

## TS-X2-SR

### 10Gbps X2 Optical Transceiver, 300m Reach

#### Features

- Compatible with X2 MSA Rev.2.0b
- Support of IEEE 802.3ae, 10GBASE-SR application at 10.3125Gbps
- Transmission distance up to 300m over MMF
- Power Supply :+3.3V, APS(+1.2V)
- Case Temperature Range: Standard: 0°C - 70°C
- Diagnostic Optics Monitoring
- Vertical Cavity Surface Emitting Laser at 850nm
- Duplex SC connector
- 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



#### Applications

- 10GE Ethernet switches and routers
- 10GE Core-routers
- 10GE Storage
- Other 10Gbps Ethernet Transmission System

#### Description

The TS-X2-SR is a highly integrated, serial optical transponder module for high-speed, 10Gbit/s data transmission applications, 4x3.125Gbps Ethernet Signal Input by XAUI Interface. The module is fully compliant to IEEE 802.3ae standard for Ethernet, making it ideally suited for 10GbE datacom (rack to-rack, client interconnection) applications. Designed for distances of up to 300m, the transponder module comprises a transmitter with a vertical cavity surface emitting laser (VCSEL), a receiver with a PIN photodiode, a XAUI-Attachment Interface, an integrated Coder /Decoder and multiplexer / de-multiplexer (SERDES: Serializer/Deserializer).

The transponder operates within a wide case temperature range of 0°C to +70°C and offers optimum heat dissipation and excellent electromagnetic shielding which enables high port densities for 10GbE systems. A 70 pin electrical connector and a duplex SC connector optical interface assure that connectivity is compliant to the X2 MSA Rev.2.0b.

Digital diagnostic monitoring (DDM) is implemented in TS-X2-SR and fully compliant with X2 DDM architecture. The unit monitors temperature, receive optical power, transmit optical power, and laser bias current.

**Absolute Maximum Ratings** <sup>\*Note</sup>

Parameter	Symbol	Min	Max	Unit
Supply Voltage Range @ 3.3V	V <sub>cc3</sub>	-0.5	4.0	V
Adaptable Power Supply (APS)	V <sub>APS</sub>	0	1.5	V
Operating Relative Humidity	RH		80	%
Storage Temperature	T <sub>s</sub>	-40	+85	°C

Note: Exceeding any one of these values may destroy the device permanently.

**Recommended Operating Conditions**

Parameter	Symbol	Min	Typical	Max	Unit
Operating Case Temperature	T <sub>c</sub>	0		+70	°C
Power Supply Voltage @ 3.3V	V <sub>cc3</sub>	3.14	3.3	3.47	V
Adaptable Power Supply (APS)	V <sub>APS</sub>	1.152	1.2	1.248	V
Power Dissipation	PD		3.5	4	W

**XAUI I/O Characteristics** <sup>\*Note</sup>

Parameter	Symbol	Min	Typical	Max	Unit	Notes
XAUI Data Rate	DR		3.125		Gb/s	
XAUI Baud Rate		-100		+100	ppm	Relative Tolerance
Differential Input Voltage Swing		220		1600	mv	8B/10B Coded Input Signal
Differential Output Voltage Swing		800		1600	mVp-p	RLOAD = 100Ω ± 5%
Differential Input Impedance		80	100	120	Ω	
Total Output Jitter	T <sub>J XAUI</sub>			0.35	UI	no pre-equalization
Total Deterministic Output Jitter	D <sub>J XAUI</sub>			0.17	UI	no pre-equalization

Note: XAUI-input-Lanes and XAUI-output-Lanes are both ac-inputs.

