



## 155M~1.25Gbps CWDM SFP Optical Transceiver, 80km Reach FPC-xxM1-08C(D)

### Features

- ◆ Multi-rate of 155M~1.25Gbps operation
- ◆ 8 CWDM DFB wavelengths laser and PIN photodetector for 80km 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

### Applications

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



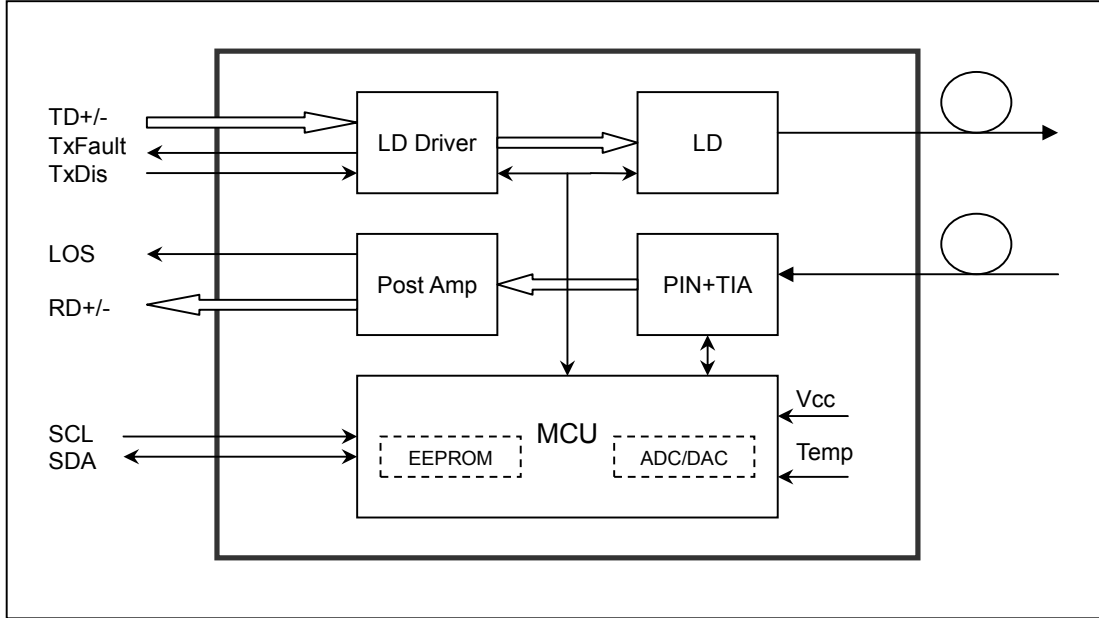
### Description

The SFP transceivers are high performance, cost effective modules supporting multi-rate of 155M~1.25Gbps and 80km transmission distance with SMF.

The transceiver consists of three sections: an uncooled CWDM DFB 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

Table 1 - Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
Supply Voltage	Vcc	-0.5	4.5	V
Storage Temperature	Ts	-40	+85	°C
Operating Humidity	-	5	85	%

### Recommended Operating Conditions

Table 2 - Recommended Operating Conditions

Parameter	Symbol	Min	Typical	Max	Unit
Operating Case Temperature	Tc	0		+70	°C
Power Supply Voltage	Vcc	3.13	3.3	3.47	V
Power Supply Current	Icc			300	mA
Data Rate		155		1250	Mbps

### FPC-xxM1-08C(D)

See table3 below for “xx” values

Table3 -λC Wavelength Guide



λC Wavelength Guide					
Code	λc	Unit	Code	λc	Unit
47	1470	nm	57	1570	nm
49	1490	nm	59	1590	nm
51	1510	nm	61	1610	nm
53	1530	nm			
55	1550	nm			

### Optical and Electrical Characteristics

FPC-xxM1-08C(D): (CWDM and PIN, 80km Reach)

Table 4 - Optical and Electrical Characteristics

Parameter	Symbol	Min	Typical	Max	Unit	Notes
<b>Transmitter</b>						
Centre Wavelength	λc	λc-6.5	λc	λc+6.5	nm	
Spectral Width (-20dB)	Δλ			1	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Average Output Power	Pout	0		5	dBm	1
Extinction Ratio	ER	9			dB	
Optical Rise/Fall Time (20%~80%)	tr/tf			260	ps	
Data Input Swing Differential	V <sub>IN</sub>	400		1800	mV	2
Input Differential Impedance	Z <sub>IN</sub>	90	100	110	Ω	
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>						
Receiver Sensitivity				-24	dBm	3
Receiver Overload		-3			dBm	3
LOS De-Assert	LOS <sub>D</sub>			-24	dBm	
LOS Assert	LOS <sub>A</sub>	-35			dBm	
LOS Hysteresis		1		4	dB	



