

40GBase QSFP+ eSR4 Optical Transceivers



Features:

- Compliant with 40GBASE-SR4 per IEEE 802.3ba D3.2 nd SFF-8436 QSFP+ MSA Rev. 4.1
- Operating at 10.3125-Gbps per lane with 64b/66b coded data
- Low power dissipation < 1.5W (Power Level-1)
- Full Digital Diagnostics Monitor Interface
- Hot pluggable electrical interface
- Standard 12/8 lane optical fiber with MPO pluggable optical connector.

Applications:

- 40GBASE-SR4 Ethernet Links
- InfiniBand QDR, DDR, and SDR
- 4G/8G/10G Fiber Channel
- SATA/SAS Storage
- HPC Interconnects

Absolute Maximum Ratings

Not necessarily applied together. Exceeding these values may cause permanent damage. Functional operation under these conditions is not implied.

| Parameter | Symbol | Min | Typical | Max | Unit | Note |
|------------------------------------|--------|------|---------|---------|------|------|
| Storage Temperature | Ts | -40 | | 85 | °C | |
| 3.3V Power Supply Voltage | Vcc | -0.5 | | 3.6 | V | |
| Data Input Voltage — Single Ended | | -0.5 | | Vcc+0.5 | V | |
| Relative Humidity | RH | 5 | | 85 | % | |
| Rx Optical Damage Threshold / Lane | DT | 3.4 | | | dBm | |

Recommended Operating Conditions

| Parameter | Symbol | Min | Typical | Max | Unit | Note |
|---|--------|-------|---------|-------------|------|------|
| Case Temperature | Tc | 0 | 40 | 70 | °C | |
| 3.3 V Power Supply Voltage | Vcc | 3.135 | 3.3 | 3.465 | V | |
| Signal Rate per Channel | | 2.5 | | 10.312 5 | Gbps | 1 |
| Control Input Voltage High | Vih | 2 | | Vcc+0.3 | V | |
| Control Input Voltage Low | Vil | -0.3 | | 0.8 | V | |
| Two Wire Serial (TWS) Interface Clock Rate | | | 100 | | kHz | |
| Power Supply Noise Ripple Susceptibility (PSNR) | PSNR | | | 50 | mVpp | 2 |
| Receiver Differential Data Output Load | | | 100 | | Ohms | |
| Fiber Length: 2000 MHz·km 50µm MMF (OM3) | | 0.5 | | 300 | m | |

Notes:

1. Lane speed up to 12.5-Gbps is available upon customer requests.
2. Power supply noise is defined as peak-to-peak noise amplitude over 1K to 15 MHz frequency range at host supply side by the recommended power supply filter for module. See Section 10 for the recommended power supply filter.

Electrical Characteristics

| Parameter | Symbol | Min | Typical | Max | Unit | Note |
|--|-----------|-------------------------------------|---------|------|------|------|
| Transceiver Electrical Characteristics | | | | | | |
| TRx Power Consumption | | | | 1.5 | W | |
| TRx Power Supply Current | Icc | | | 420 | mA | |
| TRx Power-On Initialization Time | Tpwr_init | | | 2000 | ms | 1 |
| Transmitter Electrical Characteristics | | | | | | |
| Data Input Differential Peak-to-Peak Voltage Swing | ΔVDI PP | | | 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 | Jt2 | 0.17 | | | UI | |
| J9 Jitter Tolerance | Jt9 | 0.29 | | | UI | |

| | | | | | |
|---|--|---|--------|----------|----------|
| Eye Mask Coordinates: X1, X2; Y1, Y2. | | Specification Value 0.11, 0.31; 95, 350. | UI; mV | 3 | |
| Receiver Electrical Characteristics | | | | | |
| Data Output Differential Peak-to-Peak Voltage Swing | ΔVDO pp | 200 | 900 | mVpp | 4 |
| Output Transition Time 20% to 80% | t _{rise} , t _{fall} | 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 | Jo2 | | 0.42 | UI | |
| J9 Jitter Output | Jo9 | | 0.65 | UI | |
| Eye Mask Coordinates: X1, X2; Y1, Y2. | | Specification Value 0.29, 0.5; 150, 425. | UI; mV | 3 | |

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. Hit ratio= 5×10^{-5} per sample.
4. AC-Coupled with 100 Ω differential output impedance.

