

## Product Specification

### 200GBASE-FR4 QSFP56

### Finisar® Optical Transceiver Module

**FTCC1112E2PCL: 2km 200GBASE-FR4 QSFP56**

**FTCC1122E2PCL: 500m 200GBASE-FR4 QSFP56**

#### PRODUCT FEATURES

- Hot-pluggable QSFP56 form factor
- Supports 212.5Gb/s aggregate bit rate
- 4x50G PAM4 electrical interface (200GAUI-4)
- 4x50Gb/s CWDM transmitter
- 4x50Gb/s retimed electrical interface
- Maximum power dissipation: 6W
- RoHS-6 compliant
- Operating case temperature range: 0 °C to 70 °C
- Single 3.3V power supply
- Duplex LC receptacles
- I2C management interface



#### APPLICATIONS

- 200GBASE-FR4 Ethernet

Finisar® FTCC11x2E2PCL 200G QSFP56 transceiver modules are designed for use in 200 Gigabit Ethernet interfaces over single mode fiber. They are compliant with the CMIS4.0<sup>4</sup>, QSFP MSA<sup>1</sup> and portions of IEEE P802.3bs<sup>5</sup>. The transceiver is RoHS compliant per Directive 2011/65/EU<sup>2</sup>.

#### PRODUCT SELECTION

### FTCC11x2E2PCL

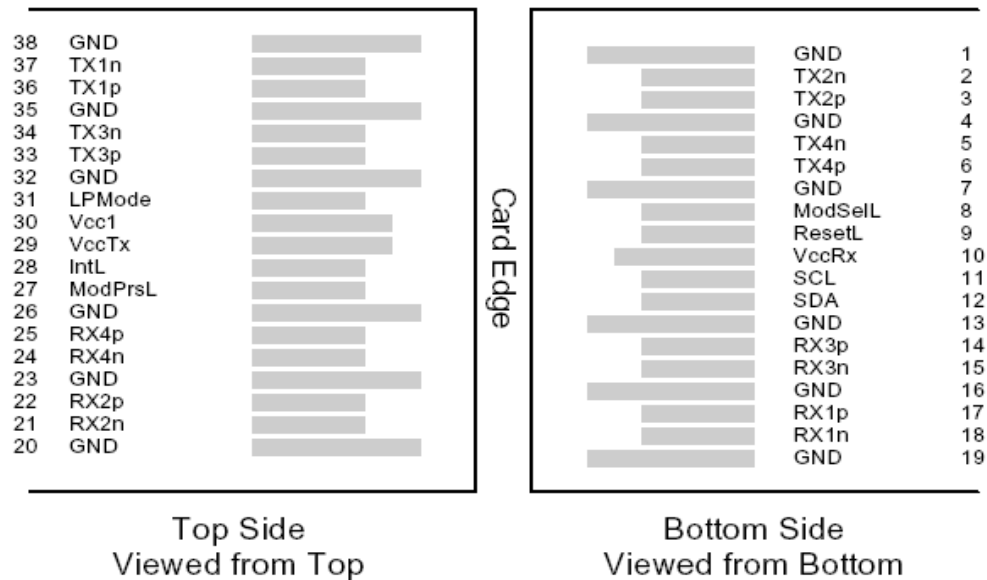
- x: 1 for 2km FR4; 2 for 500m FR4 Lite  
 E: Ethernet application  
 P: Pull-tab type release

C: Commercial temperature range (0-70C)

L: LC receptacles

## I. Pin Descriptions

QSFP56 pin-out as being defined by QSFP MSA<sup>1</sup>.



**Figure 1 – QSFP-compliant 38-pin connector (per SFF-8679)**

| 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 | VccI    | +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. Absolute Maximum Ratings**

Module performance is not guaranteed beyond the operating range (see Section VI). Exceeding the limits below may damage the transceiver module permanently.

| Parameter                           | Symbol            | Min  | Typ | Max | Unit | Ref. |
|-------------------------------------|-------------------|------|-----|-----|------|------|
| Maximum Supply Voltage              | V <sub>CC</sub>   | -0.5 |     | 3.6 | V    |      |
| Storage Temperature                 | T <sub>S</sub>    | -40  |     | 85  | °C   |      |
| Case Operating Temperature          | T <sub>OP</sub>   | 0    |     | 70  | °C   | 1    |
| Relative Humidity                   | RH                | 15   |     | 85  | %    | 2    |
| Receiver Damage Threshold, per Lane | P <sub>Rdmg</sub> | 5.7  |     |     | dBm  |      |

**Notes:**

1. 48-hour excursions, maximum
2. Non-condensing.

