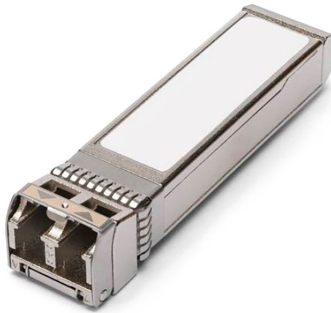




**RoHS compliant**  
**Single-Mode CWDM up to 2.67Gbps**  
**Duplex SFP Transceiver**

### Features



- Operating data rate up to 2.67Gbps
- 18-Wavelength CWDM DFB LD Transmitter from 1270nm to 1610nm, with Step 20nm
- Single 3.3V Power Supply and TTL Control Logic Interface
- Hot-Pluggable SFP Footprint Duplex LC Connector Interface
- Class 1 FDA and IEC60825-1 Laser Safety Compliant
- Operating Case Temperature Standard: -5~+70
- Extended: -20~+85
- Compliant with SFP MSA Specification
- Compliant with SFF-8472 Digital Diagnostic Monitor Interface

### Applications

- Fiber Channel Switch Infrastructure
- GBE/FE Links
- ATM Switches and Routers
- SONET / SDH Switch
- CPRI rate: 2.4576Gb/s
- Other optical links

### Ordering Information

Part No.	Data Rate(Typ.)	Power budget	Interface	Temperature	DDMI
CL-SFP-MC15-L1-XX/2,5	2.67Gbps	15dB	LC	Standard	NO
CL-SFP-MC15-L1-XX/2,5e	2.67Gbps	15dB	LC	Extended	NO
CL-SFP-MC15-L2-XX/2,5	2.67Gbps	15dB	LC	Standard	YES
CL-SFP-MC15-L2-XX/2,5e	2.67Gbps	15dB	LC	Extended	YES
CL-SFP-MC17-L2-XX/2,5	2.67Gbps	17dB	LC	Standard	NO
CL-SFP-MC17-L2-XX/2,5e	2.67Gbps	17dB	LC	Extended	NO
CL-SFP-MC17-L2-XX/2,5	2.67Gbps	17dB	LC	Standard	YES
CL-SFP-MC17-L2-XX/2,5e	2.67Gbps	17dB	LC	Extended	YES
CL-SFP-MC29-L2-XX/2,5	2.67Gbps	29dB	LC	Standard	YES
CL-SFP-MC29-L2-XX/2,5e	2.67Gbps	29dB	LC	Extended	YES
CL-SFP-MC33-L2-XX/2,5	2.67Gbps	33dB	LC	Standard	YES
CL-SFP-MC33-L2-XX/2,5e	2.67Gbps	33dB	LC	Extended	YES

Note1: Standard version, XX refer to CWDM Wavelength range 1270nm to 1610.



**RoHS compliant**  
**Single-Mode CWDM up to 2.67Gbps**  
**Duplex SFP Transceiver**

CWDM Wavelength

Band	Nomenclature	Wavelength(nm)		
		Min.	Typ.	Max.
O-band Original	L1	1264	1270	1277.5
		1284	1290	1297.5
		1304	1310	1317.5
		1324	1330	1337.5
		1344	1350	1357.5
E-band Extended		1364	1370	1377.5
		1384	1390	1397.5
		1404	1410	1417.5
		1424	1430	1437.5
		1444	1450	1457.5
S-band Short Wavelength	L2	1464	1470	1477.5
		1484	1490	1497.5
		1504	1510	1517.5
		1524	1530	1537.5
C-band Conventional		1544	1550	1557.5
L-band Long Wavelength		1564	1570	1577.5
		1584	1590	1597.5
		1604	1610	1617.5

Note2: Wavelengths from 1270 nm to 1610 nm, with 20 nm span. Please contact Carelink to confirm the wavelength availability.



