

## Product Features

- Hot pluggable XENPAK form factor
- Support of IEEE 802.3ae 10GBASE-LR at 10.3125Gbps
- Hot Pluggable 70-PIN Connector with XAUI Electrical Interface
- SC Duplex Optical Receptacle
- Uncooled 1310nm DFB Laser
- Full duplex transmission mode
- Digital Optics Monitoring
- Management and control via MDIO 2-wire bus
- Power Supply :+3.3V, APS(+1.2V)
- Commercial operating temperature:0°C to +70°C
- Up to 10Km on SMF
- RoHS Compliant



## Applications

- 10G Ethernet 10GBASE-LR

## Descriptions

LX6002CDR is a high performance and cost effective optical transponder module. It consists of 10.3Gbit/s 1310nm uncooled directly-modulated DFB transmitter and PIN receiver, 4x3.125Gbps Ethernet Signal input XAUI interface, Mux and Demux with clock and data recovery (CDR). Digital diagnostics functions are available via MDIO 2-wire bus, They are compliant with IEEE Std 802.3ae 10G Ethernet 10GBase-LR and XENPAK MSA Rev 3.0.

LX6002CDR is compliant with RoHS.

## Ordering Information

**Table 1. Ordering Information**

Part Number	Transmitter	Output Power	Receiver	Sensitivity	Reach	Temp	DDM	RoHS
LX6002CDR	1310nm DFB	-8.2 ~ 0.5dBm	PIN	< -14.4dBm	10Km	0 ~ 70°C	Available	Compliant

## Electrical Pin Description

**Table 2. Electrical Pin Description**

Pin	Logic	Symbol	Name/Description
1	-	GND	Electrical Ground
2	-	GND	Electrical Ground
3	-	GND	Electrical Ground



## LX6002CDR 10Gb/s 1310nm XENPAK Optical Transponder 10GBASE-LR 10Km Reach

4	-	5.0V	Reserved - <b>Not Required</b>
5	I	3.3V	Power Supply
6	I	3.3V	Power Supply
7	I	APS	Adaptive power supply
8	I	APS	Adaptive power supply
9	Open Drain-O	LASI	Link Alarm Status Interrupt. 10-22K $\Omega$ resistor pull-up to 1.2V on host Logic High: Normal Operation; Logic low: Link Alarm is indicated
10	Open Drain-I	RESET	Low active Reset input ,10K $\Omega$ pull-up inside Transponder Logic High: Normal Operation; Logic low: Reset asserted
11	-	VEND SPECIFIC	Vendor Specific Pin, leave unconnected
12	Open Drain-I	TX ON/OFF	High active Transmitter Enable, 10k $\Omega$ pull-up inside Transponder Logic High: Transmitter on ; Logic low: Transmitter off
13	-	RESERVED	Reserved
14	O	MOD DETECT	1K $\Omega$ to Ground inside Transponder
15	-	VEND SPECIFIC	Vendor Specific Pin, leave unconnected
16	-	VEND SPECIFIC	Vendor Specific Pin, leave unconnected
17	Open Drain-I/O	MDIO	Management Data I/O. Requires external 10-22K $\Omega$ pull-up to 1.2V on host
18	1.2V COMS-I	MDC	Management Clock Input
19	1.2V COMS-I	PRTAD4	Port Address bit 4(low=0)
20	1.2V COMS-I	PRTAD3	Port Address bit 3(low=0)
21	1.2V COMS-I	PRTAD2	Port Address bit 2(low=0)
22	1.2V COMS-I	PRTAD1	Port Address bit 1(low=0)
23	1.2V COMS-I	PRTAD0	Port Address bit 0(low=0)
24	-	VEND SPECIFIC	Vendor Specific Pin, leave unconnected
25	I	APS SET	Feedback input for APS, Input of APS setting resistor
26	-	RESERVED	Reserved
27	O	APS SENSE	APS Sense output for APS control circuit
28	I	APS	Adaptive power supply
29	I	APS	Adaptive power supply
30	I	3.3V	Power Supply
31	I	3.3V	Power Supply
32	-	5.0V	Reserved - <b>Not Required</b>
33	-	GND	Electrical Ground
34	-	GND	Electrical Ground
35	-	GND	Electrical Ground
36	-	GND	Electrical Ground
37	-	GND	Electrical Ground
38	-	RESERVED	Reserved
39	-	RESERVED	Reserved
40	-	GND	Electrical Ground
41	O	RX LANE 0+	Module XAUI output lane 0+

