



**RoHS compliant**  
**Small Form Pluggable (SFP+)**  
**SFP+ CWDM 60KM Optical Transceivers**



### Features

- 10Gb/s serial optical interface compliant to 802.3ae
- Uncooled CWDM DFB Laser: 1270nm to 1450nm
- APD Receiver
- Up to 60km transmission.
- Metal enclosure, for lower EMI
- Electrical interface compliant to SFF-8431
- 2-wire interface for management
- Specifications compliant with SFF-8472
- Single 3.3V power supply
- Case operating temperature range: -5°C to 70°C
- Class 1 Laser International Safety Standard IEC-60825

### Applications

- 10GBASE-ZR ,10G Ethernet

### Applications

- Compliant to 802.3ae
- Compliant to SFP+ SFF-8431 and SFF8432.
- Compliant to SFF 8472
- RoHS Compliant.

### Ordering Information

PART NUMBER	TX/RX	INPUT/OUTPUT	SIGNAL DETECT	TEMPERATURE	PACKAGE	Distance
CL-SFP+_C60-XX		AC/AC	TTL	-0°C to 70 °C	LC SFP +	60km
CL-SFP+_C60-XXI		AC/AC	TTL	-40°C to 85 °C	LC SFP +	60km



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## PRODUCT SELECTION

Wavelength	xx	Wavelength	xx
1270 nm	27	1370 nm	37
1290 nm	29	1390 nm	39
1310 nm	31	1410 nm	41
1330 nm	33	1430 nm	43
1350 nm	35	1450 nm	45

### I. Absolute Maximum Ratings

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Maximum Supply Voltage	Vcc	-0.5		4.7	V	
Storage Temperature	TS	-40		85	°C	
Case Operating Temperature	Tcase	-5		70	°C	

### II. Electrical Characteristics (Tcase = -5 to 70°C, VCC = 3.14 to 3.46 Volts)

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Supply Voltage	Vcc	3.14	3.3	3.46	V	
Supply Current	Icc		300	450	mA	
<b>Transmitter</b>						
Input differential impedance	Rin		100		Ω	1
Differential data input swing	Vin,pp	180		1200	mV	
Transmit Disable Voltage	VD	Vcc-1.3		Vcc	V	
Transmit Enable Voltage	VEN	Vee		Vee+ 0.8	V	2
Transmit Disable Assert Time				10	us	
<b>Receiver</b>						
Differential data output swing	Vout,pp	300		850	mV	3
Data output rise time	tr	30			ps	4
Data output fall time	tf	30			ps	4



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LOS Fault	VLOS fault	Vcc-1.3		VccHOST	V	5
LOS Normal	VLOS norm	Vee		Vee+0.8	V	5
Power Supply Rejection	PSR	100			mVpp	6

**Notes:**

1. Connected directly to TX data input pins. AC coupled thereafter.
2. Or open circuit.
3. Into 100 ohms differential termination.
4. These are unfiltered 20-80% values
5. Loss Of Signal is LVTTL. Logic 0 indicates normal operation; logic 1 indicates no signal detected.
6. Receiver sensitivity is compliant with power supply sinusoidal modulation of 20 Hz to 1.5 MHz up to specified value applied through the recommended power supply filtering network.

**III. Optical Characteristics** ( $T_{case} = -5$  to  $70^{\circ}C$ ,  $VCC = 3.14$  to  $3.46$  Volts)

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
<b>Transmitter</b>						
Output Opt. Pwr	POUT	0		5	dBm	1
Optical Wavelength	$\lambda$	$\lambda-6.5$		$\lambda+6.5$	nm	2
Wavelength Temperature Dependence			0.08	0.125	nm/ $^{\circ}C$	
Spectral Width (-20dB)	$\sigma$			1	nm	
Optical Extinction Ratio	ER	3.5			dB	
Transmitter and Dispersion Penalty	TDP			3.0	dB	
Sidemode Suppression ratio	SSRmin	30			dB	
RIN	RIN			-128	dB/Hz	
Output Eye Mask		Compliant with IEEE 802.3ae				
<b>Receiver</b>						
Rx Sensitivity	Psen			-20	dBm	3
Input Saturation Power (Overload)	Psat	-7			dBm	
Wavelength Range	$\lambda C$	1270		1610	nm	
LOS De -Assert	LOSD			-21	dBm	
LOS Assert	LOSA	-35			dBm	
LOS Hysteresis		0.5			dB	

