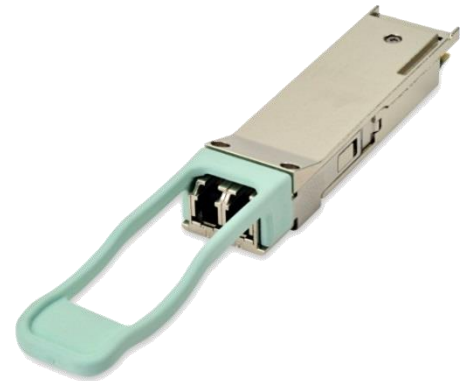


Product Specification

40GE Universal LM4 QSFP+ Optical Transceiver Module FTL4C3QE2C

PRODUCT 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 140m on OM3, 160m on OM4, and 1km on SMF
- Uncooled 4x10Gb/s CWDM transmitter
- XLPI electrical interface
- Built-in digital diagnostic functions, including Tx/Rx power monitoring
- RoHS-6 compliant



APPLICATION

- 40G Ethernet over MMF and SMF

Finisar's FTL4C3QE2C QSFP+ transceiver modules are designed for use in 40 Gigabit Ethernet links over duplex multimode or single mode fiber. They are compliant with the QSFP+ MSA^{1,2} and represent a multimode adaptation of IEEE 802.3ba 40GBASE-LR4³ referred to as LM4. Digital diagnostics functions are available via an I2C interface, as specified by the QSFP+ MSA. The optical transceiver is compliant per the RoHS Directive 2011/65/EU⁴. See Finisar Application Note AN-2038 for more details⁵.

PRODUCT SELECTION

FTL4C3QE2C

- C3: 1271 - 1331 nm CWDM over MMF and SMF
- E: 40G Ethernet
- 2: Second generation product
- C: Commercial temperature range

I. Pin Descriptions

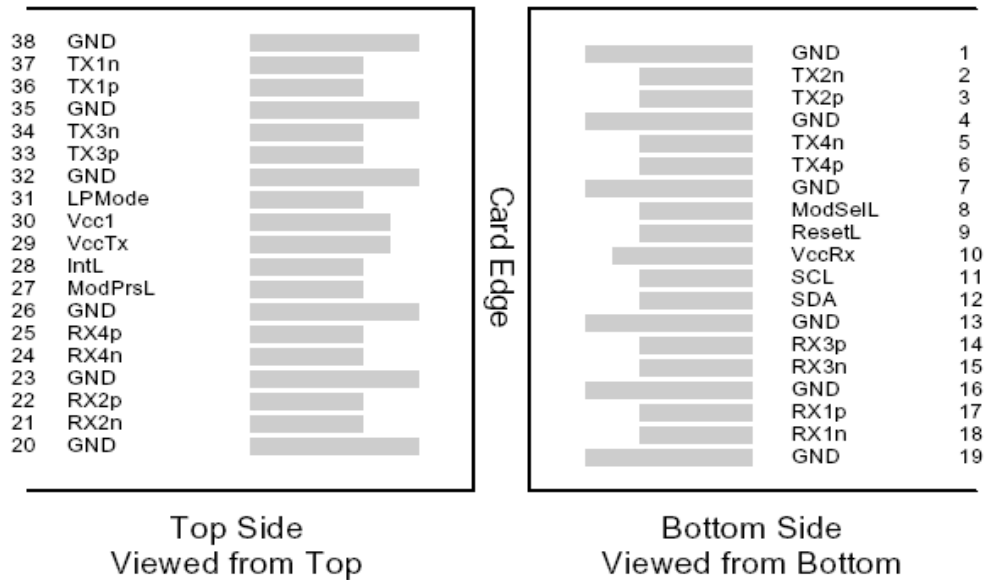


Figure 1 – QSFP+ MSA-compliant 38-pin connector

| 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.

