

40GBASE-PLR4 QSFP +1310nm 10km MTP/MPO Transceiver for SMF

QSFP-4X10G-LR-S-LL



Application

- 10GBASE-LR/LW 10G Ethernet
- OTU2, OTU1e, OTU2e

Features

- Hot-pluggable QSFP+ form factor
- Supports 4 independent streams of 10G Ethernet or OTN data
- Power dissipation < 2.5W
- RoHS-6 compliant
- Commercial case temperature range 0° C to 70° C
- Single 3.3V power supply
- Maximum link length of 10km on Single Mode Fiber (SMF)
- XLPP electrical interface
- MPO12 receptacle
- Built-in digital diagnostic functions, including Tx/Rx power monitoring

Description

QSFP+ transceiver modules are designed for use in high density 10 Gigabit Ethernet links over single mode fiber. They are compliant with the QSFP+ MSA, IEEE 802.3ae 10GBASE-LR/LW, and OTN data rates OTU2, OTU1e, and OTU2e per the ITU. Digital diagnostics functions are available via an I2C interface, as specified by the QSFP+ MSA. The transceiver is RoHS compliant per Directive 2011/65/EU5.

Product Specifications

I.General Specifications

| Parameter | Value | Unit | Notes |
|---|--|-------|-------------------------------------|
| Module Form Factor | QSFP+ | | |
| Maximum Aggregate Data Rate | 44.4 | Gb/s | |
| Maximum Data Rate per Lane | 11.095 | Gb/s | |
| Protocols Supported | 10G Ethernet | | This module is not retimed |
| Electrical Interface and Pin-out | 38-pin edge connector | | Pin-out as defined by the QSFP+ MSA |
| Maximum Power Consumption | 2.5 | Watts | |
| Management Interface | Serial, I2C-based, 400 kHz maximum frequency | | As defined by the QSFP+ MSA |

| Data Rate Specifications | Symbol | Min | Typ. | Max | Units | Ref. |
|--------------------------------|--------|------|------|-------------------|------------|------|
| Bit Rate per Lane | BR | 9.95 | | 11.10 | Mb/sec | 1 |
| Bit Error Ratio | BER | | | 10 ⁻¹² | | 2 |
| Link distance on SMF-28 | d | | | 10 | kilometers | |

Notes:

1. Compliant with 10GBASE-LR/LW, OTU2, OTU1e, and OTU2e and XLPP1.
2. Tested with a PRBS 2-1 test pattern.

II. Absolute Maximum Ratings

| Parameter | Symbol | Min | Typ. | Max | Unit | Ref. |
|-----------------------------------|---|------|------|-----|------|------|
| Maximum Supply Voltage | V _{cc1} , V _{ccTx} , V _{ccRx} | -0.5 | | 3.6 | V | |
| Storage Temperature | T _s | -40 | | 85 | ° C | |
| Case Operating Temperature | T _{op} | 0 | | 70 | ° C | |
| Relative Humidity | RH | 0 | | 85 | % | 1 |
| Damage Threshold, per Lane | DT | 3.4 | | | dBm | |

Notes:

1. Non-condensing.

III. Electrical Characteristics (TOP = 0 to 70°C, VCC = 3.1 to 3.47 Volts)

| Parameter | Symbol | Min | Typ. | Max | Unit | Ref. |
|---|-----------------------|-------------------------------------|-----------------------|------|----------|------|
| Supply Voltage | Vcc1, VccTx, VccRx | 3.1 | | 3.47 | V | |
| Supply Current | Icc | | | 1.13 | A | |
| Transmit turn-on time | | | | 2000 | ms | 1 |
| Transmitter (per Lane) | | | | | | |
| Single ended input voltage tolerance | VinT | -0.3 | | 4.0 | V | |
| Differential data input swing | Vin,pp | 120 | | 1200 | mVpp | 2 |
| Differential input threshold | | | 50 | | mV | |
| AC common mode input voltage tolerance (RMS) | | 15 | | | mV | |
| Differential input return loss | | Per IEEE P802.3ba,Section 86A.4.1.1 | | | dB | 3 |
| J2 Jitter Tolerance | Jt2 | 0.17 | | | UI | |
| J9 Jitter Tolerance | Jt9 | 0.29 | | | UI | |
| Data Dependent Pulse Width Shrinkage | DDPWS | 0.07 | | | UI | |
| Eye mask colordinates {X1, X2, Y1, Y2} | | | 0.11, 0.31 95, 350 | | UI mV | 4 |