Optical Characteristics

| Parameter | Symbol | Min | Typical | Max | Unit | Note |
|--|-----------------|------|---------|------|------|------|
| Transmitter Optical Characteristics | | | | | | |
| Central Wavelength | λ | 840 | | 860 | nm | |
| Spectral Width – RMS | $\Delta\lambda$ | | | 0.55 | nm | |
| Output Optical Power: Average | PO_AVE | -7.6 | | 2.4 | dBm | |
| Output Optical Modulation Amplitude, per lane | OMA | -3 | | | dBm | |
| Difference in Power between any Two Lanes in OMA | | | | 4.0 | dB | |

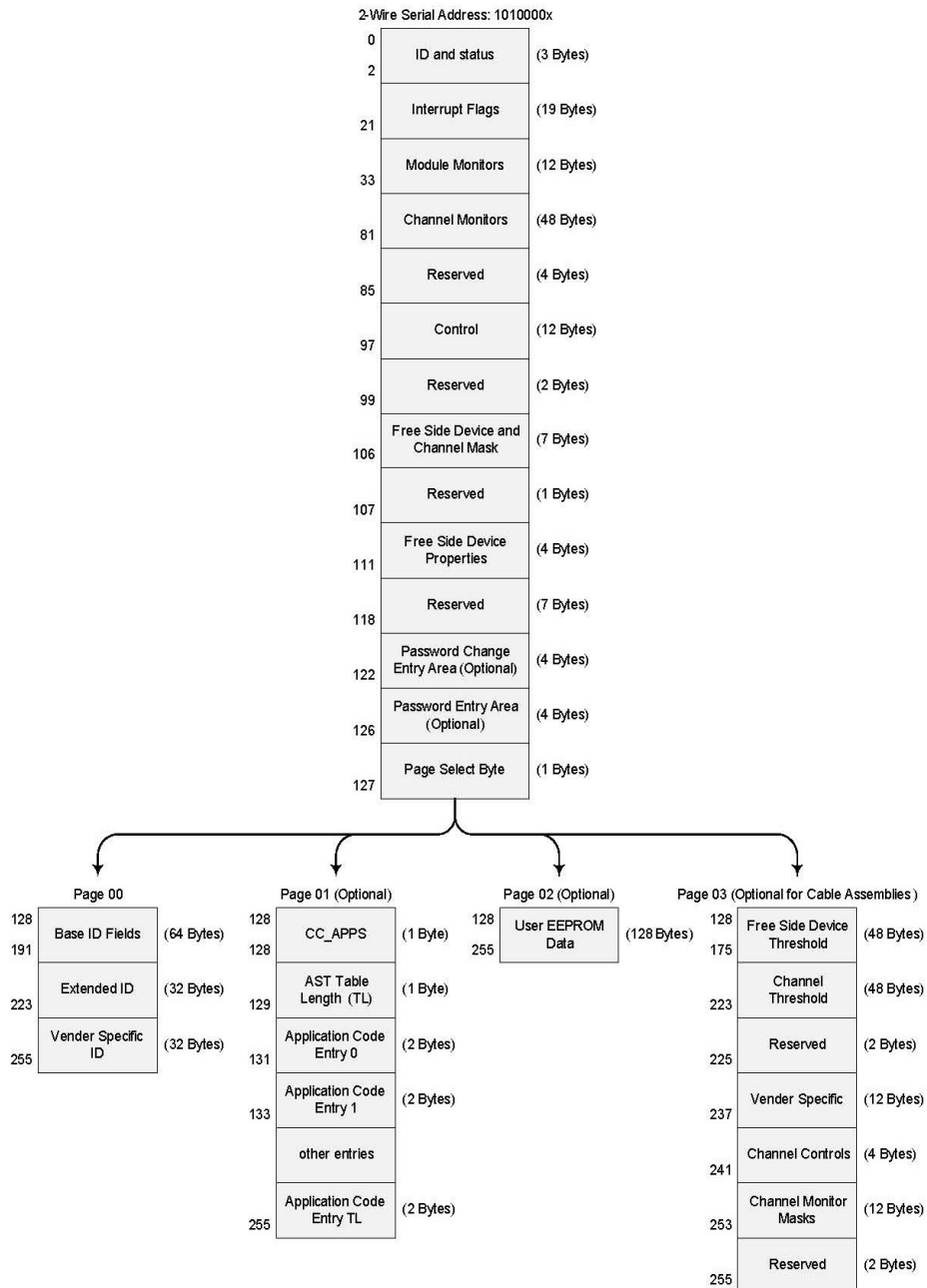
| | | | | | | |
|---|-----------|---|-----|------|-----|---|
| Transmitter and Dispersion Penalty (TDP,) each Lane | | | | 3.5 | dB | |
| Optical Extinction Ratio | ER | 3 | | | dB | |
| Disabled Output Optical Power | PO_OFF | | | -30 | dBm | |
| Eye Mask Coordinates: X1, X2, X3; Y1, Y2, Y3. | | Specification Value 0.23, 0.34, 0.43; 0.27, 0.35, 0.4 | | | UI | 1 |
| Receiver Optical Characteristics | | | | | | |
| Central wavelength, each lane | λ | 840 | 850 | 860 | nm | |
| Damage Threshold | | 3.4 | | | dBm | |
| Maximum Average power at receiver input, each lane | | | | 2.4 | dBm | |
| OMA, each Lane | | | | 3 | dBm | |
| Non-Stressed Receiver Sensitivity (Avg.) | | | | -7.5 | dBm | 2 |
| LOS Assert | | -30 | | | dBm | |
| LOS De-Assert | | | | -7.5 | dBm | |
| LOS Hysteresis | | 0.5 | | | dB | |