**Optical Interface**

Parameter	Symbol	Min	Typical	Max	Unit
<b>Transmitter Characteristics</b>					
Operating Range				300	m
Operating Data Rate			10.3125		Gb/s
Optical Transmit Power	P <sub>o</sub>	-3		-1	dBm
Input Centre Wavelength	$\lambda$	840	850	860	nm
Spectral Width	$\Delta\lambda$		0.4	0.45	dB
Extinction Ratio	ER	3.0			dB
Optical Modulation	OMA	525			$\mu$ W
Transmitter and Dispersion	TDP			3.9	dB
<b>Receiver Characteristics</b>					
Operating Data Rate			10.3125		Gb/s
Overload	P <sub>o</sub>	1			dBm
Stressed Sensitivity in OMA				-7.5	dBm
Sensitivity MINI <sup>*Note</sup>	P <sub>min</sub>			-11.1	dBm

Note: Measured at 10.3125Gb/s, Non-framed PRBS2<sup>31</sup>-1, NRZ.

**MDIO Interface**
**DC Characteristics**

Characteristic	Condition	Symbol	Minimum	Maximum	Unit
Input high voltage		V <sub>H</sub>	0.84	1.5	V
Input low voltage		V <sub>L</sub>	-0.3	0.36	V
MDIO Input current	MMD Driver in tri-state	I <sub>MDIO</sub>	-10	8	pA
MDC Input current		I <sub>MDC</sub>	-5	5	pA
Output low voltage	IOL= 100pA	V <sub>QL</sub>	-0.3		V
	IOL= 4mA	V <sub>QL</sub>		0.2	V
Output high voltage	RPULL-Up = 357 $\Omega$ $\pm$ 1% VPULL-Up = 1.14~1.5V	V <sub>QH</sub>	1.136	1.5	V
Output low current	VI = 0.2V	I <sub>QL</sub>	4		mA
MDIO Input capacitance	VI = 0~1.5V	Cin		10	pF

