



**RoHS compliant**  
**2 CH TX-1310/RX-1490 nm Single-mode Bi-directional**  
**CSFP LC 1000Mbps FE/FC/GBE, Digital Diagnostic**  
**1.0625Gbd Fiber Channel/1.25 Gigabit Ethernet**

### Features



- Support 1.25Gbps Data Links
- A type: 1310nm DFB TX /1490nm RX
- B type: 1490nm DFB TX /1310nm RX
- 40km with 9/125  $\mu$ m SMF
- Single 3.3V Power supply and TTL Logic Interface
- 2XBi-directional transceivers in 1 SFP transceiver package
- Class 1 FDA and IEC60825-1 Laser Safety Compliant
- Operating Case Temperature
- Standard: -5°C~+70°C
- Industrial: -40°C~+85°C
- Compliant with CSFP MSA Option 2
- Compliant with Digital Diagnostic Monitor Interface SFF-8472

### Applications

- Fiber Channel Links
- Gigabit Ethernet (1000Base-BX)
- Point to Point FTTH Application

### Ordering Information

PART NUMBER	TX/RX	INPUT/OUTPUT	SIGNAL DETECT	TEMPERATURE	LD Type	Distance
CL-CSFP-40-31DD	1310/1490	AC/AC	TTL	-5°C to 70 °C	-	40km
CL-CSFP-40-31DDi	1310/1490	AC/AC	TTL	-40°C to 85 °C	-	40km



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## Regulatory Compliance

Feature	Standard	Performance
Electrostatic Discharge (ESD) to the Electrical Pins	MIL-STD-883G Method 3015.7	Class 1C (>1000 V)
Electrostatic Discharge to the enclosure	EN 55024:1998+A1+A2 IEC-61000-4-2 GR-1089-CORE	Compliant with standards
Electromagnetic Interference (EMI)	FCC Part 15 Class B EN55022:2006 CISPR 22B :2006 VCCI Class B	Compliant with standards Noise frequency range: 30MHz to 6GHz. Good system EMI design practice required to achieve Class B margins. System margins are dependent on customer host board and chassis design.
Immunity	EN 55024:1998+A1+A2 IEC 61000-4-3	Compliant with standards. 1KHz sine-wave, 80% AM, from 80MHz to 1GHz. No effect on transmitter/receiver performance is detectable between these limits.
Laser Eye Safety	FDA 21CFR 1040.10 and 1040.11 EN (IEC) 60825-1:2007 EN (IEC) 60825-2:2004+A1	CDRH compliant and Class I laser product. TüV Certificate No. 50135086
Component Recognition	UL and CUL EN60950-1:2006	UL file E317337 TüV Certificate No. 50135086 (CB scheme )
RoHS6	2002/95/EC 4.1&4.2 2005/747/EC 5&7&13	Compliant with standards <sup>*note3</sup>

Note2: For update of the equipments and strict control of raw materials, Carelink has the ability to supply the customized products since Jan 1<sup>st</sup>, 2007, which meet the requirements of RoHS6 (Restrictions on use of certain Hazardous Substances) of European Union.

In light of item 5 in RoHS exemption list of RoHS Directive 2002/95/EC, Item 5: Lead in glass of cathode ray tubes, electronic components and fluorescent tubes.

In light of item 13 in RoHS exemption list of RoHS Directive 2005/747/EC, Item 13: Lead and cadmium in optical and filter glass. The three exemptions are being concerned for Carelink's transceivers, because Carelink's transceivers use glass, which may contain Pb, for components such as lenses, windows, isolators, and other electronic components.



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## Product Description

The CL-CSFP-40-XXDD series is compliant with the compact Small Form-Factor Pluggable (CSFP) MSA option 2 for Gigabit Ethernet 1000BASE-BX and Fiber Channel. Both channels have BOSA. Each BOSA is using 1310nm / 1490nm transmitter and 1490nm / 1310nm receiver. It is with the 20-pin connector to allow hot plug capability. It also can be compatible with conventional SFP.

