



# FOPSFP125SM

## 1.25Gb/s 1310nm Single-mode SFP Transceiver

### PRODUCT FEATURES

- Up to 1.25Gb/s data links
- FP laser transmitter and PIN photo-detector
- Up to 20km on 9/125µm SMF
- Hot-pluggable SFP footprint
- Duplex LC/UPC type pluggable optical interface
- Low power dissipation
- Metal enclosure, for lower EMI
- RoHS compliant and lead-free
- Single +3.3V power supply
- Compliant with SFF-8472
- Case operating temperature: Commercial: 0°C to +70°C



### APPLICATIONS

- Switch to Switch Interface
- Gigabit Ethernet
- Switched Backplane Applications
- Router/Server Interface



- Other Optical Links

## PRODUCT DESCRIPTION

The Small Form Factor Pluggable Multi-Sourcing Agreement is compatible with FOPPEX’s FOPSFP125SM Small Form Factor Pluggable (SFP) transceivers (MSA). The LD driver, limiting amplifier, digital diagnostic monitor, 1310nm FP laser, and PIN photo-detector are the five components that make up the transceiver. The module data link can travel up to 20KM in single-mode fiber at 9/125um.

The system can also disable the module through I2C. The optical output can be disabled by a TTL logic high-level input of Tx Disable. Tx Fault is used to show that the laser has degraded. The loss of a receiver's optical input signal or the state of the link with a partner is indicated by the loss of signal (LOS) output. The LOS (or Link)/Disable/Fault information can also be obtained by the system using I2C register access.

### Ordering information

Product Number	part	Data Rate (Mbps)	Media	Wave length (nm)	Transmission Distance(m)	Temperature (Tcase) (°C)	Range
FOPSFP125SM		1250	Single-mode fiber	1310	20	0~70	commercial

## I. Pin Descriptions

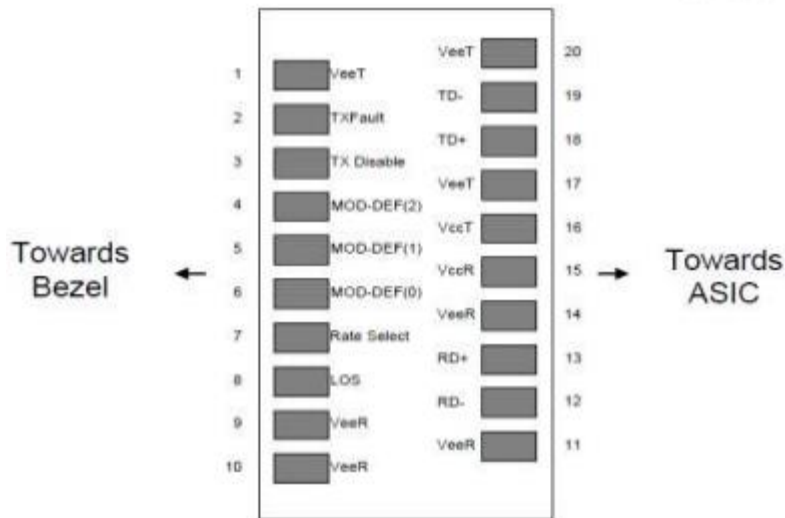
Pin	Symbol	Name/Description	Ref.
1	V <sub>EET</sub>	Transmitter Ground (Common with Receiver Ground)	1
2	T <sub>FAULT</sub>	Transmitter Fault.	
3	T <sub>DIS</sub>	Transmitter Disable. Laser output disabled on high or open.	2
4	MOD_DEF (2)	Module Definition 2. Data line for Serial ID.	3
5	MOD_DEF (1)	Module Definition 1. Clock line for Serial ID.	3
6	MOD_DEF (0)	Module Definition 0. Grounded within the module.	3
7	Rate Select	No connection required	4
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 <sub>EER</sub>	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 <sub>EER</sub>	Receiver Ground (Common with Transmitter Ground)	1
15	V <sub>CCR</sub>	Receiver Power Supply	
16	V <sub>CCT</sub>	Transmitter Power Supply	
17	V <sub>EET</sub>	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 <sub>EET</sub>	Transmitter Ground (Common with Receiver Ground)	1

