

## Product Specification

### RoHS Compliant 40km Extended Reach GBIC Transceiver

#### FTL-1419-3D

#### Product Features

- Up to 1.25Gb/s bi-directional data links
- 1310nm DFB laser transmitter
- Digital Diagnostics
- Extended operating temperature range (0°C to +70°C)
- Compatible with 3.3 & 5V systems
- Hot-pluggable (complies with GBIC specification Rev. 5.5)
- Fully metallic enclosure for low EMI
- Low power dissipation
- RoHS compliant and Lead Free



#### Applications

- 1.0625 Gb/s Fibre Channel
- 1.25 Gb/s Ethernet

Finisar's FTL-1419-3D 1310nm Extended GBIC transceivers have a maximum fiber length of 40km and comply with GBIC Specification Revision 5.5<sup>1</sup>. They are compatible with Gigabit Ethernet as specified in IEEE 802.3<sup>2</sup>, Fibre Channel FC-PH, PH2, PH3<sup>3</sup> and FC-PI-2 Rev. 10.0<sup>4</sup>. They are RoHS-6 compliant per Directive 2002/95/EC<sup>5</sup> and Finisar Application Note AN-2038<sup>9</sup>.

**I. Pin Out**

| <b>Pin Name</b> | <b>Pin #</b> | <b>Sequence</b> |
|-----------------|--------------|-----------------|
| RX_LOS          | 1            | 2               |
| GND             | 2            | 2               |
| GND             | 3            | 2               |
| MOD_DEF(0)      | 4            | 2               |
| MOD_DEF(1)      | 5            | 2               |
| MOD_DEF(2)      | 6            | 2               |
| TX_DISABLE      | 7            | 2               |
| GND             | 8            | 2               |
| GND             | 9            | 2               |
| TX_FAULT        | 10           | 2               |
| GND             | 11           | 1               |
| -RX_DAT         | 12           | 1               |
| +RX_DAT         | 13           | 1               |
| GND             | 14           | 1               |
| V <sub>CC</sub> | 15           | 2               |
| V <sub>CC</sub> | 16           | 2               |
| GND             | 17           | 1               |
| +TX_DAT         | 18           | 1               |
| -TX_DAT         | 19           | 1               |
| GND             | 20           | 1               |

**Table 1. GBIC to host connector pin assignment**

“Sequence” indicates the order in which pins make contact when the device is hot plugged. See “Table 3: Signal Definitions” in the GBIC Specification Revision 5.5.<sup>1</sup> for a description of the function of each pin list above.

## II. Electrical Power Interface

Finisar FTL-1419-3D GBICs have an extended power supply voltage range of 3.15 V to 5.5 V as described in Table 2. They are compatible with both 3.3V and 5V systems.

| Parameter                | Symbol             | Min  | Typ    | Max | Units | Notes/Conditions                      |
|--------------------------|--------------------|------|--------|-----|-------|---------------------------------------|
| Supply Current           | $I_s$              |      | 200    | 300 | mA    |                                       |
| Inrush Current           | $I_{\text{surge}}$ |      |        | 30  | mA    | Hot plug, above steady state current. |
| Absolute Supply Voltage  | $V_{\text{max}}$   | -0.3 |        | 6   | V     | Not to be applied continuously        |
| Operating Supply Voltage | $V_{\text{cc}}$    | 3.15 | 3.3, 5 | 5.5 | V     | Referenced to GND                     |

**Table 2. Electrical power interface**

## III. Low Speed Signals

RX\_LOS and TX\_DISABLE are TTL signals as described in Table 3. MOD\_DEF(1) (SCL) and MOD\_DEF(2) (SDA), are open drain CMOS signals (see section VIII, “Serial Communication Protocol”). Both MOD\_DEF(1) and MOD\_DEF(2) must be pulled up to host\_Vcc. For more detailed information, see sections 5.3.1 – 5.3.8 in the GBIC Specification Rev. 5.5<sup>1</sup>.

