

## PRELIMINARY Product Specification

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### 10km Duplex SMF 400G CFP8 Optical Transceiver

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#### FTCD1314E1BCL

#### PRODUCT FEATURES

- Hot-pluggable CFP8 form factor
- Supports 425Gb/s aggregate bit rate
- Power dissipation < 16W
- RoHS-6 compliant
- Commercial case temperature range of 0°C to 70°C
- Single 3.3V power supply
- Maximum link length of 10km on Single Mode Fiber (SMF)
- 8x50G PAM4 DFB-based LAN-WDM transmitter
- 16x25G electrical interface
- Duplex LC receptacles
- MDIO management interface



#### APPLICATIONS

- 400GBASE-LR8 400G Ethernet

Finisar's FTCD1314E1BCL 400G CFP8 transceiver modules are designed for use in 400 Gigabit Ethernet interfaces over single mode fiber. They are compliant with the CFP MSA<sup>1</sup>, IEEE P802.3bs 400GBASE-LR8<sup>2</sup> and 400GAUI-16<sup>2</sup>. Digital diagnostics functions are available via the MDIO interface, as specified by the CFP MSA and Finisar Application Note AN-20xx<sup>4</sup>. The transceiver is RoHS compliant per Directive 2011/65/EU<sup>3</sup>.

#### PRODUCT SELECTION

### FTCD1314E1BCL

- E: 400G Ethernet maximum bit rate (425 Gb/s)
- B: Bail type release
- C: Commercial temperature range
- L: LC receptacles

## I. Pin Descriptions

CFP8 pin-out as being defined by CFP MSA<sup>1</sup>.

| CFP8   |                  | CFP8 |                    |
|--------|------------------|------|--------------------|
| Bottom |                  | Top  |                    |
| 1      | GND              | 124  | GND                |
| 2      | TX15n            | 123  | TX14n              |
| 3      | TX15p            | 122  | TX14p              |
| 4      | GND              | 121  | GND                |
| 5      | TX13n            | 120  | TX12n              |
| 6      | TX13p            | 119  | TX12p              |
| 7      | GND              | 118  | GND                |
| 8      | TX11n            | 117  | TX10n              |
| 9      | TX11p            | 116  | TX10p              |
| 10     | GND              | 115  | GND                |
| 11     | TX9n             | 114  | TX8n               |
| 12     | TX9p             | 113  | TX8p               |
| 13     | GND              | 112  | GND                |
| 14     | TX7n             | 111  | TX6n               |
| 15     | TX7p             | 110  | TX6p               |
| 16     | GND              | 109  | GND                |
| 17     | TX5n             | 108  | TX4n               |
| 18     | TX5p             | 107  | TX4p               |
| 19     | GND              | 106  | GND                |
| 20     | TX3n             | 105  | TX2n               |
| 21     | TX3p             | 104  | TX2p               |
| 22     | GND              | 103  | GND                |
| 23     | TX1n             | 102  | TX0n               |
| 24     | TX1p             | 101  | TX0p               |
| 25     | GND              | 100  | GND                |
| 26     | GND (VND IO A)   | 99   | REFCLKn (VND IO E) |
| 27     | 3.3V             | 98   | REFCLKp (VND IO D) |
| 28     | 3.3V             | 97   | GND                |
| 29     | 3.3V             | 96   | TX_DIS (PRG CNTL1) |
| 30     | 3.3V             | 95   | RX_LOS (PRG ALRM1) |
| 31     | 3.3V             | 94   | MOD_LOPWR          |
| 32     | 3.3V             | 93   | MOD_ABS            |
| 33     | 3.3V             | 92   | MDC                |
| 34     | 3.3V             | 91   | MDIO               |
| 35     | GND              | 90   | MOD_SELn           |
| 36     | MCLKn (VND IO B) | 89   | GLB_ALRMn          |
| 37     | MCLKp (VND IO C) | 88   | MOD_RSTn           |
| 38     | GND              | 87   | GND                |
| 39     | RX15n            | 86   | RX14n              |
| 40     | RX15p            | 85   | RX14p              |
| 41     | GND              | 84   | GND                |
| 42     | RX13n            | 83   | RX12n              |
| 43     | RX13p            | 82   | RX12p              |
| 44     | GND              | 81   | GND                |
| 45     | RX11n            | 80   | RX10n              |
| 46     | RX11p            | 79   | RX10p              |
| 47     | GND              | 78   | GND                |
| 48     | RX9n             | 77   | RX8n               |
| 49     | RX9p             | 76   | RX8p               |
| 50     | GND              | 75   | GND                |
| 51     | RX7n             | 74   | RX6n               |
| 52     | RX7p             | 73   | RX6p               |
| 53     | GND              | 72   | GND                |
| 54     | RX5n             | 71   | RX4n               |
| 55     | RX5p             | 70   | RX4p               |
| 56     | GND              | 69   | GND                |
| 57     | RX3n             | 68   | RX2n               |
| 58     | RX3p             | 67   | RX2p               |
| 59     | GND              | 66   | GND                |
| 60     | RX1n             | 65   | RX0n               |
| 61     | RX1p             | 64   | RX0p               |
| 62     | GND              | 63   | GND                |

