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## Product Specification

### OC-12 SR-1/STM I-4 or OC-12 IR-1/STM S-4.1 2x5 SFF Transceiver

#### FTLF1322F2xTR

#### PRODUCT FEATURES

- Up to OC-12/STM-4 bi-directional data links
- Standard 2x5 pin SFF footprint (MSA compliant)
- Analog diagnostics functions
- Uncooled 1310nm FP laser transmitter
- Duplex LC connector
- Very low jitter
- Metal enclosure, for lower EMI
- Single 3.3V power supply
- Low power dissipation <700 mW typical
- Extended operating temperature range: -40°C to 85°C



#### APPLICATIONS

- SONET OC-12 SR-1 / SDH STM I-4
- SONET OC-12 IR-1 / SDH STM S-4.1

Finisar's FTLF1322S2xTR Small Form Factor (SFF) transceivers are compatible with the Small Form Factor Multi-Sourcing Agreement (MSA)<sup>1</sup>. They comply with SONET OC-12 SR-1/IR-1 (SDH STM I-4/S-4.1) standards<sup>2</sup>. The transceivers are RoHS compliant and lead-free per Directive 2002/95/EC<sup>5</sup> and Finisar Application Note AN-2038<sup>6</sup>

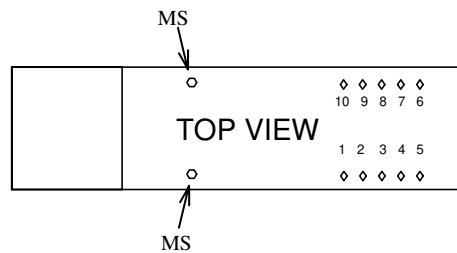
#### PRODUCT SELECTION

### FTLF1322F2xTR

|   |   |                                    |
|---|---|------------------------------------|
| x | G | 2 Grounding Pins, Short EMI shield |
|   | M | 6 Grounding Pins, Short EMI shield |
|   | K | 2 Grounding Pins, Long EMI shield  |
|   | H | 6 Grounding Pins, Long EMI shield  |

**I. Pin Descriptions**

| Pin | Symbol           | Name/Description   | Logic Family |
|-----|------------------|--|--------------|
| MS  | MS               | Mounting Studs for mechanical attachment. <b>Chassis ground is internally isolated from circuit ground.</b> Connection to chassis ground is recommended. | NA           |
| 1   | V <sub>EER</sub> | Receiver Ground (Common with Transmitter Ground)   | NA           |
| 2   | V <sub>CCR</sub> | Receiver Power Supply  | NA           |
| 3   | SD               | Signal Detect. Logic 1 indicates normal operation.   | LVTTL        |
| 4   | RD-              | Receiver Inverted DATA out. AC Coupled   | CML          |
| 5   | RD+              | Receiver Non-inverted DATA out. AC Coupled   | CML          |
| 6   | V <sub>CCT</sub> | Transmitter Power Supply   | NA           |
| 7   | V <sub>EET</sub> | Transmitter Ground (Common with Receiver Ground)   | NA           |
| 8   | T <sub>DIS</sub> | Transmitter Disable  | LVTTL        |
| 9   | TD+              | Transmitter Non-Inverted DATA in. AC Coupled.  | CML<br>ECL   |
| 10  | TD-              | Transmitter Inverted DATA in. AC Coupled.  | CML<br>ECL   |



## II. Absolute Maximum Ratings

| Parameter                       | Symbol          | Min  | Typ | Max    | Unit | Ref. |
|---------------------------------|-----------------|------|-----|--------|------|------|
| Maximum Supply Voltage          | V <sub>CC</sub> | -0.5 |     | 4.5    | V    |      |
| Storage Temperature             | T <sub>S</sub>  | -40  |     | 100    | °C   |      |
| Case Operating Temperature      | T <sub>OP</sub> | -40  |     | 85     | °C   |      |
| Relative Humidity               | RH              | 0    |     | 85     | %    | 1    |
| Lead Soldering Temperature/Time |                 |      |     | 260/10 | °C/s |      |