Electrical Pad Layout

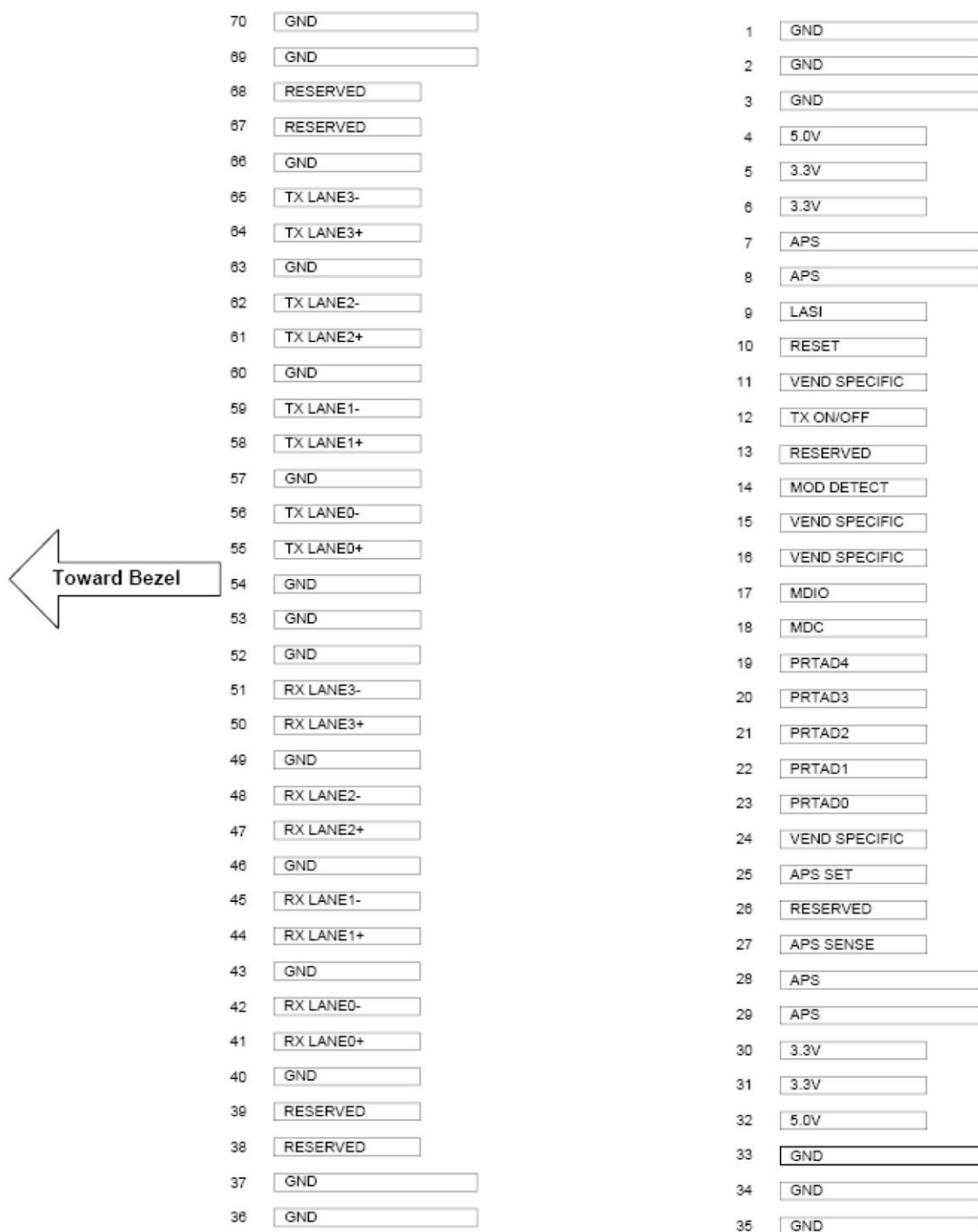


Figure2. Electrical Pin-out Details

**Pin Descriptions**

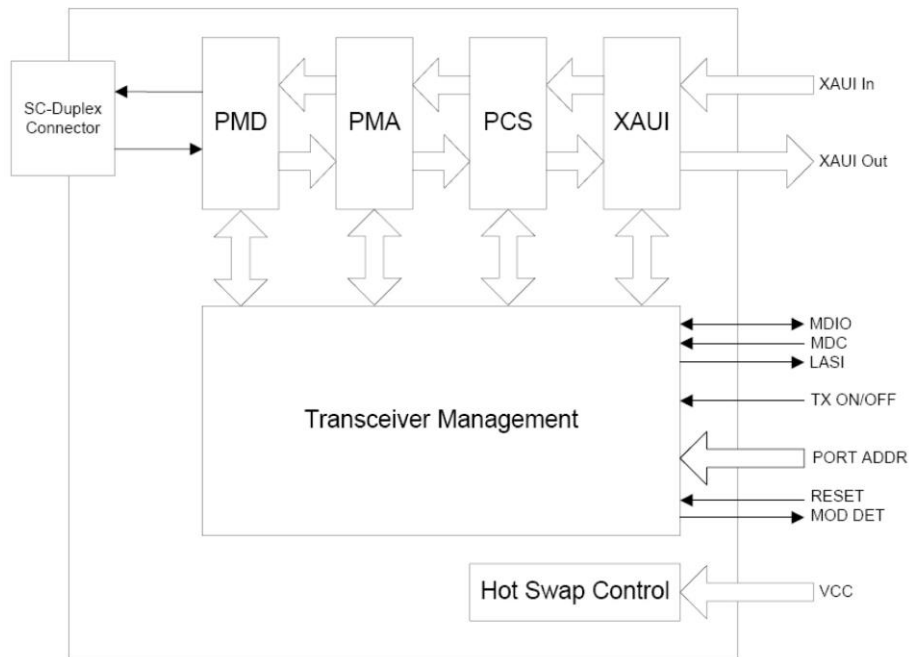
Pin No.	Name	Dir	Function	Note
1	GND		Electrical Ground	1
2	GND		Electrical Ground	1
3	GND		Electrical Ground	1
4	5.0V		Power	2
5	3.3V		Power	2
6	3.3V		Power	2
7	APS =1.2V		Adaptive Power Supply	2
8	APS =1.2V		Adaptive Power Supply	2
9	LASI		Open Drain Compatible 10K-22K pull up on host. Logic High: Normal Operation Logic Low : LASIAsserted	3
10	RESET	I	Open Drain compatible. 10-22K pull-up on transceiver Logic high = Normal operation Logic low = Reset Minimum reset assert time 1 ms	3
11	VEND SPECIFIC		Vendor Specific Pin. Leave unconnected when not in use.	6
12	TX ON/OFF	I	Open Drain compatible. 10-22K pull-up on transceiver Logic high = Transmitter On (capable) Logic low = Transmitter Off (always)	3
13	RESERVED		Reserved	3
14	MOD DETECT	O	Pulled low inside module through 1k	
15	VEND SPECIFIC		Vendor Specific Pin. Leave unconnected when not in use.	6
16	VEND SPECIFIC		Vendor Specific Pin. Leave unconnected when not in use.	6
17	MDIO	IO	Management Data IO	3,4
18	MDC	I	Management Data Clock	3,4
19	PRTAD4	I	Port Address Bit 4 (Low = 0)	3
20	PRTAD3	I	Port Address Bit 3 (Low = 0)	3
21	PRTAD2	I	Port Address Bit 2 (Low = 0)	3
22	PRTAD1	I	Port Address Bit 1 (Low = 0)	3
23	PRTAD0	I	Port Address Bit 0 (Low = 0)	3
24	VEND SPECIFIC		Vendor Specific Pin. Leave unconnected when not in use.	6
25	APS SET		Feedback input for APS	
26	RESERVED		Reserved for Avalanche Photodiode use.	6
27	APS SENSE		APS Sense Connection	
28	APS =1.2V		Adaptive Power Supply	2
29	APS =1.2V		Adaptive Power Supply	2
30	3.3V		Power	2

