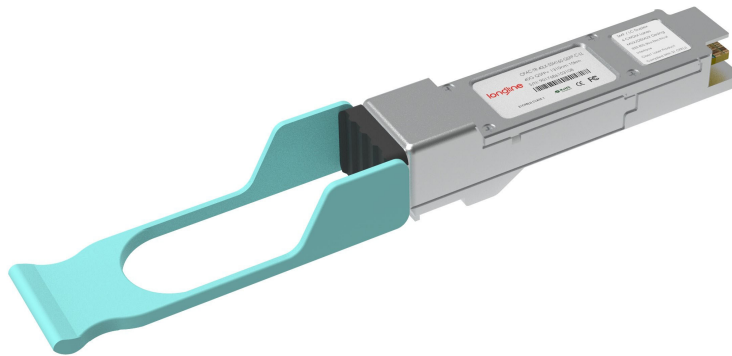


40GBASE-UNIV QSFP+ 1310nm 2km DOM Optical Transceiver Module for SMF/MMF

CPAC-TR-40LX-SSM160-QSFP-C-LL



Application

- 40G Ethernet over MMF and SMF
- Infiniband QDR and DDR interconnects

Features

- Hot-pluggable QSFP+ form factor
- Operates over duplex multimode and single mode fiber with dual LC receptacles
- Supports 41.2 Gb/s aggregate bit rate
- Power dissipation <3.5W
- Commercial case temperature range 0° C to 70° C
- Maximum link length of 150m on OM3, and 2km on SMF
- Uncooled 4x10Gb/s CWDM transmitter
- XLPP electrical interface
- Built-in digital diagnostic functions, including Tx/Rx power monitoring
- RoHS-6 Compliant

Description

The QSFP-LX4-40G is a transceiver module designed for 2km (SMF) / 150m (MMF) optical communication applications. They are compliant with the IEEE 802.3ba 40GBASE-LR4 referred to as LM4. The module converts 4 inputs channels (ch) of 10Gb/s electrical data to 4 CWDM optical signals, and multiplexes them into a single channel for 40Gb/s optical transmission. Reversely, on the receiver side, the module optically de-multiplexes a 40Gb/s input into 4 CWDM channels signals, and converts them to 4 channel output electrical data.

Product Specifications

I.General Specifications

| Parameter | Value | Unit | Notes |
|---|--|-------|-------------------------------------|
| Module Form Factor | QSFP+ | | |
| Maximum Aggregate Data Rate | 41.2 | Gb/s | |
| Maximum Data Rate per Lane | 10.3125 | Gb/s | |
| Protocols Supported | 40G Ethernet | | |
| Electrical Interface and Pin-out | 38-pin edge connector | | Pin-out as defined by the QSFP+ MSA |
| Maximum Power Consumption | 3.5 | 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 | | | 10,313 | Mb/sec | 1 |
| Bit Error Ratio | BER | | | 10-12 | | 2 |
| Link distance on OM3 | d | | | 150 | meters | |
| Link distance on OM4 | d | | | 160 | meters | |
| Link distance on SMF | d | | | 2000 | meters | |

Notes:

1. Adapted from 40GBASE-LR4, IEEE 802.3ba
2. Tested with a PRBS 231-1 test pattern.

II. Absolute Maximum Ratings

| Parameter | Symbol | Min | Typ. | Max | Unit | Ref. |
|-----------------------------------|--------------------|------|------|-----|------|------|
| Maximum Supply Voltage | Vcc1, VccTx, VccRx | -0.5 | | 4 | V | |
| Storage Temperature | Ts | -40 | | 85 | ° C | |
| Case Operating Temperature | Top | 0 | | 70 | ° C | |
| Relative Humidity | RH | 0 | | 85 | % | 1 |
| Damage Threshold, per Lane | DT | 3.4 | | | dBm | |

Notes:

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 coordinates {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} | 0 | | 800 | mVpp | 5 |
| 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.

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

| Parameter | Symbol | Min | Typ. | Max | Unit | Ref. |
|---|---------|--|------|------|-------|------|
| Transmitter (per Lane) | | | | | | |
| Signaling Speed per Lane | | | | 11.2 | GBd | 1 |
| Lane center wavelengths (range) | | 1264.5 – 1277.5 1284.5 – 1297.5 1304.5 – 1317.5 1324.5 – 1337.5 | | | nm | |
| Total Average Launch Power | POUT | | | 8.3 | dBm | |
| Average Launch Power per Lane, MMF | TXPx | -7.0 | | 4.3 | dBm | 2 |
| Average Launch Power per Lane, SMF | | -10.0 | | 2.3 | | |
| Transmit OMA per Lane, MMF | TxOMA | -3.0 | | 4.8 | dBm | |
| Transmit OMA per Lane, SMF | | -6.0 | | 3.5 | dBm | |
| Transmitter Dispersion Penalty, MMF | TXP-TDP | | | 4.7 | dBm | 3 |
| Transmitter Dispersion Penalty, SMF | | | | 2.6 | | |
| Average launch power of OFF transmitter, per Lane | | | | -30 | dBm | |
| Relative Intensity Noise | RIN | | | -128 | dB/Hz | 4 |
| Sidemode Suppression ratio | SSRmin | 30 | | | dB | |
| Optical Extinction Ratio | ER | 3.5 | | | dB | |
| Optical Return Loss Tolerance | | | | 20 | dB | |
| Transmitter Reflectance | | | | -12 | dB | |
| Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3} | | (0.25, 0.4, 0.45, 0.25, 0.28, 0.4) | | | | |