## III. Electrical Characteristics (T<sub>OP</sub> = -40 to 85 °C, V<sub>CC</sub> = 3.00 to 3.60 Volts)

| Parameter                                      | Symbol                   | Min                   | Typ | Max                   | Unit | Ref. |
|--|--------------------------|-----------------------|-----|-----------------------|------|------|
| Supply Voltage                                 | V <sub>CC</sub>          | 3.00                  |     | 3.60                  | V    |      |
| Supply Current                                 | I <sub>CC</sub>          |                       | 190 | 300                   | mA   |      |
| <b>Transmitter</b>                             |                          |                       |     |                       |      |      |
| Input differential impedance                   | R <sub>in</sub>          |                       | 100 |                       | Ω    | 2    |
| Single ended data input swing                  | V <sub>in,pp</sub>       | 250                   |     | 1200                  | mV   |      |
| Transmit Disable Voltage                       | V <sub>D</sub>           | V <sub>CC</sub> – 1.3 |     | V <sub>CC</sub>       | V    |      |
| Transmit Enable Voltage                        | V <sub>EN</sub>          | V <sub>EE</sub>       |     | V <sub>EE</sub> + 0.8 | V    | 3    |
| Transmit Disable Assert Time                   |                          |                       |     | 10                    | μs   |      |
| <b>Receiver</b>                                |                          |                       |     |                       |      |      |
| Single ended data output swing                 | V <sub>out,pp</sub>      | 300                   | 400 | 800                   | mV   | 4    |
| Data output rise/fall time                     | t <sub>r</sub>           |                       |     | 350                   | ps   | 5    |
| SD Assert                                      | V <sub>SD assert</sub>   | 2.4                   |     | V <sub>CC</sub>       | V    | 6    |
| SD De-Assert                                   | V <sub>SD deassert</sub> | V <sub>EE</sub>       |     | 0.5                   | V    | 6    |
| Power Supply Rejection                         | PSR                      | 100                   |     |                       | mVpp | 7    |
| Total Generated Receiver Jitter (peak to peak) | J <sub>RXP-P</sub>       |                       |     | 0.07                  | UI   |      |
| Total Generated Receiver Jitter (rms)          | J <sub>RXrms</sub>       |                       |     | 0.007                 | UI   |      |

### Notes:

1. Non condensing.
2. AC coupled.
3. Or open circuit.
4. Into 100 ohm differential termination.
5. 20 – 80 %
6. Signal Detect is LVTTTL. Logic 1 indicates normal operation; logic 0 indicates no signal detected.
7. All transceiver specifications are compliant with a power supply sinusoidal modulation of 20 Hz to 1.5 MHz up to specified value applied through the power supply filtering network shown on page 23 of the Small Form-factor Pluggable (SFP) Transceiver MultiSource Agreement (MSA), September 14, 2000.

**IV. Optical Characteristics (T<sub>OP</sub> = -40 to 85 °C, V<sub>CC</sub> = 3.00 to 3.60 Volts)**

| Parameter   | Symbol                          | Min  | Typ | Max   | Unit  | Ref. |
|---|---------------------------------|------|-----|-------|-------|------|
| <b>Transmitter</b>                                |                                 |      |     |       |       |      |
| Output Opt. Pwr: 9/125 SMF                        | P <sub>OUT</sub>                | -15  |     | -8    | dBm   | 1    |
| Optical Wavelength                                | $\lambda$                       | 1274 |     | 1356  | nm    | 2    |
| Spectral Width                                    | $\sigma$                        |      |     | 2.5   | nm    | 2    |
| Optical Extinction Ratio                          | ER                              | 8.2  |     |       | dB    |      |
| Optical Rise/Fall Time                            | t <sub>r</sub> / t <sub>f</sub> |      |     | 350   | ps    | 3    |
| Relative Intensity Noise                          | RIN                             |      |     | -120  | dB/Hz |      |
| Total Generated Transmitter Jitter (peak to peak) | J <sub>TXP-p</sub>              |      |     | 0.07  | UI    |      |
| Total Generated Transmitter Jitter (rms)          | J <sub>TXrms</sub>              |      |     | 0.007 | UI    |      |
| <b>Receiver</b>                                   |                                 |      |     |       |       |      |
| Rx Sensitivity @ OC-12                            | R <sub>SENS1</sub>              | -28  |     | -8    | dBm   | 4    |
| Optical Center (Input) Wavelength                 | $\lambda_C$                     | 1260 |     | 1600  | nm    |      |
| SD Assert   | SD <sub>A</sub>                 |      |     | -34   | dBm   |      |
| SD De-Assert                                      | SD <sub>D</sub>                 | -45  |     |       | dBm   |      |
| SD Hysteresis                                     |                                 | 0.5  |     | 5     | dB    |      |

Notes:

1. Class 1 Laser Safety per FDA/CDRH and EN (IEC) 60825 regulations.
2. Also specified to meet curves in FC-PI 13.0 Figures 18 and 19, which allow trade-off between wavelength, spectral width and OMA.
3. Unfiltered, 20 – 80%
4. With worst-case extinction ratio. Measured with a PRBS 2<sup>23</sup>-1 test pattern.

