

## 155Mbps CWDM SFP Optical Transceiver, 120km Reach GPC-xx03-12CD

### Features

- ◆ Data-rate of 155Mbps operation
- ◆ 9 CWDM DFB wavelengths laser and PIN photodetector for 120km transmission
- ◆ Compliant with SFP MSA and SFF-8472 with duplex LC receptacle
- ◆ Digital Diagnostic Monitoring:  
Internal Calibration or External Calibration
- ◆ 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

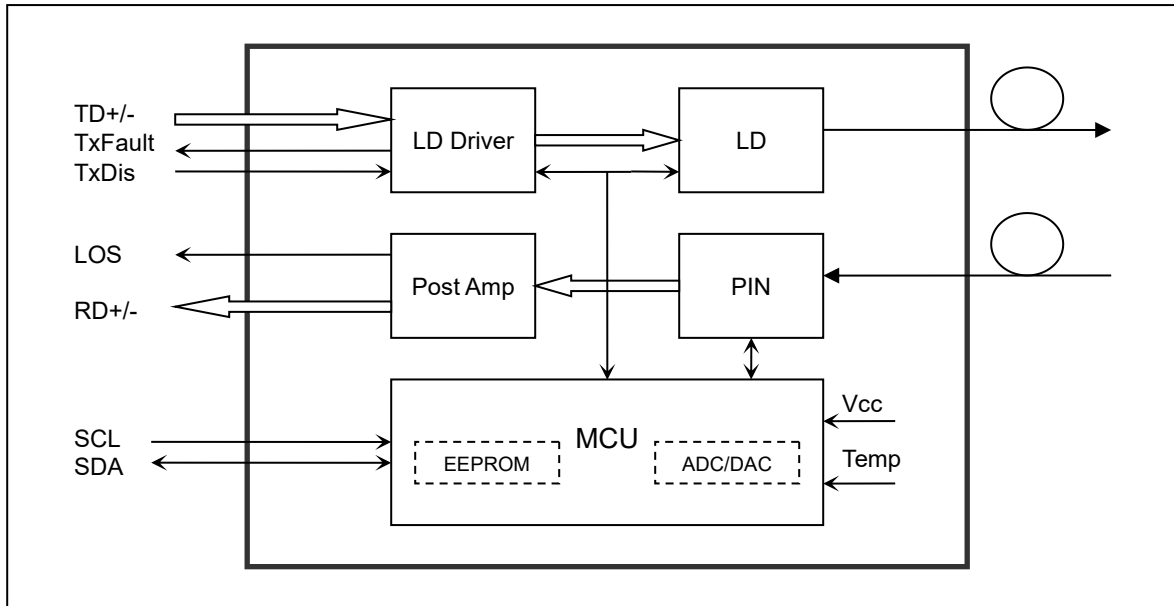
### Description

The SFP transceivers are high performance, cost effective modules supporting data-rate of 155Mbps and 120km 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	95	%

## 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		Mbps
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### GPC-xx03-12CD

See table3 below for “xx” values Table3 - $\lambda$ C Wavelength Guide

$\lambda$ C Wavelength Guide					
Code	$\lambda$ c	Unit	Code	$\lambda$ c	Unit
45	1450	nm	55	1550	nm
47	1470	nm	57	1570	nm
49	1490	nm	59	1590	nm
51	1510	nm	61	1610	nm
53	1530	nm			

## Optical and Electrical Characteristics

GPC-xx03-12CD: (CWDM and PIN, 120km Reach)

Table 4 - Optical and Electrical Characteristics

Parameter	Symbol	Min	Typical	Max	Unit	Notes
<b>Transmitter</b>						
Centre Wavelength	$\lambda$ c	$\lambda$ c-6.5	$\lambda$ c	$\lambda$ c+6.5	nm	
Spectral Width (-20dB)	$\Delta\lambda$			1	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Average Output Power	P <sub>out</sub>	0		5	dBm	1
Extinction Ratio	ER	9			dB	
Jitter Generation (RMS)				0.01	UI	
Jitter Generation (PK-PK)				0.1	UI	
Output Optical Eye	Compliant Telcordia GR-253-CORE and ITU-T G.957					
Optical Rise/Fall Time (20%~80%)	tr/tf			0.26	ns	
Data Input Swing Differential	V <sub>IN</sub>	300		1860	mV	2
Input Differential Impedance	Z <sub>IN</sub>	90	100	110	$\Omega$	
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	

