

## Product Specification

### 2 Gigabit RoHS Compliant Long-Wavelength 2x5 Pin SFF Transceiver

#### FTLF1319F1xTL

#### PRODUCT FEATURES

- Up to 2.125Gb/s bi-directional data links
- Standard 2x5 pin SFF footprint (MSA compliant)
- 1310nm Fabry-Perot laser transmitter
- Duplex LC connector
- RoHS compliant and Lead Free
- Very low jitter
- Up to 10 km on 9/125µm SMF
- Metal enclosure, for lower EMI
- Single 3.3V power supply
- Low power dissipation <700mW
- Industrial operating temperature range: -40°C to 85°C



#### APPLICATIONS

- 1.25 Gb/s 1000Base-LX Ethernet
- Dual Rate 1.063 / 2.125 Gb/s Fibre Channel

Finisar's FTLF1319F1xTL Small Form Factor (SFF) transceivers comply with the 2x5 standard package defined by the Small Form Factor Multi-Sourcing Agreement (MSA)<sup>1</sup>. They are simultaneously compatible with Gigabit Ethernet as specified in IEEE Draft P802.3z/D5.0<sup>2</sup> and Fibre Channel FC-PH, PH2, PH3<sup>3</sup> and FC-PI-2 10.0<sup>4</sup>. They are RoHS compliant and lead-free per Directive 2002/95/EC<sup>5</sup> and Finisar Appl. Note AN-2038.

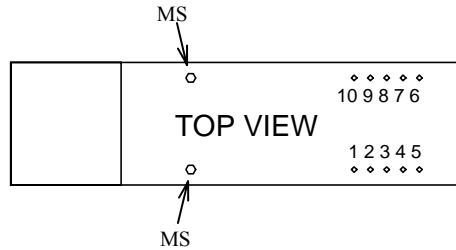
#### PRODUCT SELECTION

### FTLF1319F1xTL

|   |   |                                    |
|---|---|------------------------------------|
| 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 are 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.                                                                                                                      | See Rx spec. |
| 5   | RD+              | Receiver Non-inverted DATA out. AC Coupled                                                                                                                   | See Rx spec. |
| 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.                                                                                                                | See Tx spec  |
| 10  | TD-              | Transmitter Inverted DATA in. AC Coupled.                                                                                                                    | See Tx spec. |



## II. Absolute Maximum Ratings

| Parameter                       | Symbol          | Min | Typ | Max    | Unit | Ref. |
|---------------------------------|-----------------|-----|-----|--------|------|------|
| Maximum Supply Voltage          | V <sub>cc</sub> | 0.5 |     | 5.0    | V    |      |
| Storage Temperature             | T <sub>s</sub>  | -40 |     | 85     | °C   |      |
| Case Operating Temperature      | T <sub>A</sub>  | -40 |     | 85     | °C   |      |
| Relative Humidity               | RH              | 0   |     | 85     | %    | 1    |
| Lead Soldering Temperature/Time |                 |     |     | 260/10 | °C/s |      |

### Notes:

1. Non condensing.

**III. Electrical Characteristics** ( $T_A = -40$  to  $85$  °C,  $V_{CC} = 3.0$  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>       |                       |     | 300                   | mA   |      |
| <b>Transmitter</b>                      |                       |                       |     |                       |      |      |
| Input differential impedance            | R <sub>in</sub>       |                       | 100 |                       | Ω    | 1    |
| 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    | 2    |
| Transmit Disable Assert Time            |                       |                       |     | 10                    | us   |      |
| <b>Receiver</b>                         |                       |                       |     |                       |      |      |
| Single ended data output swing          | V <sub>out,pp</sub>   | 300                   |     | 800                   | mV   | 3    |
| Data output rise time                   | t <sub>r</sub>        |                       | 100 | 175                   | ps   | 4    |
| Data output fall time                   | t <sub>f</sub>        |                       | 100 | 175                   | ps   | 4    |
| Signal Detect Normal                    | V <sub>SD norm</sub>  | V <sub>cc</sub> – 0.5 |     | V <sub>cc</sub>       | V    | 5    |
| Signal Detect Fault                     | V <sub>SD fault</sub> | V <sub>ee</sub>       |     | V <sub>ee</sub> +0.5  | V    | 5    |
| Power Supply Rejection                  | PSR                   | 100                   |     |                       | mVpp | 6    |
| Deterministic Jitter Contribution (p-p) | RX ΔDJ                |                       |     | 50                    | ps   | 7    |
| Total Jitter Contribution (p-p)         | RX ΔTJ                |                       |     | 120                   | ps   | 8    |