42	O	RX LANE 0-	Module XAUI output lane 0-
43		GND	Electrical Ground
44	O	RX LANE 1+	Module XAUI output lane 1+
45	O	RX LANE 1-	Module XAUI output lane 1-
46		GND	Electrical Ground
47	O	RX LANE 2+	Module XAUI output lane 2+
48	O	RX LANE 2-	Module XAUI output lane 2-
49		GND	Electrical Ground
50	O	RX LANE 3+	Module XAUI output lane 3+
51	O	RX LANE 3-	Module XAUI output lane 3-
52		GND	Electrical Ground
53		GND	Electrical Ground
54		GND	Electrical Ground
55	I	TX LANE 0+	Module XAUI Input lane 0+
56	I	TX LANE 0-	Module XAUI Input lane 0-
57		GND	Electrical Ground
58	I	TX LANE 1+	Module XAUI Input lane 1+
59	I	TX LANE 1-	Module XAUI Input lane 1-
60		GND	Electrical Ground
61	I	TX LANE 2+	Module XAUI Input lane 2+
62	I	TX LANE 2-	Module XAUI Input lane 2-
63		GND	Electrical Ground
64	I	TX LANE 3+	Module XAUI Input lane 3+
65	I	TX LANE 3-	Module XAUI Input lane 3-
66		GND	Electrical Ground
67		RESERVED	Reserved
68		RESERVED	Reserved
69		GND	Electrical Ground
70		GND	Electrical Ground