## 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> | 5.5  |     |     | dBm  |      |

### Notes:

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

## III. Electrical Characteristics (EOL, T<sub>OP</sub> = 0 to 70 °C, V<sub>CC</sub> = 3.2 to 3.4 Volts)

| Parameter                                     | Symbol                  | Min                                 | Typ | Max  | Unit | Ref. |
|---|-------------------------|-------------------------------------|-----|------|------|------|
| Supply Voltage                                | V <sub>CC</sub>         | 3.2                                 |     | 3.4  | V    |      |
| Supply Current                                | I <sub>CC</sub>         |                                     |     | 5.1  | A    | 1    |
| Module total power                            | P                       |                                     |     | 16   | W    | 2    |
| <b>Transmitter</b>                            |                         |                                     |     |      |      |      |
| Signaling rate per lane                       |                         | 26.5625± 100 ppm.                   |     |      | Gb/s |      |
| Differential data input voltage per lane      | V <sub>in,pp,diff</sub> | 900                                 |     |      | mV   |      |
| 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   | %    |      |
| Single-ended voltage tolerance                | V <sub>in,pp</sub>      | -0.35                               |     | +3.3 | V    |      |
| Module stress input test                      |                         | See 83E.3.4.1 IEEE802.3bm           |     |      |      | 3    |
| Single-ended voltage tolerance range          |                         | -0.4                                |     | 3.3  | V    |      |
| DC common mode voltage                        |                         | -350                                |     | 2850 | mV   | 4    |

- Steady state, calculated at 16W and 3.135V
- Maximum total power value is specified across the full temperature and voltage range
- Meets BER specified in IEEE802.3bm 83E.1.1
- DC common mode voltage generated by the host. Specification includes effects of ground offset voltage

|  |     |                                   |  |      |      |   |
|--|-----|-----------------------------------|--|------|------|---|
| <b>Receiver</b>                                    |     |                                   |  |      |      |   |
| Signaling rate per lane                            |     | 26.5625± 100 ppm.                 |  |      | Gb/s |   |
| AC common-mode output voltage (RMS)                |     |                                   |  | 17.5 | mV   |   |
| Differential output voltage                        |     |                                   |  | 900  | mV   |   |
| Eye width  |     | 0.57                              |  |      | UI   |   |
| Eye height, differential                           |     | 228                               |  |      | mV   |   |
| Vertical eye closure                               | VEC |                                   |  | 5.5  | dB   |   |
| 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%)                  |     | 12                                |  |      | ps   |   |
| DC common mode voltage (min)                       |     | -350                              |  | 2850 | mV   | 1 |

- DC common mode voltage is 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> = 3.2 to 3.4 Volts)**

Meets 400GBASE-LR8 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 wavelengths (range)   |        | 1272.55 to 1274.54<br>1276.89 to 1278.89<br>1281.25 to 1283.27<br>1285.65 to 1287.68<br>1294.53 to 1296.59<br>1299.02 to 1301.09<br>1303.54 to 1305.63<br>1308.09 to 1310.19 |     |      | nm    |      |
| Side-mode suppression ratio (SMSR)                                       |        | 30   |     |      | dB    |      |
| Total average launch power   |        |  |     | 13.2 | dBm   |      |
| Average launch power, each lane  |        |  |     | 5.3  | dBm   | 1    |
| Average launch power, each lane  |        | -2.8   |     |      | dBm   | 2    |
| Outer Optical Modulation Amplitude (OMA <sub>outer</sub> ), each lane    |        | 0.2  |     | 5.7  | dBm   | 3    |
| Difference in launch power between any two lanes (OMA <sub>outer</sub> ) |        |  |     | 4    | dB    |      |
| Launch power in OMA <sub>outer</sub> minus TDECQ, each lane              |        | -1.1   |     |      | 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>15,1OMA</sub>   |        |  |     | -132 | dB/Hz |      |
| Optical return loss tolerance  |        |  |     | 15.1 | dB    |      |
| Transmitter reflectance  |        |  |     | -26  | dB    | 4    |

