# OPB10G-xx60DxR

10GBASE-BX SFP+ BiDi Transceiver, 1270nm-TX/1330nm-RX or 1330nm-TX/1270nm-RX, 60km

## Features

- Supports 9.95 to 11.3Gb/s bit rates
- Simplex LC Connector
- Hot pluggable SFP+ footprint
- OPB10G-2360DxR: Uncooled 1270nm DFB transmitter, 1330nm PIN photo-detector
- OPB10G-3260DxR: Uncooled 1330nm DFB transmitter, 1270nm PIN photo-detector
- Applicable for 60km SMF connection
- Low power consumption < 1.5W
- Digital Diagnostic Monitor Interface
- Optical interface compliant to IEEE 802.3ae 10GBASE-ER
- Electrical interface compliant to SFF-8431
- ROHS compliant and lead-free
- Operating Temperature: Standard 0~70ºC, Industrial -40~85ºC

## Applications

- 10GBASE-ER/10GBASE-EW Ethernet
- 10G Fibre Channel
- 10G Network interface cards and Fiber Media Converters
- Other Optical Links

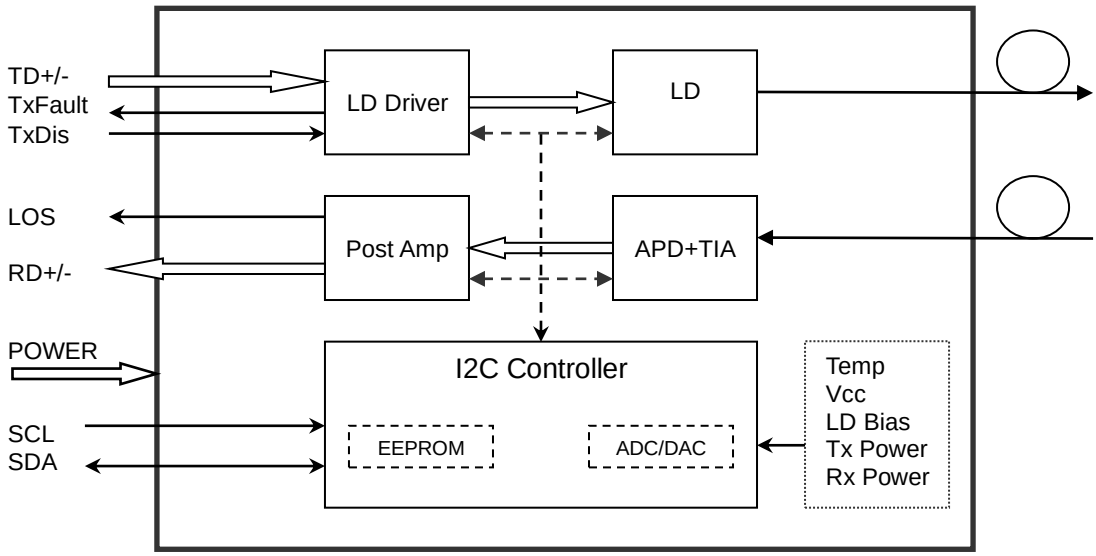
## Description

Optcore's OPB10G-xx60DxR series is a small form factor pluggable Bi-Directional module for optical data communications such as 10GBASE-ER/EW defined by IEEE 802.3ae. It is with the SFP+ 20-pin connector to allow hot plug capability. The BiDi SFP+ transceiver is designed for single mode fiber and operates at a nominal wavelength of 1270nm or 1330nm; The transmitter section uses a multiple quantum well DFB, a class 1 laser compliant according to International Safety Standard IEC-60825. The receiver section consists of an APD photodiode integrated with a TIA. The transceiver designs are optimized for high performance and cost-effectiveness to supply customers with the best telecommunication solutions.

Additionally, the 10GBASE-BX SFP+ 60km transceiver has been integrated with an enhanced digital diagnostic monitoring interface (DDMI) per SFF-8472, which provides real-time monitoring of the transceiver temperature, laser bias current, optical power, received optical power, and transceiver supply voltage. All transceivers are Class 1 laser products that comply with FDA/CDRH and IEC-60825 standards.

There are two versions of the series 10GBASE-BX SFP+ 60km transceiver. The Standard grade (0~70ºC) is for commonly commercial applications, and the Industrial grade (-40~85ºC) is made with robust and reliable components to meet the needs of Industrial Ethernet application under harsh environmental conditions.