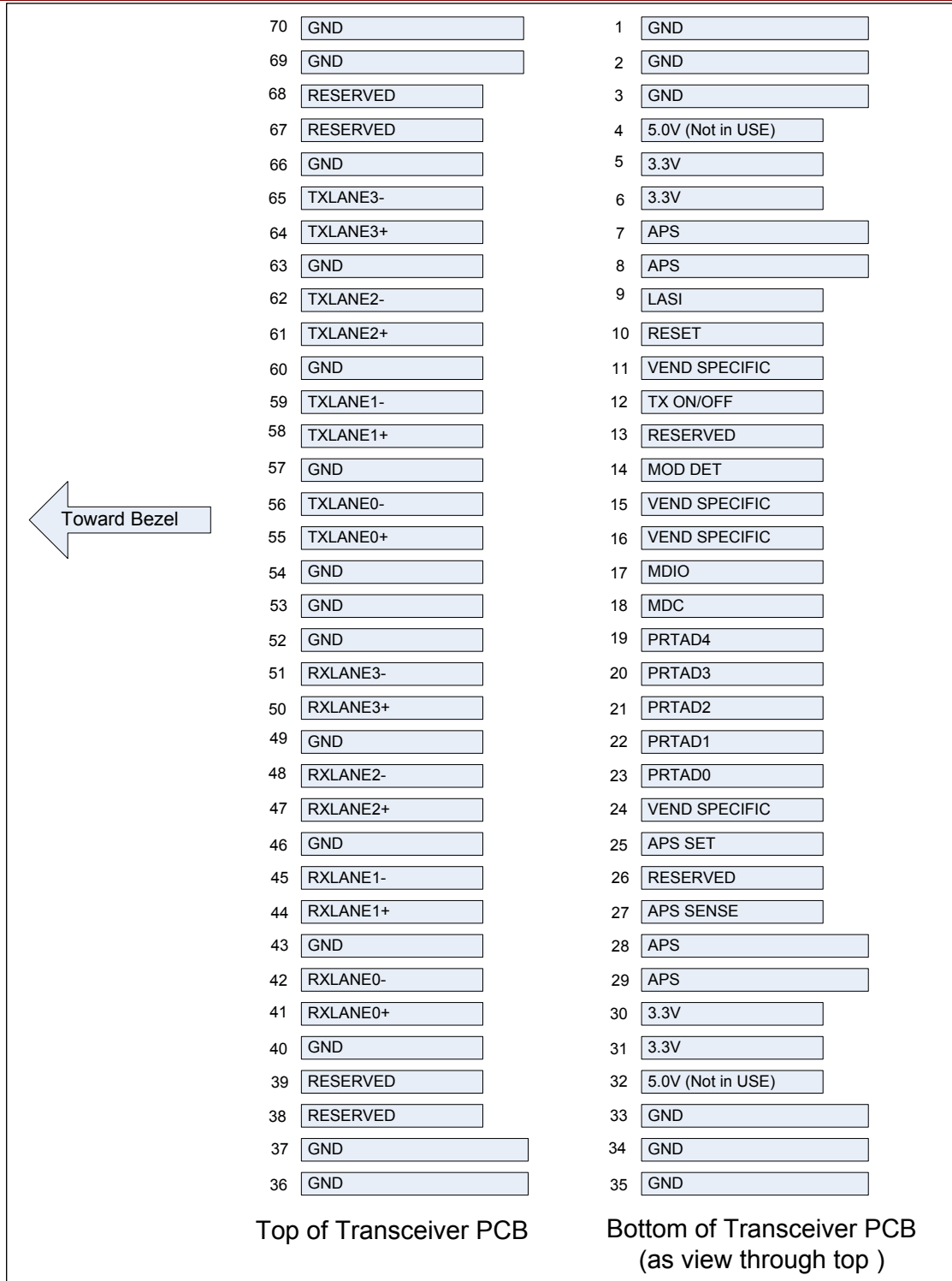


Figure 1. XENPAK Transponder Electrical Pad Layout

## Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of the data sheet. Exposure to absolute maximum ratings for

extended periods can adversely affect device reliability.

**Table 3. Absolute Maximum Ratings**

Parameter	Symbol	Minimum	Maximum	Unit
Storage Temperature	T <sub>s</sub>	-40	85	°C
Supply Voltage	V <sub>CC3</sub>	0	4.0	V
Supply Voltage APS	V <sub>CC5</sub>	0	1.5	V
Average Receive Optical Power	RXP <sub>max</sub>		1.5	dBm

## Recommended Operating Conditions

**Table 4. Recommended Operating Conditions**

Parameter	Symbol	Min	Typ	Max	Unit
Operating Case Temperature	T <sub>c</sub>	0	25	70	°C
Supply Voltage	V <sub>CC3</sub>	3.135	3.3	3.465	V
Supply Voltage	V <sub>aps</sub>	1.152	1.2	1.248	V
Total Power Dissipation	-		3.5	4.0	W

## Transponder Electrical Characteristics

**Table 5. Transponder Electrical Characteristics**

XAUI I/O	Symbol	Minimum	Typical	Maximum	Unit	Notes
XAUI Data Rate	DR	-	3.125		Gb/s	-
XAUI Baud Rate Tolerance		-100	-	+100	ppm	-
XAUI Eye Mask	According to IEEE 802.3ae					
Output Differential Impedance	Z <sub>OUT_XAUI</sub>	80	100	120	Ω	
Differential Input Amplitude	V <sub>in_xaui</sub>	220		1600	mv	1
Differential Output Amplitude	V <sub>out_xaui</sub>	800		1600	mv	1
Total Jitter	T <sub>JXAUI</sub>			0.35	UI	2
Deterministic Jitter	D <sub>JXAUI</sub>			0.37	UI	2
<b>1.2V CMOS I/O</b>						
Output High Voltage	V <sub>OH</sub>	1	-	-	V	-
Output Low Voltage	V <sub>OL</sub>	-	-	0.15	V	-
Input High Voltage	V <sub>IH</sub>	0.84	-	1.5	V	-
Input Low Voltage	V <sub>IL</sub>	-	-	0.36	V	-
<b>MDIO I/O</b>						
Output High Voltage	V <sub>OHM</sub>	1.0	-	1.5	V	-
Output Low Voltage	V <sub>OLM</sub>	-0.3	-	0.2	V	-

Input High Voltage	$V_{IHM}$	0.84	-	1.5	V
Input Low Voltage	$V_{ILM}$	-0.3		0.36	V
MDIO Data Hold Time	$t_{HOLD}$	10			ns
MDIO Data Setup Time	$t_{SU}$	10			ns
Delay from MDC Rising Edge to MDIO Data Change	$t_{DELAY}$			300	ns
MDC Clock Rate	$f_{MAX}$			2.5	MHz