Receiver						
Centre Wavelength	$\lambda_c$	1260		1620	nm	
Receiver Sensitivity				-34	dBm	3
Receiver Overload		-3			dBm	3
LOS De-Assert	LOS <sub>D</sub>			-34	dBm	
LOS Assert	LOS <sub>A</sub>	-45			dBm	
LOS Hysteresis		1		4	dB	
Data Output Swing Differential	V <sub>out</sub>	370		1800	mV	4
LOS	High	2.0		V <sub>cc</sub>	V	
	Low	0		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>23</sup>-1 test pattern @155Mbps, BER  $\leq 1 \times 10^{-12}$ .
4. Internally AC-coupled.

## Timing and Electrical

**Table 5 - Timing and Electrical**

Parameter	Symbol	Min	Typical	Max	Unit
Tx Disable Negate Time	t <sub>on</sub>			1	ms
Tx Disable Assert Time	t <sub>off</sub>			10	$\mu$ s
Time To Initialize, including Reset of Tx Fault	t <sub>init</sub>			300	ms
Tx Fault Assert Time	t <sub>fault</sub>			100	$\mu$ s
Tx Disable To Reset	t <sub>reset</sub>	10			$\mu$ s
LOS Assert Time	t <sub>loss_on</sub>			100	$\mu$ s
LOS De-assert Time	t <sub>loss_off</sub>			100	$\mu$ s
Serial ID Clock Rate	f <sub>serial_clock</sub>			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

## EEPROM Information

The SFP MSA defines a 256-byte memory map in EEPROM describing the transceiver's capabilities, standard interfaces, manufacturer, and other information, which is accessible over a 2 wire serial interface at the 8-bit address 1010000X (A0h). The memory contents refer to Table 6.

**Table 6 - EEPROM Serial ID Memory Contents (A0h)**

Addr.	Field Size (Bytes)	Name of Field	Hex	Description
0	1	Identifier	03	SFP
1	1	Ext. Identifier	04	MOD4
2	1	Connector	07	LC
3—10	8	Transceiver	00 08 04 00 00 00 00 00	OC-3,Single mode long reach
11	1	Encoding	03	NRZ
12	1	BR, nominal	02	155Mbps
13	1	Reserved	00	
14	1	Length (9um)-km	78	120km
15	1	Length (9um)	FF	
16	1	Length (50um)	00	
17	1	Length (62.5um)	00	
18	1	Length (copper)	00	
19	1	Reserved	00	
20—35	16	Vendor name	47 69 67 61 6C 69 67 68 74 20 20 20 20 20 20 20	"Gigalight"(ASC II )
36	1	Reserved	00	
37—39	3	Vendor OUI	00 00 00	
40—55	16	Vendor PN	47 50 43 2D 34 35 30 33 2D 31 32 43 44 20 20 20	"GPC-4503-12CD "(ASC II )
56—59	4	Vendor rev	xx xx xx xx	xx.xx revision (ASC II )
60-61	2	Wavelength	05 AA	1450nm
62	1	Reserved	00	
63	1	CC BASE	xx	Check sum of bytes 0 - 62
64—65	2	Options	00 1A	LOS,TX_FAULT and TX_DISABLE
66	1	BR, max	00	
67	1	BR, min	00	

68—83	16	Vendor SN	xx xx xx xx xx xx xx xx xx xx xx xx xx xx xx xx	ASC II
84—91	8	Vendor date code	xx xx xx xx xx xx 20 20	Year(2 bytes),Month(2 bytes),Day(2 bytes)
92	1	Diagnostic type	xx	Diagnostics
93	1	Enhanced option	80	Diagnostics(Optional Alarm/warning flags)
94	1	SFF-8472	01	Diagnostics(SFF-8472 Rev 9.3)
95	1	CC EXT	xx	Check sum of bytes 64 - 94
96—255	160			

## Diagnostics

Table 7 – Diagnostics Specification

Parameter	Range	Unit	Accuracy	Calibration
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	-33 to -9	dBm	±3dB	Internal / External