Notes:

1. Hit ratio= 5×10^{-5} per sample.
2. Measured with 10.3125-Gbps of PRBS-31 at 10^{-12} BER.

Memory Map

The memory map is structured as a single address and multiple page approaches, according to the QSFP+ SFF-8436 MSA specification as shown in the below. For more detailed description of this memory map or lower pages, please see our Memory Map document with flexible customization settings.



EEPROM Serial ID Memory Contents

Accessing Serial ID Memory uses the 2 wire address 1010000X (A0H). Memory Contents of Serial ID are shown in Table as below.

Serial ID Memory Contents

| Data Address | Size (Bytes) | Name of Field | Contents(Hex) | Description |
|-----------------------|--------------|-----------------------------|----------------------------|-----------------------|
| BASE ID FIELDS | | | | |
| 0 | 1 | Identifier | 0D | QSFP |
| 1-2 | 2 | Status Indicator | 00 00 | |
| 3-21 | 19 | Interrupt Flags | All 00 | |
| 22-33 | 12 | Module Monitors | All 00 | |
| 34-81 | 48 | Channel Monitors | All 00 | |
| 82-85 | 4 | Reserved | 00 00 00 00 | |
| 86-97 | 12 | Control | All 00 | |
| 98-99 | 2 | Reserved | 00 00 | |
| 100-106 | 7 | Module & Channel Masks | 00 00 00 00 00 00 00 | |
| 107-118 | 12 | Reserved | All 00 | |
| 119-122 | 4 | Password Change Entry | 00 00 00 00 | |
| 123-126 | 4 | Password Entry | 00 00 00 00 | |
| 127 | 1 | Page Select | 00 | |
| 128 | 1 | Identifier | 0D | QSFP+ |
| 129 | 1 | Ext. Identifier | 00 | |
| 130 | 1 | Connector | 0C | MPO Connector |
| 131-138 | 8 | Specification Compliance | 00 00 00 00 40 40 06 00 | 40G eSR4 over 300m |
| 139 | 1 | Encoding | 05 | 64B/66B |
| 140 | 1 | BR-Normal | 67 | 10.3Gbps per lane |
| 141 | 1 | Extended Rate Select | 00 | unspecified |
| 142 | 1 | Length SM-km | 00 | |
| 143 | 1 | Length, OM3-2m | 96 | |
| 144 | 1 | Length, OM2-1m | 42 | |
| 145 | 1 | Length, OM1-1m | 00 | |
| 146 | 1 | Length, Cu-1m | 00 | not support copper |