| Parameter        | Symbol          | Min            | Max            | Units | Notes/Conditions                                                    |
|------------------|-----------------|----------------|----------------|-------|---------------------------------------------------------------------|
| GBIC Output LOW  | $V_{\text{OL}}$ | 0              | 0.5            | V     | 4.7k to 10k pull-up to host_Vcc, measured at host side of connector |
| GBIC Output HIGH | $V_{\text{OH}}$ | host_Vcc - 0.5 | host_Vcc + 0.3 | V     | 4.7k to 10k pull-up to host_Vcc, measured at host side of connector |
| GBIC Input LOW   | $V_{\text{IL}}$ | 0              | 0.8            | V     | 4.7k to 10k pull-up to Vcc, measured at GBIC side of connector      |
| GBIC Input HIGH  | $V_{\text{IH}}$ | 2              | Vcc + 0.3      | V     | 4.7k to 10k pull-up to Vcc, measured at GBIC side of connector      |

**Table 3. Low speed signals – electronic characteristics**

| Parameter                | Symbol     | Min | Typ | Max  | Units | Notes/Conditions                                                         |
|--------------------------|------------|-----|-----|------|-------|--------------------------------------------------------------------------|
| RX_LOS Assert Level      | --         | -34 |     |      | dBm   |                                                                          |
| RX_LOS Deassert Level    | --         |     |     | -24  | dBm   |                                                                          |
| RX_LOS Hysteresis        | --         | 0.5 |     |      | dB    |                                                                          |
| RX_LOS Assert Delay      | t_loss_on  |     |     | 100  | μsec  | From detection of loss of signal to assertion of RX_LOS                  |
| RX_LOS Negate Delay      | t_loss_off |     |     | 100  | μsec  | From detection of presence of signal to negation of RX_LOS               |
| TX_DISABLE Assert Time   | t_off      |     |     | 10   | μsec  | Rising edge of TX_DISABLE to fall of output signal below 10% of nominal  |
| TX_DISABLE Negate Time   | t_on       |     |     | 1000 | μsec  | Falling edge of TX_DISABLE to rise of output signal above 90% of nominal |
| TX_DISABLE Reset Time    | t_reset    | 10  |     |      | μsec  | TX_DISABLE HIGH before TX_DISABLE set LOW                                |
| TX_FAULT Initialize Time | t_init     |     |     | 300  | msec  | From power on after VCC > 4.5V                                           |
| TX_FAULT Assert Time     | t_fault    |     |     | 100  | μsec  | From occurrence of fault                                                 |

**Table 4. Low speed signal parameters**

#### IV. High Speed Electrical Interface

All high-speed PECL signals are AC-coupled internally.

| Parameter           | Symbol                          | Min | Typ | Max               | Units | Notes/Conditions                          |
|---------------------|---------------------------------|-----|-----|-------------------|-------|-------------------------------------------|
| Data Input Voltage  | V <sub>in</sub>                 | 650 |     | 2000              | mV    | PECL differential peak - peak             |
| Data Output Voltage | V <sub>out</sub>                | 370 |     | 2000              | mV    | PECL differential peak - peak             |
| PECL rise/fall      | t <sub>r</sub> , t <sub>f</sub> |     |     | 260               | psec  | 20%-80% differential                      |
| Bit Error Rate      | BER                             |     |     | 10 <sup>-12</sup> |       | PRBS 2 <sup>7</sup> - 1 test data pattern |
| Tx Input Impedance  | Z <sub>in</sub>                 |     | 75  |                   | Ohm   |                                           |
| Rx Output Impedance | Z <sub>out</sub>                |     | 75  |                   | Ohm   |                                           |

