



## 4G CWDM SFP 40km Transceiver FPC-xx4G-04xD

### Features

- ◆ Single 3.3 V supply
- ◆ 40 km reach
- ◆ Supports 1.06/2.125/4.25Gb/s Fiber Channel Operation
- ◆ Gigabit Ethernet compatible
- ◆ CWDM DFB Laser
- ◆ SFP MSA SFF-8074i compliant
- ◆ Digital Diagnostic SFF-8472 compliant
- ◆ Compatible with RoHS
- ◆ Operating case temperature:  
Standard : 0 to +70°C  
Industrial : -40 to +85°C



### Applications

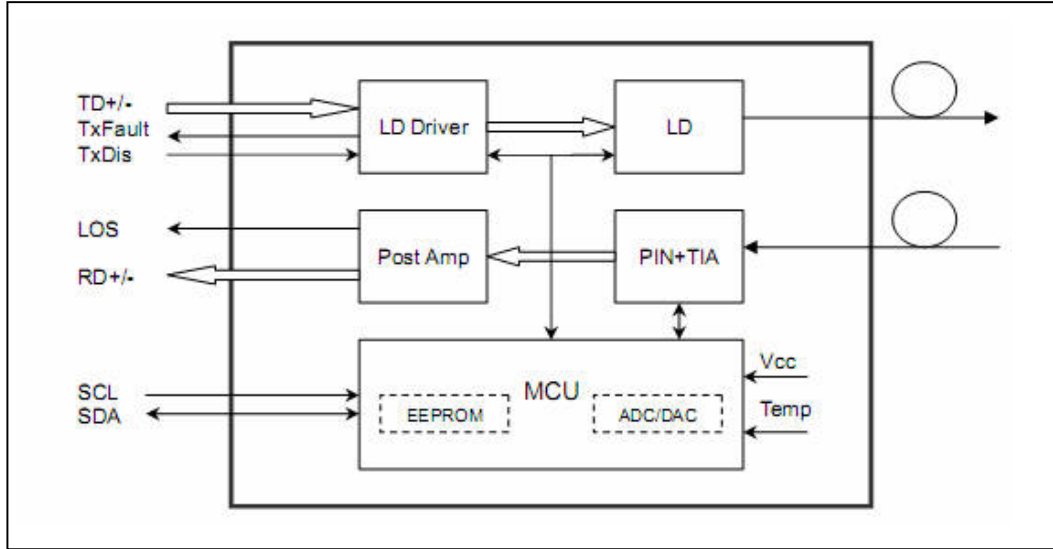
- ◆ Tri Rate 1.0625 / 2.125 / 4.25Gbp/s Fiber Channel

### Description

The transceiver consists of three sections: a CWDM 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 the Small Form Factor Pluggable Multi-Sourcing Agreement (MSA)<sup>1</sup>. They are compatible with Fiber Channel per FC-PI-2 Rev. 10.0. Also simultaneously compatible with Gigabit Ethernet as specified in IEEE Std 802.3.

### Module Block Diagram



### Absolute Maximum Ratings

Table 1 - Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Units	Notes
Storage Temperature	Tst	-40	+85	°C	-
Operating Case Temperature	Tc	0	70	°C	-
Operating Humidity	RH	5	90	%	Non-condensing
Power Supply Voltage	Vcc-Vee	0	3.6	V	-

### Recommended Operating Conditions

Table 2 - Recommended Operating Conditions

Parameter	Symbol	Min	Typical	Max	Unit
Operating Case Temperature	Standard	Tc	0	+70	°C
	Industrial	Tc	-40	+85	°C
Power Supply Voltage	Vcc	3.13	3.3	3.47	V
Power Supply Current	Icc			300	mA

### Optical and Electrical Characteristics

FPC-XX4G-04x(D): ( CWDM+PIN, 40km Reach)