II. General Product Characteristics

| 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 | | | 140 | m | |
| Link distance on OM4 | d | | | 160 | m | |
| Link distance on SMF | d | | | 1000 | m | |

Notes:

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

III. Absolute Maximum Ratings

| Parameter | Symbol | Min | Typ | Max | Unit | Ref. |
|----------------------------|--------------------------|------|-----|-----|------|------|
| Maximum Supply Voltage | Vcc1, VccTx, VccRx | -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 | 5.5 | | | dBm | |

Notes:

1. Non-condensing.

IV. Electrical Characteristics (T_{OP} = 0 to 70°C, V_{CC} = 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 | I _{cc} | | | 1.13 | A | |
| Link turn-on time | | | | | | |
| Transmit turn-on time | | | | 2000 | ms | 2 |
| 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} | 3 |
| 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 | 4 |
| J2 Jitter Tolerance | J _{t2} | 0.17 | | | UI | |
| J9 Jitter Tolerance | J _{t9} | 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 | 5 |
| Receiver (per Lane) | | | | | | |
| Single-ended output voltage | | -0.3 | | 4.0 | V | |
| Differential data output swing | V _{out,pp} | 0 | | 800 | mV _{pp} | 6 |
| 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 | 4 |
| Common mode output return loss | | | Per IEEE P802.3ba, Section 86A.4.2.2 | | dB | 4 |
| Output transition time, 20% to 80% | | 28 | | | ps | |
| J2 Jitter output | J _{o2} | | | 0.42 | UI | |
| J9 Jitter output | J _{o9} | | | 0.65 | UI | |
| Eye mask coordinates #1 {X1, X2 Y1, Y2} | | | 0.29, 0.5 150, 425 | | UI mV | 5 |
| Power Supply Ripple Tolerance | PSR | 50 | | | mV _{pp} | |

Notes:

1. Maximum total power value is specified across the full temperature and voltage range.

2. From power-on and end of any fault conditions.
3. After internal AC coupling. Self-biasing 100Ω differential input.
4. 10 MHz to 11.1 GHz range.
5. Hit ratio = 5 x 10E-5.
6. AC coupled with 100Ω differential output impedance.

V. Optical Characteristics (T_{OP} = 0 to 70°C, V_{CC} = 3.1 to 3.47 Volts)

| Parameter | Symbol | Min | Typ | Max | Unit | Ref. |
|---|--------------------|-------|--|-------|-------|------|
| Transmitter | | | | | | |
| Signaling Speed per Lane | | | 10.3125 | | 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 | P _{OUT} | | | 10.3 | dBm | |
| Transmit OMA per Lane, MMF | TxOMA | -3.0 | | 4.8 | dBm | |
| Transmit OMA per Lane, SMF | | -6.0 | | 3.5 | | |
| Average Launch Power per Lane, MMF | TXP _x | -7.0 | | 4.3 | dBm | 2 |
| Average Launch Power per Lane, SMF | | -10.0 | | 2.3 | | |
| Optical Extinction Ratio | ER | 3.5 | | | dB | |
| Transmitter Dispersion Penalty, MMF | TDP | | | 4.7 | dB | |
| Transmitter Dispersion Penalty, SMF | | | | 2.6 | | |
| Transmitter OMA - TDP, MMF | TxP-TDP | | | -7.2 | dBm | 3 |
| Transmitter OMA - TDP, SMF | | | | -6.8 | | |
| Sidemode Suppression ratio | SSR _{min} | 30 | | | dB | |
| Average launch power of OFF transmitter, per lane | | | | -30 | dBm | |
| Relative Intensity Noise | RIN | | | -128 | dB/Hz | 4 |
| 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} | | | |
| Receiver | | | | | | |
| Signaling Speed per Lane | | | 10.3125 | | 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 | RxOMA | | | 4.8 | dBm | |
| Receive Power (OMA) per Lane, SMF | | | | 3.3 | | |
| Average Receive Power per Lane, MMF | RXP _x | -10.0 | | 4.3 | dBm | 6,7 |
| Average Receive Power per Lane, SMF | | -13.7 | | 2.3 | | |
| Receiver Sensitivity (OMA) per Lane, MMF | Rxsens | | | -10.5 | dBm | 7 |
| Receiver Sensitivity (OMA) per Lane, SMF | | | | -10.5 | | |
| Stressed Receiver Sensitivity (OMA) per Lane, MMF | SRS | | | -5.0 | dBm | 6 |
| Stressed Receiver Sensitivity (OMA) per Lane, SMF | | | | -8.5 | | |
| Damage Threshold per Lane | P _{MAX} | | | 5.5 | dBm | |

| | | | | | | |
|--|------------------|-----|--|------|-----|---|
| 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 | GHz | |
| LOS De-Assert | LOS _D | | | -12 | dBm | 7 |
| LOS Assert | LOS _A | -28 | | | dBm | 7 |
| LOS Hysteresis | | 0.5 | | | 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*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.