1. As the total average launch power limit has to be met, not all of the lanes can operate at the maximum average launch power, each lane.
2. 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.
3. Even if the TDECQ < 1 dB, the OMA<sub>outer</sub> (min) must exceed this value
4. 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 ± 100 ppm  |      |      | GBd  |      |
| Modulation format   |        | PAM4   |      |      |      |      |
| Lane wavelengths (range)  |        | 1272.55 to 1274.54<br>1276.89 to 1278.89<br>1281.25 to 1283.27<br>1285.65 to 1287.68<br>1294.53 to 1296.59<br>1299.02 to 1301.09<br>1303.54 to 1305.63<br>1308.09 to 1310.19 |      |      | nm   |      |
| Damage threshold, each lane   |        | 6.3  |      |      | dBm  | 1    |
| Average receive power, each lane  |        |  |      | 5.3  | dBm  |      |
| Average receive power, each lane  |        | -8.6   |      |      | dBm  | 2    |
| Receive power (OMA <sub>outer</sub> ), each lane                          |        |  |      | 5.7  | dBm  |      |
| Difference in receive power between any two lanes (OMA <sub>outer</sub> ) |        |  |      | 4.5  | dBm  |      |
| Receiver reflectance  |        |  |      | -26  | dB   |      |
| Receiver sensitivity (OMA <sub>outer</sub> ), each lane                   |        |  |      | -7.1 | dBm  | 3    |
| Stressed receiver sensitivity (OMA <sub>outer</sub> ), each lane          |        |  |      | -4.7 | dBm  | 4    |
| Conditions of stressed receiver sensitivity test:                         |        |  |      |      |      |      |
| Stressed eye closure for PAM4 (SECQ), lane under test                     |        |  | 3.3  |      | dB   | 5    |
| OMA <sub>outer</sub> of each aggressor lane                               |        |  | -0.2 |      | dBm  |      |

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.
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                |     |     | 425                | Gb/s  | 1    |
| Bit Error Ratio                     | BER               |     |     | 2x10 <sup>-4</sup> |       | 2    |
| <b>Maximum Supported Distances</b>  |                   |     |     |                    |       |      |
| Fiber Type                          |                   |     |     |                    |       |      |
| SMF per G.652                       | L <sub>max1</sub> |     |     | 10                 | km    |      |

### Notes:

1. Supports 400GBASE-LR8 per IEEE P802.3bs.
2. As defined by IEEE P802.3bs.

### Timing Parameters

| Parameter                      | Symbol | Min | Typ  | Max | Units | Ref. |
|--------------------------------|--------|-----|------|-----|-------|------|
| Time for Rx recovery after LOS |        |     | 0.45 | 2   | S     |      |

## VI. Environmental Specifications

Finisar FTCD1314 CFP8 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 FTCD1314 CFP8 transceivers are Class 1 Laser Products. They are certified per the following standards:

| Feature           | Agency   | Standard                                    | Certificate Number |
|-------------------|----------|---|--------------------|
| Laser Eye Safety  | FDA/CDRH | CDRH 21 CFR 1040 and Laser Notice 50        | TBD                |
| Laser Eye Safety  | TÜV      | EN 60825-1: 2007<br>IEC 60825-2: 2004+A1+A2 | TBD                |
| Electrical Safety | TÜV      | EN 60950                                    | TBD                |
| Electrical Safety | UL/CSA   | CLASS 3862.07<br>CLASS 3862.87              | TBD                |

Copies of the referenced certificates are available at Finisar Corporation upon request. Complies with FDA performance standards for laser products except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007.

## VIII. Digital Diagnostics Functions

FTCD1314 CFP8 transceivers support the MDIO-based diagnostics interface specified in the CFP MSA<sup>1</sup>. See Finisar Application Note AN-20xx (TBD).

