Product Specification
10Gbit/s X2 1310 nm Transponder
(TRP10GDP0303, TRP10GDP03CA)

General Description and Applications

The TRP10GDP0303 is a highly integrated, serial optical transponder module for high-speed, 10Gbit/s data transmission applications. The module is fully compliant to IEEE 802.3ae standard for Ethernet, making it ideally suited for 10 GbE datacom (rack-to-rack, client interconnection) applications. Designed for distances of up to 10km the transponder module comprises a transmitter with a directly modulated uncooled 1310nm DFB laser, a receiver with a PIN photodiode, a XAUI-Attachment Interface, an integrated Coder / Decoder and multiplexer / demultiplexer (SERDES: Serializer / Deserializer). The transponder operates within a wide temperature range of 0°C to +70°C and offers optimum heat dissipation and excellent electromagnetic shielding which enables high port densities for 10 GbE systems. A 70 pin electrical connector and a duplex SC connector optical interface assure that connectivity is compliant to the X2 and XENPAK MSA.

Standard	*Description*	*Nominal Baud Rate*	*Unit*
IEEE 802.3ae	10 GBASE-LR	10.3125	GBd

FEATURES & BENEFITS

- Compatible with X2 MSA Rev. 2.0b
- Compliant to IEEE 802.3ae 10GBASE-LR at 10.3125 Gbit/s
- Transmission distance up to 10 km over SMF
- Low Power Consumption 2.3 W (typ.)
- Temperature Range 0°C - 70°C
- Laser Class 1 compliant
- SC duplex connector
- Uncooled 1310nm DFB Laser
- Hot pluggable 70-pin connector with XAUI electrical interface
- Management and control via MDIO 2-wire interface
- Complaint with the EU RoHS 6 Environmental requirements

Electrical Characteristics

Absolute Maximum Ratings

Rating	*Conditions/Remark*	*Symbol*	*Min*	*Typ*	*Max*	*Units*
Storage Ambient Temperature	non condensing	ϑ_{stg}	-10		+85	°C
Powered Case Temperature	non condensing	ϑ_c	-10		+75	°C
Adaptable Power Supply (APS)	Voltage @ Pin APS Sense	$V_{APSsense}$	-0.3		1.5	V
Supply Voltage 3.3V Rail		V_{CC3}	-0.3		4.0	V
Supply Voltage 5V Rail		V_{CC5}	-0.5		7.0	V
Input Voltage Low Speed Signals	RESET, TxOn/Off, PRTADR4..0	V_I	-0.5		3.6	V
Clamp Currents Low Speed Signals	RESET, TxOn/Off, PRTADR4..0 V<0V	I_{IK}	-50			mA
LASI Voltage		V_Q	-0.5		3.6	V
LASI Sink Current	Continuous Sink Current	I_{QL}			20	mA
XAUI Input Level		V_{IXAUI}	-0,4		2.3	V
Differential XAUI Input Amplitude		$\|V_{IDXAUI}\|$			1000	mV
Optical Receiver Input Power	Average Receiver Input Power	P_{Rx}			+1.5	dBm
Static Discharge Voltage	MIL STD 883 Method 3015.1				500	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 / Remark*	*Symbol*	*Min*	*Typ*	*Max*	*Units*
Operating Case Temperature Range		ϑ_{Case}	0		+70	°C
APS Feedback Voltage[1)]	R1=1kΩ ±0,1%, R2=787Ω±0,1%	$V_{Feedback}$	770	800	815	mV
	R1=1kΩ ±1%, R2=787Ω±1%	$V_{Feedback}$	785		812	mV
APS Sense Voltage[1)]	Just for informational purposes	$V_{APSsense}$	1,186		1,282	V
Power Supply Voltage @ 3.3V		V_{CC3}	3.135	3.3	3.465	V
Power Supply Voltage @ 5.0V		V_{CC5}	4.75	5.00	5.25	V

1) The device is designed to operate in the APS control environment described and specified in the XENPAK-MSA (page 22 to 24 of Revision 3.0). In this environment the *APS-Sense Voltage* requirements will be automatically satisfied if *APS-Feedback Voltage* is within its recommended range. The operating *APS-Sense Voltage* is for informational purposes only and is subject to change without further notice.

