

FAST ETHERNET SFP SINGLE MODE TRANSCEIVERS WITH DIGITAL DIAGNOSTICS

TRPAFESM

Product Description

The TRPAFESM SFP series of fiber optic transceivers with integrated digital diagnostics monitoring functionality provide a quick and reliable interface for 100BASE-FX Fast Ethernet single mode applications. The diagnostic functions, alarm and warning features as described in the Multi-Source Agreement (MSA) document, SFF-8472 (Rev. 9.4), are provided via an I²C serial interface.

The transmitter optical output power is compliant with ANSI X3.184-1993 standard for FDDI SMF-PMD category I. All modules satisfy Class I Laser Safety requirements in accordance with the U.S. FDA/CDRH and international IEC-60825 standards.

The transceivers connect 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 types of transceivers without removing the power supply from the host system.

The transceivers have bail-type latches, which offer an easy and convenient way to release the modules. The latch is compliant with the SFP MSA.

The transmitter design incorporates a highly reliable 1310nm InGaAsP laser and a driver circuit. The receiver features a transimpedance amplifier IC for high sensitivity and wide dynamic range. The transmitter and receiver DATA interfaces are AC-coupled internally. LV-TTL Transmitter Disable control input and Loss of Signal output interfaces are also provided.

The transceivers operate from a single +3.3V power supply over an operating case temperature range of -5°C to +70°C ("B" option) or -40°C to +85°C ("A" option). The housing is made of plastic and metal for EMI immunity.



Features

- Compatible with SFP MSA
- Designed for Fast Ethernet 100BASE-FX Applications
- Digital Diagnostics through Serial Interface
- Internal Calibration for Digital Diagnostics
- 1310nm Fabry Perot Laser Transmitter
- Eye Safe (Class I Laser Safety)
- Hot-pluggable
- 40°C to +85°C Operating Case Temperature Option
- TX Fault & Loss of Signal Outputs
- TX Disable Input
- Duplex LC Optical Interface
- Single +3.3V Power Supply

Absolute Maximum Ratings

Parameter	Symbol	Minimum	Maximum	Units
Storage Temperature	T_{st}	- 40	+ 85	°C
Operating Case Temperature ¹	"B" option	- 5	+ 70	°C
	"A" option	- 40	+ 85	
Supply Voltage	V_{cc}	0	+ 4.5	V
Input Voltage	V_{in}	0	V_{cc}	V

¹ Measured on top side of SFP module at the front center vent hole of the cage.

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

All parameters guaranteed only at typical data rate

Parameter	Symbol	Minimum	Typical	Maximum	Units
Operating Data Rate ¹	B	-	125	-	Mb/s
Optical Output Power ²	P_O	- 19.0	-	- 14.0	dBm
Center Wavelength	λ_C	1261	-	1360	nm
Spectral Width (RMS)	$\Delta\lambda_{RMS}$	-	-	5.0	nm
Optical Rise/Fall Time (10% to 90%)	t_r, t_f	-	-	2	ns
Extinction Ratio	P_{hi}/P_{lo}	10	-	-	dB
Optical Output Power of OFF Transmitter	P_{OFF}	-	-	- 45	dBm
Duty Cycle Distortion (Peak-to-Peak)	DCD	-	-	1.0	ns
Random Jitter (peak-to-peak) ³	RJ	-	-	0.76	ns
Data Dependent Jitter (peak-to-peak)	DDJ	-	-	0.6	ns
Optical Output Eye ⁴	Compliant with Telcordia GR-253-CORE and ITU-T Recommendation G.957 OC-3/STM-1 Eye Mask				

¹ Data rate ranges from 50Mb/s to 266Mb/s. However, some degradation may be incurred in overall performance.
² Measured average power coupled into single mode fiber. The minimum power specified is at Beginning-of-Life.
³ Defined as 12.6 times the rms value per FDDI SMF-PMD.
⁴ Compliance with the Optical Pulse Envelope in FDDI SMF-PMD is not specified and is not claimed.

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

All parameters guaranteed only at typical data rate

Parameter	Symbol	Minimum	Typical	Maximum	Units
Operating Data Rate ¹	B	-	125	-	Mb/s
Receiver Sensitivity (2.5×10^{-10} BER) ²	P_{min}	- 32.5	- 35.0	-	dBm
Maximum Input Optical Power (2.5×10^{-10} BER) ²	P_{max}	- 7.0	0	-	dBm
LOS Thresholds	Increasing Light Input	P_{los+}	$P_{los-} + 1.5$ dB	-	dBm
	Decreasing Light Input	P_{los-}	- 45.0	-	
LOS Hysteresis	-	1.5	-	-	dB
LOS Timing Delay	Increasing Light Input	t_{loss_off}	-	100	μ s
	Decreasing Light Input	t_{loss_on}	-	350	
Wavelength of Operation	λ	1100	-	1600	nm
Contributed Duty Cycle Distortion Jitter (peak-to-peak)	DCD	-	-	0.4	ns
Contributed Data Dependent Jitter (peak-to-peak)	DDJ	-	-	1.0	ns
Contributed Random Jitter (peak-to-peak) ³	RJ	-	-	2.14	ns

