10Gb/s 300m VCSEL SFP+ Optical Transceiver

GTR2SP1S

Features

- Hot Pluggable SFP+ MSA package
- SFF-8431, SFF-8432 compliant
- IEEE802.3ae 10Gbase-SR/SW compliant
- Up to 300m transmission on OM3 MMF
- Multi rate 10.3125Gb/s~10.5Gb/s
- 850nm VCSEL and PIN receiver
- SFI high speed electrical interface
- 2-wire serial interface with Digital Diagnostic
- +3.3V power supply
- Power consumption less than 1W
- Operating case temperature: -5 to 70 ℃
- Duplex LC Receptacle
- ROHs-6 compliant

Applications

- 10GBase-SR/SW Ethernet
- 10G Fiber Channel, etc

Description

GWorld Opto's GTR2SP1S 10G 850nm VCSEL transceivers are designed for use in 10G Ethernet links and 10G Fiber Channel, etc, and it can support multi-rate from 10.3125Gb/s to 10.5Gb/s. Digital diagnostics are available via 2-wire serial interface as specified in the SFF-8472.

The transceiver's designs are optimized for high performance and cost efficiency to provide customers the best solutions for Datacom and Telecom applications.

The transceiver is RoHS-6 compliant and lead-free per Directive 2002/95/EC.

Product Selection

GTR2SP1S

G: GWorld
TR: Transceiver
SP1: SFP+ Solution 1
S: 10G Base-SR/SW 300m

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1 10Gb/s SFP+ electrical parameters

1.1 Absolute Maximum Ratings

The limit of the maximum value is shown as below Table 1. (If operating out the limit of the maximum value will cause permanent damage).

Table 1 10Gb/s SFP+ module limit the maximum value

Parameter	Symbol	Conditions	Min.	Max	Unit
Storage temperature（case）	T_{stg}	—	-40	+85	℃
Operating case temperature	Top	—	-5	+70	℃
Relative humidity	RH	0	—	85	%
Damage Threshold for Receiver	Pmax	—	—	+2.0	dBm
Power Supply	Vcc 3.3V	—	-0.5	+4.0	V
	Vcc 5.0V	—	—	—	V
ESD Sensitivity on module and all host pins	HBM	Human Body model R=1.5K, C=100pF	—	2000	V

1.2 Recommended operating conditions

The recommended working conditions are shown as below Table 2.

Table 2 10Gb/s SFP+ recommended working conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit
Operating Case Temperature	Tc	-5		+70	℃
Supply voltage	Vcc 3.3V	+3.15	+3.3	+3.45	V
	Vcc 5.0V	-	—	—	V
Supply Current	Icc 3.3V	—	—	280	mA
	Icc 5.0V	—	—	—	mA
Power dissipation	P	—	—	1	W
Link Distance	L	2	—	300m	OM3 MMF

2 10Gb/s SFP+ Specifications

2.1 Optical Specifications

Table 3 10Gb/s SFP+ Optical Specifications (transmission distance 300m)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Transmitter						
Center Wavelength	λc		840		860	nm
Signal speed(nominal)	BR		-	10.3125	10.5	Gbps
Avarage Optical Output Power	Pout		-7.3	—	-1.0	dBm
Average Optical Output Power of TX_DIS Transmitter	Poff	TX_DIS=H	—	—	-30	dBm
Optical Eye Mask		10.3125Gb/s	Compliant with IEEE			

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			802.3-2008			
Extinction Ratio	E_R		3.0	—	—	dB
Dispersion Penalty	DP		—	—	3.9	dB
Relative Intensity Noise	RIN	Mod off	—	—	-130	dB/Hz
Optical Return Loss Tolerance	ORLT		—	—	12	dB
Receiver						
Center Wavelength Range	λc		840	—	860	nm
Receiver Sensitivity	Psen		—	—	-9.9	dBm
Stressed Receiver Sensitivity	Psen_str				-7.5	dBm
Receiver sensitivity (max) in OMA	P_{sen_OMA}				-11.1	dBm
Receiver Overload	Pov		-1	—	—	dBm
Receiver Reflectance	Ref		—	—	-12	dB
LOS Assert	LOSass		-25	—	—	dBm
LOS Deassert	LOSde-ass		—	—	-15	dBm
LOS Hysteresis			0.5	—	—	dB

