

## TK-1324-3LCD20

### 1.25Gbps SFP Optical Transceiver, 20KM Reach

#### Features

- Data-rate of 1.25Gbps operation
- 1310nm FP laser and PIN photodetector for 20KM transmission
- Compliant with SFP MSA and SFF-8472 with duplex LC receptacle
- Digital Diagnostic Monitoring:  
Internal Calibration or External Calibration
- Compatible with SONET OC-24-LR-1
- Compatible with RoHS
- +3.3V single power supply
- Operating case temperature:  
Standard : 0 to +70° C  
Extended : -20 to +85° C  
Industrial : -40 to +85°



TK-1324-3LCD20

#### Applications

- Gigabit Ethernet
- Fiber Channel
- Switch to Switch interface
- Switched backplane applications
- Router/Server interface
- Other optical transmission systems

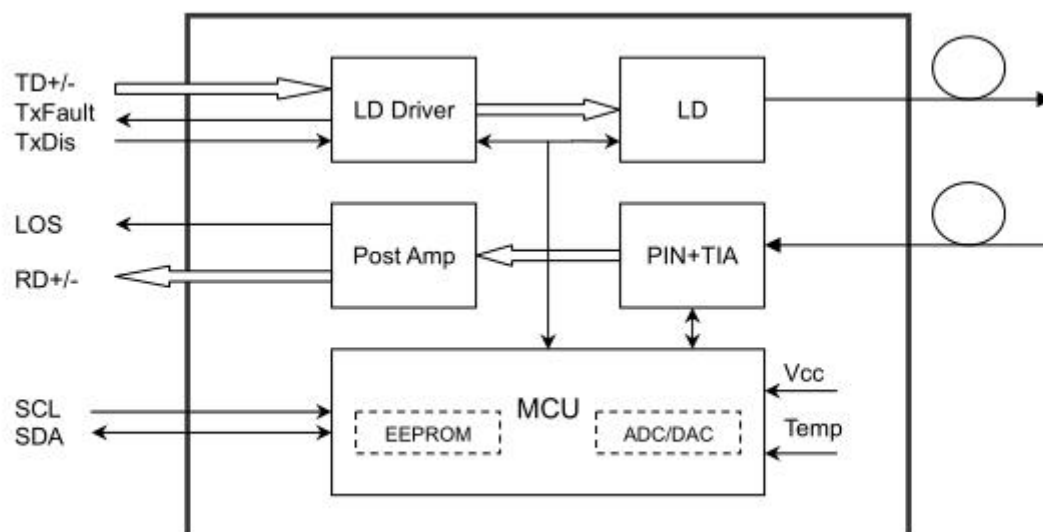
#### Description

The SFP transceivers are high performance, cost effective modules supporting data-rate of 1.25Gbps and 20KM transmission distance with SMF.

The transceiver consists of three sections: a FP laser transmitter, a PIN photodiode integrated with a trans-impedance preamplifier (TIA) and MCU control unit. All modules satisfy class I laser safety requirements.

The transceivers are compatible with SFP Multi-Source Agreement (MSA) and SFF-8472. For further information, please refer to SFP MSA.

## Module Block Diagram



## Absolute Maximum Ratings

| Parameter                  | Symbol | Min  | Typ | Max | Unit | Ref. |
|----------------------------|--------|------|-----|-----|------|------|
| Maximum Supply Voltage     | Vcc    | -0.5 |     | 4.7 | V    |      |
| Storage Temperature        | TS     | -40  |     | 85  | °C   |      |
| Case Operating Temperature | TOP    | 0    |     | 70  | °C   |      |