¹ Data rate ranges from 50Mb/s to 266Mb/s. However, some degradation may be incurred in overall performance.
² Specified in average optical input power, and when measured at 1310nm wavelength, 125Mb/s, 2⁷-1 PRBS with optical input rise/fall time of 2.5ns and optimum sampling.
³ Defined as 12.6 times the rms value per FDDI SMF-PMD.

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

Parameter	Symbol	Minimum	Typical	Maximum	Units
Input Voltage Swing (TD+ & TD-) ¹	V_{PP-DIF}	0.25	-	2.4	V
Input HIGH Voltage (TX Disable) ²	V_{IH}	2.0	-	V_{CC}	V
Input LOW Voltage (TX Disable) ²	V_{IL}	0	-	0.8	V
Output HIGH Voltage (TX_FAULT) ³	V_{OH}	2.0	-	$V_{CC} + 0.3$	V
Output LOW Voltage (TX_FAULT) ³	V_{OL}	0	-	0.8	V

¹ Differential peak-to-peak voltage.
² There is an internal 4.7 to 10k Ω pull-up resistor to V_{CC} .
³ Open collector compatible, 4.7 to 10k Ω pull-up resistor to V_{CC} (Host Supply Voltage).

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

Parameter	Symbol	Minimum	Typical	Maximum	Units
Output Voltage Swing (RD+ & RD-) ¹	V_{PP-DIF}	0.6	-	2.0	V
Output HIGH Voltage (LOS) ²	V_{OH}	2.0	-	$V_{CC} + 0.3$	V
Output LOW Voltage (LOS) ²	V_{OL}	0	-	0.5	V

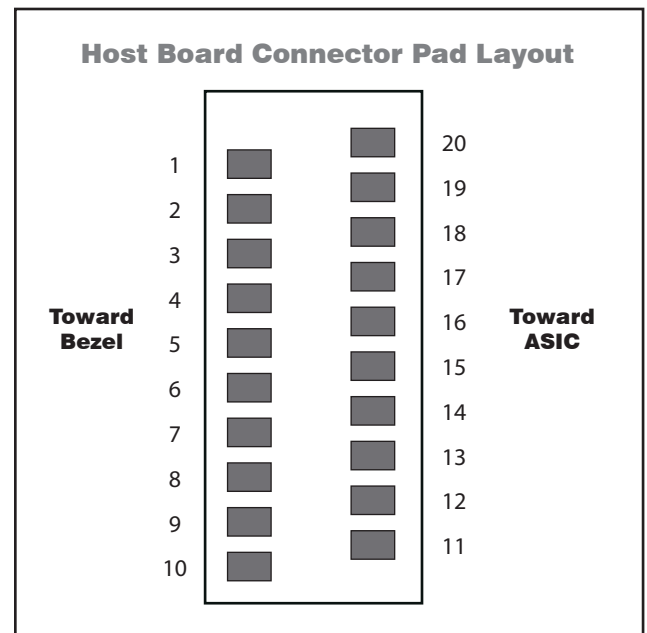
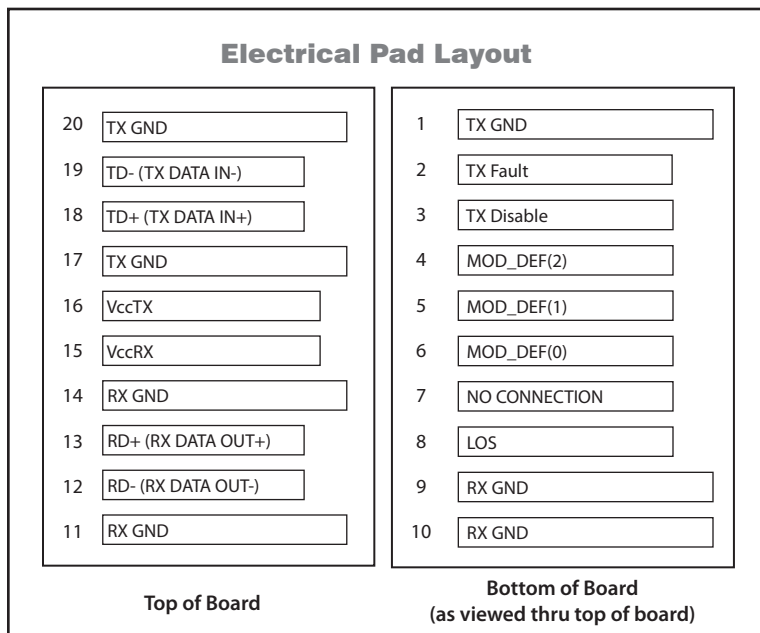
¹ Differential peak-to-peak voltage across external 100 Ω load.
² Open collector compatible, 4.7 to 10k Ω pull-up resistor to V_{CC} (Host Supply Voltage).

