



RoHS compliant
CWDM Transceiver, 41dB margin
Small Form Pluggable (SFP), 3.3V
1.0625Gbd Fiber Channel/1.25 Gigabit Ethernet, DDM



Features

- CWDM wavelength Laser Transmitter
- Single +3.3V power supply
- Up to 200km on 9/125 μ m SMF
- Operating Temperature Range (0 $^{\circ}$ C to +70 $^{\circ}$ C)
- Hot-Pluggable electrical interface
- Digital diagnostic monitoring
- Duplex LC receptacle optical interface
- Low power dissipation
- Excellent EMI and ESD protection
- Compliant with Small Form-Factor Pluggable (SFP) Transceiver Multi-Source Agreement (MSA) and SFF-8472 v9.3

Application

- Distributed multi-processing
- Switch to switch interface
- High speed I/O for file server
- Bus extension application
- Channel extender, data storage

Ordering Information

PART NUMBER	WAVELENGTH	INPUT/OUTPUT	SIGNAL DETECT	VOLTAGE	TEMPERATURE
CL-SFP-C41-L127	1270 nm	AC/AC	TTL	3.3V/5V	0 $^{\circ}$ C to 70 $^{\circ}$ C
CL-SFP-C41-L129	1290 nm	AC/AC	TTL	3.3V/5V	0 $^{\circ}$ C to 70 $^{\circ}$ C
CL-SFP-C41-L131	1310 nm	AC/AC	TTL	3.3V/5V	0 $^{\circ}$ C to 70 $^{\circ}$ C
CL-SFP-C41-L133	1330 nm	AC/AC	TTL	3.3V/5V	0 $^{\circ}$ C to 70 $^{\circ}$ C
CL-SFP-C41-L135	1350 nm	AC/AC	TTL	3.3V/5V	0 $^{\circ}$ C to 70 $^{\circ}$ C
CL-SFP-C41-L137	1370 nm	AC/AC	TTL	3.3V/5V	0 $^{\circ}$ C to 70 $^{\circ}$ C
CL-SFP-C41-L139	1390 nm	AC/AC	TTL	3.3V/5V	0 $^{\circ}$ C to 70 $^{\circ}$ C
CL-SFP-C41-L141	1410 nm	AC/AC	TTL	3.3V/5V	0 $^{\circ}$ C to 70 $^{\circ}$ C
CL-SFP-C41-L143	1430 nm	AC/AC	TTL	3.3V/5V	0 $^{\circ}$ C to 70 $^{\circ}$ C



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CL-SFP-C41-L127i	1270 nm	AC/AC	TTL	3.3V/5V	-40°C to 85 °C
CL-SFP-C41-L129i	1290 nm	AC/AC	TTL	3.3V/5V	-40°C to 85 °C
CL-SFP-C41-L131i	1310 nm	AC/AC	TTL	3.3V/5V	-40°C to 85 °C
CL-SFP-C41-L133i	1330 nm	AC/AC	TTL	3.3V/5V	-40°C to 85 °C
CL-SFP-C41-L135i	1350 nm	AC/AC	TTL	3.3V/5V	-40°C to 85 °C
CL-SFP-C41-L137i	1370 nm	AC/AC	TTL	3.3V/5V	-40°C to 85 °C
CL-SFP-C41-L139i	1390 nm	AC/AC	TTL	3.3V/5V	-40°C to 85 °C
CL-SFP-C41-L141i	1410 nm	AC/AC	TTL	3.3V/5V	-40°C to 85 °C
CL-SFP-C41-L143i	1430 nm	AC/AC	TTL	3.3V/5V	-40°C to 85 °C

Absolute Maximum Ratings

Operating of SFP beyond the Absolute Conditions Listed in Table 1 will degrade or damage the products. It's not implied that the products would function above the recommended operating environment, it's possible to reduce the reliability and lifetime of device if Recommended Operating Environment is exceeded (Refer to table 2)