Table 3 - Optical and Electrical Characteristics



Parameter	Symbol	Min	Typical	Max	Unit	Notes
<b>Transmitter</b>						
Data Rate			4.25		Gb/S	
Centre Wavelength	$\lambda_c$	-6.5nm	1XXX	+6.5nm	nm	
Spectral Width	$\Delta\lambda$			1	nm	
Side Mode Suppression Ratio	SMSR	20			dB	
Average Output Power(BOL)	P <sub>out</sub>	0		5	dBm	1
Extinction Ratio	ER	5			dB	
Average Launch Power-OFF Transmitter	P <sub>out</sub>			-40	dBm	
Optical Eye Diagram	Fiber Channel Compliant					
Optical Rise/Fall Time (20%~80%)	tr/tf			120	ps	
Data Input Swing Differential	V <sub>IN</sub>	200		2400	mV	2
Input Differential Impedance	Z <sub>IN</sub>	90	100	120	$\Omega$	
TX Disable	Disable	2.0		V <sub>cc</sub>	V	
	Enable	0		0.8	V	
TX Fault	Fault	2.0		V <sub>cc</sub>	V	
	Normal	0		0.8	V	
<b>Receiver</b>						
Centre Wavelength	$\lambda_c$	1260		1610	nm	
Receiver Sensitivity(BOL)	Sen			-18	dBm	3
LOS De-Assert	LOS <sub>D</sub>			-18	dBm	
LOS Assert	LOS <sub>A</sub>	-28			dBm	
LOS Hysteresis		0.5		6	dB	
Receiver Reflectance				-20	dB	
Data Output Swing Differential	V <sub>out</sub>	350		1800	mV	4
Loss of Signal (LOS) Assert Time	T <sub>Assert</sub>			500	nS	
Loss of Signal (LOS) Deassert Time	T <sub>Deassert</sub>			500	nS	
LOS	High	2.0		V <sub>cc</sub>	V	
	Low			0.8	V	

**Notes:**

1. The optical power is launched into SMF.
2. PECL input, internally AC-coupled and terminated.
3. Measured with a PRBS 2<sup>7</sup>-1 test pattern @4250Mbps, BER  $\leq 1 \times 10^{-12}$ .
4. CML Output, internally AC-coupled.

**Timing and Electrical**

**Table 4 - Timing and Electrical**

Parameter	Symbol	Min	Typical	Max	Unit
Tx Disable Negate Time	t <sub>on</sub>			1	ms



Tx Disable Assert Time	t_off			10	μs
Time To Initialize, including Reset of Tx Fault	t_init			300	ms
Tx Fault Assert Time	t_fault			100	μs
Tx Disable To Reset	t_reset	10			μs
LOS Assert Time	t_loss_on			100	μs
LOS De-assert Time	t_loss_off			100	μs
Serial ID Clock Rate	f_serial_clock			400	KHz
MOD_DEF (0:2)-High	V <sub>H</sub>	2		V <sub>cc</sub>	V
MOD_DEF (0:2)-Low	V <sub>L</sub>			0.8	V