Receiver (per Lane)

| | | | | | | |
|---|---------------------|--------------------------------------|--|------|----------|-----|
| Single-ended output voltage | | -0.3 | | 4.0 | V | |
| Differential data output swing | V _{out,pp} | 200 | | 400 | mVpp | 5,6 |
| | | 300 | | 600 | | |
| | | 400 | | 800 | | |
| | | 600 | | 1200 | | |
| AC common mode output voltage (RMS) | | | | 7.5 | mV | |
| Termination mismatch at 1 MHz | | | | 5 | % | |
| Differential output return loss | | Per IEEE P802.3ba, Section 86A.4.2.1 | | | dB | 3 |
| Common mode output return loss | | Per IEEE P802.3ba, Section 86A.4.2.2 | | | dB | 3 |
| Output transition time, 20% to 80% | | 28 | | | ps | |
| J2 Jitter output | Jo2 | | | 0.42 | UI | |
| J9 Jitter output | Jo9 | | | 0.65 | UI | |
| Eye mask coordinates #1 {X1, X2, Y1, Y2} | | 0.29, 0.5 150, 425 | | | UI mV | 4 |
| Power Supply Ripple Tolerance | PSR | 50 | | | mVpp | |

Notes:

1. From power-on and end of any fault conditions.
2. After internal AC coupling. Self-biasing 100Ω differential input.
3. 10 MHz to 11.1 GHz range
4. Hit ratio = 5 x 10E-5.
5. AC coupled with 100Ω differential output impedance.
6. Output voltage settable in four discrete ranges via I2C command.

IV. Optical Characteristics (TOP = 0 to 70°C, VCC = 3.1 to 3.47 Volts)

| Parameter | Symbol | Min | Typ. | Max | Unit | Ref. |
|--|-----------|------|-------------------------------|--------|-------|------|
| Transmitter | | | | | | |
| Signaling Speed per Lane | | 9.95 | | 10.095 | GBd | 1 |
| Lane center wavelength | λ | 1290 | | 1330 | | |
| Average Launch Power per Lane | TXPx | -6.0 | | -1.0 | dBm | 2 |
| Transmit OMA per Lane | TxOMA | -5.2 | | 3.0 | dBm | |
| Transmitter and Dispersion Penalty | TDP | | | 3.2 | dB | |
| Transmit OMA per lane minus TDP | | -6.2 | | | m | |
| Optical Extinction Ratio | ER | 6.0 | | | dB | |
| Sidemode Suppression ratio | SSRmin | 30 | | | dB | |
| Average launch power of OFF transmitter, per lane | | | | -30 | dBm | |
| Relative Intensity Noise | RIN | | | -128 | dB/Hz | 3 |
| Tx Jitter | Txj | | | -20 | dB | |
| Transmitter Reflectance | | | | -12 | | |
| Transmitter eye mask definition | | | Per 802.3ae, G.693, and G.691 | | | |

