

## **GCP-XX8G-XXC** 8.5Gbps CWDM SFP+ Fiber Channel Optical Transceiver

### **Features**

- ◆ Up to 8.5Gb/s bi-directional data links
- ◆ Hot Pluggable SFP+ footprint
- ◆ 4-Wavelengths CWDM DFB transmitter from 1270nm to 1330nm, PIN photo-detector
- ◆ Transmission distance up to 10km/20KM on 9/125  $\mu$ m SMF
- ◆ Digital Status monitoring Interface
- ◆ Duplex LC connector
- ◆ RoHS compliant and Lead Free
- ◆ Metal enclosure for lower EMI
- ◆ Single 3.3V power supply
- ◆ Operating case temperature: 0 to 70°C
- ◆ Compliant with FC-P1-4 800-Mx-SN-I, SFF-8431 , SFF-8432 and SFF-8472



### **Applications**

- ◆ Tri Rate 1.0625/2.125/4.25/8.5Gbs Fiber Channel

### **Product description**

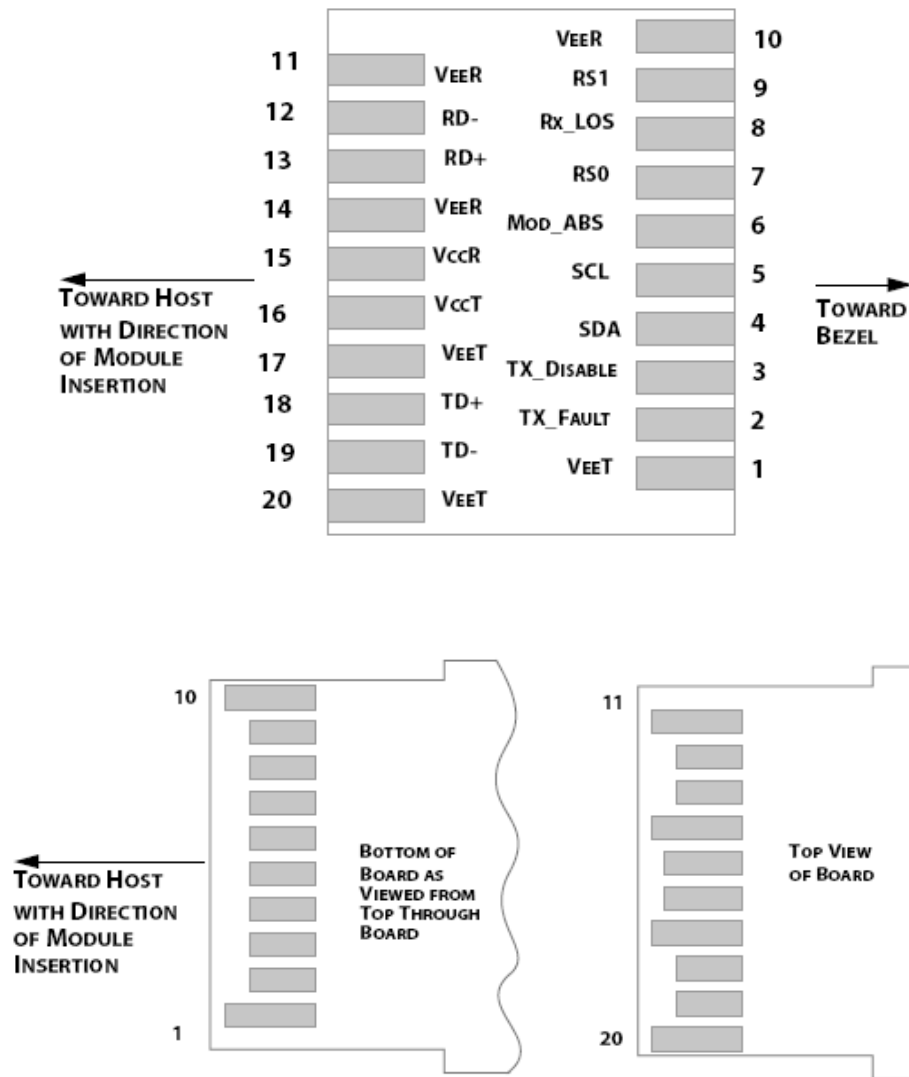
GCP-XX8G-01C transceivers are designed for using in Fiber Channel links up to 8.5Gb/s data rate over multimode fiber and compliant to SFI electrical specifications. The transmitter input and receiver output impedance is 100 Ohms differential. Data lines are internally AC coupled. The module provides differential termination and reduce differential to common mode conversion for quality signal termination and low EMI.

### **Pin definition**

The SFP+ modules are hot-pluggable. Hot pluggable refers to plugging in or unplugging a module while

the host board is powered. The SFP+ host connector is a 0.8 mm pitch 20 position right angle improved connector specified by SFF-8083, or stacked connector with equivalent with equivalent electrical performance. Host PCB contact assignment is shown in Figure 2 and contact definitions are given in Table 2.