**Table 5. High-speed electrical interface**

**V. Optical Parameters**

| Parameter                          | Symbol         | Min  | Typ  | Max  | Units   | Notes/Conditions                                           |
|------------------------------------|----------------|------|------|------|---------|------------------------------------------------------------|
| <b>TRANSMITTER CHARACTERISTICS</b> |                |      |      |      |         |                                                            |
| Transmitter Center Wavelength      | $\lambda_c$    | 1290 | 1310 | 1340 | nm      |                                                            |
| Side Mode Suppression Ratio        | SMSR           | 30   |      |      | dB      |                                                            |
| Spectral Width (-20dB)             | $\sigma$       |      |      | 1    | nm      |                                                            |
| Transmitter Optical Output Power   | $P_{out}$      | -2   |      | +3   | dBm     | Average power coupled into single mode fiber               |
| Transmitter Extinction Ratio       | ER             | 9    |      |      | dB      |                                                            |
| Transmitter Eye Mask Margin        | --             | 20   |      |      | %       | Conforms to IEEE 802.3 and Fibre Channel Eye Masks         |
| Transmitter Rise/Fall Time         | $t_r / t_f$    |      |      | 260  | ps      | 20%-80% differential unfiltered                            |
| Total Transmitter Jitter           |                |      |      | 160  | ps      | Peak to peak, filtered                                     |
| Relative Intensity Noise           | RIN            |      |      | -120 | dB / Hz |                                                            |
| Dispersion Penalty at 40km         |                |      |      | 1    | dB      | With SMF-28 fiber                                          |
| <b>RECEIVER CHARACTERISTICS</b>    |                |      |      |      |         |                                                            |
| Optical Input Wavelength           | $\lambda_{in}$ | 1260 |      | 1610 | nm      |                                                            |
| Receiver Reflectance               | $R_{RX}$       |      |      | -14  | dB      |                                                            |
| Optical Input Power                | $P_{in}$       | -23  |      | -1   | dBm     | BER < $10^{-12}$ w/ PRBS $2^7 - 1$ test pattern @ 1.25Gb/s |
| Total Receiver Jitter              |                |      |      | 160  | ps      | Peak to peak, filtered in loopback                         |

**Note:** Parameters are specified over temperature and voltage, at end of life unless otherwise noted.

**Table 6. Optical parameters**

**VI. General Specifications**

| Parameter           | Symbol | Min | Typ            | Max | Units  | Notes/Conditions                     |
|---------------------|--------|-----|----------------|-----|--------|--------------------------------------|
| Data Rate           | BR     |     | 1.25<br>1.0625 |     | Gb/sec | Fibre Channel, IEEE 802.3 Compatible |
| Fiber Length*       | L      | 0   |                | 40  | km     | 9 $\mu$ m Core Single Mode Fiber     |
| Total System Budget | --     | 21  |                |     | dB     |                                      |

\*An attenuation of <0.55dB/km is assumed. Fiber loss budget plus all other system penalties must not exceed 21 dB.

**Table 7. General specifications**

**VII. Environmental Specifications**

| Parameter         | Symbol           | Min | Typ | Max | Units | Notes/Conditions                                   |
|-------------------|------------------|-----|-----|-----|-------|----------------------------------------------------|
| Operating Temp    | T <sub>op</sub>  | 0   |     | 70  | °C    | Case Temperature                                   |
| Relative Humidity | RH               | 0   |     | 85  | %     | Non Condensing                                     |
| Storage Temp      | T <sub>sto</sub> | -40 |     | 85  | °C    |                                                    |
| Eye Safety        | --               |     |     |     |       | CDRH and IEC-825 Class 1 Laser Product. See Note 1 |

**Note 1:** Complies with FDA performance standards for laser products except for deviations pursuant to Laser Notice No. 50, dated July 26, 2001.

**Table 8. Environmental specifications**

**VIII. Serial Communication Protocol**

All Finisar optical GBICs implement serial identification features described for ‘Module Definition “4”’ as outlined in Annex D of the GBIC Specification<sup>1</sup>. These GBICs use an Atmel AT24C01A 128 byte E<sup>2</sup>PROM at address A0H. For details on interfacing with the E<sup>2</sup>PROM, see the Atmel data sheet titled “AT24C01A/02/04/08/16 2-Wire Serial CMOS E<sup>2</sup>PROM.”<sup>6</sup>

The FTL-1419-3D also supports extended diagnostic features as described in Finisar Applications Note AN-2030, “Digital Diagnostic Monitoring Interface for Optical Transceivers”<sup>8</sup>, and additional information is available in SFF standard titled: “Digital Diagnostic Monitoring Interface for Optical Transceivers”<sup>7</sup> (SFF-8472 rev9.3). A controller IC that monitors system parameters such as laser current, module temperature, transmitter power, and received power is accessible at address A2H.

