

# SFP Single Mode Fiber BIDI Transceiver

## 1250Mbps 3km

### Product Features

- Uncooled Laser Diode with MQW Structure
- InGaAs PIN-TIA Photodiode Receiver
- 9/125μm SMF
- BIDI Single Mode Transceiver SFP Footprint
- LC Or SC Optical Interface Are Optional
- Compliant With SFP MSA and SFF -8472
- Digital Diagnostic Monitoring Interface
- Single +3.3V Power Supply
- CML Differential Inputs and Outputs
- LVTTTL Signal Detection Output
- Compliant With ITU-T G.957
- Compliant With RoHS and Lead Free
- Metal Enclosure for Lower EMI
- Operating Case Temperature :

Standard: 0 to +70°C

Extend : -20 to +85°C

Industrial : -40 to +85°C

### Product Applications

- Fast Ethernet
- ATM/SONET/SDH
- Switch/Router
- Other Optical Transmission Systems

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## General Description

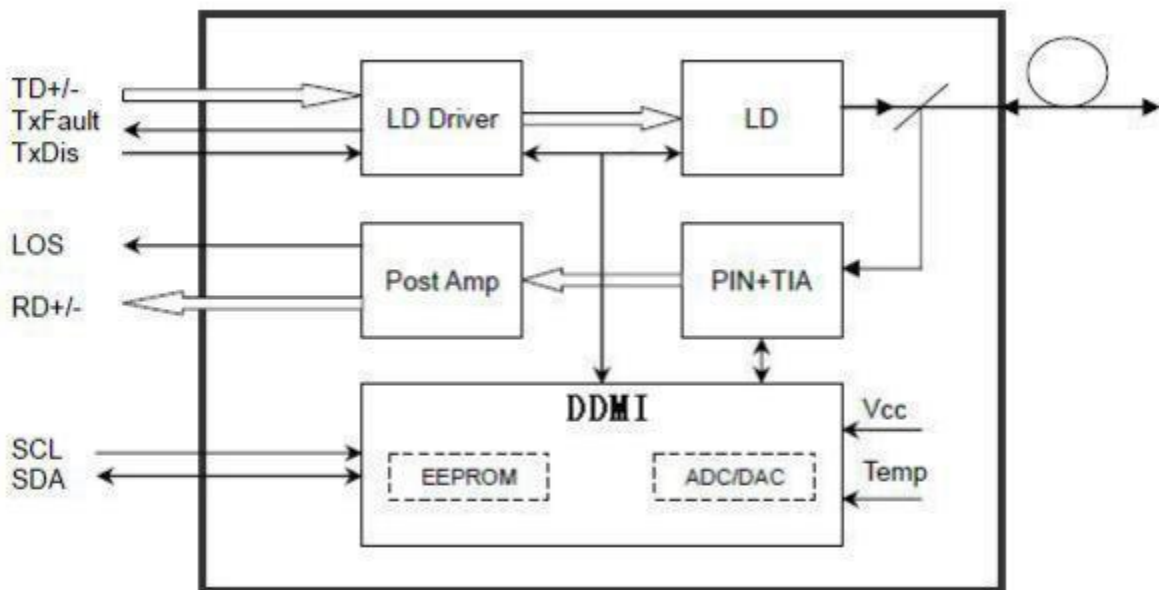
The SFP transceivers are high performance , cost effective modules supporting data - rate of 1250Mbps on 9/125  $\mu$ m SMF

The transceiver consists of three sections : a laser transmitter , a PIN photodiode integrated with a trans - impedance preamplifier (TIA) and DDMI control unit . All modules satisfy class I laser safety requirements .