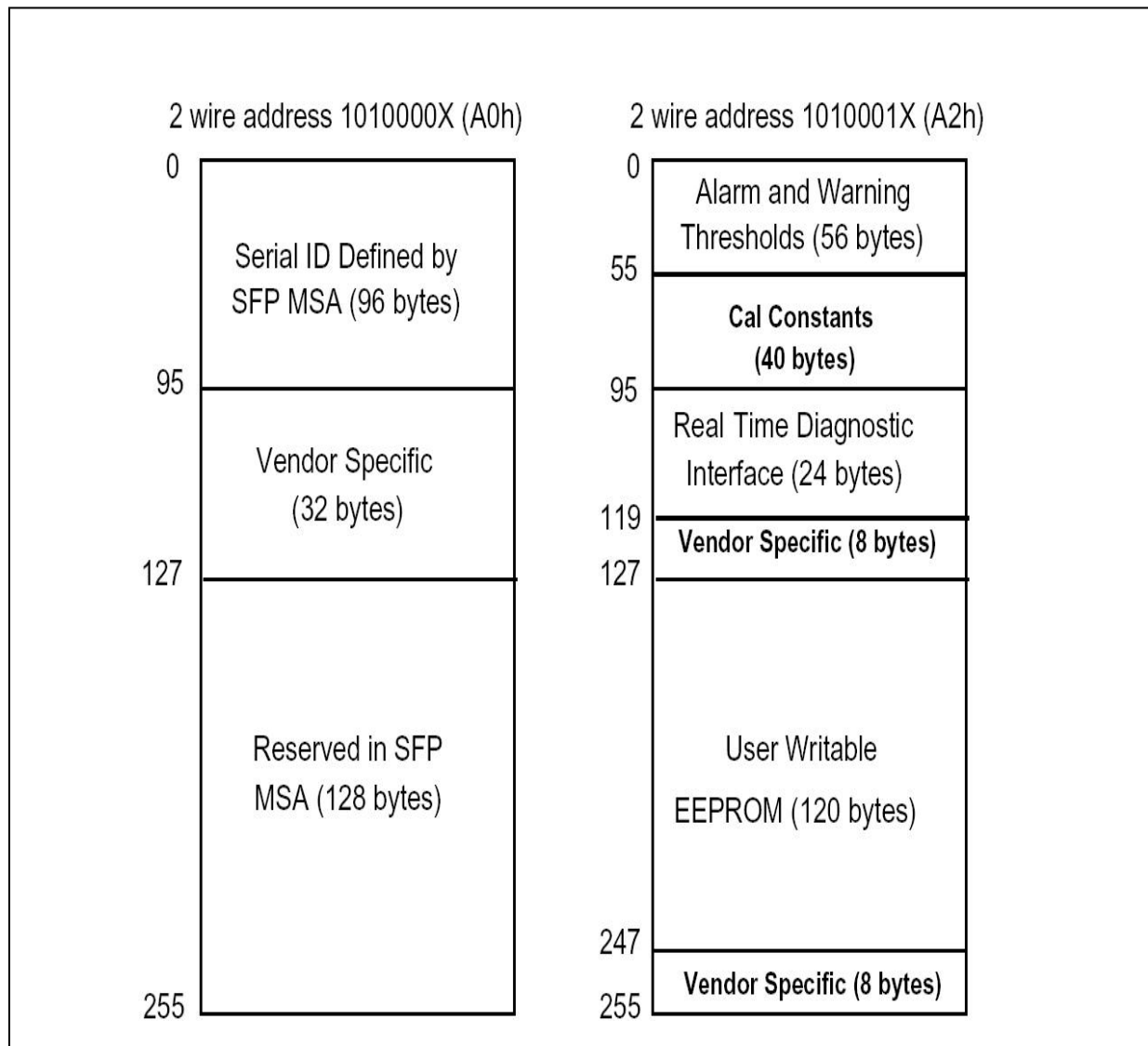
## Digital Diagnostic Memory Map

The transceivers provide serial ID memory contents and diagnostic information about the present