**RoHS compliant**  
**Single-Mode CWDM up to 2.67Gbps**  
**Duplex SFP Transceiver**

## Regulatory Compliance

Product Certificate	Certificate Number	Applicable Standard
TUV	R50135086	EN 60950-1:2006+A11+A1+A12
		EN 60825-1:2007
		EN 60825-2:2004+A1+A2
UL	E317337	UL 60950-1
		CSA C22.2 No. 60950-1-07
EMC CE	AE 50285865 0001	EN 55022:2010
		EN 55024:2010
CB	JPTUV-049251	IEC 60825-1
		IEC 60950-1
FCC	WTF14F0514437E	47 CFR PART 15 OCT., 2013
FDA	1331340-000	CDRH 1040.10
ROHS	RHS01G006464	2011/65/EU

Note3: The above certificate number updated to June 2014, because some certificate will be updated every year, such as FCC, FDA and ROHS. For the latest certification information, please check with Carelink.

## Product Description

The CL-SFP-MCYY-LZ-XX/2,5 series single mode transceivers is small form factor pluggable module for bi-directional serial optical data communications such as SONET OC-48 / SDH STM-16 / OC-12 / OC-3, Gigabit Ethernet 1000BASE, Fibre Channel 1x/2x SM-LC-L FC-PI. It is with the SFP 20-pin connector to allow hot plug capability. This module is designed for single mode fiber and operates at a nominal wavelength of CWDM wavelength. There are eighteen center wavelengths available from 1270nm to 1610nm, with each step 20nm.

The transmitter section uses a multiple quantum well CWDM DFB laser and is a class 1 laser compliant according to International Safety Standard IEC-60825. The receiver section uses an integrated InGaAs detector preamplifier (IDP) mounted in an optical header and a limiting post-amplifier IC. The CL-SFP-MCYY-LZ-XX/2,5 series are designed to be compliant with SFF-8472 Multi-source Agreement (MSA).

## Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	Ts	-40	+85	°C
Supply Voltage	Vcc	-0.5	3.6	V
Operating Relative Humidity		-	95	%

\*Exceeding any one of these values may destroy the device immediately.



**RoHS compliant**  
**Single-Mode CWDM up to 2.67Gbps**  
**Duplex SFP Transceiver**

Recommended Operating Conditions

Parameter		Symbol	Min.	Typical	Max.	Unit
Operating Case Temperature	T <sub>c</sub>	Standard	0	-	+70	°C
		Extended	-20	-	+85	
Power Supply Voltage		V <sub>CC</sub>	3.15	3.3	3.45	V
Power Supply Current		I <sub>CC</sub>	-	-	300	Ma
Data Rate	OC-48/STM-16 FEC			2.67		Gbps
	OC-48/STM-16		-	2.488	-	
	2FC		-	2.125	-	
	GBE		-	1.25	-	
	FC		-	1.063	-	Mbps
	ATM		-	622	-	
	OC-3/STM-1		-	155	-	
	FE		-	100	-	

Performance Specifications – Electrical

Parameter	Symbol	Min.	Typ.	Max	Unit	Notes
<b>Transmitter</b>						
CML Inputs(Differential)	V <sub>in</sub>	400		1600	mVpp	AC coupled inputs
Input Impedance (Differential)	Z <sub>in</sub>	85	100	115	ohm	R <sub>in</sub> > 100 kohm @ DC
TX_Dis	Disable	2		V <sub>CC</sub> +0.3	V	
	Enable	0		0.8		
TX_FAULT	Fault	2		V <sub>CC</sub> +0.3	V	
	Normal	0		0.8		
<b>Receiver</b>						
CML Outputs (Differential)	V <sub>out</sub>	400		1200	mVpp	AC coupled outputs <sup>*(Note6)</sup>
Output Impedance (Differential)	Z <sub>out</sub>	85	100	115	ohm	
RX_LOS	LOS	2		V <sub>CC</sub> +0.3	V	
	Normal	0		0.8	V	
MOD_DEF ( 0:2 )	VoH	2.5			V	With Serial ID
	VoL	0		0.5	V	