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

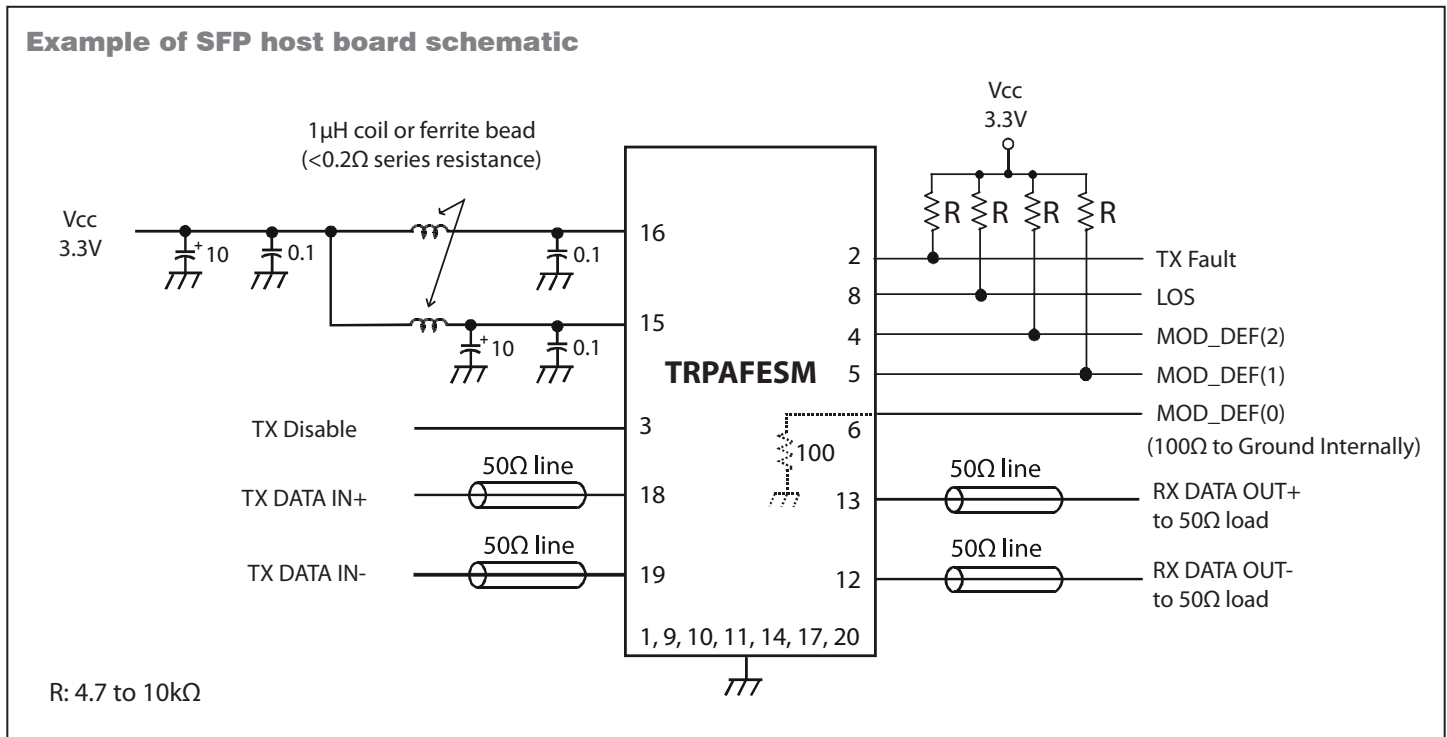
Parameter	Symbol	Minimum	Typical	Maximum	Units
Supply Voltage	V_{CC}	3.13	3.3	3.47	V
Supply Current	I_{CC}	-	175	245	mA

Module Definition

MOD_DEF(0) pin 6	MOD_DEF(1) pin 5	MOD_DEF(2) pin 4	Interpretation by Host
TTL LOW	SCL	SDA	Serial module definition protocol



Example of SFP host board schematic



Application Notes

Electrical Interface: All signal interfaces are compliant with the SFP MSA specification. The high speed DATA interface is differential AC-coupled internally with 0.1μF 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 - 10kΩ resistor on the host board.

Loss of Signal (LOS): The Loss of Signal circuit monitors the level of the incoming optical signal and generates a 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 - 10kΩ resistor on the host board. TX Fault is non-latching (automatically deasserts when fault goes away).

