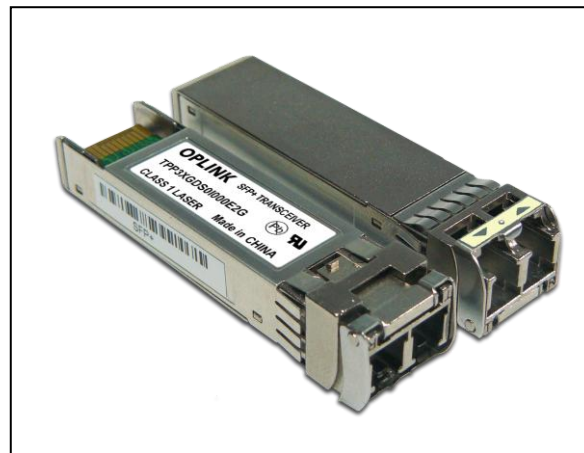




Features

- ☑ 850nm VCSEL laser
- ☑ Transmission distance up to 300m on OM3 MM fiber
- ☑ Low power consumption
- ☑ Wide Case Operating Temperature Range
- ☑ Compliant with SFP+ Electrical MSA SFF-8431
- ☑ Compliant with SFP+ Mechanical MSA SFF-8432
- ☑ Digital Diagnostics Monitoring (DDM) through Serial Interface comply with SFF-8472, Rev. 10.4
- ☑ RoHS 6/6 compliant
- ☑ Compliant with product safety standards



Description

The TPP3XGDS0x000E2G is an enhanced small form factor pluggable (SFP+) fiber optic transceiver with digital diagnostics monitoring functionality (DDM). Supporting Ethernet and Fiber Channel standards makes it ideally suited for 10Gbps data-com and storage area network applications. DDM functionality (alarm and warning features) is integrated into the design via an I²C serial interface per the Multi-Source Agreement (MSA) SFF-8472, Rev. 10.4.

The transceiver supports data rates ranging from 11.3Gbps down to 8Gbps. It provides an excellent solution for transmission at 850nm over up to 300m 2000MHz-km multimode fiber. The sub-watt power consumption and excellent EMI performance allow system design with high port density. The product is RoHS compliant and is designed and tested in accordance with industry safety standards. The transceiver is Class I Laser product per U.S. FDA/CDRH and international IEC-60825 standards.

The TPP3XGDS0x000E2G transceiver connects to standard 20-pad SFP+ connectors for hot plug capability. This allows the system designer to make configuration changes or maintenance by simply plugging in different transceivers without removing the power supply from the host system. The transmitter and receiver DATA interfaces are internally AC-coupled. LV-TTL Transmitter Disable control input and Loss of Signal (LOS) output interfaces are also provided.

The transceiver has bail-type latch, which offers an easy and convenient way to release the modules. The latch is compliant with the SFP MSA.

The transceiver operates from a single +3.3V power supply over an operating case temperature range of -5°C to +70°C (Commercial), or -5°C to +85°C (Extended). The housing is made of metal for EMI immunity.

Absolute Maximum Ratings

| Parameters | Symbol | Min | Max | Units |
|--|------------|-------|-------|-------|
| Storage Temperature Range | T_{ST} | - 40 | + 85 | °C |
| Operating Temperature Range ¹ | Commercial | - 5 | + 70 | °C |
| | Extended | - 5 | + 85 | |
| Operating Relative Humidity ² | RH | 0 | 85 | % |
| Supply Voltage Range | V_{CC} | - 0.5 | + 3.6 | V |

¹ Measured on top side of SFP+ module at the front center vent hole of the cage
² Non condensing