## Electrical Characteristics (TOP = 0 to 70°C, VCC = 3.15 to 3.60Volts)

| Parameter                      | Symbol     | Min     | Typ | Max         | Unit | Ref. |
|--------------------------------|------------|---------|-----|-------------|------|------|
| Supply Voltage                 | Vcc        | 3.15    | 3.3 | 3.6         | V    |      |
| Supply Current                 | Icc        |         | 185 | 250         | mA   |      |
| <b>Transmitter</b>             |            |         |     |             |      |      |
| Input differential impedance   | Rin        |         | 100 |             | Ω    | 1    |
| Single ended data input swing  | Vin,pp     | 250     |     | 1200        | mV   |      |
| Transmit Disable Voltage       | VD         | Vcc-1.3 |     | Vcc         | V    |      |
| Transmit Enable Voltage        | VEN        | Vee     |     | Vee+ 0.8    | V    | 2    |
| Transmit Disable Assert Time   |            |         |     | 10          | us   |      |
| <b>Receiver</b>                |            |         |     |             |      |      |
| Single ended data output swing | Vout,pp    | 250     |     | 800         | mV   | 3    |
| Data output rise time          | tr         |         | 100 | 175         | ps   | 4    |
| Data output fall time          | tf         |         | 100 | 175         | ps   | 4    |
| LOS Fault                      | VLOS fault | Vcc-0.5 |     | VccHOS<br>T | V    | 5    |
| LOS Normal                     | VLOS norm  | Vee     |     | Vee+0.5     | V    | 5    |
| Power Supply Rejection         | PSR        | 100     |     |             | mVpp | 6    |

### Notes:

- 1) Connected directly to TX data input pins. AC coupled thereafter.
- 2) Or open circuit.

- 3) Into 100 ohms differential termination.
- 4) 20 – 80 %
- 5) Loss Of Signal is LVTTTL. Logic 0 indicates normal operation; logic 1 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.

## Optical Characteristics (TOP = 0 to 70°C, VCC = 3.15 to 3.60 Volts)

| Parameter                                 | Symbol      | Min  | Typ  | Max   | Unit  | Ref. |
|-------------------------------------------|-------------|------|------|-------|-------|------|
| <b>Transmitter</b>                        |             |      |      |       |       |      |
| Output Opt. Pwr (End of Life)             | POUT        | -9.0 |      | -3.0  | dBm   | 1    |
| Optical Wavelength                        | $\lambda$   | 1270 | 1310 | 1360  | nm    |      |
| Wavelength Temperature Dependence         |             |      | 0.08 | 0.125 | nm/°C |      |
| Spectral Width (-20dB)                    | $\sigma$    |      |      | 3.0   | nm    |      |
| Optical Extinction Ratio                  | ER          | 10   |      |       | dB    |      |
| Sidemode Supression ratio                 | SSRmin      | 30   |      |       | dB    |      |
| Optical Rise/Fall Time                    | tr/ tf      |      | 100  | 160   | ps    |      |
| RIN                                       | RIN         |      |      | -120  | dB/Hz |      |
| Transmitter Jitter (peak to peak)         |             |      |      | 100   | ps    |      |
| <b>Receiver</b>                           |             |      |      |       |       |      |
| Average Rx Sensitivity @ Gigabit Ethernet | RSSENS3     |      |      | -24.0 | dBm   | 2    |
| Maximum Input Power                       | PMAX        | -3.0 |      |       | dBm   |      |
| Optical Center Wavelength                 | $\lambda_C$ | 1260 | 1310 | 1620  | nm    |      |
| LOS De -Assert                            | LOSD        |      |      | -26   | dBm   |      |
| LOS Assert                                | LOSA        | -30  |      |       | dBm   |      |
| LOS Hysteresis                            |             |      | 1.0  |       | dB    |      |
| Receiver Jitter Generation @1.25Gbps      |             |      |      | 160   | ps    | 3    |

### Notes:

- 7) Class 1 Laser Safety per FDA/CDRH and IEC-825-1 regulations.
- 8) With worst-case extinction ratio. Measured with a PRBS 27-1 test pattern, @1.25Gb/s, BER<10<sup>-12</sup>.
- 9) Jitter added by receiver (peak to peak). Measured at -18.0dBm average Rx sensitivity, PRBS 27-1 test pattern.