## Transceiver functional diagram




## Absolute Maximum Ratings

| Parameter | Symbol | Min | Max | Unit | Notes |
|---|---|---|---|---|---|
| Maximum Supply Voltage | Vcc | -0.5 | 4.5 | V | |
| Storage Temperature | $T_S$ | -40 | 85 | °C | |
| Operating Humidity | RH | 5 | 85 | % | |

## Recommended Operating Conditions

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Notes |
|---|---|---|---|---|---|---|
| Power Supply Voltage | Vcc | 3.13 | 3.3 | 3.47 | V | |
| Power Supply Current | Icc | | | 450 | mA | |
| Case Operating Temperature | Tc | 0 | | 70 | °C | Standard |
| | | -40 | | 85 | °C | Industrial |
| Data Rate | | 9.95 | 10.3125 | 11.3 | Gbps | |
| Maximum Link Length | $L_{MAX}$ | | | 60 | km | |

## Optical Characteristics

| Parameter | Symbol | Min. | Typ | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| ***Transmitter*** | | | | | | |
| Operating Wavelength | λ | 1260 | 1270 | 1280 | nm | OPB10G-2360DxR |
| | | 1320 | 1330 | 1340 | | OPB10G-3260DxR |
| Ave. output power (Enabled) | $P_{AVE}$ | 0 | | 5.0 | dBm | 1 |
| Side-Mode Suppression Ratio | SMSR | 30 | | | dB | |
| Extinction Ratio | ER | 3.5 | 5.0 | | dB | |
| RMS spectral width | Δλ | | | 1 | nm | |
| Rise/Fall time (20%~80%) | Tr/Tf | | | 50 | ps | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Dispersion penalty | $T_{DP}$ | | | 3.2 | dB | |
| Relative Intensity Noise | $R_{IN}$ | | | -128 | dB/Hz | |
| Output Optical Eye | Compliant with IEEE 802.3ae | | | | | |
| ***Receiver*** | | | | | | |
| Operating Wavelength | λ | 1320 | 1330 | 1340 | nm | OPB10G-2360DxR |
| | | 1260 | 1270 | 1280 | | OPB10G-3260DxR |
| Receiver Sensitivity | $P_{SEN2}$ | | | -20.0 | dBm | 2 |
| Receive Power Overload | $P_{AVE}$ | | | -7 | dBm | 3 |
| Receiver Reflectance | $R_{rx}$ | | | -12 | dB | |
| LOS Assert | Pa | -35 | | | dBm | |
| LOS De-assert | Pd | | | -21 | dBm | |
| LOS Hysteresis | Pd-Pa | 0.5 | | | dB | |

**Note:**

1. Average power figures are informative only, per IEEE 802.3ae.
2. Measured with worst ER=5 dB; BER<$10^{-12}$, $2^{31}$-1 PRBS.
3. When using this SFP+ BiDi ZR transceiver in short-distance transmission, please add a fiber attenuator (≥12dB) to avoid receiver damage and overload.

## Electrical Characteristics

| Parameter | Symbol | Min. | Typ | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| ***Transmitter*** | | | | | | |
| Differential data input swing | $V_{IN,PP}$ | 180 | | 700 | mVpp | 1 |
| Transmit Disable Voltage | VD | VCC-0.8 | | Vcc | V | |
| Transmit Enable Voltage | $V_{EN}$ | Vee | | Vee+0.8 | | |
| Input differential impedance | Rin | | 100 | | Ω | |
| ***Receiver*** | | | | | | |
| Differential data output swing | Vout,pp | 350 | | 700 | mVpp | 2 |
| Output rise time and fall time | Tr, Tf | 28 | | | Ps | 3 |
| LOS asserted | $V_{LOS\_F}$ | VCC-0.8 | | Vcc | V | 4 |
| LOS de-asserted | $V_{LOS\_N}$ | Vee | | Vee+0.8 | V | 4 |

**Notes:**

1. Connected directly to TX data input pins. AC coupling from pins into laser driver IC.
2. Into 100Ω differential termination.
3. 20 – 80%. Measured with Module Compliance Test Board and OMA test pattern. Use of four 1's and four 0's sequence in the PRBS 9 is an acceptable alternative.
4. LOS is an open collector output. Should be pulled up with 4.7kΩ – 10kΩ on the host board. Normal operation is logic 0; loss of signal is logic 1.

