

### TTD4580-35-PI-C

Arris® TTD4580-35-PI Compatible TAA 10GBase-DWDM SFP+ Transceiver (SMF, 1549.32nm, 80km, LC, DOM, -40 to 95C)

#### Features:

- Cooled DWDM EML Transmitter with TEC
- APD Receiver
- Supports 9.95Gbps to 11.3Gbps Bit Rates
- Maximum Link Length of 80km
- LC/UPC Duplex Optical Connector Interface
- Power Consumption: 2.8W
- Single 3.3V Power Supply
- Compliant to SFF-8431 for Electrical Interface; SFF-8432 for Mechanical Interface
- Hot-Pluggable
- Operating Temperature: -40 to 95 Celsius
- RoHS Compliant and Lead-Free



#### Applications:

- 10x Gigabit Ethernet over DWDM
- 8x/10x Fibre Channel
- Access, Metro and Enterprise

#### Product Description

This Arris® TTD4580-35-PI compatible SFP+ transceiver provides 10GBase-DWDM throughput up to 80km over single-mode fiber (SMF) using a wavelength of 1549.32nm via an LC connector. It can operate at temperatures between -40 and 95C. It is guaranteed to be 100% compatible with the equivalent Arris® transceiver. This easy to install, hot swappable transceiver has been programmed, uniquely serialized and data-traffic and application tested to ensure that it will initialize and perform identically. Digital optical monitoring (DOM) support is also present to allow access to real-time operating parameters. This transceiver is Trade Agreements Act (TAA) compliant. We stand behind the quality of our products and proudly offer a limited lifetime warranty.

ProLabs' transceivers are RoHS compliant and lead-free.

TAA refers to the Trade Agreements Act (19 U.S.C. & 2501-2581), which is intended to foster fair and open international trade. TAA requires that the U.S. Government may acquire only "U.S.-made or designated country end products.")



### Wavelength Guide (100GHz ITU-T Channels)

| ITU Channel # | Frequency (THz) | Center Wavelength (nm) |
|---------------|-----------------|------------------------|
| 17            | 191.7           | 1563.86                |
| 18            | 191.8           | 1563.05                |
| 19            | 191.9           | 1562.23                |
| 20            | 192.0           | 1561.42                |
| 21            | 192.1           | 1560.61                |
| 22            | 192.2           | 1559.79                |
| 23            | 192.3           | 1558.98                |
| 24            | 192.4           | 1558.17                |
| 25            | 192.5           | 1557.36                |
| 26            | 192.6           | 1556.55                |
| 27            | 192.7           | 1555.75                |
| 28            | 192.8           | 1554.94                |
| 29            | 192.9           | 1554.13                |
| 30            | 193.0           | 1553.33                |
| 31            | 193.1           | 1552.52                |
| 32            | 193.2           | 1551.72                |
| 33            | 193.3           | 1550.92                |
| 34            | 193.4           | 1550.12                |
| 35            | 193.5           | 1549.32                |
| 36            | 193.6           | 1548.51                |
| 37            | 193.7           | 1547.72                |
| 38            | 193.8           | 1546.92                |
| 39            | 193.9           | 1546.12                |
| 40            | 194.0           | 1545.32                |
| 41            | 194.1           | 1544.53                |
| 42            | 194.2           | 1543.73                |
| 43            | 194.3           | 1542.94                |
| 44            | 194.4           | 1542.14                |
| 45            | 194.5           | 1541.35                |
| 46            | 194.6           | 1540.56                |
| 47            | 194.7           | 1539.77                |
| 48            | 194.8           | 1538.98                |
| 49            | 194.9           | 1538.19                |
| 50            | 195.0           | 1537.40                |
| 51            | 195.1           | 1536.61                |
| 52            | 195.2           | 1535.82                |
| 53            | 195.3           | 1535.04                |

|    |       |         |
|----|-------|---------|
| 54 | 195.4 | 1534.25 |
| 55 | 195.5 | 1533.47 |
| 56 | 195.6 | 1532.68 |
| 57 | 195.7 | 1531.90 |
| 58 | 195.8 | 1531.12 |
| 59 | 195.9 | 1530.33 |
| 60 | 196.0 | 1529.55 |

#### Absolute Maximum Ratings

| Parameter                   | Symbol     | Min. | Typ.    | Max. | Unit | Notes |
|-----------------------------|------------|------|---------|------|------|-------|
| Data Rate                   | DR         |      | 10.3125 |      | Gbps | 1     |
| Storage Temperature         | Tstg       | -40  |         | 95   | °C   |       |
| Operating Relative Humidity | RH         | 0    |         | 85   | %    | 2     |
| Operating Temperature       | Tc         | -40  |         | 95   |      | 3     |
| Maximum Supply Voltage      | VccT, VccR | -0.5 |         | 4.0  | V    |       |

#### Notes:

1. Distances are calculated for worst-case fiber and transceiver characteristics based on the optical and electrical specifications shown in this document using techniques specified in IEEE 802.3. These distances are consistent with those specified for 10GBASE-ZR and 10GBASE-ZW.
2. Non-condensing.
3. With airflows.

