



### **FTL4E1QE1C-OPC**

Finisar® FTL4E1QE1C Compatible TAA 40GBase-ER4 QSFP+ Transceiver (SMF, 1270nm to 1330nm, 40km, LC, DOM)

#### **Features**

- SFF-8436 Compliance
- Duplex LC Connector
- Single-mode Fiber
- Commercial Temperature 0 to 70 Celsius
- Hot Pluggable
- Metal with Lower EMI
- Excellent ESD Protection
- RoHS Compliant and Lead Free



#### **Applications:**

- 40GBase Ethernet
- Access and Enterprise

#### **Product Description**

This Finisar® FTL4E1QE1C compatible QSFP+ transceiver provides 40GBase-ER4 throughput up to 40km over single-mode fiber (SMF) using a wavelength of 1270nm to 1330nm via an LC connector. It is guaranteed to be 100% compatible with the equivalent Finisar® transceiver. This easy to install, hot swappable transceiver has been programmed, uniquely serialized and data-traffic and application tested to ensure that it will initialize and perform identically. Digital optical monitoring (DOM) support is also present to allow access to real-time operating parameters. This transceiver is Trade Agreements Act (TAA) compliant. We stand behind the quality of our products and proudly offer a limited lifetime warranty.

OptioConnect's transceivers are RoHS compliant and lead-free.

TAA refers to the Trade Agreements Act (19 U.S.C. & 2501-2581), which is intended to foster fair and open international trade. TAA requires that the U.S. Government may acquire only "U.S.-made or designated country end products."



### Absolute Maximum Ratings

| Parameter                   | Symbol | Min.            | Typ. | Max. | Unit |
|-----------------------------|--------|-----------------|------|------|------|
| Power Supply Voltage        | Vcc    | -0.5            |      | 3.6  | V    |
| Storage Temperature         | Tst    | -40             |      | 85   | °C   |
| Case Operating Temperature  | Top    | 0               |      | 70   | °C   |
| Humidity (non-condensing)   | Rh     | 0               |      | 95   | %    |
| Damage Threshold. Each lane |        | TH <sub>d</sub> | 3.8  |      | dBm  |

### Recommended Operating Conditions

| Parameter                  | Symbol | Min.  | Typ.    | Max.  | Unit |
|----------------------------|--------|-------|---------|-------|------|
| Supply Voltage             | Vcc    | 3.135 | 3.3     | 3.465 | V    |
| Operating Case Temperature | Tca    | -40   |         | 85    | °C   |
| Data Rate Per Lane         |        |       | 10.3125 | 11.2  | Gbps |
| Control Input Voltage High |        | 2     |         | Vcc   | V    |
| Control Input Voltage Low  |        | 0     |         | 0.8   | V    |
| Link Distance with G.652   | D      |       |         | 40    | km   |