## IX. Memory Contents

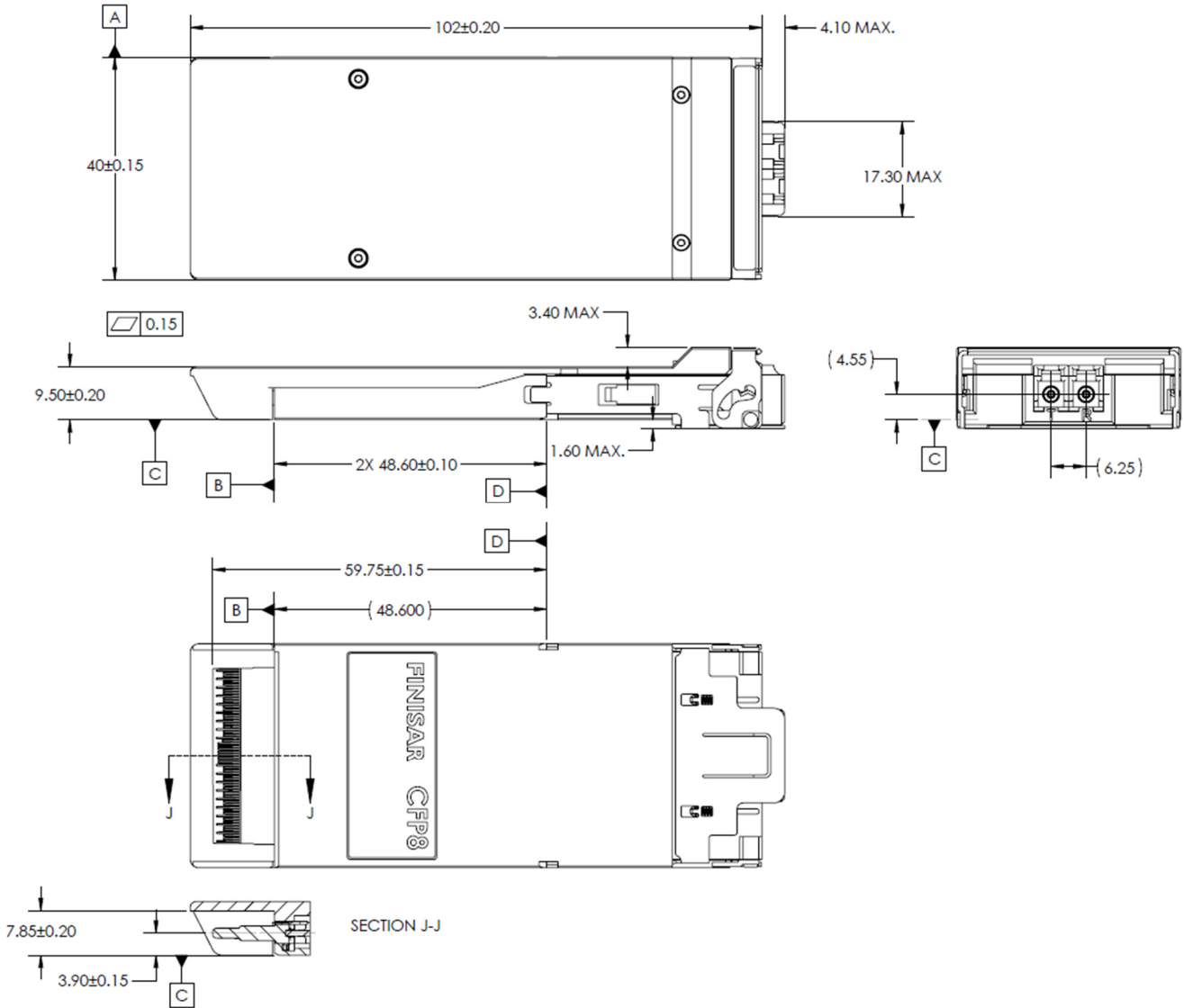
Per the CFP MSA<sup>1</sup>. See Finisar Application Note AN-20xx (TBD).

## X. Host PCB Layout and Bezel Recommendations

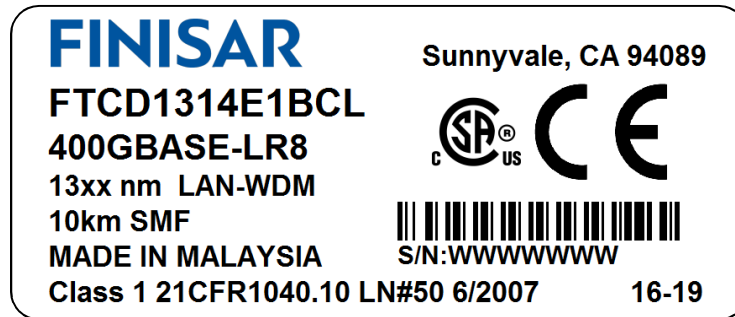
Per CFP MSA Hardware Specification for CFP8<sup>1</sup>.

**XI. Mechanical Specifications**

Finisar FTCD1314 CFP8 transceivers are compatible with the CFP MSA specification for CFP8 pluggable form factor modules.



**Figure 1. FTCD1314E1BCL Mechanical Dimensions (Bail version)**



**Figure 2. Standard Product Label**

## **XII. References**

1. CFP8 Hardware Specification and CFP MSA Management Interface Specifications (MIS), Rev TBD.; CFP MSA, [www.cfp-msa.org](http://www.cfp-msa.org)
2. IEEE P802.3bs, PMD Type 400GBASE-LR8, 400GAUI-16 electrical interface
3. 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.” Certain products may use one or more exemption as allowed by the directive.
4. Application Note AN-20xx (TBD), Finisar Corporation.

### **For More Information:**

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