

Accelar™

10GbE 850nm XENPAK transceiver module



Key benefits

- High reliability
- In-house precision alignment
- Industry-wide physical and optical specification
- Enhanced thermal solution
- Denser I/O implementation
- Multivendor availability
- Proven field reliability and robustness

Applications

- 10 Gigabit Ethernet (LAN PHY) 10GBASE-SR
- Cross-connect switches
- Router interconnect
- MAN aggregation links
- Short reach LAN/MAN interconnects
- Computer cluster cross-connect
- Custom high-speed data pipes

PL-XKC-SC-S45-0C

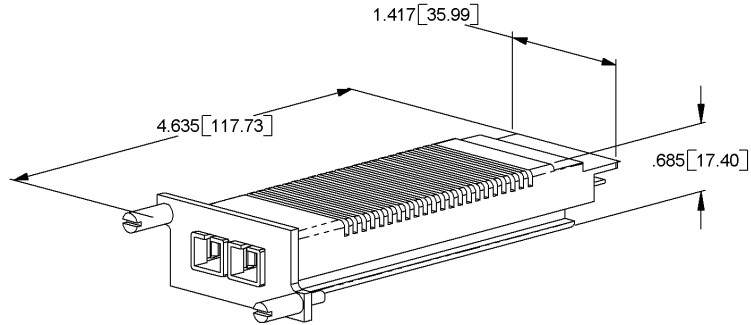
Picolight XENPAK transceiver is the first XENPAK shortwave transceiver module, and is another in Picolight's *Accelar* family of products customized for short reach LAN, SAN and intra-POP applications. The transceiver features Picolight's high reliability 850 nm oxide vertical-cavity surface-emitting laser (VCSEL). The XAUI electrical interface employs only four differential data channels for communications within the module, and satisfies electrical and optical requirements defined by the IEEE 802.3 10 Gigabit Ethernet (10GBASE-SR). The transceiver's mechanical footprint complies with the XENPAK MSA v3.0. With the combination of XAUI transceiver chips and 10 Gigabit optics, this module provides a hot-z-pluggable, low power solution that simplifies manufacturers' systems.

Highlights

- ◆ **Industry's first hot pluggable XENPAK optical module for 10G Ethernet, propelling deployment of 10G links and delivering cost efficient optics to the network bottlenecks**
- ◆ **Enables flexible designs for backplanes and extended line cards using XAUI interface for up to 20 inch PC board traces**
- ◆ **System monitoring and component mapping via MDC/MDIO management interface**
- ◆ **Design based on high volume optoelectronics packaging**
- ◆ **Controlled supply chain and reliable long-term supply based on Picolight's reliable VCSELs and PIN diodes**

PL-XKC-SC-S45-0C features

- Uses a Picolight high speed, 850 nm, oxide VCSEL and PIN diode
- Low power consumption (< 4W)
- Mechanical design features compliant with XENPAK MSA v3.0
- Center-pull bail mechanism for consistent installation and removal
- PCI-compliant low profile module
- 0°C To 70°C case temperature operating range
- 10.3125 Gbit/s serial optical interface
- SC receptacled optical connector
- Integrated MUX/DEMUX and deskew functionality
- XAUI compatible electrical interface, 4 channels operating at 3.125 Gbit/s
- 70 pin connector electrically identical to XENPAK
- Bit error rate < 1x10⁻¹²
- 300 m minimum range over 2000 MHz-km, 50/125µm multimode fiber
- 86 m minimum range over 500 MHz-km 50/125µm multimode fiber
- Transmit disable and signal detect functions via management interface
- MDC/MDIO compatible management interface
- Data and clock recovery
- IEC 60825-1 Class 1 laser eye safe
- FCC Class B compliant
- ESD Class 2 per MIL-STD 883 Method 3015



The eye safe, cost effective PL-XKC-SC-S45-0C transceiver complies with the IEEE 802.3 10 Gigabit Ethernet serial short wavelength specification known as 10GBASE-SR. The module's XENPAK-compliant footprint, similar in size to a GBIC, enables switch manufacturers to supply bandwidth to their systems with minimal chassis and blade redesign.

Ordering information

Part Number:	Description:	Contact Information:
PL-XKC-SC-S45-0C	Shortwave XENPAK duplex SC receptacled XAUI 10 Gigabit Ethernet transceiver module, low profile version	Picolight Incorporated 1480 Arthur Avenue Louisville, CO 80027 Tel: 303.530.3189 E-mail: sales@picolight.com Web site: www.picolight.com

Section 1 Functional description

The PL-XKC-SC-S45-0C 850 nm VCSEL-based 10 Gigabit Ethernet Transceiver is designed to transmit and receive serial optical data over 50/125 μm or 62.5/125 μm optical fiber.

