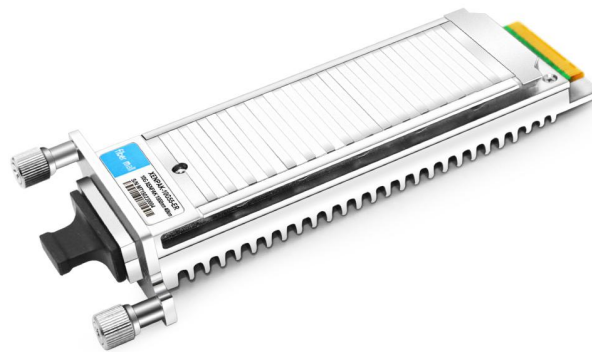


# XENPAK-10G55-ER

10Gbps XENPAK ER Transceiver, Single Mode, 40km Reach



## Product Features

- ❖ Compatible with XENPAK MSA Rev.3.0
- ❖ Support of IEEE802.3ae 10GBASE-ER
- ❖ Transmission Distance up to 40km(SMF)
- ❖ Uncooled directly modulated 1550nm Cooled EML Laser
- ❖ Temperature Range 0 to 70° C
- ❖ Adaptable Power Supply (APS:+1.2V)
- ❖ SC duplex Optical connector
- ❖ Hot pluggable 70-pin connector with XAUI electrical interface

- ❖ Management and control via MDIO 2-wire interface
- ❖ Compatible with RoHS

## Applications

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

## Product Description

The XENPAK Module is a highly integrated, Serial optical transponder module for high-speed, 10Gbit/s data transmission applications. 4×3.125Gbps Ethernet Signal Input by XAUI Interface. An integrated Coder / Decoder and multiplexer / demultiplexer (SERDES: Serializer / Deserializer). Designing for 10GBASE-ER Transmission with an uncooled directly modulated 1550nm Cooled EML Laser. 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 10 GbE systems. A 70 pin electrical connector and a duplex SC connector optical interface assure that connectivity is compliant to the XENPAK MSA Rev.3.0.

## Absolute Maximum Ratings

| Parameter                         | Symbol | Min  | Max | Unit | Note |
|-----------------------------------|--------|------|-----|------|------|
| Storage Ambient Temperature Range |        | -40  | +85 | °C   |      |
| Powered case Temperature Range    |        | 0    | +70 | °C   |      |
| Supply Voltage APS                | Vaps   | 0    | 1.5 | V    |      |
| Supply Voltage Range @ 3.3V       | Vcc3   | -0.5 | 4.0 | V    |      |

Any stress beyond the maximum ratings can result in permanent damage. The device specifications are guaranteed only under the recommended operating conditions.

## Recommended Operating Conditions

| Parameter                  | Symbol | Min   | Typical | Max   | Unit |
|----------------------------|--------|-------|---------|-------|------|
| Operating Case Temperature | Tc     | 0     |         | +70   | ° C  |
| Power Supply Voltage       | VCC3   | 3.13  | 3.3     | 3.47  | V    |
|                            | Vaps   | 1.152 | 1.2     | 1.248 |      |
| Power Dissipation          | PD     |       | 3.5     | 4     | W    |

## Electrical DC Characteristics

| (VCC3=3.14V to 3.47V,VCCaps=1.152V to 1.248V,Tc=0 to 70)                                  |        |       |         |      |      |
|---|--------|-------|---------|------|------|
| Parameter   | Symbol | Min   | Typical | Max  | Unit |
| <b>1.2V CMOS(1.8V CMOS Compatible1)I/O DC Characteristics (PRTAD;LASI;RESET;TX_ONOFF)</b> |        |       |         |      |      |
| Output High Voltage   | Voh    | 1     |         |      | V    |
| Output Low Voltage  | Vol    |       |         | 0.15 | V    |
| Input High Voltage  | Vih    | 0.84  |         | 1.5  | V    |
| Input Low Voltage   | Vil    |       |         | 0.36 | V    |
| Input Pull-down Current   | Ipd    | 20    |         | 120  | uA   |
| <b>XAUI I/O DC Characteristics (TXLANE[0..3]; RXLANE[0..3])</b>                           |        |       |         |      |      |
| Differential Input Amplitude (pk-pk) 4)   |        | 220   |         | 1600 | mV   |
| Differential Output Amplitude (pk-pk) 4)  |        | 800   |         | 1600 |      |
| <b>MDIO I/O DC Characteristics (MDIO; MDC)</b>  |        |       |         |      |      |
| Output Low Voltage  | VOL    | - 0.3 |         | 0.2  | V    |
| Output Low Current  | IOL    |       |         | 20   | mA   |
| Input High Voltage  | VIH    | 0.84  |         | 1.5  | V    |
| Input Low Voltage   | VIL    | - 0.3 |         | 0.36 | V    |