## Pin Descriptions

| Pin | Symbol             | Name/Description                                               | Ref. |
|-----|--------------------|----------------------------------------------------------------|------|
| 1   | V <sub>EET</sub>   | Transmitter Ground (Common with Receiver Ground)               | 1    |
| 2   | T <sub>FAULT</sub> | Transmitter Fault.                                             | 2    |
| 3   | T <sub>DIS</sub>   | Transmitter Disable. Laser output disabled on high or open.    | 3    |
| 4   | MOD_DEF(2)         | Module Definition 2. Data line for Serial ID.                  | 4    |
| 5   | MOD_DEF(1)         | Module Definition 1. Clock line for Serial ID.                 | 4    |
| 6   | MOD_DEF(0)         | Module Definition 0. Grounded within the module.               | 4    |
| 7   | Rate Select        | No connection required                                         |      |
| 8   | LOS                | Loss of Signal indication. Logic 0 indicates normal operation. | 5    |
| 9   | V <sub>EER</sub>   | Receiver Ground (Common with Transmitter Ground)               | 1    |
| 10  | V <sub>EER</sub>   | Receiver Ground (Common with Transmitter Ground)               | 1    |

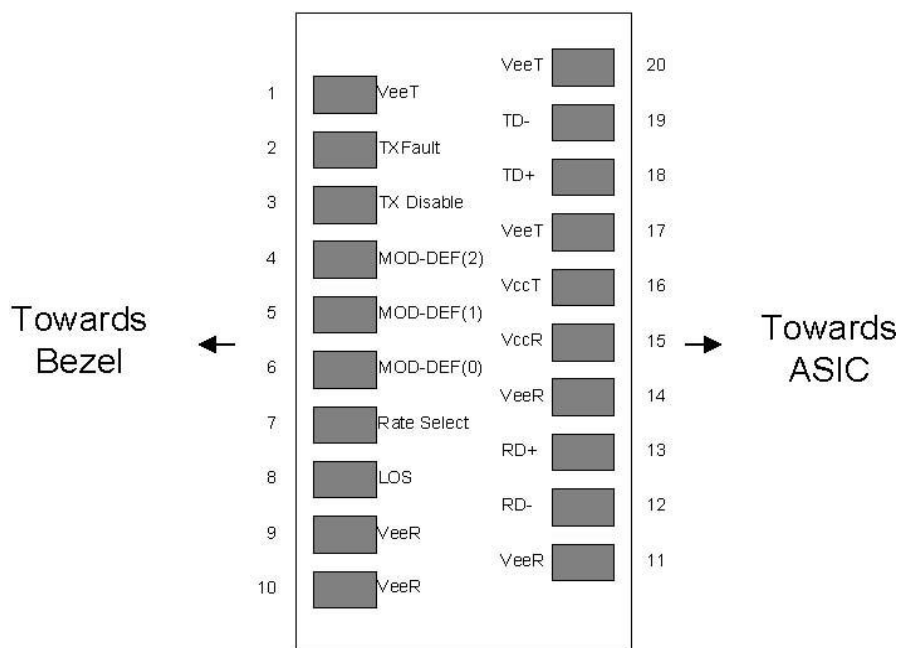
|    |           |                                                  |   |
|----|-----------|--------------------------------------------------|---|
| 11 | $V_{EER}$ | Receiver Ground (Common with Transmitter Ground) | 1 |
| 12 | RD-       | Receiver Inverted DATA out. AC Coupled           |   |
| 13 | RD+       | Receiver Non-inverted DATA out. AC Coupled       |   |
| 14 | $V_{EER}$ | Receiver Ground (Common with Transmitter Ground) | 1 |
| 15 | $V_{CCR}$ | Receiver Power Supply                            |   |
| 16 | $V_{CCT}$ | Transmitter Power Supply                         |   |
| 17 | $V_{EET}$ | Transmitter Ground (Common with Receiver Ground) | 1 |
| 18 | TD+       | Transmitter Non-Inverted DATA in. AC Coupled.    |   |
| 19 | TD-       | Transmitter Inverted DATA in. AC Coupled.        |   |
| 20 | $V_{EET}$ | Transmitter Ground (Common with Receiver Ground) | 1 |

**Notes:**

- 10) Circuit ground is internally isolated from chassis ground.
- 11)  $T_{FAULT}$  is an open collector/drain output, which should be pulled up with a 4.7k – 10k Ohms resistor on the host board if intended for use. Pull up voltage should be between 2.0V to  $V_{CC} + 0.3V$ . A high output indicates a transmitter fault caused by either the TX bias current or the TX output power exceeding the preset alarm thresholds. A low output indicates normal operation. In the low state, the output is pulled to <0.8V.
- 12) Laser output disabled on  $T_{DIS} > 2.0V$  or open, enabled on  $T_{DIS} < 0.8V$ .
- 13) Should be pulled up with 4.7k - 10kohms on host board to a voltage between 2.0V and 3.6V. MOD\_DEF(0) pulls line low to indicate module is plugged in.
- 14) LOS is open collector output. Should be pulled up with 4.7k – 10 kohms on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.