**V. General Specifications**

| Parameter   | Symbol            | Min | Typ | Max        | Units  | Ref. |
|---|-------------------|-----|-----|------------|--------|------|
| Data Rate   | BR                |     | 622 |            | Mb/sec | 1    |
| Bit Error Rate  | BER               |     |     | $10^{-10}$ |        | 2    |
| Max. Supported Link Length on 9/125 $\mu$ m SMF @ OC-12 | L <sub>MAX5</sub> |     | 15  |            | km     | 4    |

**Notes:**

- SONET OC-12 SR/SDH STM I-4 and SONET OC-12 IR-1/SDH STM S-4.1 compliant.
- Tested with a PRBS  $2^{31}-1$  test pattern.
- Attenuation of 0.55 dB/km is used for the link length calculations (per GR-253 CORE). Distances are indicative only. Please refer to the Optical Specifications in Table IV to calculate a more accurate link budget based on specific conditions in your application.

**VI. Environmental Specifications**

Finisar 1310nm SFP transceivers have an extended operating temperature range from  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  case temperature.

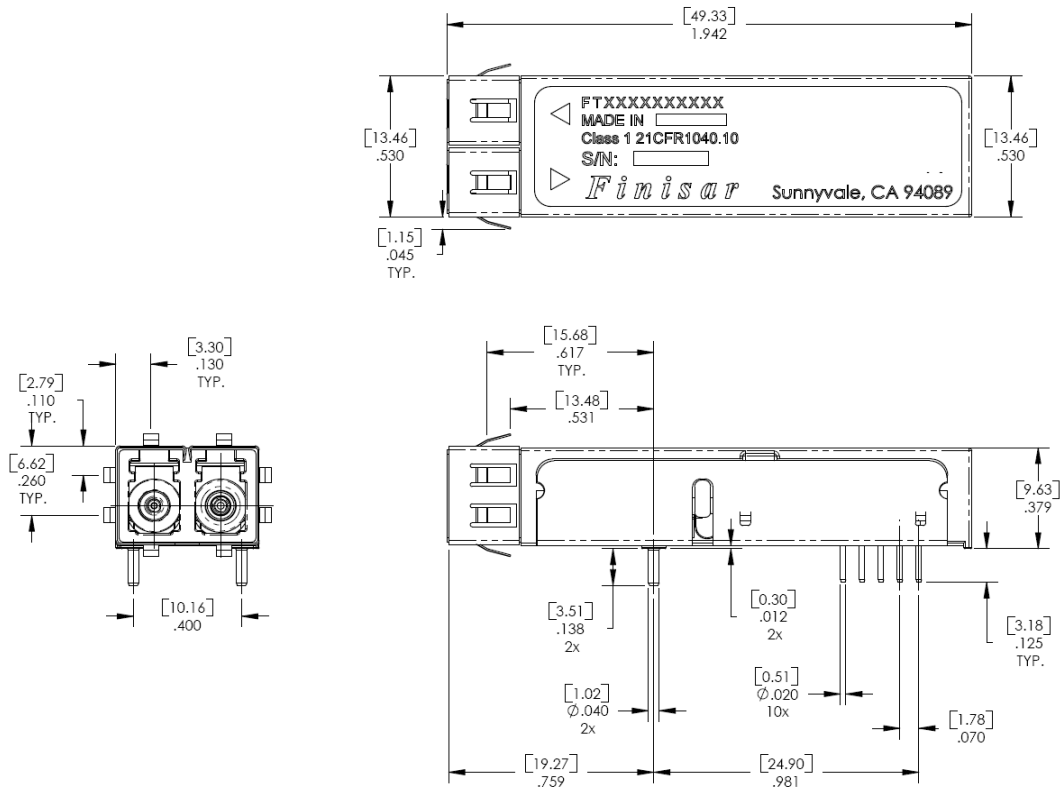
| Parameter                  | Symbol           | Min | Typ | Max | Units              | Ref. |
|----------------------------|------------------|-----|-----|-----|--------------------|------|
| Case Operating Temperature | T <sub>op</sub>  | -40 |     | 85  | $^{\circ}\text{C}$ |      |
| Storage Temperature        | T <sub>sto</sub> | -40 |     | 100 | $^{\circ}\text{C}$ |      |

**VII. Regulatory Compliance**

Finisar transceivers are Class 1 Laser Products and comply with US FDA regulations. These products are certified by TÜV and CSA to meet the Class 1 eye safety requirements of EN (IEC) 60825 and the electrical safety requirements of EN (IEC) 60950. Copies of certificates are available at Finisar Corporation upon request.