Power Supply Characteristics

Parameter	*Conditions*	*Symbol*	*Min*	*Typ*	*Max*	*Units*
5V Supply Current	P_{Rx} = 0 …0.5… 1.125mW	I_{VCC5}	0.38	1.6	3.5	mA
3.3V Supply Current	RESET=H, TxOn/Off = H	I_{VCC3}	310	465	786	mA
APS Supply Current	$V_{Feedback}$ = 788…800…812mV	I_{VCCAPS}	550	650	755	mA
APS-Input Capacitance		C_{APS}	127	158	200	µF

XAUI High Speed Line Output – Electrical Characteristics (AC-Coupled)

Parameter	*Conditions*	*Symbol*	*Min*	*Typ*	*Max*	*Units*
Nominal XAUI Data Rate				3.125		GBd
XAUI Data Rate Tolerance			-100		+100	ppm
Differential Output Voltage Swing	R_{LOAD} = 100Ω ± 5%		800		1000	mV_{P-P}
Differential Transition Time	20% - 80%		60		130	ps
Total Output Jitter					0.17	UI
Total Deterministic Output Jitter					0.08	UI

XAUI High Speed Line Input - Electrical Characteristics (AC-Coupled)

Parameter	*Conditions*	*Symbol*	*Min*	*Typ*	*Max*	*Units*
Nominal XAUI Baud Rate				3.125		GBd
Nominal XAUI Baud Rate Tolerance			-100		+100	ppm
Differential Input Voltage Swing	8B/10B Coded Input Signal	V_{ID}	175		1600	mV_{P-P}
Differential Return Loss	100MHz – 2.5GHz	SDD11	10			dB
Common Mode Return Loss	100MHz – 2.5GHz	SCC11	6			dB
Total Peak-to-Peak Jitter Tolerance	Sinusoidal Jitter @ 0 … 20MHz	T_{jRDS}	0.32			UI
Differential Input Impedance		R_{IND}	90	100	110	Ω

Optical Characteristics

General Parameters

Parameter	*Conditions*	*Symbol*	*Min*	*Typ*	*Max*	*Units*
Operating Range		l_{OP}	2		10,000	m
Nominal Signaling Speed		f_{OPT}		10.3125		GBd
Speed Variation from Nominal Speed		Δf_{OPT}	-100		+100	ppm