- 1) For 1.8 V CMOS Voh = 1.65 V min., Vol = 0.15 V max., Vih = 1.17 V min., Vil = 0.63 V max.
- 2) Rpull-up = 10 kΩ to 1.8 V.
- 3) Vin = 1.8 V.
- 4) 4) AC coupled

## Electrical AC Characteristics

| (VCC3 = 3.14 V to 3.47 V, VCC aps = 1.152 V to 1.248 V, TC = 0° C to 70° C) |  |     |         |      |        |
|---|--|-----|---------|------|--------|
| Parameter   | Symbol                                       | Min | Typical | Max  | Unit   |
| <b>XAUI Input AC Characteristics (TXLANE[0..3])</b>                         |  |     |         |      |        |
| XAUI Baud Rate  | DRin   |     | 3.125   |      | Gbit/s |
| Differential Input Impedance  | ZIN  | 80  | 100     | 120  | Ω      |
| <b>XAUI Output AC Characteristics (RXLANE[0..3])</b>                        |  |     |         |      |        |
| XAUI Baud Rate  | DRout  |     | 3.125   |      | Gbit/s |
| XAUI Eye Mask (far-end)   | According to IEEE 802.3ae                    |     |         |      |        |
| Output Differential Impedance   | ZO   | 80  | 100     | 120  | Ω      |
| Total Jitter <sup>4)</sup>  | TJXAUI                                       |     |         | 0.35 | UI     |
| Deterministic Jitter <sup>4)</sup>  | DJXAUI                                       |     |         | 0.37 | UI     |
| <b>Power-On Reset AC Characteristics</b>                                    |  |     |         |      |        |
| Power-On Reset AC Characteristics   | According to XENPAK MSA Issue 3.0, 2002-9-18 |     |         |      |        |
| <b>MDIO I/O AC Characteristics (MDIO; MDC)</b>                              |  |     |         |      |        |
| MDIO Data Hold Time   | tHOLD  | 10  |         |      | ns     |
| MDIO Data Setup Time  | tSU  | 10  |         |      | ns     |
| Delay from MDC Rising Edge to MDIO Data Change                              | tDELAY                                       |     |         | 300  | ns     |
| MDC Clock Rate  | fMAX   |     |         | 2.5  | MHz    |

- 1) 100 MHz to 2.5 GHz
- 2) At crossing point
- 3) Per IEEE Std 802.3ae
- 4) At near-end, No pre-equalization, 1 UI = 320 ps.