**RoHS compliant**  
**Single-Mode CWDM up to 2.67Gbps**  
**Duplex SFP Transceiver**

**Optical and Electrical Characteristics**  
 (CWDM DFB and PIN-TIA, 15dB)

Parameter	Symbol	Min.	Typical	Max.	Uni
Power budget		15			dB
Data Rate		100M		2.67G	bps
<b>Transmitter</b>					
Center Wavelength	$\lambda_c$	$\lambda_c-6$	$\lambda_c$	$\lambda_c+7.5$	nm
Spectral Width (-20Db)	$\Delta\lambda$			1	nm
Side Mode Suppression Ratio	SMSR	30			dB
Average Output Power @9/125um SMF	P <sub>out</sub>	-5		0	dBm
Extinction Ratio*(Note5)	EX	8.2			dB
Rise/Fall Time(20% 80%)	tr/tf			150	ps
Output Optical Eye*(Note5)	ANSI Fiber Channel and Gigabit Ethernet Compliant*(Note9)				
TX_Disable Assert Time	t <sub>off</sub>			10	μs
P <sub>out</sub> @TX Disable Asserted	P <sub>out</sub>			-45	dBm
<b>Receiver</b>					
Center Wavelength	$\lambda_c$	1260		1600	nm
Receiver Sensitivity*(Note7)	Multirate*(Note4)	P <sub>min</sub>		-20	dBm
Receiver Overload	P <sub>max</sub>	-3			dBm
Return Loss		12			dB
Optical Path Penalty*(Note8)				1	dB
LOS De-Assert	LOSD			-21	dBm
LOS Assert	LOSA	-35			dBm
LOS Hysteresis*(Note10)		0.5			dB



**RoHS compliant**  
**Single-Mode CWDM up to 2.67Gbps**  
**Duplex SFP Transceiver**

(CWDM DFB and PIN-TIA, 17dB)

Parameter	Symbol	Min.	Typical	Max.	Unit
Power budget		17			dB
Data Rate		0.1		2.67	Gbps
<b>Transmitter</b>					
Center Wavelength	$\lambda_c$	$\lambda_c-6$	$\lambda_c$	$\lambda_c+7.5$	nm
Spectral Width (-20Db)	$\Delta\lambda$			1	nm
Side Mode Suppression Ratio	SMSR	30			dB
Average Output Power @9/125um SMF	P <sub>out</sub>	-3		+2	dBm
Extinction Ratio <sup>*(Note5)</sup>	EX	8.2			dB
Rise/Fall Time(20% 80%)	tr/tf			150	ps
Output Optical Eye <sup>*(Note5)</sup>	ANSI Fiber Channel and Gigabit Ethernet Compliant <sup>*(Note9)</sup>				
TX_Disable Assert Time	t <sub>off</sub>			10	μs
P <sub>out</sub> @TX Disable Asserted	P <sub>out</sub>			-45	dBm
<b>Receiver</b>					
Center Wavelength	$\lambda_c$	1260		1600	nm
Receiver Sensitivity <sup>*(Note7)</sup>   Multirate <sup>*(Note4)</sup>	P <sub>min</sub>			-20	dBm
Receiver Overload	P <sub>max</sub>	-3			dBm
Return Loss		12			dB
Optical Path Penalty <sup>*(Note8)</sup>				1	dB
LOS De-Assert	LOSD			-21	dBm
LOS Assert	LOSA	-35			dBm
LOS Hysteresis <sup>*(Note10)</sup>		0.5			dB



**RoHS compliant**  
**Single-Mode CWDM up to 2.67Gbps**  
**Duplex SFP Transceiver**

(CWDM DFB and APD, 29dB)

Parameter	Symbol	Min.	Typical	Max.	Unit
Power budget		29			dB
Data Rate		0.1		2.67	Gbps
<b>Transmitter</b>					
Center Wavelength	$\lambda_c$	$\lambda_c-6$	$\lambda_c$	$\lambda_c+7.5$	nm
Spectral Width (-20Db)	$\Delta\lambda$			1	nm
Side Mode Suppression Ratio	SMSR	30			dB
Average Output Power @9/125um SMF	P <sub>out</sub>	0		+5	dBm
Extinction Ratio <sup>*(Note5)</sup>	EX	8.2			dB
Rise/Fall Time(20% 80%)	tr/tf			150	ps
Output Optical Eye <sup>*(Note5)</sup>	ANSI Fiber Channel and Gigabit Ethernet Compliant <sup>*(Note9)</sup>				
TX_Disable Assert Time	t <sub>off</sub>			10	μs
P <sub>out</sub> @TX Disable Asserted	P <sub>out</sub>			-45	dBm
<b>Receiver</b>					
Center Wavelength	$\lambda_c$	1260		1600	nm
Receiver Sensitivity <sup>*(Note7)</sup>	Multirate <sup>*(Note4)</sup>	P <sub>min</sub>		-29	dBm
Receiver Overload	P <sub>max</sub>	-9			dBm
Return Loss		12			dB
Optical Path Penalty <sup>*(Note8)</sup>				1	dB
LOS De-Assert	LOSD			-30	dBm
LOS Assert	LOSA	-42			dBm
LOS Hysteresis <sup>*(Note10)</sup>		0.5			dB