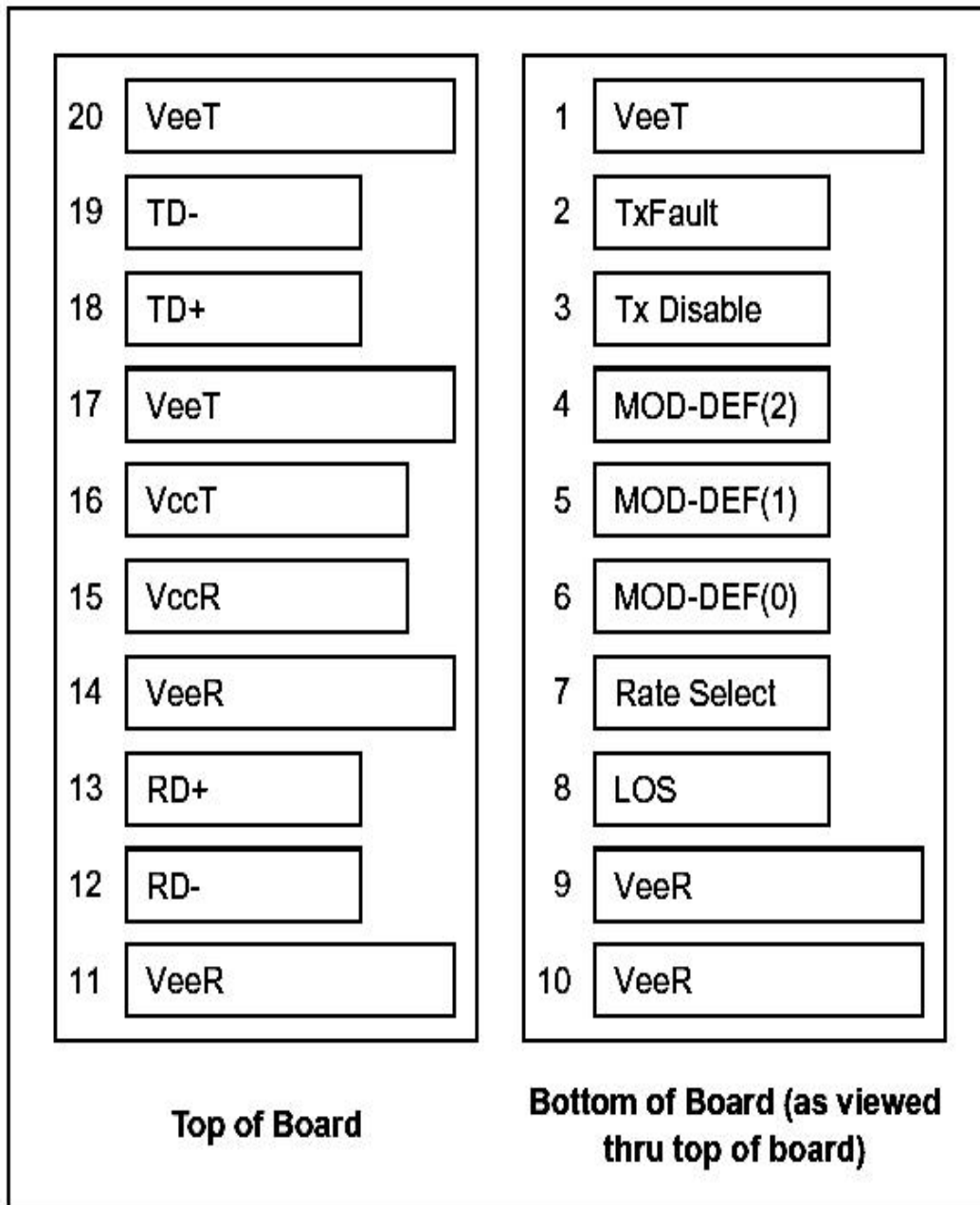
operating conditions by the 2-wire serial interface (SCL, SDA).

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 Descriptions

Pin	Signal Name	Description	Plug Seq.	Notes
1	V <sub>EET</sub>	Transmitter Ground	1	