## Optical Interface Operating Conditions

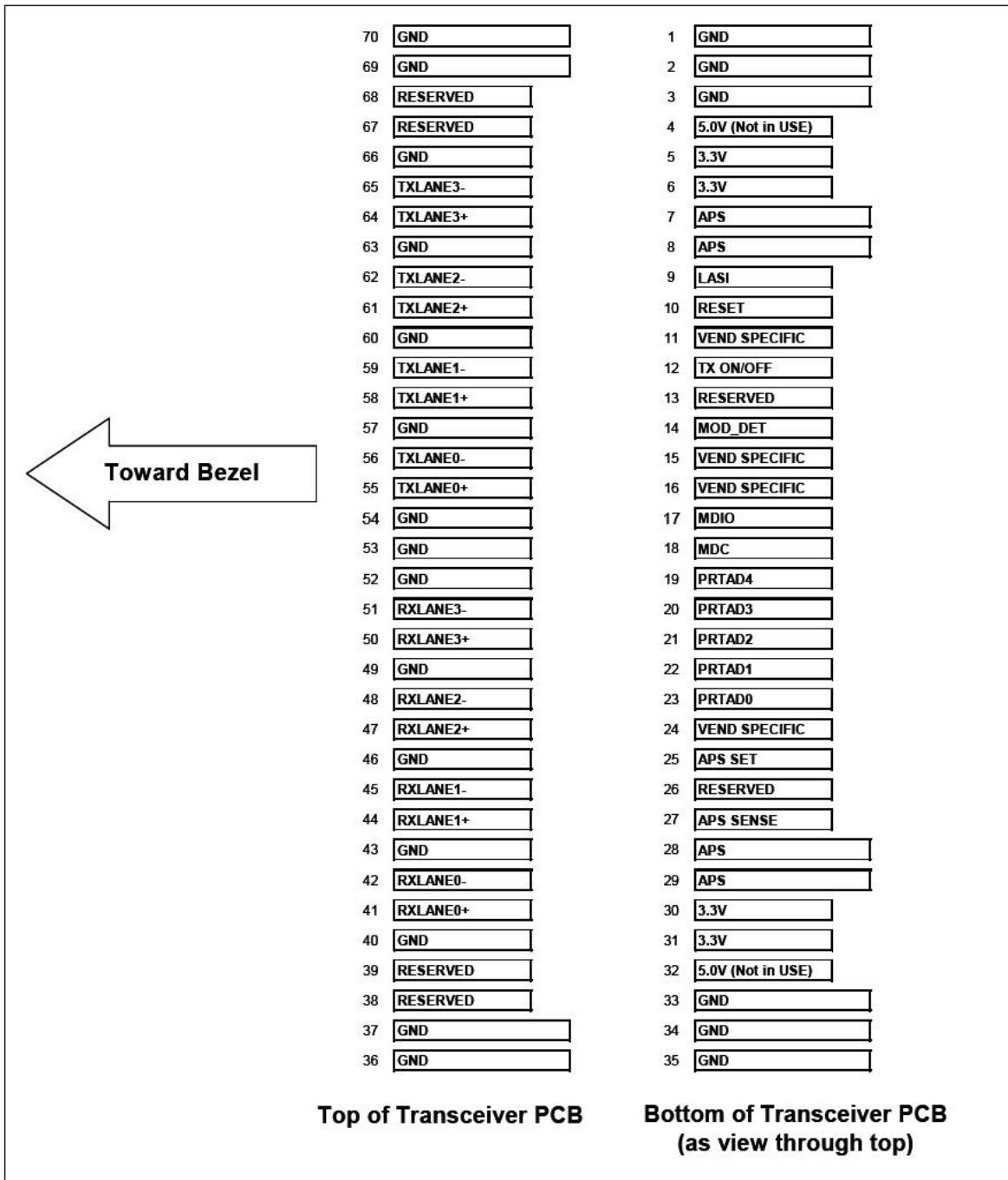
| Parameter       | Fiber Type        | Symbol | Min | Typical | Max    | Units |
|-----------------|-------------------|--------|-----|---------|--------|-------|
| Operating range | Single Mode Fiber | Lop    | 2   |         | 10,000 | m     |
| Data Rate       | 10GBASE-LRmodule  | DR0    |     | 10.3125 |        | Gbps  |

## Optical Characteristics

| (VCC3 = 3.14 V to 3.47 V, VCC aps = 1.152 V to 1.248 V, TC = 0° C to 70° C, BER1E-12, Bit Rate 10.3125) |                           |       |         |        |       |
|---|---------------------------|-------|---------|--------|-------|
| Parameter   | Symbol                    | Min   | Typical | Max    | Unit  |
| <b>Transmitter</b>  |                           |       |         |        |       |
| Average Launch Power  | PAvg                      | - 1.0 |         | +2.0   | dBm   |
| Transmitter and Dispersion Penalty  | TDP                       |       |         | 3.2    | dB    |
| Center Wavelength Range1)   | $\lambda$                 | 1260  | 1310    | 1355   | nm    |
| SMSR  | SWSR                      | 30    |         |        | dB    |
| Extinction Ratio  | ER                        | 9.0   |         |        | dB    |
| Relative Intensity Noise <sup>2</sup> OMA   | RIN                       |       |         | - 128  | dB/Hz |
| Eye Mask Definition   | According to IEEE 802.3ae |       |         |        |       |
| Optical Return Loss Tolerance   | ORLT                      |       |         | 12     | dB    |
| Average Launch Power of OFF Transmitter   | Poff                      |       |         | - 30   | dBm   |
| <b>Receiver</b>   |                           |       |         |        |       |
| Stressed Receiver Sensitivity in OMA  | Pssen                     |       |         | - 11.3 | dBm   |
| Receiver Sensitivity in OMA <sup>2</sup> )  | Psen                      |       |         | - 14.0 | dBm   |
| Power Overload  | Po                        | 0.5   |         |        | dBm   |
| Signal Detect Assert Level  | PSD                       |       |         | -16    | dBm   |
| Signal Detect Hysteresis  | PSD                       | 1     |         |        | dB    |
| Center Wavelength Range   | $\lambda$                 | 1530  | 1550    | 1570   | nm    |