**RoHS compliant**  
**Single-Mode CWDM up to 2.67Gbps**  
**Duplex SFP Transceiver**

(CWDM DFB and APD, 33dB)

Parameter	Symbol	Min.	Typical	Max.	Unit
Power budget		33			dB
Data Rate		0.1		2.67	Gbps
<b>Transmitter</b>					
Center Wavelength	$\lambda_c$	$\lambda_c-6$	$\lambda_c$	$\lambda_c+7.5$	nm
Spectral Width (-20Db)	$\Delta\lambda$			1	nm
Side Mode Suppression Ratio	SMSR	30			Db
Average Output Power @9/125um SMF	P <sub>out</sub>	4		7	dBm
Extinction Ratio*(Note5)	EX	8.2			Db
Rise/Fall Time(20% 80%)	tr/tf			150	ps
Output Optical Eye*(Note5)	ANSI Fiber Channel and Gigabit Ethernet Compliant*(Note9)				
TX_Disable Assert Time	t <sub>off</sub>			10	$\mu$ s
P <sub>out</sub> @TX Disable Asserted	P <sub>out</sub>			-45	dBm

<b>Receiver</b>						
Center Wavelength		$\lambda_c$	1260		1600	nm
Receiver Sensitivity*(Note7)	Multirate*(Note4)	P <sub>min</sub>			-29	dB
Receiver Overload		P <sub>max</sub>	-9			dB
Return Loss			12			Db
Optical Path Penalty*(Note8)					1	Db
LOS De-Assert		LOSD			-30	dB
LOS Assert		LOSA	-42			dB
LOS Hysteresis*(Note10)			0.5			Db

Note4: Multirate:2.67Gb/s/OC-48/2X FC/1X FC/ OC-12/OC-03/GE/FE.

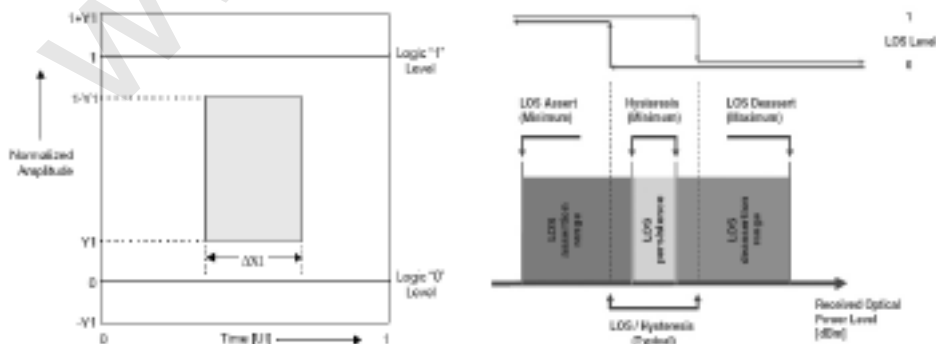
Note5: Filtered, measured with a PRBS 2<sub>23</sub>-1 test pattern @2.5Gbps.

Note6: CML logic, internally AC coupled.

Note7: Minimum average optical power measured at BER less than 1E-12 and ER=9Db.

Note8: Measured with a PRBS 2<sub>23</sub>-1 tests pattern @2.5Gbps, BER<sub>1</sub>~10<sup>-12</sup>.