**III. Electrical Characteristics (EOL, T<sub>OP</sub> = 0 to +70 °C, V<sub>CC</sub> = 3.135 to 3.465 Volts)**

| Parameter                                     | Symbol                  | Min                                 | Typ | Max   | Unit | Ref. |
|-----------------------------------------------|-------------------------|-------------------------------------|-----|-------|------|------|
| Supply Voltage                                | V <sub>CC</sub>         | 3.135                               | 3.3 | 3.465 | V    |      |
| Supply Current                                | I <sub>CC</sub>         |                                     |     | 1.914 | A    |      |
| Module total power                            | P                       |                                     |     | 6.0   | W    | 1    |
| <b>Transmitter</b>                            |                         |                                     |     |       |      |      |
| Signaling rate per lane                       |                         | 26.5625 ± 100 ppm.                  |     |       | Gbd  |      |
| Differential data input voltage per lane      | V <sub>in,pp,diff</sub> | 900                                 |     |       | mV   | 2    |
| Differential input return loss                |                         | Per equation (83E-5)<br>IEEE802.3bm |     |       | dB   |      |
| Differential to common mode input return loss |                         | Per equation (83E-6)<br>IEEE802.3bm |     |       | dB   |      |
| Differential termination mismatch             |                         |                                     |     | 10    | %    |      |
| Module stress input test                      |                         | Per 120E.3.4.1                      |     |       |      | 3    |

|                                                    |  |                                   |  |      |     |   |
|----------------------------------------------------|--|-----------------------------------|--|------|-----|---|
|                                                    |  | IEEE802.3bs                       |  |      |     |   |
| Single-ended voltage tolerance range               |  | -0.4                              |  | 3.3  | V   |   |
| DC common mode voltage                             |  | -350                              |  | 2850 | mV  | 4 |
| <b>Receiver</b>                                    |  |                                   |  |      |     |   |
| Signaling rate per lane                            |  | 26.5625 ± 100 ppm.                |  |      | Gbd |   |
| AC common-mode output voltage (RMS)                |  |                                   |  | 17.5 | mV  |   |
| Differential output voltage                        |  |                                   |  | 900  | mV  |   |
| Near-end ESMW (Eye symmetry mask width)            |  | 0.265                             |  |      | UI  |   |
| Near-end Eye height, differential (min)            |  | 70                                |  |      | mV  |   |
| Far-end ESMW (Eye symmetry mask width)             |  | 0.2                               |  |      | UI  |   |
| Far-end Eye height, differential (min)             |  | 30                                |  |      | mV  |   |
| Far-end pre-cursor ISI ratio                       |  | -4.5                              |  | 2.5  | %   |   |
| Differential output return loss                    |  | Per equation 83E-2<br>IEEE802.3bm |  |      |     |   |
| Common to differential mode conversion return loss |  | Per equation 83E-3<br>IEEE802.3bm |  |      |     |   |
| Differential termination mismatch                  |  |                                   |  | 10   | %   |   |
| Transition time (min, 20% to 80%)                  |  | 9.5                               |  |      | ps  |   |
| DC common mode voltage (min)                       |  | -350                              |  | 2850 | mV  | 4 |

**Notes:**

1. Maximum total power value is specified across the full temperature and voltage range.
2. With the exception to 120E.3.1.2 that the pattern is PRBS31Q or scrambled idle.
3. Meets specified BER
4. DC common mode voltage generated by the host. Specification includes effects of ground offset voltage.