Data Output Swing Differential	Vout	370		1800	mV	6
LOS	High	2.0		Vcc	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  $2^7-1$  test pattern @1250Mbps, BER  $\leq 1 \times 10^{-12}$ .  
Measured with a PRBS  $2^{23}-1$  test pattern @622Mbps, BER  $\leq 1 \times 10^{-10}$ .  
Measured with a PRBS  $2^{23}-1$  test pattern @155Mbps, BER  $\leq 1 \times 10^{-10}$ .
4. Internally AC-coupled.

## Timing and Electrical

**Table 5 - Timing and Electrical**

Parameter	Symbol	Min	Typical	Max	Unit
Tx Disable Negate Time	t_on			1	ms
Tx Disable Assert Time	t_off			10	$\mu$ s
Time To Initialize, including Reset of Tx Fault	t_init			300	ms
Tx Fault Assert Time	t_fault			100	$\mu$ s
Tx Disable To Reset	t_reset	10			$\mu$ s
LOS Assert Time	t_loss_on			100	$\mu$ s
LOS De-assert Time	t_loss_off			100	$\mu$ s
Serial ID Clock Rate	f_serial_clock			400	KHz
MOD_DEF (0:2)-High	V <sub>H</sub>	2		Vcc	V
MOD_DEF (0:2)-Low	V <sub>L</sub>			0.8	V

## Diagnostics

**Table 5 – Diagnostics Specification**

Parameter	Range	Unit	Accuracy	Calibration
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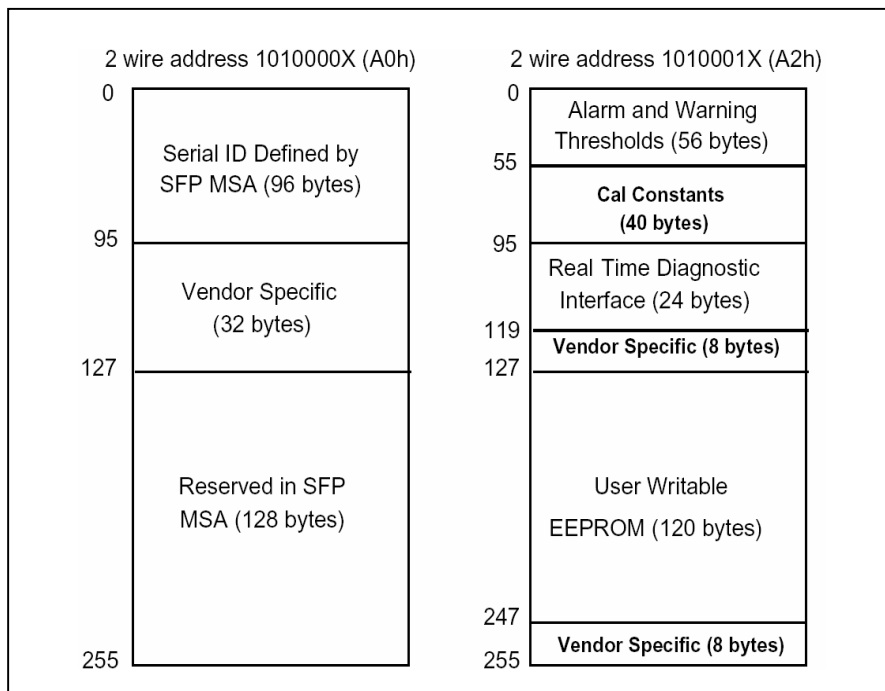
Temperature	0 to +70	°C	±3°C	Internal / External
Voltage	3.0 to 3.6	V	±3%	Internal / External
Bias Current	0 to 100	mA	±10%	Internal / External
TX Power	0 to +5	dBm	±3dB	Internal / External
RX Power	-24 to -3	dBm	±3dB	Internal / External