Note9: Eye Pattern Mask Note10: LOS Hysteresis

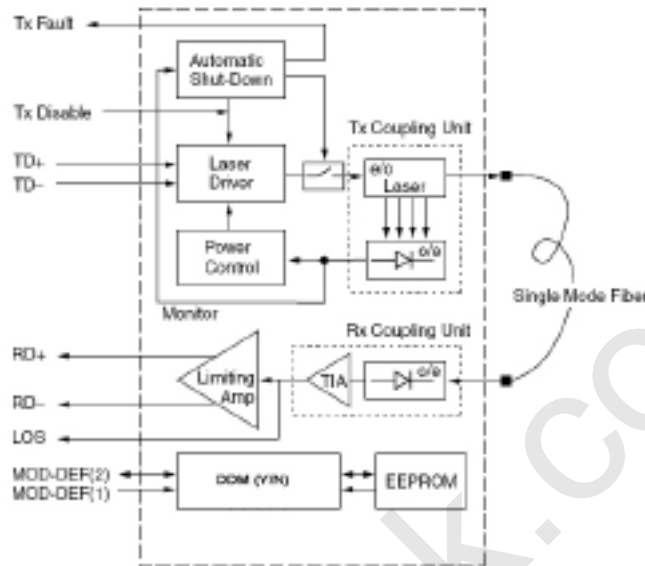




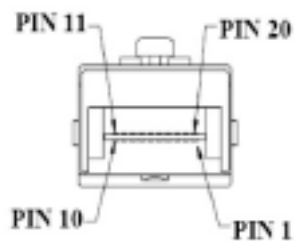
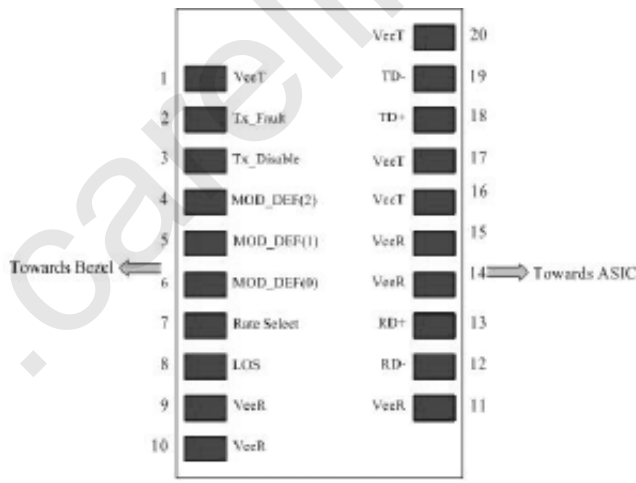


**RoHS compliant  
Single-Mode CWDM up to 2.67Gbps  
Duplex SFP Transceiver**

Functional Description of Transceiver



SFP Transceiver Electrical Pad Layout





RoHS compliant  
Single-Mode CWDM up to 2.67Gbps  
Duplex SFP Transceiver

Pin Function Definitions

Pin Num.	Name	Function	Plug Seq.	Notes
1	VeeT	Transmitter Ground	1	5)
2	TX Fault	Transmitter Fault Indication	3	1)
3	TX Disable	Transmitter Disable	3	2) Module disables on high or open
4	MOD-DEF2	Module Definition 2	3	3) Data line for Serial ID.
5	MOD-DEF1	Module Definition 1	3	3) Clock line for Serial ID.
6	MOD-DEF0	Module Definition 0	3	3) Grounded within the module.
7	Rate Select	Not Connect	3	Function not available
8	LOS	Loss of Signal	3	4)
9	VeeR	Receiver Ground	1	5)
10	VeeR	Receiver Ground	1	5)
11	VeeR	Receiver Ground	1	5)
12	RD-	Inv. Received Data	3	6)
13	RD+	Received Data Out	3	6)
14	VeeR	Receiver Ground	1	5)
15	VccR	Receiver Power	2	7) 3.3 ± 5%
16	VccT	Transmitter Power	2	7) 3.3 ± 5%
17	VeeT	Transmitter Ground	1	5)
18	TD+	Transmit Data In	3	8)
19	TD-	Inv. Transmit Data	3	8)
20	VeeT	Transmitter Ground	1	5)