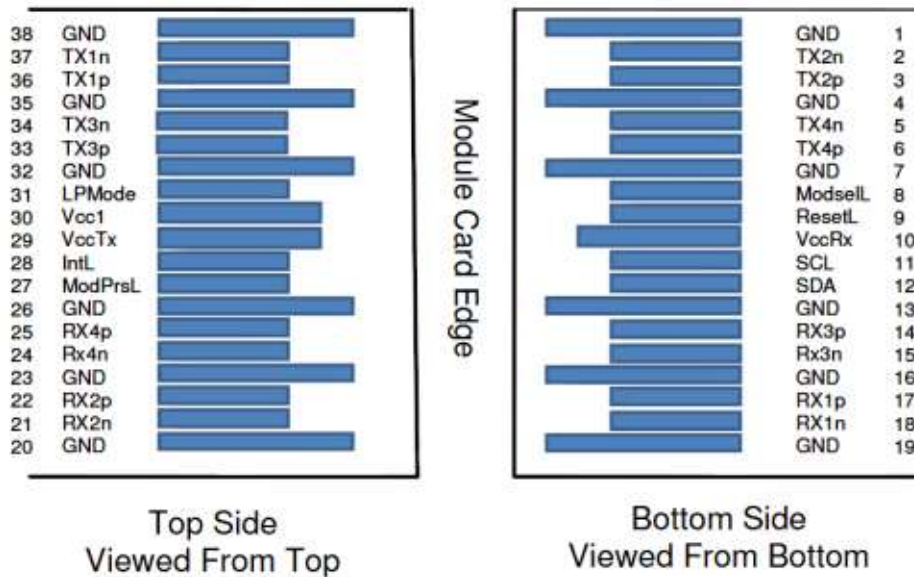
| | | | | |
|---------|----|--------------------------|--|--|
| 147 | 1 | Device technology | 00 | |
| 148-163 | 16 | Vendor name | 57 41 56 45 53 50 4C 49 54 54 45 52 20 20 20 20 | EGISMOS |
| 164 | 1 | Extended Module Codes | 04 | |
| 165-167 | 3 | Vendor OUI | 00 0F 0E | |
| 168-183 | 16 | Vendor Part Number | 57 53 54 2D 51 53 46 50 2B 65 53 52 34 2D 43 20 | EGS-QSFP+eSR4-C |
| 184-185 | 2 | Vendor rev | 30 32 | 02 |
| 186-187 | 2 | Wavelength | 42 68 | |
| 188-189 | 2 | Wavelength Tolerance | 07 D0 | |
| 190 | 1 | Max case temp | 46 | 70C |
| 191 | 1 | Check code for [128-190] | Xx | |
| 192-195 | 4 | Options | 00 00 00 12 | |
| 196-211 | 16 | Vendor SN | CC CM YY MM ID SN SN SN SN 20 20 20 20 20 20 20 | CC: Country code CM: CM code YY: Year MM: Month ID: Product ID SN: Sequence |
| 212-219 | 8 | Date code | YY YY MM MM DD DD LL LL | YY: Year MM: Month DD: Day of month LL: Lot number |
| 220 | 1 | DOM type | 08 | For average power |
| 221 | 1 | Enhanced Options | 00 | |
| 222 | 1 | Reserved | 00 | |
| 223-255 | 33 | Vendor specified | Xx | |

Low Speed Electrical Specification

Low Speed Control and Sense Signals

| Parameter | Symbol | Min | Max | Unit | Condition |
|---|----------------|----------------------|-----------------------|------|---|
| SCL and SDA | VOL | 0 | 0.4 | V | IOL(max)=3.0mA |
| | VOH | V _{CC} -0.5 | V _{CC} +0.3 | V | |
| SCL and SDA | VIL | -0.3 | V _{CC} *0.3 | V | |
| | VIH | V _{CC} *0.7 | V _{CC} + 0.5 | V | |
| Capacitance for SCL and SDA I/O pin | C _i | | 14 | pF | |
| Total bus capacitive load for SCL and SDA | C _b | | 100 | pF | 3.0 k Ohms Pullup resistor, max |
| | | | 200 | pF | 1.6 k Ohms pullup resistor max |
| LPMode, Reset and ModSelL | VIL | -0.3 | 0.8 | V | I _{in} ≤ 125 uA for 0V < V _{in} , V _{CC} |
| | VIH | 2 | V _{CC} +0.3 | V | |
| ModPrsL and IntL | VOL | 0 | 0.4 | V | IOL=2.0mA |
| | VOH | V _{CC} -0.5 | V _{CC} +0.3 | V | |