Notes:

1. AC coupled.
2. Or open circuit.
3. Into 100 Ω differential termination.
4. 20 – 80 %
5. Signal detect is LVTTTL. Logic 1 indicates normal operation; logic 0 indicates no signal detected.
6. Receiver sensitivity is compliant with power supply sinusoidal modulation of 20 Hz to 1.5 MHz up to specified value applied through the recommended power supply filtering network.
7. Measured with DJ-free data input signal. In actual application, output DJ will be the sum of input DJ and ΔDJ.
8. If measured with TJ-free data input signal. In actual application, output TJ will be given by:

$$TJ_{OUT} = DJ_{IN} + \Delta DJ + \sqrt{(TJ_{IN} - DJ_{IN})^2 + (\Delta TJ - \Delta DJ)^2}$$

**IV. Optical Characteristics (T<sub>A</sub> = -40 to 85 °C, V<sub>CC</sub> = 3.0 to 3.60 Volts)**

| Parameter                         | Symbol                          | Min   | Typ | Max   | Unit  | Ref. |
|-----------------------------------|---------------------------------|-------|-----|-------|-------|------|
| <b>Transmitter</b>                |                                 |       |     |       |       |      |
| Output Opt. Power                 | P <sub>OUT</sub>                | -9.5  |     | -3    | dBm   | 1    |
| Optical Wavelength                | λ                               | 1270  |     | 1355  | nm    | 2    |
| Spectral Width                    | σ                               |       |     | 3     | nm    | 2    |
| Optical Modulation Amplitude      | OMA                             | 174   |     |       | μW    | 2,3  |
| Optical Rise/Fall Time            | t <sub>r</sub> /t <sub>f</sub>  |       | 100 | 160   | ps    | 4    |
| RIN                               |                                 |       |     | -120  | dB/Hz |      |
| Deterministic Jitter Contribution | TX ΔDJ                          |       | 20  | 56.5  | ps    | 5    |
| Total Jitter Contribution         | TX ΔTJ                          |       | <65 | 119   | ps    | 6    |
| Extinction Ratio                  | ER                              | 9     |     |       |       |      |
| <b>Receiver</b>                   |                                 |       |     |       |       |      |
| Receiver Sensitivity = 1.06 Gb/s  | R <sub>XSENS</sub>              |       |     | -22   | dBm   | 7, 8 |
| Receiver Sensitivity = 2.125 Gb/s | R <sub>XSENS</sub>              |       |     | -21   | dBm   | 7, 8 |
| Receiver Sensitivity = 1.25 Gb/s  | R <sub>XSENS</sub>              |       |     | -22   | dBm   | 7, 8 |
| Stressed RX sens. =1.0625 Gb/s    |                                 | 0.055 |     |       | mW    |      |
| Stressed RX sens. =2.125 Gb/s     |                                 | 0.096 |     |       | mW    |      |
| Stressed RX sens. =1.25 Gb/s      |                                 |       | -18 | -14.5 | dBm   |      |
| Average Received Power            | R <sub>XMAX</sub>               |       |     | 0     | dBm   |      |
| Receiver Elec. 3 dB cutoff freq.  |                                 |       |     | 1500  | MHz   |      |
| Optical Center Wavelength         | λ <sub>C</sub>                  | 1270  |     | 1600  | nm    |      |
| Return Loss                       |                                 | 12    |     |       | dB    |      |
| Signal Detect Assert              | P <sub>A</sub>                  |       | -23 | -19   | dBm   |      |
| Signal Detect De-Assert           | P <sub>D</sub>                  | -30   | -25 |       | dBm   |      |
| Signal Detect Hysteresis          | P <sub>A</sub> - P <sub>D</sub> | 0.5   |     |       | dB    |      |