The transceivers are compliant with the Small Form -Factor Pluggable (SFP)

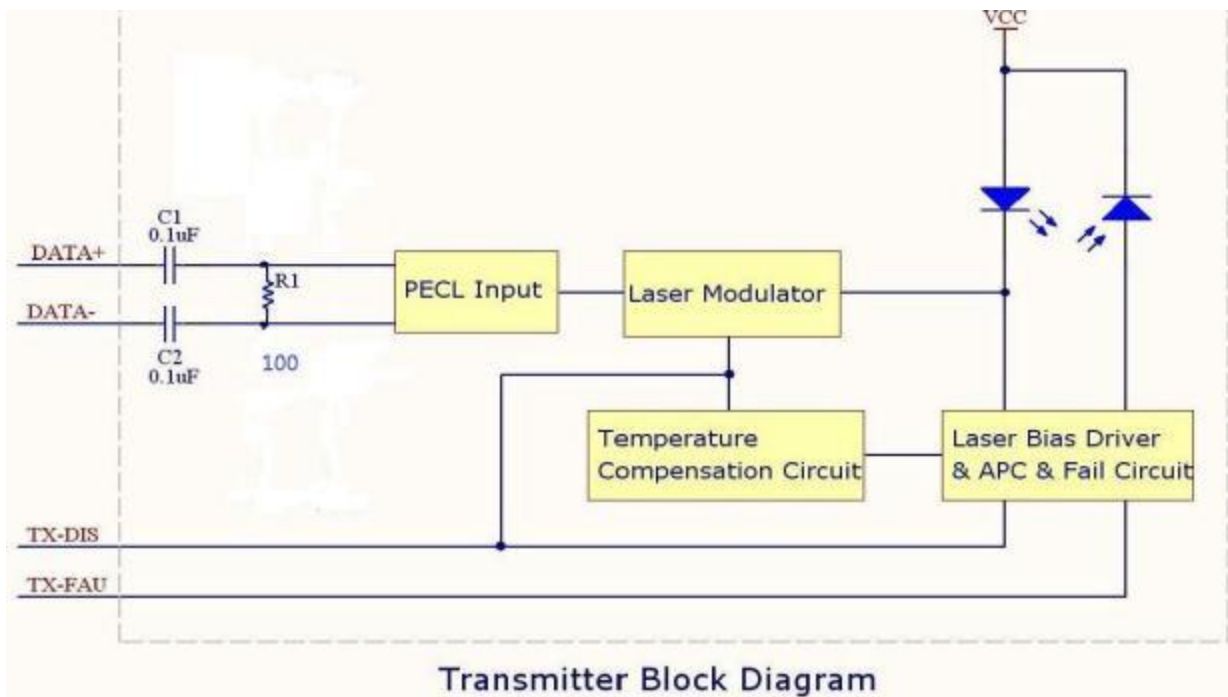
Multi -Source Agreement (MSA) and SFF -8472 . For further information , please refer to SFP

MSA .