**IV. Optical Characteristics (EOL, T<sub>OP</sub> = 0 to +70 °C, V<sub>CC</sub> = 3.135 to 3.465 Volts)**

Meets 200GBASE-FR4 as being defined by IEEE P802.3bs

| Parameter                                                                    | Symbol | Min                                  | Typ                          | Max                                  | Unit  | Ref. |
|------------------------------------------------------------------------------|--------|--------------------------------------|------------------------------|--------------------------------------|-------|------|
| <b>Transmitter</b>                                                           |        |                                      |                              |                                      |       |      |
| Signaling rate (each lane (range))                                           |        | 26.5625 ± 100 ppm                    |                              |                                      | Gbd   |      |
| Modulation format                                                            |        | PAM4                                 |                              |                                      |       |      |
| Lane wavelength (range)                                                      |        | 1264.5<br>1284.5<br>1304.5<br>1324.5 | 1271<br>1291<br>1311<br>1331 | 1277.5<br>1297.5<br>1317.5<br>1337.5 | nm    |      |
| Side-mode suppression ratio (SMSR)                                           |        | 30                                   |                              |                                      | dB    |      |
| Total average launch power                                                   |        |                                      |                              | 10.7                                 | dBm   |      |
| Average launch power, each lane                                              |        |                                      |                              | 4.7                                  | dBm   |      |
| Average launch power, each lane                                              |        | -4.2                                 |                              |                                      | dBm   | 1    |
| Difference in launch power between any two lanes (OMA <sub>outer</sub> ) max |        |                                      |                              | 4                                    | dB    |      |
| Outer Optical Modulation Amplitude (OMA <sub>outer</sub> ), each lane        |        | -1.2                                 |                              | 4.5                                  | dBm   | 2    |
| Launch power in OMA <sub>outer</sub> minus TDECQ, each lane                  |        | -2.5                                 |                              |                                      | dBm   |      |
| Transmitter and dispersion eye closure for PAM4 (TDECQ), each lane           |        |                                      |                              | 3.3                                  | dB    |      |
| Average launch power of OFF transmitter, each lane                           |        |                                      |                              | -30                                  | dBm   |      |
| Extinction ratio                                                             |        | 3.5                                  |                              |                                      | dB    |      |
| RIN <sub>17.1OMA</sub>                                                       |        |                                      |                              | -132                                 | dB/Hz |      |

|                               |  |  |  |      |    |   |
|-------------------------------|--|--|--|------|----|---|
| Optical return loss tolerance |  |  |  | 17.1 | dB |   |
| Transmitter reflectance       |  |  |  | -26  | dB | 3 |

**Notes:**

1. Average launch power, each lane (min) is informative and not the principal indicator of signal strength. A transmitter with launch power below this value cannot be compliant; however, a value above this does not ensure compliance.
2. Even if the TDECQ < 1.4 dB for an extinction ratio of  $\geq 4.5$  dB or TDECQ < 1.3 dB for an extinction ratio of < 4.5 dB, the OMA<sub>outer</sub> (min) must exceed this value.
3. Transmitter reflectance is defined looking into the transmitter

| Parameter                                                                 | Symbol | Min                                  | Typ                          | Max                                  | Unit | Ref. |
|---------------------------------------------------------------------------|--------|--------------------------------------|------------------------------|--------------------------------------|------|------|
| <b>Receiver</b>                                                           |        |                                      |                              |                                      |      |      |
| Signaling rate (each lane (range))                                        |        | 26.5625 $\pm$ 100 ppm                |                              |                                      | GBd  |      |
| Modulation format                                                         |        | PAM4                                 |                              |                                      |      |      |
| Lane wavelength (range)                                                   |        | 1264.5<br>1284.5<br>1304.5<br>1324.5 | 1271<br>1291<br>1311<br>1331 | 1277.5<br>1297.5<br>1317.5<br>1337.5 | nm   |      |
| Damage threshold, each lane                                               |        | 5.7                                  |                              |                                      | dBm  | 1    |
| Average receive power, each lane                                          |        |                                      |                              | 4.7                                  | dBm  |      |
| Average receive power, each lane                                          |        | -8.2                                 |                              |                                      | dBm  | 2    |
| Receive power (OMA <sub>outer</sub> ), each lane                          |        |                                      |                              | 4.5                                  | dBm  |      |
| Difference in receive power between any two lanes (OMA <sub>outer</sub> ) |        |                                      |                              | 4.1                                  | dB   |      |
| Receiver reflectance                                                      |        |                                      |                              | -26                                  | dB   |      |
| Receiver sensitivity (OMA <sub>outer</sub> ), each lane                   |        |                                      |                              | -6.5                                 | dBm  | 3    |
| Stressed receiver sensitivity (OMA <sub>outer</sub> ), each lane          |        |                                      |                              | -3.6                                 | dBm  | 4    |
| Conditions of stressed receiver sensitivity test: (note 5)                |        |                                      |                              |                                      |      |      |
| Stressed eye closure for PAM4 (SECQ), lane under test                     |        | 3.3                                  |                              |                                      | dB   |      |
| OMA <sub>outer</sub> of each aggressor lane                               |        | 0.5                                  |                              |                                      | dBm  |      |
| LOS De-Assert                                                             |        |                                      |                              | -9                                   | dBm  |      |
| LOS Assert                                                                |        | -22                                  |                              | -12                                  | dBm  |      |
| LOS Hysteresis                                                            |        | 0.5                                  |                              |                                      | dB   |      |