Conventional SFP can function when plugged into a C-SFP socket. No damage to C-SFP and host board if C-SFP module is plugged into a conventional SFP socket The CL-CSFP-40-XXDD 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.

## Recommended Operating Conditions

Parameter	Symbol	Min.	Typical	Max.	Unit	
Operating Case Temperature	Tc	CL-CSFP-40-XXDD	-5		+70	°C
		CL-CSFP-40-XXDDi	-40		+85	
Power Supply Voltage	Vcc	3.15	3.3	3.45	V	
Power Supply Current	Icc			300per channel	mA	
Data Rate	FC		1.063		Gbps	
	GBE		1.25		Gbps	



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Performance Specifications – Electrical

Parameter	Symbol	Min.	Typ.	Max	Unit	Notes
<b>Transmitter</b>						
LVPECL Compatible Inputs(Differential)	Vin	400		2000	mVpp	AC coupled inputs <sup>*(note5)</sup>
Input Impedance (Differential)	Zin	85	100	115	ohm	Rin > 100 kohm @ DC
TX_Dis	Disable	2		Vcc+0.3	V	
	Enable	0		0.8		
TX_FAULT	Fault	2		Vcc+0.3	V	
	Normal	0		0.5		
<b>Receiver</b>						
CML Outputs (Differential)	Vout	400		800	mVpp	AC coupled outputs <sup>*(note5)</sup>
Output Impedance (Differential)	Zout	85	100	115	ohm	
RX_LOS	LOS	2		Vcc+0.3	V	
	Normal	0		0.8	V	
MOD_DEF (0:2)	VoH	2.5			V	With Serial ID
	VoL	0		0.5	V	

Optical and Electrical Characteristics

1310nm DFB and PIN, 40km

Parameter	Symbol	Min.	Typical	Max.	Unit
9µm Core Diameter SMF	L		40		km
Data Rate			1063/1250		Mbps
<b>Transmitter</b>					
Center Wavelength	$\lambda_c$	1290	1310	1330	nm
Spectral Width (-20dB)	$\Delta\lambda$			1	nm
Average Output Power <sup>*(note3)</sup>	Pout	-3		+2	dBm
Extinction Ratio @ 1250Mbps	ER	6			dB
Rise/Fall Time(20%~80%)	tr/tf			0.26	ns
Total Jitter	TJ			260	ps
Output Optical Eye <sup>*(note4)</sup>	Compliant with IEEE 802.3z <sup>*(note7)</sup>				
TX_Disable Assert Time	t_off			10	us



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<b>P<sub>out</sub>@TX Disable Asserted</b>	<b>P<sub>out</sub></b>			-45	dBm
<b>Receiver</b>					
Center Wavelength	$\lambda_c$	1480	1490	1500	nm
Receiver Sensitivity <sup>*(note6)</sup> @1250Mbps	P <sub>min</sub>			-24	dBm
Receiver Overload	P <sub>max</sub>	-3			dBm
LOS De-Assert@1250Mbps	LOSD			-25	dBm
LOS Assert	LOSA	-42			dBm
LOS Hysteresis <sup>*(note8)</sup>		0.5			dB