Transmitter Performance Characteristics (Over Operating Case Temperature, $V_{CC}=3.13$ to $3.47V$)

| Parameter | Symbol | Min | Typ | Max | Units |
|--|-----------------------|-----|-------|-------|-------|
| Data Rate | B | 8.0 | - | 11.3 | Gb/s |
| Center Wavelength | λ_C | 840 | 850 | 860 | nm |
| Spectral Width | $\Delta\lambda_{rms}$ | - | - | 0.45 | nm |
| Average Launch Power ¹ | P_{avg} | - 5 | - | - 1 | dBm |
| Launch Power in OMA ¹ | P_{OMA} | - | - 1.5 | - | dBm |
| Extinction Ratio | ER | 3 | - | - | dB |
| Relative Intensity Noise | RIN_{12OMA} | - | - | - 128 | dB/Hz |
| Average Launch Power of OFF Transmitter | P_{off} | - | - | - 30 | dBm |
| Transmitter and Dispersion Penalty @ 10.3125Gb/s | TDP | - | - | 3.9 | dB |

¹ Launch power figures are informative only, per IEEE 802.3ae.

Receiver Performance Characteristics (Over Operating Case Temperature, $V_{CC}=3.13$ to $3.47V$)

| Parameter | Symbol | Min | Typ | Max | Units |
|--|--------------------------------------|------------|------|--------|-------|
| Data Rate | B | 8.0 | - | 11.3 | Gb/s |
| Wavelength of Operation | λ | 840 | - | 860 | nm |
| Receiver Sensitivity | P_{avg} @ 10.3125Gb/s ¹ | - | - | - 9.9 | dBm |
| | OMA @ 10.3125Gb/s ¹ | - | - | - 11.1 | |
| Stressed Receiver Sensitivity in OMA (@10.3125Gb/s) ² | - | - | - | - 7.5 | dBm |
| Maximum Input Power (10^{-12} BER) | P_{MAX} | + 0.5 | - | - | dBm |
| LOS Hysteresis | - | 0.5 | - | - | dB |
| LOS Thresholds | Increasing Light Input | P_{los+} | - | - 11 | dBm |
| | Decreasing Light Input | P_{los-} | - 30 | - | |

¹ Specified with BER $<1 \times 10^{-12}$ and PRBS $2^{31}-1$.
² Compliant with IEEE 802.3ae

Note: The specified characteristics are met within the recommended range of operation. Unless otherwise noted typical data are quoted at nominal voltage and +25°C ambient temperature.

Laser Safety:

All transceivers are Class I Laser products per FDA/CDRH and IEC-60825 standards. They must be operated under specified operating conditions.



Oplink Communications, Inc.

DATE OF MANUFACTURE:

This product complies with
21 CFR 1040.10 and 1040.11
Meets Class I Laser Safety Requirements

Transmitter Electrical Characteristics (Over Operating Case Temperature, $V_{CC}=3.13$ to $3.47V$)

| Parameter | Symbol | Min | Typ | Max | Units |
|--|---------------|-----|-----|--------------|----------|
| Differential Input Impedance | Z_d | - | 100 | - | Ω |
| Differential Input Voltage Swing | $V_{PP-DIFF}$ | 180 | - | 700 | mV |
| Input High Voltage (TX Disable) ¹ | V_{IH} | 2.0 | - | V_{CC} | V |
| Input LOW Voltage (TX Disable) ¹ | V_{IL} | 0 | - | 0.8 | V |
| Output High Voltage (TX Fault) ² | VOH | 2.0 | - | $V_{CC}+0.3$ | V |
| Output LOW Voltage (TX Fault) ² | VOL | 0 | - | 0.8 | V |

¹There is an internal 4.7 k Ω to 10 k Ω pull-up resistor to V_{CC}
²Open collector compatible, 4.7 k Ω to 10 k Ω pull-up resistor to V_{CC} (Host Supply Voltage)