### 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).

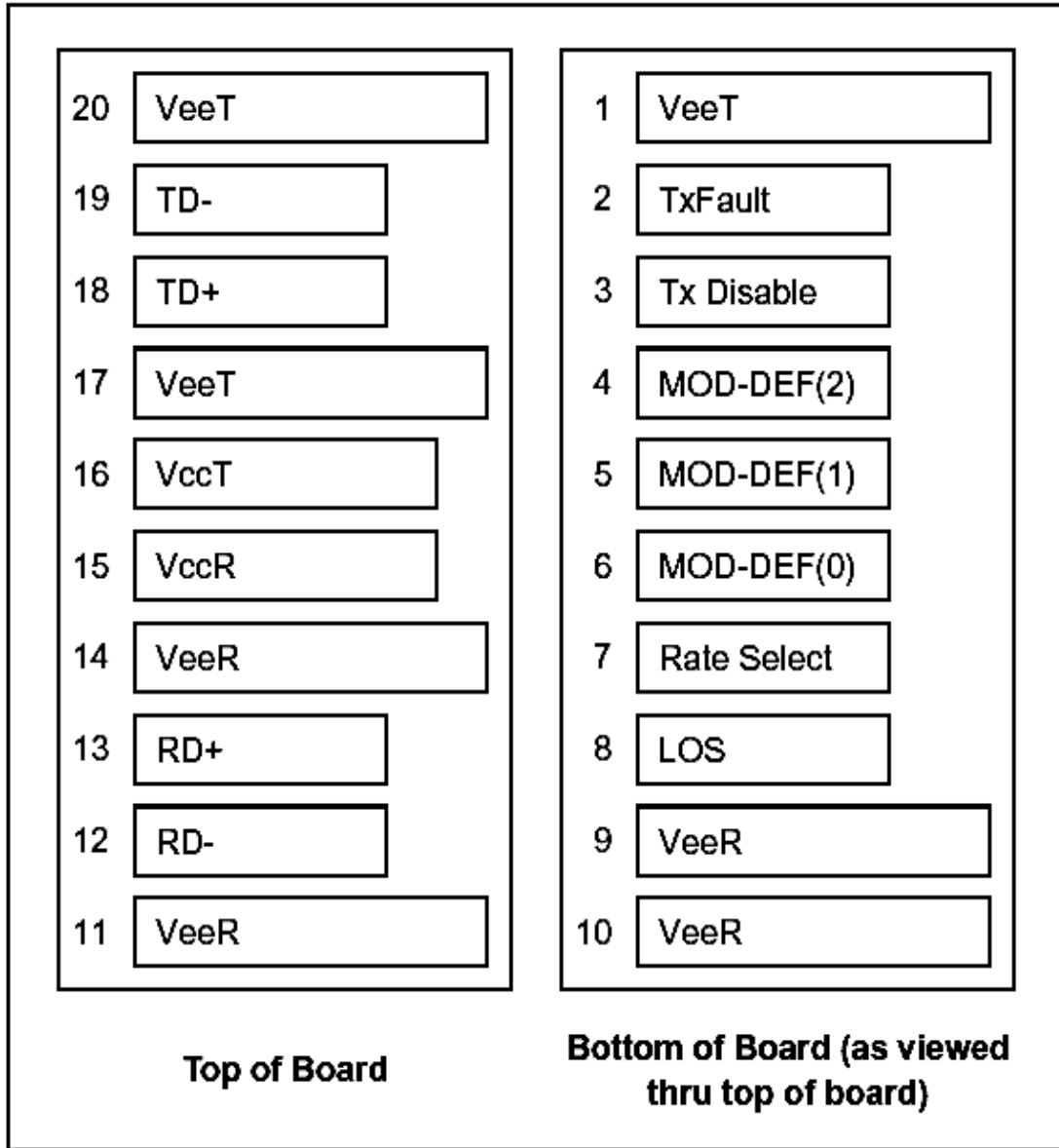
The diagnostic information with internal calibration or external calibration all are implemented, including received power monitoring, transmitted power monitoring, bias current monitoring, supply voltage monitoring and temperature monitoring.