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 | Tx2p | 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 | LVTTTL-I | ModSelL | Module Select | 3 | |
| 9 | LVTTTL-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 | LVTTTL-O | ModPrsL | Module Present | 3 | |
| 28 | LVTTTL-O | IntL | Interrupt | 3 | |
| 29 | | Vcc Tx | +3.3V Power supply transmitter | 2 | 2 |
| 30 | | Vcc1 | +3.3V Power supply | 2 | 2 |
| 31 | LVTTTL-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 |

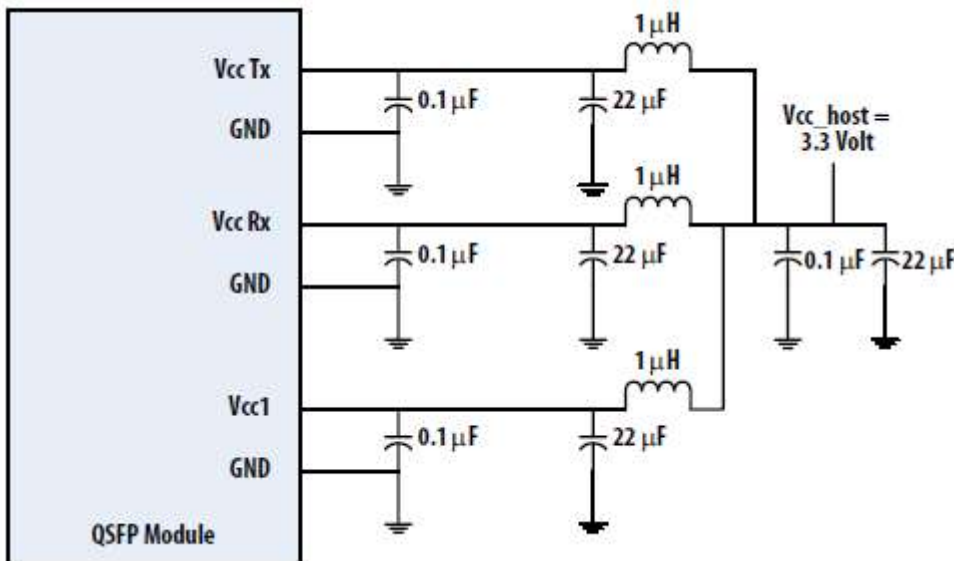
| | | | | | |
|----|-------|------|-------------------------------------|---|---|
| 36 | CML-I | Tx1p | Transmitter Non-Inverted Data Input | 3 | |
| 37 | CML-I | Tx1n | Transmitter Inverted Data Input | 3 | |
| 38 | | GND | Ground | 1 | 1 |

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.