## Electrical Characteristics

| Parameter                                     | Symbol      | Min.   | Typ. | Max.       | Unit  | Notes |
|-----------------------------------------------|-------------|--------|------|------------|-------|-------|
| Transmitter Differential Input Voltage        | Vp          | 2.5    |      |            | V     |       |
| Module Supply Voltage                         | VccT, VccR  | +3.135 |      | -3.465     | V     |       |
| Total Power Consumption                       | PC          |        |      | 2.8        | W     | 1     |
| Power Supply Noise Tolerance                  | PSNT        |        |      | 66         | mVp-p | 2     |
| Low-Speed Signal Electrical Characteristics   |             |        |      |            |       |       |
| Tx_Fault, Rx_LOS                              | VOL         | -0.3   |      | 0.4        | V     | 3     |
|                                               | VOH         | -50    |      | 37.5       | μA    | 4     |
| Tx_Disable, RS0, RS1                          | VIL         | -0.3   |      | 0.8        | V     | 5     |
|                                               | VIH         | 2.0    |      | VccT + 0.3 | V     | 5     |
| Low-Speed Signals Timing Specifications       |             |        |      |            |       |       |
| Tx_Disable Assert Time                        | t_off       |        |      | 100        | μs    | 6     |
| Tx_Disable Negate Time                        | t_on        |        |      | 2          | ms    | 7     |
| Time to Initialize (Cold and Warm Start Time) | t_start_up  |        |      | 90         | s     | 8, 9  |
| Rx_LOS Assert Delay                           | t_los_on    |        |      | 100        | μs    | 10    |
| Rx_LOS Negate Delay                           | t_los_off   |        |      | 100        | μs    | 11    |
| Tx_Fault Assert                               | tx_fault_on |        |      | 1          | ms    | 12    |
| Tx_Fault Reset                                | t_reset     | 10     |      |            | μs    | 13    |

### Notes:

1. With airflows.
2. 10Hz to 10MHz.
3. At 0.7mA.
4. Measured with a 4.7kΩ load pull up to the Host\_Vcc.
5. Tx\_Disable has an internal 4.7kΩ to 10kΩ pull up to the VccT.
6. Rising edge of Tx\_Disable to fall of output signal below 10% of nominal.
7. Falling edge of Tx\_Disable to rise of output signal above 90% of nominal. This only applies in normal operation, not during start up or fault recovery.
8. Time from power on or falling edge of Tx\_Disable to when the modulated optical output rises above 90% of nominal and the 2-wire interface is available.
9. Cooled type.
10. From occurrence of loss of signal to assertion of Rx\_LOS.
11. From occurrence of presence of signals to negation of Rx\_LOS.
12. From occurrence of fault to assertion of Tx\_Fault.
13. Time Tx\_Disable must be held high to reset the Tx\_Fault.

## High-Speed Signal Electrical Characteristics

| Parameter                                                | Symbol      | Min. | Typ. | Max.   | Unit     | Notes |
|----------------------------------------------------------|-------------|------|------|--------|----------|-------|
| Module Transmitter Input Electrical Specifications at B' |             |      |      |        |          |       |
| Tx Input Differential Voltage                            | VI          | 190  |      | 700    | mV       | 1     |
| Differential Input Resistance                            | RI          | 95   | 100  | 105    | $\Omega$ |       |
| Differential Input S-Parameter (Note 2)                  | SDD11       |      |      | Note 3 | dB       | 3     |
|                                                          |             |      |      | Note 4 | dB       | 4     |
| Reflected Differential to Common-Mode Conversion         | SCD11       |      |      | -10    | dB       | 5     |
| Module Receiver Output Electrical Specifications at C'   |             |      |      |        |          |       |
| Rx Output Differential Voltage                           | VO          | 300  |      | 850    | mV       | 1     |
| Termination Mismatch at 1MHz                             | $\Delta ZM$ |      |      | 5      | %        |       |
| Single-Ended Output Voltage Tolerance                    |             | -0.3 |      | 4.0    | V        |       |
| Output AC Common-Mode Voltage                            |             |      |      | 7.5    | mV       | 6     |
| Differential Output S-Parameter                          | SDD22       |      |      | Note 6 | dB       | 7     |
|                                                          |             |      |      | Note 7 | dB       | 8     |
| Common-Mode Output Reflection Coefficient                | SCC22       |      |      | Note 8 | dB       | 9     |
|                                                          |             |      |      | -3     | dB       | 10    |
| Rx Output Rise/Fall Time                                 | Tr/Tf       | 28   |      |        | ps       | 11    |
| Rx Output Total Jitter                                   | TJ          |      |      | 0.70   | Ulp-p    |       |
| Rx Output Deterministic Jitter                           | DJ          |      |      | 0.42   | Ulp-p    |       |

