

40GBASE-PLR4L QSFP+ 1310nm 1.4km MTP/MPO Transceiver for SMF

QSFP-PIR4-40G-LL



Application

- 10GBASE-LR Lite 10G Ethernet

Features

- Hot-pluggable QSFP+ form factor
- Maximum link length of 1.4km and 4dB insertion loss on single mode fiber (SMF)
- Built-in digital diagnostic functions, including Tx/Rx power monitoring
- Supports 4 independent streams of 10GBASE-LR Lite
- Commercial case temperature range 0° C to 70° C
- RoHS-6 compliant
- Power dissipation < 2.5W
- Single 3.3V power supply
- MPO12 receptacle
- XLPP electrical interface

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 and a Lite version of IEEE 802.3ae 10GBASE-LR/LW. Digital diagnostics functions are available via an I2C interface, as specified by the QSFP+ MSA. The transceiver is RoHS compliant per Directive 2011/65/EU.

Product Specifications

I. General Product Characteristics

| Parameter | Value | Unit | Notes |
|---|--|-------|-------------------------------------|
| Module Form Factor | QSFP+ | | |
| Number of Lanes | 4 Tx and 4 Rx | | |
| Maximum Aggregate Data Rate | 41.2 | Gb/s | |
| Maximum Data Rate per Lane | 10.3125 | 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 | Unit | Ref. |
|--------------------------------------|--------|------|------|-------------------|------------|------|
| Bit Rate per Lane | BR | 9.95 | | 10.313 | Mb/sec | |
| Bit Error Ratio | BER | | | 10 ⁻¹² | | 1 |
| Link distance on SMF-28 | d | | | 2 | kilometers | 2 |
| Link insertion loss on SMF-28 | | | | 4.0 | db | 2 |

Notes:

1. Tested with a PRBS 231-1 test pattern.
2. 10GBASE-LR Lite.

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 | |

Note:

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 | V _{cc1} , V _{ccTx} , V _{ccRx} | 3.1 | | 3.47 | V | |
| Supply Current | I _{cc} | | | 1.13 | A | |
| Transmit turn-on time | | | | 2000 | ms | 1 |
| Transmitter (per Lane) | | | | | | |
| Single ended input voltage tolerance | V _{inT} | -0.3 | | 4.0 | V | |
| Differential data input swing | V _{in,pp} | 120 | | 1200 | mV _{pp} | 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 | J _{t2} | 0.17 | | | UI | |

Transmitter (per Lane)

| | | | | | | |
|---|-------|------|-----------------------|--|----------|---|
| 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 | Vout,pp | 200 | | 400 | mVpp | 5.6 |
| | | 300 | | 600 | | |
| | | 400 | 500 | 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 = 5×10^{-5} .
5. AC coupled with 100Ω differential output impedance.
6. Output voltage is settable in 4 discrete steps via I2C. Default is 400–800 mV.

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 | | 10.3125 | GBd | 1 |
| Lane center wavelength | λ | 1260 | | 1355 | | |
| Total Launch Power | P_{OUT} | | | 6.5 | dBm | |
| Transmit OMA per Lane | TxOMA | -6.4 | | 3.0 | dBm | |
| Transmitter and Dispersion Penalty | TDP | | | 6.4 | dBm | |
| Transmit OMA - TDP | Tp-OMA | -8.4 | | | | |
| Average Launch Power per Lane | TXP_x | -9.4 | | 0.5 | | 2 |
| Optical Extinction Ratio | ER | 3.5 | | | dB | |
| Sidemode Suppression ratio | SSR _{mim} | 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 | |
| Transmitte Reflectance | | Per 802.3ae requirements | | | | |
| Transmitter eye mask definition | | Per 802.3ae requirements | | | | |

| Parameter | Symbol | Min | Typ. | Max | Unit | Ref. |
|---|-----------|-------|------|---------|------|------|
| Receiver | | | | | | |
| Signaling Speed per Lane | | 9.95 | | 10.3125 | GBd | 4 |
| Lane center wavelength | λ | 1260 | | 1355 | nm | |
| Damage Threshold per Lane | P_{MAX} | | | 3.5 | 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 | | | -12 | dBm | |
| Receive electrical 3 dB upper cutoff frequency, per lane | | | | 12.3 | GHz | |
| LOS De-Assert | LOS_D | | | -17 | dBm | |
| LOS Assert | LOS_A | -30 | | | dBm | |
| LOS Hysteresis | | | 0.5 | | dB | |
| Link Power Budget | | | | | | |
| Power Budget | | 6.2 | | | dB | |
| Link Insertion Loss | | 4.0 | | | dB | 6 |

Notes:

1. Transmitter consists of 4 lasers operating between 9.95 and 10.3 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 10.3 Gb/s each.
5. Minimum value is informative, equals min TxOMA with infinite ER and max channel insertion loss.
6. Insertion loss includes 0.8 dB for fiber attenuation and 3.2 dB for connector and splice loss.

V. Pin Description

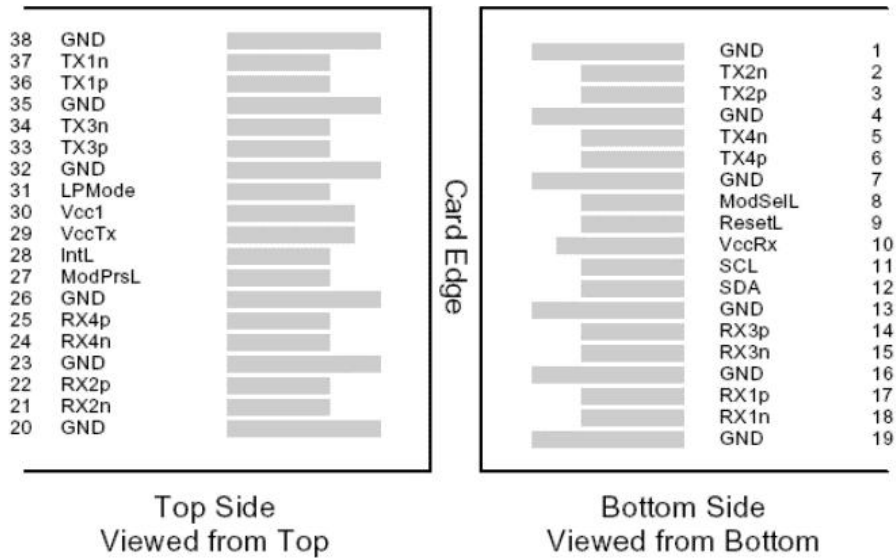


Figure 1 – QSFP+ MSA-compliant 38-pin connector

| 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 | 21 |
| 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:

Circuit ground is internally isolated from chassis ground.

VI. Mechanical Specifications

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