Recommended Host Board Power Supply Circuit



Application in System

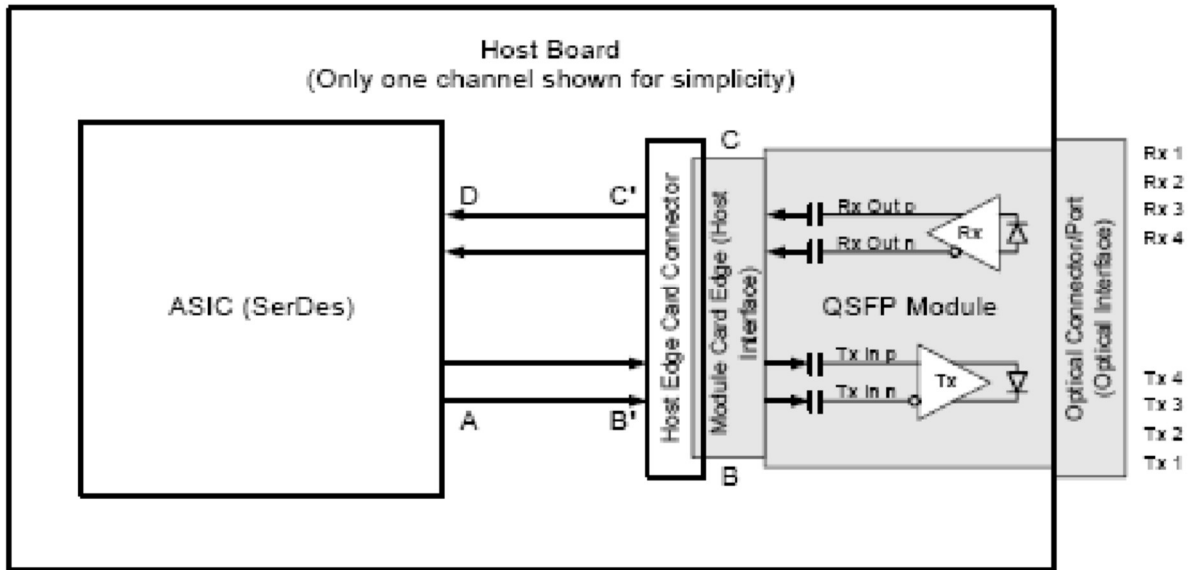


Figure 2: Application Reference Model