## Diagnostics

**Table 5 – Diagnostics Specification**

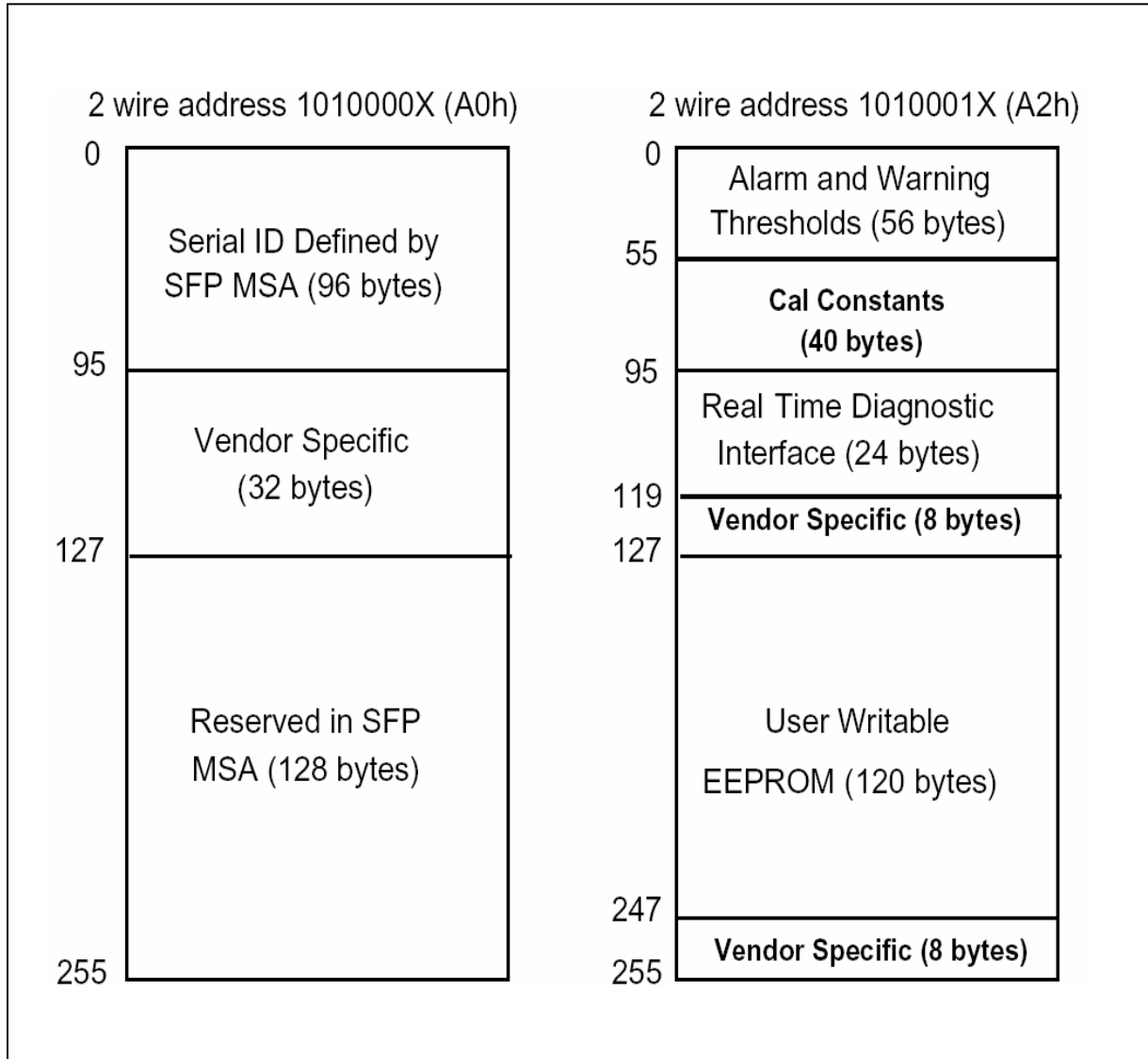
Parameter	Range	Unit	Accuracy	Calibration
Temperature	0 to +70	°C	±3°C	Internal / External
	-40 to +85			
Voltage	3.0 to 3.6	V	±3%	Internal / External
Bias Current	0 to 100	mA	±10%	Internal / External
TX Power	-9 to -3	dBm	±3dB	Internal / External
RX Power	-23 to -3	dBm	±3dB	Internal / External

## Digital Diagnostic Memory Map

The transceivers provide serial ID memory contents and diagnostic information about the present operating conditions by the 2-wire serial interface (SCL, SDA).