Notes:

- 1) TX Fault is an open collector/drain output, which should be pulled up with a 4.7K – 10K<sub>Ω</sub> resistor on the host board. Pull up voltage between 2.0V and VccT, R+0.3V. When high, output indicates a laser fault of some kind. Low indicates normal operation. In the low state, the output will be pulled to < 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 4.7 – 10 K<sub>Ω</sub> resistor. Its states are:  
Low (0 – 0.8V): Transmitter on  
(>0.8, < 2.0V): Undefined  
High (2.0 – 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 – 10K<sub>Ω</sub> resistor on the host board. The pull-up voltage shall be VccT or VccR .  
Mod-Def 0 is grounded by the module to indicate that the module is present



**RoHS compliant**  
**Single-Mode CWDM up to 2.67Gbps**  
**Duplex SFP Transceiver**

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 (Loss of Signal) is an open collector/drain output, which should be pulled up with a 4.7K – 10K<sub>Ω</sub> resistor. Pull up voltage between 2.0V and VccT, R+0.3V. When high, this output indicates the received optical power is below the worst-case receiver sensitivity (as defined by the standard in use). Low indicates normal operation. In the low state, the output will be pulled to < 0.8V.

5) VeeR and VeeT may be internally connected within the SFP module.

6) RD-/+ : These are the differential receiver outputs. They are AC coupled 100<sub>Ω</sub> differential lines which should be terminated with 100<sub>Ω</sub> (differential) at the user SERDES. The AC coupling is done inside the module and is thus not required on the host board. The voltage swing on these lines will be between 400 and 2000 Mv differential (200 – 1000 Mv single ended) when properly terminated.

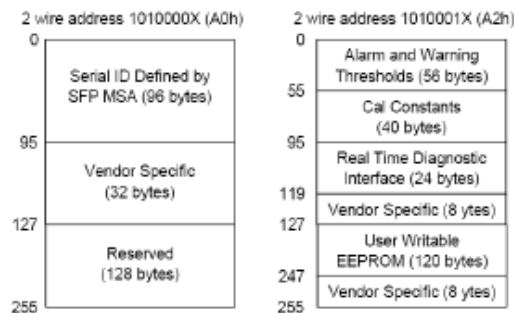
7) VccR and VccT are the receiver and transmitter power supplies. They are defined as 3.3V ±5% at the SFP connector pin. Maximum supply current is 300Ma. Recommended host board power supply filtering is shown below. Inductors with DC resistance of less than 1 ohm should be used in order to maintain the required voltage at the SFP input pin with 3.3V supply voltage. When the recommended supply-filtering network is used, hot plugging of the SFP transceiver module will result in an inrush current of no more than 30Ma greater than the steady state value. VccR and VccT may be internally connected within the SFP transceiver module.

8) TD-/+ : These are the differential transmitter inputs. They are AC-coupled, differential lines with 100<sub>Ω</sub> differential termination inside the module. The AC coupling is done inside the module and is thus not required on the host board. The inputs will accept differential swings of 400 – 2000Mv (200 – 1000Mv single-ended).

**EEPROM:**

The serial interface uses the 2-wire serial CMOS EEPROM protocol defined for the ATMEL AT24C02/04 family of components. When the serial protocol is activated, the host generates the serial clock signal (SCL). The positive edge clocks data into those segments of the EEPROM that are not writing protected within the SFP transceiver. The negative edge clocks data from the SFP transceiver. The serial data signal (SDA) 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. If the module is defined as external calibrated, 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 define as following .For detail EEPROM information, please refer to the related document of SFF 8472 Rev 9.3.





**RoHS compliant  
Single-Mode CWDM up to 2.67Gbps  
Duplex SFP Transceiver**

**EEPROM Serial ID Memory Contents**

Accessing Serial ID Memory uses the 2 wire address 1010000X(A0). Memory Contents of Serial ID are shown in Table 1.