Receiver Electrical Characteristics (Over Operating Case Temperature, $V_{CC}=3.13$ to $3.47V$)

| Parameter | Symbol | Min | Typ | Max | Units |
|--|------------------|--------------|-----|--------------|----------|
| Differential Output Impedance | Z_d | - | 100 | - | Ω |
| Differential Output Swing | $V_{PP-DIFF}$ | 300 | 450 | 850 | mV |
| Output Rise and Fall time 20% to 80% | t_{RH}, t_{FH} | 24 | - | - | ps |
| Output HIGH Voltage (LOS) ¹ | VOH | $V_{CC}-1.3$ | - | $V_{CC}+0.3$ | V |
| Output Low Voltage (LOS) ¹ | VOL | 0 | - | 0.8 | V |

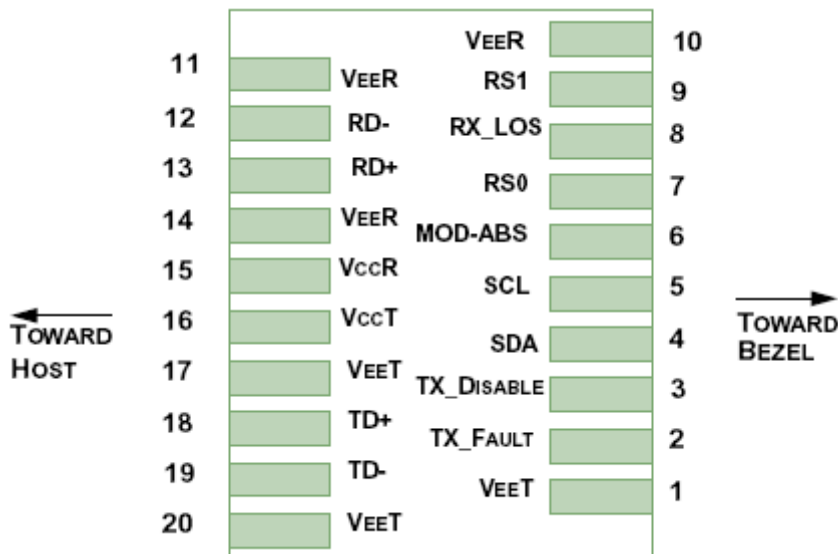
¹Open collector compatible, 4.7 k Ω to 10k Ω pull-up resistor to V_{CC} (Host Supply Voltage)

Electrical Power Supply Characteristics (Over Operating Case Temperature, $V_{CC}=3.13$ to $3.47V$)

| Parameter | Symbol | Min | Typ | Max | Units |
|-----------------------------|-----------|------|------|------|-------|
| Power Supply Voltage | V_{CC} | 3.13 | 3.30 | 3.47 | V |
| DC Common Mode Voltage | V_{CM} | 0 | - | 3.6 | V |
| Supply Current ¹ | I_{VCC} | - | - | 280 | mA |
| Power Consumption | P_W | - | 0.6 | 1.0 | W |

Note: The specified characteristics are met within the recommended range of operation. Unless otherwise noted typical data are quoted at nominal voltage and +25°C ambient temperature.

Connector Pin-out



Electrical Pin Definition

| PIN | Logic | Symbol | Name / Description |
|-----|-----------|-------------------|---|
| 1 | - | <i>VeeT</i> | Module Transmitter Ground |
| 2 | LVTTL-O | <i>TX_Fault</i> | Module Transmitter Fault |
| 3 | LVTTL-I | <i>TX_Disable</i> | Transmitter Disable; Turns off transmitter laser output |
| 4 | LVTTL-I/O | <i>SDA</i> | 2-Wire Serial Interface Data Line |
| 5 | LVTTL-I/O | <i>SCL</i> | 2-Wire Serial Interface Clock |
| 6 | - | <i>MOD-ABS</i> | Module Definition, Grounded in the module |
| 7 | LVTTL-I | <i>RS0</i> | No function implemented |
| 8 | LVTTL-O | <i>RX_LOS</i> | Receiver Loss of Signal Indication |
| 9 | LVTTL-I | <i>RS1</i> | No function implemented |
| 10 | - | <i>VeeR</i> | Module Receiver Ground |
| 11 | - | <i>VeeR</i> | Module Receiver Ground |
| 12 | CML-O | <i>RD-</i> | Receiver Inverted Data Output |
| 13 | CML-O | <i>RD+</i> | Receiver Non-Inverted Data Output |
| 14 | - | <i>VeeR</i> | Module Receiver Ground |
| 15 | - | <i>VccR</i> | Module Receiver 3.3V Supply |
| 16 | - | <i>VccT</i> | Module Transmitter 3.3V Supply |
| 17 | - | <i>VeeT</i> | Module Transmitter Ground |
| 18 | CML-I | <i>TD+</i> | Transmitter Non-Inverted Data Input |
| 19 | CML-I | <i>TD-</i> | Transmitter Inverted Data Input |
| 20 | - | <i>VeeT</i> | Module Transmitter Ground |