1490nm DFB and PIN, 40km

Parameter	Symbol	Min.	Typical	Max.	Unit
9 $\mu$ m Core Diameter SMF	L		40		km
Data Rate			1063/1250		Mbps
<b>Transmitter</b>					
Center Wavelength	$\lambda_c$	1480	1490	1500	nm
Spectral Width (-20dB)	$\Delta\lambda$			1	nm
Average Output Power <sup>*(note3)</sup>	P <sub>out</sub>	-5		0	dBm
Extinction Ratio @ 1250Mbps	ER	6			dB
Side Mode Suppression Ratio	SMSR	30			dB
Rise/Fall Time(20%~80%)	t <sub>r</sub> /t <sub>f</sub>			0.26	ns
Output Optical Eye <sup>*(note4)</sup>	Compliant with IEEE 802.3ah-2004 <sup>*(note7)</sup>				
TX_Disable Assert Time	t <sub>off</sub>			10	us
P <sub>out</sub> @TX Disable Asserted	P <sub>out</sub>			-45	dBm
<b>Receiver</b>					
Center Wavelength	$\lambda_c$	1290		1330	nm
Receiver Sensitivity <sup>*(note6)</sup> @1250Mbps	P <sub>min</sub>			-24	dBm
Receiver Overload	P <sub>max</sub>	-3			dBm
Return Loss		12			dB
Optical Path Penalty				1	dB
LOS De-Assert@1250Mbps	LOSD			-25	dBm
LOS Assert	LOSA	-45			dBm
LOS Hysteresis <sup>*(note8)</sup>		0.5			dB

Note3: Output is coupled into a 9/125 $\mu$ m single-mode fiber.

Note4: Filtered, measured with a PRBS 27-1.

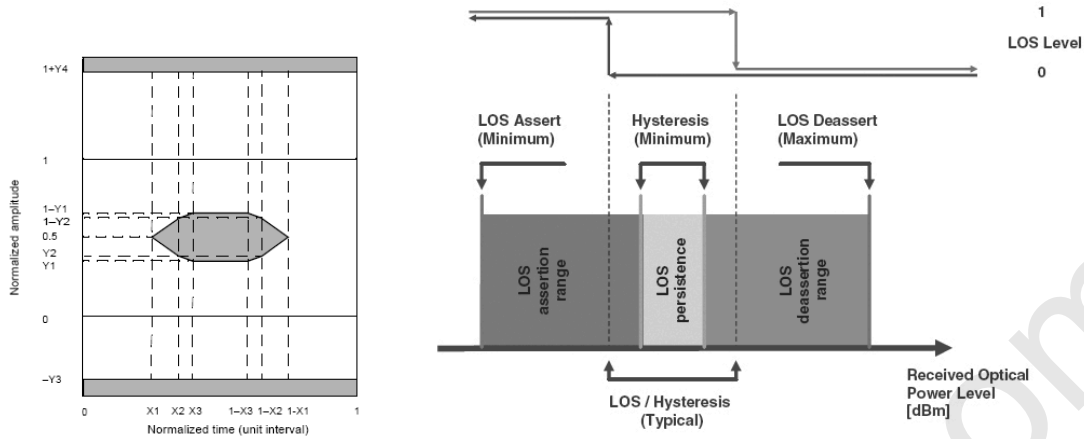
Note5: LVPECL logic, internally AC coupled.

Note6: Minimum average optical power measured at BER less than 1E-12, with a 27-1 PRBS and ER=9 dB.