Transmitter

The transmitter converts 4 lanes of serial 8b/10b coded XAUI electrical data into 64b/66b coded serial optical data at a data rate of 10.3125 Gbit/s.

The transmitter has an internal PIN monitor diode circuit that is used to ensure constant optical power output across supply voltage and temperature variations.

Receiver

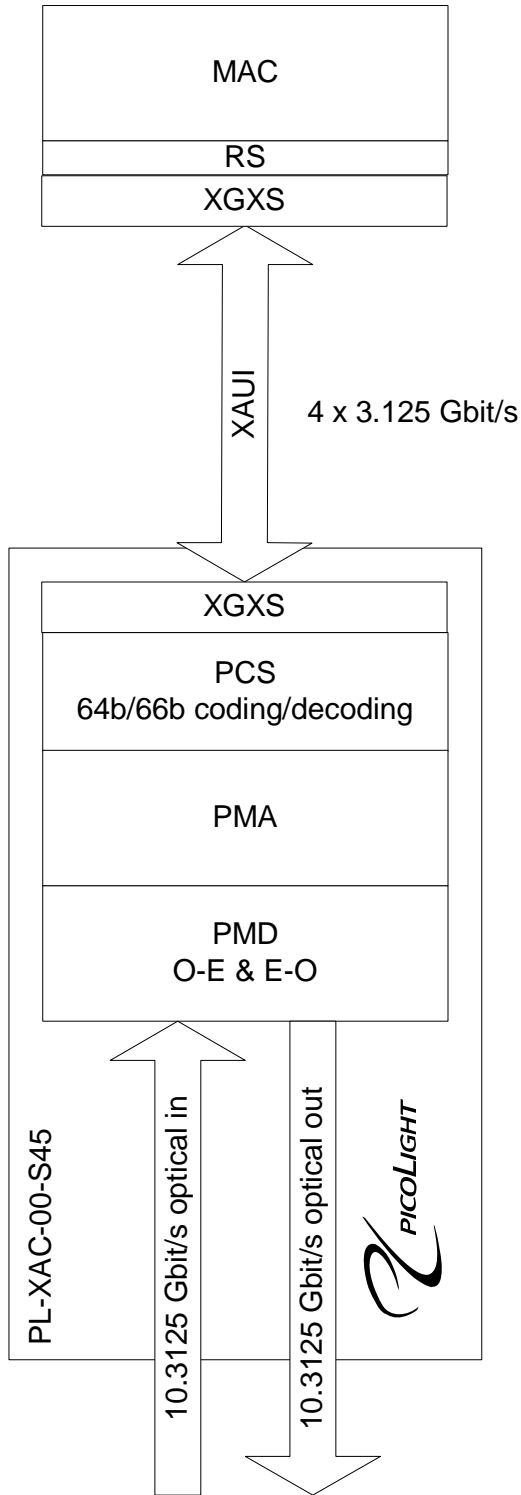
The receiver converts 64b/66b coded serial optical data into 4 lanes of serial 8b/10b coded XAUI electrical data.

Filtering

Power supply filtering is recommended for both the transmitter and receiver. Filtering should be placed on the host assembly as close to the Vcc pins as possible for optimal performance.

The LAN PHY application is shown in Figure 1 on page 4.

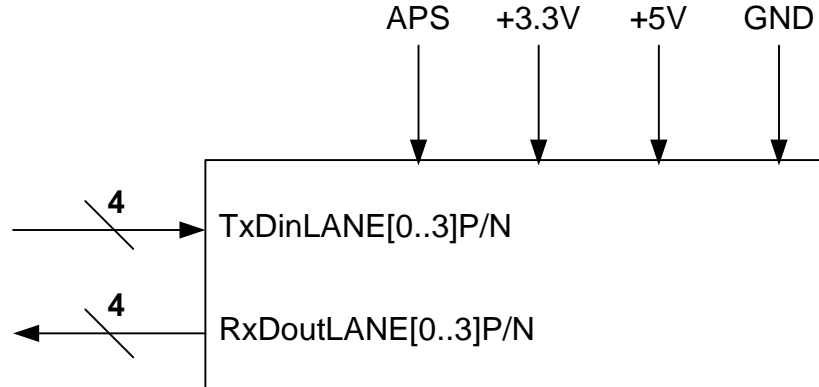
Figure 1 10 Gigabit Ethernet LAN PHY application



Section 2 Application schematics

Recommended connections to the PL-XKC-SC-S45-0C transceiver are shown in Figure 2 below.