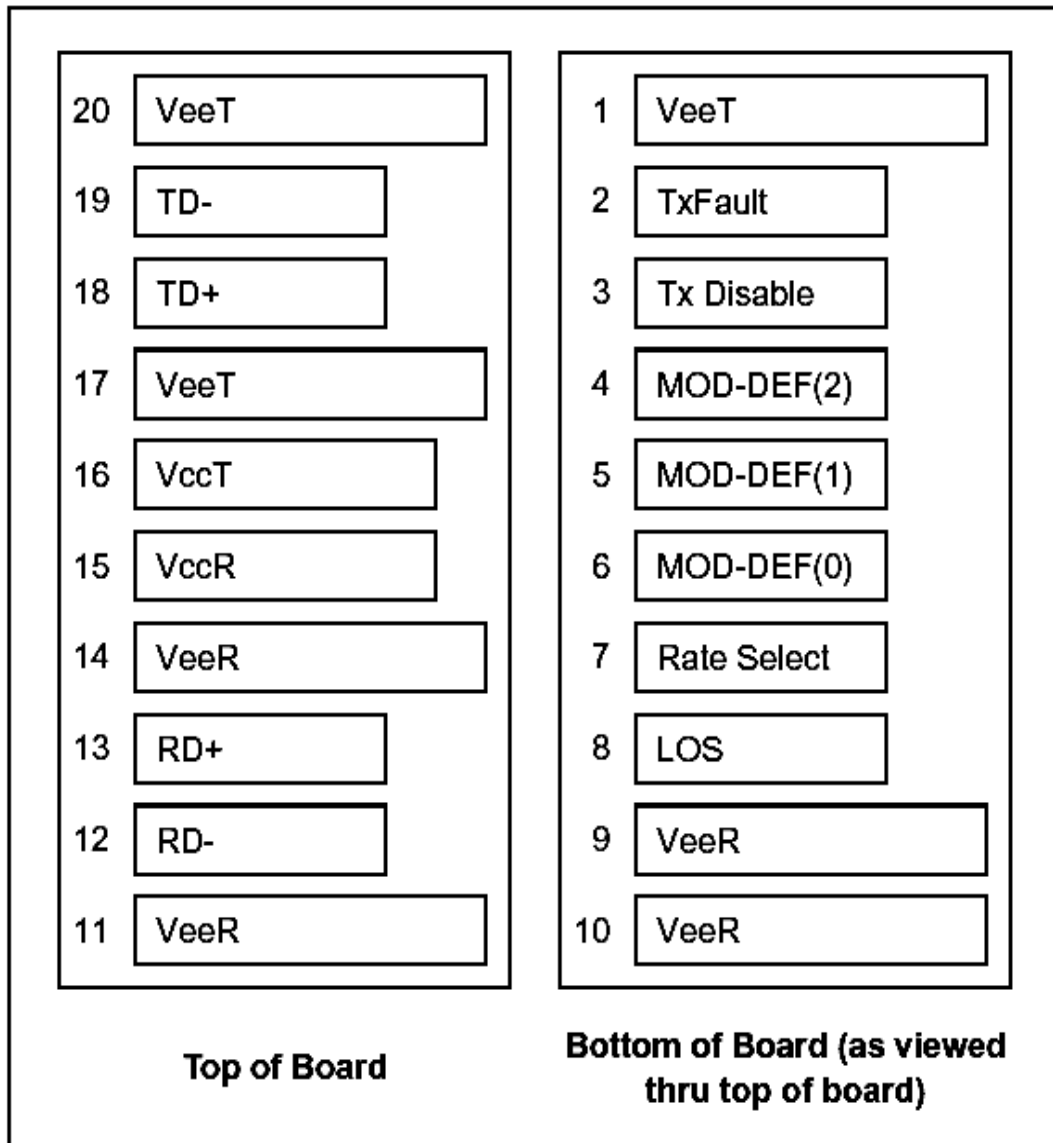
The diagnostic information with internal calibration or external calibration all are implemented, including received power monitoring, transmitted power monitoring, bias current monitoring, supply voltage monitoring and temperature monitoring.

The digital diagnostic memory map specific data field defines as following.