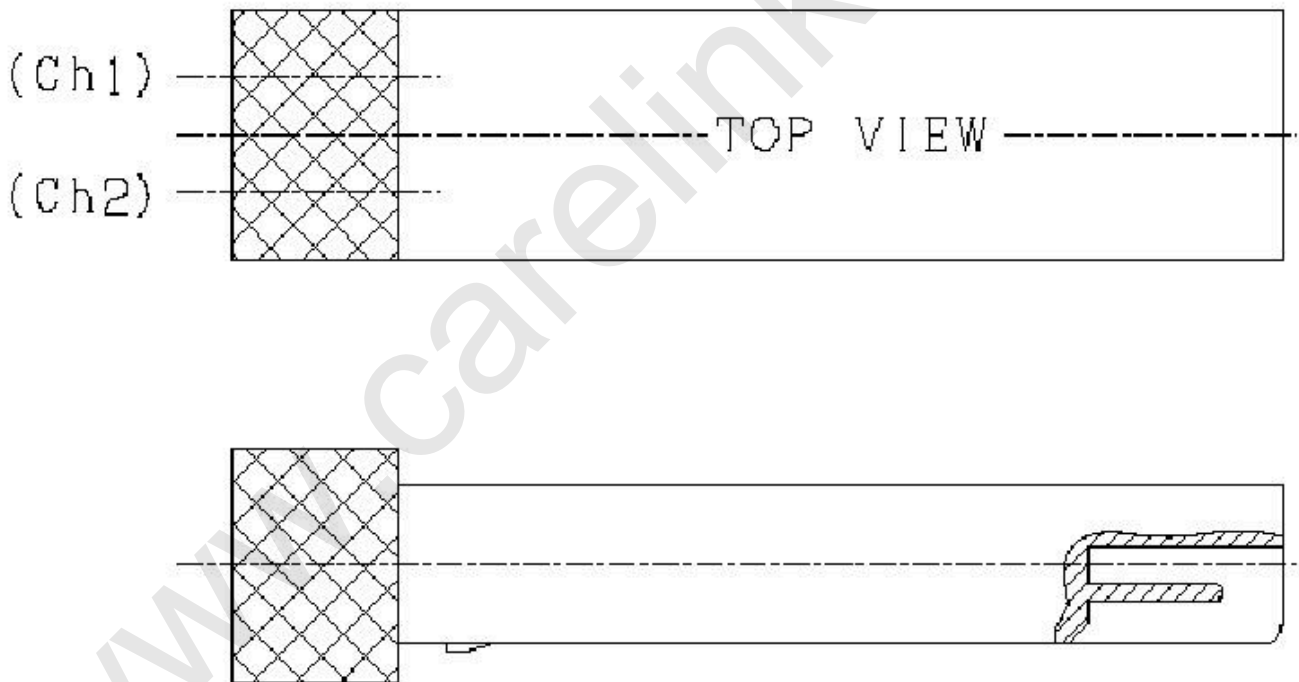
Note7: Eye Pattern Mask Note8: LOS Hysteresis



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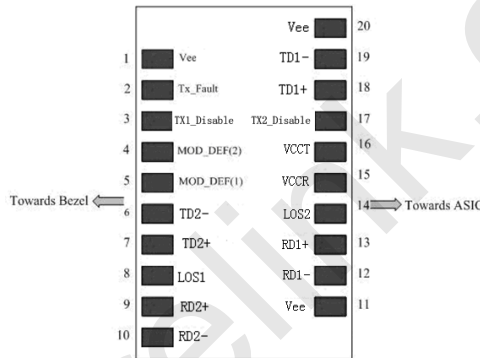
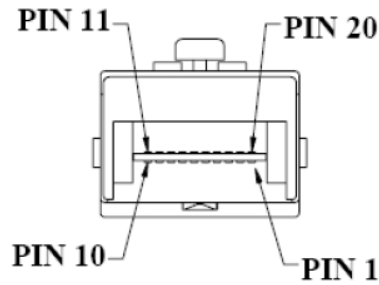
**Channel Description of Transceiver**





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CSFP Transceiver Electrical Pad Layout



Pin Function Definitions

Pin NO.	Name	Channel No.	Function	Notes
1	Vee	Common	Transceiver Ground	Note 3
2	TX Fault	Common	Transmitter Fault Indication	Note 8
3	TX1_Disable	1	Transmitter Disable of Ch1	Note 1, Module disables on high or open
4	MOD-DEF2	Common	Two-Wires interface Data	Note 2, 2wire serial ID interface SDA
5	MOD-DEF1	Common	Two-Wires interface Clock	Note 2, 2wire serial ID interface SCL
6	TD2-	2	Inverted Transmit Data Input of Ch2	Note6
7	TD2+	2	Transmit Data Input of Ch2	Note6