- 1) Conforms to IEEE triple trade-off between center wavelength, RMS spectral width and minimum OMA.
- 2) Receiver sensitivity, which is defined for an ideal input signal is informative only.

## Electrical PAD Layout



### Host PCB XENPAK PINOUT

|    |                   |          |    |
|----|-------------------|----------|----|
| 1  | GND               | GND      | 70 |
| 2  | GND               | GND      | 69 |
| 3  | GND               | RESERVED | 68 |
| 4  | 5.0V (Not in USE) | RESERVED | 67 |
| 5  | 3.3V              | GND      | 66 |
| 6  | 3.3V              | TXLANE3- | 65 |
| 7  | APS               | TXLANE3+ | 64 |
| 8  | APS               | GND      | 63 |
| 9  | LASI              | TXLANE2- | 62 |
| 10 | RESET             | TXLANE2+ | 61 |
| 11 | VEND SPECIFIC     | GND      | 60 |
| 12 | TX ON/OFF         | TXLANE1- | 59 |
| 13 | RESERVED          | TXLANE1+ | 58 |
| 14 | MOD_DET           | GND      | 57 |
| 15 | VEND SPECIFIC     | TXLANE0- | 56 |
| 16 | VEND SPECIFIC     | TXLANE0+ | 55 |
| 17 | MDIO              | GND      | 54 |
| 18 | MDC               | GND      | 53 |
| 19 | PRTAD4            | GND      | 52 |
| 20 | PRTAD3            | RXLANE3- | 51 |
| 21 | PRTAD2            | RXLANE3+ | 50 |
| 22 | PRTAD1            | GND      | 49 |
| 23 | PRTAD0            | RXLANE2- | 48 |
| 24 | VEND SPECIFIC     | RXLANE2+ | 47 |
| 25 | APS SET           | GND      | 46 |
| 26 | RESERVED          | RXLANE1- | 45 |
| 27 | APS SENSE         | RXLANE1+ | 44 |
| 28 | APS               | GND      | 43 |
| 29 | APS               | RXLANE0- | 42 |
| 30 | 3.3V              | RXLANE0+ | 41 |
| 31 | 3.3V              | GND      | 40 |
| 32 | 5.0V (Not in USE) | RESERVED | 39 |
| 33 | GND               | RESERVED | 38 |
| 34 | GND               | GND      | 37 |
| 35 | GND               | GND      | 36 |