Table 1 Serial ID Memory Contents

Addr.	Size (Bytes)	Name of Field	Hex	Description
<b>BASE ID FIELDS</b>				
0	1	Identifier	03	SFP
1	1	Ext. Identifier	04	SFP function is defined by serial ID only
2	1	Connector	07	LC Connector
3-10	8	Transceiver	XX	Transmitter Code
11	1	Encoding	03	NRZ
12	1	BR, Nominal	XX <sup>(Note11)</sup>	
13	1	Reserved	00	
14	1	Length (9μm)km	XX	Transceiver transmit distance
15	1	Length(9μm)100m	00	
16	1	Length (50μm) 10m	00	
17	1	Length(62.5μm)10m	00	
18	1	Length (Copper)	00	Not compliant
19	1	Reserved	00	
20-35	16	Vendor name	XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX <sup>(Note11)</sup>	Vendor name (ASCII)
36	1	Reserved	00	
37-39	3	Vendor OUI	XX XX XX <sup>(Note11)</sup>	
40-55	16	Vendor PN		Transceiver part number
56-59	4	Vendor rev	XX XX XX XX <sup>(Note11)</sup>	
60-61	2	Wavelength	XX XX <sup>(Note11)</sup>	CWDM
62	1	Reserved	00	
63	1	CC_BASE	Check Sum (Variable)	Check code for Base ID Fields
<b>EXTENDED ID FIELDS</b>				
64-65	2	Options	00 1A	TX_DISABLE, TX_FAULT and Loss of Signal implemented.
66	1	BR,max	00	
67	1	BR,min	00	
68-83	16	Vendor SN	XX XX XX XX XX XX XX XX 20 20 20 20	Serial Number of transceiver (ASCII). For