Figure 2 Recommended application schematic for the PL-XKC-SC-S45-0C transceiver



Notes

- ◆ Power supply filtering components should be placed on the opposite side of the PCB directly under the PL-XKC-SC-S45-0C transceiver, as close to the supply pins as possible for optimal performance.

Section 3 Technical data

Technical data related to the 10GbE 850nm XENPAK transceiver includes:

- Section 3.1 Pin function definitions below
- Section 3.2 Absolute maximum ratings on page 9
- Section 3.3 Electrical characteristics on page 9
- Section 3.4 Optical characteristics on page 10
- Section 3.5 Optical link distances on page 11
- Section 3.6 Regulatory compliance on page 12
- Section 3.7 PCB layout on page 12
- Section 3.8 Connectors on page 12
- Section 3.9 Management interface on page 12

3.1 Pin function definitions

Table 1 Transceiver pinout

<p>70 GND</p> <p>69 GND</p> <p>68 RESERVED</p> <p>67 RESERVED</p> <p>66 GND</p> <p>65 TX LANE3-</p> <p>64 TX LANE3+</p> <p>63 GND</p> <p>62 TX LANE2-</p> <p>61 TX LANE2+</p> <p>60 GND</p> <p>59 TX LANE1-</p> <p>58 TX LANE1+</p> <p>57 GND</p> <p>56 TX LANE0-</p> <p>55 TX LANE0+</p> <p>54 GND</p> <p>53 GND</p> <p>52 GND</p> <p>51 RX LANE3-</p> <p>50 RX LANE3+</p> <p>49 GND</p> <p>48 RX LANE2-</p> <p>47 RX LANE2+</p> <p>46 GND</p> <p>45 RX LANE1-</p> <p>44 RX LANE1+</p> <p>43 GND</p> <p>42 RX LANE0-</p> <p>41 RX LANE0+</p> <p>40 GND</p> <p>39 RESERVED</p> <p>38 RESERVED</p> <p>37 GND</p> <p>36 GND</p>	<p>← Toward Bezel</p>	<p>1 GND</p> <p>2 GND</p> <p>3 GND</p> <p>4 5.0V</p> <p>5 3.3V</p> <p>6 3.3V</p> <p>7 APS</p> <p>8 APS</p> <p>9 LASI</p> <p>10 RESET</p> <p>11 VEND SPECIFIC</p> <p>12 TX ON/OFF</p> <p>13 RESERVED</p> <p>14 MOD DETECT</p> <p>15 VEND SPECIFIC</p> <p>16 VEND SPECIFIC</p> <p>17 MDIO</p> <p>18 MDC</p> <p>19 PRTAD4</p> <p>20 PRTAD3</p> <p>21 PRTAD2</p> <p>22 PRTAD1</p> <p>23 PRTAD0</p> <p>24 VEND SPECIFIC</p> <p>25 APS SET</p> <p>26 RESERVED</p> <p>27 APS SENSE</p> <p>28 APS</p> <p>29 APS</p> <p>30 3.3V</p> <p>31 3.3V</p> <p>32 5.0V</p> <p>33 GND</p> <p>34 GND</p> <p>35 GND</p>
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Top of Transceiver PCB

Bottom of Transceiver PCB
(as viewed through top)

Table 2 Pin descriptions

Name	Type	No. Pins	Pins	Description/Notes
Power and ground				
+5.0V	Power	2	4, 32	
+3.3V	Power	4	5, 6, 30, 31	
APS	Power	4	7, 8, 28, 29	Adaptable power supply
GND	Power	21	1, 2, 3, 33, 34, 35, 36, 37, 40, 43, 46, 49, 52, 53, 54, 57, 60, 63, 66, 69, 70	
APS SENSE		1	27	See XENPAK 2.1a
APS SET		1	25	See XENPAK 2.1a
DNC	N/A	6	13, 26, 38, 39, 67, 68	Do not connect
NC	N/A	1	16	Not connected
Management interface				
MDC/MDIO	-	2	18, 17	Customer use 10 Gigabit Ethernet management interface: MDC (clock) and MDIO (data I/O) MDC Must be active during Reset to establish system operation.
Module				
Reset	Selectable	1	10	Resets module, active low (no pullup), must be debounced. Reset must be activated to establish system operation.
MOD DETECT		1	14	Pulled low inside module to 1K
LASI		1	9	Open drain compatible, 10K-22K pull up on host, Logic High: Normal Operation Logic Low: LASI Asserted
Receive				
RxDout[0..3]P/N	XAUI output	8	41, 42, 44, 45, 47, 48, 50, 51	Receive data (internally AC decoupled)
Transmit				
TxDin[0..3]P/N	XAUI input	8	55, 56, 58, 59, 61, 62, 64, 65	Transmit data (internally AC decoupled)
Laser monitoring and control functions				
V_SEL	Power	1	11	Used together to set voltage for pins marked "Selectable": Set V_SEL>2.0V, VDDIOSYS = 3.3V to enable 3.3V logic Set V_SEL<0.8V, VDDIOSYS = 1.8V to enable 1.2V logic See Section 3.3 Electrical characteristics on page 9 for definitions of 3.3V and 1.2V logic
VDDIOSYS	Power	1	24	