VI. Memory Map and Control Registers

Compatible with SFF-8636². Please see Finisar Application Note AN-2104⁶ for memory map details.

Although this module is designed for both multimode and single mode fiber operation, the Tx and Rx power monitors are calibrated for multimode fiber. Therefore, the DDM reading should be relied upon only for multimode operation.

VII. Environmental Specifications

Finisar FTL4C3QE2C transceivers have an operating temperature range from 0°C to +70°C case temperature.

| Environmental Specifications | Symbol | Min | Typ | Max | Units | Ref. |
|------------------------------|------------------|-----|-----|-----|-------|------|
| Case Operating Temperature | T _{op} | 0 | | 70 | °C | |
| Storage Temperature | T _{sto} | -40 | | 85 | °C | |

VIII. Regulatory Compliance

Finisar FTL4C3QE2C transceivers are RoHS-6 Compliant. Copies of certificates are available at Finisar Corporation upon request.

FTL4C3QE2C transceiver modules are Class 1 laser eye safety compliant per IEC 60825-1.

IX. Mechanical Specifications

The FTL4C3QE2C mechanical specifications are compliant to the QSFP+ MSA transceiver module specifications.

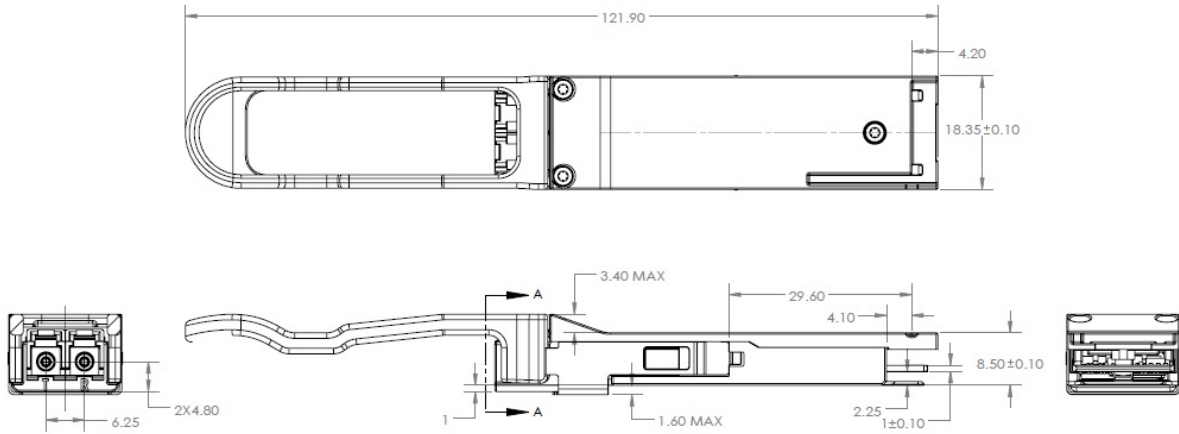


Figure 2 – FTL4C3QE2C mechanical drawing.



Figure 3 – FTL4C3QE2C Product Label (not to scale)

X. References

1. SFF-8436 – Specification for QSFP+ Copper and Optical Transceiver, Rev 4.8, October 2013.
2. SFF-8636 – Common Management Interface, Rev. 2.3, October 2014.
3. IEEE 802.3ba – PMD Type 40GBASE-LR4.
4. Directive 2011/65/EU of the European Council Parliament and of the Council, “on the restriction of the use of certain hazardous substances in electrical and electronic equipment”. Certain products may use one or more exemptions as allowed by the Directive.
5. “Application Note AN-2038: Finisar Implementation of RoHS Compliant Transceivers”.
6. “Application Note AN-2104: QSFP+ 40G LR4 Transceiver EEPROM Mapping,” Rev. A, Finisar Corporation, June, 2013.

XI. For More Information

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