**Notes:**

1. Internally AC coupled.
2. XAUI Output ,No pre-equalization.

## Transmitter Optical Characteristics

**Table 6. Transmitter Optical Characteristics**

Parameter	Symbol	Minimum	Typical	Maximum	Unit	Notes
Operating Data Rate	-	-	10.3125	-	Gb/s	-
Launch Average Optical Power	$P_o$	-8.2	-	0.5	dBm	1
Launch Power in OMA	$P_{o-OMA}$	-5.2			dBm	
Center Wavelength Range	$\lambda_c$	1290	1310	1330	nm	-
Side Mode Suppression Ratio	SMSR	30			dB	
Spectral Width (-20dB)	$\Delta\lambda$		-	0.6	nm	
Extinction Ratio	EX	3.5	-	-	dB	-
Transmitter and Dispersion Penalty	TDP	-	-	3.2	dB	-
Average Optical Power (Laser Off)	$P_{OFF}$	-	-	-30	dBm	1
Eye Diagram			IEEE802.3ae Compliant			

**Notes:**

1. The optical power is launched into 9/125 $\mu$ m SMF..

## Receiver Optical Characteristics

**Table 7. Receiver Optical Characteristics**

Parameter	Symbol	Minimum	Typical	Maximum	Unit	Notes
Operating Data Rate	-	-	10.3125	-	Gb/s	-
Center Wavelength	$\lambda_c$	1260	-	1360	nm	
Receiver Overload ( $P_{avg}$ )	$P_{OL}$	0.5	-	-	dBm	1
Stressed Sensitivity (OMA)	-	-	-	-10.3	dBm	
Receiver Sensitivity (OMA)	$S_{OMA}$	-	-	-12.6	dBm	1
Average sensitivity	S			-14.4	dBm	1
Optical Return Loss	ORL	12	-	-	dB	-

**Notes:**

1. PRBS 2<sup>31</sup>-1 test pattern, BER<10<sup>-12</sup>.

## Mechanical specifications

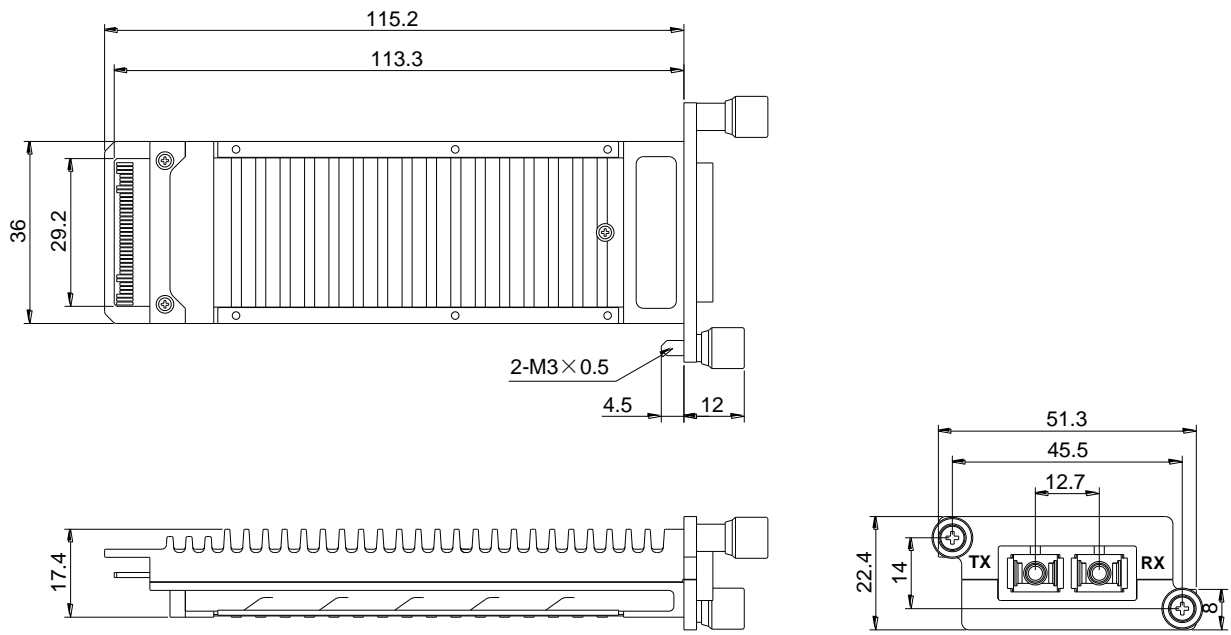


Figure 4. Outline Drawing

## For More Information

Linktel Technologies Co., Ltd



**LX6002CDR**  
**10Gb/s 1310nm XENPAK Optical Transponder**  
**10GBASE-LR 10Km Reach**

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