Table 1-- Absolute Maximum Conditions

Parameter	Symbol	Min	Max	Units
Storage Temperature	T _{ST}	-40	+85	°C
Relative Humidity	RH	5	95	%
Supply Voltage	V _{CC}	0	+3.8	V



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Table 2– Recommended Operating Environment

Parameter	Symbol	Min	Typ	Max	Units
Supply Voltage	V_{CC}	+3.1	+3.3	+3.5	V
Supply Current	$I_{TX}+I_{RX}$	-	200	300	mA
Operating Temperature	Commerce level	T_{OP}	0	+70	°C
Data Rate	B		1250		Mbits/s
Transmitter Differential Input Voltage	V_{TD}	200		2400	mV _{p,p}
Signal Outputs	TX_FAULT	V_{OH}	$V_{CC}-0.4$	V_{CC}	V
	LOS	V_{OL}	V_{EE}	$V_{EE}+0.4$	
Signal Inputs	TX_DISABLE	V_{IH}	$V_{CC}-1.300$	V_{CC}	V
	MOD_DEF1,2	V_{IL}	V_{EE}	$V_{EE}+0.800$	

Optical Parameters

Table 3 CL-SFP-C41-L1XX Transceiver Optical and Electrical Characteristics

Parameter	Symbol	Min	Typ	Max	Units
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(Ambient Operating Temperature $T_a=0^{\circ}\text{C}$ to $+70^{\circ}\text{C}$, $V_{CC} = 3.1\text{V}$ to 3.5V)



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Data rate	B	-	1250	-	Mb/s
Output Center Wavelength	λ_C	1427	1430	1437.5	nm
Output Spectral width (-20dB)	λ	-	-	1.0	nm
Average Optical Output Power	P_o	2	-	-	dBm
Extinction Ratio	EXT	9	-	-	dB
Power Supply Current	I_{CCT}	-	100	150	mA
Optic Output Eye: Compliant with IEEE802.3z eye masks when filtered					
Receiver					
Receiver Sensitivity	S	-	-	-30	dBm
Maximum Input Power	P_{MAX}	-9	-	-	dBm
Operation Center Wavelength	λ_C	1100	-	1600	nm
Loss of Signal	Assert	LOS_A	-45	-	dBm
	Deassert	LOS_D	-	-30	dBm
LOS Hysteresis	LOS_{HYS}	1.0	-	4.0	dB
Transmitter					

Table 4 CL-SFP-C41-L1XX Transceiver Optical and Electrical Characteristics
 (Ambient Operating Temperature $T_a=0^{\circ}C$ to $+70^{\circ}C$, $V_{CC}=3.1V$ to $3.5V$)

Parameter	Symbol	Min	Typ	Max	Units
Transmitter					



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Data rate	B	-	1250	-	Mb/s
Output Center Wavelength	λ_C	1447	1450	1457.5	nm
Output Spectral width (-20dB)	λ	-		1.0	nm
Average Optical Output Power	P_o	2			dBm
Extinction Ratio	EXT	9	-	-	dB
Power Supply Current	I_{CCT}	-	100	150	mA
Optic Output Eye: Compliant with IEEE802.3z eye masks when filtered					
Receiver					
Receiver Sensitivity	S	-		-30	dBm
Maximum Input Power	P_{MAX}	-9		-	dBm
Operation Center Wavelength	λ_C	1100		1600	nm
Loss of Signal	Assert	LOS_A	-45	-	dBm
	Deassert	LOS_D	-	-30	dBm
LOS Hysteresis		LOS_{HYS}	1.0	4.0	dB

EEPROM Information Functions

The standard SFP serial ID provides access to identification information that describes the transceiver's capabilities, standard interfaces, manufacturer, and other information.