## Diagnostics

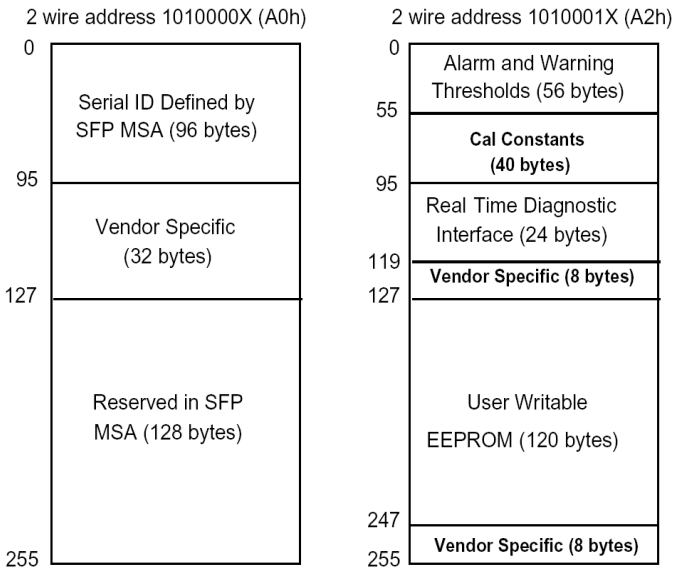
| Parameter | Range | Unit | Accuracy | Calibration |
|---|---|---|---|---|
| Temperature | 0 to +70 | °C | ±3°C | Internal |
| | -40 to +85 | | | |
| Voltage | 3.0 to 3.6 | V | ±3% | Internal |
| Bias Current | 0 to 15 | mA | ±10% | Internal |
| TX Power | -6.0 to -0.5 | dBm | ±3dB | Internal |
| RX Power | -16 to -1 | dBm | ±3dB | Internal |

## Digital Diagnostic Memory Map

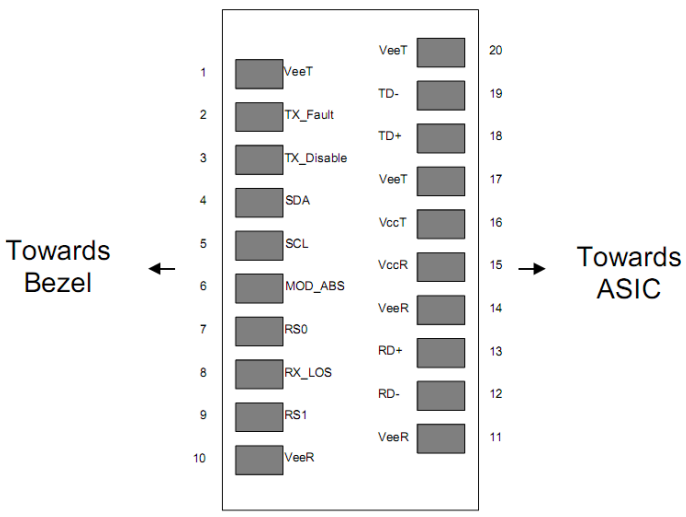
The 10GBASE-BX SFP+ 60km transceivers provide serial ID memory contents and diagnostic information about the present operating conditions by the 2-wire serial interface (SCL, SDA).

The diagnostic information with internal calibration or external calibration all are implemented, including received power monitoring, transmitted power monitoring, bias current monitoring, supply voltage monitoring and temperature monitoring.

The digital diagnostic memory map specific data field defines as following.




## Pin Definitions



## Pin Descriptions

| Pin | Signal Name | Description | Plug Seq. | Notes |
|---|---|---|---|---|
| 1 | $V_{EET}$ | Transmitter Ground | 1 | |
| 2 | TX FAULT | Transmitter Fault Indication | 3 | Note 1 |
| 3 | TX DISABLE | Transmitter Disable | 3 | Note 2 |
| 4 | SDA | SDA Serial Data Signal | 3 | |
| 5 | SCL | SCL Serial Clock Signal | 3 | |
| 6 | MOD_ABS | Module Absent. Grounded within the module | 3 | |
| 7 | RS0 | Not Connected | 3 | |
| 8 | LOS | Loss of Signal | 3 | Note 3 |
| 9 | RS1 | Not Connected | 3 | |
| 10 | $V_{EER}$ | Receiver ground | 1 | |
| 11 | $V_{EER}$ | Receiver ground | 1 | |
| 12 | RD- | Inv. Received Data Out | 3 | Note 4 |
| 13 | RD+ | Received Data Out | 3 | Note 4 |
| 14 | $V_{EER}$ | Receiver ground | 1 | |
| 15 | $V_{CCR}$ | Receiver Power Supply | 2 | |
| 16 | $V_{CCT}$ | Transmitter Power Supply | 2 | |
| 17 | $V_{EET}$ | Transmitter Ground | 1 | |
| 18 | TD+ | Transmit Data In | 3 | Note 5 |
| 19 | TD- | Inv. Transmit Data In | 3 | Note 5 |
| 20 | $V_{EET}$ | Transmitter Ground | 1 | |