**Notes:**

1. The receiver shall be able to tolerate, without damage, continuous exposure to an optical input signal having this average power level
2. Average receive power, each lane (min) is informative and not the principal indicator of signal strength. A received power below this value cannot be compliant; however, a value above this does not ensure compliance.
3. Receiver sensitivity (OMA<sub>outer</sub>), each lane (max) is informative and is defined for a transmitter with SECQ up to 1.4 dB.
4. Measured with conformance test signal at TP3 (see 122.8.9) for the BER specified in 122.1.1.
5. These test conditions are for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

## V. General Specifications

| Parameter                           | Symbol | Min | Typ | Max                  | Units | Ref. |
|-------------------------------------|--------|-----|-----|----------------------|-------|------|
| Bit Rate (all wavelengths combined) | BR     |     |     | 212.5                | Gb/s  | 1    |
| Bit Error Ratio                     | BER    |     |     | 2.4x10 <sup>-4</sup> |       | 2    |
| <b>Maximum Supported Distances</b>  |        |     |     |                      |       |      |
| Fiber Type                          |        |     |     |                      |       |      |

|               |                   |       |  |  |      |   |  |
|---------------|-------------------|-------|--|--|------|---|--|
| SMF per G.652 | 200GBASE-FR4      | Lmax1 |  |  | 2000 | m |  |
|               | 200GBASE-FR4 Lite | Lmax2 |  |  | 500  | m |  |

**Notes:**

1. Supports 200GBASE-FR4 per IEEE P802.3bs.
2. As defined by IEEE P802.3bs.

**VI. Environmental Specifications**

Finisar® FTCC11x2 QSFP56 transceivers have a commercial operating case temperature range of 0 °C to 70 °C.

| Parameter                  | Symbol           | Min | Typ | Max | Units | Ref. |
|----------------------------|------------------|-----|-----|-----|-------|------|
| Case Operating Temperature | T <sub>op</sub>  | 0   |     | 70  | °C    |      |
| Storage Temperature        | T <sub>sto</sub> | -40 |     | 85  | °C    |      |

**VII. Regulatory Compliance**

Finisar® FTCC11x2 transceivers are Class 1 Laser Products. They are certified per the following standards:

| Feature           | Agency     | Standard                                          |
|-------------------|------------|---------------------------------------------------|
| Laser Eye Safety  | FDA/CDRH   | CDRH 21 CFR 1040.10 and Laser Notice 56           |
| Laser Eye Safety  | UL/CSA/TÜV | IEC/EN 60825-1:2014<br>IEC/EN 60825-2: 2004+A1+A2 |
| Electrical Safety | UL/CSA/TÜV | IEC/UL/EN 62368-1:2014                            |

Copies of the referenced certificates are available at II-VI Incorporated upon request. Complies with FDA performance standards for laser products except for deviations pursuant to Laser Notice No. 56.

Caution: Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

**VIII. Digital Diagnostics Functions**

FTCC11x2 QSFP56 transceivers support the I2C-based diagnostics interface.