**Notes:**

1. Class 1 Laser Safety per FDA/CDRH and IEC-825-1 regulations.
2. Also specified to meet curves in FC-PI-2 10.0 Figures 18 and 19, which allow trade-off between wavelength, spectral width and OMA.
3. Equivalent extinction ratio specification for Fibre Channel. Allows smaller ER at higher average power.
4. Unfiltered, 20-80%. Complies with IEEE 802.3 (Gig. E), FC 1x and 2x eye mask when filtered.
5. Measured with DJ-free data input signal. In actual application, output DJ will be the sum of input DJ and ΔDJ.
6. If measured with TJ-free data input signal. In actual application, output TJ will be given by:

$$TJ_{OUT} = DJ_{IN} + \Delta DJ + \sqrt{(TJ_{IN} - DJ_{IN})^2 + (\Delta TJ - \Delta DJ)^2}$$

7. Measured with conformance signals defined in FC-PI-2 10.0 specifications.
8. Measured with PRBS 2<sup>7</sup>-1 at 10<sup>-12</sup> BER.

**V. General Specifications**

| Parameter                                                          | Symbol            | Min | Typ                       | Max        | Units  | Ref. |
|--------------------------------------------------------------------|-------------------|-----|---------------------------|------------|--------|------|
| Data Rate                                                          | BR                |     | 1.0625,<br>1.25,<br>2.125 |            | Gb/sec | 1    |
| Bit Error Rate                                                     | BER               |     |                           | $10^{-12}$ |        | 2    |
| Max. Supported Link Length on 9/125 $\mu$ m SMF @ 2x Fibre Channel | L <sub>MAX1</sub> |     | 10                        |            | km     | 3    |
| Max. Supported Link Length on 9/125 $\mu$ m SMF @ Gigabit Ethernet | L <sub>MAX1</sub> |     | 10                        |            | km     | 4    |

**Notes:**

1. Gigabit Ethernet and 1x, 2x Fibre Channel compatible, per IEEE 802.3 and FC-PI-2 10.0, respectively. Typical maximum data rate extends to 2.5Gb/s.
2. Tested with PRBS 2<sup>7</sup>-1 test pattern.
3. Dispersion limited per FC-PI-2 10.0
4. Attenuation of 0.55 dB/km is used for the link length calculations. 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 SFF transceivers have an extended operating temperature range from –40°C to +85°C case temperature.

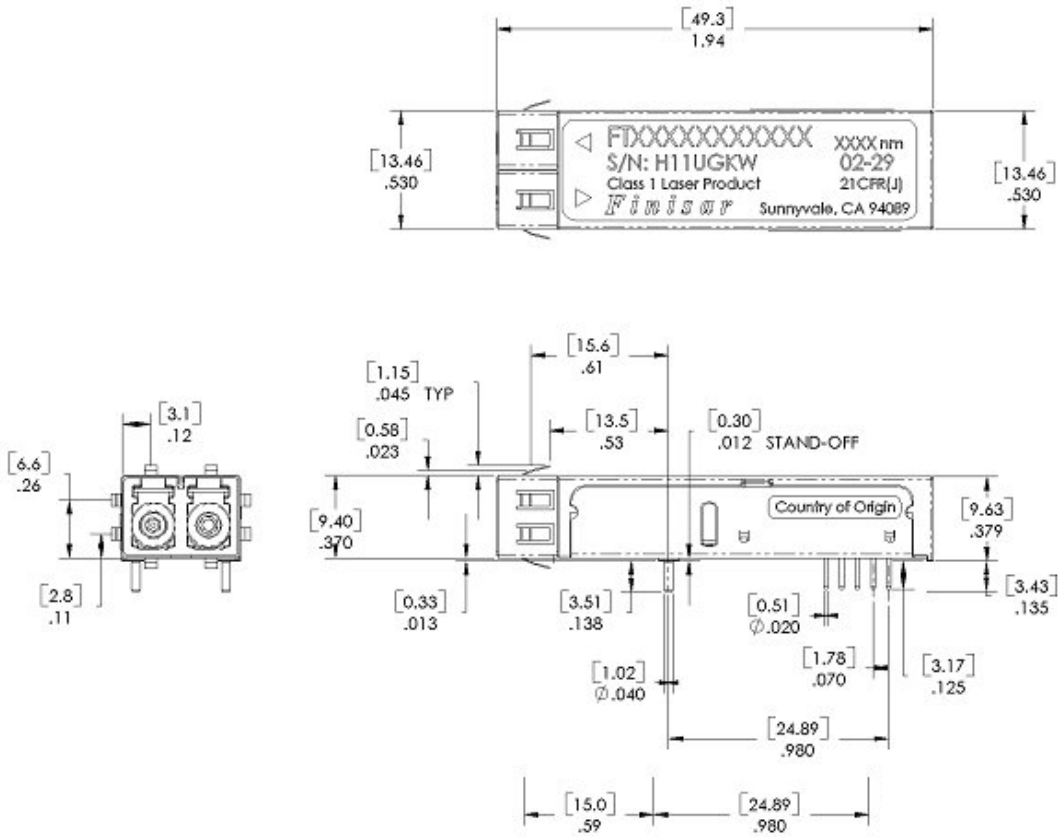
| Parameter                  | Symbol           | Min | Typ | Max | Units | Ref. |
|----------------------------|------------------|-----|-----|-----|-------|------|
| Case Operating Temperature | T <sub>op</sub>  | -40 |     | 85  | °C    |      |
| Storage Temperature        | T <sub>sto</sub> | -40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