## Electrical Characteristics

| Parameter                                              | Symbol  | Min.                   | Typ. | Max. | Unit     | Notes |
|--------------------------------------------------------|---------|------------------------|------|------|----------|-------|
| Power Consumption                                      |         |                        |      | 3.5  | W        |       |
| Supply Current                                         | Icc     |                        |      | 1.1  | A        |       |
| Transceiver Power-on Initialization Time               |         |                        |      | 2000 | ms       | 1     |
| Transmitter                                            |         |                        |      |      |          |       |
| Single-ended Input Voltage                             |         | -0.3                   |      | 4.0  | V        |       |
| AC Common Mode Input Voltage Tolerance                 |         | 15                     |      |      | mV       |       |
| Differential Input Voltage Swing Threshold             |         | 50                     |      |      | mVpp     |       |
| Differential Input Voltage Sing                        | Vin, pp | 190                    |      | 700  | mVpp     |       |
| Differential Input Impedance                           | Zin     | 90                     | 100  | 110  | Ohm      |       |
| Differential Input Return Loss                         |         | IEEE 802.3ba 86A.4.11  |      |      | dB       |       |
| J2 Jitter Tolerance                                    | Jt2     | 0.17                   |      |      | UI       |       |
| J9 Jitter Tolerance                                    | Jt9     | 0.29                   |      |      | UI       |       |
| Data Dependent Pulse Width Shrinkage (DDPWS) Tolerance |         | 0.07                   |      |      | UI       |       |
| Eye Mask Coordinates {X1, X2, Y1, Y2}                  |         | 0.11,0.31<br>95, 350   |      |      | UI<br>mV |       |
| Receiver                                               |         |                        |      |      |          |       |
| Single Ended Output Voltage                            |         | -0.3                   |      | 4.0  | V        |       |
| AC Common Mode Output Voltage                          |         |                        |      | 7.5  | mV       |       |
| Differential Output Voltage Swing                      | Vout,pp | 300                    |      | 850  | mVpp     |       |
| Differential Output Impedance                          | Zout    | 90                     | 100  | 110  | Ohm      |       |
| Termination Mismatch at 1MHz                           |         |                        |      | 5    | %        |       |
| Differential Output Return Loss                        |         | IEEE 802.3ba 86A.4.2.1 |      |      | dB       |       |
| Common Mode Output Return Loss                         |         | IEEE 802.3ba 86A.4.2.2 |      |      | dB       |       |
| Output Transition Time                                 |         | 28                     |      |      | ps       |       |
| J2 Jitter Output                                       | Jo2     |                        |      | 0.42 | UI       |       |
| J9 Jitter Output                                       | Jo9     |                        |      | 0.65 | UI       |       |
| Eye Mask Coordinates {X1, X2, Y1, Y2}                  |         | 0.29, 0.5<br>150, 420  |      |      | UI<br>mV |       |

### Notes:

1. Power-on Initialization Time is the time from when the power supply voltages reach and remain above the minimum recommended operating supply voltages to the time when the module is fully functional.
2. The single ended input voltage tolerance is the allowable range of the instantaneous input signals.

## Optical Characteristics

| Parameter                                                                     | Symbol               | Min.                          | Typ. | Max.   | Unit  | Notes |
|-------------------------------------------------------------------------------|----------------------|-------------------------------|------|--------|-------|-------|
| Wavelength Assignment                                                         | L0                   | 12694.5                       | 1271 | 1277.5 | nm    |       |
|                                                                               | L1                   | 1284.5                        | 1291 | 1297.5 | nm    |       |
|                                                                               | L2                   | 1304.5                        | 1311 | 1317.5 | nm    |       |
|                                                                               | L3                   | 1324.5                        | 1331 | 1337.5 | nm    |       |