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8	LOS1	1	Loss of Signal of CH1	Note7
9	RD2+	2	Received Data output of Ch2	Note4
10	RD2-	2	Inverted Received Data output of Ch2	Note4
11	VEE	Common	Transceiver Ground	Note3
12	RD1-	1	Inverted Received Data output of Ch1	Note4
13	RD1+	1	Received Data output of Ch1	Note4
14	LOS2	2	Loss of Signal of CH2	Note7
15	VCCR	Common	Receiver power	Note 5, 3.3V± 5%
16	VCCT	Common	Transmitter Power	Note 5, 3.3V± 5%
17	TX2_ Disable	2	Transmitter Disable of Ch2	Note 1, Module disables on high or open
18	TD1+	1	Transmit Data Input of Ch1	Note6
19	TD1-	1	Inverted Transmit Data Input of Ch1	Note6
20	VEE	Common	Transceiver Ground	Note6

**Notes:**

- 1) TX\_disable1, 2 are 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
- 2) Mod-Def 1, 2. These are the module definition pins. They should be pulled up with a 4.7K<sub>Ω</sub> – 10K<sub>Ω</sub> resistor on the host board. The pull-up voltage shall be VccT or VccR.  
Mod-Def 1 is the clock line of two wire serial interfaces for serial ID. Mod-Def 2 is the data line of two wire serial interface for serial ID
- 3) VEE may be internally connected within the SFP module.
- 4) RD1, 2-/+ : 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.
- 5) VccT, VccR are the power supplies. They are defined as 3.3V ±5% at the SFP connector pin. Maximum supply current is 400Ma@3.3V. Vcc may be internally connected within the SFP transceiver module.
- 6) TD1, 2-/+ : 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.





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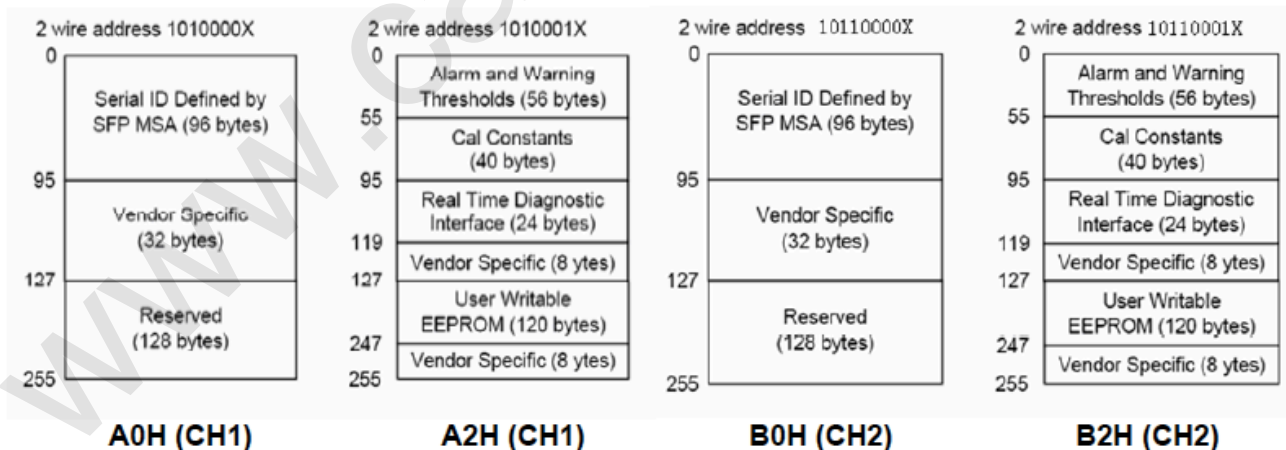
7) LOS1,2 (Loss of Signal) is an open collector/drain output, which should be pulled up with a 4.7K – 10KΩ resistor. Pull up voltage between 2.0V and VccT, R+0.3V. When high, this output indicates the received optical power is below the worst-case receiver sensitivity (as defined by the standard in use). Low indicates normal operation. In the low state, the output will be pulled to < 0.4V.

8) TX Fault report transceiver status as following:

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 either in Channel 1 or Channel 2. The Host shall read Channel 1/2:  
 A2H/AAH: 110 for details: TX Fault from channel 1 if bit 2 is set in [A2H:110]; TX Fault from channel 2 if bit 2 is set in [B2H:110]. Low indicates normal operation. In the low state, the output will be pulled to < 0.8V.