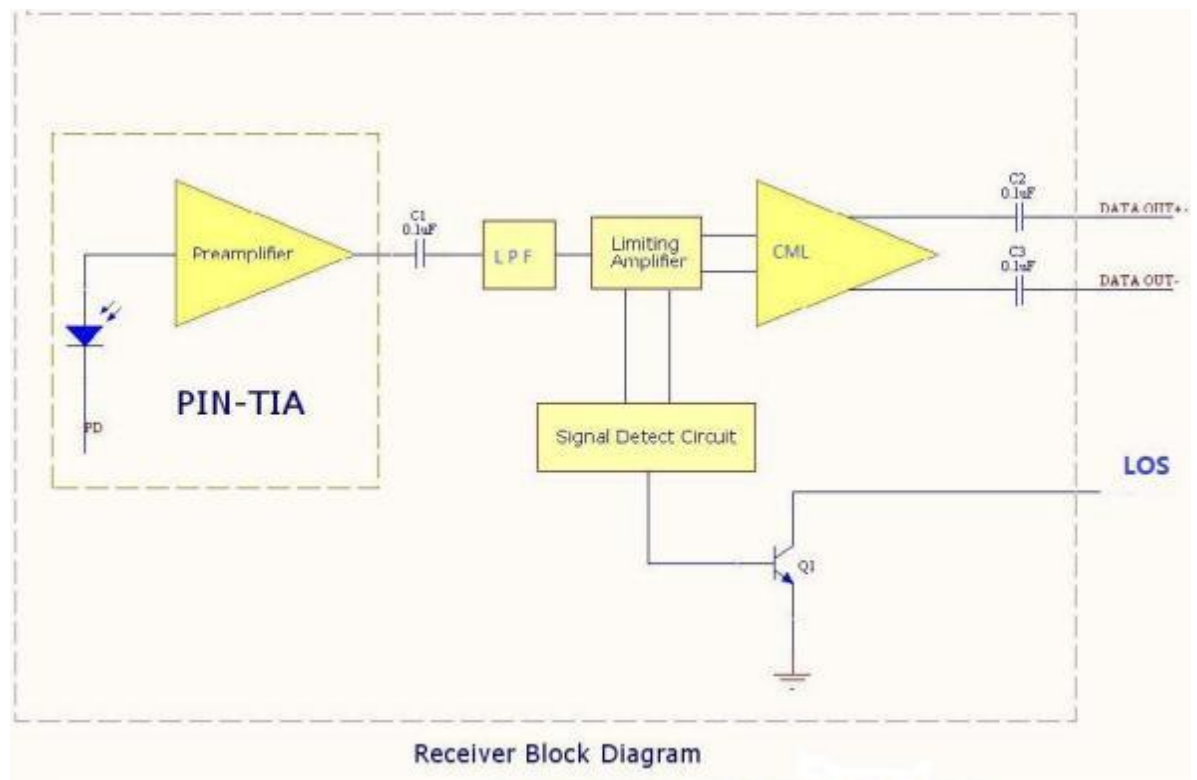
## Transmitter Section

The transmitter is designed for single mode fiber and operates at a nominal wavelength of 1310nm or 1550nm. The transmitter module uses a laser diode and full IEC825 and CDRH class 1 eye safety. The output power can be disabled via the single TX-disable pin. Logic LVTTTL HIGH level disables the transmitter. It contains APC function, temperature compensation circuit, PECL data inputs, LVTTTL TX-disable input and TX-fault Output interface.



## Receiver Section

The receiver section uses a hermetic packaged front end receiver ( InGaAs PIN and preamplifier) . The post amplifier is AC coupled to preamplifier through a capacitor and a low pass filter . The capacitor and LPF are enough to pass the signal from 100Mb/s to 1300Mb/s without significant distortion or performance penalty . The LPF limits the preamplifier bandwidth to improve receiver sensitivity . As the input optical is decreased , LOS will switch from low to high . As the input optical power is increased from very low levels , LOS will switch back from high to low .



## DDMI Section

The DDMI contains an EEPROM . It provides access to sophisticated identification information that describes the transceiver' s capabilities , standard interfaces , manufacturer , and other information .

The serial interface uses the 2 -wire serial CMOS EEPROM protocol defined for the 24C02 . When the serial protocol is activated , the host generates the serial clock signal (SCL , Mod Def 1) . The positive edge clocks data into those segments of the EEPROM that are not write protected within the SFP transceiver . The negative edge clocks data from the SFP transceiver . The serial data signal (SDA , Mod Def 2) is bi -directional for serial data transfer . The host uses SDA in conjunction with SCL to mark the start and end of serial protocol activation . The memories are organized as a series of 8 -bit data words that can be addressed individually or sequentially .

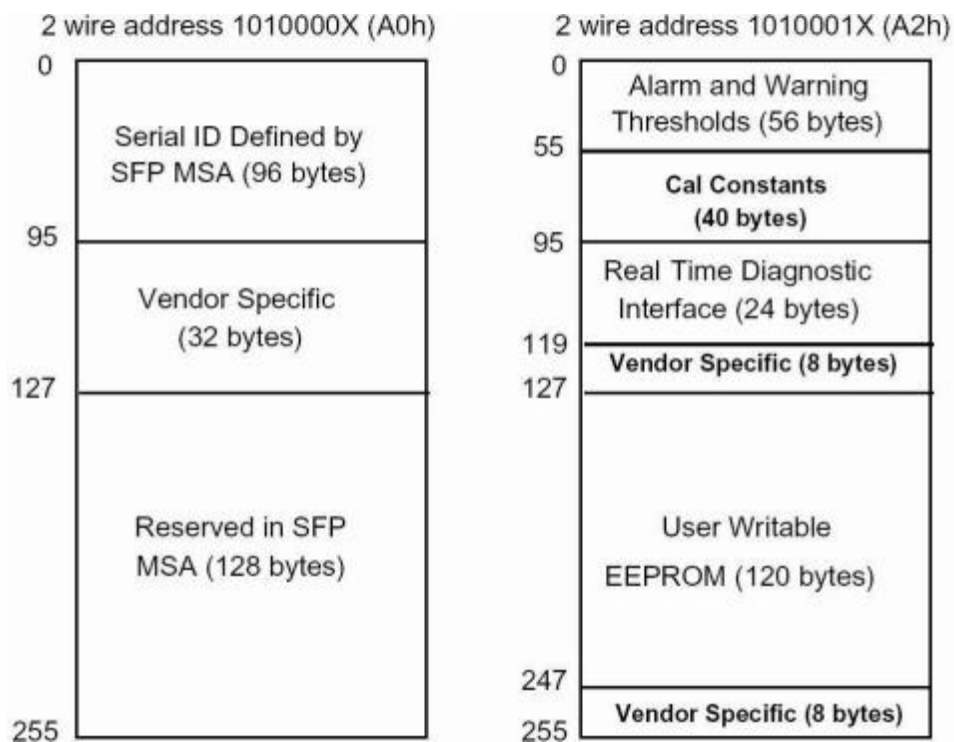
The Module provides diagnostic information about the present operating conditions . The