31	3.3V		Power	2
32	5.0V		Power	2
33	GND		Electrical Ground	1
34	GND		Electrical Ground	1
35	GND		Electrical Ground	1
36	GND		Electrical Ground	1
37	GND		Electrical Ground	1
38	RESERVED		Reserved	
39	RESERVED		Reserved	
40	GND		Electrical Ground	1
41	RX LANE0+	O	Module XAUI Output Lane 0+	5
42	RX LANE0-	O	Module XAUI Output Lane 0-	5
43	GND		Electrical Ground	1
44	RX LANE1+	O	Module XAUI Output Lane 1+	5
45	RX LANE1-	O	Module XAUI Output Lane 1-	5
46	GND		Electrical Ground	1
47	RX LANE2+	O	Module XAUI Output Lane 2+	5
48	RX LANE2-	O	Module XAUI Output Lane 2-	5
49	GND		Electrical Ground	1
50	RX LANE3+	O	Module XAUI Output Lane 3+	5
51	RX LANE3-	O	Module XAUI Output Lane 3-	5
52	GND		Electrical Ground	1
53	GND		Electrical Ground	1
54	GND		Electrical Ground	1
55	TX LANE0+	I	Module XAUI Output Lane 0+	5
56	TX LANE0-	I	Module XAUI Output Lane 0-	5
57	GND		Electrical Ground	1
58	TX LANE1+	I	Module XAUI Output Lane 1+	5
59	TX LANE1-	I	Module XAUI Output Lane 1-	5
60	GND		Electrical Ground	1
61	TX LANE2+	I	Module XAUI Output Lane 2+	5
62	TX LANE2-	I	Module XAUI Output Lane 2-	5
63	GND		Electrical Ground	1
64	TX LANE3+	I	Module XAUI Output Lane 3+	5
65	TX LANE3-	I	Module XAUI Output Lane 3-	5
66	GND		Electrical Ground	1
67	RESERVED		Reserved	
68	RESERVED		Reserved	
69	GND		Electrical Ground	1
70	GND		Electrical Ground	1

Notes:

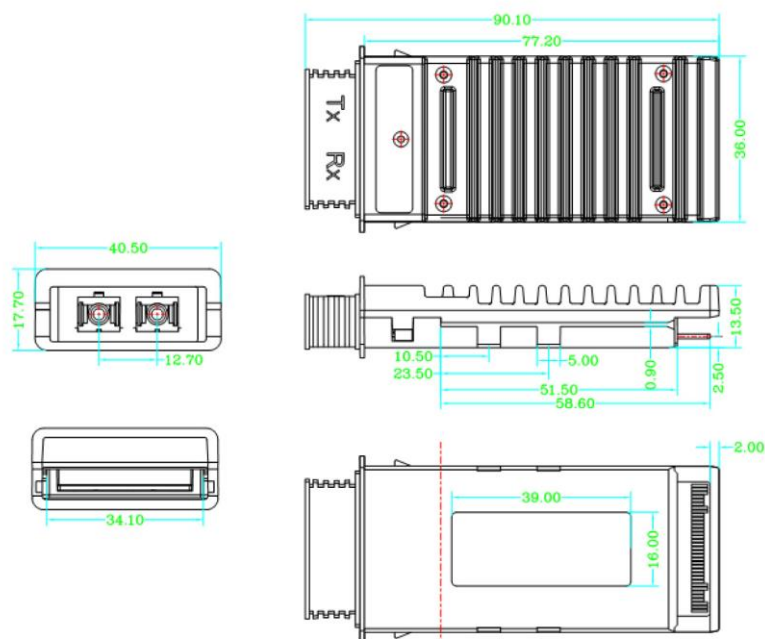
- 1) Ground connections are common for TX and RX.
- 2) All connector contacts are rated at 0.5A nominal.
- 3) 1.2V CMOS compatible.
- 4) MDIO and MDC timing must comply with IEEE802.3ae, Clause 45.3
- 5) XAUI output characteristics should comply with IEEE802.3ae Clause 47.

6) Transceivers will be MSA compliant when no signals are present on the vendor specific pins.



**Figure1.** Functional Diagram of Typical X2 Style Transceiver

## Package Dimensions



**Regulatory Compliance**

Feature	Standard	Performance
Electrostatic Discharge (ESD) to the Electrical Pins	MIL-STD-883G Method 3015.7	Class 1C (>1000 V)
Electrostatic Discharge to the enclosure	EN 55024:1998+A1+A2 IEC-61000-4-2 GR-1089-CORE	Compliant with standards
Electromagnetic Interference (EMI)	FCC Part 15 Class B EN55022:2006 CISPR 22B :2006 VCCI Class B	Compliant with standards Noise frequency range: 30 MHz to 6 GHz. Good system EMI design practice required to achieve Class B margins. System margins depend on customer host board and chassis design.
Immunity	EN 55024:1998+A1+A2 IEC 61000-4-3	Compliant with standards. 1kHz sine-wave, 80% AM, from 80 MHz to 1 GHz. No effect on transmitter/receiver performance is detectable between these limits.
Laser Eye Safety	FDA 21CFR 1040.10 and 1040.11 EN (IEC) 60825-1:2007 EN (IEC) 60825-2:2004+A1	CDRH compliant and Class I laser product. TüV Certificate No. 50135086
Component Recognition	UL and CUL EN60950-1:2006	UL file E317337 TüV Certificate No. 50135086 (CB scheme )
RoHS6	2002/95/EC 4.1&4.2 2005/747/EC 5&7&13	Compliant with standards <sup>*note</sup>

**Note:**

For update of the equipments and strict control of raw materials, TONGSION has the ability to supply the customized products since Jan 1st, 2007, which meets the requirements of RoHS6 (Restrictions on use of certain Hazardous Substances) of European Union.

In light of item 5 in RoHS exemption list of RoHS Directive 2002/95/EC, Item 5: Lead in glass of cathode ray tubes, electronic components and fluorescent tubes.

In light of item 13 in RoHS exemption list of RoHS Directive 2005/747/EC, Item 13: Lead and cadmium in optical and filter glass. The three exemptions are being concerned for TONGSION's transceivers, because TONGSION's transceivers use glass, which may contain Pb, for components such as lenses, isolators, and other electronic components.



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**Ordering information**

Part Number	Product Description
TS-X2-SR	850nm, 10Gbps, SC, 300m, 0°C~+70°C, With DDM

**Important Notice**

Performance figures, data and any illustrative material provided in this data sheet are typical and must be specifically confirmed in writing by TONGSION before they become applicable to any particular order or contract. In accordance with the TONGSION policy of continuous improvement specifications may change without notice.

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**Contact:**

[sales@tongsion.com](mailto:sales@tongsion.com)

<http://www.tongsion.com>