**Pin Definitions**

Pin Diagram



### Pin Descriptions

Pin	Signal Name	Description	Plug Seq.	Notes
1	V <sub>EET</sub>	Transmitter Ground	1	
2	TX FAULT	Transmitter Fault Indication	3	Note 1
3	TXDISABLE	Transmitter Disable	3	Note 2



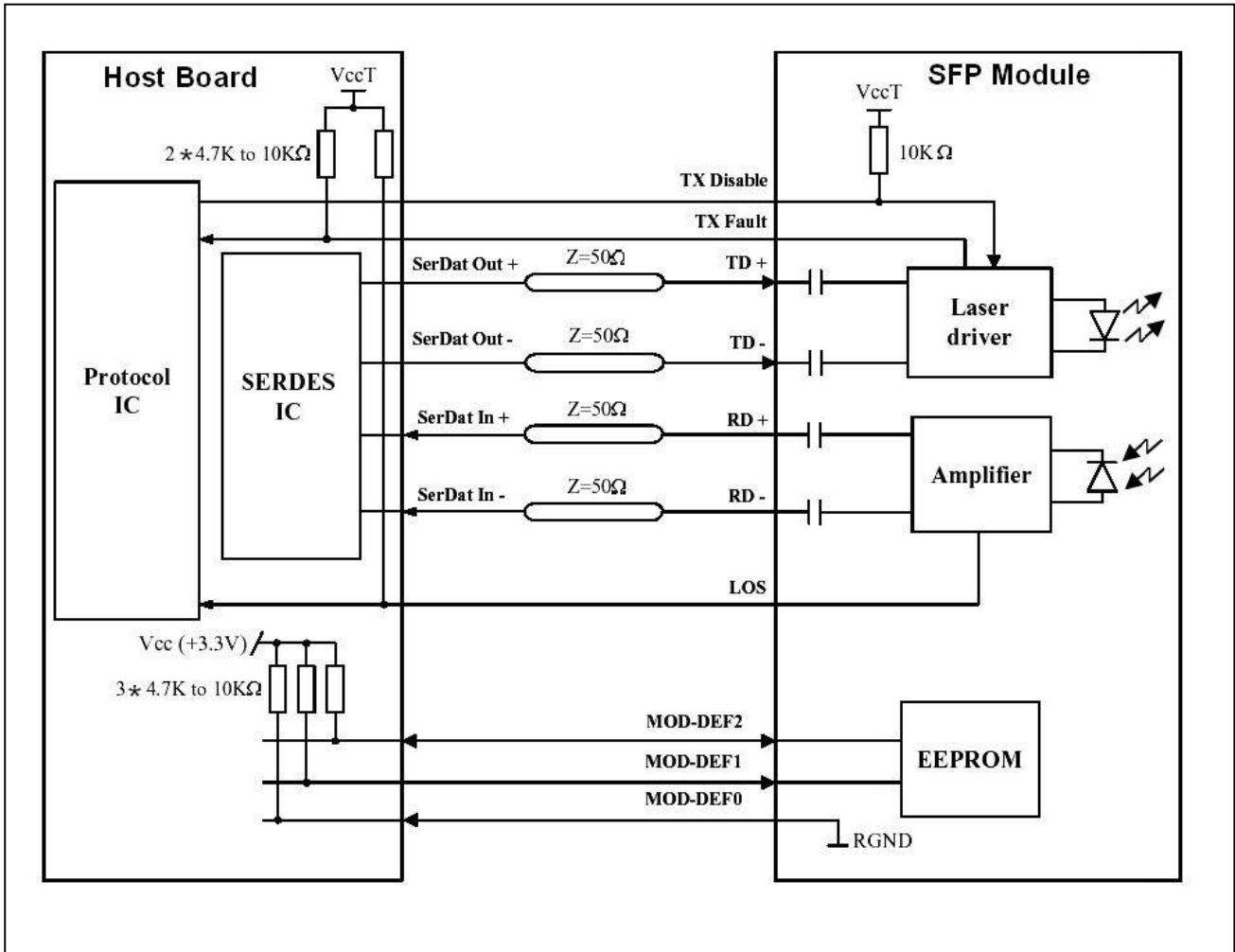
4	MOD_DEF(2)	SDA Serial Data Signal	3	Note 3
5	MOD_DEF(1)	SCL Serial Clock Signal	3	Note 3
6	MOD_DEF(0)	TTL Low	3	Note 3
7	Rate Select	Not Connected	3	
8	LOS	Loss of Signal	3	Note 4
9	V <sub>EER</sub>	Receiver ground	1	
10	V <sub>EER</sub>	Receiver ground	1	
11	V <sub>EER</sub>	Receiver ground	1	
12	RD-	Inv. Received Data Out	3	Note 5
13	RD+	Received Data Out	3	Note 5
14	V <sub>EER</sub>	Receiver ground	1	
15	V <sub>CCR</sub>	Receiver Power Supply	2	
16	V <sub>CCT</sub>	Transmitter Power Supply	2	
17	V <sub>EET</sub>	Transmitter Ground	1	
18	TD+	Transmit Data In	3	Note 6
19	TD-	Inv. Transmit Data In	3	Note 6
20	V <sub>EET</sub>	Transmitter Ground	1	