transceiver generates this diagnostic data by digitization of internal analog signals . Calibration and alarm/warning threshold data is written during device manufacture . Received power monitoring , transmitted power monitoring , bias current monitoring , supply voltage monitoring and temperature monitoring all are implemented . The diagnostic

data are raw A/D values and must be converted to real world units using calibration constants stored in EEPROM locations 56 – 95 at wire serial bus address A2h . The digital

diagnostic memory map specific data field defines as following .

➤ **Memory Map**



## Performance Specifications

### ➤ Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit	
Storage Temperature	Tst	-40	+85	°C	
Operating Temperature	To	DFP2 -**24 -*C**	0	+70	°C
		DFP2 -**24 -*E**	-20	+85	°C
		DFP2 -**24 -*I**	-40	+85	°C
Input Voltage	-	GND	Vcc	V	
Power Supply Voltage	Vcc-Vee	0	+3.6	V	

**Note :** Stress in excess of maximum absolute ratings can cause permanent damage to the module

### ➤ Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Unit	
Storage Temperature	Tst	-40	-	+85	°C	
Operating Case Temperature	Tc	OFP2 -**24 -*C**	0	-	+70	°C
		OFP2 -**24 -*E**	-20	-	+85	°C
		OFP2 -**24 -*I**	-40	-	+85	°C
Power Supply Voltage	Vcc	3.1	3.3	3.5	V	
Power Supply Current	Icc	-	-	300	mA	
Data Rate	DR	-	155	-	Mbps	

## Optical Specification

Transmitter							
Parameter		Symbol	Min	Typ	Max	Unit	Note
Center Wavelength	1310 FP	λ <sub>c</sub>	1261	1310	1360	nm	
	1550		1501	1550	1600		
Spectral Width	1310nmFP	Δλ	-	-	4	nm	-
	1550nm DFB				1		
Average Optical Output Power		P <sub>o</sub>	-9	-	-3	dBm	20KM
Extinction Ratio		ER	9	-	-	dB	-
Optical Rise/Fall Time(20%-80%)		Tr/ Tf	-	-	0.27	ns	-
Output Eye Diagram		Compliant with ITU-T G .957					
Receiver							
Parameter		Symbol	Min	Typ	Max	Unit	Note
Operate Wavelength	1550	-	1501	1550	1600	nm	
	1310	-	1261	1310	1360	nm	
Receiver Sensitivity		R <sub>SENS</sub>	-	-	-24	dBm	1
Receiver Saturation		P <sub>RS</sub>	-3	-	-	dBm	1
LOS Assert		-	-40	-	-	dBm	Alarm: High - level
LOS De -Assert		-	-	-	-24	dBm	
LOS Hysteresis		-	0.5	-	5	dBm	-

Note : 1 . Minimum Sensitivity and saturation levels for a 2<sup>23</sup> - 1 PRBS test pattern @155Mbps .