SFP+ module contacts mates with the host in the order of ground, power, followed by signal as illustrated by Figure 3 and the contact sequence order listed in Table 2.



<i>Contacts</i>	<i>logic</i>	<i>Symbol</i>	<i>Power Sequence Order</i>	<i>Name/Description</i>
1		VeeT	1st	Module Transmitter Ground
2	LVTTL-O	TX_Fault	3rd	Module Transmitter Fault
3	LVTTL-I	TX_Disable	3rd	Transmitter Disable; Turns off transmitter laser output
4	LVTTL-I/O	SDA	3rd	2-wire Serial Interface Data Line (Same as MOD-DEF2 in the INF-8074i)
5	LVTTL-I/O	SCL	3rd	2-wire Serial Interface Clock (Same as MOD-DEF1 in the INF-8074i)
6		Mod_ABS	3rd	Module Absent, connected to VeeT or VeeR in the module
7	LVTTL-I	RS0	3rd	Rate Select 0, optionally controls SFP+ module receiver. When high input signaling rate > 4.25 GBd and when low input signaling rate ≤ 4.25 GBd.
8	LVTTL-O	Rx_LOS	3rd	Receiver Loss of Signal Indication (In FC designated as Rx_LOS and in Ethernet designated as Signal Detect)
9	LVTTL-I	RS1	3rd	Rate Select 1, optionally controls SFP+ transmitter. When high input signaling rate > 4.25 GBd and when low input signaling rate ≤ 4.25 GBd.
10		VeeR	1st	Module Receiver Ground
11		VeeR	1st	Module Receiver Ground
12	CML-O	RD-	3rd	Receiver Inverted Data Output
13	CML-O	RD+	3rd	Receiver Non-Inverted Data Output
14		VeeR	1st	Module Receiver Ground
15		VccR	2nd	Module Receiver 3.3 V Supply
16		VccT	2nd	Module Transmitter 3.3 V Supply
17		VeeT	1st	Module Transmitter Ground
18	CML-I	TD+	3rd	Transmitter Non-Inverted Data Input
19	CML-I	TD-	3rd	Transmitter Inverted Data Input
20		VeeT	1st	Module Transmitter Ground

**Table 2: SFP+ Module PIN Definition**

### Absolute maximum rating

These values represent the damage threshold of the module. Stress in excess of any of the individual Absolute Maximum Ratings can cause immediate catastrophic damage to the module even if all other

parameters are within Recommended Operating Conditions.

Parameters	Symbol	Min.	Max.	Unit
Power Supply Voltage	V <sub>CC</sub>	0	+3.6	V
Storage Temperature	T <sub>c</sub>	-40	+85	°C
Operating Case Temperature	T <sub>c</sub>	0	+70	°C
Relative Humidity	RH	5	95	%

Table 3: Absolute Maximum Rating

### Recommended operating environment

Recommended Operating Environment specifies parameters for which the electrical and optical characteristics hold unless otherwise noted.

Parameter	Symbol	Min.	Typical	Max	Unit
Power Supply Voltage	V <sub>CC</sub>	3.135	3.300	3.465	V
Operating Case Temperature	T <sub>c</sub>	0	25	70	°C

Table 4: Recommended Operating Environment

### LOW Speed Characteristics

Parameter	Symbol	Min.	Typical	Max	Unit
Power Consumption			1.2	1.2	W
TX_Fault,RX_LOS	VOL	0		0.4	V
	VOH	Host_Vcc-0.5		Host_Vcc+0.3	V
TX_DIS	VIL	-0.3		0.8	V
	VIH	2.0		VCCT+0.3	V
RS0,RS1	VIL	-0.3		0.8	V
	VIH	2.0		VCCT+0.3	V

### Electrical characteristics

#### Transmitter Input Characteristics

Parameter	Conditions	Symbol	Min.	Typical	Max	Unit
Nominal Data Rate		VID	2.125	8.5	8.5	Gbd
Reference Differential Input Impedance		Z <sub>d</sub>		100		Ω

Input AC Common Mode Input Voltage				0	25	mV (RMS)
Differential Input Voltage Swing		VID	150		900	mV
Differential Input S-parameter	0.01-3.9GHz	SDD11			-10	dB
	3.9-8.5GHz		Note1		Note1	
Differential to Common Mode Conversion Note 2	0.01-8.5GHz	SCD11			-10	dB
Data Dependant Jitter		DDJ			0.1	UI(p-p)
Total Jitter		TJ			0.28	UI(P-P)
Uncorrelated Jitter		UJ			0.023	RMS

