

## Product Specification

# XENPAK 10G ER 40km SC Optical Transceiver



### Features

- XAUI Electrical Interface: 4 Lanes @ 3.125Gbit/s
- Hot Z-Pluggable
- SC-Duplex Optical Receptacle
- MDIO, DOM Support
- cooled 1.5 $\mu$ m DFB-LD
- PIN Photo-detector
- Operating Case Temperature: 0 to 70 °C
- Compliant to IEEE 802.3ae 10GBASE-ER Application
- Compliant to XENPAK MSA
- Mechanical Footprint: 4.76`` L x 1.42`` W x 0.46`` H

### Reference

- IEEE 802.3ae as 10GBASE-ER, XENPAK MSA Release3.0

### Product Description

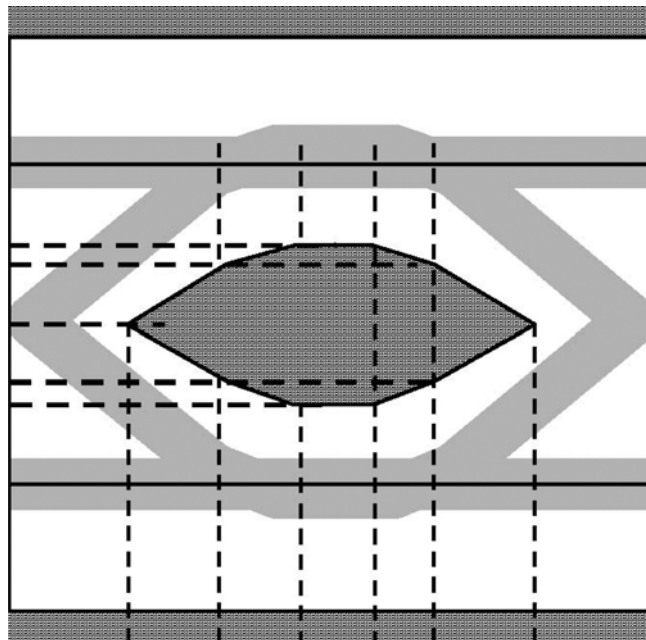
A-GEAR's 10GbE XENPAK transceiver module XENPAK 10G ER 40km SC is a hot pluggable in the Z-direction module that is usable in typical router line card applications, Storage, IP network and LAN and compliant to XENPAK MSA. The XENPAK 10G ER 40km SC is a fully integrated 10.3Gbit/s optical transceiver 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 DFB Laser Diode to achieve 40km over standard single mode fiber as 10GBASE-ER of the IEEE 802.3ae.

## Optical Characteristics

Parameter	Symbol	Min.	Typical	Max.	Units
Center Wavelength	$A_c$	1540	1550	1560	nm
Signaling speed		-	10.3125	-	Gbit/s
Signaling speed variation from nominal		-100	-	+ 100	ppm
Optical modulation amplitude	OMA	-5.2	-	-	dBm <sup>[1]</sup>
Optical Output Power	$P_f$	-1	-	+3	dBm <sup>[2]</sup>
Optical Waveform	-	Figure 13			-
Side Mode Suppression Ratio	$S_r$	30	-	-	dB <sup>[2]</sup>
Extinction Ratio	$E_r$	8.2	-	-	dB
Off Transmit Power	$P_{off}$	-	-	-30	dBm <sup>[2]</sup>
Optical Output turn-off Time	$T_{TX-OFF}$	-	-	100	$\mu s$ <sup>[3]</sup>
Receiver Sensitivity in OMA	OMA rmin	-21	-	-7	dBm
Receiver Overload	$R_{ro}$	+0.5	-	-	dBm <sup>[2]</sup>
Receiver Return Loss	$R_L$	12	-	-	dB <sup>[2]</sup>

**Notes:**

- [1] The maximum value of  $R_{MDIO}$  depends on bus loading ( $C_L$ ), input capacitance( $C_i$ ), and MDC frequency ( $1/T_{ck}$ ).
- [2] Average
- [3] Figure10