## ➤ Electrical Specification

Transmitter							
Parameter	Symbol	Min	Typ	Max	Unit	Note	
Power Supply Current	I <sub>CC</sub> T	-	70	150	mA	2	
Input Differential Impedance	Z <sub>IN</sub>	90	100	110	Ω	-	
Input Swing Differential Voltage	V <sub>IN</sub>	500	-	2400	mV	3	
TX -Disable Voltage	Disable	-	2.0	-	V <sub>CC</sub>	V	-
	Enable	-	0	-	0.8	V	-
TX -Fault Voltage	Fault	-	2.0	-	V <sub>CC</sub>	V	-
	Normal	-	0	-	0.8	V	-
Receiver							
Parameter	Symbol	Min	Typ	Max	Unit	Note	
Power Supply Current	I <sub>CC</sub> R	-	70	140	mA	2	
Output Swing Differential Voltage	V <sub>OUT</sub>	600	-	2000	mV	4	
LOS Voltage	High	-	2.0	-	V <sub>CC</sub>	V	-
	Low	-	0	-	0.8	V	-

Note : 2 . The current excludes the output load current .

3 . CML input , internally AC -coupled and terminated .

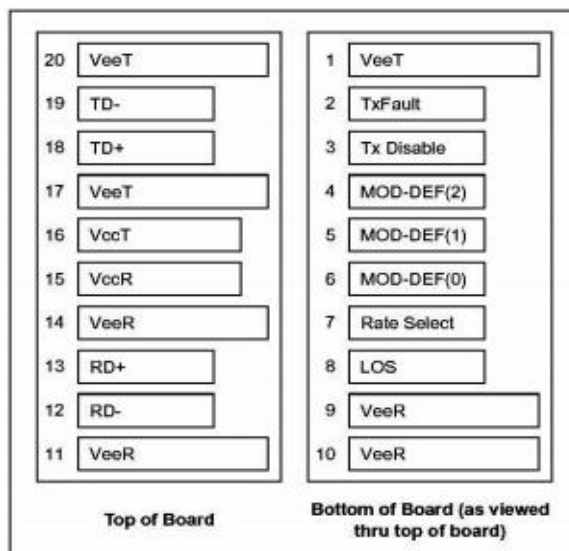
4 . Internally AC -coupled .

## ➤ Diagnostics Specification

Parameter	Range	Unit	Accuracy	Calibration
Temperature	0 to +70	°C	±3	Internal/ External
	-40 to +85			Internal/ External
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	±3	Internal/ External
RX Power	-24 to -3	dBm	±3	Internal/ External

## Pin Definitions

### ➔ PIN Diagram



## ➤ PIN Description

PIN	Name	Description	Notes
1	V <sub>EE</sub> T	Transmitter Ground	-
2	TX FAULT	Transmitter Fault Indication	Note 1
3	TX DISABLE	Transmitter Disable	Note 2
4	MOD_DEF(2)	SDA Serial Data Signal	Note 3
5	MOD_DEF(1)	SCL Serial Clock Signal	Note 3
6	MOD_DEF(0)	Module Absent . Grounded within the module	Note 3
7	Rate Select	Not Connected	-
8	LOS	Loss of Signal	Note 4
9	V <sub>EE</sub> R	Receiver ground	-
10	V <sub>EE</sub> R	Receiver ground	-
11	V <sub>EE</sub> R	Receiver ground	-
12	RD-	Inv . Received Data Out	Note 5
13	RD+	Received Data Out	Note 5
14	V <sub>EE</sub> R	Receiver ground	-
15	V <sub>CC</sub> R	Receiver Power Supply	3.3V±5%
16	V <sub>CC</sub> T	Transmitter Power Supply	3.3V±5%
17	V <sub>EE</sub> T	Transmitter Ground	-
18	TD+	Transmit Data In	Note 6
19	TD-	Inv . Transmit Data In	Note 6
20	V <sub>EE</sub> T	Transmitter Ground	-