### Notes:

1. Voltage swing for 1G operation is equivalent to voltage swing in 10G operation.
2. Measured at B'' with Host Compliance Board and Module Compliance Board pair.
3. Reflection Coefficient given by equation SDD11 (dB) < -12 + 2 × SQRT (f), with f in GHz. 0.01 to 4.1GHz.
4. Reflection Coefficient given by equation SDD11 (dB) < -6.3 + 13 × log10 (f/5.5), with f in GHz. 4.1 to 11.1GHz.
5. 0.01 to 11.1GHz.
6. The RMS value is measured by calculating the standard deviation of the histogram for one UI of the common mode signal.
7. Reflection Coefficient given by equation SDD22 (dB) < -12 + 2 × SQRT (f), with f in GHz. 0.01 to 4.1GHz.
8. Reflection Coefficient given by equation SDD22 (dB) < -6.3 + 13 × log10 (f/5.5), with f in GHz. 4.1 to 11.1GHz.
9. Reflection Coefficient given by equation SCC22 (dB) < -7 + 1.6 × f, with f in GHz. 0.01 to 2.5GHz.
10. 2.5 to 11.1GHz.
11. 20-80%.

## Optical Characteristics

| Parameter                           | Symbol                        | Min.                        | Typ. | Max.              | Unit  | Notes |
|-------------------------------------|-------------------------------|-----------------------------|------|-------------------|-------|-------|
| Transmitter                         |                               |                             |      |                   |       |       |
| Peak Wavelength                     | $\lambda_P$                   | ITU-T 694.1 Grid Wavelength |      |                   | nm    | 1     |
| Center Wavelength Spacing           |                               | 100                         |      |                   | GHz   |       |
| Spectral Width at -20dB             | $\Delta\lambda$ -20dB         |                             |      | 0.30              | nm    | 2     |
| Side-Mode Suppression Ratio         | SMSR                          | 30.0                        |      |                   | dB    |       |
| Average Optical Power               | PAVE                          | 0                           |      | +5.0              | dBm   |       |
| Extinction Ratio                    | ER                            | 8.2                         |      |                   | dB    | 3     |
| Transmitter and Dispersion Penalty  | TDP                           |                             |      | 3.5               | dB    |       |
| Laser Off Power                     | Poff                          |                             |      | -30.0             | dBm   |       |
| Relative Intensity Noise            | RIN <sub>12</sub> OMA         |                             |      | -128.0            | dB/Hz |       |
| Wavelength Stability After Start-Up |                               | $\lambda_P$ - 100           |      | $\lambda_P$ + 100 | pm    |       |
| Transmitter Output Eye Mask         | IEEE 802.3-2012 Clause 52.9.7 |                             |      |                   |       | 7     |
| Receiver                            |                               |                             |      |                   |       |       |
| Operating Wavelength                | $\lambda_O$                   | 1260                        |      | 1600              | nm    |       |
| Receiver Sensitivity (Average)      | S                             |                             |      | -23.0             | dBm   | 4     |
| Receiver Power (Pave) Overload      | OL                            | -6.0                        |      |                   | dBm   | 4     |
| Sensitivity (OMA)                   | SOMA                          |                             |      | -21.9             | dBm   | 4     |
| Receiver Reflectance                | RR                            |                             |      | -27.0             | dB    | 5     |
| Loss of Signal - Asserted           | LOSA                          | -37.0                       |      |                   | dBm   | 6     |
| Loss of Signal - De-Asserted        | LOSD                          |                             |      | -24.0             | dBm   | 6     |
| Loss of Signal Hysteresis           | LOSH                          | 0.5                         | 2.5  | 5.0               | dB    |       |

### Notes:

1. See 100GHz ITU-T Channels Wavelength Guide.
2. At -20dB.
3. At 10.3Gbps, PRBS 2<sup>31</sup>-1.
4. Measured with at 10.3125Gbps, ER>8.2dB, PRBS 2<sup>31</sup>-1, and BER<1x10<sup>-12</sup>.
5. At  $\lambda_O$ .
6. Loss of Signal (LOS) detection responds only to OMA and the indicator will respond unpredictably with the application of un-modulated optical.
7. See Eye Mask Diagram below.