Note1. Measured with PRBS 2^{31}-1 @ 10.3125Gb/s

2.2 Electrical specifications

Table 4 10Gb/s SFP+ Electrical Interface Specifications

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit
Transmitter							
Differential Data Input Amplitude		Vin-diff		180	—	700	mVpp
Input Differential Impedance		Zdiff		85	100	115	ohm
Tx_Fault	Normal Operation	V_{OL}		-0.3	—	0.4	V
	Transmitter Fault	V_{OH}		2.4	—	Vcc	V
Tx_Disable	Normal Operation	V_{IL}		-0.3	—	0.8	V
	Laser Disable	V_{IH}		2.0	—	Vcc+0.3	V
Receiver							
Differential Data Output amplitude		Vout-diff		300	—	850	mVpp
Output Differential Impedance		Zdiff		80	100	120	ohm
Rx_LOS	Normal Operation	V_{OL}		-0.3	—	0.4	V
	Lose Signal	V_{OH}		2.4	—	Vcc	V
Output Rise/Fall Time,			20%~80%	28	—	—	ps

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3 10Gb/s SFP+ Function Diagram

3.1 Internal reference structure

The internal structure of 10Gb/s SFP+ shown as Figure 1.

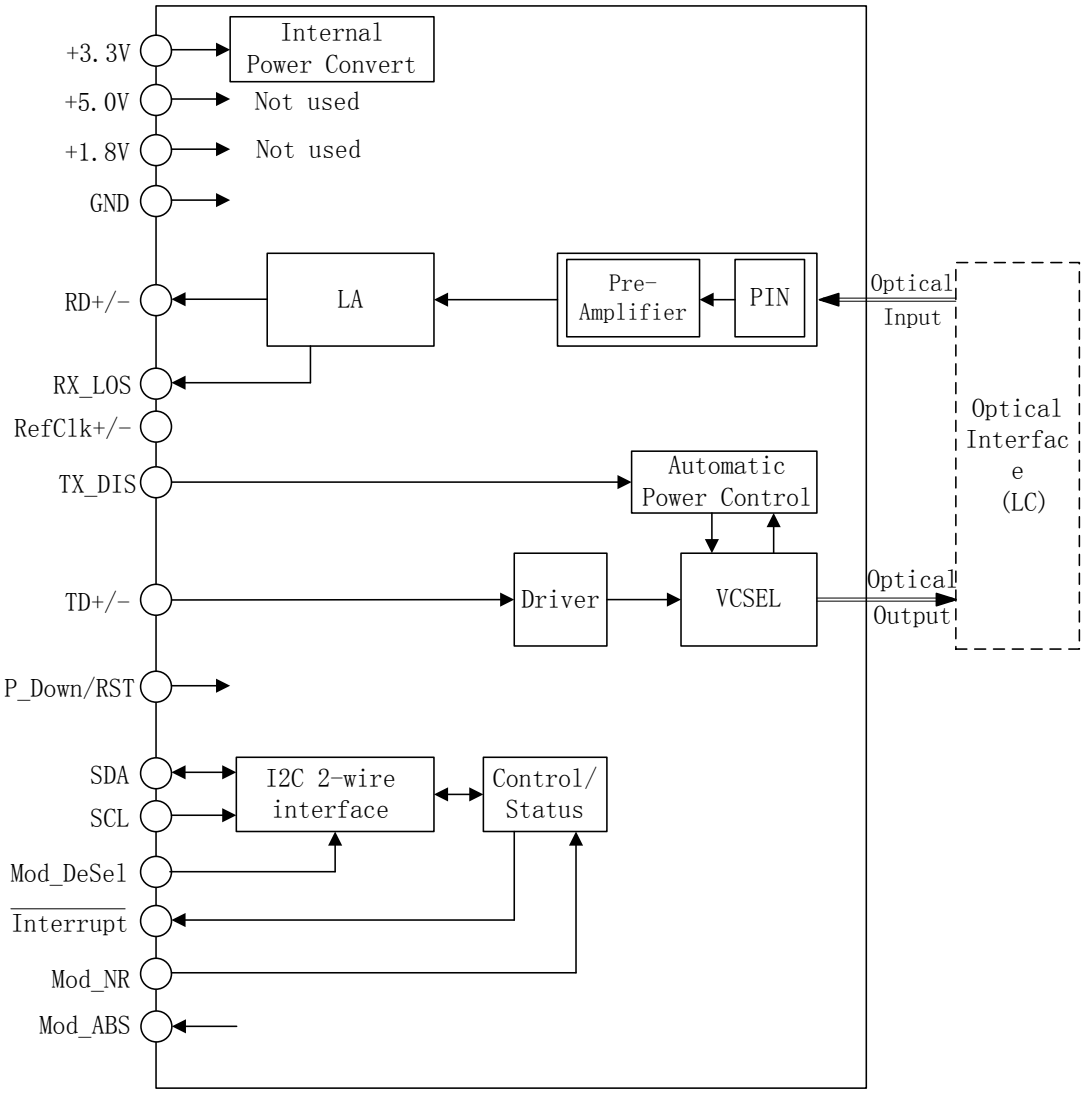

Figure 1. 300m 10Gb/s SFP+ internal structure

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3.2 Recommended Interface Circuit