**VII. Regulatory Compliance**

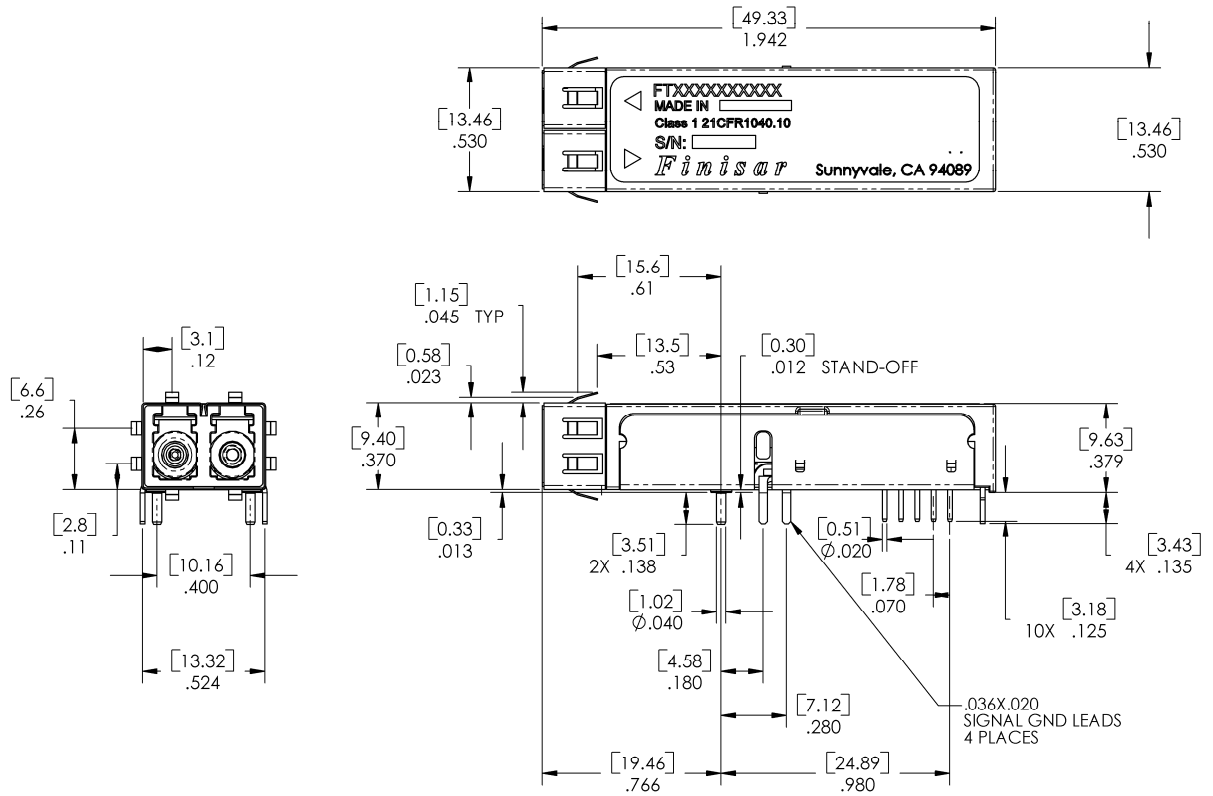
Finisar transceivers are Class 1 Laser Products and comply with US FDA regulations. These products are certified by TÜV and CSA to meet the Class 1 eye safety requirements of EN (IEC) 60825 and the electrical safety requirements of EN (IEC) 60950. Copies of certificates are available at Finisar Corporation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

