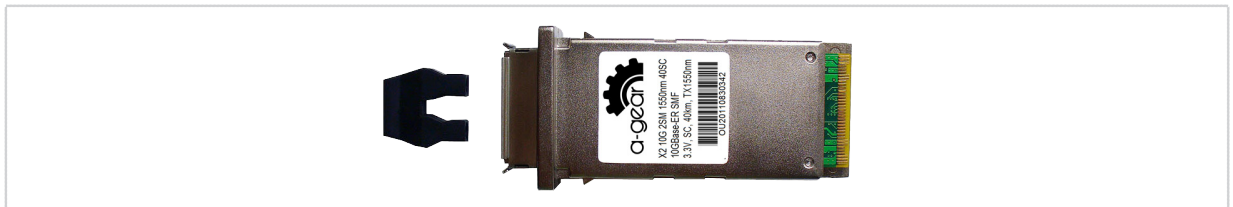


## Product Specification

### X2 10G ER 40km SC Optical Transceiver



#### 1. Features

- XAUI Electrical Interface: 4 Lanes @ 3.125Gbit/s
- Cooled 1550nm EML
- Hot Z-Pluggable
- SC-Duplex Optical Receptacle
- MDIO, DOM Support
- Pin Photo-detector
- Compliant to X2 MSA
- Compliant to IEEE 802.3ae 10GBASE-ER Application
- Operating Case Temperature: 0°C to 70°C

#### 2. Reference

- IEEE 802.3ae as 10GBASE-ER, X2 MSA Release1.0B.

#### 3. Product Description

A-GEAR's 10Gb/s X2 transceiver module X2 10G ER 40km SC is a hot pluggable in the Z-direction module that is usable in typical router line card applications, Storage, IP network and LAN and compliant to X2 MSA. The X2 10G ER 40km SC is a fully integrated 10.3Gbit/s optical transceiver module that consists of a 10.3Gbit/s optical transmitter and receiver, XAUI interface, Mux and Demux with clock and data recovery (CDR). This version of A-GEAR Inc. transceiver line uses an cooled 1550nm EML Laser Diode to achieve 40km over standard single mode fiber as 10GBASE-ER of the IEEE 802.3ae.

## 4. Performance Specifications

### 4.1. Optical Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit
Center Wavelength	$\lambda_c$	1530	1550	1570	nm
Signaling speed		-	10.3125	-	Gbit/s
Signaling speed variation from nominal		-100	-	+100	ppm
Optical modulation amplitude	OMA	-2.1	-	-	dBm
Optical Output Power	Pf	-1	-	+4	dBm <sup>[1]</sup>
Side Mode Suppression Ratio	Sr	30	-	-	dB <sup>[1]</sup>
Extinction Ratio	Er	8.2	-	-	dB
Off Transmit Power	P <sub>OFF</sub>	-	-	-30	dBm <sup>[1]</sup>
Tx Jitter Generation(peak-to-peak)	T <sub>XJ1</sub>	-	-	0.3	UI
Tx Jitter Generation(RMS)	T <sub>XJ2</sub>	-	-	0.1	UI
Receiver Sensitivity in	R <sub>SENSE</sub>	-	-	-16.5	dBm
Receiver Overload	R <sub>ro</sub>	+0.5	-	-	dBm <sup>[1]</sup>
Receiver Return Loss	R <sub>L</sub>	12	-	-	dB <sup>[1]</sup>

**Notes:**

[1] Average

## 5. Electrical Performance

### 5.1. Power Supply Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit
Supply Voltage	V <sub>CC1</sub>	3.135	3.300	3.465	V
Supply Voltage	V <sub>CC2</sub>	1.152	1.200	1.248	V
Supply Current	I <sub>CC1</sub>	-	-	1.2	A <sup>[1]</sup>
Supply Current	I <sub>CC2</sub>	-	-	1.7	A <sup>[2]</sup>
Power Consumption	P <sub>DS</sub>	-	-	4.0	W
Power supply stabilization time	T <sub>DF</sub>	-	-	500	ms <sup>[3]</sup>
Initialization Time	T <sub>INIT</sub>	-	-	5	s <sup>[3]</sup>
RESET Assert Time	T <sub>RESET</sub>	1	-	-	ms <sup>[4]</sup>
Hold Time after rising edge of RESET	T <sub>HOLD</sub>	500	-	-	ms <sup>[4]</sup>