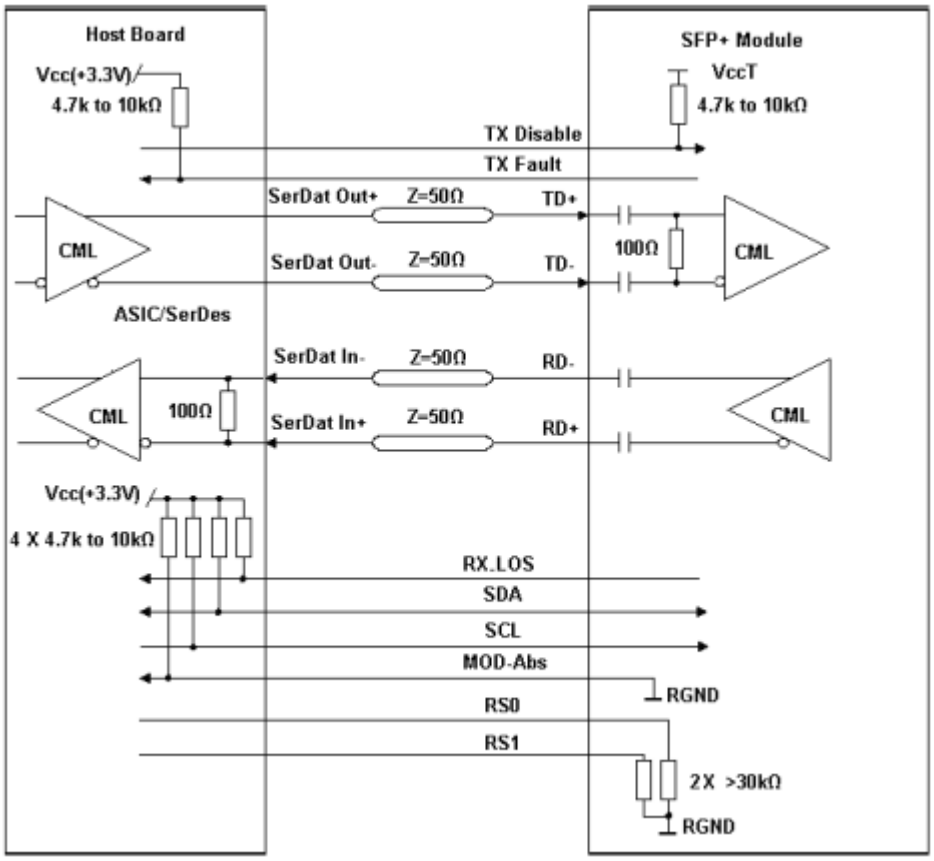

Figure 2. Recommended Interface Circuit

3.3 Pin layout

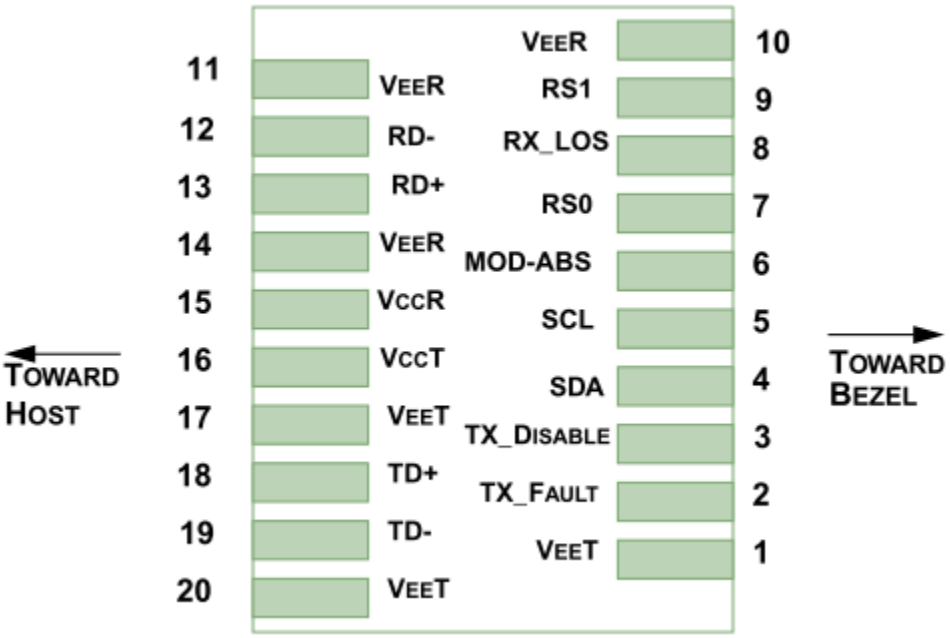

Figure 3. Host PCB SFP+ Pinout Top View

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3.4 Pin definition

Table 5 10Gb/s SFP+ Pin Definition(first raw)

PIN	Name	Logic	Description
1	$V_{EE}T$	GND	Module Transmitter Ground[1]
2	TX_F_{AULT}	LVTTL-O	Module Transmitter Fault[2]
3	TX_DISABLE	LVTTL-I	Transmitter Disable; Turns off transmitter laser output[3]
4	SDL	LVTTL-I/O	2-Wire Serial Interface Data Line (MOD-DEF2)
5	SCL	LVTTL-I/O	2-Wire Serial Interface Clock (MOD-DEF1)
6	MOD_ABS		Module Absent, connected to $V_{EE}T$ or $V_{EE}R$ in the module[2]
7	RS0	LVTTL-I	Rate Select 0, NOT implement[4]
8	RX_LOS	LVTTL-O	Receiver Loss of Signal Indication (in FC designated as RX_LOS, in SONET designated as LOS, and in Ethernet designated as NOT Signal Detect)[2]
9	RS1	LVTTL-I	Rate Select 1, NOT implement[4]
10	$V_{EE}R$	GND	Module Receiver Ground[1]

Table 6 10Gb/s SFP+ Pin Definition(second raw)

PIN	Name	Logic	Description
11	$V_{EE}R$	GND	Module Receiver Ground[1]
12	RD-	CML-O	Receiver Inverted Data Output
13	RD+	CML-O	Receiver Non-Inverted Data Output
14	$V_{EE}R$	LVTTL-O	Module Receiver Ground[1]
15	$V_{CC}R$	Power	Module Receiver 3.3 V Supply
16	$V_{CC}T$	Power	Module Transmitter 3.3 V Supply
17	$V_{EE}T$	GND	Module Transmitter Ground[1]
18	TD+	CML-I	Transmitter Non-Inverted Data Input
19	TD-	CML-I	Transmitter Inverted Data Input
20	$V_{EE}T$	GND	Module Transmitter Ground[1]

Note1: Module ground pins GND are isolated from the module case and chassis ground within the module.

Note2: Shall be pulled up with 4.7~10kohm to a voltage between 3.15V and 3.45V on the host board.