Additionally, SFP transceivers provide a unique enhanced digital diagnostic monitoring interface, which allows real-time access to device operating parameters such as transceiver temperature, laser bias current, transmitted optical power, and received optical power and transceiver supply voltage. It also defines a sophisticated system of alarm and warning flags, which alerts end - users when particular operating parameters are outside of a factory set normal range.

The SFP MSA defines a 256- byte memory map in E2PROM that is accessible over a 2- wire serial interface at the 8 bit address 1010000X (A0h). The digital diagnostic monitoring interface makes use of the 8 bit address 1010001X (A2h), so the originally defined serial ID memory map remains unchanged. The interface is identical to, and is thus fully backward compatible with both the GBIC Specification and the SFP Multi Source Agreement. The complete interface is described in "Digital Diagnostics Monitoring Interface for SFP Optical Transceivers".



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2 wire address 1010000X(A0h)		2 wire address 1010001X(A2h)	
0	Serial ID Defined by SFP MSA (96 bytes)	0	Alarm and Warning Thresholds (56 bytes)
95	Vendor Specific (32 bytes)	55	Cal constants (40 bytes)
127	Reserved in SFP MSA(128 bytes)	95	Real Time Diagnostic Interface(24 bytes)
255		119	Vendor specific(8 bytes)
		127	User Writable EEPROM (120 bytes)
		247	Vendor specific(8 bytes)
		255	

EEPROM Serial ID Memory Contents:



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Table 10 Serial ID Memory Contents

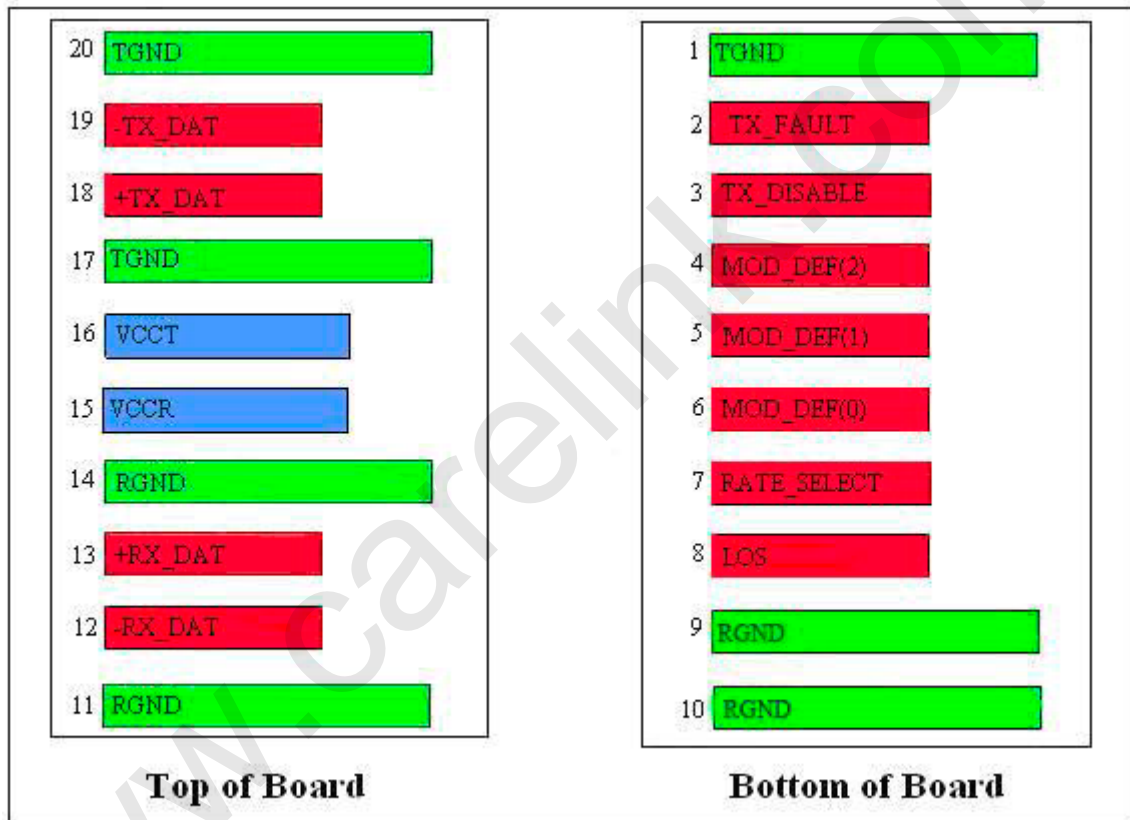
Data Address	Size (Byte)	Name of Field	Description
Base ID Fields			
0	1	Identifier	SFP
1	1	Ext. Identifier	SFP function is defined by serial ID only
2	1	Connector	LC Connector
3-10	8	Transceiver	Transceiver Codes
11	1	Encoding	NRZ
12	1	BR, Nominal	1250Mbps
13	1	Reserved	
14	1	Length(9μm)km	Transceiver transmit distance
15	1	Length(9μm)100m	
16	1	Length(50μm)10m	
17	1	Length(62.5μm)10m	
18	1	Length(Copper)	Not compliant
19	1	Reserved	
20-35	16	Vendor Name	SFP vendor name: Carelink
36	1	Reserved	
37-39	3	Vendor OUI	
40-55	16	Vendor PN	
56-59	4	Vendor rev	3.0
60-61	2	Wavelength	Transceiver wavelength
62	1	Reserved	
63	1	CC_BASE	Check code for Base ID Fields
Extended ID Fields			
64-65	2	Options	TX_FAULT, TX_DISABLE and Loss of Signal implemented.
66	1	BR, max	
67	1	BR, min	
68-83	16	Vendor SN	Serial number
84-91	8	Date code	Manufactory date code
92	1	Diagnostic Monitoring Type	Digital diagnostic monitoring implemented, "externally calibrated" is implemented, RX measurement type is "Average Power".
93	1	Enhanced Options	Optional Alarm/Warning flags implemented for all monitored quantities, Optional Soft RX_LOS monitoring implemented.