| Parameter | Symbol | Min | Typ. | Max | Unit | Ref. |
|--|--------|--|------|-------|------|------|
| Receiver(per Lane) | | | | | | |
| Signaling Speed per Lane | | | | 11.2 | GBd | 5 |
| Lane center wavelengths(range) | | 1264.5 – 1277.5 1284.5 – 1297.5 1304.5 – 1317.5 1324.5 – 1337.5 | | | nm | |
| Receive Power (OMA) per Lane, MMF | | | | 4.8 | | |
| | RXOMA | | | | dBm | |
| Receive Power (OMA) per Lane, SMF | | | | 3.3 | | |
| Damage Threshold per Lane | PMAX | | | 5.5 | dBm | |
| Average Receive Power per Lane, MMF | | -10.0 | | 4.3 | | |
| | RXPx | | | | dBm | |
| Average Receive Power per Lane, SMF | | -13.7 | | 2.3 | | 6 |
| Receiver Sensitivity (OMA) per Lane, MMF | | | | -10.5 | | |
| | Rxsens | | | | dBm | |
| Receiver Sensitivity (OMA) per Lane, SMF | | | | -10.5 | | 7 |
| Stressed Receiver Sensitivity (OMA) per Lane, MMF | | | | -5.0 | | |
| | SRS | | | | dBm | |
| Stressed Receiver Sensitivity (OMA) per Lane, SMF | | | | -8.5 | | |

| | | | | | | |
|---|------|-----|---|------|-----|---|
| Return Loss | RL | | | -20 | dB | |
| Vertical eye closure penalty, per lane | | | | 3.6 | dB | |
| Receive electrical 3 dB upper cutoff frequency, per lane | | | | 12.3 | dB | |
| LOS De-Assert | LOSD | | | -12 | dBm | 8 |
| LOS Assert | LOSA | -28 | | | dBm | 8 |
| LOS Hysteresis | | | 1 | | dB | |

Notes:

1. Transmitter consists of 4 lasers operating at 10.3Gb/s each.
2. Minimum value is informative.
3. Even if TDP < 0.5 dB (MMF) or TDP < 0.8 dB (SMF), TxP – TDP must be greater than this value.
4. RIN is scaled by $10 \cdot \log(10/4)$ to maintain SNR outside of transmitter.
5. Receiver consists of 4 photodetectors operating at 10.3Gb/s each.
6. Minimum value is informative, equals min TxOMA with infinite ER and max channel insertion loss.
7. SMF receiver sensitivity guaranteed by design, but not measured in production.
8. LOS Assert and De-Assert values are informative and may vary between MMF and SMF uses.

V. Pin Description

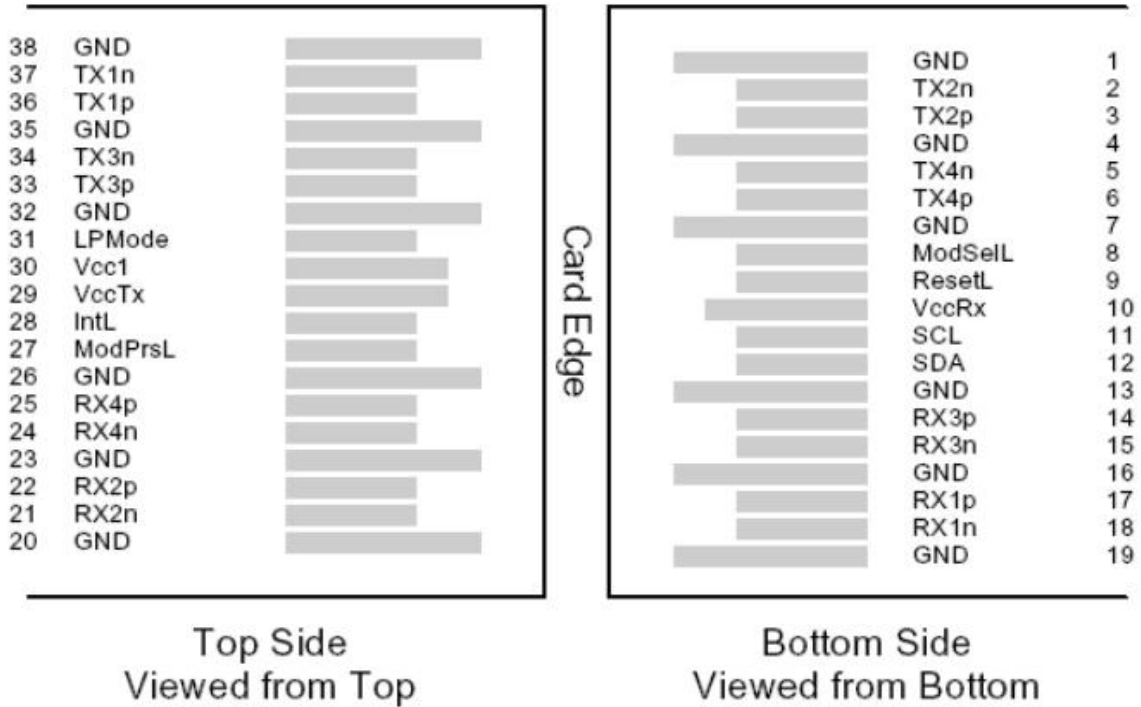


Figure 1 – QSFP+ MSA-compliant 38-pin connector

| 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 |

Note:

1.Circuit ground is internally isolated from chassis ground.

VI. Mechanical Specifications

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