**Notes:**

[1] +3.3 V

[2] APS

- [3] Figure 7
- [4] Figure 9

### 5.2. XAUI Driver Characteristics

Parameter	Min.	Typical	Max.	Unit
Baud Rate	-	3.125	-	Gbit/s
Baud Rate Tolerance	-100	-	+100	ppm
Differential Amplitude	800	-	1600	mVPP <sup>[1]</sup>

**Notes:**

- [1] AC, near-end value

### 5.3. 1.2V CMOS Interface Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit
Input High Voltage	V <sub>IH</sub>	0.84	-	1.5	V
Input Low Voltage	V <sub>IL</sub>	-0.3	-	0.36	V
Input Pull-down Current	I <sub>in</sub>	20	40	120	μA <sup>[1]</sup>
Output High Voltage	V <sub>OH</sub>	1.0	-	-	V <sup>[2]</sup>
Output Low Voltage	V <sub>OL</sub>	-	-	0.2	V <sup>[2]</sup>
Pull up Resistance	R <sub>LASI</sub>	10	-	22	k ohm
Capacitance	C <sub>LASI</sub>	-	-	10	pF
Load Capacitance	C <sub>Load</sub>	-	-	320	pF
Hold Time after rising edge of RESET	T <sub>HOLD</sub>	500	-	-	ms <sup>[4]</sup>

**Notes:**

- [1] V<sub>IH</sub>=1.2V
- [2] Pull-up=10k ohm to 1.2V

### 5.4. MDIO Bidirectional Interface Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit
Input High Voltage	V <sub>IHM</sub>	0.84	-	1.5	V
Input Low Voltage	V <sub>ILM</sub>	-0.3	-	0.36	V
Output High Voltage	V <sub>OHM</sub>	1.0	-	1.5	V
Output Low Voltage	V <sub>OLM</sub>	-0.3	-	0.2	V
Pull up Resistance	R <sub>MDIO</sub>	200	-	-	Ohm
MDC min high/low time	T <sub>HM</sub> , T <sub>LM</sub>	160	-	-	ns
MDC Frequency	1/T <sub>CK</sub>	T <sub>BD</sub>	-	2.5	MHz
Setup time	T <sub>DIS</sub>	10	-	-	ns
Hold time	T <sub>DIH</sub>	10	-	-	ns
MDIO output delay after rising edge of MDC	T <sub>PD</sub>	0	-	300	ns

Parameter	Symbol	Min.	Typical	Max.	Unit
Input Capacitance	C <sub>i</sub>	-	-	10	pF
Bus Loading	C <sub>L</sub>	-	-	470	pF

**Notes:**

The maximum value of RMDIO depends on bus loading (C<sub>L</sub>), input capacitance (C<sub>i</sub>), and MDC frequency (1/T<sub>CK</sub>).