Table 2 Pin descriptions

Name	Type	No. Pins	Pins	Description/Notes
TXON/OFF	Selectable	1	12	Optical output enable, active high (on)
PRTAD[0..4]	Selectable	5	23, 22, 21, 20, 19	32 configurable PHY addresses are allowed. Pin setting latched at power-on reset. 0 = low.
TXALARM	Open collector	1	15	Optical transmit fault, Open collector active high

3.2 Absolute maximum ratings

(CW operation unless otherwise stated)			
Parameter	Symbol	Ratings	Unit
Storage Temperature	T _{st}	-40 to +100	°C
Operating case temperature	T _{op}	0 to 70	°C
Relative Humidity	RH	5 to 95 (non-condensing)	%

3.3 Electrical characteristics

(T _{op} = 0°C - 70°C case, CW operation unless otherwise stated)						
Parameter	Symbol	Min	Typ.	Max	Unit	Notes
Selectable inputs in 1.2V mode						
Input high level	V _{IH}	0.84		1.5	V	
Input low level	V _{IL}	0		0.36	V	
Selectable inputs in 3.3V mode						
Input high level	V _{IH}	2.0		3.3	V	
Input low level	V _{IL}	0		0.8	V	
Supply currents and voltages						
Voltage ₁	V _{cc1}	3.1355	3.3	3.465	V	With Respect to GND
Voltage ₂	V _{cc2}	4.75	5.0	5.25	V	
Voltage ₃	V _{cc3}	1.75	1.8	1.95		APS
Supply Current ₁	I _{cc1}		0.060		A	
Supply Current ₂	I _{cc2}		0.170		A	
Supply Current ₃	I _{cc3}		1.30		A	APS
Transmitter						
Data input baud rate nominal			3.125		GBd	
Data input bit rate tolerance				+/-100	ppm	
Data Input Voltage Differential	V _{I-DIFF}	200		1600	mV	AC coupled signals
Data input Differential Resistance	R _I	95	100	105	Ω	

3.3 Electrical characteristics (continued)

(T _{op} = 0°C - 70°C case, CW operation unless otherwise stated)						
Parameter	Symbol	Min	Typ.	Max	Unit	Notes
Data input differential skew tolerance				75	ps	
Receiver						
Data output differential voltage	V _{O-DIFF}	200		1600	mV	AC coupled signals
Data output bit rate stability				+/-100	ppm	
Data output baud rate nominal			3.125		GBd	
Data output skew				15	ps	

3.4 Optical characteristics

(T _{case} = 25°C, CW operation unless otherwise stated)						
Parameter	Symbol	Min	Typ.	Max	Unit	Notes
Transmitter						
Signal speed			10.3125		Gbps	
Signal tolerance				+/-100	ppm	
Extinction Ratio	Er	3			dB	
Triple trade off curve compliance						Triple trade off curves define OMA, Spectral Width and Center Wavelength (any two parameters fix third)
OMA (Optical modulation amplitude)		-4.3	-3.6		dBm	
RMS Spectral Width	DI		0.35	0.45	nm	
Center Wavelength	λ _p	840	850	860	nm	
Relative Intensity Noise	RIN ₁₂ OMA			-128	dB/Hz	
Receiver						
Signal Speed			10.3125		GBd	
Wavelength	λ _p	840		860	nm	
Return Loss		12.0			dB	
Average receive power				-1.0	dBm	
Stressed Rx Sensitivity OMA	S _S			-7.5	dBm	
Bit Error Rate	BER	10 ⁻¹²				Without FEC

3.5 Optical link distances

Data Rate	Fiber Type	Modal Bandwidth @ 850nm (MHz-km)	Distance Range (m)
10.3125 Gbps	62.5/125um MMF	160	2 - 26
	62.5/125um MMF	200	2 - 33
	50/125um MMF	400	2 - 66
	50/125um MMF	500	2 - 82
	50/125um MMF	2000	2 - 300

3.6 Regulatory compliance

The PL-XKC-SC-S45-0C complies with common ESD, EMI, Immunity, and Component recognition requirements and specifications (see details in Table 3 on page 12).

