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Product Specification
10Gbit/s XFP LR, 1310 nm Transceiver
TRX10GDP0301

General Description and Applications

The TRX10GDP0x01 is a serial optical transceiver module for 10Gbit/s applications. It is ideally suited for datacom application. Designed for long reach the transceiver module comprises a transmitter with an uncooled laser and a receiver with a PIN photodiode. The transceiver operates within a temperature range of 0°C to +70°C and offers optimum heat dissipation and excellent electromagnetic shielding thus enabling high port densities for 10GbE systems. A 30 pin electrical connector and a duplex LC connector optical interface assure the MSA compliant connectivity of the solid metal XFP package.

Standard	*Description*	*Nominal Baud Rate*	*Unit*
IEEE 802.3ae	10GBASE-LR	10.31	GBd

FEATURES & BENEFITS

- Fully compliant to XFP MSA Rev. 4.5
- Operating at data rate of 9.95 Gb/s to 10.7Gb/s
- Compliant with 10GBASE-LR for Ethernet Application
- Transmission distance up to 10km over single mode fiber
- Low power consumption <1.5W (typ.)
- Wide operating temperature range: 0°C to +70°C
- Laser Class 1 compliant
- Uncooled 1310nm Laser
- LC duplex connector
- Hot pluggable 30pin connector
- XFI electrical interface, AC-coupled
- Compliant with the EU RoHS 6 environmental requirements

Electrical Characteristics

Absolute Maximum Ratings

Rating	*Conditions*	*Symbol*	*Min*	*Max*	*Units*
Storage Ambient Temperature Range		ϑ_{stg}	-40	+85	°C
Powered Case Temperature Range		ϑ_c	0	+75	°C
Operating Relative Humidity		RH	8	80	%
Supply Voltage Range @ 5.0V		V_{CC5}	0.5	6.0	V
Supply Voltage Range @ 3.3V		V_{CC3}	0.5	3.6	V
Open Drain VCC Level		V_{OD}		3.6	V
Static Discharge Voltage on XFI High Speed Pins	HBM human body model per JEDEC JESD22-A114-B			500	V
Static Discharge Voltage excluding XFI High Speed Pins	HBM human body model			2,000	V
Static Discharge Voltage on XFP Module	EN61000-4-2 Criterion B: Air Discharge Direct Contact discharge			15,000 8,000	V V

Any stress beyond the maximum ratings can result in permanent damage. The device specifications are guaranteed only under the recommended operating conditions.

Recommended Operating Conditions

Parameter	*Conditions*	*Symbol*	*Min*	*Typ*	*Max*	*Units*
Operating Case Temperature Range		ϑ_{Case}	0		+70	°C
Transceiver total Power Consumption		P_{TOT}	1.15	1.41	1.78	W
Power Supply Voltage @ 5.0V		V_{CC5}	4.75	5.00	5.25	V
Power Supply Voltage @ 3.3V		V_{CC3}	3.135	3.300	3.465	V
Supply Current	@ V_{CC5}	I_{VCC5}	0.5	1	4	mA
Supply Current	@ V_{CC3}	I_{VCC3}	379	432	516	mA

High Speed Line Characteristics

Parameter	*Conditions*	*Symbol*	*Min*	*Typ*	*Max*	*Units*
Baud Rate nominal	As defined by related standard		9.95		11.3	Gbd
Baud Rate Tolerance			-100		+100	ppm

High Speed Line Output - DC Characteristics

Parameter	*Conditions*	*Symbol*	*Min*	*Typ*	*Max*	*Units*
Single Ended Output Impedance		Z_{SE}	40	50	60	Ω
Differential Output Impedance		Z_{OD}	80	100	120	Ω

High Speed Line Output - AC Characteristics

Parameter	*Conditions*	*Symbol*	*Min*	*Typ*	*Max*	*Units*
Differential Output Amplitude		V_{OSPP}	340		850	mV
Output Common Mode		V_{CM}	0		3.6	V
Transition Time Low to High		t_r	24			ps
Transition Time High to Low		t_f	24			ps
Differential Output Return Loss	0.05 – 0.1GHz 0.1 – 5.5GHz 5.5 – 12GHz		20 8 see 1)			dB dB
Common Mode Output Return Loss[2])	0.1 – 15GHz	SCC 22	3			dB
Total Peak-to-Peak Jitter		D_j			0.34	UI
Output AC Common Mode Voltage					15	mV (RMS)

1) SDD22(dB) = 8 - 20.66 log10(f15.5) with f in GHz
2) Common mode reference impedance is 25Ω. Common mode return loss helps absorb reflection and noise improving EMI.