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94	1	SFF-8472 Compliance	Includes functionality described in Rev 9.3 SFF-8472.
95	1	CC_EXT	Check sum for the extended ID Fields
Vendor Specific ID Fields			
96-127	32	Vendor Specific	Depends on customer information

Assignment & Signal Definition





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Table 11—SFP to host connector pin assignment

Pin #	Pin Name	Plug Sequence	Input/Output	Description
1	TGND	1		Transmitter Ground
2	TX_FAULT	3	Output	Transmit Fault Indication
3	TX_DISABLE	3	Input	Transmit Disable
4	MOD_DEF(2)	3	Input/Output	SDA Serial Data Signal
5	MOD_DEF(1)	3	Input	SCL Serial Clock Signal
6	MOD_DEF(0)	3	I/O	Grounded to indicate that the module is present
7	Rate Select	3	Output	Select Between Full or Reduced Receiver Bandwidth
8	LOS	3	Output	Loss of Signal
9	RGND	1		Receiver Ground
10	RGND	1		Receiver Ground
11	RGND	1		Receiver Ground
12	-RX_DAT	3	Output	Differential receiver outputs.
13	+RX_DAT	3	Output	Differential receiver outputs.
14	RGND	1		Receiver Ground
15	VCCR	2	Input	Receiver power supply
16	VCCT	2	Input	Transmitter power supply
17	TGND	1		Transmitter Ground
18	+TX_DAT	3	Input	Differential transmitter inputs.
19	-TX_DAT	3	Input	Differential transmitter inputs.
20	TGND	1		Transmitter Ground



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Plug Seq: Pin engagement sequence during hot plugging.