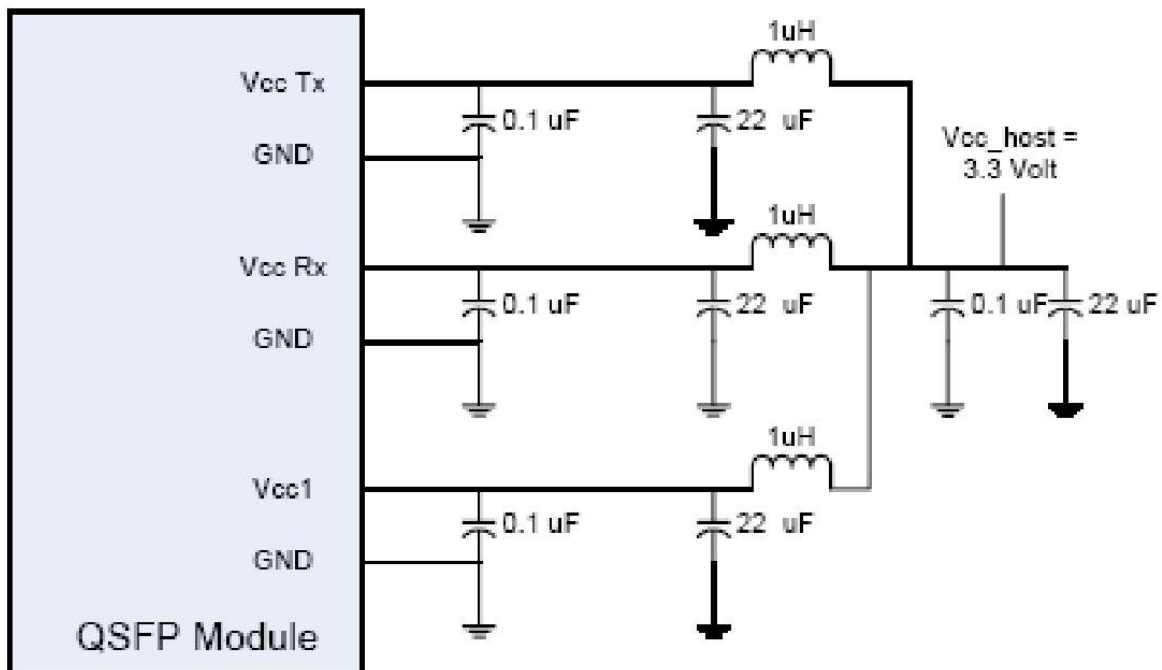
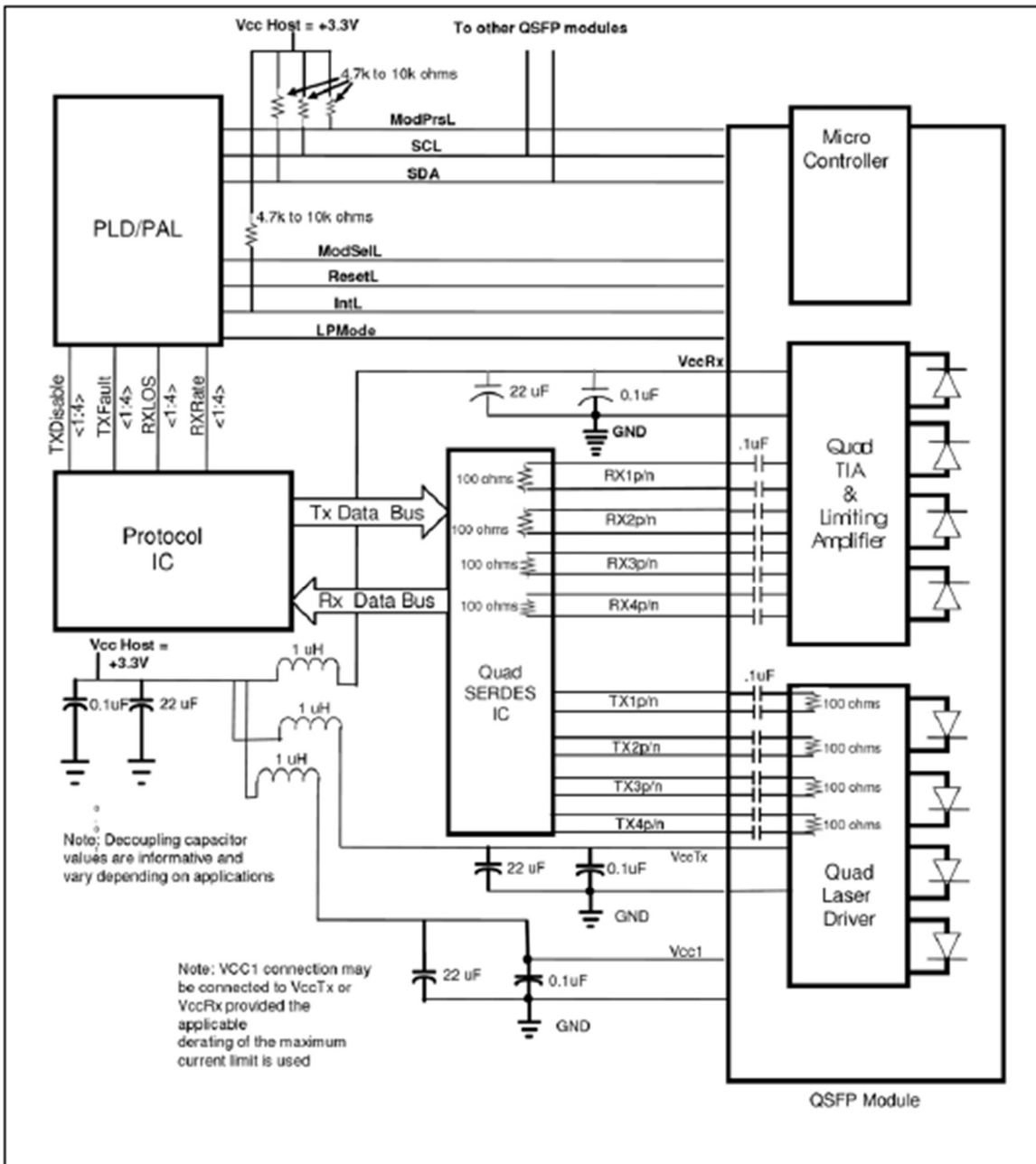
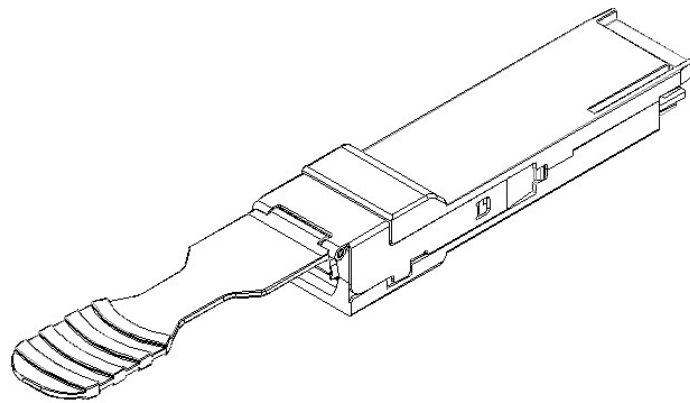
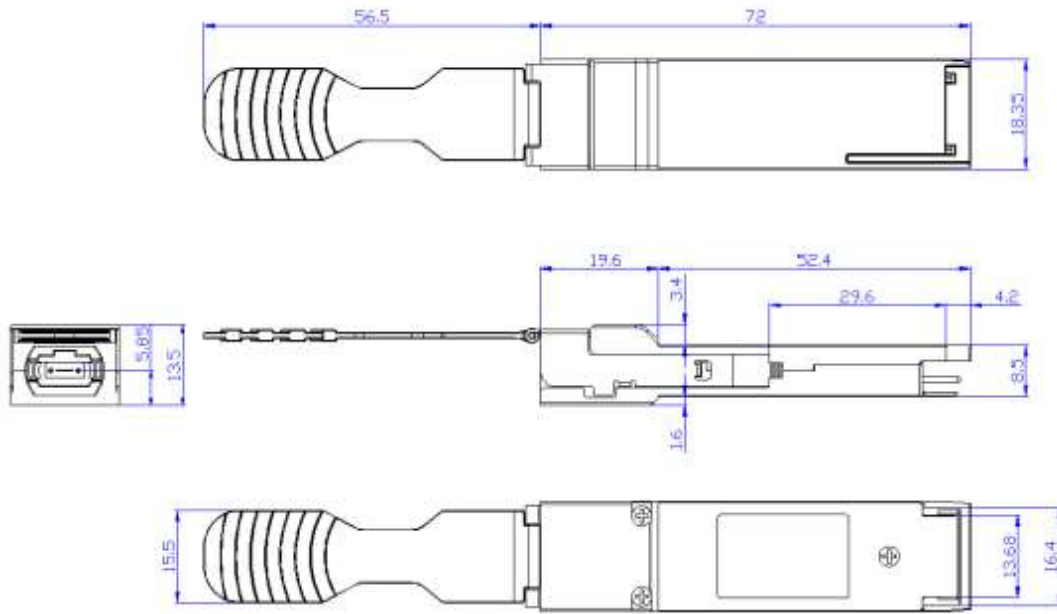