### VIII. Mechanical Specifications

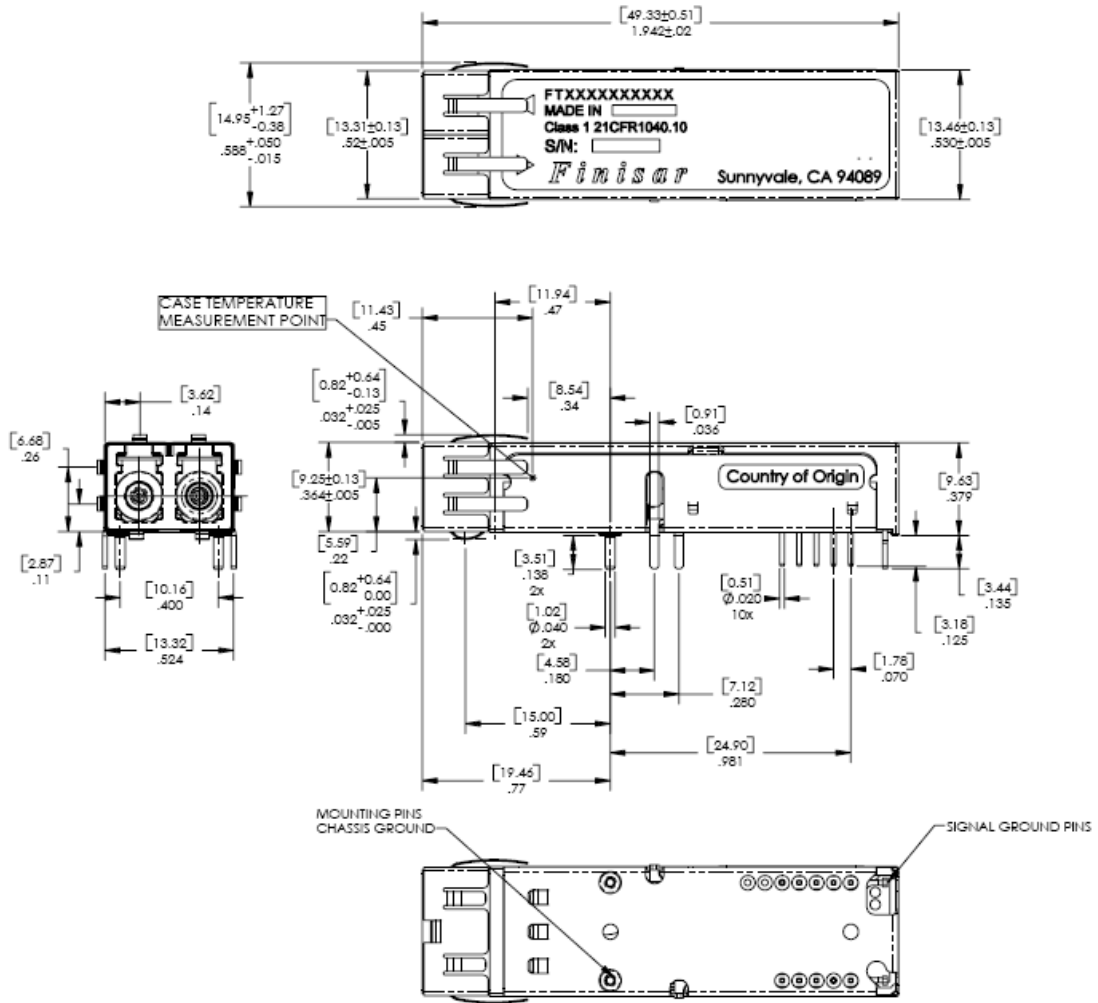
Finisar’s OC-12/STM-4 Small Form Factor (SFF) transceivers comply with the standard dimensions defined by the Small Form Factor Multi-Sourcing Agreement (MSA).