1) TX Fault is an open collector/drain output, which should be pulled up with a 4.7K Ω –10K Ω 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. Its states are:

Low (0 – 0.8V): Transmitter on

(>0.8, < 2.0V): Undefined

High (2.0 – VCC): 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 Ω –10K Ω 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

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) Not in used.

5) LOS (Loss of Signal) is an open collector/drain output, which should be pulled up with a 4.7K Ω –10K Ω 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.

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

7) RD-/+ : These are the differential receiver outputs. They are AC coupled 100 differential lines which should be terminated with 100 (differential) at the user SERDES. The AC coupling is done inside the module and is thus not required on the host board.

8) 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 300 mA. Recommended host board power supply filtering is shown below. Inductors with DC resistance of less than 1 Ω could 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 30 mA greater than the steady state value. VccR and VccT may be internally connected within the SFP transceiver module.

9) TD-/+ : These are the differential transmitter inputs. They are AC-coupled, differential lines with 100 differential terminations inside the module. The AC coupling is done inside the module and is thus not required on the host board.

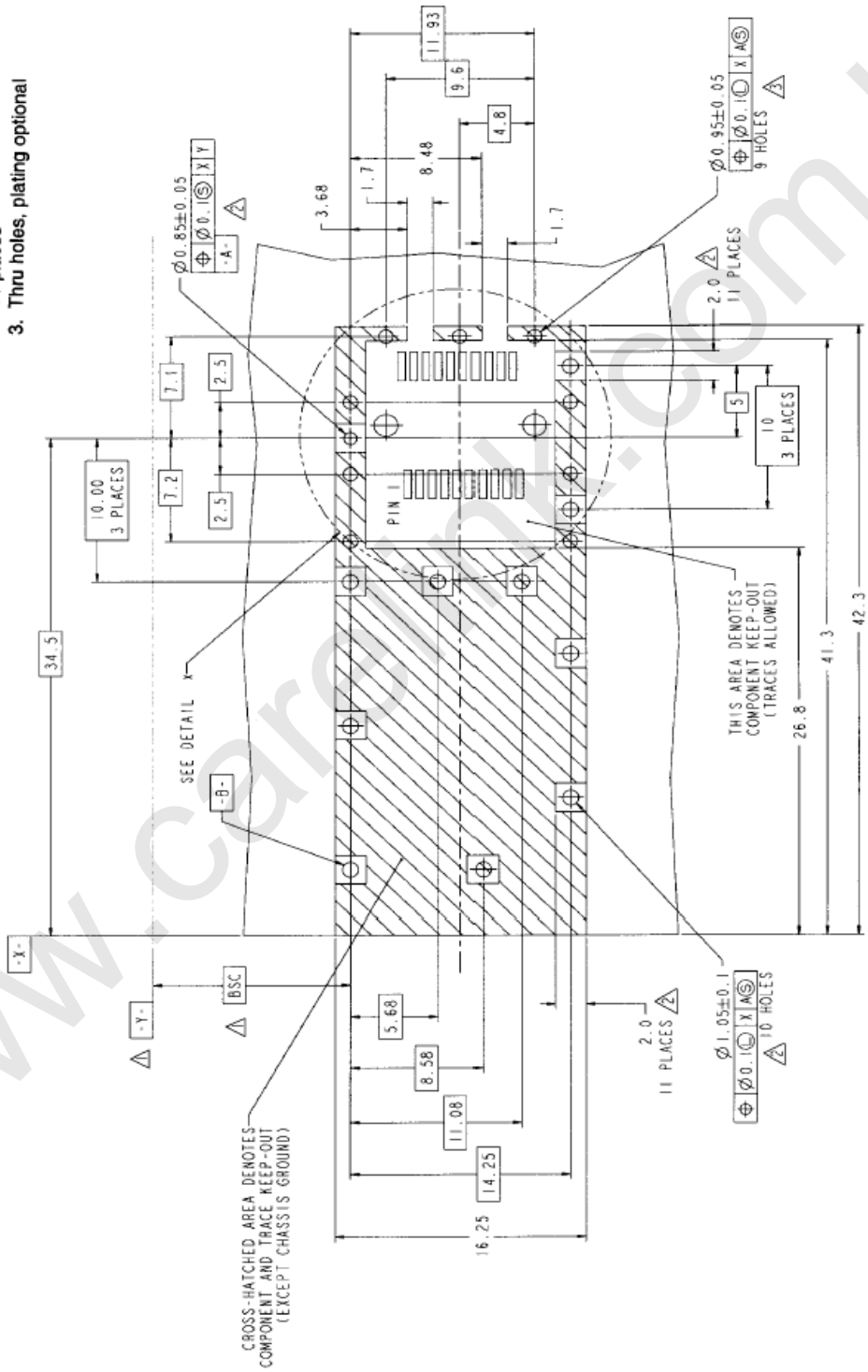


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Host Board Layout

A typical host board mechanical layout for attaching the SFP Connector and Cage System is shown in Figures 1 and 2.

- Notes:
1. Datum and basic dimensions established by customer
 2. Pads and vias are chassis ground, .11 places
 3. Thru holes, plating optional





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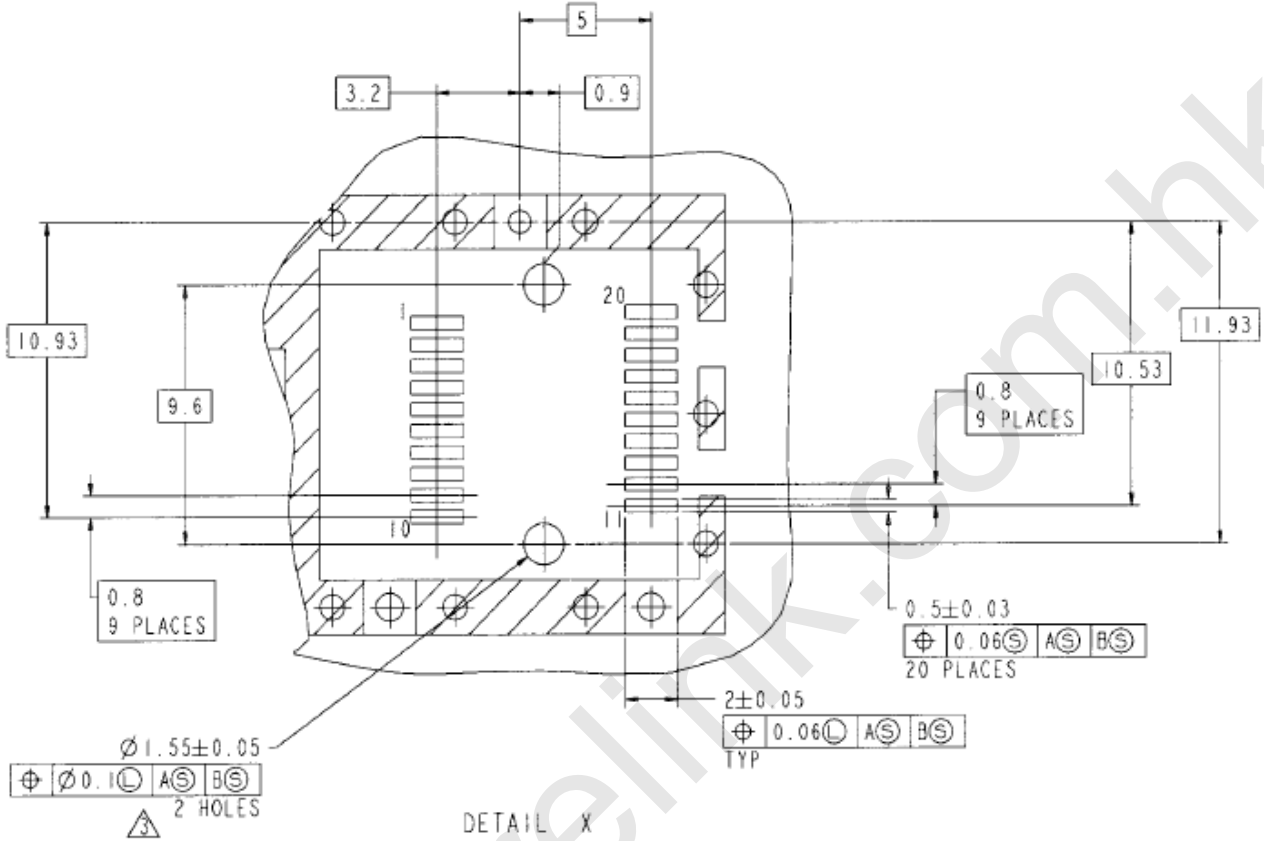