Application Notes

Electrical interface: All signal interfaces are compliant with the SFP+ MSA specification. The high speed DATA interface is differential AC-coupled internally and can be directly connected to a 3.3V SERDES IC. All low speed control and sense output signals are open collector TTL compatible and should be pulled up with a 4.7 k Ω - 10k Ω resistor on the host board.

Loss of Signal (LOS): The Loss of Signal circuit monitors the level of the incoming optical signal and generates logic HIGH when an insufficient photocurrent is produced.

TX Fault: The output indicates LOW when the transmitter is operating normally and HIGH with a laser fault including laser end-of-life. TX Fault is an open collector/drain output and should be pulled up with a 4.7 k Ω - 10k Ω resistor on the host board.

TX Disable: When the TX Disable pin is at logic HIGH, the transmitter optical output is disabled. The laser is also disabled if this line is left floating, as it is pulled high inside the transceiver.

Serial Identification and Monitoring: The module definition of SFP is indicated by the MOD_ABS pin and the

2-wire serial interface. Upon power up, the 2-wire interface appears as NC (no connection), and MOD_ABS is TTL LOW. When the host system detects this condition, it activates the serial protocol (standard two-wire I²C serial interface) and generates the serial clock signal (SCL). The positive edge clocks data into the EEPROM segments of the device that are not write protected, and the negative edge clocks data from the device. The serial data signal (SDA) is for serial data transfer. The host uses SDA in conjunction with SCL to mark the start and end of serial protocol activation. The supported monitoring functions are temperature, voltage, bias current, transmitter power, average receiver signal, all alarms and warnings, and software monitoring of TX Fault/LOS. The device is internally calibrated.

The data transfer protocol and the details of the mandatory and vendor specific data structures are defined in the SFP MSA, and SFF-8472, Rev. 10.4.

Power supply and grounding: The power supply line should be well-filtered. All power supply bypass capacitors should be as close to the transceiver module as possible.