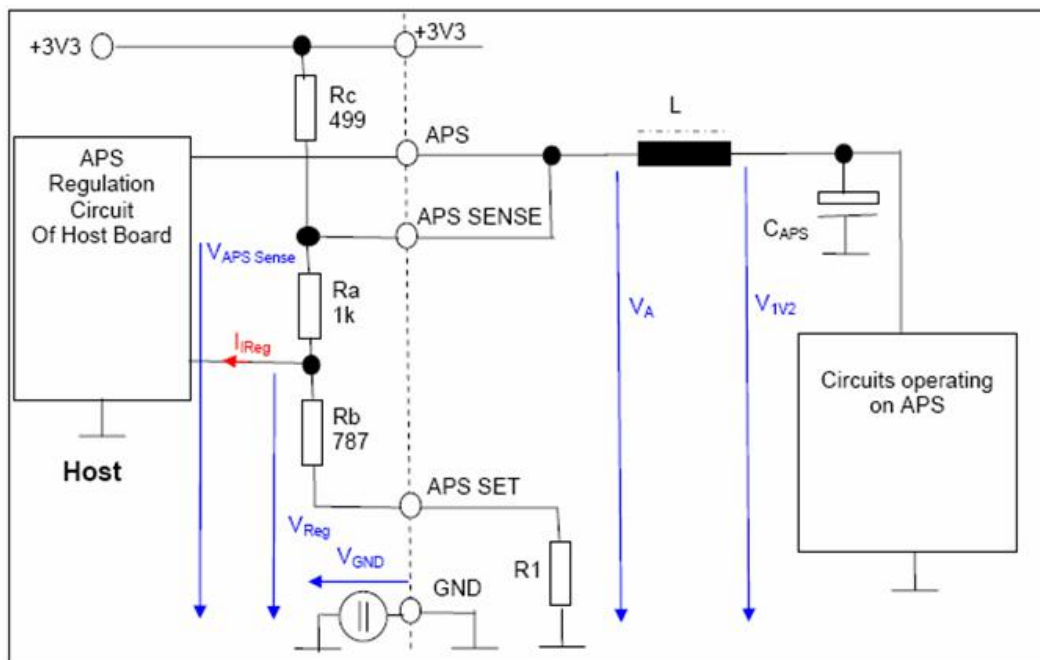
## Pin Descriptions

| Signal Name     | Level      | I/O | Pin NO.   | Description   |
|-----------------|------------|-----|---|---|
| GND             |            |     | 1,2,3,33,34,35,36,37,40,43,46,49,52,53,54,57,60,63,66,69,70 | Ground connection for signal ground on the module   |
| APS             | +1.2V      |     | 7,8,28,29   | Input from Adaptive Power Supply  |
| APS SENSE       | +1.2V      |     | 27  | APS Sense Output. Connected to the APS Sense Output. Connected to the APS input from APS  |
| APS SET         |            |     | 25  | Feedback input from APS. Connected to GND through a 1.18Kohm resistor inside the transponder.   |
| 3.3V            | +3.3 V DC  |     | 5,6,30,31   | DC Power Input, +5.0 V DC, Nominal  |
| Reserved        |            |     | 25  | Reserved for APD  |
| Reserved        |            |     | 13  | Reserved  |
| MDIO            | Open Drain | I/O | 17  | Management Data I/O. Requires external 10-22K $\Omega$ pull-up to the APS on host   |
| MDC             | 1.2V CMOS  | I   | 18  | Management Data Clock Input   |
| PRTAD4          | 1.2V CMOS  | I   | 19  | Port Address Input bit 4  |
| PRTAD3          | 1.2V CMOS  | I   | 20  | Port Address Input bit 3  |
| PRTAD2          | 1.2V CMOS  | I   | 21  | Port Address Input bit 2  |
| PRTAD1          | 1.2V CMOS  | I   | 22  | Port Address Input bit 1  |
| PRTAD0          | 1.2V CMOS  | I   | 23  | Port Address Input bit 0  |
| LASI            | Open Drain | O   | 9   | Link Alarm Status Interrupt Output. Open Drain Compatible Output with 10 - 20 k $\Omega$ pull-up on host. Logic high = Normal Operation Logic low = Status Flag Triggered |
| RESET           | Open Drain | I   | 10  | Reset Input. Open Drain Compatible Input with 22 k $\Omega$ pull-up to APS internal to transponder. Logic high = Normal Operation Logic low = RESET                       |
| Vendor Specific |            |     | 11,15,16,24   | Vendor Specific Pins. Leave unconnected when not used.  |
| TX ON/OFF       | Open Drain | I   | 12  | TX ON/OFF Input. Open Drain Compatible Input with 22 k $\Omega$ pull-up to APS internal to transponder. Logic high = Transmitter On Logic low = Transmitter Off           |