**VIII. Mechanical Specifications**

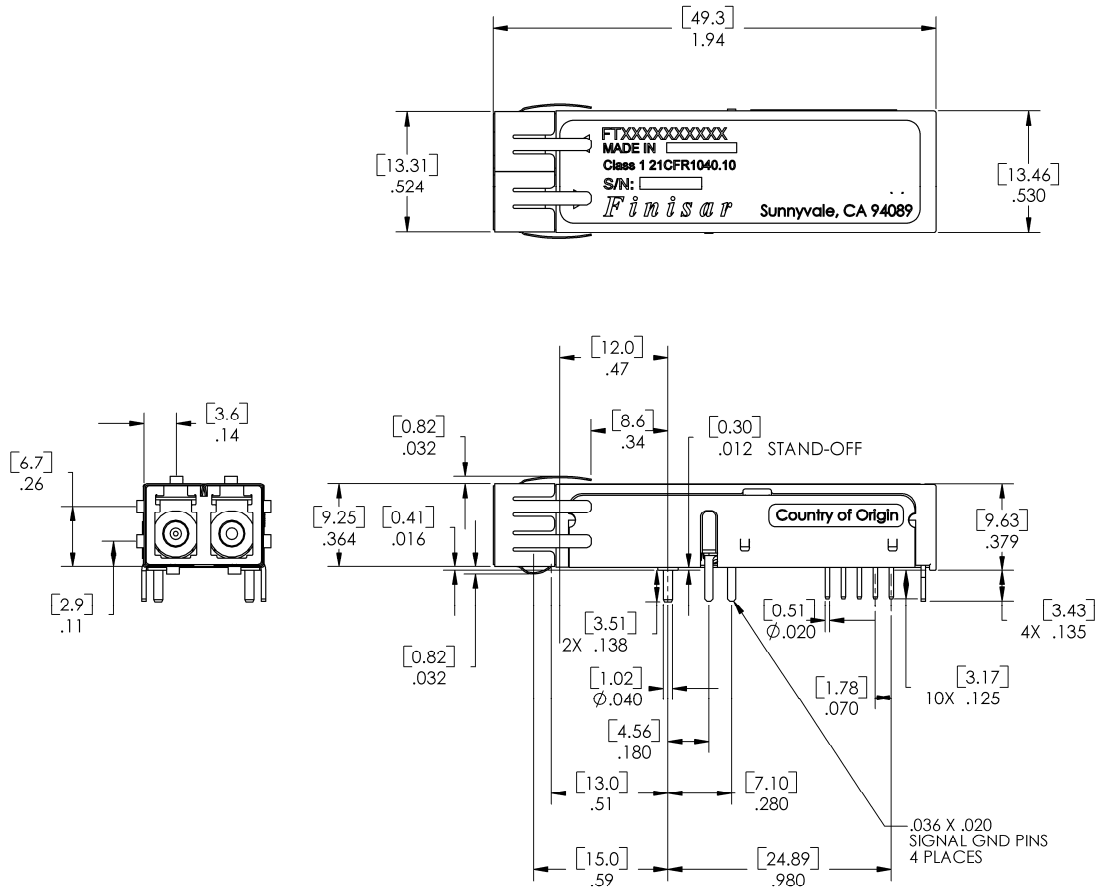
Finisar’s Small Form Factor (SFF) transceivers comply with the standard dimensions defined by the Small Form Factor Multi-Sourcing Agreement (MSA).