Note3: The pin is pulled up to $V_{CC}T$ with a 4.7K-10KΩ resistor in the module

Note4: The pins are pulled low to $V_{EE}T$ with a >30kΩ resistor in the module.

The host board power supply should be well filtered shown in Figure 4, to meet the noise filtering requirements in most system and achieve SFP+ module specifications performance.

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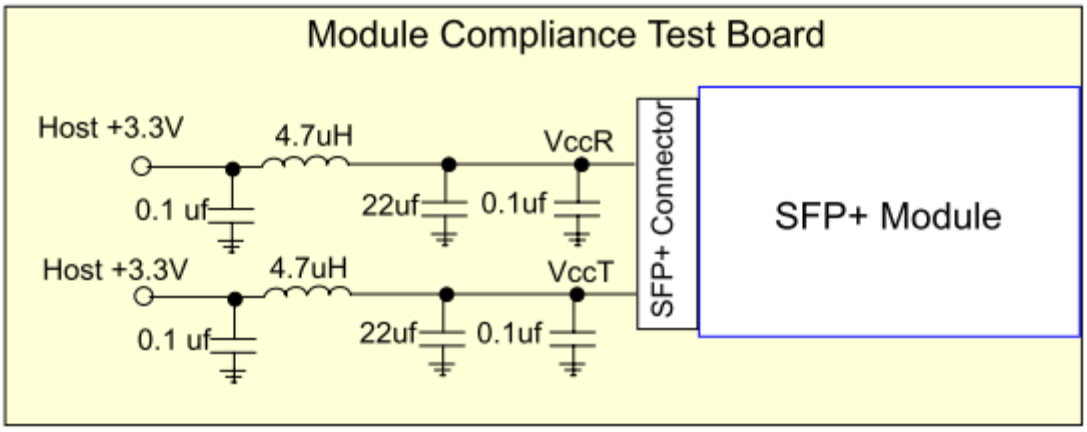

Figure 4. Example of Host Board Supply Filtering Network

4 10Gb/s SFP+ Mechanical Specifications

10Gb/s SFP+ mechanical dimensions should be compliant with SFF-8432. Detailed dimensions are shown in Figure 5.

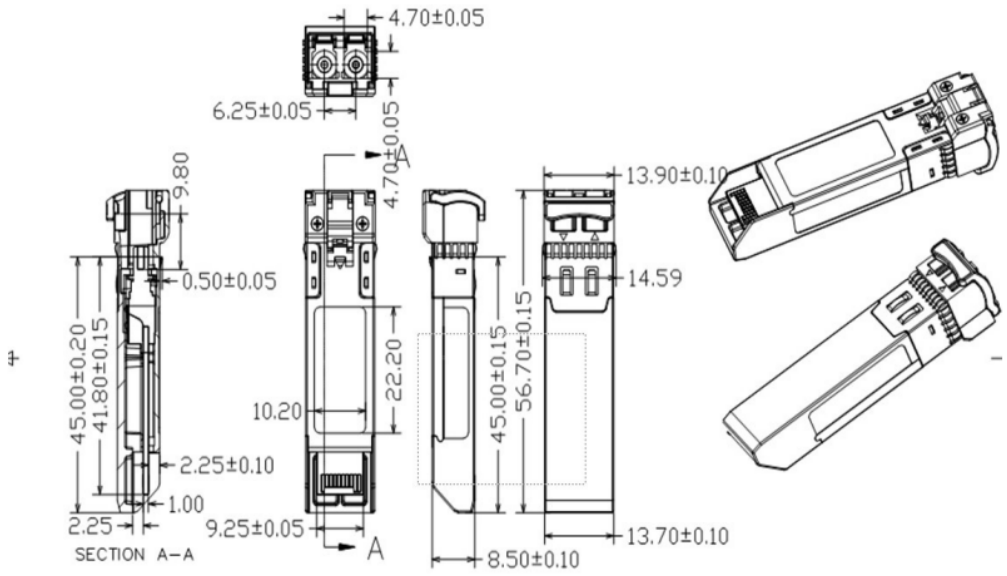

Figure 5. 10Gb/s SFP+ Mechanical Dimensions

The mechanical dimensions of the electrical connectors on the SFP+ module PCB are shown in Figure 6.