| Transmitter                                                                   |                      |                               |      |        |       |       |
| Side Mode Suppression Ratio                                                   | SMSR                 | 30                            |      |        | dB    |       |
| Total Average Launch Power                                                    | P <sub>T</sub>       |                               |      | 10.5   | dBm   |       |
| Average Launch Power, each Lane                                               | P <sub>AVG</sub>     | -3.7                          |      | 4.5    | dBm   |       |
| Optical Modulation Amplitude (OMA), each Lane                                 | P <sub>OMA</sub>     | .07                           |      | 5      | dBm   | 1     |
| Difference in Launch Power between and Two Lanes (OMA)                        | P <sub>tx,diff</sub> |                               |      | 4.7    | dB    |       |
| Launch Power in OMA minus Transmitter and Dispersion Penalty (TDP), each Lane |                      | 1.5                           |      |        | dBm   |       |
| TDP, each Lane                                                                | TDP                  |                               |      | 2.6    | dB    |       |
| Extinction Ratio                                                              | ER                   | 5.5                           |      |        | dB    |       |
| Relative Intensity Noise                                                      | RIN                  |                               |      | -128   | dB/Hz |       |
| Optical Return Loss Tolerance                                                 | TOL                  |                               |      | 20     | dB    |       |
| Transmitter Reflectance                                                       | R <sub>T</sub>       |                               |      | -12    | dB    |       |
| Transmitter Eye Mask Definition {X1, X2, X3, Y1, Y2, Y3}                      |                      | {0.25,0.4,0.45,0.25,0.28,0.4} |      |        |       |       |
| Average Launch Power OFF Transmitter, each Lane                               | P <sub>off</sub>     |                               |      | -30    | dBm   |       |
| Receiver                                                                      |                      |                               |      |        |       |       |
| Damage Threshold, each Lane                                                   | TH <sub>d</sub>      | 3.8                           |      |        | dBm   | 2     |
| Average Receive Power, each Lane                                              |                      | -20.2                         |      | -1.5   | dBm   |       |
| Receiver Reflectance                                                          | R <sub>R</sub>       |                               |      | -26    | dB    |       |
| Receiver Power (OMA), each Lane                                               |                      |                               |      | -1     | dBm   |       |
| Receiver Sensitivity (OMA), each Lane                                         | SEN                  |                               |      | -18    | dBm   |       |
| Stressed Receiver Sensitivity (OMA), each Lane                                |                      |                               |      | -15.8  | dBm   | 3     |
| Difference in Receiver Power between and Two Lanes (OMA)                      | P <sub>rx,diff</sub> |                               |      | 7      | dB    |       |
| LOS Assert                                                                    | LOSA                 | -35                           |      |        | dBm   |       |
| LOS De-assert                                                                 | LOSD                 |                               |      | -20    | dBm   |       |
| LOS Hysteresis                                                                | LOSH                 | 0.5                           |      |        | dB    |       |
| Receiver Electrical 3 dB upper Cutoff Frequency, each Lane                    | F <sub>c</sub>       |                               |      | 12.3   | GHz   |       |
| Conditions of Stress Receiver Sensitivity Test (Note 4)                       |                      |                               |      |        |       |       |
| Vertical Eye Closure Penalty, each Lane                                       |                      |                               | 2.2  |        | dB    |       |
| Stressed Eye J2 Jitter, each Lane                                             |                      |                               | 0.3  |        | UI    |       |
| Stressed Eye J9 Jitter, each Lane                                             |                      |                               | 0.47 |        | UI    |       |