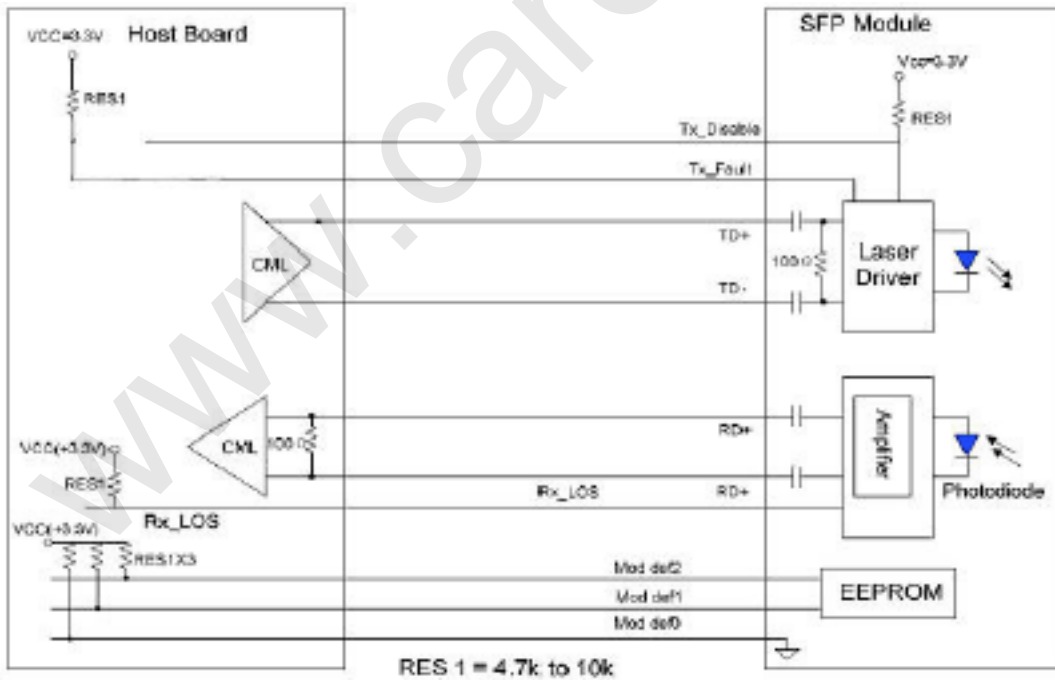


**RoHS compliant  
Single-Mode CWDM up to 2.67Gbps  
Duplex SFP Transceiver**

			20 20 20 20 <sup>(Note11)</sup>	example "B000822".
84-91	8	Date code	XX XX XX XX XX XX XX XX <sup>(Note11)</sup>	Manufactory date code. For example "080405".
92	1	Diagnostic Monitoring Type	XX <sup>(Note11)</sup>	Digital diagnostic monitoring implemented
93	1	Enhanced Options	XX <sup>(Note11)</sup>	Optional flags
94	1	SFF_8472 Compliance	XX <sup>(Note11)</sup>	01 for diagnostics (Rev9.3 SFF-8472).
95	1	CC_EXT	Check Sum (Variable)	Check sum for Extended ID Field.
<b>VENDOR SPECIFIC ID FIELDS</b>				
96-127	32	Vendor Specific	Read only	Depends on customer information
128-255	128	Reserved	Read only	

Note11: The "xx" byte should be filled in according to practical case. For more information, please refer to the related document of SFP Multi-Source Agreement (MSA).

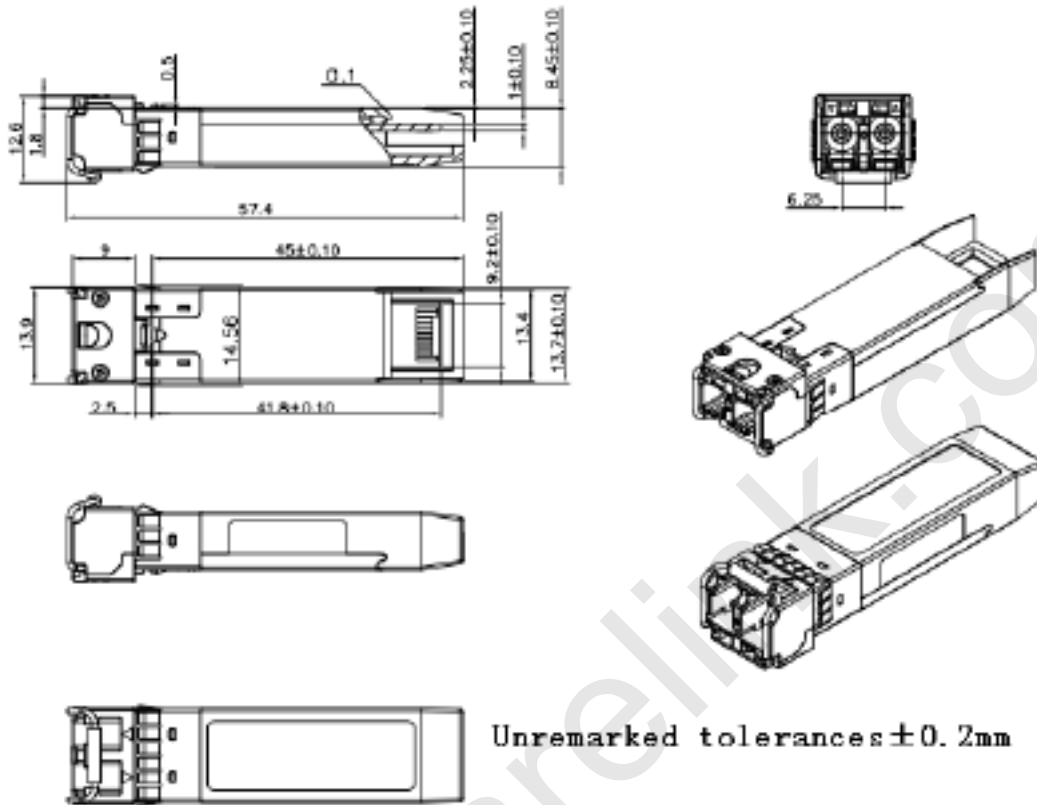
**Recommend Circuit Schematic**





**RoHS compliant**  
**Single-Mode CWDM up to 2.67Gbps**  
**Duplex SFP Transceiver**

**Mechanical Specifications**



**Laser Emission Data**

Wavelength	>1260nm
Total output power (as defined by FDA: 7mm aperture at 20cm distance)	<0.79Mw
Total output power (as defined by IEC: 7mm aperture at 10cm distance)	<10Mw
Beam divergence	12.5°

**Laser Emission**