**Notes:**

Plug Seq.: Pin engagement sequence during hot plugging.

- 1) TX Fault is an open collector output, which should be pulled up with a 4.7k~10kΩ resistor on the host board to a voltage between 2.0V and V<sub>cc</sub>+0.3V. Logic 0 indicates normal operation; Logic 1 indicates a laser fault of some kind. In the low state, the output will be pulled to less than 0.8V.
- 2) TX Disable is an input that is used to shut down the transmitter optical output. It is pulled up within the module with a 4.7k~10kΩ resistor. Its states are:  
 Low (0 to 0.8V): Transmitter on  
 (>0.8V, < 2.0V): Undefined  
 High (2.0 to 3.465V): Transmitter Disabled  
 Open: Transmitter Disabled
- 3) Mod-Def 0,1,2. These are the module definition pins. They should be pulled up with a 4.7k~10kΩ resistor on the host board. The pull-up voltage shall be V<sub>ccT</sub> or V<sub>ccR</sub>.  
 Mod-Def 0 is grounded by the module to indicate that the module is present  
 Mod-Def 1 is the clock line of two wire serial interface for serial ID  
 Mod-Def 2 is the data line of two wire serial interface for serial ID
- 4) LOS is an open collector output, which should be pulled up with a 4.7k~10kΩ resistor. Pull up voltage between 2.0V and V<sub>cc</sub>+0.3V. Logic 1 indicates loss of signal; Logic 0 indicates normal operation. In the low state, the output will be pulled to less than 0.8V.
- 5) RD-/+ : These are the differential receiver outputs. They are internally AC-coupled 100 differential lines which should be terminated with 100Ω (differential) at the user SERDES.
- 6) TD-/+ : These are the differential transmitter inputs. They are internally AC-coupled, differential lines with 100Ω differential termination inside the module.