## 6. X2 Pin Configuration

Pin #	Symbol	I/O	Logic	Description
1	GND	I	Supply	Electrical ground
2	GND	I	Supply	Electrical ground
3	GND	I	Supply	Electrical ground
4	RESERVED	-	-	Reserved
5	3.3 V	I	Supply	Power
6	3.3 V	I	Supply	Power
7	APS	I	Supply	Adaptive Power Supply
8	APS	I	Supply	Adaptive Power Supply
9	LASI	O	Open Drain	Link Alarm Status Interrupt. 10-22k ohm pull up on host.
10	RESET	I	1.2 V CMOS	TX OFF when MDIO RESET
11	VEND SPECIFIC	-	-	Vendor Specific Pin. Leave unconnected.
12	TX ON/OFF	I	1.2 V CMOS	Transmitter ON/OFF
13	RESERVED	-	-	Reserved
14	MOD DETECT	O	-	Pulled low inside module through 1k ohm.
15	VEND SPECIFIC	-	-	Vendor Specific Pin. Leave unconnected.
16	VEND SPECIFIC	-	-	Vendor Specific Pin. Leave unconnected.
17	MDIO	I/O	Open Drain	Management Data IO
18	MDC	I	1.2V CMOS	Management Data Clock
19	PRTAD4	I	1.2V CMOS	Port Address bit 4 (Low=0)
20	PRTAD3	I	1.2V CMOS	Port Address bit 3 (Low=0)
21	PRTAD2	I	1.2V CMOS	Port Address bit 2 (Low=0)
22	PRTAD1	I	1.2V CMOS	Port Address bit 1 (Low=0)
23	PRTAD0	I	1.2V CMOS	Port Address bit 0 (Low=0)
24	VEND SPECIFIC	-	-	Vendor Specific Pin. Leave unconnected.
25	APS SET	O	-	Feedback output for APS
26	RESERVED	-	-	Reserved for Avalanche Photodiode use.
27	APS SENSE	O	Analog	APS Sense Connection
28	APS	I	Supply	Adaptive Power Supply



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Pin #	Symbol	I/O	Logic	Description
29	APS	I	Supply	Adaptive Power Supply
30	3.3 V	I	Supply	Power
31	3.3 V	I	Supply	Power
32	RESERVED	-	-	Reserved
33	GND	I	Supply	Electrical Ground
34	GND	I	Supply	Electrical Ground
35	GND	I	Supply	Electrical Ground
36	GND	I	Supply	Electrical Ground
37	GND	I	Supply	Electrical Ground
38	RESERVED	-	-	Reserved
39	RESERVED	-	-	Reserved
40	GND	I	Supply	Electrical Ground
41	RX LANE 0+	O	AC	Module XAUI Output Lane 0+
42	RX LANE 0-	O	AC	Module XAUI Output Lane 0-
43	GND	I	Supply	Electrical Ground
44	RX LANE 1 +	O	AC	Module XAUI Output Lane 1 +
45	RX LANE 1-	O	AC	Module XAUI Output Lane 1-
46	GND	I	Supply	Electrical Ground
47	RX LANE 2+	O	AC	Module XAUI Output Lane 2+
48	RX LANE 2-	O	AC	Module XAUI Output Lane 2-
49	GND	I	Supply	Electrical Ground
50	RX LANE 3+	O	AC	Module XAUI Output Lane 3+
51	RX LANE 3-	O	AC	Module XAUI Output Lane 3-
52	GND	I	Supply	Electrical Ground
53	GND	I	Supply	Electrical Ground
54	GND	I	Supply	Electrical Ground
55	TX LANE 0+	I	AC	Module XAUI Input Lane 0+
56	TX LANE 0-	I	AC	Module XAUI Input Lane 0-
57	GND	I	Supply	Electrical Ground
58	TX LANE 1+	I	AC	Module XAUI Input Lane 1+
59	TX LANE 1-	I	AC	Module XAUI Input Lane 1-
60	GND	I	Supply	Electrical Ground
61	TX LANE 2+	I	AC	Module XAUI Input Lane 2+
62	TX LANE 2-	I	AC	Module XAUI Input Lane 2-
63	GND	I	Supply	Electrical Ground
64	TX LANE 3+	I	AC	Module XAUI Input Lane 3+



Pin #	Symbol	I/O	Logic	Description
65	TX LANE 3-	I	AC	Module XAUI Input Lane 3-
66	GND	I	Supply	Electrical Ground
67	RESERVED	-	-	Reserved
68	RESERVED	-	-	Reserved
69	GND	I	Supply	Electrical Ground
70	GND	I	Supply	Electrical Ground

**Notes:**

Case is connected to electrical ground in the module.