High Speed Line Input - DC Characteristics

Parameter	*Conditions*	*Symbol*	*Min*	*Typ*	*Max*	*Units*
Differential Output Impedance		R_{IND}	80	100	120	Ω
Input AC Common Mode Input Voltage			0		25	mV (RMS)
Source to Sink DC Potential Difference		V_{CM}	0		3.6	V

High Speed Line Input - AC Characteristics

Parameter	*Conditions*	*Symbol*	*Min*	*Typ*	*Max*	*Units*
Differential Input Voltage Swing		V_{ID}	120		820	mV
Differential Return Loss	0.05 – 0.1GHz 0.1 – 5.5GHz 5.5 – 12GHz	SDD11	20 8 see 1)			dB
Common Mode Return Loss	0.1 – 15GHz	SCC11	3			dB
Total Jitter		T_j			0.61	UI

1) SDD11(dB) = 8 - 20.66 log10(f15.5) with f in GHz

Optical Characteristics

General Parameters

Parameter	Conditions	Symbol	Min	Typ	Max	Units
Operating Range		l_{OP}			10	km
Nominal Signalling Speed	Depending on used standard and provided reference clock	f_{OPT}	9.95		11.3	GBd
Speed Variation from Nominal Speed		Δf_{OPT}	-100		+100	ppm

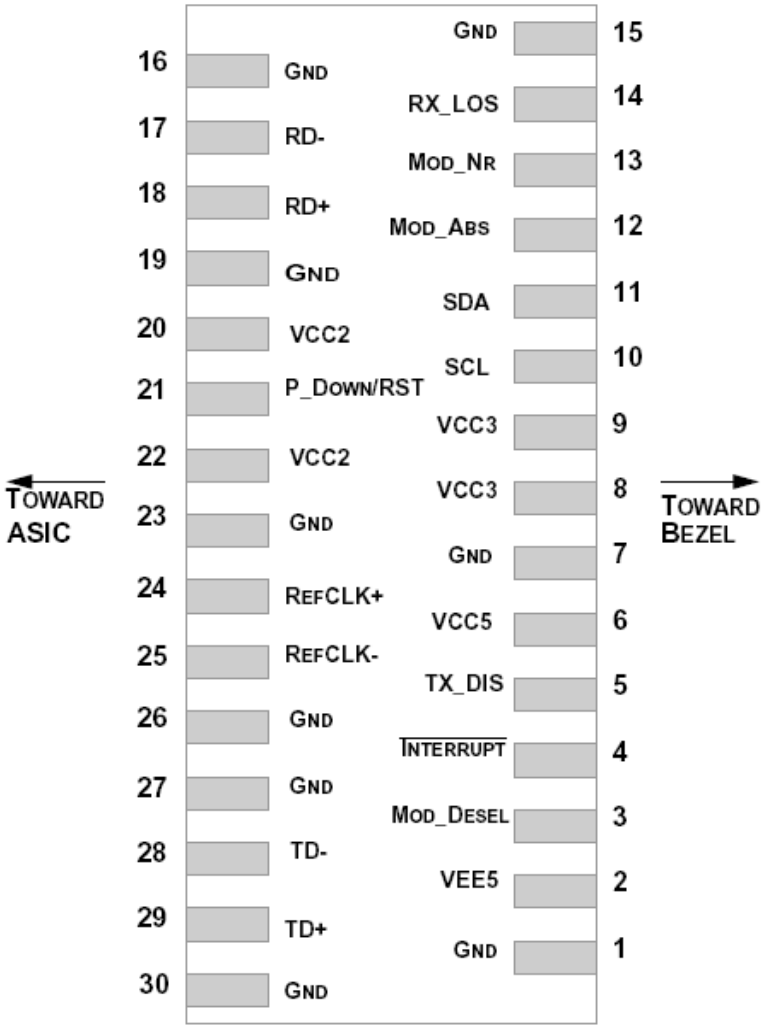
Optical Transmitter

Parameter	Conditions	Symbol	Min	Typ	Max	Units
Nominal Wavelength		λ_{TRP}	1290	1310	1330	nm
Spectral Width	-20dB down	$\Delta\lambda$	0.07	0.25	0.49	nm
Side Mode Suppression Ratio		SMSR	30	46	63	dB
Optical Output Power		P_{out}	-6.0	-3.5	-1.0	dBm
Extinction Ratio	10GBase-LR		5	5.8	7.5	dB
Optical Modulation Amplitude		OMA	302	596	1000	µW
Laser Turn OFF Time	after TX_DIS goes to low		80	95	110	µs
Relative Intensity Noise		RIN			-125	dB/Hz