- 1) Differential Return Loss given by equation  $SDD11(dB) = -8 + 13.33 \log_{10}(f/5.5)$ , with f in GHz  
2) Common mode reference impedance is 25Ω. Differential to common mode conversion relates to generation of EMI

### Receiver Output Characteristics

Parameter	Conditions	Symbol	Min.	Typical	Max	Unit
Nominal Data Rate		VID	2.125	8.5	8.5	Gbd
Reference Differential Input Impedance		Zd		100		Ω
Termination Mismatch		$\Delta Z_d$			5	%
Output AC Common Mode Input Voltage					15	mV (RMS)
Output Rise and Fall time	20% to 80%	$t_{RH}, t_{FH}$			35	ps
Differential Input Voltage Swing	Zload=100ohm	VOD	350		800	mV
Differential Input S-parameter	0.01-3.9GHz	SDD22			-10	dB
	3.9-8.5GHz		Note1		Note1	
Differential to Common Mode Conversion Note2	0.01-6.5GHz	SCCD22			-7	dB
Differential to Common Mode Conversion Note2	6.5-8.5GHz	SCCD22			-3	dB
Data Dependant Jitter		DDJ			0.42	UI(p-p)
Total Jitter		TJ			0.71	UI(P-P)

- 1) Return Loss given by equation  $Sxx22(dB) = -8 + 13.33 \log_{10}(f/5.5)$ , with f in GHz  
2) Common mode reference impedance is 25Ω. Common mode return loss helps absorb reflection and noise improving EMI

## General Specifications

Parameter	Symbol	Min.	Typical	Max	Unit	Notes
Data Rate	DR		1.0625 2.125 4.25 8.5		Gb/sec	
Fiber Length on 9/125um SMF	L			20	km	1
				20	km	2
				20	km	3
				20	km	4

- 1) At 1.0625 Gb/s Fibre Channel data rate.  
2) At 2.125 Gb/s Fibre Channel data rate.  
3) At 4.25 Gb/s Fibre Channel data rate.  
4) At 8.5 Gb/s Fibre Channel data rate.

## Optical characteristics

Parameter	Symbol	Min.	Typical	Max	Unit	Notes
<b>Transmitter</b>						
Center Wavelength	$\lambda_t$	1270		1330	nm	
RMS spectral width	Pm	-	-	1	nm	
Average Optical Power	Pavg	-9.0	-	-1	dBm	2
Extinction Ratio	ER	3.5	-	-	dB	3,4,5,6
Relative Intensity Noise	Rin			-128	dB/Hz	
<b>Receiver</b>						
Center Wavelength	$\lambda_r$	1260	-	1360	nm	
Receiver Sensitivity	Psens	-	-	-14.4	dBm	3
	Psens			-18	dBm	4
	Psens			-23	dBm	5
	Psens			-25	dBm	6
LOS Assert	Los	-30	-		dBm	
LOS De-assert				-19		
Overload	Pin	-	-	-1.0	dBm	3
Receiver Reflectance		-	-	-12	dB	

Note: 1. The following optical characteristics are defined over the Recommended Operating Environment unless otherwise specified.  
2. The optical power is launched into MMF  
3. Measured with a PRBS 2 7-1 test pattern @8.5Gbps, BER≤10<sup>-12</sup>.  
4. Measured with a PRBS 2 7-1 test pattern @4.25Gbps, BER≤10<sup>-12</sup>.  
5. Measured with a PRES 2 7-1 test pattern @2.125Gbps, BER≤10<sup>-12</sup>.  
6. Measured with a PRES 2 7-1 test pattern @1.0625Gbps, BER≤10<sup>-12</sup>.

## Digital Diagnostic Functions

The following digital diagnostic characteristics are defined over the Recommended Operating Environment unless otherwise specified. It is compliant to SFF8472 Rev9.2 with internal calibration mode. For external calibration mode please contact our sales staff.

Parameter	Symbol	Min.	Max	Unit	Notes
<b>Accuracy</b>					
Transceiver Temperature	DMI_Temp	-3	+3	degC	Over operating temp
TX Output optical power	DMI_TX	-3	+3	dB	
RX Input optical power	DMI_RX	-3	+3	dB	-3dBm to -12dBm range
Transceiver Supply voltage	DMI_VCC	-0.08	+0.08	V	Full operating range
Bias current monitor	DMI_Ibias	-10%	10%	mA	
<b>Dynamic Range Accuracy</b>					
Transceiver Temperature	DMI_Temp	-5	70	degC	
TX Output optical power	DMI_TX	-9	-1	dBm	
RX Input optical power	DMI_RX	-18	0	dBm	
Transceiver Supply voltage	DMI_VCC	3.0	3.6	V	
Bias current monitor	DMI_Ibias	0	16	mA	



## Control and status I/O timing characteristics

Timing characteristics of control and status I/O are included in Table 8, which is also defined in SFF-8431.