### Notes :

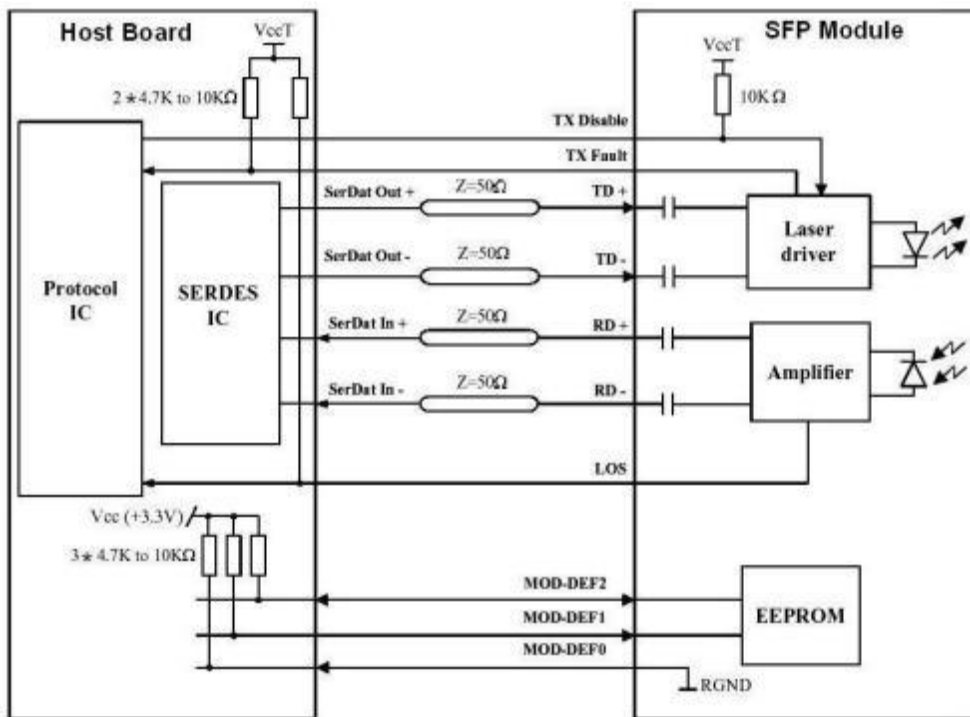
- 1) TX Fault is an open collector output , which should be pulled up with a 4.7k~10kΩ resistor on the host board to a voltage between 2.0V and V<sub>CC</sub>+0.3V . Logic 0 indicates normal operation; Logic 1 indicates a laser fault of some kind . In the low state , the output will be pulled to less 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>CC</sub>T or V<sub>CC</sub>R .  
 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 Vcc+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 100Ω 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.

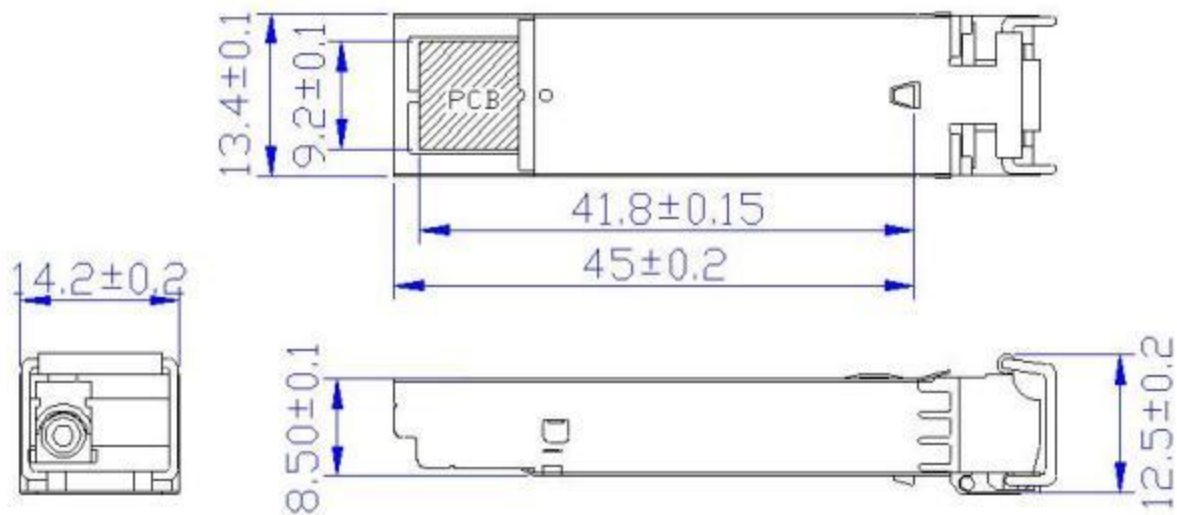
## Recommended Circuit





◆ LC Side Interface

## Product Datasheet



## ➤ SC Side Interface