## Electrical Performance

Parameter	Symbol	Min.	Typical	Max.	Units
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>	-	-	1.4	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
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

## XAUI Driver Characteristics

Parameter	Min.	Typ.	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

## 1.2V CMOS Interface Characteristics

Parameter	Symbol	Min.	Typical	Max.	Units
Baud Rate		-	3.125	-	Gbit/s
Baud Rate Tolerance		-100	-	+ 100	ppm
Differential Amplitude		200	-	1600	mVpp <sup>[1]</sup>
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>[2]</sup>
Output High Voltage	V <sub>OH</sub>	1.0	-	-	V <sup>[3]</sup>
Output Low Voltage	V <sub>OL</sub>	-	-	0.2	V <sup>[3]</sup>
Pull up Resistance	R <sub>LAS1</sub>	10	-	22	k ohm <sup>[4]</sup>

Parameter	Symbol	Min.	Typical	Max.	Units
Capacitance	C <sub>LAS1</sub>	-	-	10	pF <sup>[4]</sup>
Load Capacitance	C <sub>Load</sub>	-	-	320	pF <sup>[4]</sup>

**Notes:**

- [1] AC
- [2] V<sub>ih</sub>=1.2V
- [3] Pull-up=10k ohm to 1.2V
- [4] Figure 8

### MDIO Bidirectional Interface Characteristics

Parameter	Symbol	Min.	Typical	Max.	Units
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 <sup>[1,4]</sup>
MDC min high/low time	T <sub>HM</sub> , T <sub>LM</sub>	160	-	-	ns <sup>[2]</sup>
MDC Frequency	1/T <sub>CK</sub>	T <sub>BD</sub>	-	2.5	MHz
Setup time	T <sub>DIS</sub>	10	-	-	ns <sup>[2]</sup>
Hold time	T <sub>DIH</sub>	10	-	-	ns <sup>[2]</sup>
MDIO output delay after rising edge of MDC	T <sub>PD</sub>	0	-	300	ns <sup>[3]</sup>
Input Capacitance	C <sub>i</sub>	-	-	10	pF <sup>[1]</sup>
Bus Loading	C <sub>L</sub>	-	-	470	pF <sup>[1]</sup>

**Notes:**

- [1] Figure 5
- [2] Figure 3
- [3] Figure 4
- [4] The maximum value of R<sub>MDIO</sub> depends on bus loading (C<sub>L</sub>), input capacitance(C<sub>i</sub>), and MDC frequency(1/T<sub>CK</sub>).

### XENPAK 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

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Pin	Symbol	I/O	Logic	Description
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	1.2 V CMOS	Management Data Clock
19	PRTAD4	I	1.2 V CMOS	Port Address bit 4 (Low=0)
20	PRTAD3	I	1.2 V CMOS	Port Address bit 3 (Low=0)
21	PRTAD2	I	1.2 V CMOS	Port Address bit 2 (Low=0)
22	PRTAD1	I	1.2 V CMOS	Port Address bit 1 (Low=0)
23	PRTAD0	I	1.2 V 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
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-

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Pin	Symbol	I/O	Logic	Description
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+
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

**Note: Case is connected to electrical ground in the module.**

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70	GND	1	GND
69	GND	2	GND
68	RESERVED	3	GND
67	RESERVED	4	RESERVED
66	GND	5	3.3V
65	TX LANE3	6	3.3V
64	TX LANE3+	7	APS
63	GND	8	APS
62	TX LANE2	9	LASI
61	TX LANE2+	10	RESET
60	GND	11	VEND SPECIFIC
59	TX LANE1	12	TX ON/OFF
58	TX LANE1+	13	RESERVED
57	GND	14	MOD DETECT
56	TX LANE0	15	VEND SPECIFIC
55	TX LANE0+	16	VEND SPECIFIC
54	GND	17	MDIO
53	GND	18	MDC
52	GND	19	PRTAD4
51	RX LANE3	20	PRTAD3
50	RX LANE3+	21	PRTAD2
49	GND	22	PRTAD1
48	RX LANE2	23	PRTAD0
47	RX LANE2+	24	VEND SPECIFIC
46	GND	25	APS SET
45	RX LANE1	26	RESERVED
44	RX LANE1+	27	APS SENSE
43	GND	28	APS
42	RX LANE0	29	APS
41	RX LANE0+	30	3.3V
40	GND	31	3.3V
39	RESERVED	32	RESERVED
38	RESERVED	33	GND
37	GND	34	GND
36	GND	35	GND