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	VEET	Transmitter Ground	1	
2	TX FAULT	Transmitter Fault Indication	3	Note 1
3	TXDISABLE	Transmitter Disable	3	Note 2



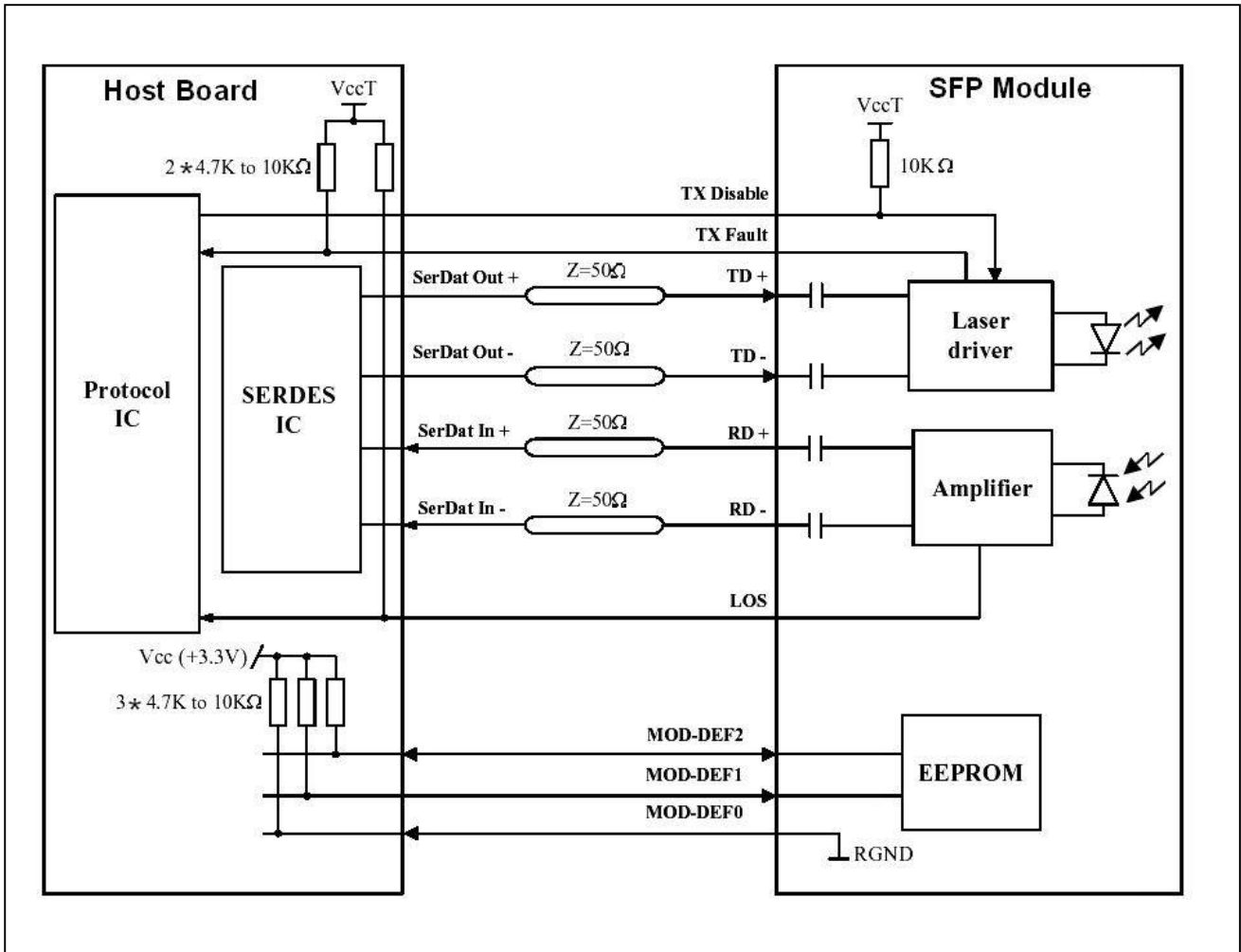
4	MOD_DEF(2)	SDA Serial Data Signal	3	Note 3
5	MOD_DEF(1)	SCL Serial Clock Signal	3	Note 3
6	MOD_DEF(0)	TTL Low	3	Note 3
7	Rate Select	Not Connected	3	
8	LOS	Loss of Signal	3	Note 4
9	V <sub>EER</sub>	Receiver ground	1	
10	V <sub>EER</sub>	Receiver ground	1	
11	V <sub>EER</sub>	Receiver ground	1	
12	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.