**Notes:**

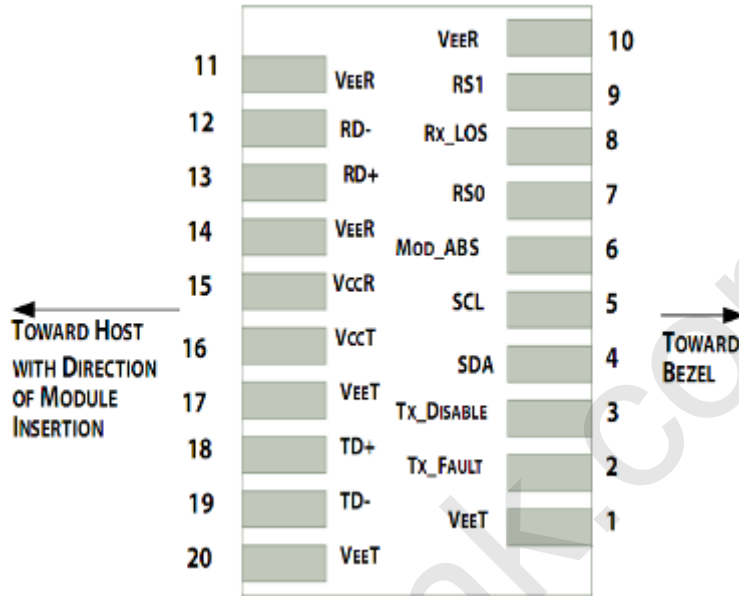
1. Class 1 Laser Safety per FDA/CDRH and IEC-825-1 regulations.
2. " $\lambda$ " is: 1270, 1290, 1310, 1330, 1350, 1370, 1390, 1410, 1430, 1450, please the "product selection"
3. With worst-case extinction ratio. Measured with a PRBS 2



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31-1 test pattern, @10.325Gb/s, BER<10<sup>-12</sup>.

#### IV. Pin Descriptions



Pin out of Connector Block on Host Board

Pin	Symbol	Name/Description	Ref.
1	V <sub>EET</sub>	Transmitter Ground (Common with Receiver Ground)	1
2	T <sub>FAULT</sub>	Transmitter Fault.	2
3	T <sub>DIS</sub>	Transmitter Disable. Laser output disabled on high or open.	3
4	SDA	2-wire Serial Interface Data Line	4
5	SCL	2-wire Serial Interface Clock Line	4
6	MOD_ABS	Module Absent. Grounded within the module	4
7	RS0	Rate Select 0	5
8	LOS	Loss of Signal indication. Logic 0 indicates normal operation.	6
9	RS1	No connection required	1
10	V <sub>EER</sub>	Receiver Ground (Common with Transmitter Ground)	1
11	V <sub>EER</sub>	Receiver Ground (Common with Transmitter Ground)	1
12	RD-	Receiver Inverted DATA out. AC Coupled	
13	RD+	Receiver Non-inverted DATA out. AC Coupled	
14	V <sub>EER</sub>	Receiver Ground (Common with Transmitter Ground)	1
15	V <sub>CCR</sub>	Receiver Power Supply	
16	V <sub>CCT</sub>	Transmitter Power Supply	
17	V <sub>EET</sub>	Transmitter Ground (Common with Receiver Ground)	1
18	TD+	Transmitter Non-Inverted DATA in. AC Coupled.	
19	TD-	Transmitter Inverted DATA in. AC Coupled.	
20	V <sub>EET</sub>	Transmitter Ground (Common with Receiver Ground)	1