TX Disable: When the TX Disable pin is at logic HIGH, the transmitter optical output is disabled (less than -45dBm).

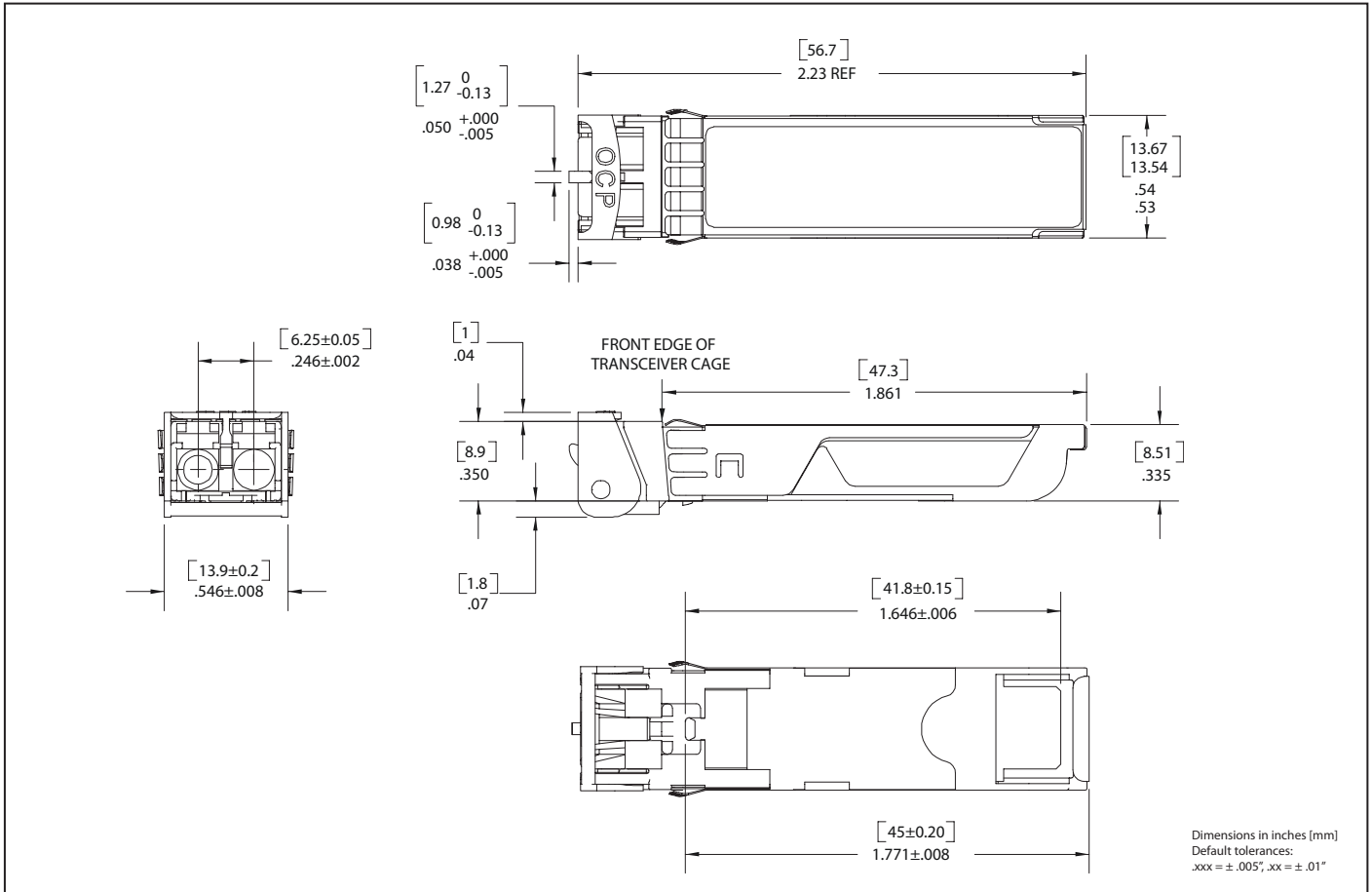
Serial Identification and Monitoring: The module definition of SFP is indicated by the three module definition pins, MOD_DEF(0), MOD_DEF(1) and MOD_DEF(2). Upon power up, MOD_

DEF(1:2) appear as NC (no connection), and MOD_DEF(0) 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 SFP that are not write protected, and the negative edge clocks data from the SFP. 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. 9.4.

Power Supply and Grounding: The power supply line should be well-filtered. All 0.1μF power supply bypass capacitors should be as close to the transceiver module as possible.

Package Outline



Ordering Information

Oplink can provide a remarkable range of customized optical solutions. For detail, please contact Oplink's Sales and Marketing for your requirements and ordering information (510) 933-7200 or Sales@oplink.com.