**Notes:**

Plug Seq.: Pin engagement sequence during hot plugging.

1. TX Fault is an open collector output, which should be pulled up with a 4.7k~10kΩ resistor on the host board to a voltage between 2.0V and Vcc+0.3V. Logic 0 indicates normal operation; Logic 1 indicates a laser fault of some kind. In the low state, the output will be pulled to less than 0.8V.

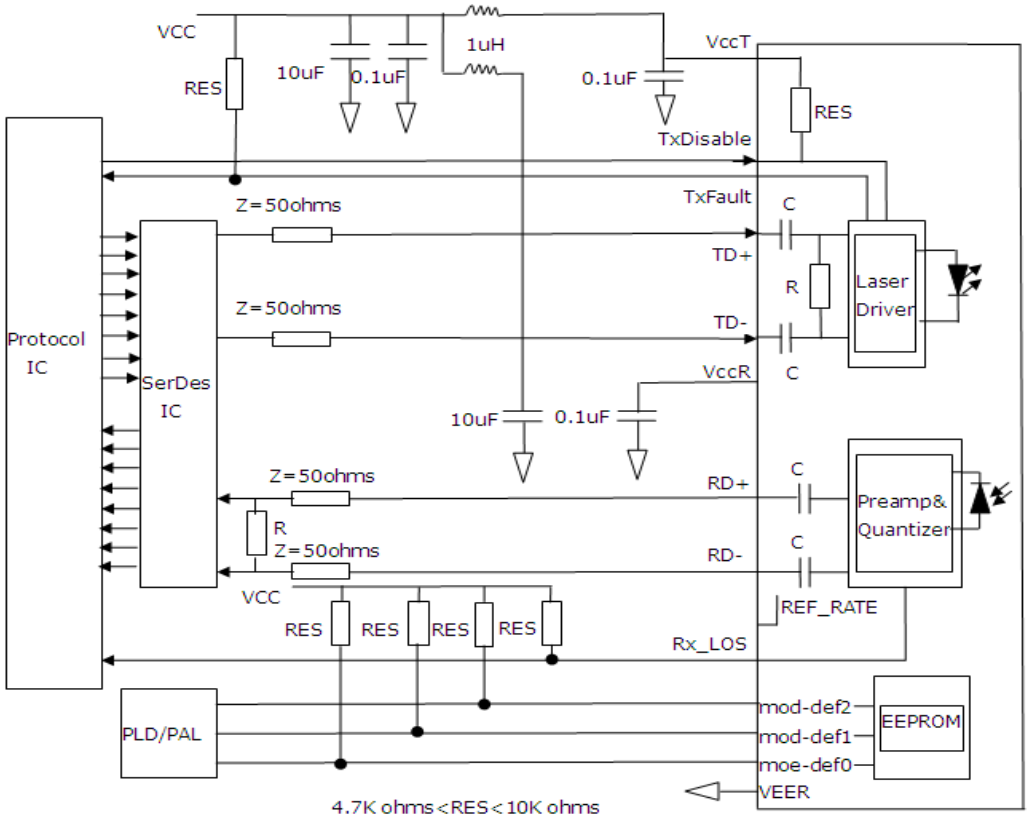
2. Laser output disabled on TDIS >2.0V or open, enabled on TDIS <0.8V.

3. LOS is open collector output. Should be pulled up with 4.7k~10kΩ on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.