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**Notes:**

1. Circuit ground is internally isolated from chassis ground.
2. T<sub>FAULT</sub> is an open collector/drain output, which should be pulled up with a 4.7k – 10k Ohms resistor on the host board if intended for use. Pull up voltage should be between 2.0V to V<sub>cc</sub> + 0.3V. A high output indicates a transmitter fault caused by either the TX bias current or the TX output power exceeding the preset alarm thresholds. A low output indicates normal operation. In the low state, the output is pulled to <0.8V.
3. Laser output disabled on T<sub>DIS</sub> > 2.0V or open, enabled on T<sub>DIS</sub> < 0.8V.
4. Should be pulled up with 4.7kΩ- 10kΩ host board to a voltage between 2.0V and 3.6V. MOD\_ABS pulls line low to indicate module is plugged in.
5. Internally pulled down per SFF-8431 Rev 4.1.
6. LOS is open collector output. It should be pulled up with 4.7kΩ – 10kΩ on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.

## **V. Digital Diagnostic Functions**

Carelink CL-SFP+\_C60-XX transceivers support the 2-wire serial communication protocol as defined in the SFP MSA. The standard SFP serial ID provides access to identification information that describes the transceiver's capabilities, standard interfaces, manufacturer, and other information.

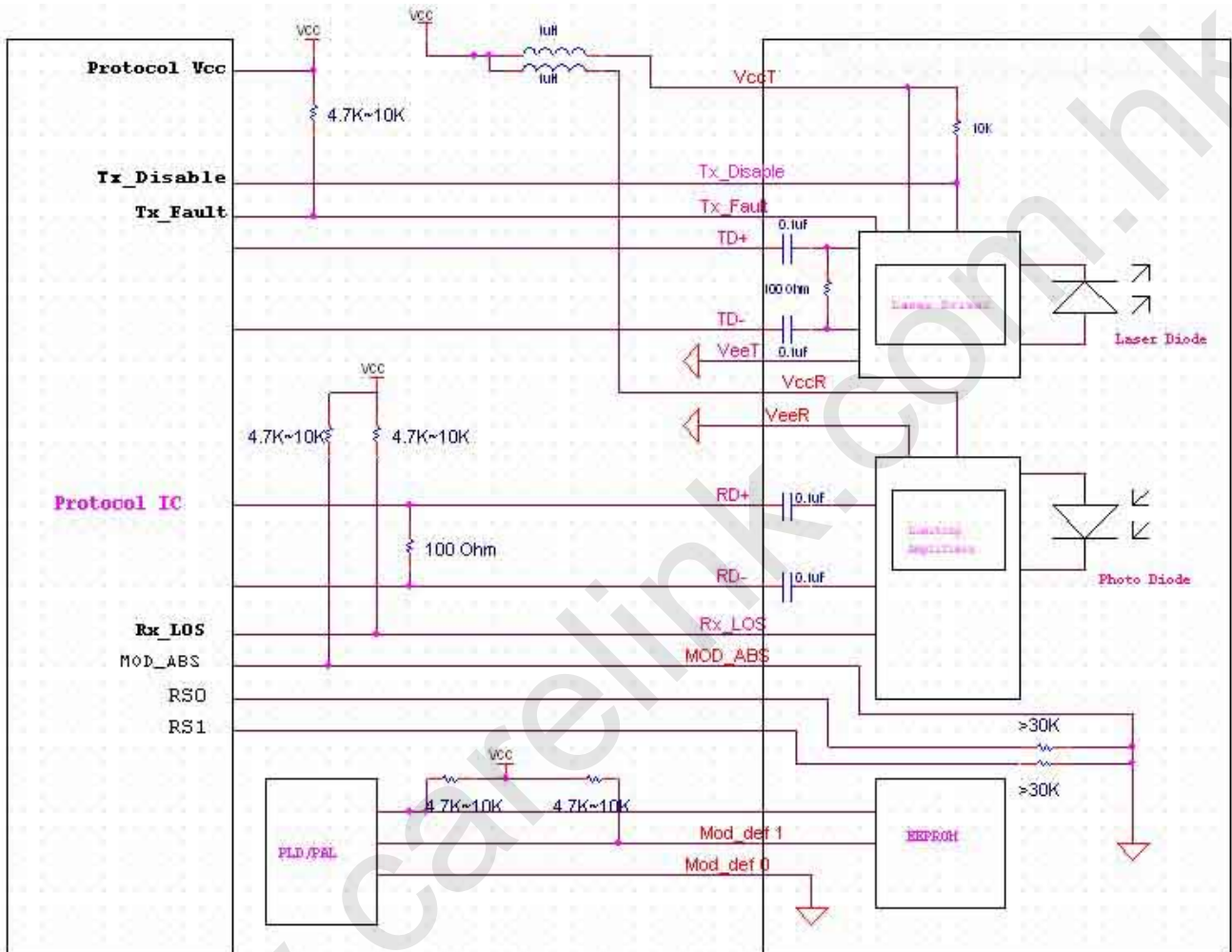
Additionally, Carelink SFP+ transceivers provide a unique enhanced digital diagnostic monitoring interface, which allows real-time access to device operating parameters such as transceiver temperature, laser bias current, transmitted optical power, received optical power and transceiver supply voltage. 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 EEPROM 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 operating and diagnostics information is monitored and reported by a Digital Diagnostics Transceiver Controller (DDTC) inside the transceiver, which is accessed through a 2-wire serial interface. When the serial protocol is activated, the serial clock signal (SCL, Mod Def 1) is generated by the host. The positive edge clocks data into the SFP transceiver into those segments of the EEPROM that are not write-protected. 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.