## Pin Definitions

### Pin Diagram



Pinout of Connector Block on Host Board

## Digital Diagnostic Functions

TAKFLY TK-1324-3LCD20 transceivers support the 2-wire serial communication protocol as defined in the SFP MSA1. It is very closely related to the EEPROM defined in the GBIC standard, with the same electrical specifications.

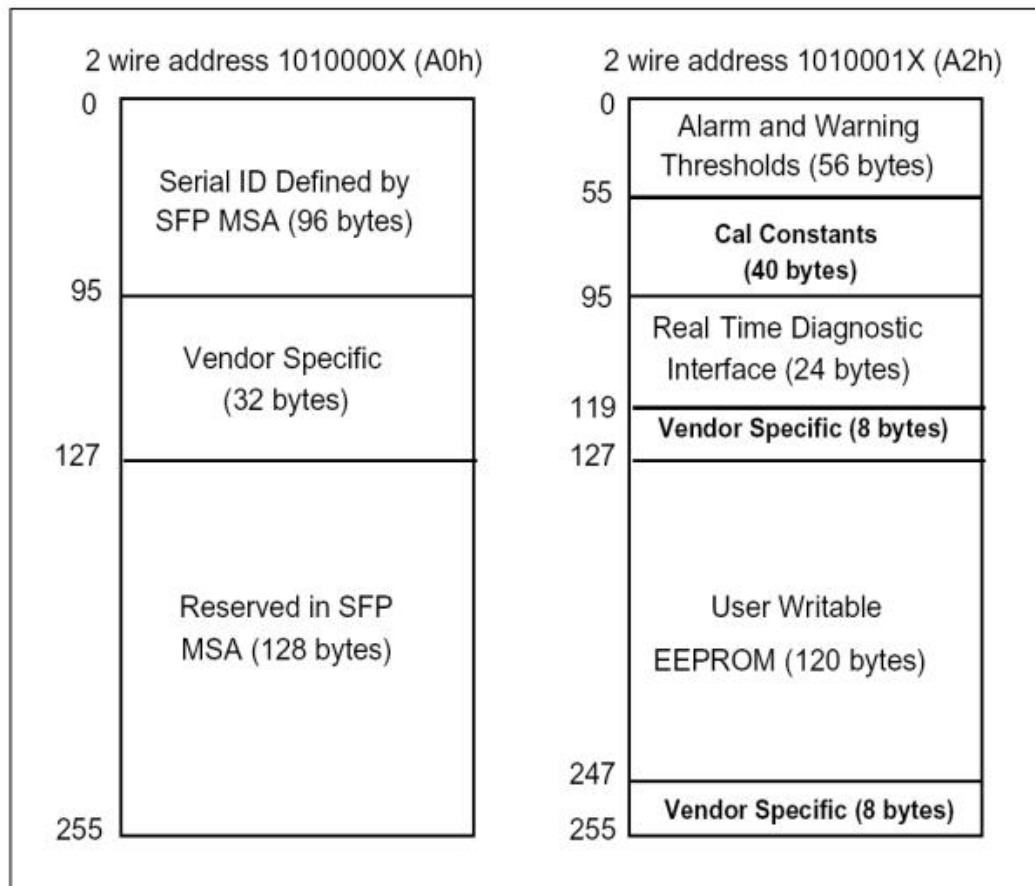
The standard SFP serial ID provides access to identification information that describes the transceiver's capabilities, standard interfaces, manufacturer, and other information. Additionally, TAKFLY SFP transceivers provide a unique enhanced digital diagnostic monitoring interface, which allows real-time access to device operating parameters such as transceiver temperature, laser bias current, transmitted optical power, received optical power and transceiver supply voltage. It also defines a sophisticated system of alarm and warning flags, which alerts end-users when particular operating parameters are outside of a factory set normal range.