Notes:

- Internal isolation exists between circuit ground and chassis ground.
- Laser output disabled on TDIS >2.0V or open, enabled on TDIS <0.8V.
- 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.
- This is an optional input used to control the receiver bandwidth for compatibility with multiple data rates (most likely Fiber Channel 1x and 2x Rates). If implemented, the input will be internally pulled down with > 30kΩ resistor. The input states are:
  - Low (0 – 0.8V): Reduced Bandwidth
  - (>0.8, < 2.0V): Undefined
  - High (2.0 – 3.465V): Full Bandwidth
  - Open: Reduced Bandwidth
- LOS is open collector output should be pulled up with 4.7k - 10kohms on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.



Pin out of Connector Block on Host Board

## II. Absolute Maximum Ratings

Parameter	Symbol	Min	Typ.	Max	Unit	Note
Storage Temperature	$T_s$	-40		85	°C	
Storage Ambient Humidity	$H_A$	5		95	%	
Power Supply Voltage	$V_{CC}$	-0.5		4	V	
Signal Input Voltage		-0.3		$V_{CC} + 0.3$	V	
Receiver Damage Threshold		+5			dBm	

## III. Recommended Operating Conditions

Parameter	Symbol	Min	Typ.	Max	Unit	Note
Case Operating Temperature	$T_{case}$	0		70	°C	FOPSFP125SM
Ambient Humidity	$H_A$	5		70	%	Non-condensing
Power Supply Voltage	$V_{CC}$	3.13	3.3	3.47	V	
Power Supply Current	$I_{CC}$			280	mA	



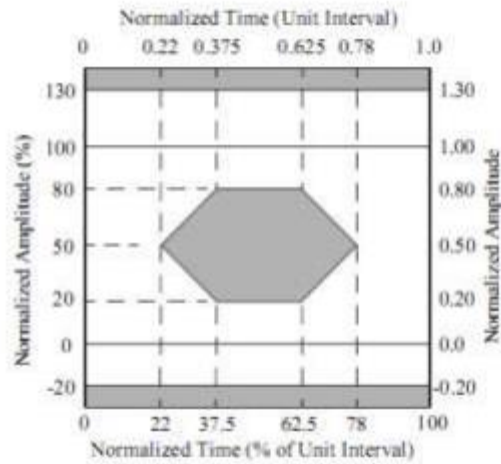
Power Supply Noise Rejection				100	mVp-p	100Hz to 1MHz
Data Rate			1250/1250		Mbps	TX Rate/RX Rate
Transmission Distance				20	KM	
Coupled Fiber	Single-mode fiber					90/125um SMF

#### IV. Specification of Transmitter

Parameter	Symbol	Min	Typ.	Max	Unit	Notes
Average Output Power	$P_{OUT}$	-9		-3	dBm	
Extinction Ratio	ER	9			dB	
Center Wavelength	$\lambda_c$	1270	1310	1360	nm	FP Laser
Spectrum Bandwidth (RMS)	$\sigma$			3.5	nm	
Transmitter OFF Output Power	$P_{OFF}$			-45	dBm	
Differential Line Input Impedance	RIN	90	100	110	Ohm	
Jitter P-P	$J$			128	ps	Note (1)
Output Eye Mask	Compliant with IEEE802.3 z (class 1 laser safety)					Note (2)

Note (1): Measure at  $2^7-1$  NRZ PRBS pattern

Note (2): Transmitter eye mask definition



## V. Specification of Receiver

Parameter	Symbol	Min	Typ.	Max	Unit	Notes
Input Optical Wavelength	$\lambda_{IN}$	1270		1610	nm	PIN-TIA
Receiver Sensitivity	$P_{IN}$			-20	dBm	Note (1)
Input Saturation Power (Overload)	$P_{SAT}$	-3			dBm	
Los Of Signal Assert	$P_A$			-20	dBm	
Los Of Signal De-assert	$P_D$	-38			dBm	Note (2)
LOS Hysteresis	$P_A - P_D$	0.5	2	6	dB	