Optical Transmitter

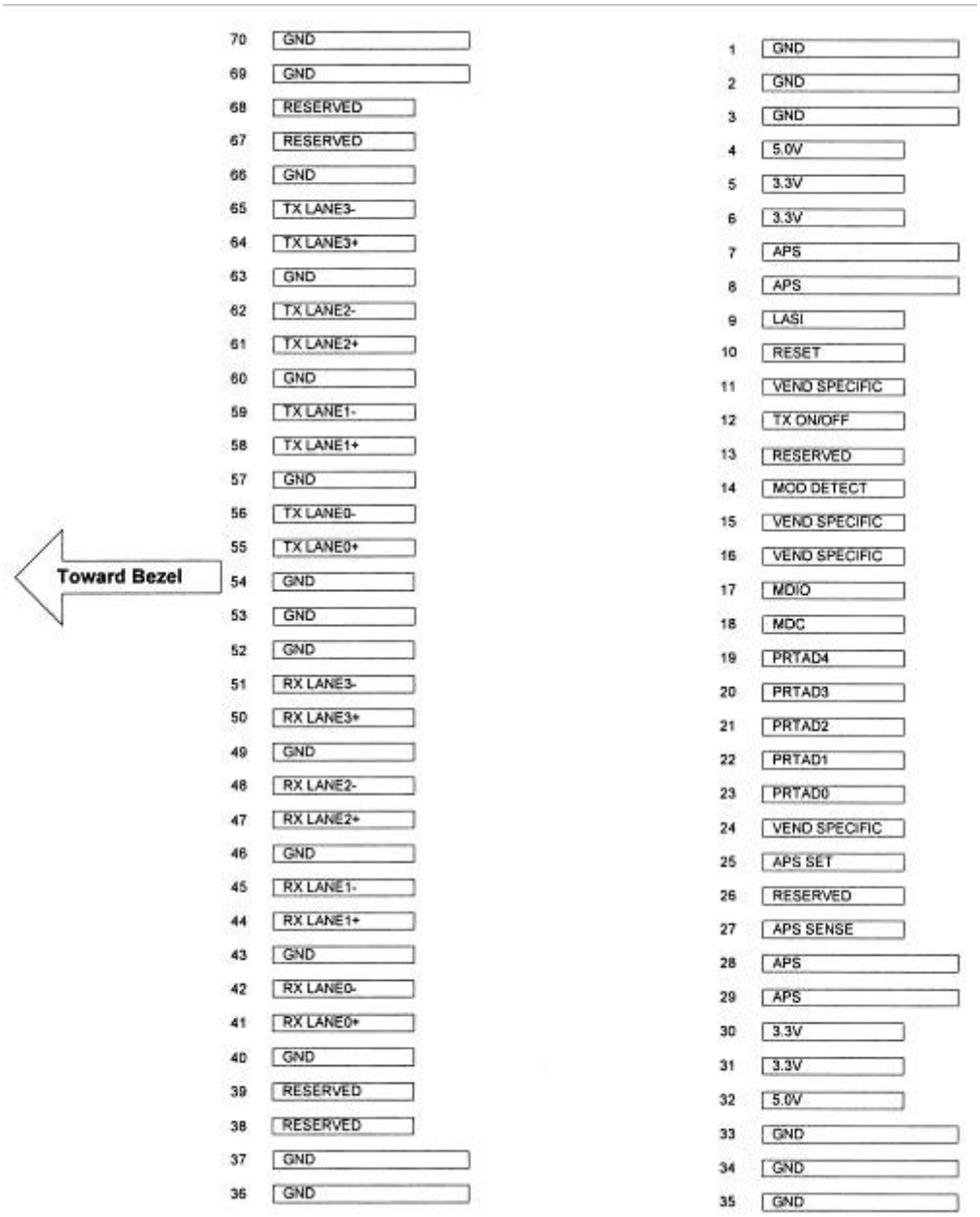
Parameter	*Conditions*	*Symbol*	*Min*	*Typ*	*Max*	*Units*
Nominal Wavelength		λ_{TRP}	1260	1310	1355	nm
Spectral Width	-20dB down	$\Delta\lambda$			0.2	nm
Side Mode Suppression Ratio		SMSR	30			dB
Optical Output Power		P_{out}	-6		-1.0	dBm
Extinction Ratio	EOL	ER	6	8		dB
Optical Modulation Amplitude		OMA	500			µW
Overshoot	Bessel-Thompson Filter	OS			40	%

Optical Receiver

Parameter	*Conditions*	*Symbol*	*Min*	*Typ*	*Max*	*Units*
Center Wavelength		λ_C	1260	1310	1360	nm
Receiver Sensitivity	in OMA, BER 10^{-12} @ 2^{31}-1	P_{IN}	-12.6			dBm
Stressed Receiver Sensitivity	in OMA	P_{IN}	-10.3			dBm
Saturation Input Power		P_{SAT}	0.5			dBm
LOS Detect Asserted		P_{LOS}	-30			dBm
Optical Return Loss		ORL			-12	dB

Note: The specified characteristics are met within the recommended range of operating conditions and under the default settings of output power and modulation amplitude. A change in setting of the optical output power will affect the dynamic behavior of the output signal. Unless otherwise noted typical data is quoted at 3.3V supply voltage and +25°C ambient temperature.

Edge-Board-Connector-Pinning and Layout



Upper Row

Lower Row
(top view through PCB)