**FTLF1319F1GTL**



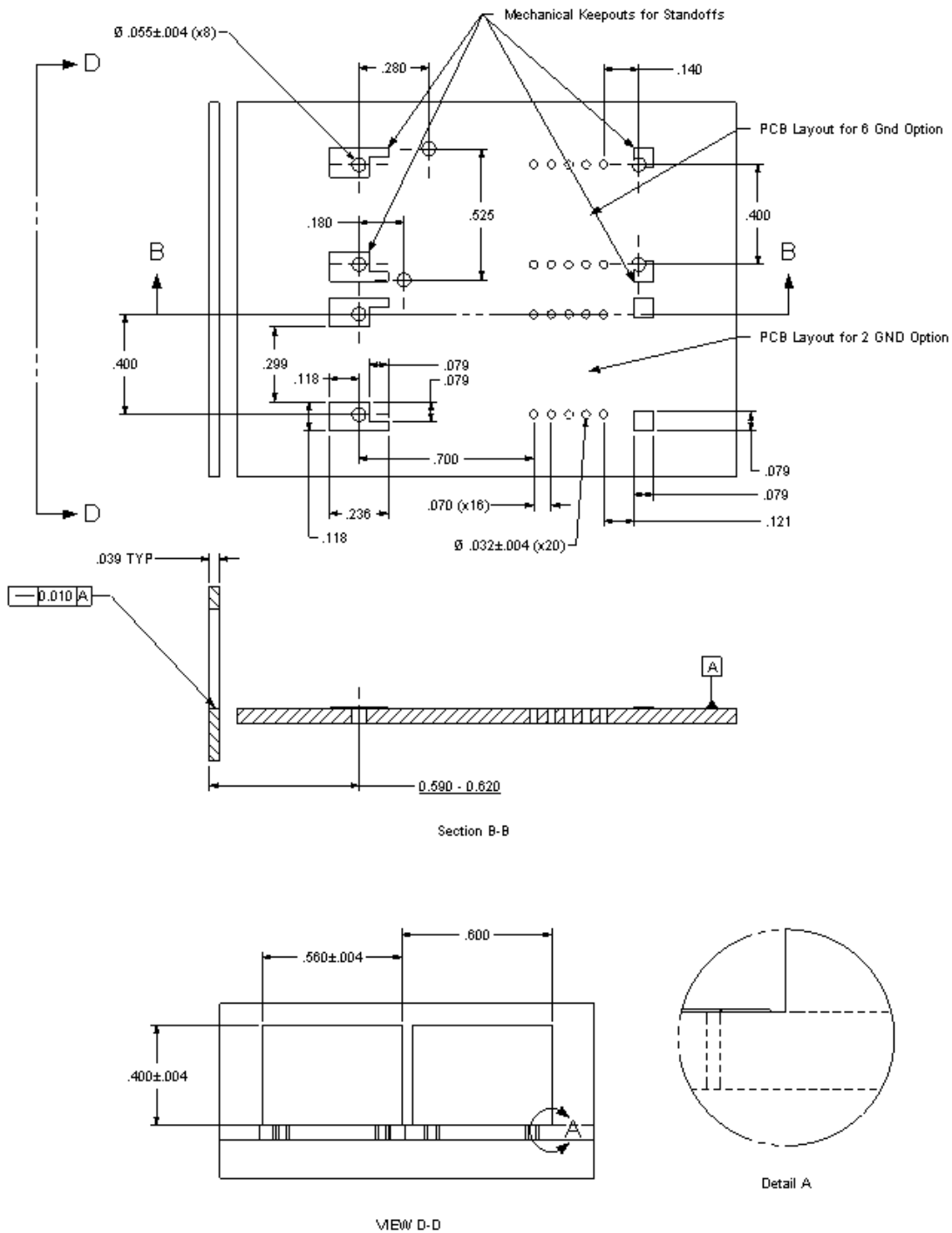
**FTLF1319F1MTL**



**FTLF1319F1HTL**



**IX. PCB Layout and Bezel Recommendations**



**Minimum Recommended Pitch is 0.600"**

**X. References**

1. Small Form Factor (SFF) Transceiver Multi-source Agreement (MSA). January 6, 1998.
2. “IEEE Draft P802.3z/D5.0 ‘Media Access Control (MAC) Parameters, Physical Layer, Repeater and Management Parameters for 1000Mb/s Operation’”. IEEE Standards Department, 1998.
3. “Fibre Channel Physical and Signaling Interface (FC-PH, FC-PH2, FC-PH3)”. American National Standard for Information Systems.
4. “Fibre Channel Draft Physical Interface Specification (FC-PI-2 10.0)”. American National Standard for Information Systems.
5. 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.

**XI. For More Information**

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