Note (1): Measured with Light source 1310nm, ER= 9dB; BER =  $< 10^{-12}$  @ PRBS =  $2^7-1$  NRZ

Note (2): When LOS de-asserted, the RX data+/- output is High-level (fixed)



## VI. Electrical Interface Characteristics

Parameter	Symbol	Min	Typ.	Max	Unit	Ref.
<b>Transmitter</b>						
Total Supply Current	I <sub>CC</sub>			A	mA	Note (1)
Transmitter Disable Input-High	V <sub>DISH</sub>	2		V <sub>CC</sub> +0.3	V	
Transmitter Disable Input-Low	V <sub>DISL</sub>	0		0.8	V	
Transmitter Fault Input-High	V <sub>DISL</sub>	2		V <sub>CC</sub> +0.3	V	
Transmitter Fault Input-Low	V <sub>TxFH</sub>	0		0.8	V	
<b>Receiver</b>						
Total Supply Current	I <sub>CC</sub>			B	mA	Note (1)
LOSS Output Voltage-High	V <sub>LOSH</sub>	2		V <sub>CC</sub> +0.3	V	LVTTTL
LOSS Output Voltage-Low	V <sub>LOSL</sub>	0		0.8	V	

Note (1): A (TX) + B (RX) = 280mA (Not include termination circuit)

## VII. Digital Diagnostic Functions

The SFP MSA's 2-wire serial communication protocol is supported by FOPPEX's FOPSFP125SM transceivers. With the same electrical characteristics, it is extremely similar to the E2PROM described in the GBIC standard. Access to identification data describing the transceiver's capabilities, common interfaces, manufacturer, and other details is made possible by the standard SFP serial ID.

Foppex SFP transceivers also include a special enhanced digital diagnostic monitoring interface that enables real-time access to device operating metrics such transceiver temperature, laser bias current, transmitted optical power, received optical power, and transceiver supply voltage. Additionally, it specifies a complex system of alarm and warning flags that warns end users when specific operating parameters depart from a factory-defined typical range.