## 2-Wire Interface Electrical Specifications

| Parameter                                 | Symbol | Min.     | Typ. | Max.     | Unit    | Notes |
|-------------------------------------------|--------|----------|------|----------|---------|-------|
| Host 2-Wire Vcc                           | VccH   | 3.14     |      | 3.46     | V       | 1     |
| SCL and SDA                               | VOL    | 0.0      |      | 0.8      | V       | 2     |
|                                           | VOH    | Vcch-0.5 |      | Vcch+0.3 | V       |       |
| SCL and SDA                               | VIL    | -0.3     |      | VccT*0.3 | V       | 3     |
|                                           | VIH    | VccT*0.7 |      | VccT+0.5 | V       |       |
| Input Current on the SCL and SDA Contacts | li     | -10      |      | 10       | $\mu$ A |       |
| Capacitance on SCL and SDA Contacts       | Ci     |          |      | 14       | pF      | 4     |
| Total Bus Capacitance for SCL and SDA     | Cb     |          |      | 100      | pF      | 5, 6  |
|                                           |        |          |      | 290      | pF      | 5, 7  |

### Notes:

1. The host 2-wire Vcc is the voltage used for resistive pull-ups for the 2-wire interface.
2. RP pulled to VccT/R. Rp is the pull-up resistor. Active bus termination may be used by the host in place of a pull up resistor. Pull-ups can be connected to any one of several power supplies; however, the host board design shall ensure that no module contact has voltage exceeding module VccT/R+0.5V nor requires the module to sink more than 3.0mA current.
3. These voltages are measured on the other side of the connector to the device under test.
4. Ci is the capacitance looking into the module SCL and SDA contacts.
5. Cb is the total bus capacitance on the SCL or SDA bus.
6. At 400kHz, 3.0k $\Omega$  Rp, max. At 100kHz, 8.0k $\Omega$  Rp, max.
7. At 400kHz, 1.1k $\Omega$  Rp, max. At 100kHz, 2.75k $\Omega$  Rp, max.

## 2-Wire Timing Specifications

| Parameter                                         | Symbol       | Min. | Typ. | Max. | Unit | Notes |
|---------------------------------------------------|--------------|------|------|------|------|-------|
| Clock Frequency                                   | fSCL         | 0    |      | 400  | kHz  | 1     |
| Clock Pulse Width Low                             | tLOW         | 1.3  |      |      | μs   |       |
| Clock Pulse Width High                            | tHIGH        | 0.6  |      |      | μs   |       |
| Stop to Start Time                                | tBUF         | 20   |      |      | μs   | 2     |
| Start Hold Time                                   | tHD,STA      | 0.6  |      |      | μs   |       |
| Start Set-Up Time                                 | tSU,STA      | 0.6  |      |      | μs   |       |
| Data In Hold Time                                 | tHD,DAT      | 0    |      |      | μs   |       |
| Data In Set-Up Time                               | tSU,DAT      | 0.1  |      |      | μs   |       |
| Input Rise Time (100kHz)                          | tR,100       |      |      | 1000 | ns   | 3     |
| Input Rise Time (400kHz)                          | tR,400       |      |      | 300  | ns   | 3     |
| Input Fall Time (100kHz)                          | tF,100       |      |      | 300  | ns   | 4     |
| Input Fall Time (400kHz)                          | tF,400       |      |      | 300  | ns   | 4     |
| Stop Set-Up Time                                  | tSU,STO      | 0.6  |      |      | μs   |       |
| Serial Interface Clock Holdoff "Clock Stretching" | t_clock_hold |      |      | 500  | μs   | 5     |

### Notes:

1. Module shall operate with fSCL up to 100kHz without requiring clock stretching. The module may clock stretch with fSCL greater than 100kHz and up to 400kHz.
2. Between STOP and START and between ACK and restart.
3. From (VIL, MAX. - 0.15) to (VIH, MIN. + 0.15).
4. From (VIH, MIN. + 0.15) to (VIL, MAX. - 0.15).
5. Maximum time the module may hold the SCL line low before continuing with a read or write operation.