## 7. Mechanical dimensions

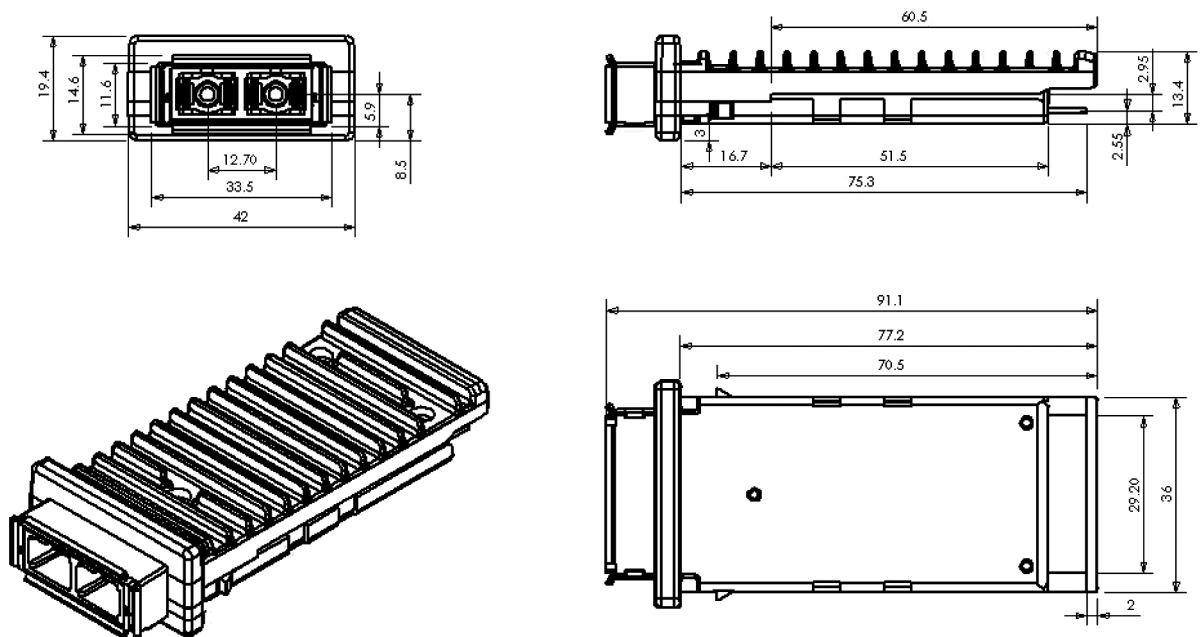


Figure 1. Mechanical dimensions.

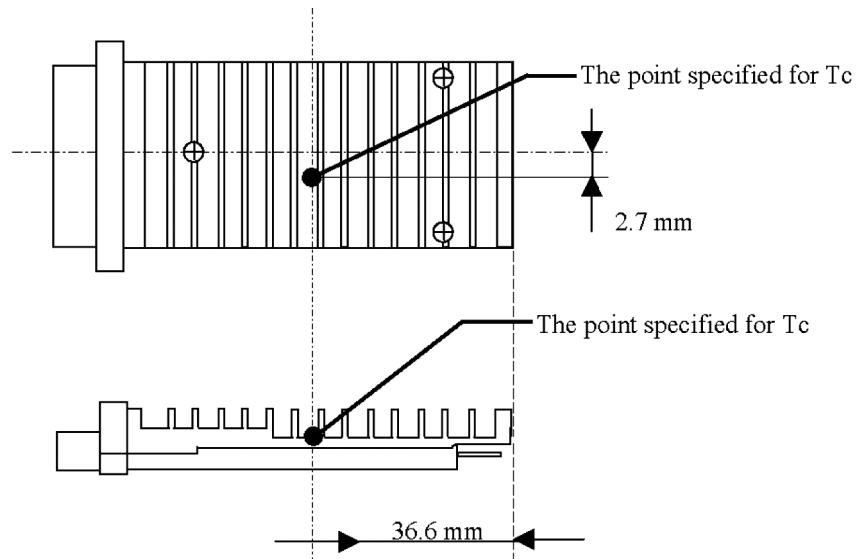


Figure 2. The Point Specified for Case Temperature (Tc).