I2C clock speed, digital diagnostic accuracy and digital diagnostic range can be found in the table below. Values in the table represent the worst-case values over temperature, voltage, and life.

| Parameter                           | Symbol                    | Min | Typ | Max     | Units | Notes/Conditions                                       |
|-------------------------------------|---------------------------|-----|-----|---------|-------|--------------------------------------------------------|
| I <sup>2</sup> C Clock Speed        |                           | 0   |     | 100,000 | Hz    | Bus can be driven blind                                |
| <b>Accuracy</b>                     |                           |     |     |         |       |                                                        |
| Internal Transceiver Temperature    | DD <sub>Temperature</sub> | -3  |     | +3      | °C    | Measured at controller IC                              |
| Internal Transceiver Supply Voltage | DD <sub>Voltage</sub>     | -3  |     | +3      | %     | Measured at controller IC                              |
| Tx Bias Current                     | DD <sub>Bias</sub>        | -10 |     | +10     | %     |                                                        |
| Tx Output Power                     | DD <sub>TxPower</sub>     | -3  |     | +3      | dB    | 100% tested in production tested at room temp to ±2 dB |
| Received Average Power              | DD <sub>RxPower</sub>     | -3  |     | +3      | dB    | 100% tested in production tested at room temp to ±2 dB |
| <b>Range</b>                        |                           |     |     |         |       |                                                        |
| Internal Transceiver Temperature    | DD <sub>Temperature</sub> | -40 |     | 85      | °C    |                                                        |
| Internal Transceiver Supply Voltage | DD <sub>Voltage</sub>     | 3.0 |     | 6.0     | V     |                                                        |
| Tx Bias Current                     | DD <sub>Bias</sub>        | 0   |     | 90      | mA    |                                                        |
| Tx Output Power                     | DD <sub>TxPower</sub>     | -3  |     | 4       | dBm   |                                                        |
| Received Average Power              | DD <sub>RxPower</sub>     | -23 |     | -1      | dBm   |                                                        |