*Figure 1. XENPAK Pin Configuration.*

**Mechanical dimensions**

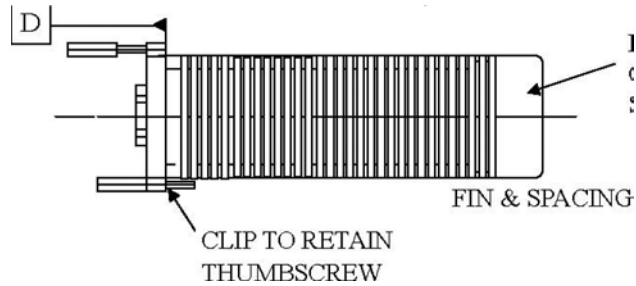


Figure 2. Mechanical dimensions Refer.

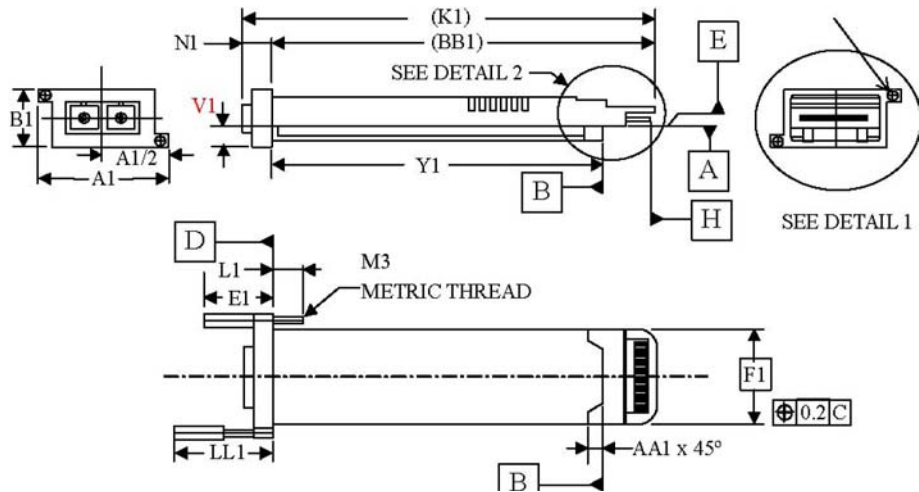


Figure 3. Mechanical dimensions of End View of Transceiver.