ESD, EMI, and Immunity are dependent on the overall system design. Information included herein is intended as a figure of merit for designers to use as a basis for design decisions.

Table 3 Regulatory compliance

Feature	Test Method	Performance
Laser Eye Safety	IEC 60825-1 Amendment 2 (2001-01) IEC 60825-2 1997	Class 1 laser safe.
Electrostatic Discharge (ESD) to electrical pins	MIL-STD 883C; Method 3015.4	Class 1 (> 1 kV)
Electrostatic Discharge (ESD) to optical connector	IEC 61000-4-2: 1999	Withstand discharges of 15 kV using a "Human Body Model" probe
Electromagnetic Interference (EMI)	FCC Part 15 Subpart J Class B CISPR 22: 1997 EN 55022: 1998 Class B VCCI Class I	Noise frequency range: 30 MHz to 10 GHz. Good system EMI design practice required to achieve Class B margins.
Immunity	IEC 61000-4-3: 1998	Field strength of 3 V/m RMS, from 10 MHz to 1 GHz. No effect on transceiver performance is detectable between these limits.
Component	UL 1950 CSA C22.2 #950 IEC 60950: 1999	

3.7 PCB layout

Recommended PCB layout is given in XENPAK MSA v3.0

3.8 Connectors

Fiber

The XENPAK module has a duplex SC connector.

Electrical

The electrical connector is the 70-way, two row PCB edge connector. Customer connector is Tyco/AMP Part No. 1367337-1 or Molex Part No. 74441-0003.

3.9 Management interface

The module provides a MDC/MDIO 10 Gigabit Ethernet management interface.

Section 4 Related information

Other information related to the 10GbE 850nm XENPAK transceiver includes:

- Section 4.1 Package and handling instructions below
- Section 4.2 ESD discharge (ESD) below
- Section 4.3 Eye safety on page 14

4.1 Package and handling instructions

Pigtails and connector covers

The PL-XKC-SC-S45-0C is supplied with an SC duplex receptacle. The connector covers supplied protect the connector during standard manufacturing processes and handling by preventing contamination from dust, aqueous solutions, body oils, or airborne particles.

Note: It is recommended that the connector plug remain on whenever the transceiver optical fiber connector is not inserted.

Recommended cleaning and de-greasing chemicals

Picolight recommends the use of methyl, isopropyl and isobutyl alcohols for cleaning.

Do not use halogenated hydrocarbons (e.g. trichloroethane, ketones such as acetone, chloroform, ethyl acetate, MEK, methylene chloride, methylene dichloride, phenol, N-methylpyrrolidone).

Flammability

The PL-XKC-SC-S45-0C housing is a zinc casting.

4.2 ESD discharge (ESD)

Handling

Normal ESD precautions are required during the handling of this module. This transceiver is shipped in ESD protective packaging. It should be removed from the packaging and otherwise handled in an ESD protected environment utilizing standard grounded benches, floor mats, and wrist straps.

Test and operation

In most applications, the optical connector will protrude through the system chassis and be subjected to the same ESD environment as the system. Once properly installed in the system, this transceiver should meet and exceed common ESD testing practices and fulfill system ESD requirements.

Typical of optical transceivers, this module's receiver contains a highly sensitive optical detector and amplifier which may become temporarily saturated during an ESD strike. This could result in a short burst of bit errors. Such an event might require that the application re-acquire synchronization at the higher layers (e.g. Serializer/Deserializer chip).

4.3 Eye safety

The PL-XKC-SC-S45-0C is an international Class 1 laser product per IEC 60825-1 Amendment 2 (2001) and IEC 60825-2 1997. The PL-XKC-SC-S45-0C is an eye safe device when operated within the limits of this specification.

Operating this product in a manner inconsistent with intended usage and specification may result in hazardous radiation exposure.

CAUTION!

Tampering with this laser based product or operating this product outside the limits of this specification may be considered an act of "manufacturing," and will require, under law, recertification of the modified product with the U.S. Food and Drug Administration (21 CFR 1040).

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