**Notes:**

1. Even if the TDP<0.8 dB, the OMA min must exceed the minimum value specified here.
2. The receiver shall be able to tolerate, without damage, continuous exposure to a modulated optical input signal having this power level on one lane. The receiver does not have to operate correctly at this input power.
3. Measured with conformance test signal at receiver input for BER=  $1 \times 10^{-12}$ .
4. Vertical eye closure penalty and stressed eye jitter are test conditions for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

## Pin Descriptions

| Pin | Logic       | Symbol  | Name/Descriptions                                  | Ref. |
|-----|-------------|---------|----------------------------------------------------|------|
| 1   |             | GND     | Module Ground                                      | 1    |
| 2   | CML-I       | Tx2-    | Transmitter inverted data input                    |      |
| 3   | CML-I       | Tx2+    | Transmitter non-inverted data input                |      |
| 4   |             | GND     | Module Ground                                      | 1    |
| 5   | CML-I       | Tx4-    | Transmitter inverted data input                    |      |
| 6   | CML-I       | Tx4+    | Transmitter non-inverted data input                |      |
| 7   |             | GND     | Module Ground                                      | 1    |
| 8   | LVTTL-I     | MODSEIL | Module Select                                      | 2    |
| 9   | LVTTL-I     | ResetL  | Module Reset                                       | 2    |
| 10  |             | VCCRx   | +3.3v Receiver Power Supply                        |      |
| 11  | LVC MOS-I   | SCL     | 2-wire Serial interface clock                      | 2    |
| 12  | LVC MOS-I/O | SDA     | 2-wire Serial interface data                       | 2    |
| 13  |             | GND     | Module Ground                                      | 1    |
| 14  | CML-O       | RX3+    | Receiver non-inverted data output                  |      |
| 15  | CML-O       | RX3-    | Receiver inverted data output                      |      |
| 16  |             | GND     | Module Ground                                      | 1    |
| 17  | CML-O       | RX1+    | Receiver non-inverted data output                  |      |
| 18  | CML-O       | RX1-    | Receiver inverted data output                      |      |
| 19  |             | GND     | Module Ground                                      | 1    |
| 20  |             | GND     | Module Ground                                      | 1    |
| 21  | CML-O       | RX2-    | Receiver inverted data output                      |      |
| 22  | CML-O       | RX2+    | Receiver non-inverted data output                  |      |
| 23  |             | GND     | Module Ground                                      | 1    |
| 24  | CML-O       | RX4-    | Receiver inverted data output                      |      |
| 25  | CML-O       | RX4+    | Receiver non-inverted data output                  |      |
| 26  |             | GND     | Module Ground                                      | 1    |
| 27  | LVTTL-O     | ModPrsL | Module Present, internal pulled down to GND        |      |
| 28  | LVTTL-O     | IntL    | Interrupt output should be pulled up on host board | 2    |
| 29  |             | VCCTx   | +3.3v Transmitter Power Supply                     |      |
| 30  |             | VCC1    | +3.3v Power Supply                                 |      |
| 31  | LVTTL-I     | LPMODE  | Low Power Mode                                     | 2    |
| 32  |             | GND     | Module Ground                                      | 1    |
| 33  | CML-I       | Tx3+    | Transmitter non-inverted data input                |      |
| 34  | CML-I       | Tx3-    | Transmitter inverted data input                    |      |
| 35  |             | GND     | Module Ground                                      | 1    |
| 36  | CML-I       | Tx1+    | Transmitter non-inverted data input                |      |
| 37  | CML-I       | Tx1-    | Transmitter inverted data input                    |      |
| 38  |             | GND     | Module Ground                                      | 1    |

**Notes:**

1. GND is the symbol for signal and supply (power) common for QSFP+ modules. 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. VccRx, Vcc1 and Vxx Tx are the receiving and transmission power suppliers and shall be applied concurrently. Recommend host board power supply filtering is shown in image below. VccRx, Vcc1 and Vcc Tx may be internally connected within the QSFP+ transceiver module in any combination. The connector pins are each rated for a maximum current of 500mA

**Recommended Power Supply Filter**

Electrical Pin-out Details



Digital Diagnostic Functions

The following digital diagnostic characteristics are defined over the normal operating conditions unless otherwise specified.

| Parameter                               | Symbol       | Min. | Max. | Unit | Notes                            |
|-----------------------------------------|--------------|------|------|------|----------------------------------|
| Temperature monitor absolute error      | DMI_Temp     | -3   | +3   | °C   | Over operating temperature range |
| Supply voltage monitor absolute error   | DMI_VCC      | -0.1 | 0.1  | V    | Over full operating range        |
| Channel RX power monitor absolute error | DMI_RX_Ch    | -2   | 2    | dB   | 1                                |
| Channel Bias current monitor            | DMI_Ibias_Ch | -10% | 10%  | mA   |                                  |
| Channel TX power monitor absolute error | DMI_TX_Ch    | -2   | 2    | dB   | 1                                |

Notes:

1. Due to measurement accuracy of different single mode fibers, there could be an additional +/-1 dB fluctuation, or a +/- 3 dB total accuracy.

Mechanical Specifications



## **OptioConnect**

### **Innovation for the Future of High-Speed Networking**

#### **Who We Are**

OptioConnect is reshaping the landscape of communication and high-speed networking through intelligent technology. With a core focus on cutting edge technology, we deliver smarter fiber optic solutions for enterprise networks, data centers, and next-gen telecom infrastructures.

#### **What We Do**

At OptioConnect, we fuse advanced engineering with intelligent automation to drive the future of networking. Our AI-integrated solutions are designed to optimize performance and streamline operations with:

- Superior Performance
- Network and traffic optimization
- Intelligent energy management
- Seamless OEM compatibility
- Scalable cost-efficiency

#### **Smarter Networks by Design**

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#### **Our Team**

Our engineers, data scientists, and network architects bring decades of experience and a future-focused mindset. We provide hands-on support with intelligent insights that turn complex challenges into simple solutions.

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