Optical Receiver

Parameter	Conditions	Symbol	Min	Typ	Max	Units
Center Wavelength		λ_C	1290	1310	1330	nm
Average Received Power		P_{IN}	-15		0.5	dBm
Receiver Sensitivity (OMA)	10GBase-LR, BER 10^{-12} @ 2^{31}-1	P_{IN}	-18.8	-17.5	-15	dBm
Stressed Receiver Sensitivity (OMA)	10GBase-LR	P_{IN}	-12.2			dBm
Saturation Input Power		P_{SAT}			1	dBm
LOS Detect Asserted		P_{LOS}	-30	-21	-18	dBm
Optical Return Loss		ORL			-14	dB
Receiver Reflectance			-27			dB

Hostboard Connector Pinout



Top View

Electrical Pin Definition

PIN	Logic	Symbol	Name / Description	Note
1		GND	Module Ground	1
2		VEE5	Optional -5.2V Power Supply	
3	LVTTL-I	Mod_DeSel	Mode De-select; When held low allows module to respond to 2-wire serial interface commands	
4	LVTTL-O	$\overline{\text{Interrupt}}$	Interrupt (inverted); Indicates presence of an important condition which can be read over the 2-wire serial interface	2
5	LVTTL-I	TX_DS	Transmitter Disable; Turns off transmitter laser output	
6		VCC5	+5V Power Supply	
7		GND	Module Ground	1
8		VCC3	+3.3V Power Supply	
9		VCC3	+3.3V Power Supply	
10	LVTTL-I/O	SCL	2-Wire Serial Interface Clock	2
11	LVTTL-I/O	SDA	2-Wire Serial Interface Data Line	2
12	LVTTL-O	Mod_Abs	Indicates Module is not present. Grounded in the module	2
13	LVTTL-O	Mod_NR	Module Not Ready; Indicating module operational fault	2
14	LVTTL-O	RX_LOS	Receiver Loss Of Signal Indicator	2
15		GND	Module Ground	1
16		GND	Module Ground	1
17	CML-O	RD-	Receiver Inverted Data Output	
18	CML-O	RD+	Receiver Non-Inverted Data Output	
19		GND	Module Ground	1
20		VCC2	+1.8V Power Supply (not required by TRX10GDP)	
21	LVTTL-O	P_Down/RST	Power down; When high, requires the module to limit power consumption to 1.5W or below. 2-Wire serial interface must be functional in the low power mode.	
			Reset; The falling edge initiates a complete reset of the module including the 2-wire serial interface, equivalent to a power cycle.	
22		VCC2	+1.8V Power Supply (not required by TRX10GDP)	
23		GND	Module Ground	1
24	PECL-I	RefCLK+	Reference Clock Non-Inverted Input, AC coupled on the host board	
25	PECL-I	RefCLK-	Reference Clock Inverted Input, AC coupled on the host board	
26		GND	Module Ground	1
27		GND	Module Ground	1
28	CML-I	TD-	Transmitter Inverted Data Input	
29	CML-I	TD+	Transmitter Non-Inverted Data Input	
30		GND	Module Ground	1

1) Module ground pins GND are isolated from the module case and chassis ground within the module.
2) Shall be pulled up with 4.7KΩ -10KΩ to a voltage between 3.15V and 3.45V on the host board.

2-wire Management Interface

Memory specification

Parameter	Symbol	Min.	Max.	Unit	Conditions
Complete Single or Sequential Write	t_{WR}		16	ms	Complete (up to) 4 Byte Write
Endurance (Write Cycles)		50 k	> 200 k	cycles	