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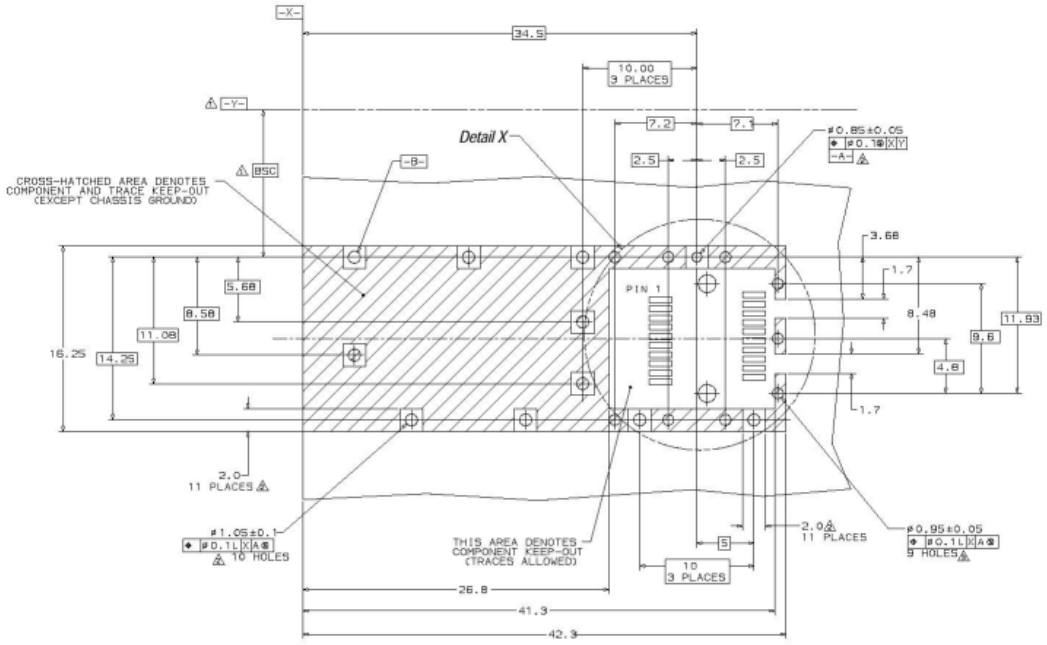

Figure 6 Mechanical Dimensions of Electrical Connectors on SFP+ module PCB

Table 7 specifies the fiber and fiber connector for 10Gb/s SFP+, for applications, a configuration of the optical connector should be supported.

Table 7 Fiber Connector Type

Parameter	Specification	Units
Weight	<250	g
Flatness	<0.05	mm
Roughness	<6.5	Ra
Connector	Straight LC/PC	

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5 Management Interface

GWorld GTR2SP1L SFP+ transceivers support the 2-wire serial communication protocol as defined in the SFP MSA . It is very closely related to the E^2PROM defined in the GBIC standard, with the same electrical specifications.

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

Additionally, GWorld SFP+ transceivers provide a 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 E^2PROM 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 operating and diagnostics information is monitored and reported by a Digital Diagnostics Transceiver Controller 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 E^2PROM 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.

6 Ordering Information

Table 8 Order Information

Part No.	Application	Data Rate	Transmitter	Receiver	Fiber Type	Connector
GTR2SP1S	10GBase-SR/SW Ethernet 10G FC	10.3125Gb/s 10.5Gb/s	VCSEL	PIN	MMF	LC/PC

7 Revision History

Rev.	Date	Modification	Note
V1.0	Apr 30th, 2013		New
V2.0	Sep 30th, 2013	Update mechanical spec and period	Updated

Warnings

Handling Precautions: This device is susceptible to damage as a result of electrostatic discharge (ESD). A static free environment is highly recommended. Follow guidelines according to proper ESD procedures.

Laser Safety: Radiation emitted by laser devices can be dangerous to human eyes. Avoid eye exposure to direct or indirect radiation.

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