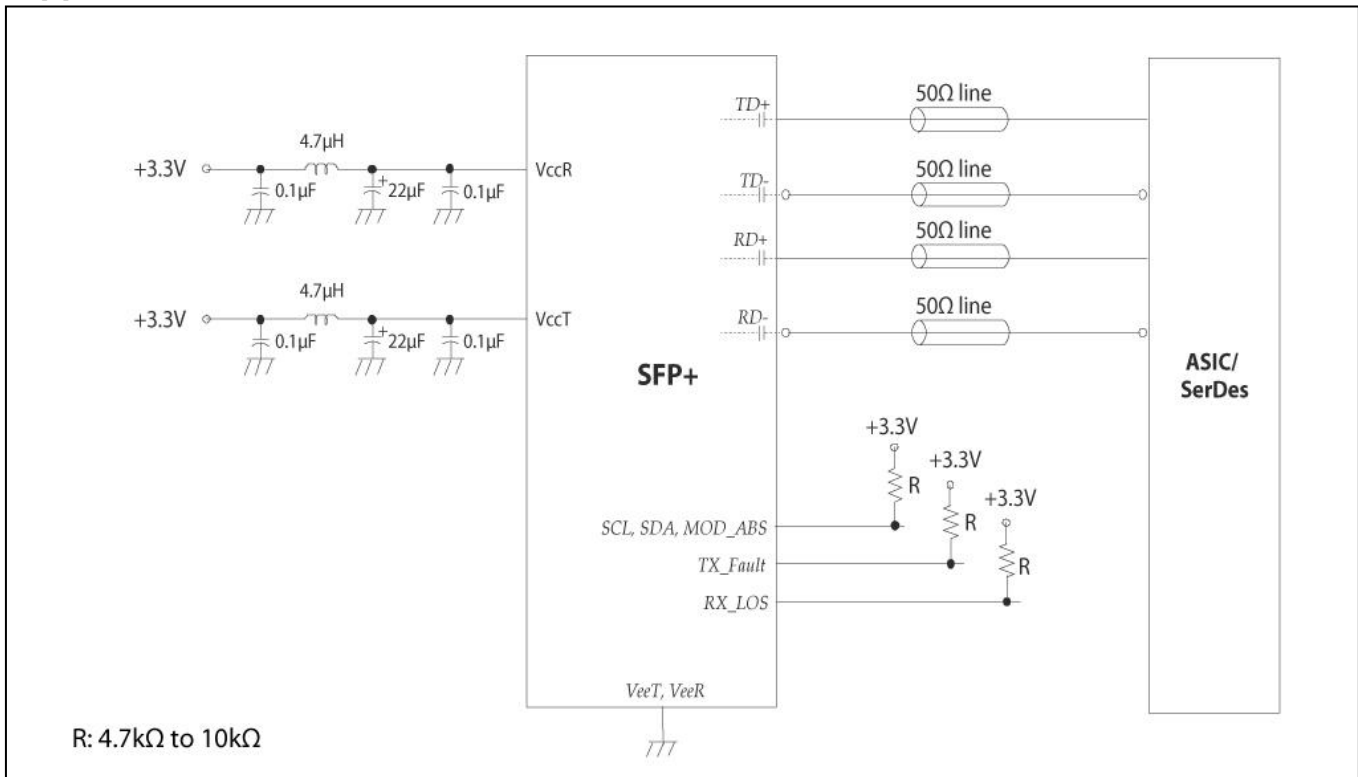
Interfacing the Transceivers

Communication is via a serial 2-wire serial interface. As described in the document SFF-8472 (REV. 10.4) there are two distinct address spaces:

| Base Address A0(hex) | |
|----------------------|---|
| Byte Address | Content |
| 0 – 95 | Serial Transceiver ID as defined in SFP MSA |
| 96 – 127 | OPLINK Specific |
| 128 – 255 | Reserved |