**FTLF1322F2GTR – 2 pin version**

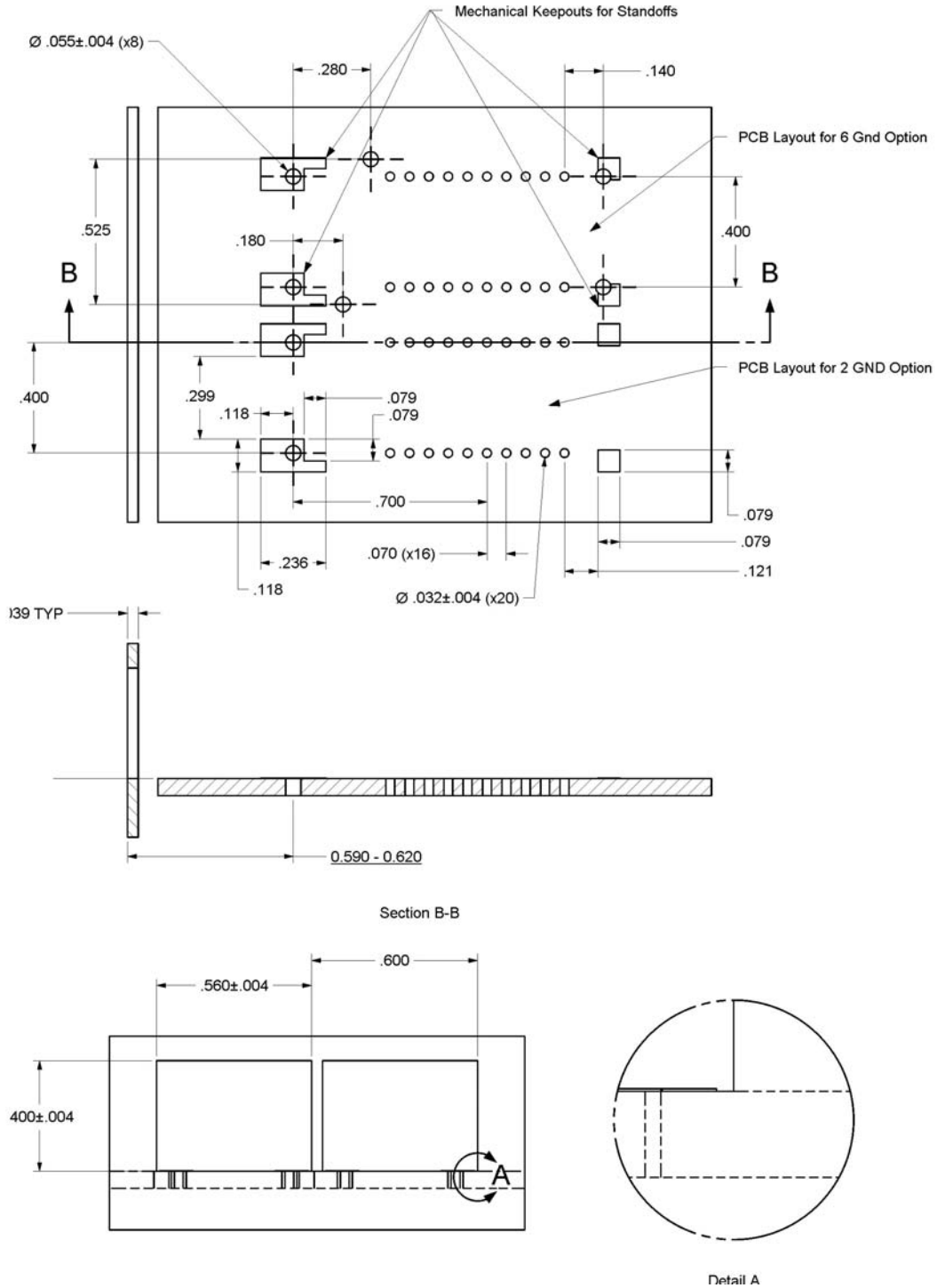






**FTLF1322F2HTR – 6 pin version (Long EMI Shield)**

**IX. PCB Layout and Bezel Recommendations**



**Minimum Recommended Pitch is 0.600"**

**X. References**

1. Small Form Factor (SFF) Transceiver Multisource Agreement (MSA). January 1998.
2. Bellcore GR-253 and ITU-T G.957 Specifications (Transmitter Optical Output Power complies with SONET OC-48 requirements only).
3. IEEE Std 802.3, 2002 Edition, Clause 38, PMD Type 1000BASE-LX. IEEE Standards Department, 2002. (Transmit Optical Output has a minimum Extinction Ratio of 8.2 dB only).
4. Directive 2002/95/EC of the European Council Parliament and of the Council. “On the restriction of the use of certain hazardous substances in electrical and electronic equipment”. January 27, 2003.
5. “Application Note AN-2038: Finisar Implementation of RoHS Compliant Transceivers: Finisar Corporation, January 21, 2005.
6. “Fibre Channel Draft Physical Interface Specification (FC-PI 13.0)”. American National Standard for Information Systems. (\*)

**XI. For More Information**

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