**EEPROM**

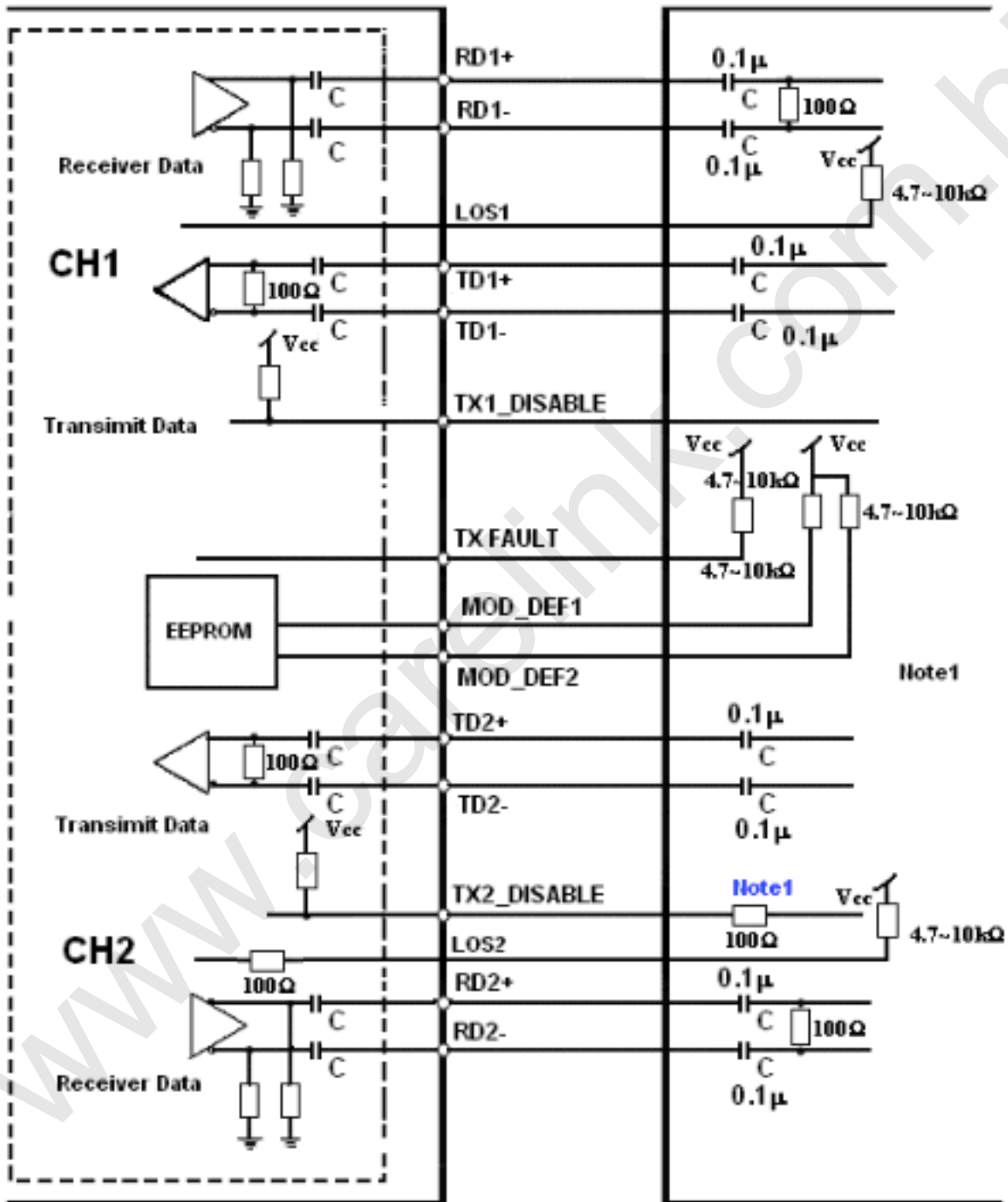
The serial interface uses the 2-wire serial CMOS EEPROM protocol defined for the ATMEL AT24C02/04 family of components. When the serial protocol is activated, the host generates the serial clock signal (SCL). The positive edge clocks data into those segments of the EEPROM that are not write protected 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/B2H. 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.





