

### QDD-400GB-DCO-ZRP-1DBM-C-AO

Cisco® 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)
- Duplex LC Connector
- Supports 400/300/200/100Gbps
- Coherent Receivers
- Power Dissipation is  $\leq 26.1W$
- Tunable C-Band Transmitter
- Operating Case Temperature: 15 to 75 Celsius
- Single +3.3V Power Supply
- Supports both CFEC and oFEC
- Tunable Output Power: -9dBm to +1dBm
- RoHS Compliant and Lead Free



#### Applications

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

#### Product Description

This Cisco® 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 is guaranteed to be 100% compatible with the equivalent Cisco® transceiver. This easy to install, hot swappable transceiver has been programmed, uniquely serialized and data-traffic and application tested to ensure that it will initialize and perform identically. Digital optical monitoring (DOM) support is also present to allow 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.

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

TAA refers to the Trade Agreements Act (19 U.S.C. & 2501-2581), which is intended to foster fair and open international trade. TAA requires that the U.S. Government may acquire only "U.S. – made or designated country end products."



## 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   |
|-------------------------------------|-----------------|------------------|-------------|------------------|----------|---------|
| <b>Transmitter</b>                  |                 |                  |             |                  |          |         |
| 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       |         |
| <b>Receiver</b>                     |                 |                  |             |                  |          |         |
| 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. |       |

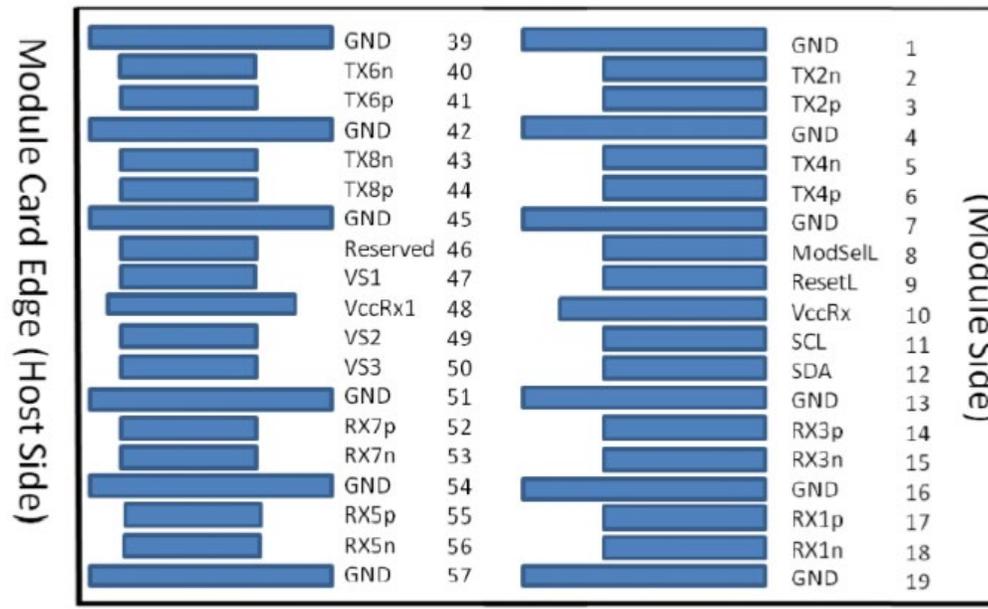
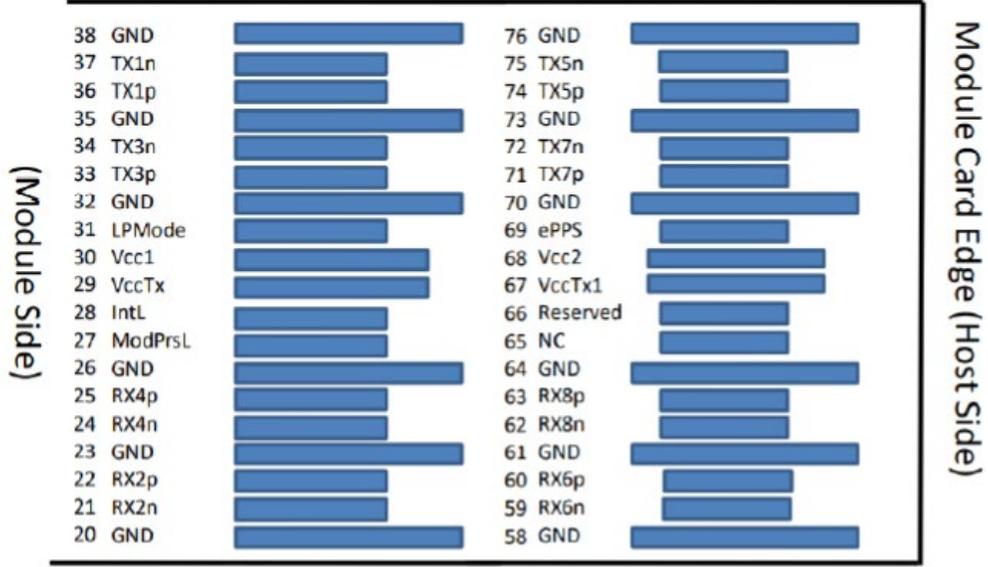
|    |             |          |  |   |
|----|-------------|----------|--|---|
| 35 |             | GND      | Module Ground (Logic and Power Return Path).         | 1 |
| 36 | CML-I       | Tx1+     | Transmit Differential Pairs from Host to Module.     |   |
| 37 | CML-I       | Tx1-     | Transmit 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 |