Electrical Pin Definition – Pins 01 to 40 of 70

Symbol	*Logic*	*PIN*	*Name / Description*	*Note*
3.3V		5, 6, 30, 31	Power Supply of Optical Receiver and Transmitter and Control Circuits	2
5.0V		4, 32	Power Supply of Optical Receiver Front-end	2
APS		7, 8, 28, 29	Adaptive Power Supply, Supply of PHY XS and PCS Layer Devices	2
APS SENSE		27	APS Sense Output for APS Control Circuit	
APS SET		25	Feedback Input for APS, Input of APS Setting Resistor	
GND		1, 2, 3, 33, 34, 35, 36, 37, 40, 43, 46, 49, 52, 53, 54, 57, 60, 63, 66, 69, 70	Common Electrical Ground	1
LASI	1.2V CMOS Open Drain Output	9	Link Alarm Status Interrupt, low active, Open Drain Output Supposed to operate with 10KΩ - 22KΩ pull upon host. Logic High: Normal Operation Logic Low: Link Alarm is indicated	
MDC		18	Management Clock Input	3
MDIO		17	Management Data IO	3
MOD DETECT		14	1kΩ to Ground for APS Circuit Environment	
PRTADO	1.2V CMOS Input	23	Port Address Bit 0 (Low = 0), internally pulled up by 18kΩ	
PRTAD1	1.2V CMOS Input	22	Port Address Bit 1 (Low = 0), internally pulled up by 18kΩ	
PRTAD2	1.2V CMOS Input	21	Port Address Bit 2 (Low = 0), internally pulled up by 18kΩ	
PRTAD3	1.2V CMOS Input	20	Port Address Bit 3 (Low = 0), internally pulled up by 18kΩ	
PRTAD4	1.2V CMOS Input	19	Port Address Bit 4 (Low = 0), internally pulled up by 18kΩ	
RESERVED		13, 38, 39, 67, 68	Reserved by MSA, internally not connected	
RESERVED		26	Reserved for Avalanche Photodiode use, internally not connected	5
RESET	1.2V CMOS Input	10	Low active Reset Input 10KΩ pull-up on Transceiver Logic high = Normal Operation Logic Low = Reset asserted	
TX ON/OFF	1.2V CMOS Input	12	High active Transmitter Enable Input 10KΩ pull-up on Transceiver Logic high = Transmitter active (normal Operation) And Register Bit 1.9.0 set to low as well Logic Low = shut down of Transmitter	
VENDSPECIFIC		11, 15, 16, 24	Vendor Specific Pin,. for proper operation leave unconnected	5

Electrical Pin Definition – Pins 41 to 70 of 70

Symbol	Logic	PIN	Name / Description	Note
RX LANE0+		41	Module XAUI Output Lane 0+	4
RX LANE0-		42	Module XAUI Output Lane 0-	4
RXLANE1+		44	Module XAUI Output Lane 1+	4
RXLANE1-		45	Module XAUI Output Lane 1-	4
RX LANE2+		47	Module XAUI Output Lane 2+	4
RX LANE2-		48	Module XAUI Output Lane 2-	4
RX LANE3+		50	Module XAUI Output Lane 3+	4
RX LANE3-		51	Module XAUI Output Lane 3-	4
TX LANE0+		55	Module XAUI Input Lane 0+	4
TX LANE0-		56	Module XAUI Input Lane 0-	4
TXLANE1 +		58	Module XAUI Input Lane 1+	4
TXLANE1-		59	Module XAUI Input Lane 1-	4
TX LANE2+		61	Module XAUI Input Lane 2+	4
TX LANE2-		62	Module XAUI Input Lane 2-	4
TX LANE3+		64	Module XAUI Input Lane 3+	4
TX LANE3-		65	Module XAUI Input Lane 3-	4

1) Ground connections are common for TX and RX.
2) All connector contacts are rated at 0.5A nominal.
3) MDIO and MDC timing must comply with IEEE 802.3ae clause 45.3.
4) XAUI output characteristics comply with IEEE 802.3ae clause 47.
5) Transceivers will be MSA compliant when no signals are present on the vendor specific pins

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
Static Discharge Voltage	MIL STD 883 Method 3015.1			500	V	

Thermal Management

The transponder is designed for an operation within a case temperature range between 0 to +70°C at an altitude of < 3km. The built in heatsink provides an optimized thermal performance.
The user needs to guarantee per system design not to exceed this temperature range. It has to be considered that in case of usage of multiple modules on a single hostboard that there is a temperature rise among the modules hosted side by side (see figure below). Airflow direction and air speed needs to be chosen accordingly.
For further information it is referred to the MSA document.