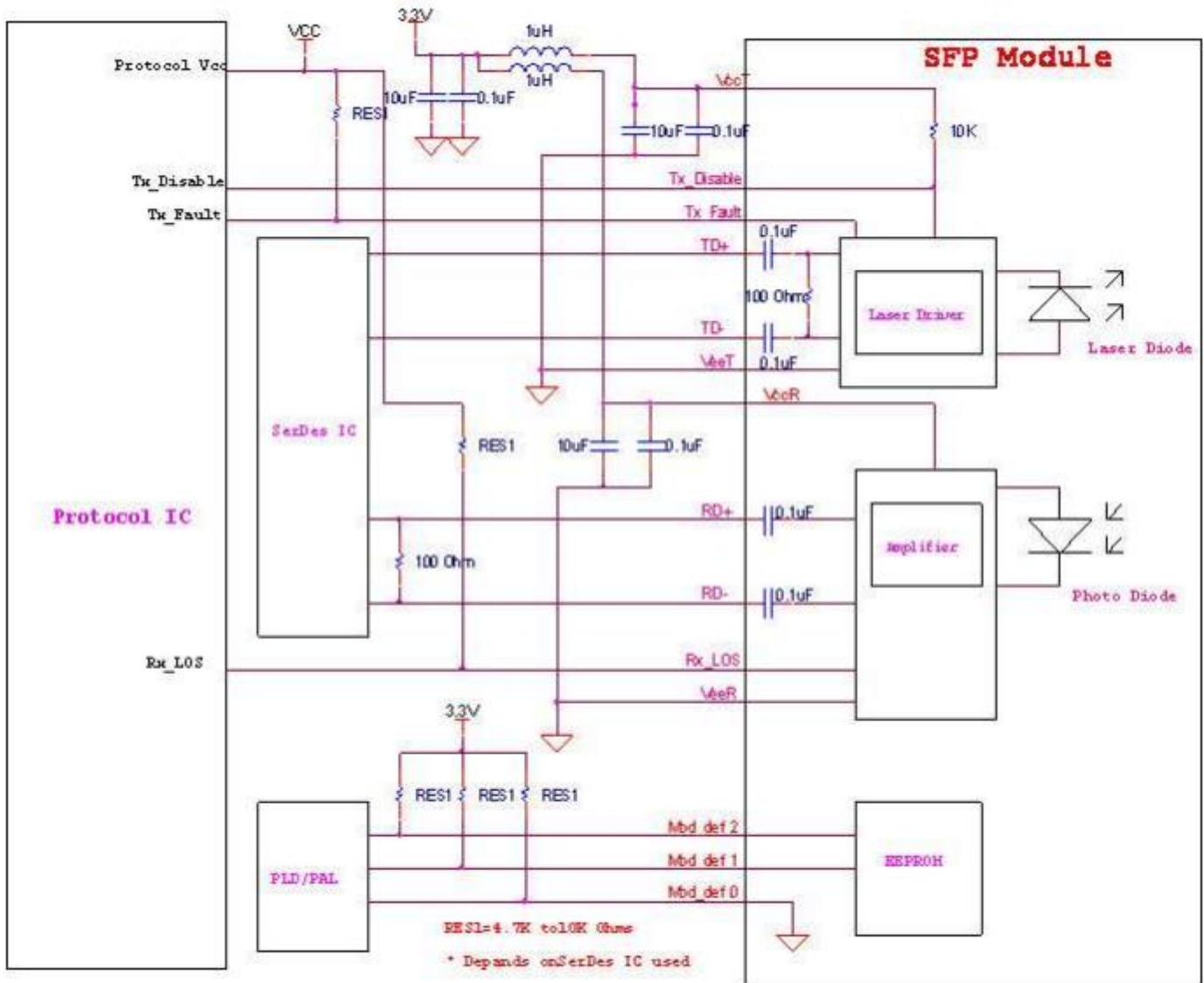
At the 8-bit address 1010000X, the SFP MSA provides a 256-byte memory map in E2PROM that is reachable over a 2-wire serial interface (A0h). The initial serial ID memory map is unaltered because the digital diagnostic monitoring interface uses the 8-bit address 1010001X (A2h). Both the GBIC Specification and the SFP Multi Source Agreement are fully backward compatible with the interface because they are identical to one another.

A Digital Diagnostics Transceiver Controller (DDTC) inside the transceiver, which is accessed through a 2-wire serial interface, keeps track of and reports on the operational and diagnostics data. The host generates the serial clock signal (SCL, Mod Def 1) when the serial protocol is enabled.

The E2PROM's non-write-protected segments receive data from the SFP transceiver via the positive edge. Data from the SFP transceiver is clocked by the negative edge. For serial data transfer, the serial data signal (SDA, Mod Def 2) is bi-directional. SDA and SCL are used by the host to signal the beginning and conclusion of serial protocol activation. Eight-bit data words that can be addressed singly or consecutively make up the memory structure.

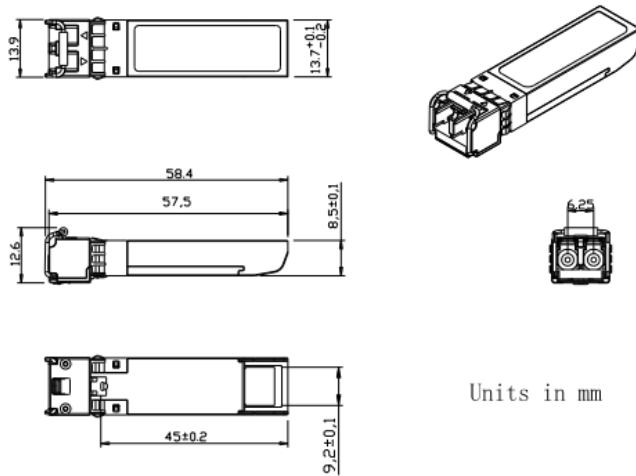
The FOPSFP125SM's digital diagnostics are by default internally calibrated.

### VIII. Recommend Circuit Schematic





## IX. Mechanical Specifications (Unit: mm)



FOPSFP125SM

## X. 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