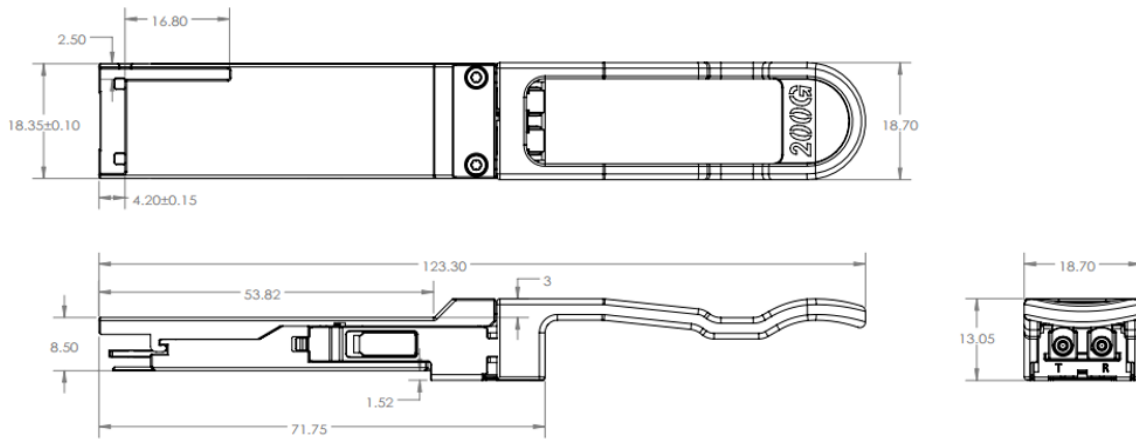
| Parameter                          | Symbol    | Min  | Typ | Max | Units | Ref. |
|------------------------------------|-----------|------|-----|-----|-------|------|
| Reported case temperature accuracy | Tcase_Err | -3   |     | 3   | °C    |      |
| Reported voltage accuracy          | Vcc_Err   | -100 |     | 100 | mV    |      |
| Reported Tx output power accuracy  | Pout_Err  | -3   |     | 3   | dB    |      |
| Reported Rx input power accuracy   | Pin_Err   | -3   |     | 3   | dB    |      |
| Reported Tx bias current accuracy  | Ibias_Err | -10  |     | 10  | %     |      |

## IX. Management Interface

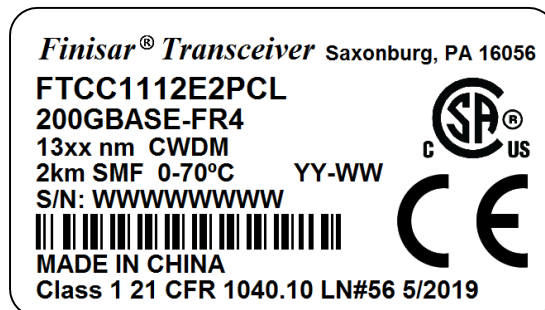
The module should implement and be compliant to Common Management Interface Specification (CMIS) Rev. 4.0.

## X. Mechanical Specifications

Finisar® FTCC11x2 QSFP56 transceivers are compatible with the QSFP MSA specification for QSFP pluggable form factor modules.



**Figure 2. FTCC11x2 Mechanical Dimensions (Pull Tab version)**



**Figure 3. Standard Product Label – FTCC1112E2PCL (not to scale)**

## XI. References

1. SFF-8665: “QSFP+ 28Gb/s 4X Pluggable Transceiver Solution (QSFP28)”, Rev 1.9, June 29, 2015 and associated SFF documents referenced therein:

- i. SFF-8661
  - ii. SFF-8679
  - iii. SFF-8662
  - iv. SFF-8663
  - v. SFF-8672
2. Directive 2011/65/EU of the European Parliament and of the Council, “on the restriction of the use of certain hazardous substances in electrical and electronic equipment,” July 1, 2011.
3. “Application Note AN-2038: Finisar Implementation Of RoHS Compliant Transceivers”, January 21, 2005.
4. Common Management Interface Specification (CMIS) Rev 4.0.
5. IEEE P802.3bs, 200GAUI-4 Interface.

**For More Information:**

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