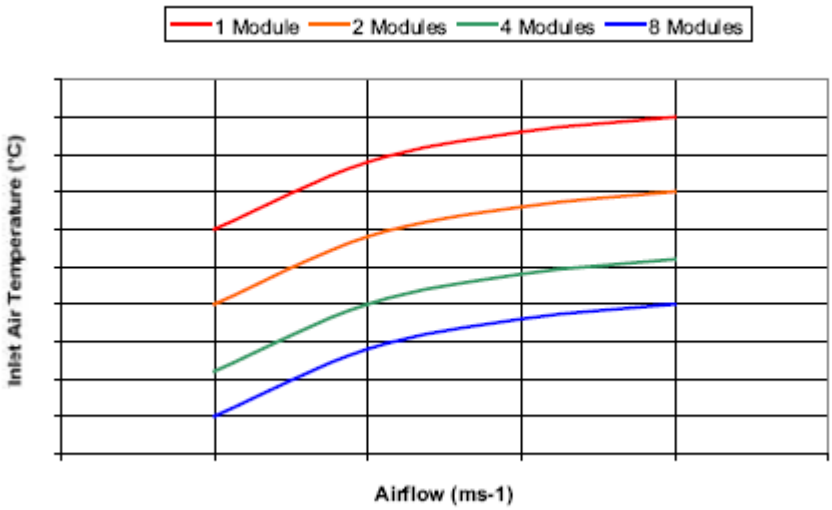
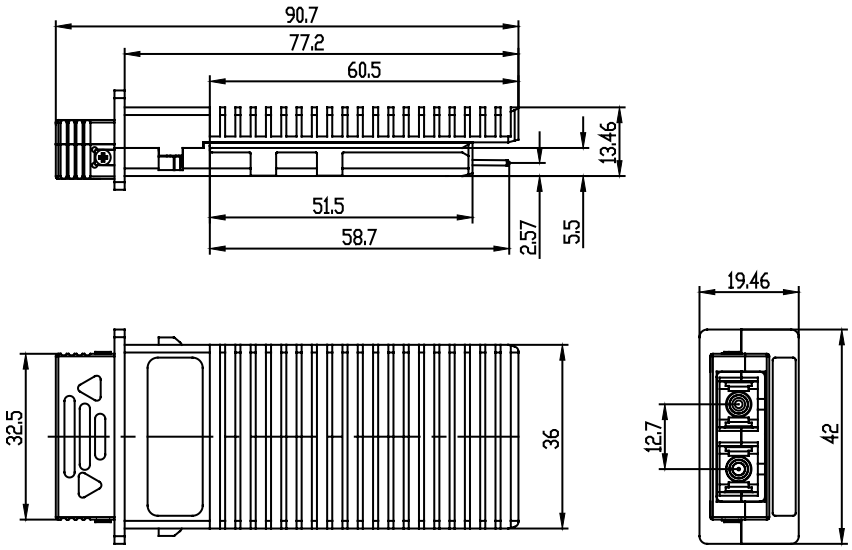


Figure 1 *Thermal behaviour of multiple modules*

Mechanical Drawing



Eye Safety

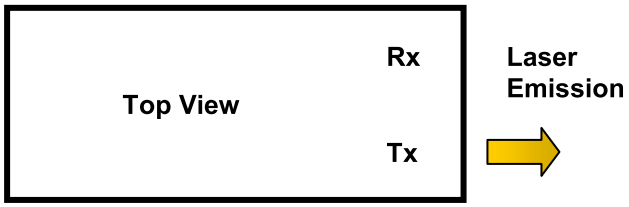
This laser based multimode transceiver is a Class 1 product. It complies with IEC 60825-1/A2: 2001 and FDA performance standards for laser products (21 CFR 1040.10 and 1040.11) except for deviations pursuant to Laser Notice 50, dated July 26, 2001.

CLASS 1 LASER PRODUCT

To meet laser safety requirements the transceiver shall be operated within the Absolute Maximum Ratings.

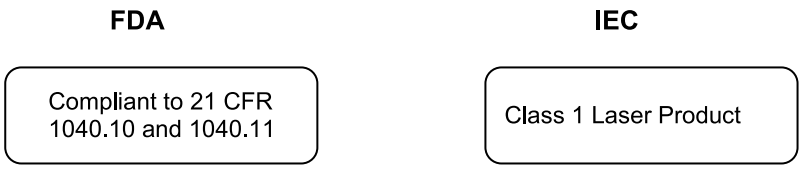
Note: All adjustments have been made at the factory prior to shipment of the devices. No maintenance or alteration to the device is required. Tampering with or modifying the device in any way will result in a voided product warranty. Failure to adhere to the above restrictions could result in a modification 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



Ordering Information

Application	Standard	Part Number
10G Ethernet	IEEE 802.3ae 10GBASE-LR	TRP10GDP0303 TRP10GDP03CA (HP customized)

EUROPE

FCI Deutschland GmbH
Wernerwerkdamm 16
13629 Berlin, Germany
Ph: +49 30 750 795 00
Fax: +49 30 386 37 54

AMERICAS

MergeOptics
1551 McCarthy Blvd, Suite 116
Milpitas, CA 95035 USA
Phone: 408-493-9970

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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