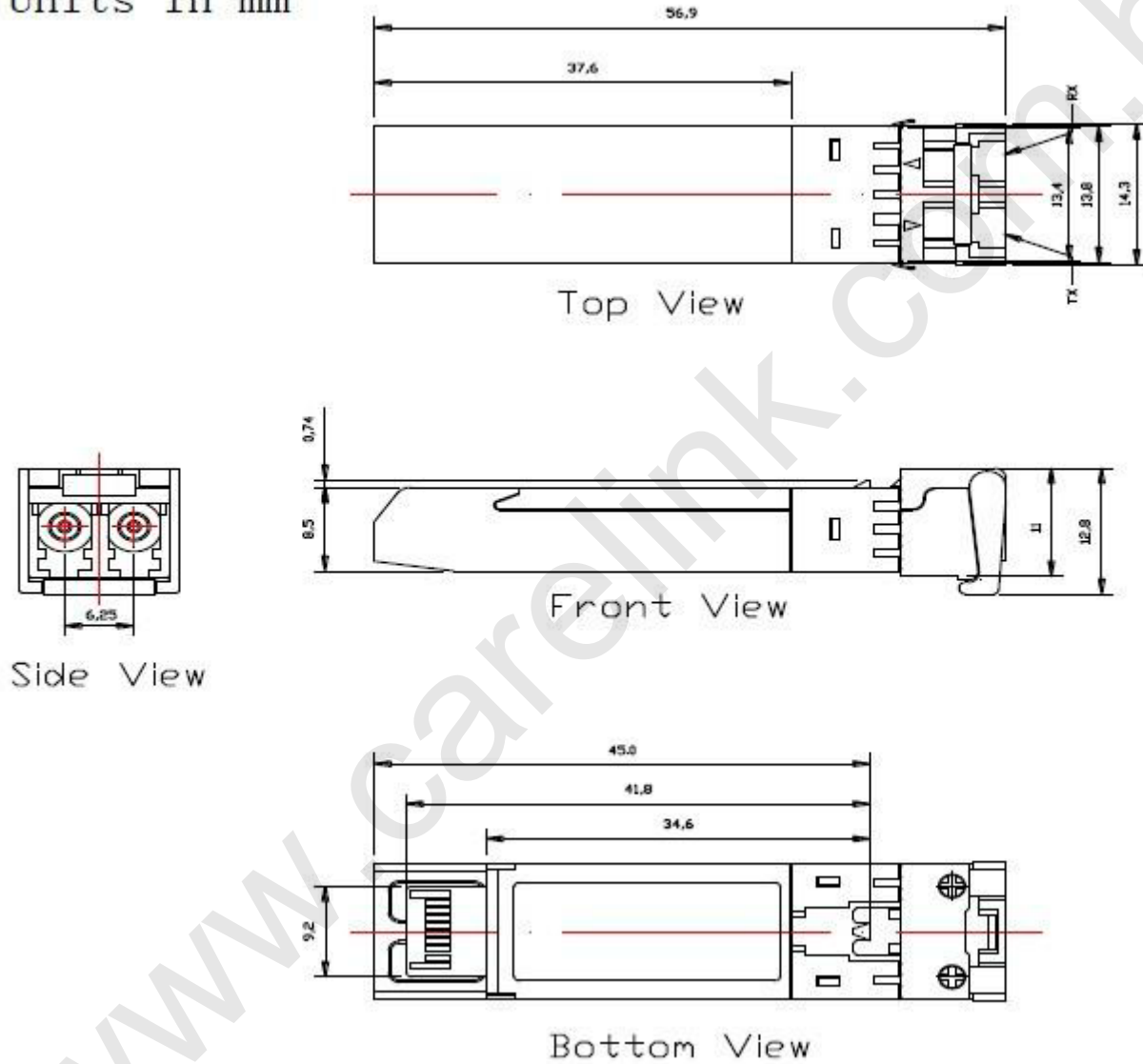
Figure 2 SFP Host Board Mechanical Layout (Cont.)