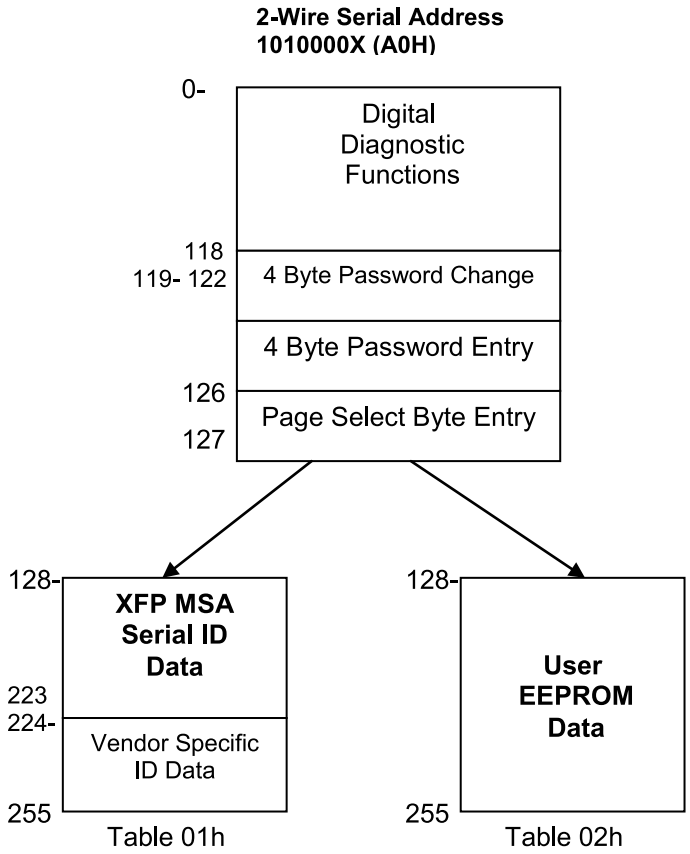
Single Byte Writable Memory Blocks

Byte Address	Volatile or NV	Description
110	V	General Control Bits
118	V	Packet Error Checking Control
127	V	Table Select Byte

Multiple Byte Writable Memory Blocks

Byte Address	Volatile or NV	Description
88-93	V	Interrupt Masking Bits
119-122	V	Password Change Entry
123-126	V	Password Entry
128-255	NV	Table 02h – Customer Writable

Memory overview



The Transceiver module provides a lower memory (byte address 0-127) as well as table 01h and table 02h. The device address of module is always A0h.

Electro Static Discharge (ESD)

The maximum electrostatic charge based on a human body model and the conditions as outlined below is:

Parameter	*Conditions*	*Symbol*	*Min*	*Typ*	*Max*	*Units*
On XFI High Speed Pins	JEDEC JESD22-A114-B				500	V
On XFI Pins excluding High Speed Pins	JEDEC JESD22-A114-B				2,000	V
On XFP Module	Air Discharge EN61000-4-2 criterion B				15,000	V
On XFP Module	Direct Contact Discharge EN61000-4-2 criterion B				8,000	V

Thermal Management

The transceiver is designed for an operation within a case temperature range between 0 to +70°C at an altitude of < 3km. The user needs to guarantee per system design to not exceed this temperature range. It has to be considered that in case of use of multiple modules on a single hostboard that there is a temperature rise among the modules hosted side by side. Airflow direction and air speed needs to be chosen accordingly.

Ordering Information

Standard	Description	Nominal Baud Rate	Unit	Part Number
IEEE 802.3ae	10GBASE-LR	10.31	GBd	TRX10GDP0301

Eye Safety

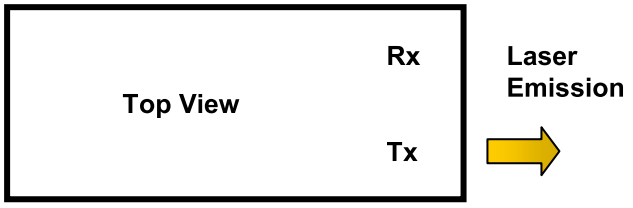
This laser based multimode transceiver is a Class 1 product. It complies with IEC 60825-1: 2007 and FDA performance standards for laser products (21 CFR 1040.10 and 1040.11) except for deviations pursuant to Laser Notice 50, dated June 24, 2007.

CLASS 1 LASER PRODUCT

Caution: use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation.

Note: All adjustments have been made at the factory prior to shipment of the devices. No maintenance or alteration to the device is required. Tampering with or modifying the performance of the device will result in voided product warranty. Failure to adhere to the above restrictions could result in a modification that is considered an act of "manufacturing", and will require, under law, recertification of the modified product with the U.S. Food and Drug Administration (ref. 21 CFR 1040.10 (i)).

Laser Emission Data



Wavelength	1310 nm
Maximum total output power (as defined by IEC: 7 mm aperture at 14 mm distance)	15.6 mW / 11.9 dBm
Beam divergence (full angle) / NA (half angle)	11° / 0.1 rad

Required Labeling

FDA

Compliant to 21 CFR 1040.10 and 1040.11

IEC

Class 1 Laser Product

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More information about FCI's complete range of High Speed Input/Output products can be found on www.fciconnect.com/hsio

For more information about e-catalog or FCI sales offices, headquarters, agents and local distributors, visit www.fciconnect.com

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