intelligent energy management
- Seamless OEM compatibility
- Scalable cost-efficiency

#### **Smarter Networks by Design**

Innovation isn't just a goal—it's our process. We embed AI and machine learning across our R&D and product lines, enabling adaptive performance, automated tuning, and faster deployment cycles. The result? Networks that don't just work—they learn, evolve, and outperform.

#### **Our Team**

Our engineers, data scientists, and network architects bring decades of experience and a future-focused mindset. We provide hands-on support with intelligent insights that turn complex challenges into simple solutions.

#### **Our Mission**

To deliver AI-enhanced connectivity that reduces cost, increases speed, and maximizes efficiency—empowering our partners to operate at the forefront of a rapidly evolving digital world.

#### **Let's Connect**

Discover how OptioConnect's intelligent infrastructure solutions can power your network's next leap forward.

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