The SFP MSA defines a 256-byte memory map in EEPROM that is accessible over a 2-wire serial interface at the 8 bit address 1010000X (A0h). The digital diagnostic monitoring interface makes use

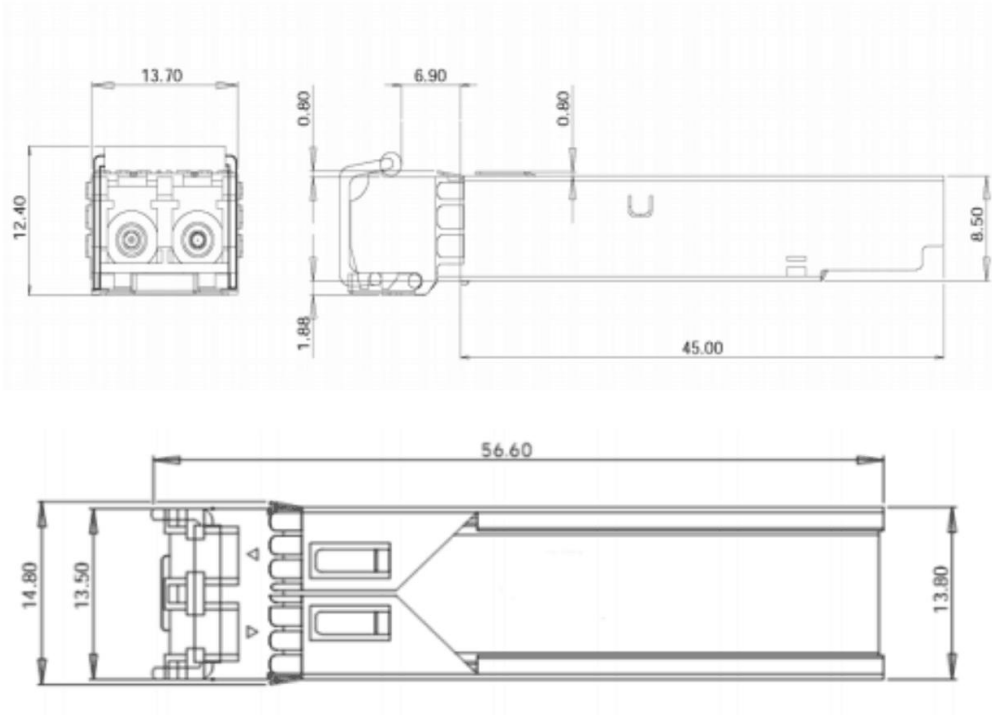
of the 8 bit address 1010001X (A2h), so the originally defined serial ID memory map remains unchanged. The interface is identical to, and is thus fully backward compatible with both the GBIC Specification and the SFP Multi Source Agreement.

The operating and diagnostics information is monitored and reported by a Digital Diagnostics Transceiver Controller (DDTC) inside the transceiver, which is accessed through a 2-wire serial interface. When the serial protocol is activated, the serial clock signal (SCL, Mod Def 1) is generated by the host. The positive edge clocks data into the SFP transceiver into those segments of the E2PROM that are not write-protected. The negative edge clocks data from the SFP transceiver. The serial data signal (SDA, Mod Def 2) is bi-directional for serial data transfer. The host uses SDA in conjunction with SCL to mark the start and end of serial protocol activation. The memories are organized as a series of 8-bit data words that can be addressed individually or sequentially.

Digital diagnostics for the TK-1324-3LCD20 are Internally calibrated by default.



Mechanical Specifications



Regulatory Compliance

| Feature                            | Reference                                        | Performance               |
|------------------------------------|--------------------------------------------------|---------------------------|
| Electrostatic discharge (ESD)      | IEC/EN 61000-4-2                                 | Compatible with standards |
| Electromagnetic Interference (EMI) | FCC Part 15 Class B EN 55022 Class B (CISPR 22A) | Compatible with standards |
| Laser Eye Safety                   | FDA 21CFR 1040.10, 1040.11 IEC/EN 60825-1, 2     | Class 1 laser product     |
| Component Recognition              | IEC/EN 60950, UL                                 | Compatible with standards |
| ROHS                               | 2002/95/EC                                       | Compatible with standards |
| EMC                                | EN61000-3                                        | Compatible with standards |