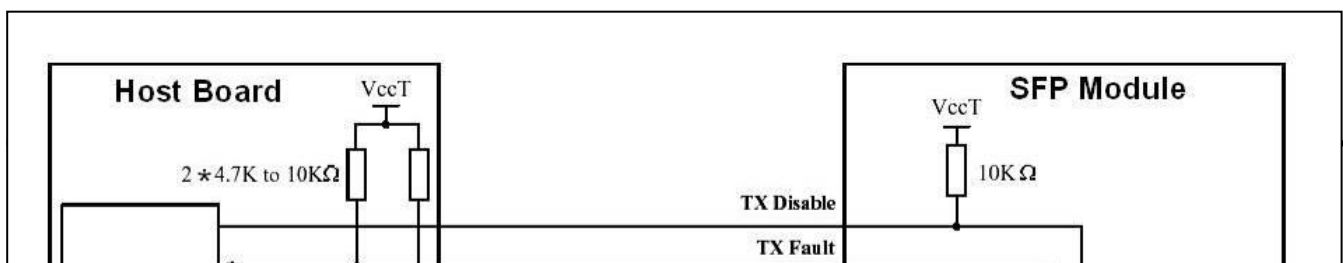
2	TX FAULT	Transmitter Fault Indication	3	Note 1
3	TX DISABLE	Transmitter Disable	3	Note 2
4	MOD_DEF(2)	SDA Serial Data Signal	3	Note 3
5	MOD_DEF(1)	SCL Serial Clock Signal	3	Note 3
6	MOD_DEF(0)	TTL Low	3	Note 3
7	Rate Select	Not Connected	3	
8	LOS	Loss of Signal	3	Note 4
9	V <sub>EEER</sub>	Receiver ground	1	
10	V <sub>EEER</sub>	Receiver ground	1	
11	V <sub>EEER</sub>	Receiver ground	1	
12	RD-	Inv. Received Data Out	3	Note 5
13	RD+	Received Data Out	3	Note 5
14	V <sub>EEER</sub>	Receiver ground	1	
15	V <sub>CCCR</sub>	Receiver Power Supply	2	
16	V <sub>CCCT</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





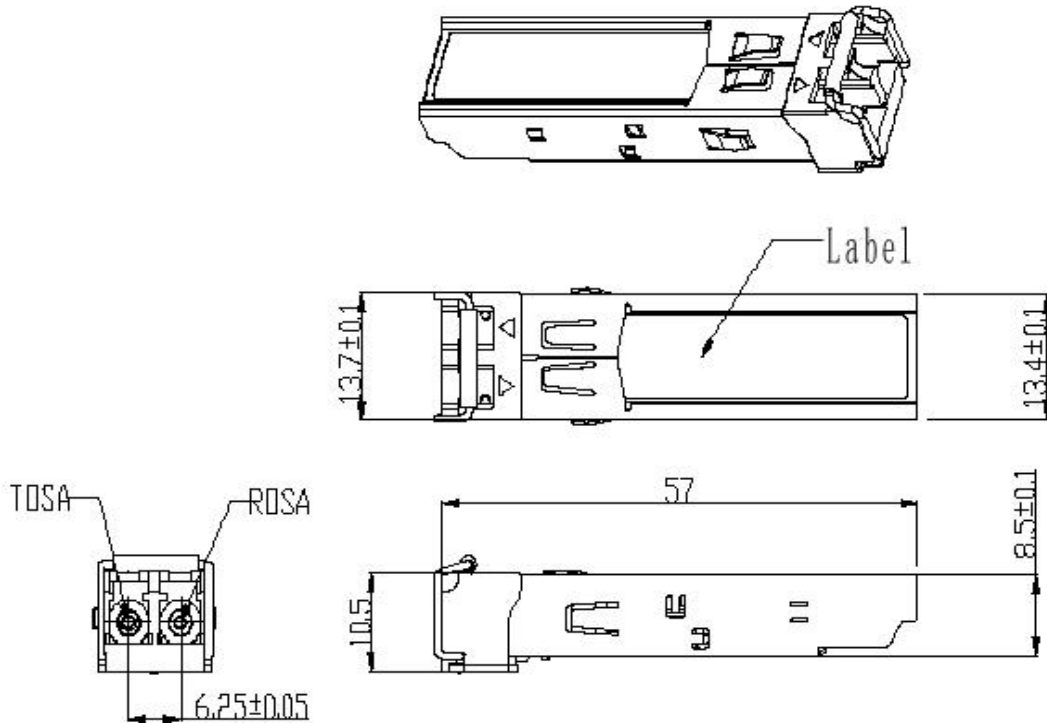
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Optical Network Transceiver Innovator

## Mechanical Dimensions





## Regulatory Compliance

GIGALIGHT 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
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GPC-xx03-12CD	CWDM 1450nm~1610nm, 155Mbps, 120km, 0°C ~ +70°C, With Digital Diagnostic Monitoring
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## 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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