## 2-Wire Bus Timing Diagram



## Pin Descriptions

| Pin | Symbol     | Name/Description                                                                 | Plug Seq.       | Notes |
|-----|------------|----------------------------------------------------------------------------------|-----------------|-------|
| 1   | VeeT       | Transmitter Signal Ground.                                                       | 1 <sup>st</sup> |       |
| 2   | Tx_Fault   | Transmitter Fault (LVTTL-O) – High indicates a fault condition.                  | 3 <sup>rd</sup> | 1     |
| 3   | Tx_Disable | Transmitter Disable (LVTTL-I) – High or open disables the transmitter.           | 3 <sup>rd</sup> | 2     |
| 4   | SDA        | 2-Wire Serial Interface Data Line (LVCMOS – I/O). Same as MOD-DEF2 in INF-8074.  | 3 <sup>rd</sup> | 3     |
| 5   | SCL        | 2-Wire Serial Interface Clock Line (LVCMOS – I/O). Same as MOD-DEF1 in INF-8074. | 3 <sup>rd</sup> | 3     |
| 6   | MOD_ABS    | Module Absent. Controlled by the module.                                         | 3 <sup>rd</sup> | 4     |
| 7   | RS0        | Receiver Rate Select 0. Not Used. Internally pulled down, 51kΩ.                  | 3 <sup>rd</sup> |       |
| 8   | RX_LOS     | Receiver Loss of Signal Indication (LVTTL-O).                                    | 3 <sup>rd</sup> | 1     |
| 9   | RS1        | Transmitter Rate Select 1. Not Used. Internally pulled down, 51kΩ.               | 3 <sup>rd</sup> |       |
| 10  | VeeR       | Receiver Signal Ground.                                                          | 1 <sup>st</sup> |       |
| 11  | VeeR       | Receiver Signal Ground.                                                          | 1 <sup>st</sup> |       |
| 12  | RD-        | Receiver Data Output, Inverted (CML-O).                                          | 3 <sup>rd</sup> |       |
| 13  | RD+        | Receiver Data Output, Non-Inverted (CML-O).                                      | 3 <sup>rd</sup> |       |
| 14  | VeeR       | Receiver Signal Ground.                                                          | 1 <sup>st</sup> |       |
| 15  | VccR       | Receiver Power +3.3V.                                                            | 2 <sup>nd</sup> |       |
| 16  | VccT       | Transmitter Power +3.3V.                                                         | 2 <sup>nd</sup> |       |
| 17  | VeeT       | Transmitter Signal Ground.                                                       | 1 <sup>st</sup> |       |
| 18  | TD+        | Transmitter Data Input, Non-Inverted (CML-I).                                    | 3 <sup>rd</sup> |       |
| 19  | TD-        | Transmitter Data Input, Inverted (CML-I).                                        | 3 <sup>rd</sup> |       |
| 20  | VeeT       | Transmitter Signal Ground.                                                       | 1 <sup>st</sup> |       |

### Notes:

1. This is an open drain output that, on the host board, requires a 4.7kΩ to 10kΩ pull-up resistor to the Host\_Vcc.
2. This input is internally biased high with a 4.7kΩ to 10kΩ pull-up resistor to the VccT.
3. 2-wire serial interface clock and data lines require an external pull-up resistor dependent on the capacitance load.
4. They must be pulled up with a 4.7kΩ to 10kΩ resistor on the host board. MOD\_ABS is grounded by the module to indicate that the module is present.