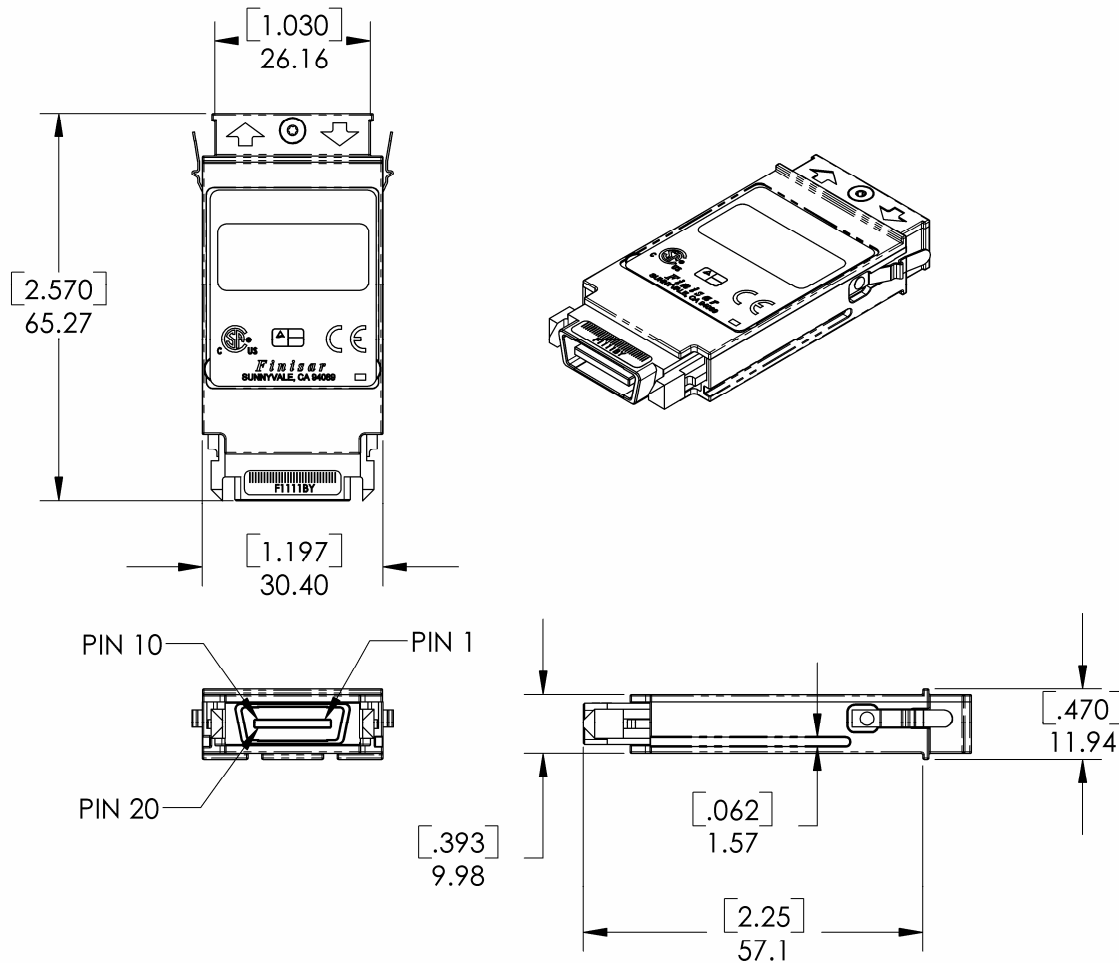
**Table 9. Digital Diagnostic Accuracy and Range Limits**

## IX. Mechanical Specifications

Finisar GBICs are compatible with the mechanical specifications outlined in the GBIC Specification Revision 5.5, Section 6<sup>1</sup>.

| Insertion, Extraction, and Retention Forces |        |     |     |     |         |                        |
|---------------------------------------------|--------|-----|-----|-----|---------|------------------------|
| Parameter                                   | Symbol | Min | Typ | Max | Units   | Notes/Conditions       |
| GBIC insertion                              | $F_I$  | 0   |     | 20  | Newtons | ~4.5 lbs               |
| GBIC extraction                             | $F_E$  | 0   |     | 15  | Newtons | ~3.3 lbs               |
| GBIC retention                              | $F_R$  | 130 |     | N/A | Newtons | Straight out ~29.3 lbs |

**Table 10. Insertion, extraction, and retention forces**



**Figure 1. GBIC outline drawing**

**X. References**

1. “Gigabit Interface Converter (GBIC) Revision 5.5”. Sun Microsystems Computer Company et. al., August 16, 1999. <http://playground.sun.com/pub/OEmod/>
2. IEEE Std 802.3. IEEE Standards Department, 2002.
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 Rev. 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.
6. “AT24C01A/02/04/08/16 2-Wire Serial CMOS E<sup>2</sup>PROM”. Atmel Corporation. [www.Atmel.com](http://www.Atmel.com)
7. “Digital Diagnostics Monitoring Interface for Optical Transceivers”. SFF Document Number SFF-8472, Revision 9.3.
8. “Application Note AN-2030: Digital Diagnostic Monitoring Interface for Optical Transceivers”, Finisar Corporation, April 2002.
9. “Application Note AN-2038: Finisar Implementation of RoHS Compliant Transceivers”, Finisar Corporation, March 2005.

\* The GBIC Standard, FC-PI-2 and IEEE 802.3 do not specify a 1310nm single-mode interface for 40km applications. The FTL-1419-3D complies with these standards except for the following optical parameters: receiver sensitivity and transmit output power. See Table 6 for details.

**XI. For More Information**

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