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SFP Outline Drawing

Units in mm



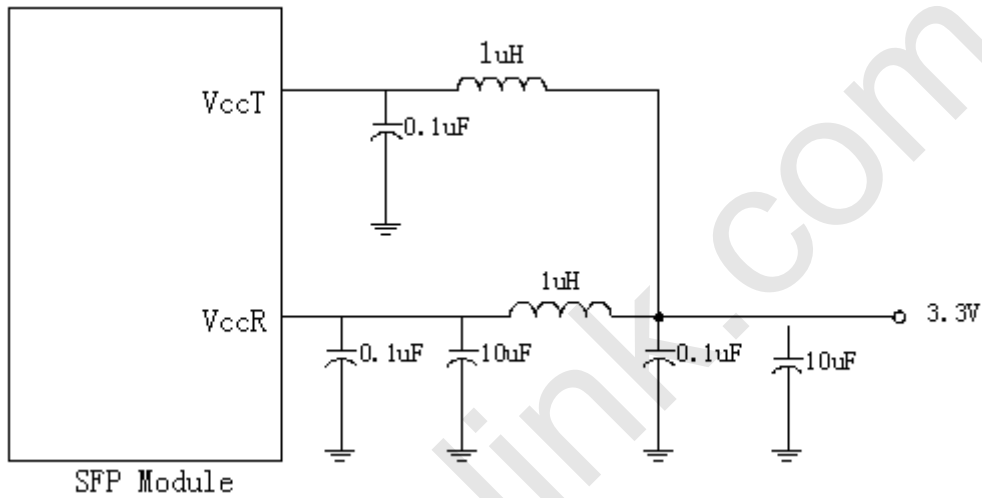
Figures 3



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Power Supply Information

The Transceiver includes internal circuit components to filter power supply noise. Under some conditions of EMI and power supply noise, external power supply filtering may be necessary. If receiver sensitivity is found to be degraded by power supply noise, the filter network illustrated in the following figure may be used to improve performance. The values of the filter components are general recommendations and may be changed to suit a particular system environment. Shielded inductors are recommended.



Note: Specifications subject to change without notice.



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Eye Safety Mark

<p>The LM2 series multimode transceiver is a class 1 laser product. It complies with EN 60825-1 and FDA 21 CFR 1040.10 and 1040.11. In order to meet laser safety requirements the transceiver shall be operated within the Absolute Maximum Ratings.</p> <p>Caution All adjustments have been done at the factory before the shipment of the devices. No maintenance and user serviceable part is required. Tampering with and modifying the performance of the device will result in voided product warranty.</p>	<p>Required Mark</p> <div style="border: 1px solid black; padding: 5px; text-align: center;"><p>Class 1 Laser Product Complies with 21 CFR 1040.10 and 1040.11</p></div>
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Note : All information contained in this document is subject to change without notice.