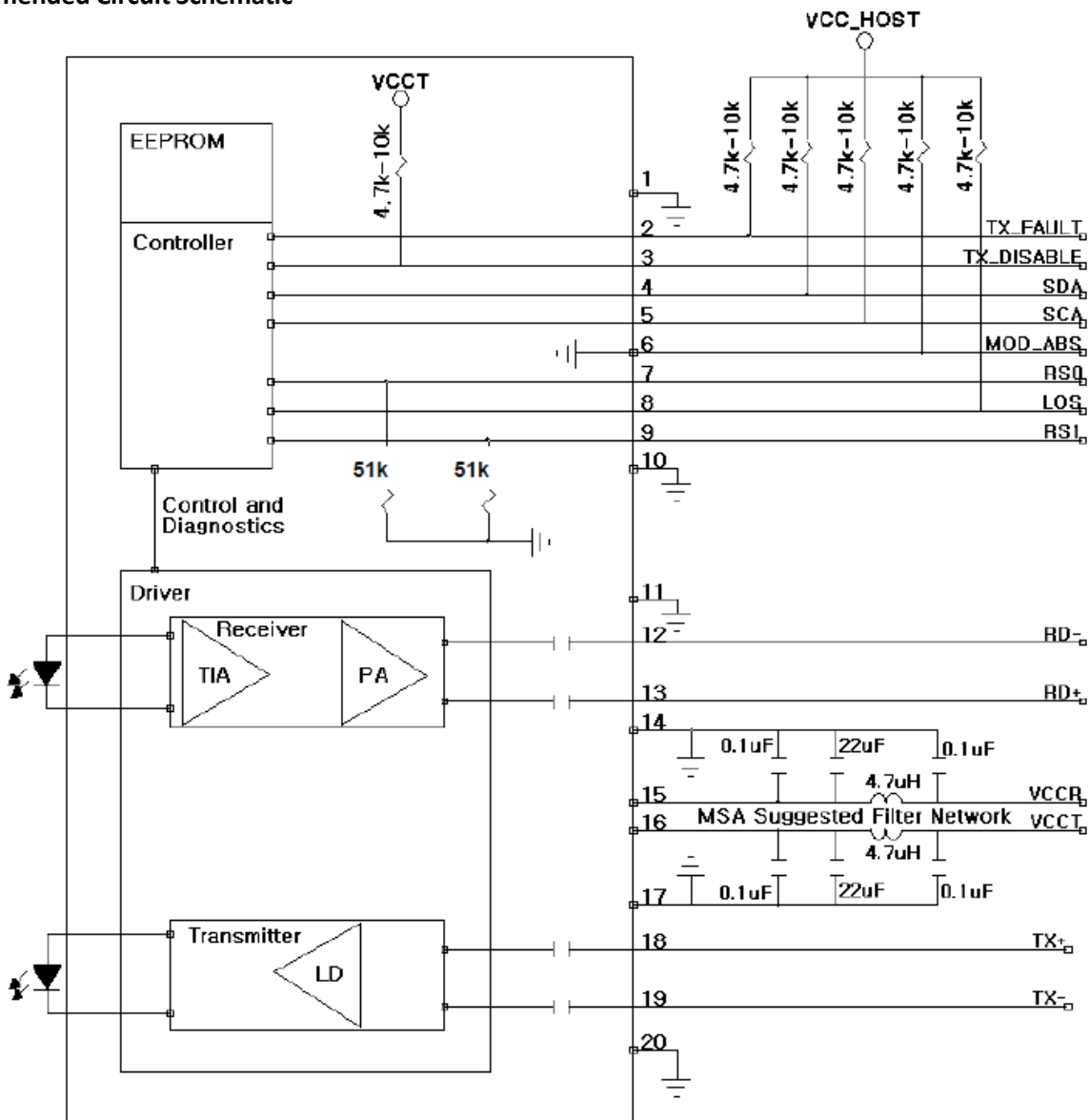
Electrical Pad Layout



Host Board



### Recommended Circuit Schematic



**Mechanical Specifications**



## About ProLabs

Our experience comes as standard; for over 15 years ProLabs has delivered optical connectivity solutions that give our customers freedom and choice through our ability to provide seamless interoperability. At the heart of our company is the ability to provide state-of-the-art optical transport and connectivity solutions that are compatible with over 90 optical switching and transport platforms.

## Complete Portfolio of Network Solutions

ProLabs is focused on innovations in optical transport and connectivity. The combination of our knowledge of optics and networking equipment enables ProLabs to be your single source for optical transport and connectivity solutions from 100Mb to 400G while providing innovative solutions that increase network efficiency. We provide the optical connectivity expertise that is compatible with and enhances your switching and transport equipment.

## Trusted Partner

Customer service is our number one value. ProLabs has invested in people, labs and manufacturing capacity to ensure that you get immediate answers to your questions and compatible product when needed. With Engineering and Manufacturing offices in the U.K. and U.S. augmented by field offices throughout the U.S., U.K. and Asia, ProLabs is able to be our customers best advocate 24 hours a day.



## Contact Information

ProLabs US

Email: [sales@prolabs.com](mailto:sales@prolabs.com)

Telephone: 952-852-0252

ProLabs UK

Email: [salesupport@prolabs.com](mailto:salesupport@prolabs.com)

Telephone: +44 1285 719 600