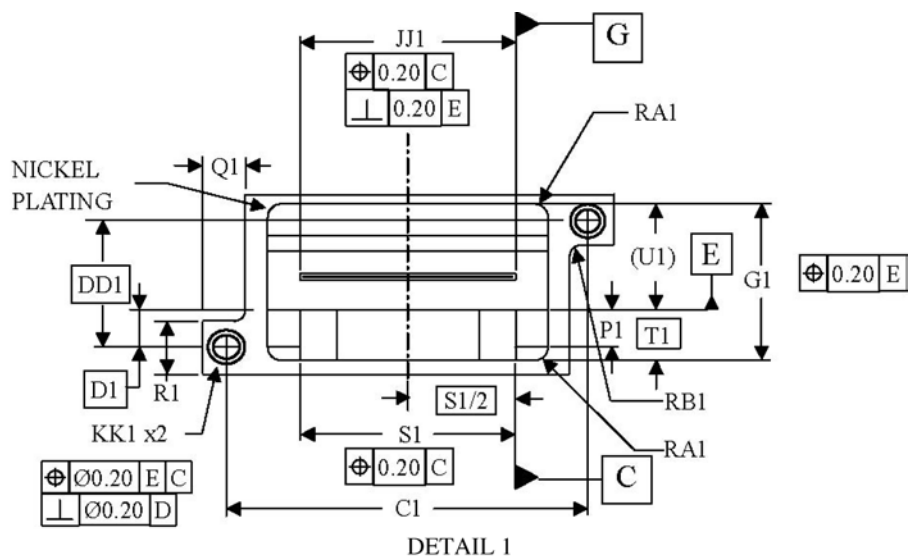


Figure 4. Mechanical dimensions of Side Elevation Transceiver.



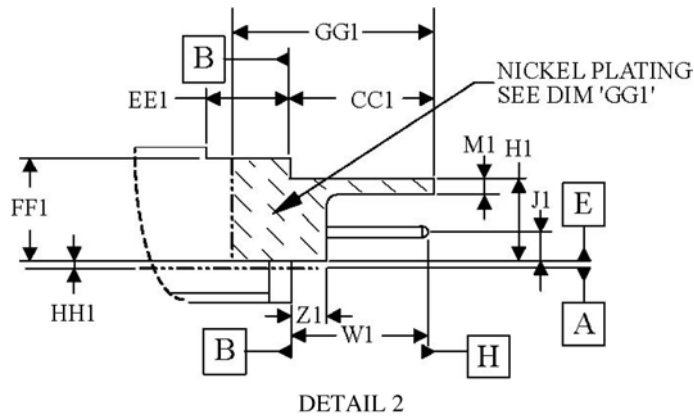


Figure 5. Orientation Keying of TX and RX Orientation Vs PCB Table.

## Package Dimensions

Key	Value		Tolerance, mm	Comments
	mm	inch		
A1	51.3	2.020	±0.20	Width of Bezel overall
B1	22.4	0.882	±0.20	Height of Bezel overall
C1	45.5	1.791	BASIC	Distance between captive screws in 'X' axis (Horizontal)
D1	3.7	0.136	BASIC	Datum 'E' to lower captive screw
E1	20.75	0.817	Maximum	Extension of captive screw
F1	36.0	1.417	±0.20	Width of Transceiver body
G1	17.4	0.685	±0.20	Height of Transceiver body
H1	8.15	0.321	±0.20	Datum 'E' to top of Over-hanging Ledge
J1	3.05	0.120	±0.25	Datum 'E' to centerline of Transceiver PCB
K1	121.0	4.764	REF	Length of Transceiver overall minus protruding captive screw heads
L1	5.00	0.197	±0.20	Length of captive screw from Datum 'D' to end of threaded end
M1	1.5	0.059	±0.20	Thickness of Over-hanging Ledge
N1	5.8	0.228	±0.20	Datum 'D' to front of Transceiver Bezel
P1	4.07	0.160	Minimum	Slot or channel formed by Interposer to accommodate Customers PCB range. Use of an Interposer spring is not a requirement of this specification.
Q1	4.65	0.183	±0.20	Protrusion of side flange on Transceiver Bezel
R1	7.12	0.280	±0.20	Height of side flange on Transceiver Bezel
S1	29.5	1.161	±0.20	Width of Transceiver slot to accommodate rail or Customers PCB