Figure 3: Recommended Host Board Power Supply Filtering

Recommended Interface Circuit



Mechanical Design Diagram



Unit: mm

Regulatory Compliance

| Feature | Test Method | Performance |
|--|---|--------------------------------------|
| Laser Eye Safety | FDA 21 CFR 1040.10 and 1040.11 IEC 60825-1: 1994+ A11: 1996+ A2: 2001 IEC 60825-2: 2004 + A1: 2006 EN 60825-1:1994+A1:2002+A2:2001 EN 60825-2: 2004 | Compliant with Class 1 laser product |
| Electrostatic Discharge (ESD) to the Electrical Pins | MIL-STD-883E Method 3015.4 Human Body Model | Class 1 (>1.5kV) |
| Electrostatic Discharge (ESD) Immunity | IEC 61000-4-2: 2001 | Class 2 (>4.0kV) |
| Electromagnetic Interference (EMI) | FCC Part 15 Subpart J Class B CISPR22:1997+A1:2000+A2:2002, Class B EN55022:1998+A1:2000+A2:2003, Class B | Compliant with standards |

Sum Up

| Part No | Specification | | | | | | | | | |
|-----------------|---------------|--------------------|-------------|-----------------------|----------|-----------------|--------|------------------------------|-------------|------------------|
| | Package | Data rate per Lane | Laser | Optical Power | Detector | Rx Sensitivity | Temp | Reach | Other | Application code |
| EGS-QSFP+eSR4-C | QSFP+ | 10.3 Gbps | 850nm VCSEL | -3.0 dBm~ +2.4 dBm | PIN | -7.5 dBm In OMA | 0~70°C | 400m for OM4 300m for OM3 | DDM RoHS | 40GBASE-eSR4 |