|                           |  |   |             |   |
|---------------------------|--|---|-------------|---|
| MOD DETECT                |  | O | 14          | Pulled low inside transponder through a 1 kΩ resistor to Ground |
| Reserved                  |  | I | 67,68,38,39 | Reserved For Future Use   |
| TX LANE 3 -<br>TX LANE 3+ |  | I | 65<br>64    | Module XAUI Input Lane 3 -<br>Module XAUI Input Lane 3+         |
| TX LANE 2 -<br>TX LANE 2+ |  | I | 62<br>61    | Module XAUI Input Lane 2 -<br>Module XAUI Input Lane 2+         |
| TX LANE 1 -<br>TX LANE 1+ |  | I | 59<br>58    | Module XAUI Input Lane 1 -<br>Module XAUI Input Lane 1+         |
| TX LANE 0 -<br>TX LANE 0+ |  | I | 56<br>55    | Module XAUI Input Lane 0 -<br>Module XAUI Input Lane 0+         |
| RX LANE 0+<br>RX LANE 0 - |  | O | 41<br>42    | Module XAUI Output Lane 0+<br>Module XAUI Output Lane 0 -       |
| RX LANE 1+<br>RX LANE 1 - |  | O | 44<br>45    | Module XAUI Output Lane 1+<br>Module XAUI Output Lane 1 -       |
| RX LANE 2+<br>RX LANE 2 - |  | O | 47<br>48    | Module XAUI Output Lane 2+<br>Module XAUI Output Lane 2 -       |
| RX LANE 3+<br>RX LANE 3 - |  | O | 50<br>51    | Module XAUI Output Lane 3+<br>Module XAUI Output Lane 3 -       |

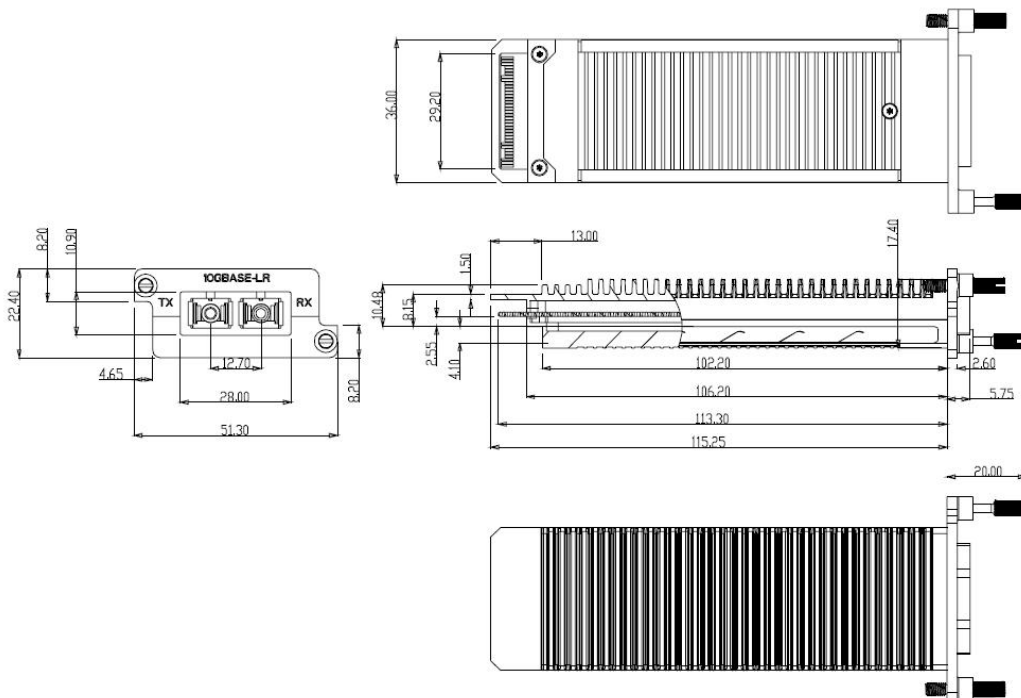
## Block Diagram of Adapter Power Supply Circuit



## Eye Safety

This laser based multimode transceiver is a Class 1 product. It complies with IEC 60825-1 Ed.2: 2007 and FDA performance standards for laser products (21 CFR 1040.10 and 1040.11) except for deviations pursuant to Laser Notice 50, dated June 24, 2007.

## Package Outline



## Ordering Information

| Part Number     | Product Description                              |
|-----------------|--|
| XENPAK-10G55-ER | 10.3125Gbps Xenpak ER, 1550nm, 40km, 0°C ~ +70°C |