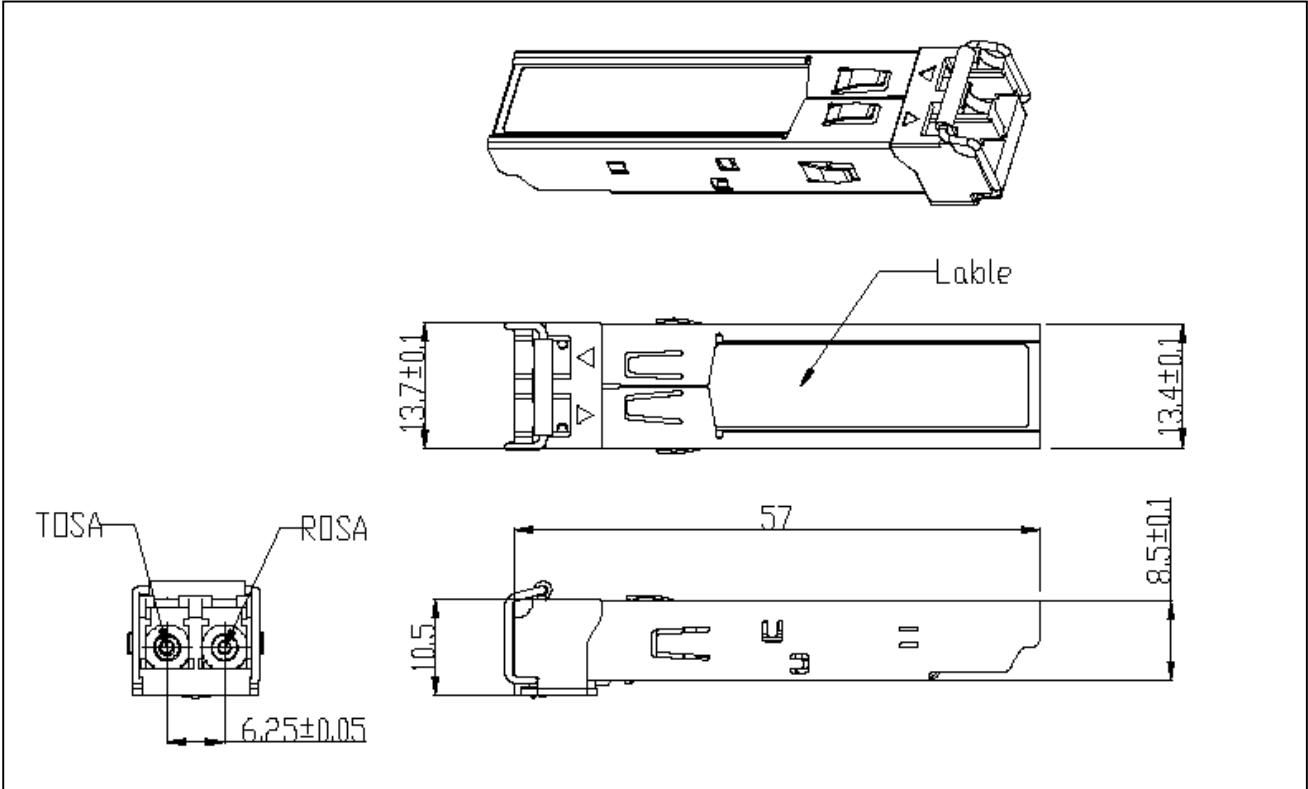
**Recommended Interface Circuit**







### Mechanical Dimensions



### Regulatory Compliance

FIBERER SFP transceiver is designed to be Class I Laser safety compliant and is certified per the following standards

Feature	Agency	Standard	Certificate / Comments
Laser Safety	FDA	CDRH 21 CFR 1040 and Laser Notice No. 50	1120294-000
Product Safety	BST	EN 60825-1: 2007 EN 60825-2: 2004 EN 60950-1: 2006	BT0905142002
Environmental protection	SGS	RoHS Directive 2002/95/EC	GZ0902008346/CHE M
EMC	CCIC	EN 55022: 2006+A1: 2007 EN 55024: 1998+A1: 2001+A2: 2003	CTE09050018

### Ordering information



Part Number	Product Description
FPC-XX4G-04CD	XX=47~61, 4.25Gbps, 40km, 0°C ~ +70°C, With Digital Diagnostic Monitoring
FPC-XX4G-04TD	XX=47~61, 4.25Gbps, 40km, -40°C ~ +85°C, With Digital Diagnostic Monitoring

### References

1. Small Form Factor Pluggable (SFP) Transceiver Multi-Source Agreement (MSA), September 2000.
2. Telcordia GR-253-CORE and ITU-T G.957 Specifications.

### Important Notice

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