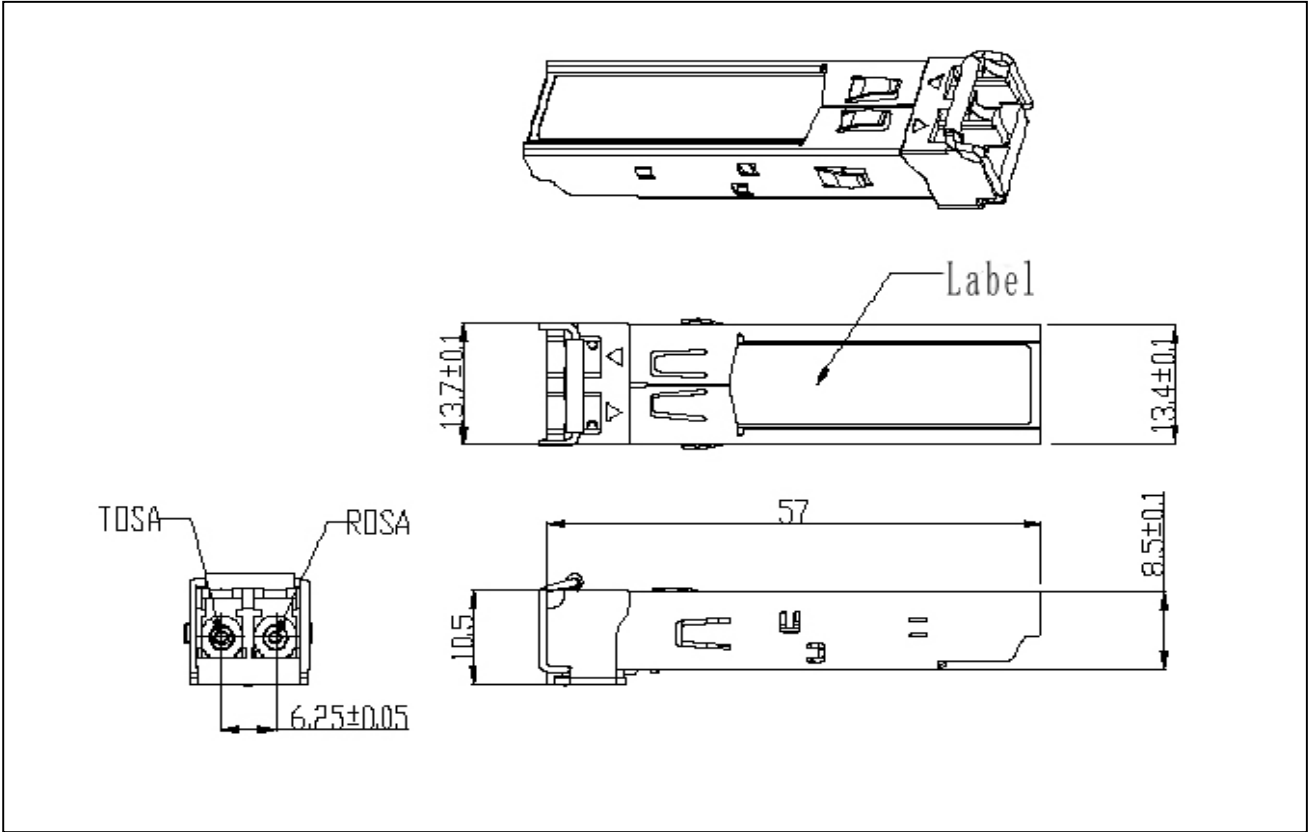
- TX Fault is an open collector output, which should be pulled up with a 4.7k~10kΩ resistor on the host board to a voltage between 2.0V and V<sub>cc</sub>+0.3V. Logic 0 indicates normal operation; Logic 1 indicates a laser fault of some kind. In the low state, the output will be pulled to less than 0.8V.
- 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
- 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
- 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.
- 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.
- 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/CHEM
EMC	CCIC	EN 55022: 2006+A1: 2007 EN 55024: 1998+A1: 2001+A2: 2003	CTE09050018

## Ordering information



Part Number	Product Description
FPC-xxM1-08C	CWDM 1470nm~1610nm, 155M~1.25Gbps, 80km, 0°C ~ +70°C
FPC-xxM1-08CD	CWDM 1470nm~1610nm, 155M~1.25Gbps, 80km, 0°C ~ +70°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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