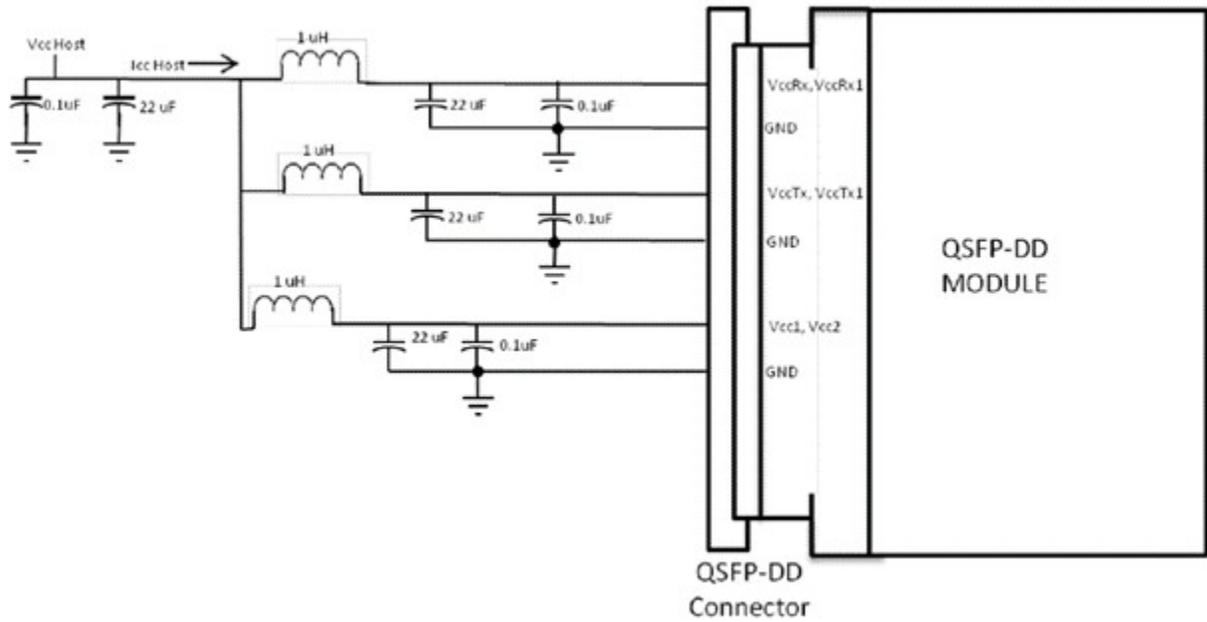
**Notes:**

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



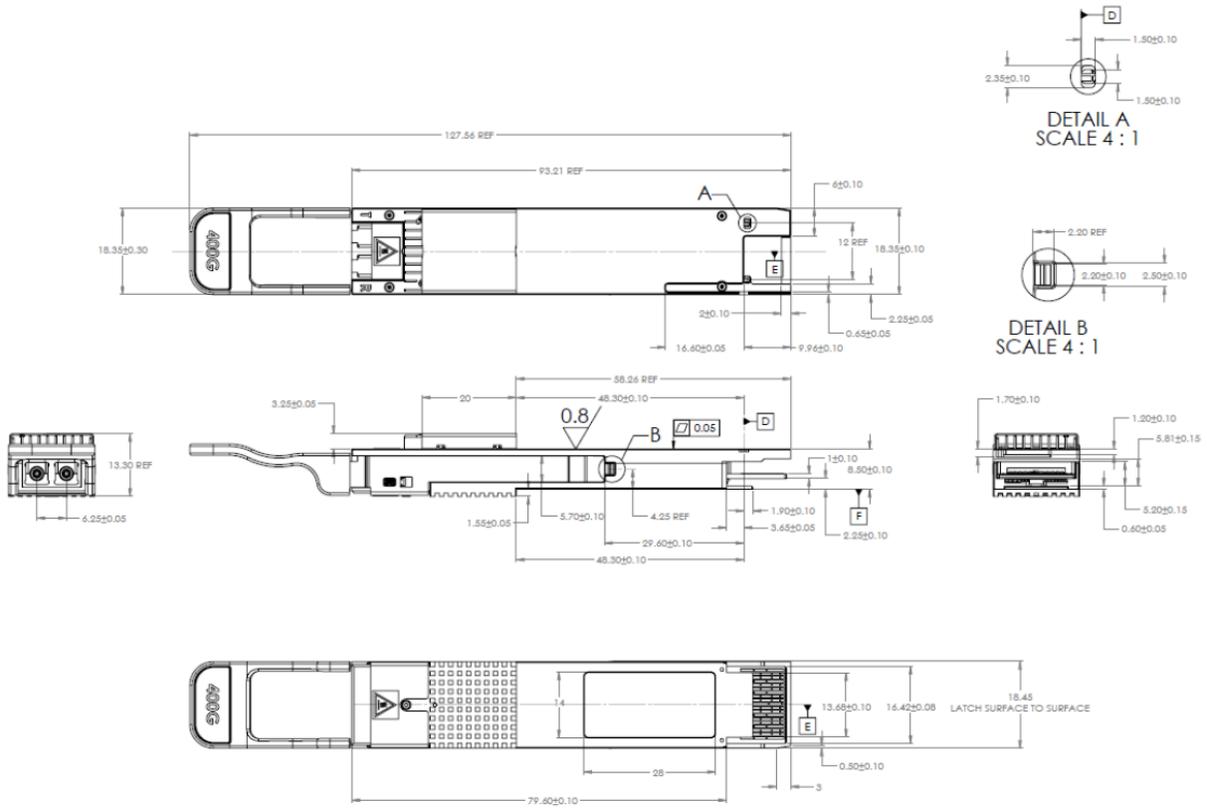
## Recommended Power Supply Filter



### Notes:

1. Filter capacitor values are informative vary depending on applications.  $V_{cc1}$  and/or  $V_{cc2}$  may be connected to the  $V_{ccTx}$ ,  $V_{ccTx1}$  or  $V_{ccRx}$ ,  $V_{ccRx1}$  provided the applicable derating of the maximum current limit is used.

# Mechanical Specifications



## About AddOn Networks

In 1999, AddOn Networks entered the market with a single product. Our founders fulfilled a severe shortage for compatible, cost-effective optical transceivers that compete at the same performance levels as leading OEM manufacturers. Adhering to the idea of redefining service and product quality not previously had in the fiber optic networking industry, AddOn invested resources in solution design, production, fulfillment, and global support.

Combining one of the most extensive and stringent testing processes in the industry, an exceptional free tech support center, and a consistent roll-out of innovative technologies, AddOn has continually set industry standards of quality and reliability throughout its history.

Reliability is the cornerstone of any optical fiber network and is engrained in AddOn's DNA. It has played a key role in nurturing the long-term relationships developed over the years with customers. AddOn remains committed to exceeding industry standards with certifications from ranging from NEBS Level 3 to ISO 9001:2005 with every new development while maintaining the signature reliability of its products.



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