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Key	Value		Tolerance, mm	Comments
	mm	inch		
T1	5.42	0.213	BASIC	Datum 'E' to bottom of Transceiver
U1	11.98	0.472	REF	Datum 'E' to top of Transceiver
V1	7.92	0.312	±0.20	Datum 'E' to bottom of Transceiver Bezel
W1	11.10	0.437	±0.20	Datum 'B' to end of protruding Transceiver PCB
Y1	102.20	4.024	±0.20	Datum 'D' to Datum 'B'
Z1	4.0	0.157	±0.20	Datum 'B' to end of side protective shroud to mate with EMI/Conn. Shield
AA1	3.0	0.118	±0.50	Datum 'B' to end of 45° chamfer
BB1	115.2	4.535	REF	Length of Module from Datum 'D' to rear Over-hanging Ledge
CC1	13.0	0.512	±0.50	Datum 'B' to end of Over-hanging Ledge for EMI Plating
DD1	13.96	0.550	BASIC	Distance between captive screws in 'Y' axis (Vertical)
EE1	10.0	0.394	Minimum	Datum 'B' end of recess for insertion clearance
FF1	10.48	0.422	±0.50	Datum 'E' to top of recess for insertion clearance
GG1	20.0	0.787	Minimum	Length of Transceiver side wall for EMI plating
HH1	0.25	0.01	BASIC	Datum 'A' to Datum 'E'
JJ1	29.2	1.150	±0.10	Width of Transceiver PCB
KK1	3.0	0.118	N/A	Hole for 3mm screw Thumbscrew, tapped or clearance
LL1	25.8	1.016	Maximum	Length of Thumbscrew
RA1	1.25	0.049	Minimum	External radius or chamfer of Transceiver
RB1	1.5	0.059	Maximum	Internal radius or chamfer on exterior flange of Transceiver Bezel

**Definition of Datums**

DATUM	DESCRIPTION TRANSCIEVER/LINECARD
A	CUSTOMERS PCB TOP SURFACE
B	PHYSICAL HARD STOP FOR TRANSCIEVER
C	EDGE OF TRANSCIEVER SLOT
D	BACK SURFACE OF TRANSCIEVER BEZEL, SAFETY HARD STOP
E	TRANSCIEVER TOP SURFACE OF SLOT 'P1'
F	FRONT SURFACE OF CUSTOMERS FACEPLATE
G	EDGE OF TRANSCIEVER'S PCB
H	LEADING EDGE OF TRANSCIEVER PCB

DATUM	DESCRIPTION TRANSCEIVER/LINECARD
J	EDGE OF CUT-OUT IN CUSTOMER'S PCB
K	PHYSICAL HARD STOP ON CUSTOMER'S PCB

## Optical Connector

Parameter	Specifications	Remarks
SC Duplex Receptacle	IEC61754-4	Optical bores 12.25/13.15mm
SC Duplex plug	IEC61754-4	Optical bores 12.25/13.15mm

## 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
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

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Device Address (Dec) Register Address (Hex)	PMA/PMD 1	PCS 3	PHY XS 4
0x0027	Reserved	10GBASE-R PCS Test pattern Seed B0	Reserved
0x0028	Reserved	10GBASE-R PCS Test pattern Seed B1	Reserved
0x0029	Reserved	10GBASE-R PCS Test pattern Seed B2	Reserved
0x002A	Reserved	10GBASE-R PCS Test pattern Seed B3	Reserved
0x002B	Reserved	10GBASE-R PCS Test pattern Control	Reserved
0x8000	Reserved	10GBASE-R PCS Test pattern Error counter	Reserved
0x8007 - 0x807D	NVR (XENPAK Register)	Reserved	
0x807E-0x80AD	Customer AREA	Reserved	
0x80AE - 0x8106	XGIGA Specific Area(XENPAK Register)	Reserved	
0x9000	RX_ALARM Control (XENPAK Register)	Reserved	
0x9001	TX_ALARM Control (XENPAK Register)	Reserved	
0x9002	LASI Control (XENPAK Register)	Reserved	
0x9003	RX_ALARM Status (XENPAK Register)	Reserved	
0x9004	TX_ALARM Status (XENPAK Register)	Reserved	
0x9005	LASI Status (XENPAK 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	



## **USER INFORMATION**

### **Handling Precaution**

CAUTION: Take proper electrostatic-discharge(ESD) precautions which handling these device. These devices are sensitive to ESD

### **Laser Safety**

This product complies with IEC 60825-1 Class 1.  
Because of size constraints, laser safety labeling is not affixed to the module but is attached to the outside of the shipping box