## 8. Register Definition

Device Address (Dec) Register Address (Hex)	PMA/PMD 1	PCS 3	PHY XS 4
0x0000	PMA/PMD Control1	PCS Control1	PHY XS Control1
0x0001	PMA/PMD Status1	PCS Status1	PHY XS Status1
0x0002	PMA/PMD Device Identifier0	PCS Device Identifier0	PHY XS Device Identifier0
0x0003	PMA/PMD Device Identifier1	PCS Device Identifier1	PHY XS Device Identifier1
0x0004	PMA/PMD Speed Ability	PCS Speed Ability	PHY XS Speed Ability
0x0005	PMA/PMD Device in Package1	PCS Device in Package1	PHY XS Device in Package1
0x0006	PMA/PMD Device in Package2	PCS Device in Package2	PHY XS Device in Package2
0x0007	10G PMA/PMD Control2	PCS Control2	Reserved
0x0008	10G PMA/PMD Status2	PCS Status2	PHY XS Status2
0x0009	10G PMD Transmit Disable	Reserved	Reserved
0x000A	10G PMD Receive Signal O.K.	Reserved	Reserved
0x000E	Package Identifier0	Reserved	Reserved
0x000F	Package Identifier1	Reserved	Reserved
0x0018	Reserved	Reserved	10G PHY XGXS Lane Status
0x0019	Reserved	Reserved	10G PHY XGXS Test Control
0x0020	Reserved	10GBASE-R PCS Status1	Reserved
0x0021	Reserved	10GBASE-R PCS Status2	Reserved
0x0022	Reserved	10GBASE-R PCS Test pattern Seed A0	Reserved

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Device Address (Dec) Register Address (Hex)	PMA/PMD 1	PCS 3	PHY XS 4
0x0023	Reserved	10GBASE-R PCS Test pattern Seed A1	Reserved
0x0024	Reserved	10GBASE-R PCS Test pattern Seed A2	Reserved
0x0025	Reserved	10GBASE-R PCS Test pattern Seed A3	Reserved
0x0026	Reserved	10GBASE-R PCS Test pattern Seed B0	Reserved
0x0027	Reserved	10GBASE-R PCS Test pattern Seed B1	Reserved
0x0028	Reserved	10GBASE-R PCS Test pattern Seed B2	Reserved
0x0029	Reserved	10GBASE-R PCS Test pattern Seed B3	Reserved
0x002A	Reserved	10GBASE-R PCS Test pattern Control	Reserved
0x002B	Reserved	10GBASE-R PCS Test pattern Error counter	Reserved
0x8000	NVR Control/Status (X2 Register)		Reserved
0x8007 - 0x807D	NVR (X2 Register)		Reserved
0x807E- 0x80AD	Customer AREA		Reserved
0x80AE - 0x8106	XGIGA Specific Area (X2 Register)		Reserved
0x9000	RX_ALARM Control (X2 Register)		Reserved
0x9001	TX_ALARM Control (X2 Register)		Reserved
0x9002	LASI Control (X2 Register)		Reserved
0x9003	RX_ALARM Status (X2 Register)		Reserved
0x9004	TX_ALARM Status (X2 Register)		Reserved
0x9005	LASI Status (X2 Register)		Reserved
0x9006	TX FLAG Control Bits		Reserved
0x9007	RX_FLAG Control Bits		Reserved
0xA000 - 0xA027	Alarm and Warning Thresholds		Reserved
0xA060 - 0xA069	Digital Optical Monitoring Interface		Reserved
0xA06F	DOM Capability - Extended		Reserved
0xA070	TX_ALARM_FLAG Bits		Reserved
0xA071	RX_ALARM_FLAG Bits		Reserved
0xA074	TX_WARNING_FLAG Bits		Reserved
0xA075	RX_WARNING_FLAG Bits		Reserved
0xA100	Optional Digital Optical Monitoring (DOM) Control/Status		Reserved