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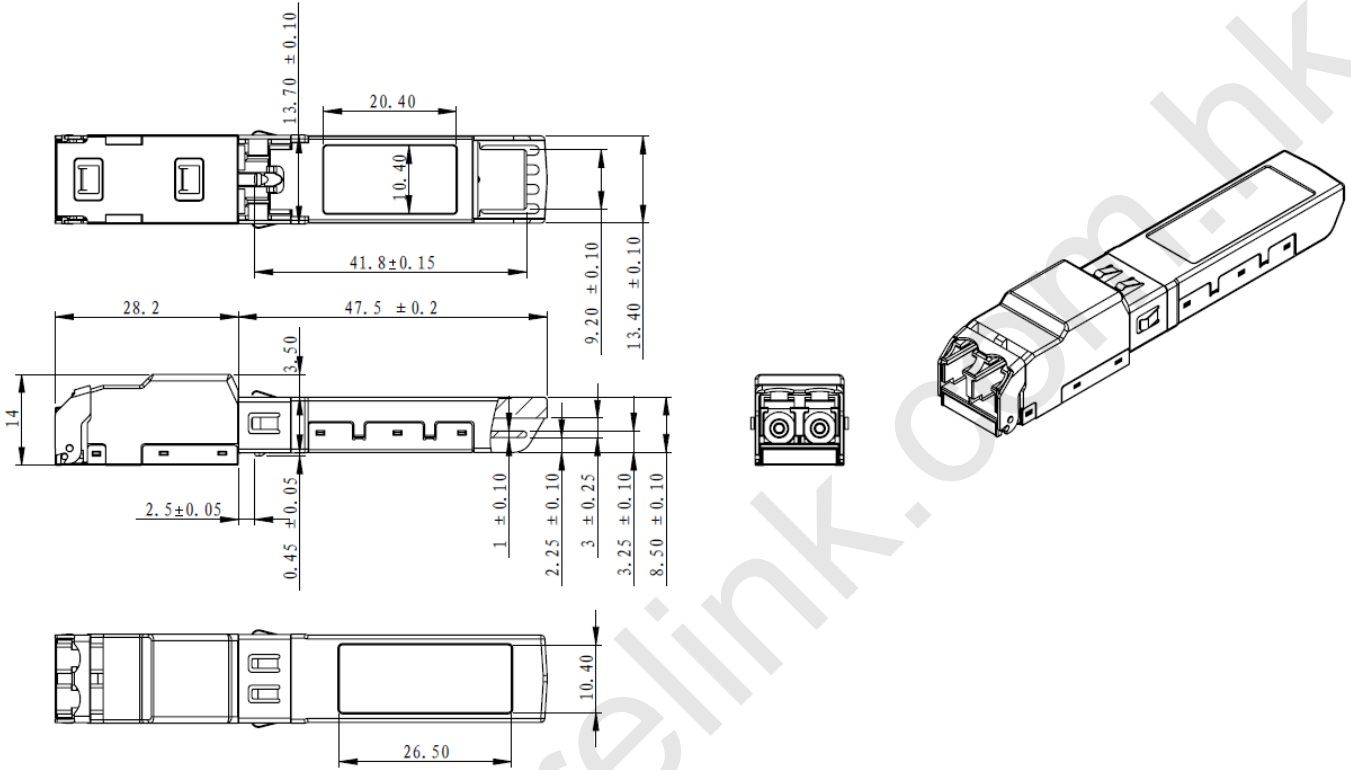
### Recommended Circuit Schematic





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### Mechanical Specifications



### Laser Emission