| Parameter | Symbol | Min | Typ. | Max | Unit | Ref. |
|---|------------------|-------|------|--------|------|------|
| Receiver | | | | | | |
| Signaling Speed per Lane | | 9.95 | | 10.095 | GBd | 4 |
| Lane center wavelength | λ | 1260 | | 1355 | | |
| Damage Threshold per Lane | P_{MAX} | | | 1.5 | dBm | |
| Average Receive Power per Lane | RXPx | -14.4 | | 0.5 | dBm | 5 |
| Receiver Sensitivity (OMA) per Lane | Rxsens | | | -12.6 | dBm | |
| Stressed Receiver Sensitivity (OMA) per Lane | SRS | | | -10.3 | dBm | |
| Return Loss | R_L | | | -14 | dBm | |
| Receive electrical 3 dB upper cutoff frequency, per lane | | | | 12.3 | GHz | |
| LOS De-Assert | LOS _D | | | -14 | dBm | |
| LOS Assert | LOS _A | -30 | | -17 | dBm | |
| LOS Hysteresis | | | 0.5 | | dB | |

Notes:

1. Transmitter consists of 4 lasers operating between 9.95 and 11.10 Gb/s each.
2. Minimum value is informative.
3. RIN is scaled by $10 \cdot \log(10/4)$ to maintain SNR outside of transmitter.
4. Receiver consists of 4 photodetectors operating between 9.95 and 11.10 Gb/s each.
5. Minimum value is informative, equals min TxOMA with infinite ER and max channel insertion loss.

V. Pin Description

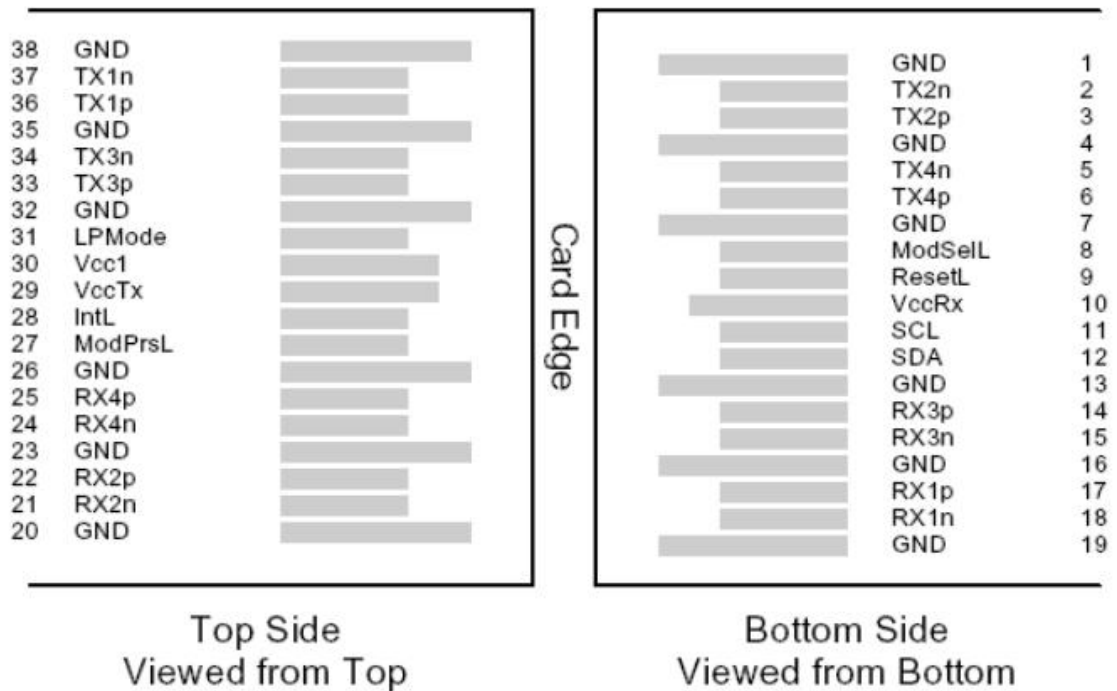


Figure 1 – QSFP+ MSA-compliant 38-pin connector

| 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.

VI. Mechanical Specifications

The mechanical specifications are compliant to the QSFP+ MSA transceiver module specifications.