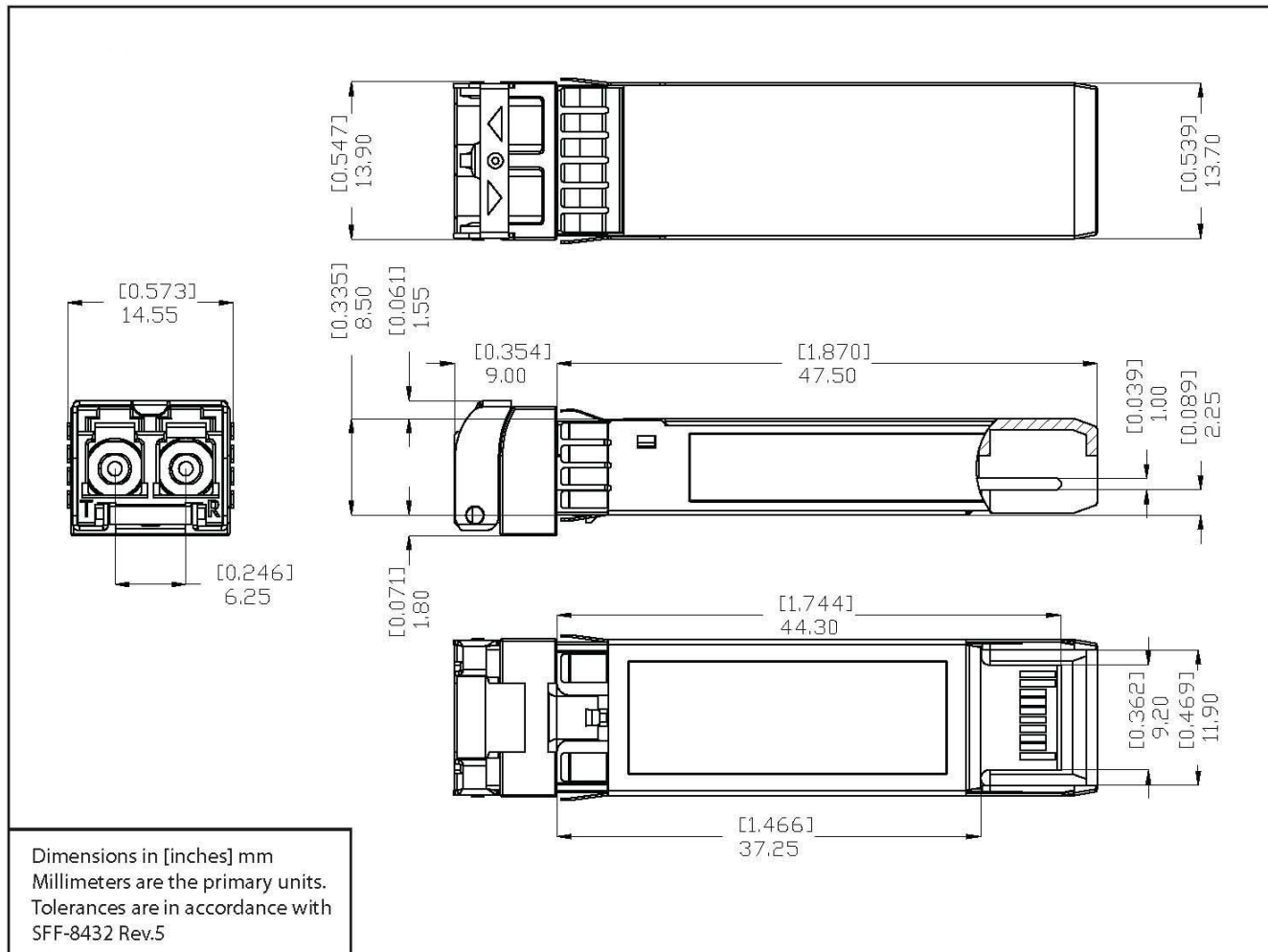
| Base Address A2(hex) | |
|----------------------|---|
| Byte Address | Content |
| 0 - 55 | Alarm & Warnings thresholds & limits |
| 56 - 95 | External calibration constants (not used) |
| 96 – 119 | Values from real time diagnostic monitoring |
| 120 – 127 | Not used |
| 128 – 247 | Customer specific, writable area |
| 248 - 255 | Not used |

Application Schematics



ESD & Electromagnetic Compatibility

| Requirements | Standard | Status |
|---|--|---|
| Electro Static Discharge to the Electrical Pins (ESD) | EIA/JESD22-A114-B MIL-STD 883C Method 3015.7 | Exceeds requirements Class 1B (>1000V) |
| Immunity to ESD (housing, receptacle) | IEN 61000-4-2 | Exceeds requirements Discharges ranging from 2kV to 15kV without damages to the transceiver |
| Electromagnetic Emission (EMI) | FCC Part 15, Class B EN 55022 Class B CISPR 22 | Exceeds requirements Class B |



Ordering Information

| Model Name | Operating Temperature | Nominal Wavelength (nm) | Distance (m) |
|------------------|-----------------------|-------------------------|--------------|
| TPP3XGDS0C000E2G | - 5°C to + 70°C | 850 | 300 |
| TPP3XGDS0E000E2G | - 5°C to + 85°C | 850 | 300 |

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