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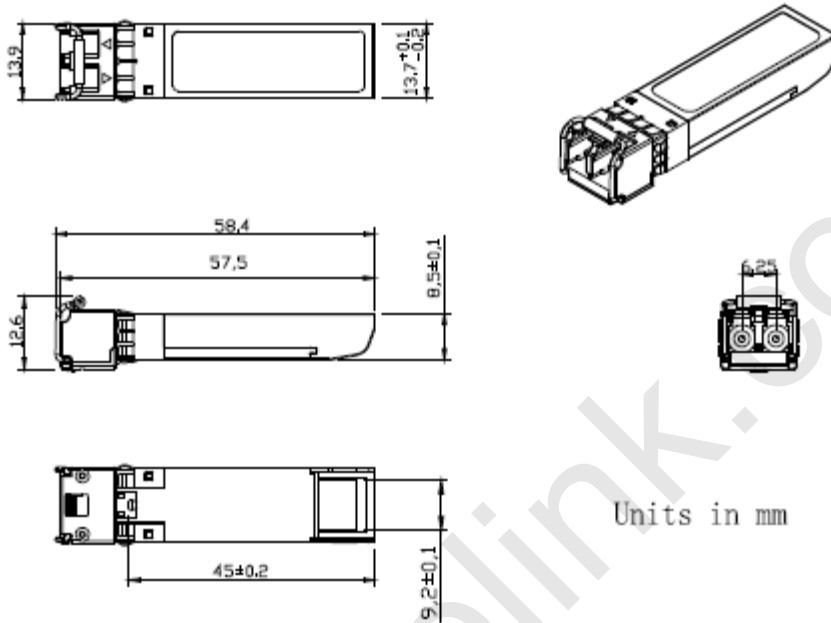
## VI. Host - Transceiver Interface Block Diagram





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**VII. Outline Dimensions**



**VIII. Regulatory Compliance**

Feature	Reference	Performance
Electrostatic discharge (ESD)	IEC/EN 61000-4-2	Compatible with standards
Electromagnetic Interference (EMI)	FCC Part 15 Class B EN 55022 Class B (CISPR 22A)	Compatible with standards
Laser Eye Safety	FDA 21CFR 1040.10, 1040.11 IEC/EN 60825-1, 2	Class 1 laser product
Component Recognition	IEC/EN 60950 , UL	Compatible with standards
ROHS	2002/95/EC	Compatible with standards
EMC	EN61000-3	Compatible with standards