<i>Parameter</i>	<i>Symbol</i>	<i>Min.</i>	<i>Max.</i>	<i>Unit</i>	<i>Conditions</i>
TX_Disable assert time	t_off		100	μs	rising edge of TX_Disable to fall of output signal below 10% of nominal
TX_Disable negate time	t_on		2	ms	Falling edge of Tx_Disable to rise of output signal above 90% of nominal. This only applies in normal operation, not during start up or fault recovery.
Time to initialize 2-wire interface	t_2w_start_up		300	ms	From power on or hot plug after the supply meeting <a href="#">Table 8</a> .
Time to initialize	t_start_up		300	ms	From power supplies meeting <a href="#">Table 8</a> or hot plug or Tx disable negated during power up, or Tx_Fault recovery, until non-cooled power level I part (or non-cooled power level II part already enabled at power level II for Tx_Fault recovery) is fully operational.
Time to initialize cooled module	t_start_up_cooled		90	s	From power supplies meeting <a href="#">Table 8</a> or hot plug, or Tx disable negated during power up or Tx_Fault recovery, until cooled power level I part (or cooled power level II part during fault recovery) is fully operational.
Time to Power Up to Level II	t_power_level2		300	ms	From falling edge of stop bit enabling power level II until non-cooled module is fully operational
Time to Power Down from Level II	t_power_down		300	ms	From falling edge of stop bit disabling power level II until module is within power level I requirements
TX_Fault assert	TX_Fault_on		1	ms	From occurrence of fault to assertion of TX_Fault
TX_Fault assert for cooled module	TX_Fault_on_cooled		50	ms	From occurrence of fault to assertion of TX_Fault
TX_Fault Reset	t_reset	10		μs	Time TX_Disable must be held high to reset TX_Fault
RS0, RS1 rate select timing for FC	t_RS0_FC, RS1_FC		500	μs	From assertion till stable output
RS0, RS1 rate select timing non FC	t_RS0, t_RS1		10	ms	From assertion till stable output
Rx_LOS assert delay	t_los_on		100	μs	From occurrence of loss of signal to assertion of Rx_LOS
Rx_LOS negate delay	t_los_off		100	μs	From occurrence of presence of signal to negation of Rx_LOS

**Table 8: Timing Characteristics**



## Mechanical

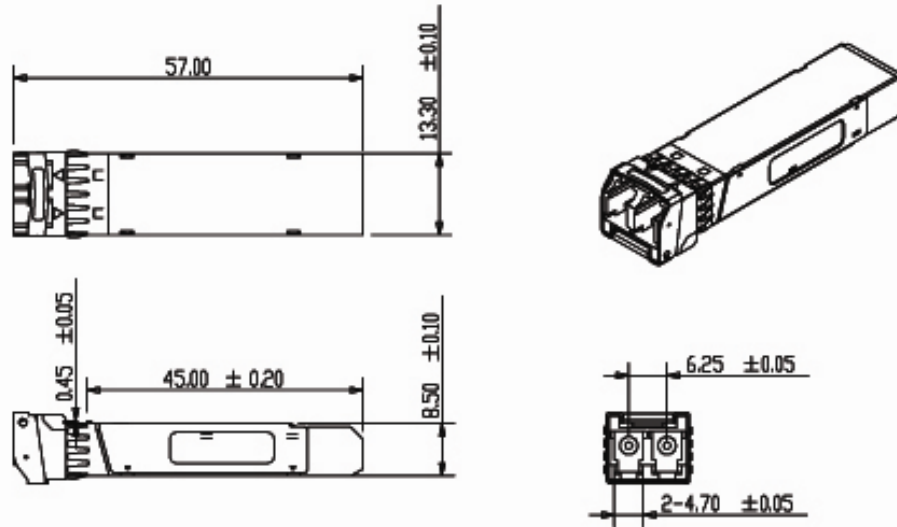


Table 9: Key Mechanical Dimensions

## ESD

This transceiver is specified as ESD threshold 2kV for all electrical input pins, tested per MIL-STD-883, Method 3015.4 /JESD22-A114-A (HBM). However, normal ESD precautions are still required during the handling of this module. This transceiver is shipped in ESD protective packaging. It should be removed from the packaging and handled only in an ESD protected environment.

## LASER SAFETY

This is a Class 1 Laser Product according to IEC 60825-1:1993+A1:1997+A2:2001. This product complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated (July 26, 2001)

## Ordering information

Part Number	Product Description
GCP-XX8G-01C	1270nm~1330nm, with step 20nm CWDM DFB, 8.5Gbps, 10km, 0°C ~ +70°C
GCP-XX8G-02C	1270nm~1330nm, with step 20nm CWDM DFB, 8.5Gbps, 20km, 0°C ~ +70°C

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