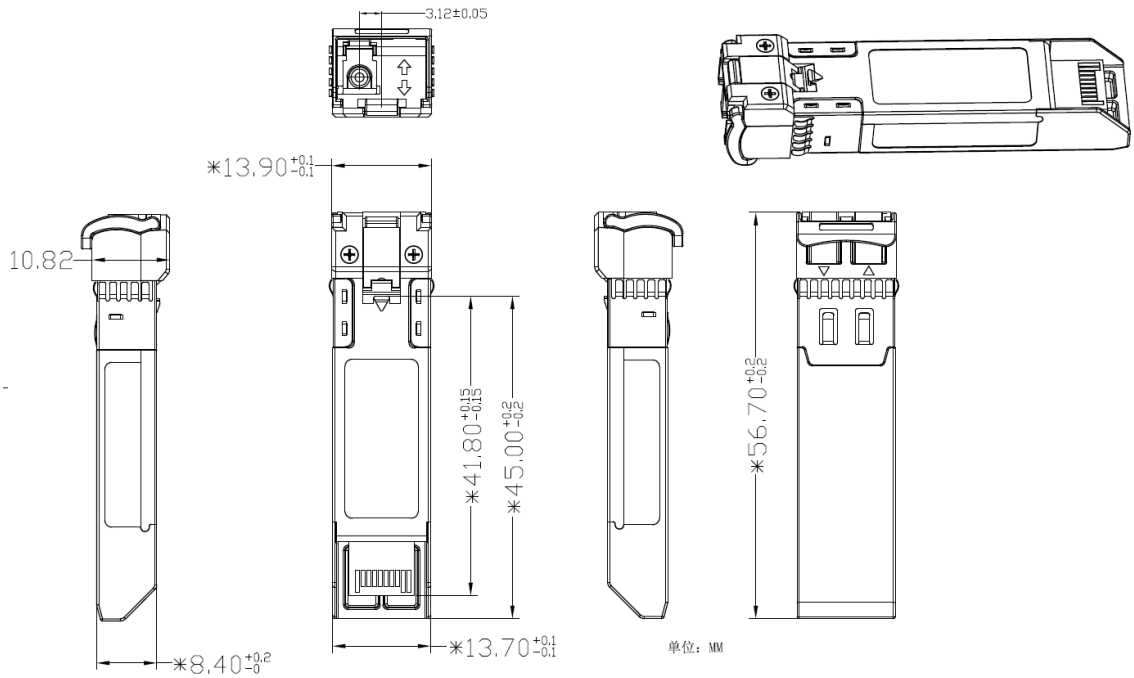
4. RD-/+: These are the differential receiver outputs. They are internally AC-coupled 100 differential lines which should be terminated with 100Ω (differential) at the user SERDES.

5. TD-/+: These are the differential transmitter inputs. They are internally AC-coupled, differential lines with 100Ω differential termination inside the module.

## Recommended Interface Circuit




## Mechanical Dimensions




## Ordering information

| Part number | Description |
|---|---|
| OPB10G-2360DCR | 10GBASE-BX SFP+ Transceiver, 1270nm-TX/1330nm-RX, 60km, LC, DDM, 0ºC~+70ºC |
| OPB10G-3260DCR | 10GBASE-BX SFP+ Transceiver, 1330nm-TX/1270nm-RX, 60km, LC, DDM, 0ºC~+70ºC |
| OPB10G-2360DTR | 10GBASE-BX SFP+ Industrial Transceiver, 1270nm-TX/1330nm-RX, 60km, LC, DDM, -40ºC~+85ºC |

| | |
|---|---|
| OPB10G-3260DTR | 10GBASE-BX SFP+ Industrial Transceiver, 1330nm-TX/1270nm-RX, 60km, LC, DDM, -40ºC~+85ºC |

## Warnings

***Process plug***

The transceiver optics is supplied with a dust cover. This plug protects the transceiver optics during standard manufacturing processes by preventing contamination from air borne particles.It is recommended that the dust cover remain in the transceiver whenever an optical fiber connector is not inserted.

***Handling Precautions***

The transceiver optics is susceptible to damage as a result of electrostatic discharge (ESD). A static free environment is highly recommended. Follow guidelines according to proper ESD procedures.

***Laser Safety***

The transceiver optics is a Class 1 laser product per international standard IEC 60825-1. Radiation emitted by laser devices can be dangerous to human eyes. Avoid eye exposure to direct or indirect radiation.

## Appendix A. Document Revision

| Version No | Date | Description |
|---|---|---|
| DS/V1.0/EN | 2018-01-10 | Preliminary datasheet |
| DS/V211028/EN | 2021-10-28 | Update outline dimension |
| DS/V3.0/EN | 2024-10-29 | Add document revision |

For more product information, visit us on the web at www.optcore.net